Supplementary Information for

Programmable Regiodivergent Light-Driven Cyclisation of Acyclic 1,5-Dienes Unlocks Rigid Bicyclic Architectures

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Table of Contents

1. Materials and General Methods

1.1. Glassware, Solvents and Reagents

All reactions were conducted under an inert atmosphere of nitrogen using standard Schlenk manifold techniques unless mentioned otherwise. All glassware was oven-dried at >100 °C and allowed to cool to room temperature under a positive pressure of nitrogen. Reactions were monitored by TLC until deemed complete using aluminium-backed silica plates. Plates were visualised under ultraviolet light (254 nm) and/or by staining with $KMnO_4$ solution. Cooling of reaction mixtures to 0 °C was achieved using an ice-water bath. Cooling of reaction mixtures to −78 °C was achieved using a dry ice-acetone bath. "Room temperature" refers to an ambient temperature of 23 ± 2 °C.

All anhydrous solvents (MeOH, CH_3CN, acetone, DMF, DMSO, 1,4-dioxane, Et_2O, THF, CH_2Cl_2, 1,2-Dichloroethane, etc.) were commercially supplied (ACROS). All reagents were purchased from commercial sources [Sigma Aldrich (Merck), Across, Fischer, Fluorochem Ltd, TCI, etc.] and used as received unless otherwise stated. Irradiation of reaction mixtures was achieved using a 40 W KSPR160L-427 nm (or 370 and 390 nm) Kessil light (100% intensity). Brine refers to a saturated aqueous solution of NaCl.

1.2. Chromatography and Instrumentation

Flash column chromatography (FCC) was carried out using the Biotage IsoleraTM flash purification system equipped with a high-efficiency silica column (Biotage® Sfär Silica HC D High Capacity Duo, 20 μm).

NMR spectra were recorded at various field strengths, as indicated, using Bruker 400 MHz and Bruker 500 MHz for ^{1}H, ^{13}C, ^{19}F acquisitions. All NMR spectra were recorded at ~25 °C in $CDCl_3$ unless otherwise stated. All reported ^{1}H and ^{13}C chemical shifts (δ_H, δ_C) are referenced to the residual signal of deuterated solvents ($CDCl_3$: δ_H = 7.26 ppm, δ_C = 77.16 ppm; $(CD_3)_2SO$: δ_H = 2.50 ppm, δ_C = 39.52 ppm; $(CD_3)_2CO$: δ_H = 2.05 ppm, δ_C = 206.26 ppm; CD_3CN: δ_H = 1.94 ppm, δ_C = 118.26 ppm; CD_2Cl_2: δ_H = 5.32 ppm, δ_C = 53.84 ppm). Chemical shifts (δ) are reported in parts per million (ppm) to the nearest 0.01 ppm for ^{1}H, ^{19}F NMR and 0.1 ppm for ^{13}C NMR. Coupling constants (*J*) are reported in Hertz (Hz). Multiplicities are reported as follows: s (singlet), d (doublet), t (triplet), q (quartet), pent. (quintet), hept. (septet), m (multiplet), br. (broad signal), app. (apparent). The ^{1}H NMR spectra are reported as follows: chemical shift (multiplicity, coupling constants, number of protons).

High resolution mass spectra (HRMS) were recorded on a Bruker Daltonics MicrOTOF II by Electrospray Ionisation (ESI); a Thermo Scientific QExactive by Electron Ionisation (EI); a Thermo Scientific Orbitrap Elite by ESI or Atmospheric Pressure Chemical Ionisation (APCI); or a Bruker UltrafleXtreme by Matrix-assisted Laser Desorption/Ionisation (MALDI).

IR spectra were recorded neat as a thin film on a Perkin Elmer Spectrum One FT-IR. Selected absorption maxima (ν_{max}) are reported in wavenumbers (cm^{-1})

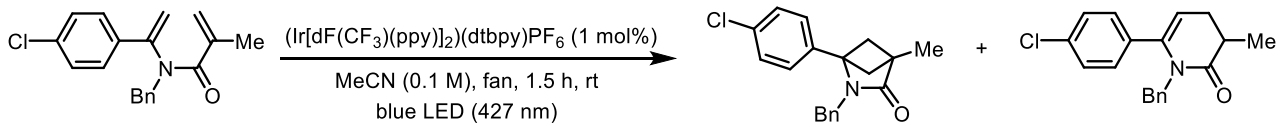
1.3. Naming of Compounds

Compound names are those generated by ChemDraw Professional 20.0 software (PerkinElmer), following the IUPAC nomenclature.

2. Experimental Data

2.1. Reaction Optimisation Studies

Supplementary Table S1. Optimisation of the intramolecular cycloaddition of precursor **1c**

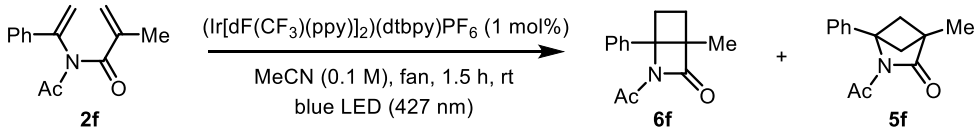


1c **3c** **4c (unstable)**

Entry	variation	E_T (kcal/mol)	$E_1/_2$ [M*/M$^{\bullet-}$] (V)	$E_1/_2$ [M$^{\bullet+}$/M*] (V)	**3c** (% yield)	**4c** (% yield)
1	$[Ru(bpy)_3](PF_6)_2$ as PC	46.5	+0.77	-0.81	0	0
2	$[Ir(ppy)_2(dtbbpy)]PF_6$ as PC	49.2	+0.66	-0.96	52	35
3	*fac*-$[Ir(ppy)_3]$ as PC	58.1	+0.31	-1.73	52	35
4	$(Ir[dF(CF_3)(ppy)]_2)(dtbpy)PF_6$ as PC	61.8	+1.21	-0.89	54 (52)	16 (14)
5	*fac*-$[Ir(dF(ppy))_3]$ as PC	63.5	+0.34	-1.44	51	34
6	thioxanthone as PC[a]	65.6	+ 1.18	-1.11	45	0
7	THF as solvent				52	33
8	CH_2Cl_2 as solvent[b]				48	45
9	EtOAc as solvent				52	31
10	Acetone as solvent				54	30
11	Et_2O as solvent				54	33
12	HFIP as solvent				0	72 (72)
13	15 min (reaction time)				47	35
14	30 min (reaction time)				51	20
15	0.2 M (concentration)				52	26
16	0.5 M (concentration)				51	27
17	without PC				0	0
18	without light				0	0

Yields determined by quantitative NMR spectroscopy of the crude reaction mixture using CH_2Br_2 as the internal standard. Isolated yields in the parentheses. a. 390 nm blue LED was used. b. gram scal, $Ir[dF(CF_3)(ppy)]_2)(dtbpy)PF_6$ (0.5 mol%), 1.5 h.

Supplementary Table S2. Optimisation of the intramolecular cycloaddition of precursor **2f**



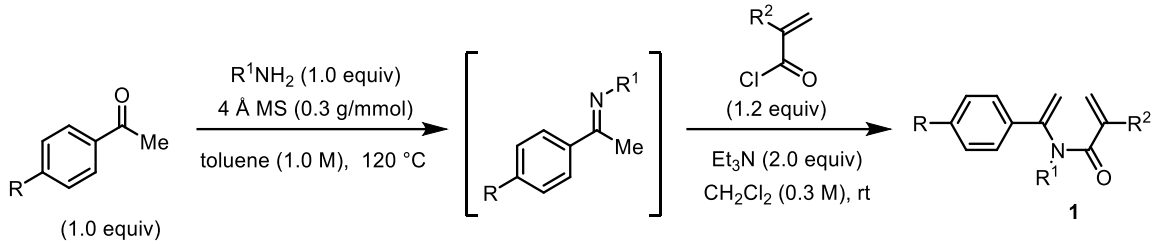
Entry	variation	E_T (kcal/mol)	$E_1/_2$ [M*/M$^{\bullet-}$] (V)	$E_1/_2$ [M$^{\bullet+}$/M*] (V)	**6f** (% yield)	**5f** (% yield)
1	$[Ru(bpy)_3](PF_6)_2$ as PC	46.5	+0.77	-0.81	0	0
2	$[Ir(ppy)_2(dtbbpy)]PF_6$ as PC	49.2	+0.66	-0.96	36	3
3	*fac*-$[Ir(ppy)_3]$ as PC	58.1	+0.31	-1.73	48	5
4	$(Ir[dF(CF_3)(ppy)]_2)(dtbpy)PF_6$ as PC	61.8	+1.21	-0.89	80 (76)	8 (5)
5	*fac*-$[Ir(dF(ppy))_3]$ as PC	63.5	+0.34	-1.44	80	8
6	thioxanthone as PC[a]	65.6	+ 1.18	-1.11	79	8
7	THF as solvent				79	10
8	CH_2Cl_2 as solvent				80	9
9	EtOAc as solvent				80	9
10	Acetone as solvent				80	9
11	Et_2O as solvent				79	10
12	HFIP as solvent				85 (79)	3
13	15 min (reaction time)				80	8
14	30 min (reaction time)				80	8
15	0.2 M (concentration)				80	8
16	0.5 M (concentration)				79	9
17	without PC				0	0
18	without light				0	0

Yields determined by quantitative NMR spectroscopy of the crude reaction mixture using CH_2Br_2 as the internal standard. Isolated yields in the parentheses. a. 390 nm blue LED was used.

For substrates bearing *N*-substituents with varying electronic properties (**Figure 2A in the main text**), the product distributions resulting from the competing 5-*exo*-trig and 6-*endo*-trig cyclisations under the optimal conditions, together with the corresponding product characterisation data, are provided in **Section 2.4 (Synthesis of Cyclisation Products)** of the Supporting Information.

2.2 General Procedure

2.2.1. General Procedure A: Synthesis of Cyclisation Precursors (1)

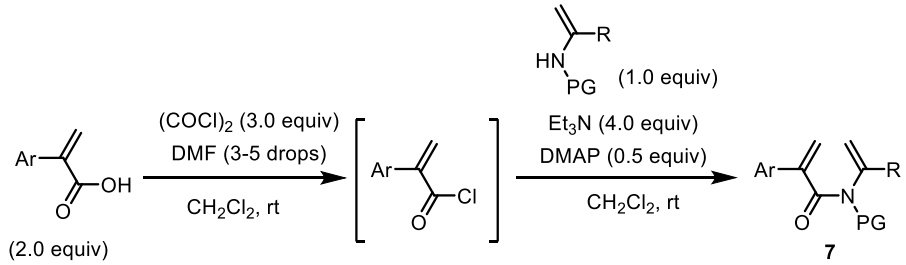


An oven-dried round-bottom flask equipped with a magnetic stir bar and a 15 cm condenser was charged with 4 Å molecular sieves (powder, 0.3 g/mmol) under an argon atmosphere in a glovebox. The flask was sealed with a rubber septum, removed from the glovebox, and kept under a nitrogen atmosphere using a balloon. Anhydrous toluene (1.0 M), the ketone (1.0 equiv), and amine (1.0 equiv) were added sequentially via syringe. The reaction mixture was heated to 120 °C under nitrogen for 5 h, then cooled to room temperature. The resulting mixture was rapidly filtered through anhydrous $MgSO_4$ and washed with anhydrous CH_2Cl_2 (approximately 0.3 M with respect to ketone).[A] The filtrate was collected in an oven-dried round-bottom flask and the crude imine was used directly in the next step without further purification.

The flask containing the crude imine (1.0 equiv) was sealed and kept under a nitrogen atmosphere using a balloon. Triethylamine (2.0 equiv) was added, followed by the acyl chloride (1.2 equiv). The reaction mixture was stirred at room temperature until completion of the reaction (TLC). The reaction was quenched with saturated aqueous $NaHCO_3$ and extracted with CH_2Cl_2 three times. The combined organic extracts were dried over anhydrous $MgSO_4$, filtered, and concentrated *in vacuo*. The crude product was purified using a Biotage automated flash chromatography system to afford the desired products.

Notes: (**A**) Due to the inherent instability of the imine, which is prone to hydrolysis, the crude imine was immediately and rapidly filtered (over $MgSO_4$) upon cooling to room temperature, and the residue was washed with anhydrous CH_2Cl_2. The receiving round-bottom flask was also oven-dried to minimise exposure to moisture and achieve the highest possible yield.

2.2.2. General Procedure A: Synthesis of Cyclisation Precursors (7)



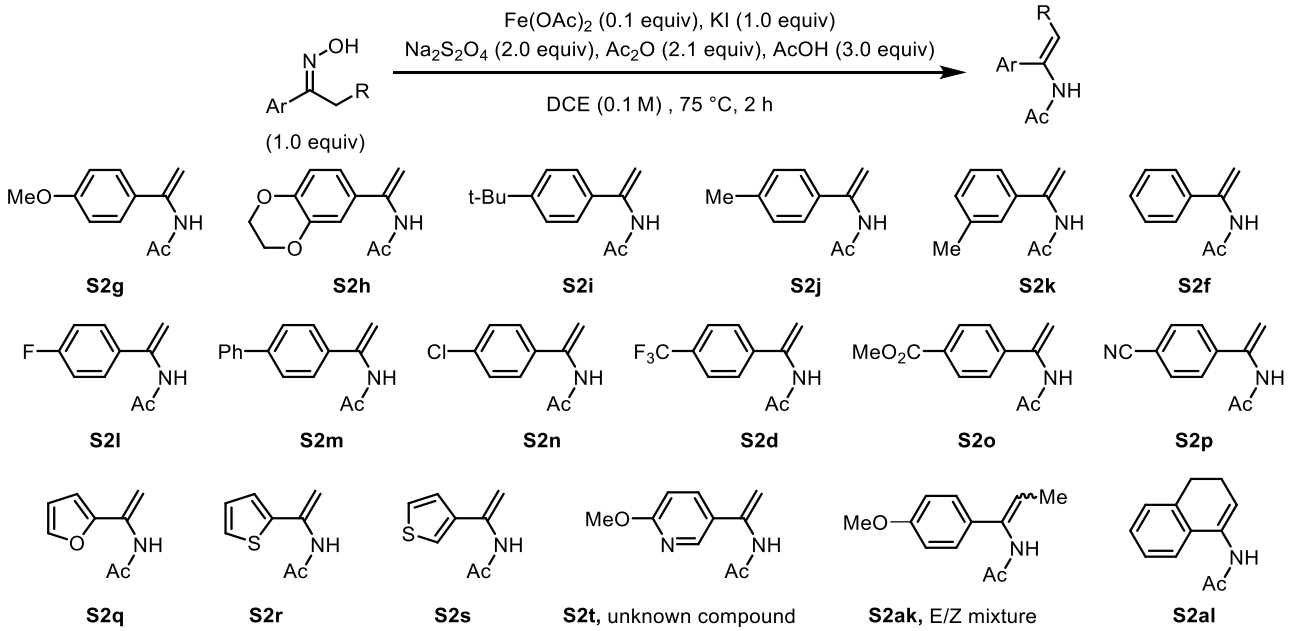
An oven-dried round-bottom flask containing carboxylic acid (2.0 equiv) was sealed and subjected to three N_2 evacuation/refill cycles before pre-sparged anhydrous CH_2Cl_2 (0.3 M with respect to carboxylic acid) was added. The solution was cooled to 0 °C before oxalyl chloride (3.0 equiv) was added, followed by DMF (3-5 drops). The reaction mixture was allowed to warm to room temperature and stirred for 1 h. The reaction was then concentrated under reduced pressure to afford the crude acyl chloride which was used directly for the next step without further purification.

The crude acyl chloride (2.0 equiv) was re-dissolved in anhydrous CH_2Cl_2 (0.3 M with respect to enamide) at room temperature. Et_3N (4.0 equiv) was then added, followed by the addition of the enamide (1.0 equiv) in anhydrous CH_2Cl_2 (1.0 M with respect to enamide) and DMAP (0.5 equiv). The reaction mixture was stirred overnight until completion of the reaction (TLC). The reaction was quenched with brine and extracted with CH_2Cl_2 three times. The combined extracts were dried over anhydrous $MgSO_4$ and concentrated *in vacuo*. The crude product was purified using a Biotage automated flash chromatography system to afford the desired product.

2.2.3. General Procedure C: Synthesis of Cyclisation Precursors (2)

Almost all *N*-acetyl enamides used in this study (shown in **Supplementary Figure S1**) are known compounds and were synthesised according to the modified literature-reported procedure shown below.[1] The ^1H and ^{13}C NMR spectra of our samples were consistent with the reported data.[1-5] For enamides that have not been previously reported, full characterisation data are provided.

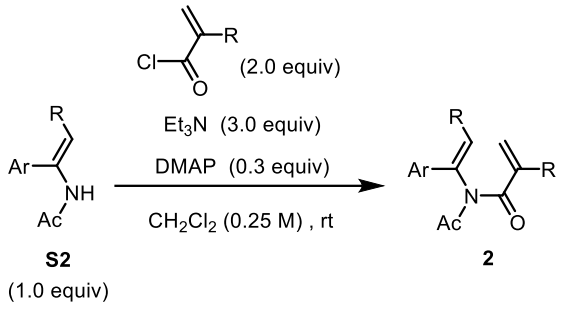
Supplementary Figure S1. List of *N*-acetyl enamides used as starting materials in the synthesis of cyclisation precursors



To an oven-dried round-bottom flask equipped with a magnetic stir bar and a 15 cm condenser, acetophenone oxime (1.0 equiv), KI (1.0 equiv), $Na_2S_2O_4$ (2.0 equiv), and $Fe(OAc)_2$ (0.1 equiv) were added under an argon atmosphere in a glovebox. The flask was sealed with a rubber septum, removed from the glovebox, and kept under a nitrogen atmosphere using a balloon. 1,2-Dichloroethane (DCE, 0.1 M), acetic acid (3.0 equiv), and acetic anhydride (2.1 equiv) were added to the mixture via syringe. The reaction mixture was heated to 75 °C for 2 h, then cooled to room temperature. The resulting mixture was quenched with saturated $NaHCO_3$ solution and extracted with CH_2Cl_2 three times. The combined organic layers were dried over anhydrous $MgSO_4$, filtered, concentrated under reduced pressure, and purified using a Biotage automated flash chromatography system to afford the desired product.[A]

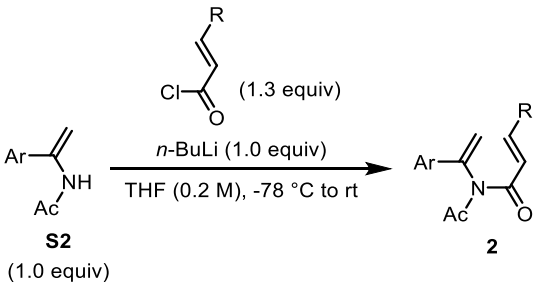
Notes: (**A**) If the crude product after column chromatography is not sufficiently pure, further purification can be performed either by a second round of chromatography or by recrystallisation. Since the product is typically a solid, it often precipitates during rotary evaporation. In such cases, recrystallisation from a petroleum ether/Et_2O solvent system can be used for purification.

2.2.3.1 General Procedure C1: Synthesis of Cyclisation Precursors (2)



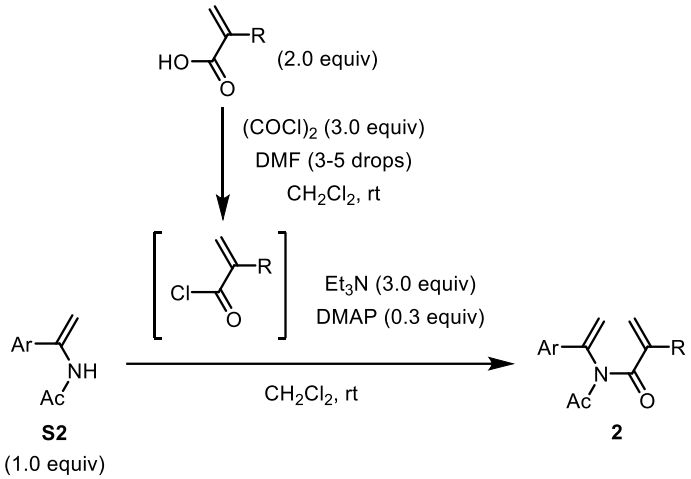
In an oven-dried round-bottom flask, the *N*-acetyl enamide **S2** (1.0 equiv) was dissolved in anhydrous CH_2Cl_2 (0.25 M) at room temperature. Et_3N (3.0 equiv) was then added, followed by the addition of acyl chloride (2.0 equiv) and DMAP (0.3 equiv). The reaction mixture was stirred overnight. The reaction was quenched with brine and extracted with CH_2Cl_2 three times. The combined extracts were dried over anhydrous $MgSO_4$ and concentrated *in vacuo*. The crude product was purified by Biotage automated flash chromatography system to afford the needed product **2**.

2.2.3.2 General Procedure C2: Synthesis of Cyclisation Precursors (2)



An oven-dried round-bottom flask charged with *N*-acetyl enamide **S2** (1.0 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous THF (0.2 M) was then added, and the reaction mixture was cooled to –78 °C. *n*-BuLi (1.0 equiv) was added dropwise at –78 °C, and the mixture was stirred at this temperature for 10 minutes. Acyl chloride (1.3 equiv) was subsequently added at –78 °C, and the reaction was allowed to warm to room temperature over 1 h. The reaction was then quenched with brine and extracted with ethyl acetate three times. The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude product was purified by a Biotage automated flash chromatography system to afford the desired compound **2**.

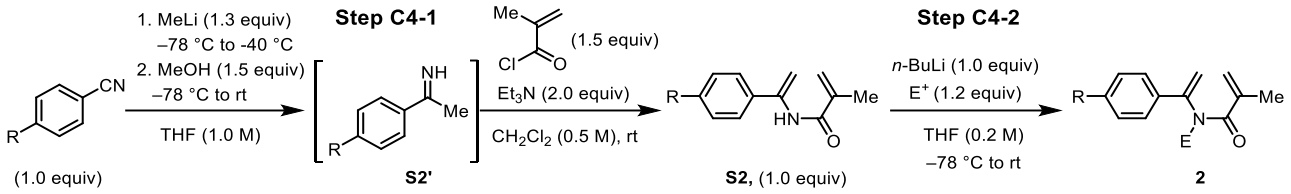
2.2.3.3 General Procedure C3: Synthesis of Cyclisation Precursors (2)



An oven-dried round-bottom flask containing carboxylic acid (2.0 equiv) was sealed and subjected to three N_2 evacuation/refill cycles before pre-sparged anhydrous CH_2Cl_2 (0.3 M with respect to carboxylic acid) was added. Oxalyl chloride (3.0 equiv) was then added, followed by the addition of DMF (3-5 drops). The reaction mixture was allowed to stir at room temperature for 1 h. The reaction was then concentrated under reduced pressure to afford the crude acyl chloride which was used directly for the next step without further purification.

The crude acyl chloride (2.0 equiv) was redissolved in anhydrous CH_2Cl_2 (0.25 M with respect to *N*-acetyl enamide) at room temperature. Et_3N (3.0 equiv) was then added, followed by the addition of *N*-acetyl enamide **S2** (1.0 equiv) and DMAP (0.3 equiv). The reaction mixture was stirred overnight until completion of the reaction (TLC). The reaction was quenched with brine and extracted with CH_2Cl_2 three times. The combined extracts were dried over anhydrous $MgSO_4$ and concentrated *in vacuo*. The crude product was purified by a Biotage automated flash chromatography system to afford the desired product **2**.

2.2.3.4 General Procedure C4: Synthesis of Cyclisation Precursors (2)



Step C4-1: To an oven-dried round-bottom flask charged with benzonitrile (1.0 equiv) and a magnetic stir bar was added anhydrous THF (1.0 M) under a nitrogen atmosphere. The solution was cooled to –78 °C, and MeLi solution (1.3 equiv) was added dropwise. After stirring at –78 °C for 5 min, the reaction was warmed to -40 °C and stirred for 2 h. Then the mixture was cooled again to –78 °C, followed by the dropwise addition of anhydrous MeOH (1.5 equiv). The reaction was allowed to warm to room temperature over the course of 1 h. The reaction mixture was then immediately filtered through anhydrous $MgSO_4$ under reduced pressure and washed with anhydrous CH_2Cl_2 (approximately 0.5 M with respect to benzonitrile) under nitrogen protection to prevent decomposition of the imine intermediate.[A] The filtrate was collected in an oven-dried round-bottom flask, sealed with a rubber septum, and protected under a nitrogen balloon. Et_3N (2.0 equiv) and methacryloyl chloride (1.5 equiv) were then added to the filtrate under a nitrogen atmosphere. The reaction mixture was stirred at room temperature for 12 h. Upon completion, the reaction mixture was then quenched with brine and extracted with ethyl acetate three times. The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude product was purified by a Biotage automated flash chromatography system to afford *N*-H 1,5-diene **S2**.

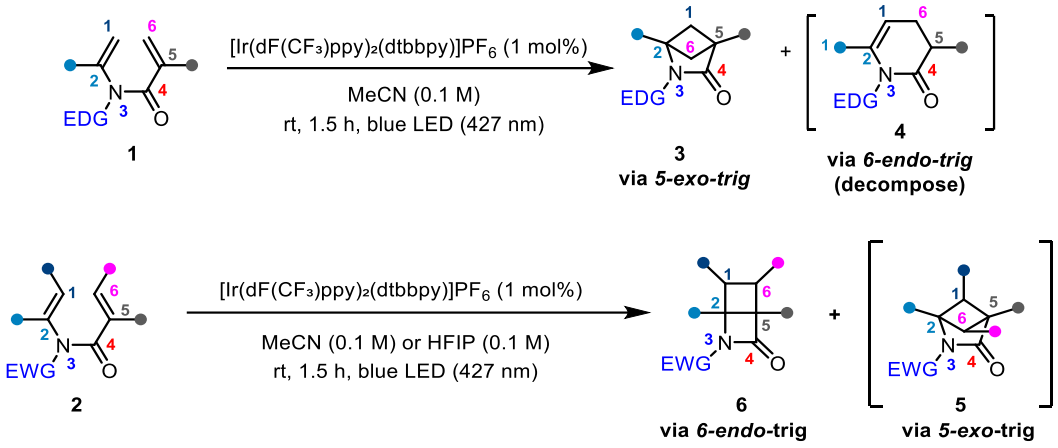
Notes: (**A**) The *N*-H imine intermediate S2' is unstable at room temperature; hence, the $MgSO_4$ filtration of the crude *N*-H imine intermediate S2' should be carried out rapidly under reduced pressure and under a nitrogen atmosphere. The filtrate containing the crude *N*-H imine S2' was immediately subjected to acylation without further purification.

(**B**) Although acylation steps typically do not require long reaction times, we found that upon addition of methacryloyl chloride, the reaction mixture rapidly formed a mixture of enamine S2 and its imine isomer, as evidenced by crude ^1H NMR analysis. Importantly, stirring the reaction at room temperature for 12 h led to substantial conversion of the imine into the enamine, thereby affording S2 in improved yield.

Step C4-2: An oven-dried round-bottom flask charged with *N*-H 1,5-diene **S2** (1.0 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous THF (0.2 M) was then added, and the reaction mixture was cooled to –78 °C. *n*-BuLi solution (1.0 equiv) was added dropwise at –78 °C, and the mixture was stirred at this temperature for 10 minutes. Electrophile (1.2

equiv) was subsequently added at –78 °C, and the reaction was allowed to warm to room temperature over 1 hour. The reaction was then quenched with brine and extracted with ethyl acetate three times. The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude product was purified by a Biotage automated flash chromatography system to afford the desired compound **2**.

2.2.4. General Procedure D: Synthesis of Cyclisation Products



An oven-dried round-bottom flask containing the substrate (1.0 equiv) and $[Ir(dF(CF_3)ppy)_2(dtbbpy)]PF_6$ (1.0 mol%) was sealed and subjected to three evacuation–backfill cycles with N_2. Anhydrous solvent[A] (0.1 M) pre-sparged with N_2 was added, and the flask was positioned ~1 cm from a 40 W KSPR160L-427 nm Kessil light source (100% intensity).[B] The mixture was stirred under continuous irradiation at ambient temperature[C] under N_2 for 1.5 h (judged by TLC).[D,E] Concentration *in vacuo* and purification by Biotage automated flash chromatography system afforded the desired product.[F,G]

Notes: (**A**) All substrates were evaluated in MeCN as the solvent. For substrates exhibiting poor selectivity toward the 6-*endo*-trig pathway, experiments using HFIP as the solvent were additionally performed and are specifically indicated in the corresponding characterisation data.

(**B**) When thioxanthone (0.1 equiv) is used as a photosensitizer, a 40W KSPR160L-390 nm Kessil light (100% intensity) was used. When benzophenone (0.25 equiv) is used as a photosensitizer, a 40W KSPR160L-370 nm Kessil light (100% intensity) was used.

(**C**) The actual temperature of the reaction mixture was higher than room temperature. Fan-assisted cooling was used to maintain the temperature at around 35-40 °C. The solution temperature was monitored with a thermometer probe placed 1 cm below the solvent surface.

(**D**) Most substrates react completely in 1.5 h; substrates requiring extended reaction times are specifically indicated in the subsequent detailed data descriptions.

(**E**) The reaction was typically monitored by TLC. The product is usually slightly more polar than the starting material; however, in many cases, the products and starting precursor exhibit very similar R_f values. A relatively straightforward way to distinguish them is by their UV response under 254 nm light: product spots appear significantly weaker due to the loss of the styrenyl chromophore. Additionally, the product generally shows a slower colour development when treated with the $KMnO_4$ stain, as the reactive alkene moiety has been consumed. Of course, the most reliable method of identification is by sampling the crude reaction mixture for ^{1}H NMR analysis.

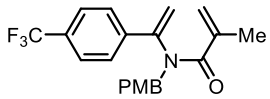
(**F**) When 1,5-diene **1** was subjected to the [2+2] cyclisation, the corresponding [2.1.1] bicyclic compound **3** was the only product that could be isolated. The six-membered-ring product (**4**) arising from the 6-*endo*-trig pathway could occasionally be detected only in trace amounts in the crude ^{1}H NMR spectrum. Time-course ^{1}H NMR monitoring at different reaction intervals (15, 30, 60, and 90 min) revealed that this species gradually decomposes over time. Furthermore, when an isolated sample of compound **4** was resubjected to the standard photochemical conditions, substantial decomposition was observed within 1 h. Owing to the intrinsic instability of this compound, except for a few selected substrates that could be isolated and fully characterised, only the yield and characterisation data of the [2.1.1] scaffolds (**3**) are reported.

(**G**) When using 1,5-diene **2** for the [2+2] cyclisation, both the [2.2.0] product (**6**) and the [2.1.1] product (**5**) could be observed in the crude ^{1}H NMR spectrum (shown below) and isolated. All products in this study were ultimately purified using a Biotage automated flash chromatography system equipped with a high-efficiency silica column (Biotage® Sfär Silica HC D High Capacity Duo, 20 µm). When the molar ratio of [2.2.0] product **6** to [2.1.1] product **5** in the crude mixture was less than 5:1, the [2.1.1] isomer **5** was also isolated and fully characterised.

2.3 Synthesis of Cyclisation Precursors

2.3.1 Synthesis and Characterisation of Precurors (1)

***N*-(4-methoxybenzyl)-*N*-(1-(4-(trifluoromethyl)phenyl)vinyl)methacrylamide (1a)**



Prepared according to **General Procedure A** using 4-(trifluoromethyl)acetophenone (1.50 g, 8.00 mmol, 1.00 equiv), toluene (8.0 mL), 4-methoxybenzylamine (1.04 mL, 8.00 mmol, 1.00 equiv) and 4 Å molecular sieves (2.40 g). Then using CH_2Cl_2 (30.0 mL), Et_3N (2.23 mL, 16.0 mmol, 2.00 equiv.) and methacryloyl chloride (0.94 mL, 9.60 mmol, 1.20 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **1a** as a colourless oil (2.33 g, 6.21 mmol, 78%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.60 (d, *J* = 8.2 Hz, 2H), 7.41 (d, *J* = 8.1 Hz, 2H), 7.20 (d, *J* = 8.6 Hz, 2H), 6.82 (d, *J* = 8.6 Hz, 2H), 5.46 (d, *J* = 0.9 Hz, 1H), 5.26 (s, 1H), 5.05 (s, 1H), 4.98 (d, *J* = 0.9 Hz, 1H), 4.73 (s, 2H), 3.78 (s, 3H), 1.73 (s, 3H).

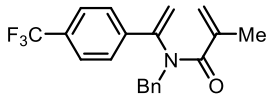
^{13}C NMR (126 MHz, $CDCl_3$) δ 172.4, 159.2, 146.5, 141.2, 140.6, 130.8 (q, *J* = 32.6 Hz), 130.5, 129.4, 126.8, 125.9 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.1 Hz), 118.3, 114.0, 113.9, 55.3, 50.5, 20.1.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.68.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1654, 1612, 1511, 1384, 1246, 1165, 1113, 1063.

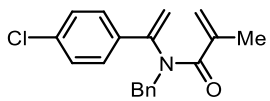
HRMS (ESI^+) calcd. for $C_{21}H_{21}F_3NO_2^+$ $[M+H]^+$: 376.1519, found: 376.1519.

***N*-benzyl-*N*-(1-(4-(trifluoromethyl)phenyl)vinyl)methacrylamide (1b)**



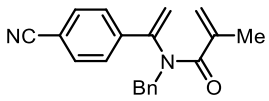
Prepared according to **General Procedure A,** known compound.[6]

***N*-benzyl-*N*-(1-(4-chlorophenyl)vinyl)methacrylamide (1c)**



Prepared according to **General Procedure A,** known compound.[6]

***N*-benzyl-*N*-(1-(4-cyanophenyl)vinyl)methacrylamide (1d)**



Prepared according to **General Procedure A** using 4-acetylbenzonitrile (1.16 g, 8.00 mmol, 1.00 equiv), toluene (8.0 mL), benzylamine (0.87 mL, 8.0 mmol, 1.0 equiv) and 4 Å molecular sieves (2.40 g). Then using CH_2Cl_2 (30.0 mL), Et_3N (2.23 mL, 16.0 mmol, 2.00 equiv) and methacryloyl chloride (0.94 mL, 9.6 mmol, 1.2 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/CH_2Cl_2 (0% to 10%), affording **1d** as a colourless oil (1.30 g, 4.30 mmol, 54%).

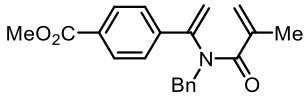
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.62 (d, J = 8.5 Hz, 2H), 7.37 (d, J = 8.5 Hz, 2H), 7.31 – 7.25 (m, 5H), 5.47 (d, J = 1.1 Hz, 1H), 5.26 (s, 1H), 5.07 (s, 2H), 4.81 (s, 2H), 1.71 (t, J = 1.3 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 172.3, 146.5, 141.7, 141.0, 137.1, 132.6, 128.9, 128.7, 127.8, 127.0, 118.7, 118.5, 114.5, 112.4, 51.4, 20.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2228, 1655, 1614, 1495, 1453, 1352, 1261, 1197, 1030.

HRMS (ESI^+) calcd. for $C_{20}H_{19}N_2O^+$ $[M+H]^+$: 303.1492, found: 303.1480.

Methyl 4-(1-(*N*-benzylmethacrylamido)vinyl)benzoate (1e)



Prepared according to **General Procedure A** using methyl 4-acetylbenzoate (1.42 g, 8.00 mmol, 1.00 equiv), toluene (8.0 mL), benzylamine (0.87 mL, 8.0 mmol, 1.0 equiv) and 4 Å molecular sieves (2.40 g). Then using CH_2Cl_2 (30.0 mL), Et_3N (2.23 mL, 16.0 mmol, 2.00 equiv) and methacryloyl chloride (0.94 mL, 9.6 mmol, 1.2 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 50%), affording **1e** as a colourless oil (588 mg, 1.76 mmol, 22%).

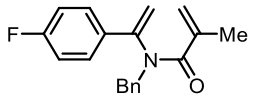
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (d, J = 8.5 Hz, 2H), 7.37 (d, J = 8.5 Hz, 2H), 7.31 – 7.25 (m, 5H), 5.46 (d, J = 0.9 Hz, 1H), 5.28 (s, 1H), 5.05 (app. p, J = 1.6 Hz, 1H), 5.00 (d, J = 0.9 Hz, 1H), 4.81 (s, 2H), 3.92 (s, 3H), 1.73 (t, J = 1.3 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 172.5, 166.6, 147.0, 141.5, 141.1, 137.3, 130.4, 130.1, 129.0, 128.6, 127.6, 126.4, 118.4, 113.7, 52.4, 51.2, 20.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1721, 1675, 1656, 1609, 1521, 1435, 1277, 1196, 1108.

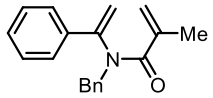
HRMS (ESI^+) calcd. for $C_{21}H_{22}NO_3^+$ $[M+H]^+$: 336.1594, found: 336.1580.

_N_-benzyl-_N_-(1-(4-fluorophenyl)vinyl)methacrylamide (1f)



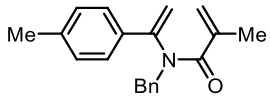
Prepared according to **General Procedure A,** known compound.[6]

_N_-benzyl-_N_-(1-phenylvinyl)methacrylamide (1g)



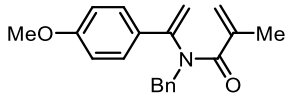
Prepared according to **General Procedure A,** known compound.[6]

_N_-benzyl-_N_-(1-(_p_-tolyl)vinyl)methacrylamide (1h)



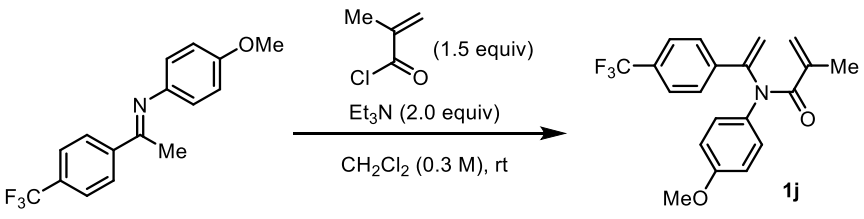
Prepared according to **General Procedure A,** known compound.[7]

_N_-benzyl-_N_-(1-(4-methoxyphenyl)vinyl)methacrylamide (1i)



Prepared according to **General Procedure A,** known compound.[6]

_N_-(4-methoxyphenyl)-_N_-(1-(4-(trifluoromethyl)phenyl)vinyl)methacrylamide (1j)



In an oven-dried round-bottom flask, *N*-(4-methoxyphenyl)-1-(4-(trifluoromethyl)phenyl)ethan-1-imine[8] (1.04 g, 3.60 mmol, 1.00 equiv) was dissolved in anhydrous CH_2Cl_2 (12.0 mL) at room temperature. Et_3N (0.99 mL, 7.1 mmol, 2.0 equiv) was then added, followed by the addition of methacryloyl chloride (0.52 mL, 5.3 mmol, 1.5 equiv). The reaction mixture was stirred overnight. The reaction was then quenched with brine (100 mL) and extracted with CH_2Cl_2 (3 × 50 mL). The

combined extracts were dried over anhydrous $MgSO_4$ and concentrated *in vacuo*. The crude product was purified by Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 50%), affording **1j** as a pale-yellow oil (1.25 g, 3.46 mmol, 98%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.62 (d, *J* = 9.1 Hz, 2H), 7.59 (d, *J* = 8.6 Hz, 2H), 7.15 (d, *J* = 9.0 Hz, 2H), 6.85 (d, *J* = 8.9 Hz, 2H), 5.59 (d, *J* = 1.0 Hz, 1H), 5.41 (s, 1H), 5.21 (app. p, *J* = 1.4 Hz, 1H), 5.13 (s, 1H), 3.79 (s, 3H), 1.82 (t, *J* = 1.3 Hz, 3H).

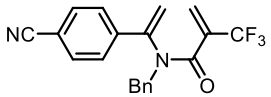
^{13}C NMR (126 MHz, $CDCl_3$) δ 171.8, 158.1, 148.2, 141.0, 140.9, 135.2, 130.1 (q, *J* = 32.6 Hz), 127.4, 126.2, 125.5 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.1 Hz), 120.5, 114.4, 113.6, 55.2, 19.6.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.65.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1660, 1617, 1508, 1321, 1299, 1243, 1165, 1112, 1065.

HRMS (ESI^+) calcd. for $C_{20}H_{19}F_3NO_2^+$ $[M+H]^+$: 362.1362, found: 362.1349.

***N*-benzyl-*N*-(1-(4-cyanophenyl)vinyl)-2-(trifluoromethyl)acrylamide (1k)**



Prepared according to **General Procedure A** using 4-acetylbenzonitrile (870 mg, 6.00 mmol, 1.00 equiv), toluene (6.0 mL), benzylamine (0.65 mL, 6.0 mmol, 1.0 equiv) and 4 Å molecular sieves (1.80 g). Then using CH_2Cl_2 (20.0 mL), Et_3N (1.67 mL, 12.0 mmol, 2.00 equiv) and 2-(trifluoromethyl)-2-propenoyl chloride[9] (1.14 g, 7.20 mmol, 1.20 equiv).[A] The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of acetone/pentane (0% to 35%) and recrystallisation, affording **1k** as a white solid (1.60 g, 4.49 mmol, 75%).

Notes: (**A**) 2-(Trifluoromethyl)-2-propenoyl chloride[9] was purified by distillation before use. It was stored in a glovebox freezer at –30 °C, where it remained stable for at least three months.

M.P.: 115-117 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.67 (d, *J* = 8.5 Hz, 2H), 7.43 (d, *J* = 8.6 Hz, 2H), 7.32 – 7.27 (m, 3H), 7.25 – 7.22 (m, 2H), 5.88 (s, 1H), 5.73 (s, 1H), 5.66 (d, *J* = 1.4 Hz, 1H), 5.08 (s, 1H), 4.80 (s, 2H).

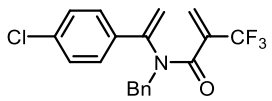
^{13}C NMR (126 MHz, $CDCl_3$) δ 164.3, 144.8, 140.1, 136.0, 134.9 (q, *J* = 31.9 Hz), 133.0, 129.1, 128.8, 128.2, 126.7, 123.8 (q, *J* = 5.3 Hz), 121.5 (q, *J* = 274.1 Hz), 118.3, 117.6, 113.0, 51.1.

^{19}F NMR (471 MHz, $CDCl_3$) δ –64.09.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2231, 1664, 1625, 1396, 1345, 1275, 1263, 1172, 1122.

HRMS (ESI^+) calcd. for $C_{20}H_{16}F_3N_2O^+$ $[M+H]^+$: 357.1209, found: 357.1219.

***N*-benzyl-*N*-(1-(4-chlorophenyl)vinyl)-2-(trifluoromethyl)acrylamide (1l)**



Prepared according to **General Procedure A** using 4-chloroacetophenone (0.78 mL, 6.0 mmol, 1.0 equiv), toluene (6.0 mL), benzylamine (0.65 mL, 6.0 mmol, 1.0 equiv) and 4 Å molecular sieves (1.80 g). Then using CH_2Cl_2 (20.0 mL), Et_3N (1.67 mL, 12.0 mmol, 2.00 equiv) and 2-(trifluoromethyl)-2-propenoyl chloride[9] (1.14 g, 7.20 mmol, 1.20 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of acetone/pentane (0% to 20%), affording **1l** as a white solid (1.71 g, 4.68 mmol, 78%).

M.P.: 44-46 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.37 (d, *J* = 8.5 Hz, 2H), 7.33 – 7.27 (m, 5H), 7.27 – 7.23 (m, 2H), 5.86 (s, 1H), 5.74 (s, 1H), 5.53 (d, *J* = 1.2 Hz, 1H), 4.89 (s, 1H), 4.78 (s, 2H).

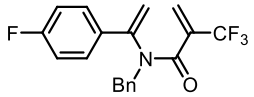
^{13}C NMR (126 MHz, $CDCl_3$) δ 164.5, 145.0, 136.3, 135.5, 134.8 (q, *J* = 31.8 Hz), 134.0, 129.4, 129.1, 128.7, 128.0, 127.5, 123.1 (q, *J* = 5.3 Hz), 121.6 (q, *J* = 274.1 Hz), 115.2, 50.6.

^{19}F NMR (471 MHz, $CDCl_3$) δ –64.12.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1663, 1626, 1396, 1342, 1276, 1261, 1171, 1136.

HRMS (ESI^+) calcd. for $C_{19}H_{16}ClF_3NO^+$ $[M+H]^+$: 366.0867, found: 366.0860.

***N*-benzyl-*N*-(1-(4-fluorophenyl)vinyl)-2-(trifluoromethyl)acrylamide (1m)**



Prepared according to **General Procedure A** using 4-fluoroacetophenone (0.73 mL, 6.0 mmol, 1.0 equiv), toluene (6.0 mL), benzylamine (0.65 mL, 6.0 mmol, 1.0 equiv) and 4 Å molecular sieves (1.80 g). Then using CH_2Cl_2 (20.0 mL), Et_3N (1.67 mL, 12.0 mmol, 2.00 equiv) and 2-(trifluoromethyl)-2-propenoyl chloride[9] (1.14 g, 7.20 mmol, 1.20 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of CH_2Cl_2/pentane (0% to 100%), affording **1m** as a white solid (1.47 g, 4.21 mmol, 70%).

M.P.: 88-90 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.37 – 7.33 (m, 2H), 7.31 – 7.24 (m, 5H), 7.11 – 7.06 (m, 2H), 5.86 (s, 1H), 5.76 (s, 1H), 5.47 (d, *J* = 1.2 Hz, 1H), 4.87 (s, 1H), 4.79 (s, 2H).

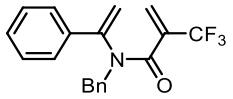
^{13}C NMR (126 MHz, $CDCl_3$) δ 164.5, 163.4 (d, *J* = 249.9 Hz), 145.1, 136.4, 134.9 (q, *J* = 31.8 Hz), 131.7 (d, *J* = 3.5 Hz), 129.1, 128.6, 128.1 (d, *J* = 8.3 Hz), 127.9, 123.0 (q, *J* = 5.3 Hz), 121.6 (q, *J* = 273.9 Hz), 116.2 (d, *J* = 21.9 Hz), 114.4, 50.7.

^{19}F NMR (471 MHz, $CDCl_3$) δ –64.13, –111.55.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1661, 1628, 1598, 1507, 1404, 1275, 1228, 1125.

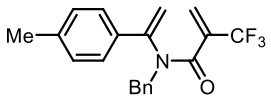
HRMS (ESI^+) calcd. for $C_{19}H_{16}F_4NO^+$ $[M+H]^+$: 350.1163, found: 350.1155.

***N*-benzyl-*N*-(1-phenylvinyl)-2-(trifluoromethyl)acrylamide (1n)**



Prepared according to **General Procedure A,** known compound.[10]

***N*-benzyl-*N*-(1-(p-tolyl)vinyl)-2-(trifluoromethyl)acrylamide (1o)**



Prepared according to **General Procedure A** using 4-methylacetophenone (0.80 mL, 6.0 mmol, 1.0 equiv), toluene (6.0 mL), benzylamine (0.65 mL, 6.0 mmol, 1.0 equiv) and 4 Å molecular sieves (1.80 g). Then using CH_2Cl_2 (20.0 mL), Et_3N (1.67 mL, 12.0 mmol, 2.00 equiv) and 2-(trifluoromethyl)-2-propenoyl chloride[9] (1.14 g, 7.20 mmol, 1.20 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of CH_2Cl_2/pentane (0% to 100%), affording **1o** as a white solid (610 mg, 1.77 mmol, 29%).

M.P.: 80-82 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 – 7.19 (m, 9H), 5.82 (s, 1H), 5.76 (s, 1H), 5.49 (s, 1H), 4.78 (s, 2H), 4.77 (s, 1H), 2.39 (s, 3H).

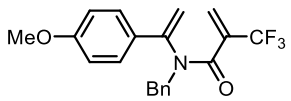
^{13}C NMR (126 MHz, $CDCl_3$) δ 164.6, 145.7, 139.6, 136.6, 134.8 (q, *J* = 31.8 Hz), 132.4, 129.9, 129.2, 128.6, 127.8, 126.1, 122.6 (q, *J* = 5.3 Hz), 121.7 (q, *J* = 274.1 Hz), 114.0, 50.4, 21.3.

^{19}F NMR (471 MHz, $CDCl_3$) δ –64.20.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1663, 1627, 1395, 1342, 1275, 1170, 1136, 1119.

HRMS (ESI^+) calcd. for $C_{20}H_{19}F_3NO^+$ $[M+H]^+$: 346.1413, found: 346.1404.

***N*-benzyl-*N*-(1-(4-methoxyphenyl)vinyl)-2-(trifluoromethyl)acrylamide (1p)**



Prepared according to **General Procedure A** using 4-methoxyacetophenone (1.05 g, 7.00 mmol, 1.00 equiv), toluene (7.0 mL), benzylamine (0.76 mL, 7.0 mmol, 1.0 equiv) and 4 Å molecular sieves (2.1 g). Then using CH_2Cl_2 (25.0 mL), Et_3N (1.95 mL, 14.0 mmol, 2.00 equiv) and 2-(trifluoromethyl)-2-propenoyl chloride[9] (1.33 g, 8.40 mmol, 1.20 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/CH_2Cl_2 (0% to 10%), affording **1p** as a colourless oil (1.38 g, 3.82 mmol, 55%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.8 Hz, 2H), 7.31 – 7.24 (m, 5H), 6.93 (d, *J* = 8.9 Hz, 2H), 5.83 (s, 1H), 5.77 (s, 1H), 5.41 (s, 1H), 4.78 (s, 2H), 4.74 (s, 1H), 3.85 (s, 3H).

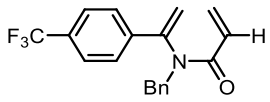
^{13}C NMR (126 MHz, $CDCl_3$) δ 164.6, 160.6, 145.4, 136.6, 134.8 (q, *J* = 31.7 Hz), 129.2, 128.6, 127.79, 127.77, 127.6, 122.5 (q, *J* = 5.3 Hz), 121.7 (q, *J* = 273.9 Hz), 114.5, 112.9, 55.5, 50.4.

^{19}F NMR (471 MHz, $CDCl_3$) δ –64.16.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1663, 1627, 1606, 1395, 1277, 1173, 1136, 1120.

HRMS (ESI^+) calcd. for $C_{20}H_{19}F_3NO_2^+$ $[M+H]^+$: 362.1362, found: 362.1344.

***N*-benzyl-*N*-(1-(4-(trifluoromethyl)phenyl)vinyl)acrylamide (1q)**



Prepared according to **General Procedure A** using 4-(trifluoromethyl)acetophenone (1.13 g, 6.00 mmol, 1.00 equiv), toluene (6.0 mL), benzylamine (0.65 mL, 6.0 mmol, 1.0 equiv) and 4 Å molecular sieves (1.80 g). Then using CH_2Cl_2 (20.0 mL), Et_3N (1.67 mL, 12.0 mmol, 2.00 equiv) and acryloyl chloride (0.59 mL, 7.2 mmol, 1.2 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **1q** as a colourless oil (1.55 g, 4.68 mmol, 78%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.2 Hz, 2H), 7.50 (d, *J* = 8.2 Hz, 2H), 7.29 – 7.21 (m, 5H), 6.53 – 6.44 (m, 2H), 5.70 (s, 1H), 5.64 (dd, *J* = 7.6, 4.8 Hz, 1H), 5.00 (s, 1H), 4.70 (s, 2H).

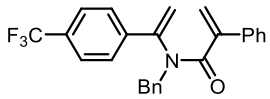
^{13}C NMR (126 MHz, $CDCl_3$) δ 166.1, 144.5, 139.4, 137.0, 131.2 (q, *J* = 32.7 Hz), 129.1, 128.8, 128.4, 128.1, 127.6, 126.5, 126.0 (q, *J* = 3.8 Hz), 123.9 (q, *J* = 272.1 Hz), 117.5, 49.9.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.69.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1657, 1616, 1407, 1321, 1275, 1267, 1223, 1166, 1115.

HRMS (ESI^+) calcd. for $C_{19}H_{17}F_3NO^+$ $[M+H]^+$: 332.1257, found: 332.1249.

N-benzyl-2-phenyl-*N*-(1-(4-(trifluoromethyl)phenyl)vinyl)acrylamide (1r)



Prepared according to **General Procedure A** using 4-(trifluoromethyl)acetophenone (1.50 g, 8.00 mmol, 1.00 equiv), toluene (8.0 mL), benzylamine (0.87 mL, 8.0 mmol, 1.0 equiv) and 4 Å molecular sieves (2.40 g). Then using CH_2Cl_2 (30.0 mL), Et_3N (2.23 mL, 16.0 mmol, 2.00 equiv) and crude 2-phenylacryloyl chloride[A] (12.0 mmol, 1.50 equiv) in CH_2Cl_2 (9.0 mL). The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of acetone/pentane (0% to 20%) and Et_2O/pentane (0% to 50%), affording **1r** as a colourless oil (1.81 g, 4.45 mmol, 56%).

Notes: (**A**) Crude 2-phenylacryloyl chloride was prepared according to **General Procedure B** (acyl chloride synthesis step) using 2-phenylacrylic acid (1.78 g, 12.0 mmol, 1.50 equiv), CH_2Cl_2 (40.0 mL), oxalyl chloride (1.22 mL, 14.4 mmol, 1.80 equiv) and DMF (5 drops).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.49 (d, *J* = 8.1 Hz, 2H), 7.33 – 7.21 (m, 12H), 5.46 (s, 1H), 5.39 (s, 1H), 5.37 (s, 1H), 4.84 (s, 2H), 4.79 (s, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.7, 145.5, 145.1, 139.7, 137.1, 136.8, 130.7 (q, *J* = 32.4 Hz), 129.1, 128.6, 128.5, 128.3, 127.8, 126.7, 126.2, 125.6 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.3 Hz), 116.1, 116.0, 50.4.

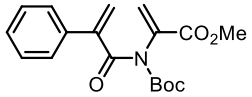
^{19}F NMR (471 MHz, $CDCl_3$) δ –62.68.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1651, 1617, 1388, 1324, 1276, 1261, 1167, 1123, 1064.

HRMS (ESI^+) calcd. for $C_{25}H_{21}F_3NO^+$ $[M+H]^+$: 408.1570, found: 408.1563.

2.3.2 Synthesis and Characterisation of Precurors (7)

Methyl 2-(*N*-(*tert*-butoxycarbonyl)-2-phenylacrylamido)acrylate (7a)



Prepared according to **General Procedure B** using 2-phenylacrylic acid (5.92 g, 40.0 mmol, 2.00 equiv), CH_2Cl_2 (133.0 mL), oxalyl chloride (5.15 mL, 60.0 mmol, 3.00 equiv) and DMF (5 drops). Then using CH_2Cl_2 (67.0 mL), Et_3N (11.2 mL, 80.0 mmol, 4.00 equiv), methyl 2-((*tert*-butoxycarbonyl)amino)acrylate[11] (4.02 g, 20.0 mmol, 1.00 equiv) in CH_2Cl_2 (20.0 mL), and DMAP (1.22 g, 10.0 mmol, 0.50 equiv). The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%) and ethyl acetate/CH_2Cl_2 (0% to 10%), affording **7a** (5.10 g, 15.41 mmol, 77%) as a colourless oil.

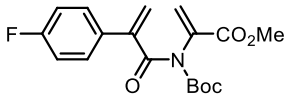
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.52 – 7.48 (m, 2H), 7.37 – 7.32 (m, 2H), 7.31 – 7.28 (m, 1H), 6.49 (d, J = 0.9 Hz, 1H), 5.79 (s, 1H), 5.78 (d, J = 0.9 Hz, 1H), 5.74 (s, 1H), 3.80 (s, 3H), 1.24 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.5, 163.6, 151.2, 146.2, 135.9, 135.5, 128.5, 128.4, 126.7, 126.1, 117.8, 84.3, 52.6, 27.5.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1732, 1689, 1439, 1368, 1275, 1212, 1113, 1091.

HRMS (ESI^+) calcd. for $C_{18}H_{21}NO_5Na^+$ $[M+Na]^+$: 354.1312, found: 354.1296.

Methyl 2-(*N*-(*tert*-butoxycarbonyl)-2-(4-fluorophenyl)acrylamido)acrylate (7b)



Prepared according to **General Procedure B** using 2-(4-fluorophenyl)acrylic acid[12] (664 mg, 4.00 mmol, 2.00 equiv), CH_2Cl_2 (13.3 mL), oxalyl chloride (0.52 mL, 6.0 mmol, 3.0 equiv) and DMF (3 drops). Then using CH_2Cl_2 (6.70 mL), Et_3N (1.12 mL, 8.00 mmol, 4.00 equiv), methyl 2-((*tert*-butoxycarbonyl)amino)acrylate[11] (402 mg, 2.00 mmol, 1.00 equiv) in CH_2Cl_2 (2.0 mL), and DMAP (122 mg, 1.00 mmol, 0.50 equiv). The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 20%) and Et_2O/CH_2Cl_2 (5% to 10%), affording **7b** (402 mg, 1.15 mmol, 58%) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.50 – 7.45 (m, 2H), 7.03 – 6.98 (m, 2H), 6.46 (d, J = 0.9 Hz, 1H), 5.74 (d, J = 0.9 Hz, 1H), 5.70 (s, 1H), 5.69 (s, 1H), 3.77 (s, 3H), 1.24 (s, 9H).

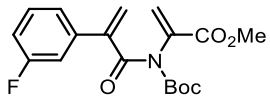
^{13}C NMR (126 MHz, $CDCl_3$) δ 171.2, 163.4, 162.7 (d, J = 248.0 Hz), 151.1, 145.1, 135.3, 132.1 (d, J = 3.5 Hz), 128.6 (d, J = 8.2 Hz), 126.1, 117.4, 115.3 (d, J = 21.7 Hz), 84.3, 52.6, 27.4.

^{19}F NMR (471 MHz, $CDCl_3$) δ –113.41.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1736, 1692, 1511, 1370, 1275, 1225, 1155, 1114.

HRMS (ESI^+) calcd. for $C_{18}H_{20}FNO_5Na^+$ $[M+Na]^+$: 372.1218, found: 372.1201.

Methyl 2-(*N*-(*tert*-butoxycarbonyl)-2-(3-fluorophenyl)acrylamido)acrylate (7c)



Prepared according to **General Procedure B** using 2-(3-fluorophenyl)acrylic acid[12] (664 mg, 4.00 mmol, 2.00 equiv), CH_2Cl_2 (13.3 mL), oxalyl chloride (0.52 mL, 6.0 mmol, 3.0 equiv) and DMF (3 drops). Then using CH_2Cl_2 (6.70 mL), Et_3N (1.12 mL, 8.00 mmol, 4.00 equiv), methyl 2-((*tert*-butoxycarbonyl)amino)acrylate[11] (402 mg, 2.00 mmol, 1.00 equiv) in CH_2Cl_2 (2.0 mL), and DMAP (122 mg, 1.00 mmol, 0.50 equiv). The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 20%) and Et_2O/CH_2Cl_2 (5% to 10%), affording **7c** (351 mg, 1.01 mmol, 50%) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 – 7.27 (m, 2H), 7.25 – 7.21 (m, 1H), 7.01 – 6.96 (m, 1H), 6.50 (d, J = 0.9 Hz, 1H), 5.79 (s, 1H), 5.771 (s, 1H), 5.768 (s, 1H), 3.81 (s, 3H), 1.25 (s, 9H).

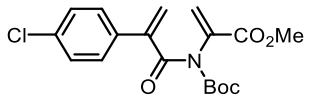
^{13}C NMR (126 MHz, $CDCl_3$) δ 170.9, 163.5, 162.9 (d, J = 245.5 Hz), 151.2, 145.2 (d, J = 2.5 Hz), 138.1 (d, J = 7.8 Hz), 135.3, 130.1 (d, J = 8.3 Hz), 126.3, 122.5 (d, J = 3.0 Hz), 118.6, 115.3 (d, J = 21.0 Hz), 113.7 (d, J = 22.6 Hz), 84.5, 52.7, 27.5.

^{19}F NMR (471 MHz, $CDCl_3$) δ –113.05.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1737, 1693, 1581, 1440, 1370, 1284, 1259, 1154, 1109.

HRMS (ESI^+) calcd. for $C_{18}H_{20}FNO_5Na^+$ $[M+Na]^+$: 372.1218, found: 372.1203.

Methyl 2-(*N*-(*tert*-butoxycarbonyl)-2-(4-chlorophenyl)acrylamido)acrylate (7d)



Prepared according to **General Procedure B** using 2-(4-chlorophenyl)acrylic acid[13] (728 mg, 4.00 mmol, 2.00 equiv), CH_2Cl_2 (13.3 mL), oxalyl chloride (0.52 mL, 6.0 mmol, 3.0 equiv) and DMF (3

drops). Then using CH_2Cl_2 (6.70 mL), Et_3N (1.12 mL, 8.00 mmol, 4.00 equiv), methyl 2-((*tert*-butoxycarbonyl)amino)acrylate[11] (402 mg, 2.00 mmol, 1.00 equiv) in CH_2Cl_2 (2.0 mL) and DMAP (122 mg, 1.00 mmol, 0.50 equiv). The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 20%) and Et_2O/CH_2Cl_2 (5% to 10%), affording **7d** (410 mg, 1.12 mmol, 56%) as a colourless oil.

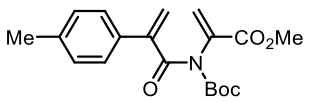
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.44 (d, *J* = 8.7 Hz, 2H), 7.31 (d, *J* = 8.6 Hz, 2H), 6.48 (d, *J* = 0.9 Hz, 1H), 5.76 (d, *J* = 1.0 Hz, 1H), 5.75 (s, 1H), 5.73 (s, 1H), 3.79 (s, 3H), 1.25 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.1, 163.5, 151.2, 145.2, 135.3, 134.4, 134.3, 128.7, 128.1, 126.2, 118.0, 84.4, 52.7, 27.5.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1735, 1691, 1581, 1493, 1369, 1285, 1257, 1154, 1111.

HRMS (ESI^+) calcd. for $C_{18}H_{20}ClNO_5Na^+$ $[M+Na]^+$: 388.0922, found: 388.0905.

Methyl 2-(*N*-(*tert*-butoxycarbonyl)-2-(*p*-tolyl)acrylamido)acrylate (7e)



Prepared according to **General Procedure B** using 2-(*p*-tolyl)acrylic acid (648 mg, 4.00 mmol, 2.00 equiv)[12], CH_2Cl_2 (13.3 mL), oxalyl chloride (0.52 mL, 6.0 mmol, 3.0 equiv) and DMF (3 drops). Then using CH_2Cl_2 (6.70 mL), Et_3N (1.12 mL, 8.00 mmol, 4.00 equiv), methyl 2-((*tert*-butoxycarbonyl)amino)acrylate[11] (402 mg, 2.00 mmol, 1.00 equiv) in CH_2Cl_2 (2.0 mL) and DMAP (122 mg, 1.00 mmol, 0.50 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 20%), affording **7e** (450 mg, 1.30 mmol, 65%) as a colourless oil.

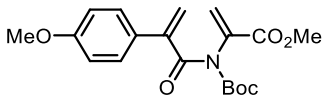
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.39 (d, *J* = 8.2 Hz, 2H), 7.15 (d, *J* = 8.0 Hz, 2H), 6.48 (s, 1H), 5.77 (s, 1H), 5.75 (d, *J* = 1.0 Hz, 1H), 5.68 (d, *J* = 1.1 Hz, 1H), 3.80 (s, 3H), 2.33 (s, 3H), 1.26 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.7, 163.6, 151.3, 146.1, 138.3, 135.5, 133.0, 129.2, 126.6, 126.1, 116.6, 84.3, 52.6, 27.5, 21.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1734, 1691, 1643, 1515, 1439, 1369, 1286, 1211, 1155, 1084, 975.

HRMS (ESI^+) calcd. for $C_{19}H_{23}NO_5Na^+$ $[M+Na]^+$: 368.1468, found: 368.1451.

Methyl 2-(*N*-(*tert*-butoxycarbonyl)-2-(4-methoxyphenyl)acrylamido)acrylate (7f)



Prepared according to **General Procedure B** using 2-(4-methoxyphenyl)acrylic acid[12] (712 mg, 4.00 mmol, 2.00 equiv), CH_2Cl_2 (13.3 mL), oxalyl chloride (0.52 mL, 6.0 mmol, 3.0 equiv) and DMF (3 drops). Then using CH_2Cl_2 (6.70 mL), Et_3N (1.12 mL, 8.00 mmol, 4.00 equiv), methyl 2-((*tert*-butoxycarbonyl)amino)acrylate[11] (402 mg, 2.00 mmol, 1.00 equiv) in CH_2Cl_2 (2.0 mL) and DMAP (122 mg, 1.00 mmol, 0.50 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **7f** (430 mg, 1.19 mmol, 60%) as a colourless oil.

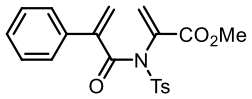
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.44 (d, *J* = 8.9 Hz, 2H), 6.87 (d, *J* = 8.8 Hz, 2H), 6.48 (s, 1H), 5.77 (s, 1H), 5.69 (s, 1H), 5.62 (s, 1H), 3.81 (s, 3H), 3.79 (s, 3H), 1.27 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.8, 163.6, 159.9, 151.4, 145.7, 135.5, 128.5, 128.1, 126.1, 115.6, 113.9, 84.3, 55.4, 52.7, 27.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1733, 1690, 1608, 1514, 1440, 1369, 1279, 1216, 1154, 1113.

HRMS (ESI^+) calcd. for $C_{19}H_{23}NO_6Na^+$ $[M+Na]^+$: 384.1418, found: 384.1406.

Methyl 2-(2-phenyl-*N*-tosylacrylamido)acrylate (7g)



Prepared according to **General Procedure B** using 2-phenylacrylic acid (4.74 g, 32.0 mmol, 2.00 equiv), CH_2Cl_2 (100.0 mL), oxalyl chloride (4.06 mL, 48.0 mmol, 3.00 equiv) and DMF (6 drops). Then using CH_2Cl_2 (54.0 mL), Et_3N (8.92 mL, 64.0 mmol, 4.00 equiv), methyl 2-((4-methylphenyl)sulfonamido)acrylate[14] (4.10 g, 16.0 mmol, 1.00 equiv) in CH_2Cl_2 (16.0 mL) and DMAP (976 mg, 8.00 mmol, 0.50 equiv). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **7g** (1.55 g, 4.03 mmol, 25%) as a colourless oil.

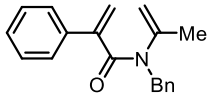
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.4 Hz, 2H), 7.35 – 7.31 (m, 2H), 7.30 – 7.25 (m, 3H), 7.23 – 7.19 (m, 2H), 6.40 (d, *J* = 0.9 Hz, 1H), 5.67 (d, *J* = 0.9 Hz, 1H), 5.61 (s, 1H), 5.45 (s, 1H), 3.63 (s, 3H), 2.43 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.4, 163.3, 145.3, 144.1, 135.2, 134.7, 133.6, 132.0, 129.7, 129.2, 128.9, 128.7, 126.3, 119.0, 52.7, 21.7.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1733, 1699, 1631, 1438, 1362, 1321, 1206, 1166, 1084, 1048.

HRMS (ESI$^+$) calcd. for $C_{20}H_{19}NO_5SNa^+$ $[M+Na]^+$: 408.0876, found: 408.0857.

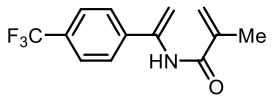
N-benzyl-2-phenyl-*N*-(prop-1-en-2-yl)acrylamide (7h)



Prepared according to **General Procedure A,** known compound.[15]

2.3.3 Synthesis and Characterisation of Precurors (2)

_N_-(1-(4-(trifluoromethyl)phenyl)vinyl)methacrylamide (S2a)



Prepared according to **General Procedure C4 (step C4-1)** using 4-(trifluoromethyl)benzonitrile (3.42 g, 20.0 mmol, 1.00 equiv), THF (20.0 mL), MeLi (8.40 mL, 3.1 M in diethoxymethane, 26.0 mmol, 1.30 equiv), MeOH (1.22 mL, 30.0 mmol, 1.50 equiv), CH_2Cl_2 (ca. 30–40 mL), Et_3N (5.58 mL, 40.0 mmol, 2.00 equiv) and methacryloyl chloride (2.93 mL, 30.0 mmol, 1.50 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 25%) afforded **S2a** (2.70 g, 10.6 mmol, 53%) as a white solid.

M.P.: 66-68 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.60 (d, *J* = 8.2 Hz, 2H), 7.51 (d, *J* = 8.2 Hz, 2H), 7.41 (s, 1H), 5.81 (s, 1H), 5.74 (s, 1H), 5.42 (q, *J* = 1.7 Hz, 1H), 5.18 (s, 1H), 1.99 (s, 3H).

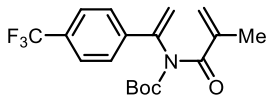
^{13}C NMR (126 MHz, $CDCl_3$) δ 167.3, 141.8, 140.4, 139.8, 130.6 (q, *J* = 32.5 Hz), 126.4, 125.7 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.1 Hz), 120.3, 105.5, 18.7.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.68.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1664, 1619, 1500, 1320, 1163, 1114, 1064, 1015.

HRMS (ESI^+) calcd. for $C_{13}H_{13}F_3NO^+$ $[M+H]^+$: 256.0944, found: 256.0941.

***Tert*-butyl methacryloyl(1-(4-(trifluoromethyl)phenyl)vinyl)carbamate (2a)**



Prepared according to **General Procedure C4 (step C4-2)** using **S2a** (510 mg, 2.00 mmol, 1.00 equiv) and THF (10.0 mL), then *n*-BuLi (0.80 mL, 2.5 M in hexane, 2.0 mmol, 1.0 equiv), and di-tert-butyl dicarbonate (523 mg, 2.40 mmol, 1.20 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2a** (590 mg, 1.66 mmol, 83 %) as a white solid.

M.P.: 75-77 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.60 (d, *J* = 8.4 Hz, 2H), 7.55 (d, *J* = 8.5 Hz, 2H), 5.74 (d, *J* = 1.2 Hz, 1H), 5.58 (s, 1H), 5.41 (q, *J* = 1.8 Hz, 1H), 5.29 (d, *J* = 1.3 Hz, 1H), 2.07 (s, 3H), 1.31 (s, 9H).

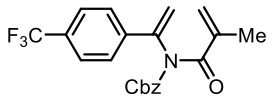
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.8, 152.6, 143.5, 142.5, 140.9, 130.7 (q, *J* = 32.5 Hz), 126.2, 125.7 (q, *J* = 3.8 Hz), 124.1 (q, *J* = 272.1 Hz), 119.4, 115.5, 83.9, 27.7, 19.0.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.68.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1737, 1690, 1636, 1370, 1323, 1276, 1155, 1115, 1064.

HRMS (ESI^+) calcd. for $C_{18}H_{20}F_3NO_3Na^+$ $[M+Na]^+$: 378.1287, found: 378.1285.

Benzyl methacryloyl(1-(4-(trifluoromethyl)phenyl)vinyl)carbamate (2b)



Prepared according to **General Procedure C4 (step C4-2)** using **S2a** (510 mg, 2.00 mmol, 1.00 equiv) and THF (10.0 mL), then *n*-BuLi (0.80 mL, 2.5 M in hexane, 2.0 mmol, 1.0 equiv) and benzyl chloroformate (0.34 mL, 2.4 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2b** (660 mg, 1.70 mmol, 85 %) as a white solid.

M.P.: 58-60 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.55 (d, *J* = 8.2 Hz, 2H), 7.49 (d, *J* = 8.1 Hz, 2H), 7.31 – 7.23 (m, 3H), 7.09 – 7.05 (m, 2H), 5.79 (d, *J* = 1.4 Hz, 1H), 5.55 (s, 1H), 5.39 (q, *J* = 1.6 Hz, 1H), 5.31 (d, *J* = 1.4 Hz, 1H), 5.10 (s, 2H), 2.04 (dd, *J* = 1.6, 1.0 Hz, 3H).

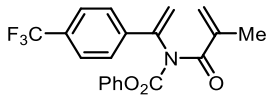
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.5, 153.9, 143.0, 142.0, 140.3 (q, *J* = 1.6 Hz), 134.5, 130.7 (q, *J* = 32.5 Hz), 128.7, 128.6, 128.5, 126.0, 125.8 (q, *J* = 3.8 Hz), 124.1 (q, *J* = 272.1 Hz), 120.0, 116.1, 69.1, 18.9.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.64.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1739, 1694, 1636, 1456, 1408, 1380, 1322, 1261, 1166, 1115.

HRMS (ESI^+) calcd. for $C_{21}H_{19}F_3NO_3^+$ $[M+H]^+$: 390.1312, found: 390.1315.

Phenyl methacryloyl(1-(4-(trifluoromethyl)phenyl)vinyl)carbamate (2c)



Prepared according to **General Procedure C4 (step C4-2)** using **S2a** (510 mg, 2.00 mmol, 1.00 equiv) and THF (10.0 mL), then *n*-BuLi (0.80 mL, 2.5 M in hexane, 2.0 mmol, 1.0 equiv) and phenyl chloroformate (0.30 mL, 2.4 mmol, 1.2 equiv). Purification by Biotage automated flash

chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2c** (610 mg, 1.63 mmol, 81 %) as a white solid.

M.P.: 88-90 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.67 (s, 4H), 7.35 – 7.30 (m, 2H), 7.24 – 7.19 (m, 1H), 6.93 – 6.89 (m, 2H), 5.90 (d, *J* = 1.5 Hz, 1H), 5.74 (d, *J* = 1.2 Hz, 1H), 5.54 (q, *J* = 1.6 Hz, 1H), 5.49 (d, *J* = 1.5 Hz, 1H), 2.13 (t, *J* = 1.3 Hz, 3H).

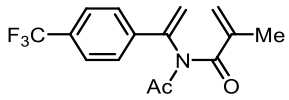
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.3, 152.6, 150.3, 142.9, 142.0, 140.2, 131.0 (q, *J* = 32.7 Hz), 129.6, 126.5, 126.2, 125.9 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.1 Hz), 120.9, 120.4, 116.5, 18.9.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.66.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1750, 1701, 1637, 1618, 1490, 1409, 1325, 1264, 1158, 1115, 1062.

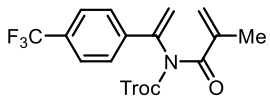
HRMS (ESI^+) calcd. for $C_{20}H_{17}F_3NO_3^+$ $[M+H]^+$: 376.1155, found: 376.1152.

_N_-acetyl-_N_-(1-(4-(trifluoromethyl)phenyl)vinyl)methacrylamide (2d)



Prepared according to **General Procedure C1, known compound.**[16]

2,2,2-Trichloroethyl methacryloyl(1-(4-(trifluoromethyl)phenyl)vinyl)carbamate (2e)



Prepared according to **General Procedure C4 (step C4-2)** using **S2a** (510 mg, 2.00 mmol, 1.00 equiv) and THF (10.0 mL), then *n*-BuLi (0.80 mL, 2.5 M in hexane, 2.0 mmol, 1.0 equiv) and 2,2,2-trichloroethyl chloroformate (0.33 mL, 2.4 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 25%) afforded **2e** (740 mg, 1.72 mmol, 86 %) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.62 (d, *J* = 9.0 Hz, 2H), 7.58 (d, *J* = 8.4 Hz, 2H), 5.87 (d, *J* = 1.5 Hz, 1H), 5.64 (s, 1H), 5.51 (q, *J* = 1.6 Hz, 1H), 5.41 (d, *J* = 1.5 Hz, 1H), 4.72 (s, 2H), 2.09 (s, 3H).

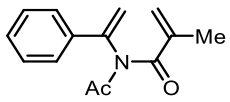
^{13}C NMR (126 MHz, $CDCl_3$) δ 172.9, 152.3, 142.6, 141.5, 139.9, 131.0 (q, *J* = 32.7 Hz), 126.3, 125.8 (q, *J* = 3.7 Hz), 124.0 (q, *J* = 272.1 Hz), 121.0, 116.9, 94.1, 75.8, 18.9.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.72.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1749, 1700, 1637, 1619, 1452, 1376, 1260, 1166, 1116, 1064.

HRMS (ESI$^+$) calcd. for $C_{16}H_{14}Cl_3F_3NO_3^+$ $[M+H]^+$: 429.9986, found: 429.9986.

***N*-acetyl-*N*-(1-phenylvinyl) methacrylamide (2f)**



Prepared according to **General Procedure C1** using *N*-(1-phenylvinyl)acetamide **S2f** (483 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2f** (460 mg, 2.01 mmol, 67 %) as a white solid.

M.P.: 65-67 ℃

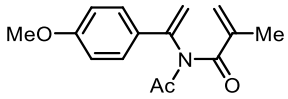
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.45 – 7.30 (m, 5H), 5.83 (s, 1H), 5.51 (s, 1H), 5.33 (s, 1H), 5.21 (s, 1H), 2.32 (s, 3H), 1.92 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.2, 173.5, 144.7, 141.4, 136.0, 129.1, 128.9, 125.6, 120.2, 114.8, 25.3, 19.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1689, 1632, 1495, 1446, 1365, 1316, 1246, 1170, 1027.

HRMS (ESI$^+$) calcd. for $C_{14}H_{15}NO_2Na^+$ $[M+Na]^+$: 252.0995, found: 252.0987.

***N*-acetyl-*N*-(1-(4-methoxyphenyl)vinyl)methacrylamide (2g)**



Prepared according to **General Procedure C1** using *N*-(1-(4-methoxyphenyl)vinyl)acetamide **S2g** (383 mg, 2.00 mmol, 1.00 equiv) and CH_2Cl_2 (8.0 mL), then Et_3N (0.84 mL, 6.0 mmol, 3.0 equiv), methacryloyl chloride (0.39 mL, 4.0 mmol, 2.0 equiv), and DMAP (73 mg, 0.60 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 50%) afforded **2g** (410 mg, 1.58 mmol, 79 %) as a colourless oil.

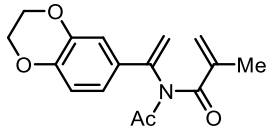
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 (d, J = 8.8 Hz, 2H), 6.83 (d, J = 8.8 Hz, 2H), 5.67 (s, 1H), 5.47 (s, 1H), 5.28 (s, 1H), 5.06 (s, 1H), 3.74 (s, 3H), 2.27 (s, 3H), 1.90 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.1, 173.4, 160.1, 144.1, 141.2, 128.4, 126.9, 119.8, 114.1, 112.6, 55.2, 25.0, 19.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1691, 1606, 1511, 1366, 1302, 1248, 1176, 1028, 892.

HRMS (ESI$^+$) calcd. for $C_{15}H_{17}NO_3Na^+$ [M+Na]$^+$: 282.1101, found: 282.1094.

***N*-acetyl-*N*-(1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)vinyl)methacrylamide (2h)**



Prepared according to **General Procedure C1** using *N*-(1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)vinyl)acetamide **S2h** (548 mg, 2.50 mmol, 1.00 equiv) and CH_2Cl_2 (10.0 mL), then Et_3N (1.05 mL, 7.50 mmol, 3.00 equiv), methacryloyl chloride (0.49 mL, 5.0 mmol, 2.0 equiv), and DMAP (92 mg, 0.75 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 50%) afforded **2h** (550 mg, 1.92 mmol, 77 %) as a colourless oil.

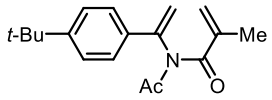
^{1}H NMR (500 MHz, $CDCl_3$) δ 6.94 – 6.90 (m, 2H), 6.81 (d, *J* = 8.3 Hz, 1H), 5.69 (s, 1H), 5.49 (s, 1H), 5.31 (d, *J* = 1.7 Hz, 1H), 5.08 (d, *J* = 1.1 Hz, 1H), 4.27 – 4.19 (m, 4H), 2.30 (s, 3H), 1.94 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.1, 173.5, 144.5, 144.0, 143.7, 141.4, 129.5, 120.0, 118.9, 117.7, 114.6, 113.3, 64.5, 64.3, 25.2, 19.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1691, 1629, 1580, 1506, 1457, 1366, 1276, 1199, 1065.

HRMS (ESI$^+$) calcd. for $C_{16}H_{17}NO_4Na^+$ [M+Na]$^+$: 310.1050, found: 310.1039.

***N*-acetyl-*N*-(1-(4-(*tert*-butyl)phenyl)vinyl)methacrylamide (2i)**



Prepared according to **General Procedure C1** using *N*-(1-(4-(*tert*-butyl)phenyl)vinyl)acetamide **S2i** (651 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2i** (630 mg, 2.21 mmol, 74 %) as a colourless oil.

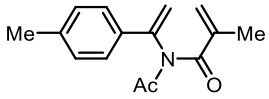
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.37 (s, 4H), 5.81 (d, *J* = 1.0 Hz, 1H), 5.52 (s, 1H), 5.33 (d, *J* = 0.9 Hz, 1H), 5.16 (d, *J* = 1.0 Hz, 1H), 2.33 (s, 3H), 1.95 (s, 3H), 1.31 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.3, 173.6, 152.4, 144.6, 141.5, 133.0, 125.9, 125.4, 120.0, 114.0, 34.8, 31.3, 25.3, 19.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1713, 1695, 1632, 1366, 1299, 1274, 1258, 1176, 840.

HRMS (ESI$^+$) calcd. for $C_{18}H_{23}NO_2Na^+$ [M+Na]$^+$: 308.1621, found: 308.1606.

N-acetyl-*N*-(1-(*p*-tolyl)vinyl)methacrylamide (2j)



Prepared according to **General Procedure C1** using *N*-(1-(*p*-tolyl)vinyl)acetamide **S2j** (525 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2j** (500 mg, 2.06 mmol, 69 %) as a white solid.

M.P.: 37-39 °C

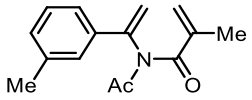
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.32 (d, *J* = 8.2 Hz, 2H), 7.15 (d, *J* = 8.0 Hz, 2H), 5.78 (s, 1H), 5.51 (s, 1H), 5.31 (s, 1H), 5.15 (s, 1H), 2.33 (s, 3H), 2.31 (s, 3H), 1.93 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.2, 173.5, 144.6, 141.4, 139.1, 133.1, 129.6, 125.5, 120.0, 113.8, 25.2, 21.2, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1691, 1629, 1512, 1452, 1366, 1315, 1295, 1250, 1187, 1109, 1017, 893.

HRMS (ESI$^+$) calcd. for $C_{15}H_{17}NO_2Na^+$ [M+Na]$^+$: 266.1152, found: 266.1143.

N-Acetyl-*N*-(1-(*m*-tolyl)vinyl)methacrylamide (2k)



Prepared according to **General Procedure C1** using *N*-(1-(*m*-tolyl)vinyl)acetamide **S2k** (525 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 35%) afforded **2k** (480 mg, 1.98 mmol, 66 %) as a white solid.

M.P.: 39-41 °C

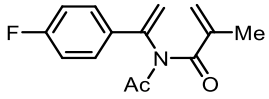
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.26 – 7.20 (m, 3H), 7.15 – 7.12 (m, 1H), 5.81 (d, *J* = 1.0 Hz, 1H), 5.51 (s, 1H), 5.32 (d, *J* = 1.7 Hz, 1H), 5.19 (d, *J* = 1.1 Hz, 1H), 2.35 (s, 3H), 2.32 (s, 3H), 1.94 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.2, 173.5, 144.8, 141.4, 138.5, 135.9, 129.9, 128.8, 126.3, 122.8, 120.1, 114.5, 25.2, 21.5, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1691, 1629, 1512, 1453, 1366, 1275, 1260, 1162, 907.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_2Na^+$ $[M+Na]^+$: 266.1152, found: 266.1144.

***N*-acetyl-*N*-(1-(4-fluorophenyl)vinyl)methacrylamide (2l)**



Prepared according to **General Procedure C1** using *N*-(1-(4-fluorophenyl)vinyl)acetamide **S2l** (537 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2l** (530 mg, 2.15 mmol, 72 %) as a white solid.

M.P.: 55-57 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41-7.36 (m, 2H), 7.06 – 6.99 (m, 2H), 5.74 (s, 1H), 5.48 (s, 1H), 5.33 (d, J = 2.1 Hz, 1H), 5.18 (s, 1H), 2.31 (s, 3H), 1.91 (s, 3H).

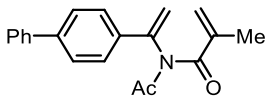
^{13}C NMR (126 MHz, $CDCl_3$) δ 174.1, 173.4, 163.1 (d, J = 249.4 Hz), 143.8, 141.3, 132.3 (d, J = 3.4 Hz), 127.6 (d, J = 8.3 Hz), 120.5, 115.9 (d, J = 21.9 Hz), 114.6, 25.2, 19.1.

^{19}F NMR (471 MHz, $CDCl_3$) δ –112.17.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1691, 1632, 1602, 1508, 1453, 1366, 1306, 1231, 1160, 1110, 1012, 895.

HRMS (ESI^+) calcd. for $C_{14}H_{14}FNO_2Na^+$ $[M+Na]^+$: 270.0901, found: 270.0898.

***N*-(1-([1,1'-biphenyl]-4-yl)vinyl)-*N*-acetylmethacrylamide (2m)**



Prepared according to **General Procedure C1** using *N*-(1-([1,1'-biphenyl]-4-yl)vinyl)acetamide **S2m** (474 mg, 2.00 mmol, 1.00 equiv) and CH_2Cl_2 (8.0 mL), then Et_3N (0.84 mL, 6.00 mmol, 3.00 equiv), methacryloyl chloride (0.39 mL, 4.0 mmol, 2.0 equiv), and DMAP (73 mg, 0.60 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 50%) afforded **2m** (440 mg, 1.44 mmol, 72 %) as a white solid.

M.P.: 140-142 °C

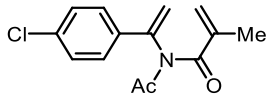
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.63 – 7.58 (m, 4H), 7.54 – 7.50 (m, 2H), 7.48 – 7.43 (m, 2H), 7.39 – 7.34 (m, 1H), 5.90 (d, *J* = 1.2 Hz, 1H), 5.56 (s, 1H), 5.37 (q, *J* = 1.6 Hz, 1H), 5.25 (d, *J* = 1.2 Hz, 1H), 2.38 (s, 3H), 1.98 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.2, 173.5, 144.4, 141.9, 141.4, 140.2, 134.8, 128.9, 127.8, 127.6, 127.1, 126.1, 120.3, 114.7, 25.3, 19.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1712, 1685, 1637, 1607, 1487, 1366, 1311, 1265, 1166, 846.

HRMS (ESI^+) calcd. for $C_{20}H_{19}NO_2Na^+$ $[M+Na]^+$: 328.1308, found: 328.1298.

N-acetyl-*N*-(1-(4-chlorophenyl)vinyl)methacrylamide (2n)



Prepared according to **General Procedure C1** using *N*-(1-(4-chlorophenyl)vinyl)acetamide **S2n** (390 mg, 2.00 mmol, 1.00 equiv) and CH_2Cl_2 (8.0 mL), then Et_3N (0.84 mL, 6.0 mmol, 3.0 equiv), methacryloyl chloride (0.39 mL, 4.0 mmol, 2.0 equiv), and DMAP (73 mg, 0.60 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 50%) afforded **2n** (424 mg, 1.61 mmol, 81 %) as a colourless oil.

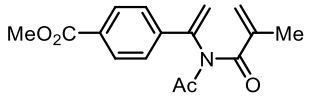
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.7 Hz, 2H), 7.27 (d, *J* = 8.8 Hz, 2H), 5.76 (d, *J* = 1.4 Hz, 1H), 5.46 (s, 1H), 5.30 (q, *J* = 1.6 Hz, 1H), 5.18 (d, *J* = 1.4 Hz, 1H), 2.28 (s, 3H), 1.88 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.8, 173.1, 143.6, 141.0, 134.7, 134.5, 128.9, 126.8, 120.4, 115.1, 25.1, 18.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1693, 1632, 1491, 1367, 1259, 1172, 1090, 1011, 834.

HRMS (ESI^+) calcd. for $C_{14}H_{15}ClNO_2^+$ $[M+H]^+$: 264.0786, found: 264.0783.

Methyl 4-(1-(N-acetylmethacrylamido)vinyl)benzoate (2o)



Prepared according to **General Procedure C1** using methyl 4-(1-acetamidovinyl)benzoate **S2o** (657 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2o** (680 mg, 2.37 mmol, 79 %) as a colourless oil.

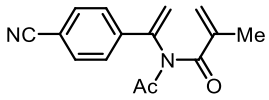
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99 (d, *J* = 8.6 Hz, 2H), 7.46 (d, *J* = 8.6 Hz, 2H), 5.90 (d, *J* = 1.4 Hz, 1H), 5.47 (s, 1H), 5.31 (q, *J* = 1.6 Hz, 1H), 5.29 (d, *J* = 1.4 Hz, 1H), 3.87 (s, 3H), 2.31 (s, 3H), 1.88 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.9, 173.3, 166.4, 143.9, 141.1, 140.3, 130.5, 130.2, 125.6, 120.7, 116.7, 52.2, 25.3, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1713, 1703, 1631, 1609, 1436, 1368, 1276, 1261, 1187,1107.

HRMS (ESI^+) calcd. for $C_{16}H_{18}NO_4^+$ $[M+H]^+$: 288.1230, found: 288.1221.

***N*-acetyl-*N*-(1-(4-cyanophenyl)vinyl)methacrylamide (2p)**



Prepared according to **General Procedure C1** using *N*-(1-(4-cyanophenyl)vinyl)acetamide **S2p** (558 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 50%) afforded **2p** (630 mg, 2.48 mmol, 83 %) as a colourless oil.

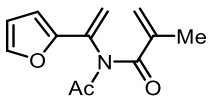
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.5 Hz, 2H), 7.49 (d, *J* = 8.6 Hz, 2H), 5.90 (d, *J* = 1.6 Hz, 1H), 5.47 (d, *J* = 1.7 Hz, 1H), 5.34-5.32 (m, 2H), 2.30 (s, 3H), 1.88 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7, 173.0, 143.2, 140.9, 140.3, 132.6, 126.1, 121.1, 118.3, 117.6, 112.4, 25.3, 19.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2228, 1692, 1631, 1506, 1367, 1315, 1299, 1239, 1188, 1108.

HRMS (ESI^+) calcd. for $C_{15}H_{14}N_2O_2Na^+$ $[M+Na]^+$: 277.0947, found: 277.0953.

***N*-acetyl-*N*-(1-(furan-2-yl)vinyl)methacrylamide (2q)**



Prepared according to **General Procedure C1** using *N*-(1-(furan-2-yl)vinyl)acetamide **S2q** (350 mg, 2.32 mmol, 1.00 equiv) and CH_2Cl_2 (9.3 mL) then Et_3N (0.97 mL, 7.0 mmol, 3.0 equiv), methacryloyl chloride (0.45 mL, 4.6 mmol, 2.0 equiv), and DMAP (85 mg, 0.70 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2q** (270 mg, 1.23 mmol, 53 %) as a pale-yellow oil.

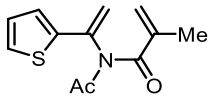
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.32 (d, *J* = 1.8 Hz, 1H), 6.33 (dd, *J* = 3.5, 1.9 Hz, 1H), 6.29 (d, *J* = 3.5 Hz, 1H), 5.77 (s, 1H), 5.46 (q, *J* = 0.9 Hz, 1H), 5.27 (s, 1H), 5.06 (s, 1H), 2.29 (s, 3H), 1.90 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.4, 172.8, 150.3, 143.1, 140.8, 135.2, 120.0, 112.7, 111.6, 108.2, 24.7, 19.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1698, 1636, 1454, 1368, 1319, 1275, 1260, 1193, 1014.

HRMS (ESI^+) calcd. for $C_{12}H_{13}NO_3Na^+$ $[M+Na]^+$: 242.0788, found: 242.0784.

***N*-acetyl-*N*-(1-(thiophen-2-yl)vinyl)methacrylamide (2r)**



Prepared according to **General Procedure C1** using *N*-(1-(thiophen-2-yl)vinyl)acetamide **S2r** (334 mg, 2.00 mmol, 1.00 equiv) and CH_2Cl_2 (8.0 mL), then Et_3N (0.84 mL, 6.0 mmol, 3.0 equiv), methacryloyl chloride (0.39 mL, 4.0 mmol, 2.0 equiv), and DMAP (73 mg, 0.60 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2r** (343 mg, 1.46 mmol, 73 %) as a pale-yellow oil.

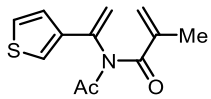
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.23 (dd, *J* = 5.0, 1.2 Hz, 1H), 7.04 (dd, *J* = 3.7, 1.2 Hz, 1H), 6.96 (dd, *J* = 5.1, 3.6 Hz, 1H), 5.74 (d, *J* = 1.4 Hz, 1H), 5.52 (s, 1H), 5.32 (q, *J* = 1.7 Hz, 1H), 5.09 (d, *J* = 1.4 Hz, 1H), 2.35 (s, 3H), 1.96 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.6, 173.1, 141.1, 140.7, 139.0, 127.8, 126.3, 125.6, 120.1, 114.0, 25.0, 19.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1691, 1623, 1434, 1365, 1276, 1259, 1164, 1037.

HRMS (ESI^+) calcd. for $C_{12}H_{13}NO_2SNa^+$ $[M+Na]^+$: 258.0559, found: 258.0553.

***N*-acetyl-*N*-(1-(thiophen-3-yl)vinyl)methacrylamide (2s)**



Prepared according to **General Procedure C1** using *N*-(1-(thiophen-3-yl)vinyl)acetamide **S2s** (501 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 35%) afforded **2s** (479 mg, 2.04 mmol, 68 %) as a pale-yellow solid.

M.P.: 47-49 °C

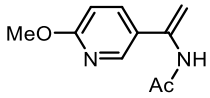
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.28 (dd, *J* = 5.1, 3.0 Hz, 1H), 7.20 (dd, *J* = 3.0, 1.4 Hz, 1H), 7.16 (dd, *J* = 5.1, 1.4 Hz, 1H), 5.73 (d, *J* = 1.2 Hz, 1H), 5.47 (s, 1H), 5.30 (q, *J* = 1.6 Hz, 1H), 5.13 (d, *J* = 1.1 Hz, 1H), 2.31 (s, 3H), 1.93 (dd, *J* = 1.7, 1.1 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.9, 173.3, 141.1, 140.2, 138.6, 127.0, 125.3, 122.6, 120.0, 114.2, 25.0, 19.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1688, 1630, 1423, 1366, 1276, 1260, 1205, 1185, 1161.

HRMS (ESI^+) calcd. for $C_{12}H_{13}NO_2SNa^+$ $[M+Na]^+$: 258.0559, found: 258.0554.

***N*-(1-(6-methoxypyridin-3-yl)vinyl)acetamide (S2t)**



Prepared according to **General Procedure C (*N*-acetyl enamides synthesis)** using (*E*)-1-(6-methoxypyridin-3-yl)ethan-1-one oxime[17] (1.66 g, 10.0 mmol, 1.00 equiv), KI (1.66 g, 10.0 mmol, 1.00 equiv), $Na_2S_2O_4$ (3.48 g, 20.0 mmol, 2.00 equiv), $Fe(OAc)_2$ (174 mg, 1.00 mmol, 0.10 equiv), DCE (100 mL), acetic acid (1.72 mL, 30.0 mmol, 3.00 equiv), and acetic anhydride (1.99 mL, 21.0 mmol, 2.10 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 60%) and recrystallisation (pentane/Et_2O) afforded **S2t** (1.10 g, 5.73 mmol, 57 %) as a white solid.

M.P.: 74-76 °C

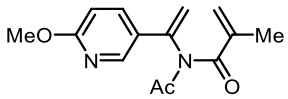
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.19 (d, *J* = 2.5 Hz, 1H), 7.57 (dd, *J* = 8.7, 2.6 Hz, 1H), 7.09 (br. s, 1H), 6.70 (d, *J* = 8.5 Hz, 1H), 5.66 (s, 1H), 5.00 (s, 1H), 3.92 (s, 3H), 2.07 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 169.3, 164.4, 144.7, 138.0, 136.7, 127.4, 110.7, 103.3, 53.7, 24.4.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1667, 1633, 1603, 1527, 1489, 1368, 1281, 1254, 1131, 1022.

HRMS (ESI^+) calcd. for $C_{10}H_{13}N_2O_2^+$ $[M+H]^+$: 193.0972, found: 193.0964.

***N*-acetyl-*N*-(1-(6-methoxypyridin-3-yl)vinyl)methacrylamide (2t)**



Prepared according to **General Procedure C1** using *N*-(1-(6-methoxypyridin-3-yl)vinyl)acetamide **S2t** (576 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00

equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2t** (537 mg, 2.07 mmol, 69 %) as a colourless oil.

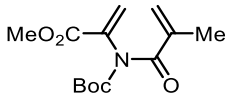
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.17 (dd, *J* = 2.7, 0.8 Hz, 1H), 7.58 (dd, *J* = 8.7, 2.6 Hz, 1H), 6.66 (dd, *J* = 8.7, 0.8 Hz, 1H), 5.67 (d, *J* = 1.3 Hz, 1H), 5.43 (s, 1H), 5.27 (q, *J* = 1.7 Hz, 1H), 5.09 (d, *J* = 1.3 Hz, 1H), 3.86 (s, 3H), 2.27 (s, 3H), 1.88 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.8, 173.1, 164.3, 144.3, 142.0, 141.1, 135.9, 125.1, 120.3, 113.9, 111.1, 53.6, 25.1, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1692, 1631, 1600, 1494, 1454, 1367, 1286, 1258, 1173, 1019.

HRMS (ESI^+) calcd. for $C_{14}H_{17}N_2O_3^+$ $[M+H]^+$: 261.1234, found: 261.1223.

Methyl 2-(*N*-(tert-butoxycarbonyl)methacrylamido)acrylate (2u)



Prepared according to **General Procedure C2** using methyl 2-((*tert*-butoxycarbonyl)amino)acrylate[11] (402 mg, 2.00 mmol, 1.00 equiv) and THF (10.0 mL), then *n*-BuLi (0.80 mL, 2.5 M in hexane, 2.0 mmol, 1.0 equiv) and methacryloyl chloride (0.25 mL, 2.6 mmol, 1.3 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 20%) afforded **2u** (461 mg, 1.71 mmol, 86 %) as a colourless oil.

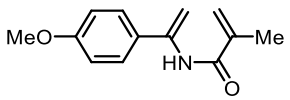
^{1}H NMR (500 MHz, $CDCl_3$) δ 6.42 (d, *J* = 0.8 Hz, 1H), 5.69 (d, *J* = 0.8 Hz, 1H), 5.54 (p, *J* = 1.1 Hz, 1H), 5.35 – 5.33 (m, 1H), 3.78 (s, 3H), 2.02 (s, 3H), 1.44 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.3, 163.7, 152.0, 142.1, 135.7, 125.6, 119.2, 84.1, 52.7, 27.8, 19.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1735, 1694, 1439, 1370, 1281, 1208, 1155, 1100.

HRMS (ESI^+) calcd. for $C_{13}H_{19}NO_5Na^+$ $[M+Na]^+$: 292.1155, found: 292.1146.

***N*-(1-(4-methoxyphenyl)vinyl)methacrylamide (S2v)**



Prepared according to **General Procedure C4 (Step C4-1)** using 4-methoxybenzonitrile (2.66 g, 20.0 mmol, 1.00 equiv), THF (20.0 mL), MeLi (16.3 mL, 1.60 M in Et_2O, 26.0 mmol, 1.30 equiv), MeOH (1.22 mL, 30.0 mmol, 1.50 equiv), CH_2Cl_2 (ca. 30–40 mL), Et_3N (5.58 mL, 40.0 mmol, 2.00 equiv) and methacryloyl chloride (2.93 mL, 30.0 mmol, 1.50 equiv). Purification by Biotage automated flash

chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **S2v** (1.09 g, 5.02 mmol, 25%) as a white solid.

M.P.: 41-43 °C

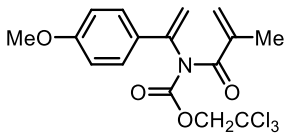
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36 (d, *J* = 8.8 Hz, 2H), 7.13 (br. s, 1H), 6.90 (d, *J* = 8.7 Hz, 2H), 5.86 (s, 1H), 5.74 (s, 1H), 5.44 – 5.41 (m, 1H), 5.05 (d, *J* = 1.0 Hz, 1H), 3.82 (s, 3H), 2.03 (dd, *J* = 1.5, 0.9 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 167.2, 160.1, 141.0, 140.1, 131.2, 127.3, 119.8, 114.3, 101.6, 55.5, 18.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1667, 1625, 1608, 1507, 1248, 1177, 1031.

HRMS (ESI^+) calcd. for $C_{13}H_{16}NO_2^+$ $[M+H]^+$: 218.1176, found: 218.1187.

2,2,2-Trichloroethyl methacryloyl(1-(4-methoxyphenyl)vinyl)carbamate (2v)



Prepared according to **General Procedure C4 (Step C4-2)** using **S2v** (326 mg, 1.50 mmol, 1.00 equiv) and THF (7.5 mL), then *n*-BuLi (0.60 mL, 2.5 M in hexane, 1.5 mmol, 1.0 equiv) and 2,2,2-trichloroethyl chloroformate (0.25 mL, 1.8 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 25%) afforded **2v** (475 mg, 1.21 mmol, 81 %) as a colourless oil.

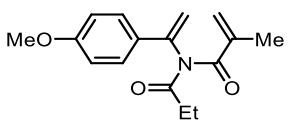
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.40 (d, *J* = 8.8 Hz, 2H), 6.86 (d, *J* = 8.9 Hz, 2H), 5.67 (s, 1H), 5.62 (s, 1H), 5.46 (s, 1H), 5.18 (s, 1H), 4.72 (s, 2H), 3.79 (s, 3H), 2.06 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.0, 160.3, 152.7, 143.3, 141.6, 128.8, 127.3, 120.5, 114.1, 112.9, 94.2, 75.7, 55.4, 19.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1746, 1698, 1634, 1608, 1511, 1452, 1248, 1178, 1130, 1087.

HRMS (ESI^+) calcd. for $C_{16}H_{16}Cl_3NO_4Na^+$ $[M+Na]^+$: 414.0037, found: 414.0026.

***N*-(1-(4-methoxyphenyl)vinyl)-*N*-propionylmethacrylamide (2w)**



Prepared according to **General Procedure C4 (Step C4-2)** using **S2v** (326 mg, 1.50 mmol, 1.00 equiv) and THF (7.5 mL), then *n*-BuLi (0.60 mL, 2.5 M in hexane, 1.5 mmol, 1.0 equiv) and propionic anhydride (0.23 mL, 1.8 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2w** (332 mg, 1.22 mmol, 81 %) as a colourless oil.

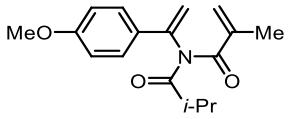
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36 (d, *J* = 8.8 Hz, 2H), 6.87 (d, *J* = 8.9 Hz, 2H), 5.71 (d, *J* = 1.2 Hz, 1H), 5.48 (s, 1H), 5.31 (dq, *J* = 2.2, 1.4 Hz, 1H), 5.10 (d, *J* = 1.1 Hz, 1H), 3.80 (s, 3H), 2.59 (q, *J* = 7.4 Hz, 2H), 1.97 (dd, *J* = 1.6, 1.0 Hz, 3H), 1.11 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 177.6, 174.5, 160.3, 144.2, 141.9, 128.8, 127.1, 119.4, 114.3, 112.9, 55.4, 30.6, 19.2, 9.4.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1690, 1627, 1607, 1511, 1454, 1252, 1172, 1029.

HRMS (ESI^+) calcd. for $C_{16}H_{19}NO_3Na^+$ $[M+Na]^+$: 296.1257, found: 296.1266.

***N*-isobutyryl-*N*-(1-(4-methoxyphenyl)vinyl)methacrylamide (2x)**



Prepared according to **General Procedure C4 (Step C4-2)** using **S2v** (326 mg, 1.50 mmol, 1.00 equiv) and THF (7.5 mL), then *n*-BuLi (0.60 mL, 2.5 M in hexane, 1.5 mmol, 1.0 equiv) and isobutyric anhydride (0.30 mL, 1.8 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 25%) afforded **2x** (370 mg, 1.29 mmol, 86 %) as a colourless oil.

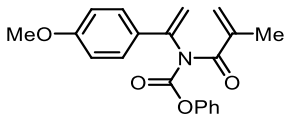
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 (d, *J* = 8.9 Hz, 2H), 6.88 (d, *J* = 8.9 Hz, 2H), 5.69 (d, *J* = 1.0 Hz, 1H), 5.54 (s, 1H), 5.34 (qd, *J* = 1.6, 0.7 Hz, 1H), 5.09 (d, *J* = 1.0 Hz, 1H), 3.80 (s, 3H), 2.95 (hept, *J* = 6.7 Hz, 1H), 1.99 (dd, *J* = 1.6, 1.0 Hz, 3H), 1.12 (d, *J* = 6.8 Hz, 6H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 181.6, 175.0, 160.4, 144.4, 142.1, 129.1, 127.2, 119.4, 114.3, 112.5, 55.5, 35.2, 19.7, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1691, 1627, 1607, 1511, 1458, 1383, 1301, 1251, 1168.

HRMS (ESI^+) calcd. for $C_{17}H_{21}NO_3Na^+$ $[M+Na]^+$: 310.1414, found: 310.1412.

Phenyl methacryloyl(1-(4-methoxyphenyl)vinyl)carbamate (2y)



Prepared according to **General Procedure C4 (Step C4-2)** using **S2v** (326 mg, 1.50 mmol, 1.00 equiv) and THF (7.5 mL), then *n*-BuLi (0.60 mL, 2.5 M in hexane, 1.5 mmol, 1.0 equiv) and phenyl chloroformate (0.22 mL, 1.8 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 25%) afforded **2y** (410 mg, 1.22 mmol, 81 %) as a white solid.

M.P.: 105-107 °C

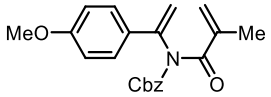
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 (d, *J* = 8.9 Hz, 2H), 7.34 – 7.28 (m, 2H), 7.22 – 7.17 (m, 1H), 6.92 (d, *J* = 8.9 Hz, 2H), 6.91 – 6.88 (m, 2H), 5.72-5.69 (m, 2H), 5.48 (q, *J* = 1.6 Hz, 1H), 5.25 (d, *J* = 1.3 Hz, 1H), 3.83 (s, 3H), 2.10 (t, *J* = 1.3 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.5, 160.3, 153.0, 150.5, 143.7, 142.1, 129.5, 129.2, 127.2, 126.3, 121.1, 119.9, 114.3, 112.4, 55.5, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1749, 1695, 1633, 1607, 1511, 1493, 1250, 1157, 1028.

HRMS (ESI^+) calcd. for $C_{20}H_{19}NO_4Na^+$ $[M+Na]^+$: 360.1206, found: 360.1221.

Benzyl methacryloyl(1-(4-methoxyphenyl)vinyl) carbamate (2z)



Prepared according to **General Procedure C4 (Step C4-2)** using **S2v** (326 mg, 1.50 mmol, 1.00 equiv) and THF (7.5 mL), then *n*-BuLi (0.60 mL, 2.5 M in hexane, 1.5 mmol, 1.0 equiv) and benzyl chloroformate (0.26 mL, 1.8 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 25%) afforded **2z** (430 mg, 1.23 mmol, 82 %) as a colourless oil.

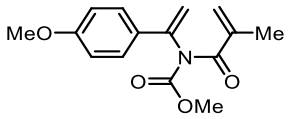
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35 (d, *J* = 8.8 Hz, 2H), 7.30 – 7.24 (m, 3H), 7.13 – 7.10 (m, 2H), 6.84 (d, *J* = 8.8 Hz, 2H), 5.61 (d, *J* = 1.1 Hz, 1H), 5.53 (s, 1H), 5.34 (q, *J* = 1.6 Hz, 1H), 5.11 (s, 2H), 5.10 (d, *J* = 1.1 Hz, 1H), 3.81 (s, 3H), 2.01 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.5, 160.2, 154.3, 143.6, 142.1, 134.8, 129.2, 128.5, 128.5, 128.3, 127.1, 119.4, 114.1, 112.1, 68.8, 55.4, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1736, 1690, 1633, 1607, 1511, 1455, 1380, 1248, 1178, 1124, 1076.

HRMS (ESI^+) calcd. for $C_{21}H_{21}NO_4Na^+$ $[M+Na]^+$: 374.1363, found: 374.1381.

Methyl methacryloyl(1-(4-methoxyphenyl)vinyl)carbamate (2aa)



Prepared according to **General Procedure C4 (Step C4-2)** using **S2v** (326 mg, 1.50 mmol, 1.00 equiv) and THF (7.5 mL), then *n*-BuLi (0.60 mL, 2.5 M in hexane, 1.5 mmol, 1.0 equiv) and methyl chloroformate (0.14 mL, 1.8 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2aa** (350 mg, 1.27 mmol, 85 %) as a colourless oil.

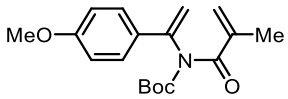
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.37 (d, *J* = 8.8 Hz, 2H), 6.86 (d, *J* = 8.9 Hz, 2H), 5.63 (d, *J* = 1.2 Hz, 1H), 5.51 (s, 1H), 5.36 (qd, *J* = 1.6, 0.6 Hz, 1H), 5.11 (d, *J* = 1.1 Hz, 1H), 3.79 (s, 3H), 3.69 (s, 3H), 2.03 (dd, *J* = 1.7, 1.0 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.3, 160.2, 155.0, 143.5, 142.1, 129.0, 127.0, 119.0, 114.1, 112.2, 55.4, 53.9, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1742, 1690, 1633, 1607, 1511, 1438, 1248, 1178, 1129, 1081.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_4Na^+$ $[M+Na]^+$: 298.1050, found: 298.1063.

***Tert*-butyl methacryloyl(1-(4-methoxyphenyl)vinyl)carbamate (2ab)**



Prepared according to **General Procedure C4 (Step C4-2)** using **S2v** (326 mg, 1.50 mmol, 1.00 equiv) and THF (7.5 mL), then *n*-BuLi (0.60 mL, 2.5 M in hexane, 1.5 mmol, 1.0 equiv) and di-*tert*-butyl dicarbonate (392 mg, 1.80 mmol, 1.20 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2ab** (396 mg, 1.25 mmol, 83 %) as a colourless oil.

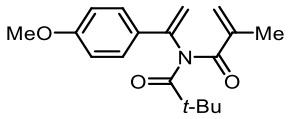
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.37 (d, *J* = 8.9 Hz, 2H), 6.86 (d, *J* = 8.9 Hz, 2H), 5.56 (t, *J* = 1.0 Hz, 1H), 5.54 (d, *J* = 0.9 Hz, 1H), 5.39 – 5.34 (m, 1H), 5.07 (d, *J* = 0.9 Hz, 1H), 3.80 (s, 3H), 2.06 (t, *J* = 1.3 Hz, 3H), 1.31 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.9, 160.1, 153.0, 144.3, 142.7, 129.9, 127.2, 118.9, 114.0, 111.6, 83.4, 55.4, 27.7, 19.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1735, 1691, 1634, 1608, 1512, 1457, 1369, 1276, 1260, 1157, 1031.

HRMS (ESI^+) calcd. for $C_{18}H_{23}NO_4Na^+$ $[M+Na]^+$: 340.1519, found: 340.1507.

***N*-(1-(4-methoxyphenyl)vinyl)-*N*-pivaloylmethacrylamide (2ac)**



Prepared according to **General Procedure C4 (Step C4-2)** using **S2v** (326 mg, 1.50 mmol, 1.00 equiv) and THF (7.5 mL), then *n*-BuLi (0.60 mL, 2.5 M in hexane, 1.5 mmol, 1.0 equiv) and trimethylacetic anhydride (0.36 mL, 1.8 mmol, 1.2 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 25%) afforded **2ac** (381 mg, 1.27 mmol, 84 %) as a colourless oil.

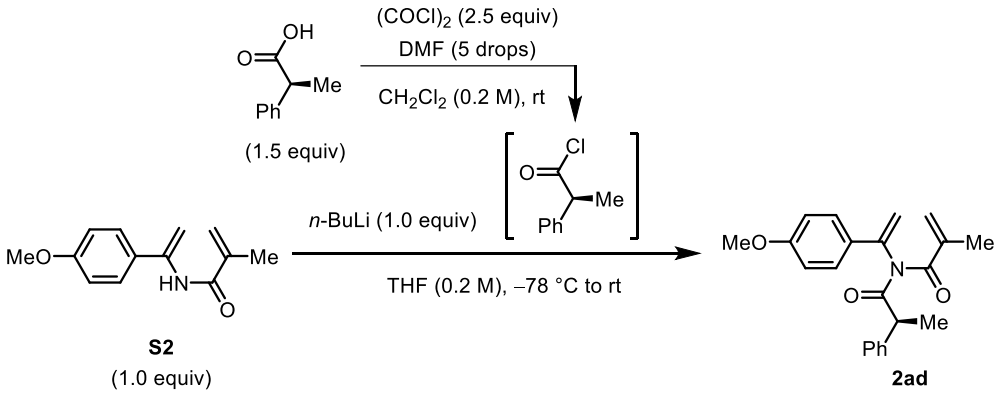
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.40 (d, *J* = 8.8 Hz, 2H), 6.87 (d, *J* = 8.9 Hz, 2H), 5.71 (s, 1H), 5.52 (d, *J* = 1.1 Hz, 1H), 5.37 (s, 1H), 4.90 (d, *J* = 1.1 Hz, 1H), 3.80 (s, 3H), 1.88 (dd, *J* = 1.6, 0.9 Hz, 3H), 1.31 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 187.4, 175.2, 160.2, 145.0, 141.4, 129.0, 127.5, 120.8, 114.2, 110.7, 55.4, 43.5, 29.0, 19.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1689, 1608, 1511, 1459, 1276, 1258, 1177, 1144, 1031.

HRMS (ESI^+) calcd. for $C_{18}H_{24}NO_3^+$ $[M+H]^+$: 302.1751, found: 302.1750.

(*S*)-*N*-(1-(4-methoxyphenyl)vinyl)-*N*-(2-phenylpropanoyl)methacrylamide (2ad)



An oven-dried 100 mL round-bottom flask containing (*S*)-(+)-2-phenylpropionic acid (266 mg, 1.77 mmol, 1.50 equiv) was sealed and subjected to three N_2 evacuation/refill cycles before pre-sparged anhydrous CH_2Cl_2 (9.0 mL) was added. Oxalyl chloride (0.25 mL, 3.0 mmol, 2.5 equiv) was then added at 0 °C, followed by the addition of DMF (5 drops). The reaction mixture was allowed to warm up to room temperature and stirred for 1 h. The reaction was then concentrated under reduced pressure to afford the crude acyl chloride and used directly for the next step without further purification.

An oven-dried 50 mL round-bottom flask charged with **S2v** (255 mg, 1.18 mmol, 1.00 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous THF (6.0 mL)

was then added, and the reaction mixture was cooled to –78 °C. *n*-BuLi (2.5 M in hexane, 0.47 mL, 1.2 mmol, 1.0 equiv) was added dropwise at –78 °C, and the mixture was stirred at this temperature for 10 minutes. Crude acyl chloride (dissolved in 2.0 mL anhydrous THF) was subsequently added at –78 °C, and the reaction was allowed to warm to room temperature over 1 hour. The reaction was then quenched with brine (50 mL) and extracted with ethyl acetate (3 × 40 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude product was purified by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 25%) to afford **2ad** (165 mg, 0.47 mmol, 40 %) as a colourless oil.

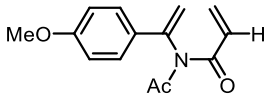
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 – 7.23 (m, 7H), 6.81 (d, *J* = 8.8 Hz, 2H), 5.63 (d, *J* = 1.1 Hz, 1H), 5.18 (d, *J* = 1.7 Hz, 1H), 5.15 (s, 1H), 4.89 (d, *J* = 1.1 Hz, 1H), 4.24 (q, *J* = 6.9 Hz, 1H), 3.79 (s, 3H), 1.88 (s, 3H), 1.43 (d, *J* = 7.0 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 178.1, 174.9, 160.3, 144.2, 141.4, 140.3, 128.8, 128.7, 128.1, 127.5, 127.2, 119.7, 114.2, 112.6, 55.4, 46.4, 19.1, 18.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1696, 1626, 1607, 1512, 1454, 1304, 1275, 1172, 1030.

HRMS (ESI^+) calcd. for $C_{22}H_{23}NO_3Na^+$ $[M+Na]^+$: 372.1570, found: 372.1568.

***N*-acetyl-*N*-(1-(4-methoxyphenyl)vinyl)acrylamide (2ae)**



Prepared according to **General Procedure C1** using *N*-(1-(4-methoxyphenyl)vinyl)acetamide **S2g** (573 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv) and acryloyl chloride (0.49 mL, 6.0 mmol, 2.0 equiv).[A] Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 40%) afforded **2ae** (285 mg, 1.16 mmol, 39 %) as a pale-yellow oil.

Notes: (**A**) When acryloyl chloride is used as the electrophile, the addition of DMAP is not required to promote the reaction. Acryloyl chloride is a highly reactive reagent and is usually stored in a glovebox freezer at −30 °C. The reaction was complete within 1 h.

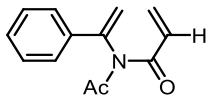
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.9 Hz, 2H), 6.85 (d, *J* = 8.9 Hz, 2H), 6.62 (dd, *J* = 16.8, 10.2 Hz, 1H), 6.44 (dd, *J* = 16.8, 1.7 Hz, 1H), 5.83 (d, *J* = 1.1 Hz, 1H), 5.70 (dd, *J* = 10.2, 1.7 Hz, 1H), 5.14 (d, *J* = 1.2 Hz, 1H), 3.75 (s, 3H), 2.46 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.0, 167.5, 160.3, 143.3, 130.5, 130.1, 127.9, 126.4, 114.3, 114.1, 55.2, 26.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1693, 1606, 1511, 1461, 1400, 1367, 1303, 1256, 1218, 1121, 1028.

HRMS (ESI$^+$) calcd. for $C_{14}H_{15}NO_3Na^+$ [M+Na]$^+$: 268.0944, found: 268.0934.

N-acetyl-*N*-(1-phenylvinyl)acrylamide (2af)



Prepared according to **General Procedure C1** using *N*-(1-phenylvinyl)acetamide **S2f** (483 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv) and acryloyl chloride (0.49 mL, 6.0 mmol, 2.0 equiv).**A** Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2af** (230 mg, 1.07 mmol, 36 %) as a colourless oil.

Notes: (**A**) When acryloyl chloride is used as the electrophile, the addition of DMAP is not required to promote the reaction. Acryloyl chloride is a highly reactive reagent and is usually stored in a glovebox freezer at −30 °C. The reaction was complete within 1 h.

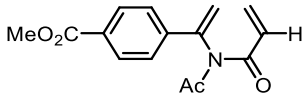
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.44 – 7.41 (m, 2H), 7.39 – 7.32 (m, 3H), 6.65 (dd, *J* = 16.7, 10.2 Hz, 1H), 6.49 (dd, *J* = 16.8, 1.7 Hz, 1H), 5.99 (d, *J* = 1.1 Hz, 1H), 5.74 (dd, *J* = 10.2, 1.7 Hz, 1H), 5.29 (d, *J* = 1.1 Hz, 1H), 2.50 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.2, 167.7, 143.9, 135.5, 130.9, 130.2, 129.3, 129.1, 125.1, 116.3, 26.4.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1697, 1634, 1518, 1401, 1367, 1306, 1221, 1191, 1050.

HRMS (ESI$^+$) calcd. for $C_{13}H_{13}NO_2Na^+$ [M+Na]$^+$: 238.0838, found: 238.0837.

Methyl 4-(1-(*N*-acetylacrylamido)vinyl)benzoate (2ag)



Prepared according to **General Procedure C1** using methyl 4-(1-acetamidovinyl)benzoate **S2o** (420 mg, 1.92 mmol, 1.00 equiv), CH_2Cl_2 (7.7 mL), Et_3N (0.80 mL, 5.8 mmol, 3.0 equiv) and acryloyl chloride (0.31 mL, 3.8 mmol, 2.0 equiv).**A** The reaction mixture was stirred at room temperature for 1 h**B**, after which a second portion of Et_3N (0.80 mL, 5.8 mmol, 3.0 equiv) and acryloyl chloride (0.31 mL, 3.8 mmol, 2.0 equiv) were added. The mixture was stirred at room temperature for an additional 1 h. Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2ag** (210 mg, 0.77 mmol, 40 %) as a colourless oil.

Notes: (**A**) When acryloyl chloride is used as the electrophile, the addition of DMAP is not required to promote the reaction. Acryloyl chloride is a highly reactive reagent and is usually stored in a glovebox freezer at −30 °C.

(**B**) After 1 h, TLC analysis indicated the presence of unreacted starting material.

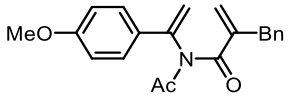
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.5 Hz, 2H), 7.48 (d, *J* = 8.5 Hz, 2H), 6.61 (dd, *J* = 16.7, 10.1 Hz, 1H), 6.50 (dd, *J* = 16.8, 1.8 Hz, 1H), 6.08 (d, *J* = 1.3 Hz, 1H), 5.77 (dd, *J* = 10.1, 1.7 Hz, 1H), 5.40 (d, *J* = 1.2 Hz, 1H), 3.91 (s, 3H), 2.50 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.1, 167.5, 166.5, 143.3, 139.9, 131.4, 130.8, 130.4, 129.9, 125.2, 118.4, 52.4, 26.4.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1700, 1632, 1609, 1435, 1401, 1368, 1275, 1217, 1185, 1107.

HRMS (ESI^+) calcd. for $C_{15}H_{15}NO_4Na^+$ $[M+Na]^+$: 296.0893, found: 296.0895.

***N*-acetyl-2-benzyl-*N*-(1-(4-methoxyphenyl)vinyl)acrylamide (2ah)**



Prepared according to **General Procedure C3** using 2-benzylacrylic acid (972 mg, 6.00 mmol, 2.00 equiv), CH_2Cl_2 (20.0 mL), oxalyl chloride (0.76 mL, 9.0 mmol, 3.0 equiv) and DMF (5 drops). Then using CH_2Cl_2 (12.0 mL), Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), *N*-(1-(4-methoxyphenyl)vinyl)acetamide **S2g** (573 mg, 3.00 mmol, 1.00 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by two successive flash chromatography separations using a Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 35% and ethyl acetate/CH_2Cl_2, 0% to 10%) afforded **2ah** (719 mg, 2.15 mmol, 72 %) as a pale-yellow oil.

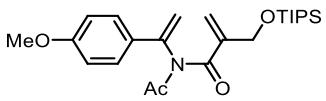
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.32 – 7.27 (m, 4H), 7.25 – 7.21 (m, 1H), 7.18 – 7.15 (m, 2H), 6.85 (d, *J* = 8.9 Hz, 2H), 5.63 – 5.60 (m, 2H), 5.17 (t, *J* = 1.7 Hz, 1H), 4.77 (d, *J* = 1.1 Hz, 1H), 3.80 (s, 3H), 3.62 (s, 2H), 2.29 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7, 173.6, 160.3, 145.3, 144.1, 137.6, 129.5, 128.6, 127.1, 126.7, 120.8, 114.3, 113.1, 55.4, 39.0, 25.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1688, 1627, 1605, 1511, 1366, 1252, 1178, 1029.

HRMS (ESI^+) calcd. for $C_{21}H_{21}NO_3Na^+$ $[M+Na]^+$: 358.1414, found: 358.1409.

***N*-acetyl-*N*-(1-(4-methoxyphenyl)vinyl)-2-(((triisopropylsilyl)oxy)methyl)acrylamide (2ai)**



Prepared according to **General Procedure C3** using 2-(((triisopropylsilyl)oxy)methyl)acrylic acid[18] (3.10 g, 12.0 mmol, 2.00 equiv), CH_2Cl_2 (40.0 mL), oxalyl chloride (1.52 mL, 18.0 mmol, 3.00 equiv) and DMF (8 drops). Then using CH_2Cl_2 (24.0 mL), Et_3N (2.51 mL, 18.0 mmol, 3.00 equiv), *N*-(1-(4-methoxyphenyl)vinyl)acetamide **S2g** (1.15 g, 6.00 mmol, 1.00 equiv), and DMAP (220 mg, 1.80 mmol, 0.30 equiv). Purification by two successive flash chromatography separations using a Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 35% and ethyl acetate/CH_2Cl_2, 0% to 10%) afforded **2ai** (1.73 g, 4.01 mmol, 67 %) as a pale-yellow oil.

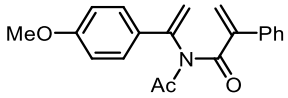
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36 (d, *J* = 8.9 Hz, 2H), 6.86 (d, *J* = 8.9 Hz, 2H), 5.70 (d, *J* = 1.1 Hz, 1H), 5.67 (td, *J* = 2.1, 0.8 Hz, 1H), 5.65 (td, *J* = 1.8 Hz, 0.9, 1H), 5.11 (d, *J* = 1.0 Hz, 1H), 4.40 (t, *J* = 1.9 Hz, 2H), 3.80 (s, 3H), 2.36 (s, 3H), 1.13 – 1.02 (m, 21H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7, 172.7, 160.3, 145.0, 144.3, 128.7, 127.1, 118.6, 114.3, 113.0, 62.8, 55.5, 25.6, 18.1, 12.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2942, 2865, 1691, 1629, 1607, 1512, 1461, 1366, 1303, 1250, 1119.

HRMS (ESI^+) calcd. for $C_{24}H_{38}NO_4Si^+$ $[M+H]^+$: 432.2565, found: 432.2581.

***N*-acetyl-*N*-(1-(4-methoxyphenyl)vinyl)-2-phenylacrylamide (2aj)**



Prepared according to **General Procedure C3** using 2-phenylacrylic acid (888 mg, 6.00 mmol, 2.00 equiv), CH_2Cl_2 (20.0 mL), oxalyl chloride (0.76 mL, 9.0 mmol, 3.0 equiv), and DMF (5 drops). Then using CH_2Cl_2 (12.0 mL), Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), *N*-(1-(4-methoxyphenyl)vinyl)acetamide **S2g** (573 mg, 3.00 mmol, 1.00 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by two successive flash chromatography separations using a Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30% and ethyl acetate/CH_2Cl_2, 0% to 8%) afforded **2aj** (800 mg, 2.49 mmol, 83 %) as a colourless oil.

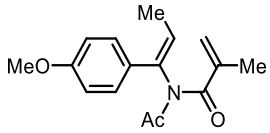
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 – 7.30 (m, 5H), 7.29 (d, *J* = 8.9 Hz, 2H), 6.85 (d, *J* = 8.9 Hz, 2H), 5.70 (d, *J* = 1.2 Hz, 1H), 5.57 (s, 1H), 5.49 (s, 1H), 5.01 (d, *J* = 1.2 Hz, 1H), 3.80 (s, 3H), 2.36 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.0, 172.5, 160.3, 146.2, 143.5, 136.4, 128.6, 128.5, 128.5, 126.9, 126.7, 118.2, 114.2, 55.4, 25.7.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1692, 1630, 1606, 1511, 1366, 1256, 1179, 1029.

HRMS (ESI$^+$) calcd. for $C_{20}H_{19}NO_3Na^+$ [M+Na]$^+$: 344.1257, found: 344.1254.

(*E*)-*N*-acetyl-*N*-(1-(4-methoxyphenyl)prop-1-en-1-yl)methacrylamide (2ak)



Prepared according to **General Procedure C1** using *N*-(1-phenylprop-1-en-1-yl)acetamide **S2ak** (*Z*/*E* mixture, 615 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2ak** (680 mg, 2.49 mmol, 83 %) as a colourless oil.

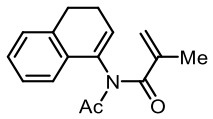
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.22 (d, *J* = 8.9 Hz, 2H), 6.82 (d, *J* = 8.9 Hz, 2H), 6.12 (q, *J* = 7.0 Hz, 1H), 5.35 (s, 1H), 5.24 (q, *J* = 1.6 Hz, 1H), 3.75 (s, 3H), 2.28 (s, 3H), 1.84 (dd, *J* = 1.7, 1.0 Hz, 3H), 1.72 (d, *J* = 7.0 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.9, 173.5, 159.5, 141.5, 137.4, 130.1, 126.6, 123.1, 118.9, 114.2, 55.3, 25.1, 19.1, 13.7.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1709, 1691, 1608, 1511, 1443, 1365, 1275, 1259, 1176, 1031.

HRMS (ESI$^+$) calcd. for $C_{16}H_{19}NO_3Na^+$ [M+Na]$^+$: 296.1257, found: 296.1246.

***N*-acetyl-*N*-(3,4-dihydronaphthalen-1-yl)methacrylamide (2al)**



Prepared according to **General Procedure C1** using *N*-(3,4-dihydronaphthalen-1-yl)acetamide **S2al** (561 mg, 3.00 mmol, 1.00 equiv) and CH_2Cl_2 (12.0 mL), then Et_3N (1.25 mL, 9.00 mmol, 3.00 equiv), methacryloyl chloride (0.59 mL, 6.0 mmol, 2.0 equiv), and DMAP (110 mg, 0.90 mmol, 0.30 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 35%) afforded **2al** (630 mg, 2.47 mmol, 82 %) as a colourless oil.

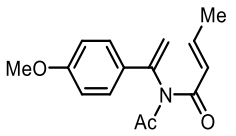
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.21 – 7.14 (m, 3H), 7.04 – 6.99 (m, 1H), 5.92 (t, *J* = 4.7 Hz, 1H), 5.47 – 5.43 (m, 1H), 5.26 – 5.24 (m, 1H), 2.92 – 2.80 (m, 2H), 2.50 – 2.40 (m, 2H), 2.34 (s, 3H), 1.96 (dd, *J* = 1.7, 1.0 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.0, 173.4, 141.4, 136.4, 136.3, 131.6, 128.7, 128.1, 128.0, 126.8, 121.9, 119.2, 27.1, 25.0, 23.0, 19.4.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1688, 1635, 1451, 1427, 1365, 1316, 1275, 1261, 1195.

HRMS (ESI^+) calcd. for $C_{16}H_{17}NO_2Na^+$ $[M+Na]^+$: 278.1152, found: 278.1153.

(*E*)-*N*-acetyl-*N*-(1-(4-methoxyphenyl)vinyl)but-2-enamide (2am)



Prepared according to **General Procedure C2** using *N*-(1-(4-methoxyphenyl)vinyl)acetamide **S2g** (252 mg, 1.32 mmol, 1.00 equiv) and THF (6.6 mL), then *n*-BuLi (0.53 mL, 2.5 M in hexane, 1.3 mmol, 1.0 equiv) and crotonoyl chloride (0.17 mL, 1.7 mmol, 1.3 equiv). Purification by Biotage automated flash chromatography system (ethyl acetate/pentane, 0% to 30%) afforded **2am** (140 mg, 0.54 mmol, 41 %) as a colourless oil.

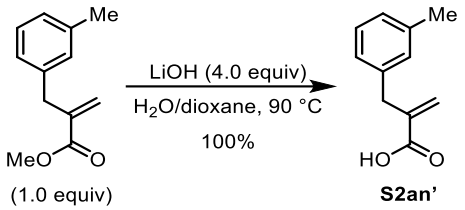
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35 (d, *J* = 8.9 Hz, 2H), 7.07 (dq, *J* = 15.1, 7.0 Hz, 1H), 6.87 (d, *J* = 8.9 Hz, 2H), 6.34 (dq, *J* = 15.1, 1.7 Hz, 1H), 5.83 (d, *J* = 1.0 Hz, 1H), 5.14 (d, *J* = 1.0 Hz, 1H), 3.78 (s, 3H), 2.46 (s, 3H), 1.84 (dd, *J* = 7.0, 1.7 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.2, 167.8, 160.3, 145.6, 143.6, 128.3, 126.5, 124.5, 114.3, 114.0, 55.4, 26.3, 18.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1693, 1636, 1606, 1513, 1462, 1367, 1275, 1260, 1214, 1181.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_3Na^+$ $[M+Na]^+$: 282.1101, found: 282.1089.

2-(3-Methylbenzyl)acrylic acid (S2an')



In a 250 mL round-bottom flask containing a solution of methyl 2-(3-methylbenzyl)acrylate[19] (11.3 g, 59.2 mmol, 1.00 equiv) in 1,4-dioxane (42.0 mL) and H_2O (120 mL) was added $LiOH·H_2O$ (9.95 g, 237 mmol, 4.00 equiv) at room temperature. The mixture was then stirred at 90 °C for 2 h. After that, the reaction was cooled to room temperature and extracted with Et_2O (50 mL). The aqueous phase was acidified with 2 N HCl until the solution reached pH = 1 and extracted with ethyl acetate (3 × 100 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure, affording **S2an'** (10.4 g, 59.1 mmol, 100%) as a colourless oil.

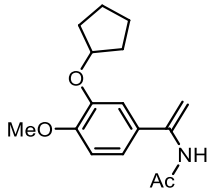
^{1}H NMR (500 MHz, $CDCl_3$) δ 11.96 (br. s, 1H), 7.25 (t, *J* = 7.4 Hz, 1H), 7.12-7.04 (m, 3H), 6.45 (d, *J* = 1.4 Hz, 1H), 5.64 (q, *J* = 1.5 Hz, 1H), 3.66 (s, 2H), 2.39 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 172.9, 139.7, 138.5, 138.2, 129.9, 128.8, 128.5, 127.3, 126.2, 37.5, 21.5.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1691, 1627, 1608, 1433, 1294, 1219, 1148.

HRMS (Nanospray) calcd. for $C_{11}H_{11}O_2$ $[M-H]^-$: 175.0765, found: 175.0753.

N-(1-(3-(cyclopentyloxy)-4-methoxyphenyl)vinyl)acetamide (S2an)



Prepared according to **General Procedure C** using (*E*)-1-(3-(cyclopentyloxy)-4-methoxyphenyl)ethan-1-one oxime[20] (12.5 g, 50.0 mmol, 1.00 equiv), KI (8.30 g, 50.0 mmol, 1.00 equiv), $Na_2S_2O_4$ (17.4 g, 100 mmol, 2.00 equiv), $Fe(OAc)_2$ (870 mg, 5.00 mmol, 0.10 equiv), 1,2-dichloroethane (500 mL), acetic acid (8.65 mL, 150 mmol, 3.00 equiv), and acetic anhydride (9.92 mL, 105 mmol, 2.10 equiv). Purification using Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 60%) afforded **S2an** (6.45 g, 23.5 mmol, 47 %) as a pale-yellow oil.

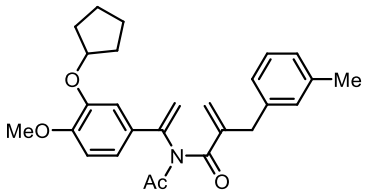
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.26 (s, 1H), 6.91-6.86 (m, 2H), 6.78-6.73 (m, 1H), 5.70 (s, 1H), 4.94 (s, 1H), 4.74 (hept, *J* = 6.3, 3.2 Hz, 1H), 3.79 (s, 3H), 2.04 (s, 3H), 1.92 – 1.76 (m, 6H), 1.60 – 1.55 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 169.3, 150.5, 147.5, 140.5, 131.3, 118.4, 113.4, 111.6, 101.3, 80.6, 56.0, 32.8, 24.4, 24.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1670, 1509, 1258, 1172, 1142.

HRMS (ESI^+) calcd. for $C_{16}H_{22}NO_3^+$ $[M+H]^+$: 276.1594, found: 276.1587.

N-acetyl-*N*-(1-(3-(cyclopentyloxy)-4-methoxyphenyl)vinyl)-2-(3-methylbenzyl) acrylamide (2an)



Prepared according to **General Procedure C3** using 2-(3-methylbenzyl)acrylic acid **S2an'** (2.07 g, 11.8 mmol, 2.00 equiv), CH_2Cl_2 (440.0 mL), oxalyl chloride (1.50 mL, 17.7 mmol, 3.00 equiv), and DMF (8 drops). Then using CH_2Cl_2 (23.6 mL), Et_3N (2.47 mL, 17.7 mmol, 3.00 equiv), *N*-(1-(3-(cyclopentyloxy)-4-methoxyphenyl)vinyl)acetamide **S2an** (1.62 g, 5.90 mmol, 1.00 equiv) in CH_2Cl_2 (6.0 mL), and DMAP (216 mg, 1.77 mmol, 0.30 equiv). Purification by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%) and ethyl acetate/CH_2Cl_2 (0% to 10%) afforded **2an** (1.76 g, 4.06 mmol, 69 %) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.17 (t, *J* = 7.5 Hz, 1H), 7.06-7.02 (m, 1H), 6.98-6.93 (m, 2H), 6.92 – 6.89 (m, 2H), 6.82-6.78 (m, 1H), 5.63 (s, 1H), 5.60 (d, *J* = 1.1 Hz, 1H), 5.18 (t, *J* = 1.7 Hz, 1H), 4.80 (d, *J* = 1.2 Hz, 1H), 4.73 (hept, *J* =3.0 Hz, 1H), 3.83 (s, 3H), 3.57 (s, 2H), 2.32 (s, 3H), 2.30 (s, 3H), 1.92 – 1.80 (m, 6H), 1.64 – 1.57 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.70, 173.66, 150.9, 147.8, 145.2, 144.2, 138.1, 137.5, 130.2, 128.9, 128.4, 127.3, 126.5, 120.9, 118.5, 113.0, 112.4, 111.8, 80.6, 56.0, 38.7, 32.8, 25.2, 24.1, 21.4.

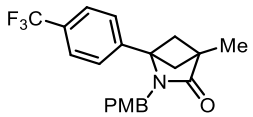
IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2958, 1689, 1628, 1602, 1512, 1421, 1365, 1256, 1222, 1140.

HRMS (ESI^+) calcd. for $C_{27}H_{32}NO_4^+$ $[M+H]^+$: 434.2326, found: 434.2314.

2.4 Synthesis of Cyclisation Products

2.4.1 Synthesis and Characterisation of Products (3 and 4)

2-(4-Methoxybenzyl)-4-methyl-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexan-3-one (3a)



Prepared according to **General Procedure D** using **1a** (780 mg, 2.08 mmol, 1.00 equiv), CH_3CN (20.8 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (23.3 mg, 20.8 μmol, 1.0 mol%). The mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **3a** (513 mg, 1.37 mmol, 66%) as a white solid and **4a** (174 mg, 0.46 mmol, 22%) as a colourless oil.[A]

Notes: (**A**) The reaction time was limited to 0.5 h. Compound **4a** is not stable under the optimised conditions and gradually decomposes as the reaction progresses. After 30 minutes, the ^{1}H NMR spectrum showed a 2.7:1 molar ratio of **3a**/**4a**, and the starting material **1a** was completely consumed (as confirmed by TLC).

M.P.: 109-111 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 (d, *J* = 7.9 Hz, 2H), 7.09 (d, *J* = 7.9 Hz, 2H), 6.60 (d, *J* = 8.6 Hz, 2H), 6.57 (d, *J* = 8.6 Hz, 2H), 4.11 (s, 2H), 3.66 (s, 3H), 2.65 (dd, *J* = 4.0, 1.9 Hz, 2H), 2.37-2.31 (m, 2H), 1.31 (s, 3H).

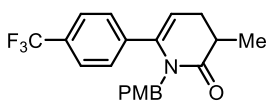
^{13}C NMR (126 MHz, $CDCl_3$) δ 182.2, 158.6, 139.3, 130.4 (q, *J* = 32.4 Hz), 130.1, 129.3, 128.0, 125.1 (q, *J* = 3.8 Hz), 123.9 (q, *J* = 272.3 Hz), 113.4, 66.4, 57.9, 55.0, 48.2, 43.8, 13.3.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.62.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1715, 1612, 1512, 1324, 1266, 1241, 1167, 1125, 1067.

HRMS (ESI^+) calcd. for $C_{21}H_{21}F_3NO_2^+$ $[M+H]^+$: 376.1519, found: 376.1520.

1-(4-Methoxybenzyl)-3-methyl-6-(4-(trifluoromethyl)phenyl)-3,4-dihydropyridin-2(1*H*)-one (4a)



^{1}H NMR (500 MHz, $CDCl_3$) δ 7.55 (d, *J* = 8.0 Hz, 2H), 7.23 (d, *J* = 7.9 Hz, 2H), 6.77 (d, *J* = 8.7 Hz, 2H), 6.69 (d, *J* = 8.8 Hz, 2H), 5.37 (dd, *J* = 6.1, 3.9 Hz, 1H), 4.97 (d, *J* = 15.1 Hz, 1H), 4.34 (d, *J* =

15.3 Hz, 1H), 3.73 (s, 3H), 2.72 – 2.61 (m, 1H), 2.40 (dt, *J* = 16.4, 6.0 Hz, 1H), 2.13 (ddd, *J* = 16.2, 11.7, 4.0 Hz, 1H), 1.29 (d, *J* = 7.0 Hz, 3H).

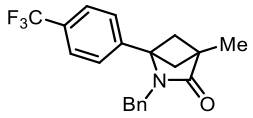
^{13}C NMR (126 MHz, $CDCl_3$) δ 174.5, 158.7, 141.3, 139.8, 130.2 (q, *J* = 32.6 Hz), 129.9, 128.7, 128.1, 125.3 (q, *J* = 3.8 Hz), 124.1 (q, *J* = 272.1 Hz), 113.7, 111.7, 55.2, 45.7, 35.7, 27.9, 15.5.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.58.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1671, 1614, 1512, 1457, 1384, 1323, 1246, 1164, 1066.

HRMS (ESI^+) calcd. for $C_{21}H_{21}F_3NO_2^+$ $[M+H]^+$: 376.1519, found: 376.1521.

2-Benzyl-4-methyl-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexan-3-one (3b)



Prepared according to **General Procedure D** using **1b** (390 mg, 1.13 mmol, 1.00 equiv), CH_3CN (11.3 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (12.7 mg, 11.3 μmol, 1.0 mol%). The mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **3b** (239 mg, 0.69 mmol, 61%) as a white solid and **4b** (81 mg, 0.23 mmol, 21%) as a colourless oil.[A]

Notes: (**A**) The reaction time was limited to 0.5 h. Compound **4b** is not stable under the optimised conditions and gradually decomposes as the reaction progresses. After 30 minutes, the ^{1}H NMR spectrum showed a 2.5:1 molar ratio of **3b**/**4b**, and the starting material **1b** was completely consumed (as confirmed by TLC).

M.P.: 60-62 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 (d, *J* = 8.1 Hz, 2H), 7.13 – 7.05 (m, 5H), 6.74 (d, *J* = 6.4 Hz, 2H), 4.20 (s, 2H), 2.73 (dd, *J* = 4.0, 2.0 Hz, 2H), 2.40 (dd, *J* = 3.8, 2.1 Hz, 2H), 1.37 (s, 3H).

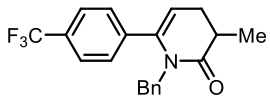
^{13}C NMR (126 MHz, $CDCl_3$) δ 182.3, 139.1, 138.2, 130.6 (q, *J* = 32.4 Hz), 128.14, 128.07, 128.05, 127.1, 125.2 (q, *J* = 3.7 Hz), 124.0 (q, *J* = 272.1 Hz), 66.6, 58.1, 48.4, 44.6, 13.5.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.65.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1722, 1623, 1496, 1411, 1378, 1323, 1276, 1164, 1121.

HRMS (ESI^+) calcd. for $C_{20}H_{19}F_3NO^+$ $[M+H]^+$: 346.1413, found: 346.1401.

1-Benzyl-3-methyl-6-(4-(trifluoromethyl)phenyl)-3,4-dihydropyridin-2(1*H*)-one (4b)



^{1}H NMR (500 MHz, $CDCl_3$) δ 7.54 (d, *J* = 8.1 Hz, 2H), 7.22 (d, *J* = 8.0 Hz, 2H), 7.19 – 7.15 (m, 3H), 6.88 – 6.84 (m, 2H), 5.39 (dd, *J* = 6.0, 3.9 Hz, 1H), 5.03 (d, *J* = 15.3 Hz, 1H), 4.42 (d, *J* = 15.4 Hz, 1H), 2.74-2.66 (m, 1H), 2.44 (dt, *J* = 16.5, 6.1 Hz, 1H), 2.18 (ddd, *J* = 16.2, 11.8, 4.0 Hz, 1H), 1.31 (d, *J* = 7.0 Hz, 3H).

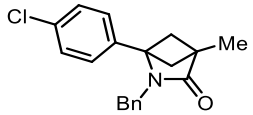
^{13}C NMR (126 MHz, $CDCl_3$) δ 174.5, 141.4, 139.7 (q, *J* = 1.6 Hz), 137.8, 130.3 (q, *J* = 32.6 Hz), 128.4, 128.2, 127.3, 127.1, 125.3 (q, *J* = 3.7 Hz), 124.1 (d, *J* = 272.1 Hz), 111.6, 46.4, 35.8, 27.9, 15.6.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.61.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1670, 1486, 1455, 1380, 1220, 1087, 1015.

HRMS (ESI^+) calcd. for $C_{20}H_{19}F_3NO^+$ $[M+H]^+$: 346.1413, found: 346.1398.

2-Benzyl-1-(4-chlorophenyl)-4-methyl-2-azabicyclo[2.1.1]hexan-3-one (3c)



Prepared according to **General Procedure D** using **1c** (385 mg, 1.24 mmol, 1.00 equiv), CH_3CN (12.4 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (13.9 mg, 12.4 μmol, 1.0 mol%). The mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%), affording **3c** (201 mg, 0.64 mmol, 52%) as a white solid and **4c** (54 mg, 0.17 mmol, 14%) as a colourless oil.[A,B]

Notes: (**A**) Due to the instability of **4c** under photoirradiation, a low yield (14%) was obtained. Notably, a higher yield of **4c** was observed when the reaction time was shortened to 0.5 h (see **Supplementary Table S1**).

(**B**) When HFIP was used as the solvent, **4c** was isolated in 72% yield while **3c** was detected in trace amounts in the crude NMR spectrum.

M.P.: 105-107 °C

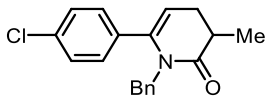
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.23 (d, *J* = 8.4 Hz, 2H), 7.15 – 7.10 (m, 3H), 6.93 (d, *J* = 8.4 Hz, 2H), 6.83 – 6.79 (m, 2H), 4.20 (s, 2H), 2.69 (dd, *J* = 4.0, 1.8 Hz, 2H), 2.37 (dd, *J* = 4.0, 1.9 Hz, 2H), 1.36 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 182.5, 138.5, 134.5, 133.8, 129.1, 128.6, 128.2, 127.1, 66.7, 58.4, 48.4, 44.4, 13.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1722, 1601, 1495, 1400, 1377, 1276, 1260, 1090, 1016.

HRMS (ESI^+) calcd. for $C_{19}H_{19}ClNO^+$ $[M+H]^+$: 312.1150, found: 312.1138.

1-Benzyl-6-(4-chlorophenyl)-3-methyl-3,4-dihydropyridin-2(1*H*)-one (4c)



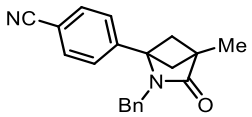
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25 (d, *J* = 8.5 Hz, 2H), 7.20 – 7.14 (m, 3H), 7.03 (d, *J* = 8.5 Hz, 2H), 6.91 – 6.87 (m, 2H), 5.31 (dd, *J* = 6.0, 3.9 Hz, 1H), 5.01 (d, *J* = 15.3 Hz, 1H), 4.42 (d, *J* = 15.4 Hz, 1H), 2.73 – 2.62 (m, 1H), 2.40 (dt, *J* = 16.4, 6.0 Hz, 1H), 2.14 (ddd, *J* = 16.2, 11.7, 3.9 Hz, 1H), 1.30 (d, *J* = 6.9 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.4, 141.3, 137.9, 134.6, 134.1, 129.2, 128.5, 128.3, 127.2, 127.0, 110.5, 46.3, 35.7, 27.8, 15.5.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1672, 1488, 1454, 1381, 1222, 1088, 1015.

HRMS (ESI^+) calcd. for $C_{19}H_{19}ClNO^+$ $[M+H]^+$: 312.1150, found: 312.1149.

4-(2-Benzyl-4-methyl-3-oxo-2-azabicyclo[2.1.1]hexan-1-yl)benzonitrile (3d)



Prepared according to **General Procedure D** using **1d** (410 mg, 1.36 mmol, 1.00 equiv), CH_3CN (13.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (15.2 mg, 13.5 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 50%), affording **3d** (275 mg, 0.91 mmol, 67%) as a white solid.

M.P.: 124-126 °C

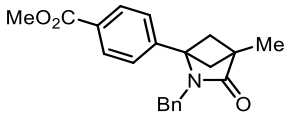
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.52 (d, *J* = 7.9 Hz, 2H), 7.13 – 7.07 (m, 5H), 6.74 (d, *J* = 6.7 Hz, 2H), 4.20 (s, 2H), 2.72 (dd, *J* = 4.1, 1.8 Hz, 2H), 2.40 (dd, *J* = 4.3, 1.5 Hz, 2H), 1.37 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 182.3, 140.3, 138.0, 132.1, 128.5, 128.3, 128.1, 127.3, 118.5, 112.4, 66.6, 58.1, 48.4, 44.7, 13.5.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2228, 1718, 1612, 1454, 1395, 1357, 1276, 1132, 1017.

HRMS (ESI$^+$) calcd. for $C_{20}H_{19}N_2O^+$ [M+H]$^+$: 303.1492, found: 303.1486.

Methyl 4-(2-benzyl-4-methyl-3-oxo-2-azabicyclo[2.1.1]hexan-1-yl)benzoate (3e)



Prepared according to **General Procedure D** using **1e** (288 mg, 0.86 mmol, 1.00 equiv), CH_3CN (8.6 mL), and [Ir(dF(CF_3)ppy)$_2$(dtbbpy)](PF_6) (9.6 mg, 8.6 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%), affording **3e** (151 mg, 0.45 mmol, 52%) as a colourless oil.

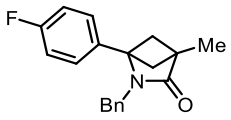
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.4 Hz, 2H), 7.10 – 7.04 (m, 5H), 6.76 – 6.72 (m, 2H), 4.18 (s, 2H), 3.89 (s, 3H), 2.69 (dd, *J* = 4.0, 1.9 Hz, 2H), 2.38 (dd, *J* = 3.9, 2.0 Hz, 2H), 1.34 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 182.4, 166.6, 140.0, 138.2, 130.1, 129.5, 128.12, 128.09, 127.7, 127.0, 66.8, 58.2, 52.2, 48.2, 44.4, 13.5.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1717, 1615, 1495, 1435, 1377, 1275, 1178, 1110, 1020.

HRMS (ESI$^+$) calcd. for $C_{21}H_{22}NO_3^+$ [M+H]$^+$: 336.1594, found: 336.1587.

2-Benzyl-1-(4-fluorophenyl)-4-methyl-2-azabicyclo[2.1.1]hexan-3-one (3f)



Prepared according to **General Procedure D** using **1f** (225 mg, 0.76 mmol, 1.00 equiv), CH_3CN (7.6 mL), and [Ir(dF(CF_3)ppy)$_2$(dtbbpy)](PF_6) (8.6 mg, 7.6 μmol, 1 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%), affording **3f** (98 mg, 0.33 mmol, 44%) as a white solid.

M.P.: 84-86 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.13 – 7.08 (m, 3H), 6.98 – 6.90 (m, 4H), 6.82 – 6.78 (m, 2H), 4.19 (s, 2H), 2.70 (dd, *J* = 4.0, 1.8 Hz, 2H), 2.37 (dd, *J* = 3.8, 2.0 Hz, 2H), 1.35 (s, 3H).

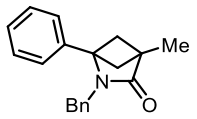
^{13}C NMR (126 MHz, $CDCl_3$) δ 182.4, 162.7 (d, *J* = 248.0 Hz), 138.5, 131.1 (d, *J* = 3.2 Hz), 129.5 (d, *J* = 8.3 Hz), 128.103, 128.097, 127.0, 115.3 (d, *J* = 21.5 Hz), 66.6, 58.4, 48.2, 44.3, 13.6.

^{19}F NMR (377 MHz, $CDCl_3$) δ –112.98.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1723, 1611, 1516, 1377, 1276, 1260, 1224, 1158, 1015.

HRMS (ESI^+) calcd. for $C_{19}H_{19}FNO^+$ $[M+H]^+$: 296.1445, found: 296.1431.

2-Benzyl-4-methyl-1-phenyl-2-azabicyclo[2.1.1]hexan-3-one (3g)



Prepared according to **General Procedure D** using **1g** (290 mg, 1.05 mmol, 1.00 equiv), CH_3CN (10.5 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.7 mg, 10.4 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%), affording **3g** (136 mg, 0.49 mmol, 47%) as a colourless oil.

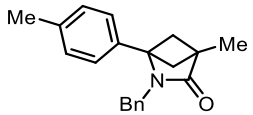
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 – 7.24 (m, 3H), 7.13 – 7.08 (m, 3H), 7.03 – 7.00 (m, 2H), 6.82 – 6.78 (m, 2H), 4.20 (s, 2H), 2.71 (dd, *J* = 4.0, 1.9 Hz, 2H), 2.39 (dd, *J* = 3.9, 2.0 Hz, 2H), 1.36 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 182.6, 138.6, 135.1, 128.4, 128.3, 128.2, 128.0, 127.6, 126.8, 67.2, 58.3, 48.2, 44.2, 13.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1717, 1495, 1448, 1376, 1357, 1276, 1260, 1130.

HRMS (ESI^+) calcd. for $C_{19}H_{20}NO^+$ $[M+H]^+$: 278.1539, found: 278.1534.

2-Benzyl-4-methyl-1-(*p*-tolyl)-2-azabicyclo[2.1.1]hexan-3-one (3h)



Prepared according to **General Procedure D** using **1h** (285 mg, 0.98 mmol, 1.00 equiv), CH_3CN (9.8 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.0 mg, 9.80 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **3h** (113 mg, 0.39 mmol, 40%) as a white solid.

M.P.: 71-73 °C

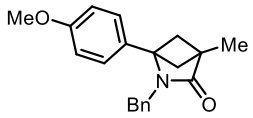
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.14 – 7.10 (m, 3H), 7.08 (d, *J* = 7.9 Hz, 2H), 6.92 (d, *J* = 8.0 Hz, 2H), 6.85 – 6.82 (m, 2H), 4.20 (s, 2H), 2.70 (dd, *J* = 4.0, 1.9 Hz, 2H), 2.37 (dd, *J* = 4.0, 1.9 Hz, 2H), 2.35 (s, 3H), 1.36 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 182.7, 138.8, 138.3, 132.1, 129.0, 128.2, 128.0, 127.6, 126.8, 67.2, 58.4, 48.2, 44.2, 21.3, 13.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1722, 1475, 1454, 1394, 1376, 1276, 1261.

HRMS (ESI^+) calcd. for $C_{20}H_{22}NO^+$ $[M+H]^+$: 292.1696, found: 292.1690.

2-Benzyl-1-(4-methoxyphenyl)-4-methyl-2-azabicyclo[2.1.1]hexan-3-one (3i)



Prepared according to **General Procedure D** using **1i** (307 mg, 1.00 mmol, 1.00 equiv), CH_3CN (10.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.2 mg, 10.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **3i** (74 mg, 0.24 mmol, 24%) as a white solid.

M.P.: 70-72 °C

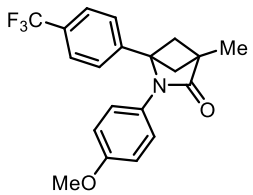
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.14 – 7.10 (m, 3H), 6.92 (d, *J* = 8.7 Hz, 2H), 6.85 – 6.82 (m, 2H), 6.78 (d, *J* = 8.7 Hz, 2H), 4.19 (s, 2H), 3.80 (s, 3H), 2.69 (dd, *J* = 4.0, 1.9 Hz, 2H), 2.36 (dd, *J* = 3.7, 1.9 Hz, 2H), 1.35 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 182.6, 159.7, 138.8, 129.0, 128.2, 128.1, 127.3, 126.9, 113.7, 67.0, 58.5, 55.4, 48.2, 44.1, 13.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1716, 1615, 1519, 1376, 1247, 1175, 1032.

HRMS (ESI^+) calcd. for $C_{20}H_{22}NO_2^+$ $[M+H]^+$: 308.1645, found: 308.1642.

2-(4-Methoxyphenyl)-4-methyl-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexan-3-one (3j)



Prepared according to **General Procedure D** using **1j** (600 mg, 1.66 mmol, 1.00 equiv), CH_3CN (16.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (18.6 mg, 16.6 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 50%), affording **3j** (363 mg, 1.01 mmol, 61%) as a pale-yellow solid.

M.P.: 80-82 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.49 (d, *J* = 8.2 Hz, 2H), 7.23 (d, *J* = 7.9 Hz, 2H), 6.73 (d, *J* = 9.0 Hz, 2H), 6.63 (d, *J* = 9.1 Hz, 2H), 3.63 (s, 3H), 2.95 (dd, *J* = 4.2, 2.0 Hz, 2H), 2.59 (dd, *J* = 4.2, 2.0 Hz, 2H), 1.40 (s, 3H).

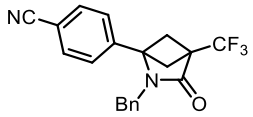
^{13}C NMR (126 MHz, $CDCl_3$) δ 181.3, 157.3, 139.6, 130.2 (q, *J* = 32.5 Hz), 129.5, 127.8, 127.1, 125.3 (q, *J* = 3.7 Hz), 123.9 (q, *J* = 272.3 Hz), 113.9, 69.1, 57.4, 55.1, 48.6, 13.4.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.57.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2248, 1748, 1725, 1509, 1324, 1290, 1165, 1123, 1067.

HRMS (ESI^+) calcd. for $C_{20}H_{19}F_3NO_2^+$ $[M+H]^+$: 362.1362, found: 362.1351.

4-(2-Benzyl-3-oxo-4-(trifluoromethyl)-2-azabicyclo[2.1.1]hexan-1-yl)benzonitrile (3k)



Prepared according to **General Procedure D** using **1k** (356 mg, 1.00 mmol, 1.00 equiv), CH_3CN (10.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.2 mg, 10.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 50%), affording **3k** (295 mg, 0.83 mmol, 83%) as a white solid.

M.P.: 134-136 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.56 (d, *J* = 7.9 Hz, 2H), 7.23-7.01 (m, 5H), 6.72 (d, *J* = 7.5 Hz, 2H), 4.23 (s, 2H), 2.97 (s, 2H), 2.79 (s, 2H).

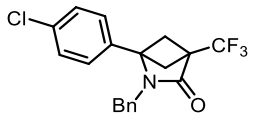
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.2, 137.9, 136.8, 132.3, 128.4, 128.3, 127.9, 127.6, 122.6 (q, *J* = 274.8 Hz), 118.0, 113.1, 65.8, 53.7, 51.5 (q, *J* = 34.7 Hz), 44.4.

^{19}F NMR (471 MHz, $CDCl_3$) δ –71.21.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2231, 1737, 1482, 1405, 1265, 1218, 1182, 1161.

HRMS (ESI^+) calcd. for $C_{20}H_{16}F_3N_2O^+$ $[M+H]^+$: 357.1209, found: 357.1210.

2-Benzyl-1-(4-chlorophenyl)-4-(trifluoromethyl)-2-azabicyclo[2.1.1]hexan-3-one (3l)



Prepared according to **General Procedure D** using **1l** (425 mg, 1.16 mmol, 1.00 equiv), CH_3CN (11.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (13.1 mg, 11.7 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **3l** (301 mg, 0.82 mmol, 71%) as a white solid.

M.P.: 67-69 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.28 (d, *J* = 8.5 Hz, 2H), 7.19 – 7.12 (m, 3H), 6.94 (d, *J* = 8.4 Hz, 2H), 6.81 – 6.77 (m, 2H), 4.24 (s, 2H), 2.93 (dd, *J* = 4.1, 1.9 Hz, 2H), 2.76 (dd, *J* = 4.1, 2.0 Hz, 2H).

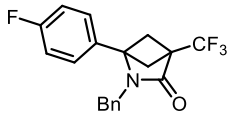
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.5 (q, *J* = 2.6 Hz), 137.3, 135.5, 131.5, 129.0, 128.9, 128.4, 128.2, 127.5, 122.8 (q, *J* = 274.9 Hz), 66.0, 53.9 (q, *J* = 2.6 Hz), 51.6 (q, *J* = 34.7 Hz), 44.3.

^{19}F NMR (471 MHz, $CDCl_3$) δ –71.29.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1734, 1480, 1403, 1320, 1217, 1182, 1153, 1119, 1091.

HRMS (ESI^+) calcd. for $C_{19}H_{16}ClF_3NO^+$ $[M+H]^+$: 366.0867, found: 366.0862.

2-Benzyl-1-(4-fluorophenyl)-4-(trifluoromethyl)-2-azabicyclo[2.1.1]hexan-3-one (3m)



Prepared according to **General Procedure D** using **1m** (349 mg, 1.00 mmol, 1.00 equiv), CH_3CN (10.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.2 mg, 10.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **3m** (192 mg, 0.55 mmol, 55%) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.18 – 7.11 (m, 3H), 7.02 – 6.96 (m, 4H), 6.80 – 6.77 (m, 2H), 4.23 (s, 2H), 2.94 (dd, *J* = 4.1, 1.9 Hz, 2H), 2.76 (dd, *J* = 3.8, 2.1 Hz, 2H).

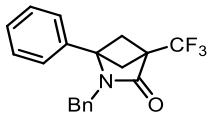
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.5 (q, *J* = 2.6 Hz), 163.2 (d, *J* = 249.2 Hz), 137.4, 129.5 (d, *J* = 8.4 Hz), 128.9 (d, *J* = 3.2 Hz), 128.4, 128.1, 127.4, 122.8 (q, *J* = 274.8 Hz), 115.7 (d, *J* = 21.8 Hz), 66.0, 54.0 (q, *J* = 2.3 Hz), 51.5 (q, *J* = 34.5 Hz), 44.2.

^{19}F NMR (471 MHz, $CDCl_3$) δ –71.29, -111.37.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1733, 1604, 1518, 1481, 1403, 1276, 1217, 1181, 1118.

HRMS (ESI^+) calcd. for $C_{19}H_{16}F_4NO^+$ $[M+H]^+$: 350.1163, found: 350.1159.

2-Benzyl-1-phenyl-4-(trifluoromethyl)-2-azabicyclo[2.1.1]hexan-3-one (3n)



Prepared according to **General Procedure D** using **1n** (185 mg, 0.56 mmol, 1.00 equiv), CH_3CN (5.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (6.3 mg, 5.6 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **3n** (120 mg, 0.36 mmol, 65%) as a white solid.

M.P.: 55-57 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 – 7.37 (m, 1H), 7.37 – 7.29 (m, 2H), 7.18 – 7.11 (m, 3H), 7.04 – 7.00 (m, 2H), 6.80 – 6.76 (m, 2H), 4.25 (s, 2H), 2.95 (dd, *J* = 4.1, 1.9 Hz, 2H), 2.78 (dd, *J* = 3.7, 2.2 Hz, 2H).

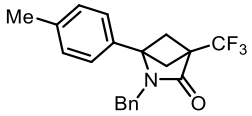
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7 (q, *J* = 2.6 Hz), 137.5, 132.9, 129.3, 128.7, 128.3, 127.5, 127.3, 122.9 (q, *J* = 274.7 Hz), 66.6, 54.0 (q, *J* = 2.3 Hz), 51.6 (q, *J* = 34.5 Hz), 44.1.

^{19}F NMR (471 MHz, $CDCl_3$) δ –71.26.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1735, 1481, 1450, 1404, 1321, 1276, 1261, 1217, 1181.

HRMS (ESI^+) calcd. for $C_{19}H_{17}F_3NO^+$ $[M+H]^+$: 332.1257, found: 332.1249.

2-Benzyl-1-(*p*-tolyl)-4-(trifluoromethyl)-2-azabicyclo[2.1.1]hexan-3-one (3o)



Prepared according to **General Procedure D** using **1o** (345 mg, 1.00 mmol, 1.00 equiv), CH_3CN (10.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.2 mg, 10.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **3o** (178 mg, 0.52 mmol, 52%) as a white solid.

M.P.: 66-68 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.19 – 7.12 (m, 5H), 6.92 (d, *J* = 8.2 Hz, 2H), 6.84 – 6.80 (m, 2H), 4.24 (s, 2H), 2.93 (dd, *J* = 4.1, 1.9 Hz, 2H), 2.75 (dd, *J* = 4.0, 2.1 Hz, 2H), 2.39 (s, 3H).

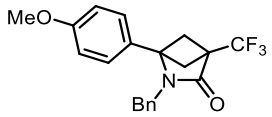
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.8 (q, *J* = 2.3 Hz), 139.3, 137.6, 129.9, 129.3, 128.3, 128.2, 127.4, 127.3, 122.9 (q, *J* = 274.8 Hz), 66.5, 54.0 (q, *J* = 2.3 Hz), 51.6 (q, *J* = 34.3 Hz), 44.1, 21.3.

^{19}F NMR (471 MHz, $CDCl_3$) δ –71.26.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1733, 1403, 1275, 1261, 1218, 1180, 1150, 1109.

HRMS (ESI$^+$) calcd. for $C_{20}H_{19}F_3NO^+$ $[M+H]^+$: 346.1413, found: 346.1403.

2-Benzyl-1-(4-methoxyphenyl)-4-(trifluoromethyl)-2-azabicyclo[2.1.1]hexan-3-one (3p)



Prepared according to **General Procedure D** using **1p** (375 mg, 1.04 mmol, 1.00 equiv), CH_3CN (10.4 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.7 mg, 10.4 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 50%), affording **3p** (135 mg, 0.37 mmol, 36%) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.18 – 7.12 (m, 3H), 6.92 (d, *J* = 8.7 Hz, 2H), 6.86 – 6.80 (m, 4H), 4.23 (s, 2H), 3.83 (s, 3H), 2.92 (dd, *J* = 4.1, 1.9 Hz, 2H), 2.74 (dd, *J* = 3.9, 2.0 Hz, 2H).

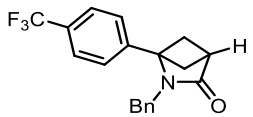
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7 (q, *J* = 2.6 Hz), 160.3, 137.7, 128.9, 128.29, 128.28, 127.3, 125.0, 122.9 (q, *J* = 274.9 Hz), 114.1, 66.4, 55.5, 54.1 (q, *J* = 2.2 Hz), 51.6 (q, *J* = 34.3 Hz), 44.0.

^{19}F NMR (471 MHz, $CDCl_3$) δ –71.29.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1732, 1616, 1521, 1481, 1403, 1275, 1217, 1179, 1152.

HRMS (ESI$^+$) calcd. for $C_{20}H_{19}F_3NO_2^+$ $[M+H]^+$: 362.1362, found: 362.1353.

2-Bbenzyl-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexan-3-one (3q)



Prepared according to **General Procedure D** using **1q** (331 mg, 1.00 mmol, 1.00 equiv), CH_3CN (11.2 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.2 mg, 10.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 50%), affording **3q** (156 mg, 0.47 mmol, 47%) as a pale-yellow solid.

M.P.: 52-54 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.50 (d, *J* = 8.0 Hz, 2H), 7.14 – 7.07 (m, 5H), 6.77 – 6.74 (m, 2H), 4.21 (s, 2H), 2.93 (t, *J* = 2.7 Hz, 1H), 2.80 – 2.75 (m, 2H), 2.62 – 2.59 (m, 2H).

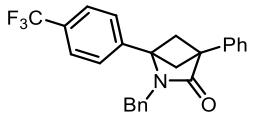
^{13}C NMR (126 MHz, $CDCl_3$) δ 181.9, 139.1 (q, *J* = 1.6 Hz), 138.0, 130.8 (q, *J* = 32.6 Hz), 128.2, 128.1, 128.0, 127.2, 125.4 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.1 Hz), 70.6, 54.3, 44.3, 43.2.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.70.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1721, 1621, 1496, 1411, 1382, 1322, 1164, 1119, 1105.

HRMS (ESI^+) calcd. for $C_{19}H_{17}F_3NO^+$ $[M+H]^+$: 332.1257, found: 332.1250.

2-Benzyl-4-phenyl-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexan-3-one (3r)



Prepared according to **General Procedure D** using **1r** (430 mg, 1.06 mmol, 1.00 equiv), CH_3CN (10.6 mL), and [Ir(dF(CF_3)ppy)$_2$(dtbbpy)](PF_6) (11.9 mg, 10.6 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **3r** (180 mg, 0.44 mmol, 42%) as a white solid.

M.P.: 89-91 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.58 (d, *J* = 8.0 Hz, 2H), 7.46 – 7.40 (m, 4H), 7.37 – 7.33 (m, 1H), 7.23 (d, *J* = 8.0 Hz, 2H), 7.20 – 7.14 (m, 3H), 6.87 – 6.83 (m, 2H), 4.34 (s, 2H), 3.18 (dd, *J* = 4.0, 1.9 Hz, 2H), 2.82 (dd, *J* = 3.9, 1.9 Hz, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 179.9, 138.8, 138.0, 135.8, 130.8 (q, *J* = 32.7 Hz), 128.5, 128.24, 128.22, 128.1, 127.6, 127.22, 127.17, 125.4 (q, *J* = 3.7 Hz), 124.0 (q, *J* = 272.1 Hz), 65.8, 57.6, 55.0, 44.8.

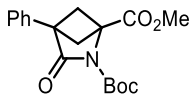
^{19}F NMR (471 MHz, $CDCl_3$) δ –62.57.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1722, 1411, 1321, 1165, 1120, 1067.

HRMS (ESI^+) calcd. for $C_{25}H_{21}F_3NO^+$ $[M+H]^+$: 408.1570, found: 408.1562.

2.4.2 Synthesis and Characterisation of Products (8)

2-(*tert*-Butyl) 1-methyl 3-oxo-4-phenyl-2-azabicyclo[2.1.1]hexane-1,2-dicarboxylate (8a)



Prepared according to **General Procedure D** using **7a** (460 mg, 1.39 mmol, 1.00 equiv), CH_3CN (14.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (15.6 mg, 13.9 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **8a** (382 mg, 1.15 mmol, 83%) as a white solid.

M.P.: 124-126 °C

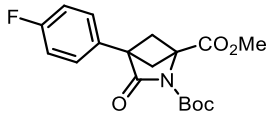
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.39 – 7.35 (m, 2H), 7.34 – 7.30 (m, 1H), 7.25 – 7.22 (m, 2H), 3.83 (s, 3H), 2.91 (dd, *J* = 4.8, 2.0 Hz, 2H), 2.81 (dd, *J* = 4.8, 2.0 Hz, 2H), 1.51 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.2, 166.7, 149.6, 133.7, 128.7, 128.2, 127.0, 83.9, 62.9, 56.1, 53.0, 52.6, 28.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1801, 1751, 1718, 1439, 1370, 1309, 1259, 1218, 1117.

HRMS (ESI^+) calcd. for $C_{18}H_{21}NO_5Na^+$ $[M+Na]^+$: 354.1312, found: 354.1296.

2-(*tert*-Butyl) 1-methyl 4-(4-fluorophenyl)-3-oxo-2-azabicyclo[2.1.1]hexane-1,2-dicarboxylate (8b)



Prepared according to **General Procedure D** using **7b** (386 mg, 1.10 mmol, 1.00 equiv), CH_3CN (11.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (12.4 mg, 11.1 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **8b** (330 mg, 0.95 mmol, 85%) as a white solid.

M.P.: 99-101 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.19 – 7.16 (m, 2H), 7.02 – 6.97 (m, 2H), 3.78 (s, 3H), 2.84 (dd, *J* = 4.8, 2.0 Hz, 2H), 2.76 (dd, *J* = 4.8, 2.0 Hz, 2H), 1.46 (s, 9H).

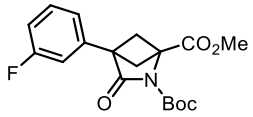
^{13}C NMR (126 MHz, $CDCl_3$) δ 174.0, 166.4, 162.4 (d, *J* = 247.0 Hz), 149.3, 129.5 (d, *J* = 3.1 Hz), 128.8 (d, *J* = 8.3 Hz), 115.5 (d, *J* = 21.5 Hz), 83.8, 62.7, 55.3, 52.9, 52.4, 27.9.

^{19}F NMR (471 MHz, $CDCl_3$) δ –113.63.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1798, 1749, 1716, 1610, 1517, 1439, 1369, 1218, 1116.

HRMS (ESI^+) calcd. for $C_{18}H_{20}FNO_5Na^+$ $[M+Na]^+$: 372.1218, found: 372.1200.

2-(*tert*-Butyl) 1-methyl 4-(3-fluorophenyl)-3-oxo-2-azabicyclo[2.1.1]hexane-1,2-dicarboxylate (8c)



Prepared according to **General Procedure D** using **7c** (174 mg, 0.50 mmol, 1.00 equiv), CH_3CN (5.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (5.6 mg, 5.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **8c** (151 mg, 0.43 mmol, 87%) as a white solid.

M.P.: 128-130 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.32 (td, *J* = 8.0, 5.8 Hz, 1H), 7.02 – 6.97 (m, 2H), 6.95 (ddd, *J* = 9.6, 2.6, 1.7 Hz, 1H), 3.82 (s, 3H), 2.89 (dd, *J* = 4.8, 2.0 Hz, 2H), 2.79 (dd, *J* = 4.8, 2.0 Hz, 2H), 1.49 (s, 9H).

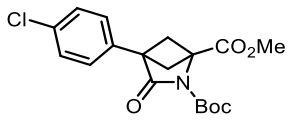
^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7, 166.5, 162.8 (d, *J* = 246.7 Hz), 149.4, 136.1 (d, *J* = 7.7 Hz), 130.3 (d, *J* = 8.3 Hz), 122.8 (d, *J* = 3.0 Hz), 115.2 (d, *J* = 21.0 Hz), 114.3 (d, *J* = 22.3 Hz), 84.0, 62.8, 55.6 (d, *J* = 2.1 Hz), 53.0, 52.6, 28.0.

^{19}F NMR (471 MHz, $CDCl_3$) δ –112.36.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1801, 1787, 1749, 1716, 1589, 1442, 1369, 1300, 1156.

HRMS (ESI^+) calcd. for $C_{18}H_{20}FNO_5Na^+$ $[M+Na]^+$: 372.1218, found: 372.1201.

2-(*tert*-Butyl) 1-methyl 4-(4-chlorophenyl)-3-oxo-2-azabicyclo[2.1.1]hexane-1,2-dicarboxylate (8d)



Prepared according to **General Procedure D** using **7d** (295 mg, 0.81 mmol, 1.00 equiv), CH_3CN (8.1 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (9.1 mg, 8.1 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **8d** (256 mg, 0.70 mmol, 88%) as a white solid.

M.P.: 109-111 °C

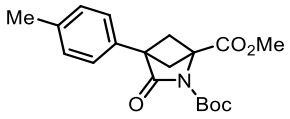
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.5 Hz, 2H), 7.15 (d, *J* = 8.5 Hz, 2H), 3.80 (s, 3H), 2.86 (dd, *J* = 4.8, 2.0 Hz, 2H), 2.77 (dd, *J* = 4.8, 2.0 Hz, 2H), 1.48 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.8, 166.4, 149.3, 134.1, 132.2, 128.8, 128.5, 83.9, 62.8, 55.4, 52.9, 52.5, 27.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1798, 1748, 1716, 1498, 1369, 1301, 1218, 1149.

HRMS (ESI^+) calcd. for $C_{18}H_{20}ClNO_5Na^+$ $[M+Na]^+$: 388.0922, found: 388.0903.

2-(*tert*-Butyl) 1-methyl 3-oxo-4-(*p*-tolyl)-2-azabicyclo[2.1.1]hexane-1,2-dicarboxylate (8e)



Prepared according to **General Procedure D** using **7e** (365 mg, 1.06 mmol, 1.00 equiv), CH_3CN (10.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.9 mg, 10.6 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **8e** (281 mg, 0.81 mmol, 77%) as a white solid.

M.P.: 140-142 °C

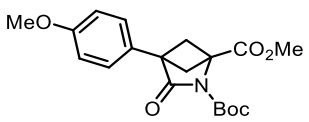
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.17 (d, *J* = 7.9 Hz, 2H), 7.12 (d, *J* = 8.3 Hz, 2H), 3.82 (s, 3H), 2.87 (dd, *J* = 4.7, 2.0 Hz, 2H), 2.77 (dd, *J* = 4.8, 2.0 Hz, 2H), 2.33 (s, 3H), 1.51 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.2, 166.6, 149.4, 137.8, 130.6, 129.2, 126.8, 83.6, 62.7, 55.7, 52.8, 52.4, 27.9, 21.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1785, 1751, 1718, 1444, 1369, 1309, 1210, 1151, 1113.

HRMS (ESI^+) calcd. for $C_{19}H_{23}NO_5Na^+$ $[M+Na]^+$: 368.1468, found: 368.1453.

2-(*tert*-Butyl) 1-methyl 4-(4-methoxyphenyl)-3-oxo-2-azabicyclo[2.1.1]hexane-1,2-dicarboxylate (8f)



Prepared according to **General Procedure D** using **7f** (330 mg, 0.91 mmol, 1.00 equiv), CH_3CN (9.1 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (10.2 mg, 9.1 μmol, 1 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **8f** (252 mg, 0.70 mmol, 76%) as a white solid.

M.P.: 125-127 °C

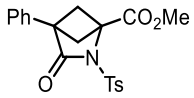
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.14 (d, *J* = 8.7 Hz, 2H), 6.87 (d, *J* = 8.8 Hz, 2H), 3.80 (s, 3H), 3.75 (s, 3H), 2.84 (dd, *J* = 4.7, 2.0 Hz, 2H), 2.75 (dd, *J* = 4.8, 1.9 Hz, 2H), 1.48 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.4, 166.7, 159.3, 149.4, 128.1, 125.7, 114.0, 83.6, 62.7, 55.5, 55.2, 52.9, 52.4, 27.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1799, 1786, 1748, 1715, 1616, 1519, 1439, 1369, 1248, 1152.

HRMS (ESI^+) calcd. for $C_{19}H_{23}NO_6Na^+$ $[M+Na]^+$: 384.1418, found: 384.1405.

Methyl 3-oxo-4-phenyl-2-tosyl-2-azabicyclo[2.1.1]hexane-1-carboxylate (8g)



Prepared according to **General Procedure D** using **7g** (1.19 g, 3.09 mmol, 1.00 equiv), CH_3CN (31.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (34.8 mg, 31.0 μmol, 1 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%), affording **8g** (1.05 g, 2.73 mmol, 88%) as a white solid.

M.P.: 138-140 °C

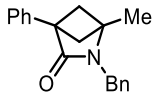
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.92 (d, *J* = 8.3 Hz, 2H), 7.39 – 7.28 (m, 5H), 7.13 (d, *J* = 8.3 Hz, 2H), 3.92 (s, 3H), 2.81-2.73 (m, 4H), 2.44 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.4, 166.0, 145.3, 136.2, 132.9, 129.9, 128.7, 128.4, 128.0, 126.9, 66.6, 55.9, 53.1, 52.9, 21.8.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1782, 1747, 1597, 1439, 1363, 1225, 1201, 1140, 1089.

HRMS (ESI^+) calcd. for $C_{20}H_{19}NO_5SNa^+$ $[M+Na]^+$: 408.0876, found: 408.0860.

2-Benzyl-1-methyl-4-phenyl-2-azabicyclo[2.1.1]hexan-3-one (8h)



Prepared according to **General Procedure D** using **7h** (1.26 g, 4.55 mmol, 1.00 equiv), CH_3CN (45.5 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (51.1 mg, 0.046 mmol, 1 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **8h** (845 mg, 3.05 mmol, 67%) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.42 – 7.26 (m, 10H), 4.58 (s, 2H), 2.76 (dd, *J* = 4.0, 1.9 Hz, 2H), 2.51 (dd, *J* = 3.9, 2.0 Hz, 2H), 1.37 (s, 3H).

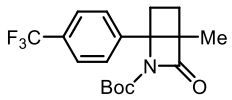
^{13}C NMR (126 MHz, $CDCl_3$) δ 181.0, 139.4, 136.6, 128.6, 128.4, 127.7, 127.23, 127.18, 62.1, 59.3, 55.4, 43.8, 16.5.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1713, 1604, 1503, 1454, 1399, 1334, 1276, 1164, 1075.

HRMS (ESI^+) calcd. for $C_{19}H_{20}NO^+$ $[M+H]^+$: 278.1539, found: 278.1533.

2.4.3 Synthesis and Characterisation of Products (5, 6 and 9)

***tert*-Butyl 4-methyl-3-oxo-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.2.0]hexane-2-carboxylate (6a)**



Prepared according to **General Procedure D** using **2a** (490 mg, 1.38 mmol, 1.00 equiv), CH_3CN (13.8 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (15.5 mg, 13.8 mmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **6a** (132 mg, 0.37 mmol, 27%) as a white solid and **5a** (222 mg, 0.63 mmol, 45 %) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 1:1.6 molar ratio of **6a**/**5a**.

M.P.: 94-96 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.65 (d, *J* = 8.2 Hz, 2H), 7.41 (d, *J* = 8.2 Hz, 2H), 3.11 – 2.96 (m, 1H), 2.57 – 2.48 (m, 2H), 2.22 – 2.12 (m, 1H), 1.41 (s, 9H), 1.06 (s, 3H).

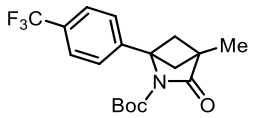
^{13}C NMR (126 MHz, $CDCl_3$) δ 170.6, 147.7, 139.7, 130.1 (q, *J* = 32.7 Hz), 126.7, 125.6 (q, *J* = 3.7 Hz), 124.1 (q, *J* = 272.1 Hz), 83.7, 65.9, 61.9, 28.0, 26.3, 25.7, 13.1.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.63.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1800, 1720, 1620, 1371, 1320, 1278, 1151, 1119, 1067.

HRMS (ESI^+) calcd. for $C_{18}H_{20}F_3NO_3Na^+$ $[M+Na]^+$: 378.1287, found: 378.1288.

***tert*-Butyl 4-methyl-3-oxo-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexane-2-carboxylate (5a)**



M.P.: 121-123 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.1 Hz, 2H), 7.37 (d, *J* = 8.1 Hz, 2H), 2.73 (dd, *J* = 4.7, 2.0 Hz, 2H), 2.41 (dd, *J* = 4.7, 2.0 Hz, 2H), 1.35 (s, 3H), 1.13 (s, 9H).

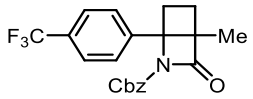
^{13}C NMR (126 MHz, $CDCl_3$) δ 178.6, 149.5, 141.4, 130.2 (q, *J* = 32.4 Hz), 127.0, 125.4 (q, *J* = 3.8 Hz), 124.1 (q, *J* = 272.1 Hz), 82.5, 67.7, 54.8, 49.9, 27.6, 13.2.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.62.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1790, 1720, 1623, 1368, 1324, 1266, 1159, 1125, 1068.

HRMS (ESI^+) calcd. for $C_{18}H_{20}F_3NO_3Na^+$ $[M+Na]^+$: 378.1287, found: 378.1289.

Benzyl 4-methyl-3-oxo-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.2.0]hexane-2-carboxylate (6b)



Prepared according to **General Procedure D** using **2b** (530 mg, 1.36 mmol, 1.00 equiv), CH_3CN (13.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (15.3 mg, 13.6 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/CH_2Cl_2 (2% to 5%), affording **6b** (176 mg, 0.45 mmol, 33%) as a white solid and **5b** (178 mg, 0.45 mmol, 33 %) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 1:1 molar ratio of **6b**/**5b**.

M.P.: 142-144 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.2 Hz, 2H), 7.41 (d, *J* = 8.1 Hz, 2H), 7.32 – 7.29 (m, 3H), 7.25 – 7.21 (m, 2H), 5.26 (d, *J* = 12.4 Hz, 1H), 5.19 (d, *J* = 12.4 Hz, 1H), 3.10 – 3.00 (m, 1H), 2.61 – 2.50 (m, 2H), 2.25 – 2.15 (m, 1H), 1.10 (s, 3H).

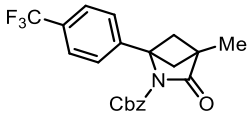
^{13}C NMR (126 MHz, $CDCl_3$) δ 170.1, 148.8, 139.2, 134.9, 130.2 (q, *J* = 32.6 Hz), 128.6, 128.5, 128.1, 126.8, 125.7 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.1 Hz), 68.1, 66.0, 62.4, 26.3, 25.6, 13.0.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.58.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1812, 1715, 1620, 1393, 1320, 1205, 1169, 1116, 1067.

HRMS (ESI^+) calcd. for $C_{21}H_{19}F_3NO_3^+$ $[M+H]^+$: 390.1312, found: 390.1317.

Benzyl 4-methyl-3-oxo-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexane-2-carboxylate (5b)



M.P.: 124-126 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.56 (d, *J* = 8.1 Hz, 2H), 7.36 (d, *J* = 7.6 Hz, 2H), 7.29 – 7.26 (m, 3H), 7.15 – 7.11 (m, 2H), 5.01 (s, 2H), 2.77 (dd, *J* = 4.8, 2.0 Hz, 2H), 2.45 (dd, *J* = 4.7, 2.0 Hz, 2H), 1.39 (s, 3H).

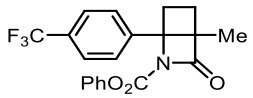
^{13}C NMR (126 MHz, $CDCl_3$) δ 177.8, 151.0, 140.4, 134.9, 130.2 (q, *J* = 32.4 Hz), 128.4, 128.2, 127.9, 127.1, 125.2 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.2 Hz), 67.9, 67.7, 54.4, 49.9, 13.1.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.44.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1797, 1720, 1623, 1412, 1382, 1324, 1276, 1265, 1169, 1123.

HRMS (ESI^+) calcd. for $C_{21}H_{19}F_3NO_3^+$ $[M+H]^+$: 390.1312, found: 390.1313.

Phenyl 4-methyl-3-oxo-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.2.0]hexane-2-carboxylate (6c)



Prepared according to **General Procedure D** using **2c** (490 mg, 1.31 mmol, 1.00 equiv), CH_3CN (13.1 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (14.7 mg, 13.1 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/CH_2Cl_2 (2% to 8%), affording **6c** (220 mg, 0.59 mmol, 45%) as a white solid and **5c** (90 mg, 0.24 mmol, 18 %) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 2:1 molar ratio of **6c**/**5c**.

M.P.: 134-136 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.70 (d, *J* = 8.2 Hz, 2H), 7.52 (d, *J* = 8.1 Hz, 2H), 7.37 – 7.33 (m, 2H), 7.24 – 7.20 (m, 1H), 7.16 – 7.13 (m, 2H), 3.12 (ddd, *J* = 13.6, 11.5, 6.3 Hz, 1H), 2.72 (ddd, *J* = 13.8, 8.7, 5.6 Hz, 1H), 2.63 (ddd, *J* = 13.0, 8.7, 6.2 Hz, 1H), 2.27 (ddd, *J* = 13.1, 11.5, 5.6 Hz, 1H), 1.15 (s, 3H).

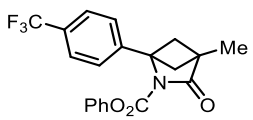
^{13}C NMR (126 MHz, $CDCl_3$) δ 170.0, 149.9, 147.1, 139.0, 130.3 (q, *J* = 32.6 Hz), 129.5, 126.8, 126.4, 125.8 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.1 Hz), 121.2, 66.3, 62.6, 26.4, 25.8, 13.1.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.58.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1810, 1736, 1620, 1494, 1411, 1321, 1275, 1190, 1164, 1067.

HRMS (ESI^+) calcd. for $C_{20}H_{16}F_3NO_3Na^+$ $[M+Na]^+$: 398.0974, found: 398.0970.

Phenyl 4-methyl-3-oxo-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexane-2-carboxylate (5c)



M.P.: 154-156 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.1 Hz, 2H), 7.46 (d, *J* = 7.8 Hz, 2H), 7.29 – 7.25 (m, 2H), 7.17 – 7.13 (m, 1H), 6.99 – 6.95 (m, 2H), 2.88 (dd, *J* = 4.8, 2.1 Hz, 2H), 2.52 (dd, *J* = 4.8, 2.0 Hz, 2H), 1.44 (s, 3H).

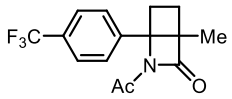
^{13}C NMR (126 MHz, $CDCl_3$) δ 177.3, 150.2, 149.6, 140.0, 130.5 (q, *J* = 32.5 Hz), 129.4, 127.3, 126.0, 125.4 (q, *J* = 3.8 Hz), 124.0 (d, *J* = 272.1 Hz), 121.3, 68.2, 54.3, 50.1, 13.2.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.61.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1793, 1733, 1623, 1494, 1413, 1324, 1275, 1199, 1166, 1067.

HRMS (ESI^+) calcd. for $C_{20}H_{16}F_3NO_3Na^+$ $[M+Na]^+$: 398.0974, found: 398.0971.

2-acetyl-4-methyl-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.2.0]hexan-3-one (6d)



Prepared according to **General Procedure D** using **2d** (280 mg, 0.94 mmol, 1.00 equiv), CH_3CN (9.4 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (10.5 mg, 9.4 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 60%), affording **6d** (175 mg, 0.59 mmol, 63%) as a white solid and **5d** (49 mg, 0.16 mmol, 18%) as a white solid.[A,B]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 3.4:1 molar ratio of **6d**/**5d**.

(**B**) When HFIP was used as the solvent, **6d** was isolated in 78% yield. The crude ^{1}H NMR spectrum indicated a 12:1 molar ratio of **6d**:**5d**.

M.P.: 70-72 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.2 Hz, 2H), 7.37 (d, *J* = 8.1 Hz, 2H), 3.07 – 2.96 (m, 1H), 2.60 – 2.47 (m, 5H), 2.29 – 2.20 (m, 1H), 1.09 (s, 3H).

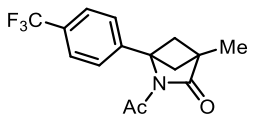
^{13}C NMR (126 MHz, $CDCl_3$) δ 170.9, 168.1, 139.1, 130.1 (q, *J* = 32.6 Hz), 126.6, 125.7 (q, *J* = 3.8 Hz), 124.0 (q, *J* = 272.1 Hz), 65.6, 61.5, 26.4, 26.4, 24.4, 13.0.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.65.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1777, 1703, 1619, 1411, 1374, 1320, 1275, 1267, 1163, 1066.

HRMS (ESI^+) calcd. for $C_{15}H_{14}F_3NO_2Na^+$ $[M+Na]^+$: 320.0869, found: 320.0865.

2-Acetyl-4-methyl-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.1.1]hexan-3-one (5d)



M.P.: 60-62 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.0 Hz, 2H), 7.37 (d, *J* = 7.8 Hz, 2H), 2.74 (dd, *J* = 4.6, 2.0 Hz, 2H), 2.44 (dd, *J* = 4.7, 2.1 Hz, 2H), 2.40 (s, 3H), 1.39 (s, 3H).

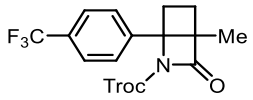
^{13}C NMR (126 MHz, $CDCl_3$) δ 179.3, 169.6, 141.0, 130.2 (q, *J* = 32.5 Hz), 126.9, 125.3 (q, *J* = 3.8 Hz), 124.2 (q, *J* = 272.1 Hz), 67.9, 54.6, 49.9, 25.8, 13.3.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.58.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1763, 1696, 1372, 1320, 1287, 1161, 1119, 1067.

HRMS (ESI^+) calcd. for $C_{15}H_{14}F_3NO_2Na^+$ $[M+Na]^+$: 320.0869, found: 320.0863.

2,2,2-Trichloroethyl 4-methyl-3-oxo-1-(4-(trifluoromethyl)phenyl)-2-azabicyclo[2.2.0]hexane-2-carboxylate (6e)



Prepared according to **General Procedure D** using **2e** (580 mg, 1.35 mmol, 1.00 equiv), CH_3CN (13.5 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (15.2 mg, 13.5 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/CH_2Cl_2 (2% to 5%), affording **6e** (375 mg, 0.87 mmol, 65 %) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 4:1 molar ratio of **6e**/**5e**.

M.P.: 117-119 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.65 (d, *J* = 8.2 Hz, 2H), 7.45 (d, *J* = 8.1 Hz, 2H), 4.77 (d, *J* = 11.9 Hz, 1H), 4.72 (d, *J* = 12.0 Hz, 1H), 3.12 (ddd, *J* = 13.5, 11.4, 6.3 Hz, 1H), 2.64 (ddd, *J* = 13.7, 8.7, 5.5 Hz, 1H), 2.56 (ddd, *J* = 13.1, 8.7, 6.2 Hz, 1H), 2.22 (ddd, *J* = 13.2, 11.5, 5.5 Hz, 1H), 1.13 (s, 3H).

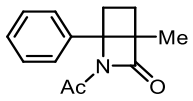
^{13}C NMR (126 MHz, $CDCl_3$) δ 170.1, 147.0, 138.7, 130.4 (q, *J* = 32.6 Hz), 126.9, 125.8 (q, *J* = 3.8 Hz), 123.9 (q, *J* = 272.4 Hz), 94.2, 74.8, 66.6, 63.1, 26.1, 25.5, 13.0.

^{19}F NMR (471 MHz, $CDCl_3$) δ –62.66.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1814, 1733, 1620, 1379, 1316, 1276, 1166, 1118, 1067, 1015.

HRMS (ESI^+) calcd. for $C_{16}H_{14}Cl_3F_3NO_3^+$ $[M+H]^+$: 429.9986, found: 429.9986.

2-acetyl-4-methyl-1-phenyl-2-azabicyclo[2.2.0]hexan-3-one (6f)



Prepared according to **General Procedure D** using 2f (540 mg, 2.36 mmol, 1.00 equiv), CH_3CN (23.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (26.5 mg, 23.6 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/CH_2Cl_2 (2% to 6%), affording **6f** (411 mg, 1.79 mmol, 76%) as a colourless oil and **5f** (26 mg, 0.11 mmol, 5 %) as a white solid.[A,B]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 10:1 molar ratio of **6f**/**5f**.

(**B**) When HFIP was used as the solvent, **6f** was isolated in 79% yield. The crude ^{1}H NMR spectrum indicated a 30:1 molar ratio of **6f**:**5f**.

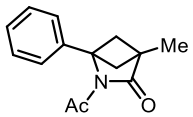
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 – 7.34 (m, 2H), 7.31 – 7.27 (m, 1H), 7.27 – 7.24 (m, 2H), 3.08 – 2.99 (m, 1H), 2.58 – 2.46 (m, 5H), 2.24 – 2.17 (m, 1H), 1.09 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.6, 168.1, 134.9, 128.7, 127.9, 126.1, 66.2, 61.1, 26.5, 26.4, 24.5, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1771, 1701, 1497, 1371, 1309, 1270, 1193, 1075, 970.

HRMS (ESI^+) calcd. for $C_{14}H_{15}NO_2Na^+$ $[M+Na]^+$: 252.0995, found: 252.0986.

2-Acetyl-4-methyl-1-phenyl-2-azabicyclo[2.1.1]hexan-3-one (5f)



M.P.: 100-102 °C

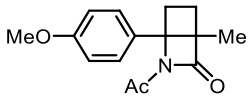
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.39 – 7.31 (m, 3H), 7.29 – 7.26 (m, 2H), 2.73 (dd, J = 4.7, 2.1 Hz, 2H), 2.42 (dd, J = 4.6, 2.1 Hz, 2H), 2.38 (s, 3H), 1.38 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 179.9, 169.4, 137.1, 128.3, 128.1, 126.5, 68.7, 54.6, 49.7, 26.0, 13.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1766, 1681, 1449, 1374, 1359, 1297, 1163.

HRMS (ESI^+) calcd. for $C_{14}H_{16}NO_2^+$ $[M+H]^+$: 230.1176, found: 230.1169.

2-Acetyl-1-(4-methoxyphenyl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6g)



Gram scale: Prepared according to **General Procedure D** using **2g** (3.31 g, 12.8 mmol, 1.00 equiv), CH_3CN (128 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (71.7 mg, 63.9 μmol, 0.50 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 60%), affording **6g** (2.71 g, 10.5 mmol, 82%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 24:1 molar ratio of **6g**/**5g**.

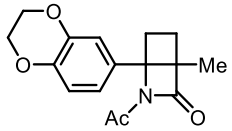
^1H NMR (500 MHz, $CDCl_3$) δ 7.17 (d, J = 8.8 Hz, 2H), 6.89 (d, J = 8.8 Hz, 2H), 3.76 (s, 3H), 2.97 (ddd, J = 12.9, 11.4, 6.0 Hz, 1H), 2.56 – 2.42 (m, 5H), 2.20 – 2.11 (m, 1H), 1.08 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.7, 168.0, 159.2, 127.3, 127.0, 114.0, 65.9, 60.8, 55.2, 26.4, 26.3, 24.4, 12.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1771, 1700, 1614, 1515, 1445, 1371, 1309, 1272, 1179, 1104, 1031.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_3Na^+$ $[M+Na]^+$: 282.1101, found: 282.1093.

2-Acetyl-1-(2,3-dihydrobenzo[*b*][1,4]dioxin-6-yl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6h)



Prepared according to **General Procedure D** using **2h** (430 mg, 1.50 mmol, 1.00 equiv), CH_3CN (15.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (16.8 mg, 15.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of (Et_2O/ethyl acetate 3:1)/pentane (10% to 50%), affording **6h** (225 mg, 0.78 mmol, 52%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 15:1 molar ratio of **6h**/**5h**.

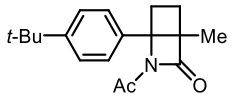
^1H NMR (500 MHz, $CDCl_3$) δ 6.83 (d, J = 8.4 Hz, 1H), 6.73 (d, J = 2.3 Hz, 1H), 6.70 (dd, J = 8.4, 2.2 Hz, 1H), 4.20 (s, 4H), 2.97 – 2.89 (m, 1H), 2.51 – 2.39 (m, 5H), 2.17 – 2.10 (m, 1H), 1.07 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.6, 168.0, 143.6, 143.3, 128.1, 119.1, 117.4, 115.2, 65.7, 64.31, 64.30, 60.9, 26.23, 26.21, 24.4, 12.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1770, 1701, 1588, 1510, 1425, 1372, 1310, 1276, 1261, 1194, 1124.

HRMS (ESI^+) calcd. for $C_{16}H_{17}NO_4Na^+$ $[M+Na]^+$: 310.1050, found: 310.1039.

2-acetyl-1-(4-(*tert*-butyl)phenyl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6i)



Prepared according to **General Procedure D** using **2i** (540 mg, 1.90 mmol, 1.00 equiv), CH_3CN (19.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (21.3 mg, 19.0 mmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (10% to 50%), affording **6i** (350 mg, 1.23 mmol, 65%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 13:1 molar ratio of **6i**/**5i**.

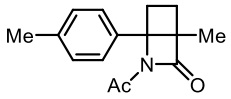
^1H NMR (500 MHz, $CDCl_3$) δ 7.38 (d, J = 8.5 Hz, 2H), 7.18 (d, J = 8.5 Hz, 2H), 3.01 (ddd, J = 12.6, 11.4, 5.8 Hz, 1H), 2.58 – 2.44 (m, 5H), 2.24 – 2.15 (m, 1H), 1.30 (s, 9H), 1.10 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.7, 168.1, 150.7, 131.8, 125.8, 125.6, 66.1, 61.0, 34.6, 31.3, 26.48, 26.46, 24.5, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1774, 1703, 1371, 1311, 1277, 1191, 970.

HRMS (ESI^+) calcd. for $C_{18}H_{23}NO_2Na^+$ $[M+Na]^+$: 308.1621, found: 308.1629.

2-Acetyl-4-methyl-1-(*p*-tolyl)-2-azabicyclo[2.2.0]hexan-3-one (6j)



Prepared according to **General Procedure D** using **2j** (302 mg, 1.24 mmol, 1.00 equiv), CH_3CN (12.4 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (13.9 mg, 12.4 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 60%), affording **6j** (206 mg, 0.85 mmol, 68%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 15:1 molar ratio of **6j**:**5j**.

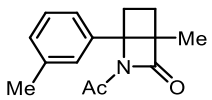
^1H NMR (500 MHz, $CDCl_3$) δ 7.19 (d, J = 8.0 Hz, 2H), 7.14 (d, J = 8.2 Hz, 2H), 3.06 – 2.98 (m, 1H), 2.58 – 2.44 (m, 5H), 2.34 (s, 3H), 2.24 – 2.13 (m, 1H), 1.10 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.8, 168.1, 137.8, 132.0, 129.5, 126.1, 66.2, 61.0, 26.5, 26.4, 24.6, 21.2, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1772, 1702, 1518, 1447, 1371, 1310, 1270, 1186, 1105, 1037.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_2Na^+$ $[M+Na]^+$: 266.1152, found: 266.1140.

2-Acetyl-4-methyl-1-(*m*-tolyl)-2-azabicyclo[2.2.0]hexan-3-one (6k)



Prepared according to **General Procedure D** using **2k** (365 mg, 1.50 mmol, 1.00 equiv), CH_3CN (15.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (16.9 mg, 15.1 mmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 60%), affording **6k** (272 mg, 1.12 mmol, 75%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 11:1 molar ratio of **6k**/**5k**.

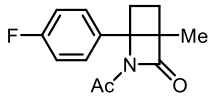
^1H NMR (500 MHz, $CDCl_3$) δ 7.29 – 7.25 (m, 1H), 7.11 (dp, *J* = 7.5, 0.9 Hz, 1H), 7.07 – 7.03 (m, 2H), 3.07 – 2.98 (m, 1H), 2.57 – 2.46 (m, 5H), 2.36 (s, 3H), 2.25 – 2.17 (m, 1H), 1.09 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.7, 168.1, 138.3, 134.9, 128.8, 128.6, 126.8, 123.2, 66.2, 61.0, 26.5, 26.3, 24.5, 21.7, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1772, 1702, 1609, 1448, 1371, 1310, 1275, 1276, 1193, 1038.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_2Na^+$ $[M+Na]^+$: 266.1152, found: 266.1142.

2-Acetyl-1-(4-fluorophenyl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6l)



Prepared according to **General Procedure D** using **2l** (305 mg, 1.23 mmol, 1.00 equiv), CH_3CN (12.3 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (13.9 mg, 12.4 mmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of (Et_2O/ethyl acetate 3:1)/pentane (10% to 40%), affording **6l** (208 mg, 0.84 mmol, 68%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 11:1 molar ratio of **6l**/**5l**.

^1H NMR (500 MHz, $CDCl_3$) δ 7.27 – 7.22 (m, 2H), 7.11 – 7.05 (m, 2H), 3.00 (ddd, *J* = 13.0, 11.5, 6.0 Hz, 1H), 2.60 – 2.45 (m, 5H), 2.26 – 2.18 (m, 1H), 1.11 (s, 3H).

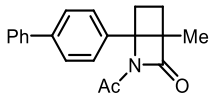
^{13}C NMR (126 MHz, $CDCl_3$) δ 171.3, 168.1, 162.3 (d, *J* = 247.2 Hz), 130.9 (d, *J* = 3.2 Hz), 127.9 (d, *J* = 8.3 Hz), 115.6 (d, *J* = 21.8 Hz), 65.6, 61.0, 26.5, 26.4, 24.4, 12.9.

^{19}F NMR (471 MHz, $CDCl_3$) δ –114.23.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1773, 1701, 1603, 1513, 1448, 1372, 1311, 1269, 1230, 1161, 1097.

HRMS (ESI^+) calcd. for $C_{14}H_{14}FNO_2Na^+$ $[M+Na]^+$: 270.0901, found: 270.0893.

1-([1,1'-biphenyl]-4-yl)-2-acetyl-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6m)



Prepared according to **General Procedure D** using **2m** (305 mg, 1.00 mmol, 1.00 equiv), CH_3CN (10.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.2 mg, 10.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of (Et_2O/ethyl acetate 3:1)/pentane (10% to 40%), affording **6m** (194 mg, 0.64 mmol, 64%) as a white solid.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 7:1 molar ratio of **6m**/**5m**.

M.P.: 77-79 °C

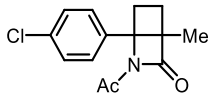
^1H NMR (500 MHz, $CDCl_3$) δ 7.62 (d, J = 8.4 Hz, 2H), 7.61 – 7.58 (m, 2H), 7.45 (t, J = 7.6 Hz, 2H), 7.38 – 7.33 (m, 3H), 3.08 (ddd, J = 12.8, 11.5, 5.9 Hz, 1H), 2.63 – 2.50 (m, 5H), 2.28 – 2.21 (m, 1H), 1.16 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.6, 168.2, 140.8, 140.5, 133.9, 128.9, 127.6, 127.4, 127.2, 126.6, 66.1, 61.2, 26.49, 26.47, 24.5, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1773, 1702, 1487, 1371, 1311, 1276, 1191, 1104, 970.

HRMS (ESI^+) calcd. for $C_{20}H_{19}NO_2Na^+$ $[M+Na]^+$: 328.1308, found: 328.1299.

2-acetyl-1-(4-chlorophenyl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6n)



Prepared according to **General Procedure D** using **2n** (380 mg, 1.44 mmol, 1.00 equiv), CH_3CN (14.4 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (16.2 mg, 14.4 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (10% to 60%), affording **6n** (294 mg, 1.12 mmol, 77%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 7:1 molar ratio of **6n**/**5n**.

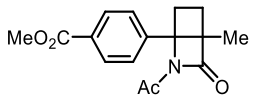
^1H NMR (500 MHz, $CDCl_3$) δ 7.32 (d, J = 8.6 Hz, 2H), 7.17 (d, J = 8.6 Hz, 2H), 2.99 – 2.91 (m, 1H), 2.54 – 2.42 (m, 5H), 2.21 – 2.14 (m, 1H), 1.06 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.1, 167.9, 133.8, 133.6, 128.8, 127.5, 65.5, 61.1, 26.29, 26.27, 24.3, 12.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1773, 1701, 1495, 1371, 1310, 1277, 1264, 1194, 1094.

HRMS (ESI^+) calcd. for $C_{14}H_{14}ClNO_2Na^+$ $[M+Na]^+$: 286.0605, found: 286.0601.

Methyl 4-(2-acetyl-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexan-1-yl)benzoate (6o)



Prepared according to **General Procedure D** using **2o** (550 mg, 1.92 mmol, 1.00 equiv), CH_3CN (19.2 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (21.5 mg, 19.2 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of CH_2Cl_2/ethyl acetate (0% to 10%), affording **6o** (345 mg, 1.20 mmol, 63%) as a colourless oil and **5o** (95 mg, 0.33 mmol, 17 %) as a white solid.[A,B]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 3:1 molar ratio of **6o**/**5o**.

(**B**) When HFIP was used as the solvent, **6o** was isolated in 71% yield. The crude ^1H NMR spectrum indicated a 8:1 molar ratio of **6o**/**5o**.

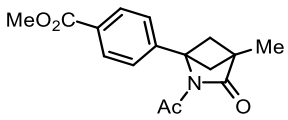
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.99 (d, *J* = 8.5 Hz, 2H), 7.28 (d, *J* = 8.5 Hz, 2H), 3.84 (s, 3H), 3.04 – 2.93 (m, 1H), 2.54 – 2.42 (m, 5H), 2.24 – 2.15 (m, 1H), 1.02 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.8, 167.8, 166.4, 139.9, 129.8, 129.5, 126.1, 65.6, 61.4, 52.1, 26.3, 26.2, 24.3, 12.8.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1775, 1702, 1612, 1435, 1372, 1311, 1275, 1192, 1110.

HRMS (ESI^+) calcd. for $C_{16}H_{17}NO_4Na^+$ $[M+Na]^+$: 310.1050, found: 310.1056.

Methyl 4-(2-acetyl-4-methyl-3-oxo-2-azabicyclo[2.1.1]hexan-1-yl)benzoate (5o)



M.P.: 141-143 °C

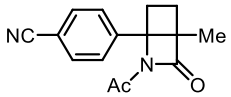
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.5 Hz, 2H), 7.31 (d, *J* = 8.4 Hz, 2H), 3.89 (s, 3H), 2.71 (dd, *J* = 4.6, 2.1 Hz, 2H), 2.43 (dd, *J* = 4.6, 2.1 Hz, 2H), 2.37 (s, 3H), 1.36 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 179.3, 169.2, 166.7, 141.9, 129.6, 129.5, 126.4, 67.9, 54.4, 52.1, 49.7, 25.7, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1758, 1721, 1692, 1368, 1275, 1262, 1180, 1099.

HRMS (ESI^+) calcd. for $C_{16}H_{17}NO_4Na^+$ $[M+Na]^+$: 310.1050, found: 310.1040.

4-(2-Acetyl-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexan-1-yl)benzonitrile (6p)



Prepared according to **General Procedure D** using **2p** (508 mg, 2.00 mmol, 1.00 equiv), CH_3CN (20.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (22.4 mg, 20.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/CH_2Cl_2 (0% to 10%), affording **6p** (272 mg, 1.07 mmol, 54%) as a white solid and **5p** (125 mg, 0.49 mmol, 25 %) as a white solid.[A,B]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 2:1 molar ratio of **6p**/**5p**.

(**B**) When HFIP was used as the solvent, **6p** was isolated in 64% yield. The crude ^1H NMR spectrum indicated a 6:1 molar ratio of **6p**:**5pp**.

M.P.: 79-81 °C

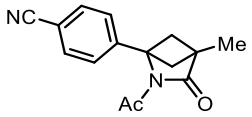
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.5 Hz, 2H), 7.34 (d, *J* = 8.7 Hz, 2H), 3.02 – 2.92 (m, 1H), 2.55 – 2.47 (m, 2H), 2.45 (s, 3H), 2.27 – 2.19 (m, 1H), 1.05 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.4, 167.9, 140.3, 132.4, 126.9, 118.4, 111.6, 65.3, 61.6, 26.3, 26.2, 24.3, 12.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2228, 1775, 1701, 1609, 1372, 1310, 1275, 1266, 1190, 970.

HRMS (ESI^+) calcd. for $C_{15}H_{14}N_2O_2Na^+$ $[M+Na]^+$: 277.0947, found: 277.0937.

4-(2-Acetyl-4-methyl-3-oxo-2-azabicyclo[2.1.1]hexan-1-yl)benzonitrile (5p)



M.P.: 141-143 °C

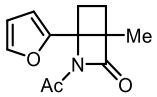
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.62 (d, *J* = 8.4 Hz, 2H), 7.35 (d, *J* = 8.4 Hz, 2H), 2.71 (dd, *J* = 4.7, 2.1 Hz, 2H), 2.44 (dd, *J* = 4.6, 2.1 Hz, 2H), 2.37 (s, 3H), 1.37 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 178.9, 169.4, 142.2, 132.0, 127.2, 118.7, 111.7, 67.6, 54.3, 49.8, 25.6, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2227, 1762, 1693, 1613, 1371, 1357, 1276, 1261, 1175.

HRMS (ESI^+) calcd. for $C_{15}H_{15}N_2O_2^+$ $[M+H]^+$: 255.1128, found: 255.1120.

2-Acetyl-1-(furan-2-yl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6q)



Prepared according to **General Procedure D** using **2q** (257 mg, 1.17 mmol, 1.00 equiv), CH_3CN (11.7 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (13.2 mg, 11.8 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 60%), affording **6q** (136 mg, 0.62 mmol, 53%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a >25:1 molar ratio of **6q**/**5q**.

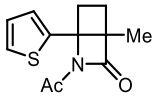
^1H NMR (500 MHz, $CDCl_3$) δ 7.35 (dd, *J* = 1.9, 0.9 Hz, 1H), 6.33 (dd, *J* = 3.3, 1.8 Hz, 1H), 6.28 (dd, *J* = 3.3, 0.9 Hz, 1H), 2.90 (ddd, *J* = 13.2, 11.4, 6.5 Hz, 1H), 2.48 (ddd, *J* = 13.5, 8.6, 5.4 Hz, 1H), 2.43 – 2.36 (m, 4H), 2.15 (ddd, *J* = 13.0, 11.4, 5.4 Hz, 1H), 1.17 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.7, 167.8, 148.9, 143.1, 110.7, 108.9, 61.6, 60.8, 25.80, 25.76, 24.2, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1775, 1704, 1449, 1372, 1275, 1268, 1190, 970.

HRMS (ESI^+) calcd. for $C_{12}H_{13}NO_3Na^+$ $[M+Na]^+$: 242.0788, found: 242.0785.

2-Acetyl-4-methyl-1-(thiophen-2-yl)-2-azabicyclo[2.2.0]hexan-3-one (6r)



Prepared according to **General Procedure D** using **2r** (310 mg, 1.32 mmol, 1.00 equiv), CH_3CN (13.2 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (14.8 mg, 13.2 μmol, 1 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 60%), affording **6r** (244 mg, 1.04 mmol, 79%) as a pale-yellow oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a >25:1 molar ratio of **6r**/**5r**.

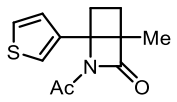
^1H NMR (500 MHz, $CDCl_3$) δ 7.25 (dd, *J* = 5.1, 1.3 Hz, 1H), 6.98 (dd, *J* = 5.0, 3.5 Hz, 1H), 6.94 (dd, *J* = 3.6, 1.3 Hz, 1H), 2.91 (ddd, *J* = 13.6, 11.4, 6.6 Hz, 1H), 2.63 (ddd, *J* = 13.9, 8.6, 5.6 Hz, 1H), 2.46 – 2.38 (m, 4H), 2.17 (ddd, *J* = 13.1, 11.4, 5.6 Hz, 1H), 1.13 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.8, 167.7, 139.0, 127.5, 125.7, 125.5, 63.4, 62.0, 28.3, 25.9, 24.3, 12.7.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1773, 1703, 1442, 1370, 1293, 1266, 1188, 962.

HRMS (ESI^+) calcd. for $C_{12}H_{13}NO_2SNa^+$ $[M+Na]^+$: 258.0559, found: 258.0553.

2-Acetyl-4-methyl-1-(thiophen-3-yl)-2-azabicyclo[2.2.0]hexan-3-one (6s)



Prepared according to **General Procedure D** using **2s** (300 mg, 1.28 mmol, 1.00 equiv), CH_3CN (12.8 mL), and [Ir(dF(CF_3)ppy)$_2$(dtbbpy)](PF_6) (14.3 mg, 12.7 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/CH_2Cl_2 (0% to 10%), affording **6s** (210 mg, 0.89 mmol, 70%) as a colourless oil.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 20:1 molar ratio of **6s**/**5s**.

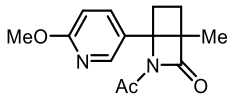
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.32 (ddd, *J* = 5.2, 3.0, 1.3 Hz, 1H), 7.15 (dt, *J* = 3.1, 1.1 Hz, 1H), 6.94 (dt, *J* = 5.0, 1.1 Hz, 1H), 2.89 (ddd, *J* = 13.6, 11.4, 6.6 Hz, 1H), 2.59 (ddd, *J* = 13.7, 8.7, 5.7 Hz, 1H), 2.48 – 2.42 (m, 4H), 2.19 (ddd, *J* = 13.0, 10.7, 5.6 Hz, 1H), 1.12 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.4, 168.1, 137.0, 126.7, 125.5, 122.6, 63.7, 61.2, 27.8, 26.2, 24.4, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1770, 1699, 1371, 1295, 1275, 1266, 1200, 1036.

HRMS (ESI^+) calcd. for $C_{12}H_{13}NO_2SNa^+$ $[M+Na]^+$: 258.0559, found: 258.0551.

2-Acetyl-1-(6-methoxypyridin-3-yl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6t)



Prepared according to **General Procedure D** using **2t** (370 mg, 1.42 mmol, 1.00 equiv), CH_3CN (14.2 mL), and [Ir(dF(CF_3)ppy)$_2$(dtbbpy)](PF_6) (16.0 mg, 14.3 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%), affording **6t** (275 mg, 1.06 mmol, 74%) as a colourless oil.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 11:1 molar ratio of **6t**/**5t**.

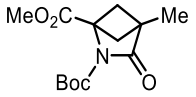
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (d, *J* = 2.6 Hz, 1H), 7.37 (dd, *J* = 8.7, 2.7 Hz, 1H), 6.65 (d, *J* = 8.6 Hz, 1H), 3.82 (s, 3H), 2.87 (ddd, *J* = 13.0, 11.4, 6.0 Hz, 1H), 2.50 – 2.34 (m, 5H), 2.11 (td, *J* = 11.8, 5.4 Hz, 1H), 1.03 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.9, 167.8, 163.6, 144.9, 136.4, 123.4, 110.7, 64.1, 61.0, 53.4, 26.19, 26.15, 24.2, 12.8.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1774, 1701, 1607, 1568, 1497, 1446, 1375, 1311, 1277, 1192, 1023.

HRMS (ESI$^+$) calcd. for $C_{14}H_{17}N_2O_3^+$ [M+H]$^+$: 261.1234, found: 261.1224.

2-(*tert*-Butyl) 1-methyl 4-methyl-3-oxo-2-azabicyclo[2.1.1]hexane-1,2-dicarboxylate (5u)



Prepared according to **General Procedure D** using **2u** (1.05 g, 3.90 mmol, 1.00 equiv), CH_3CN (240 mL, 0.016 M) and benzophenone (177 mg, 0.97 mmol, 0.25 equiv).[A] The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **5u** (830 mg, 3.09 mmol, 79%) as a white solid.

Notes: (**A**) 40 W Kessil KSPR160L lamp (370 nm, 100% intensity) was used.

M.P.: 77-79 °C

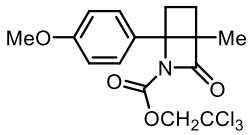
^{1}H NMR (500 MHz, $CDCl_3$) δ 3.76 (s, 3H), 2.46 (dd, *J* = 4.9, 1.8 Hz, 2H), 2.41 (dd, *J* = 4.9, 1.8 Hz, 2H), 1.45 (s, 9H), 1.26 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 176.7, 166.9, 149.5, 83.5, 63.8, 53.4, 52.4, 49.7, 28.0, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1801, 1749, 1715, 1439, 1306, 1210, 1157, 1088, 1036.

HRMS (ESI$^+$) calcd. for $C_{13}H_{19}NO_5Na^+$ [M+Na]$^+$: 292.1155, found: 292.1145.

2,2,2-Trichloroethyl 1-(4-methoxyphenyl)-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexane-2-carboxylate (6v)



Prepared according to **General Procedure D** using **2v** (630 mg, 1.61 mmol, 1.00 equiv), CH_3CN (16.1 mL), and [Ir(dF(CF_3)ppy)$_2$(dtbbpy)](PF_6) (18.0 mg, 16.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **6v** (470 mg, 1.20 mmol, 75%) as a colourless oil.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a >25:1 molar ratio of **6v**/**5v**.

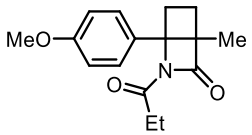
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.21 (d, *J* = 8.8 Hz, 2H), 6.88 (d, *J* = 8.8 Hz, 2H), 4.77 (d, *J* = 12.0 Hz, 1H), 4.66 (d, *J* = 11.9 Hz, 1H), 3.76 (s, 3H), 3.05 (ddd, *J* = 13.5, 11.4, 6.4 Hz, 1H), 2.58 (ddd, *J* = 13.7, 8.7, 5.5 Hz, 1H), 2.48 (ddd, *J* = 13.0, 8.7, 6.4 Hz, 1H), 2.13 (ddd, *J* = 13.0, 11.4, 5.5 Hz, 1H), 1.10 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.9, 159.4, 147.0, 127.6, 126.4, 114.0, 94.3, 74.5, 66.9, 62.2, 55.2, 26.1, 25.4, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1810, 1732, 1614, 1516, 1445, 1379, 1315, 1278, 1252, 1178, 1093.

HRMS (ESI^+) calcd. for $C_{16}H_{16}Cl_3NO_4Na^+$ $[M+Na]^+$: 414.0037, found: 414.0030.

1-(4-Methoxyphenyl)-4-methyl-2-propionyl-2-azabicyclo[2.2.0]hexan-3-one (6w)



Prepared according to **General Procedure D** using **2w** (280 mg, 1.03 mmol, 1.00 equiv), CH_3CN (10.3 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.5 mg, 0.010 mmol, 1 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **6w** (232 mg, 0.85 mmol, 83%) as a colourless oil.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 20:1 molar ratio of **6w**/**5w**.

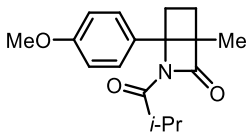
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.16 (d, *J* = 8.9 Hz, 2H), 6.89 (d, *J* = 8.8 Hz, 2H), 3.76 (s, 3H), 2.97 (ddd, *J* = 12.9, 11.4, 6.0 Hz, 1H), 2.88 – 2.72 (m, 2H), 2.50 (ddd, *J* = 12.8, 8.7, 5.3 Hz, 1H), 2.44 (ddd, *J* = 12.8, 8.7, 6.0 Hz, 1H), 2.15 (ddd, *J* = 12.8, 11.4, 5.3 Hz, 1H), 1.17 (t, *J* = 7.5 Hz, 3H), 1.08 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 172.0, 171.5, 159.2, 127.3, 127.1, 114.0, 65.5, 60.6, 55.2, 30.5, 26.4, 26.3, 12.9, 8.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1772, 1699, 1614, 1515, 1461, 1371, 1249, 1178, 1031.

HRMS (ESI^+) calcd. for $C_{16}H_{19}NO_3Na^+$ $[M+Na]^+$: 296.1257, found: 296.1271.

2-Isobutyryl-1-(4-methoxyphenyl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (6x)



Prepared according to **General Procedure D** using **2x** (275 mg, 0.96 mmol, 1.00 equiv), CH_3CN (9.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (10.8 mg, 9.6 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **6x** (183 mg, 0.64 mmol, 67%) as a colourless oil.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated an 18:1 molar ratio of **6x**/**5x**.

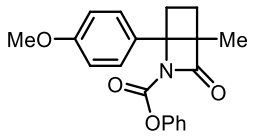
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.15 (d, *J* = 8.8 Hz, 2H), 6.89 (d, *J* = 8.8 Hz, 2H), 3.77 (s, 3H), 3.34 (hept, *J* = 6.9 Hz, 1H), 3.04 – 2.91 (m, 1H), 2.52 – 2.41 (m, 2H), 2.21 – 2.12 (m, 1H), 1.25 (d, *J* = 7.0 Hz, 3H), 1.17 (d, *J* = 6.8 Hz, 3H), 1.09 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 175.3, 171.2, 159.2, 127.3, 127.2, 114.1, 65.4, 60.4, 55.3, 35.1, 26.5, 26.3, 19.1, 17.4, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1773, 1698, 1614, 1516, 1462, 1386, 1248, 1179, 1032.

HRMS (ESI^+) calcd. for $C_{17}H_{21}NO_3Na^+$ $[M+Na]^+$: 310.1414, found: 310.1427.

Phenyl 1-(4-methoxyphenyl)-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexane-2-carboxylate (6y)



Prepared according to **General Procedure D** using **2y** (337 mg, 1.00 mmol, 1.00 equiv), CH_3CN (10.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.2 mg, 10.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **6y** (232 mg, 0.69 mmol, 69%) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 16:1 molar ratio of **6y**/**5y**.

M.P.: 143-145 °C

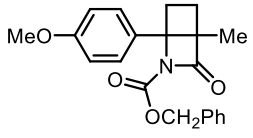
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.34 – 7.28 (m, 4H), 7.18 (t, *J* = 7.4 Hz, 1H), 7.11 (d, *J* = 8.1 Hz, 2H), 6.95 (d, *J* = 8.9 Hz, 2H), 3.78 (s, 3H), 3.07 (ddd, *J* = 13.6, 11.4, 6.3 Hz, 1H), 2.66 (ddd, *J* = 13.8, 8.7, 5.6 Hz, 1H), 2.56 (ddd, *J* = 13.0, 8.7, 6.3 Hz, 1H), 2.18 (ddd, *J* = 13.0, 11.4, 5.6 Hz, 1H), 1.15 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.8, 159.3, 149.9, 147.0, 129.3, 127.5, 126.7, 126.1, 121.2, 114.1, 66.7, 61.8, 55.2, 26.4, 25.5, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1806, 1737, 1614, 1516, 1320, 1276, 1253, 1180, 1024.

HRMS (ESI^+) calcd. for $C_{20}H_{19}NO_4Na^+$ $[M+Na]^+$: 360.1206, found: 360.1222.

Benzyl 1-(4-methoxyphenyl)-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexane-2-carboxylate (6z)



Prepared according to **General Procedure D** using **2z** (365 mg, 1.04 mmol, 1.00 equiv), CH_3CN (10.4 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.7 mg, 10.4 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **6z** (191 mg, 0.54 mmol, 52%) as a white solid.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 10:1 molar ratio of **6z**/**5z**.

M.P.: 137-139 °C

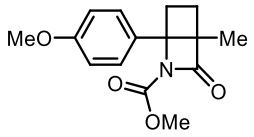
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 – 7.27 (m, 3H), 7.24 – 7.19 (m, 4H), 6.90 (d, *J* = 8.9 Hz, 2H), 5.23 (d, *J* = 12.5 Hz, 1H), 5.18 (d, *J* = 12.5 Hz, 1H), 3.80 (s, 3H), 3.06 – 2.96 (m, 1H), 2.55 – 2.43 (m, 2H), 2.15 – 2.08 (m, 1H), 1.10 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.9, 159.3, 148.8, 135.1, 128.4, 128.2, 127.8, 127.5, 126.9, 114.0, 67.6, 66.4, 61.6, 55.2, 26.3, 25.5, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1803, 1713, 1613, 1516, 1455, 1387, 1314, 1283, 1252, 1207, 1180.

HRMS (ESI^+) calcd. for $C_{21}H_{21}NO_4Na^+$ $[M+Na]^+$: 374.1363, found: 374.1382.

Methyl 1-(4-methoxyphenyl)-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexane-2-carboxylate (6aa)



Prepared according to **General Procedure D** using **2aa** (285 mg, 1.04 mmol, 1.00 equiv), CH_3CN (10.4 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.7 mg, 10.4 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **6aa** (173 mg, 0.63 mmol, 61%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 10:1 molar ratio of **6aa**/**5aa**.

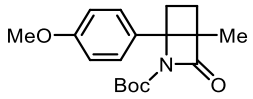
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.20 (d, *J* = 8.8 Hz, 2H), 6.90 (d, *J* = 8.8 Hz, 2H), 3.78 (s, 3H), 3.77 (s, 3H), 2.99 (ddd, *J* = 13.1, 11.4, 6.0 Hz, 1H), 2.51 (ddd, *J* = 13.3, 8.7, 5.4 Hz, 1H), 2.45 (ddd, *J* = 12.9, 8.7, 6.1 Hz, 1H), 2.12 (ddd, *J* = 13.0, 11.5, 5.4 Hz, 1H), 1.07 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.9, 159.3, 149.6, 127.5, 126.9, 114.1, 66.2, 61.4, 55.2, 53.3, 26.3, 25.7, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1790, 1729, 1614, 1516, 1438, 1320, 1278, 1252, 1178, 1030.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_4Na^+$ $[M+Na]^+$: 298.1050, found: 298.1064.

***tert*-Butyl 1-(4-methoxyphenyl)-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexane-2-carboxylate (6ab)**



Prepared according to **General Procedure D** using **2ab** (2.63 g, 8.30 mmol, 1.00 equiv), CH_3CN (83.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (46.6 mg, 41.5 μmol, 0.50 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **6ab** (1.09 g, 3.44 mmol, 41%) as a colourless oil and **5ab** (240 mg, 0.76 mmol, 9%) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 4.5:1 molar ratio of **6ab**/**5ab**.

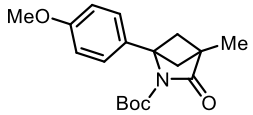
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.17 (d, *J* = 8.9 Hz, 2H), 6.88 (d, *J* = 8.8 Hz, 2H), 3.77 (s, 3H), 3.01 – 2.91 (m, 1H), 2.49 – 2.39 (m, 2H), 2.11 – 2.03 (m, 1H), 1.36 (s, 9H), 1.04 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.4, 159.1, 147.7, 127.5, 127.4, 113.8, 82.9, 66.2, 61.1, 55.2, 27.9, 26.3, 25.5, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1796, 1718, 1614, 1516, 1457, 1370, 1321, 1251, 1152, 1035.

HRMS (ESI^+) calcd. for $C_{18}H_{23}NO_4Na^+$ $[M+Na]^+$: 340.1519, found: 340.1507.

***tert*-Butyl 1-(4-methoxyphenyl)-4-methyl-3-oxo-2-azabicyclo[2.1.1]hexane-2-carboxylate (5ab)**



M.P.: 96-98 °C

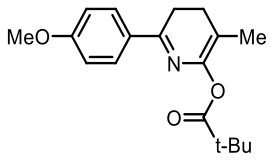
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.14 (d, *J* = 8.8 Hz, 2H), 6.86 (d, *J* = 8.8 Hz, 2H), 3.78 (s, 3H), 2.68 (dd, *J* = 4.6, 2.1 Hz, 2H), 2.34 (dd, *J* = 4.6, 2.1 Hz, 2H), 1.31 (s, 3H), 1.14 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 179.1, 159.4, 149.7, 129.5, 127.9, 113.6, 81.7, 68.4, 55.3, 54.9, 49.6, 27.7, 13.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1786, 1722, 1702, 1615, 1519, 1455, 1360, 1291, 1246, 1157, 1032.

HRMS (ESI^+) calcd. for $C_{18}H_{23}NO_4Na^+$ $[M+Na]^+$: 340.1519, found: 340.1508.

6-(4-Methoxyphenyl)-3-methyl-4,5-dihydropyridin-2-yl pivalate (9)



Prepared according to **General Procedure D** using **2ac** (315 mg, 1.05 mmol, 1.00 equiv), CH_3CN (10.5 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (11.7 mg, 10.4 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%), affording **9** (193 mg, 0.64 mmol, 61%) as a colourless oil.

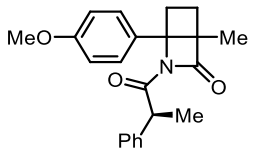
^{1}H NMR (500 MHz, CD_2Cl_2) δ 7.87 (d, *J* = 8.9 Hz, 2H), 6.93 (d, *J* = 8.9 Hz, 2H), 3.84 (s, 3H), 2.77 (t, *J* = 9.8 Hz, 2H), 2.36-2.28 (m, 2H), 1.73 (s, 3H), 1.36 (s, 9H).

^{13}C NMR (126 MHz, CD_2Cl_2) δ 176.8, 162.7, 162.0, 145.9, 130.9, 128.8, 114.0, 108.3, 55.7, 39.2, 27.4, 26.1, 24.3, 15.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1745, 1607, 1512, 1461, 1276, 1259, 1116, 1029.

HRMS (ESI^+) calcd. for $C_{18}H_{24}NO_3^+$ $[M+H]^+$: 302.1751, found: 302.1743.

(1*S*,4*S*)-1-(4-methoxyphenyl)-4-methyl-2-((*S*)-2-phenylpropanoyl)-2-azabicyclo[2.2.0] hexan-3-one & (1*R*,4*R*)-1-(4-methoxyphenyl)-4-methyl-2-((*S*)-2-phenylpropanoyl)-2-azabicyclo[2.2.0]hexan-3-one (6ad and 6ad')



Diastereoisomer 1

Prepared according to **General Procedure D** using **2ad** (151 mg, 0.43 mmol, 1.00 equiv), CH_3CN (4.3 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (4.8 mg, 4.3 μmol, 1 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 25%) and CH_2Cl_2/pentane (0% to 100%), affording **6ad** (41 mg, 0.12 mmol, 27%) as a colourless oil and **6ad'** (40.3 mg, 0.12 mmol, 27%) as a colourless oil.[A]

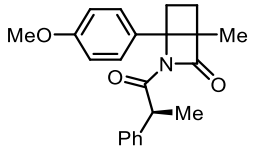
Notes: (**A**) The crude ^{1}H NMR spectrum indicated an 18:1 molar ratio of (**6ad+6ad'**)/(**5ab+5ad'**). The specific identity of the diastereomers could not be confirmed so no assignment has been made.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.42 – 7.39 (m, 2H), 7.35 – 7.31 (m, 2H), 7.29 – 7.25 (m, 1H), 7.20 (d, *J* = 8.8 Hz, 2H), 6.92 (d, *J* = 8.7 Hz, 2H), 4.64 (q, *J* = 7.0 Hz, 1H), 3.82 (s, 3H), 2.87 (dt, *J* = 13.5, 8.7 Hz, 1H), 2.20 (ddd, *J* = 13.7, 7.7, 6.4 Hz, 1H), 2.01-1.96 (m, 2H), 1.52 (d, *J* = 7.1 Hz, 3H), 1.07 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 172.4, 171.5, 159.3, 139.7, 128.7, 128.2, 127.5, 127.4, 114.2, 66.0, 60.6, 55.4, 45.9, 26.4, 26.1, 18.9, 12.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1777, 1700, 1517, 1454, 1358, 1275, 1260, 1179.

HRMS (ESI^+) calcd. for $C_{22}H_{23}NO_3Na^+$ $[M+Na]^+$: 372.1570, found: 372.1568.



Diastereoisomer 2

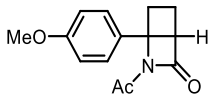
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.39 – 7.27 (m, 5H), 6.80 (d, *J* = 8.9 Hz, 2H), 6.74 (d, *J* = 8.8 Hz, 2H), 4.60 (q, *J* = 7.3 Hz, 1H), 3.76 (s, 3H), 3.02 (ddd, *J* = 13.0, 11.4, 6.1 Hz, 1H), 2.56 (dt, *J* = 12.8, 6.9 Hz, 1H), 2.49 (ddd, *J* = 12.7, 8.6, 6.1 Hz, 1H), 2.14 (ddd, *J* = 12.7, 11.4, 5.4 Hz, 1H), 1.48 (d, *J* = 7.0 Hz, 3H), 0.97 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 172.0, 171.1, 159.2, 140.4, 128.8, 128.2, 127.4, 127.2, 126.9, 114.0, 65.6, 60.7, 55.3, 46.6, 26.5, 26.0, 17.9, 13.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1775, 1701, 1516, 1453, 1356, 1275, 1260, 1179.

HRMS (ESI^+) calcd. for $C_{22}H_{23}NO_3Na^+$ $[M+Na]^+$: 372.1570, found: 372.1566.

2-Acetyl-1-(4-methoxyphenyl)-2-azabicyclo[2.2.0]hexan-3-one (6ae)



Prepared according to **General Procedure D** using **2ae** (220 mg, 0.90 mmol, 1.00 equiv), CH_3CN (9.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (10.0 mg, 9.0 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **6ae** (120 mg, 0.49 mmol, 55%) as a colourless oil and **5ae** (17 mg, 0.07 mmol, 8%) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 5:1 molar ratio of **6ae**/**5ae**.

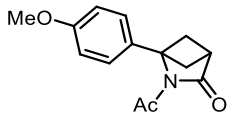
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.28 (d, *J* = 8.8 Hz, 2H), 6.87 (d, *J* = 8.8 Hz, 2H), 3.76 (s, 3H), 3.61 (dd, *J* = 9.4, 2.9 Hz, 1H), 2.90 (ddd, *J* = 13.3, 11.4, 6.6 Hz, 1H), 2.68 (ddd, *J* = 13.3, 8.6, 5.8 Hz, 1H), 2.63 – 2.53 (m, 1H), 2.39 (s, 3H), 2.26 (dddd, *J* = 13.1, 8.6, 6.6, 2.9 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.7, 167.9, 159.3, 129.0, 127.4, 113.8, 63.1, 55.2, 54.3, 28.9, 24.3, 18.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1771, 1699, 1613, 1516, 1463, 1371, 1288, 1250, 1211, 1178, 1032.

HRMS (ESI^+) calcd. for $C_{14}H_{15}NO_3Na^+$ $[M+Na]^+$: 268.0944, found: 268.0937.

2-Acetyl-1-(4-methoxyphenyl)-2-azabicyclo[2.1.1]hexan-3-one (5ae)



M.P.: 86-88 °C

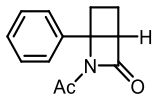
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.19 (d, *J* = 8.7 Hz, 2H), 6.89 (d, *J* = 8.7 Hz, 2H), 3.81 (s, 3H), 3.02 (t, *J* = 2.7 Hz, 1H), 2.76-2.71 (m, 2H), 2.61-2.55 (m, 2H), 2.38 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 178.8, 169.6, 159.5, 129.3, 127.7, 113.7, 72.7, 55.3, 50.6, 44.4, 26.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1759, 1693, 1614, 1519, 1369, 1348, 1289, 1246, 1177, 1126, 1036.

HRMS (ESI^+) calcd. for $C_{14}H_{15}NO_3Na^+$ $[M+Na]^+$: 268.0944, found: 268.09443.

2-Acetyl-1-phenyl-2-azabicyclo[2.2.0]hexan-3-one (6af)



Prepared according to **General Procedure D** using **2af** (150 mg, 0.70 mmol, 1.00 equiv), CH_3CN (7.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (7.8 mg, 7.0 μmol, 1 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **6af** (77 mg, 0.36 mmol, 51%) as a colourless oil and **5af** (38 mg, 0.18 mmol, 25%) as a white solid.[A,B]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 2:1 molar ratio of **6af**/**5af**.

(**B**) When HFIP was used as the solvent, **6af** was isolated in 58% yield. The crude ^{1}H NMR spectrum indicated a 5:1 molar ratio of **6af**:**5af**.

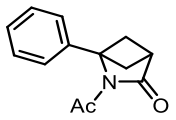
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.374 (s, 2H), 7.366 (s, 2H), 7.34 – 7.26 (m, 1H), 3.66 (dd, *J* = 9.5, 2.9 Hz, 1H), 2.97 (ddd, *J* = 13.3, 11.4, 6.6 Hz, 1H), 2.72 (ddd, *J* = 13.4, 8.6, 5.8 Hz, 1H), 2.63 (dddd, *J* = 13.1, 11.4, 9.5, 5.8 Hz, 1H), 2.43 (s, 3H), 2.31 (dddd, *J* = 13.1, 8.6, 6.6, 2.9 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.6, 168.0, 137.0, 128.6, 128.2, 126.2, 63.4, 54.6, 28.8, 24.4, 18.8.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1773, 1700, 1371, 1285, 1210, 1183, 997.

HRMS (ESI$^+$) calcd. for $C_{13}H_{13}NO_2Na^+$ $[M+Na]^+$: 238.0838, found: 238.0839.

2-Acetyl-1-phenyl-2-azabicyclo[2.1.1]hexan-3-one (5af)



M.P.: 94-96 °C

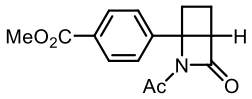
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.39 – 7.32 (m, 3H), 7.29 – 7.27 (m, 2H), 3.04 (t, *J* = 2.7 Hz, 1H), 2.78-2.74 (m, 2H), 2.63-2.60 (m, 2H), 2.39 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 178.7, 169.5, 137.1, 128.3, 128.2, 126.3, 72.7, 50.6, 44.4, 26.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1760, 1678, 1450, 1375, 1305, 1198, 1127, 1088, 985.

HRMS (ESI$^+$) calcd. for $C_{13}H_{13}NO_2Na^+$ $[M+Na]^+$: 238.0838, found: 238.0837.

Methyl 4-(2-acetyl-3-oxo-2-azabicyclo[2.2.0]hexan-1-yl)benzoate (6ag)



Prepared according to **General Procedure D** using **2ag** (185 mg, 0.68 mmol, 1.00 equiv), CH_3CN (6.8 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (7.6 mg, 6.8 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%), affording **6ag** as a colourless oil (43 mg, 0.16 mmol, 23%) and **5ag** (92 mg, 0.34 mmol, 50%) as a white solid.[A,B]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 1:2 molar ratio of **6ag**/**5ag**.

(**B**) When HFIP was used as the solvent, **6ag** was isolated in 32% yield. The crude ^{1}H NMR spectrum indicated a 1.3:1 molar ratio of **6ag**/**5ag**.

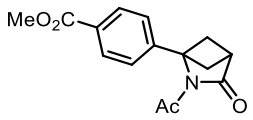
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.4 Hz, 2H), 7.42 (d, *J* = 8.5 Hz, 2H), 3.90 (s, 3H), 3.68 (dd, *J* = 9.5, 2.9 Hz, 1H), 3.02 – 2.94 (m, 1H), 2.75 – 2.62 (m, 2H), 2.43 (s, 3H), 2.37 – 2.29 (m, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.2, 168.0, 166.6, 141.9, 129.94, 129.91, 126.3, 63.0, 54.9, 52.3, 28.8, 24.4, 18.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1778, 1702, 1613, 1435, 1409, 1372, 1275, 1185, 1108, 1019.

HRMS (ESI$^+$) calcd. for $C_{15}H_{15}NO_4Na^+$ $[M+Na]^+$: 296.0893, found: 296.0891.

Methyl 4-(2-acetyl-3-oxo-2-azabicyclo[2.1.1]hexan-1-yl)benzoate (5ag)



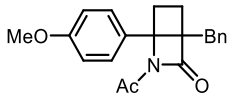
M.P.: 107-109 °C

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.4 Hz, 2H), 7.31 (d, *J* = 8.4 Hz, 2H), 3.89 (s, 3H), 3.03 (t, *J* = 2.8 Hz, 1H), 2.76-2.72 (m, 2H), 2.64-2.58 (m, 2H), 2.36 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 178.1, 169.4, 166.6, 141.9, 129.7, 129.5, 126.2, 71.9, 52.2, 50.4, 44.3, 25.8.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1768, 1696, 1613, 1436, 1371, 1347, 1276, 1195, 1113. **HRMS** (ESI^+) calcd. for $C_{15}H_{15}NO_4Na^+$ $[M+Na]^+$: 296.0893, found: 296.0893.

2-Acetyl-4-benzyl-1-(4-methoxyphenyl)-2-azabicyclo[2.2.0]hexan-3-one (6ah)



Prepared according to **General Procedure D** using **2ah** (595 mg, 1.78 mmol, 1.00 equiv), CH_3CN (17.8 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (19.9 mg, 17.7 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **6ah** (422 mg, 1.26 mmol, 71%) as a colourless oil.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a >25:1 molar ratio of **6ah**/**5ah**.

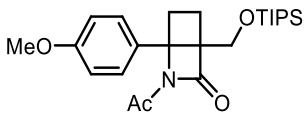
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.24 – 7.19 (m, 5H), 7.00 – 6.95 (m, 4H), 3.86 (s, 3H), 2.97 (ddd, *J* = 13.6, 11.3, 6.6 Hz, 1H), 2.93 (d, *J* = 14.8 Hz, 1H), 2.77 (d, *J* = 15.0 Hz, 1H), 2.55 – 2.48 (m, 4H), 2.36 – 2.23 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.1, 168.0, 159.4, 135.4, 129.7, 128.3, 127.6, 126.8, 126.5, 114.2, 66.1, 64.4, 55.4, 33.8, 26.1, 24.5, 23.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1773, 1702, 1614, 1515, 1454, 1371, 1276, 1253, 1179, 1029.

HRMS (ESI^+) calcd. for $C_{21}H_{21}NO_3Na^+$ $[M+Na]^+$: 358.1414, found: 358.1410.

2-acetyl-1-(4-methoxyphenyl)-4-(((triisopropylsilyl)oxy)methyl)-2-azabicyclo[2.2.0] hexan-3-one (6ai)



Prepared according to **General Procedure D** using **2ai** (530 mg, 1.23 mmol, 1.00 equiv), CH_3CN (12.3 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (13.8 mg, 12.3 μmol, 1.0 mol%). The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 50%) and ethyl acetate/CH_2Cl_2 (0% to 10%), affording **6ai** (372 mg, 0.86 mmol, 70%) as a colourless oil.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a >25:1 molar ratio of **6ai**/**5ai**.

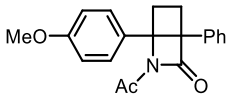
^1H NMR (500 MHz, $CDCl_3$) δ 7.27 (d, *J* = 8.8 Hz, 2H), 6.86 (d, *J* = 8.8 Hz, 2H), 3.84 (d, *J* = 11.6 Hz, 1H), 3.78 (d, *J* = 11.6 Hz, 1H), 3.76 (s, 3H), 3.01 – 2.92 (m, 1H), 2.58 – 2.44 (m, 5H), 2.28 – 2.21 (m, 1H), 0.98 – 0.86 (m, 21H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 169.6, 168.0, 159.3, 127.8, 127.1, 113.9, 66.9, 66.5, 58.5, 55.4, 27.1, 24.6, 20.1, 17.84, 17.79, 11.7.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2942, 2865, 1777, 1706, 1615, 1516, 1462, 1371, 1307, 1276, 1179.

HRMS (ESI^+) calcd. for $C_{24}H_{38}NO_4Si^+$ $[M+H]^+$: 432.2565, found: 432.2586.

2-Acetyl-1-(4-methoxyphenyl)-4-phenyl-2-azabicyclo[2.2.0]hexan-3-one (6aj)



Prepared according to **General Procedure D** using **2aj** (500 mg, 1.56 mmol, 1.00 equiv), CH_3CN (15.6 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (17.5 mg, 15.6 μmol, 1.0 mol%). The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%) and ethyl acetate/CH_2Cl_2 (0% to 10%), affording **6aj** (168 mg, 0.52 mmol, 34%) as a pale-yellow oil and **5aj** (211 mg, 0.66 mmol, 42%) as a pale-yellow solid.[A]

Notes: (**A**) The crude ^1H NMR spectrum indicated a 1:1.2 molar ratio of **6aj**/**5aj**.

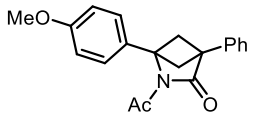
^1H NMR (500 MHz, $CDCl_3$) δ 7.25 – 7.16 (m, 5H), 7.06 (d, *J* = 8.8 Hz, 2H), 6.77 (d, *J* = 8.8 Hz, 2H), 3.72 (s, 3H), 3.18 (ddd, *J* = 13.1, 10.0, 7.7 Hz, 1H), 2.82 – 2.77 (m, 2H), 2.72 (ddd, *J* = 13.1, 8.3, 5.6 Hz, 1H), 2.53 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 169.8, 168.2, 159.2, 133.6, 128.6, 127.9, 127.8, 126.9, 126.7, 113.8, 68.6, 67.7, 55.2, 27.6, 27.1, 24.7.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1774, 1707, 1612, 1516, 1448, 1372, 1276, 1259, 1179.

HRMS (ESI^+) calcd. for $C_{20}H_{20}NO_3^+$ $[M+H]^+$: 322.1438, found: 322.1434.

2-acetyl-1-(4-methoxyphenyl)-4-phenyl-2-azabicyclo[2.1.1]hexan-3-one (5aj)



M.P.: 134-136 °C

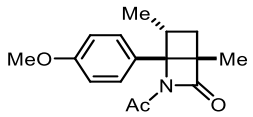
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.45 (t, *J* = 7.4 Hz, 2H), 7.40 – 7.36 (m, 1H), 7.34 – 7.29 (m, 4H), 6.95 (d, *J* = 8.7 Hz, 2H), 3.84 (s, 3H), 3.17 (dd, *J* = 4.2, 2.5 Hz, 2H), 2.79 (dd, *J* = 4.2, 2.3 Hz, 2H), 2.45 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 177.6, 169.4, 159.5, 134.5, 128.8, 128.6, 128.0, 127.8, 127.0, 113.7, 67.6, 56.2, 55.3, 54.0, 26.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1766, 1707, 1612, 1516, 1448, 1372, 1276, 1259, 1179.

HRMS (ESI^+) calcd. for $C_{20}H_{19}NO_3Na^+$ $[M+Na]^+$: 344.1257, found: 344.1254.

(±)-(1*S*,4*S*,6*R*)-2-acetyl-1-(4-methoxyphenyl)-4,6-dimethyl-2-azabicyclo[2.2.0]hexan-3-one (6ak)



Prepared according to **General Procedure D** using **2ak** (510 mg, 1.87 mmol, 1.00 equiv), CH_3CN (18.7 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (21.0 mg, 18.7 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of pentane/ethyl acetate (0% to 35%), affording **6ak** (340 mg, 1.25 mmol, 67%) as a colourless oil.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 7:1 molar ratio of **6ak**/**5ak**.

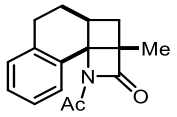
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.18 (d, *J* = 8.8 Hz, 2H), 6.90 (d, *J* = 8.8 Hz, 2H), 3.77 (s, 3H), 3.47 (dp, *J* = 10.5, 7.1 Hz, 1H), 2.46 (s, 3H), 2.21 (dd, *J* = 12.9, 10.6 Hz, 1H), 1.99 (dd, *J* = 12.9, 7.2 Hz, 1H), 1.17 (d, *J* = 7.0 Hz, 3H), 1.06 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 172.2, 168.3, 159.2, 127.3, 127.0, 114.1, 68.9, 57.5, 55.2, 33.1, 32.7, 24.5, 16.8, 12.4.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1771, 1704, 1612, 1515, 1445, 1371, 1275, 1179, 1033.

HRMS (ESI$^+$) calcd. for $C_{16}H_{19}NO_3Na^+$ [M+Na]$^+$: 296.1257, found: 296.1246.

(±)-(2a*S*,3a*S*,9b*S*)-1-acetyl-2a-methyl-3,3a,4,5-tetrahydro-1*H*-naphtho[1',2':1,4] cyclobuta[1,2-b]azet-2(2a*H*)-one (6al)



Prepared according to **General Procedure D** using **2al** (465 mg, 1.82 mmol, 1.00 equiv), CH_3CN (18.2 mL), and [Ir(dF(CF_3)ppy)$_2$(dtbbpy)](PF_6) (20.0 mg, 17.8 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 40%), affording **6al** (246 mg, 0.96 mmol, 53%) as a colourless oil and **5al** (78 mg, 0.31 mmol, 17%) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 3:1 molar ratio of **6al**/**5al**.

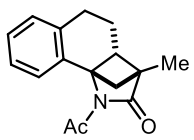
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.22 – 7.17 (m, 3H), 7.09 – 7.05 (m, 1H), 2.93 – 2.87 (m, 1H), 2.85 (ddd, *J* = 15.6, 6.8, 3.7 Hz, 1H), 2.74 – 2.66 (m, 1H), 2.64 (dd, *J* = 13.2, 8.1 Hz, 1H), 2.47 (s, 3H), 2.02 (dddd, *J* = 13.5, 10.2, 6.7, 3.8 Hz, 1H), 1.84 (dd, *J* = 13.3, 5.5 Hz, 1H), 1.79 (dddd, *J* = 13.4, 6.8, 5.4, 3.9 Hz, 1H), 1.05 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 171.7, 167.8, 139.3, 130.3, 128.5, 127.7, 126.7, 124.9, 64.5, 60.2, 36.1, 31.9, 28.0, 27.4, 24.4, 13.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1774, 1701, 1457, 1371, 1308, 1276, 1199, 962.

HRMS (ESI$^+$) calcd. for $C_{16}H_{17}NO_2Na^+$ [M+Na]$^+$: 278.1152, found: 278.1151.

(±)-(3*R*,3a*R*,9b*S*)-1-acetyl-3-methyl-3,3a,4,5-tetrahydro-3,9b-methanobenzo[g]indol-2(1*H*)-one (5al)



M.P.: 114-116 °C

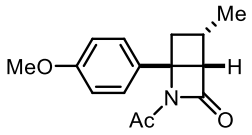
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.19 – 7.15 (m, 3H), 7.14 – 7.10 (m, 1H), 2.95 – 2.87 (m, 1H), 2.82 (dt, *J* = 16.2, 3.7 Hz, 1H), 2.77 – 2.71 (m, 1H), 2.68 (d, *J* = 8.2 Hz, 1H), 2.49 (s, 3H), 2.44 (dd, *J* = 8.2, 7.0 Hz, 1H), 2.15 – 2.09 (m, 2H), 1.26 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 181.3, 169.7, 136.2, 132.3, 129.2, 127.6, 127.5, 126.0, 66.4, 61.1, 54.0, 52.1, 28.3, 26.0, 22.2, 10.8.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1758, 1696, 1447, 1361, 1276, 1261, 1182, 1146.

HRMS (ESI^+) calcd. for $C_{16}H_{17}NO_2Na^+$ $[M+Na]^+$: 278.1152, found: 278.1155.

(±)-(1*R*,4*S*,5*S*)-2-acetyl-1-(4-methoxyphenyl)-5-methyl-2-azabicyclo[2.2.0]hexan-3-one (6am)



Prepared according to **General Procedure D** using **2am** (135 mg, 0.52 mmol, 1.00 equiv), CH_3CN (5.2 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (5.8 mg, 5.2 μmol, 1.0 mol%). The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of pentane/ethyl acetate (0% to 40%), affording **6am** (31 mg, 0.12 mmol, 23%) as a white solid and **5am** (60 mg, 0.23 mmol, 44%) as a white solid.[A,B]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a 1:2.2 molar ratio of **6am**/**5am**.

(**B**) When HFIP was used as the solvent, **6am** was isolated in 27% yield. The crude ^{1}H NMR spectrum indicated a 1:1 molar ratio of **6am**:**5am**.

M.P.: 55-57 °C

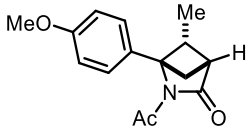
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30 (d, *J* = 8.8 Hz, 2H), 6.89 (d, *J* = 8.8 Hz, 2H), 3.80 (s, 3H), 3.27 (d, *J* = 2.4 Hz, 1H), 2.93 (dd, *J* = 13.4, 7.7 Hz, 1H), 2.75-2.66 (m, 1H), 2.44-2.38 (m, 4H), 1.33 (d, *J* = 7.0 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 168.2, 168.2, 159.5, 129.6, 127.6, 114.0, 61.3, 60.9, 55.4, 37.6, 28.5, 24.5, 22.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1774, 1700, 1613, 1516, 1457, 1371, 1277, 1259, 1179, 1027.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_3Na^+$ $[M+Na]^+$: 282.1101, found: 282.1090.

(±)-(1*S*,4*R*,5*R*)-2-acetyl-1-(4-methoxyphenyl)-5-methyl-2-azabicyclo[2.1.1]hexan-3-one (5am)



M.P.: 106-108 °C

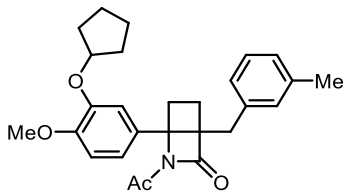
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.17 (d, *J* = 8.7 Hz, 2H), 6.88 (d, *J* = 8.7 Hz, 2H), 3.80 (s, 3H), 2.94 (qd, *J* = 6.4, 2.8 Hz, 1H), 2.89 (t, *J* = 2.7 Hz, 1H), 2.64 (d, *J* = 7.4 Hz, 1H), 2.43 (s, 3H), 2.39 (dd, *J* = 7.3, 2.6 Hz, 1H), 1.25 (d, *J* = 6.4 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 178.4, 170.3, 159.3, 129.4, 127.5, 113.6, 74.5, 56.6, 55.3, 49.3, 48.3, 26.0, 11.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1760, 1694, 1614, 1519, 1462, 1364, 1276, 1177, 1030.

HRMS (ESI^+) calcd. for $C_{15}H_{17}NO_3Na^+$ $[M+Na]^+$: 282.1101, found: 282.1091.

2-Acetyl-1-(3-(cyclopentyloxy)-4-methoxyphenyl)-4-(3-methylbenzyl)-2-azabicyclo[2.2.0] hexan-3-one (6an)



Prepared according to **General Procedure D** using **2an** (1.69 g, 3.90 mmol, 1.00 equiv), CH_3CN (39.0 mL), and $[Ir(dF(CF_3)ppy)_2(dtbbpy)](PF_6)$ (43.8 mg, 39.0 μmol, 1.0 mol%). The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of Et_2O/pentane (0% to 60%) and pentane/ethyl acetate (0% to 30%), affording **6an** (1.02 g, 2.36 mmol, 60%) as a white solid.[A]

Notes: (**A**) The crude ^{1}H NMR spectrum indicated a >25:1 molar ratio of **6an**/**5an**.

M.P.: 89-91 °C

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.07 (t, *J* = 7.5 Hz, 1H), 6.98 – 6.94 (m, 1H), 6.89 (d, *J* = 8.4 Hz, 1H), 6.81 (dd, *J* = 8.4, 2.2 Hz, 1H), 6.77 (d, *J* = 7.5 Hz, 1H), 6.68 (d, *J* = 2.1 Hz, 1H), 6.58 (s, 1H), 4.72-4.66 (m, 1H), 3.86 (s, 3H), 2.90 (ddd, *J* = 13.5, 11.3, 6.7 Hz, 1H), 2.85 (d, *J* = 14.9 Hz, 1H), 2.76 (d, *J* = 14.8 Hz, 1H), 2.50 – 2.42 (m, 4H), 2.34 – 2.22 (m, 2H), 2.20 (s, 3H), 1.91 – 1.81 (m, 6H), 1.66 – 1.55 (m, 2H).

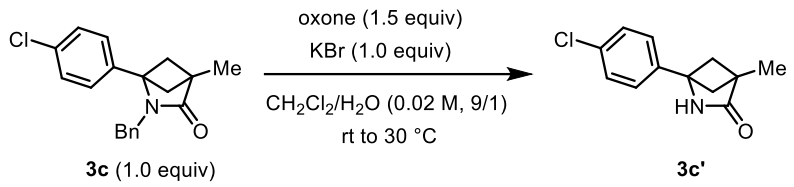
^{13}C NMR (126 MHz, $CDCl_3$) δ 171.2, 167.8, 149.9, 147.7, 137.7, 135.3, 130.6, 128.0, 127.2, 127.2, 126.7, 119.0, 113.2, 111.9, 80.5, 66.3, 64.6, 56.1, 33.6, 32.9, 32.7, 26.0, 24.4, 24.1, 23.5, 21.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 2955, 1773, 1705, 1516, 1419, 1371, 1276, 1254.

HRMS (ESI^+) calcd. for $C_{27}H_{32}NO_4^+$ $[M+H]^+$: 434.2326, found: 434.2311.

2.5 Product Derivatisation Studies

1-(4-Chlorophenyl)-4-methyl-2-azabicyclo[2.1.1]hexan-3-one (3c')



An oven-dried 50 mL round-bottom flask charged with **3c** (62 mg, 0.20 mmol, 1.0 equiv), KBr (33.8 mg, 0.20 mmol, 1.0 equiv) and oxone (92 mg, 0.30 mmol, 1.5 equiv) were sealed and subjected to three cycles of evacuation and nitrogen backfilling. CH_2Cl_2 (9.0 mL) and H_2O (1.0 mL) were added at room temperature, and the mixture was stirred at 30 ℃ for 7 h. The reaction was quenched with sat. aq. $NaHCO_3$ solution (50 mL) and extracted with CH_2Cl_2 (3×30 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 60%), affording **3c'** (35 mg, 0.16 mmol, 79%) as a white solid.

M.P.: 149-151 ℃

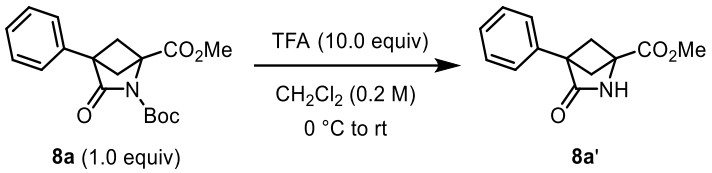
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35 (d, *J* = 8.5 Hz, 2H), 7.24 (d, *J* = 8.5 Hz, 2H), 5.69 (s, 1H), 2.69 (dd, *J* = 3.9, 2.0 Hz, 2H), 2.49 (d, *J* = 4.9 Hz, 2H), 1.33 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 185.8, 135.4, 134.4, 129.1, 127.5, 63.4, 59.4, 50.6, 13.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 3186, 1720, 1600, 1496, 1400, 1378, 1245, 1129, 1088.

HRMS (ESI^+) calcd. for $C_{12}H_{13}ClNO^+$ $[M+H]^+$: 222.0680, found: 222.0675.

Methyl 3-oxo-4-phenyl-2-azabicyclo[2.1.1]hexane-1-carboxylate (8a')



To an oven-dried 100 mL round-bottom flask containing a solution of **8a** (1.32 g, 4.00 mmol, 1.00 equiv) in CH_2Cl_2 (20.0 mL, 0.2 M), was added TFA (3.00 mL, 40.0 mmol, 10.0 equiv) at 0 °C. The mixture was then stirred at room temperature for 1 h before being concentrated *in vacuo* and diluted with ethyl acetate (50 mL). Then, the mixture was basified to pH 10-11 using 1 M aq. NaOH solution and the aqueous phase were extracted with ethyl acetate (2×50 mL). The combined organic layers

were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 100%), affording **8a'** (561 mg, 2.43 mmol, 61%) as a white solid.

M.P.: 116-118 °C

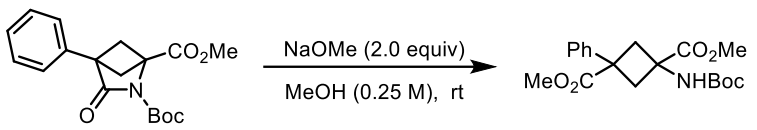
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.40 – 7.35 (m, 2H), 7.33 – 7.27 (m, 3H), 6.38 (s, 1H), 3.82 (s, 3H), 3.05 – 2.97 (m, 4H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 180.8, 167.6, 134.9, 128.5, 127.8, 126.9, 60.3, 58.7, 58.0, 52.7.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1731, 1438, 1293, 1266, 1209, 1154, 1140, 1101.

HRMS (ESI^+) calcd. for $C_{13}H_{14}NO_3^+$ $[M+H]^+$: 232.0968, found: 232.0957.

Dimethyl 1-((tert-butoxycarbonyl)amino)-3-phenylcyclobutane-1,3-dicarboxylate (8a")



8a (1.0 equiv) **8a"**

An oven-dried 25 mL round-bottom flask charged with **8a** (180 mg, 0.54 mmol, 1.00 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Sodium methoxide solution (0.5 M in MeOH, 2.17 mL, 1.08 mmol, 2.00 equiv) was added dropwise at room temperature, and the mixture was stirred at this temperature for 1 h. Then the reaction was quenched with brine (50 mL) and extracted with CH_2Cl_2 (3 × 30 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **8a"** (197 mg, 0.54 mmol, 100%) as a white solid.

M.P.: 153-155 °C

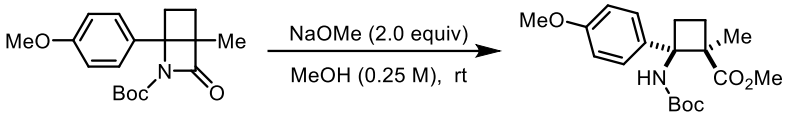
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 – 7.29 (m, 2H), 7.27 – 7.20 (m, 3H), 5.30 (s, 1H), 3.65 (s, 3H), 3.62 (s, 3H), 3.11 (s, 4H), 1.43 (s, 9H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 175.8, 173.0, 155.1, 142.2, 128.5, 127.1, 126.0, 80.2, 55.0, 52.7, 52.5, 47.7, 41.2, 28.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1721, 1495, 1448, 1367, 1275, 1260, 1215, 1158, 1096.

HRMS (ESI^+) calcd. for $C_{19}H_{25}NO_6Na^+$ $[M+Na]^+$: 386.1574, found: 386.1582.

(±)-Methyl (1*R*,2*R*)-2-((tert-butoxycarbonyl)amino)-2-(4-methoxyphenyl)-1methylcyclobutane -1-carboxylate (10)



6ab (1.0 equiv) **10**

An oven-dried 50 mL round-bottom flask charged with **6ab** (160 mg, 0.50 mmol, 1.00 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Sodium methoxide solution (0.5 M in MeOH, 2.0 mL, 1.0 mmol, 2.0 equiv) was added dropwise at room temperature, and the mixture was stirred at this temperature for 2 h. Then, the reaction was quenched with brine (50 mL) and extracted with CH_2Cl_2 (3 × 30 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **10** (162 mg, 0.46 mmol, 93%) as a colourless oil.

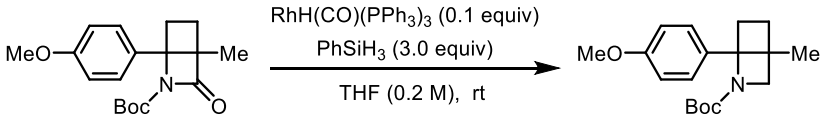
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.8 Hz, 2H), 6.82 (d, *J* = 8.8 Hz, 2H), 6.04 (br. s, 1H), 3.76 (s, 3H), 3.75 (s, 3H), 2.72 (dt, *J* = 11.6, 8.7 Hz, 1H), 2.63 (dt, *J* = 10.9, 8.9 Hz, 1H), 2.50 (br. s, 1H), 1.69 (ddd, *J* = 11.0, 8.5, 3.4 Hz, 1H), 1.25 (s, 9H), 0.94 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 176.3, 158.3, 154.7, 134.3, 128.1, 113.2, 79.3, 64.0, 55.2, 52.1, 50.5, 28.3, 27.2, 24.8, 22.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1714, 1612, 1513, 1462, 1366, 1275, 1260, 1153, 1120, 1062.

HRMS (ESI^+) calcd. for $C_{19}H_{27}NO_5Na^+$ $[M+Na]^+$: 372.1781, found: 372.1784.

***tert*-Butyl 1-(4-methoxyphenyl)-4-methyl-2-azabicyclo[2.2.0]hexane-2-carboxylate (11)**



6ab (1.0 equiv) **11**

To an oven-dried 25 mL round-bottom flask equipped with a magnetic stir bar was added **6ab** (160 mg, 0.50 mmol, 1.0 equiv) and $RhH(CO)(PPh_3)_3$ (46.0 mg, 50.0 μmol, 0.10 equiv) under an argon atmosphere in a glovebox. Anhydrous THF (2.5 mL, 0.2 M) and phenylsilane ($PhSiH_3$, 0.18 mL, 1.5 mmol, 3.0 equiv) were added and the vessel was removed from the glovebox. The reaction was stirred at room temperature overnight under a nitrogen atmosphere. After completion, the crude reaction mixture was concentrated under reduced pressure and purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient

elution of ethyl acetate/pentane (0% to 30%) and ethyl acetate/CH_2Cl_2 (0% to 10%). The desired product **11** (64 mg, 0.21 mmol, 42%) was obtained as a colourless oil.[A]

Notes: (**A**) Two sets of peaks were observed in the ^1H and ^{13}C NMR spectra due to carbamate rotamers.

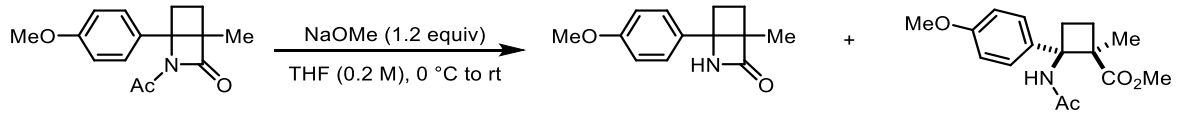
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.25 – 7.20 (m, 2H, *overlapping*), 6.91 – 6.86 (m, 2H, *overlapping*), 4.13 (d, *J* = 8.5 Hz, 1H, *major*), 4.10 (d, *J* = 8.5 Hz, 1H, *minor*), 3.94-3.87 (m, 1H, *overlapping*), 3.81 (s, 3H, *major*), 3.79 (s, 3H, *minor*), 2.86-2.76 (m, 1H, *overlapping*), 2.72 – 2.64 (m, 1H, *minor*), 2.54 (ddd, *J* = 13.2, 9.0, 6.0 Hz, 1H, *major*), 2.41-2.28 (m, 1H, *overlapping*), 2.12-1.97 (m, 1H, *overlapping*), 1.47 (s, 9H, *minor*), 1.26 (s, 9H, *major*), 0.93 (s, 3H, *major*), 0.91 (s, 3H, *minor*).

^{13}C NMR (126 MHz, $CDCl_3$) δ 158.62 (*minor*), 158.58 (*major*), 155.9 (*major*), 155.1 (*minor*), 131.5 (*major*), 131.2 (*minor*), 127.6 (*major*), 127.4 (*minor*), 113.8 (*minor*), 113.4 (*major*), 79.5 (*minor*), 79.3 (*major*), 75.2 (*major*), 74.7 (*minor*), 62.7 (*minor*), 61.1 (*major*), 55.3 (*overlapping*), 43.0 (*major*), 42.8 (*minor*), 30.8 (*minor*), 30.6 (*major*), 28.9 (*overlapping*), 28.7 (*minor*), 28.5 (*major*), 19.3 (*overlapping*).

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1693, 1613, 1513, 1455, 1384, 1364, 1275, 1260, 1176, 1147, 1035.

HRMS (ESI^+) calcd. for $C_{18}H_{25}NO_3Na^+$ $[M+Na]^+$: 326.1727, found: 326.1732.

1-(4-Methoxyphenyl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (12)



6g (1.0 equiv) **12**, major **12'**, minor

An oven-dried 50 mL round-bottom flask charged with **6g** (430 mg, 1.66 mmol, 1.00 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous THF (8.30 mL, 0.2 M) was then added, and the reaction mixture was cooled to 0 °C. Sodium methoxide solution (0.5 M in MeOH, 4.0 mL, 2.0 mmol, 1.2 equiv) was added dropwise at 0°C, and the mixture was stirred at this temperature for 45 minutes. Then, the reaction was allowed to warm to room temperature and quenched with brine (60 mL) and extracted with CH_2Cl_2 (3 × 40 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 60%), affording **12** (231 mg, 1.06 mmol, 64%) as a white solid and **12'** (106 mg, 0.36 mmol, 22%) as a colourless oil.

M.P.: 126-128 °C

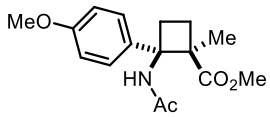
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.27 (d, *J* = 8.9 Hz, 2H), 6.92 (d, *J* = 8.8 Hz, 2H), 6.26 (s, 1H), 3.82 (s, 3H), 2.98 – 2.87 (m, 1H), 2.38 – 2.35 (m, 1H), 2.34 – 2.30 (m, 1H), 2.05 – 1.99 (m, 1H), 1.04 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.6, 159.2, 129.5, 127.7, 114.1, 63.4, 62.6, 55.4, 29.6, 24.2, 13.6.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1741, 1612, 1515, 1463, 1276, 1260, 1179, 1032.

HRMS (ESI^+) calcd. for $C_{13}H_{16}NO_2^+$ $[M+H]^+$: 218.1176, found: 218.1179.

(±)-Methyl (1*R*,2*R*)-2-acetamido-2-(4-methoxyphenyl)-1-methylcyclobutane-1-carboxylate (12')



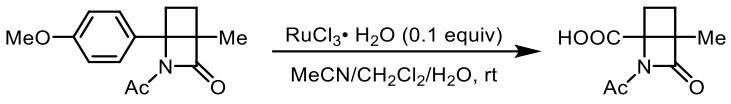
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.34 – 7.30 (m, 3H), 6.83 (d, *J* = 8.8 Hz, 2H), 3.79 (s, 3H), 3.77 (s, 3H), 2.83 – 2.74 (m, 1H), 2.67 – 2.55 (m, 2H), 1.88 (s, 3H), 1.78 – 1.71 (m, 1H), 1.00 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 177.0, 169.5, 158.4, 134.0, 128.2, 113.4, 64.4, 55.3, 52.3, 50.2, 28.0, 24.9, 24.4, 22.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1716, 1682, 1611, 1513, 1460, 1369, 1275, 1260, 1181, 1148, 1035.

HRMS (ESI^+) calcd. for $C_{16}H_{21}NO_4Na^+$ $[M+Na]^+$: 314.1363, found: 314.1367.

2-Acetyl-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexane-1-carboxylic acid (13)



6g (1.0 equiv) **13**

In an oven-dried 250 mL round-bottom flask, **6g** (990 mg, 3.82 mmol, 1.00 equiv) was dissolved in anhydrous MeCN (20 mL), CH_2Cl_2 (20 mL) and H_2O (30 mL) at room temperature. Ruthenium(III) chloride hydrate (86 mg, 0.38 mmol, 0.10 equiv) was then added, followed by $NaIO_4$ (16.4 g, 76.4 mmol, 20.0 equiv). The reaction mixture was stirred at room temperature overnight until completion of the reaction (TLC). The reaction was quenched with 1 M aqueous HCl solution (80 mL) and extracted with ethyl acetate three times (3 × 50 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 100%) and ethyl acetate/CH_2Cl_2 (0% to 50%), affording **13** (625 mg, 3.17 mmol, 83%) as a white solid.

M.P.: 138-140 °C

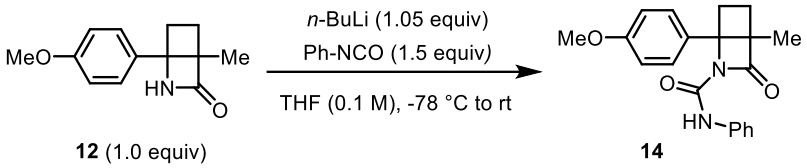
^{1}H NMR (500 MHz, $CDCl_3$) δ 11.42 (s, 1H), 3.06 – 2.94 (m, 1H), 2.49-2.37 (m, 4H), 2.29 – 2.16 (m, 2H), 1.38 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 172.3, 168.8, 167.6, 61.8, 61.7, 26.2, 23.8, 23.3, 13.2.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1783, 1708, 1376, 1318, 1276, 1261, 1194, 1106.

HRMS (Nanospray) calcd. for $C_9H_{10}NO_4$ $[M-H]^-$: 196.0615, found: 196.0614.

1-(4-Methoxyphenyl)-4-methyl-3-oxo-N-phenyl-2-azabicyclo[2.2.0]hexane-2-carboxamide (14)



12 (1.0 equiv) **14**

An oven-dried 25 mL round-bottom flask charged with **12** (44 mg, 0.20 mmol, 1.0 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous THF (2.0 mL, 0.1 M) was then added, and the reaction mixture was cooled to –78 °C. *n*-BuLi (2.5 M in hexane, 84 µL, 0.21 mmol, 1.05 equiv) was added dropwise at –78 °C, and the mixture was stirred at this temperature for 5 minutes. Phenyl isocyanate (32 µL, 0.30 mmol, 1.5 equiv) was subsequently added at –78 °C, and the reaction was allowed to warm to room temperature over 1 hour. The reaction was then quenched with brine (50 mL) and extracted with ethyl acetate (3 × 30 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 30%), affording **14** (60 mg, 0.18 mmol, 89%) as a white solid.

M.P.: 124-126 °C

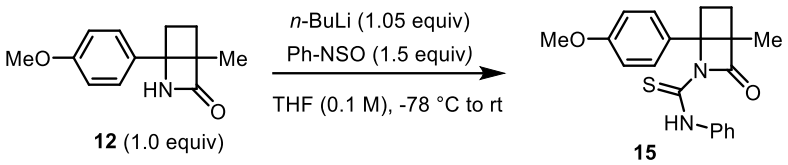
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.80 (s, 1H), 7.57 – 7.50 (m, 2H), 7.34 – 7.27 (m, 4H), 7.10 (tt, *J* = 7.2, 1.2 Hz, 1H), 6.94 (d, *J* = 8.9 Hz, 2H), 3.81 (s, 3H), 3.05 (ddd, *J* = 13.7, 11.3, 6.3 Hz, 1H), 2.68 (ddd, *J* = 13.8, 8.7, 5.9 Hz, 1H), 2.51 (ddd, *J* = 13.0, 8.7, 6.3 Hz, 1H), 2.22 (ddd, *J* = 13.1, 11.3, 5.8 Hz, 1H), 1.15 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.9, 159.4, 147.8, 137.4, 129.2, 127.6, 127.1, 124.2, 119.6, 114.2, 67.2, 61.6, 55.4, 26.8, 26.2, 13.1.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1752, 1710, 1602, 1546, 1446, 1252, 1180.

HRMS (ESI^+) calcd. for $C_{20}H_{21}N_2O_3^+$ $[M+H]^+$: 337.1547, found: 337.1546.

1-(4-Methoxyphenyl)-4-methyl-3-oxo-N-phenyl-2-azabicyclo[2.2.0]hexane-2-carbothioamide (15)



An oven-dried 25 mL round-bottom flask charged with **12** (44 mg, 0.20 mmol, 1.0 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous THF (2.0 mL, 0.1 M) was then added, and the reaction mixture was cooled to –78 °C. *n*-BuLi (2.5 M in hexane, 84 µL, 0.21 mmol, 1.05 equiv) was added dropwise at –78 °C, and the mixture was stirred at this temperature for 5 minutes. Phenyl isothiocyanate (36 µL, 0.30 mmol, 1.5 equiv) was subsequently added at –78 °C, and the reaction was allowed to warm to room temperature over 1 hour. The reaction was then quenched with brine (50 mL) and extracted with ethyl acetate (3×30 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 35%), affording **15** (55 mg, 0.16 mmol, 78%) as a white solid.

M.P.: 70-72 °C

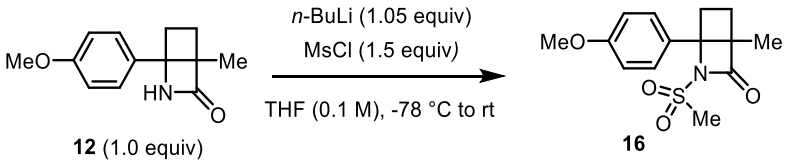
^{1}H NMR (500 MHz, $CDCl_3$) δ 10.58 (s, 1H), 7.75 – 7.72 (m, 2H), 7.41 – 7.37 (m, 2H), 7.29 (d, *J* = 8.9 Hz, 2H), 7.25 – 7.21 (m, 1H), 6.94 (d, *J* = 8.8 Hz, 2H), 3.82 (s, 3H), 3.09 (ddd, *J* = 14.0, 11.4, 6.4 Hz, 1H), 2.92 (ddd, *J* = 14.0, 8.8, 6.0 Hz, 1H), 2.58 (ddd, *J* = 13.0, 8.8, 6.4 Hz, 1H), 2.27 (ddd, *J* = 13.1, 11.3, 6.0 Hz, 1H), 1.12 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 174.9, 172.5, 159.2, 137.6, 128.9, 127.8, 126.7, 126.4, 123.5, 114.0, 69.6, 60.6, 55.3, 27.3, 25.6, 12.9.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1741, 1601, 1515, 1374, 1312, 1250, 1227, 1178, 1031.

HRMS (ESI^+) calcd. for $C_{20}H_{21}N_2O_2S^+$ $[M+H]^+$: 353.1318, found: 353.1317.

1-(4-Methoxyphenyl)-4-methyl-2-(methylsulfonyl)-2-azabicyclo[2.2.0]hexan-3-one (16)



An oven-dried 25 mL round-bottom flask charged with **12** (44 mg, 0.20 mmol, 1.0 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous THF (2.0 mL, 0.1 M) was then added, and the reaction mixture was cooled to –78 °C. *n*-BuLi (2.5 M in hexane, 84 µL, 0.21 mmol, 1.05 equiv) was added dropwise at –78 °C, and the mixture was stirred at this temperature for

5 minutes. Methanesulfonyl chloride (23 µL, 0.30 mmol, 1.5 equiv) was subsequently added at –78 °C, and the reaction was allowed to warm to room temperature over 1 hour. The reaction was then quenched with brine (50 mL) and extracted with ethyl acetate (3 × 30 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 50%), affording **16** (32 mg, 0.11 mmol, 54%) as a colourless oil.

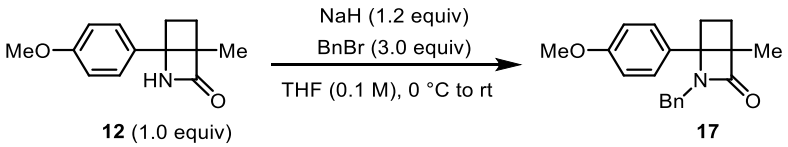
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.29 (d, *J* = 8.8 Hz, 2H), 6.95 (d, *J* = 8.8 Hz, 2H), 3.82 (s, 3H), 3.08 (ddd, *J* = 13.9, 11.4, 6.8 Hz, 1H), 3.02 (s, 3H), 2.87 (ddd, *J* = 14.0, 8.7, 5.4 Hz, 1H), 2.58 (ddd, *J* = 13.1, 8.7, 6.8 Hz, 1H), 2.16 (ddd, *J* = 13.1, 11.4, 5.4 Hz, 1H), 1.20 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.8, 159.9, 128.2, 126.3, 114.4, 70.9, 62.9, 55.4, 43.3, 26.6, 25.5, 13.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1780, 1676, 1601, 1513, 1349, 1245, 1151, 1028.

HRMS (ESI^+) calcd. for $C_{14}H_{17}NO_4SNa^+$ $[M+Na]^+$: 318.0770, found: 318.0770.

2-Benzyl-1-(4-methoxyphenyl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (17)



An oven-dried 25 mL round-bottom flask charged with **12** (44 mg, 0.20 mmol, 1.0 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous THF (2.0 mL, 0.1 M) was then added, and the reaction mixture was cooled to 0 °C. NaH (60% dispersion in mineral oil, 9.6 mg, 0.24 mmol, 1.2 equiv) was added at 0 °C, and the mixture was stirred at this temperature for 30 minutes. Benzoyl bromide (71 µL, 0.60 mmol, 3.0 equiv) was subsequently added at 0 °C, and the reaction was allowed to warm to room temperature over 1 hour. The reaction was then quenched with brine (50 mL) and extracted with ethyl acetate three times (3 × 30 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 40%), affording **17** (50 mg, 0.16 mmol, 81%) as a colourless oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.27 – 7.18 (m, 5H), 7.10 (d, *J* = 8.8 Hz, 2H), 6.87 (d, *J* = 8.8 Hz, 2H), 4.59 (d, *J* = 14.8 Hz, 1H), 4.02 (d, *J* = 14.8 Hz, 1H), 3.80 (s, 3H), 2.67 (ddd, *J* = 13.0, 11.0, 6.2 Hz,

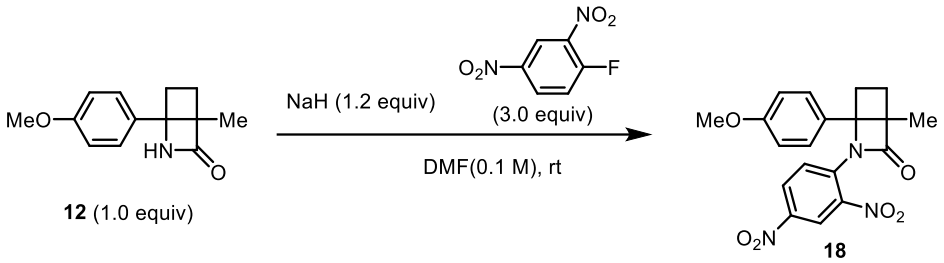
1H), 2.26 (ddd, *J* = 12.5, 8.6, 6.2 Hz, 1H), 1.88 (ddd, *J* = 12.6, 11.0, 5.5 Hz, 1H), 1.78 (ddd, *J* = 13.0, 8.6, 5.6 Hz, 1H), 1.06 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.5, 159.2, 136.6, 129.0, 128.7, 128.2, 127.7, 127.6, 114.1, 67.3, 62.5, 55.4, 44.2, 25.4, 24.8, 13.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1733, 1611, 1513, 1454, 1297, 1250, 1177, 1030.

HRMS (ESI^+) calcd. for $C_{20}H_{22}NO_2^+$ $[M+H]^+$: 308.1645, found: 308.1642.

2-(2,4-Dinitrophenyl)-1-(4-methoxyphenyl)-4-methyl-2-azabicyclo[2.2.0]hexan-3-one (18)



An oven-dried 25 mL round-bottom flask charged with **12** (65 mg, 0.30 mmol, 1.0 equiv) was sealed and subjected to three cycles of evacuation and nitrogen backfilling. Anhydrous DMF (3.0 mL, 0.1 M) was then added at room temperature, followed by the addition of NaH (60% dispersion in mineral oil, 14.4 mg, 0.360 mmol, 1.2 equiv). The mixture was stirred at room temperature for 30 minutes. 1-Fluoro-2,4-dinitrobenzene (113 μL, 0.90 mmol, 3.0 equiv) was then added and the reaction was stirred at room temperature for 1 hour. The reaction was then quenched with brine (50 mL) and extracted with ethyl acetate (3 × 30 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified by two successive flash chromatography separations using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 50%) and ethyl acetate/CH_2Cl_2 (0% to 10%), affording **18** (88 mg, 0.23 mmol, 77%) as a pale-yellow solid.

M.P.: 140-142 °C

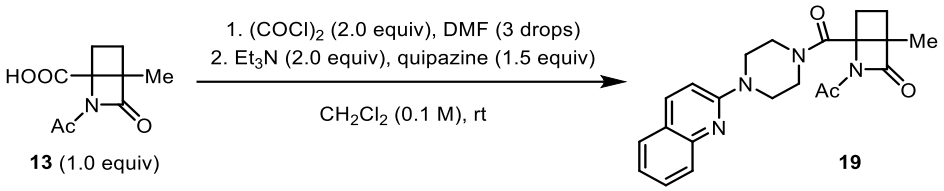
^{1}H NMR (500 MHz, $CDCl_3$) δ 8.67 (d, *J* = 2.5 Hz, 1H), 8.25 (dd, *J* = 9.0, 2.5 Hz, 1H), 7.36 (d, *J* = 8.9 Hz, 2H), 7.04 (d, *J* = 9.0 Hz, 1H), 6.95 (d, *J* = 8.8 Hz, 2H), 3.80 (s, 3H), 3.26 (ddd, *J* = 13.7, 11.4, 5.8 Hz, 1H), 2.66 (ddd, *J* = 13.6, 8.9, 6.4 Hz, 1H), 2.51 (ddd, *J* = 13.0, 8.9, 5.7 Hz, 1H), 2.20 (ddd, *J* = 13.1, 11.3, 6.3 Hz, 1H), 1.15 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.0, 160.0, 142.7, 141.9, 133.7, 128.2, 127.9, 125.1, 121.9, 120.1, 114.8, 68.8, 63.0, 55.4, 25.74, 25.66, 13.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1762, 1600, 1515, 1334, 1253, 1180, 1137, 1030.

HRMS (ESI$^+$) calcd. for $C_{19}H_{18}N_3O_6^+$ [M+H]$^+$: 384.1190, found: 384.1190.

2-Acetyl-4-methyl-1-(4-(quinolin-2-yl)piperazine-1-carbonyl)-2-azabicyclo[2.2.0]hexan-3-one (19)



An oven-dried 25 mL round-bottom flask containing **13** (78 mg, 0.40 mmol, 1.0 equiv) was sealed and subjected to three N_2 evacuation/refill cycles before pre-sparged anhydrous CH_2Cl_2 (4.0 mL, 0.1 M) was added. Oxalyl chloride (68 µL, 0.80 mmol, 2.0 equiv) was then added at room temperature, followed by the addition of DMF (3 drops). The reaction mixture was stirred at room temperature for 1 h. The reaction was then concentrated under reduced pressure to afford the crude acyl chloride, which was used directly for the next step without further purification.

The crude acyl chloride was re-dissolved in anhydrous CH_2Cl_2 (4.0 mL, 0.1 M) at room temperature. Et_3N (112 µL, 0.80 mmol, 2.0 equiv) was then added, followed by the addition of quipazine (150 mg, 0.60 mmol, 1.5 equiv). The reaction mixture was stirred at room temperature for 1 h until complete (TLC). The reaction was then quenched with brine (50 mL) and extracted with CH_2Cl_2 (3 × 30 mL). The combined extracts were dried over anhydrous $MgSO_4$ and concentrated *in vacuo*. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/CH_2Cl_2 (0% to 50%), affording **19** (87 mg, 0.22 mmol, 55%) as a white solid.

M.P.: 189-191 °C

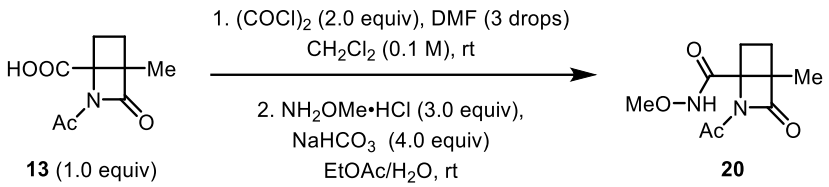
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.91 (d, *J* = 9.0 Hz, 1H), 7.73 (s, 1H), 7.60 (dd, *J* = 8.1, 1.5 Hz, 1H), 7.54 (ddd, *J* = 8.5, 7.0, 1.5 Hz, 1H), 7.24 (ddd, *J* = 8.0, 7.2, 1.4 Hz, 1H), 6.95 (d, *J* = 9.1 Hz, 1H), 4.14 – 3.91 (m, 4H), 3.72 – 3.35 (m, 4H), 2.78 (ddd, *J* = 13.0, 11.4, 7.1 Hz, 1H), 2.51 (ddd, *J* = 13.0, 8.3, 4.8 Hz, 1H), 2.42 (s, 3H), 2.36 (ddd, *J* = 12.9, 8.3, 7.0 Hz, 1H), 2.07 (ddd, *J* = 12.9, 11.4, 4.8 Hz, 1H), 1.48 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.3, 168.1, 166.3, 156.9, 147.6, 137.9, 129.8, 127.3, 126.7, 123.2, 122.9, 109.6, 62.1, 45.5, 44.9, 42.6, 27.9, 25.9, 24.1, 14.0.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1781, 1701, 1635, 1603, 1506, 1428, 1376, 1302, 1276, 1230.

HRMS (ESI$^+$) calcd. for $C_{22}H_{25}N_4O_3^+$ [M+H]$^+$: 393.1921, found: 393.1911.

2-Acetyl-*N*-methoxy-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexane-1-carboxamide (20)



An oven-dried 25 mL round-bottom flask containing **13** (60 mg, 0.30 mmol, 1.0 equiv) was sealed and subjected to three N_2 evacuation/refill cycles before pre-sparged anhydrous CH_2Cl_2 (3.0 mL, 0.1 M) was added. Oxalyl chloride (51 µL, 0.60 mmol, 2.0 equiv) was then added at room temperature, followed by the addition of DMF (3 drops). The reaction mixture was stirred at room temperature for 1 h. The reaction was then concentrated under reduced pressure to afford the crude acyl chloride which was used directly for the next step without further purification.

In another oven-dried 25 mL round-bottom flask, methoxyamine hydrochloride (76 mg, 0.90 mmol, 3.0 equiv) was added to a biphasic mixture of $NaHCO_3$ (101 mg, 1.20 mmol, 4.00 equiv) in EtOAc/H_2O (2:1, 3.0 mL). The mixture was stirred at room temperature for 5 minutes and then transferred to a round-bottom flask containing the crude acyl chloride. The reaction mixture was then stirred at room temperature for 1 h until complete (TLC). The reaction was then quenched with brine (50 mL) and extracted with CH_2Cl_2 (3 × 30 mL). The combined extracts were dried over anhydrous $MgSO_4$ and concentrated *in vacuo*. The crude reaction mixture was purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 65%), affording **20** (56 mg, 0.25 mmol, 83%) as a white solid.

M.P.: 100-102 °C

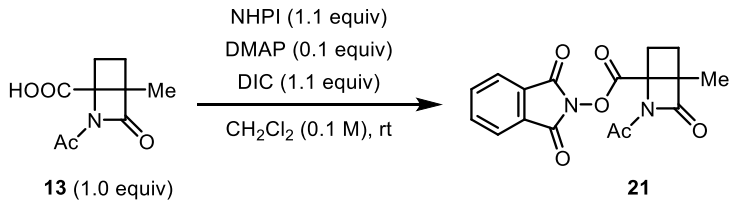
^{1}H NMR (500 MHz, $CDCl_3$) δ 9.51 (s, 1H), 3.72 (s, 3H), 2.91 (ddd, *J* = 13.4, 11.3, 6.7 Hz, 1H), 2.45 (s, 3H), 2.37 (ddd, *J* = 12.9, 8.6, 6.7 Hz, 1H), 2.26 (ddd, *J* = 13.0, 11.3, 5.6 Hz, 1H), 2.18 (ddd, *J* = 13.4, 8.6, 5.7 Hz, 1H), 1.39 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 170.2, 169.9, 165.2, 64.5, 62.6, 61.3, 26.3, 25.2, 24.1, 13.3.

IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1785, 1709, 1659, 1504, 1374, 1312, 1276, 1195, 1065.

HRMS (ESI^+) calcd. for $C_{10}H_{15}N_2O_4^+$ $[M+H]^+$: 227.1026, found: 227.1026.

1,3-dioxoisoindolin-2-yl 2-acetyl-4-methyl-3-oxo-2-azabicyclo[2.2.0]hexane-1-carboxylate (21)



In an oven-dried 25 mL round-bottom flask carboxylic acid **16** (60 mg, 0.30 mmol, 1.0 equiv), *N*-hydroxyphthalimide (NHPI, 54 mg, 0.33 mmol, 1.1 equiv) and DMAP (3.6 mg, 0.03 mmol, 0.10 equiv) were dissolved in anhydrous CH_2Cl_2 (3.0 mL, 0.1 M) at room temperature. *N*,*N*'-Diisopropylcarbodiimide (DIC, 51 µL, 0.33 mmol, 1.1 equiv) was then added and the reaction was stirred at room temperature for 1 h. The crude product was directly purified using a Biotage automated flash chromatography system with a gradient elution of ethyl acetate/pentane (0% to 50%), affording **21** (89 mg, 0.26 mmol, 87%) as a colourless oil.

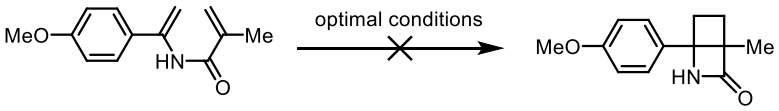
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.86 (dd, *J* = 5.5, 3.1 Hz, 2H), 7.79 (dd, *J* = 5.5, 3.1 Hz, 2H), 3.15 – 3.07 (m, 1H), 2.52 – 2.46 (m, 4H), 2.40 – 2.31 (m, 2H), 1.56 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 167.9, 166.7, 163.8, 161.3, 135.0, 128.8, 124.2, 63.2, 60.1, 26.3, 23.8, 23.8, 13.5.

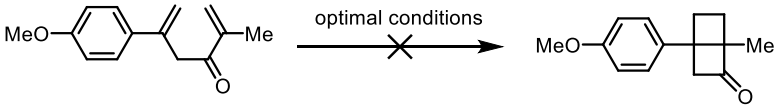
IR (ATR): $\tilde{\nu}$ (cm^{-1}) = 1785, 1742, 1712, 1372, 1316, 1275, 1260, 1185, 1074.

HRMS (ESI^+) calcd. for $C_{17}H_{14}N_2O_6Na^+$ $[M+Na]^+$: 365.0744, found: 365.0738.

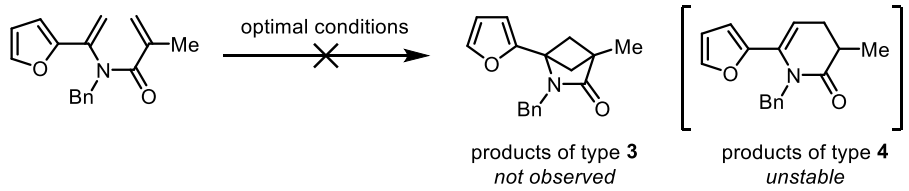
2.6 Unsuccessful Substrates



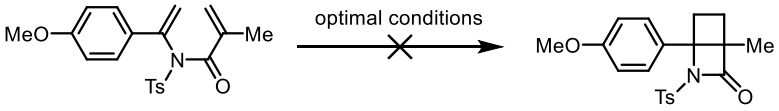
Crude ^{1}H NMR analysis after 1.5 h showed a significant amount of unreacted starting material, whereas after 24 h, the spectrum appeared complex and the desired product could not be identified.



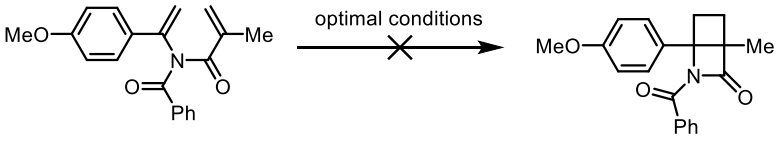
No product formation was detected, and the crude ^{1}H NMR spectrum after 1.5 h exhibited significant complexity.



No product formation was detected, and the crude ^{1}H NMR spectrum after 1.5 h exhibited significant complexity. This may be due to the electron-rich nature of the furan moiety favouring the 6-*endo*-trig pathway, leading predominantly to the formation of the corresponding six-membered-ring product **4.** However, due to the photoinstability of **4** under the reaction conditions, no identifiable species were observed in the reaction mixture.

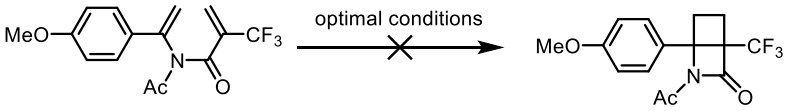


No product formation was detected, and the crude ^{1}H NMR spectrum after 1.5 h exhibited significant complexity.



<20% ^{1}H NMR yield

The crude ^{1}H NMR spectrum after 1.5 h showed that the desired product was present in less than 20% yield.



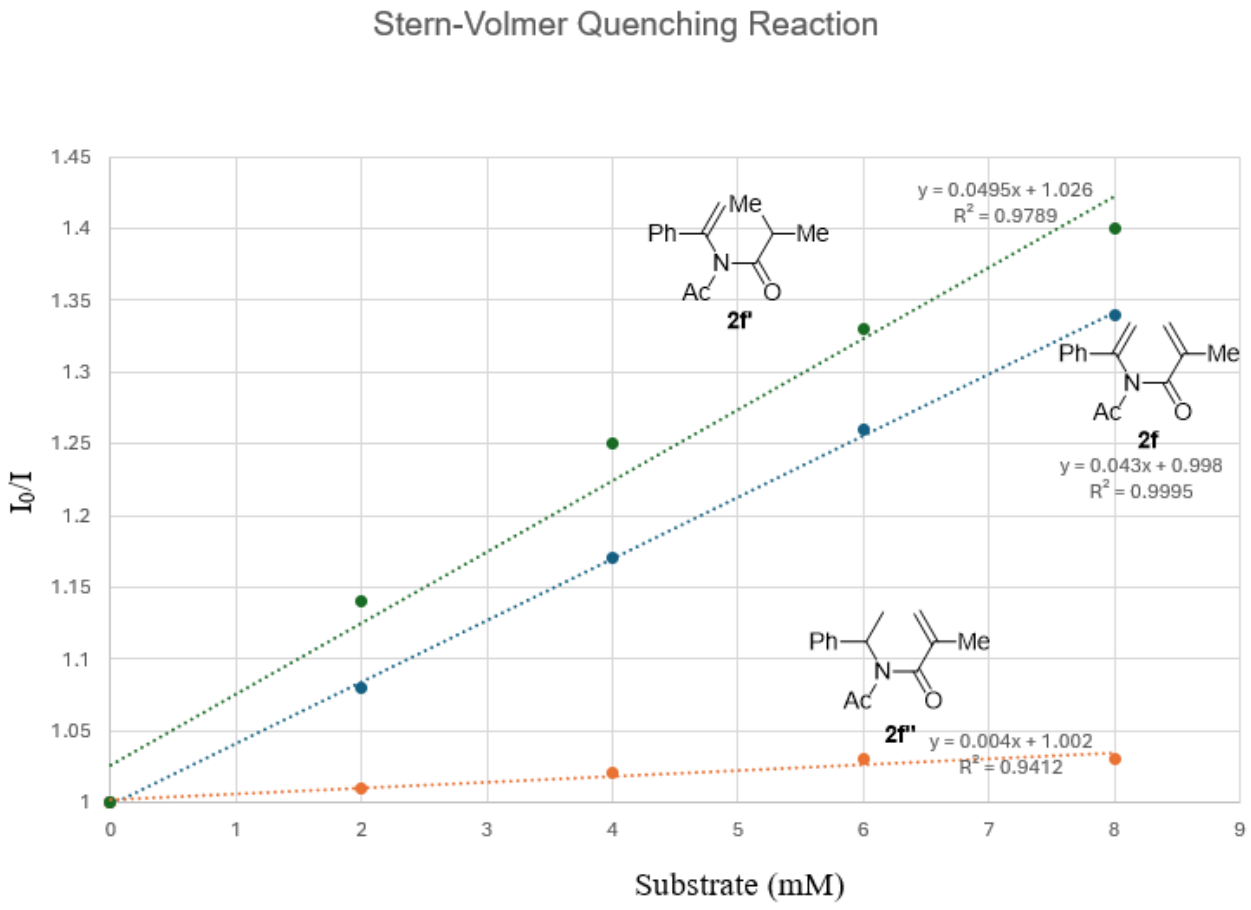
<10% ^{1}H NMR yield

The crude ^{1}H NMR spectrum after 1.5 h showed that the desired product was present in less than 10% yield.

Supplementary Figure S2. Unsuccessful substrates

3. Stern-Volmer Quenching Studies

All samples were prepared using stock solutions of $(Ir[dF(CF_3)(ppy)]_2)(dtbpy)PF_6$ (0.10 mM), **2f** (0.01 M), **2f'** (0.01 M) or **2f"** (0.01 M) in dry MeCN. To a volumetric flask was added $(Ir[dF(CF_3)(ppy)]_2)(dtbpy)PF_6$ (200 µL, 0.10 mM) and the respective amount of quencher. The volume was then adjusted to 3 mL with dry MeCN. The solution was transferred to a 1-cm quartz cuvette and degassed by sparging with nitrogen gas for 15 min. Emission spectra were recorded using a FluoroMax spectrofluorometer with an excitation wavelength of 420 nm. The emission intensities for the Stern-Volmer analysis were observed at 472 nm. The ratio of I_0/I was plotted as a function of the quencher concentration (I_0: emission intensity of $(Ir[dF(CF_3)(ppy)]_2)(dtbpy)PF_6$ without quencher; I: emission intensity of $(Ir[dF(CF_3)(ppy)]_2)(dtbpy)PF_6$ in the presence of quencher). The Stern-Volmer analysis shows that $(Ir[dF(CF_3)(ppy)]_2)(dtbpy)PF_6$ is only efficiently quenched by the styrene moiety in **2f** or **2f'**, while the enone moiety (**2f"**) does not quench the photocatalyst.



Supplementary Figure S3. Stern-Volmer quenching study

4. Crystallographic Data (X-Ray)

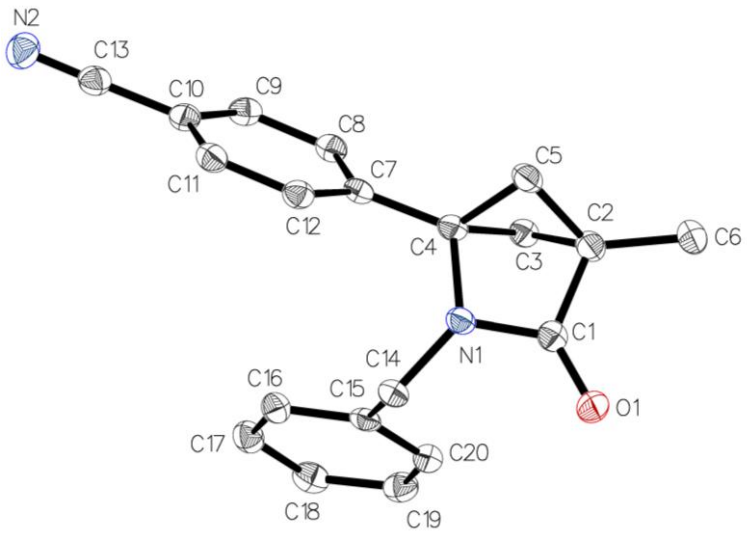
4.1 Structure Report for 3d

Crystallographic data are presented in the Tables below. A single crystal of **3d** was coated in perfluoropolyether oil and mounted on a glass fibre. X-ray measurements were made using a Bruker D8 Venture dual source kappa CPAD diffractometer with Cu K_a radiation (λ= 1.54184 Å).[21] Intensities were integrated from several series of exposures, each exposure covering 0.5° in ω or ϕ. Absorption corrections were applied, based on multiple and symmetry-equivalent measurements.[22] The structure was solved by direct methods and refined by least squares on weighted F^2 values for all reflections (see **Table S3**).[23]

All non-hydrogen atoms were assigned anisotropic displacement parameters and refined without positional constraints. All hydrogen atoms were constrained to ideal geometries and were assigned isotropic displacement parameters equal to 1.2 times that of their parent atom.

Refinement proceeded smoothly to give the residuals shown in **Table S3**. Complex neutral-atom scattering factors were used.[24]

The absolute configuration of the molecule has been established with a Flack/Parsons parameter value of 0.02(9).[25]



Supplementary Figure S4: Molecular structure of **3d** with thermal ellipsoids shown at the 50% probability level; hydrogen atoms have been omitted for clarity

Supplementary Table S3. Crystal data and structure refinement for **3d**.

Identification code	cu_ZZX652Cu2_0m	
Empirical formula	C_{20} H_{18} N_2 O	
Formula weight	302.36	
Temperature	108(2) K	
Wavelength	1.54184 Å	
Crystal system	Monoclinic	
Space group	C2	
Unit cell dimensions	a = 17.4943(12) Å	α = 90°
	b = 7.3922(5) Å	β = 103.709(2)°
	c = 12.5448(8) Å	γ = 90°
Volume	1576.09(18) Å^3	
Z	4	
Density (calculated)	1.274 Mg/m^3	
Absorption coefficient	0.624 mm^{-1}	
F(000)	640	
Crystal size	0.320 x 0.240 x 0.160 mm	
θ range for data collection	3.627 to 68.742°	
Index ranges	-21<=h<=20, -8<=k<=8, -15<=l<=15	
Reflections collected	11966	
Independent reflections	2821 [R_{int} = 0.0313]	
Completeness to θ = 67.684°	99.0 %	
Absorption correction	Numerical	
Max. and min. transmission	1.0000 and 0.7772	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	2821 / 1 / 210	
Goodness-of-fit on F^2	S = 1.078	
R indices [for 2779 reflections with I>2σ(I)]		R_1 = 0.0317, wR_2 = 0.0765
R indices (for all 2821 data)	R_1 = 0.0329, wR_2 = 0.0771	
Weighting scheme	$w^{-1} = \sigma^2(F_o^2) + (aP)^2 + (bP)$,	
	where $P = [\max(F_o^2, 0) + 2F_c^2]/3$	
	a = 0.0487, b = 0.3852	
Absolute structure (Flack) parameter	0.02(9)	
Extinction coefficient	0.0032(5)	
Largest diff. peak and hole	0.274 and -0.206 eÅ^{-3}	

Supplementary Table S4. Bond lengths [Å] and angles [°] for **3d**.

C(1)-O(1)	1.224(2)
C(1)-N(1)	1.369(2)
C(1)-C(2)	1.527(3)
C(2)-C(6)	1.501(3)
C(2)-C(5)	1.562(3)
C(2)-C(3)	1.571(3)
C(3)-C(4)	1.562(2)
C(4)-C(7)	1.487(2)
C(4)-N(1)	1.501(2)
C(4)-C(5)	1.549(3)
C(7)-C(8)	1.391(3)
C(7)-C(12)	1.400(2)
C(8)-C(9)	1.382(3)
C(9)-C(10)	1.399(3)
C(10)-C(11)	1.394(3)
C(10)-C(13)	1.435(2)
C(11)-C(12)	1.382(3)
C(13)-N(2)	1.152(3)
C(14)-N(1)	1.456(2)
C(14)-C(15)	1.518(2)
C(15)-C(16)	1.391(3)
C(15)-C(20)	1.397(2)
C(16)-C(17)	1.391(3)
C(17)-C(18)	1.390(3)
C(18)-C(19)	1.390(3)
C(19)-C(20)	1.382(3)
O(1)-C(1)-N(1)	127.64(17)
O(1)-C(1)-C(2)	129.23(17)
N(1)-C(1)-C(2)	103.08(15)
C(6)-C(2)-C(1)	117.65(16)
C(6)-C(2)-C(5)	124.64(17)
C(1)-C(2)-C(5)	99.99(14)
C(6)-C(2)-C(3)	123.83(16)
C(1)-C(2)-C(3)	97.93(14)
C(5)-C(2)-C(3)	85.60(13)
C(4)-C(3)-C(2)	81.62(13)
C(7)-C(4)-N(1)	115.98(14)

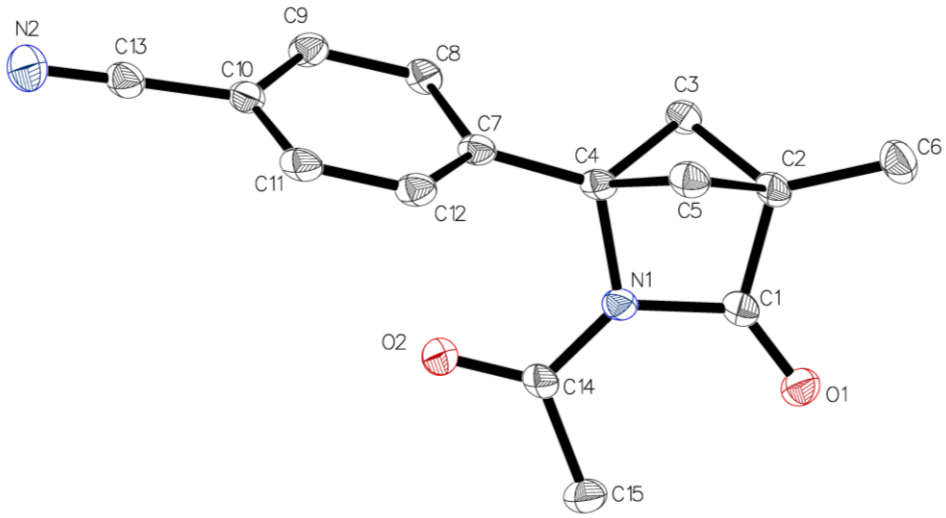
C(7)-C(4)-C(5)	121.93(15)
N(1)-C(4)-C(5)	99.25(14)
C(7)-C(4)-C(3)	125.50(14)
N(1)-C(4)-C(3)	101.60(13)
C(5)-C(4)-C(3)	86.32(13)
C(4)-C(5)-C(2)	82.31(13)
C(8)-C(7)-C(12)	118.98(17)
C(8)-C(7)-C(4)	120.09(15)
C(12)-C(7)-C(4)	120.85(15)
C(9)-C(8)-C(7)	120.78(16)
C(8)-C(9)-C(10)	119.65(16)
C(11)-C(10)-C(9)	120.25(16)
C(11)-C(10)-C(13)	120.46(16)
C(9)-C(10)-C(13)	119.29(16)
C(12)-C(11)-C(10)	119.39(16)
C(11)-C(12)-C(7)	120.92(17)
N(2)-C(13)-C(10)	178.6(2)
N(1)-C(14)-C(15)	114.84(14)
C(16)-C(15)-C(20)	118.68(16)
C(16)-C(15)-C(14)	120.44(15)
C(20)-C(15)-C(14)	120.84(16)
C(17)-C(16)-C(15)	120.80(17)
C(18)-C(17)-C(16)	119.85(17)
C(19)-C(18)-C(17)	119.72(17)
C(20)-C(19)-C(18)	120.18(16)
C(19)-C(20)-C(15)	120.73(17)
C(1)-N(1)-C(14)	123.15(15)
C(1)-N(1)-C(4)	102.64(14)
C(14)-N(1)-C(4)	126.14(14)

4.2 Structure Report for 5p

Crystallographic data are presented in the Tables below. A single crystal of **5p** was coated in perfluoropolyether oil and mounted on a glass fibre. X-ray measurements were made using a Bruker D8 Venture dual source kappa CPAD diffractometer with Mo K_α radiation (λ = 0.71073 Å).[21] Intensities were integrated from several series of exposures, each exposure covering 0.5° in ω or ϕ. Absorption corrections were applied, based on multiple and symmetry-equivalent measurements.[22] The structure was solved by direct methods and refined by least squares on weighted F^2 values for all reflections (see **Table S5**).[23]

All non-hydrogen atoms were assigned anisotropic displacement parameters and refined without positional constraints. The positions of the methyl hydrogen atoms were assigned by a rotating group refinement with fixed, idealised C-H distances. All other hydrogen atoms were constrained to ideal geometries. All hydrogen atoms were assigned isotropic displacement parameters equal to 1.5 times (methyl hydrogen atoms) or 1.2 times (all other hydrogen atoms) that of their parent atom.

Refinement proceeded smoothly to give the residuals shown in **Table S5**. Complex neutral-atom scattering factors were used.[24]



Supplementary Figure S5: Molecular structure of **5p** with thermal ellipsoids shown at the 50% probability level; hydrogen atoms have been omitted for clarity

Supplementary Table S5. Crystal data and structure refinement for **5p**.

Identification code	zzx752_2	
Empirical formula	C_{15} H_{14} N_2 O_2	
Formula weight	254.28	
Temperature	100(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	$P2_1/n$	
Unit cell dimensions	a = 7.5188(6) Å	α = 90°
	b = 12.0570(10) Å	β = 95.497(3)°
	c = 14.2757(12) Å	γ = 90°
Volume	1288.20(18) $Å^3$	
Z	4	
Density (calculated)	1.311 Mg/m^3	
Absorption coefficient	0.089 mm^{-1}	
F(000)	536	
Crystal size	0.590 x 0.330 x 0.230 mm	
θ range for data collection	2.215 to 28.343°	
Index ranges	-10<=h<=10, -15<=k<=16, -18<=l<=19	
Reflections collected	13926	
Independent reflections	3165 [R_{int} = 0.0961]	
Completeness to θ = 25.242°	98.9 %	
Absorption correction	Numerical	
Max. and min. transmission	1.0000 and 0.5363	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	3165 / 0 / 174	
Goodness-of-fit on F^2	S = 1.076	
R indices [for 2224 reflections with $I>2\sigma(I)$]		R_1 = 0.0887, wR_2 = 0.2660
R indices (for all 3165 data)	R_1 = 0.1174, wR_2 = 0.2908	
Weighting scheme	$w^{-1} = \sigma^2(F_o^2) + (aP)^2$,	
	where $P = [\max(F_o^2, 0) + 2F_c^2]/3$	
	a = 0.1986	
Largest diff. peak and hole	0.530 and -0.528 $eÅ^{-3}$	

Supplementary Table S6. Bond lengths [Å] and angles [°] for **5p**

C(1)-O(1)	1.206(3)
C(1)-N(1)	1.414(3)
C(1)-C(2)	1.521(3)
C(2)-C(6)	1.500(4)
C(2)-C(3)	1.562(4)
C(2)-C(5)	1.563(3)
C(3)-C(4)	1.548(3)
C(4)-C(7)	1.490(3)
C(4)-N(1)	1.511(3)
C(4)-C(5)	1.547(4)
C(7)-C(8)	1.389(4)
C(7)-C(12)	1.401(3)
C(8)-C(9)	1.388(4)
C(9)-C(10)	1.393(4)
C(10)-C(11)	1.399(4)
C(10)-C(13)	1.437(4)
C(11)-C(12)	1.379(4)
C(13)-N(2)	1.152(4)
C(14)-O(2)	1.215(3)
C(14)-N(1)	1.389(3)
C(14)-C(15)	1.501(3)
O(1)-C(1)-N(1)	128.2(2)
O(1)-C(1)-C(2)	129.9(2)
N(1)-C(1)-C(2)	101.87(19)
C(6)-C(2)-C(1)	116.9(2)
C(6)-C(2)-C(3)	123.7(2)
C(1)-C(2)-C(3)	99.7(2)
C(6)-C(2)-C(5)	124.8(2)
C(1)-C(2)-C(5)	98.54(19)
C(3)-C(2)-C(5)	86.34(19)
C(4)-C(3)-C(2)	82.33(18)
C(7)-C(4)-N(1)	116.94(19)
C(7)-C(4)-C(5)	123.21(19)
N(1)-C(4)-C(5)	99.23(19)
C(7)-C(4)-C(3)	123.8(2)
N(1)-C(4)-C(3)	99.97(17)
C(5)-C(4)-C(3)	87.39(19)

C(4)-C(5)-C(2)	82.32(18)
C(8)-C(7)-C(12)	119.4(2)
C(8)-C(7)-C(4)	120.3(2)
C(12)-C(7)-C(4)	120.2(2)
C(9)-C(8)-C(7)	120.8(2)
C(8)-C(9)-C(10)	119.0(2)
C(9)-C(10)-C(11)	120.6(2)
C(9)-C(10)-C(13)	119.5(3)
C(11)-C(10)-C(13)	119.8(2)
C(12)-C(11)-C(10)	119.6(2)
C(11)-C(12)-C(7)	120.2(3)
N(2)-C(13)-C(10)	178.8(2)
O(2)-C(14)-N(1)	121.3(2)
O(2)-C(14)-C(15)	121.8(2)
N(1)-C(14)-C(15)	116.9(2)
C(14)-N(1)-C(1)	128.6(2)
C(14)-N(1)-C(4)	128.0(2)
C(1)-N(1)-C(4)	102.23(18)

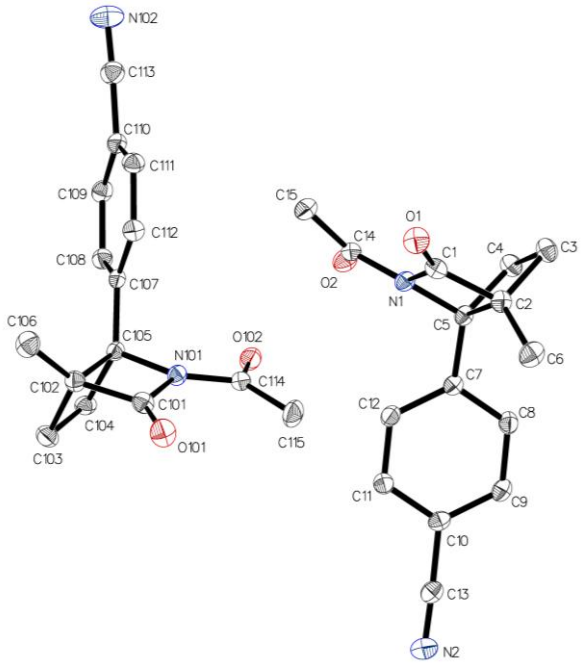
4.3 Structure Report for 6p

Crystallographic data are presented in the Tables below. A single crystal of **6p** was coated in perfluoropolyether oil and mounted on a glass fibre. X-ray measurements were made using a Bruker D8 Venture dual source kappa CPAD diffractometer with Mo K_α radiation (λ = 0.71073 Å).[21] Intensities were integrated from several series of exposures, each exposure covering 0.5° in ω or ϕ. Absorption corrections were applied, based on multiple and symmetry-equivalent measurements.[22] The structure was solved by direct methods and refined by least squares on weighted F^2 values for all reflections (see **Table S7**).[23]

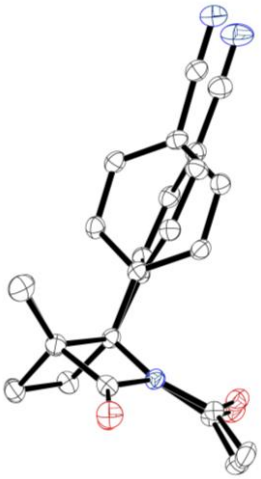
All non-hydrogen atoms were assigned anisotropic displacement parameters and refined without positional constraints. The positions of the methyl hydrogen atoms were assigned by a rotating group refinement with fixed, idealised C-H distances. All other hydrogen atoms were constrained to ideal geometries. All hydrogen atoms and were assigned isotropic displacement parameters equal to 1.5 times (methyl hydrogen atoms) or 1.2 times (all other hydrogen atoms) that of their parent atom.

Refinement proceeded smoothly to give the residuals shown in **Table S7**. Complex neutral-atom scattering factors were used.[24]

The unit cell contains two distinct molecules (shown in **Figure S6**) with identical stereochemistry. An overlay of the two molecules (shown in **Figure S7**) shows that they mainly differ in the conformation of the cyanophenyl ring with the N1-C5-C7-C8 torsion angle differing from its N101-C105-C107-C108 counterpart by 58.59(16)° with an additional slight difference in the positions of the acyl substituent of the N1-C5 ring, presumably accounted for by packing forces within the structure.

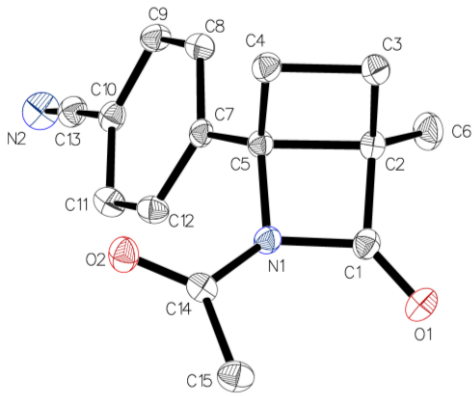


Supplementary Figure S6: Molecular structures of the two independent molecules found in the unit cell for **6p** with thermal ellipsoids shown at the 50% probability level; hydrogen atoms have been omitted for clarity.



Supplementary Figure S7: Overlay of the two independent molecules found in the unit cell for **6p** with thermal ellipsoids shown at the 50% probability level; hydrogen atoms have been omitted for clarity.

The molecular structure of the first molecule within the unit cell is shown in **Figure S8**. Within the four-membered C2-C5 ring, the C2-C3 bond is slightly [0.015(3) Å] longer than those seen for C3-C4 and C4-C5, whilst the C2-C5 bond that links the bridgehead atoms is appreciably [0.047(2) Å] longer than the C4-C5 bond.



Supplementary Figure S8: Molecular structure of one of the two independent molecules found in the unit cell for 6p with thermal ellipsoids shown at the 50% probability level; hydrogen atoms have been omitted for clarity.

Supplementary Table S7. Crystal data and structure refinement for **6p**

Identification code	mo_ZZX752_1_0m	
Empirical formula	C_{15} H_{14} N_2 O_2	
Formula weight	254.28	
Temperature	100(2) K	
Wavelength	0.71073 Å	
Crystal system	Triclinic	
Space group	P-1	
Unit cell dimensions	a = 9.696(3) Å	α= 84.369(7)°.
	b = 12.448(4) Å	β= 68.207(7)°.
	c = 12.746(4) Å	γ = 68.928(7)°.
Volume	1331.8(7) Å^3	
Z	4	
Density (calculated)	1.268 Mg/m^3	
Absorption coefficient	0.086 mm^{-1}	
F(000)	536	
Crystal size	0.960 x 0.520 x 0.190 mm^3	
Theta range for data collection	1.755 to 28.271°.	
Index ranges	-12<=h<=12, -16<=k<=16, -16<=l<=16	
Reflections collected	28961	
Independent reflections	6407 [R_{int} = 0.0495]	
Completeness to theta = 25.242°	99.2 %	
Absorption correction	Numerical	
Max. and min. transmission	1.0000 and 0.8452	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	6407 / 0 / 347	
Goodness-of-fit on F^2	1.079	
Final R indices [I>2σ(I)]	R_1 = 0.0472, wR_2 = 0.1115	
R indices (all 6407 data)	R_1 = 0.0557, wR_2 = 0.1181	
Weighting scheme	$w^{-1} = \sigma^2(F_o^2) + (aP)^2 + (bP)$,	
	where $P = [\max(F_o^2, 0) + 2F_c^2]/3$	
	a = 0.0577, b = 0.5294	
Largest diff. peak and hole	0.407 and -0.346 e.Å^{-3}	

Supplementary Table S8. Bond lengths [Å] and angles [°] for **6p**

C(1)-O(1)	1.2056(16)
C(1)-N(1)	1.4112(17)
C(1)-C(2)	1.5247(18)
C(2)-C(6)	1.5106(18)
C(2)-C(3)	1.5676(18)
C(2)-C(5)	1.5990(18)
C(3)-C(4)	1.5528(19)
C(3)-H(3A)	0.9900
C(3)-H(3B)	0.9900
C(4)-C(5)	1.5523(17)
C(4)-H(4A)	0.9900
C(4)-H(4B)	0.9900
C(5)-N(1)	1.4867(15)
C(5)-C(7)	1.4952(16)
C(6)-H(6A)	0.9800
C(6)-H(6B)	0.9800
C(6)-H(6C)	0.9800
C(7)-C(8)	1.3992(17)
C(7)-C(12)	1.4003(17)
C(8)-C(9)	1.3884(17)
C(8)-H(8)	0.9500
C(9)-C(10)	1.3997(18)
C(9)-H(9)	0.9500
C(10)-C(11)	1.3973(17)
C(10)-C(13)	1.4461(17)
C(11)-C(12)	1.3866(17)
C(11)-H(11)	0.9500
C(12)-H(12)	0.9500
C(13)-N(2)	1.1507(17)
C(14)-O(2)	1.2160(16)
C(14)-N(1)	1.3971(16)
C(14)-C(15)	1.5036(18)
C(15)-H(15A)	0.9800
C(15)-H(15B)	0.9800
C(15)-H(15C)	0.9800
C(101)-O(101)	1.2073(16)
C(101)-N(101)	1.4080(16)
C(101)-C(102)	1.5280(18)

C(102)-C(106)	1.5084(18)
C(102)-C(103)	1.5661(18)
C(102)-C(105)	1.5987(17)
C(103)-C(104)	1.5537(18)
C(103)-H(10C)	0.9900
C(103)-H(10D)	0.9900
C(104)-C(105)	1.5485(17)
C(104)-H(10A)	0.9900
C(104)-H(10B)	0.9900
C(105)-N(101)	1.4895(16)
C(105)-C(107)	1.5036(16)
C(106)-H(10E)	0.9800
C(106)-H(10F)	0.9800
C(106)-H(10G)	0.9800
C(107)-C(108)	1.3959(18)
C(107)-C(112)	1.4036(17)
C(108)-C(109)	1.3960(17)
C(108)-H(108)	0.9500
C(109)-C(110)	1.4020(19)
C(109)-H(109)	0.9500
C(110)-C(111)	1.398(2)
C(110)-C(113)	1.4507(17)
C(111)-C(112)	1.3895(17)
C(111)-H(111)	0.9500
C(112)-H(112)	0.9500
C(113)-N(102)	1.1488(18)
C(114)-O(102)	1.2178(16)
C(114)-N(101)	1.3927(16)
C(114)-C(115)	1.5048(18)
C(115)-H(11A)	0.9800
C(115)-H(11B)	0.9800
C(115)-H(11C)	0.9800
O(1)-C(1)-N(1)	131.31(12)
O(1)-C(1)-C(2)	136.16(12)
N(1)-C(1)-C(2)	92.51(9)
C(6)-C(2)-C(1)	118.59(11)
C(6)-C(2)-C(3)	120.37(11)
C(1)-C(2)-C(3)	110.72(10)
C(6)-C(2)-C(5)	124.92(11)
C(1)-C(2)-C(5)	86.00(9)

C(3)-C(2)-C(5)	88.40(9)
C(4)-C(3)-C(2)	91.05(9)
C(4)-C(3)-H(3A)	113.5
C(2)-C(3)-H(3A)	113.5
C(4)-C(3)-H(3B)	113.5
C(2)-C(3)-H(3B)	113.5
H(3A)-C(3)-H(3B)	110.8
C(5)-C(4)-C(3)	90.63(9)
C(5)-C(4)-H(4A)	113.5
C(3)-C(4)-H(4A)	113.5
C(5)-C(4)-H(4B)	113.5
C(3)-C(4)-H(4B)	113.5
H(4A)-C(4)-H(4B)	110.8
N(1)-C(5)-C(7)	116.63(10)
N(1)-C(5)-C(4)	111.59(9)
C(7)-C(5)-C(4)	122.85(10)
N(1)-C(5)-C(2)	86.84(9)
C(7)-C(5)-C(2)	120.76(10)
C(4)-C(5)-C(2)	89.90(9)
C(2)-C(6)-H(6A)	109.5
C(2)-C(6)-H(6B)	109.5
H(6A)-C(6)-H(6B)	109.5
C(2)-C(6)-H(6C)	109.5
H(6A)-C(6)-H(6C)	109.5
H(6B)-C(6)-H(6C)	109.5
C(8)-C(7)-C(12)	119.00(11)
C(8)-C(7)-C(5)	119.40(11)
C(12)-C(7)-C(5)	121.39(10)
C(9)-C(8)-C(7)	120.81(11)
C(9)-C(8)-H(8)	119.6
C(7)-C(8)-H(8)	119.6
C(8)-C(9)-C(10)	119.42(11)
C(8)-C(9)-H(9)	120.3
C(10)-C(9)-H(9)	120.3
C(11)-C(10)-C(9)	120.28(11)
C(11)-C(10)-C(13)	118.91(11)
C(9)-C(10)-C(13)	120.78(11)
C(12)-C(11)-C(10)	119.69(11)
C(12)-C(11)-H(11)	120.2
C(10)-C(11)-H(11)	120.2

C(11)-C(12)-C(7)	120.65(11)
C(11)-C(12)-H(12)	119.7
C(7)-C(12)-H(12)	119.7
N(2)-C(13)-C(10)	177.77(13)
O(2)-C(14)-N(1)	118.99(11)
O(2)-C(14)-C(15)	124.88(12)
N(1)-C(14)-C(15)	116.11(11)
C(14)-C(15)-H(15A)	109.5
C(14)-C(15)-H(15B)	109.5
H(15A)-C(15)-H(15B)	109.5
C(14)-C(15)-H(15C)	109.5
H(15A)-C(15)-H(15C)	109.5
H(15B)-C(15)-H(15C)	109.5
C(14)-N(1)-C(1)	132.98(10)
C(14)-N(1)-C(5)	128.16(10)
C(1)-N(1)-C(5)	94.64(9)
O(101)-C(101)-N(101)	131.57(12)
O(101)-C(101)-C(102)	136.30(12)
N(101)-C(101)-C(102)	92.11(10)
C(106)-C(102)-C(101)	118.59(12)
C(106)-C(102)-C(103)	119.67(11)
C(101)-C(102)-C(103)	109.89(10)
C(106)-C(102)-C(105)	126.92(10)
C(101)-C(102)-C(105)	86.32(9)
C(103)-C(102)-C(105)	88.07(9)
C(104)-C(103)-C(102)	91.30(9)
C(104)-C(103)-H(10C)	113.4
C(102)-C(103)-H(10C)	113.4
C(104)-C(103)-H(10D)	113.4
C(102)-C(103)-H(10D)	113.4
H(10C)-C(103)-H(10D)	110.7
C(105)-C(104)-C(103)	90.33(10)
C(105)-C(104)-H(10A)	113.6
C(103)-C(104)-H(10A)	113.6
C(105)-C(104)-H(10B)	113.6
C(103)-C(104)-H(10B)	113.6
H(10A)-C(104)-H(10B)	110.9
N(101)-C(105)-C(107)	114.59(10)
N(101)-C(105)-C(104)	111.74(9)
C(107)-C(105)-C(104)	121.79(11)

N(101)-C(105)-C(102) 86.41(9)
C(107)-C(105)-C(102) 125.29(10)
C(104)-C(105)-C(102) 90.27(9)
C(102)-C(106)-H(10E) 109.5
C(102)-C(106)-H(10F) 109.5
H(10E)-C(106)-H(10F) 109.5
C(102)-C(106)-H(10G) 109.5
H(10E)-C(106)-H(10G) 109.5
H(10F)-C(106)-H(10G) 109.5
C(108)-C(107)-C(112) 119.25(11)
C(108)-C(107)-C(105) 121.14(11)
C(112)-C(107)-C(105) 119.61(11)
C(107)-C(108)-C(109) 120.72(12)
C(107)-C(108)-H(108) 119.6
C(109)-C(108)-H(108) 119.6
C(108)-C(109)-C(110) 119.32(12)
C(108)-C(109)-H(109) 120.3
C(110)-C(109)-H(109) 120.3
C(111)-C(110)-C(109) 120.38(11)
C(111)-C(110)-C(113) 119.34(12)
C(109)-C(110)-C(113) 120.24(12)
C(112)-C(111)-C(110) 119.69(12)
C(112)-C(111)-H(111) 120.2
C(110)-C(111)-H(111) 120.2
C(111)-C(112)-C(107) 120.59(12)
C(111)-C(112)-H(112) 119.7
C(107)-C(112)-H(112) 119.7
N(102)-C(113)-C(110) 177.20(14)
O(102)-C(114)-N(101) 118.50(11)
O(102)-C(114)-C(115) 124.94(12)
N(101)-C(114)-C(115) 116.55(12)
C(114)-C(115)-H(11A) 109.5
C(114)-C(115)-H(11B) 109.5
H(11A)-C(115)-H(11B) 109.5
C(114)-C(115)-H(11C) 109.5
H(11A)-C(115)-H(11C) 109.5
H(11B)-C(115)-H(11C) 109.5
C(114)-N(101)-C(101) 135.89(11)
C(114)-N(101)-C(105) 126.90(10)
C(101)-N(101)-C(105) 95.15(9)

Supplementary Table S9. Torsion angles [°] for **6p**.

O(1)-C(1)-C(2)-C(6)	53.2(2)
N(1)-C(1)-C(2)-C(6)	-128.40(12)
O(1)-C(1)-C(2)-C(3)	-92.10(17)
N(1)-C(1)-C(2)-C(3)	86.35(11)
O(1)-C(1)-C(2)-C(5)	-178.87(15)
N(1)-C(1)-C(2)-C(5)	-0.42(8)
C(6)-C(2)-C(3)-C(4)	129.21(12)
C(1)-C(2)-C(3)-C(4)	-86.25(11)
C(5)-C(2)-C(3)-C(4)	-1.13(9)
C(2)-C(3)-C(4)-C(5)	1.16(9)
C(3)-C(4)-C(5)-N(1)	85.42(11)
C(3)-C(4)-C(5)-C(7)	-128.56(12)
C(3)-C(4)-C(5)-C(2)	-1.14(9)
C(6)-C(2)-C(5)-N(1)	122.83(12)
C(1)-C(2)-C(5)-N(1)	0.40(8)
C(3)-C(2)-C(5)-N(1)	-110.50(9)
C(6)-C(2)-C(5)-C(7)	3.52(18)
C(1)-C(2)-C(5)-C(7)	-118.91(11)
C(3)-C(2)-C(5)-C(7)	130.19(11)
C(6)-C(2)-C(5)-C(4)	-125.54(13)
C(1)-C(2)-C(5)-C(4)	112.03(9)
C(3)-C(2)-C(5)-C(4)	1.13(9)
N(1)-C(5)-C(7)-C(8)	-172.97(11)
C(4)-C(5)-C(7)-C(8)	42.57(17)
C(2)-C(5)-C(7)-C(8)	-69.87(15)
N(1)-C(5)-C(7)-C(12)	1.66(17)
C(4)-C(5)-C(7)-C(12)	-142.80(12)
C(2)-C(5)-C(7)-C(12)	104.76(14)
C(12)-C(7)-C(8)-C(9)	-3.07(19)
C(5)-C(7)-C(8)-C(9)	171.69(12)
C(7)-C(8)-C(9)-C(10)	-0.45(19)
C(8)-C(9)-C(10)-C(11)	3.10(19)
C(8)-C(9)-C(10)-C(13)	-174.59(12)
C(9)-C(10)-C(11)-C(12)	-2.18(19)
C(13)-C(10)-C(11)-C(12)	175.55(12)
C(10)-C(11)-C(12)-C(7)	-1.4(2)
C(8)-C(7)-C(12)-C(11)	4.01(19)
C(5)-C(7)-C(12)-C(11)	-170.65(12)

O(2)-C(14)-N(1)-C(1)	160.89(12)
C(15)-C(14)-N(1)-C(1)	-17.57(18)
O(2)-C(14)-N(1)-C(5)	10.09(18)
C(15)-C(14)-N(1)-C(5)	-168.36(11)
O(1)-C(1)-N(1)-C(14)	21.7(2)
C(2)-C(1)-N(1)-C(14)	-156.91(12)
O(1)-C(1)-N(1)-C(5)	179.02(13)
C(2)-C(1)-N(1)-C(5)	0.45(9)
C(7)-C(5)-N(1)-C(14)	-78.37(15)
C(4)-C(5)-N(1)-C(14)	69.94(15)
C(2)-C(5)-N(1)-C(14)	158.58(11)
C(7)-C(5)-N(1)-C(1)	122.61(11)
C(4)-C(5)-N(1)-C(1)	-89.07(11)
C(2)-C(5)-N(1)-C(1)	-0.43(9)
O(101)-C(101)-C(102)-C(106)	51.3(2)
N(101)-C(101)-C(102)-C(106)	-130.18(11)
O(101)-C(101)-C(102)-C(103)	-91.51(18)
N(101)-C(101)-C(102)-C(103)	87.01(11)
O(101)-C(101)-C(102)-C(105)	-178.12(16)
N(101)-C(101)-C(102)-C(105)	0.40(9)
C(106)-C(102)-C(103)-C(104)	130.97(12)
C(101)-C(102)-C(103)-C(104)	-86.69(11)
C(105)-C(102)-C(103)-C(104)	-1.30(9)
C(102)-C(103)-C(104)-C(105)	1.34(9)
C(103)-C(104)-C(105)-N(101)	84.93(11)
C(103)-C(104)-C(105)-C(107)	-134.36(11)
C(103)-C(104)-C(105)-C(102)	-1.31(9)
C(106)-C(102)-C(105)-N(101)	123.09(13)
C(101)-C(102)-C(105)-N(101)	-0.38(8)
C(103)-C(102)-C(105)-N(101)	-110.46(9)
C(106)-C(102)-C(105)-C(107)	5.3(2)
C(101)-C(102)-C(105)-C(107)	-118.18(12)
C(103)-C(102)-C(105)-C(107)	131.74(12)
C(106)-C(102)-C(105)-C(104)	-125.15(13)
C(101)-C(102)-C(105)-C(104)	111.38(9)
C(103)-C(102)-C(105)-C(104)	1.30(9)
N(101)-C(105)-C(107)-C(108)	128.44(12)
C(104)-C(105)-C(107)-C(108)	-11.26(17)
C(102)-C(105)-C(107)-C(108)	-127.71(13)
N(101)-C(105)-C(107)-C(112)	-51.71(14)

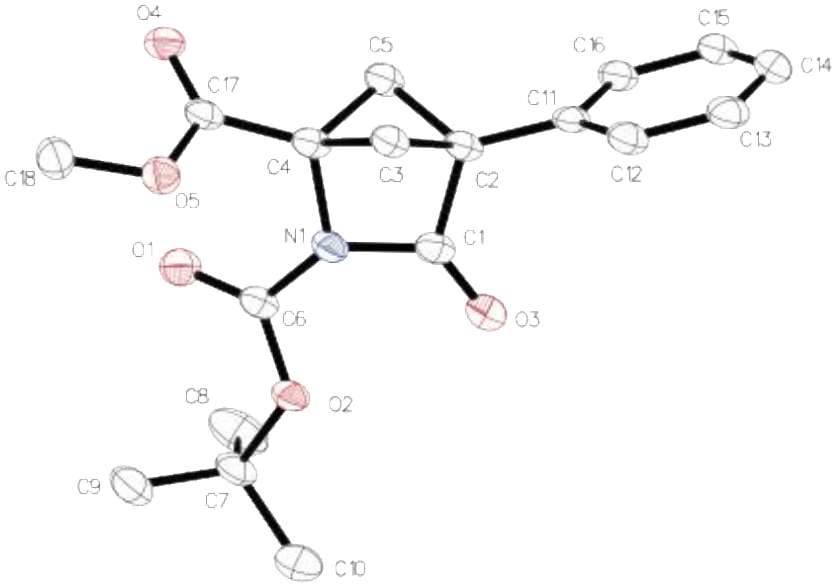
C(104)-C(105)-C(107)-C(112)	168.59(11)
C(102)-C(105)-C(107)-C(112)	52.15(16)
C(112)-C(107)-C(108)-C(109)	-1.66(17)
C(105)-C(107)-C(108)-C(109)	178.20(11)
C(107)-C(108)-C(109)-C(110)	-0.23(18)
C(108)-C(109)-C(110)-C(111)	1.96(18)
C(108)-C(109)-C(110)-C(113)	-176.03(11)
C(109)-C(110)-C(111)-C(112)	-1.76(18)
C(113)-C(110)-C(111)-C(112)	176.25(11)
C(110)-C(111)-C(112)-C(107)	-0.17(18)
C(108)-C(107)-C(112)-C(111)	1.87(18)
C(105)-C(107)-C(112)-C(111)	-177.99(11)
O(102)-C(114)-N(101)-C(101)	166.89(13)
C(115)-C(114)-N(101)-C(101)	-14.4(2)
O(102)-C(114)-N(101)-C(105)	7.50(18)
C(115)-C(114)-N(101)-C(105)	-173.77(11)
O(101)-C(101)-N(101)-C(114)	14.6(2)
C(102)-C(101)-N(101)-C(114)	-164.02(14)
O(101)-C(101)-N(101)-C(105)	178.20(14)
C(102)-C(101)-N(101)-C(105)	-0.43(9)
C(107)-C(105)-N(101)-C(114)	-66.39(15)
C(104)-C(105)-N(101)-C(114)	77.32(14)
C(102)-C(105)-N(101)-C(114)	166.17(11)
C(107)-C(105)-N(101)-C(101)	127.85(11)
C(104)-C(105)-N(101)-C(101)	-88.44(11)
C(102)-C(105)-N(101)-C(101)	0.41(9)

4.4 Structure Report for 8a

Crystallographic data are presented in the Tables below. A single crystal of **8a** was coated in perfluoropolyether oil and mounted on a glass fibre. X-ray measurements were made using a Bruker D8 Venture dual source kappa CPAD diffractometer with Mo K_α radiation (λ = 0.71073 Å).[21] Intensities were integrated from several series of exposures, each exposure covering 0.5° in ω or ϕ. Absorption corrections were applied, based on multiple and symmetry-equivalent measurements.[22] The structure was solved by direct methods and refined by least squares on weighted F^2 values for all reflections (see **Table S10**).[23]

All non-hydrogen atoms were assigned anisotropic displacement parameters and refined without positional constraints. The positions of the methyl hydrogen atoms were assigned by a rotating group refinement with fixed, idealised C-H distances. All other hydrogen atoms were constrained to ideal geometries. All hydrogen atoms were assigned isotropic displacement parameters equal to 1.5 times (methyl) or 1.2 times (all other hydrogen atoms) that of their parent atom.

Refinement proceeded smoothly to give the residuals shown in **Table S10**. Complex neutral-atom scattering factors were used.[24]



Supplementary Figure S9: Molecular structure of **8a** with thermal ellipsoids shown at the 50% probability level; hydrogen atoms have been omitted for clarity

Supplementary Table S10. Crystal data and structure refinement for **8a**.

Identification code	zzx606	
Empirical formula	$C_{18}H_{21}NO_5$	
Formula weight	331.36	
Temperature	100(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	$P2_1/n$	
Unit cell dimensions	a = 5.986(8) Å	α = 90°
	b = 30.35(4) Å	β = 98.61(3)°
	c = 9.570(14) Å	γ = 90°
Volume	1719(4) Å^3	
Z	4	
Density (calculated)	1.280 Mg/m^3	
Absorption coefficient	0.094 mm^{-1}	
F(000)	704	
Crystal size	0.200 x 0.100 x 0.020 mm	
θ range for data collection	2.255 to 24.998°	
Index ranges	-7<=h<=7, -36<=k<=36, -11<=l<=11	
Reflections collected	31906	
Independent reflections	3026 [R_{int} = 0.0839]	
Completeness to θ = 24.998°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.9590 and 0.8116	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	3026 / 0 / 221	
Goodness-of-fit on F^2	S = 1.076	
R indices [for 2236 reflections with $I>2\sigma(I)$]		R_1 = 0.0488, wR_2 = 0.1262
R indices (for all 3026 data)	R_1 = 0.0725, wR_2 = 0.1408	
Weighting scheme	$w^{-1} = \sigma^2(F_o^2) + (aP)^2 + (bP)$,	
	where $P = [\max(F_o^2, 0) + 2F_c^2]/3$	
	a = 0.0759, b = 0.3963	
Largest diff. peak and hole	0.211 and -0.418 eÅ^{-3}	

Supplementary Table S11. Bond lengths [Å] and angles [°] for **8a**.

C(1)-C(2)	1.545(3)
C(1)-N(1)	1.427(3)
C(1)-O(3)	1.215(3)
C(2)-C(3)	1.576(3)
C(2)-C(5)	1.589(3)
C(2)-C(11)	1.500(3)
C(3)-H(3A)	0.9900
C(3)-H(3B)	0.9900
C(3)-C(4)	1.559(3)
C(4)-C(5)	1.549(3)
C(4)-C(17)	1.513(4)
C(4)-N(1)	1.509(3)
C(5)-H(5A)	0.9900
C(5)-H(5B)	0.9900
C(6)-N(1)	1.403(3)
C(6)-O(1)	1.218(3)
C(6)-O(2)	1.333(3)
C(7)-C(8)	1.525(3)
C(7)-C(9)	1.521(3)
C(7)-C(10)	1.531(4)
C(7)-O(2)	1.506(3)
C(8)-H(8A)	0.9800
C(8)-H(8B)	0.9800
C(8)-H(8C)	0.9800
C(9)-H(9A)	0.9800
C(9)-H(9B)	0.9800
C(9)-H(9C)	0.9800
C(10)-H(10A)	0.9800
C(10)-H(10B)	0.9800
C(10)-H(10C)	0.9800
C(11)-C(12)	1.401(3)
C(11)-C(16)	1.404(3)
C(12)-H(12)	0.9500
C(12)-C(13)	1.395(3)
C(13)-H(13)	0.9500
C(13)-C(14)	1.399(3)
C(14)-H(14)	0.9500
C(14)-C(15)	1.396(4)

C(15)-H(15)	0.9500
C(15)-C(16)	1.394(3)
C(16)-H(16)	0.9500
C(17)-O(4)	1.210(3)
C(17)-O(5)	1.348(3)
C(18)-H(18A)	0.9800
C(18)-H(18B)	0.9800
C(18)-H(18C)	0.9800
C(18)-O(5)	1.463(3)

N(1)-C(1)-C(2)	101.4(2)
O(3)-C(1)-C(2)	130.44(19)
O(3)-C(1)-N(1)	128.10(19)
C(1)-C(2)-C(3)	99.68(18)
C(1)-C(2)-C(5)	98.88(18)
C(3)-C(2)-C(5)	85.60(17)
C(11)-C(2)-C(1)	118.2(2)
C(11)-C(2)-C(3)	124.41(18)
C(11)-C(2)-C(5)	122.91(18)
C(2)-C(3)-H(3A)	115.0
C(2)-C(3)-H(3B)	115.0
H(3A)-C(3)-H(3B)	112.0
C(4)-C(3)-C(2)	81.95(15)
C(4)-C(3)-H(3A)	115.0
C(4)-C(3)-H(3B)	115.0
C(5)-C(4)-C(3)	87.60(15)
C(17)-C(4)-C(3)	122.84(18)
C(17)-C(4)-C(5)	122.99(18)
N(1)-C(4)-C(3)	98.95(16)
N(1)-C(4)-C(5)	102.59(19)
N(1)-C(4)-C(17)	116.13(18)
C(2)-C(5)-H(5A)	115.0
C(2)-C(5)-H(5B)	115.0
C(4)-C(5)-C(2)	81.85(16)
C(4)-C(5)-H(5A)	115.0
C(4)-C(5)-H(5B)	115.0
H(5A)-C(5)-H(5B)	112.0
O(1)-C(6)-N(1)	122.2(2)
O(1)-C(6)-O(2)	128.07(19)
O(2)-C(6)-N(1)	109.67(18)

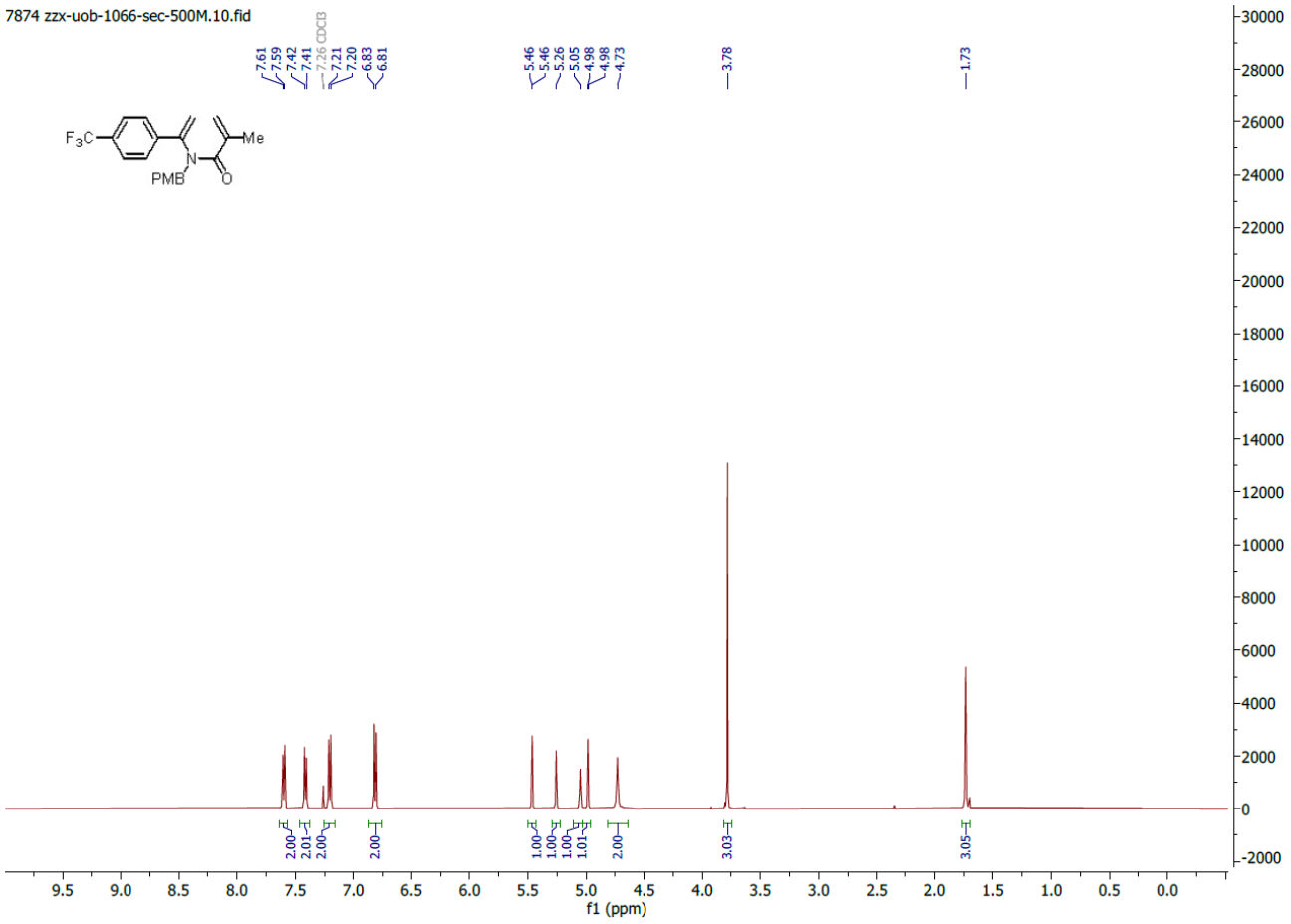
C(8)-C(7)-C(10)	112.1(2)
C(9)-C(7)-C(8)	113.0(2)
C(9)-C(7)-C(10)	110.3(2)
O(2)-C(7)-C(8)	108.47(19)
O(2)-C(7)-C(9)	110.52(19)
O(2)-C(7)-C(10)	101.81(18)
C(7)-C(8)-H(8A)	109.5
C(7)-C(8)-H(8B)	109.5
C(7)-C(8)-H(8C)	109.5
H(8A)-C(8)-H(8B)	109.5
H(8A)-C(8)-H(8C)	109.5
H(8B)-C(8)-H(8C)	109.5
C(7)-C(9)-H(9A)	109.5
C(7)-C(9)-H(9B)	109.5
C(7)-C(9)-H(9C)	109.5
H(9A)-C(9)-H(9B)	109.5
H(9A)-C(9)-H(9C)	109.5
H(9B)-C(9)-H(9C)	109.5
C(7)-C(10)-H(10A)	109.5
C(7)-C(10)-H(10B)	109.5
C(7)-C(10)-H(10C)	109.5
H(10A)-C(10)-H(10B)	109.5
H(10A)-C(10)-H(10C)	109.5
H(10B)-C(10)-H(10C)	109.5
C(12)-C(11)-C(2)	121.45(19)
C(12)-C(11)-C(16)	118.86(18)
C(16)-C(11)-C(2)	119.68(19)
C(11)-C(12)-H(12)	119.8
C(13)-C(12)-C(11)	120.4(2)
C(13)-C(12)-H(12)	119.8
C(12)-C(13)-H(13)	119.9
C(12)-C(13)-C(14)	120.3(2)
C(14)-C(13)-H(13)	119.9
C(13)-C(14)-H(14)	120.2
C(15)-C(14)-C(13)	119.61(19)
C(15)-C(14)-H(14)	120.2
C(14)-C(15)-H(15)	119.9
C(16)-C(15)-C(14)	120.1(2)
C(16)-C(15)-H(15)	119.9
C(11)-C(16)-H(16)	119.7

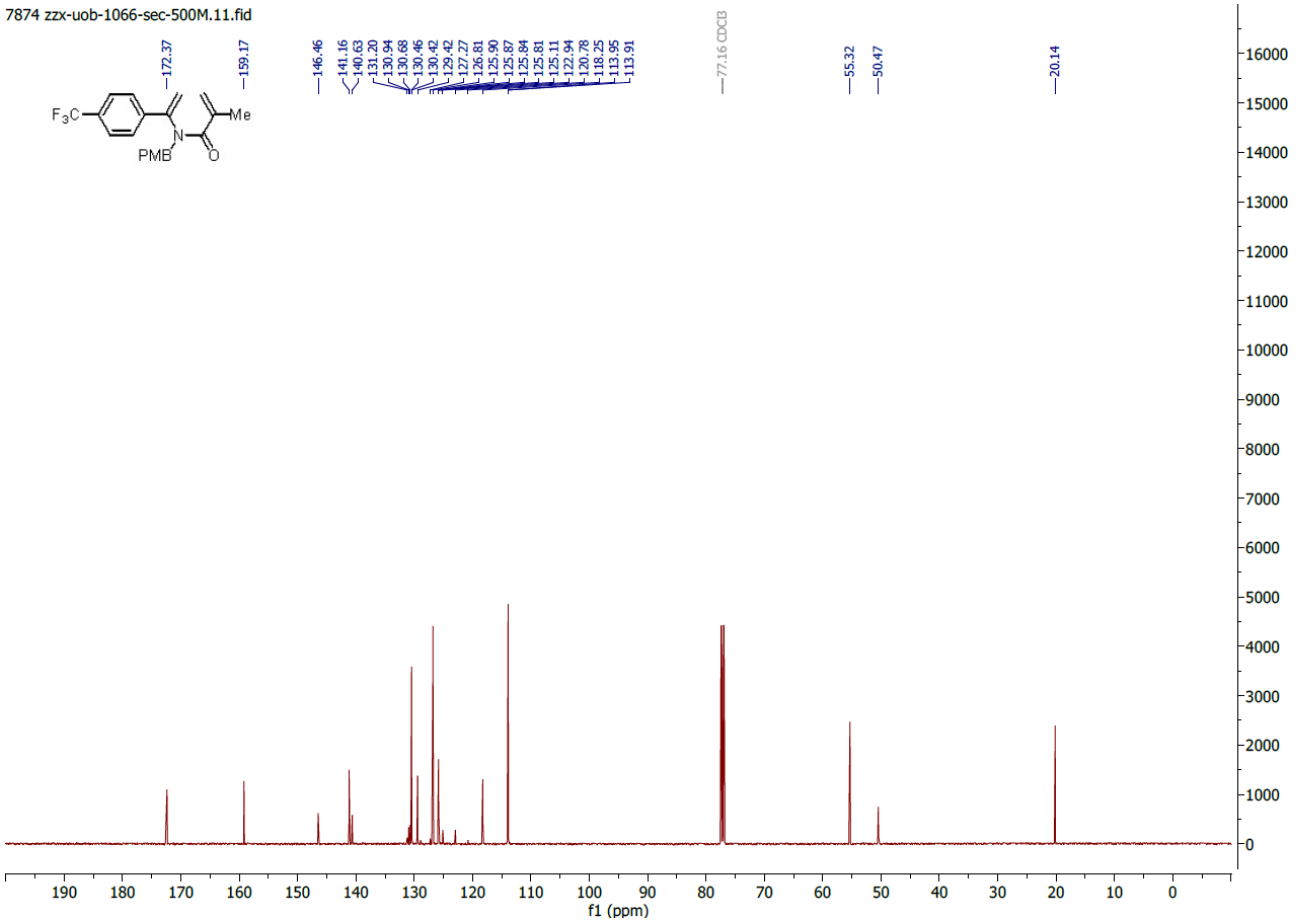
C(15)-C(16)-C(11)	120.7(2)
C(15)-C(16)-H(16)	119.7
O(4)-C(17)-C(4)	123.85(19)
O(4)-C(17)-O(5)	125.4(2)
O(5)-C(17)-C(4)	110.70(17)
H(18A)-C(18)-H(18B)	109.5
H(18A)-C(18)-H(18C)	109.5
H(18B)-C(18)-H(18C)	109.5
O(5)-C(18)-H(18A)	109.5
O(5)-C(18)-H(18B)	109.5
O(5)-C(18)-H(18C)	109.5
C(1)-N(1)-C(4)	102.27(18)
C(6)-N(1)-C(1)	128.19(19)
C(6)-N(1)-C(4)	124.02(17)
C(6)-O(2)-C(7)	121.02(16)
C(17)-O(5)-C(18)	115.34(16)

5. NMR Spectra

5.1 NMR Spectra of Cyclisation Precursors (1)

Compound 1a

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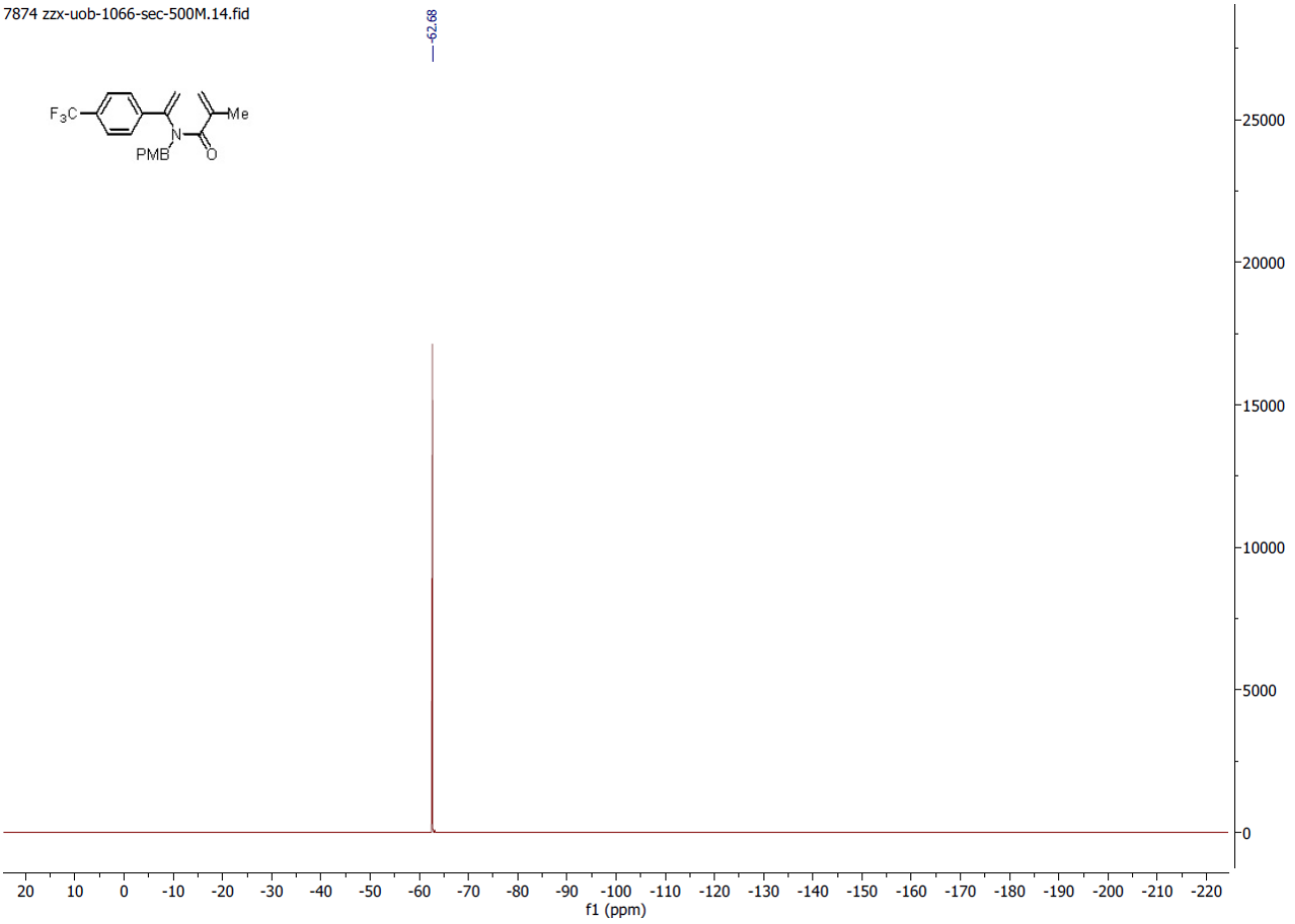
146.46
141.16
140.63
131.20
130.94
130.68
130.46
130.42
129.42
127.27
126.81
125.90
125.87
125.84
125.81
125.11
122.94
120.78
118.25
113.95
113.91
77.16 CDCl3
55.32
50.47
20.14
F3C
Me
N
PMB
O
f1 (ppm)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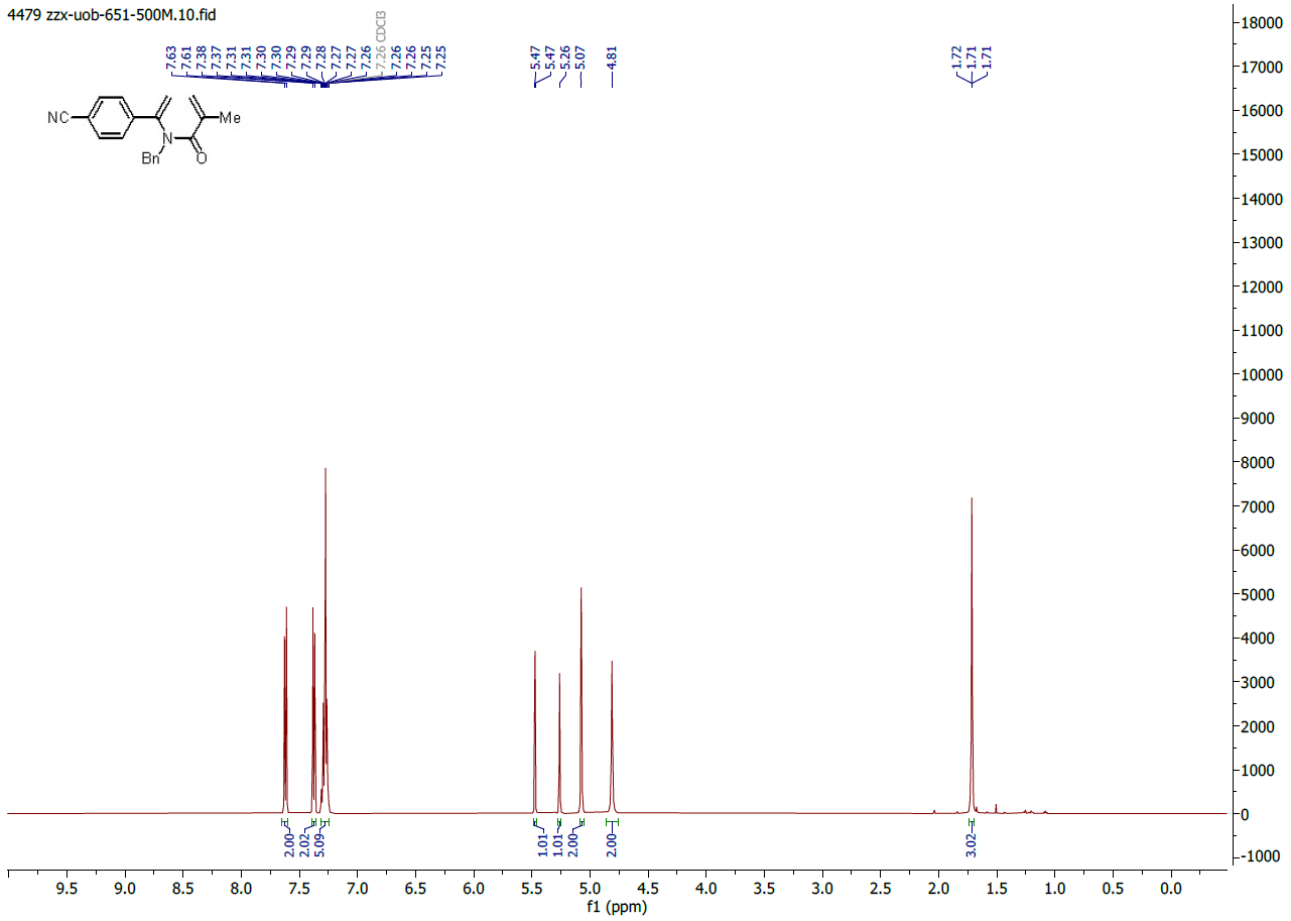
F3C
Me
N
PMB
O
f1 (ppm)

Compound 1d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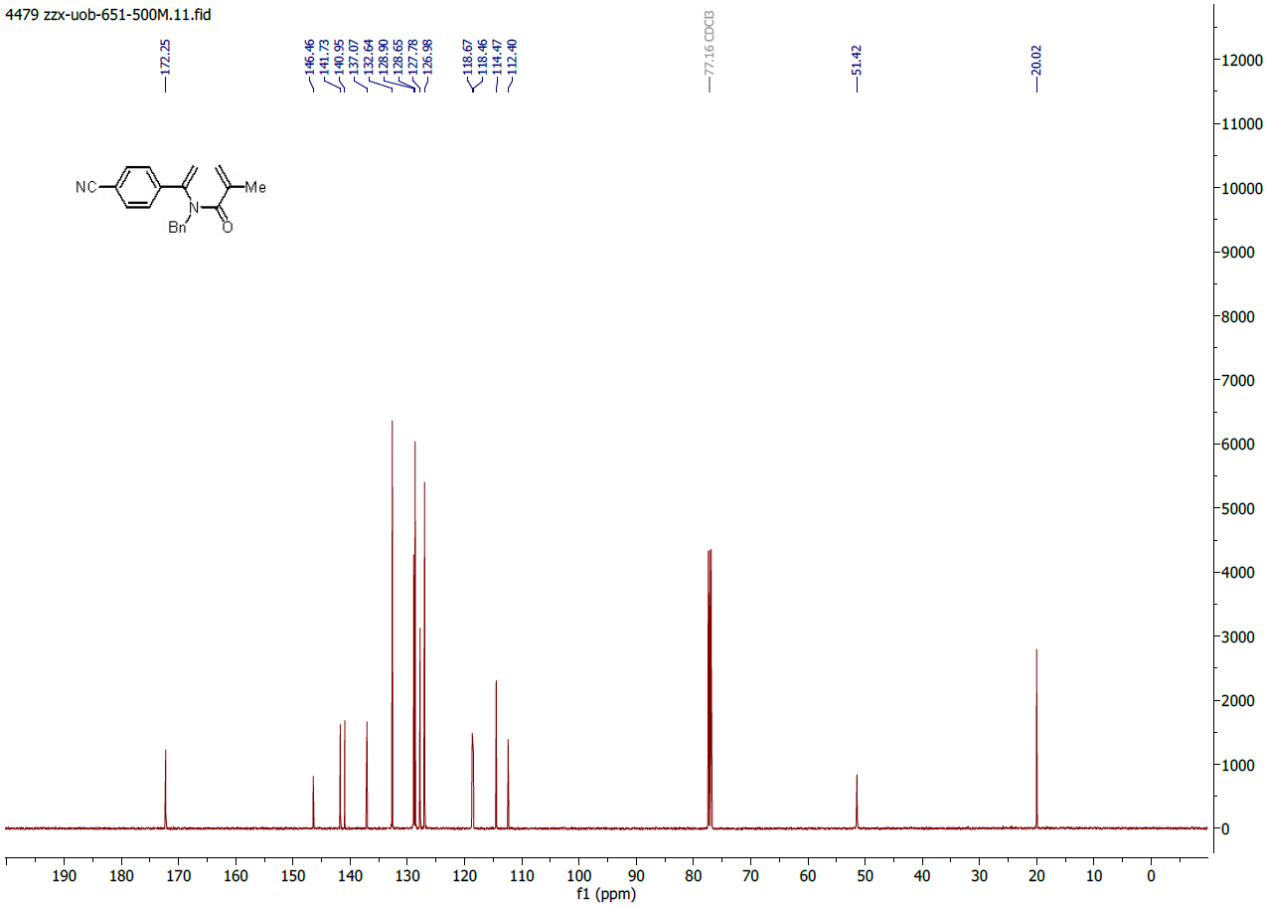
NC
Me
N
Bn
O
f1 (ppm)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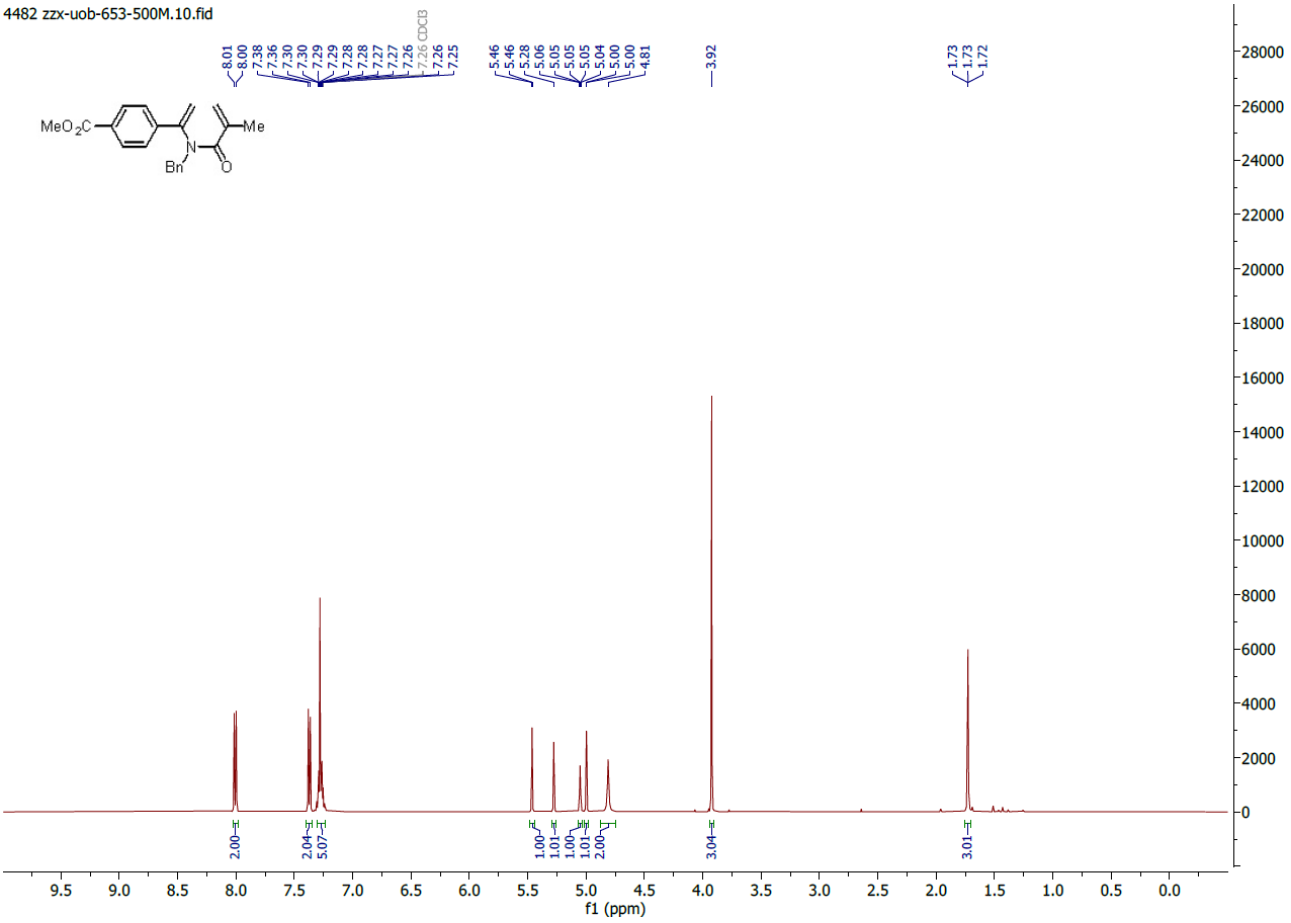
Me
N
Bn
O
f1 (ppm)

Compound 1e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8.00
7.38
7.36
7.30
7.30
7.29
7.29
7.28
7.28
7.27
7.27
7.26
7.26 CDCl3
7.26
7.25
5.46
5.46
5.28
5.06
5.05
5.05
5.05
5.04
5.00
5.00
4.81
3.92
1.73
1.73
1.72
MeO2C
Me
N
Bn
O
2.00
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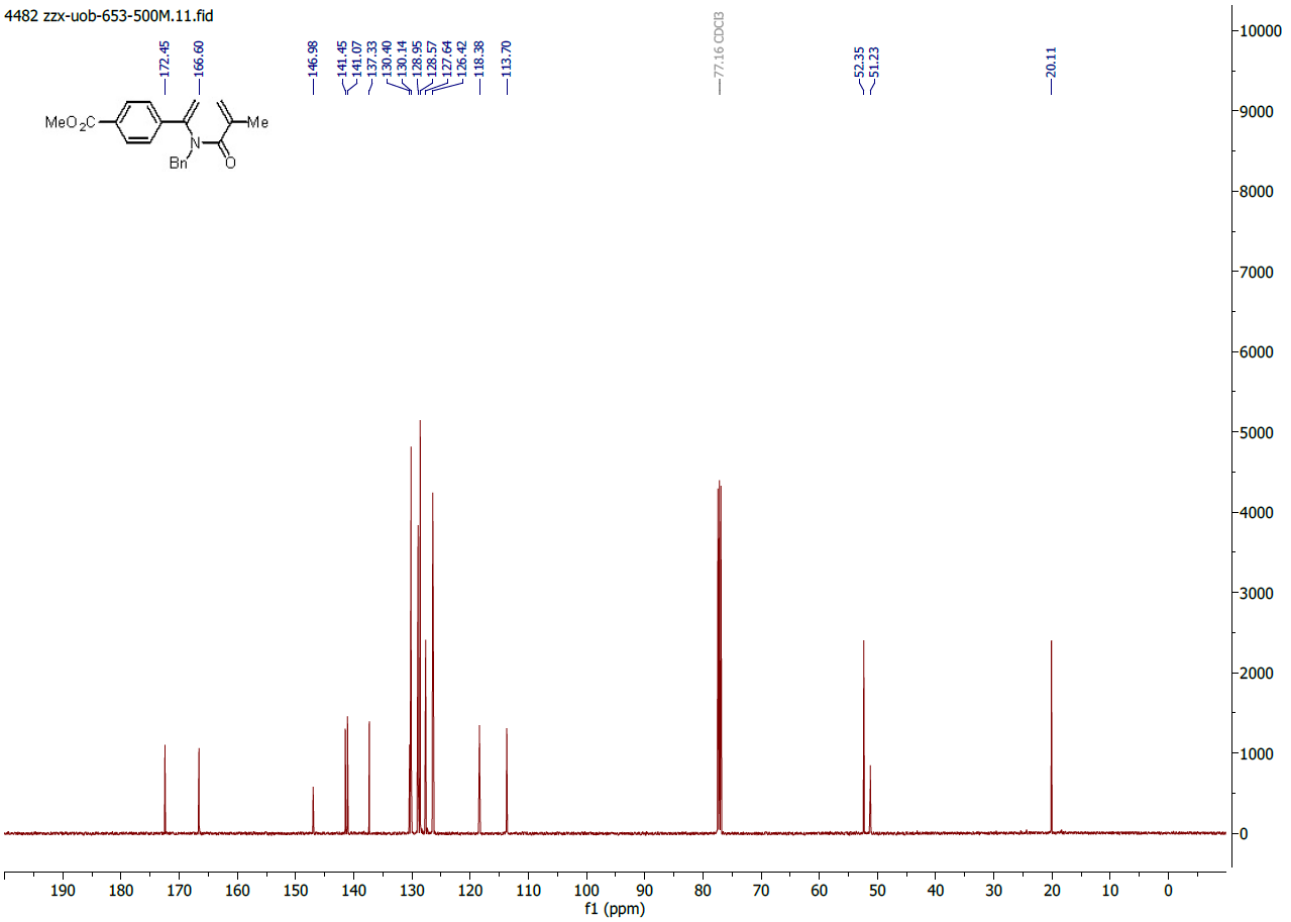
5.07
1.00
1.01
1.00
1.01
2.00
3.04
3.01
f1 (ppm)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141.07
137.33
130.40
130.14
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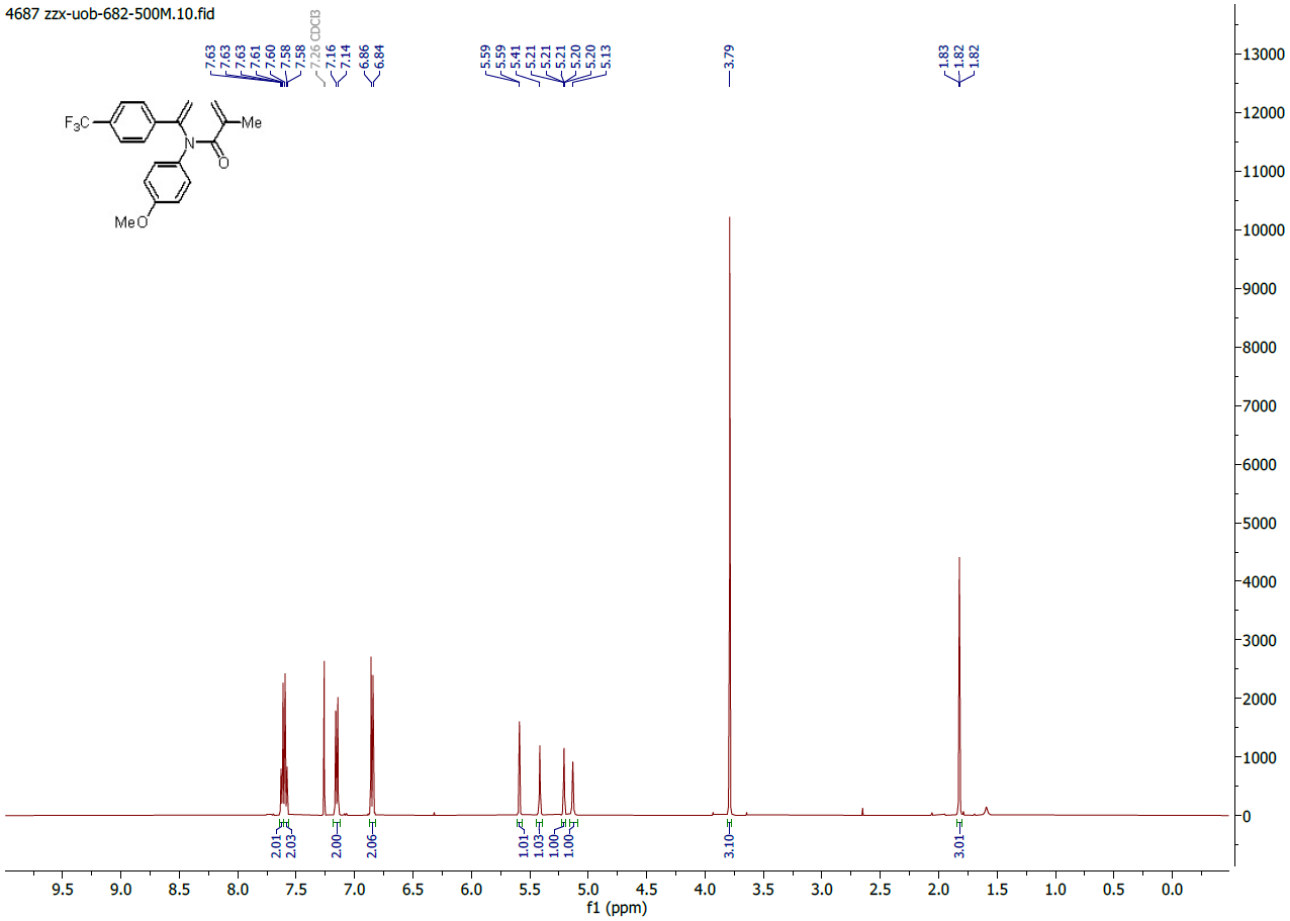
128.57
127.64
126.42
118.38
113.70
77.16 CDCl3
52.35
51.23
20.11
MeO2C
Me
N
Bn
O
f1 (ppm)

Compound 1j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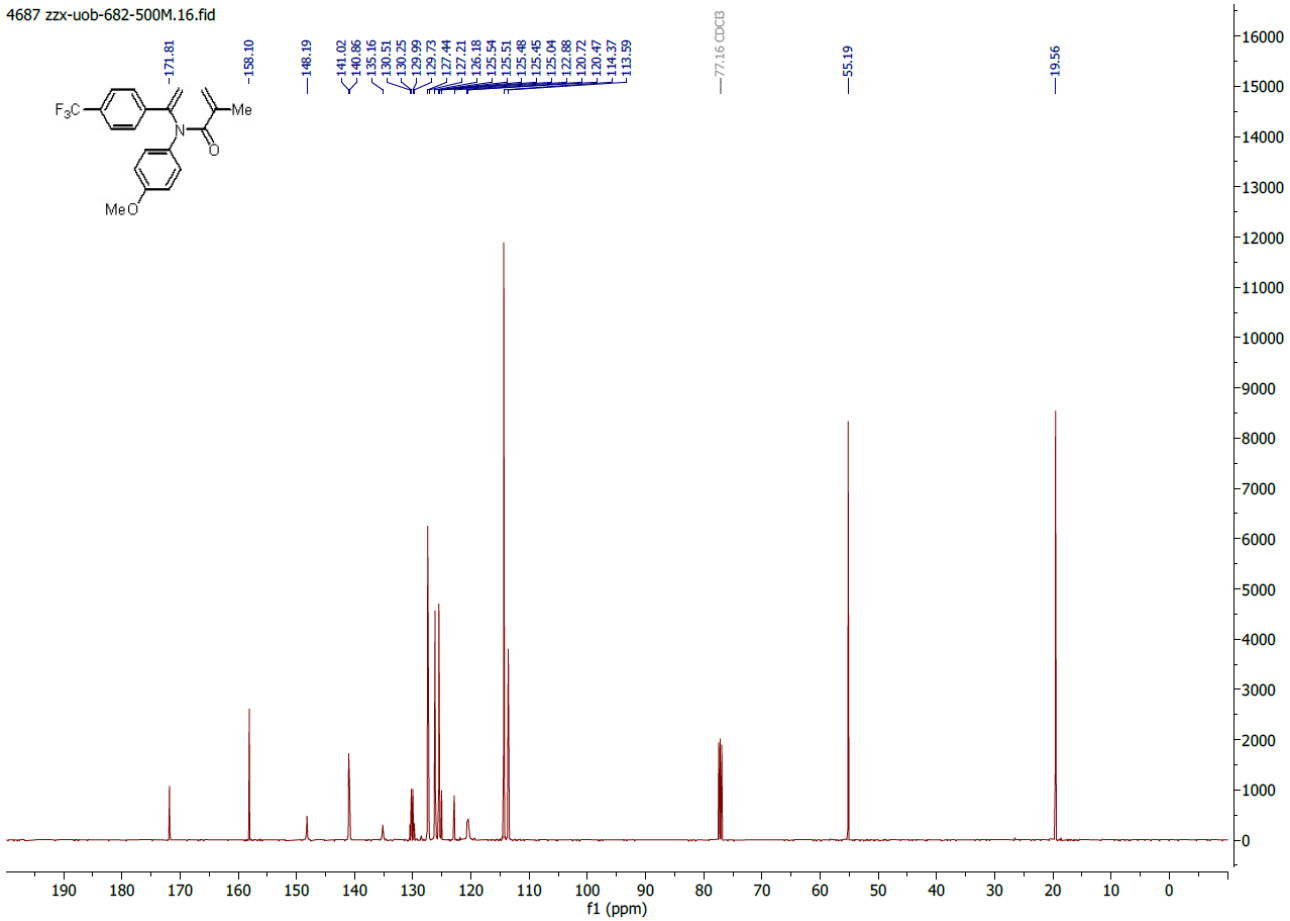
7.63
7.63
7.61
7.60
7.58
7.58
7.26 CDCl3
7.16
7.14
6.86
6.84
5.59
5.59
5.41
5.21
5.21
5.21
5.20
5.20
5.13
3.79
1.83
1.82
1.82
F3C
Me
N
O
MeO
2.01
2.03
2.00
2.06
1.01
1.03
1.00
1.00
3.10
3.01
f1 (ppm)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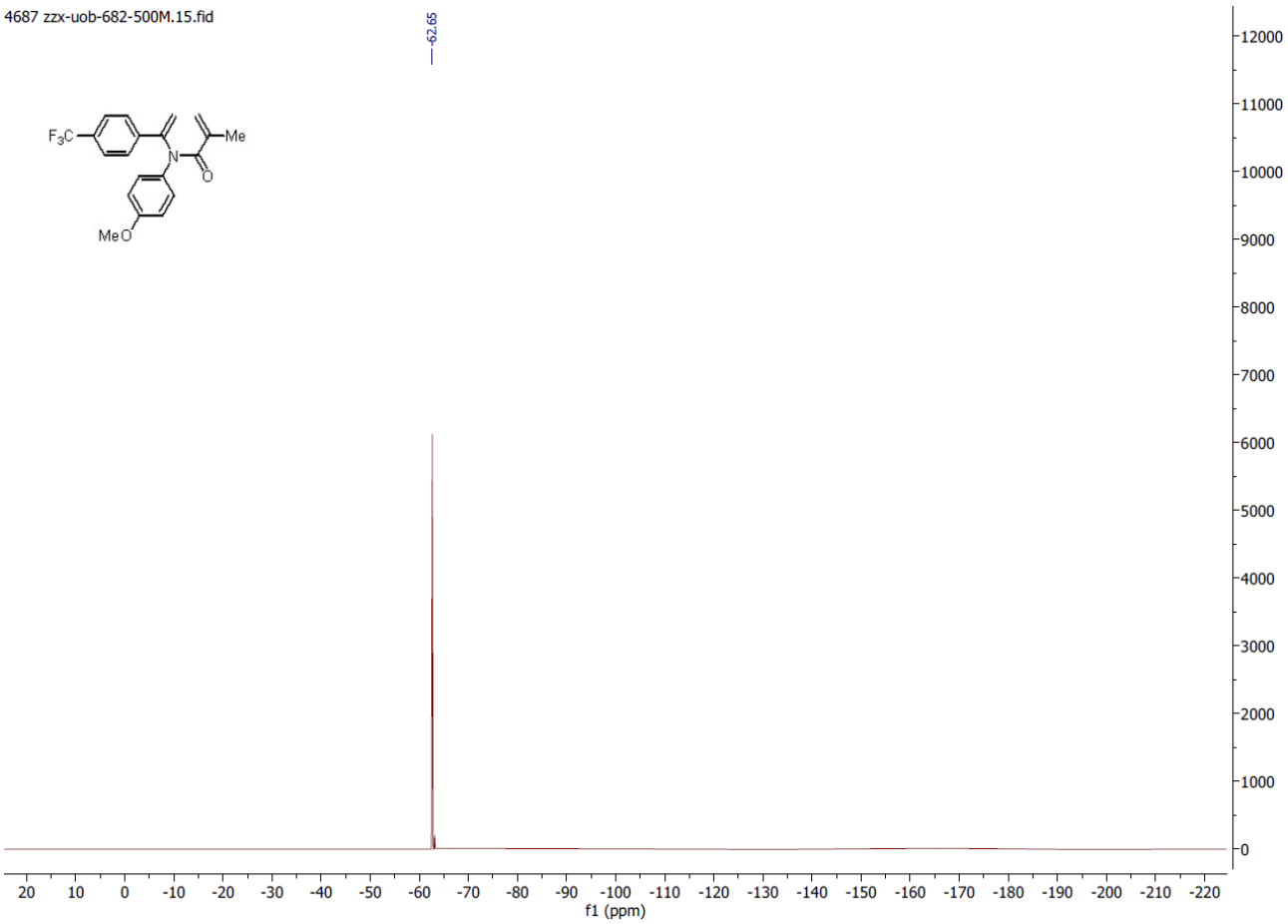
158.10
148.19
141.02
140.86
135.16
130.51
130.25
129.99
129.73
127.44
127.21
126.18
125.54
125.51
125.48
125.45
125.04
122.88
120.72
120.47
114.37
113.59
77.16 CDCl3
55.19
19.56
F3C
Me
N
O
MeO
f1 (ppm)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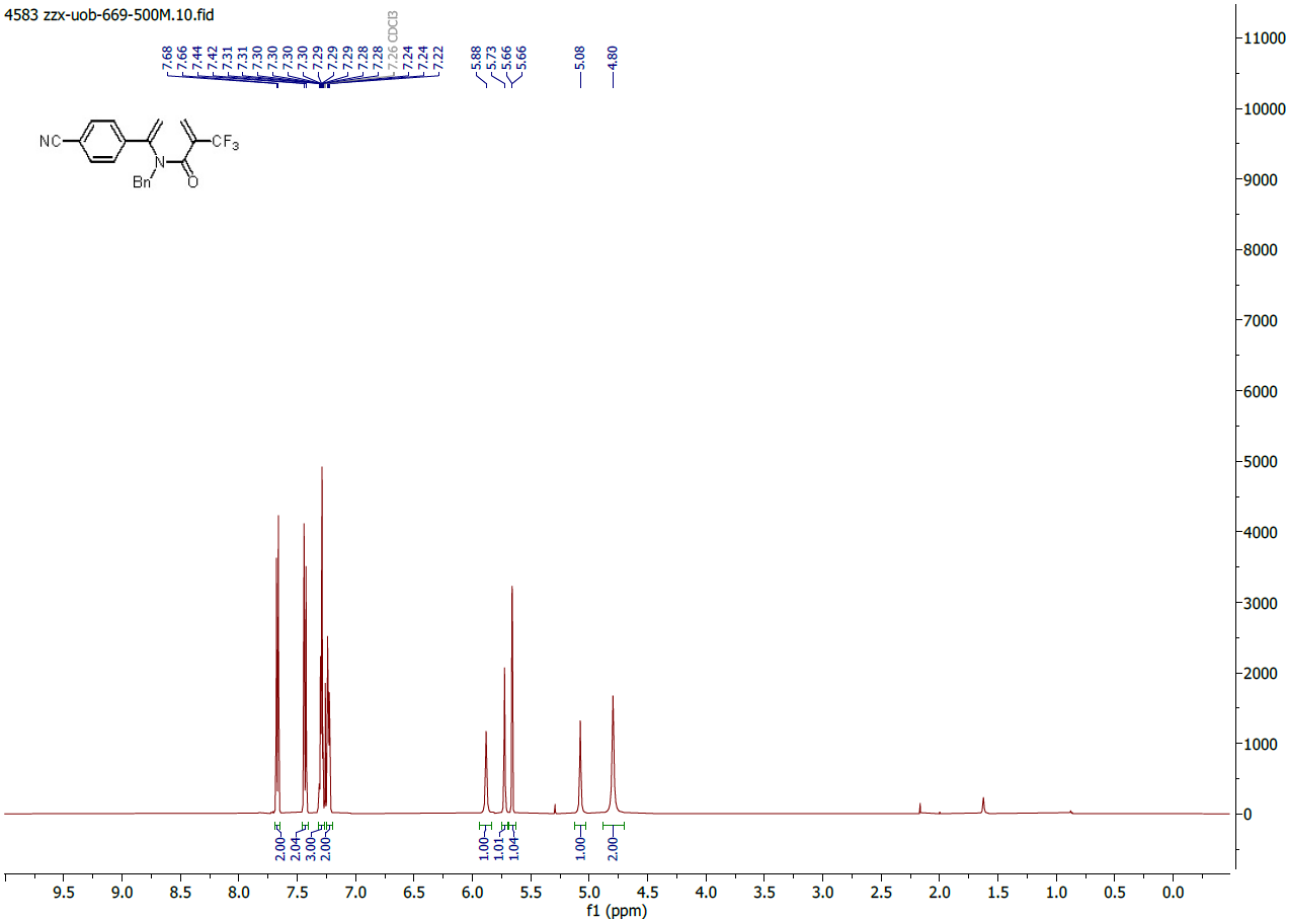
-62.65
F3C
N
O
Me
MeO
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

Compound 1k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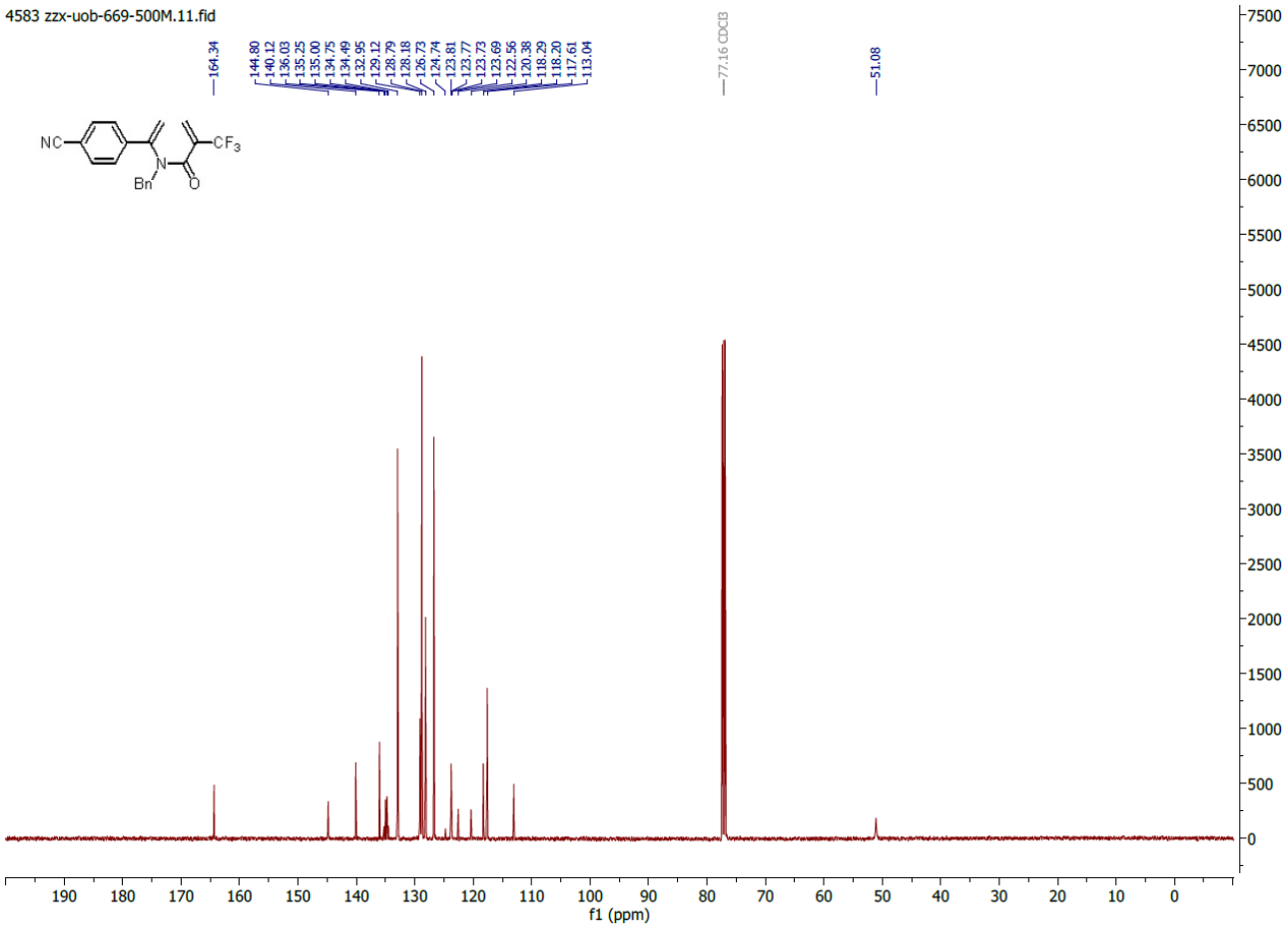
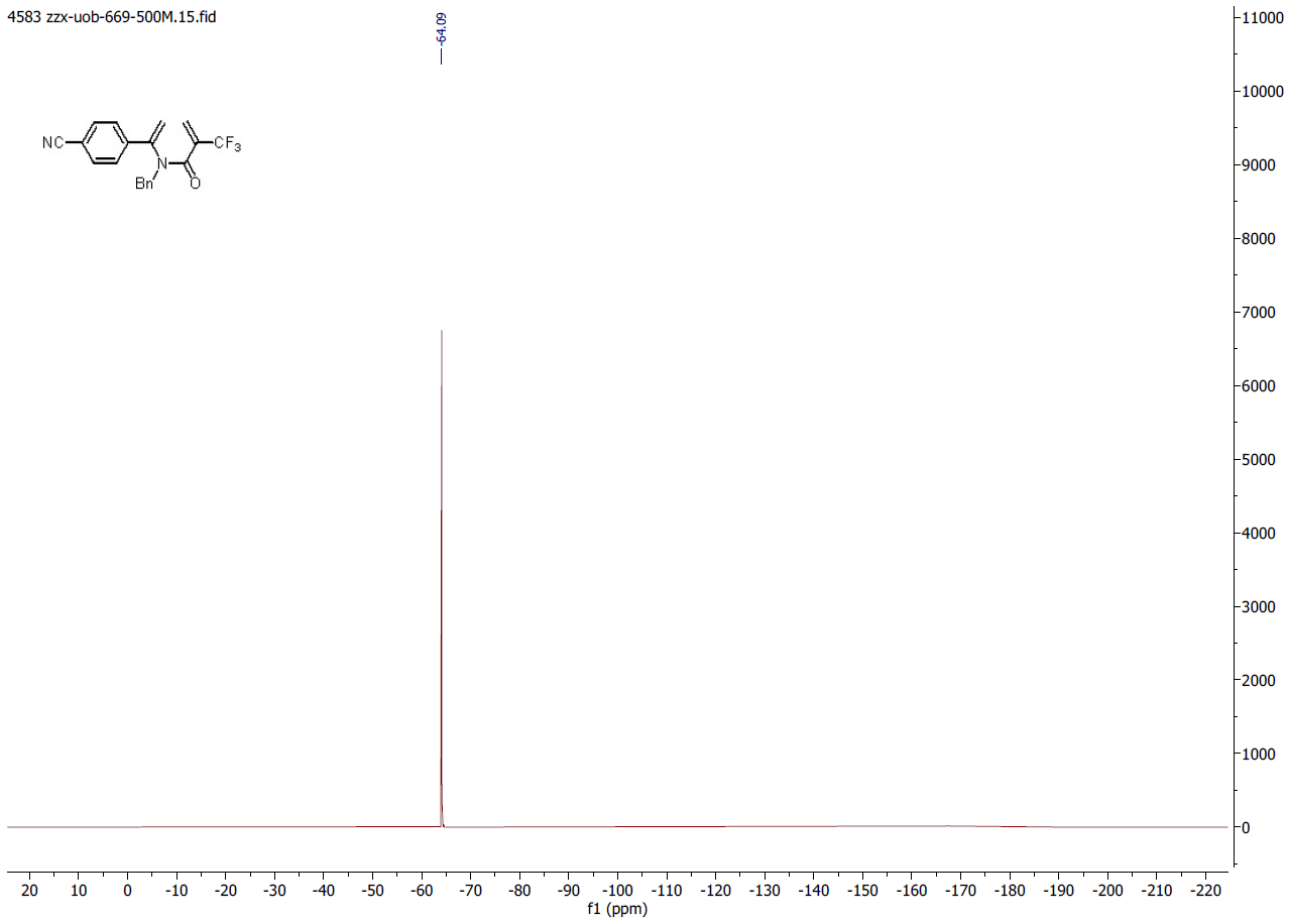
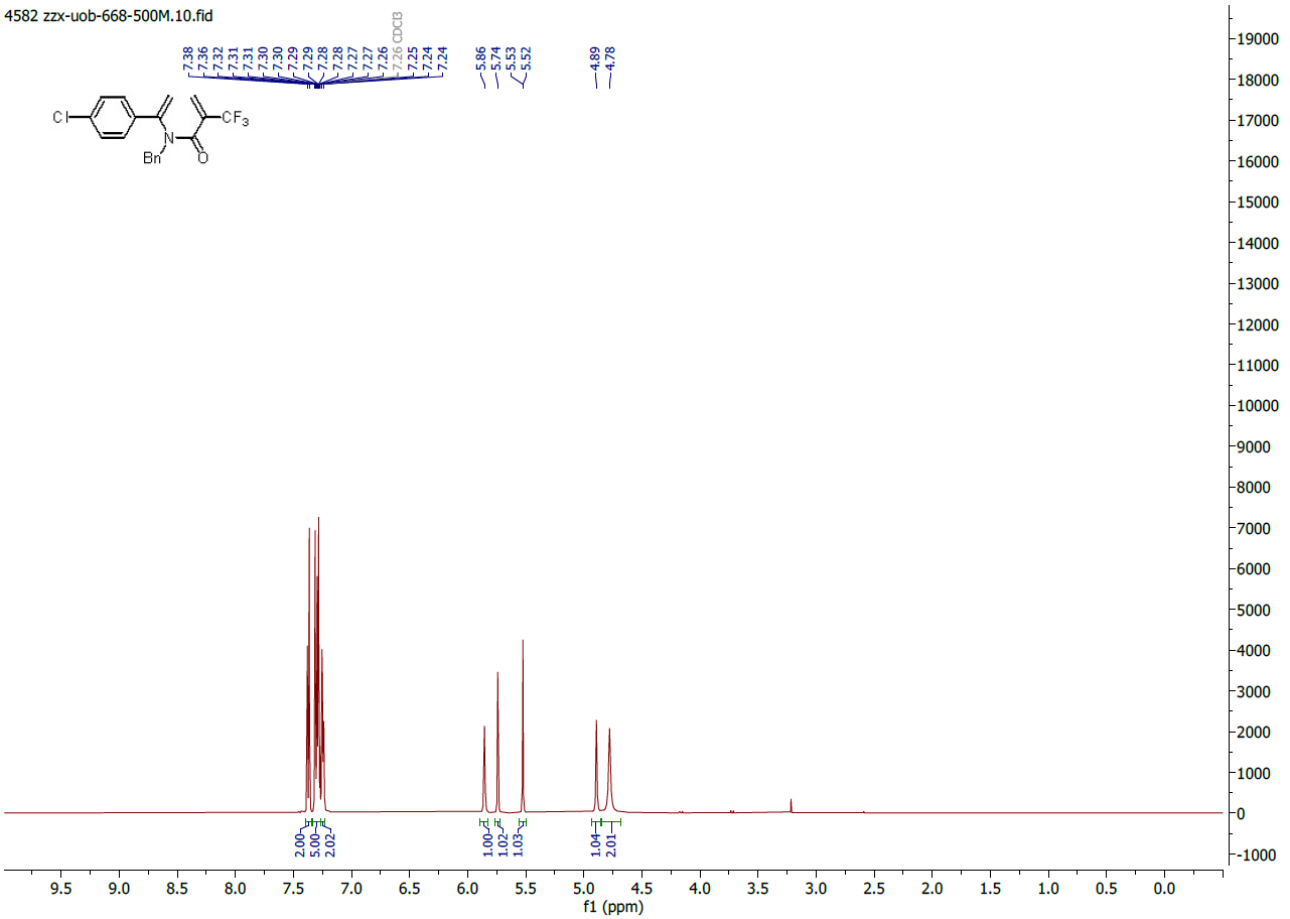
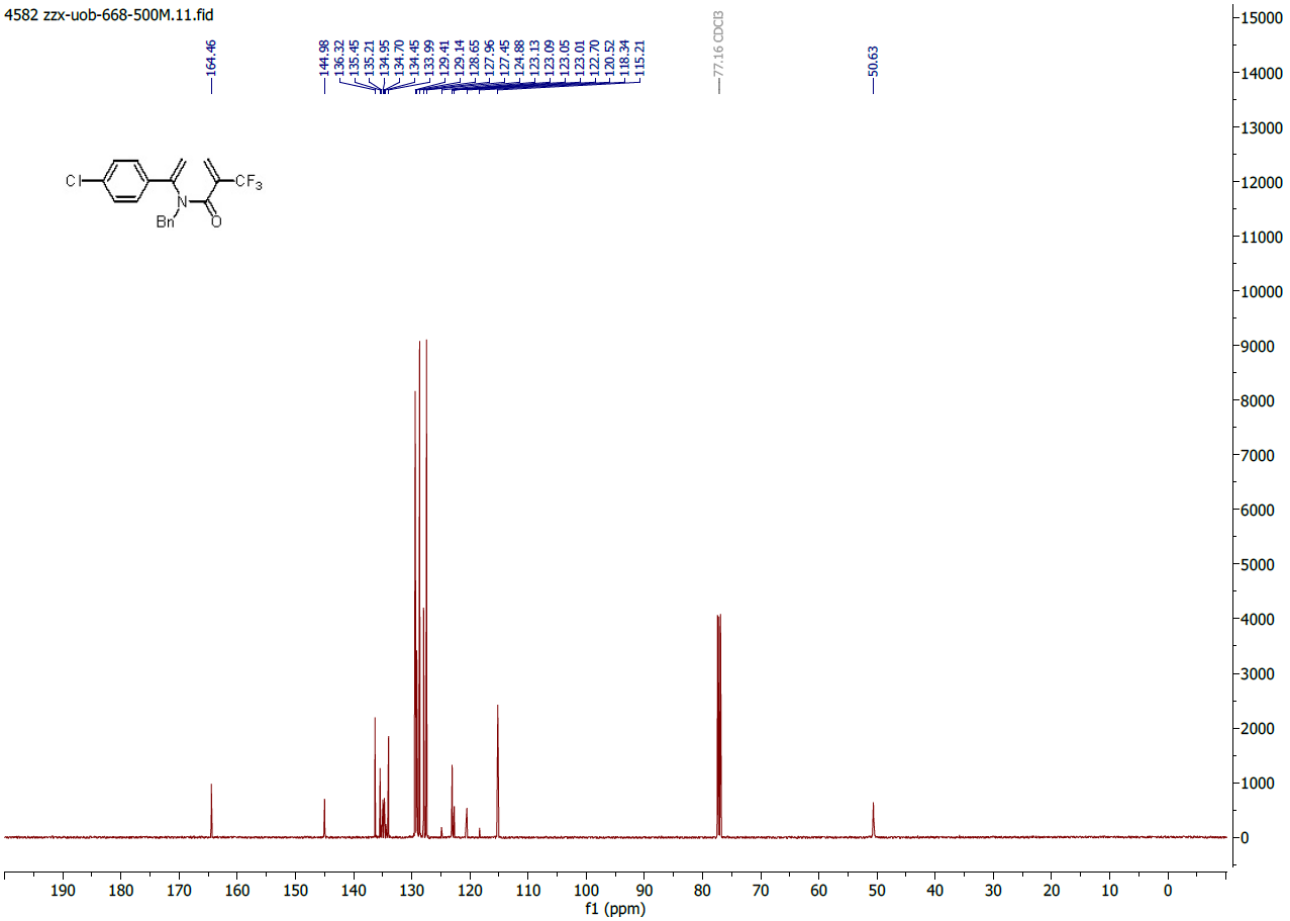
7.44
7.42
7.31
7.31
7.30
7.30
7.30
7.30
7.29
7.29
7.29
7.28
7.28
7.26 CDCl3
7.24
7.24
7.22
5.88
5.73
5.66
5.66
5.08
4.80
NC
CF3
N
Bn
O
2.00
2.04
3.00
2.00
1.00
1.01
1.04
1.00
2.00
f1 (ppm)

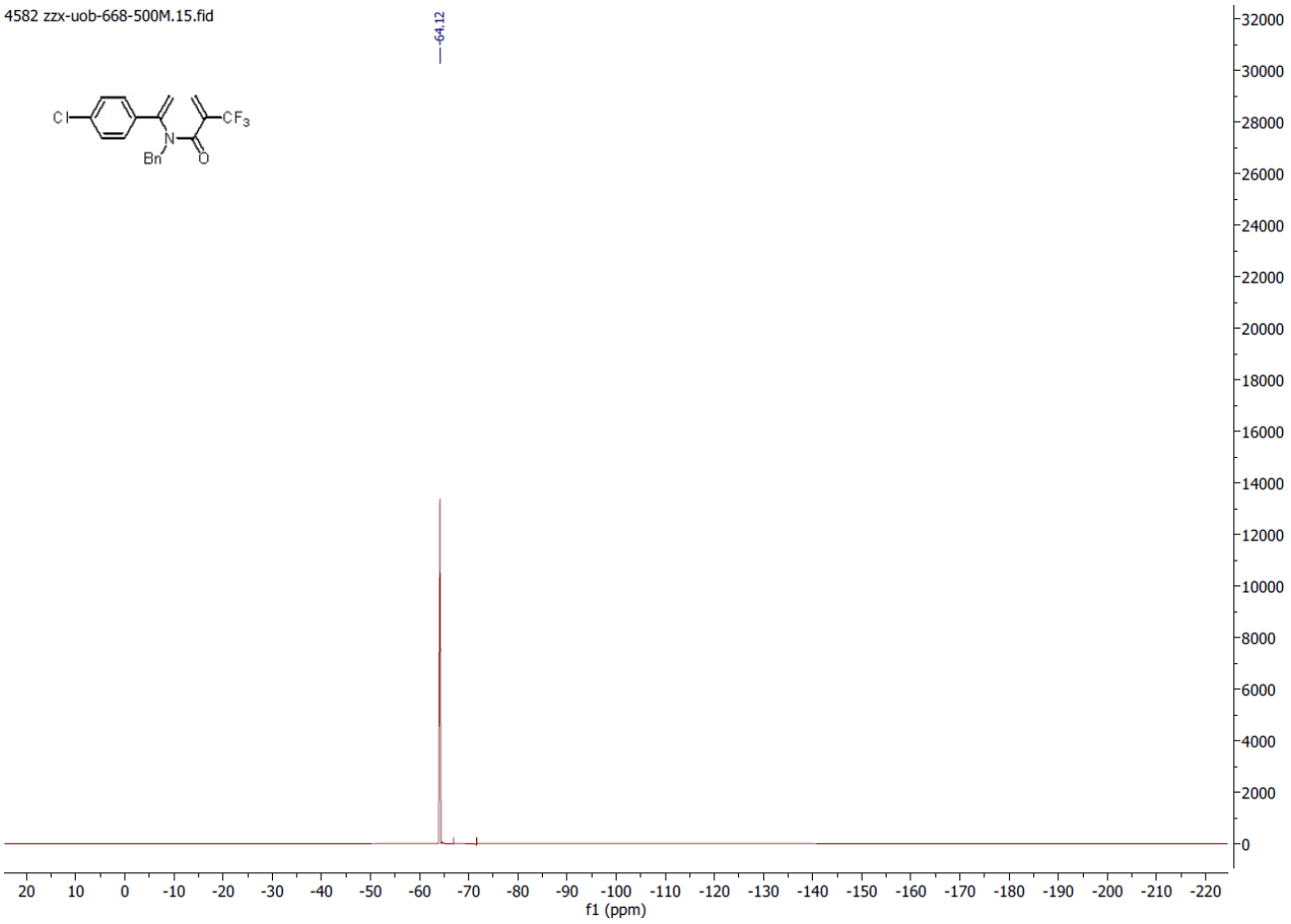

4583 zzx-uob-669-500M.11.fid
164.34
144.80
140.12
136.03
135.25
135.00
134.75
134.49
132.95
129.12
128.79
128.18
126.73
124.74
123.81
123.77
123.73
123.69
122.56
120.38
118.29
118.20
117.61
113.04
77.16 CDCl3
51.08
NC
CF3
N
Bn
O
f1 (ppm)


4583 zzx-uob-669-500M.15.fid
-64.09
NC
CF3
N
Bn
O
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

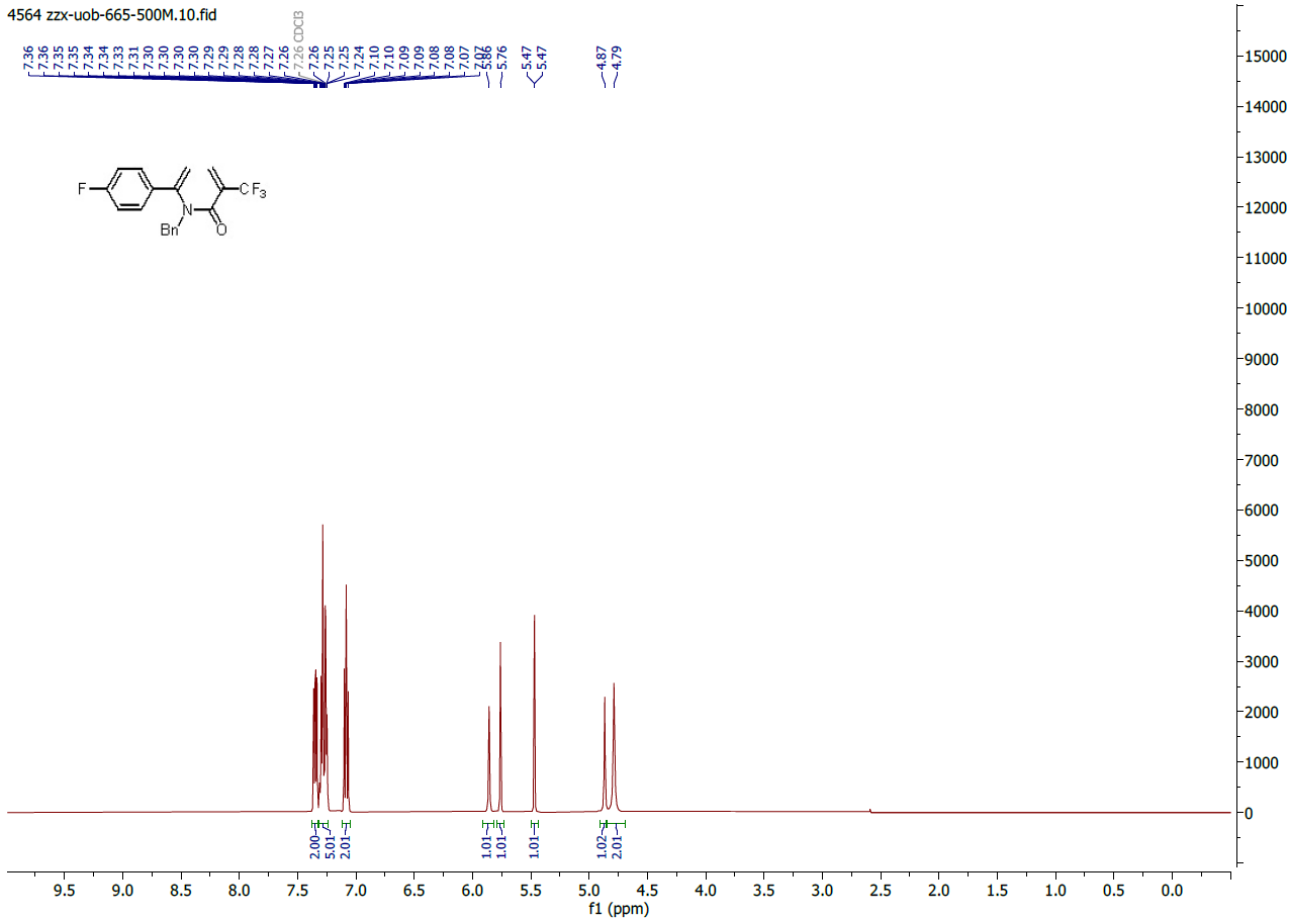
Compound 1l

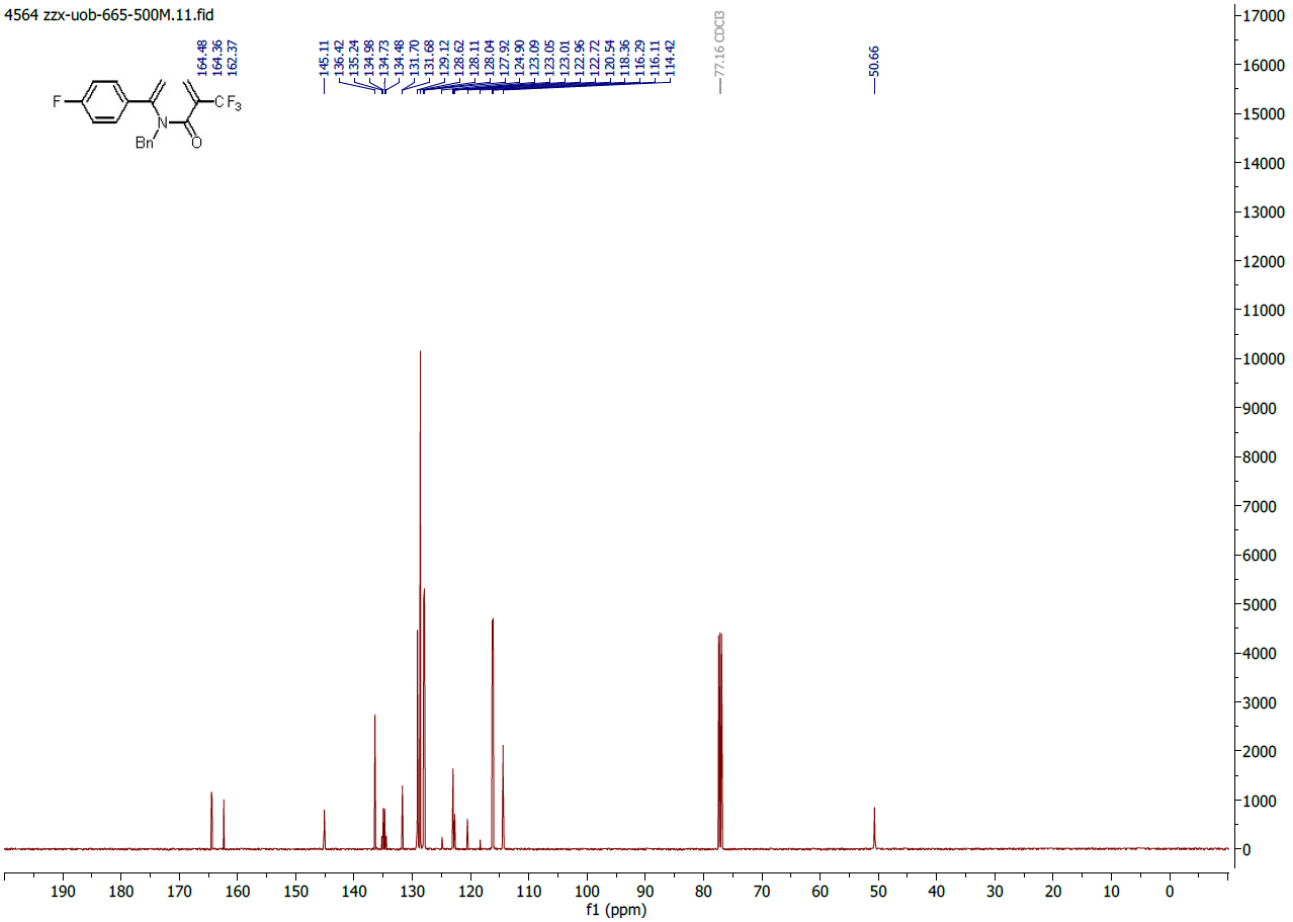

4582 zzx-uob-668-500M.10.fid
f1 (ppm)

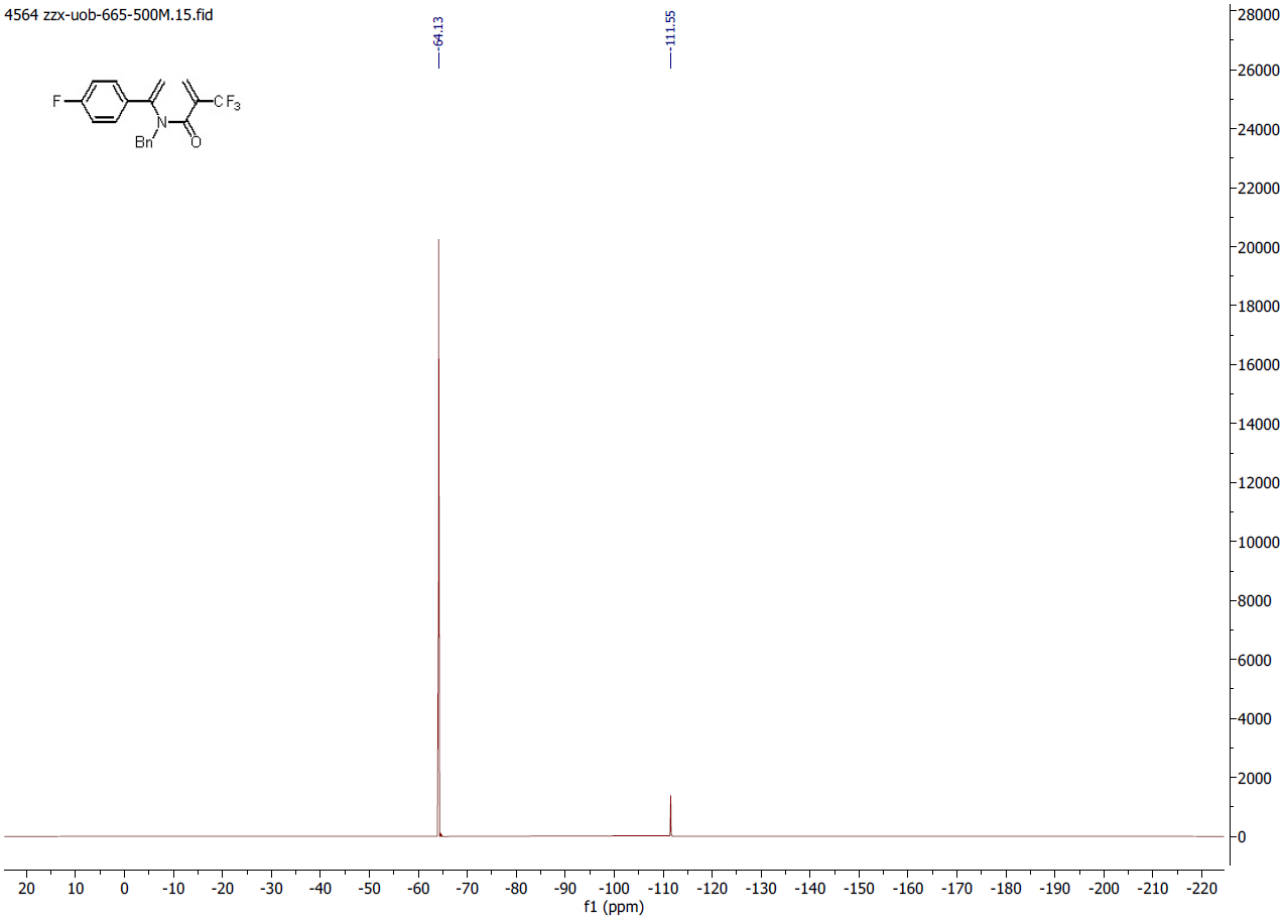

4582 zzx-uob-668-500M.11.fid
f1 (ppm)


4582 zzx-uob-668-500M.15.fid
-64.12
Cl
N
Bn
O
CF3
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

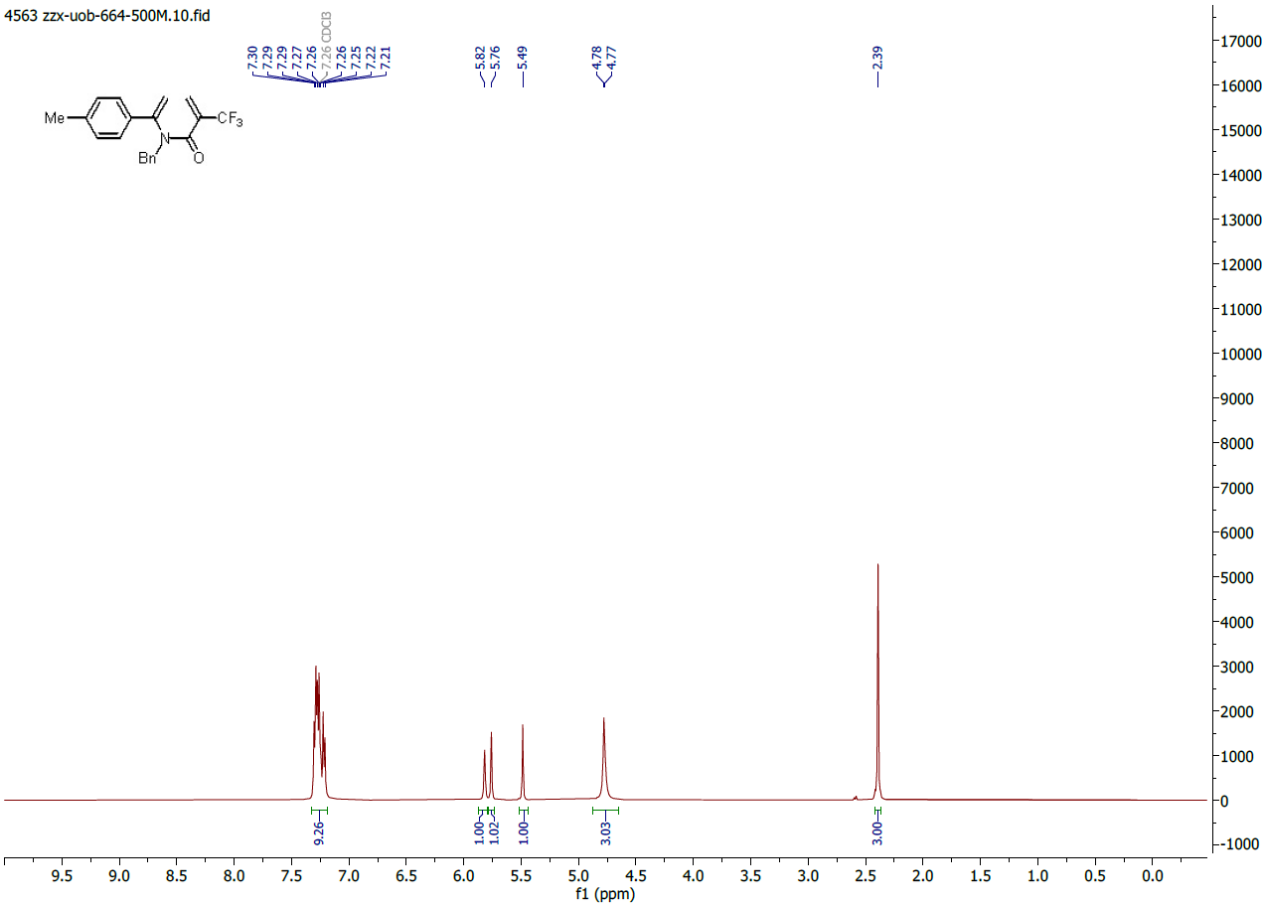
Compound 1m

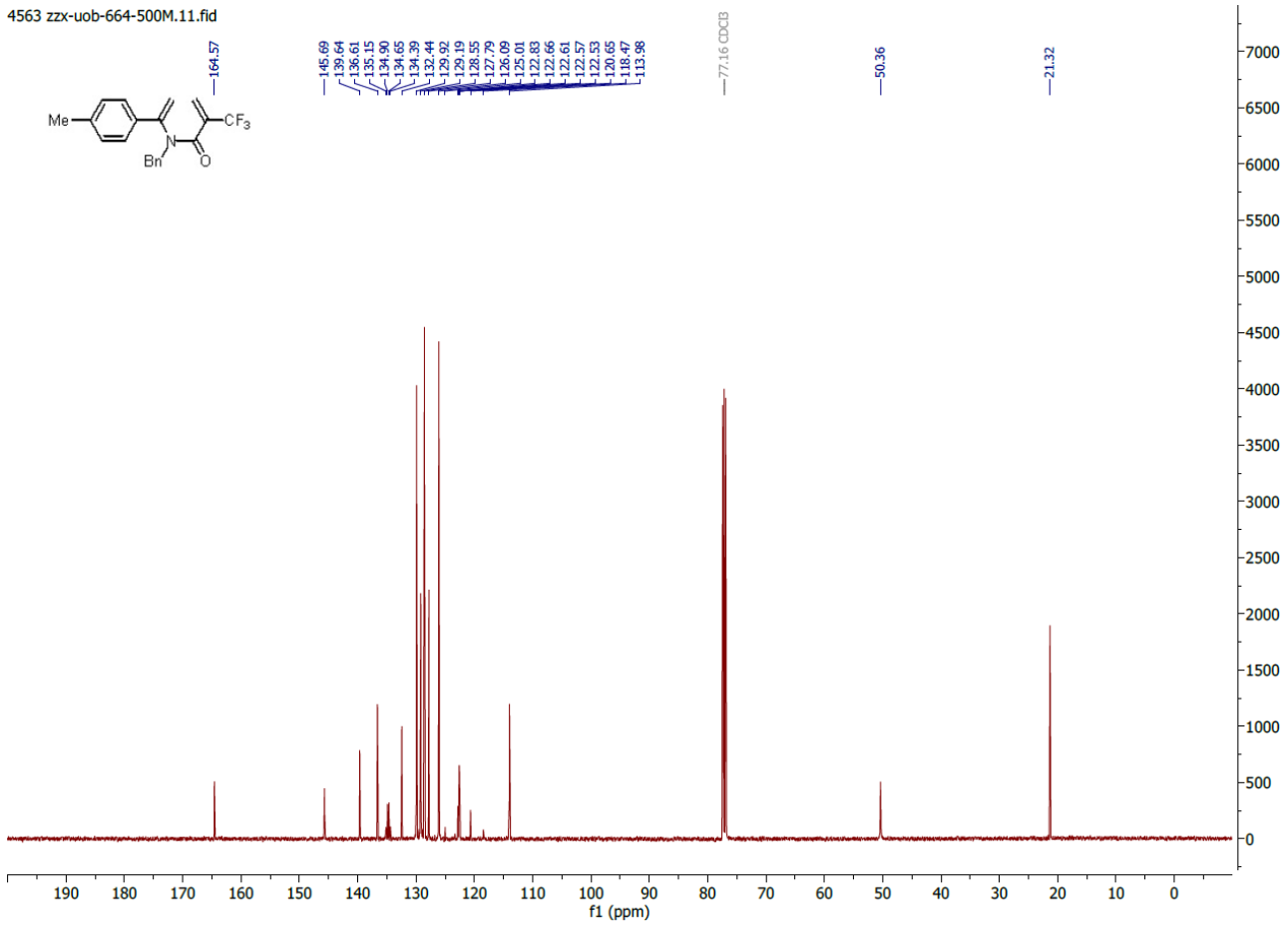

4564 zzx-uob-665-500M.10.fid
f1 (ppm)

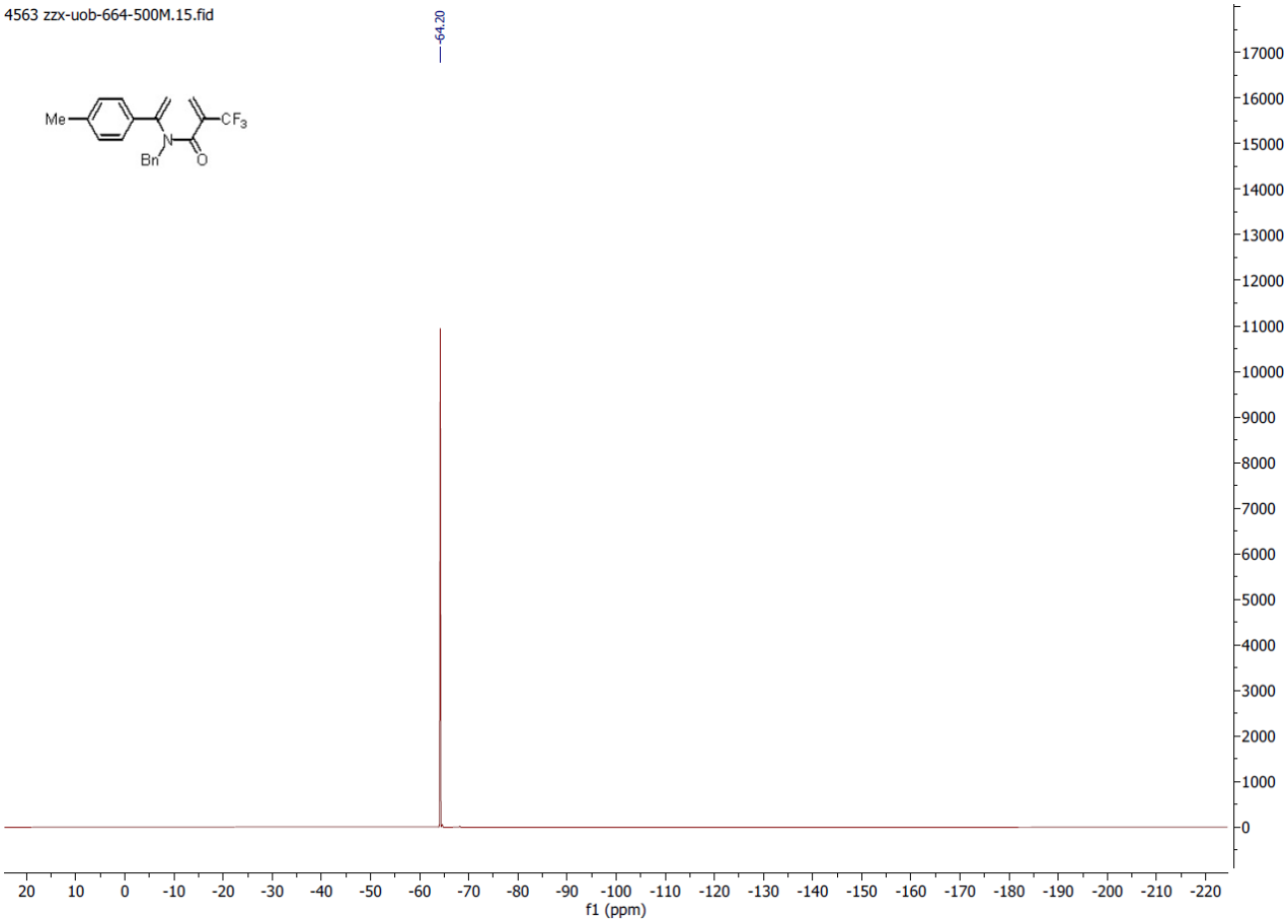

4564 zzx-uob-665-500M.11.fid
f1 (ppm)


4564 zzx-uob-665-500M.15.fid
-64.13
-111.55
F
N
Bn
O
CF3
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

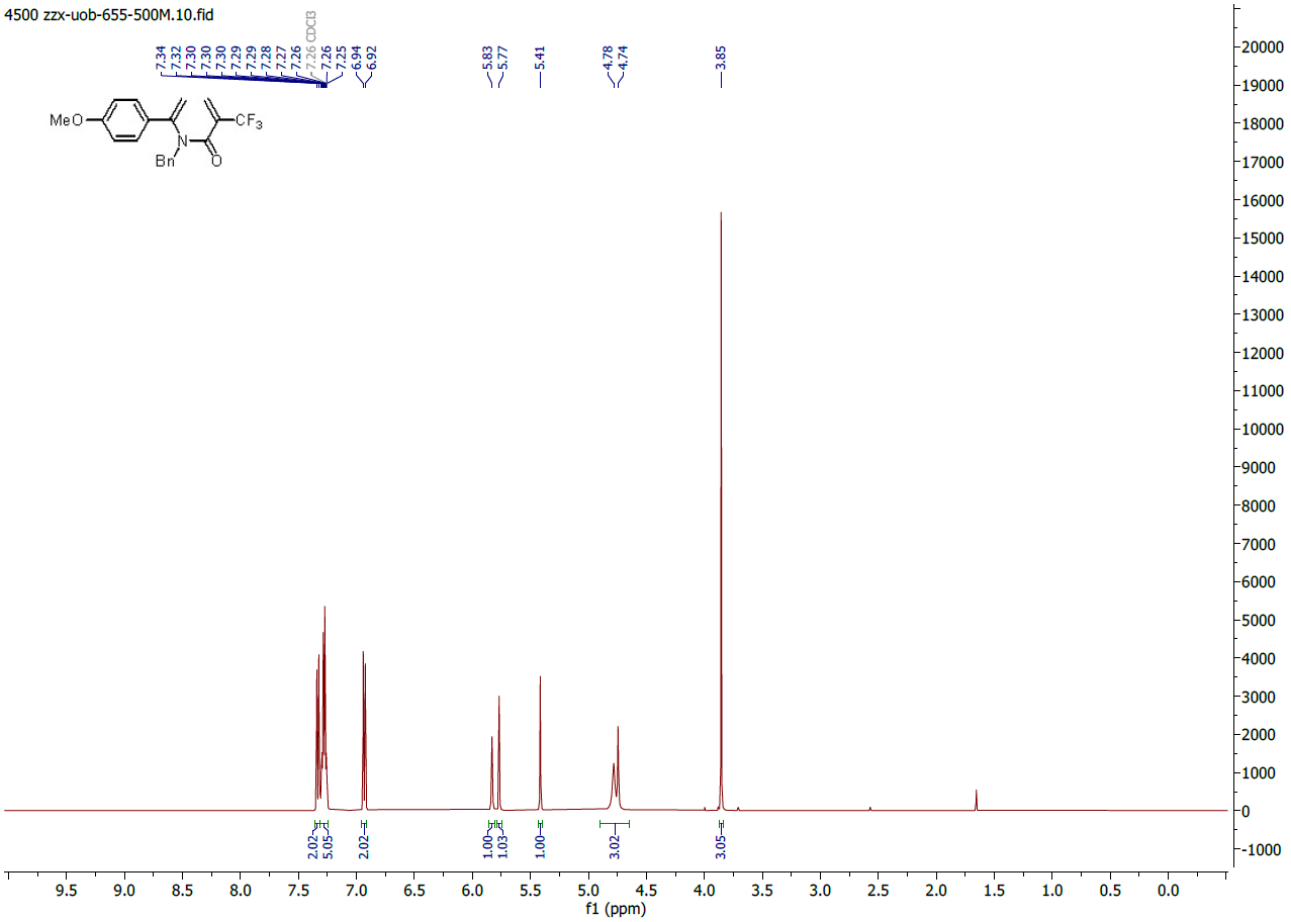
Compound 1o

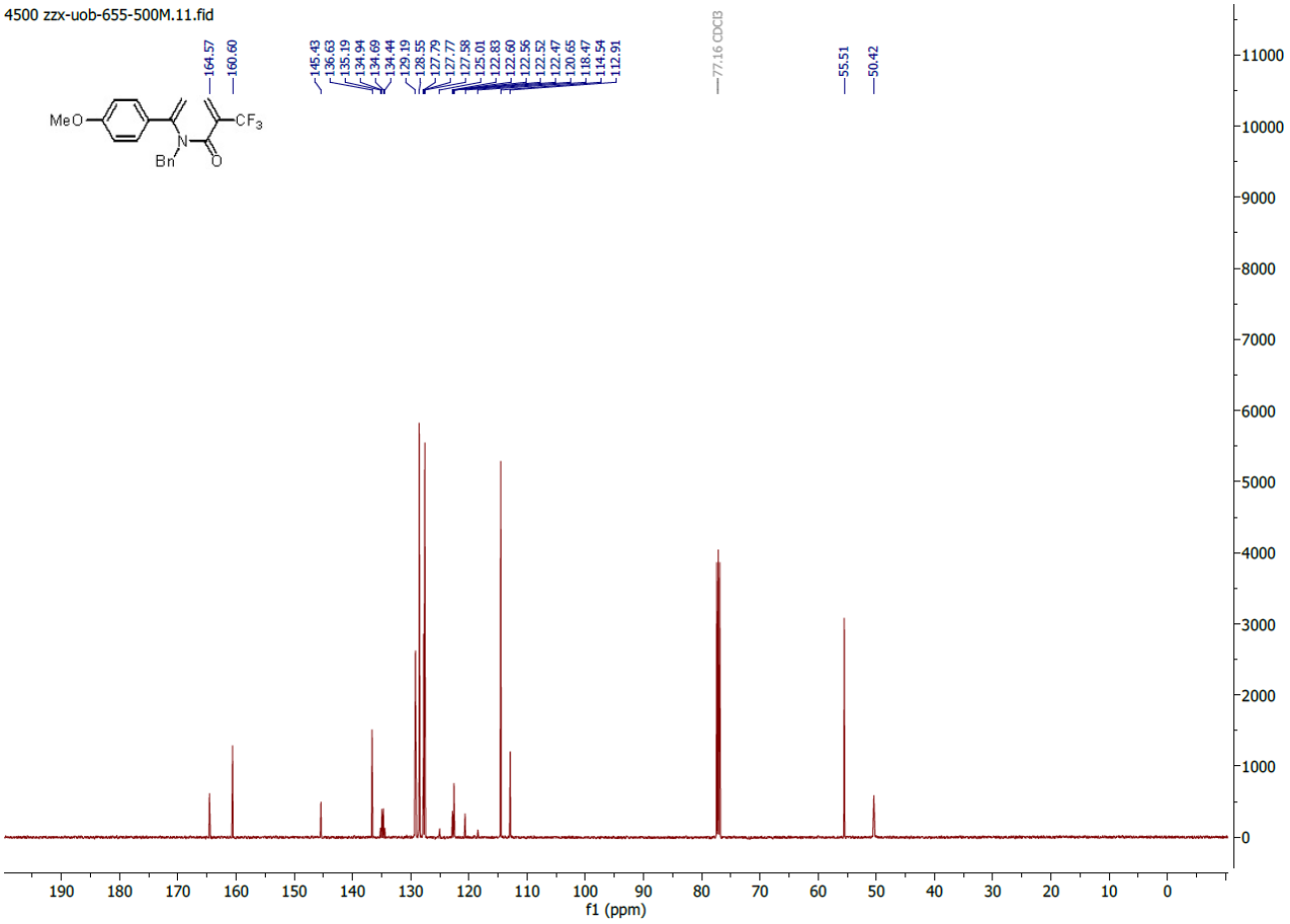

4563 zzx-uob-664-500M.10.fid
Me
CF3
Bn
N
O
7.30
7.29
7.29
7.27
7.26
7.26 CDCB
7.26
7.25
7.22
7.21
5.82
5.76
5.49
4.78
4.77
2.39
9.26
1.00
1.02
1.00
3.03
3.00
f1 (ppm)

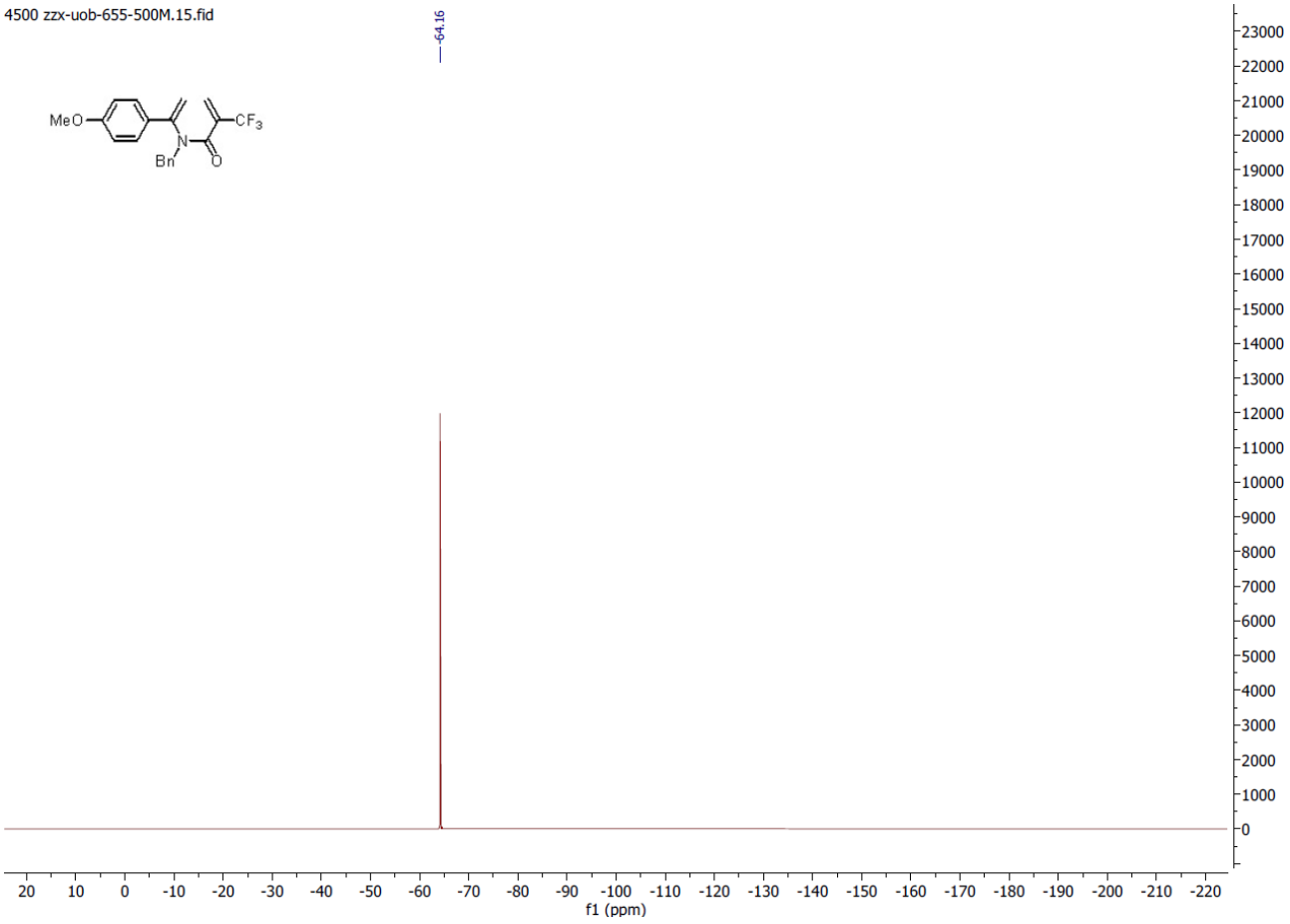

4563 zzx-uob-664-500M.11.fid
Me
CF3
Bn
N
O
164.57
145.69
139.64
136.61
135.15
134.90
134.65
134.39
132.44
129.92
129.19
128.55
127.79
126.09
125.01
122.83
122.66
122.61
122.57
122.53
120.65
118.47
113.98
77.16 CDCB
50.36
21.32
f1 (ppm)


4563 zzx-uob-664-500M.15.fid
-64.20
Me
CF3
N
Bn
O
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

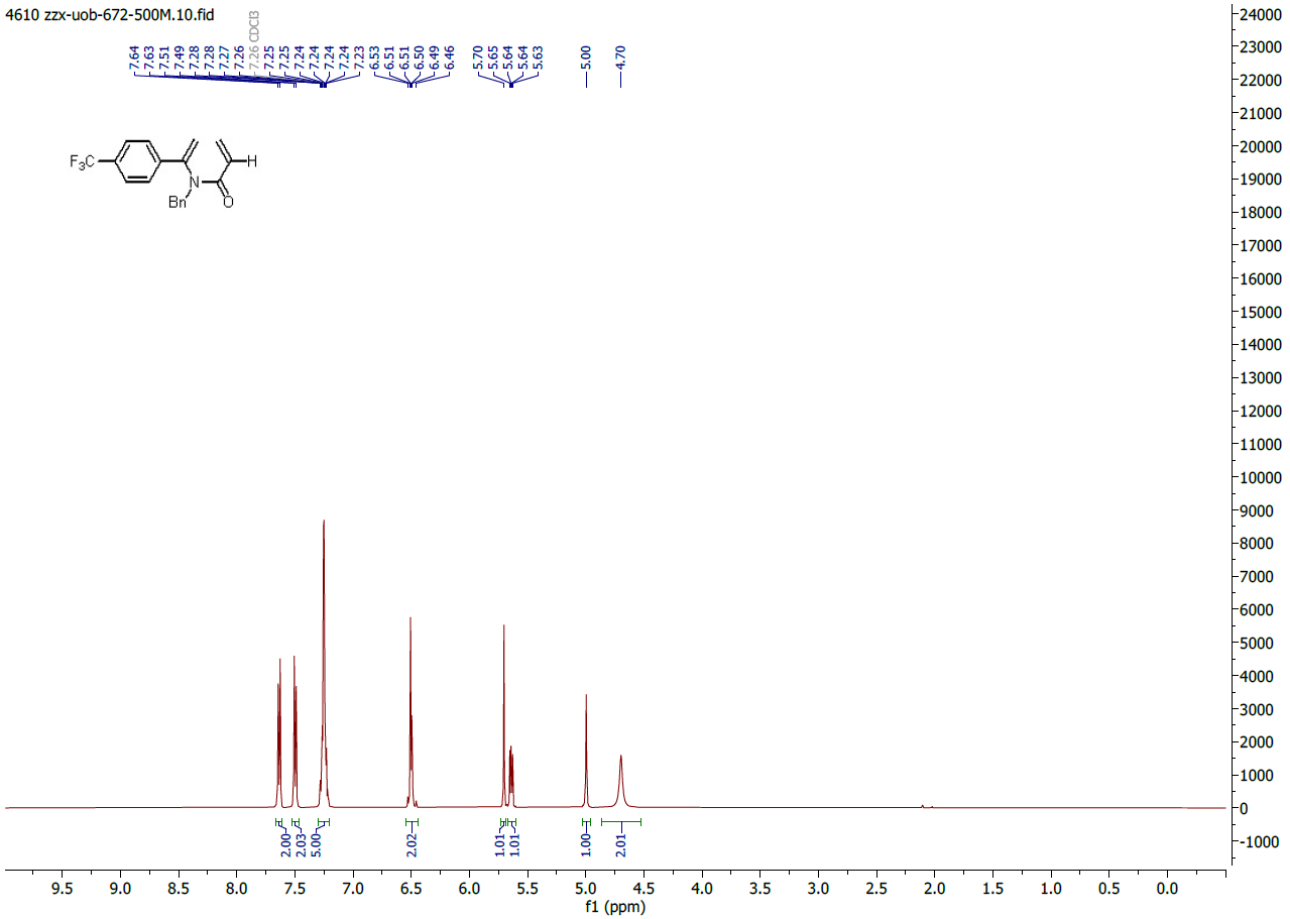
Compound 1p

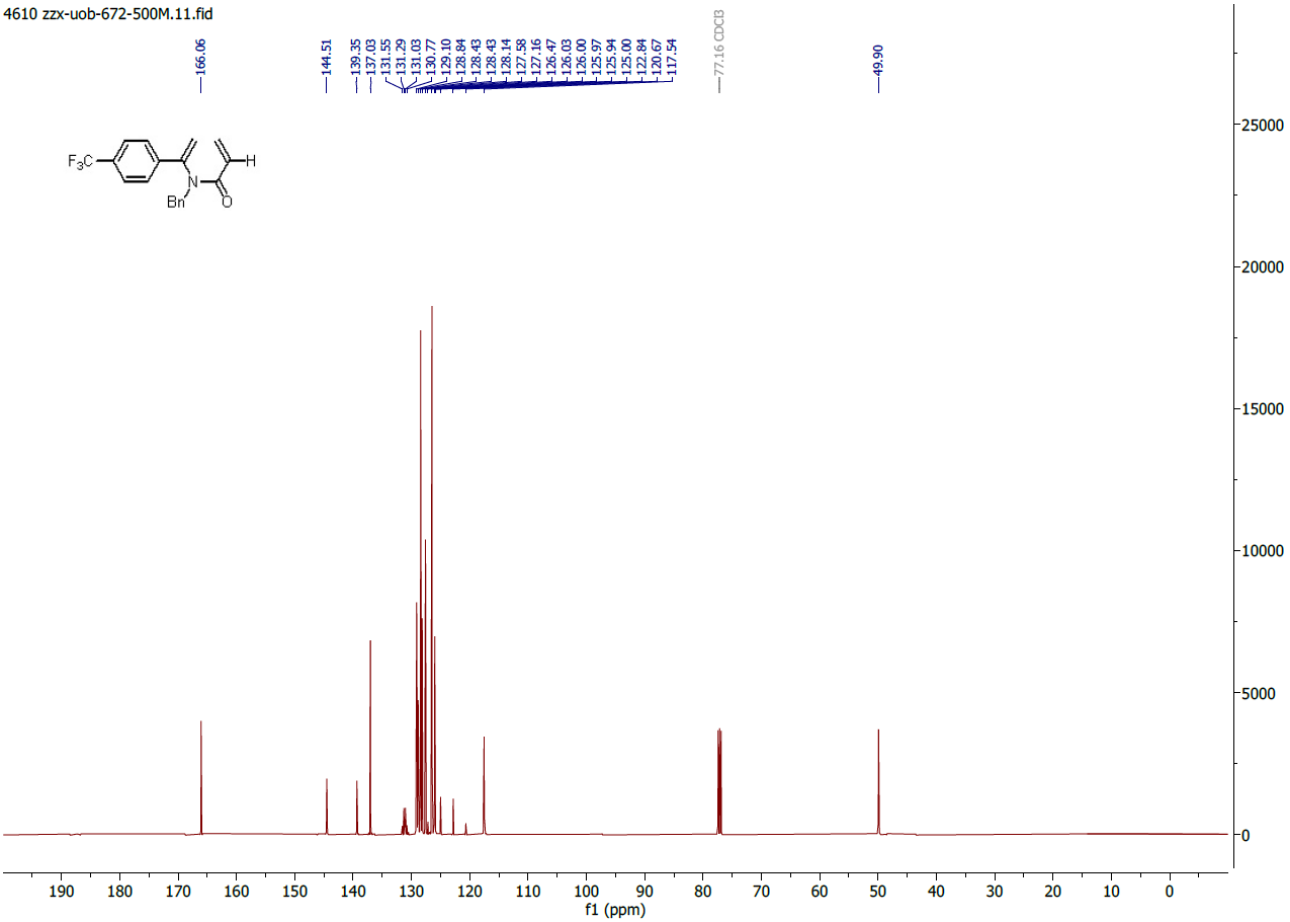

4500 zzx-uob-655-500M.10.fid
7.34
7.32
7.30
7.30
7.30
7.29
7.29
7.28
7.27
7.26
7.26 CDCl3
7.26
7.25
6.94
6.92
5.83
5.77
5.41
4.78
4.74
3.85
MeO
CF3
N
Bn
O
2.02
5.05
2.02
1.00
1.03
1.00
3.02
3.05
f1 (ppm)

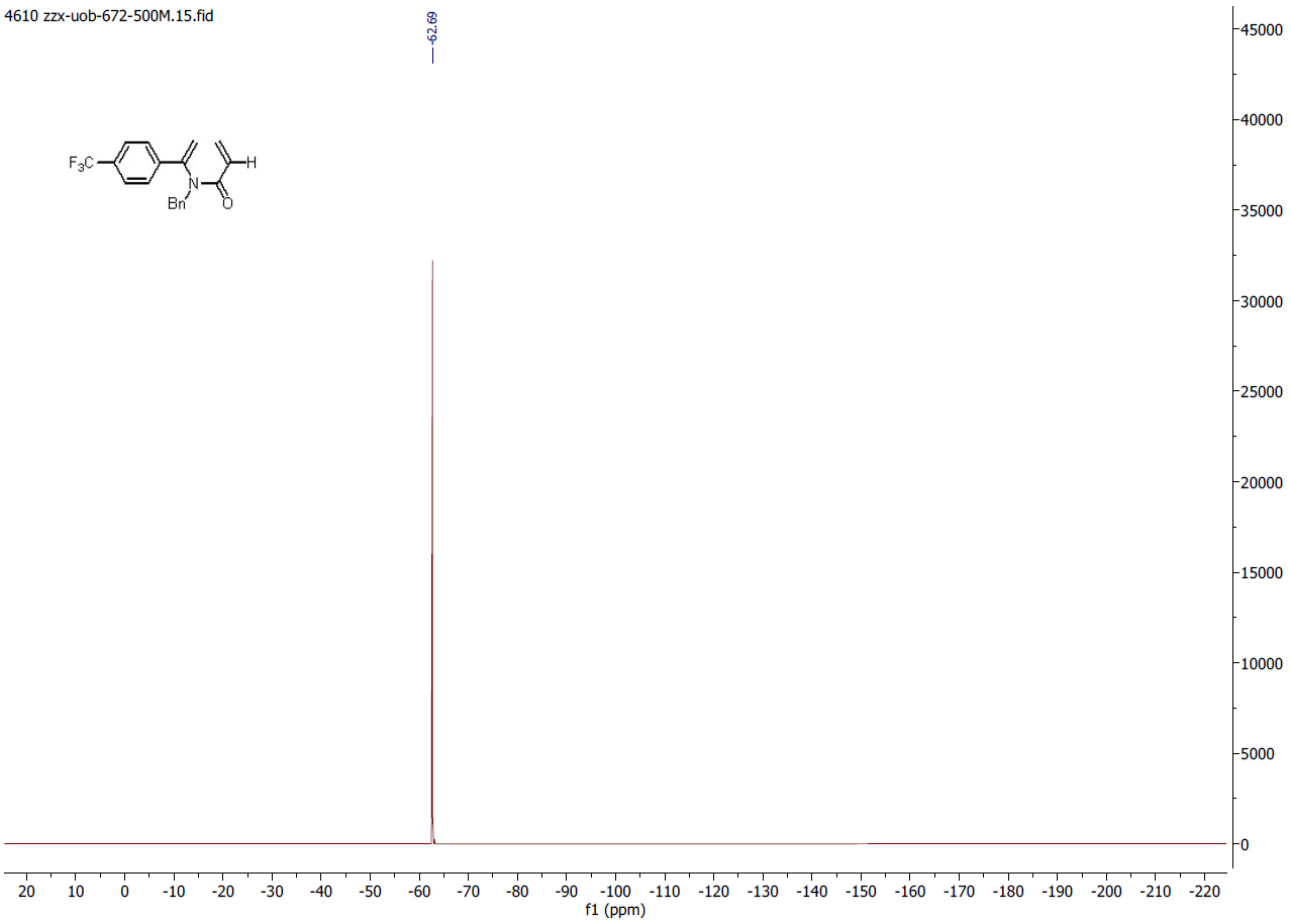

4500 zzx-uob-655-500M.11.fid
164.57
160.60
145.43
136.63
135.19
134.94
134.69
134.44
129.19
128.55
127.79
127.77
127.58
125.01
122.83
122.60
122.56
122.52
122.47
120.65
118.47
114.54
112.91
77.16 CDCl3
55.51
50.42
MeO
CF3
N
Bn
O
f1 (ppm)


4500 zzx-uob-655-500M.15.fid
-64.16
MeO
CF3
N
Bn
O
23000
22000
21000
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

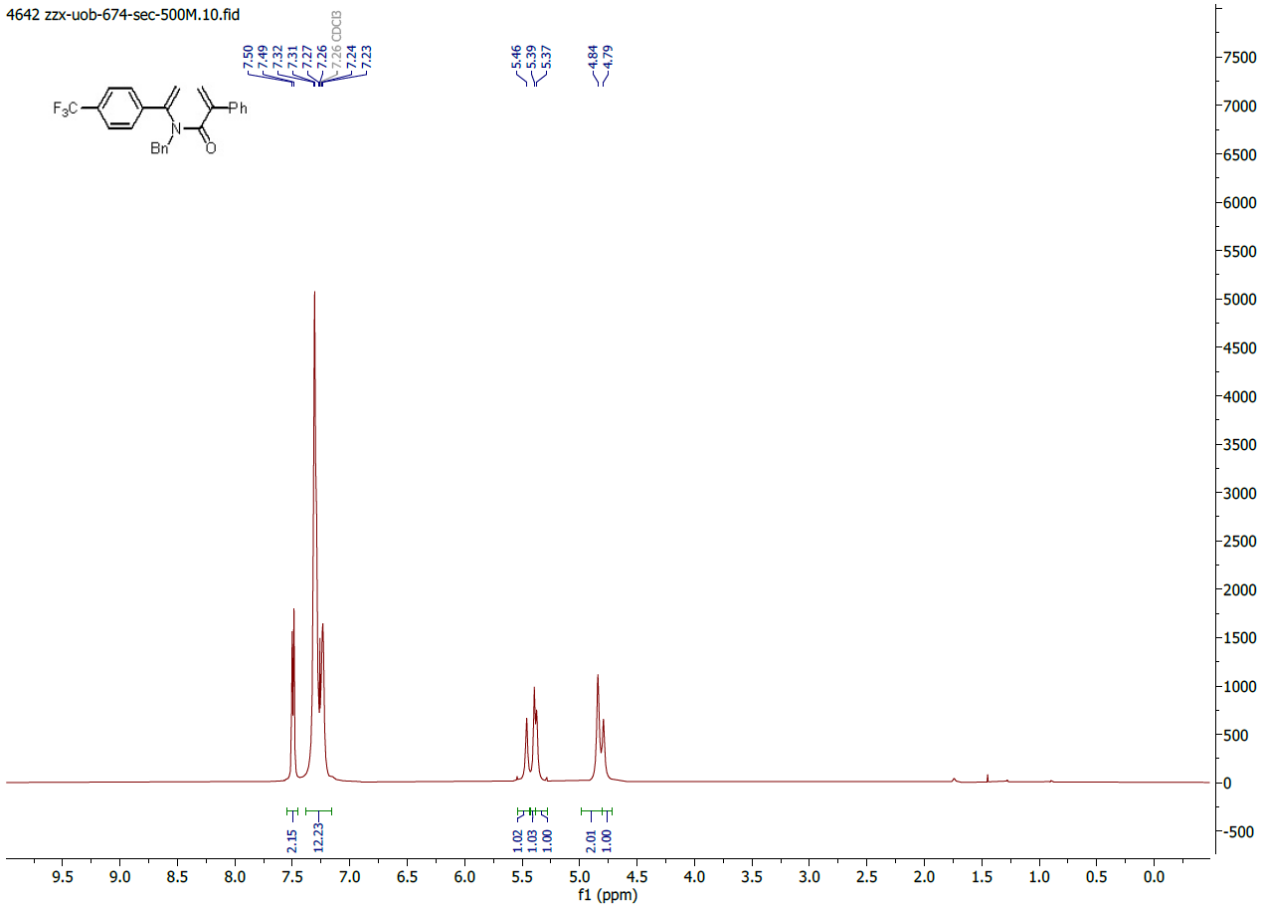
Compound 1q

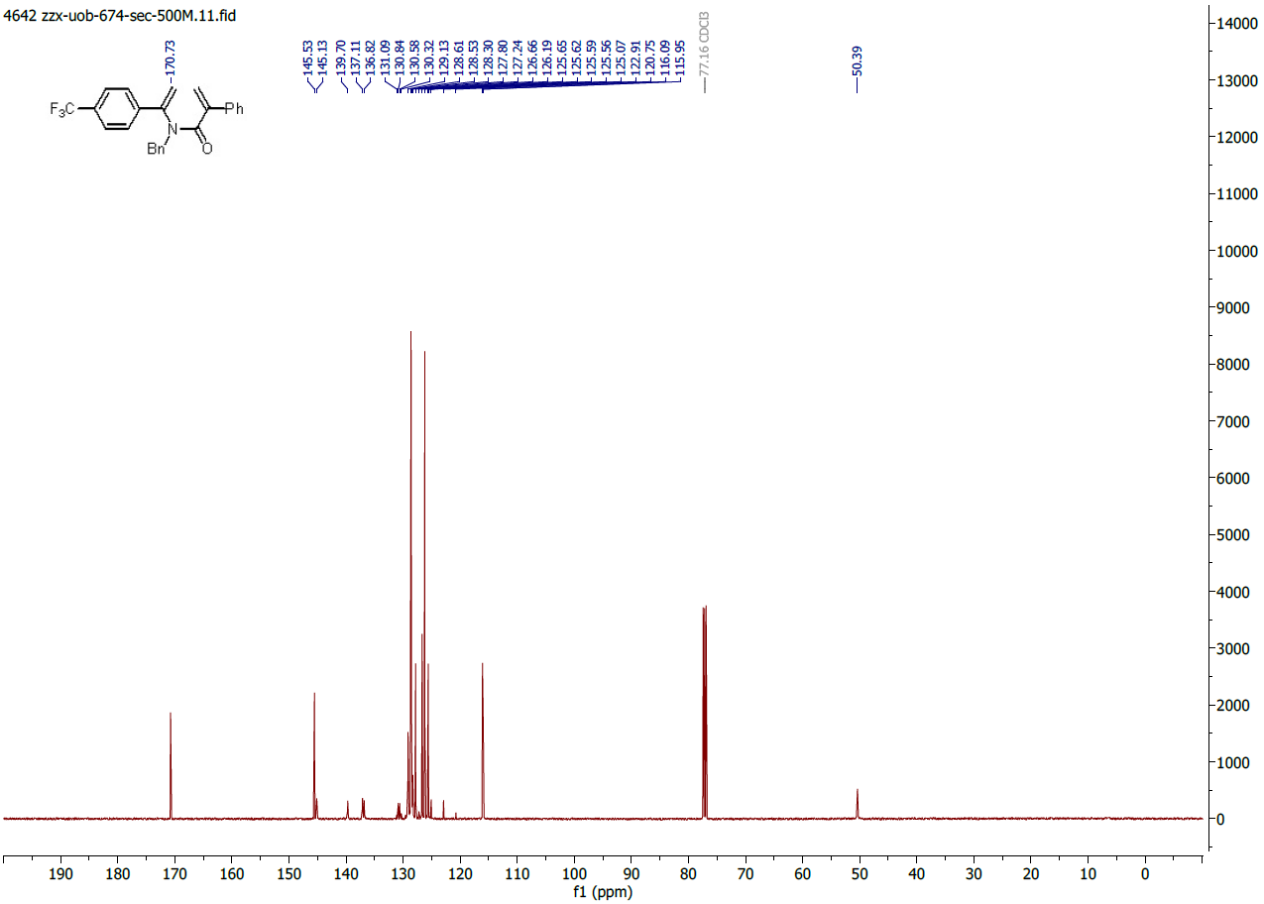

4610 zzx-uob-672-500M.10.fid
7.64
7.63
7.51
7.49
7.28
7.28
7.27
7.26
7.26 CDCl3
7.25
7.25
7.24
7.24
7.24
7.24
7.23
6.53
6.51
6.51
6.50
6.49
6.46
5.70
5.65
5.64
5.64
5.63
5.00
4.70
F3C
N
Bn
O
H
2.00
2.03
5.00
2.02
1.01
1.01
1.00
2.01
f1 (ppm)

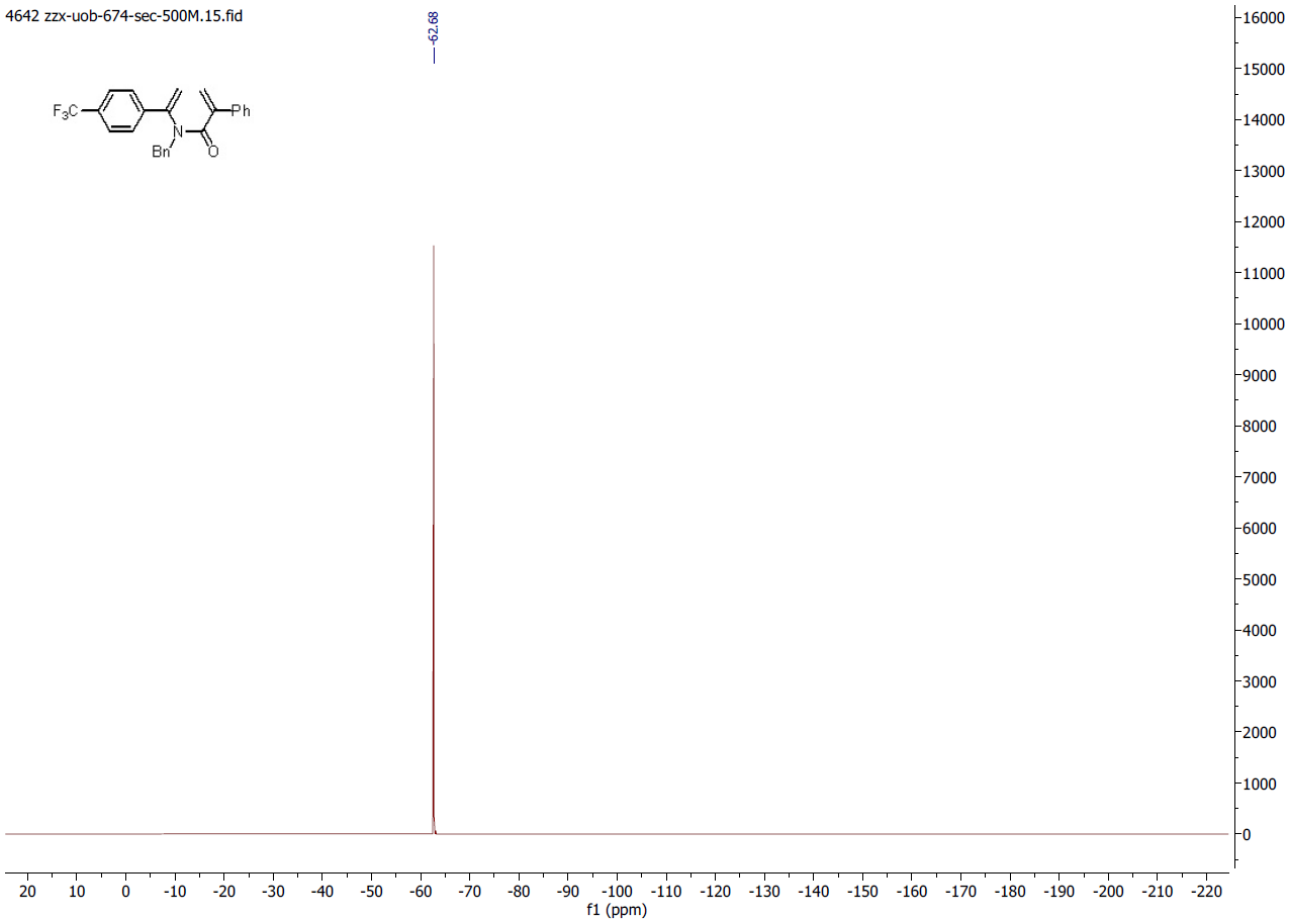

4610 zzx-uob-672-500M.11.fid
166.06
144.51
139.35
137.03
131.55
131.29
131.03
130.77
129.10
128.84
128.43
128.43
128.14
127.58
127.16
126.47
126.03
126.00
125.97
125.94
125.00
122.84
120.67
117.54
77.16 CDCl3
49.90
F3C
N
Bn
O
H
f1 (ppm)


4610 zzx-uob-672-500M.15.fid
-62.69
F3C
N
Bn
O
H
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

Compound 1r

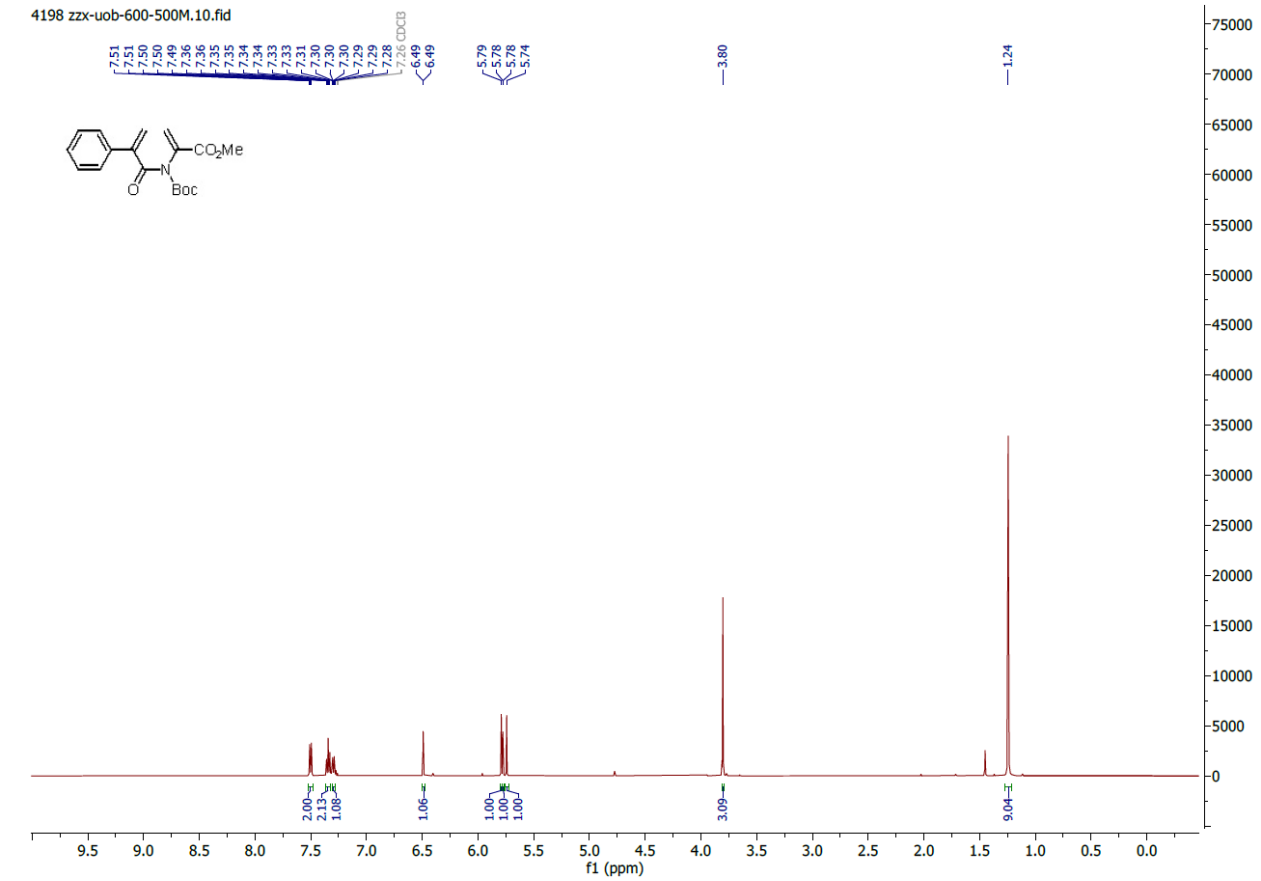

4642 zzx-uob-674-sec-500M.10.fid
7.50
7.49
7.32
7.31
7.27
7.26
7.26 CDCl3
7.24
7.23
5.46
5.39
5.37
4.84
4.79
F3C
Ph
N
Bn
O
2.15
12.23
1.02
1.03
1.00
2.01
1.00
f1 (ppm)

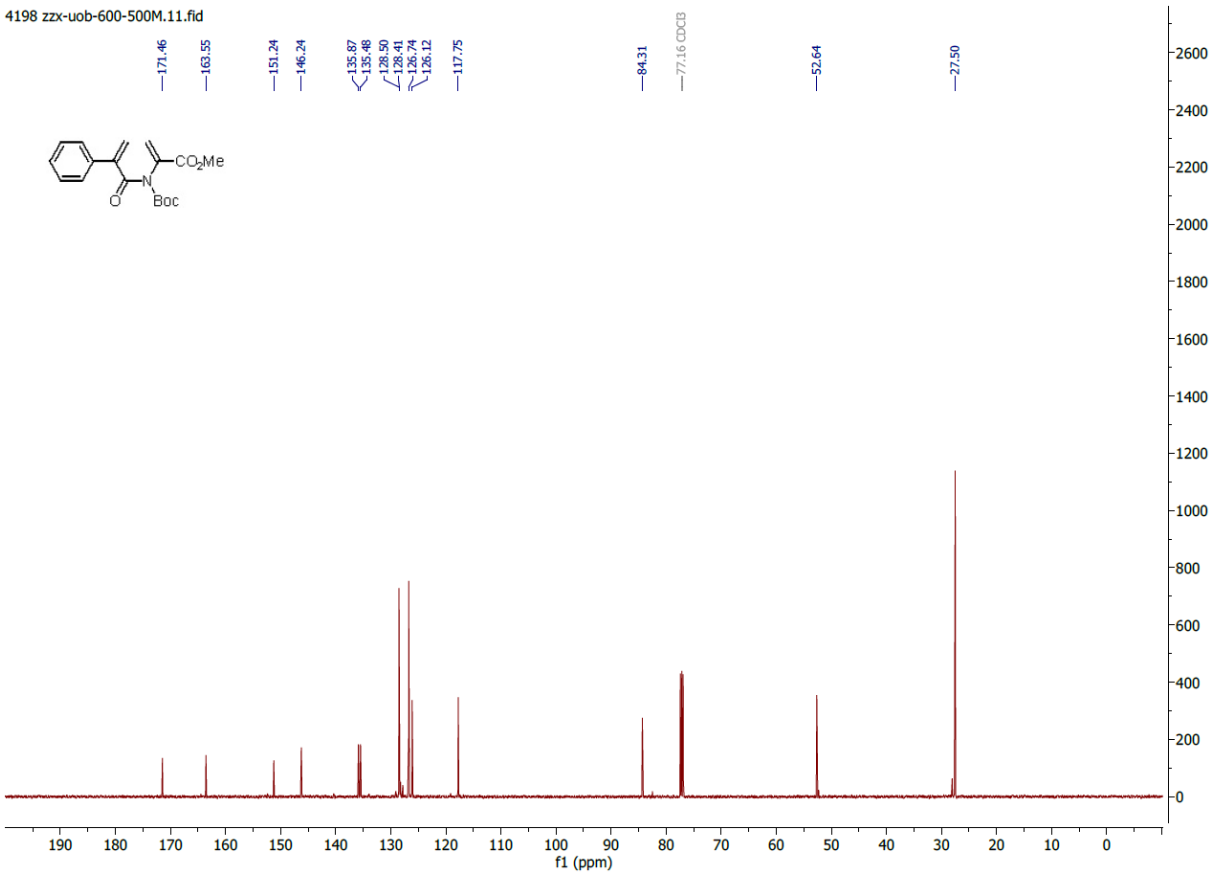

4642 zzx-uob-674-sec-500M.11.fid
170.73
145.53
145.13
139.70
137.11
136.82
131.09
130.84
130.58
130.32
129.13
128.61
128.53
128.30
127.80
127.24
126.66
126.19
125.65
125.62
125.59
125.56
125.07
122.91
120.75
116.09
115.95
77.16 CDCl3
50.39
F3C
Ph
N
Bn
O
f1 (ppm)


4642 zzx-uob-674-sec-500M.15.fid
-62.68
F3C
Ph
N
Bn
O
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

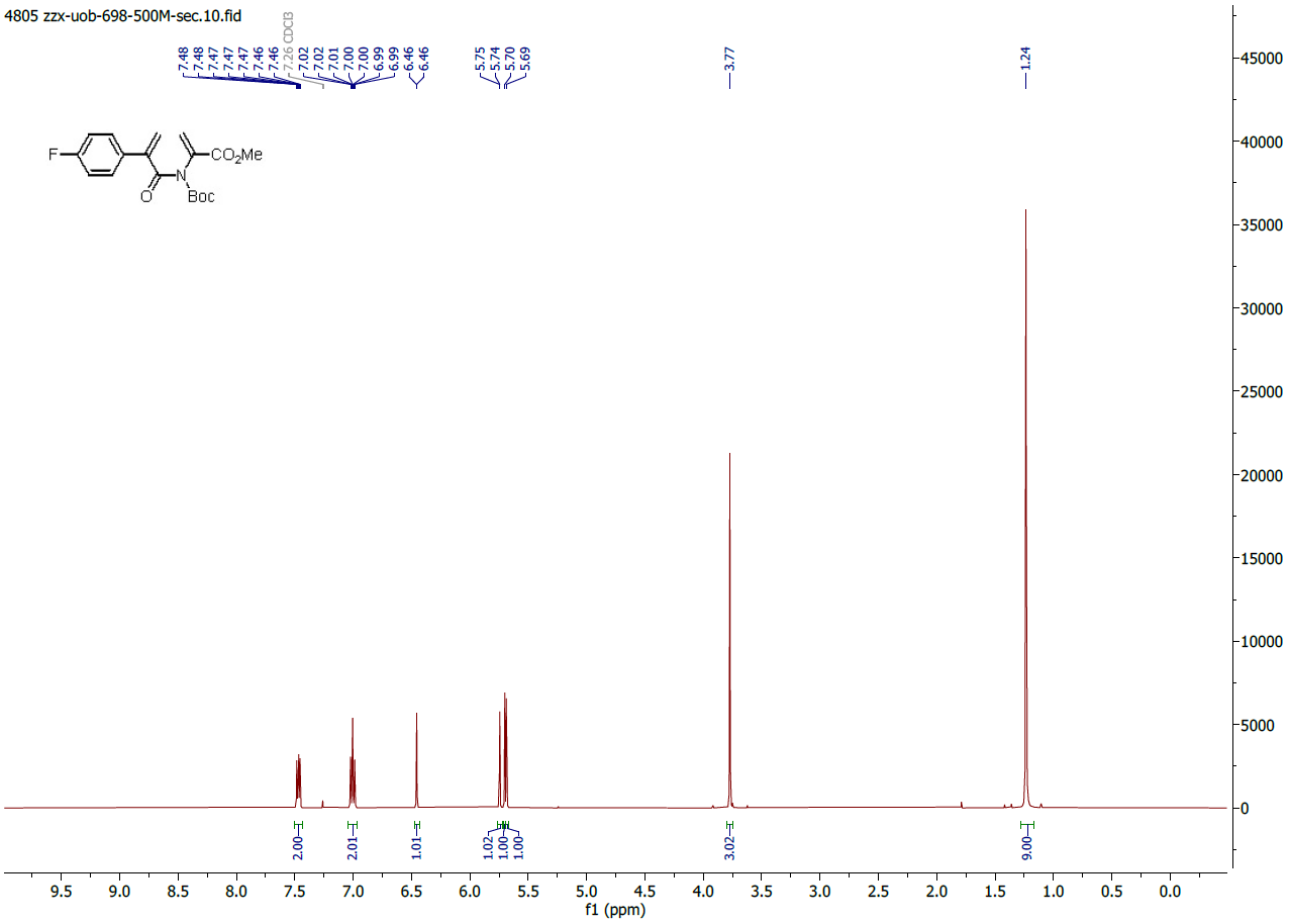
5.2 NMR Spectra of Cyclisation Precursors (7)

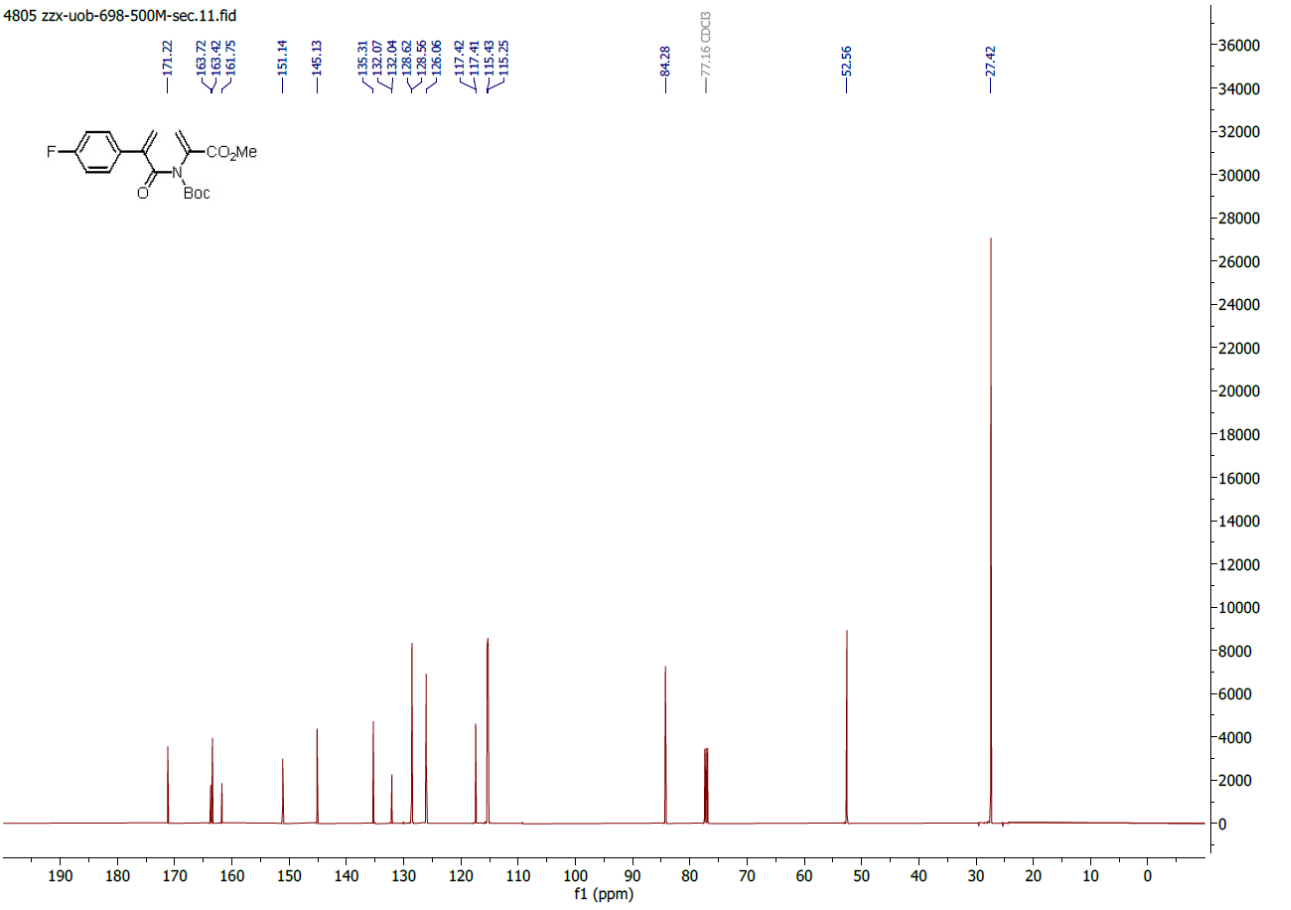
Compound 7a

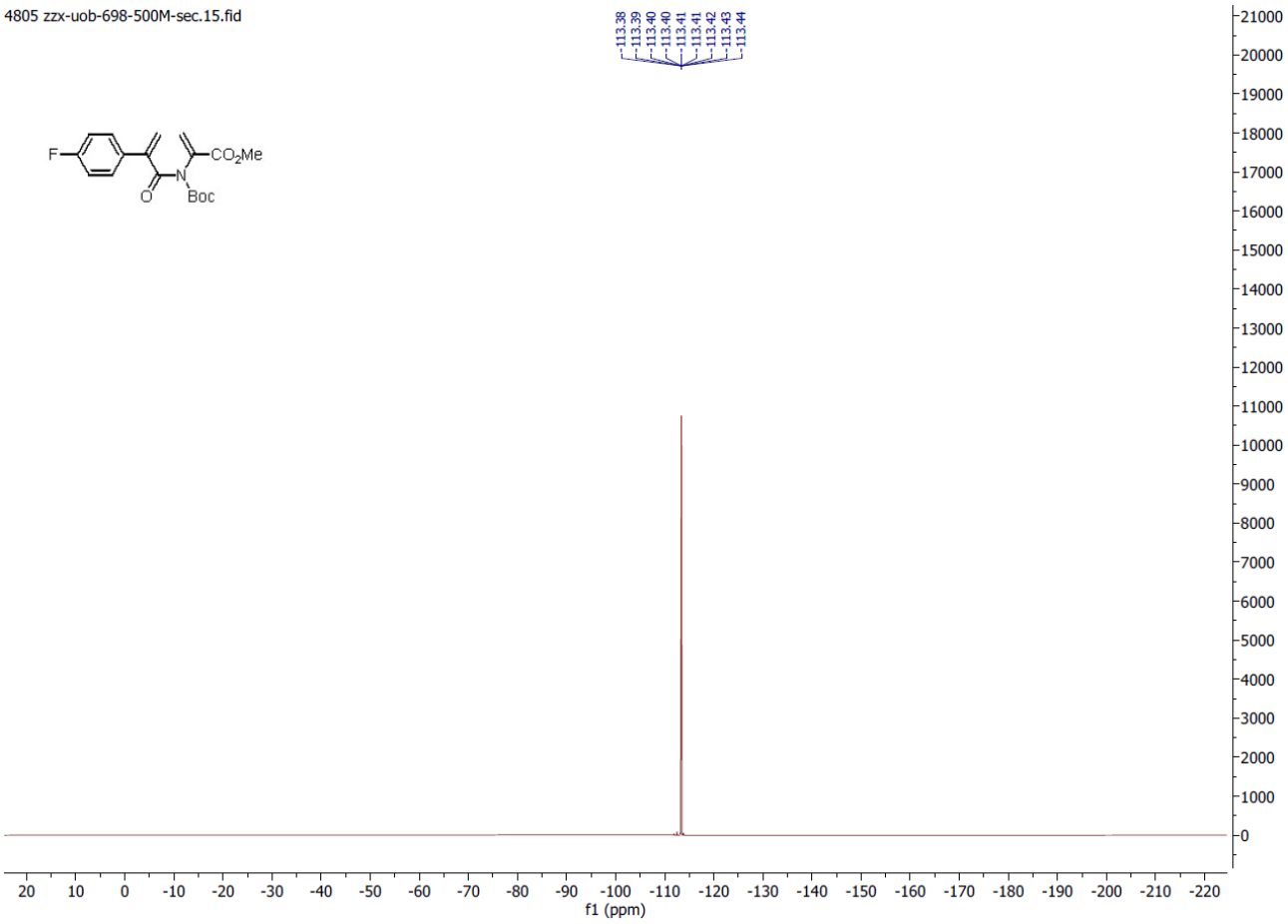




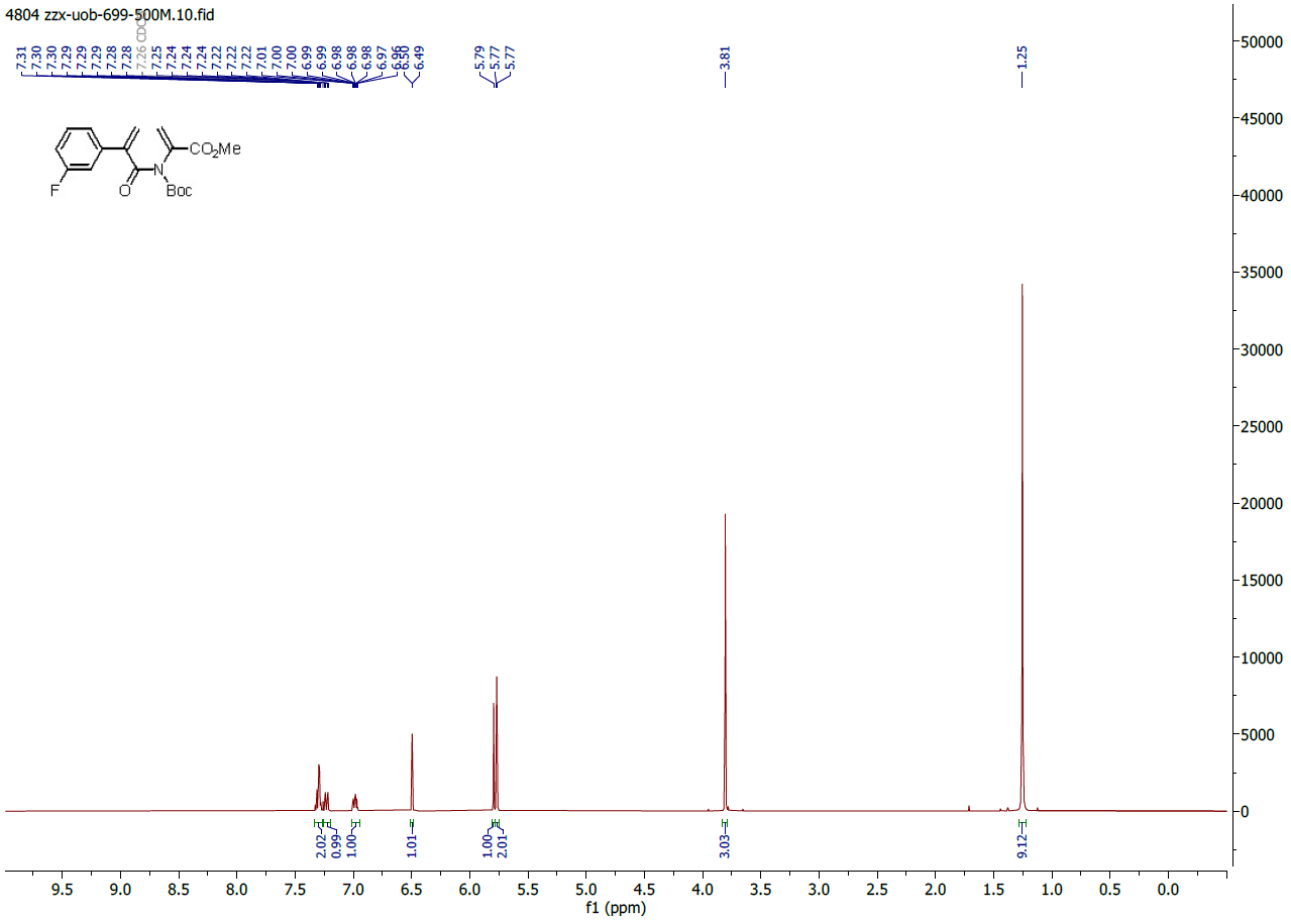
Compound 7b

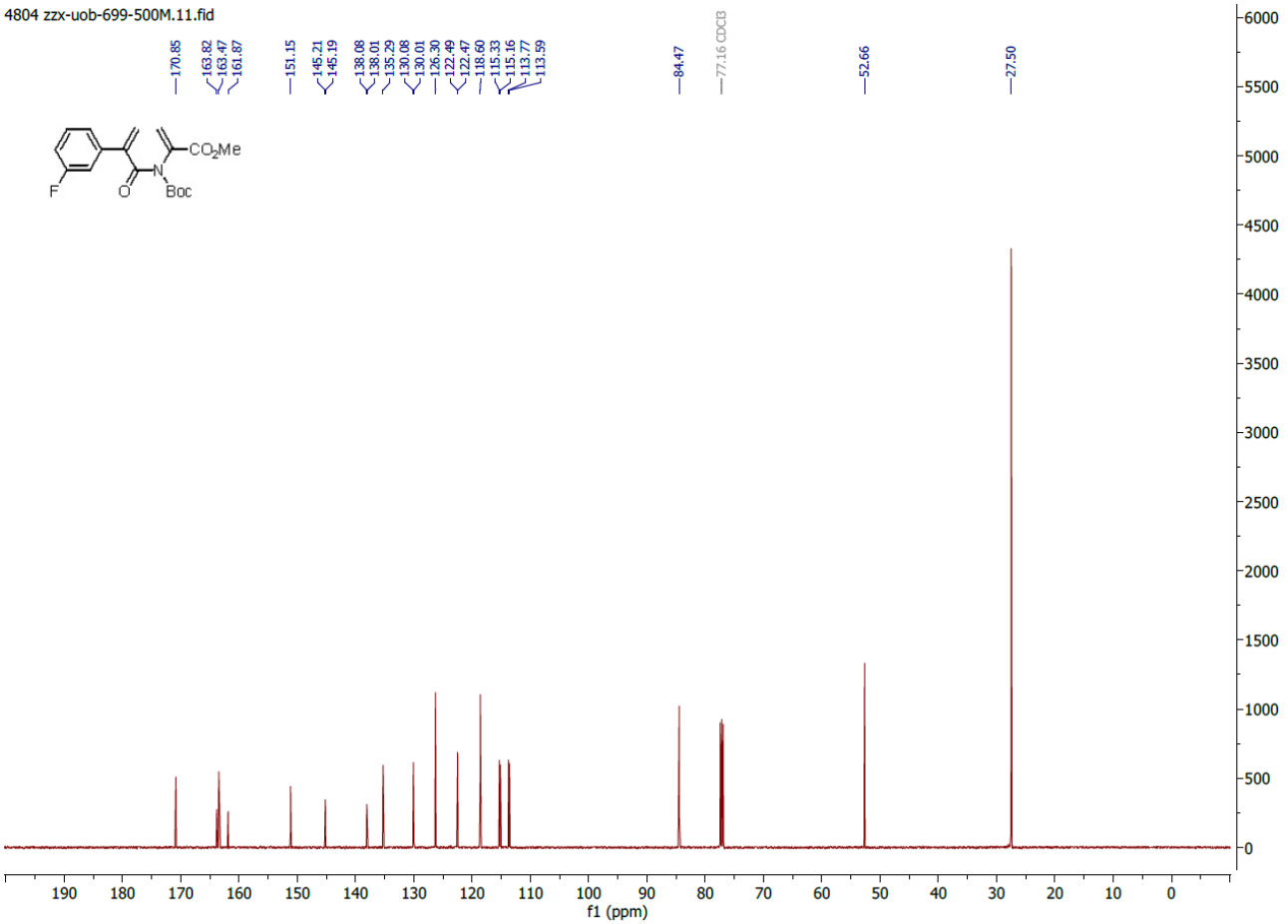

4805 zzx-uob-698-500M-sec.10.fid
7.48
7.48
7.47
7.47
7.47
7.46
7.46
7.26 CDCl3
7.02
7.02
7.01
7.00
7.00
6.99
6.99
6.46
6.46
5.75
5.74
5.70
5.69
3.77
1.24
F
CO2Me
N
Boc
O
2.00
2.01
1.01
1.02
1.00
1.00
3.02
9.00
f1 (ppm)

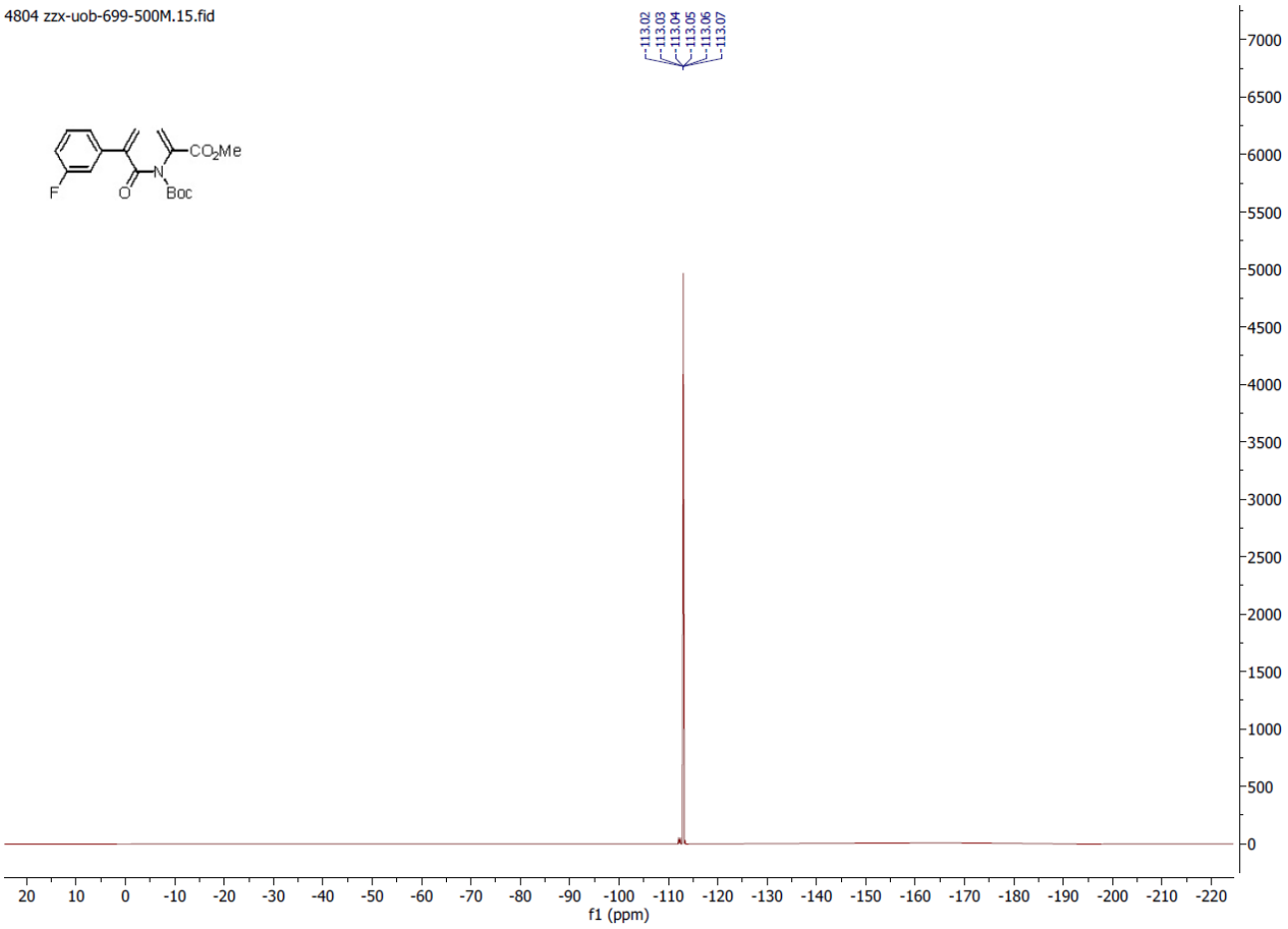

4805 zzx-uob-698-500M-sec.11.fid
171.22
163.72
163.42
161.75
151.14
145.13
135.31
132.07
132.04
128.62
128.56
126.06
117.42
117.41
115.43
115.25
84.28
77.16 CDCl3
52.56
27.42
F
CO2Me
N
Boc
O
f1 (ppm)


4805 zzx-uob-698-500M-sec.15.fid
113.38
113.39
113.40
113.40
113.41
113.41
113.42
113.43
113.44
F
CO2Me
N
O
Boc
21000
20000
19000
18000
17000
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

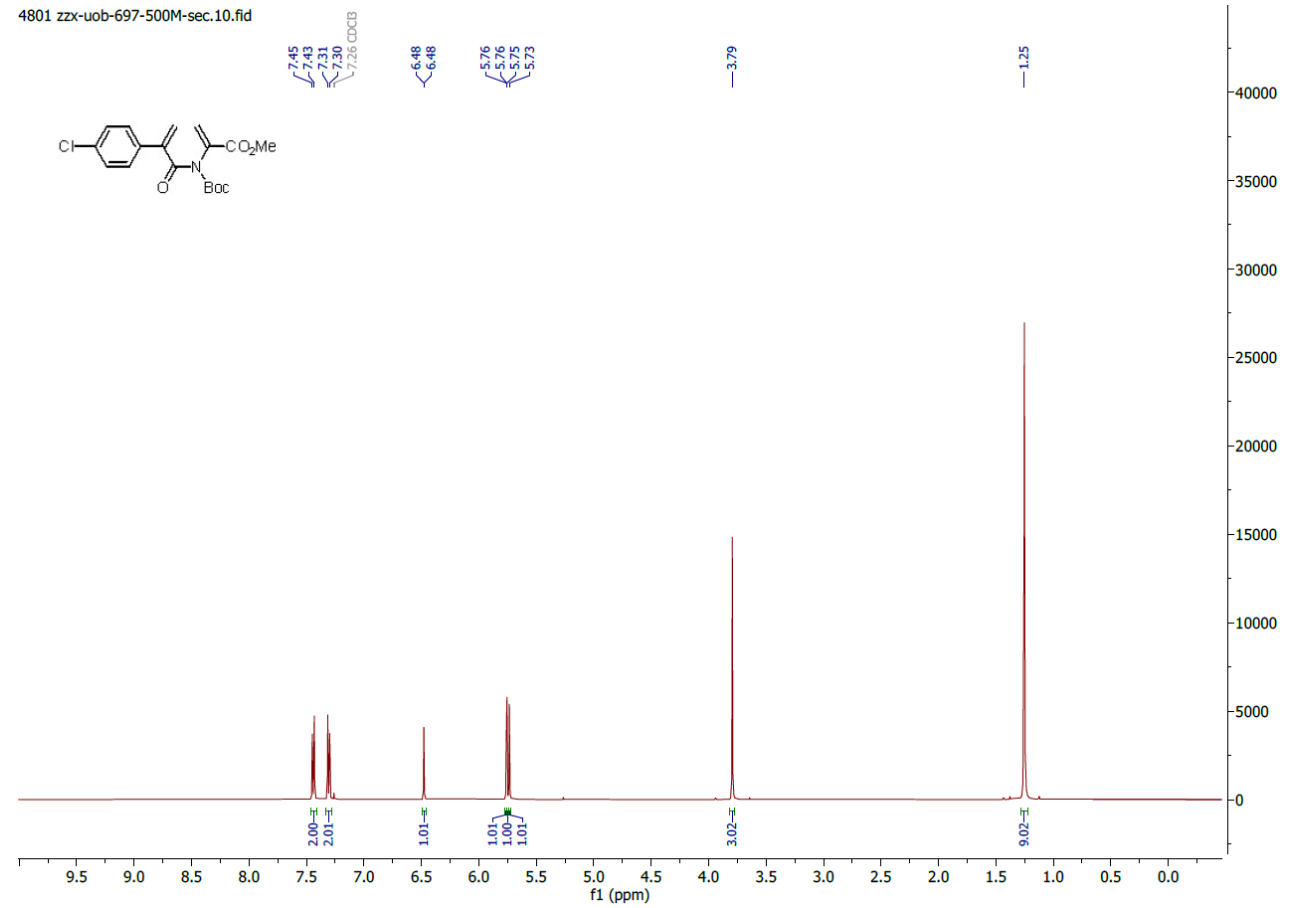
Compound 7c

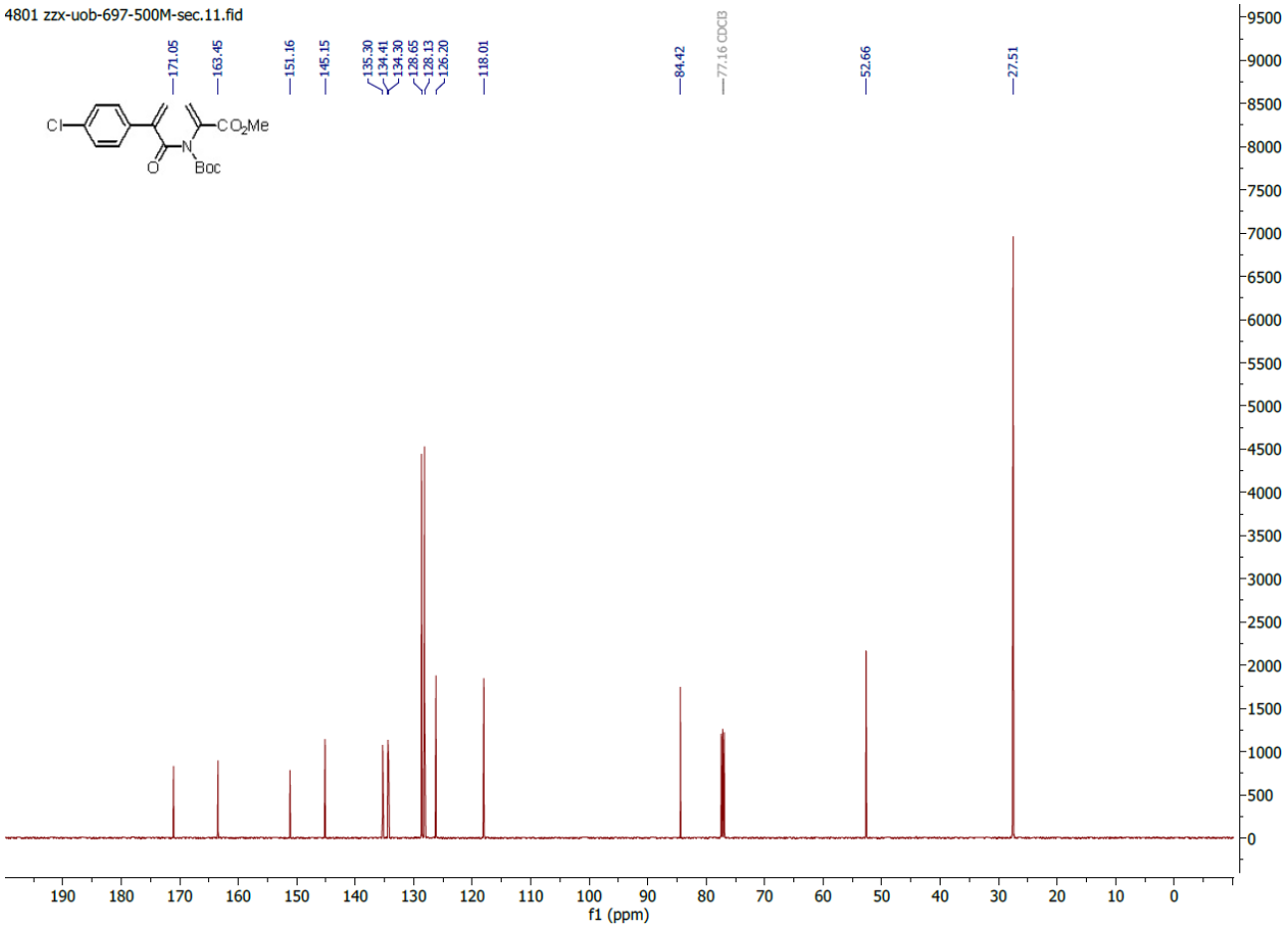

4804 zzx-uob-699-500M.10.fid
7.31
7.30
7.30
7.29
7.29
7.29
7.28
7.28
7.26 CDCl3
7.25
7.24
7.24
7.24
7.22
7.22
7.22
7.22
7.01
7.00
7.00
6.99
6.99
6.98
6.98
6.98
6.97
6.96
6.96
6.49
5.79
5.77
5.77
3.81
1.25
CO2Me
N
Boc
F
O
2.02
0.99
1.00
1.01
1.00
2.01
3.03
9.12
f1 (ppm)


4804 zzx-uob-699-500M.11.fid
170.85
163.82
163.47
161.87
151.15
145.21
145.19
138.08
138.01
135.29
130.08
130.01
126.30
122.49
122.47
118.60
115.33
115.16
113.77
113.59
84.47
77.16 CDCl3
52.66
27.50
CO2Me
N
Boc
F
O
f1 (ppm)

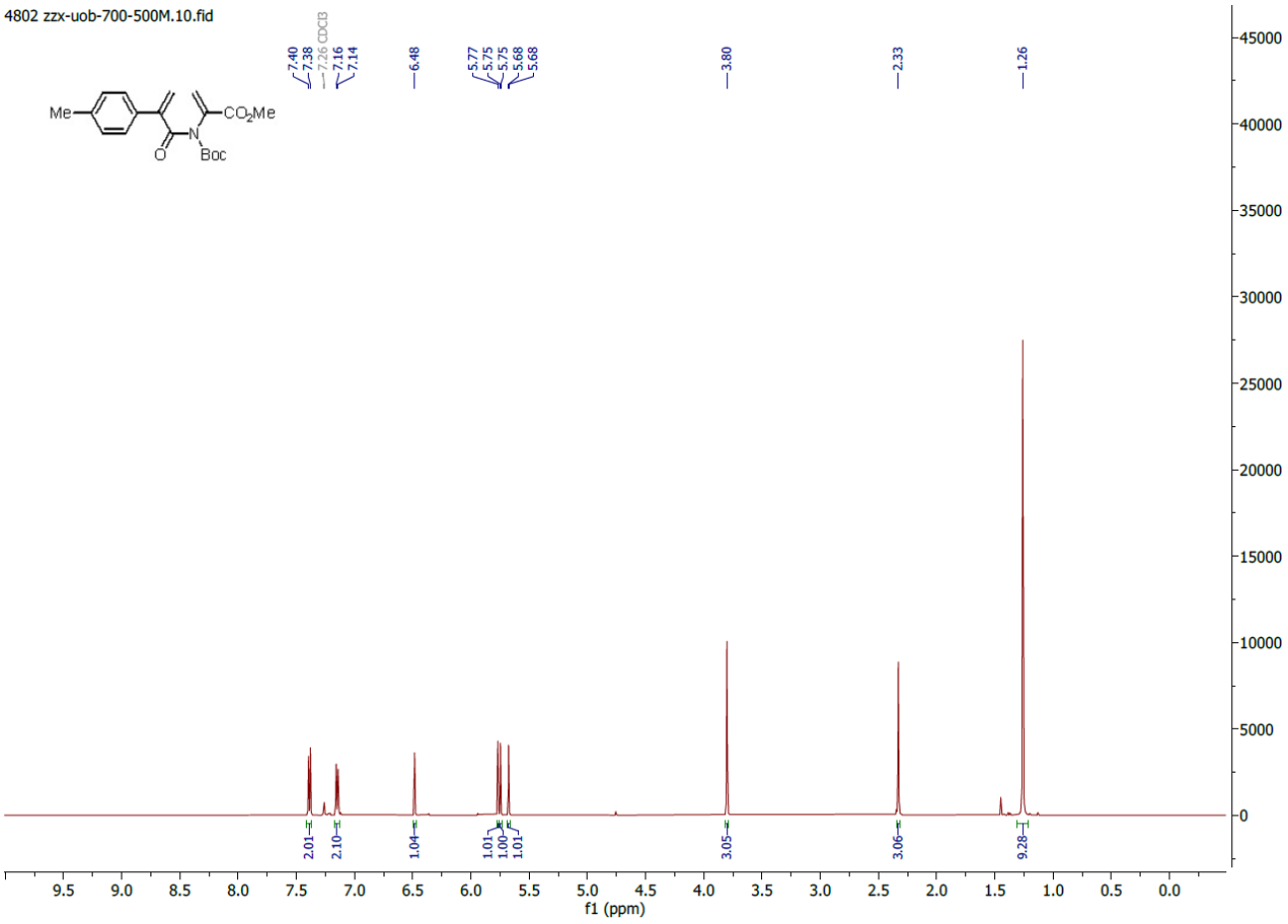

4804 zzx-uob-699-500M.15.fid
-113.02
-113.03
-113.04
-113.05
-113.06
-113.07
CO2Me
F
O
N
Boc
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

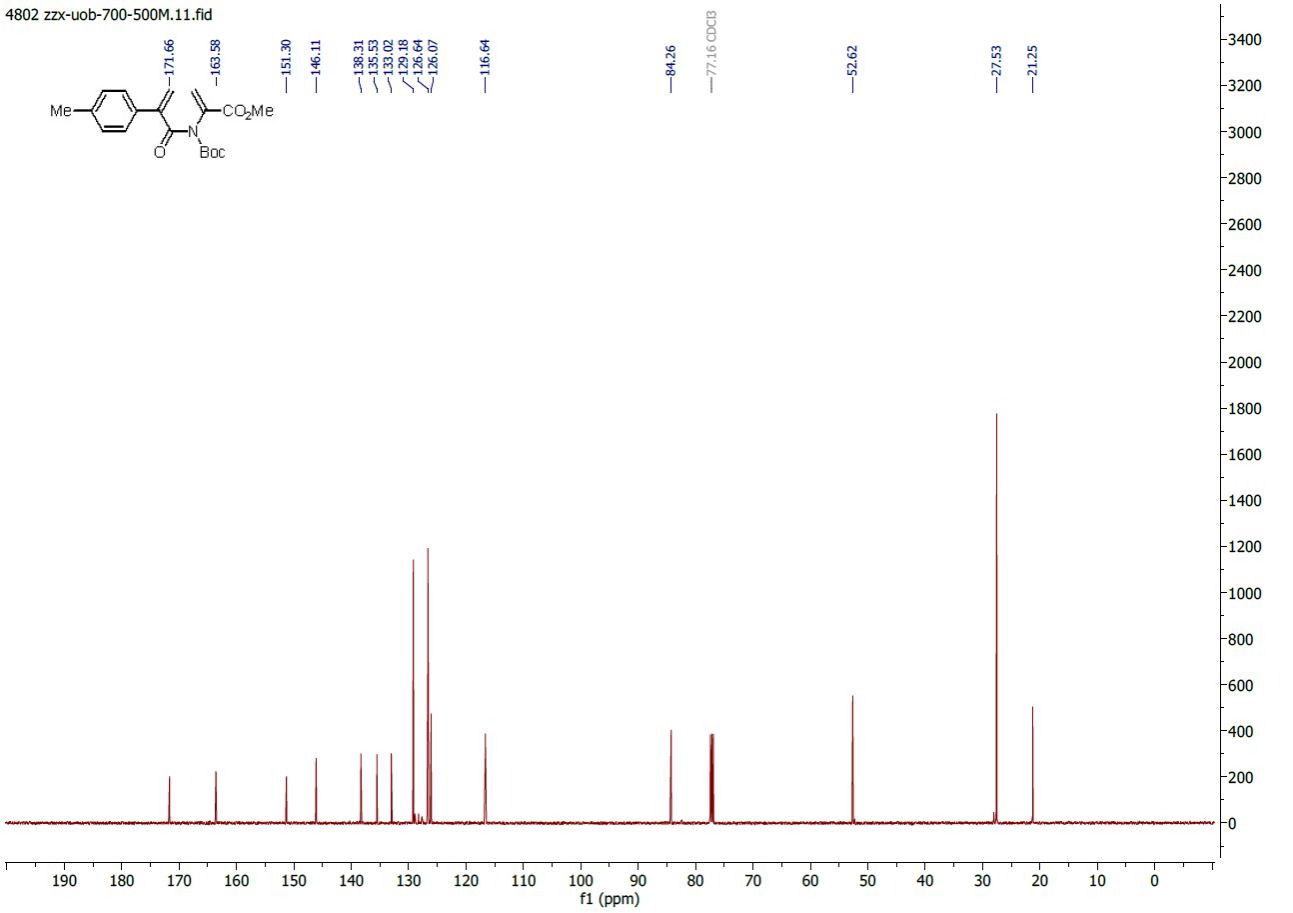
Compound 7d


4801 zzx-uob-697-500M-sec.10.fid
7.45
7.43
7.31
7.30
7.26 CDCl3
6.48
6.48
5.76
5.76
5.75
5.73
3.79
1.25
Cl
CO2Me
N
O
Boc
2.00
2.01
1.01
1.01
1.00
1.01
3.02
9.02
f1 (ppm)

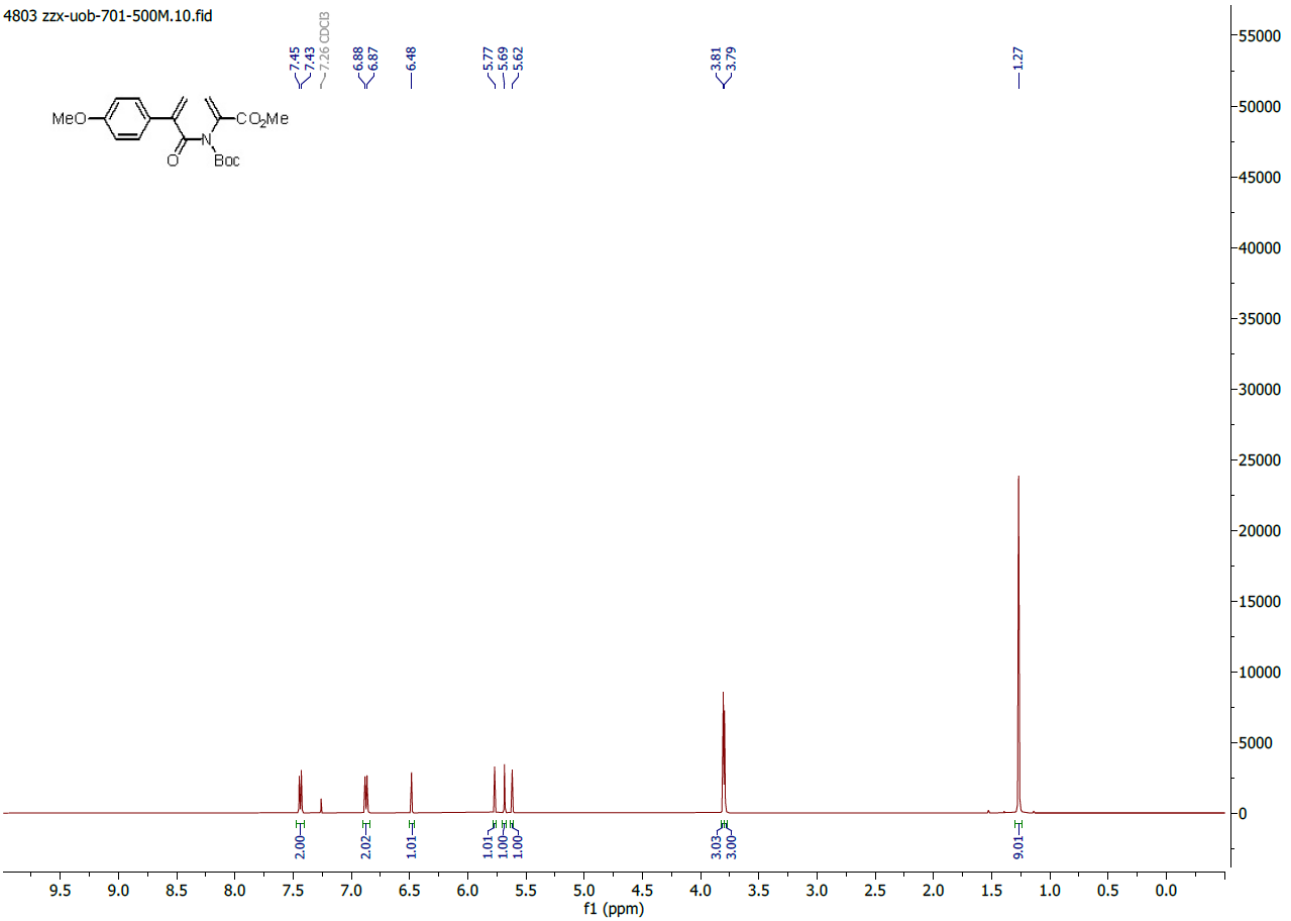

4801 zzx-uob-697-500M-sec.11.fid
171.05
163.45
151.16
145.15
135.30
134.41
134.30
128.65
128.13
126.20
118.01
84.42
77.16 CDCl3
52.66
27.51
Cl
CO2Me
N
O
Boc
f1 (ppm)

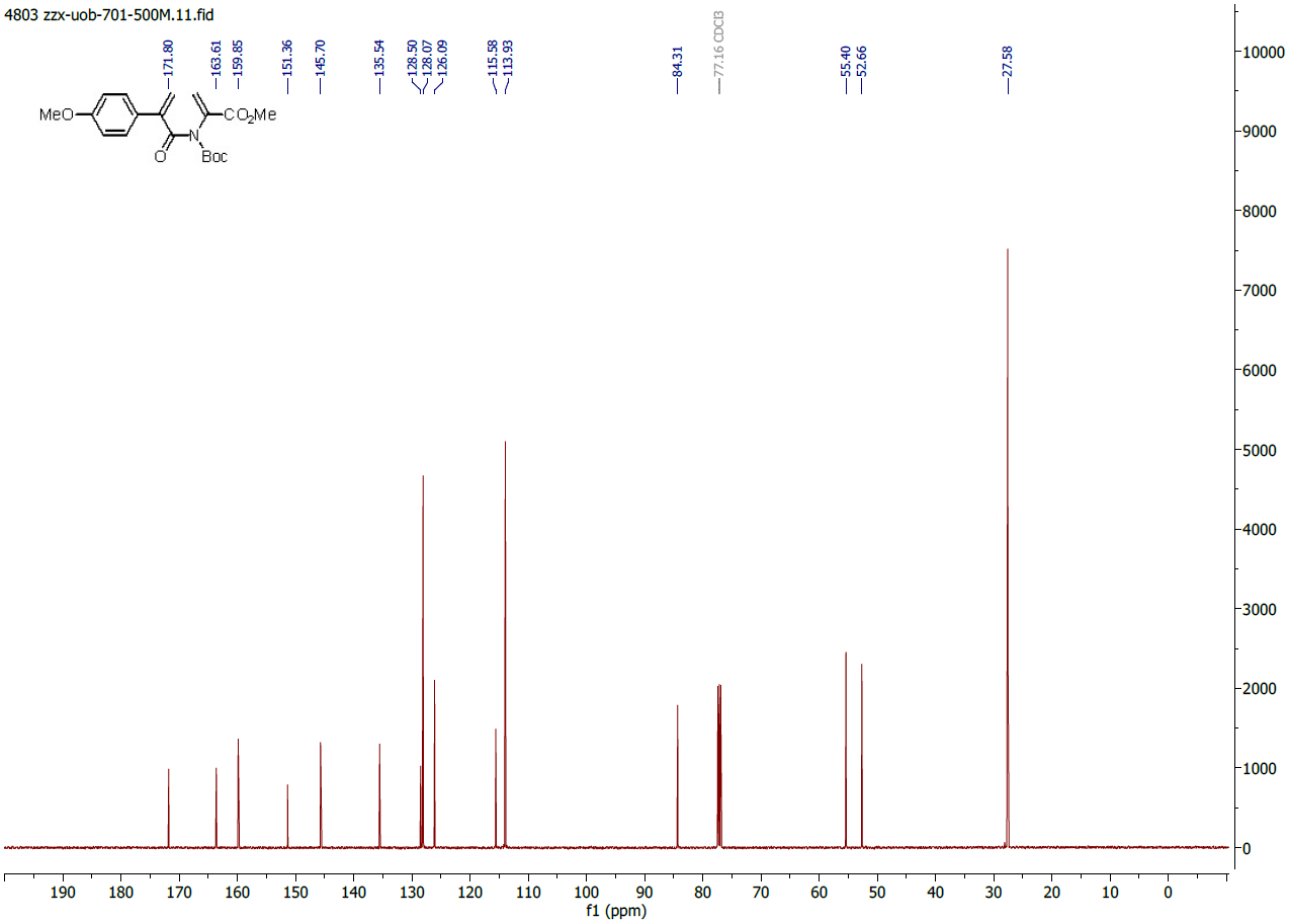
Compound 7e


4802 zzx-uob-700-500M.10.fid
Me
CO2Me
N
Boc
O
7.40
7.38
7.26 CDCl3
7.16
7.14
6.48
5.77
5.75
5.75
5.68
5.68
3.80
2.33
1.26
2.01
2.10
1.04
1.01
1.00
1.01
3.05
3.06
9.28
f1 (ppm)

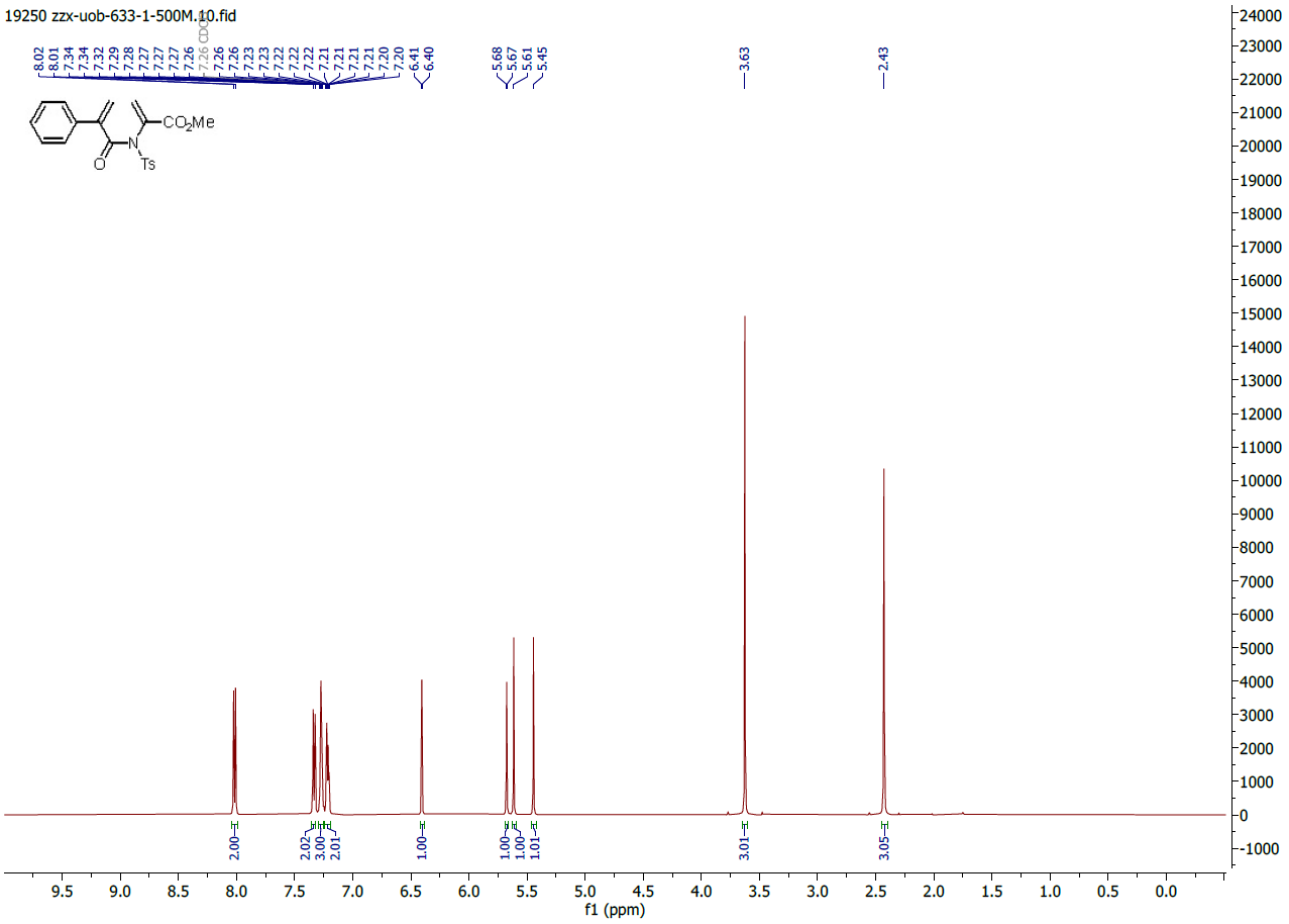

4802 zzx-uob-700-500M.11.fid
Me
CO2Me
N
Boc
O
171.66
163.58
151.30
146.11
138.31
135.53
133.02
129.18
126.64
126.07
116.64
84.26
77.16 CDCl3
52.62
27.53
21.25
f1 (ppm)

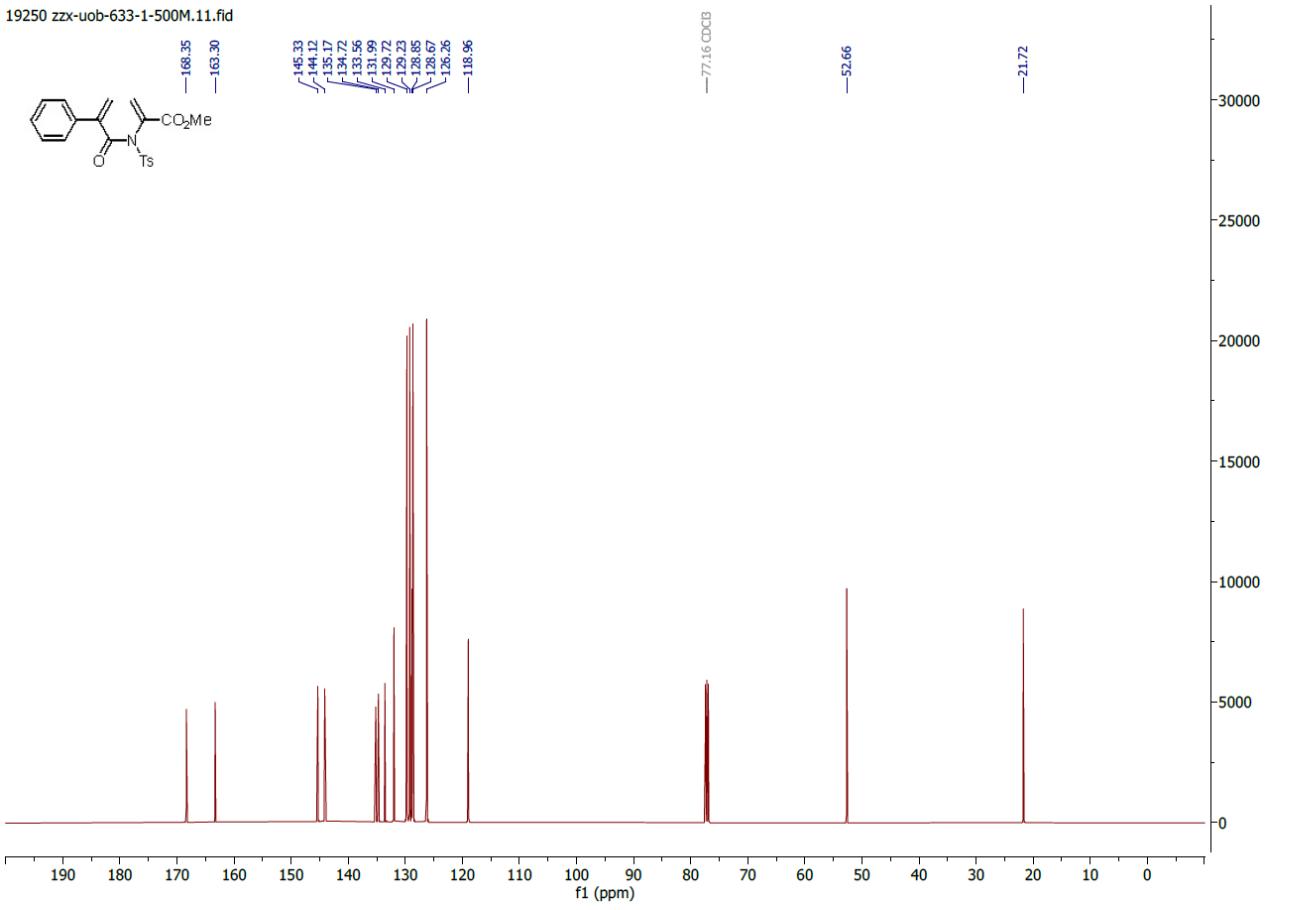
Compound 7f


4803 zzx-uob-701-500M.10.fid
7.45
7.43
7.26 CDCl3
6.88
6.87
6.48
5.77
5.69
5.62
3.81
3.79
1.27
MeO
CO2Me
N
Boc
O
2.00
2.02
1.01
1.01
1.00
1.00
3.03
3.00
9.01
f1 (ppm)


4803 zzx-uob-701-500M.11.fid
171.80
163.61
159.85
151.36
145.70
135.54
128.50
128.07
126.09
115.58
113.93
84.31
77.16 CDCl3
55.40
52.66
27.58
MeO
CO2Me
N
Boc
O
f1 (ppm)

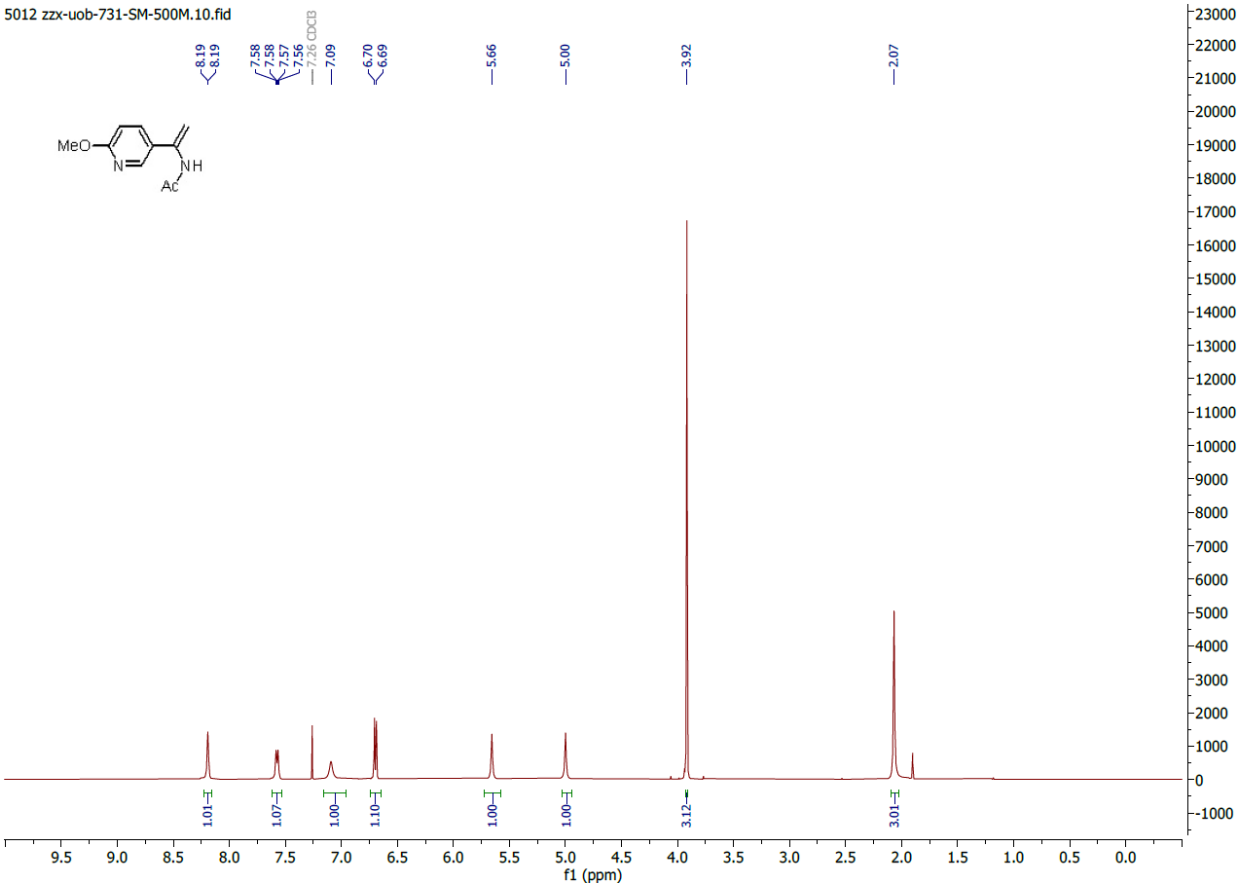
Compound 7g

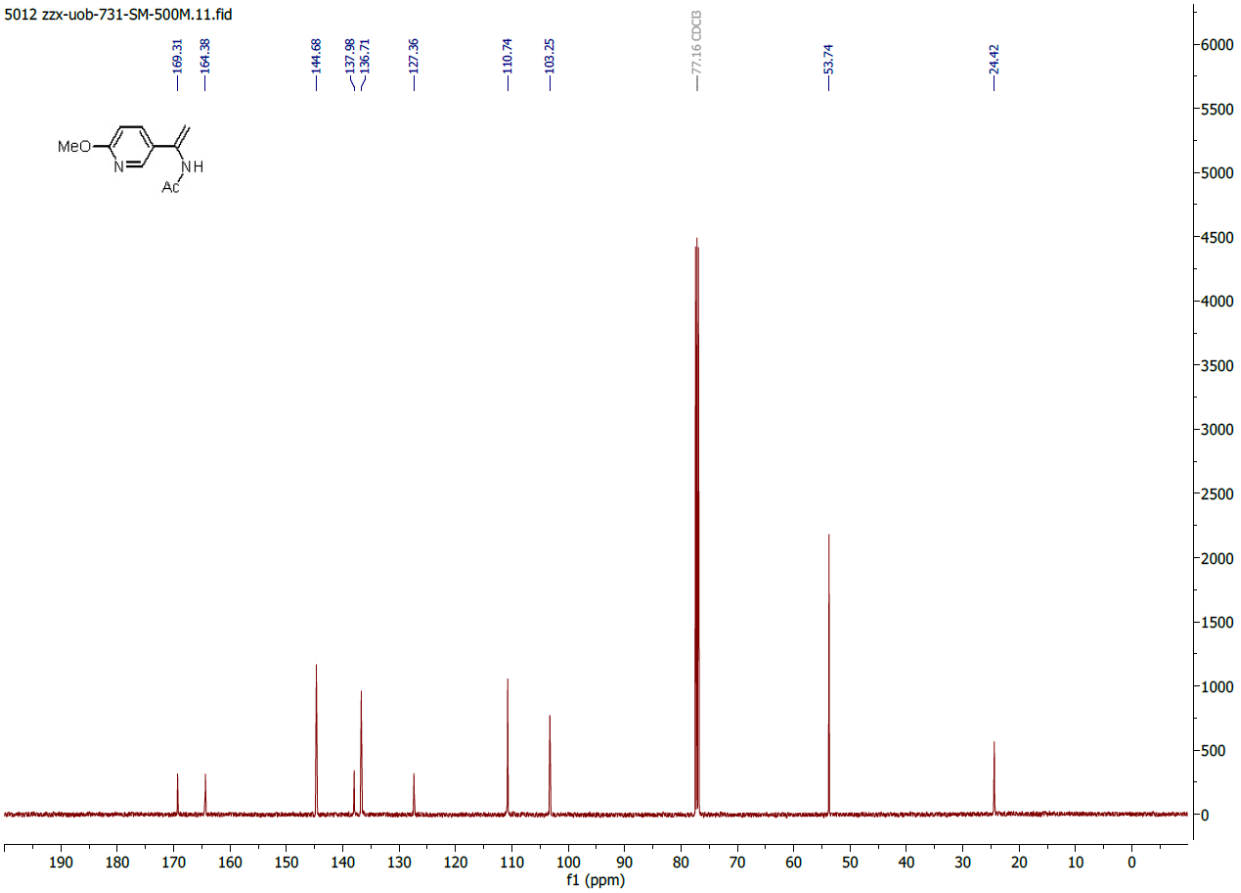

19250 zzx-uob-633-1-500M.10.fid
8.02
8.01
7.34
7.34
7.32
7.29
7.28
7.27
7.27
7.27
7.26
7.26 CDCl3
7.26
7.23
7.23
7.22
7.22
7.21
7.21
7.21
7.20
7.20
6.41
6.40
5.68
5.67
5.61
5.45
3.63
2.43
CO2Me
N
Ts
O
2.00
2.02
3.00
2.01
1.00
1.00
1.00
1.01
3.01
3.05
f1 (ppm)


19250 zzx-uob-633-1-500M.11.fid
168.35
163.30
145.33
144.12
135.17
134.72
133.56
131.99
129.72
129.23
128.85
128.67
126.26
118.96
77.16 CDCl3
52.66
21.72
CO2Me
N
Ts
O
f1 (ppm)

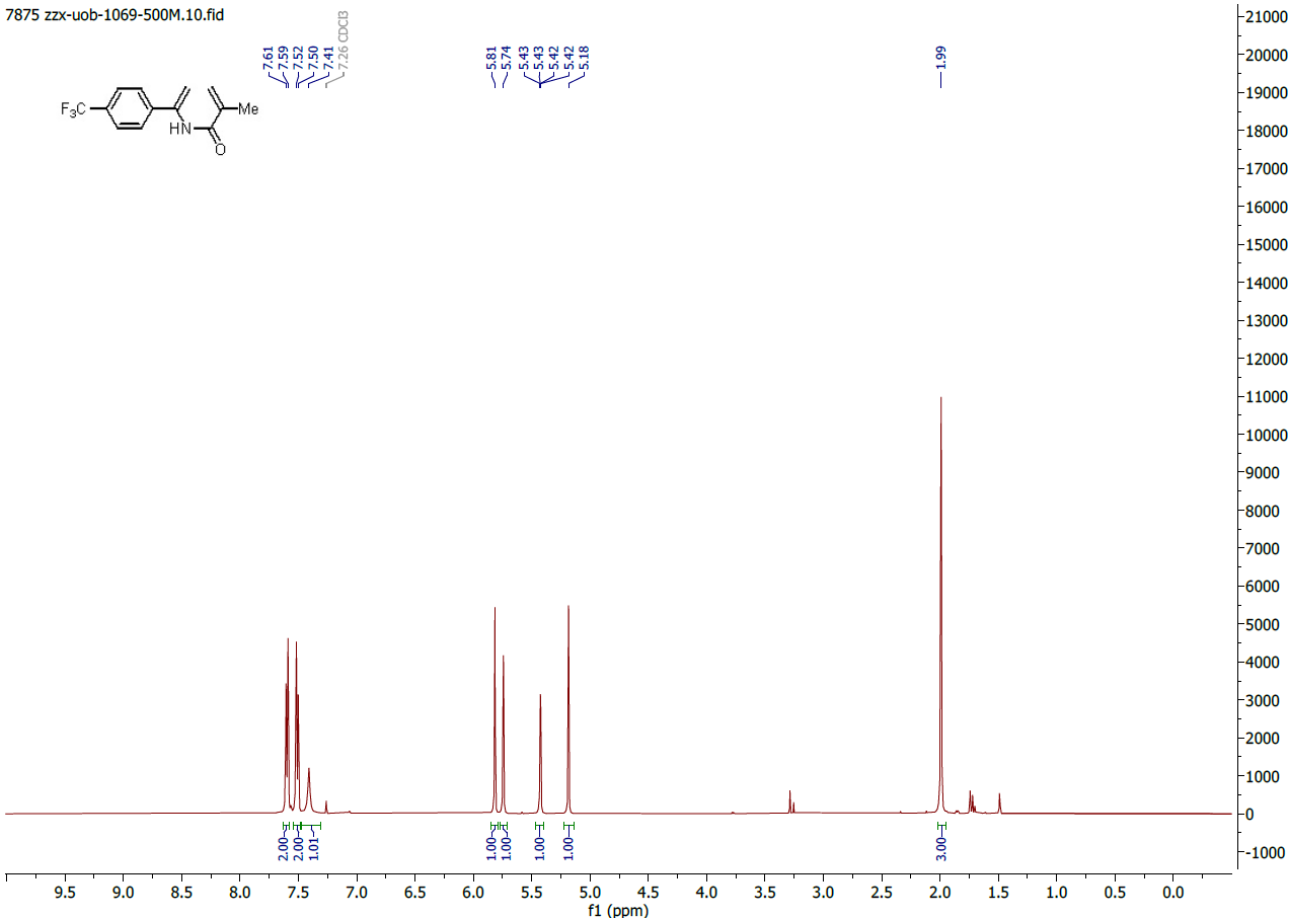
5.3 NMR Spectra of Cyclisation Precursors (2)

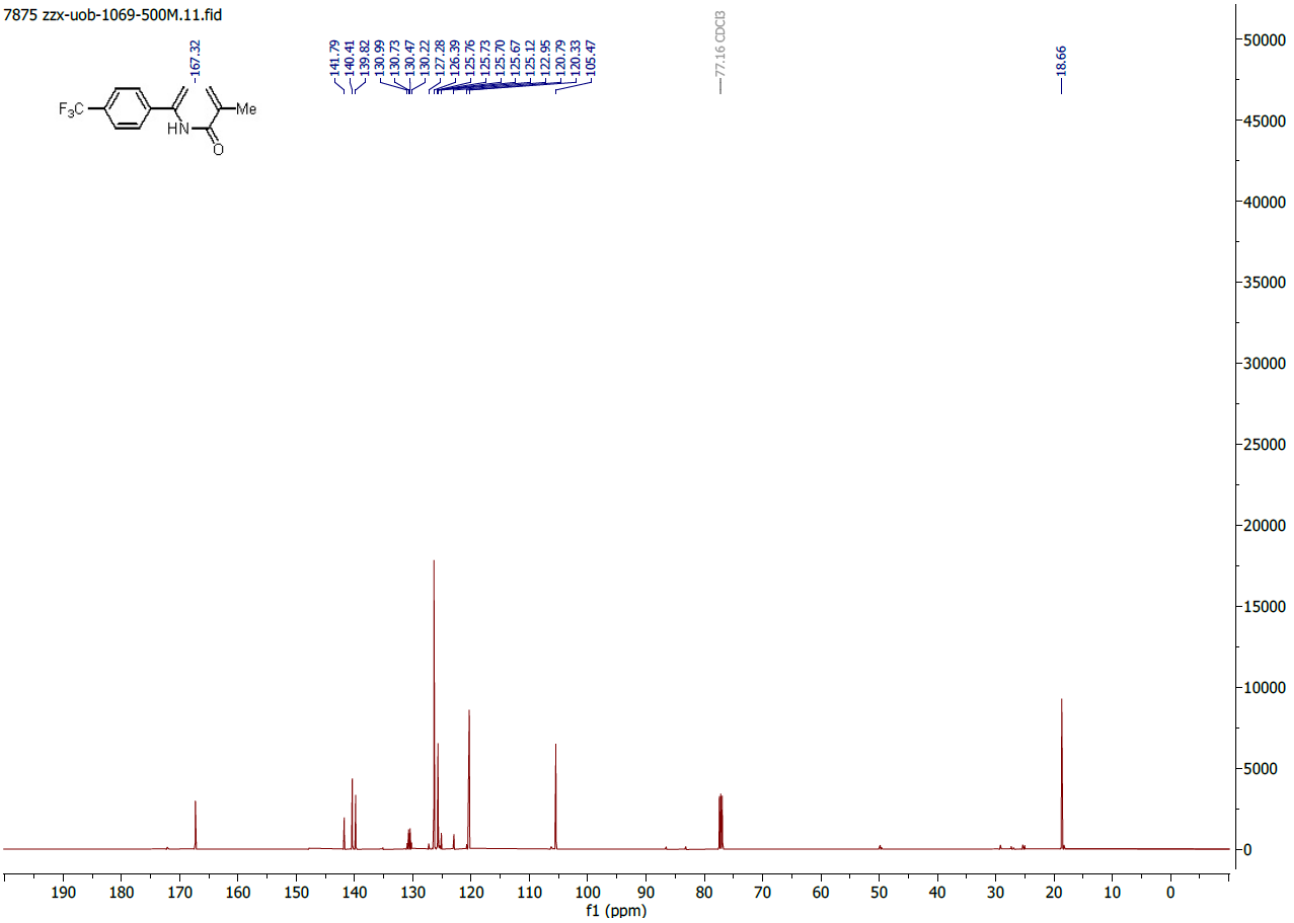
Compound S2t

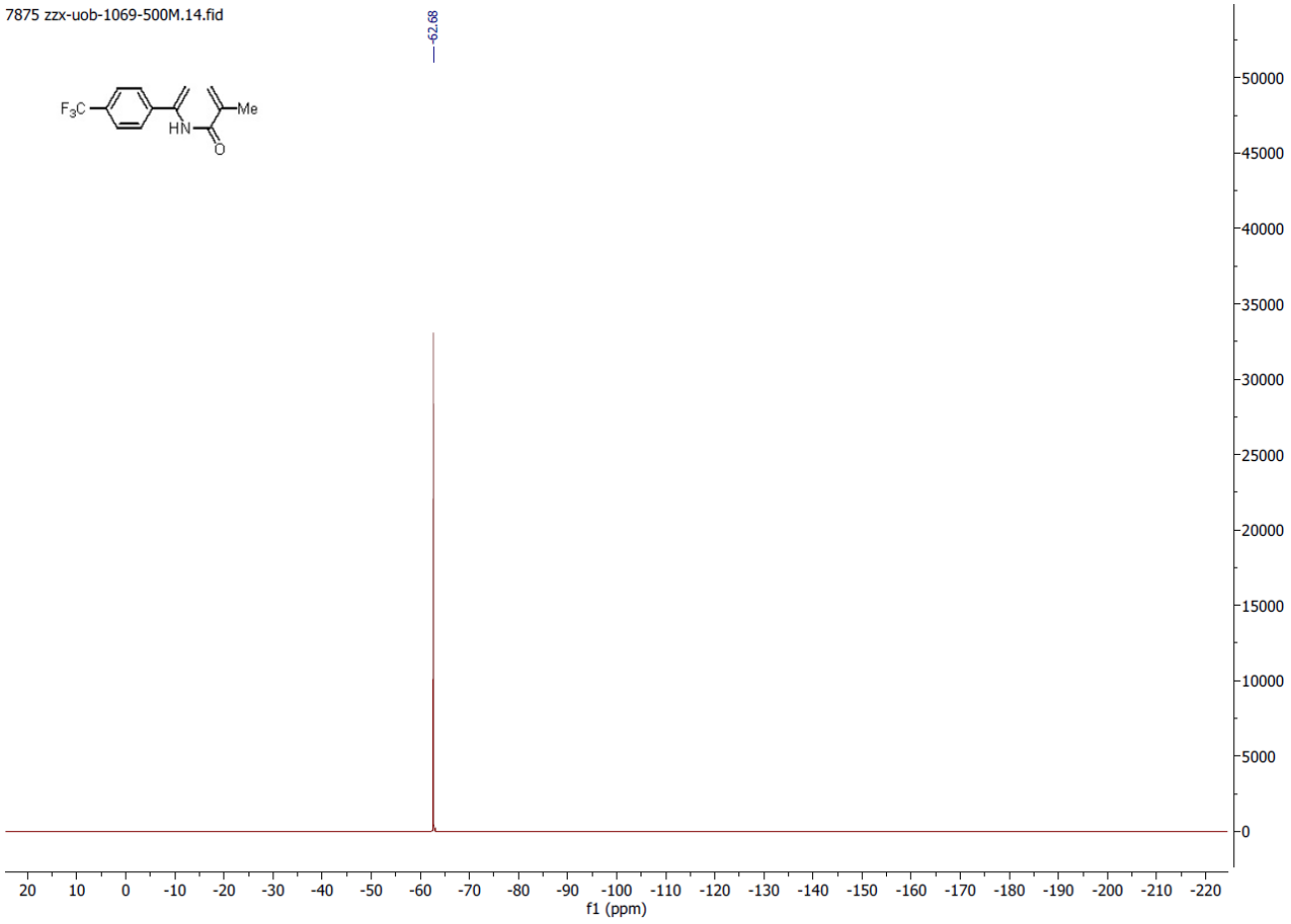




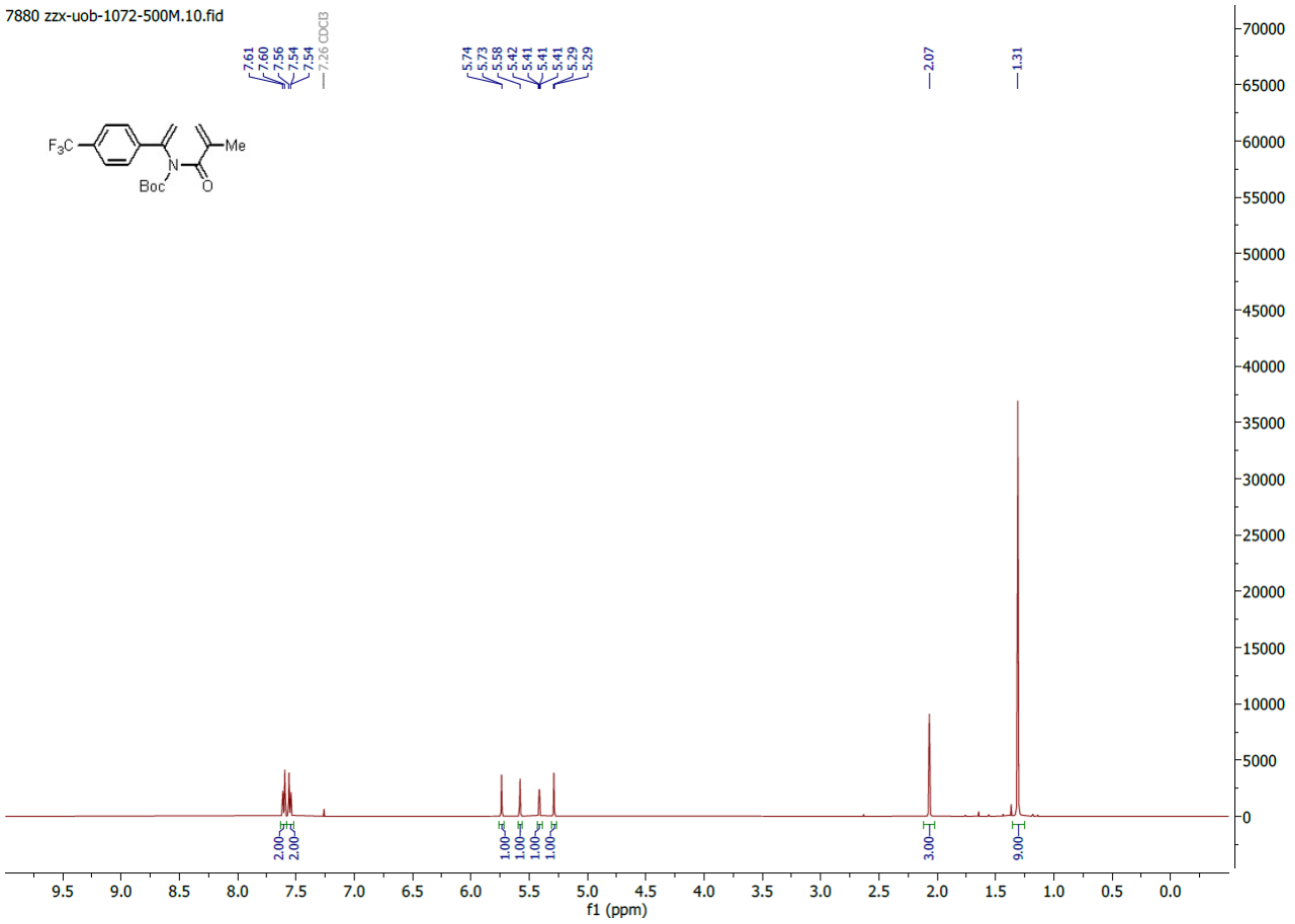
Compound S2a

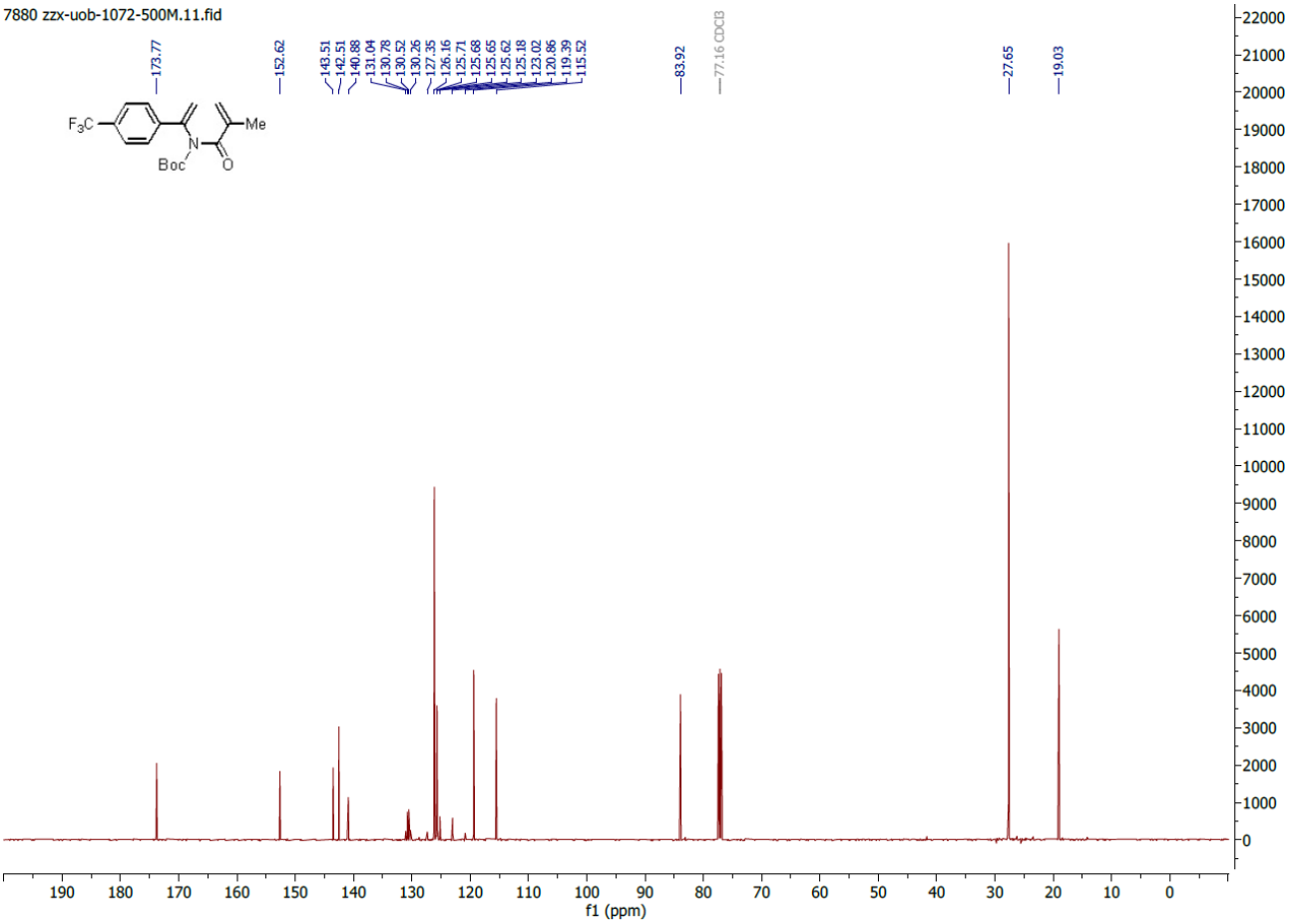


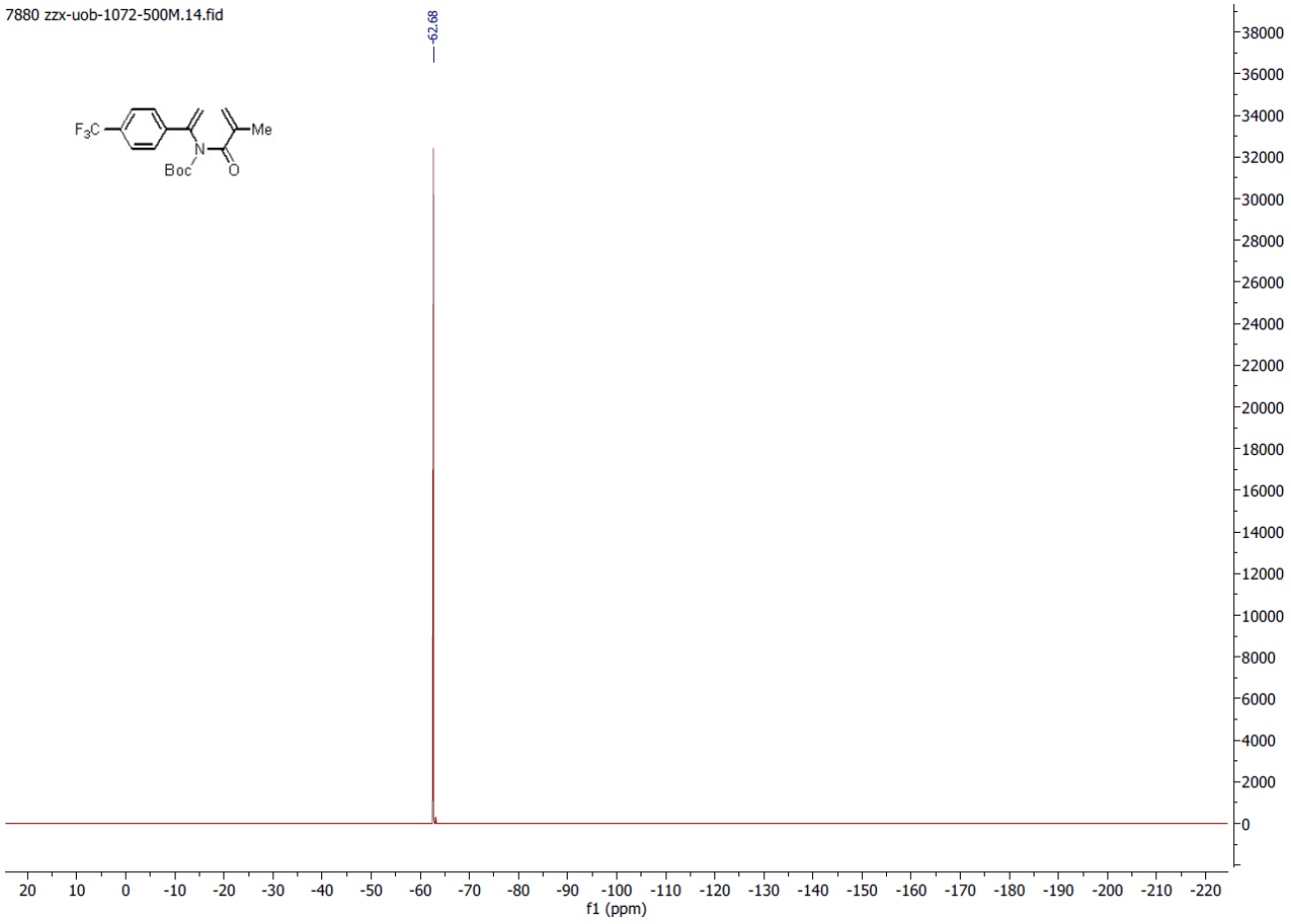



7875 zzx-uob-1069-500M.14.fid
-62.68
F3C
HN
O
Me
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

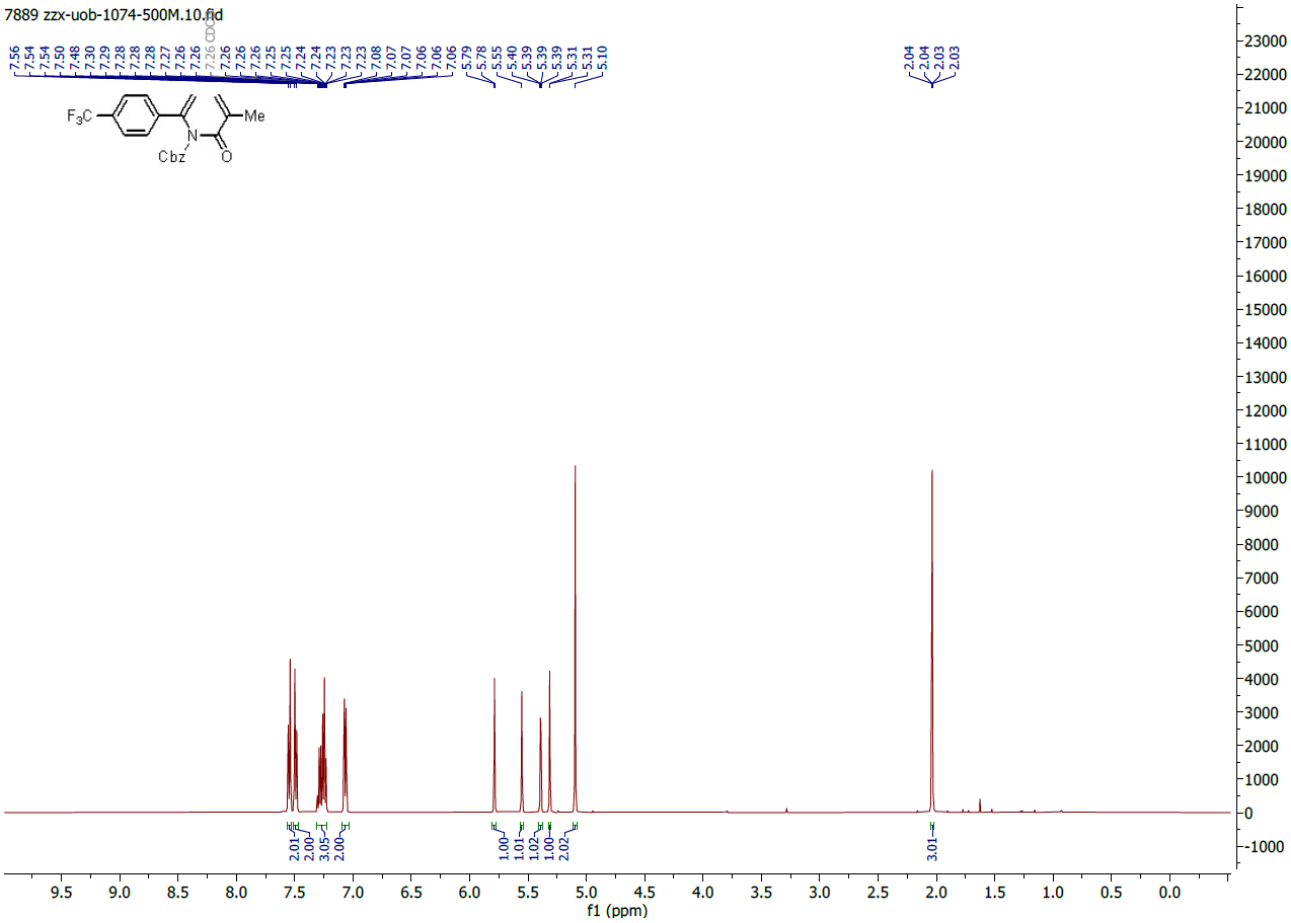
Compound 2a

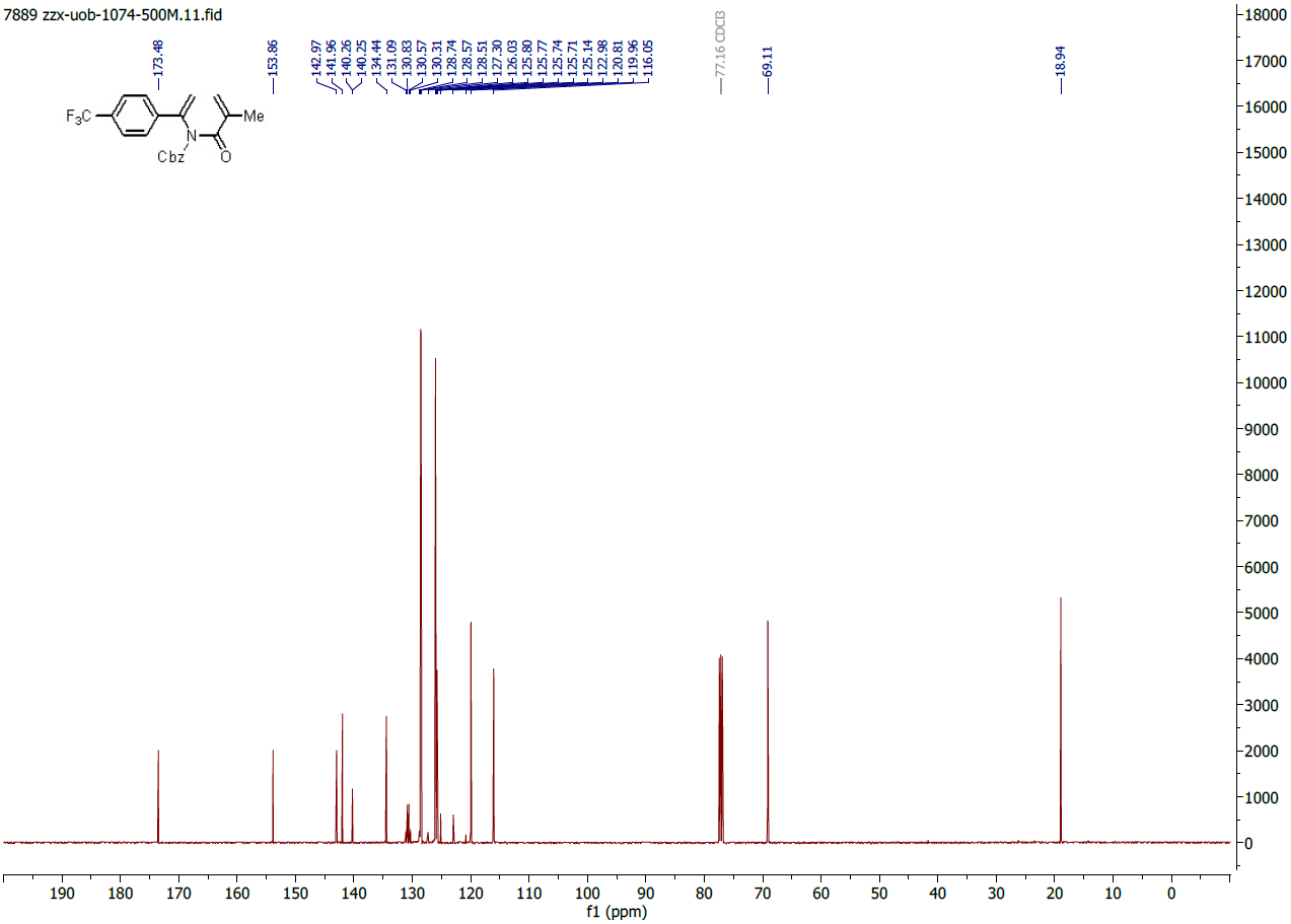

7880 zzx-uob-1072-500M.10.fid
7.61
7.60
7.56
7.54
7.54
7.26 CDCl3
5.74
5.73
5.58
5.42
5.41
5.41
5.41
5.29
5.29
2.07
1.31
F3C
N
Boc
O
Me
2.00
2.00
1.00
1.00
1.00
1.00
3.00
9.00
f1 (ppm)

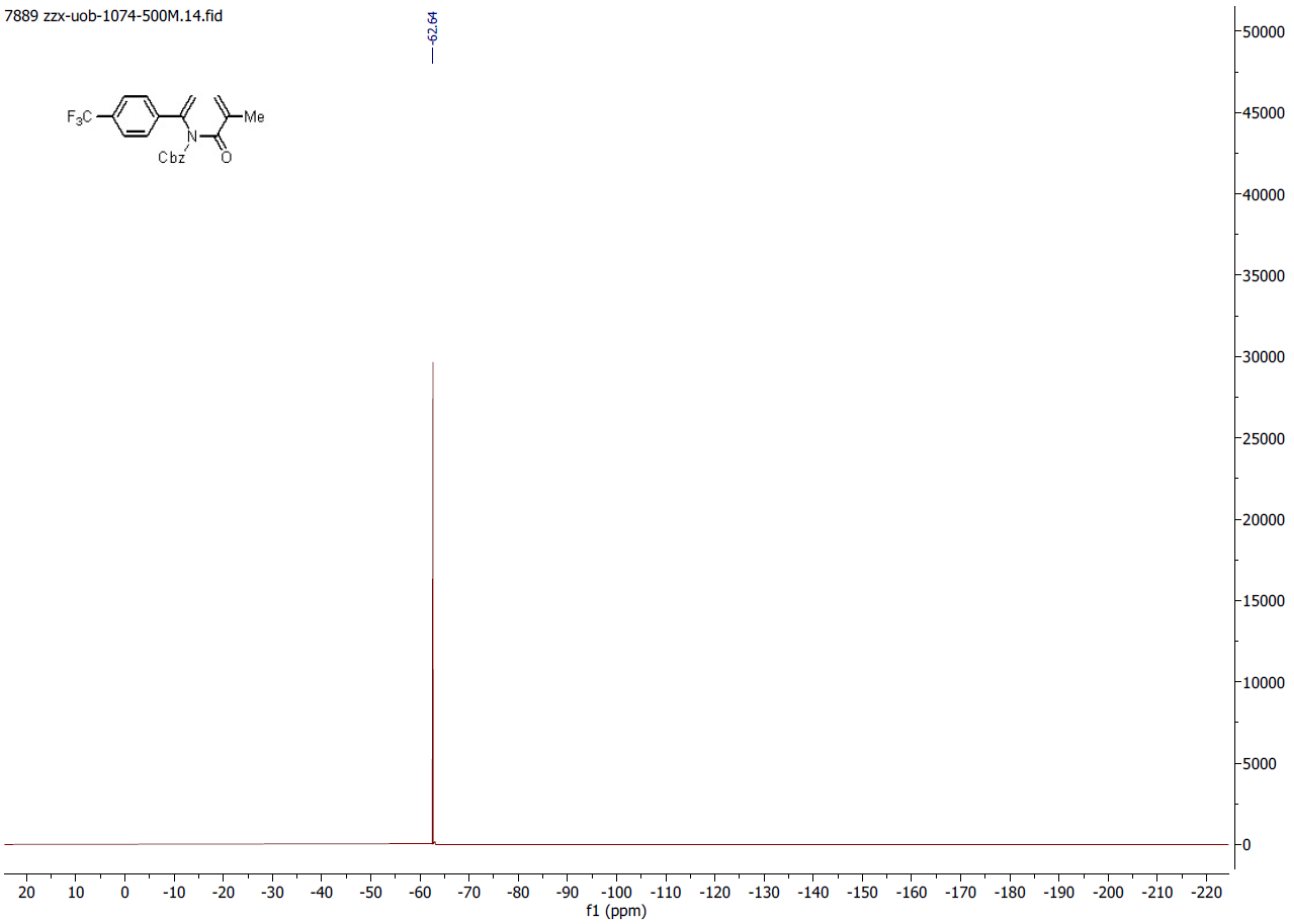

7880 zzx-uob-1072-500M.11.fid
173.77
152.62
143.51
142.51
140.88
131.04
130.78
130.52
130.26
127.35
126.16
125.71
125.68
125.65
125.62
125.18
123.02
120.86
119.39
115.52
83.92
77.16 CDCl3
27.65
19.03
F3C
N
Boc
O
Me
f1 (ppm)


7880 zzx-uob-1072-500M.14.fid
-62.68
F3C
N
Boc
O
Me
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

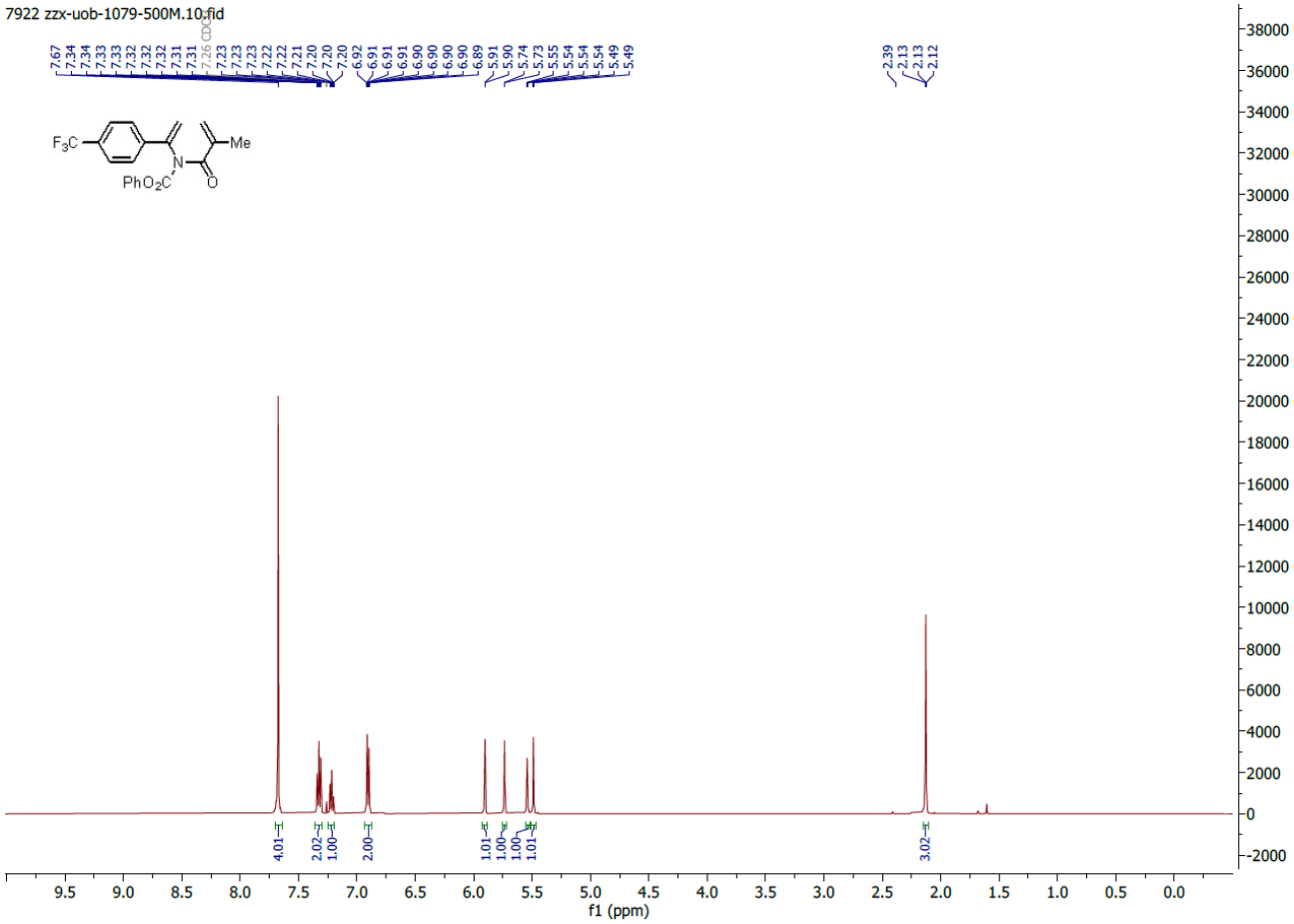
Compound 2b

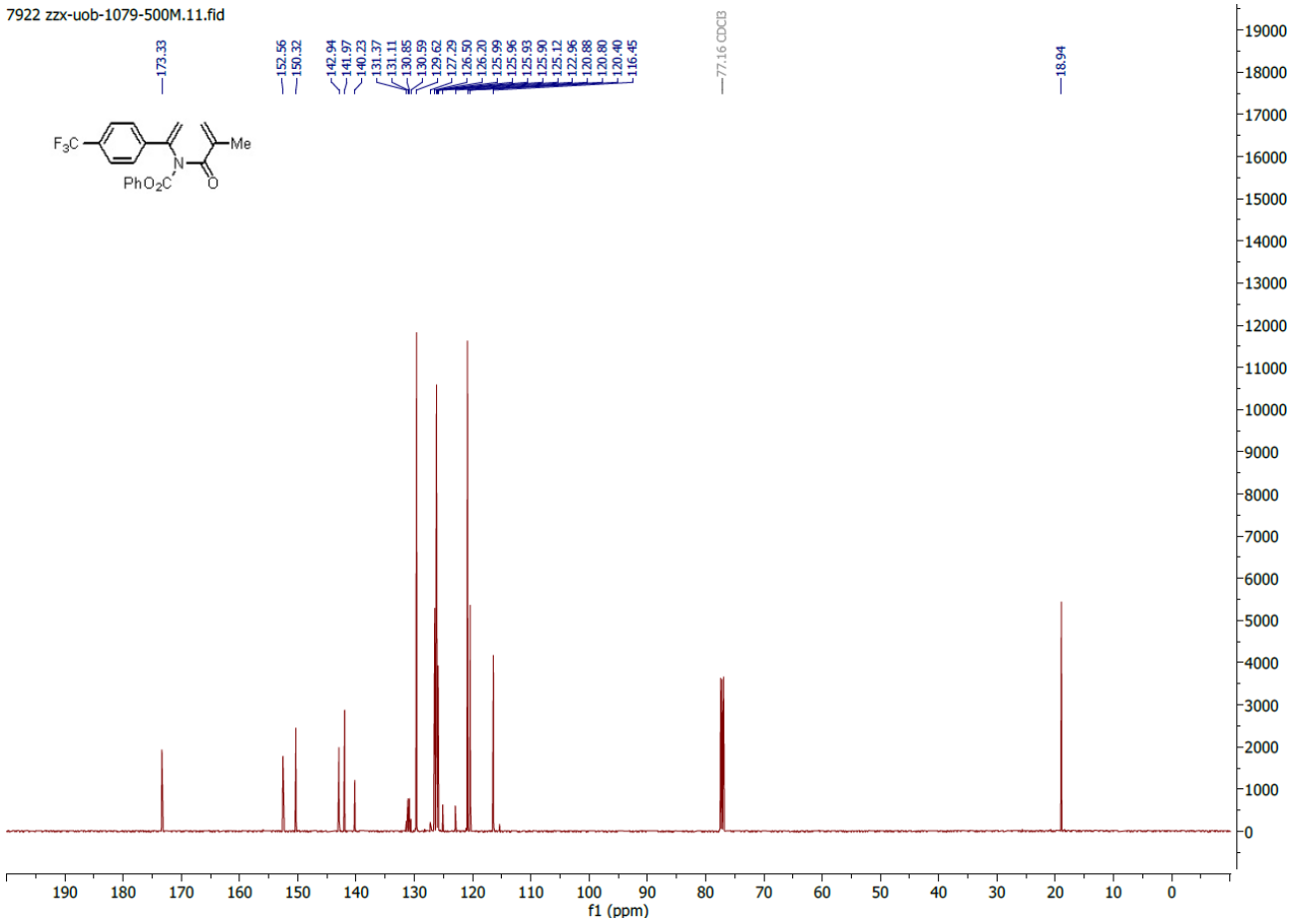

7889 zzx-uob-1074-500M.10.fid
F3C
Me
N
Cbz
O
f1 (ppm)

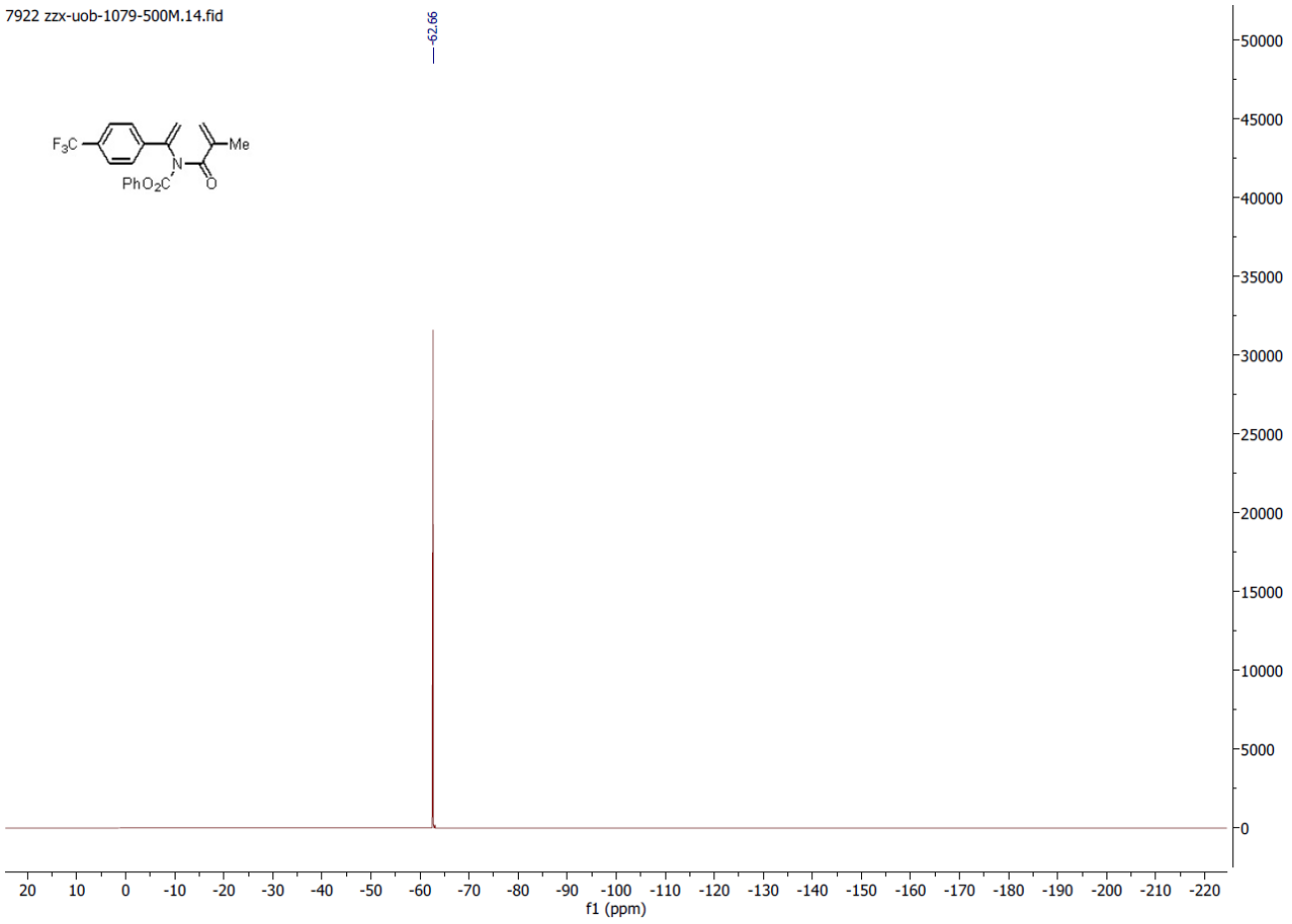

7889 zzx-uob-1074-500M.11.fid
F3C
Me
N
Cbz
O
f1 (ppm)


7889 zzx-uob-1074-500M.14.fid
-62.64
F3C
Me
N
Cbz
O
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

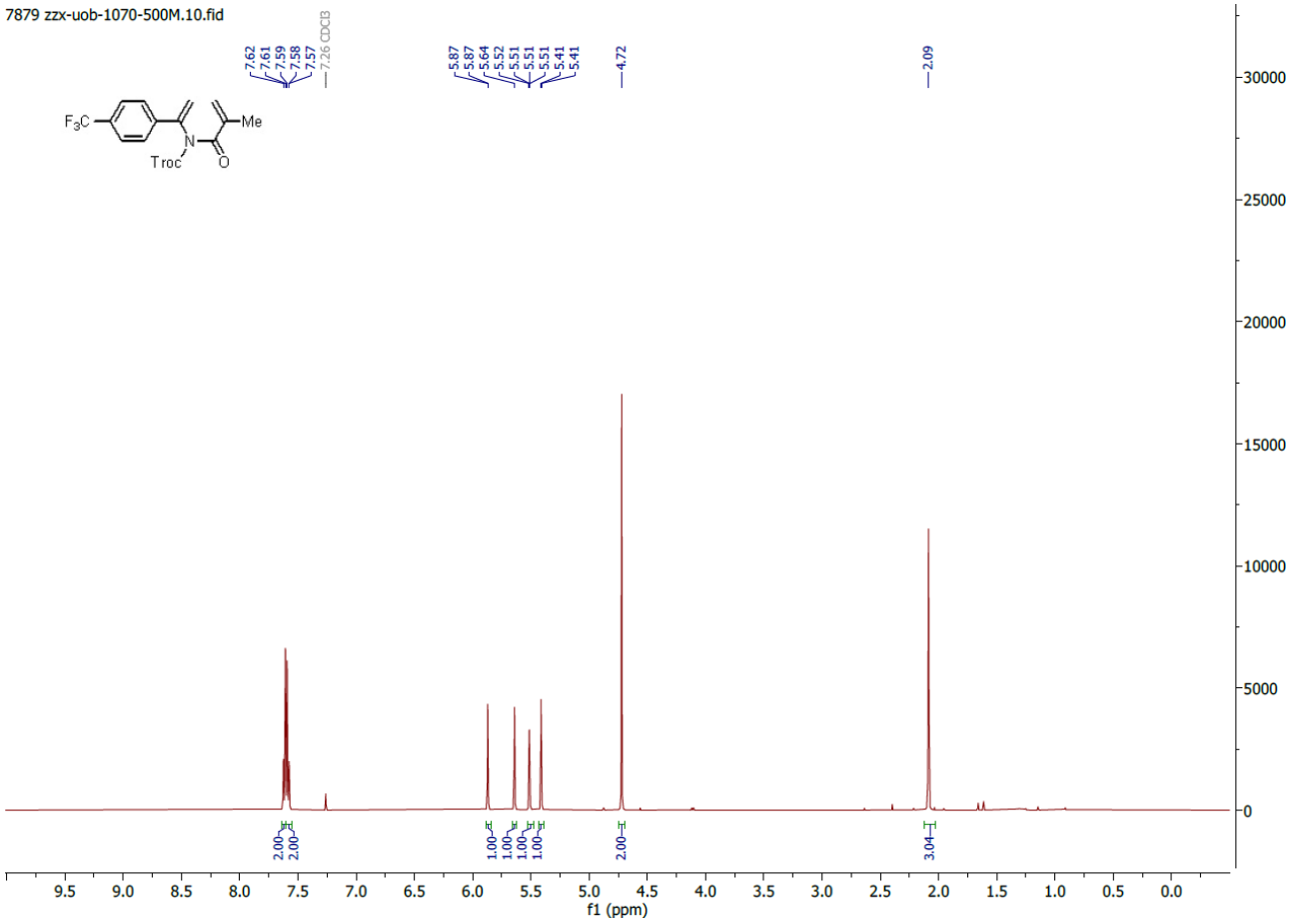
Compound 2c

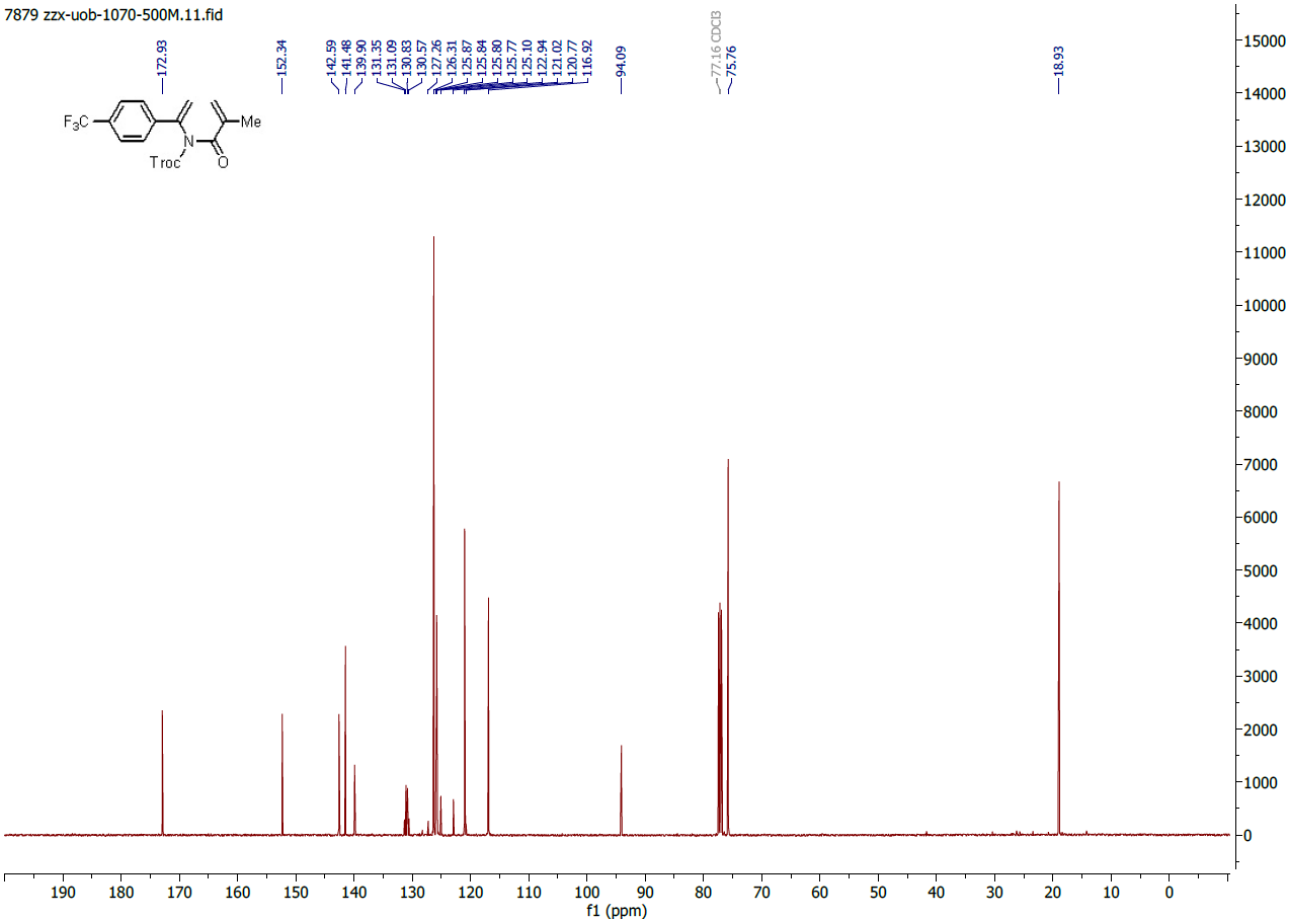

7922 zzx-uob-1079-500M.10.fid
7.67
7.34
7.34
7.33
7.33
7.32
7.32
7.32
7.31
7.31
7.26 CDCl3
7.23
7.23
7.23
7.22
7.22
7.21
7.20
7.20
7.20
6.92
6.91
6.91
6.91
6.90
6.90
6.90
6.90
6.90
6.89
5.91
5.90
5.74
5.73
5.55
5.54
5.54
5.54
5.49
5.49
2.39
2.13
2.13
2.12
F3C
Me
N
PhO2C
O
4.01
2.02
1.00
2.00
1.01
1.00
1.00
1.01
3.02
f1 (ppm)

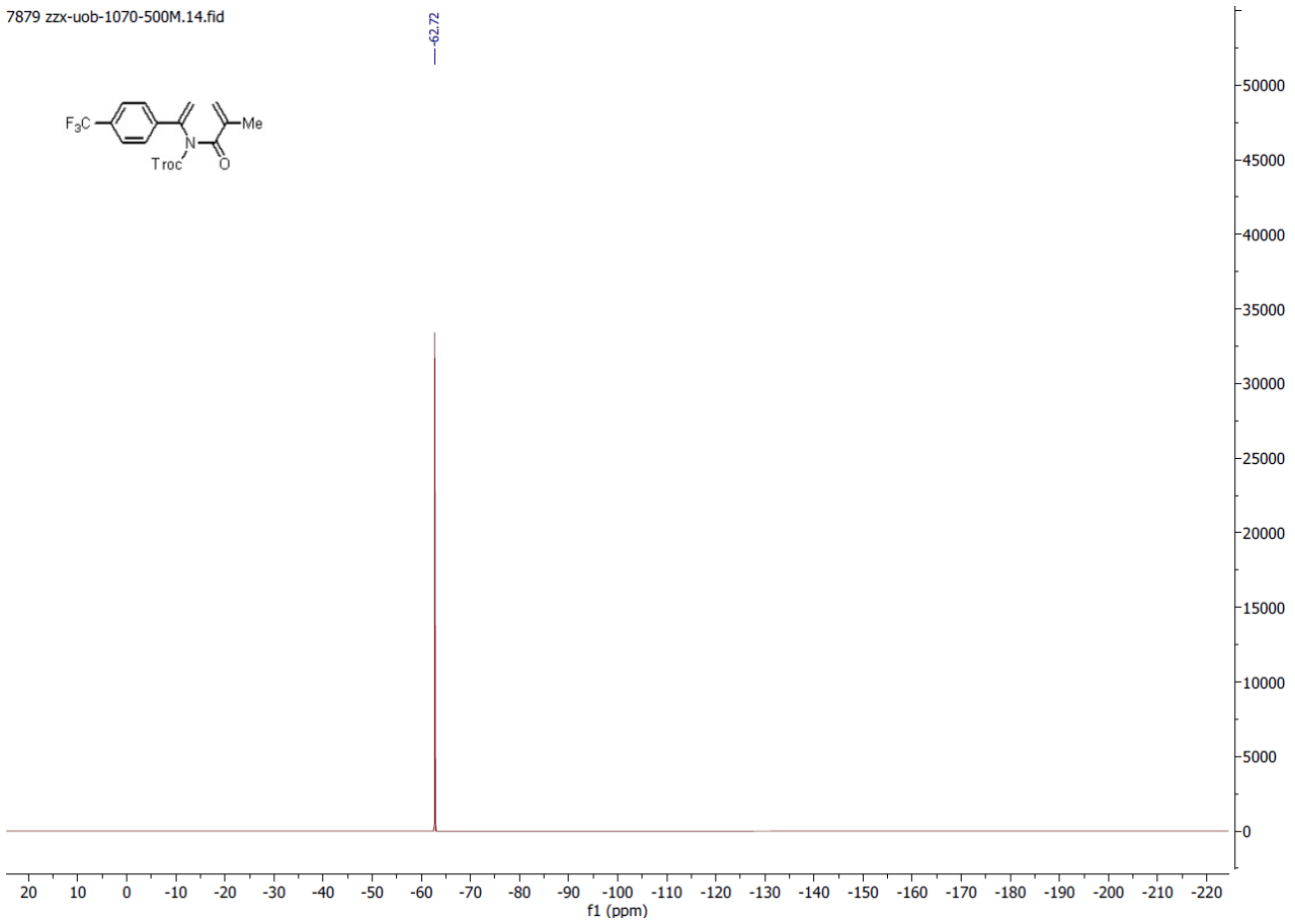

7922 zzx-uob-1079-500M.11.fid
173.33
152.56
150.32
142.94
141.97
140.23
131.37
131.11
130.85
130.59
129.62
127.29
126.50
126.20
125.99
125.96
125.93
125.90
125.12
122.96
120.88
120.80
120.40
116.45
77.16 CDCl3
18.94
F3C
Me
N
PhO2C
O
f1 (ppm)


7922 zzx-uob-1079-500M.14.fid
-62.66
F3C
Me
N
PhO2C
O
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

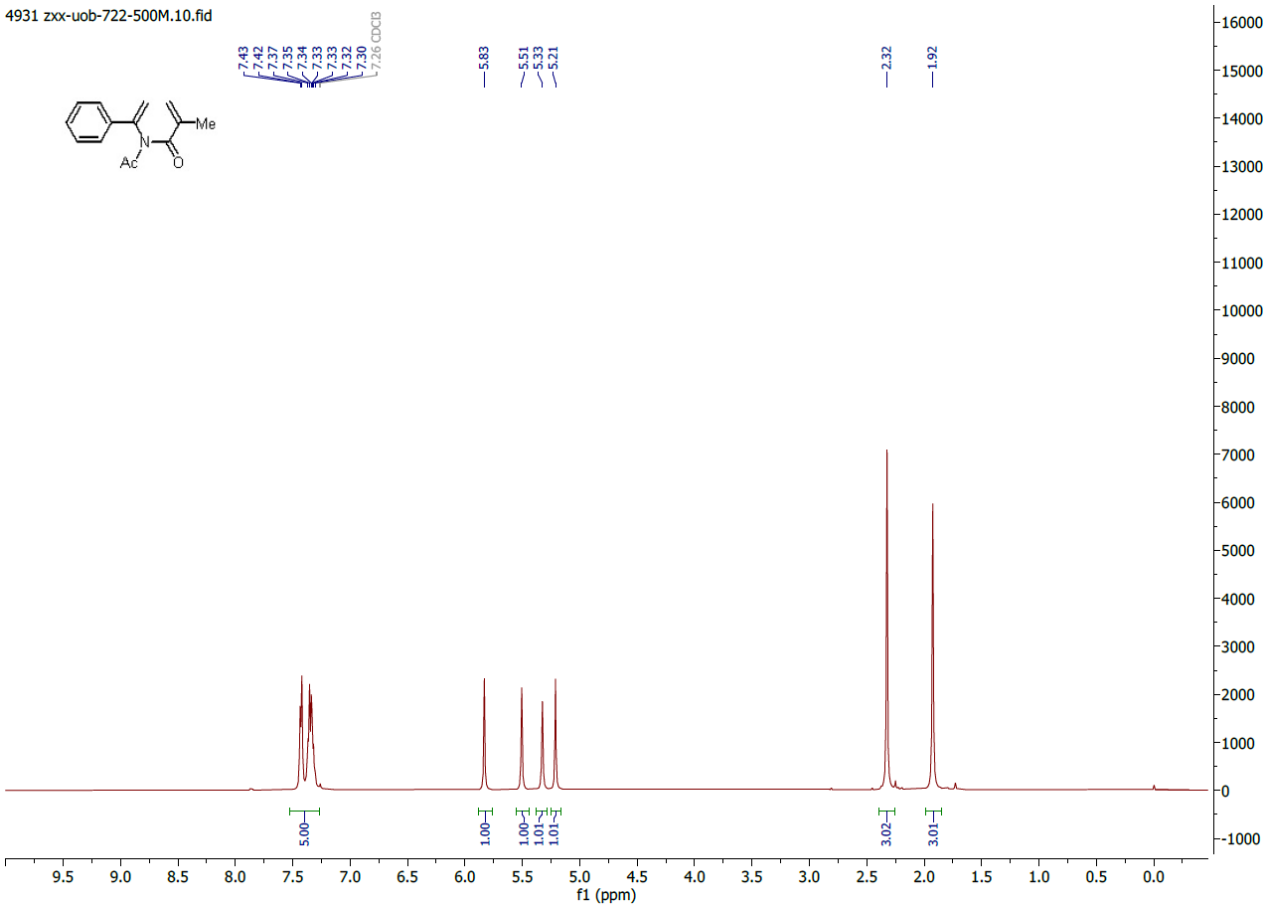
Compound 2e

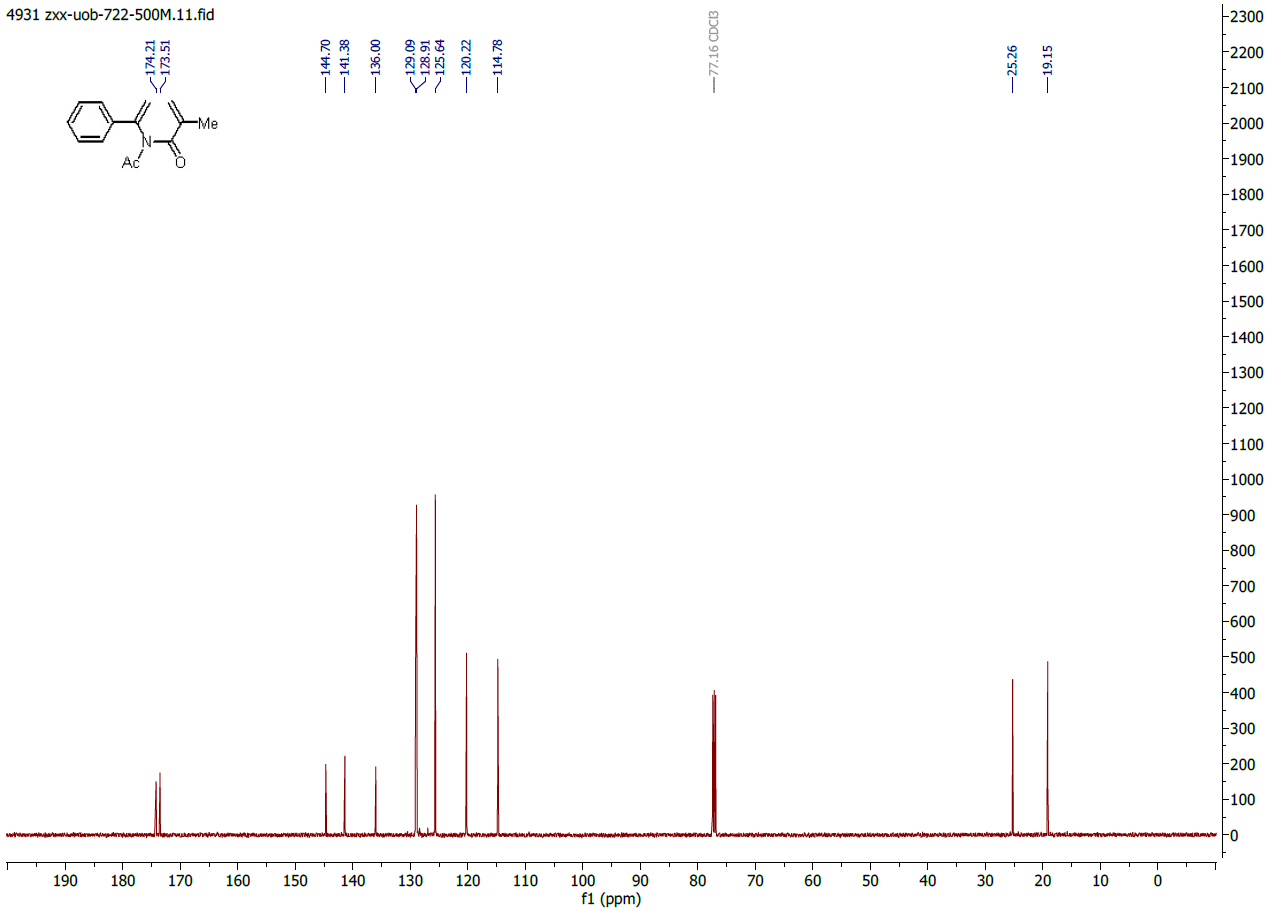

7879 zzx-uob-1070-500M.10.fid
7.62
7.61
7.59
7.58
7.57
7.26 CDCl3
5.87
5.87
5.64
5.52
5.51
5.51
5.51
5.41
5.41
4.72
2.09
F3C
Me
N
Troc
O
2.00
2.00
1.00
1.00
1.00
1.00
2.00
3.04
f1 (ppm)


7879 zzx-uob-1070-500M.11.fid
172.93
152.34
142.59
141.48
139.90
131.35
131.09
130.83
130.57
127.26
126.31
125.87
125.84
125.80
125.77
125.10
122.94
121.02
120.77
116.92
94.09
77.16 CDCl3
75.76
18.93
F3C
Me
N
Troc
O
f1 (ppm)

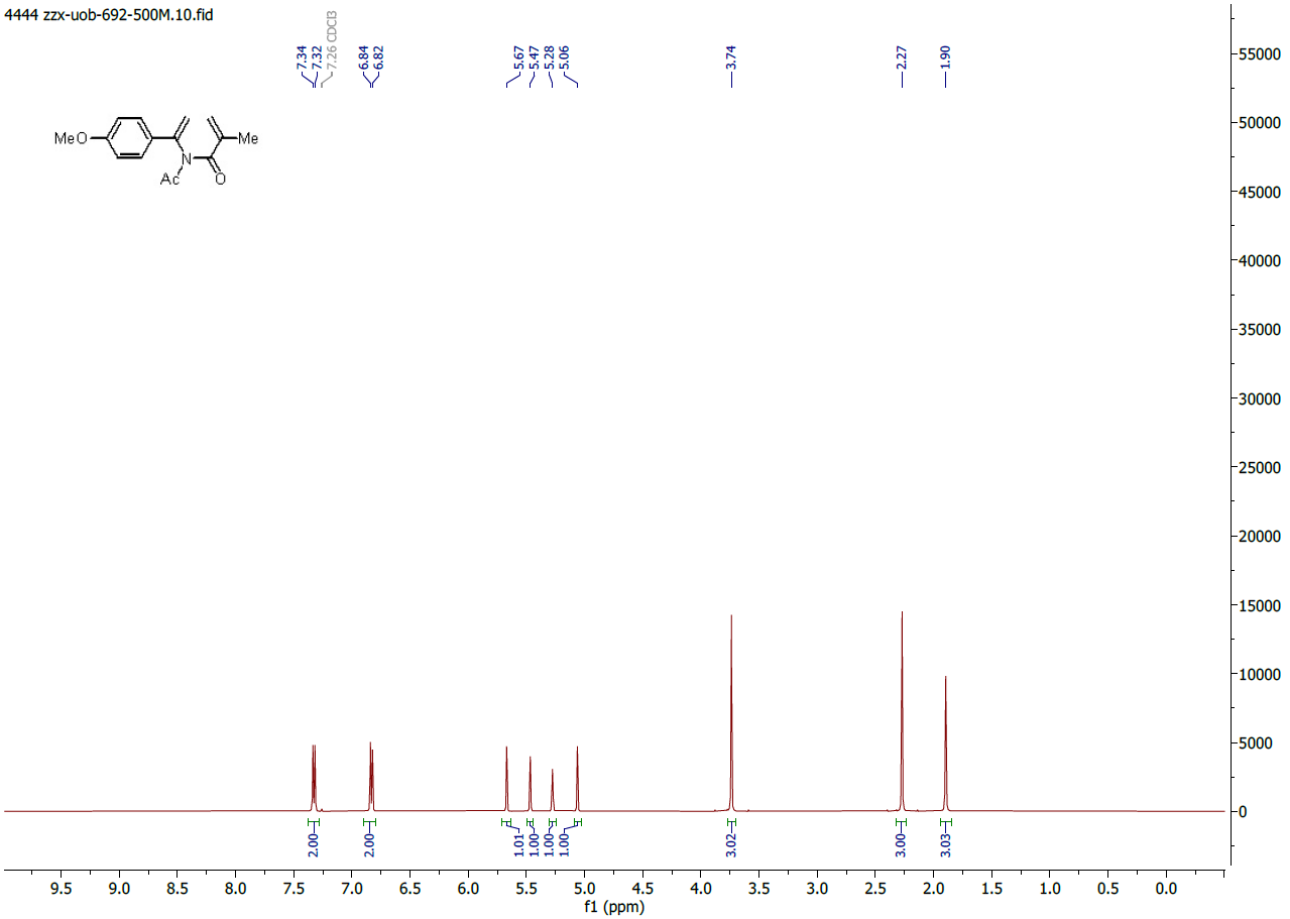

7879 zzx-uob-1070-500M.14.fid
-62.72
F3C
N
Troc
O
Me
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

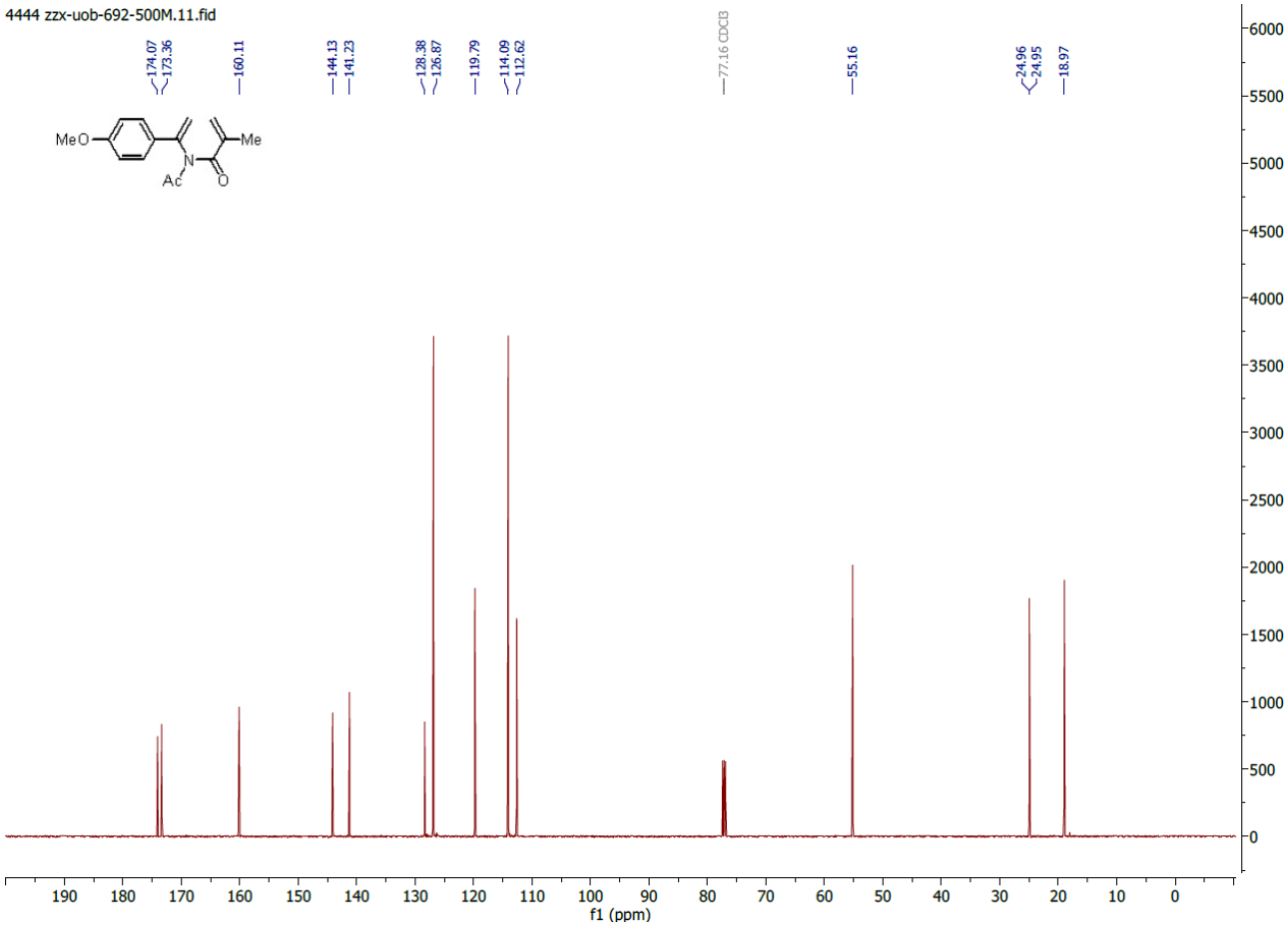
Compound 2f


4931 zxx-uob-722-500M.10.fid
7.43
7.42
7.37
7.35
7.34
7.33
7.33
7.32
7.30
7.26 CDCl3
5.83
5.51
5.33
5.21
2.32
1.92
Me
Ac
O
N
5.00
1.00
1.00
1.01
1.01
3.02
3.01
f1 (ppm)

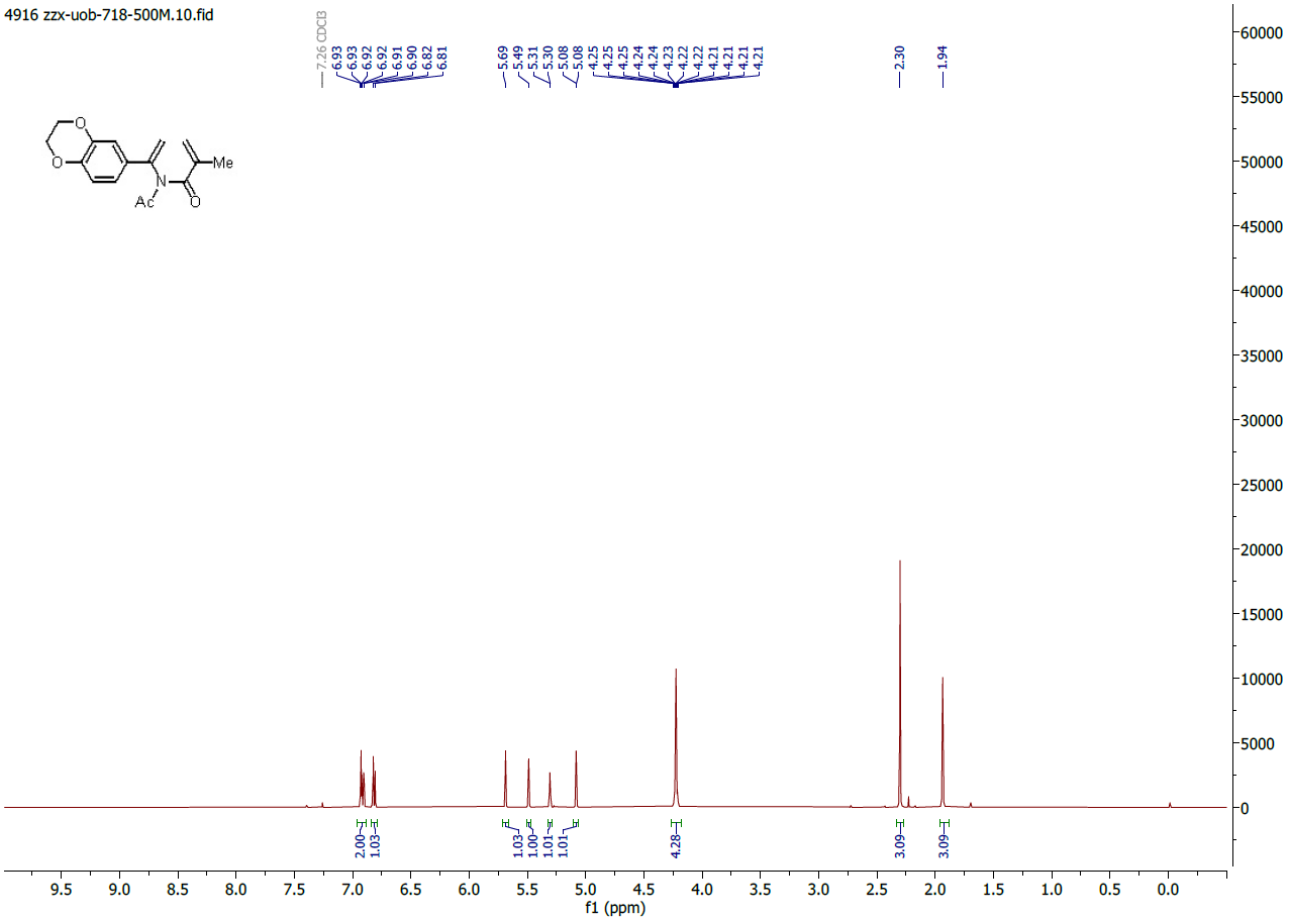

4931 zxx-uob-722-500M.11.fid
174.21
173.51
144.70
141.38
136.00
129.09
128.91
125.64
120.22
114.78
77.16 CDCl3
25.26
19.15
Me
Ac
O
N
f1 (ppm)

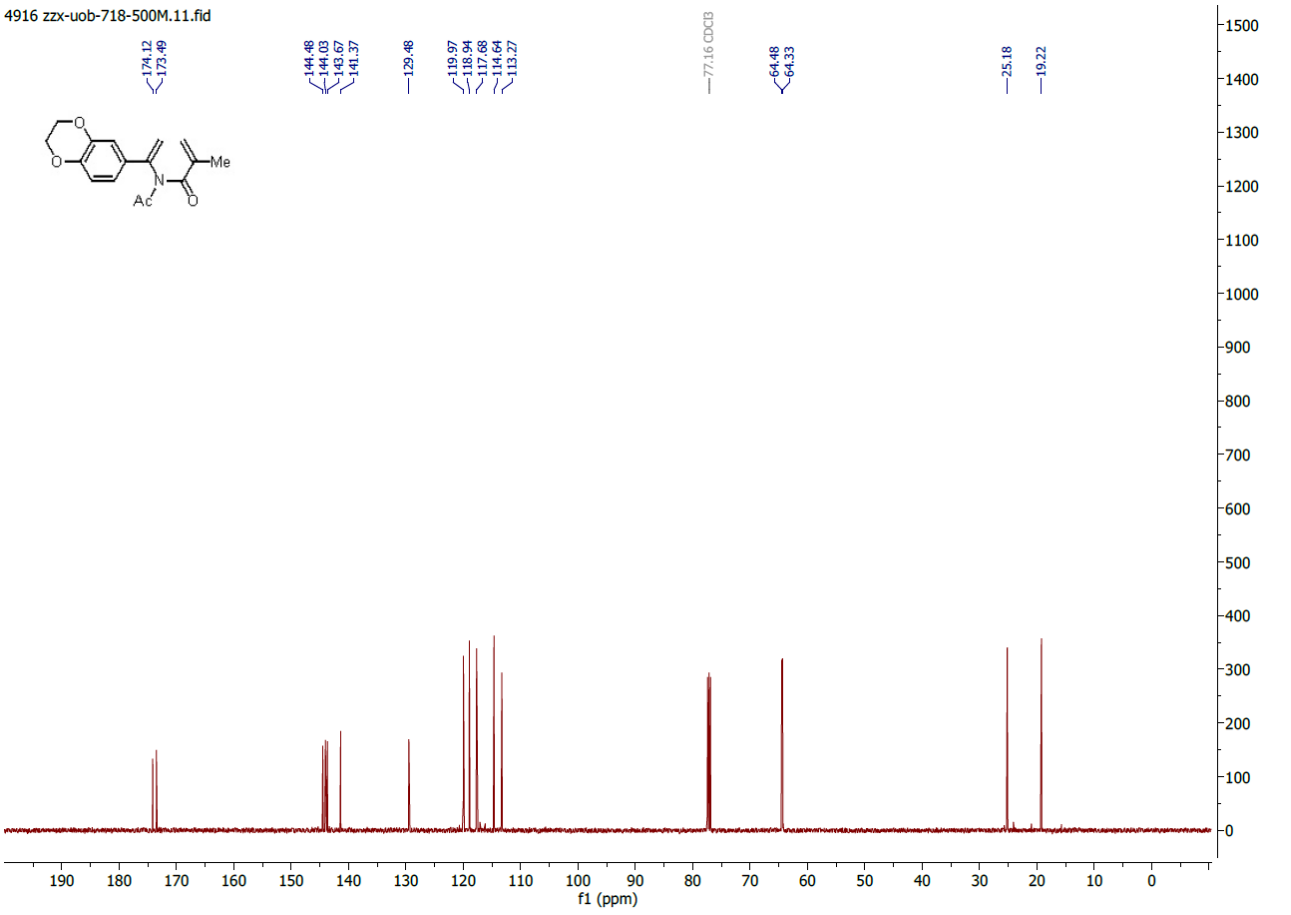
Compound 2g


4444 zzx-uob-692-500M.10.fid
7.34
7.32
7.26 CDCl3
6.84
6.82
5.67
5.47
5.28
5.06
3.74
2.27
1.90
MeO
Me
N
Ac
O
2.00
2.00
1.01
1.00
1.00
1.00
3.02
3.00
3.03
f1 (ppm)

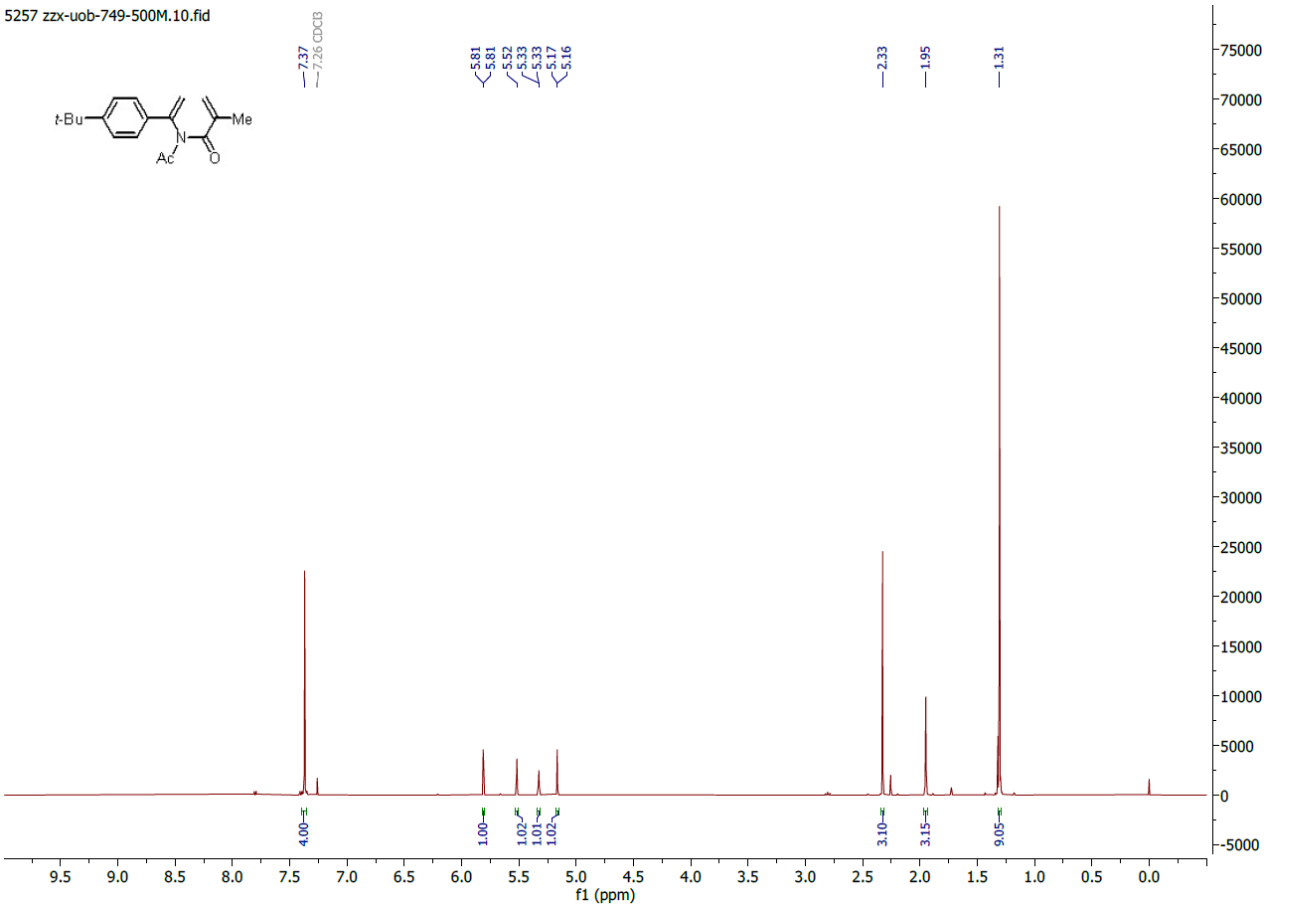

4444 zzx-uob-692-500M.11.fid
174.07
173.36
160.11
144.13
141.23
128.38
126.87
119.79
114.09
112.62
77.16 CDCl3
55.16
24.96
24.95
18.97
MeO
Me
N
Ac
O
f1 (ppm)

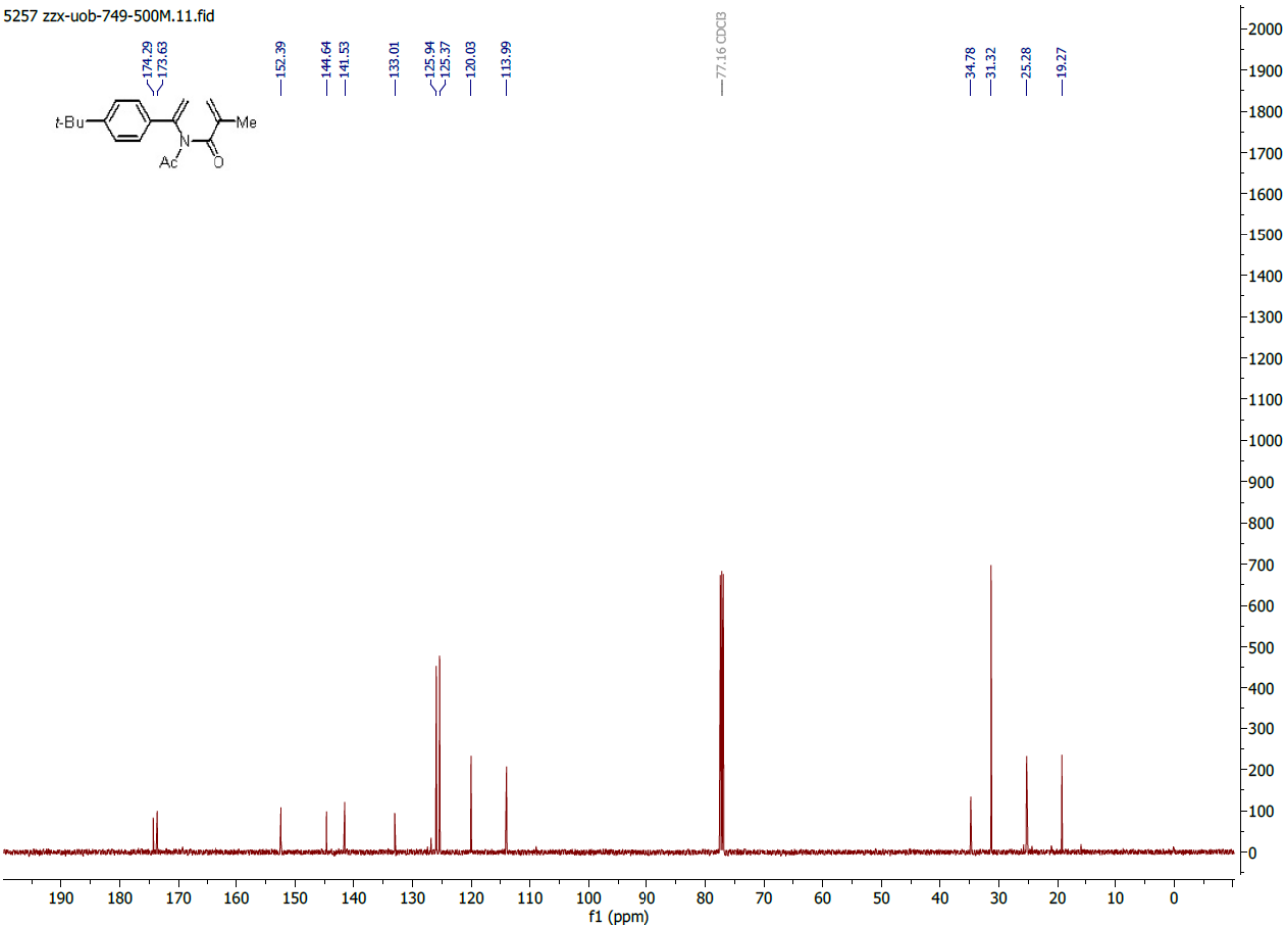
Compound 2h


4916 zzx-uob-718-500M.10.fid
7.26 CDCl3
6.93
6.93
6.92
6.92
6.91
6.90
6.82
6.81
5.69
5.49
5.31
5.30
5.08
5.08
4.25
4.25
4.24
4.24
4.23
4.22
4.22
4.21
4.21
4.21
4.21
2.30
1.94
Me
N
Ac
O
O
2.00
1.03
1.03
1.00
1.01
1.01
4.28
3.09
3.09
f1 (ppm)

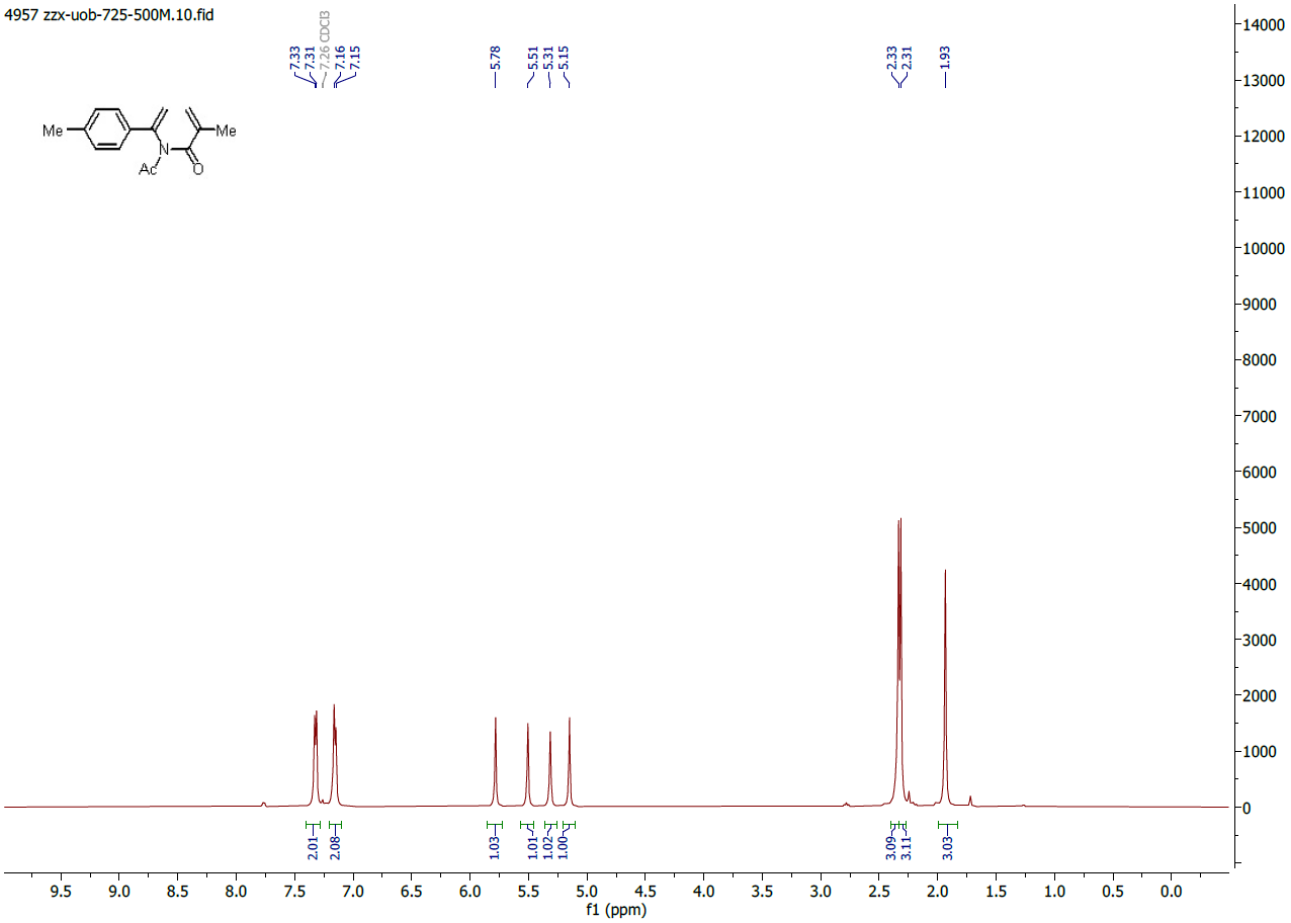

4916 zzx-uob-718-500M.11.fid
174.12
173.49
144.48
144.03
143.67
141.37
129.48
119.97
118.94
117.68
114.64
113.27
77.16 CDCl3
64.48
64.33
25.18
19.22
Me
N
Ac
O
O
f1 (ppm)

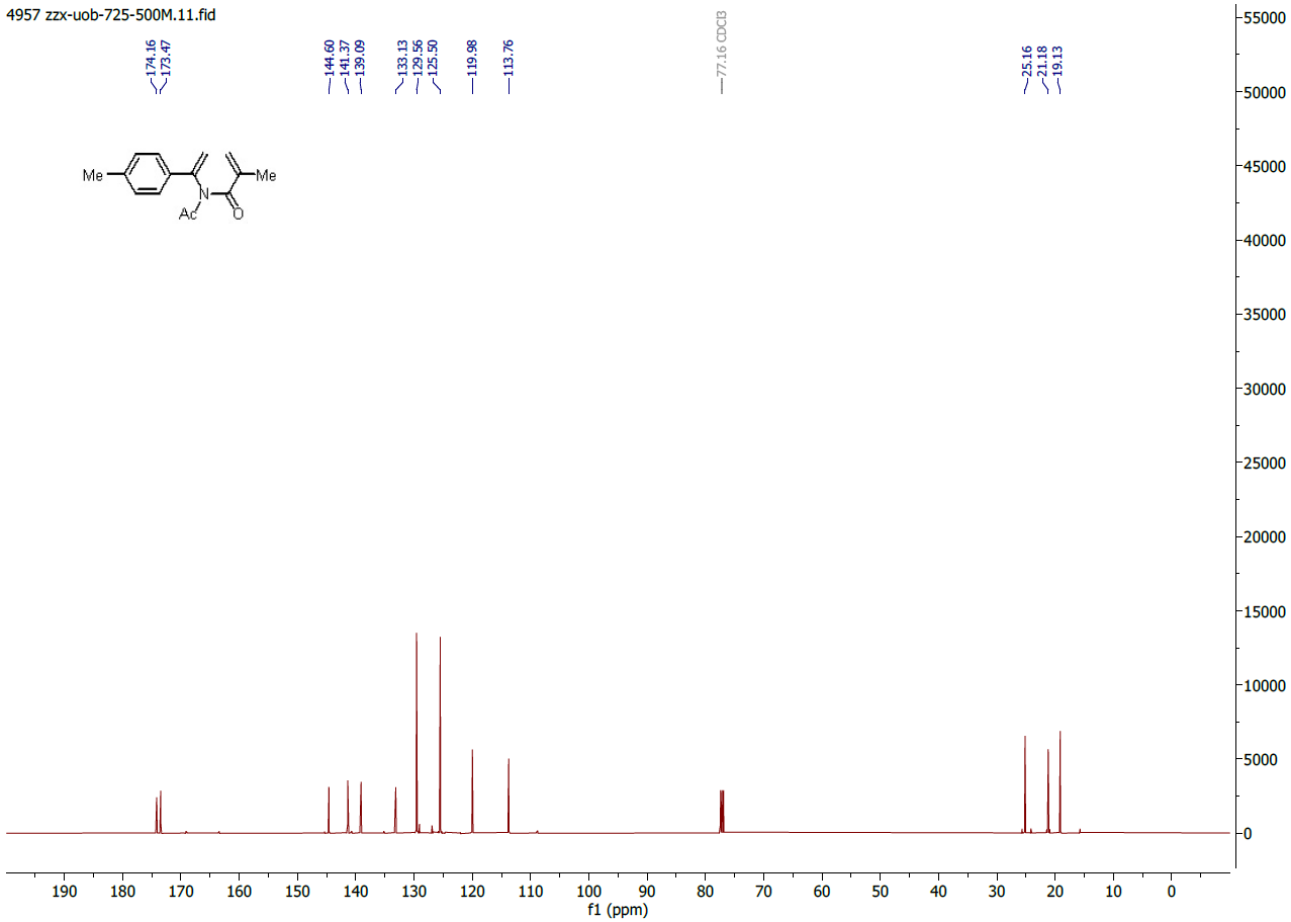
Compound 2i


5257 zzx-uob-749-500M.10.fid
7.37
7.26 CDCl3
5.81
5.81
5.52
5.33
5.33
5.17
5.16
2.33
1.95
1.31
t-Bu
Me
N
Ac
O
4.00
1.00
1.02
1.01
1.02
3.10
3.15
9.05
f1 (ppm)

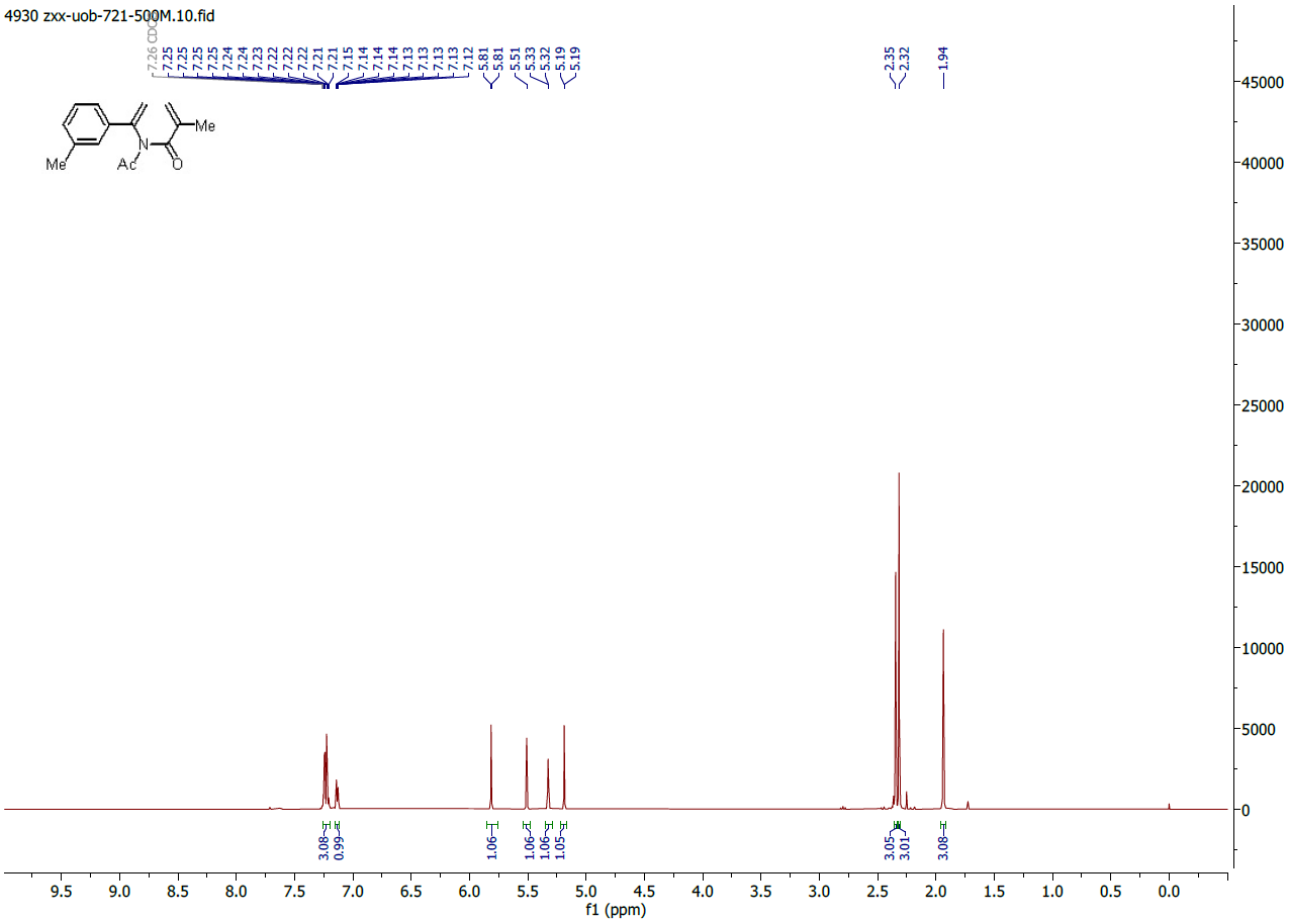

5257 zzx-uob-749-500M.11.fid
174.29
173.63
152.39
144.64
141.53
133.01
125.94
125.37
120.03
113.99
77.16 CDCl3
34.78
31.32
25.28
19.27
t-Bu
Me
N
Ac
O
f1 (ppm)

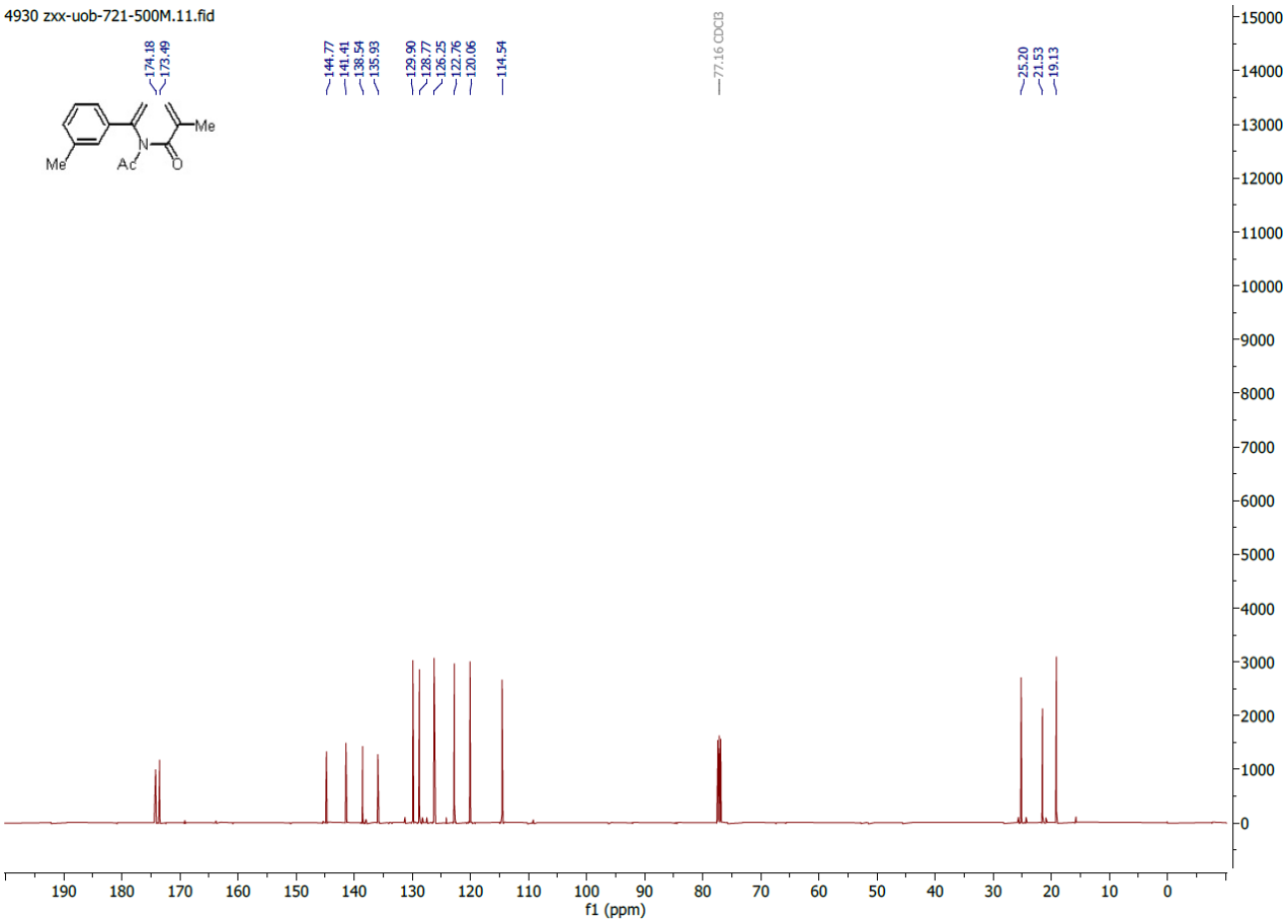
Compound 2j


4957 zzx-uob-725-500M.10.fid
7.33
7.31
7.26 CDCl3
7.16
7.15
5.78
5.51
5.31
5.15
2.33
2.31
1.93
Me
Me
N
Ac
O
2.01
2.08
1.03
1.01
1.02
1.00
3.09
3.11
3.03
f1 (ppm)

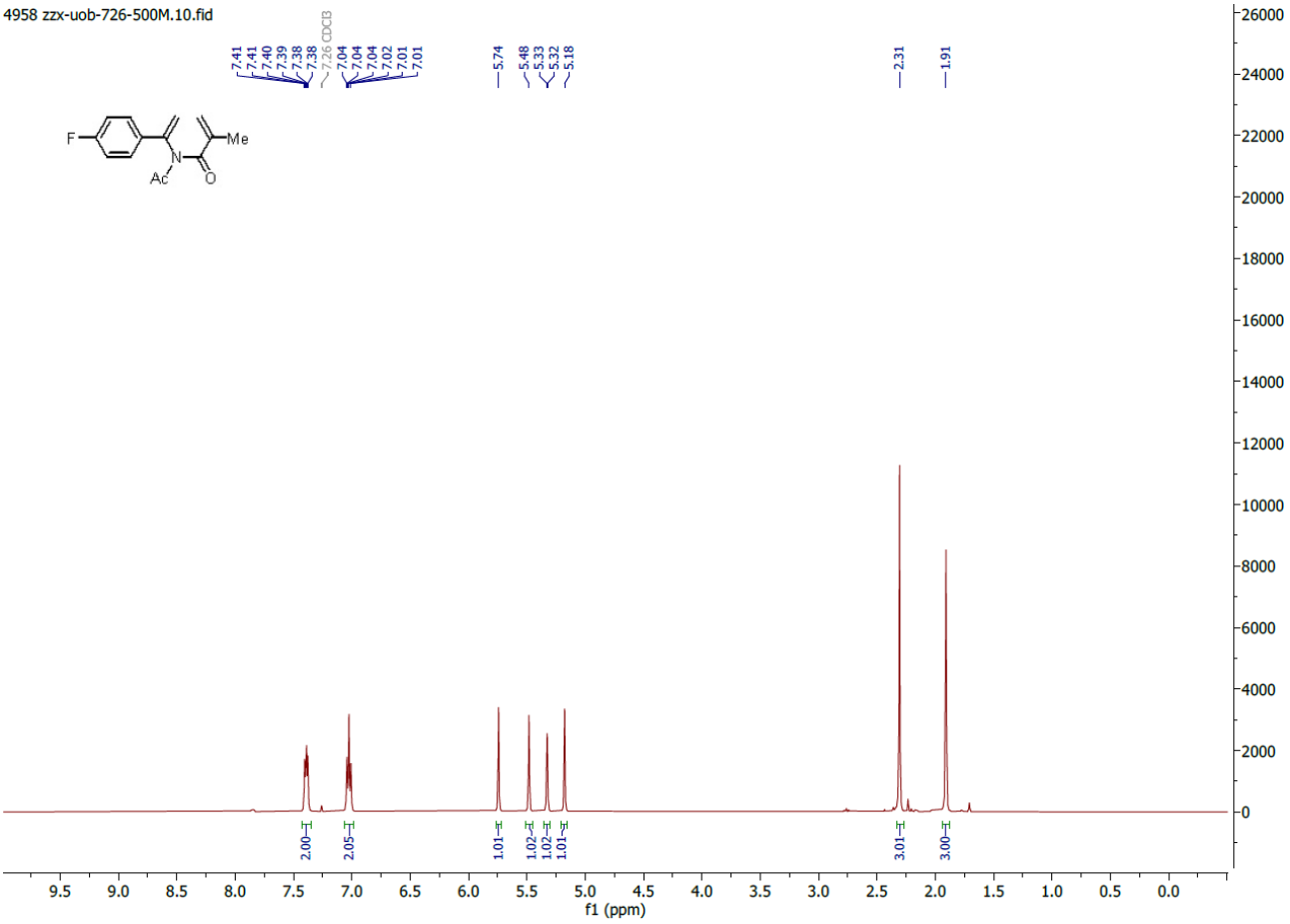

4957 zzx-uob-725-500M.11.fid
174.16
173.47
144.60
141.37
139.09
133.13
129.56
125.50
119.98
113.76
77.16 CDCl3
25.16
21.18
19.13
Me
Me
N
Ac
O
f1 (ppm)

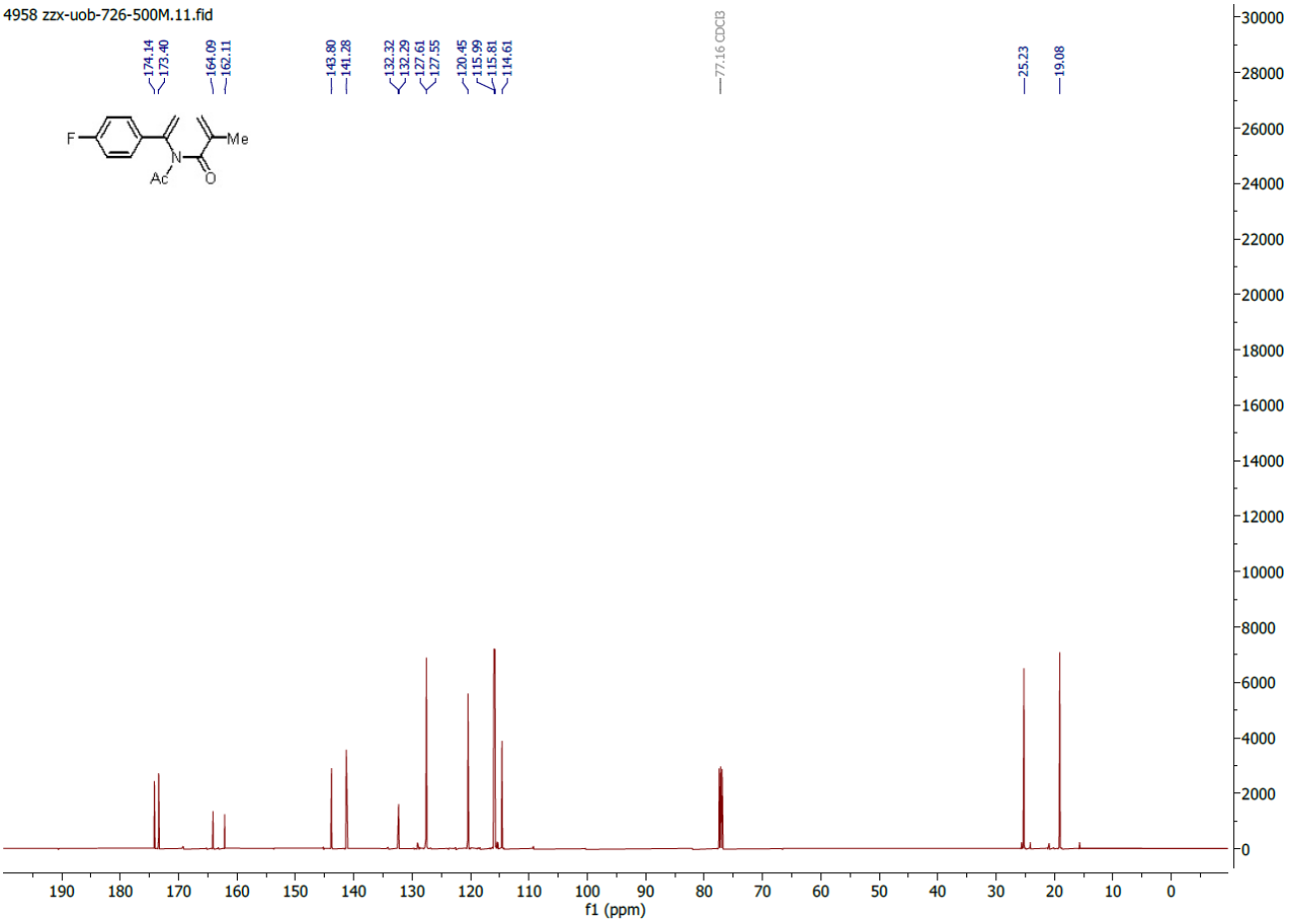
Compound k

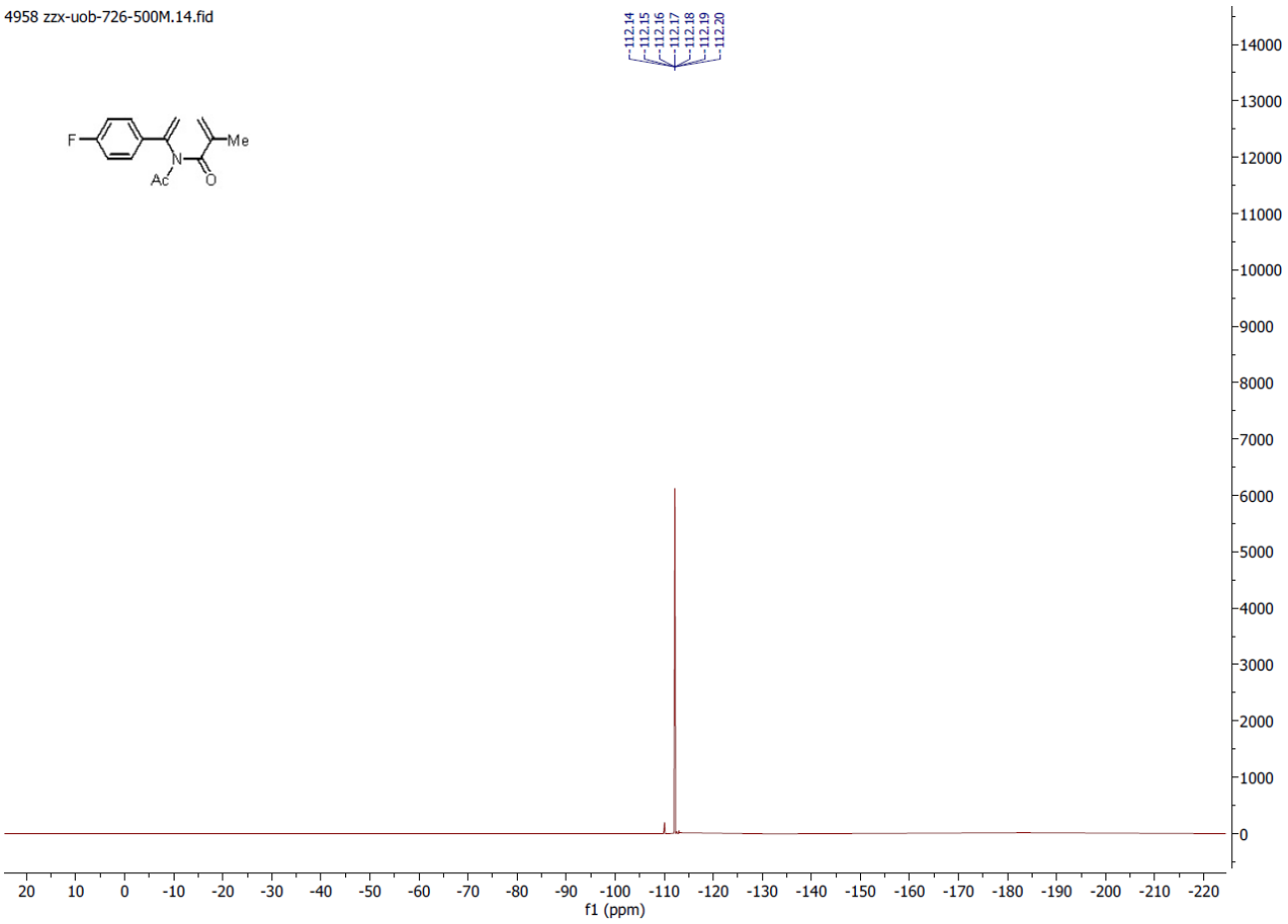

4930 zxx-uob-721-500M.10.fid
Me
Ac
Me
O
f1 (ppm)


4930 zxx-uob-721-500M.11.fid
Me
Ac
Me
O
f1 (ppm)

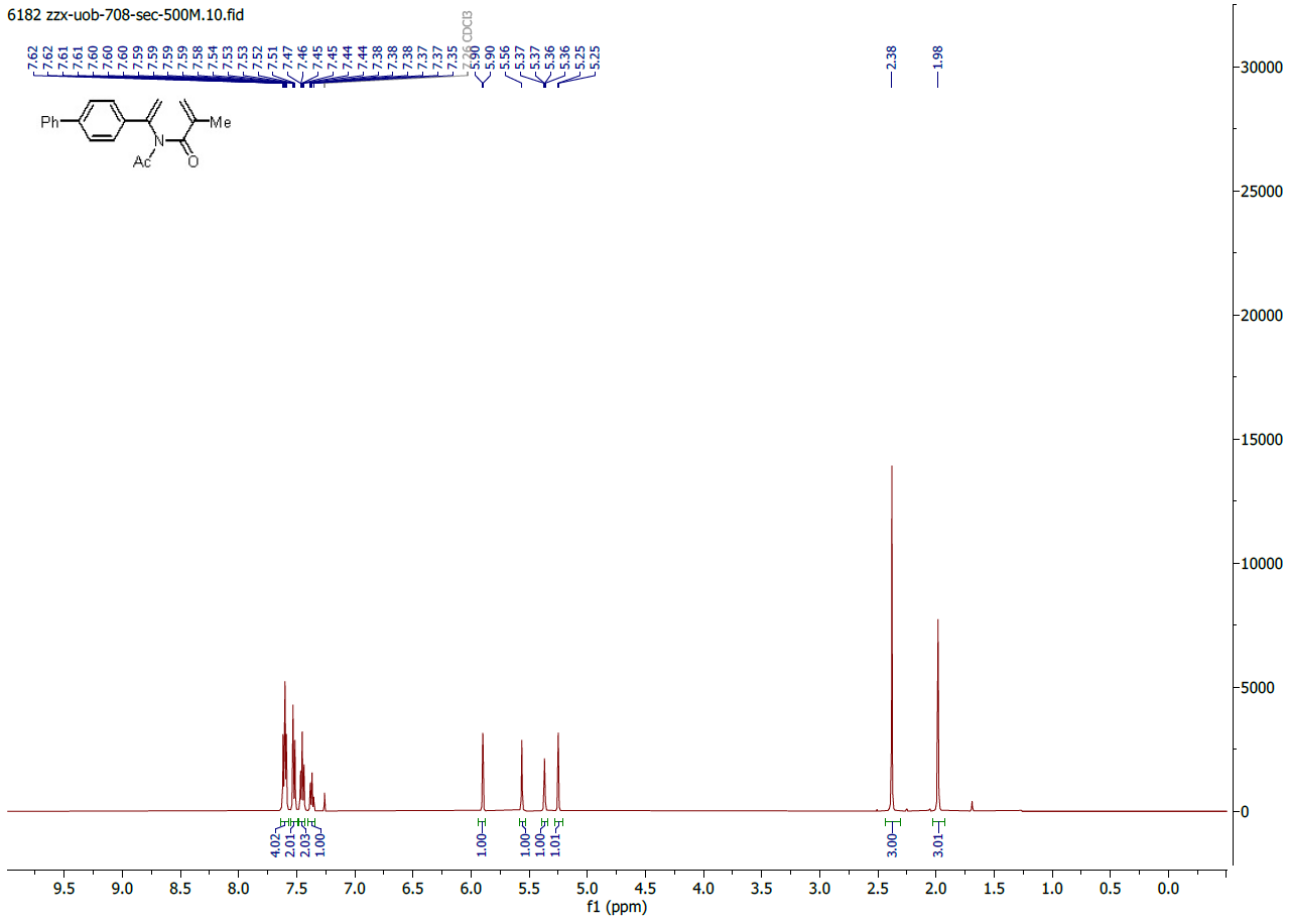
Compound 2l

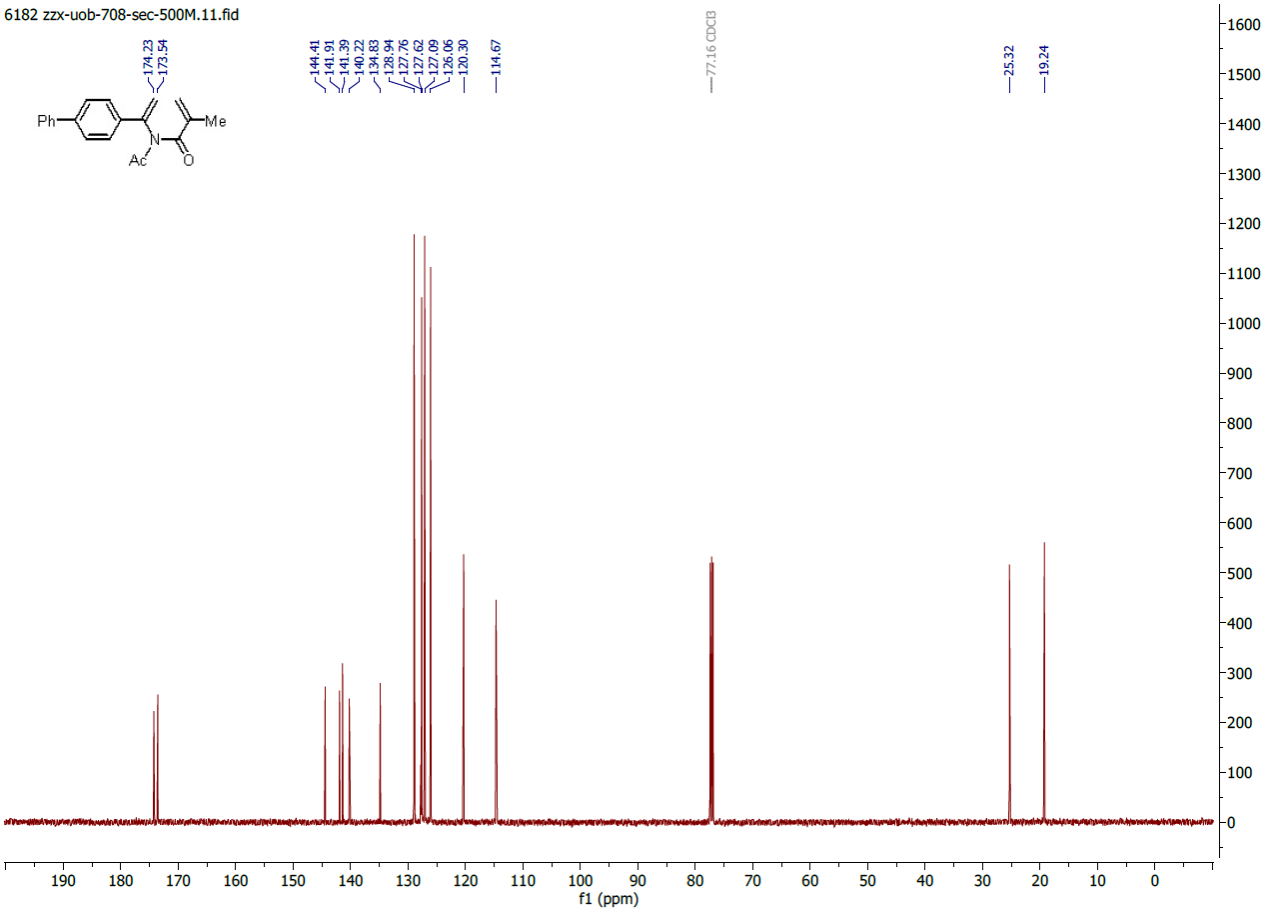

4958 zzx-uob-726-500M.10.fid
7.41
7.41
7.40
7.39
7.38
7.38
7.26 CDCl3
7.04
7.04
7.04
7.02
7.01
7.01
5.74
5.48
5.33
5.32
5.18
2.31
1.91
F
N
Ac
O
Me
2.00
2.05
1.01
1.02
1.02
1.01
3.01
3.00
f1 (ppm)


4958 zzx-uob-726-500M.11.fid
174.14
173.40
164.09
162.11
143.80
141.28
132.32
132.29
127.61
127.55
120.45
115.99
115.81
114.61
77.16 CDCl3
25.23
19.08
F
N
Ac
O
Me
f1 (ppm)

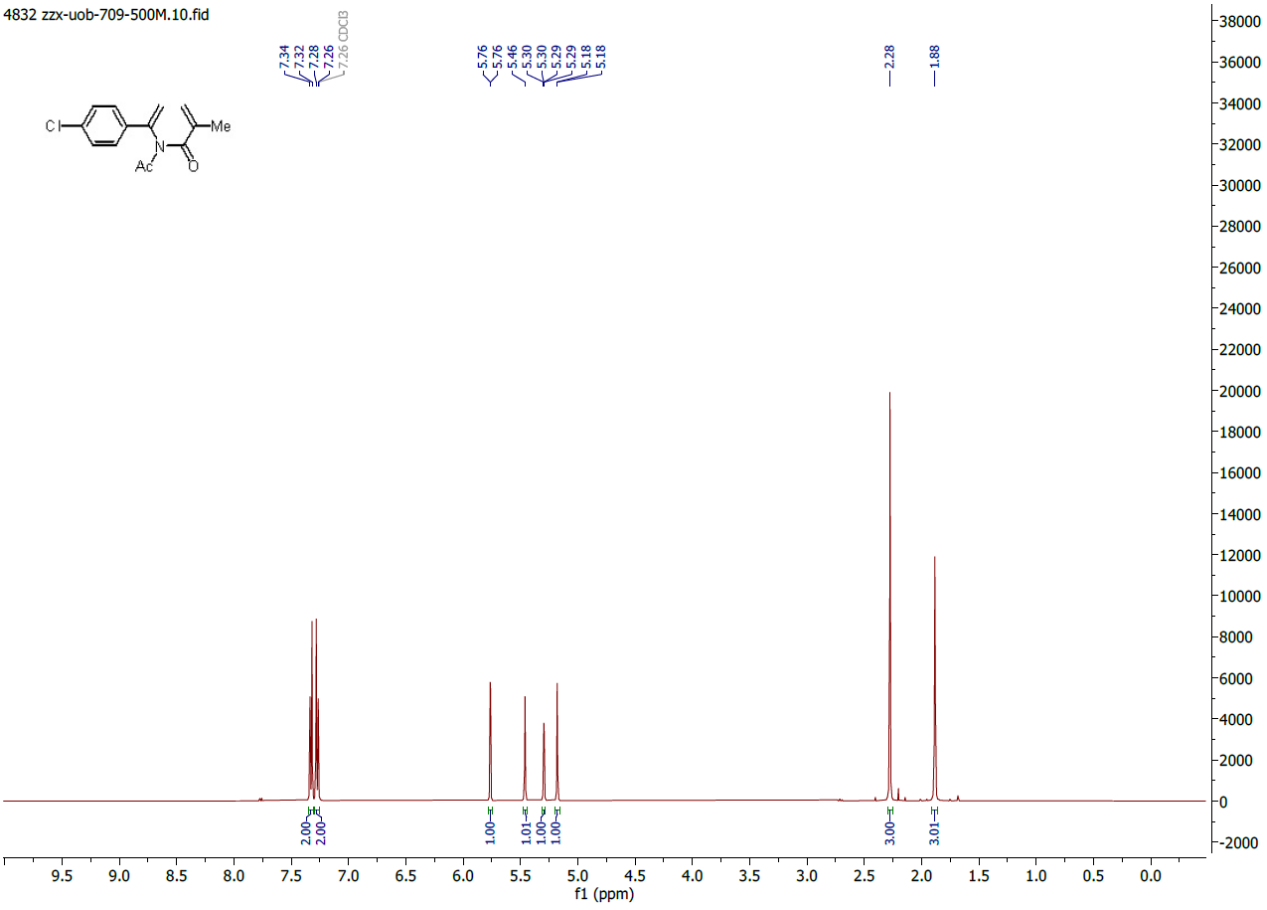

4958 zzx-uob-726-500M.14.fid
-112.14
-112.15
-112.16
-112.17
-112.18
-112.19
-112.20
F
N
Ac
O
Me
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

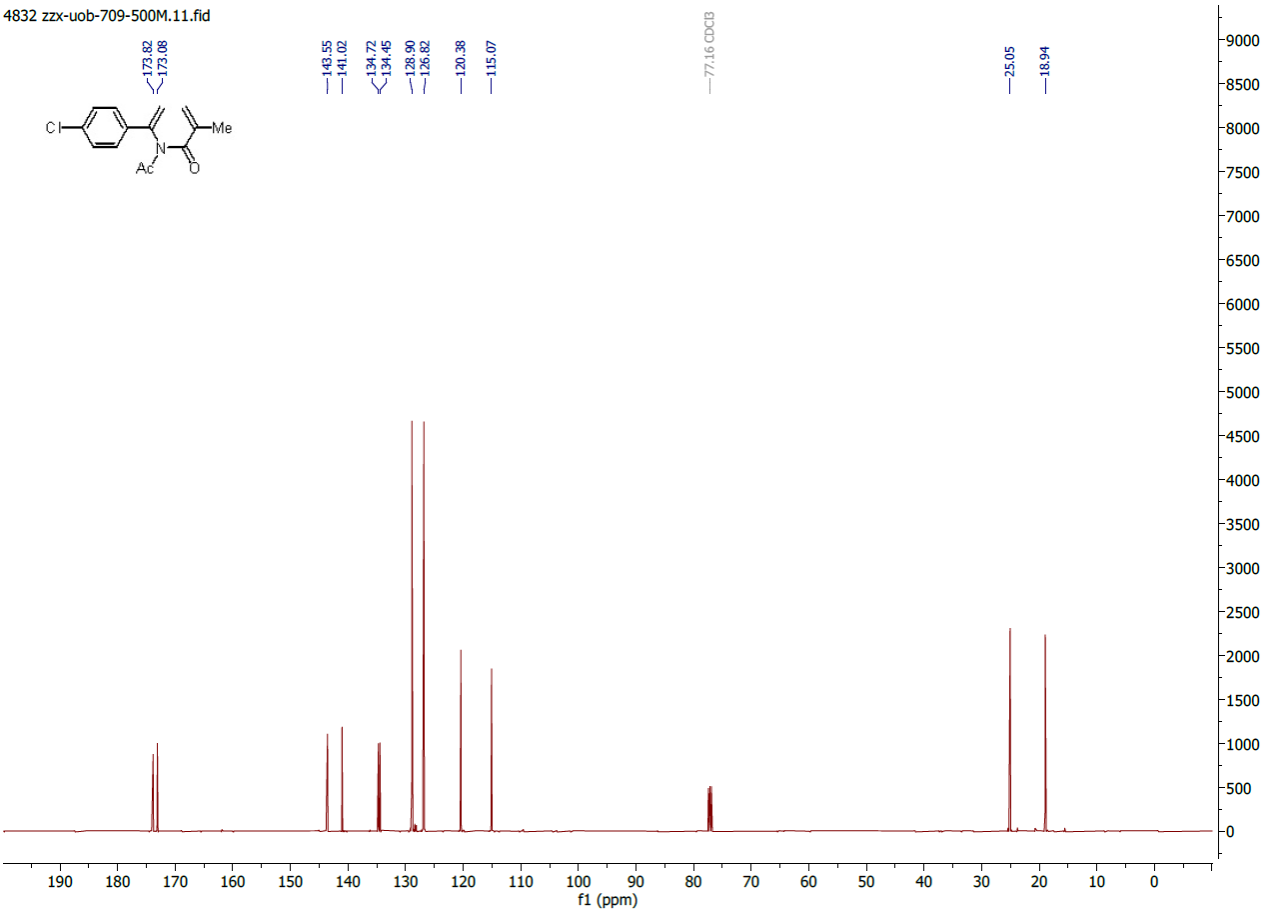
Compound 2m


6182 zzx-uob-708-sec-500M.10.fid
Ph
Me
N
Ac
O
f1 (ppm)

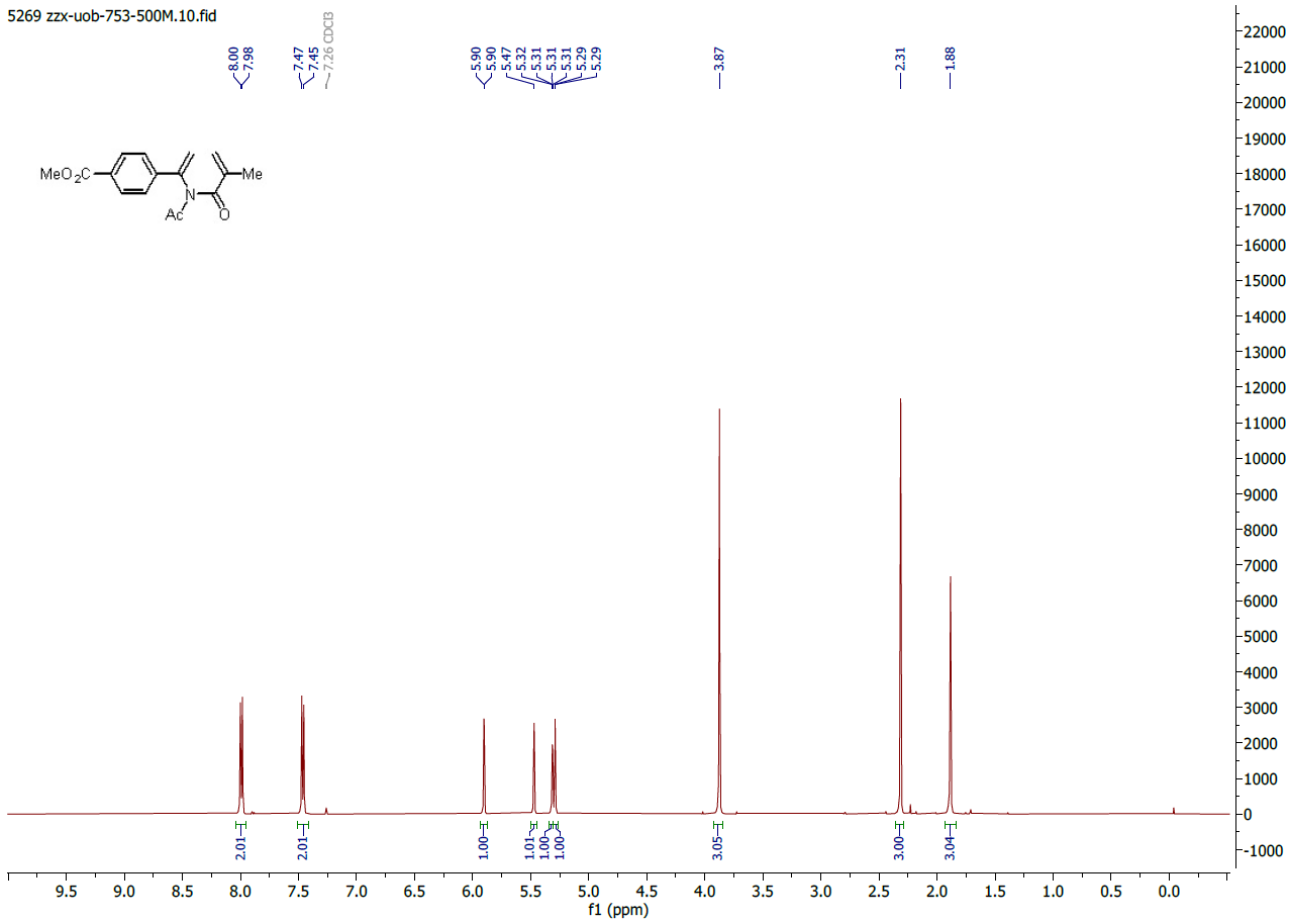

6182 zzx-uob-708-sec-500M.11.fid
Ph
Me
N
Ac
O
f1 (ppm)

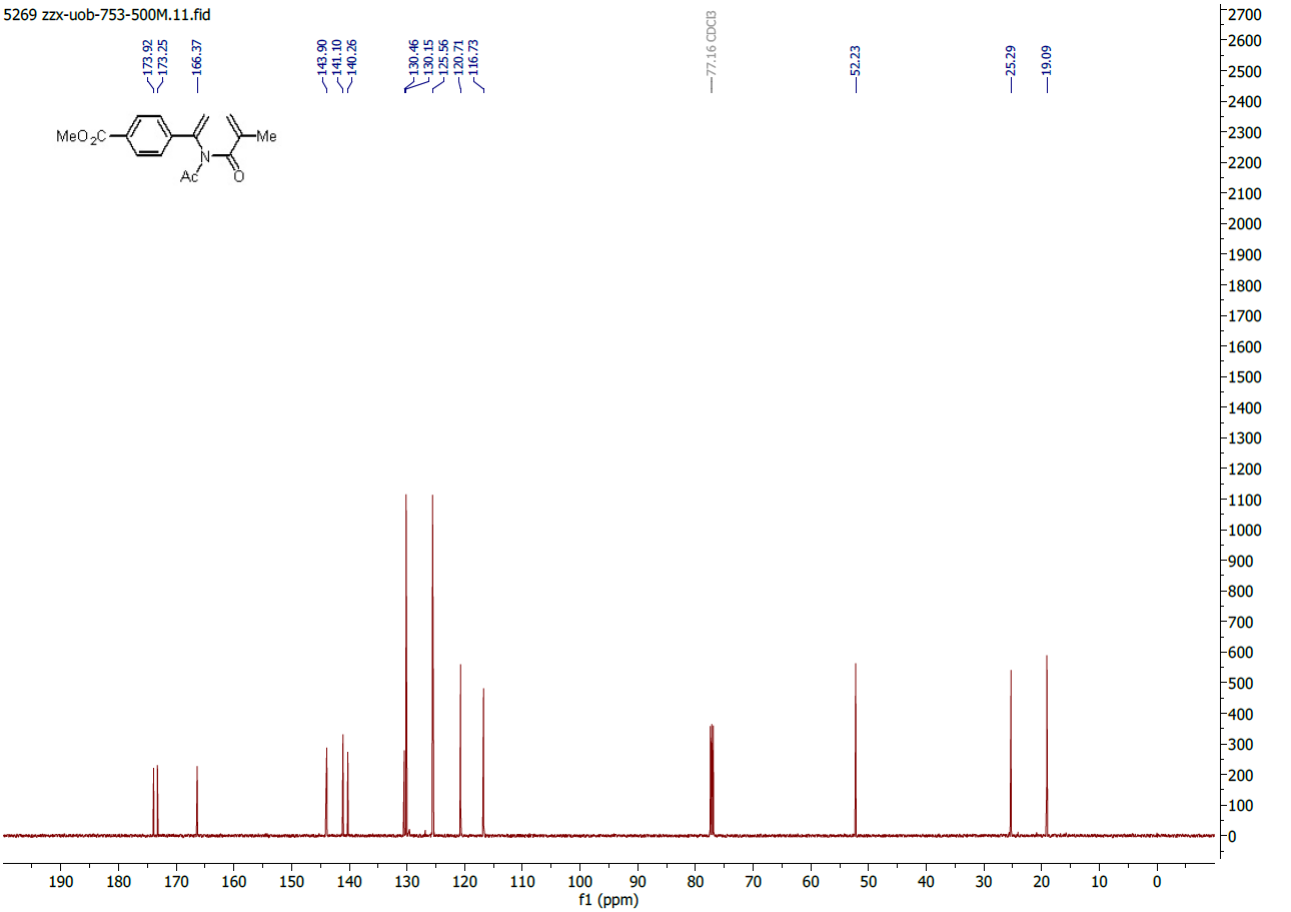
Compound 2n


4832 zzx-uob-709-500M.10.fid
7.34
7.32
7.28
7.26
7.26 CDCl3
5.76
5.76
5.46
5.30
5.30
5.29
5.29
5.18
5.18
2.28
1.88
Cl
Me
Ac
N
O
2.00
2.00
1.00
1.01
1.00
1.00
3.00
3.01
f1 (ppm)

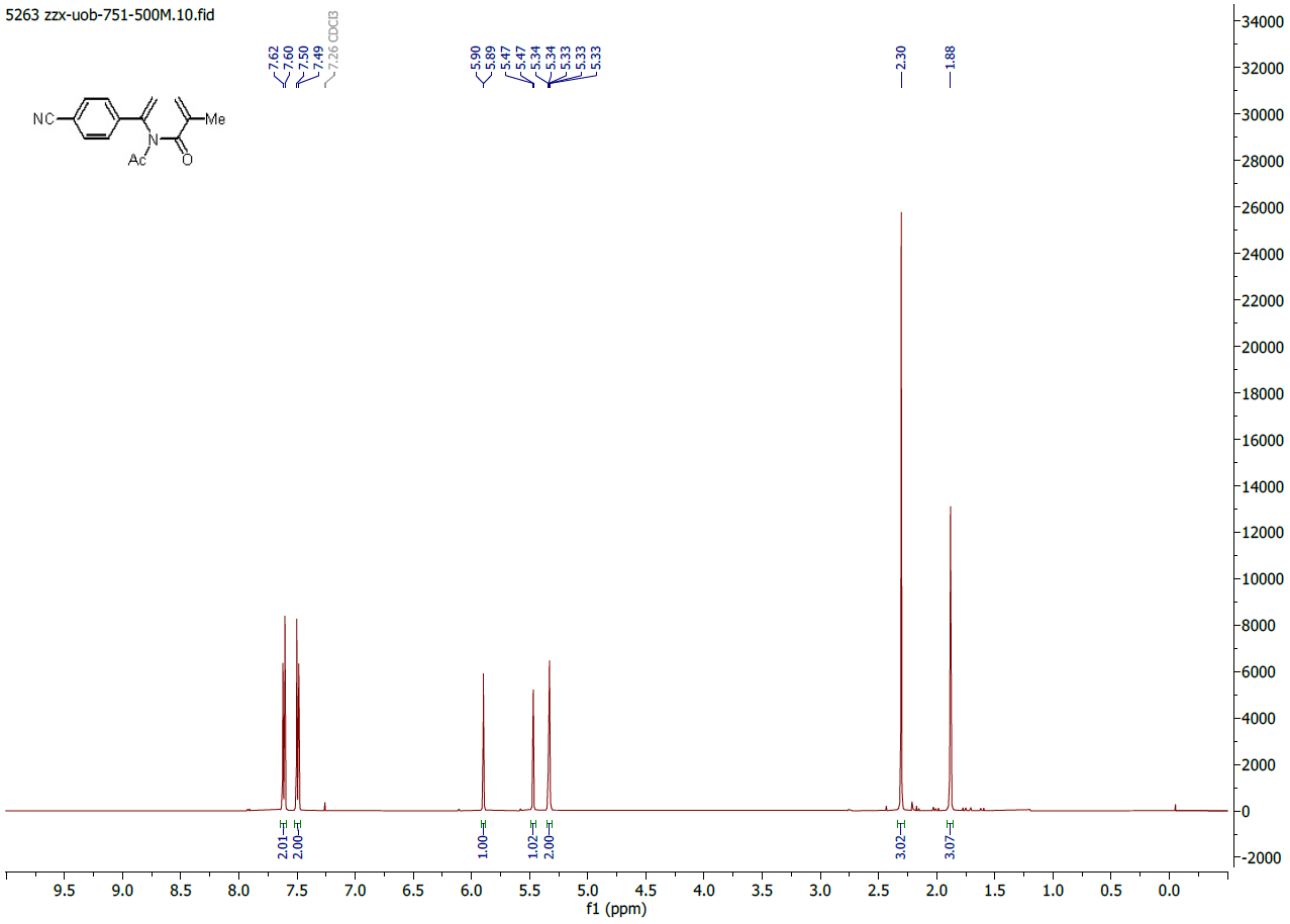

4832 zzx-uob-709-500M.11.fid
173.82
173.08
143.55
141.02
134.72
134.45
128.90
126.82
120.38
115.07
77.16 CDCl3
25.05
18.94
Cl
Me
Ac
N
O
f1 (ppm)

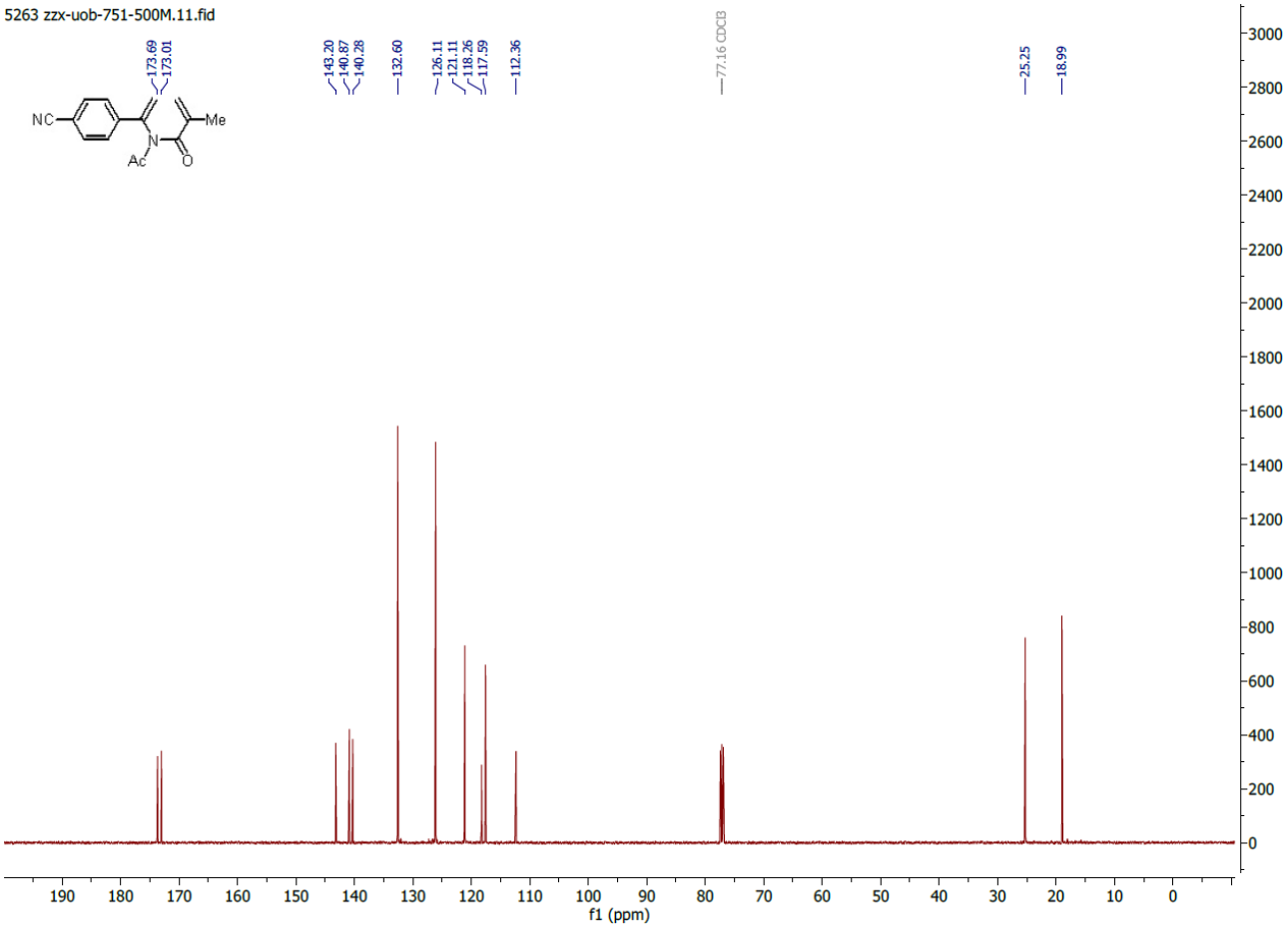
Compound 2o


5269 zzx-uob-753-500M.10.fid
8.00
7.98
7.47
7.45
7.26 CDCl3
5.90
5.90
5.47
5.32
5.31
5.31
5.31
5.29
5.29
3.87
2.31
1.88
MeO2C
Me
N
Ac
O
2.01
2.01
1.00
1.01
1.00
1.00
3.05
3.00
3.04
f1 (ppm)

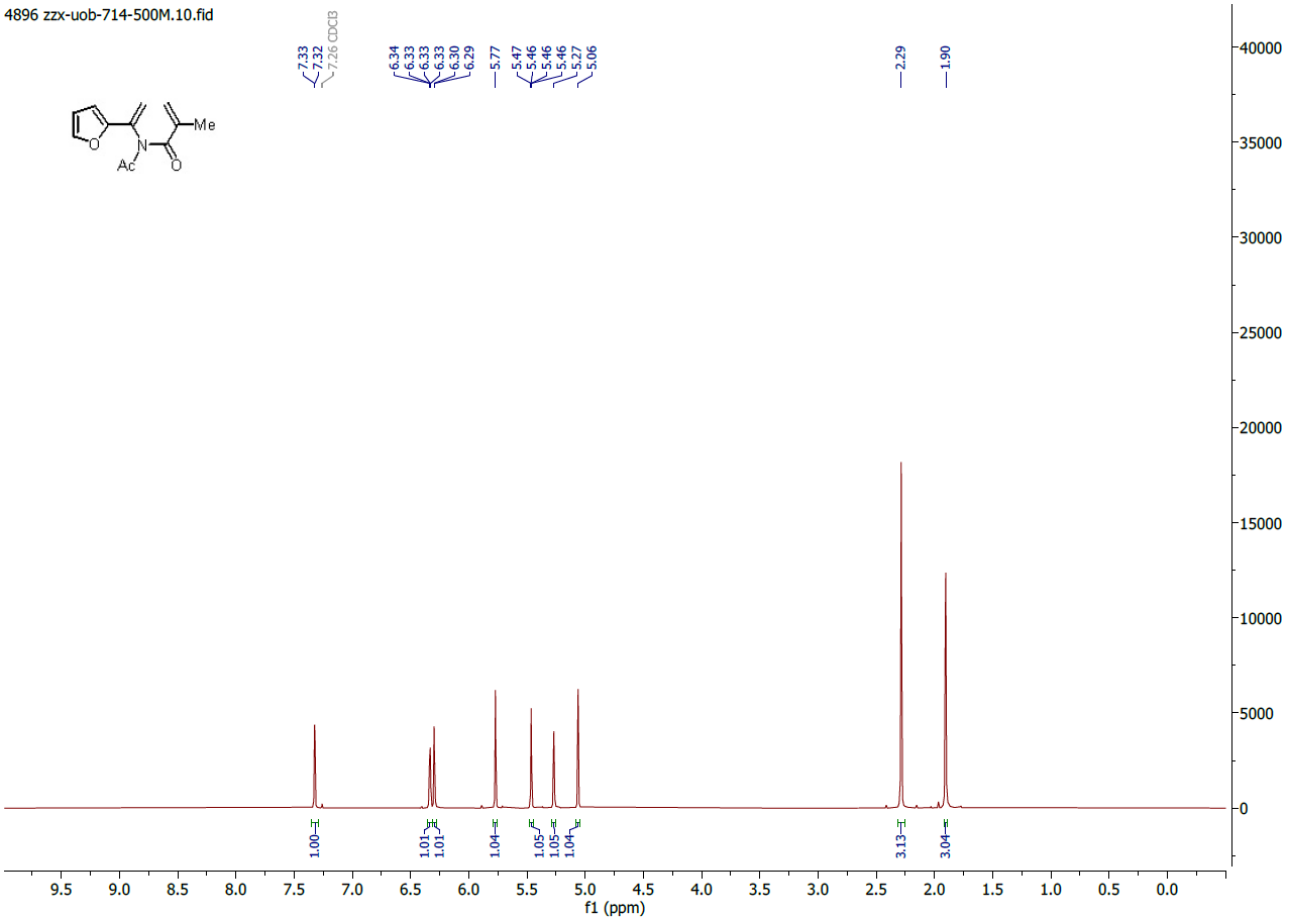

5269 zzx-uob-753-500M.11.fid
173.92
173.25
166.37
143.90
141.10
140.26
130.46
130.15
125.56
120.71
116.73
77.16 CDCl3
52.23
25.29
19.09
MeO2C
Me
N
Ac
O
f1 (ppm)

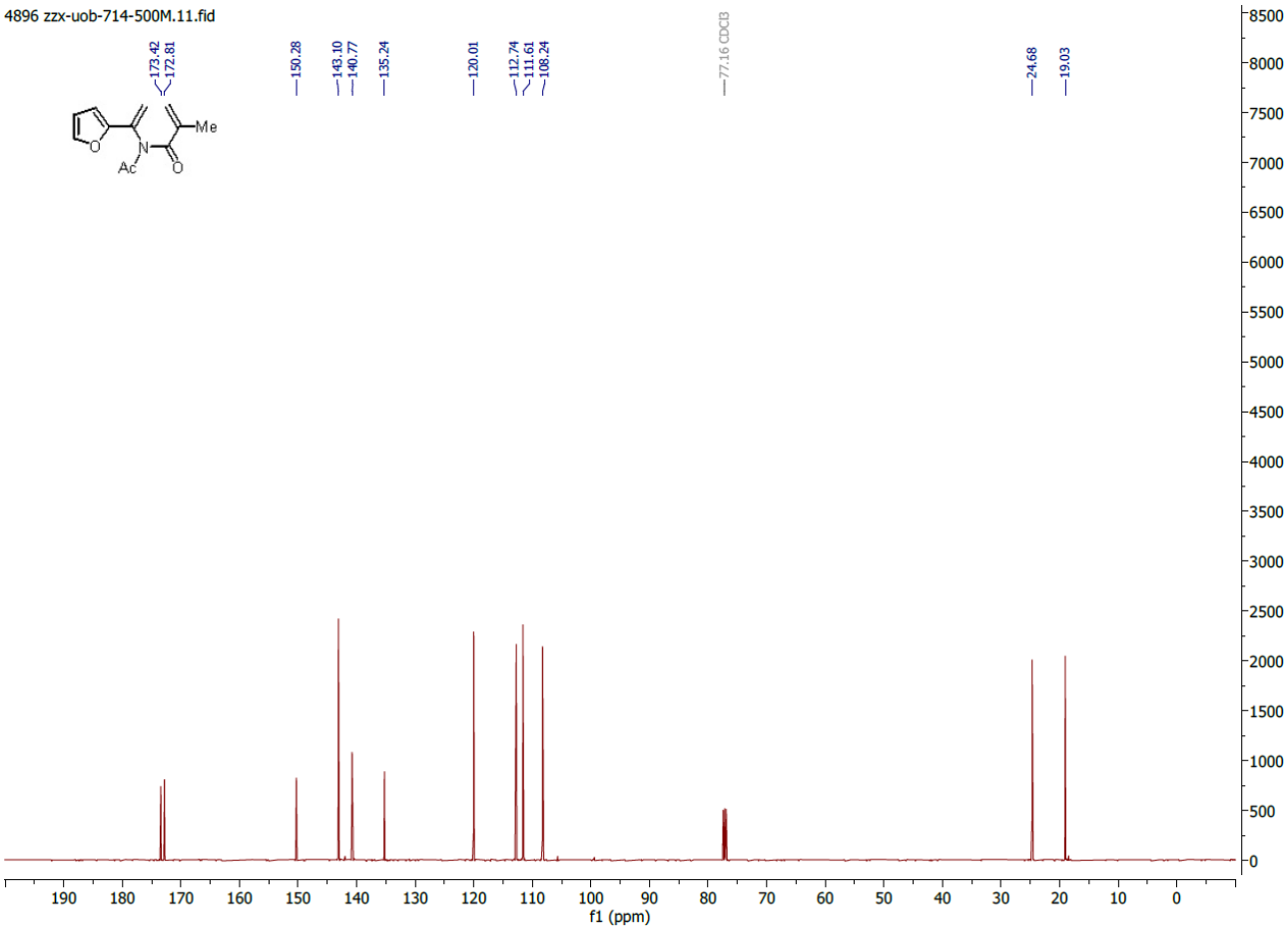
Compound 2p


5263 zzx-uob-751-500M.10.fid
7.62
7.60
7.50
7.49
7.26 CDCl3
5.90
5.89
5.47
5.47
5.34
5.34
5.33
5.33
5.33
2.30
1.88
NC
Me
N
Ac
O
2.01
2.00
1.00
1.02
2.00
3.02
3.07
f1 (ppm)

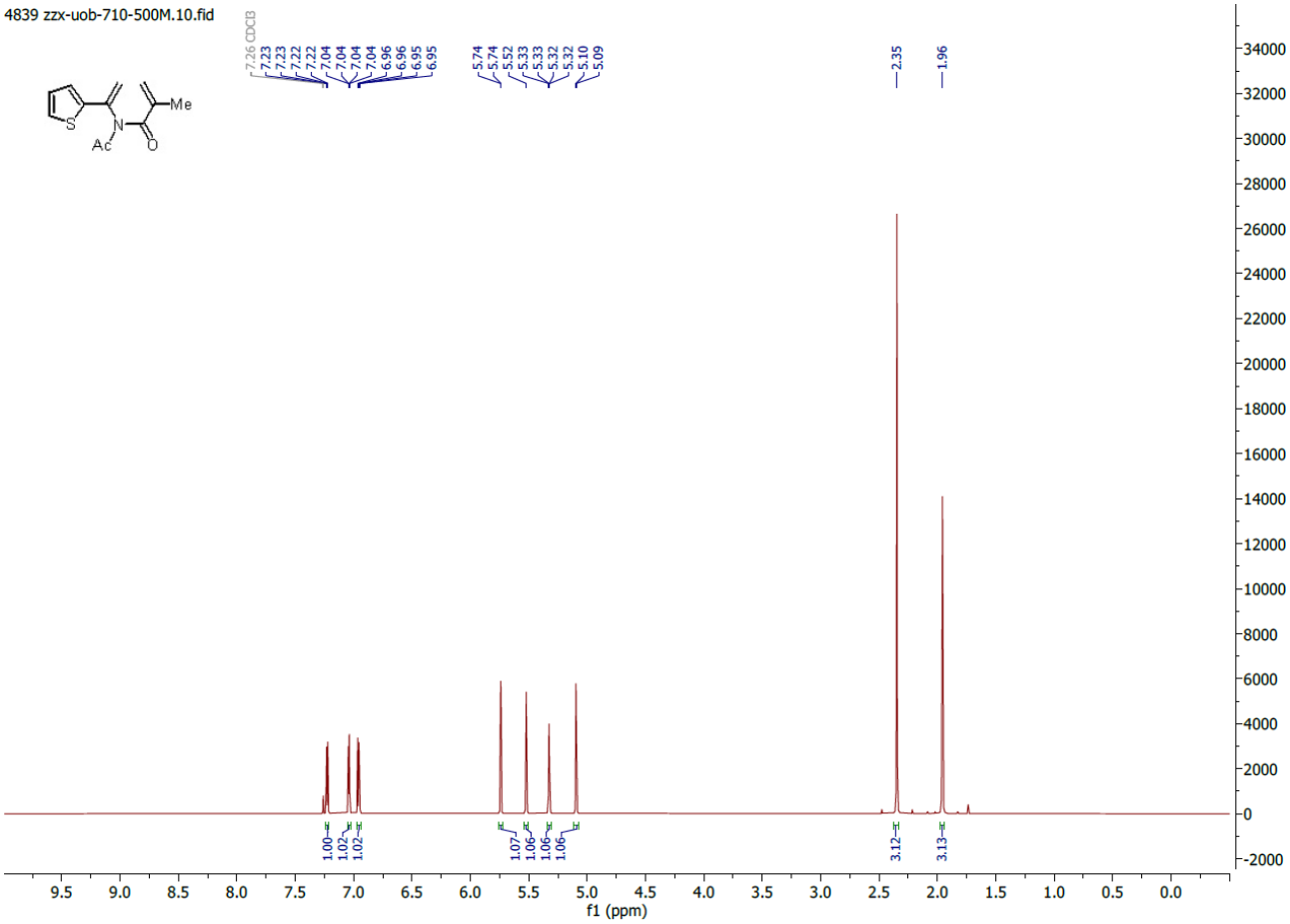

5263 zzx-uob-751-500M.11.fid
173.69
173.01
143.20
140.87
140.28
132.60
126.11
121.11
118.26
117.59
112.36
77.16 CDCl3
25.25
18.99
NC
Me
N
Ac
O
f1 (ppm)

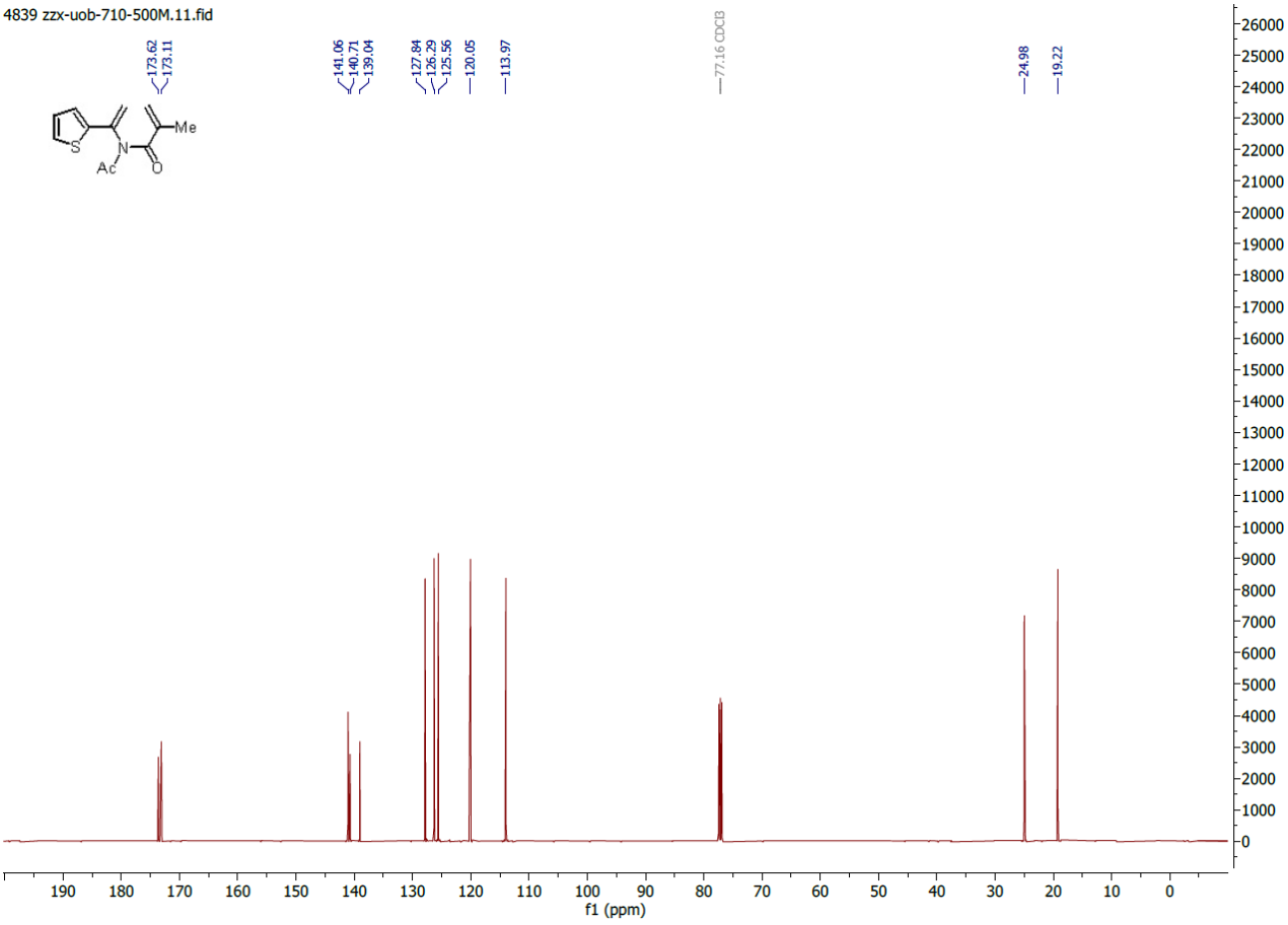
Compound 2q


4896 zzx-uob-714-500M.10.fid
7.33
7.32
7.26 CDCl3
6.34
6.33
6.33
6.33
6.30
6.29
5.77
5.47
5.46
5.46
5.46
5.27
5.06
2.29
1.90
Me
Ac
O
O
1.00
1.01
1.01
1.04
1.05
1.05
1.04
3.13
3.04
f1 (ppm)

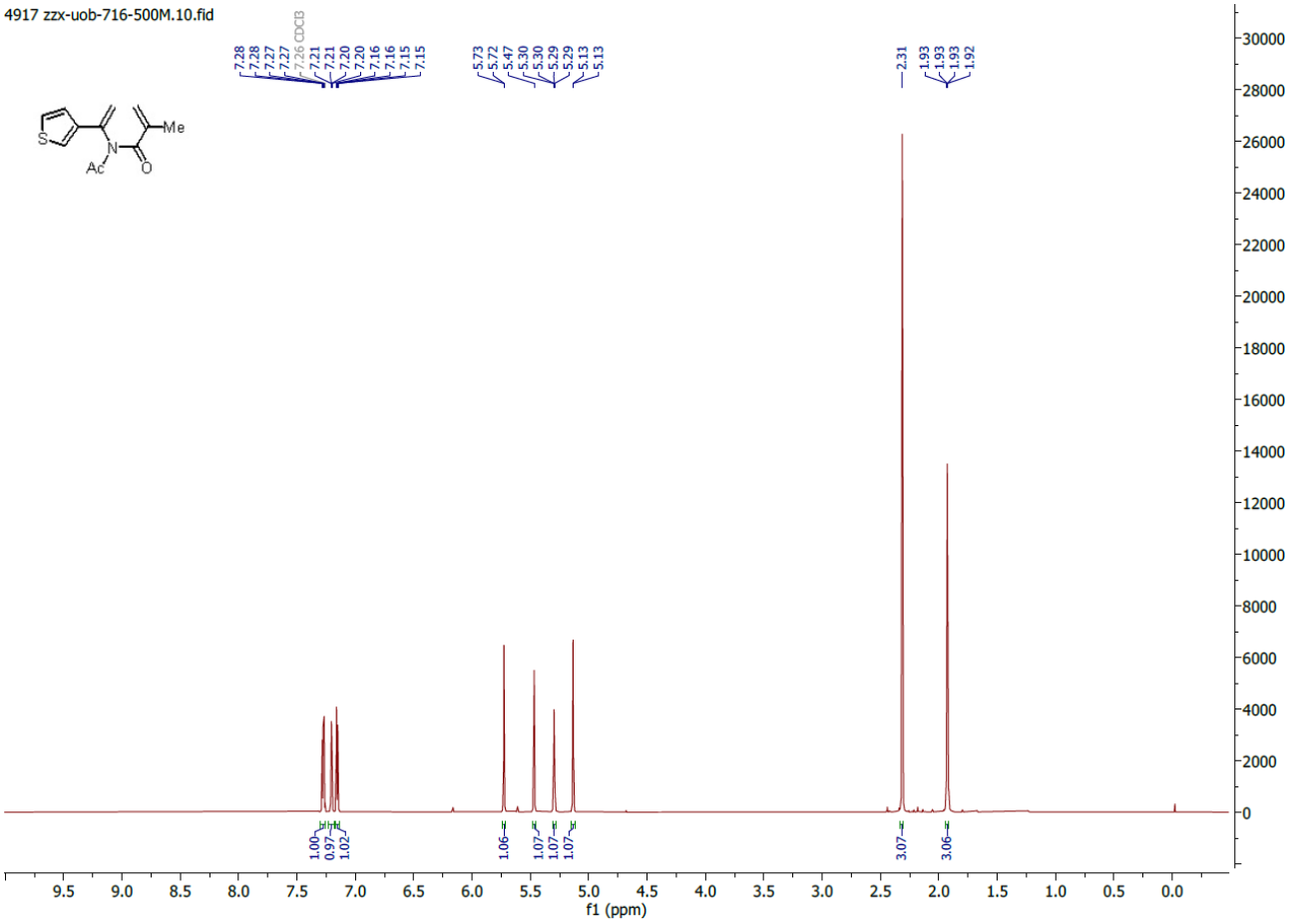

4896 zzx-uob-714-500M.11.fid
173.42
172.81
150.28
143.10
140.77
135.24
120.01
112.74
111.61
108.24
77.16 CDCl3
24.68
19.03
Me
Ac
O
O
f1 (ppm)

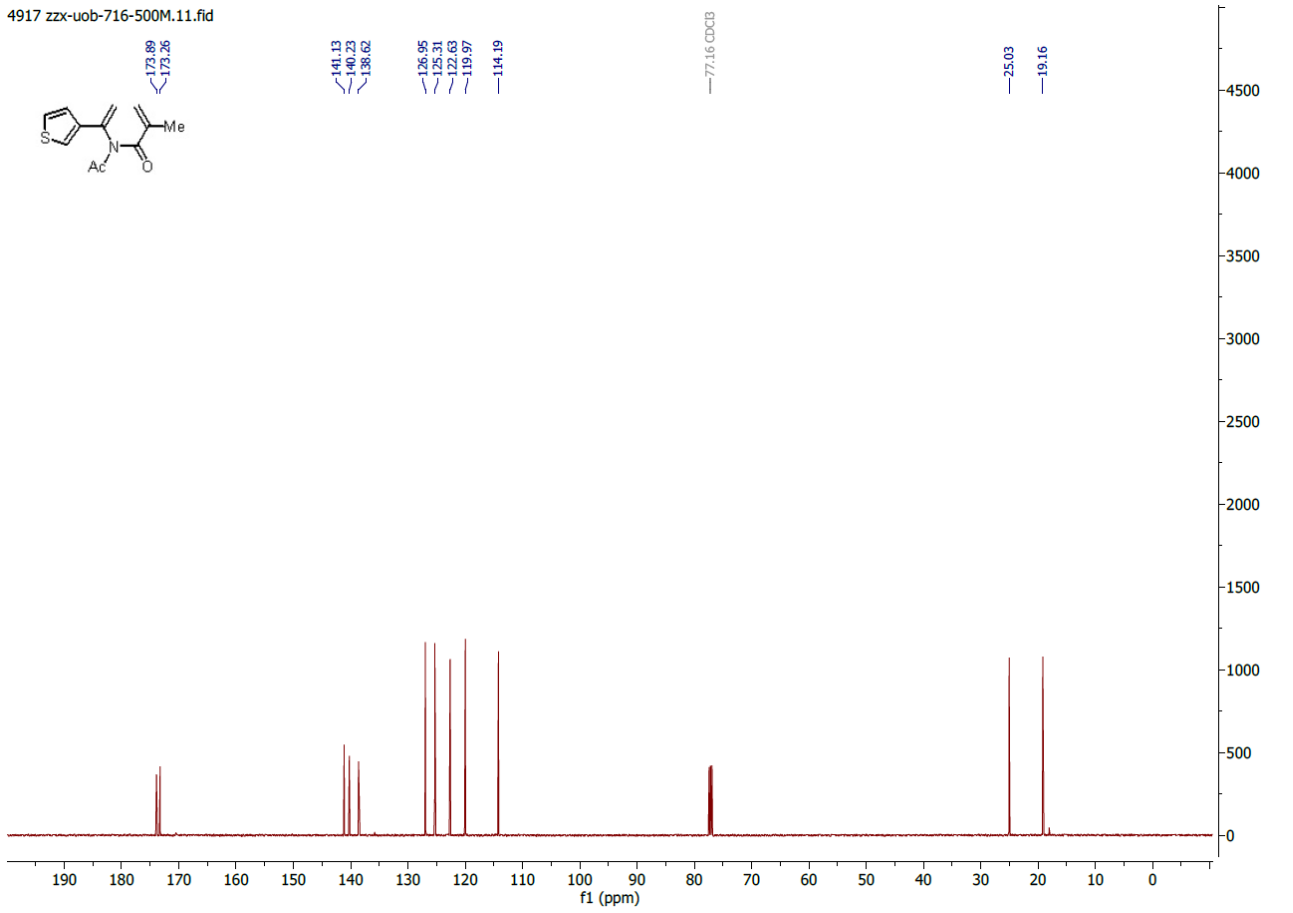
Compound 2r


4839 zzx-uob-710-500M.10.fid
7.26 CDCB
7.23
7.23
7.23
7.22
7.22
7.04
7.04
7.04
7.04
6.96
6.96
6.95
6.95
5.74
5.74
5.52
5.33
5.33
5.32
5.32
5.10
5.09
2.35
1.96
Me
N
Ac
O
S
1.00
1.02
1.02
1.07
1.06
1.06
1.06
3.12
3.13
f1 (ppm)

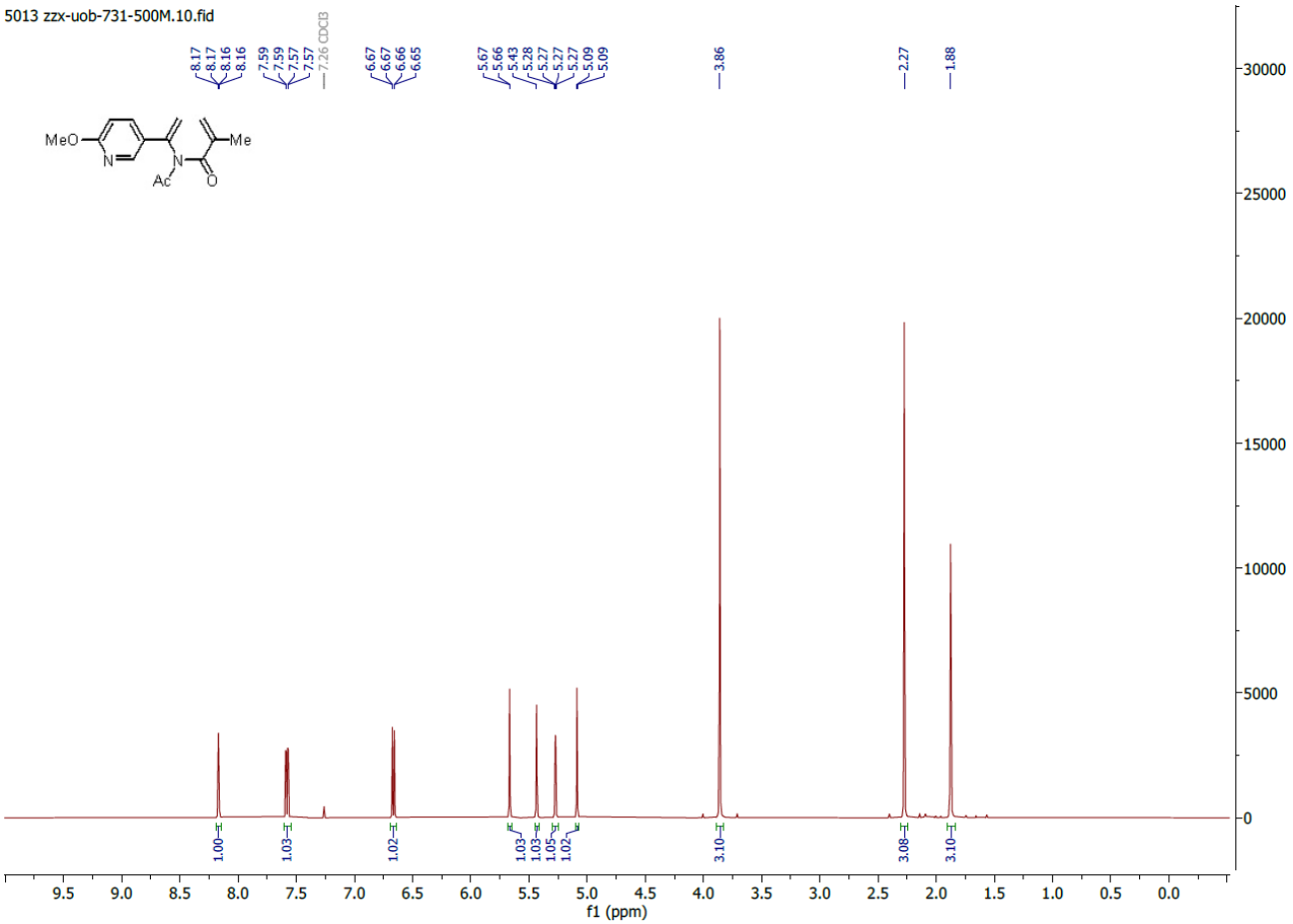

4839 zzx-uob-710-500M.11.fid
173.62
173.11
141.06
140.71
139.04
127.84
126.29
125.56
120.05
113.97
77.16 CDCB
24.98
19.22
Me
N
Ac
O
S
f1 (ppm)

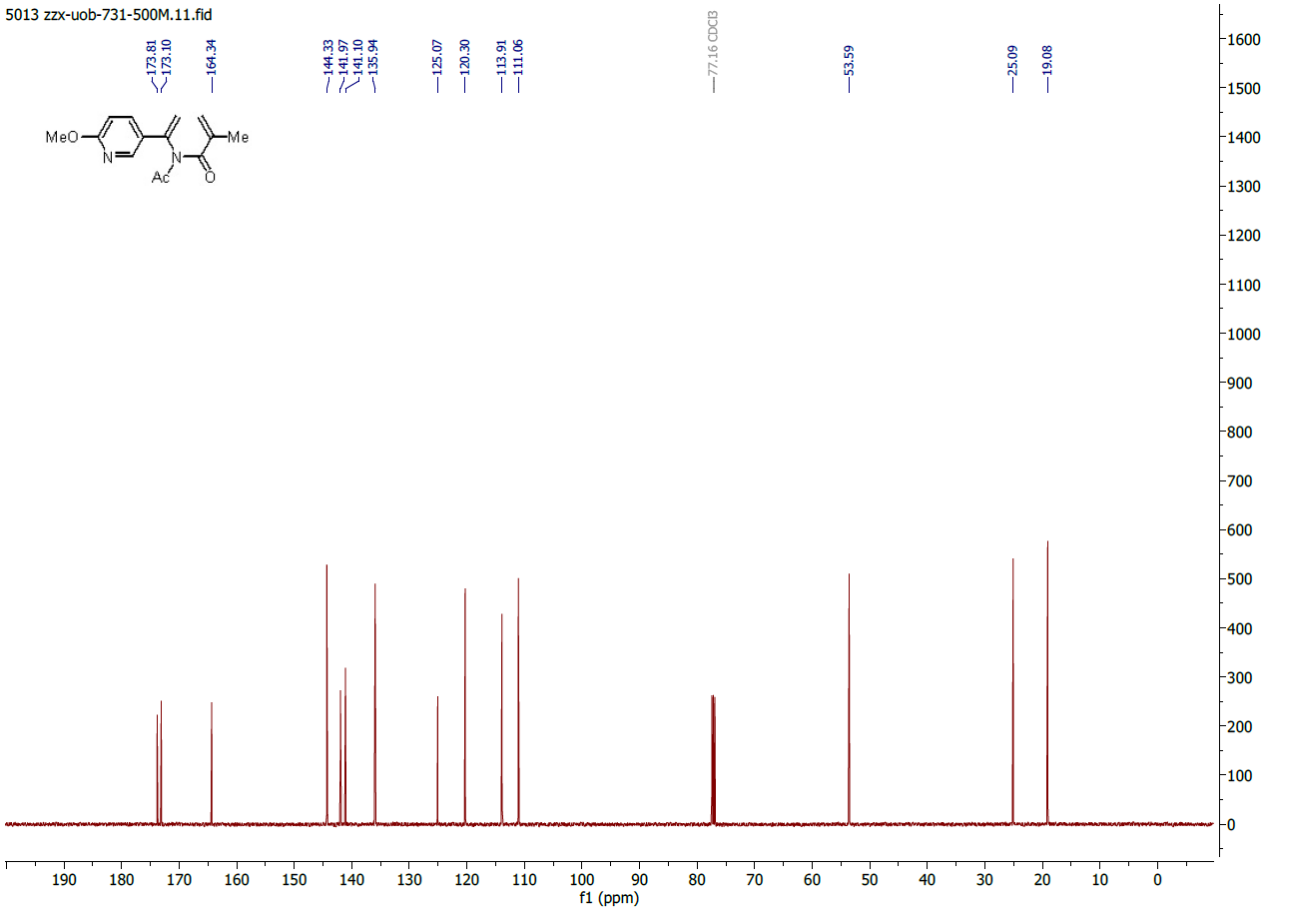
Compound 2s


4917 zzx-uob-716-500M.10.fid
7.28
7.28
7.27
7.27
7.26 CDCl3
7.21
7.21
7.20
7.20
7.16
7.16
7.15
7.15
5.73
5.72
5.47
5.30
5.30
5.29
5.29
5.13
5.13
2.31
1.93
1.93
1.93
1.92
1.00
0.97
1.02
1.06
1.07
1.07
1.07
3.07
3.06
f1 (ppm)

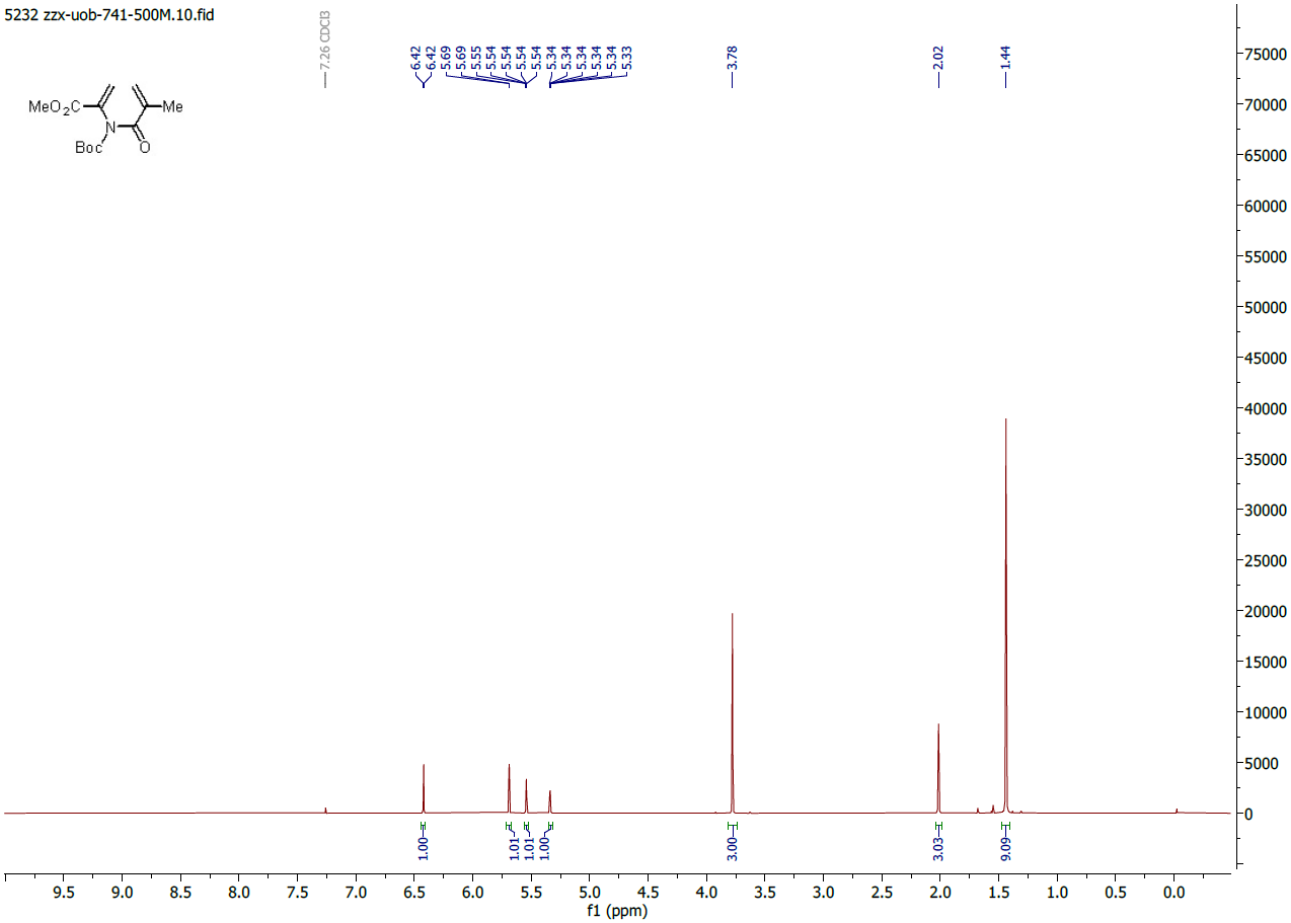

4917 zzx-uob-716-500M.11.fid
173.89
173.26
141.13
140.23
138.62
126.95
125.31
122.63
119.97
114.19
77.16 CDCl3
25.03
19.16
f1 (ppm)

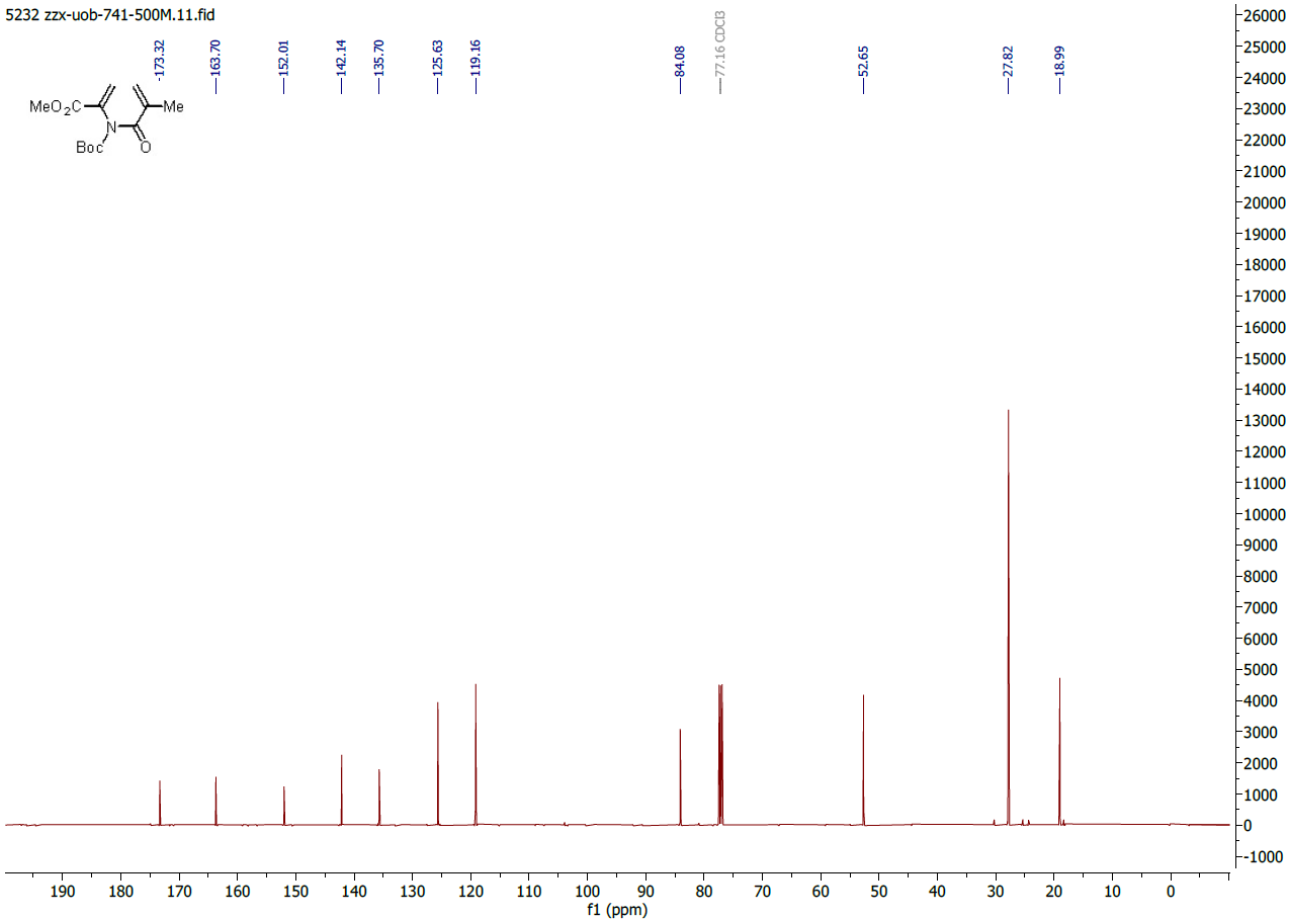
Compound 2t


5013 zzx-uob-731-500M.10.fid
8.17
8.17
8.16
8.16
7.59
7.59
7.57
7.57
7.57
7.26 CDCl3
6.67
6.67
6.66
6.65
5.67
5.66
5.43
5.28
5.27
5.27
5.27
5.09
5.09
3.86
2.27
1.88
MeO
N
N
Ac
O
Me
1.00
1.03
1.02
1.03
1.03
1.05
1.02
3.10
3.08
3.10
f1 (ppm)

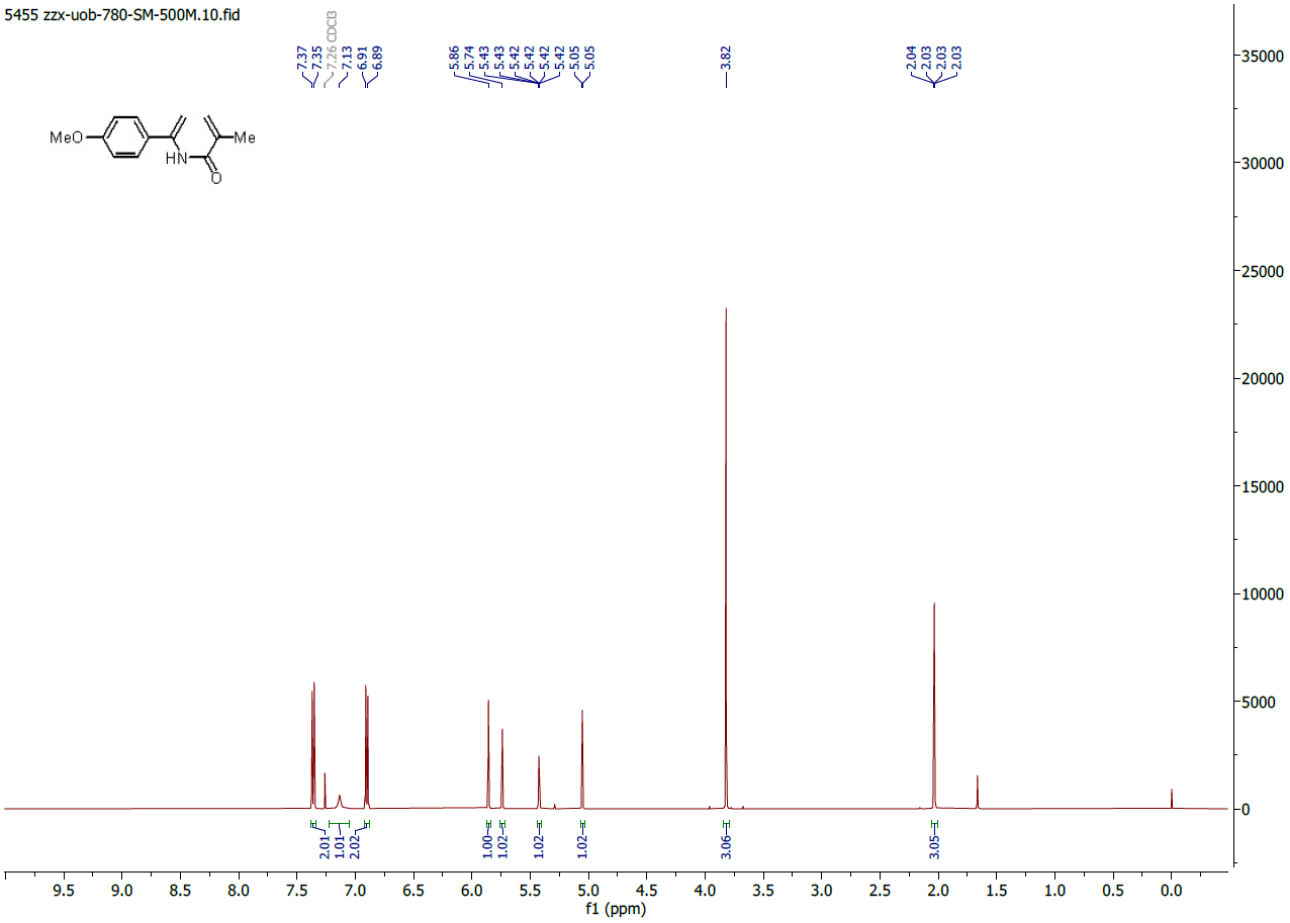

5013 zzx-uob-731-500M.11.fid
173.81
173.10
164.34
144.33
141.97
141.10
135.94
125.07
120.30
113.91
111.06
77.16 CDCl3
53.59
25.09
19.08
MeO
N
N
Ac
O
Me
f1 (ppm)

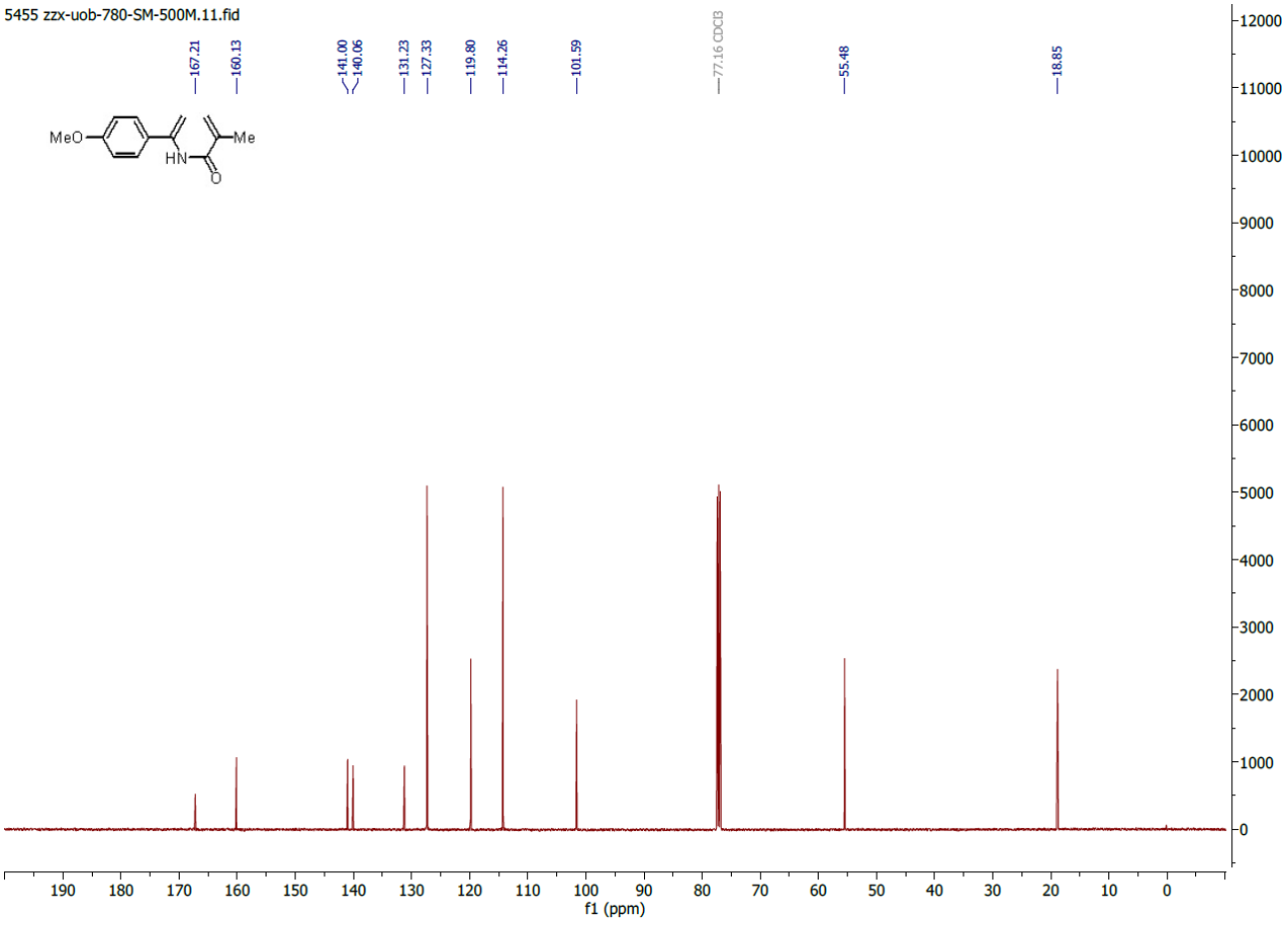
Compound 2u


5232 zzx-uob-741-500M.10.fid
MeO2C
Me
N
Boc
O
7.26 CDCl3
6.42
6.42
5.69
5.69
5.55
5.54
5.54
5.54
5.54
5.34
5.34
5.34
5.34
5.34
5.34
5.33
3.78
2.02
1.44
1.00
1.01
1.01
1.00
3.00
3.03
9.09
f1 (ppm)

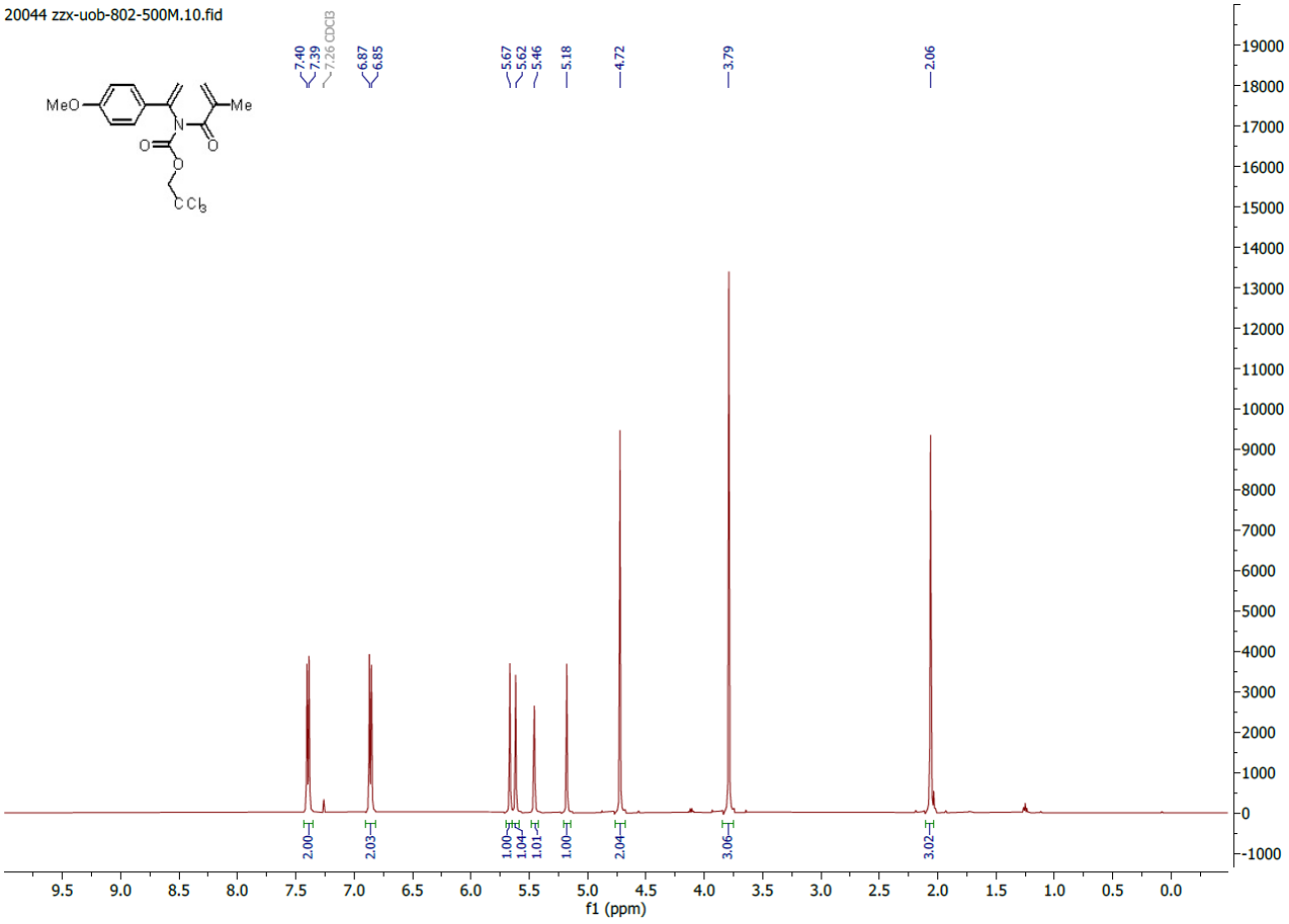

5232 zzx-uob-741-500M.11.fid
MeO2C
Me
N
Boc
O
173.32
163.70
152.01
142.14
135.70
125.63
119.16
84.08
77.16 CDCl3
52.65
27.82
18.99
f1 (ppm)

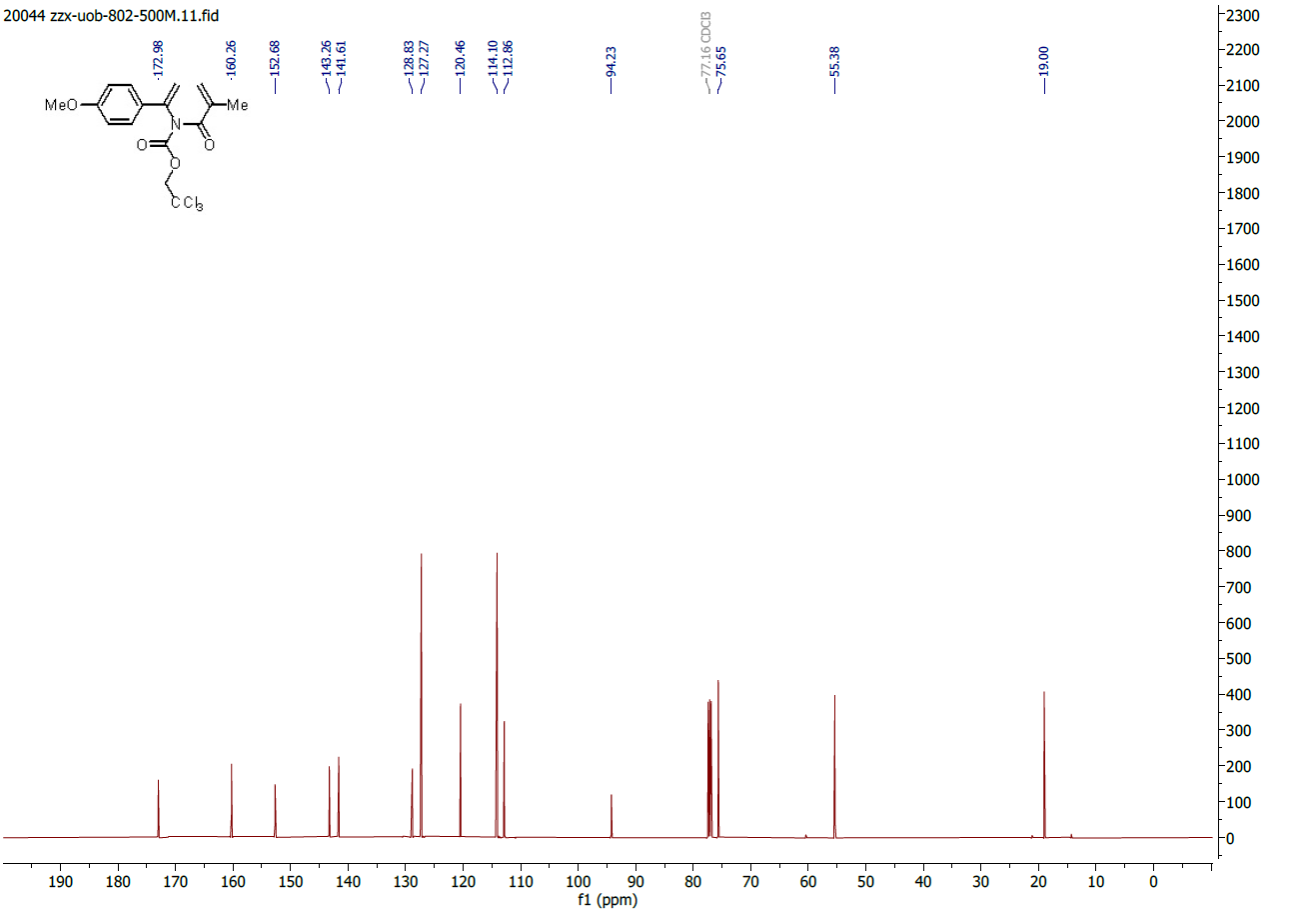
Compound S2v



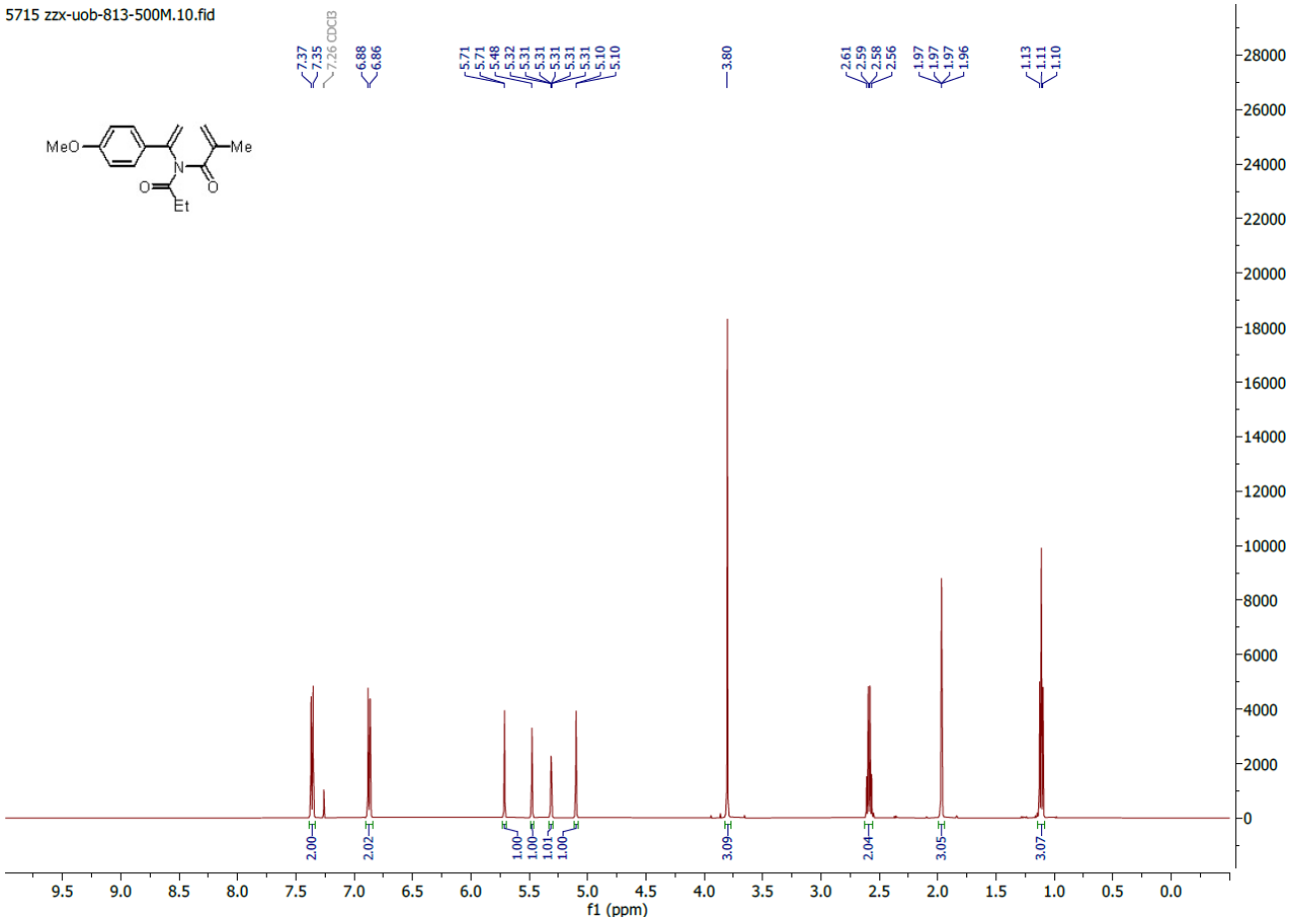


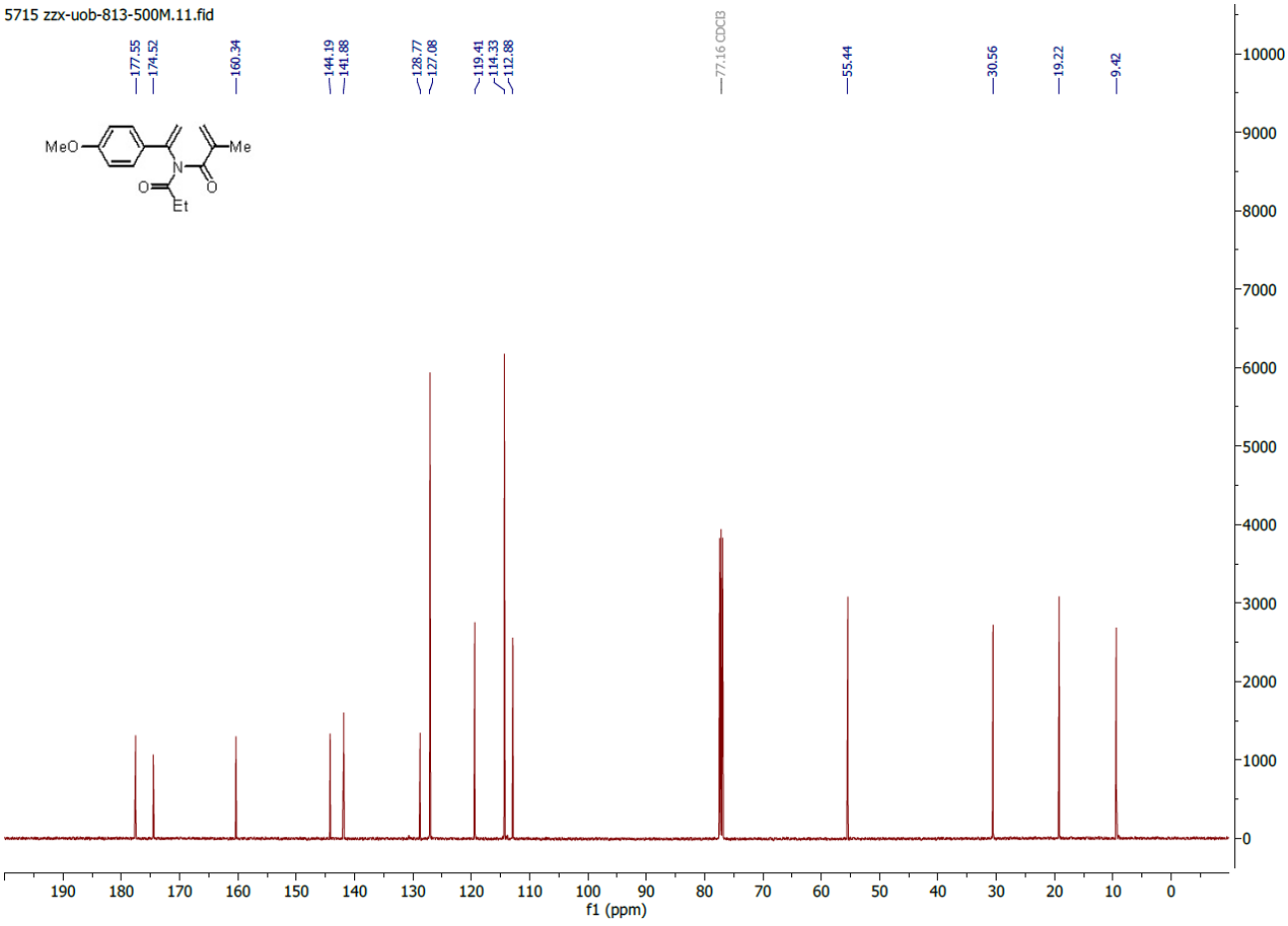
Compound 2v


20044 zzx-uob-802-500M.10.fid
7.40
7.39
7.26 CDCl3
6.87
6.85
5.67
5.62
5.46
5.18
4.72
3.79
2.06
MeO
Me
O
N
O
O
CCl3
2.00
2.03
1.00
1.04
1.01
1.00
2.04
3.06
3.02
f1 (ppm)

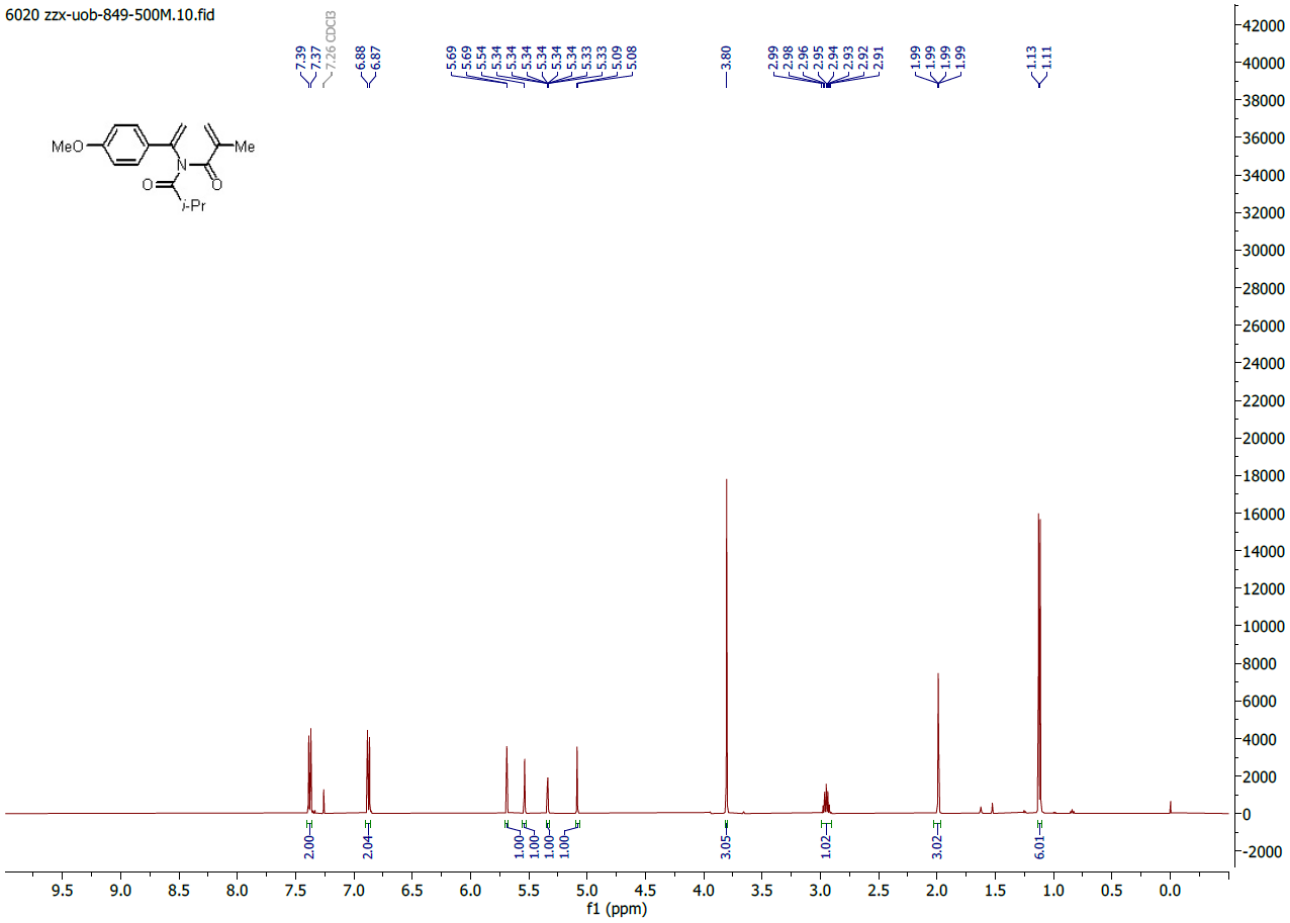

20044 zzx-uob-802-500M.11.fid
172.98
160.26
152.68
143.26
141.61
128.83
127.27
120.46
114.10
112.86
94.23
77.16 CDCl3
75.65
55.38
19.00
MeO
Me
O
N
O
O
CCl3
f1 (ppm)

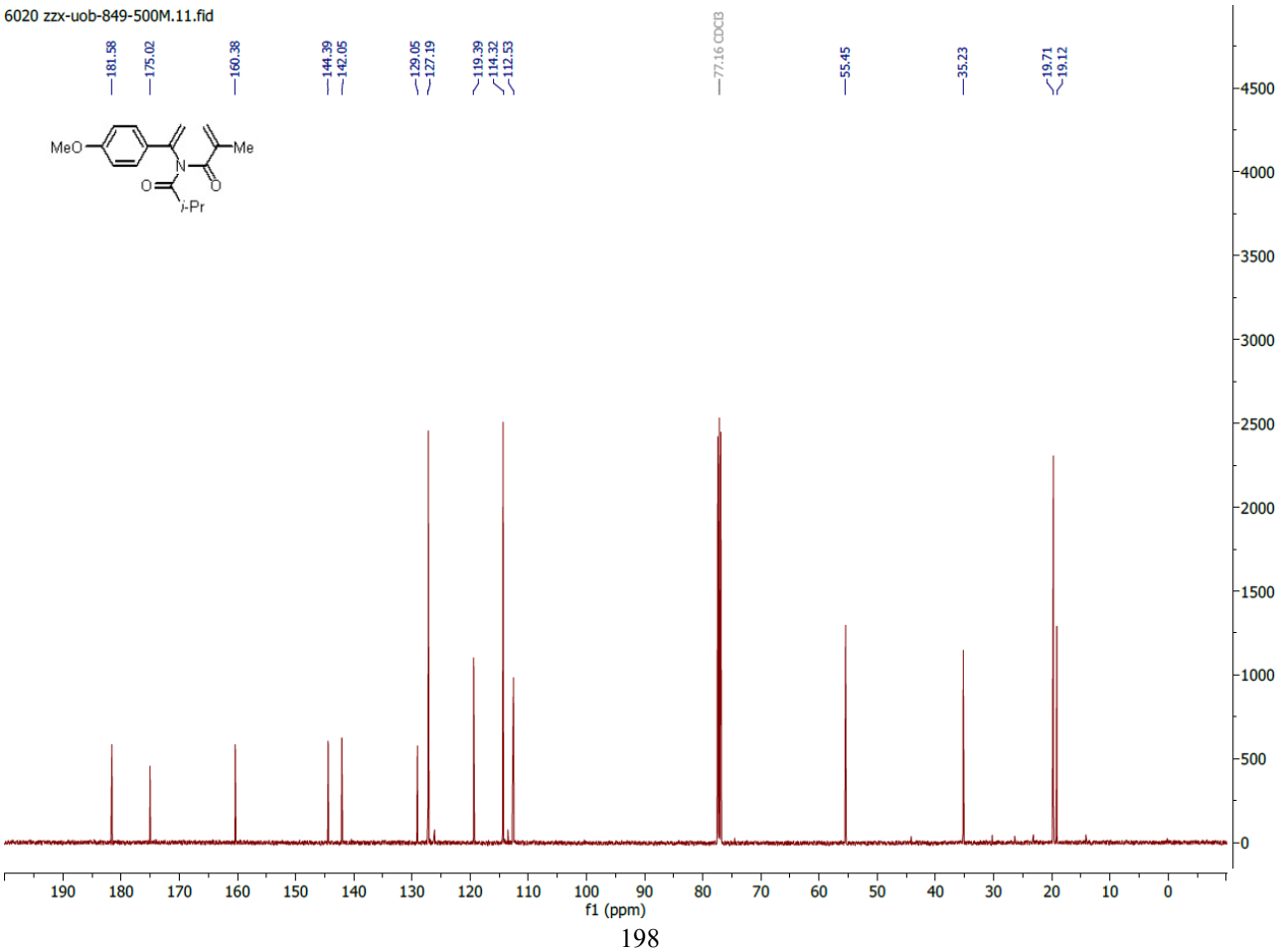
Compound 2w


5715 zzx-uob-813-500M.10.fid
MeO
Me
N
O
O
Et
f1 (ppm)

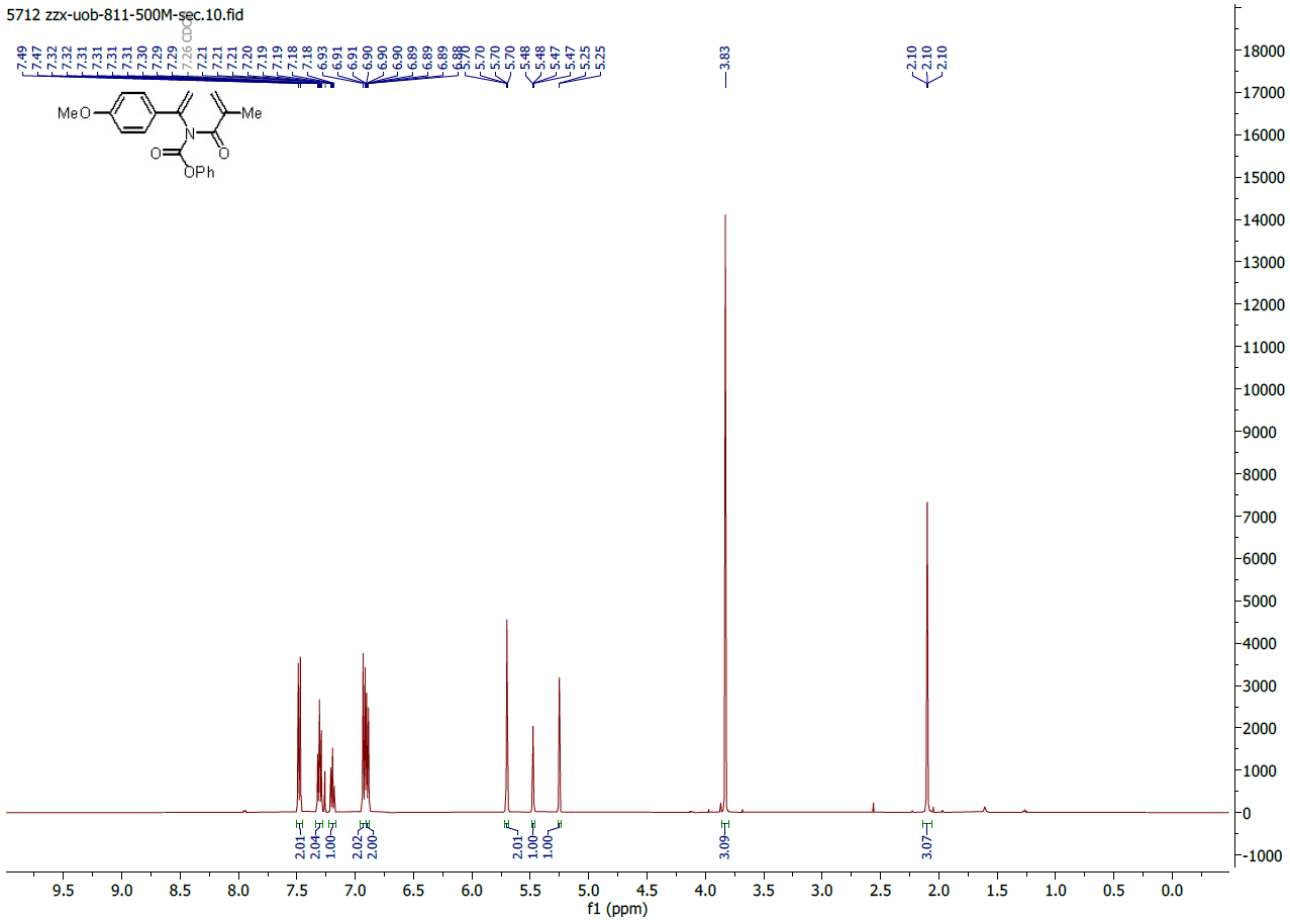

5715 zzx-uob-813-500M.11.fid
MeO
Me
N
O
O
Et
f1 (ppm)

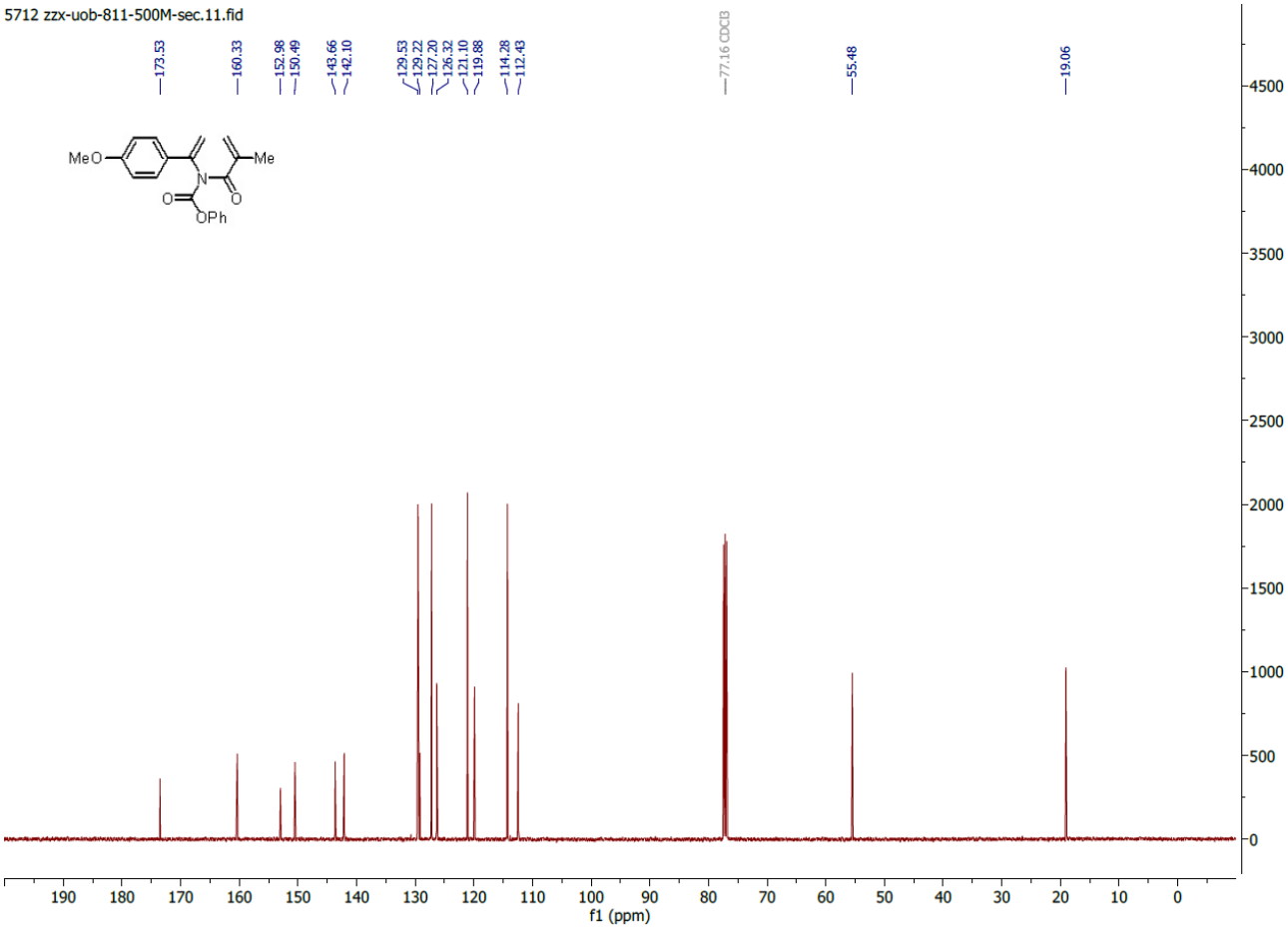
Compound 2x


6020 zzx-uob-849-500M.10.fid
7.39
7.37
7.26 CDCl3
6.88
6.87
5.69
5.69
5.54
5.34
5.34
5.34
5.34
5.34
5.34
5.33
5.33
5.09
5.08
3.80
2.99
2.98
2.96
2.95
2.94
2.93
2.92
2.91
1.99
1.99
1.99
1.99
1.13
1.11
MeO
Me
N
O
O
i-Pr
2.00
2.04
1.00
1.00
1.00
1.00
3.05
1.02
3.02
6.01
f1 (ppm)

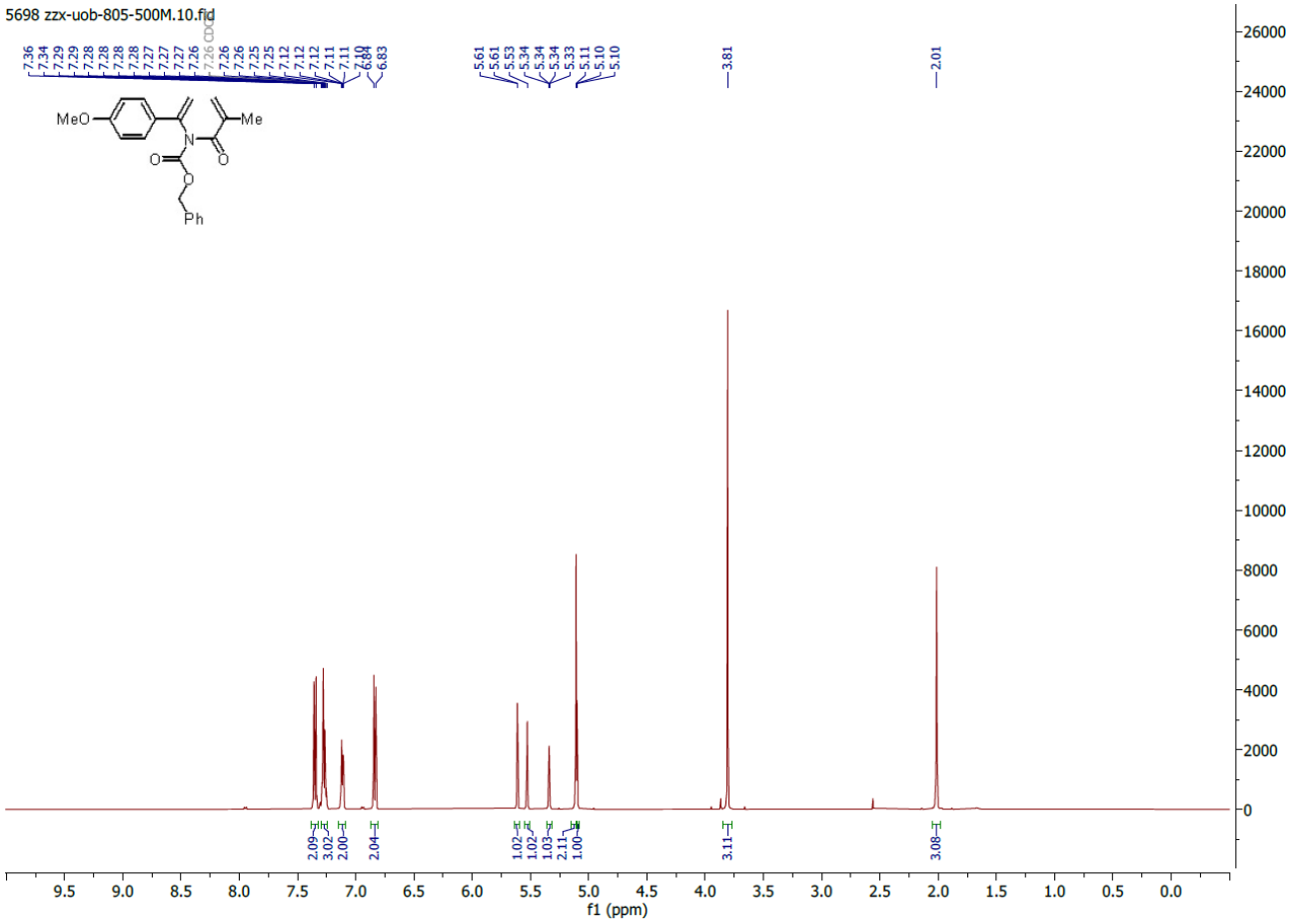

6020 zzx-uob-849-500M.11.fid
181.58
175.02
160.38
144.39
142.05
129.05
127.19
119.39
114.32
112.53
77.16 CDCl3
55.45
35.23
19.71
19.12
MeO
Me
N
O
O
i-Pr
f1 (ppm)

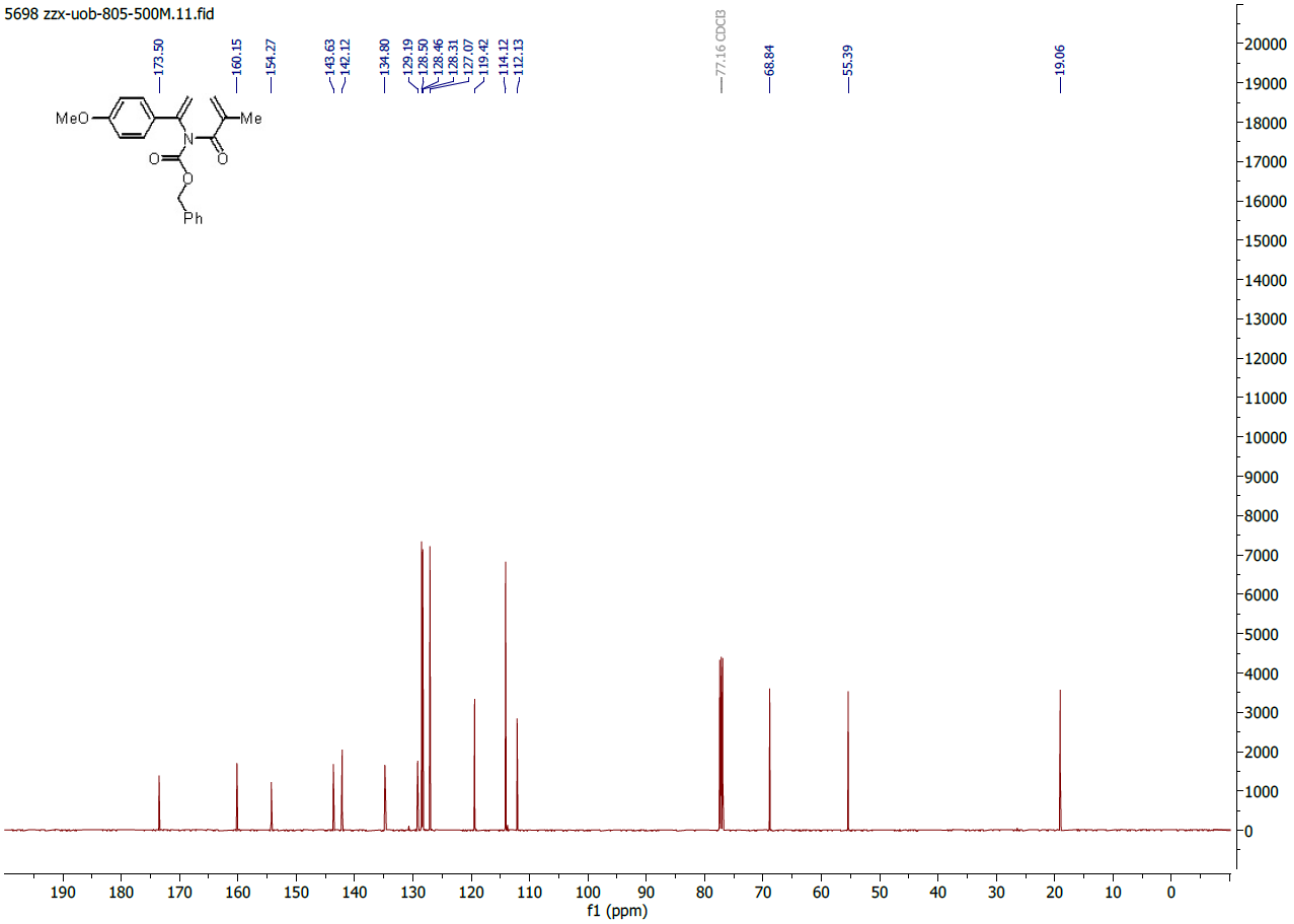
Compound 2y


5712 zzx-uob-811-500M-sec.10.fid
MeO
Me
OPh
f1 (ppm)

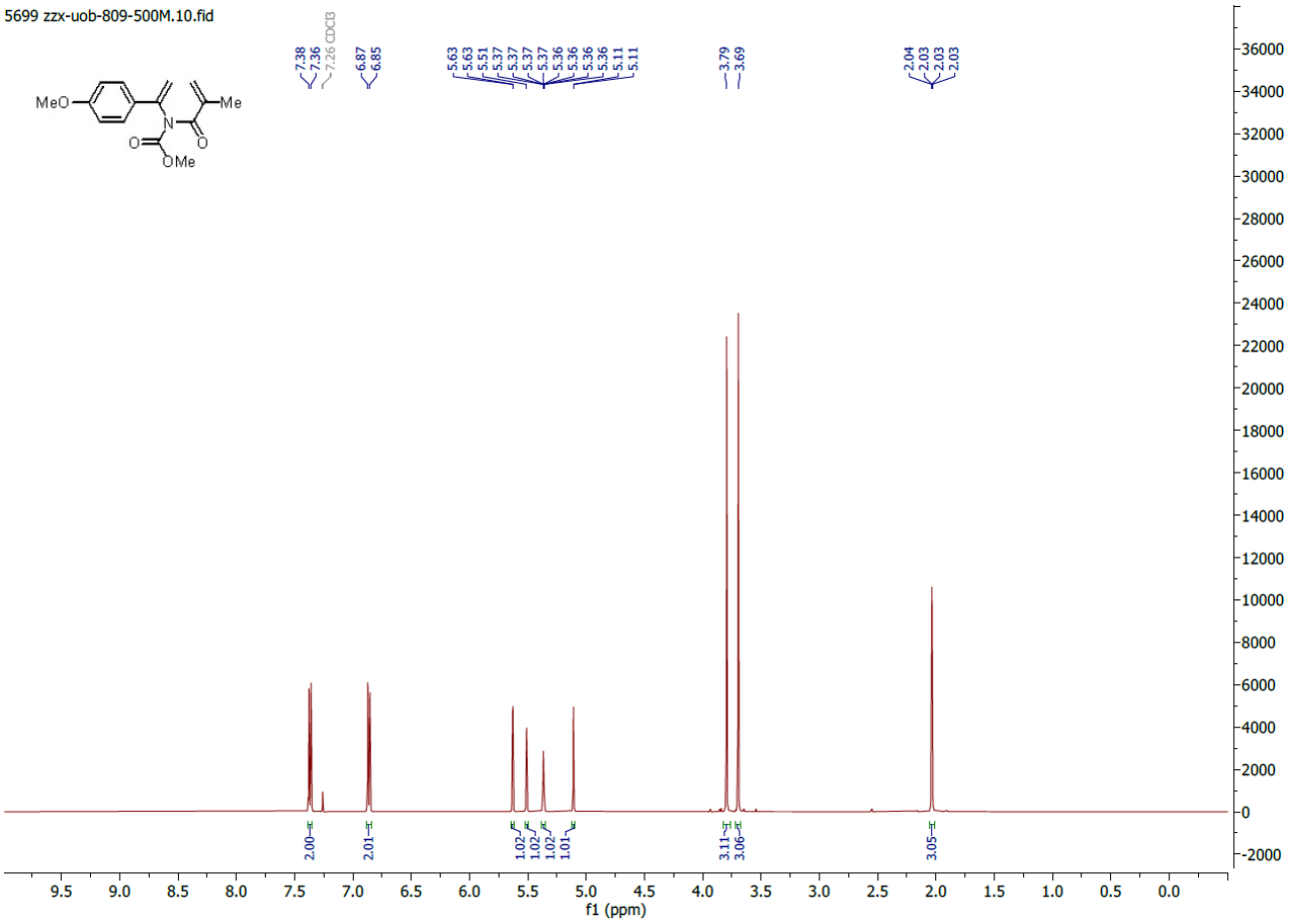

5712 zzx-uob-811-500M-sec.11.fid
MeO
Me
OPh
f1 (ppm)

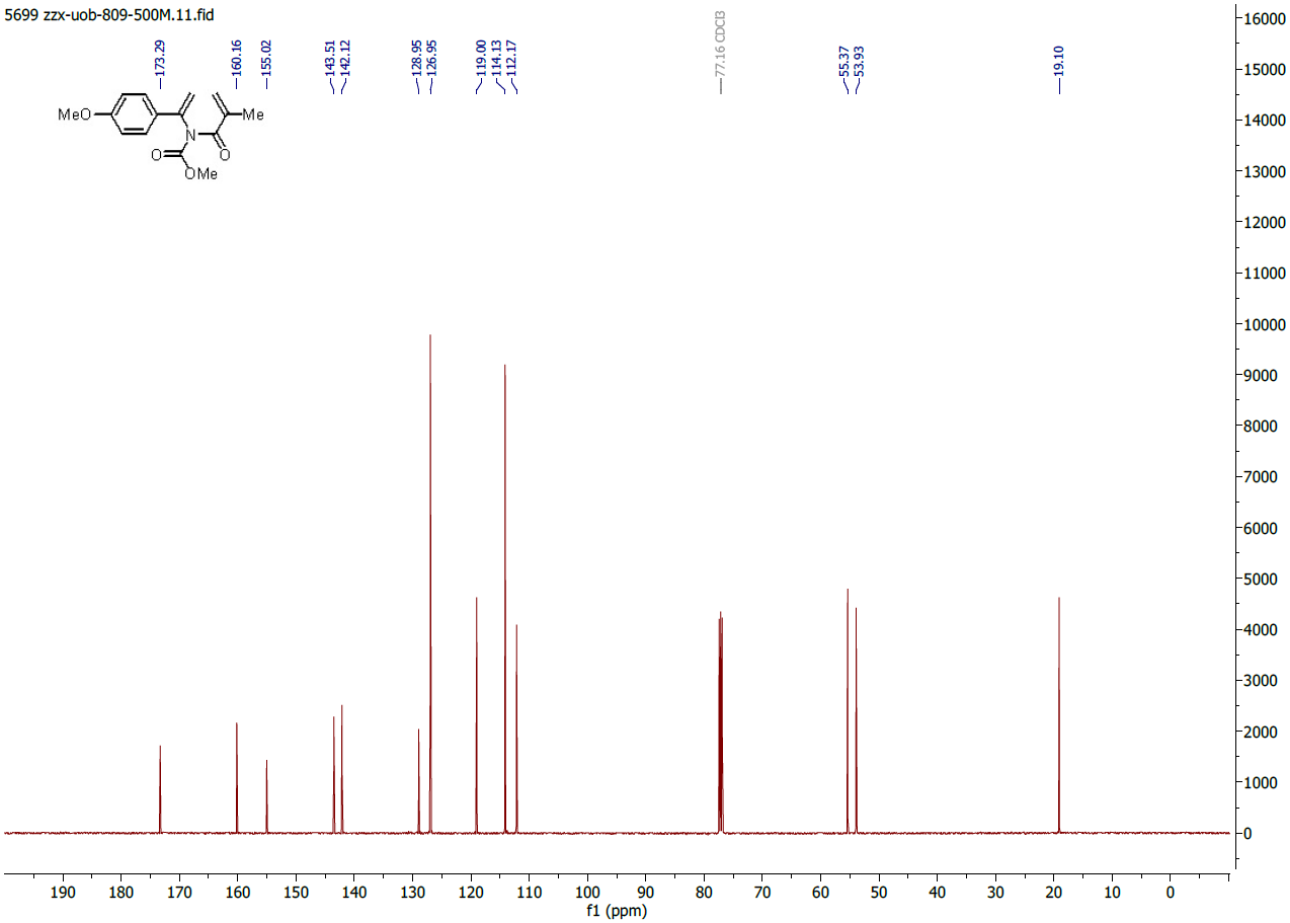
Compound 2z


5698 zzx-uob-805-500M.10.fid
MeO
Me
N
O
O
O
Ph
f1 (ppm)

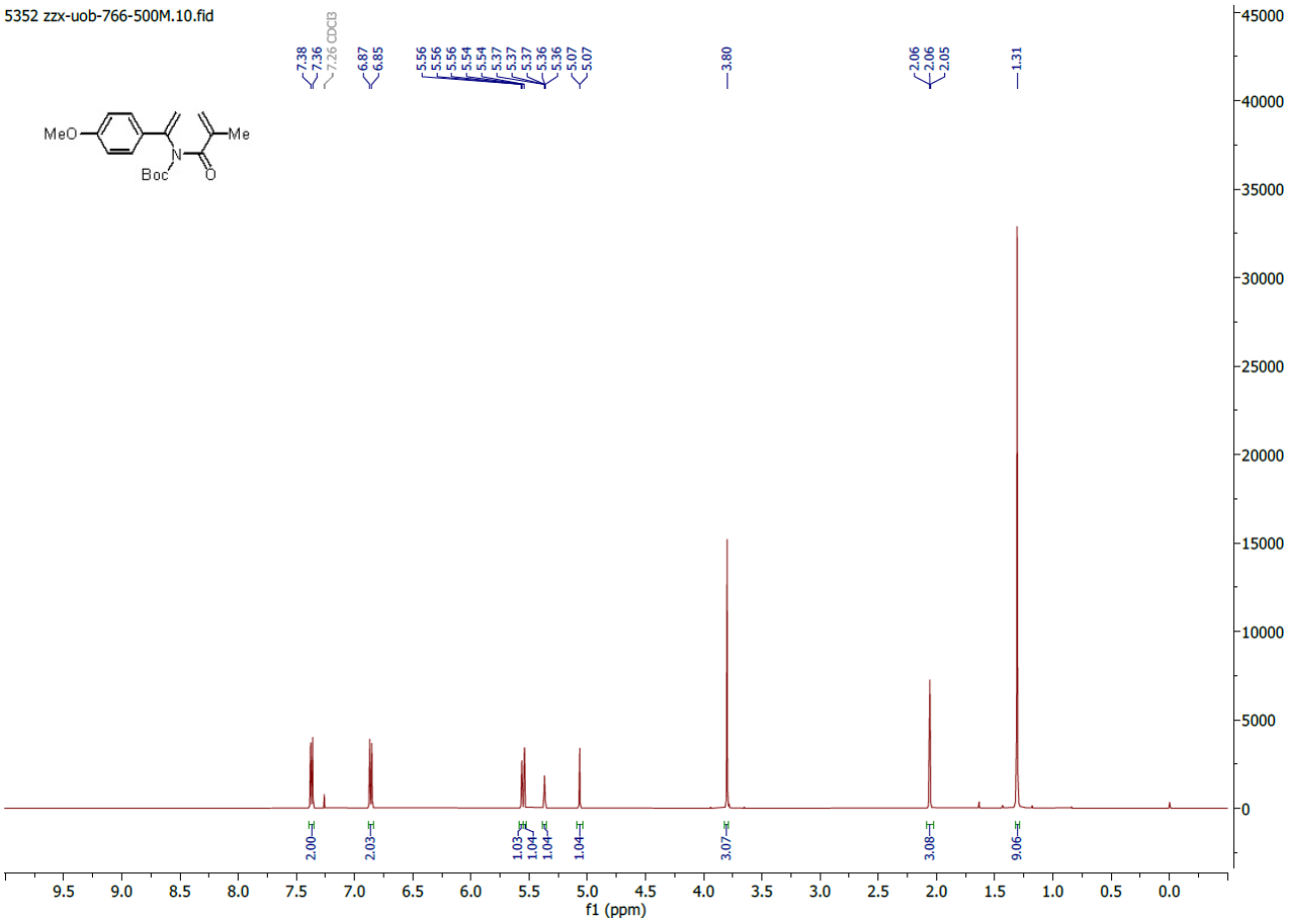

5698 zzx-uob-805-500M.11.fid
MeO
Me
N
O
O
O
Ph
f1 (ppm)

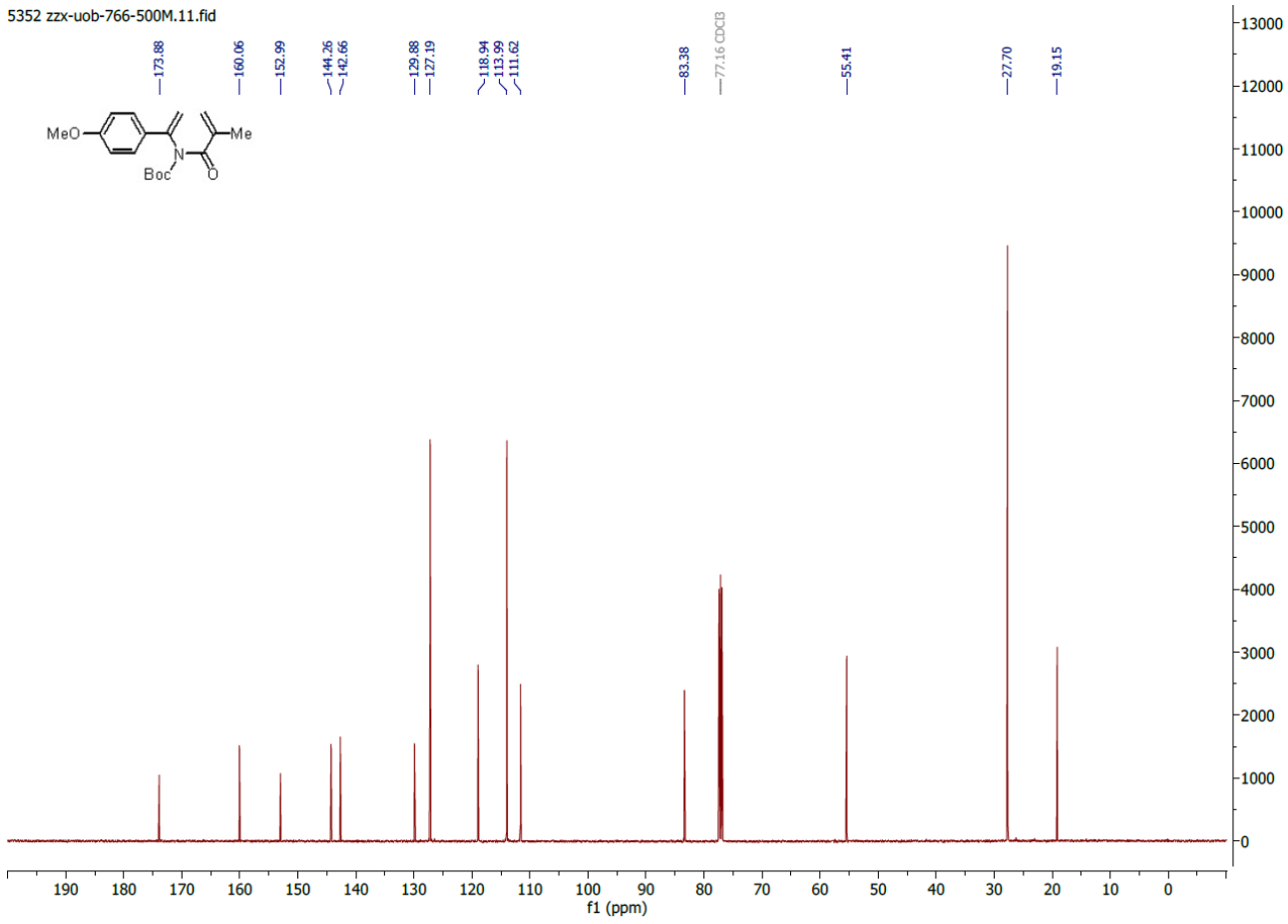
Compound 2aa



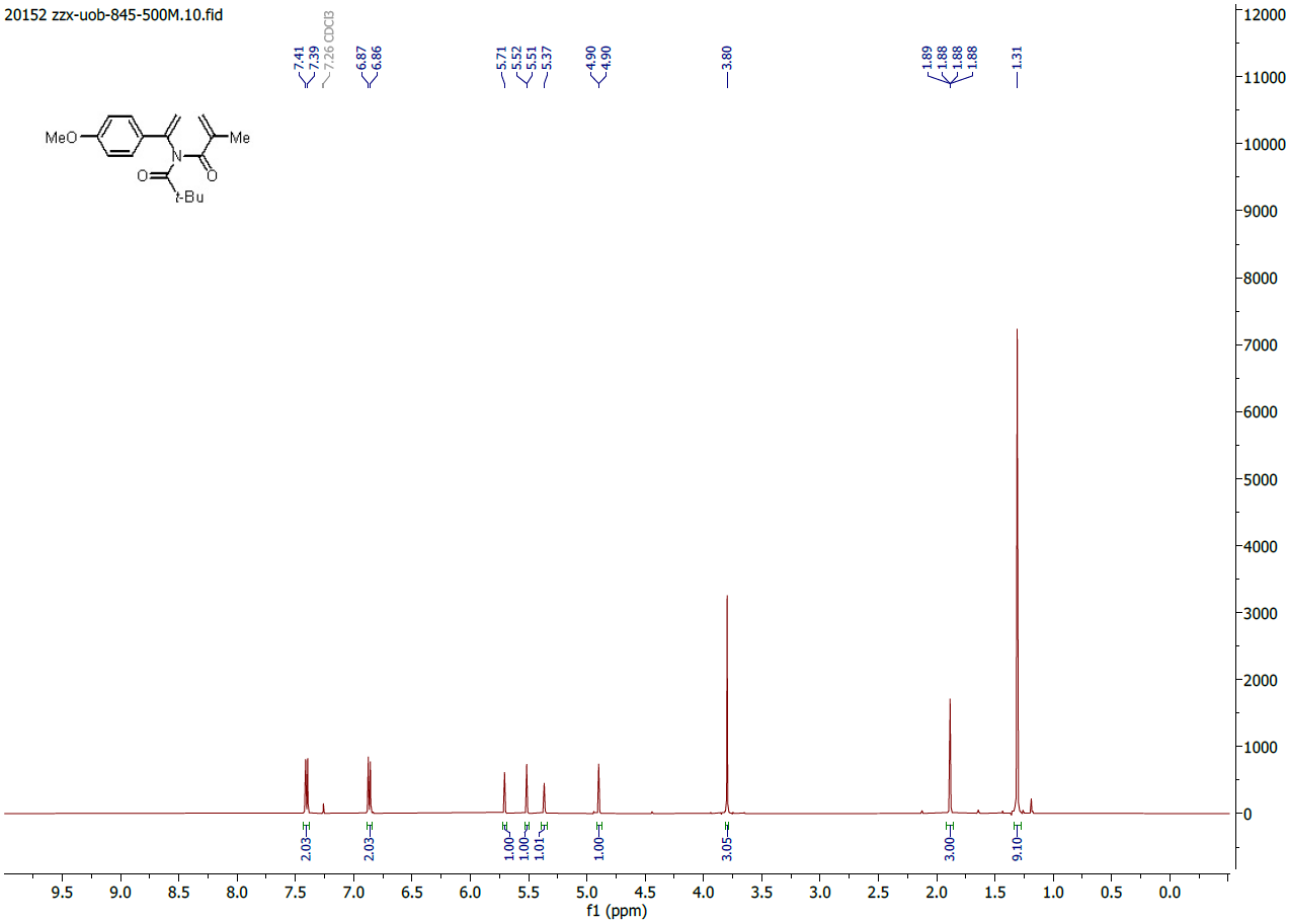


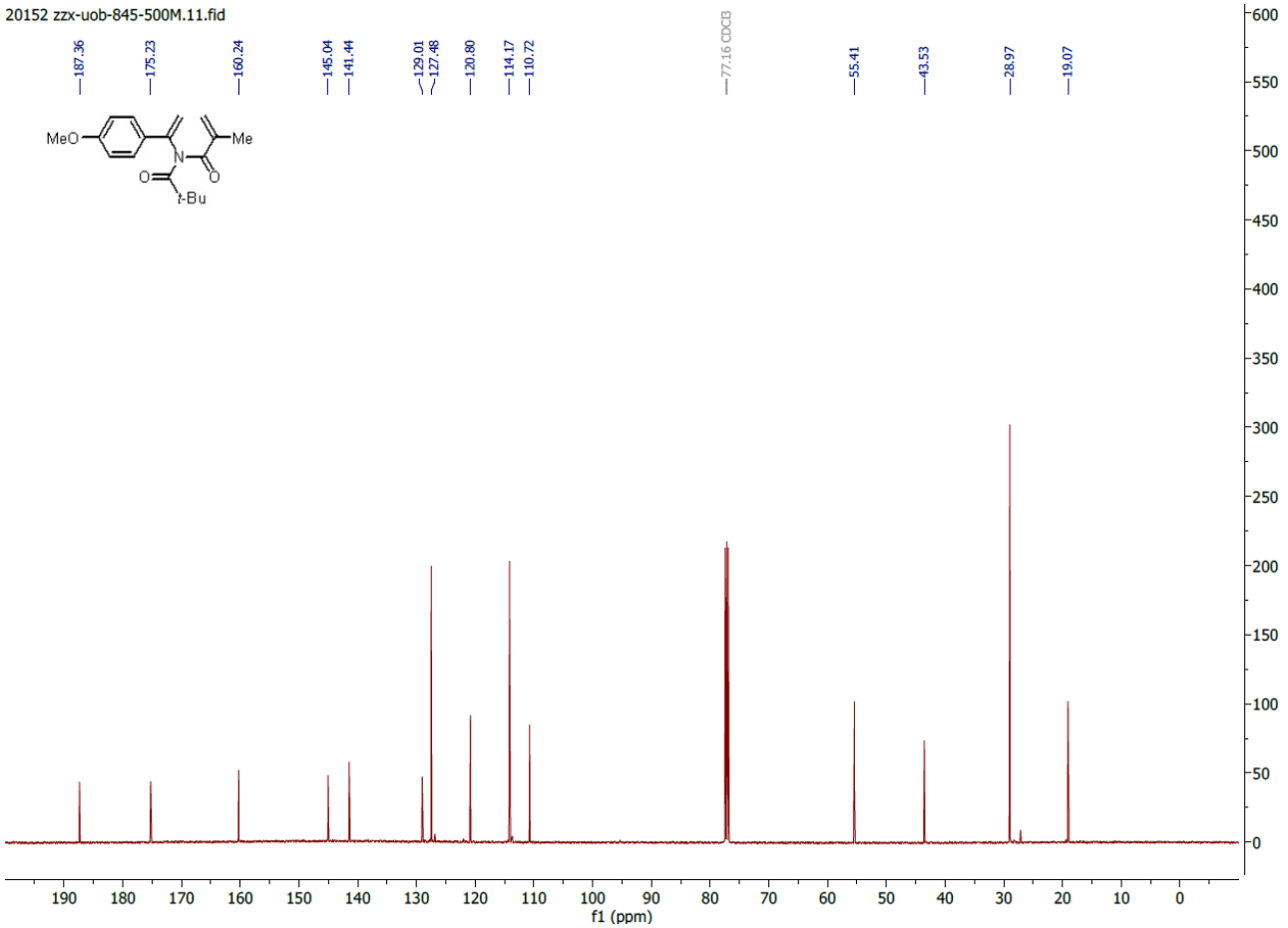
Compound 2ab



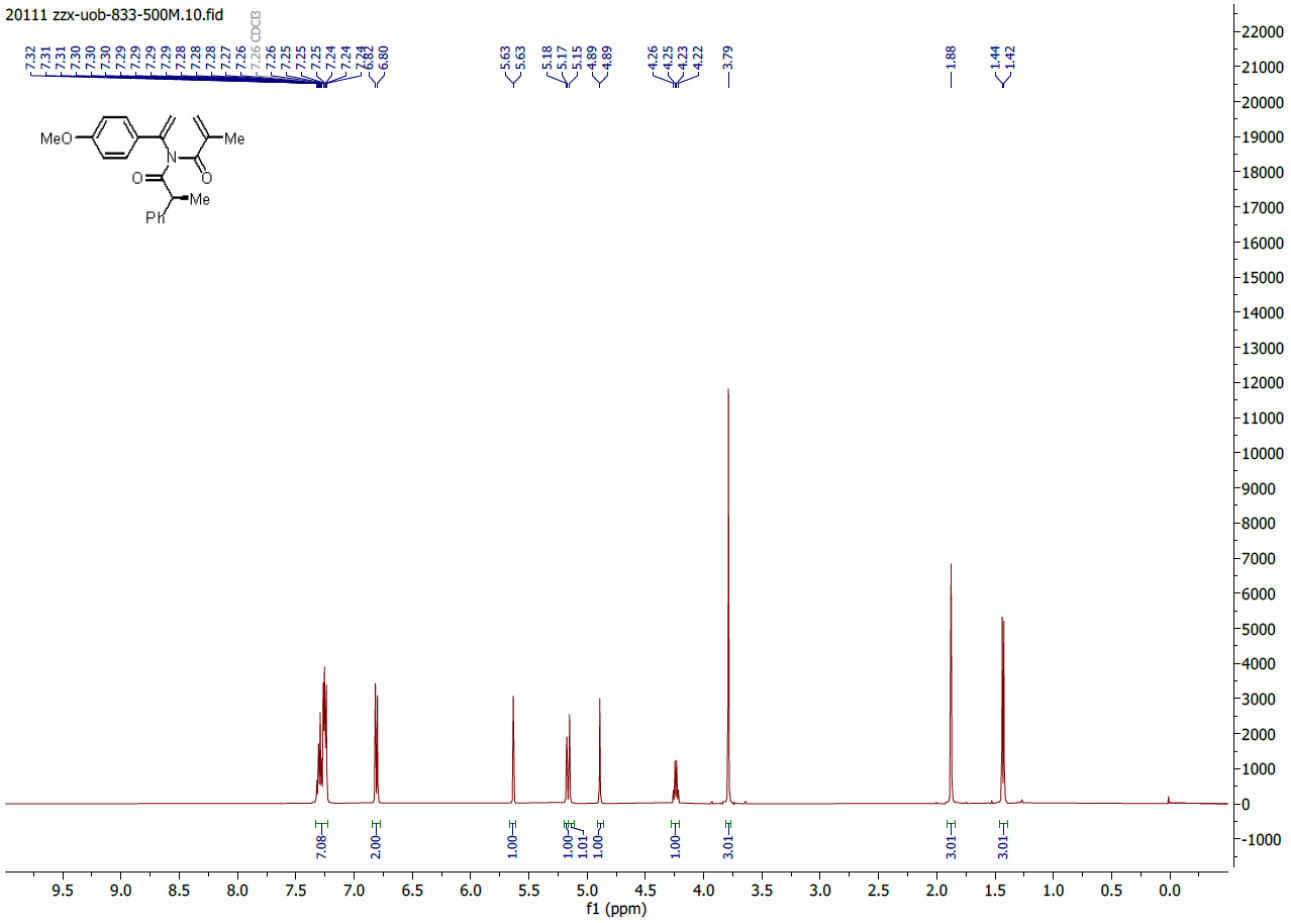


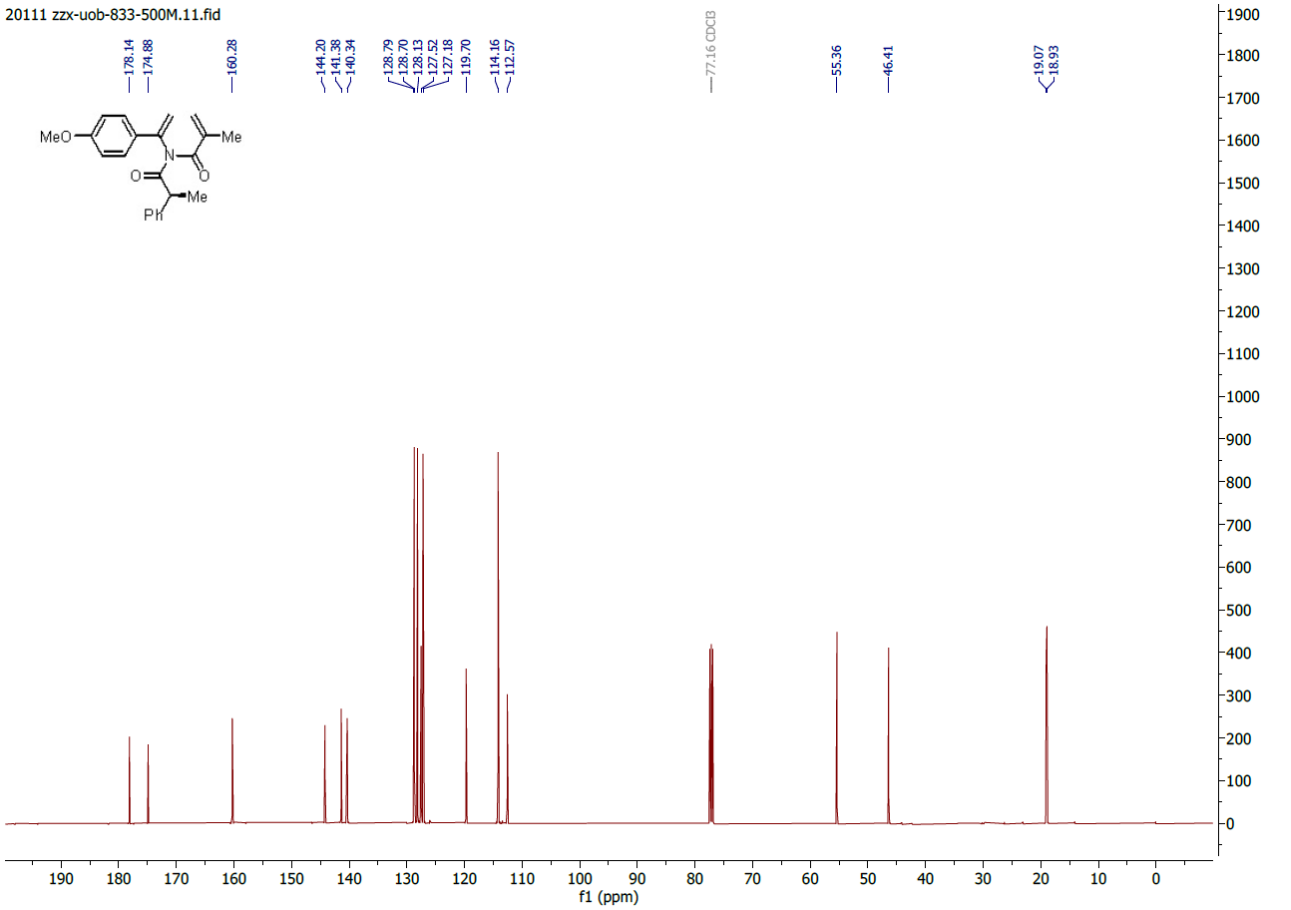
Compound 2ac



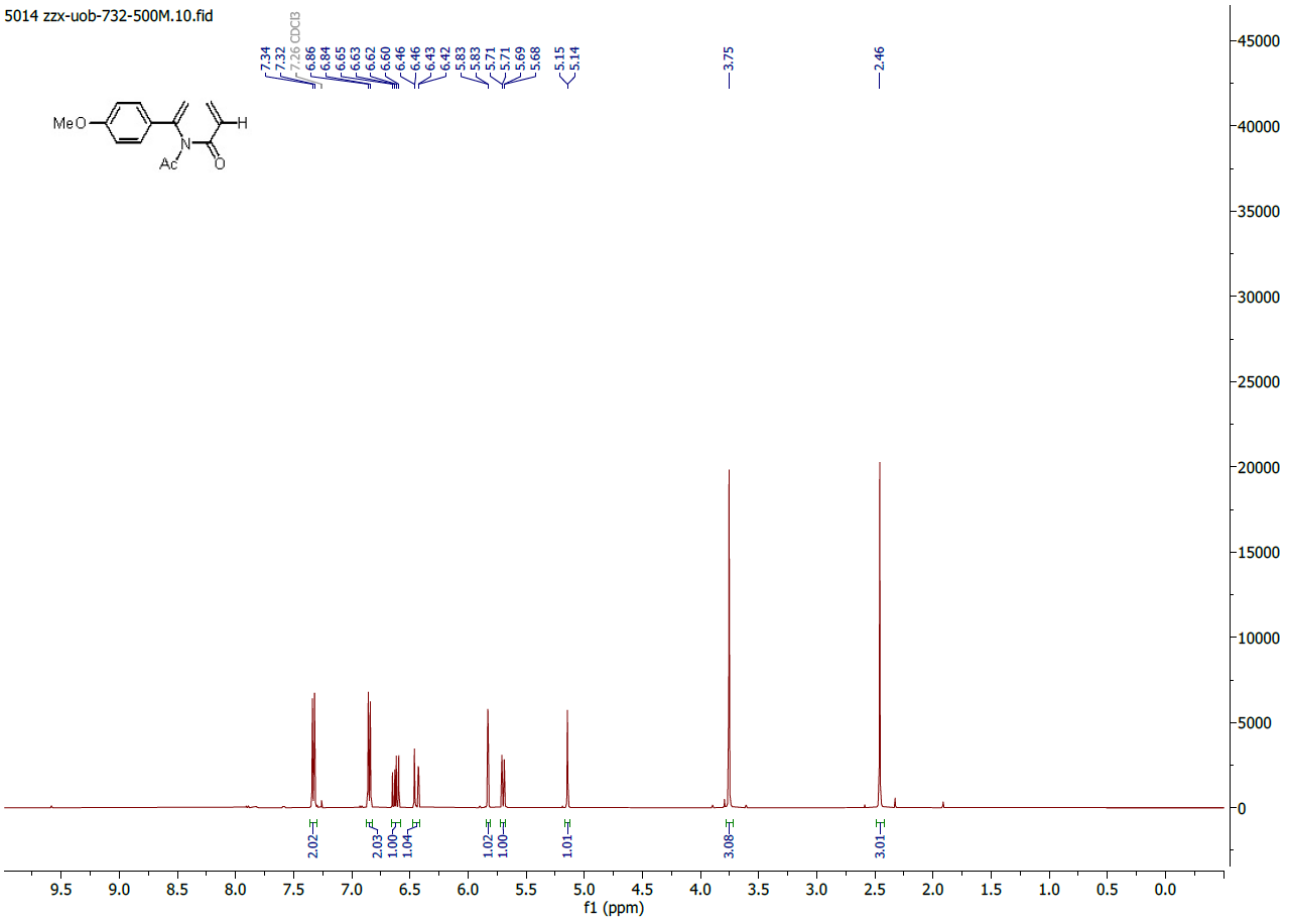


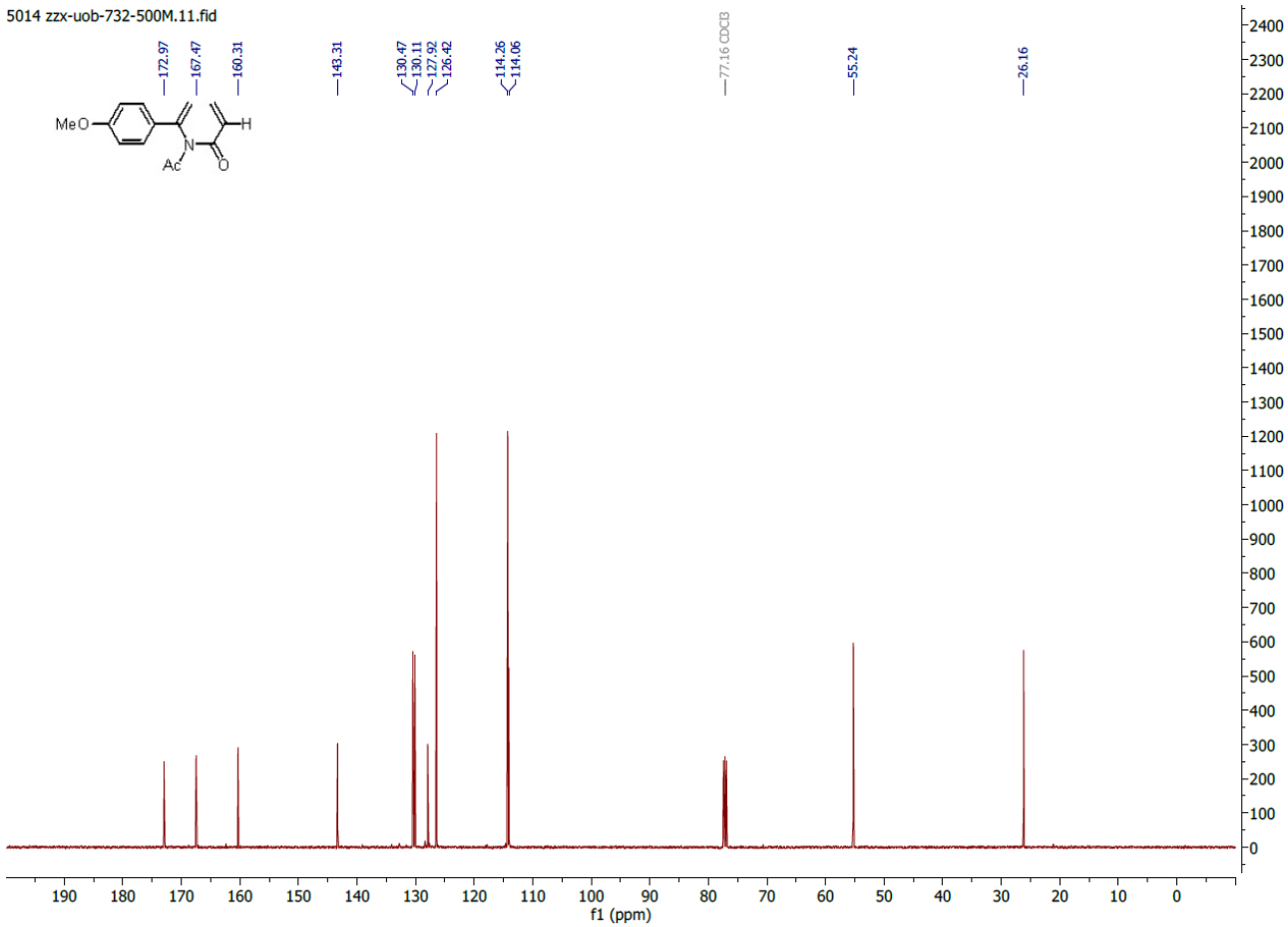
Compound 2ad



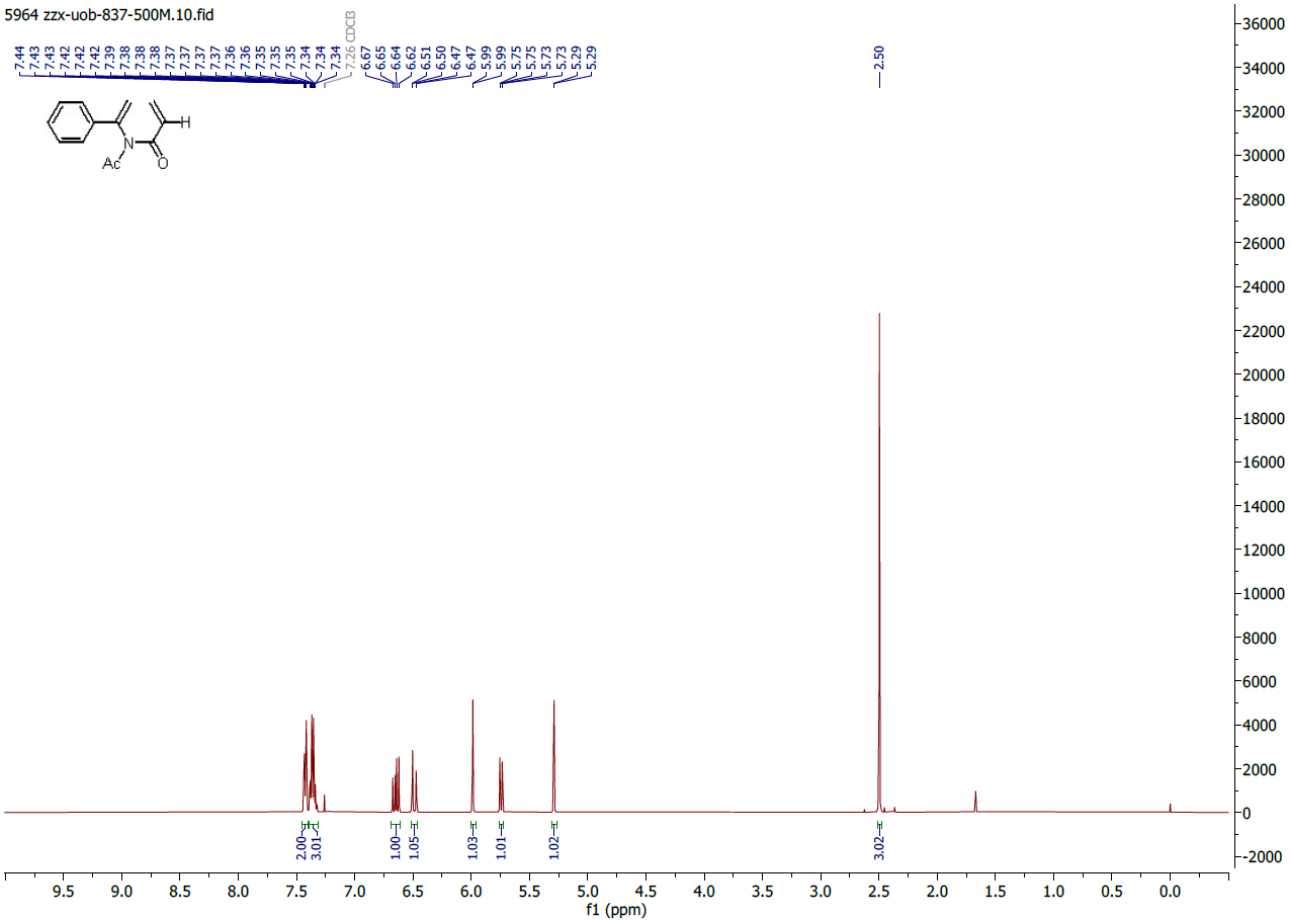


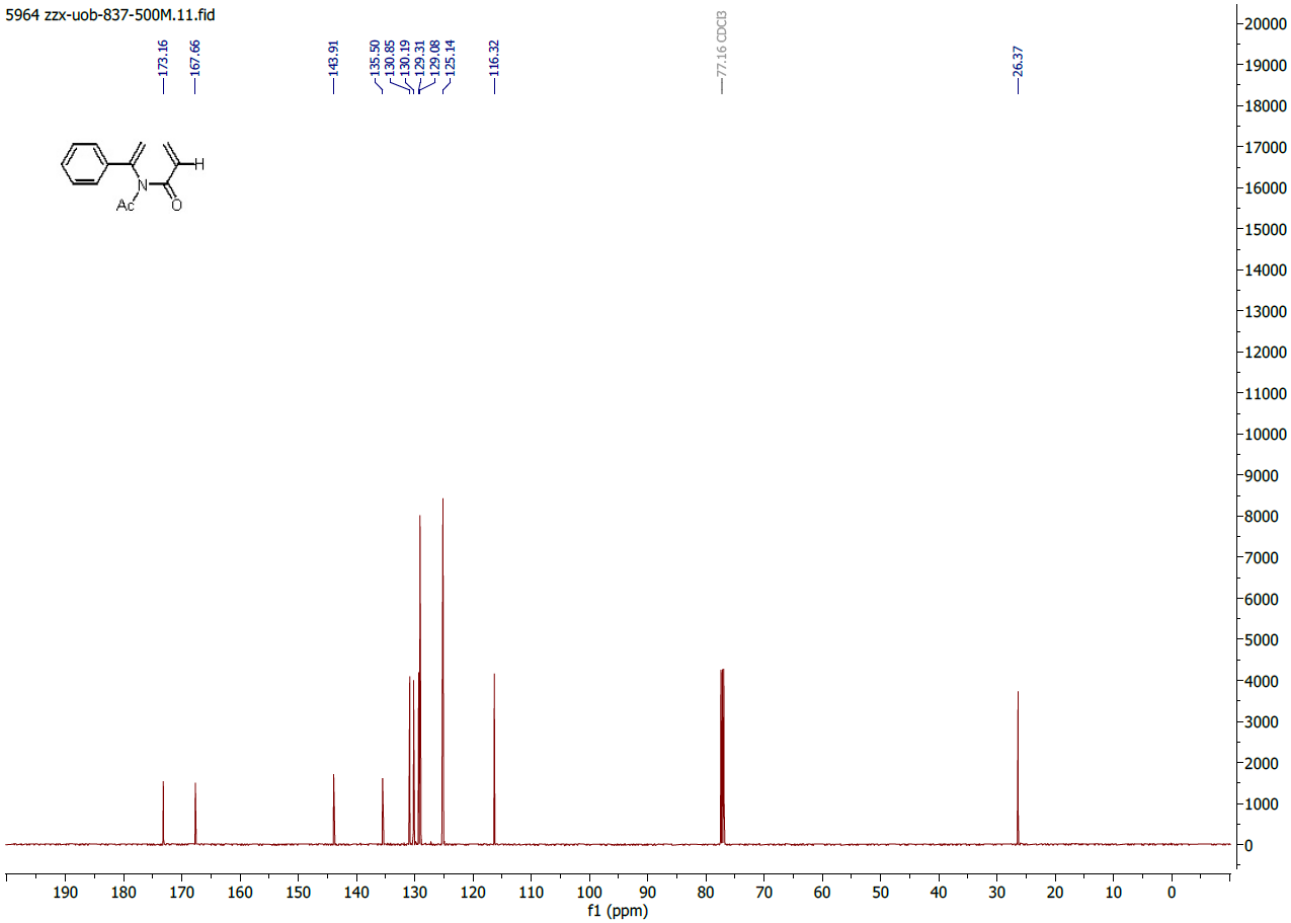
Compound 2ae



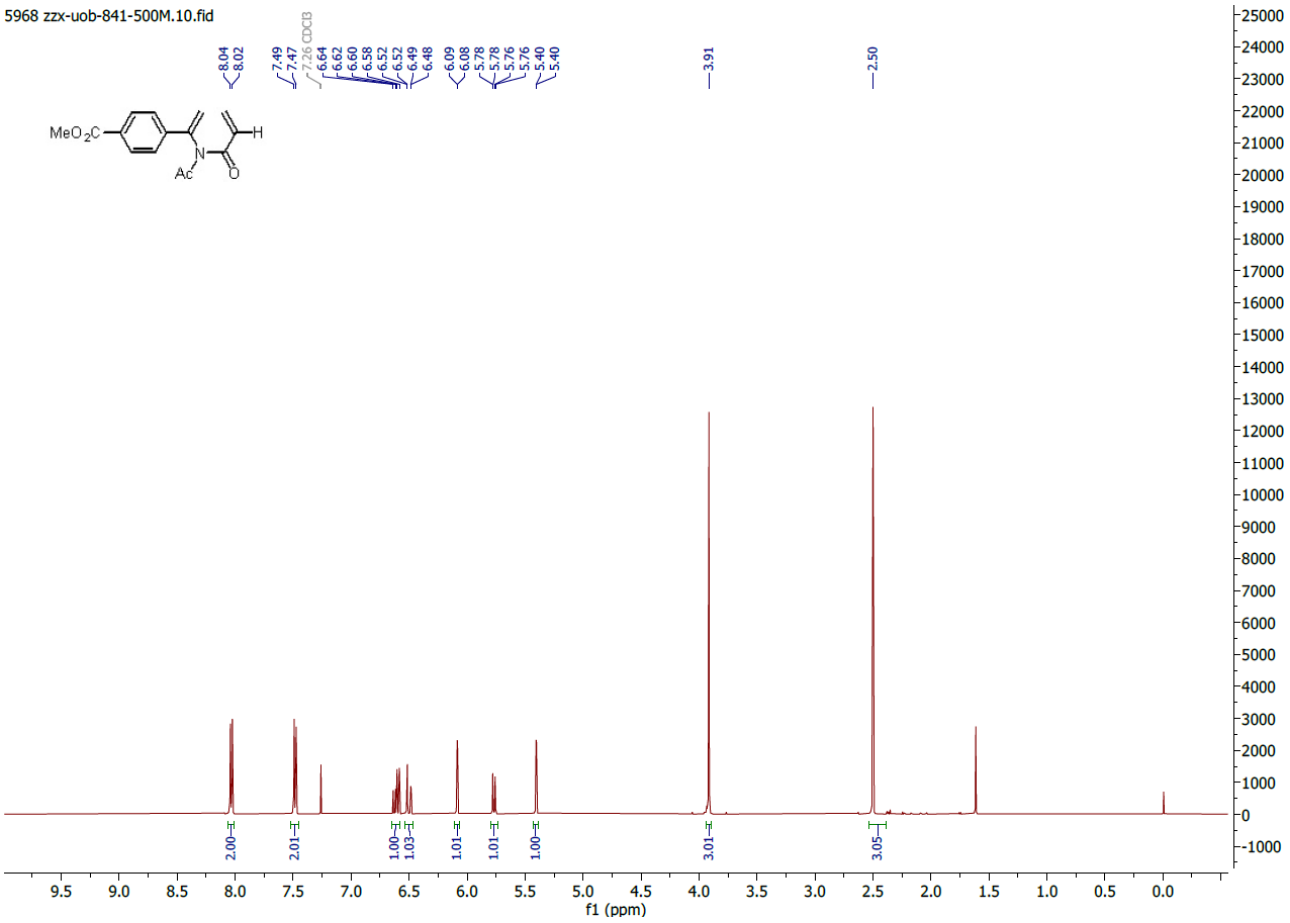


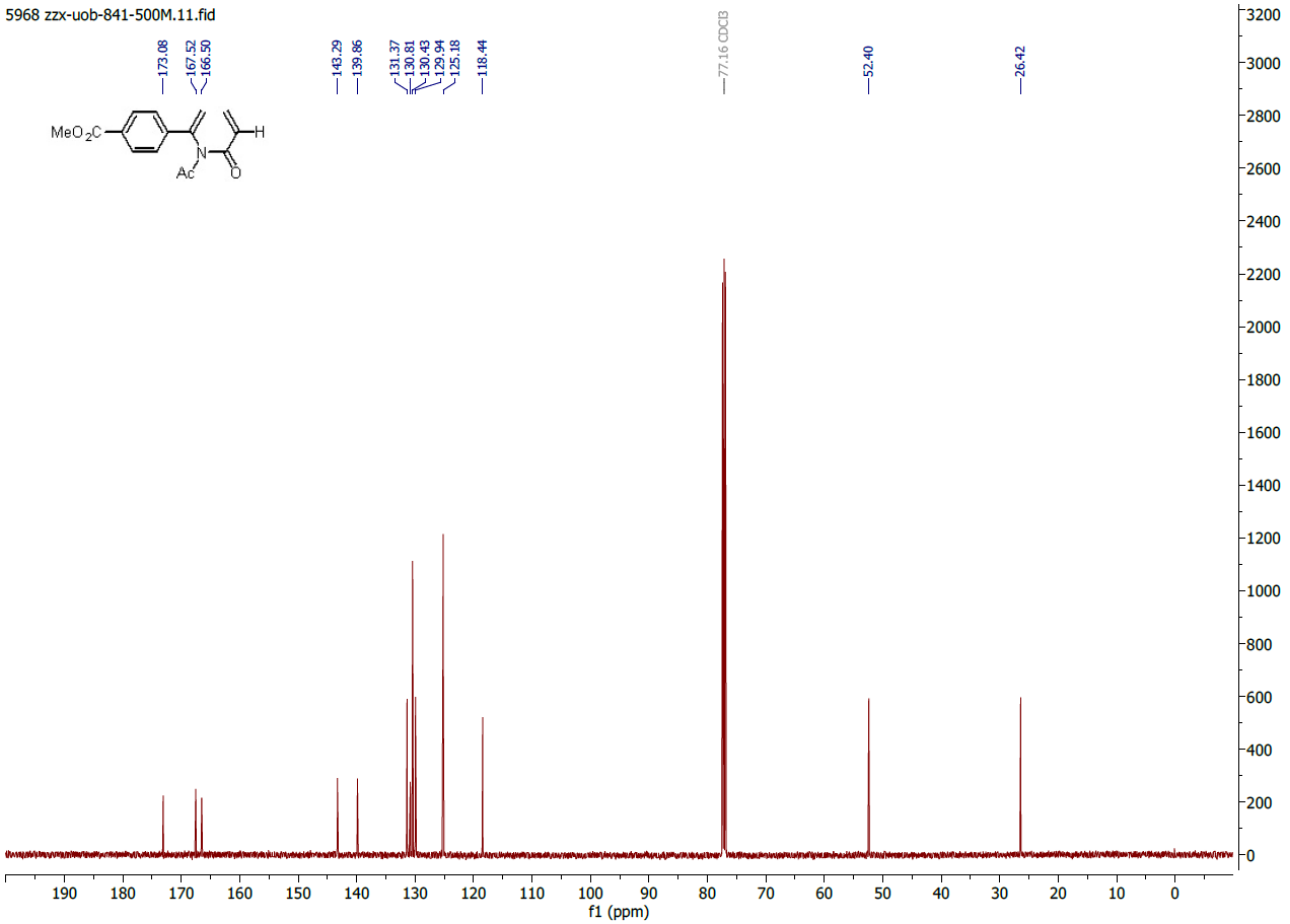
Compound 2af



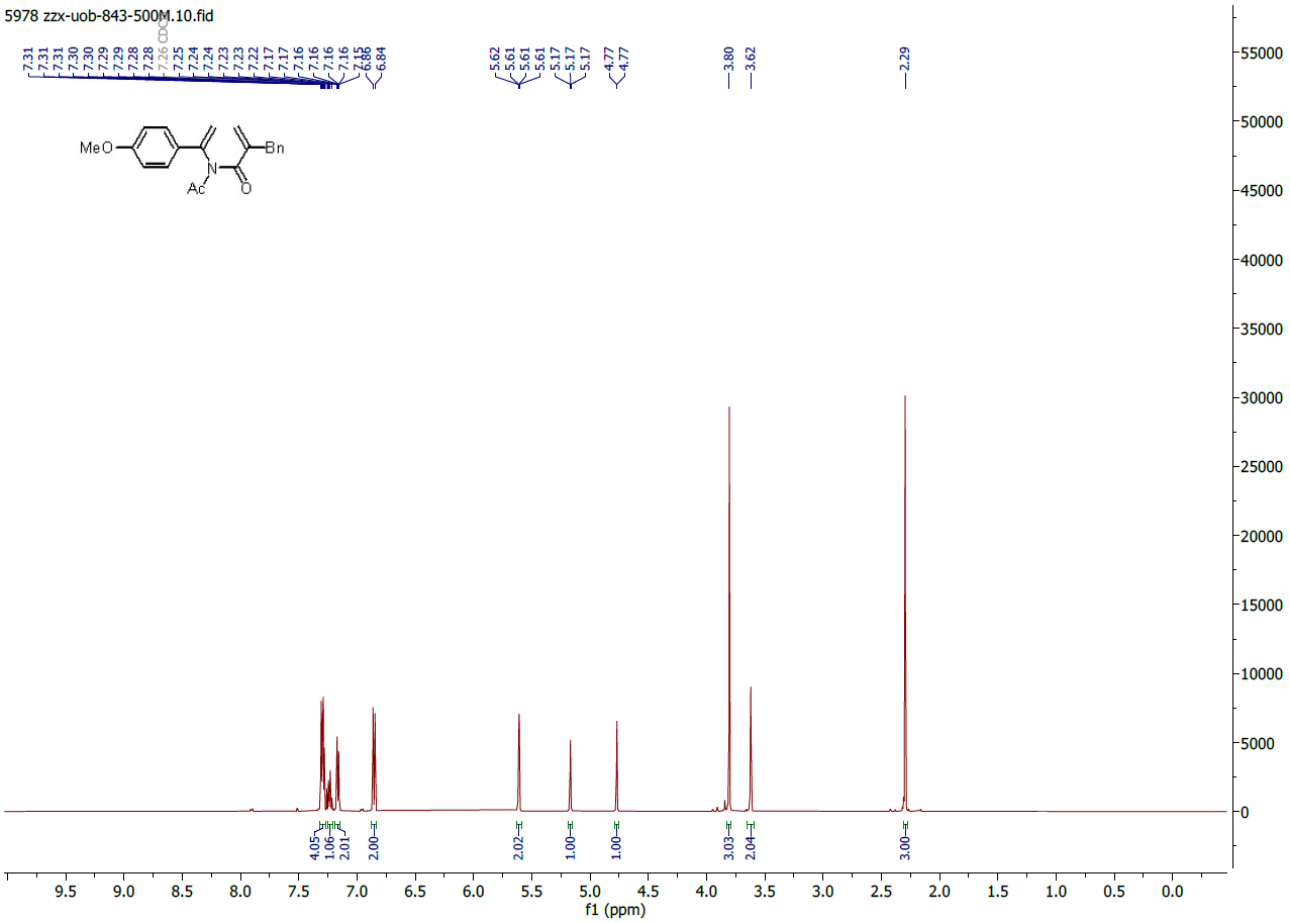


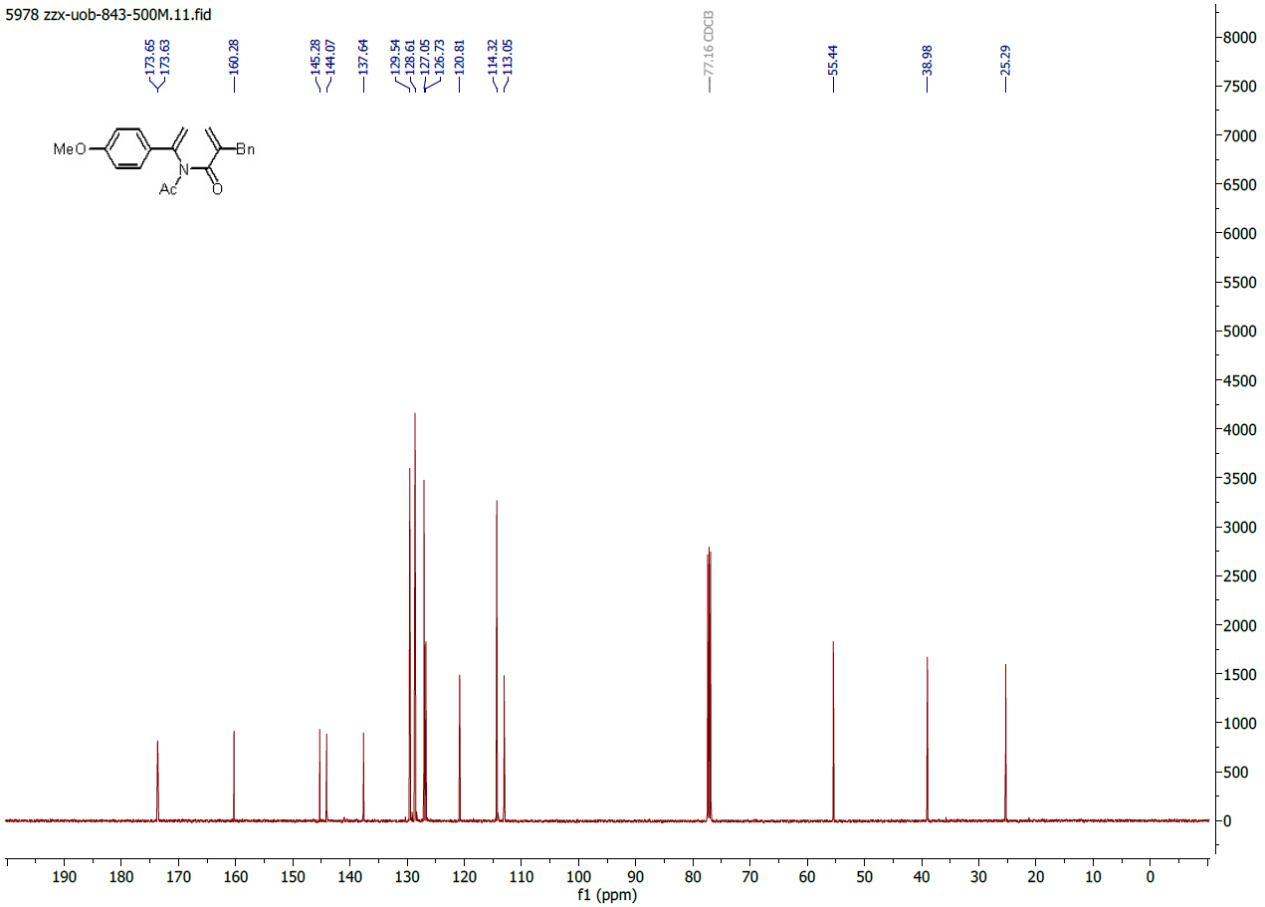
Compound 2ag



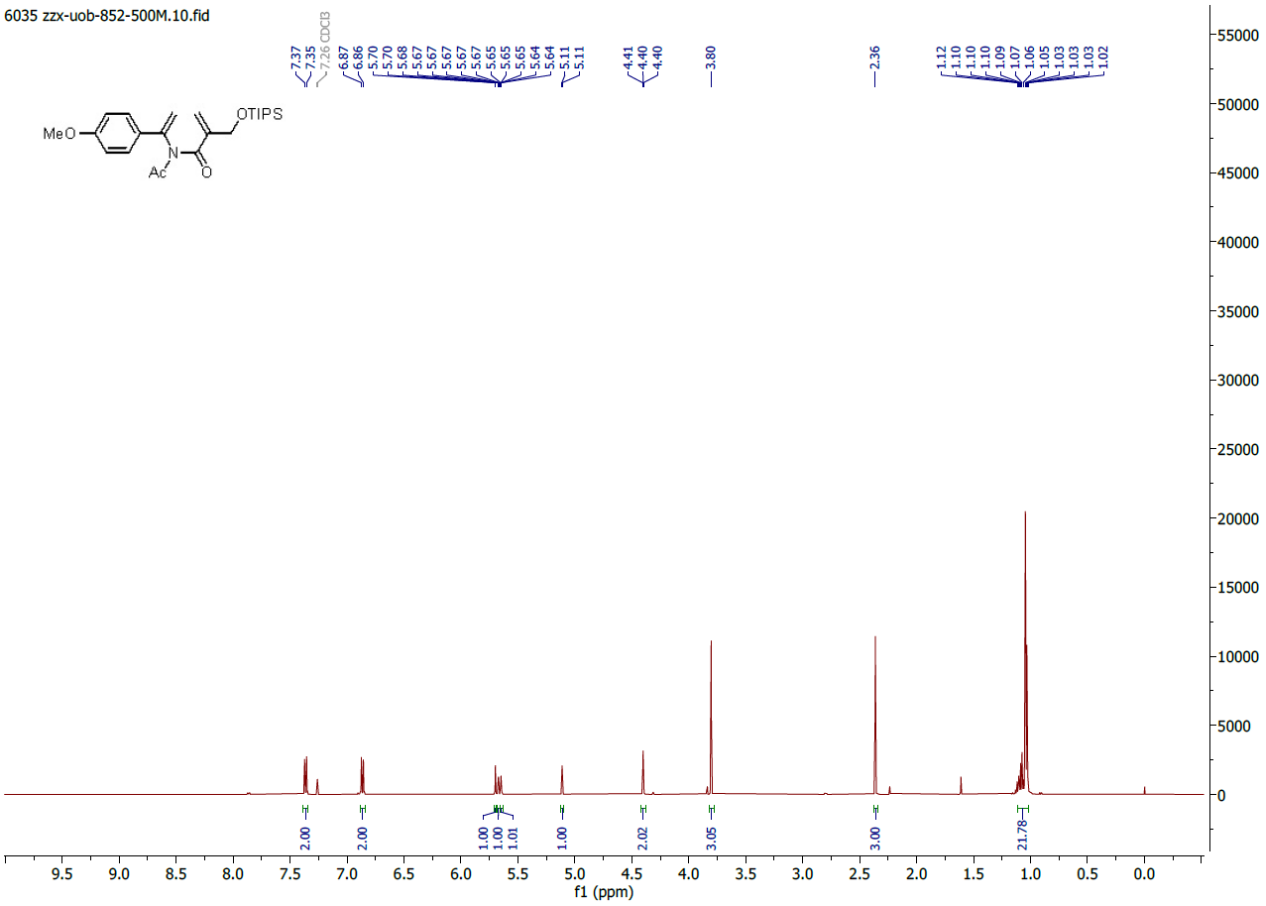


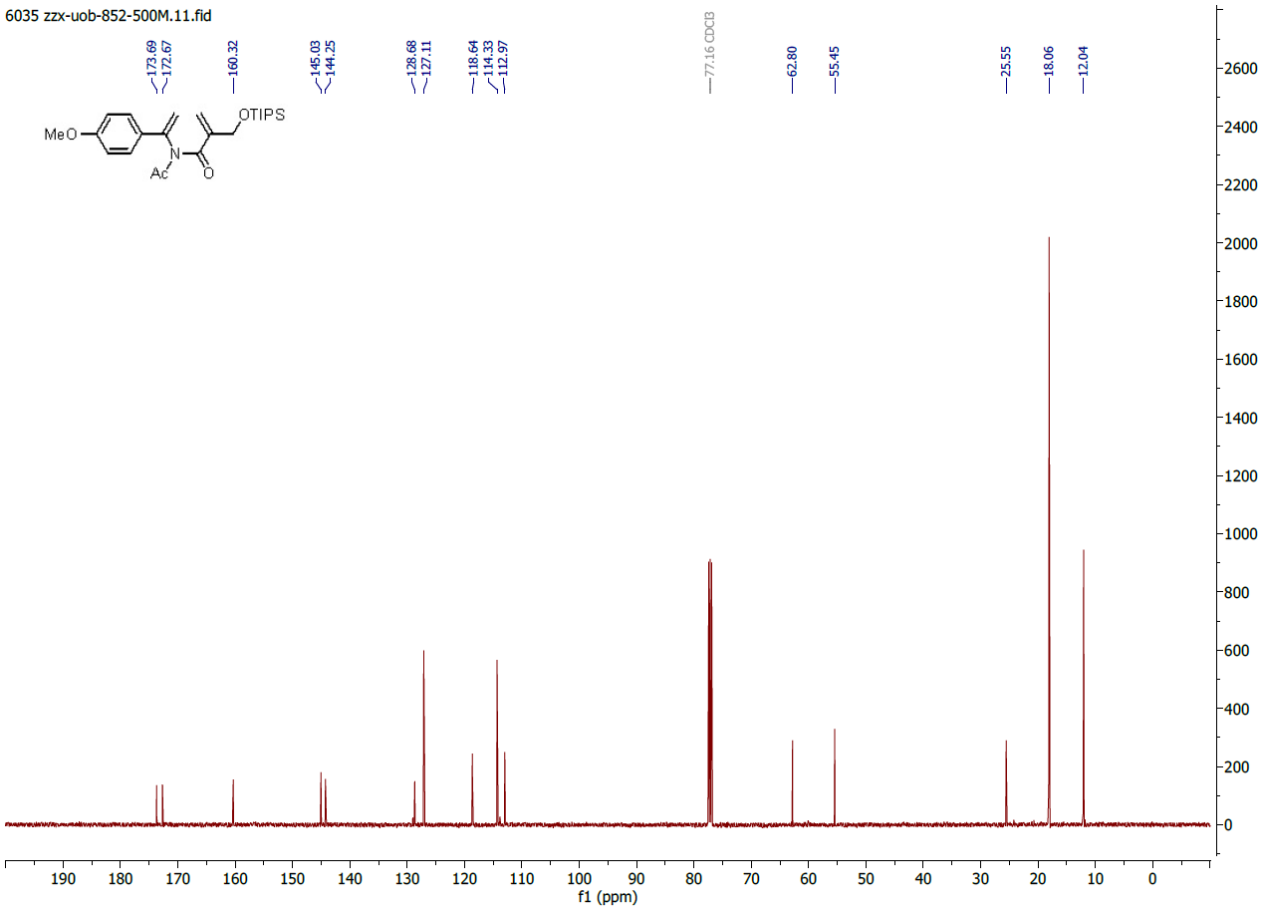
Compound 2ah



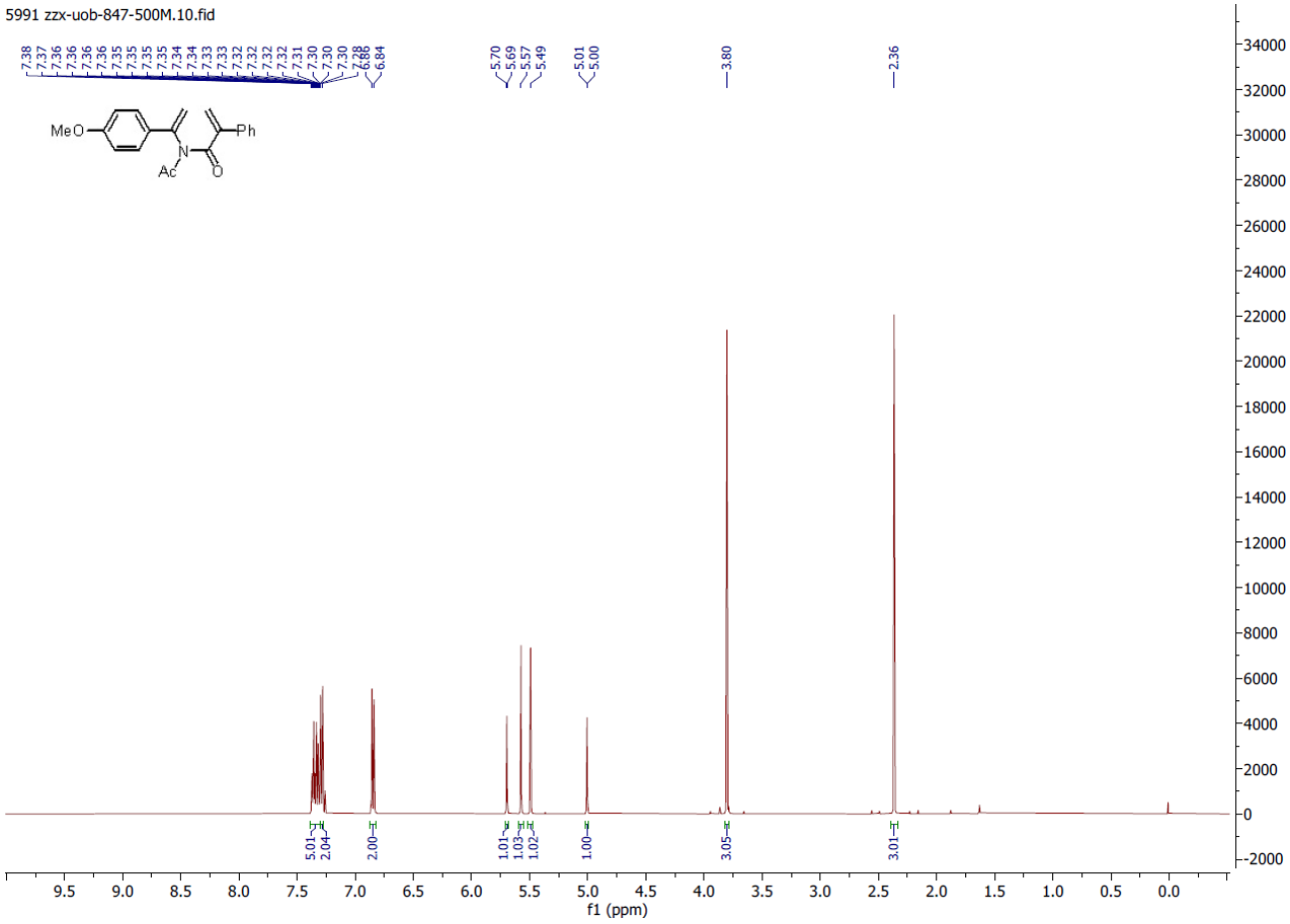


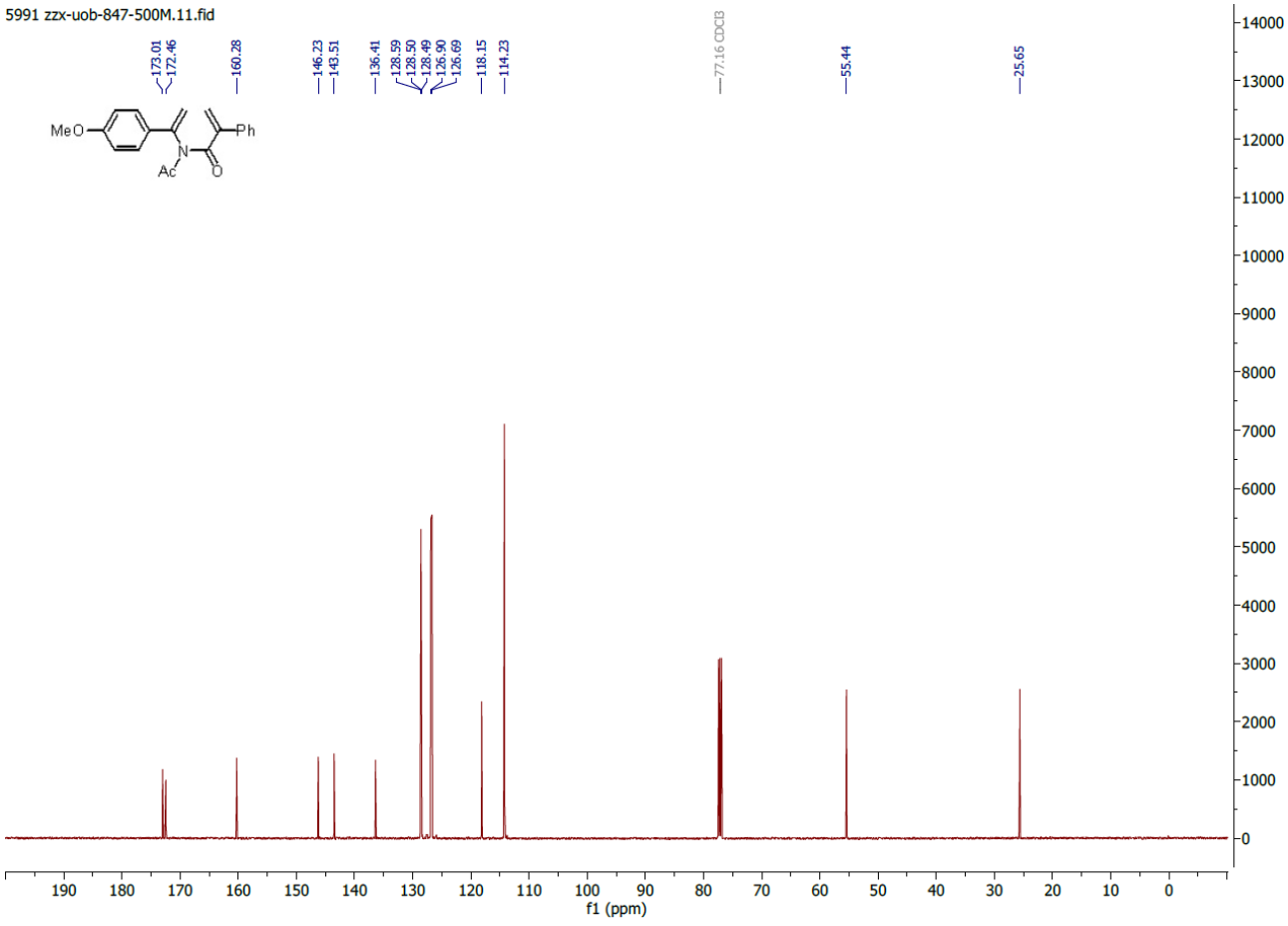
Compound 2ai



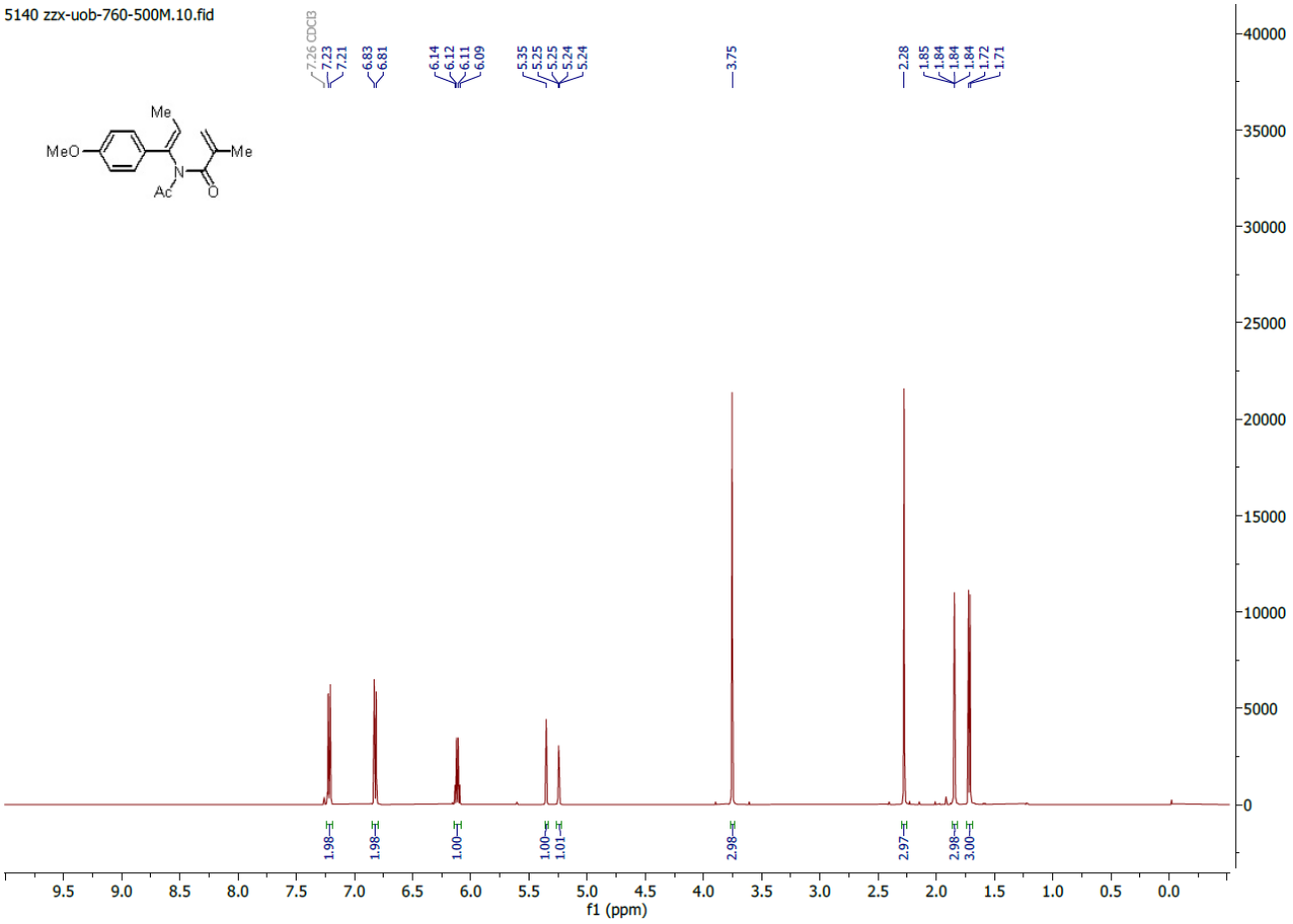


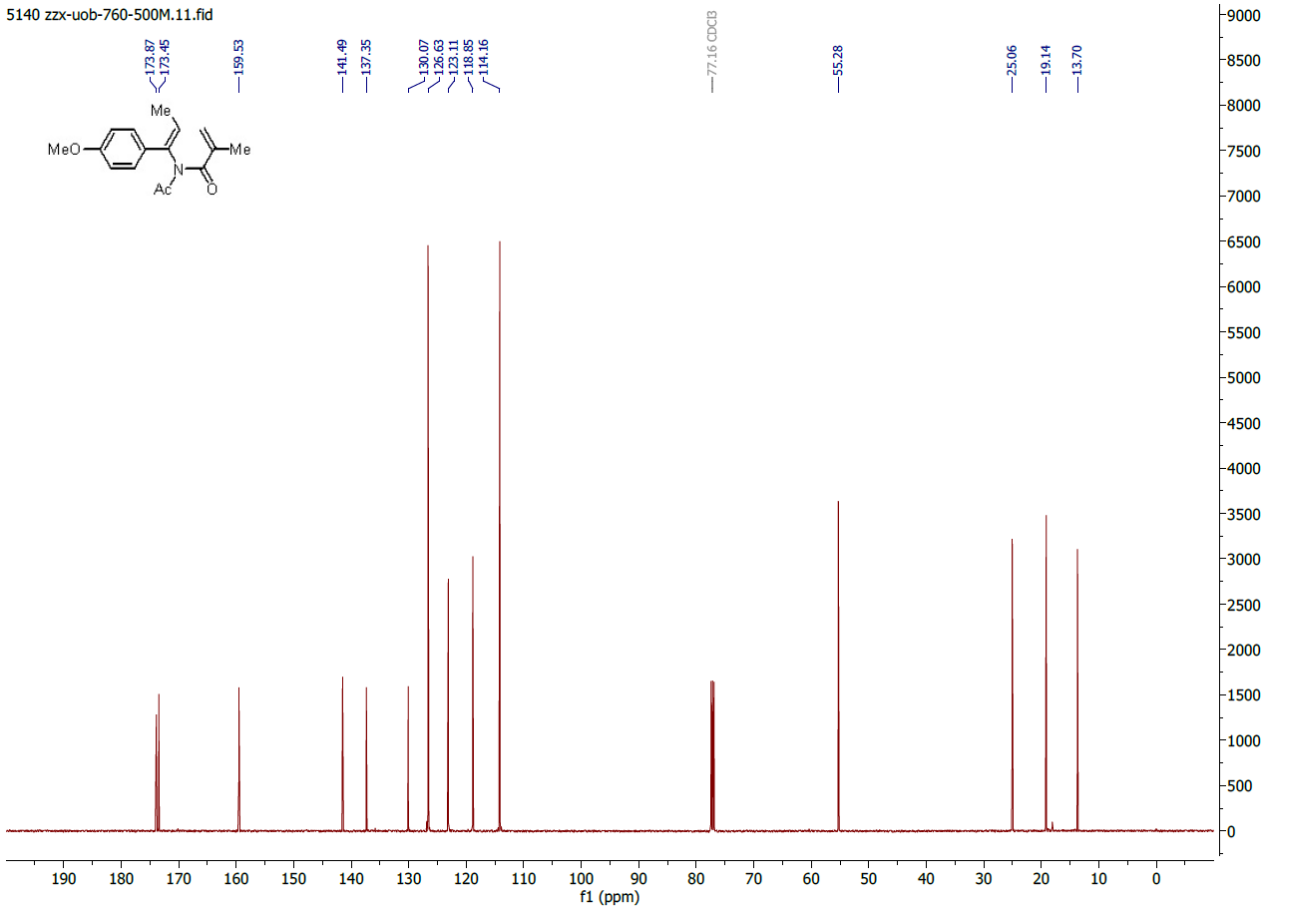
Compound 2aj



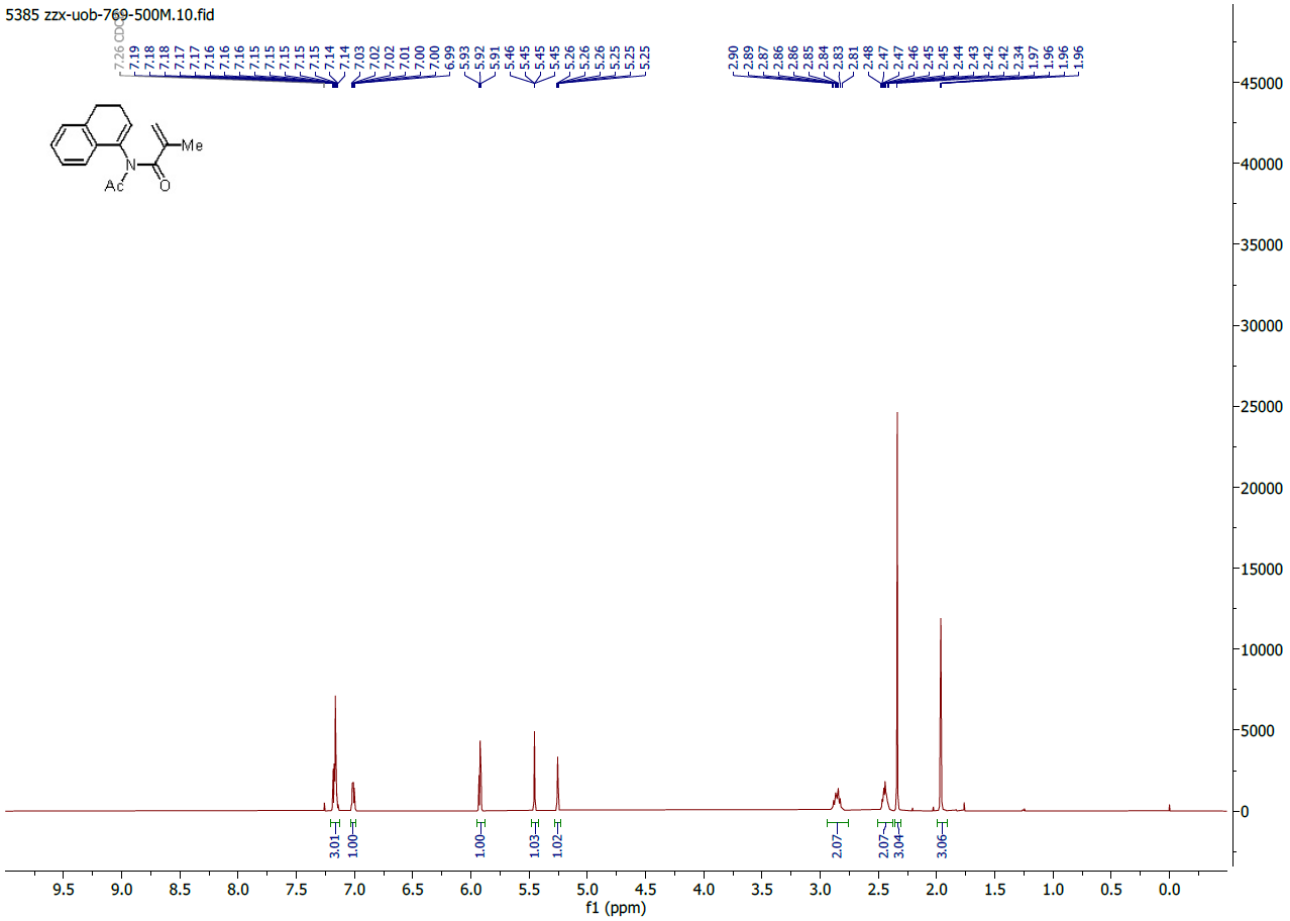


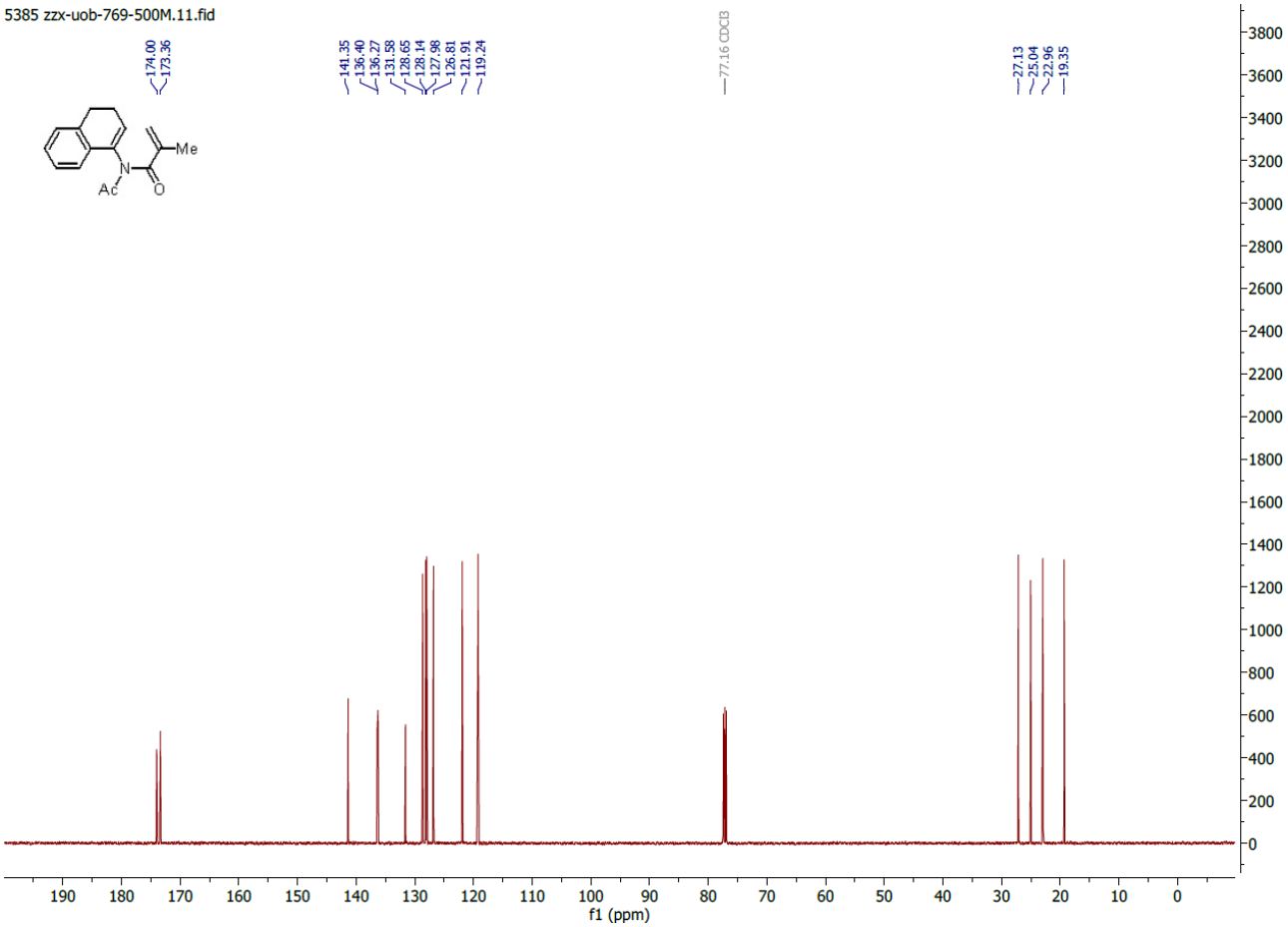
Compound 2ak



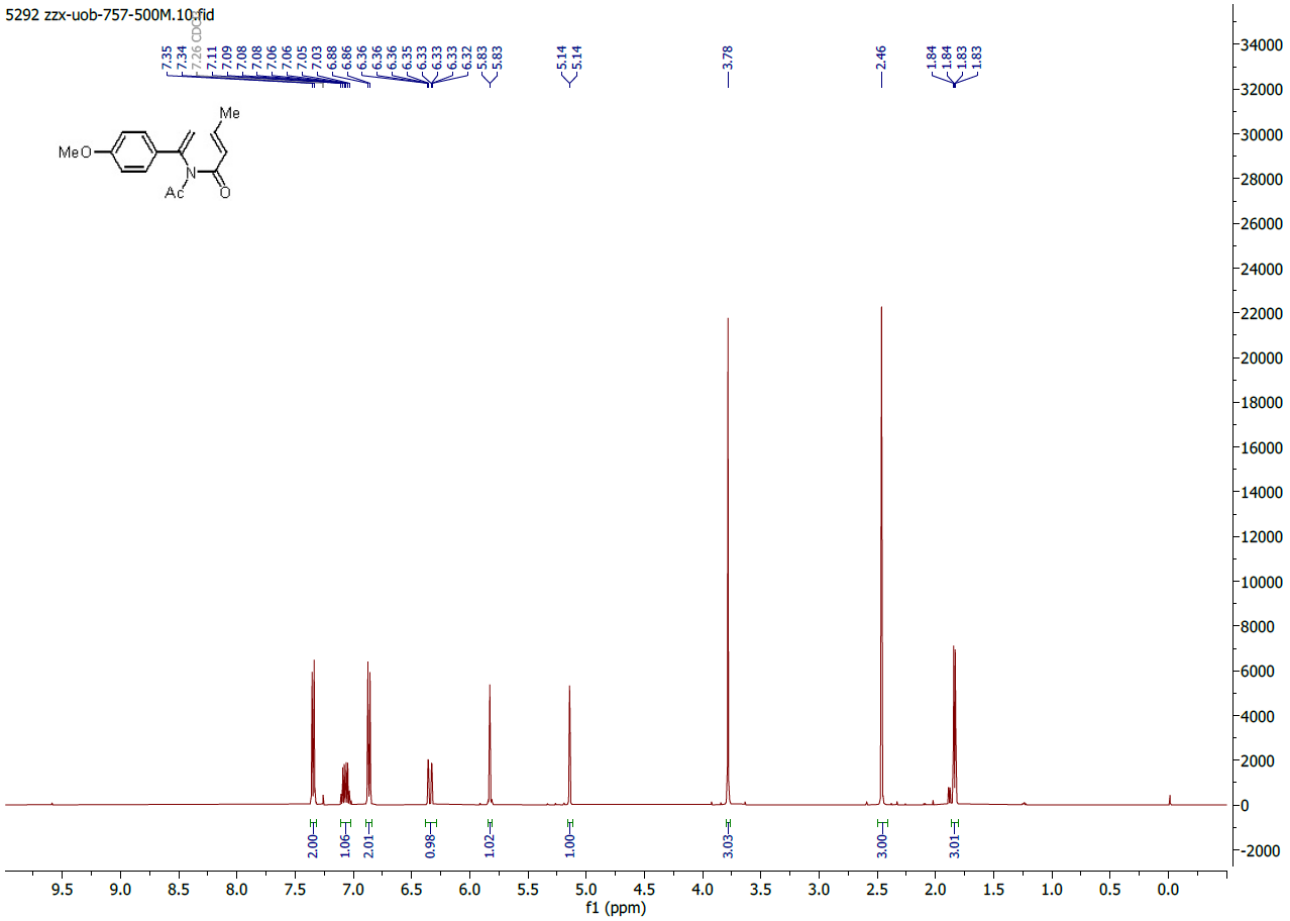


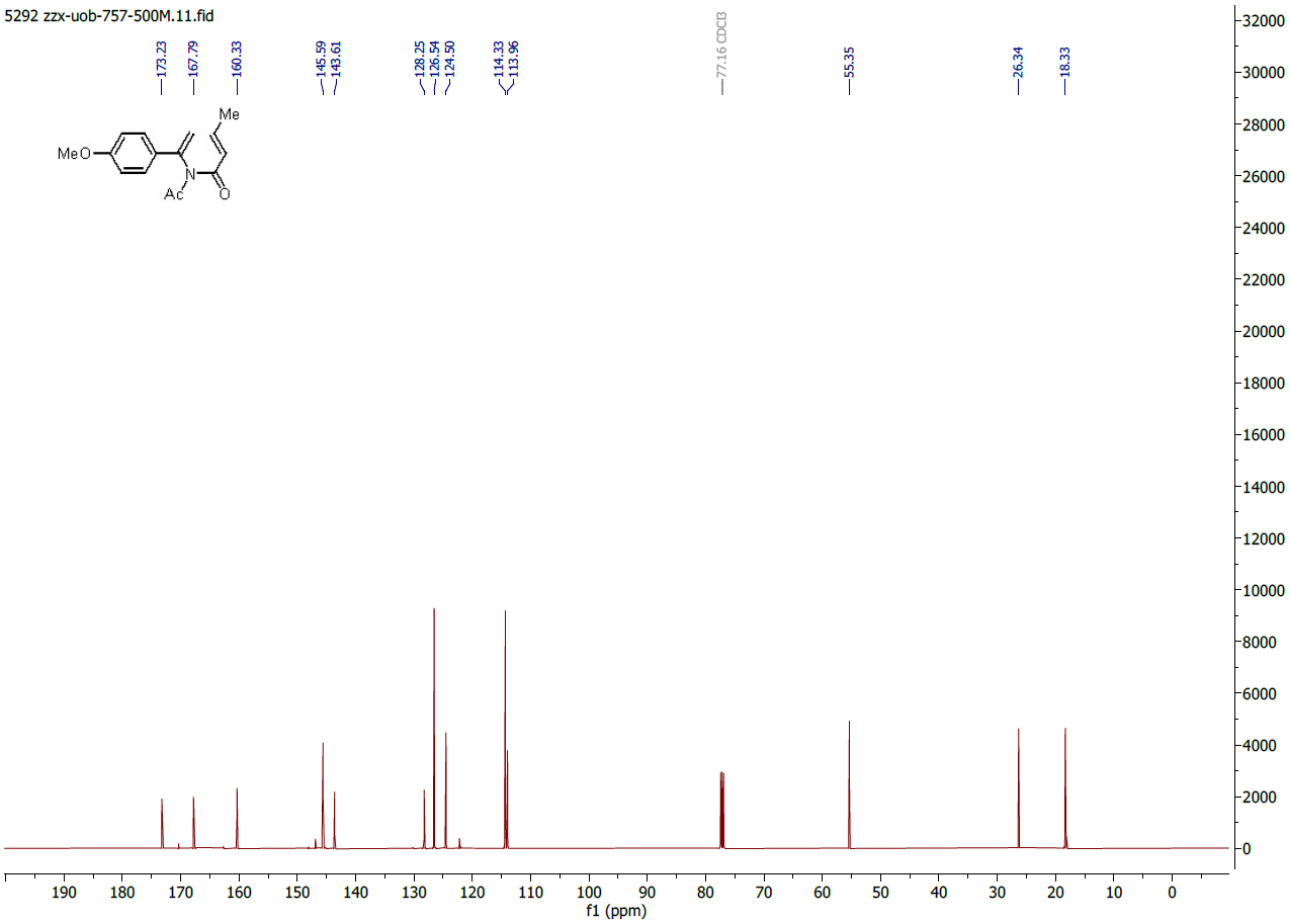
Compound 2al



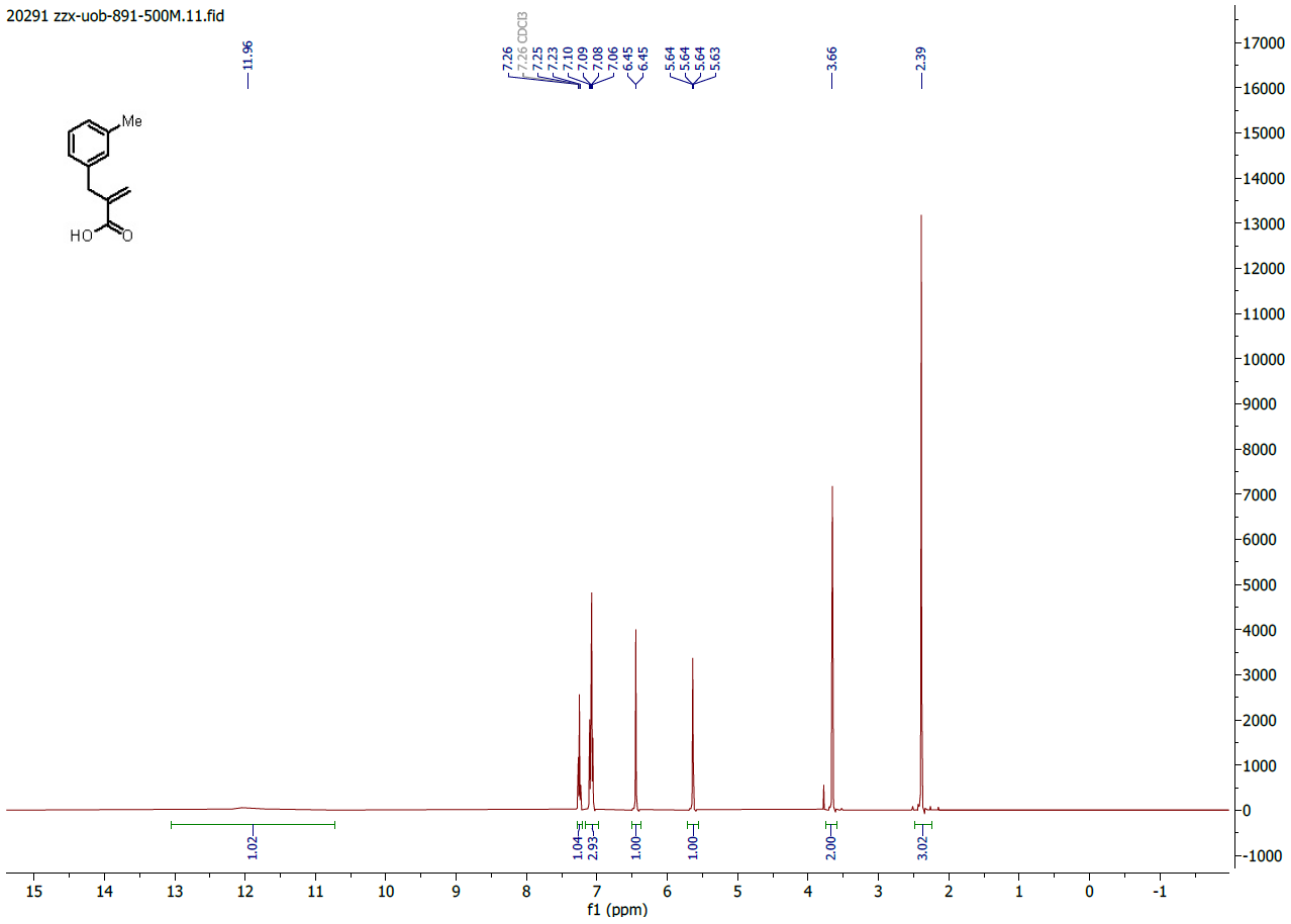


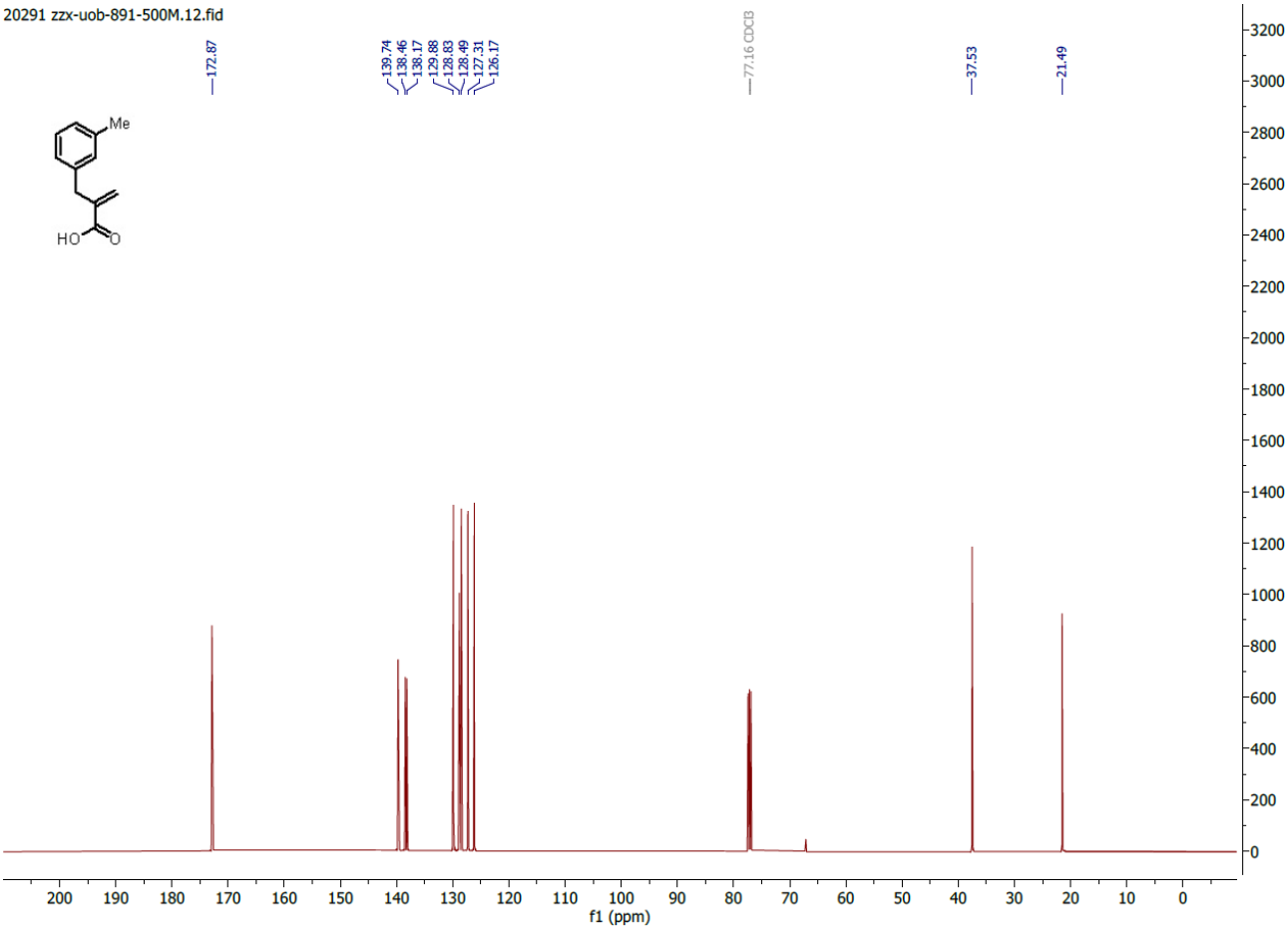
Compound 2am



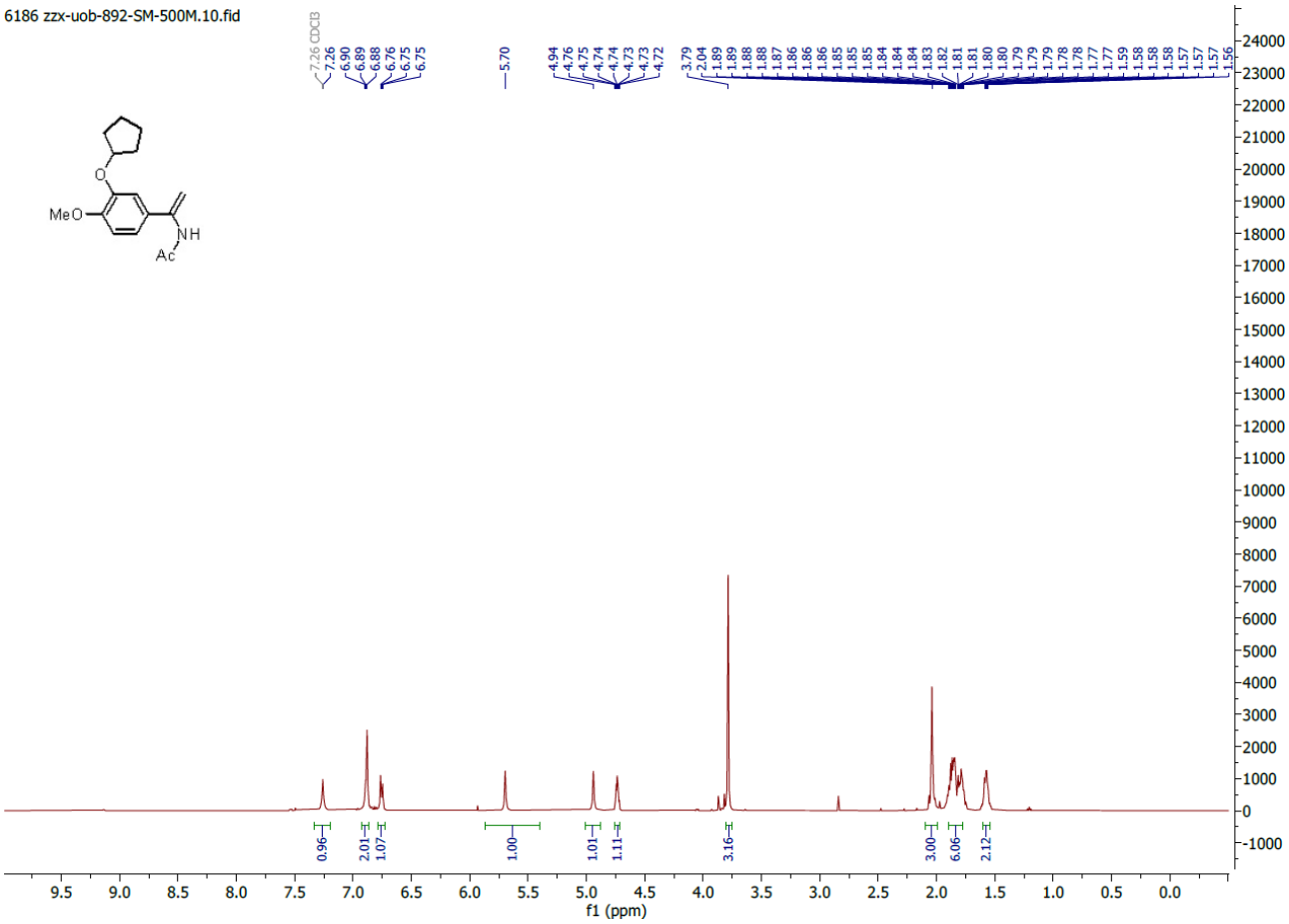


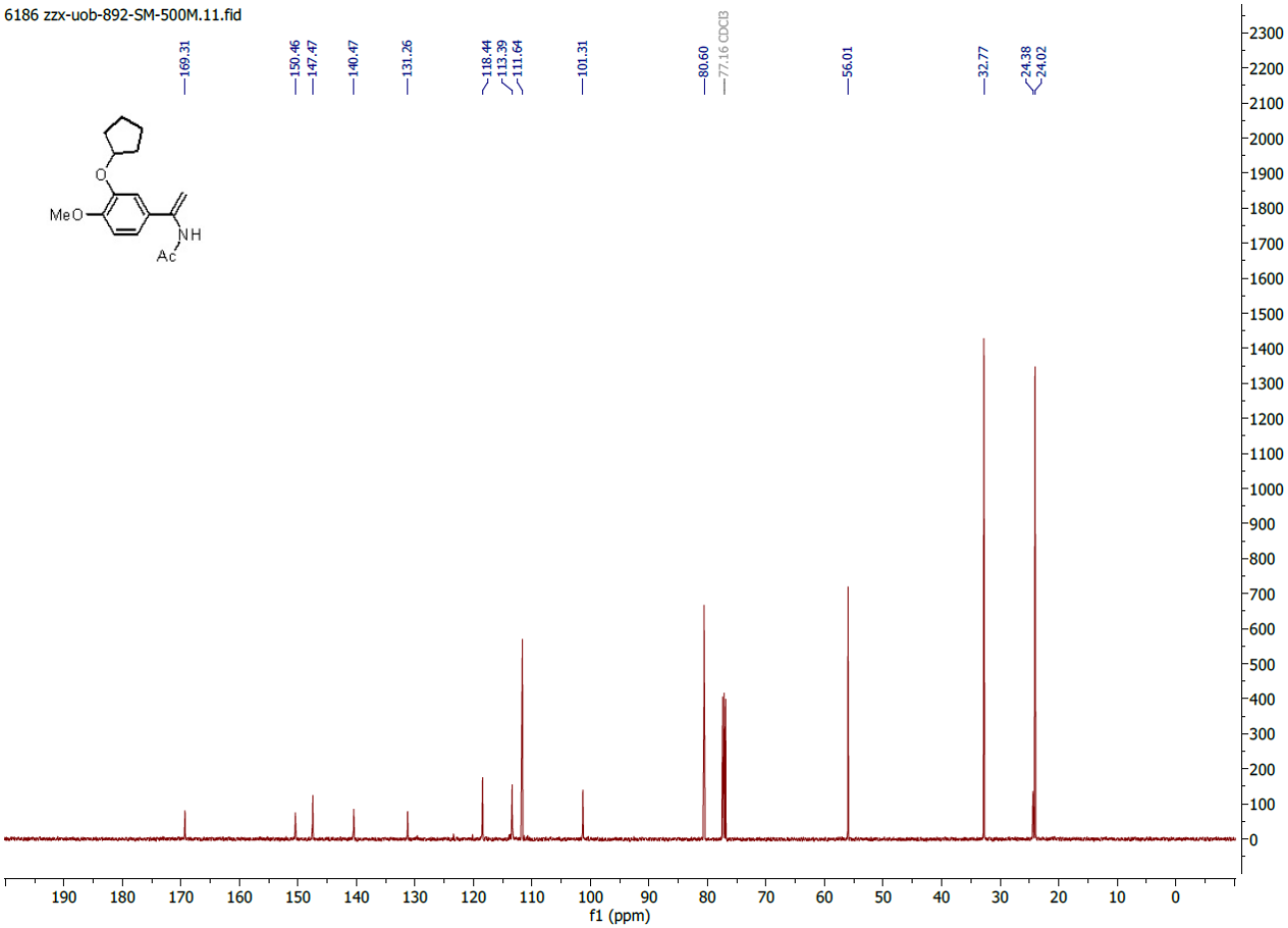
Compound S2an’



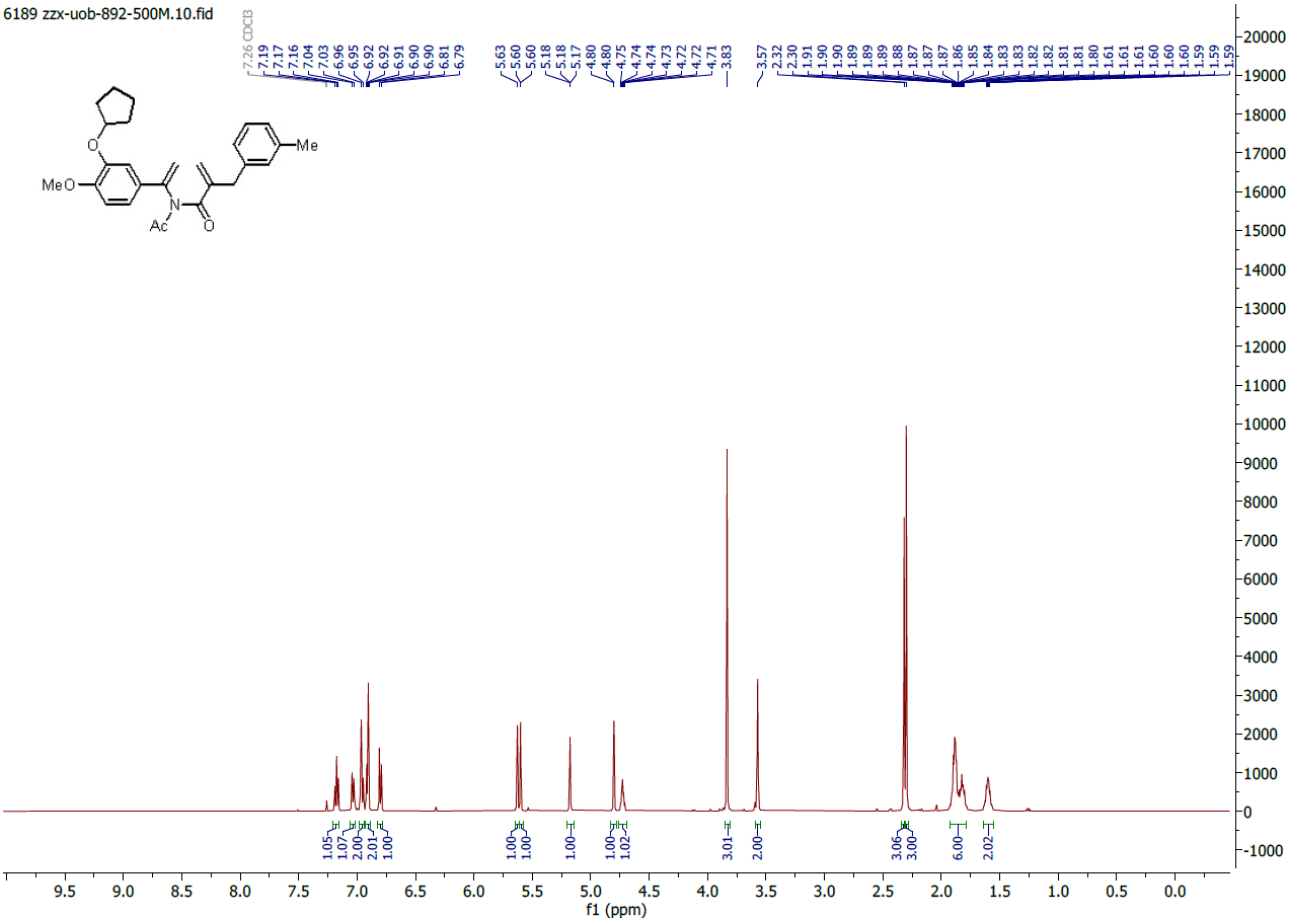


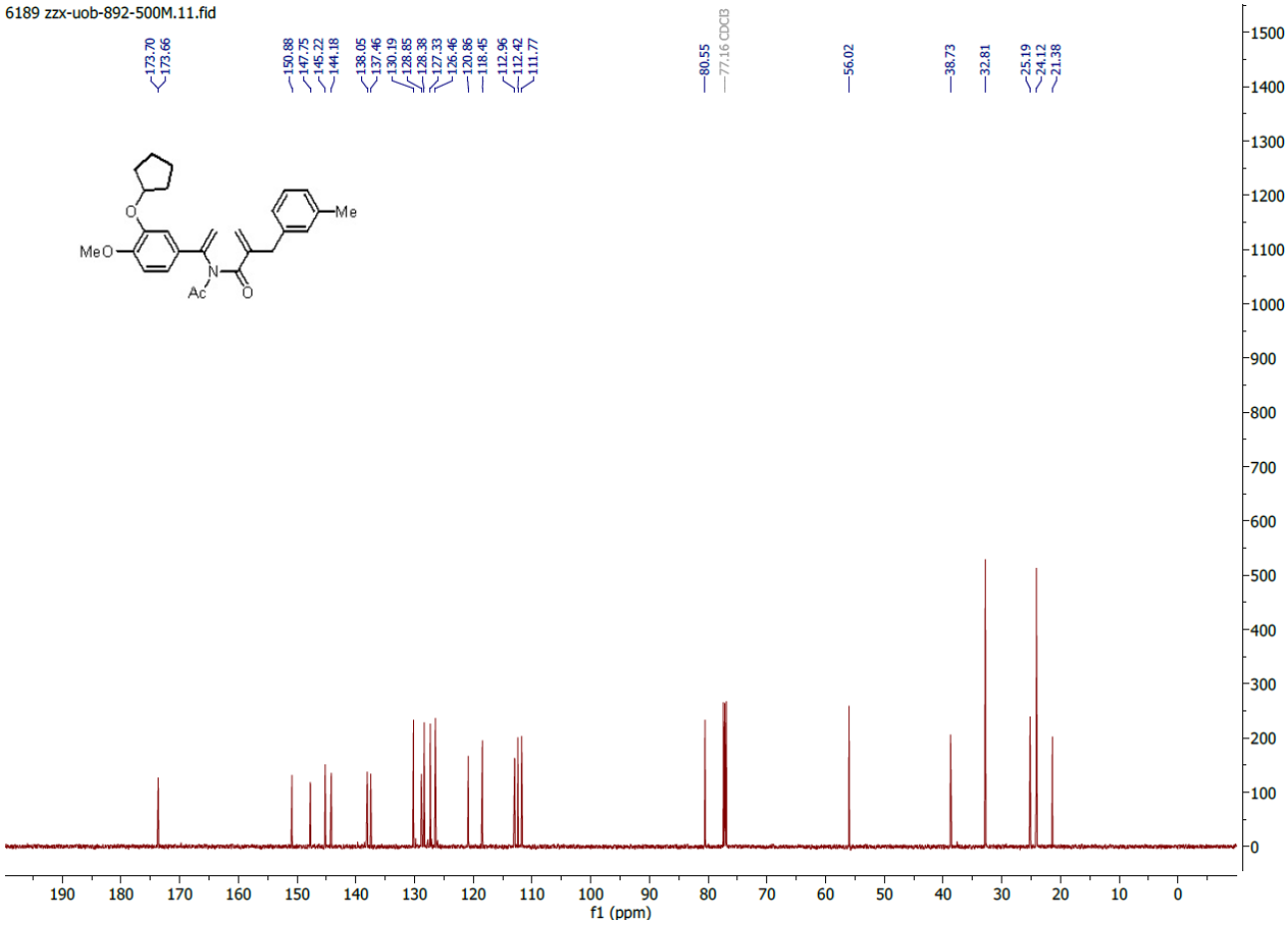
Compound S2an





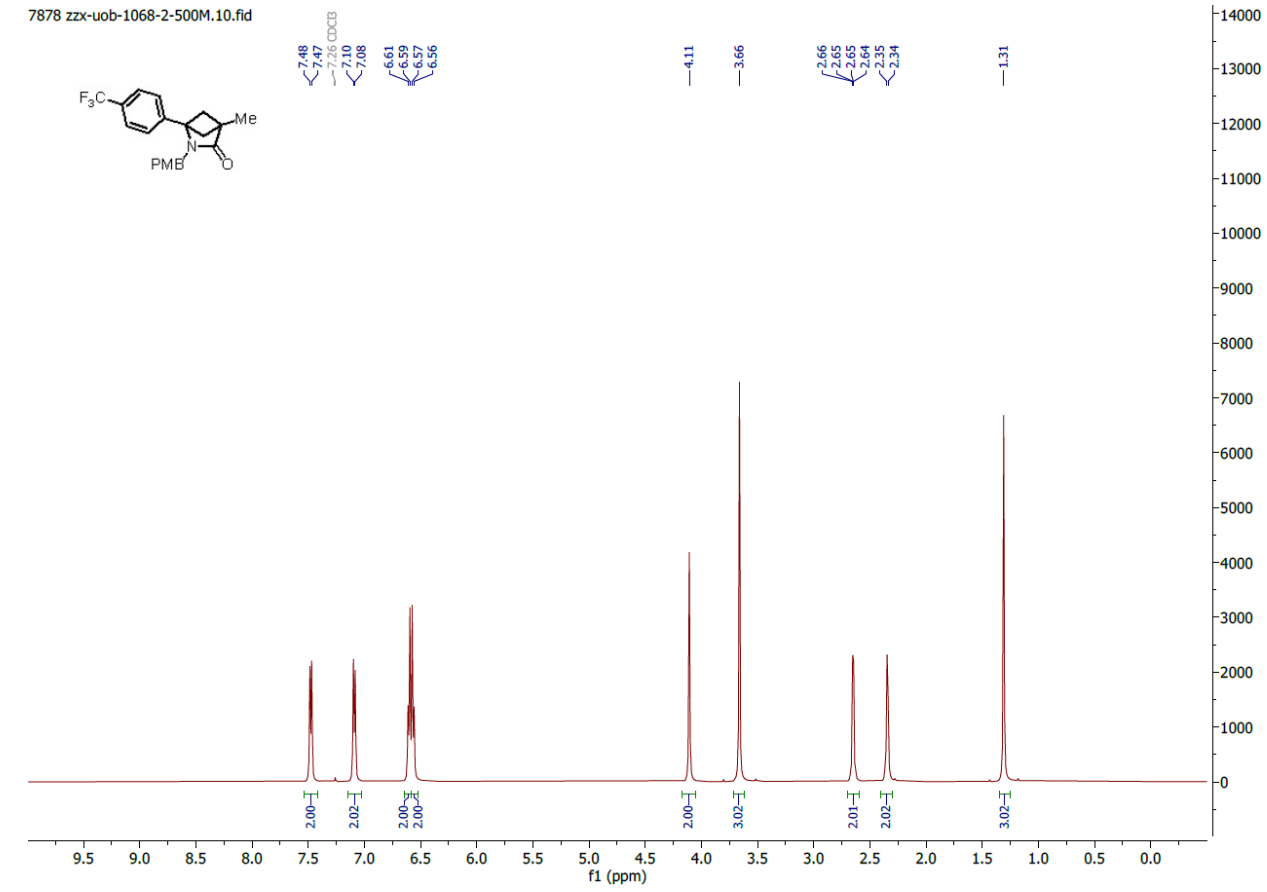
Compound 2an

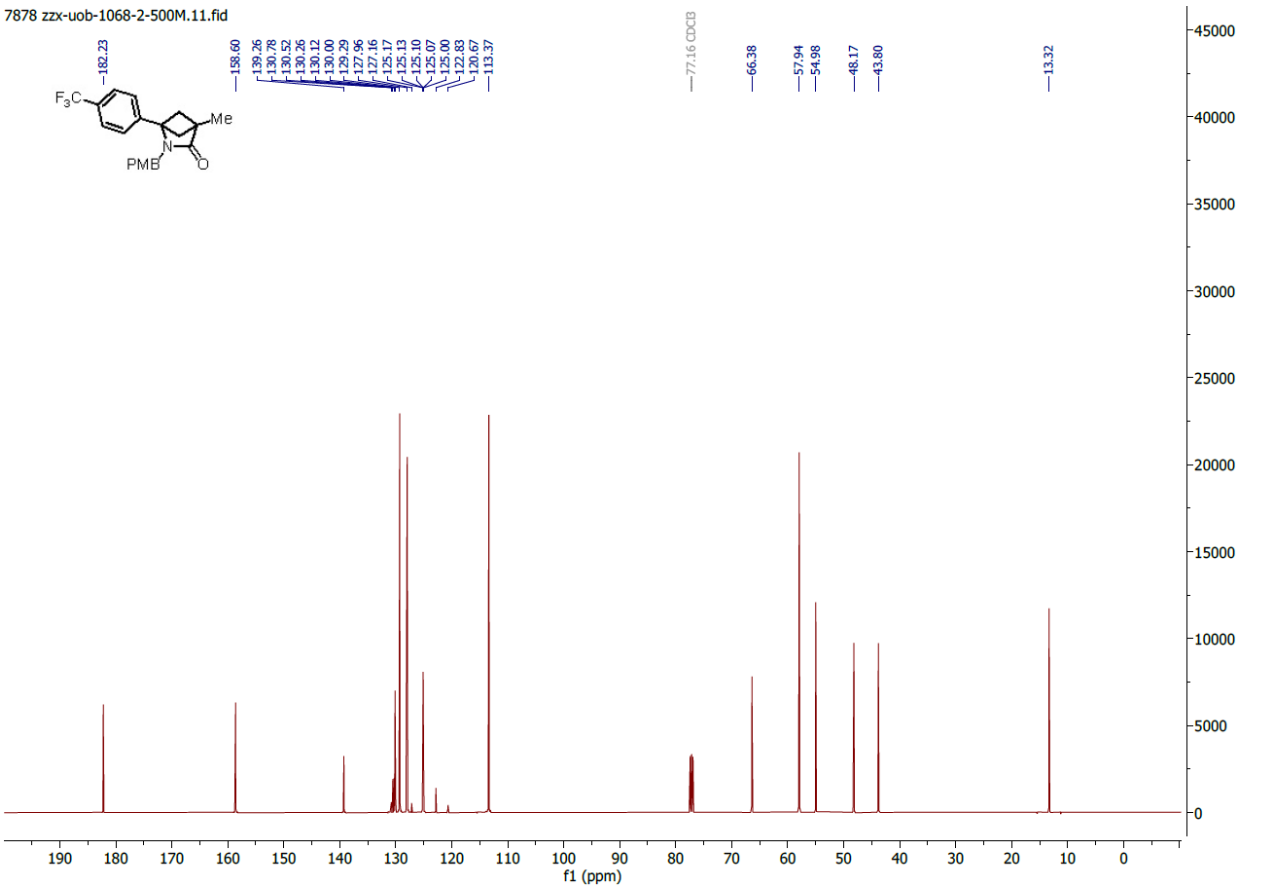


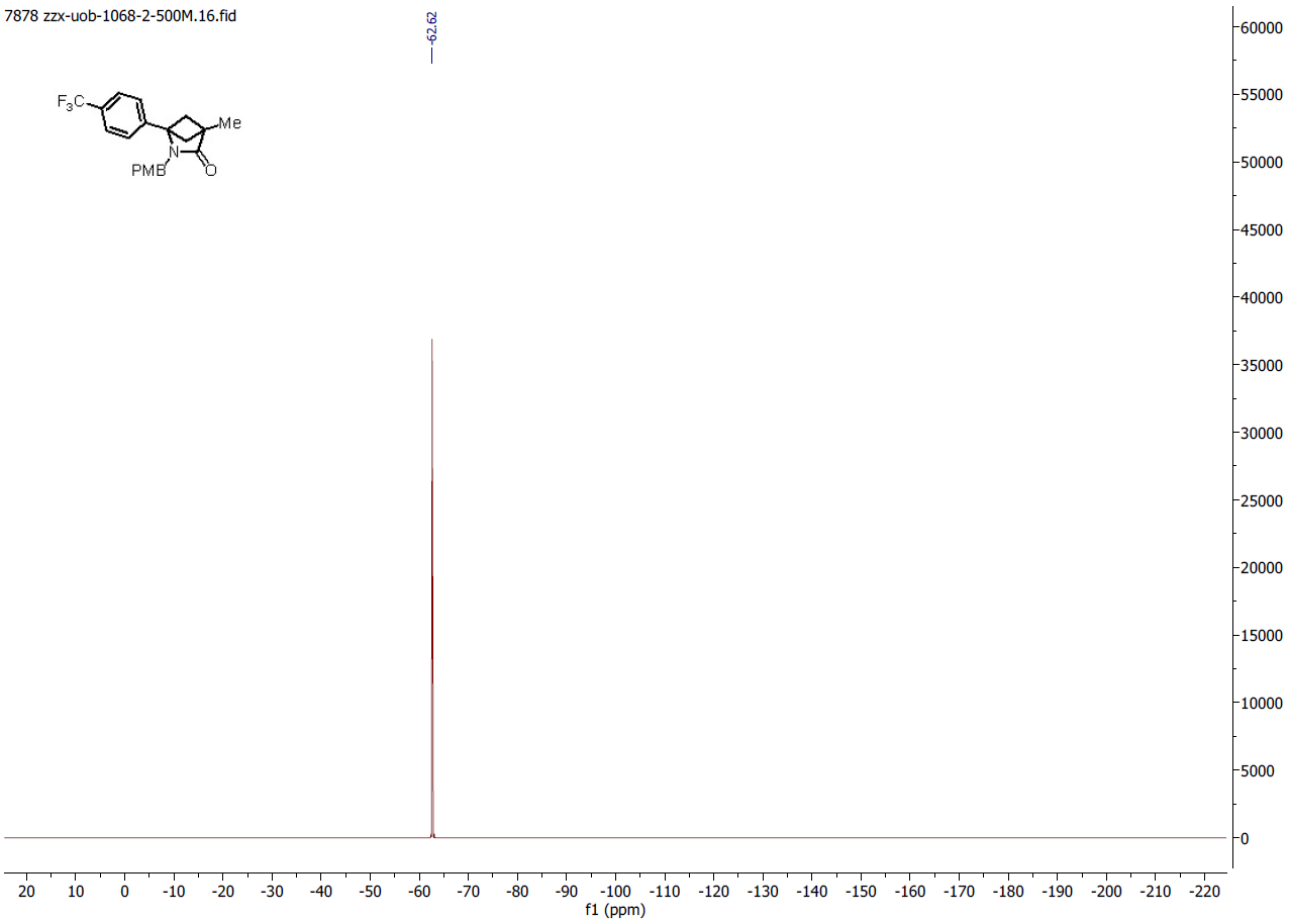


5.4 NMR Spectra of Products (3 and 4)

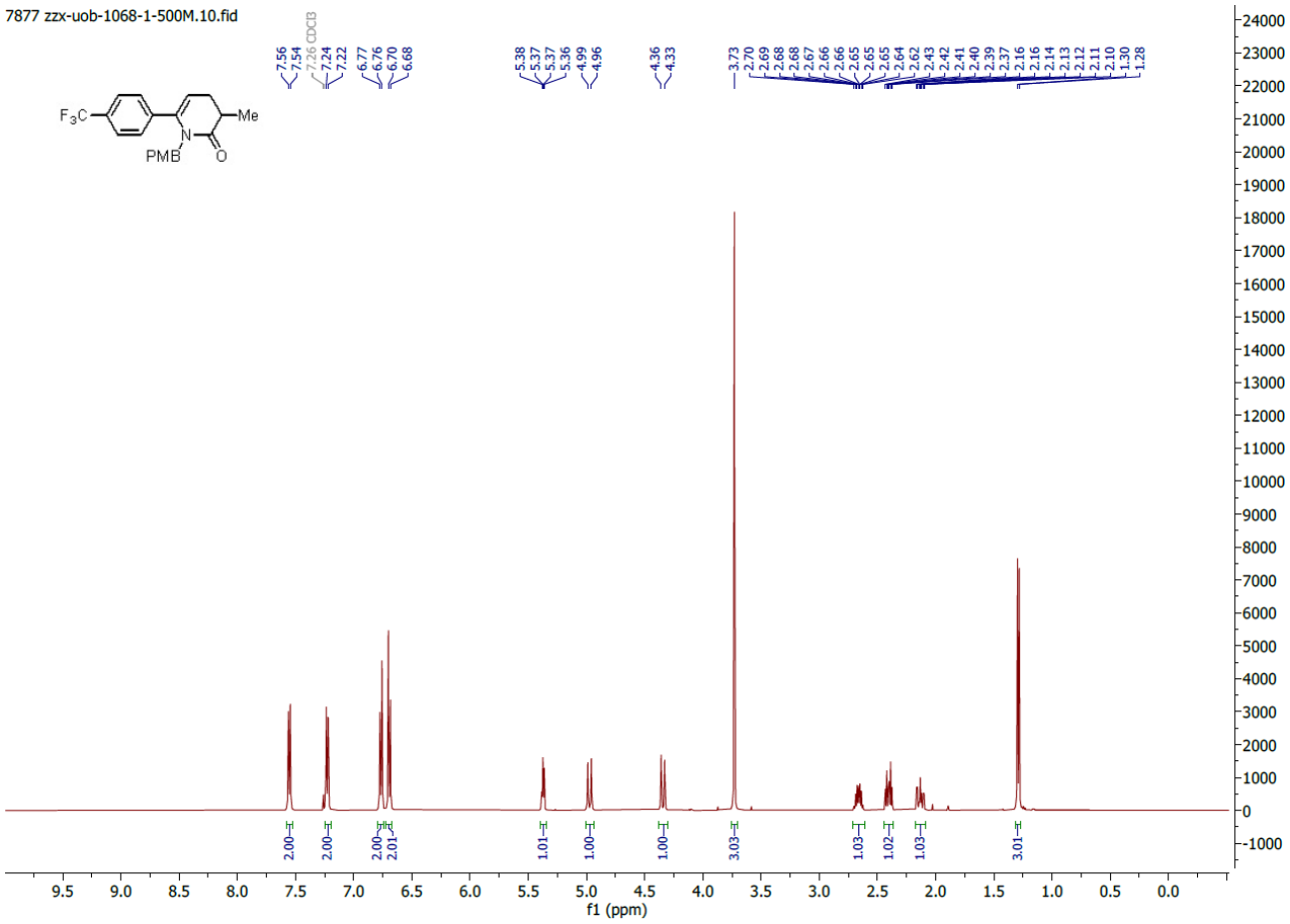
Compound 3a

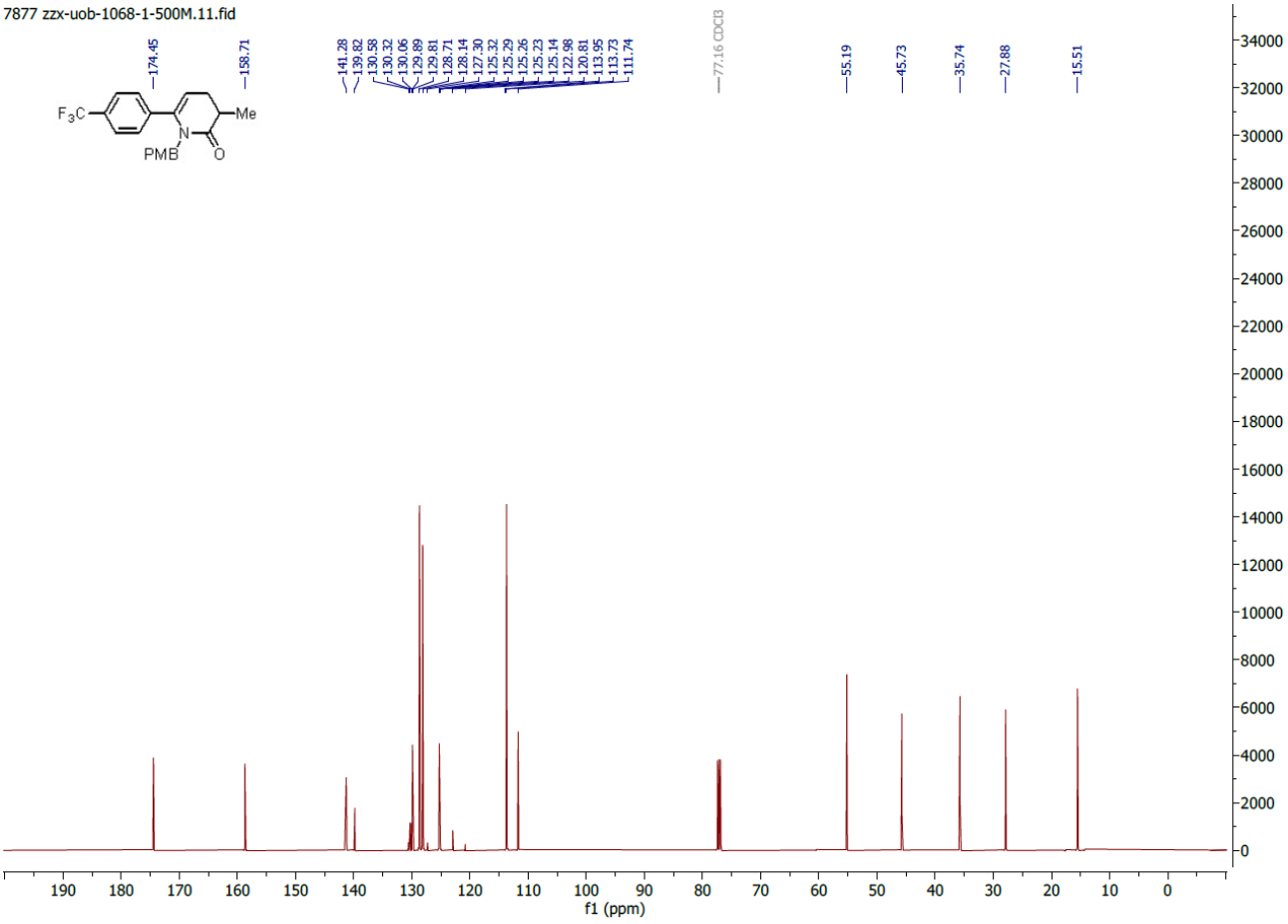


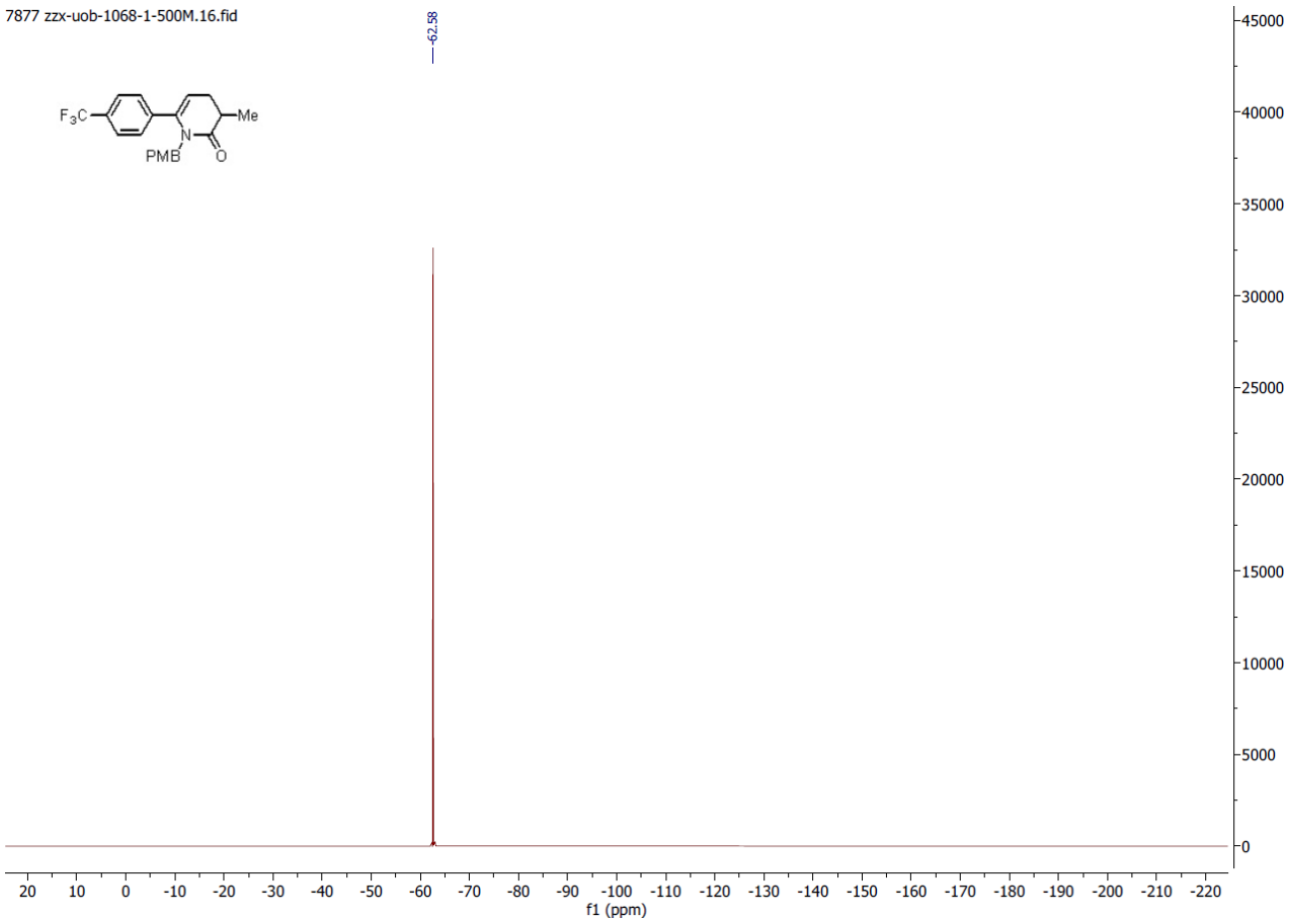



7878 zzx-uob-1068-2-500M.16.fid
62.62
F3C
Me
N
PMB
O
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

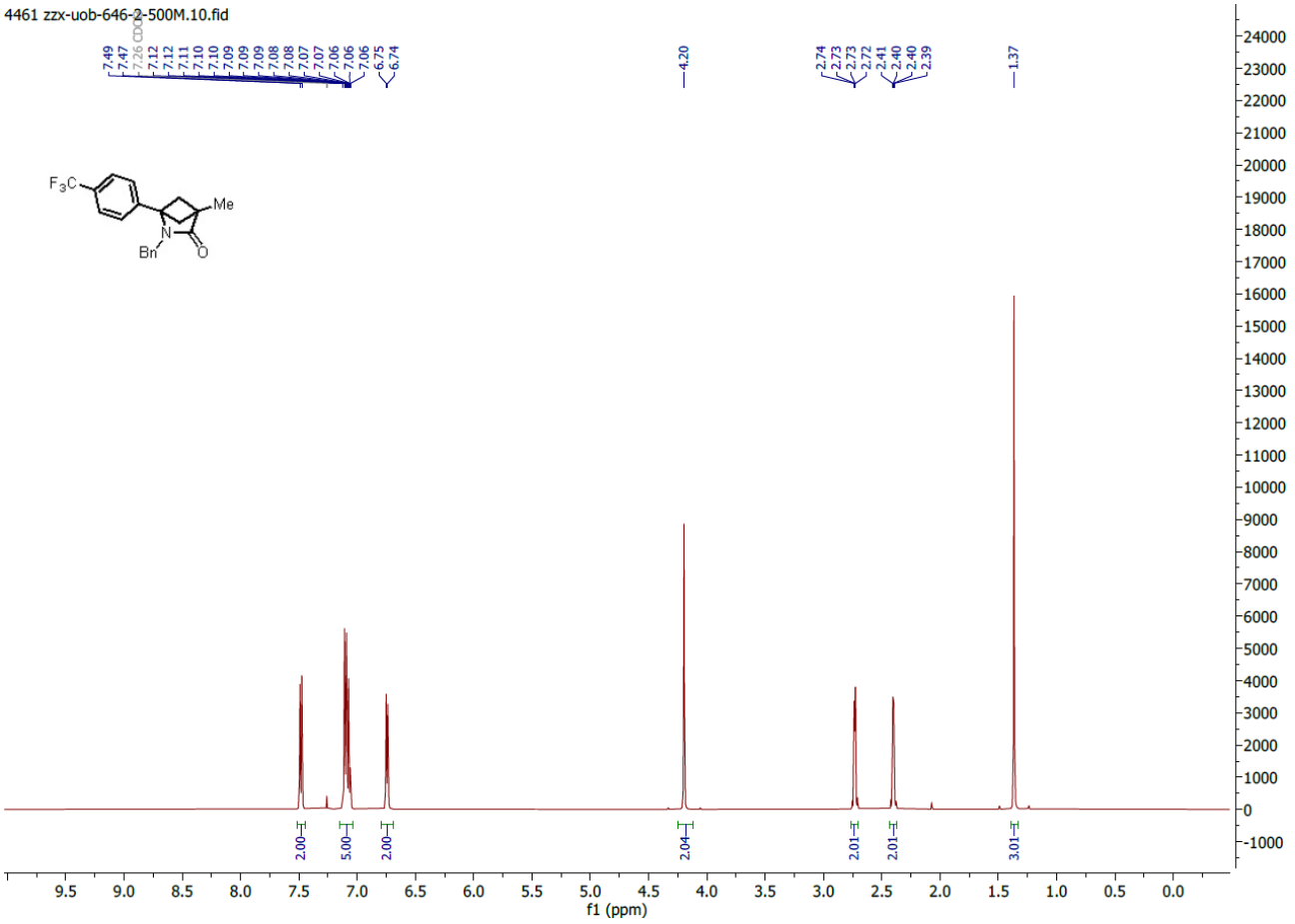
Compound 4a

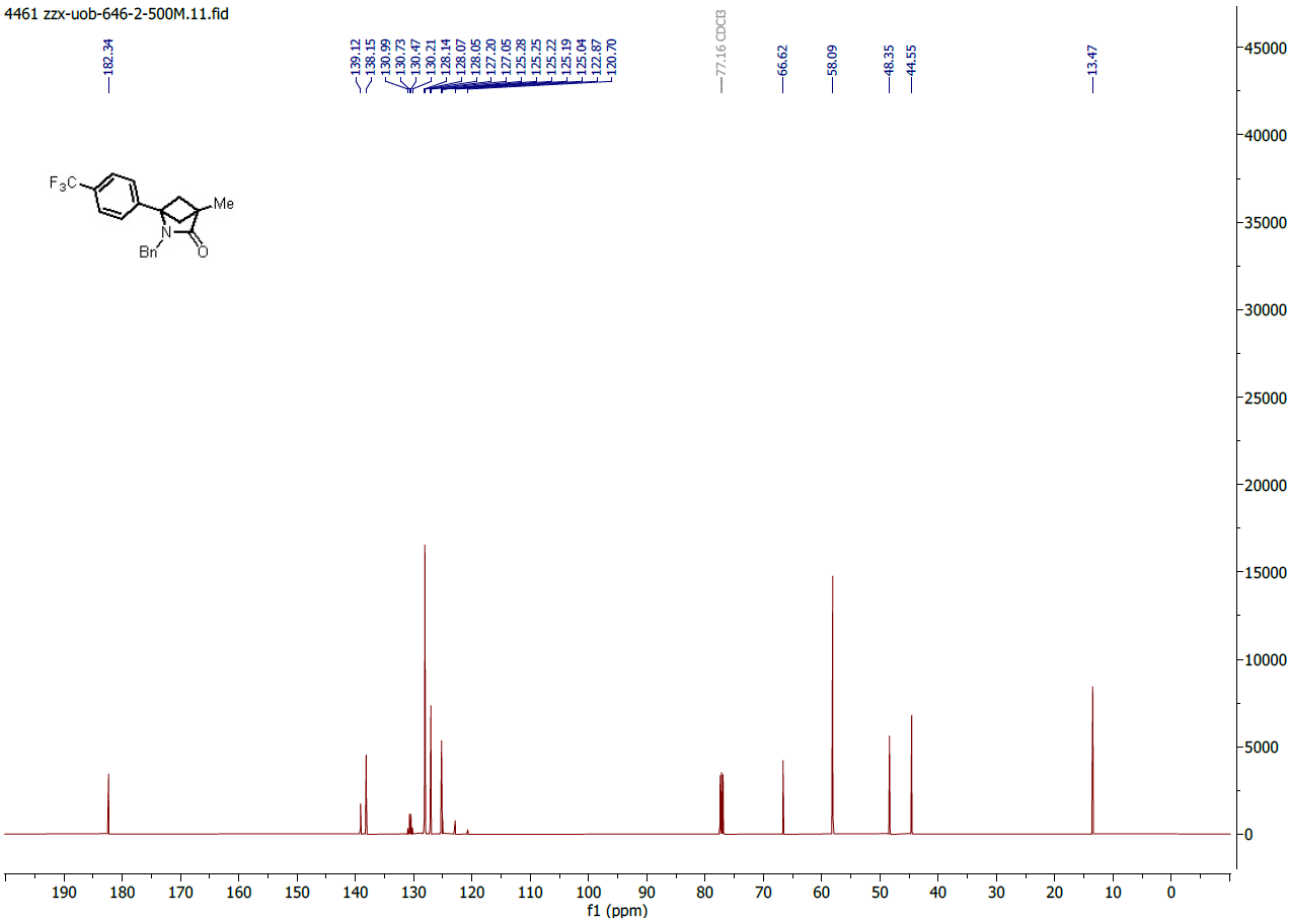

7877 zzx-uob-1068-1-500M.10.fid
F3C
Me
PMB
N
O
f1 (ppm)

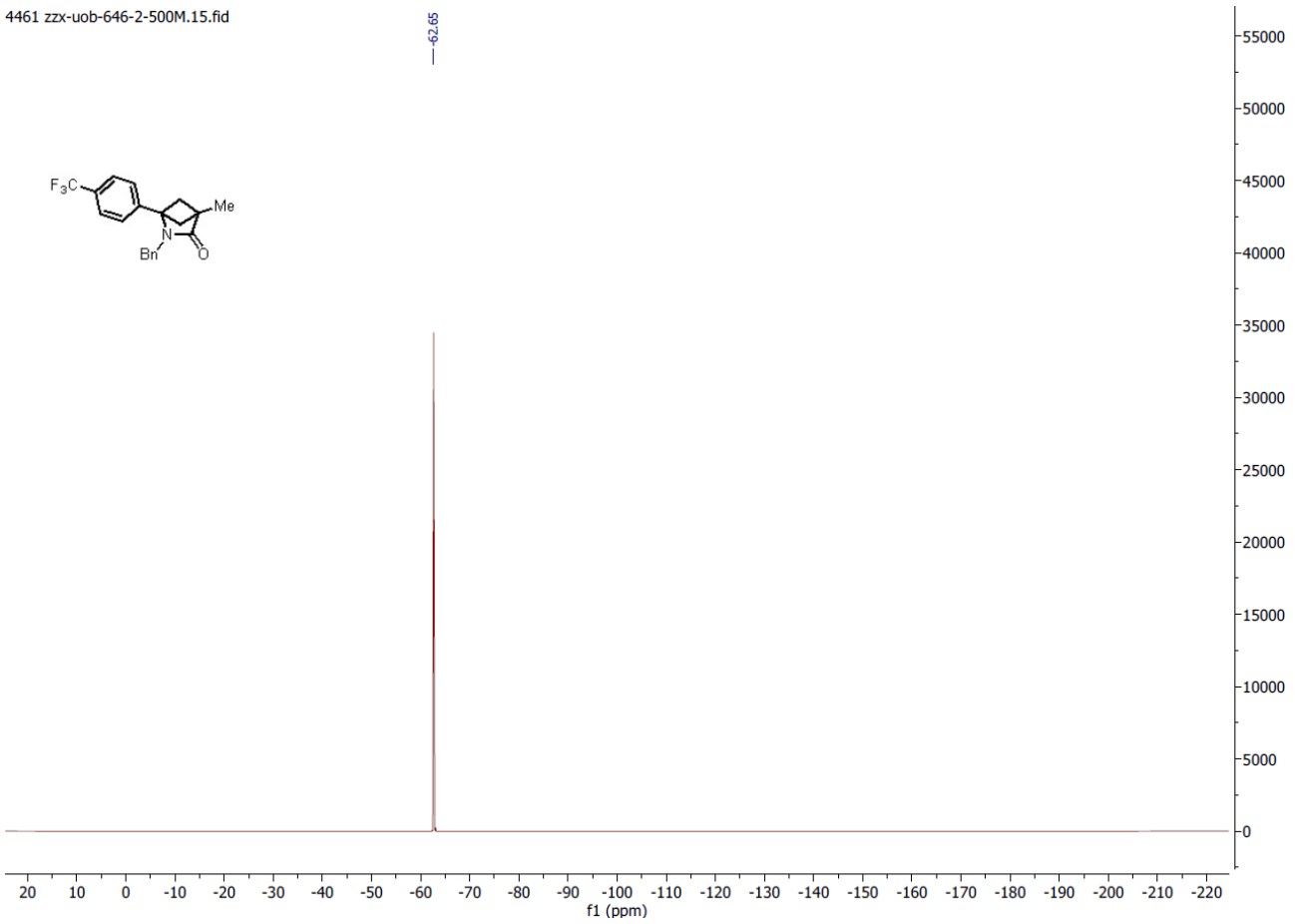

7877 zzx-uob-1068-1-500M.11.fid
F3C
Me
PMB
N
O
f1 (ppm)


7877 zzx-uob-1068-1-500M.16.fid
-62.58
F3C
Me
N
PMB
O
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

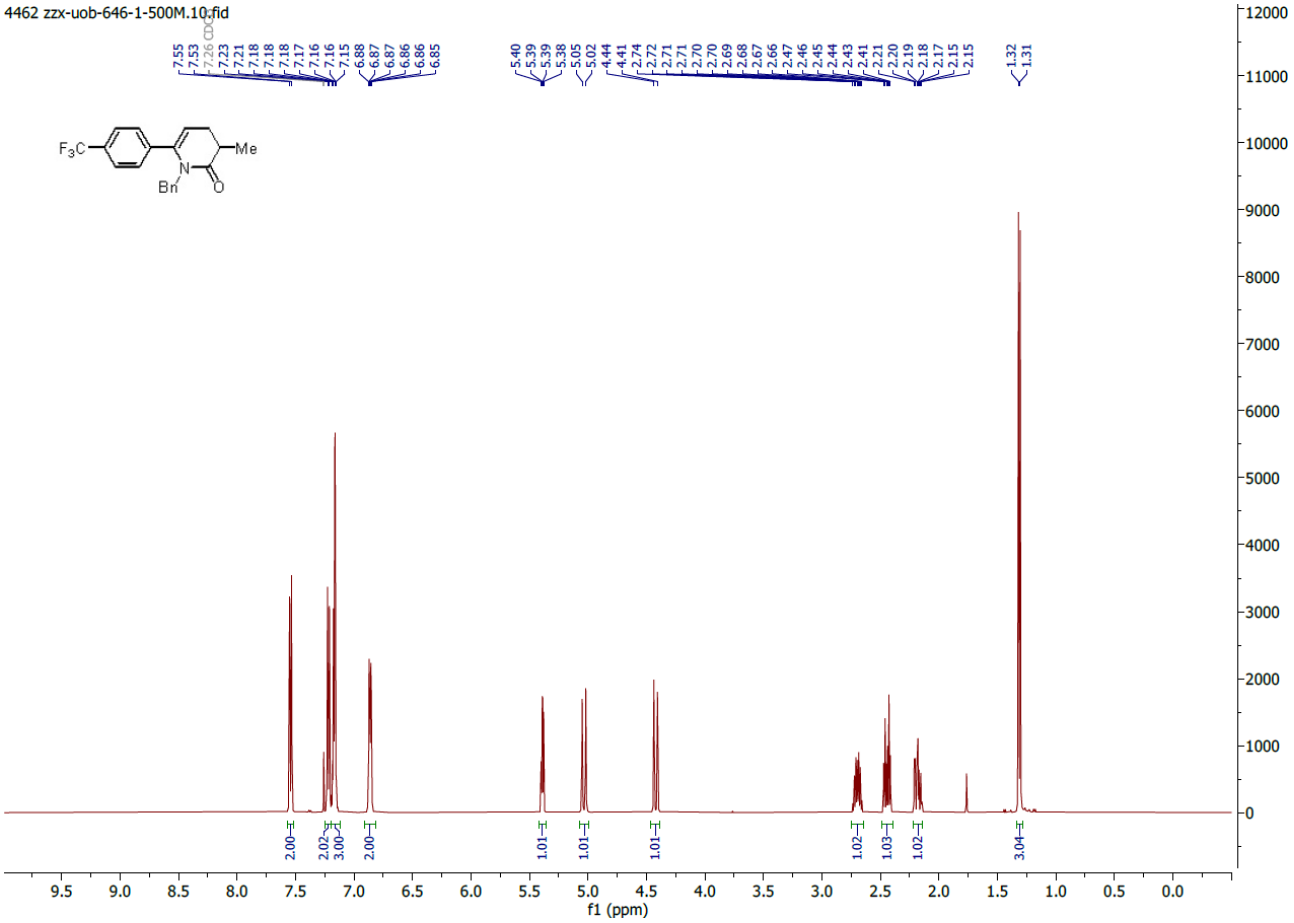
Compound 3b

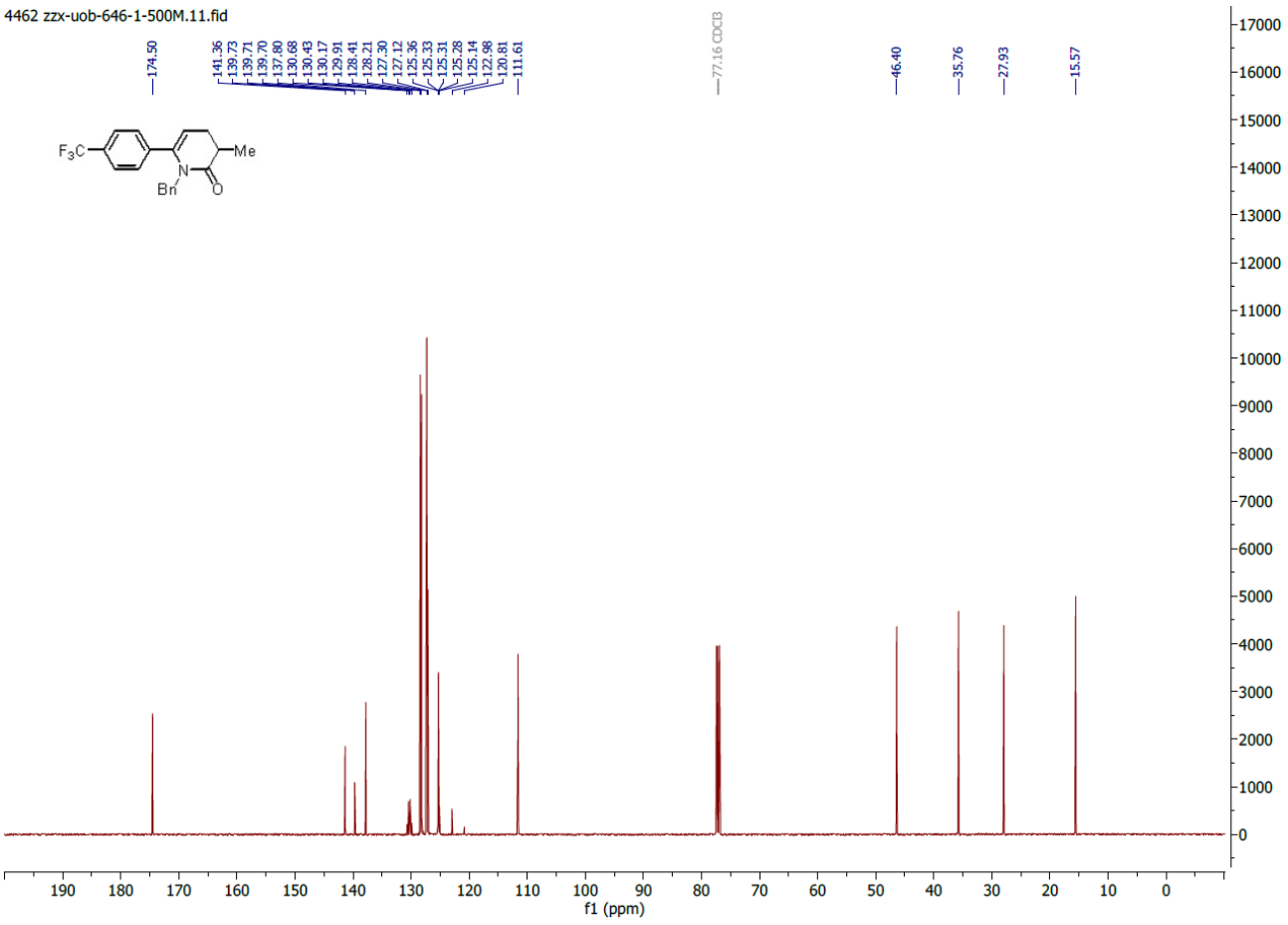

4461 zzx-uob-646-2-500M.10.fid
7.49
7.47
7.26 CDCl3
7.12
7.12
7.11
7.10
7.10
7.09
7.09
7.09
7.08
7.08
7.07
7.07
7.07
7.06
7.06
7.06
6.75
6.74
4.20
2.74
2.73
2.73
2.72
2.41
2.40
2.40
2.39
1.37
F3C
Me
N
Bn
O
2.00
5.00
2.00
2.04
2.01
2.01
3.01
f1 (ppm)

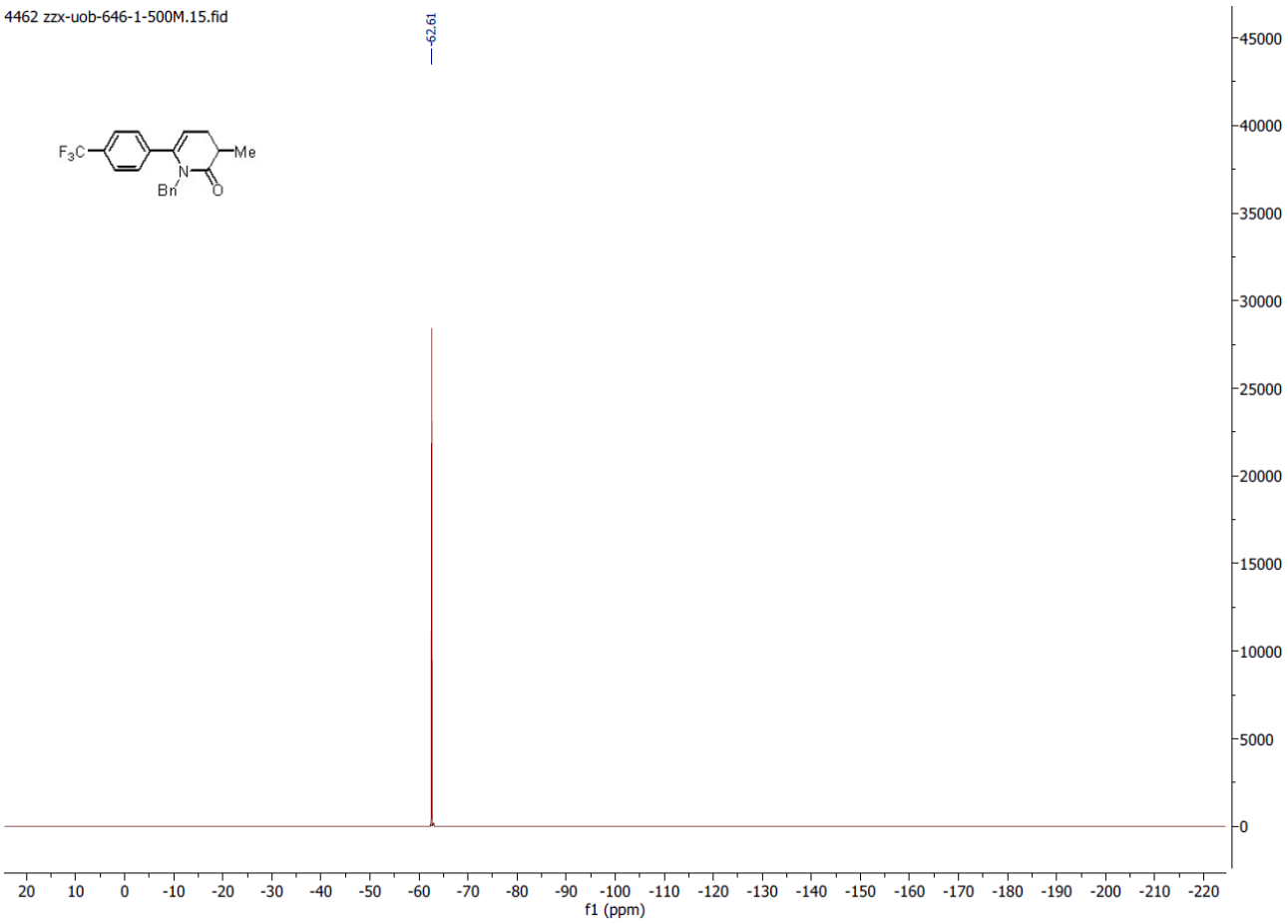

4461 zzx-uob-646-2-500M.11.fid
182.34
139.12
138.15
130.99
130.73
130.47
130.21
128.14
128.07
128.05
127.20
127.05
125.28
125.25
125.22
125.19
125.04
122.87
120.70
77.16 CDCl3
66.62
58.09
48.35
44.55
13.47
F3C
Me
N
Bn
O
f1 (ppm)


4461 zzx-uob-646-2-500M.15.fid
-62.65
F3C
Me
N
Bn
O
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

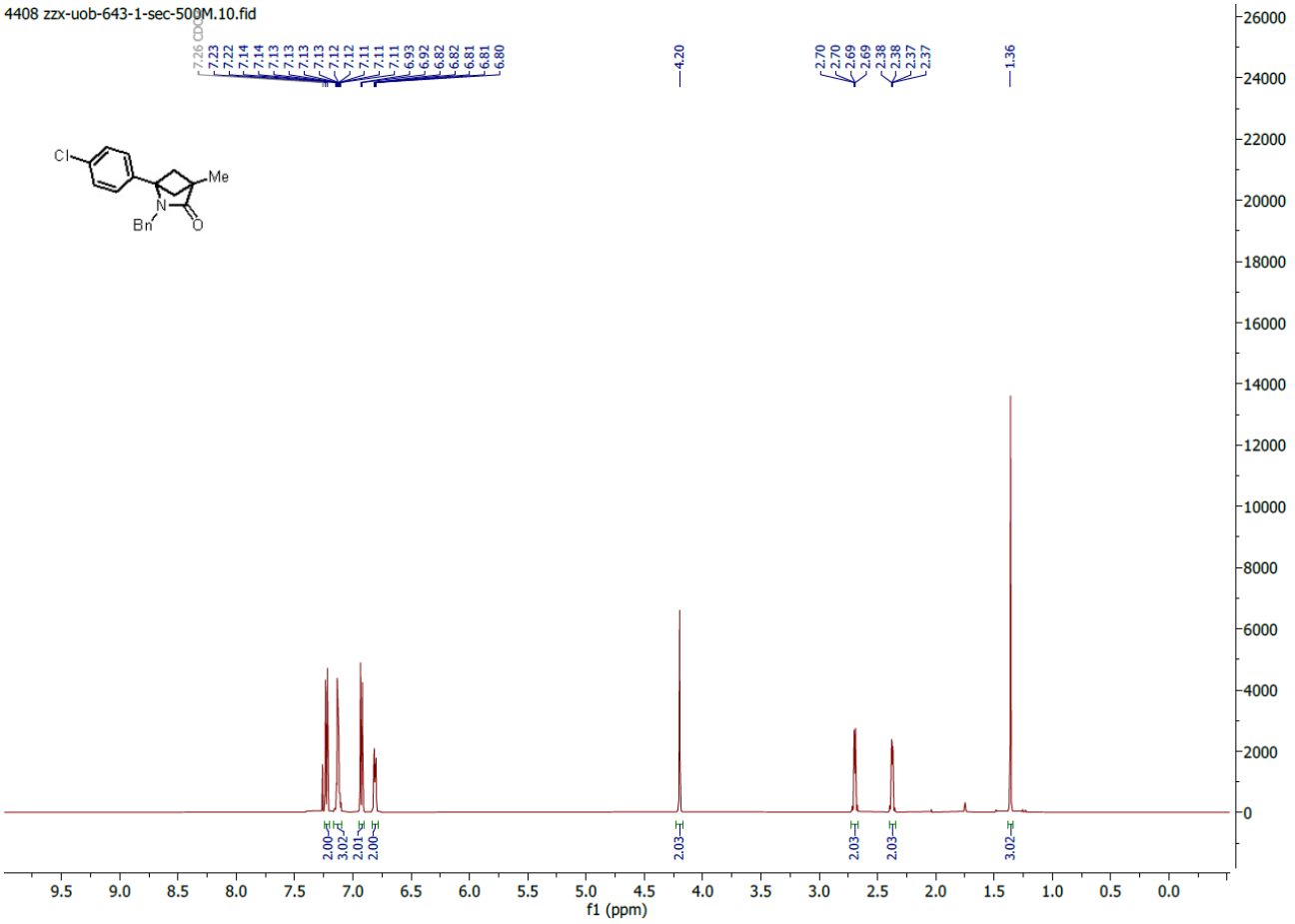
Compound 4b

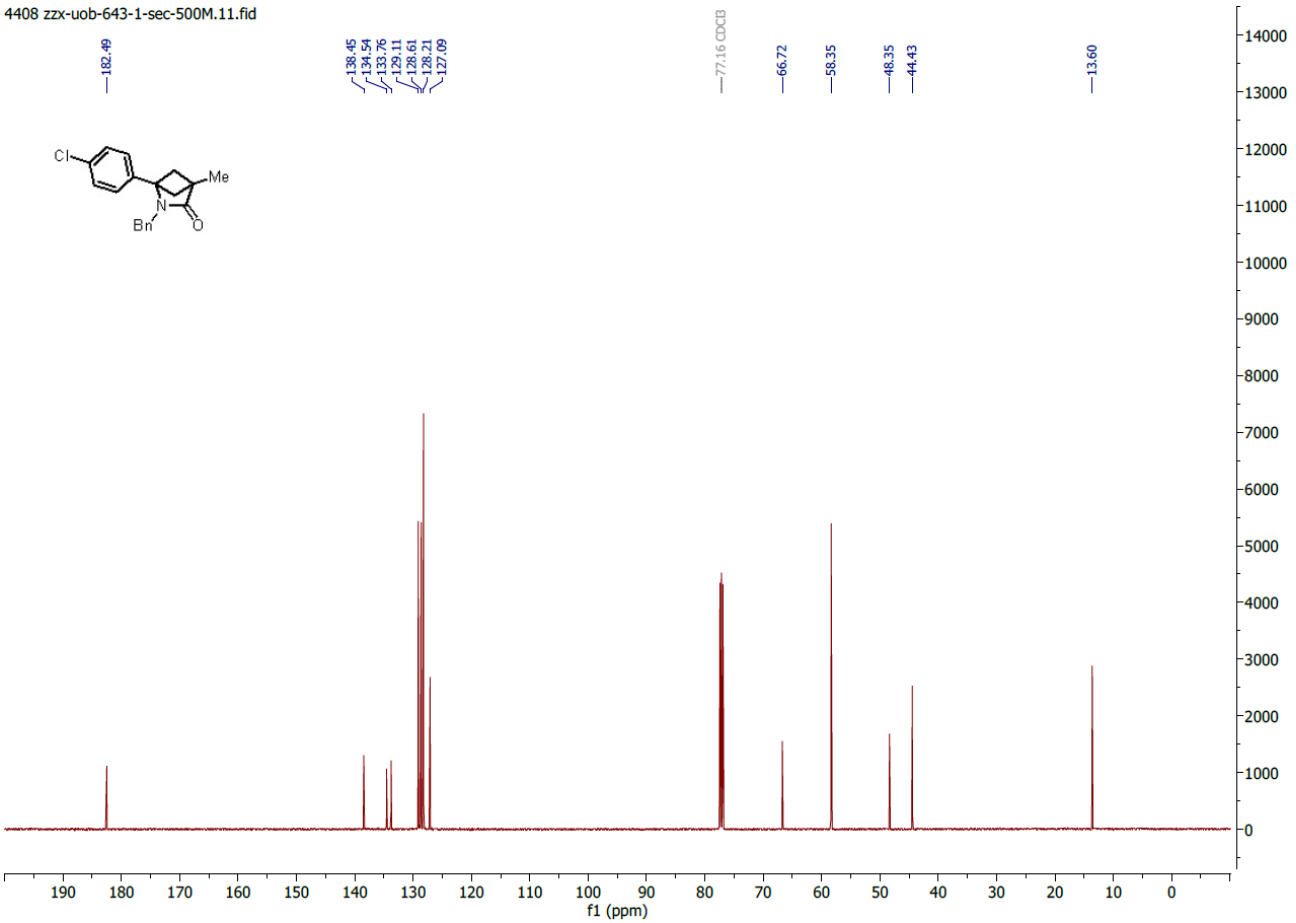

4462 zzx-uob-646-1-500M.10.fid
F3C
Me
N
Bn
O
f1 (ppm)


4462 zzx-uob-646-1-500M.11.fid
F3C
Me
N
Bn
O
f1 (ppm)

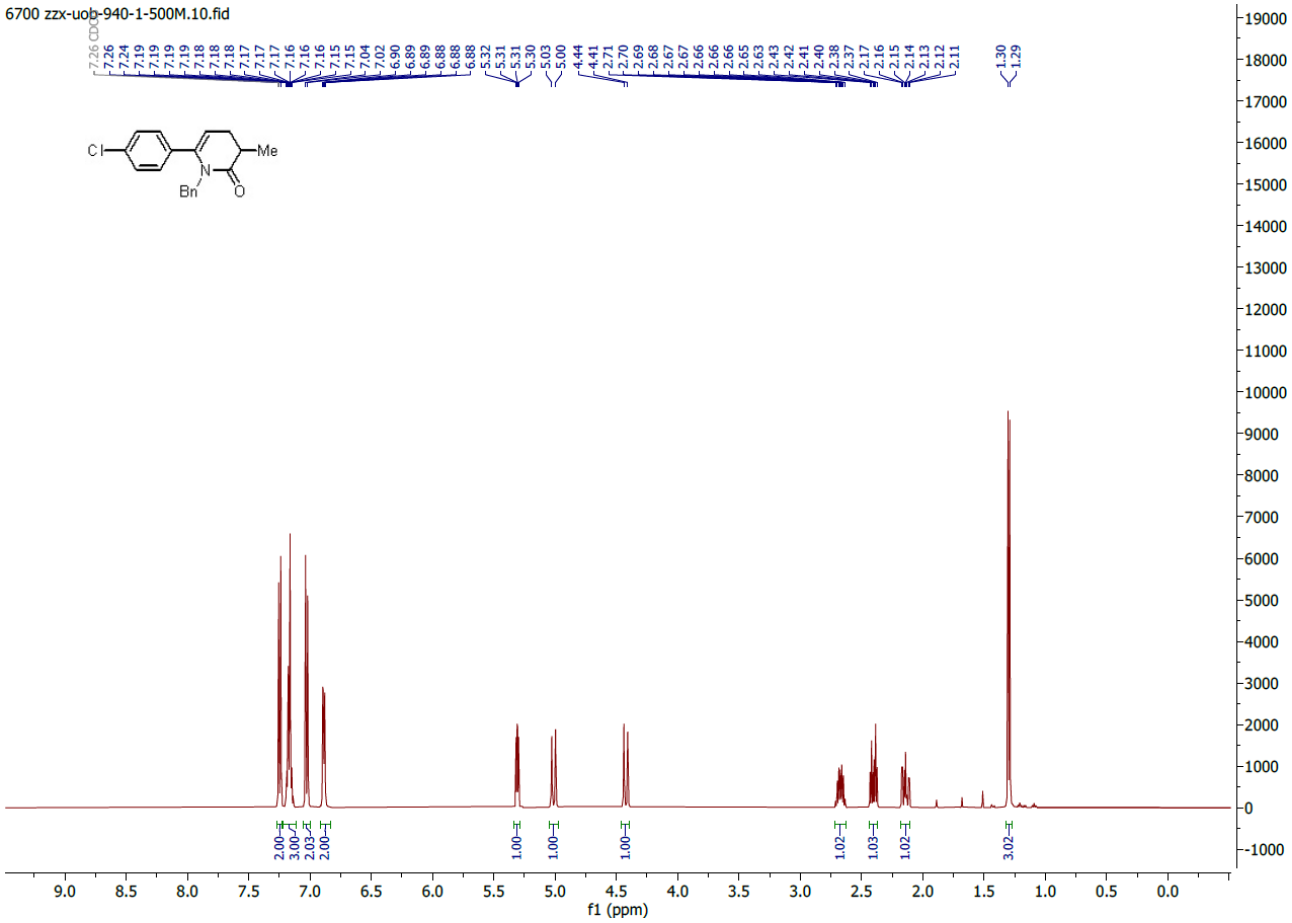

4462 zzx-uob-646-1-500M.15.fid
-62.61
F3C
Me
N
Bn
O
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

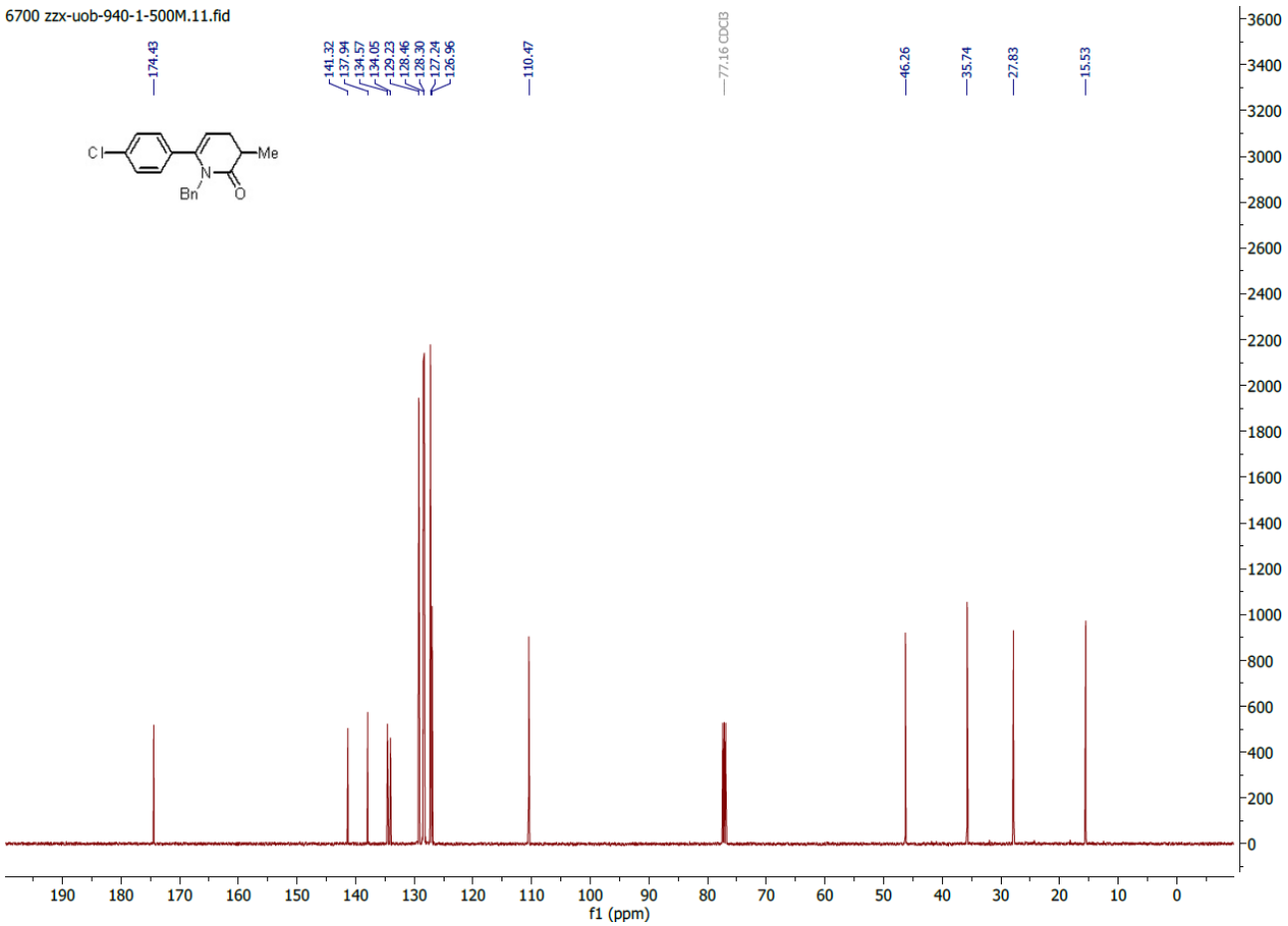
Compound 3c


4408 zzx-uob-643-1-sec-500M.10.fid
7.26 CDCl3
7.23
7.22
7.14
7.14
7.13
7.13
7.13
7.13
7.12
7.12
7.11
7.11
7.11
6.93
6.92
6.82
6.82
6.81
6.81
6.80
4.20
2.70
2.70
2.69
2.69
2.38
2.38
2.37
2.37
1.36
Cl
Me
N
Bn
O
2.00
3.02
2.01
2.00
2.03
2.03
2.03
3.02
f1 (ppm)

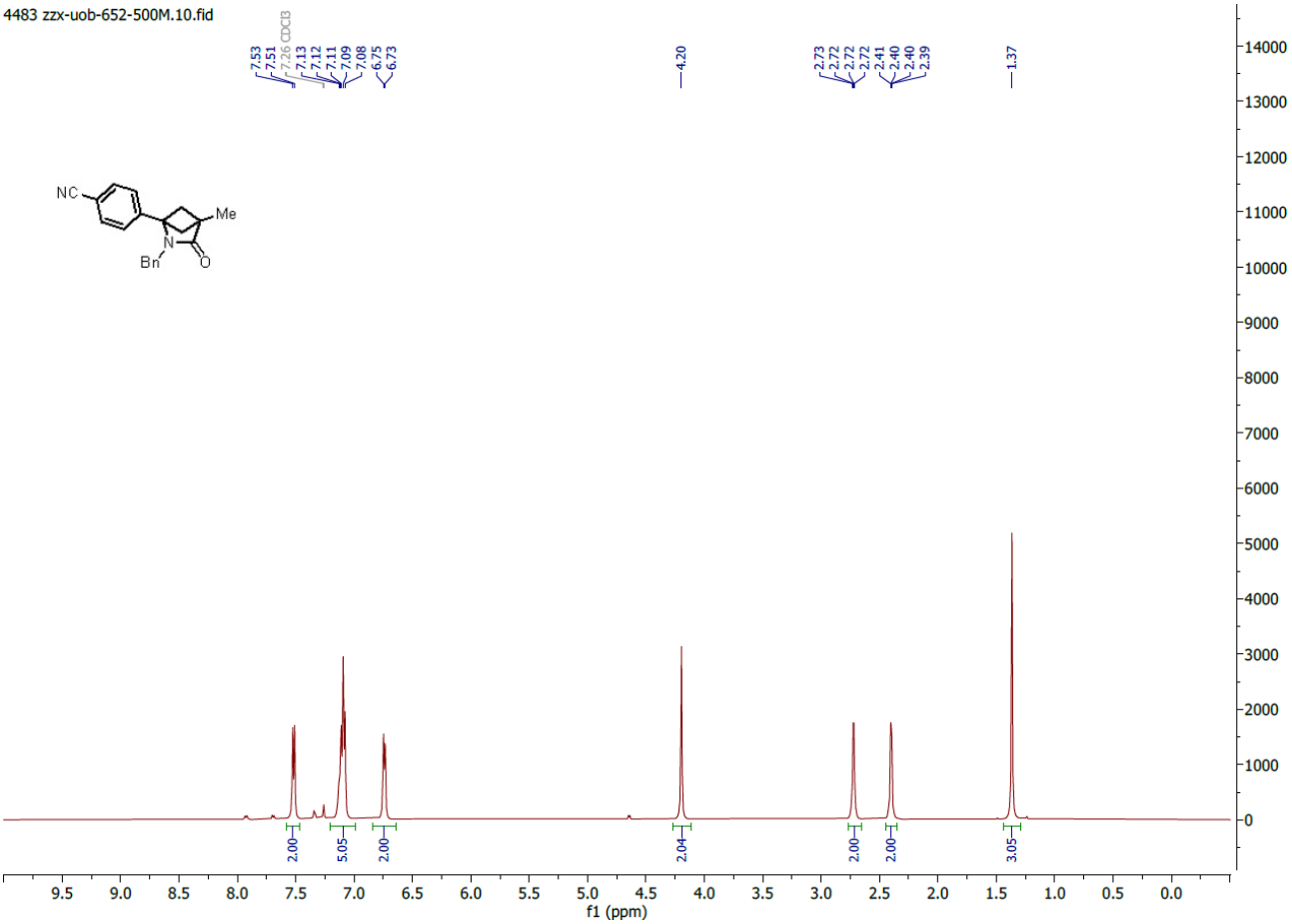

4408 zzx-uob-643-1-sec-500M.11.fid
182.49
138.45
134.54
133.76
129.11
128.61
128.21
127.09
77.16 CDCl3
66.72
58.35
48.35
44.43
13.60
Cl
Me
N
Bn
O
f1 (ppm)

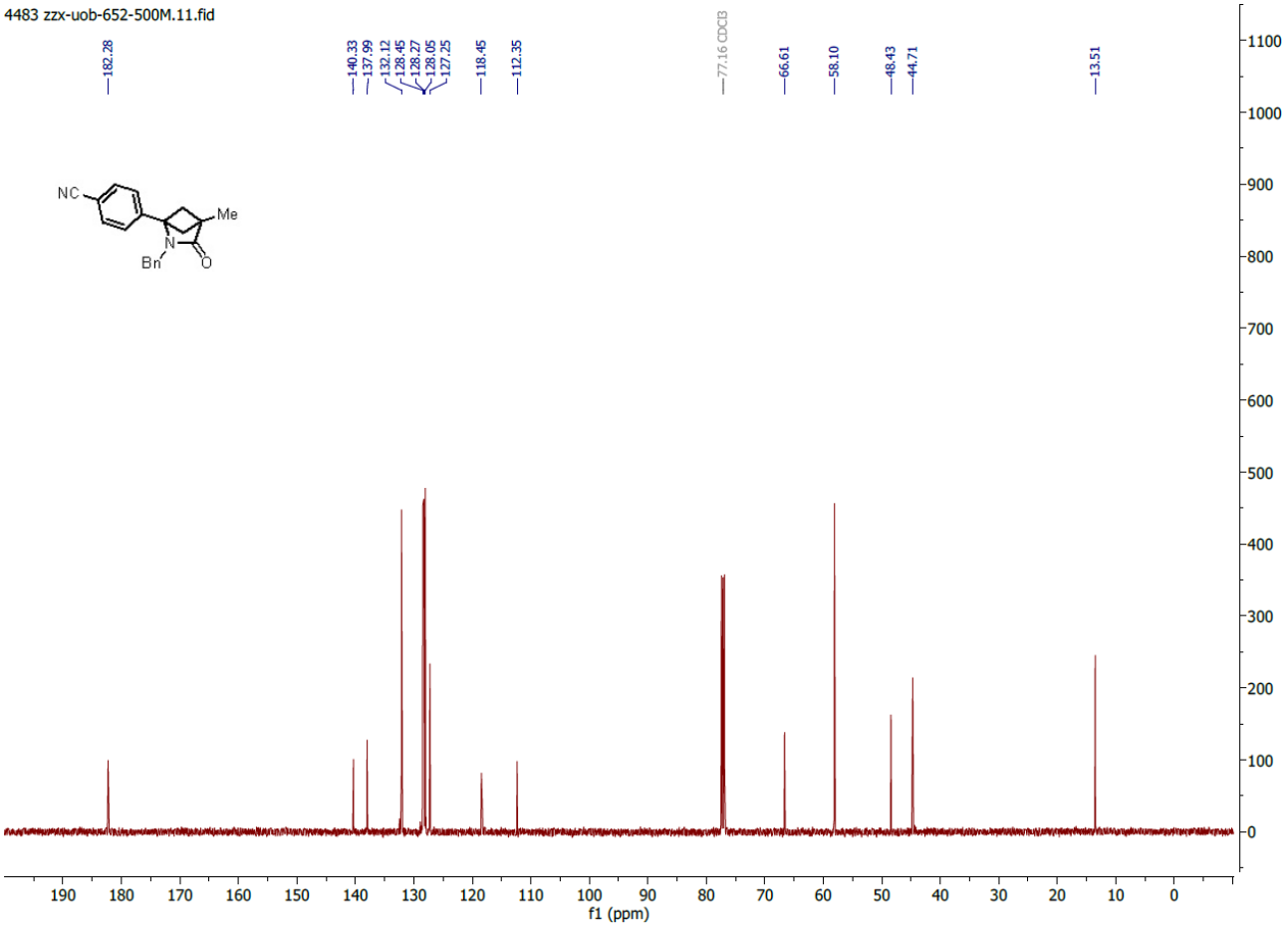
Compound 4c


6700 zzx-uob-940-1-500M.10.fid
Cl
Me
N
Bn
O
f1 (ppm)

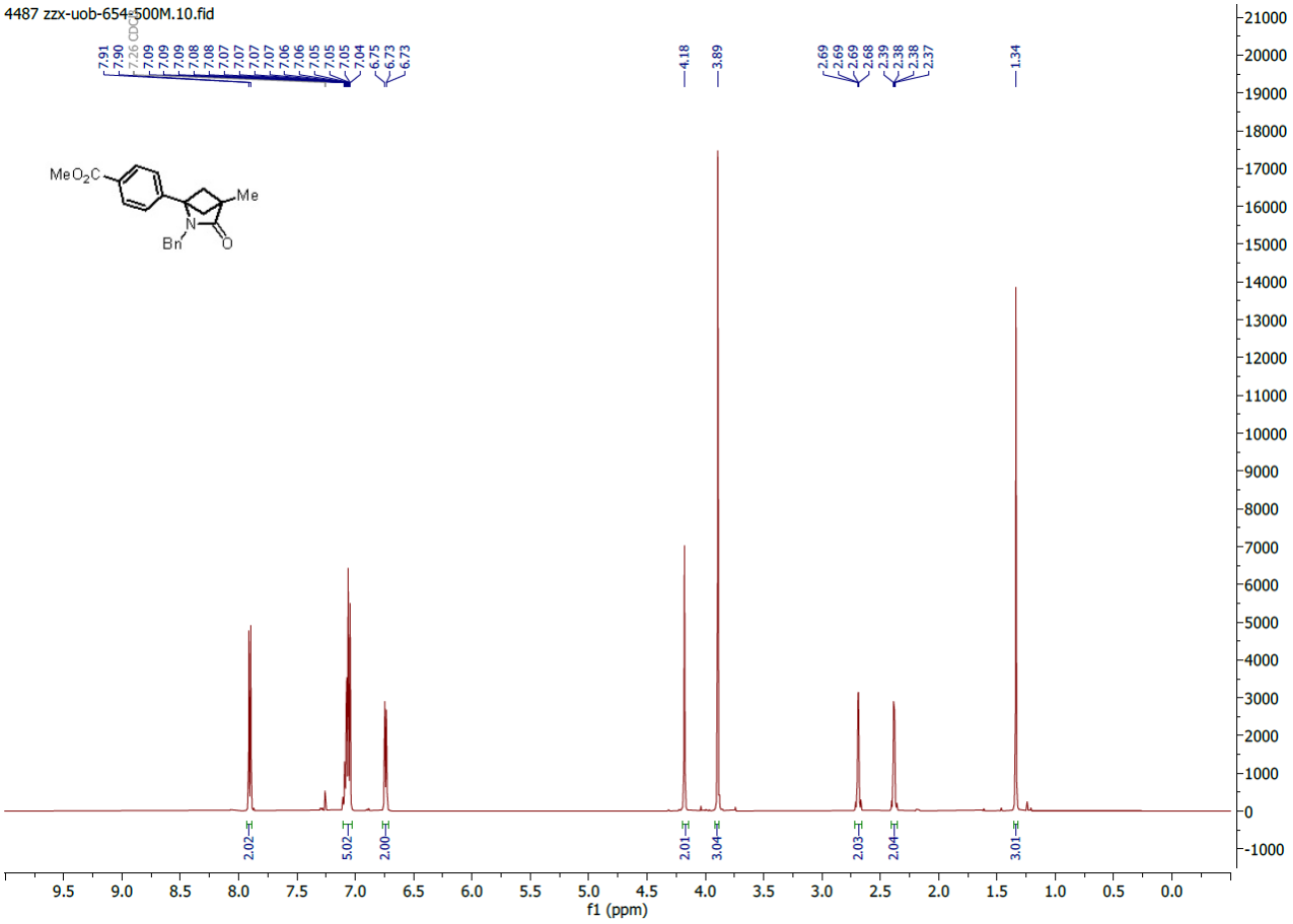

6700 zzx-uob-940-1-500M.11.fid
174.43
141.32
137.94
134.57
134.05
129.23
128.46
128.30
127.24
126.96
110.47
77.16 CDCl3
46.26
35.74
27.83
15.53
Cl
Me
N
Bn
O
f1 (ppm)

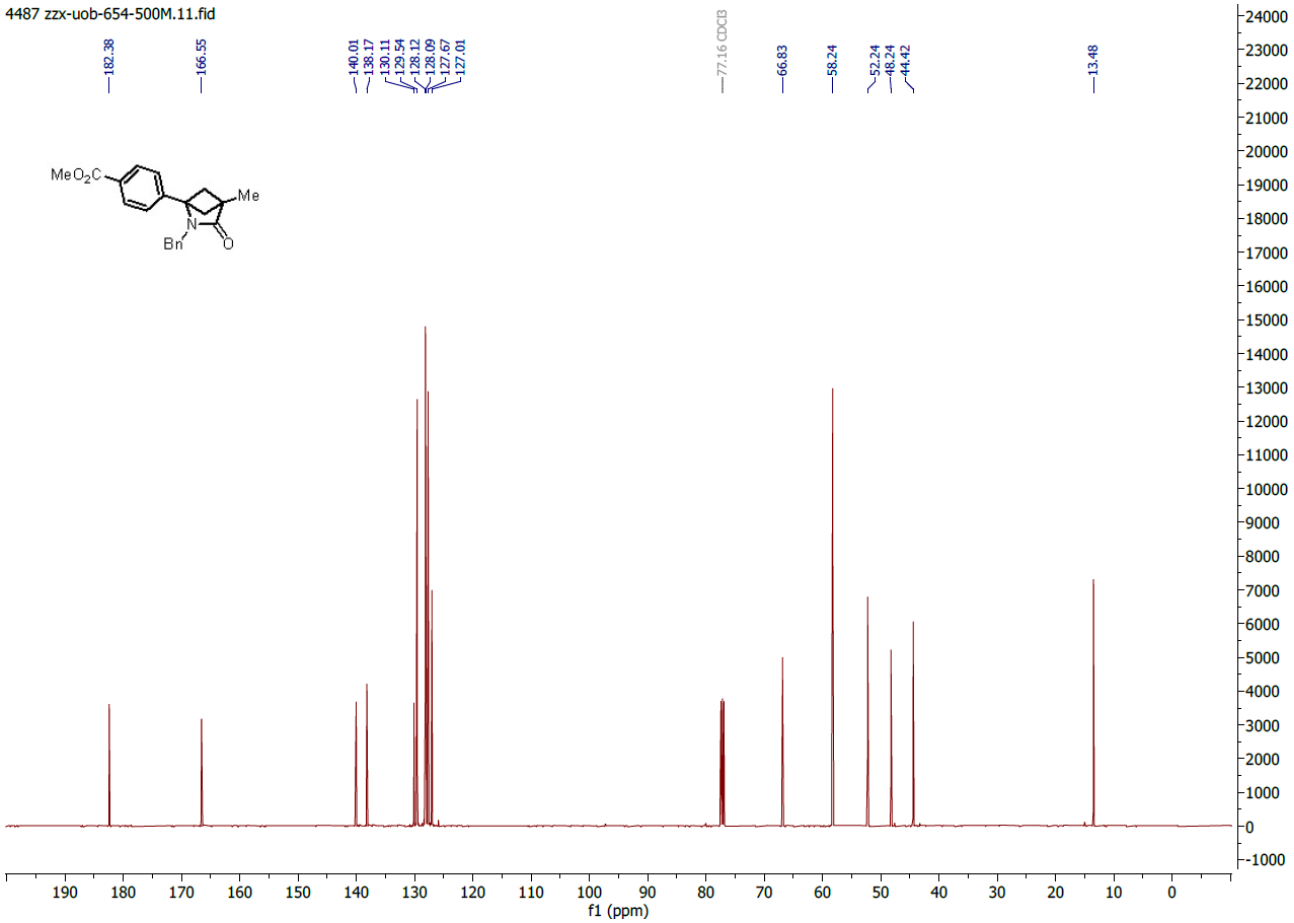
Compound 3d


4483 zzx-uob-652-500M.10.fid
7.53
7.51
7.26 CDCl3
7.13
7.12
7.11
7.09
7.08
6.75
6.73
4.20
2.73
2.72
2.72
2.72
2.41
2.40
2.40
2.39
1.37
NC
Me
N
Bn
O
2.00
5.05
2.00
2.04
2.00
2.00
3.05
f1 (ppm)

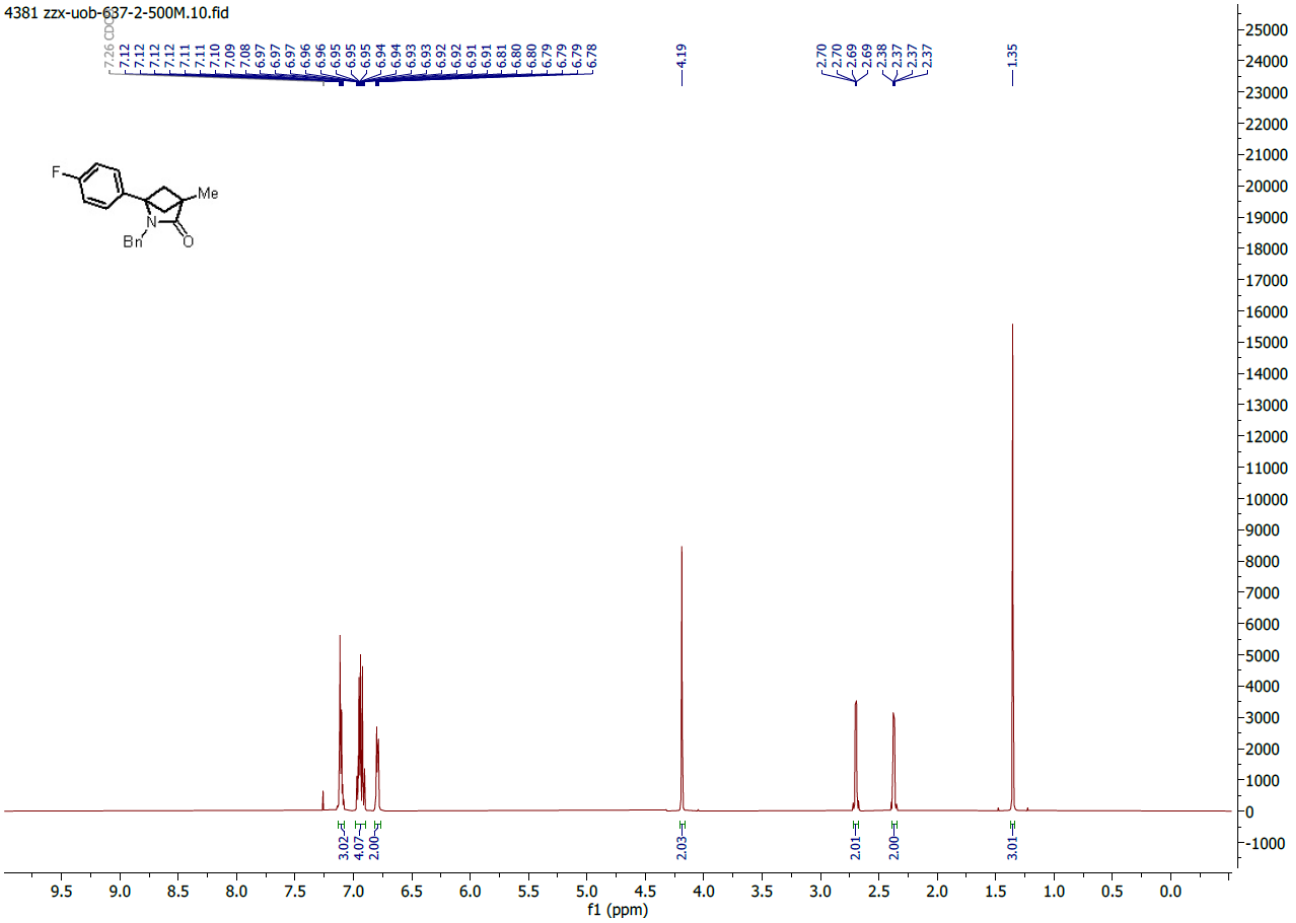

4483 zzx-uob-652-500M.11.fid
182.28
140.33
137.99
132.12
128.45
128.27
128.05
127.25
118.45
112.35
77.16 CDCl3
66.61
58.10
48.43
44.71
13.51
NC
Me
N
Bn
O
f1 (ppm)

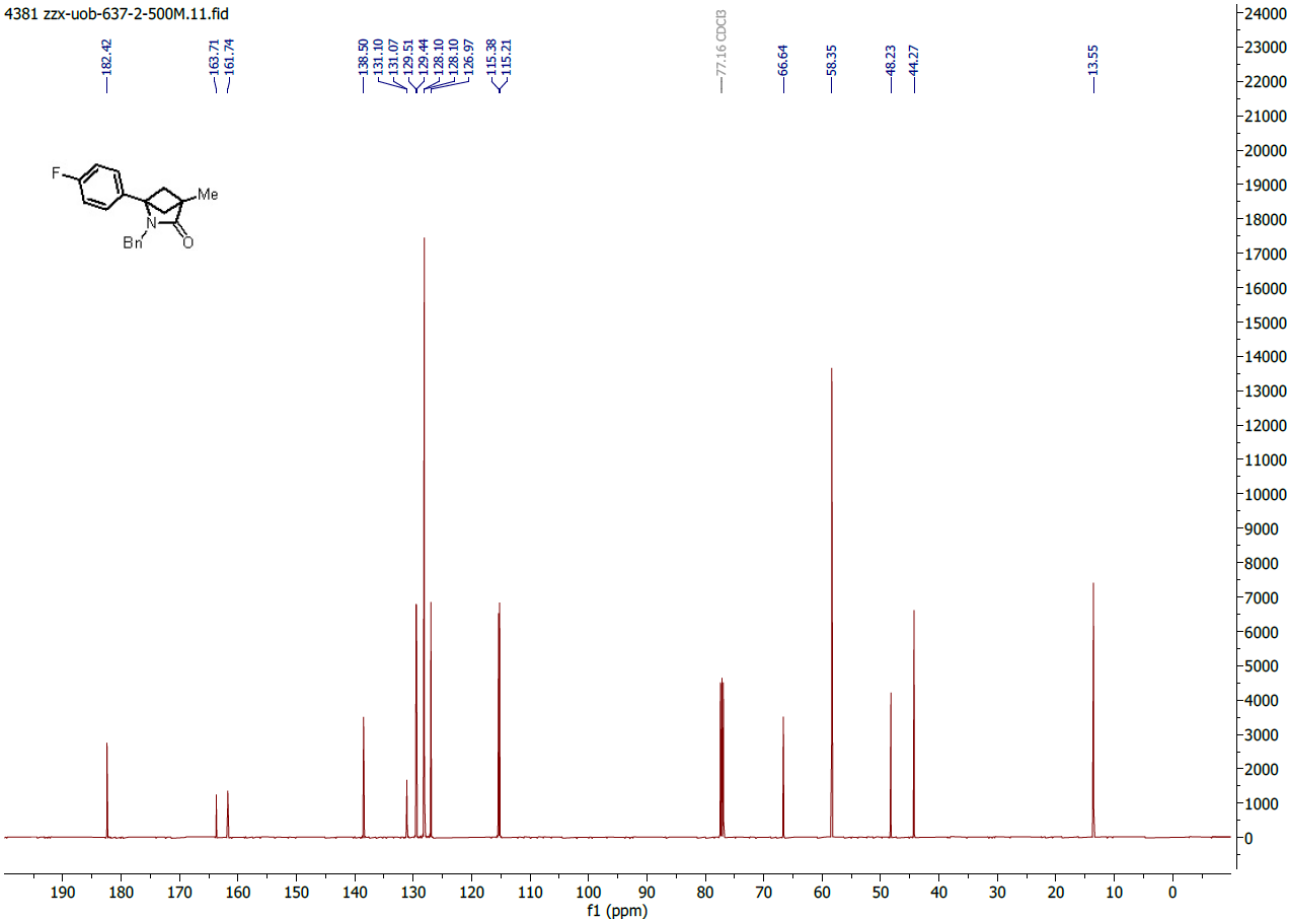
Compound 3e

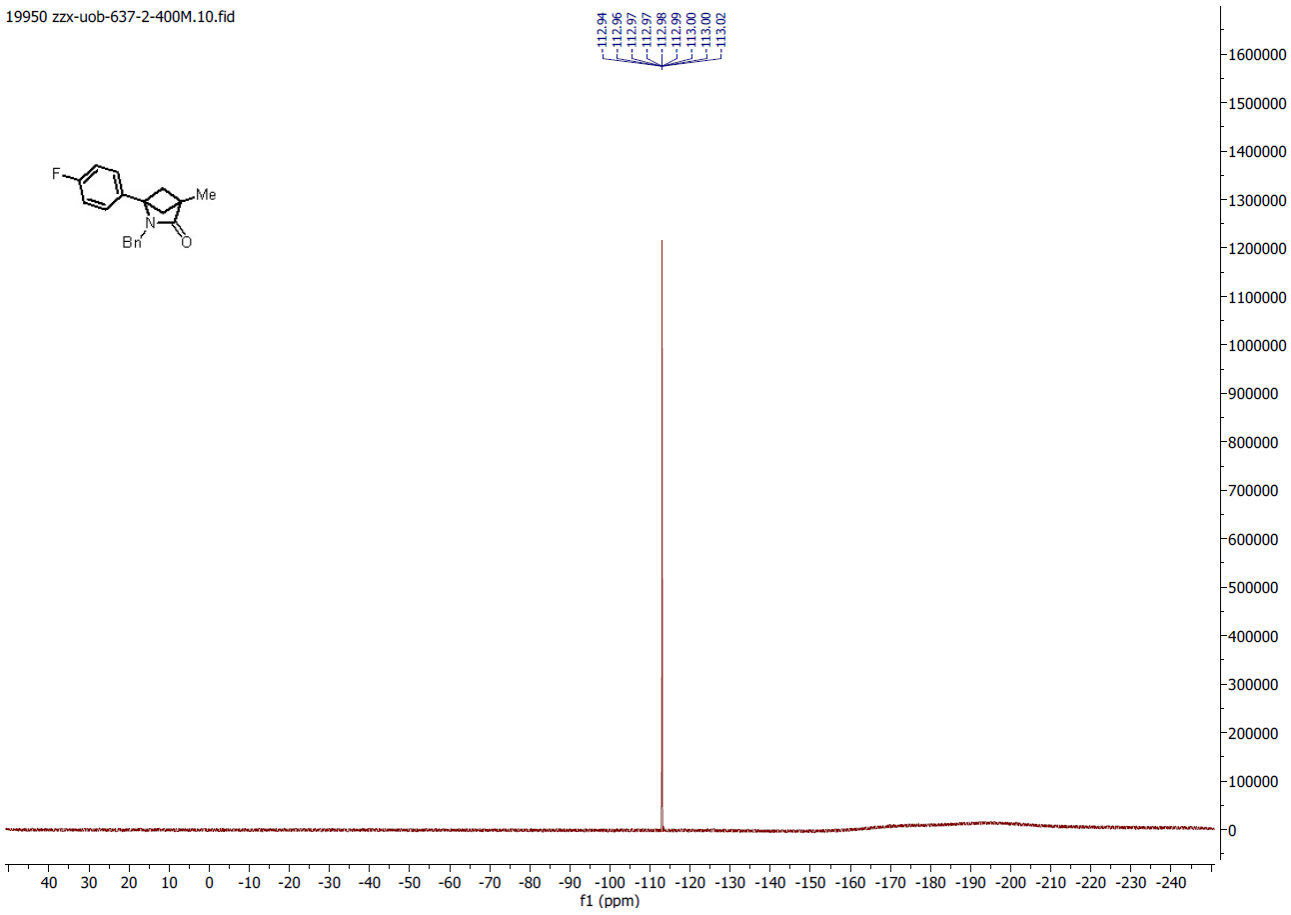

4487 zzx-uob-654-500M.10.fid
7.91
7.90
7.26 CDCl3
7.09
7.09
7.09
7.08
7.08
7.07
7.07
7.07
7.07
7.06
7.06
7.05
7.05
7.05
7.04
6.75
6.73
6.73
4.18
3.89
2.69
2.69
2.69
2.68
2.39
2.38
2.38
2.37
1.34
MeO2C
Me
N
Bn
O
2.02
5.02
2.00
2.01
3.04
2.03
2.04
3.01
f1 (ppm)


4487 zzx-uob-654-500M.11.fid
182.38
166.55
140.01
138.17
130.11
129.54
128.12
128.09
127.67
127.01
77.16 CDCl3
66.83
58.24
52.24
48.24
44.42
13.48
MeO2C
Me
N
Bn
O
f1 (ppm)

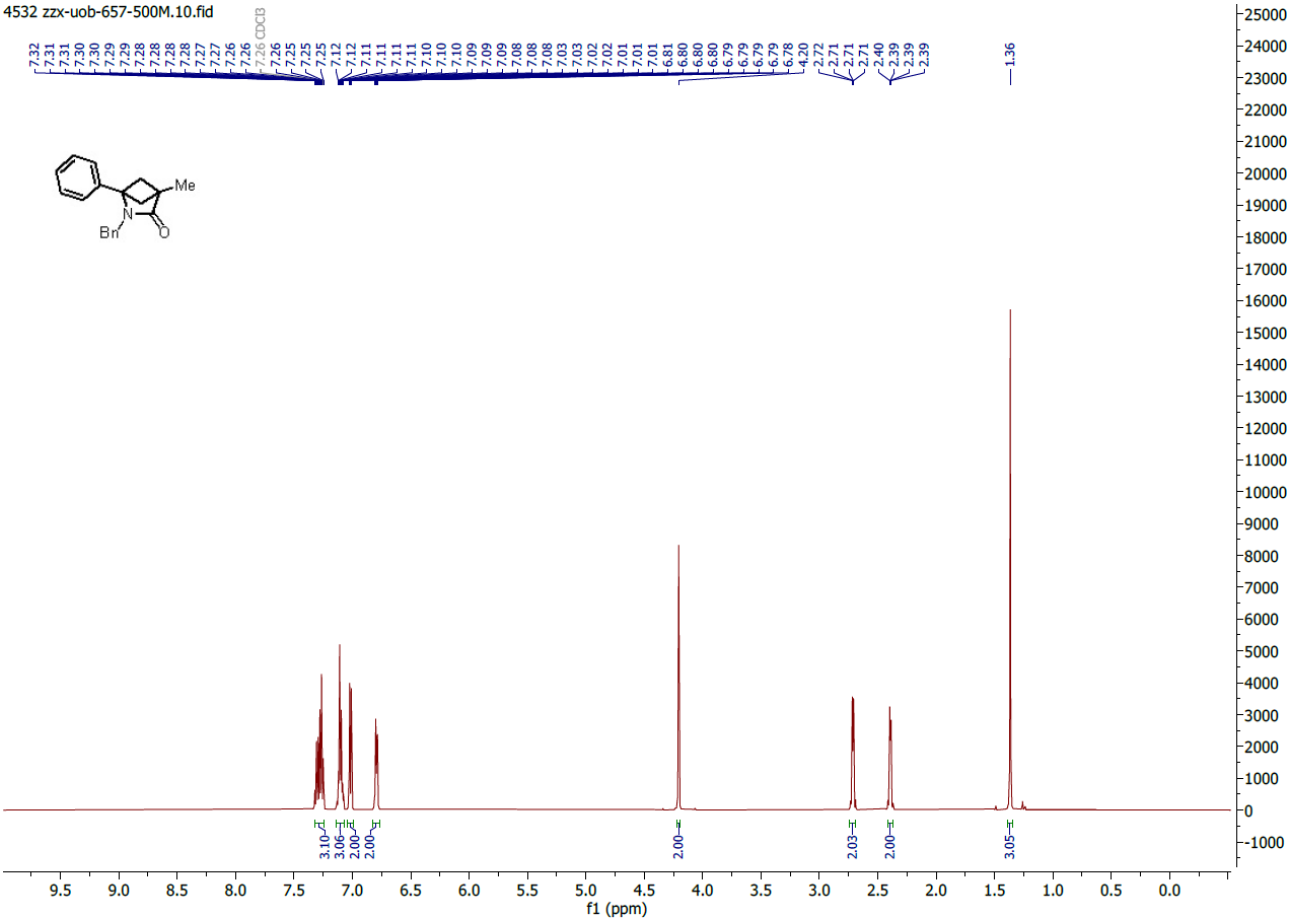
Compound 3f

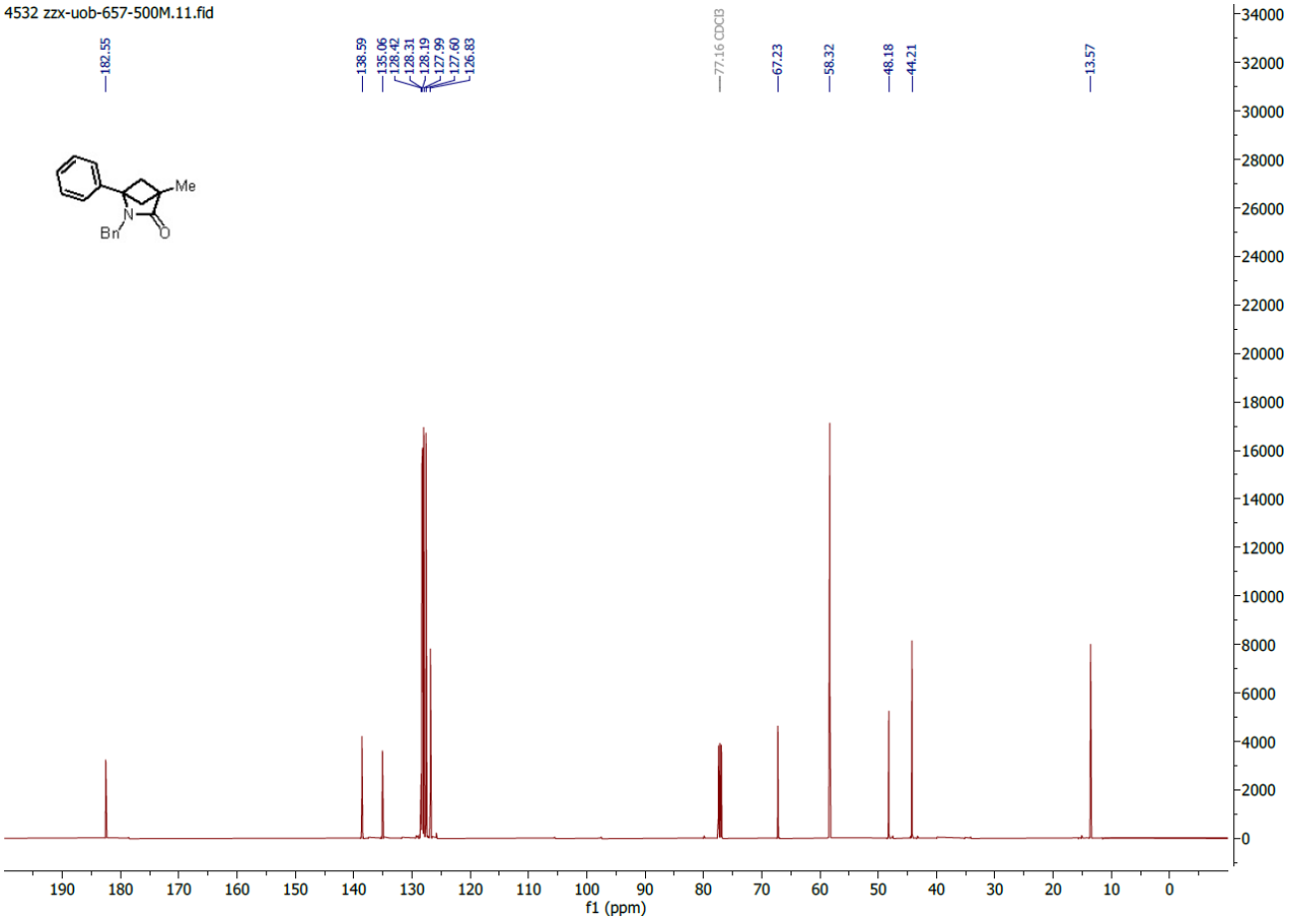

4381 zzx-uob-637-2-500M.10.fid
7.26 CDCl3
7.12
7.12
7.12
7.12
7.11
7.11
7.10
7.09
7.08
6.97
6.97
6.97
6.96
6.96
6.95
6.95
6.95
6.95
6.94
6.94
6.93
6.93
6.92
6.92
6.91
6.91
6.81
6.80
6.80
6.79
6.79
6.79
6.78
4.19
2.70
2.70
2.69
2.69
2.38
2.37
2.37
2.37
1.35
F
Me
N
Bn
O
3.02
4.07
2.00
2.03
2.01
2.00
3.01
f1 (ppm)


4381 zzx-uob-637-2-500M.11.fid
182.42
163.71
161.74
138.50
131.10
131.07
129.51
129.44
128.10
128.10
126.97
115.38
115.21
77.16 CDCl3
66.64
58.35
48.23
44.27
13.55
F
Me
N
Bn
O
f1 (ppm)

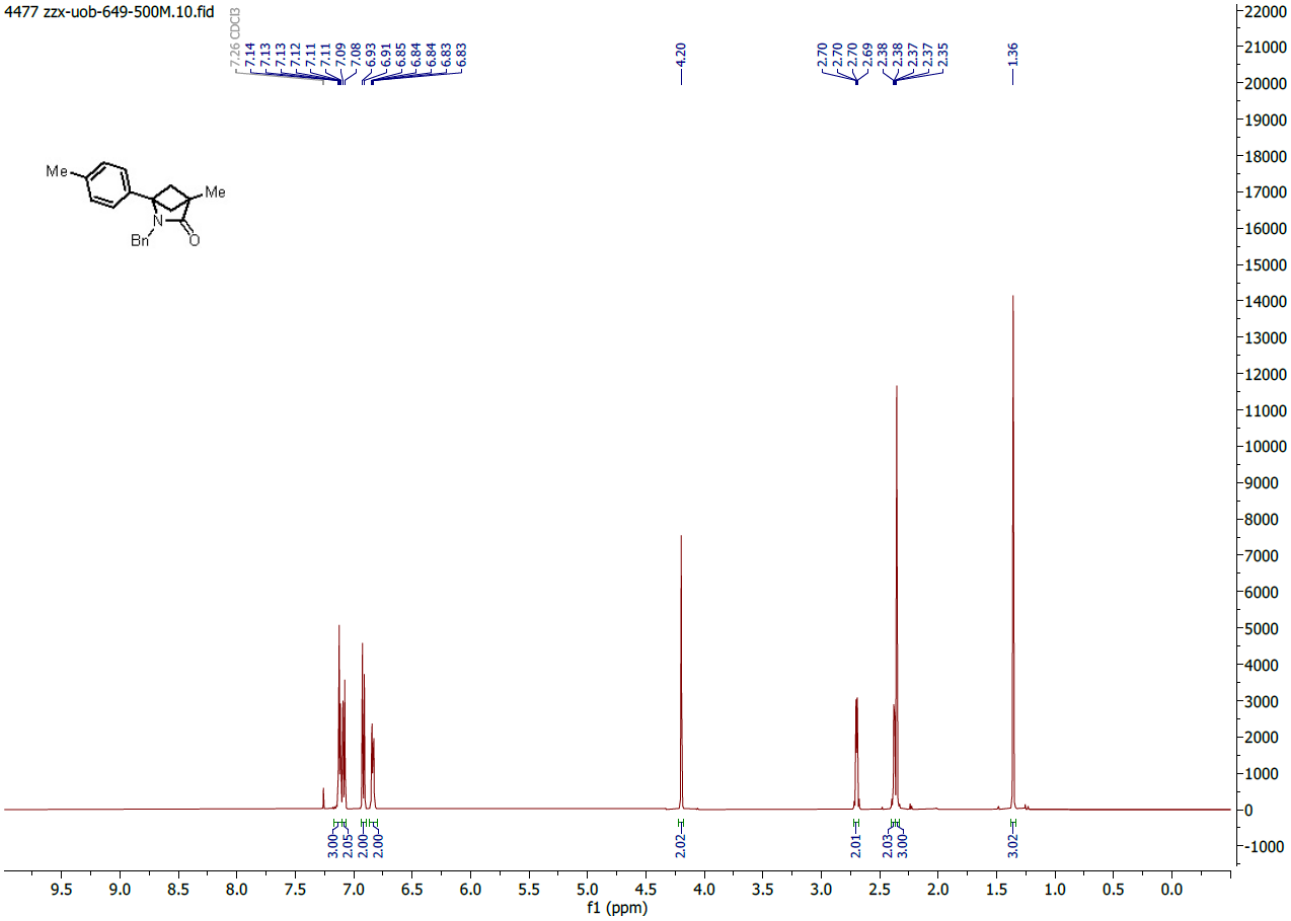

19950 zzx-uob-637-2-400M.10.fid
112.94
112.96
112.97
112.97
112.98
112.99
113.00
113.00
113.02
F
Me
N
Bn
O
1600000
1500000
1400000
1300000
1200000
1100000
1000000
900000
800000
700000
600000
500000
400000
300000
200000
100000
0
40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220 -230 -240
f1 (ppm)

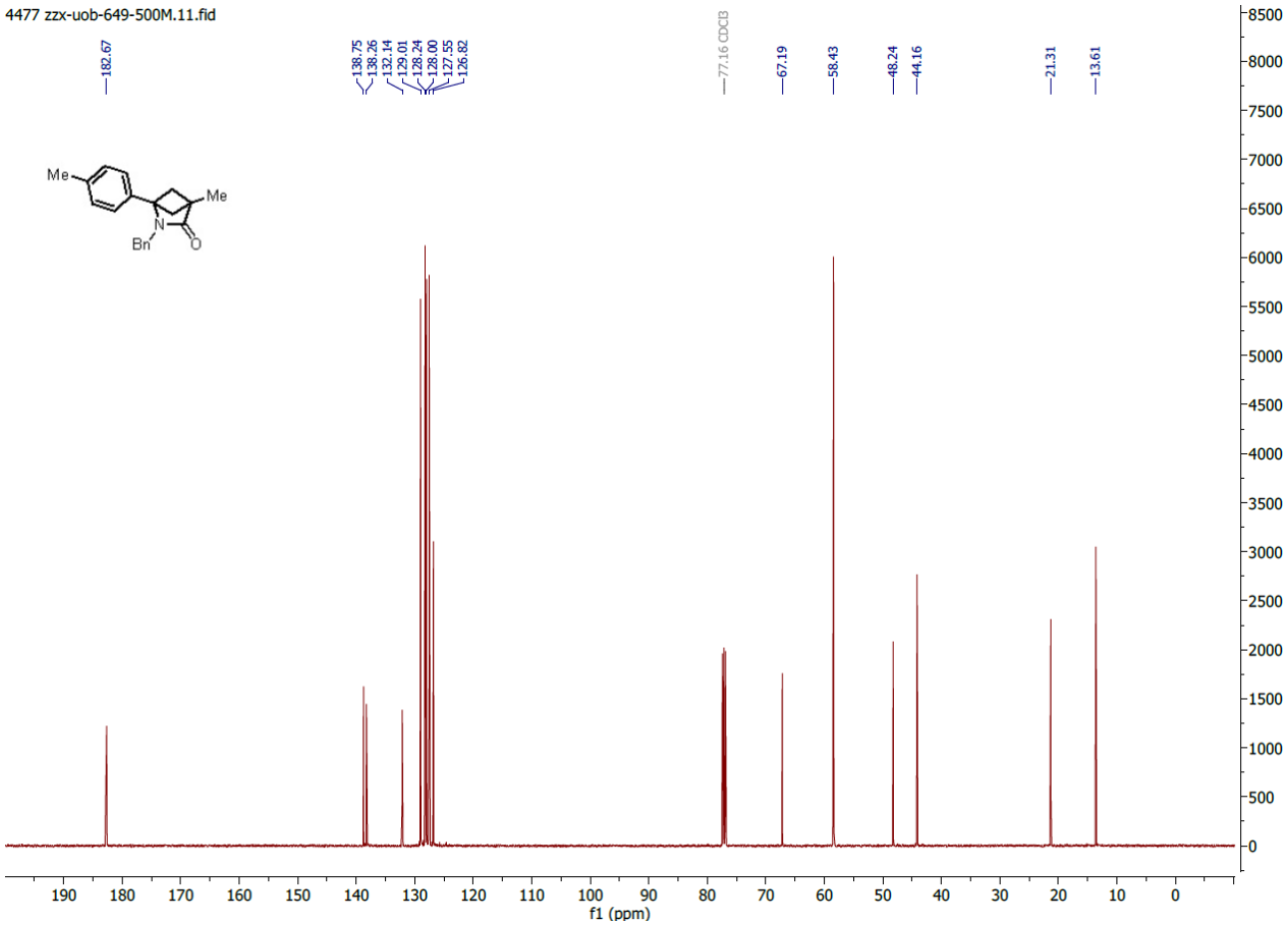
Compound 3g


4532 zzx-uob-657-500M.10.fid
Me
Br
N
O
f1 (ppm)

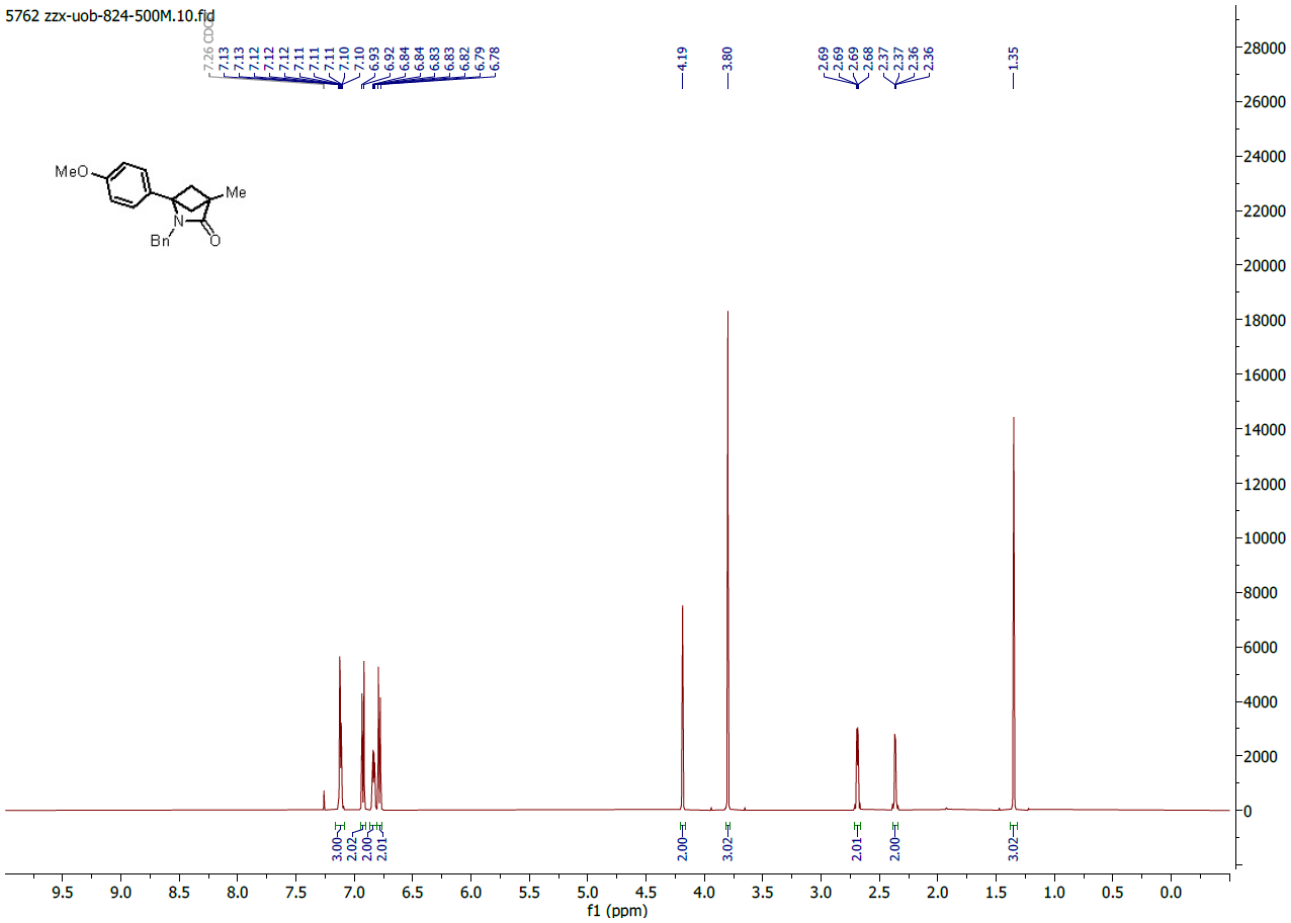

4532 zzx-uob-657-500M.11.fid
Me
Br
N
O
f1 (ppm)

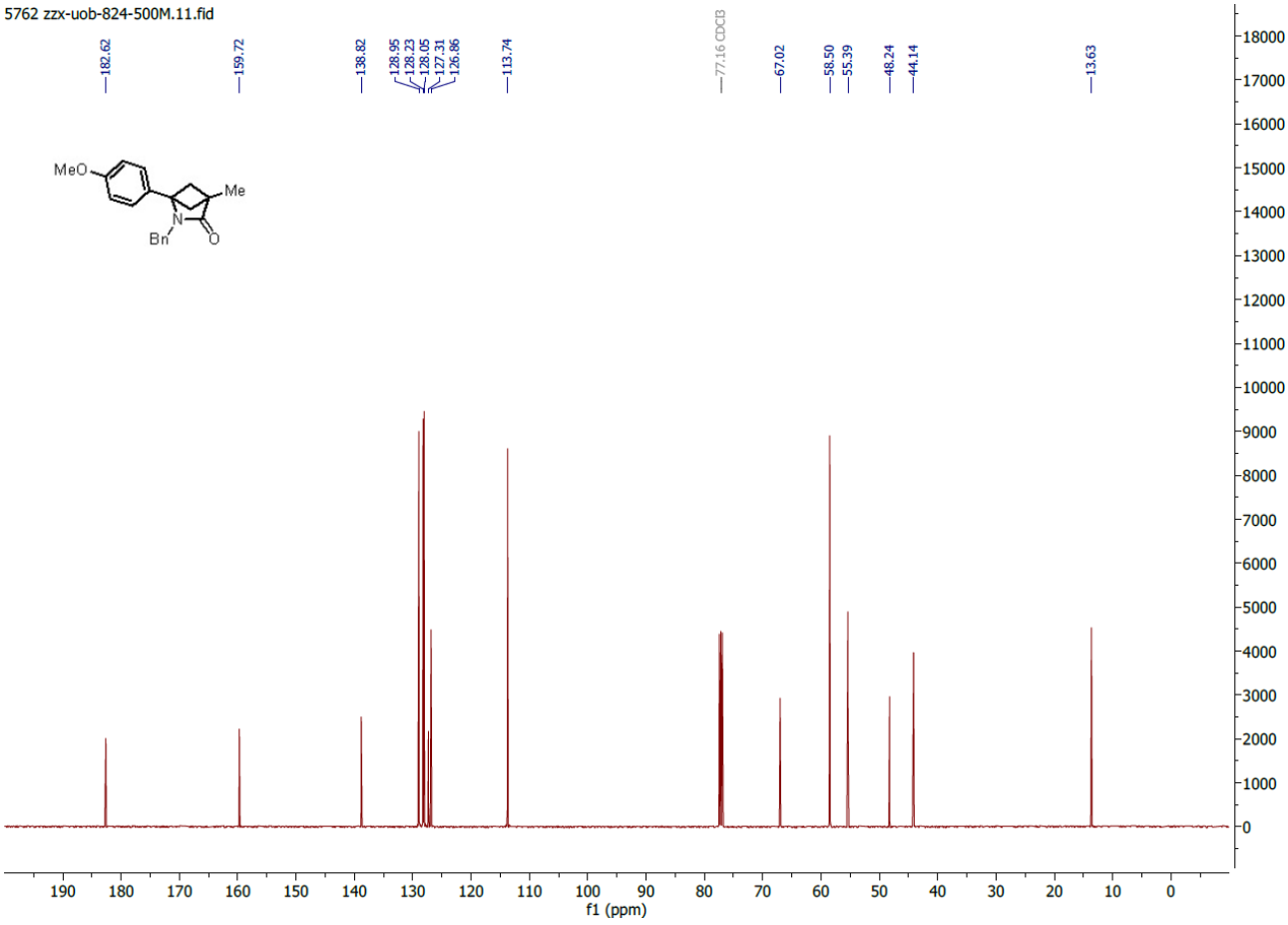
Compound 3h


4477 zzx-uob-649-500M.10.fid
7.26 CDCl3
7.14
7.13
7.13
7.12
7.11
7.11
7.09
7.08
6.93
6.91
6.85
6.84
6.84
6.84
6.83
6.83
4.20
2.70
2.70
2.70
2.69
2.38
2.38
2.37
2.37
2.35
1.36
Me
Me
N
Bn
O
3.00
2.05
2.00
2.00
2.02
2.01
2.03
3.00
3.02
f1 (ppm)

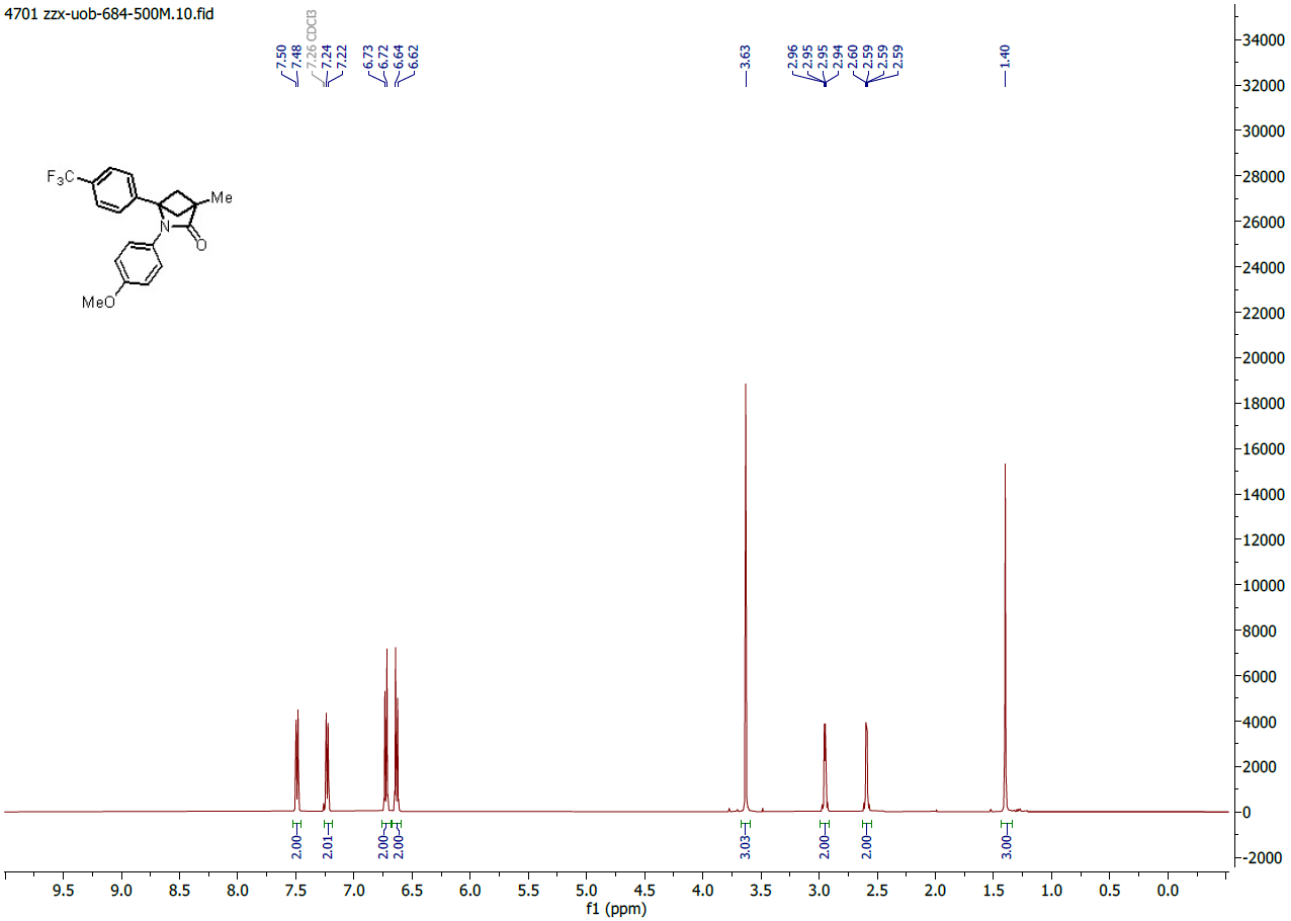

4477 zzx-uob-649-500M.11.fid
182.67
138.75
138.26
132.14
129.01
128.24
128.00
127.55
126.82
77.16 CDCl3
67.19
58.43
48.24
44.16
21.31
13.61
Me
Me
N
Bn
O
f1 (ppm)

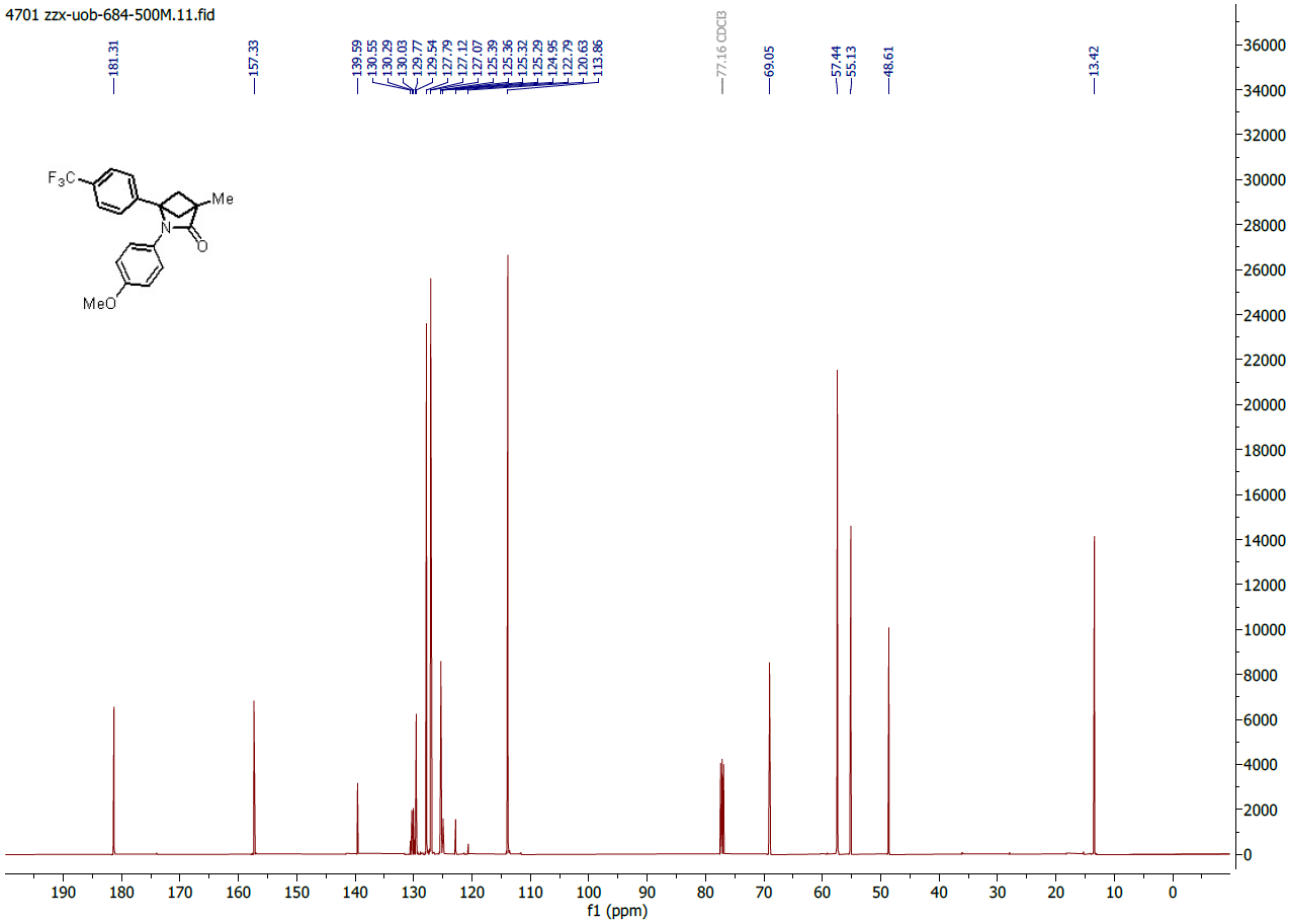
Compound 3i

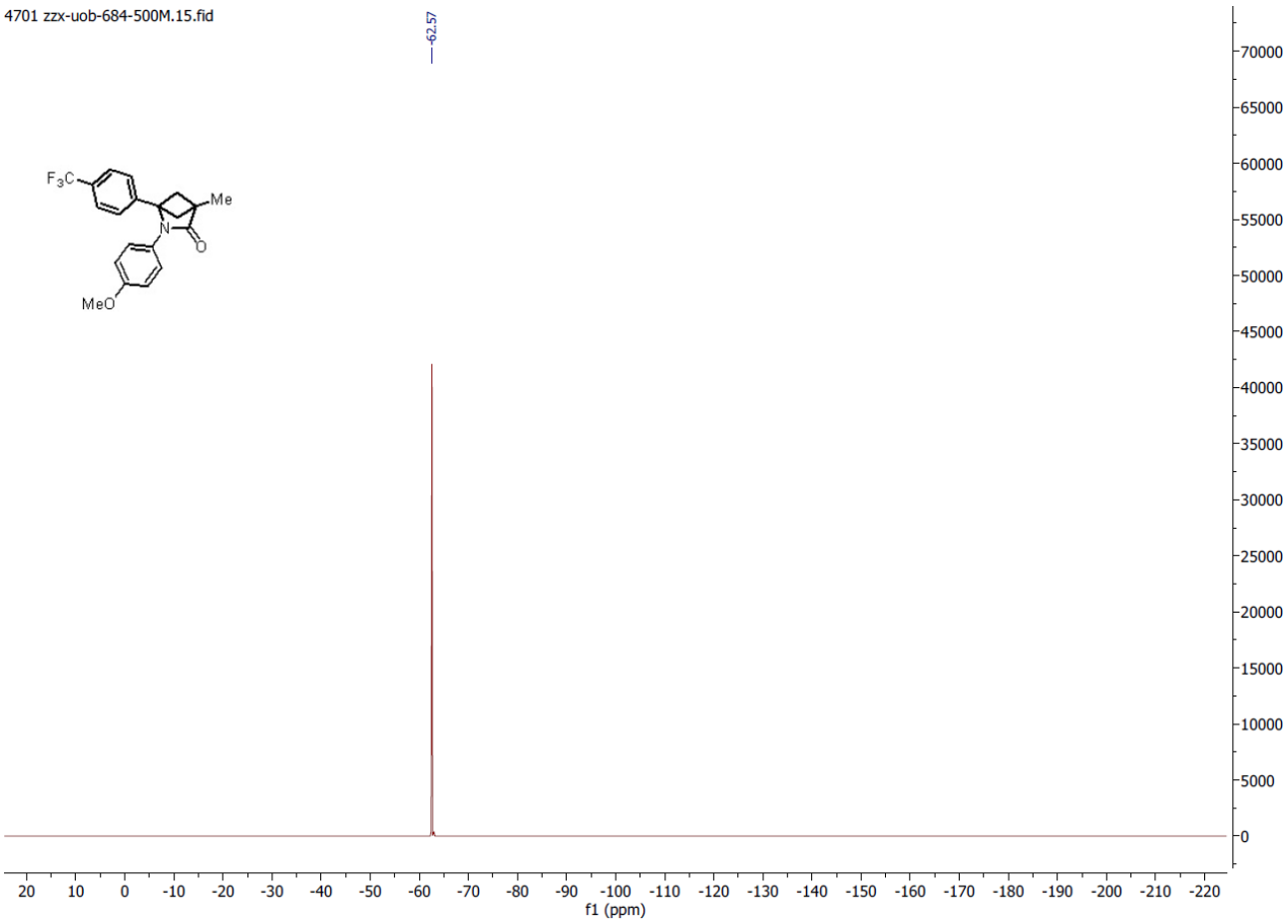

5762 zzx-uob-824-500M.10.fid
MeO
Me
N
Bn
O
f1 (ppm)


5762 zzx-uob-824-500M.11.fid
MeO
Me
N
Bn
O
f1 (ppm)

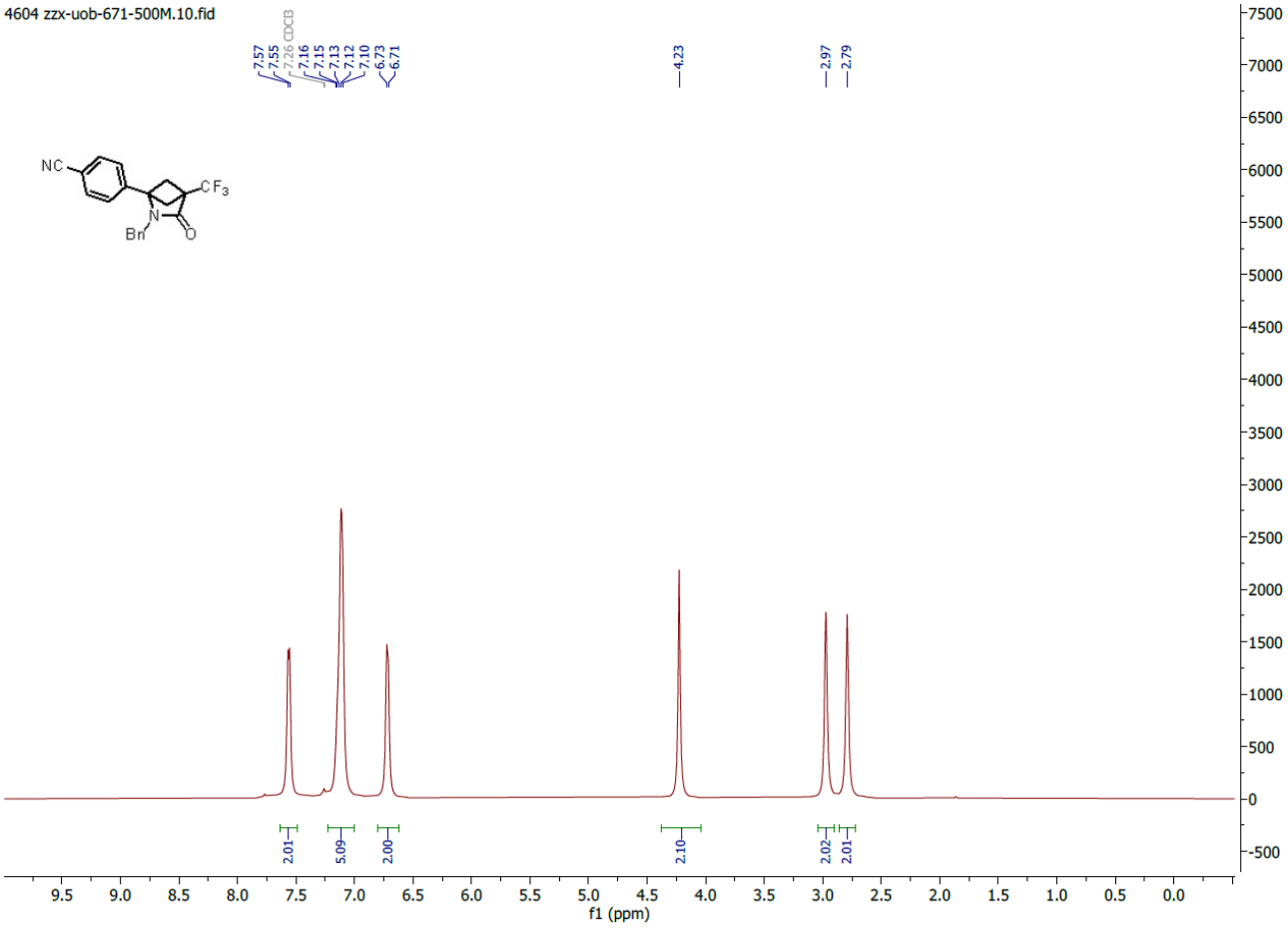
Compound 3j

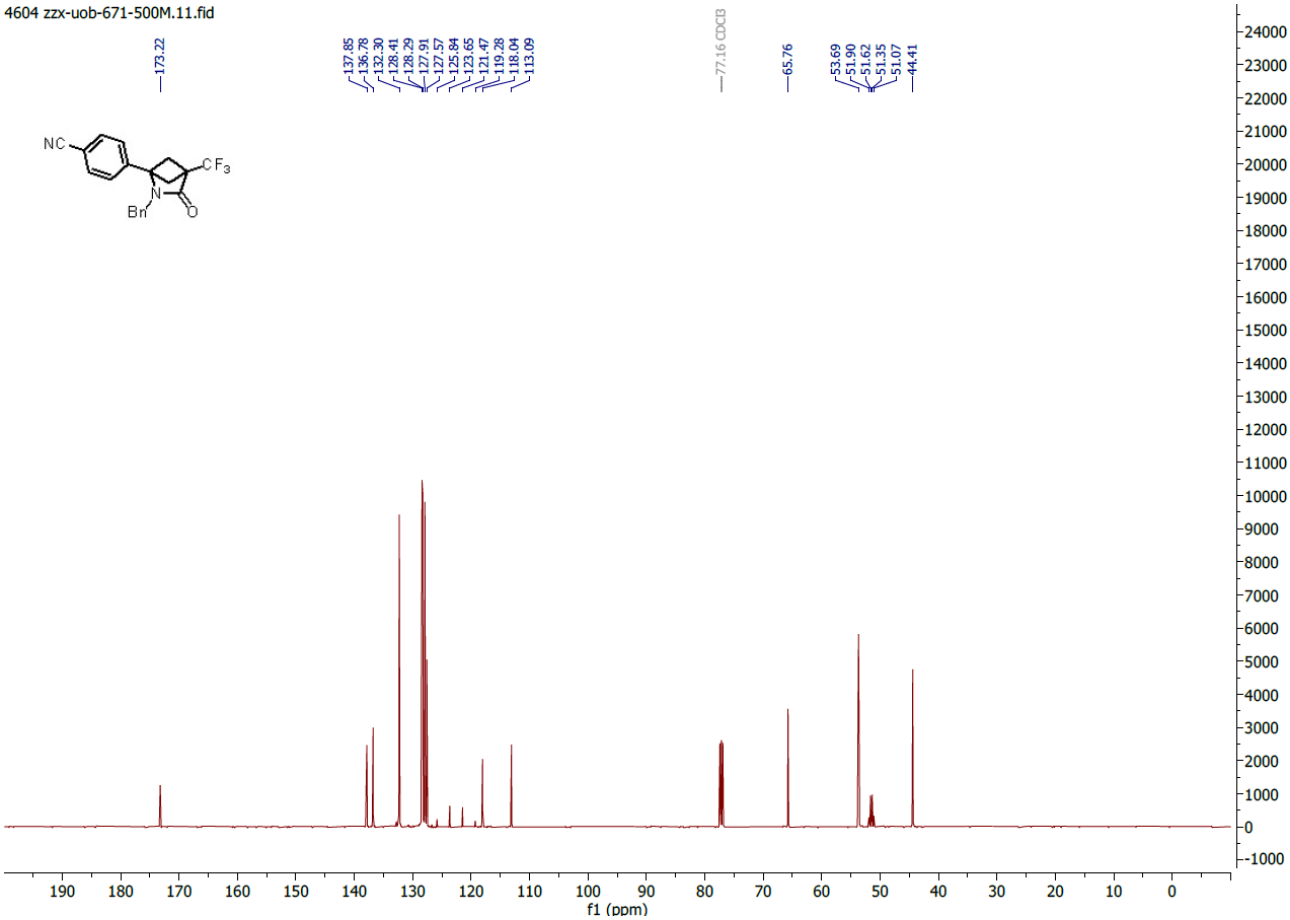

4701 zzx-uob-684-500M.10.fid
7.50
7.48
7.26 CDCl3
7.24
7.22
6.73
6.72
6.64
6.62
3.63
2.96
2.95
2.95
2.94
2.60
2.59
2.59
2.59
1.40
F3C
Me
N
O
MeO
2.00
2.01
2.00
2.00
3.03
2.00
2.00
3.00
f1 (ppm)

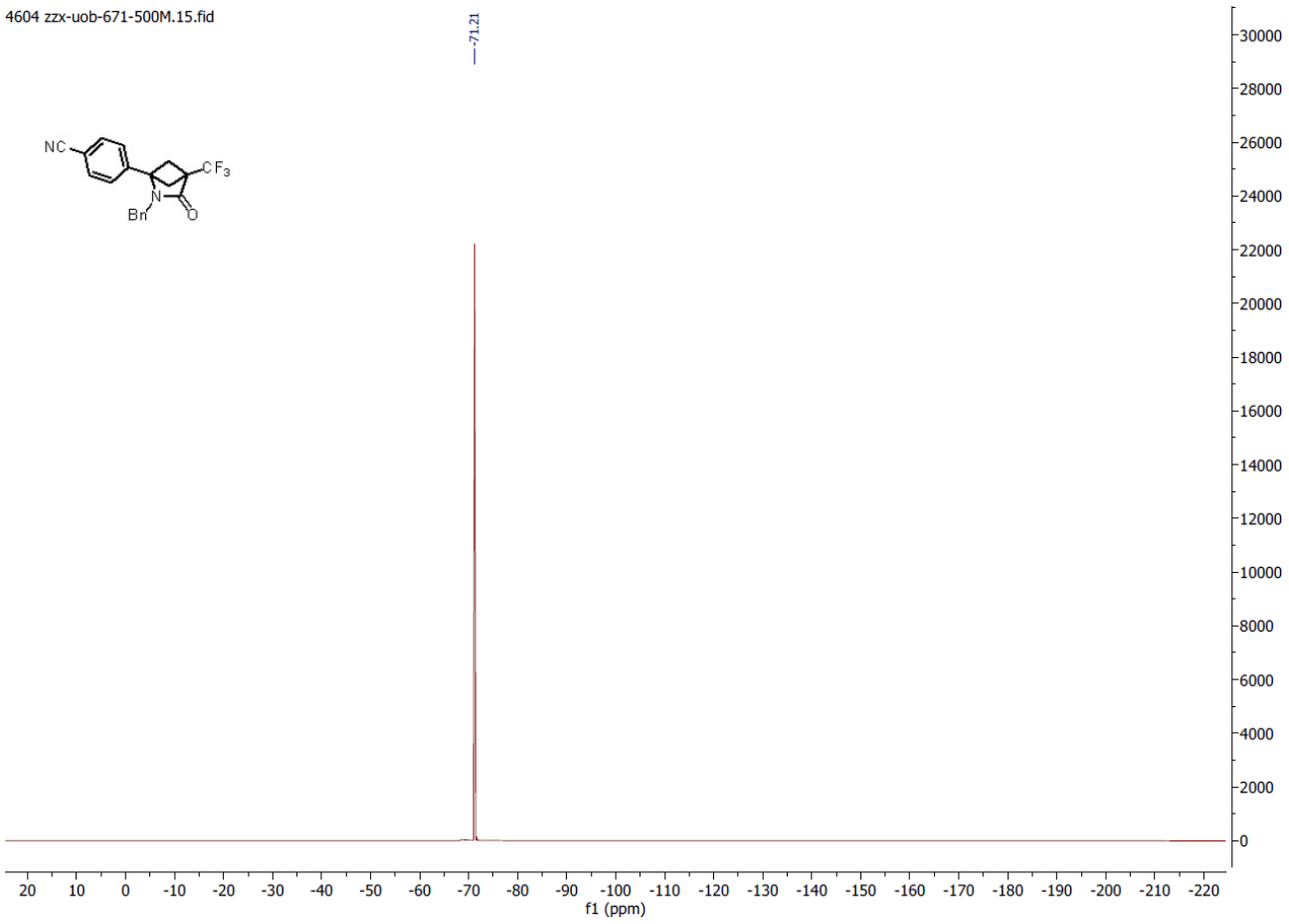

4701 zzx-uob-684-500M.11.fid
181.31
157.33
139.59
130.55
130.29
130.03
129.77
129.54
127.79
127.12
127.07
125.39
125.36
125.32
125.29
124.95
122.79
120.63
113.86
77.16 CDCl3
69.05
57.44
55.13
48.61
13.42
F3C
Me
N
O
MeO
f1 (ppm)


4701 zzx-uob-684-500M.15.fid
-62.57
F3C
Me
N
O
MeO
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

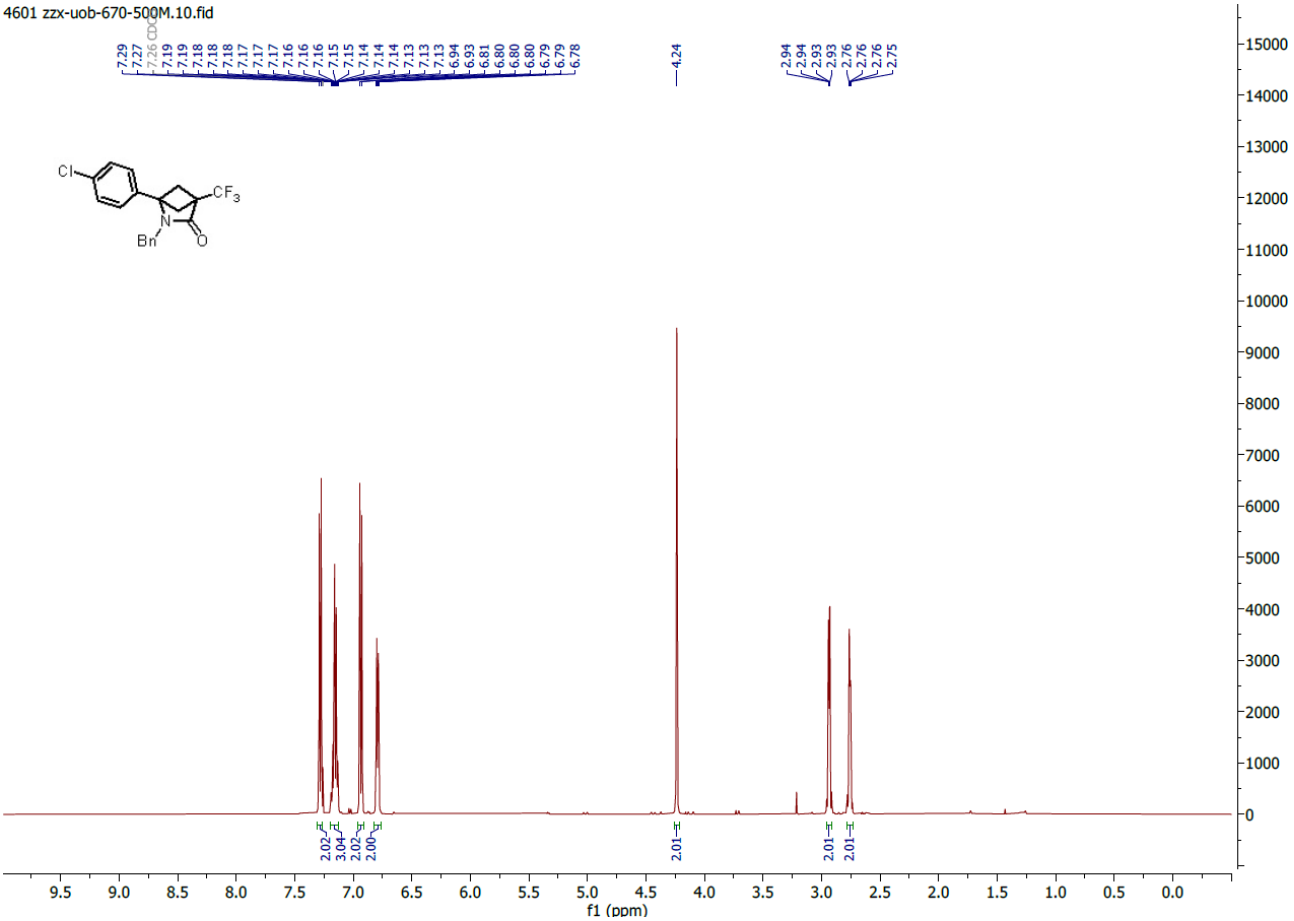
Compound 3k

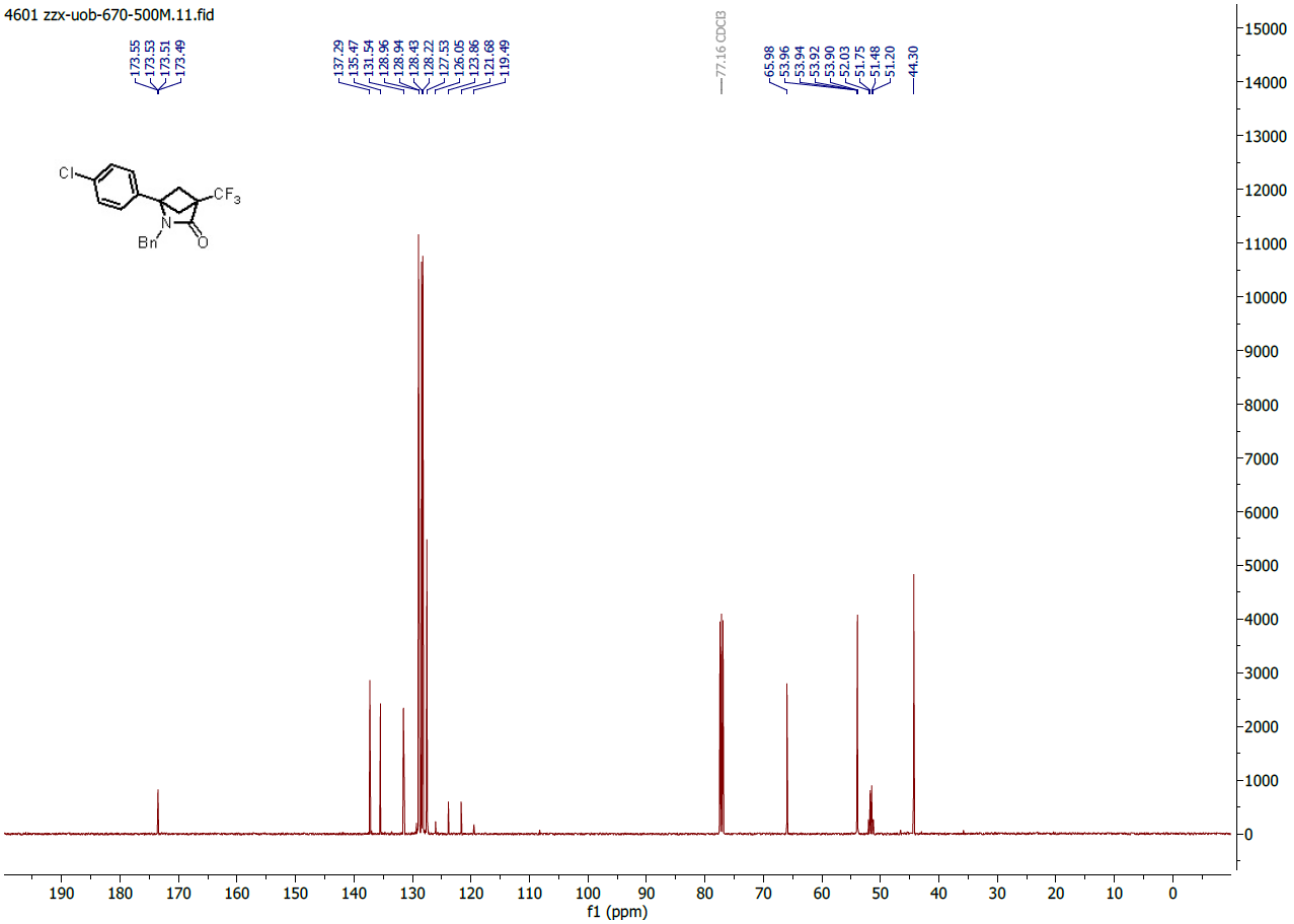

4604 zzx-uob-671-500M.10.fid
7.57
7.55
7.26 CDCl3
7.16
7.15
7.13
7.12
7.10
6.73
6.71
4.23
2.97
2.79
NC
CF3
N
Br
O
2.01
5.09
2.00
2.10
2.02
2.01
f1 (ppm)

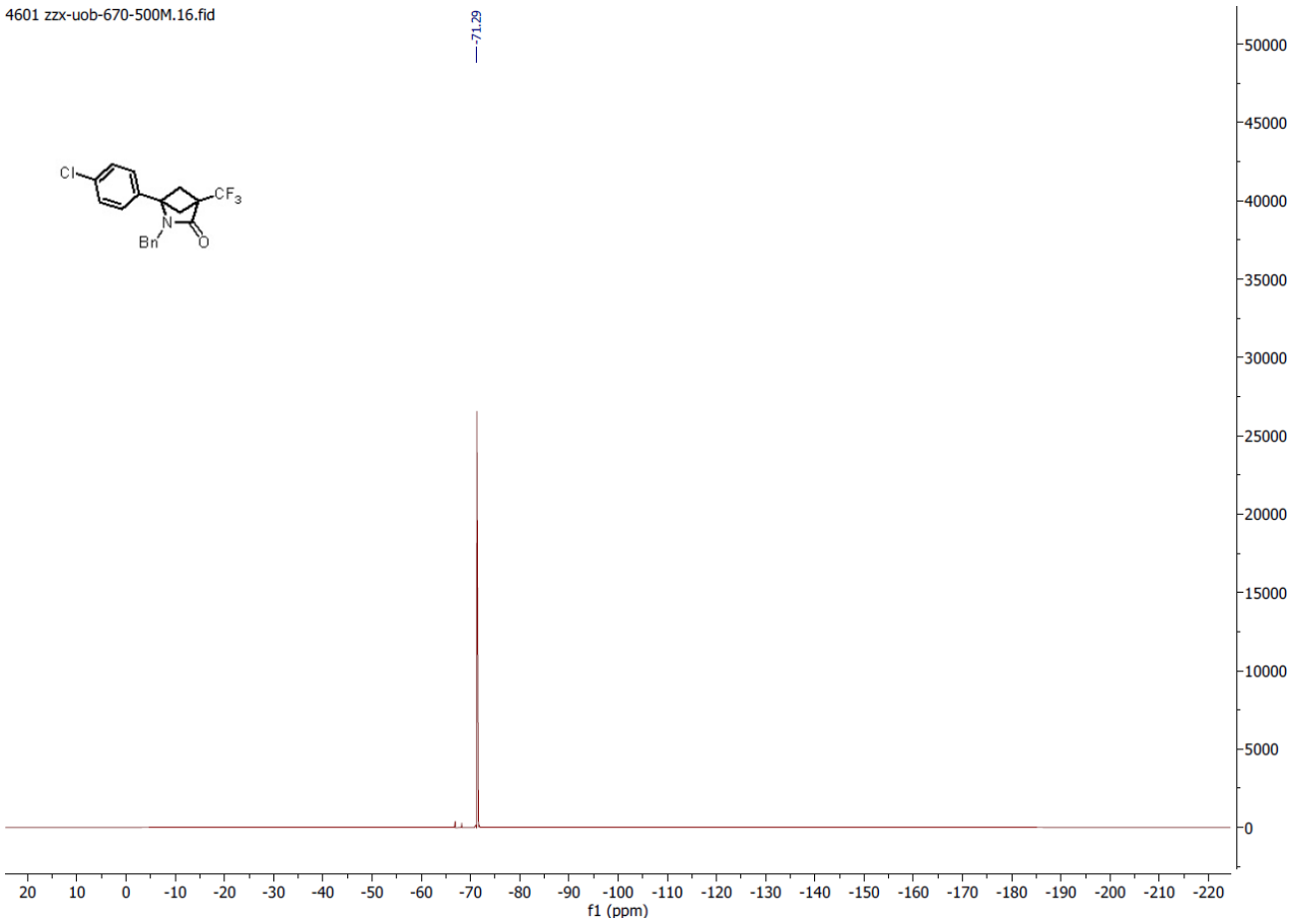

4604 zzx-uob-671-500M.11.fid
173.22
137.85
136.78
132.30
128.41
128.29
127.91
127.57
125.84
123.65
121.47
119.28
118.04
113.09
77.16 CDCl3
65.76
53.69
51.90
51.62
51.35
51.07
44.41
NC
CF3
N
Br
O
f1 (ppm)


4604 zzx-uob-671-500M.15.fid
-71.21
NC
CF3
N
Bn
O
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

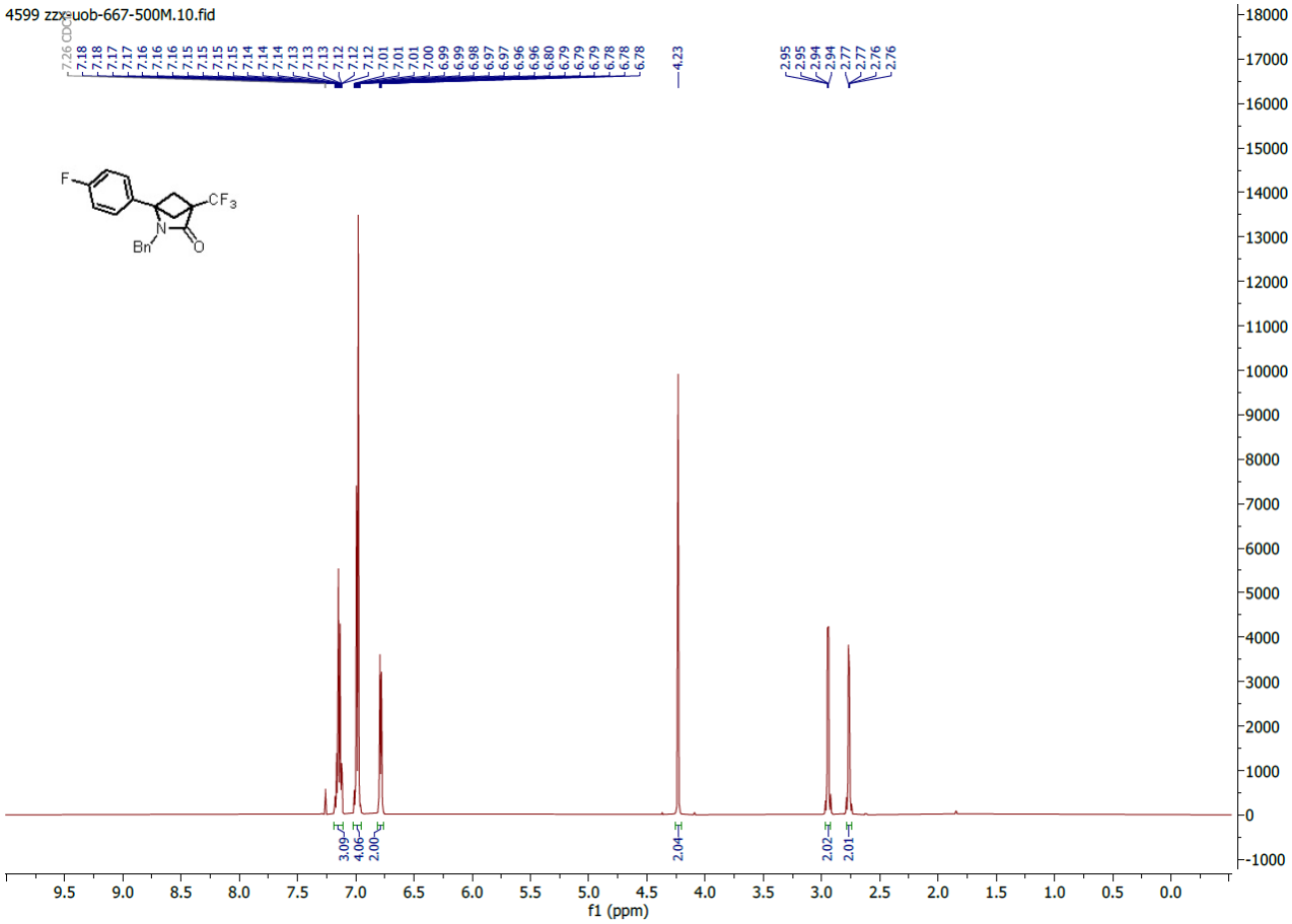
Compound 3l

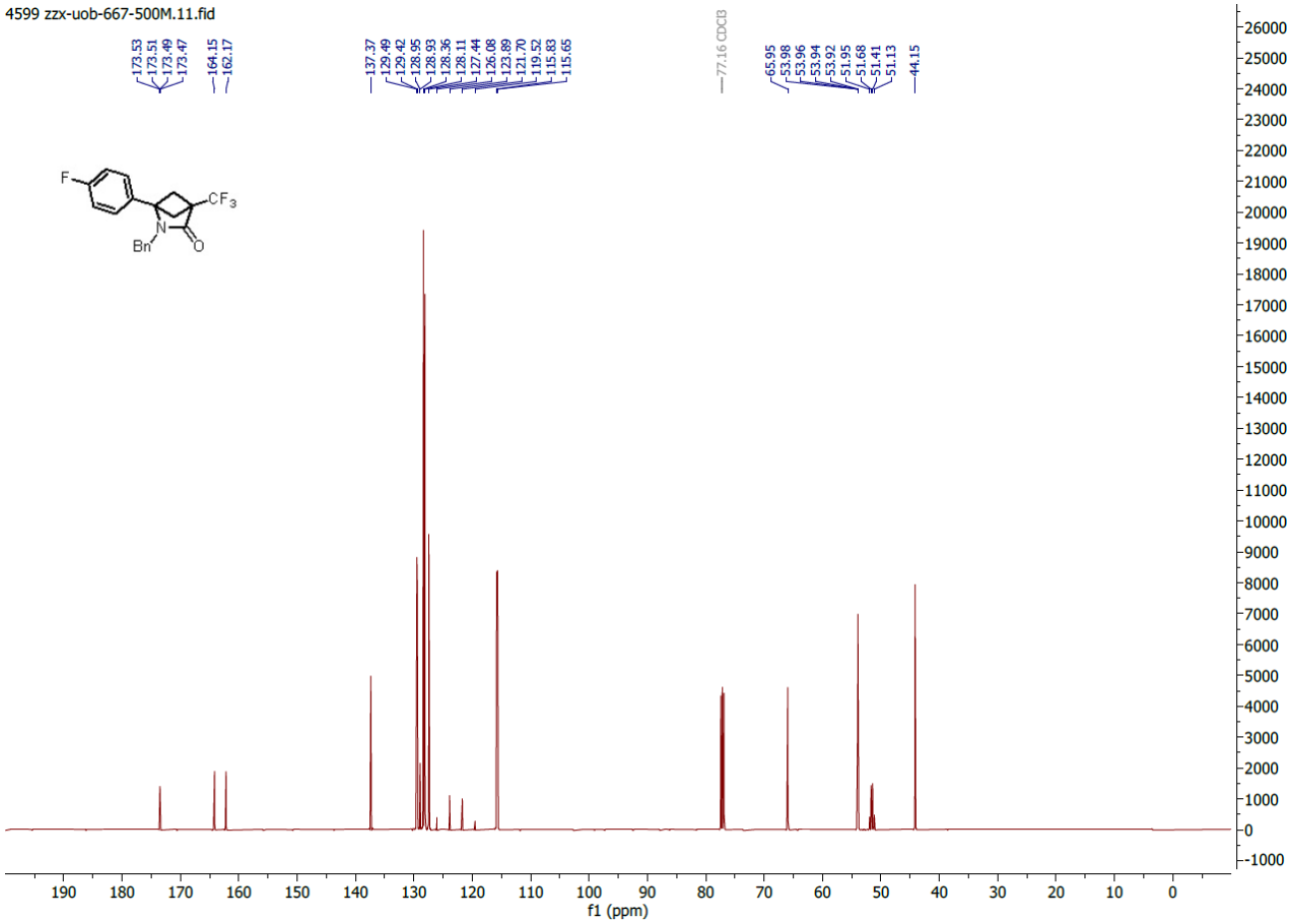

4601 zzx-uob-670-500M.10.fid
7.29
7.27
7.26 CDCl3
7.19
7.19
7.18
7.18
7.18
7.17
7.17
7.17
7.17
7.16
7.16
7.16
7.15
7.15
7.14
7.14
7.14
7.13
7.13
7.13
6.94
6.93
6.81
6.80
6.80
6.80
6.79
6.79
6.78
4.24
2.94
2.94
2.93
2.93
2.76
2.76
2.76
2.75
Cl
CF3
N
Bn
O
2.02
3.04
2.02
2.00
2.01
2.01
2.01
f1 (ppm)

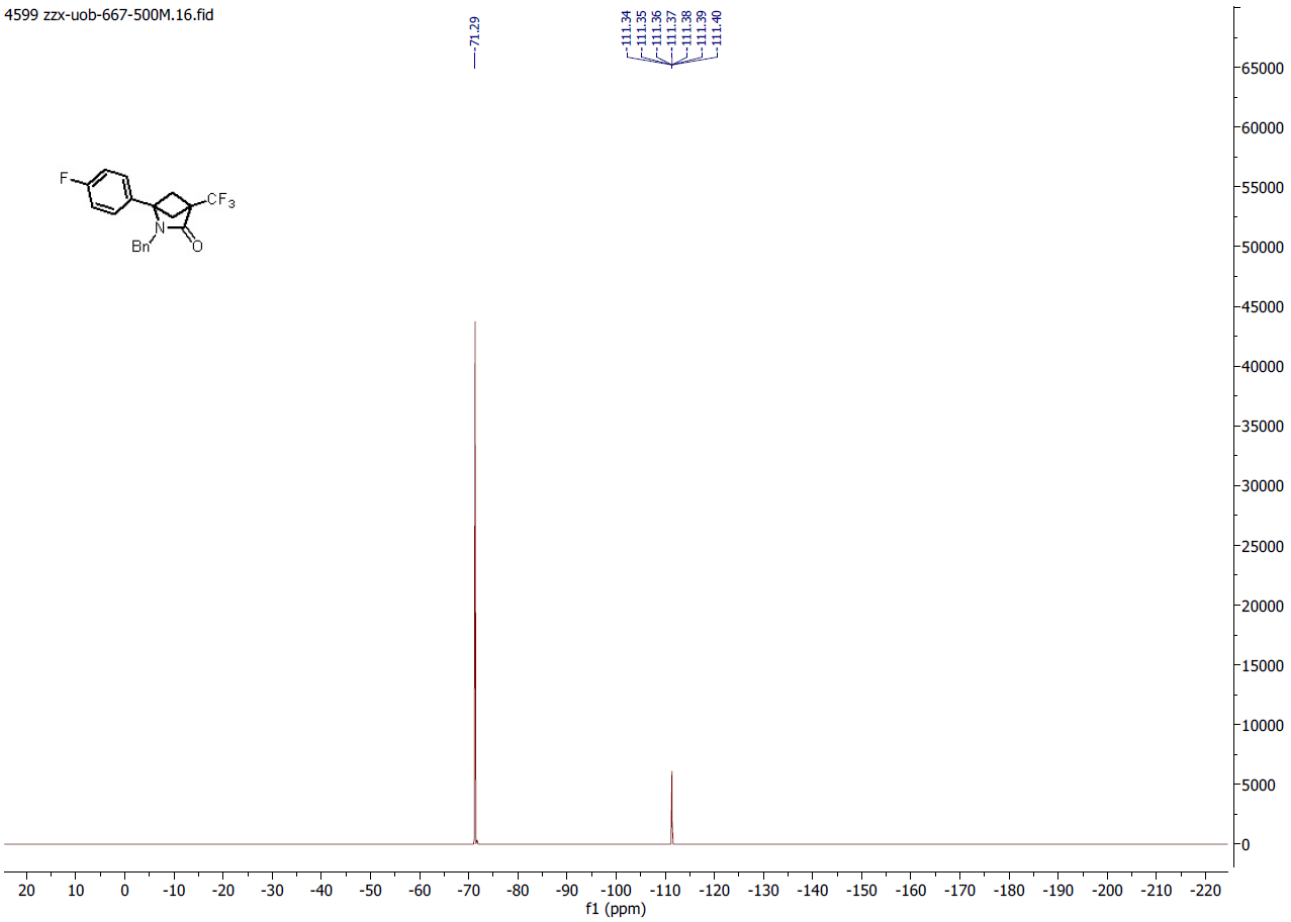

4601 zzx-uob-670-500M.11.fid
173.55
173.53
173.51
173.49
137.29
135.47
131.54
128.96
128.94
128.43
128.22
127.53
126.05
123.86
121.68
119.49
77.16 CDCl3
65.98
53.96
53.94
53.92
53.90
52.03
51.75
51.48
51.20
44.30
Cl
CF3
N
Bn
O
f1 (ppm)


4601 zzx-uob-670-500M.16.fid
-71.29
Cl
CF3
N
Bn
O
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

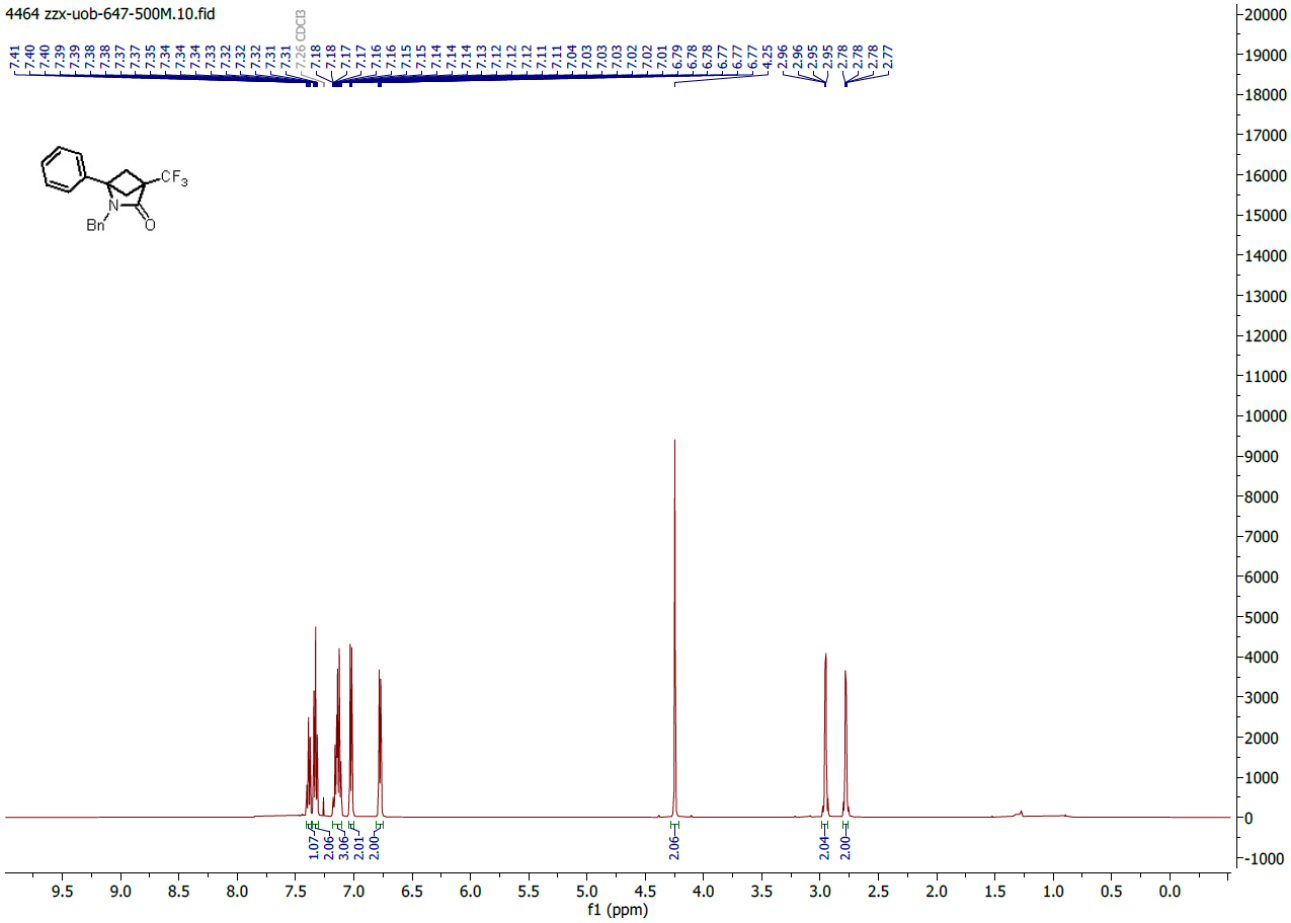
Compound 3m

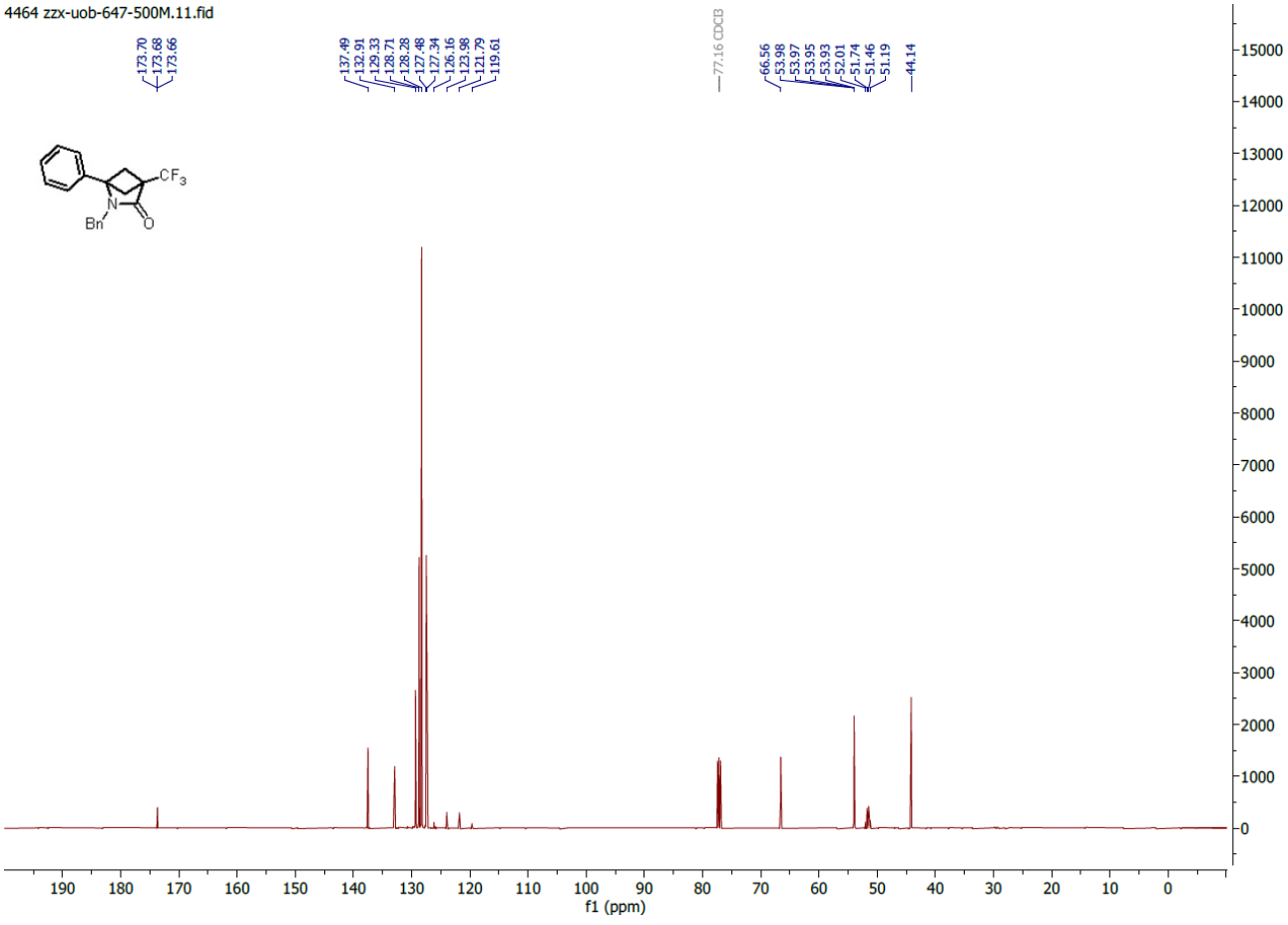

4599 zzx-uob-667-500M.10.fid
F
CF3
N
Bn
O
f1 (ppm)

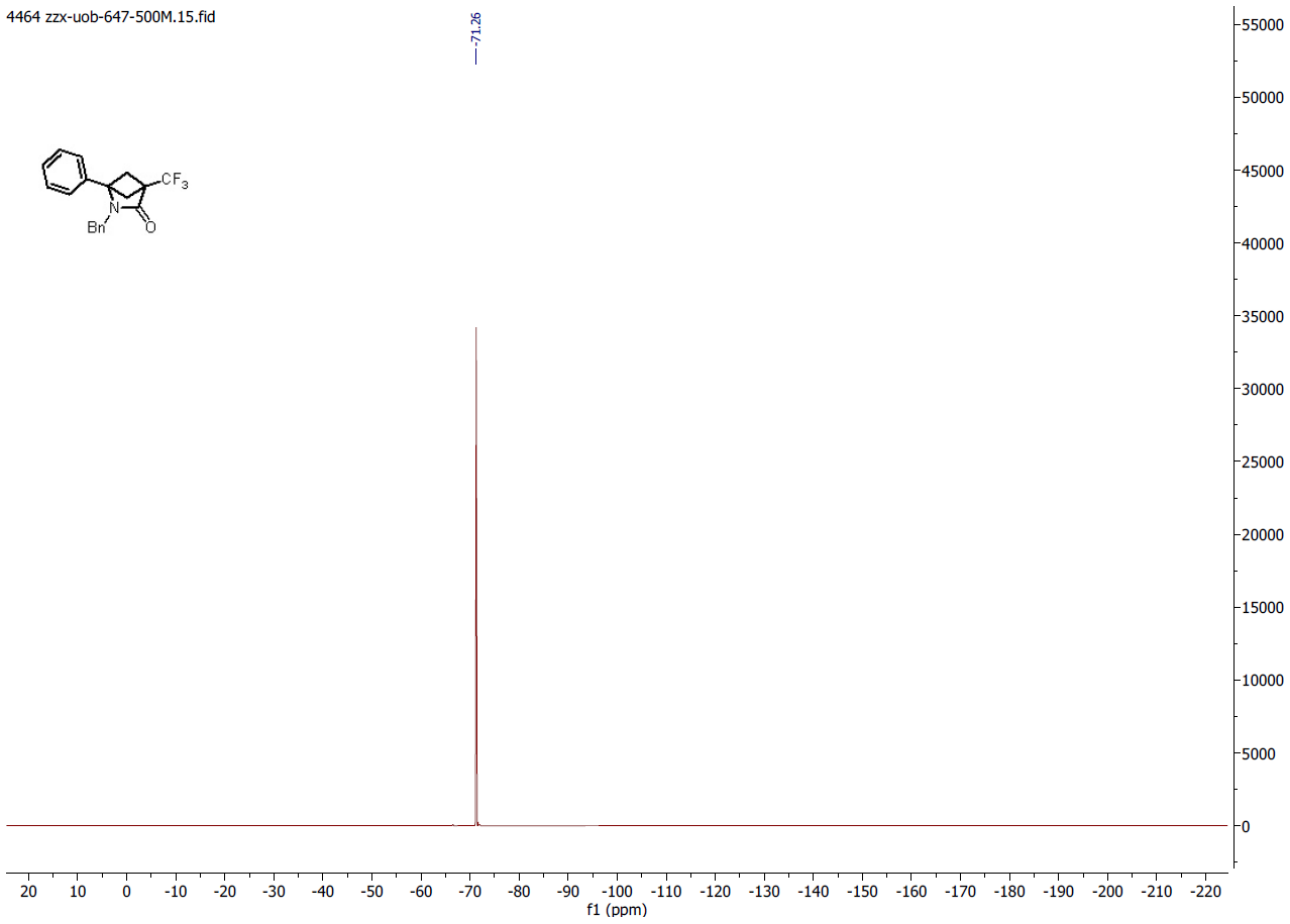

4599 zzx-uob-667-500M.11.fid
F
CF3
N
Bn
O
f1 (ppm)


4599 zzx-uob-667-500M.16.fid
-71.29
-111.34
-111.35
-111.36
-111.37
-111.38
-111.39
-111.40
F
CF3
N
Bn
O
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

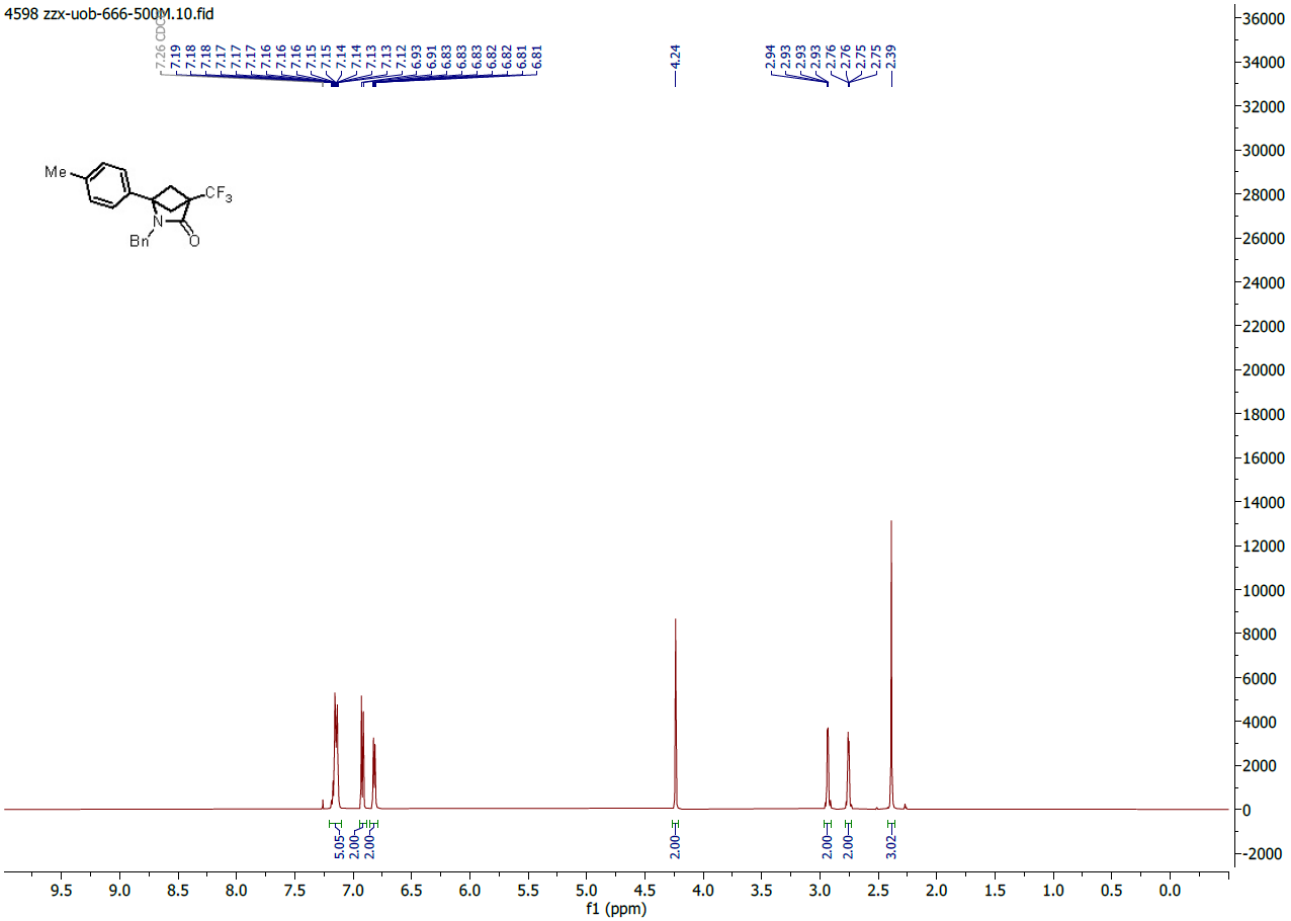
Compound 3n

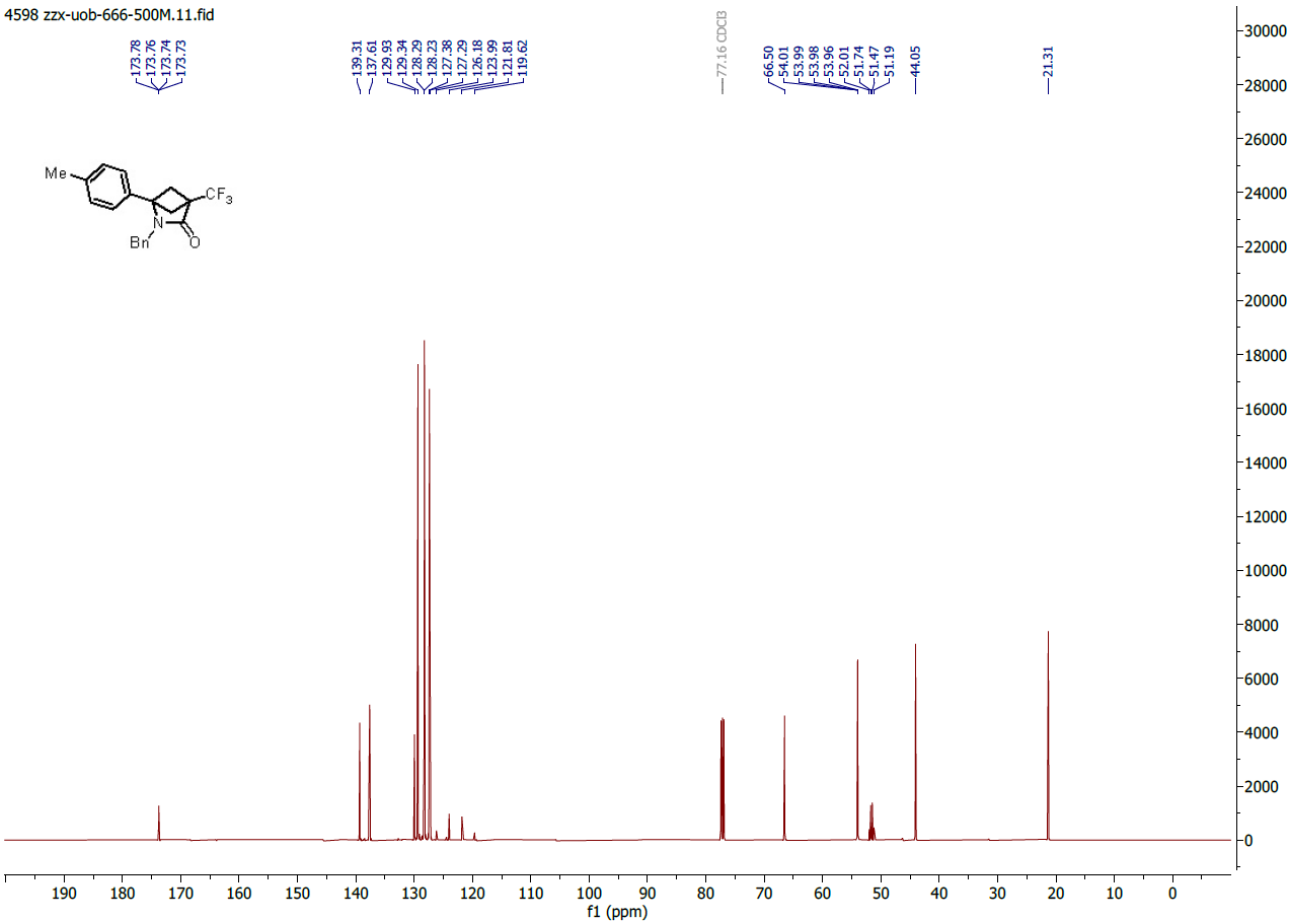

4464 zzx-uob-647-500M.10.fid
CF3
Bn
N
O
f1 (ppm)

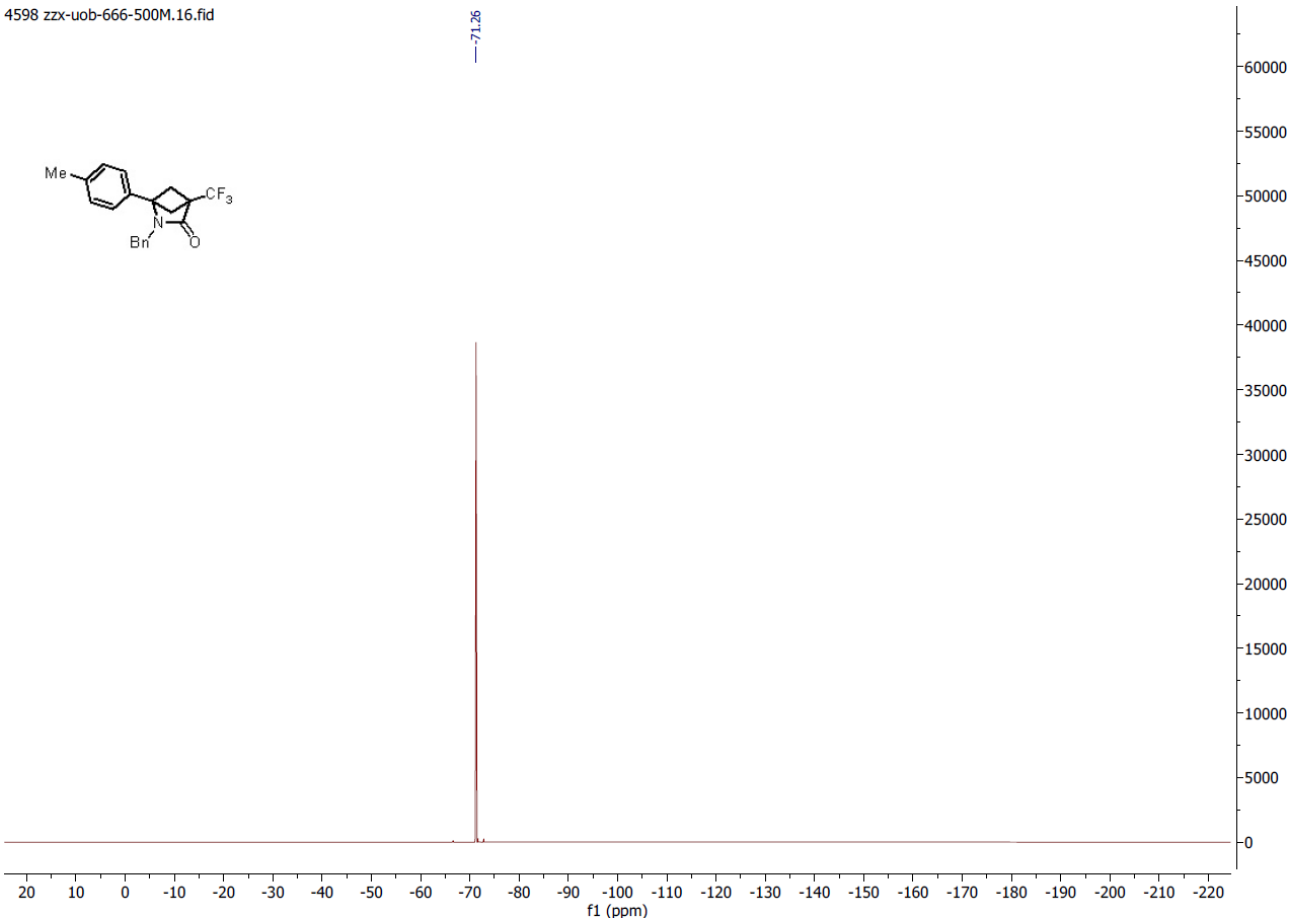

4464 zzx-uob-647-500M.11.fid
CF3
Bn
N
O
f1 (ppm)


4464 zzx-uob-647-500M.15.fid
-71.26
CF3
N
Bn
O
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

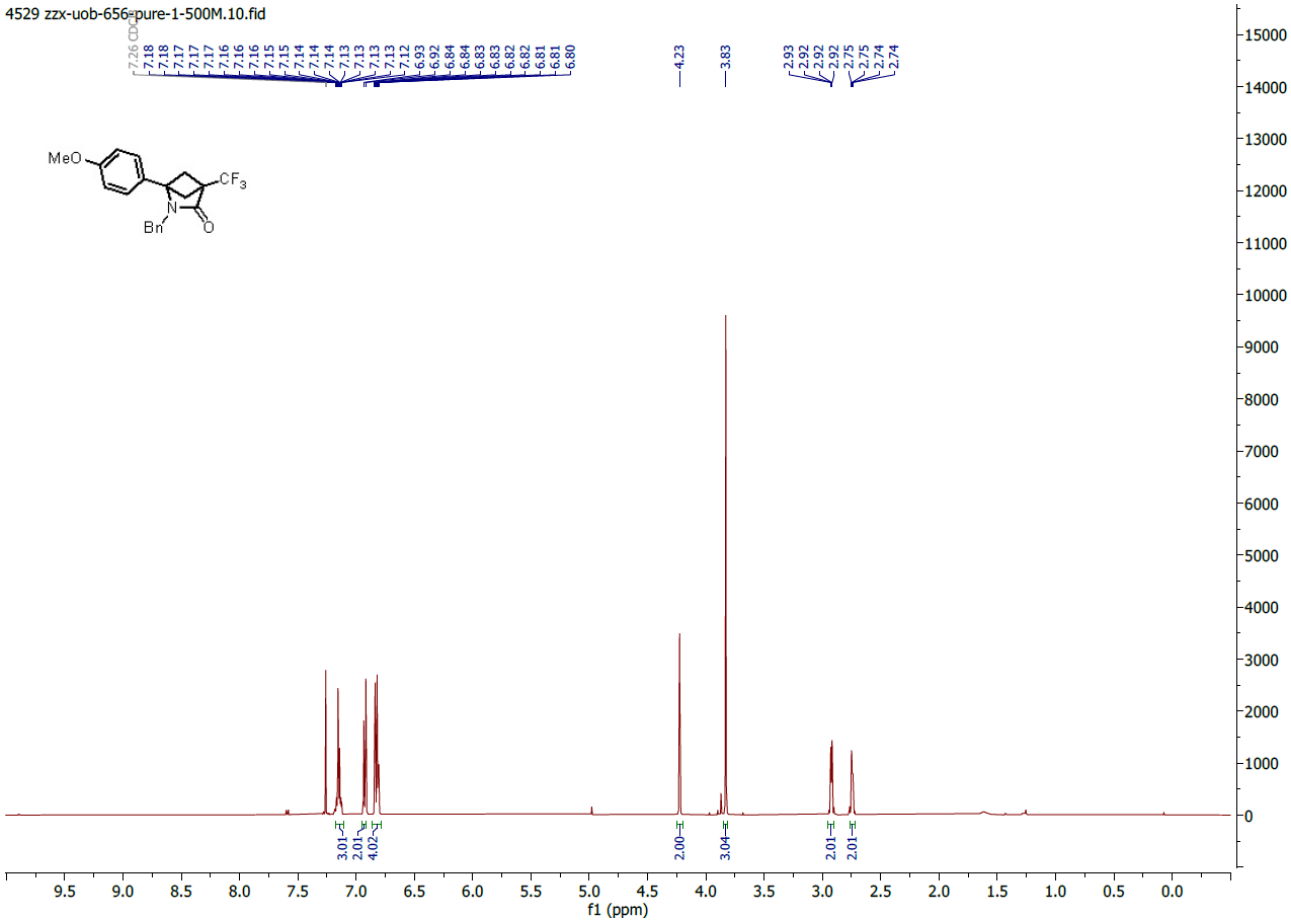
Compound 3o

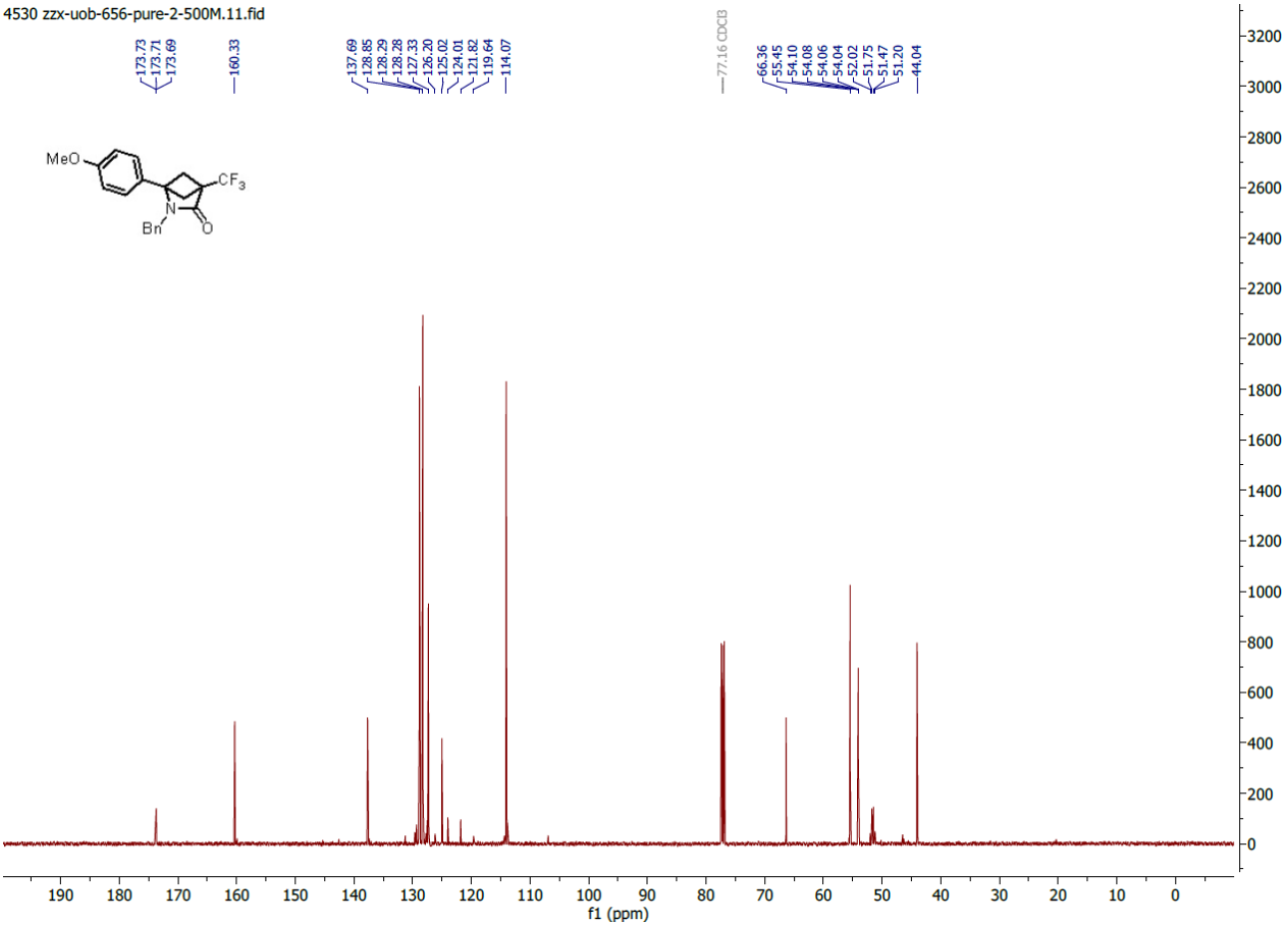

4598 zzx-uob-666-500M.10.fid
Me
CF3
N
Bn
O
f1 (ppm)

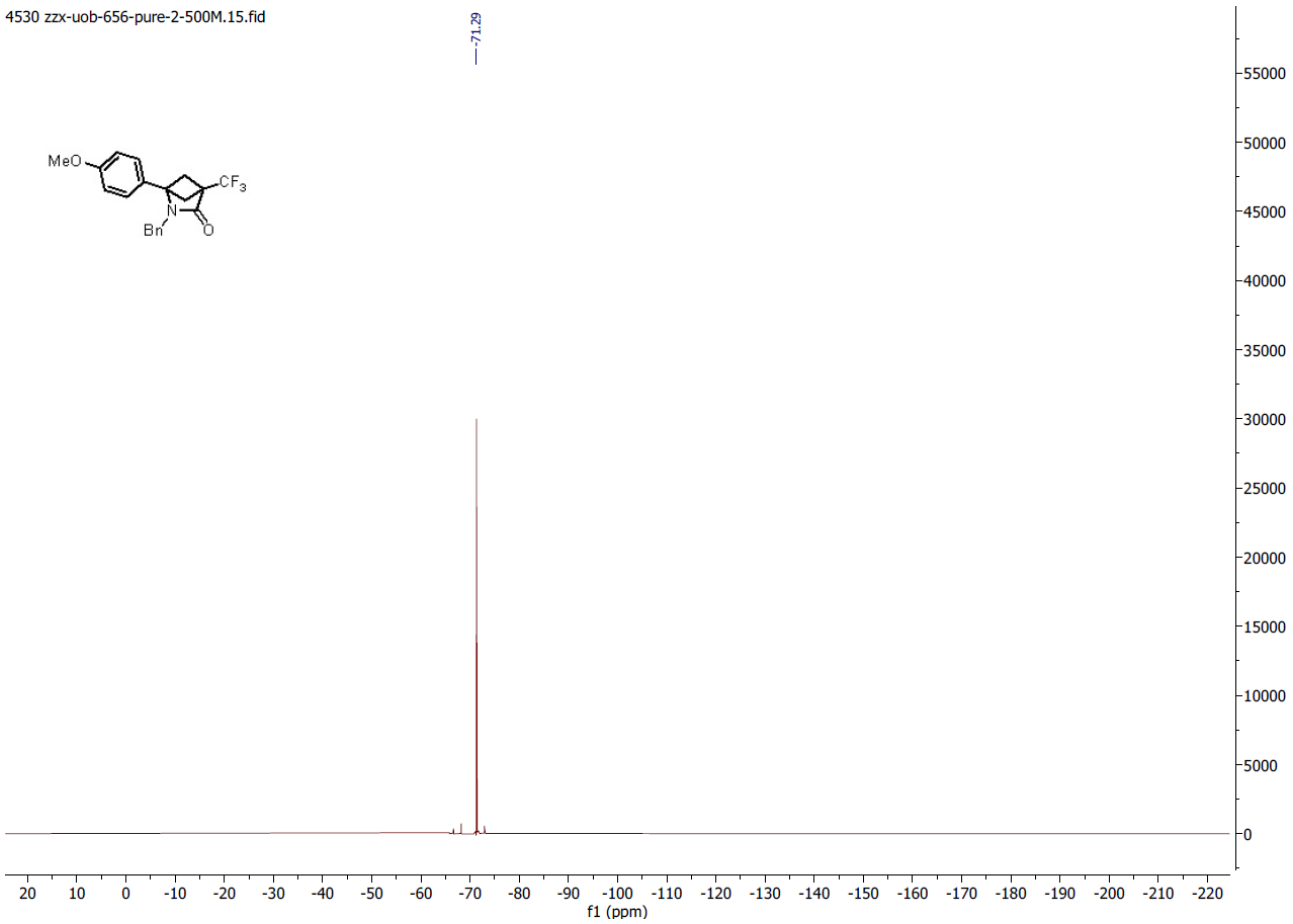

4598 zzx-uob-666-500M.11.fid
Me
CF3
N
Bn
O
f1 (ppm)


4598 zzx-uob-666-500M.16.fid
-71.26
Me
CF3
N
Bn
O
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

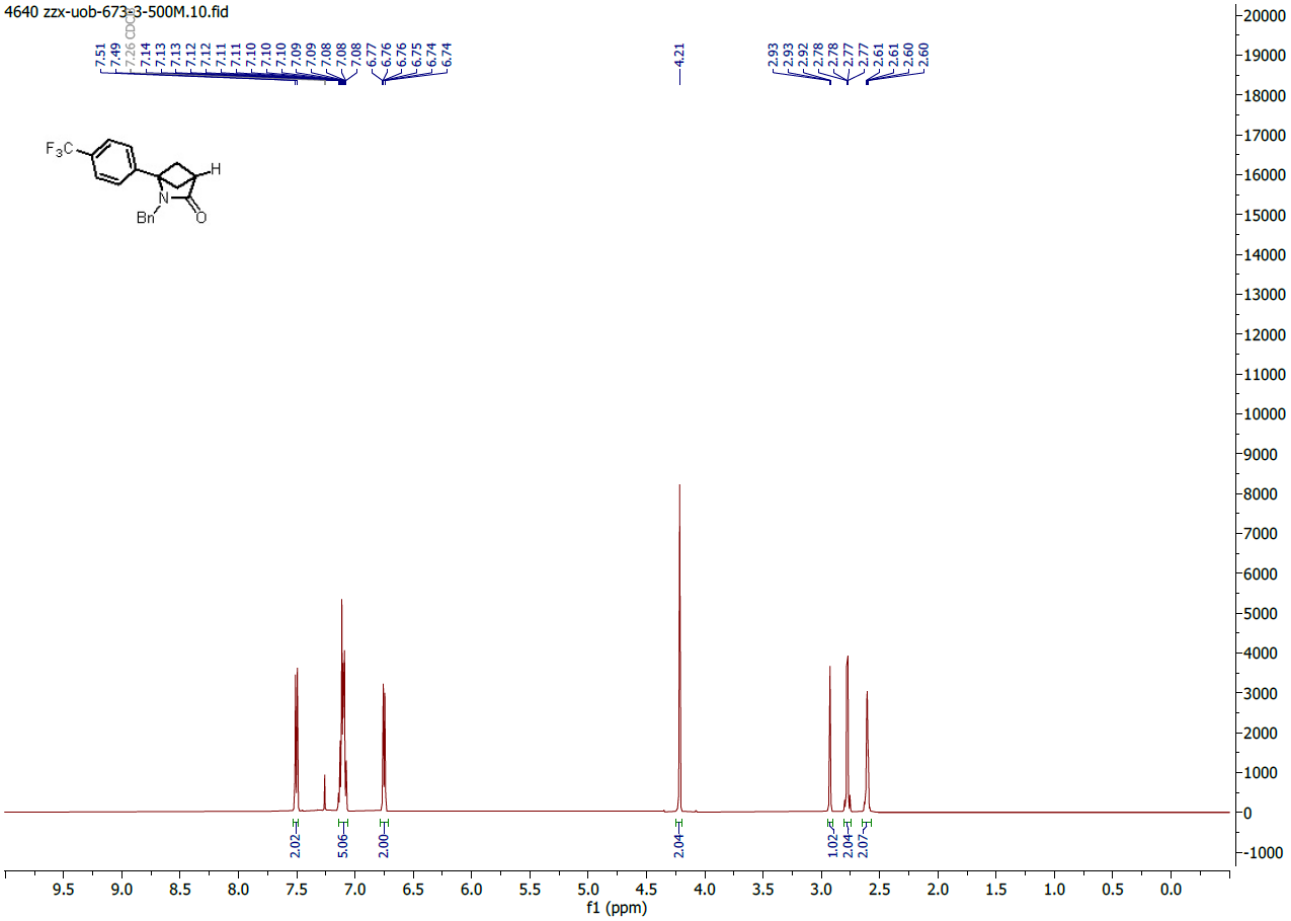
Compound 3p

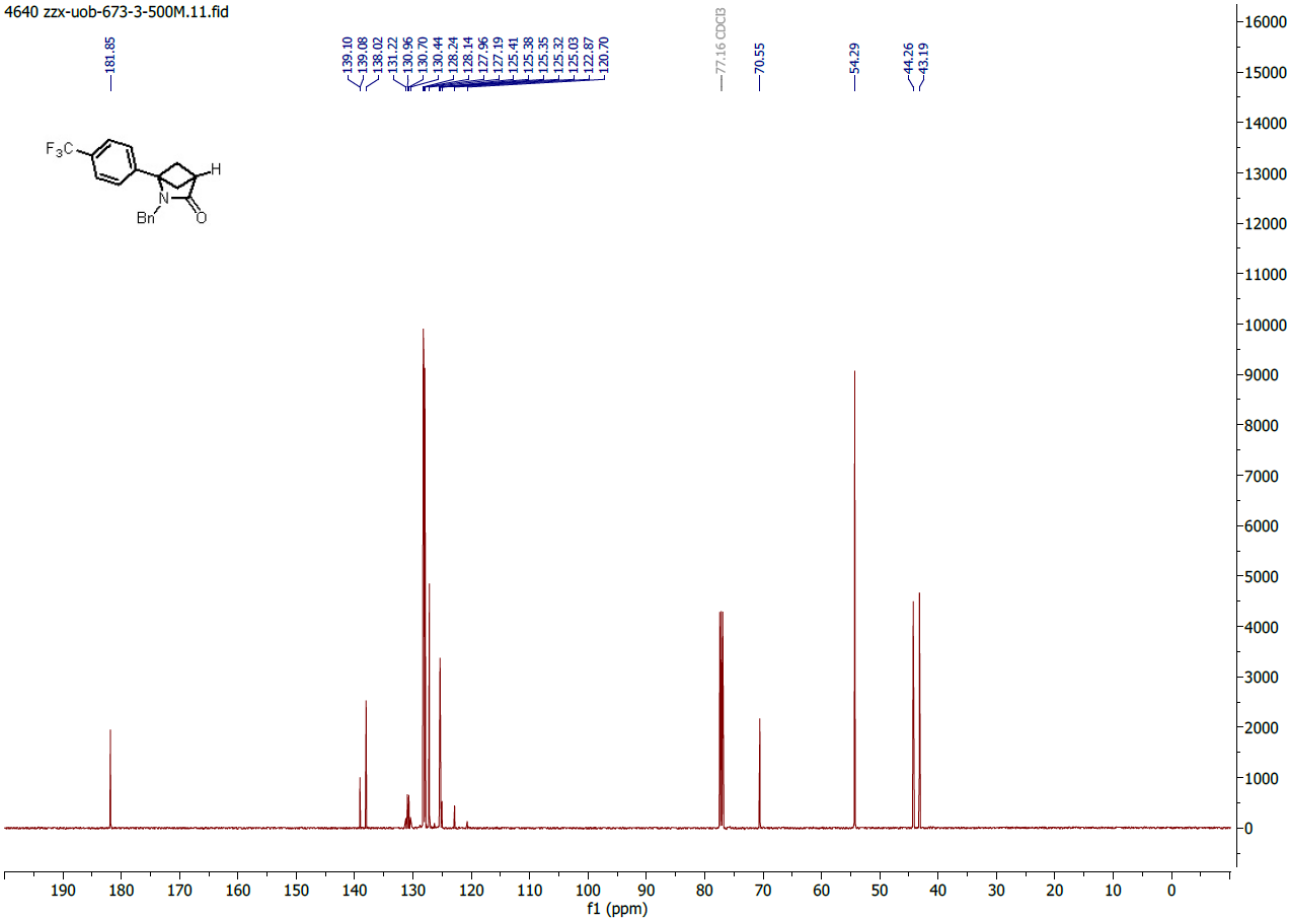

4529 zzx-uob-656-pure-1-500M.10.fid
MeO
CF3
Bn
N
O
f1 (ppm)

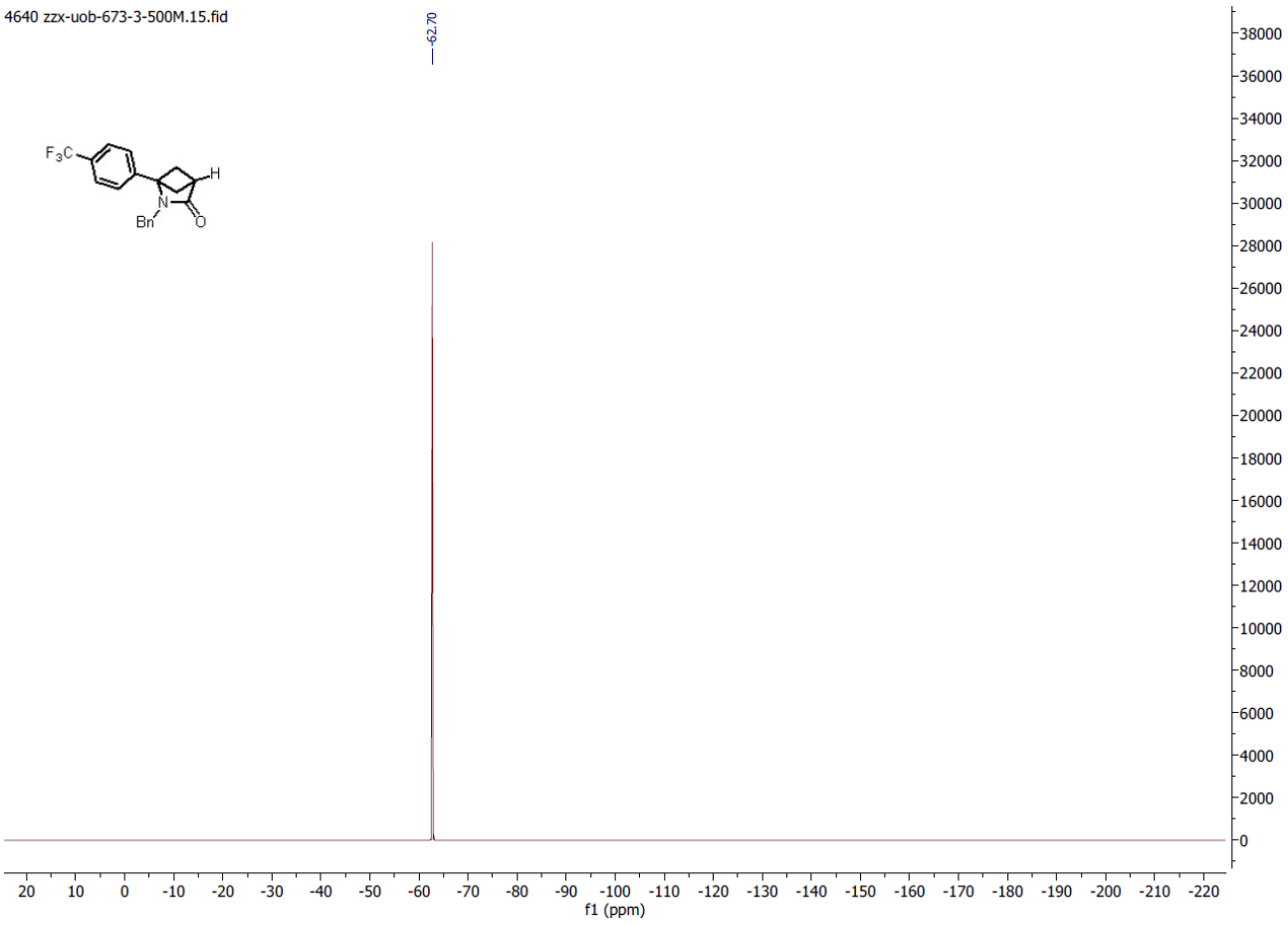

4530 zzx-uob-656-pure-2-500M.11.fid
MeO
CF3
Bn
N
O
f1 (ppm)


4530 zzx-uob-656-pure-2-500M.15.fid
-71.29
MeO
CF3
N
Bn
O
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

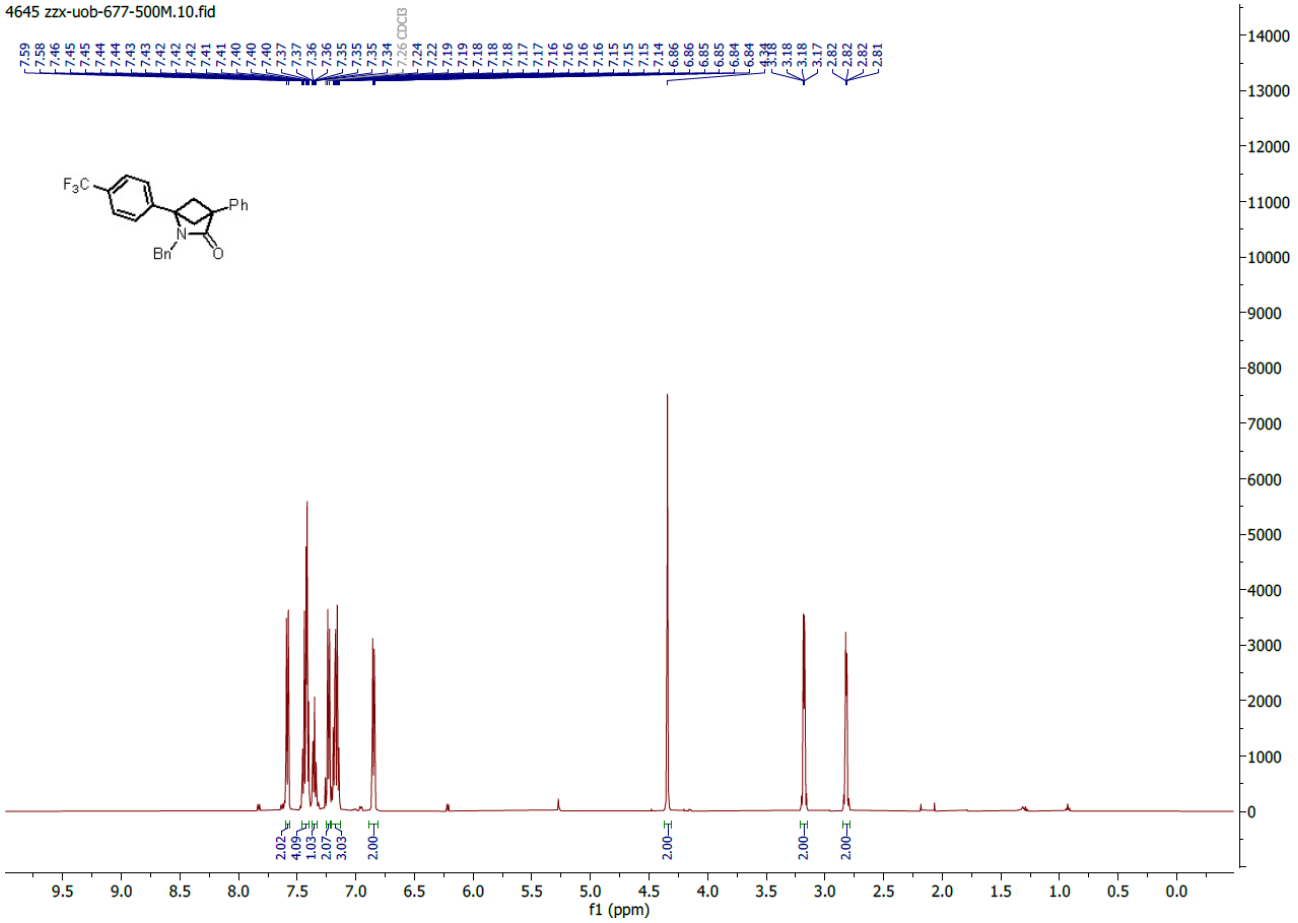
Compound 3q

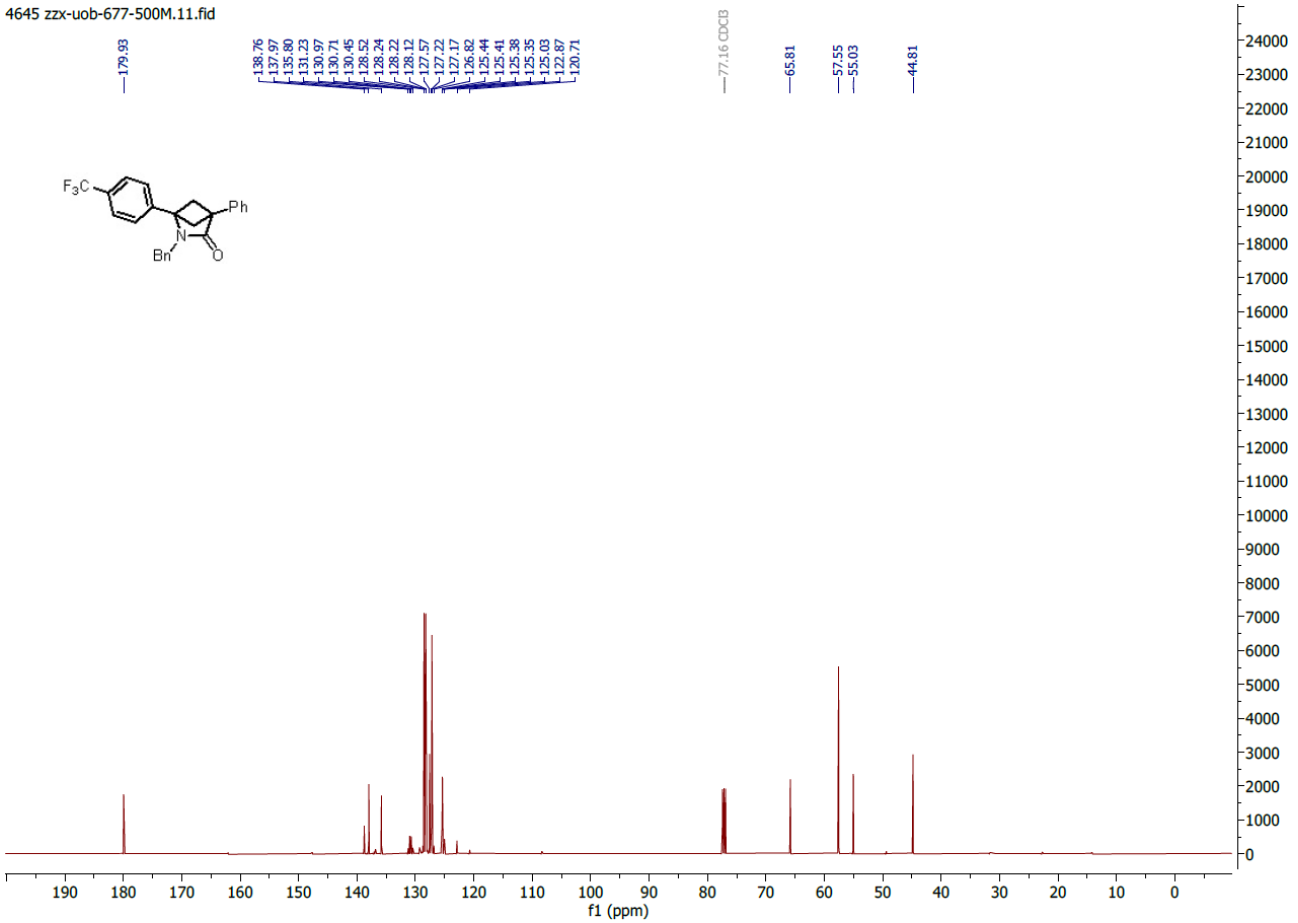

4640 zzx-uob-673-3-500M.10.fid
7.51
7.49
7.26 CDCl3
7.14
7.13
7.13
7.12
7.12
7.12
7.11
7.11
7.10
7.10
7.10
7.09
7.09
7.08
7.08
7.08
6.77
6.76
6.76
6.75
6.74
6.74
4.21
2.93
2.93
2.92
2.78
2.78
2.77
2.77
2.61
2.61
2.60
2.60
2.60
F3C
H
N
Bn
O
2.02
5.06
2.00
2.04
1.02
2.04
2.07
f1 (ppm)

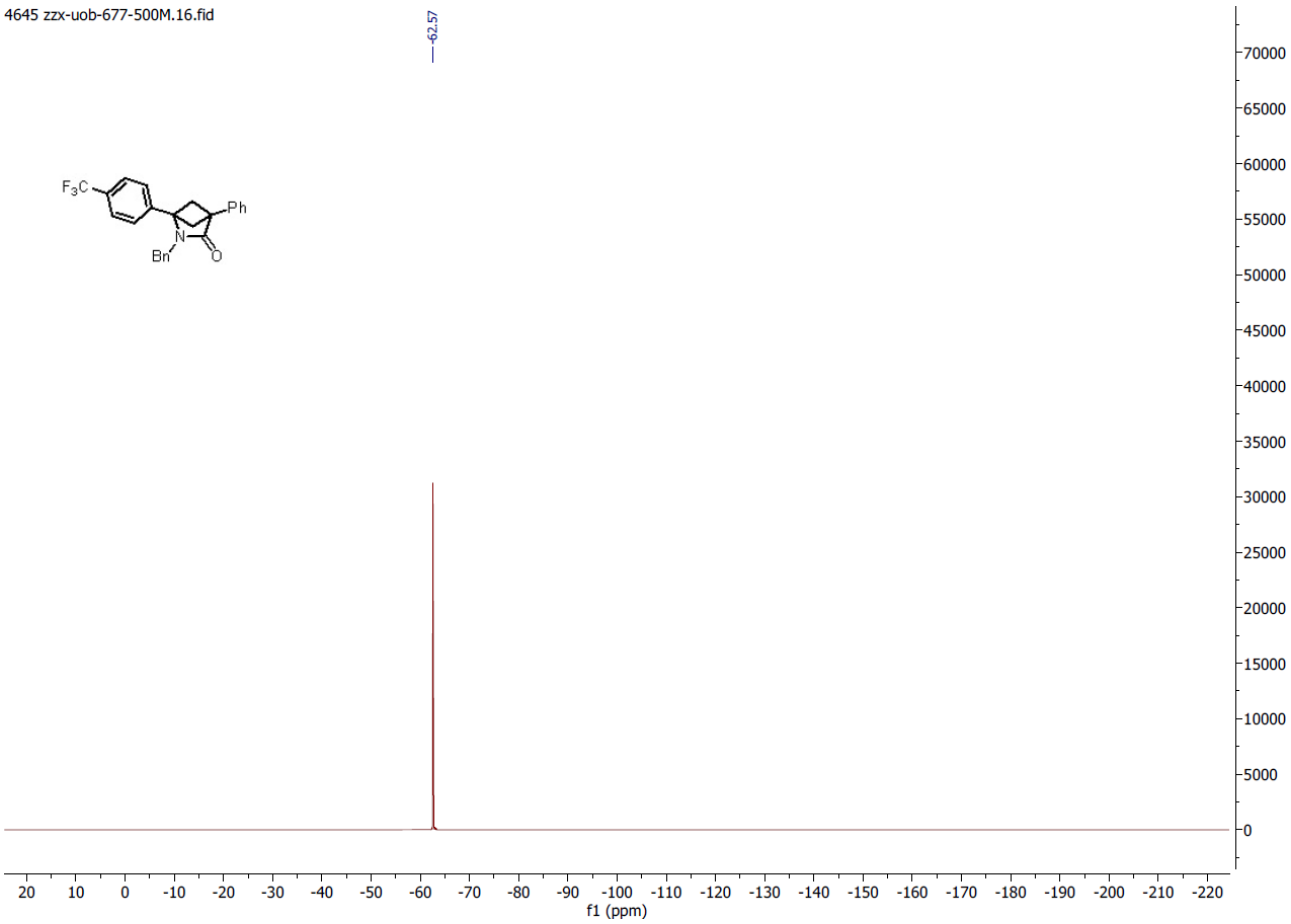

4640 zzx-uob-673-3-500M.11.fid
181.85
139.10
139.08
138.02
131.22
130.96
130.70
130.44
128.24
128.14
127.96
127.19
125.41
125.38
125.35
125.32
125.03
122.87
120.70
77.16 CDCl3
70.55
54.29
44.26
43.19
F3C
H
N
Bn
O
f1 (ppm)


4640 zzx-uob-673-3-500M.15.fid
-62.70
F3C
H
N
Bn
O
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

Compound 3r

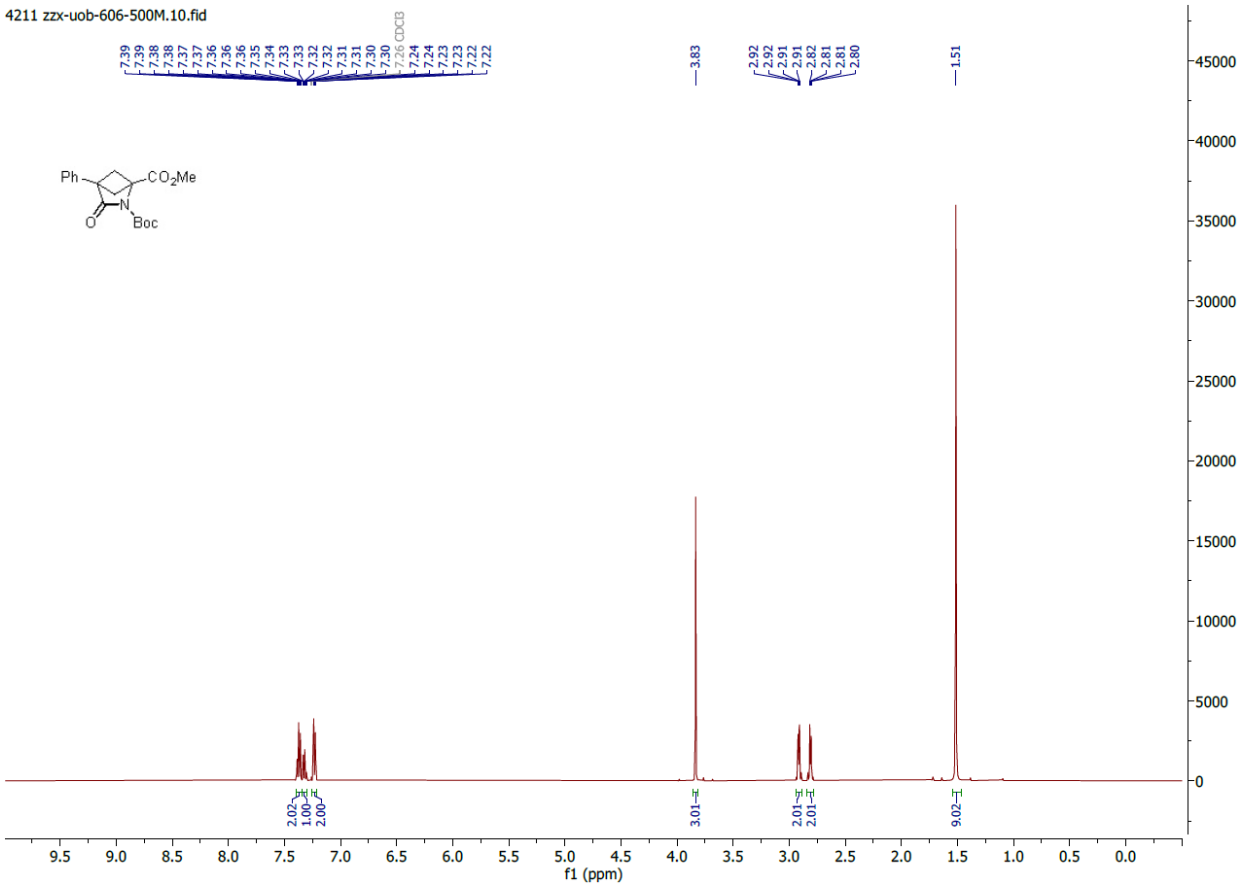

4645 zzx-uob-677-500M.10.fid
F3C
Ph
Bn
N
O
f1 (ppm)

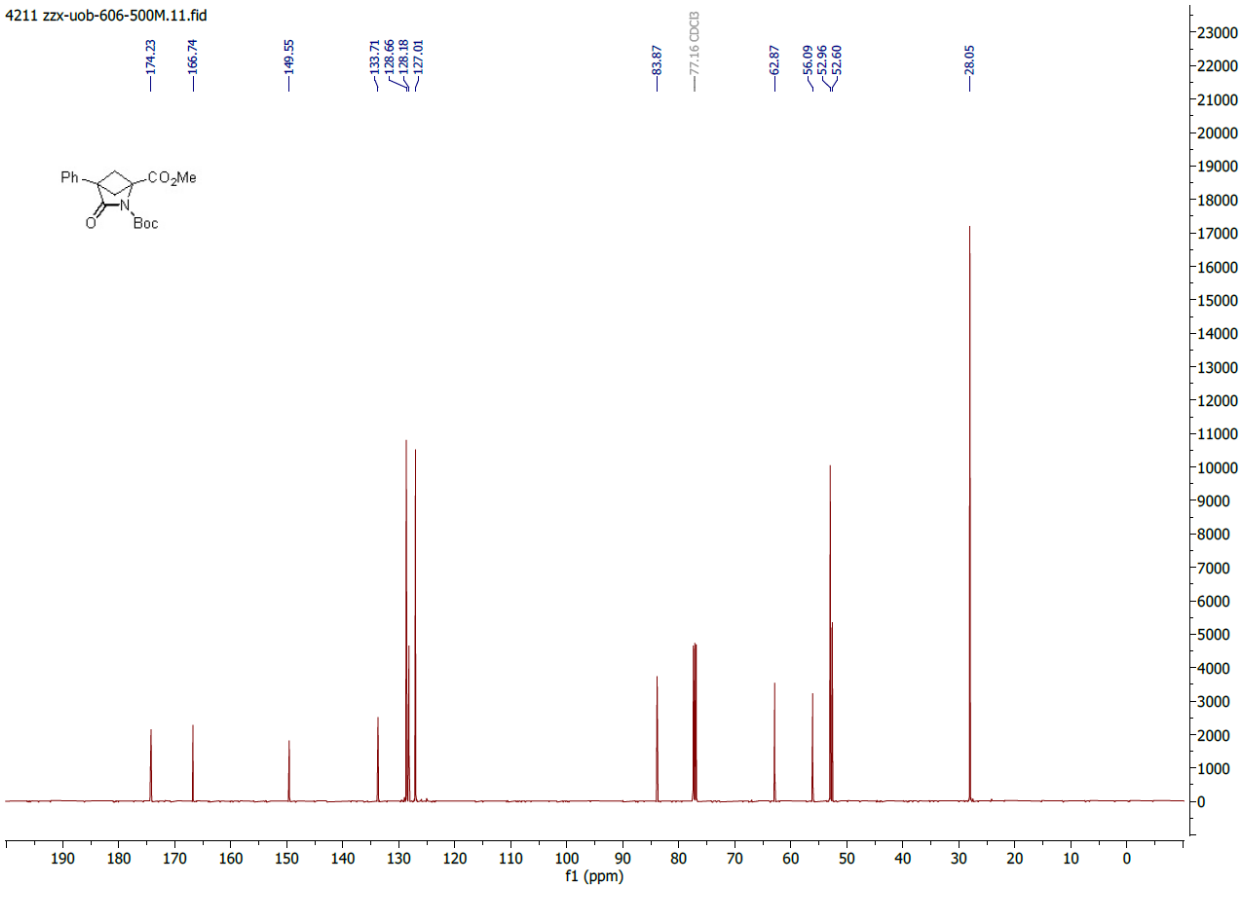

4645 zzx-uob-677-500M.11.fid
179.93
138.76
137.97
135.80
131.23
130.97
130.71
130.45
128.52
128.24
128.22
128.12
127.57
127.22
127.17
126.82
125.44
125.41
125.38
125.35
125.03
122.87
120.71
77.16 CDCl3
65.81
57.55
55.03
44.81
F3C
Ph
Bn
N
O
f1 (ppm)


4645 zzx-uob-677-500M.16.fid
-62.57
F3C
Ph
N
Bn
O
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

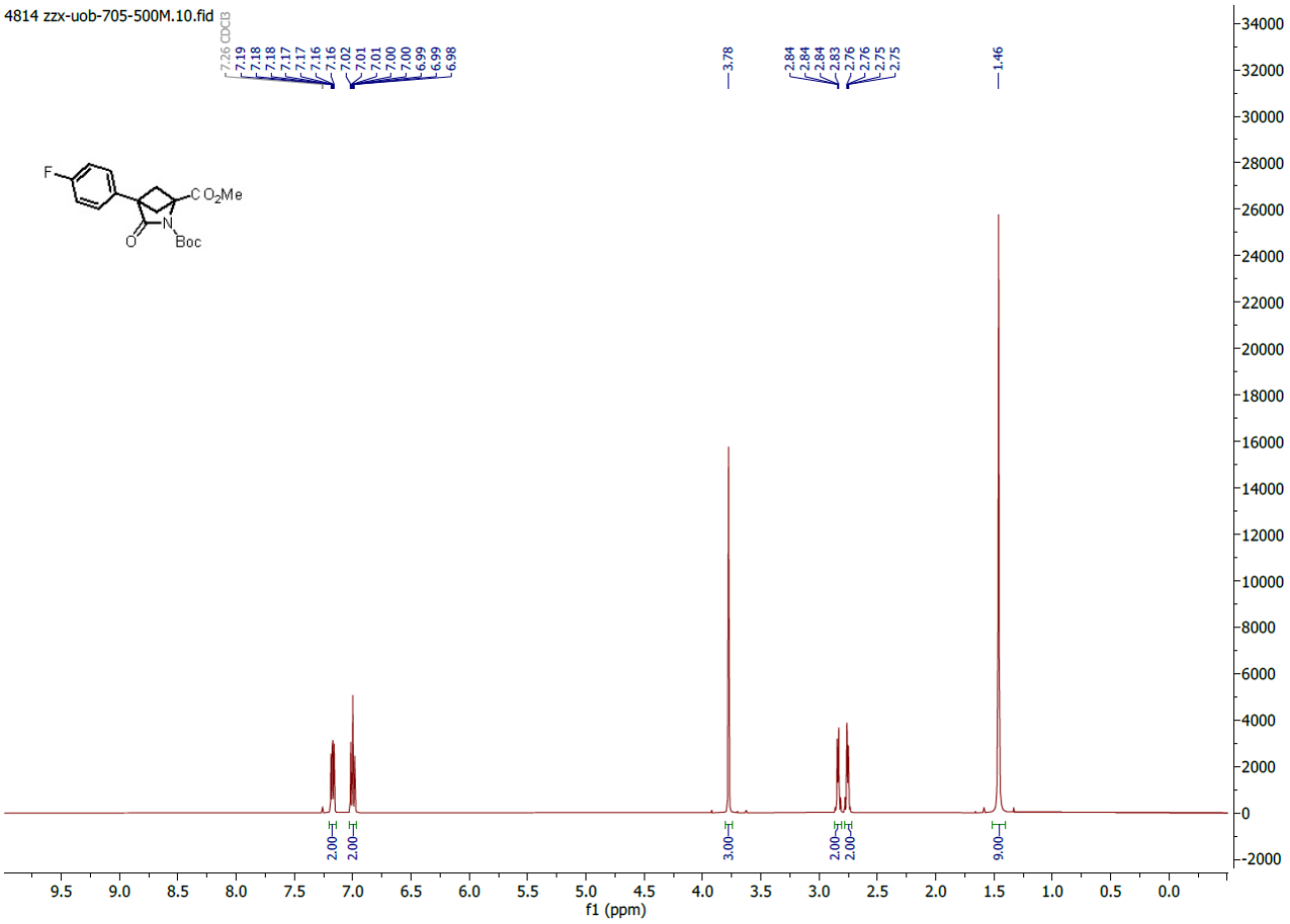
5.5 NMR Spectra of Products (8)

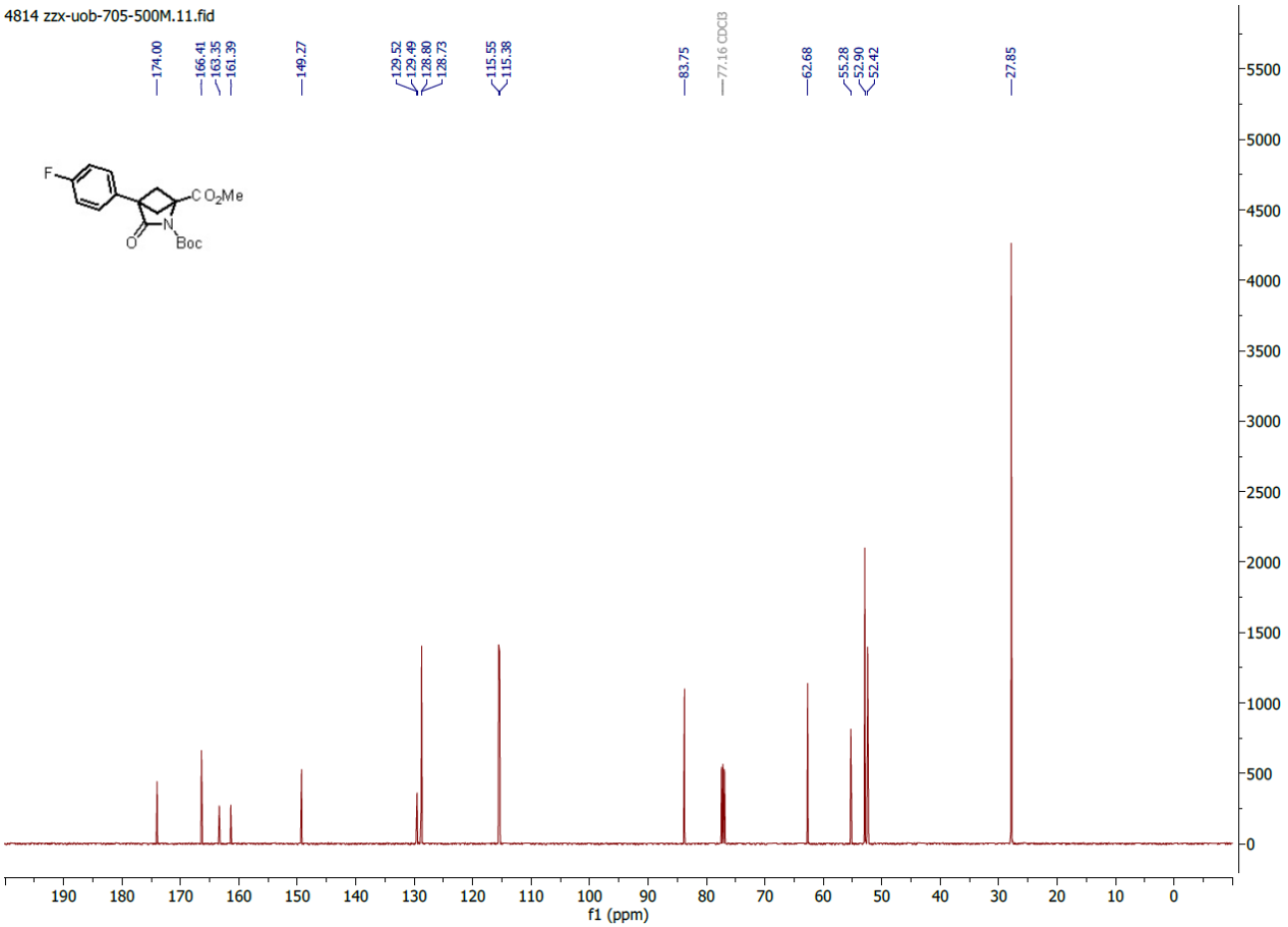
Compound 8a

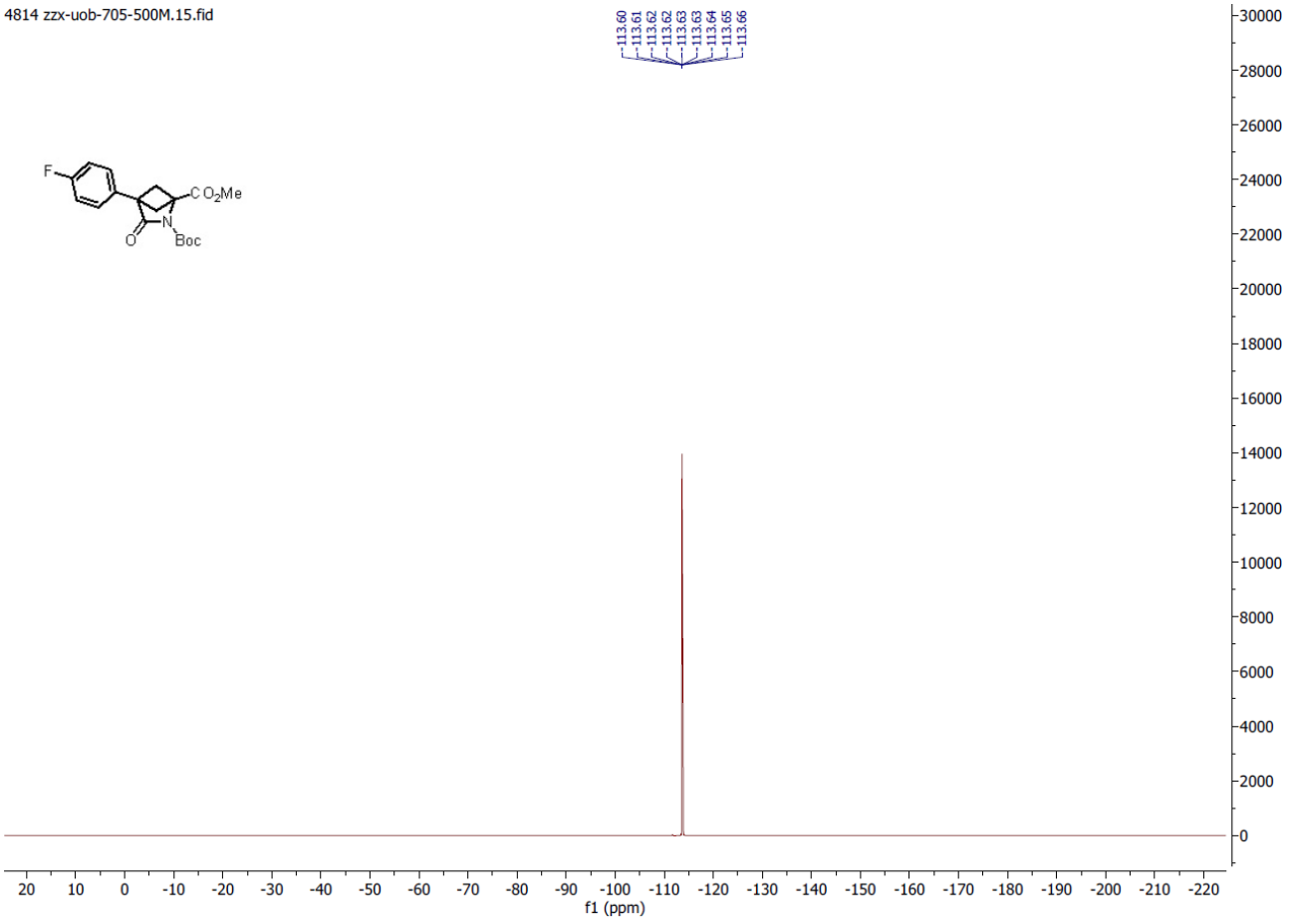




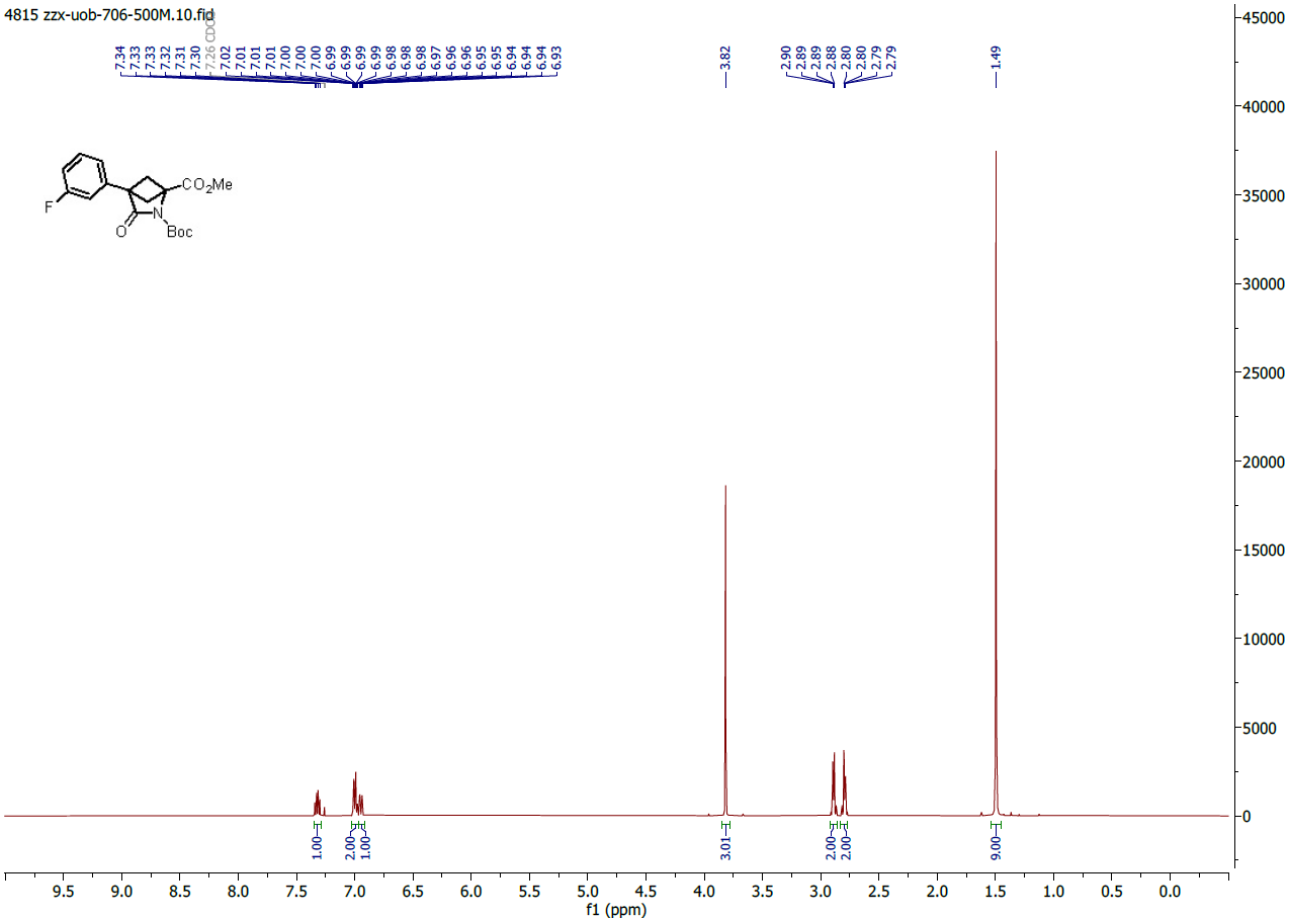
Compound 8b

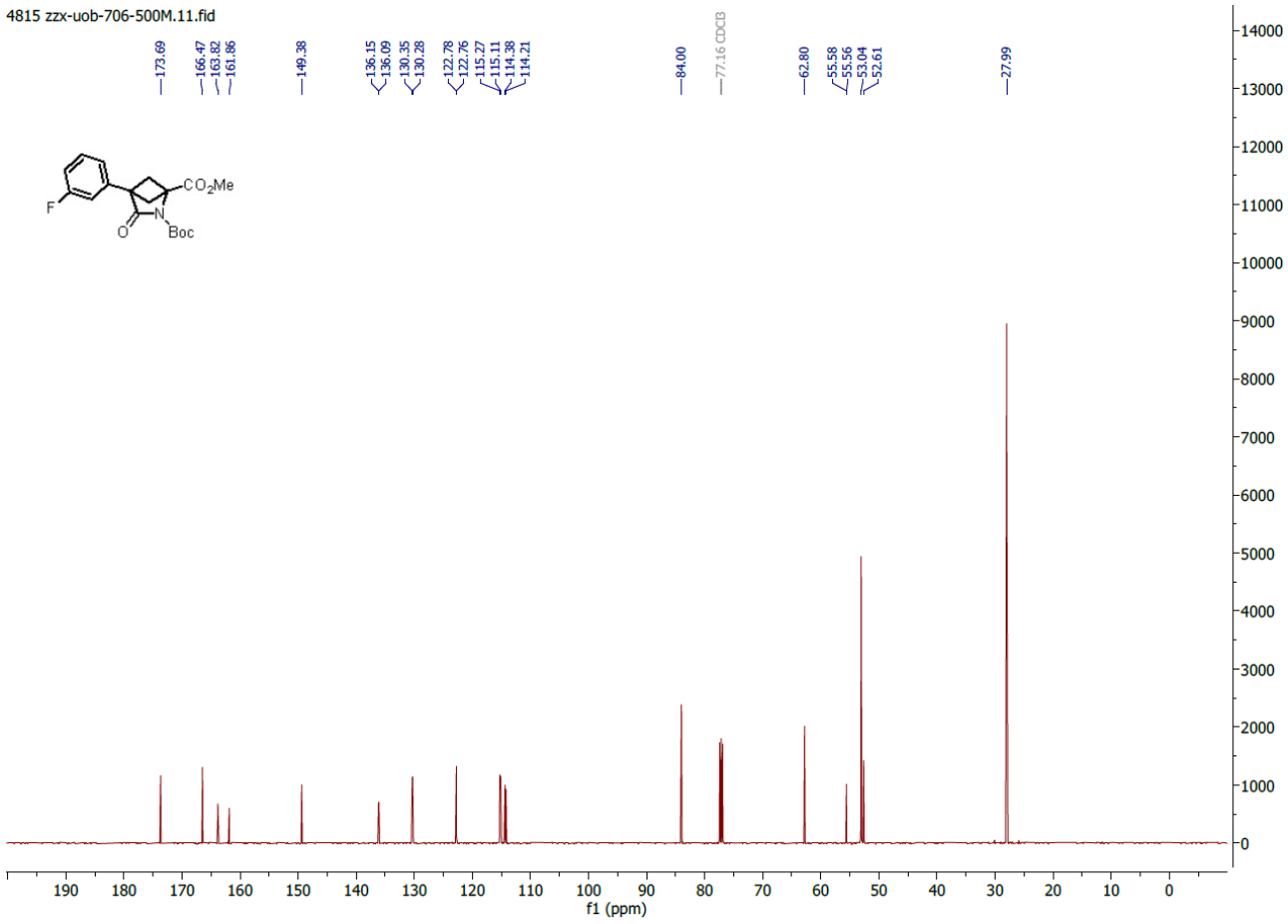

4814 zzx-uob-705-500M.10.fid
7.26 CDCl3
7.19
7.18
7.18
7.17
7.17
7.16
7.16
7.02
7.01
7.01
7.00
7.00
6.99
6.99
6.98
3.78
2.84
2.84
2.84
2.83
2.76
2.76
2.75
2.75
1.46
F
CO2Me
N
O
Boc
2.00
2.00
3.00
2.00
2.00
9.00
f1 (ppm)

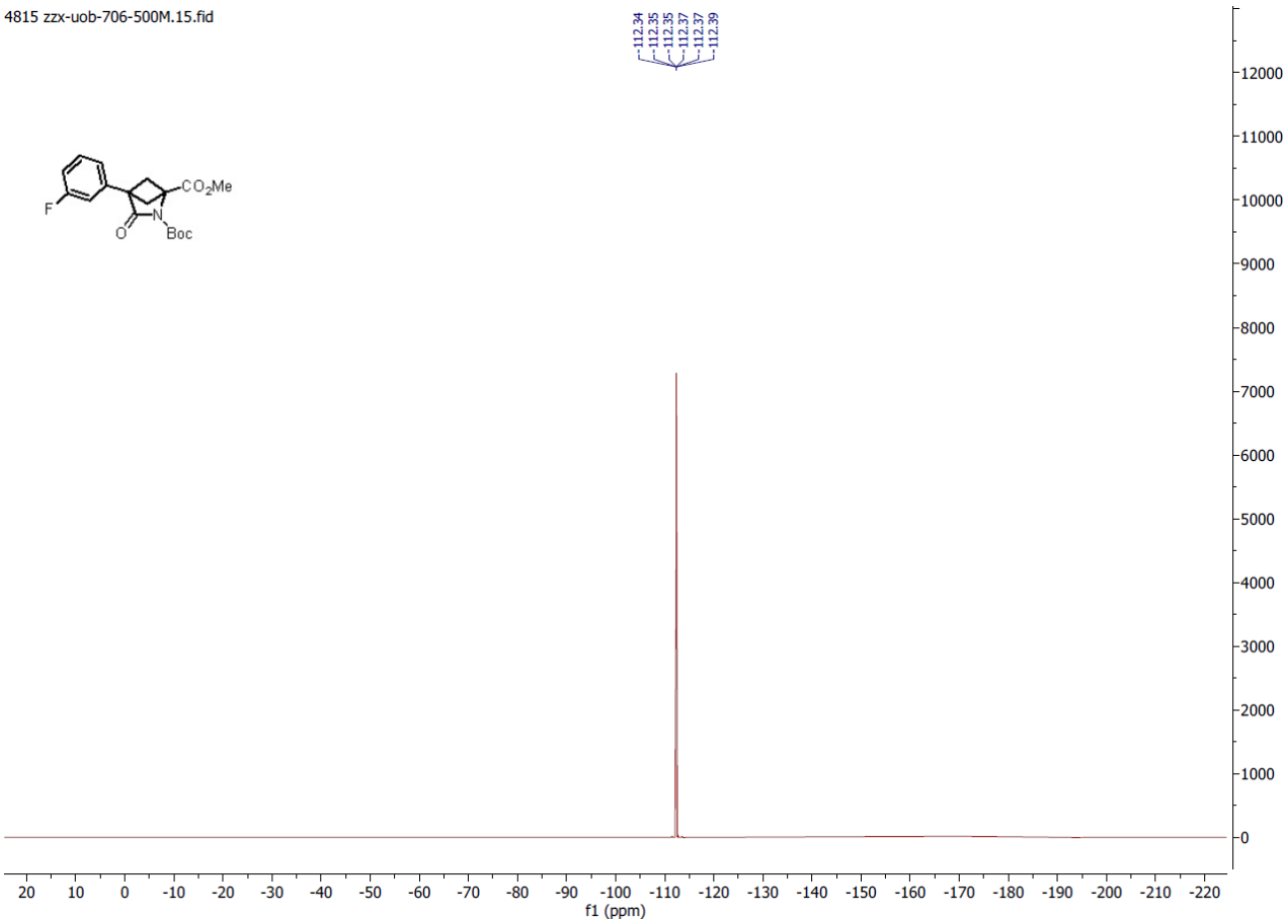

4814 zzx-uob-705-500M.11.fid
174.00
166.41
163.35
161.39
149.27
129.52
129.49
128.80
128.73
115.55
115.38
83.75
77.16 CDCl3
62.68
55.28
52.90
52.42
27.85
F
CO2Me
N
O
Boc
f1 (ppm)


4814 zzx-uob-705-500M.15.fid
113.60
113.61
113.62
113.62
113.63
113.63
113.64
113.65
113.66
F
CO2Me
N
Boc
O
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

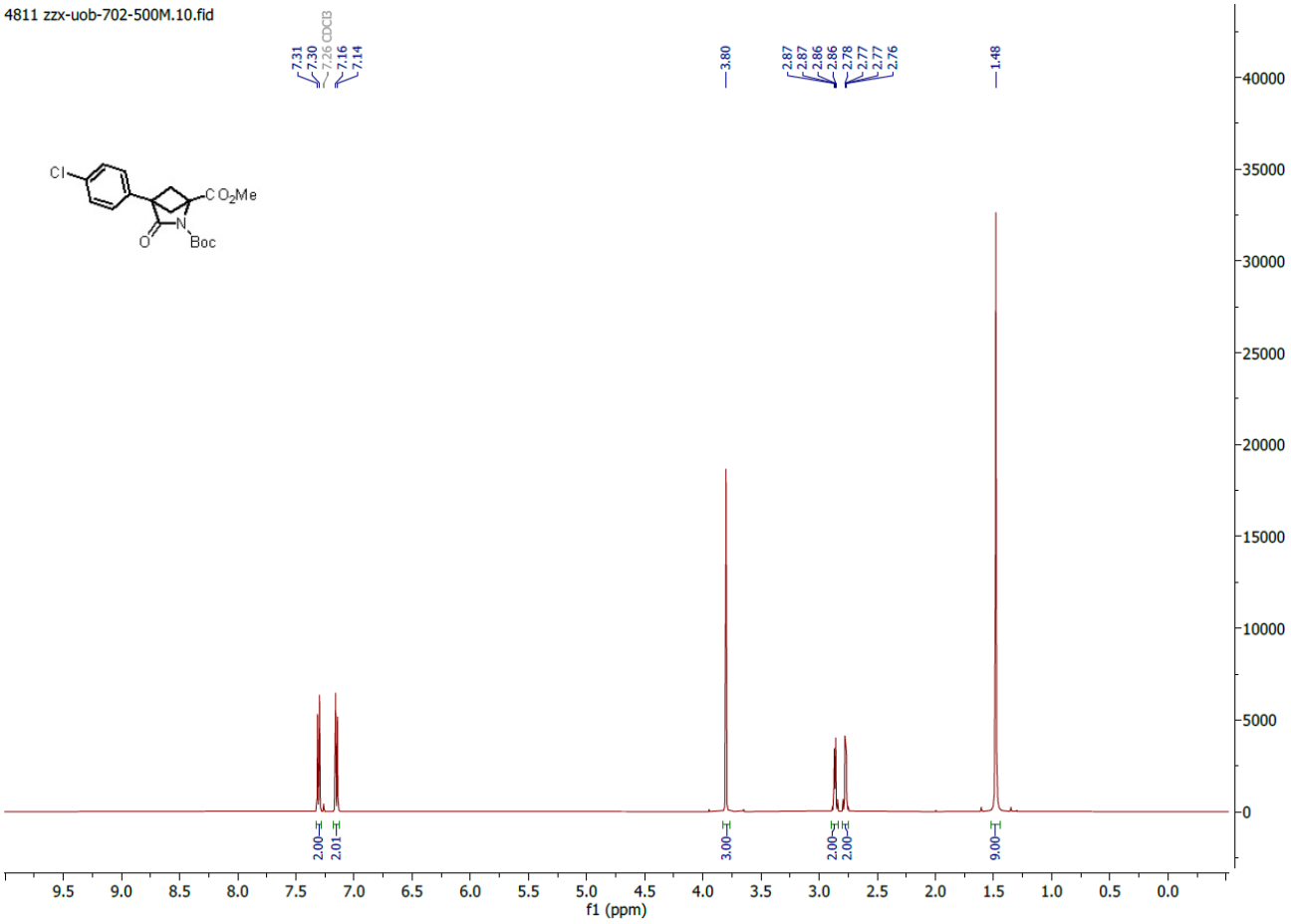
Compound 8c

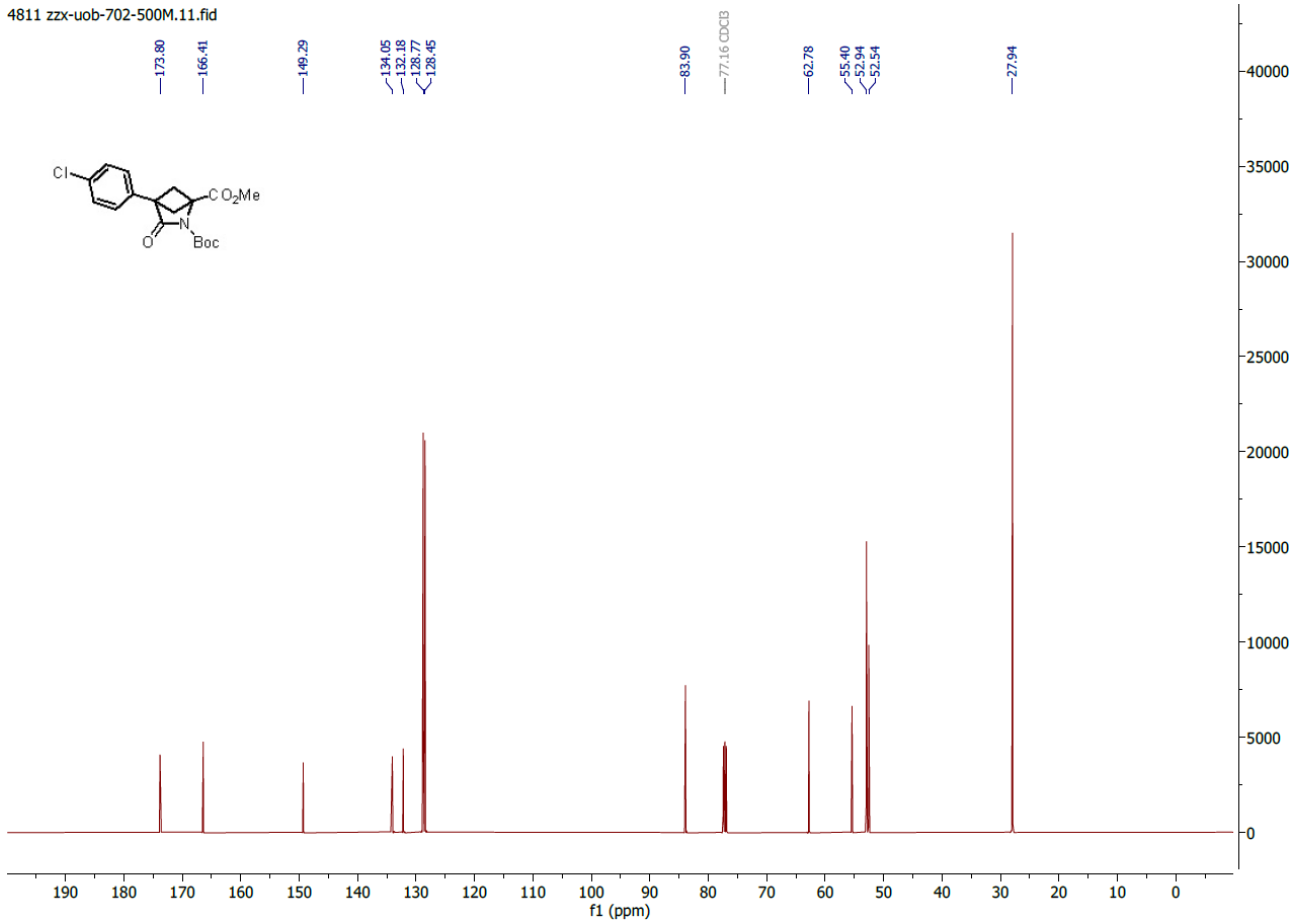

4815 zzx-uob-706-500M.10.fid
7.34 7.33 7.33 7.32 7.31 7.30 7.26 CDCl3 7.02 7.01 7.01 7.01 7.00 7.00 7.00 7.00 6.99 6.99 6.99 6.99 6.98 6.98 6.98 6.97 6.96 6.96 6.95 6.95 6.94 6.94 6.94 6.93
3.82
2.90 2.89 2.89 2.88 2.80 2.80 2.79 2.79
1.49
CO2Me
F
N
O
Boc
1.00 2.00 1.00 3.01 2.00 2.00 9.00
f1 (ppm)


4815 zzx-uob-706-500M.11.fid
173.69 166.47 163.82 161.86 149.38 136.15 136.09 130.35 130.28 122.78 122.76 115.27 115.11 114.38 114.21
84.00
77.16 CDCl3
62.80 55.58 55.56 53.04 52.61
27.99
CO2Me
F
N
O
Boc
f1 (ppm)

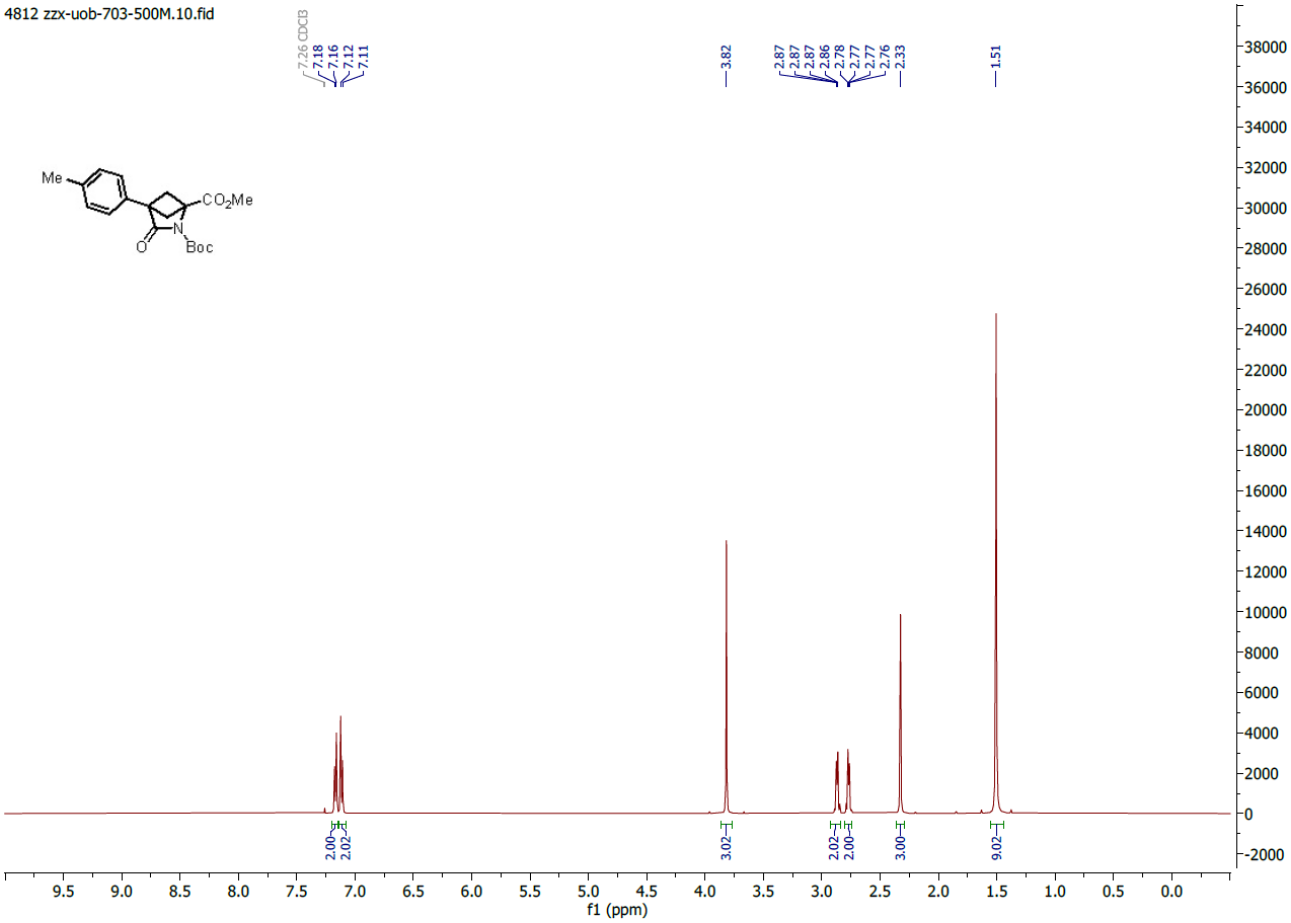

4815 zzx-uob-706-500M.15.fid
-112.34
-112.35
-112.35
-112.37
-112.37
-112.39
F
CO2Me
O
N
Boc
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

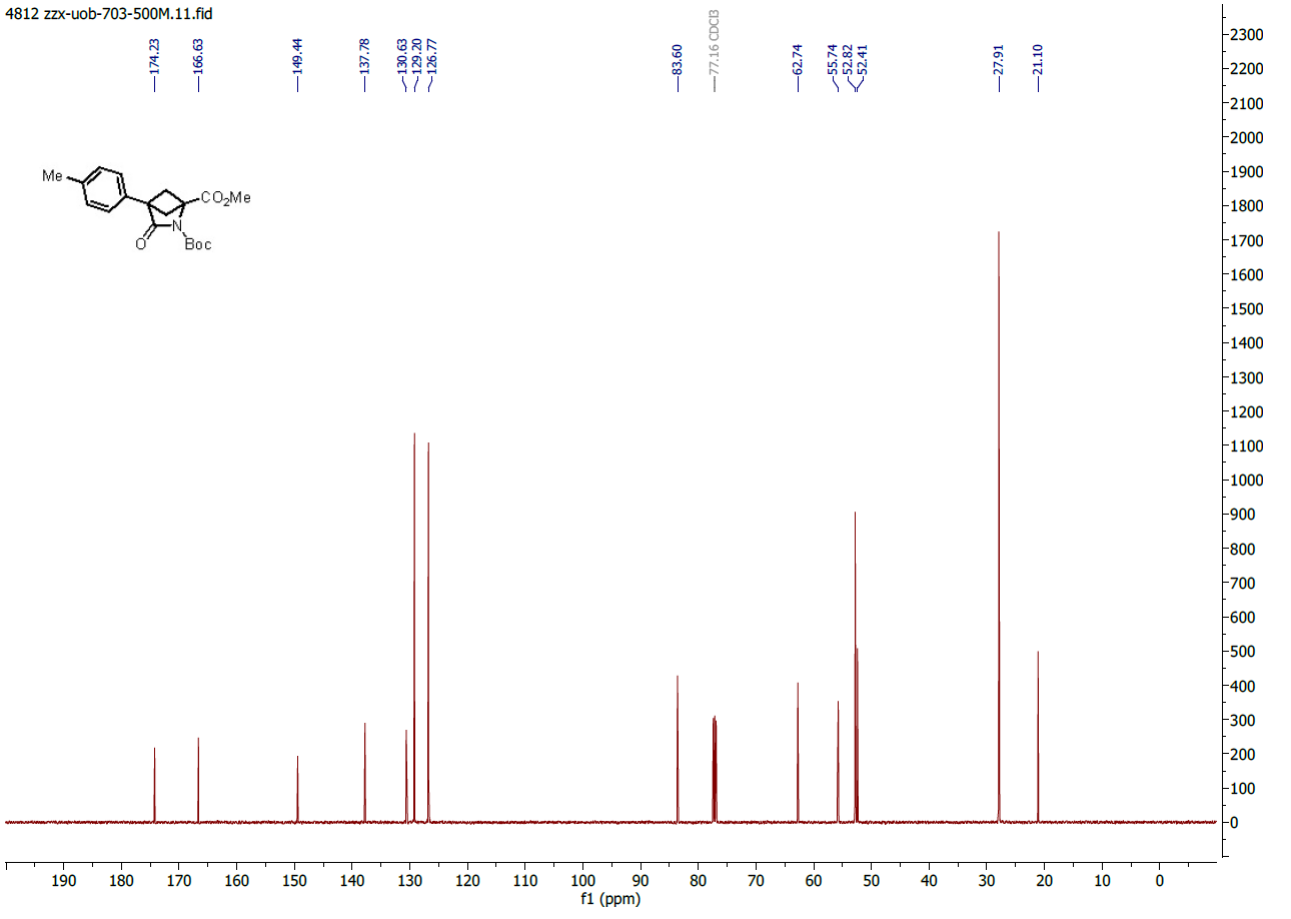
Compound 8d


4811 zzx-uob-702-500M.10.fid
7.31
7.30
7.26 CDCl3
7.16
7.14
3.80
2.87
2.87
2.86
2.86
2.78
2.77
2.77
2.76
1.48
Cl
CO2Me
N
Boc
O
2.00
2.01
3.00
2.00
2.00
9.00
f1 (ppm)

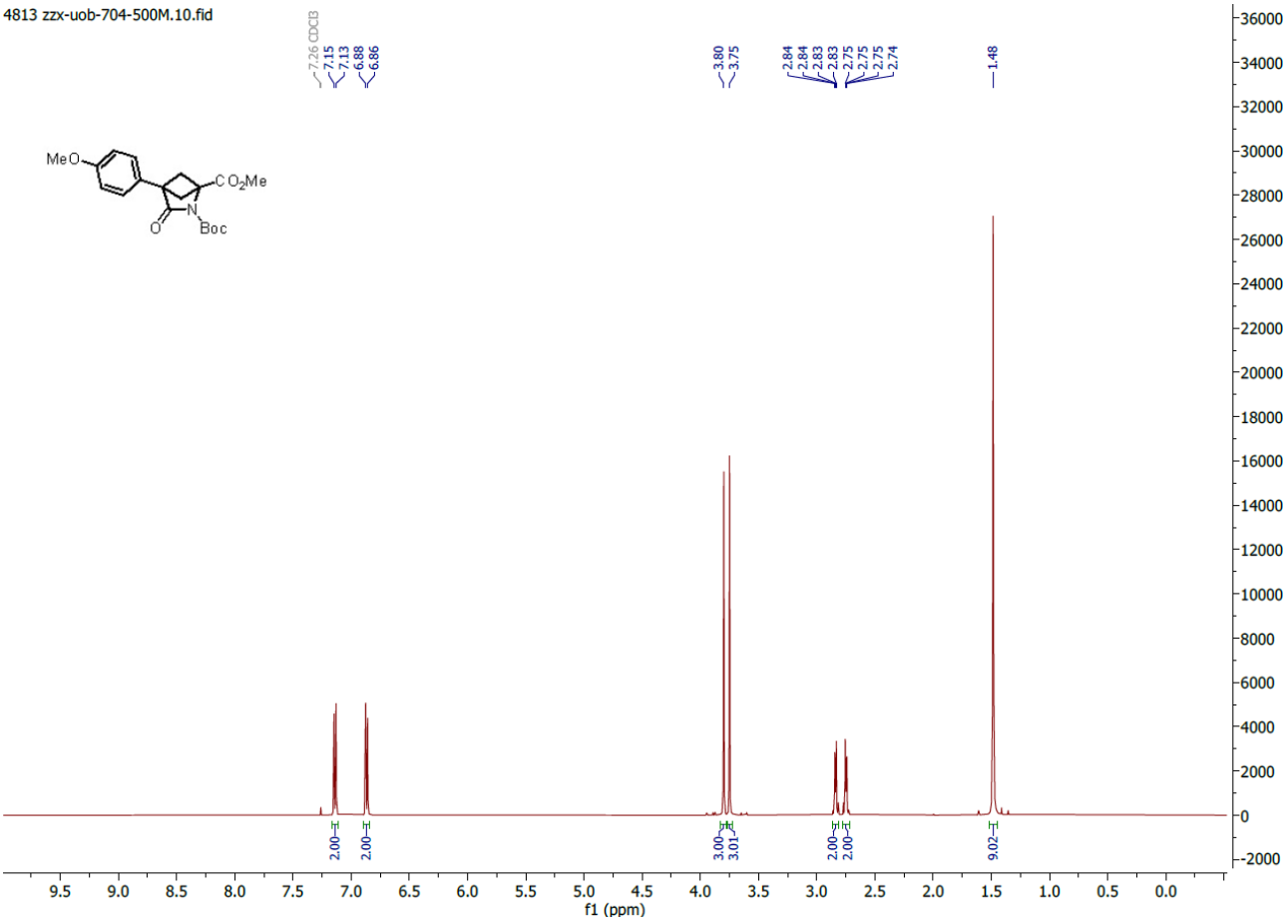

4811 zzx-uob-702-500M.11.fid
173.80
166.41
149.29
134.05
132.18
128.77
128.45
83.90
77.16 CDCl3
62.78
55.40
52.94
52.54
27.94
Cl
CO2Me
N
Boc
O
f1 (ppm)

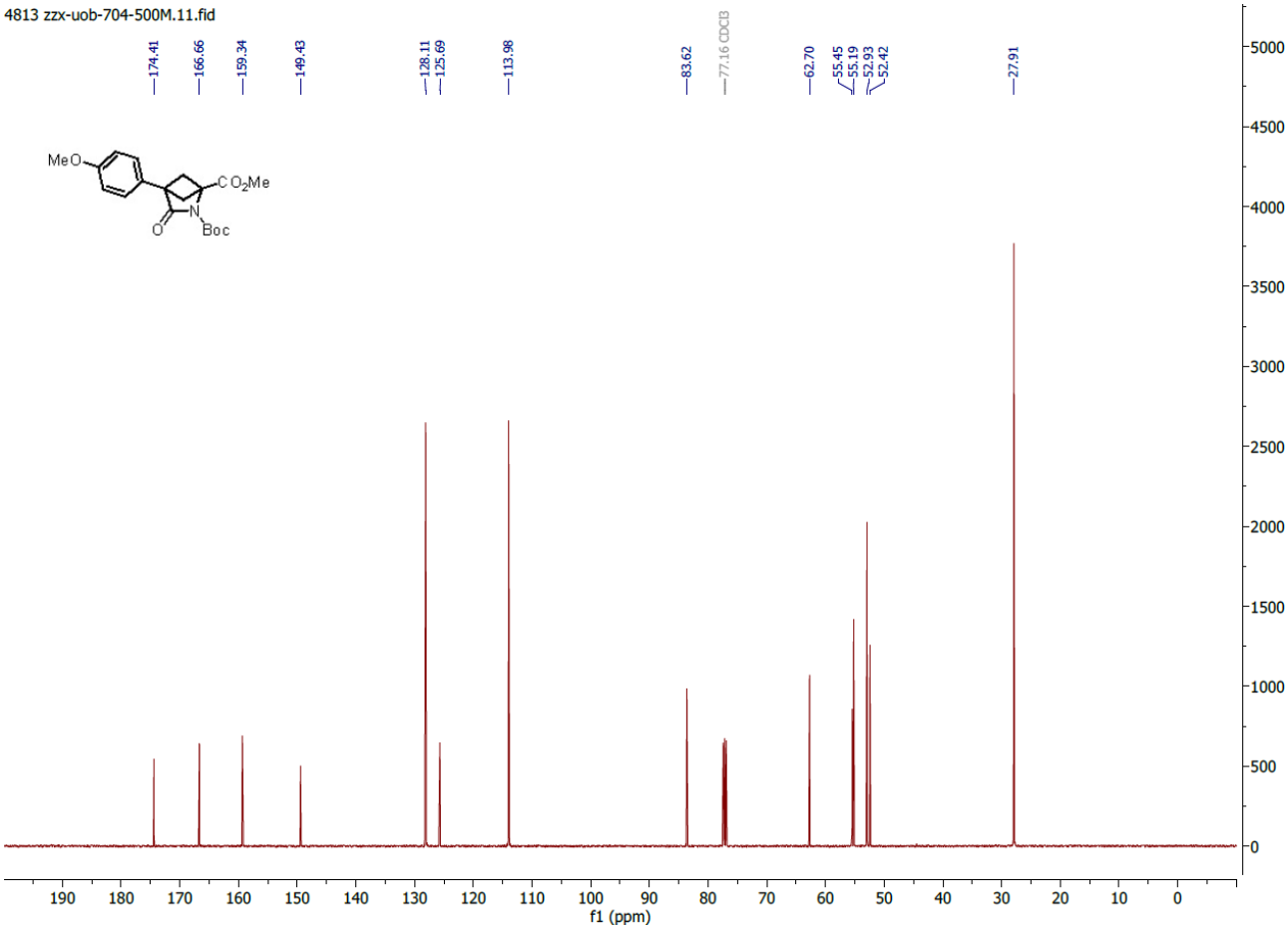
Compound 8e


4812 zzx-uob-703-500M.10.fid
7.26 CDCl3
7.18
7.16
7.12
7.11
3.82
2.87
2.87
2.87
2.86
2.78
2.77
2.77
2.76
2.33
1.51
Me
CO2Me
N
Boc
O
2.00
2.02
3.02
2.02
2.00
3.00
9.02
f1 (ppm)

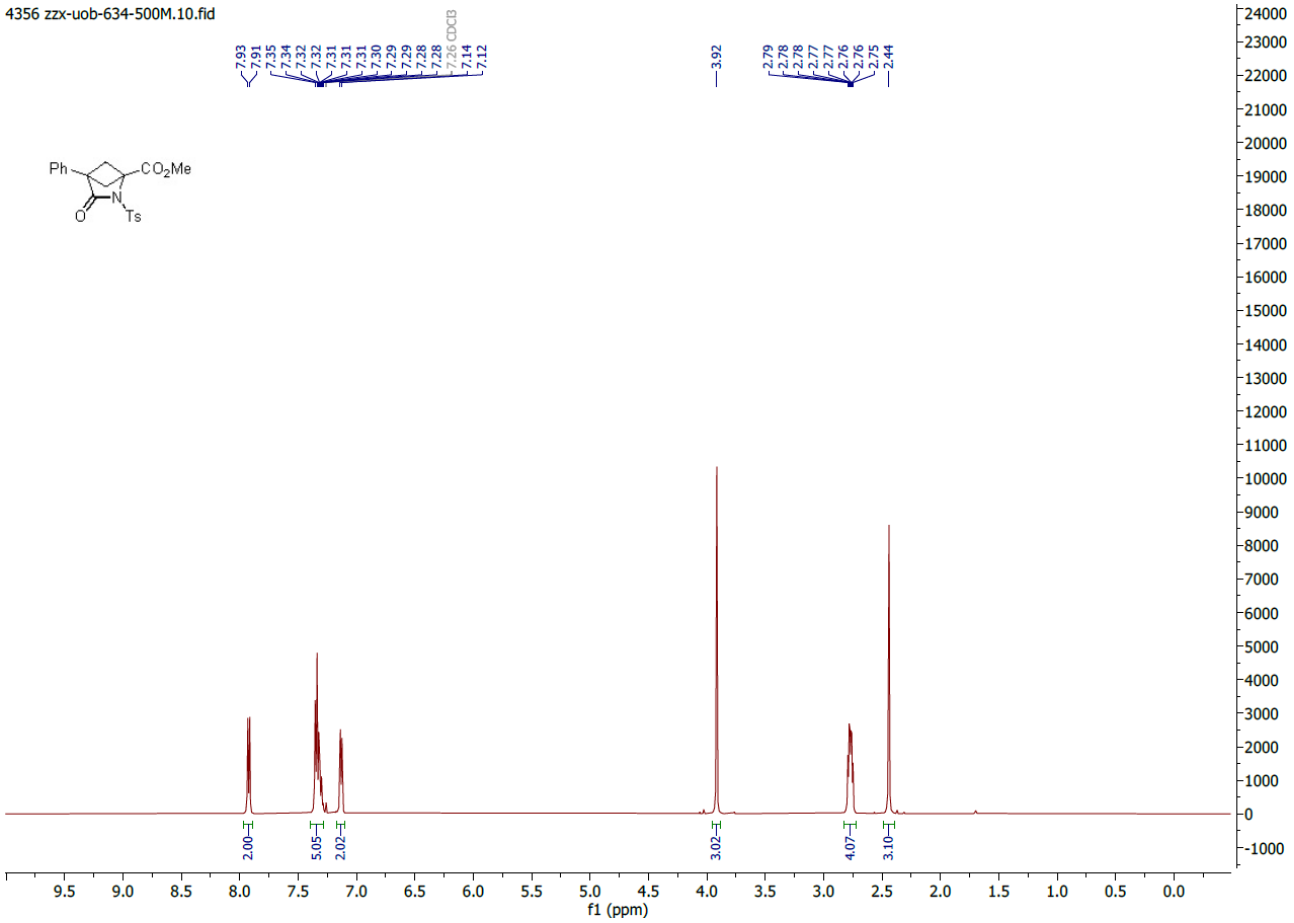

4812 zzx-uob-703-500M.11.fid
174.23
166.63
149.44
137.78
130.63
129.20
126.77
83.60
77.16 CDCl3
62.74
55.74
52.82
52.41
27.91
21.10
Me
CO2Me
N
Boc
O
f1 (ppm)

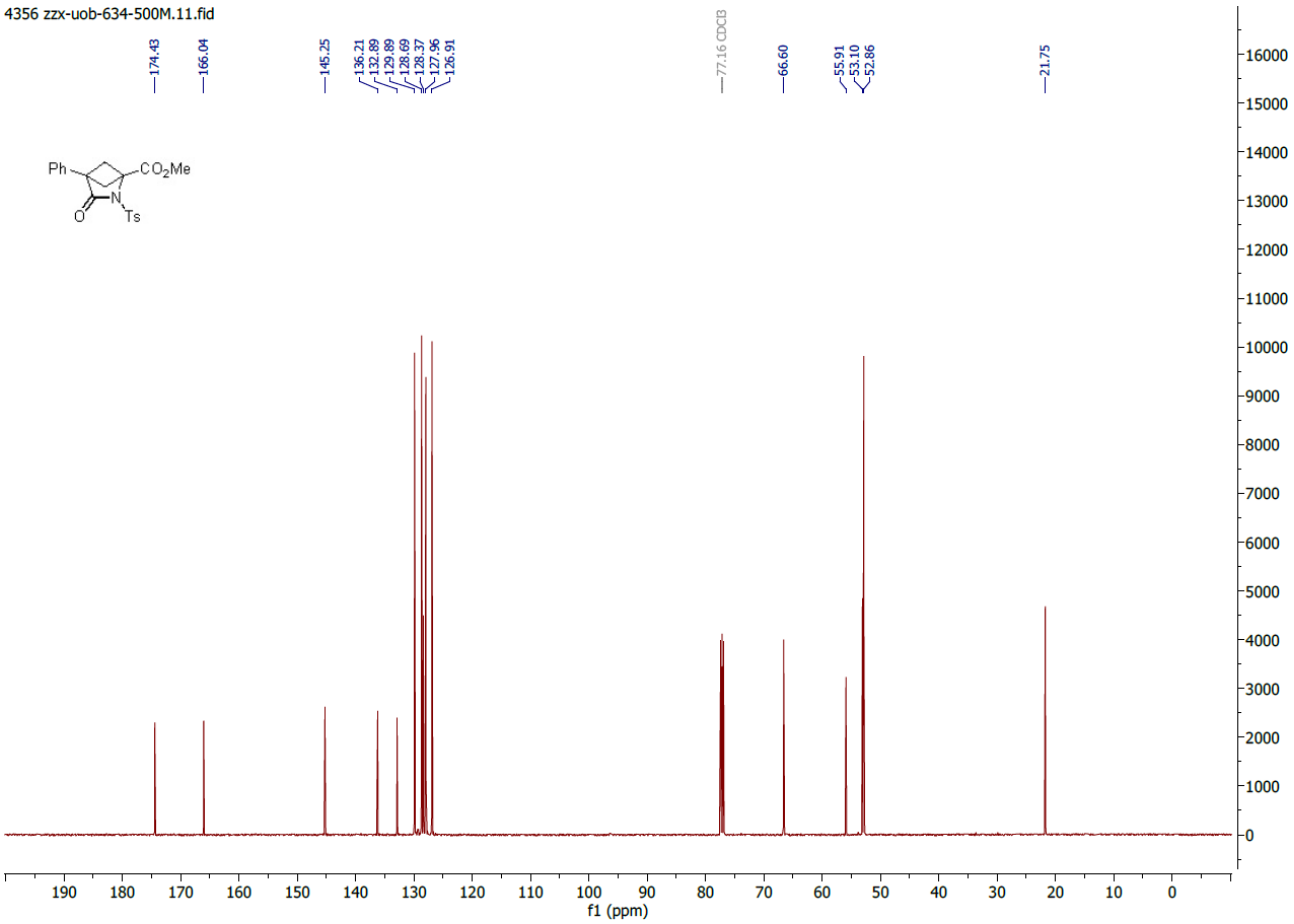
Compound 8f


4813 zzx-uob-704-500M.10.fid
7.26 CDCl3
7.15
7.13
6.88
6.86
3.80
3.75
2.84
2.84
2.83
2.83
2.75
2.75
2.75
2.74
1.48
MeO
CO2Me
N
Boc
O
2.00
2.00
3.00
3.01
2.00
2.00
9.02
f1 (ppm)

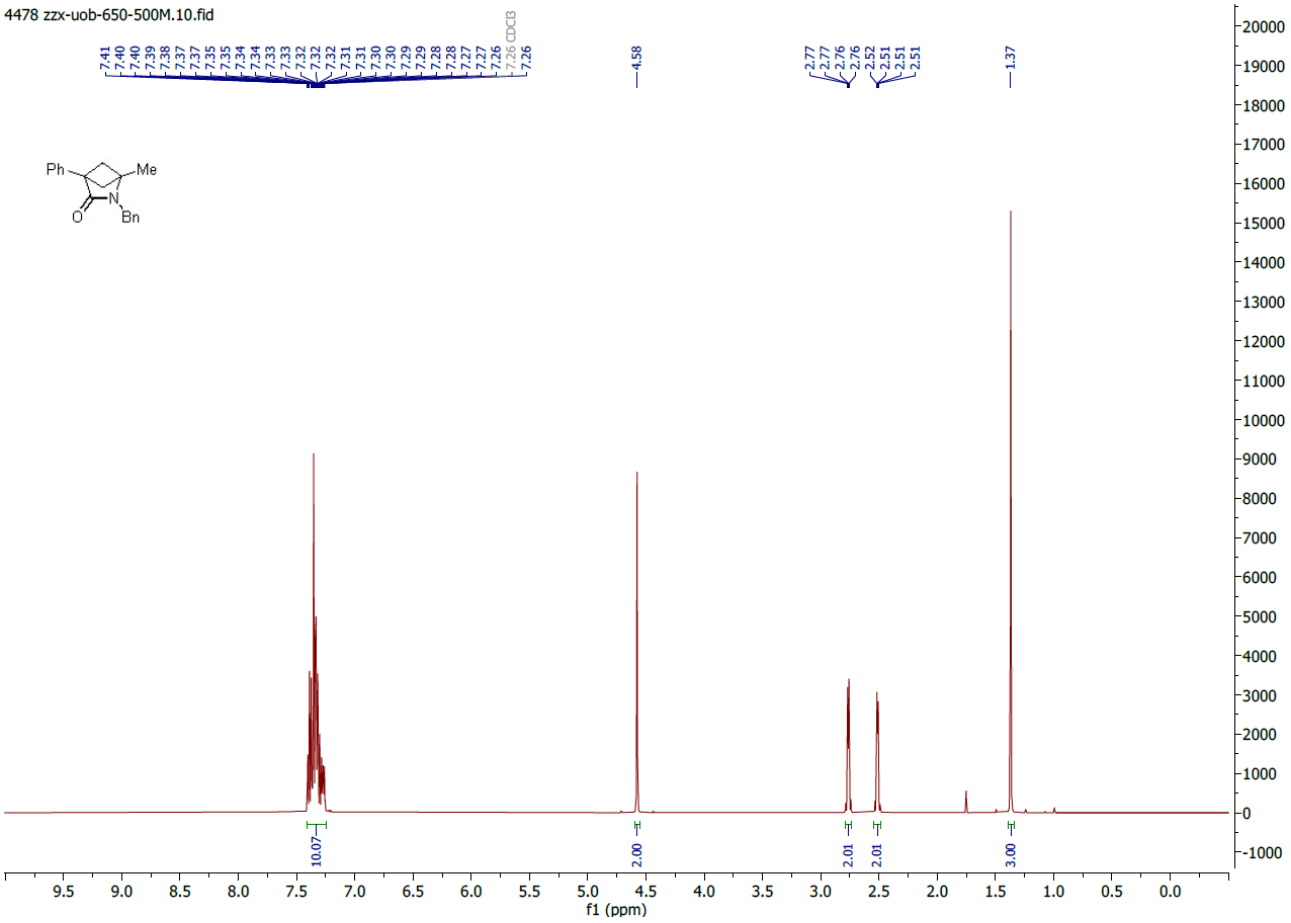

4813 zzx-uob-704-500M.11.fid
174.41
166.66
159.34
149.43
128.11
125.69
113.98
83.62
77.16 CDCl3
62.70
55.45
55.19
52.93
52.42
27.91
MeO
CO2Me
N
Boc
O
f1 (ppm)

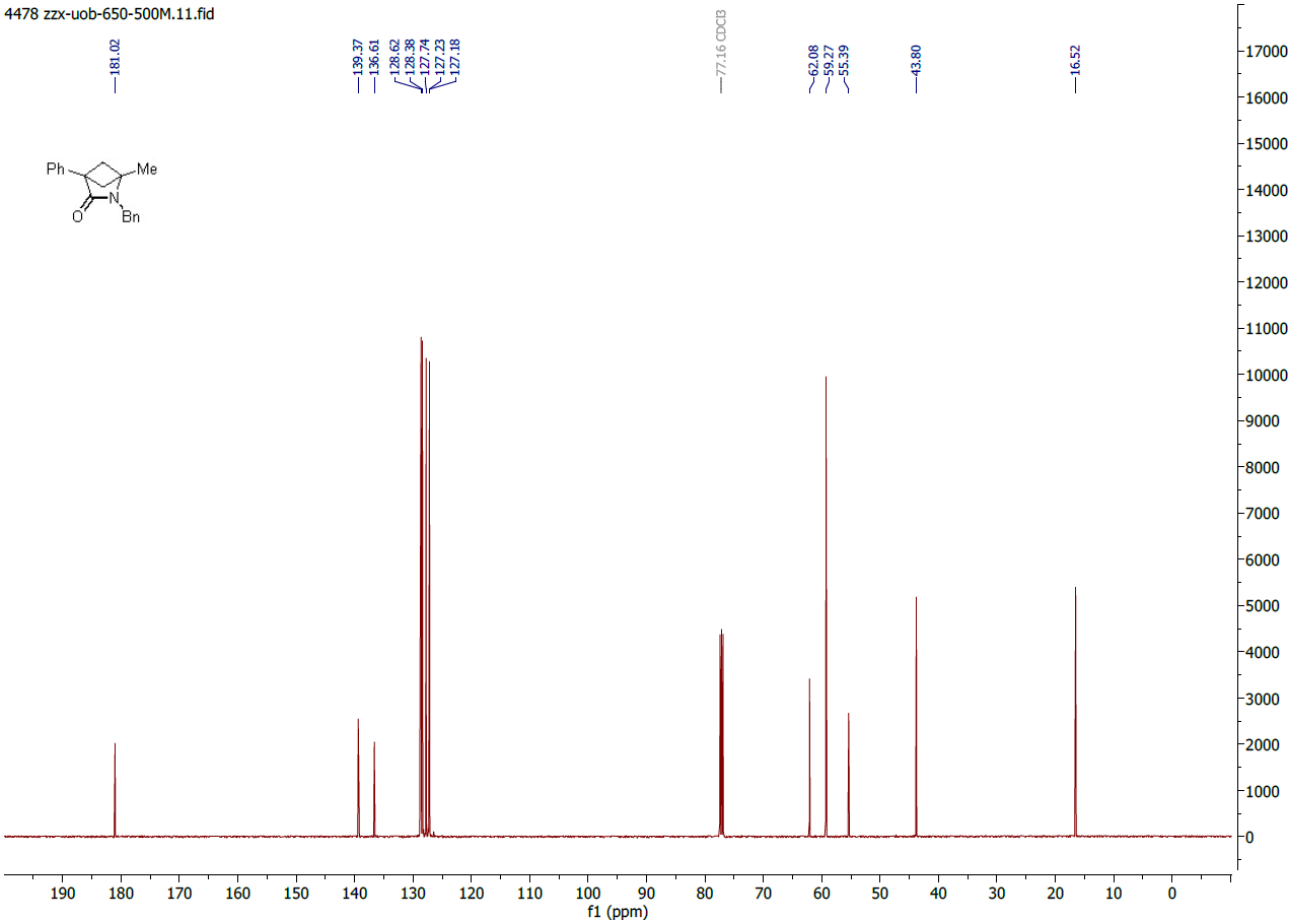
Compound 8g


4356 zzx-uob-634-500M.10.fid
7.93
7.91
7.35
7.34
7.32
7.32
7.31
7.31
7.31
7.30
7.29
7.29
7.28
7.28
7.26 CDCl3
7.14
7.12
3.92
2.79
2.78
2.78
2.77
2.77
2.76
2.76
2.75
2.44
Ph
CO2Me
N
O
Ts
2.00
5.05
2.02
3.02
4.07
3.10
f1 (ppm)


4356 zzx-uob-634-500M.11.fid
174.43
166.04
145.25
136.21
132.89
129.89
128.69
128.37
127.96
126.91
77.16 CDCl3
66.60
55.91
53.10
52.86
21.75
Ph
CO2Me
N
O
Ts
f1 (ppm)

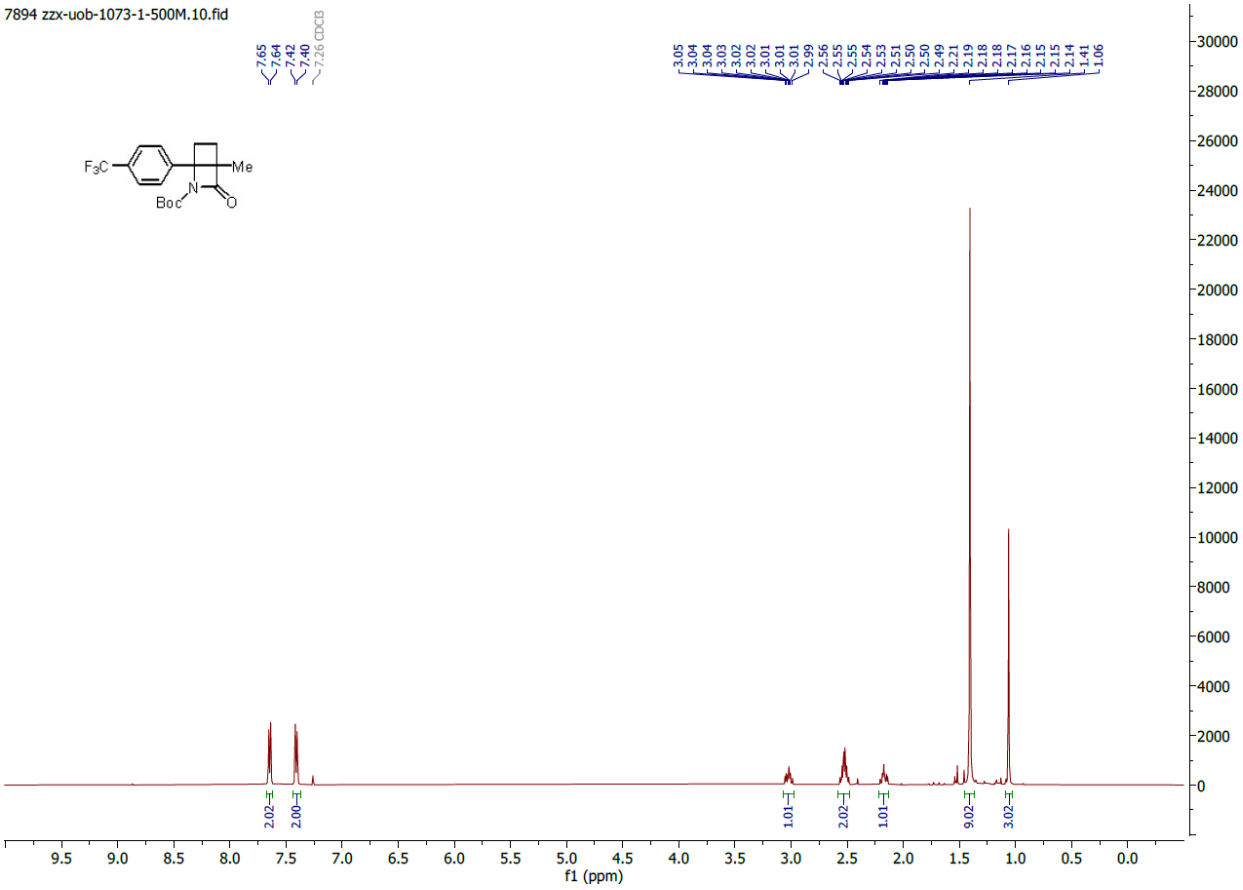
Compound 8h

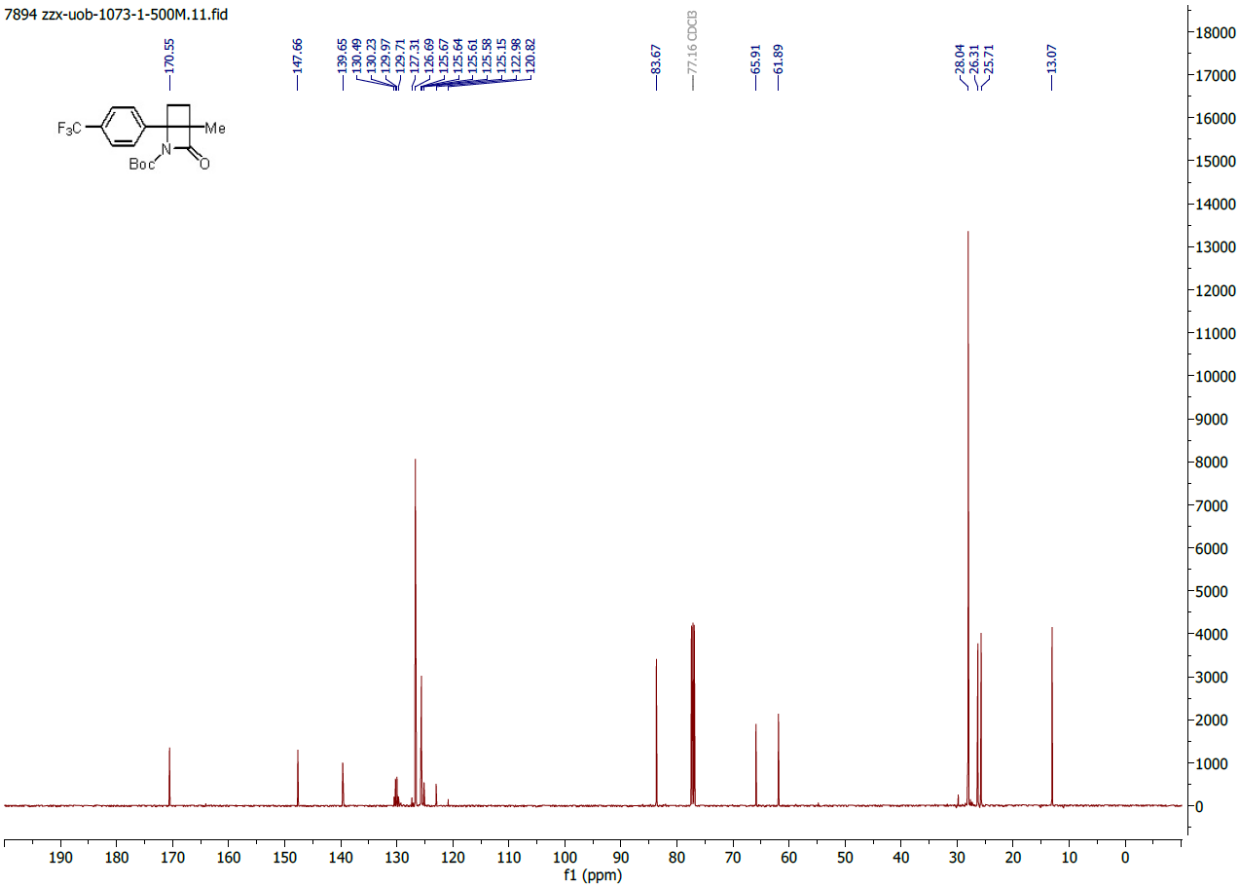

4478 zzx-uob-650-500M.10.fid
7.41 7.40 7.40 7.39 7.38 7.37 7.37 7.35 7.35 7.34 7.34 7.33 7.33 7.32 7.32 7.32 7.31 7.31 7.30 7.30 7.29 7.29 7.28 7.28 7.27 7.27 7.26 7.26 CDCl3
4.58
2.77 2.77 2.76 2.76 2.52 2.51 2.51 2.51
1.37
Ph
Me
N
O
Bn
10.07
2.00
2.01
2.01
3.00
f1 (ppm)

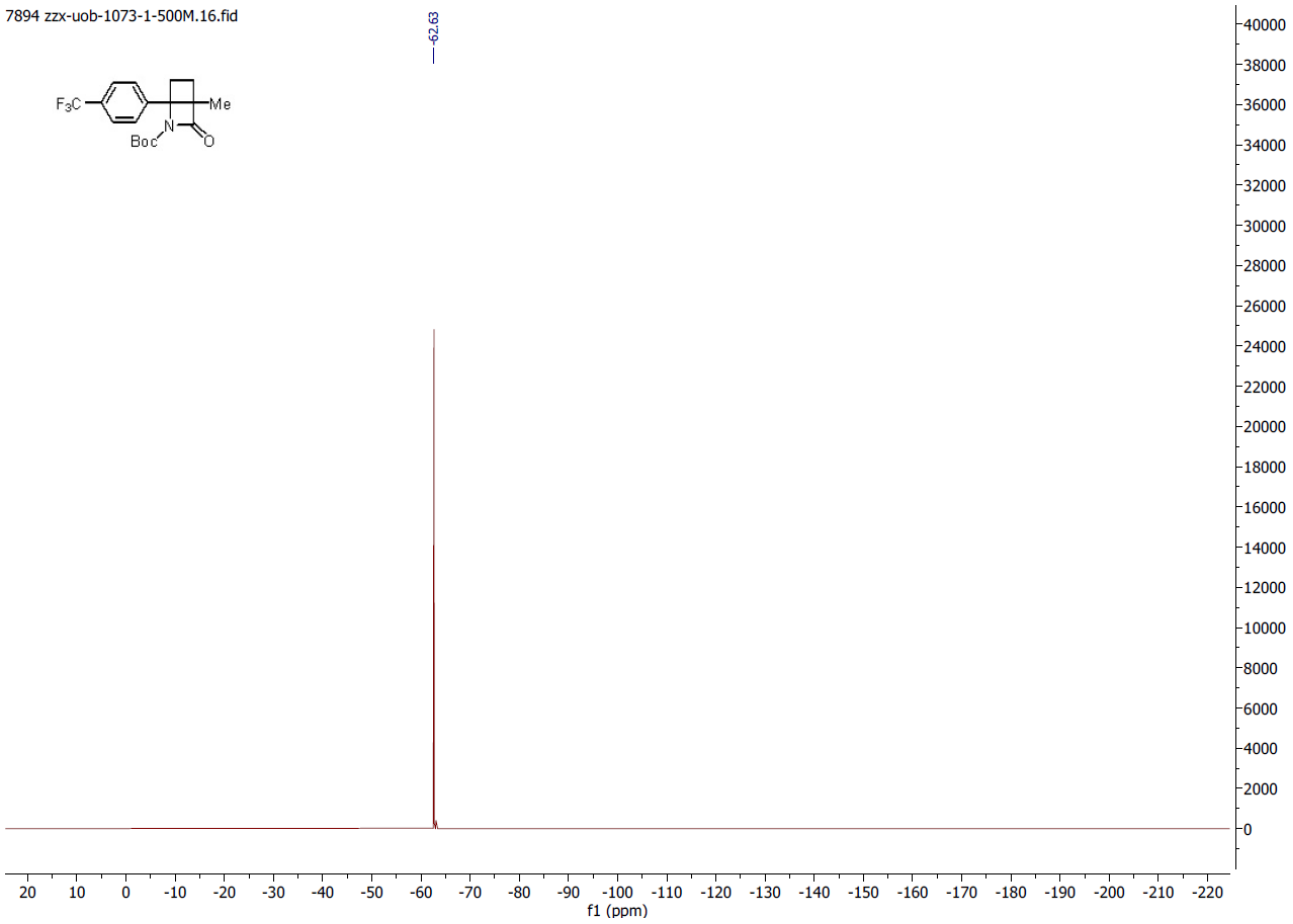

4478 zzx-uob-650-500M.11.fid
181.02
139.37 136.61 128.62 128.38 127.74 127.23 127.18
77.16 CDCl3
62.08 59.27 55.39
43.80
16.52
Ph
Me
N
O
Bn
f1 (ppm)

5.6 NMR Spectra of Products (5, 6 and 9)

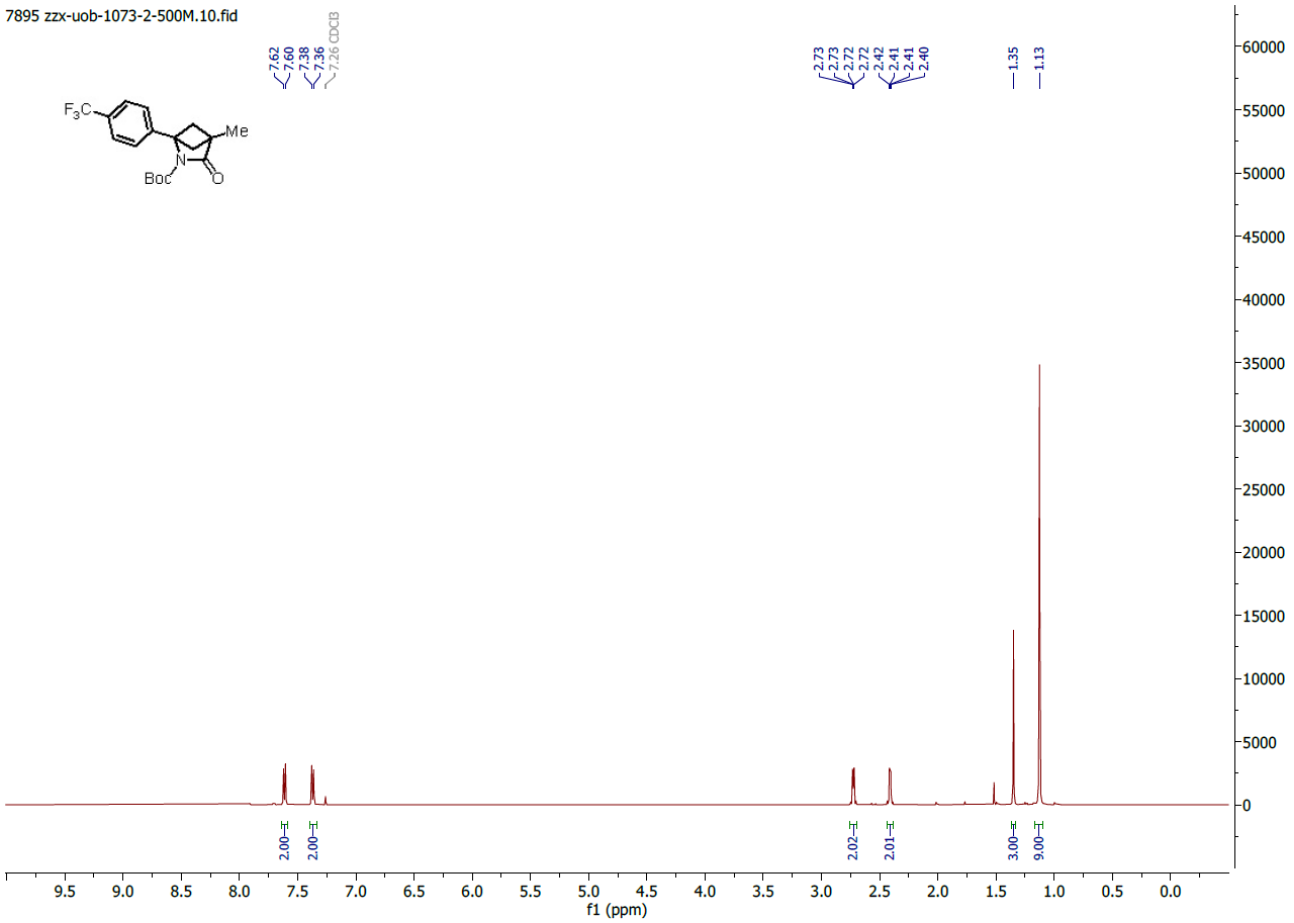
Compound 6a

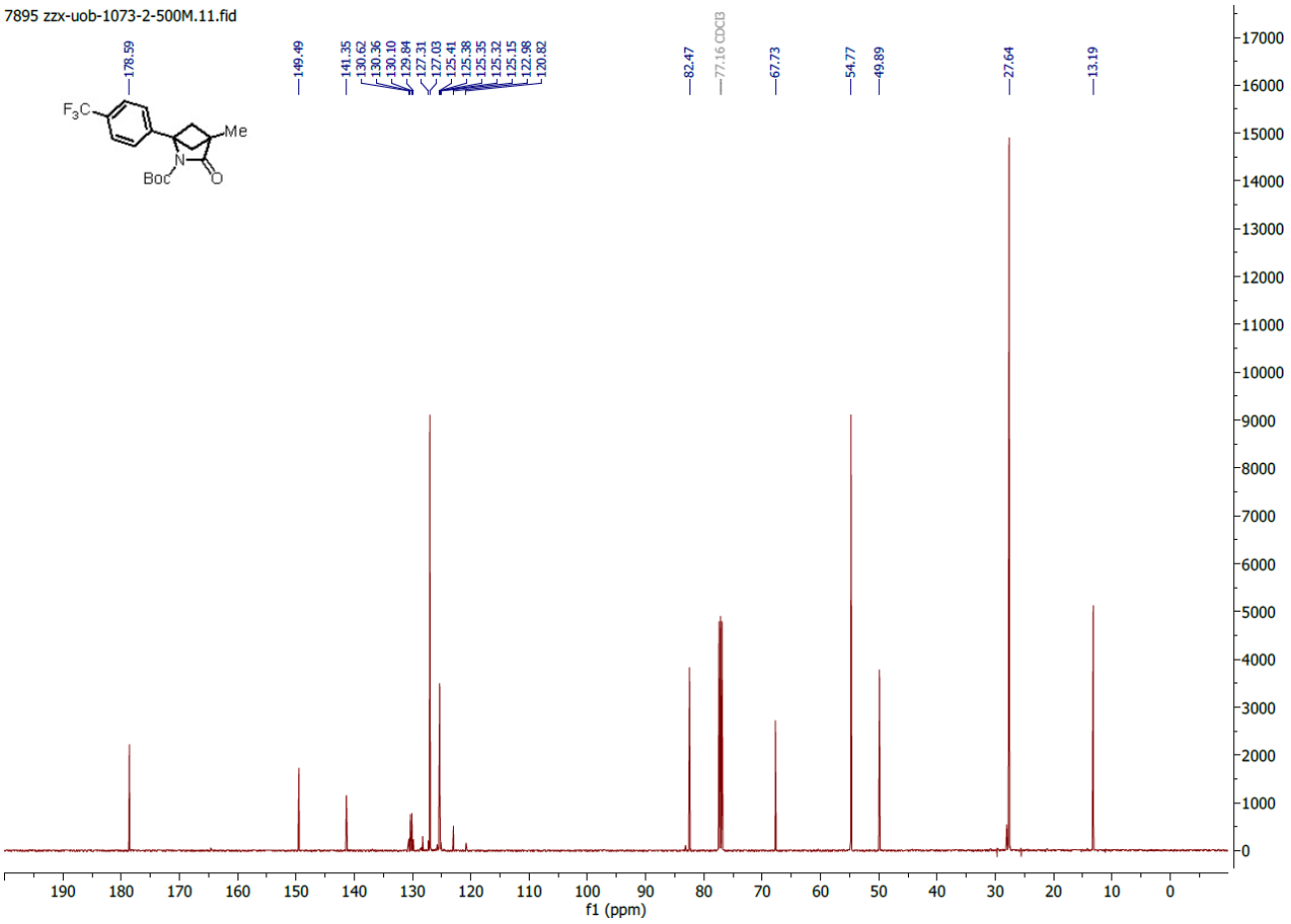


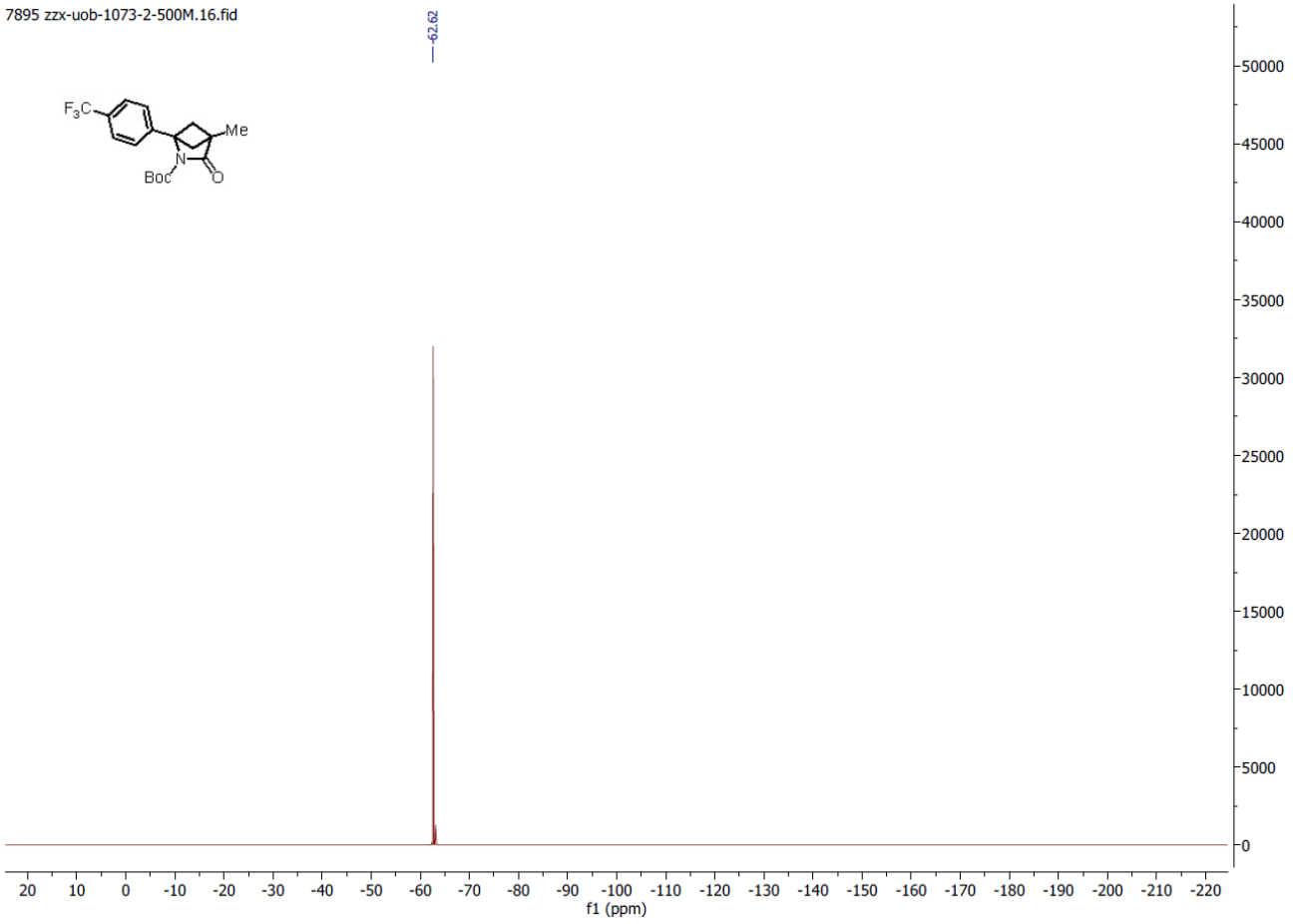



7894 zzx-uob-1073-1-500M.16.fid
-62.63
F3C
Me
N
Boc
O
40000
38000
36000
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

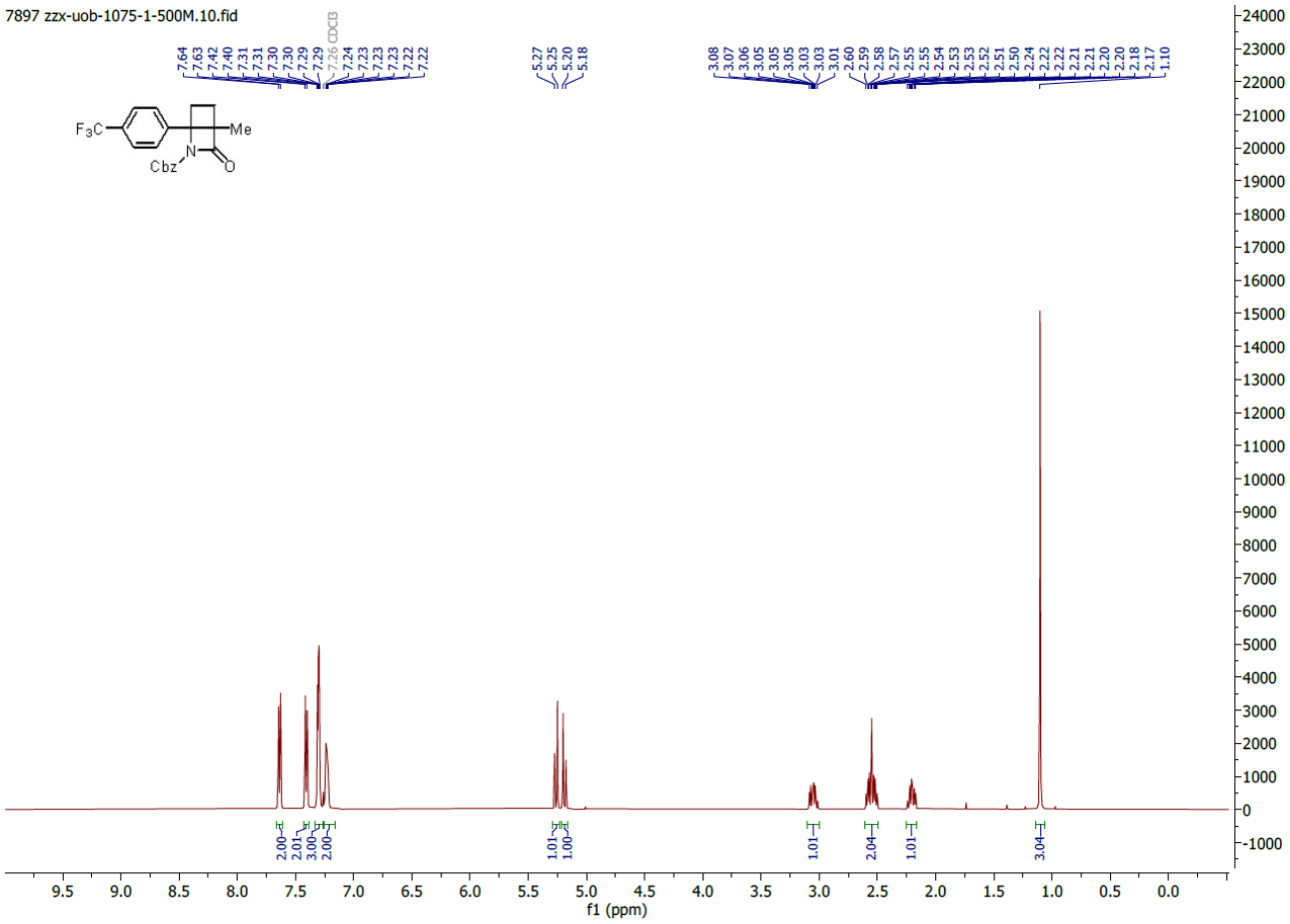
Compound 5a

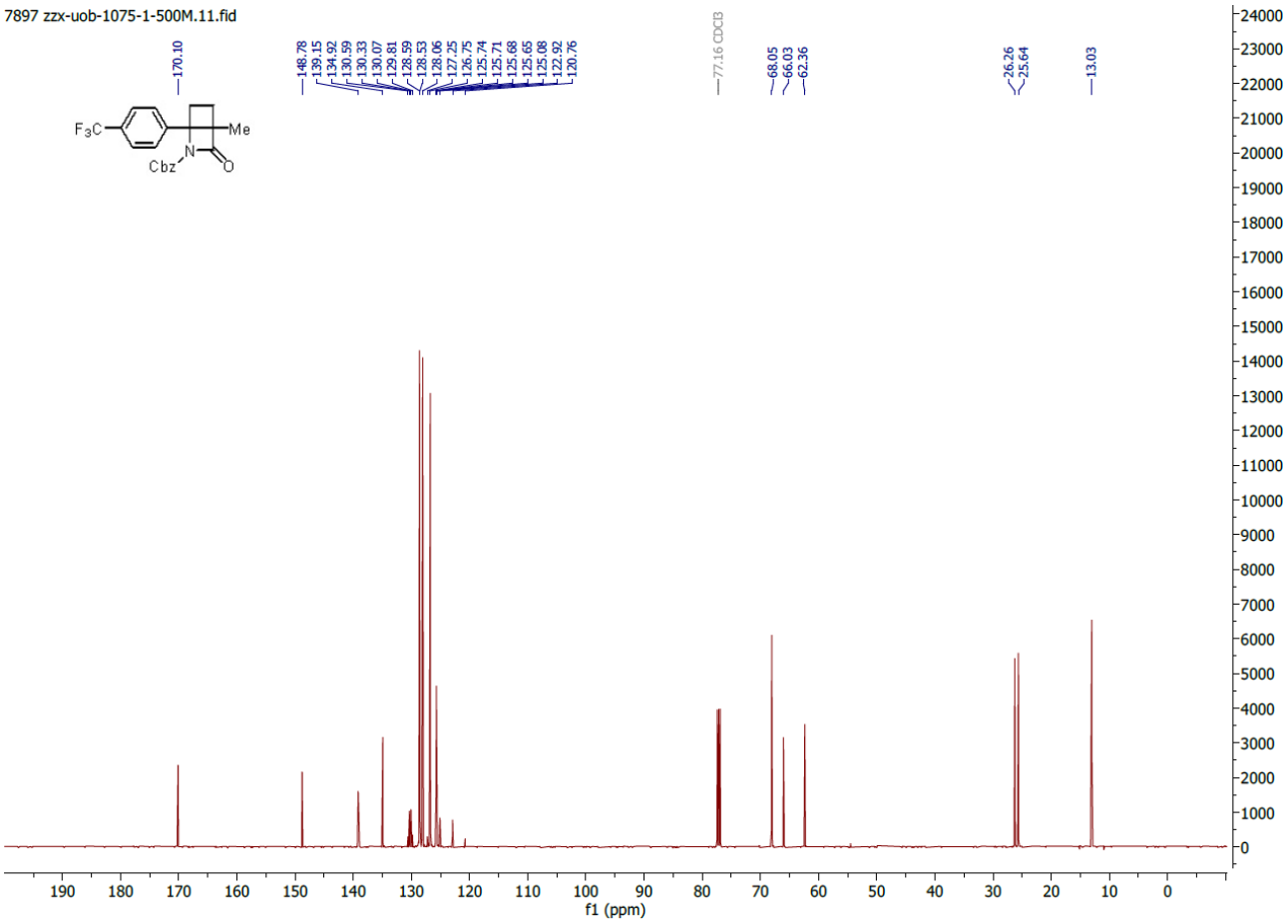

7895 zzx-uob-1073-2-500M.10.fid
7.62
7.60
7.38
7.36
7.26 CDCl3
2.73
2.73
2.72
2.72
2.42
2.41
2.41
2.40
1.35
1.13
F3C
Me
N
Boc
O
2.00
2.00
2.02
2.01
3.00
9.00
f1 (ppm)

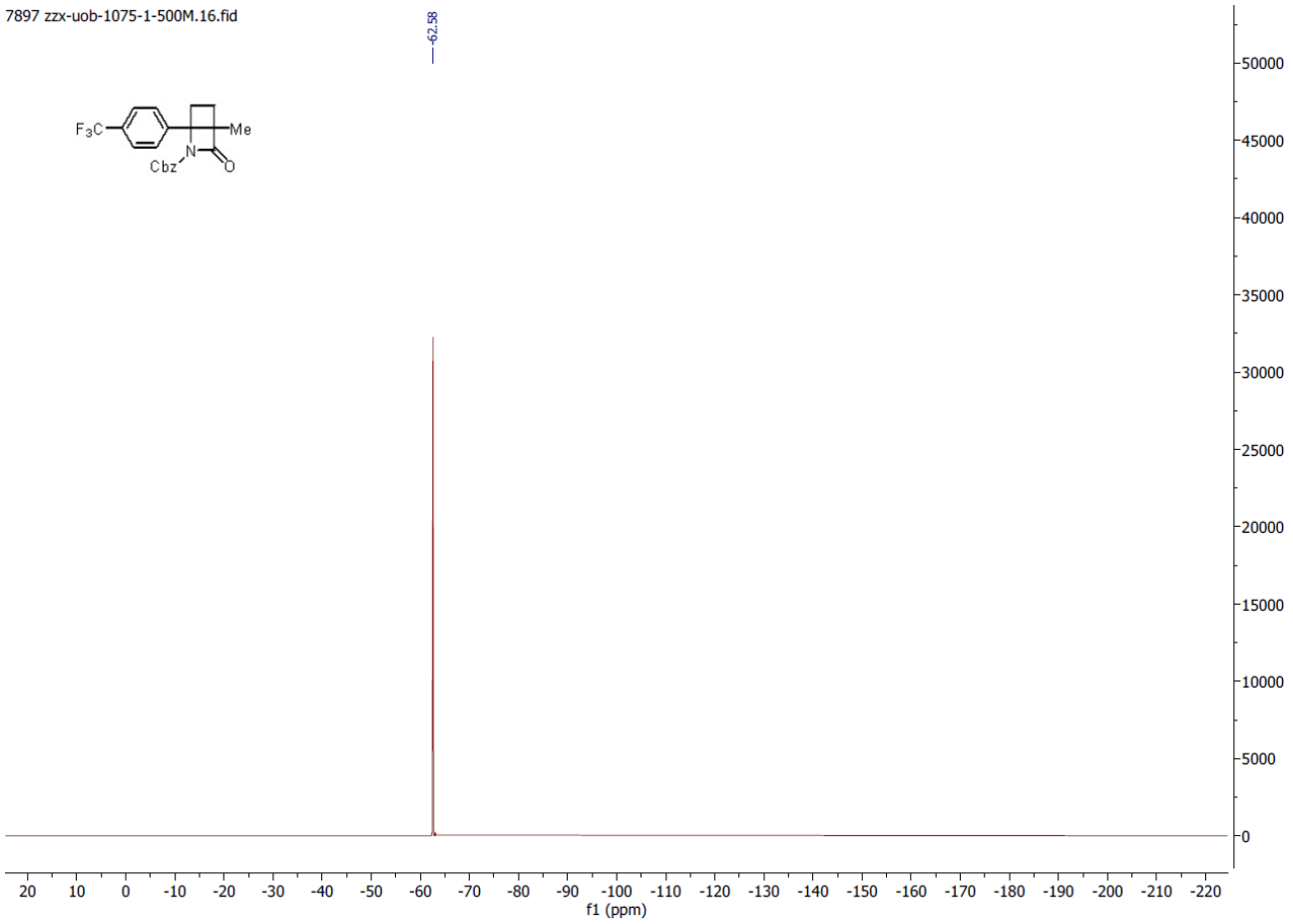

7895 zzx-uob-1073-2-500M.11.fid
178.59
149.49
141.35
130.62
130.36
130.10
129.84
127.31
127.03
125.41
125.38
125.35
125.32
125.15
122.98
120.82
82.47
77.16 CDCl3
67.73
54.77
49.89
27.64
13.19
F3C
Me
N
Boc
O
f1 (ppm)


7895 zzx-uob-1073-2-500M.16.fid
-62.62
F3C
Me
N
Boc
O
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

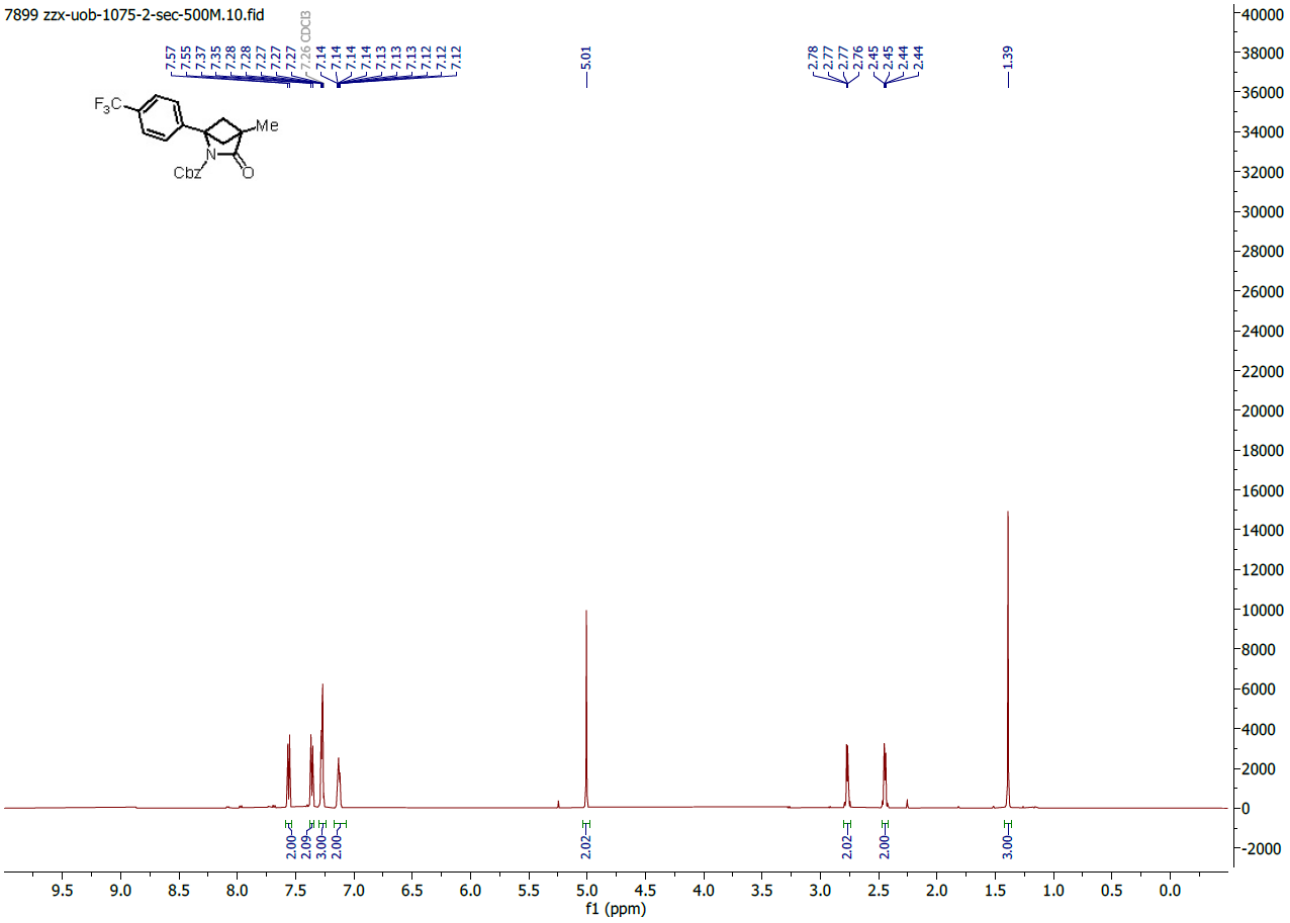
Compound 6b

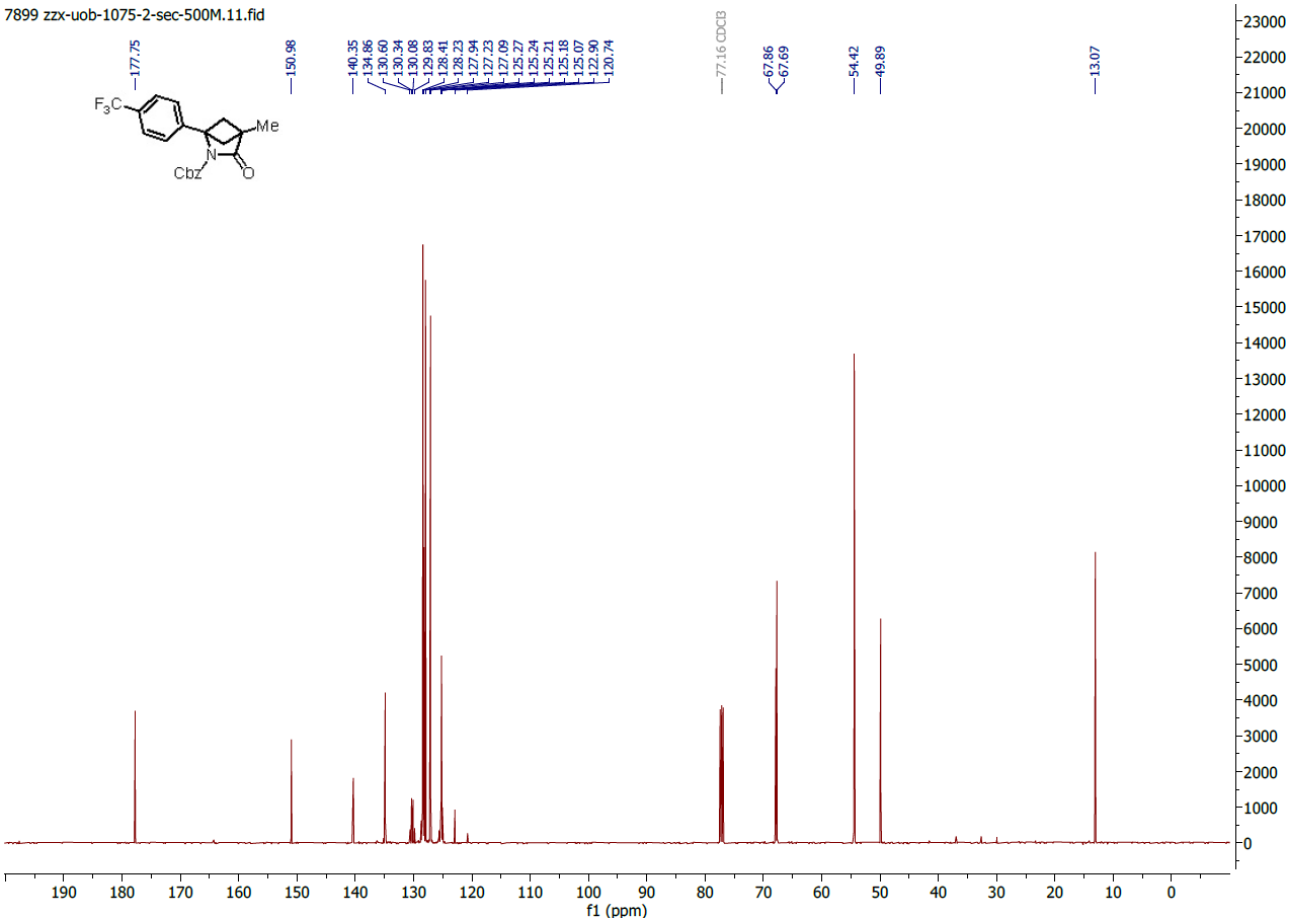

7897 zzx-uob-1075-1-500M.10.fid
F3C
Me
Cbz
N
O
f1 (ppm)

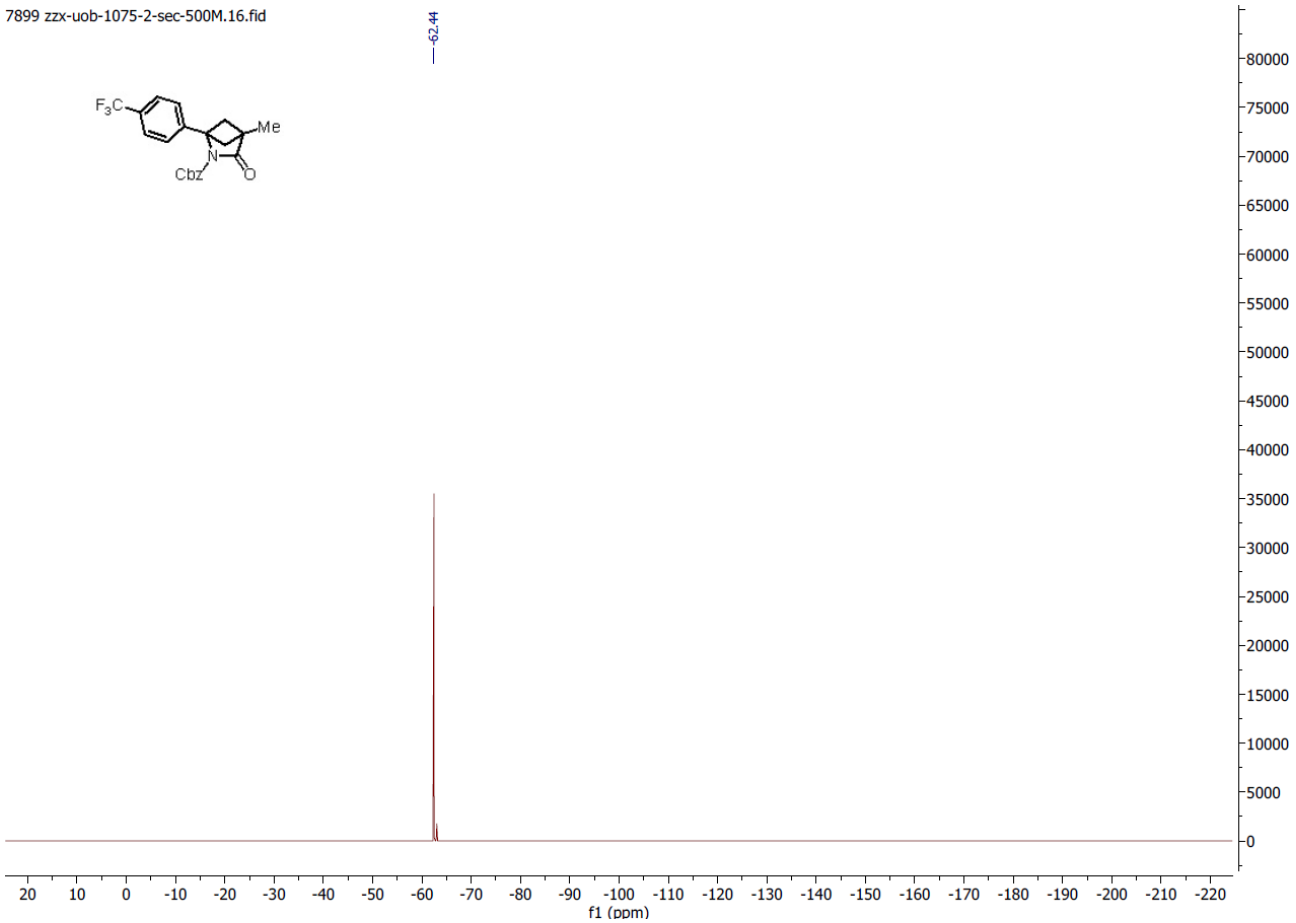

7897 zzx-uob-1075-1-500M.11.fid
F3C
Me
Cbz
N
O
f1 (ppm)


7897 zzx-uob-1075-1-500M.16.fid
-62.58
F3C
Me
N
Cbz
O
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

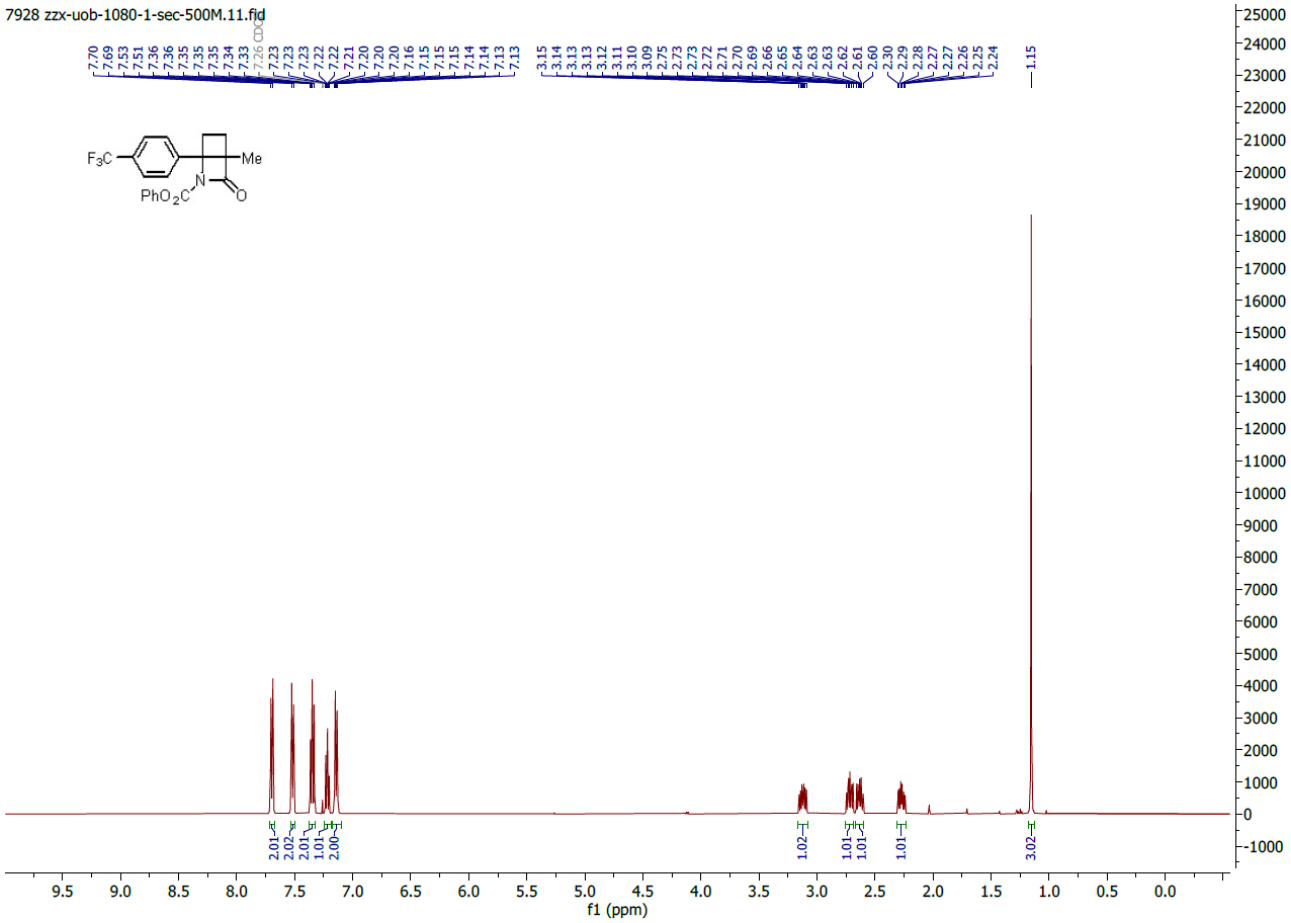
Compound 5b

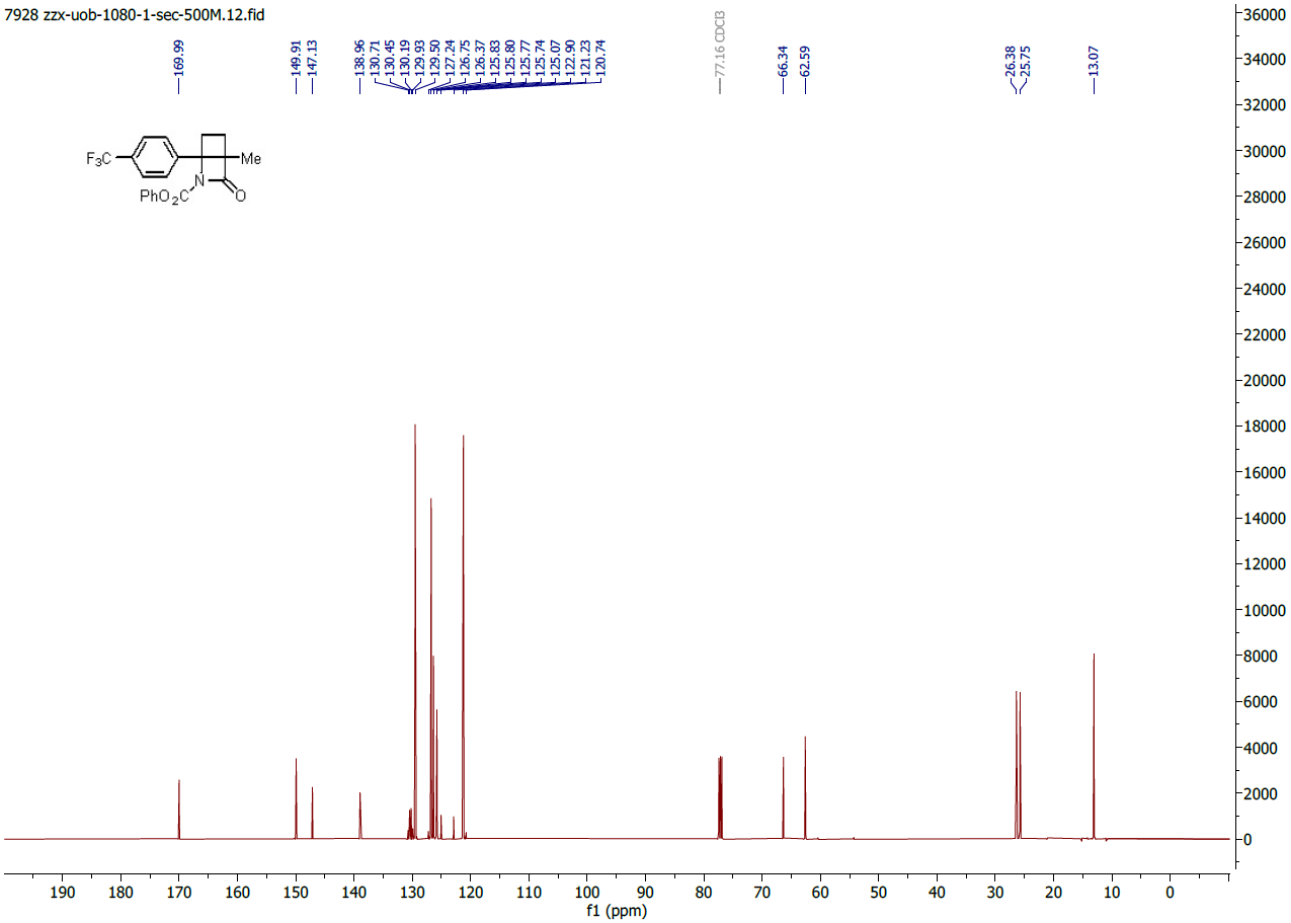

7899 zzx-uob-1075-2-sec-500M.10.fid
7.57
7.55
7.37
7.35
7.28
7.28
7.27
7.27
7.27
7.26 CDCl3
7.14
7.14
7.14
7.13
7.13
7.13
7.12
7.12
7.12
5.01
2.78
2.77
2.77
2.76
2.45
2.45
2.44
2.44
1.39
F3C
Me
N
Cbz
O
2.00
2.09
3.00
2.00
2.02
2.02
2.00
3.00
f1 (ppm)

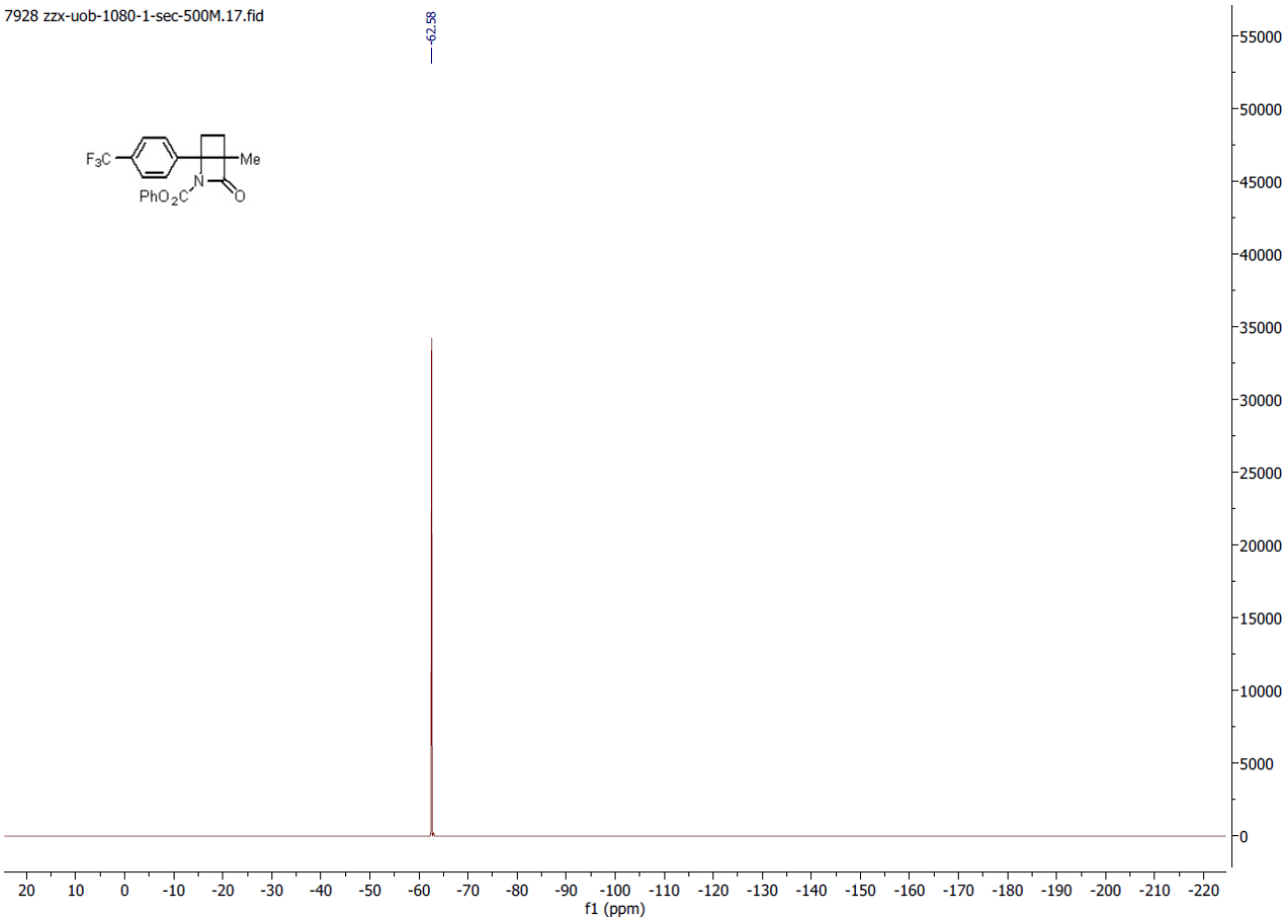

7899 zzx-uob-1075-2-sec-500M.11.fid
177.75
150.98
140.35
134.86
130.60
130.34
130.08
129.83
128.41
128.23
127.94
127.23
127.09
125.27
125.24
125.21
125.18
125.07
122.90
120.74
77.16 CDCl3
67.86
67.69
54.42
49.89
13.07
F3C
Me
N
Cbz
O
f1 (ppm)


7899 zzx-uob-1075-2-sec-500M.16.fid
-62.44
F3C
Me
N
Cbz
O
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

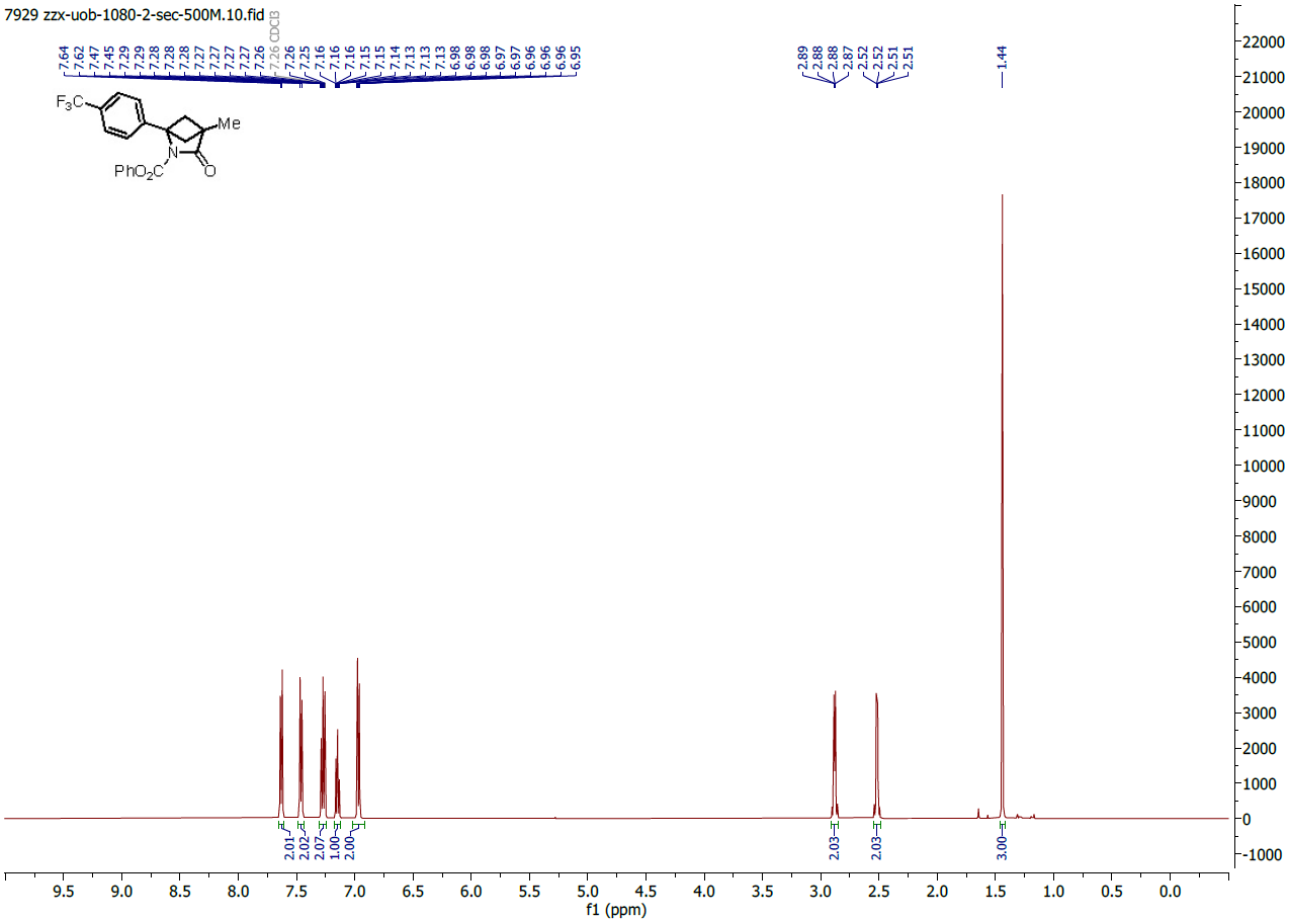
Compound 6c

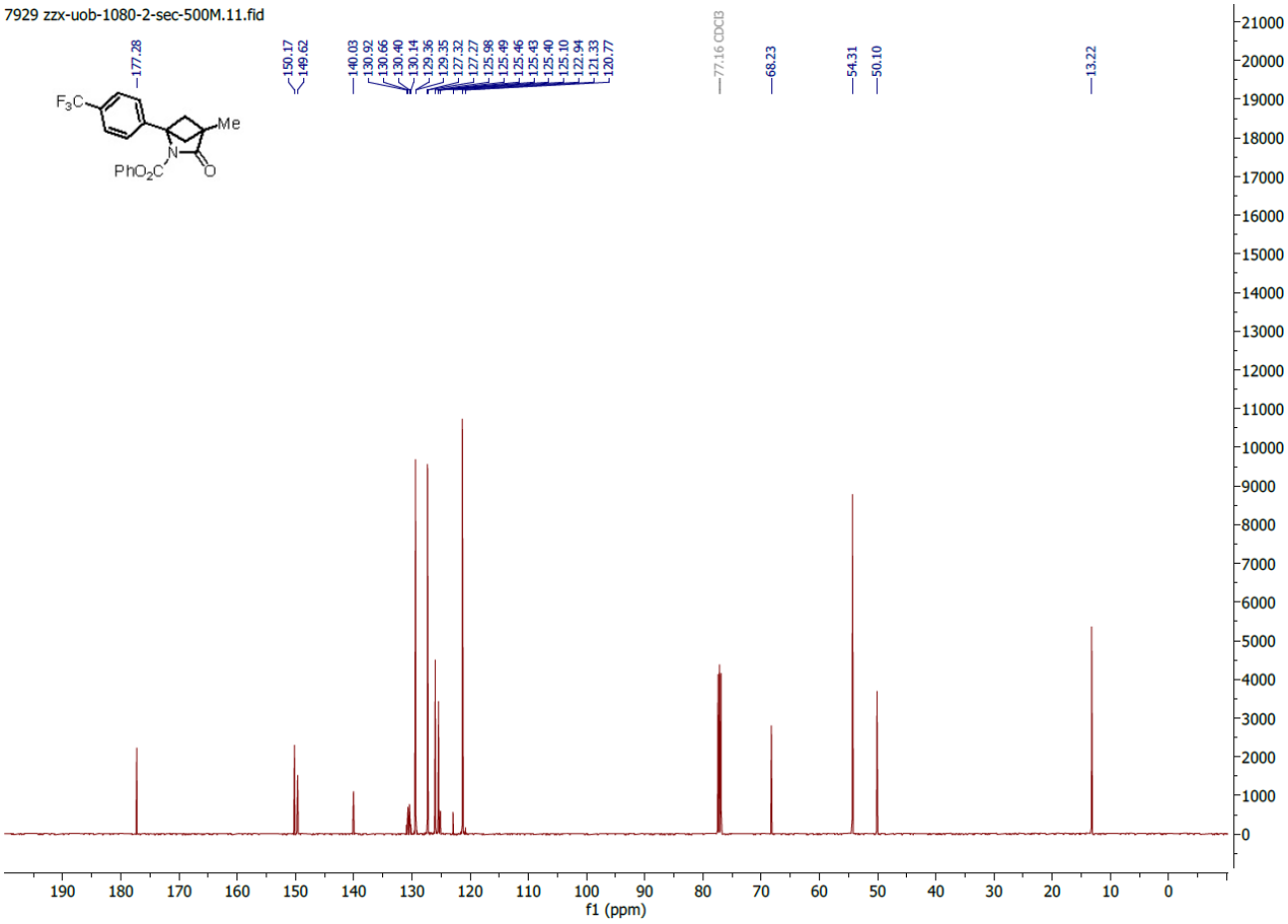

7928 zzx-uob-1080-1-sec-500M.11.fid
F3C
Me
PhO2C
N
O
f1 (ppm)

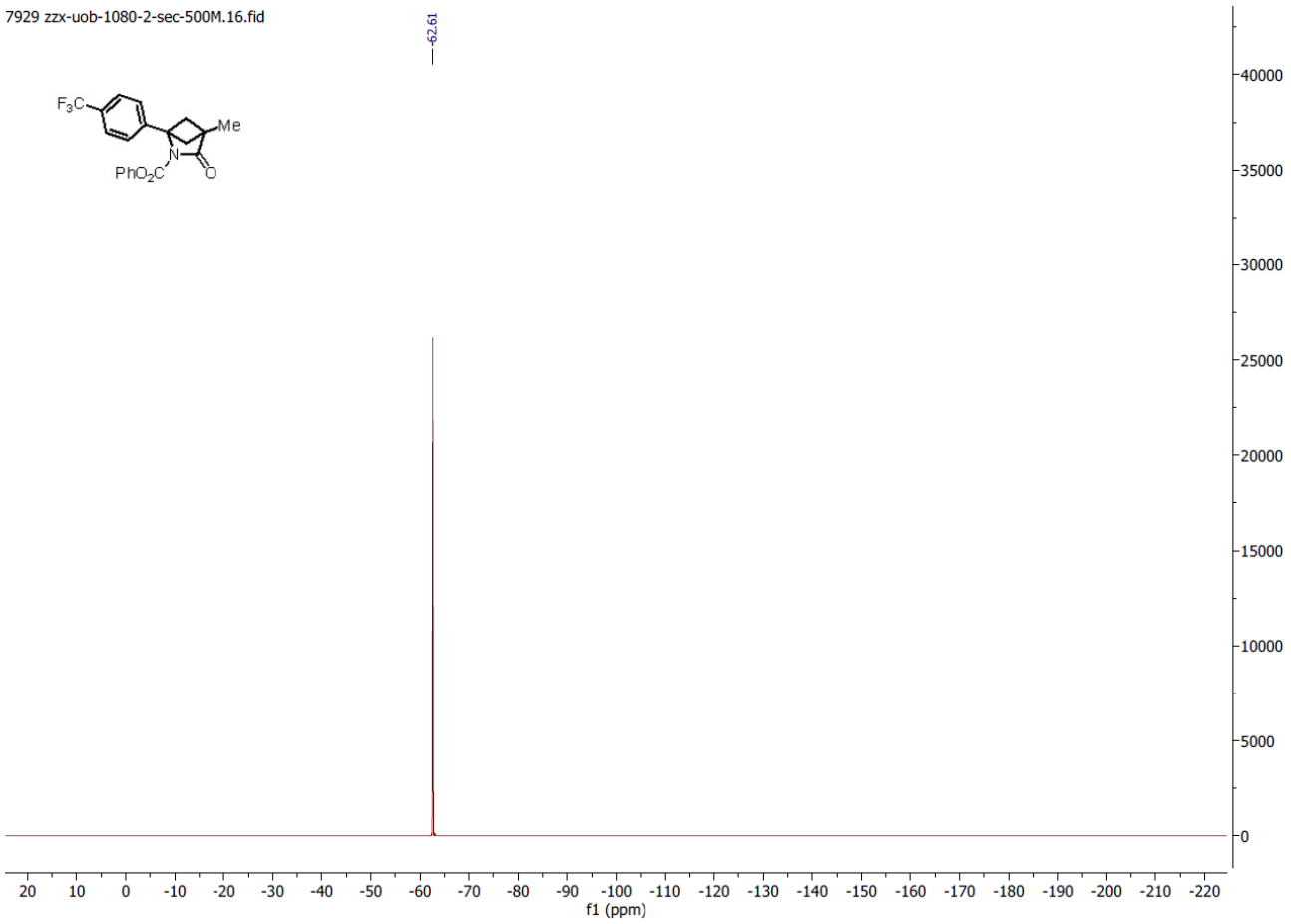

7928 zzx-uob-1080-1-sec-500M.12.fid
F3C
Me
PhO2C
N
O
f1 (ppm)


7928 zzx-uob-1080-1-sec-500M.17.fid
-62.58
F3C
Me
PhO2C
N
O
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

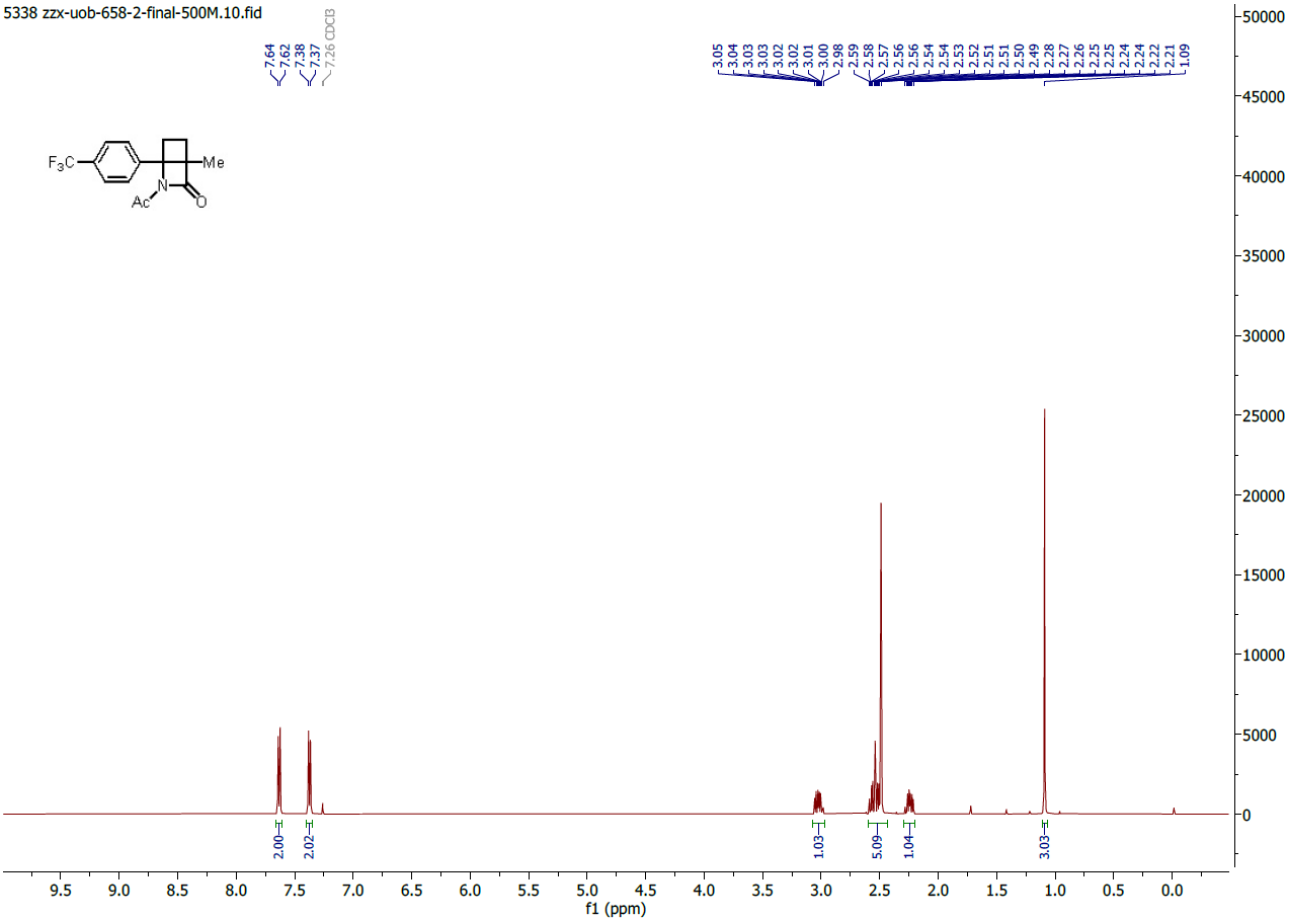
Compound 5c

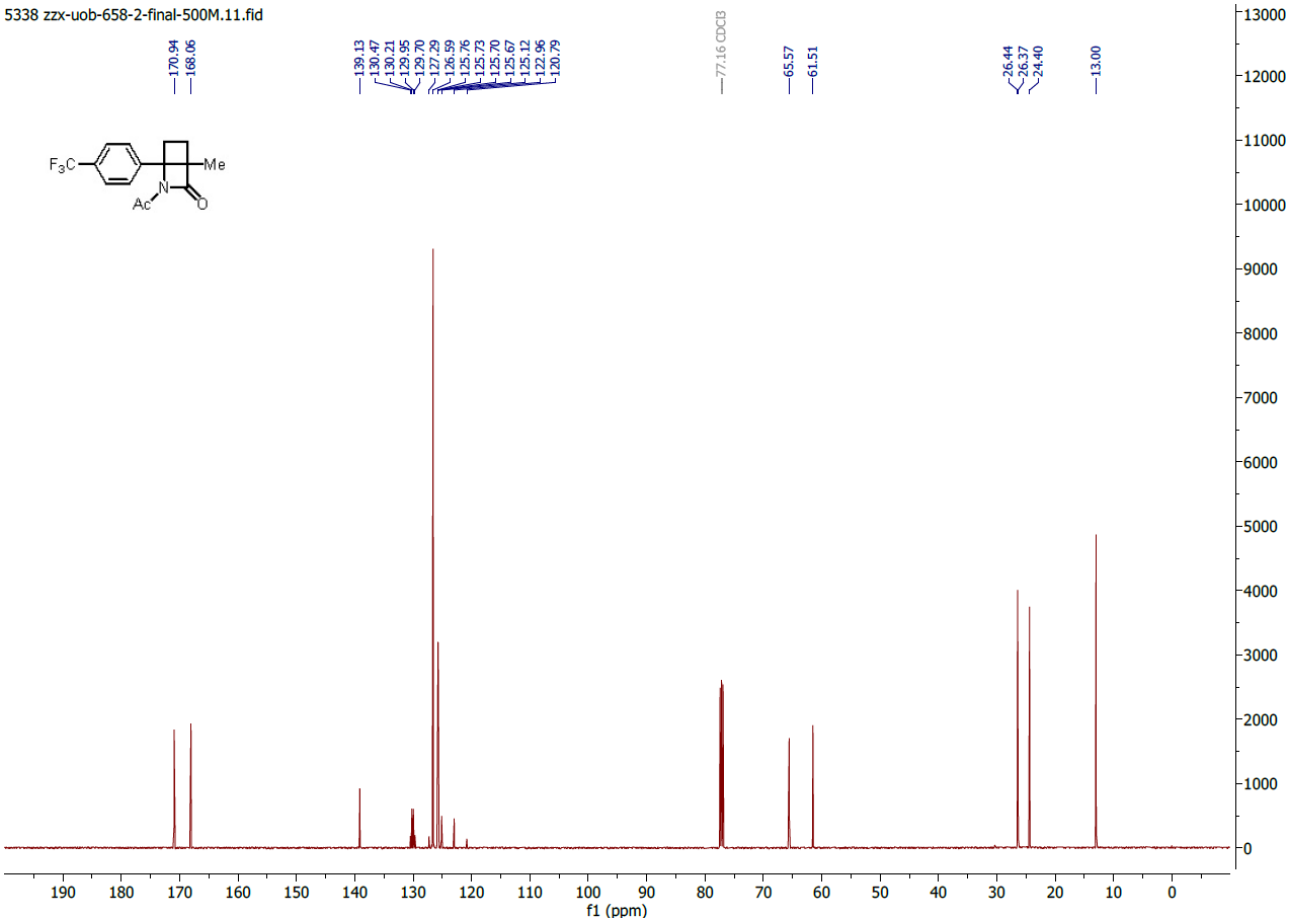

7929 zzx-uob-1080-2-sec-500M.10.fid
F3C
Me
PhO2C
N
O
f1 (ppm)

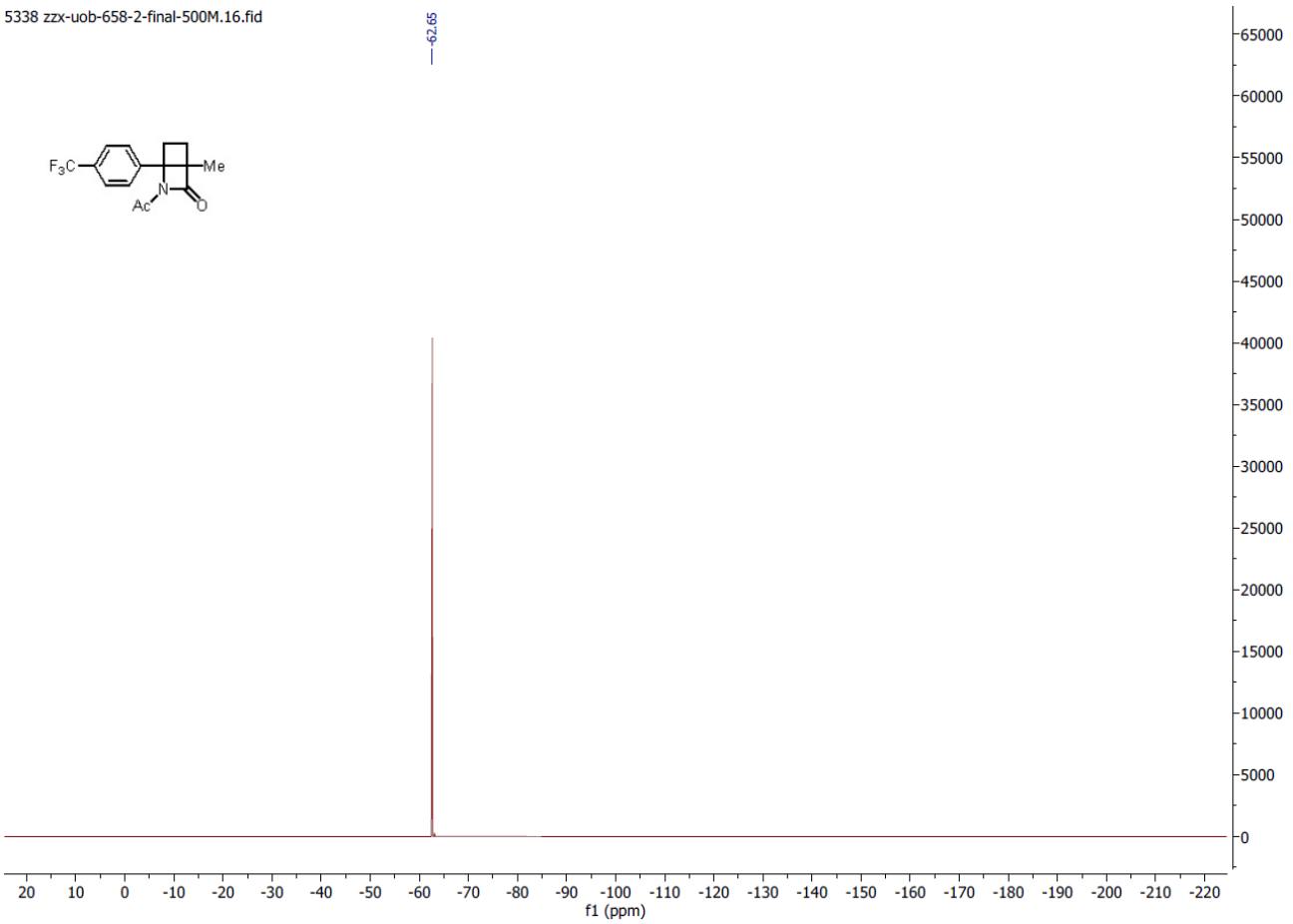

7929 zzx-uob-1080-2-sec-500M.11.fid
F3C
Me
PhO2C
N
O
f1 (ppm)


7929 zzx-uob-1080-2-sec-500M.16.fid
62.61
F3C
Me
PhO2C
N
O
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

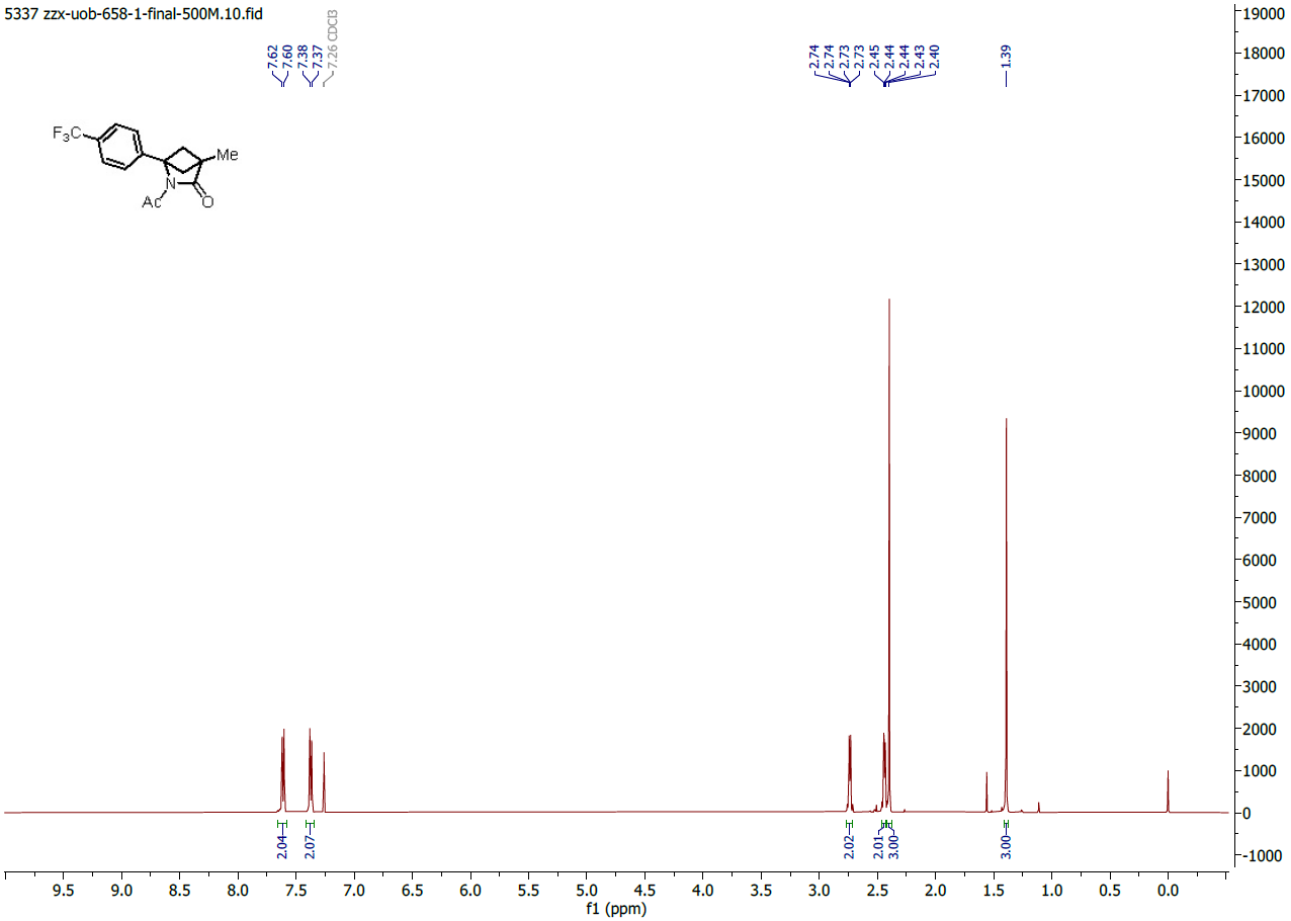
Compound 6d

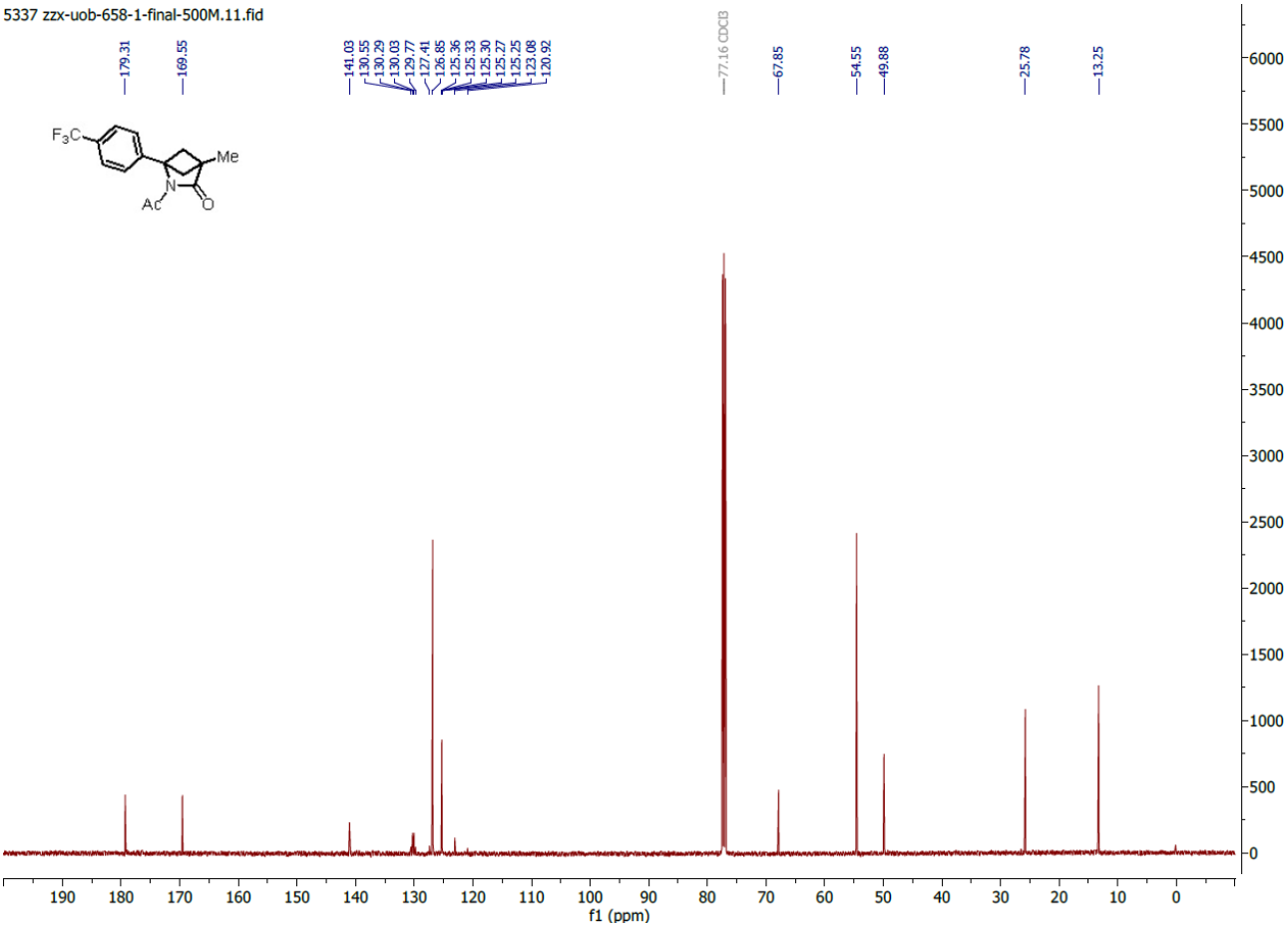

5338 zzx-uob-658-2-final-500M.10.fid
7.64
7.62
7.38
7.37
7.26 CDCl3
F3C
Me
N
Ac
O
2.00
2.02
1.03
5.09
1.04
3.03
f1 (ppm)

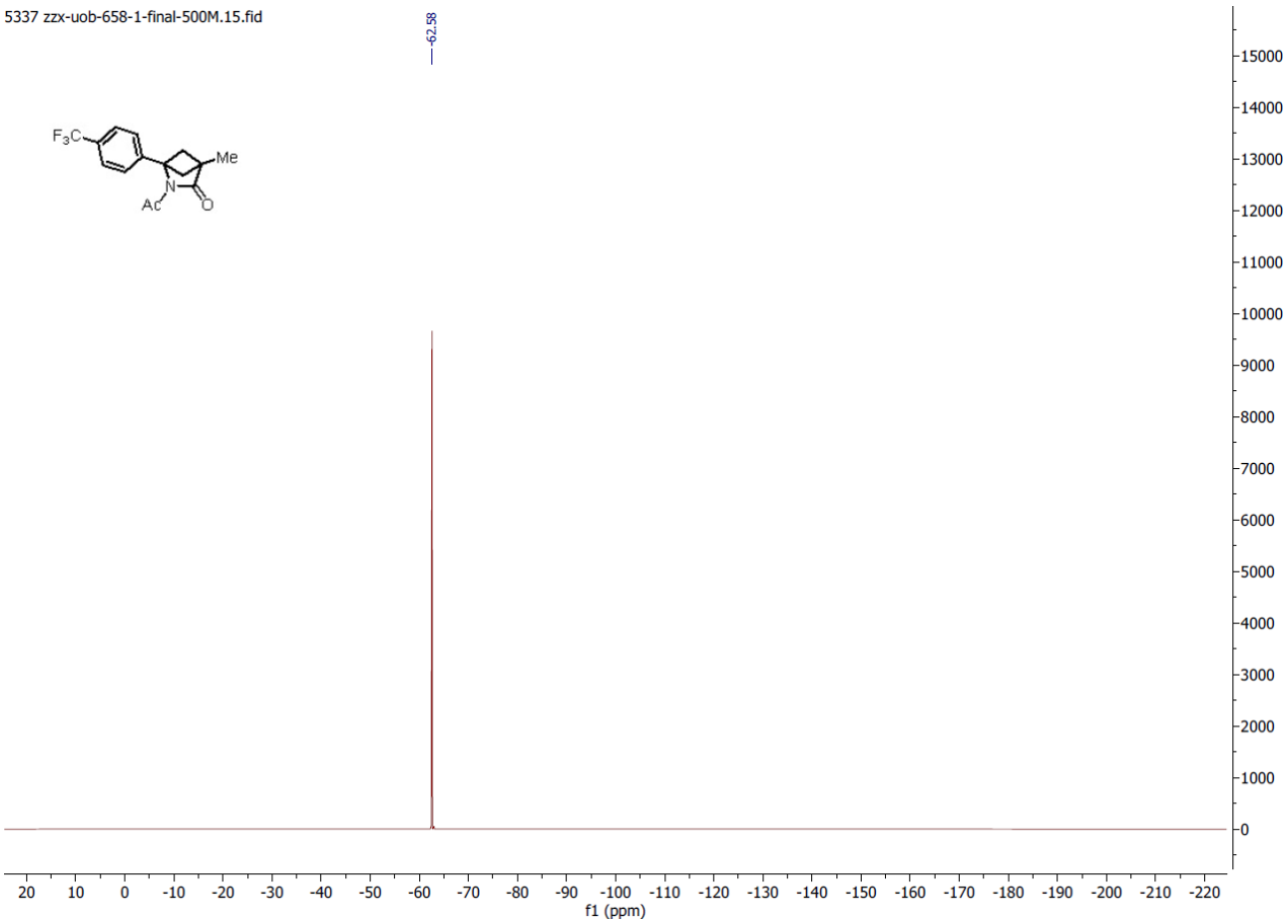

5338 zzx-uob-658-2-final-500M.11.fid
170.94
168.06
139.13
130.47
130.21
129.95
129.70
127.29
126.59
125.76
125.73
125.70
125.67
125.12
122.96
120.79
77.16 CDCl3
65.57
61.51
26.44
26.37
24.40
13.00
F3C
Me
N
Ac
O
f1 (ppm)


5338 zzx-uob-658-2-final-500M.16.fid
-62.65
F3C
Me
N
Ac
O
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

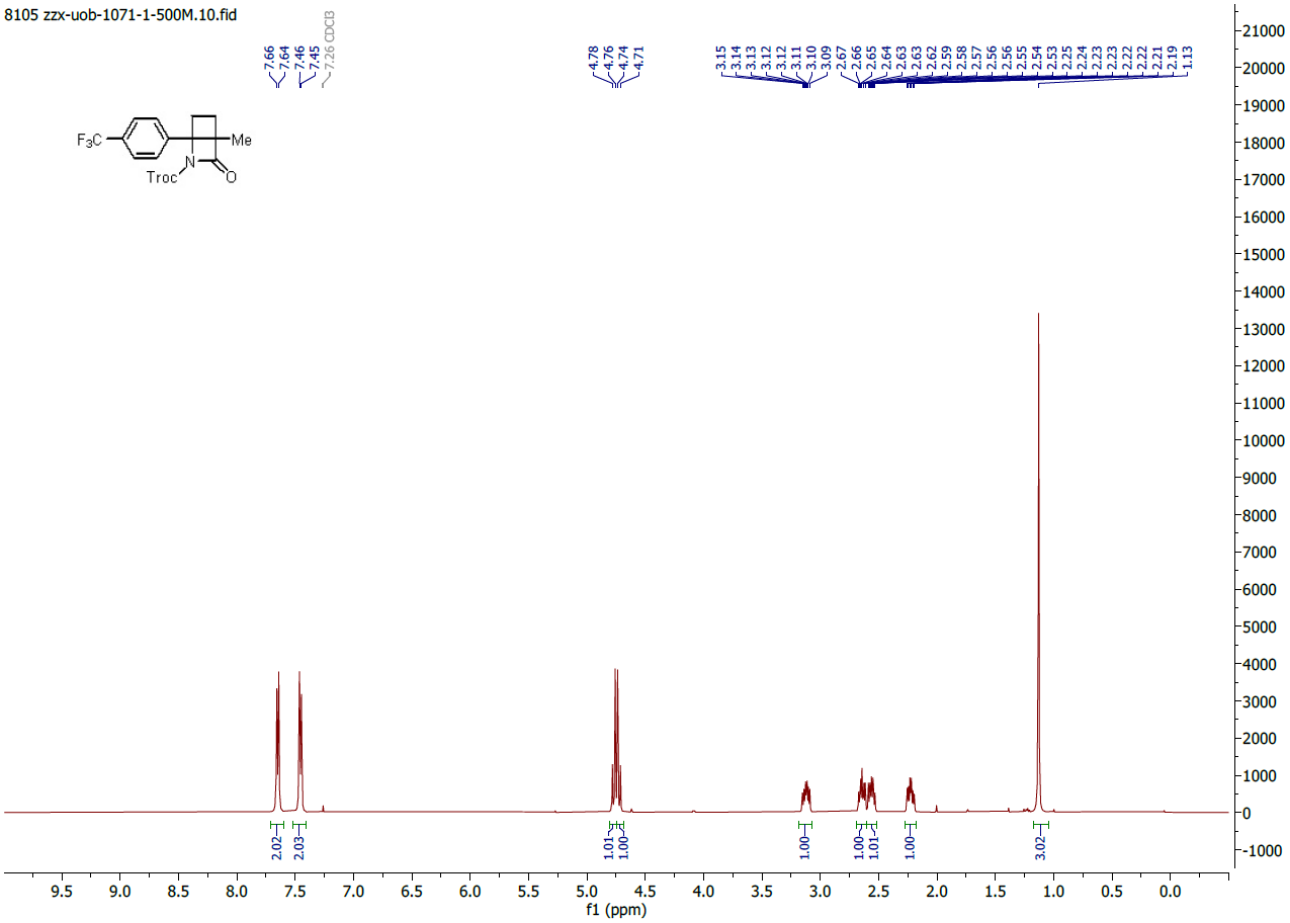
Compound 5d

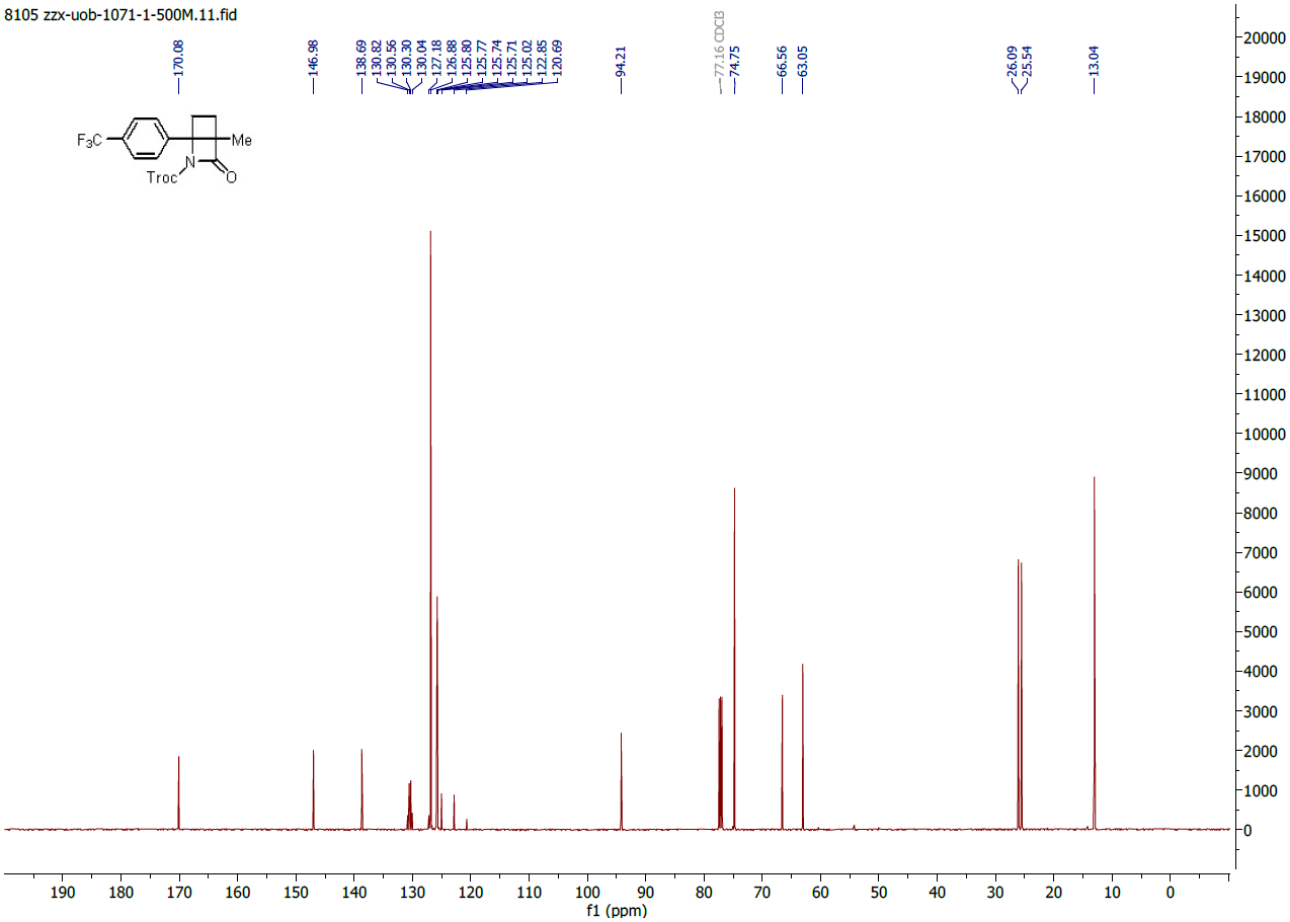

5337 zzx-uob-658-1-final-500M.10.fid
7.62
7.60
7.38
7.37
7.26 CDCl3
2.74
2.74
2.73
2.73
2.45
2.44
2.44
2.43
2.40
1.39
F3C
Me
N
Ac
O
2.04
2.07
2.02
2.01
3.00
3.00
f1 (ppm)

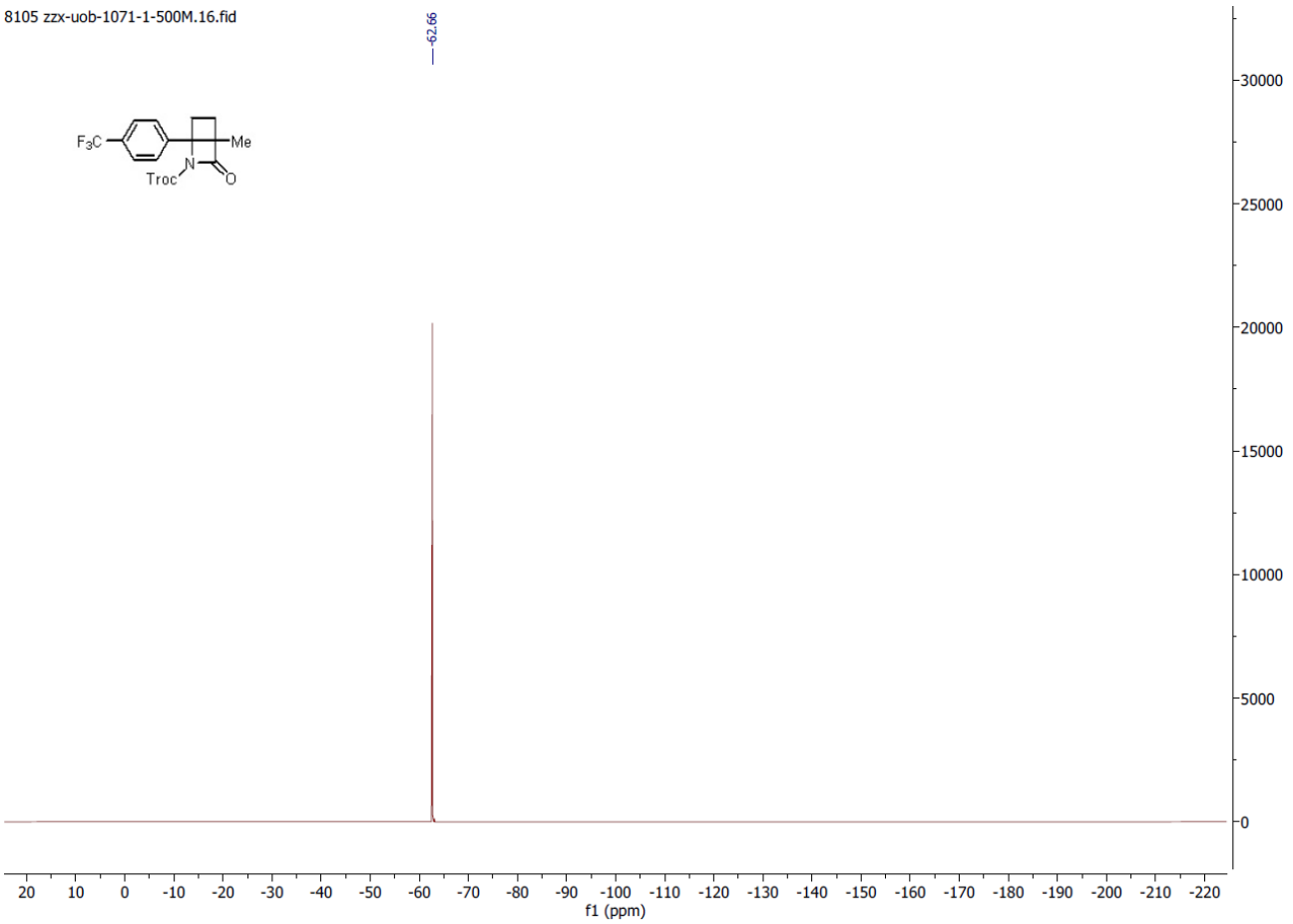

5337 zzx-uob-658-1-final-500M.11.fid
179.31
169.55
141.03
130.55
130.29
130.03
129.77
127.41
126.85
125.36
125.33
125.30
125.27
125.25
123.08
120.92
77.16 CDCl3
67.85
54.55
49.88
25.78
13.25
F3C
Me
N
Ac
O
f1 (ppm)


5337 zzx-uob-658-1-final-500M.15.fid
-62.58
F3C
Me
N
Ac
O
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

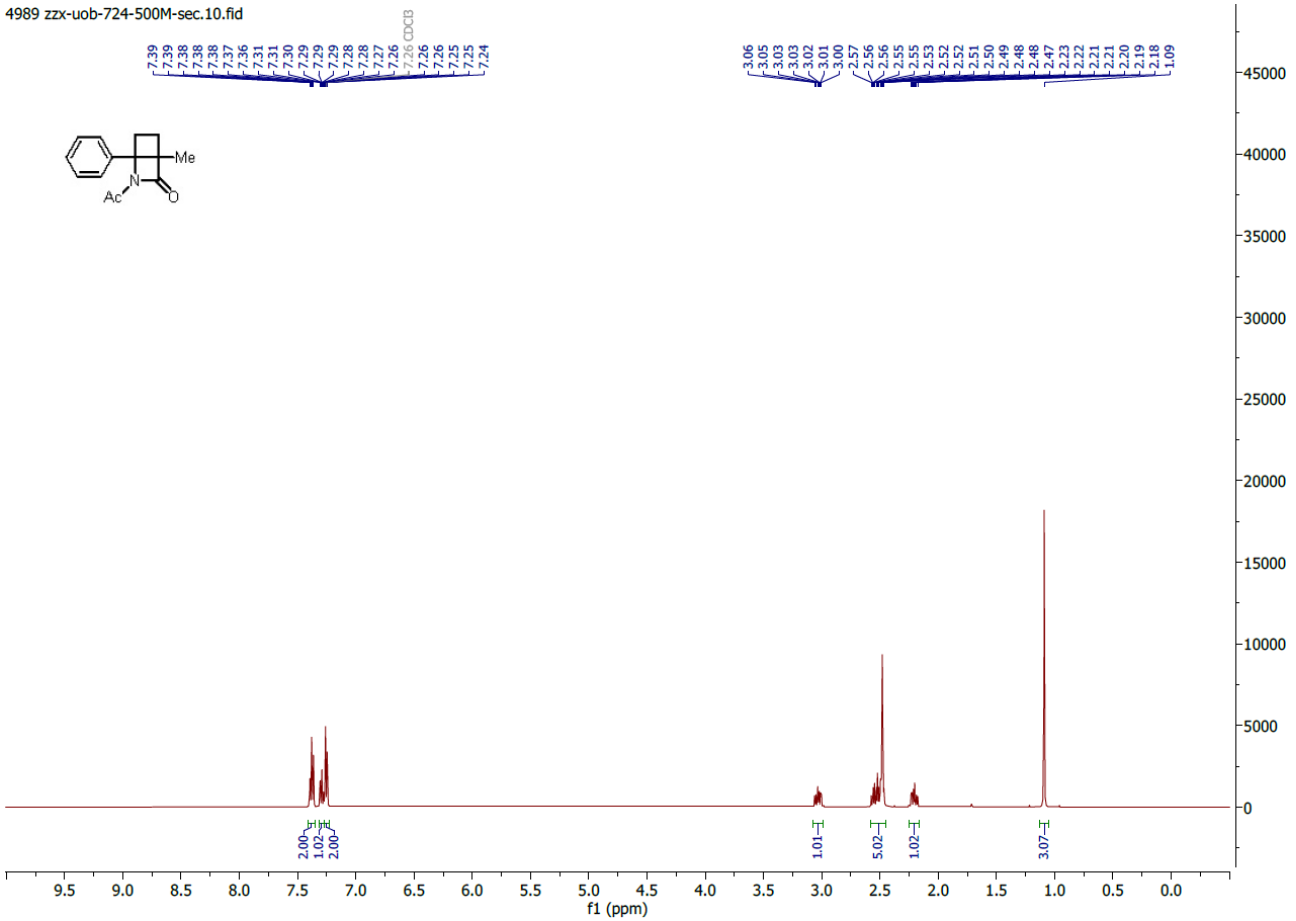
Compound 6e

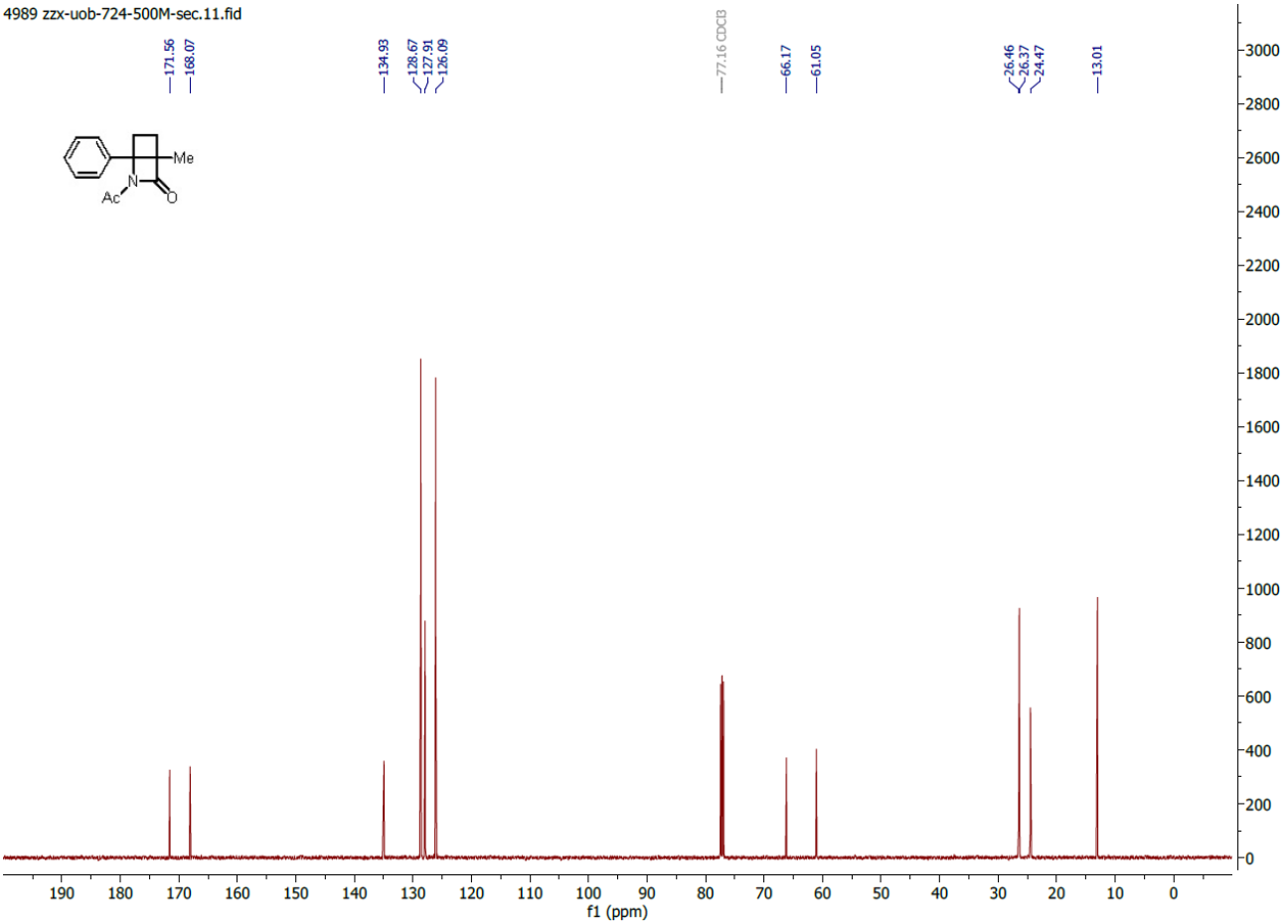

8105 zzx-uob-1071-1-500M.10.fid
7.66
7.64
7.46
7.45
7.26 CDCl3
4.78
4.76
4.74
4.71
3.15
3.14
3.13
3.12
3.12
3.11
3.10
3.09
2.67
2.66
2.65
2.64
2.63
2.63
2.62
2.59
2.58
2.57
2.56
2.56
2.55
2.54
2.53
2.25
2.24
2.23
2.23
2.22
2.22
2.21
2.19
1.13
F3C
Me
N
Troc
O
2.02
2.03
1.01
1.00
1.00
1.00
1.01
1.00
3.02
f1 (ppm)


8105 zzx-uob-1071-1-500M.11.fid
170.08
146.98
138.69
130.82
130.56
130.30
130.04
127.18
126.88
125.80
125.77
125.74
125.71
125.02
122.85
120.69
94.21
77.16 CDCl3
74.75
66.56
63.05
26.09
25.54
13.04
F3C
Me
N
Troc
O
f1 (ppm)

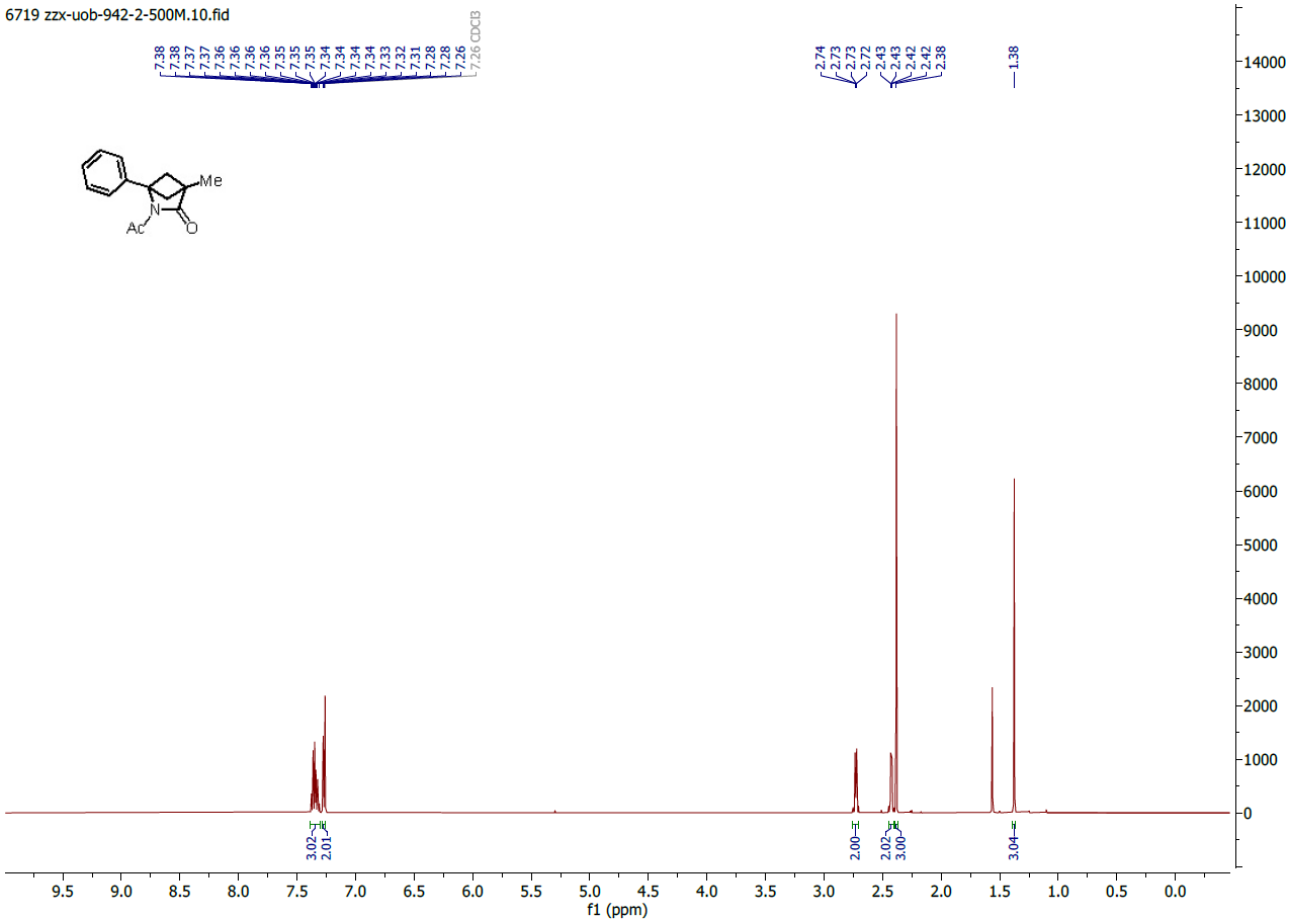

8105 zzx-uob-1071-1-500M.16.fid
-62.66
F3C
Me
Troc
N
O
30000
25000
20000
15000
10000
5000
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

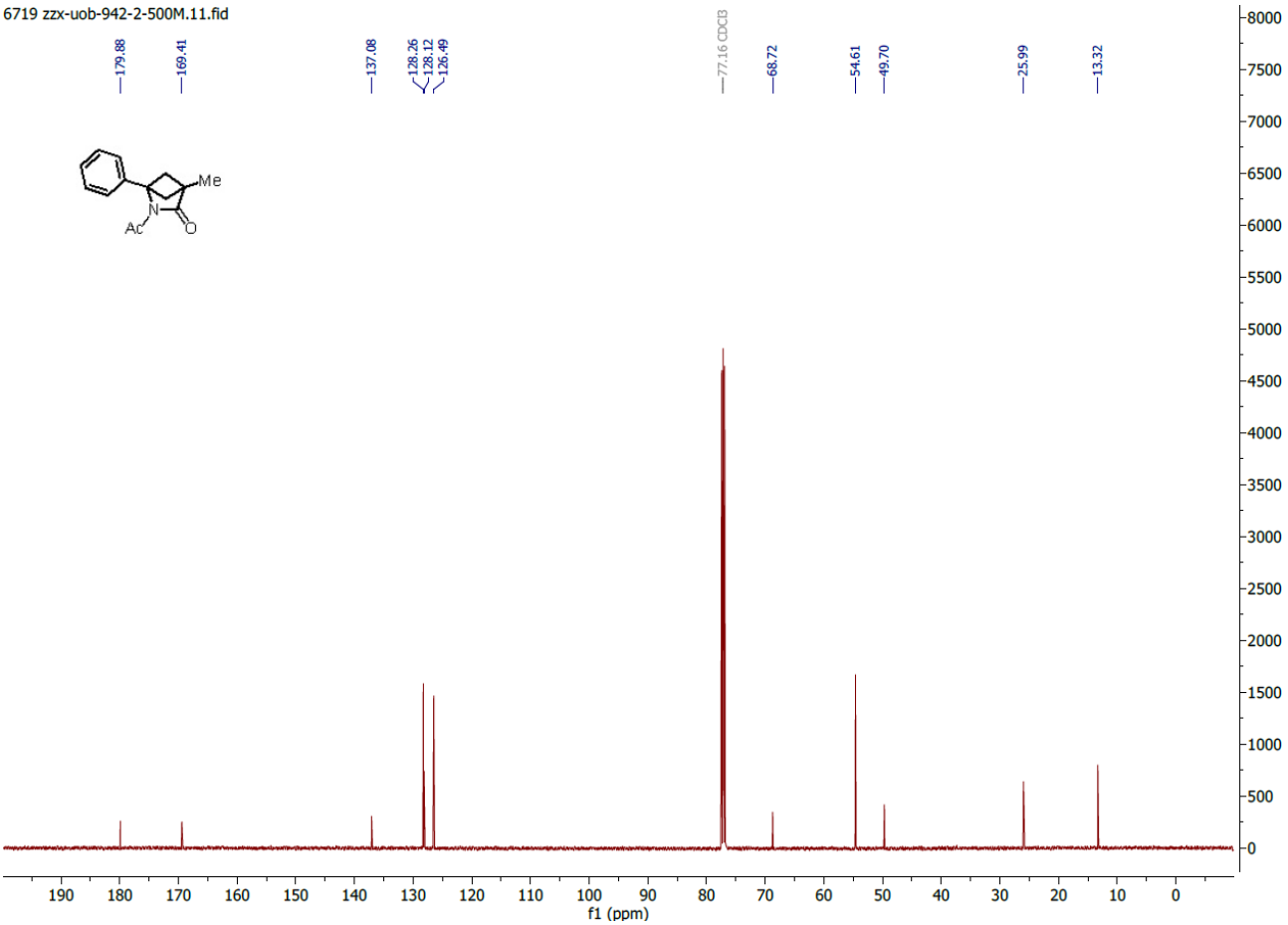
Compound 6f


4989 zzx-uob-724-500M-sec.10.fid
Me
Ac
N
O
f1 (ppm)

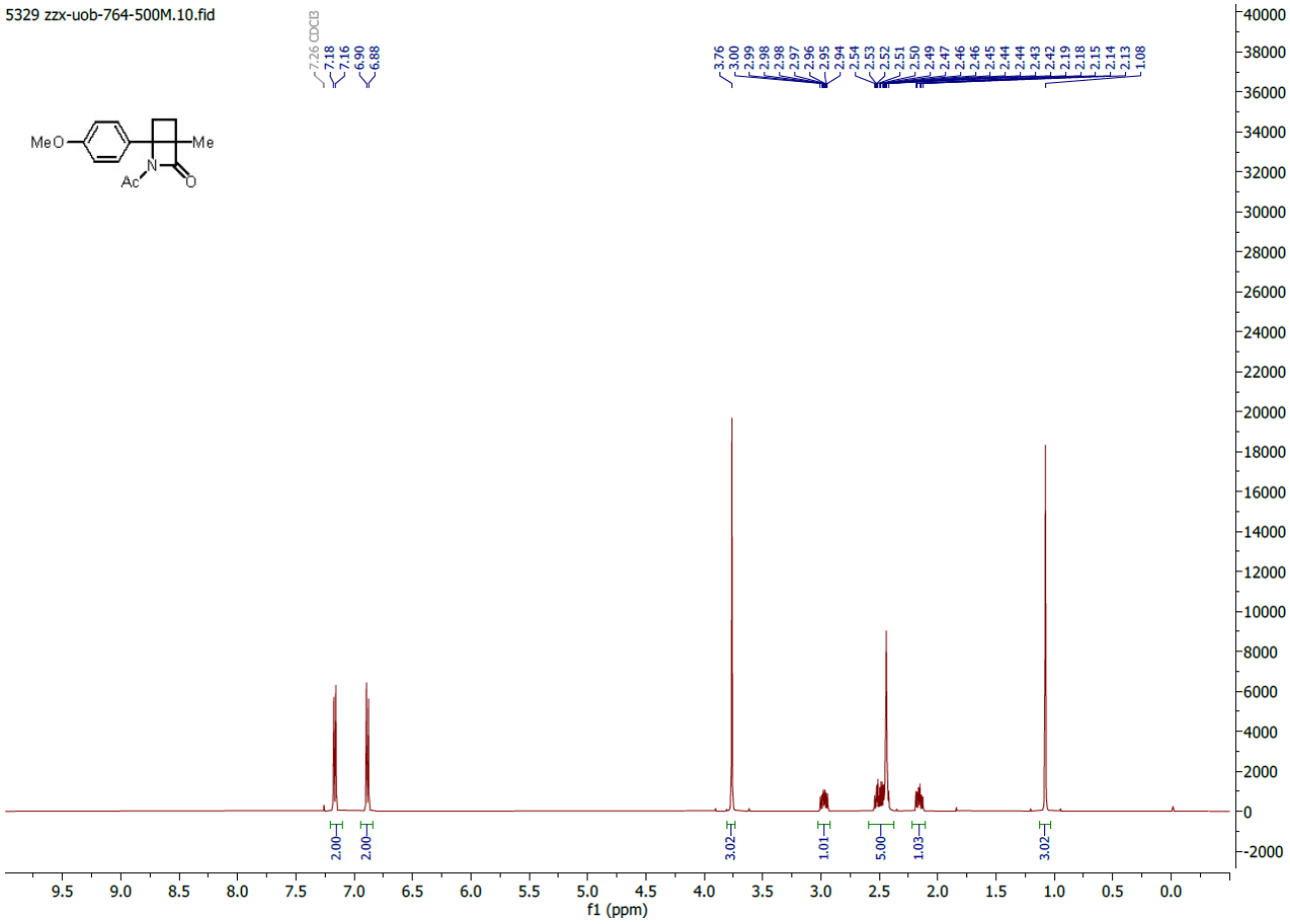

4989 zzx-uob-724-500M-sec.11.fid
171.56
168.07
134.93
128.67
127.91
126.09
77.16 CDCl3
66.17
61.05
26.46
26.37
24.47
13.01
Me
Ac
N
O
f1 (ppm)

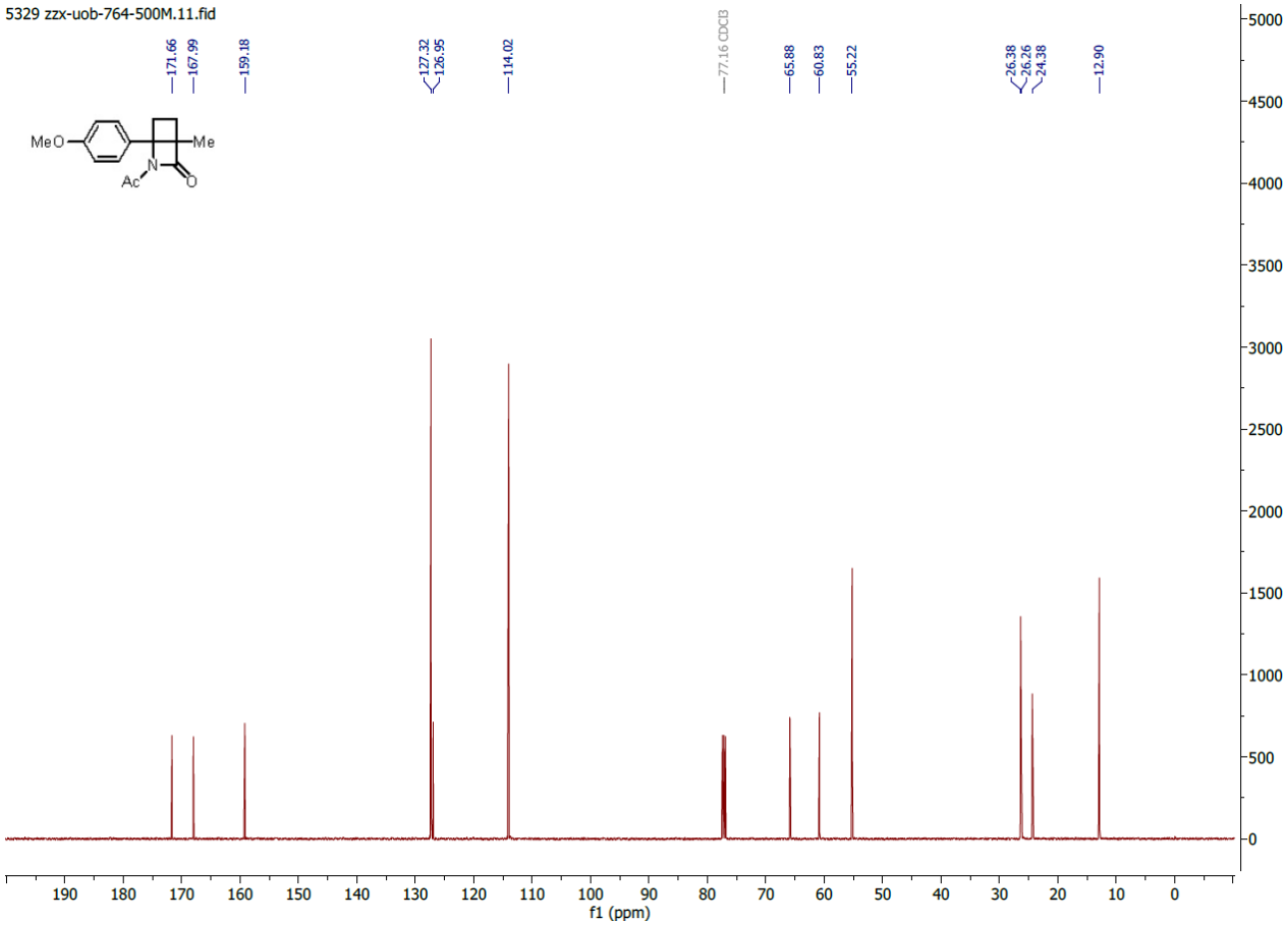
Compound 5f


6719 zzx-uob-942-2-500M.10.fid
7.38
7.38
7.37
7.37
7.36
7.36
7.36
7.35
7.35
7.35
7.34
7.34
7.34
7.34
7.33
7.32
7.31
7.28
7.26
7.26 CDCl3
2.74
2.73
2.73
2.72
2.43
2.42
2.42
2.38
1.38
Me
N
Ac
O
3.02
2.01
2.00
2.02
3.00
3.04
f1 (ppm)

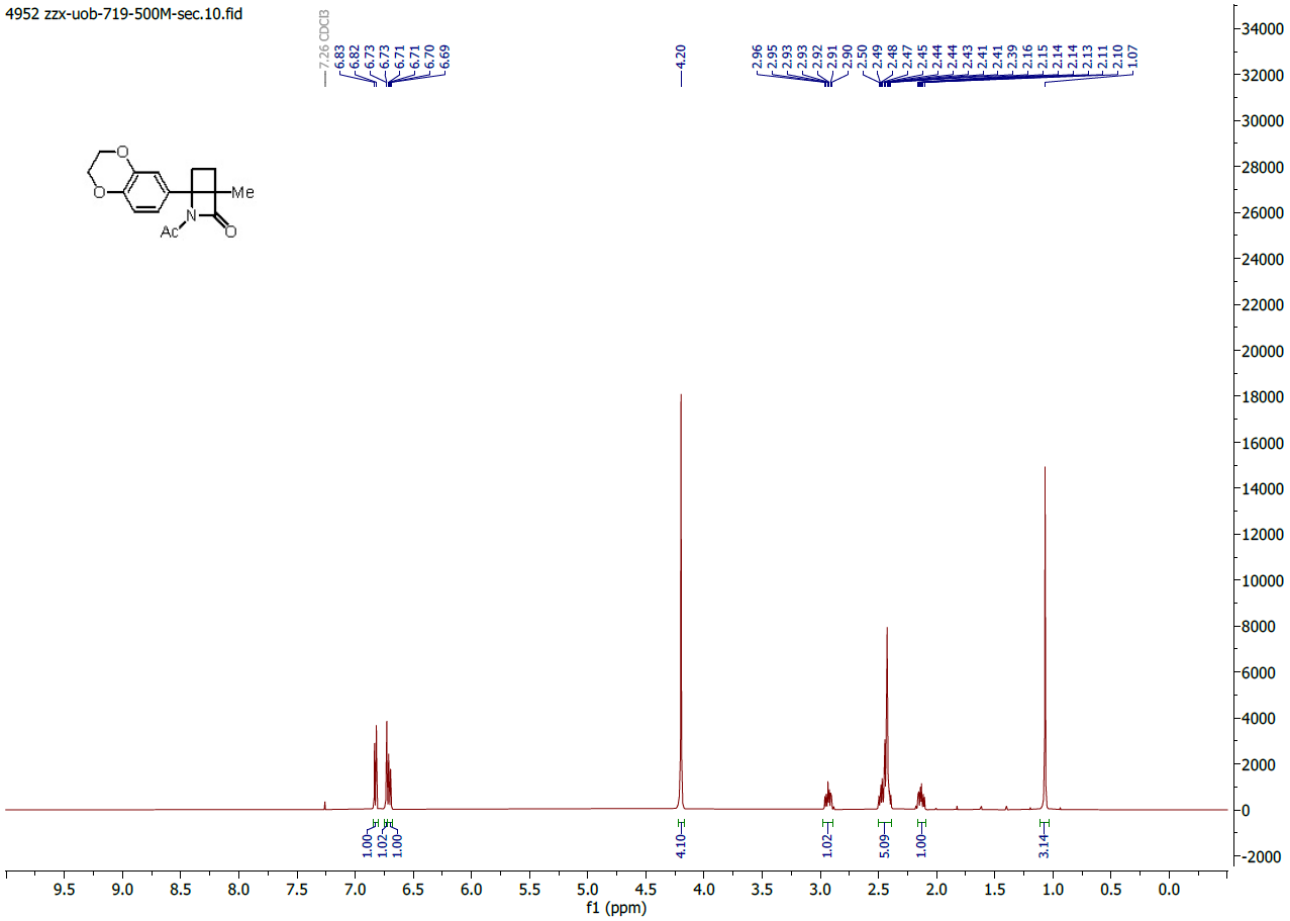

6719 zzx-uob-942-2-500M.11.fid
179.88
169.41
137.08
128.26
128.12
126.49
77.16 CDCl3
68.72
54.61
49.70
25.99
13.32
Me
N
Ac
O
f1 (ppm)

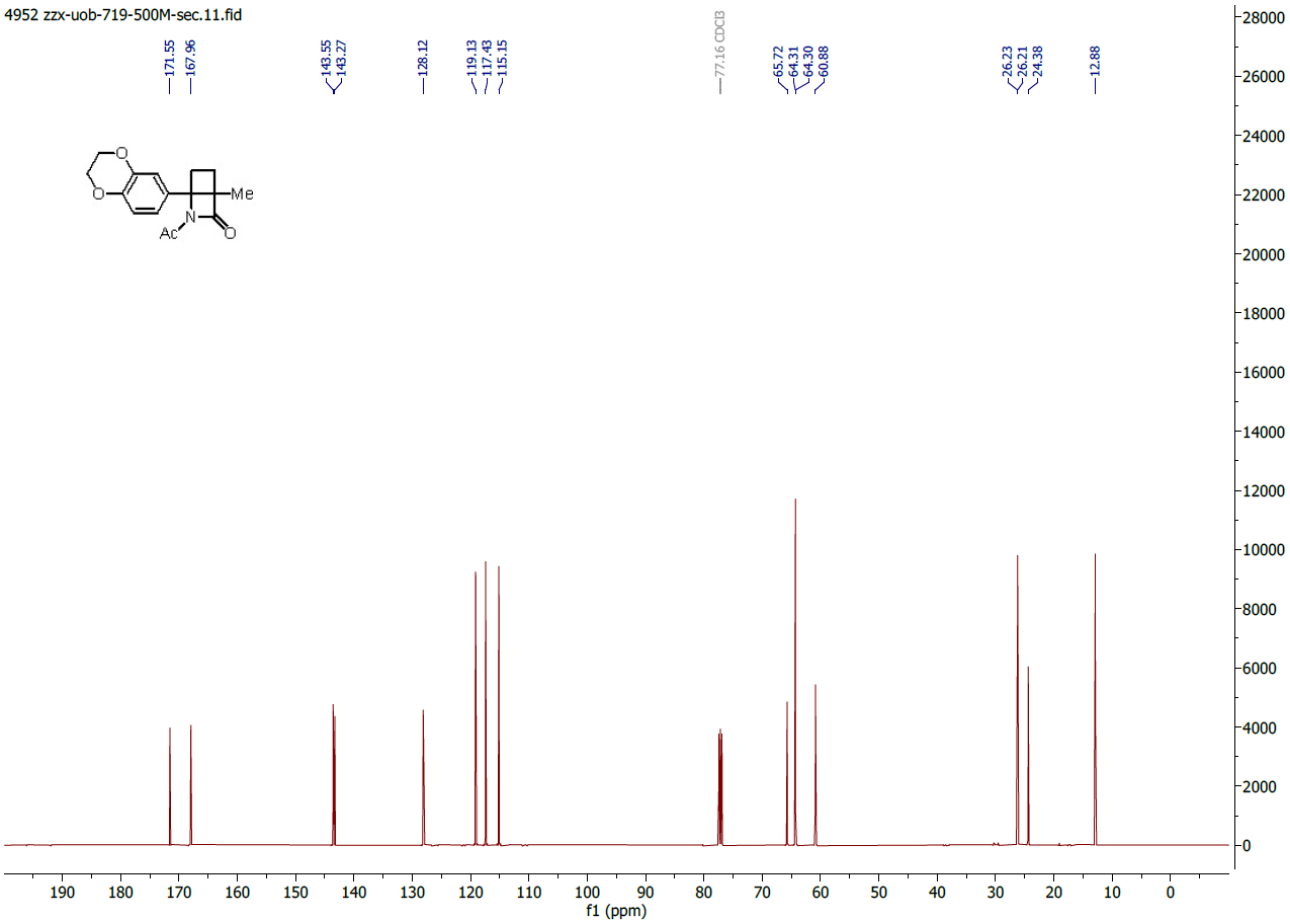
Compound 6g


5329 zzx-uob-764-500M.10.fid
MeO
Me
Ac
N
O
f1 (ppm)

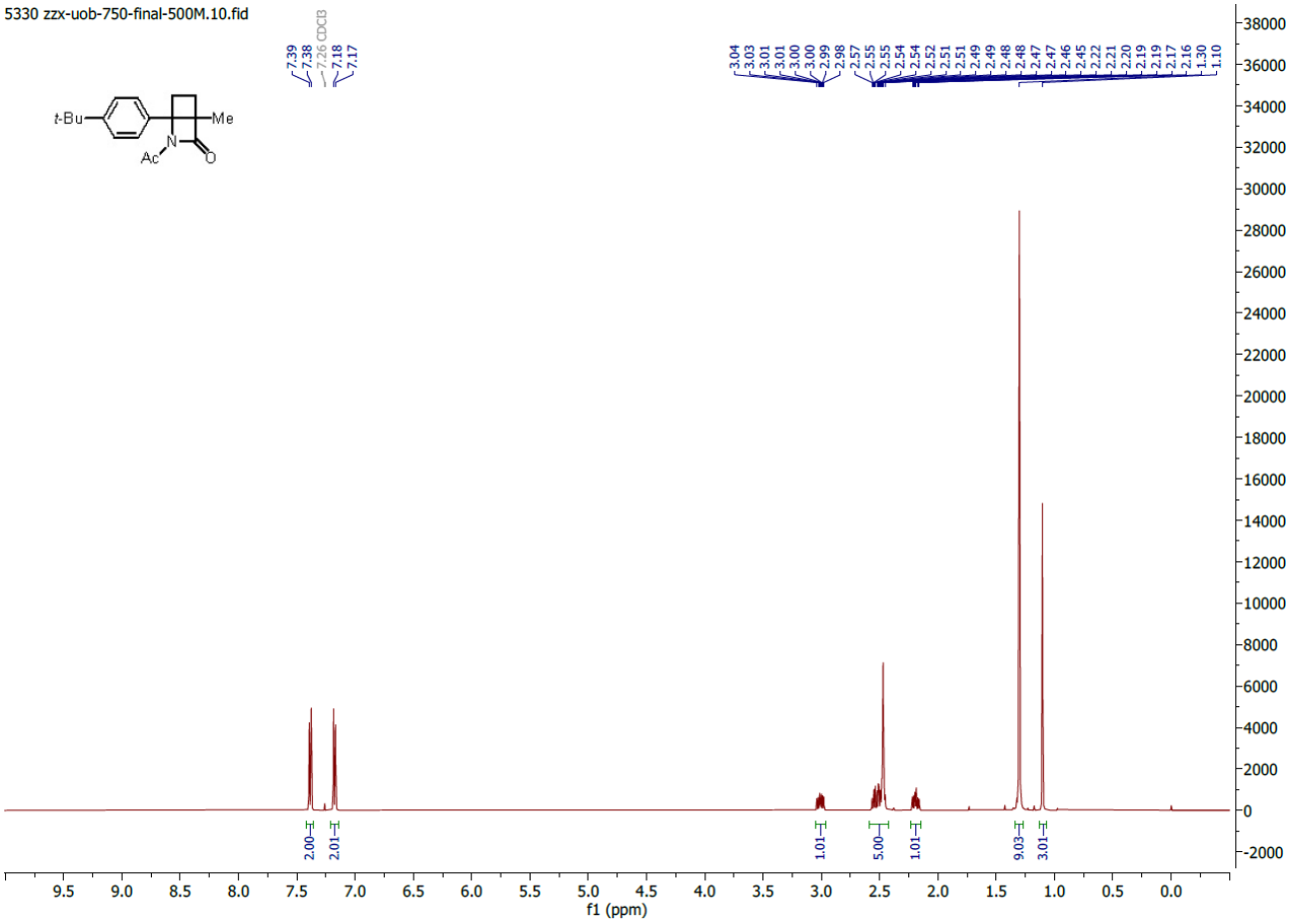

5329 zzx-uob-764-500M.11.fid
MeO
Me
Ac
N
O
f1 (ppm)

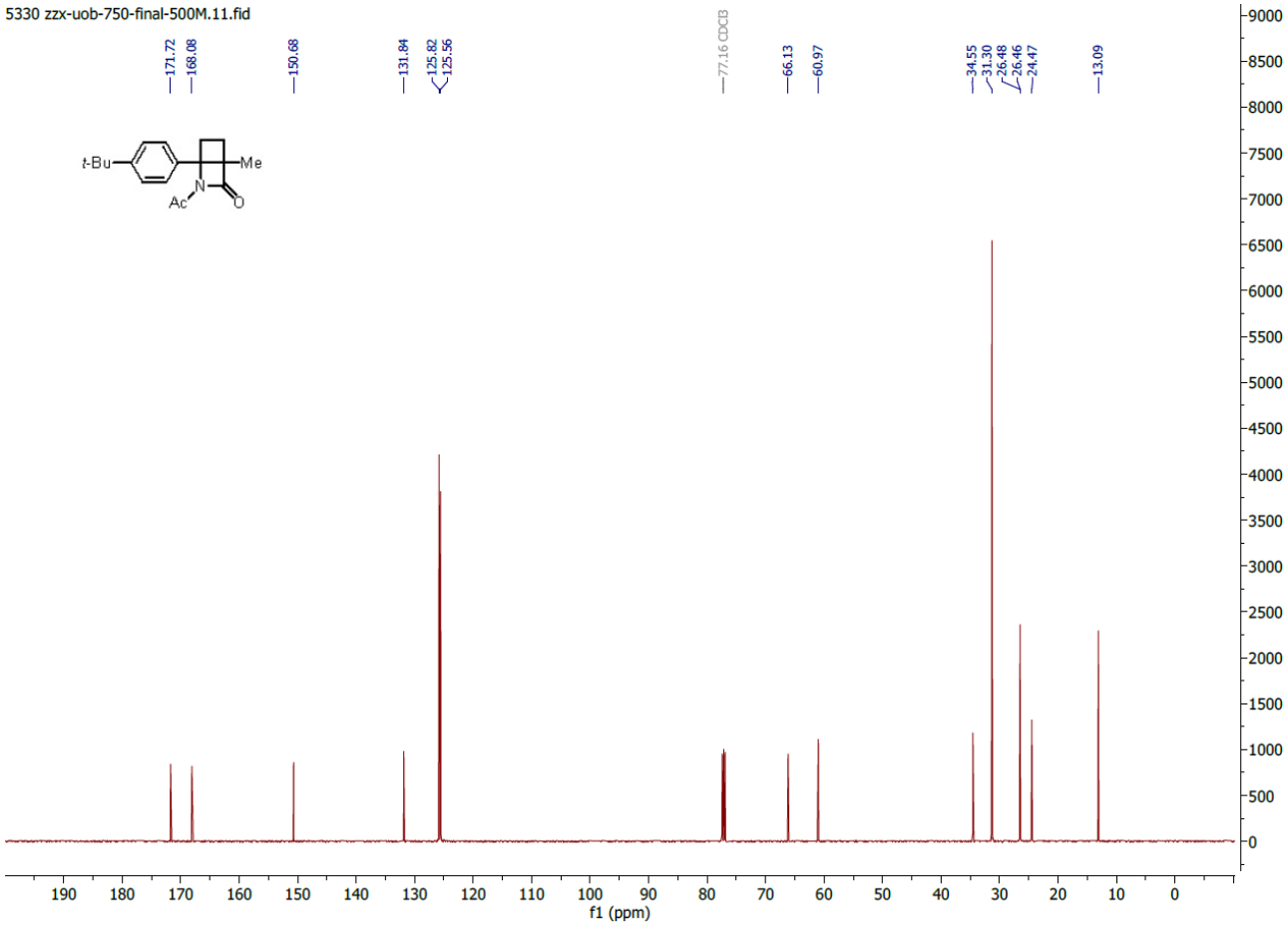
Compound 6h


4952 zzx-uob-719-500M-sec.10.fid
7.26 CDCl3
6.83
6.82
6.73
6.73
6.71
6.71
6.70
6.69
4.20
2.96
2.95
2.93
2.93
2.92
2.91
2.90
2.50
2.49
2.48
2.47
2.45
2.44
2.44
2.43
2.41
2.41
2.39
2.16
2.15
2.14
2.14
2.13
2.11
2.10
1.07
Me
Ac
N
O
O
O
1.00
1.02
1.00
4.10
1.02
5.09
1.00
3.14
f1 (ppm)

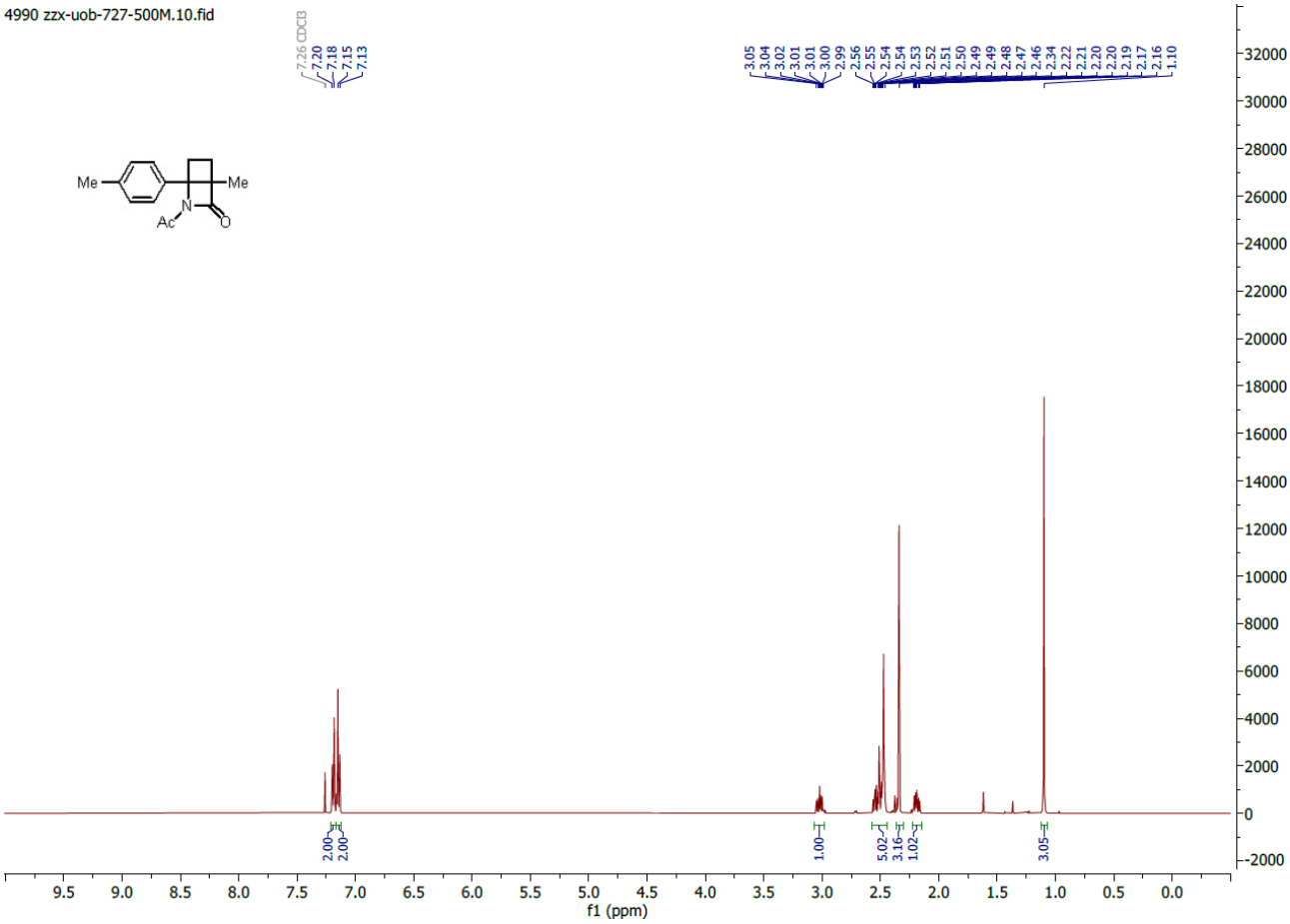

4952 zzx-uob-719-500M-sec.11.fid
171.55
167.96
143.55
143.27
128.12
119.13
117.43
115.15
77.16 CDCl3
65.72
64.31
64.30
60.88
26.23
26.21
24.38
12.88
Me
Ac
N
O
O
O
f1 (ppm)

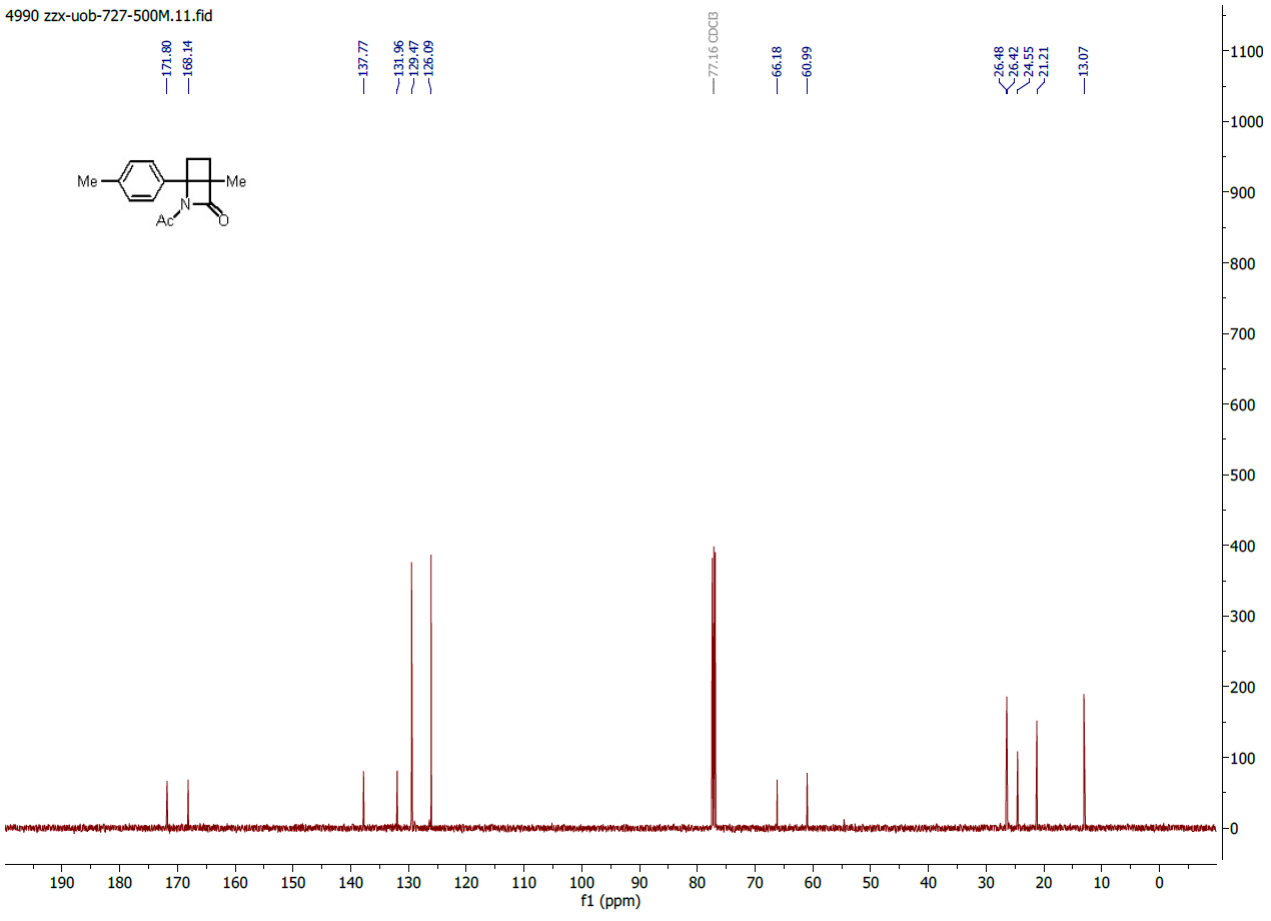
Compound 6i


5330 zzx-uob-750-final-500M.10.fid
7.39
7.38
7.26 CDCl3
7.18
7.17
3.04
3.03
3.01
3.01
3.00
3.00
2.99
2.98
2.57
2.55
2.55
2.54
2.54
2.52
2.51
2.51
2.49
2.49
2.48
2.48
2.47
2.47
2.46
2.45
2.22
2.21
2.20
2.19
2.19
2.17
2.16
1.30
1.10
t-Bu
Me
N
Ac
O
2.00
2.01
1.01
5.00
1.01
9.03
3.01
f1 (ppm)

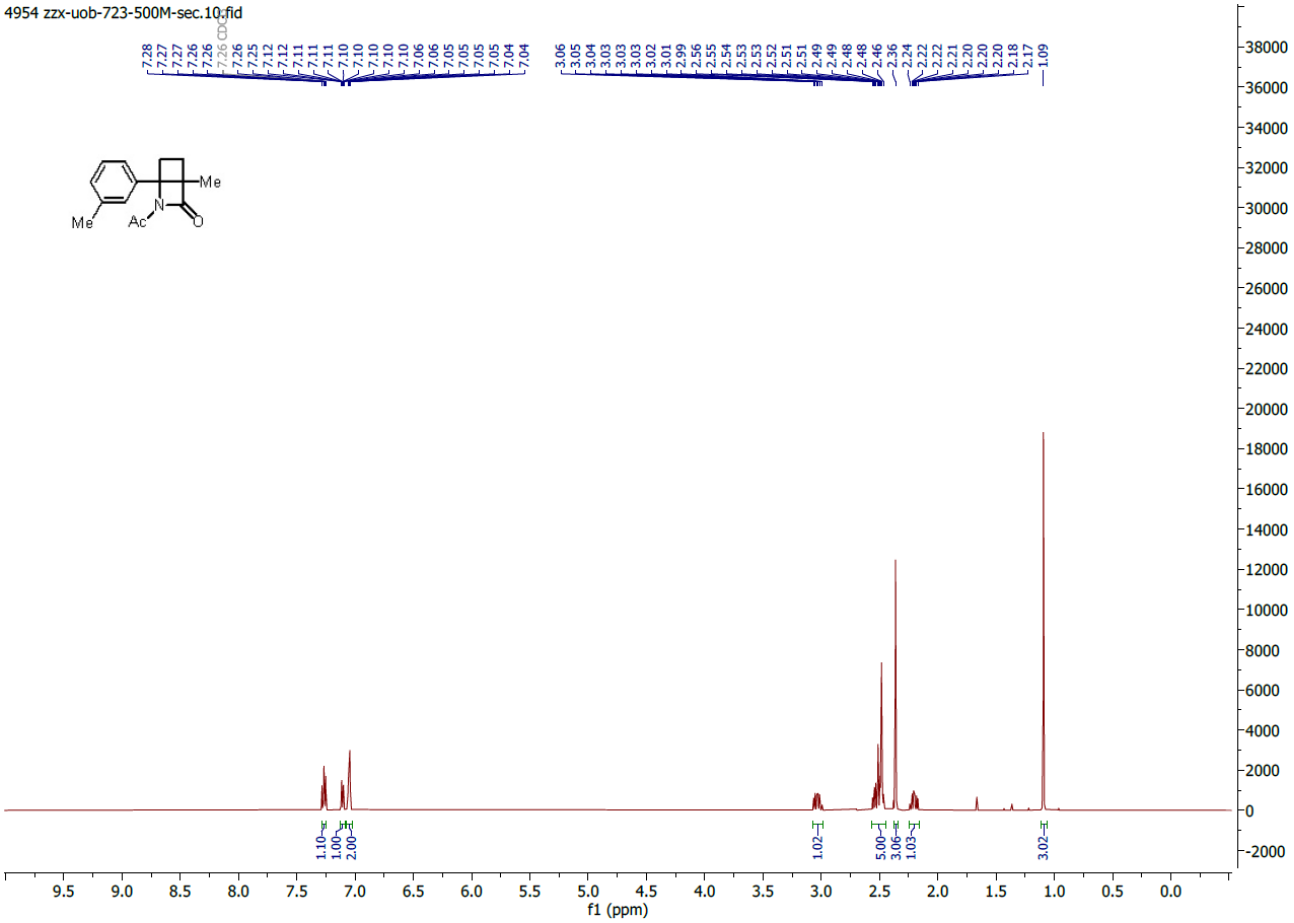

5330 zzx-uob-750-final-500M.11.fid
171.72
168.08
150.68
131.84
125.82
125.56
77.16 CDCl3
66.13
60.97
34.55
31.30
26.48
26.46
24.47
13.09
t-Bu
Me
N
Ac
O
f1 (ppm)

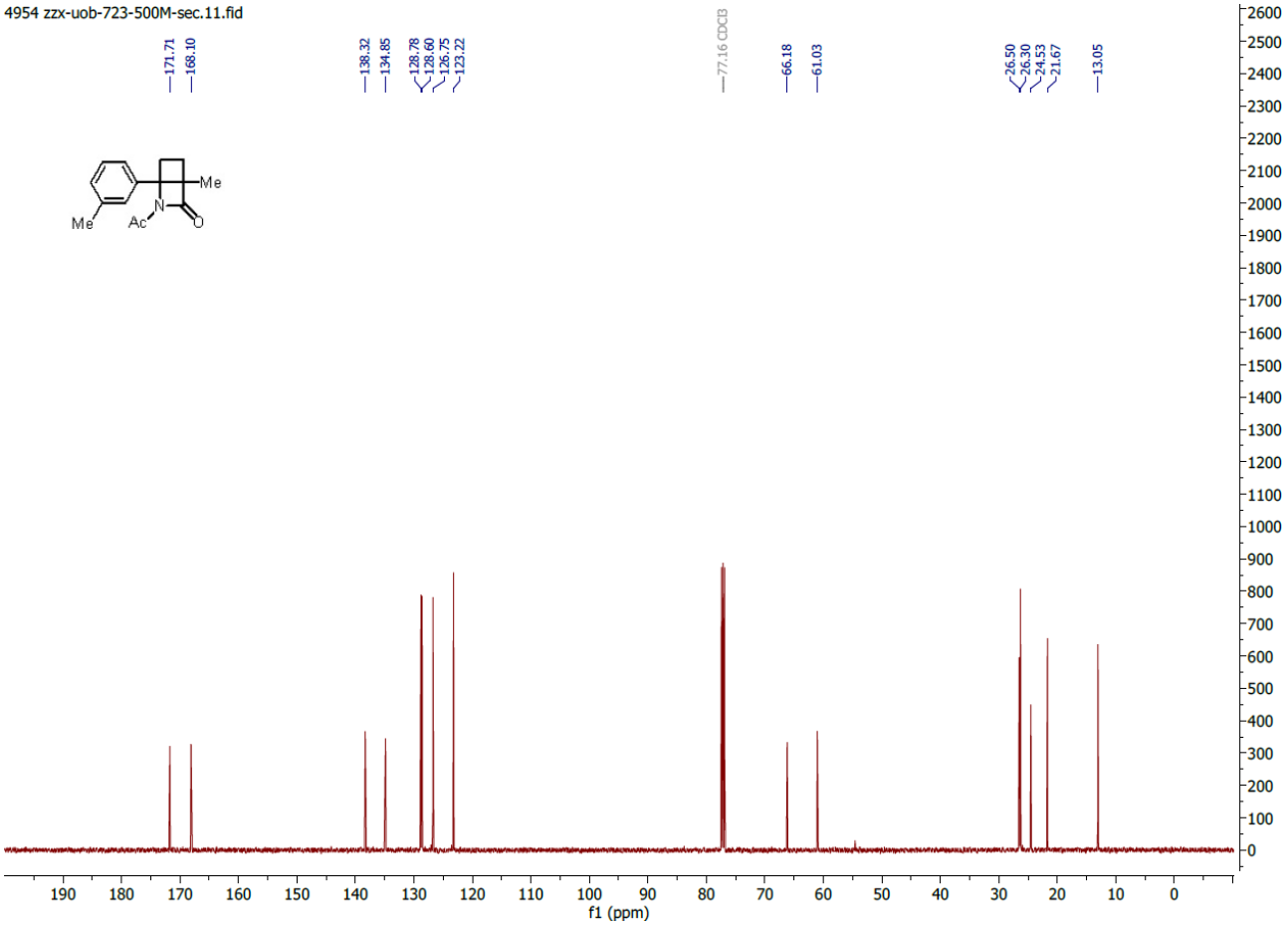
Compound 6j


4990 zzx-uob-727-500M.10.fid
Me
Me
Ac
N
O
f1 (ppm)

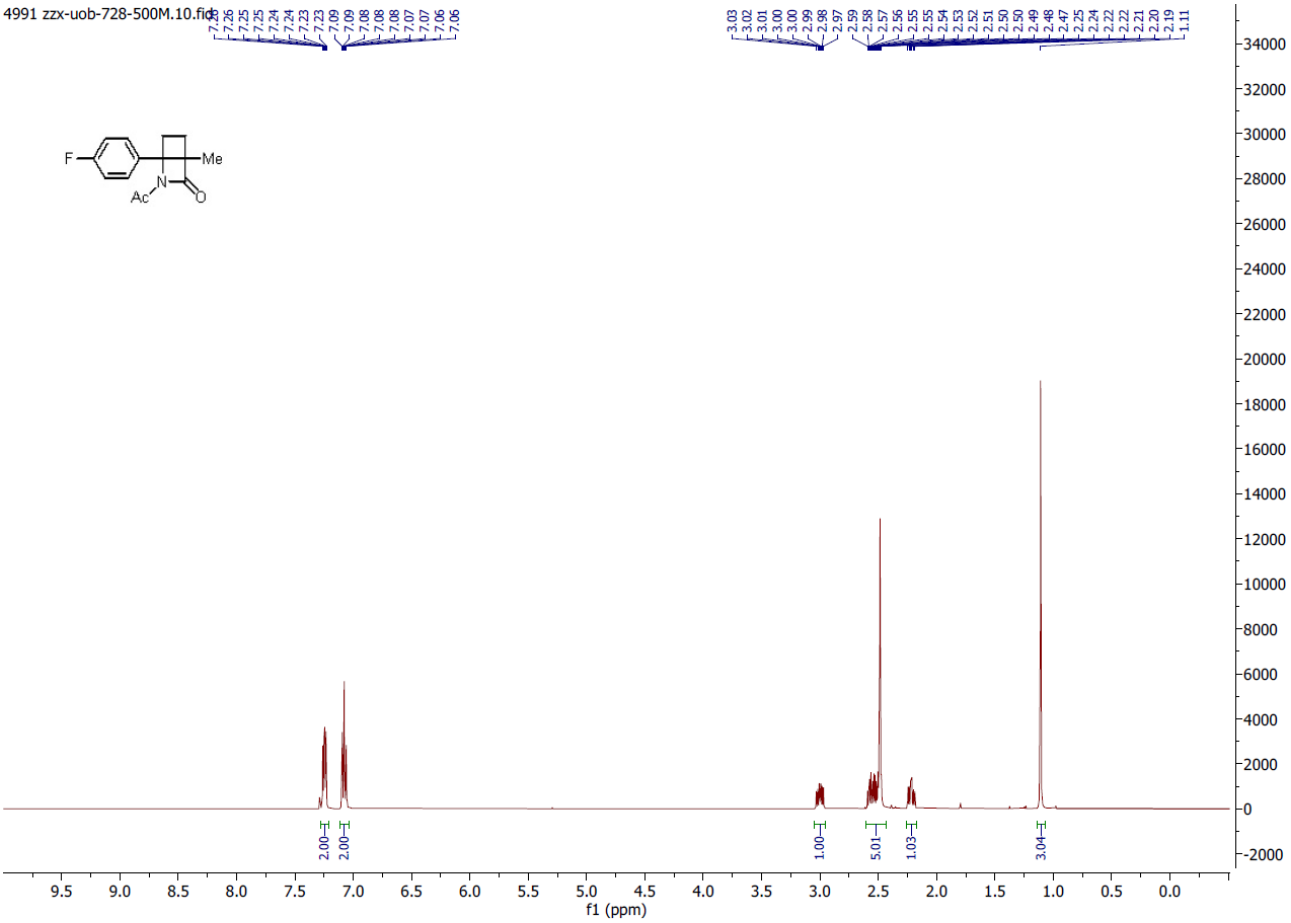

4990 zzx-uob-727-500M.11.fid
171.80
168.14
137.77
131.96
129.47
126.09
77.16 CDCl3
66.18
60.99
26.48
26.42
24.55
21.21
13.07
Me
Me
Ac
N
O
f1 (ppm)

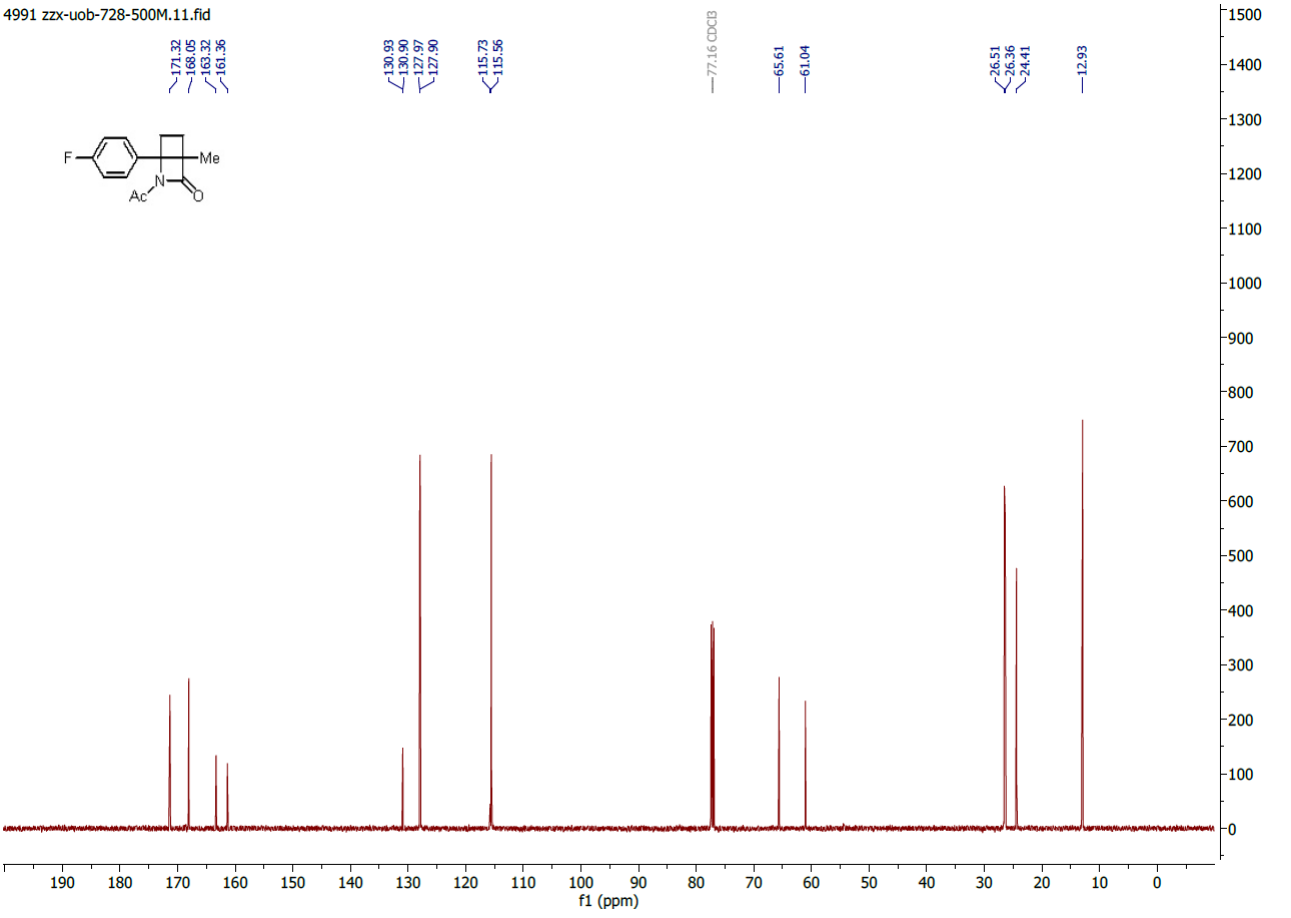
Compound 6k

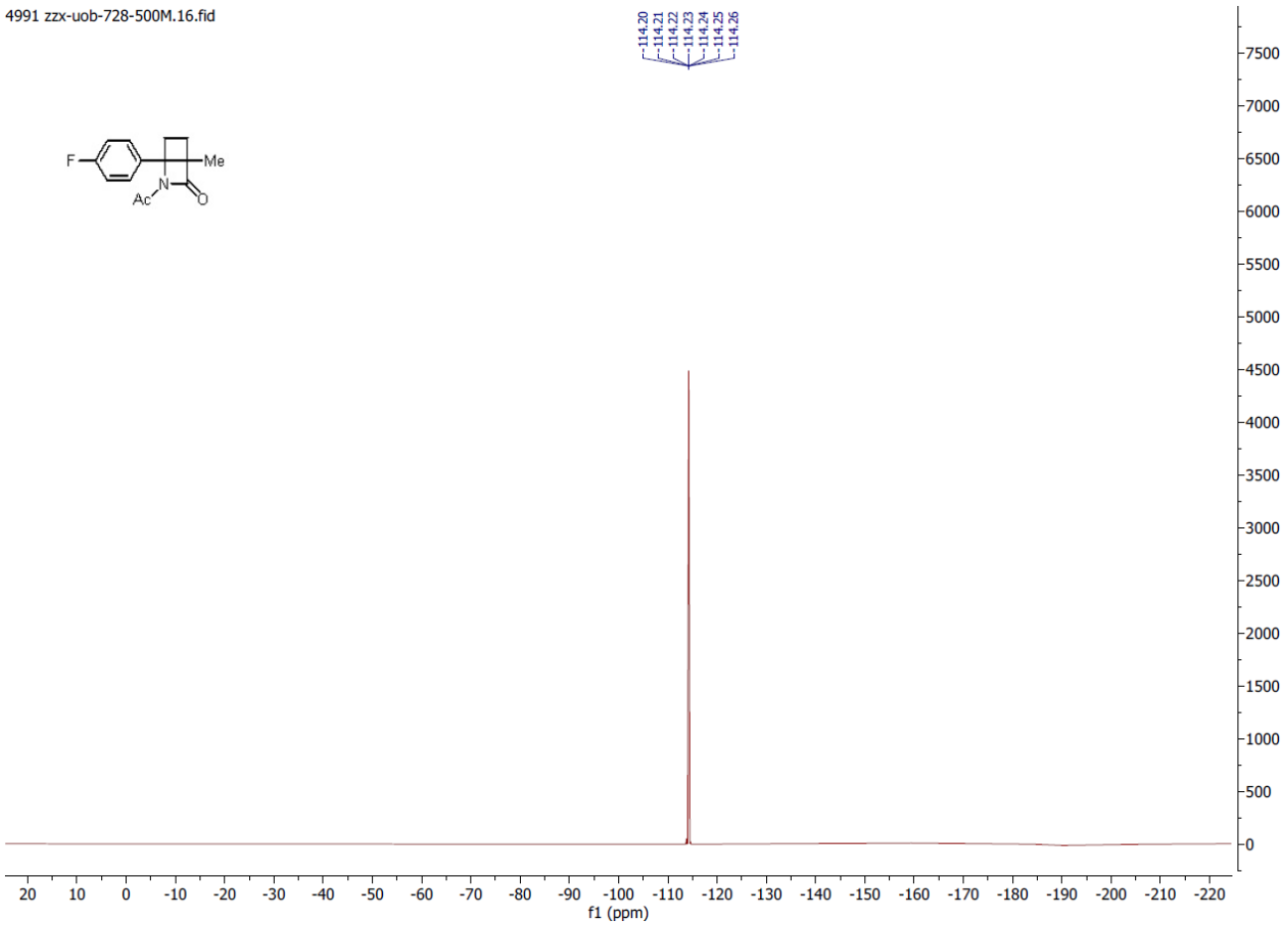

4954 zzx-uob-723-500M-sec.10.fid
Me
Ac
Me
f1 (ppm)


4954 zzx-uob-723-500M-sec.11.fid
171.71
168.10
138.32
134.85
128.78
128.60
126.75
123.22
77.16 CDCl3
66.18
61.03
26.50
26.30
24.53
21.67
13.05
Me
Ac
Me
f1 (ppm)

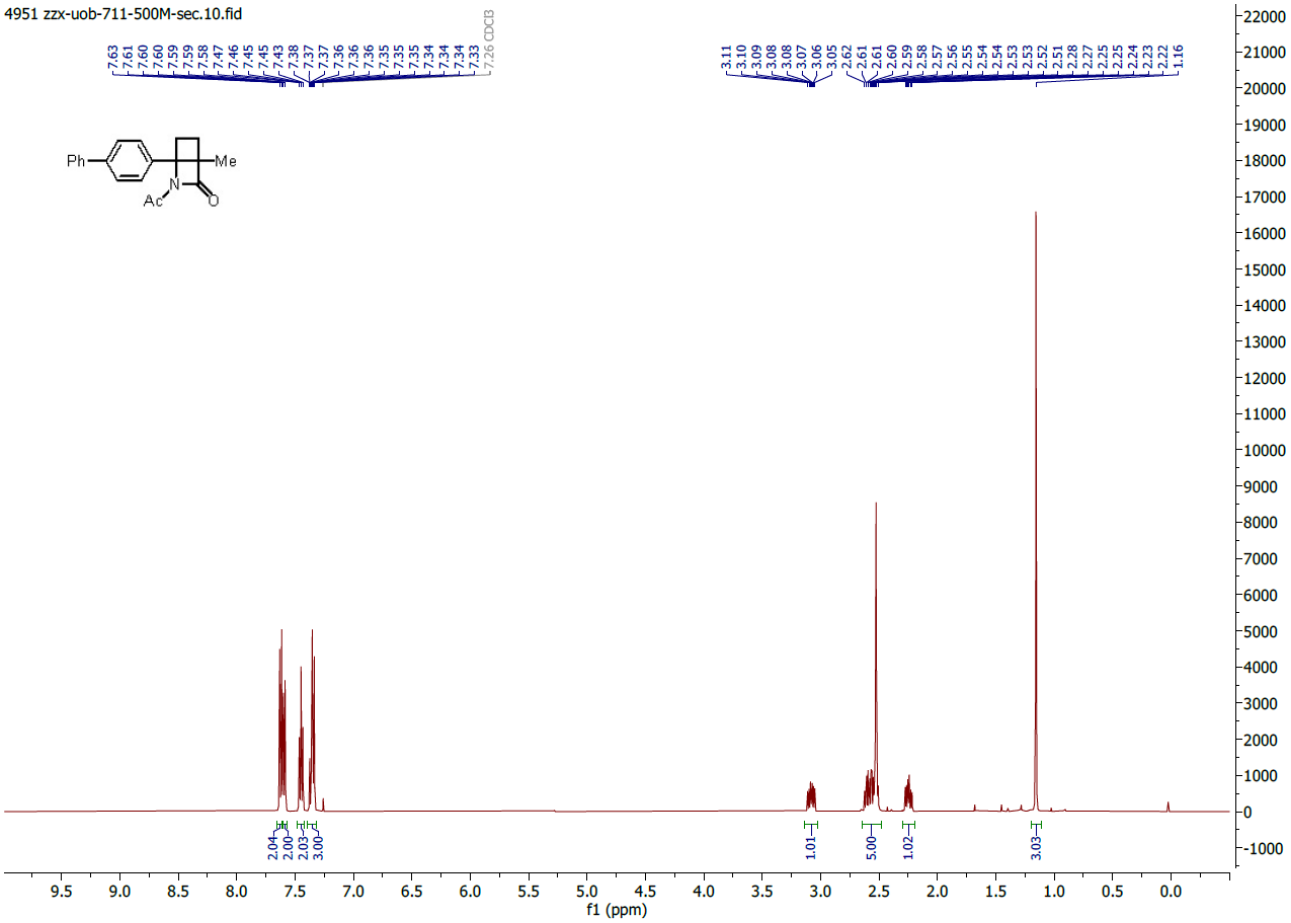
Compound 6l

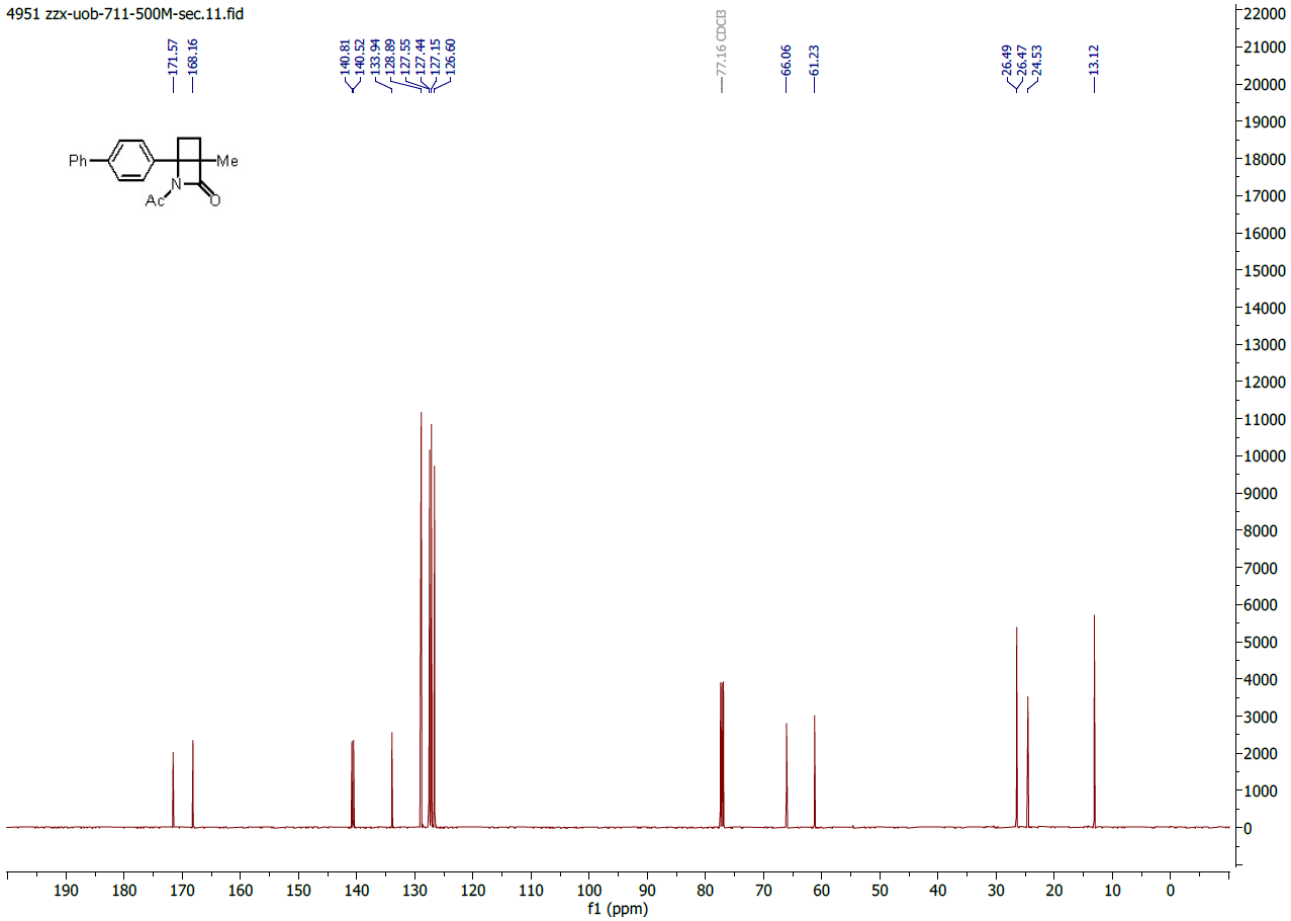

4991 zzx-uob-728-500M.10.fid
F
Me
Ac
N
O
f1 (ppm)


4991 zzx-uob-728-500M.11.fid
171.32
168.05
163.32
161.36
130.93
130.90
127.97
127.90
115.73
115.56
77.16 CDCl3
65.61
61.04
26.51
26.36
24.41
12.93
F
Me
Ac
N
O
f1 (ppm)

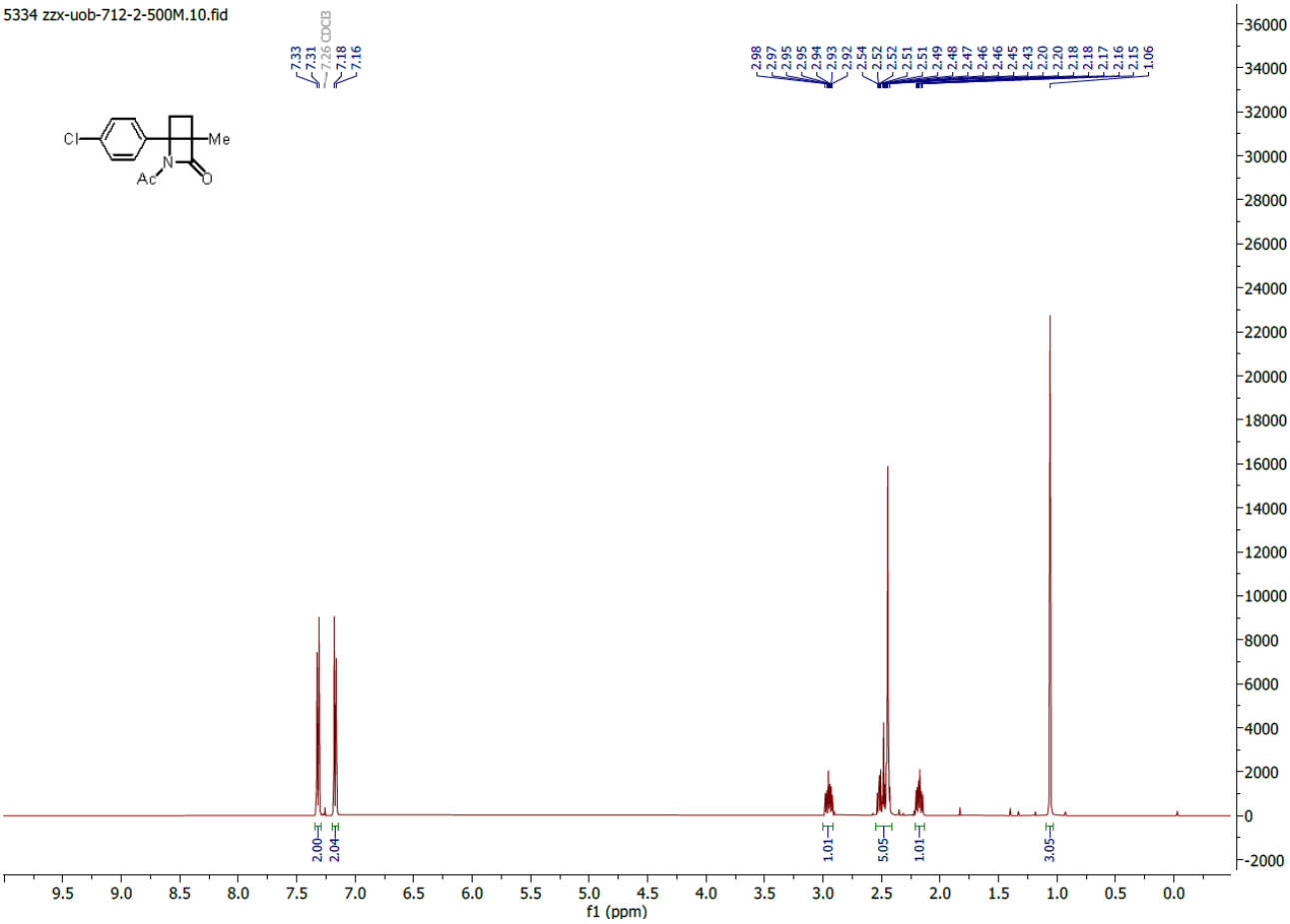

4991 zzx-uob-728-500M.16.fid
114.20
114.21
114.22
114.23
114.24
114.25
114.26
F
Me
N
Ac
O
7500
7000
6500
6000
5500
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

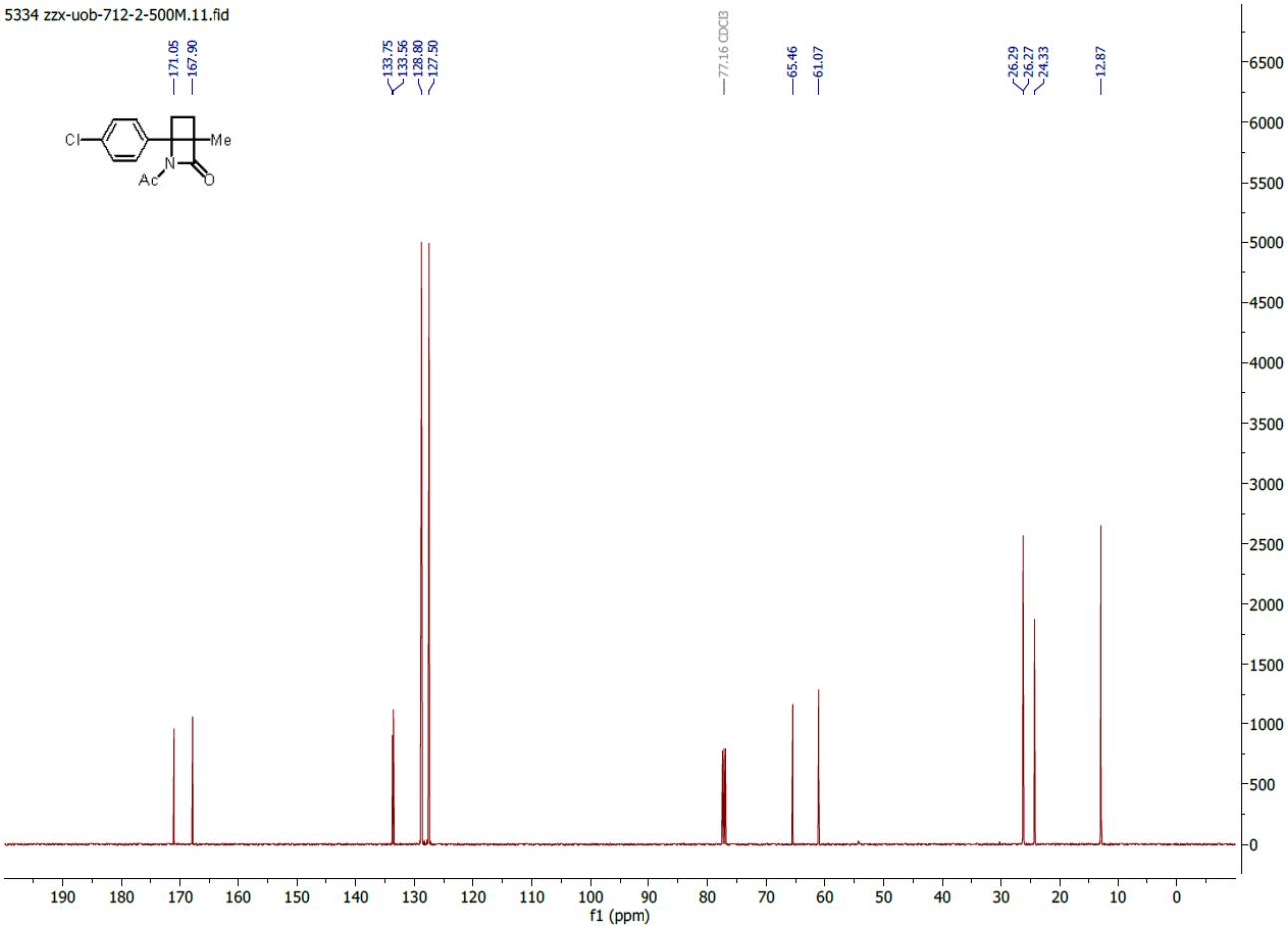
Compound 6m


4951 zzx-uob-711-500M-sec.10.fid
Ph
Me
Ac
N
O
f1 (ppm)

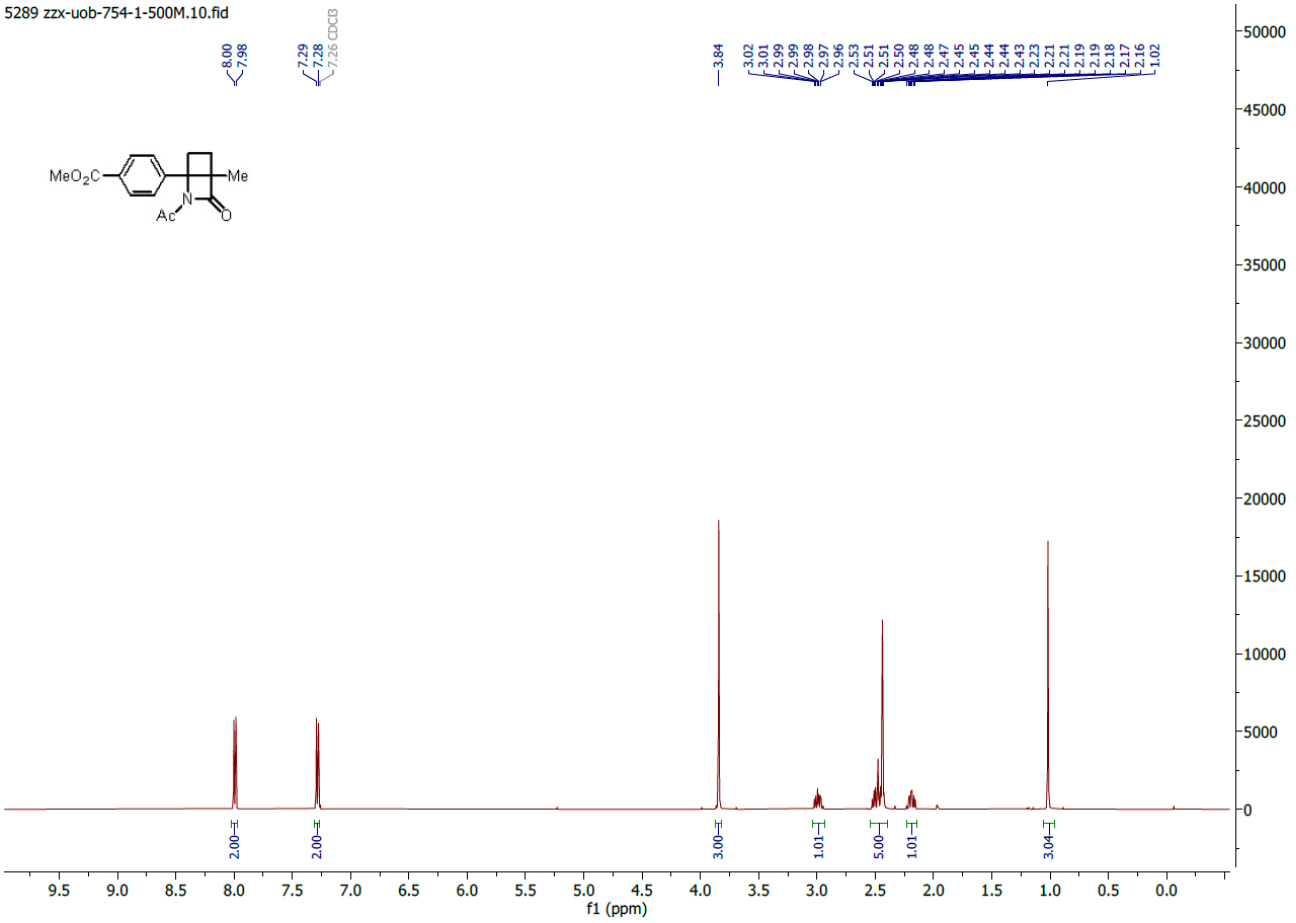

4951 zzx-uob-711-500M-sec.11.fid
Ph
Me
Ac
N
O
f1 (ppm)

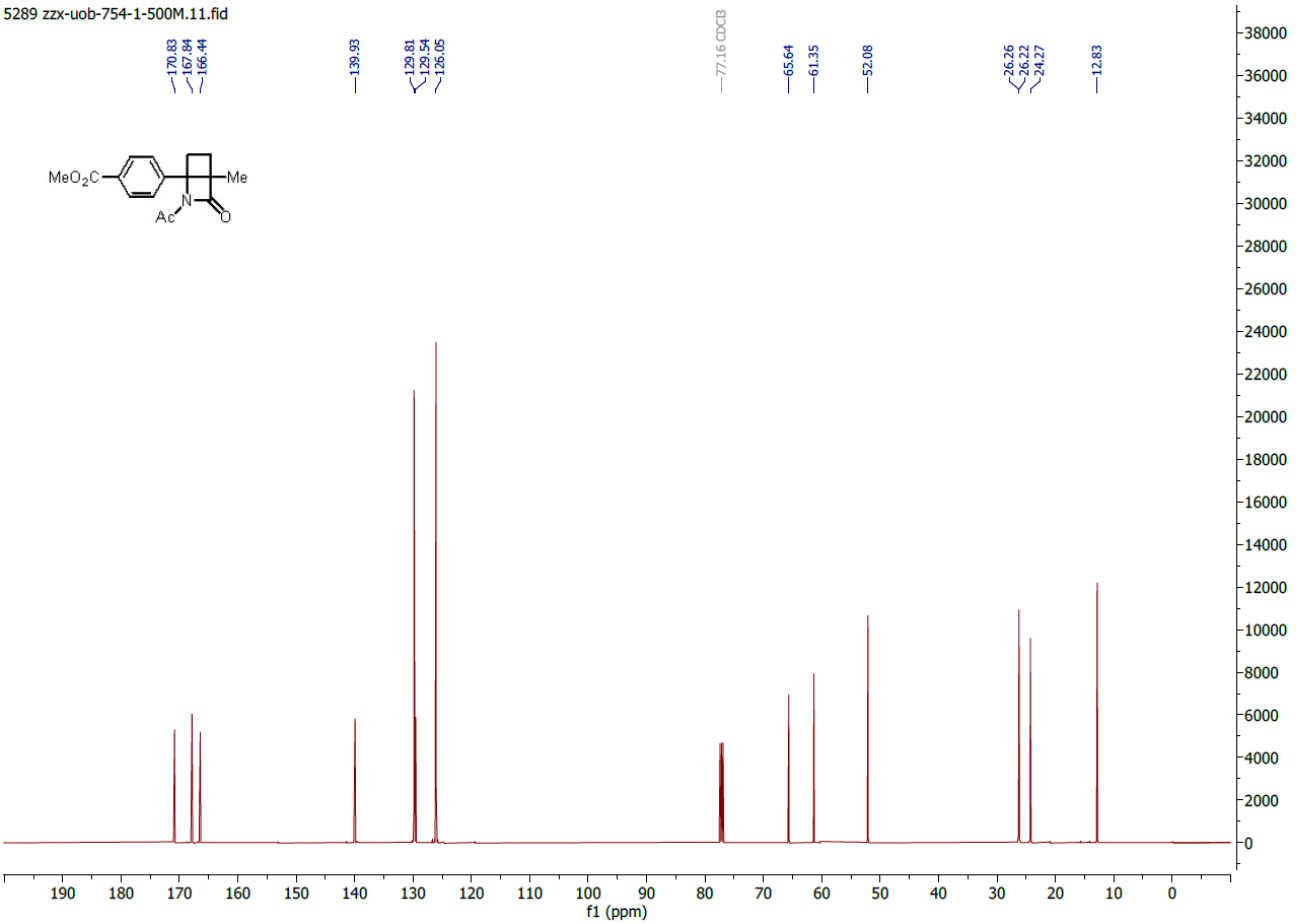
Compound 6n


5334 zzx-uob-712-2-500M.10.fid
Cl
Me
Ac
N
O
f1 (ppm)

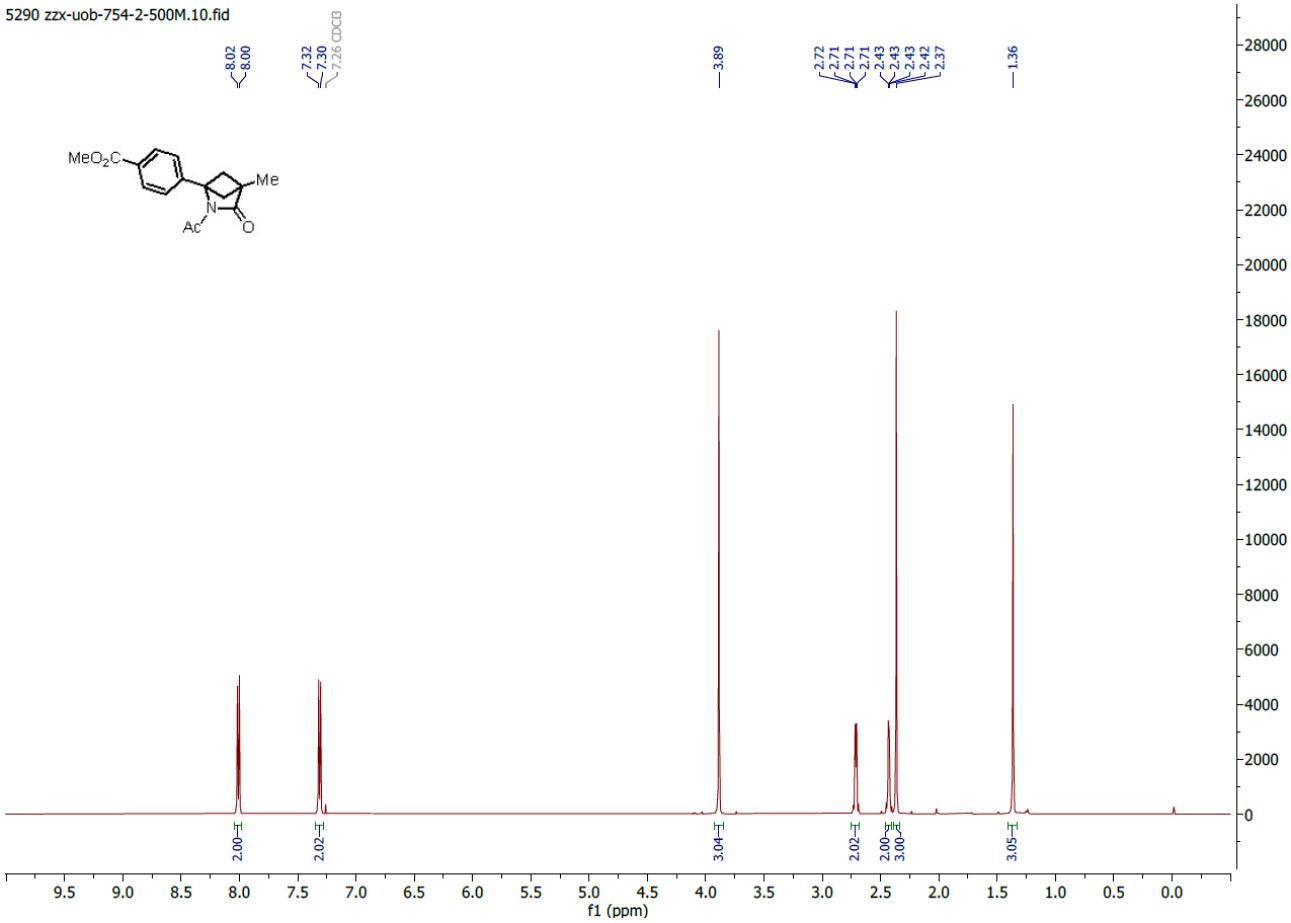

5334 zzx-uob-712-2-500M.11.fid
Cl
Me
Ac
N
O
f1 (ppm)

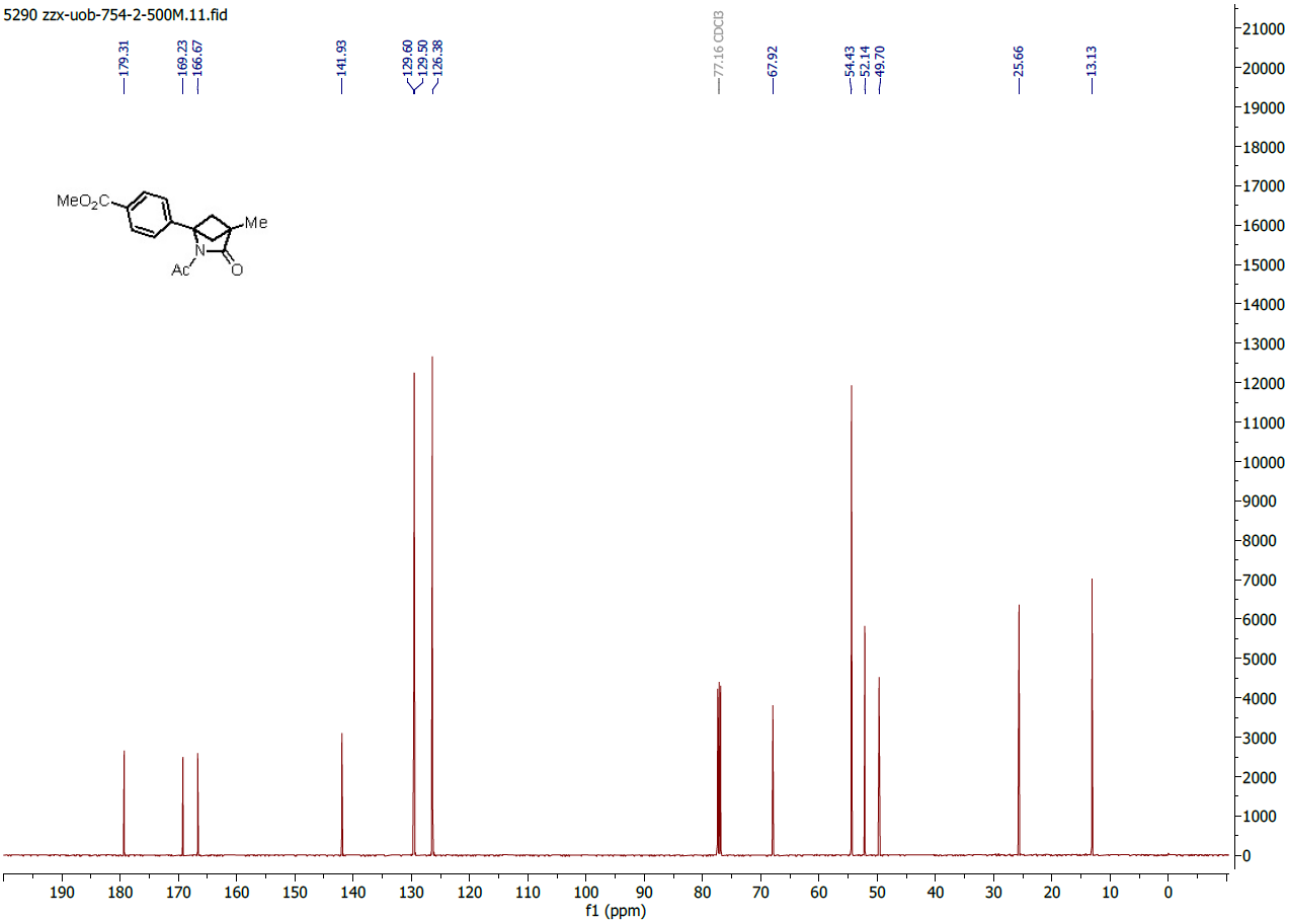
Compound 6o


5289 zzx-uob-754-1-500M.10.fid
8.00
7.98
7.29
7.28
7.26 CDCB
3.84
3.02
3.01
2.99
2.99
2.98
2.97
2.96
2.53
2.51
2.51
2.50
2.48
2.48
2.47
2.45
2.45
2.44
2.44
2.43
2.23
2.21
2.21
2.19
2.19
2.18
2.17
2.16
1.02
MeO2C
Me
N
Ac
O
2.00
2.00
3.00
1.01
5.00
1.01
3.04
f1 (ppm)

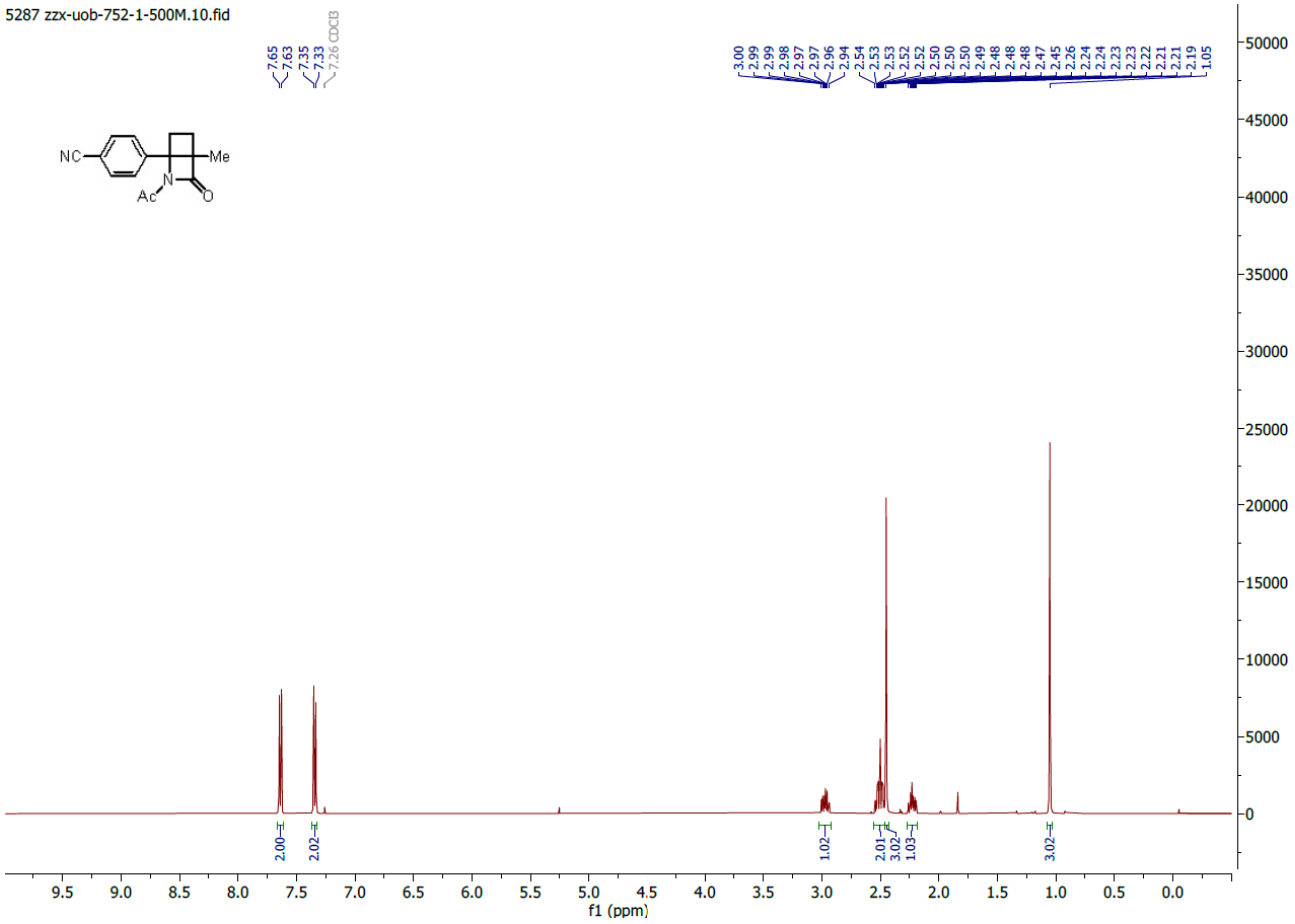

5289 zzx-uob-754-1-500M.11.fid
170.83
167.84
166.44
139.93
129.81
129.54
126.05
77.16 CDCB
65.64
61.35
52.08
26.26
26.22
24.27
12.83
MeO2C
Me
N
Ac
O
f1 (ppm)

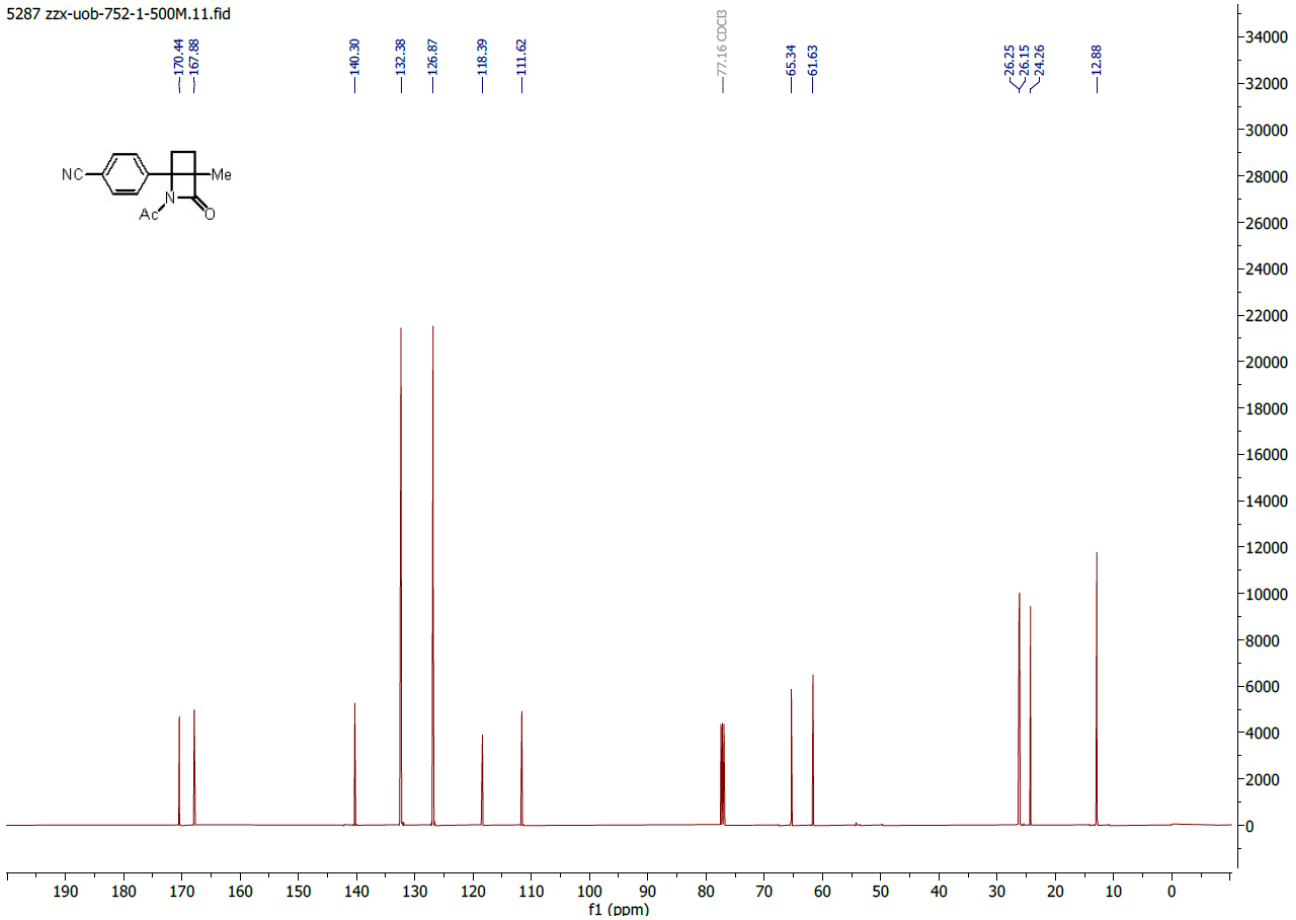
Compound 5o


5290 zzx-uob-754-2-500M.10.fid
8.02
8.00
7.32
7.30
7.26 CDCl3
3.89
2.72
2.71
2.71
2.71
2.43
2.43
2.43
2.42
2.37
1.36
MeO2C
Me
Ac
N
O
2.00
2.02
3.04
2.02
2.00
3.00
3.05
f1 (ppm)

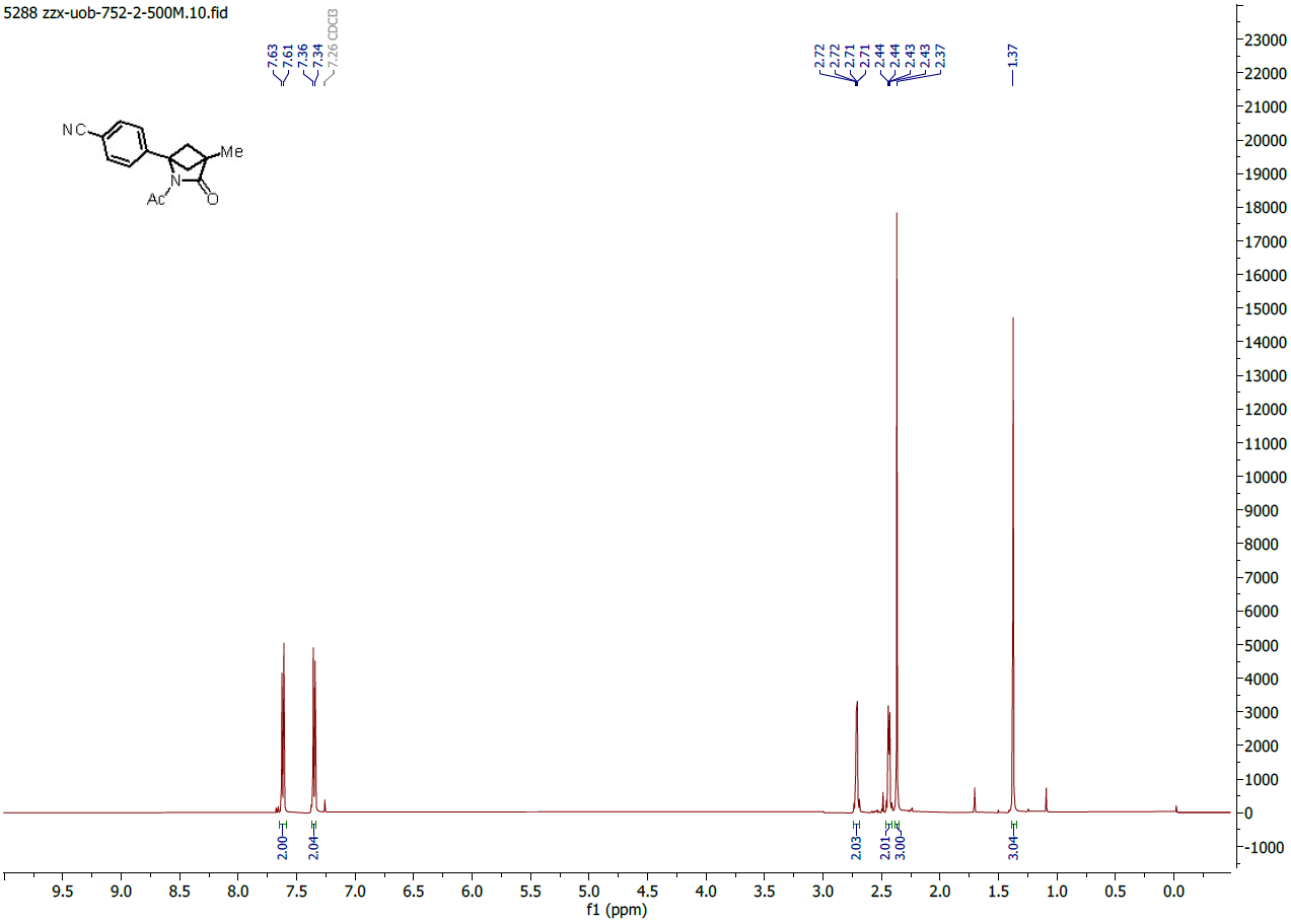

5290 zzx-uob-754-2-500M.11.fid
179.31
169.23
166.67
141.93
129.60
129.50
126.38
77.16 CDCl3
67.92
54.43
52.14
49.70
25.66
13.13
MeO2C
Me
Ac
N
O
f1 (ppm)

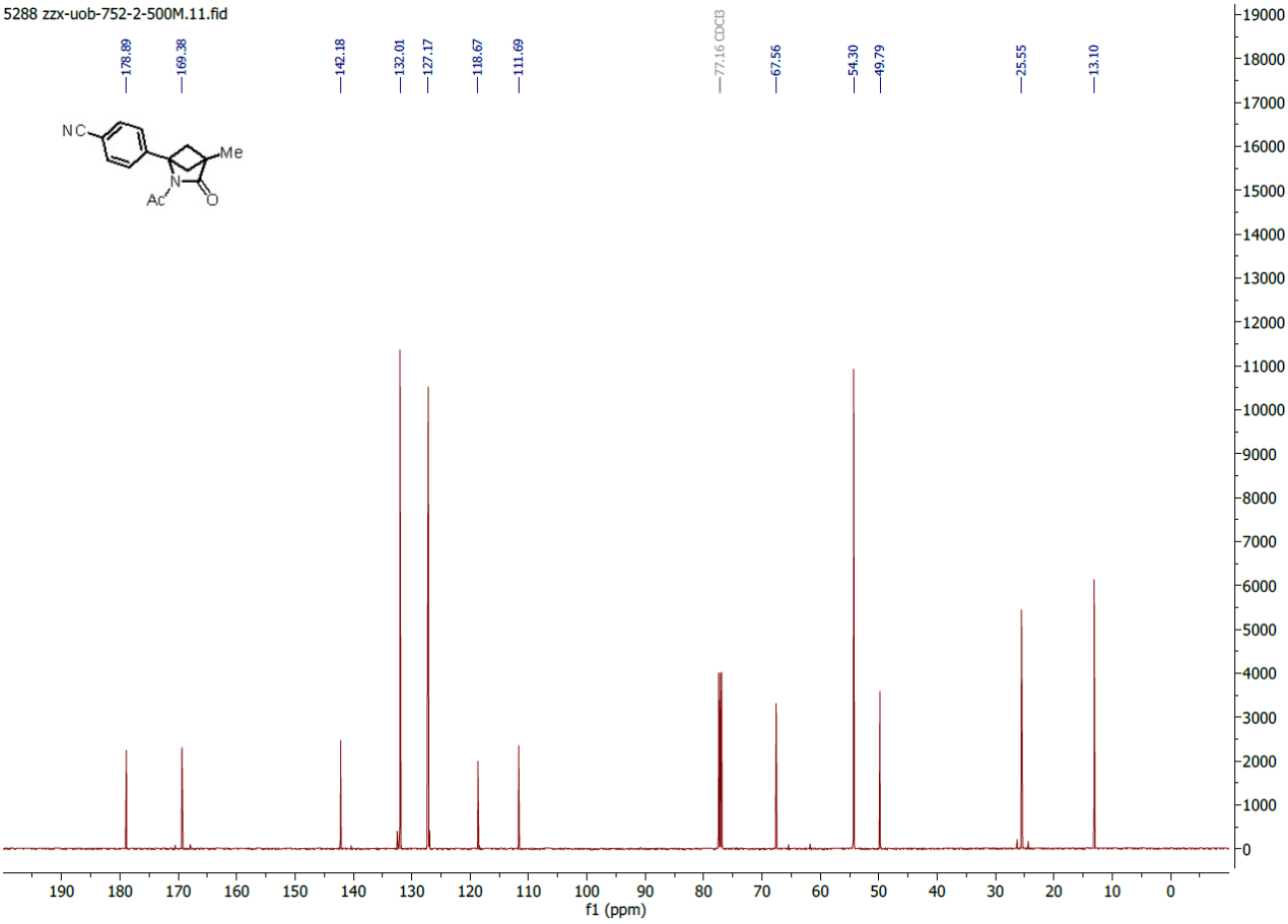
Compound 6p


5287 zzx-uob-752-1-500M.10.fid
7.65
7.63
7.35
7.33
7.26 CDCl3
3.00
2.99
2.99
2.98
2.97
2.97
2.96
2.94
2.54
2.53
2.53
2.52
2.52
2.50
2.50
2.50
2.49
2.48
2.48
2.48
2.47
2.45
2.26
2.24
2.24
2.23
2.23
2.22
2.21
2.21
2.19
1.05
NC
Me
Ac
N
O
2.00
2.02
1.02
2.01
3.02
1.03
3.02
f1 (ppm)

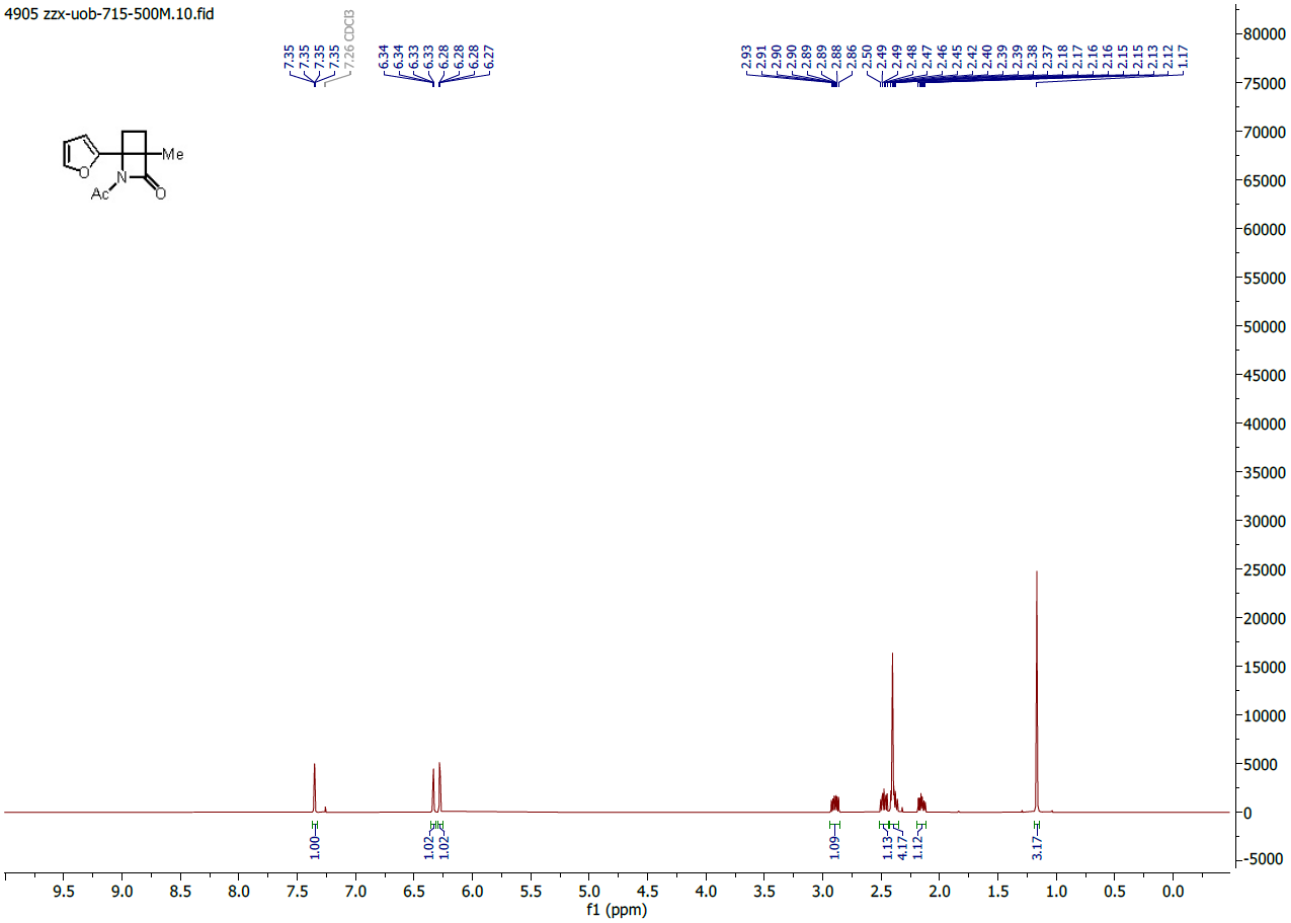

5287 zzx-uob-752-1-500M.11.fid
170.44
167.88
140.30
132.38
126.87
118.39
111.62
77.16 CDCl3
65.34
61.63
26.25
26.15
24.26
12.88
NC
Me
Ac
N
O
f1 (ppm)

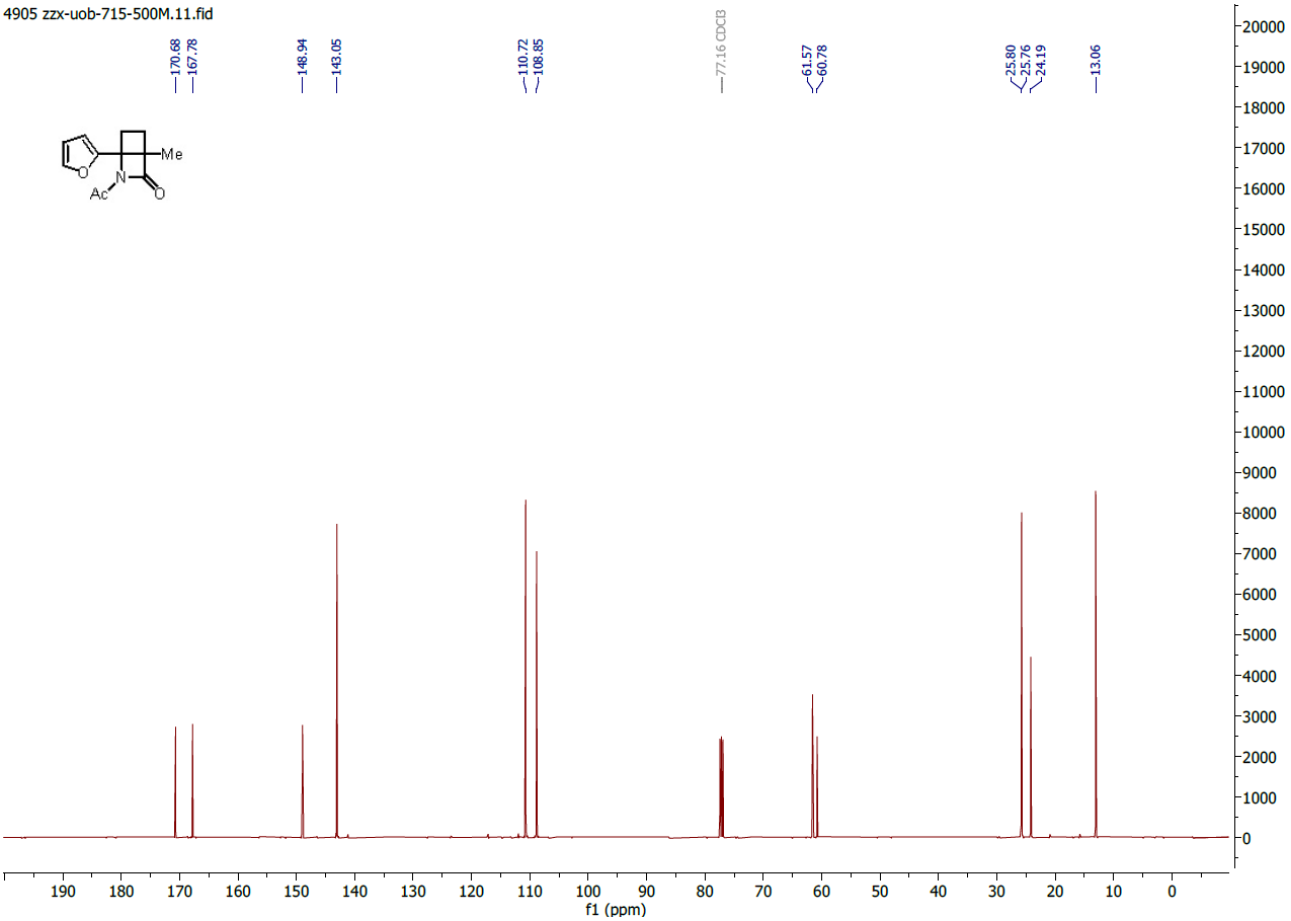
Compound 5p


5288 zzx-uob-752-2-500M.10.fid
7.63
7.61
7.36
7.34
7.26 CDCl3
2.72
2.72
2.71
2.71
2.44
2.44
2.43
2.43
2.37
1.37
NC
Me
N
Ac
O
2.00
2.04
2.03
2.01
3.00
3.04
f1 (ppm)

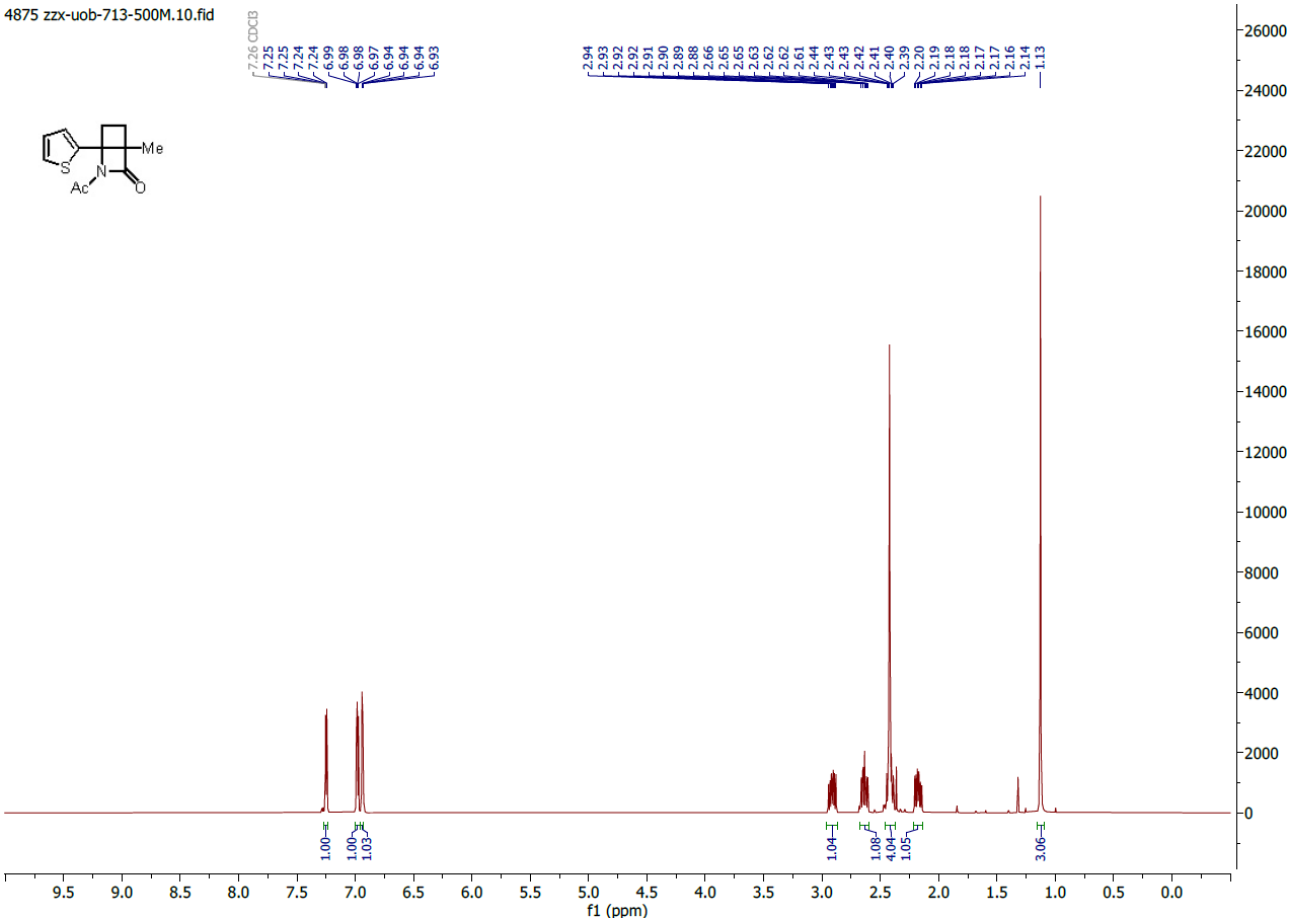

5288 zzx-uob-752-2-500M.11.fid
178.89
169.38
142.18
132.01
127.17
118.67
111.69
77.16 CDCl3
67.56
54.30
49.79
25.55
13.10
NC
Me
N
Ac
O
f1 (ppm)

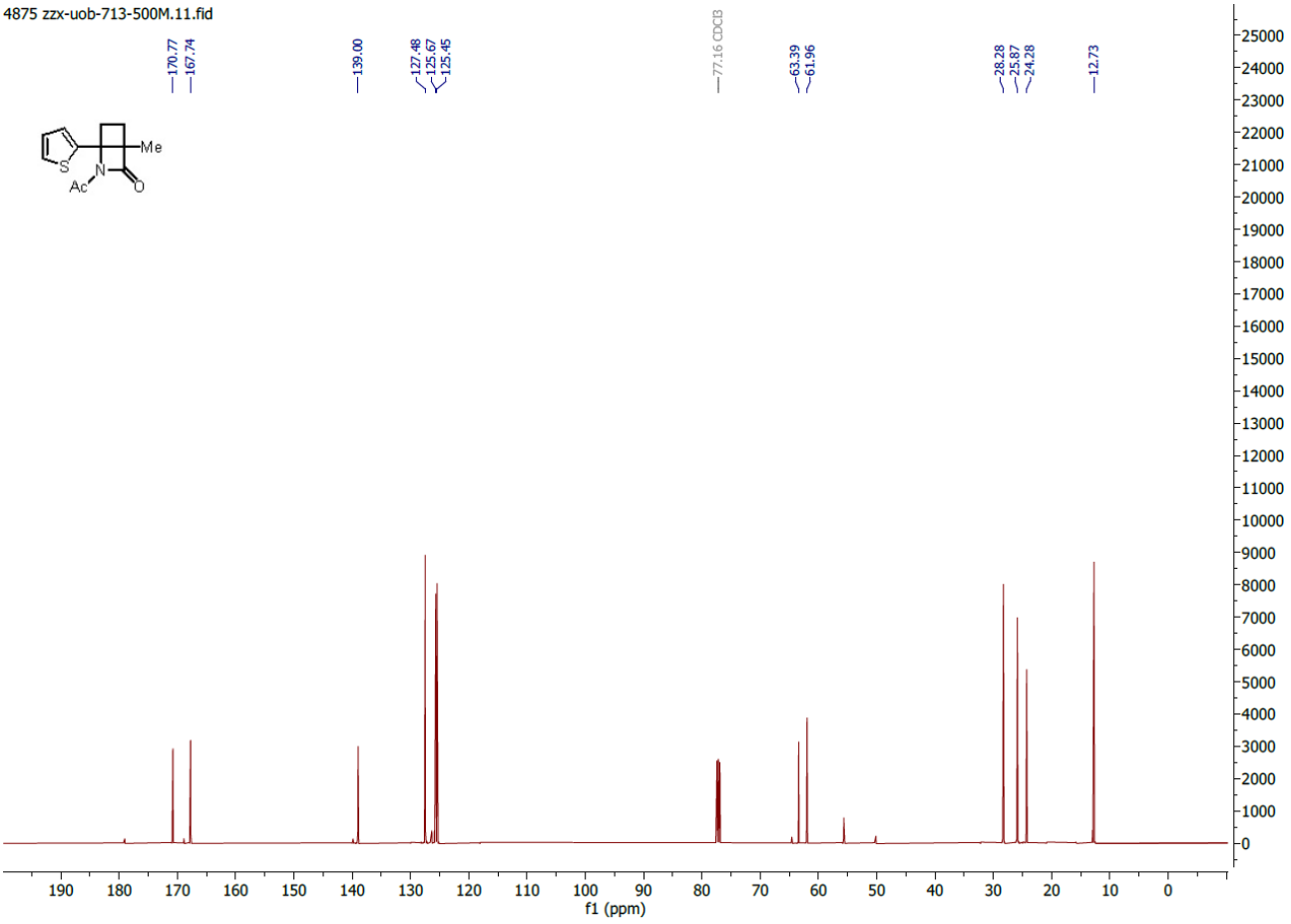
Compound 6q


4905 zzx-uob-715-500M.10.fid
7.35
7.35
7.35
7.35
7.26 CDCl3
6.34
6.34
6.33
6.33
6.28
6.28
6.28
6.27
2.93
2.91
2.90
2.90
2.89
2.89
2.88
2.86
2.50
2.49
2.49
2.48
2.47
2.46
2.45
2.42
2.40
2.39
2.39
2.38
2.37
2.18
2.17
2.16
2.16
2.15
2.15
2.13
2.12
1.17
Me
Ac
N
O
1.00
1.02
1.02
1.09
1.13
4.17
1.12
3.17
f1 (ppm)

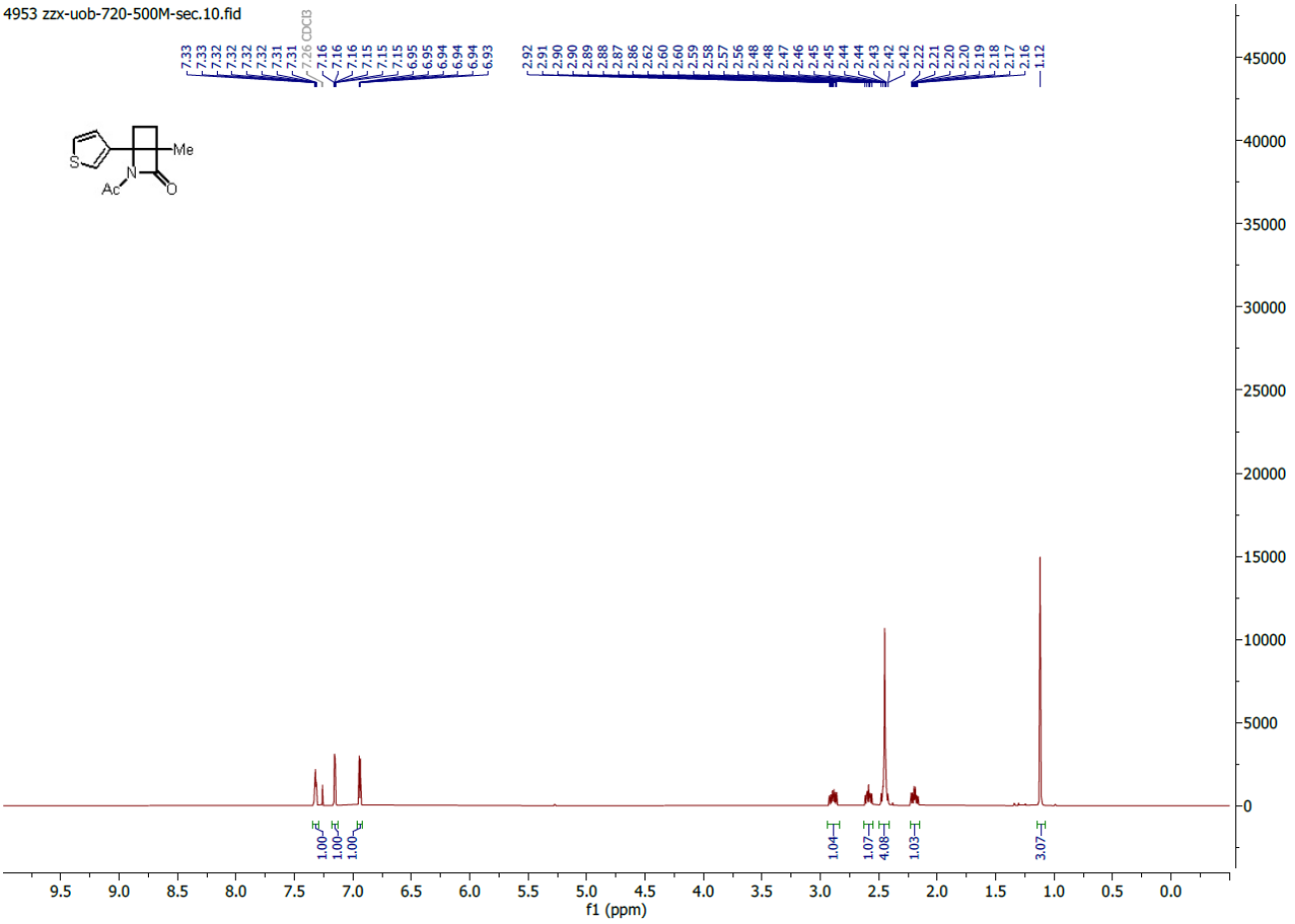

4905 zzx-uob-715-500M.11.fid
170.68
167.78
148.94
143.05
110.72
108.85
77.16 CDCl3
61.57
60.78
25.80
25.76
24.19
13.06
Me
Ac
N
O
f1 (ppm)

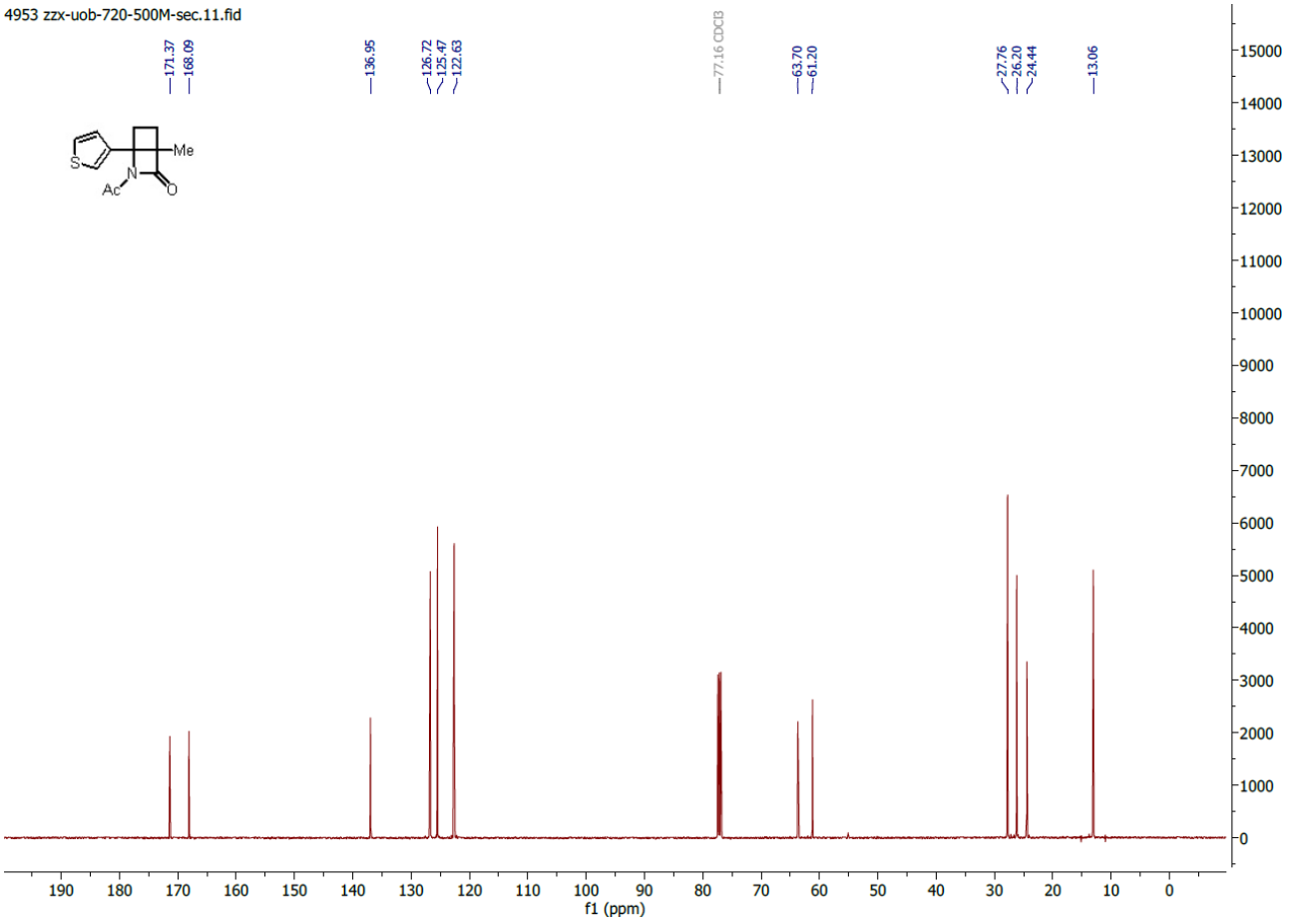
Compound 6r


4875 zzx-uob-713-500M.10.fid
Me
Ac
N
O
S
f1 (ppm)

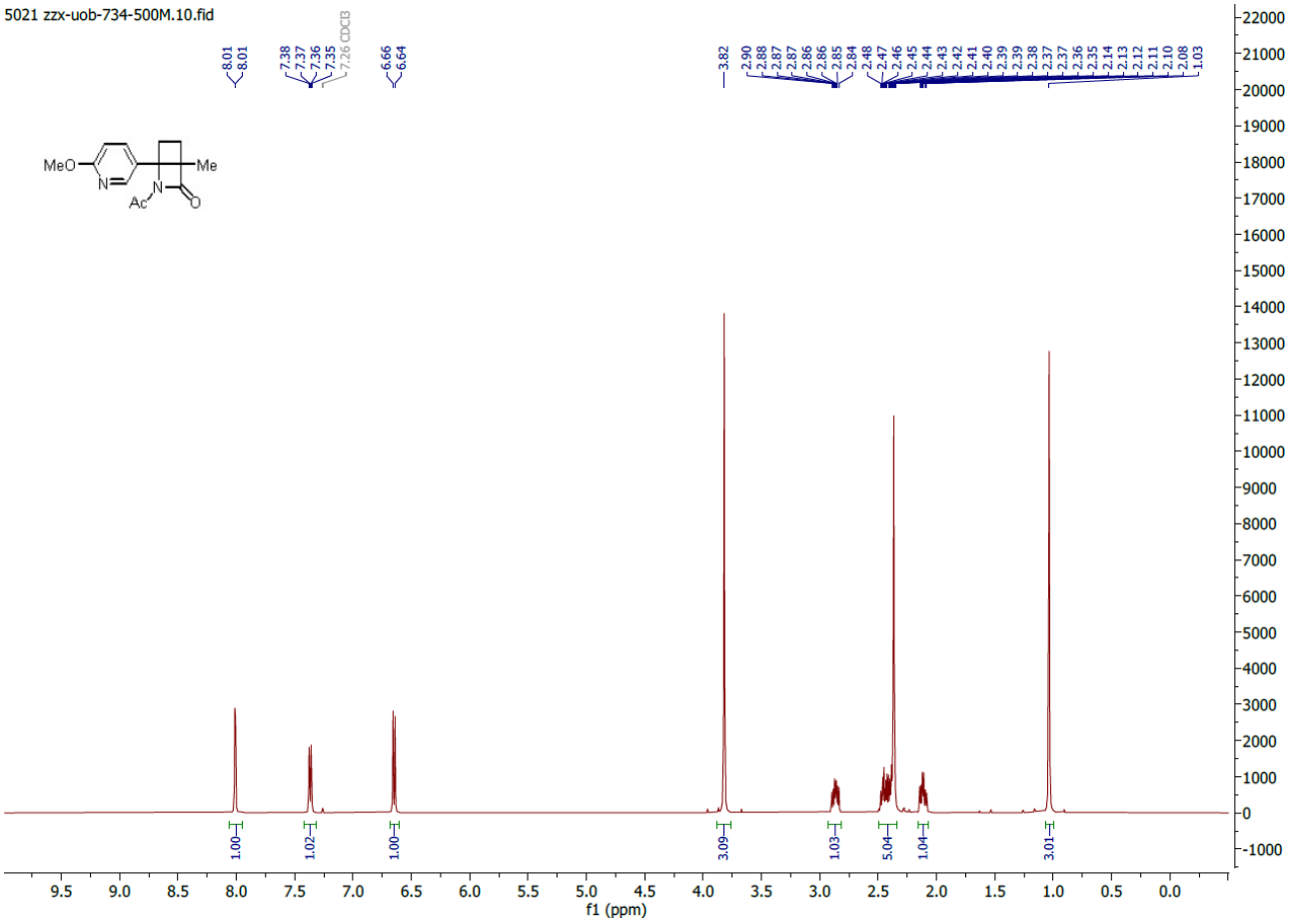

4875 zzx-uob-713-500M.11.fid
170.77
167.74
139.00
127.48
125.67
125.45
77.16 CDCl3
63.39
61.96
28.28
25.87
24.28
12.73
Me
Ac
N
O
S
f1 (ppm)

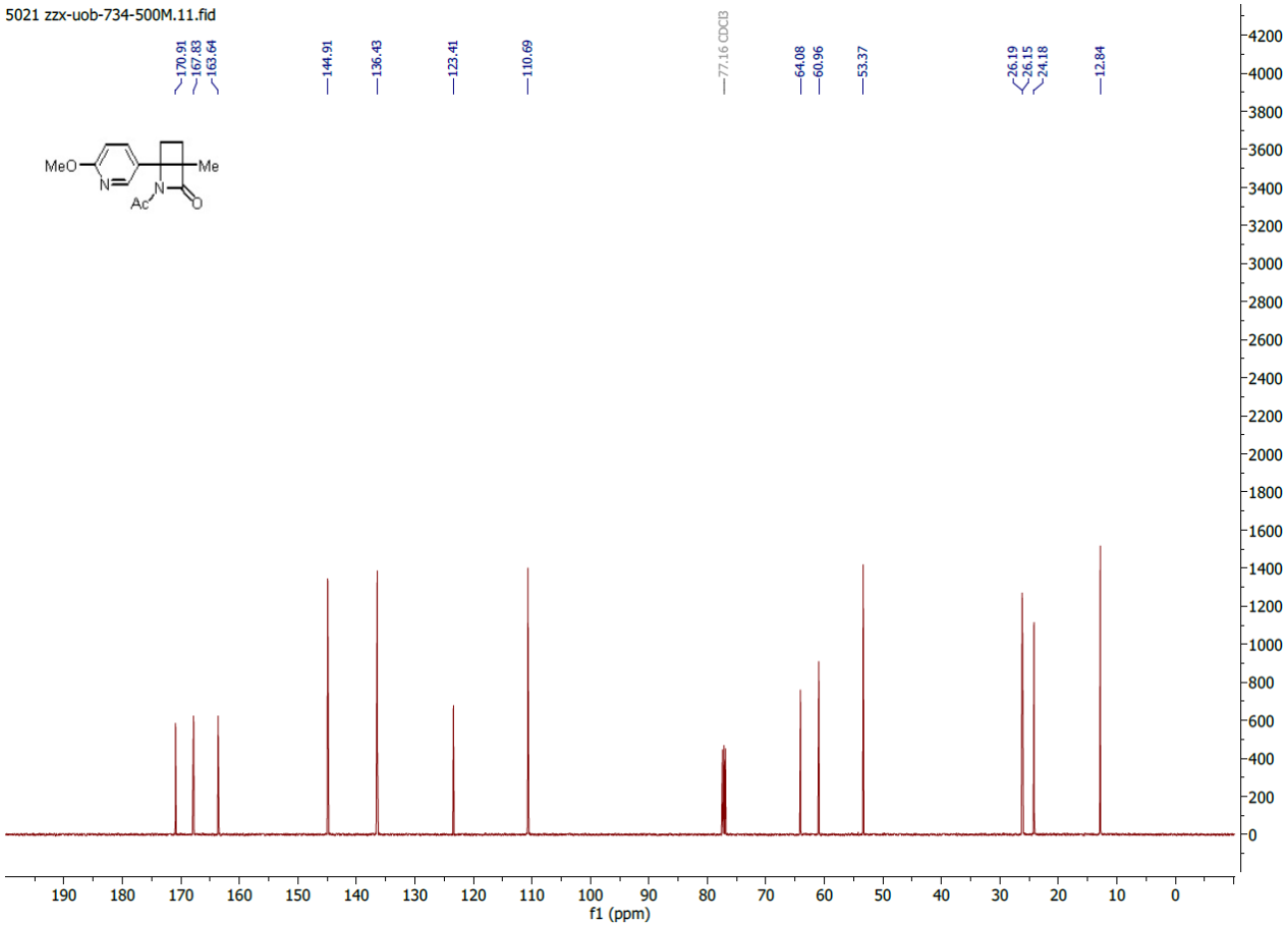
Compound 6s


4953 zzx-uob-720-500M-sec.10.fid
Me
Ac
N
O
S
f1 (ppm)

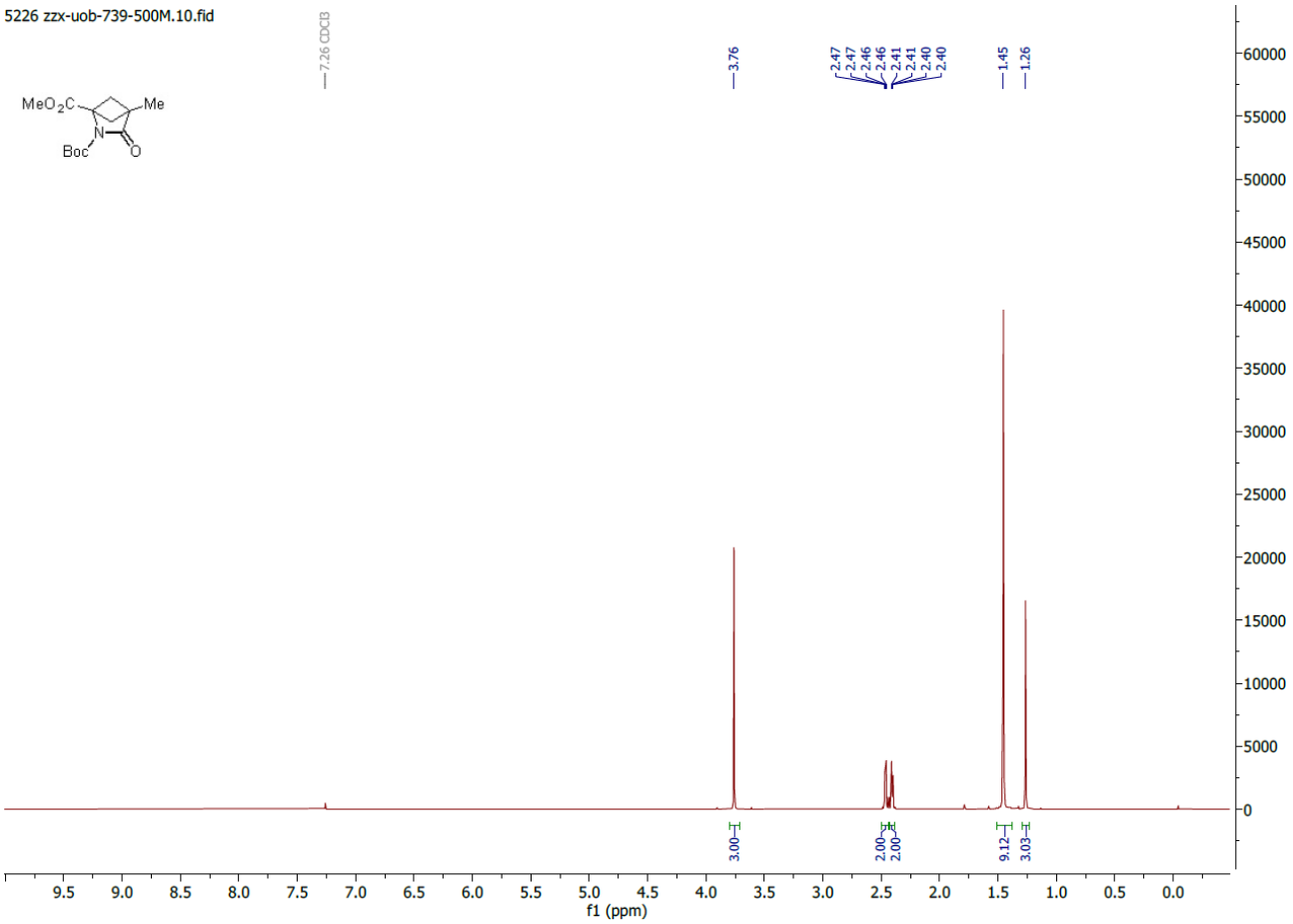

4953 zzx-uob-720-500M-sec.11.fid
171.37
168.09
136.95
126.72
125.47
122.63
77.16 CDCl3
63.70
61.20
27.76
26.20
24.44
13.06
Me
Ac
N
O
S
f1 (ppm)

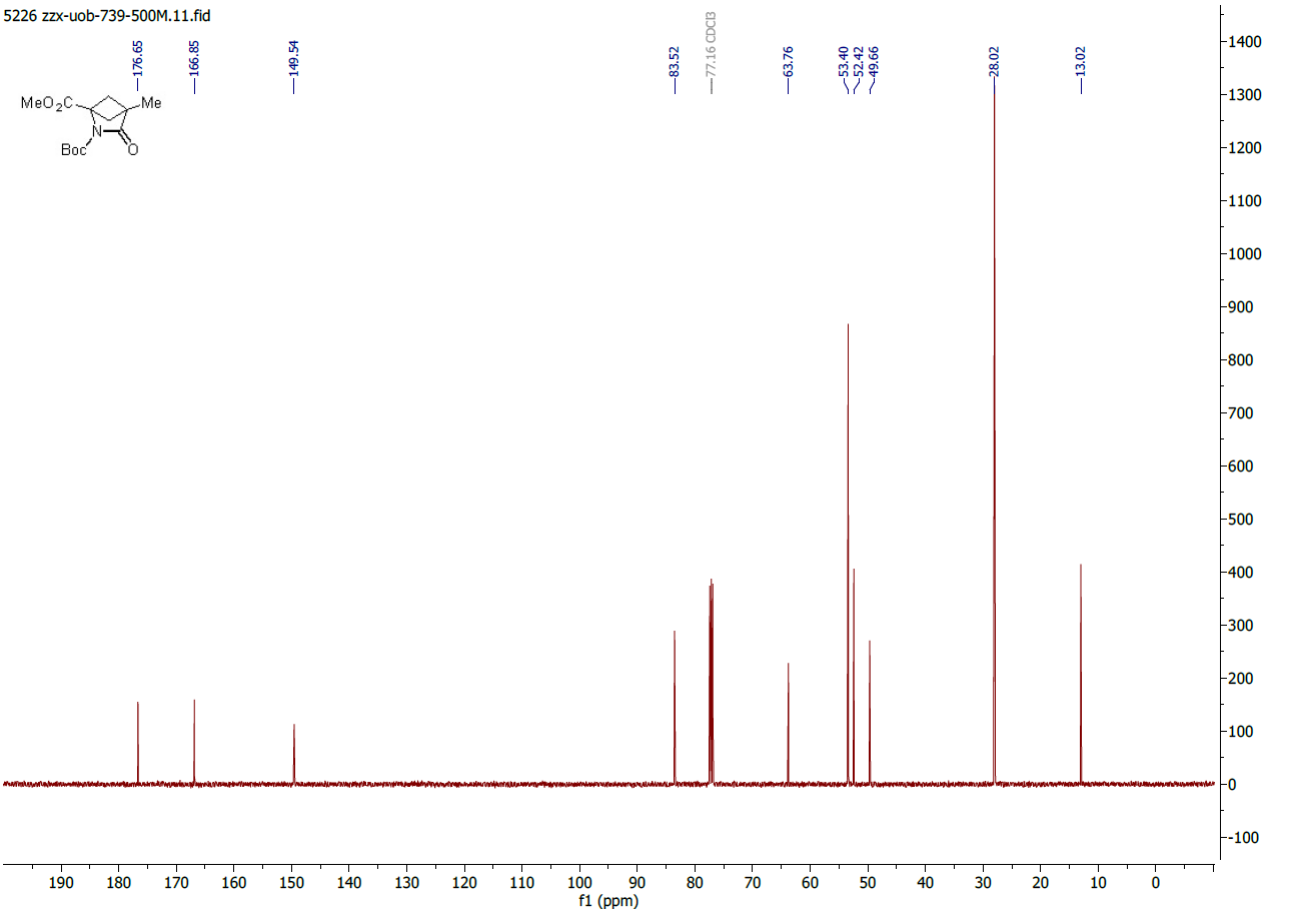
Compound 6t


5021 zzx-uob-734-500M.10.fid
MeO
Me
Ac
f1 (ppm)

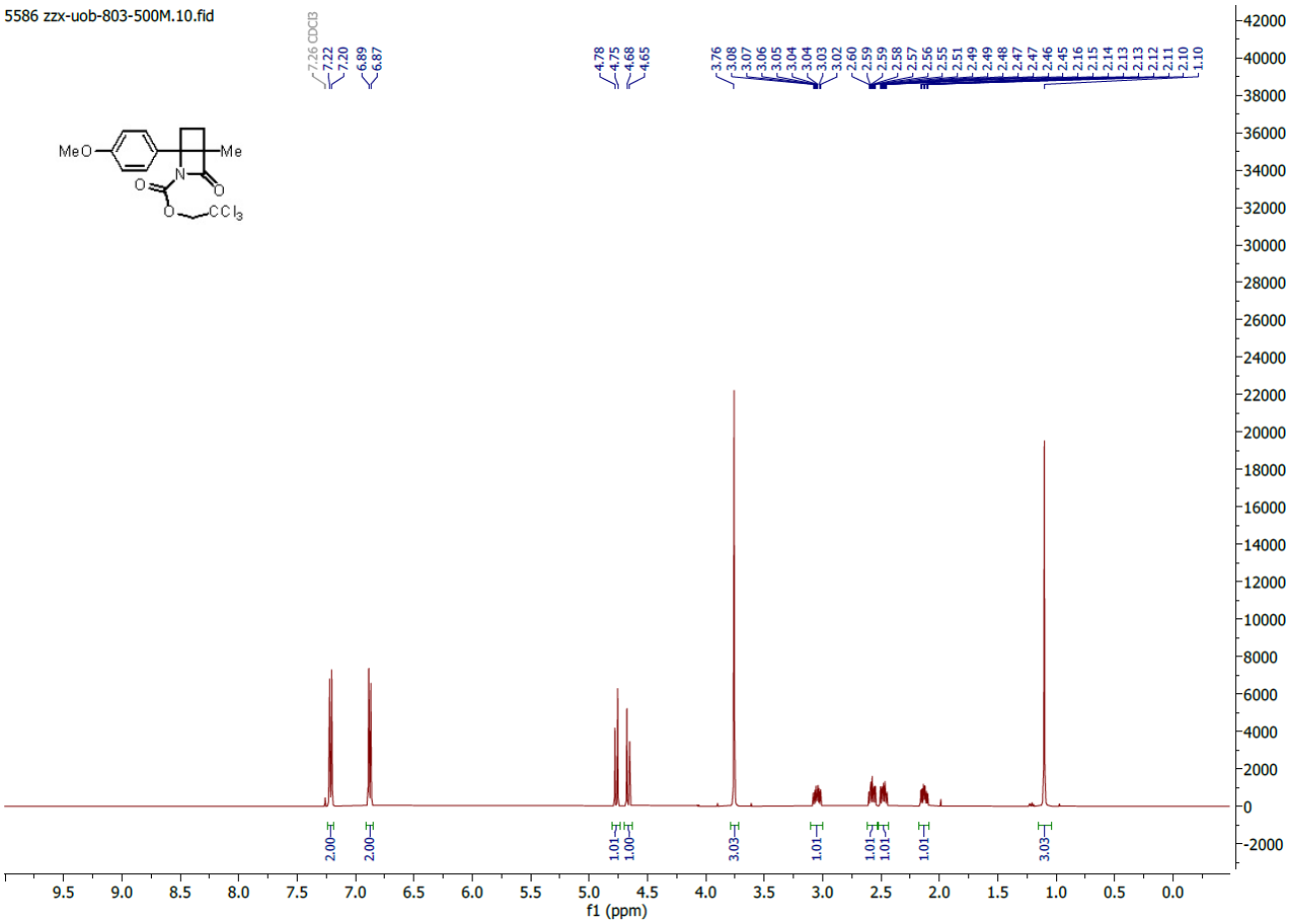

5021 zzx-uob-734-500M.11.fid
MeO
Me
Ac
f1 (ppm)

Compound 5u


5226 zzx-uob-739-500M.10.fid
7.26 CDCl3
3.76
2.47
2.47
2.46
2.46
2.41
2.41
2.40
2.40
1.45
1.26
MeO2C
Me
Boc
N
O
3.00
2.00
2.00
9.12
3.03
f1 (ppm)


5226 zzx-uob-739-500M.11.fid
176.65
166.85
149.54
83.52
77.16 CDCl3
63.76
53.40
52.42
49.66
28.02
13.02
MeO2C
Me
Boc
N
O
f1 (ppm)

Compound 6v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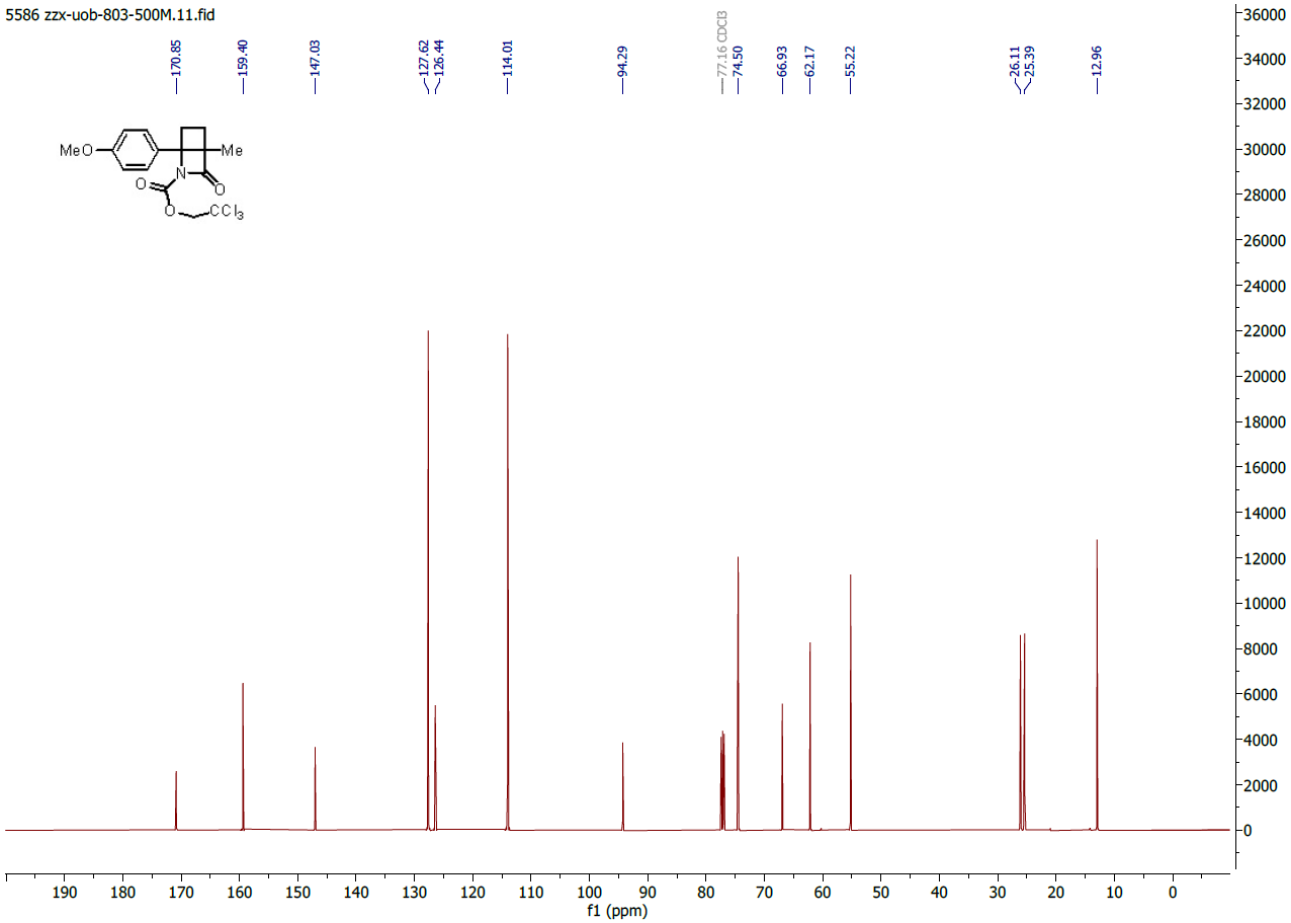
MeO
Me
N
O
O
O
CCl3
f1 (ppm)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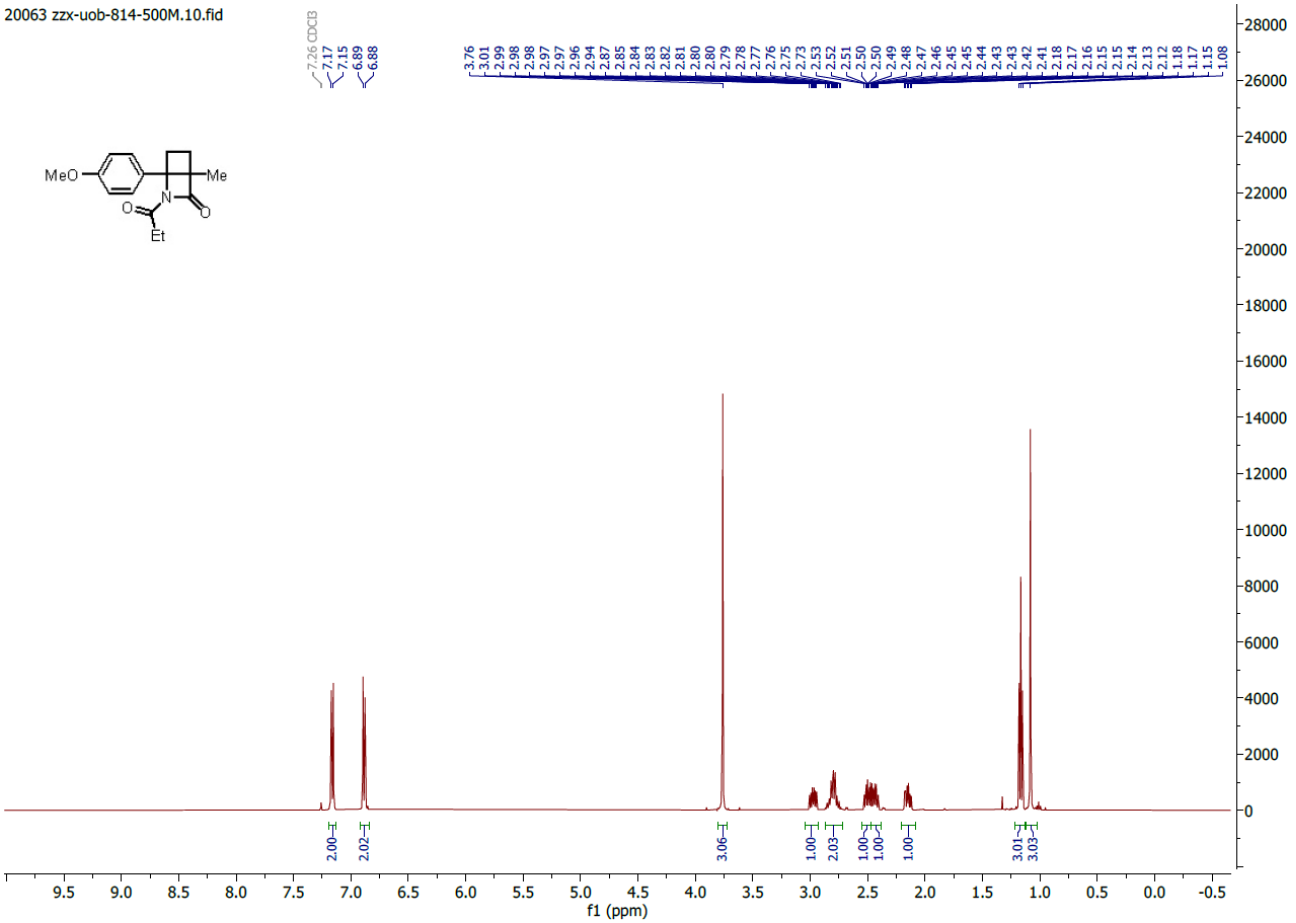
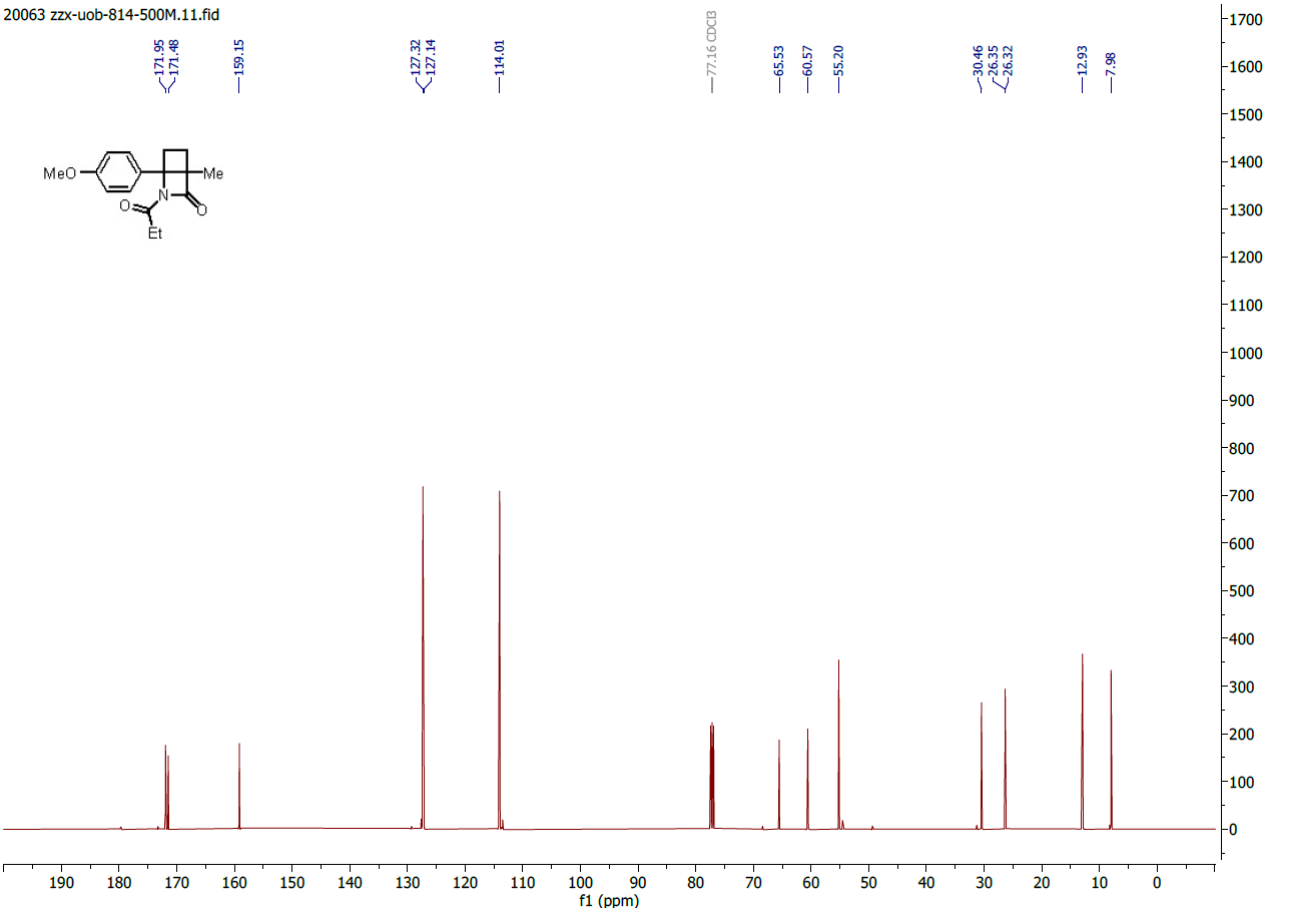
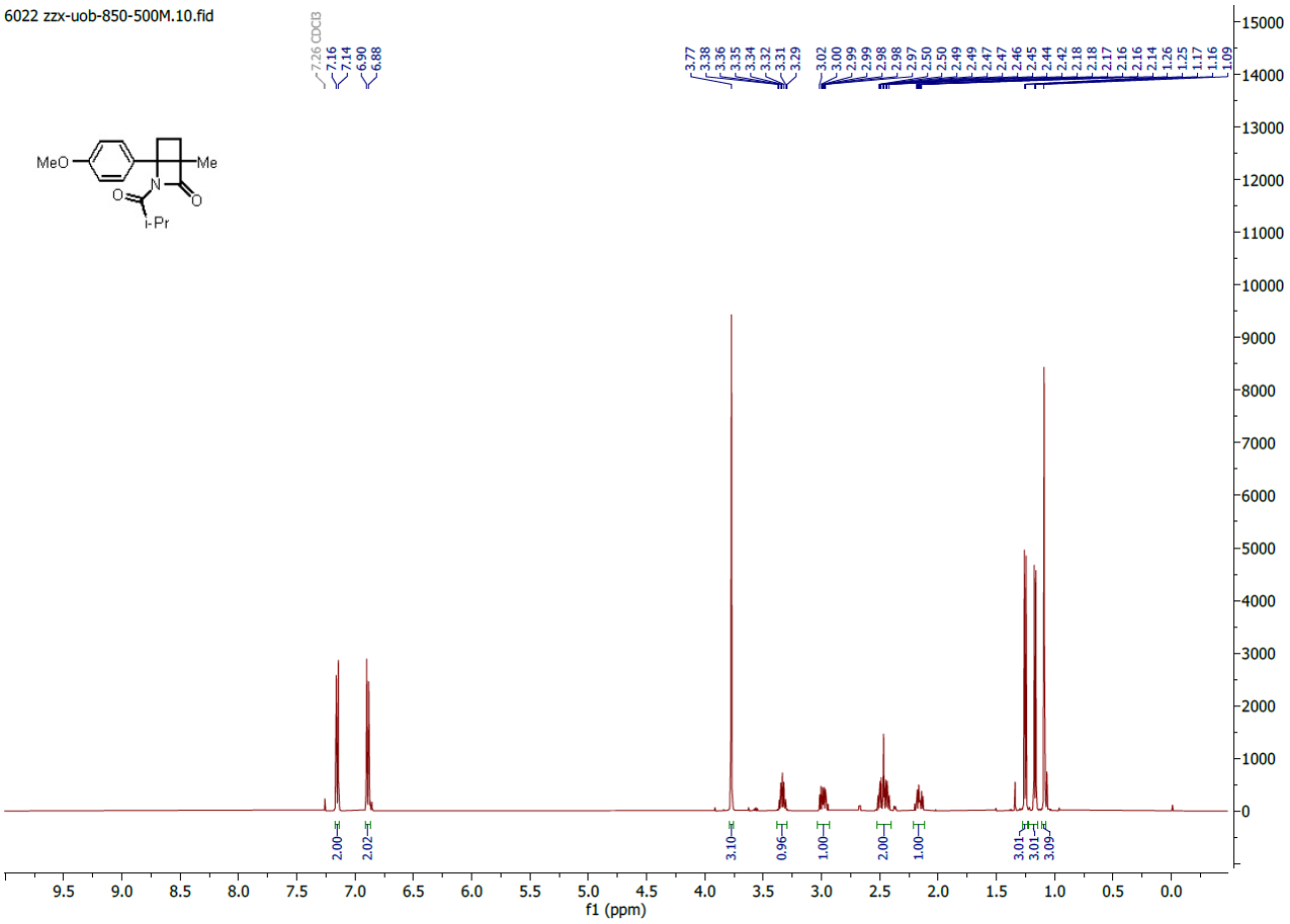
MeO
Me
N
O
O
O
CCl3
f1 (ppm)

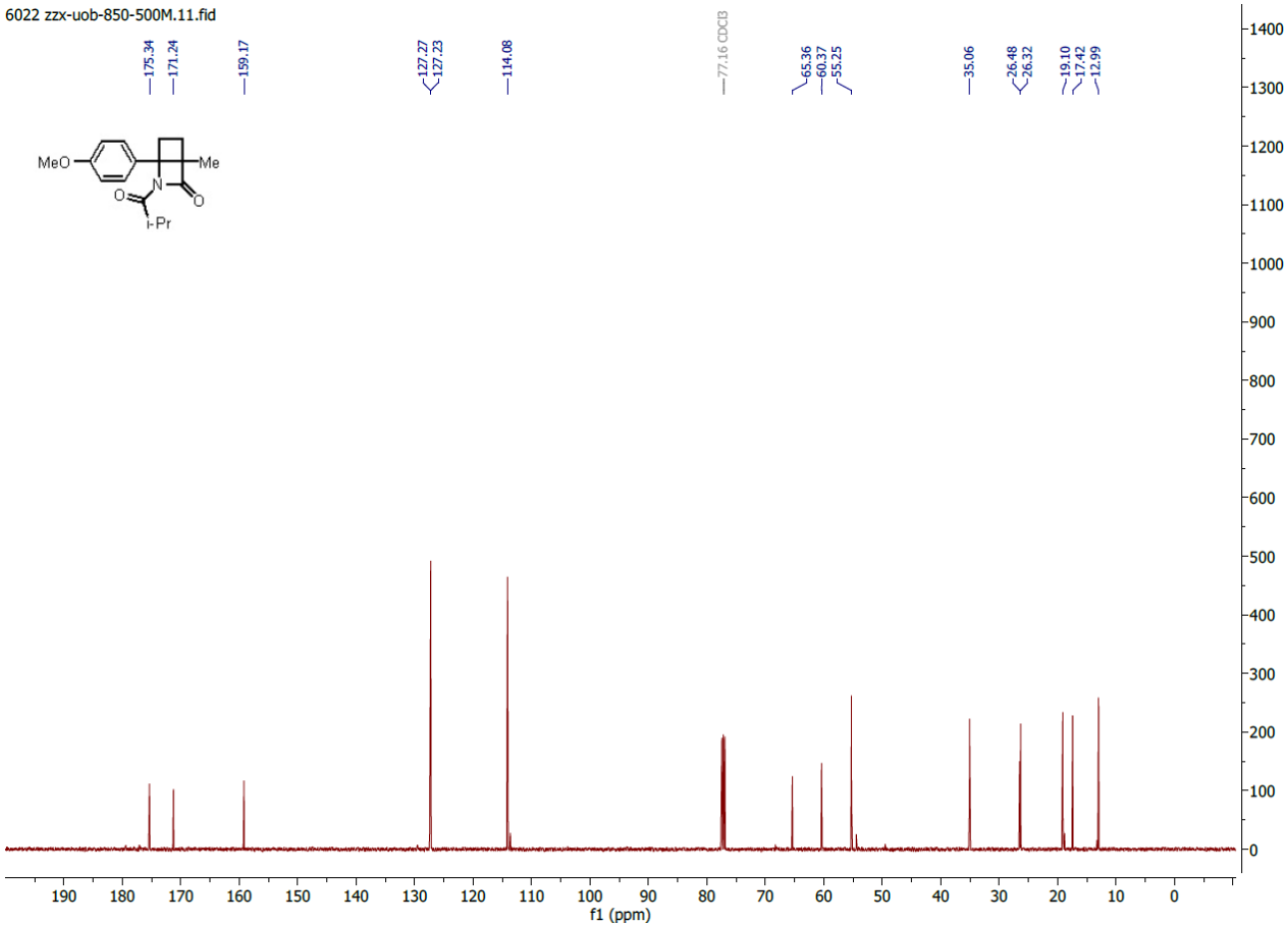
Compound 6w


20063 zzx-uob-814-500M.10.fid
MeO
Me
N
O
O
Et
f1 (ppm)


20063 zzx-uob-814-500M.11.fid
MeO
Me
N
O
O
Et
f1 (ppm)

Compound 6x


6022 zzx-uob-850-500M.10.fid
MeO
Me
N
O
O
i-Pr
f1 (ppm)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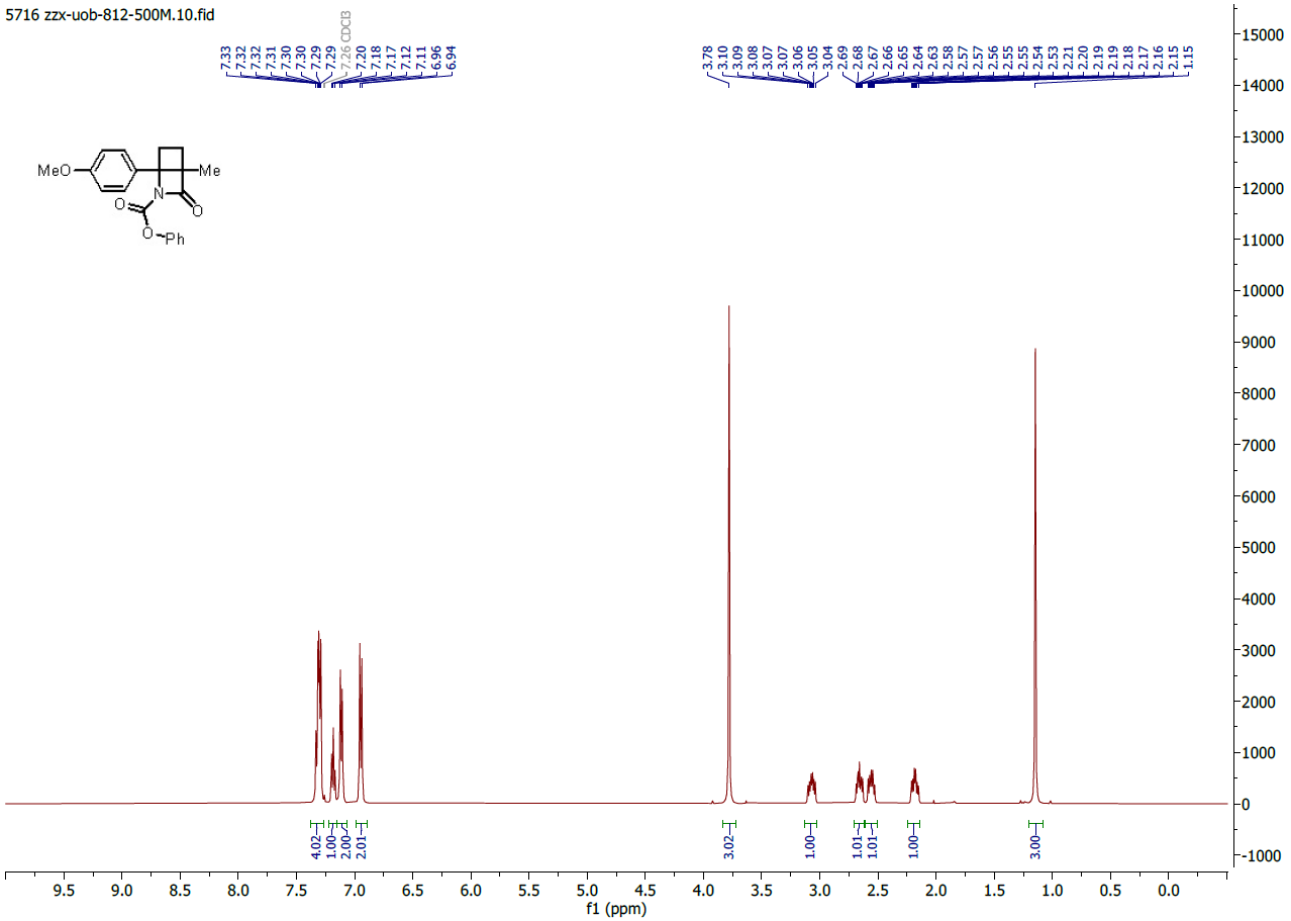
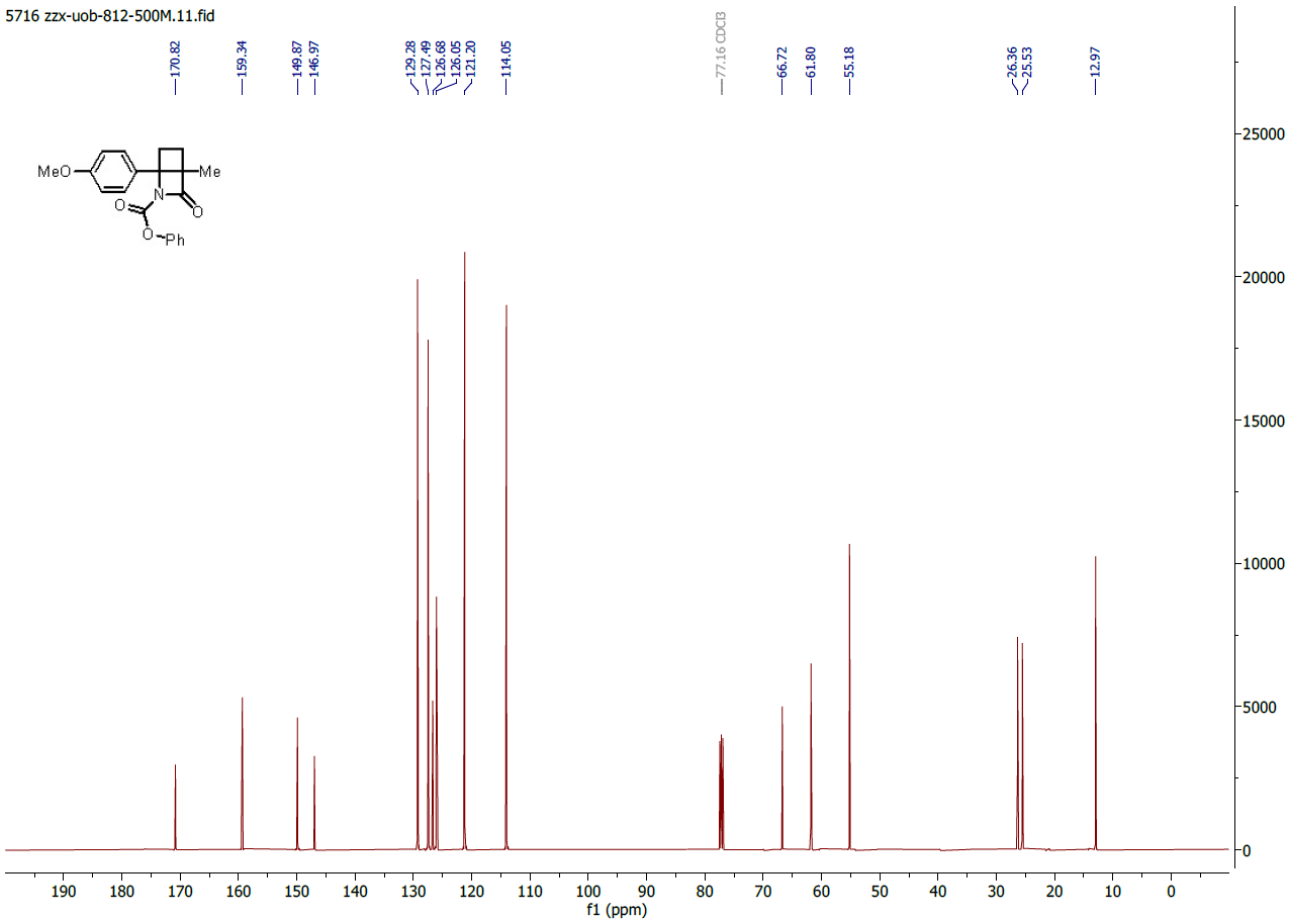
MeO
Me
N
O
O
i-Pr
f1 (ppm)

Compound 6y


5716 zzx-uob-812-500M.10.fid
MeO
Me
N
O
O
O
Ph
f1 (ppm)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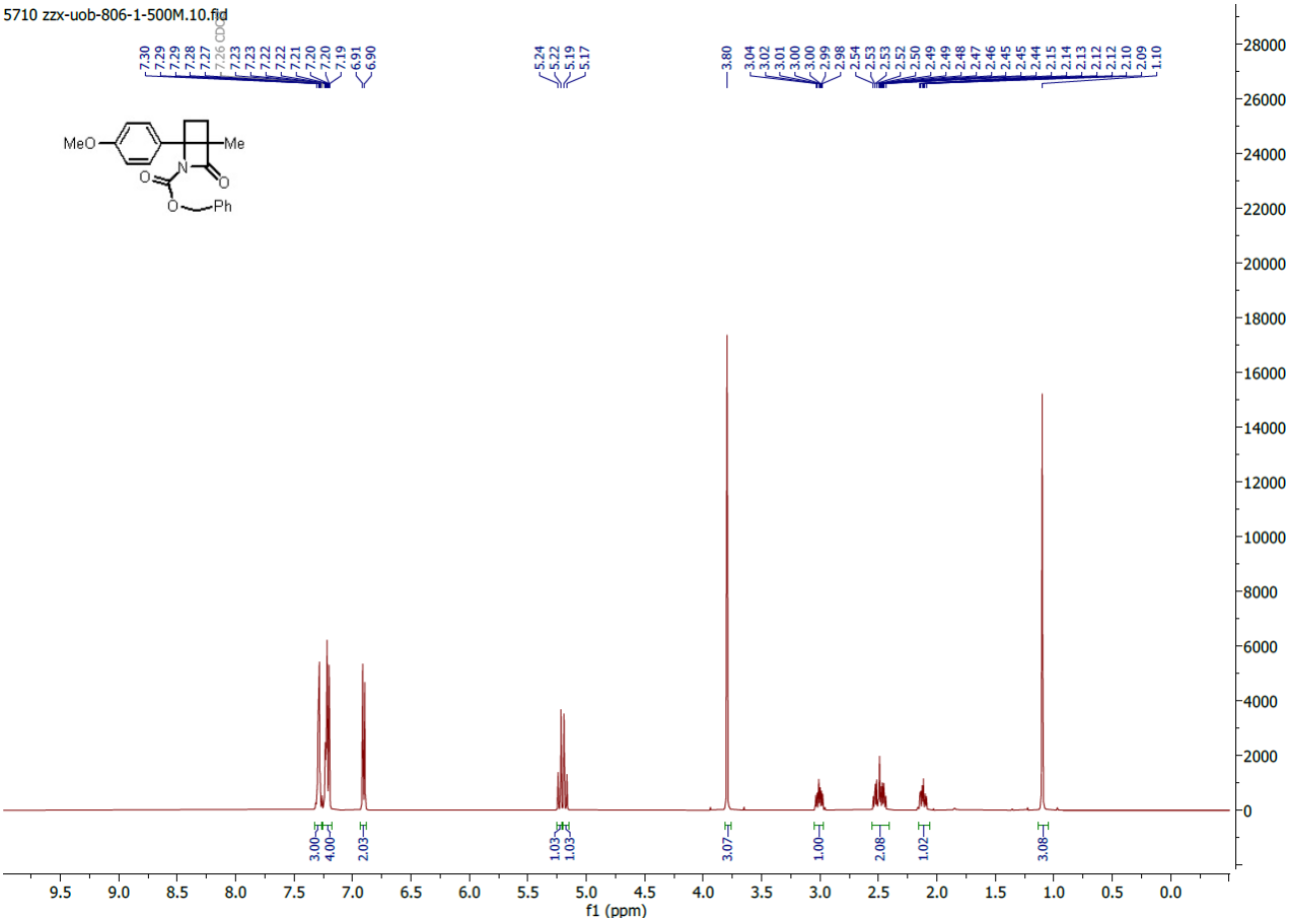
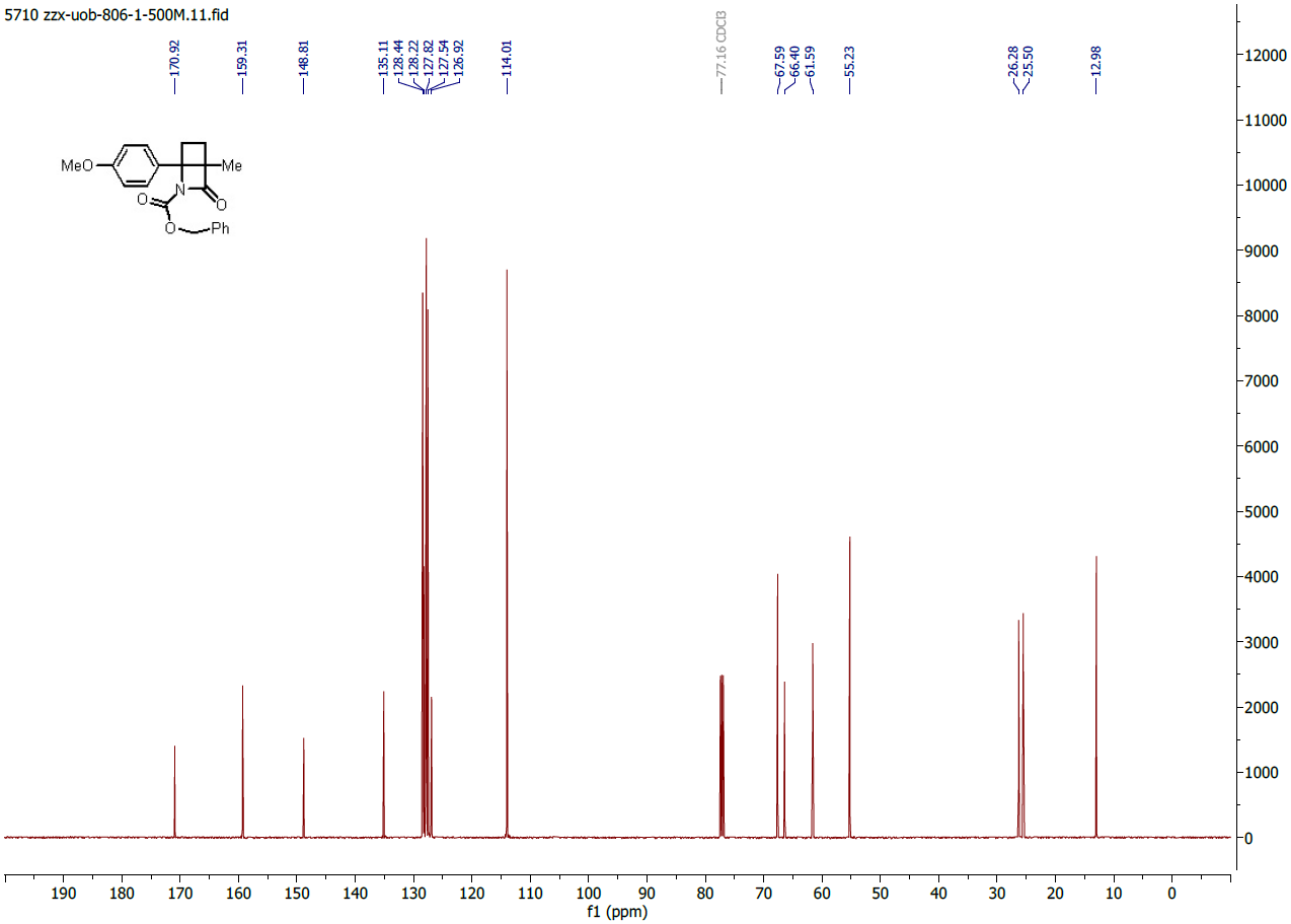
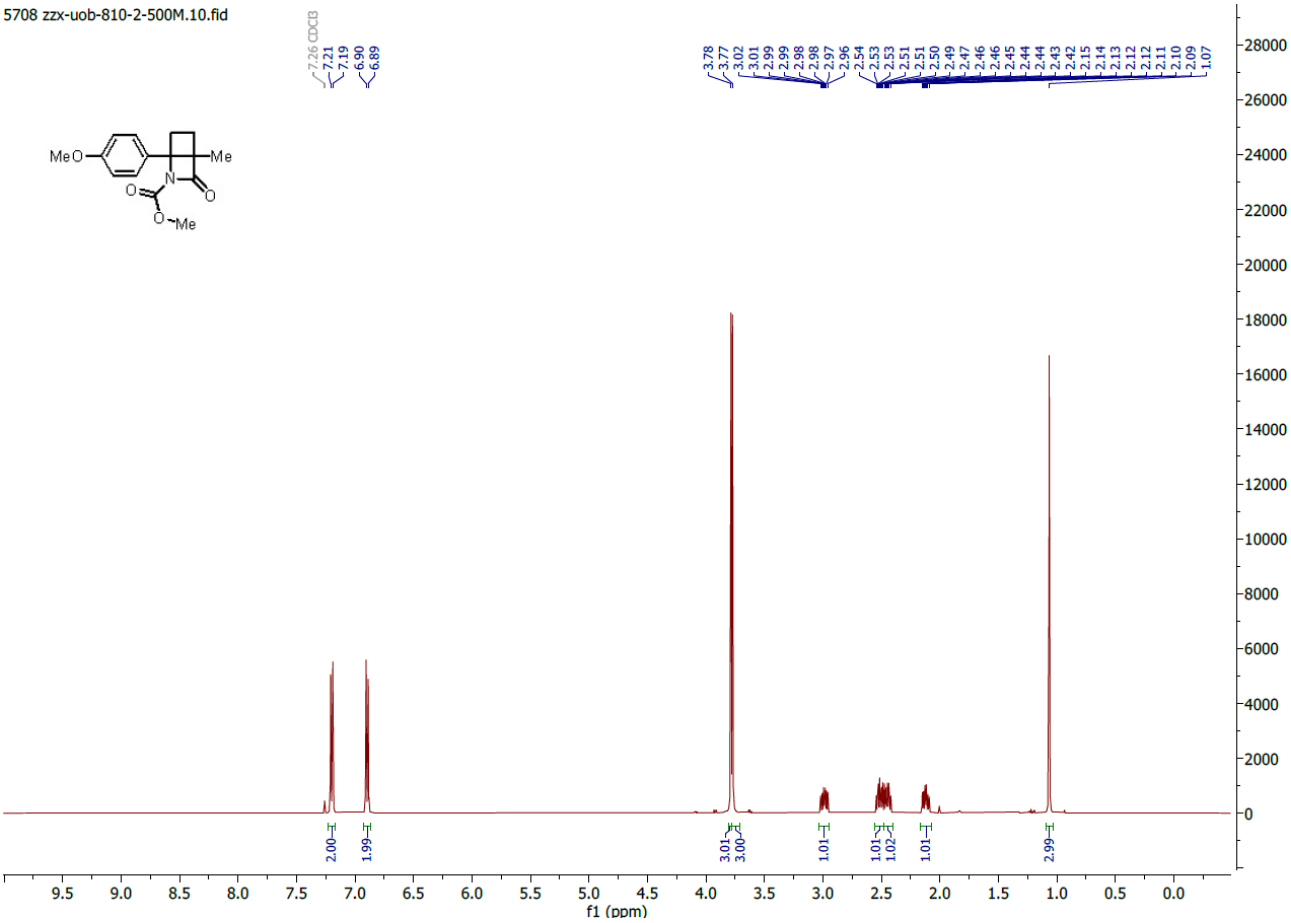
MeO
Me
N
O
O
O
Ph
f1 (ppm)

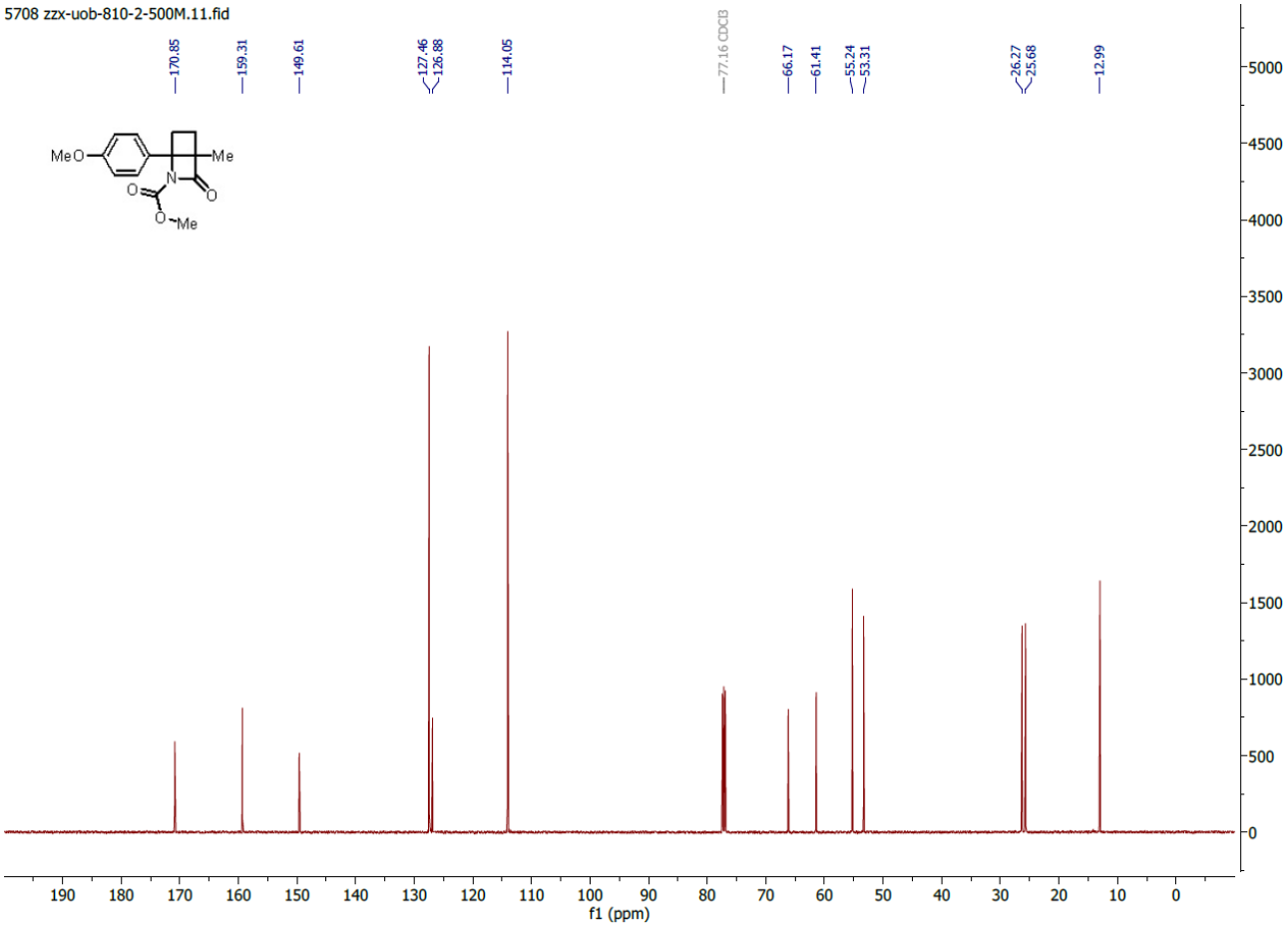
Compound 6z


5710 zzx-uob-806-1-500M.10.fid
MeO
Me
O
N
O
O
Ph
f1 (ppm)

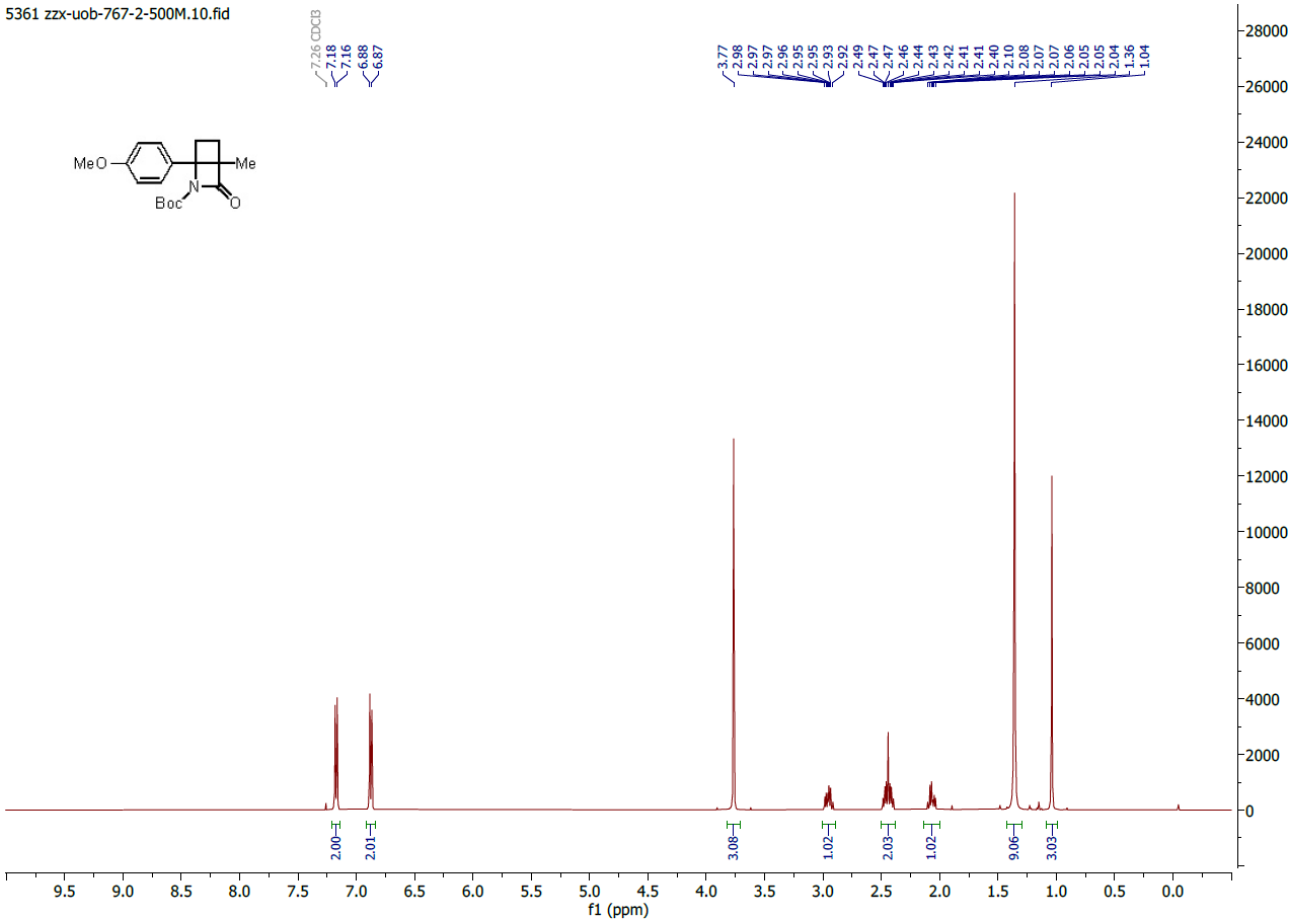

5710 zzx-uob-806-1-500M.11.fid
MeO
Me
O
N
O
O
Ph
f1 (ppm)

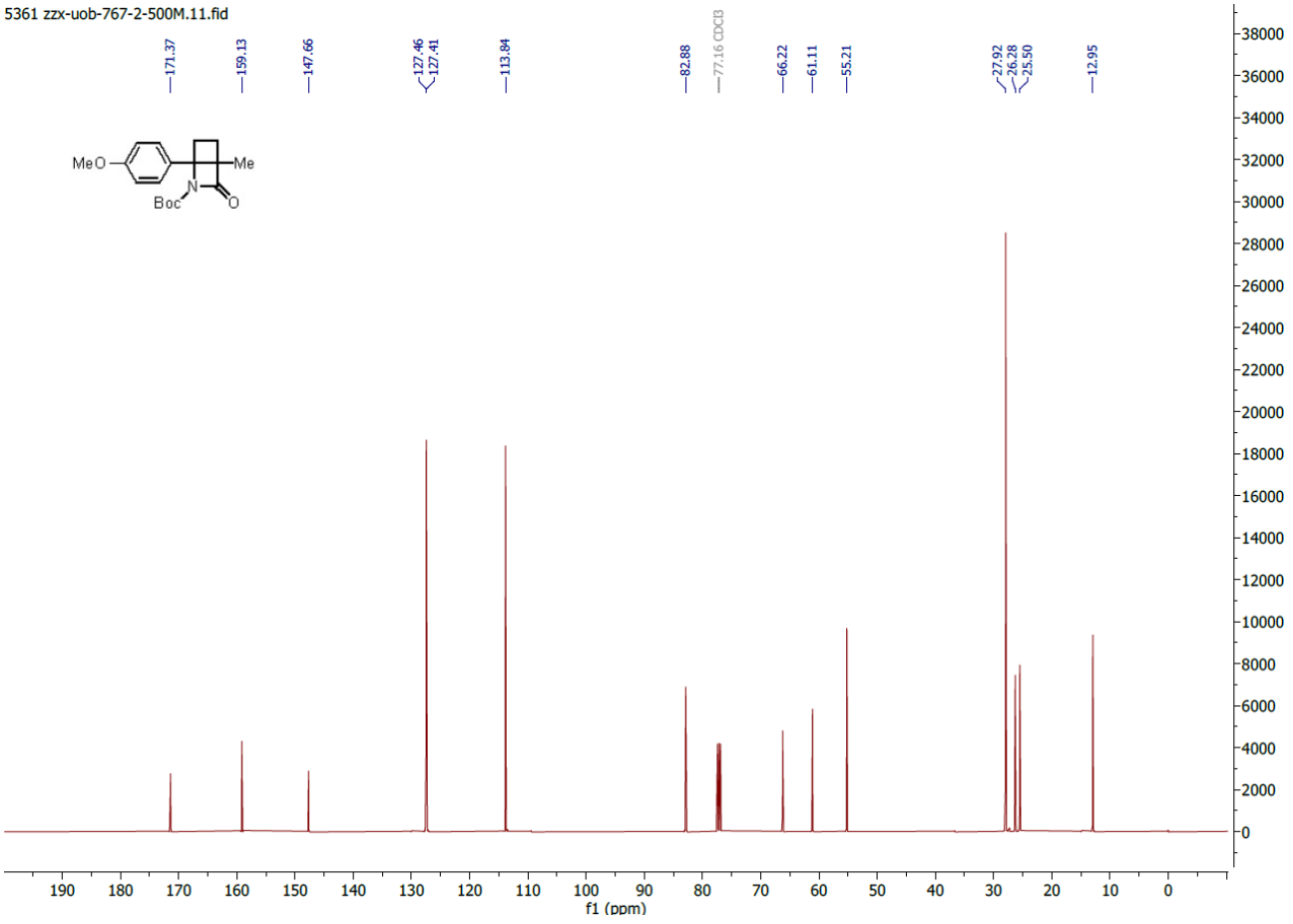
Compound 6aa



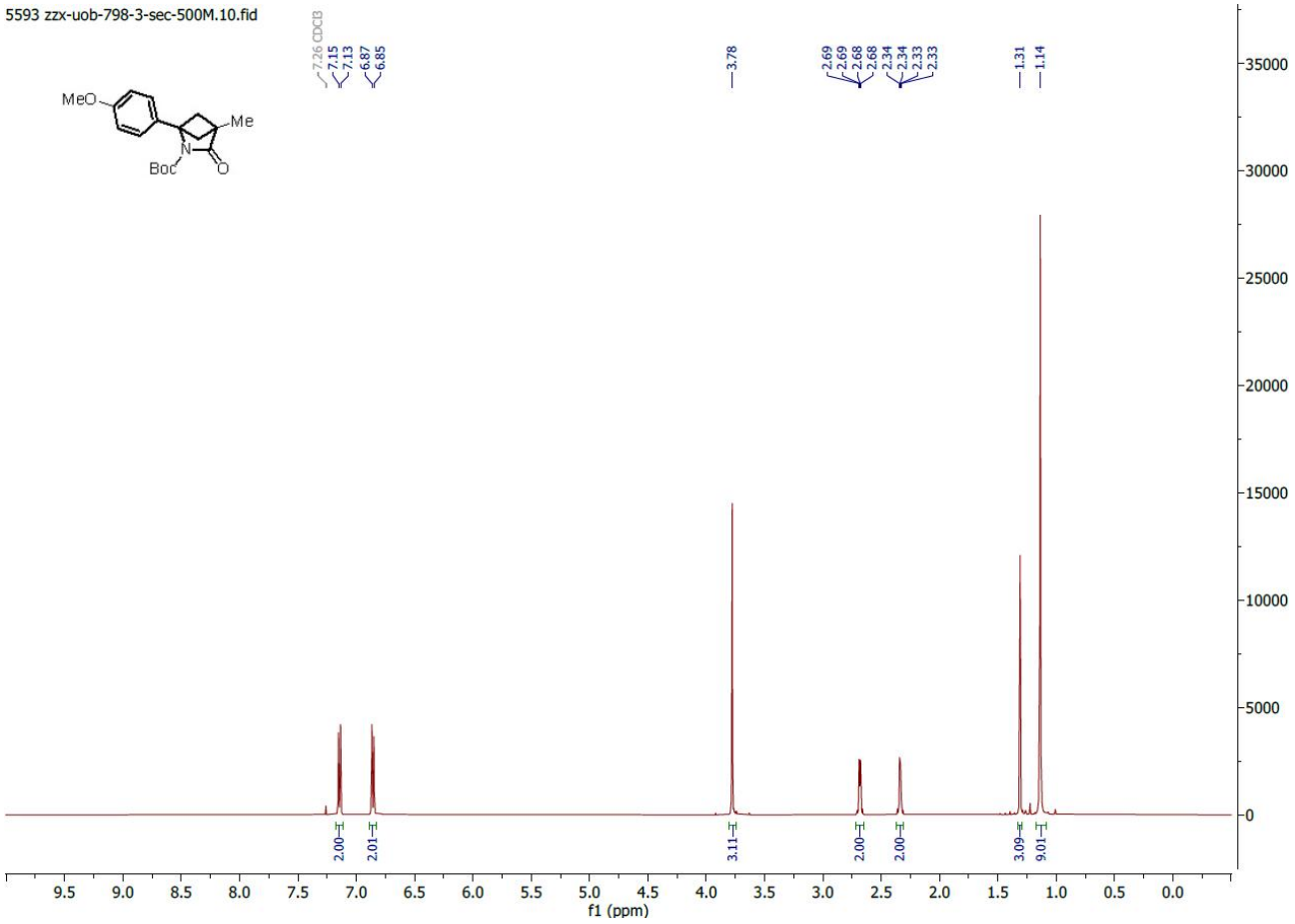


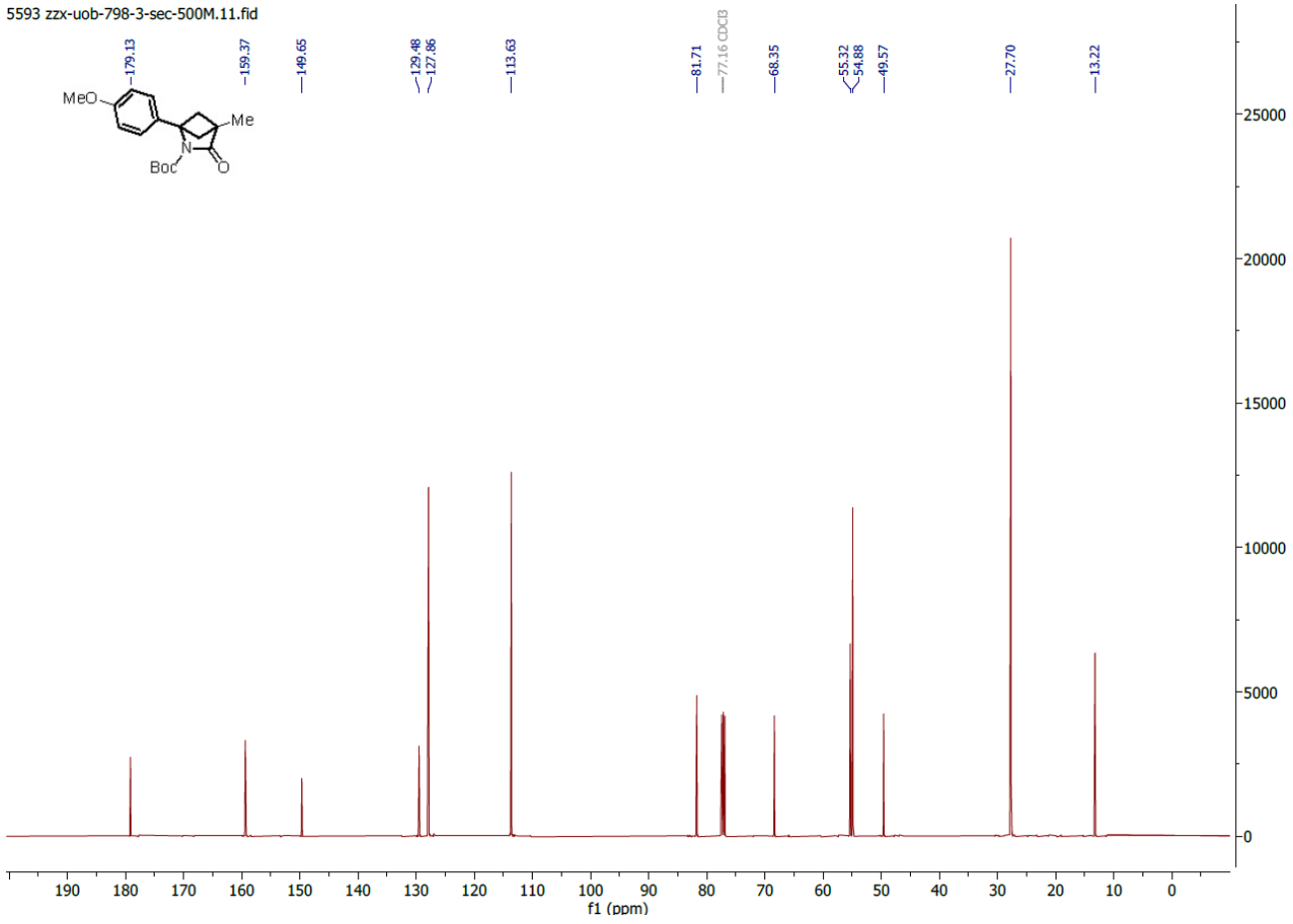
Compound 6ab



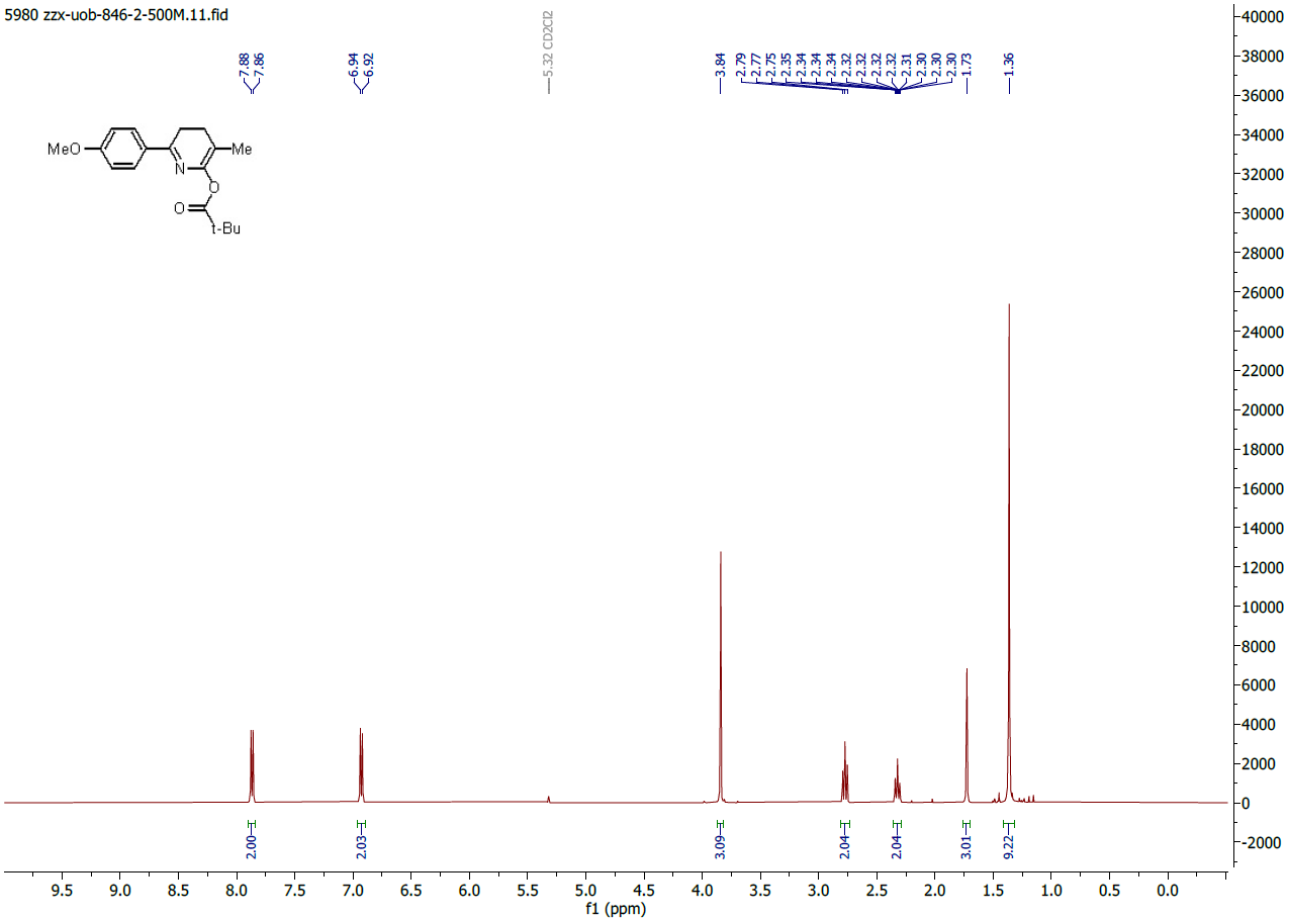


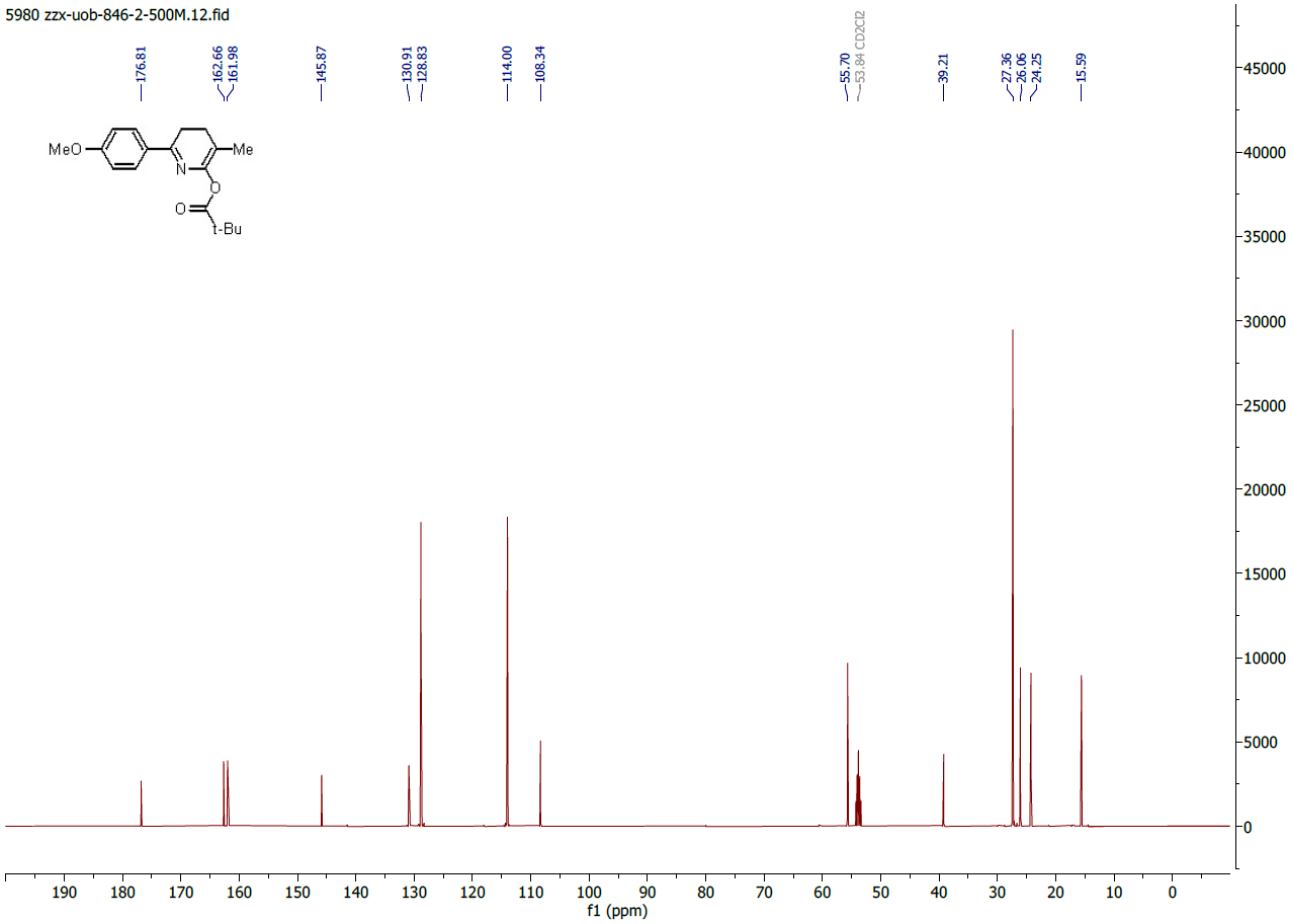
Compound 5ab





Compound 9


5980 zzx-uob-846-2-500M.11.fid
MeO
Me
N
O
O
t-Bu
f1 (ppm)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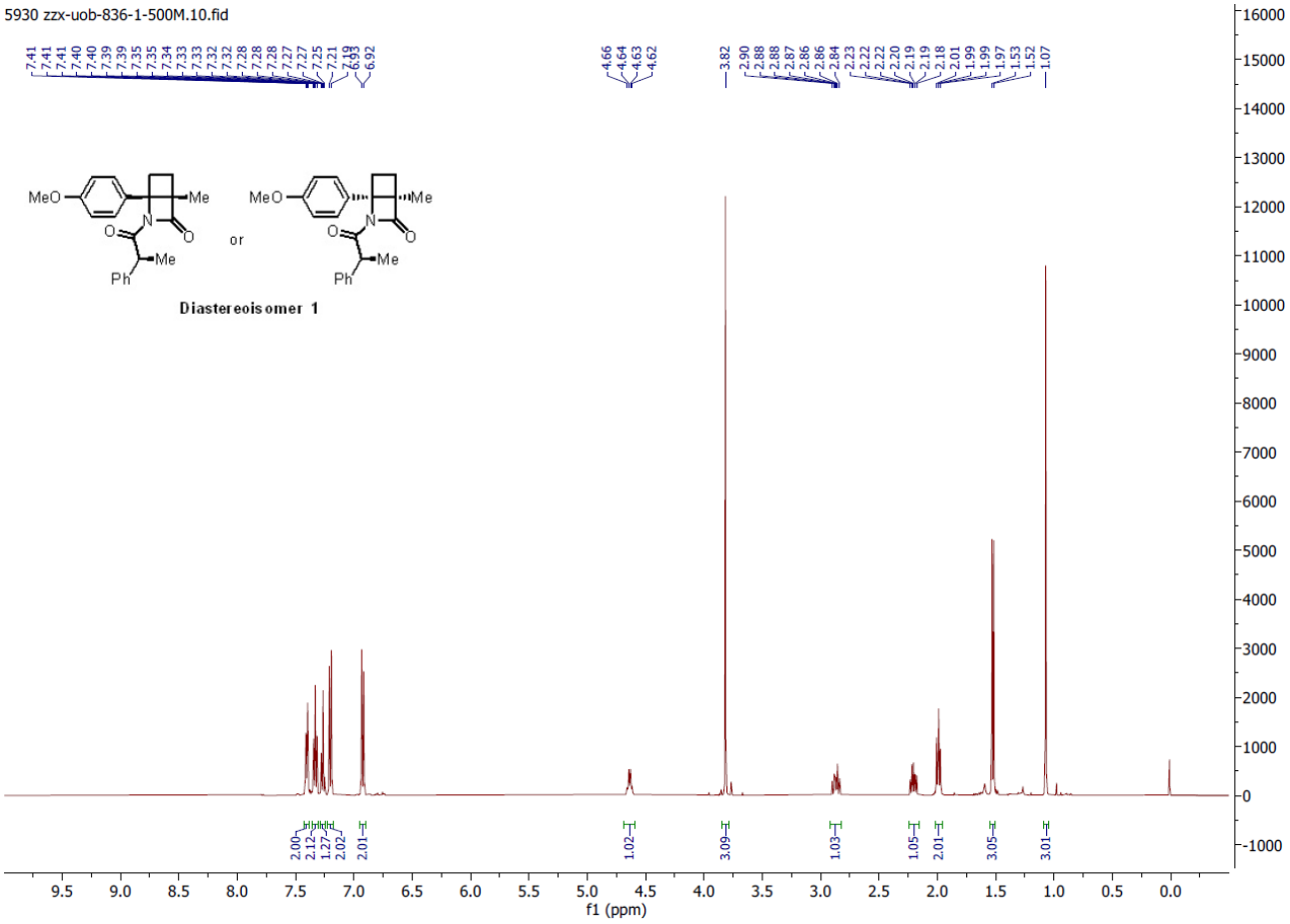
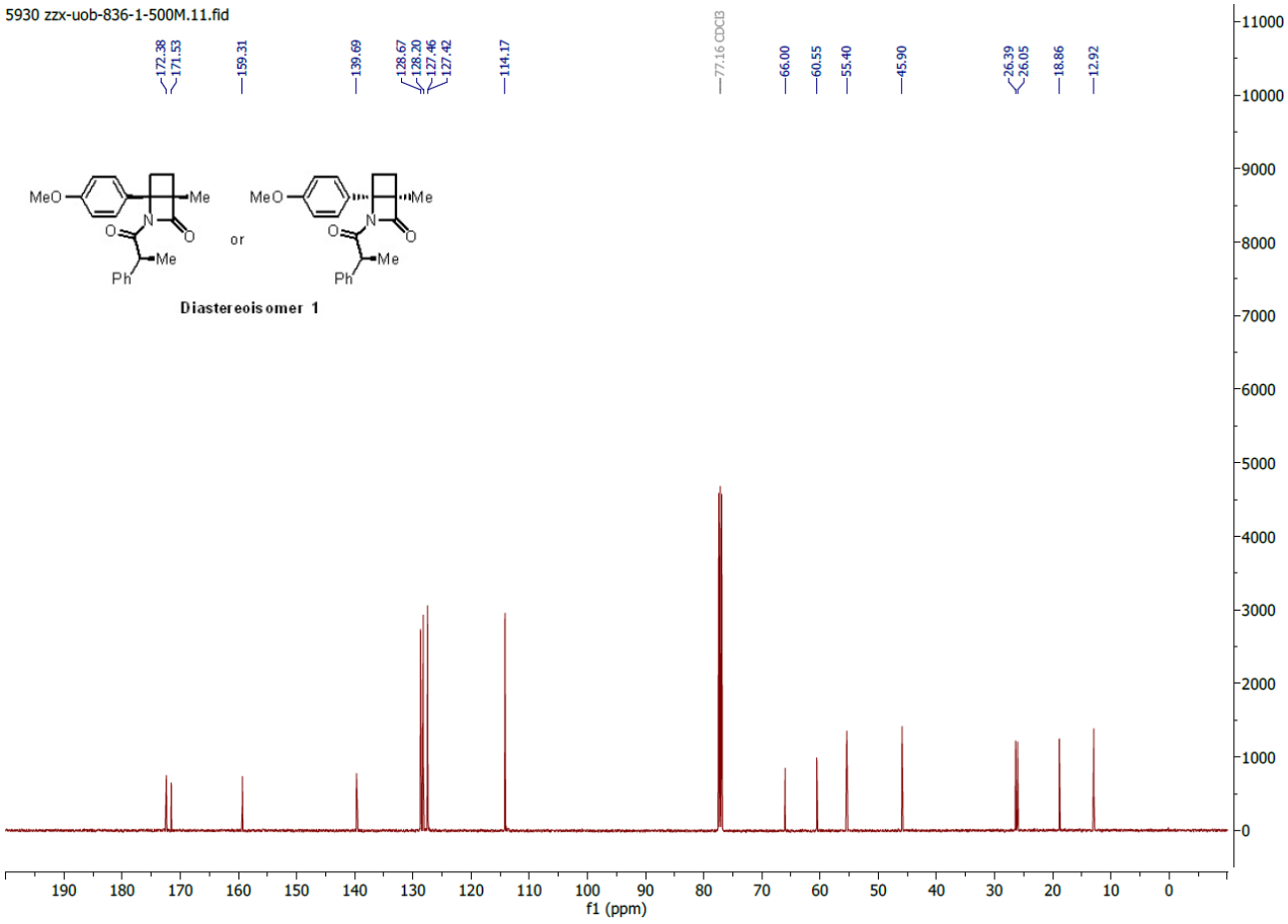
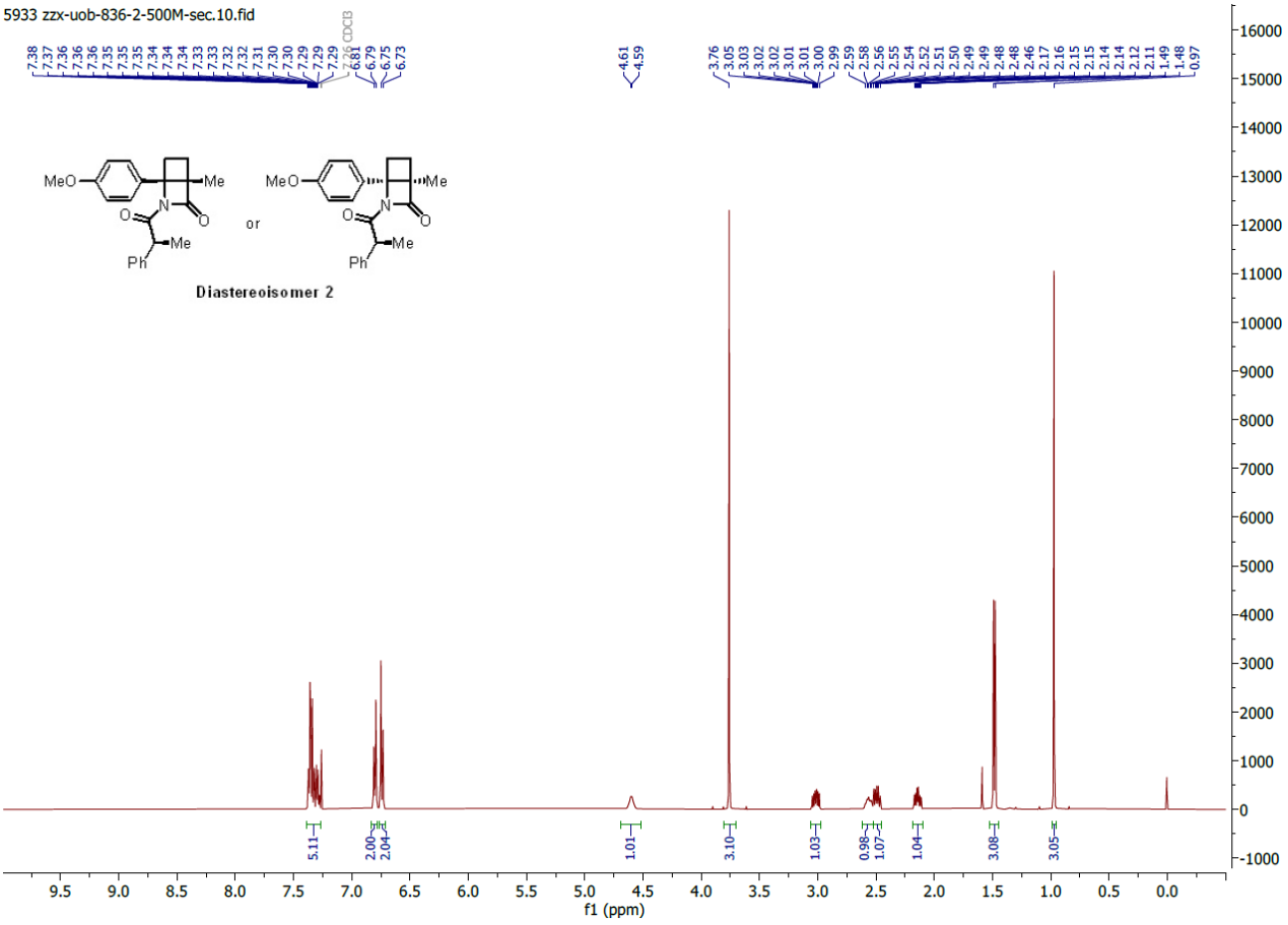
MeO
Me
N
O
O
t-Bu
f1 (ppm)

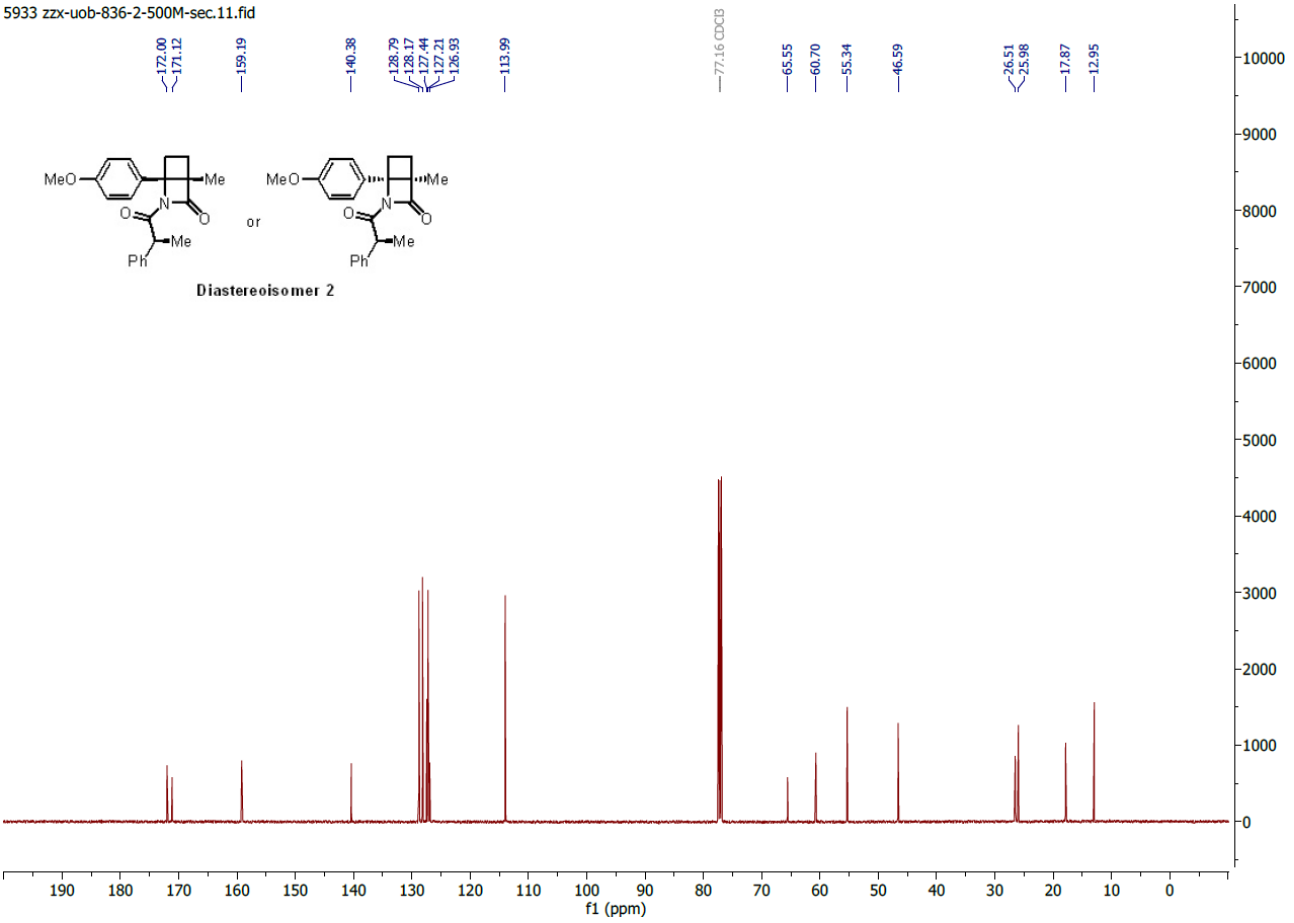
Compound 6ad and 6ad’



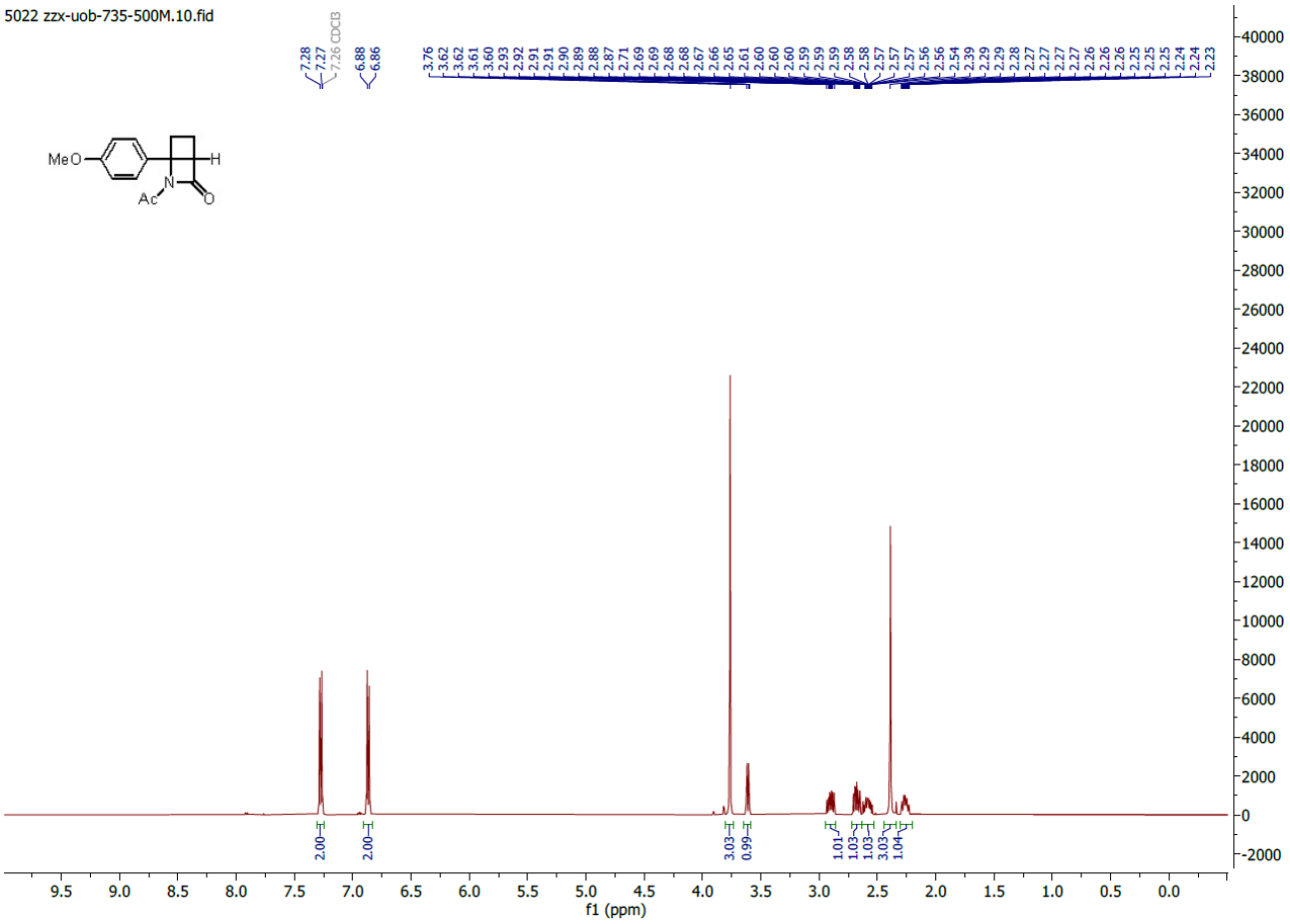


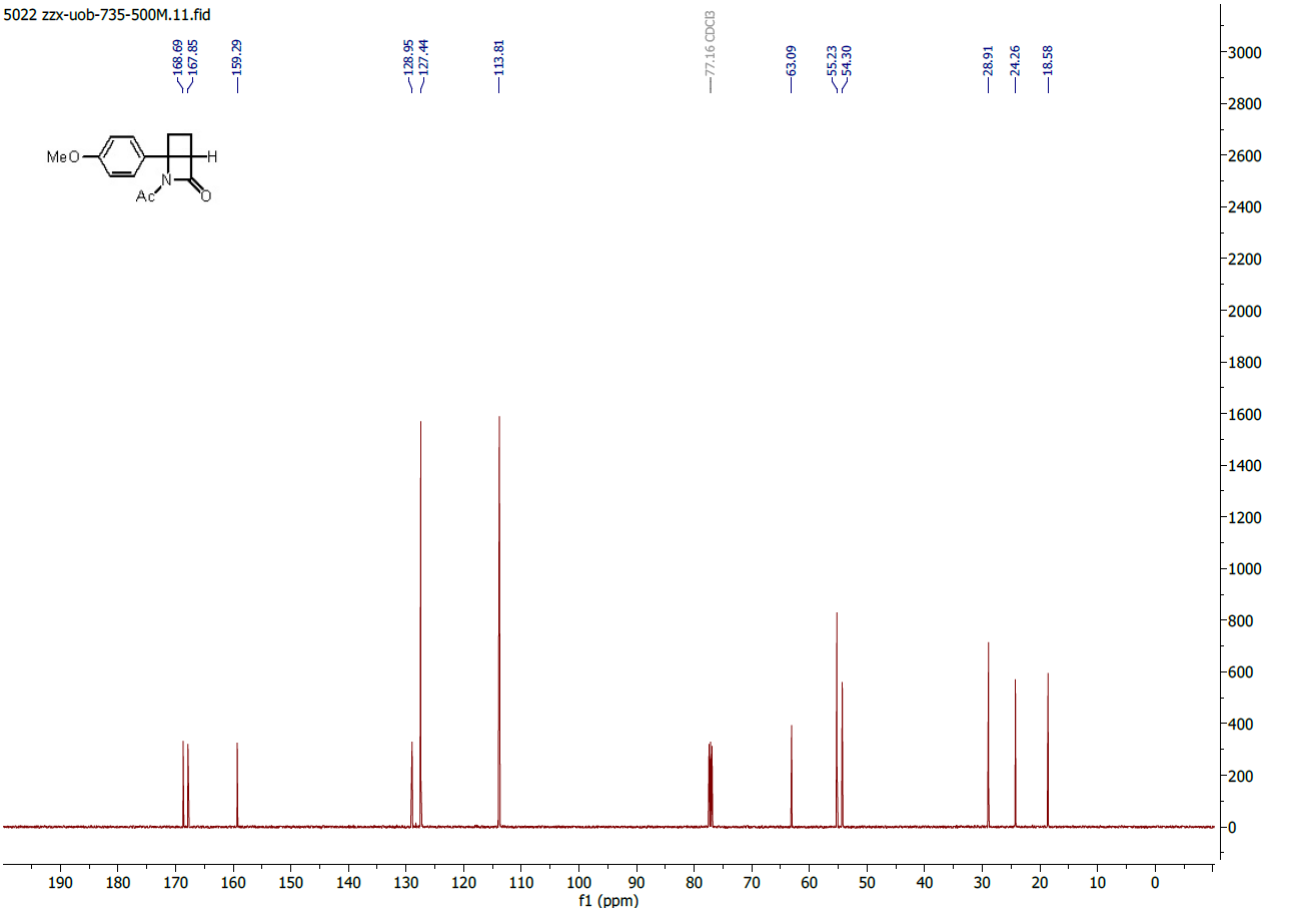
Compound 6ad and 6ad’



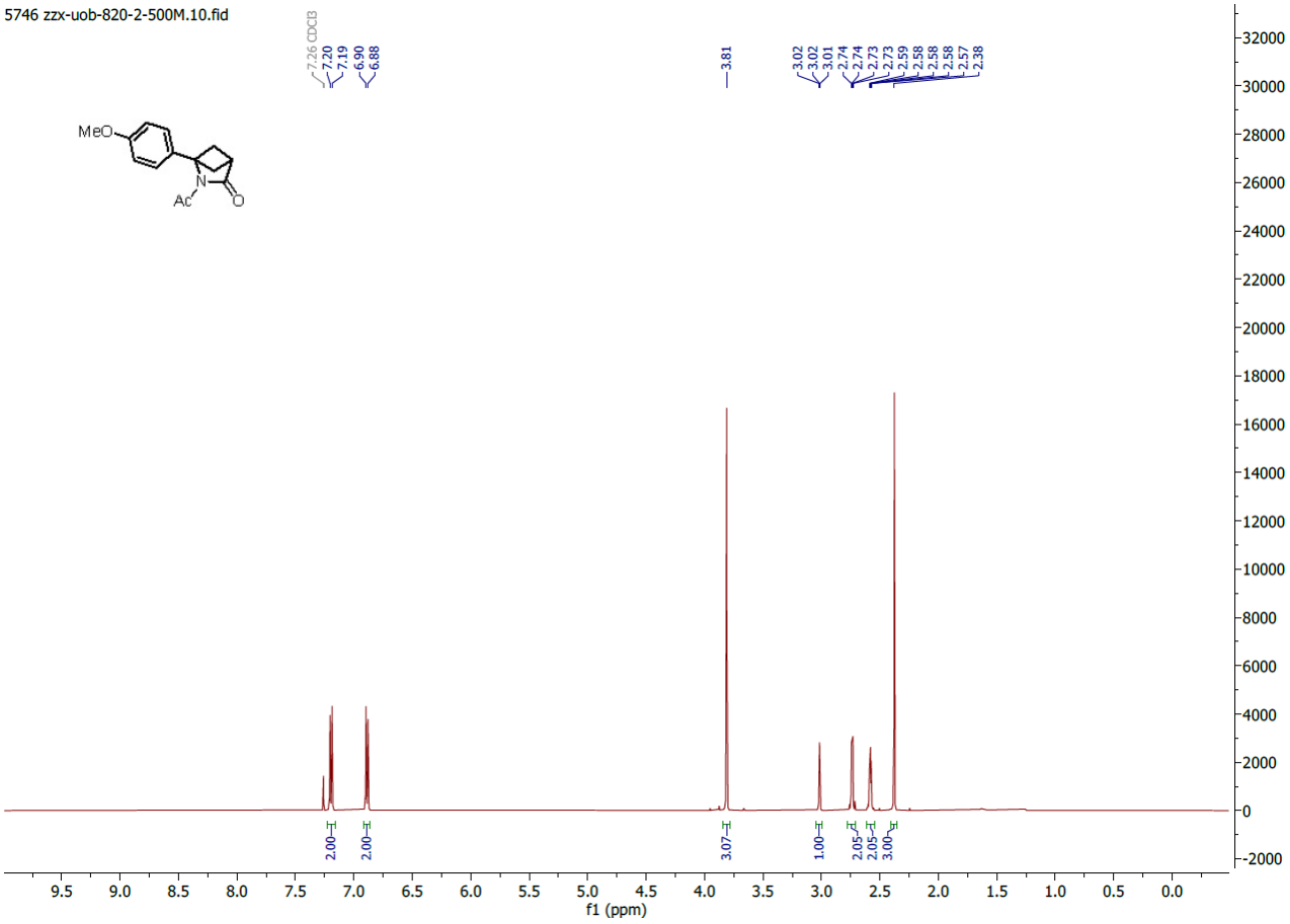


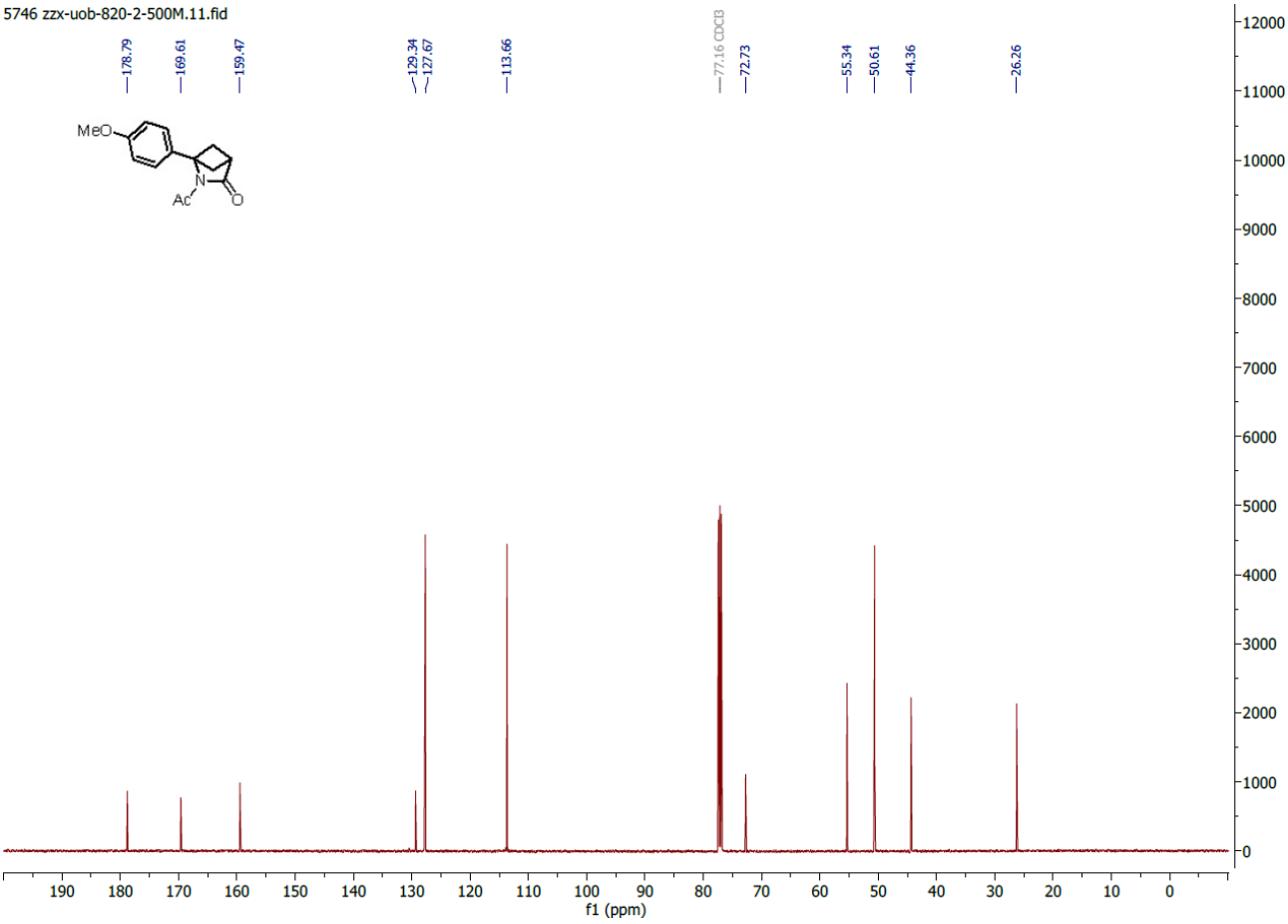
Compound 6ae



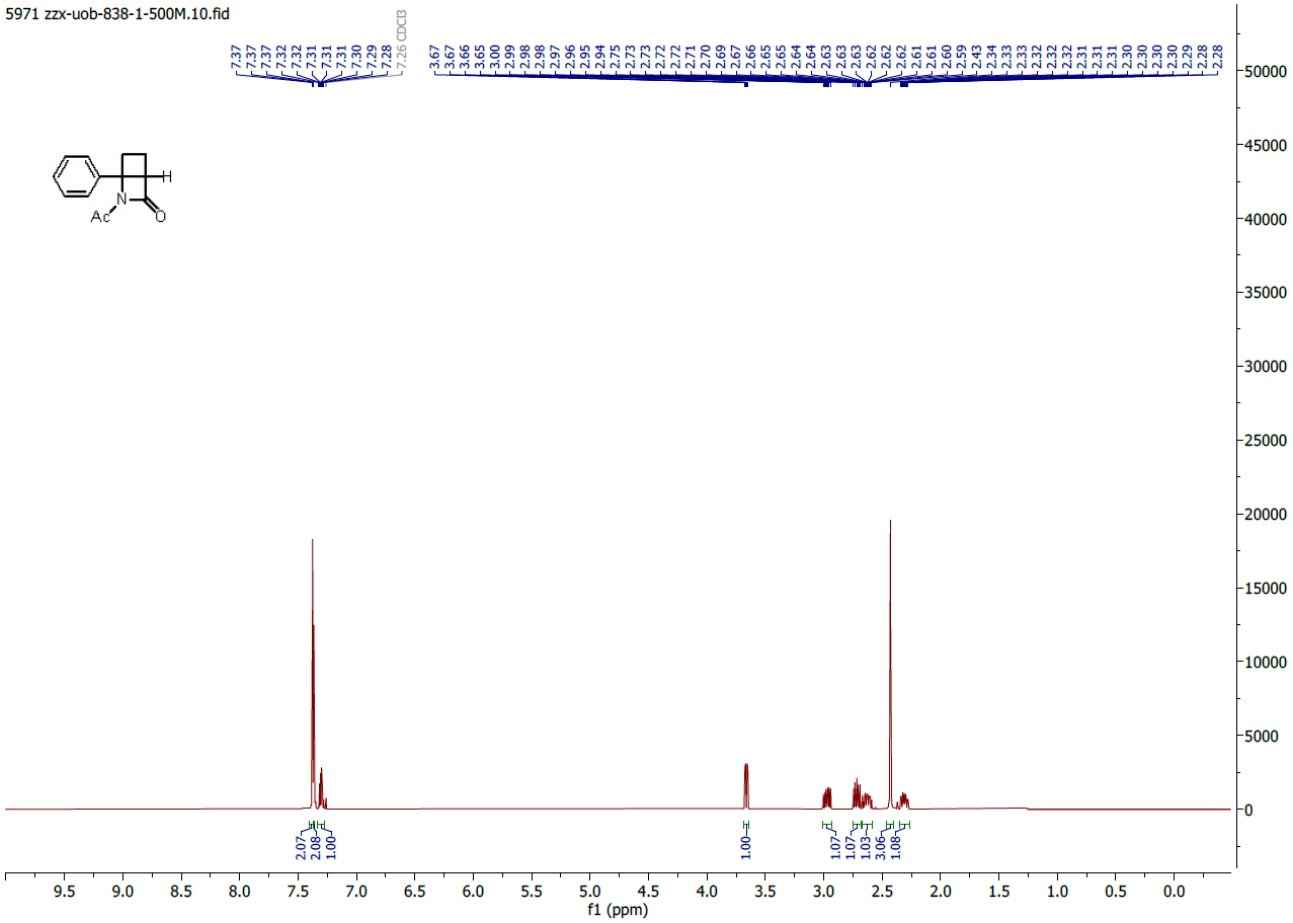


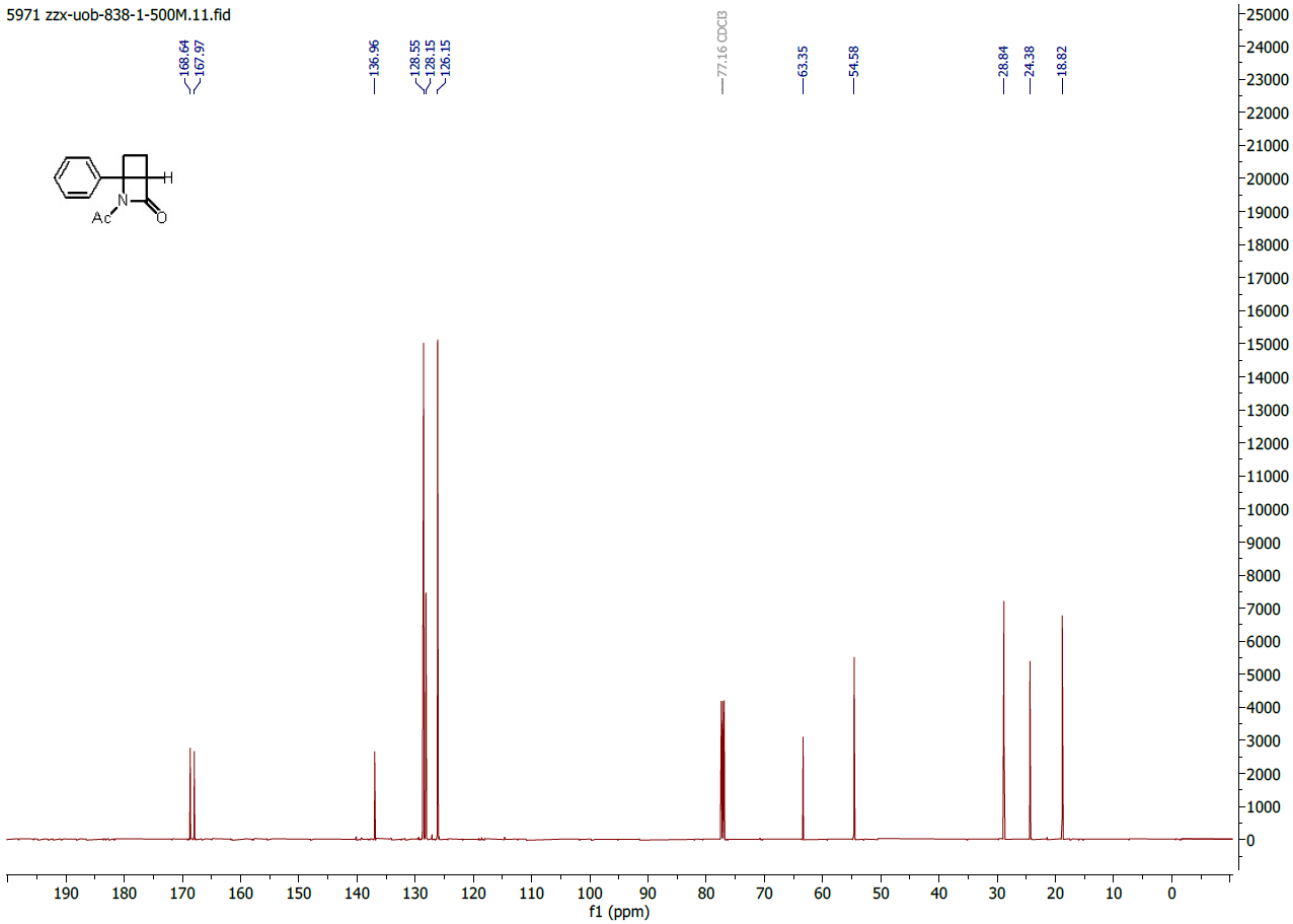
Compound 5ae



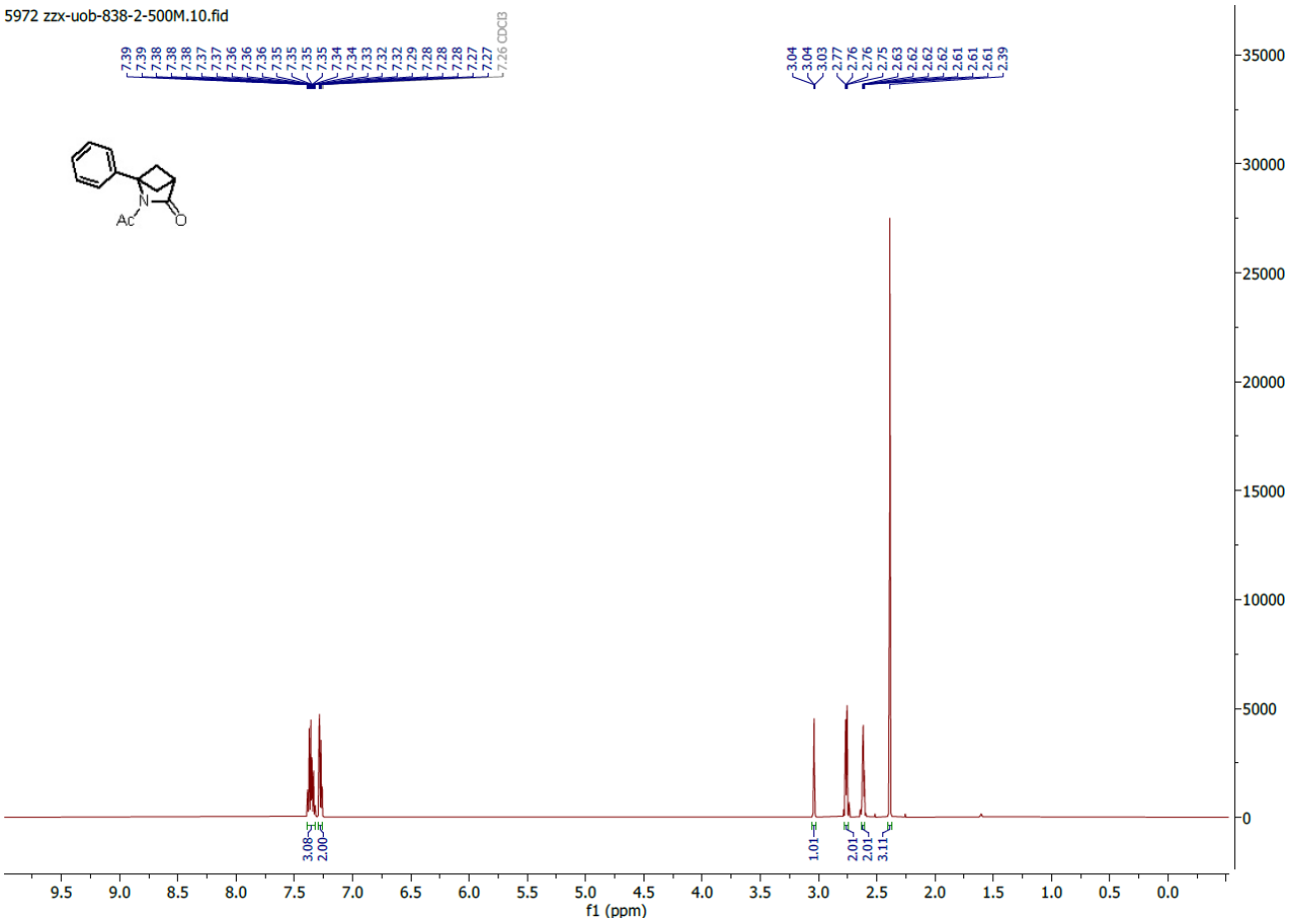


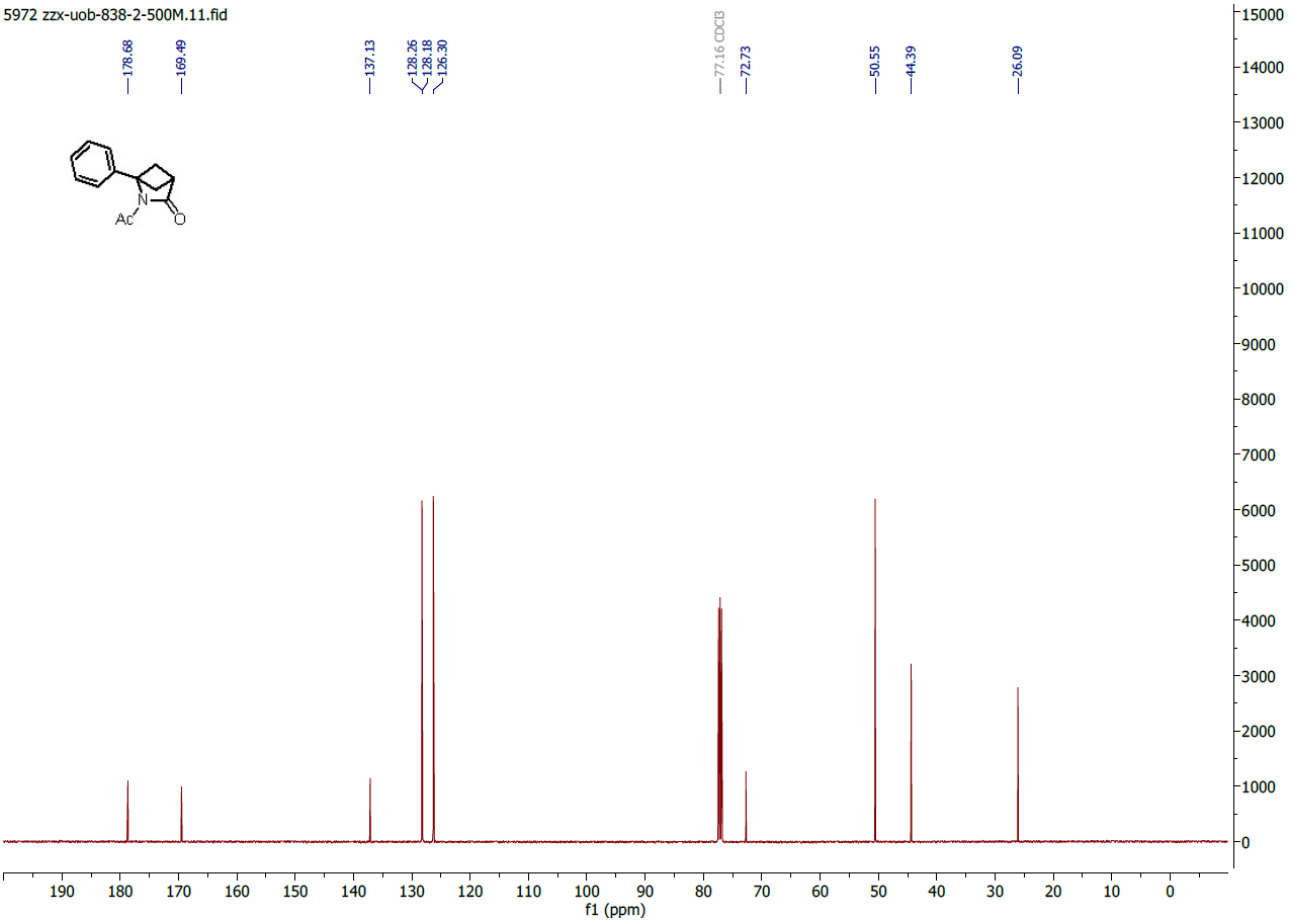
Compound 6af



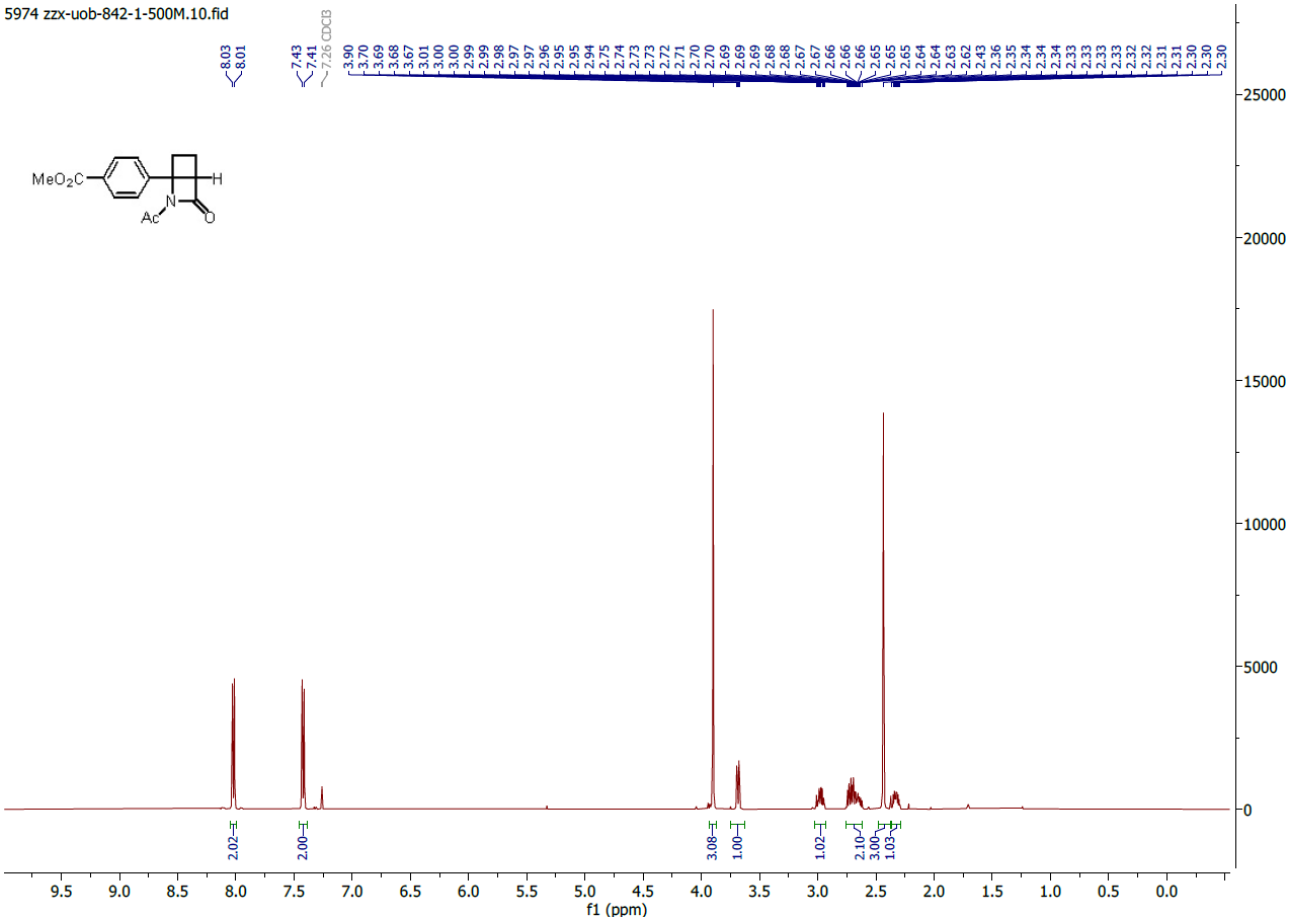


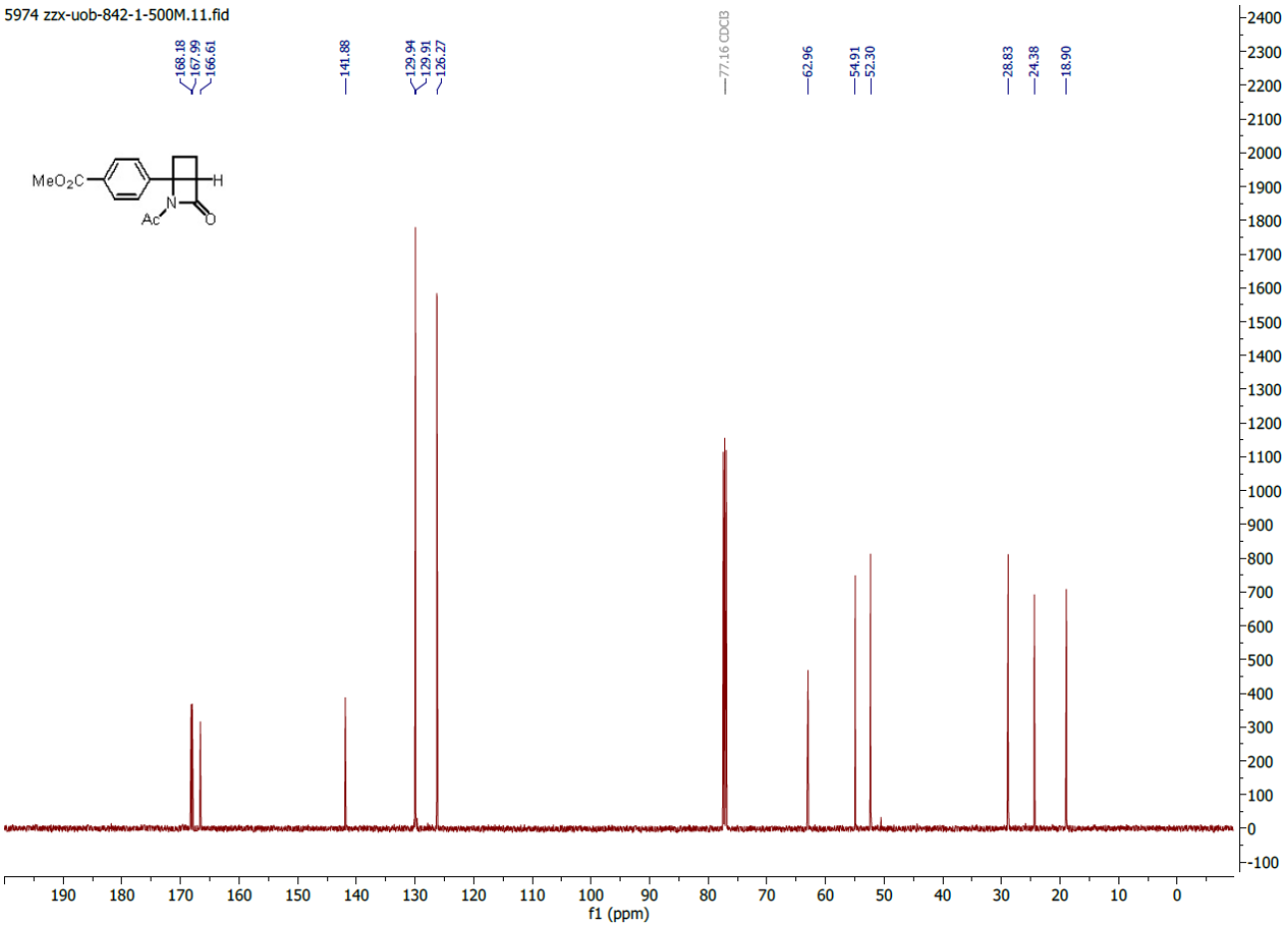
Compound 5af



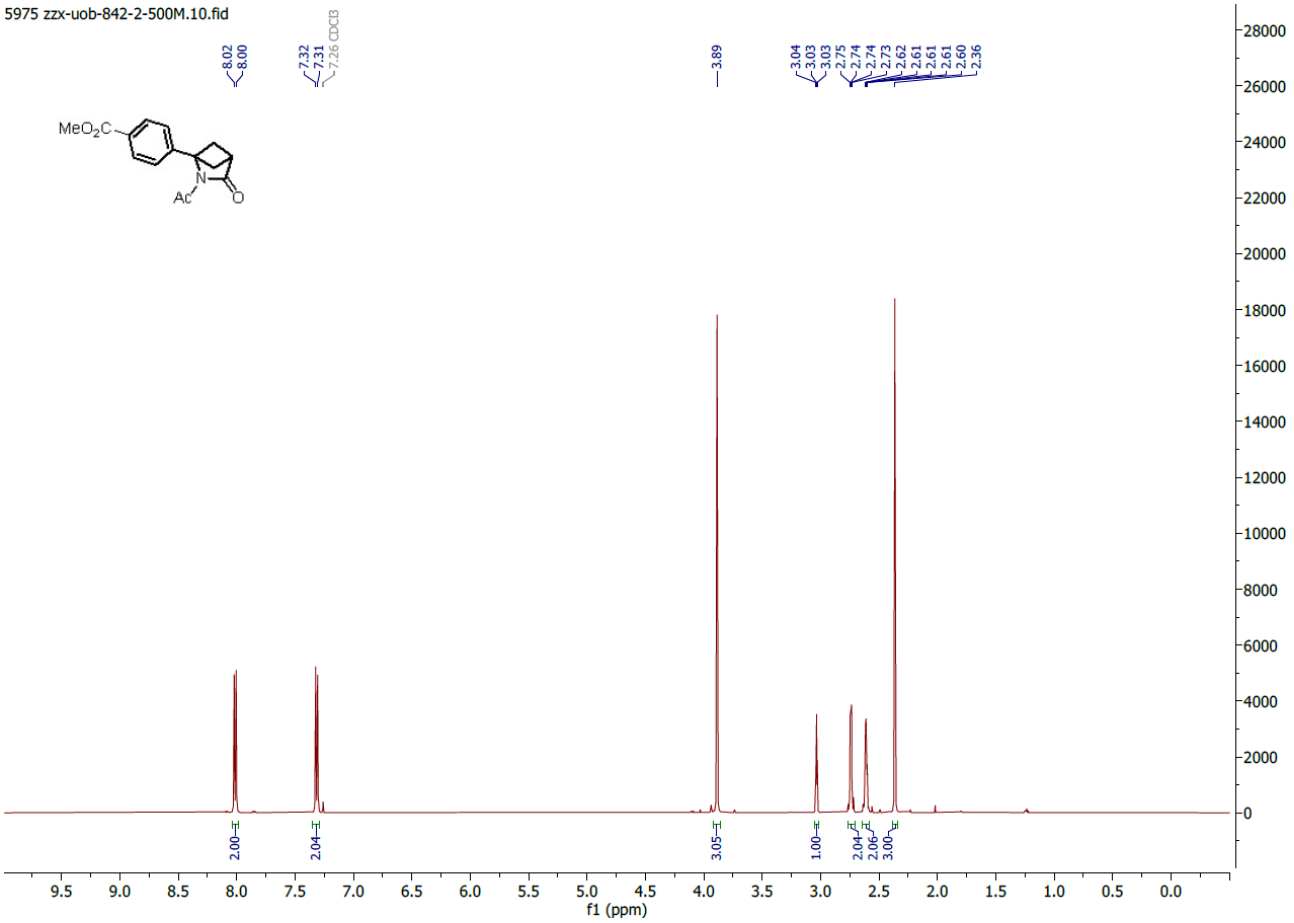


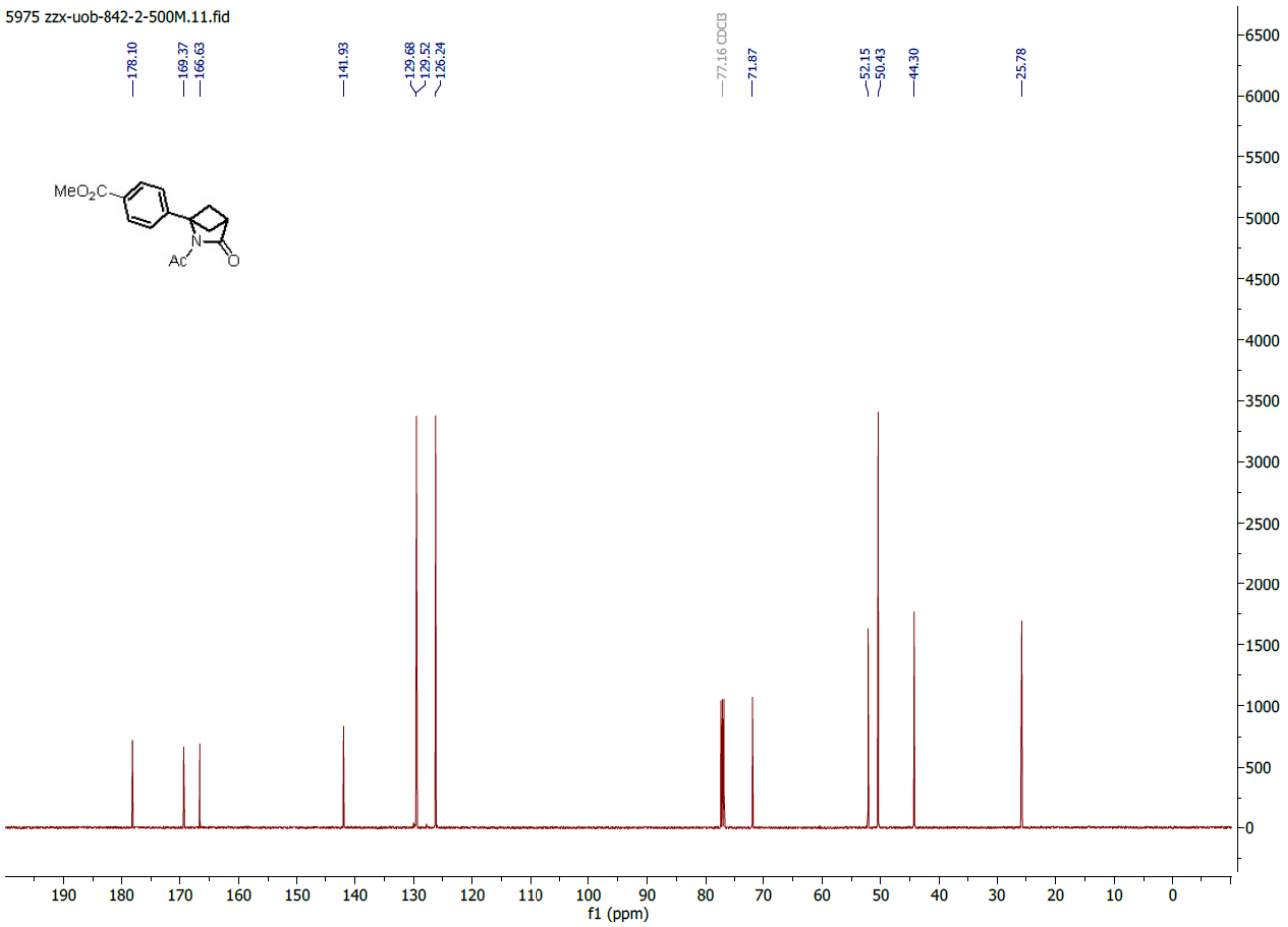
Compound 6ag



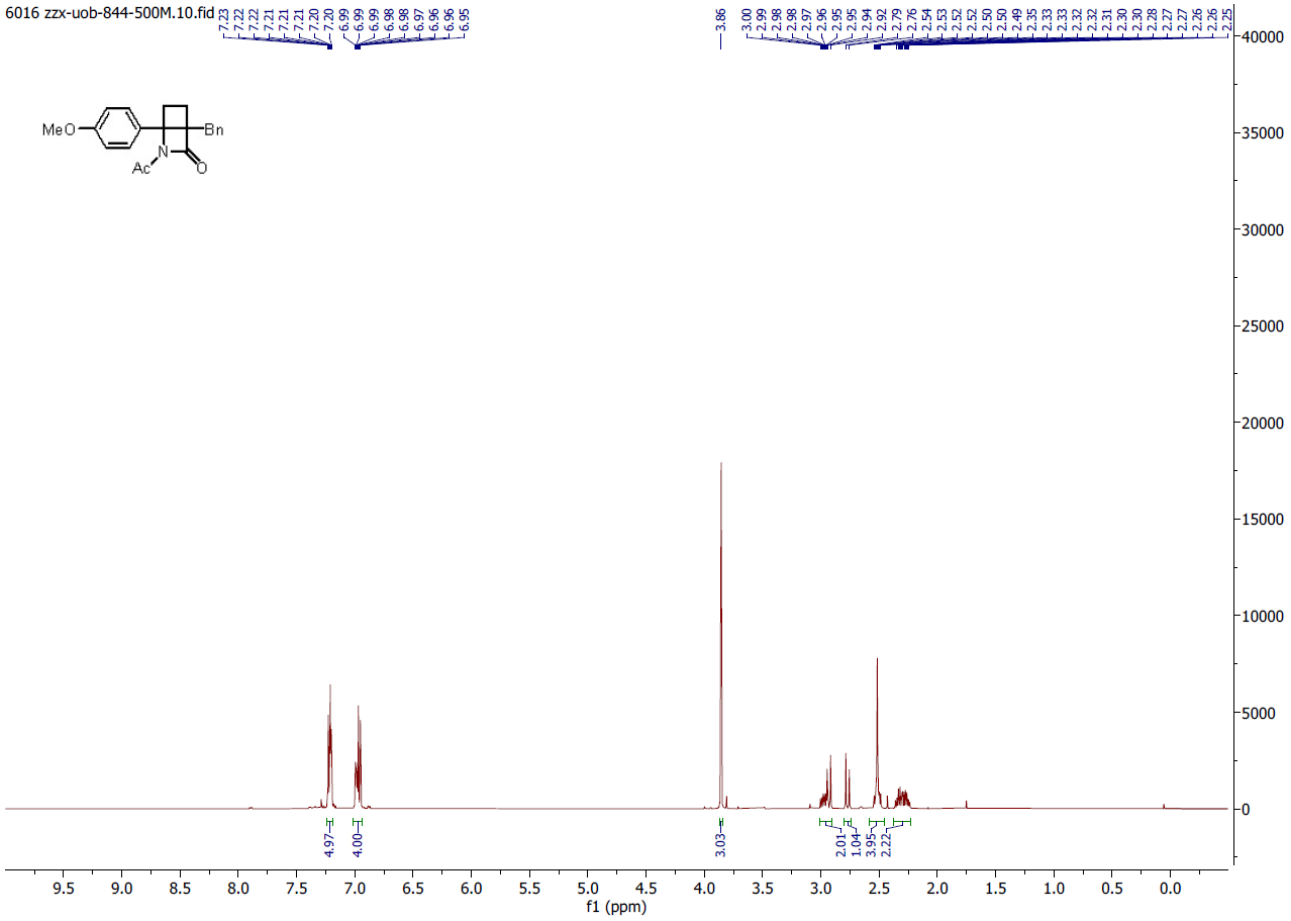


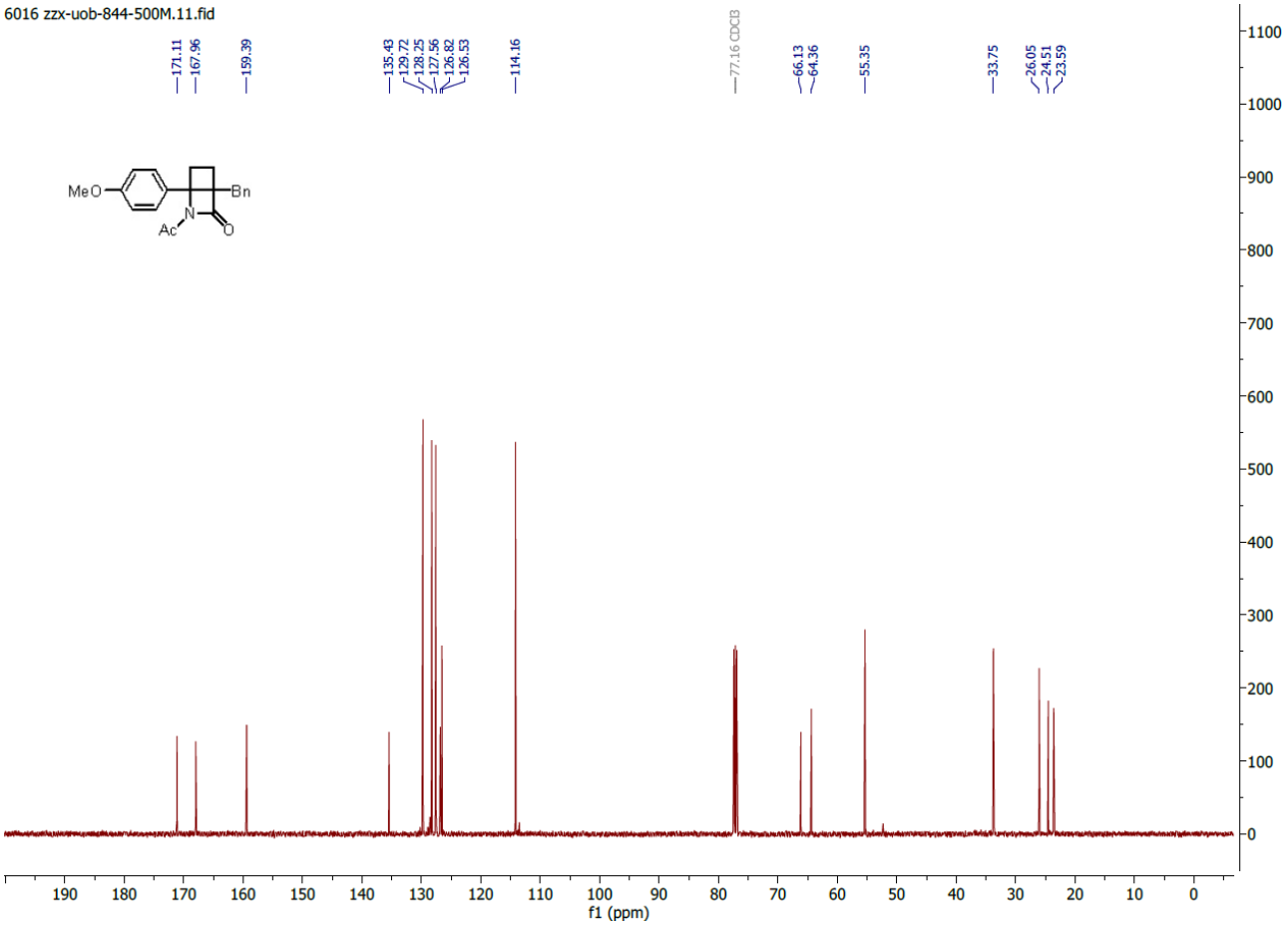
Compound 5ag



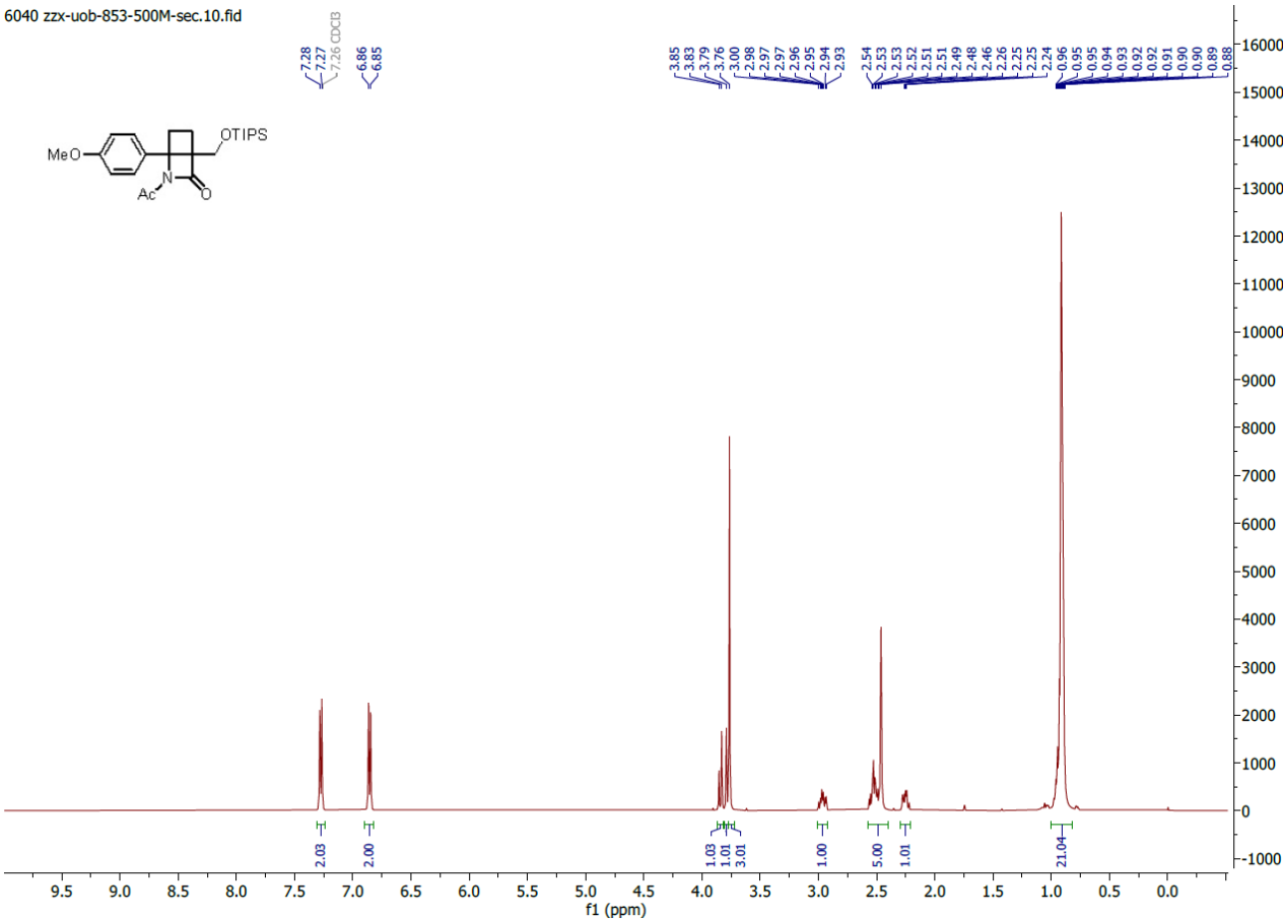


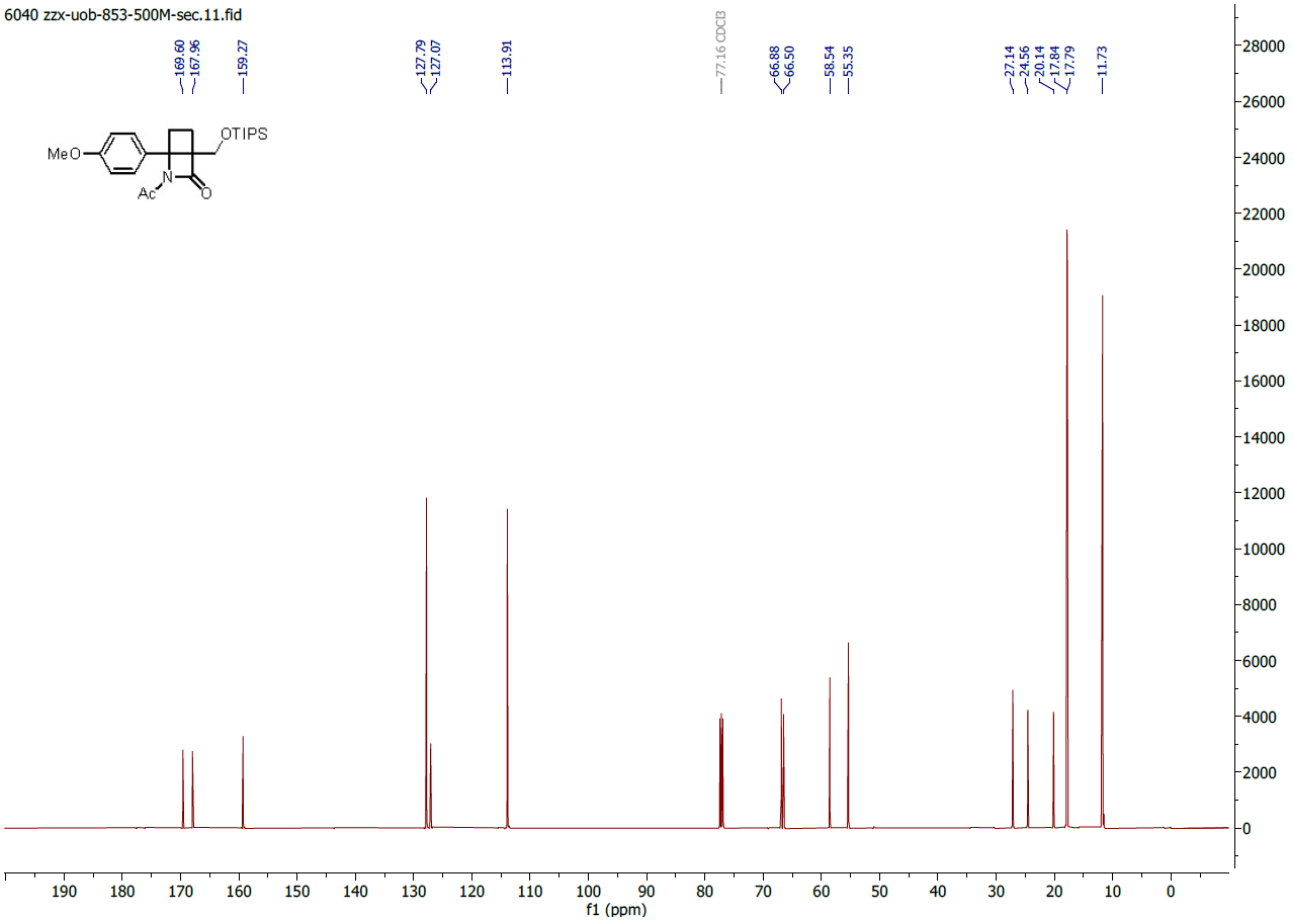
Compound 6ah



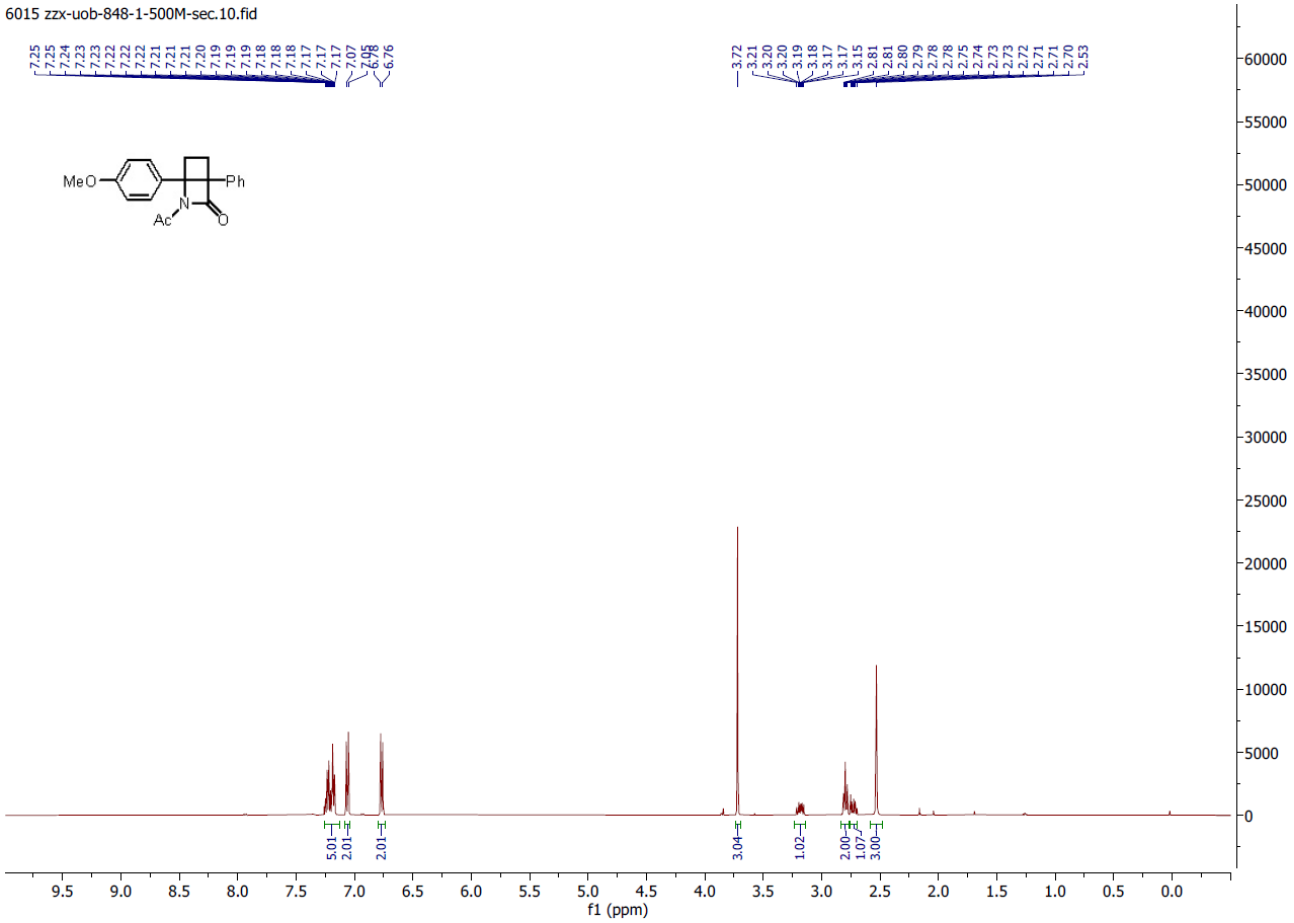


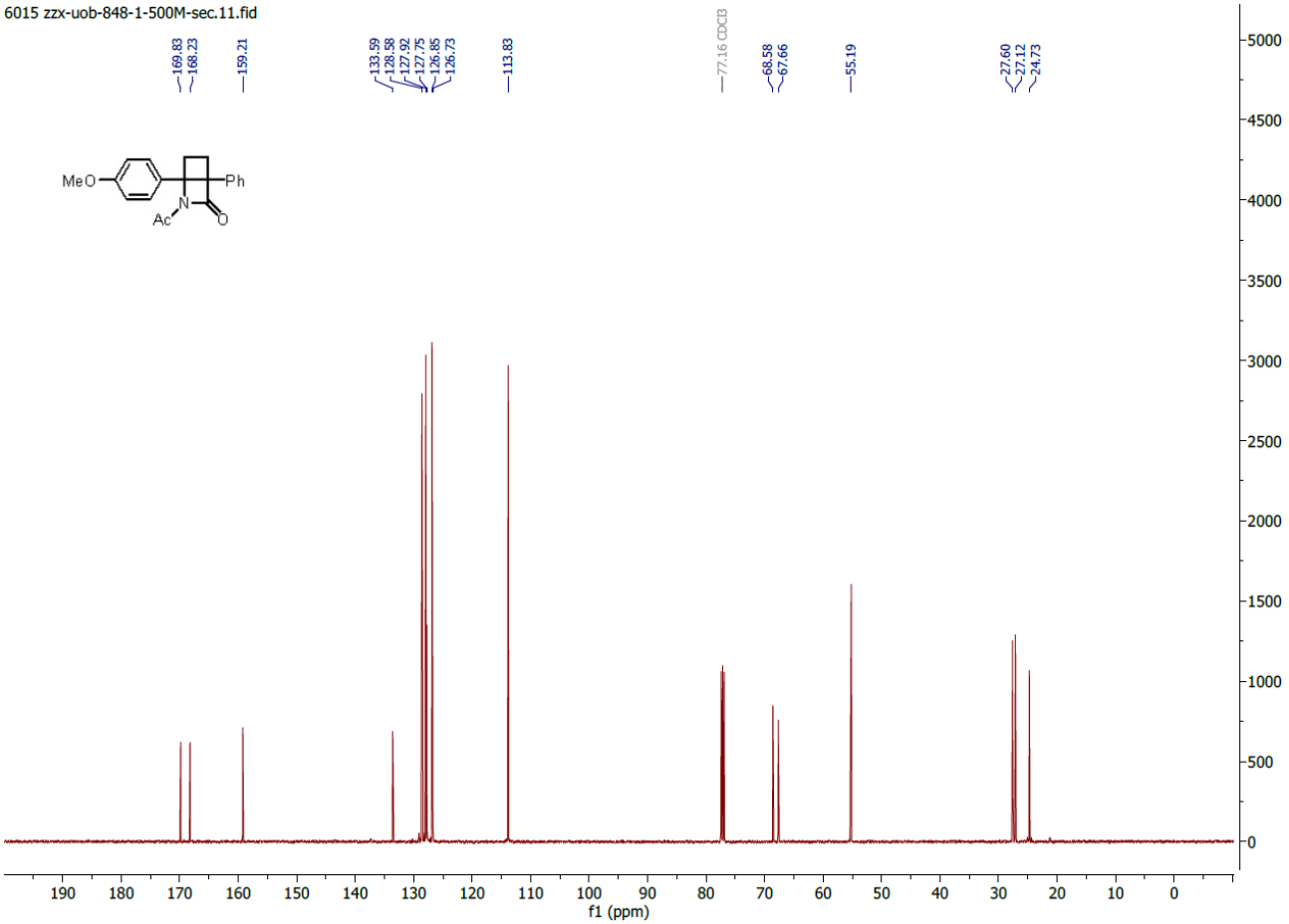
Compound 6ai



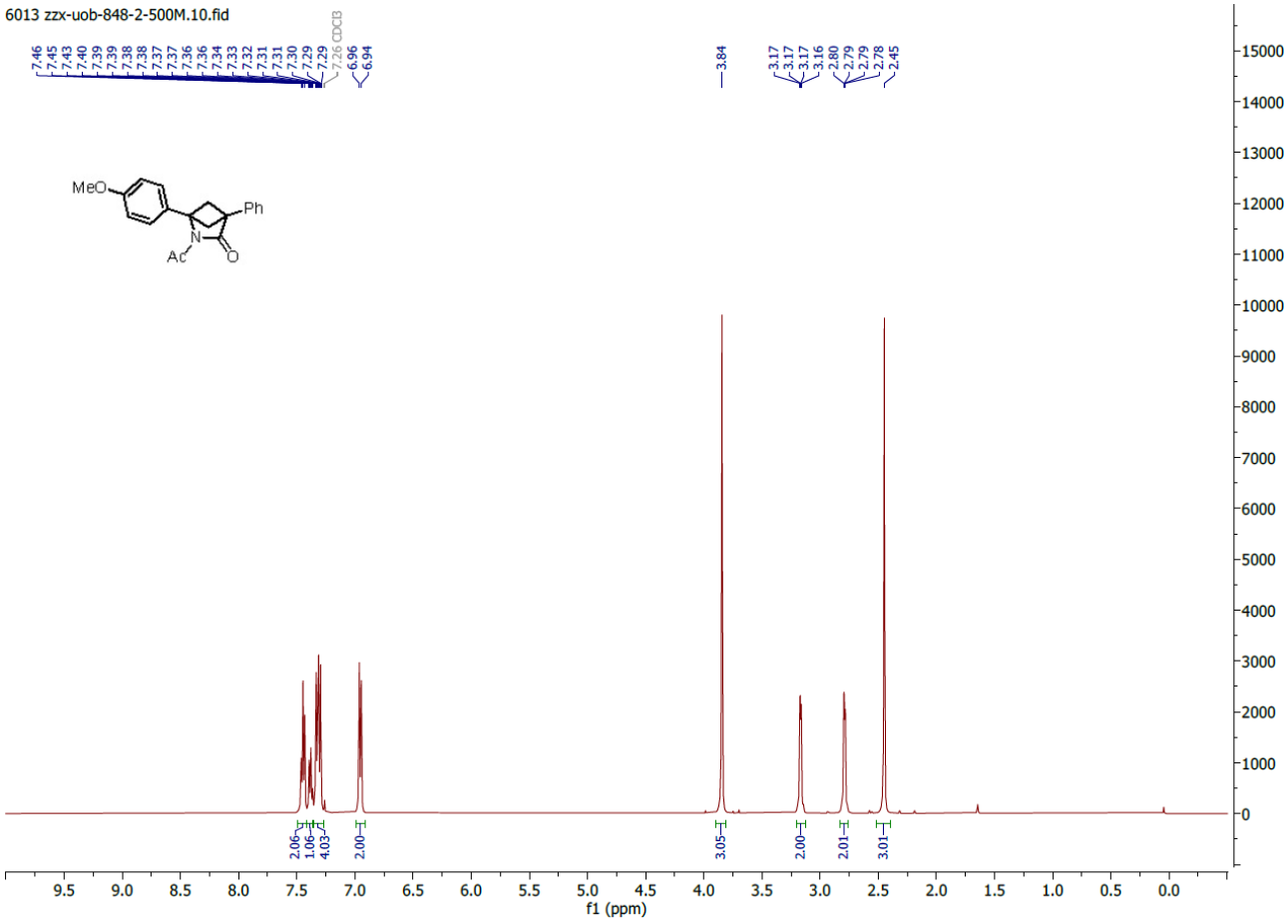


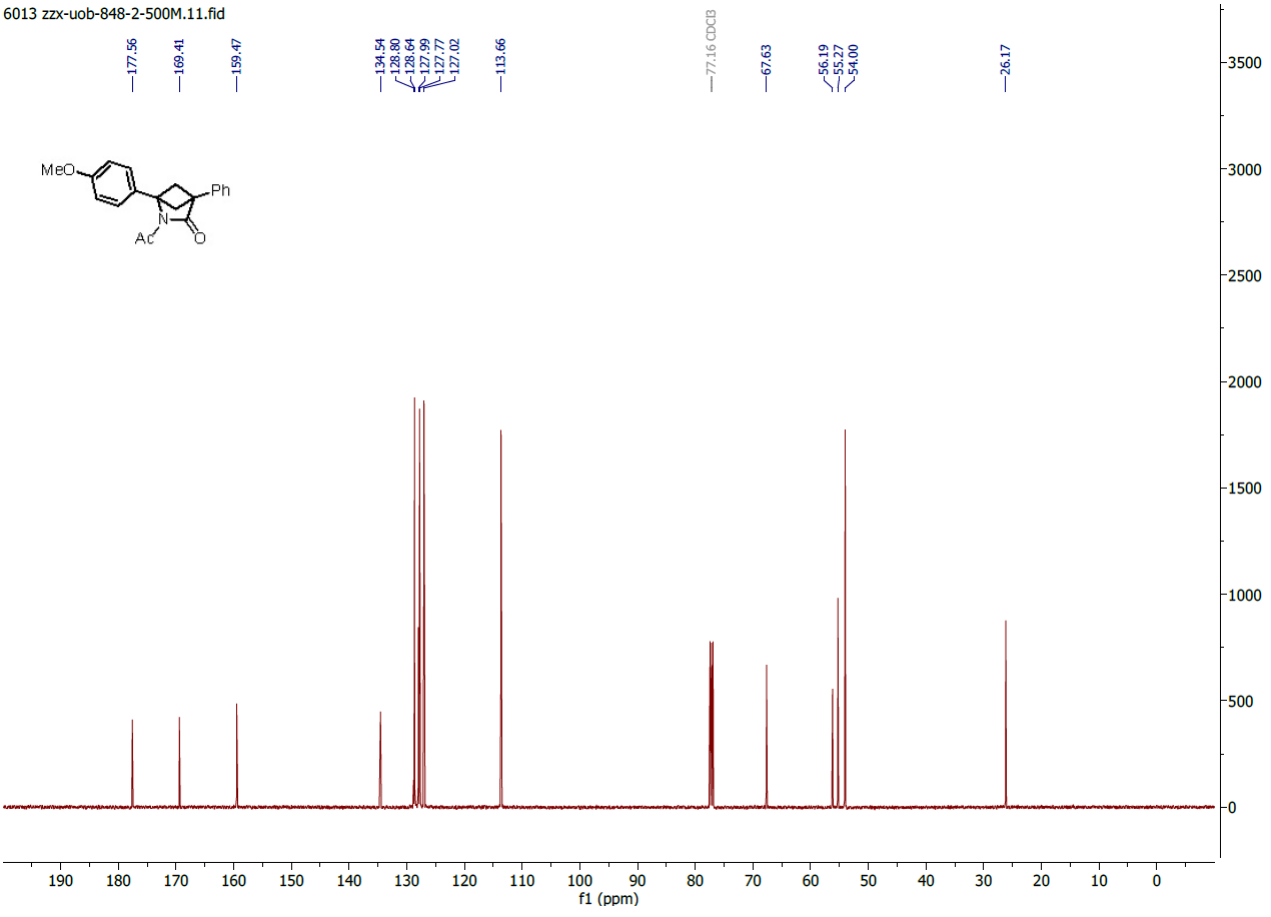
Compound 6aj



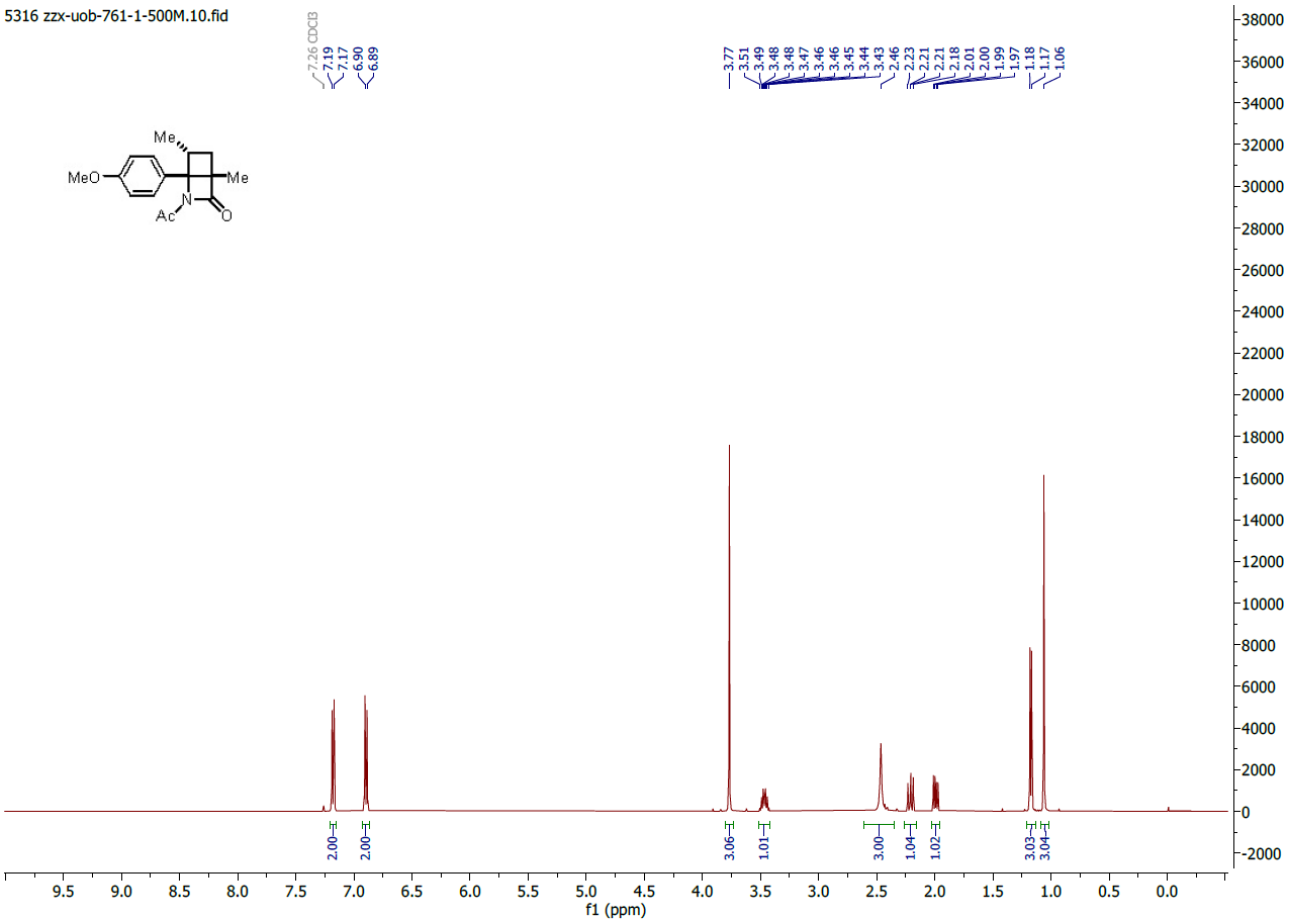


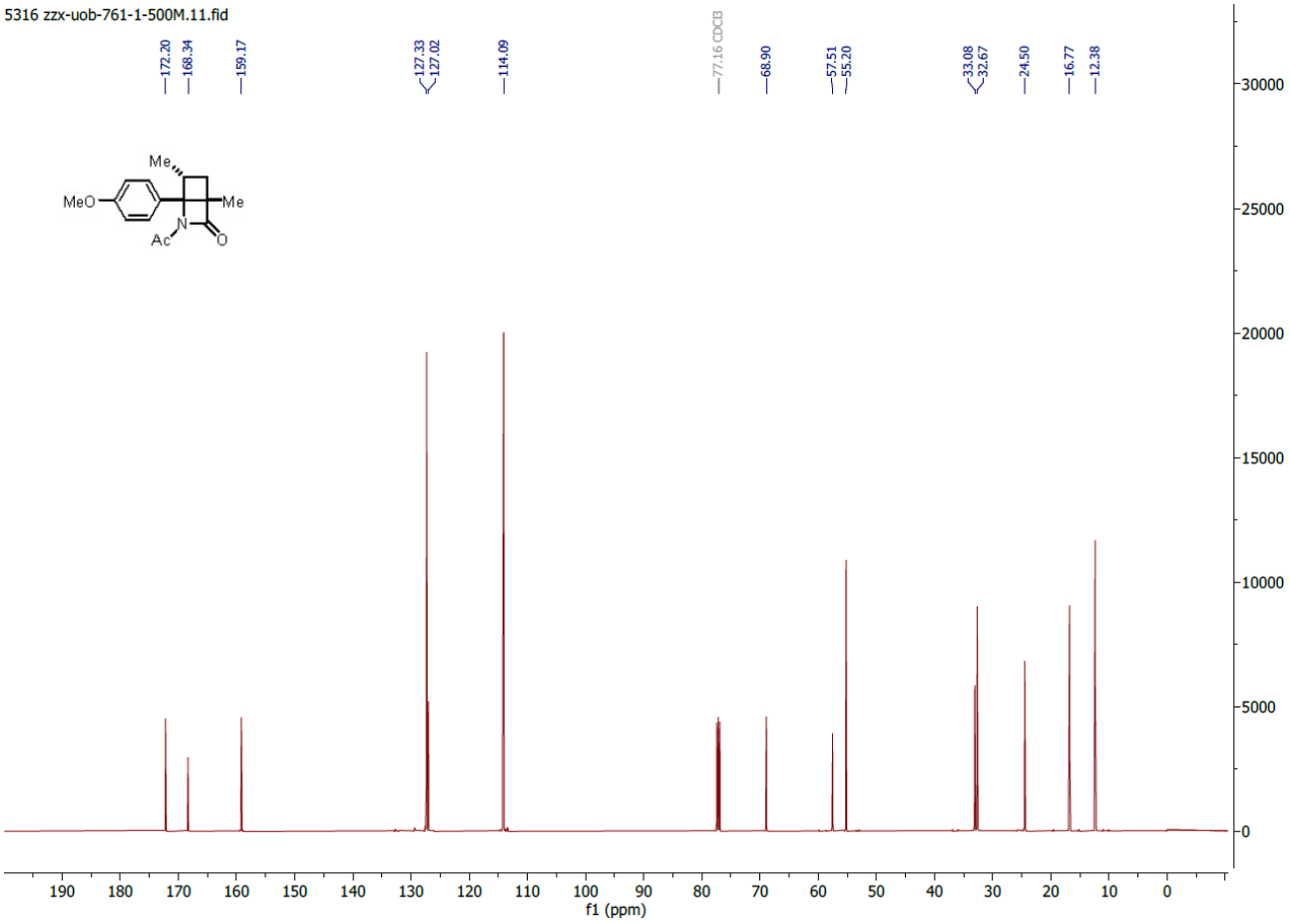
Compound 5aj



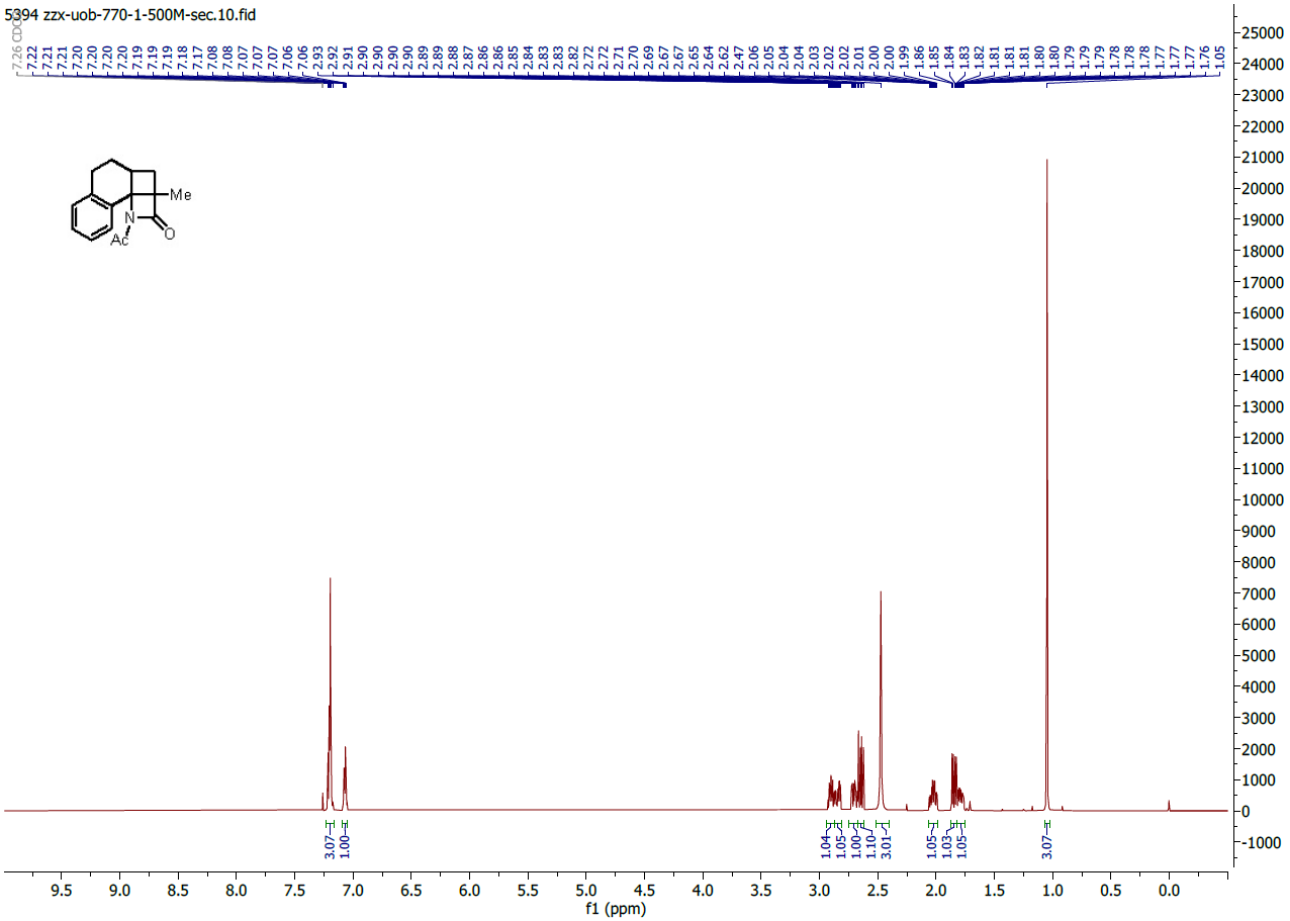


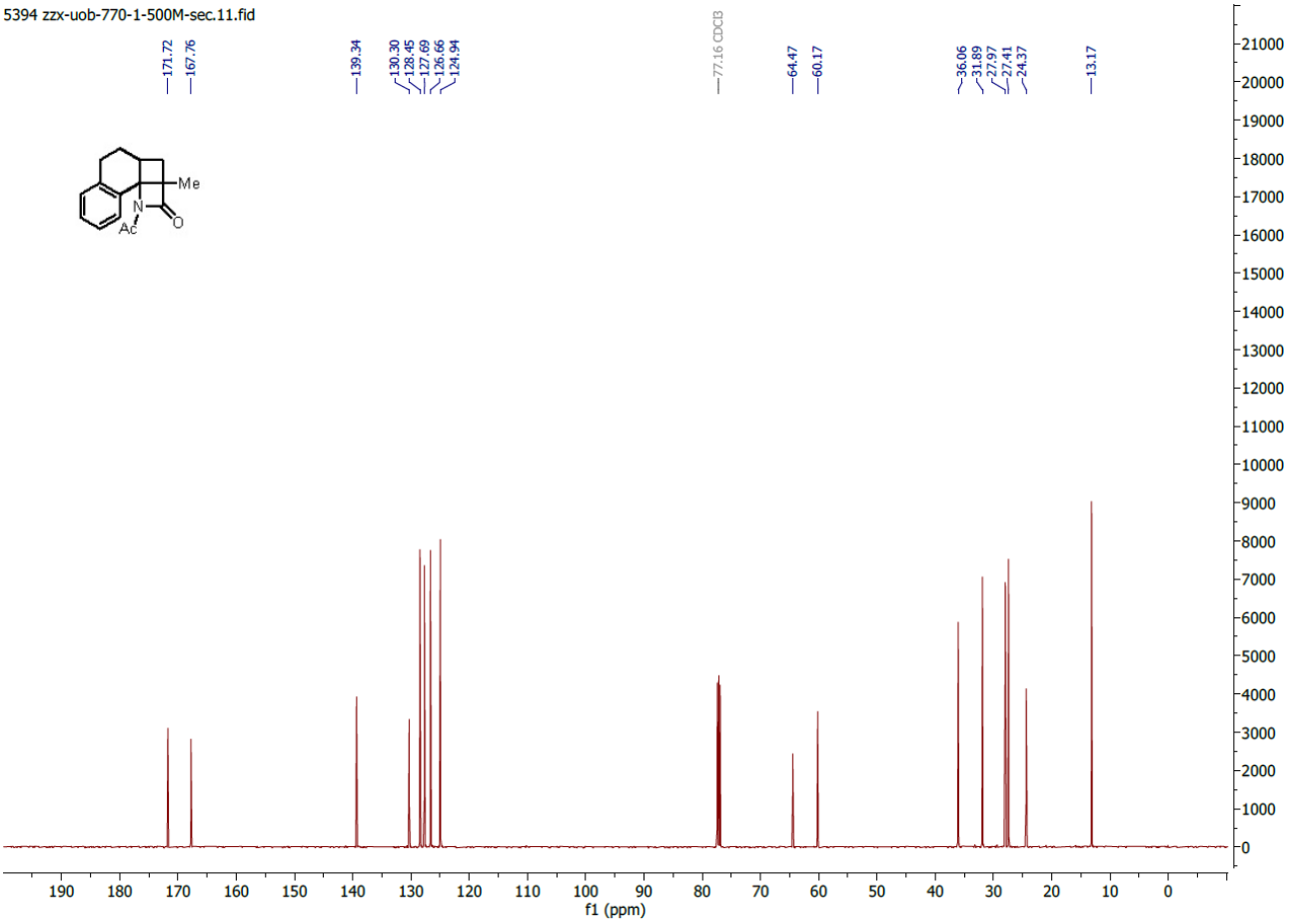
Compound 6ak



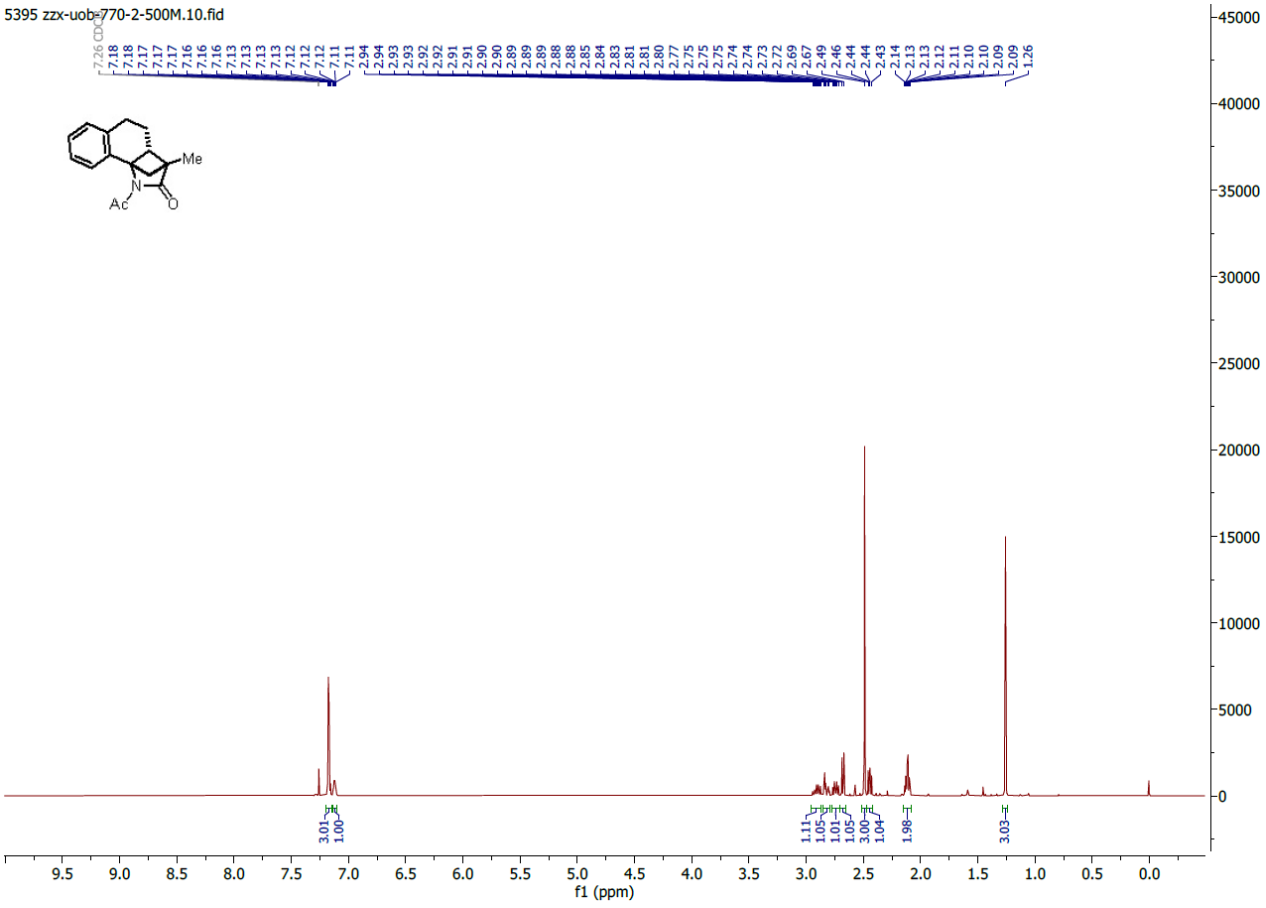


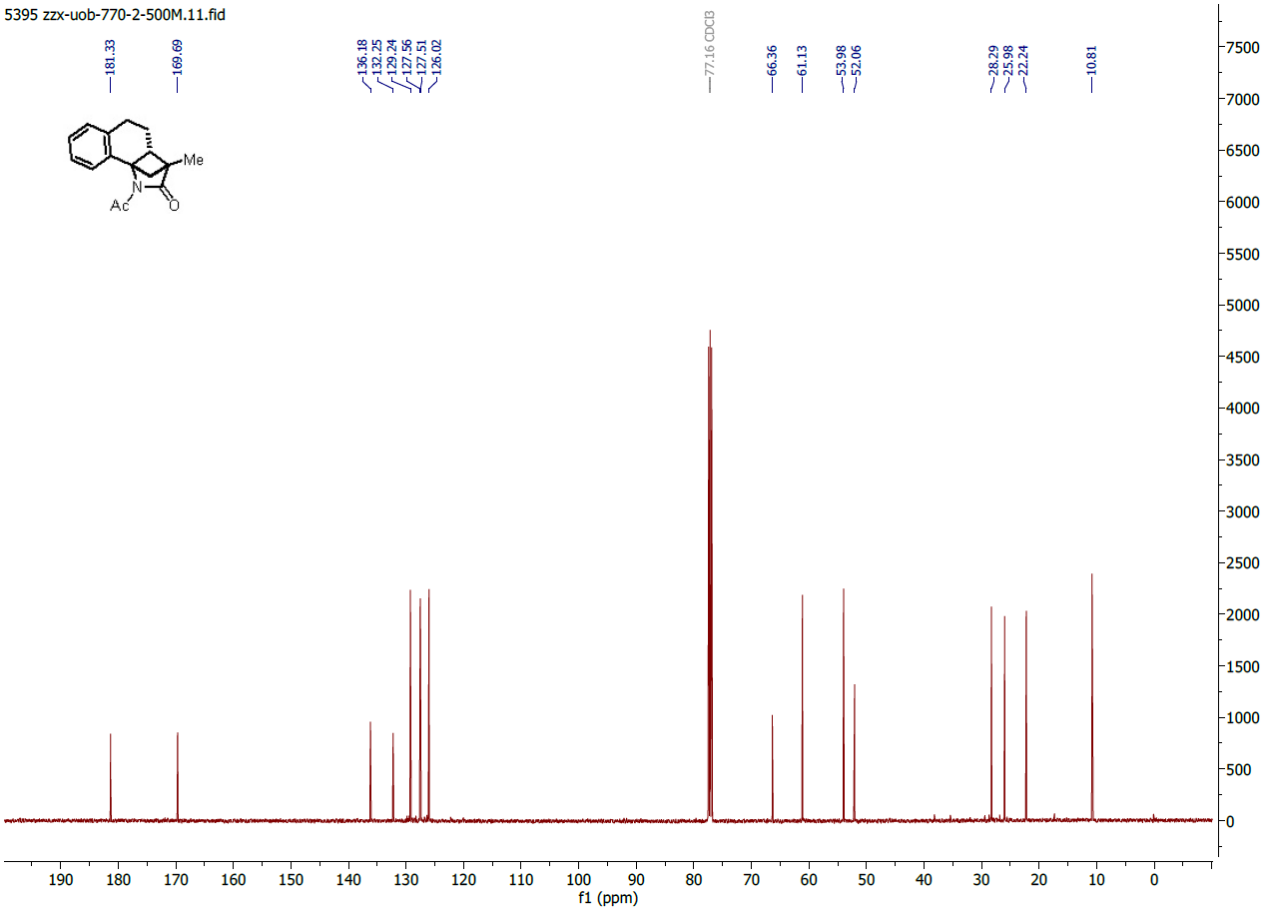
Compound 6al



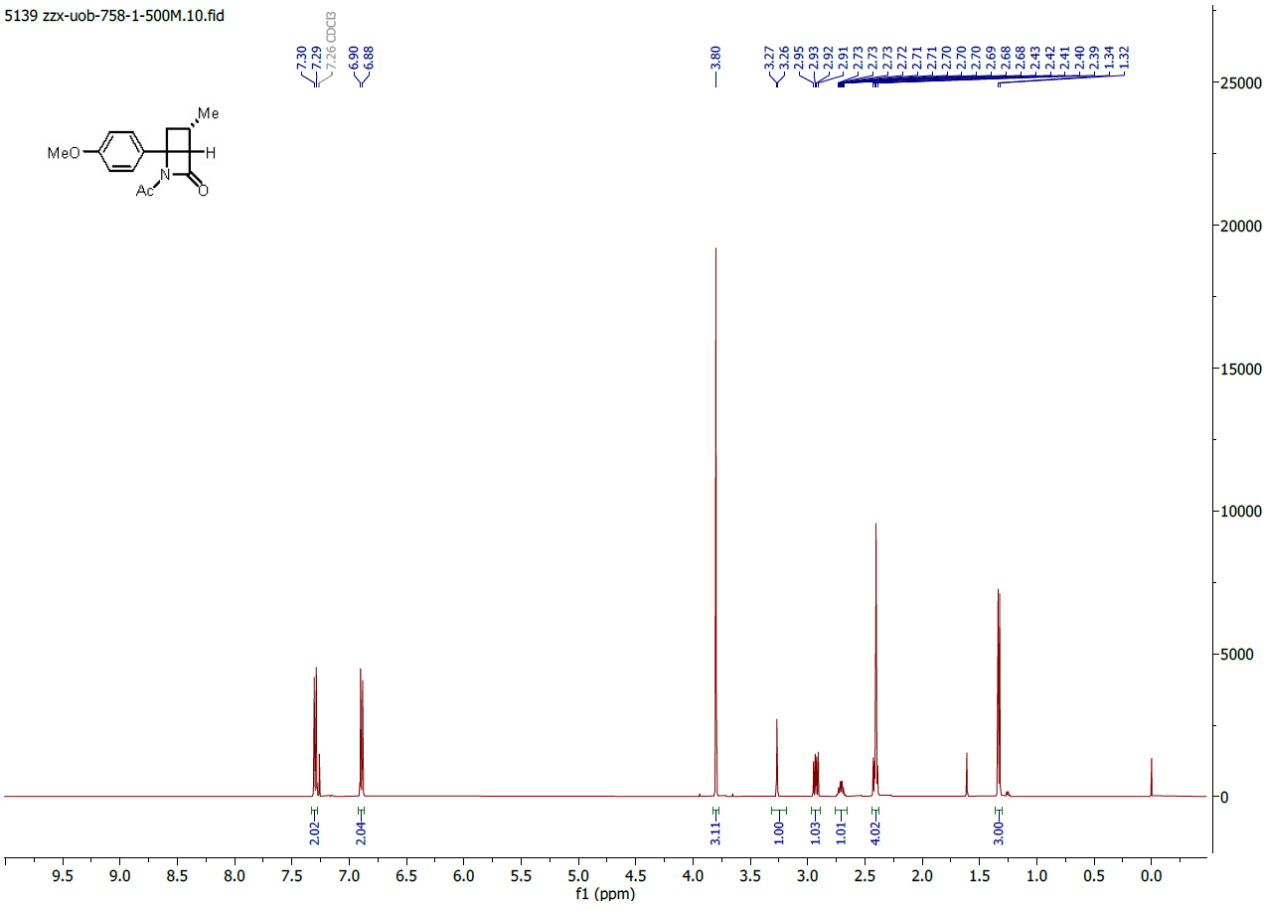


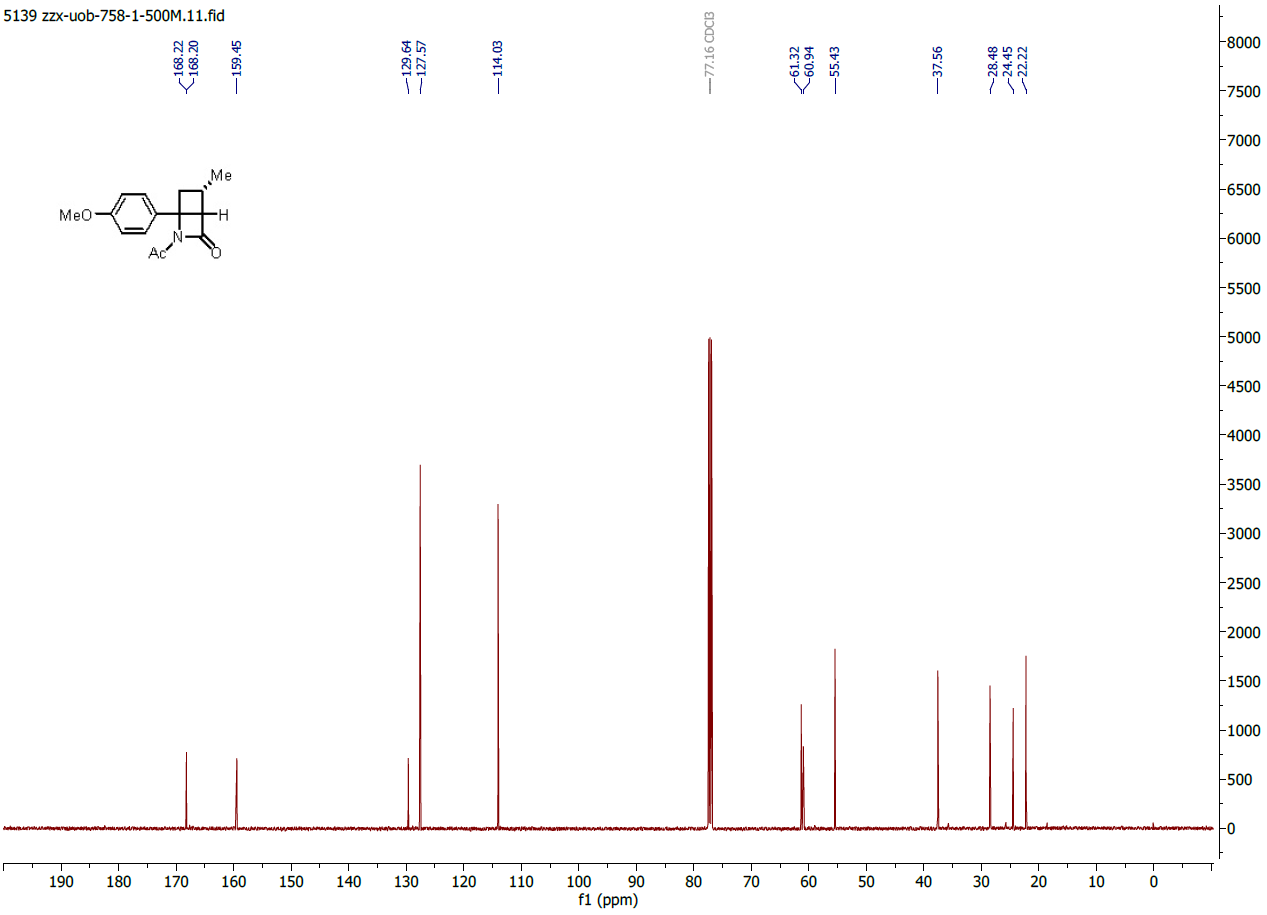
Compound 5al



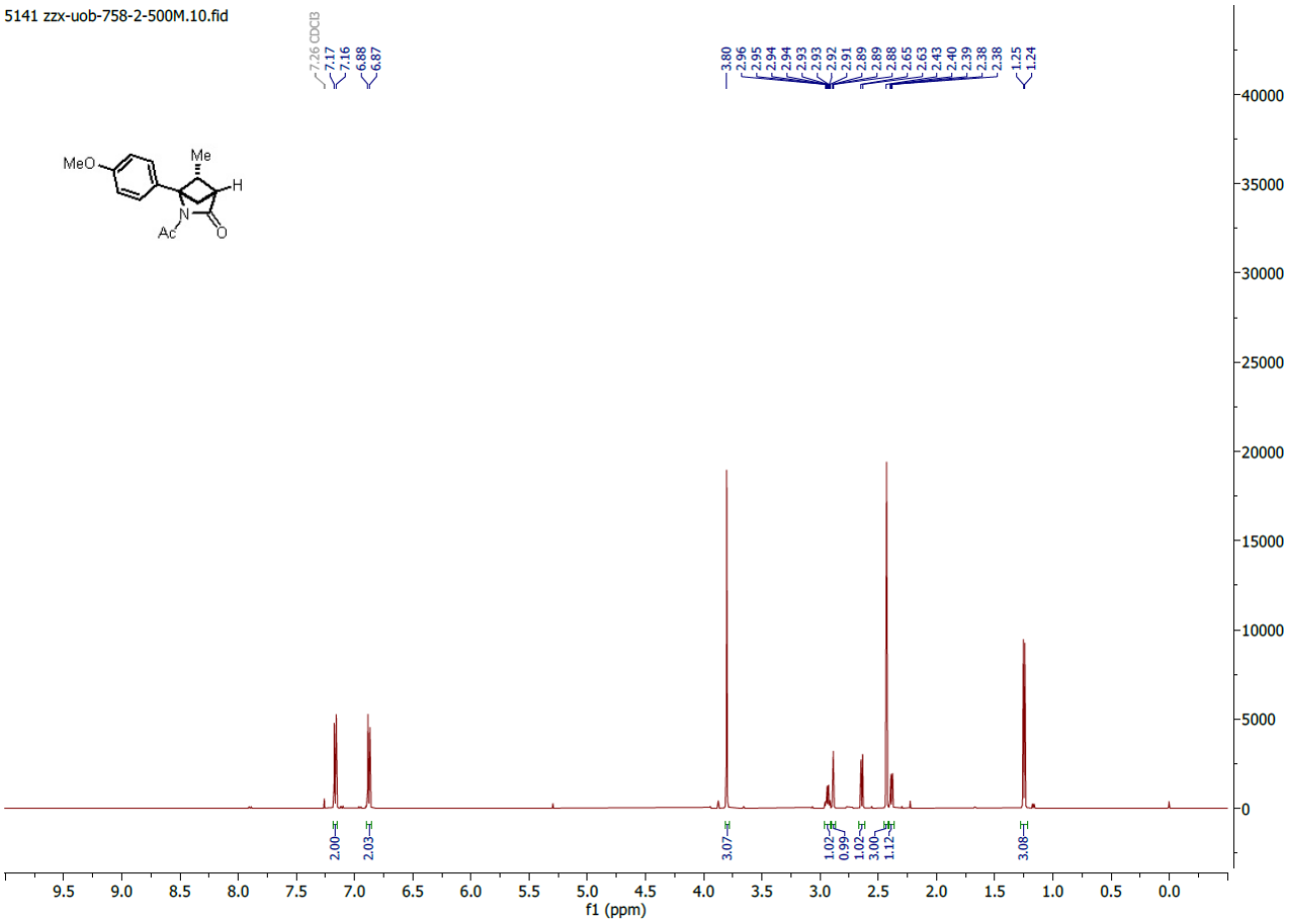


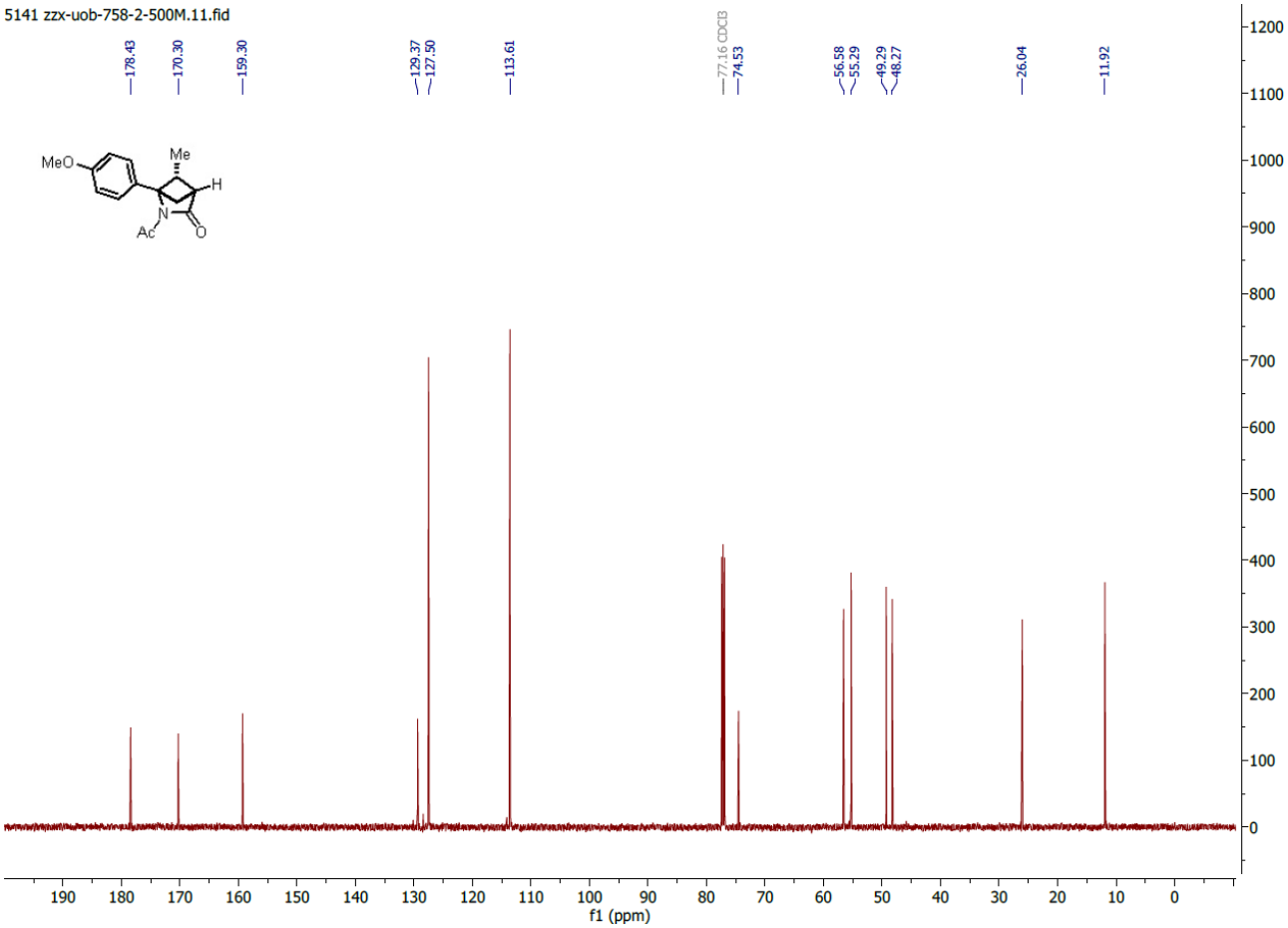
Compound 6am



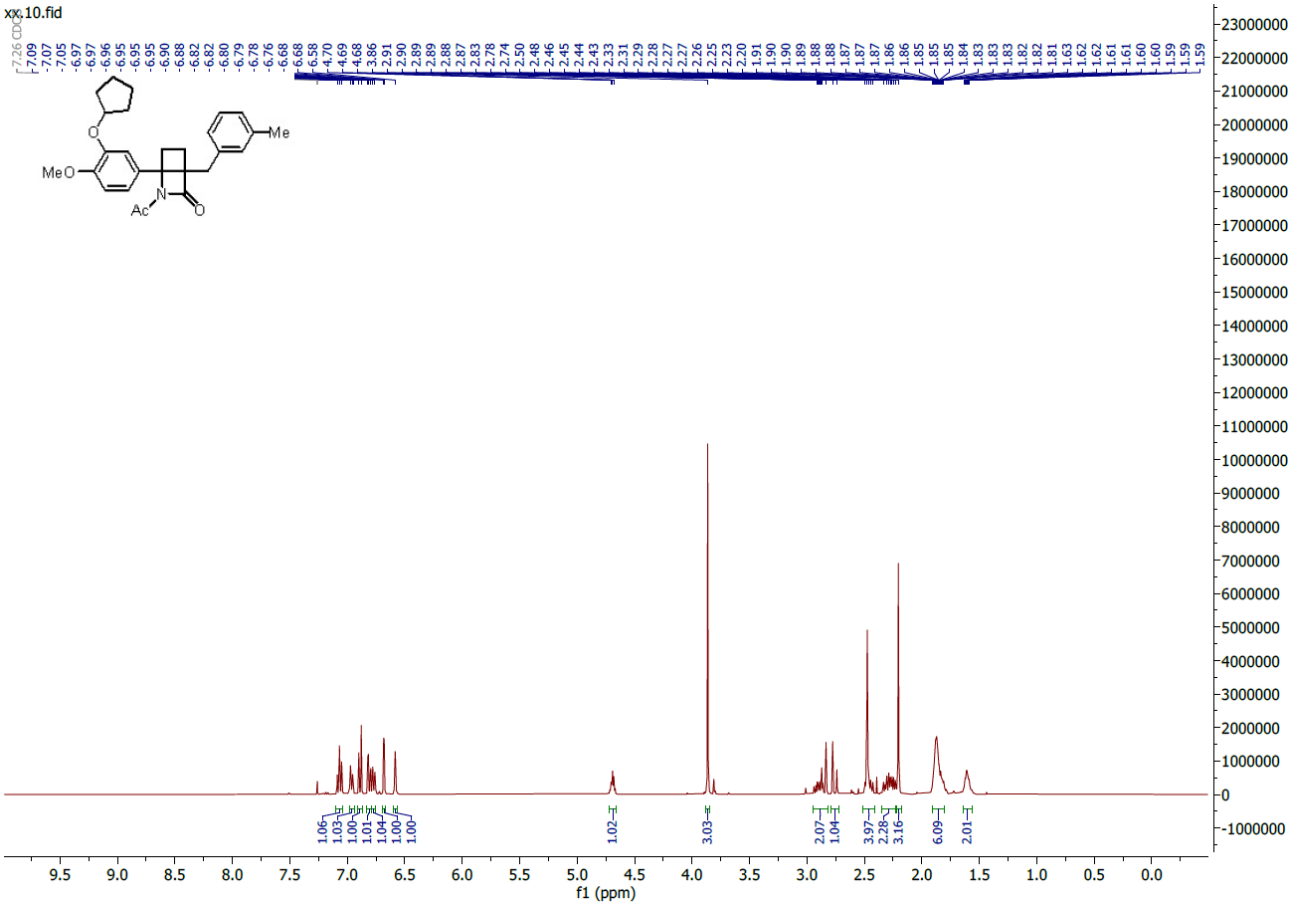


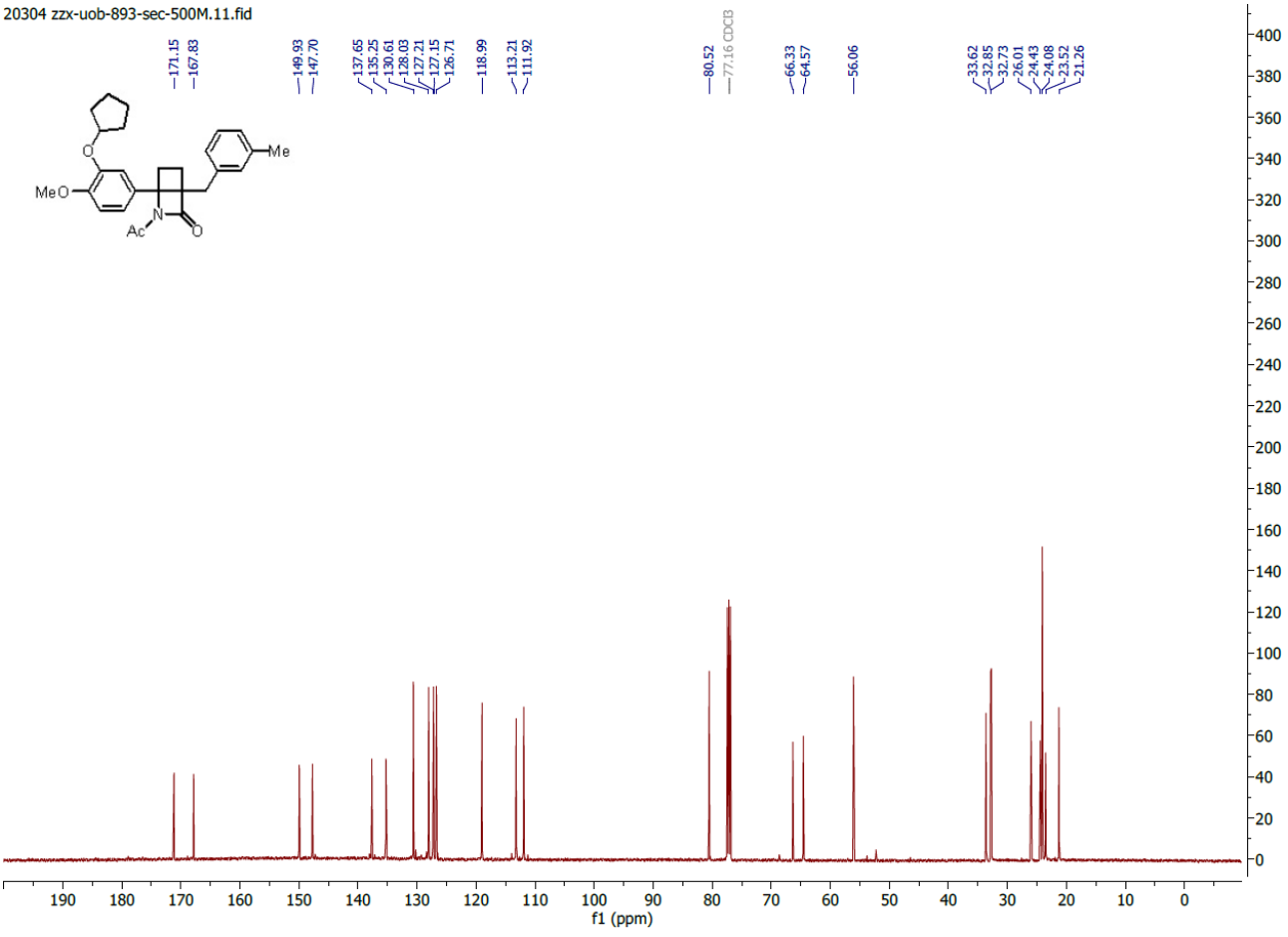
Compound 5am





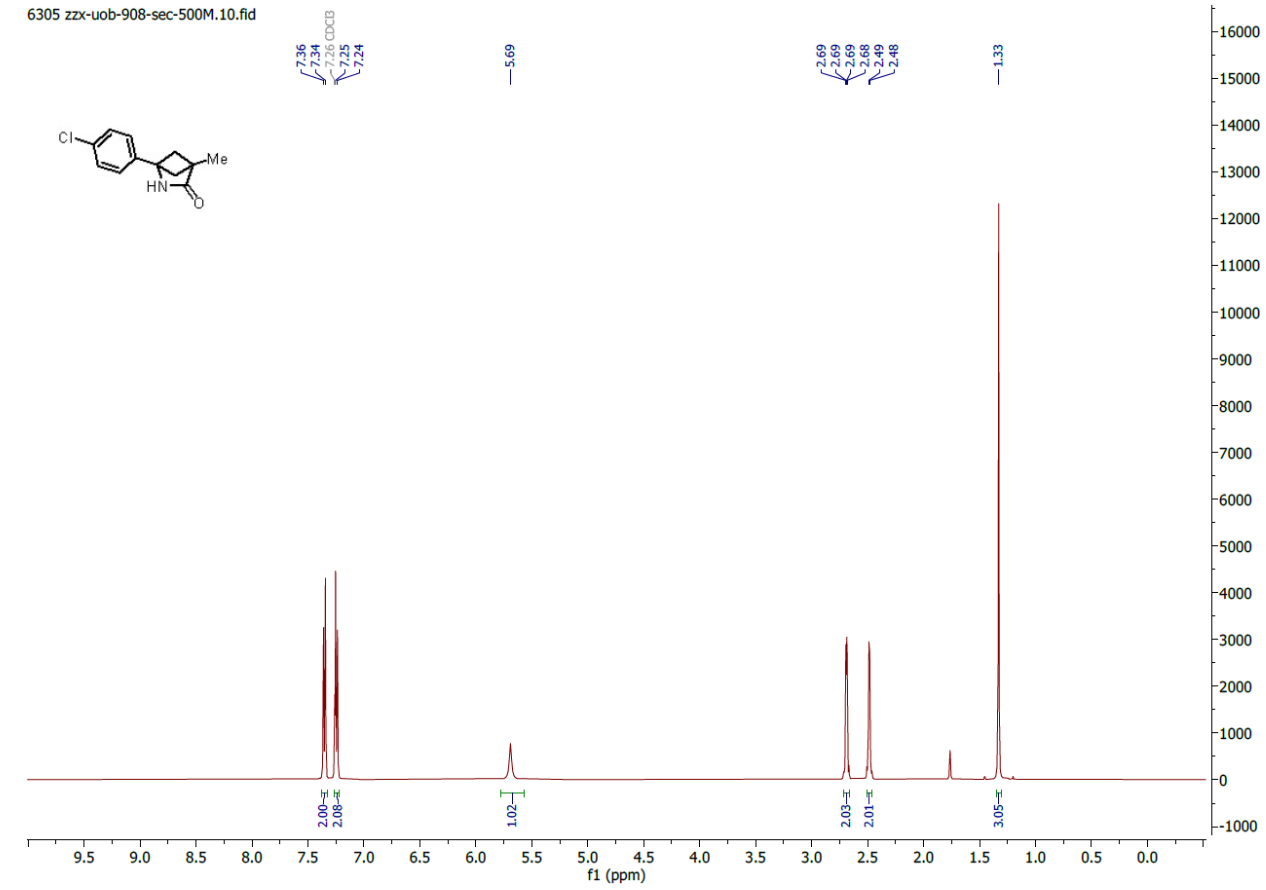
Compound 6an

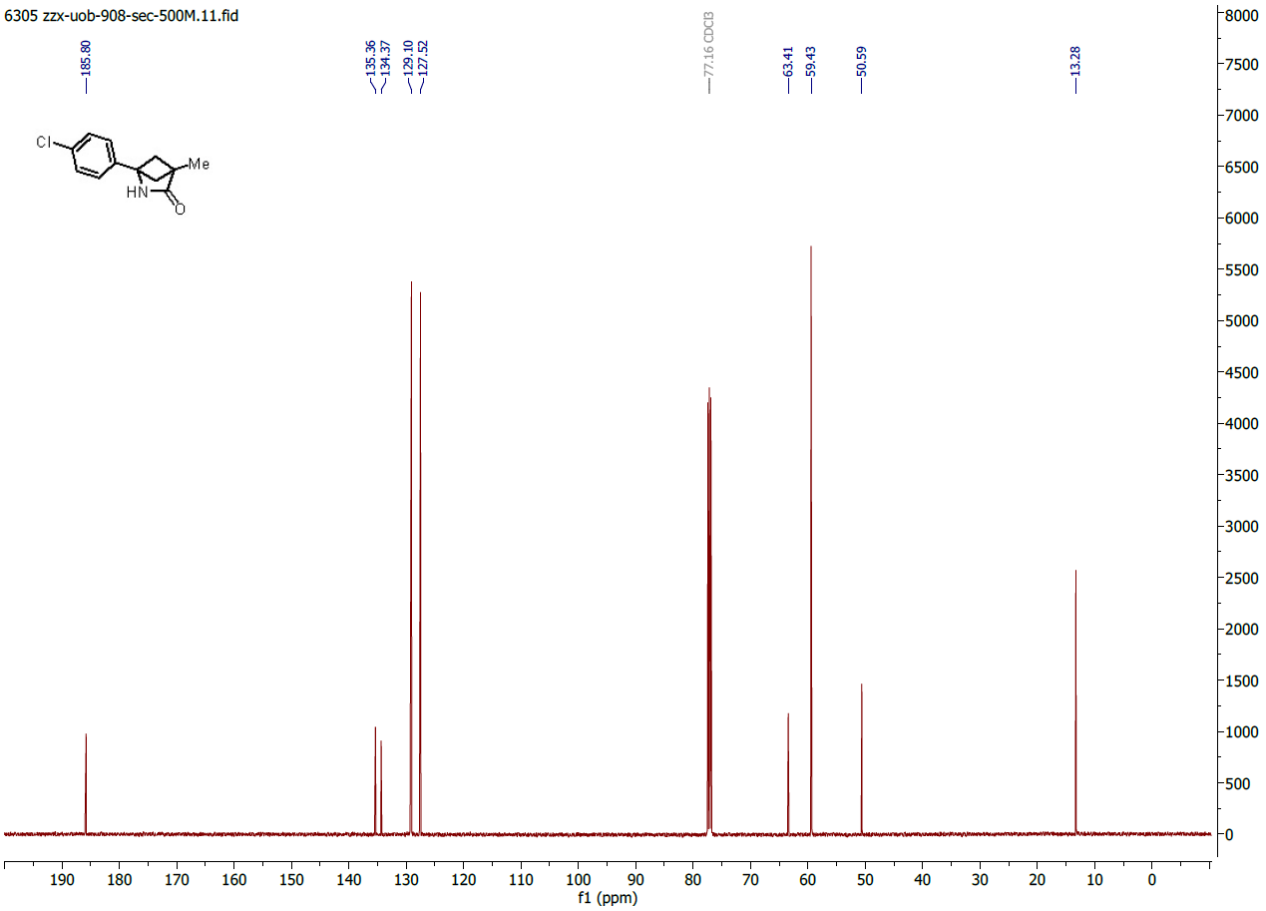




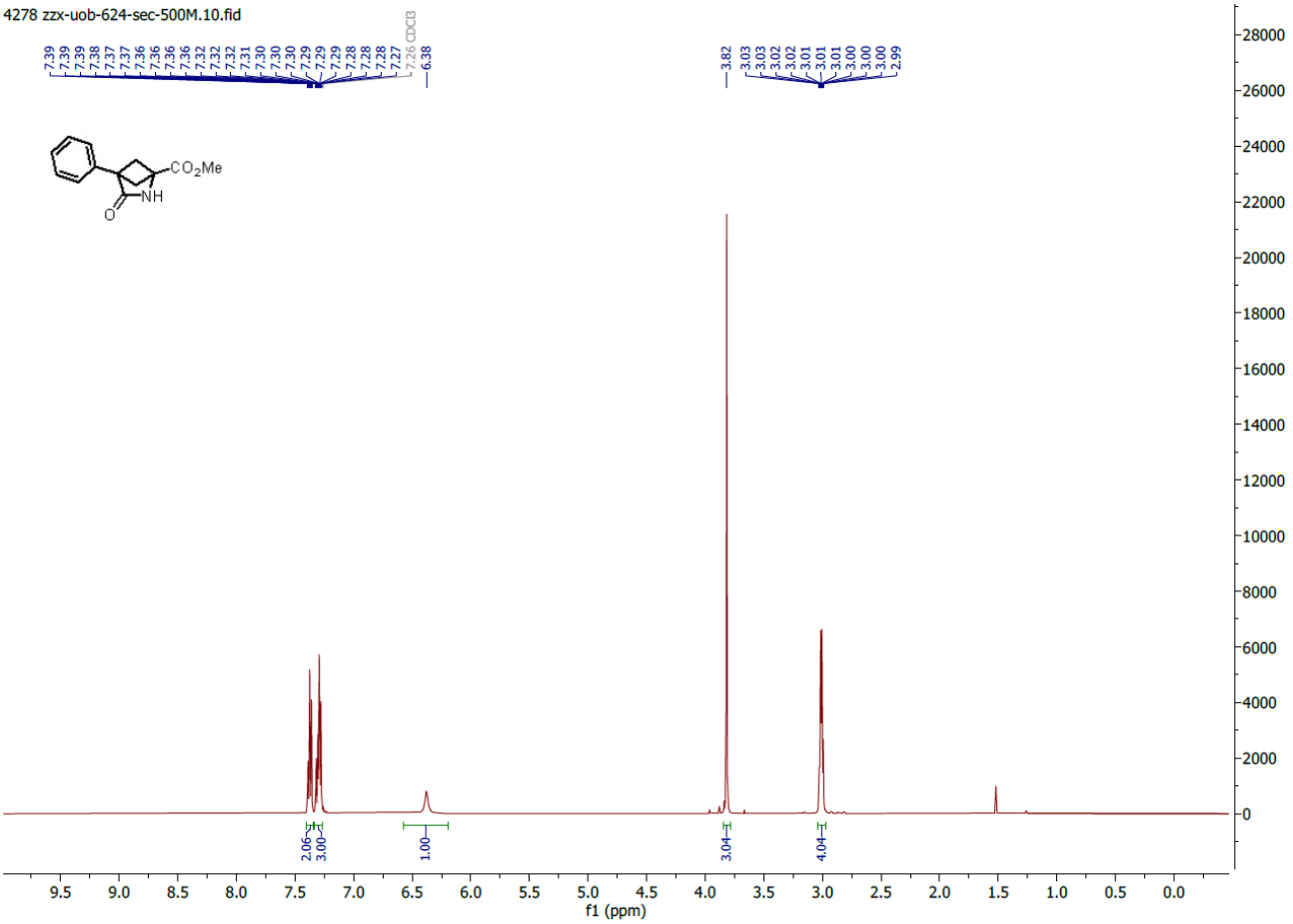
5.7 NMR Spectra of Product Derivatives

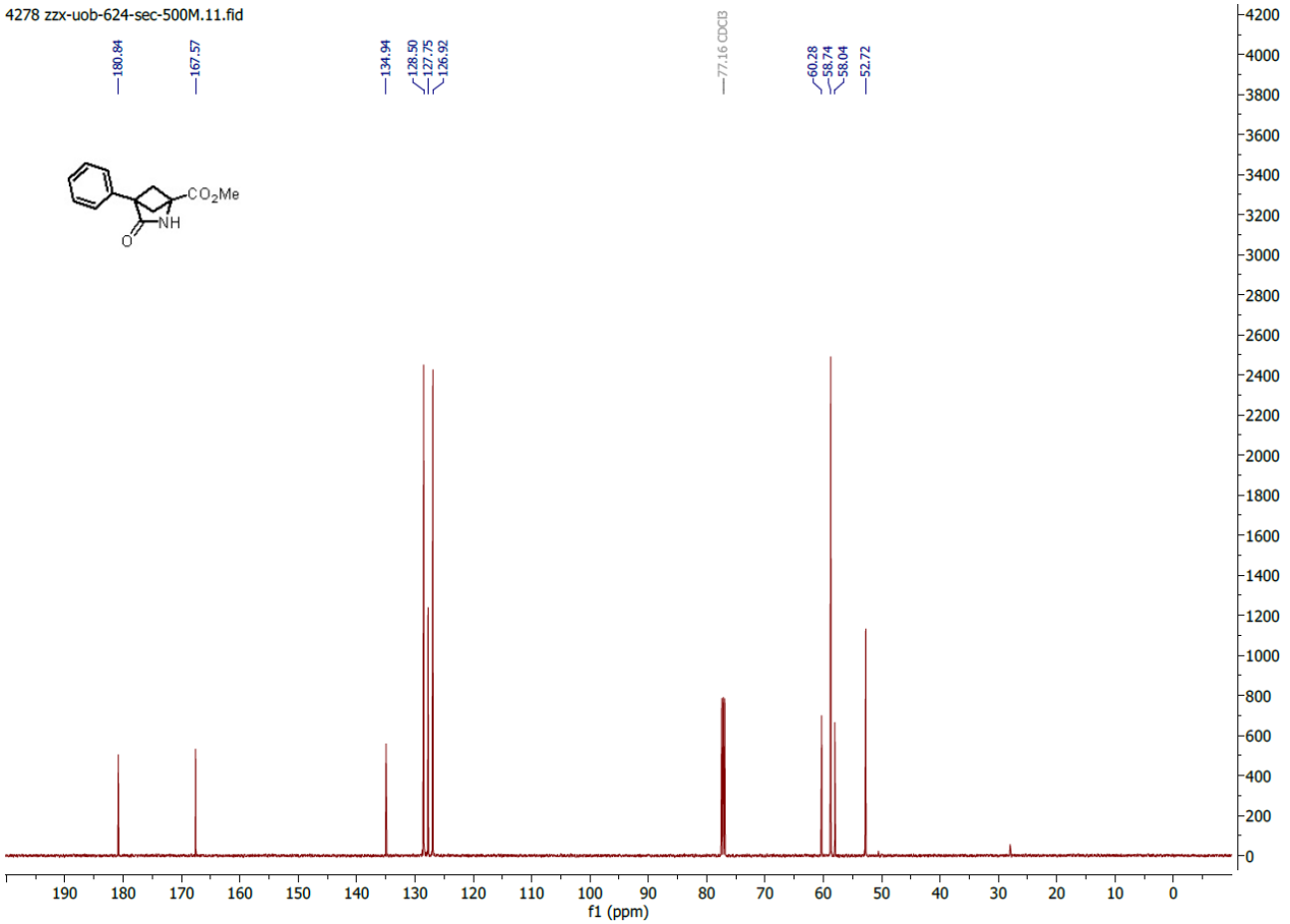
Compound 3c’



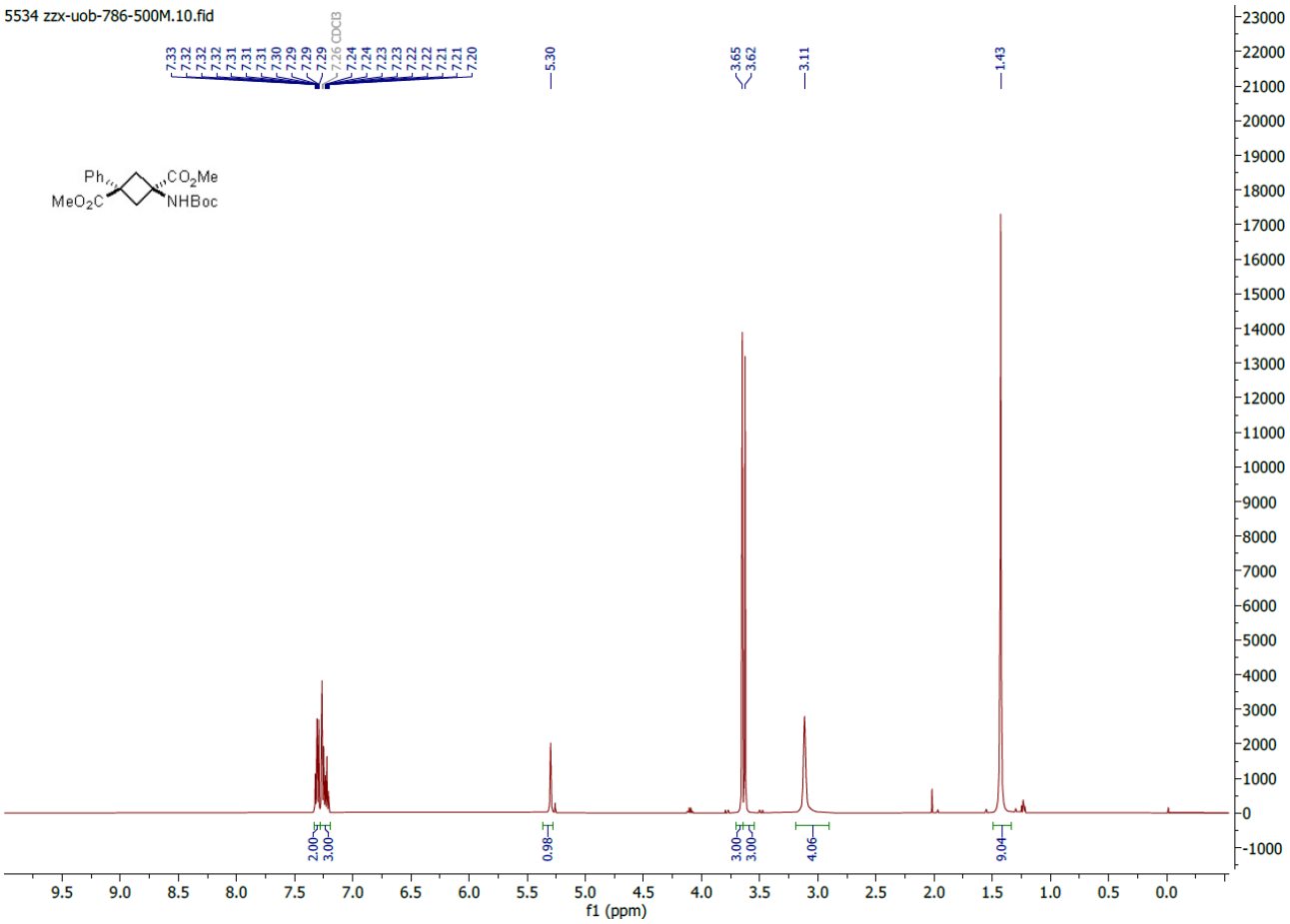


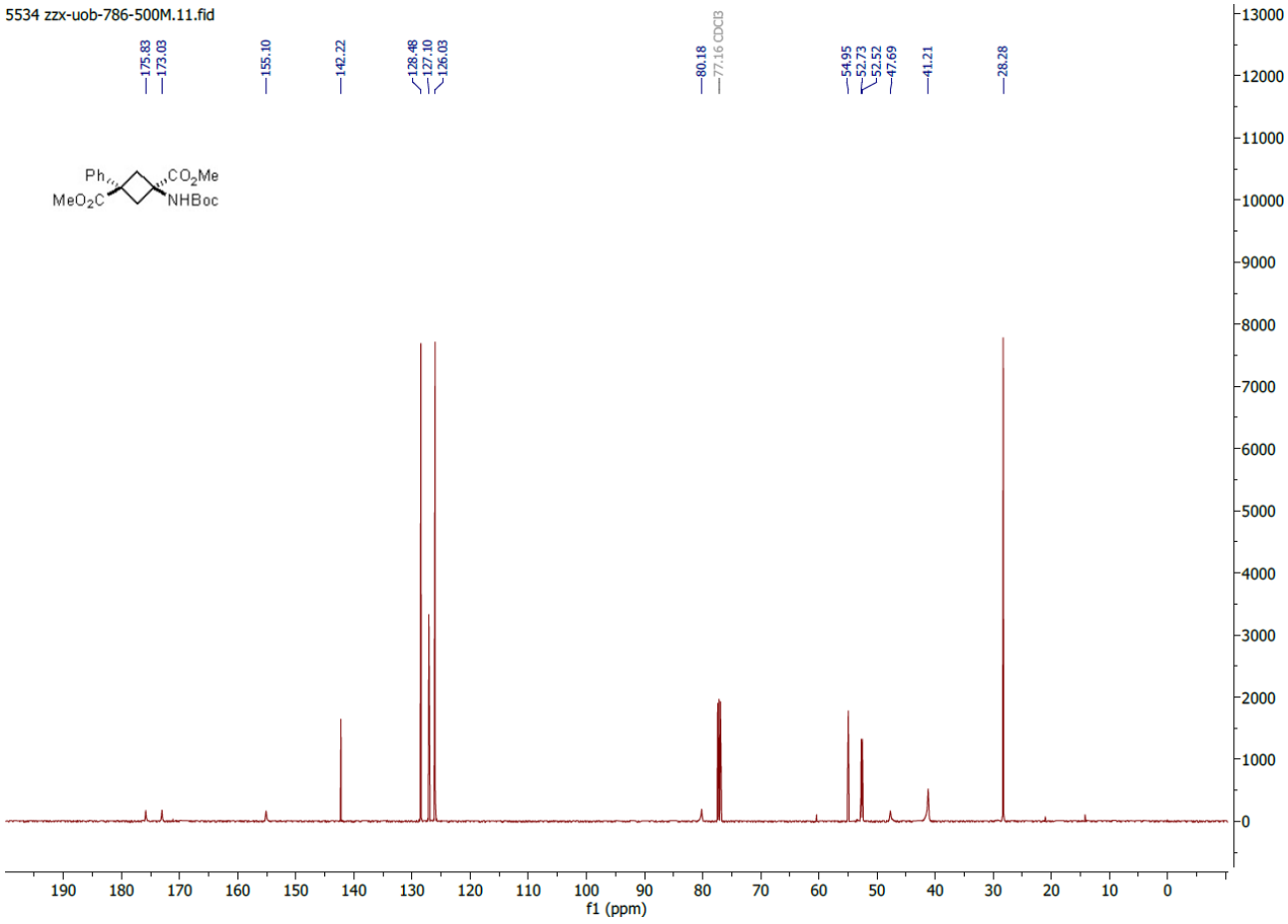
Compound 8a’


4278 zzx-uob-624-sec-500M.10.fid
CO2Me
NH
O
f1 (ppm)

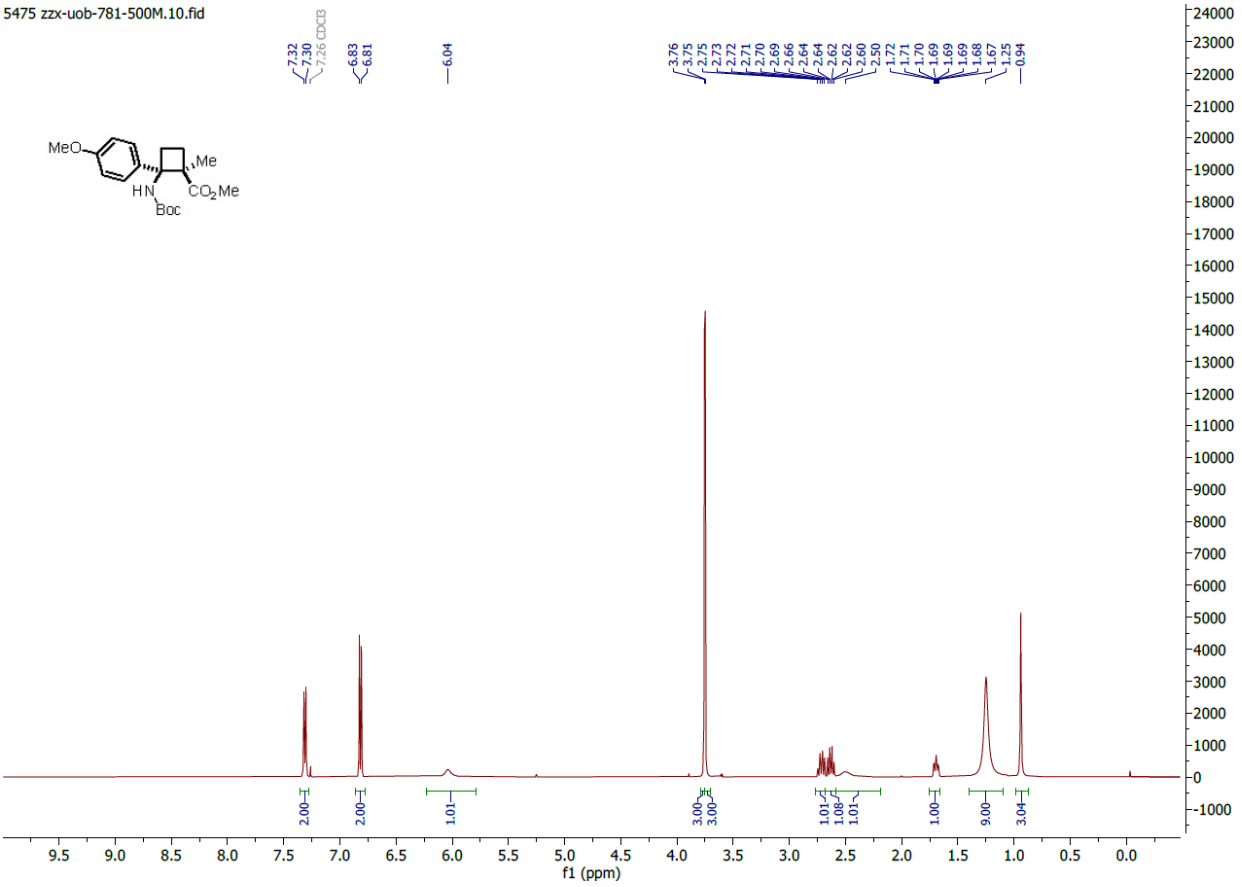

4278 zzx-uob-624-sec-500M.11.fid
CO2Me
NH
O
f1 (ppm)

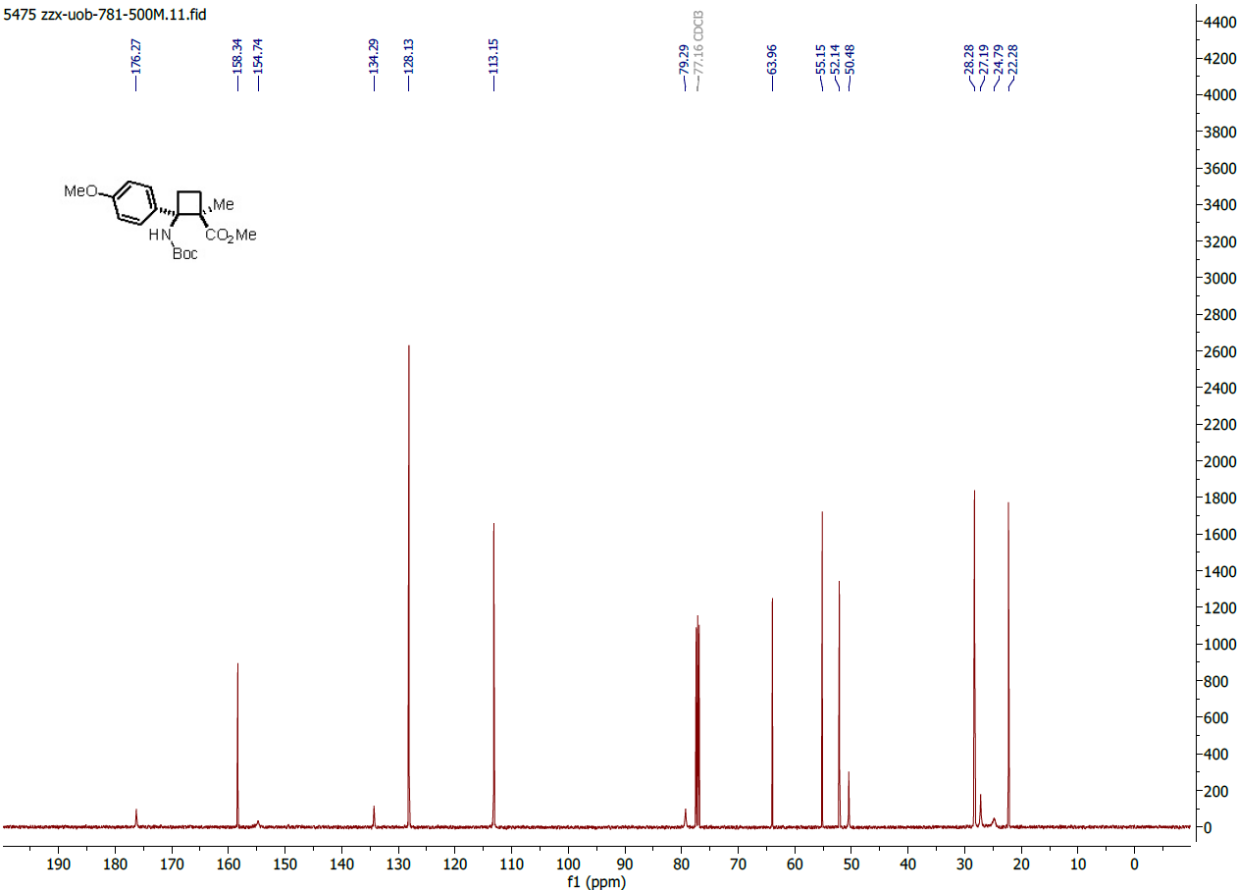
Compound 8a''


5534 zzx-uob-786-500M.10.fid
7.33
7.32
7.32
7.32
7.31
7.31
7.31
7.30
7.29
7.29
7.29
7.26 CDCl3
7.24
7.24
7.23
7.23
7.22
7.22
7.21
7.21
7.20
5.30
3.65
3.62
3.11
1.43
Ph
CO2Me
MeO2C
NHBoc
2.00
3.00
0.98
3.00
3.00
4.06
9.04
f1 (ppm)

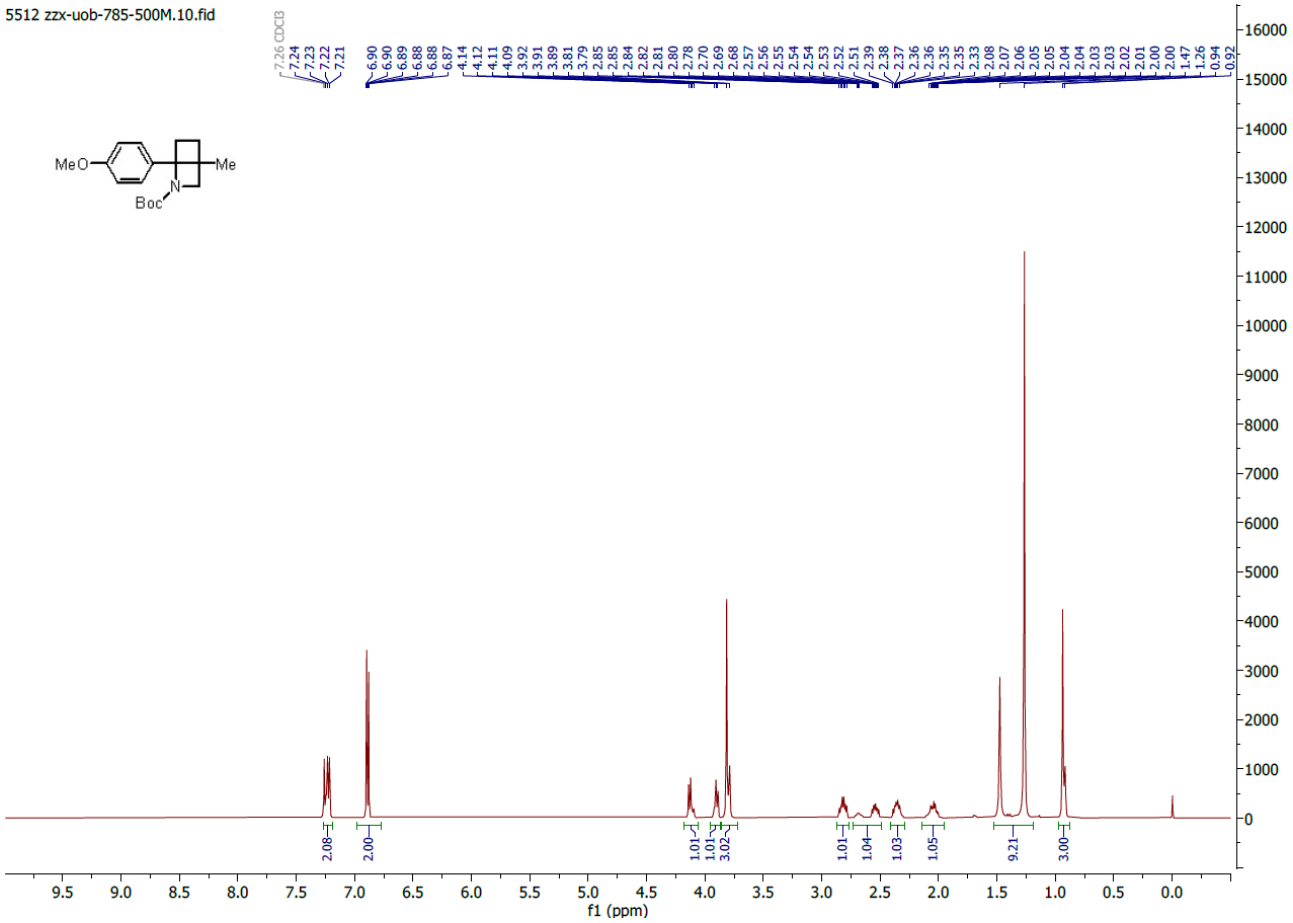

5534 zzx-uob-786-500M.11.fid
175.83
173.03
155.10
142.22
128.48
127.10
126.03
80.18
77.16 CDCl3
54.95
52.73
52.52
47.69
41.21
28.28
Ph
CO2Me
MeO2C
NHBoc
f1 (ppm)

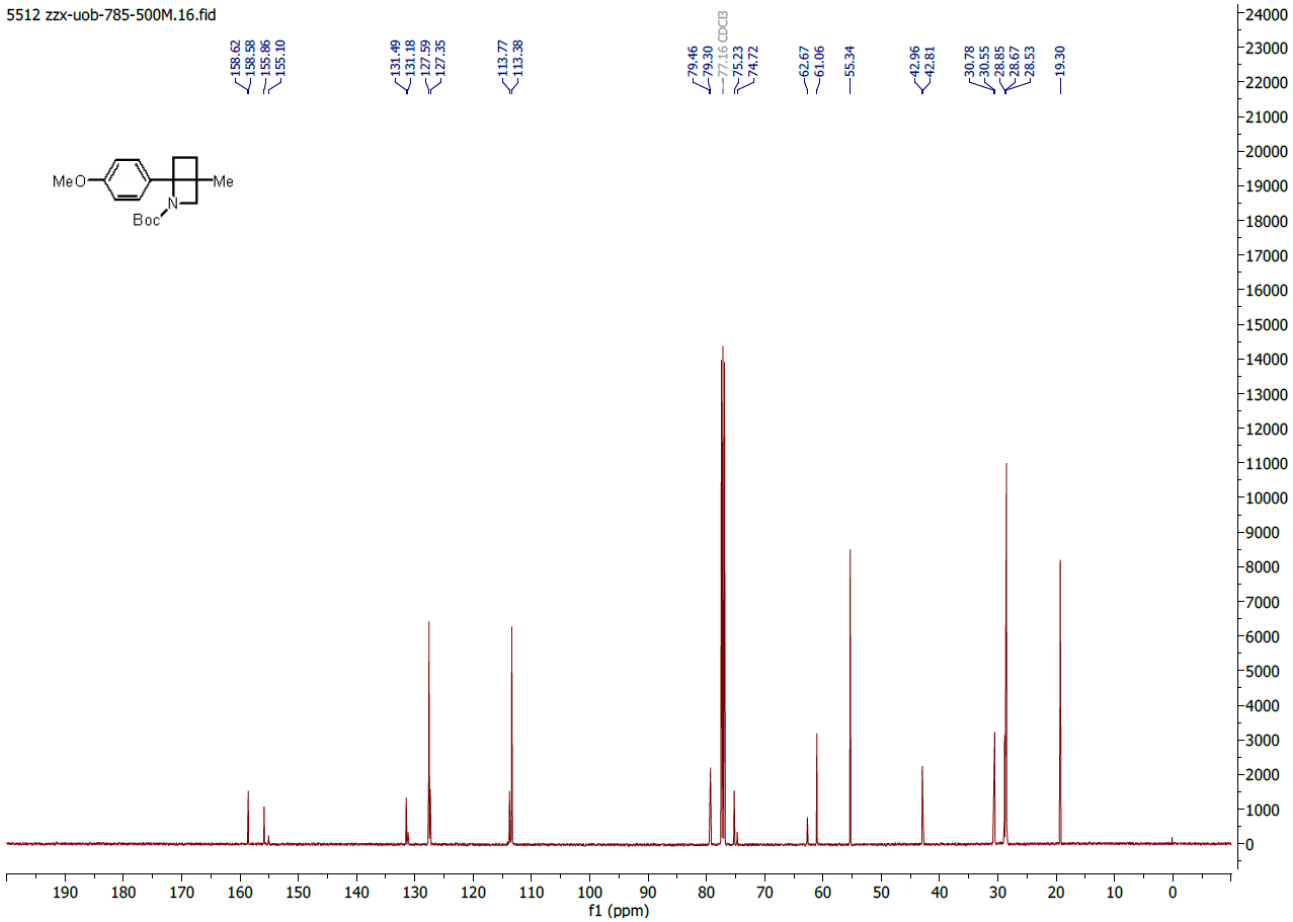
Compound 10


5475 zzx-uob-781-500M.10.fid
MeO
Me
HN
CO2Me
Boc
f1 (ppm)

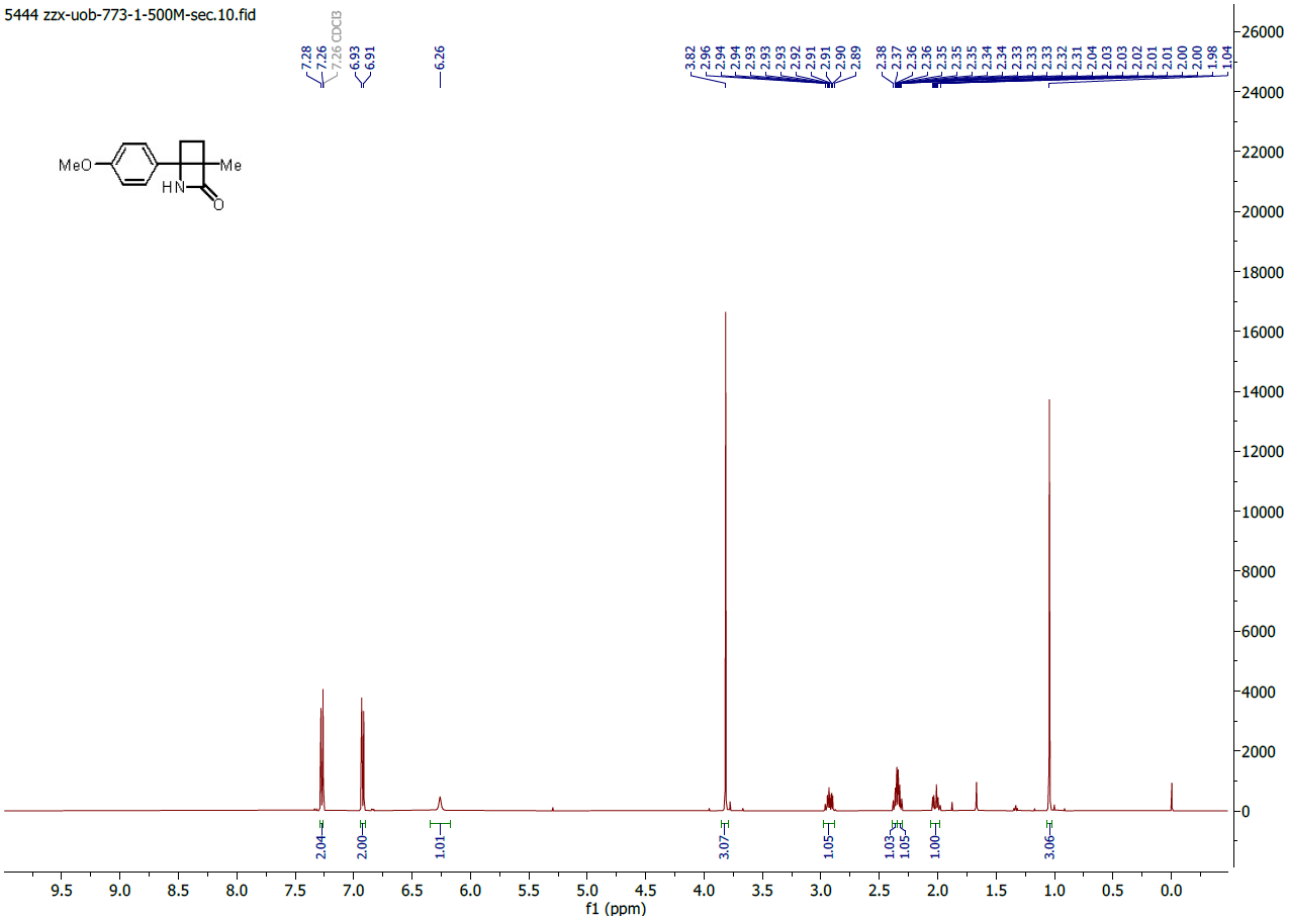

5475 zzx-uob-781-500M.11.fid
MeO
Me
HN
CO2Me
Boc
f1 (ppm)

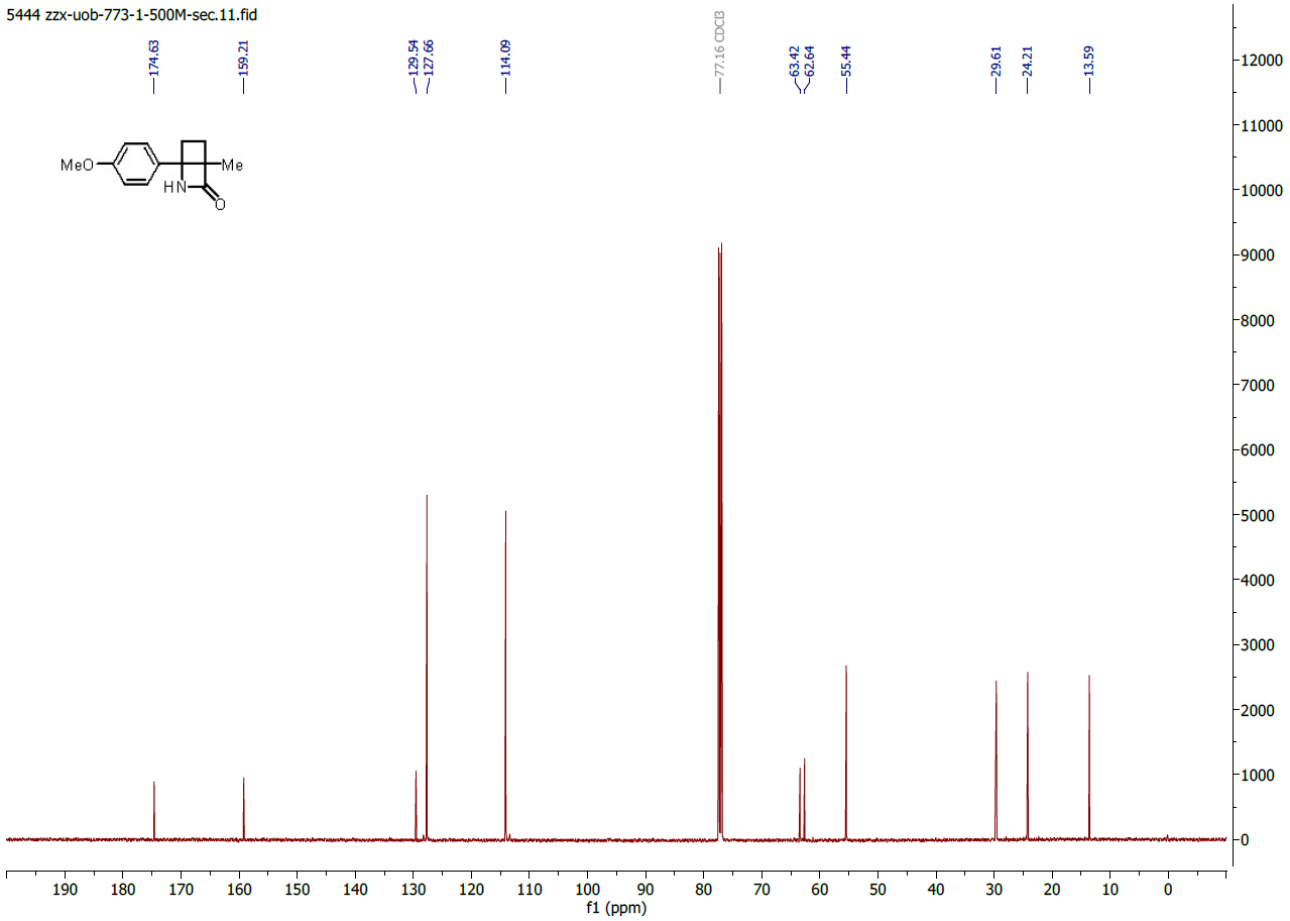
Compound 11


5512 zzx-uob-785-500M.10.fid
MeO
Me
N
Boc
f1 (ppm)

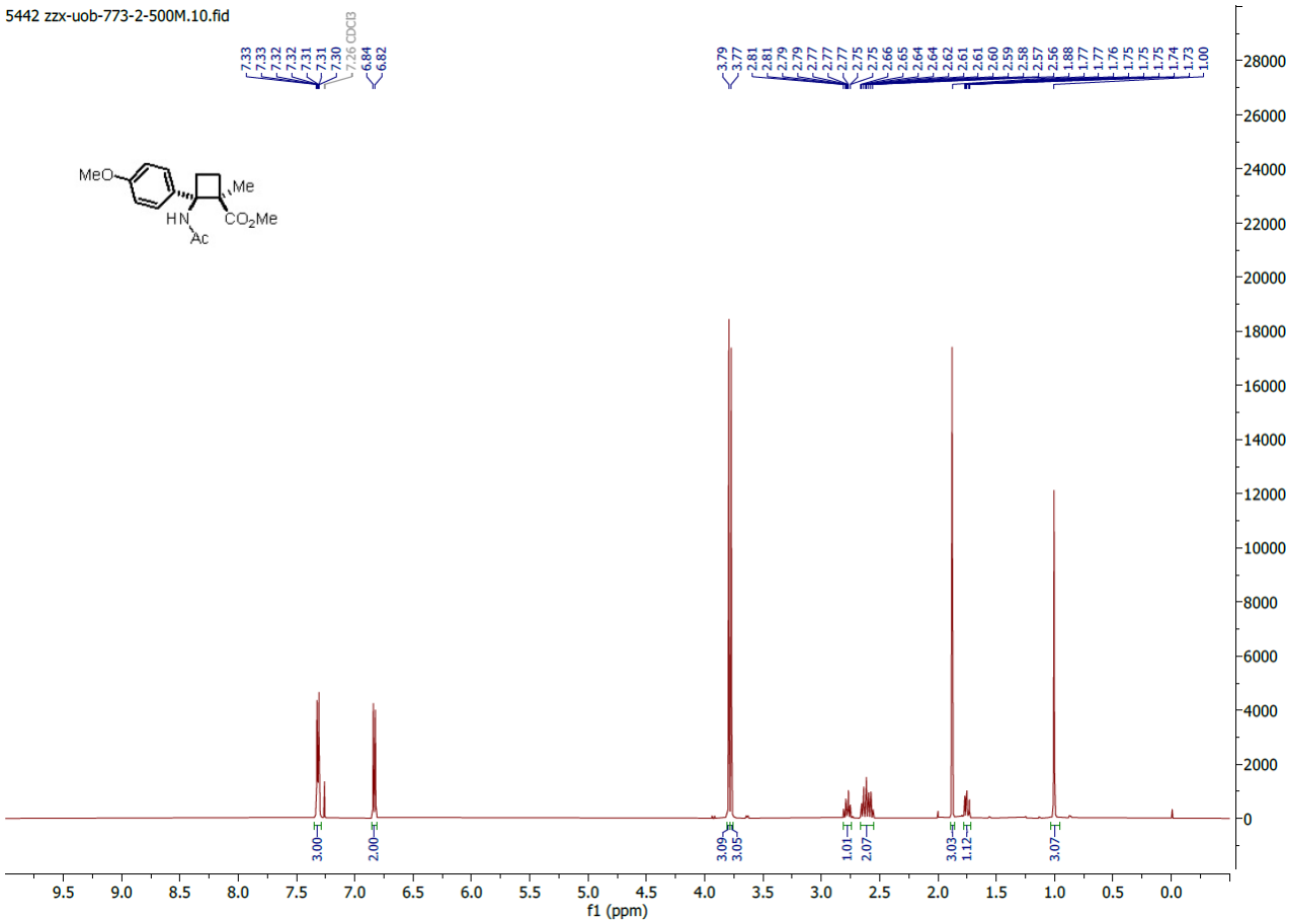

5512 zzx-uob-785-500M.16.fid
MeO
Me
N
Boc
f1 (ppm)

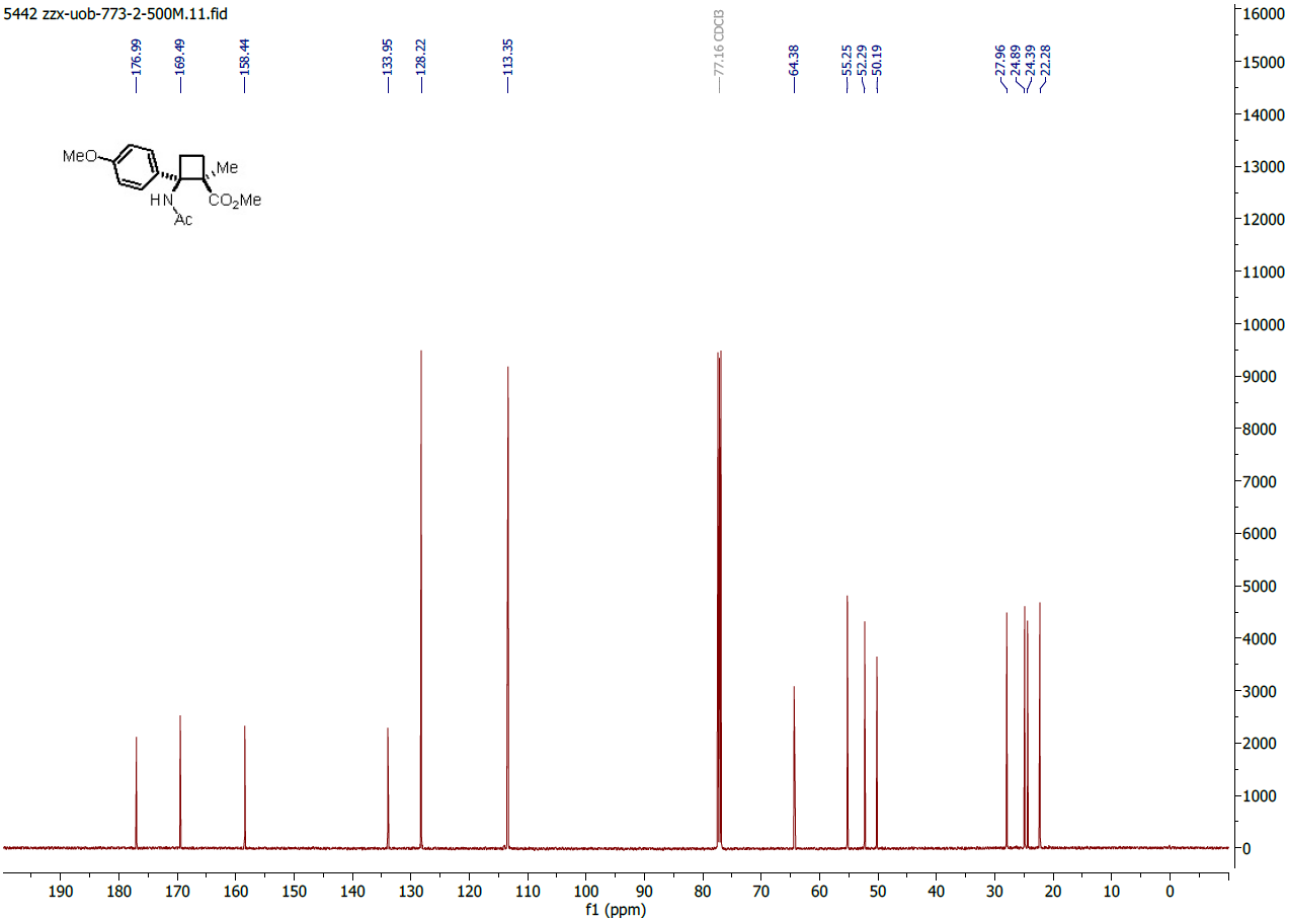
Compound 12


5444 zzx-uob-773-1-500M-sec.10.fid
MeO
Me
HN
O
f1 (ppm)

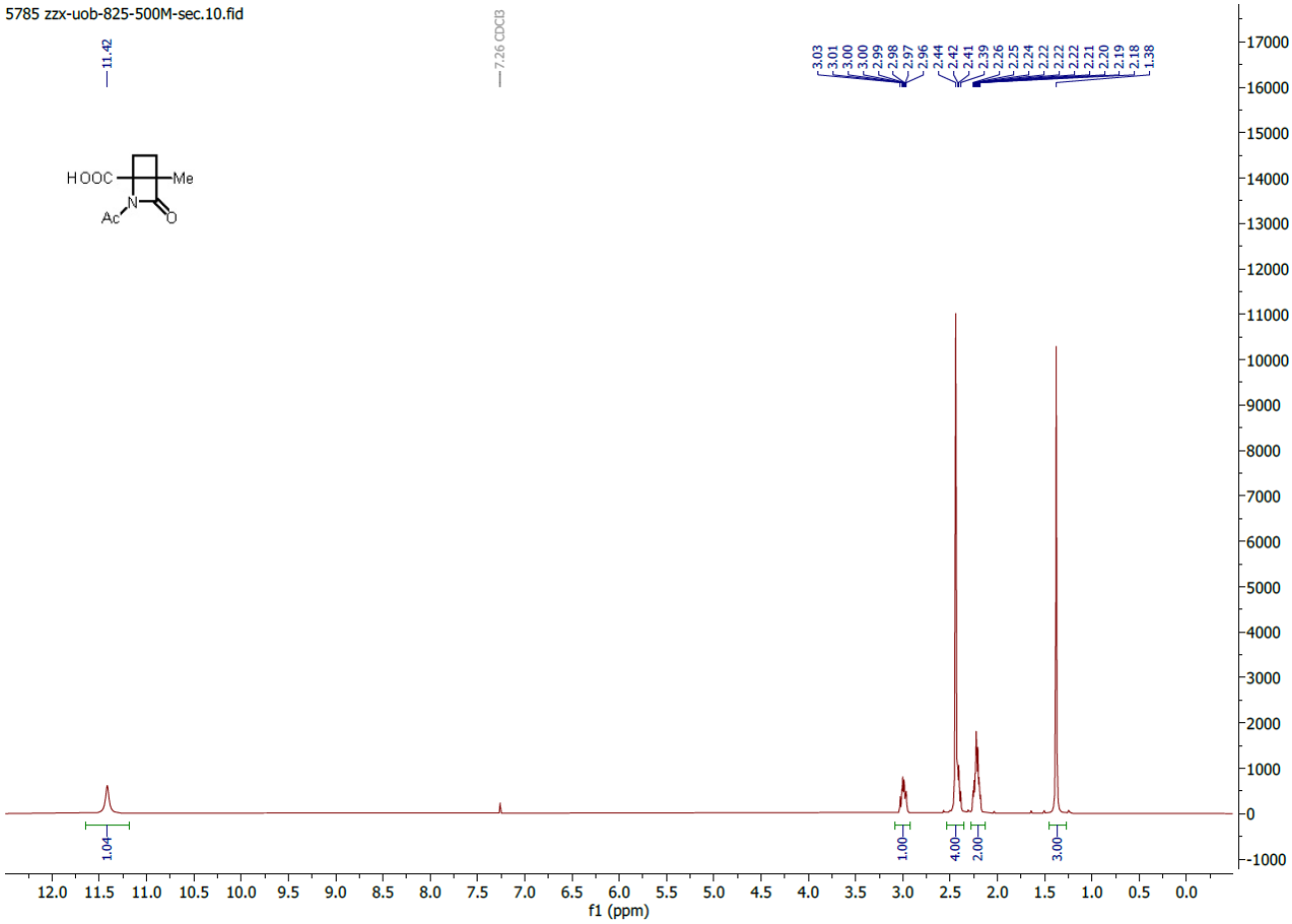

5444 zzx-uob-773-1-500M-sec.11.fid
MeO
Me
HN
O
f1 (ppm)

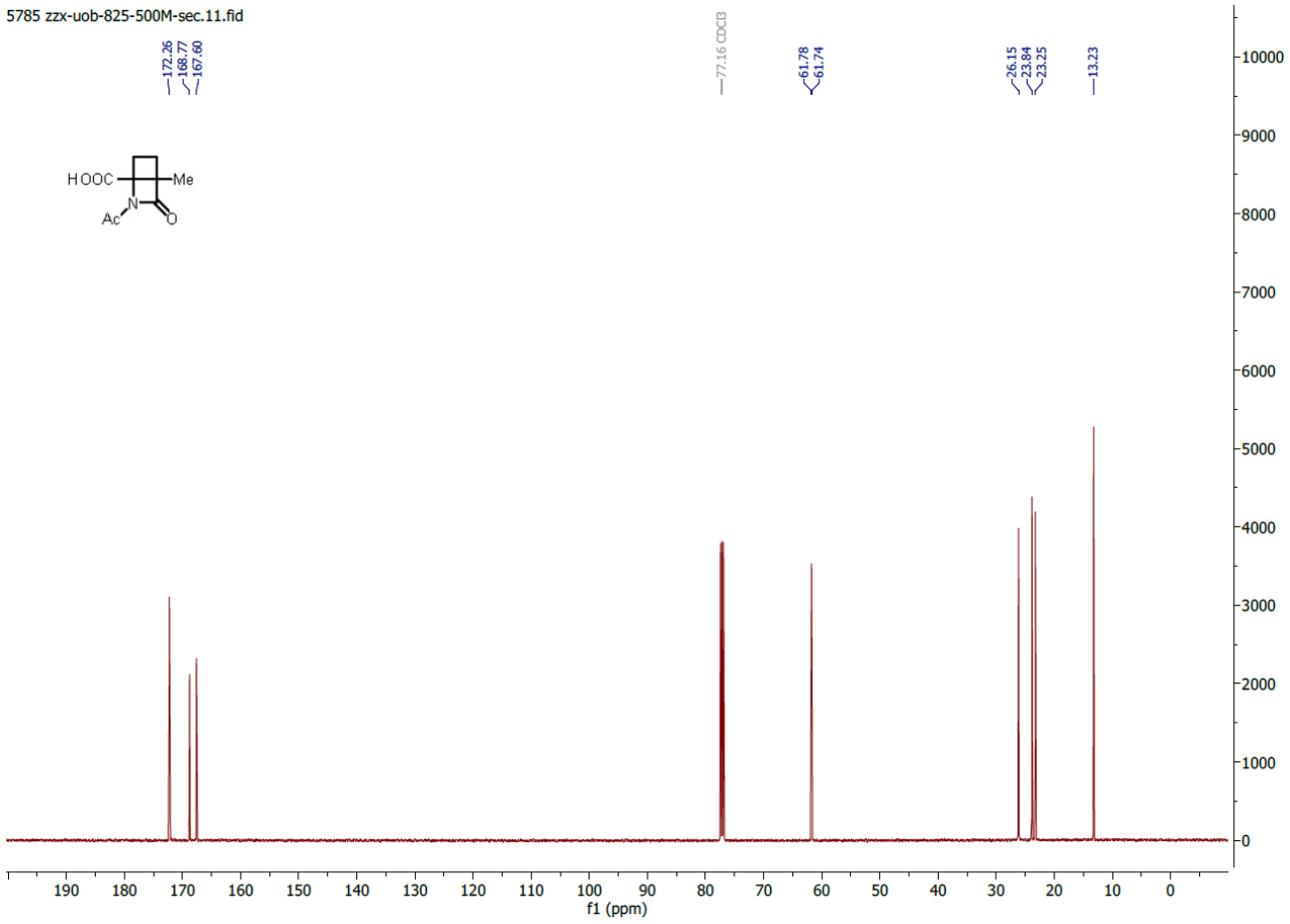
Compound 12’


5442 zzx-uob-773-2-500M.10.fid
MeO
Me
HN
CO2Me
Ac
f1 (ppm)

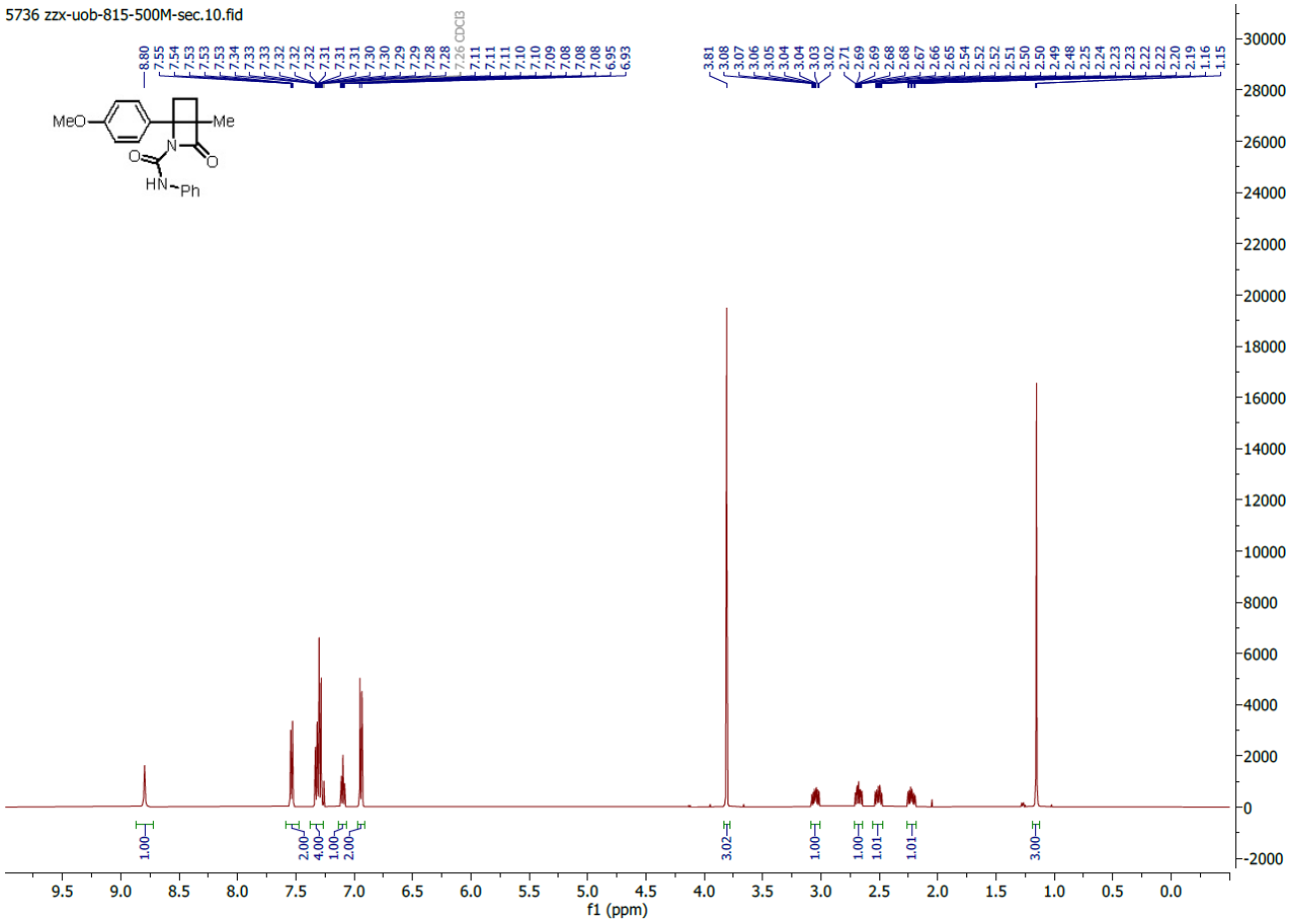

5442 zzx-uob-773-2-500M.11.fid
MeO
Me
HN
CO2Me
Ac
f1 (ppm)

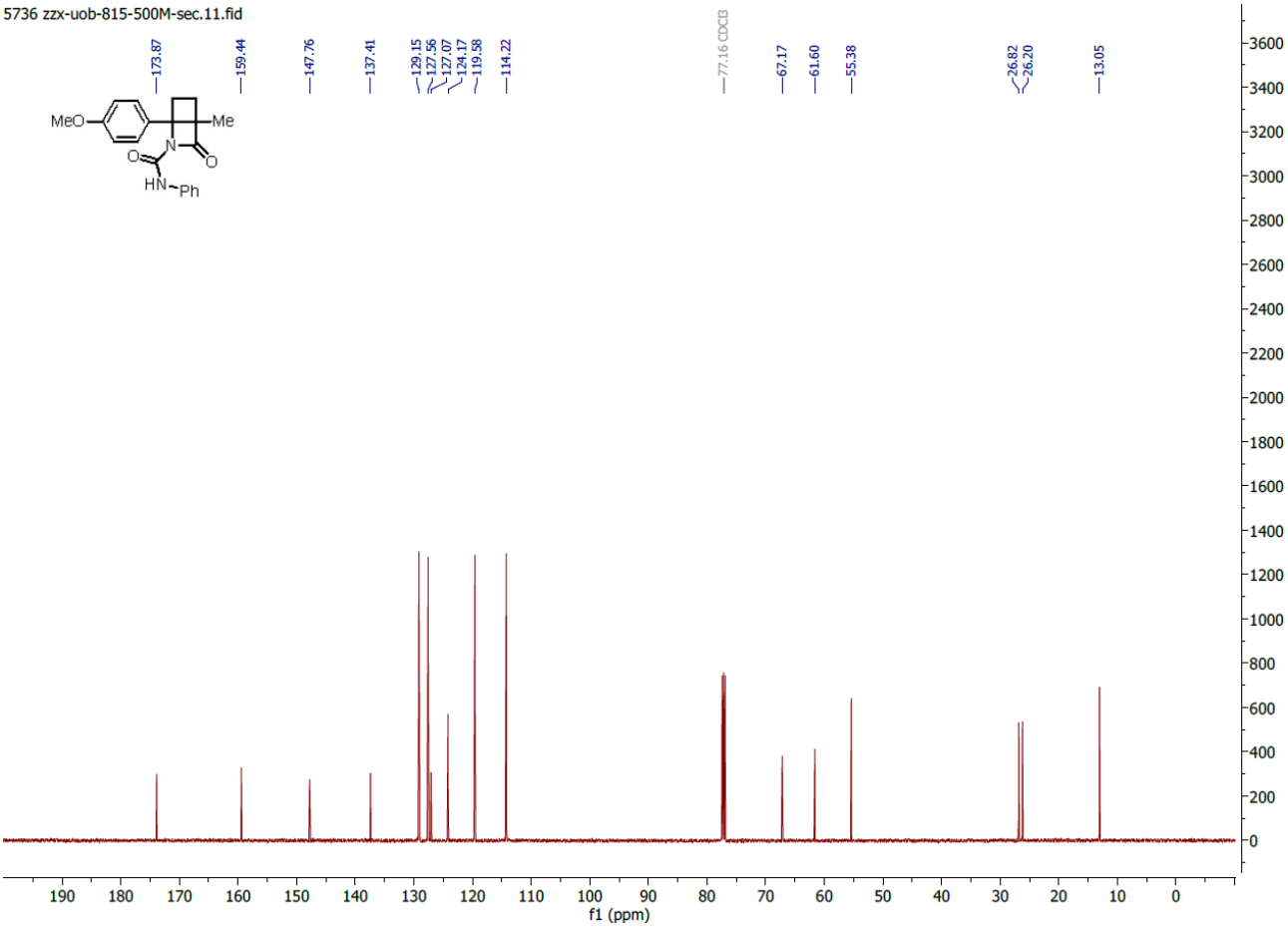
Compound 13


5785 zzx-uob-825-500M-sec.10.fid
11.42
7.26 CDCl3
3.03
3.01
3.00
3.00
2.99
2.98
2.97
2.96
2.44
2.42
2.41
2.39
2.26
2.25
2.24
2.22
2.22
2.22
2.21
2.20
2.19
2.18
1.38
HOOC
Me
N
Ac
O
1.04
1.00
4.00
2.00
3.00
f1 (ppm)

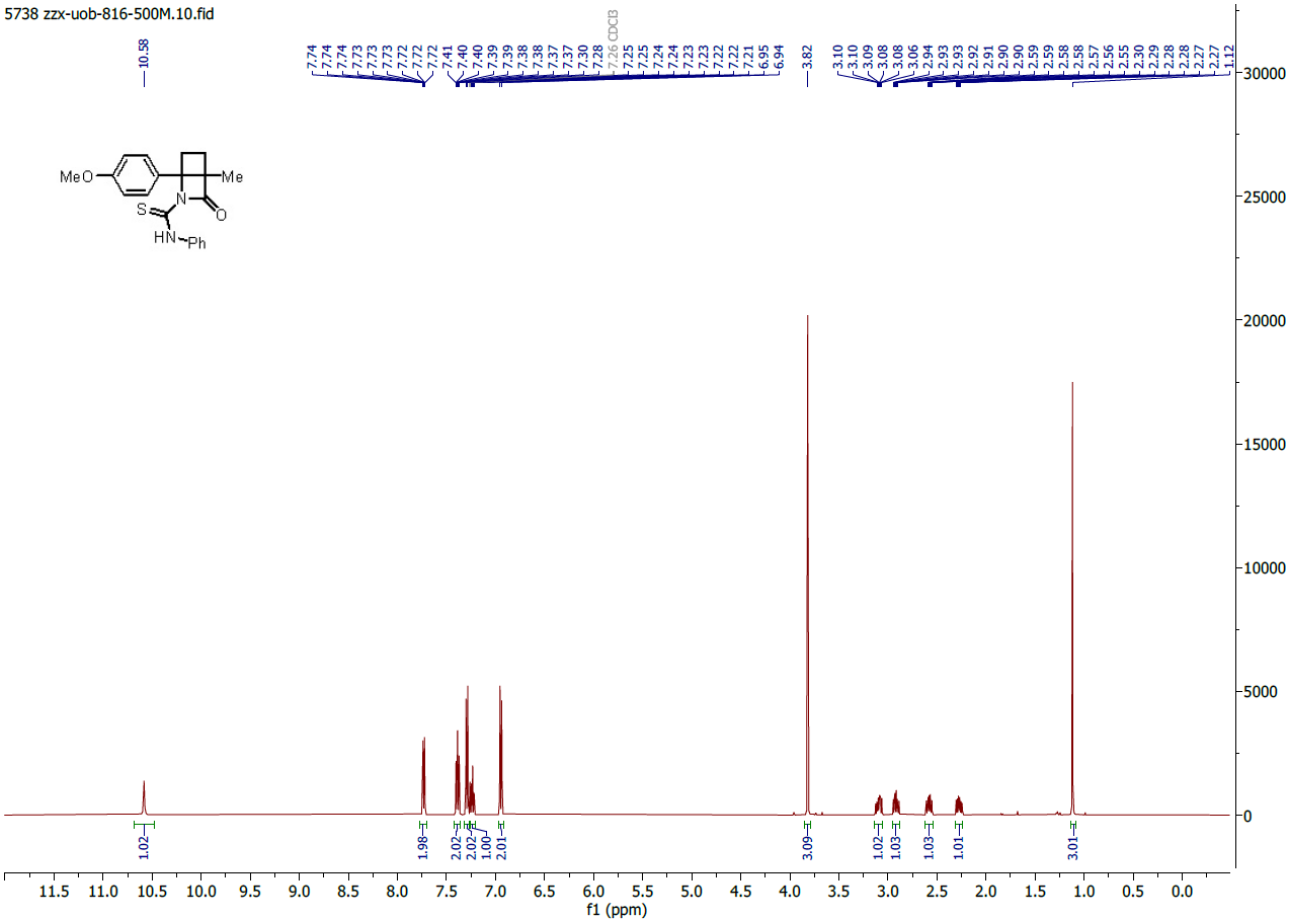

5785 zzx-uob-825-500M-sec.11.fid
172.26
168.77
167.60
77.16 CDCl3
61.78
61.74
26.15
23.84
23.25
13.23
HOOC
Me
N
Ac
O
f1 (ppm)

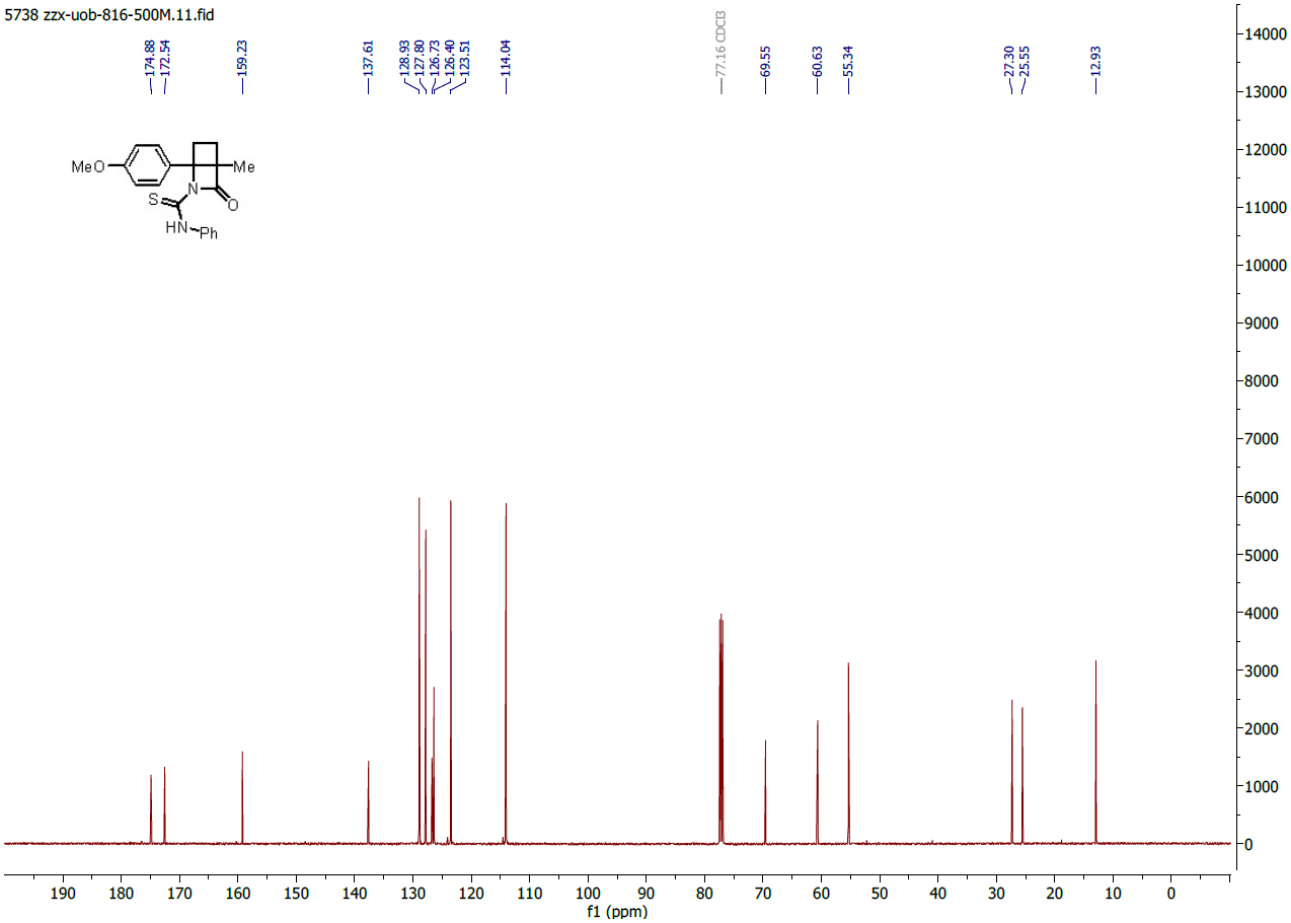
Compound 14


5736 zzx-uob-815-500M-sec.10.fid
MeO
Me
N
O
O
HN
Ph
f1 (ppm)

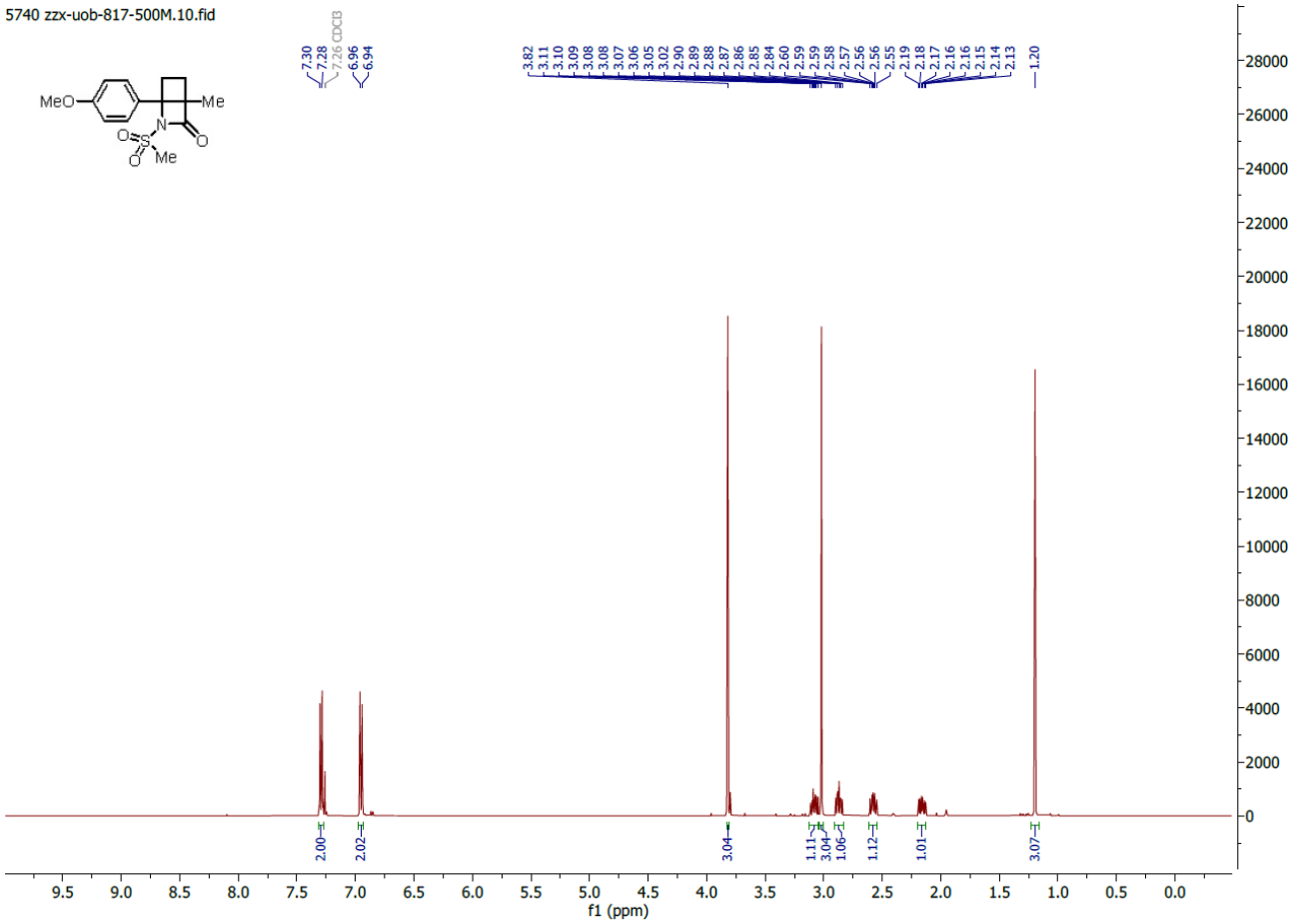

5736 zzx-uob-815-500M-sec.11.fid
MeO
Me
N
O
O
HN
Ph
f1 (ppm)

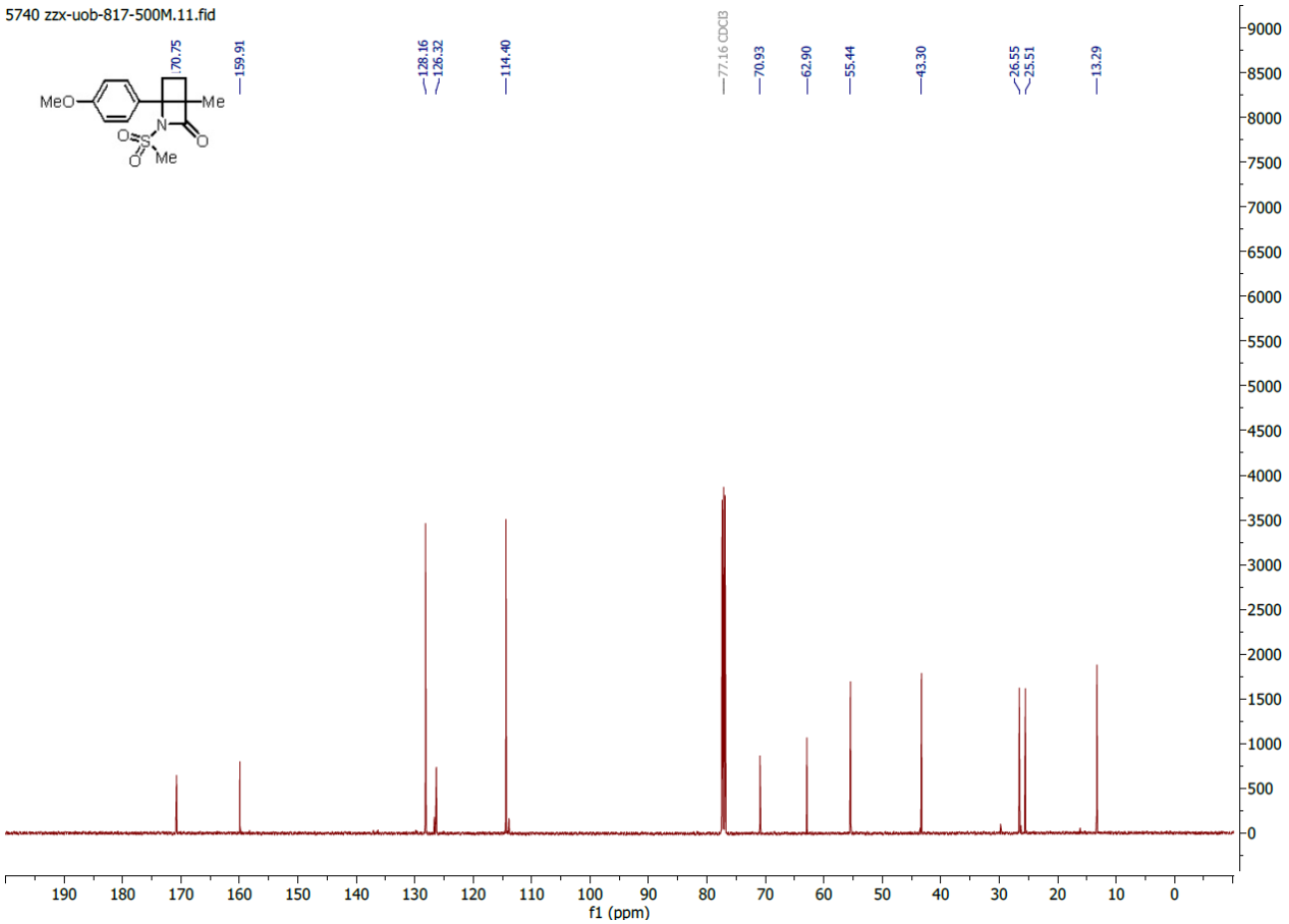
Compound 15


5738 zzx-uob-816-500M.10.fid
MeO
Me
S
N
O
HN
Ph
f1 (ppm)

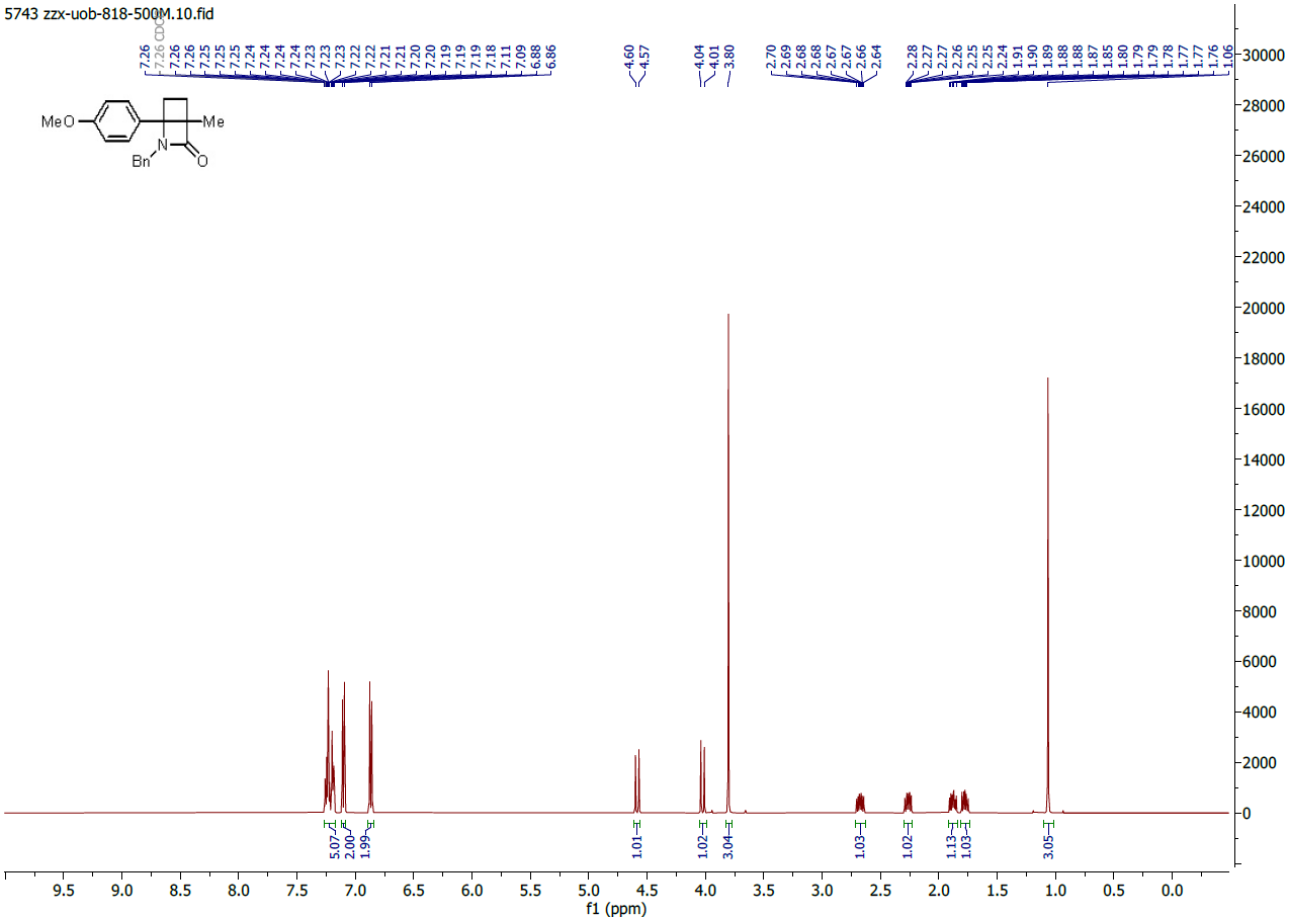

5738 zzx-uob-816-500M.11.fid
MeO
Me
S
N
O
HN
Ph
f1 (ppm)

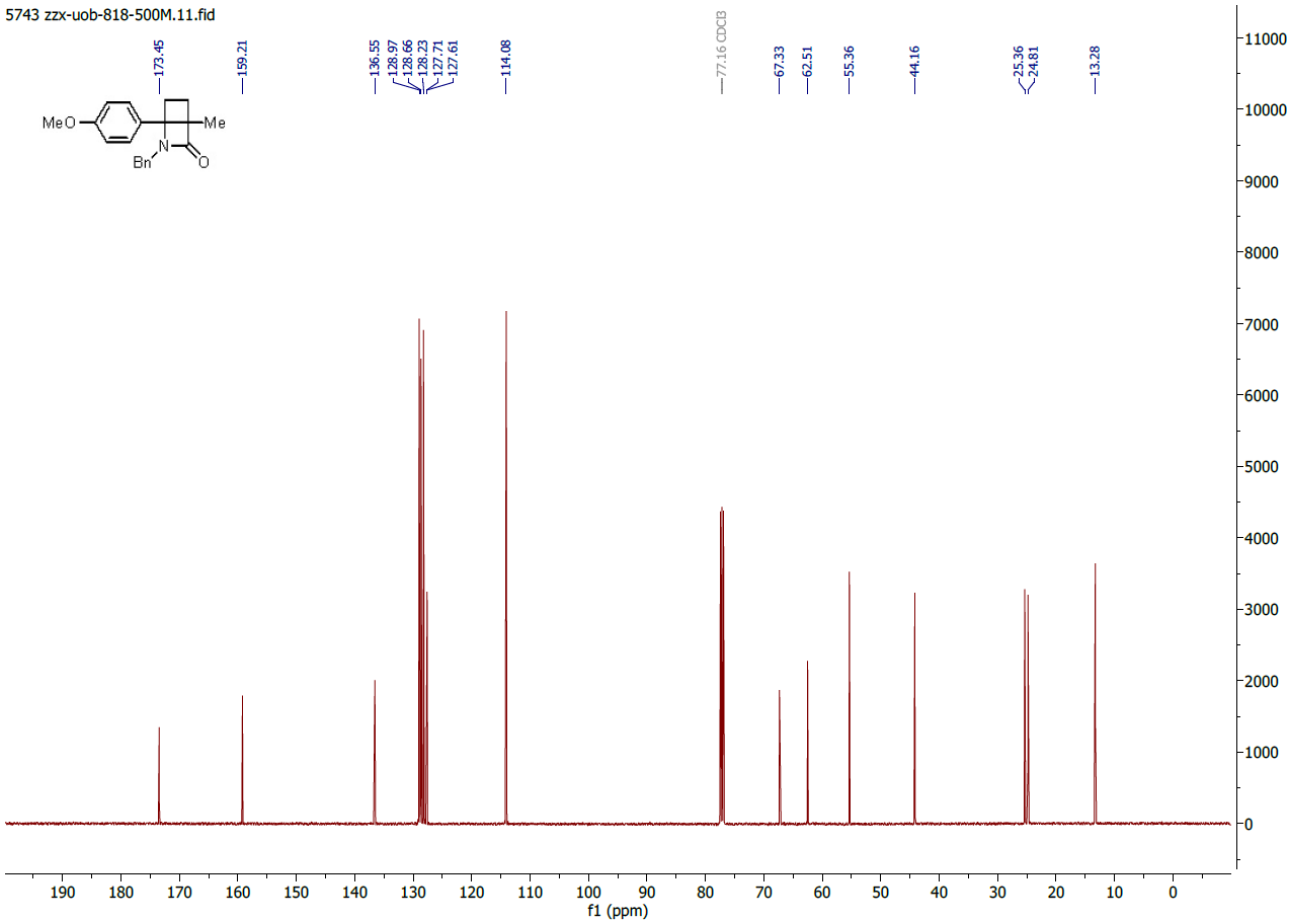
Compound 16


5740 zzx-uob-817-500M.10.fid
MeO
Me
N
O
S
O
Me
O
7.30
7.28
7.26 CDCl3
6.96
6.94
3.82
3.11
3.10
3.09
3.08
3.08
3.07
3.06
3.05
3.02
2.90
2.89
2.88
2.87
2.86
2.85
2.84
2.60
2.59
2.59
2.58
2.57
2.56
2.56
2.55
2.19
2.18
2.17
2.16
2.16
2.15
2.14
2.13
1.20
2.00
2.02
3.04
1.11
3.04
1.06
1.12
1.01
3.07
f1 (ppm)

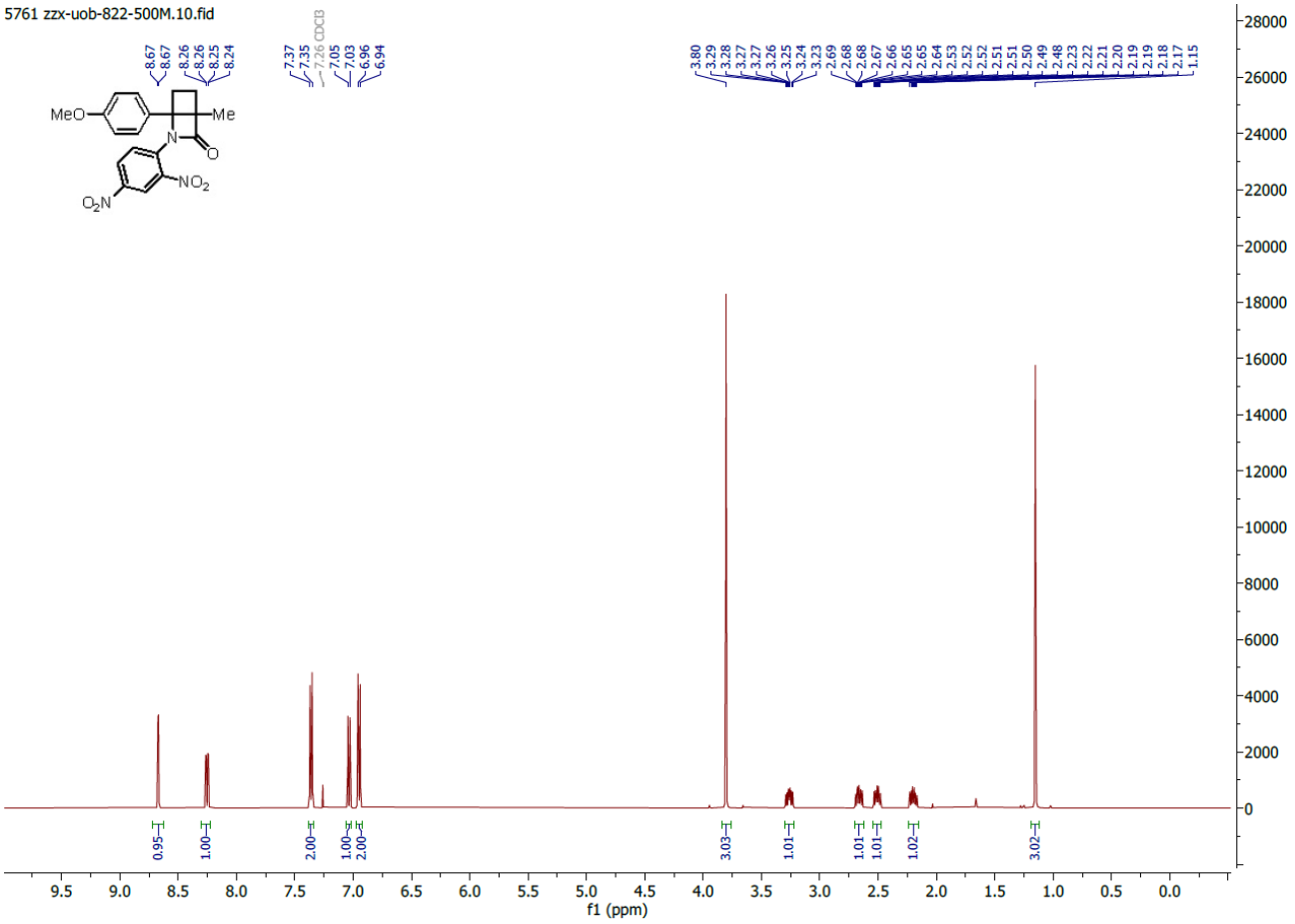

5740 zzx-uob-817-500M.11.fid
MeO
Me
N
O
S
O
Me
O
170.75
159.91
128.16
126.32
114.40
77.16 CDCl3
70.93
62.90
55.44
43.30
26.55
25.51
13.29
f1 (ppm)

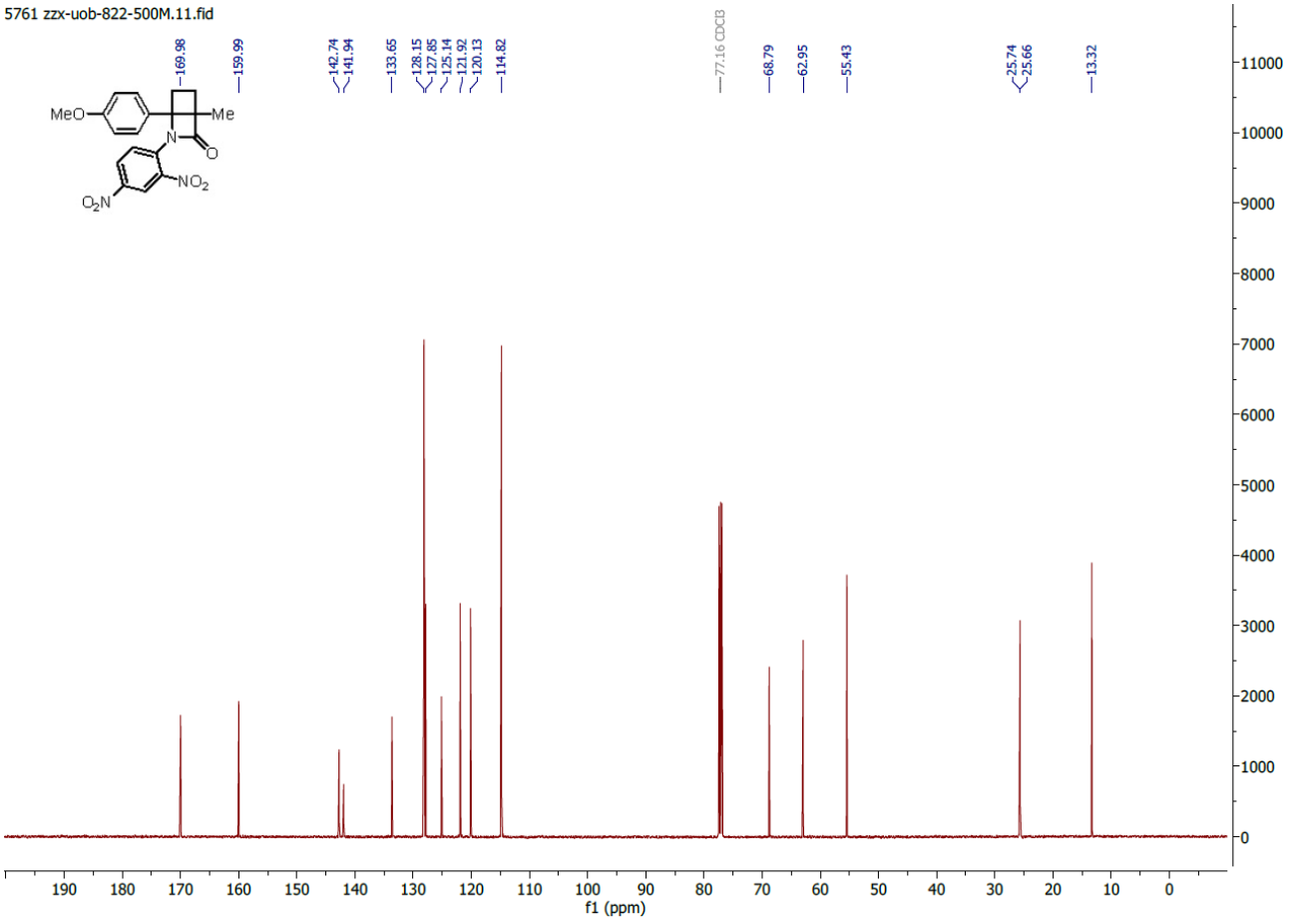
Compound 17


5743 zzx-uob-818-500M.10.fid
MeO
Me
Bn
N
O
f1 (ppm)

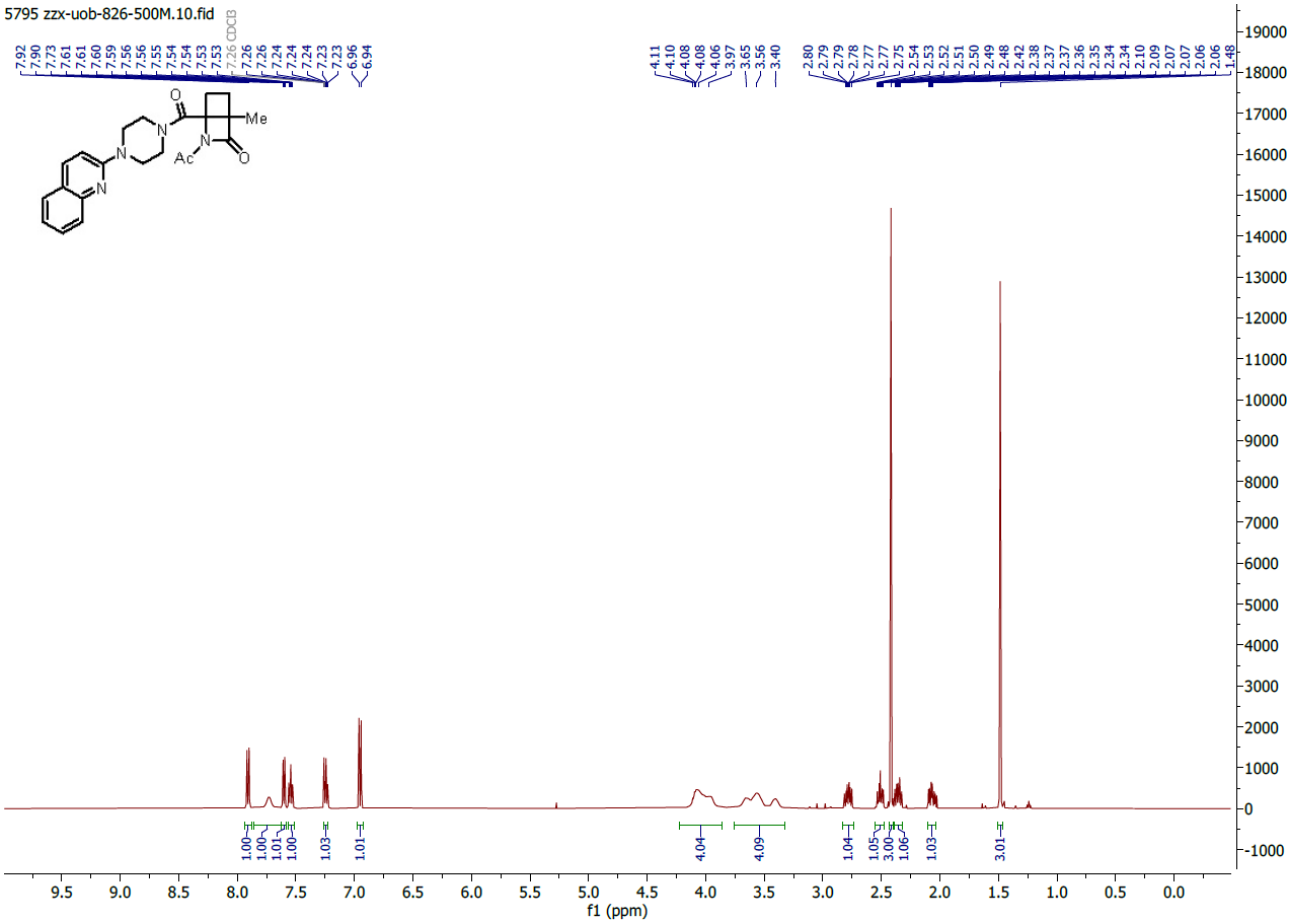

5743 zzx-uob-818-500M.11.fid
MeO
Me
Bn
N
O
f1 (ppm)

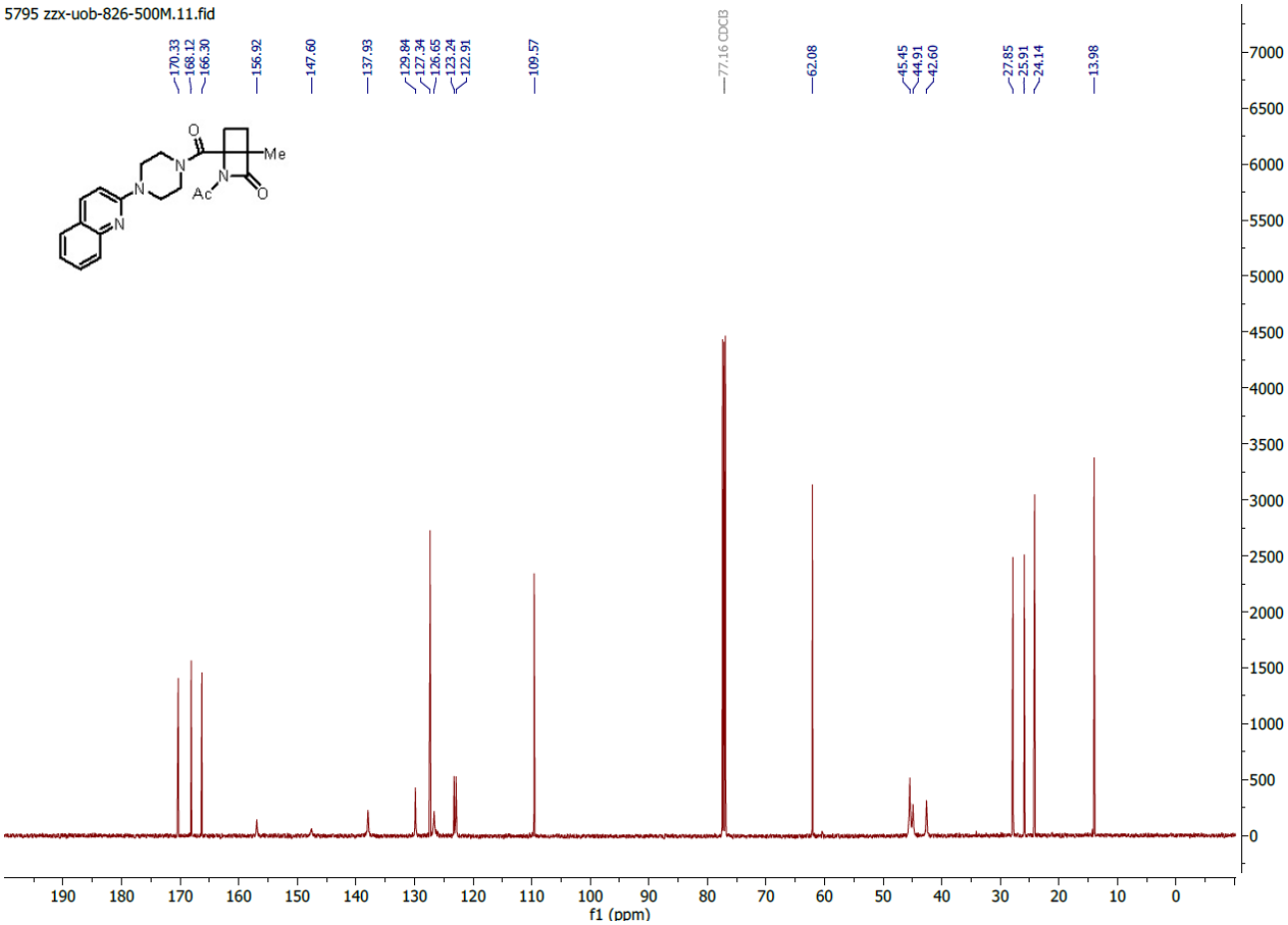
Compound 18


5761 zzx-uob-822-500M.10.fid
MeO
Me
N
O
NO2
O2N
f1 (ppm)

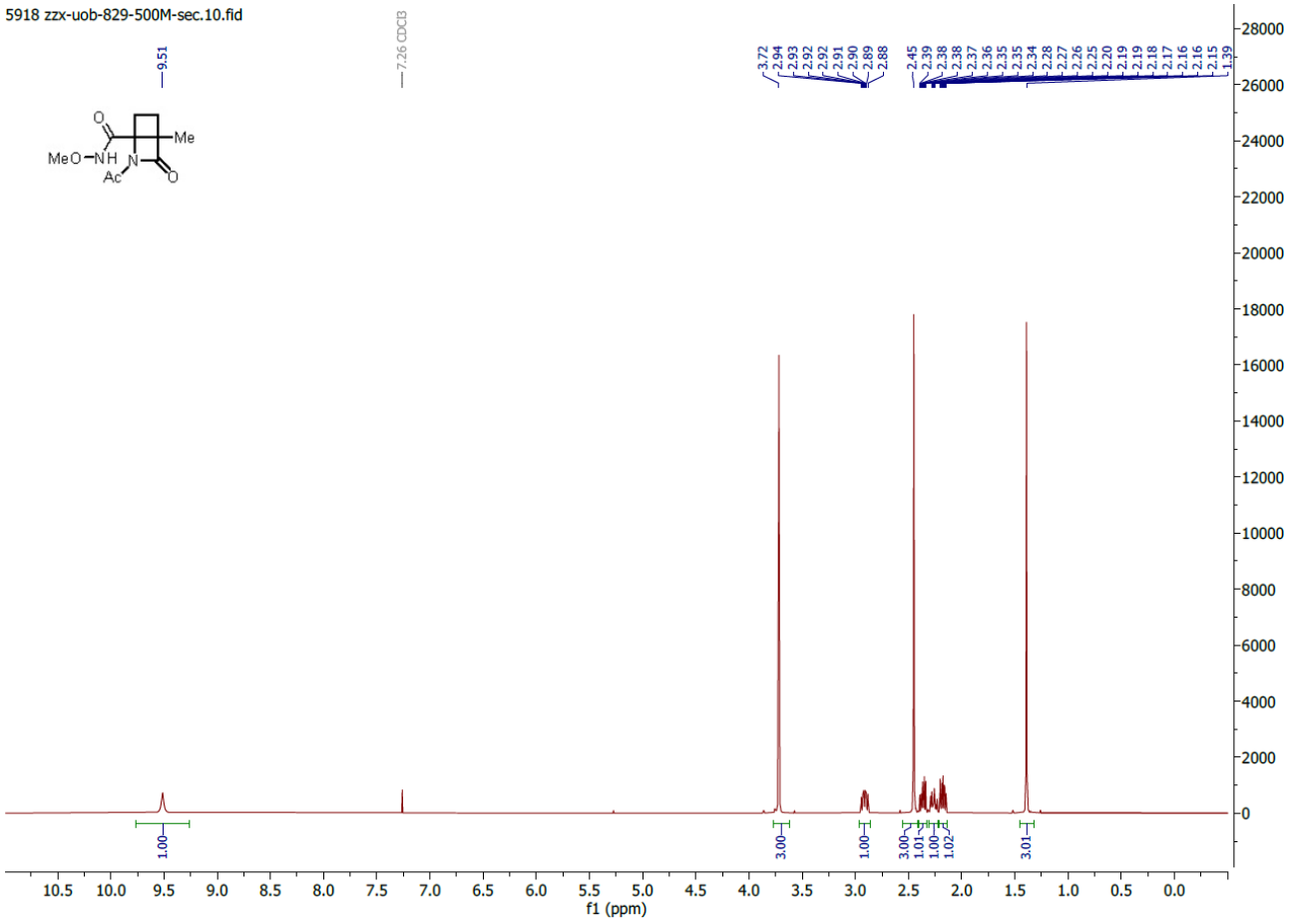

5761 zzx-uob-822-500M.11.fid
MeO
Me
N
O
NO2
O2N
f1 (ppm)

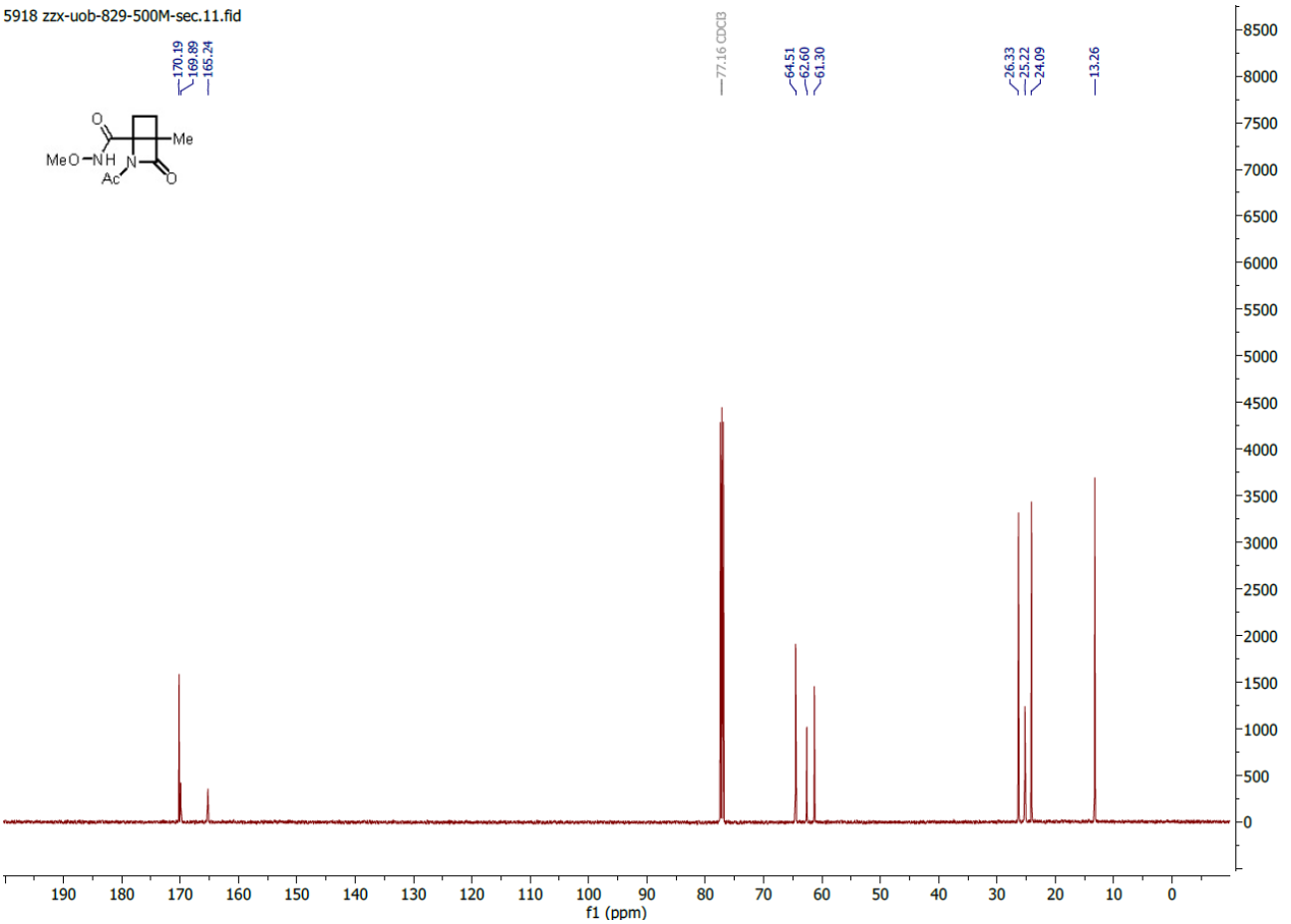
Compound 19


5795 zzx-uob-826-500M.10.fid
f1 (ppm)

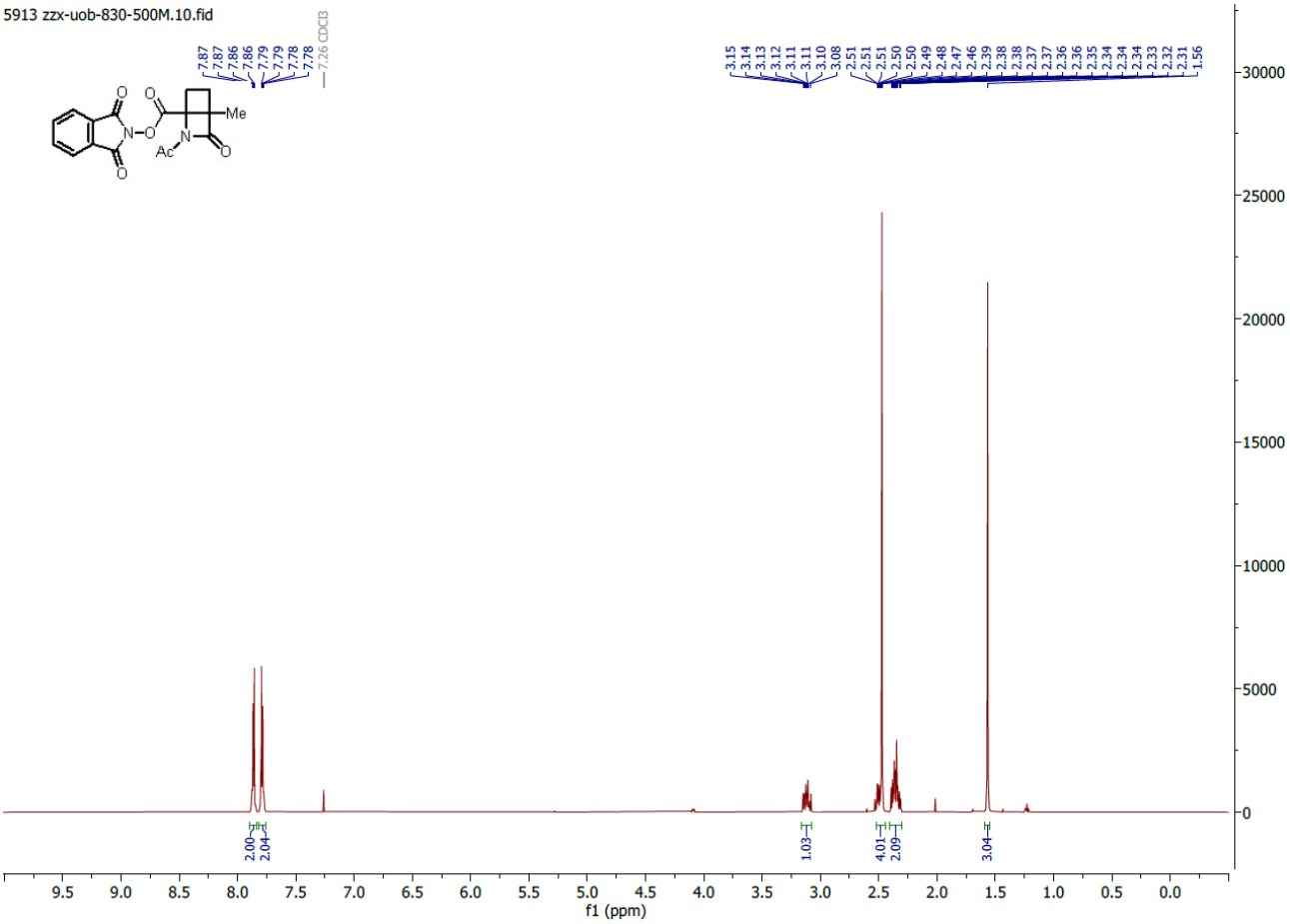

5795 zzx-uob-826-500M.11.fid
f1 (ppm)

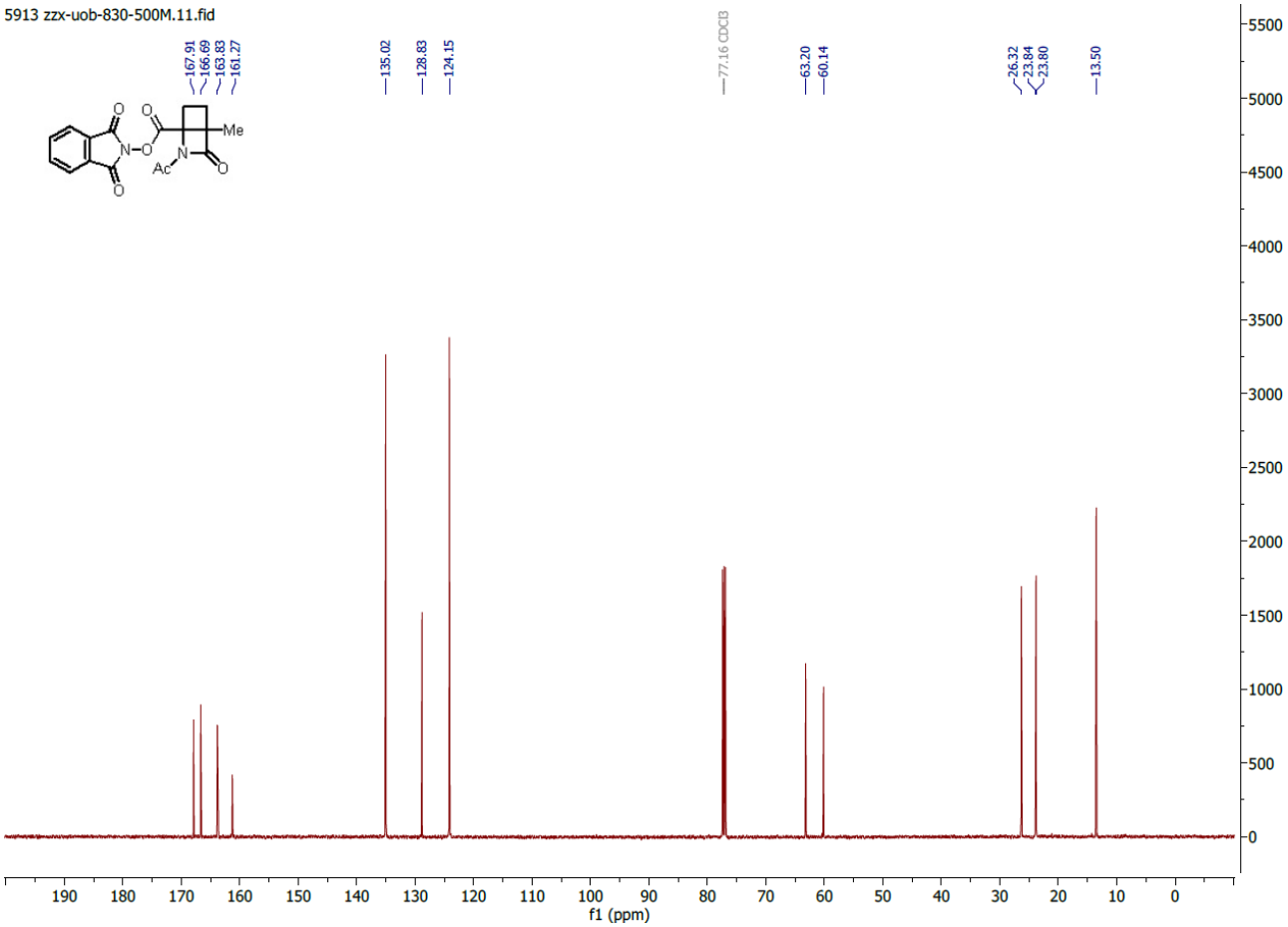
Compound 20


5918 zzx-uob-829-500M-sec.10.fid
9.51
7.26 CDCl3
3.72
2.94
2.93
2.92
2.92
2.91
2.90
2.89
2.88
2.45
2.39
2.38
2.38
2.37
2.36
2.35
2.35
2.34
2.28
2.27
2.26
2.25
2.20
2.19
2.19
2.18
2.17
2.16
2.16
2.15
1.39
Me
MeO
NH
N
Ac
O
1.00
3.00
1.00
3.00
1.01
1.00
1.02
3.01
f1 (ppm)


5918 zzx-uob-829-500M-sec.11.fid
170.19
169.89
165.24
77.16 CDCl3
64.51
62.60
61.30
26.33
25.22
24.09
13.26
Me
MeO
NH
N
Ac
O
f1 (ppm)

Compound 21


5913 zzx-uob-830-500M.10.fid
7.87
7.87
7.86
7.86
7.79
7.79
7.78
7.78
7.26 CDCl3
3.15
3.14
3.13
3.12
3.11
3.11
3.10
3.08
2.51
2.51
2.51
2.50
2.50
2.50
2.49
2.48
2.47
2.46
2.39
2.38
2.38
2.37
2.37
2.36
2.36
2.35
2.34
2.34
2.34
2.33
2.32
2.31
1.56
Me
Ac
2.00
2.04
1.03
4.01
2.09
3.04
f1 (ppm)


5913 zzx-uob-830-500M.11.fid
167.91
166.69
163.83
161.27
135.02
128.83
124.15
77.16 CDCl3
63.20
60.14
26.32
23.84
23.80
13.50
Me
Ac
f1 (ppm)

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