Supporting Information

Palladium-Catalyzed Intramolecular Aza-Wacker-Type Cyclization of Vinyl Cyclopropanecarboxamides to Access Conformationally Restricted Aza[3.1.0]bicycles

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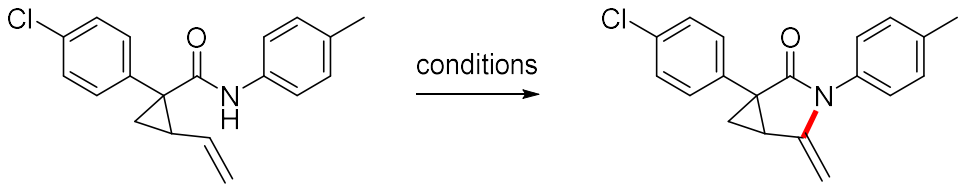
I. Optimization of reaction conditions

Table S1: Optimization of reaction conditions.[a]



1a **2a**

Entry	Cat/mol%	Base/equiv	Solvent	[O]/equiv	Time/h	Yield/%[b]
1	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	O_2	24	60
2	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	O_2	44	58[c]
3	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	O_2	24	59[d]
4	$Pd(OAc)_2$	K_2CO_3 (1.0)	DMF	O_2	8	46
5	$Pd(TFA)_2$	K_2CO_3 (1.0)	DMF	O_2	24	21 (31)
6	$PdCl_2$	K_2CO_3 (1.0)	DMF	O_2	24	19 (42)
7	$PdCl_2(MeCN)_2$	K_2CO_3 (1.0)	DMF	O_2	24	25 (27)
8	$PdCl_2$(dppe)	K_2CO_3 (1.0)	DMF	O_2	24	44
9	$Pd(dba)_2$	K_2CO_3 (1.0)	DMF	O_2	24	13 (45)
10	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	N_2	24	Trace
11	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	Air	24	Trace
12	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	O_2	33	58 (10) [e]
13	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	O_2	17	53[f]
14	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (0.5)	DMF	O_2	24	39 (30)
15	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.5)	DMF	O_2	24	60
16	$Pd(PPh_3)_2Cl_2$	AcOK (1.0)	DMF	O_2	24	26
18	$Pd(PPh_3)_2Cl_2$	K_3PO_4 (1.0)	DMF	O_2	24	45 (17)
19	$Pd(PPh_3)_2Cl_2$	Cs_2CO_3 (1.0)	DMF	O_2	24	49 (18)
20	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	NMP	O_2	24	45 (13)
21	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	CH_3CN	O_2	24	24 (43)
22	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	Dioxane	O_2	24	Trace (90)
23	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	Toluene	O_2	24	Trace (88)
24	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMSO	O_2	24	37 (39)
25	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	THF	O_2	24	Trace (94)
26	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	TBHP (2.0)	24	33
27	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	*m*-CPBA (2.0)	24	Trace (60)
28	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	$Cu(OAc)_2$ (2.0)	24	12 (69)

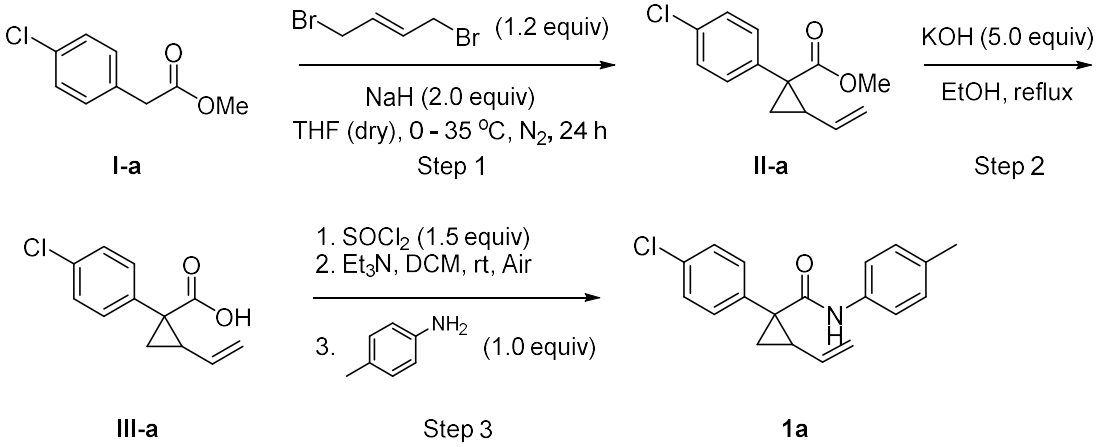
29	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	Ag_2O (2.0)	24	Trace
30	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	Oxone (2.0)	24	0
31	$Pd(PPh_3)_2Cl_2$	K_2CO_3 (1.0)	DMF	$K_2S_2O_8$ (2.0)	24	0

[a] Unless otherwise indicated, the reaction was conducted with **1a** (0.5 mmol, 1.0 equiv), [Pd] salt (5 mol%), base (1.0 equiv) and solvent (2 mL) at 50 ºC under O_2. [b] Recovered of **1a** shown in parentheses after purification by column chromatography. [c] $Pd(PPh_3)_2Cl_2$ (3 mol%). [d] $Pd(PPh_3)_2Cl_2$ (10 mol%). [e] 40 ºC. [f] 60 ºC.

II. General procedures.

1. General procedures for the synthesis of **1**.

Method A: General procedures for **1a-1j**, **1l-1x**, **1z** (**1a** as an example)[1, 2].



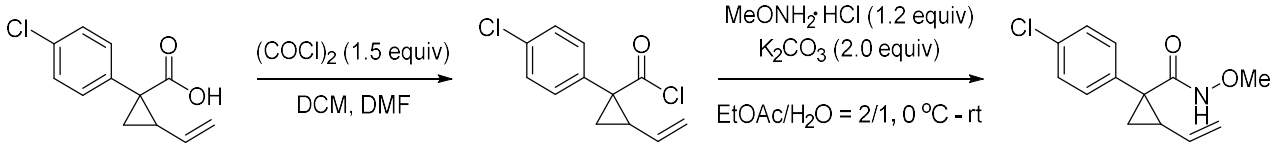
Step 1: To a flame-dried round-bottom flask under nitrogen atmosphere was added NaH (4.0 g, 100 mmol, 2.0 equiv) and THF (120 mL). The mixture was cooled to 0 ºC while stirring, upon which the methyl 2-(4-chlorophenyl) acetate **I-a** (7.7 mL, 50 mmol, 1.0 equiv) was added. The mixture was warmed to room temperature for 10 minutes then cooled to 0 ºC again. (*E*)-1,4-Dibromobut-2-ene (12.8 g, 60 mmol, 1.2 equiv) was then added dropwise, and the reaction was stirred at 35 ºC for 24 hours. The reaction was quenched by addition of saturated aqueous NH_4Cl (150 mL). The layers were separated, and the aqueous layer was extracted with ethyl acetate. The organic layers were combined, dried, filtered and concentrated to an oil. The oil was purified by flash column chromatography with PE and EA (eluent: EA/PE = 1/50) as eluent to give **II-a** as a colorless liquid (8.0 g, 34 mmol, 67%).

Step 2: Methyl 1-(4-chlorophenyl)-2-vinylcyclopropane-1-carboxylate **II-a** (8.0 g, 34 mmol, 1.0 equiv), was then dissolved in EtOH (140 mL), combined with KOH (9.5 g, 170 mmol, 5.0 equiv) and stirred under reflux for 3 hours. The reaction was cooled to room temperature and acidified to pH 3-1 with 10% HCl. The aqueous layer was extracted with dichloromethane (100 mL × 3), and the combined organic layers were dried, filtered, and concentrated to obtain the target product **III-a** as a white solid. (7.54 g, 34 mmol, 99%).

Step 3: To a 250 mL round bottom flask equipped with 100 mL CH_2Cl_2 was added **III-a** (29.0 mmol, 1.0 equiv), $SOCl_2$ (3.2 mL, 43.5 mmol, 1.5 equiv), the mixture was stirred at room temperature for 10 min, then Et_3N was added dropwise to the mixture until there is no white smoke produced. *P*-toluidine (3.1 g, 29 mmol, 1.0 equiv) was added to the system dropwise. After the mixture was stirred at room temperature for 2 hours, it was quenched by water (100 mL), and extracted with dichloromethane (120 mL × 3). The organic layers were washed with saturated brine (120 mL × 3),

and the organic layers were dried, filtered. Then the residue was purified by a flash silica gel column chromatography (eluent: EA/PE = 1/20) to give the desired product compound **1a** as a white solid (8.2 g, 90%).

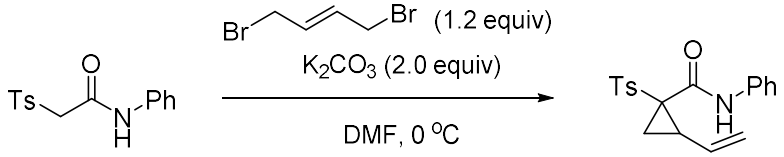
Method B: General procedure for **1k**[3].



III-k **IV-k** **1k**

A dried round-bottom flask was charged with the acid **III-k** (2.78 mmol), DCM (15 mL), and 2 drops of DMF. Then, oxalyl chloride (0.529 g, 1.5 equiv) was added dropwise within 5 minutes at 0 °C. The resulting mixture was stirred at room temperature for 3.5 hours and concentrated under reduced pressure. The residue was dissolved in EA (20 mL) and K_2CO_3 (0.768 g, 2.0 equiv), $MeONH_2 \cdot HCl$ (0.278 g, 1.2 equiv) and water (10 mL) were added sequentially. The resulting mixture was stirred at room temperature. After the completion of the reaction, extracted with EA (50 mL × 2). The organic layer was washed with saturated aqueous $NaHCO_3$ (15 mL × 2), brine (15 mL × 2), and dried over anhydrous Na_2SO_4, filtered and concentrated under reduced pressure. The crude product was recrystallized (EA) to afford the product **1k** as a white solid (0.647 g, 93%).

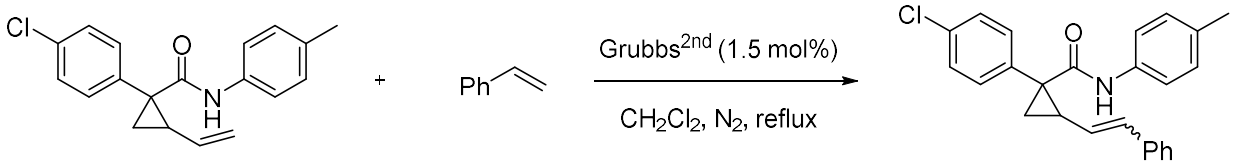
Method C: General procedure for **1y**.



I-y **1y**

To a 100 mL round bottom flask was equipped with 40 mL DMF and added *N*-phenyl-2-tosylacetamide **I-y** (8.8 mmol, 1.0 equiv), K_2CO_3 (2.43 g, 2.0 equiv), (*E*)-1,4-dibromobut-2-ene (2.26 g, 1.2 equiv), the mixture was stirred at 0 °C until **I-y** disappeared. After the completion of the reaction (monitored by TLC), it was quenched by water (20 mL), and extracted with dichloromethane (30 mL × 3). The combined filtrate was washed with saturated brine (30 mL × 3) and dried over with anhydrous Na_2SO_4. Then the residue was purified by a short flash silica gel column chromatography with PE and EA (eluent: EA/PE = 1/50) to give the desired product compounds **1y** as a white solid (1.3 g, 43%).

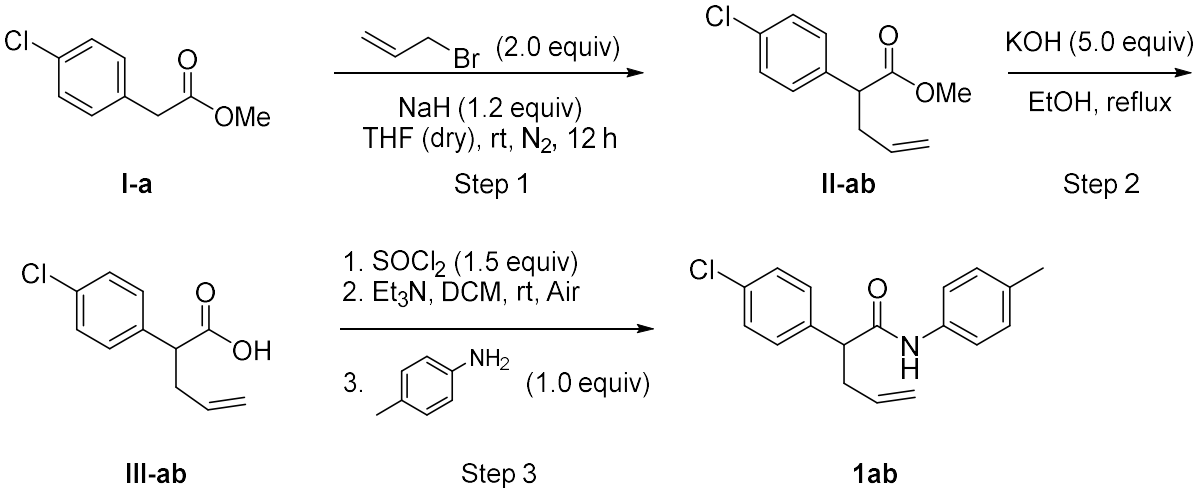
Method D: General procedure for **1aa**[4].



1a **1aa**

A dried round-bottom flask was charged with **1a** (5.0 mmol, 1.0 equiv) and 2nd generation Grubbs catalyst (64 mg, 1.5 mol%) under an atmosphere of dry nitrogen. CH_2Cl_2 (0.6 M) was added followed by styrene (17.2 mL, 30.0 equiv). The flask was sealed under an atmosphere of dry nitrogen and the mixture stirred at 45 °C for 24 h. The solvent was removed under reduced pressure and the residue was purified by flash column chromatography with PE and EA (eluent: EA/PE = 1/40) to give the desired product compound **1aa** as a white solid (871 mg, 45%).

Method E: General procedure for **1ab**



I-a Step 1 **II-ab** Step 2

III-ab Step 3 **1ab**

Step 1: To a flame-dried round-bottom flask under nitrogen atmosphere was added NaH (144 mg, 3.6 mmol, 1.2 equiv) and THF (10 mL). The mixture was cooled to 0 ºC while stirring, upon which the methyl 2-(4-chlorophenyl) acetate **I-a** (0.5 mL, 3 mmol, 1.0 equiv) was added. The mixture was warmed to room temperature for 10 minutes then cooled to 0 ºC again. 3-Bromoprop-1-ene (0.52 mL, 6 mmol, 2.0 equiv) was then added dropwise, and the reaction was stirred at room temperature for 12 hours. The reaction was quenched by addition of saturated aqueous NH_4Cl (15 mL). The layers were separated, and the aqueous layer was extracted with ethyl acetate. The organic layers were combined, dried, filtered and concentrated to an oil.

Step 2: The oil was then dissolved in EtOH (10 mL), combined with KOH (842 mg, 15 mmol, 5.0 equiv) and stirred under reflux for 3 hours. The reaction was cooled to room temperature and acidified to pH 3-1 with 10% HCl. The aqueous layer was extracted with dichloromethane, and the combined organic layers were dried, filtered, and concentrated to obtain the target product **III-ab** as a white

solid.

Step 3: To a 50 mL round bottom flask equipped with 20 mL CH_2Cl_2 was added **III-ab** (1.0 equiv), $SOCl_2$ (0.4 mL, 4.5 mmol, 1.5 equiv), the mixture was stirred at room temperature for 10 min, then Et_3N was added dropwise to the mixture until there is no white smoke produced. After the mixture was stirred at room temperature for 2 hours, it was quenched by water (15 mL), and extracted with dichloromethane (10 mL × 3). The organic layers were washed with saturated brine (10 mL × 3), and the organic layers were dried, filtered. Then the residue was purified by a flash silica gel column chromatography (eluent: EA/PE = 1/20) to give the desired product compound **1ab** as a white solid (374 mg, 42% three steps).

III. X-Ray single crystal diffraction data of 2a (CCDC NO. 2142480).

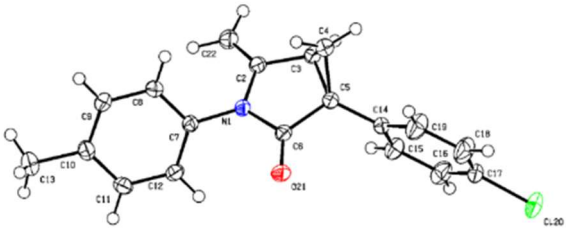


Figure S1. Note: Ortep drawing of **2a** with thermal ellipsoids set at 50% probability

Table S1. Crystal data and structure refinement for **2a**.

Identification code	**2a**
Empirical formula	$C_{19}H_{16}ClNO$
Formula weight	309.78
Temperature/K	149.99(10)
Crystal system	triclinic
Space group	P-1
a/Å	7.0254(3)
b/Å	8.4668(4)
c/Å	13.4722(6)
α/°	82.729(4)
β/°	86.836(4)
γ/°	75.912(4)
Volume/Å^3	770.76(6)
Z	2
ρ_{calc}g/cm^3	1.335
μ/mm^{-1}	2.189
F(000)	324.0
Crystal size/mm^3	0.16 × 0.1 × 0.1
Radiation	Cu Kα (λ = 1.54184)
2Θ range for data collection/°	10.848 to 143.08
Index ranges	-8 ≤ h ≤ 6, -10 ≤ k ≤ 10, -16 ≤ l ≤ 15
Reflections collected	5569
Independent reflections	2917 [R_{int} = 0.0205, R_{sigma} = 0.0259]
Data/restraints/parameters	2917/0/208

Goodness-of-fit on F^2	1.040
Final R indexes [I>=2σ (I)]	R_1 = 0.0406, wR_2 = 0.1053
Final R indexes [all data]	R_1 = 0.0427, wR_2 = 0.1067
Largest diff. peak/hole / e $Å^{-3}$	0.25/-0.43

Table S2. Bond Lengths for **2a**.

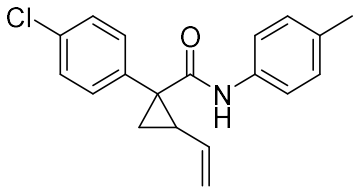
Atom	**Atom**	**Length/Å**	**Atom**	**Atom**	**Length/Å**
Cl20	C17	1.7450(16)	C6	C5	1.5111(19)
O21	C6	1.2144(18)	C5	C3	1.520(2)
N1	C7	1.4310(18)	C5	C4	1.517(2)
N1	C2	1.4211(18)	C3	C4	1.508(2)
N1	C6	1.3837(19)	C8	C9	1.383(2)
C14	C5	1.489(2)	C10	C11	1.389(2)
C14	C15	1.389(2)	C10	C9	1.393(2)
C14	C19	1.385(2)	C10	C13	1.511(2)
C12	C7	1.384(2)	C15	C16	1.385(2)
C12	C11	1.391(2)	C17	C16	1.374(3)
C7	C8	1.391(2)	C17	C18	1.374(3)
C2	C3	1.480(2)	C19	C18	1.388(3)
C2	C22	1.325(2)			

Table S3. Bond Angles for **2a**.

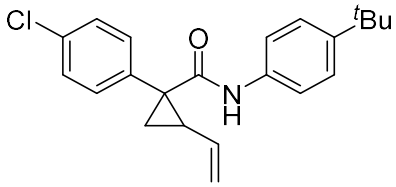
Atom	**Atom**	**Atom**	**Angle/°**	**Atom**	**Atom**	**Atom**	**Angle/°**
C2	N1	C7	122.62(12)	C6	C5	C4	111.59(12)
C6	N1	C7	124.20(12)	C4	C5	C3	59.55(10)
C6	N1	C2	113.17(12)	C2	C3	C5	106.68(12)
C15	C14	C5	119.96(14)	C2	C3	C4	115.53(13)
C19	C14	C5	121.63(14)	C4	C3	C5	60.13(10)
C19	C14	C15	118.40(14)	C9	C8	C7	119.65(13)
C7	C12	C11	119.42(13)	C11	C10	C9	118.21(14)
C12	C7	N1	121.15(13)	C11	C10	C13	121.41(14)
C12	C7	C8	120.16(13)	C9	C10	C13	120.37(14)
C8	C7	N1	118.67(12)	C3	C4	C5	60.32(10)

N1	C2	C3	106.61(12)	C10	C11	C12	121.28(14)
C22	C2	N1	126.25(14)	C8	C9	C10	121.19(14)
C22	C2	C3	127.12(14)	C16	C15	C14	121.09(15)
O21	C6	N1	125.66(13)	C16	C17	Cl20	119.52(14)
O21	C6	C5	126.90(13)	C16	C17	C18	121.47(15)
N1	C6	C5	107.42(12)	C18	C17	Cl20	118.99(13)
C14	C5	C6	119.52(12)	C17	C16	C15	119.00(16)
C14	C5	C3	124.08(12)	C14	C19	C18	121.12(16)
C14	C5	C4	122.29(13)	C17	C18	C19	118.91(16)
C6	C5	C3	105.10(12)				

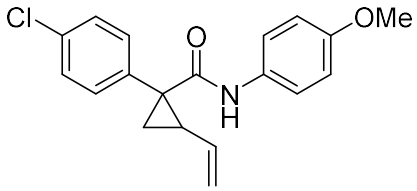
IV. Analytical data of compounds



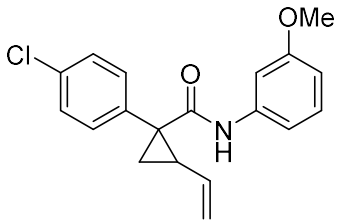
1-(4-Chlorophenyl)-N-(p-tolyl)-2-vinylcyclopropane-1-carboxamide (***1a***). white solid. Mp = 96–98 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.44–7.39 (m, 4H), 7.22 (d, J = 7.8 Hz, 2H), 7.06 (d, J = 8.4 Hz, 2H), 6.95 (s, 1H), 6.04–5.98 (m, 1H), 5.34 (d, J = 16.8 Hz, 1H), 5.13 (d, J = 10.8 Hz, 1H), 2.30–2.25 (m, 4H), 2.08 (dd, J = 7.2, 4.8 Hz, 1H), 1.39 (q, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 168.4, 138.9, 135.4, 135.3, 134.3, 134.1, 131.7, 129.6, 129.4, 119.9, 116.6, 38.2, 32.4, 21.4, 20.9. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{18}ClNO$ $[M+Na]^+$: 334.0969, found: 334.0942.



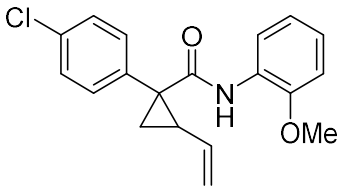
*N-(4-(Tert-butyl)phenyl)-1-(4-chlorophenyl)-2-vinylcyclopropane-1-carboxamide (**1b**).* white solid. Mp = 119–122 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.42–7.38 (m, 4H), 7.28–7.24 (m, 4H), 6.92 (s, 1H), 6.01–5.94 (m, 1H), 5.32 (dd, J = 16.8, 1.2 Hz, 1H), 5.11 (dd, J = 10.2, 1.2 Hz, 1H), 2.29–2.25 (m, 1H), 2.07 (dd, J = 6.6, 4.2 Hz, 1H), 1.37 (q, J = 4.8 Hz, 1H), 1.26 (s, 9H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 168.4, 147.6, 139.0, 135.4, 135.3, 134.3, 131.7, 129.7, 125.8, 119.7, 116.7, 38.2, 34.5, 32.4, 31.5, 21.4. **HRMS** (ESI) (m/z) calculated for $C_{22}H_{24}ClNO$ $[M+Na]^+$: 376.1439, found: 376.1434.



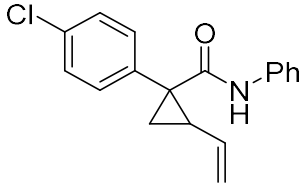
*1-(4-Chlorophenyl)-N-(4-methoxyphenyl)-2-vinylcyclopropane-1-carboxamide (**1c**).* white solid. Mp = 100–102 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.43–7.39 (m, 4H), 7.24–7.22 (m, 2H), 6.87 (s, 1H), 6.80–6.78 (m, 2H), 6.04–5.98 (m, 1H), 5.33 (dd, J = 17.4, 1.2 Hz, 1H), 5.12 (dd, J = 10.2, 1.8 Hz, 1H), 3.76 (s, 3H), 2.26 (dd, J = 16.1, 9.0 Hz, 1H), 2.07 (dd, J = 7.2, 4.8 Hz, 1H), 1.38 (q, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (150 MHz, $CDCl_3$) δ 168.4, 156.6, 139.0, 135.5, 134.3, 131.8, 131.0, 129.7, 121.9, 116.6, 114.1, 55.6, 38.1, 32.5, 21.4. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{18}ClNO_2$ $[M+Na]^+$: 350.0918, found: 350.0919.



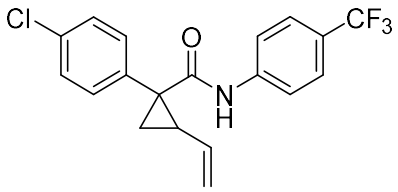
*1-(4-Chlorophenyl)-N-(3-methoxyphenyl)-2-vinylcyclopropane-1-carboxamide (**1d**).* white solid. Mp = 67–69 ºC. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.44–7.39 (m, 4H), 7.15 (t, J = 2.4 Hz, 1H), 7.12 (d, J = 8.4 Hz, 1H), 6.97 (s, 1H), 6.75 (dd, J = 8.0, 1.2 Hz, 1H), 6.63–6.60 (m, 1H), 6.04–5.94 (m, 1H), 5.34 (dd, J = 17.2, 1.2 Hz, 1H), 5.13 (dd, J = 10.0, 1.6 Hz, 1H), 3.77 (s, 3H), 2.31–2.25 (m, 1H), 2.08 (dd, J = 6.8, 4.4 Hz, 1H), 1.39 (q, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 168.5, 160.3, 139.1, 138.8, 135.3, 134.4, 131.7, 129.8, 129.7, 116.8, 111.9, 110.4, 105.5, 55.5, 38.3, 32.6, 21.5. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{18}ClNO_2$ $[M+Na]^+$: 350.0918, found: 350.0914.



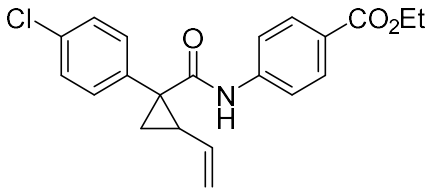
*1-(4-Chlorophenyl)-N-(2-methoxyphenyl)-2-vinylcyclopropane-1-carboxamide (**1e**).* white solid. Mp = 98–99 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.31 (d, J = 8.4 Hz, 1H), 7.80 (s, 1H), 7.42 (dd, J = 19.2, 8.4 Hz, 4H), 6.99–6.96 (m, 1H), 6.91 (t, J = 7.8 Hz, 1H), 6.75 (d, J = 7.8 Hz, 1H), 6.08–6.01 (m, 1H), 5.33 (d, J = 17.4 Hz, 1H), 5.12 (d, J = 10.2 Hz, 1H), 3.63 (s, 3H), 2.27 (q, J = 8.4 Hz, 1H), 2.08 (t, J = 5.4 Hz 1H), 1.43 (q, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 168.3, 147.8, 139.0, 135.5, 134.1, 131.9, 129.4, 127.9, 123.7, 121.2, 119.2, 116.5, 110.0, 55.8, 38.6, 32.7, 21.1. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{18}ClNO_2$ $[M+Na]^+$: 350.0918, found: 350.0911.



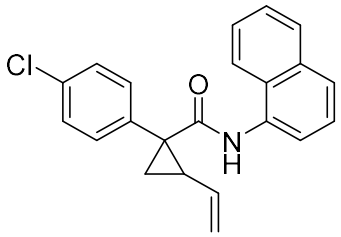
*1-(4-Chlorophenyl)-N-phenyl-2-vinylcyclopropane-1-carboxamide (**1f**).* white solid. Mp = 87–89 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.44–7.40 (m, 4H), 7.33 (d, J = 8.4 Hz, 2H), 7.26 (t, J = 7.8 Hz, 2H), 7.06 (t, J = 7.2 Hz, 1H), 6.98 (s, 1H), 6.04–5.98 (m, 1H), 5.34 (d, J = 17.4 Hz, 1H), 5.13 (d, J = 10.2 Hz, 1H), 2.28 (q, J = 8.4 Hz, 1H), 2.09 (dd, J = 7.2, 4.8 Hz, 1H), 1.40 (q, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 168.5, 138.9, 137.8, 135.3, 134.4, 131.8, 129.7, 129.0, 124.5, 119.9, 116.8, 38.2, 32.6, 21.5. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{16}ClNO$ $[M+Na]^+$: 320.0813, found: 320.0811.



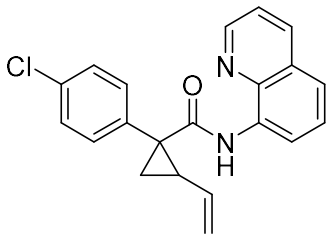
*1-(4-Chlorophenyl)-N-(4-(trifluoromethyl)phenyl)-2-vinylcyclopropane-1-carboxamide (**1g**).* white solid. Mp = 101–103 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.50 (d, J = 9.0 Hz, 2H), 7.46 (d, J = 9.0 Hz, 2H), 7.45–7.41 (m, 4H), 7.11 (s, 1H), 6.00–5.94 (m, 1H), 5.36 (dd, J = 17.4, 1.2 Hz, 1H), 5.15 (dd, J = 10.2, 1.8 Hz, 1H), 2.34–2.30 (m, 1H), 2.10 (dd, J = 7.2, 4.8 Hz, 1H), 1.43 (q, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) 168.8, 140.8, 138.3, 134.9, 134.7, 131.8, 129.9, 126.22 (q, $J_{C\text{-}F}$ = 3.0 Hz), 126.17 (q, $J_{C\text{-}F}$ = 33.2 Hz), 124.1 (q, $J_{C\text{-}F}$ = 271.8 Hz), 119.4, 117.2, 38.3, 32.9, 21.7. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -62.15. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{15}ClF_3NO$ $[M+Na]^+$: 388.0686, found: 388.0679.



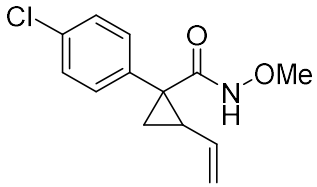
*Ethyl-4-(1-(4-chlorophenyl)-2-vinylcyclopropane-1-carboxamido)benzoate (**1h**).* white solid. Mp = 117–118 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.93 (d, J = 8.4 Hz, 2H), 7.44–7.40 (m, 6H), 7.12 (s, 1H), 6.02–5.96 (m, 1H), 5.35 (dd, J = 17.4, 1.2 Hz, 1H), 5.15 (dd, J = 10.2, 1.8 Hz, 1H), 4.34 (q, J = 7.2 Hz, 2H), 2.31 (dd, J = 16.2, 9.0 Hz, 1H), 2.10 (dd, J = 6.6, 4.2 Hz, 1H), 1.43 (q, J = 4.2 Hz, 1H), 1.37 (t, J = 7.2 Hz, 3H). **^{13}C{^{1}H} NMR** (150 MHz, $CDCl_3$) δ 168.8, 166.2, 141.8, 138.4, 135.0, 134.7, 131.8, 130.8, 129.9, 126.2, 118.8, 117.2, 61.0, 38.4, 33.0, 21.7, 14.5. **HRMS** (ESI) (m/z) calculated for $C_{21}H_{20}ClNO_3$ $[M+Na]^+$: 392.1024, found: 392.1017.



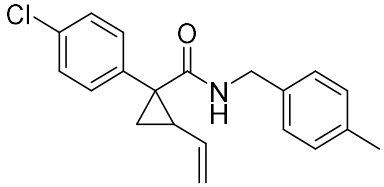
*1-(4-Chlorophenyl)-N-(naphthalen-1-yl)-2-vinylcyclopropane-1-carboxamide (**1i**).* white solid. Mp = 103–104 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.93 (d, J = 7.2 Hz, 1H), 7.81 (d, J = 7.8 Hz, 1H), 7.64 (d, J = 8.4 Hz, 1H), 7.58 (d, J = 8.4 Hz, 2H), 7.49 (d, J = 8.4 Hz, 2H), 7.45–7.39 (m, 4H), 7.21 (d, J = 7.8 Hz, 1H), 6.13–6.06 (m, 1H), 5.40 (dd, J = 16.8, 1.2 Hz, 1H), 5.17 (dd, J = 10.2, 1.8 Hz, 1H), 2.37 (dd, J = 16.2, 9.0 Hz, 1H), 2.17 (dd, J = 7.2, 4.8 Hz, 1H), 1.48 (q, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 169.1, 139.1, 135.4, 134.6, 134.1, 132.4, 132.0, 129.9, 128.9, 126.9, 126.5, 126.0, 125.83, 125.75, 120.3, 120.1, 116.8, 38.4, 32.8, 21.5. **HRMS** (ESI) (m/z) calculated for $C_{22}H_{18}ClNO$ $[M+Na]^+$: 370.0969, found: 370.0965.



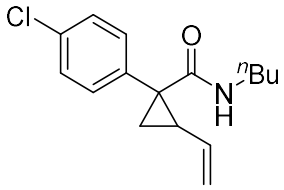
*1-(4-Chlorophenyl)-N-(quinolin-8-yl)-2-vinylcyclopropane-1-carboxamide (**1j**).* white solid. Mp = 113–114 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 9.93 (s, 1H), 8.70 (dd, J = 7.8, 1.2 Hz, 1H), 8.55 (dd, J = 4.2, 1.8 Hz, 1H), 8.07 (dd, J = 8.4, 1.8 Hz, 1H), 7.54–7.52 (m, 2H), 7.48 (t, J = 8.4 Hz, 1H), 7.46–7.43 (m, 3H), 7.35 (q, J = 4.2 Hz, 1H), 6.09–6.03 (m, 1H), 5.35 (dd, J = 16.8, 1.2 Hz, 1H), 5.11 (dd, J = 10.2, 1.8 Hz, 1H), 2.36–2.32 (m, 1H), 2.14 (dd, J = 7.2, 4.8 Hz, 1H), 1.49 (q, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 168.9, 148.3, 139.0, 138.6, 136.2, 135.6, 134.7, 134.1, 132.1, 129.5, 127.9, 127.4, 121.60, 121.55, 116.6, 115.9, 39.0, 32.8, 21.2. **HRMS** (ESI) (m/z) calculated for $C_{21}H_{17}ClN_2O$ $[M+Na]^+$: 371.0922, found: 371.0916.



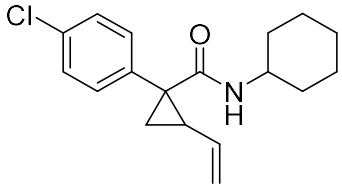
*1-(4-Chlorophenyl)-N-methoxy-2-vinylcyclopropane-1-carboxamide (**1k**)*. white solid. Mp = 82–85 ºC. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.84 (s, 1H), 7.35–7.30 (m, 4H), 5.97–5.88 (m, 1H), 5.30 (dd, J = 17.2, 1.6 Hz, 1H), 5.12 (dd, J = 10.0, 1.6 Hz, 1H), 3.64 (s, 3H), 2.18 (dd, J = 16.4, 8.8 Hz, 1H), 1.99 (dd, 6.8, 4.4 Hz, 1H), 1.31 (q, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 168.9, 137.9, 134.9, 134.3, 133.3, 131.6, 129.5, 116.8, 64.7, 35.5, 32.3, 21.1. **HRMS** (ESI) (m/z) calculated for $C_{13}H_{14}ClNO_2$ $[M+Na]^+$: 274.0605, found: 274.0604.



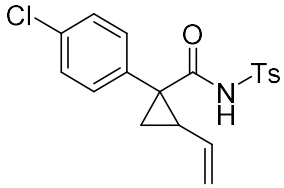
*1-(4-Chlorophenyl)-N-(4-methylbenzyl)-2-vinylcyclopropane-1-carboxamide (**1l**).* white solid. Mp = 84–86 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.35–7.31 (m, 4H), 7.08 (d, J = 7.8 Hz, 2H), 7.01 (d, J = 7.8 Hz, 2H), 6.03–5.97 (m, 1H), 5.56 (s, 1H), 5.31 (dd, J = 16.8, 1.2 Hz, 1H), 5.13 (dd, J = 10.2, 1.8 Hz, 1H), 4.39 (dd, J = 15.0, 6.0 Hz, 1H), 4.29 (dd, J = 15.0, 5.4 Hz, 1H), 2.31 (s, 3H), 2.21–2.17 (m, 1H), 2.04 (dd, J = 6.6, 4.2 Hz, 1H), 1.32 (q, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 170.3, 139.3, 137.1, 135.8, 135.3, 134.0, 131.7, 129.5, 129.4, 127.4, 116.3, 43.8, 37.5, 32.0, 21.2, 21.1. **HRMS** (ESI) (m/z) calculated for $C_{20}H_{20}ClNO$ $[M+Na]^+$: 348.1126, found: 348.1125.



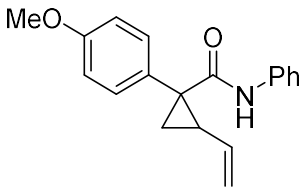
*N-Butyl-1-(4-chlorophenyl)-2-vinylcyclopropane-1-carboxamide (**1m**)*. yellow solid. Mp = 32–34 ºC. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.36–7.31 (m, 4H), 6.01–5.91 (m, 1H), 5.28 (dd, J = 17.2, 1.6 Hz, 1H), 5.24 (s, 1H), 5.09 (dd, J = 10.4, 1.6 Hz, 1H), 3.20–3.11 (m, 2H), 2.18–2.12 (m, 1H), 1.98 (dd, J = 6.8, 4.4 Hz, 1H), 1.37–1.32 (m, 2H), 1.28 (q, J = 4.4 Hz, 1H), 1.20 (dd, J = 15.2, 7.2 Hz, 2H), 0.85 (t, J = 7.2 Hz, 3H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 170.2, 139.6, 135.9, 133.9, 131.7, 129.4, 116.0, 40.0, 37.5, 31.8, 21.0, 20.1, 13.8. **HRMS** (ESI) (m/z) calculated for $C_{16}H_{20}ClNO$ $[M+Na]^+$: 300.1126, found: 300.1125.



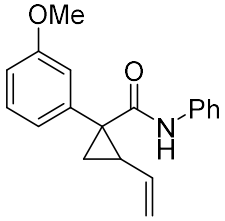
*1-(4-Chlorophenyl)-N-cyclohexyl-2-vinylcyclopropane-1-carboxamide (**1n**)*. white solid. Mp = 74 – 76 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.31–7.27 (m, 4H), 5.93–5.87 (m, 1H), 5.25 (dd, J = 17.4, 1.8 Hz, 1H), 5.11 (d, J = 7.8 Hz, 1H), 5.05 (dd, J = 10.2, 1.2 Hz, 1H), 3.71–3.64 (m, 1H), 2.13–2.09 (m, 1H), 1.92 (dd, J = 7.2, 4.8 Hz, 1H), 1.77–1.71 (m, 2H), 1.56–1.48 (m, 3H), 1.31–1.22 (m, 3H), 1.08–1.01 (m, 1H), 0.98–0.87 (m, 2H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 169.2, 139.5, 135.8, 133.7, 131.3, 129.2, 115.9, 48.7, 37.4, 33.1, 32.8, 31.5, 25.5, 24.72, 24.70, 20.8. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{22}ClNO$ $[M+Na]^+$: 326.1282, found: 326.1283.



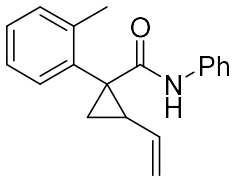
*1-(4-Chlorophenyl)-N-tosyl-2-vinylcyclopropane-1-carboxamide (**1o**)*. white solid. Mp = 147–149 ºC. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.84 (d, J = 8.4 Hz, 2H), 7.36 (d, J = 8.4 Hz, 2H), 7.31 (d, J = 8.4 Hz, 2H), 7.27–7.25 (m, 2H), 5.60–5.51 (m, 1H), 5.25 (dd, J = 17.2, 1.2 Hz, 1H), 5.00 (dd, J = 10.4, 1.2 Hz, 1H), 2.45 (s, 3H), 2.26 (dd, J = 16.4, 8.8 Hz, 1H), 1.91 (dd, J = 7.2, 4.8 Hz, 1H), 1.32 (dd, J = 8.8, 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 168.0, 145.2, 136.6, 135.5, 135.1, 133.5, 131.5, 130.0, 129.6, 128.6, 117.9, 37.8, 33.6, 21.9, 21.8. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{18}ClNO_3S$ $[M+Na]^+$: 398.0588, found: 398.0585.



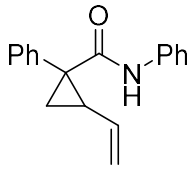
*1-(4-Methoxyphenyl)-N-phenyl-2-vinylcyclopropane-1-carboxamide (**1p**).* white solid. Mp = 90–92 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.42–7.39 (m, 2H), 7.34–7.32 (m, 2H), 7.26–7.22 (m, 2H), 7.10 (s, 1H), 7.06–7.02 (m, 1H), 6.97–6.93 (m, 2H), 6.11–6.02 (m, 1H), 5.33 (dd, J = 17.2, 1.6 Hz, 1H), 5.11 (dd, J = 10.0, 1.6 Hz, 1H), 3.85 (s, 3H), 2.31–2.25 (m, 1H), 2.06 (dd, J = 6.8, 4.0 Hz, 1H), 1.40 (q, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 169.6, 159.6, 138.1, 135.9, 132.3, 131.7, 129.0, 124.2, 119.7, 116.2, 114.9, 55.5, 38.1, 32.9, 21.6. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{19}NO_2$ $[M+Na]^+$: 316.1308, found: 316.1307.



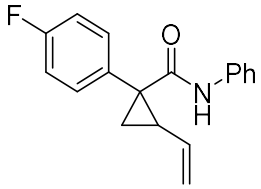
*1-(3-Methoxyphenyl)-N-phenyl-2-vinylcyclopropane-1-carboxamide (**1q**).* white solid. Mp = 86–98 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.36–7.33 (m, 3H), 7.25 (t, J = 7.8 Hz, 2H), 7.15 (s, 1H), 7.08 (d, J = 7.8 Hz, 1H), 7.04 (t, J = 7.8 Hz, 1H), 7.00 (t, J = 1.8 Hz, 1H), 6.91 (dd, J = 8.4, 2.4 Hz, 1H), 6.06–6.00 (m, 1H), 5.34 (dd, J = 17.4, 1.8 Hz, 1H), 5.11 (dd, J = 10.2, 1.2 Hz, 1H), 3.84 (s, 3H), 2.32 (dd, J = 16.2, 9.0 Hz, 1H), 2.07 (dd, J = 7.2, 4.8 Hz, 1H), 1.44 (q, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 168.9, 160.3, 141.9, 138.0, 135.7, 130.6, 129.0, 124.3, 122.6, 119.8, 116.4, 116.1, 113.8, 55.5, 39.0, 32.6, 21.3. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{19}NO_2$ $[M+Na]^+$: 316.1308, found: 316.1308.



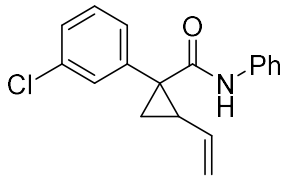
*N-phenyl-1-(o-tolyl)-2-vinylcyclopropane-1-carboxamide (**1r**).* white solid. Mp = 92–94 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.44–7.43 (m, 1H), 7.38–7.28 (m, 5H), 7.24 (t, J = 7.8 Hz, 2H), 7.05 (d, J = 7.8 Hz, 1H), 7.03 (d, J = 4.8 Hz, 1H), 6.16–6.09 (m, 1H), 5.36 (d, J = 17.4 Hz, 1H), 5.14 (d, J = 10.2 Hz, 1H), 2.39 (s, 3H), 2.34–2.29 (m, 1H), 2.18 (dd, J = 6.6, 4.2 Hz, 1H), 1.38 (q, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 169.1, 139.6, 138.3, 138.0, 135.8, 131.3, 130.7, 129.0, 128.7, 127.0, 124.4, 120.0, 116.5, 37.6, 33.8, 22.0, 19.7. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{19}NO$ $[M+Na]^+$: 300.1359, found: 300.1359.



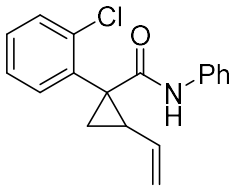
*N,1-Diphenyl-2-vinylcyclopropane-1-carboxamide (**1s**).* white solid. Mp = 77–78 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.50–7.48 (m, 2H), 7.45–7.41 (m, 2H), 7.39–7.37 (m, 1H), 7.33–7.30 (m, 2H), 7.25–7.22 (m, 2H), 7.06–7.02 (m, 2H), 6.09–6.00 (m, 1H), 5.34 (dd, J = 17.2, 1.6 Hz, 1H), 5.12 (dd, J = 10.4, 2.0 Hz, 1H), 2.36–2.29 (m, 1H), 2.09 (dd, J = 7.2, 4.4 Hz, 1H), 1.44 (q, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 169.1, 140.4, 138.0, 135.8, 130.5, 129.6, 129.0, 128.5, 124.3, 119.8, 116.4, 38.9, 32.6, 21.4. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{17}NO$ $[M+Na]^+$: 286.1202, found: 286.1201.



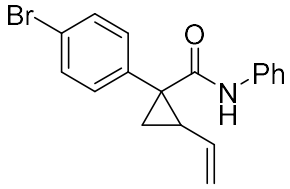
*1-(4-Fluorophenyl)-N-phenyl-2-vinylcyclopropane-1-carboxamide (**1t**).* white solid. Mp = 71–73 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.52–7.48 (m, 2H), 7.36–7.34 (m, 2H), 7.30–7.28 (m, 2H), 7.18–7.13 (m, 2H), 7.11–7.07 (m, 1H), 7.02 (s, 1H), 6.10–6.01 (m, 1H), 5.37 (dd, J = 16.8, 1.2 Hz, 1H), 5.16 (dd, J = 10.4, 1.6 Hz, 1H), 2.35–2.29 (m, 1H), 2.11 (dd, J = 7.2, 4.8 Hz, 1H), 1.43 (q, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 168.9, 162.6 (d, $J_{C\text{-}F}$ = 249.5 Hz), 137.9, 136.2 (d, $J_{C\text{-}F}$ = 3.0 Hz), 135.5, 132.2 (d, $J_{C\text{-}F}$ = 8.1 Hz), 129.0, 124.5, 119.8, 116.5 (d, $J_{C\text{-}F}$ = 22.2 Hz), 38.1, 32.8, 21.5. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -112.8. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{16}FNO$ $[M+Na]^+$: 304.1108, found: 304.1107.



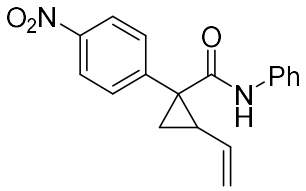
*1-(3-Chlorophenyl)-N-phenyl-2-vinylcyclopropane-1-carboxamide (**1u**).* white solid. Mp = 84–86 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.42 (d, J = 0.8 Hz, 1H), 7.35–7.29 (m, 5H), 7.19 (t, J = 8.4 Hz, 2H), 7.04–6.99 (m, 2H), 5.99–5.90 (m, 1H), 5.32 (d, J = 17.2 Hz, 1H), 5.09 (dd, J = 10.4, 0.8 Hz, 1H), 2.29–2.23 (m, 1H), 2.03 (dd, J = 7.2, 4.8 Hz, 1H), 1.35 (q, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 168.0, 142.2, 137.7, 135.1, 135.0, 130.6, 130.1, 128.8, 128.5, 128.3, 124.4, 119.9, 116.7, 38.4, 32.1, 21.2. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{16}ClNO$ $[M+Na]^+$: 320.0813, found: 320.0811.



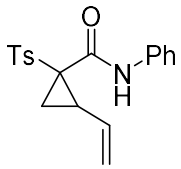
*1-(2-Chlorophenyl)-N-phenyl-2-vinylcyclopropane-1-carboxamide (**1v**).* white solid. Mp = 95–97 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.54–7.53 (m, 1H), 7.49–7.48 (m, 1H), 7.37–7.32 (m, 4H), 7.26–7.23 (m, 2H), 7.06–7.04 (m, 2H), 6.07–6.00 (m, 1H), 5.38 (dd, J = 17.4, 1.8 Hz, 1H), 5.15 (dd, J = 10.2, 1.2 Hz, 1H), 2.31 (dd, J = 16.8, 9.0 Hz, 1H), 2.22 (dd, J = 7.2, 4.8 Hz, 1H), 1.43 (q, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 167.8, 137.97, 137.95, 136.8, 135.3, 132.7, 130.7, 129.9, 129.0, 127.8, 124.5, 120.2, 117.0, 37. 7, 33.7, 22.1. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{16}ClNO$ $[M+Na]^+$: 320.0813, found: 320.0812.



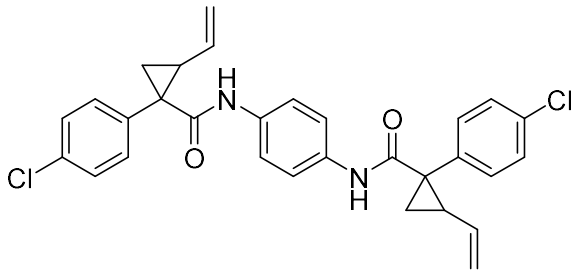
*1-(4-Bromophenyl)-N-phenyl-2-vinylcyclopropane-1-carboxamide (**1w**).* white solid. Mp = 90–92 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.59 (d, J = 8.4 Hz, 2H), 7.38 (dd, J = 14.0, 8.4 Hz, 4H), 7.29 (d, J = 7.2 Hz, 2H), 7.09 (t, J = 7.2 Hz, 1H), 7.00 (s, 1H), 6.07–5.98 (m, 1H), 5.36 (dd, J = 16.8, 0.8 Hz, 1H), 5.15 (dd, J = 10.4, 1.2 Hz, 1H), 2.31 (dd, J = 16.4, 8.8 Hz, 1H), 2.11 (dd, J = 6.8, 4.8 Hz, 1H), 1.42 (q, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 168.4, 139.4, 137.8, 135.3, 132.7, 132.1, 129.0, 124.5, 122.5, 119.9, 116.8, 38.3, 32.5, 21.4. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{16}BrNO$ $[M+Na]^+$: 364.0307, found: 364.0306.



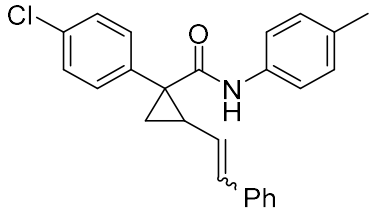
*1-(4-Nitrophenyl)-N-phenyl-2-vinylcyclopropane-1-carboxamide (**1x**).* white solid. Mp = 115–117 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.32 (dd, J = 6.8, 2.0 Hz, 2H), 7.62 (dd, J = 6.8, 2.0 Hz, 2H), 7.31–7.24 (m, 4H), 7.08 (t, J = 7.2 Hz, 1H), 6.77 (s, 1H), 5.27 (dd, J = 16.8, 0.8 Hz, 1H), 5.02 (dd, J = 10.4, 1.6 Hz, 1H), 4.89–4.80 (m, 1H), 2.83–2.77 (m, 1H), 2.10 (q, J = 4.4 Hz, 1H), 1.38 (dd, J = 6.4, 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 169.5, 148.0, 143.6, 137.5, 136.1, 133.2, 129.1, 124.9, 124.5, 120.0, 117.7, 37.3, 31.4, 22.5. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{16}N_2O_3$ $[M+Na]^+$: 331.1053, found: 331.1050.



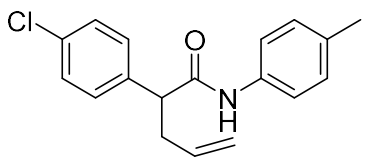
*N-Phenyl-1-tosyl-2-vinylcyclopropane-1-carboxamide (**1y**).* white solid. Mp = 140–142 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 9.26 (s, 1H), 7.71 (d, J = 8.4 Hz, 2H), 7.50 (dd, J = 8.4, 0.6 Hz, 2H), 7.35–7.33 (m, 2H), 7.31 (d, J = 8.4 Hz, 2H), 7.15 (t, J = 9.0 Hz, 1H), 5.47–5.45 (m, 2H), 5.23–5.21 (m, 1H), 3.13–3.09 (m, 1H), 2.41 (s, 3H), 2.03 (dd, J = 7.2, 5.4 Hz, 1H), 1.82 (dd, J = 9.6, 5.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 145.7, 131.6, 130.4, 129.3, 128.0, 125.1, 120.7, 120.2, 52.6, 30.1, 21.8, 17.9. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{19}NO_3S$ $[M+Na]^+$: 364.0978, found: 364.0977.



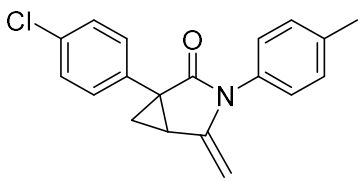
*N,N'-(1,4-Phenylene)bis((4-chlorophenyl)-2-vinylcyclopropane-1-carboxamide) (**1z**).* white solid. Mp = 190–192 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.42–7.38 (m, 8H), 7.22 (d, J = 0.8 Hz, 4H), 6.91 (s, 2H), 6.01–5.92 (m, 2H), 5.32 (dd, J = 16.0, 1.6 Hz, 2H), 5.11 (dd, J = 10.0, 1.6 Hz, 2H), 2.29–2.23 (m, 2H), 2.05 (dd, J = 6.8, 4.4 Hz, 2H), 1.37 (q, J = 4.4 Hz, 2H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 168.4, 138.8, 135.3, 134.4, 134.3, 131.8, 129.8, 120.3, 116.8, 38.2, 32.6, 21.5. **HRMS** (ESI) (m/z) calculated for $C_{30}H_{26}Cl_2N_2O_2$ $[M+Na]^+$: 539.1264, found: 539.1249.



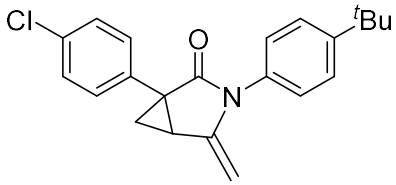
*1-(4-Chlorophenyl)-2-styryl-N-(p-tolyl)cyclopropane-1-carboxamide (**1aa**).* white solid. Mp = 156–158 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.47 (d, J = 7.8 Hz, 2H), 7.42 (d, J = 7.8 Hz, 2H), 7.37 (d, J = 7.8 Hz, 2H), 7.28 (t, J = 7.2 Hz, 2H), 7.20 (d, J = 8.4 Hz, 3H), 7.05 (d, J = 7.8 Hz, 2H), 6.94 (s, 1H), 6.68 (d, J = 16.2 Hz, 1H), 6.49 (dd, J = 15.6, 9.0 Hz, 1H), 2.42 (q, J = 8.4 Hz, 1H), 2.27 (s, 3H), 2.20–2.18 (m, 1H), 1.50 (q, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 168.5, 139.0, 137.3, 135.2, 134.4, 134.2, 131.9, 131.8, 129.8, 129.5, 128.6, 127.4, 127.3, 126.2, 120.1, 38.5, 32.8, 22.1, 21.0. **HRMS** (ESI) (m/z) calculated for $C_{25}H_{22}ClNO$ $[M+Na]^+$: 410.1282, found: 410.1284.



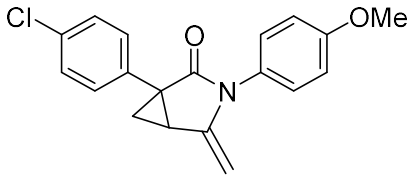
*2-(4-Chlorophenyl)-N-(p-tolyl)pent-4-enamide (**1ab**).* white solid. Mp = 89–91 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.34–7.30 (m, 6H), 7.09 (d, J = 8.4 Hz, 2H), 7.00 (s, 1H), 5.75–5.71 (m, 1H), 5.08 (d, J = 16.8 Hz, 1H), 5.01 (d, J = 10.2 Hz, 1H), 3.50 (t, J = 7.8 Hz, 1H), 2.98–2.93 (m, 1H), 2.57–2.52 (m, 1H), 2.29 (s, 3H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 170.5, 137.7, 135.4, 135.1, 134.3, 133.6, 129.60, 129.56, 129.3, 120.0, 117.6, 53.7, 37.8, 21.0. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{18}ClNO$ $[M+Na]^+$: 322.0969, found: 322.0969.



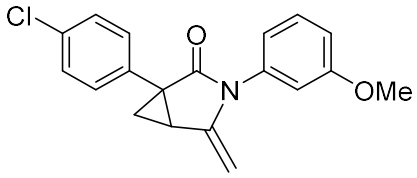
*1-(4-Chlorophenyl)-4-methylene-3-(p-tolyl)-3-azabicyclo[3.1.0]hexan-2-one (**2a**).* white solid (Yield: 60%). Mp = 156–158 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.45–7.42 (m, 2H), 7.35–7.31 (m, 2H), 7.25 (d, J = 7.6 Hz, 2H), 7.12–7.09 (m, 2H), 4.39 (d, J = 1.2 Hz, 1H), 4.17 (d, J = 0.8 Hz, 1H), 2.83 (q, J = 4.0 Hz, 1H), 2.38 (s, 3H), 1.67 (dd, J = 8.0, 4.8 Hz, 1H), 1.55 (t, J = 4.0 Hz, 1H). **^{13}C NMR** (101 MHz, $CDCl_3$) δ 173.4, 146.9, 138.2, 133.6, 133.5, 132.1, 130.13, 130.12, 128.8, 127.6, 86.9, 33.9, 25.9, 23.8, 21.3. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{16}ClNO$ $[M+H]^+$: 310.0993, found: 310.0989.



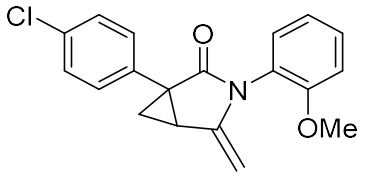
*3-(4-(Tert-butyl)phenyl)-1-(4-chlorophenyl)-4-methylene-3-azabicyclo[3.1.0]hexan-2-one (**2b**).* white solid (Yield: 46%). Mp = 165–167 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.45 (t, J = 7.8 Hz, 4H), 7.33 (d, J = 8.4 Hz, 2H), 7.15 (d, J = 8.4 Hz, 2H), 4.40 (s, 1H), 4.21 (s, 1H), 2.83 (q, J = 3.6 Hz, 1H), 1.68 (dd, J = 7.8, 4.8 Hz, 1H), 1.55 (d, J = 4.2 Hz, 1H), 1.34 (s, 9H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.4, 151.1, 146.8, 133.7, 133.5, 132.0, 130.1, 128.8, 127.2, 126.4, 87.1, 34.8, 33.8, 31.5, 25.9, 23.8. **HRMS** (ESI) (m/z) calculated for $C_{22}H_{22}ClNO$ $[M+H]^+$: 352.1463, found: 352.1458.



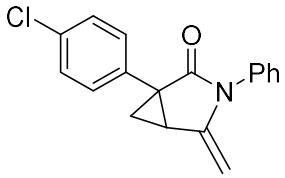
*1-(4-Chlorophenyl)-3-(4-methoxyphenyl)-4-methylene-3-azabicyclo[3.1.0]hexan-2-one (**2c**).* white solid (Yield: 59%). Mp = 53–54 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.44 (d, J = 8.4 Hz, 2H), 7.33 (d, J = 9.0 Hz, 2H), 7.13 (d, J = 9.0 Hz, 2H), 6.96 (d, J = 9.0 Hz, 2H), 4.38 (d, J = 0.6 Hz, 1H), 4.15 (s, 1H), 3.82 (s, 3H), 2.83 (dd, J = 7.8, 3.6 Hz, 1H), 1.67 (dd, J = 7.8, 4.8 Hz, 1H), 1.54 (t, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.6, 159.3, 147.1, 133.6, 133.5, 130.1, 129.0, 128.8, 127.3, 114.8, 86.9, 55.6, 33.8, 25.8, 23.8. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{16}ClNO_2$ $[M+H]^+$: 326.0942, found: 326.0943.



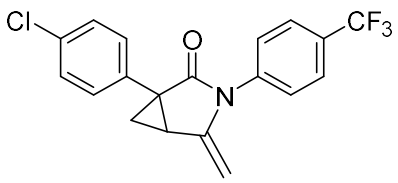
1-(4-Chlorophenyl)-3-(3-methoxyphenyl)-4-methylene-3-azabicyclo[3.1.0]hexan-2-one ***(2d)****.* white solid (Yield: 48%). Mp = 60–64 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.44 (d, J = 8.4 Hz, 2H), 7.36–7.33 (m, 3H), 6.91 (dd, J = 8.4, 1.8 Hz, 1H), 6.81 (d, J = 7.8 Hz, 1H), 6.77 (s, 1H), 4.41 (s, 1H), 4.23 (s, 1H), 3.81 (s, 3H), 2.84 (dd, J = 7.8, 4.2 Hz, 1H), 1.67 (dd, J = 7.8, 4.8 Hz, 1H), 1.55 (t, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.3, 160.5, 146.6, 135.9, 133.6, 133.5, 130.2,130.1, 128.8, 120.0, 114.3, 113.4, 87.3, 55.6, 33.9, 25.8, 23.7. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{16}ClNO_2$ $[M+H]^+$: 326.0942, found: 326.0931.



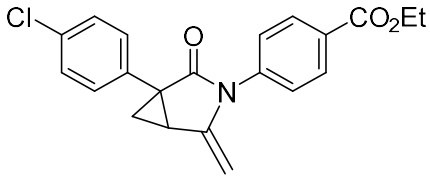
1-(4-Chlorophenyl)-3-(2-methoxyphenyl)-4-methylene-3-azabicyclo[3.1.0]hexan-2-one ***(2e)****.* white solid (Yield: 34%). Mp = 145–147 ºC. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.45 (d, J = 8.4 Hz, 2H, major), 7.43 (d, J = 8.4 Hz, 0.8H, minor), 7.39–7.35 (m, 1.4H), 7.34 –7.32 (m, 2.7H), 7.23 (d, J = 7.8 Hz, 1H), 7.04 (d, J = 7.8 Hz, 1H), 7.02–7.00 (m, 1H), 6.98 (d, J = 7.8 Hz, 1H), 4.33 (s, 1H, major), 4.31 (s, 0.4H, minor), 3.97 (s, 1H, major), 3.91 (s, 0.4H, minor), 3.83 (s, 1H, major), 3.79 (s, 3H, major), 2.83 (dd, J = 7.8, 3.6 Hz, 1H, major), 1.73 (dd, J = 7.8, 4.8 Hz, 0.4H, minor), 1.71 (t, J = 4.2 Hz, 1H, major), 1.63 (dd, J = 7.8, 4.2 Hz, 1H, major), 1.60 (t, J = 4.2 Hz, 0.4H, minor), 0.88–0.85 (m, 0.4H, mionr). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 173.6 (major), 173.5 (minor), 156.5 (major), 155.1 (minor), 146.7 (minor), 146.6 (major), 133.9 (major), 133.4 (minor), 131.0 (major), 130.4 (minor), 130.3 (major), 130.1 (minor), 130.0 (major), 129.4 (minor), 128.8 (minor), 128.7 (major), 123.2 (minor), 121.14 (minor), 121.06 (major), 112.7 (minor), 112.3 (major), 86.1 (minor), 86.0 (major), 56.2 (minor), 55.9 (major), 34.3 (minor), 33.7 (major), 26.8 (minor), 26.3 (major), 23.75 (minor), 23.73 (major). **HRMS** (ESI) (m/z) calculated for $C_{19}H_{16}ClNO_2$ $[M+H]^+$: 326.0942, found: 326.0960.



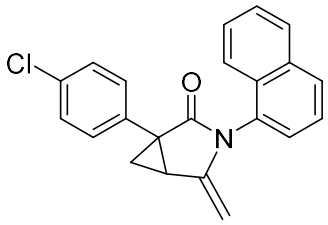
1-(4-Chlorophenyl)-4-methylene-3-phenyl-3-azabicyclo[3.1.0]hexan-2-one ***(2f)****.* white solid (Yield: 66%). Mp = 114–116 ºC. **^{1}H NMR** (600 MHz, DMSO) δ 7.52–7.49 (m, 4H), 7.44–7.40 (m, 3H), 7.28 (d, J = 7.2 Hz, 2H), 4.41 (s, 1H), 3.96 (s, 1H), 3.13 (dd, J = 7.8, 3.6 Hz, 1H), 1.83 (dd, J = 7.8, 4.2 Hz, 1H), 1.67 (t, J = 3.6 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, DMSO) δ 172.8, 146.9, 134.7, 134.2, 131.9, 130.4, 129.3, 128.3, 128.2, 128.1, 86.1, 33.2, 25.7, 22.7. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{14}ClNO$ $[M+H]^+$: 296.0837, found: 296.0846.



*1-(4-Chlorophenyl)-4-methylene-3-(4-(trifluoromethyl)phenyl)-3-azabicyclo[3.1.0]hexan-2-one (**2g**).* white solid (Yield: 49%). Mp = 72–74 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.73 (d, J = 8.0 Hz, 2H), 7.46–7.41 (m, 4H), 7.37–7.33 (m, 2H), 4.49 (d, J = 1.6 Hz, 1H), 4.27 (d, J = 1.6 Hz, 1H), 2.89 (q, J = 4.0 Hz, 1H), 1.71 (dd, J = 8.0, 4.8 Hz, 1H), 1.58 (t, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 173.2, 145.9, 138.1, 133.8, 133.1, 130.2, 130.1 (q, $J_{C\text{-}F}$ = 32 Hz), 129.8, 128.9, 128.6, 128.0, 127.1, 126.6 (q, $J_{C\text{-}F}$ = 40 Hz), 123.9 (q, $J_{C\text{-}F}$ = 270 Hz), 87.7, 34.1, 25.8, 23.5. **^{19}F NMR** (376 MHz, $CDCl_3$) δ -62.57 (s). **HRMS** (ESI) (m/z) calculated for $C_{19}H_{13}ClF_3NO$ $[M+H]^+$: 364.0711, found: 364.0705.

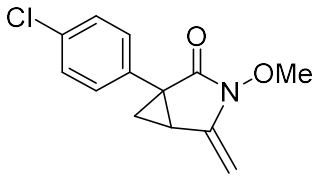


*Ethyl-4-(1-(4-chlorophenyl)-4-methylene-2-oxo-3-azabicyclo[3.1.0]hexan-3-yl)benzoate (**2h**).* white solid (Yield: 48%). Mp = 53–55 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.13 (d, J = 8.4 Hz, 2H), 7.43 (d, J = 8.4 Hz, 2H), 7.34 (t, J = 9.6 Hz, 4H), 4.46 (d, J = 1.2 Hz, 1H), 4.39 (q, J = 7.2 Hz, 2H), 4.26 (d, J = 1.2 Hz, 1H), 2.86 (dd, J = 7.8, 3.6 Hz, 1H), 1.69 (dd, J = 7.8, 4.8 Hz, 1H), 1.56 (t, J = 4.2 Hz, 1H), 1.39 (t, J = 7.2 Hz, 3H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.0, 165.9, 146.0, 138.9, 133.7, 133.2, 130.7, 130.2, 129.9, 128.8, 127.4, 87.6, 61.3, 34.1, 25.8, 23.5, 14.4. **HRMS** (ESI) (m/z) calculated for $C_{21}H_{18}ClNO_3$ $[M+H]^+$: 368.1048, found: 368.1044.

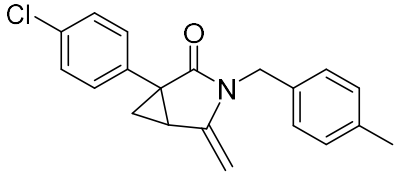


*1-(4-Chlorophenyl)-4-methylene-3-(naphthalen-1-yl)-3-azabicyclo[3.1.0]hexan-2-one (**2i**).* white solid (Yield: 74%). Mp = 172–174 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.83–7.81 (m, 4H), 7.60–7.58 (m, 1H), 7.48 (d, J = 7.2 Hz, 1H), 7.45–7.43 (m, 3H), 7.42–7.40 (m, 6H), 7.36 (dd, J = 7.2, 0.8 Hz, 1H), 7.30–7.25 (m, 4H), 7.16–7.14 (m, 1H), 4.31 (d, J = 1.2 Hz, 1H), 4.27 (d, J = 1.2 Hz, 1H), 3.79 (d, J = 1.2 Hz, 1H), 3.72 (d, J = 0.8 Hz, 1H), 2.90–2.85 (m, 2H), 1.82 (t, J = 4.4 Hz, 1H), 1.70 (dd, J = 8.0, 4.8 Hz, 2H), 1.63 (t, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.8, 173.7, 147.2, 146.5, 134.7, 133.7, 133.6, 131.6, 130.7, 130.6, 130.2, 130.1, 129.8, 129.6, 129.4, 128.9, 128.84,

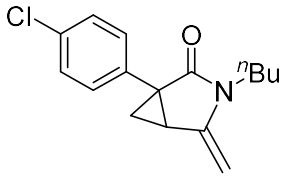
128.79, 128.6, 128.2, 127.2, 127.0, 126.7, 126.5, 126.1, 125.82, 125.76, 123.0, 122.1, 87.9, 87.6, 34.23, 34.19, 26.5, 26.4, 24.2, 24.0. **HRMS** (ESI) (m/z) calculated for $C_{22}H_{16}ClNO$ $[M+H]^+$: 346.0993, found: 346.0994.



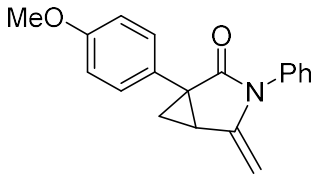
*1-(4-Chlorophenyl)-3-methoxy-4-methylene-3-azabicyclo[3.1.0]hexan-2-one (**2k**).* white solid (Yield: 47%). Mp = 127–129 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.35–7.29 (m, 4H), 4.58 (s, 1H), 4.45 (s, 1H), 3.84 (s, 3H), 2.61 (dd, J = 7.6, 4.0 Hz, 1H), 1.61 (dd, J = 7.6, 4.8 Hz, 1H), 1.38 (t, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 168.0, 140.2, 133.8, 132.9, 130.0, 128.9, 85.2, 62.7, 30.4, 23.7, 22.2. **HRMS** (ESI) (m/z) calculated for $C_{13}H_{12}ClNO_2$ $[M+H]^+$: 250.0629, found: 250.0622.



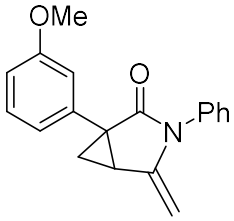
*1-(4-Chlorophenyl)-3-(4-methylbenzyl)-4-methylene-3-azabicyclo[3.1.0]hexan-2-one (**2l**).* white solid (Yield: 20%). Mp = 124–126 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.40–7.37 (m, 2H), 7.33–7.31 (m, 2H), 7.14–7.09 (m, 4H), 4.59 (dd, J = 44.0, 15.6 Hz, 2H), 4.35 (d, J = 2.0 Hz, 1H), 4.28 (d, J = 1.2 Hz, 1H), 2.69 (q, J = 3.6 Hz, 1H), 2.32 (s, 3H), 1.57 (dd, J = 8.0, 4.4 Hz, 1H), 1.35 (t, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 174.1, 144.9, 137.3, 133.7, 133.6, 133.4, 130.2, 129.5, 128.8, 127.4, 86.6, 43.5, 33.7, 25.9, 23.7, 21.2. **HRMS** (ESI) (m/z) calculated for $C_{20}H_{18}ClNO$ $[M+Na]^+$: 346.0969, found: 346.0960.



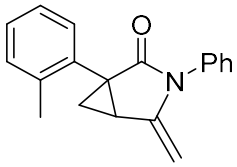
*3-Butyl-1-(4-chlorophenyl)-4-methylene-3-azabicyclo[3.1.0]hexan-2-one (**2m**).* colorless oil (Yield: 21%). **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.36–7.34 (m, 2H), 7.31–7.29 (m, 2H), 4.38 (d, J = 1.8 Hz, 1H), 4.29 (s, 1H), 3.54–3.47 (m, 1H), 3.39–3.32 (m, 1H), 2.67 (q, J = 6.0 Hz, 1H), 1.53–1.47 (m, 2H), 1.34–1.26 (m, 4H), 0.93 (t, J = 10.8 Hz, 3H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 173.9, 145.5, 133.8, 133.5, 130.1, 128.8, 85.1, 39.6, 33.7, 29.1, 25.9, 24.1, 20.2, 13.9. **HRMS** (ESI) (m/z) calculated for $C_{16}H_{18}ClNO$ $[M+Na]^+$: 298.0969, found: 298.0961.



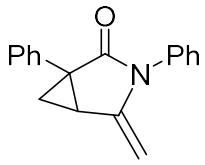
*1-(4-Methoxyphenyl)-4-methylene-3-phenyl-3-azabicyclo[3.1.0]hexan-2-one (**2p**).* white solid (Yield: 53%). Mp = 108–110 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.46–7.40 (m, 4H), 7.35 (t, J = 7.2 Hz, 1H), 7.24 (d, J = 7.6 Hz, 2H), 6.90 (d, J = 8.8 Hz, 2H), 4.38 (s, 1H), 4.17 (s, 1H), 3.81 (s, 3H), 2.80 (dd, J = 7.6, 3.6 Hz, 1H), 1.67 (dd, J = 8.0, 4.4 Hz, 1H), 1.51 (t, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 174.1, 159.2, 147.3, 135.0, 130.2, 129.4, 128.1, 127.9, 127.0, 114.1, 86.6, 55.5, 34.1, 25.6, 23.4. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{17}NO_2$ $[M+H]^+$: 292.1332, found: 292.1332.



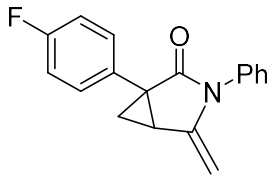
*1-(2-Methoxyphenyl)-4-methylene-3-phenyl-3-azabicyclo[3.1.0]hexan-2-one (**2q**).* white solid (Yield: 52%). Mp = 81–83 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.46–7.42 (m, 2H), 7.37–7.34 (m, 1H), 7.32–7.28 (m, 1H), 7.24–7.21 (m, 2H), 7.13–7.12 (m, 1H), 7.04–7.01 (m, 1H), 6.85–6.82 (m, 1H), 4.38 (d, J = 0.8 Hz, 1H), 4.17 (s, 1H), 3.81 (s, 3H), 2.84 (q, J = 4.0 Hz, 1H), 1.70 (dd, J = 7.6, 4.4 Hz, 1H), 1.54 (t, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 173.6, 159.8, 147.0, 136.5, 134.9, 129.6, 129.4, 128.1, 127.8, 120.7, 114.5, 113.3, 86.8, 55.4, 34.4, 26.0, 23.9. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{17}NO_2$ $[M+H]^+$: 292.1332, found: 292.1339.



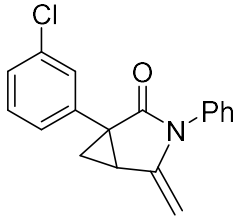
*4-Methylene-3-phenyl-1-(o-tolyl)-3-azabicyclo[3.1.0]hexan-2-one (**2r**).* white solid (Yield: 55%). Mp = 132–135 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.46 (t, J = 7.8 Hz, 2H), 7.36 (t, J = 7.2 Hz, 1H), 7.33 (d, J = 7.8 Hz, 1H), 7.26–7.24 (m, 4H), 7.22–7.19 (m, 1H), 4.43 (s, 1H), 4.21 (s, 1H), 2.68 (dd, J = 7.8, 3.6 Hz, 1H), 2.44 (s, 3H), 1.78 (q, J = 3.6 Hz, 1H), 1.59 (t, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.7, 147.4, 139.6, 135.0, 133.5, 130.8, 130.5, 129.4, 128.4, 128.1, 127.8, 126.1, 86.8, 35.0, 25.6, 22.0, 19.6. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{17}NO$ $[M+H]^+$: 276.1383, found: 276.1383.



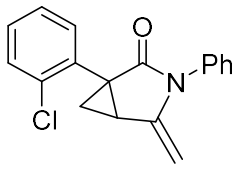
*4-Methylene-1,3-diphenyl-3-azabicyclo[3.1.0]hexan-2-one (**2s**).* white solid (Yield: 49%). Mp = 114–116 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.43–7.42 (m, 2H), 7.37 (t, J = 7.8 Hz, 2H), 7.30–7.27 (m, 3H), 7.23–7.22 (m, 1H), 7.17 (d, J = 7.8 Hz, 2H), 4.32 (d, J = 1.2 Hz, 1H), 4.10 (s, 1H), 2.77 (q, J = 4.2 Hz, 1H), 1.65 (dd, J = 7.8, 4.8 Hz, 1H), 1.47 (t, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.7, 147.1, 135.0, 129.4, 128.8, 128.6, 128.1, 127.9, 127.6, 86.7, 34.5, 25.9, 23.6. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{15}NO$ $[M+H]^+$: 262.1226, found: 262.1226.



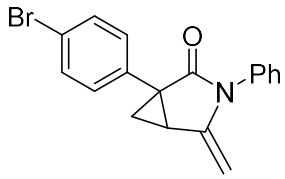
*1-(4-Fluorophenyl)-4-methylene-3-phenyl-3-azabicyclo[3.1.0]hexan-2-one (**2t**).* white solid (Yield: 57%). Mp = 120–122 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.48 (d, J = 5.4 Hz, 1H),7.47 (d, J = 3.0 Hz, 1H), 7.46–7.41 (m, 2H), 7.36 (t, J = 7.2 Hz, 1H), 7.24 (d, J = 7.8 Hz, 2H), 7.06 (t, J = 8.4 Hz, 2H), 4.41 (s, 1H), 4.19 (s, 1H), 2.84 (dd, J = 7.8, 3.6 Hz, 1H), 1.68 (dd, J = 7.8, 4.8 Hz, 1H), 1.55 (t, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.6, 162.4 (d, $J_{C\text{-}F}$ = 246.1 Hz), 146.9, 134.8, 130.7 (d, $J_{C\text{-}F}$ = 3.0 Hz), 130.6 (d, $J_{C\text{-}F}$ = 9.1 Hz) 129.5, 128.2, 127.8, 115.6 (d, $J_{C\text{-}F}$ = 21.1 Hz), 87.0, 34.0, 25.7, 23.6. **^{19}F NMR** (565 MHz, $CDCl_3$) δ -114.60. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{14}FNO$ $[M+H]^+$: 280.1132, found: 280.1139.



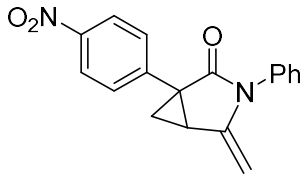
*1-(3-Chlorophenyl)-4-methylene-3-phenyl-3-azabicyclo[3.1.0]hexan-2-one (**2u**).* white solid (Yield: 51%). Mp = 116–118 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.44–7.38 (m, 3H), 7.36–7.34 (m, 1H), 7.32–7.30 (m, 1H), 7.24–7.20 (m, 2H), 7.19–7.17 (m, 2H), 4.35 (d, J = 1.2 Hz, 1H), 4.14 (d, J = 1.2 Hz, 1H), 2.81 (q, J = 4.0 Hz, 1H), 1.66 (dd, J = 8.0, 4.4 Hz, 1H), 1.52 (d, J = 4.0 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 173.1, 146.6, 137.1, 134.8, 134.5, 129.9, 129.5, 128.8, 128.3, 127.9, 127.8, 127.0, 87.3, 34.1, 26.0, 23.8. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{14}ClNO$ $[M+H]^+$: 296.0837, found: 296.0835.



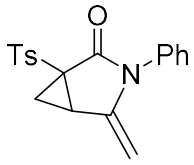
*1-(2-Chlorophenyl)-4-methylene-3-phenyl-3-azabicyclo[3.1.0]hexan-2-one (**2v**).* white solid (Yield: 53%). Mp = 162–163 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.46–7.41 (m, 4H), 7.37–7.34 (m, 1H), 7.30–7.28 (m, 2H), 7.27–7.26 (m, 1H), 7.26–7.25 (m, 1H), 4.42 (d, J = 1.2 Hz, 1H), 4.20 (s, 1H), 2.67 (q, J = 3.6 Hz, 1H), 1.83 (dd, J = 7.8, 4.8 Hz, 1H), 1.61 (t, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 173.1, 147.3, 136.9, 135.0, 133.5, 132.5, 129.7, 129.4, 128.1, 127.9, 127.1, 87.1, 35.2, 26.1, 21.2. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{14}ClNO$ $[M+H]^+$: 296.0837, found: 296.0834.



*1-(4-Bromophenyl)-4-methylene-3-phenyl-3-azabicyclo[3.1.0]hexan-2-one (**2w**).* white solid (Yield: 48%). Mp = 99–102 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.40–7.38 (m, 2H), 7.37–7.34 (m, 2H), 7.30–7.26 (m, 3H), 7.14–7.13 (m, 2H), 4.31 (d, J = 1.2 Hz, 1H), 4.10 (d, J = 1.2 Hz, 1H), 2.75 (dd, J = 7.8, 4.2 Hz, 1H), 1.58 (dd, J = 7.8, 4.8 Hz, 1H), 1.46 (t, J = 4.2 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 173.3, 146.7, 134.8, 134.1, 131.8, 130.4, 129.5, 128.2, 127.8, 121.7, 87.2, 33.9, 25.9, 23.7. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{14}BrNO$ $[M+H]^+$: 340.0332, found: 340.0323.

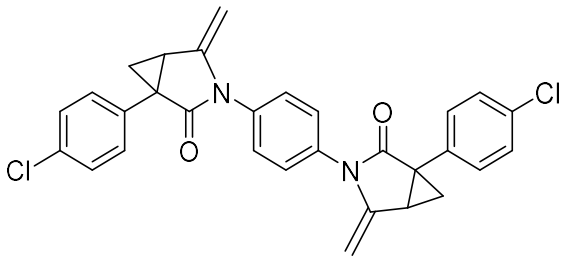


*4-Methylene-1-(4-nitrophenyl)-3-phenyl-3-azabicyclo[3.1.0]hexan-2-one (**2x**).* white solid (Yield: 58%). Mp = 193–195 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.24–8.21 (m, 2H), 7.72–7.69 (m, 2H), 7.49–7.45 (m, 2H), 7.41–7.36 (m, 1H), 7.25–7.23 (m, 2H), 4.46 (d, J = 1.2 Hz, 1H), 4.23 (d, J = 1.6 Hz, 1H), 2.99 (q, J = 4.4 Hz, 1H), 1.79 (dd, J = 8.0, 4.8 Hz, 1H), 1.70 (t, J = 4.4 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 172.4, 147.2, 146.0, 142.8, 134.5, 129.6, 129.1, 128.5, 127.8, 123.8, 87.9, 33.8, 26.9, 24.8. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{14}N_2O_3$ $[M+H]^+$: 307.1077, found: 307.1070.

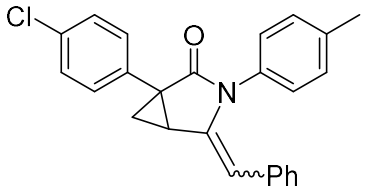


*4-Methylene-3-phenyl-1-tosyl-3-azabicyclo[3.1.0]hexan-2-one (**2y**).* white solid (Yield: 16%). Mp = 186–188 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.99 (d, J = 8.4 Hz, 2H), 7.42 (t, J = 7.8 Hz, 2H), 7.36

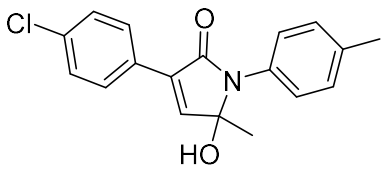
(d, J = 7.8 Hz, 3H), 7.13–7.12 (m, 2H), 4.50 (d, J = 1.8 Hz, 1H), 4.24 (d, J = 1.8 Hz, 1H), 3.49 (dd, J = 8.4, 4.8 Hz, 1H), 2.44 (s, 3H), 2.17 (dd, J = 9.0, 5.4 Hz, 1H), 1.56 (d, J = 4.8 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 166.1, 145.4, 143.2, 136.1, 133.7, 129.8, 129.6, 129.4, 128.7, 127.7, 90.1, 48.0, 26.6, 22.4, 21.9. **HRMS** (ESI) (m/z) calculated for $C_{19}H_{17}NO_3S$ $[M+H]^+$: 340.1002, found: 340.0991.



*3,3'-(1,4-Phenylene)bis(1-(4-chlorophenyl)-4-methylene-3-azabicyclo[3.1.0]hexan-2-one) (**2z**).* white solid (Yield: 24%). Mp: > 250 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.44–7.42 (m, 4H), 7.35 (d, J = 2.0 Hz, 6H), 7.33 (d, J = 2.0 Hz, 2H), 4.45 (d, J = 1.6 Hz, 2H), 4.30 (s, 2H), 2.86 (q, J = 4.0 Hz, 2H), 1.69 (dd, J = 7.6, 4.4 Hz, 2H), 1.55 (d, J = 4.0 Hz, 2H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 173.3, 146.2, 134.3, 133.7, 133.3, 130.2, 128.9, 128.6, 87.7, 34.0, 25.9, 23.6. **HRMS** (ESI) (m/z) calculated for $C_{30}H_{22}Cl_2N_2O_2$ $[M+Na]^+$: 535.0951, found: 535.0948.



*4-Benzylidene-1-(4-chlorophenyl)-3-(p-tolyl)-3-azabicyclo[3.1.0]hexan-2-one (**2aa**).* yellow solid (Yield: 25%). Mp = 198–200 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.43 (d, J = 8.4 Hz, 2H), 7.34–7.32 (m, 5H), 7.29 (d, J = 7.2 Hz, 3H), 7.21–7.16 (m, 3H), 5.71 (s, 1H), 3.15 (q, J = 4.0 Hz, 1H), 2.41 (s, 3H), 1.89 (dd, J = 7.6, 4.4 Hz, 1H), 1.70 (t, J = 4.0 Hz, 1H). **^{13}C{^{1}H} NMR** (101 MHz, $CDCl_3$) δ 173.0, 142.3, 138.5, 136.2, 133.6, 133.5, 132.1, 130.3, 130.1, 128.8, 128.6, 128.3, 128.0, 126.2, 105.2, 34.3, 24.7, 23.8, 21.4. **HRMS** (ESI) (m/z) calculated for $C_{25}H_{20}ClNO$ $[M+H]^+$: 386.1306, found: 386.1294.



*3-(4-Chlorophenyl)-5-hydroxy-5-methyl-1-(p-tolyl)-1,5-dihydro-2H-pyrrol-2-one (**2ab**).* yellow solid (Yield: 18%). Mp = 168–170 °C. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.83–8.00 (m, 2H), 7.34 (t, J = 8.8 Hz, 4H), 7.18 (d, J = 8.0 Hz, 2H), 7.06 (s, 1H), 2.90 (s, 1H), 2.38 (s, 3H), 1.51 (s, 3H). **^{13}C{^{1}H} NMR** (151 MHz, $CDCl_3$) δ 167.7, 142.5, 137.1, 135.4, 134.1, 132.7, 129.8, 128.91, 128.87, 126.6, 88.8,

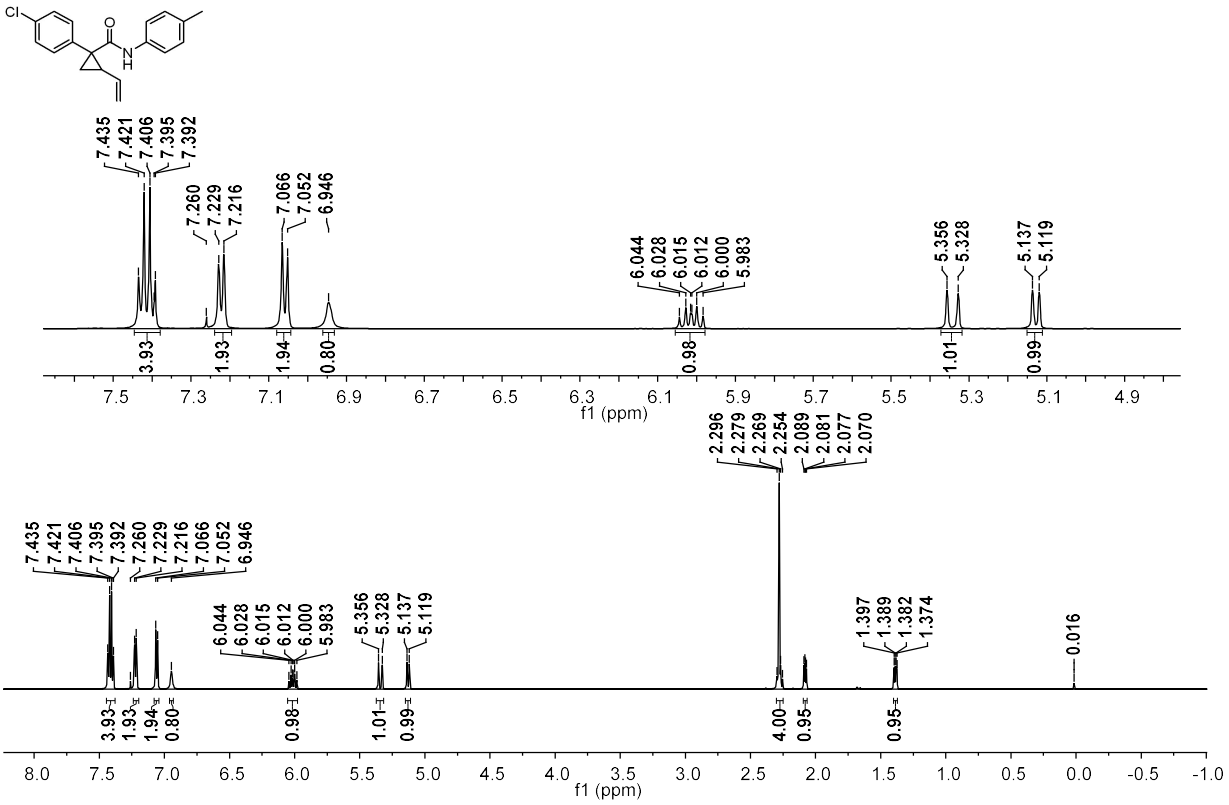
23.2, 21.3. **HRMS** (ESI) (m/z) calculated for $C_{18}H_{16}ClNO_2$ $[M+Na]^+$: 336.0762, found: 336.0762.

V. References

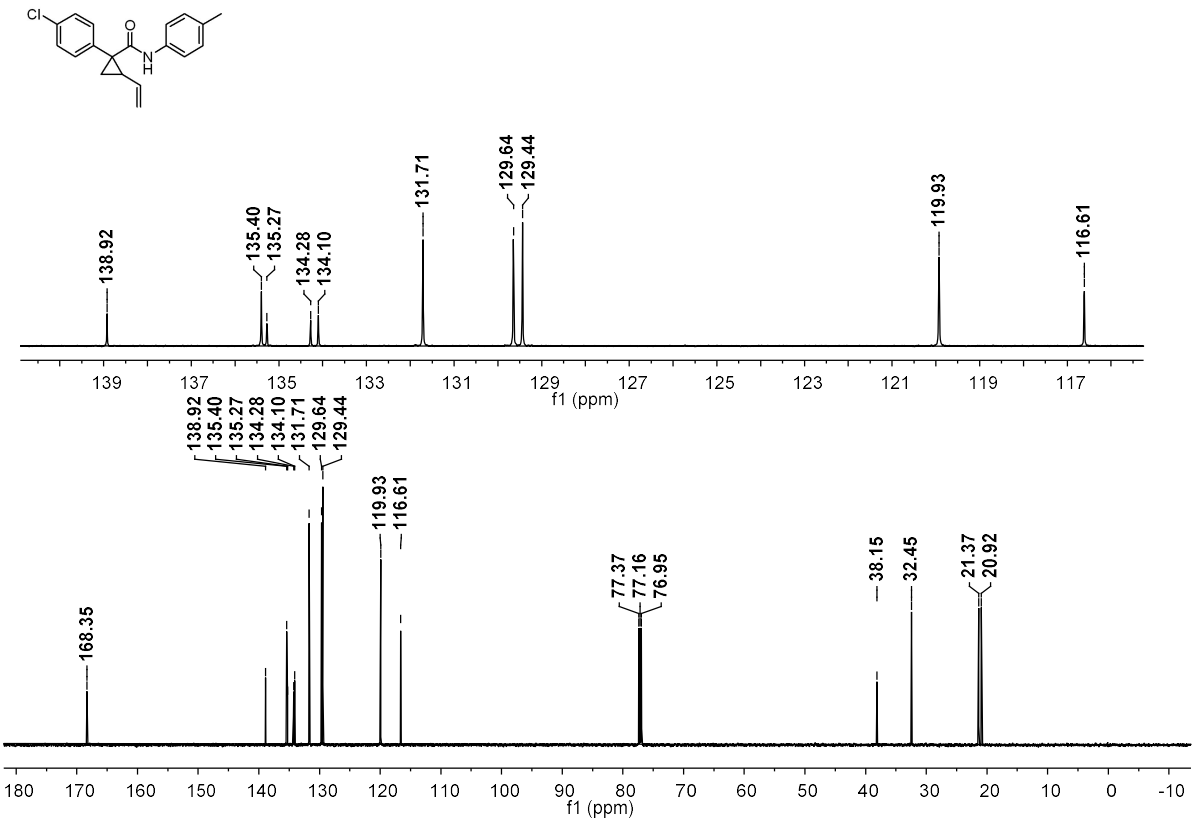
1. Matthew T. Knowe, Michael W. Danneman, Sarah Sun, Maren Pink, Jeffrey N. Johnston, Biomimetic Desymmetrization of a Carboxylic Acid, *J. Am. Chem. Soc*., 2018, **140**, 1998.
2. Zhiguo Zhang, Yongchao Zhang, Guoqing Huang, Guisheng Zhang, Organoiodine reagent-promoted intermolecular oxidative amination: synthesis of cyclopropyl spirooxindoles, *Org. Chem. Front*., 2017, **4**, 1372.
3. Senlin Wang, Xue Zhao, Daisy Zhang-Negrerie, Yunfei Du, Reductive cleavage of the N–O bond: elemental sulfur-mediated conversion of *N*-alkoxyamides to amides, *Org. Chem. Front*., 2019, **6**, 347.
4. Che-Hung Lin, Dominik Pursley, Johannes E. M. N. Klein, Johannes Teske, Jennifer A. Allen, Fabian Rami, Andreas Kohn, Bernd Plietker, Non-decarbonylative photochemical versus thermal activation of $Bu_4N[Fe(CO)_3(NO)]$-the Fe-catalyzed Cloke-Wilson rearrangement of vinyl and arylcyclopropanes, *Chem. Sci*., 2015, **6**, 7034.

VI. ^{1}H NMR and ^{13}C{^{1}H} NMR spectra

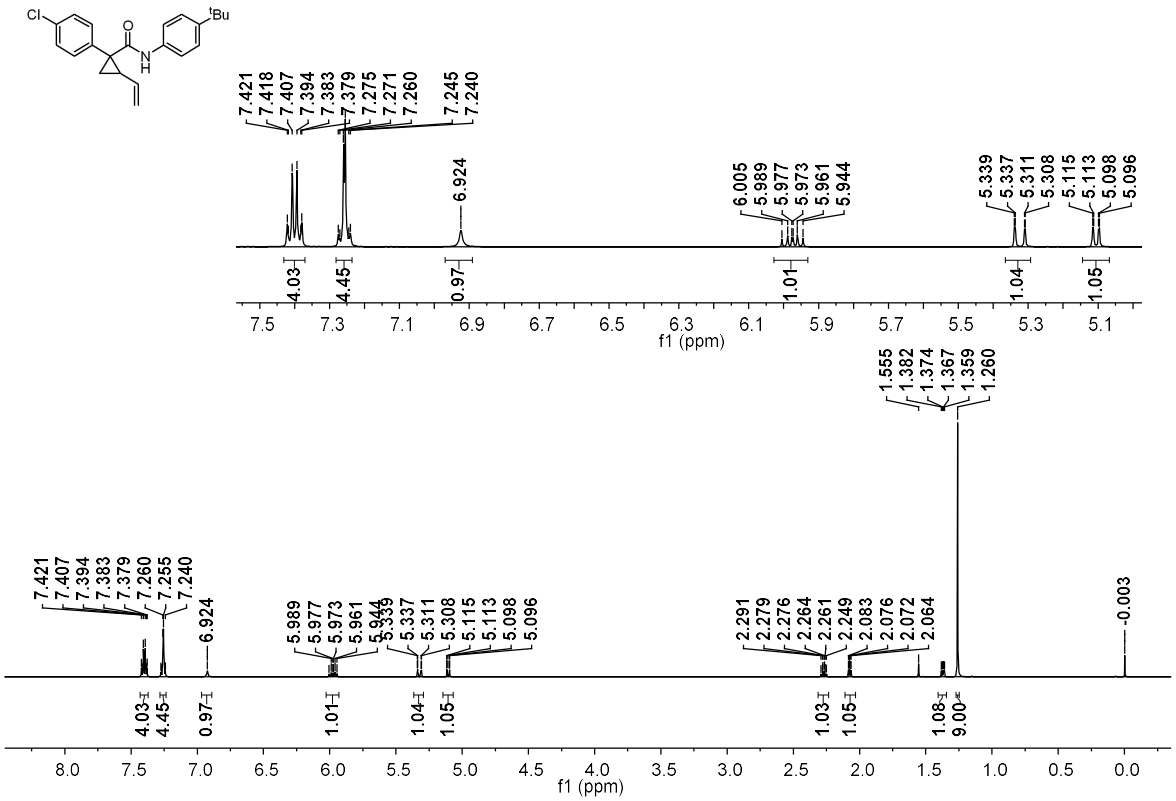
^{1}H NMR spectra of **1a** (600 MHz, $CDCl_3$)



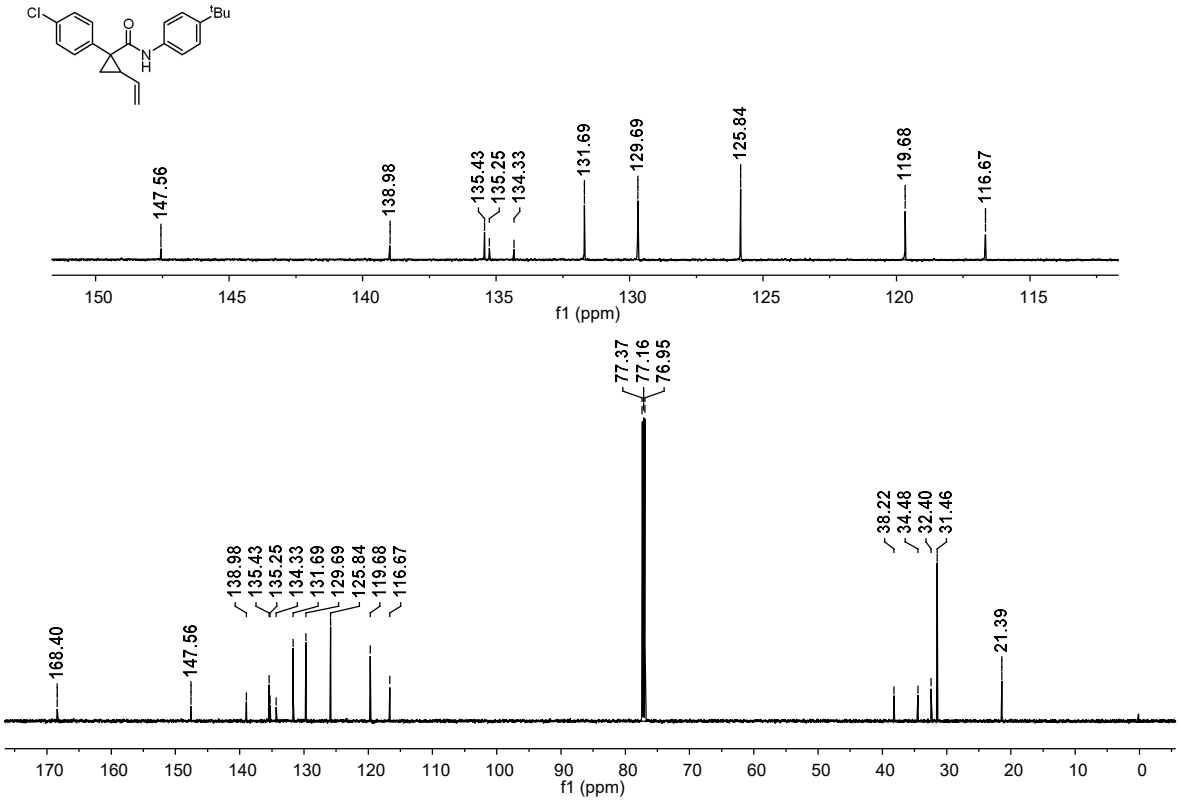
^{13}C{^{1}H} NMR spectra of **1a** (151 MHz, $CDCl_3$)



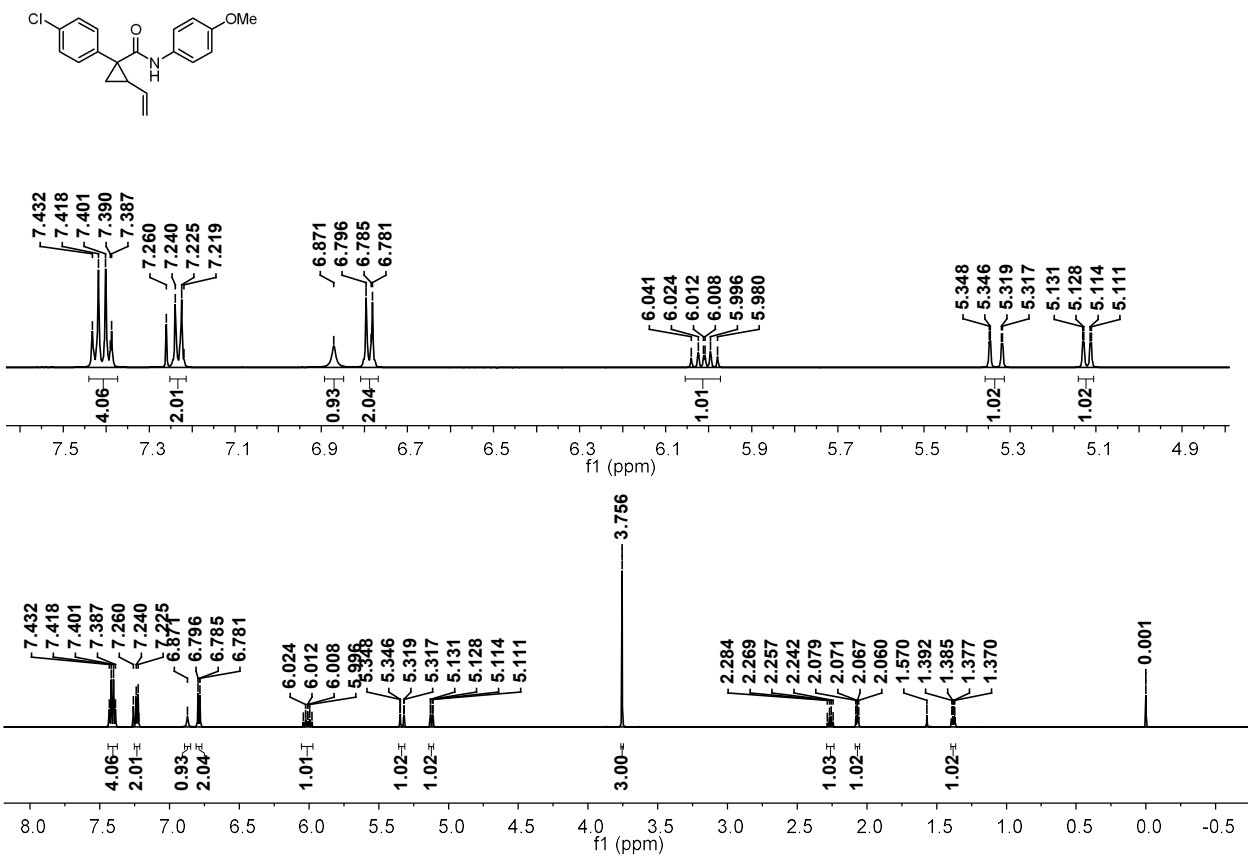
^{1}H NMR spectra of **1b** (600 MHz, $CDCl_3$)



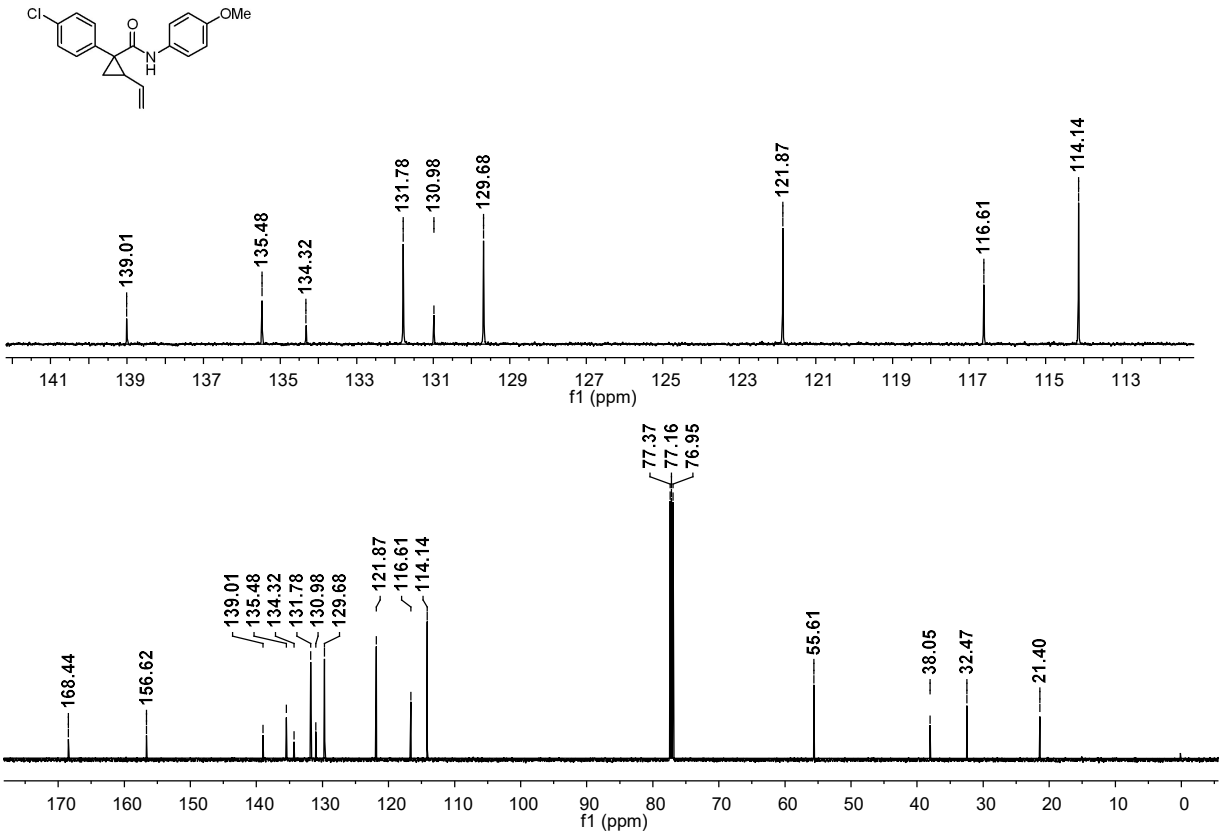
^{13}C{^{1}H} NMR spectra of **1b** (151 MHz, $CDCl_3$)



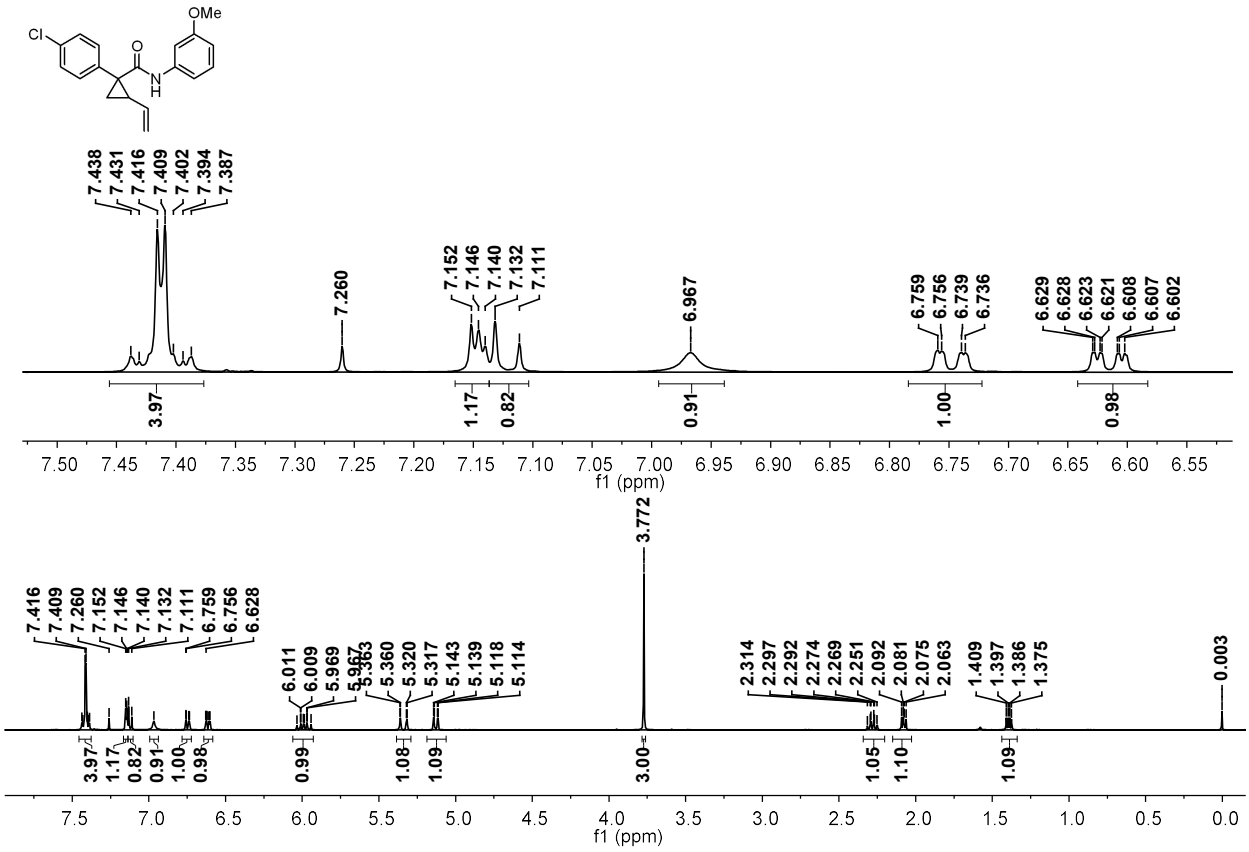
^{1}H NMR spectra of **1c** (600 MHz, $CDCl_3$)



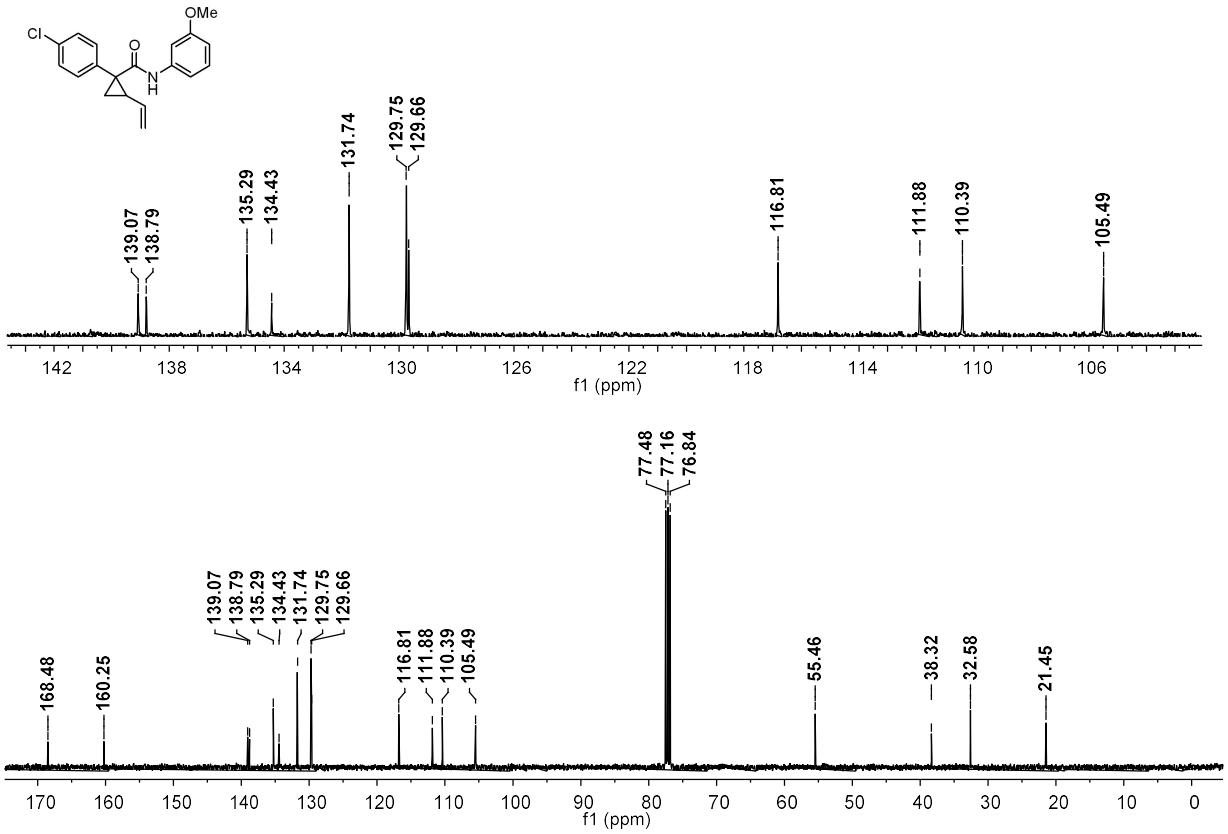
^{13}C{^{1}H} NMR spectra of **1c** (151 MHz, $CDCl_3$)



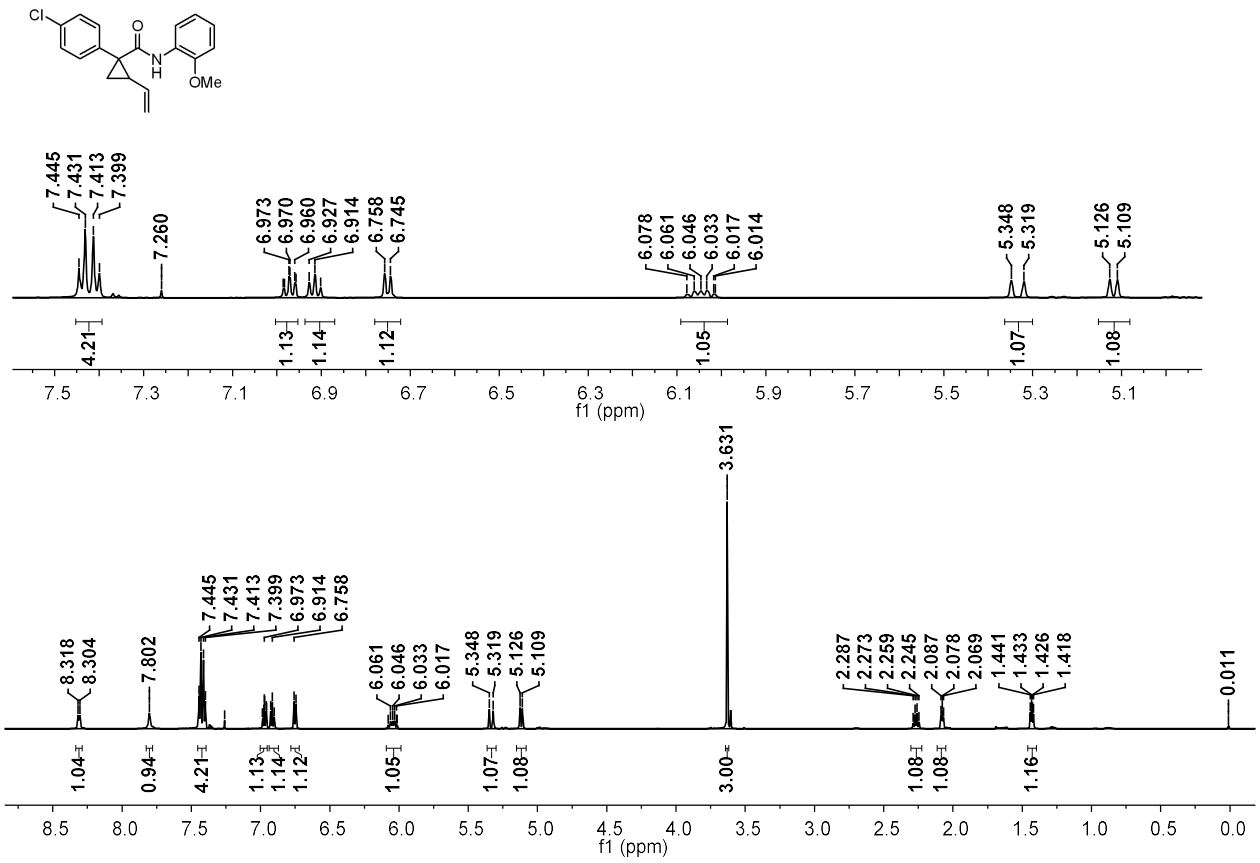
^{1}H NMR spectra of **1d** (400 MHz, $CDCl_3$)



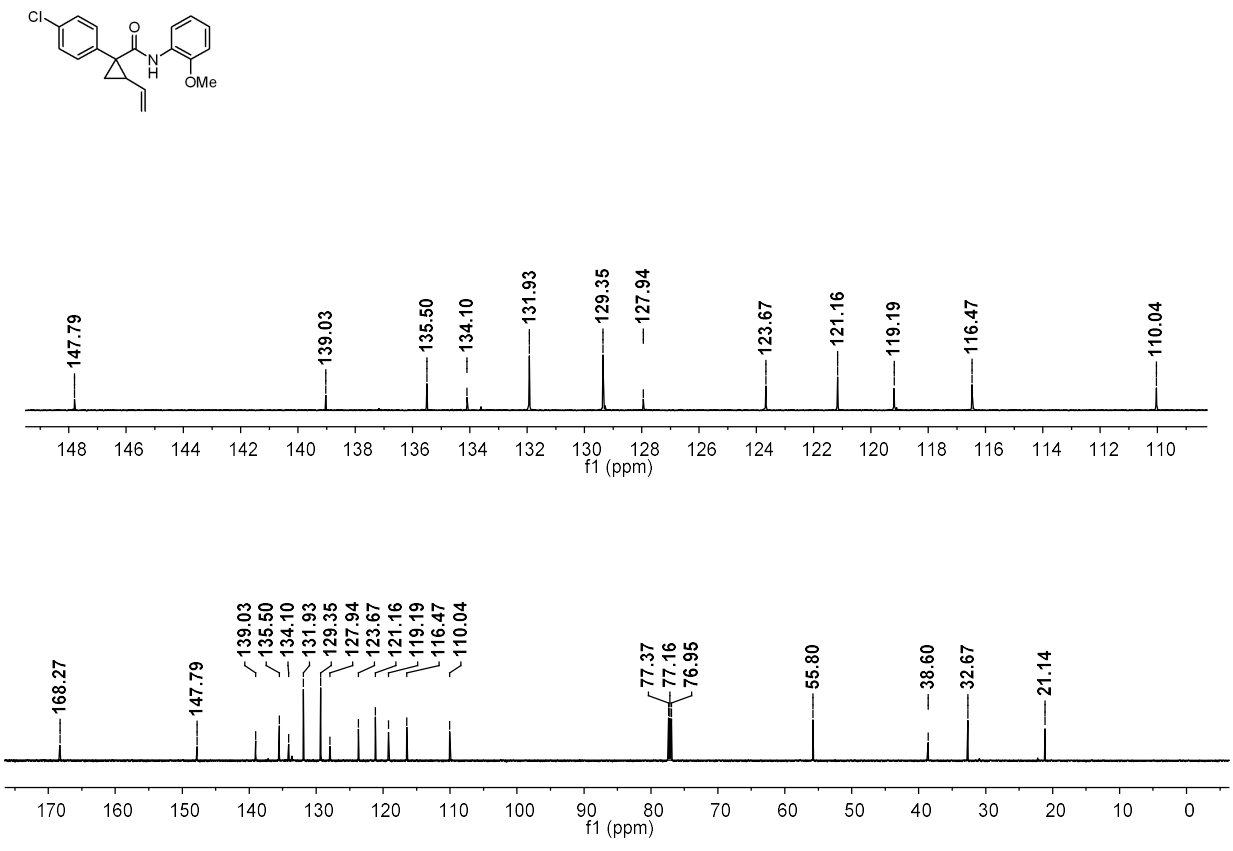
^{13}C{^{1}H} NMR spectra of **1d** (101 MHz, $CDCl_3$)



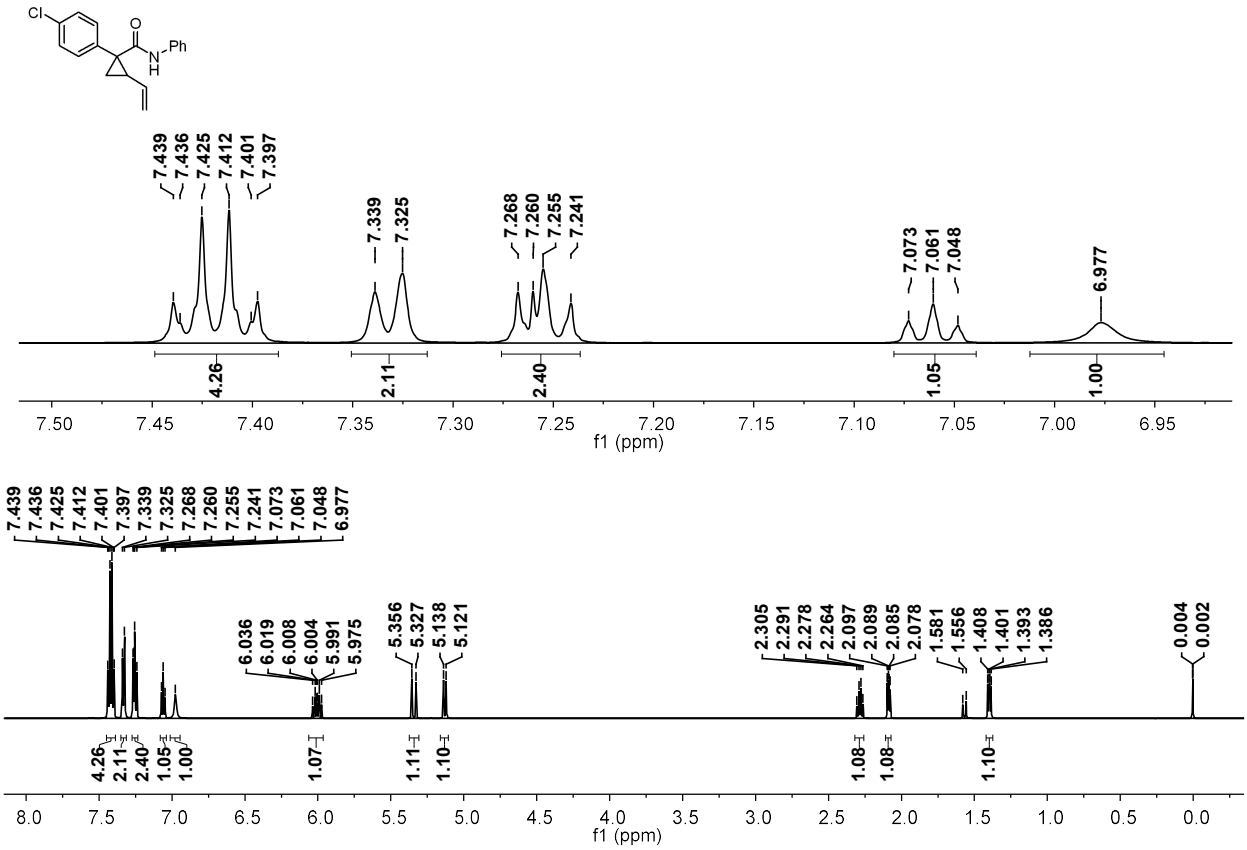
^{1}H NMR spectra of **1e** (600 MHz, $CDCl_3$)



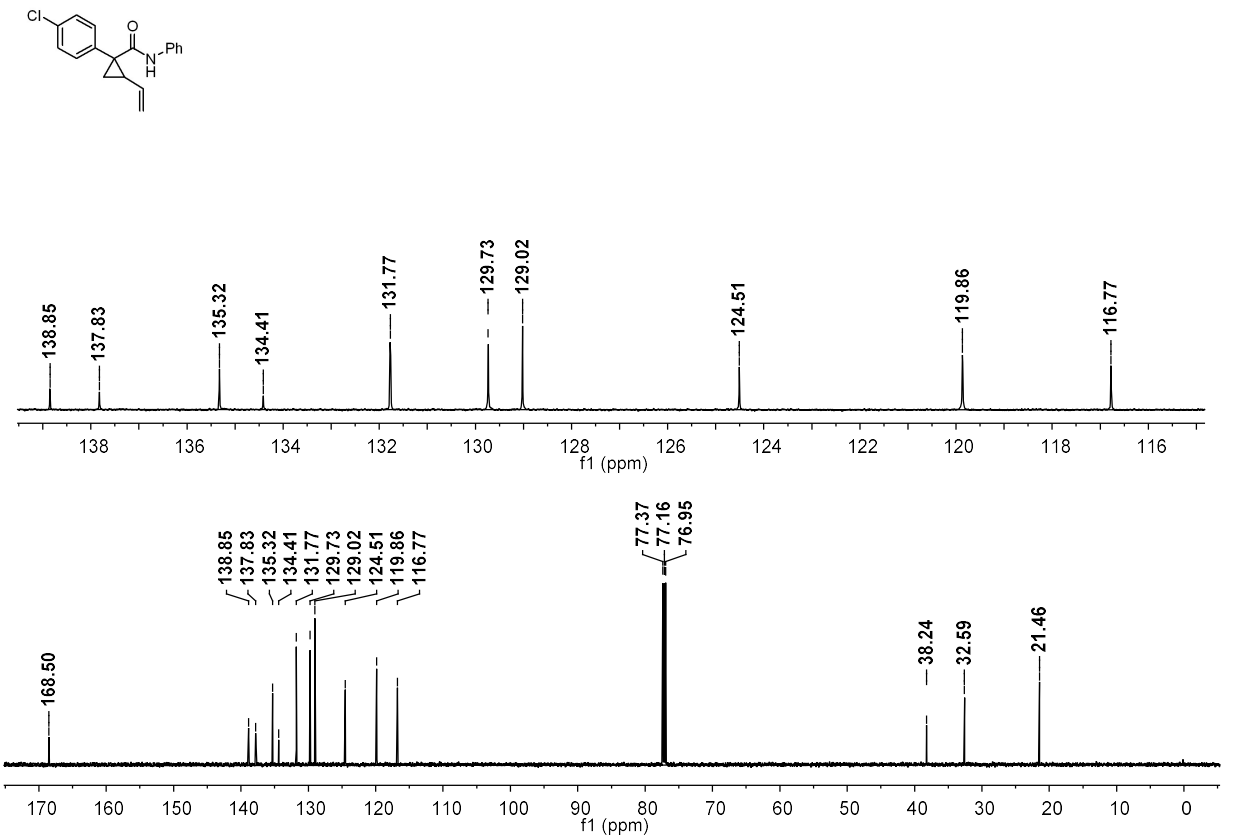
^{13}C{^{1}H} NMR spectra of **1e** (151 MHz, $CDCl_3$)



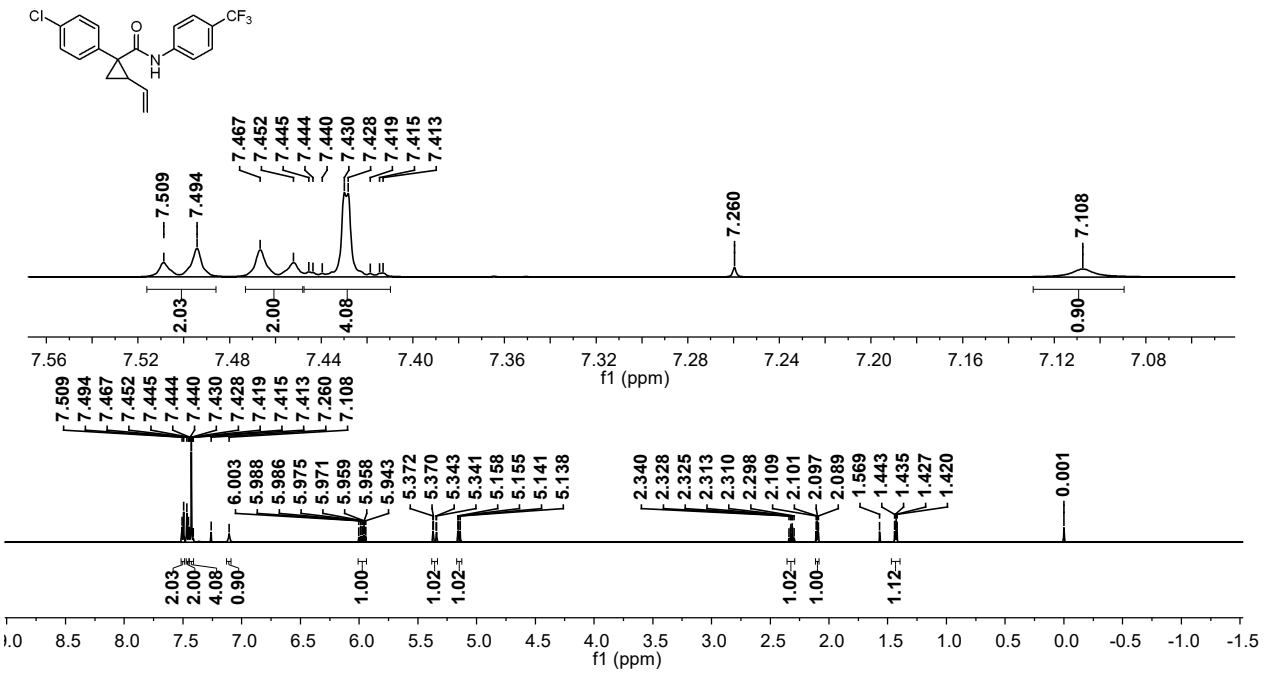
^{1}H NMR spectra of **1f** (600 MHz, $CDCl_3$)



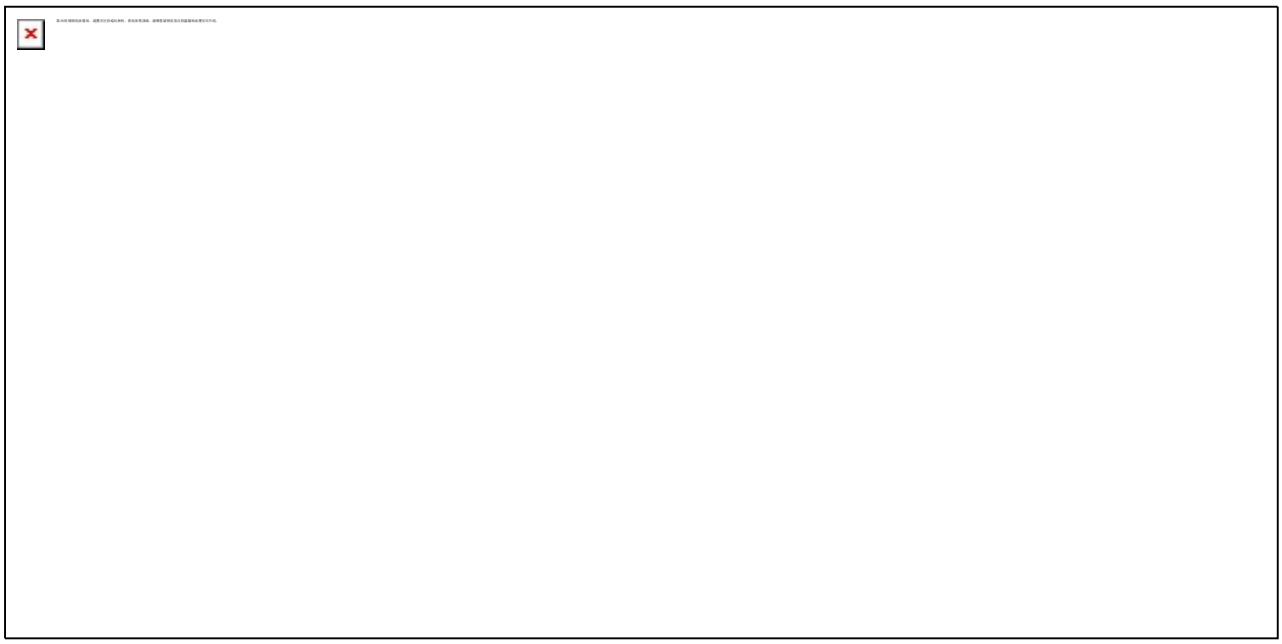
^{13}C{^{1}H} NMR spectra of **1f** (151 MHz, $CDCl_3$)



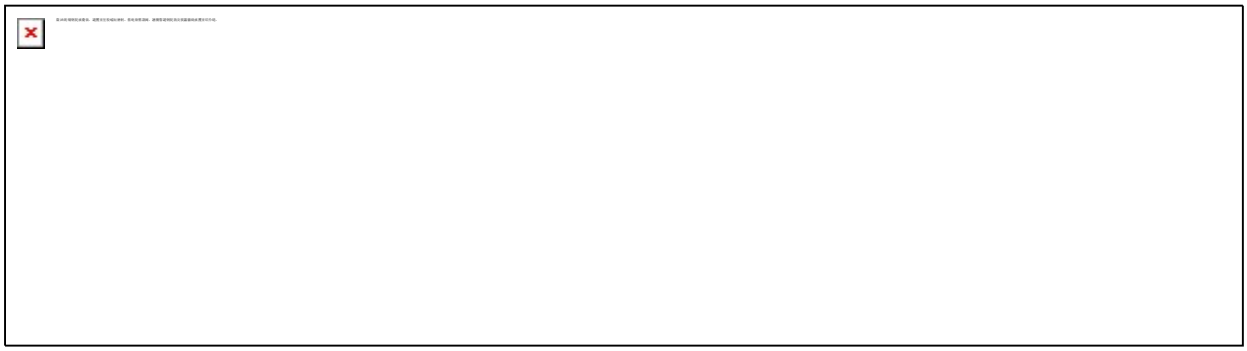
^{1}H NMR spectra of **1g** (600 MHz, $CDCl_3$)



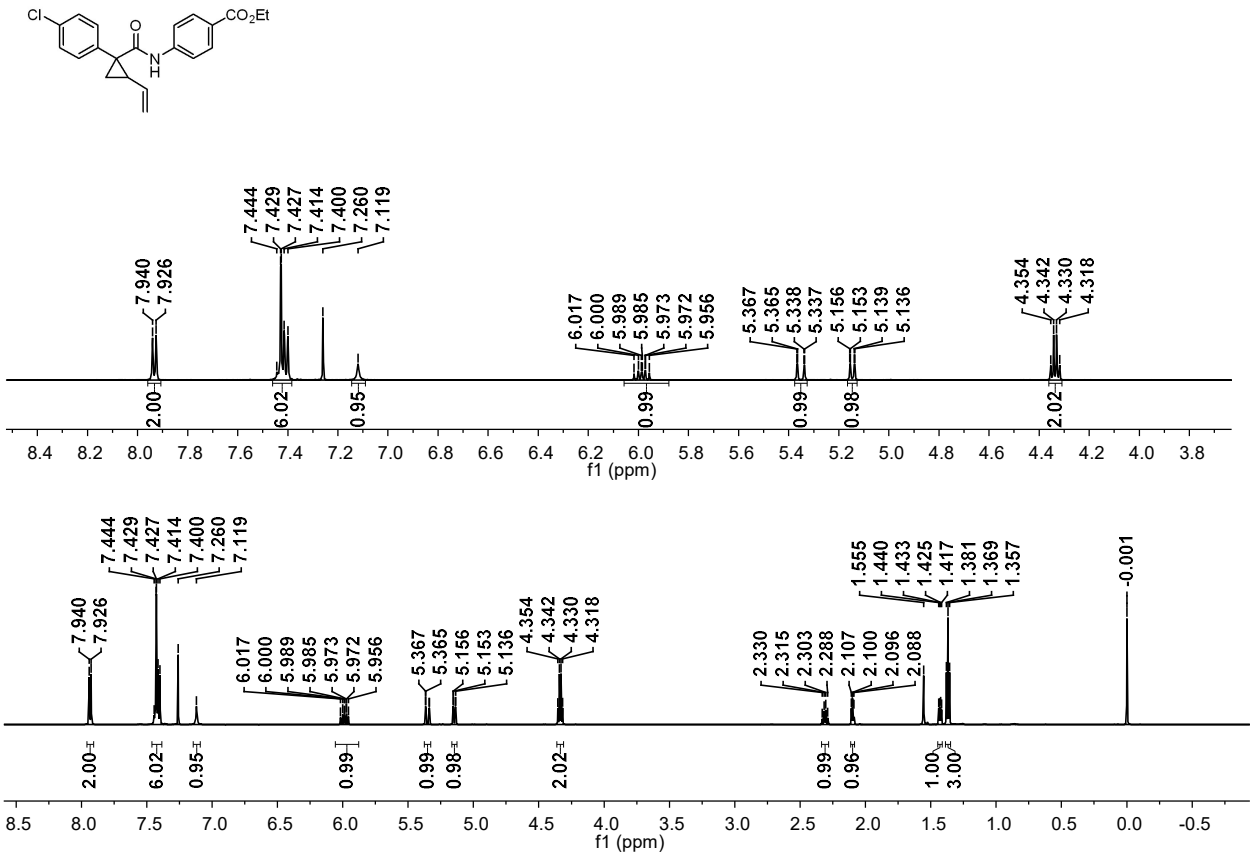
^{13}C{^{1}H} NMR spectra of **1g** (101 MHz, $CDCl_3$)



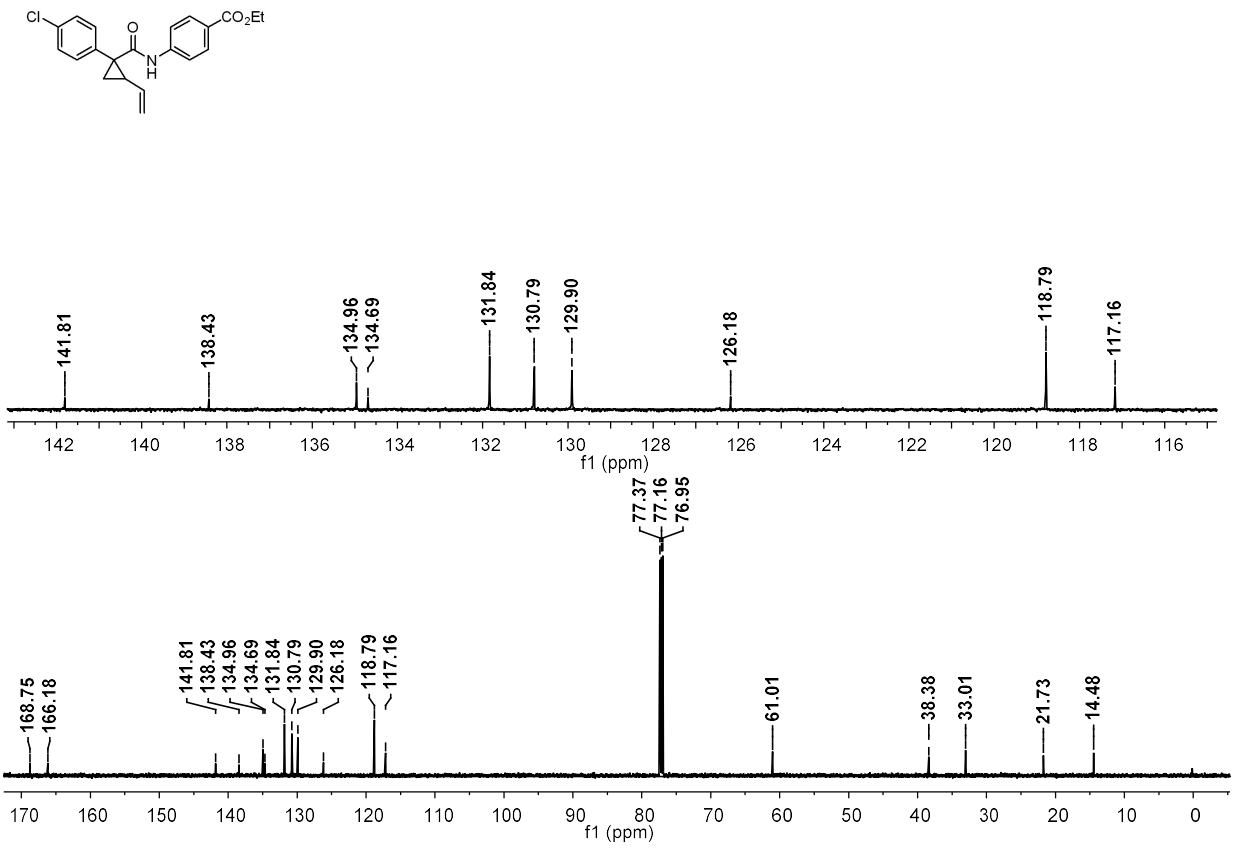
^{19}F NMR spectra of **1g** (565 MHz, $CDCl_3$)



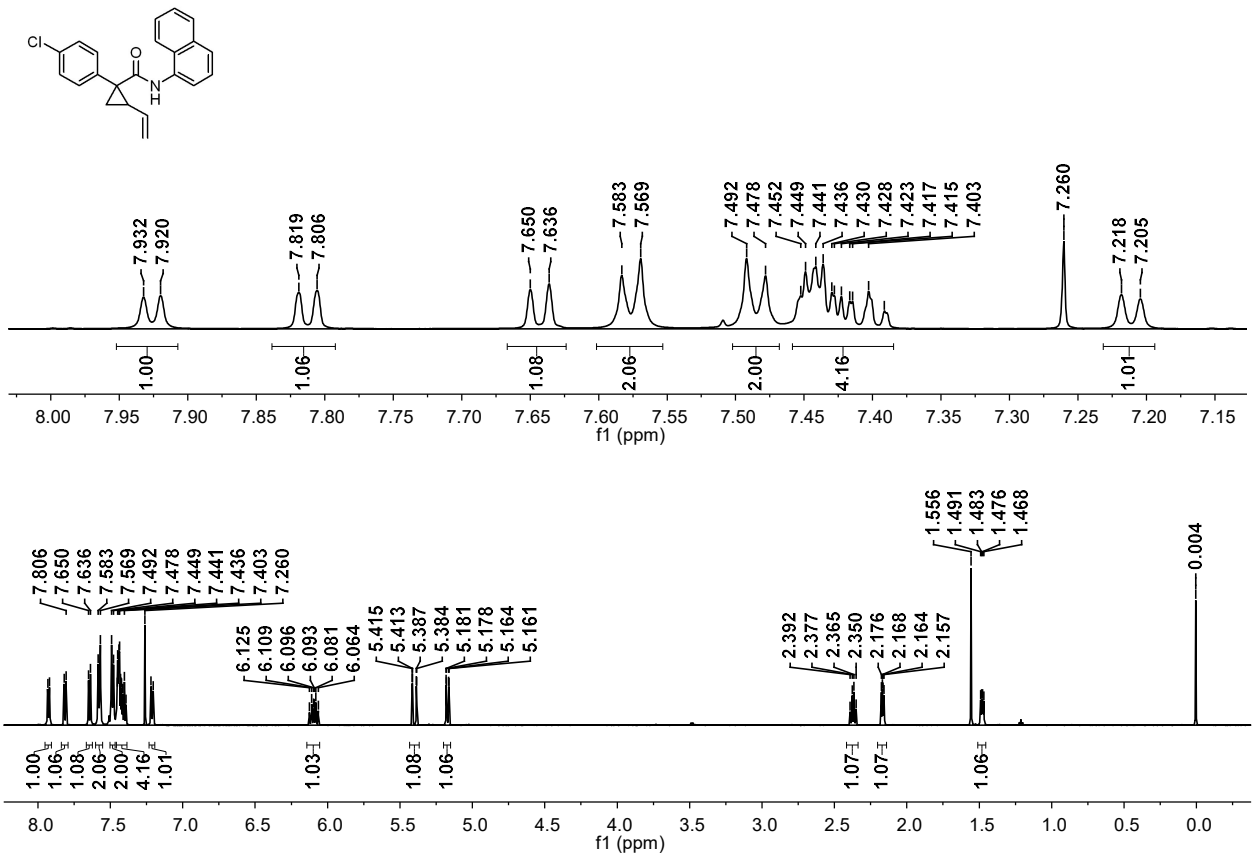
^{1}H NMR spectra of **1h** (600 MHz, $CDCl_3$)



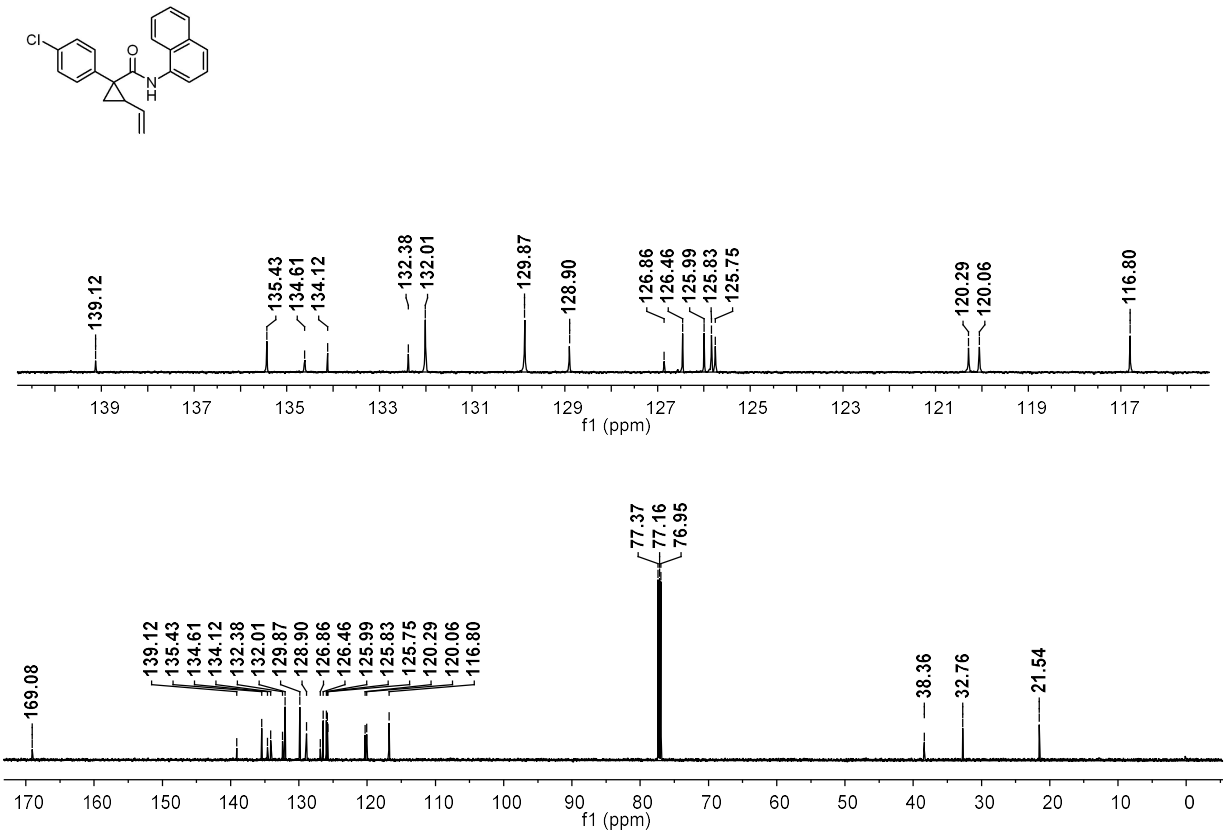
^{13}C{^{1}H} NMR spectra of **1h** (151 MHz, $CDCl_3$)



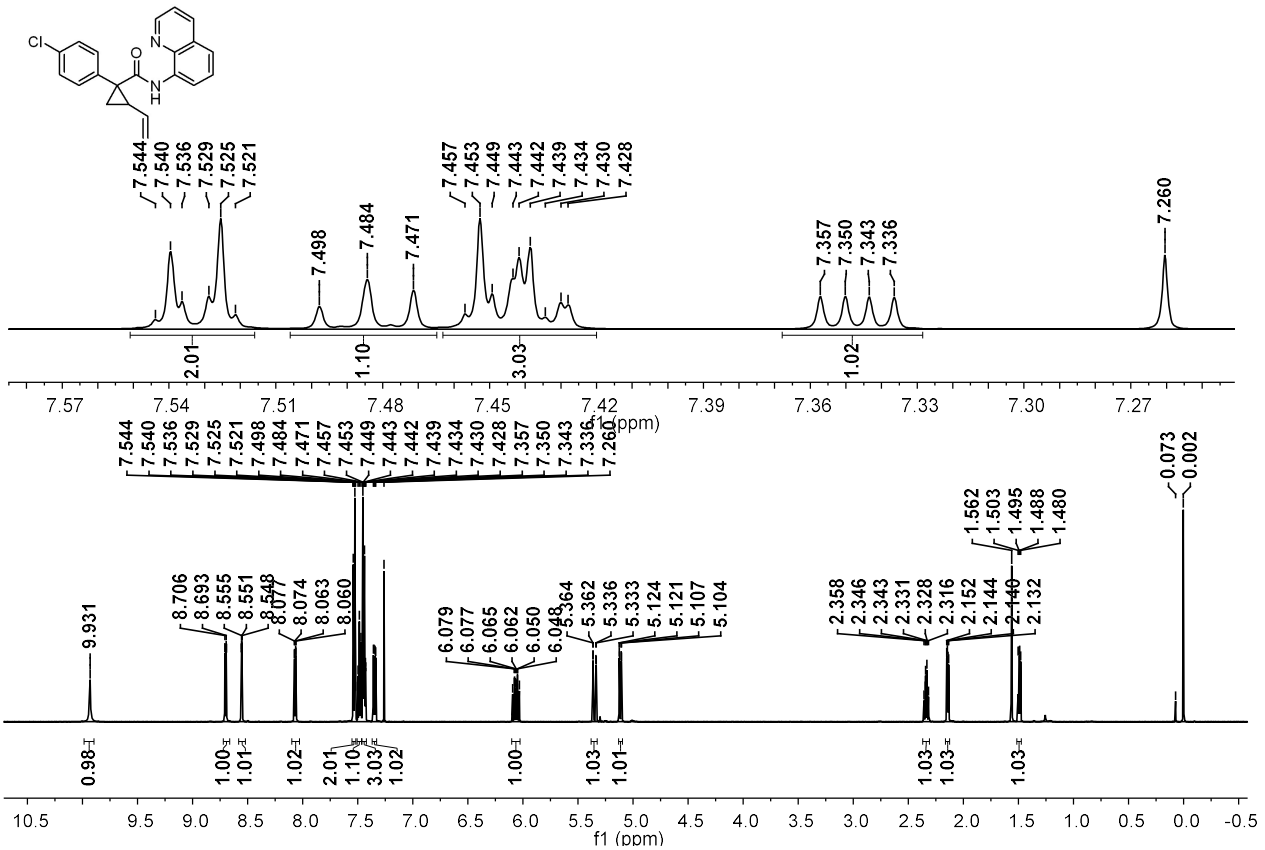
^{1}H NMR spectra of **1i** (600 MHz, $CDCl_3$)



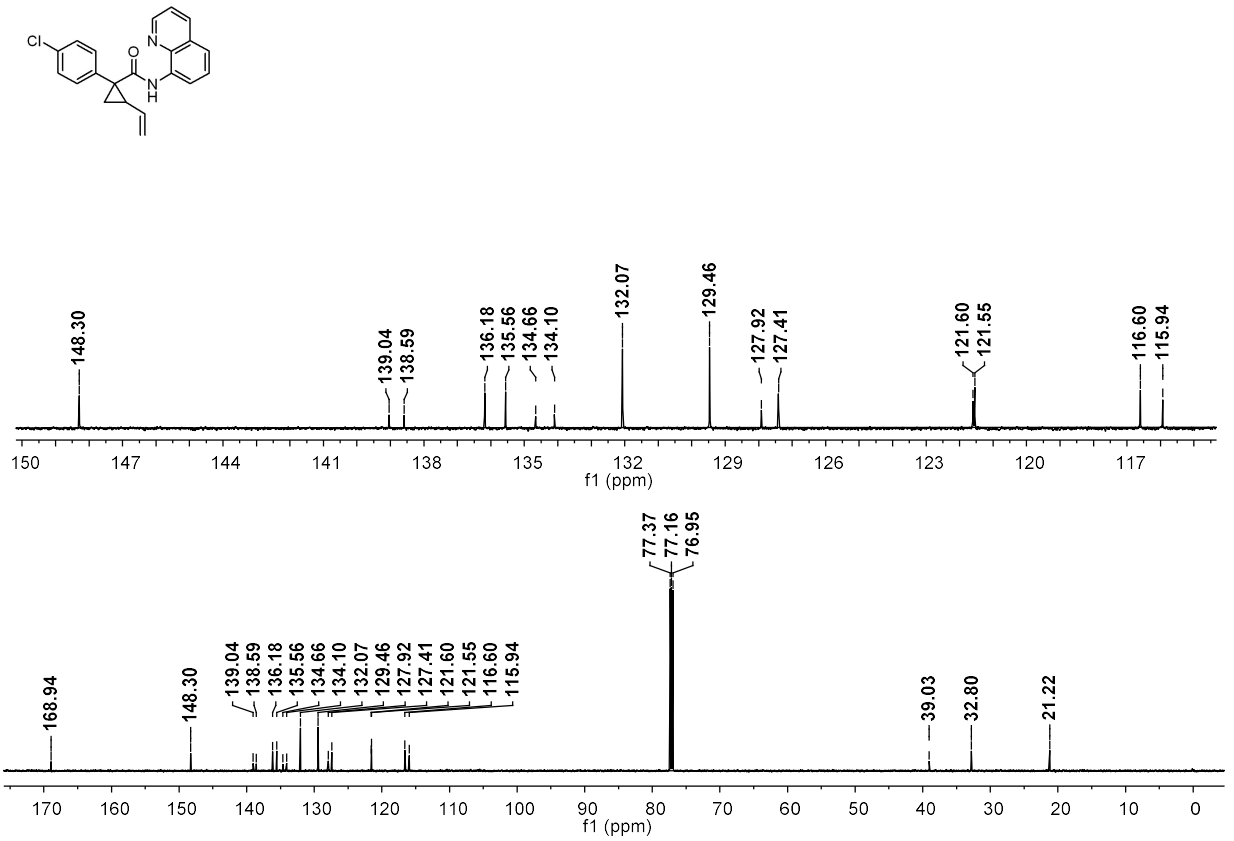
^{13}C{^{1}H} NMR spectra of **1i** (151 MHz, $CDCl_3$)



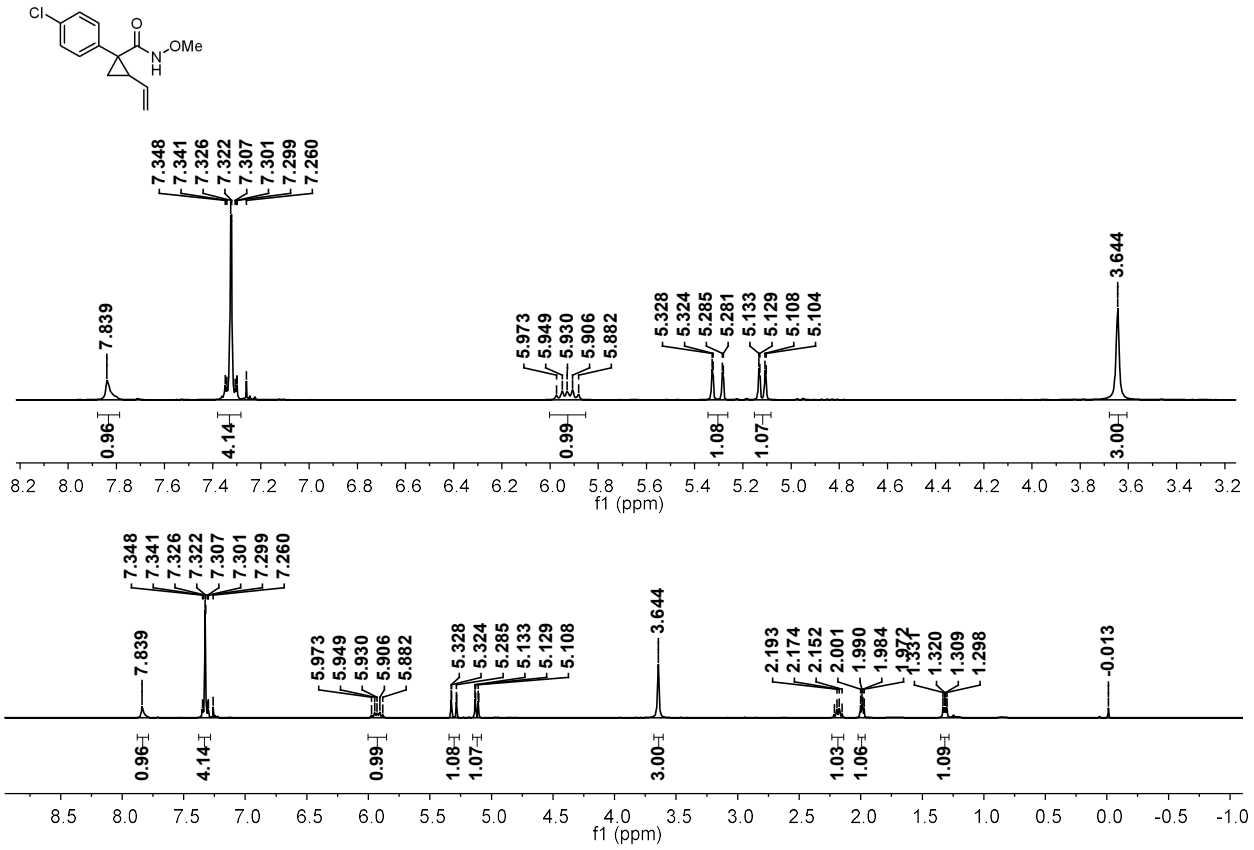
^{1}H NMR spectra of **1j** (600 MHz, $CDCl_3$)



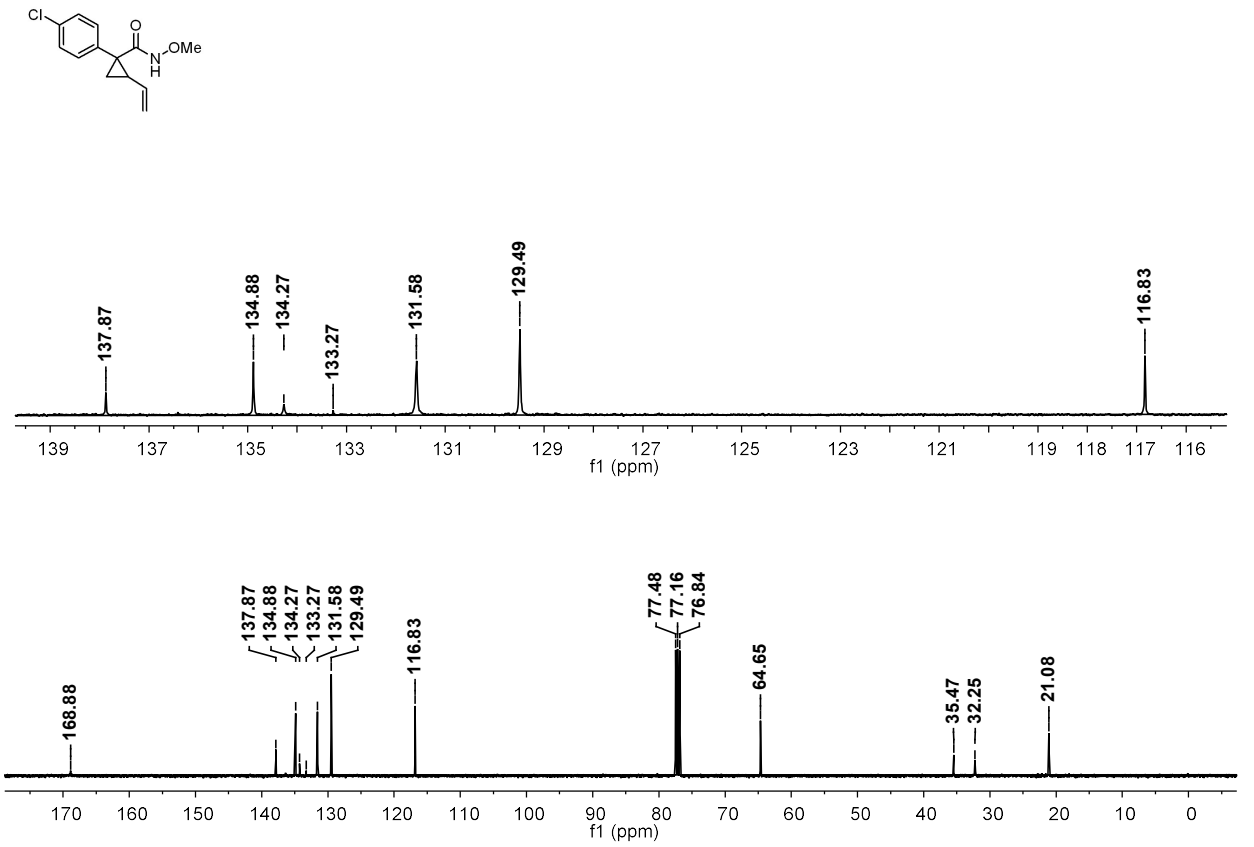
^{13}C{^{1}H} NMR spectra of **1j** (151 MHz, $CDCl_3$)



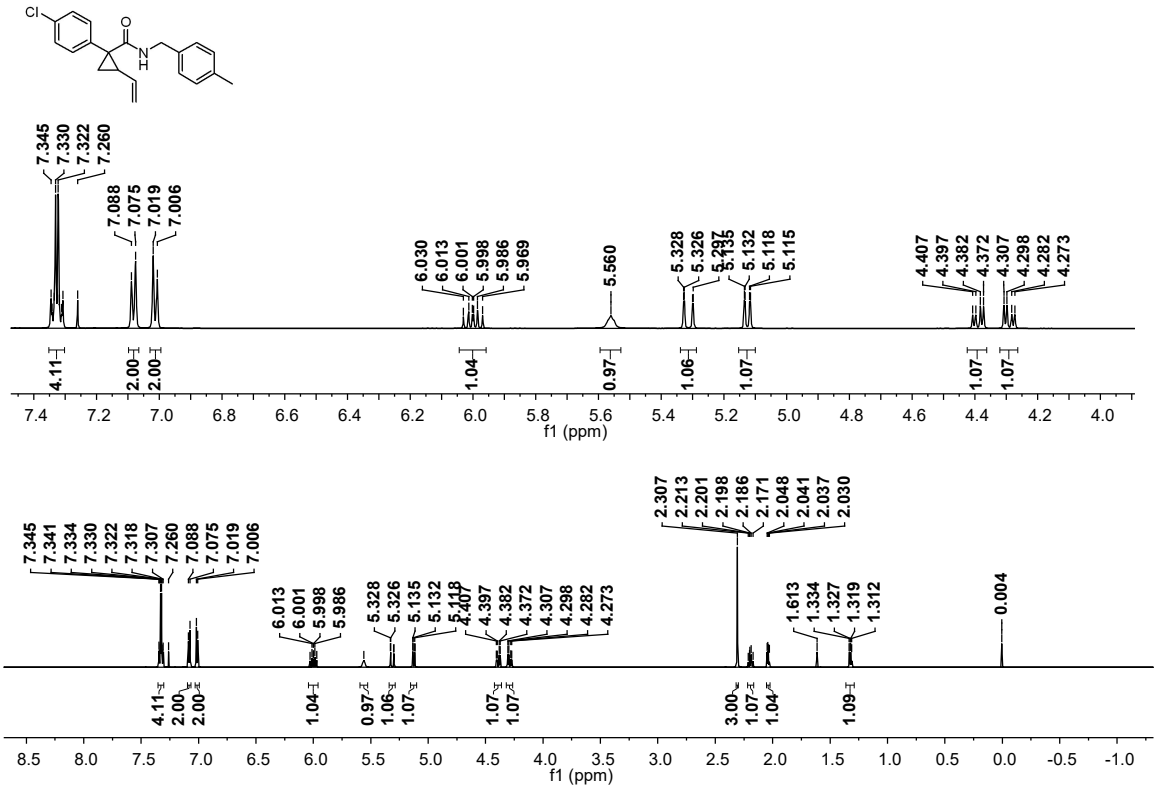
^{1}H NMR spectra of **1k** (400 MHz, $CDCl_3$)



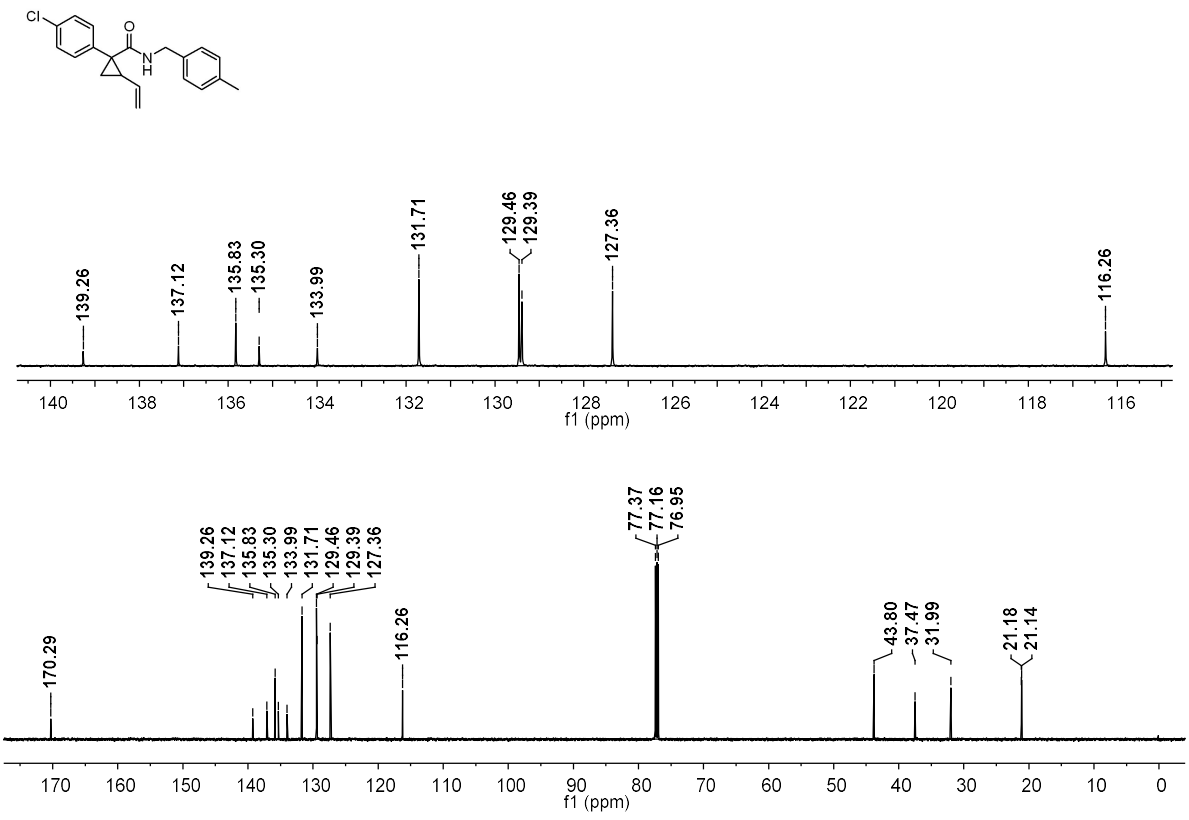
^{13}C{^{1}H} NMR spectra of **1k** (101 MHz, $CDCl_3$)



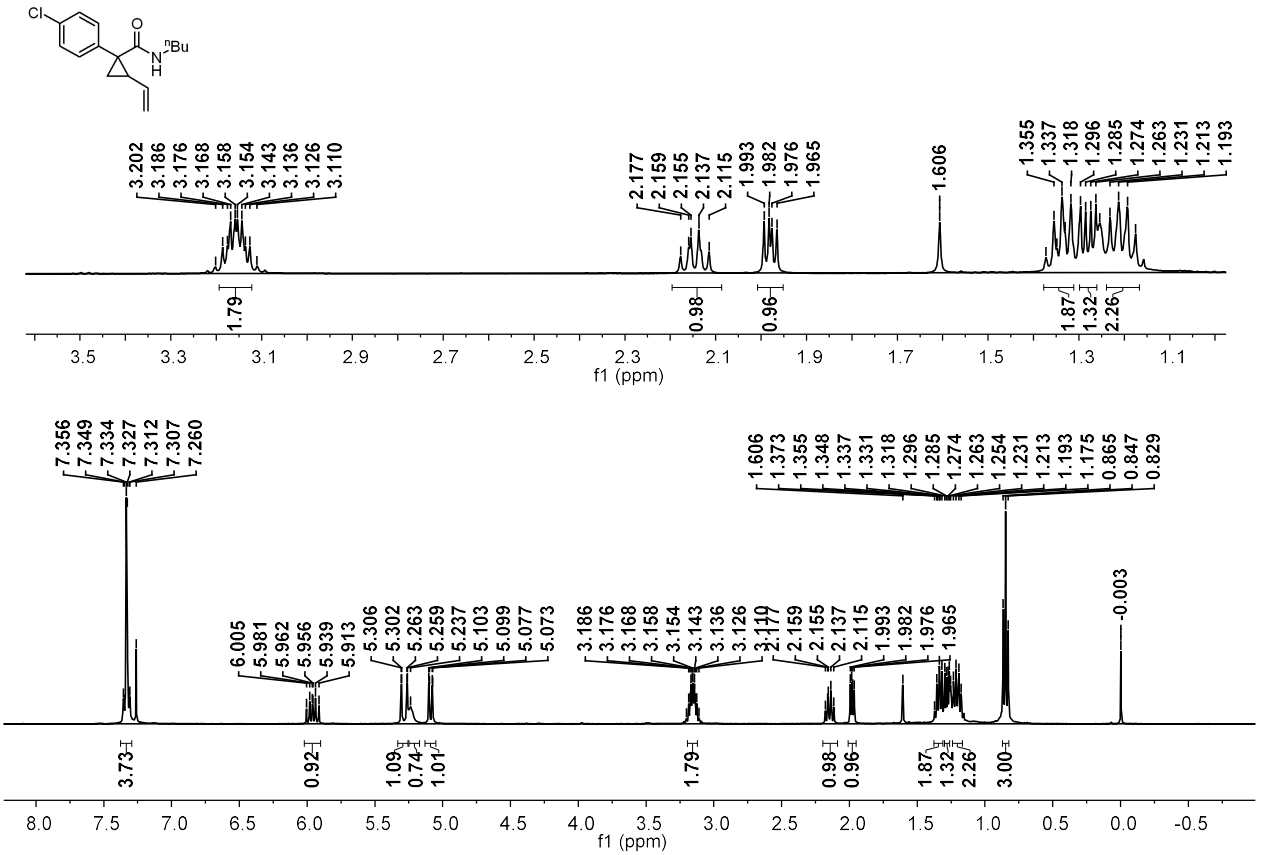
^{1}H NMR spectra of **1l** (600 MHz, $CDCl_3$)



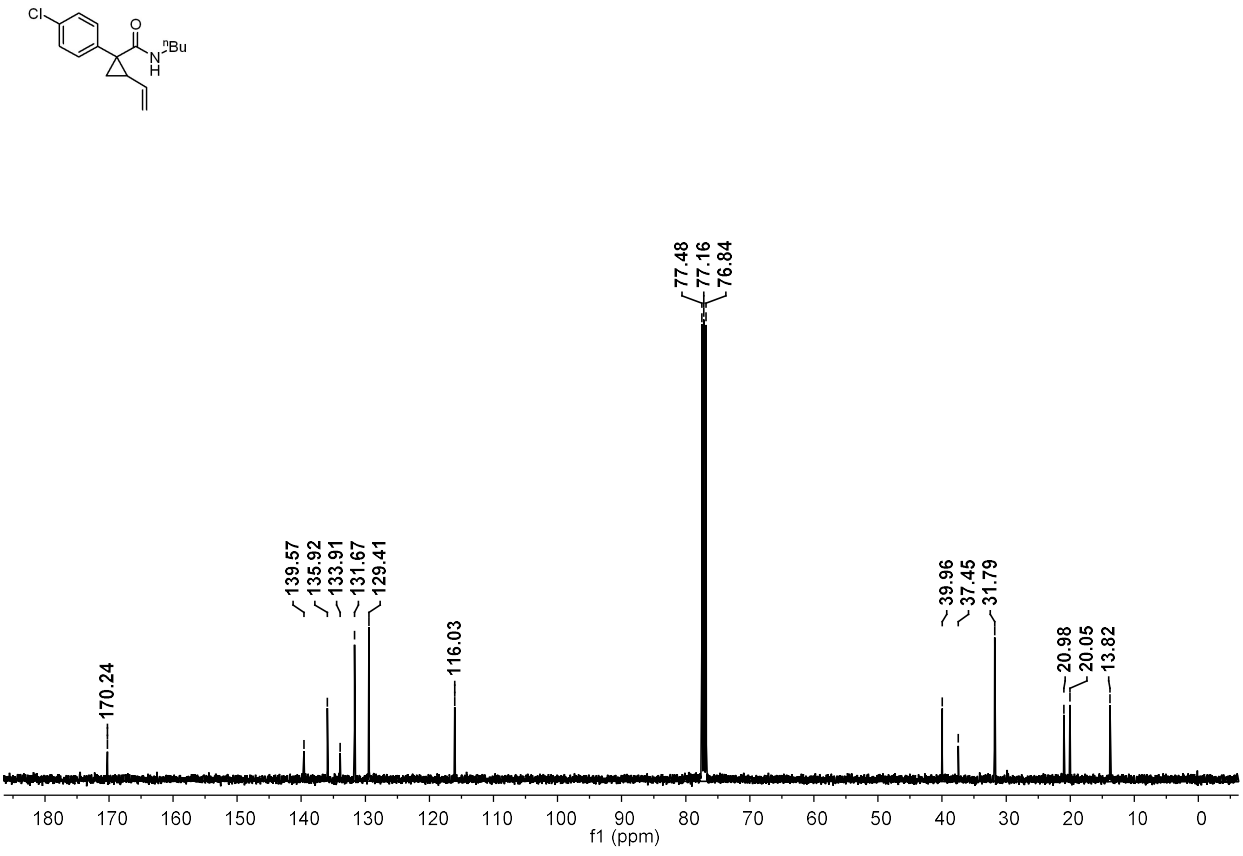
^{13}C{^{1}H} NMR spectra of **1l** (151 MHz, $CDCl_3$)



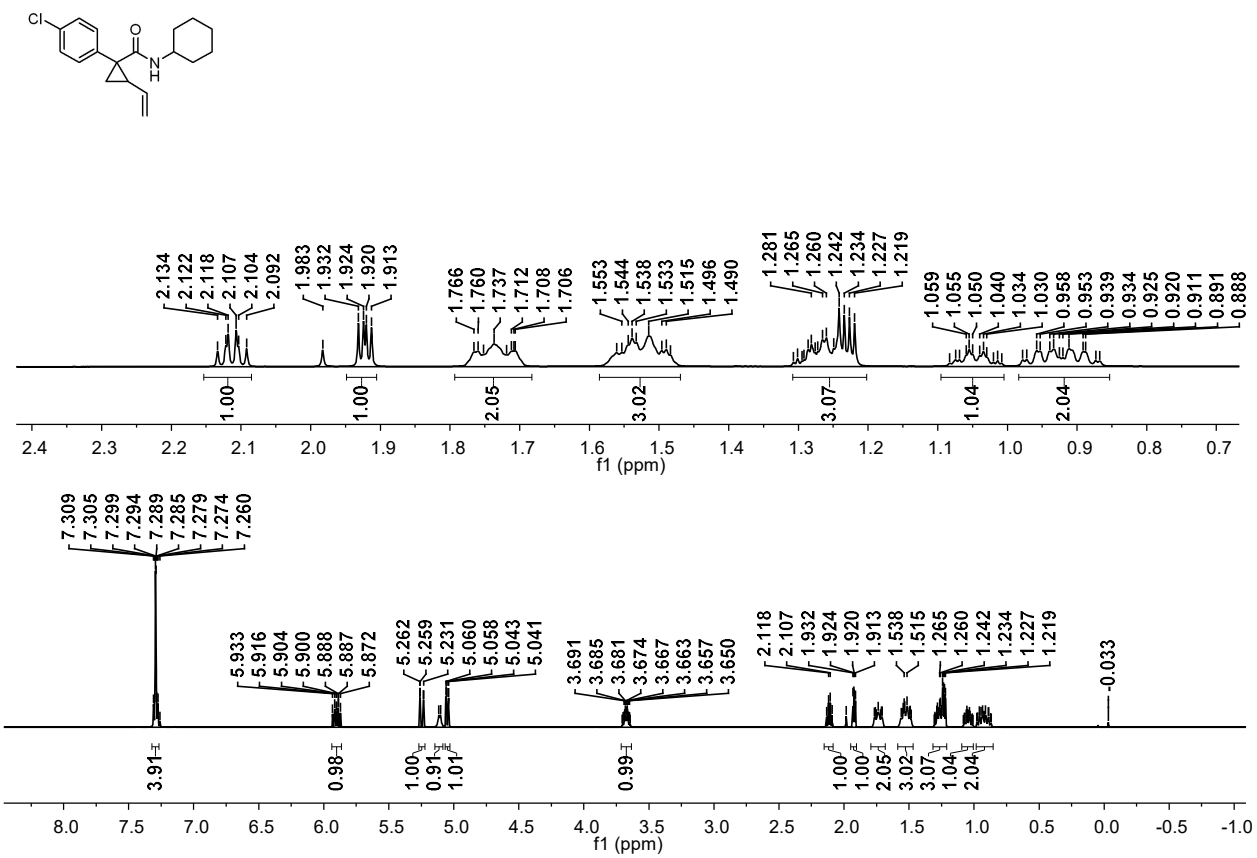
^{1}H NMR spectra of **1m** (400 MHz, $CDCl_3$)



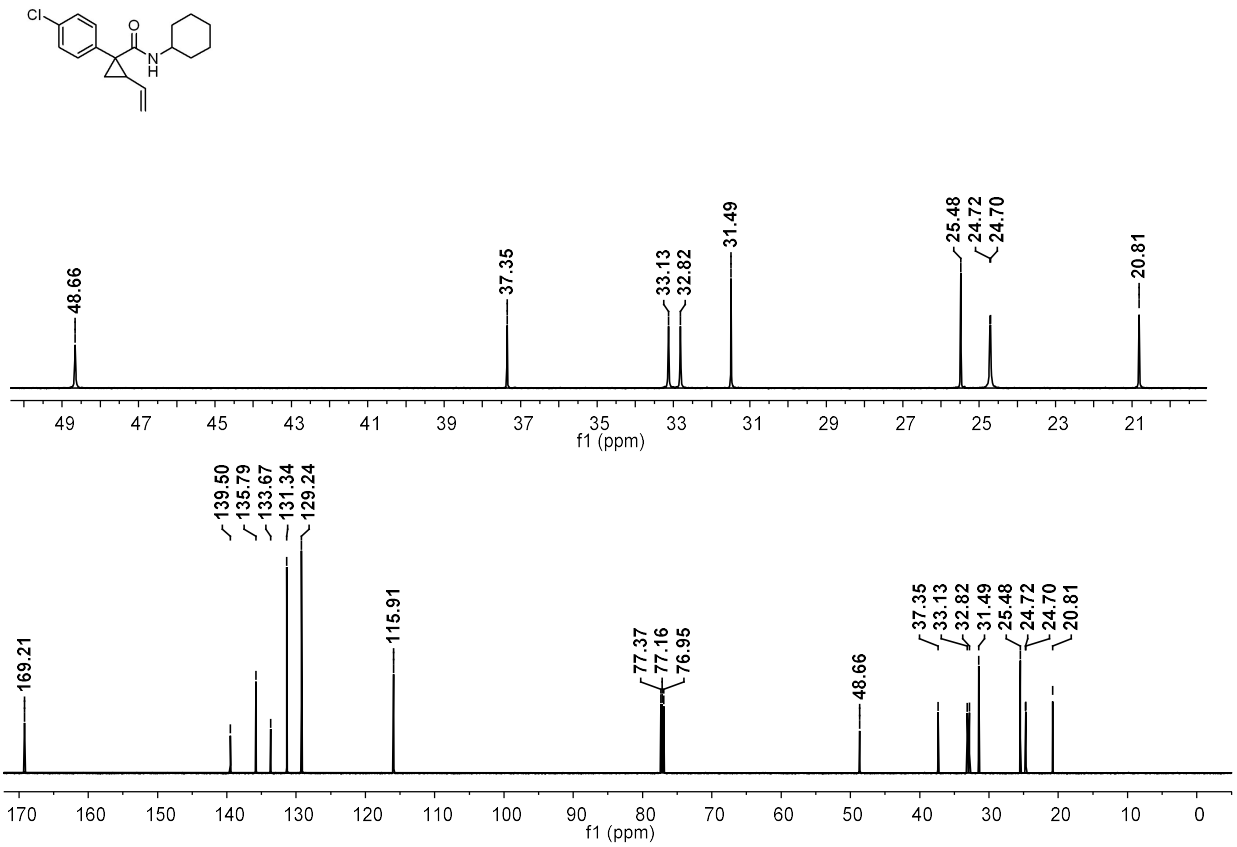
^{13}C{^{1}H} NMR spectra of **1m** (101 MHz, $CDCl_3$)



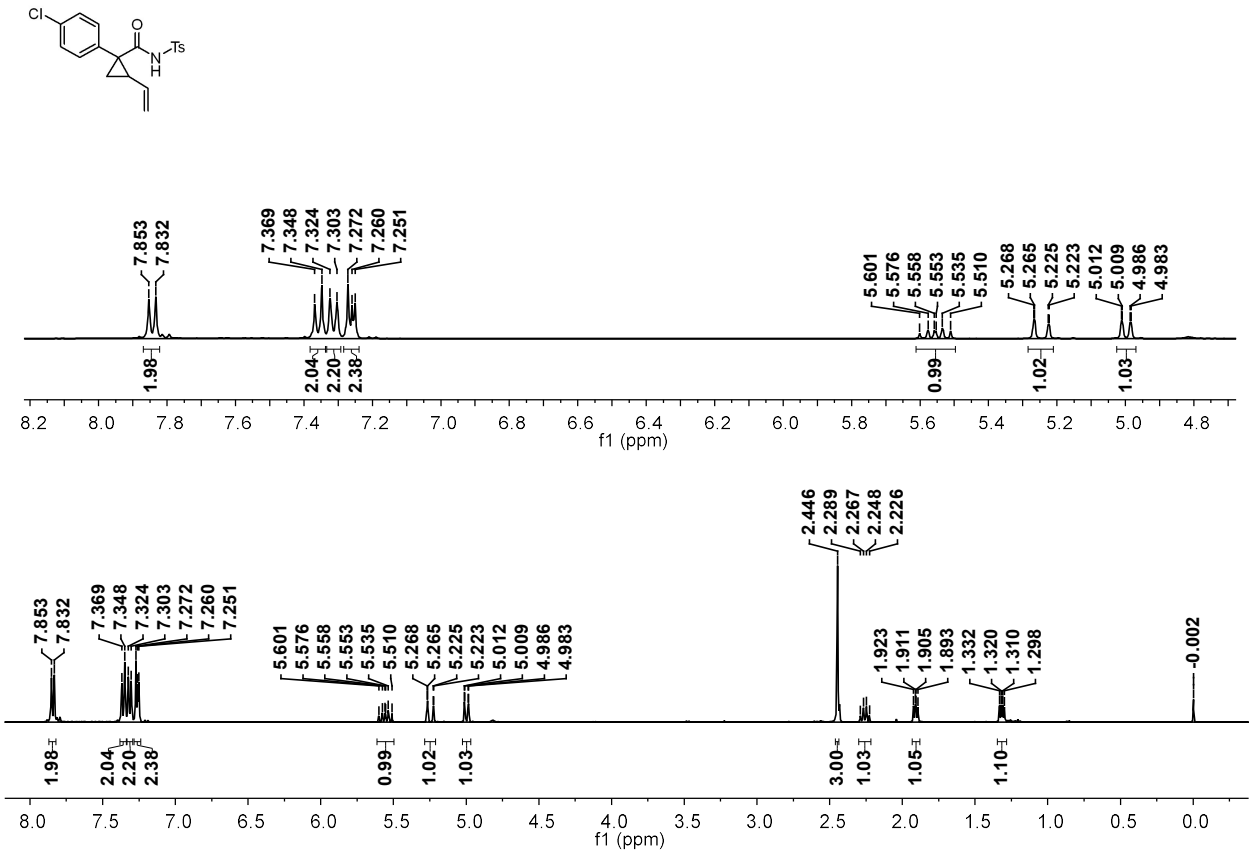
^{1}H NMR spectra of **1n** (600 MHz, $CDCl_3$)



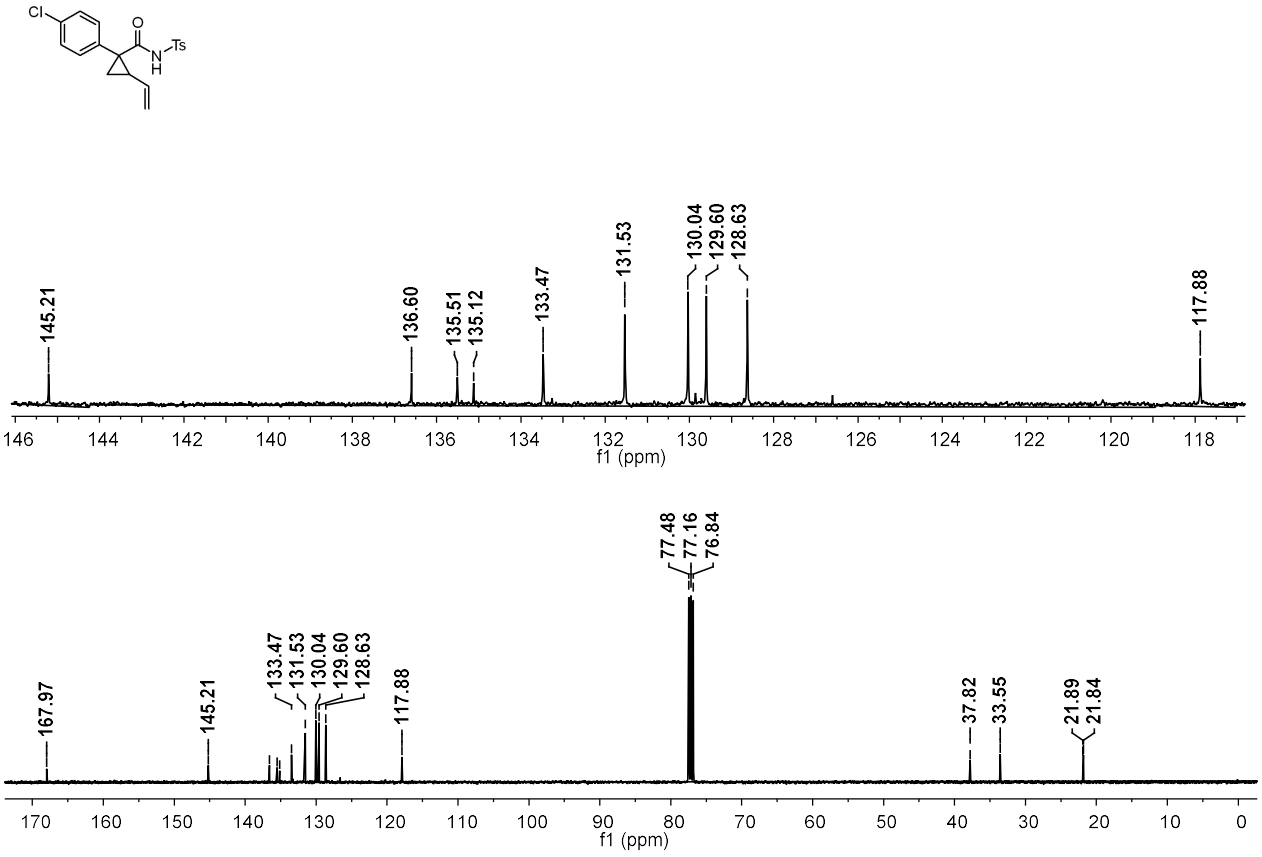
^{13}C{^{1}H} NMR spectra of **1n** (151 MHz, $CDCl_3$)



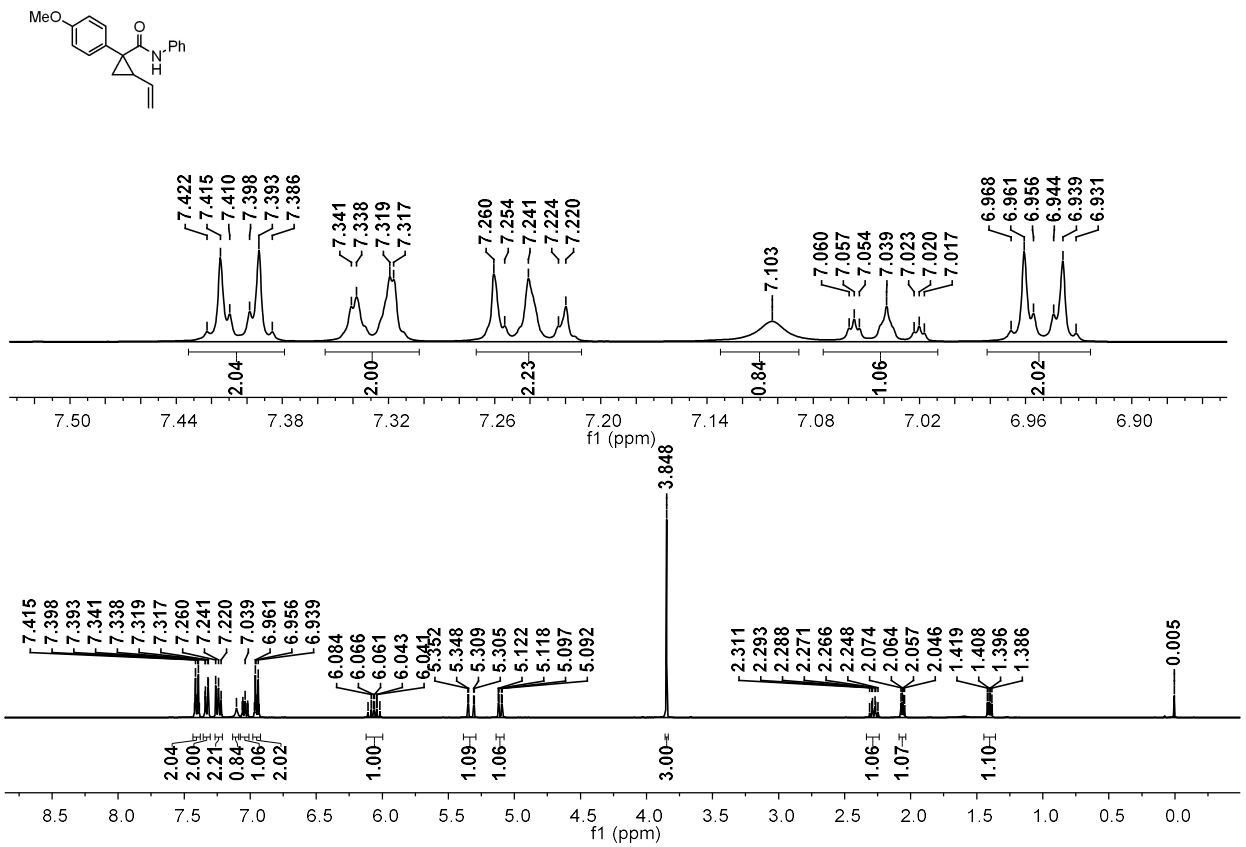
^{1}H NMR spectra of **1o** (400 MHz, $CDCl_3$)



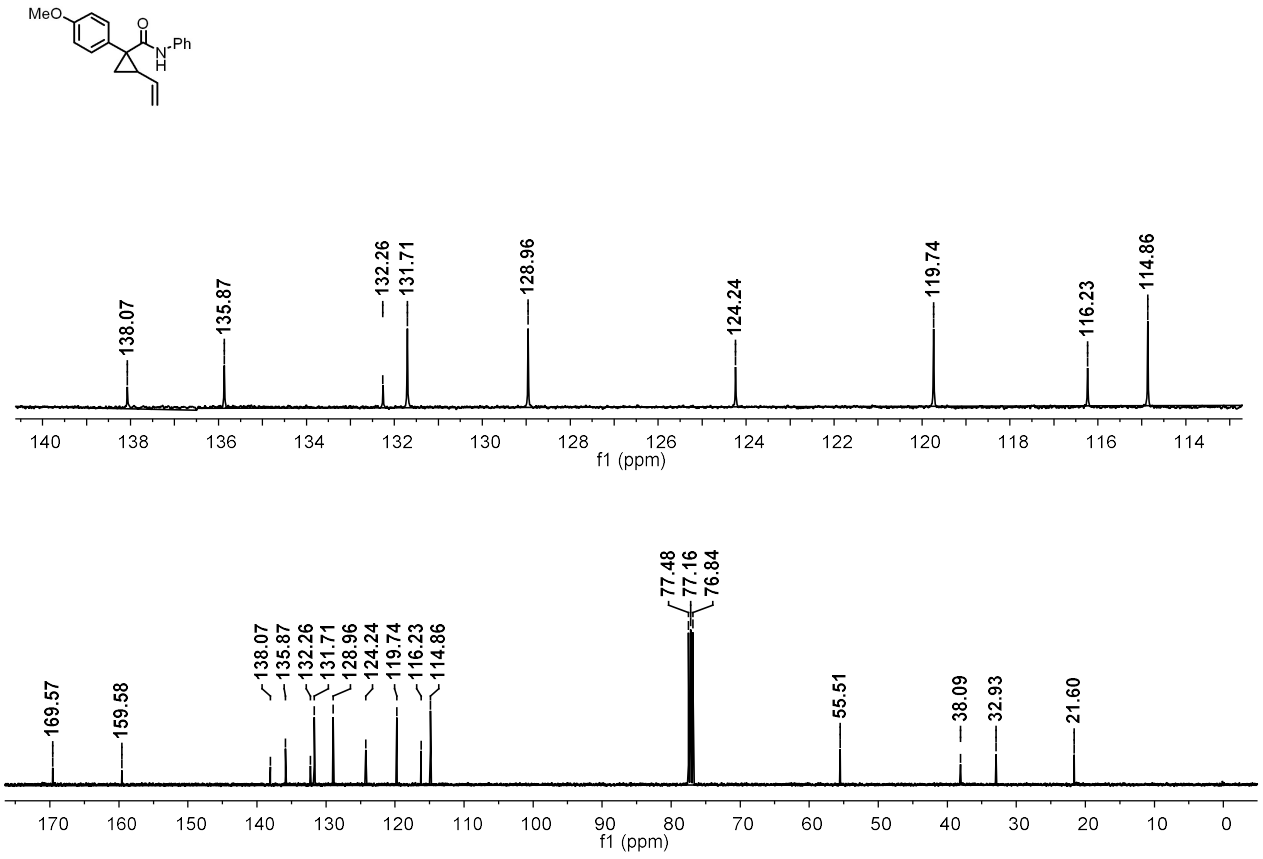
^{13}C{^{1}H} NMR spectra of **1o** (101 MHz, $CDCl_3$)



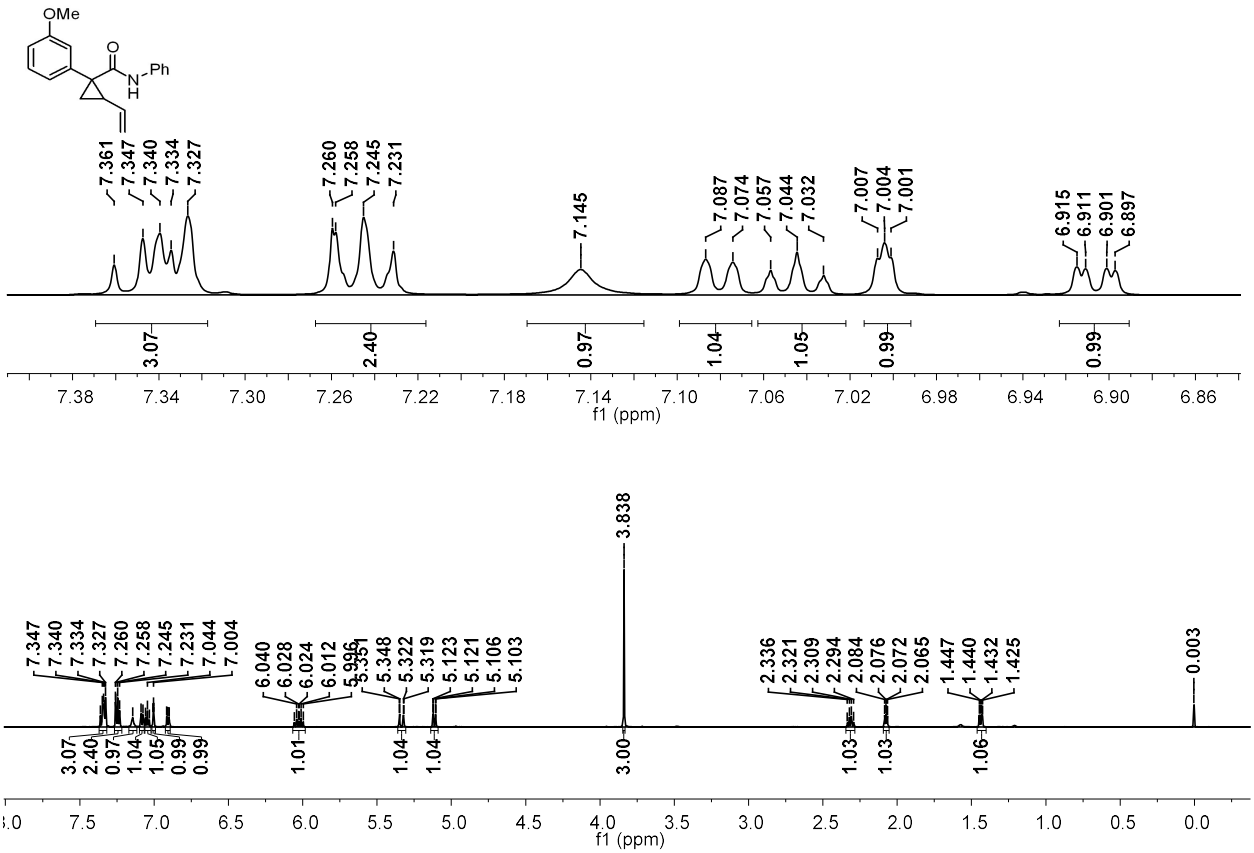
^{1}H NMR spectra of **1p** (400 MHz, $CDCl_3$)



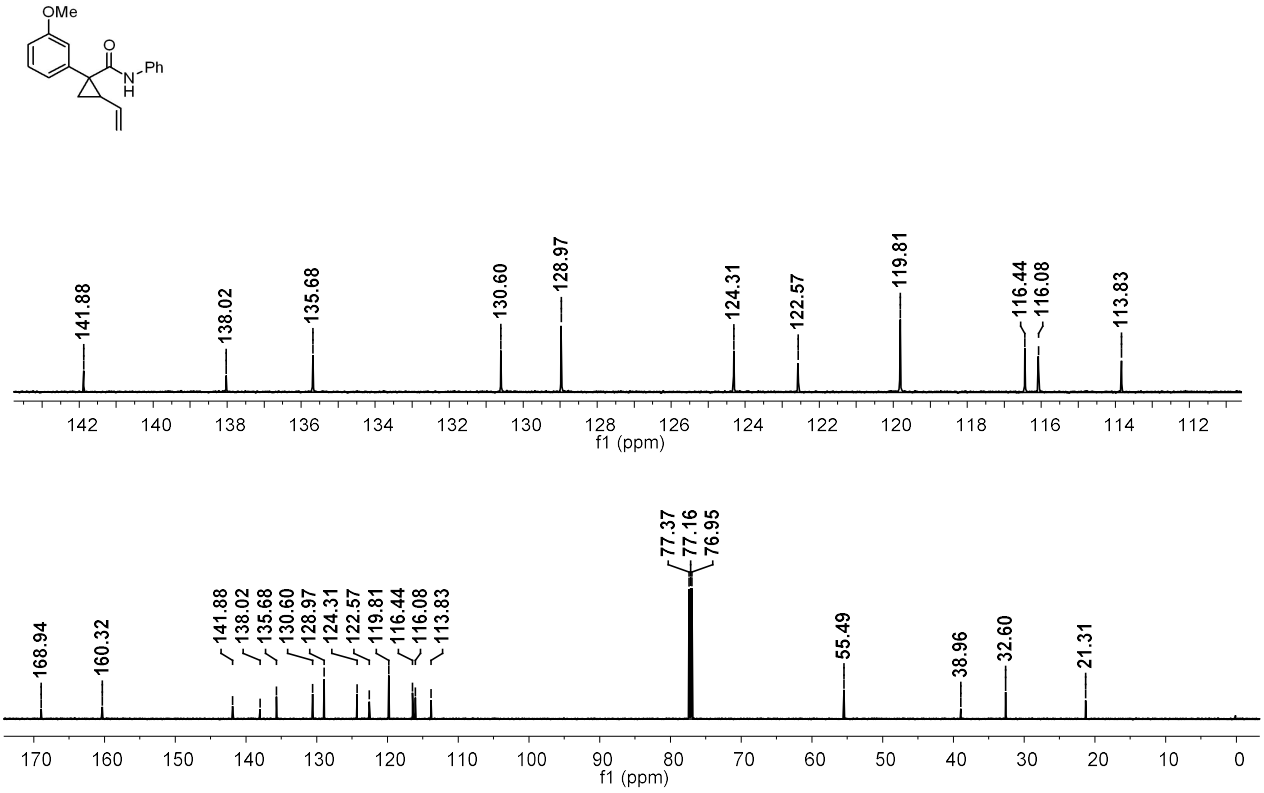
$^{13}C\{^{1}H\}$ NMR spectra of **1p** (101 MHz, $CDCl_3$)



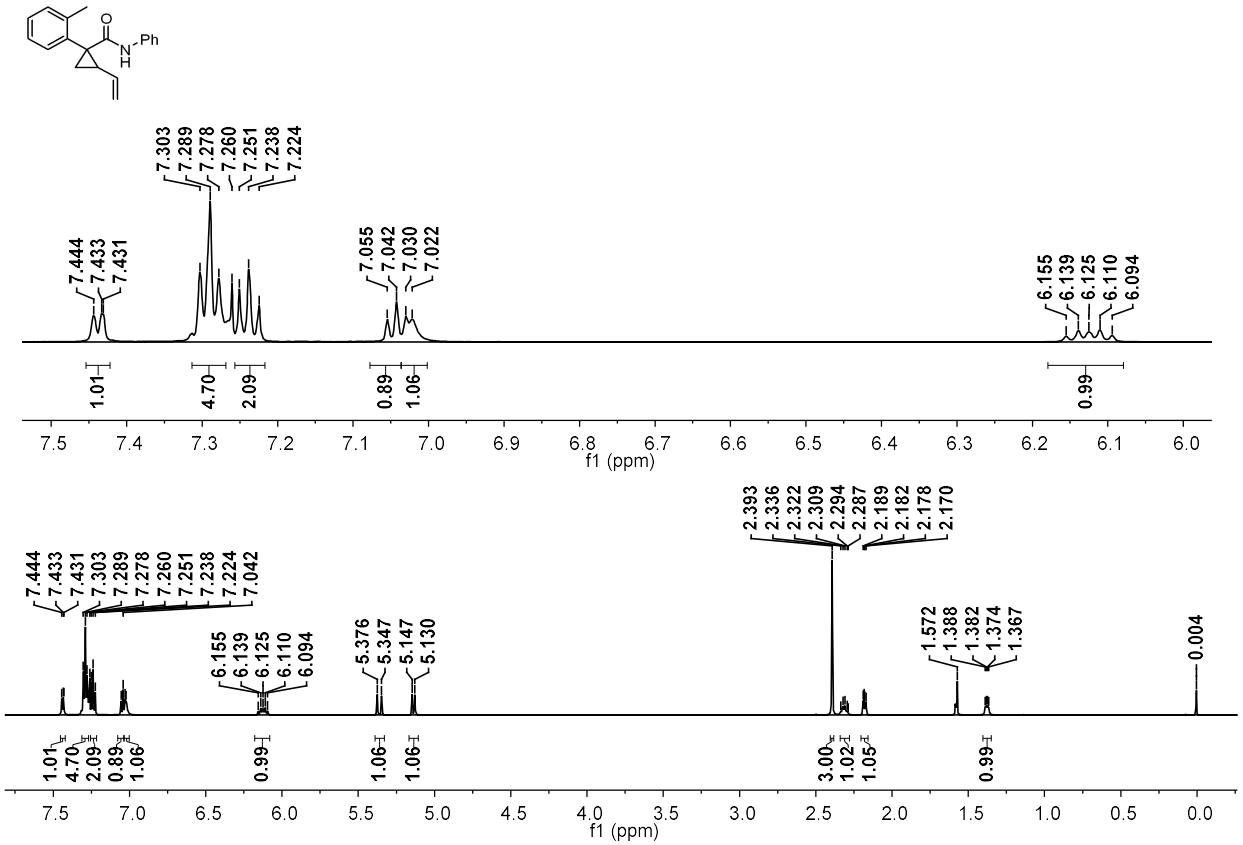
^{1}H NMR spectra of **1q** (600 MHz, $CDCl_3$)



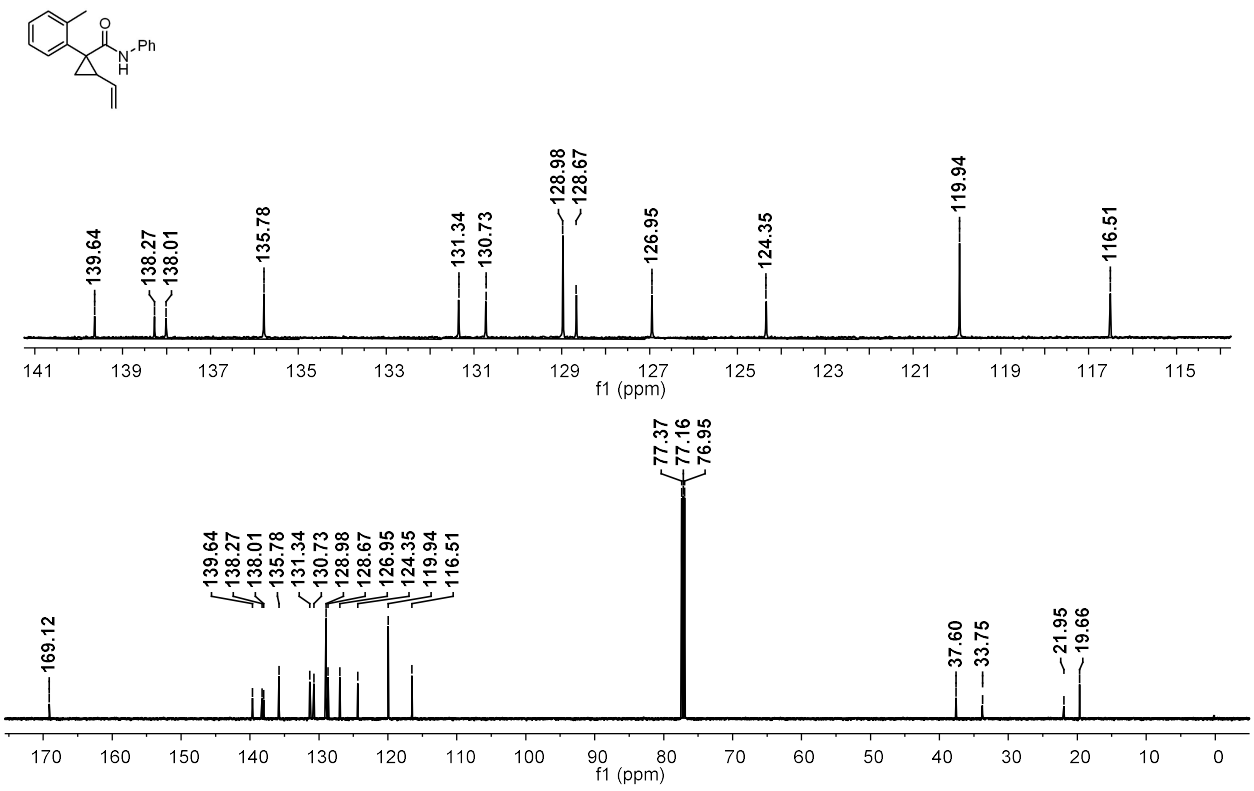
$^{13}C\{^{1}H\}$ NMR spectra of **1q** (151 MHz, $CDCl_3$)



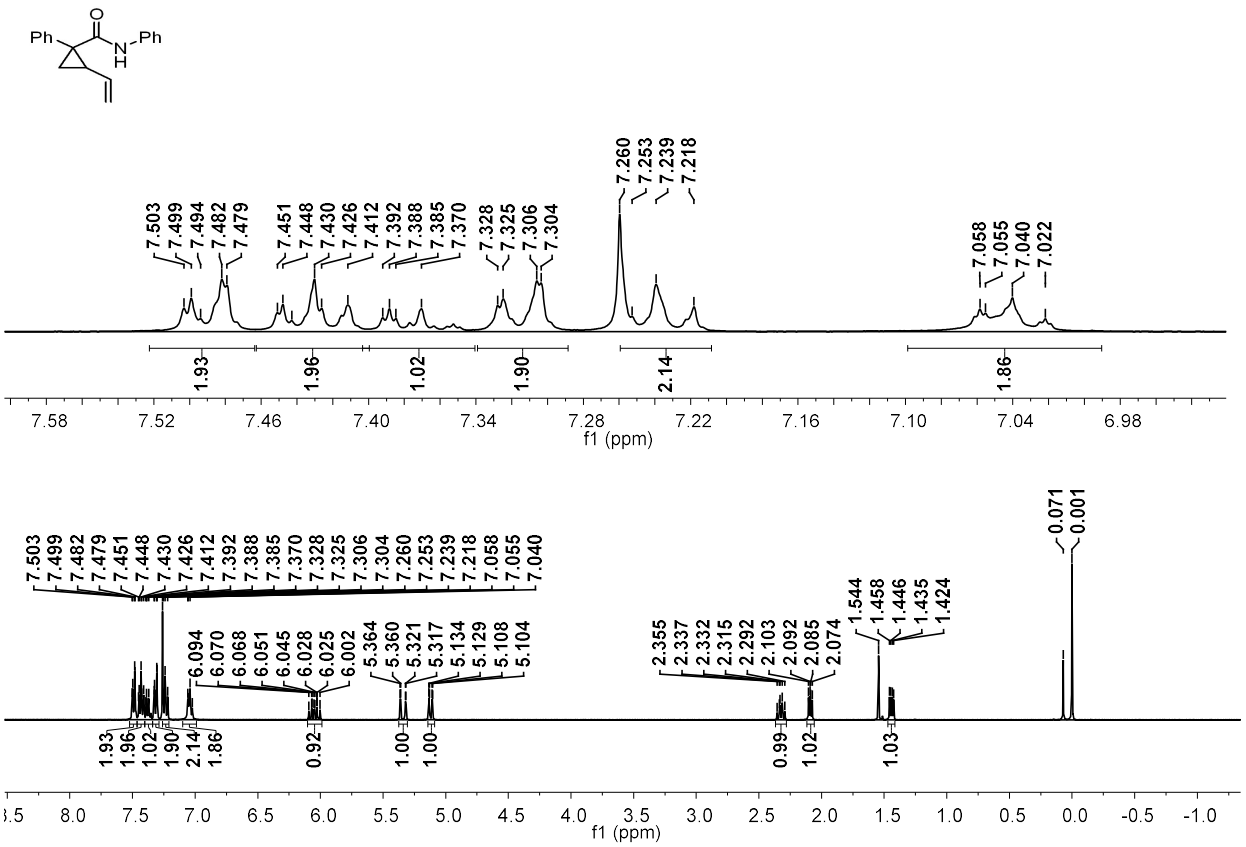
^{1}H NMR spectra of **1r** (600 MHz, $CDCl_3$)



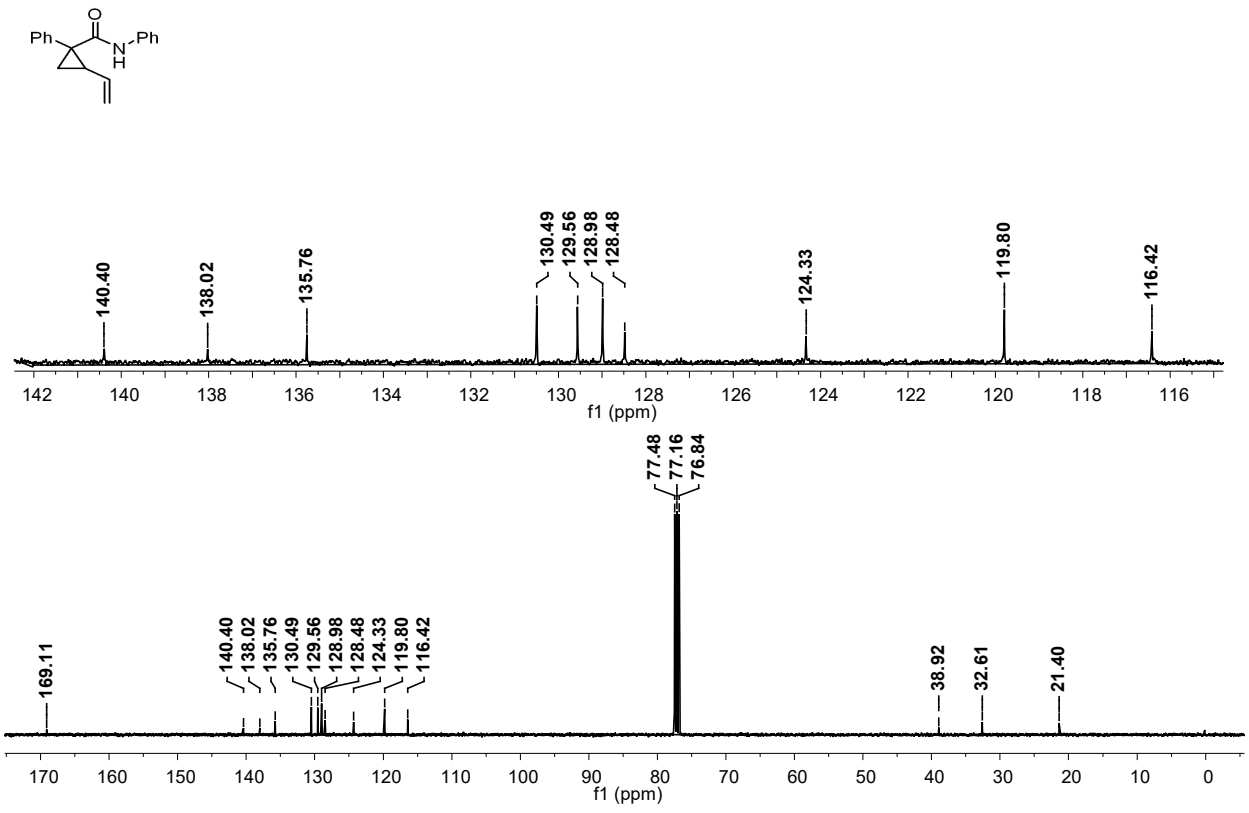
^{13}C{^{1}H} NMR spectra of **1r** (151 MHz, $CDCl_3$)



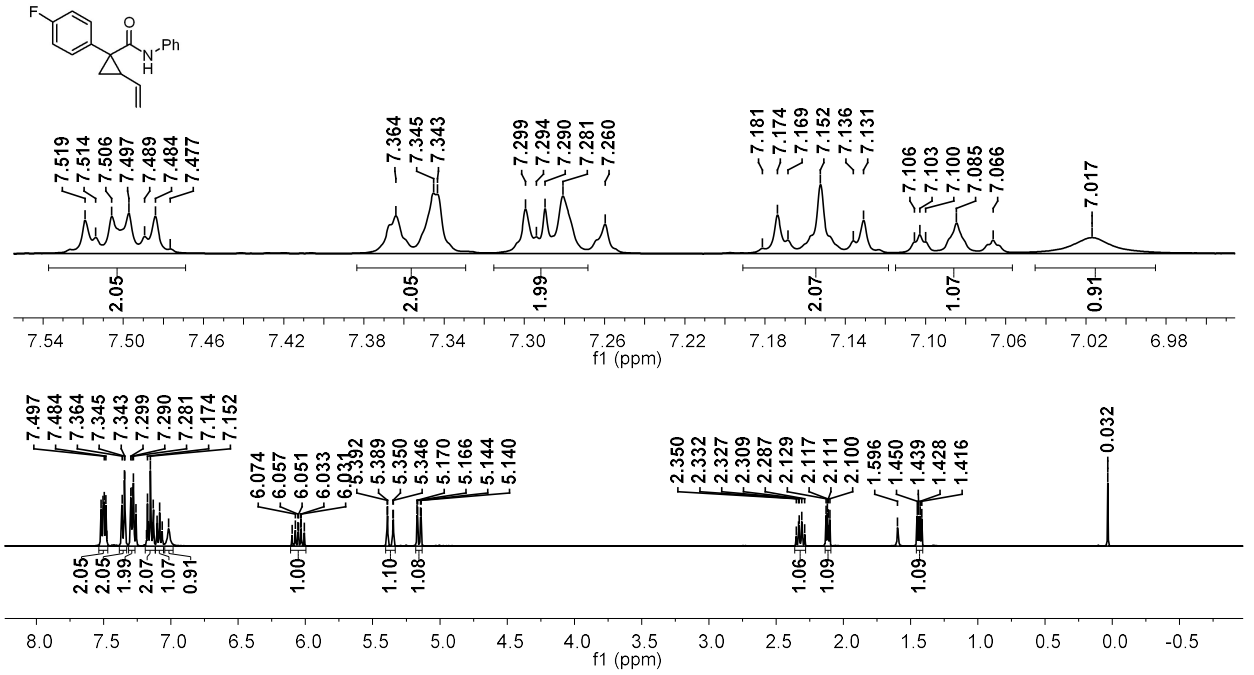
^{1}H NMR spectra of **1s** (400 MHz, $CDCl_3$)



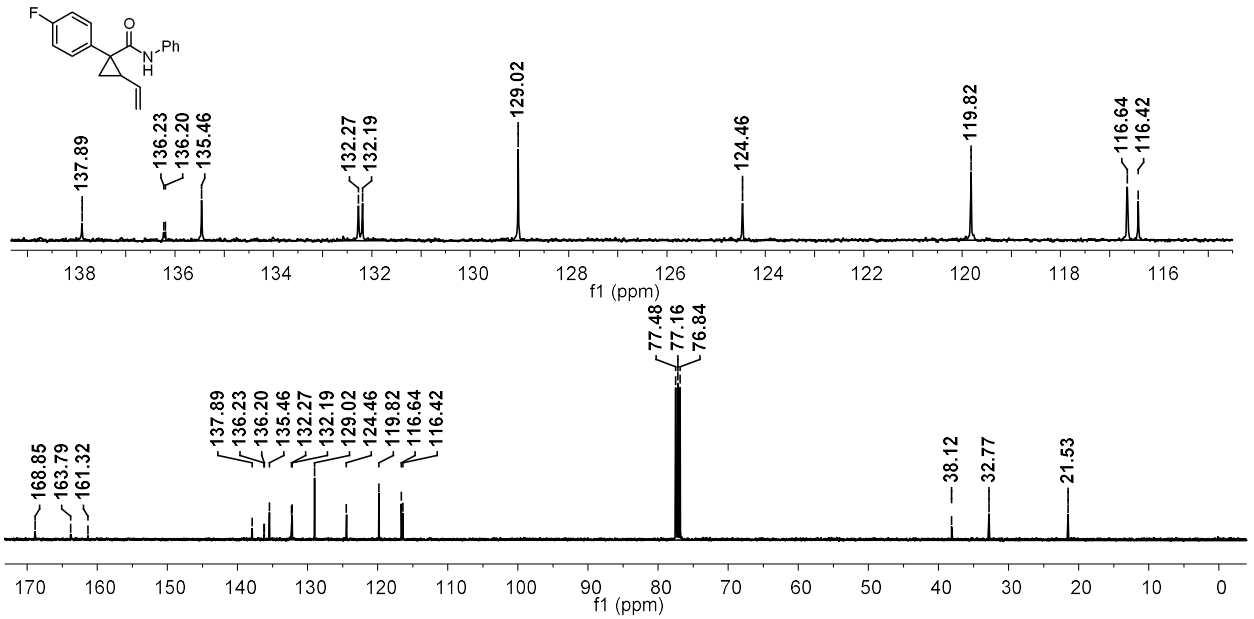
$^{13}C\{^{1}H\}$ NMR spectra of **1s** (101 MHz, $CDCl_3$)



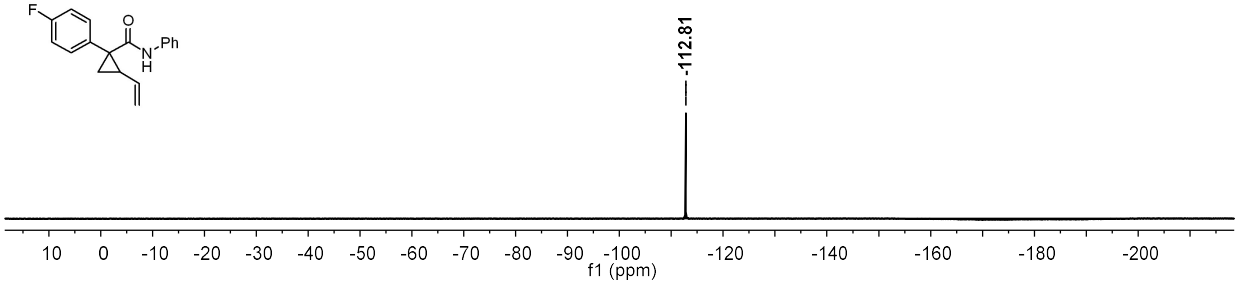
^{1}H NMR spectra of **1t** (400 MHz, $CDCl_3$)



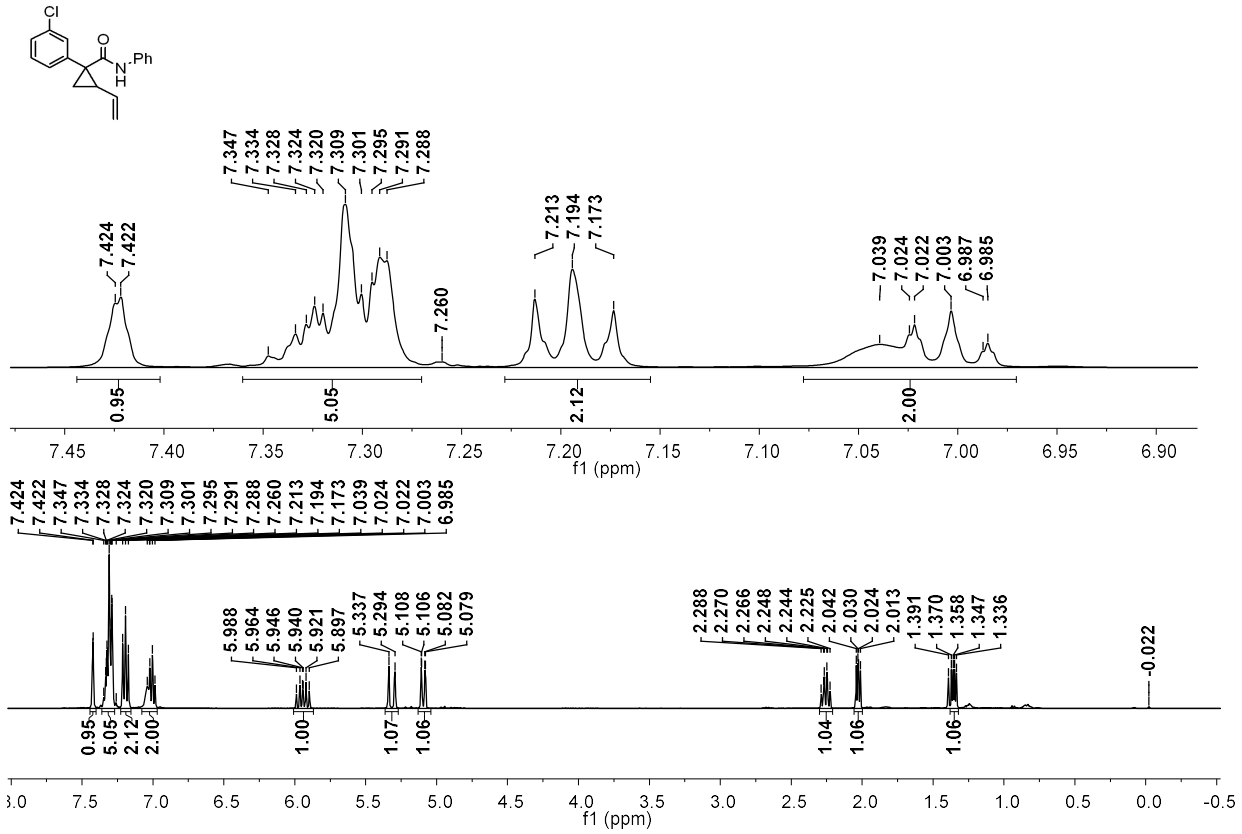
^{13}C{^{1}H} NMR spectra of **1t** (101 MHz, $CDCl_3$)



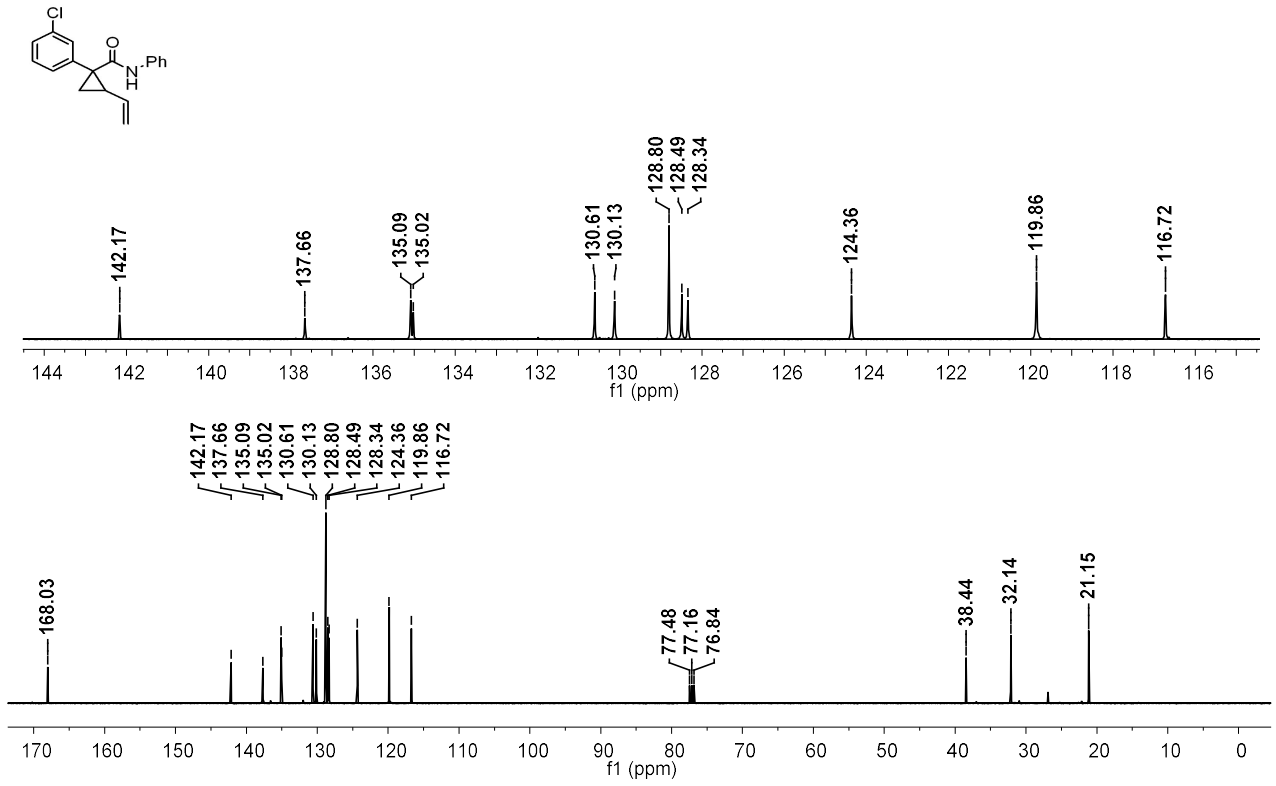
^{19}F NMR spectra of **1t** (565 MHz, $CDCl_3$)



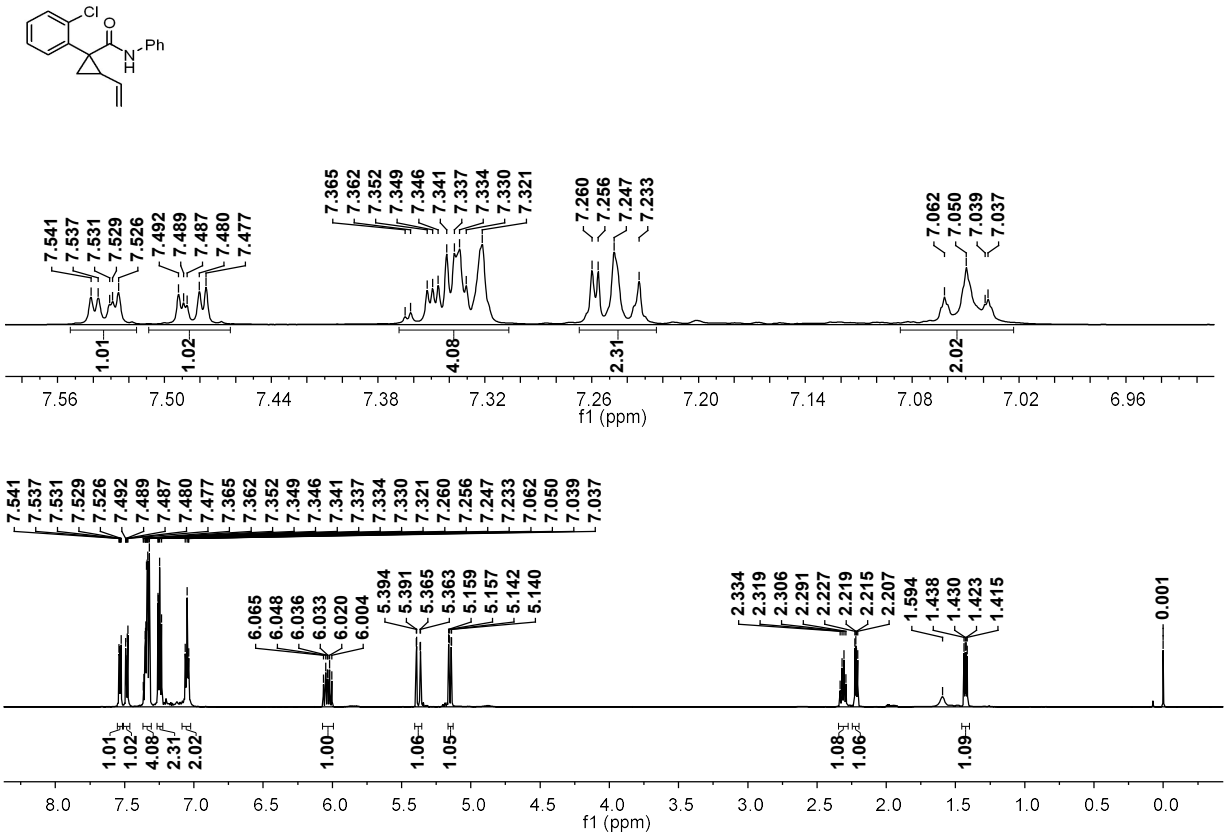
^{1}H NMR spectra of **1u** (400 MHz, $CDCl_3$)



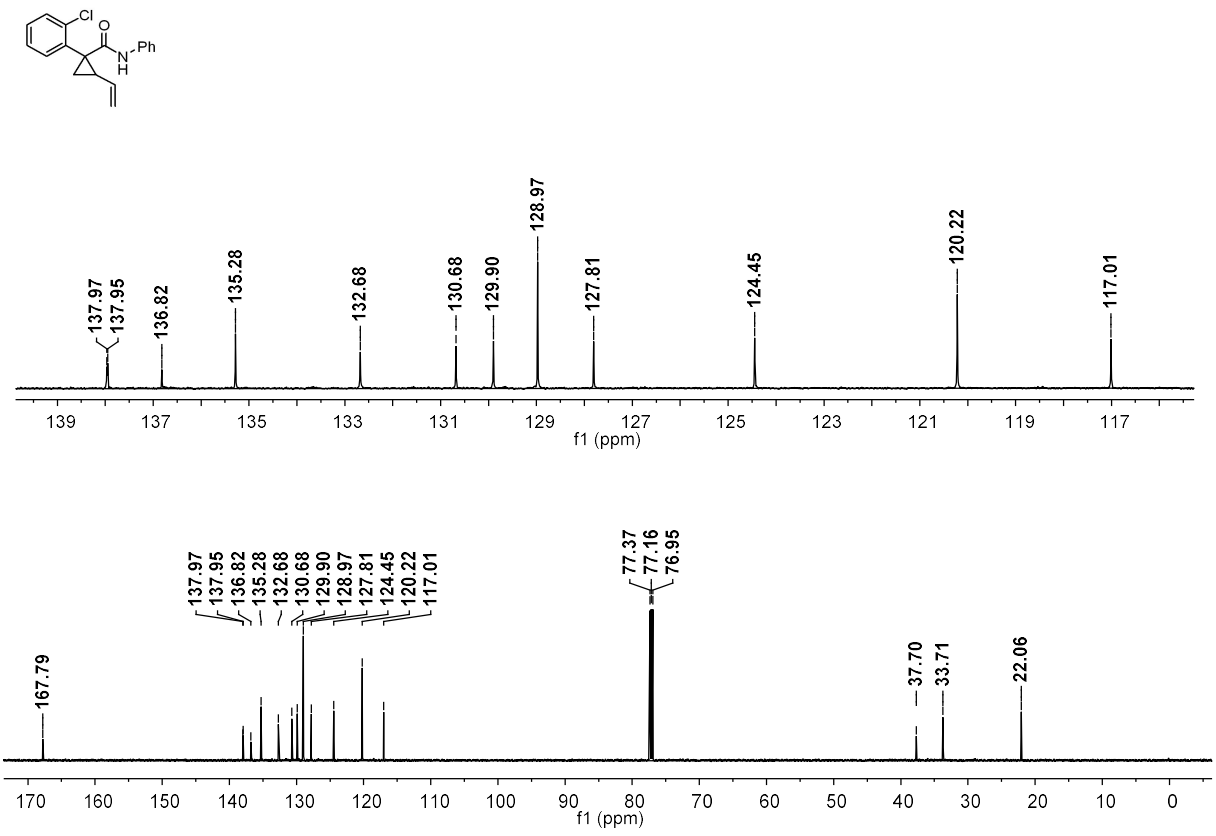
^{13}C{^{1}H} NMR spectra of **1u** (101 MHz, $CDCl_3$)



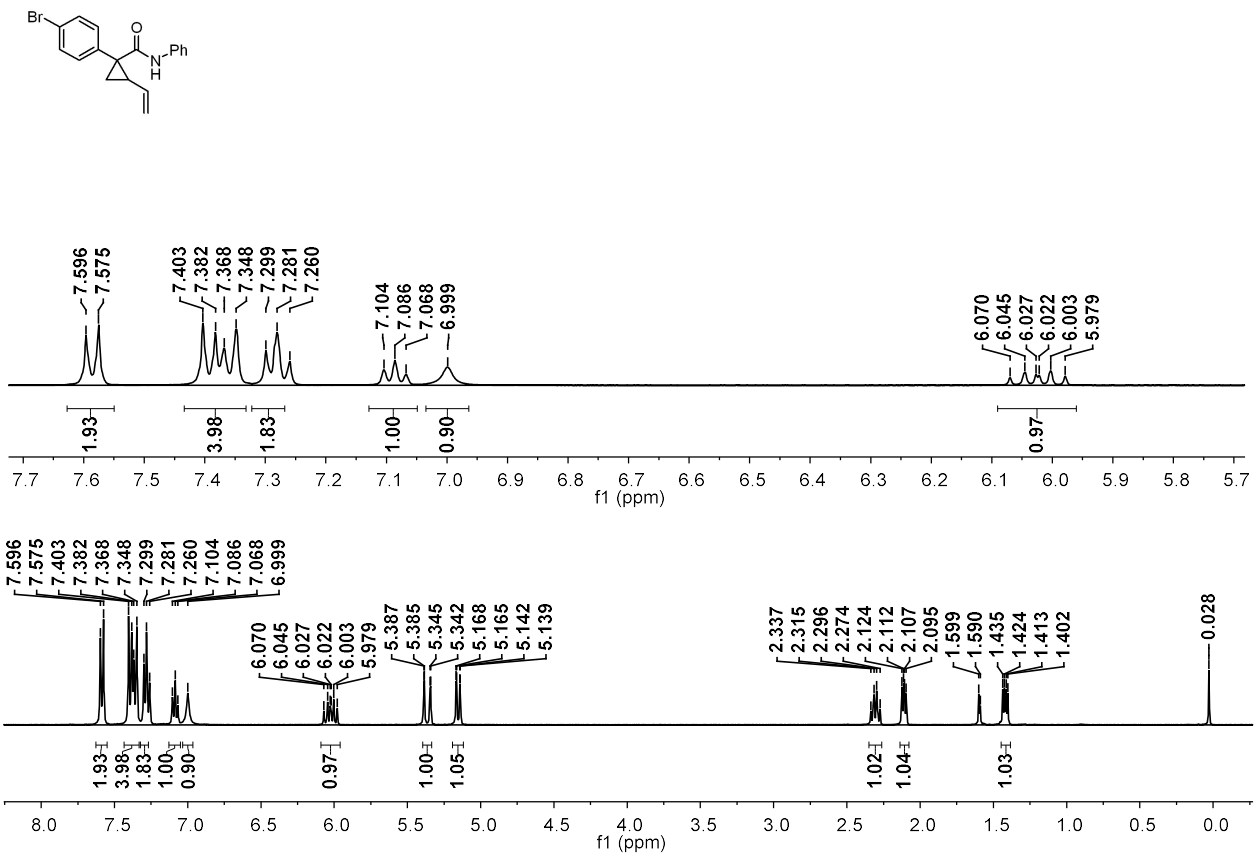
^{1}H NMR spectra of **1v** (600 MHz, $CDCl_3$)



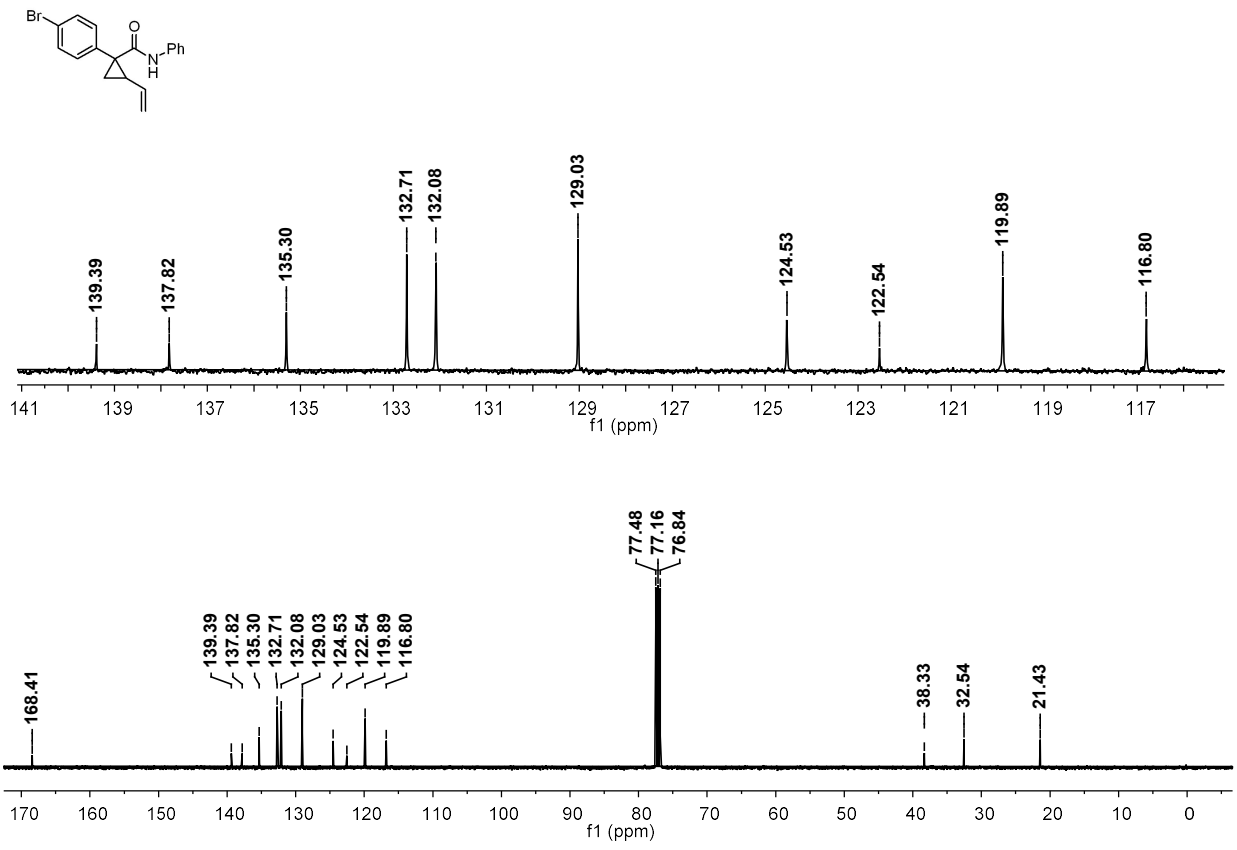
^{13}C{^{1}H} NMR spectra of **1v** (151 MHz, $CDCl_3$)



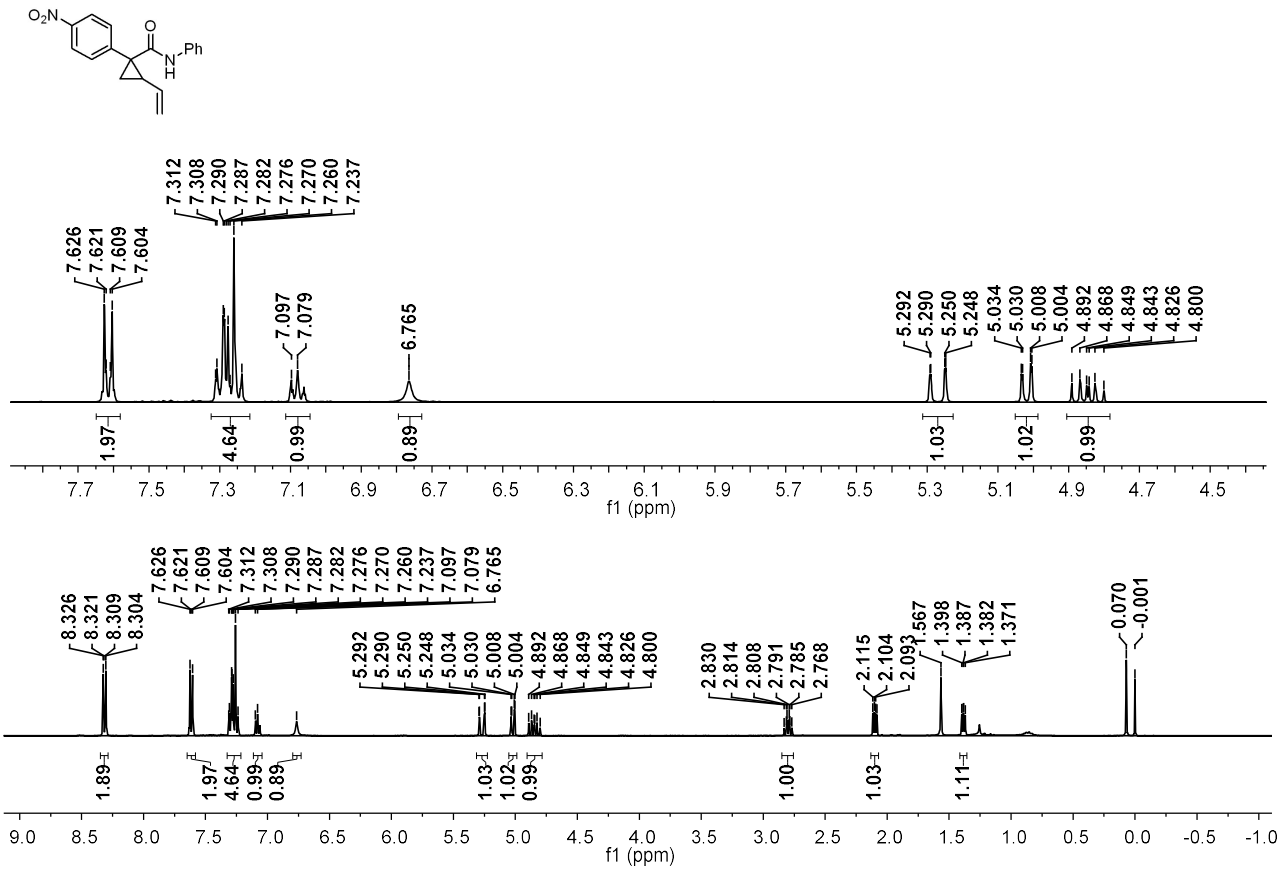
^{1}H NMR spectra of **1w** (400 MHz, $CDCl_3$)



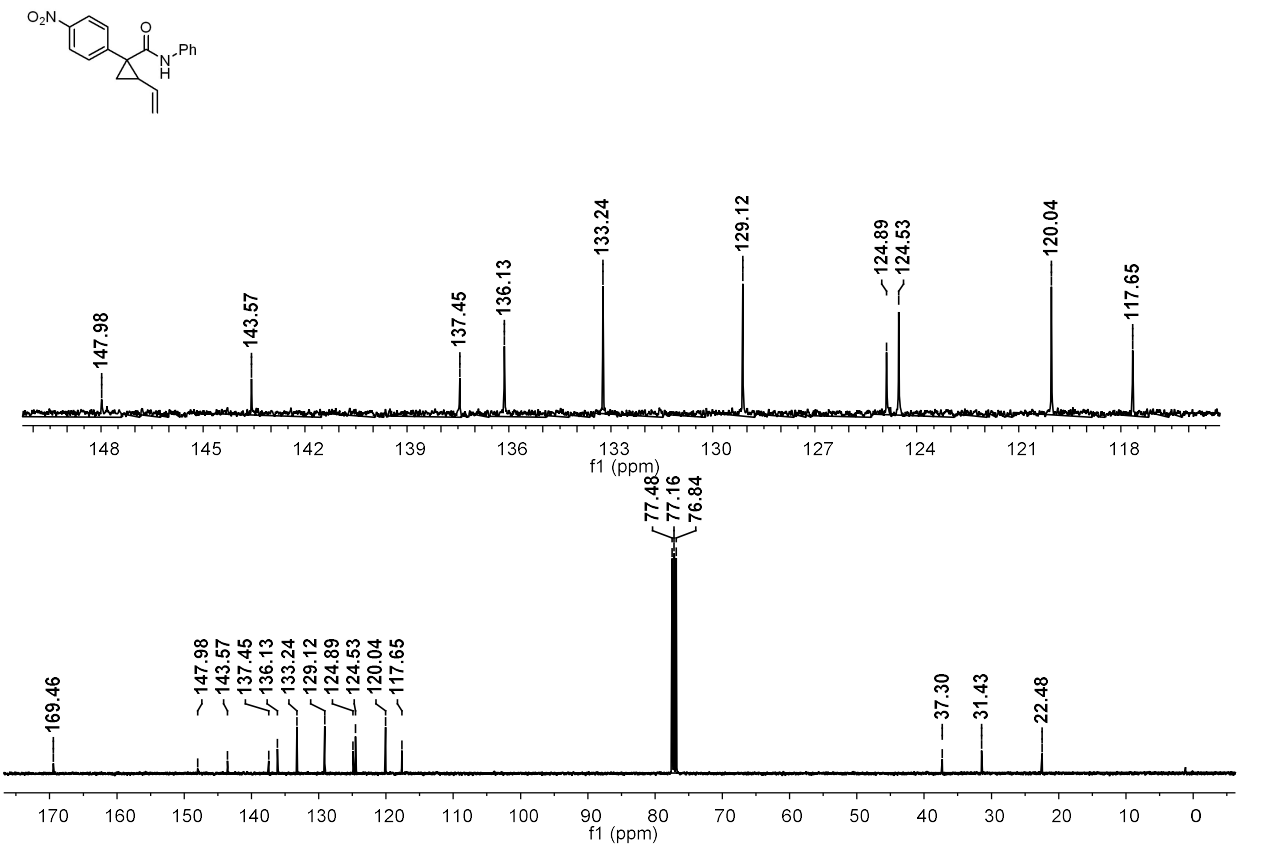
^{13}C{^{1}H} NMR spectra of **1w** (101 MHz, $CDCl_3$)



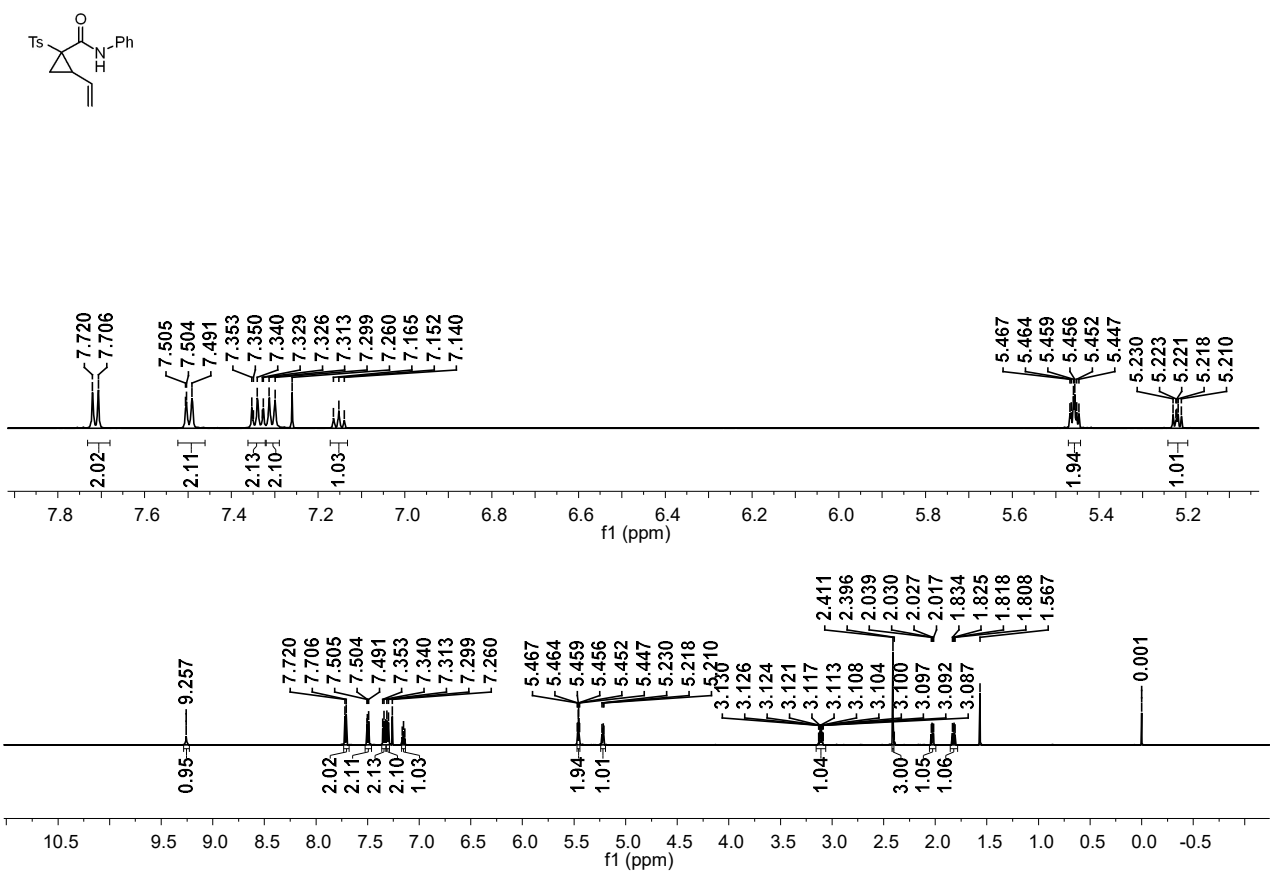
^{1}H NMR spectra of **1x** (400 MHz, $CDCl_3$)



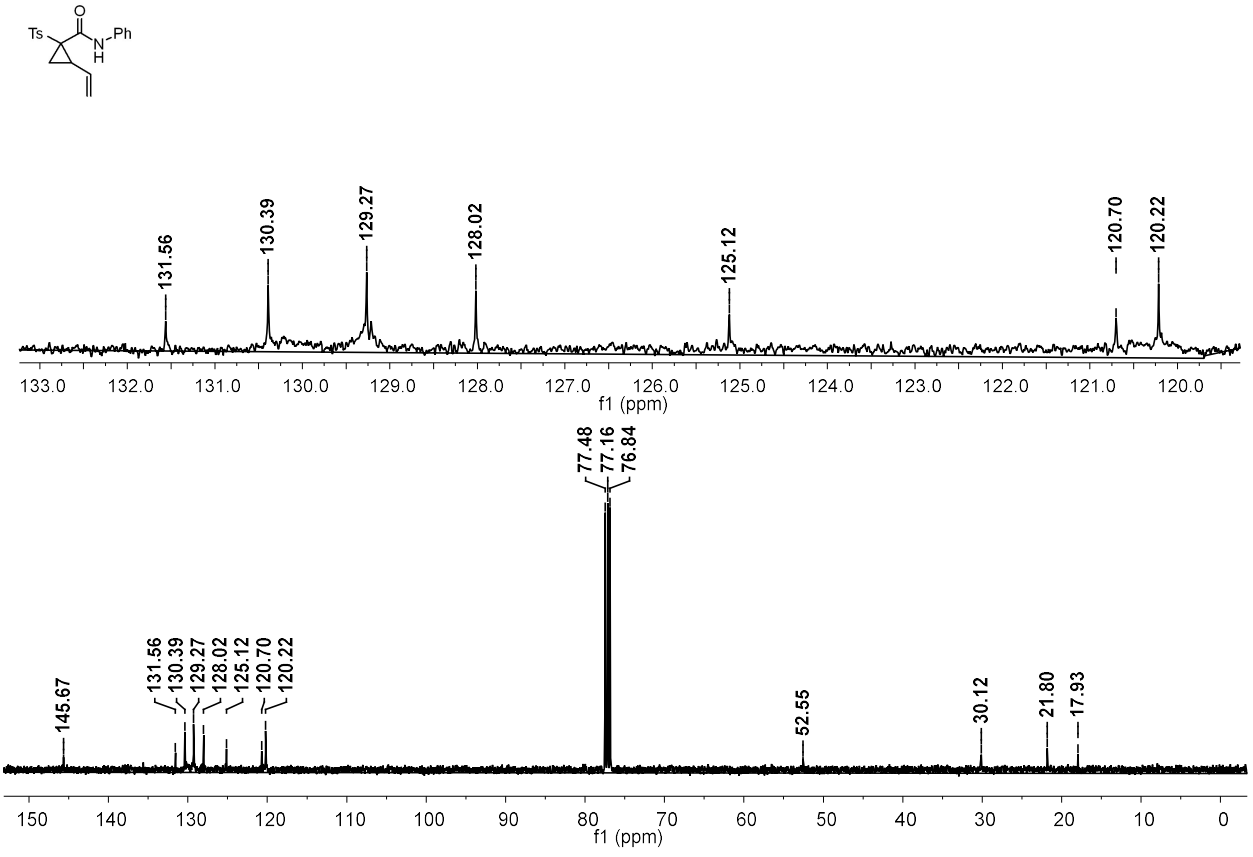
^{13}C{^{1}H} NMR spectra of **1x** (101 MHz, $CDCl_3$)



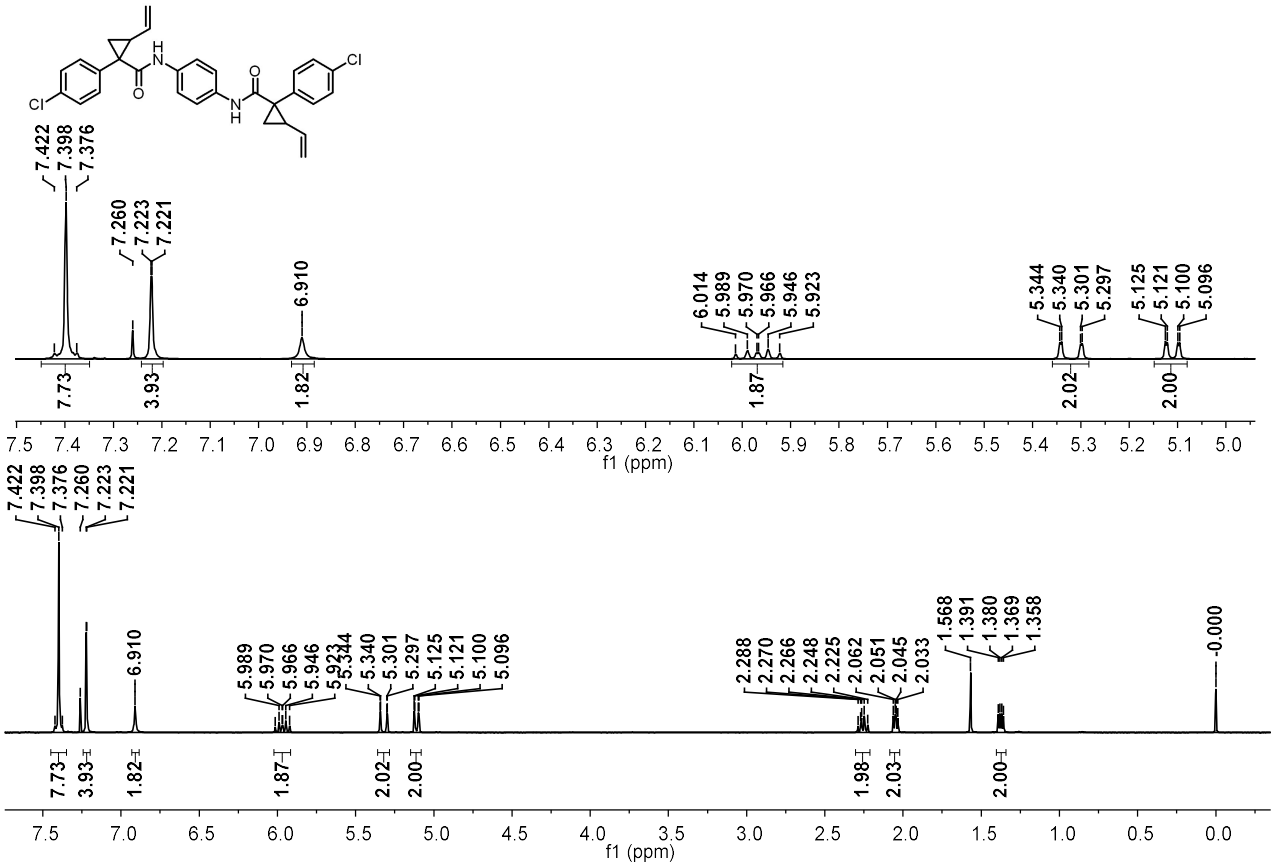
^{1}H NMR spectra of **1y** (600 MHz, $CDCl_3$)



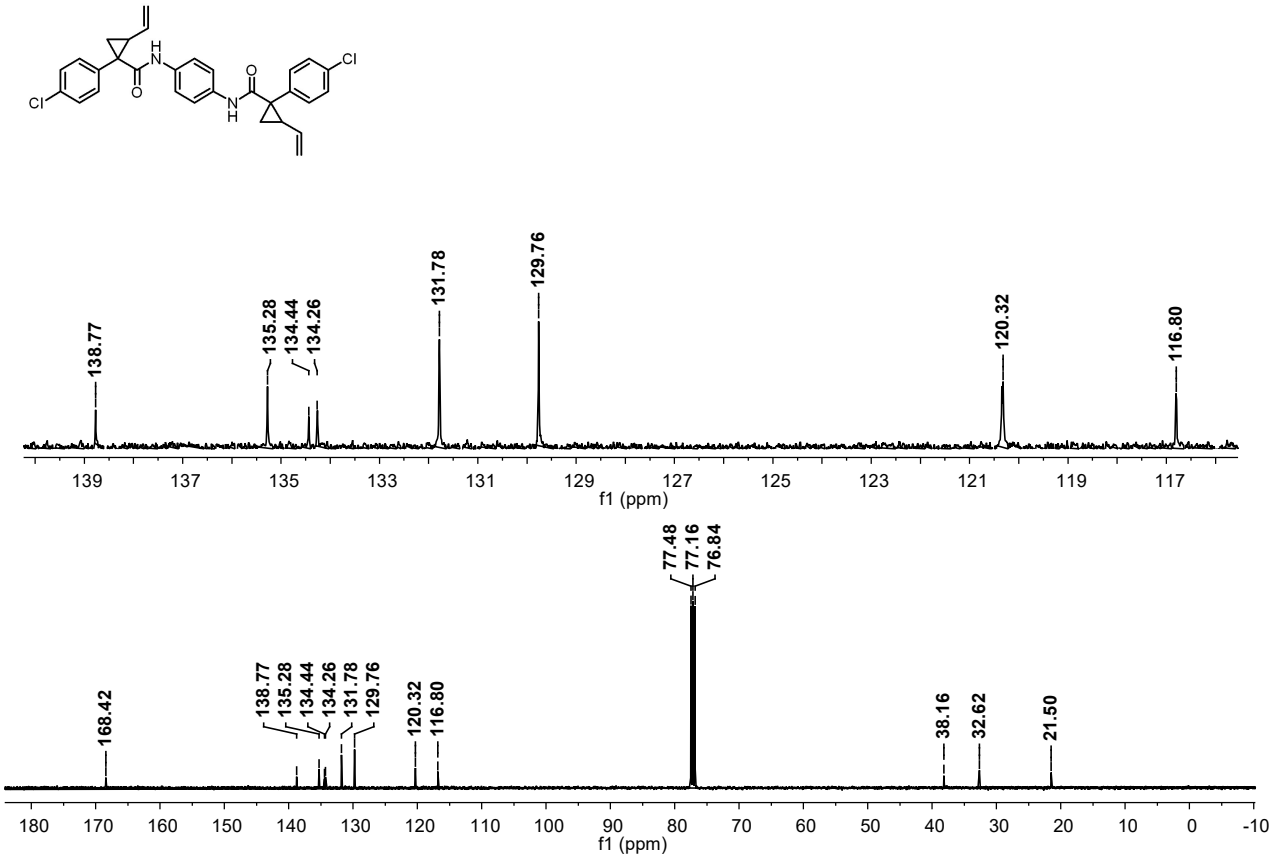
^{13}C{^{1}H} NMR spectra of **1y** (101 MHz, $CDCl_3$)



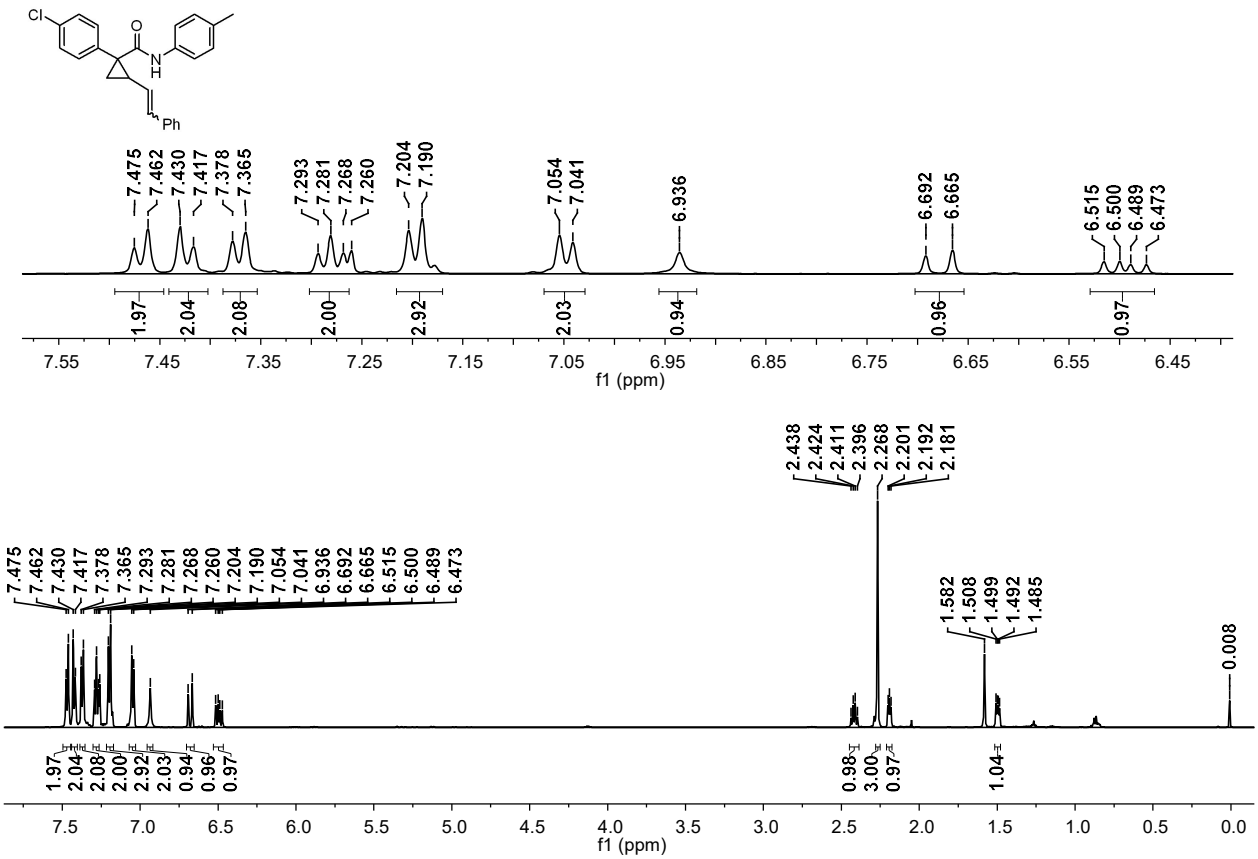
^{1}H NMR spectra of **1z** (400 MHz, $CDCl_3$)



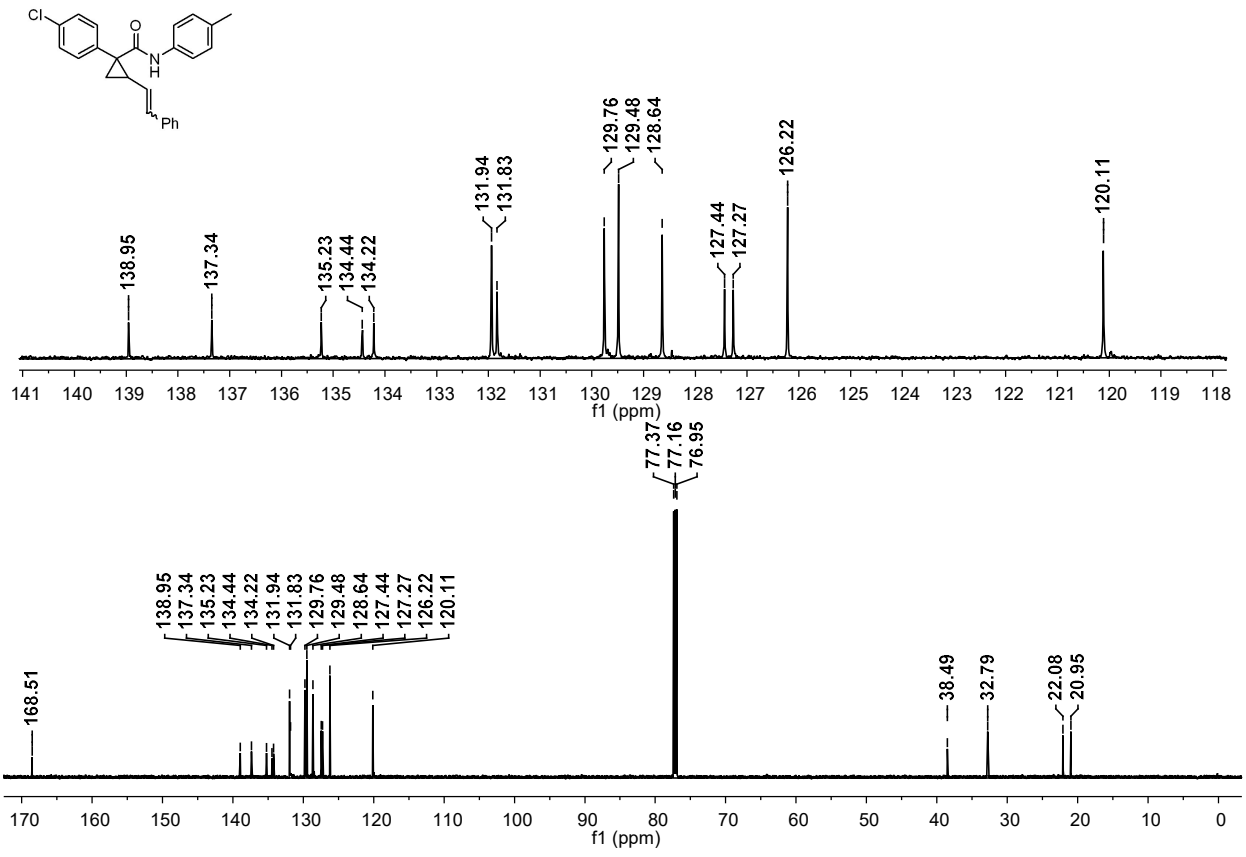
^{13}C{^{1}H} NMR spectra of **1z** (101 MHz, $CDCl_3$)



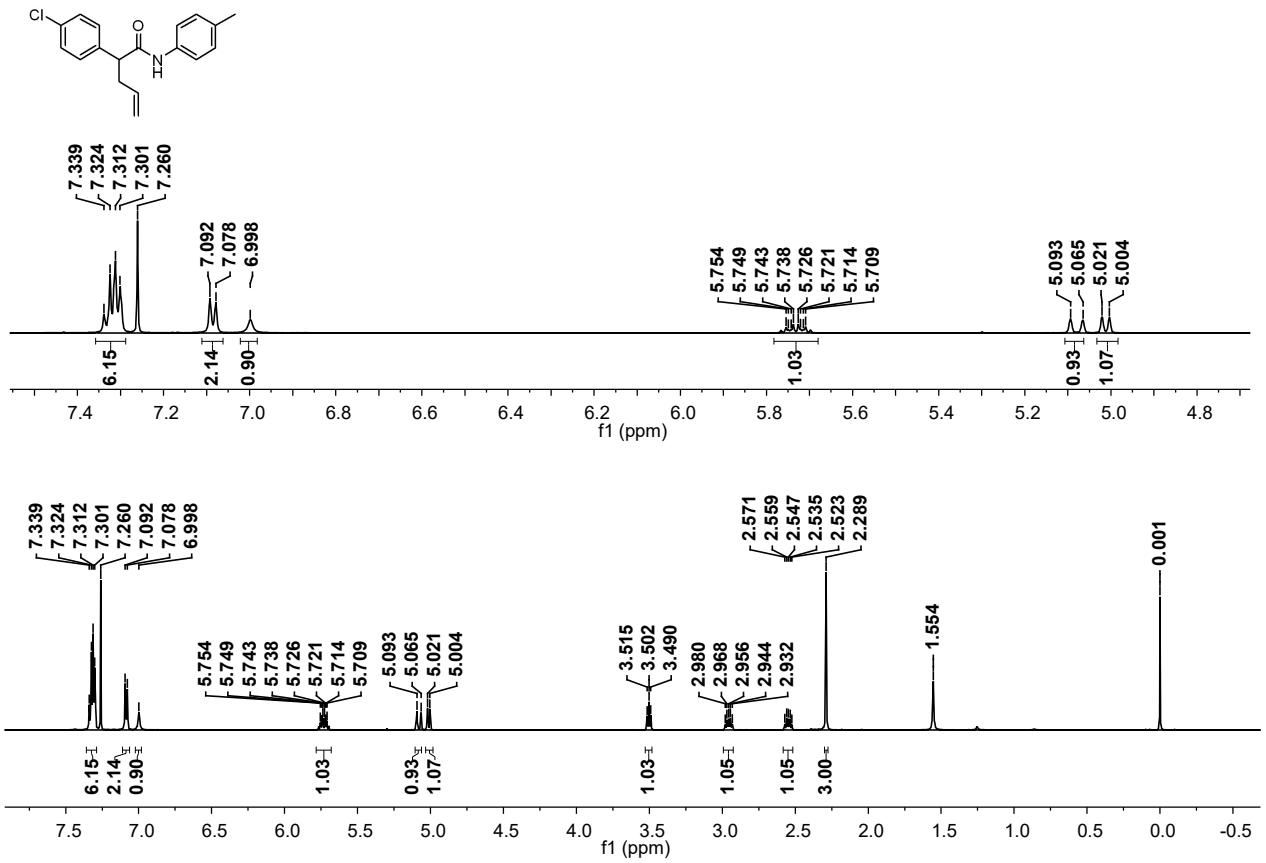
^{1}H NMR spectra of **1aa** (600 MHz, $CDCl_3$)



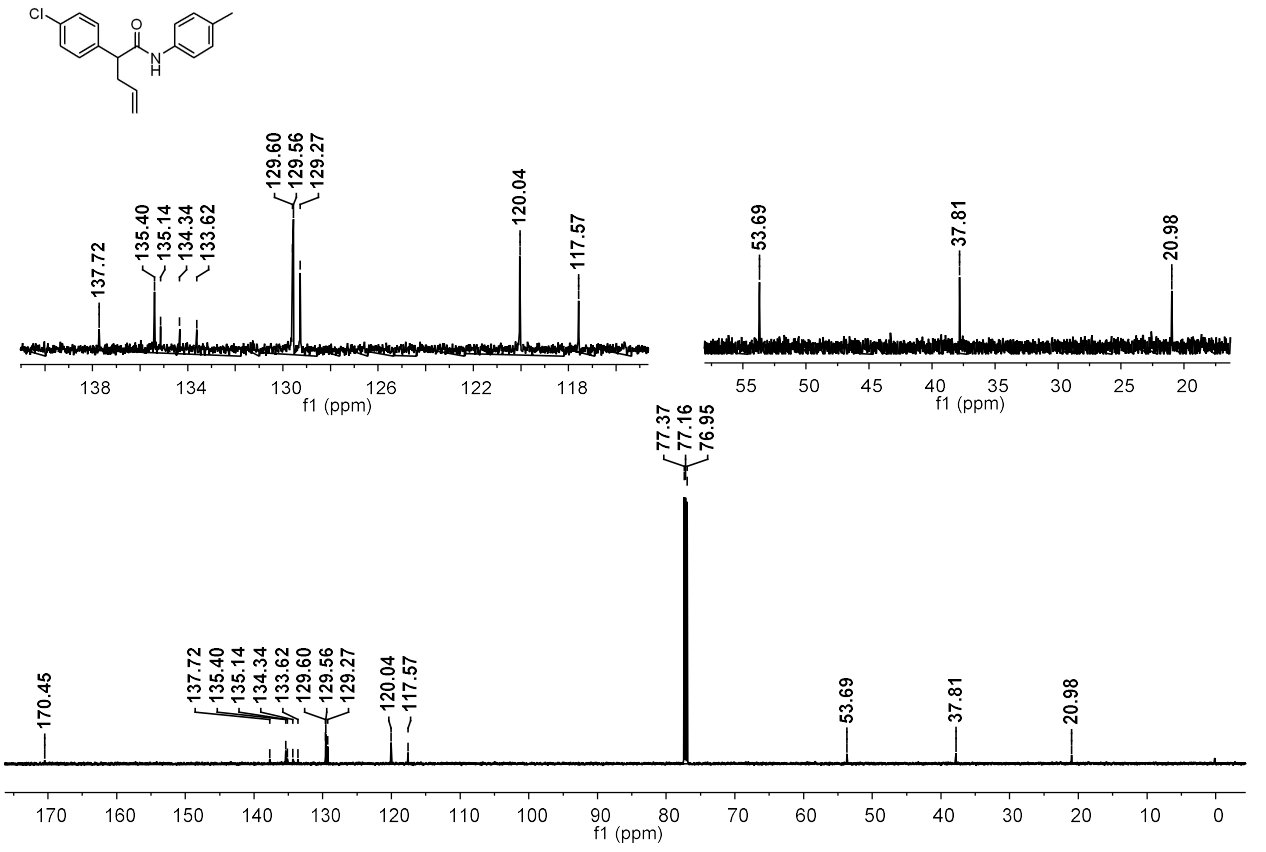
^{13}C{^{1}H} NMR spectra of **1aa** (151 MHz, $CDCl_3$)



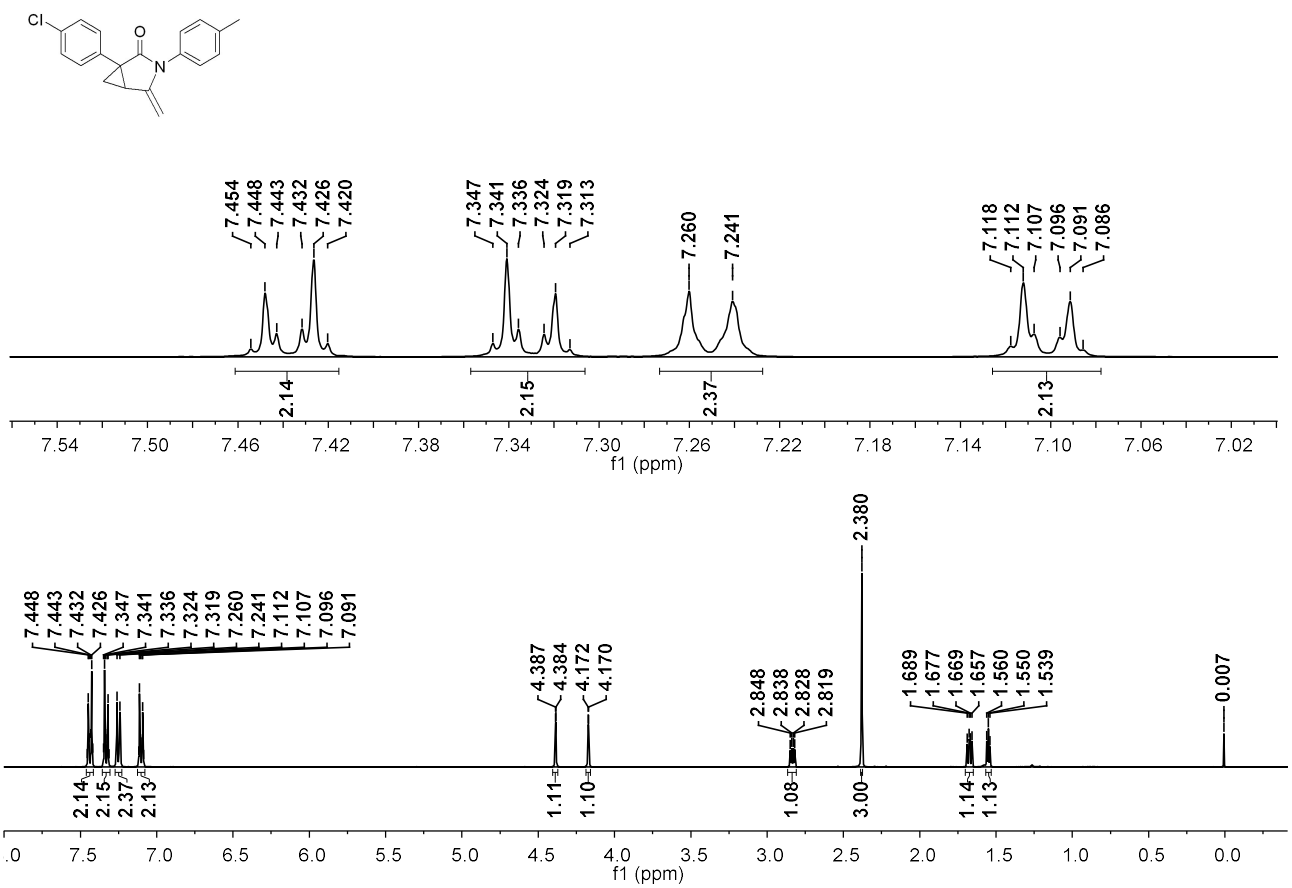
^{1}H NMR spectra of **1ab** (600 MHz, $CDCl_3$)



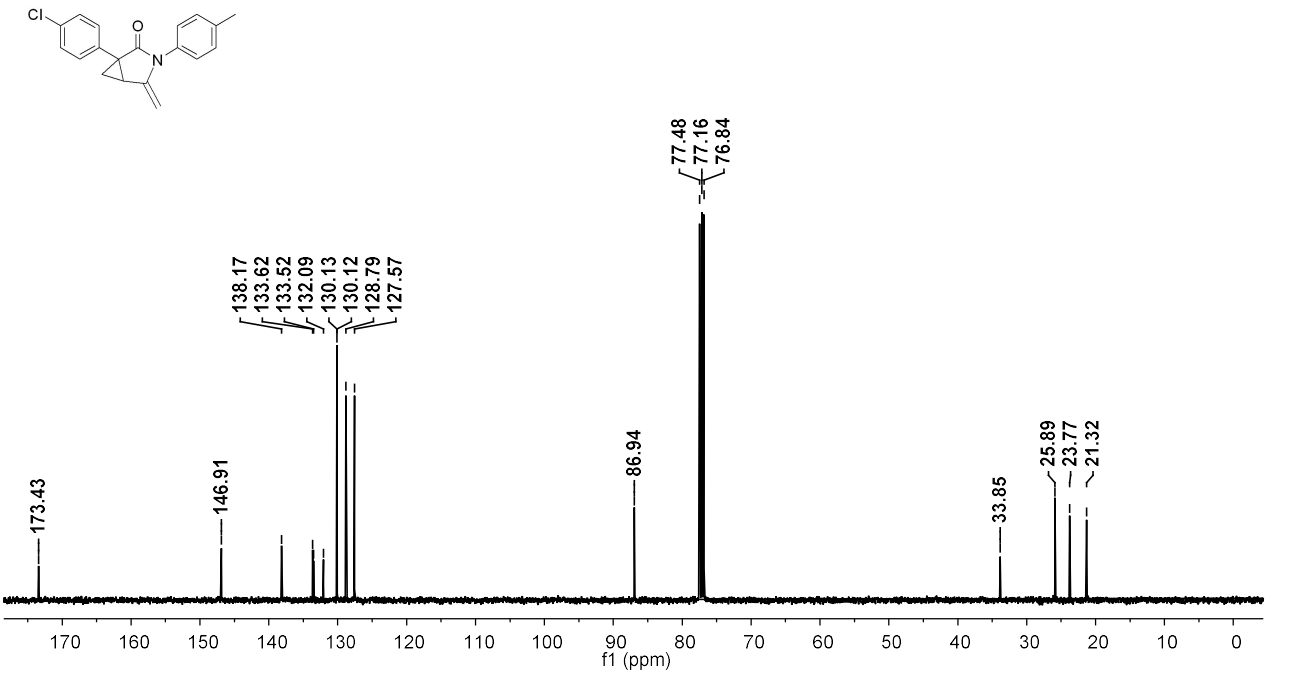
^{13}C{^{1}H} NMR spectra of **1ab** (151 MHz, $CDCl_3$)



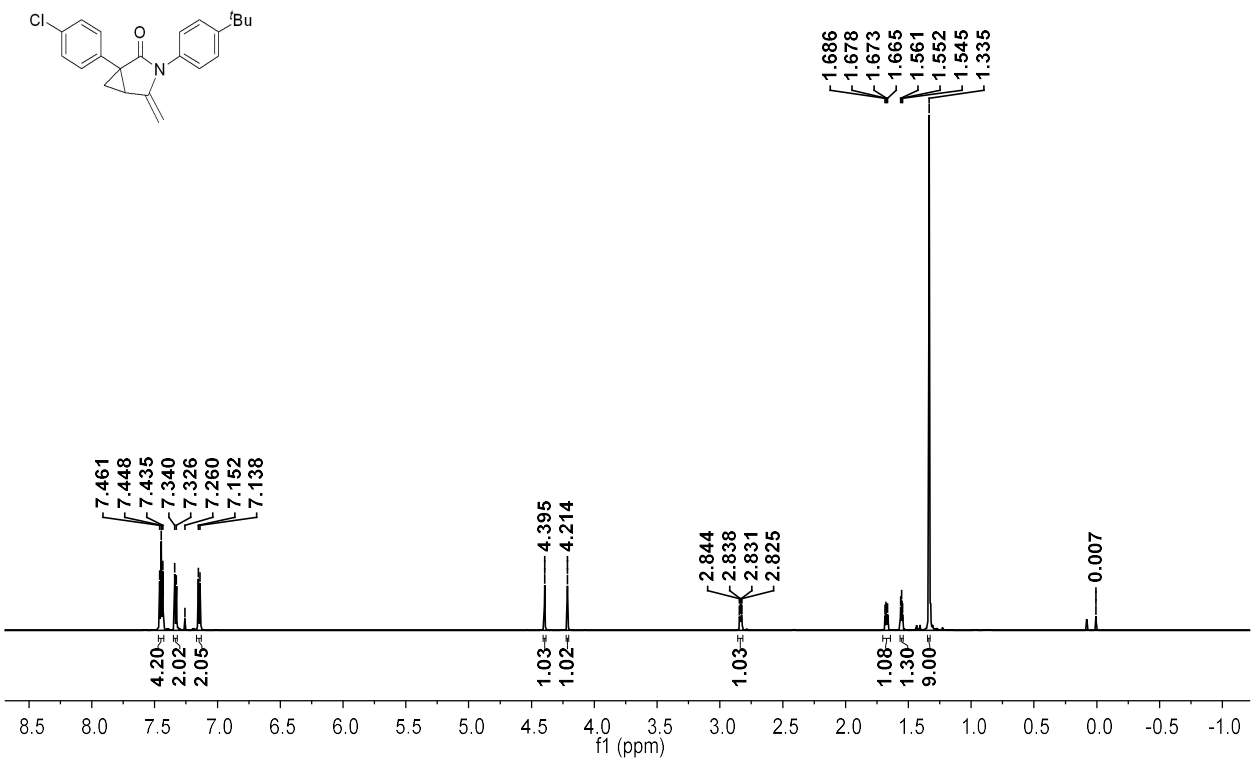
^{1}H NMR spectra of **2a** (400 MHz, $CDCl_3$)



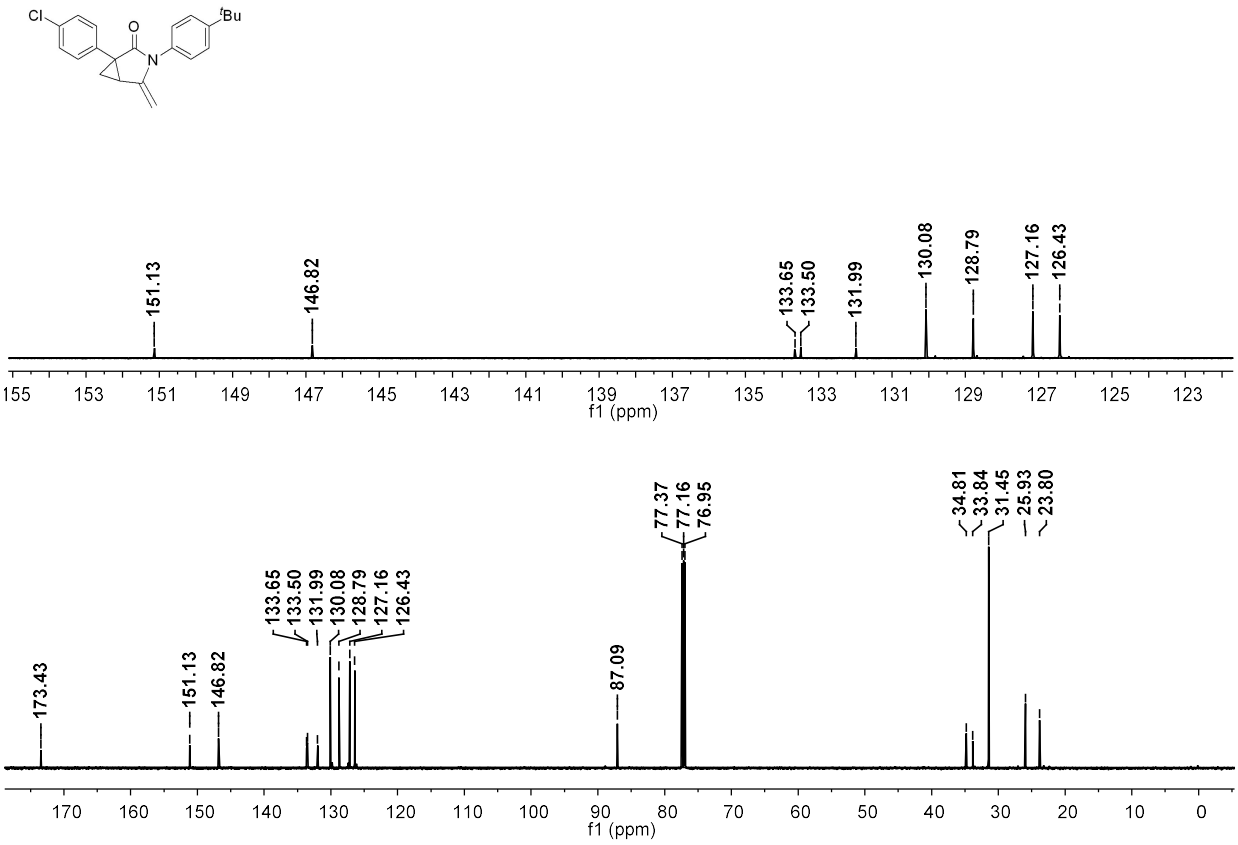
^{13}C{^{1}H} NMR spectra of **2a** (101 MHz, $CDCl_3$)



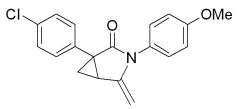
^{1}H NMR spectra of **2b** (600 MHz, $CDCl_3$)

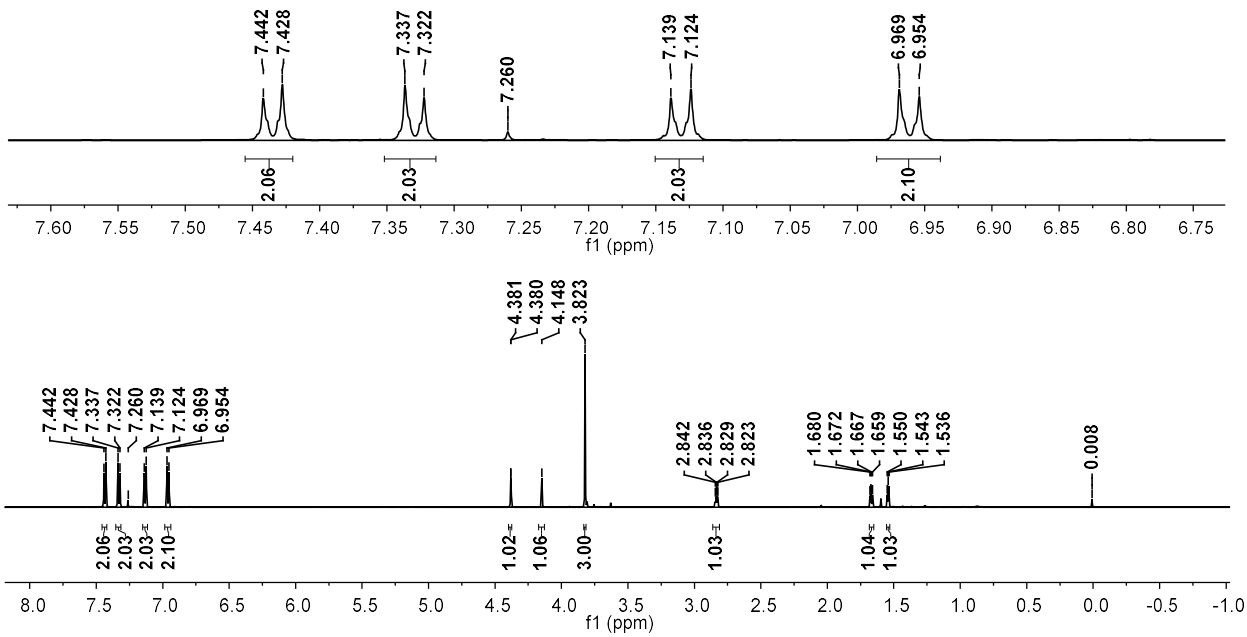


^{13}C{^{1}H} NMR spectra of **2b** (151 MHz, $CDCl_3$)

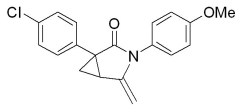


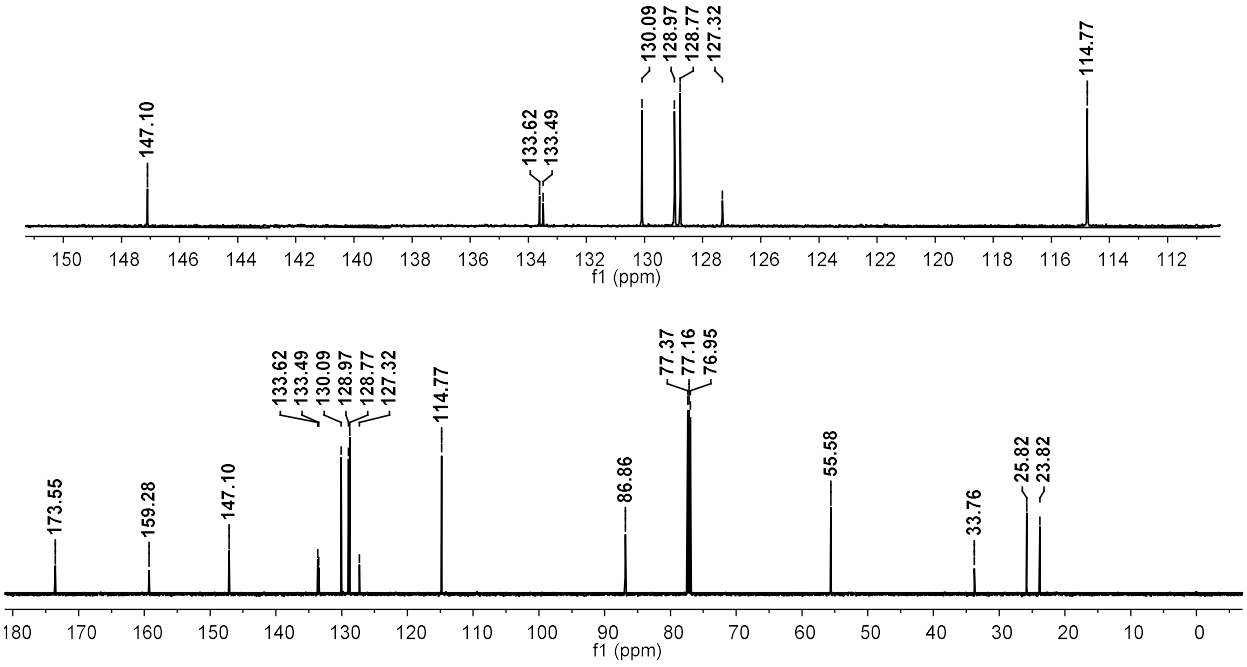
^{1}H NMR spectra of **2c** (600 MHz, $CDCl_3$)



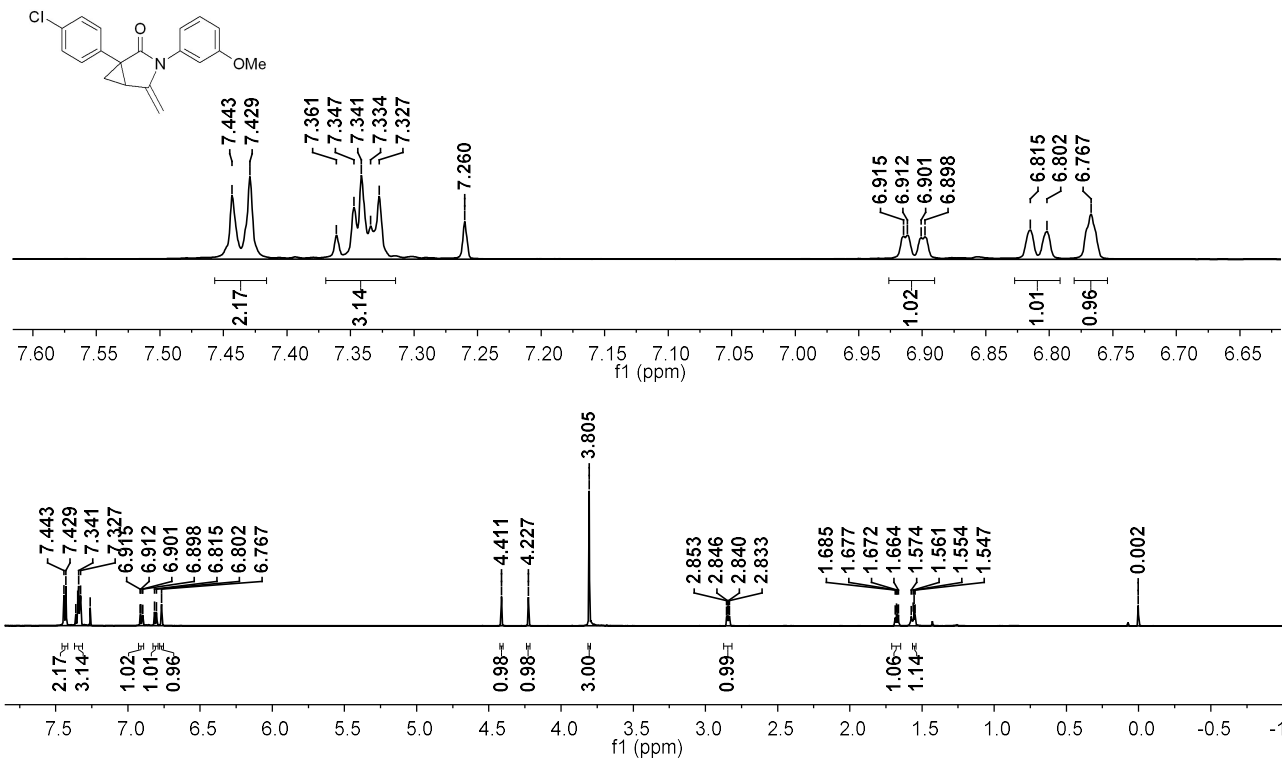


^{13}C{^{1}H} NMR spectra of **2c** (151 MHz, $CDCl_3$)

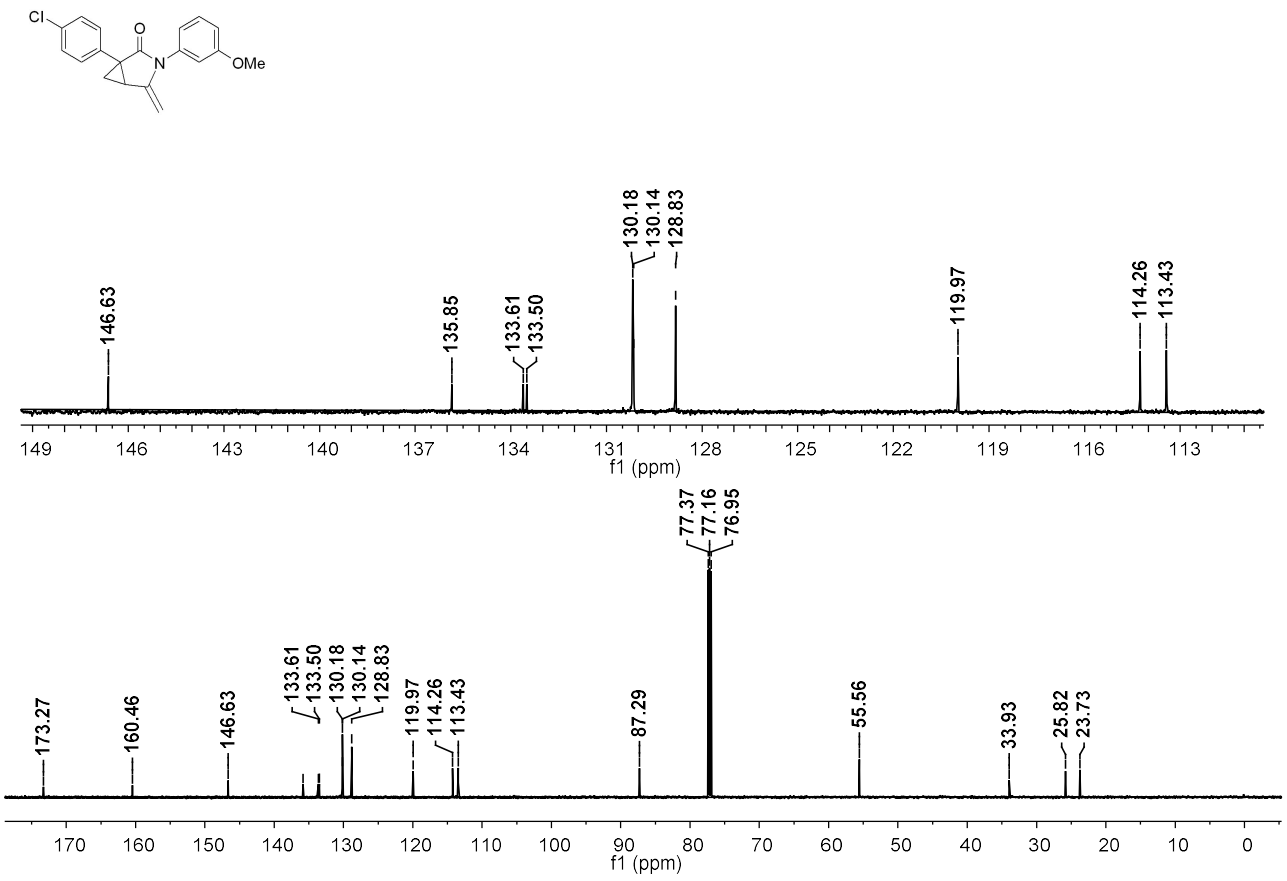




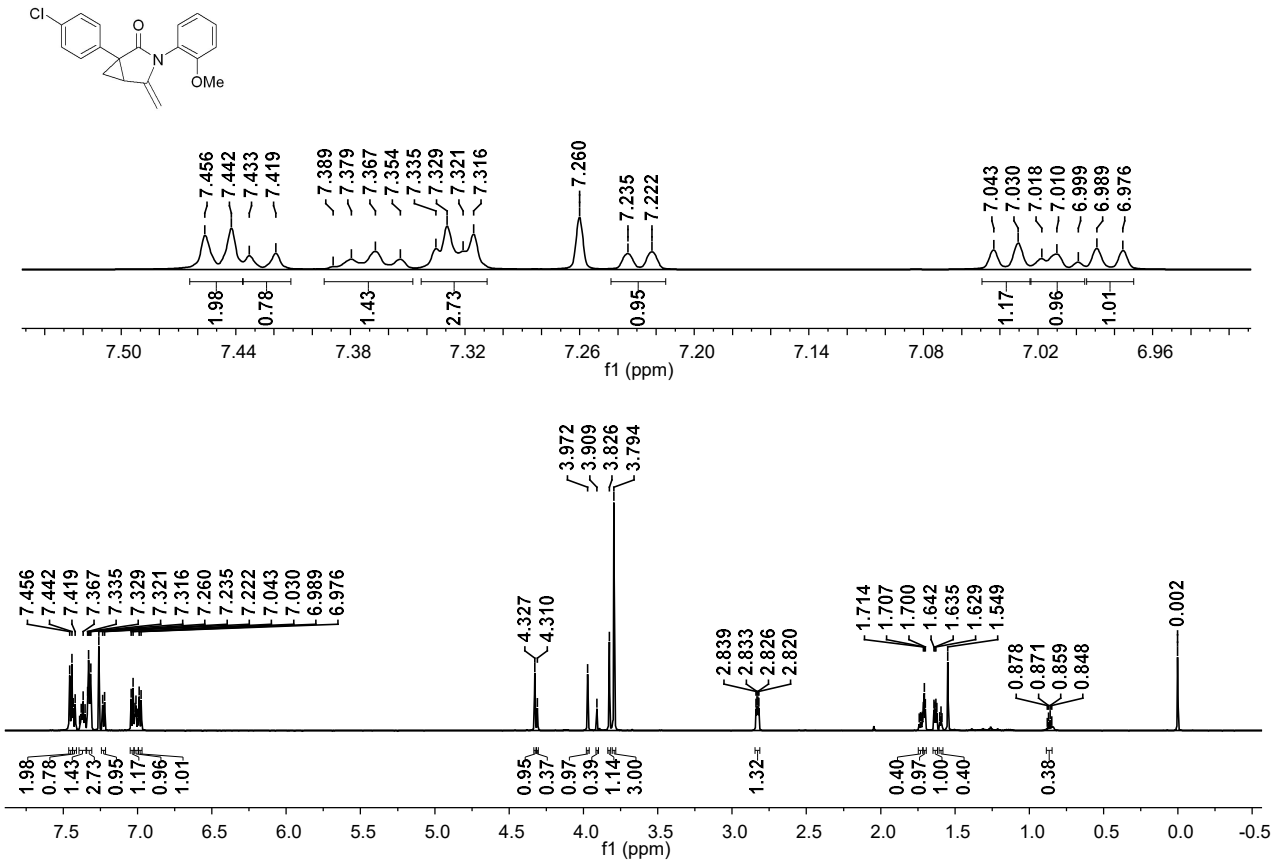
^{1}H NMR spectra of **2d** (600 MHz, $CDCl_3$)



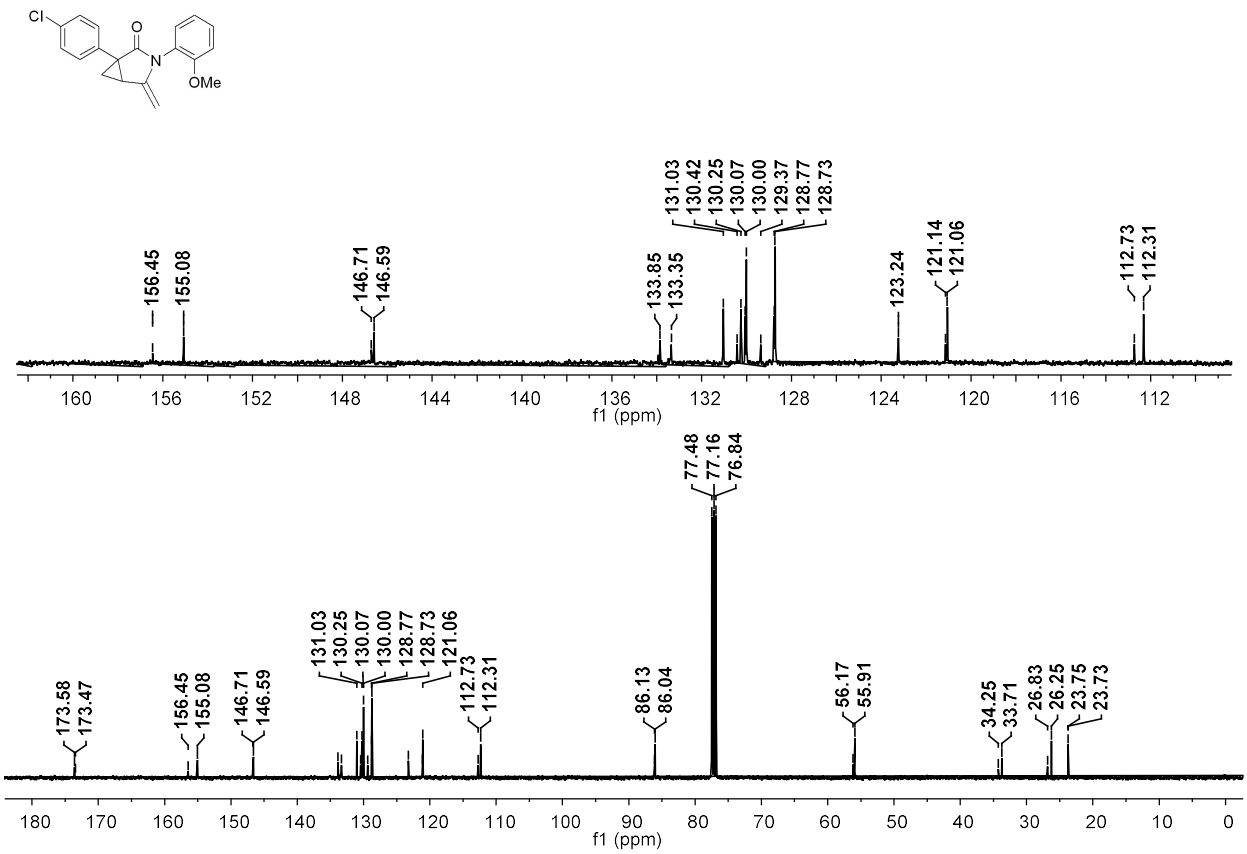
^{13}C{^{1}H} NMR spectra of **2d** (151 MHz, $CDCl_3$)



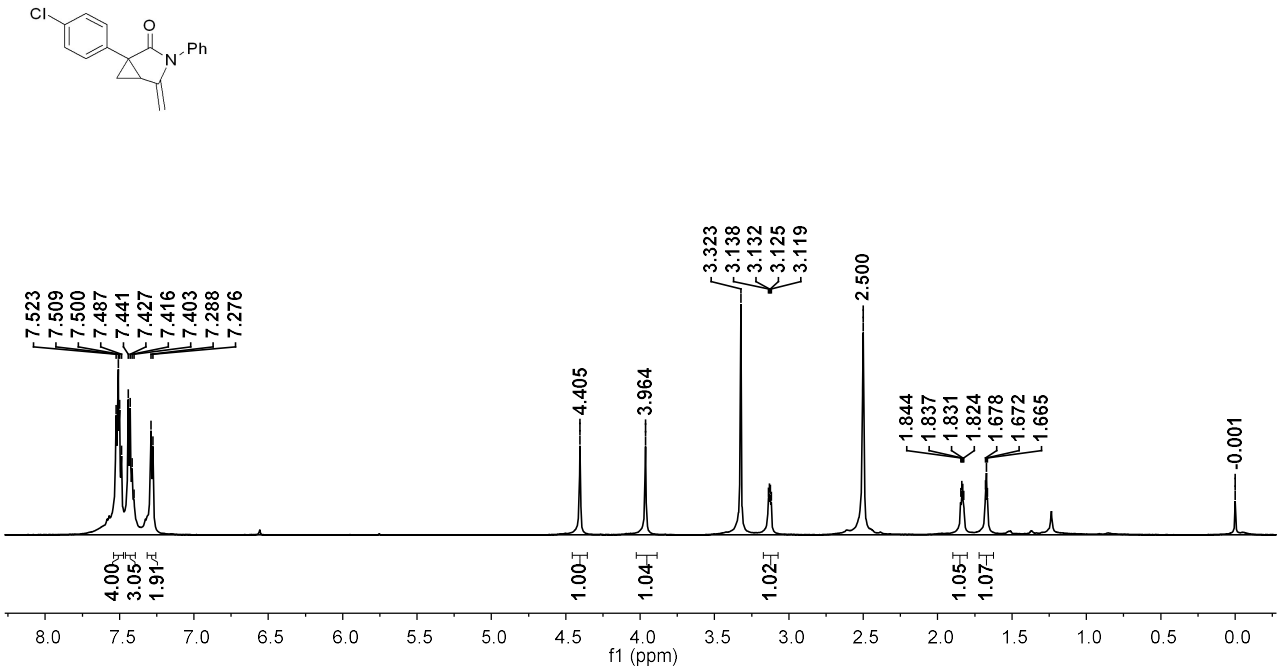
^{1}H NMR spectra of **2e** (600 MHz, $CDCl_3$)



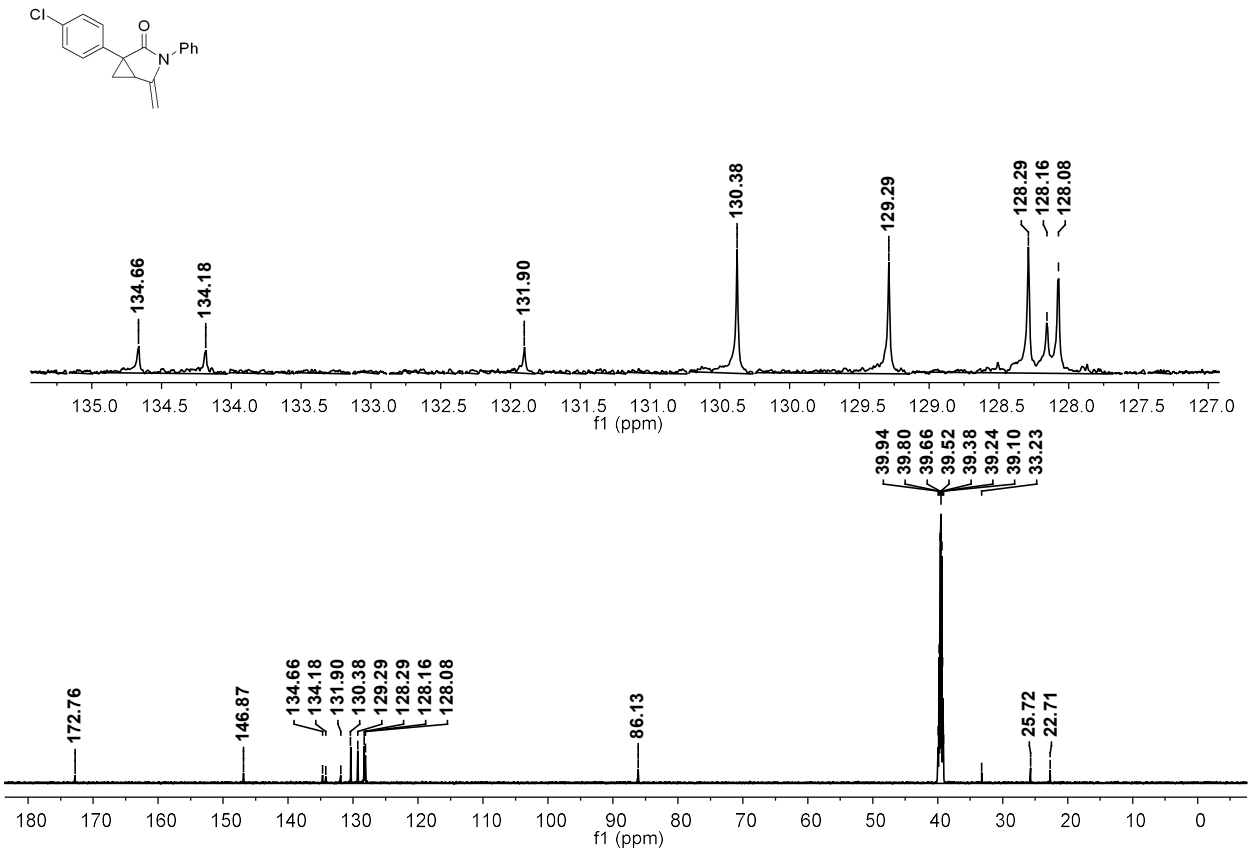
$^{13}C\{^{1}H\}$ NMR spectra of **2e** (101 MHz, $CDCl_3$)



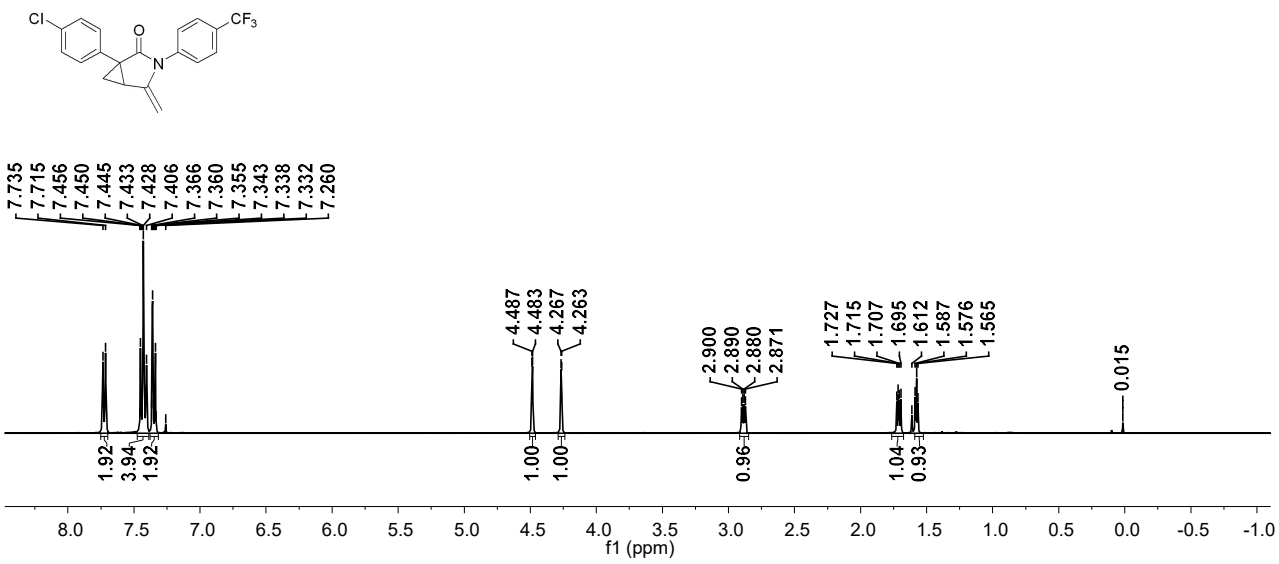
^{1}H NMR spectra of **2f** (600 MHz, DMSO)



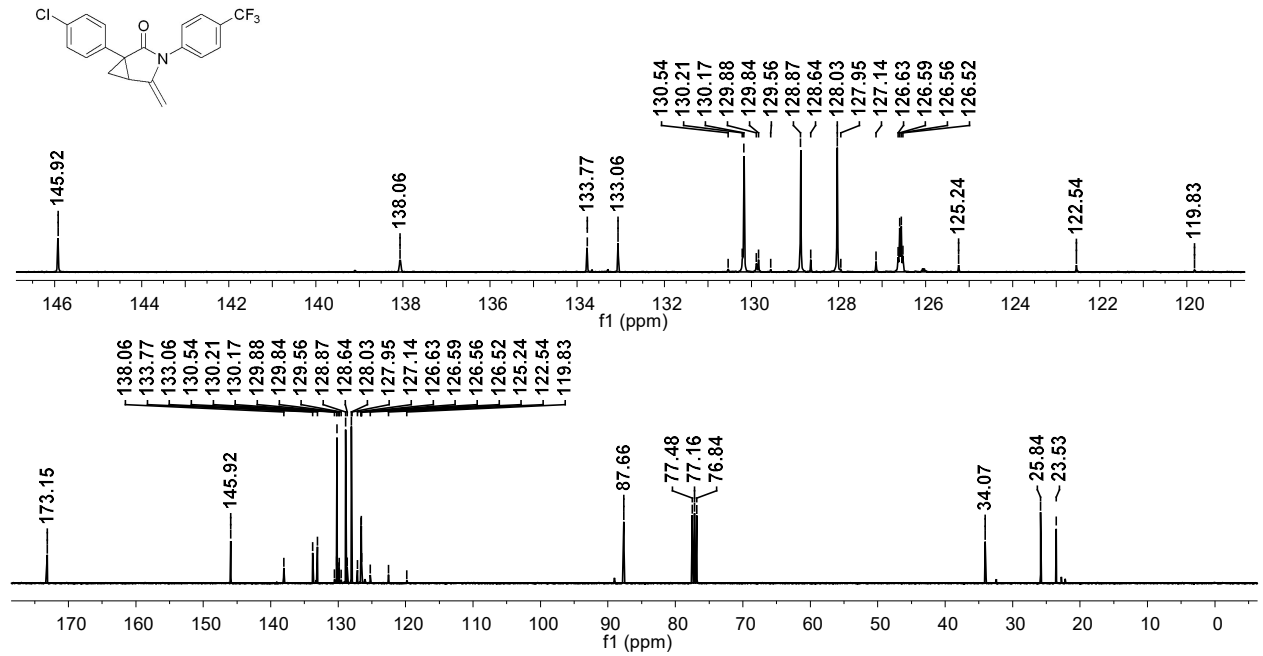
$^{13}C\{^{1}H\}$ NMR spectra of **2f** (151 MHz, DMSO)



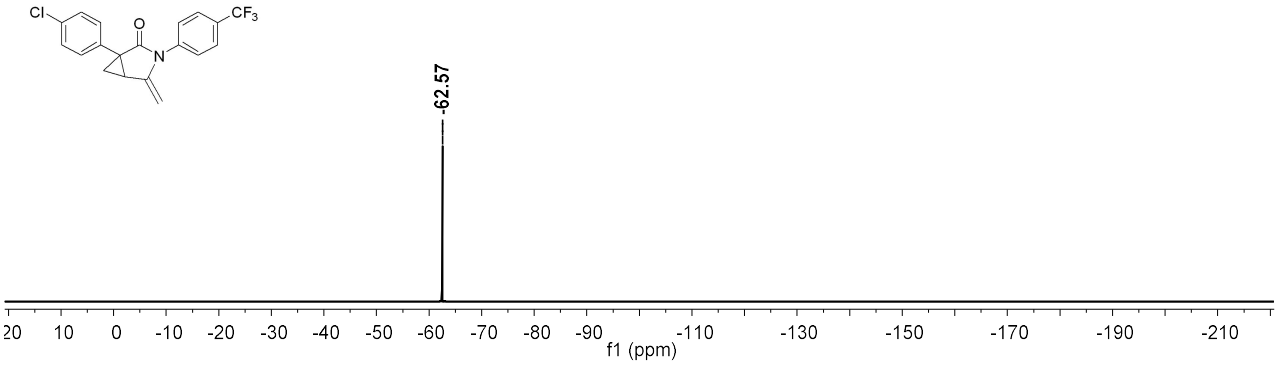
^{1}H NMR spectra of **2g** (400 MHz, $CDCl_3$)



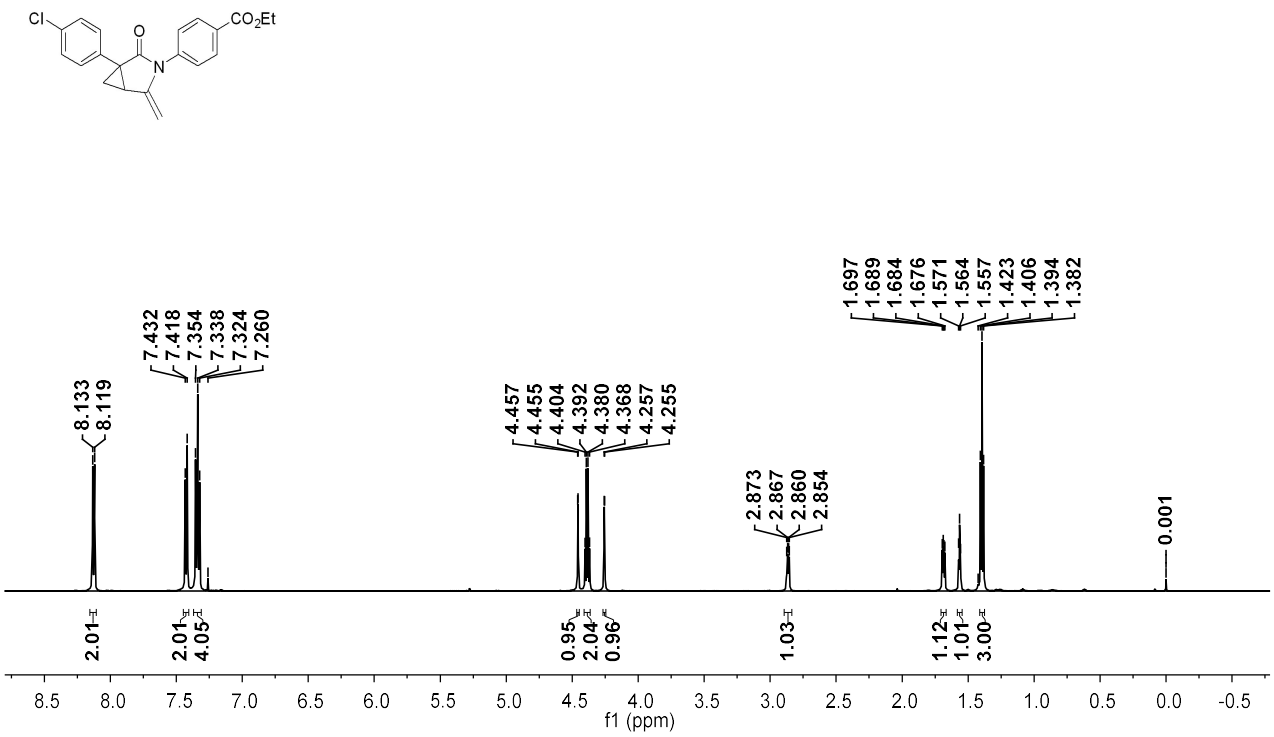
$^{13}C\{^{1}H\}$ NMR spectra of **2g** (101 MHz, $CDCl_3$)



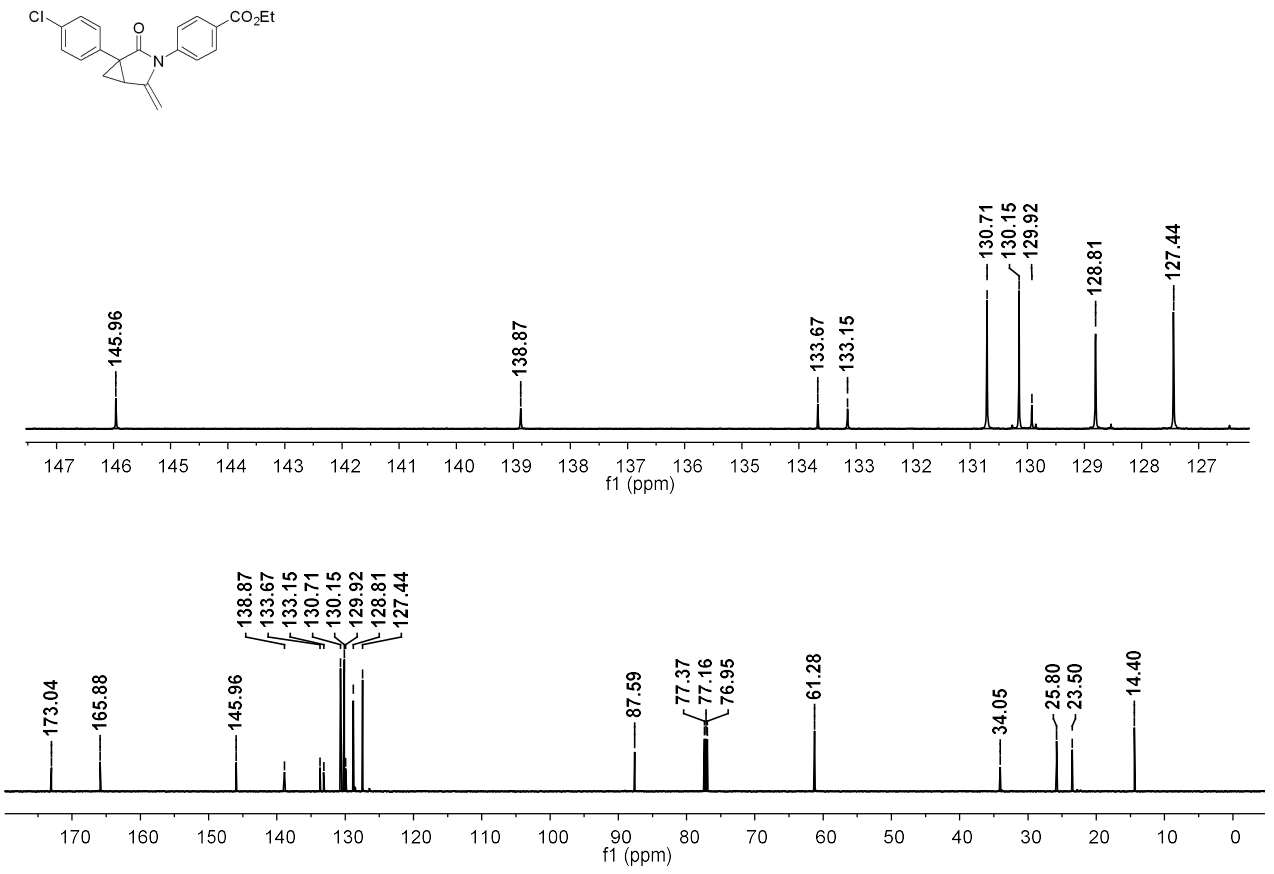
^{19}F NMR spectra of **2g** (376 MHz, $CDCl_3$)



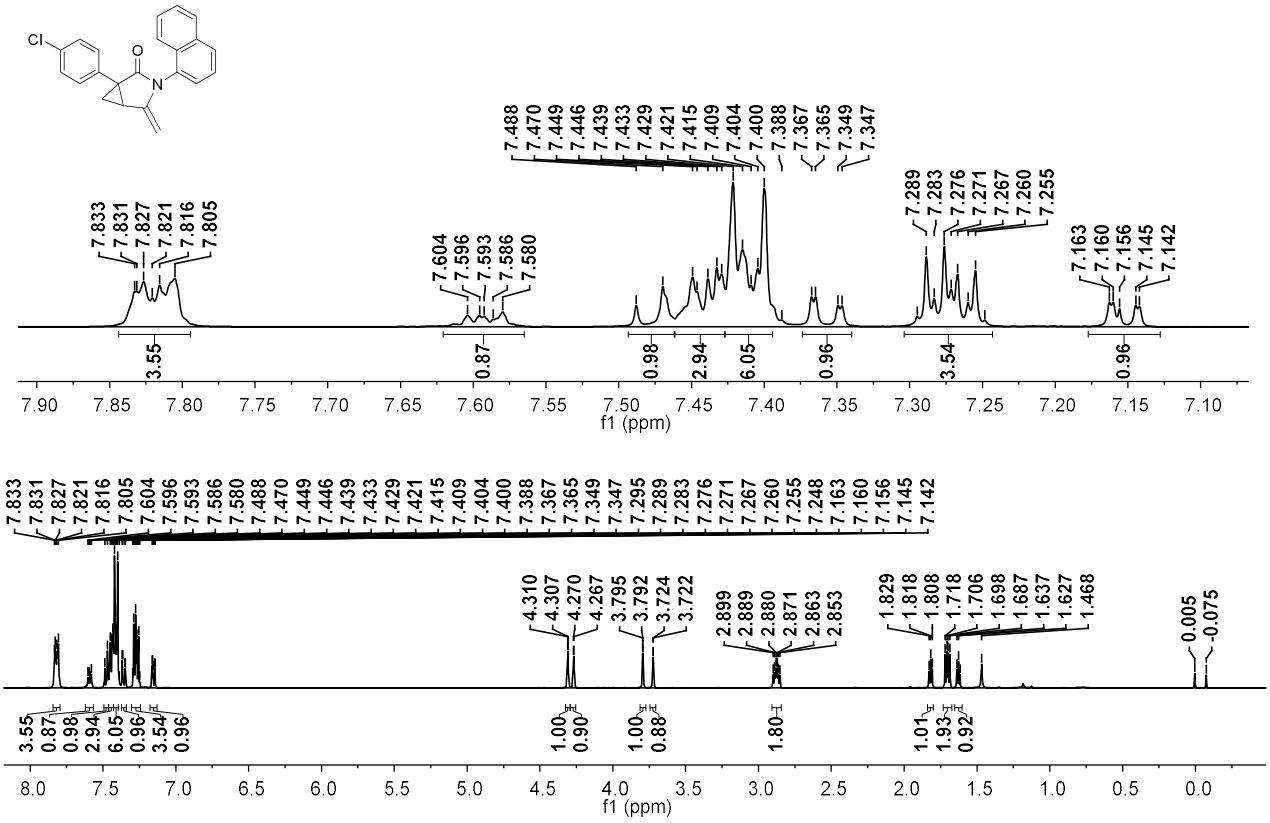
^{1}H NMR spectra of **2h** (600 MHz, $CDCl_3$)



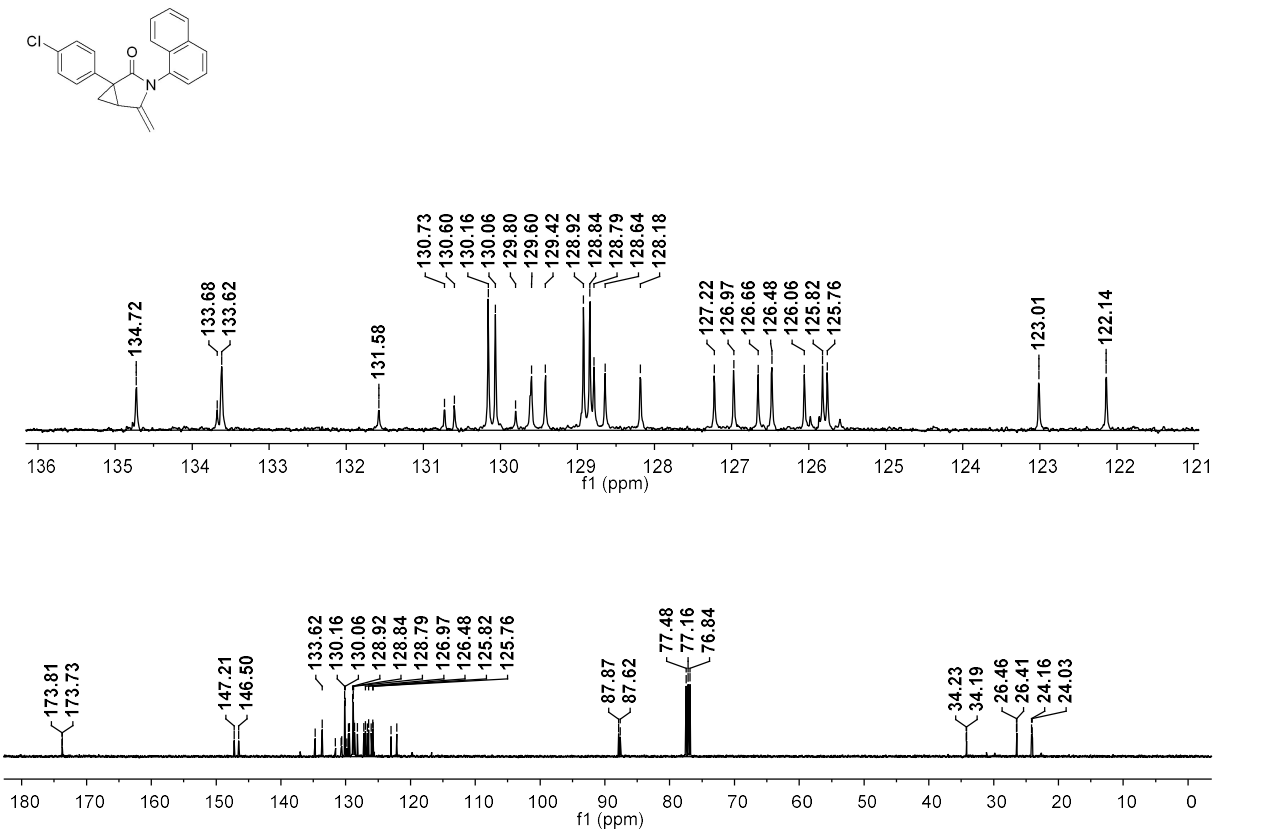
^{13}C{^{1}H} NMR spectra of **2h** (151 MHz, $CDCl_3$)



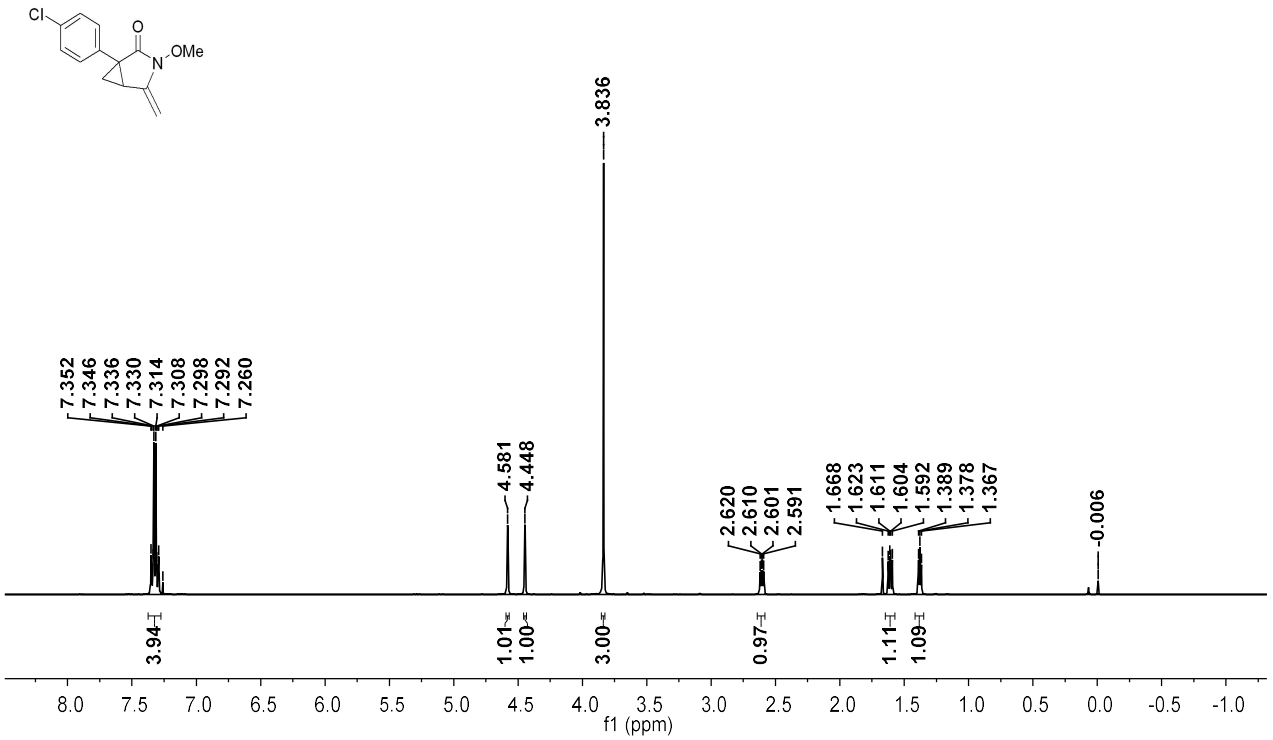
^{1}H NMR spectra of **2i** (400 MHz, $CDCl_3$)



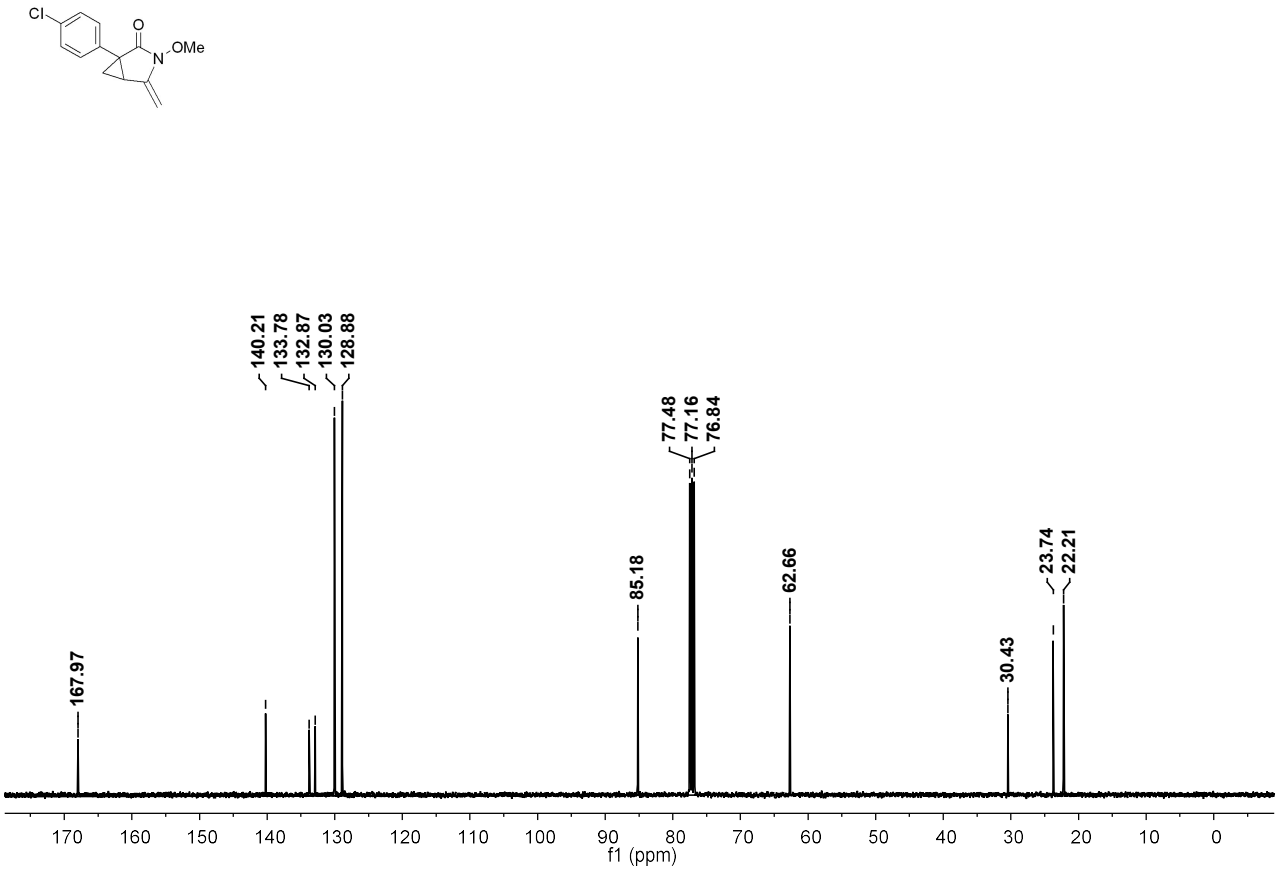
^{13}C{^{1}H} NMR spectra of **2i** (151 MHz, $CDCl_3$)



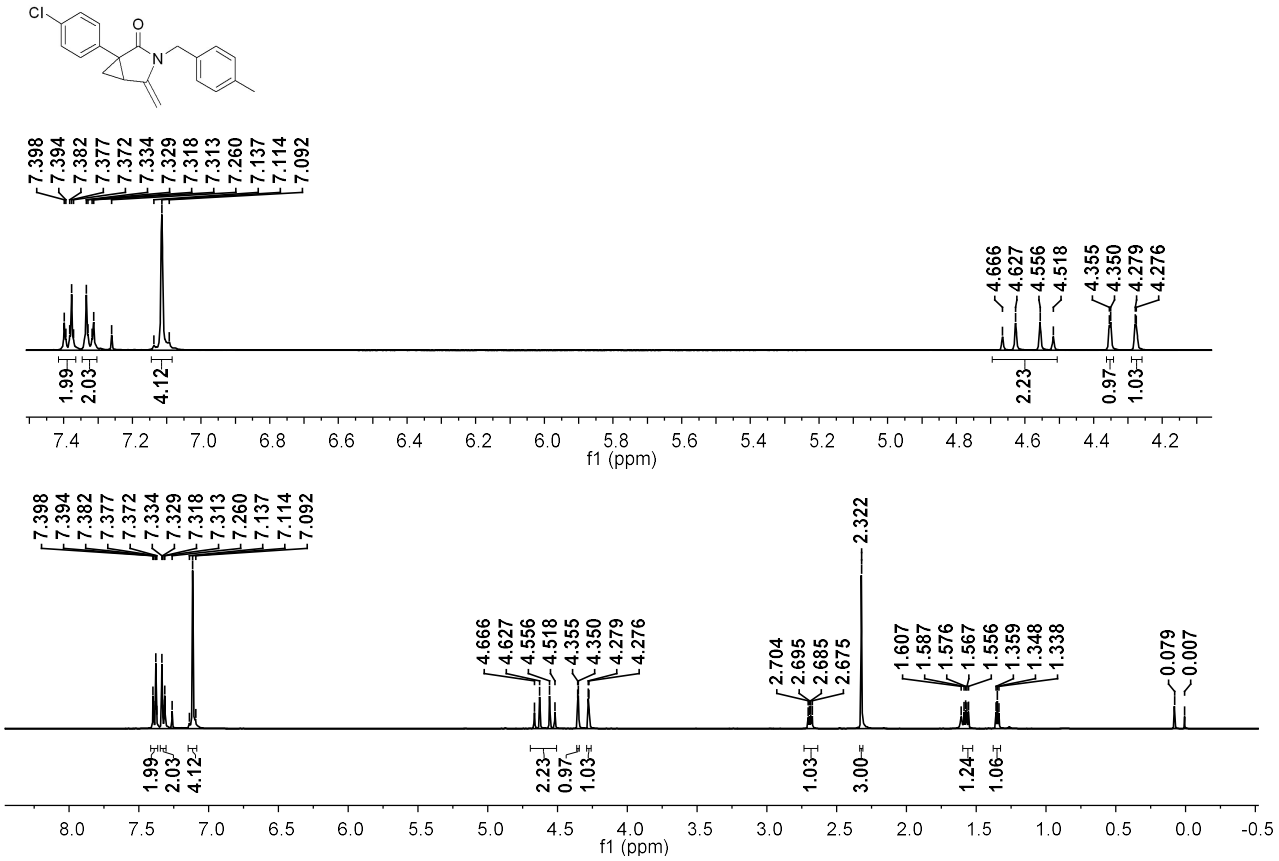
^{1}H NMR spectra of **2k** (400 MHz, $CDCl_3$)



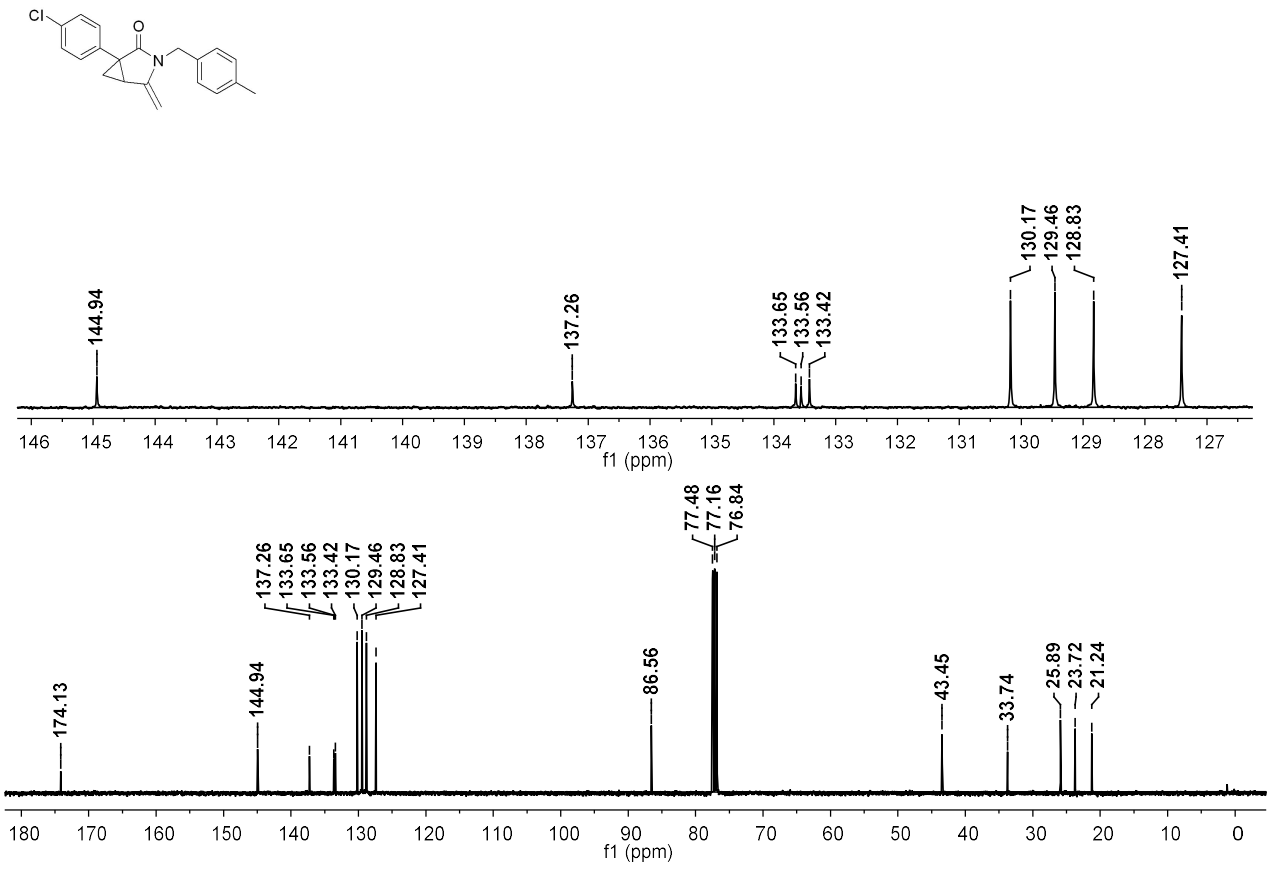
^{13}C{^{1}H} NMR spectra of **2k** (101 MHz, $CDCl_3$)



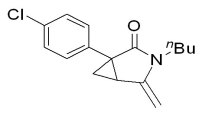
^{1}H NMR spectra of **2l** (400 MHz, $CDCl_3$)

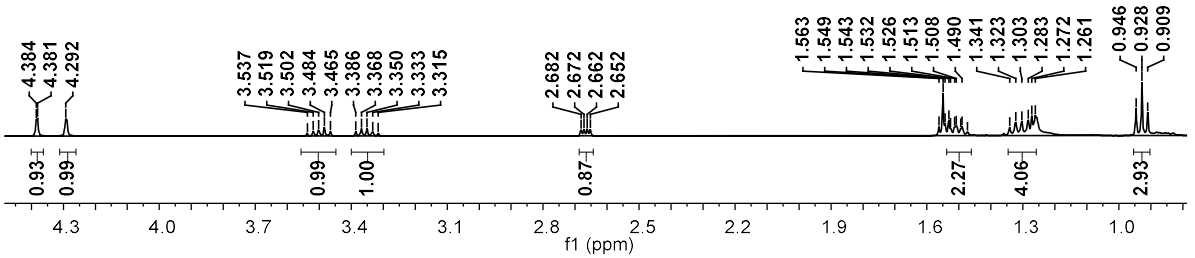


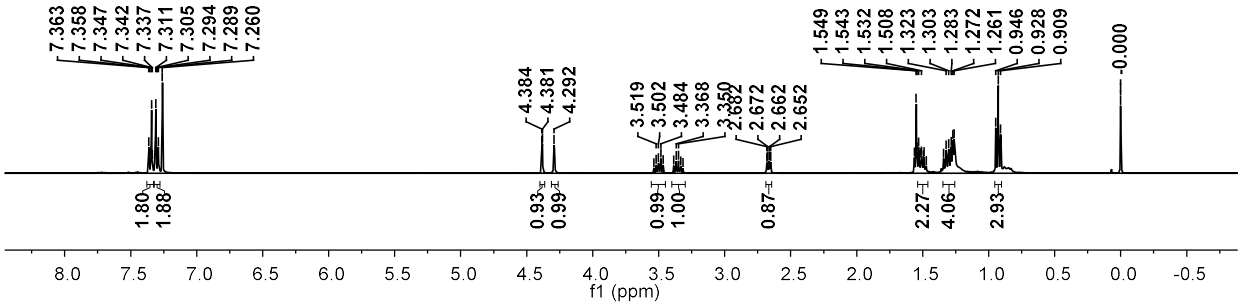
^{13}C{^{1}H} NMR spectra of **2l** (101 MHz, $CDCl_3$)



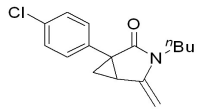
^{1}H NMR spectra of **2m** (400 MHz, $CDCl_3$)

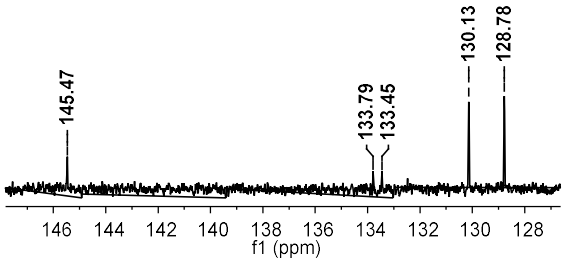


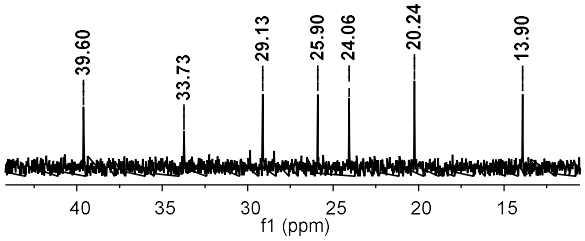


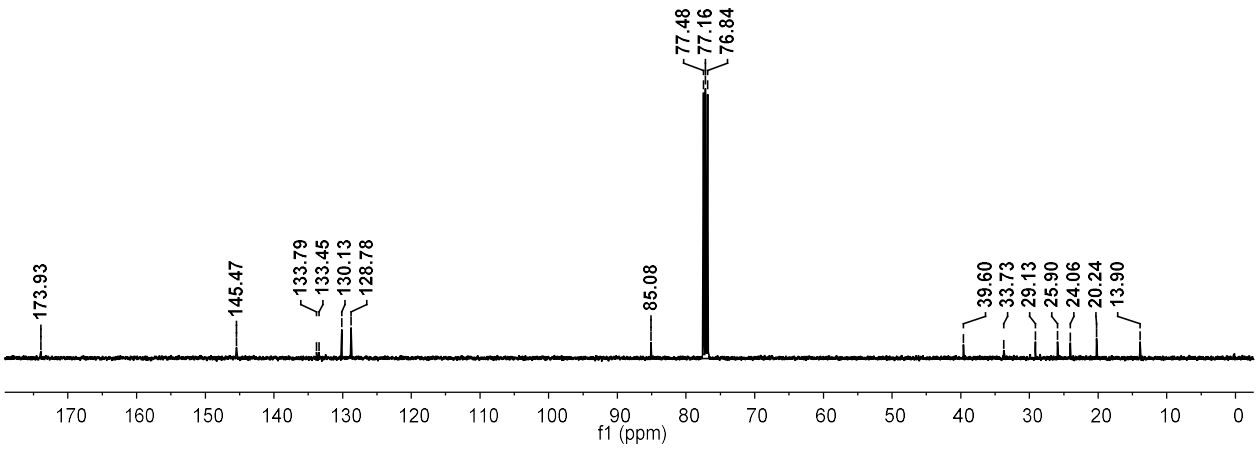


^{13}C{^{1}H} NMR spectra of **2m** (101 MHz, $CDCl_3$)

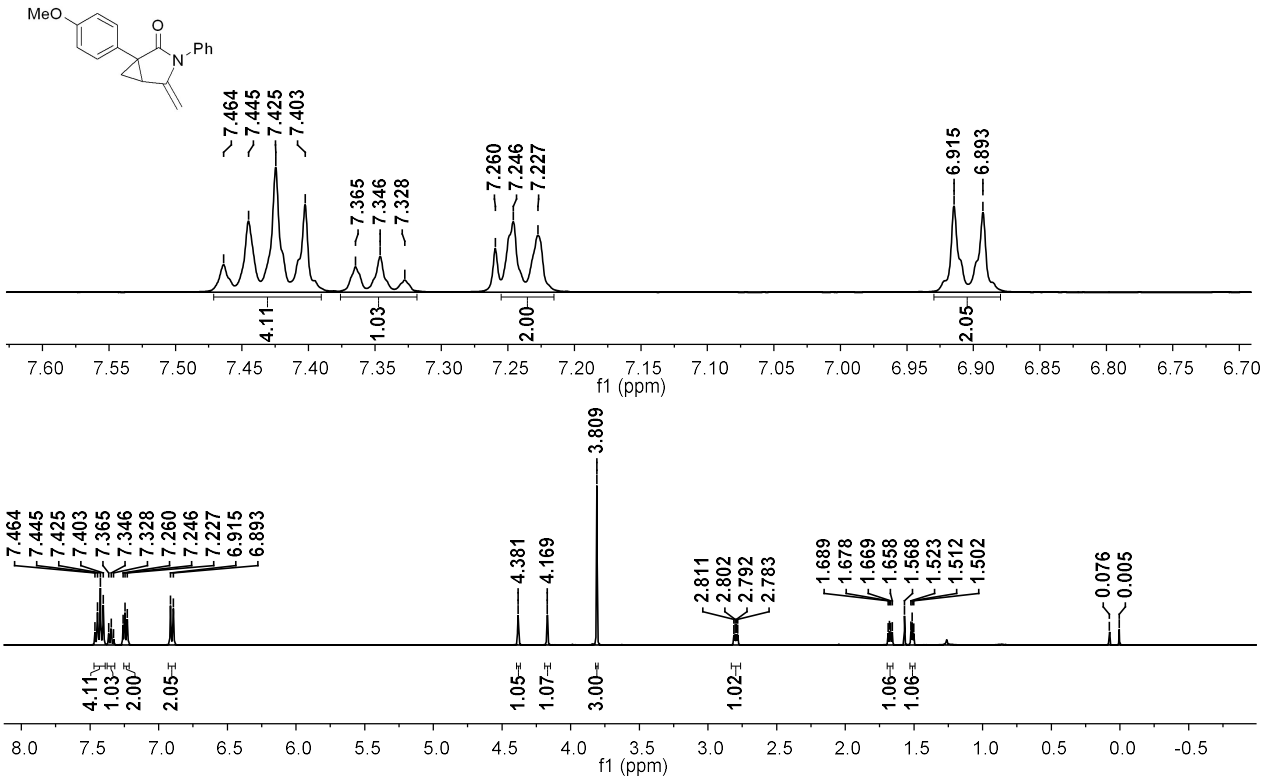




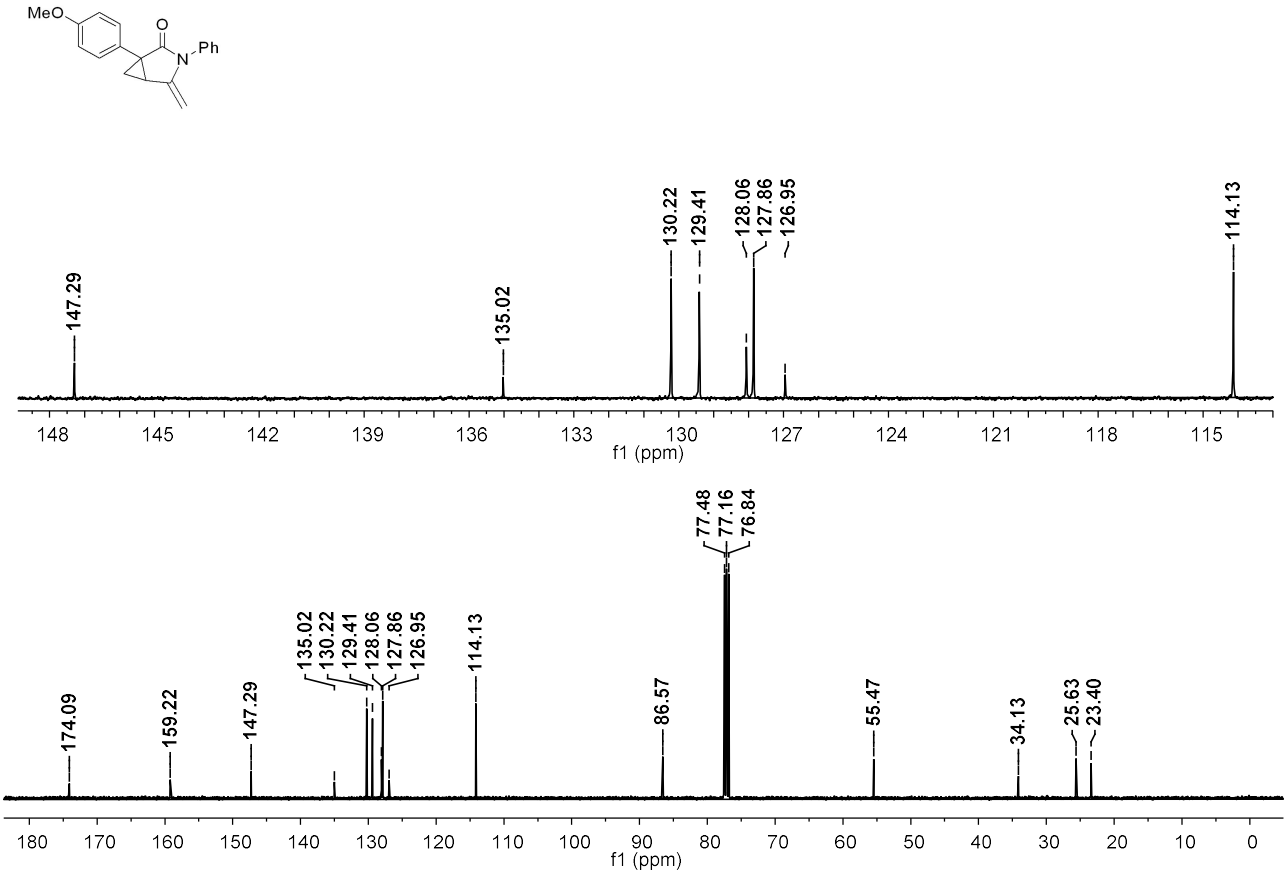




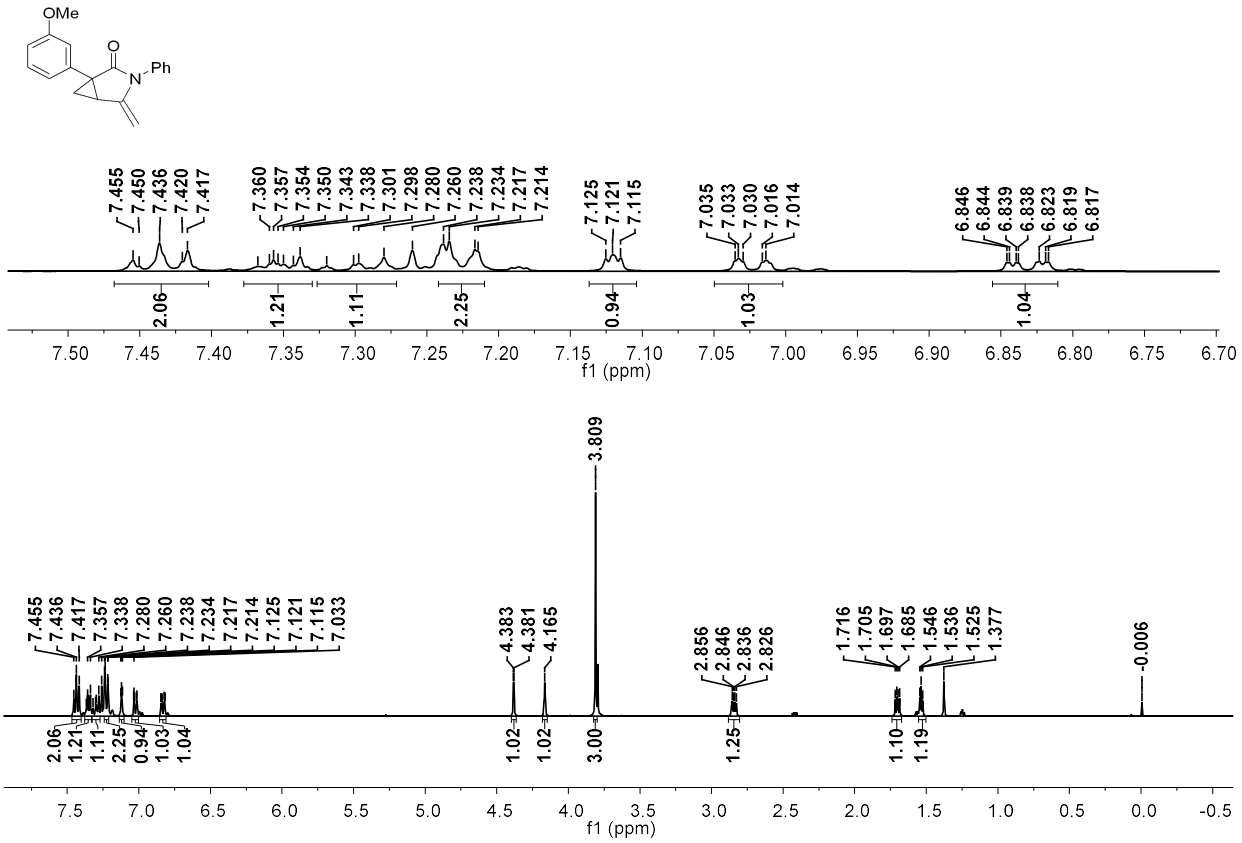
^{1}H NMR spectra of **2p** (400 MHz, $CDCl_3$)



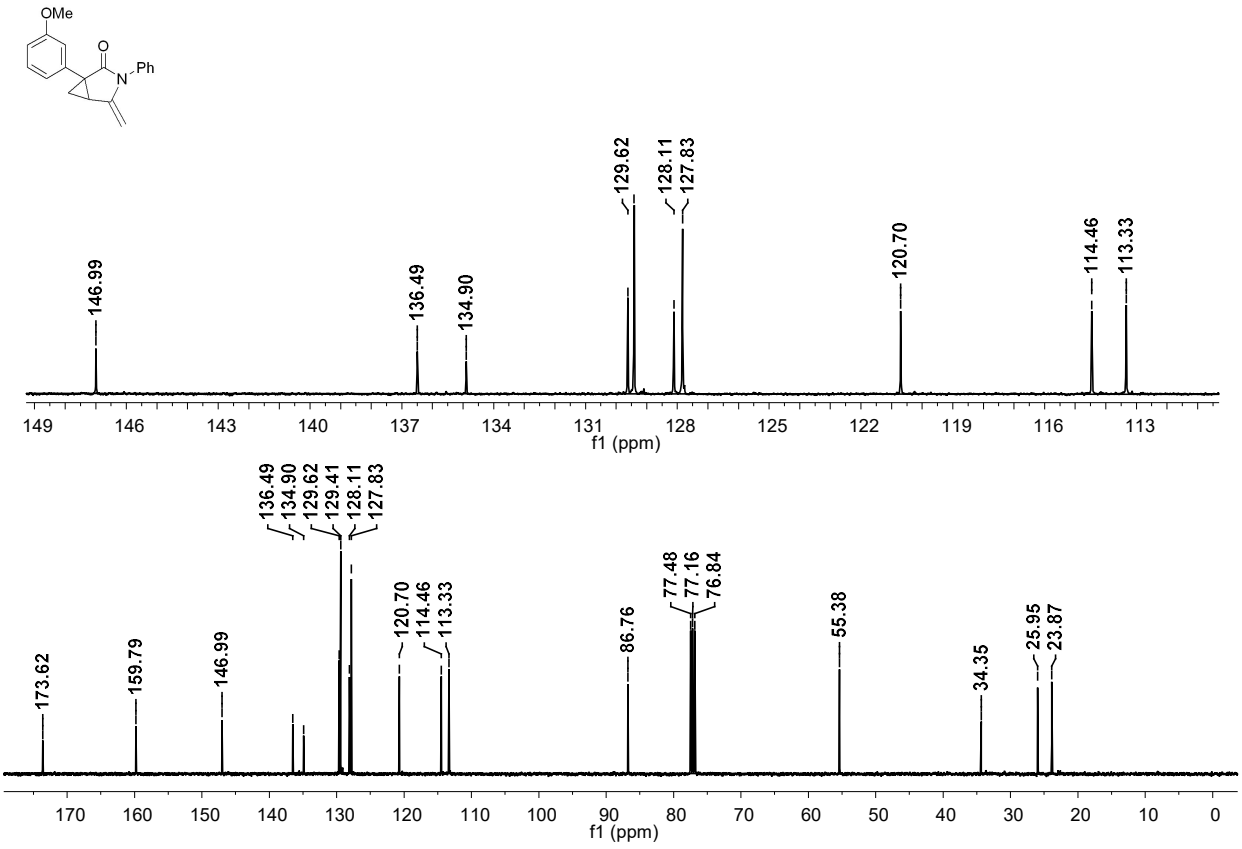
^{13}C{^{1}H} NMR spectra of **2p** (101 MHz, $CDCl_3$)



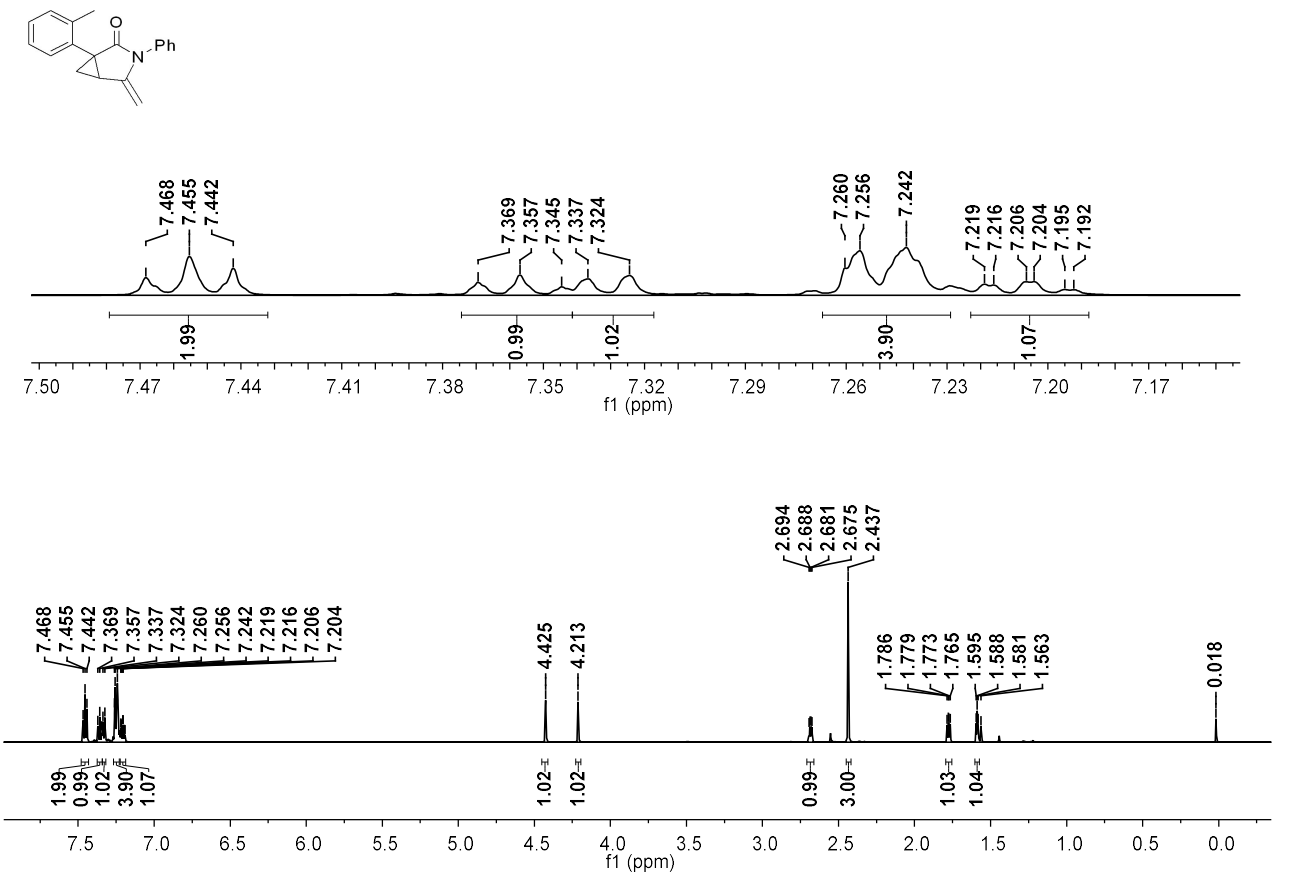
^{1}H NMR spectra of **2q** (400 MHz, $CDCl_3$)



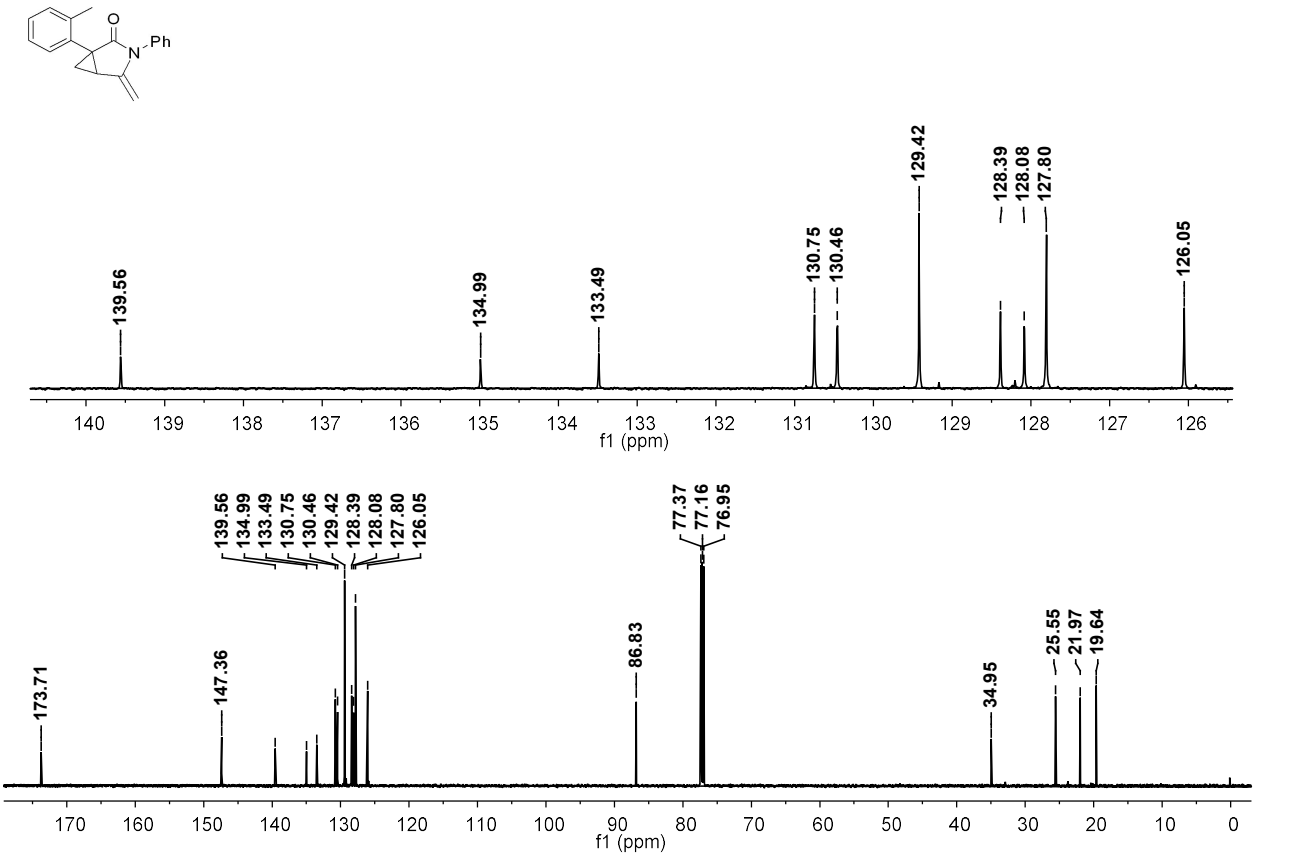
^{13}C{^{1}H} NMR spectra of **2q** (101 MHz, $CDCl_3$)



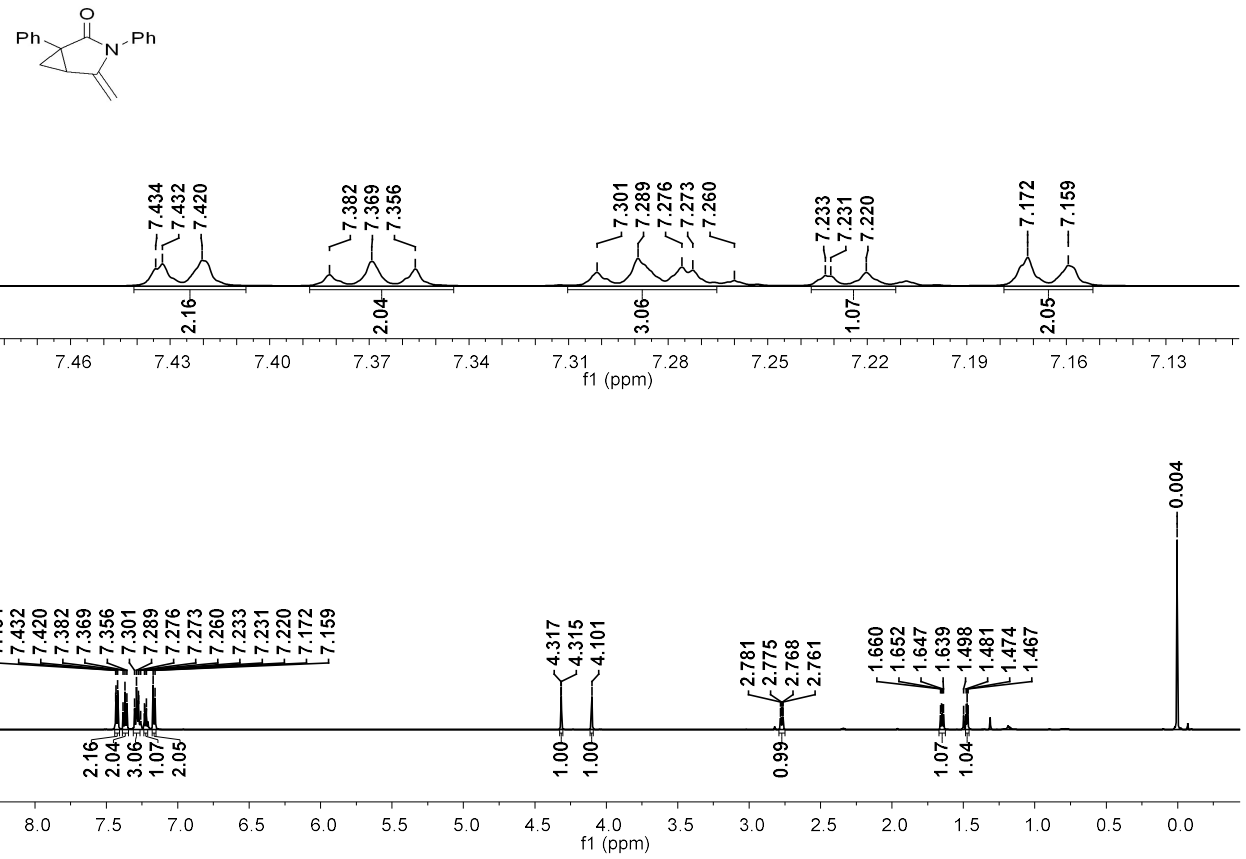
^{1}H NMR spectra of **2r** (600 MHz, $CDCl_3$)



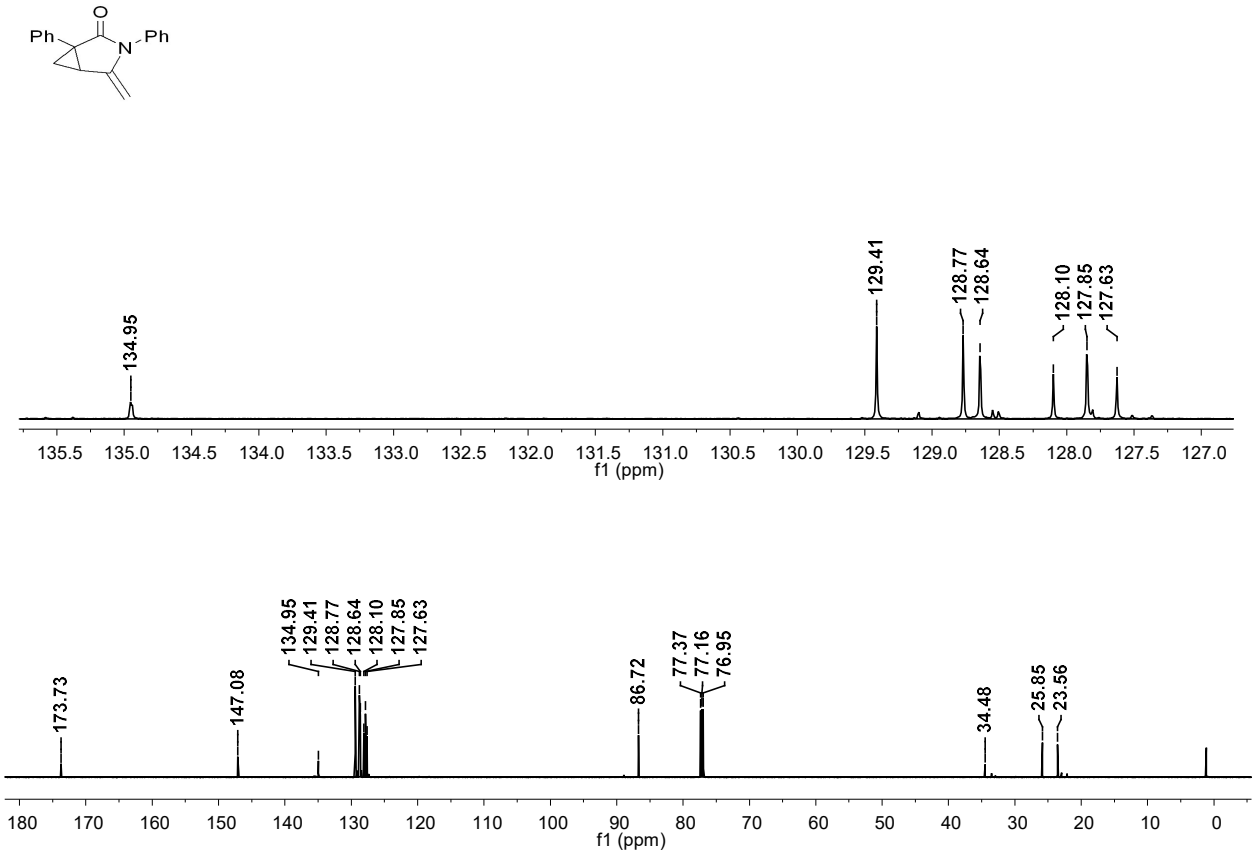
$^{13}C\{^{1}H\}$ NMR spectra of **2r** (151 MHz, $CDCl_3$)



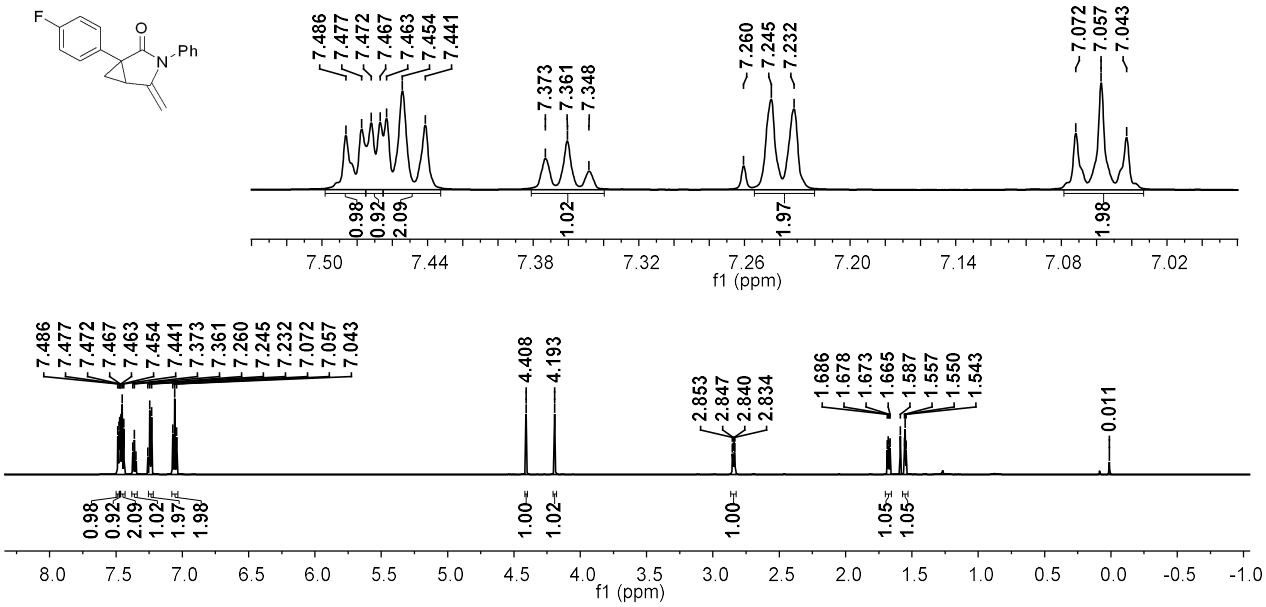
^{1}H NMR spectra of **2s** (600 MHz, $CDCl_3$)



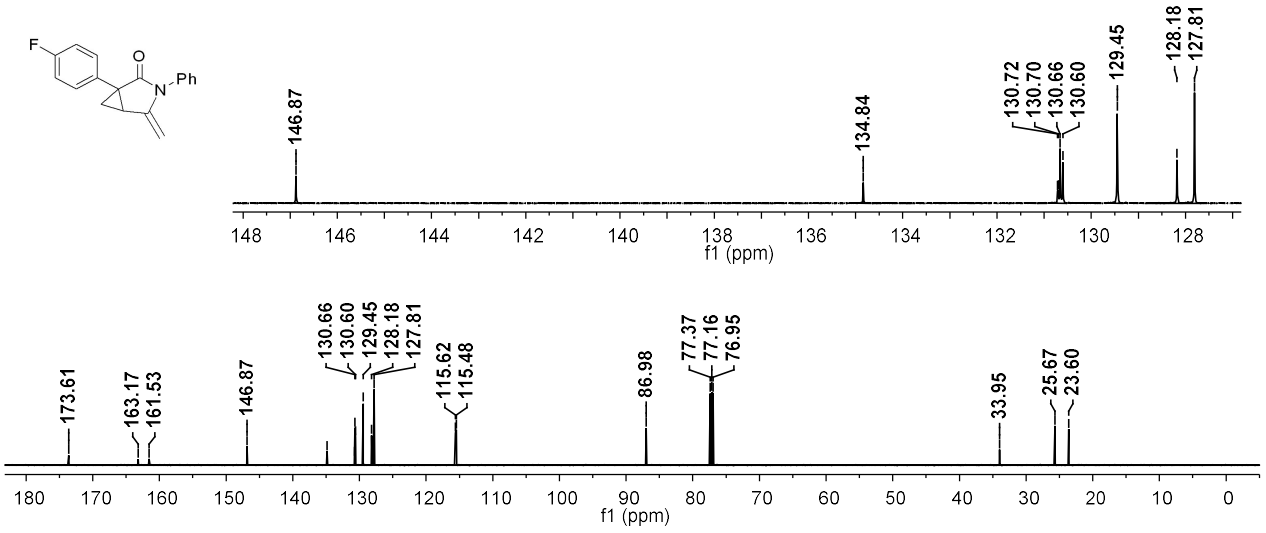
$^{13}C\{^{1}H\}$ NMR spectra of **2s** (151 MHz, $CDCl_3$)



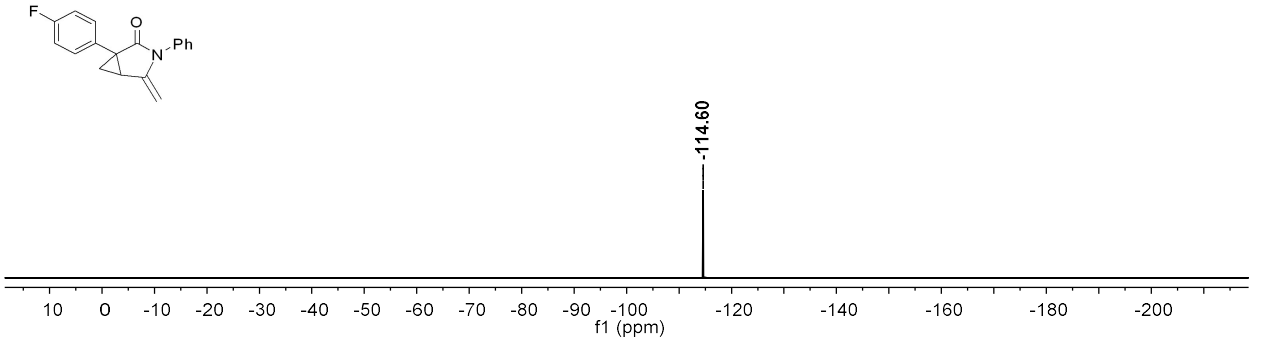
^{1}H NMR spectra of **2t** (600 MHz, $CDCl_3$)



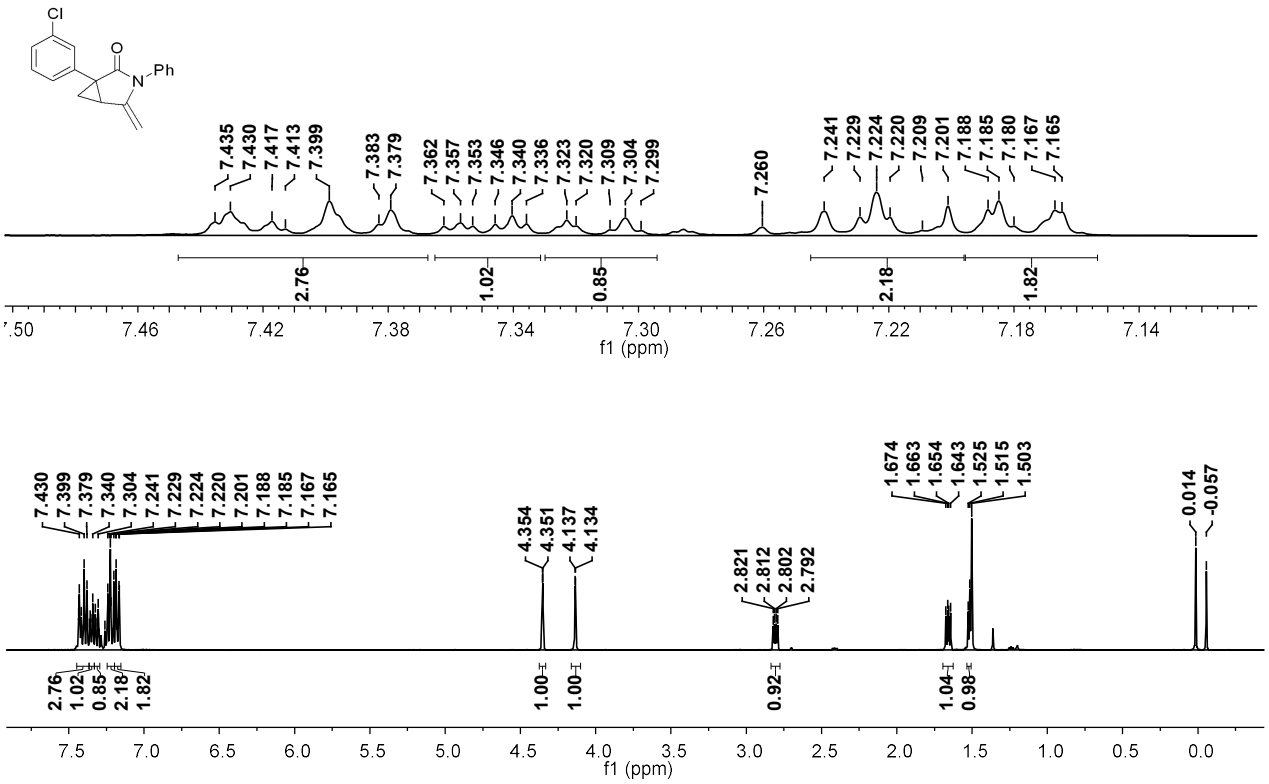
^{13}C{^{1}H} NMR spectra of **2t** (151 MHz, $CDCl_3$)



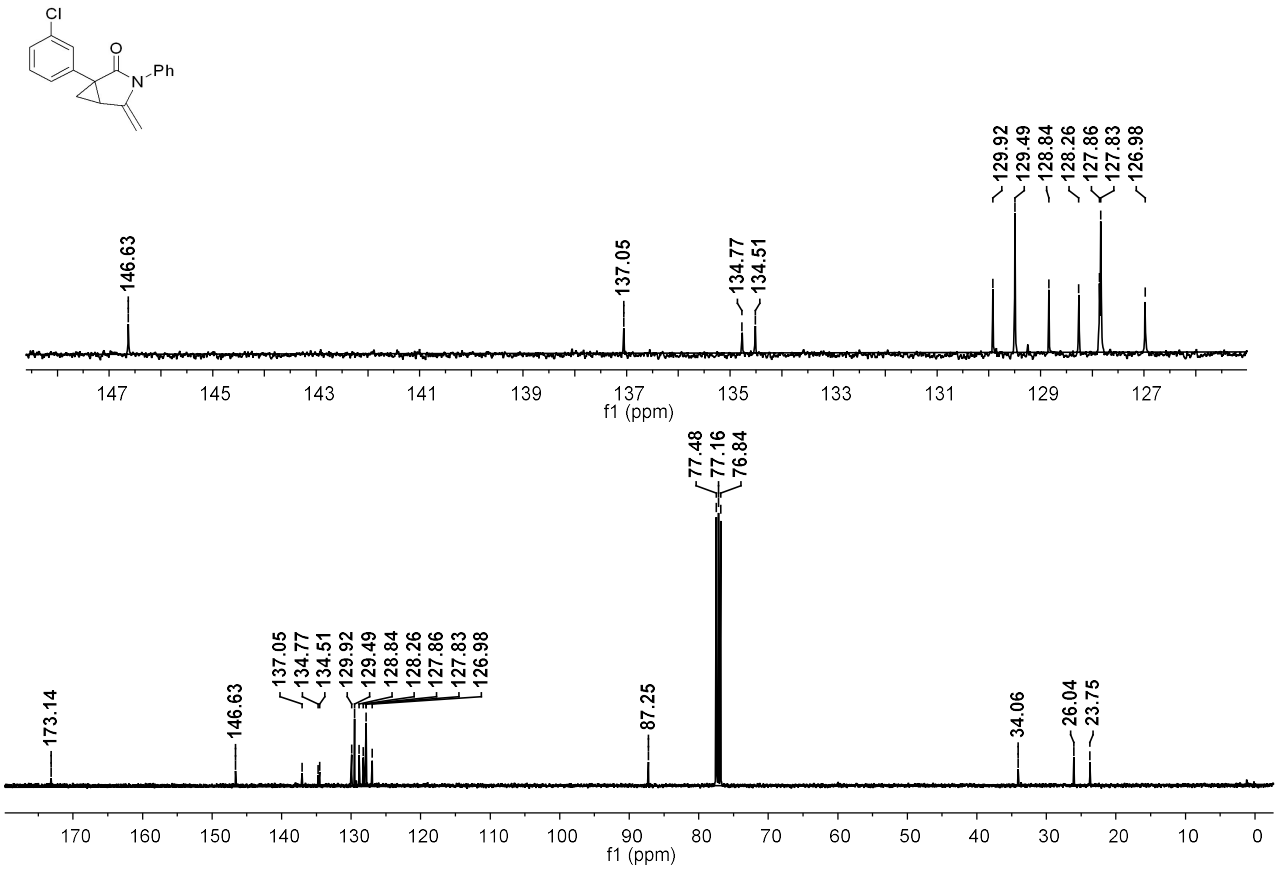
^{19}F NMR spectra of **2t** (565 MHz, $CDCl_3$)



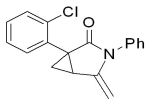
^{1}H NMR spectra of **2u** (400 MHz, $CDCl_3$)

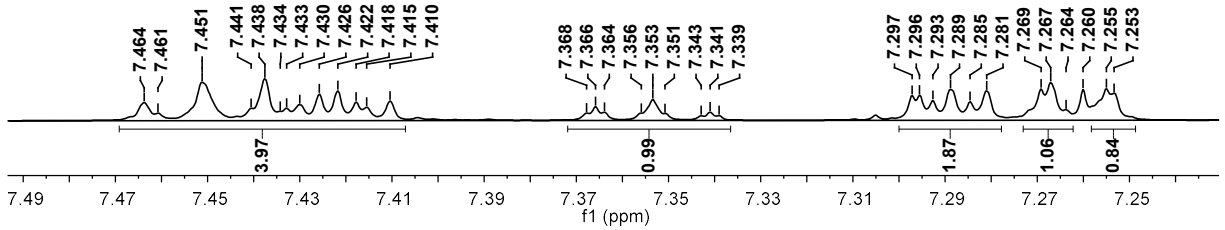


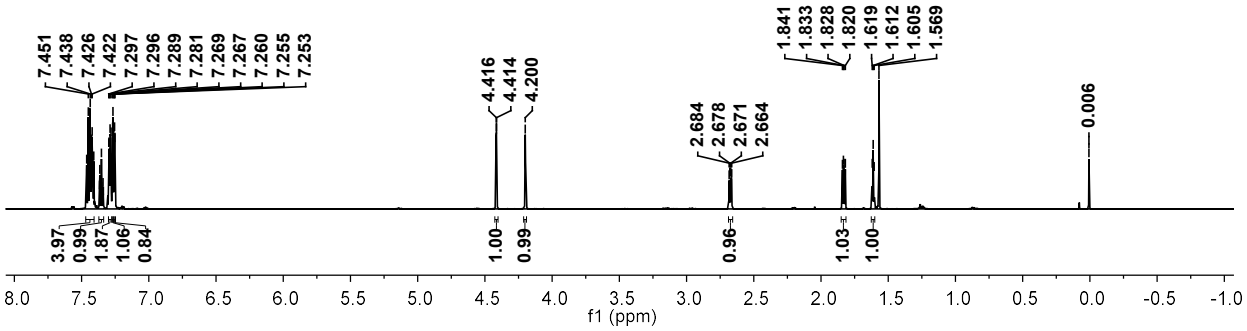
^{13}C{^{1}H} NMR spectra of **2u** (101 MHz, $CDCl_3$)



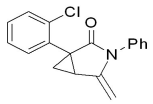
^{1}H NMR spectra of **2v** (600 MHz, $CDCl_3$)

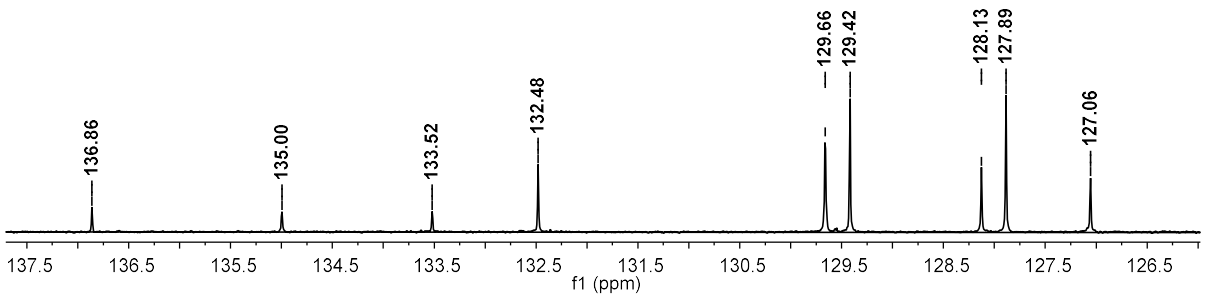


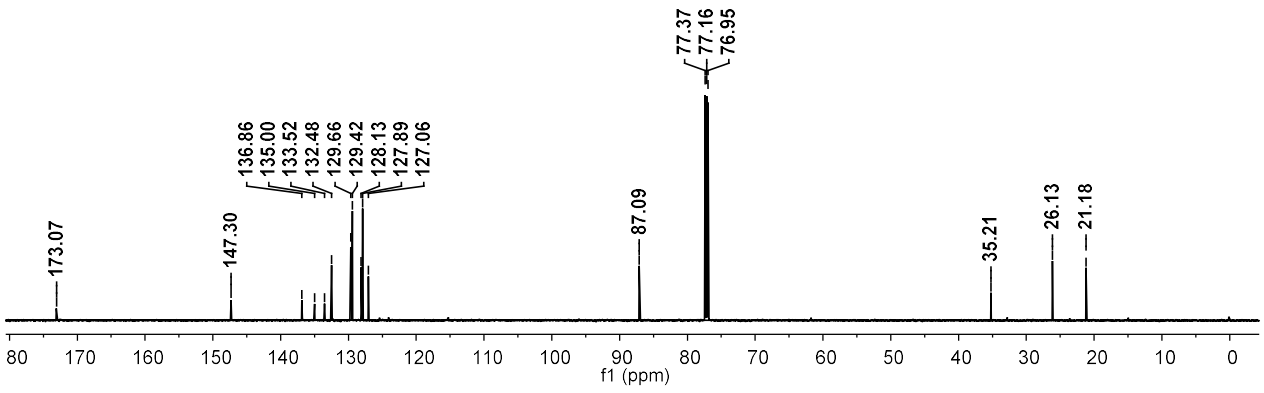




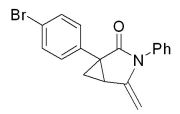
^{13}C{^{1}H} NMR spectra of **2v** (151 MHz, $CDCl_3$)

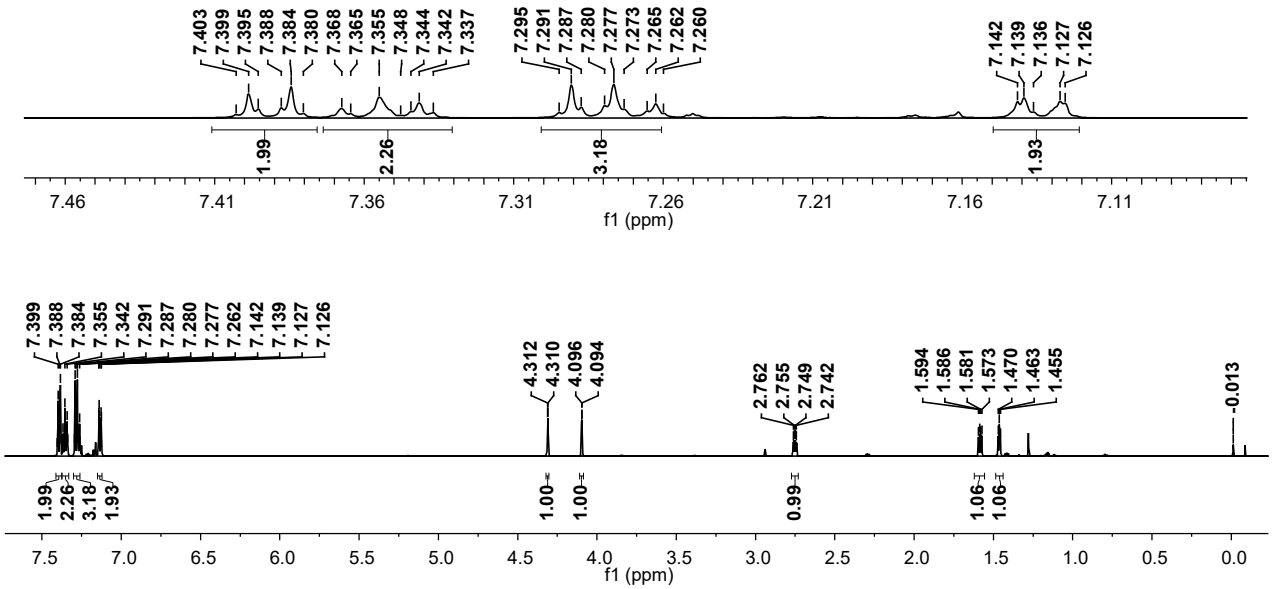




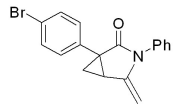


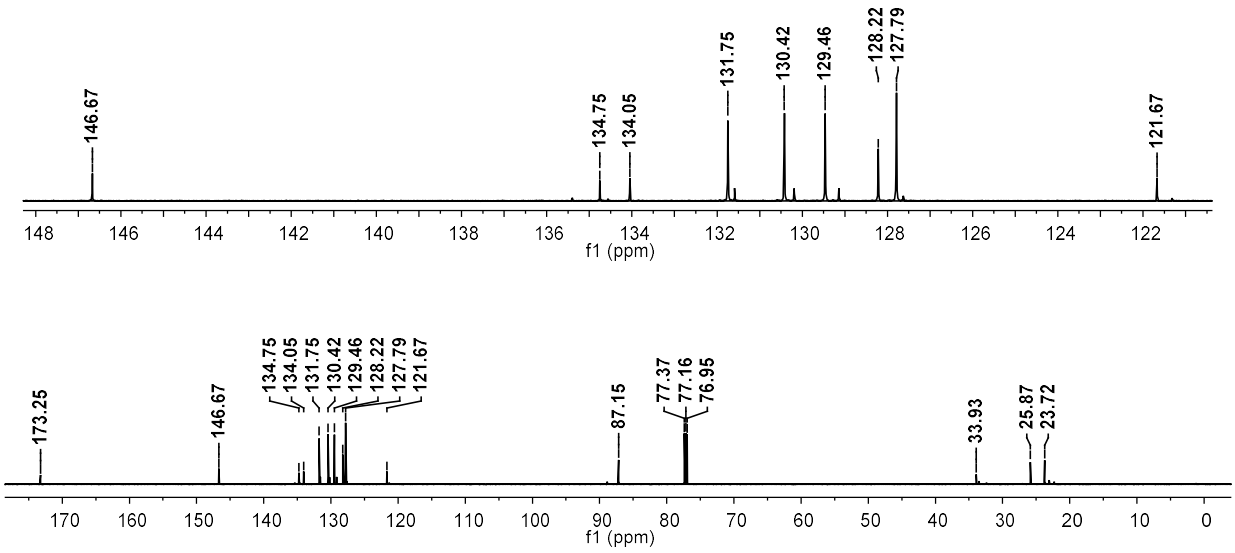
^{1}H NMR spectra of **2w** (600 MHz, $CDCl_3$)



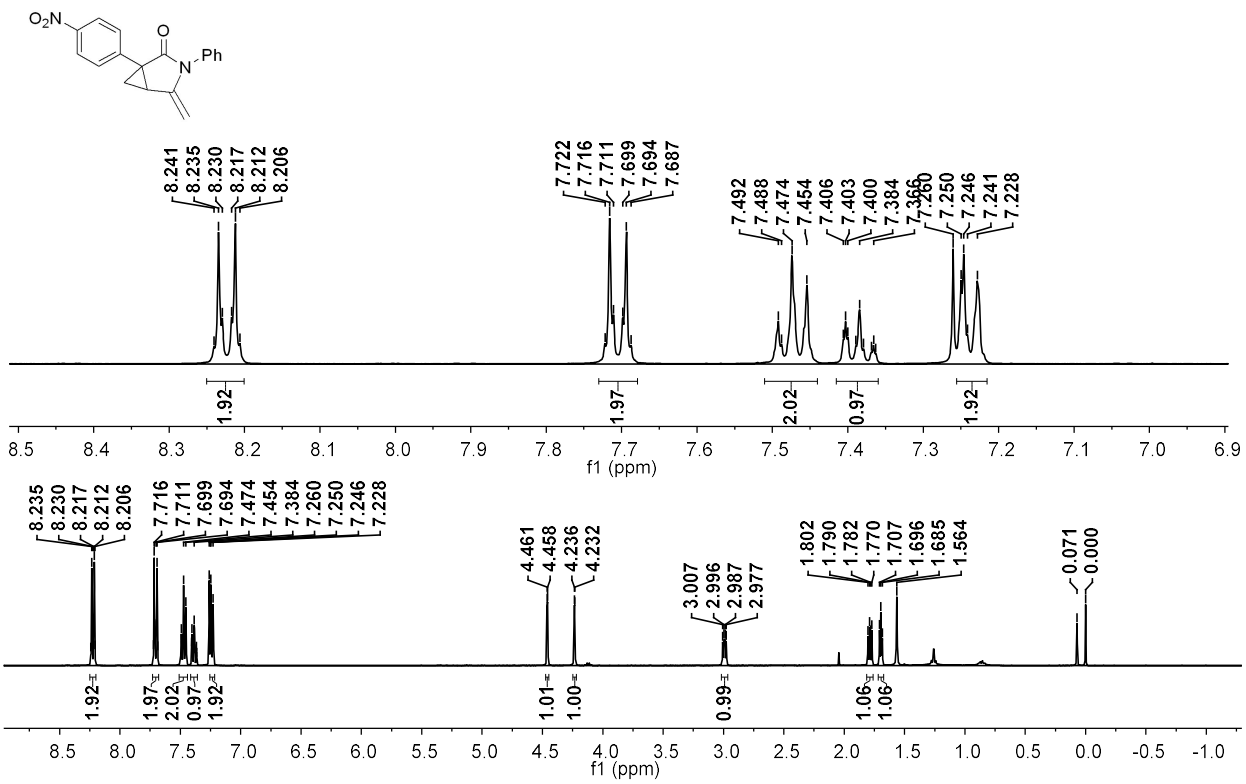


^{13}C{^{1}H} NMR spectra of **2w** (101 MHz, $CDCl_3$)

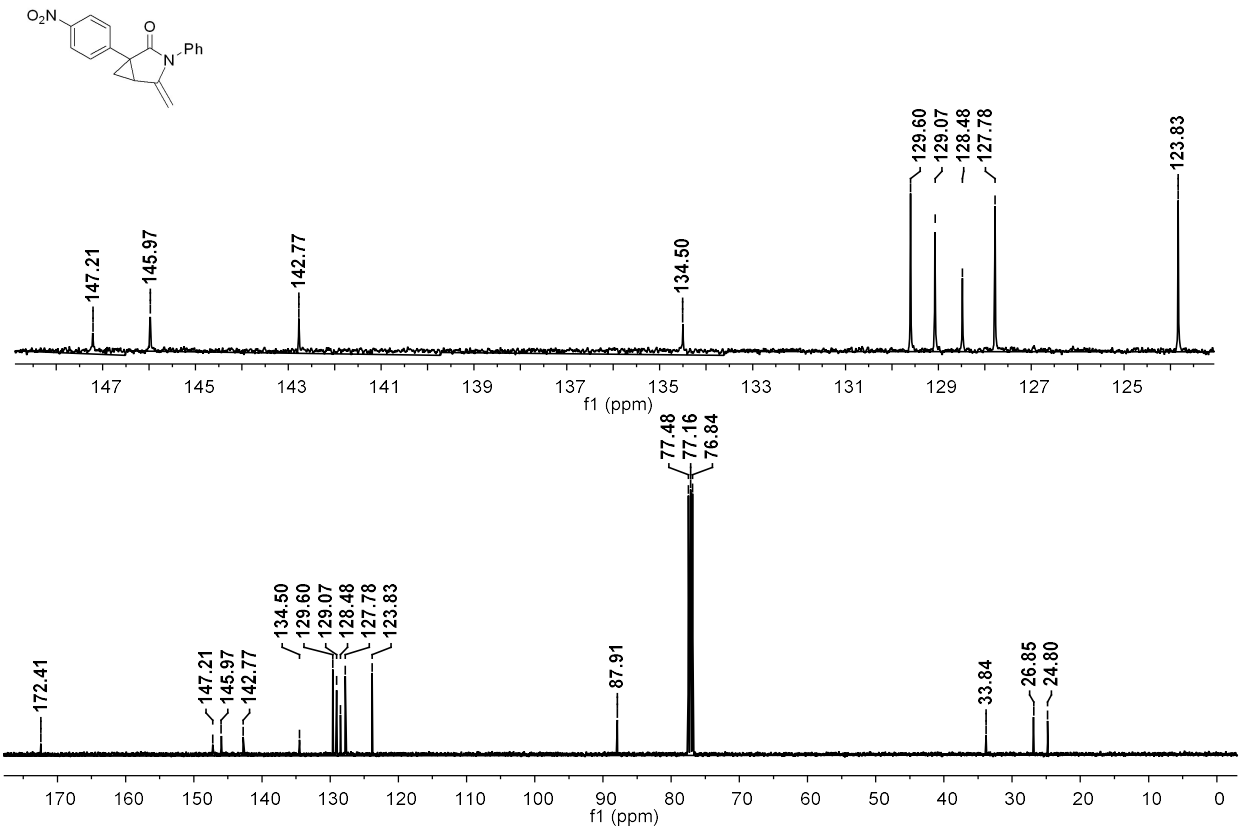




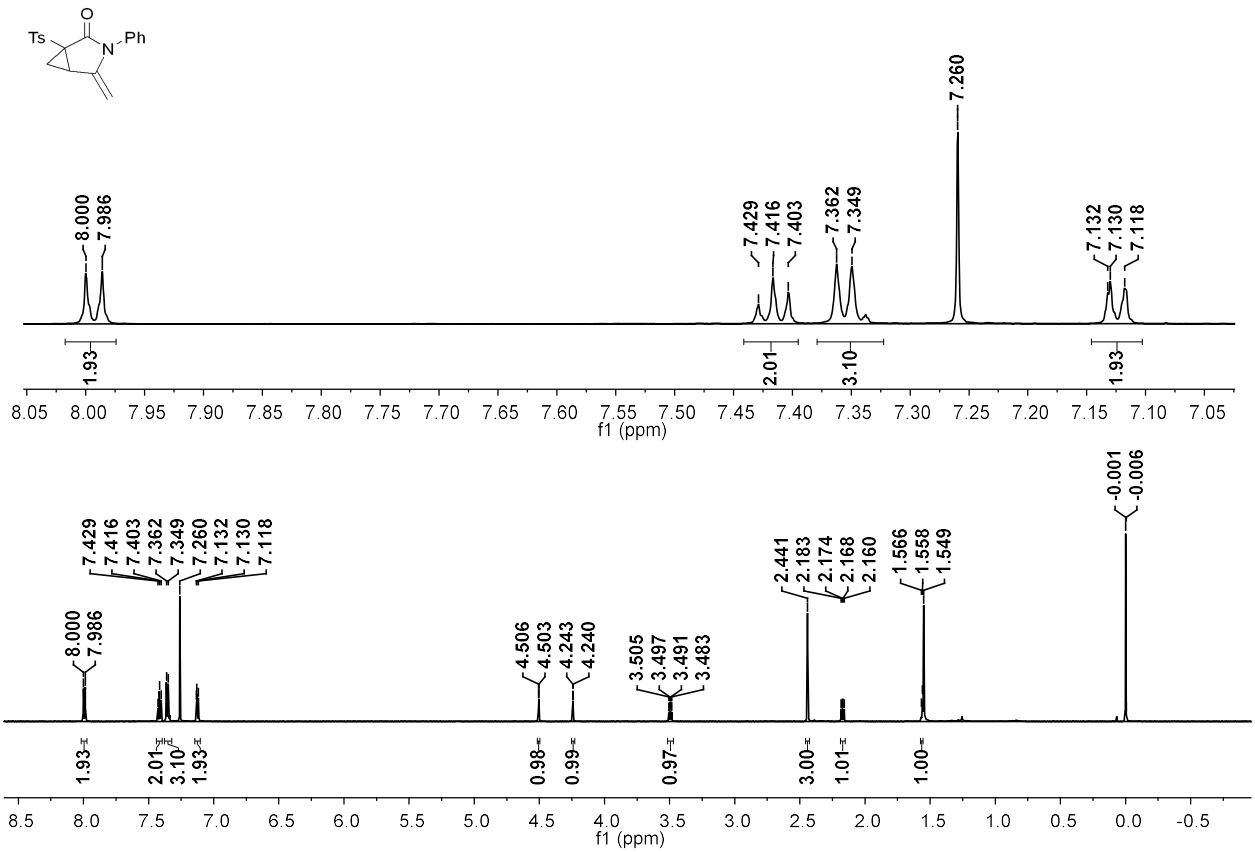
^{1}H NMR spectra of **2x** (400 MHz, $CDCl_3$)



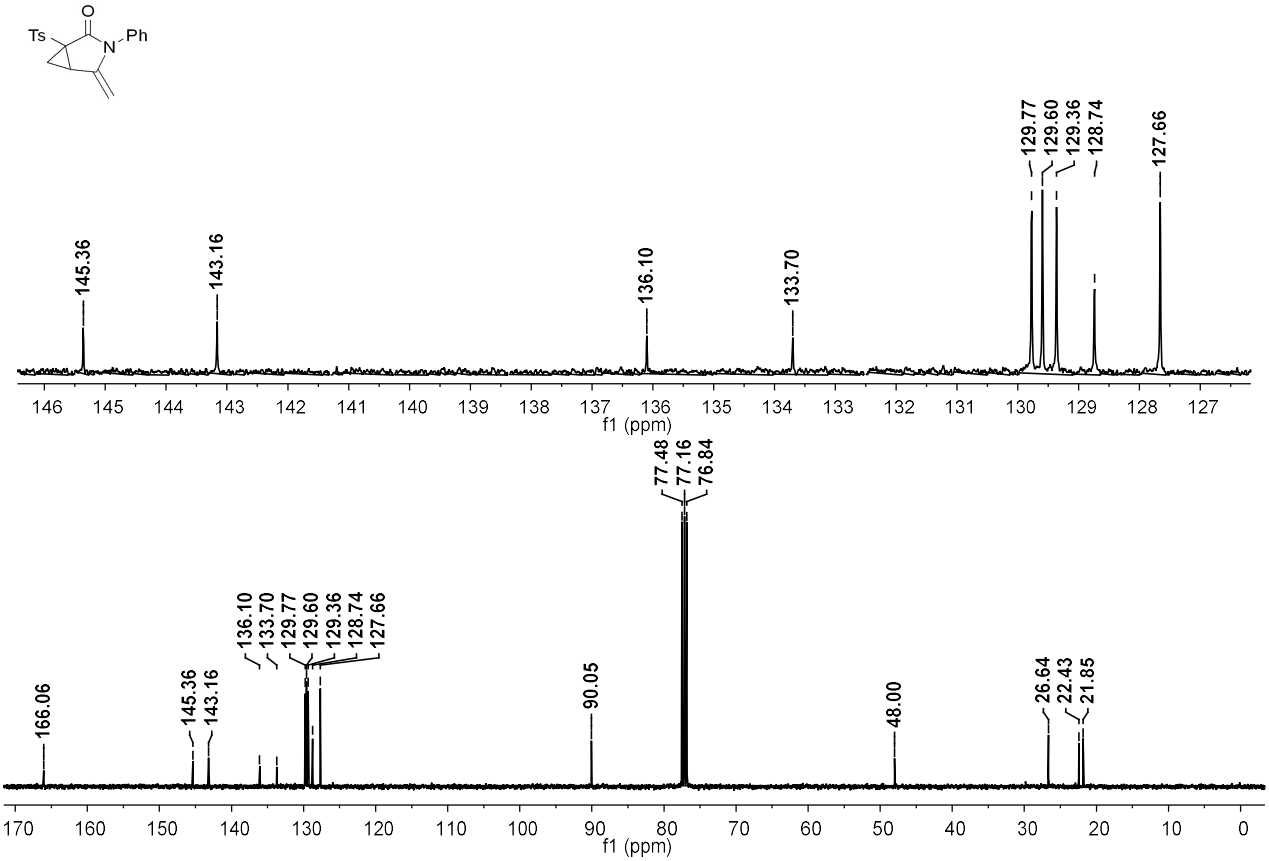
$^{13}C\{^{1}H\}$ NMR spectra of **2x** (101 MHz, $CDCl_3$)



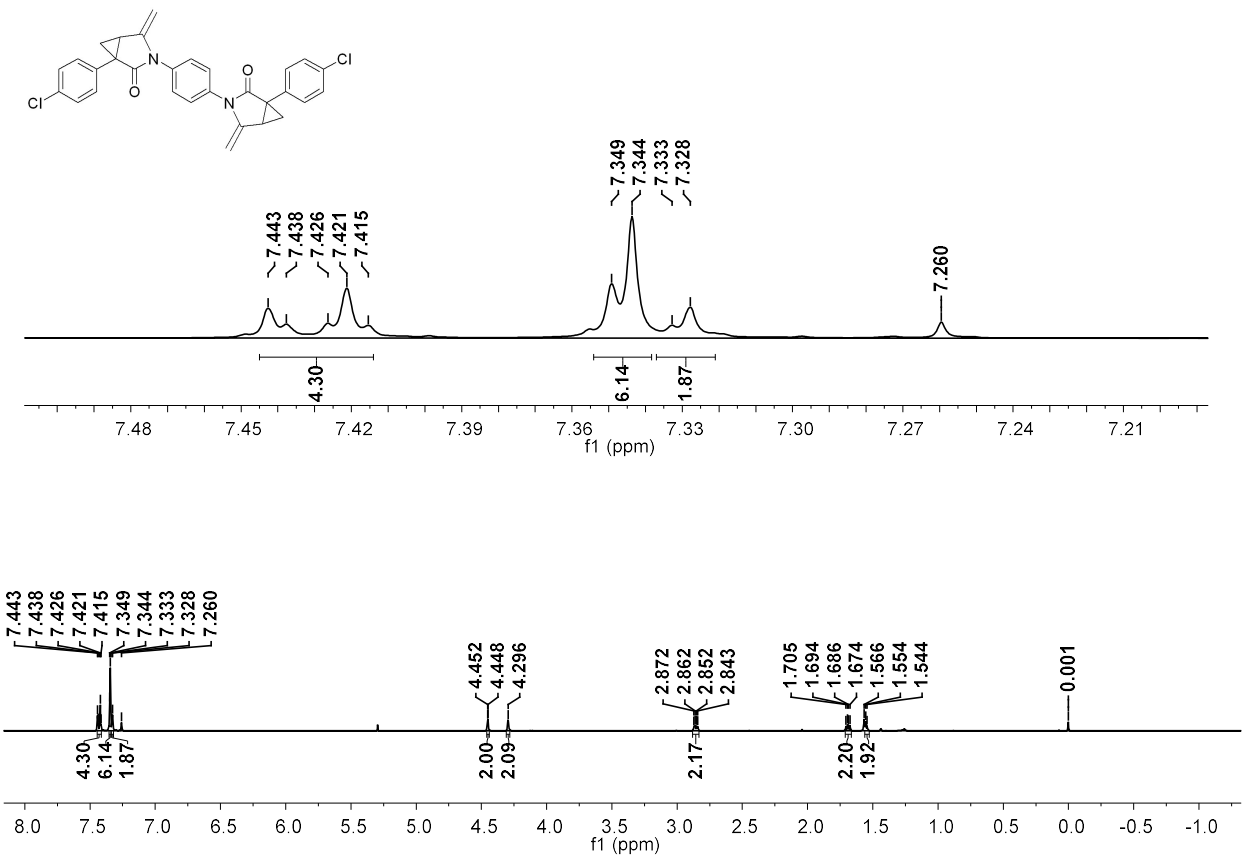
^{1}H NMR spectra of **2y** (600 MHz, $CDCl_3$)



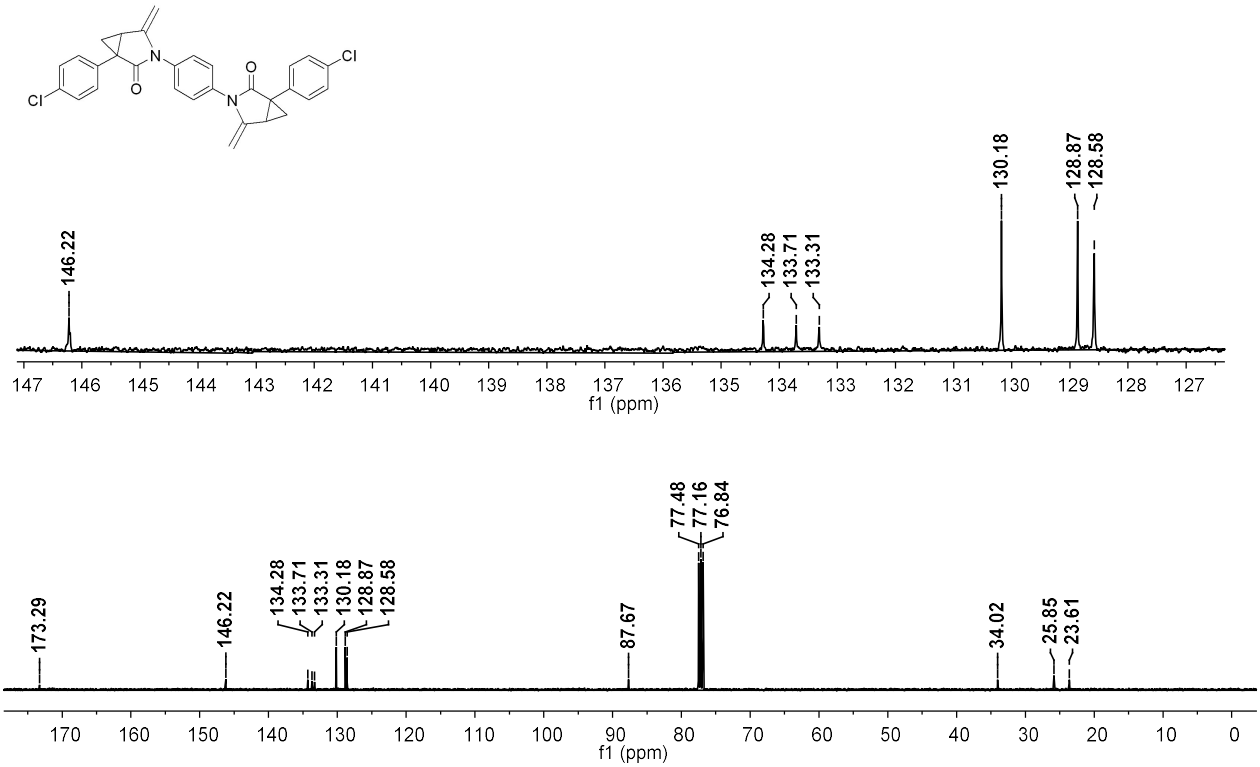
$^{13}C\{^{1}H\}$ NMR spectra of **2y** (101 MHz, $CDCl_3$)



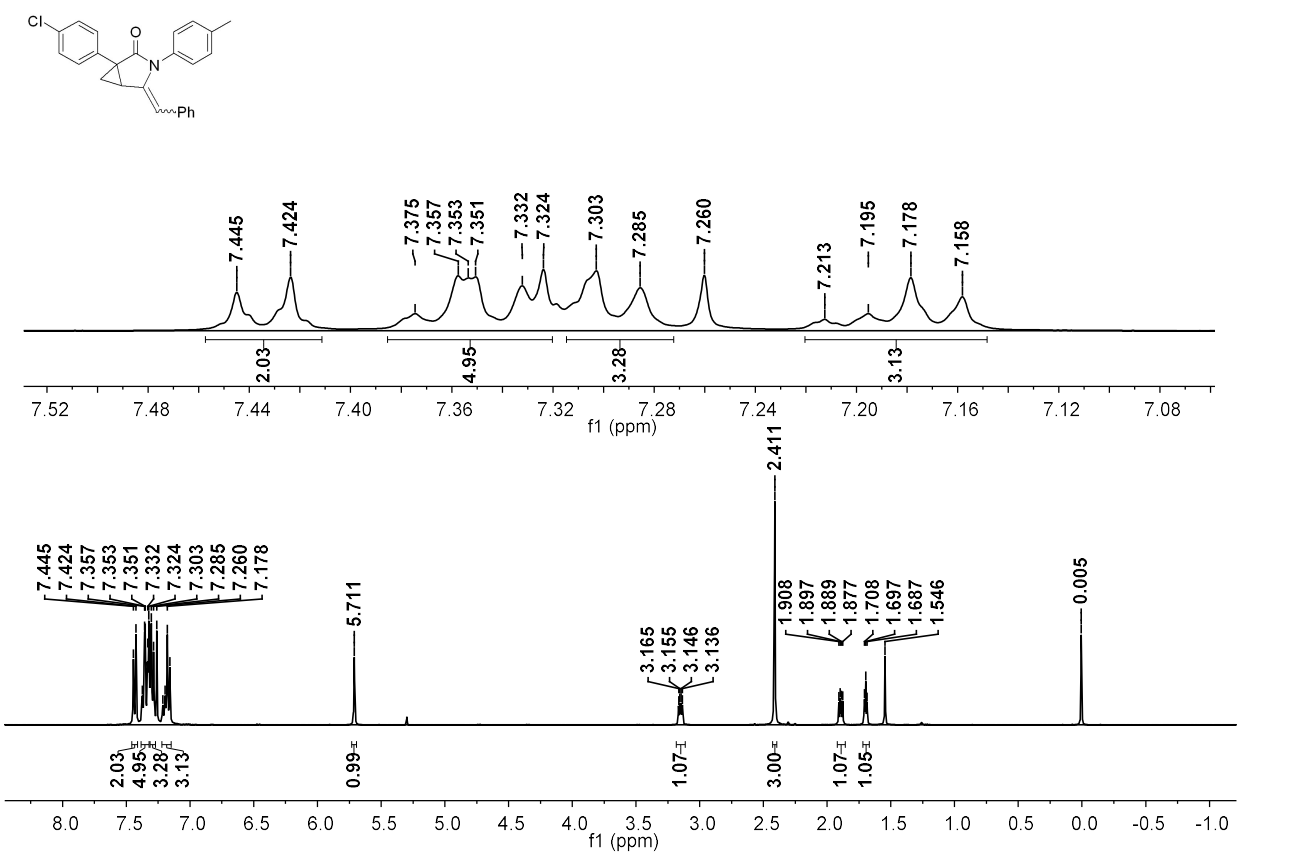
^{1}H NMR spectra of **2z** (400 MHz, $CDCl_3$)



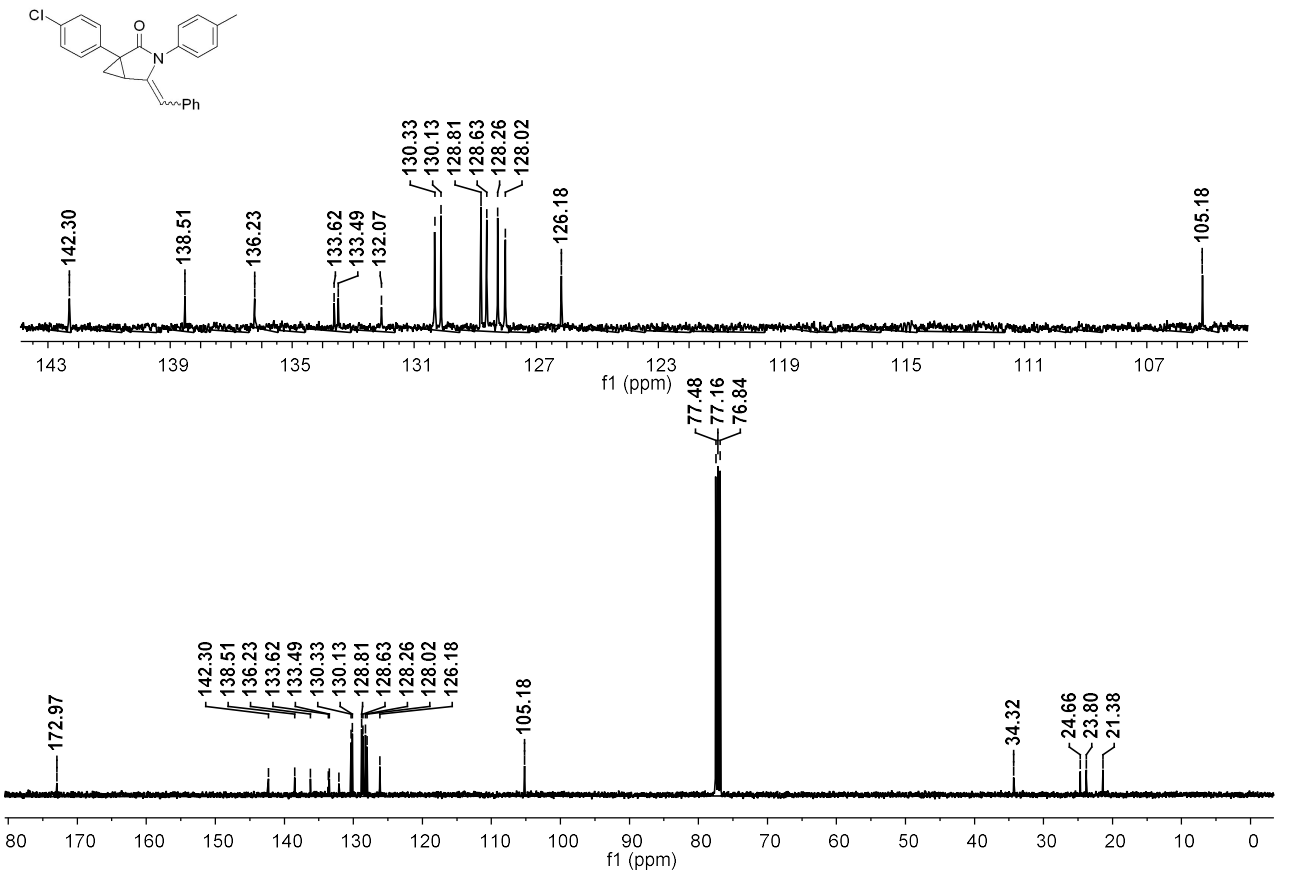
$^{13}C\{^{1}H\}$ NMR spectra of **2z** (101 MHz, $CDCl_3$)



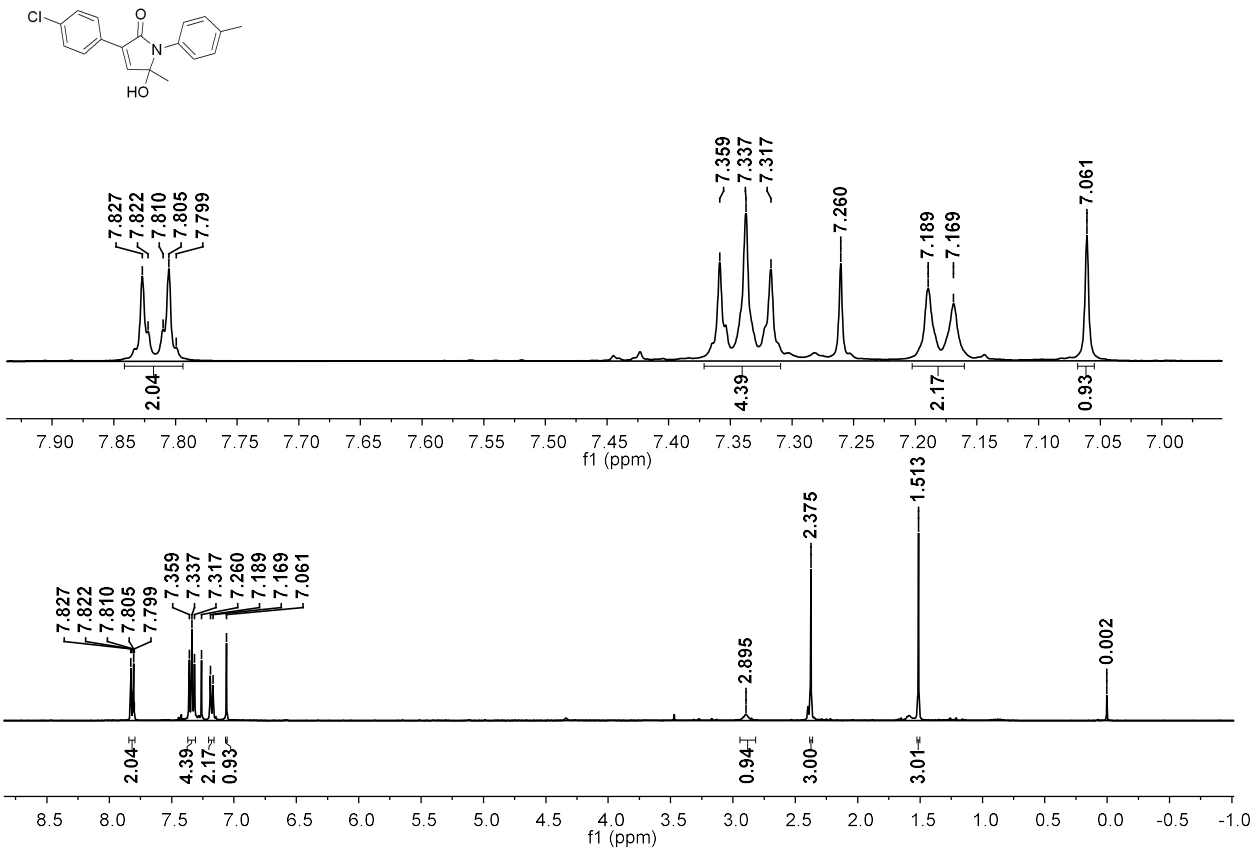
^{1}H NMR spectra of **2aa** (400 MHz, $CDCl_3$)



$^{13}C\{^{1}H\}$ NMR spectra of **2aa** (101 MHz, $CDCl_3$)



^{1}H NMR spectra of **2ab** (400 MHz, $CDCl_3$)



$^{13}C\{^{1}H\}$ NMR spectra of **2ab** (151 MHz, $CDCl_3$)