Supporting Information

The Royal Society of Chemistry (RSC)

Photo-induced Stereo- and Regiospecific Sulfonylation of C=C Multiple Bond Exploiting the Dual-reactivity of Sulfonium Iodate(I) Species

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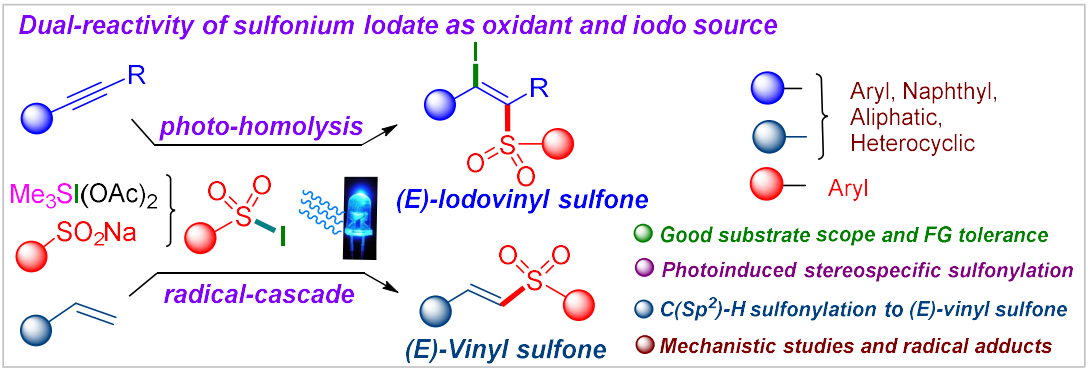


Abstract: Vinyl sulfones are privileged motifs for assembling prevalent biologically active molecules and represent "gateway functional groups" in medicinal chemistry and drug discovery. Augmented on our focus research toward bisfunctionalization of C-C multiple bonds, herein, we present a photo-induced *(E)*-stereospecific direct iodosulfonylation of alkynes and C(sp^2)-H sulfonylation of alkenes by employing sulfonium iodate species. The scope and limitation of the atom-economical protocol were well illustrated with a broad range of structurally diverse substrates tolerating various sensitive moieties to access *(E)*-vinyl sulfones in highly regioselective transformation. The mechanistic investigations involving radical/spin trapping control experiments and isolation of unprecedented BHT-Tosyl adduct evidenced the photochemical radical-sulfonylation with tosyl iodide generated *in situ* and discovering the intrinsic dual-reactivity of $Me_3SI(OAc)_2$ as oxidant as well as the source of iodine.

Supporting Material

Table of Contents

A. General Experimental Information.

General Synthesis Information:

Reactions were run in screw capped glass vials (4 mL) stirred with Teflon®-coated magnetic stir bars. Moisture and air-sensitive reactions were performed in flame-dried round bottom flasks, fitted with rubber septa or glass gas adapters, under a positive pressure of nitrogen. Moisture and air-sensitive liquids or solutions were transferred via nitrogen-flushed syringe. Experiments were monitored by thin layer chromatography (TLC). Melting points were obtained in open capillary tubes using a micro melting point apparatus and were uncorrected.

Materials:

Unless otherwise noted, materials were obtained from commercial suppliers and used without purification. Removal of solvent under reduced pressure refers to distillation with a Büchi rotary evaporator attached to a vacuum pump (~3 mmHg). Products obtained as solids or high boiling oils were dried under vacuum (~1 mmHg).

Chromatography:

Analytical TLC was performed using Whatman 250-micron aluminium backed UV F254 pre-coated silica gel flexible plates. Subsequent to elution, ultraviolet illumination at 254 nm allowed for visualization of UV active materials. Staining with p-anisaldehyde, basic potassium permanganate solution, or Molisch's reagents allowed for further visualization.

Physical Data:

Proton and Carbon nuclear magnetic resonance spectra (^{1}H, ^{13}C NMR) were recorded on Avance 300, 400 or 500 MHz and ECS 4000 MHz (JEOL) NMR spectrometers. The proton resonances are annotated as: chemical shift (δ) relative to tetramethylsilane (δ 0.0) using the residual solvent signal as an internal standard or tetramethylsilane itself: chloroform-d (δ 7.26, singlet), multiplicity (s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet; br, broad), coupling constant (*J*, Hz), and number of protons for a given resonance is indicated by nH. The chemical shifts of ^{13}C NMR are reported in ppm relative to the central line of the triplet at 77.00 ppm for $CDCl_3$. IR spectra were recorded on a PerkinElmer FT-IR spectrometer and wave numbers of maximum absorption peaks are presented in cm^{-1}. Mass analyses (ESI-MS) and HRMS were performed on Xevo G2-S QTTOF (Waters, USA) Spectrometer. Shimadzu

UV-1800 Spectrophotometer for UV studies. A blue LED apparatus (7 W ribbon λ_{max} ~ 460 nm) equipped with a magnetic stirrer and chiller was used as the light source.

Abbreviations used:

pTsNa: *p*-toluenesulfinate, $PhSO_2Na$: sodium benzenesulfinate, 4-$ClPhSO_2Na$: sodium 4-chloro benzenesulfinate, $PhSO_2NHNH_2$: sulfonyl hydrazide, CF_3SO_2Na: Langlois reagent, $PhSO_2I$: *p*-tolylsulfonyl iodide, *t*-Bu: *tert*-butyl, MeCN: acetonitrile, DCE: dichloroethane, DCM: dichloromethane, MeOH: methanol, EtOH: ethanol, AcOH: acetic acid, THF: tetrahydrofuran, EtOAc: ethylacetate, DMF: N, N-dimethylformaide. TLC: thin layer chromatography, CFL: compact fluorescent lamp, PIDA: phenyliodnium diacetate, BAIB: bis(acetoxy)iodobenzene, LEDs: light emitting diodes, TEMPO: 2,2,6,6-tetramethylpiperidin-1-yl)oxyl, BHT: 2,6-di-*tert*-butyl-4-methylphenol, RT: room temperature.

General Procedure for Sulfonylation:

An oven-dried, 10 mL glass tube was equipped with a magnetic stir bar, a rubber septum, and a threaded Teflon cap. A nitrogen-filled balloon was fitted through the septum to sustain a nitrogen atmosphere. To this vessel was added a solution of alkene/alkyne (1.0 equiv.) in solvent (3 mL) *via* syringe followed by the sequential addition $Me_3SI(OAc)_2$ (1.2-2.5 equiv.) and sulfonyl source (1.5-2.5 equiv.) at room temperature (25 °C). The reaction mixture was then purged with nitrogen (gas) for another 5 minutes with the aid of an exit needle on the septum. A stirring rate was established at 900 rpm. The reaction tube was irradiated with visible light, a common 7 W Blue LED ribbon (λ_{max}~460 nm) under stirring. The distance between the light source and the reaction flask was maintained approximately 3-4 cm, resulted in the temperature increasing up to 35 °C. The tube was then submerged in an insulated bath to maintain temperature. For safety reasons, the reaction was carried out behind an *anti*-blast shield. The reaction was stirred until the complete consumption of starting material, typically for 6-12 h (adjudged by TLC). The reaction mixture was diluted with DCM (10 mL), quenched with saturated $NaHCO_3$ (5 mL) and saturated aqueous sodium thiosulfate (2 mL) and extracted with DCM (3 × 30 mL). The combined organic layers were washed with brine solution, dried over anhydrous Na_2SO_4, concentrated *in vacuo* and purified by silica gel column chromatography (using gradient eluent of hexanes/EtOAc) to obtain the desired iodovinyl sulfone **4-33** or vinyl sulfone **34-43.**

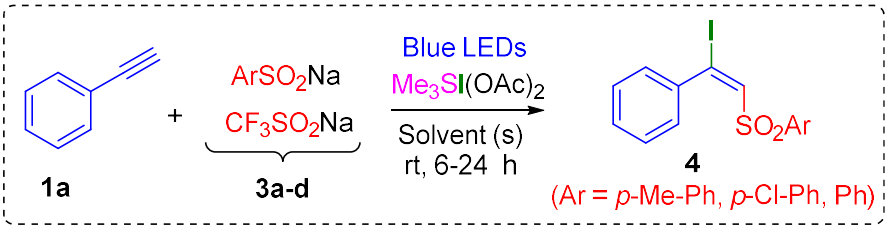
Light and Equipment Setup for the Photochemical Reaction:

(A) **(B)** **(C)**

Figure S1. Reaction conditions for visible light mediated sulfonylation; **(A)** Blue LED irradiation setup, **(B)** Reaction vessel and insulated bath with circulation pipes (inlet, outlet), N_2 ballon and vaccum tubing. **(C)** The complete reaction setup with reaction vessel, insulated bath, chiller and the circulation tubings.

B. Optimizations Studies.

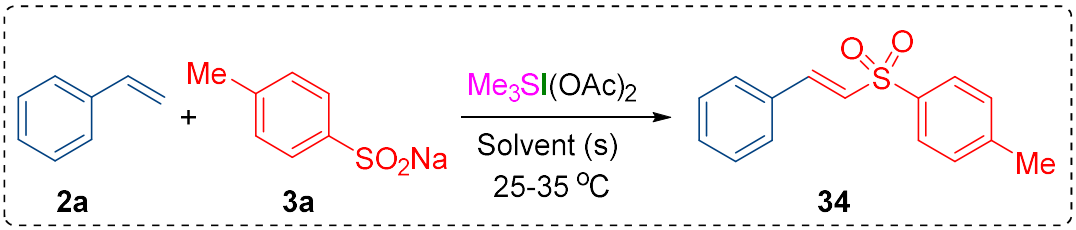
Table S1. Preliminary Studies and Optimization of (*E*)-Stereospecific Sulfonylation using Sulfonium Iodate Reagent. [a]



S. No	Reagent (equiv)	3a-d (equiv)	Solvent	Yield %[b]
1.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	MeCN	**4a**; 37
2.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	DCE	**4a**; 68
3.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	THF	**4a**; 69
4.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	1,4-Dioxane	**4a**; 65
5.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	AcOH	**4a**; 71
6.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	DMF	**4a**; 49
7.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	Toluene	**4a**; 38
8.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	H_2O	**4a**; 50
9.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) **(3a)**	MeCN: H_2O; 2:1	**4a**; 54
10.	**$Me_3SI(OAc)_2$ (1.2)**	**pTsNa (1.5) (3a)**	**MeCN: AcOH; 2:1**	**4a; 86**
11.[c]	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) (3a)	MeCN: AcOH; 2:1	**4a;** 28
12.[d]	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) (3a)	MeCN: AcOH; 2:1	**4a;** 41
13.[e]	$Me_3SI(OAc)_2$ (1.2)	pTsNa (1.5) (3a)	MeCN: AcOH; 2:1	**4a;** 53
14.	$Me_3SI(OAc)_2$ (1.2)	4-Cl $PhSO_2Na$ (1.5) **(3b)**	MeCN: AcOH; 2:1	**4b**; 76
15.	$Me_3SI(OAc)_2$ (1.2)	$PhSO_2Na$ (1.5) **(3c)**	MeCN: AcOH; 2:1	**4c**; 60
16.	$Me_3SI(OAc)_2$ (1.2)	CF_3SO_2Na (1.5) **(3d)**	MeCN: AcOH; 2:1	**4d**; NR

[a] Reaction conditions: Phenyl acetylene **1a** (1.0 mmol, 1.0 equiv), $Me_3SI(OAc)_2$ (1.2 equiv), $ArSO_2Na$; **3a-3c** or CF_3SO_2Na; **3d** (1.5 equiv), solvent (2 mL), stirred at 25 to 35 °C for 12 h, irradiated with Blue LEDs (7W), unless otherwise noted. [b] The isolated and unoptimized yields after chromatography. [c] The reaction was performed in dark condition. [d] The reaction was performed in light. [e] The reaction was performed in green LEDs.

Table S2. Screening of *(E)*-Stereospecific Vinyl-Sulfonylation using Sulfonium Iodate Reagent.[a]

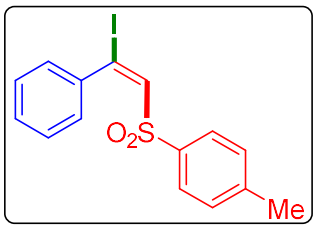


S. No	Reagent (equiv)	3a (equiv)	Solvent	Yield %[b]
1.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (1.5)	MeCN	28
2.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	MeCN	57
3.	$Me_3SI(OAc)_2$ (1.2)	pTsNa (2.5)	MeCN	36
4.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	H_2O	20
5.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	AcOH	12
6.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	1,4-Dioxane	12
7.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	Toluene	18
8.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	MeOH	22
9.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	1,4-Dioxane	8
10.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	DCM	70
11.	**$Me_3SI(OAc)_2$ (1.5)**	**pTsNa (2.5)**	**MeCN**	**91**
12.[c]	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	MeCN	33
13.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	CH_3CN: H_2O; 2:1	46
14.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	CH_3CN: AcOH; 1:2	27
15.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	CH_3CN: AcOH; 1:1	33
16.	$Me_3SI(OAc)_2$ (1.5)	pTsNa (2.5)	CH_3CN: AcOH; 2:1	32

[a] Reaction conditions: 2a (1.0 mmol, 1.0 equiv), $Me_3SI(OAc)_2$ (1.5 equiv), $ArSO_2Na$ (2.5 equiv), solvent (2 mL), stirred at 25°C for 12 h, irradiated with a Blue LEDs (7W), unless otherwise noted. [b] The isolated and unoptimized yields after chromatography. [c] The reaction was performed in dark condition.

C. Chemical Synthesis and Spectroscopic Characterization Data.

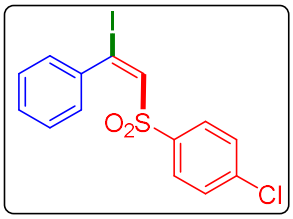
Representative Procedure for Iodovinyl sulfonylation:



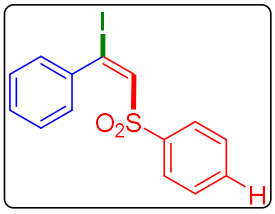
***(E)-1-((2-iodo-2-phenylvinyl)sulfonyl)-4-methylbenzene (4a)*:** A preformed solution of ethynylbenzene **1a** (102 mg, 1.0 mmol, 1.0 equiv) in CH_3CN:AcOH (2:1; 3 mL) was treated with 4-Methylphenyl sulfinic acid sodium salt (267 mg, 1.5 mmol, 1.5 equiv.) followed by $Me_3SI(OAc)_2$ (386 mg, 1.2 mmol, 1.2 equiv.) at room temperature (25 °C). The resulting mixture was stirred under nitrogen atmosphere and irradiated with visible light (7 W Blue LED strips). Following the usual workup and purification by silica gel column chromatography using hexanes as eluent, the desired compound **4a** was obtained as pale-yellow oil (330 mg, 0.86 mmol, 86%). Rf (4% EtOAc/Hexane) 0.5; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, J = 8.4 Hz, 2H), 7.36 (s, 1H), 7.31-7.25 (m, 3H), 7.24 (d, J = 1.5 Hz, 2H), 7.19 (d, J = 8.1 Hz, 2H), 2.39 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.52, 141.21, 139.60, 137.25, 129.72, 129.62, 127.86, 127.81, 127.64, 114.13, 21.58; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[1-10]

Procedure for Gram-scale synthesis of iodovinyl sulfone:

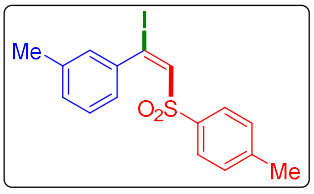
A preformed solution of ethynylbenzene **1a** (1 g, 9.804 mmol) in CH_3CN: AcOH (2:1; 10 mL) was treated with 4-Methylphenyl sulfinic acid sodium salt (2.6 g, 14.706 mmol, 1.5 equiv.) followed by $Me_3SI(OAc)_2$ (3.8 g, 11.765 mmol, 1.2 equiv.) at room temperature (25 °C). The resulting mixture was stirred under nitrogen atmosphere and irradiated with visible light (7 W Blue LED). Following the usual workup and purification by silica gel column chromatography using hexanes as eluent, the desired compound **4a** was obtained as pale-yellow oil (3.0 g, 7.843 mmol, 80%). The overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[1-10]



(E)-1-chloro-4-((2-iodo-2-phenylvinyl)sulfonyl)benzene (4b): Following general iodovinyl sulfonylation procedure using ethynylbenzene **1a** (90 mg, 100 µL, 0.762 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (234 mg, 0.579 mmol, 76%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48-7.44 (m, 2H), 7.39 (s, 1H), 7.34-7.27 (m, 5H), 7.20 (d, J = 1.4 Hz, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.94, 140.20, 139.44, 138.60, 129.94, 129.26, 129.22, 128.01, 127.60, 115.23; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[1, 4,7]

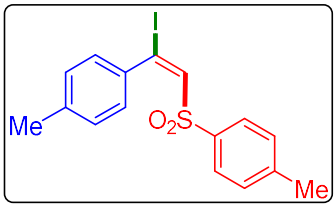


(E)-1-iodo-2-(phenylsulfonyl)vinyl)benzene (4c): Following general iodovinyl sulfonylation procedure using ethynylbenzene **1a** (90 mg, 100 µL, 0.762 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (169 mg, 0.457 mmol, 60%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, J = 8.6 Hz, 2H), 7.39 (s, 1H), 7.36-7.28 (m, 6H), 7.19 (dd, J = 8.2, 1.6 Hz, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.96, 140.20, 139.45, 138.62, 129.95, 129.27, 129.23, 128.01, 127.61, 115.22; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[1, 3-7]

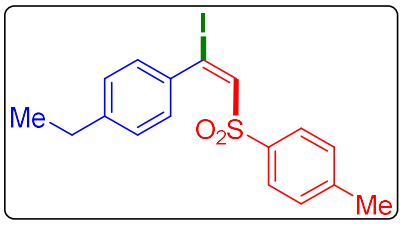


(E)-1-(1-iodo-2-tosylvinyl)-3-methylbenzene (5): Following general iodovinyl sulfonylation procedure using 1-ethynyl-3-methylbenzene **1b** (90 mg, 100 µL, 0.775 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white

solid (194 mg, 0.488 mmol, 63%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 (d, J = 8.4 Hz, 2H), 7.35 (s, 1H), 7.20-7.15 (m, 3H), 7.10 (d, J = 7.9 Hz, 1H), 7.04 (d, J = 7.6 Hz, 1H), 6.92 (s, 1H), 2.40 (s, 3H), 2.28 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.41, 141.18, 139.52, 137.62, 137.34, 130.50, 129.51, 127.95, 127.88, 127.79, 124.74, 114.48, 21.56, 21.22; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[5]

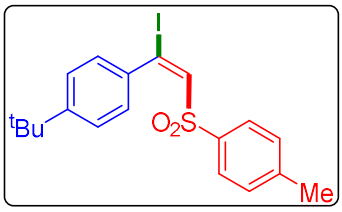


(E)-1-((1-iodo-2-(p-tolyl)vinyl)sulfonyl)-4-methylbenzene (6): Following general iodovinyl sulfonylation procedure using 1-ethynyl-4-methylbenzene **1c** (92 mg, 100 µL, 0.789 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (192 mg, 0.481 mmol, 61%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, J = 8.3 Hz, 2H), 7.30 (s, 1H), 7.20 (d, J = 8.1 Hz, 2H), 7.16 (d, J = 8.2 Hz, 2H), 7.10 (d, J = 8.0 Hz, 2H), 2.40 (s, 3H), 2.36 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.50, 140.57, 140.16, 137.39, 136.82, 129.61, 128.53, 127.83, 127.77, 114.73, 21.60, 21.43; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature. [2,5,7,10,15]

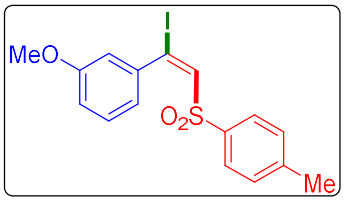


(E)-1-ethyl-4-(1-iodo-2-tosylvinyl)benzene (7): Following general iodovinyl sulfonylation procedure using 1-ethynyl-4-ethylbenzene **1d** (93 mg, 100 µL, 0.715 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (186 mg, 0.450 mmol, 63%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, J = 8.4 Hz, 2H), 7.33 (s, 1H), 7.17 (dd, J = 8.2, 2.0 Hz, 4H), 7.10 (d, J = 8.3 Hz, 2H), 2.65 (q, J = 7.6 Hz, 2H), 2.39 (s, 3H), 1.25 (t, J = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.40, 144.39, 140.85, 137.35, 136.95, 129.54, 127.91, 127.87, 127.34, 114.75, 28.71, 21.59, 15.28; the overall

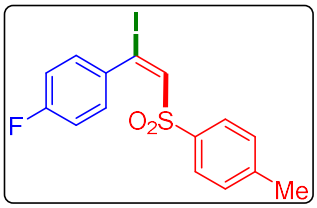
spectroscopic data are in complete agreement with assigned structures and consistent with literature.[2-4]



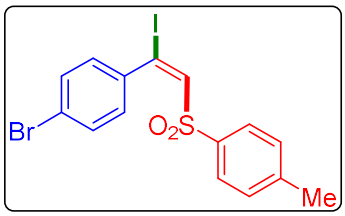
(E)-1-(tert-butyl)-4-(1-iodo-2-tosylvinyl)benzene (8): Following general iodovinyl sulfonylation procedure using 1-(tert-butyl)-4-ethynylbenzene **1e** (88 mg, 100 µL, 0.557 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as yellow semi-solid (159 mg, 0.362 mmol, 65%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 (d, J = 8.4 Hz, 2H), 7.37 (s, 1H), 7.25 (d, J = 9.9 Hz, 2H), 7.13 (t, J = 8.6 Hz, 4H), 2.37 (s, 3H), 1.32 (s, 9H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 153.21, 144.24, 141.21, 137.20, 136.56, 129.41, 127.87, 127.70, 124.77, 114.71, 34.78, 31.16, 31.07, 21.55; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature. [3]



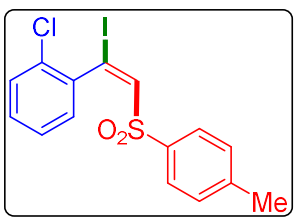
(E)-1-(1-iodo-2-tosylvinyl)-3-methoxybenzene (9): Following general iodovinyl sulfonylation procedure using 1-ethynyl-3-methoxybenzene **1f** (104 mg, 100 µL, 0.787 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (209 mg, 0.504 mmol, 64%). Mp: 89-91 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50-7.44 (m, 2H), 7.35 (s, 1H), 7.23-7.16 (m, 3H), 6.87-6.80 (m, 2H), 6.65 (dd, J = 2.6, 1.6 Hz, 1H), 3.76 (s, 3H), 2.39 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.65, 144.46, 141.46, 140.59, 137.11, 129.52, 128.96, 127.87, 119.97, 115.85, 113.55, 112.46, 55.16, 21.53; HRMS (ESI) *m/z* $[M + NH_4]^+$ calculated for $[C_{16}H_{19}NIO_3S]^+$: 432.0125; found: 432.0112.



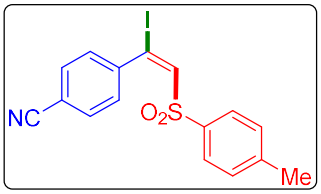
(E)-1-fluoro-4-(1-iodo-2-tosylvinyl)benzene (10): Following general iodovinyl sulfonylation procedure using 4-fluoro-2-ethynylbenzene **1g** (105 mg, 0.873 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (340 mg, 0.847 mmol, 97%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 (d, J = 8.4 Hz, 2H), 7.35 (s, 1H), 7.26 (dd, J = 9.2, 4.8 Hz, 3H), 7.22 (s, 1H), 6.98 (t, J = 8.6 Hz, 2H), 2.41 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.17 (d, $^{1}J_{CF}$ = 251.4 Hz), 144.78, 141.61, 137.19, 135.67, 135.65 (d, $^{4}J_{CF}$ = 3.6 Hz), 130.02, 129.98 (d, $^{3}J_{CF}$ = 8.8 Hz), 127.78, 115.06 (d, $^{2}J_{CF}$ = 22.1 Hz), 114.95, 112.54, 21.60; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[1,3]



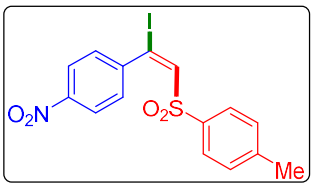
(E)-1-bromo-4-(1-iodo-2-tosylvinyl)benzene (11): Following general iodovinyl sulfonylation procedure using 4-bromo-2-ethynylbenzene **1h** (100 mg, 0.552 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (158 mg, 0.342 mmol, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, J = 8.3 Hz, 2H), 7.43 (d, J = 8.5 Hz, 2H), 7.34 (s, 1H), 7.24 (d, J = 7.8 Hz, 2H), 7.11 (d, J = 8.5 Hz, 2H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.90, 141.73, 138.54, 137.09, 131.15, 129.79, 129.24, 127.87, 124.19, 111.93, 21.65; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[2,3,6]



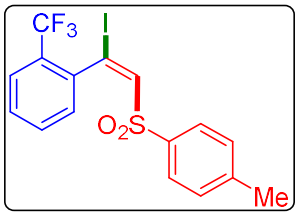
(E)-1-chloro-2-(1-iodo-2-tosy)vinyl)benzene (12): Following general iodovinyl sulfonylation procedure using 2-chloro-1-ethynylbenzene **1i** (112 mg, 100 µL, 0.817 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as yellow solid (229 mg, 0.547 mmol, 67%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, J = 8.1 Hz, 2H), 7.36 (s, 1H), 7.29-7.27 (m, 3H), 7.25-7.21 (m, 3H), 2.40 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.44, 161.93, 141.50, 140.10, 135.55, 133.63, 130.07, 129.07, 127.73, 115.28, 115.20, 115.06, 114.98, 113.13; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[1]



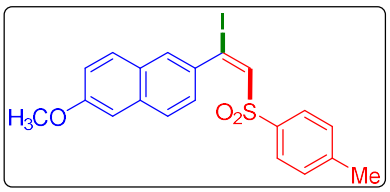
(E)-4-(1-iodo-2-tosylvinyl)benzonitrile (13): Following general iodovinyl sulfonylation procedure using 4-ethynyl benzonitrile **1j** (100 mg, 0.787 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale yellow semi solid (248 mg, 0.606 mmol, 77%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64-7.60 (m, 2H), 7.52 (d, J = 8.4 Hz, 2H), 7.38-7.34 (m, 3H), 7.27 (d, J = 9.6 Hz, 2H), 2.44 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.26, 144.08, 142.22, 136.80, 131.69, 129.99, 128.20, 127.80, 117.97, 113.28, 109.76, 21.65; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[2]



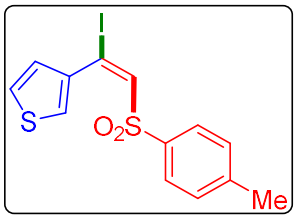
(E)-1-((1-iodo-2-(4-nitrophenyl)vinyl)sulfonyl)-4-methylbenzene (14): Following general iodovinyl sulfonylation procedure using 1-ethynyl-4-nitrobenzene **1k** (100 mg, 0.680 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (277 mg, 0.646 mmol, 95%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, J = 8.8 Hz, 2H), 7.48 (d, J = 8.4 Hz, 2H), 7.35 (d, J = 8.8 Hz, 2H), 7.31 (s, 1H), 7.21 (d, J = 7.8 Hz, 2H), 2.37 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 148.01, 145.94, 145.39, 142.38, 136.75, 130.05, 128.48, 127.83, 123.20, 109.11, 21.66; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature. [4]



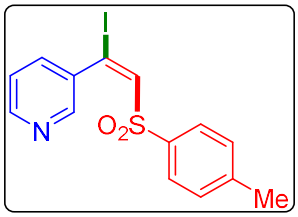
(E)-1-(1-iodo-2-tosylvinyl)-2-(trifluoromethyl)sulfonyl)benzene (15): Following general iodovinyl sulfonylation procedure using 1-ethynyl-2-(trifluoromethyl)benzene **1l** (150 mg, 100 µL, 0.829 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (273 mg, 0.605 mmol, 73%). Mp: 154-156 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, J = 7.8 Hz, 1H), 7.57 (d, J = 8.4 Hz, 3H), 7.48 (t, J = 7.7 Hz, 1H), 7.28 (s, 3H), 7.26 (s, 1H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.39 (d, $^{1}J_{CF}$ = 251.9 Hz), 140.85, 137.15 (d, $^{2}J_{CF}$ = 50.5 Hz), 129.54, 127.89 (d, $^{4}J_{CF}$ = 4.8 Hz), 127.34, 114.75, 25.15 (d, $^{3}J_{CF}$ = 8.9 Hz), 15.28; HRMS (ESI) *m/z* $[M + NH_4]^+$ calculated for $[C_{16}H_{16}NF_3IO_2S]^+$: 469.9893; found: 469.9879.



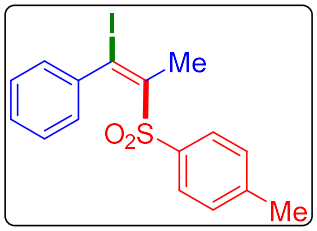
(E)-2-(1-iodo-2-tosylvinyl)-6-methoxynaphthalene (16): Following general iodo vinyl sulfonylation procedure using 2-ethynyl-6-methoxynaphthalene **1m** (100 mg, 0.549 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as yellow solid (209 mg, 0.450 mmol, 82%). Mp: 126-128 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, J = 9.0 Hz, 1H), 7.61 (d, J = 9.2 Hz, 2H), 7.43 (s, 1H), 7.39 (d, J = 8.3 Hz, 2H), 7.24-7.16 (m, 2H), 7.10 (d, J = 2.5 Hz, 1H), 7.05 (d, J = 8.0 Hz, 2H), 3.94 (s, 3H), 2.32 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.90, 144.42, 141.25, 137.32, 134.96, 134.50, 130.07, 129.44, 127.86, 127.43, 127.32, 126.48, 125.61, 119.65, 114.92, 105.75, 55.39, 21.52; HRMS (ESI) m/z $[M + NH_4]^+$ calculated for $[C_{20}H_{21}NIO_3S]^+$: 482.0281; found: 482.0267.



(E)-3-(1-iodo-2-tosylvinyl)thiophene (17): Following general iodovinyl sulfonylation procedure using 3-ethynylthiophene **1n** (100 mg, 0.926 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale yellow semi solid (224 mg, 0.574 mmol, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54-7.51 (m, 1H), 7.44 (d, J = 8.3 Hz, 2H), 7.28 (s, 1H), 7.13 (d, J = 8.3 Hz, 3H), 6.90 (dd, J = 5.1, 1.3 Hz, 1H), 2.32 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.50, 141.31, 138.68, 137.09, 129.54, 128.34, 127.60, 127.51, 125.26, 107.45, 21.56; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[1-3,7]

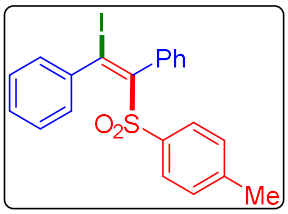


(E)-3-(1-iodo-2-tosylvinyl)pyridine (18): Following general iodovinyl sulfonylation procedure using 3-ethynyl pyridine **1o** (100 mg, 0.971 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale yellow solid (224 mg, 0.583 mmol, 60%). Mp: 150-152 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.56 (dd, J = 4.9, 1.6 Hz, 1H), 8.45 (dd, J = 2.4, 0.9 Hz, 1H), 7.64-7.60 (m, 1H), 7.52 (d, J = 8.3 Hz, 2H), 7.44 (s, 1H), 7.30-7.25 (m, 3H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 150.37, 147.49, 145.13, 142.72, 136.97, 136.03, 135.21, 129.99, 127.80, 122.62, 108.99, 21.65; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[3]

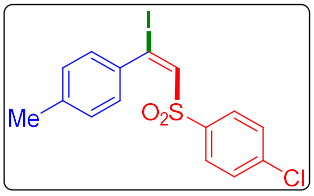


(E)-1-((1-iodo-1-phenylprop-1-en-2-yl)sulfonyl)-4-methylbenzene (19): Following general iodovinyl sulfonylation procedure using prop-1-yn-1-ylbenzene **1p** (93 mg, 0.704 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (174 mg, 0.436 mmol, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (d, J = 8.4 Hz, 2H), 7.24-7.21 (m, 3H), 7.16 (d, J = 8.5 Hz, 2H), 7.12-7.09 (m, 2H), 2.51 (s, 3H), 2.39 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.13, 143.89, 142.94, 137.22, 129.50, 129.42,

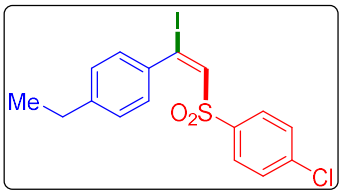
128.59, 127.67, 127.56, 115.73, 27.05, 21.60; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[2,3]



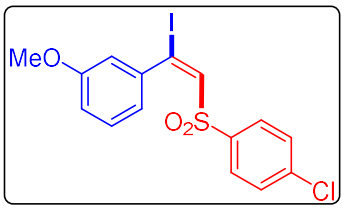
(E)-(1-iodo-2-tosylethene-1,2-diyl)dibenzene (20): Following general iodovinyl sulfonylation procedure using 1,2-diphenylethyne **1q** (100 mg, 0.561 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (170 mg, 0.370 mmol, 66%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33-7.24 (m, 8H), 7.20-7.16 (m, 2H), 7.10 (d, J = 8.0 Hz, 2H), 7.02 (d, J = 8.3 Hz, 2H), 2.29 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.00, 144.23, 142.46, 139.30, 136.67, 130.23, 129.16, 128.96, 128.48, 128.29, 127.81, 127.31, 118.05, 21.59; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[2]



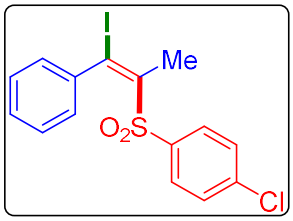
(E)-1-chloro-4-((2-iodo-2-(p-tolyl)vinyl)sulfonyl)benzene (21): Following general iodovinyl sulfonylation procedure using 1-ethynyl-4-methylbenzene **1c** (92 mg, 100 µL, 0.789 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (257 mg, 0.615 mmol, 78%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, J = 8.6 Hz, 2H), 7.34 (d, J = 10.1 Hz, 3H), 7.14-7.07 (m, 4H), 2.36 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.46, 140.27, 140.15, 138.66, 136.62, 129.27, 129.17, 128.62, 127.70, 115.83, 21.43; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[5-7]



(E)-1-chloro-4-((2-(4-ethylphenyl)-2-iodovinyl)sulfonyl)benzene (22): Following general iodovinyl sulfonylation procedure using 1-ethynyl-4-ethylbenzene **1d** (93 mg, 100 µL, 0.715 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (232 mg, 0.536 mmol, 75%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, J = 8.6 Hz, 2H), 7.36 (s, 1H), 7.30 (d, J = 8.6 Hz, 2H), 7.13-7.07 (m, 4H), 2.65 (q, J = 7.6 Hz, 2H), 1.25 (t, J = 7.6 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.68, 140.51, 140.02, 138.55, 136.71, 129.28, 129.03, 127.78, 127.42, 115.74, 28.68, 15.36; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[4]

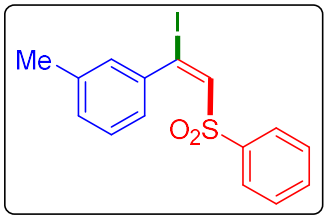


(E)-1-(2-((4-chlorophenyl)sulfonyl)-1-iodovinyl)-3-methoxybenzene (23): Following iodovinyl sulfonylation procedure using 1-ethynyl-3-methoxybenzene **1f** (104 mg, 100 µL, 0.787 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale yellow semi solid (225 mg, 0.519 mmol, 66%). Mp: 73-75 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, J = 8.7 Hz, 2H), 7.38 (s, 1H), 7.33 (d, J = 8.6 Hz, 2H), 7.19 (dd, J = 8.4, 7.6 Hz, 1H), 6.85 (dd, J = 8.4, 3.6 Hz, 1H), 6.78 (dd, J = 7.6, 2.6 Hz, 1H), 6.60 (dd, J = 2.6, 1.7 Hz, 1H), 3.77 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.72, 141.28, 140.57, 140.18, 133.39, 129.05, 128.91, 127.85, 120.04, 116.02, 114.16, 112.59, 55.27; HRMS (ESI) *m/z* $[M + NH_4]^+$ calculated for $[C_{15}H_{16}NClIO_3S]^+$: 451.9579; found: 451.9566.

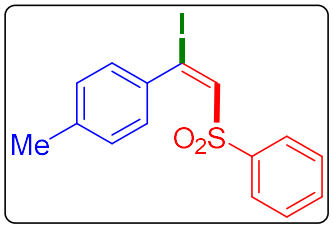


(E)-1-chloro-4-((1-iodo-1-phenylprop-1-en-2-yl)sulfonyl)benzene (24): Following general iodovinyl sulfonylation procedure using prop-1-yn-1-ylbenzene **1p** (93 mg, 0.704 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as yellow solid (188 mg, 0.451 mmol, 64%). Mp: 121-123 °C; ^{1}H NMR (400

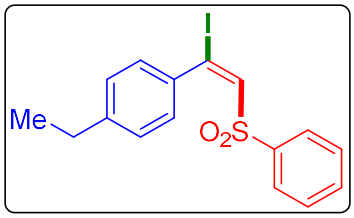
MHz, $CDCl_3$) δ 7.37 (d, J = 8.7 Hz, 2H), 7.30 (d, J = 8.7 Hz, 2H), 7.24-7.20 (m, 3H), 7.06 (dd, J = 7.6, 2.0 Hz, 2H), 2.55 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.99, 142.58, 139.75, 138.81, 129.05, 129.03, 128.83, 127.76, 127.70, 116.15, 26.82; HRMS (ESI) *m/z* [M + H]$^+$ calculated for $[C_{15}H_{13}ClIO_2S]^+$: 418.9364; found: 418.9365.



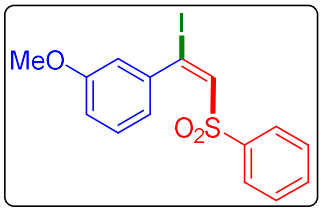
(E)-1-(1-iodo-2-(phenylsulfonyl)vinyl)-3-methylbenzene (25): Following general iodovinyl sulfonylation procedure using 1-ethynyl-3- methylbenzene **1b** (90 mg, 100 µL, 0.775 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (187 mg, 0.488 mmol, 63%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57-7.51 (m, 3H), 7.40-7.34 (m, 3H), 7.16 (t, J = 7.6 Hz, 1H), 7.09 (d, J = 7.6 Hz, 1H), 7.02 (d, J = 7.4 Hz, 1H), 6.90 (s, 1H), 2.26 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.92, 140.14, 139.36, 137.60, 133.27, 130.55, 128.80, 127.86, 127.79, 127.75, 124.66, 115.05, 21.20; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[5-7]



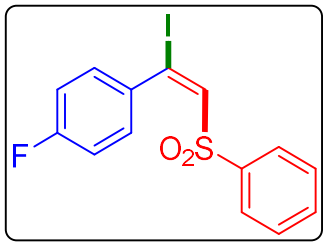
(E)-1-(1-iodo-2-(phenylsulfonyl)vinyl)-4-methylbenzene (26): Following general iodovinyl sulfonylation procedure using 1-ethynyl-4-methylbenzene **1c** (92 mg, 100 µL, 0.789 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as yellow solid (182 mg, 0.473 mmol, 60%).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62-7.58 (m, 2H), 7.55 (t, J = 7.5 Hz, 1H), 7.42-7.37 (m, 2H), 7.33 (s, 1H), 7.14 (d, J = 8.3 Hz, 2H), 7.08 (d, J = 7.7 Hz, 2H), 2.35 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.50, 140.42, 140.20, 136.68, 133.40, 128.97, 128.64, 128.46, 127.72, 115.32, 21.37; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[5-7]



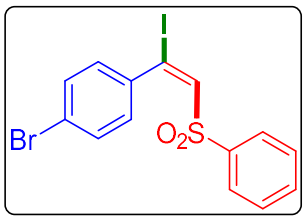
(E)-1-ethyl-4-(1-iodo-2-(phenylsulfonyl)vinyl)benzene (27): Following general iodovinyl sulfonylation procedure using 1-ethynyl-4-ethylbenzene **1d** (93 mg, 100 µL, 0.715 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (211 mg, 0.529 mmol, 74%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 (d, J = 7.7 Hz, 2H), 7.51 (d, J = 7.4 Hz, 1H), 7.39-7.33 (m, 3H), 7.15 (d, J = 7.9 Hz, 2H), 7.08 (d, J = 8.0 Hz, 2H), 2.63 (q, J = 7.6 Hz, 2H), 1.24 (t, J = 7.7 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 146.37, 140.53, 140.11, 136.75, 133.30, 128.80, 127.69, 127.31, 115.34, 28.60, 15.24; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[4]



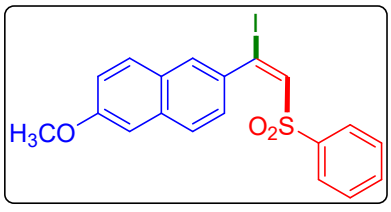
(E)-1-(1-iodo-2-(phenylsulfonyl)vinyl)-3-methoxybenzene (28): Following general iodovinyl sulfonylation procedure using 1-ethynyl-3-methoxybenzene **1f** (104 mg, 100 µL, 0.787 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as a white solid (208 mg, 0.519 mmol, 66%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60-7.52 (m, 3H), 7.41-7.36 (m, 3H), 7.20 -7.15 (m, 1H), 6.86-6.79 (m, 2H), 6.67-6.65 (m, 1H), 3.76 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.84, 141.24, 140.47, 140.16, 138.56, 129.35, 129.14, 119.94, 115.95, 114.54, 112.60, 55.28; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[5]



(E)-1-fluoro-4-(1-iodo-2-(phenylsulfonyl)vinyl)benzene (29): Following general iodovinyl sulfonylation procedure using 4-fluoro-2-ethynylbenzene **1g** (105 mg, 0.873 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale yellow solid (203 mg, 0.524 mmol, 60%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55-7.48 (m, 3H), 7.36 (dd, J = 8.2, 7.4 Hz, 2H), 7.31 (s, 1H), 7.20-7.15 (m, 2H), 6.90 (t, J = 8.6 Hz, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.18 (d, $^{1}J_{CF}$ = 251.6 Hz), 141.50, 140.10, 134.59 (d, $^{2}J_{CF}$ = 193.2 Hz), 130.07, 129.07, 127.73, 115.13 (dd, $^{3}J_{CF}$ = 21.9, 7.4 Hz), 114.98, 113.13; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[5-7]

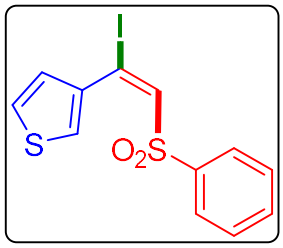


(E)-1-bromo-4-(1-iodo-2-(phenylsulfonyl)vinyl)benzene (30): Following general iodovinyl sulfonylation procedure using 4-bromo-2-ethynylbenzene **1h** (100 mg, 0.552 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (161 mg, 0.359 mmol, 65%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (d, J = 7.0 Hz, 2H), 7.43 (dd, J = 16.4, 6.9 Hz, 5H), 7.36 (d, J = 1.4 Hz, 1H), 7.13-7.08 (m, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.13, 140.51, 138.38, 138.29, 131.22, 129.42, 129.23, 129.13, 124.40, 113.20; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature. [6,7]

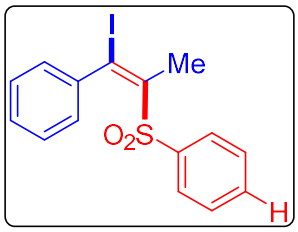


(E)-2-(1-iodo-2-phenylsulfonyl)vinyl)-6-methoxynaphthalene (31): Following general iodovinyl sulfonylation procedure using 2-ethynyl-6-methoxynaphthalene **1m** (100 mg, 0.549 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as yellow solid (149 mg, 0.329 mmol, 60%). Mp: 108-110 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69-7.63 (m, 2H), 7.58 (d, J = 8.6 Hz, 1H), 7.52-7.42 (m, 4H), 7.26-7.22 (m, 2H), 7.18 (ddd, J = 8.9, 3.6, 2.2 Hz, 2H), 7.09 (d, J = 2.5 Hz, 1H), 3.93 (s, 3H); ^{13}C NMR

(101 MHz, $CDCl_3$) δ 158.93, 141.08, 141.01, 140.92, 140.85, 140.21, 134.95, 134.35, 133.30, 130.11, 128.81, 128.72, 127.76, 127.37, 127.32, 126.55, 125.56, 125.45, 119.77, 119.66, 115.64, 105.78, 105.64, 55.36; HRMS (ESI) *m/z* $[M + NH_4]^+$ calculated for $[C_{19}H_{19}NIO_3S]^+$: 468.0125; found: 468.0112.

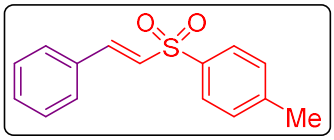


(E)-3-(1-iodo-2-(phenylsulfonyl)vinyl)thiophene (32): Following general iodovinyl sulfonylation procedure using 3-ethynylthiophene **1n** (100 mg, 0.926 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale yellow semi solid (230 mg, 0.611 mmol, 66%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64-7.57 (m, 3H), 7.54 (t, J = 7.5 Hz, 1H), 7.43-7.36 (m, 3H), 7.19 (dd, J = 5.1, 3.1 Hz, 1H), 6.92 (dd, J = 5.1, 1.4 Hz, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.12, 139.98, 138.63, 133.43, 128.89, 128.24, 127.53, 125.39, 107.96; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature. [1-3]



(E)-1-((1-iodo-1-phenylprop-1-en-2-yl)sulfonyl)benzene (33): Following general iodo vinyl sulfonylation procedure using prop-1-yn-1-ylbenzene **1p** (93 mg, 0.704 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale yellow solid (173 mg, 0.451 mmol, 64%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51-7.46 (m, 3H), 7.36 (d, J = 7.3 Hz, 2H), 7.22-7.18 (m, 3H), 7.09-7.06 (m, 2H), 2.53 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.85, 142.69, 140.20, 133.05, 128.74, 127.56, 116.03, 26.89; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[7]

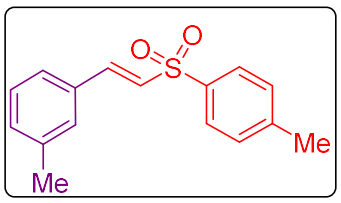
Representative Procedure for Vinyl sulfonylation:



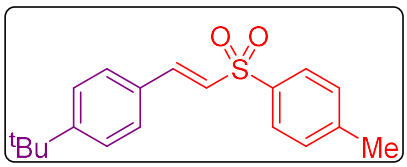
***(E)-1-methyl-4-(styrylsulfonyl)benzene (34)*:** A preformed solution of styrene **2a** (104 mg, 1.0 mmol, 1.0 equiv) in CH_3CN (3 mL) was treated with 4-Methylphenyl sulfinic acid sodium salt (445 mg, 2.5 mmol, 2.5 equiv.) followed by Me_3SI (306 mg, 1.5 mmol, 1.5 equiv) and $PhI(OAc)_2$ (483 mg, 1.5 mmol, 1.5 equiv) generating $Me_3SI(OAc)_2$ *in-situ* at room temperature (25 °C). The resulting mixture was stirred under nitrogen atmosphere and irradiated with visible light (7 W Blue LED strips). Following the usual workup and purification by silica gel column chromatography using hexanes as eluent, the desired compound **34** was obtained as white solid (235 mg, 0.91 mmol, 91%). Rf (4% EtOAc/Hexane) 0.5; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, J = 8.3 Hz, 2H), 7.65 (d, J = 15.4 Hz, 1H), 7.46 (d, J = 5.7 Hz, 2H), 7.40-7.31 (m, 5H), 6.87 (d, J = 15.4 Hz, 1H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.37, 141.90, 137.67, 132.40, 131.07, 129.94, 129.03, 128.49, 127.67, 127.55, 21.57; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[10-17]

Procedure for Gram-scale synthesis of vinyl sulfone:

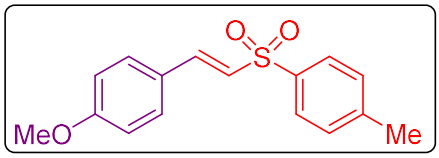
A preformed solution of styrene **2a** (1.1 g, 10.576 mmol) in CH_3CN (10 mL) was treated with 4-Methylphenyl sulfinic acid sodium salt (4.7 g, 26.44 mmol, 2.5 equiv.) followed by Me_3SI (3.2 g, 15.865 mmol, 1.5 equiv) and $PhI(OAc)_2$ (5.1 g, 15.865 mmol, 1.5 equiv) generating $Me_3SI(OAc)_2$ *in-situ* at room temperature (25 °C). The resulting mixture was stirred under nitrogen atmosphere and irradiated with visible light (7 W Blue LED). Following the usual workup and purification by silica gel column chromatography using hexanes as eluent, the desired compound **34** was obtained as white solid (3.4 g, 8.989 mmol, 85%). The overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[10-17]



(E)-1-methyl-3-(2-tosylvinyl)benzene (35): Following general vinyl sulfonylation procedure using 1-methyl-3-vinylbenzene **2b** (90 mg, 0.762 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as dark yellow solid (126 mg, 0.465 mmol, 61%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, J = 8.3 Hz, 2H), 7.62 (d, J = 15.4 Hz, 1H), 7.33 (d, J = 8.0 Hz, 2H), 7.27 (d, J = 5.3 Hz, 3H), 7.21 (d, J = 2.9 Hz, 1H), 6.84 (dd, J = 15.4, 2.5 Hz, 1H), 2.42 (s, 3H), 2.34 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.26, 142.03, 138.70, 137.69, 132.26, 131.86, 129.86, 129.00, 128.85, 127.58, 127.22, 125.68, 21.52, 21.16; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[11,13,16]

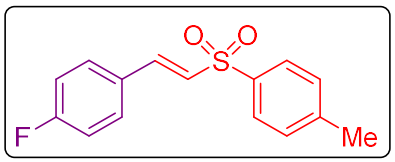


(E)-1-(tert-butyl)-4-(2-tosylvinyl)sulfonyl)benzene (36): Following general vinyl sulfonylation procedure using 1-(tert-butyl)-4-vinylbenzene **2c** (90 mg, 0.562 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (109 mg, 0.348 mmol, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (d, J = 8.3 Hz, 2H), 7.56 (d, J = 15.4 Hz, 1H), 7.31 (d, J = 2.2 Hz, 4H), 7.22 (d, J = 7.9 Hz, 2H), 6.74 (d, J = 15.4 Hz, 1H), 2.32 (s, 3H), 1.20 (s, 9H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 154.68, 144.12, 141.77, 137.79, 129.80, 129.51, 128.29, 127.48, 126.44, 125.91, 34.81, 30.94, 21.47; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[11,13,14]

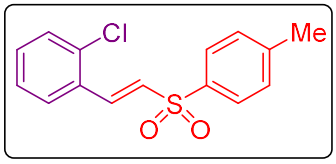


(E)-1-methoxy-4-(2-tosylvinyl)sulfonyl)benzene (37): Following general vinyl sulfonylation procedure using 1-methoxy-4-vinylbenzene **2d** (100 mg, 0.746 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale yellow semi solid (146 mg, 0.507 mmol, 68%).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, J = 8.4 Hz, 2H), 7.62 (s, 1H), 7.42 (d, J = 9.0 Hz, 2H), 7.33 (d, J = 7.4 Hz, 2H), 6.89 (d, J = 8.9 Hz, 2H), 6.70 (d, J = 15.3 Hz, 1H), 3.83 (s, 3H), 2.43 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 161.93, 144.09, 141.69, 138.14, 130.26, 129.85, 127.51, 125.01, 124.76, 114.44, 55.38, 21.54; the

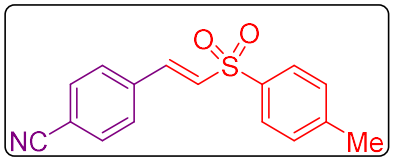
overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[10,16,17]



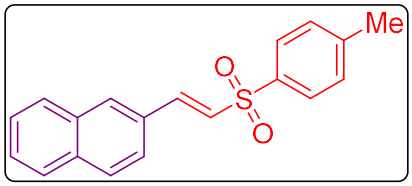
(E)-1-fluoro-4-(2-tosylvinyl)sulfonyl)benzene (38): Following general vinyl sulfonylation procedure using 1-fluoro-4-vinylbenzene **2e** (100 mg, 0.819 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (140 mg, 0.508 mmol, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, J = 8.3 Hz, 2H), 7.62 (d, J = 15.4 Hz, 1H), 7.47 (dd, J = 8.8, 5.2 Hz, 2H), 7.34 (d, J = 8.0 Hz, 2H), 7.07 (t, J = 8.6 Hz, 2H), 6.82 (d, J = 15.4 Hz, 1H), 2.42 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.21 (d, $^{1}J_{CF}$ = 252.8 Hz), 144.43, 140.54, 137.53, 130.53, 130.49 (d, $^{4}J_{CF}$ = 8.7 Hz), 127.45 (d, $^{2}J_{CF}$ = 36.6 Hz), 116.22 (d, $^{3}J_{CF}$ = 22.1 Hz), 21.56; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[11-14,16]



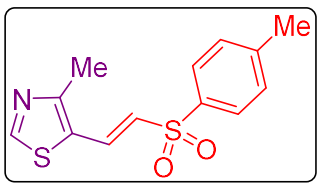
(E)-1-chloro-2-(2-tosylvinyl)sulfonyl)benzene (39): Following general vinyl sulfonylation procedure using 1-chloro-2-vinylbenzene **2f** (110 mg, 0.797 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (152 mg, 0.518 mmol, 65%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, J = 15.6 Hz, 1H), 7.77 (t, J = 7.2 Hz, 2H), 7.42 (d, J = 7.2 Hz, 1H), 7.34 (d, J = 7.4 Hz, 1H), 7.27 (q, J = 6.9 Hz, 3H), 7.18 (d, J = 7.3 Hz, 1H), 6.81 (d, J = 15.2 Hz, 1H), 2.36 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.57, 137.82, 137.28, 135.23, 131.78, 130.74, 130.34, 130.00, 128.17, 127.85, 127.16, 21.60; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[10,13,14]



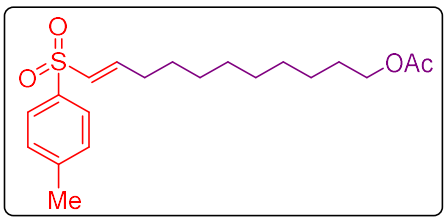
(E)-4-(tosylvinyl)sulfonyl)benzonitrile (40): Following general vinyl sulfonylation procedure using 1-cyano-4-vinylbenzene **2g** (110 mg, 0.853 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (198 mg, 0.699 mmol, 82%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78-7.73 (m, 2H), 7.57 (d, J = 17.6 Hz, 3H), 7.53-7.48 (m, 2H), 7.32-7.27 (m, 2H), 6.91 (dd, J = 15.5, 2.0 Hz, 1H), 2.37 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 144.94, 139.18, 136.78, 136.65, 132.68, 131.27, 130.09, 128.82, 127.83, 117.99, 114.09, 21.58; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[11,12,14,17]



(E)-2-(2-tosylvinyl)naphthalene (41): Following general vinyl sulfonylation procedure using 2-vinylnaphthalene **2h** (100 mg, 0.649 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as white solid (128 mg, 0.415 mmol, 64%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33-7.24 (m, 7H), 7.20-7.16 (m, 2H), 7.10 (d, J = 8.0 Hz, 2H), 7.02 (d, J = 8.3 Hz, 2H), 2.29 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 149.00, 144.23, 142.46, 139.30, 136.67, 130.23, 129.16, 128.96, 128.48, 128.29, 127.81, 127.31, 118.05, 21.59; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[12-14,16,17]

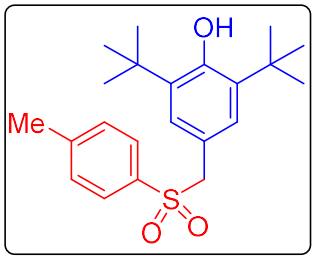


(E)-4-methyl-5-(2-tosylvinyl)thiazole (42): Following general vinyl sulfonylation procedure using 4-methyl-5-vinylthiazole **2i** (109 mg, 0.872 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as yellow solid (199 mg, 0.715 mmol, 82%). Mp: 122-124 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.74 (s, 1H), 7.85-7.77 (m, 3H), 7.36 (d, J = 8.2 Hz, 2H), 6.59 (d, J = 15.0 Hz, 1H), 2.59 (s, 3H), 2.44 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 157.19, 153.72, 144.53, 137.28, 131.02, 129.95, 128.37, 127.61, 126.01, 21.51, 15.62; HRMS (ESI) *m/z* $[M + H]^+$ calculated for $[C_{13}H_{14}NO_2S_2]^+$: 280.0460; found: 280.0461.

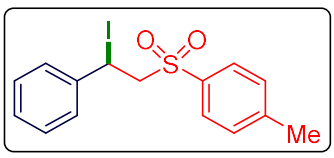


(E)-11-tosylundec-10-en-1-yl acetate (43): Following general vinyl sulfonylation procedure using undec-10-en-1-yl acetate **2j** (100 mg, 0.505 mmol) and purified by silica gel column chromatography, eluting with hexanes afforded the title compound as pale-yellow liquid (140 mg, 0.384 mmol, 76%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (dd, J = 8.4, 2.1 Hz, 2H), 7.37-7.30 (m, 2H), 7.01-6.89 (m, 1H), 6.30 (dd, J = 15.1, 1.6 Hz, 1H), 4.04 (td, J = 6.8, 2.2 Hz, 2H), 2.43 (d, J = 2.4 Hz, 3H), 2.26-2.17 (m, 2H), 2.04 (d, J = 2.4 Hz, 3H), 1.60 (dd, J = 10.4, 4.2 Hz, 2H), 1.50-1.39 (m, 2H), 1.26 (s, 10H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.15, 146.54, 144.05, 137.64, 130.44, 129.75, 127.47, 64.47, 31.31, 29.17, 29.04, 29.02, 28.86, 28.43, 27.43, 25.73, 21.48, 20.92; HRMS (ESI) *m/z* $[M + H]^+$ calculated for $[C_{20}H_{31}O_4S]^+$: 367.1938; found: 367.1938.

D. Mechanistic Studies and spectroscopic data.

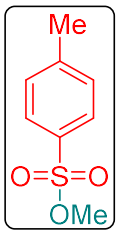


2,6-di-tert-butyl-4-(tosylmethyl)phenol (44): A preformed solution of $PhI(OAc)_2$ (646 mg, 2.006 mmol, 2.2 equiv.), Me_3SI (409 mg, 2.006 mmol, 2.2 equiv.), p-TsNa (487 mg, 2.735 mmol, 3.0 equiv.) and BHT (802 mg, 3.647 mmol, 4.0 equiv.) dissolved in 5 mL of MeCN: AcOH in 2:1 ratio, was treated with *phenyl acetylene* (**1a**) (93 mg, 100 µL, 0.912 mmol, 1.0 equiv.) at room temperature. The mixture was stirred under nitrogen atmosphere and irradiated with visible light (7 W Blue LED strips). The distance between the light source and the reaction flask was approximately 3-4 cm, resulted in the temperature increasing up to 35 °C. For safety reasons, the reaction was carried out behind an antiblast shield. The reaction was stirred until the completion of starting material, typically for 15 h (adjudged by TLC). The reaction mixture was diluted with DCM (10 mL), quenched with saturated $NaHCO_3$ (5 mL) and saturated aqueous sodium thiosulfate (2 mL) and extracted with DCM (3 × 30 mL). The combined organic layers were washed with brine solution, dried over anhydrous Na_2SO_4, concentrated *in vacuo* and purified by silica gel column chromatography using hexanes as eluent to afford the compound **44** as white solid (246 mg, 0.657 mmol, 72%). Rf (10% EtOAc) 0.5; Mp: 133-135 °C; IR (Film): 3565, 2958, 1745, 1431, 1292, 1229, 1138, 887, 790, 755, 636, 518 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 7.44 (d, J = 8.3 Hz, 2H), 7.29-7.15 (m, 2H), 6.73 (s, 2H), 5.27 (d, J = 21.2 Hz, 1H), 4.19 (s, 2H), 2.41 (s, 3H), 1.32 (s, 18H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 154.15, 144.29, 135.90, 134.81, 129.25, 128.85, 127.62, 118.86, 63.19, 34.06, 29.98, 21.50; HRMS (ESI) *m/z* $[M + NH_4]^+$ calculated for $[C_{22}H_{34}NO_3S]^+$: 392.2254; found: 392.2256.

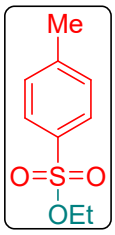


***(R)-1-((2-iodo-2-phenylethyl)sulfonyl0-4-methylbenzene (45)*:** A preformed solution of styrene **2a** (91 mg, 100 µL, 0.871 mmol, 1.0 equiv) in CH_3CN:AcOH (2:1; 3 mL) was treated

with 4-Methylphenyl sulfinic acid sodium salt (233 mg, 1.306 mmol, 1.5 equiv.) followed by Me_3SI (215 mg, 1.045 mmol, 1.2 equiv) and $PhI(OAc)_2$ (337 mg, 1.045 mmol, 1.2 equiv) generating $Me_3SI(OAc)_2$ *in-situ* at room temperature (25 °C). The resulting mixture was stirred under nitrogen atmosphere and irradiated with visible light (7 W Blue LED strips). Following the usual workup and purification by silica gel column chromatography using hexanes as eluent, the desired compound **45** was obtained as white solid (222 mg, 0.575 mmol, 66%). Rf (4% EtOAc/Hexane) 0.5; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85-7.77 (m, 2H), 7.35 (d, J = 8.0 Hz, 2H), 7.32-7.21 (m, 5H), 5.27-5.21 (m, 1H), 3.47 (dd, J = 14.4, 10.0 Hz, 1H), 3.30 (dd, J = 14.3, 1.8 Hz, 1H), 2.44 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 145.07, 140.66, 136.00, 129.92, 128.56, 128.10, 127.86, 125.53, 68.30, 63.78, 21.51; the overall spectroscopic data are in complete agreement with assigned structures and consistent with literature.[18,19]



Methyl-4-methylbenzene sulfonate (46): A preformed solution of styrene **2a** (91 mg, 100 µL, 0.871 mmol) in MeOH (3 mL) was treated with 4-Methylphenyl sulfinic acid sodium salt (388 mg, 2.178 mmol, 2.5 equiv.) followed by Me_3SI (266 mg, 1.3067 mmol, 1.5 equiv) and $PhI(OAc)_2$ (421 mg, 1.3067 mmol, 1.5 equiv) generating $Me_3SI(OAc)_2$ *in-situ* at room temperature (25 °C). The resulting mixture was stirred under nitrogen atmosphere and irradiated with visible light (7 W Blue LED strips). Following the usual workup and purification by silica gel column chromatography using hexanes as eluent, the desired compound **46** was obtained as white solid (110 mg, 0.592 mmol, 68%). Rf (4% EtOAc/Hexane) 0.5; ^{1}H NMR (400 MHz, $CDCl_3$) 7.69 (d, J = 8.3 Hz, 2H), 7.30-7.24 (m, 2H), 3.63 (s, 3H), 2.35 (s, 3H).



Ethyl-4-methylbenzene sulfonate (47): A preformed solution of styrene **2a** (91 mg, 100 µL, 0.871 mmol) in EtOH (3 mL) was treated with 4-Methylphenyl sulfinic acid sodium salt (388 mg, 2.178 mmol, 2.5 equiv.) followed by Me_3SI (266 mg, 1.3067 mmol, 1.5 equiv) and $PhI(OAc)_2$ (421 mg, 1.3067 mmol, 1.5 equiv) generating $Me_3SI(OAc)_2$ *in-situ* at room temperature (25 °C). The resulting mixture was stirred under nitrogen atmosphere and irradiated with visible light (7 W Blue LED strips). Following the usual workup and purification by silica gel column chromatography using hexanes as eluent, the desired compound **47** was obtained as white solid (157 mg, 0.784 mmol, 90%). Rf (4% EtOAc/Hexane) 0.5; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (d, J = 8.1 Hz, 2H), 7.25 (d, J = 8.0 Hz, 2H), 3.99 (q, J = 7.1 Hz, 2H), 2.34 (s, 3H), 1.18 (t, J = 7.1 Hz, 3H).

E. References for Supporting Information.

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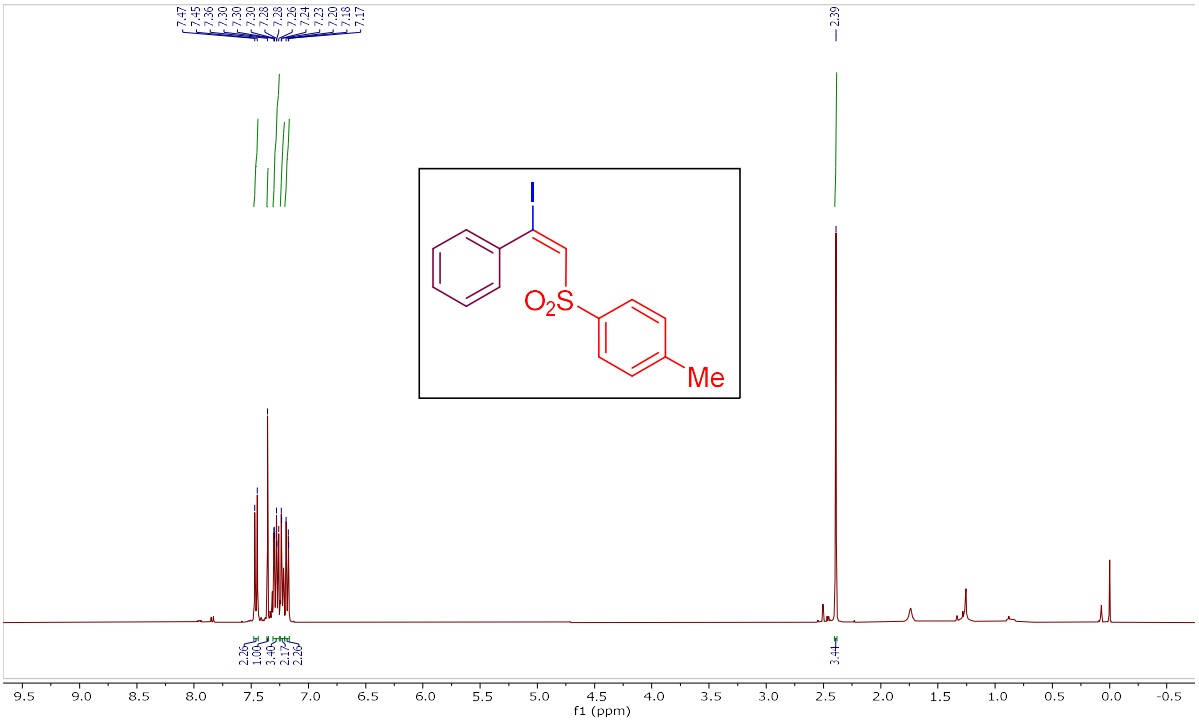
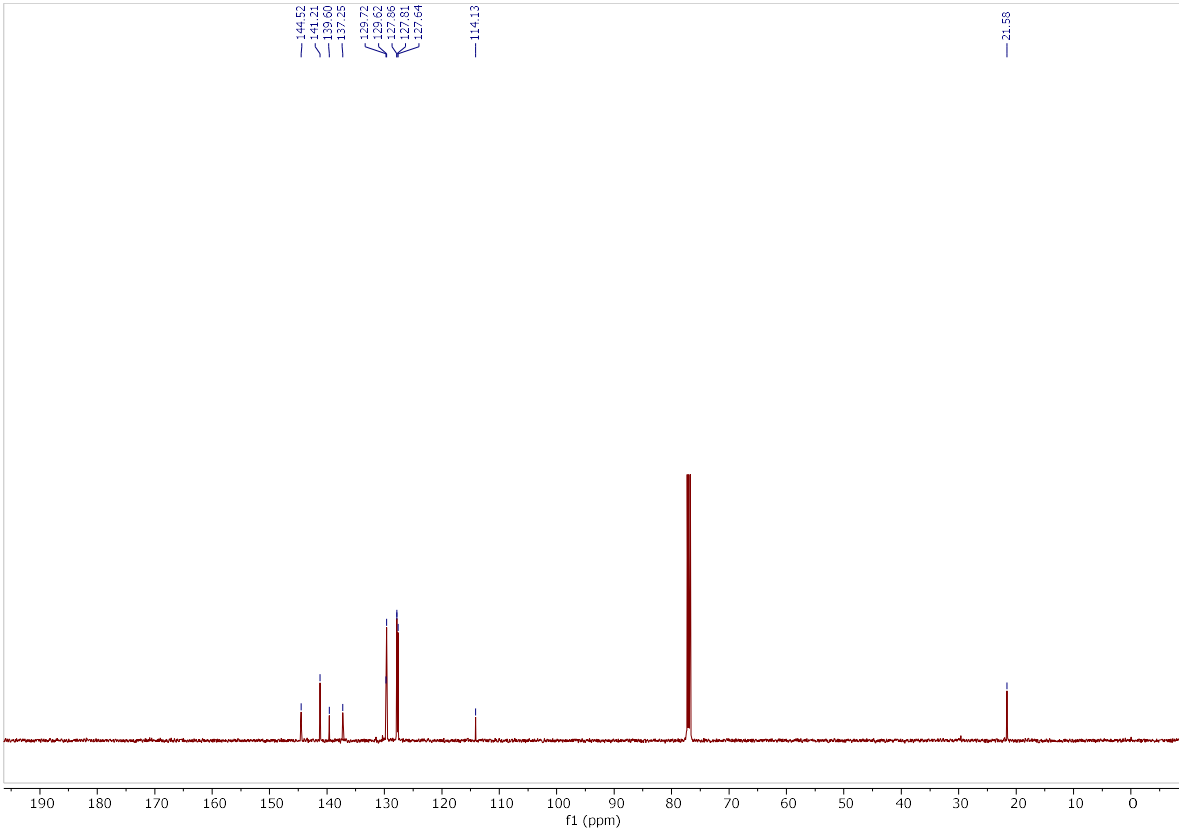
F. ^{1}H and ^{13}C NMR Spectra.

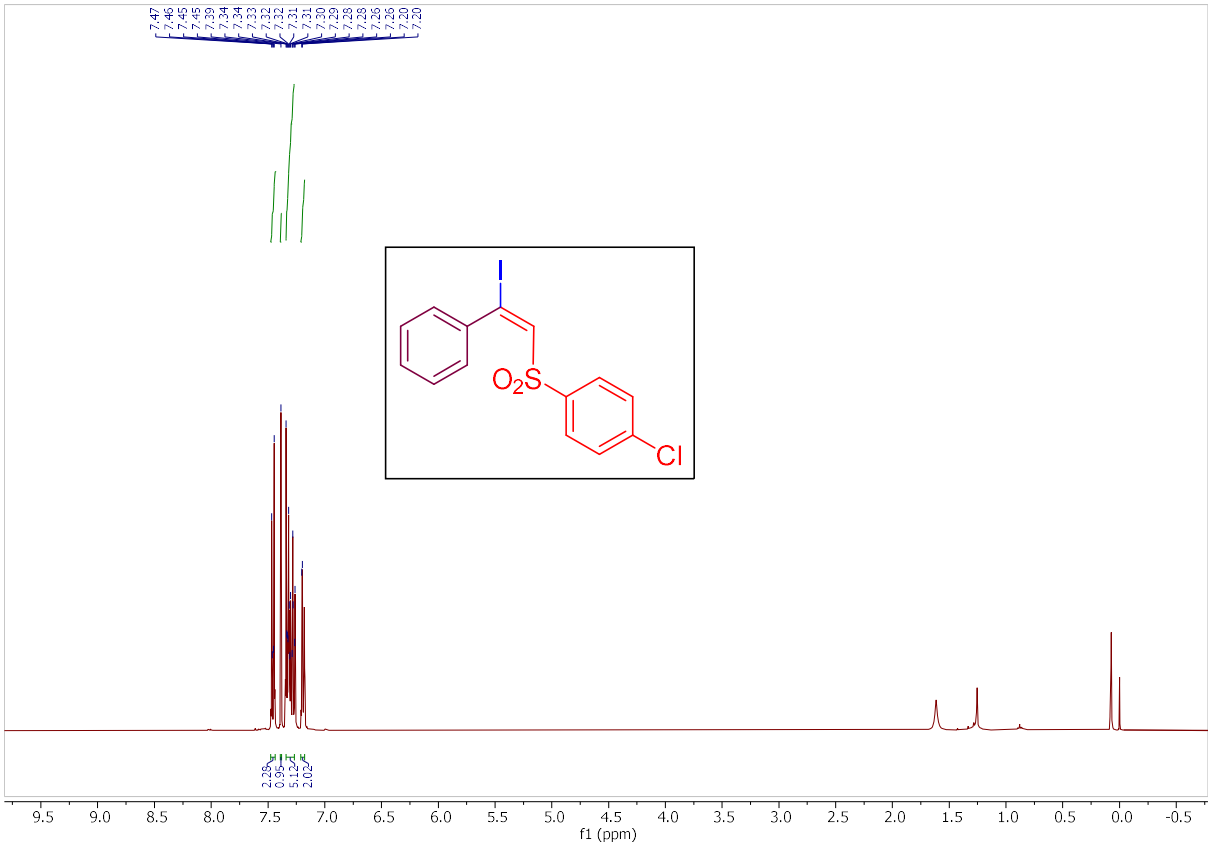
^{1}H NMR Spectrum of compound **4a** in $CDCl_3$



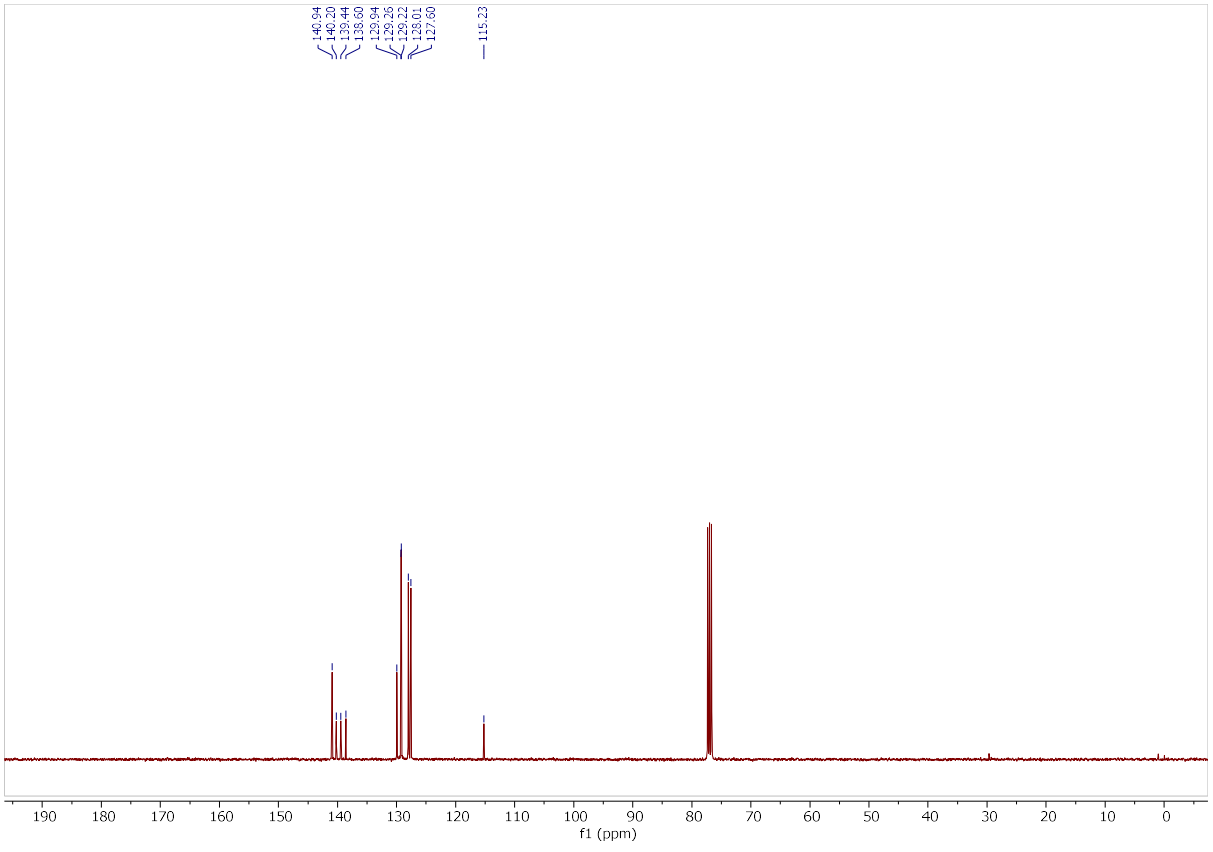
^{13}C NMR Spectrum of compound **4a** in $CDCl_3$



^{1}H-NMR Spectrum of compound **4b** in $CDCl_3$



^{13}C-NMR Spectrum of compound **4b** in $CDCl_3$



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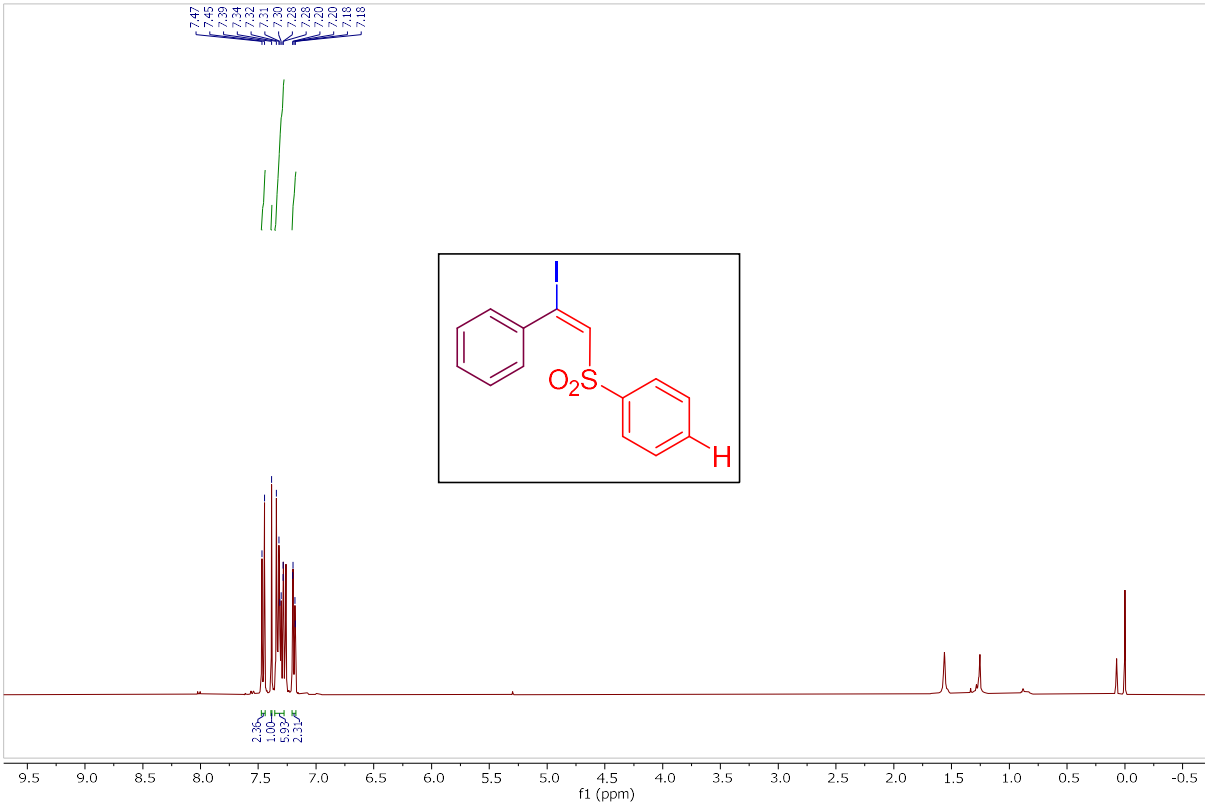
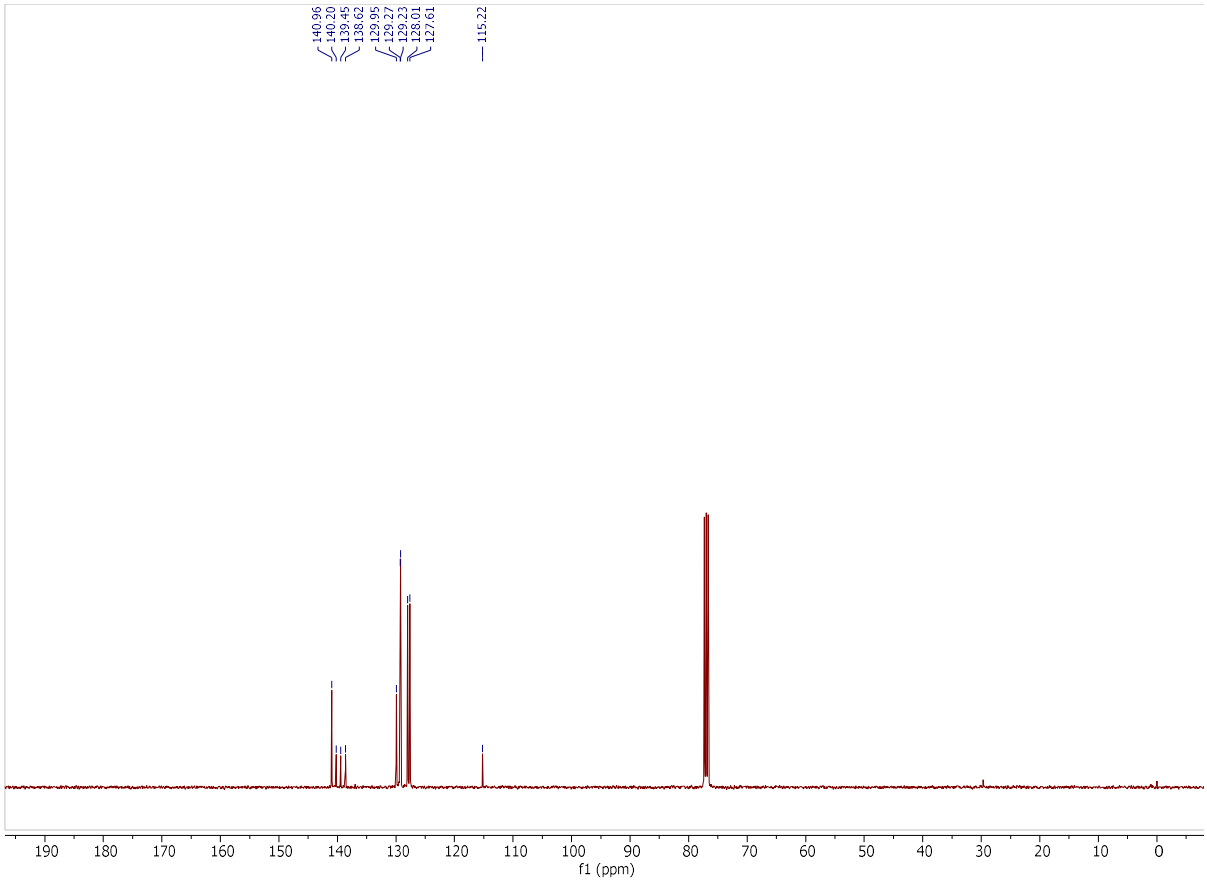
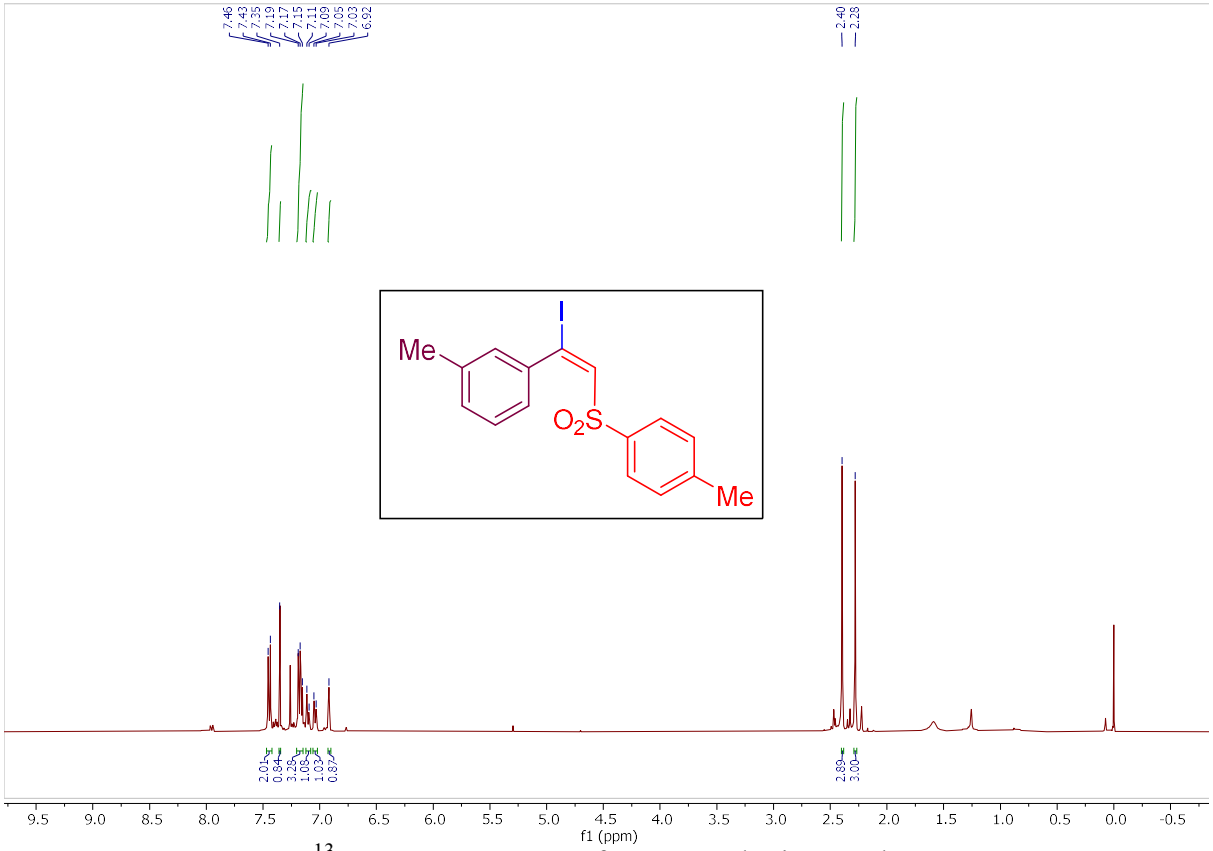


^{13}C NMR Spectrum of compound **4c** in $CDCl_3$



^{1}H-NMR Spectrum of compound **5** in $CDCl_3$



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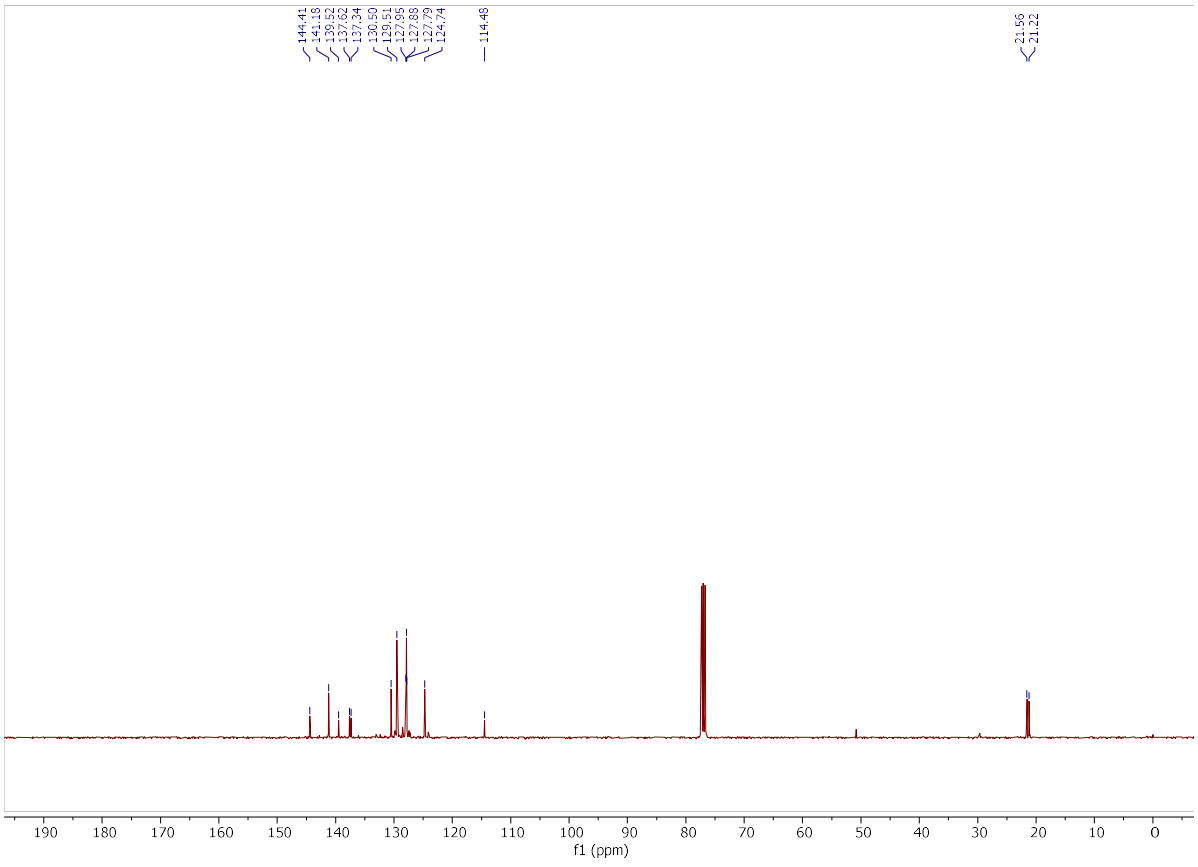

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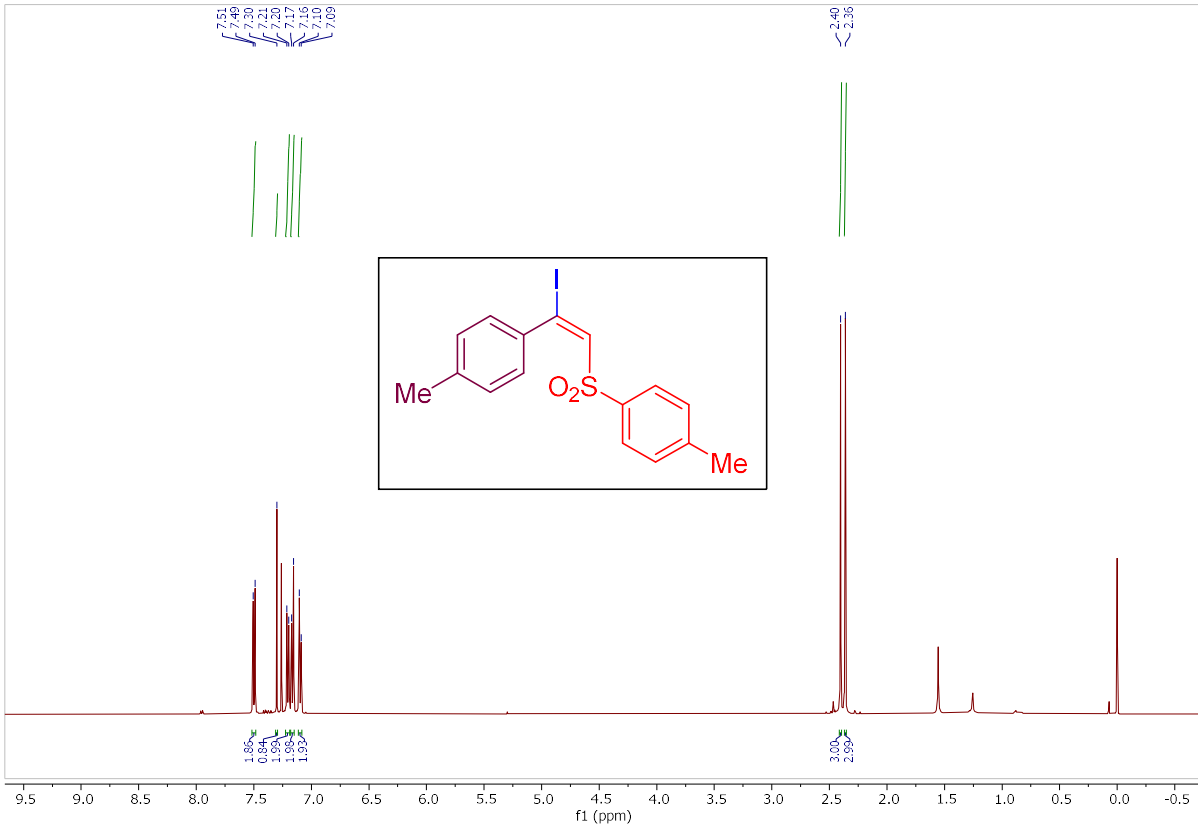

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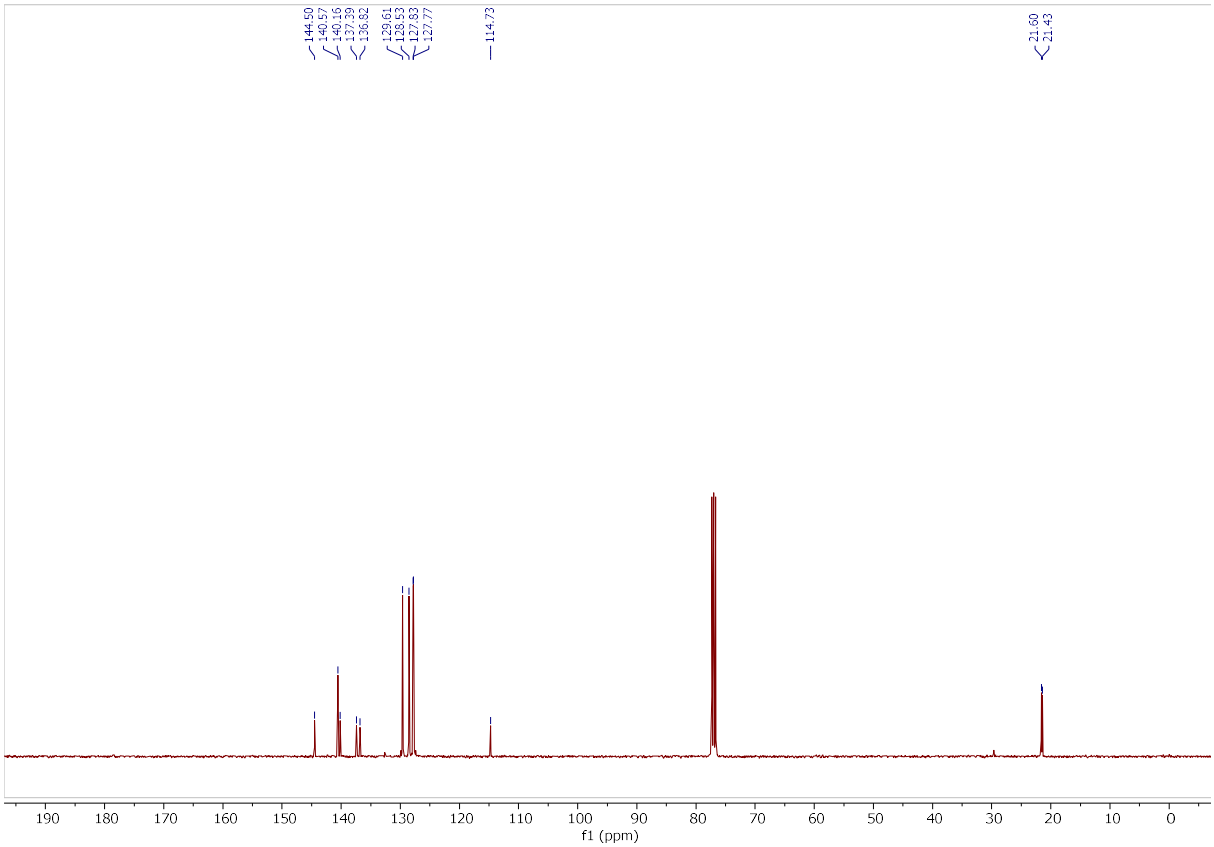

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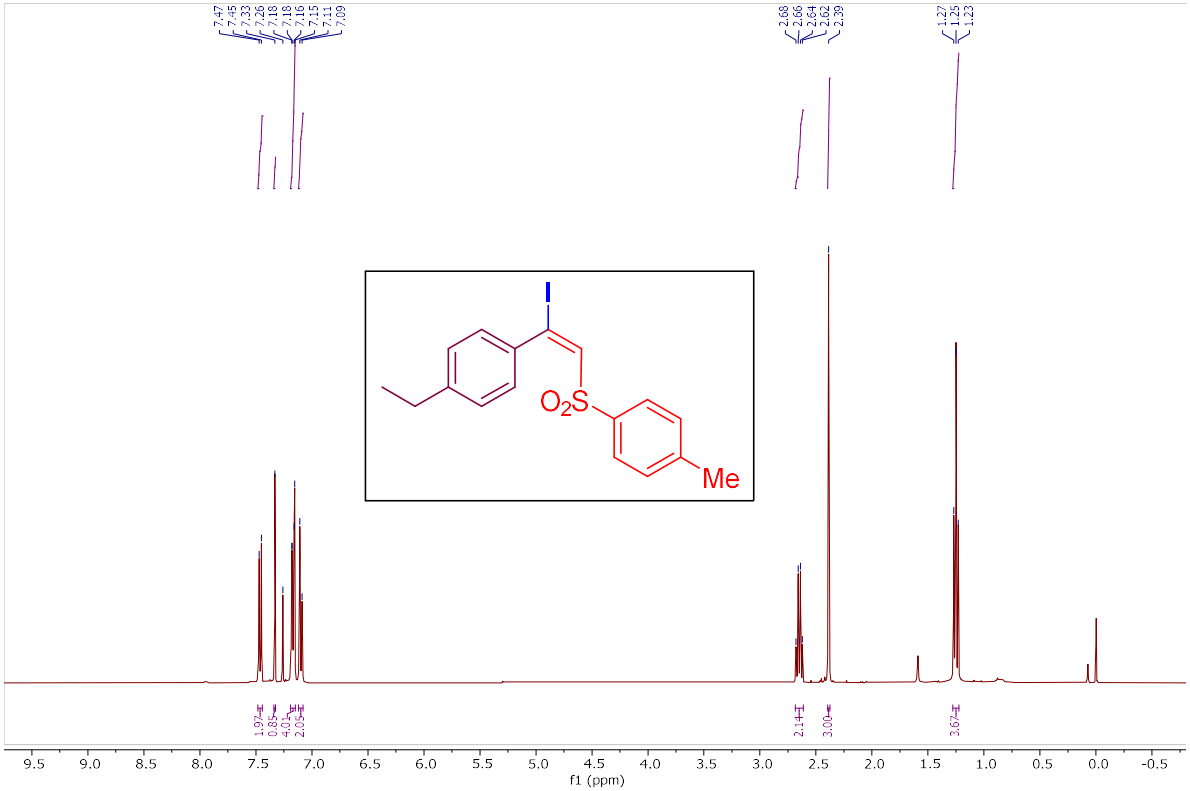

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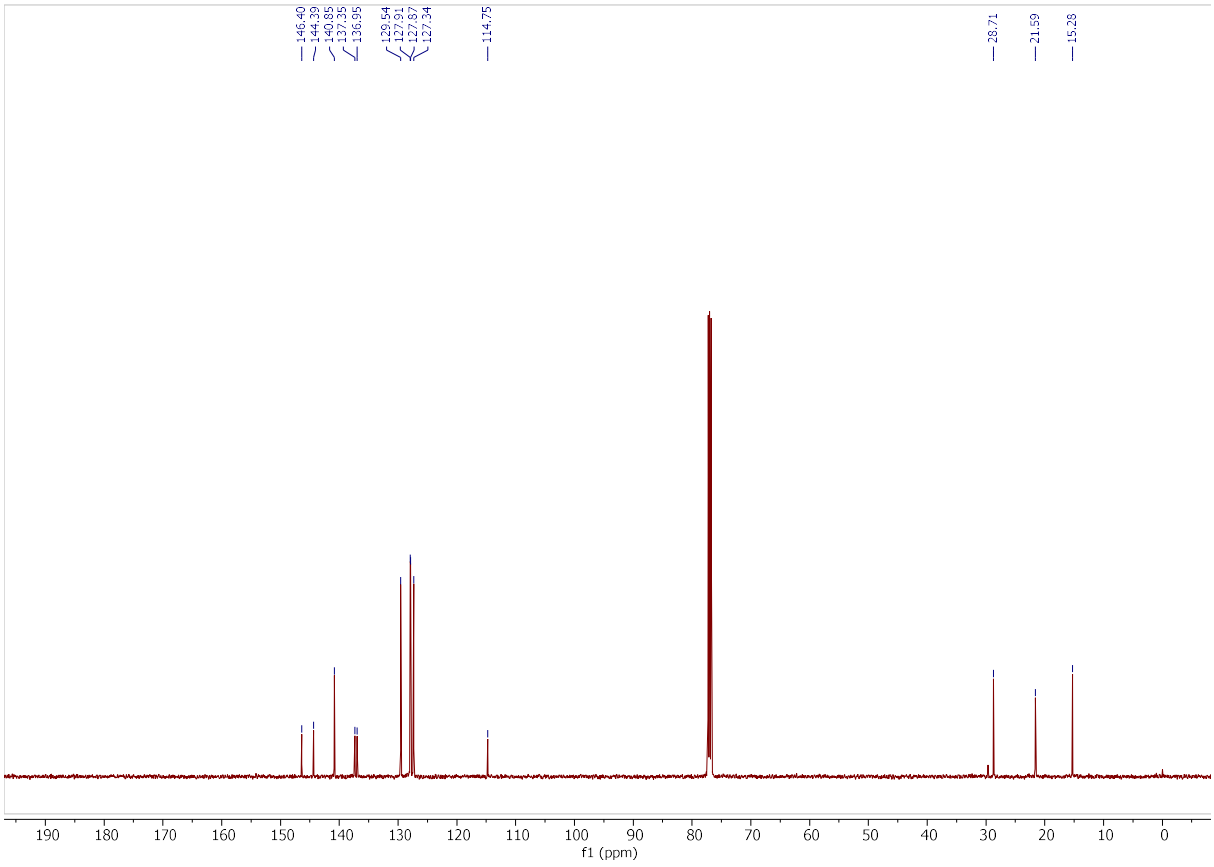
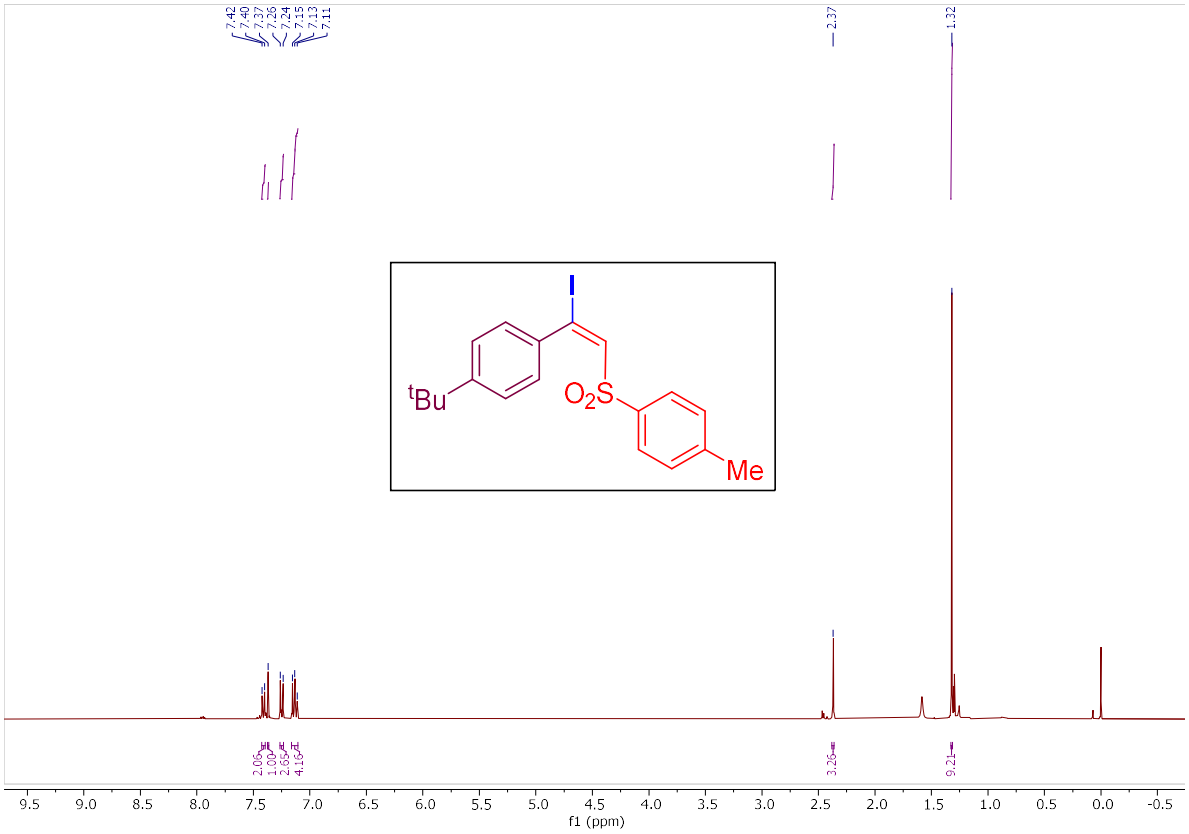
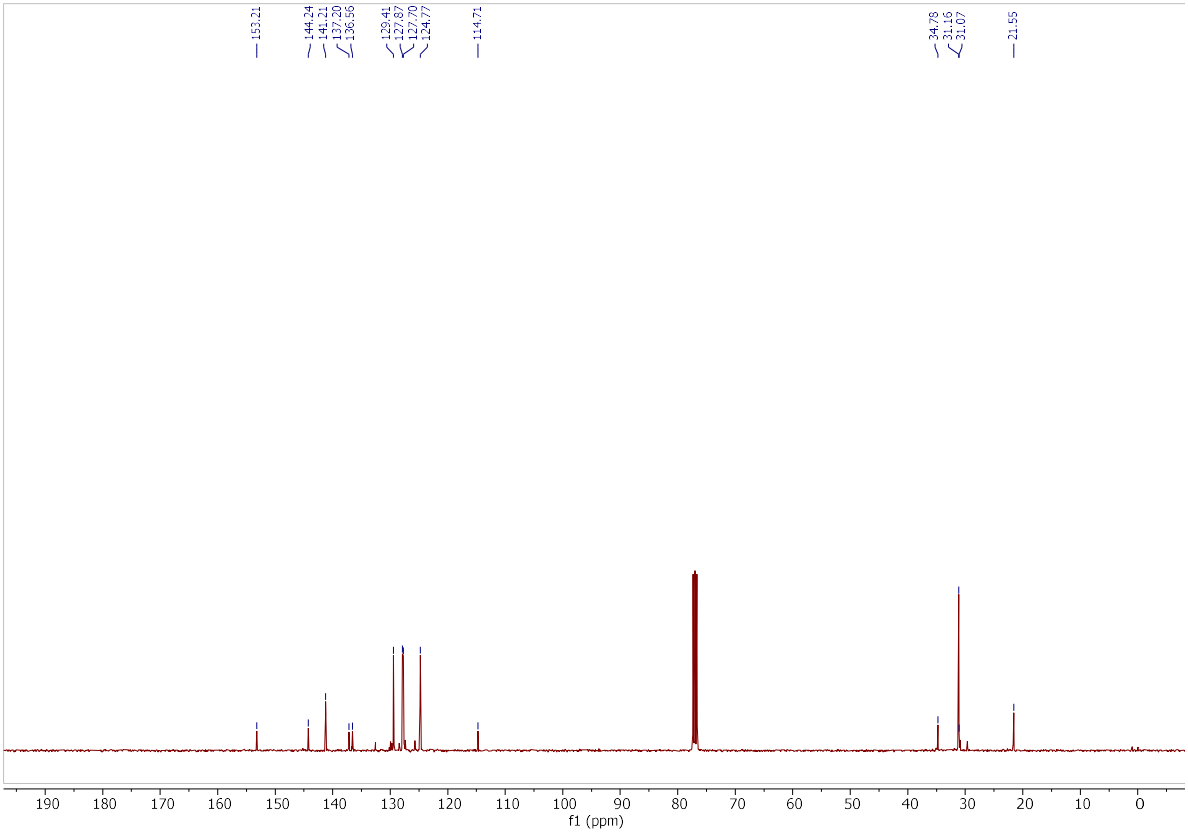


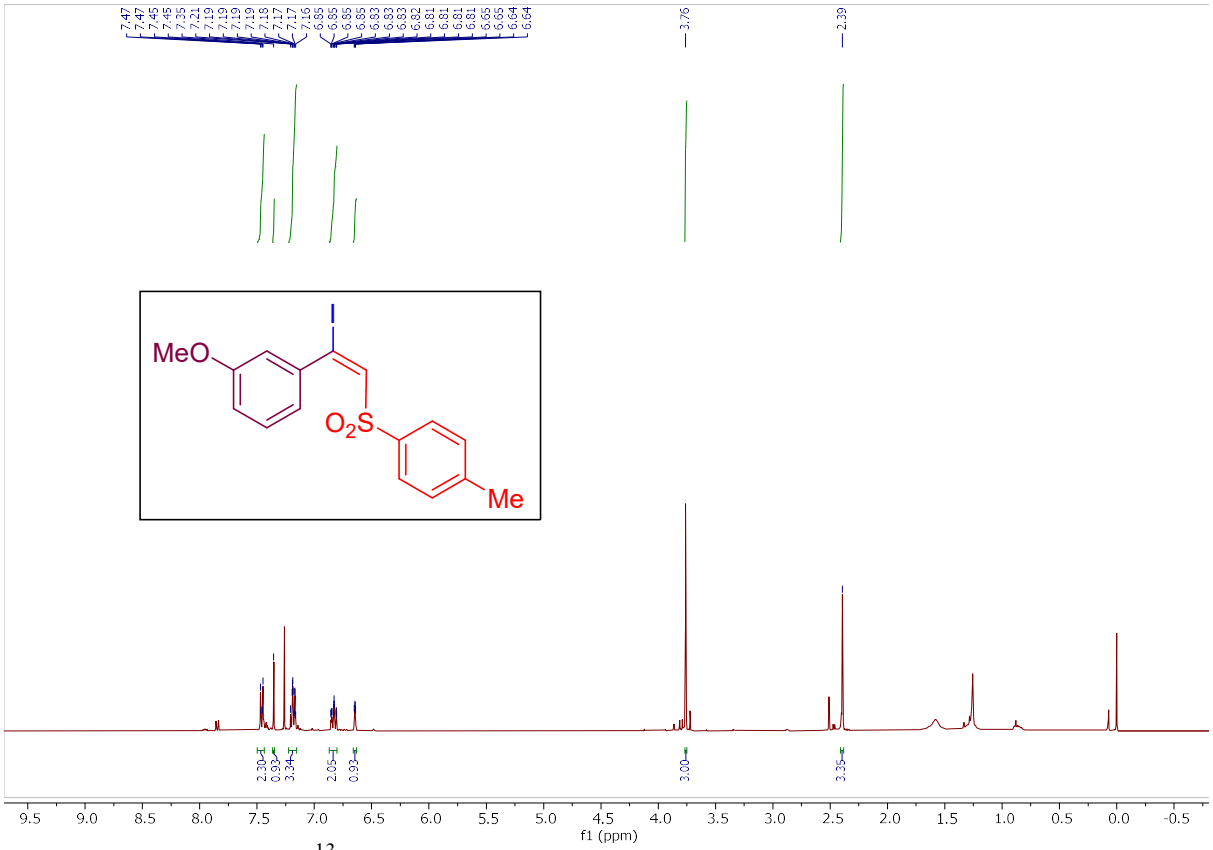
^{1}H-NMR Spectrum of compound **8** in $CDCl_3$



^{13}C-NMR Spectrum of compound **8** in $CDCl_3$



^{1}H NMR Spectrum of compound **9** in $CDCl_3$



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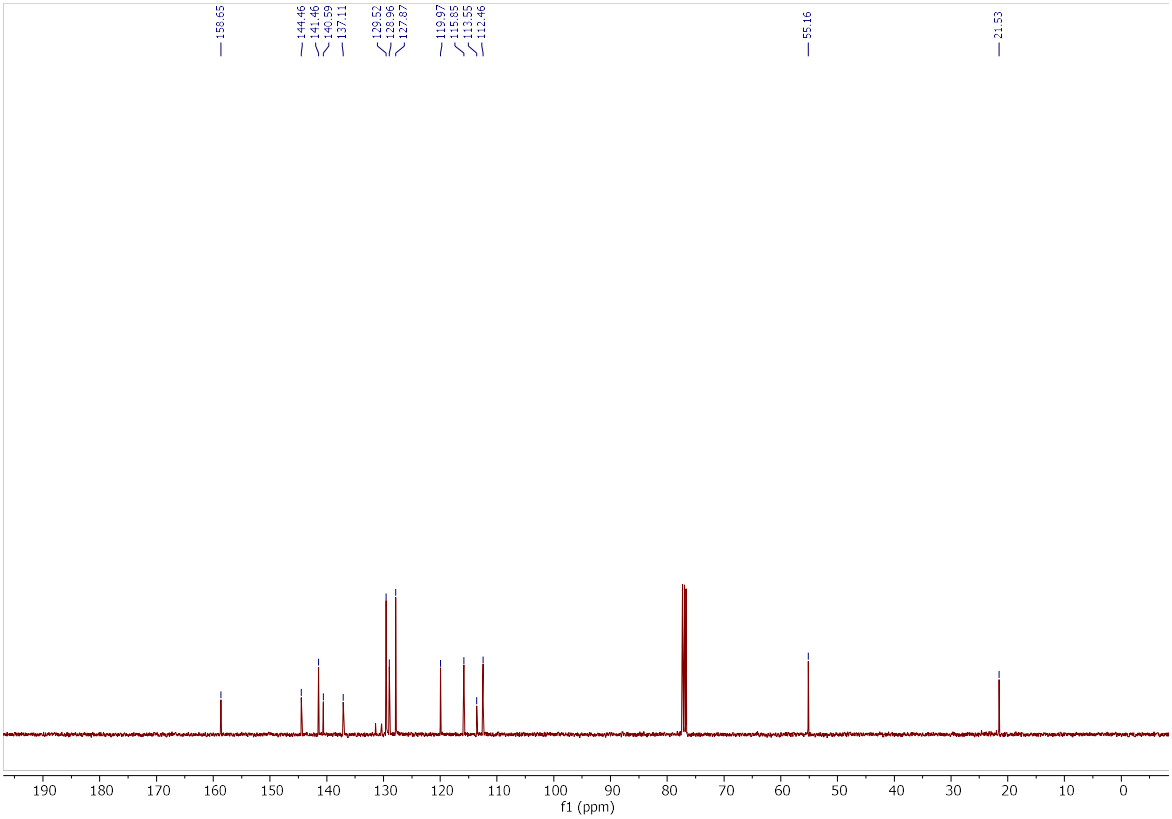
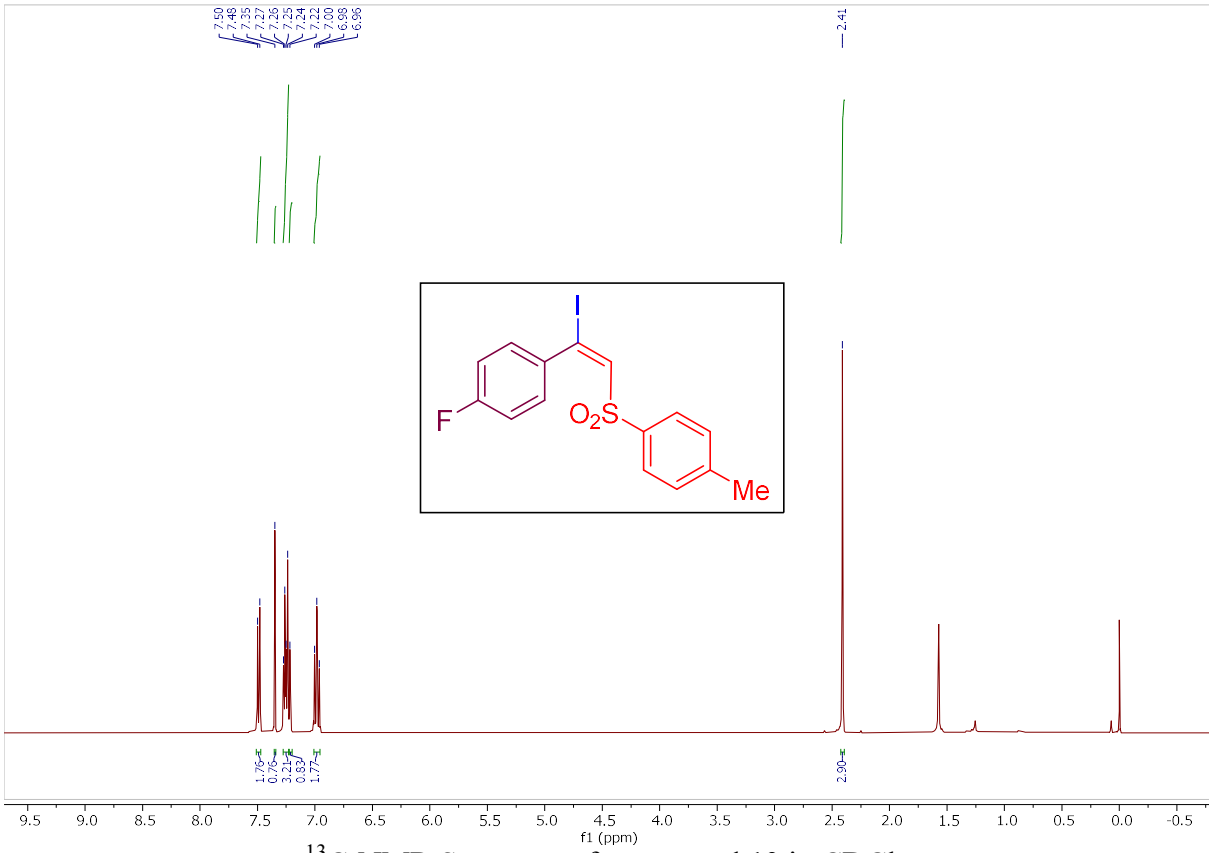
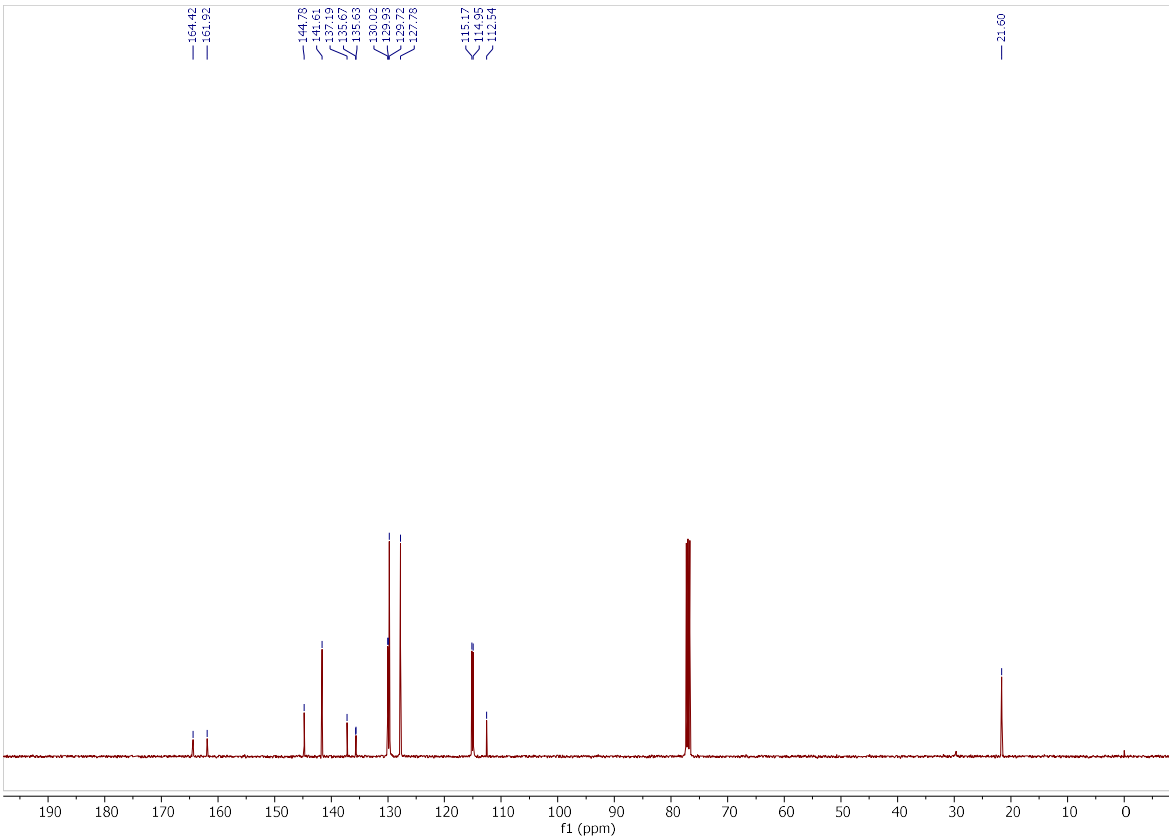


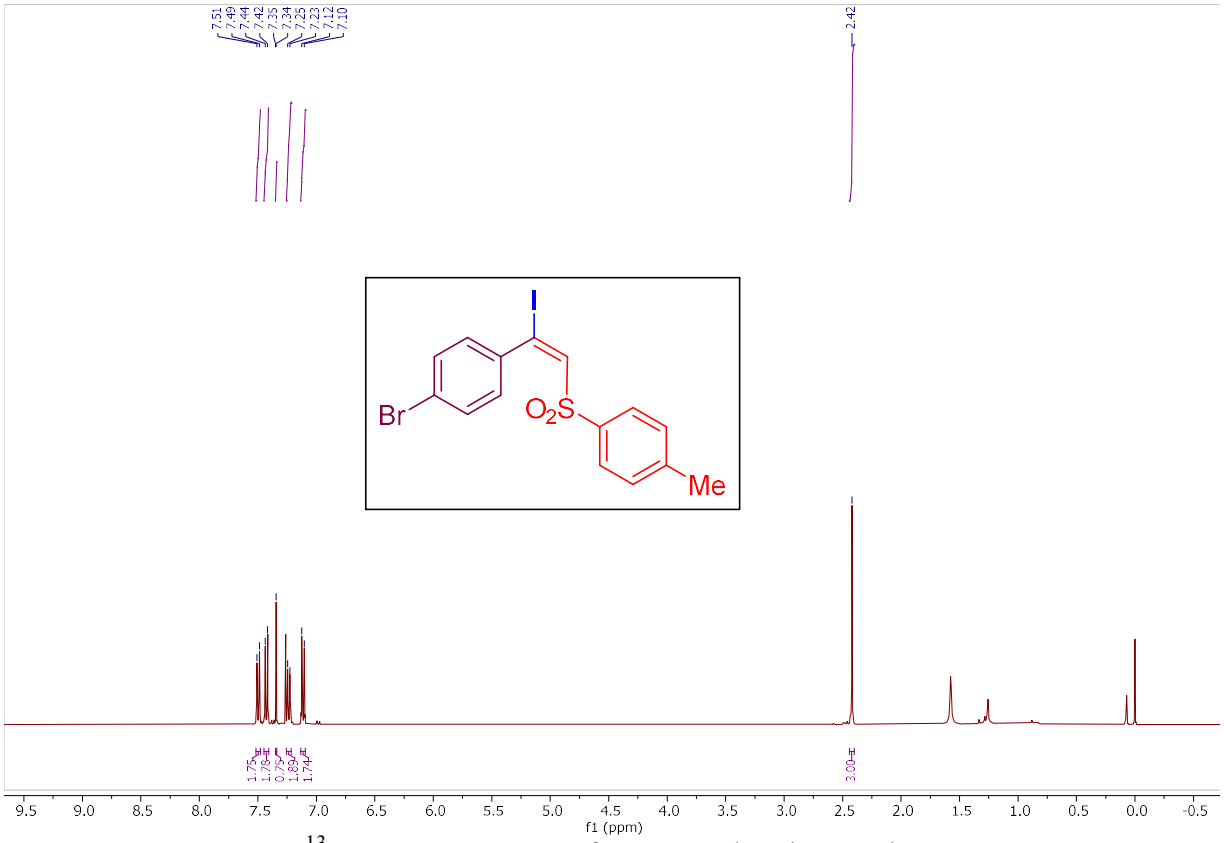
^{1}H-NMR Spectrum of compound **10** in $CDCl_3$



^{13}C-NMR Spectrum of compound **10** in $CDCl_3$



^{1}H-NMR Spectrum of compound **11** in $CDCl_3$



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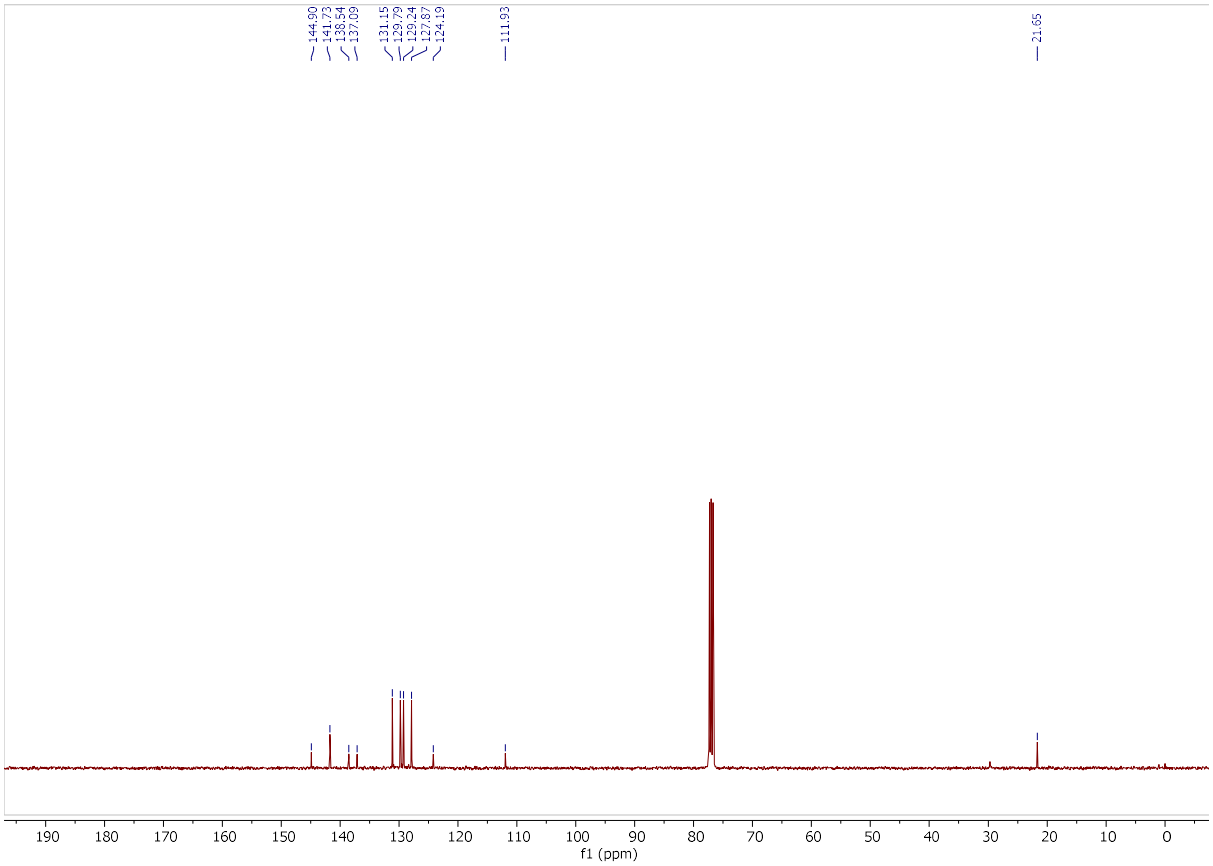
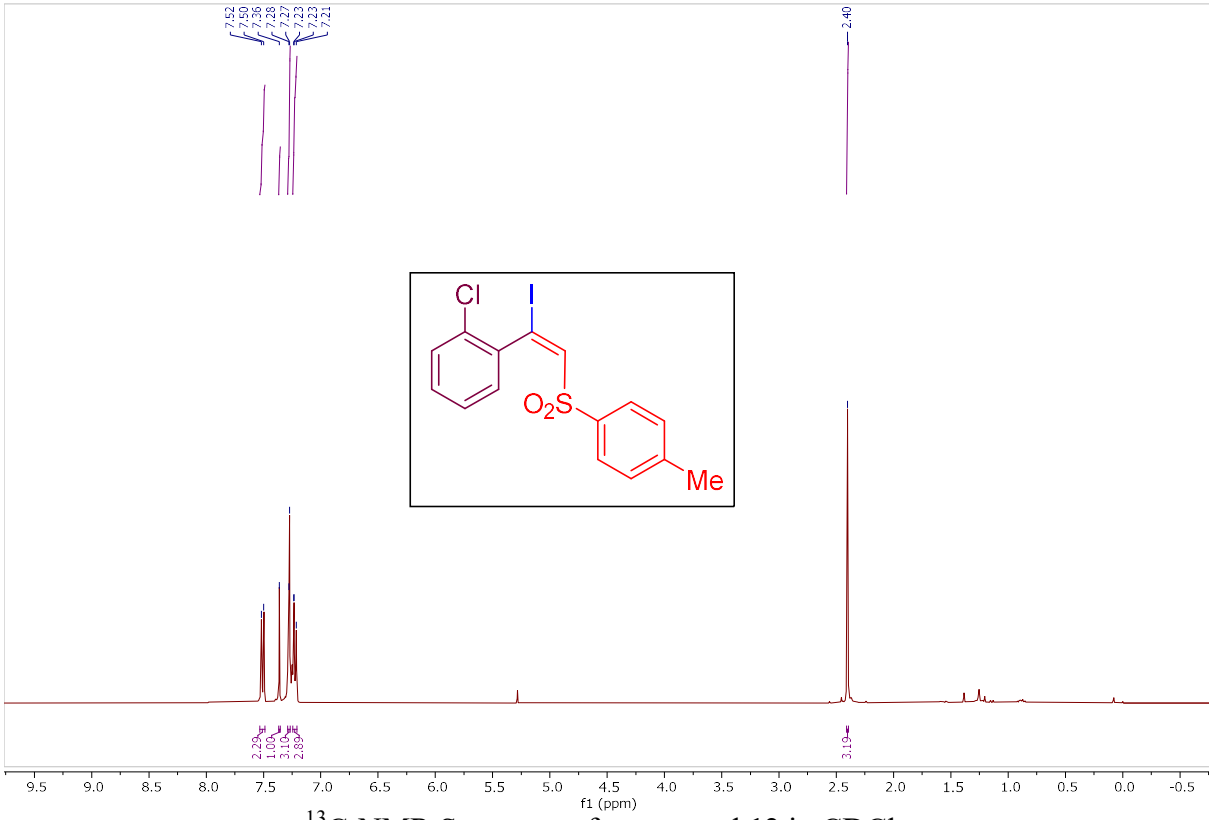


^{1}H-NMR Spectrum of compound **12** in $CDCl_3$



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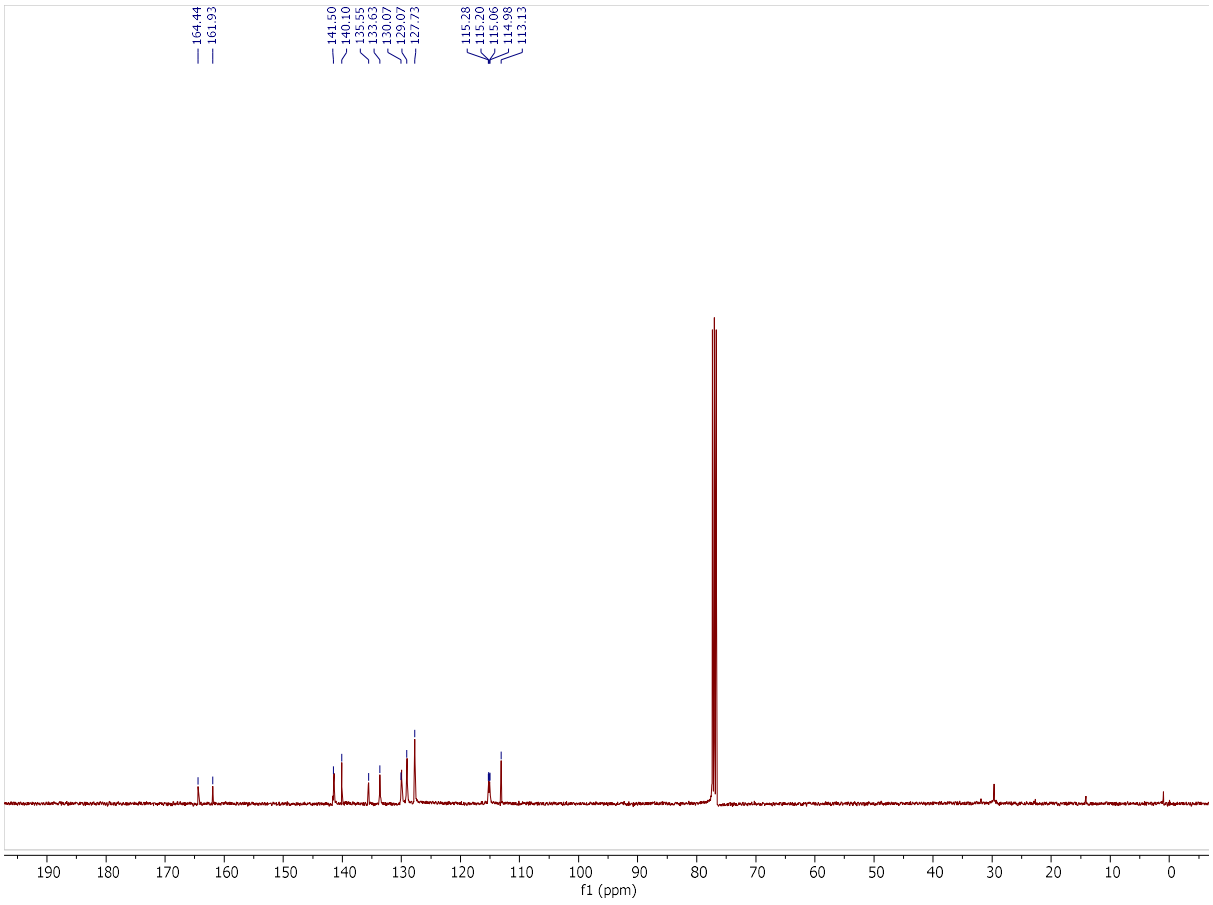

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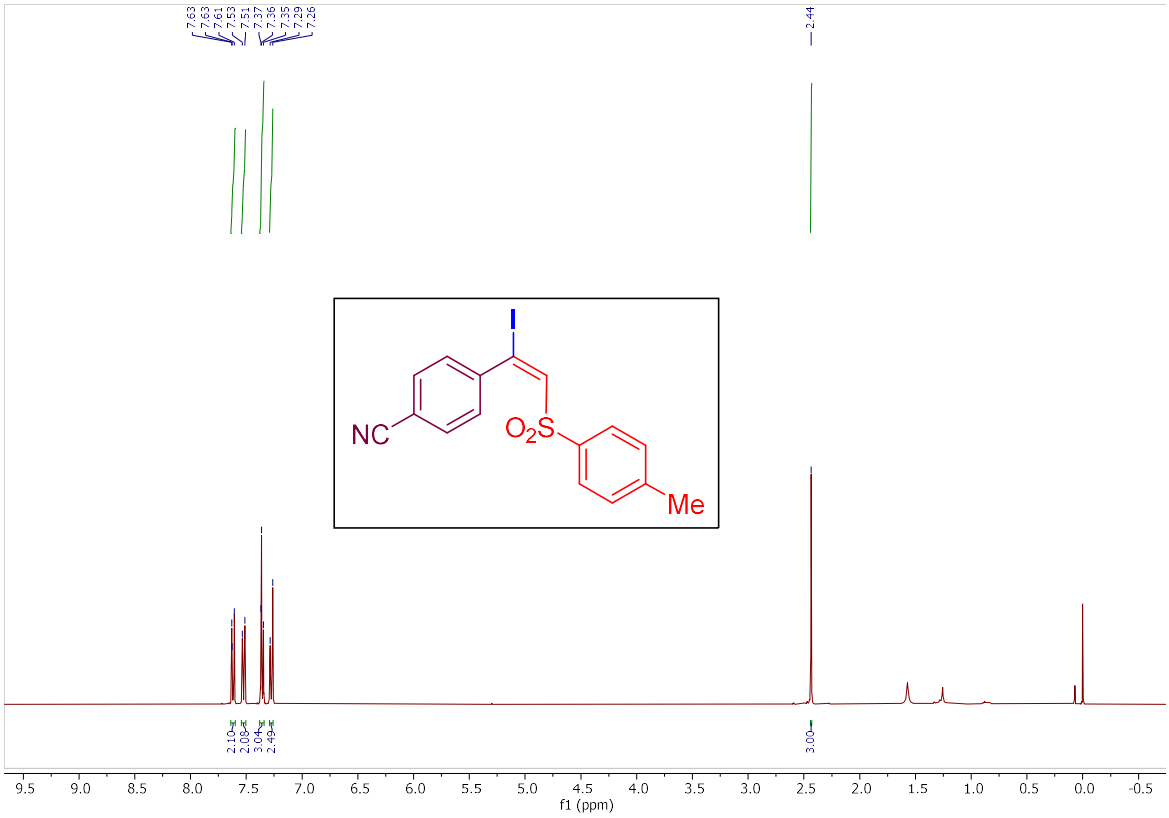

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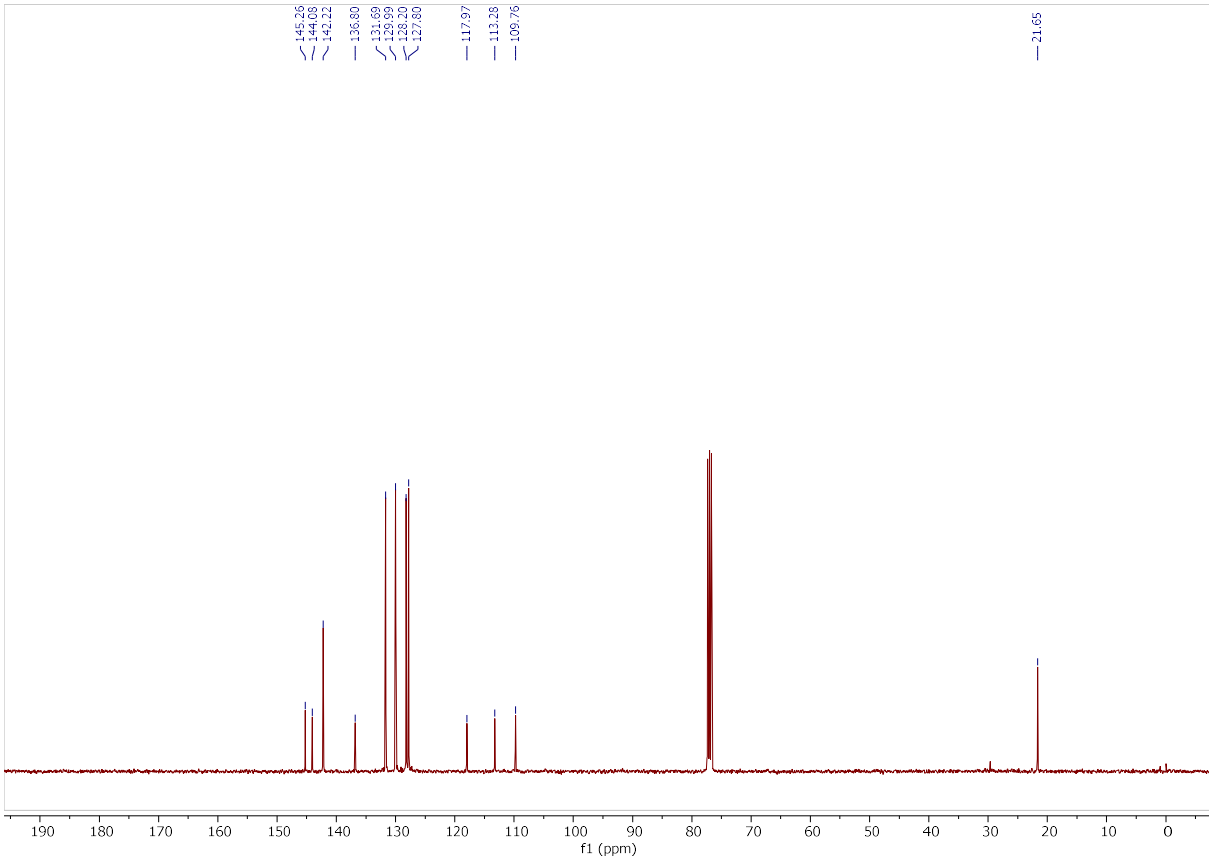

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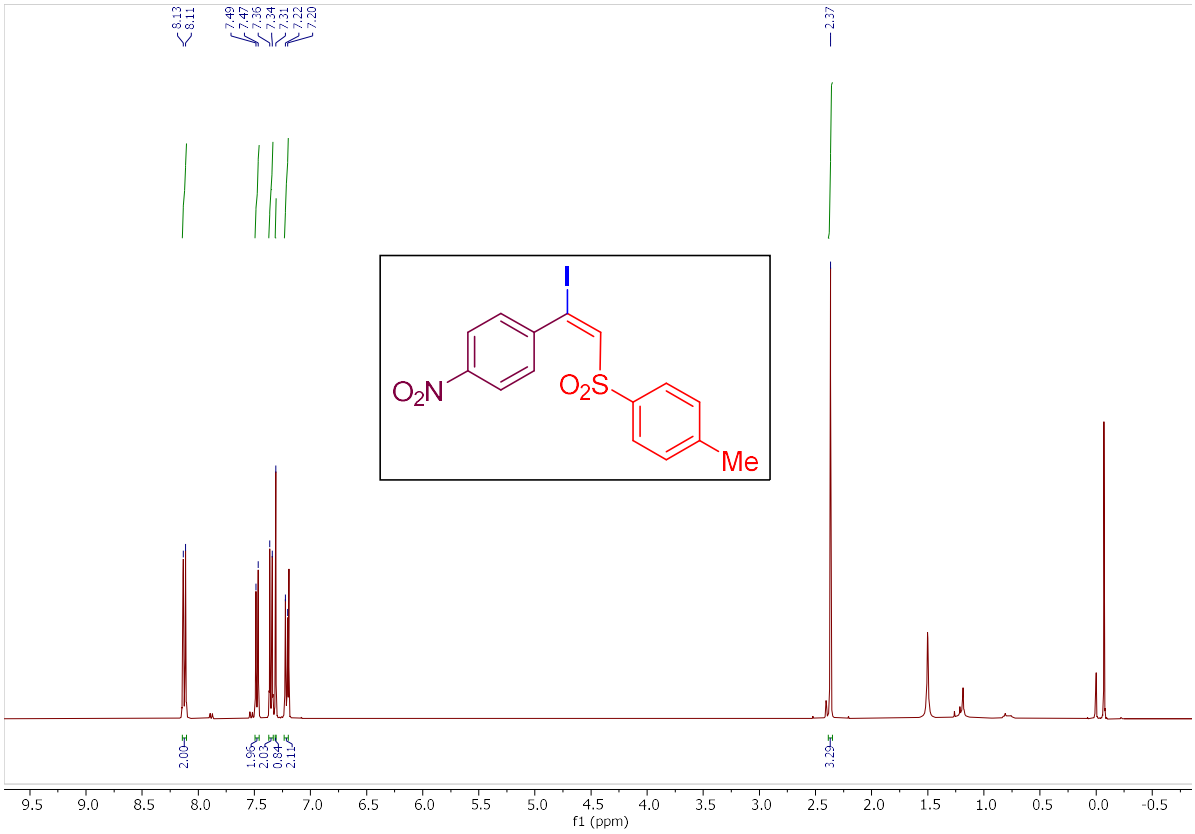
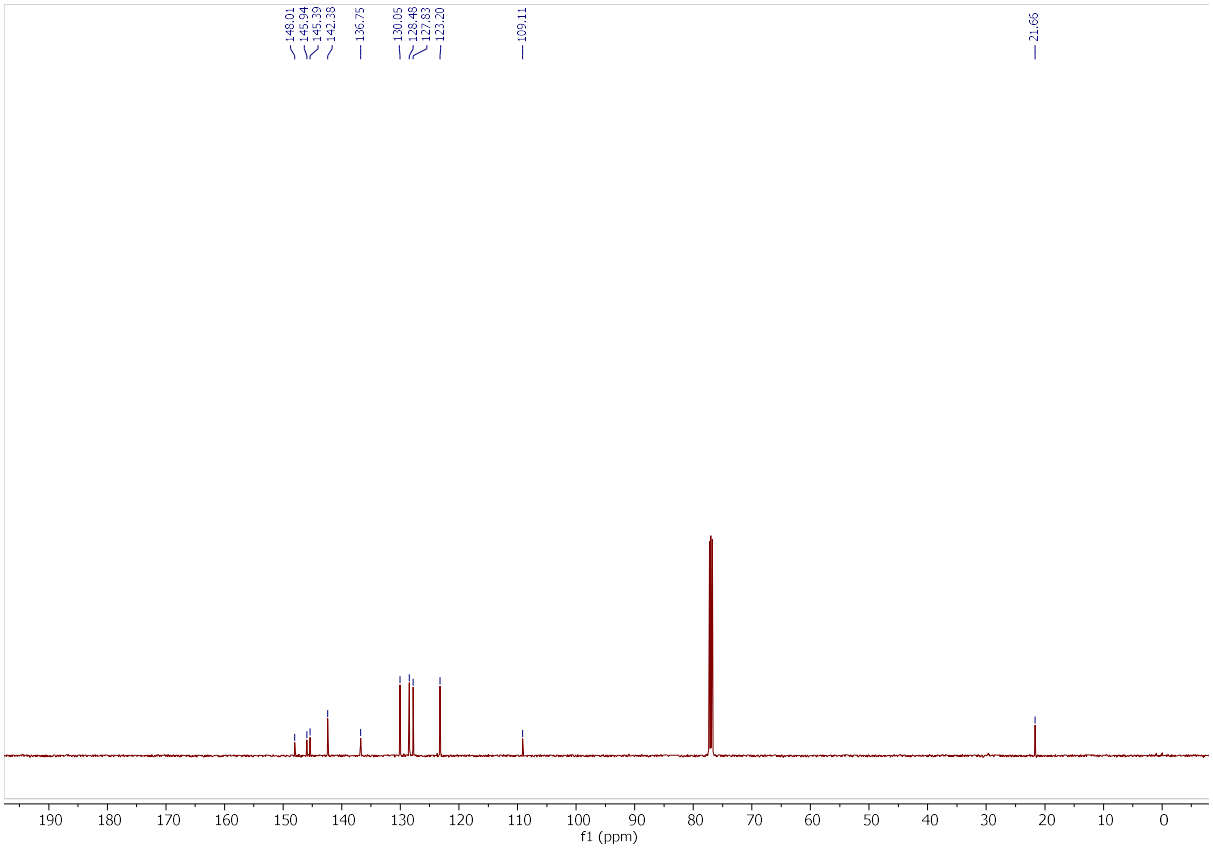


^{13}C-NMR Spectrum of compound **14** in $CDCl_3$



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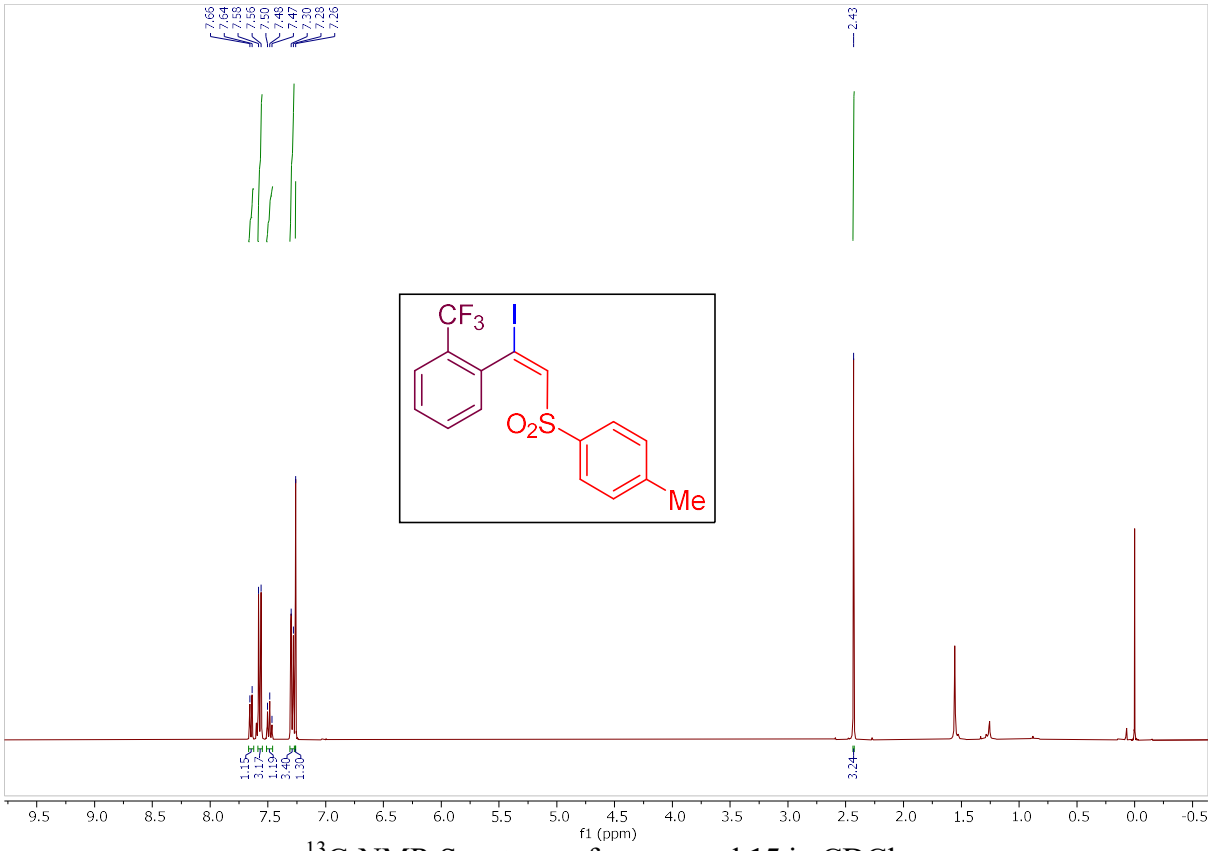
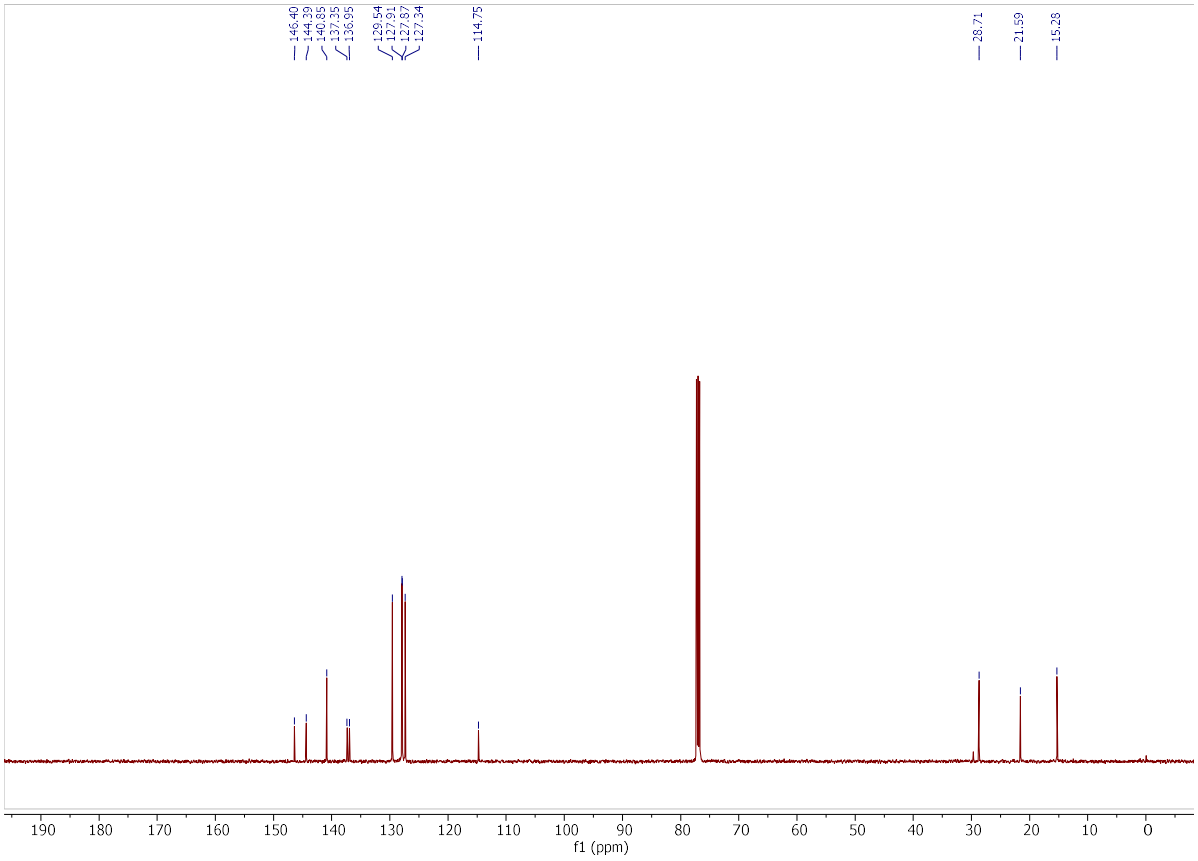
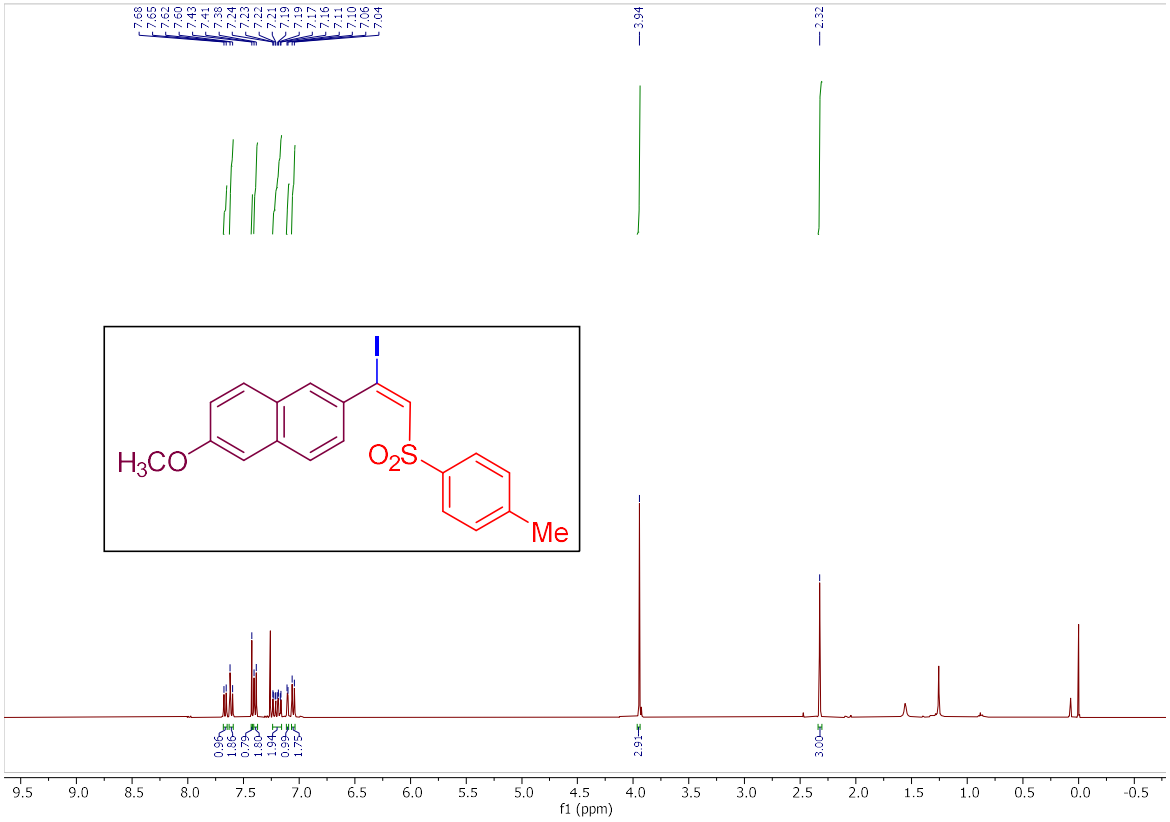


^{13}C-NMR Spectrum of compound **15** in $CDCl_3$



^{1}H-NMR Spectrum of compound **16** in $CDCl_3$



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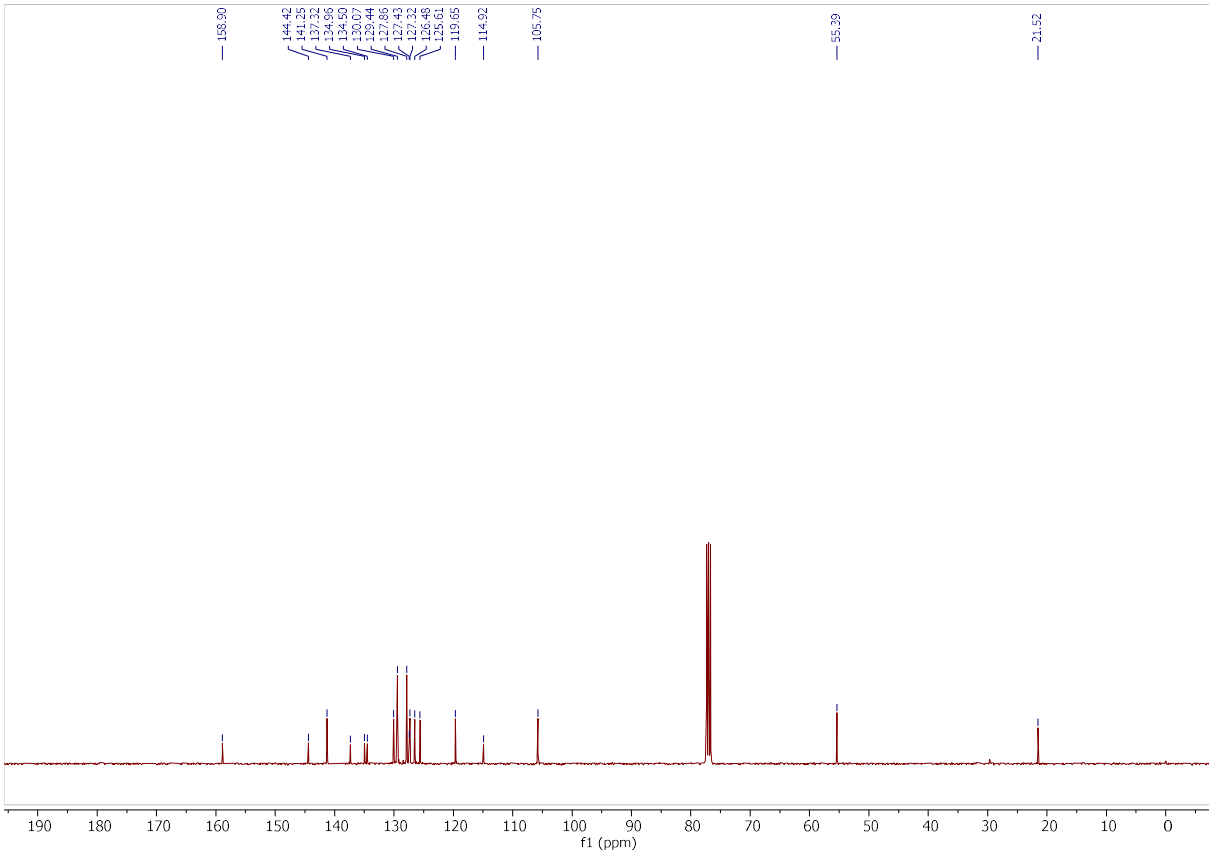
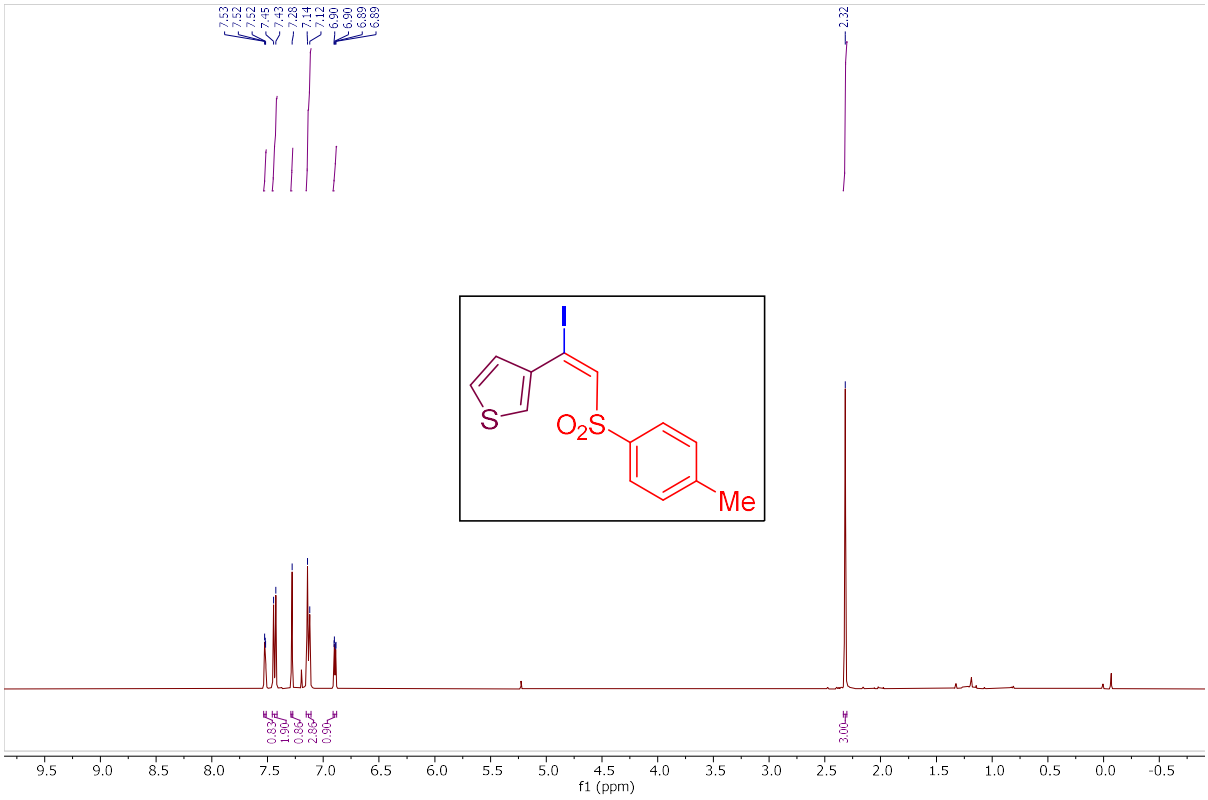
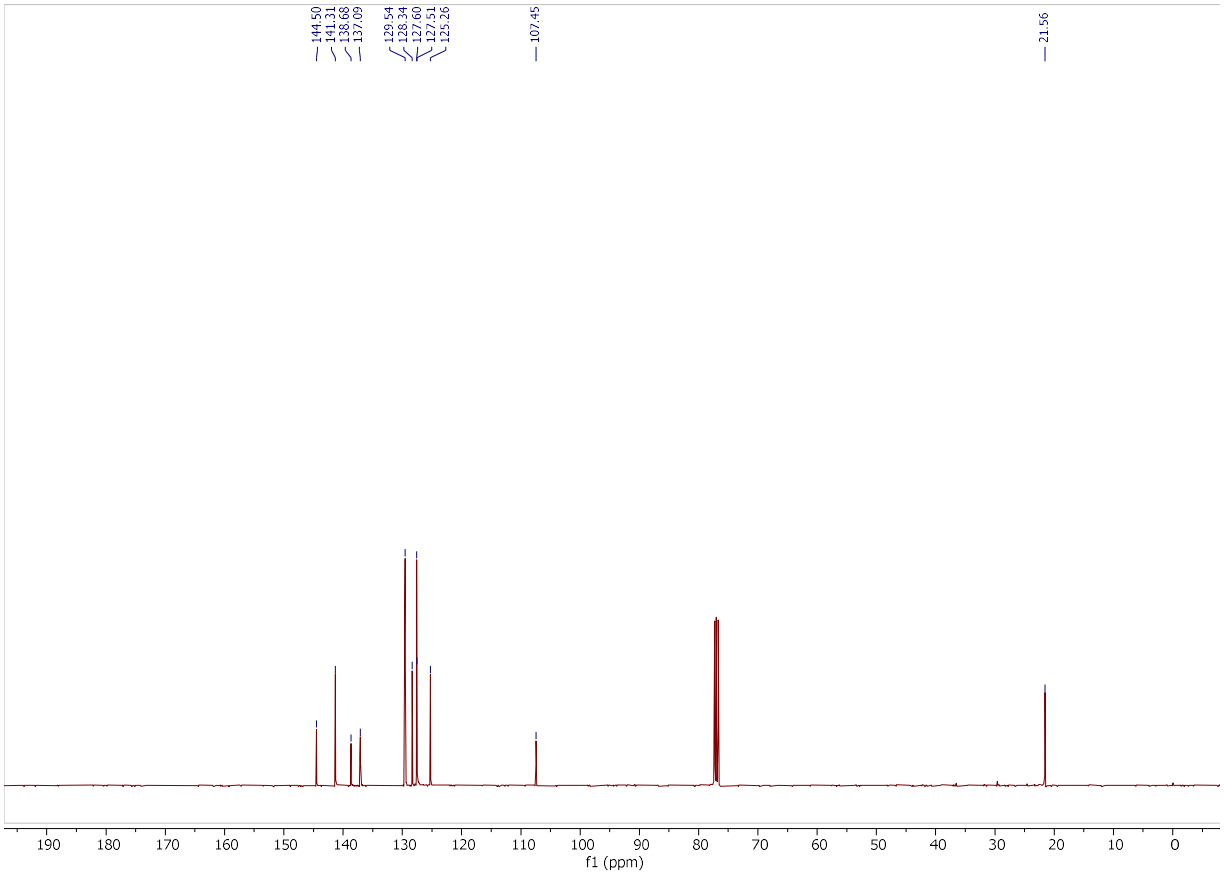


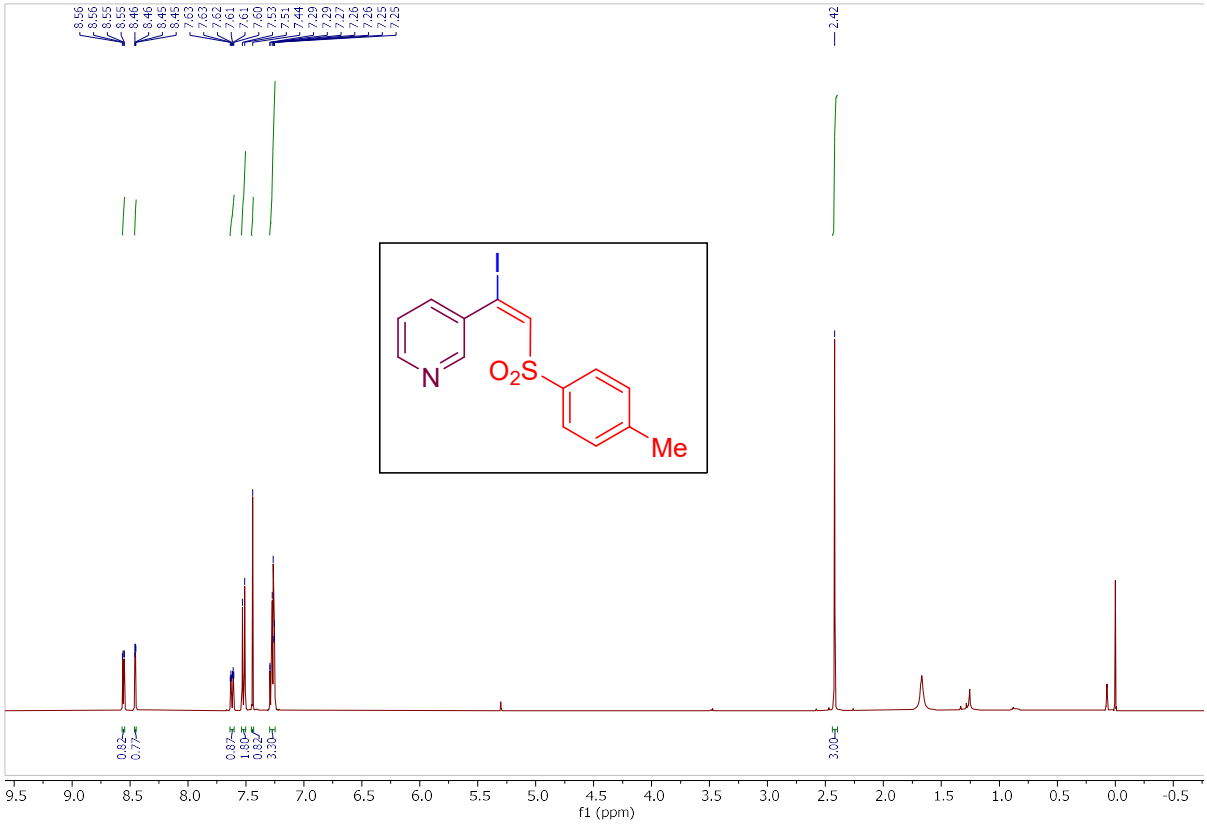
^{1}H-NMR Spectrum of compound **17** in $CDCl_3$



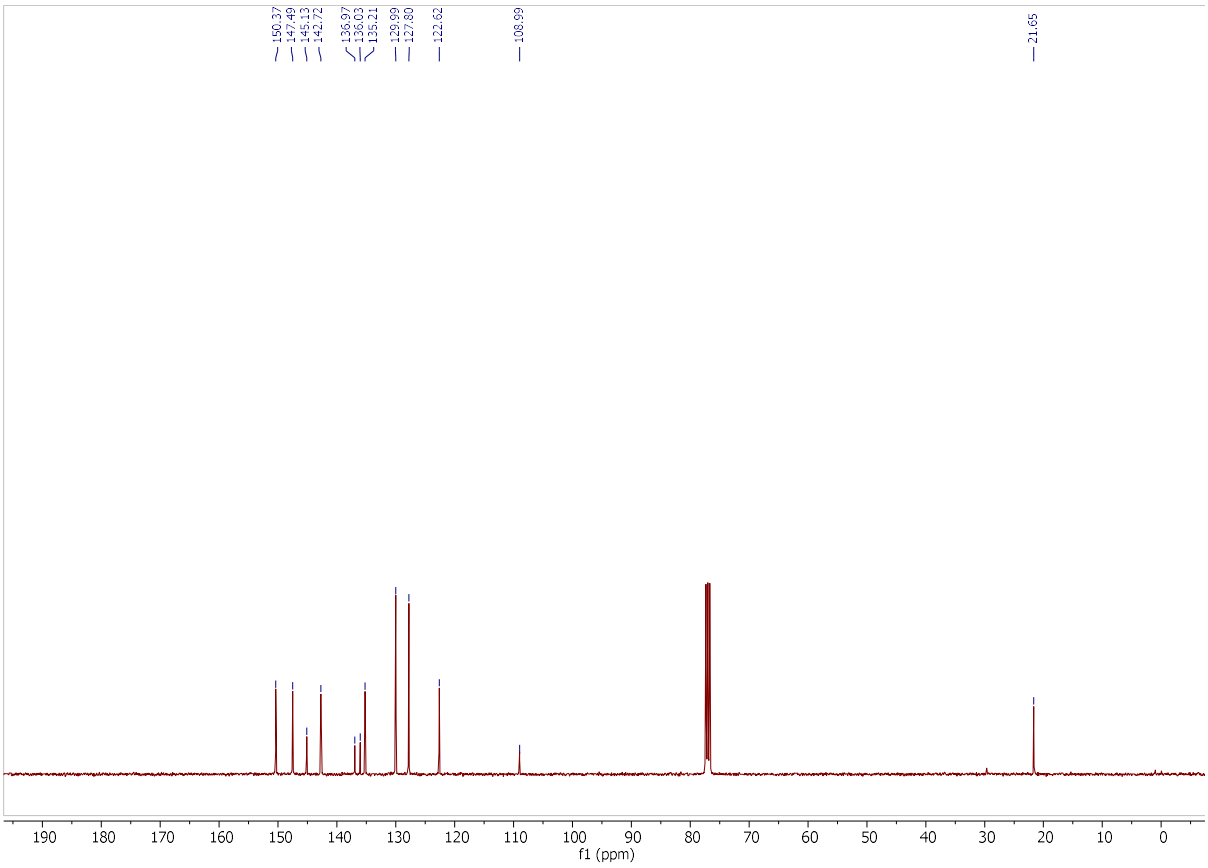
^{13}C-NMR Spectrum of compound **17** in $CDCl_3$



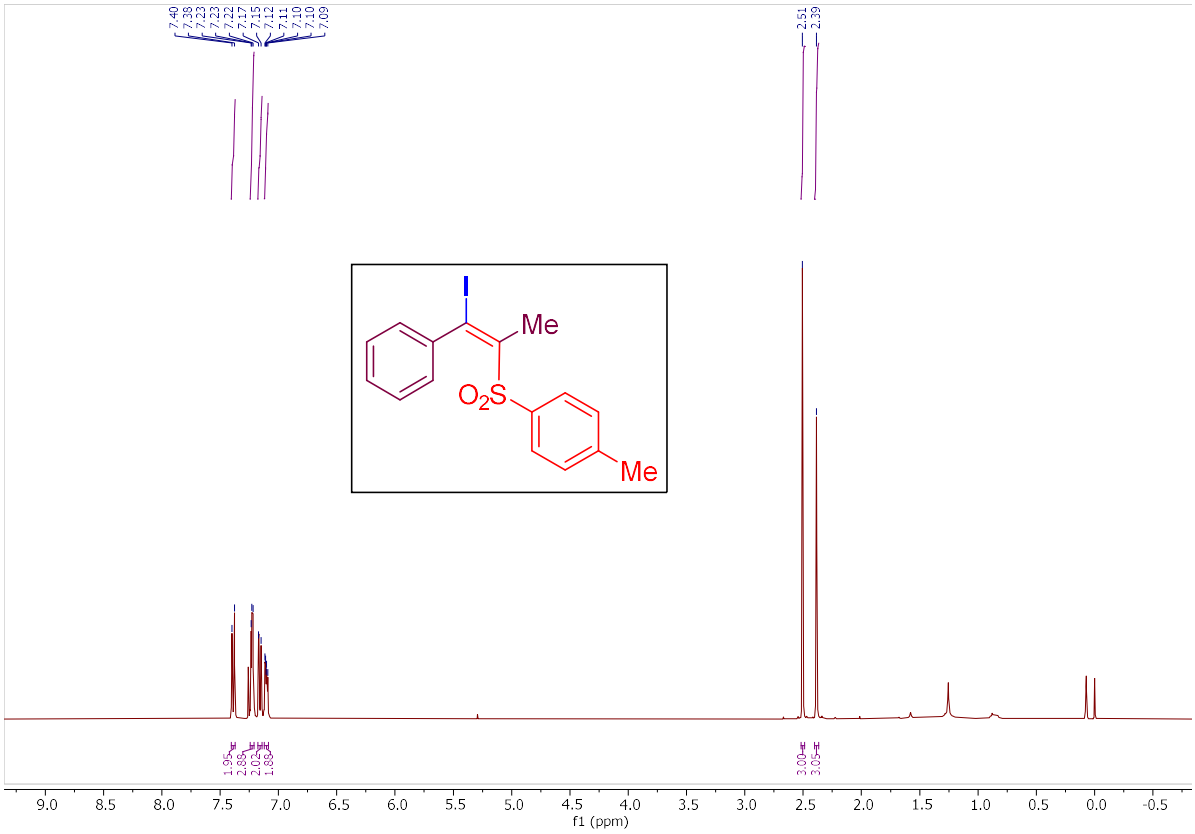
^{1}H-NMR Spectrum of compound **18** in $CDCl_3$



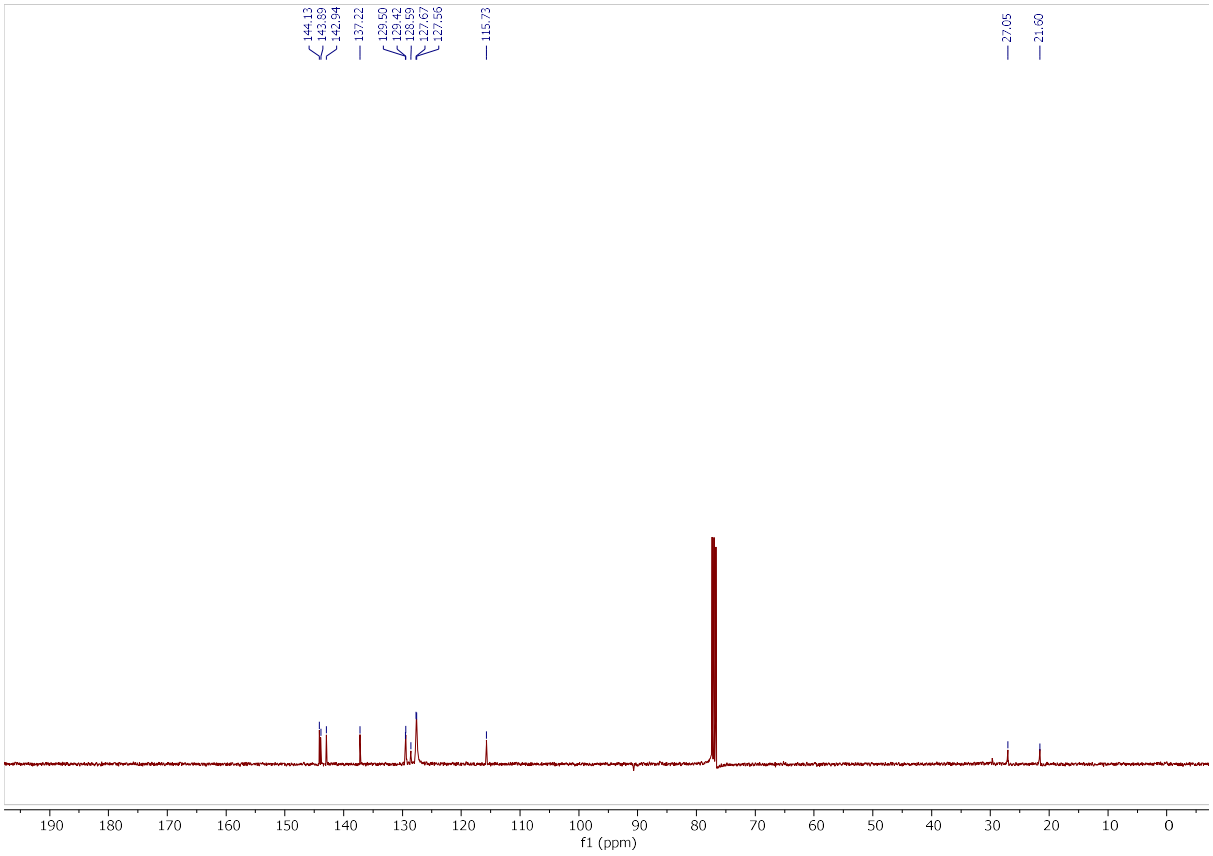
^{13}C-NMR Spectrum of compound **18** in $CDCl_3$



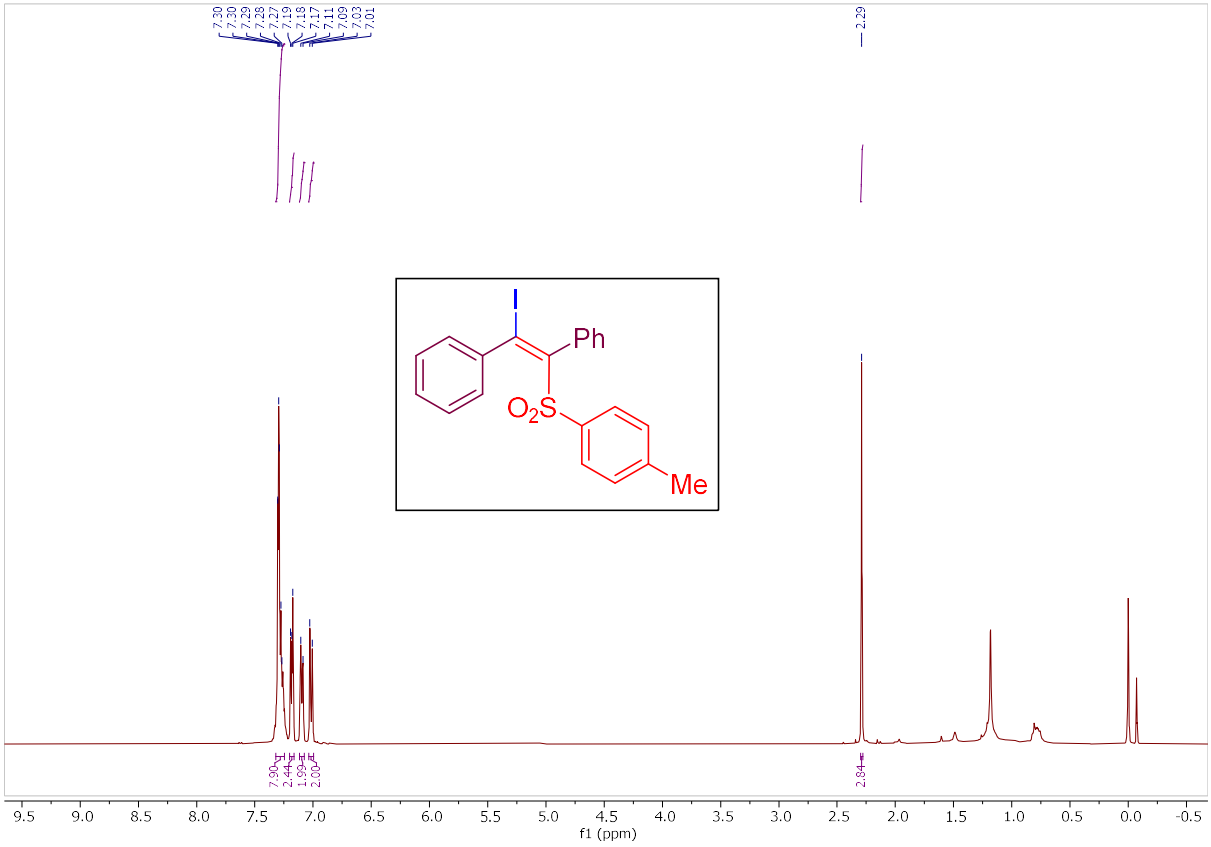
^{1}H-NMR Spectrum of compound **19** in $CDCl_3$



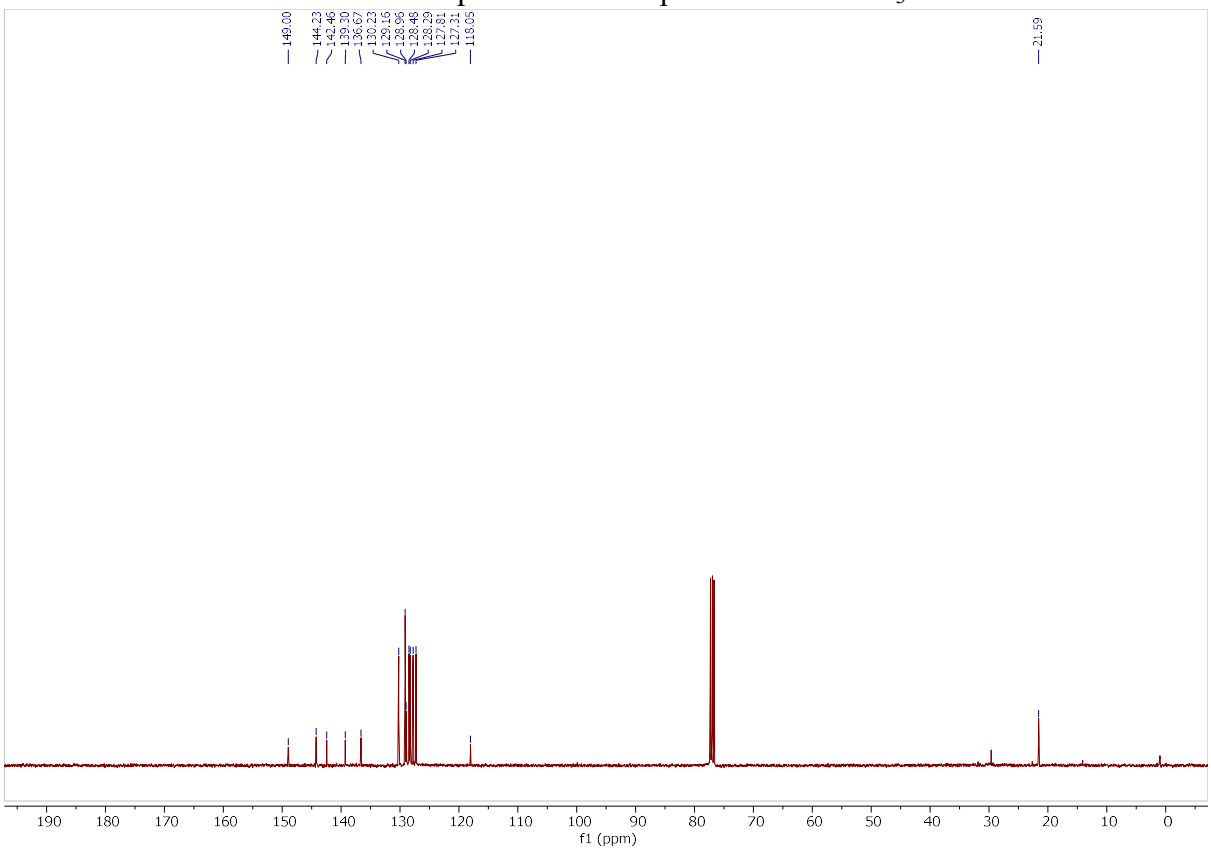
^{13}C-NMR Spectrum of compound **19** in $CDCl_3$



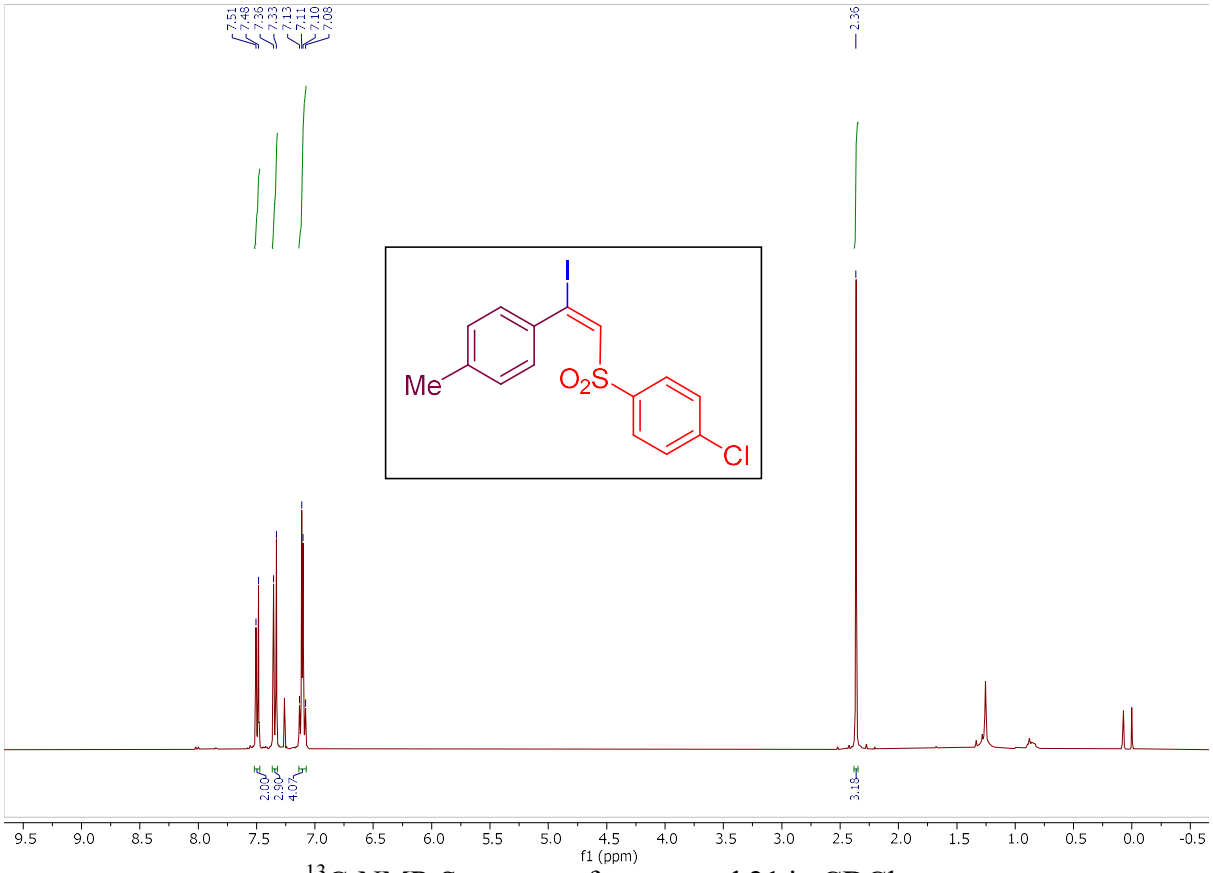
^{1}H-NMR Spectrum of compound **20** in $CDCl_3$



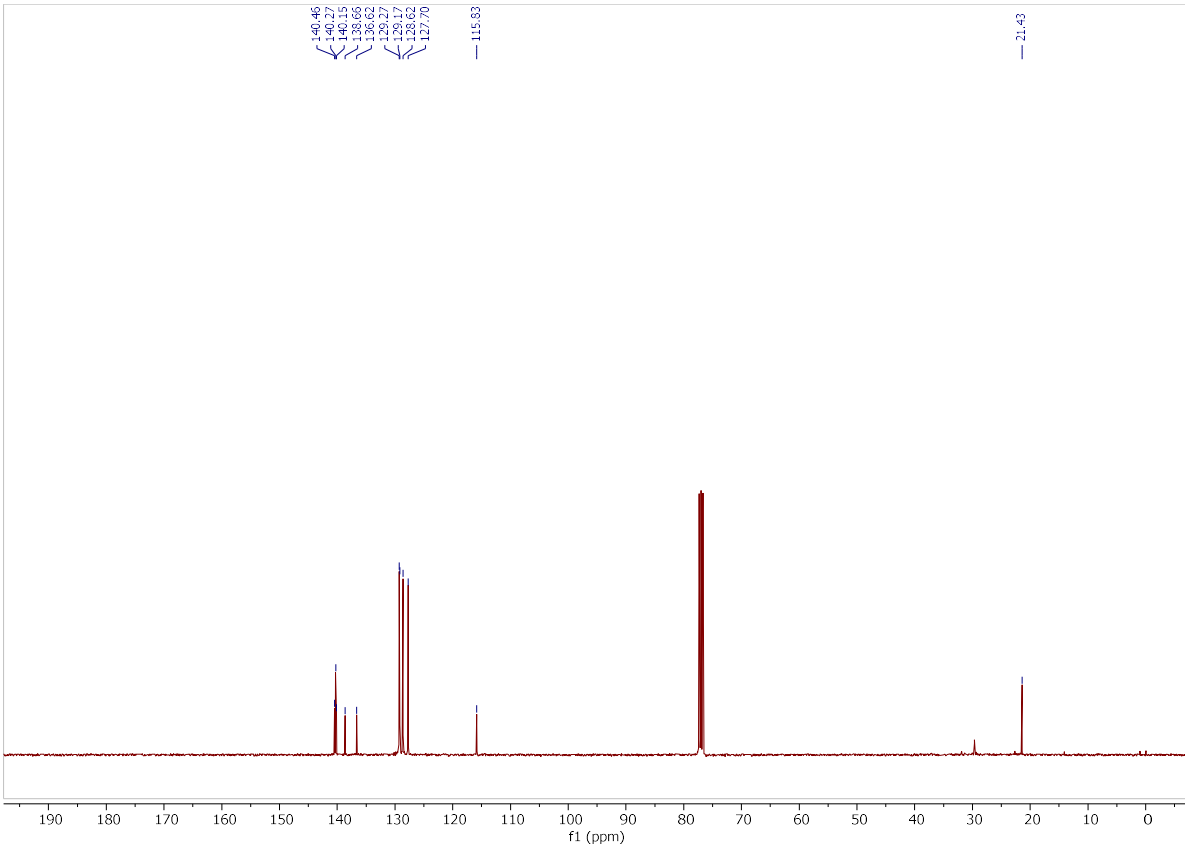
^{13}C-NMR Spectrum of compound **20** in $CDCl_3$



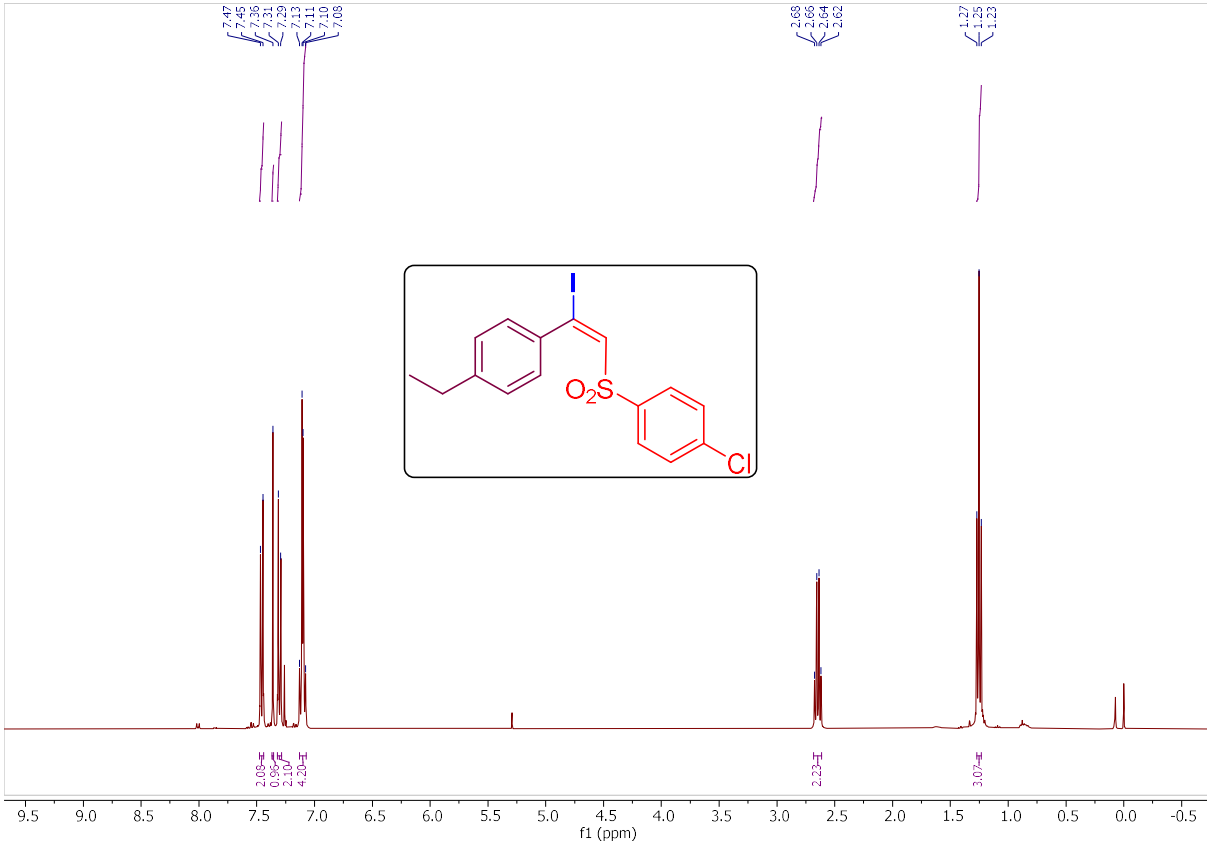
^{1}H-NMR Spectrum of compound **21** in $CDCl_3$



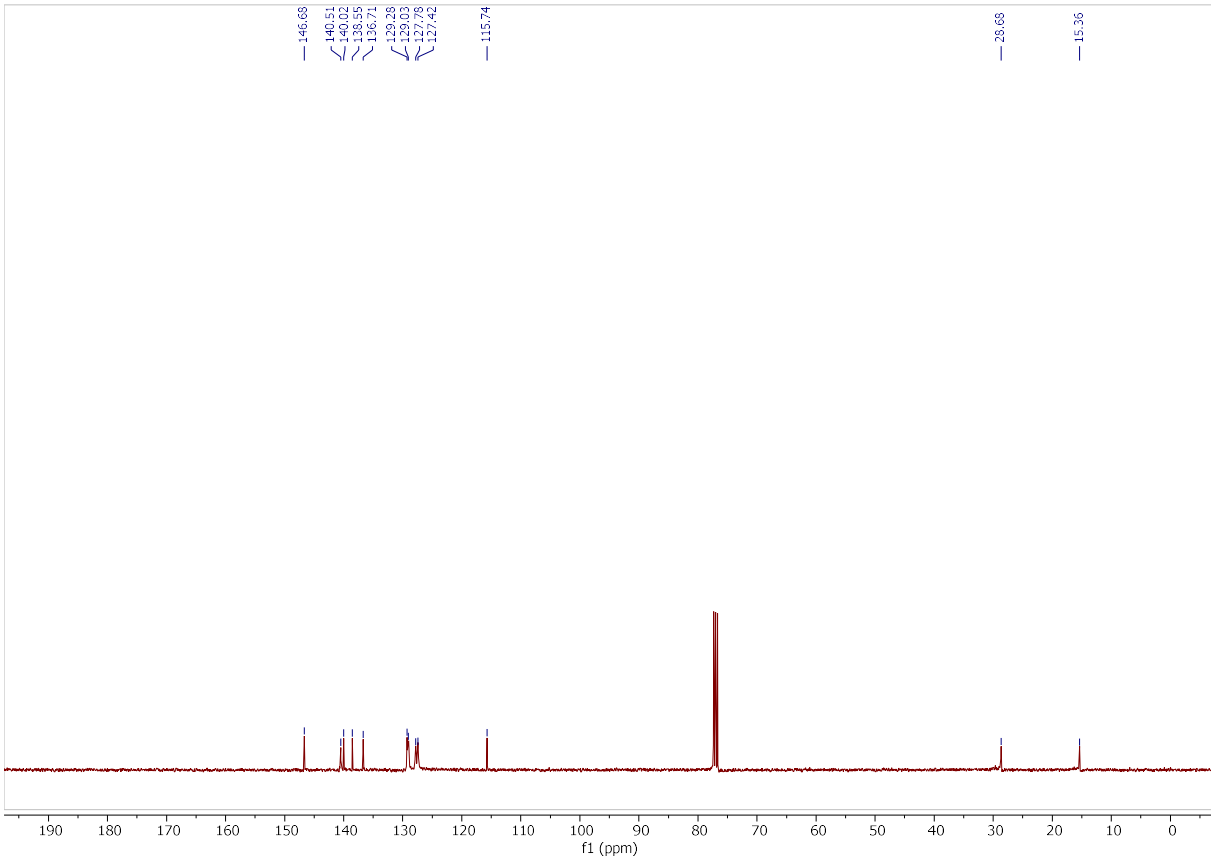
^{13}C-NMR Spectrum of compound **21** in $CDCl_3$



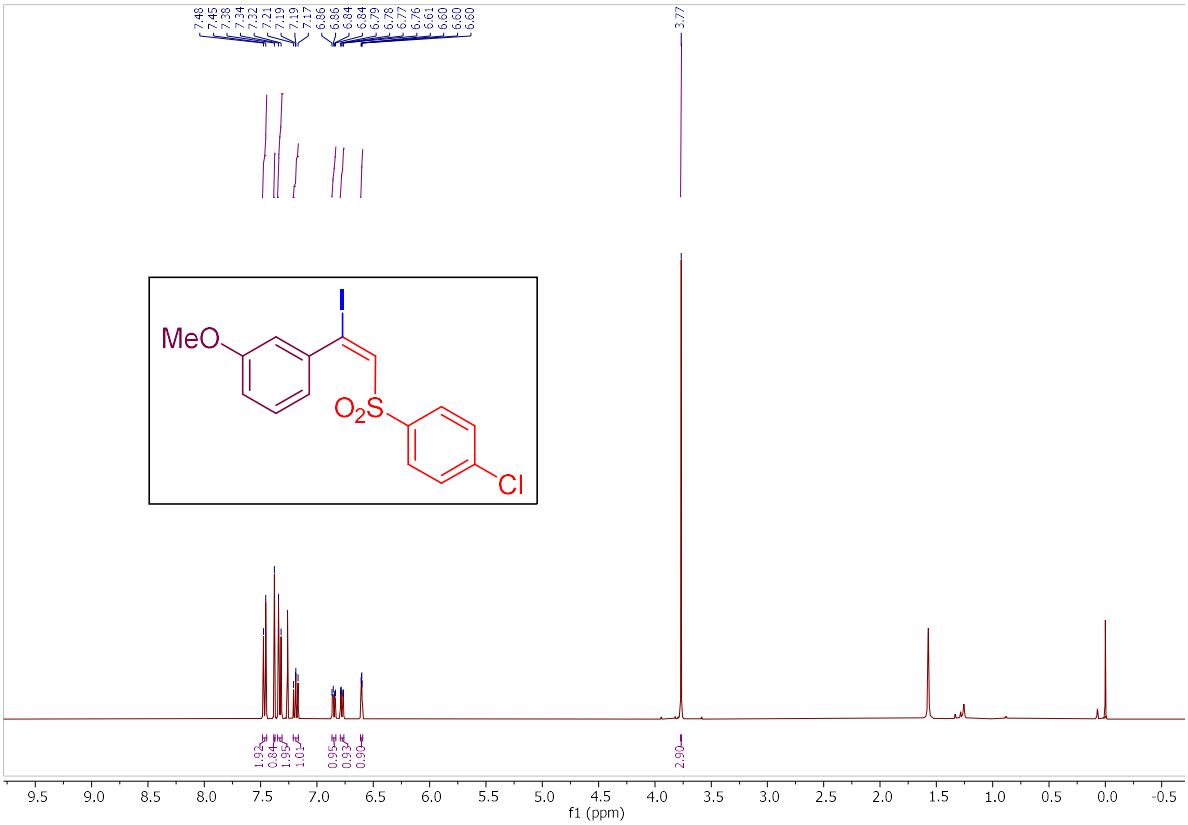
^{1}H-NMR Spectrum of compound **22** in $CDCl_3$



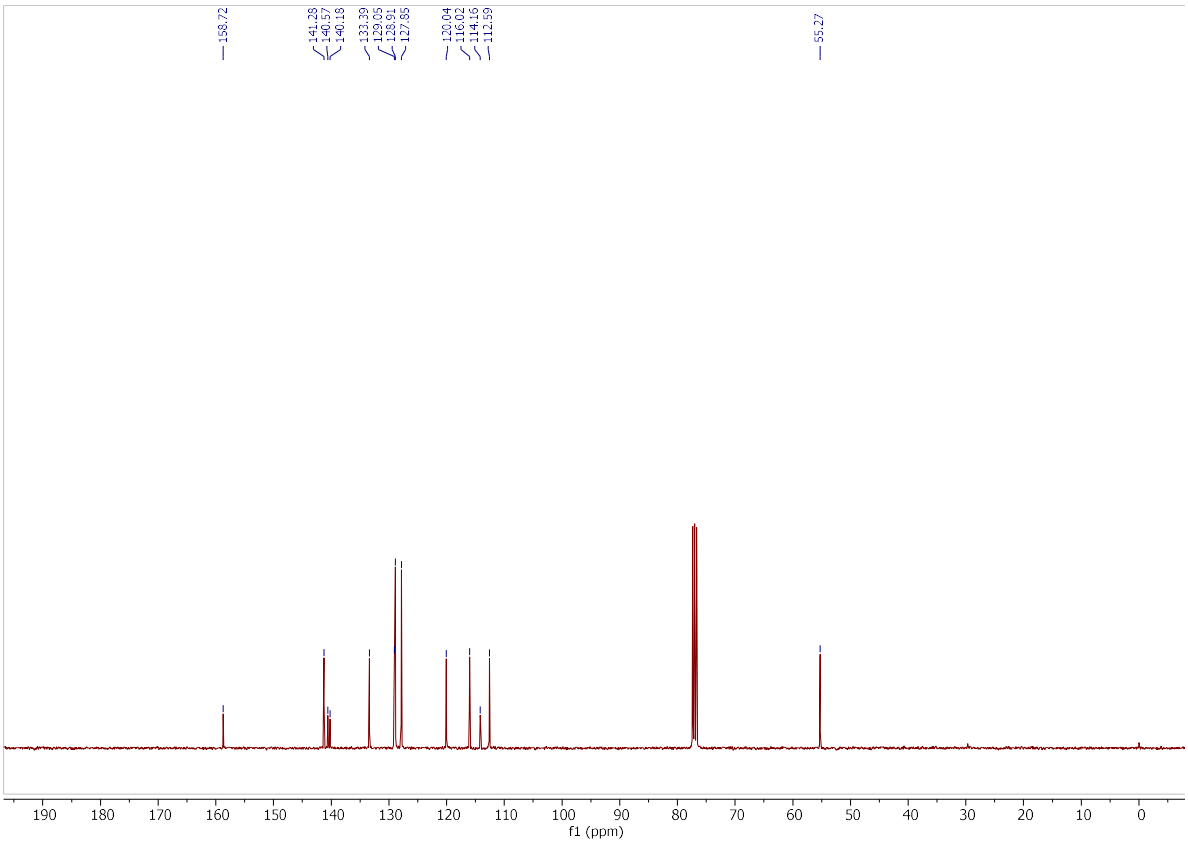
^{13}C-NMR Spectrum of compound **22** in $CDCl_3$



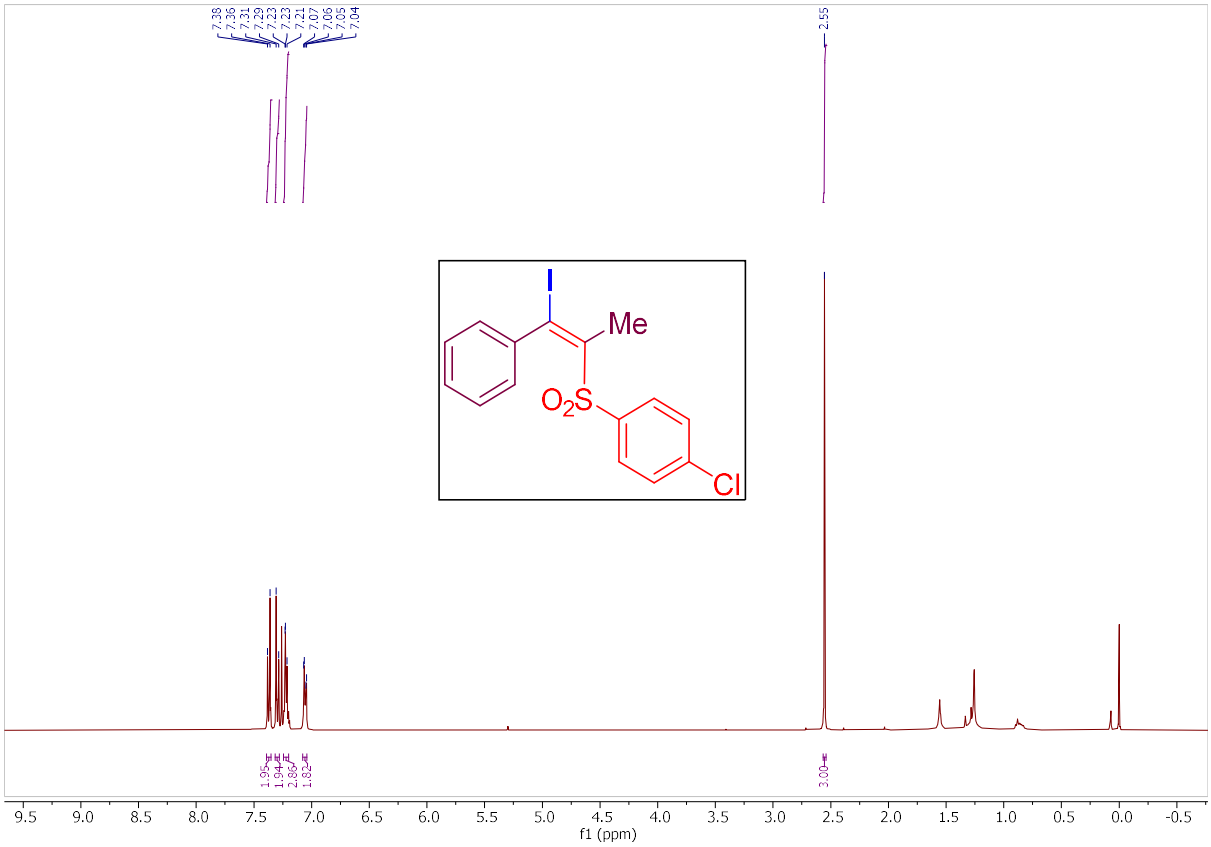
^{1}H NMR Spectrum of compound **23** in $CDCl_3$



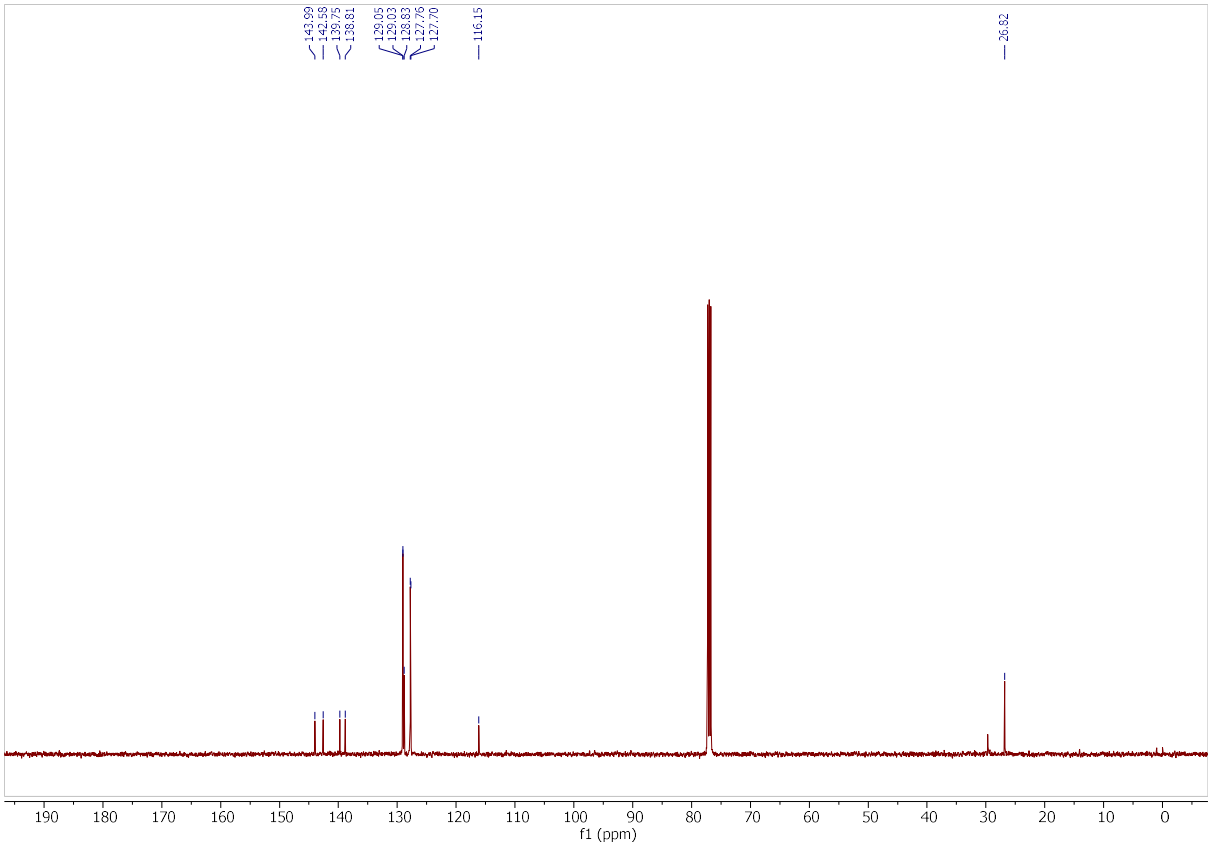
^{13}C NMR Spectrum of compound **23** in $CDCl_3$



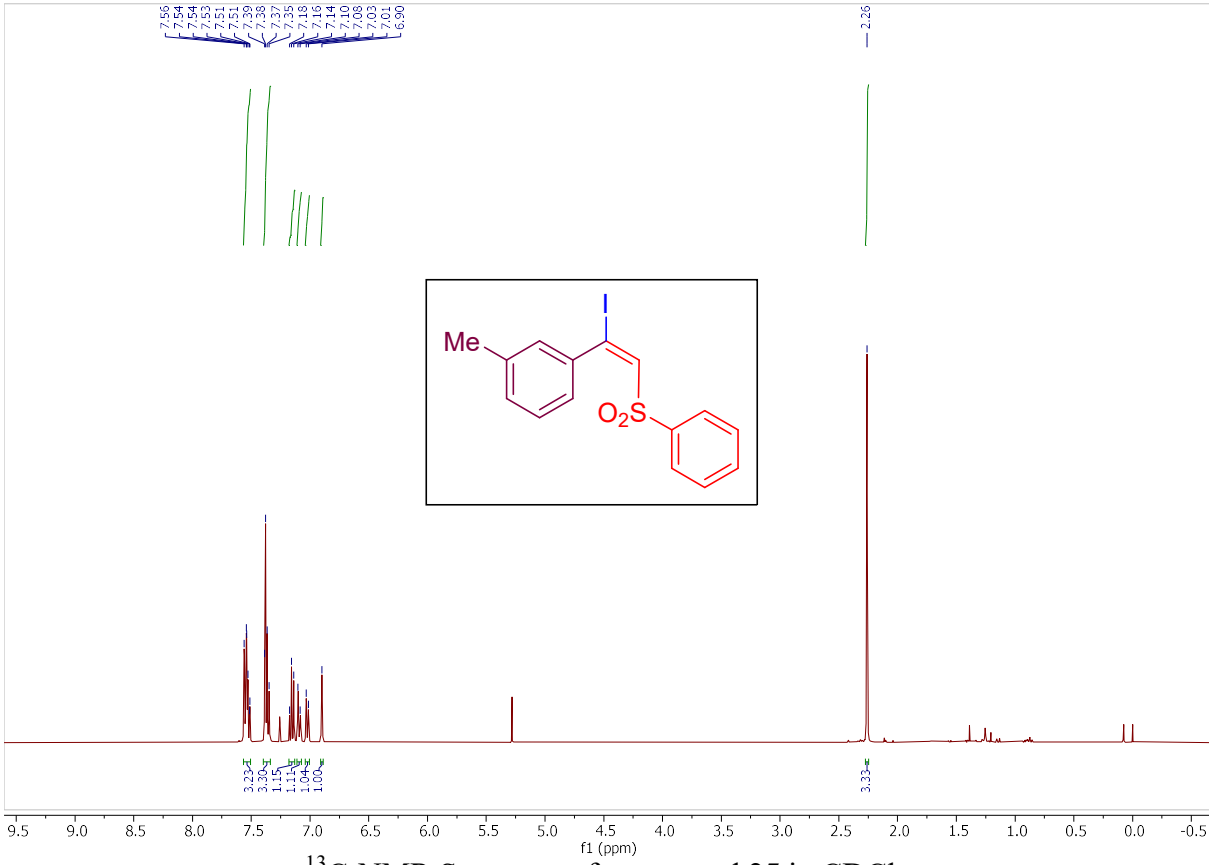
^{1}H NMR Spectrum of compound **24** in $CDCl_3$



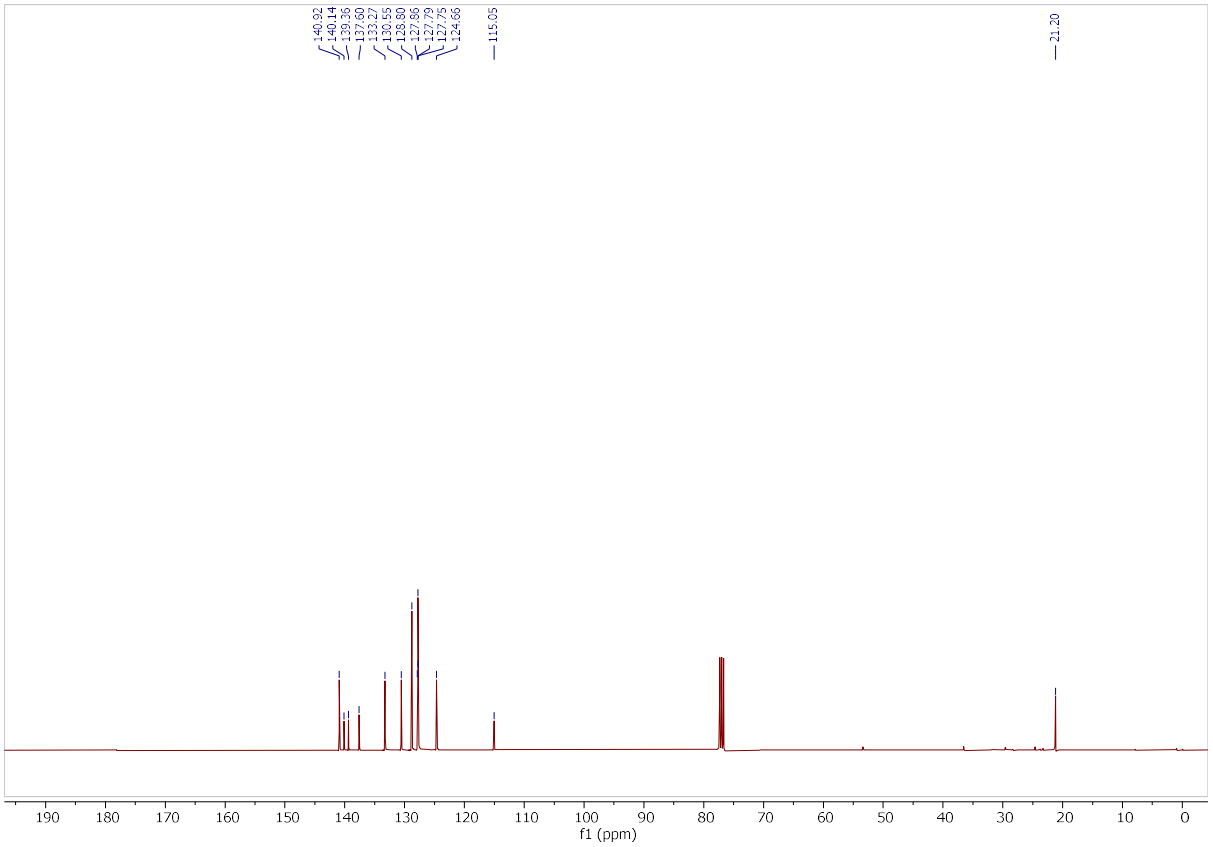
^{13}C NMR Spectrum of compound **24** in $CDCl_3$



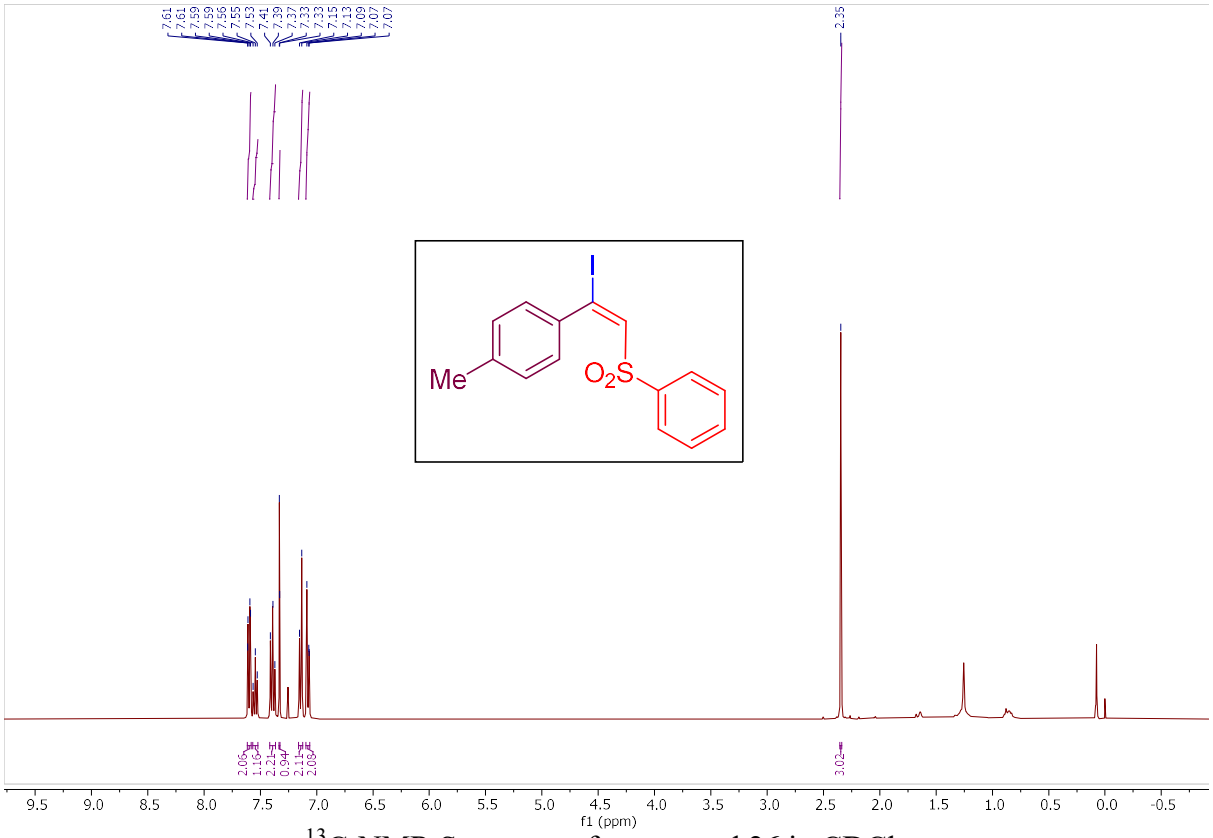
^{1}H-NMR Spectrum of compound **25** in $CDCl_3$



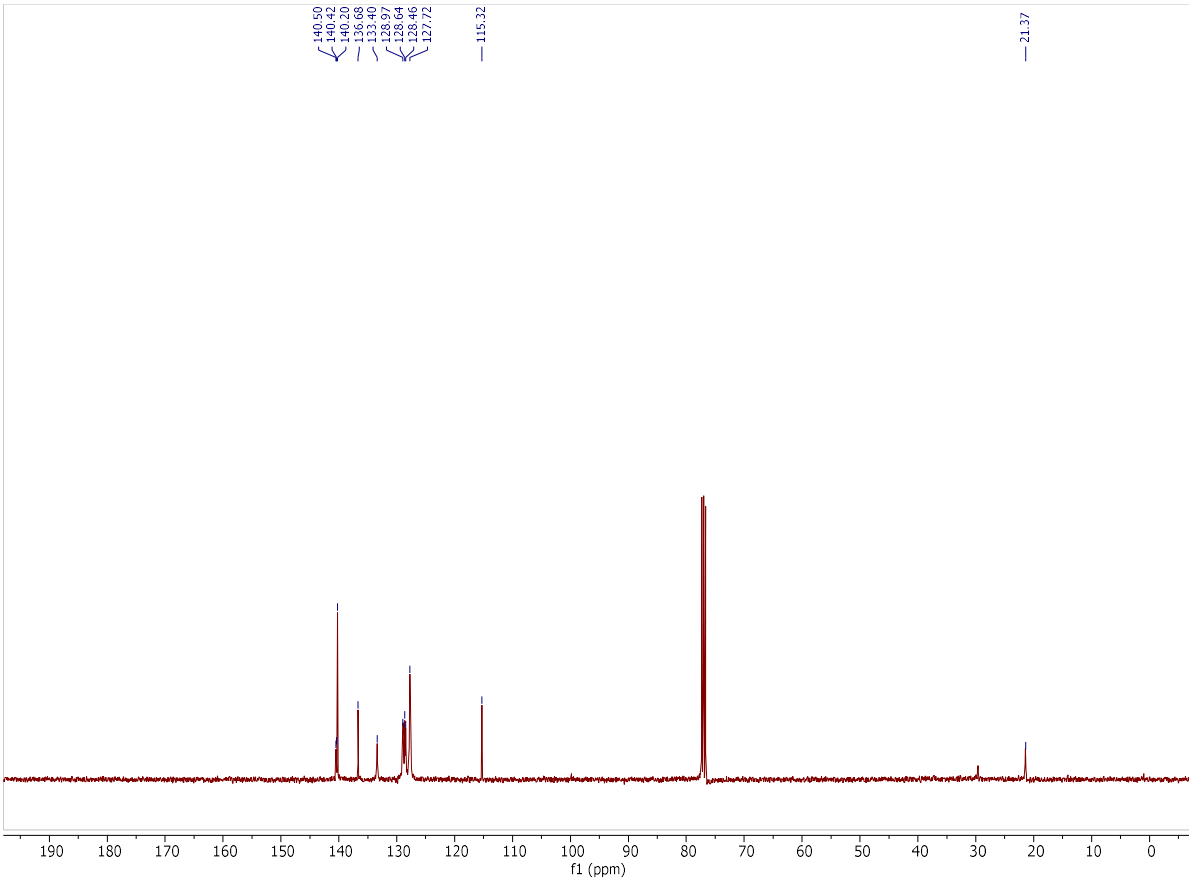
^{13}C-NMR Spectrum of compound **25** in $CDCl_3$



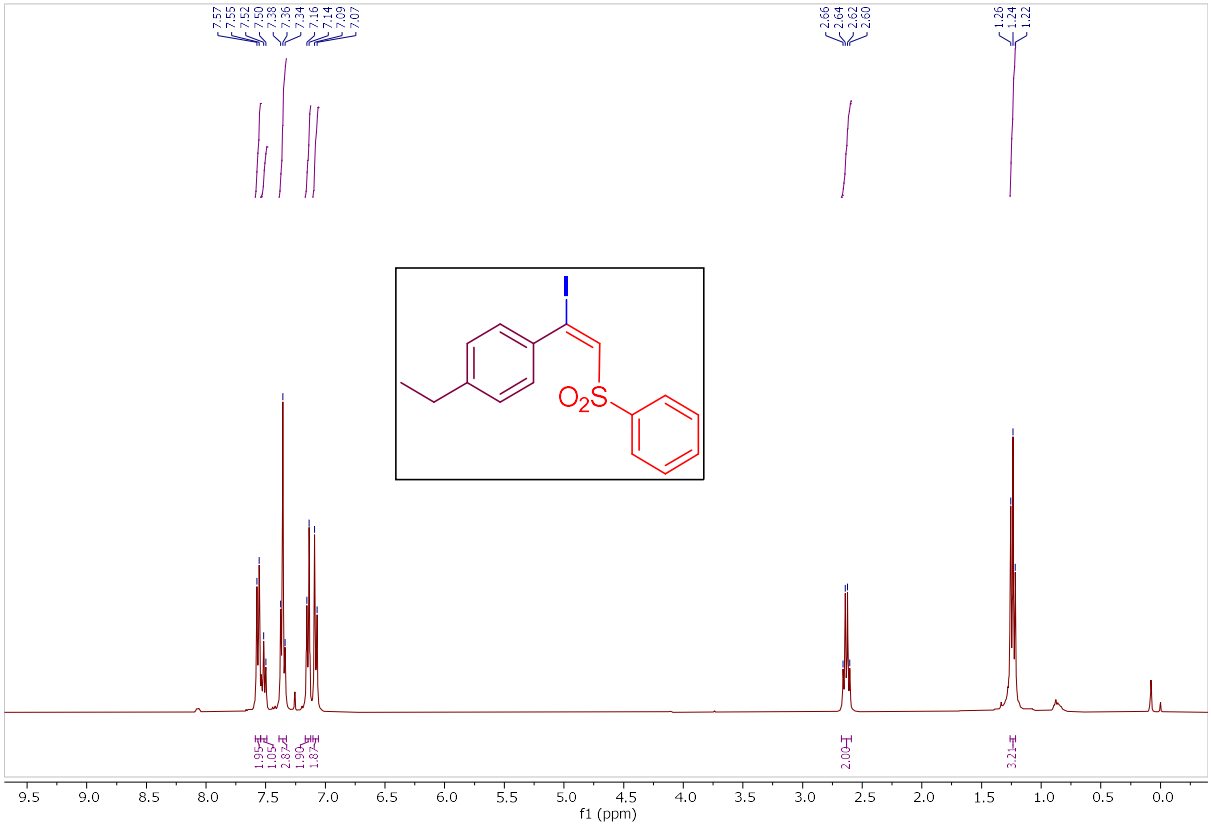
^{1}H-NMR Spectrum of compound **26** in $CDCl_3$



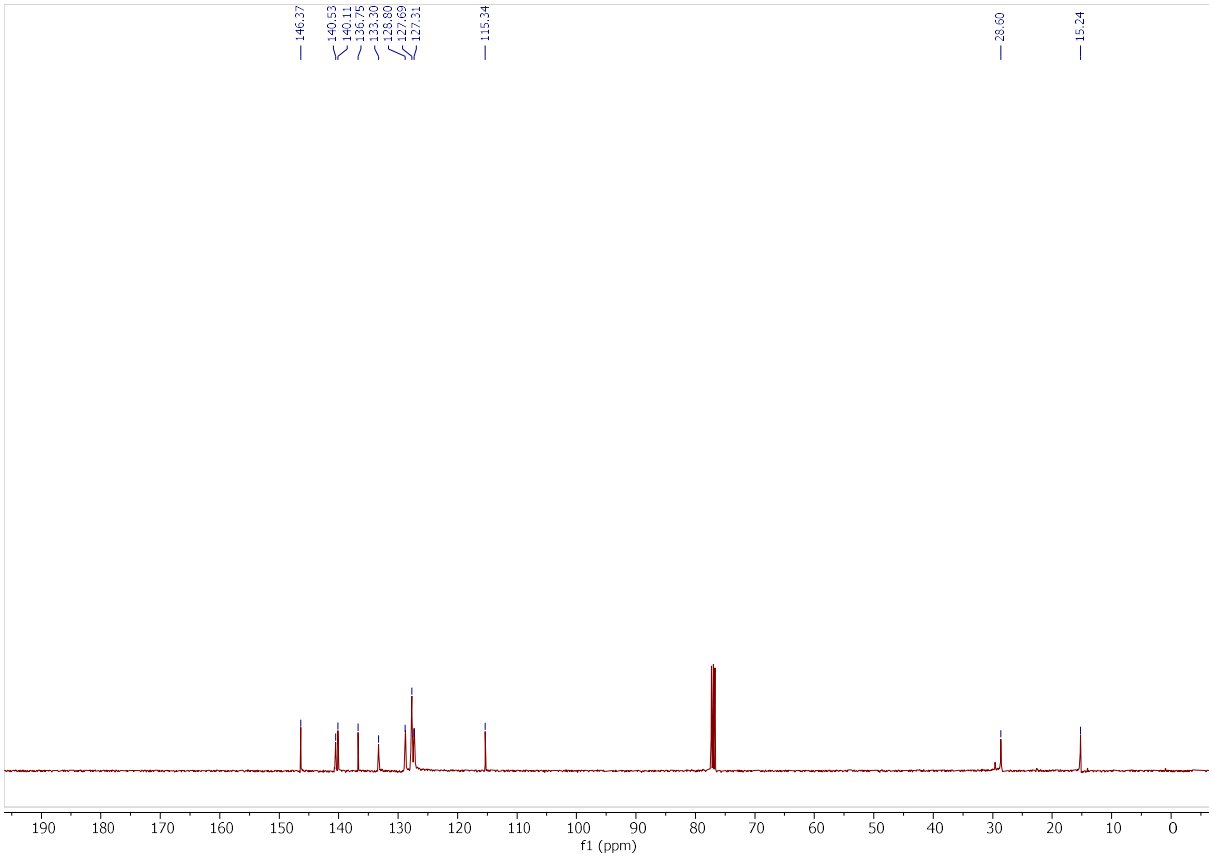
^{13}C-NMR Spectrum of compound **26** in $CDCl_3$



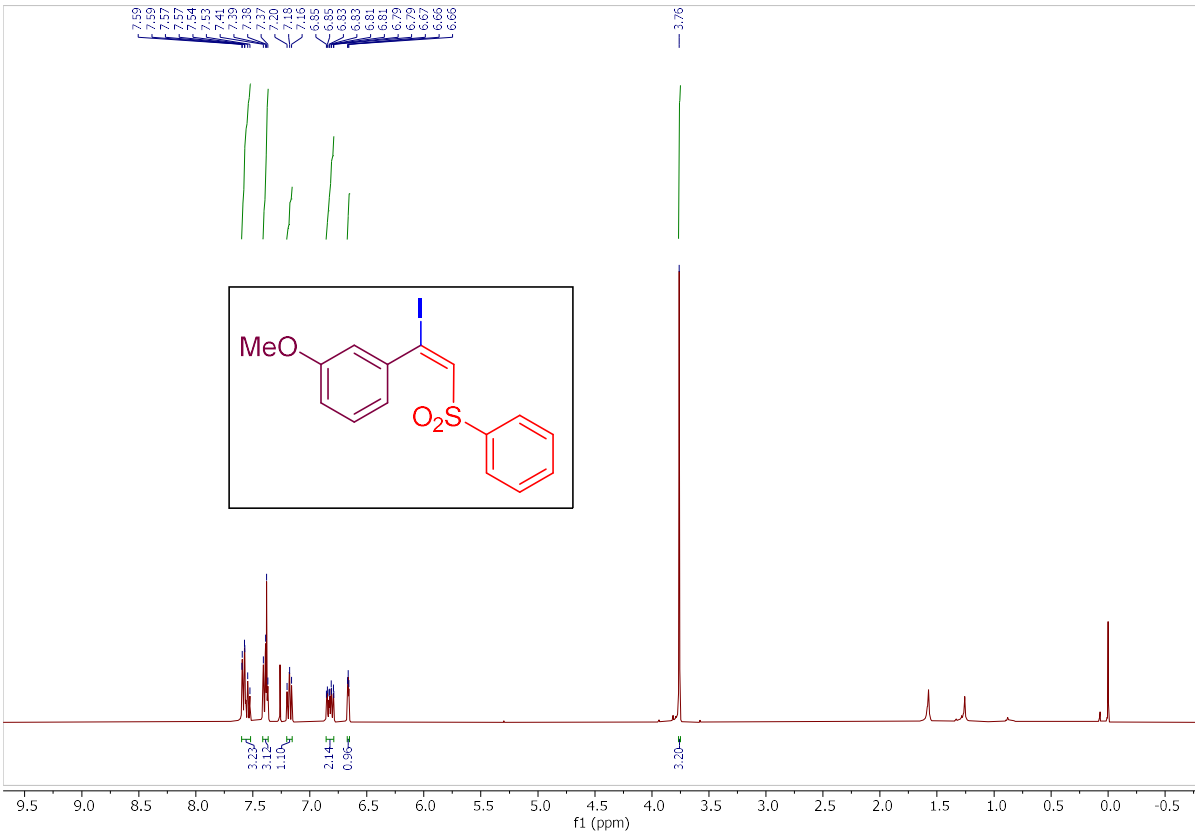
^{1}H-NMR Spectrum of compound **27** in $CDCl_3$



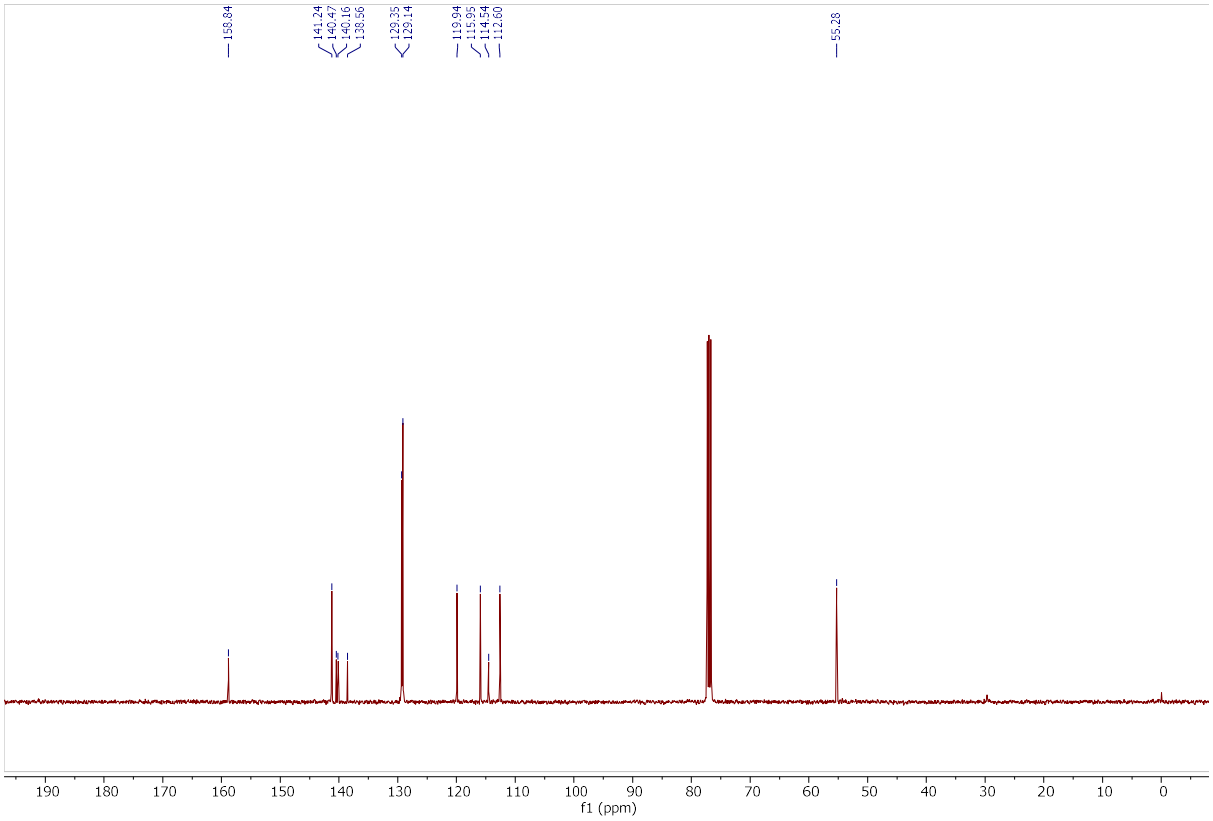
^{13}C-NMR Spectrum of compound **27** in $CDCl_3$



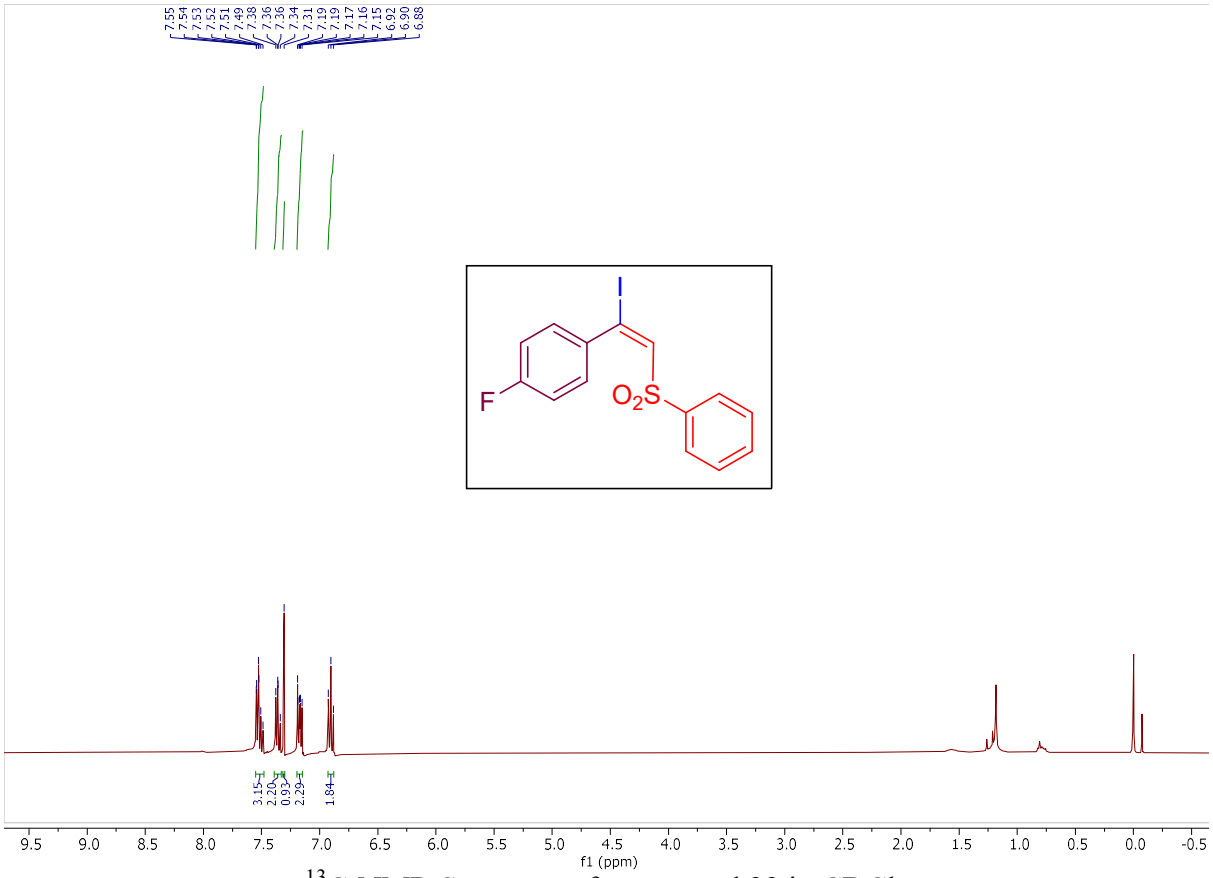
^{1}H NMR Spectrum of compound **28** in $CDCl_3$



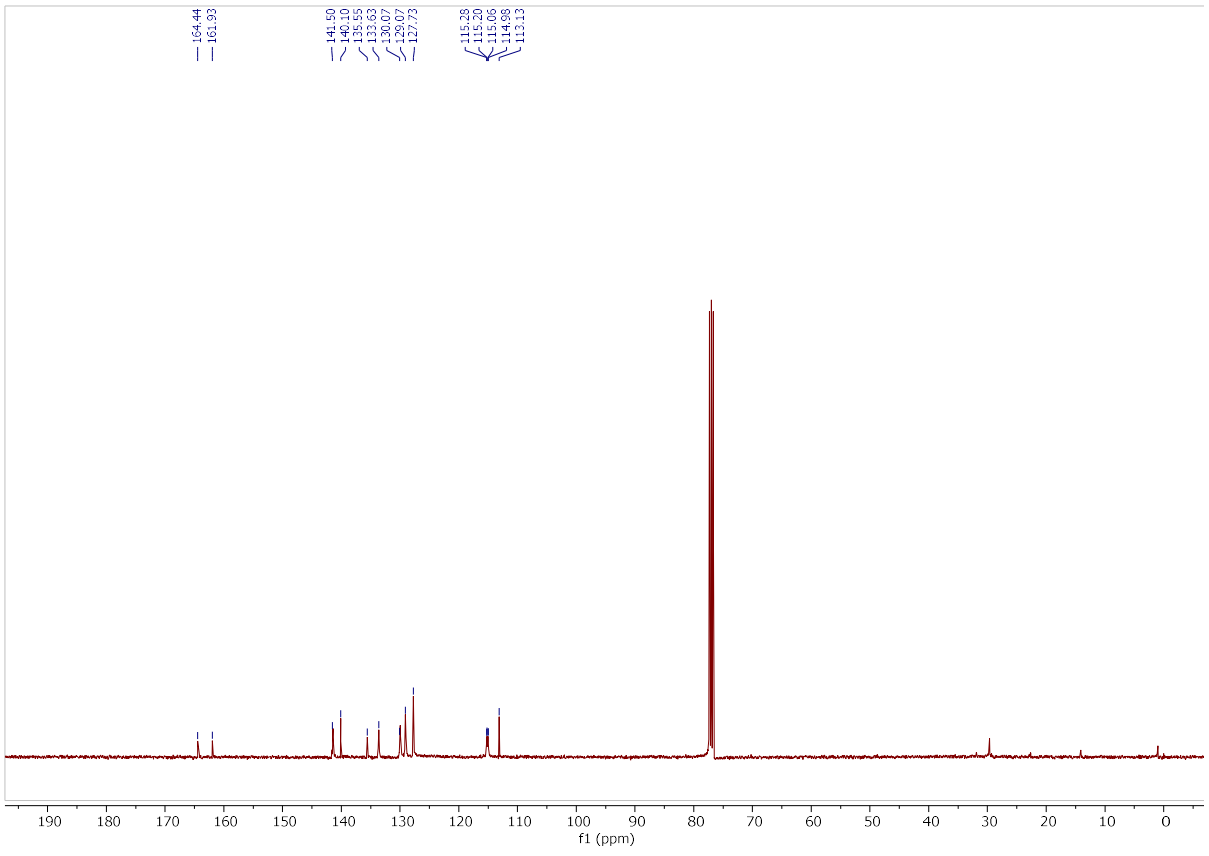
^{13}C NMR Spectrum of compound **28** in $CDCl_3$



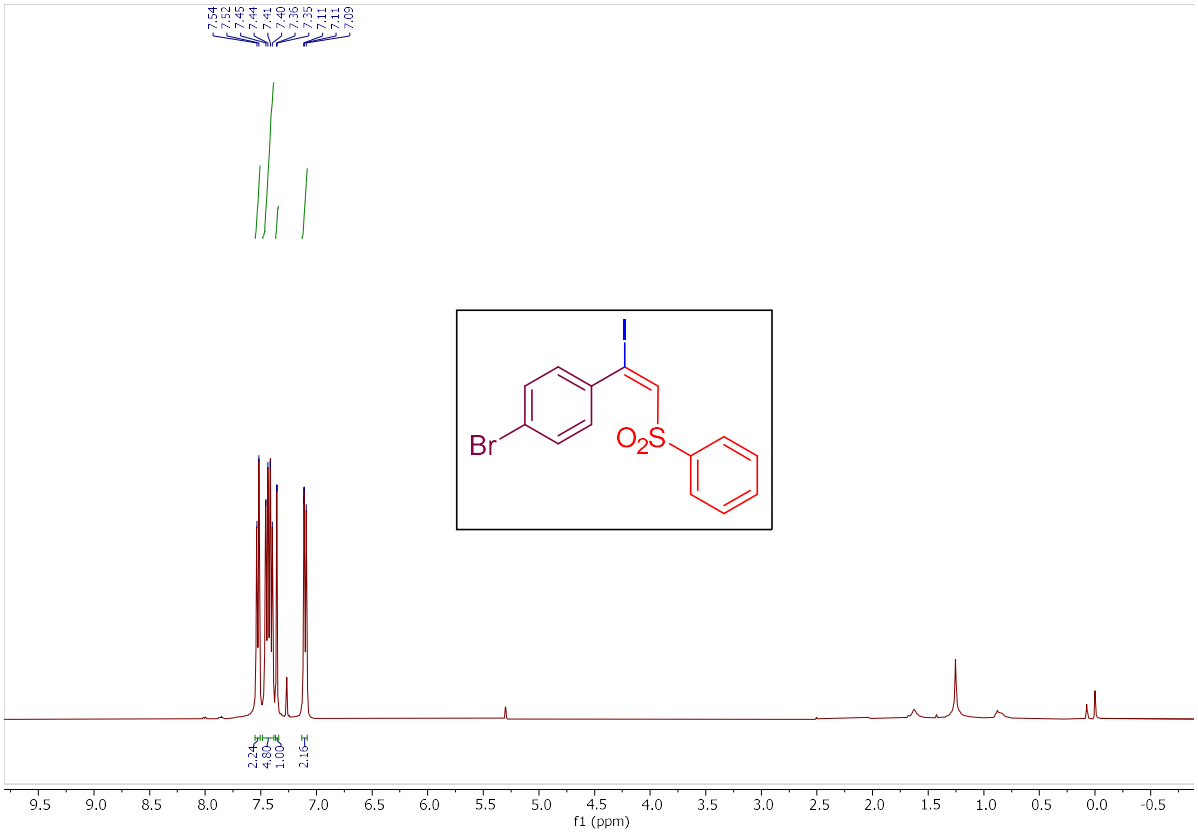
^{1}H-NMR Spectrum of compound **29** in $CDCl_3$



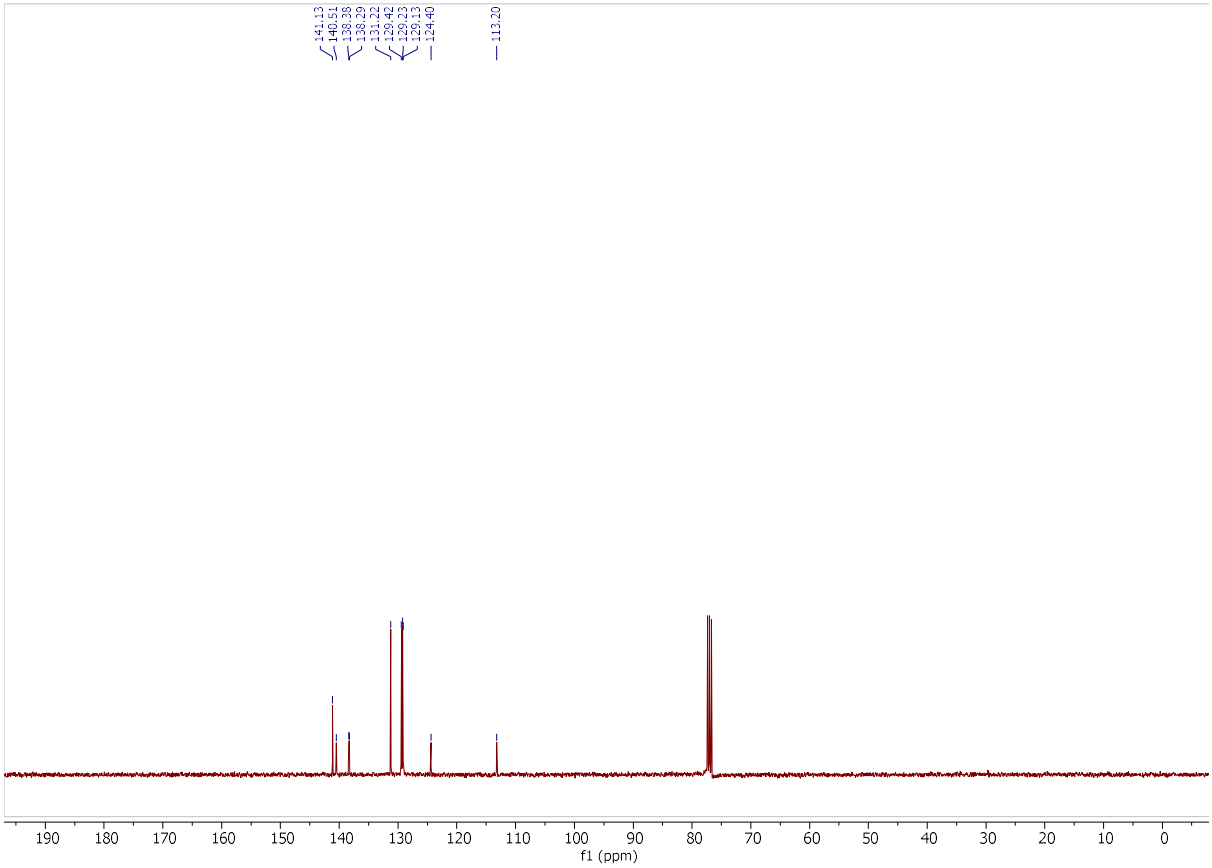
^{13}C-NMR Spectrum of compound **29** in $CDCl_3$



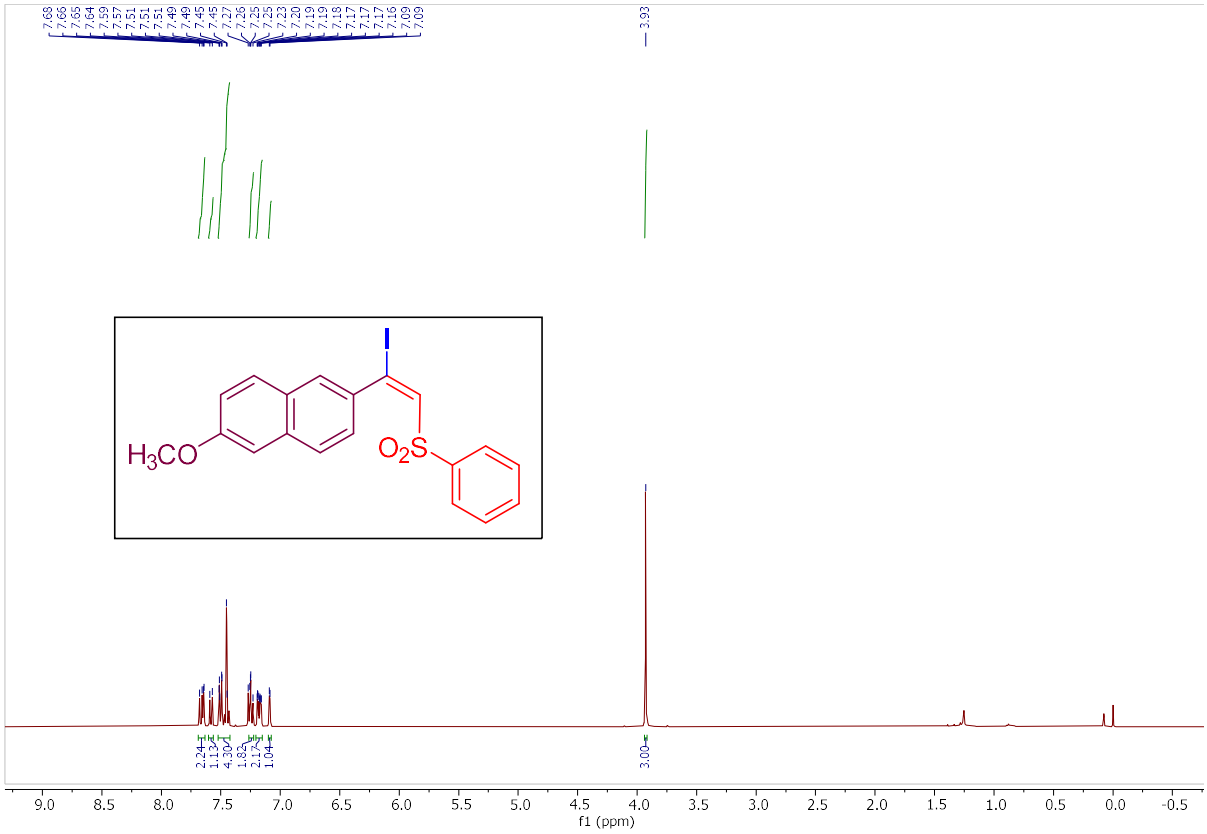
^{1}H-NMR Spectrum of compound **30** in $CDCl_3$



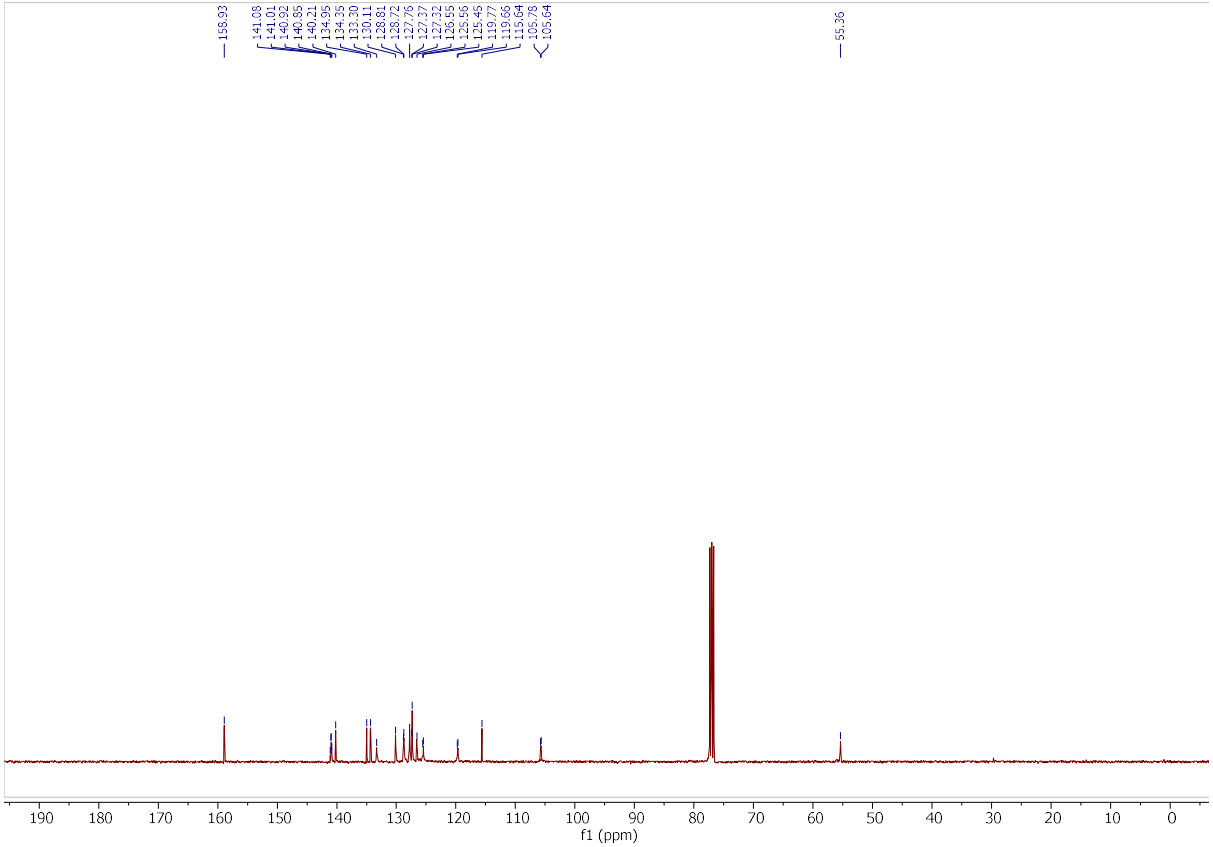
^{13}C-NMR Spectrum of compound **30** in $CDCl_3$



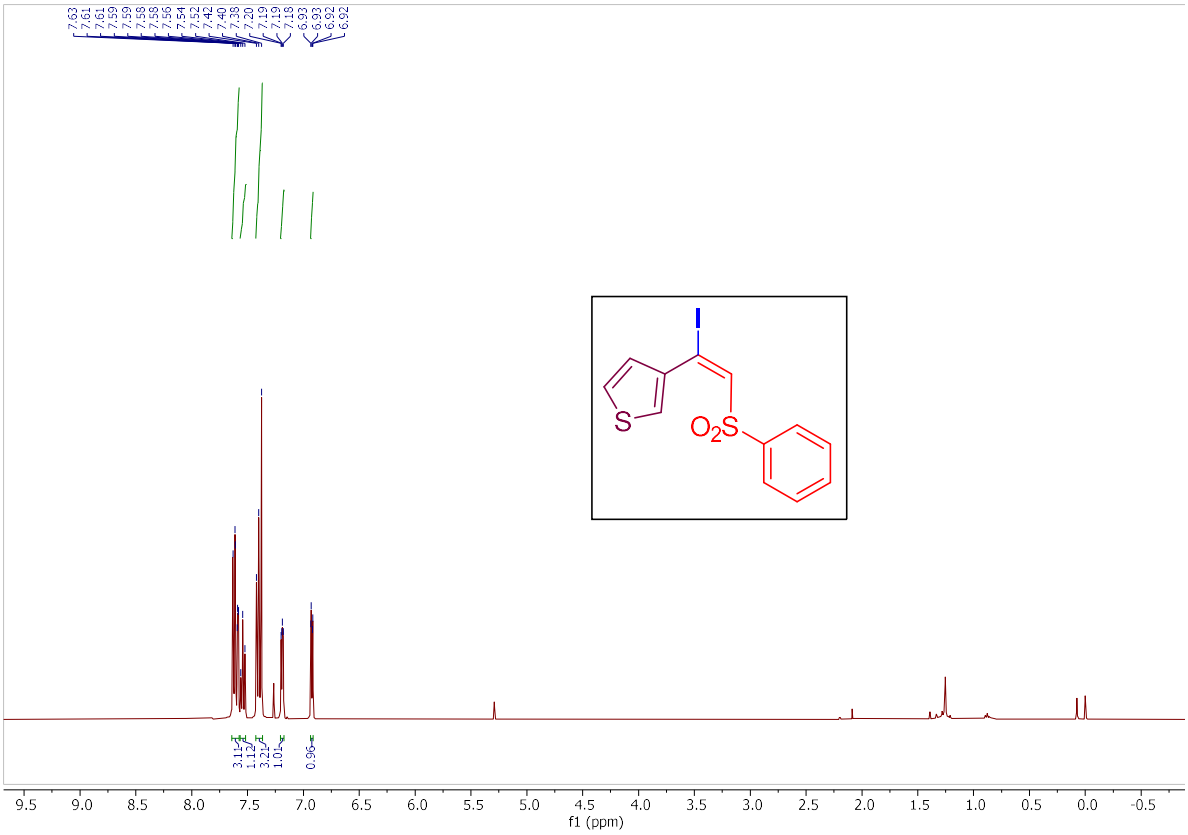
^{1}H-NMR Spectrum of compound **31** in $CDCl_3$



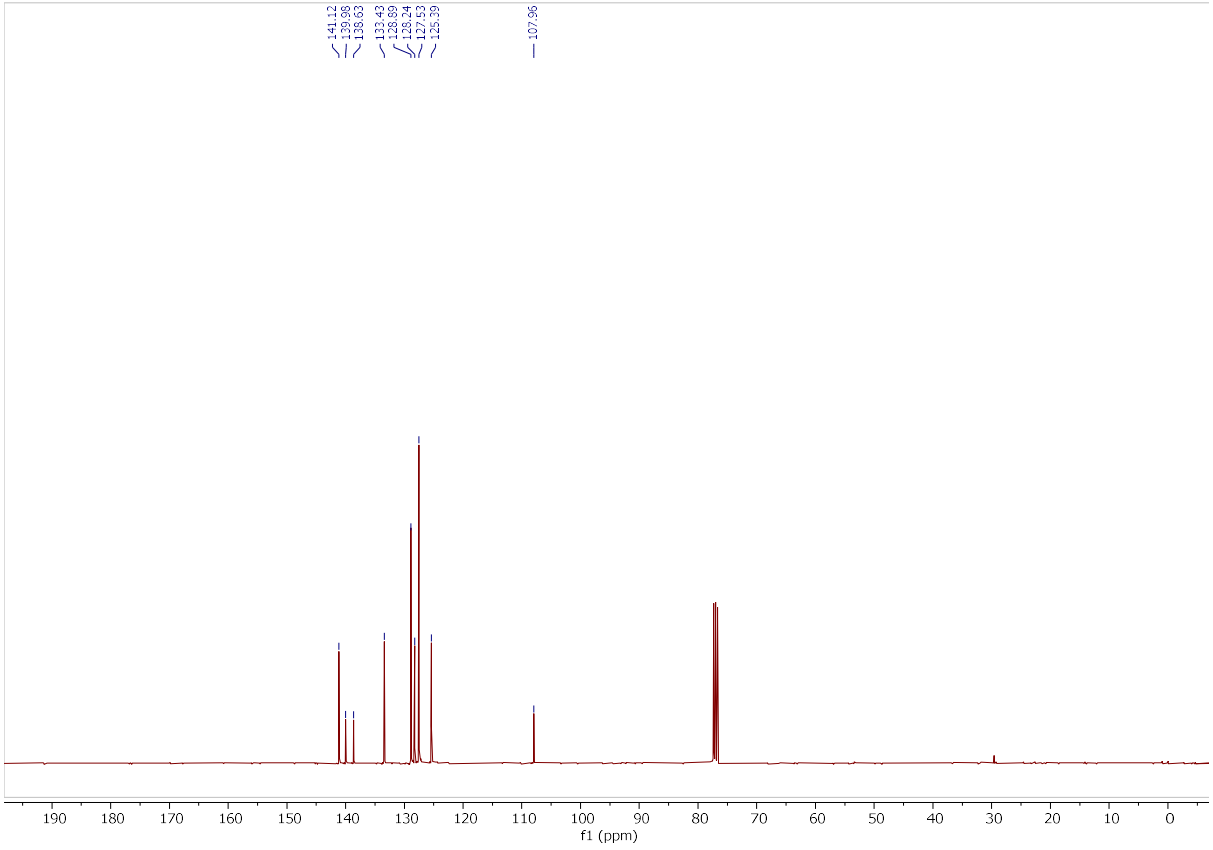
^{13}C-NMR Spectrum of compound **31** in $CDCl_3$



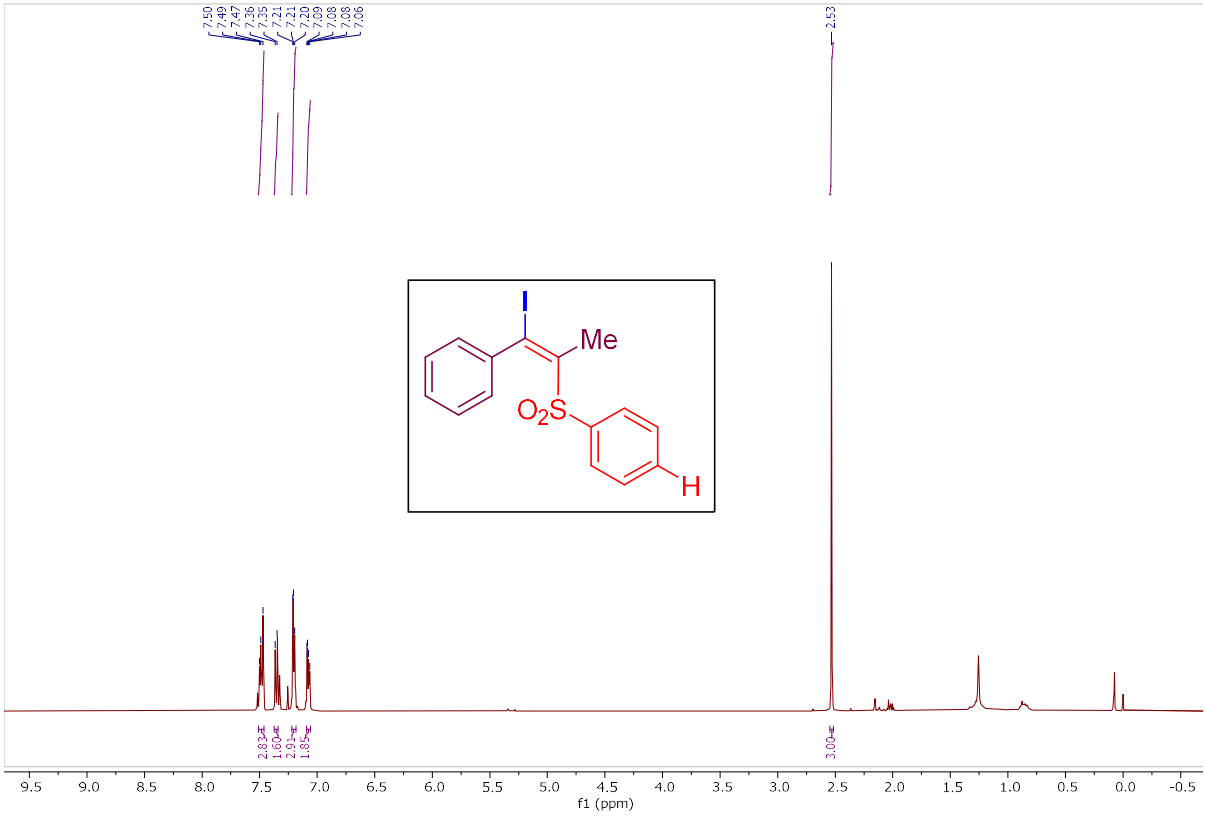
^{1}H-NMR Spectrum of compound **32** in $CDCl_3$



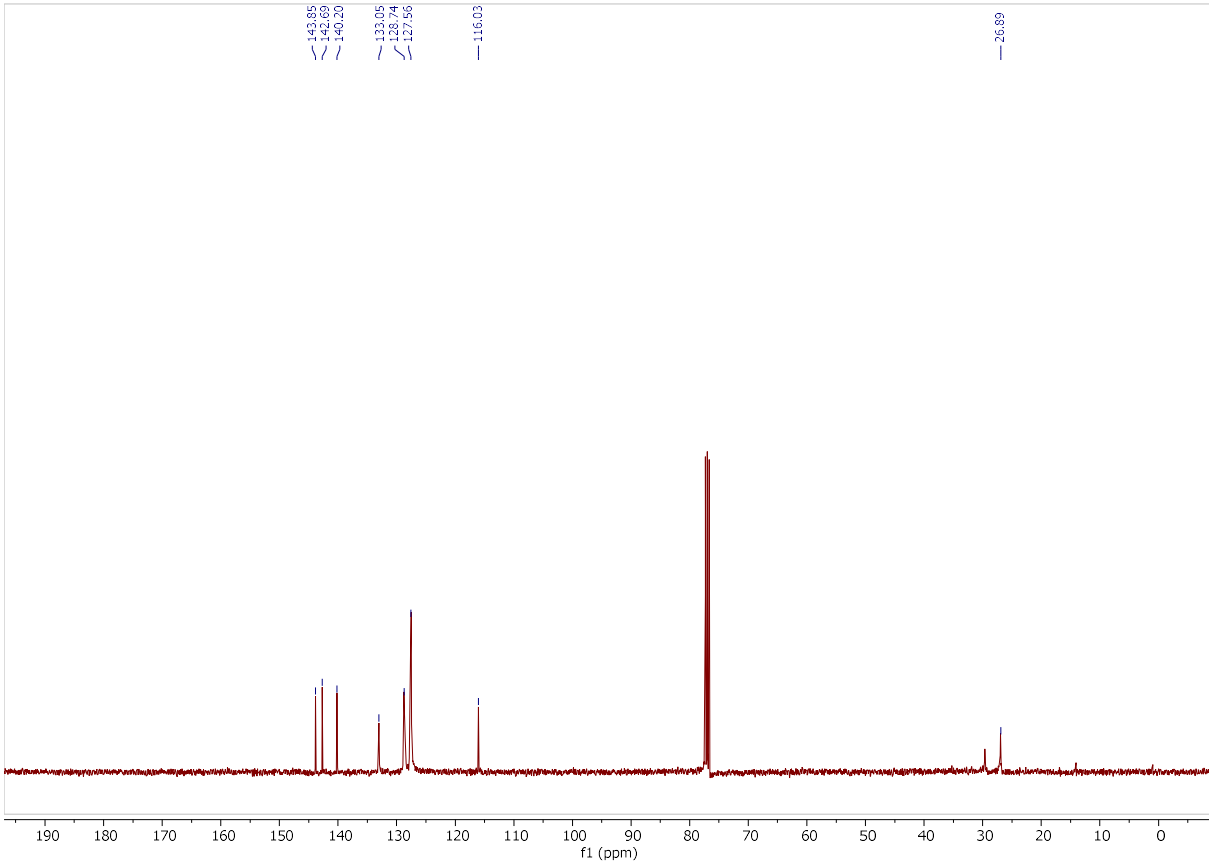
^{13}C-NMR Spectrum of compound **32** in $CDCl_3$



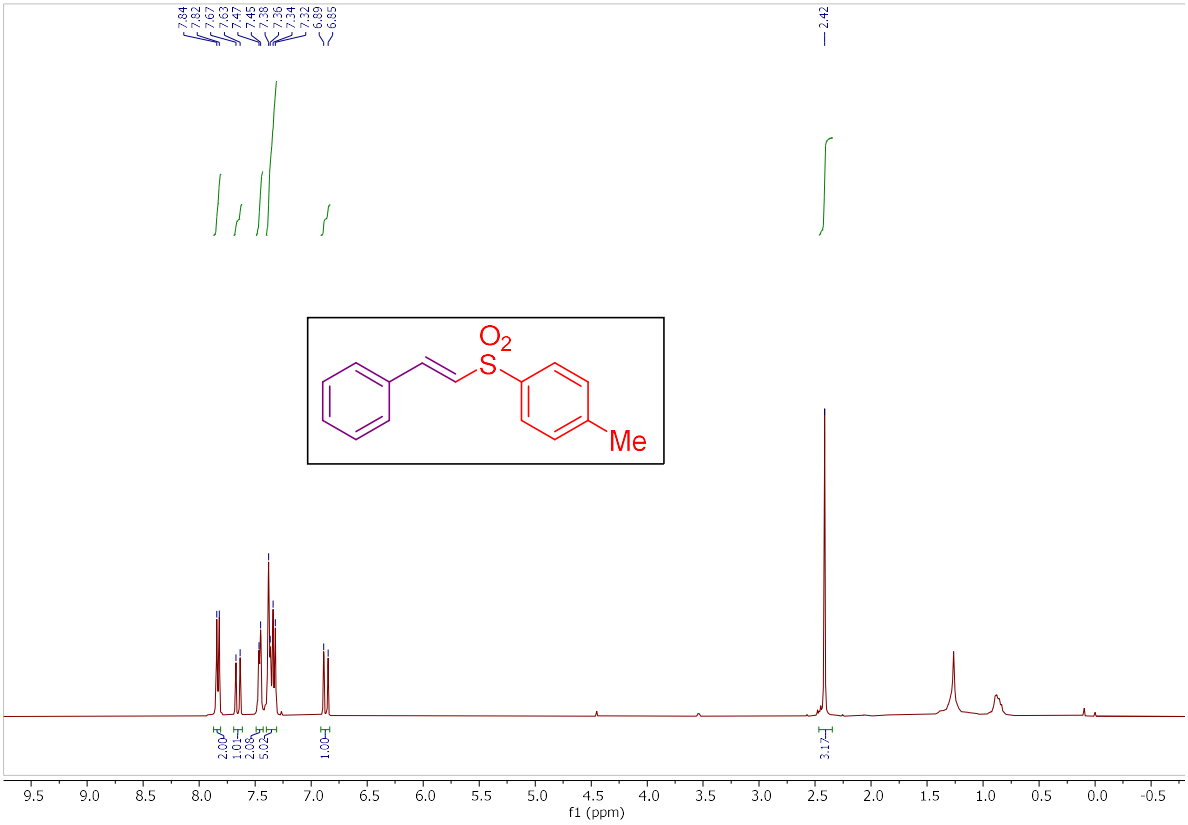
^{1}H-NMR Spectrum of compound **33** in $CDCl_3$



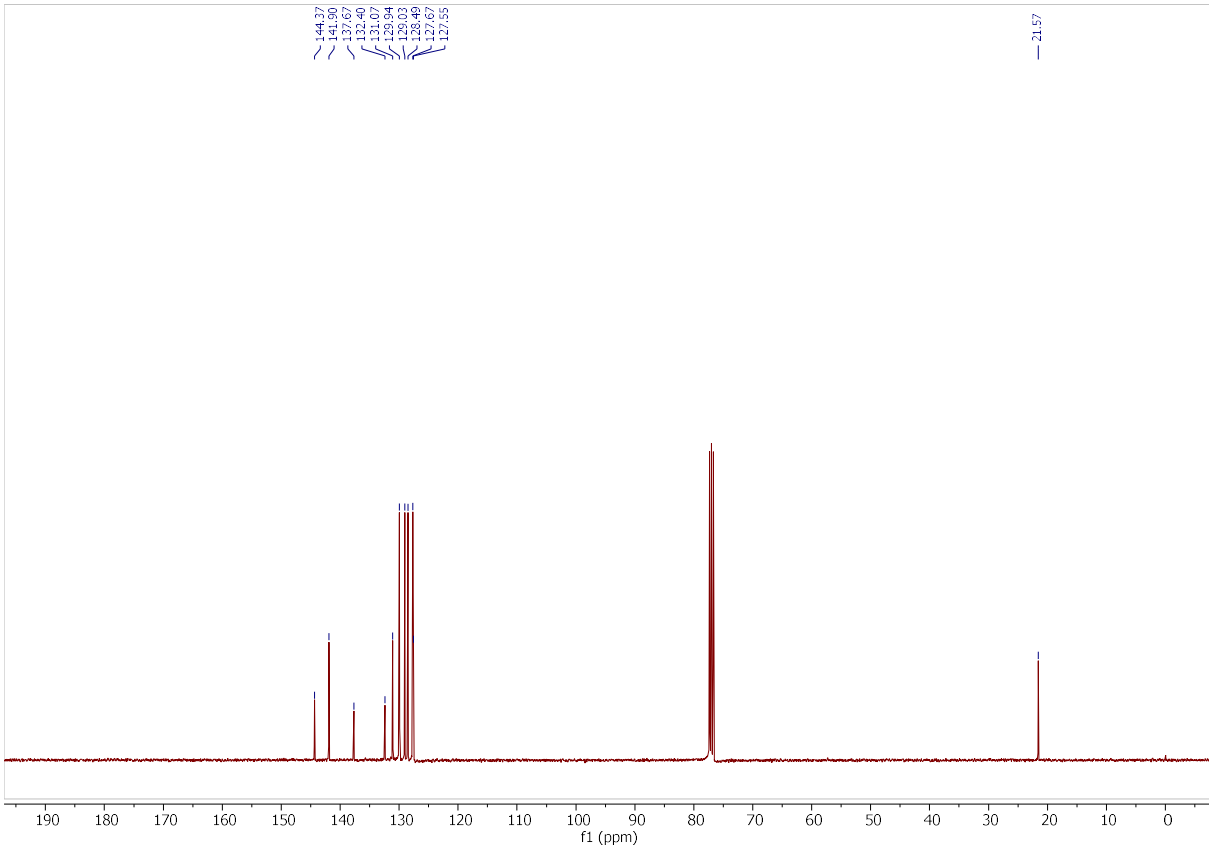
^{13}C-NMR Spectrum of compound **33** in $CDCl_3$



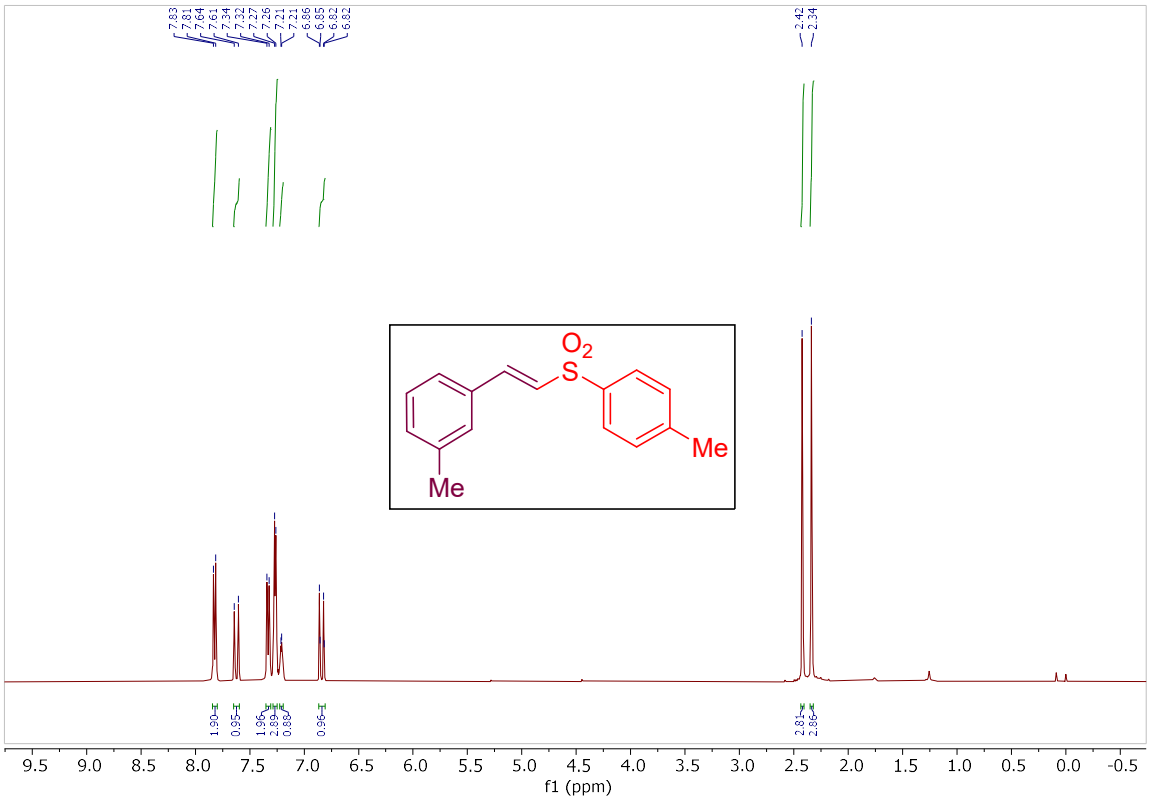
^{1}H-NMR Spectrum of compound **34** in $CDCl_3$



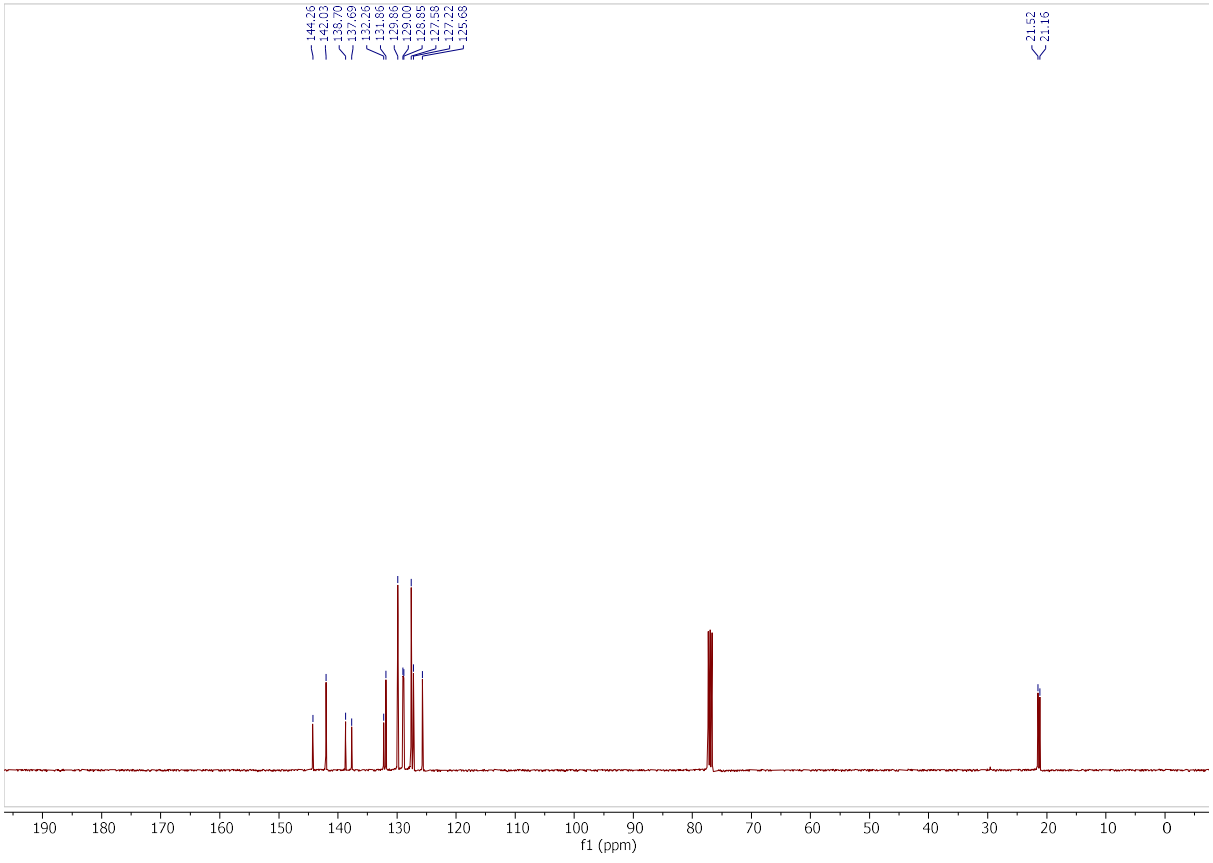
^{13}C-NMR Spectrum of compound **34** in $CDCl_3$



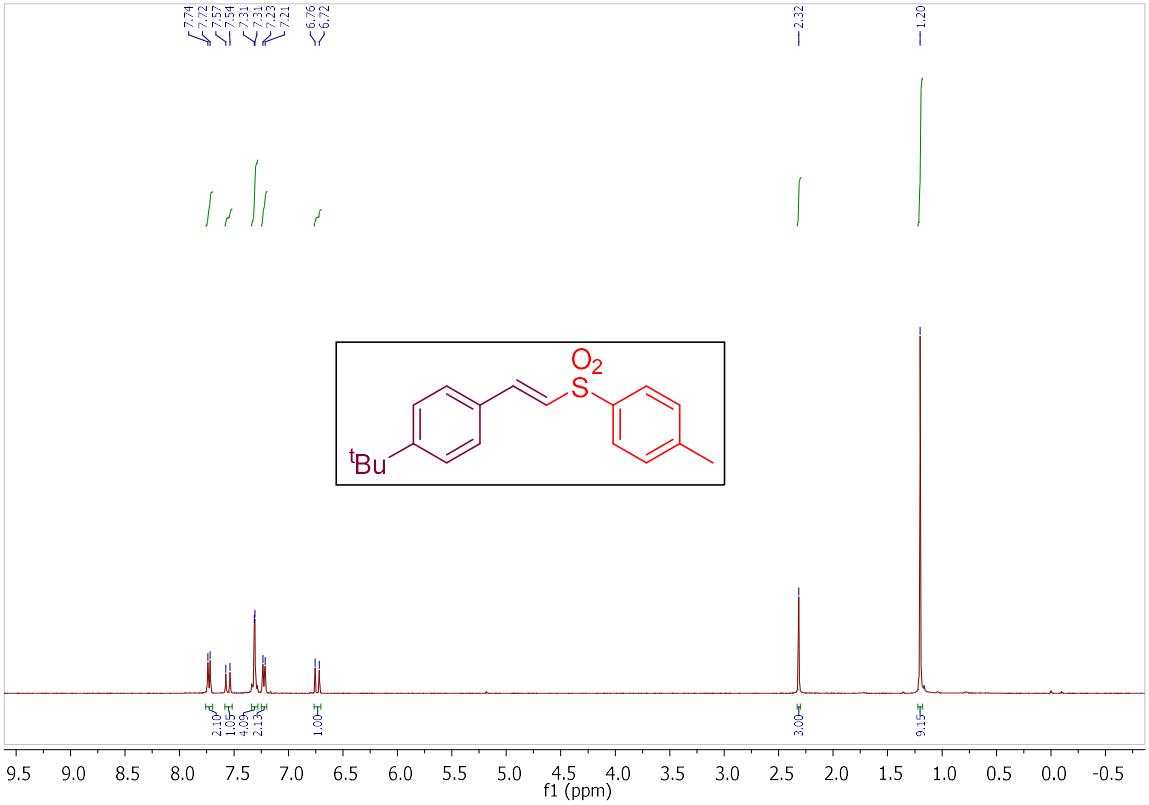
^{1}H-NMR Spectrum of compound **35** in $CDCl_3$



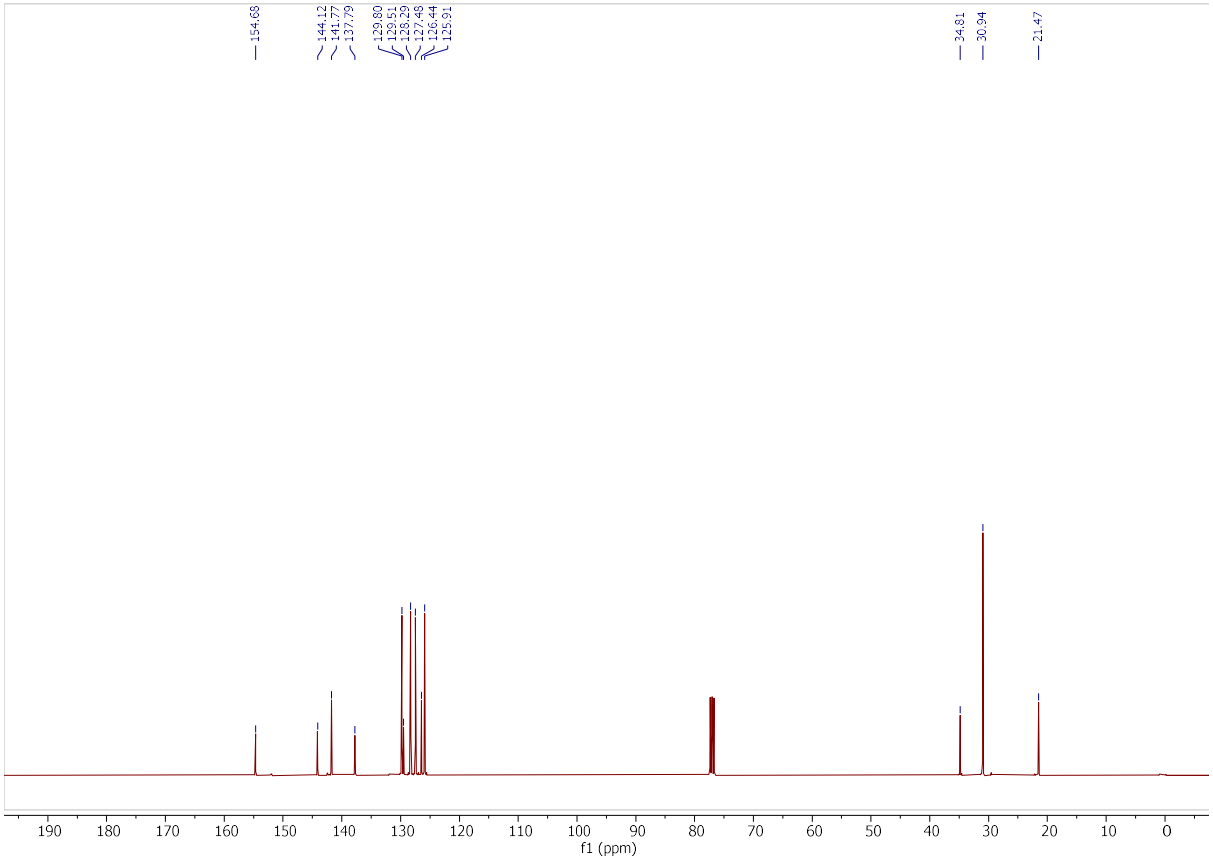
^{13}C-NMR Spectrum of compound **35** in $CDCl_3$



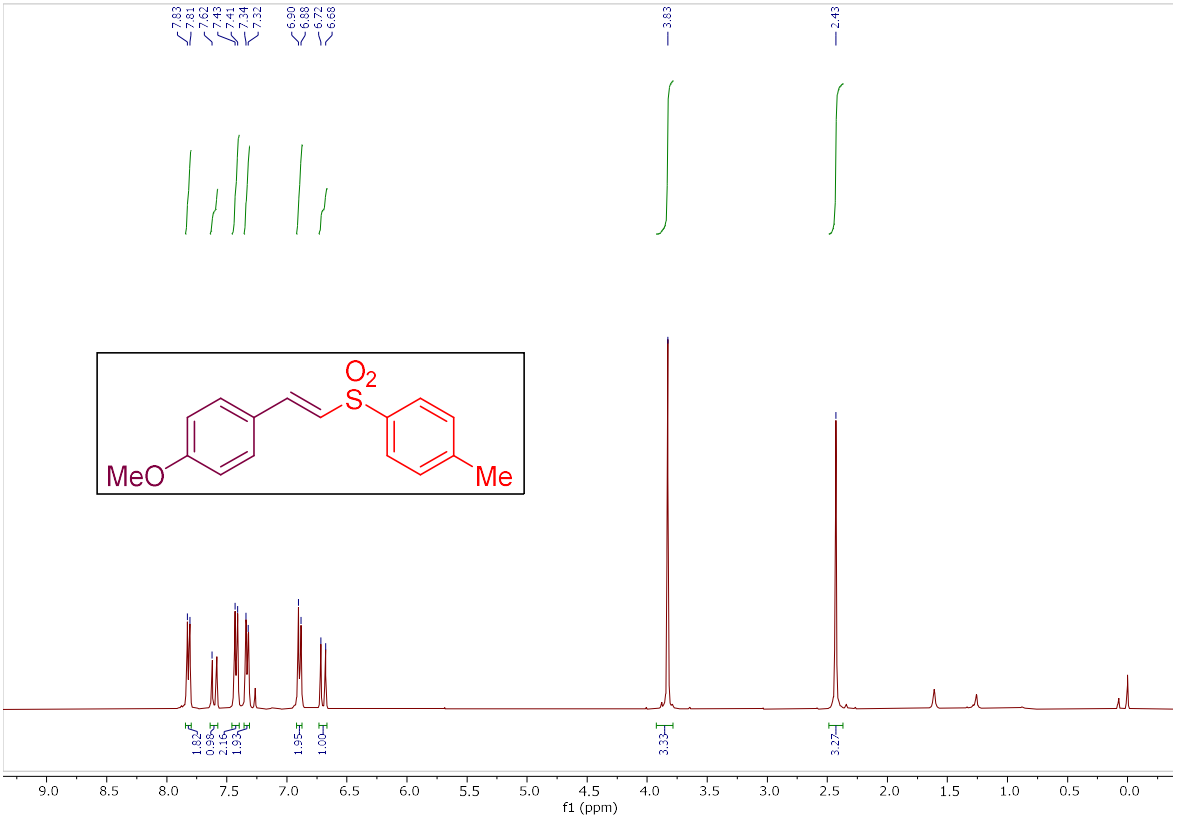
^{1}H-NMR Spectrum of compound **36** in $CDCl_3$



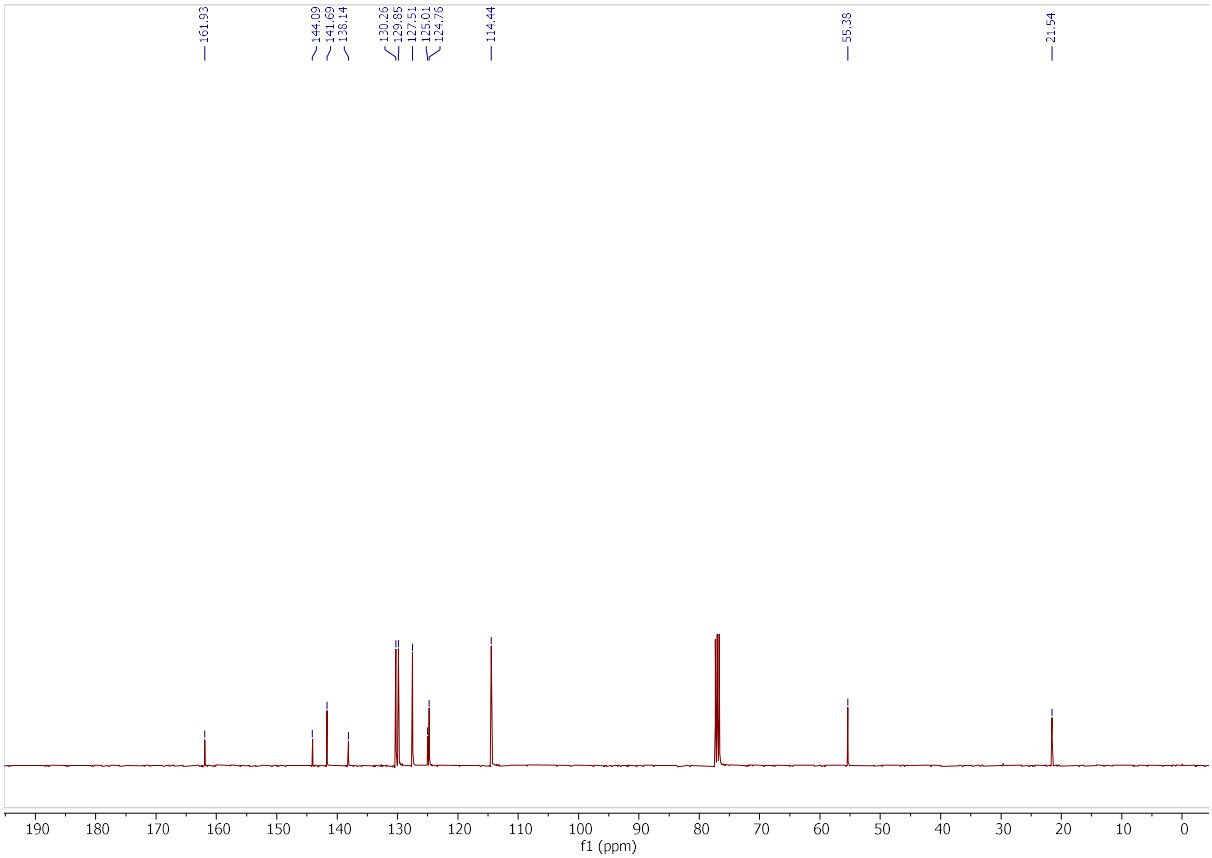
^{13}C-NMR Spectrum of compound **36** in $CDCl_3$



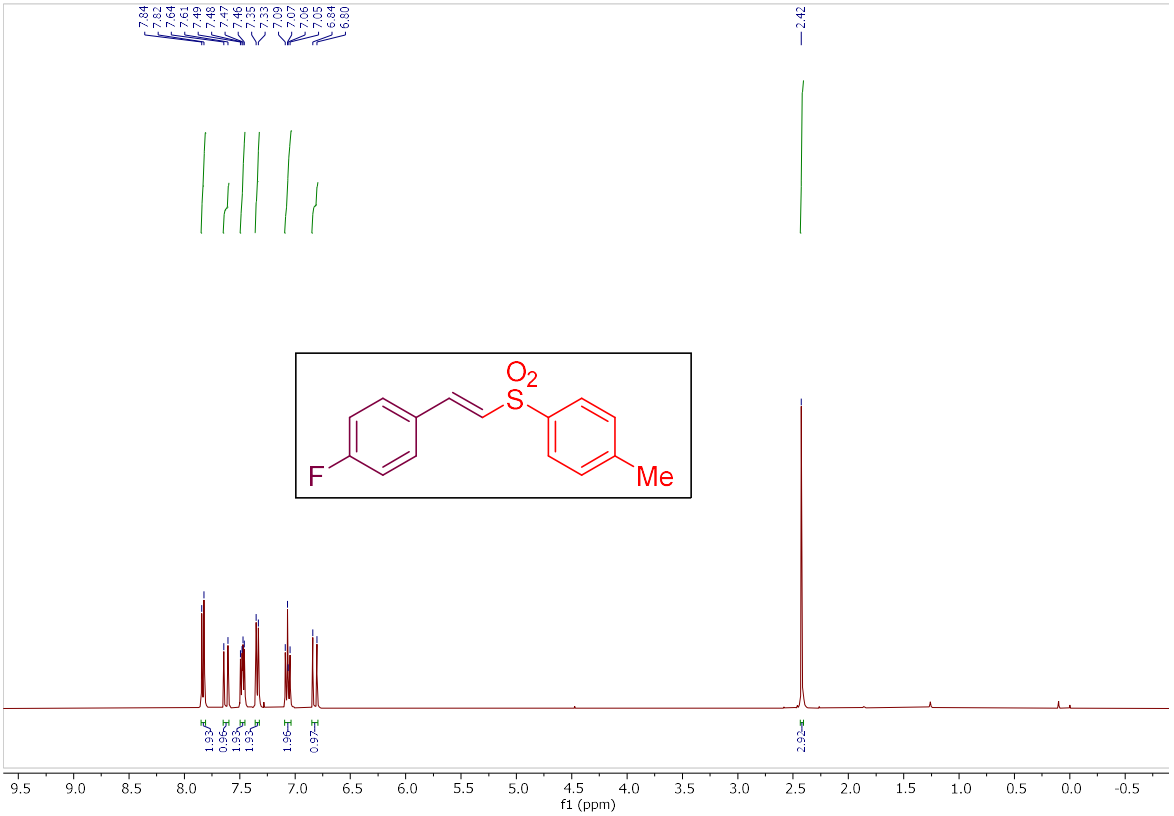
^{1}H-NMR Spectrum of compound **37** in $CDCl_3$



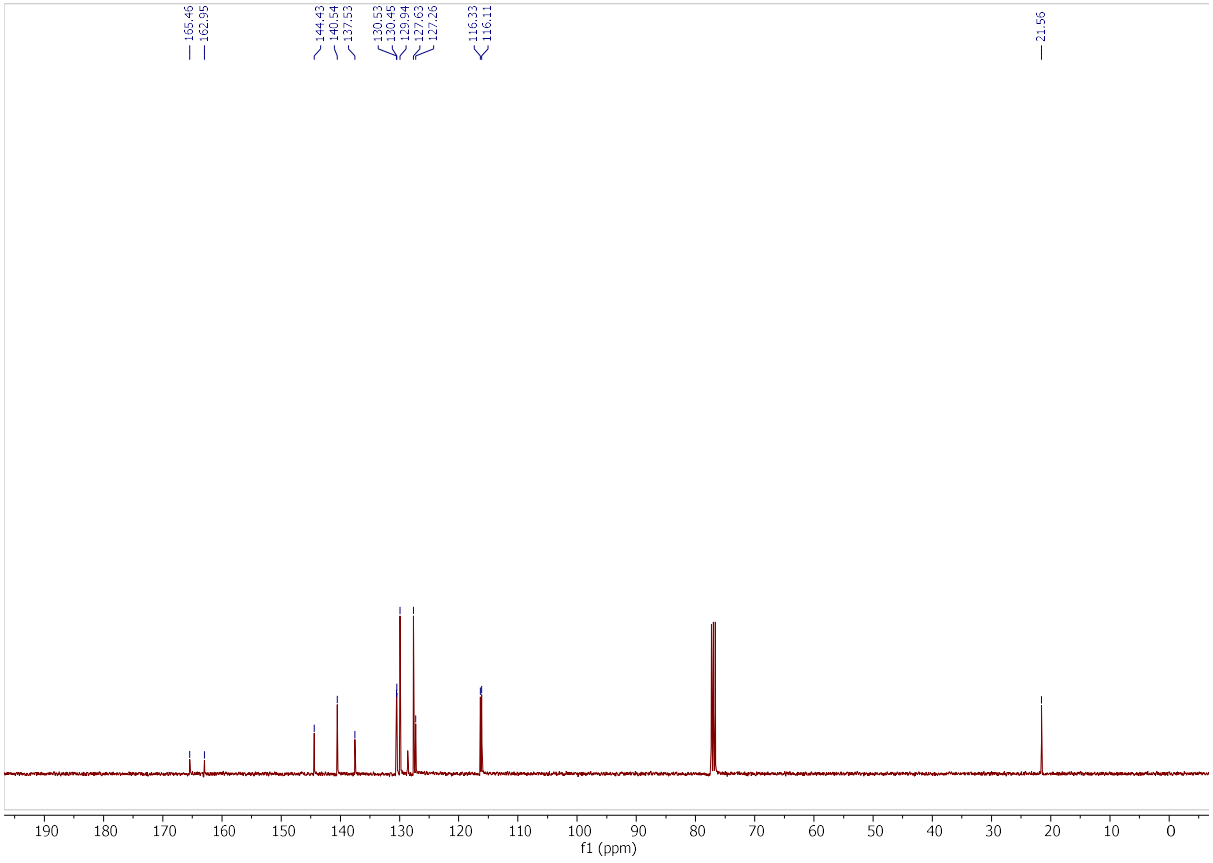
^{13}C-NMR Spectrum of compound **37** in $CDCl_3$



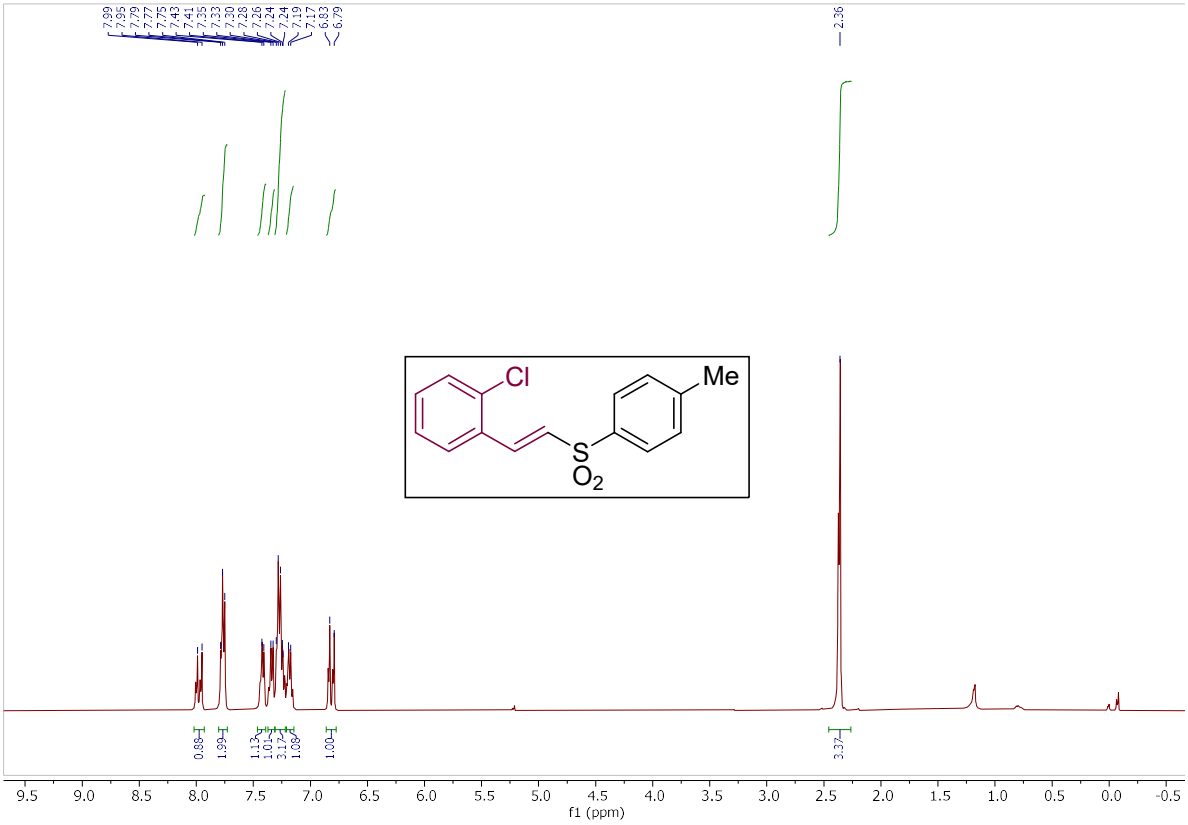
^{1}H-NMR Spectrum of compound **38** in $CDCl_3$



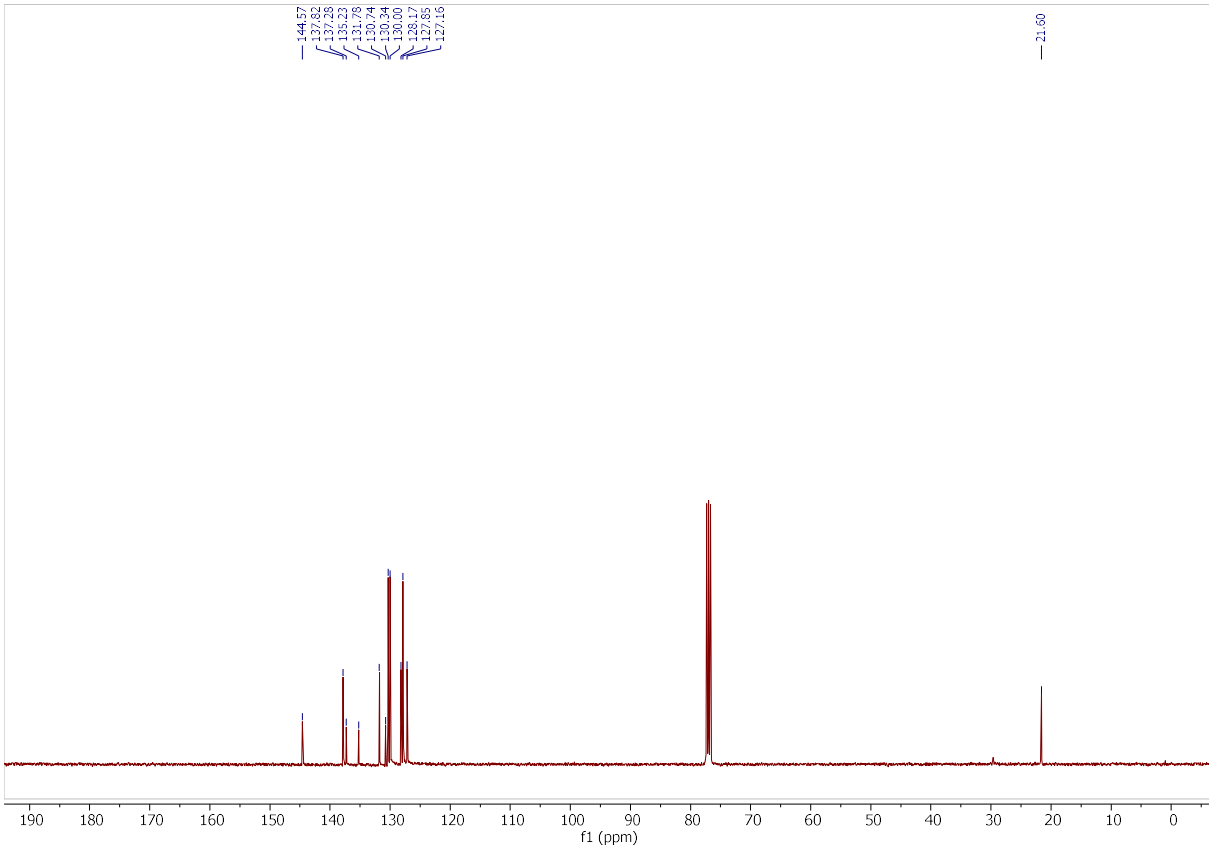
^{13}C-NMR Spectrum of compound **38** in $CDCl_3$



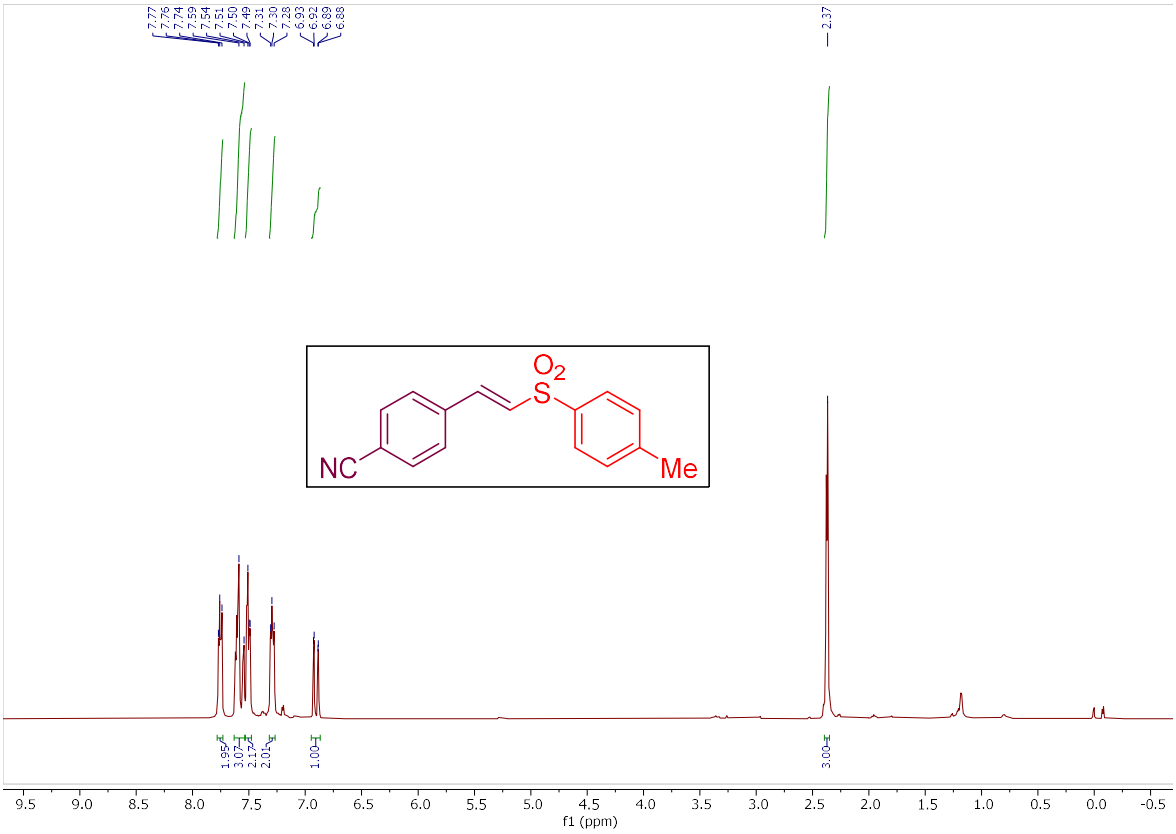
^{1}H-NMR Spectrum of compound **39** in $CDCl_3$



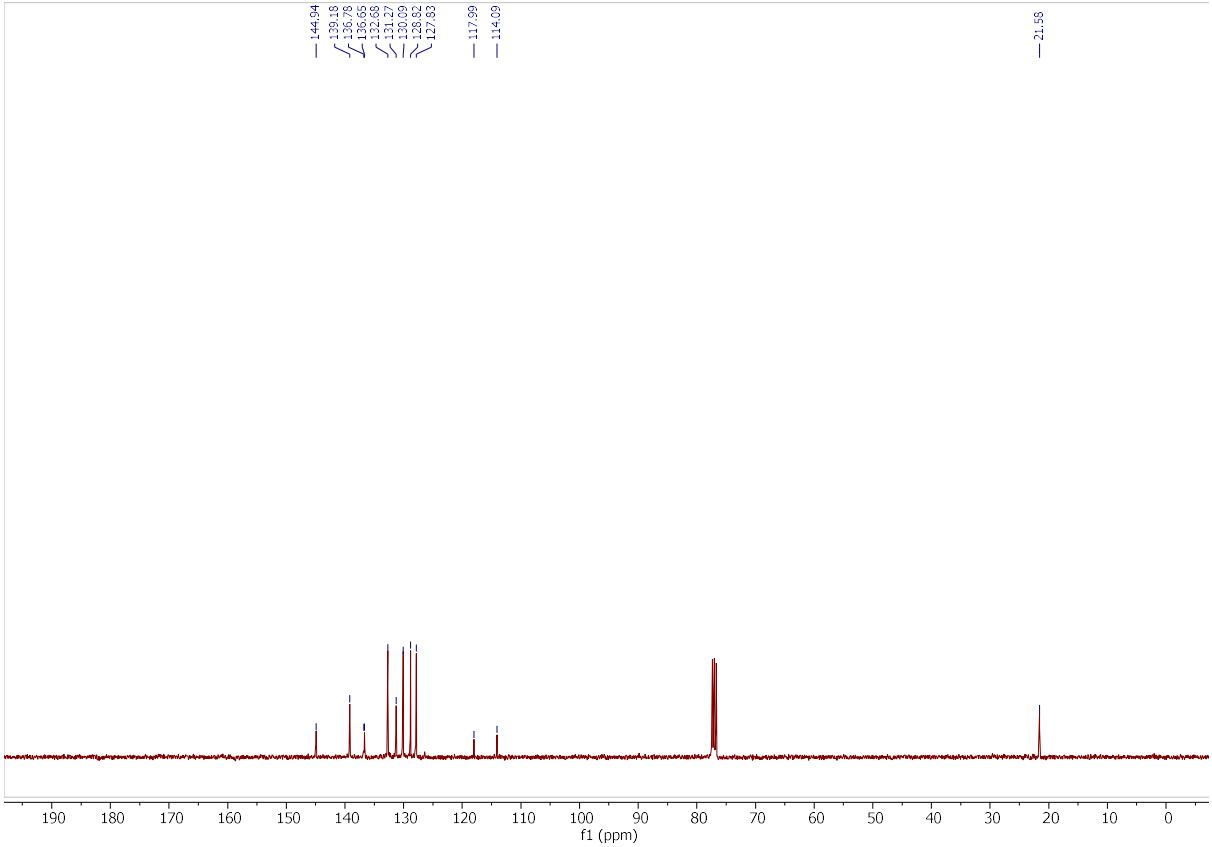
^{13}C-NMR Spectrum of compound **39** in $CDCl_3$



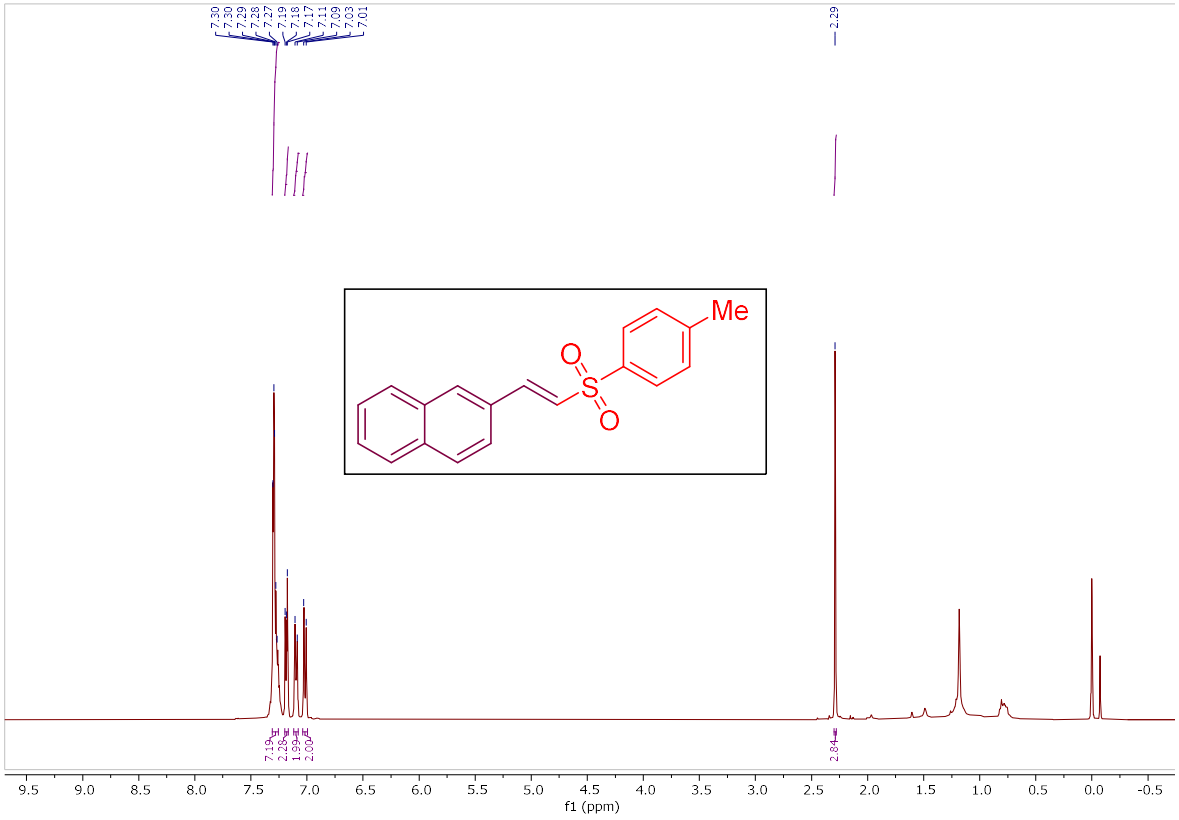
^{1}H-NMR Spectrum of compound **40** in $CDCl_3$



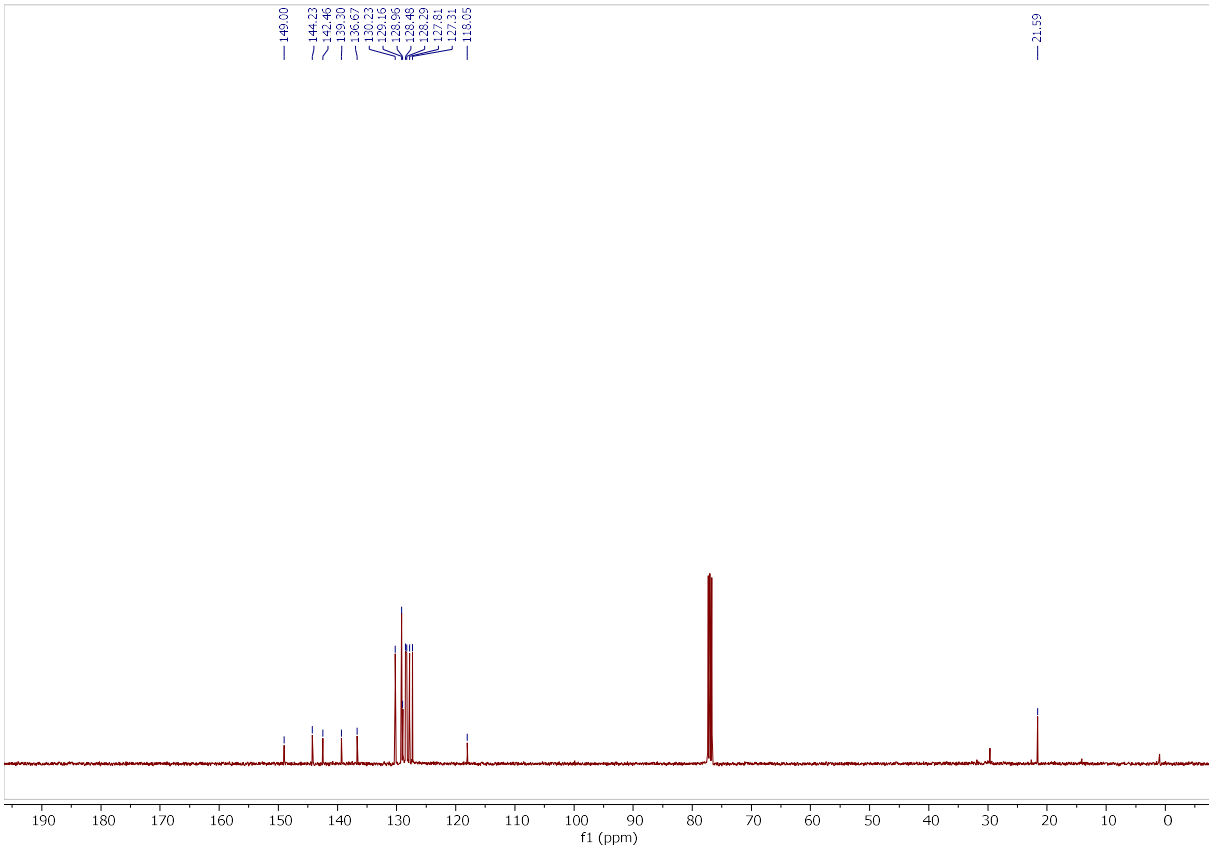
^{13}C-NMR Spectrum of compound **40** in $CDCl_3$



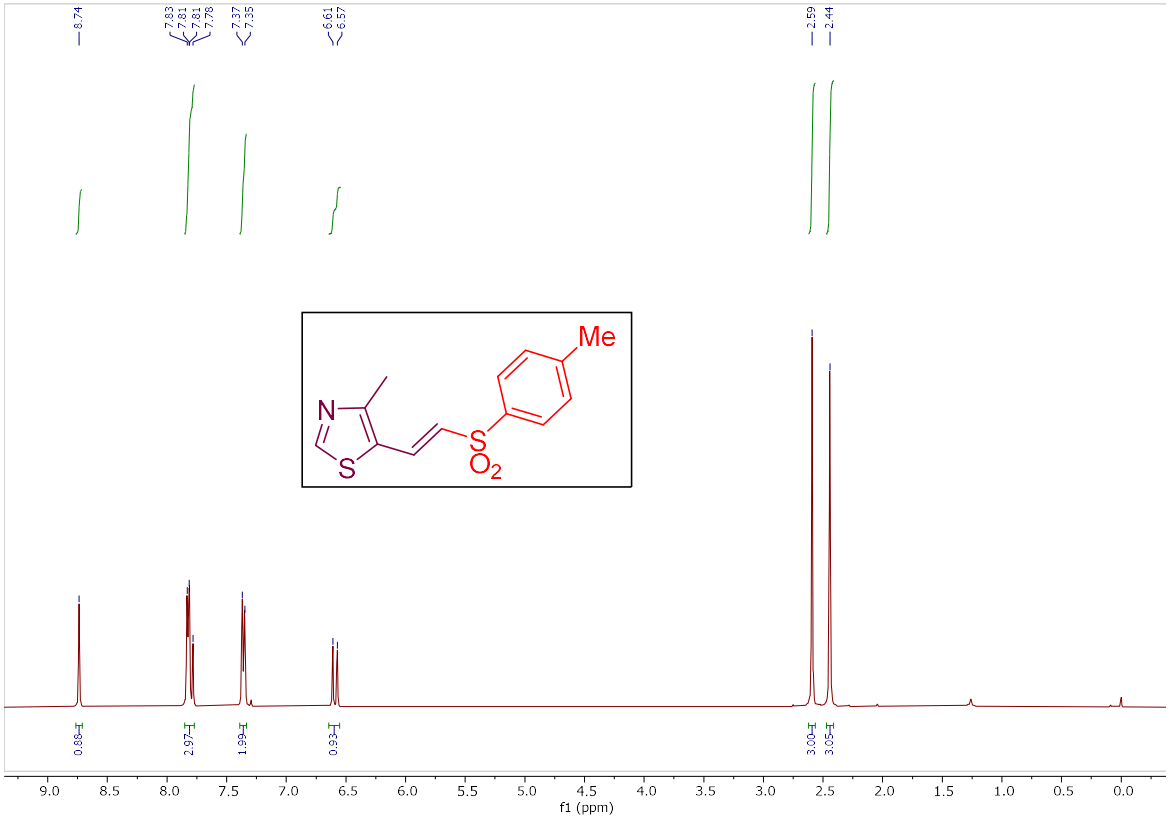
^{1}H-NMR Spectrum of compound **41** in $CDCl_3$



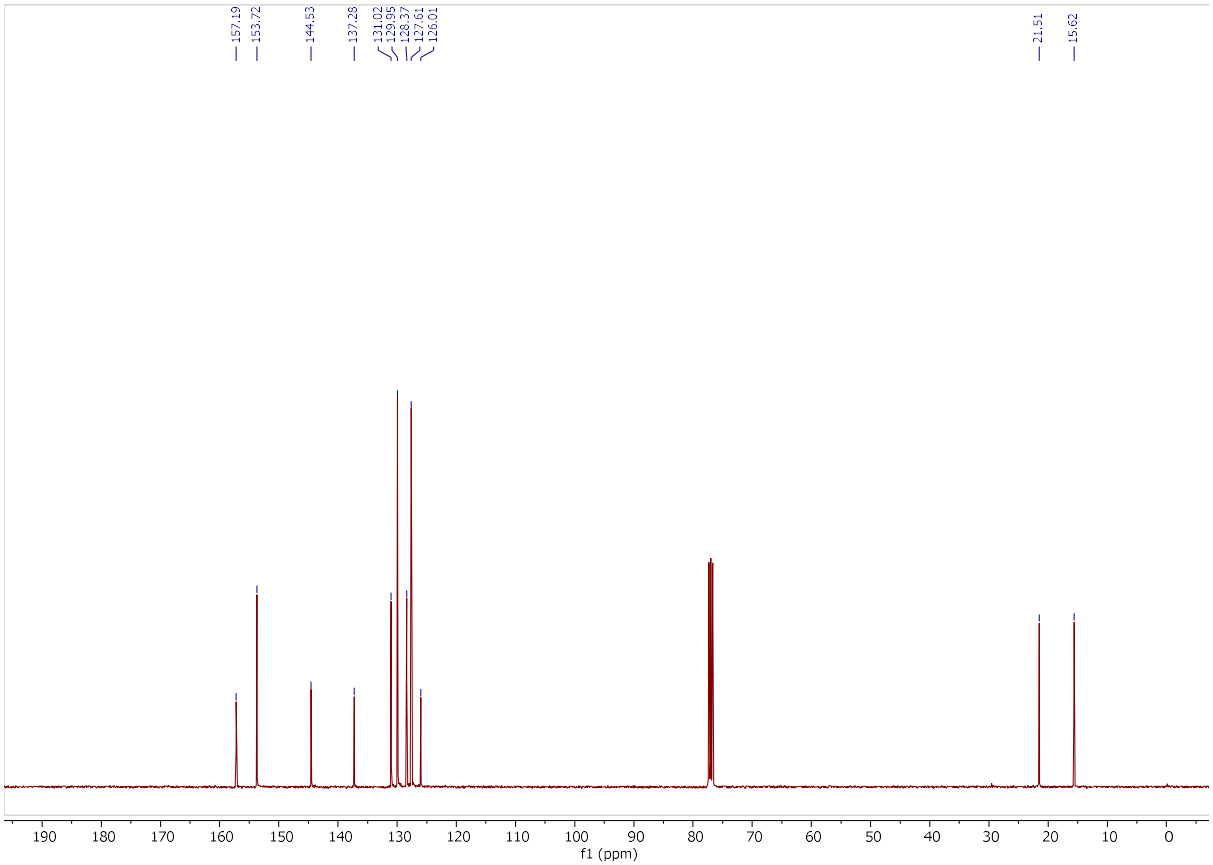
^{13}C-NMR Spectrum of compound **41** in $CDCl_3$



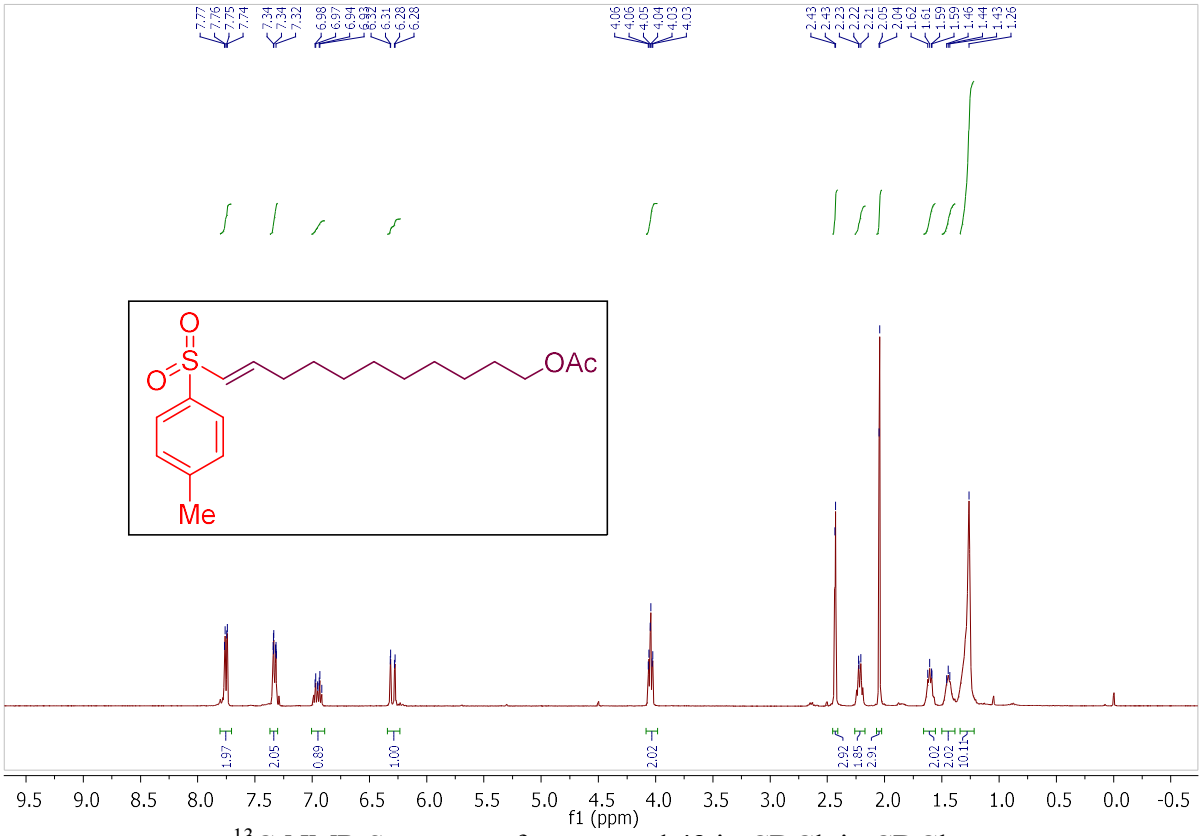
^{1}H-NMR Spectrum of compound **42** in $CDCl_3$



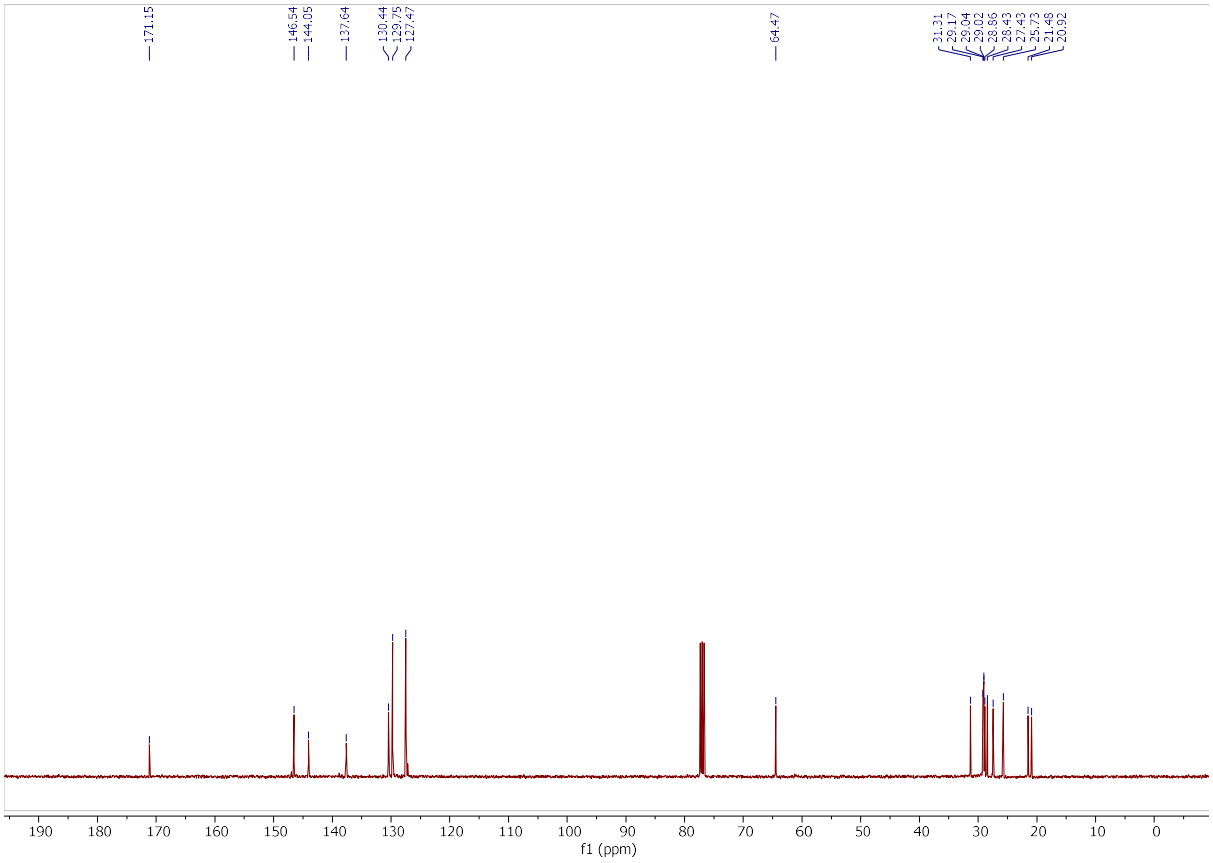
^{13}C-NMR Spectrum of compound **42** in $CDCl_3$



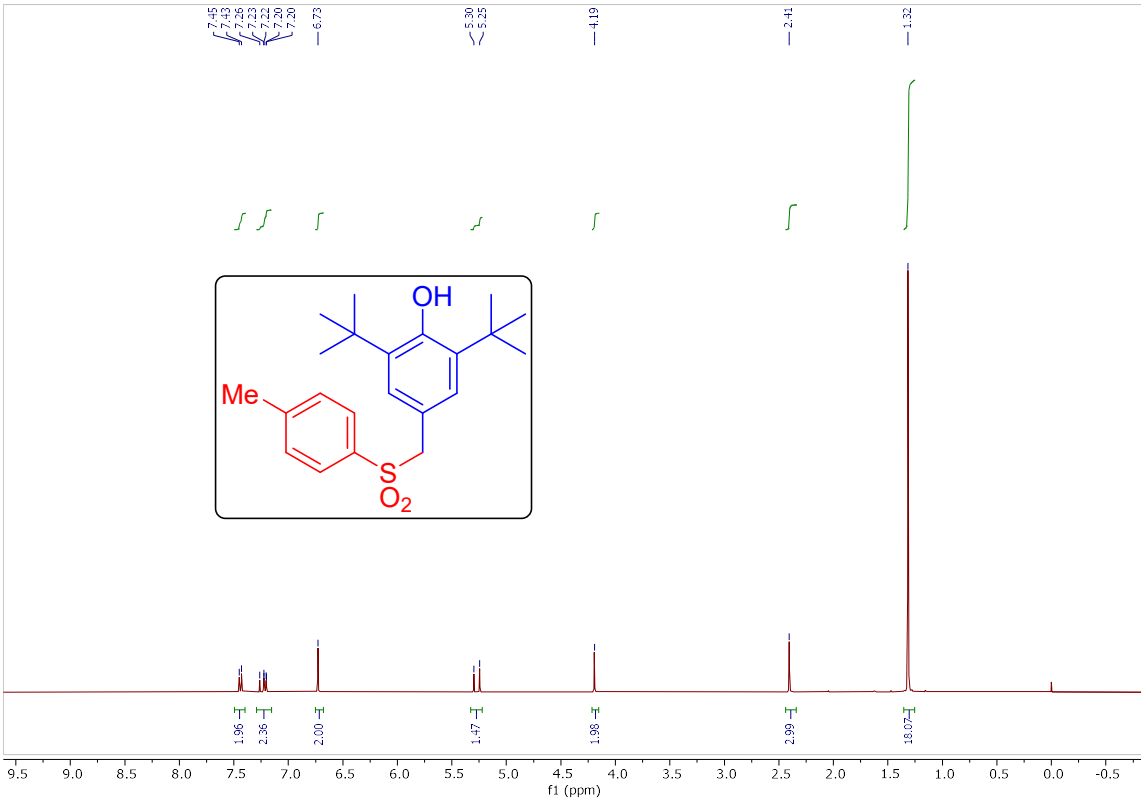
^{1}H-NMR Spectrum of compound **43** in $CDCl_3$



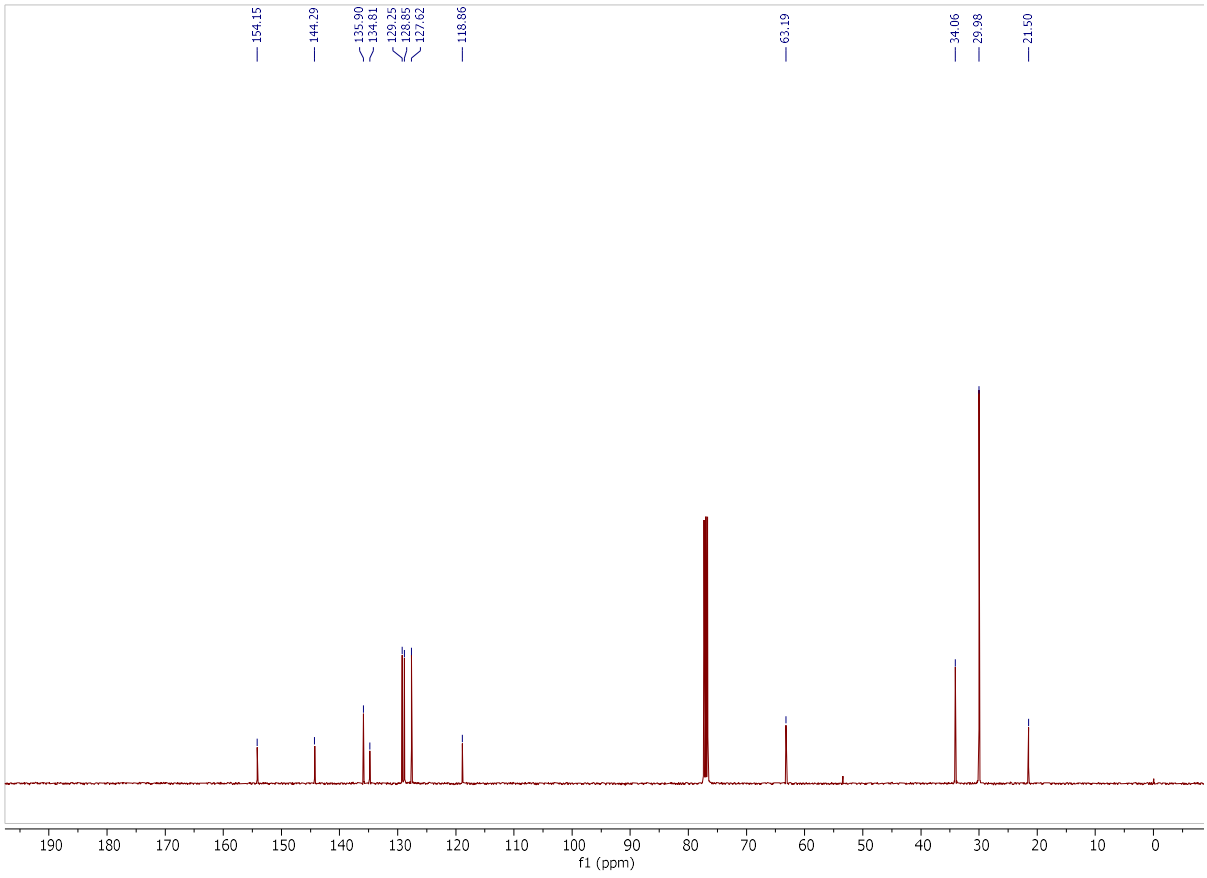
^{13}C-NMR Spectrum of compound **43** in $CDCl_3$ in $CDCl_3$



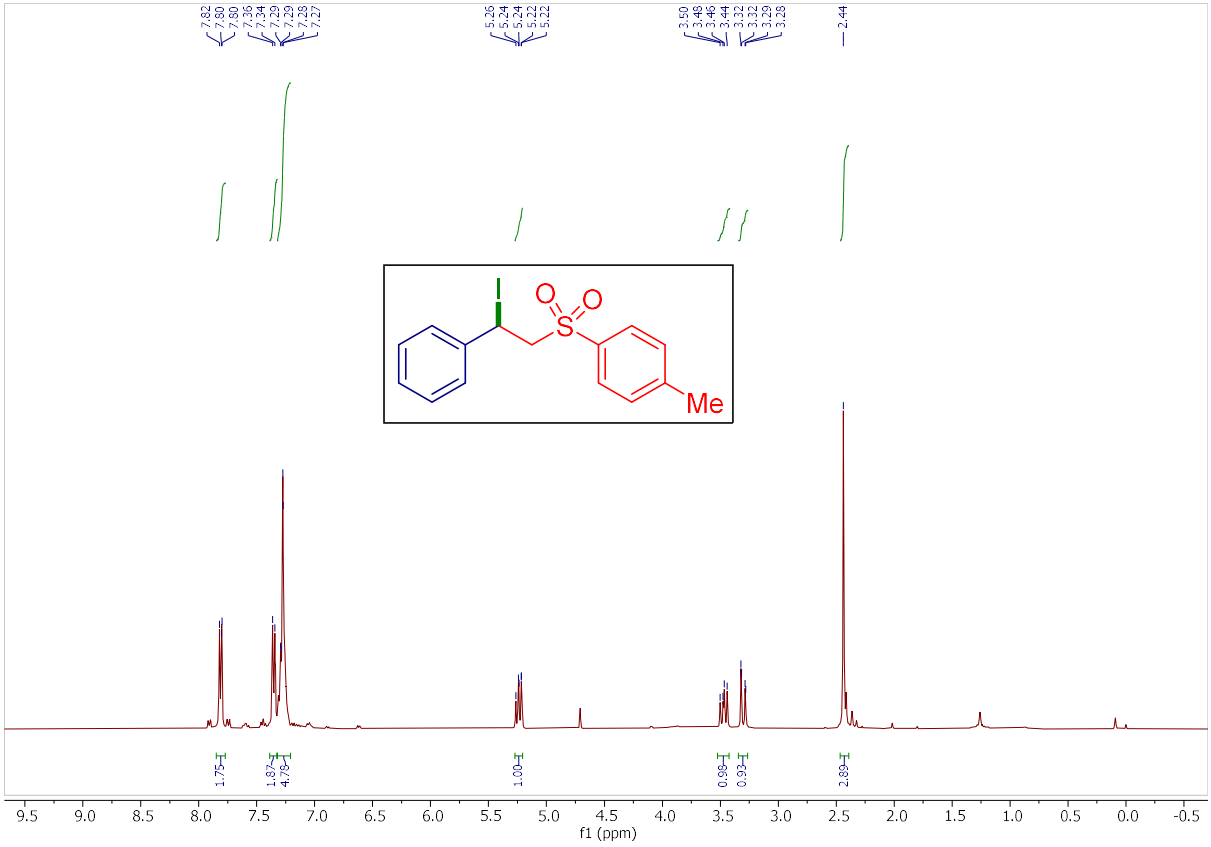
^{1}H NMR Spectrum of compound **44** in $CDCl_3$



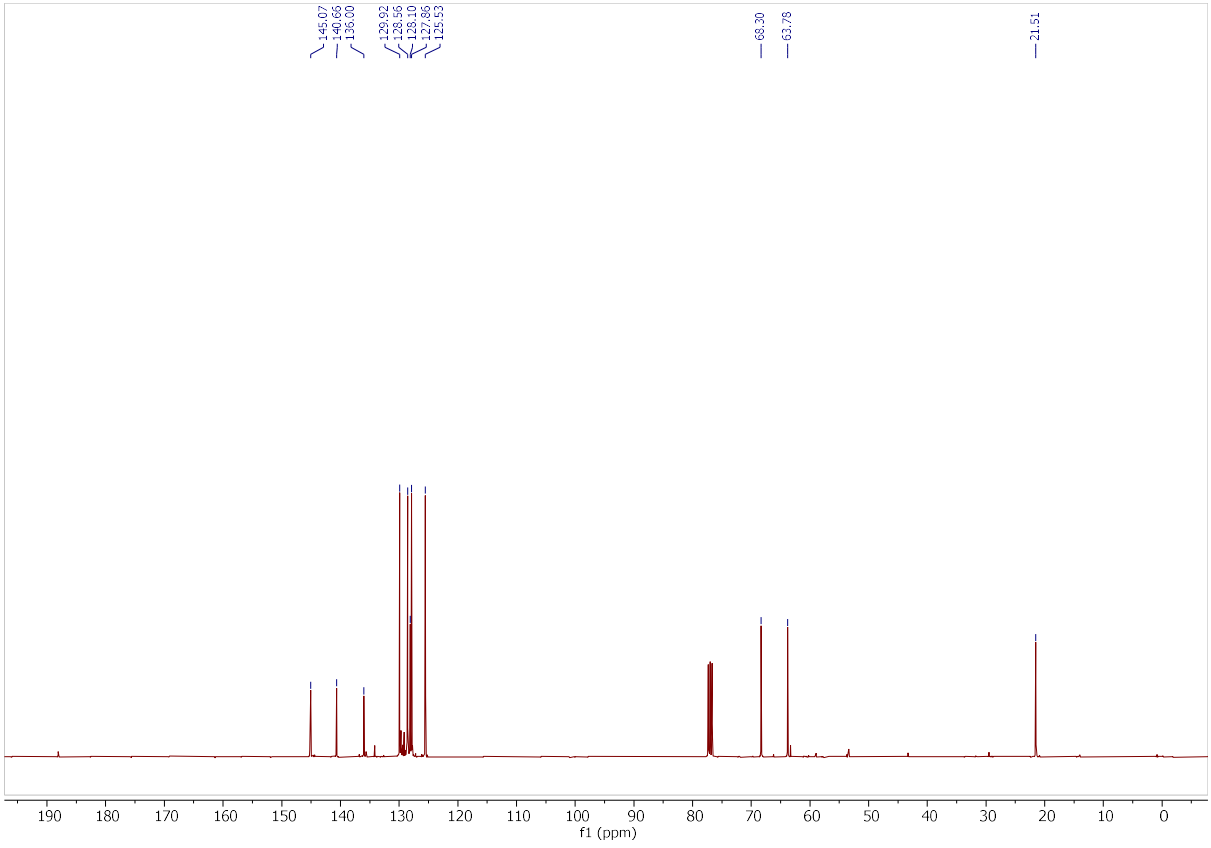
^{13}C NMR Spectrum of compound **44** in $CDCl_3$



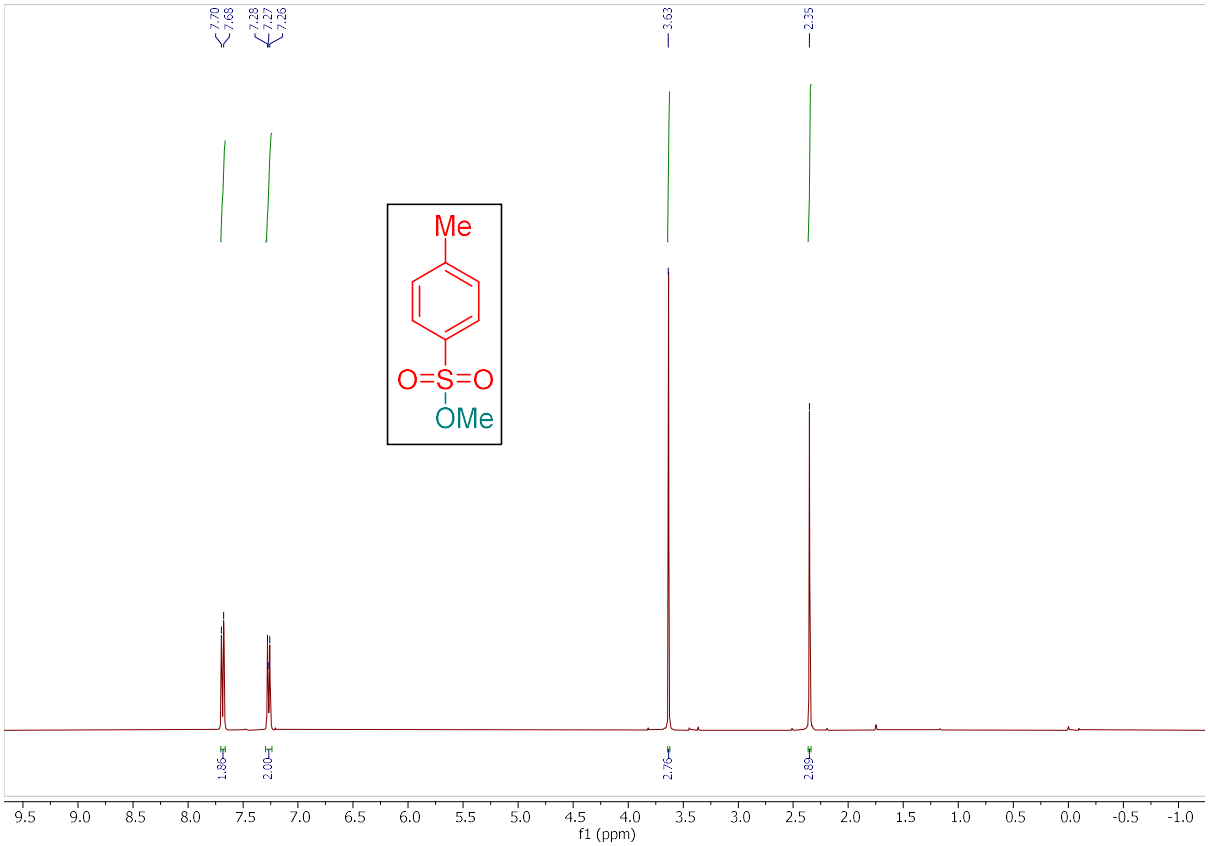
^{1}H NMR Spectrum of compound **45** in $CDCl_3$



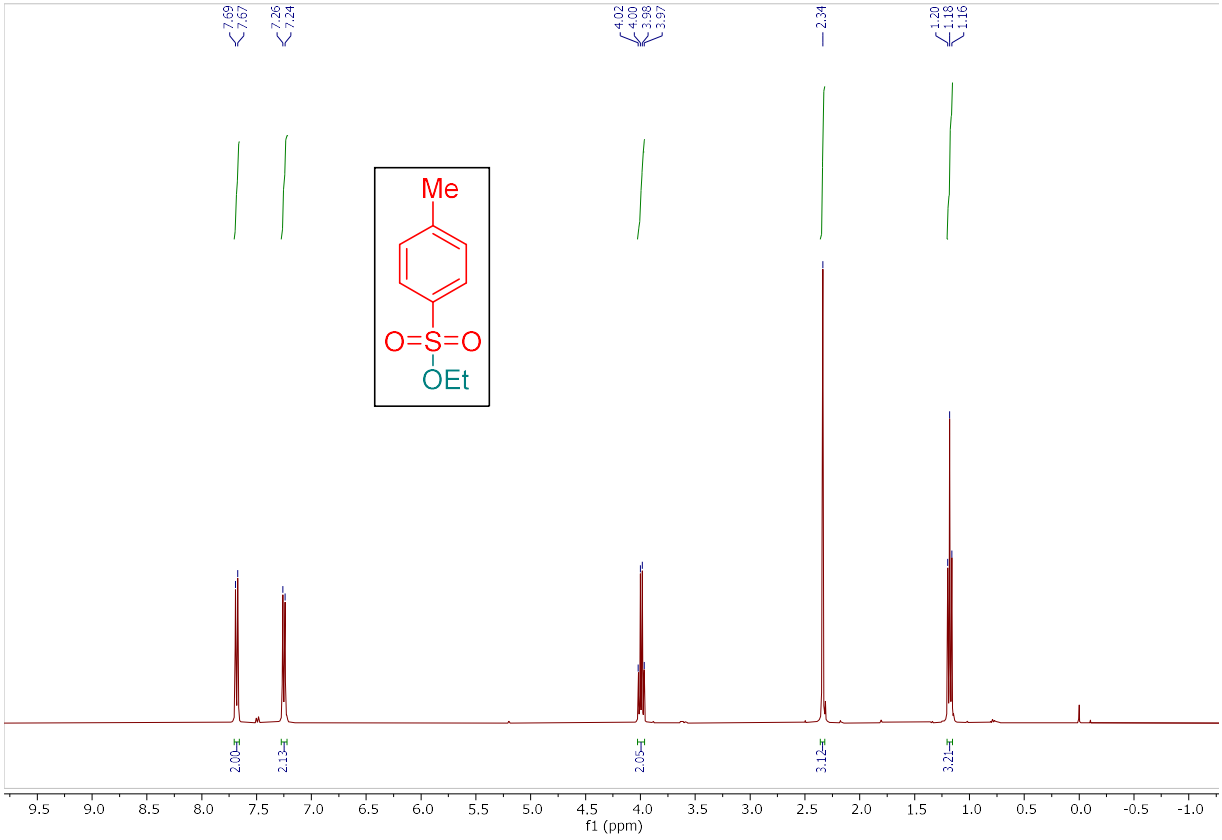
^{13}C NMR Spectrum of compound **45** in $CDCl_3$



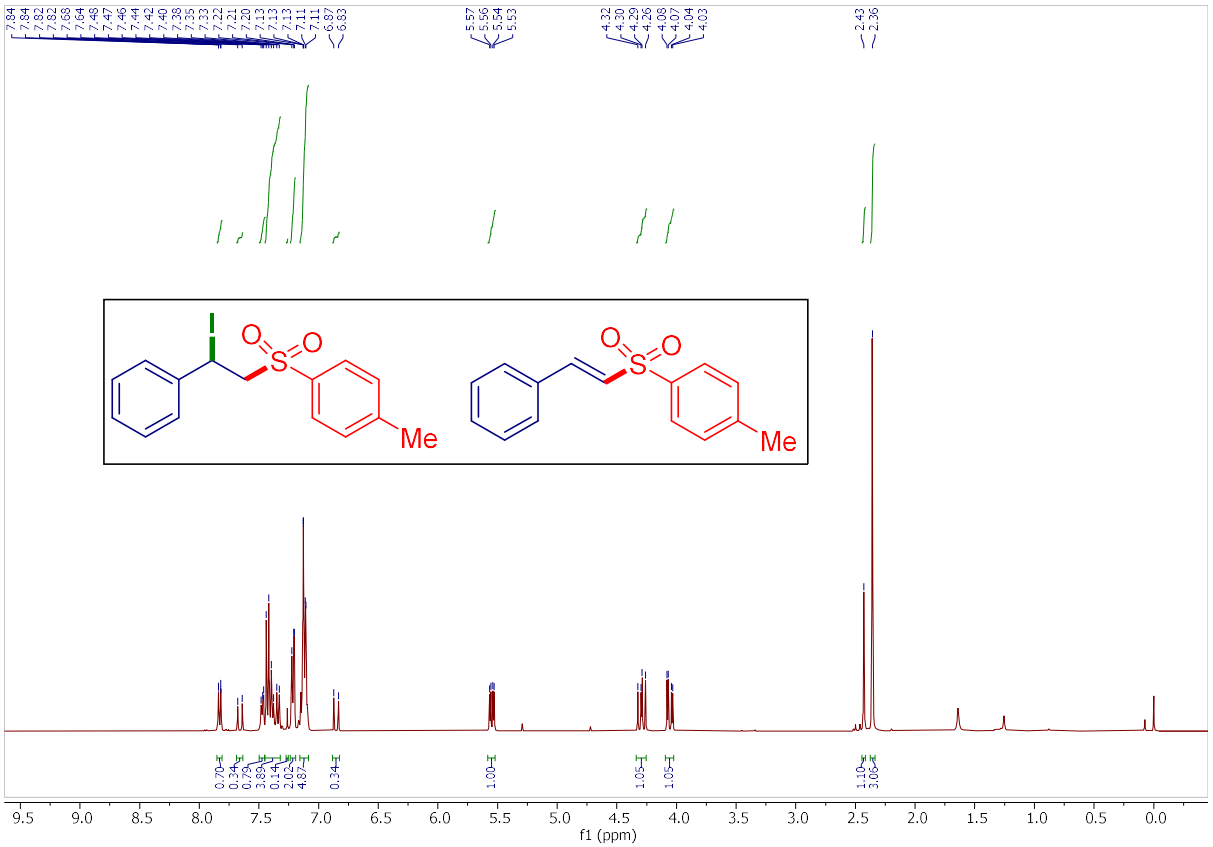
^{1}H NMR Spectrum of compound **46** in $CDCl_3$



^{1}H NMR Spectrum of compound **47** in $CDCl_3$



^{1}H NMR Spectrum of mixture **45** and **34** in $CDCl_3$



^{13}C NMR Spectrum of mixture **45** and **34** in $CDCl_3$