Supporting Information

Palladium single-atom/cluster cocatalyst supported on non-enzymatic browning glucose breaks the activity-selectivity trade-off in C(sp^3)-H arylation

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Supplementary Methods

All the reagents were purchased from Aladdin and Alfa without further purification. Thin layer chromatography (TLC) was performed on pre-coated silica gel GF254 plates. The ^{1}H NMR and ^{13}C NMR spectra were measured on a 600 MHz Bruker Avance III nuclear magnetic resonance spectrometer, using $CDCl_3$ or DMSO as the solvent with tetramethylsilane (TMS) as the internal standard. Chemical shifts (δ) are expressed in ppm. The structures of known compounds were further corroborated by comparing their ^{1}H NMR data with those of literature. The HRMS(ESI) analysis was detected on Thermo Scientific Q Exactive Focus or Shimadzu LCMS-IT-TOF.

X-ray diffraction (XRD) spectra were obtained on Regaku Ultima IV. Fourier Transform Infrared spectrometer (FTIR) were obtained on Thermo-Fisher IS5. X-ray photoelectron spectra (XPS) were collected on a Thermo Fischer ESCA LAB 250 spectrometers with monochromatic Al Kα as the X-ray source. Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) of Pd in the solid samples was performed on an Agilent 720. The transmission electron microscope (TEM) and high resolution transmission electron microscopy (HRTEM) images were recorded on a FEI Talos 200A transmission electron microscope employing an accelerating voltage of 200 kV. High-angle annular dark-field scanning transmission electron microscopy (HAADF-STEM), energy-dispersive X-ray spectroscopy (EDS) mapping and aberration corrected high-angle annular dark-field scanning transmission electron microscopy (AC HAADF-STEM) were performed on a Thermo-Fisher Themis Z operated at 300 kV. Pd K-edge X-ray absorption fine structure (XAFS) analyses were performed with Si (111) crystal monochromators at the BL14W Beam line at the Shanghai Synchrotron Radiation Facility (SSRF) (Shanghai, China). Before the analysis at the beamline, samples were placed into aluminum sample holders and sealed using Kapton tape film. The XAFS spectra were recorded at room temperature using a 4-channel Silicon Drift Detector (SDD) Bruker 5040. Pd K-edge extended X-ray absorption fine structure (EXAFS) spectra were recorded in transmission mode. Negligible changes in the line-shape and peak position of Pd K-edge XANES spectra were observed between two scans taken for a specific sample. The spectra were analyzed by the software codes Athena. Solid state 13C NMR and 27Si NMR experiments were performed on a 600 MHz NMR spectrometer (JEOL ECZ600R/S3) equipped with a 14.09T superconducting magnet and a 3.2 mm double-resonance MAS probe (JEOL RESONANCE Inc., Japan).

Supplementary Note 1： The TEM of catalysts

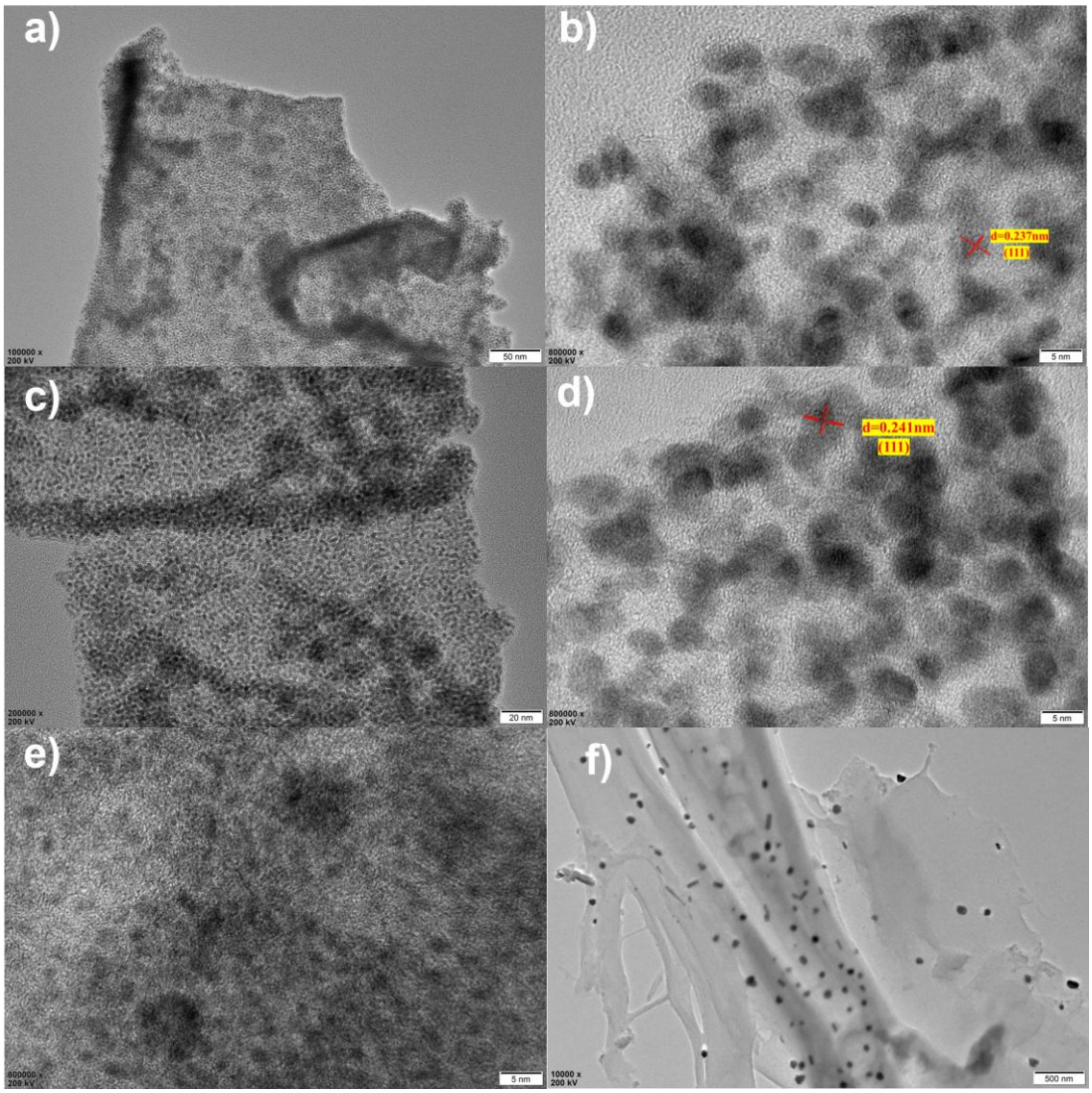


Fig. S1 a) TEM image of fresh Pd/APTE-BTMO-glucose; b) HRTEM image of fresh Pd/APTE-BTMO-glucose; c) TEM image of used (1st) Pd/APTE-BTMO-glucose; d) HRTEM image of used (1st) Pd/APTE-BTMO-glucose; e) TEM image of fresh Pd/APTE-BTMO-cellulose; f) TEM image of used Pd/APTE-BTMO-cellulose.

Supplementary Note 2： The ICP-OES analysis results

Table S1. Characterization results of ICP-OES for C(sp^3)-H arylation reaction

catalyst	Pd content (wt.%)
fresh Pd/APTE -glucose	3.27
used Pd/APTE-glucose (1st cycle)	2.09
used Pd/APTE-glucose (5th cycle)	1.96

Table S2. Characterization results of ICP-OES for C(sp^2)-H arylation reaction

catalyst	Pd content (wt.%)
fresh Pd/APTE-BTMO-glucose	3.37
used Pd/APTE-BTMO-glucose (1st cycle)	2.44
used Pd/APTE-BTMO-glucose (5th cycle)	2.31
fresh Pd/APTE-BTMO-cellulose	3.36
used Pd/APTE-BTMO-cellulose (1st cycle)	1.63

Supplementary Note 3：Original EXAFS oscillation data and the FEFF-fitted EXAFS spectra

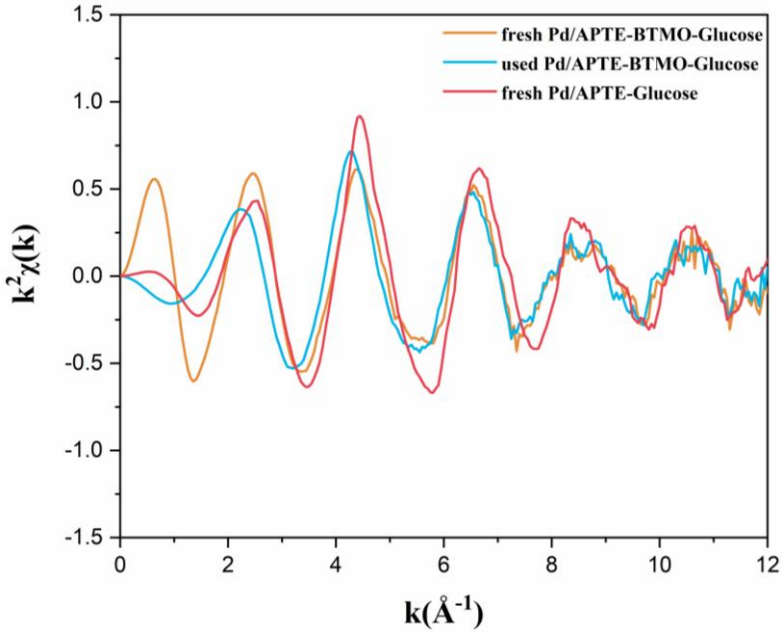


Fig. S2 Original EXAFS oscillation data

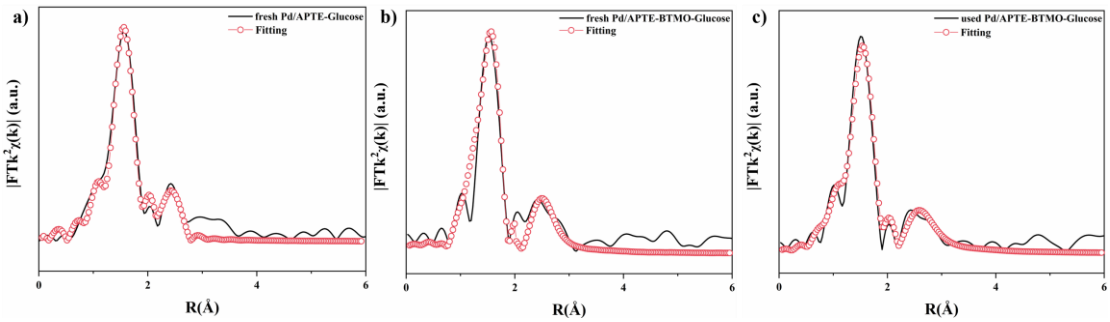


Fig. S3 a) The FEFF-fitted EXAFS spectra of fresh Pd/APTE-glucose; b) The FEFF-fitted EXAFS spectra of fresh Pd/APTE-BTMO-glucose; c) The FEFF-fitted EXAFS spectra of used Pd/APTE-BTMO-glucose.

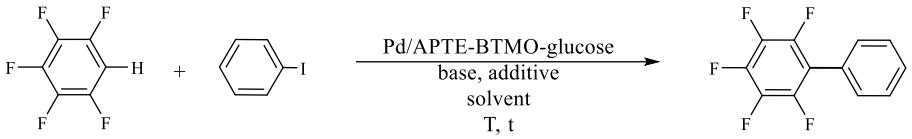
Supplementary Note 4：The EXAFS fitting results

Table S3. Structural parameters of Pd/APTE-BTMO-glucose catalyst extracted from the EXAFS fitting

Catalysts	Scattering pair	CN	R(Å)	$\sigma^2(10^{-3}Å^2)$	ΔE	R-factor
Fresh Pd/APTE-glucose	Pd-N	3.8±0.6	2.03	2.1	2.9	0.008
	Pd-Pd	0.8±0.3	2.71	6.8	-3.9	0.011
Fresh Pd/APTE-BTMO-glucose	Pd-N	3.9±0.4	2.03	4.2	8.7	0.011
	Pd-Pd	0.8±0.1	2.78	4.0	2.0	0.019
Used Pd/APTE-BTMO-glucose	Pd-N	4.2±0.4	2.03	4.2	-2.9	0.009
	Pd-Pd	1.3±0.6	2.74	3.0	-8.3	0.016

Supplementary Note 5：Experimental Details

Table S4. Reaction conditions screening [a]



1a **2a** **3aa**

Entry	Base	Additive	Solvent	T (℃)	t (h)	Yield (%)[c]
1	K_3PO_4	pivalic acid	DMF	100	24	68
2	K_3PO_4	pivalic acid	DMF	90	24	54
3	K_3PO_4	pivalic acid	DMF	110	24	78
4	K_3PO_4	pivalic acid	DMF	120	24	64
5	$KHCO_3$	pivalic acid	DMF	110	24	83
6	$NaHCO_3$	pivalic acid	DMF	110	24	76
7	KOAc	pivalic acid	DMF	110	24	74
8	K_2CO_3	pivalic acid	DMF	110	24	61
9	$KHCO_3$	isovaleric acid	DMF	110	24	70
10	$KHCO_3$	*p*-toluic acid	DMF	110	24	61
11	$KHCO_3$	acetic acid	DMF	110	24	56
12	$KHCO_3$	isobutyric acid	DMF	110	24	88
13	$KHCO_3$	isobutyric acid	DMA	110	24	79
14	$KHCO_3$	isobutyric acid	THF	110	24	70
15	$KHCO_3$	isobutyric acid	DMF	110	8	59
16	$KHCO_3$	isobutyric acid	DMF	110	12	71
17	$KHCO_3$	isobutyric acid	DMF	110	36	82
18[b]	$KHCO_3$	isobutyric acid	DMF	110	24	NR
19	-	isobutyric acid	DMF	110	24	NR
20	$KHCO_3$	-	DMF	110	24	trace

[a] Reaction conditions: catalyst (25 mg), polyfluorobenzene **1a** (0.2 mmol), iodobenzene **2a** (0.2 mmol), base (2.0 eq.), additive (0.5 eq.), solvent (1 mL); [b] without catalyst; [c] Isolated yield.

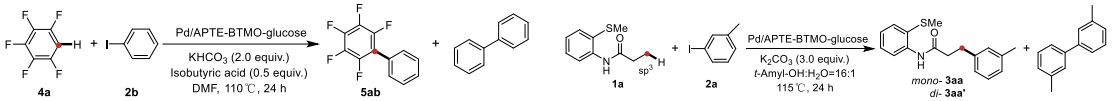
Table S5. The results of hot filtration test for C(sp^3)-H arylation reaction [a]

Catalyst	Hot-filtration test	
	Conversion (%)	Conversion (%)
Pd/APTE-glucose	44	45
Pd/APTE-BTMO-cellulose	31	40

Table S6. The results of hot filtration test for C(sp^2)-H arylation reaction [a]

Catalyst	Hot-filtration test	
	Conversion (%)	Conversion (%)
Pd/APTE-BTMO-glucose	52	53

Table S7. Heterogeneous/homogeneous Pd catalysts screening [a]



Entry	Catalyst	Yield %[b]				TON[c]
		3aa	**3aa'**	Biphenyl	**1a**	
1	Pd/APTE-BTMO-glucose	60	33	8	6	13
2	$Pd(OAc)_2$ (7 mol%)	61	34	7	5	14
3	5 wt.% Pd/C (commercial)	52	23	19	24	11
4	Pd/APTE-BTMO-cellulose	55	23	13	14	11
5	Pd/APTE-glucose	49	46	6	5	14

Entry	Catalyst	Yield %[b]			TON[d]
		5ab	Biphenyl	**4a**	
6	Pd/APTE-BTMO-glucose	88	trace	10	26
7	Pd/APTE-glucose	69	trace	30	20
8	$Pd(OAc)_2$ (3.5 mol%)	63	30	36	18
9	5 wt.% Pd/C (commercial)	71	20	19	23
10	Pd/APTE-BTMO-cellulose	81	trace	16	24

[a] Reaction conditions: **1a** (0.1 mmol), **2a** (0.3 mmol), catalyst (7 mmol%), K_2CO_3 (3.0 equiv.), and *t*-Amyl-OH : H_2O (16:1, 1 mL) for 24 h at 115 ℃; **4a** (0.2 mmol), **2b** (0.2 mmol), catalyst (3.5 mmol%), $KHCO_3$ (0.4 mmol) and isobutyric acid (0.1 mmol) in solvent DMF (1 mL) for 24 h at 110 ℃. [b] Isolated yield. [c] TON calculation was based on the isolated yield of **1a**; [d] TON calculation was based on the isolated yield of **4a**.

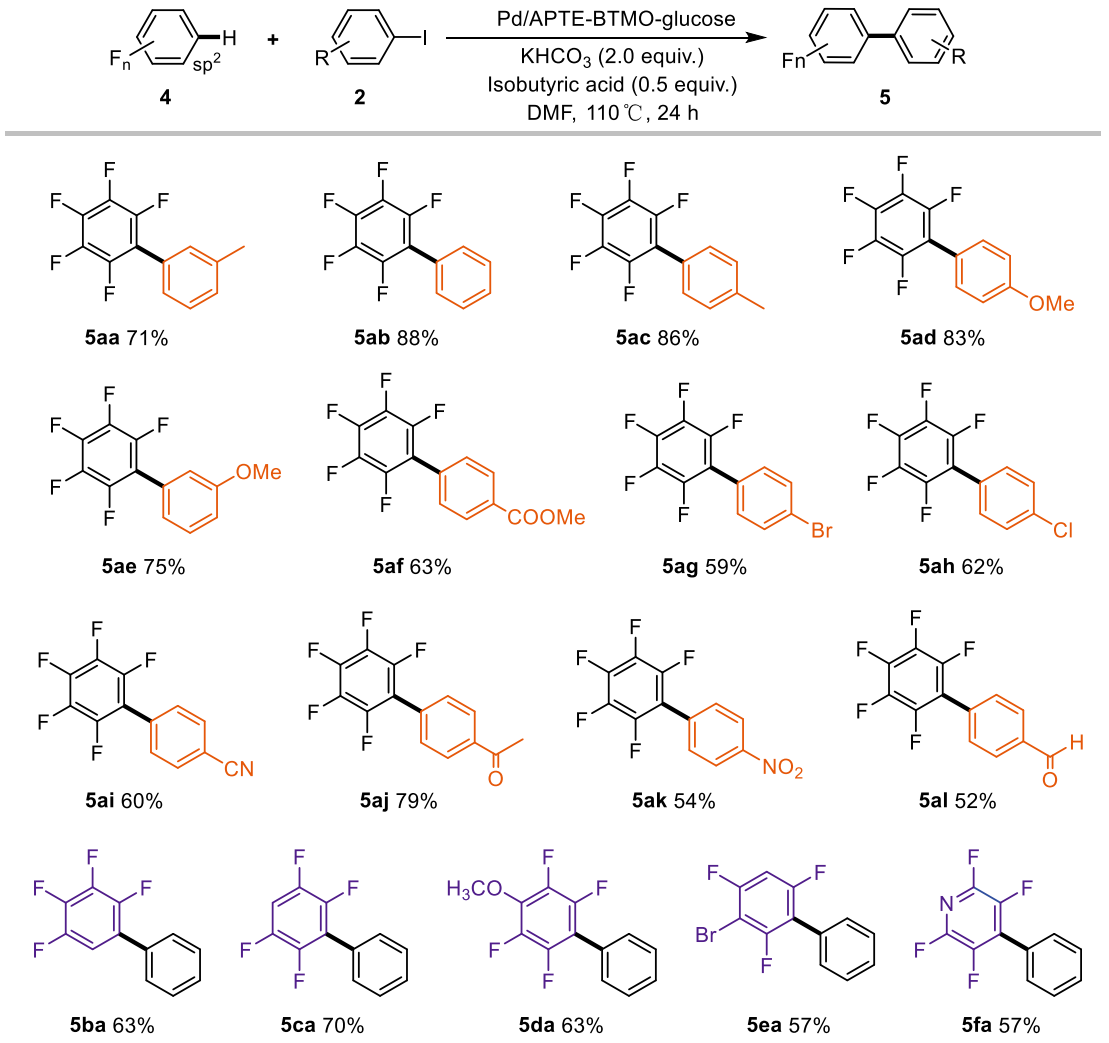
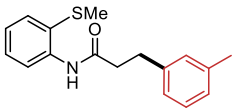
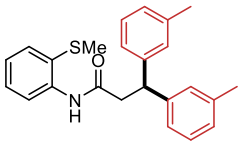


Fig. S4 The scope of Substrates for C(sp^2)-H bond arylation: 4 (0.2 mmol), **2** (0.2 mmol), Pd/APTE-BTMO-glucose (25 mg), $KHCO_3$ (0.4 mmol) and isobutyric acid (0.1 mmol) in solvent DMF (1 mL) for 24 h at 110 ℃.

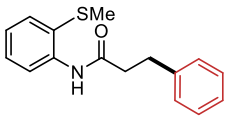
Characterization data for products



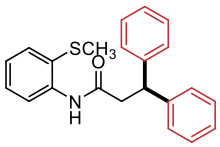
N-(2-(methylthio)phenyl)-3-(m-tolyl)propanamide **3aa.** Yield: 49% (M=285.40, 14.0 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.32 (d, *J* = 8.3 Hz, 1H), 8.23 (s, 1H), 7.45 (d, *J* = 7.8 Hz, 1H), 7.28 (t, *J* = 7.9 Hz, 1H), 7.18 (t, *J* = 7.5 Hz, 1H), 7.08 – 7.04 (m, 3H), 7.01 (d, *J* = 7.6 Hz, 1H), 3.04 (t, *J* = 7.8 Hz, 2H), 2.73 (t, *J* = 7.8 Hz, 2H), 2.32 (s, 3H), 2.26 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.5, 140.5, 138.4, 138.2, 133.1, 129.2, 129.0, 128.5, 127.1, 125.3, 125.1, 124.3, 120.6, 39.7, 31.4, 21.4, 18.9; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{17}H_{20}NOS$ 286.1265, found 286.1233.



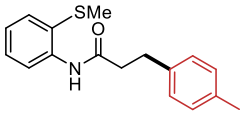
N-(2-(methylthio)phenyl)-3,3-di-m-tolylpropanamide **3aa'**. Yield: 46% (M=375.53, 17.3 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.24 (d, *J* = 8.3 Hz, 1H), 8.19 (s, 1H), 7.41 (d, *J* = 7.6 Hz, 1H), 7.23 (d, *J* = 7.2 Hz, 1H), 7.16 (t, *J* = 7.9 Hz, 2H), 7.09 (d, *J* = 6.7 Hz, 4H), 7.02 – 6.97 (m, 3H), 4.59 (t, *J* = 7.8 Hz, 1H), 3.13 (d, *J* = 7.8 Hz, 2H), 2.29 (s, 6H), 2.15 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.5, 143.6 (2C), 138.4, 138.2 (2C), 133.2, 129.0, 128.6 (2C), 128.6 (2C), 127.4 (2C), 125.1, 124.6 (2C), 124.3, 120.7, 47.4, 44.7, 21.5, 18.9; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{24}H_{26}NOS$ 376.1735, found 376.1696.



N-(2-(methylthio)phenyl)-3-phenylpropanamide **3ab.**[1] Yield: 56% (M=271.38, 15.2 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.33 (d, *J* = 8.2 Hz, 1H), 8.23 (s, 1H), 7.46 (d, *J* = 7.7 Hz, 1H), 7.31-7.26 (m, 5H), 7.20 (t, *J* = 7.2 Hz, 1H), 7.05 (t, *J* = 7.6 Hz, 1H), 3.09 (t, *J* = 7.7 Hz, 2H), 2.75 (t, *J* = 7.7 Hz, 2H), 2.26 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.4, 140.6, 138.3, 133.1, 129.0, 128.6, 128.4, 126.4, 125.1, 124.3, 120.6, 39.7, 31.5, 18.9.

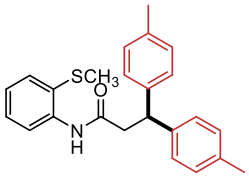


N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3ab'.**[1] Yield: 33% (M=347.48, 11.5 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20 (d, *J* = 7.6 Hz, 2H), 7.54 (d, *J* = 8.0 Hz, 2H), 7.44-7.38 (m, 3H), 7.33-7.26 (m, 4H), 7.26-7.19 (m, 2H), 7.03 (t, *J* = 7.6 Hz, 1H), 4.77 (t, *J* = 7.7 Hz, 1H), 3.17 (t, *J* = 7.5 Hz, 2H), 2.17 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.3, 143.5, 138.3, 133.2, 129.0, 128.7, 127.8, 126.6, 125.1, 124.3, 120.6, 47.4, 44.6, 19.0.

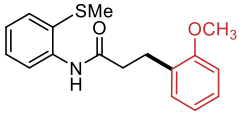


N-(2-(methylthio)phenyl)-3-(p-tolyl)propanamide **3ac.**[2] Yield: 55% (M=285.40, 15.7 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.33 (d, *J* = 8.3 Hz, 1H), 8.23 (s, 1H), 7.46 (d, *J* = 7.7 Hz, 1H), 7.29 (t, *J* = 7.8 Hz,

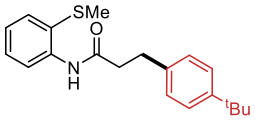
1H), 7.15 (d, *J* = 7.7 Hz, 2H), 7.10 (d, *J* = 7.7 Hz, 2H), 7.05 (t, *J* = 7.6 Hz, 1H), 3.04 (t, *J* = 7.7 Hz, 2H), 2.72 (t, *J* = 7.7 Hz, 2H), 2.31 (s, 3H), 2.26 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.5, 138.4, 137.4, 135.8, 133.1, 129.3, 129.0, 128.2, 125.0, 124.3, 120.6, 39.8, 31.1, 21.0, 18.9.



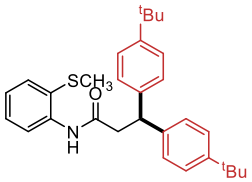
N-(2-(methylthio)phenyl)-3,3-di-p-tolylpropanamide **3ac'**.[3] Yield: 34% (M=375.53, 12.8 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.25 (d, *J* = 8.3 Hz, 1H), 8.22 (s, 1H), 7.42 (d, *J* = 7.7 Hz, 1H), 7.23 (d, *J* = 8.0 Hz, 1H), 7.17 (d, *J* = 7.8 Hz, 4H), 7.08 (d, *J* = 7.8 Hz, 4H), 7.01 (t, *J* = 7.7 Hz, 1H), 4.61 (t, *J* = 7.8 Hz, 1H), 3.12 (d, *J* = 7.8 Hz, 2H), 2.27 (s, 6H), 2.14 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.5, 140.8, 138.5, 136.1, 133.3, 129.4, 129.0, 127.5, 125.0, 124.2, 120.6, 46.7, 44.8, 21.0, 19.0.



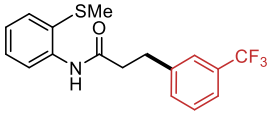
1-(2-methoxyphenyl)-N-(2-(methylthio)phenyl)propanamide **3ad.**[4] Yield: 76% (M=301.40, 22.8 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.34 (d, *J* = 8.3 Hz, 1H), 8.27 (s, 1H), 7.45 (d, *J* = 7.8 Hz, 1H), 7.28 (t, *J* = 7.8 Hz, 1H), 7.21-7.18 (m, 2H), 7.04 (t, *J* = 7.6 Hz, 1H), 6.89-6.85 (m, 2H), 3.84 (s, 3H), 3.07 (t, *J* = 7.8 Hz, 2H), 2.72 (t, *J* = 7.8 Hz, 2H), 2.28 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 171.1, 157.5, 138.5, 133.1, 130.1, 129.6, 129.0, 128.7, 127.7, 124.2, 120.6, 115.4, 110.3, 55.2, 38.1, 26.8, 18.9.



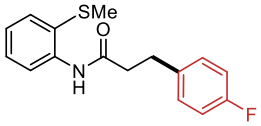
3-(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)propanamide **3ae.**[5] Yield: 52% (M=327.49, 17.0 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.34 (d, *J* = 8.2 Hz, 1H), 8.25 (s, 1H), 7.46 (d, *J* = 7.8 Hz, 1H), 7.33 – 7.29 (m, 3H), 7.20 (d, *J* = 7.8 Hz, 2H), 7.05 (t, *J* = 7.6 Hz, 1H), 3.06 (t, *J* = 7.7 Hz, 2H), 2.74 (t, *J* = 7.8 Hz, 2H), 2.24 (s, 3H), 1.30 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.5, 149.2, 138.4, 137.4, 133.1, 129.0, 128.0, 125.5, 125.0, 124.3, 120.6, 39.7, 34.4, 31.4, 30.9, 18.9.



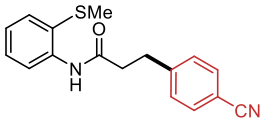
3,3-bis(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)propanamide **3ae'.** Yield: 30% (M=459.69, 13.8 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.27-8.19 (m, 2H), 7.41 (d, *J* = 7.5 Hz, 1H), 7.39-7.34 (m, 1H), 7.29 (d, *J* = 8.3 Hz, 4H), 7.23 (d, *J* = 8.2 Hz, 4H), 7.00 (t, *J* = 7.6 Hz, 1H), 4.62 (t, *J* = 7.7 Hz, 1H), 3.14 (d, *J* = 7.8 Hz, 2H), 2.10 (s, 3H), 1.26 (s, 18H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.6, 149.2, 140.6, 138.5, 133.3, 129.0, 127.3, 125.6, 125.0, 124.2, 120.7, 46.6, 44.9, 34.4, 31.3, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{30}H_{38}NOS$ 460.2674, found 460.2617.



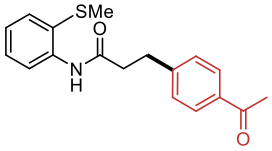
N-(2-(methylthio)phenyl)-3-(3-(trifluoromethyl)phenyl)propanamide **3af.** Yield: 58% (M=339.37, 19.5 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.30 (d, *J* = 8.2 Hz, 1H), 8.21 (s, 1H), 7.52 (s, 1H), 7.47 (t, *J* = 7.9 Hz, 3H), 7.41 (t, *J* = 7.7 Hz, 1H), 7.29 (t, *J* = 7.8 Hz, 1H), 7.07 (t, *J* = 7.6 Hz, 1H), 3.15 (t, *J* = 7.7 Hz, 2H), 2.77 (t, *J* = 7.6 Hz, 2H), 2.28 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.7, 141.5, 138.1, 132.9, 132.0, 130.9 (q, *J* = 32.4 Hz, 1C), 129.1, 128.9, 125.2, 125.1(d, *J* = 4.5 Hz, 1C), 124.5, 123.3(d, *J* = 4.8 Hz, 1C), 120.7, 39.2, 31.1, 18.8; ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.59 (s, 3F); HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{17}H_{17}F_3NOS$ 340.0983, found 340.0945.



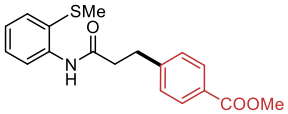
3-(4-fluorophenyl)-N-(2-(methylthio)phenyl)propanamide **3ag.**[6] Yield: 35% (M=289.37, 10.2 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.31 (d, *J* = 8.2 Hz, 1H), 8.20 (s, 1H), 7.46 (d, *J* = 7.8 Hz, 1H), 7.29 (t, *J* = 7.8 Hz, 1H), 7.23 – 7.20 (m, 2H), 7.06 (t, *J* = 7.6 Hz, 1H), 6.97 (t, *J* = 8.6 Hz, 2H), 3.05 (t, *J* = 7.6 Hz, 2H), 2.72 (t, *J* = 7.6 Hz, 2H), 2.28 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.1, 161.6 (d, *J* = 244.1 Hz, 1C), 138.2, 136.2, 133.0, 129.8 (d, *J* = 7.9 Hz, 2C), 128.9, 125.1, 124.4, 120.6, 115.4 (d, *J* = 21.2 Hz, 1H), 39.8, 30.6, 18.9; ^{19}F NMR (565 MHz, $CDCl_3$) δ -116.93 (s, 1F).



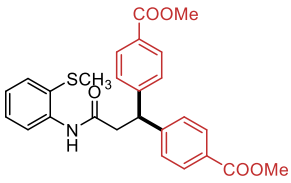
3-(4-cyanophenyl)-N-(2-(methylthio)phenyl)propanamide **3ah.**[7] Yield: 50% (M=296.39, 14.8 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.27 (d, *J* = 8.2 Hz, 1H), 8.19 (s, 1H), 7.59 (d, *J* = 7.9 Hz, 2H), 7.46 (d, *J* = 7.7 Hz, 1H), 7.38 (d, *J* = 7.9 Hz, 2H), 7.28 (d, *J* = 7.8 Hz, 1H), 7.08 (t, *J* = 7.5 Hz, 1H), 3.14 (t, *J* = 7.5 Hz, 2H), 2.76 (t, *J* = 7.5 Hz, 2H), 2.31 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.4, 146.3, 137.9, 132.8, 132.4, 129.3, 128.9, 125.3, 124.6, 120.7, 118.9, 110.3, 38.6, 31.3, 18.9.



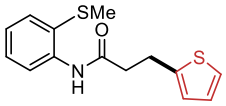
3-(4-acetylphenyl)-N-(2-(methylthio)phenyl)propanamide **3ai.** Yield: 51% (M=313.42, 15.9 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.30 (d, *J* = 8.3 Hz, 1H), 8.22 (s, 1H), 7.90 (d, *J* = 7.9 Hz, 2H), 7.45 (d, *J* = 7.8 Hz, 1H), 7.36 (d, *J* = 7.9 Hz, 2H), 7.29 (t, *J* = 7.9 Hz, 1H), 7.07 (t, *J* = 7.6 Hz, 1H), 3.15 (t, *J* = 7.6 Hz, 2H), 2.77 (t, *J* = 7.6 Hz, 2H), 2.58 (s, 3H), 2.28 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.7, 169.8, 146.3, 138.1, 135.5, 128.9, 128.8, 128.7, 125.2, 124.5, 120.7, 39.0, 31.3, 26.6, 18.9; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{18}H_{20}NO_2S$ 314.1215, found 314.1179.



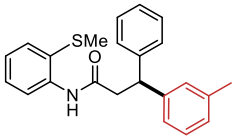
methyl 4-(3-((2-(methylthio)phenyl)amino)-3-oxopropyl)benzoate **3aj.** Yield: 46% (M=329.41, 15.1 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.30 (d, *J* = 8.3 Hz, 1H), 8.22 (s, 1H), 7.97 (d, *J* = 8.2 Hz, 2H), 7.45 (d, *J* = 7.8 Hz, 1H), 7.34 (d, *J* = 7.9 Hz, 2H), 7.29 (t, *J* = 7.8 Hz, 1H), 7.06 (t, *J* = 7.6 Hz, 1H), 3.90 (s, 3H), 3.14 (t, *J* = 7.6 Hz, 2H), 2.76 (t, *J* = 7.6 Hz, 2H), 2.28 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.9, 167.0, 146.0, 138.1, 132.9, 130.0, 128.9, 128.5, 128.4, 125.2, 124.5, 120.7, 52.0, 39.0, 31.4, 18.9; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{18}H_{20}NO_3S$ 330.1215, found 330.1128.



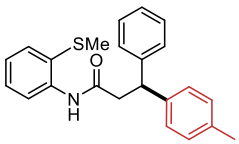
dimethyl 4,4'-(3-((2-(methylthio)phenyl)amino)-3-oxopropane-1,1-diyl)dibenzoate **3aj'.** Yield: 19% (M=463.55, 8.7 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.24-8.14 (m, 2H), 7.97 (d, *J* = 8.3 Hz, 4H), 7.42 (d, *J* = 7.3 Hz, 1H), 7.36 (d, *J* = 8.0 Hz, 4H), 7.24 (t, *J* = 7.2 Hz, 1H), 7.04 (t, *J* = 7.5 Hz, 1H), 4.84 (t, *J* = 7.7 Hz, 1H), 3.88 (s, 6H), 3.19 (d, *J* = 7.7 Hz, 2H), 2.20 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.4, 166.7, 147.9, 137.9, 133.0, 130.2, 128.9, 127.9, 125.3, 124.7, 120.8, 52.1, 47.2, 43.8, 18.9; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{26}H_{26}NO_5S$ 464.1531, found 464.1481.



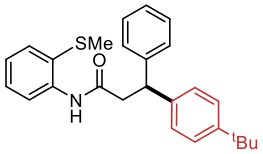
N-(2-(methylthio)phenyl)-3-(thiophen-2-yl)propanamide **3ak.** Yield: 55% (M=277.40, 15.1 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.33 (d, *J* = 8.2 Hz, 1H), 8.27 (s, 1H), 7.47 (d, *J* = 7.7 Hz, 1H), 7.29 (t, *J* = 7.8 Hz, 1H), 7.13 (d, *J* = 5.1 Hz, 1H), 7.06 (t, *J* = 7.5 Hz, 1H), 6.92 (t, 1H), 6.88 (d, *J* = 3.5 Hz, 1H), 3.30 (t, *J* = 7.4 Hz, 2H), 2.80 (t, *J* = 7.4 Hz, 2H), 2.30 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.8, 143.1, 138.3, 133.1, 129.0, 127.0, 125.1, 124.9, 124.4, 123.6, 120.7, 39.8, 25.6, 19.0.



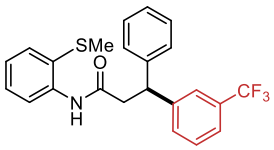
N-(2-(methylthio)phenyl)-3-phenyl-3-(m-tolyl)propanamide **3ba.** Yield: 58% (M=361.50, 20.8 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.24 (d, *J* = 8.3 Hz, 1H), 8.21 (s, 1H), 7.42 (d, *J* = 7.7 Hz, 1H), 7.28 (q, *J* = 8.8, 7.9 Hz, 4H), 7.23 (d, *J* = 7.8 Hz, 1H), 7.19-7.15 (m, 2H), 7.10 (d, *J* = 4.9 Hz, 2H), 7.03-6.98 (m, 2H), 4.65 (t, *J* = 7.8 Hz, 1H), 3.15 (d, *J* = 7.8 Hz, 2H), 2.29 (s, 3H), 2.15 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.4, 143.7, 143.4, 138.4, 138.3, 133.2, 129.0, 128.7, 128.6, 127.7, 127.4, 126.6, 125.0, 124.7, 124.3, 120.6, 47.4, 44.6, 21.5, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{23}H_{24}NOS$ 3621.1578, found 362.1538.



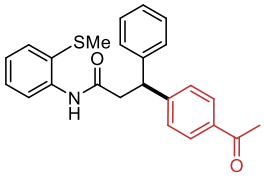
N-(2-(methylthio)phenyl)-3-phenyl-3-(p-tolyl)propanamide **3bc.** Yield: 47% (M=361.50, 16.9 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.24 (d, *J* = 8.3 Hz, 1H), 8.22 (s, 1H), 7.42 (d, *J* = 8.0 Hz, 1H), 7.30-7.26 (m, 4H), 7.25-7.22 (m, 1H), 7.20-7.16 (m, 3H), 7.09 (d, *J* = 7.7 Hz, 2H), 7.01 (t, *J* = 7.5 Hz, 1H), 4.65 (t, *J* = 7.8 Hz, 1H), 3.14 (d, *J* = 7.8 Hz, 2H), 2.28 (s, 3H), 2.15 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.4, 143.8, 140.5, 138.4, 136.2, 133.3, 129.4, 129.0, 128.7, 127.7 127.6, 126.6, 125.0, 124.3, 120.6, 47.0, 44.7, 21.0, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{23}H_{24}NOS$ 362.1578, found 362.1536.



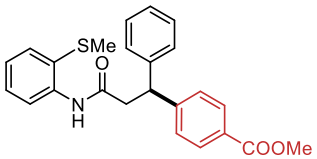
3-(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3be.** Yield: 50% (M=403.58, 20.3 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.28-8.18 (m, 2H), 7.42 (d, *J* = 7.7 Hz, 1H), 7.32-7.29 (m, 3H), 7.28 (d, *J* = 2.1 Hz, 2H), 7.27-7.25 (m, 1H), 7.25-7.23 (m, 1H), 7.22 (d, *J* = 8.1 Hz, 2H), 7.17 (t, *J* = 7.1 Hz, 1H), 7.01 (t, *J* = 7.5 Hz, 1H), 4.66 (t, *J* = 7.7 Hz, 1H), 3.15 (d, *J* = 6.8 Hz, 2H), 2.13 (s, 3H), 1.26 (s, 9H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.5, 149.3, 143.7, 140.4, 138.4, 133.3, 129.0, 128.7, 127.8, 127.3, 126.6, 125.6, 125.0, 124.3, 120.6, 47.0, 44.8, 34.4, 31.3, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{26}H_{30}NOS$ 404.2048, found 404.2006.



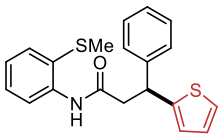
N-(2-(methylthio)phenyl)-3-phenyl-3-(3-(trifluoromethyl)phenyl)propanamide **3bf.** Yield: 48% (M=415.47, 19.8 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.26 – 8.14 (m, 2H), 7.55 (s, 1H), 7.49 (d, *J* = 7.7 Hz, 1H), 7.46 (d, *J* = 7.8 Hz, 1H), 7.43-7.38 (m, 2H), 7.32-7.27 (m, 4H), 7.25-7.17 (m, 2H), 7.03 (t, *J* = 7.6 Hz, 1H), 4.78 (t, *J* = 7.7 Hz, 1H), 3.17 (dd, *J* = 7.7, 3.7 Hz, 2H), 2.18 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.7, 144.6, 142.6, 138.0, 133.0, 131.4, 131.0 (q, *J* = 31.8 Hz, 1C), 129.2, 128.9, 127.7, 127.0, 125.3, 125.0, 124.5, 124.3 (q, *J* = 3.8 Hz, 1C), 123.6 (q, *J* = 3.9 Hz, 1C), 123.2, 120.8, 47.1, 44.3, 18.9; ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.50 (s, 3F); HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{23}H_{21}F_3NOS$ 416.1296, found 416.1246.



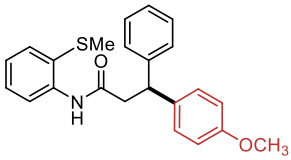
3-(4-acetylphenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bi.** Yield: 37% (M=389.51, 14.4 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.27 – 8.14 (m, 2H), 7.89 (d, *J* = 8.0 Hz, 2H), 7.44-7.39 (m, 3H), 7.32-7.27 (m, 4H), 7.26-7.23 (m, 1H), 7.23-7.19 (m, 1H), 7.03 (t, *J* = 7.6 Hz, 1H), 4.77 (t, *J* = 7.7 Hz, 1H), 3.18 (d, *J* = 7.8 Hz, 2H), 2.55 (s, 3H), 2.19 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.8, 149.1, 142.7, 138.1, 135.7, 133.1, 128.9, 128.9, 128.8, 128.0, 127.7, 127.0, 125.2, 124.5, 120.7, 47.3, 44.1, 26.6, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{24}H_{24}NO_2S$ 390.1528, found 390.1485.



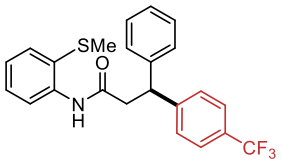
methyl 4-(3-((2-(methylthio)phenyl)amino)-3-oxo-1-phenylpropyl)benzoate **3bj.** Yield: 40% (M=405.51, 16 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.24 – 8.18 (m, 2H), 7.96 (d, *J* = 8.0 Hz, 2H), 7.42 (d, *J* = 7.8 Hz, 1H), 7.38 (d, *J* = 8.0 Hz, 2H), 7.32 – 7.27 (m, 4H), 7.25 – 7.22 (m, 1H), 7.22 – 7.19 (m, 1H), 7.03 (t, *J* = 7.6 Hz, 1H), 4.77 (t, *J* = 7.7 Hz, 1H), 3.88 (s, 3H), 3.17 (d, *J* = 7.8 Hz, 2H), 2.18 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.9, 166.9, 148.8, 142.7, 138.1, 133.1, 130.0, 129.0, 128.9, 128.6, 127.8, 127.7, 126.9, 125.2, 124.5, 120.7, 52.0, 47.3, 44.2, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{24}H_{24}NO_3S$ 406.1477, found 406.1434.



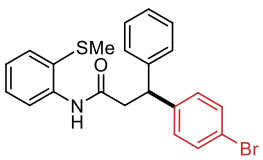
N-(2-(methylthio)phenyl)-3-phenyl-3-(thiophen-2-yl)propanamide **3bk.** Yield: 39% (M=353.50, 13.8mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.29-8.19 (m, 2H), 7.43 (d, *J* = 6.1 Hz, 1H), 7.35 (d, *J* = 7.7 Hz, 2H), 7.31 (t, *J* = 7.6 Hz, 2H), 7.26-7.23 (m, 1H), 7.22 (t, *J* = 7.3 Hz, 1H), 7.15 (dd, *J* = 4.7, 1.6 Hz, 1H), 7.03 (t, *J* = 7.5 Hz, 1H), 6.93-6.87 (m, 2H), 4.93 (t, *J* = 7.6 Hz, 1H), 3.22 (dd, *J* = 14.5, 7.7 Hz, 1H), 3.12 (dd, *J* = 14.5, 7.7 Hz, 1H), 2.20 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.7, 147.6, 143.2, 138.3, 133.2, 129.0, 128.8, 127.6, 127.1, 126.8, 125.1, 124.5, 124.4, 124.1, 120.7, 46.1, 43.2, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{20}H_{20}NOS_2$ 354.0986, found 354.0949.



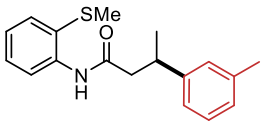
3-(4-methoxyphenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bl.** Yield: 45% (M=377.50, 17.0 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.27-8.18 (m, 2H), 7.42 (d, *J* = 7.5 Hz, 1H), 7.28 (d, *J* = 4.4 Hz, 4H), 7.24 (d, *J* = 7.9 Hz, 1H), 7.21 (d, *J* = 8.3 Hz, 2H), 7.19-7.16 (m, 1H), 7.02 (t, *J* = 7.6 Hz, 1H), 6.82 (d, *J* = 8.6 Hz, 2H), 4.64 (t, *J* = 7.8 Hz, 1H), 3.75 (s, 3H), 3.12 (d, *J* = 7.0 Hz, 2H), 2.16 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.4, 158.3, 143.9, 138.4, 135.7, 133.2, 129.0, 128.7, 128.7, 127.7, 126.6, 125.1, 124.3, 120.7, 114.1, 55.2, 46.7, 44.9, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{23}H_{24}NO_2S$ 378.1528, found 378.1488.



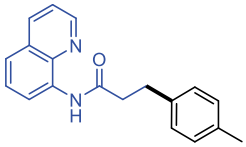
N-(2-(methylthio)phenyl)-3-phenyl-3-(4-(trifluoromethyl)phenyl)propanamide **3bm.** Yield: 42% (M=415.47, 17.3 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20 (d, *J* = 7.6 Hz, 2H), 7.54 (d, *J* = 8.0 Hz, 2H), 7.42 (s, 3H), 7.32 – 7.27 (m, 4H), 7.25 (d, *J* = 4.2 Hz, 1H), 7.21 (t, *J* = 7.6 Hz, 1H), 7.03 (t, *J* = 7.5 Hz, 1H), 4.77 (t, *J* = 7.7 Hz, 1H), 3.17 (t, *J* = 7.5 Hz, 2H), 2.17 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.8, 147.7, 142.6, 138.0, 133.0, 128.9 (q, *J* = 32.3 Hz, 1C), 128.9, 128.2, 127.7, 127.0, 125.7 (q, *J* = 3.6 Hz, 1C), 125.3, 125.1, 124.6, 123.2, 120.8, 47.1, 44.2, 18.8; ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.50 (s, 3F); HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{23}H_{21}F_3NOS$ 416.1296, found 416.1246.



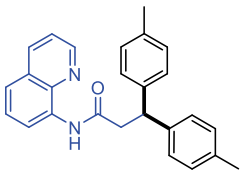
3-(4-bromophenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bn.** Yield: 46% (M=426.37, 19.8 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.21 (t, 2H), 7.43 (d, *J* = 7.7 Hz, 1H), 7.40 (d, *J* = 8.1 Hz, 2H), 7.29 (dd, *J* = 15.9, 8.5 Hz, 4H), 7.24 (d, *J* = 8.6 Hz, 1H), 7.21 (d, *J* = 7.1 Hz, 1H), 7.17 (d, *J* = 8.1 Hz, 2H), 7.03 (t, *J* = 7.6 Hz, 1H), 4.66 (t, *J* = 7.8 Hz, 1H), 3.12 (d, *J* = 17.1 Hz, 2H), 2.18 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.0, 143.0, 142.6, 138.1, 133.1, 131.8, 129.5, 129.0, 128.8, 127.7, 126.9, 125.2, 124.5, 120.7, 120.5, 46.8, 44.4, 19.0; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{22}H_{21}BrNOS$ 426.0527, found 426.0482.



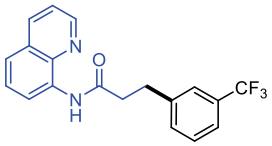
N-(2-(methylthio)phenyl)-3-(m-tolyl)butanamide **3ca.** Yield: 52% (M=299.43, 15.5 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.29 (d, *J* = 8.3 Hz, 1H), 8.15 (s, 1H), 7.44 (d, *J* = 7.8 Hz, 1H), 7.30-7.26 (m, 1H), 7.19 (t, *J* = 7.5 Hz, 1H), 7.12-7.07 (m, 2H), 7.06-6.99 (m, 2H), 3.42-3.33 (m, 1H), 2.72 (dd, *J* = 14.2, 7.3 Hz, 1H), 2.63 (dd, *J* = 14.4, 7.6 Hz, 1H), 2.32 (s, 3H), 2.23 (s, 3H), 1.37 (d, *J* = 7.0 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.1, 145.7, 138.4, 138.2, 133.1, 128.9, 128.6, 127.6, 127.3, 125.1, 124.3, 123.8, 120.7, 47.0, 37.0, 22.0, 21.5, 18.9; HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{18}H_{22}NOS$ 300.1424, found 300.1392.



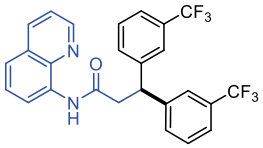
N-(quinolin-8-yl)-3-(p-tolyl)propanamide **3ec.**[9] Yield: 52% (M=290.37, 15.1 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.79 (s, 1H), 8.79 (d, *J* = 7.5 Hz, 1H), 8.76 (d, *J* = 3.0 Hz, 1H), 8.14 (d, *J* = 8.3 Hz, 1H), 7.53 (t, *J* = 7.9 Hz, 1H), 7.48 (d, *J* = 7.5 Hz, 1H), 7.43 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.19 (d, *J* = 7.7 Hz, 2H), 7.10 (d, *J* = 7.7 Hz, 2H), 3.10 (dd, *J* = 9.1, 6.8 Hz, 2H), 2.88 – 2.83 (m, 2H), 2.30 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.8, 148.0, 138.3, 137.7, 136.4, 135.7, 134.5, 129.2, 128.3, 127.9, 127.4, 121.5, 121.4, 116.6, 39.9, 31.1, 21.0.



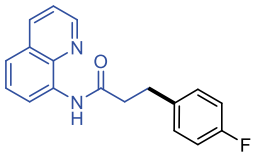
N-(quinolin-8-yl)-3,3-di-p-tolylpropanamide **3ec'.**[10] Yield: 41% (M=380.49, 15.6 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.77 (s, 1H), 8.75 (d, *J* = 2.7 Hz, 1H), 8.71 (d, *J* = 7.1 Hz, 1H), 8.13 (d, *J* = 7.9 Hz, 1H), 7.50 – 7.45 (m, 2H), 7.43 (dd, *J* = 8.2, 4.3 Hz, 1H), 7.22 (d, *J* = 7.9 Hz, 4H), 7.07 (d, *J* = 7.7 Hz, 4H), 4.70 (t, *J* = 7.8 Hz, 1H), 3.29 (d, *J* = 7.8 Hz, 2H), 2.25 (s, 6H).



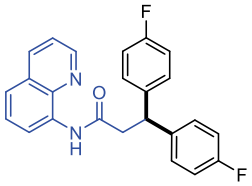
N-(quinolin-8-yl)-3-(3-(trifluoromethyl)phenyl)propanamide **3ef.**[11] Yield:71% (M=344.34, 24.4 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.79 (s, 1H), 8.80-8.73 (m, 2H), 8.15 (d, *J* = 8.1 Hz, 1H), 7.56-7.55 (m, 1H), 7.53 (d, *J* = 7.7 Hz, 1H), 7.51-7.47 (m, 2H), 7.47-7.42 (m, 2H), 7.39 (t, *J* = 7.7 Hz, 1H), 3.20 (t, *J* = 7.8 Hz, 2H), 2.91 (t, *J* = 7.8 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.1, 148.1, 141.7, 138.3, 136.4, 134.3, 132.0, 130.9 (q, *J* = 31.9 Hz, 1C), 129.0, 128.0, 127.4, 125.2 (q, *J* = 3.9 Hz, 1C), 124.2 (q, *J* = 272.6 Hz, 1C), 123.2 (q, *J* = 3.9 Hz, 1C), 121.6, 121.6, 116.6, 39.3, 31.2; ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.58 (s, 3F).



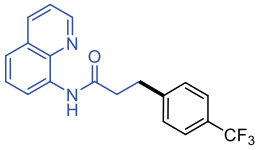
N-(quinolin-8-yl)-3,3-bis(3-(trifluoromethyl)phenyl)propanamide **3ef'.** Yield: 19% (M=488.43, 9.3 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.78 (s, 1H), 8.76 (dd, *J* = 4.3, 1.6 Hz, 1H), 8.70-8.63 (m, 1H), 8.15 (d, *J* = 7.9 Hz, 1H), 7.58 (s, 2H), 7.53-7.49 (m, 4H), 7.48-7.44 (m, 3H), 7.42 (t, *J* = 7.8 Hz, 2H), 4.93 (t, *J* = 7.7 Hz, 1H), 3.35 (d, *J* = 7.7 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.4, 148.1, 143.8, 138.1, 136.5, 134.0, 131.3, 131.2 (q, *J* = 32.1 Hz, 1C), 129.4, 127.9, 127.4, 124.5 (q, *J* = 3.7 Hz, 1C), 124.0 (q, *J* = 270.9 Hz, 1C), 123.9 (q, *J* = 3.9 Hz, 1C), 121.8, 121.6, 116.8, 46.8, 43.9; ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.58 (s, 6F); HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{26}H_{19}F_6N_2O$ 489.1401, found 489.1349.



3-(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg.**[11] Yield: 58% (M=294.33, 17.1 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.76 (s, 1H), 8.77 (d, *J* = 6.1 Hz, 1H), 8.76 (dd, *J* = 4.3, 1.7 Hz, 1H), 8.14 (dd, *J* = 8.3, 1.7 Hz, 1H), 7.53 (t, *J* = 7.9 Hz, 1H), 7.49 (d, *J* = 6.8 Hz, 1H), 7.43 (dd, *J* = 8.3, 4.2 Hz, 1H), 7.24 (dd, *J* = 8.5, 5.6 Hz, 2H), 6.97 (t, *J* = 8.7 Hz, 2H), 3.11 (t, *J* = 7.7 Hz, 2H), 2.85 (t, *J* = 7.7 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.5, 161.5 (d, *J* = 244.0 Hz, 1C), 148.1, 138.3, 136.4 (d, *J* = 3.3 Hz, 1C), 136.4, 134.4, 129.8 (d, *J* = 7.8 Hz, 2C), 127.9, 127.4, 121.6, 121.5, 116.5, 115.3 (d, *J* = 21.3 Hz, 2C), 39.8, 30.6; ^{19}F NMR (565 MHz, $CDCl_3$) δ -117.13 (s, 1F).

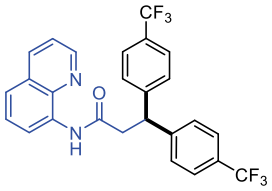


3,3-bis(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg'.** Yield: 31% (M=388.42, 12.1 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.76 (s, 1H), 8.76 (d, *J* = 3.7 Hz, 1H), 8.69 (dd, *J* = 6.4, 2.6 Hz, 1H), 8.15 (d, *J* = 8.2 Hz, 1H), 7.49 (d, *J* = 6.5 Hz, 2H), 7.45 (dd, *J* = 8.3, 4.3 Hz, 1H), 7.29 – 7.26 (m, 3H), 6.97 (t, *J* = 8.5 Hz, 4H), 4.76 (t, *J* = 7.8 Hz, 1H), 3.26 (d, *J* = 7.7 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 169.2, 161.6 (d, *J* = 245.0 Hz, 2C), 147.9, 139.3 (d, *J* = 3.3 Hz, 2C), 138.0, 136.7, 134.1, 129.2 (d, *J* = 7.9 Hz, 4C), 128.0, 127.5, 121.7, 121.6, 116.9, 115.5 (d, *J* = 21.2 Hz, 4C), 45.7, 44.6; ^{19}F NMR (565 MHz, $CDCl_3$) δ -116.41 (s, 2F); HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{24}H_{19}F_2N_2O$ 389.1465, found 389.1430.

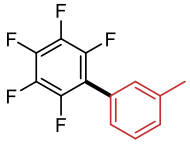


N-(quinolin-8-yl)-3-(4-(trifluoromethyl)phenyl)propanamide **3en.**[12] Yield: 60% (M=344.34, 20.7 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.78 (s, 1H), 8.80 – 8.74 (m, 2H), 8.15 (d, *J* = 8.2 Hz, 1H), 7.54 (t, *J* = 7.2 Hz, 3H), 7.50 (d, *J* = 8.1 Hz, 1H), 7.44 (dd, *J* = 8.2, 4.2 Hz, 1H), 7.41 (d, *J* = 7.9 Hz, 2H), 3.20 (t, *J* = 7.7 Hz, 2H), 2.90 (t, *J* = 7.7 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.1, 148.1, 144.9, 138.3,

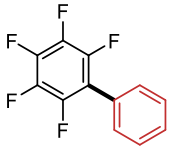
136.4, 134.3, 128.7 (q, J = 32.7 Hz, 1C), 128.0, 127.4, 125.5 (q, J = 3.8 Hz, 1C), 124.3 (q, J = 269.9 Hz, 1C), 121.6, 116.6, 39.1, 31.2; ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.38 (s, 3F).



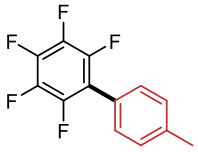
N-(quinolin-8-yl)-3,3-bis(4-(trifluoromethyl)phenyl)propanamide **3en'.** Yield: 31% (M=488.43, 15.1 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 9.79 (s, 1H), 8.79 – 8.73 (m, 1H), 8.67 (t, J = 4.5 Hz, 1H), 8.16 (d, J = 8.2 Hz, 1H), 7.56 (d, J = 8.1 Hz, 4H), 7.50 (d, J = 4.5 Hz, 2H), 7.47 – 7.43 (m, 5H), 4.93 (t, J = 7.7 Hz, 1H), 3.35 (d, J = 7.7 Hz, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 168.5, 148.1, 146.9, 138.1, 136.6, 134.0, 129.3 (q, J = 32.4 Hz, 1C), 128.2, 128.0, 127.4, 125.8 (q, J = 3.3 Hz, 1C), 124.1 (q, J = 270.0 Hz, 1C), 121.9, 121.7, 116.8, 46.7, 43.6; ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.56 (s, 6F); HRMS(ESI): m/z $[M+H]^+$ calcd for $C_{26}H_{19}F_6N_2O$ 489.1401, found 489.1344.



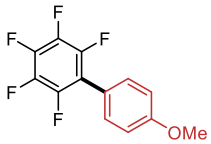
2,3,4,5,6-pentafluoro-3'-methyl-1,1'-biphenyl **5aa**.[13] Yield: 71% (M=258.19, 36.8 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.38 (t, J = 7.6 Hz, 1H), 7.27 (d, J = 7.7 Hz, 1H), 7.21 (d, J = 12.5 Hz, 2H), 2.41 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 144.2(dm, J = 247.5 Hz, 2C), 140.3(dm, J = 253.2 Hz, 1C), 137.8(dm, J = 251.5 Hz, 2C), 138.5, 130.8, 130.1, 128.6, 127.2, 126.3, 116.2(m, 1C), 21.4; ^{19}F NMR (565 MHz, Chloroform-d) δ -143.12 (dd, J = 23.0, 8.1 Hz, 2F), -155.97 (t, J = 21.0 Hz, 1F), -162.47 (dd, J = 21.6, 14.3 Hz, 2F).



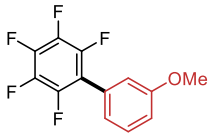
2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ab**.[14] Yield: 88% (M=244.16, 42.9 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.47 (m, J = 13.0, 7.2 Hz, 3H), 7.43 – 7.40 (d, 2H); ^{13}C NMR (151 MHz, Chloroform-d) δ 144.2(dm, J = 247.6 Hz, 2C), 140.4(dm, J = 253.2 Hz, 1C), 138.0(dm, J = 251.5 Hz, 2C), 130.2(t, 1C), 129.4, 128.8, 126.5, 116.0(m, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -143.07 – -143.57 (m, 2F), -155.68 (t, J = 21.0 Hz, 1F), -162.31 (dd, J = 22.8, 8.1 Hz, 2F).



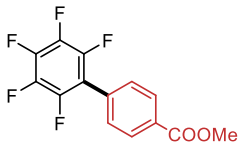
2,3,4,5,6-pentafluoro-4'-methyl-1,1'-biphenyl **5ac**.[13] Yield: 86% (M=258.19, 44.2 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.31 (s, 4H), 2.42 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 144.0(dm, J = 247.5 Hz, 2C), 140.2(dm, J = 253.5 Hz, 1C), 139.4, 137.9(dm, J = 251.5 Hz, 2C), 130.0(2C), 129.5(2C), 123.4, 116.0(m, 1C), 21.4; ^{19}F NMR (565 MHz, Chloroform-d) δ -143.38 (dd, J = 23.0, 8.1 Hz, 2F), -156.15 (t, J = 21.0 Hz, 1F), -162.47 (dd, J = 21.3, 14.3 Hz, 2F).



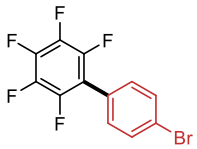
2,3,4,5,6-pentafluoro-4'-methoxy-1,1'-biphenyl **5ad**.[13] Yield: 83% (M=274.19, 45.5 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.36 (d, *J* = 8.8 Hz, 2H), 7.01 (d, *J* = 8.8 Hz, 2H), 3.86 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 160.3, 144.2(dm, J = 246.6 Hz, 2C), 140.4(dm, J = 253.2 Hz, 1C), 138.0(dm, J = 251.5 Hz, 2C), 138.2, 131.4(t, 2C), 118.4, 116.4, 115.8(m, 1C), 114.3(2C), 55.3; ^{19}F NMR (565 MHz, Chloroform-d) δ -143.64 (dd, J = 23.1, 8.2 Hz, 2F), -156.52 (t, J = 21.0 Hz, 1F), -162.56 (dd, J = 21.4, 14.3 Hz, 2F).



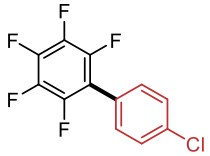
2,3,4,5,6-pentafluoro-3'-methoxy-1,1'-biphenyl **5ae**.[13] Yield: 75% (M=274.19, 41.1 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.40 (t, *J* = 8.0 Hz, 1H), 7.02 – 6.98 (m, 2H), 6.94 (s, 1H), 3.84 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 159.7, 144.2(dm, J = 252.0 Hz, 2C), 140.5(dm, J = 253.2 Hz, 1C), 137.6(dm, J = 251.5 Hz, 2C), 129.8, 127.5, 122.5(t, 1C), 115.91, 114.93, 55.39; ^{19}F NMR (565 MHz, Chloroform-d) δ -142.78 (dd, J = 23.1, 8.1 Hz, 2F), -155.55 (t, J = 21.1 Hz, 1F), -162.22 (td, J = 22.2, 8.1 Hz, 2F).



methyl 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-3-carboxylate **5af**.[13] Yield: 63% (M=302.20, 38 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.16 (d, *J* = 8.4 Hz, 2H), 7.52 (d, *J* = 8.4 Hz, 2H), 3.96 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 166.4, 144.1(dm, J = 248.4 Hz, 2C), 140.8(dm, J = 255.0 Hz, 1C), 137.9(dm, J = 252.2 Hz, 2C), 131.0,130.9, 130.3(t, 2C), 129.9(2C), 115.0(m, 1C), 52.3; ^{19}F NMR (565 MHz, Chloroform-d) δ -142.76 (dd, J = 22.5, 8.1 Hz, 2F), -154.11 (t, J = 20.8 Hz, 1F), -161.58 (td, J = 21.9, 8.3 Hz, 2F).

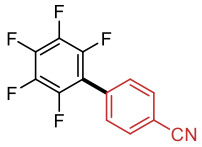


4'-bromo-2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ag**.[15] Yield: 59% (M=323.06, 38.1 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.57 (s, 4H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 144.3(dm, J = 246.3 Hz, 2C), 140.5(dm, J = 255.0 Hz, 1C), 138.0(dm, J = 252.2 Hz, 2C), 132.1, 130.6(t, 2C), 128.8, 127.5, 127.2, 115.0(m, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -142.96 (dd, J = 22.7, 8.2 Hz, 2F), -154.45 (t, J = 21.0 Hz, 1F), -161.66 (td, J = 22.2, 8.2 Hz, 2F).

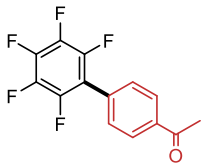


4'-chloro-2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ah**.[16] Yield: 62% (M=278.61, 34.5 mg). ^{1}H NMR (600

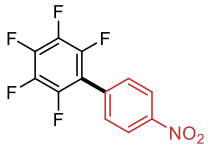
MHz, Chloroform-*d*) δ 7.51 – 7.46 (m, 2H), 7.37 (d, *J* = 6.6 Hz, 2H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 144.1(dm, J = 249.9 Hz, 2C), 140.6(dm, J = 255.0 Hz, 1C), 137.9(dm, J = 251.0 Hz, 2C), 135.7, 131.5(t, 2C), 129.1(2C), 124.8, 114.8(m, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -143.14 (dd, J = 22.6, 8.3 Hz, 2F), -154.82 (d, J = 20.7 Hz, 1F), -161.57 – -162.09 (m, 2F).



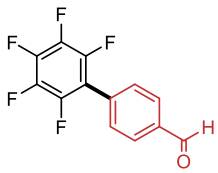
2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-carbonitrile **5ai**.[13] Yield: 60% (M=269.17, 32.3 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.80 (d, *J* = 8.8 Hz, 2H), 7.57 (d, *J* = 8.0 Hz, 2H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 144.1(dm, J = 248.3 Hz, 2C), 141.3(dm, J = 256.1 Hz, 1C), 137.9(dm, J = 251.0 Hz, 2C), 132.5(2C), 131.0(t, 2C), 118.1, 113.4(m, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -142.75 (dd, J = 22.2, 8.0 Hz, 2F), -152.82 (t, J = 21.0 Hz, 1F), -160.92 (td, J = 22.0, 8.1 Hz, 2F).



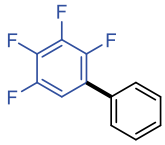
1-(2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-yl)ethan-1-one **5aj**.[13] Yield: 79% (M=286.20, 38.5 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.08 (d, *J* = 8.5 Hz, 2H), 7.55 (d, *J* = 8.5 Hz, 2H), 2.66 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 197.3, 144.1(dm, J = 248.9 Hz, 2C), 140.9(dm, J = 255.3 Hz, 1C), 137.9(dm, J = 252.2 Hz, 2C), 137.5, 131.1, 130.5(t, 2C), 128.6(2C), 114.9(m, 1C), 26.6; ^{19}F NMR (565 MHz, Chloroform-d) δ -142.79 (dd, J = 22.2, 8.0 Hz, 2F), -154.02 (t, J = 20.8 Hz, 1F), -161.55 (td, J = 22.1, 8.2 Hz, 2F).



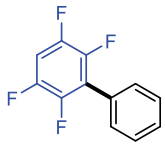
2,3,4,5,6-pentafluoro-4'-nitro-1,1'-biphenyl **5ak**.[15] Yield: 54% (M=289.16, 31.3 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.37 (d, *J* = 8.8 Hz, 2H), 7.64 (d, *J* = 8.8 Hz, 2H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 148.3, 144.1(dm, J = 250.4 Hz, 2C), 141.4(dm, J = 255.3 Hz, 1C), 138.1(dm, J = 252.7 Hz, 2C), 133.0, 131.3(t, 2C), 124.0(2C), 131.8(m, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -142.50 (dd, J = 22.0, 8.1 Hz, 2F), -152.45 (t, J = 20.8 Hz, 1F), -160.76 (td, J = 21.6, 21.2, 8.1 Hz, 2F).



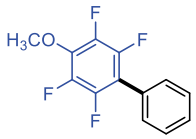
2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-carbaldehyde **5al**.[13] Yield: 52% (M=272.17, 28.1 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 10.10 (s, 1H), 8.02 (d, *J* = 8.3 Hz, 2H), 7.62 (d, *J* = 8.3 Hz, 2H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 191.5, 144.1(dm, J = 248.9 Hz, 2C), 141.0(dm, J = 255.3 Hz, 1C), 138.0(dm, J = 252.6 Hz, 2C), 136.7, 132.4, 131.0(t, 2C), 129.9(2C), 114.7(m, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -142.65 (dd, J = 22.4, 8.2 Hz, 2F), -153.50 (t, J = 20.8 Hz, 1F), -161.28 (td, J = 22.0, 8.2 Hz, 2F).



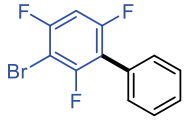
2,3,4,5-tetrafluoro-1,1'-biphenyl **5ba**.[17] Yield: 63% (M=226.17, 28.6 mg). ^{1}H NMR (600 MHz, CDCl3) δ 7.50-7.40 (m, 5H), 7.06 (q, *J* = 7.7 Hz, 1H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 147.1(dm, J = 257.1 Hz, 1C), 144.7(dm, J = 255.3 Hz, 1C), 140.5(m, 1C), 139.7(dm, J = 252.6 Hz, 1C), 133.1, 128.9(2C), 128.8(t, 2C), 125.5(m, 1C), 111.4(t, 1C), 111.3(t, 1C); ^{19}F NMR (565 MHz, Chloroform-*d*) δ -139.64– -139.68 (m, *J* = 10.5 Hz, 1F), -143.72– -143.77 (m, *J* = 5.9 Hz, 1F), -155.14 – -155.32 (m, 1F), -157.01 – -157.36 (m, 1F).



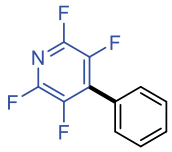
2,3,5,6-tetrafluoro-1,1'-biphenyl **5ca**.[17] Yield: 70% (M=226.17, 31.7 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.52-7.47 (m, 2H), 7.47-7.43 (m, 3H), 7.06 (p, *J* = 8.4 Hz, 1H).; ^{13}C NMR (151 MHz, Chloroform-*d*) δ 146.3(dm, J = 246.5 Hz, 2C), 143.8(dm, J = 245.7 Hz, 2C), 130.1(t, 2C), 129.2, 128.6(2C), 127.5(t, 1C), 121.6(t, 1C), 104.9(t, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -139.19 (dd, J = 22.4, 12.7 Hz, 2F), -143.91 (dd, J = 22.2, 13.0 Hz, 2F).



2,3,5,6-tetrafluoro-4-methoxy-1,1'-biphenyl **5da**.[17] Yield: 63% (M=256.20, 32 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.49-7.46 (m, 2H), 7.45-7.41 (m, 3H), 4.12 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 144.3(dm, J = 246.0 Hz, 2C), 141.2(dm, J = 246.9 Hz, 2C), 137.5(m, 1C), 130.2(t, 2C), 128.9, 128.6(2C), 127.3, 114.3(t, 1C), 62.2(t, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -145.19 (dd, J = 21.9, 8.6 Hz, 2F), -158.25 (dd, J = 22.1, 8.9 Hz, 2F).

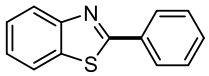


3-bromo-2,4,6-trifluoro-1,1'-biphenyl **5ea**.[18] Yield: 57% (M=287.08, 32.7 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.49 – 7.45 (m, 2H), 7.43 (d, *J* = 6.2 Hz, 1H), 7.42 – 7.39 (m, 2H), 6.88 (t, *J* = 9.0 Hz, 1H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 159.0(dm, J = 250.1 Hz, 1C), 158.7(dm, J = 249.5 Hz, 1C), 157.3(dm, J = 247.5 Hz, 1C), 130.2(2C), 128.8, 128.5(2C), 127.8, 116.1(m, 1C), 101.0(m, 1C), 94.0(m, 1C); ^{19}F NMR (565 MHz, Chloroform-d) δ -103.94 (d, J = 5.9 Hz, 1F), -104.84 (d, J = 6.4 Hz, 1F), -112.41 (t, J = 6.1 Hz, 1F).

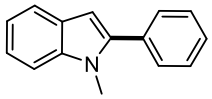


2,3,5,6-tetrafluoro-4-phenylpyridine **5fa**.[17] Yield: 57% (M=227.16, 27.9 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.59 – 7.50 (m, 5H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 143.6(dm, J = 244.5 Hz, 2C), 139.4(dm, J = 257.2 Hz, 2C), 133.5(m, 1C), 130.6, 129.8(t, 2C), 129.0(2C), 125.9; ^{19}F NMR (565

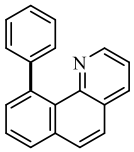
MHz, Chloroform-d) δ -90.74 (td, J = 28.9, 13.7 Hz, 2F), -144.81 – -145.42 (m, 2F).



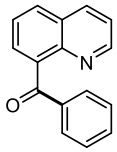
2-phenylbenzo[d]thiazole **6**.[19] Yield: 54% (M=211.28, 22.8 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.11 (s, 3H), 7.92 (d, *J* = 5.7 Hz, 1H), 7.51 (s, 4H), 7.41 (d, *J* = 6.5 Hz, 1H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 168.2, 154.0, 135.0, 133.5, 131.1, 129.1, 127.6, 126.4, 125.3, 123.2, 121.6.



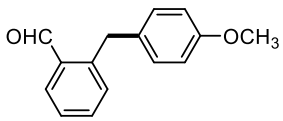
1-methyl-2-phenyl-1H-indole **7**.[20] Yield: 52% (M=207.28, 21.4 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.64 (d, *J* = 7.8 Hz, 1H), 7.50 (dd, *J* = 24.4, 7.1 Hz, 4H), 7.39 (dd, *J* = 24.1, 7.6 Hz, 2H), 7.28 – 7.23 (m, 1H), 7.15 (t, *J* = 7.4 Hz, 1H), 6.57 (s, 1H), 3.75 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 141.6, 138.4, 132.9, 129.4, 128.5, 127.9, 121.7, 120.5, 119.9, 109.6, 101.7, 31.2.



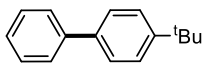
10-phenylbenzo[h]quinoline **8**.[21] Yield: 53% (M=255.32, 27.0 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.57 (s, 1H), 8.20 (s, 1H), 7.93 (dd, *J* = 24.3, 7.9 Hz, 2H), 7.73 (d, *J* = 8.9 Hz, 2H), 7.59 (d, *J* = 6.2 Hz, 1H), 7.41 (d, *J* = 19.3 Hz, 6H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 146.8, 146.6, 146.2, 141.7, 135.4, 135.0, 131.5, 128.8, 128.4, 128.0, 127.4, 127.3, 125.9, 125.8, 121.1.



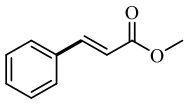
phenyl(quinolin-8-yl)methanone **9**.[22] Yield: 57% (M=233.27, 26.6 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 8.85 (s, 1H), 8.22 (d, *J* = 6.7 Hz, 1H), 7.97 (d, *J* = 6.8 Hz, 1H), 7.84 (d, *J* = 6.3 Hz, 2H), 7.75 (s, 1H), 7.64 (d, *J* = 6.0 Hz, 1H), 7.55 (s, 1H), 7.42 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 197.9, 150.9, 146.2, 139.4, 137.8, 136.0, 133.2, 130.2, 129.7, 128.3, 128.3, 128.2, 125.9, 121.7.



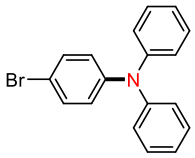
2-(4-methoxybenzyl)benzaldehyde **10**.[23] Yield: 52% (M=226.28, 11.8 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 10.26 (s, 1H), 7.86 (s, 1H), 7.53 (td, *J* = 6.5 Hz, 1H), 7.41 (td, *J* = 6.6 Hz, 1H), 7.26 (d, 1H), 7.06 (s, 2H), 6.82 (s, 2H), 4.39 (s, 2H), 3.77 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 192.4, 158.1, 143.5, 133.9, 132.4, 131.9, 131.5, 129.7, 126.9, 114.0, 55.3, 37.2.



4-(tert-butyl)-1,1'-biphenyl **11**.[24] Yield: 98% (M=210.32, 41.3 mg). ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.65 (d, *J* = 8.4 Hz, 2H), 7.60 (d, *J* = 8.3 Hz, 2H), 7.53 (d, *J* = 8.2 Hz, 2H), 7.48 (t, *J* = 7.6 Hz, 2H), 7.41 – 7.34 (m, 1H), 1.42 (s, 9H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 150.3, 141.1, 138.4, 128.8, 127.1, 127.0, 126.9, 126.7, 125.8, 125.7, 34.6, 31.4.



methyl cinnamate **12**.[25] Yield: 92% (M=162.19, 29.8 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.70 (d, *J* = 16.0 Hz, 1H), 7.56 – 7.50 (m, 2H), 7.42 – 7.32 (m, 3H), 6.45 (d, *J* = 16.0 Hz, 1H), 3.81 (s, 3H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 167.4, 144.9, 134.4, 130.3, 128.9, 128.1, 117.8, 51.7.



4-bromo-N,N-diphenylaniline **13**.[26] Yield: 71% (M=324.22, 60.0 mg). ^{1}H NMR (600 MHz, Chloroform-*d*) δ 7.30 (d, *J* = 7.1 Hz, 2H), 7.23 (d, *J* = 5.3 Hz, 4H), 7.09 – 6.99 (m, 6H), 6.93 (d, *J* = 6.2 Hz, 2H); ^{13}C NMR (151 MHz, Chloroform-*d*) δ 147.4, 147.1, 132.2, 129.4, 125.2, 124.5, 123.3, 114.8.

References:

1. Shabashov, D.; Daugulis, O. Auxiliary-Assisted Palladium-Catalyzed Arylation and Alkylation of sp^2 and sp^3 Carbon-Hydrogen Bonds. *J. Am. Chem. Soc.* **2010**, *132*, 3965–3972.
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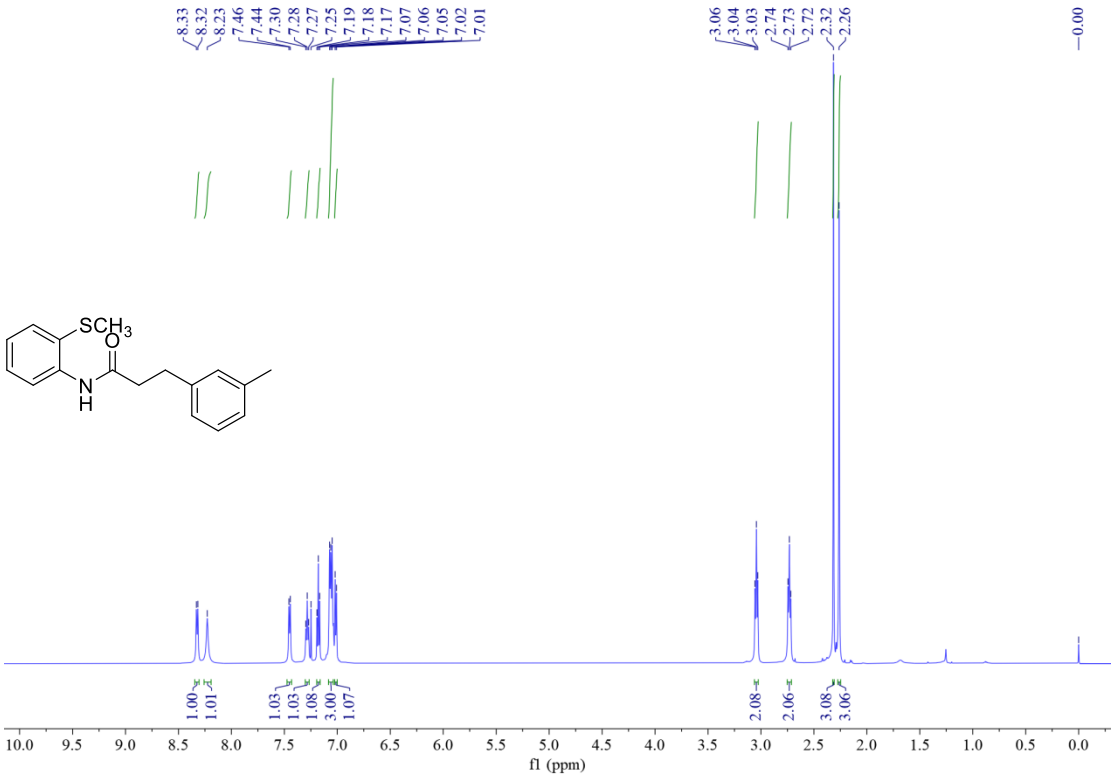
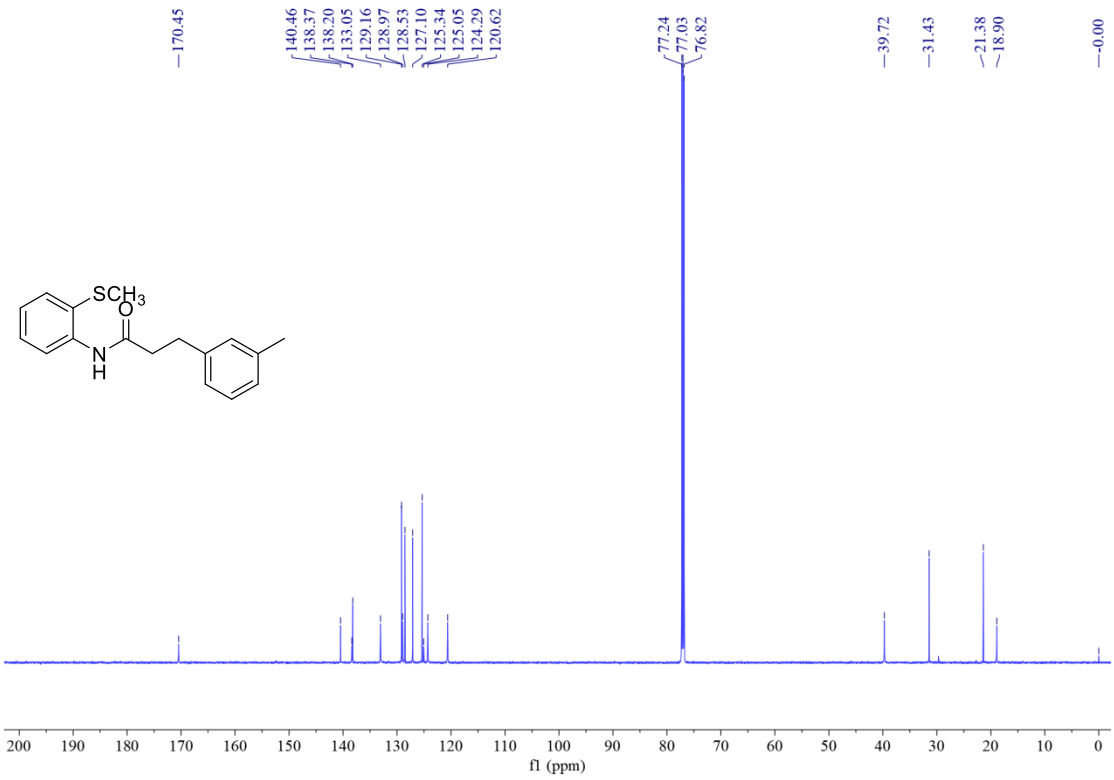
NMR and HRMS spectra of products

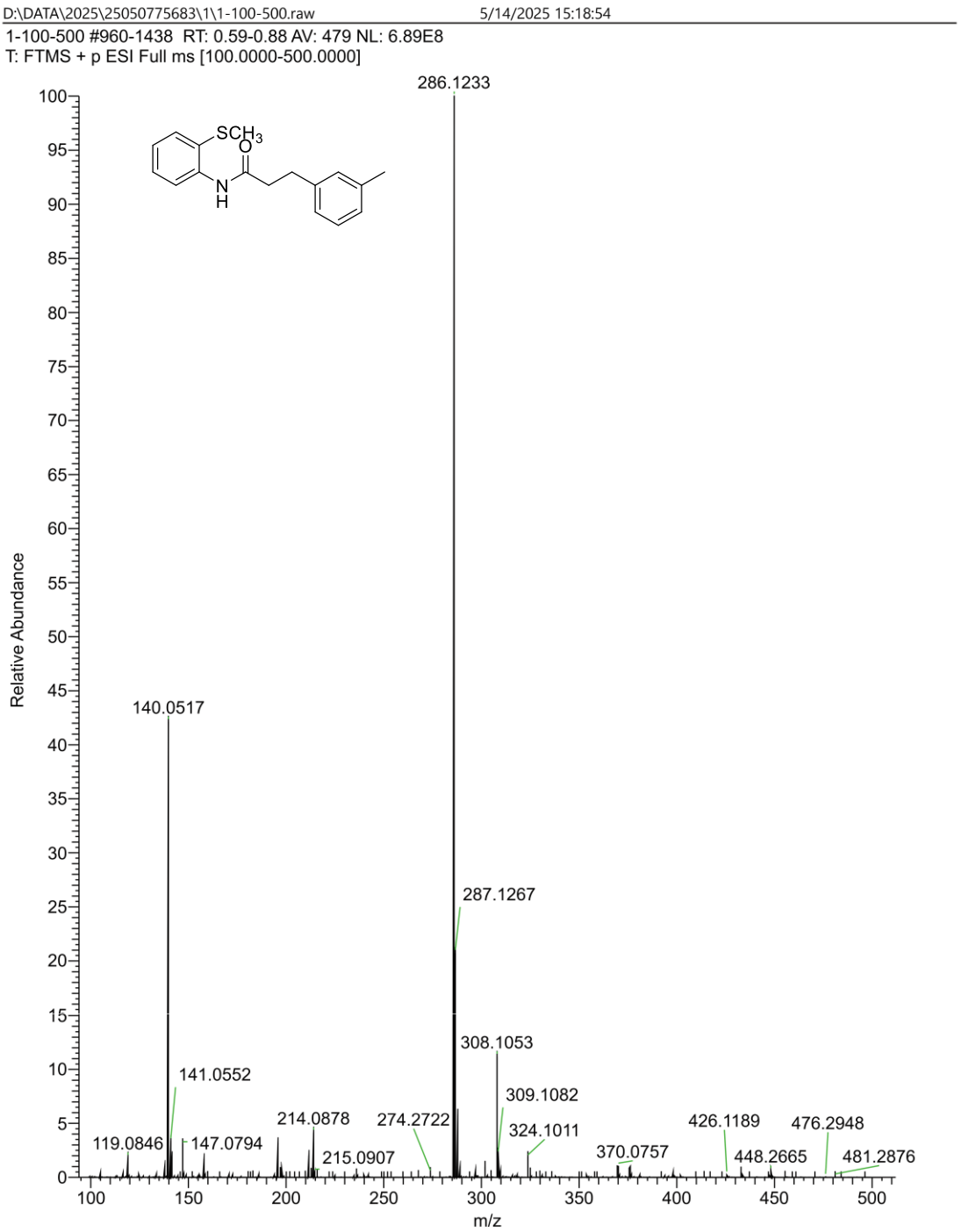
^{1}H NMR of N-(2-(methylthio)phenyl)-3-(m-tolyl)propanamide **3aa**



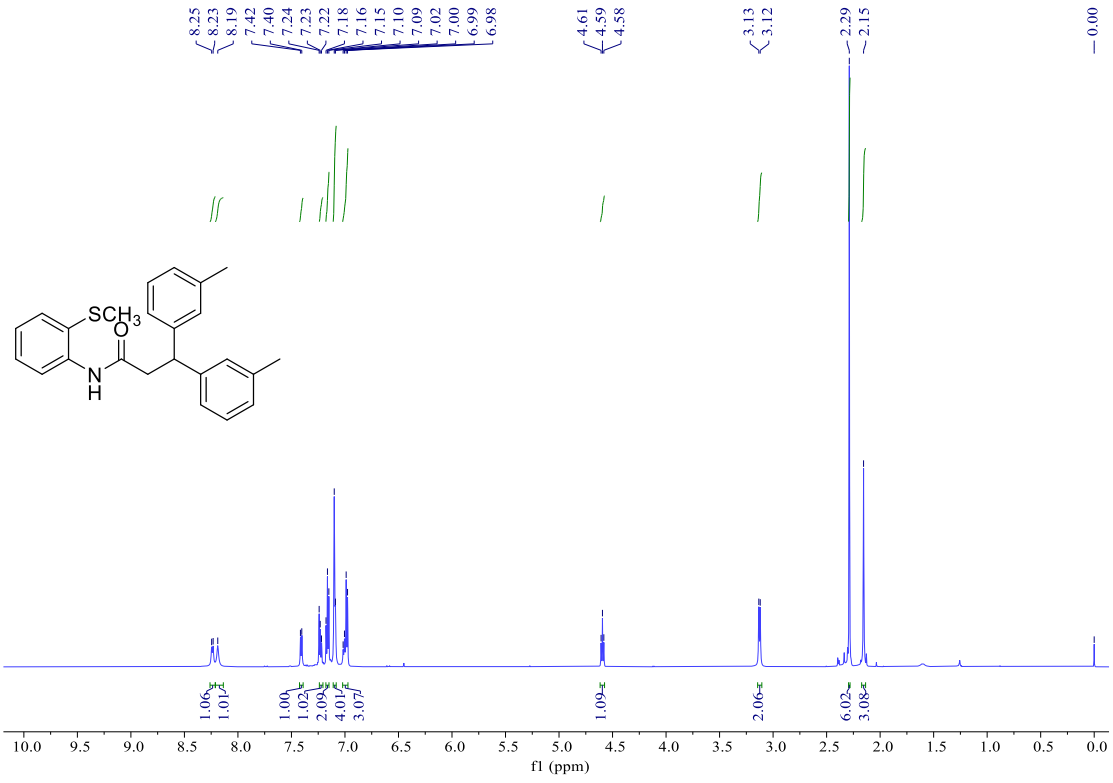
^{13}C NMR of N-(2-(methylthio)phenyl)-3-(m-tolyl)propanamide **3aa**



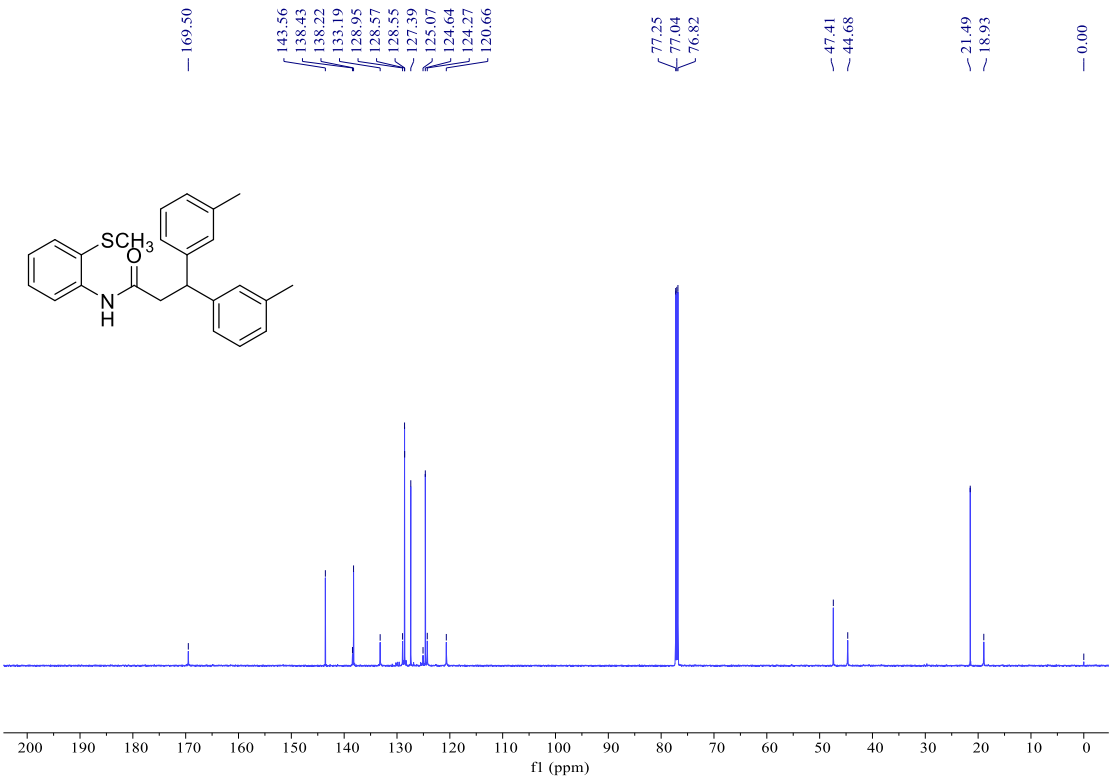
HRMS(ESI) of N-(2-(methylthio)phenyl)-3-(m-tolyl)propanamide **3aa**



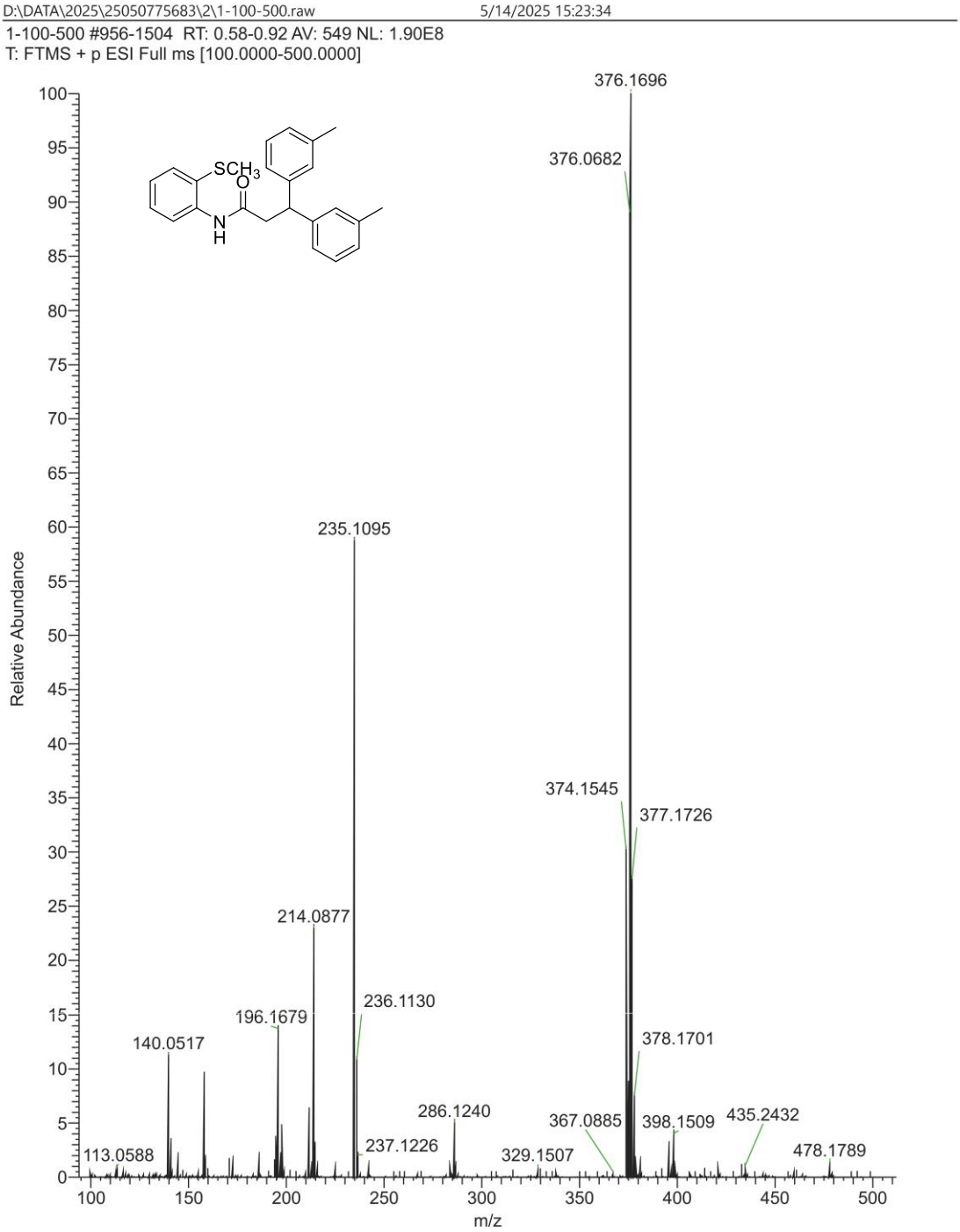
^{1}H NMR of N-(2-(methylthio)phenyl)-3,3-di-m-tolylpropanamide **3aa'**



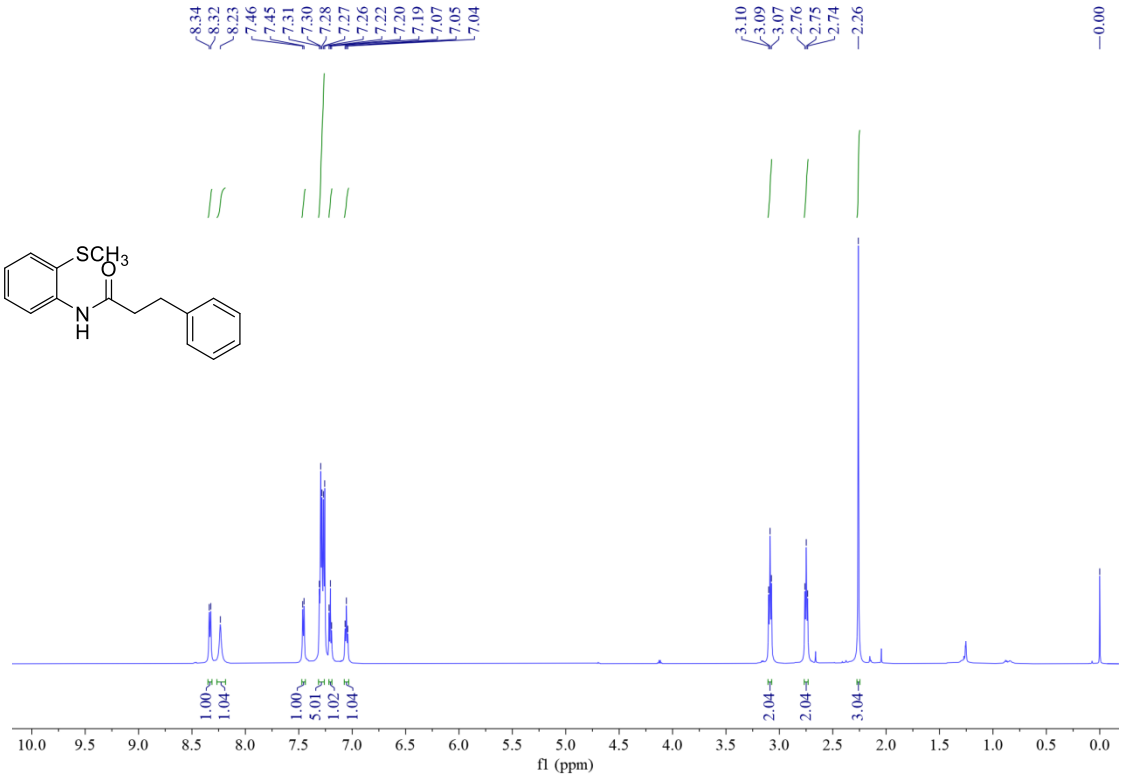
^{13}C NMR of N-(2-(methylthio)phenyl)-3,3-di-m-tolylpropanamide **3aa'**



HRMS(ESI) of N-(2-(methylthio)phenyl)-3,3-di-m-tolylpropanamide **3aa'**



^{1}H NMR of N-(2-(methylthio)phenyl)-3-phenylpropanamide **3ab**



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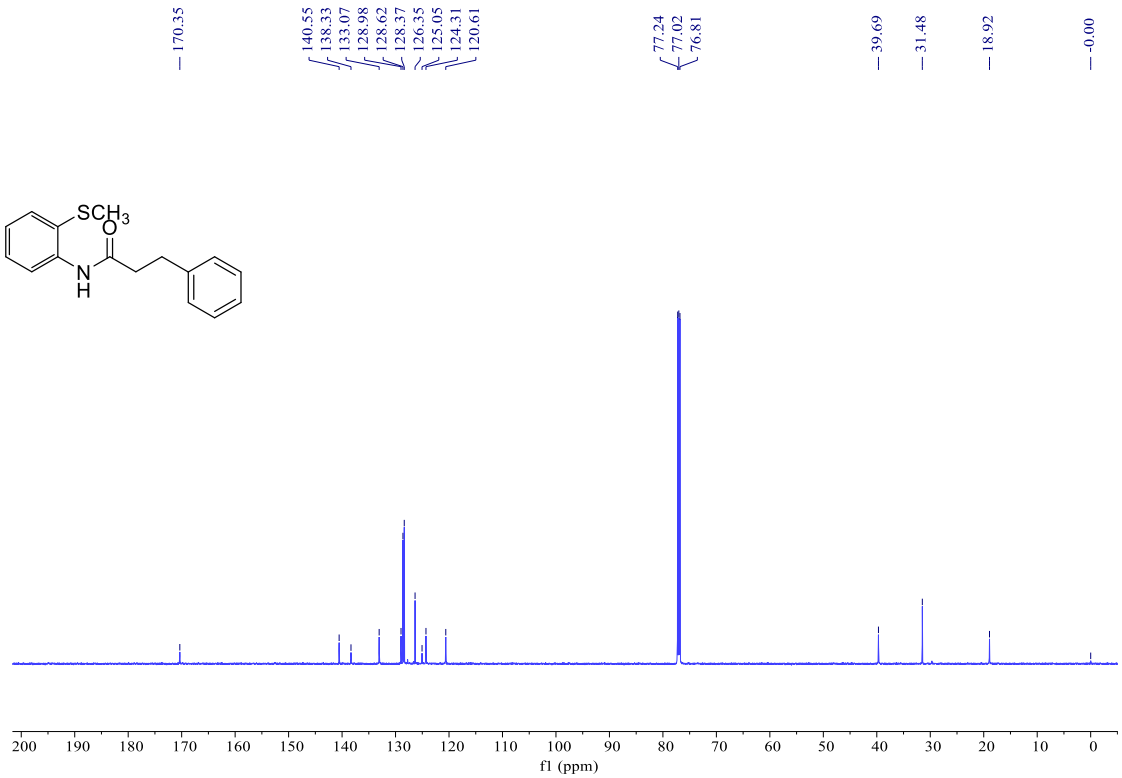
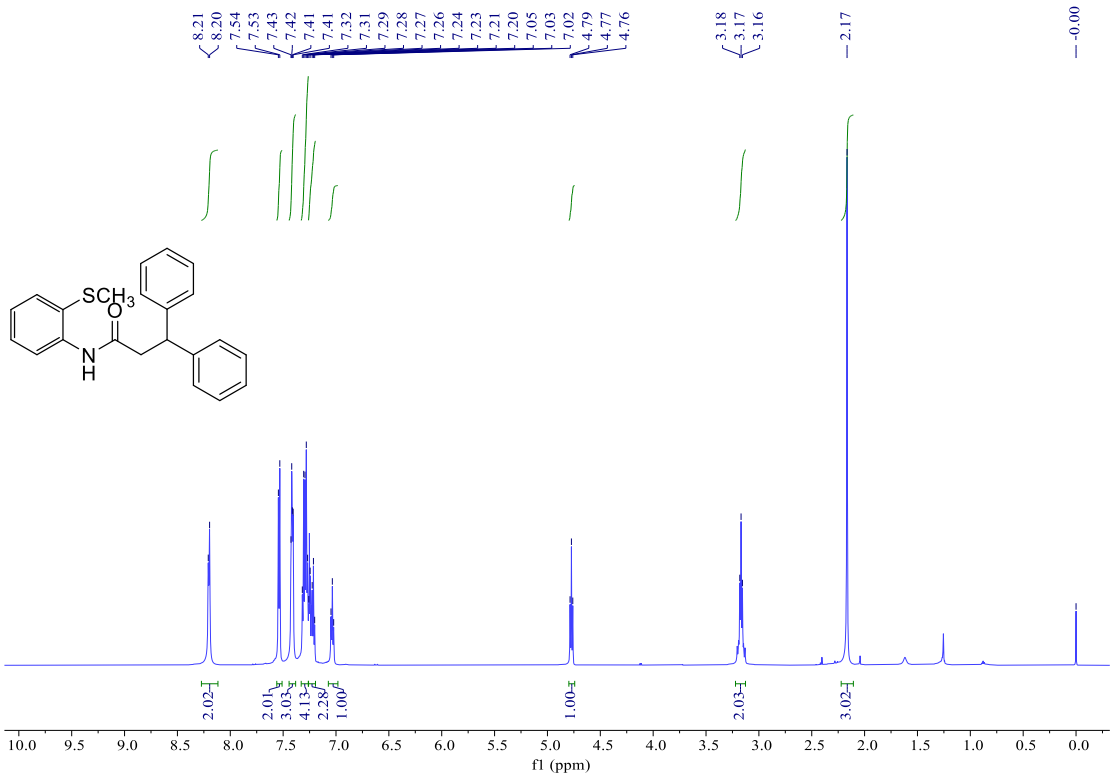
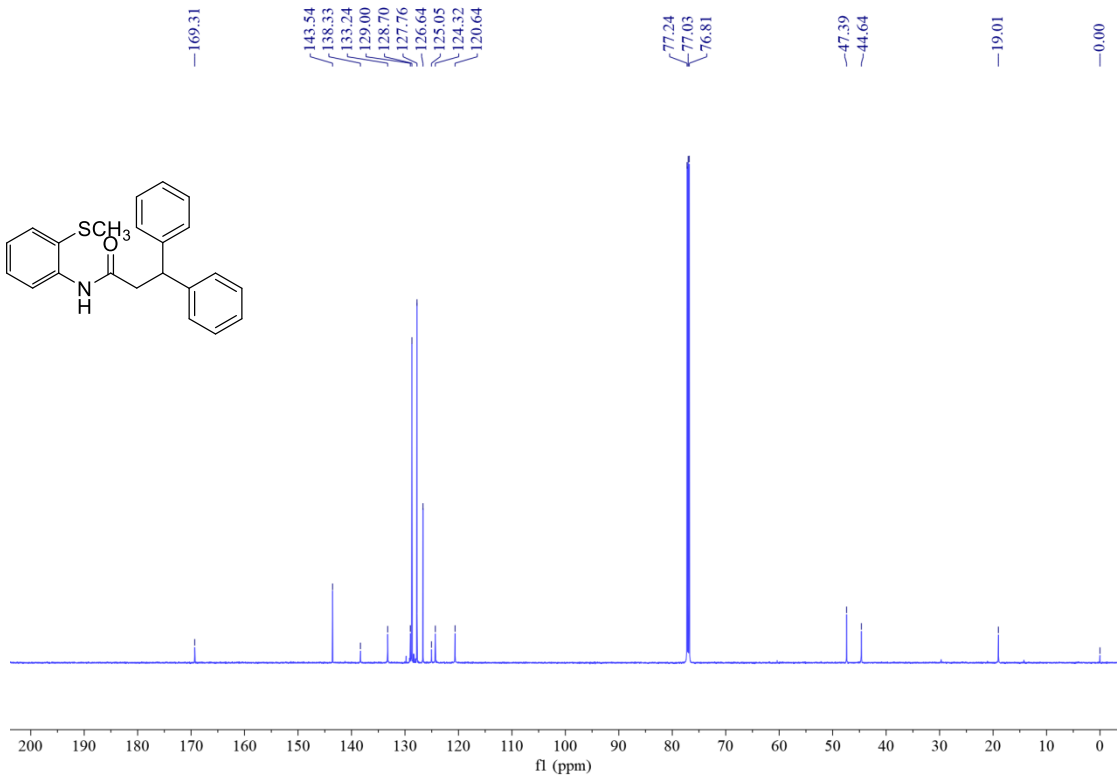


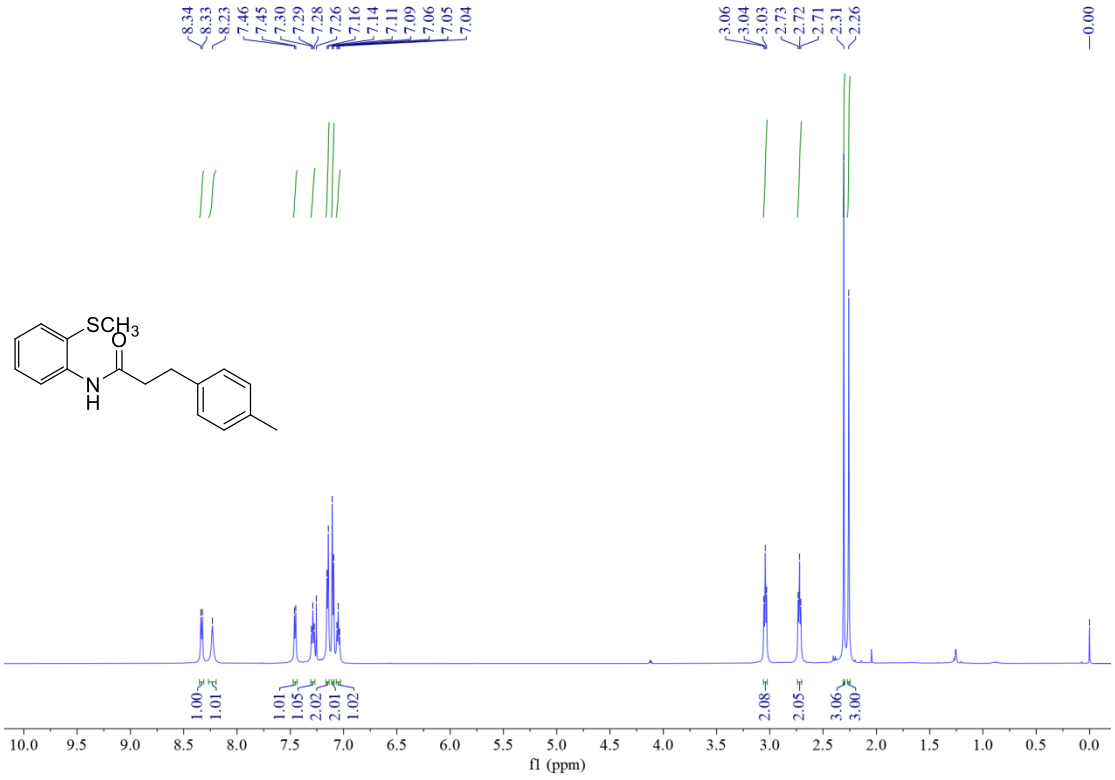
^{1}H NMR of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3ab'**



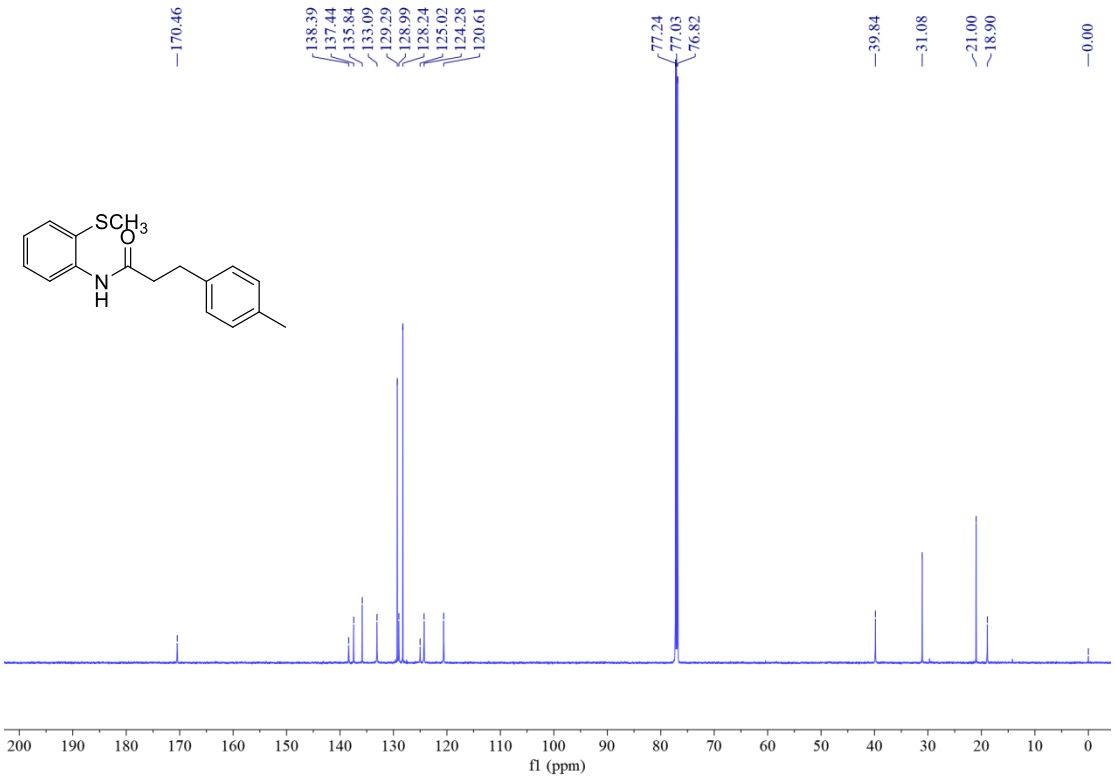
^{13}C NMR of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3ab'**



^{1}H NMR of N-(2-(methylthio)phenyl)-3-(p-tolyl)propanamide **3ac**



^{13}C NMR of N-(2-(methylthio)phenyl)-3-(p-tolyl)propanamide **3ac**



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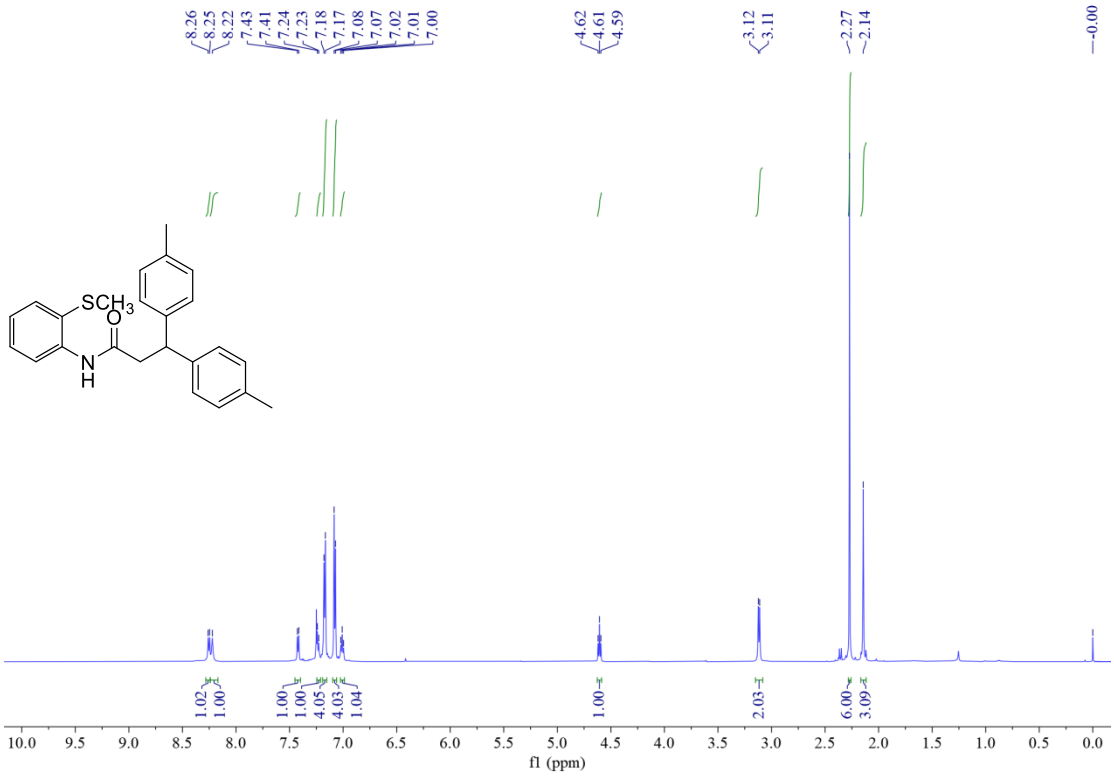

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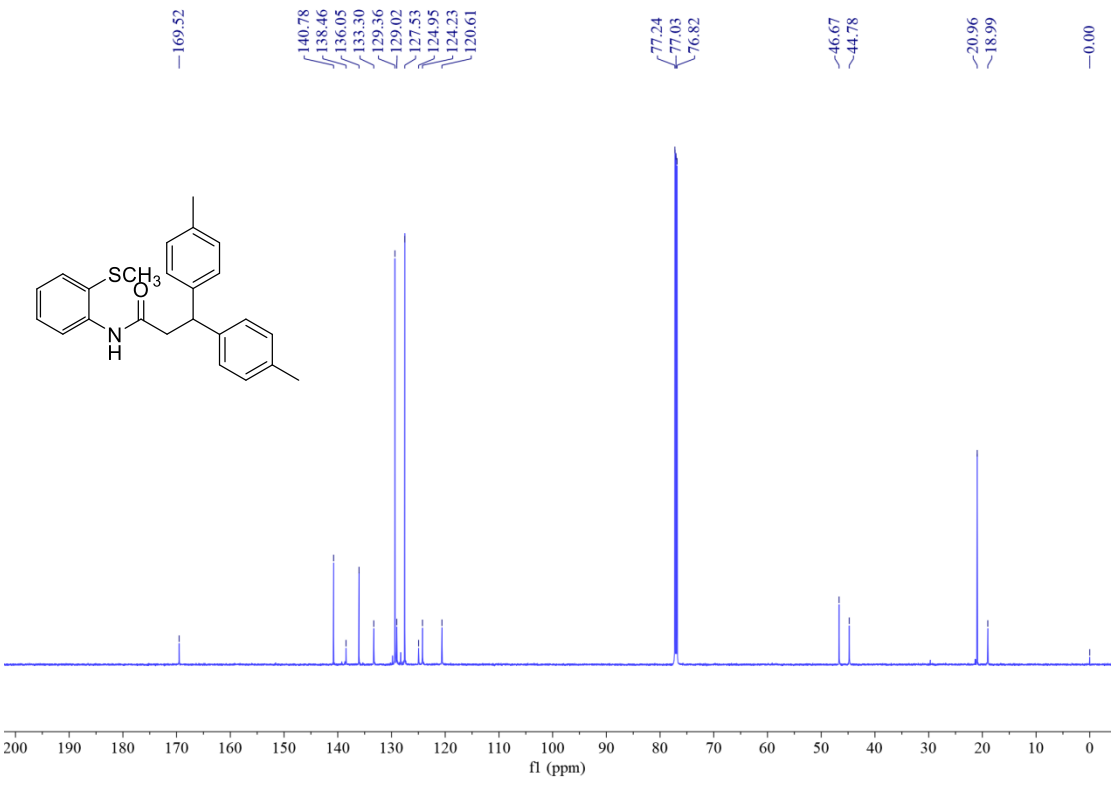
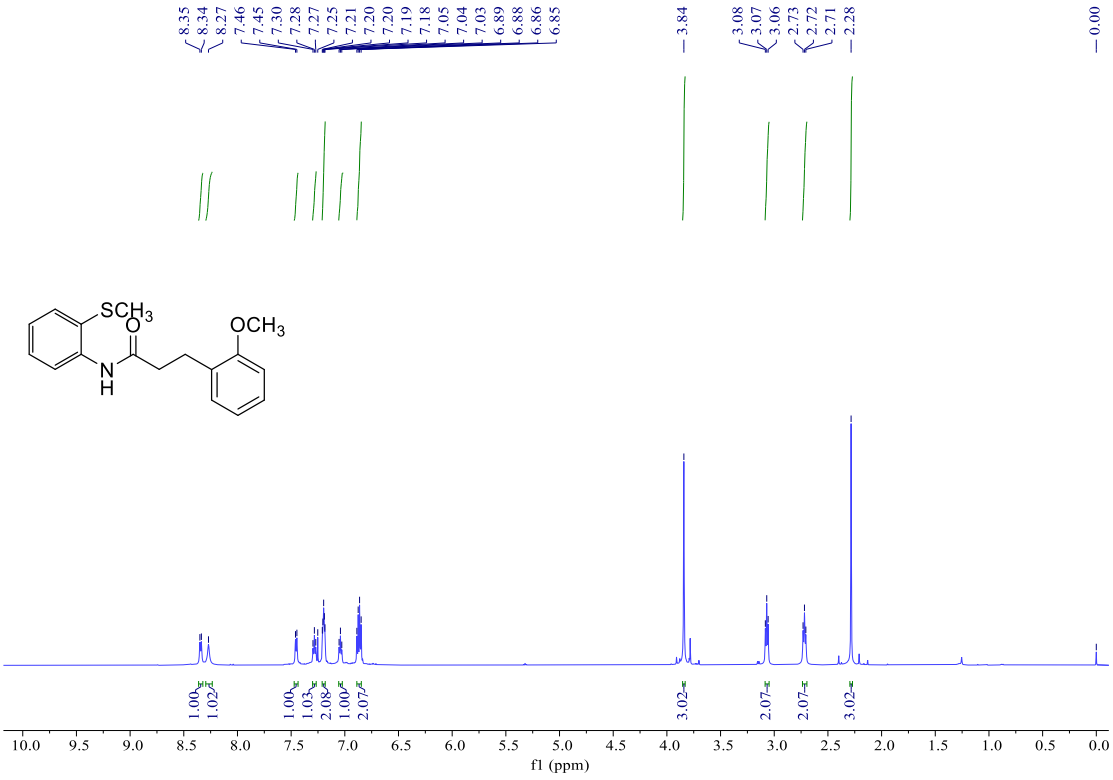
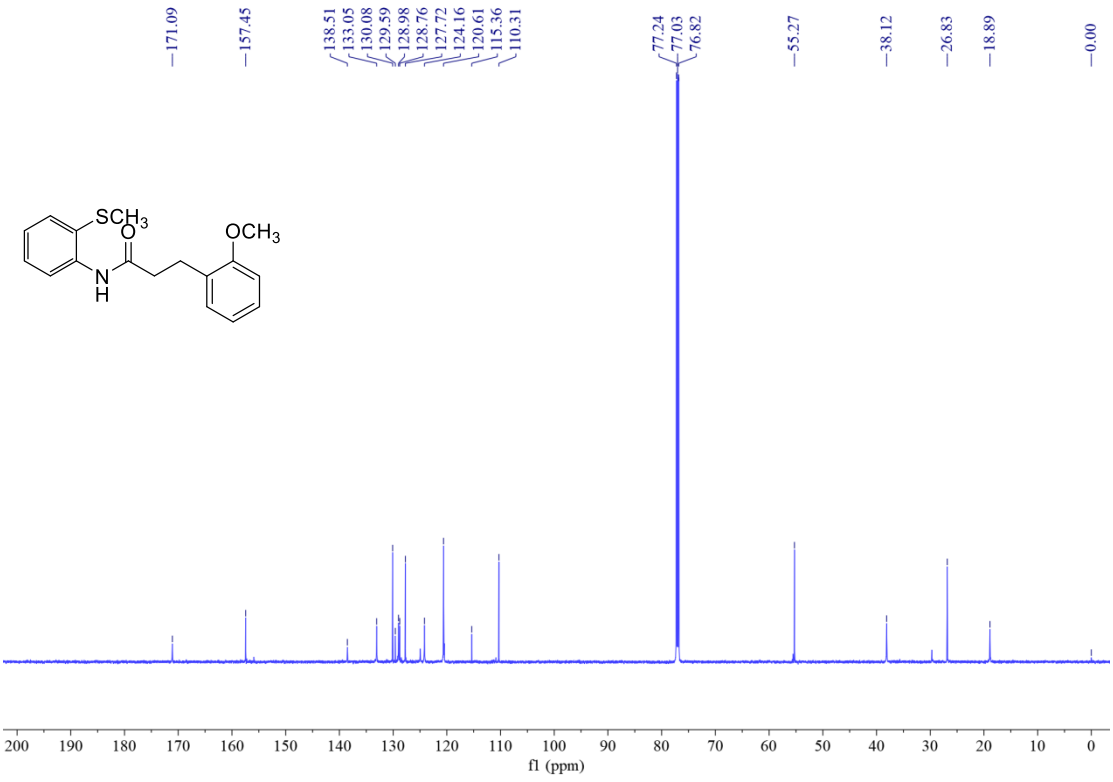


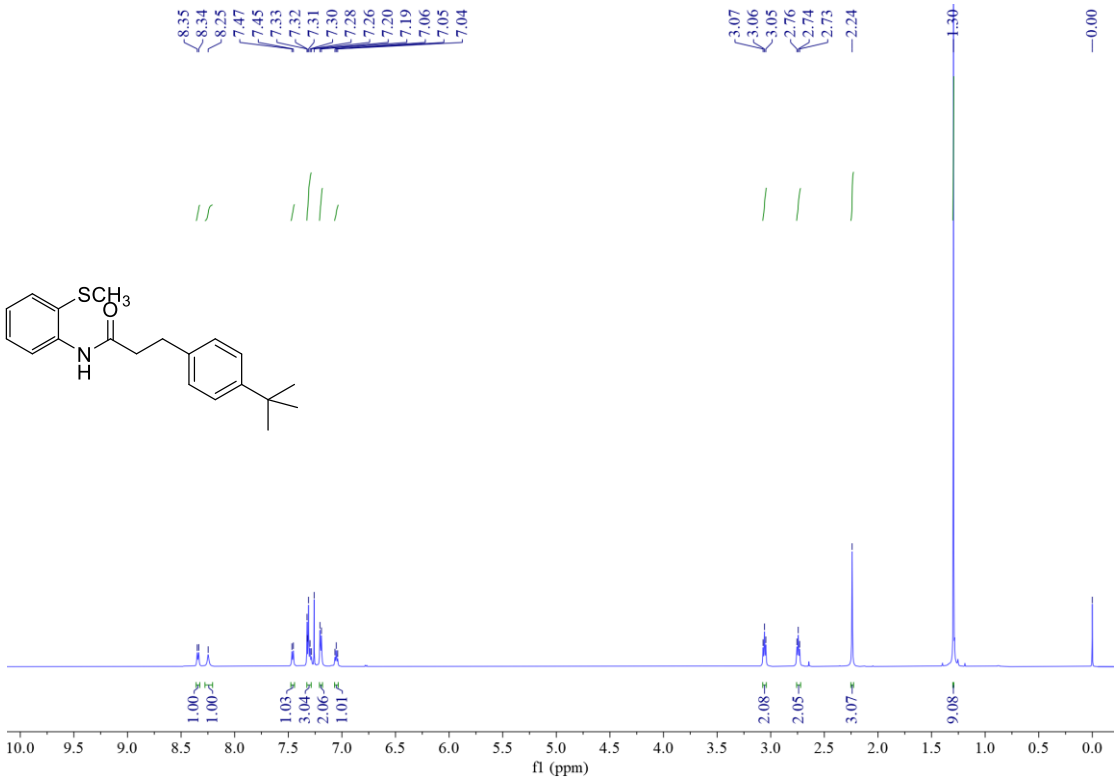
^{1}H NMR of 3-(2-methoxyphenyl)-N-(2-(methylthio)phenyl)propanamide **3ad**



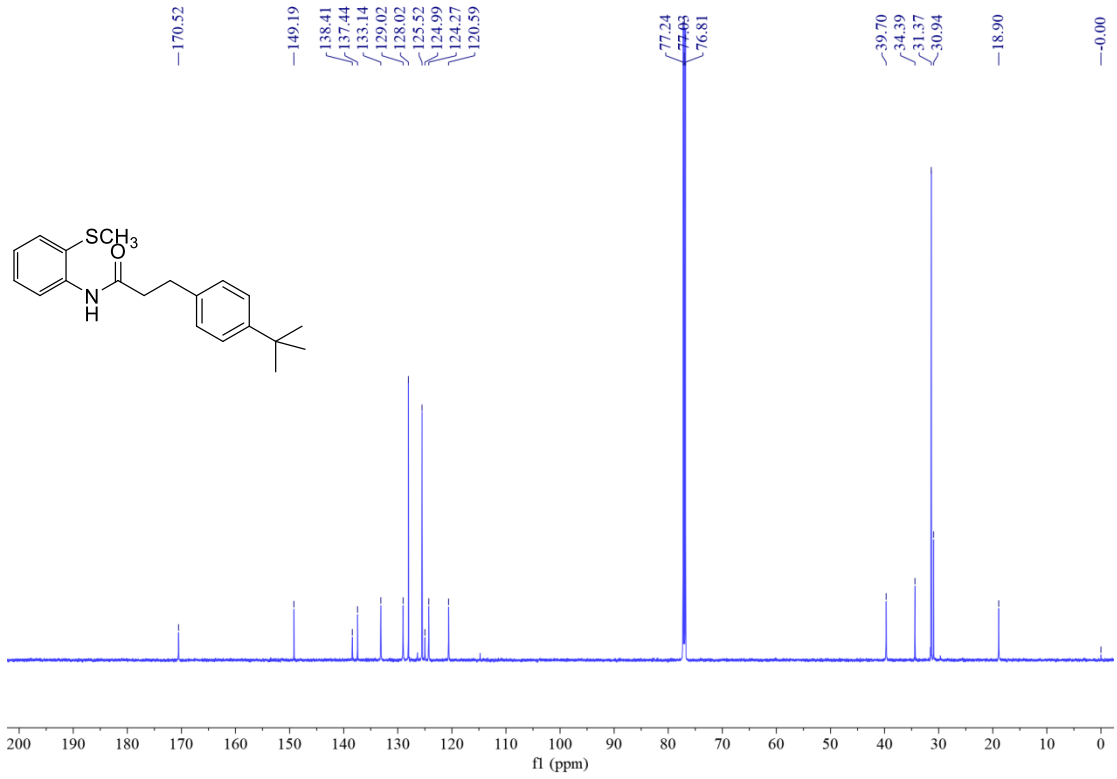
^{13}C NMR of 3-(2-methoxyphenyl)-N-(2-(methylthio)phenyl)propanamide **3ad**



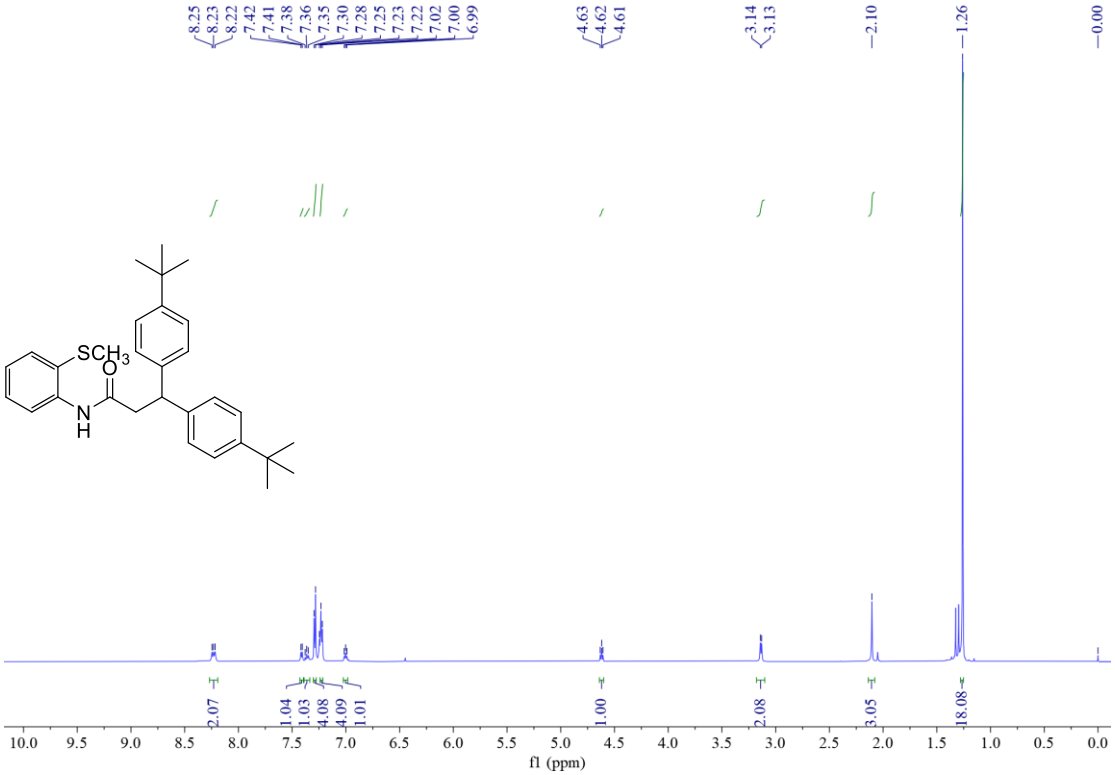
^{1}H NMR of 3-(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)propanamide **3ae**



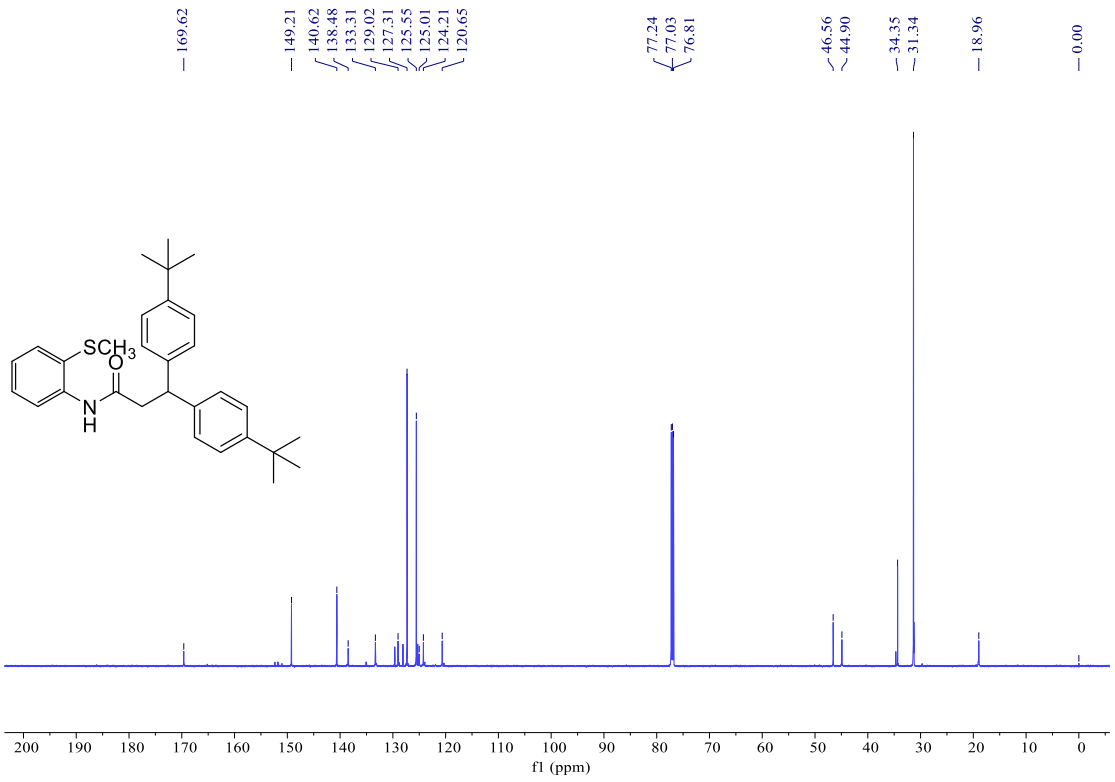
^{13}C NMR of 3-(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)propanamide **3ae**



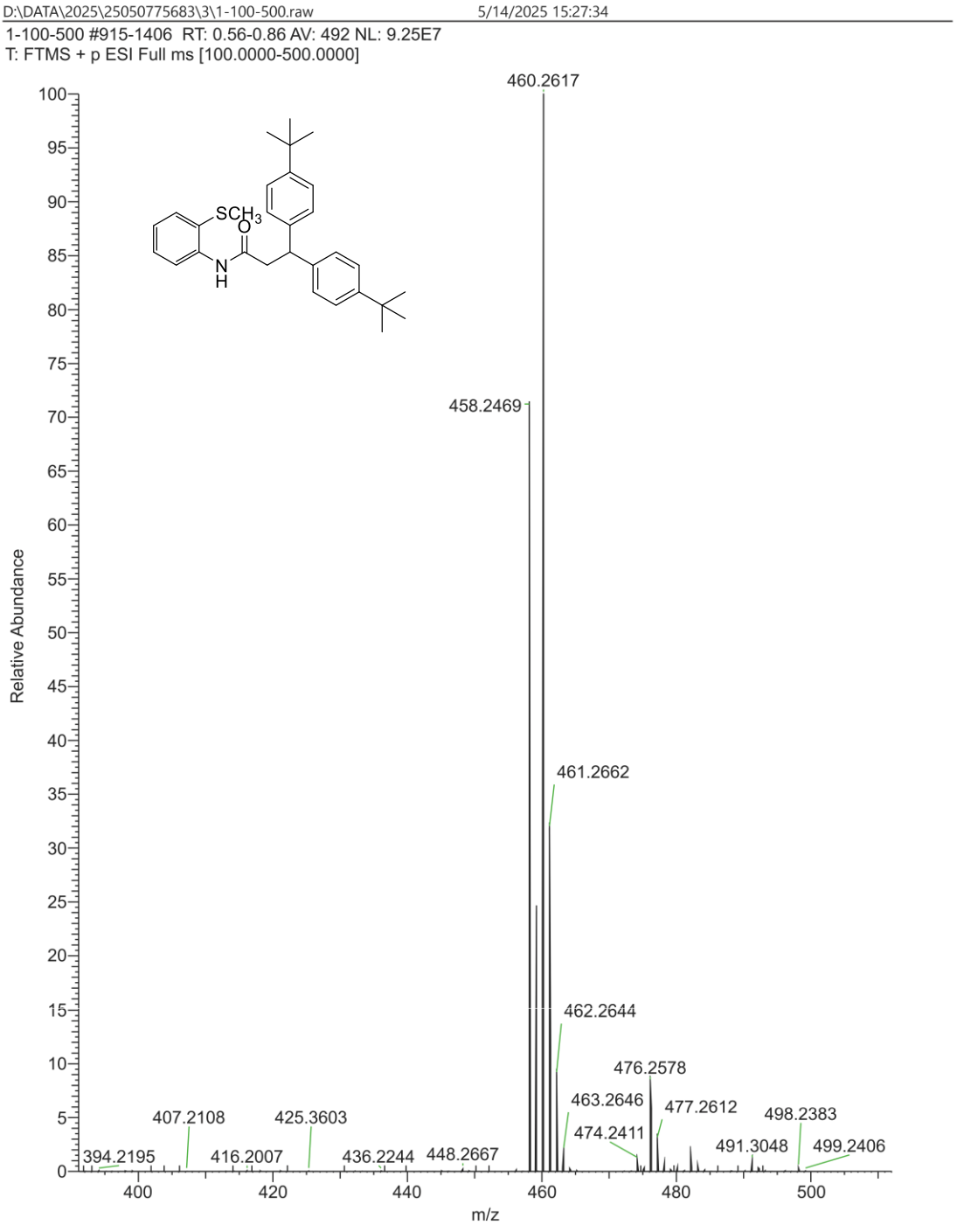
^{1}H NMR of 3,3-bis(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)propanamide **3ae'**



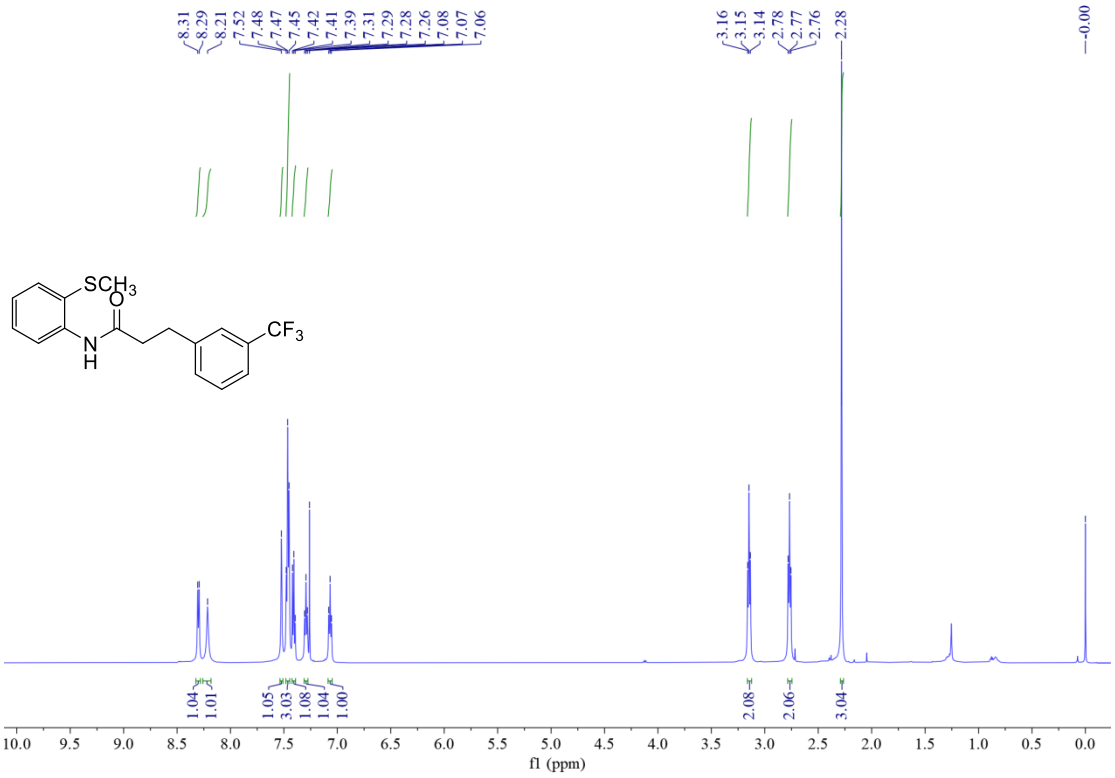
^{13}C NMR of 3,3-bis(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)propanamide **3ae'**



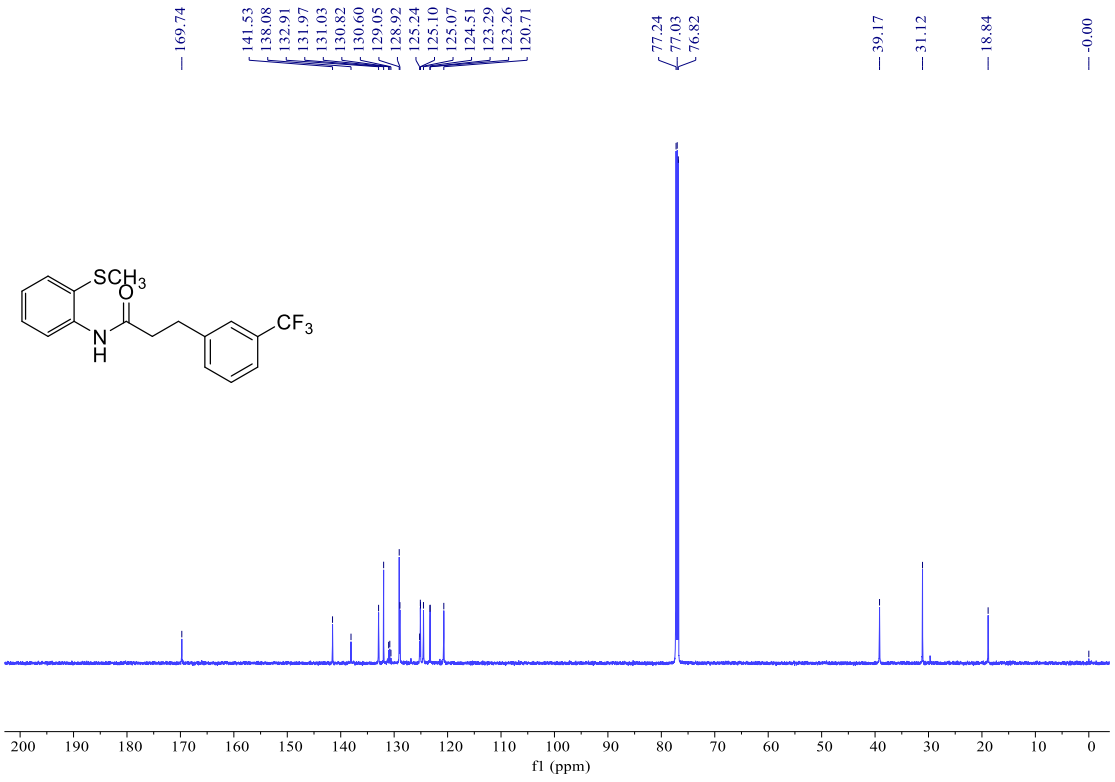
HRMS(ESI) of 3,3-bis(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)propanamide **3ae'**



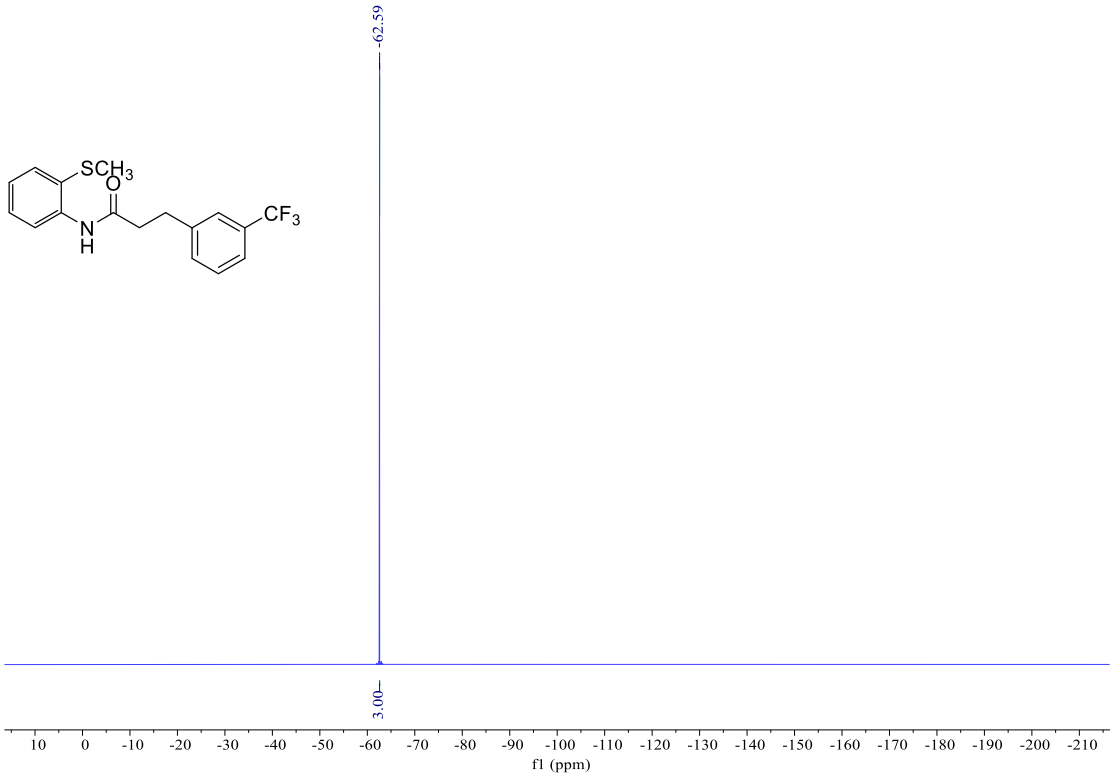
^{1}H NMR of N-(2-(methylthio)phenyl)-3-(3-(trifluoromethyl)phenyl)propanamide **3af**



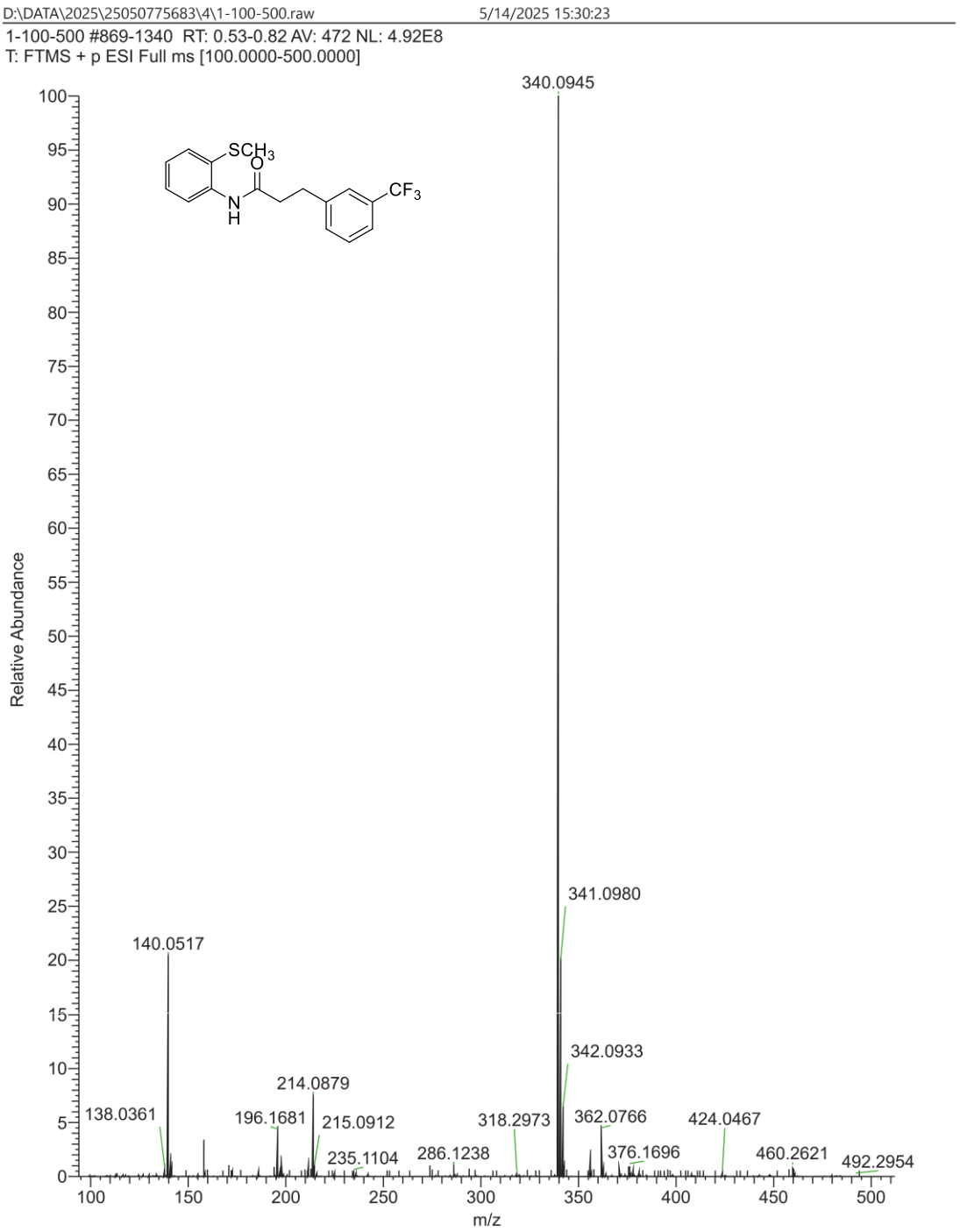
^{13}C NMR of N-(2-(methylthio)phenyl)-3-(3-(trifluoromethyl)phenyl)propanamide **3af**



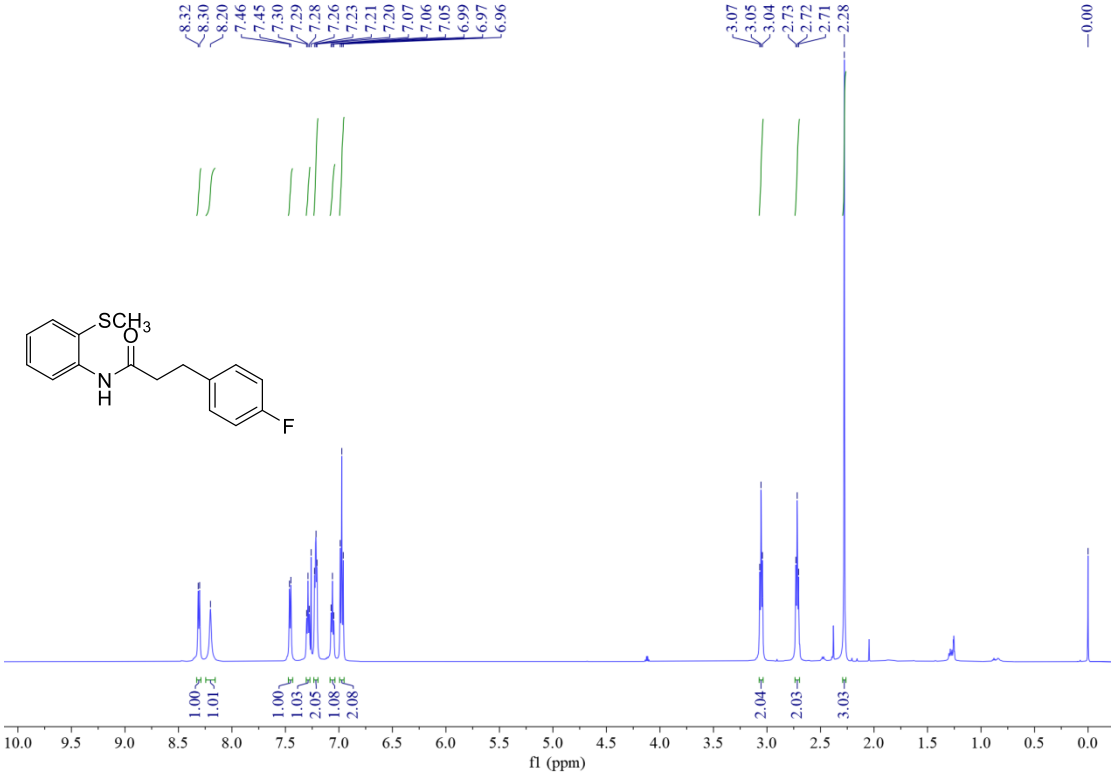
^{19}F NMR of N-(2-(methylthio)phenyl)-3-(3-(trifluoromethyl)phenyl)propanamide **3af**



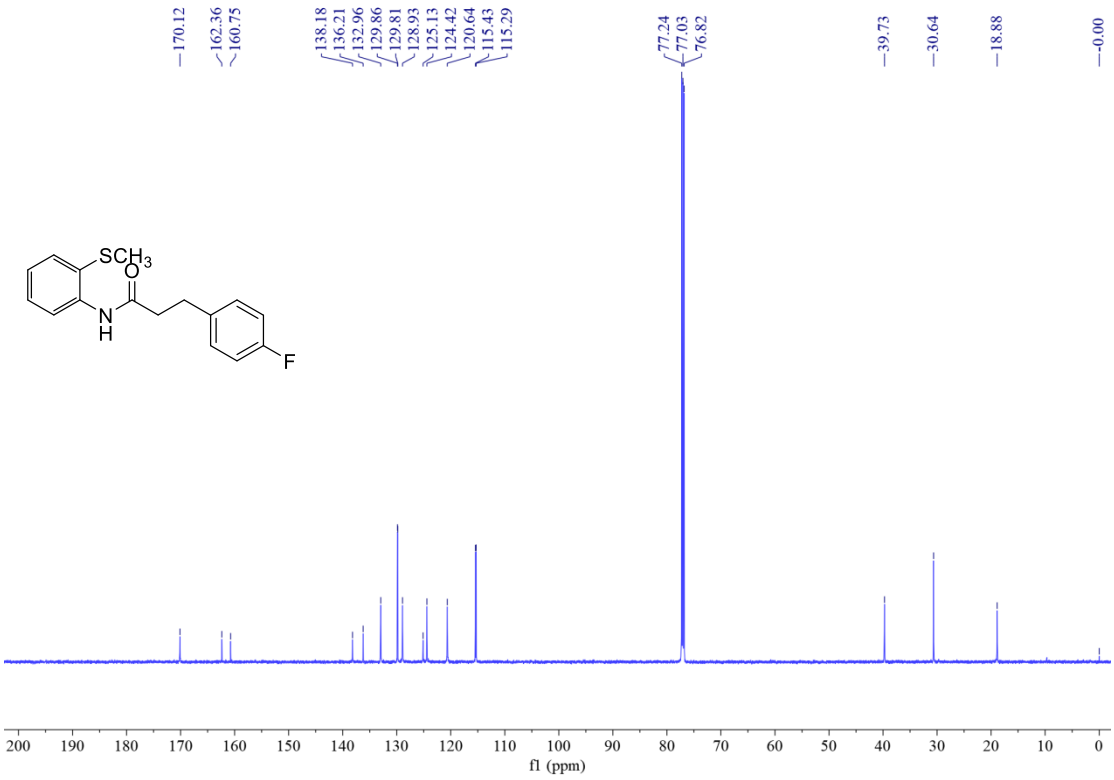
HRMS(ESI) of N-(2-(methylthio)phenyl)-3-(3-(trifluoromethyl)phenyl)propanamide **3af**



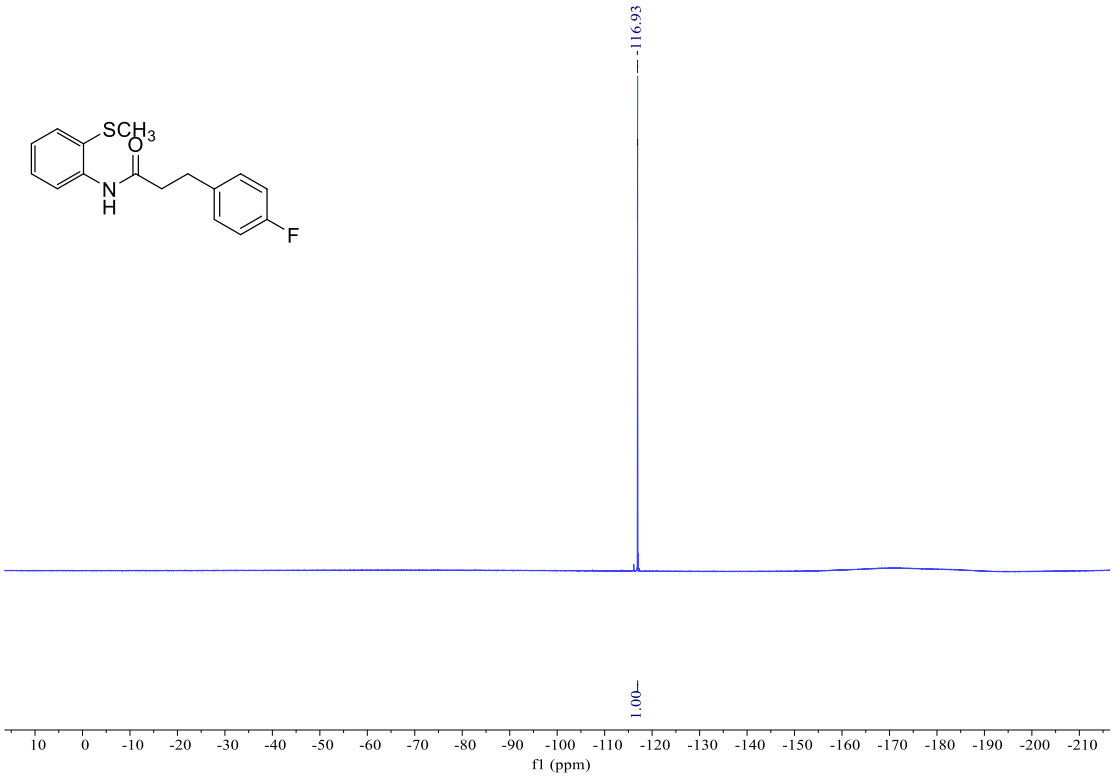
^{1}H NMR of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3ag**



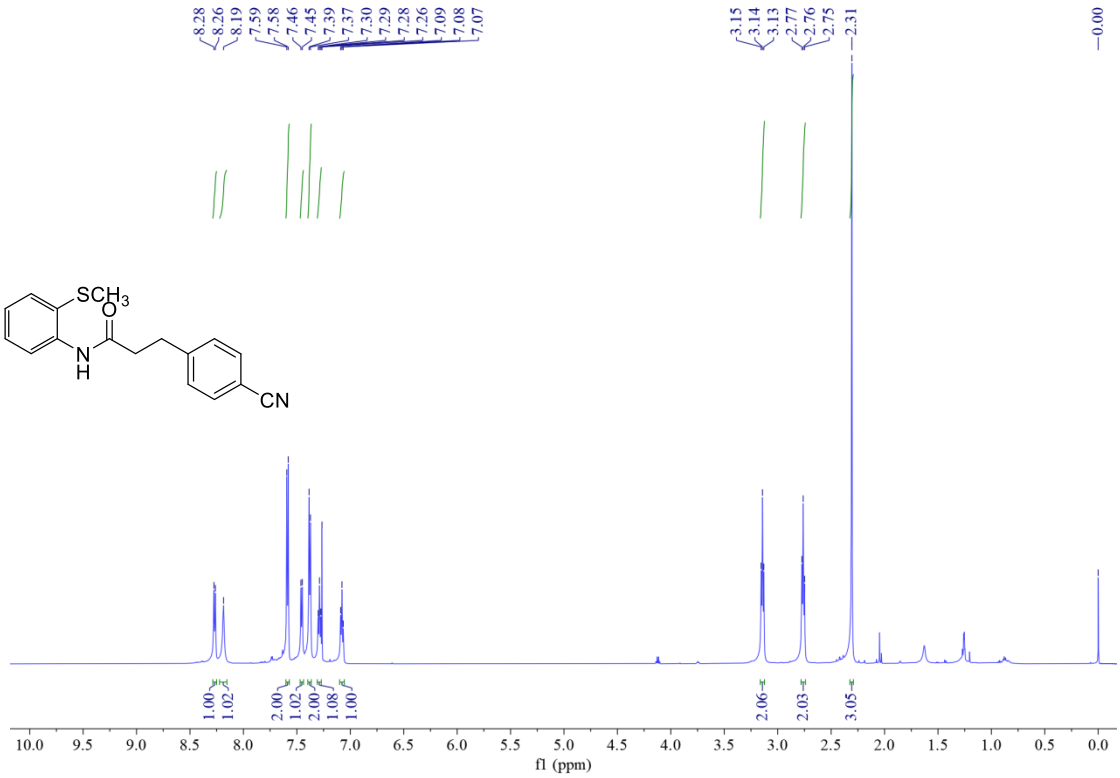
^{13}C NMR of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3ag**



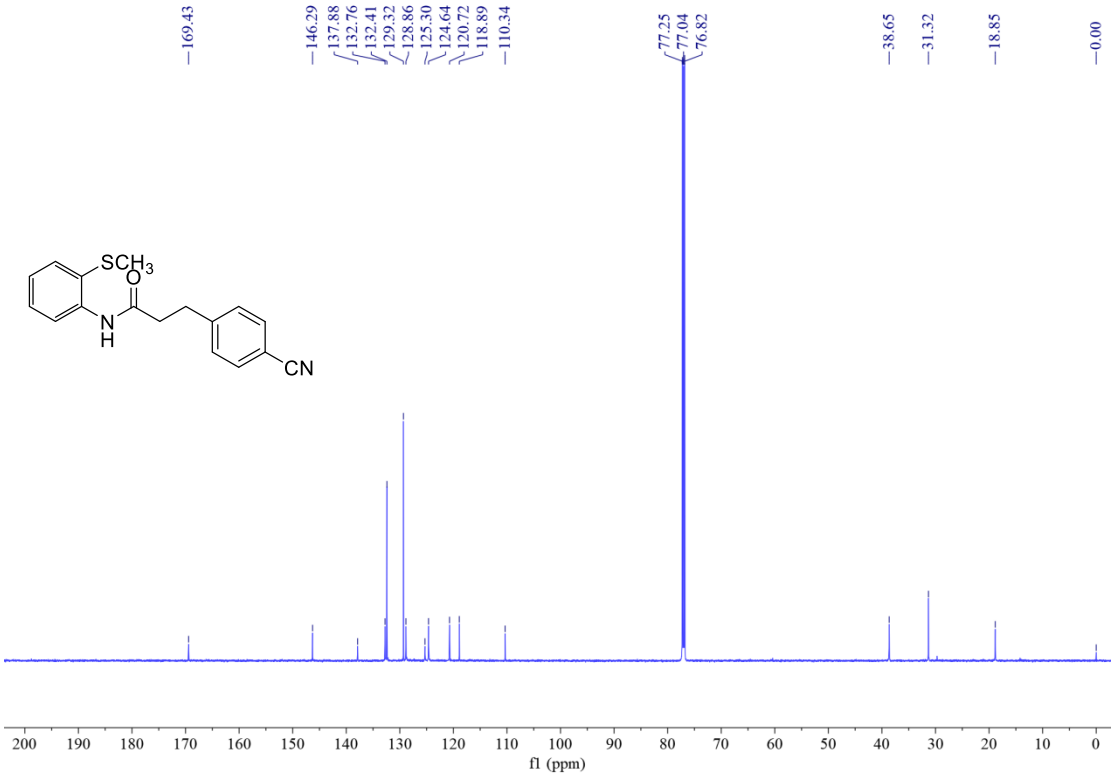
^{19}F NMR of 3-(4-fluorophenyl)-N-(2-(methylthio)phenyl)propanamide **3ag**



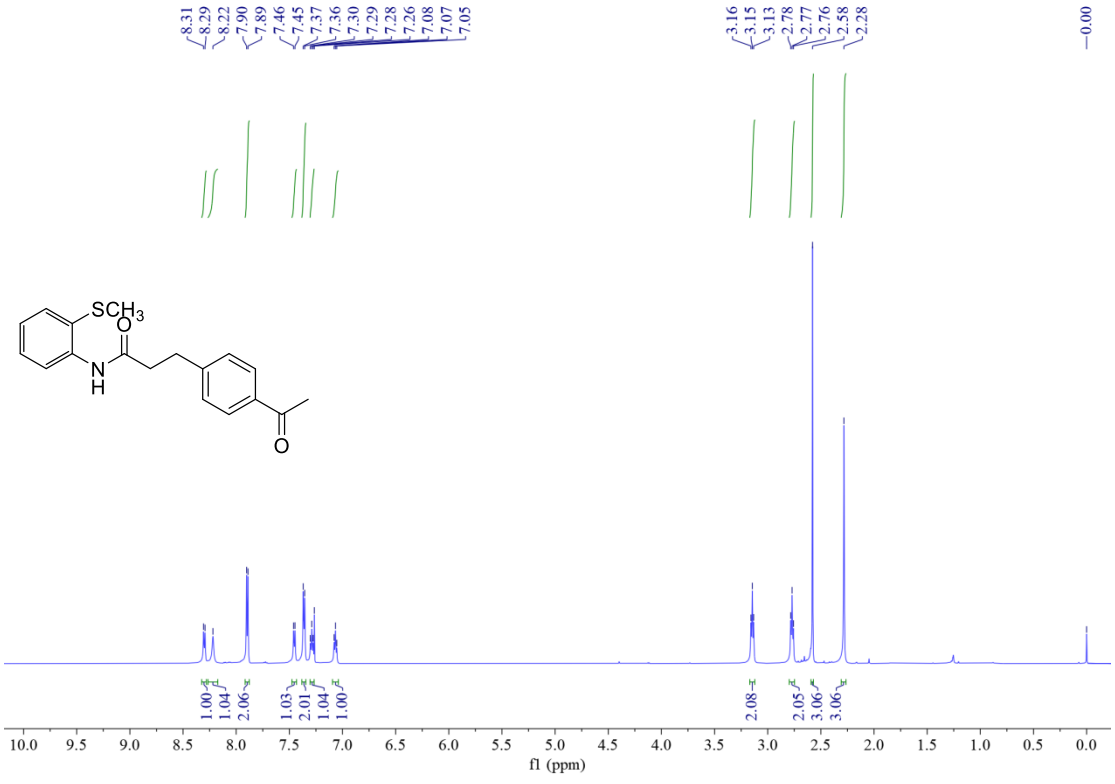
^{1}H NMR of 3-(4-cyanophenyl)-N-(2-(methylthio)phenyl)propanamide **3ah**



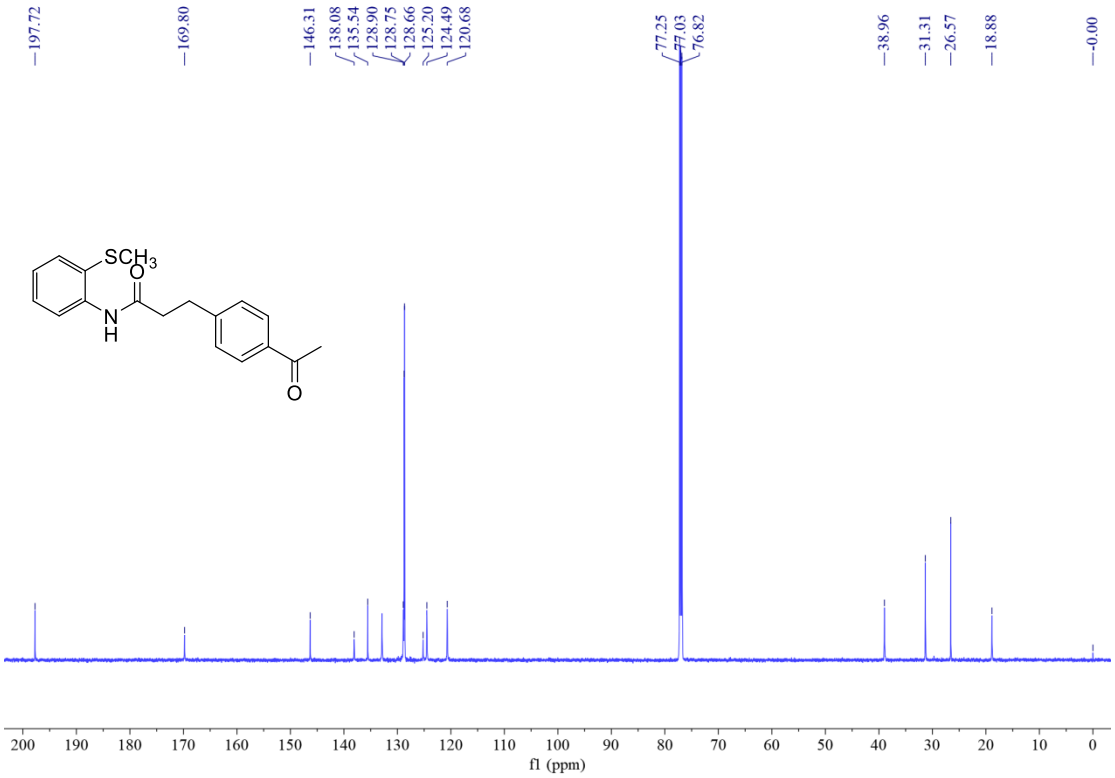
^{13}C NMR of 3-(4-cyanophenyl)-N-(2-(methylthio)phenyl)propanamide **3ah**



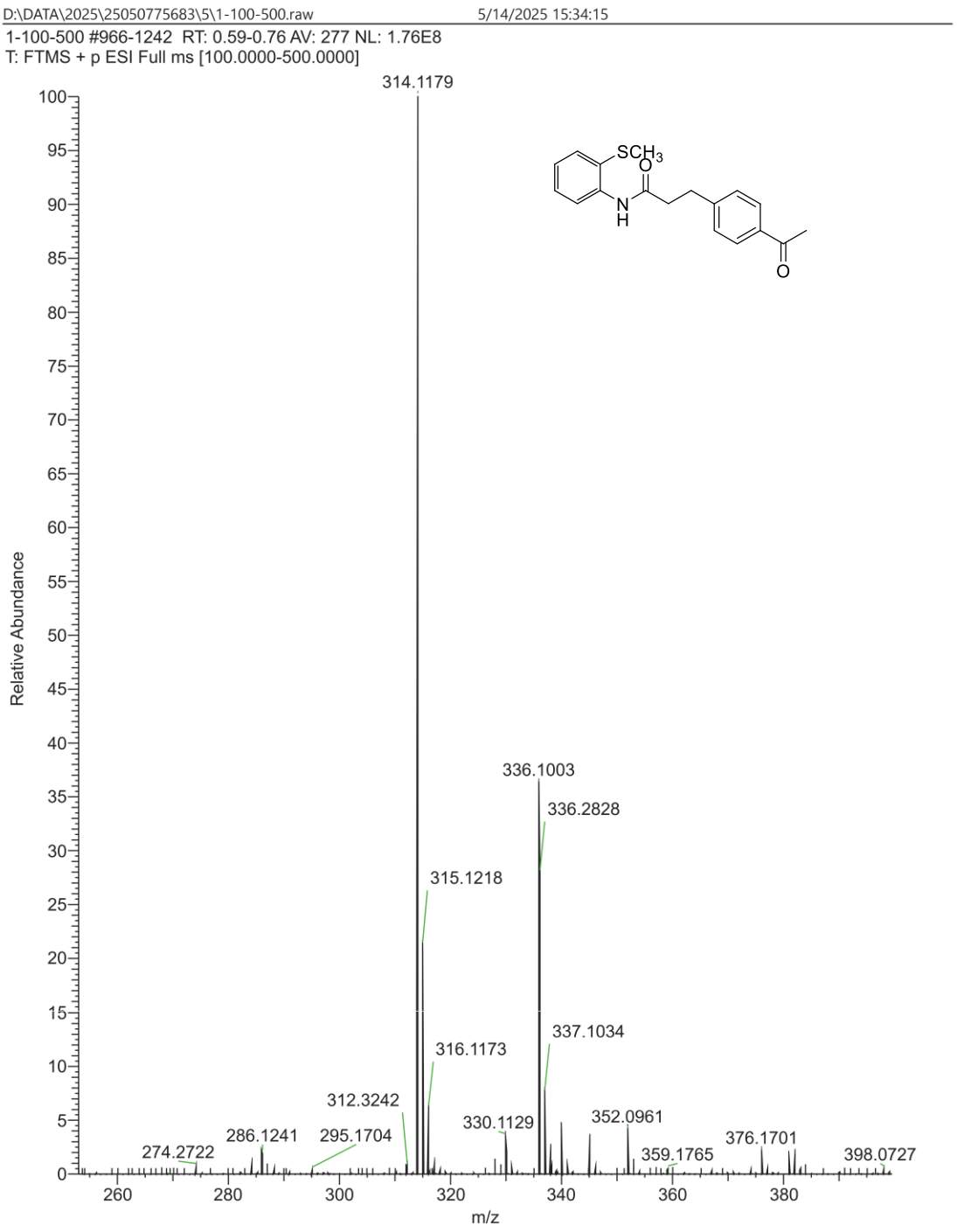
^{1}H NMR of 3-(4-acetylphenyl)-N-(2-(methylthio)phenyl)propanamide **3ai**



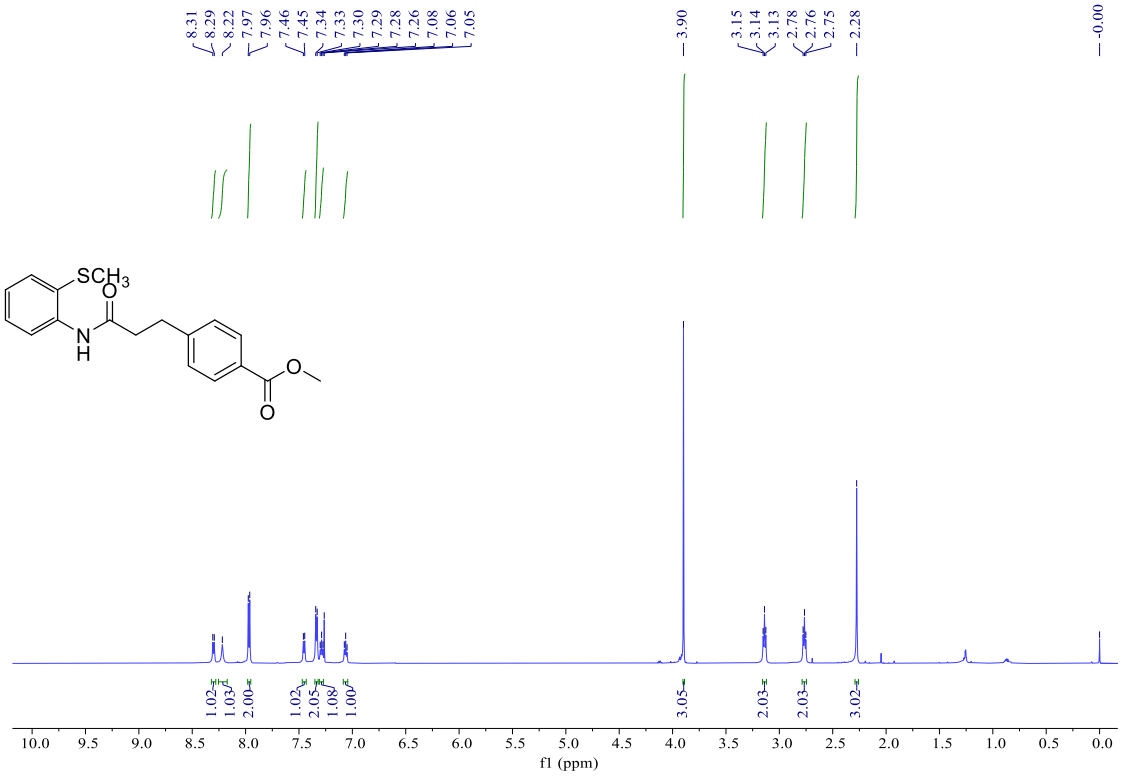
^{13}C NMR of 3-(4-acetylphenyl)-N-(2-(methylthio)phenyl)propanamide **3ai**



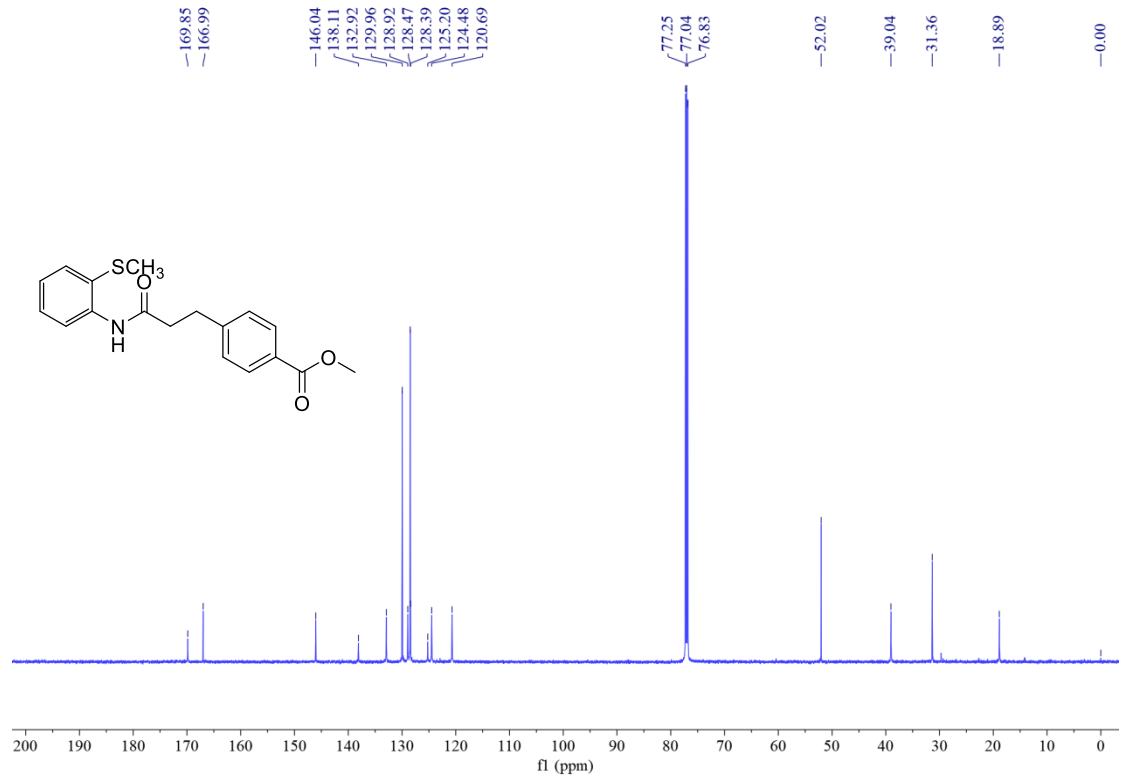
HRMS(ESI) of 3-(4-acetylphenyl)-N-(2-(methylthio)phenyl)propanamide **3ai**



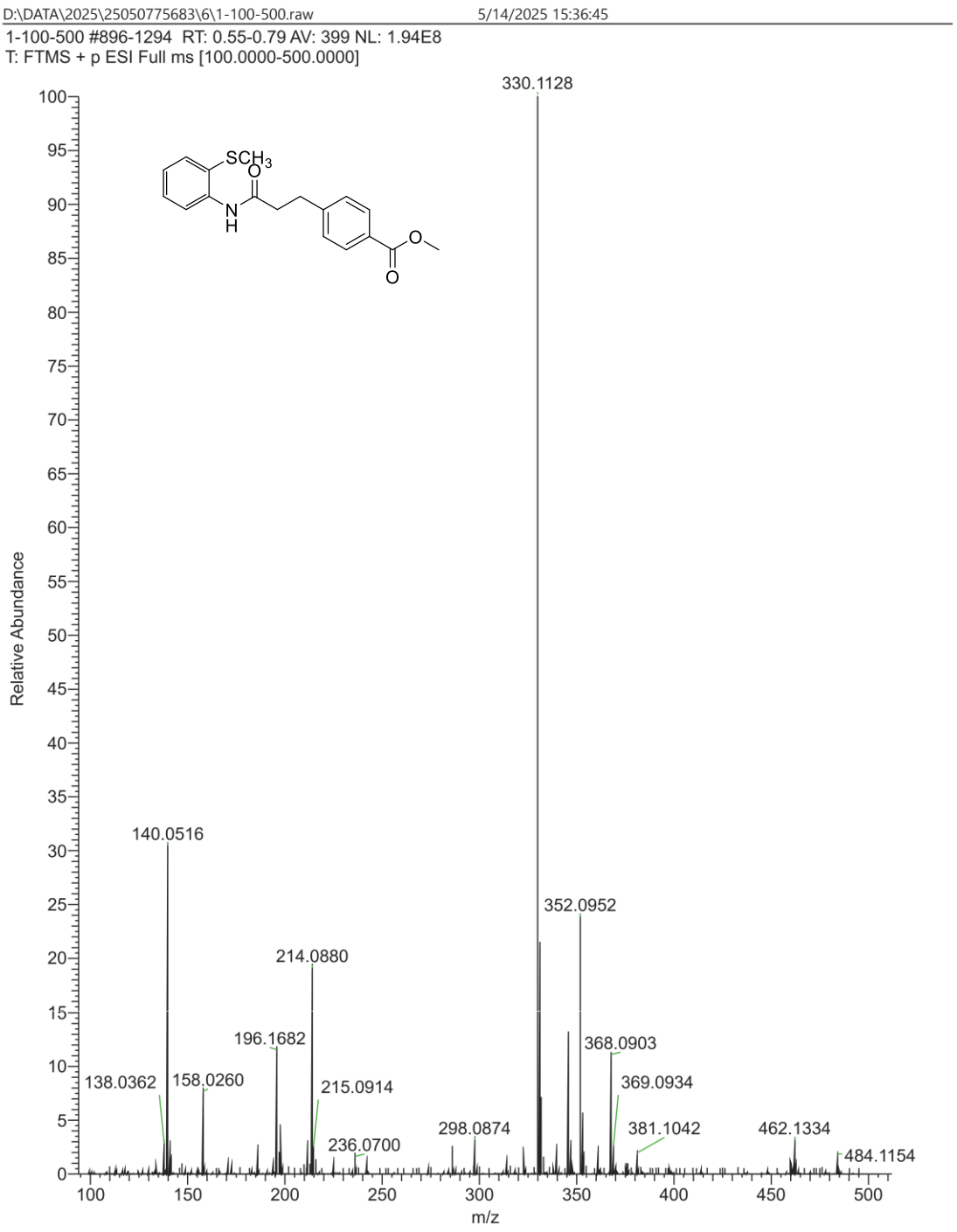
^{1}H NMR of methyl 4-(3-((2-(methylthio)phenyl)amino)-3-oxopropyl)benzoate **3aj**



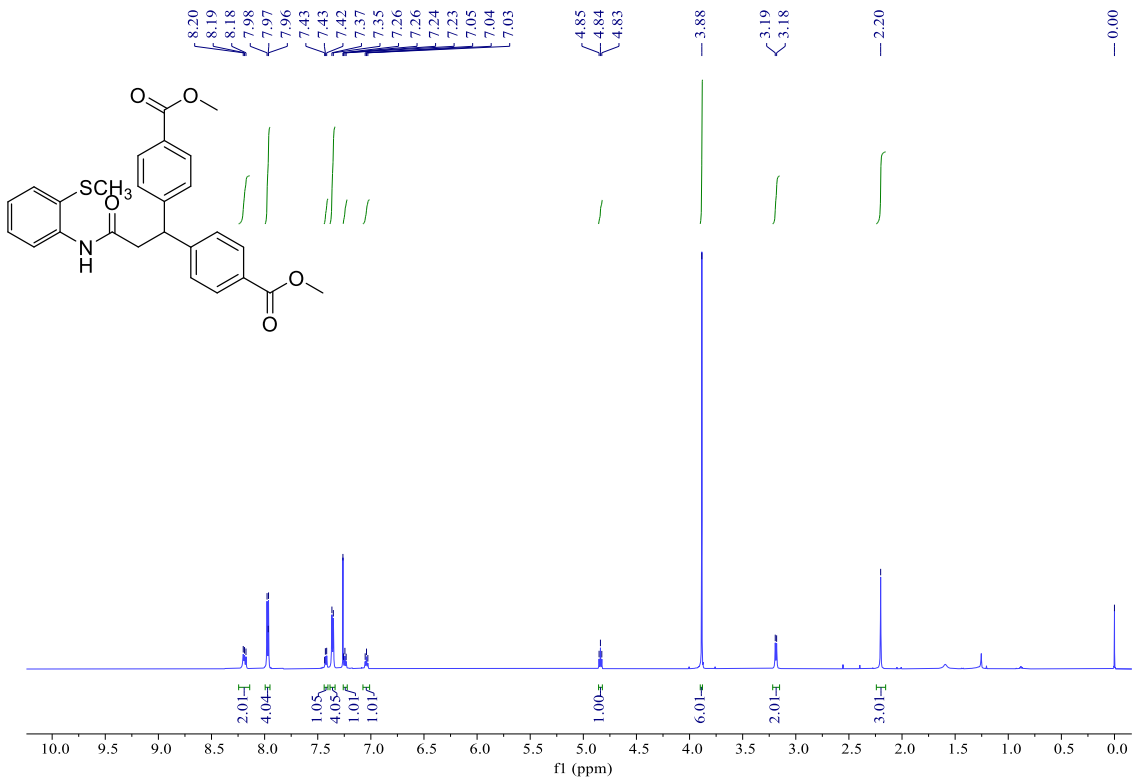
^{13}C NMR of methyl 4-(3-((2-(methylthio)phenyl)amino)-3-oxopropyl)benzoate **3aj**



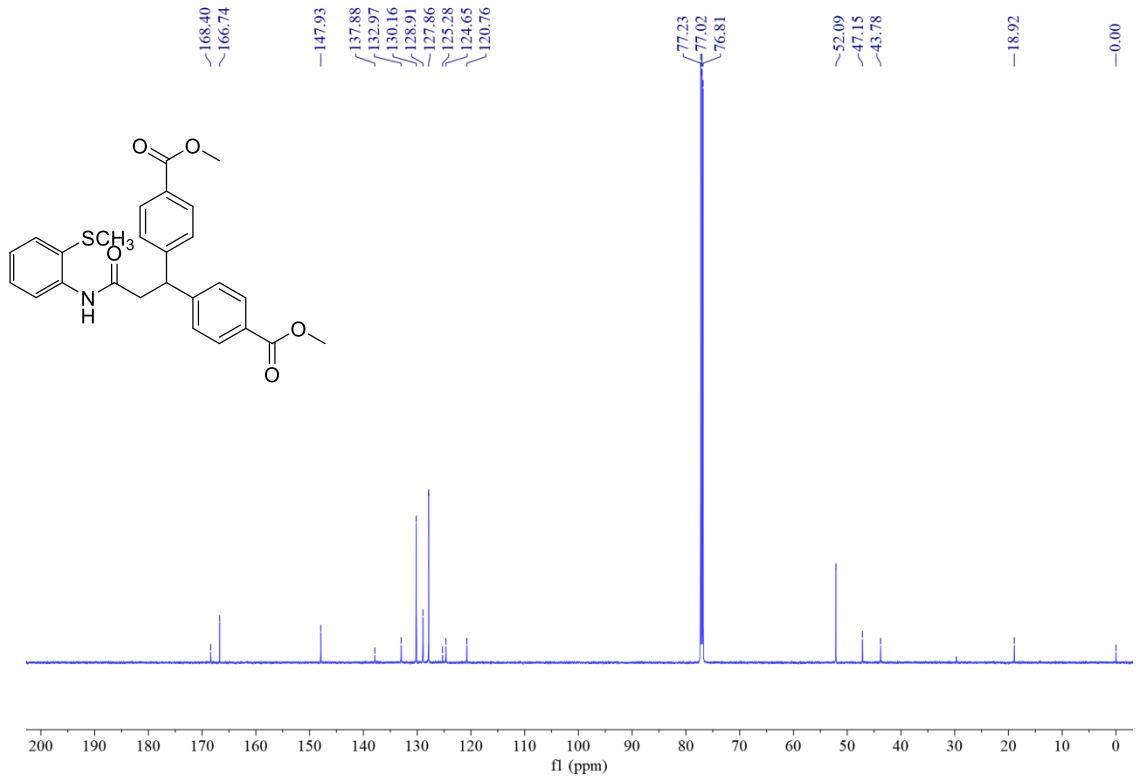
HRMS(ESI) of methyl 4-(3-((2-(methylthio)phenyl)amino)-3-oxopropyl)benzoate **3aj**



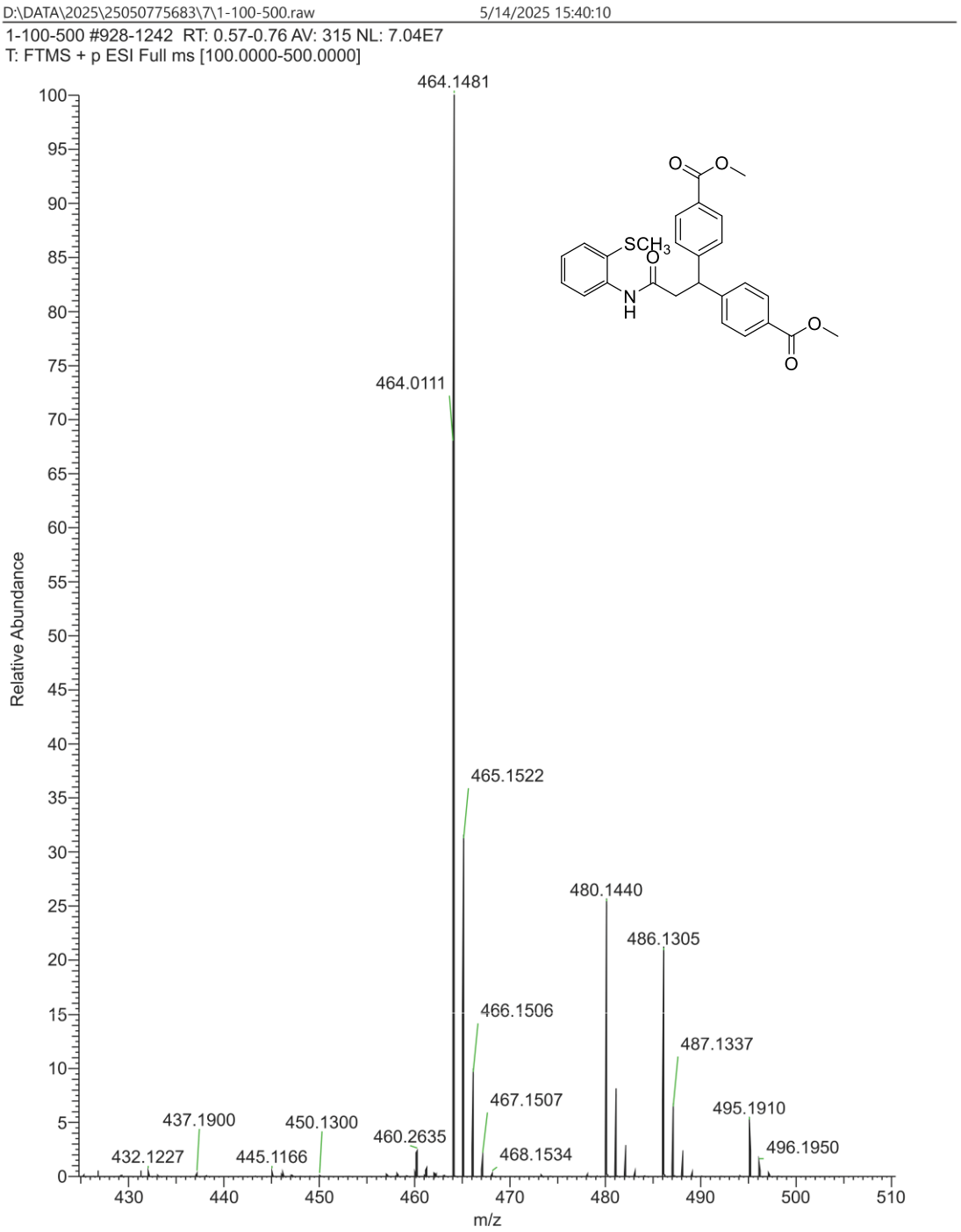
^{1}H NMR of dimethyl 4,4'-(3-((2-(methylthio)phenyl)amino)-3-oxopropane-1,1-diyl)dibenzoate **3aj'**



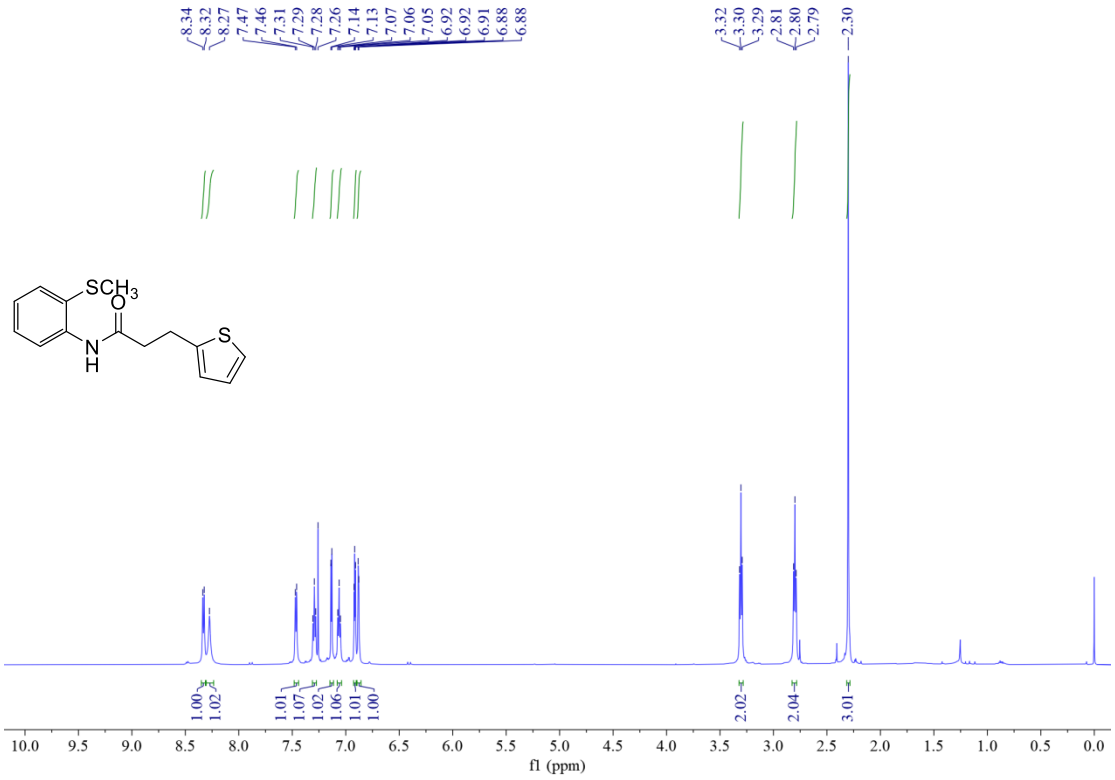
^{13}C NMR of dimethyl 4,4'-(3-((2-(methylthio)phenyl)amino)-3-oxopropane-1,1-diyl)dibenzoate **3aj'**



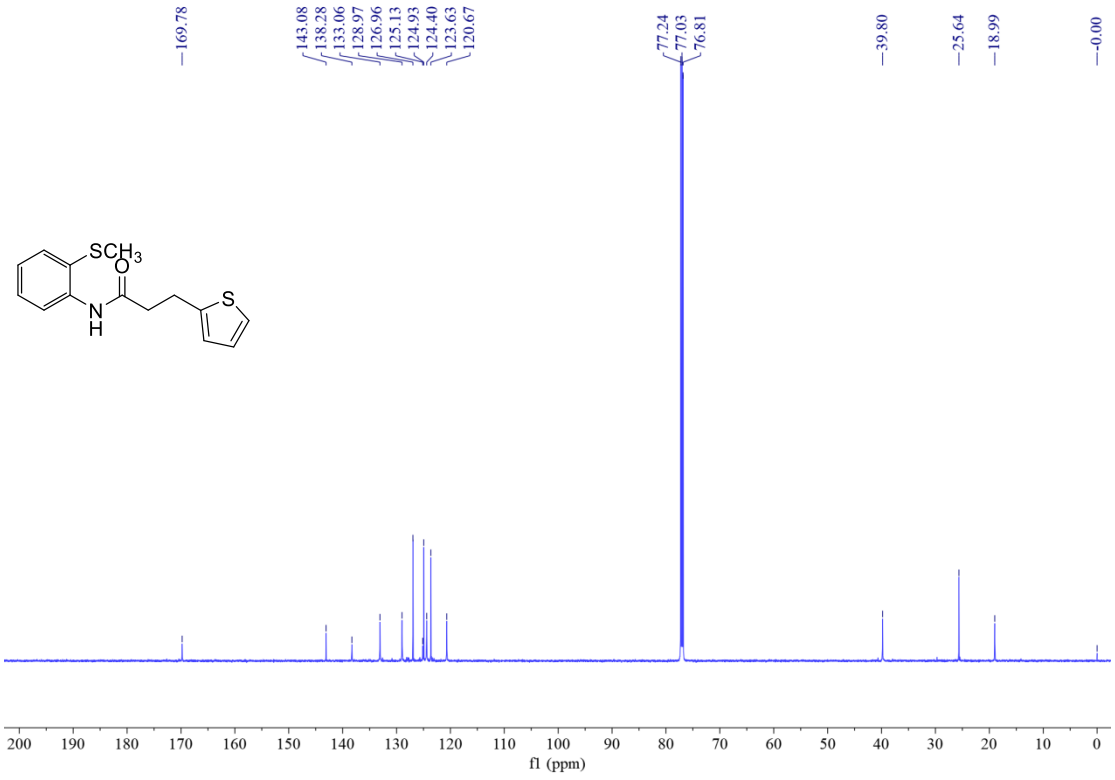
HRMS(ESI) of dimethyl 4,4'-(3-((2-(methylthio)phenyl)amino)-3-oxopropane-1,1-diyl)dibenzoate **3aj'**



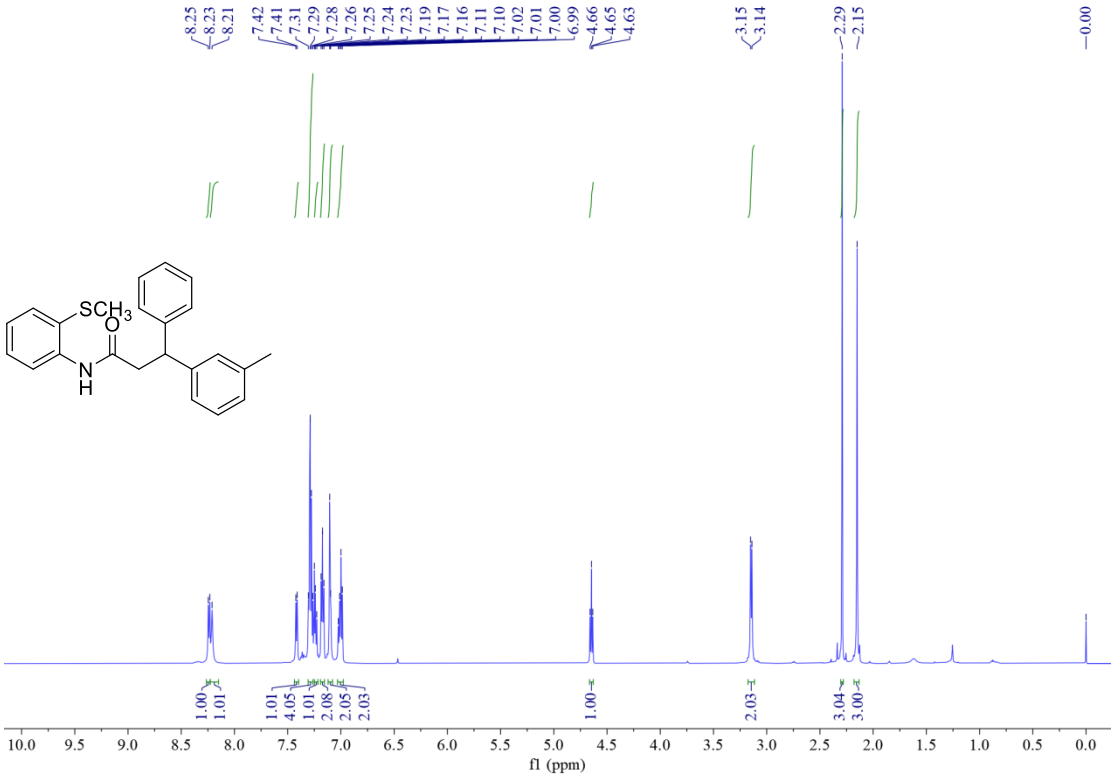
^{1}H NMR of N-(2-(methylthio)phenyl)-3-(thiophen-2-yl)propanamide **3ak**



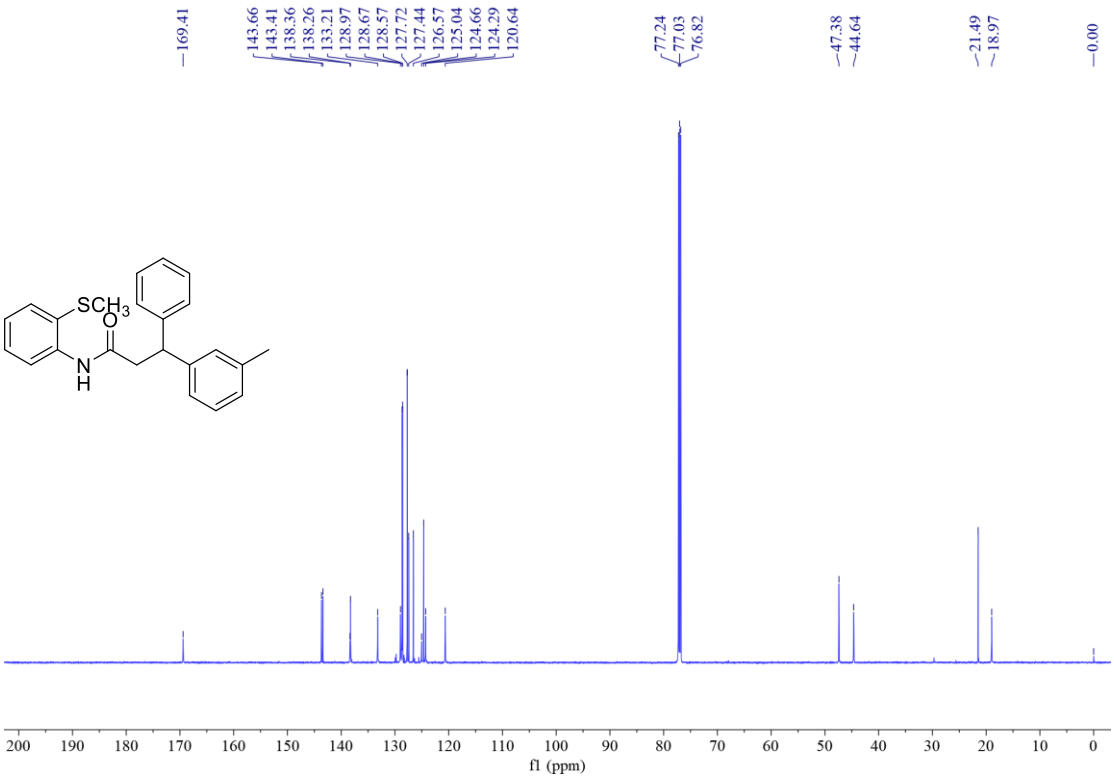
^{13}C NMR of N-(2-(methylthio)phenyl)-3-(thiophen-2-yl)propanamide **3ak**



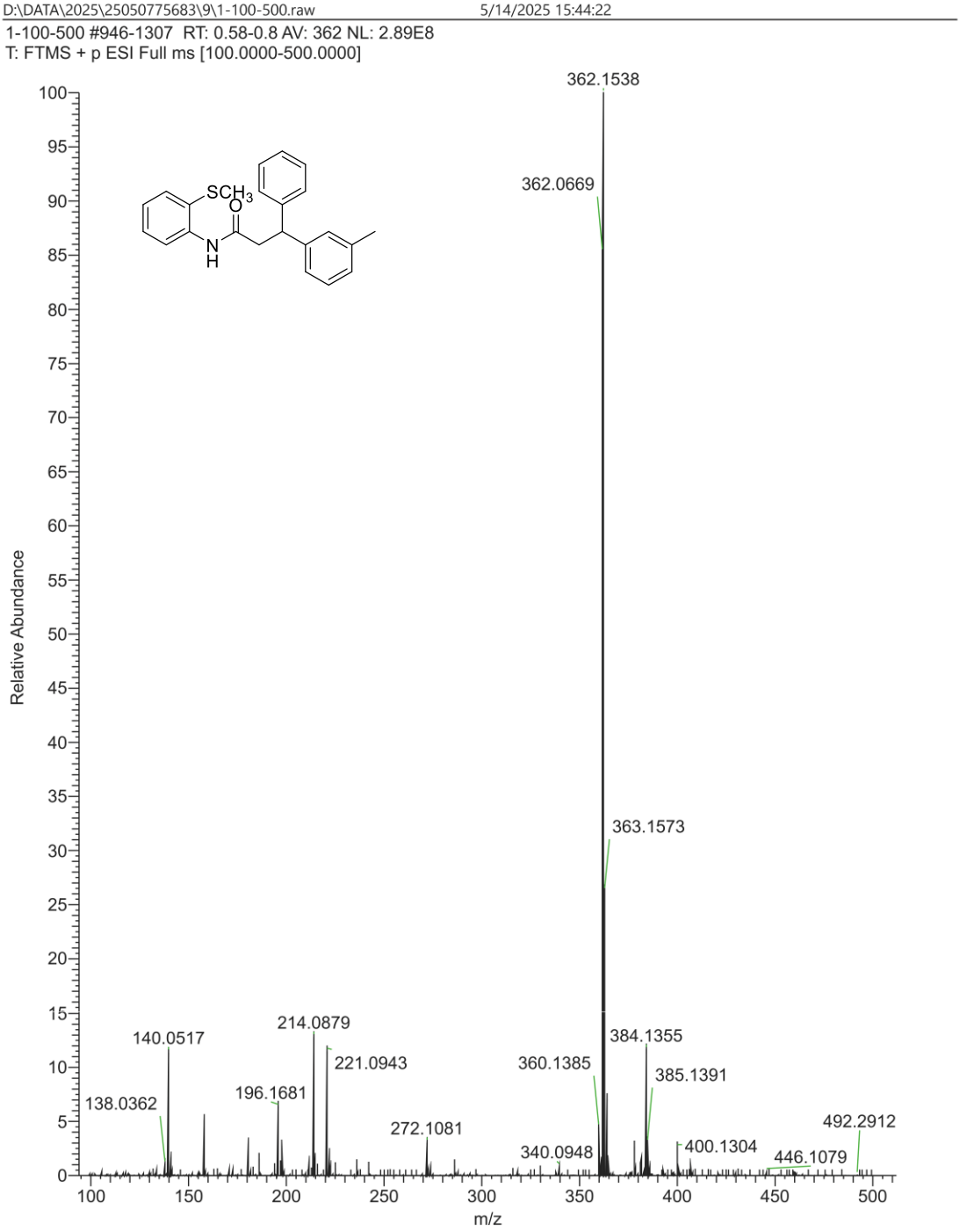
^{1}H NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(m-tolyl)propanamide **3ba**



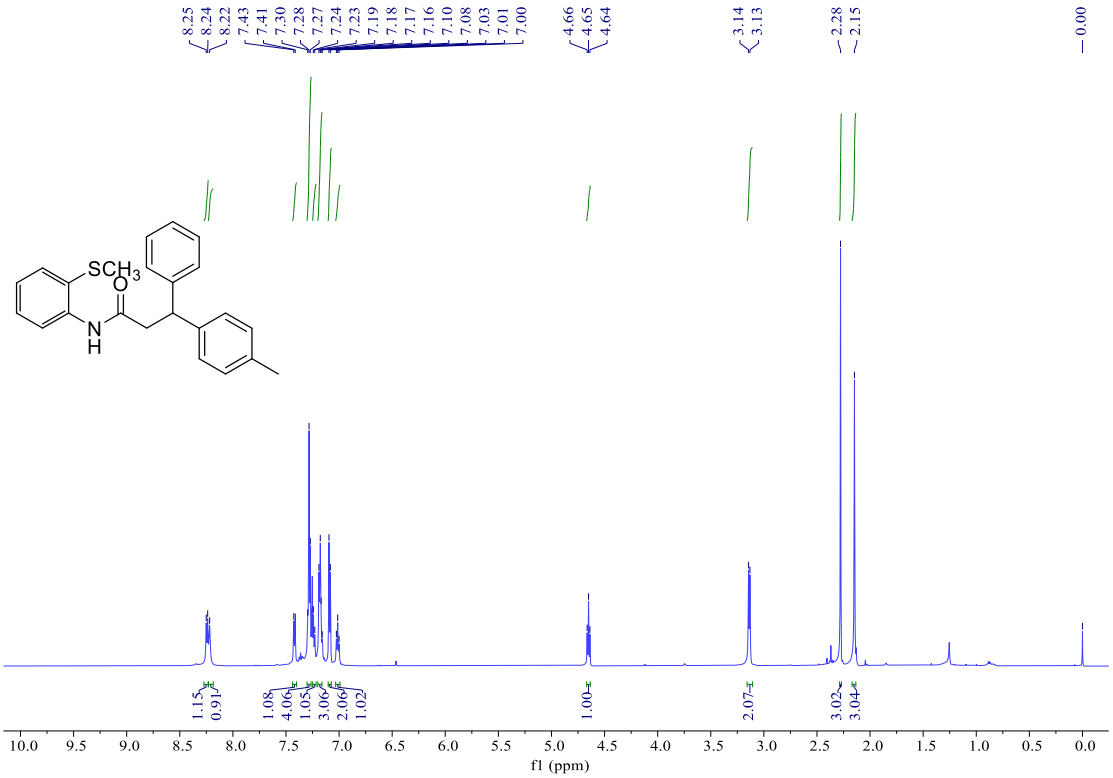
^{13}C NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(m-tolyl)propanamide **3ba**



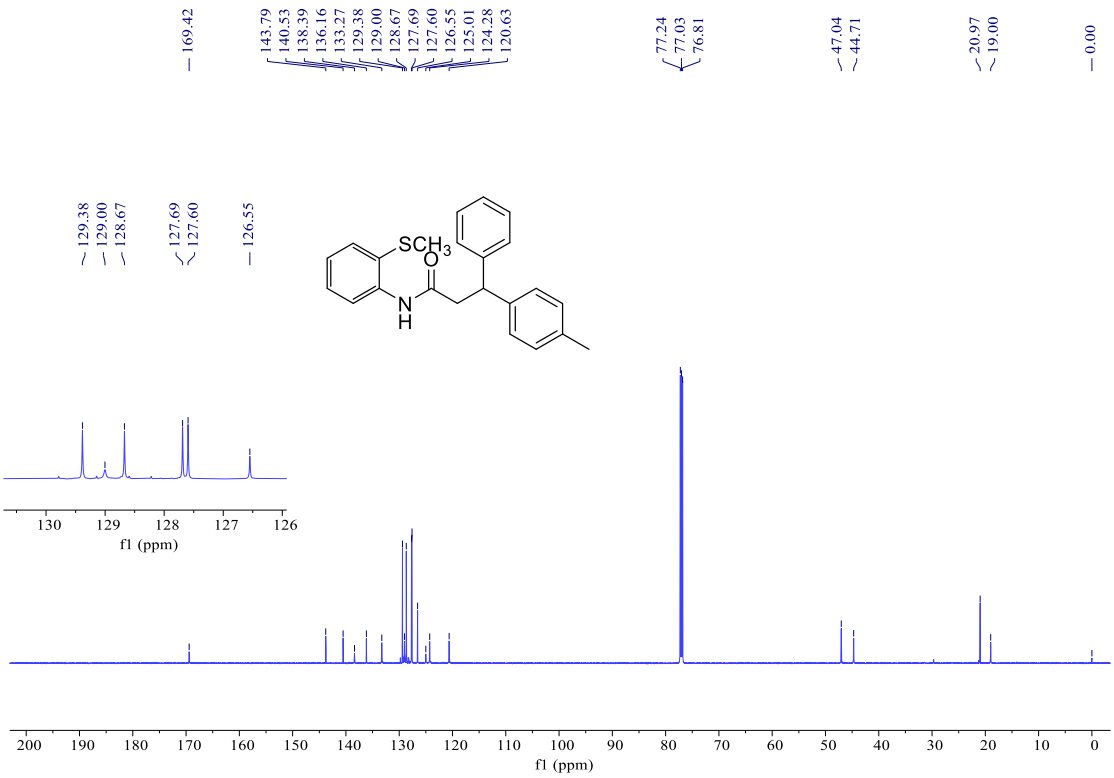
HRMS(ESI) of N-(2-(methylthio)phenyl)-3-phenyl-3-(m-tolyl)propanamide **3ba**



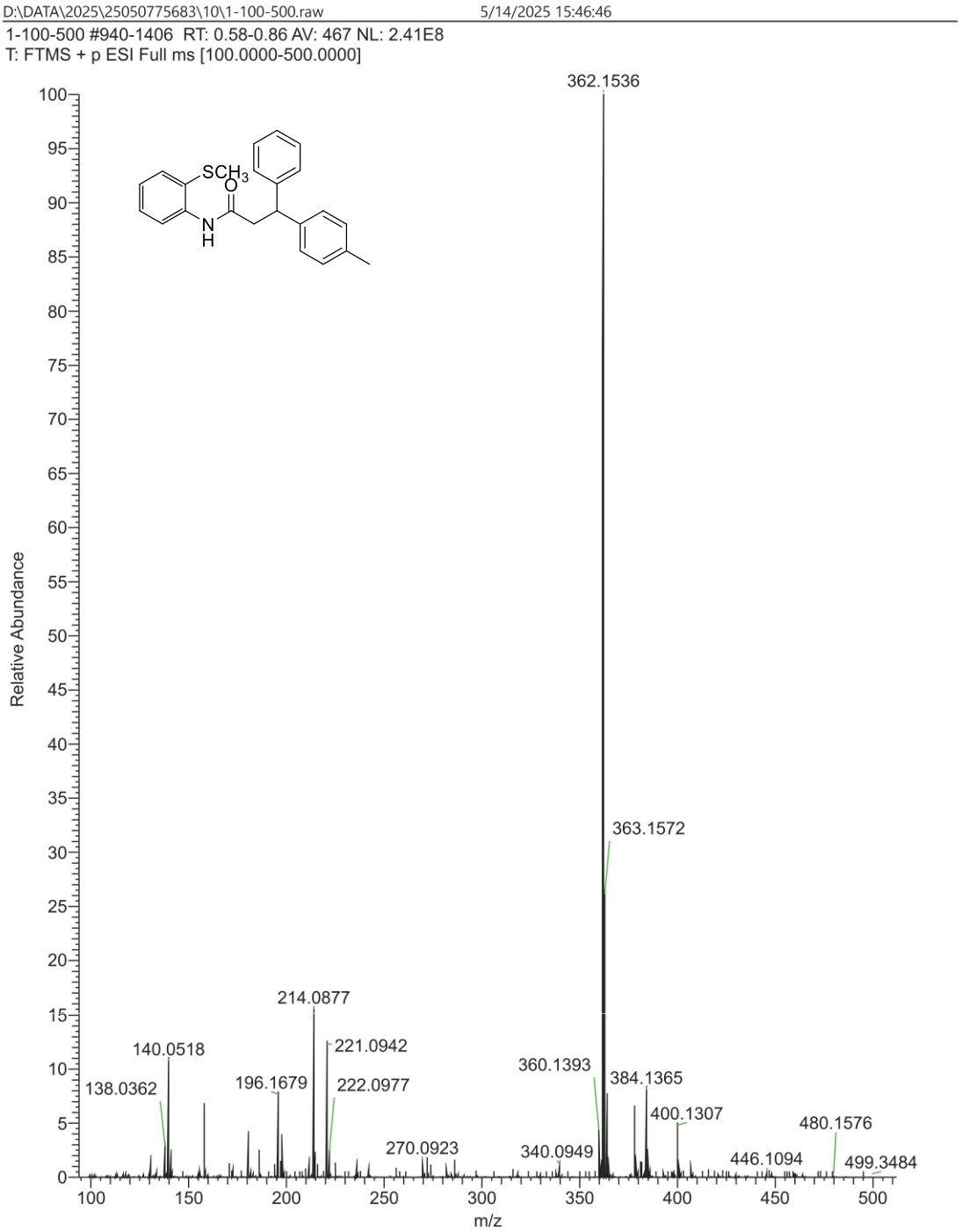
^{1}H NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(p-tolyl)propanamide **3bc**



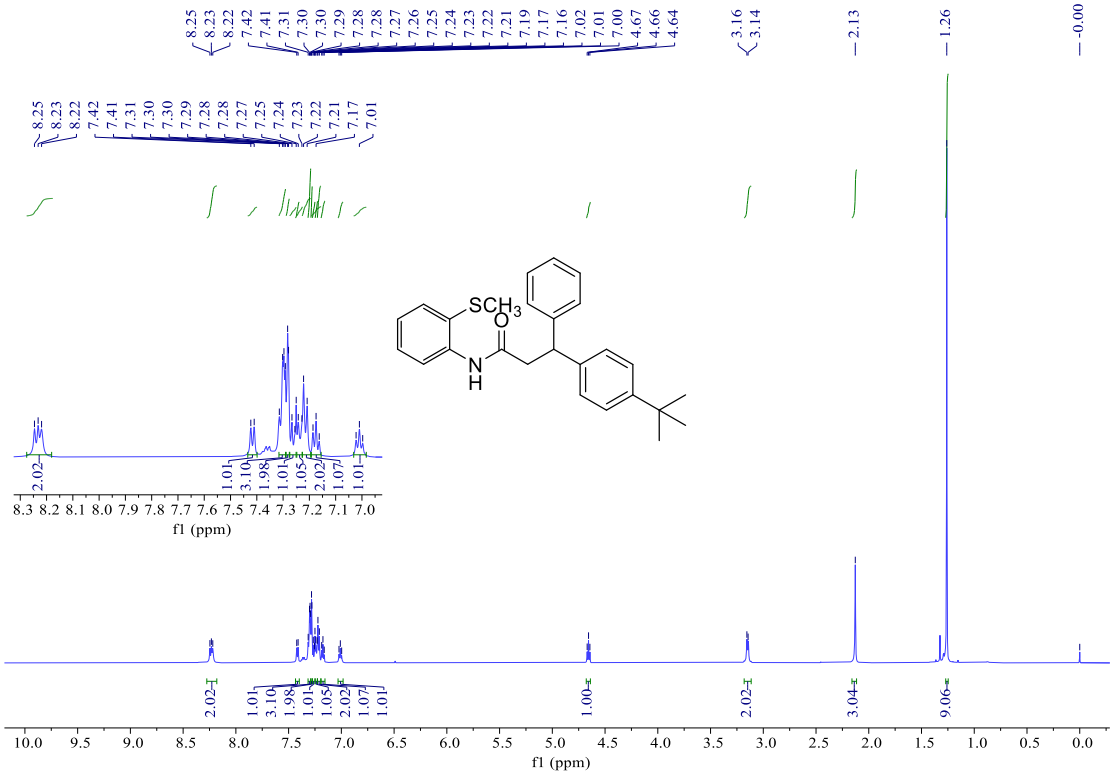
^{13}C NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(p-tolyl)propanamide **3bc**



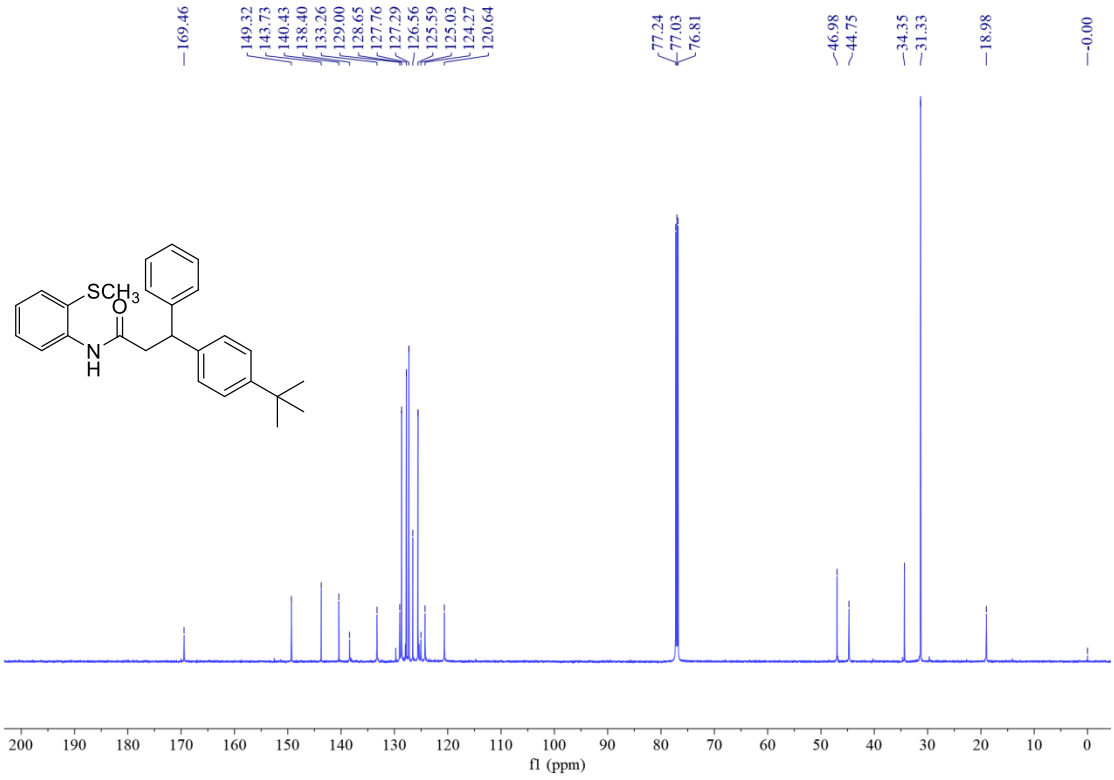
HRMS(ESI) of N-(2-(methylthio)phenyl)-3-phenyl-3-(p-tolyl)propanamide **3bc**



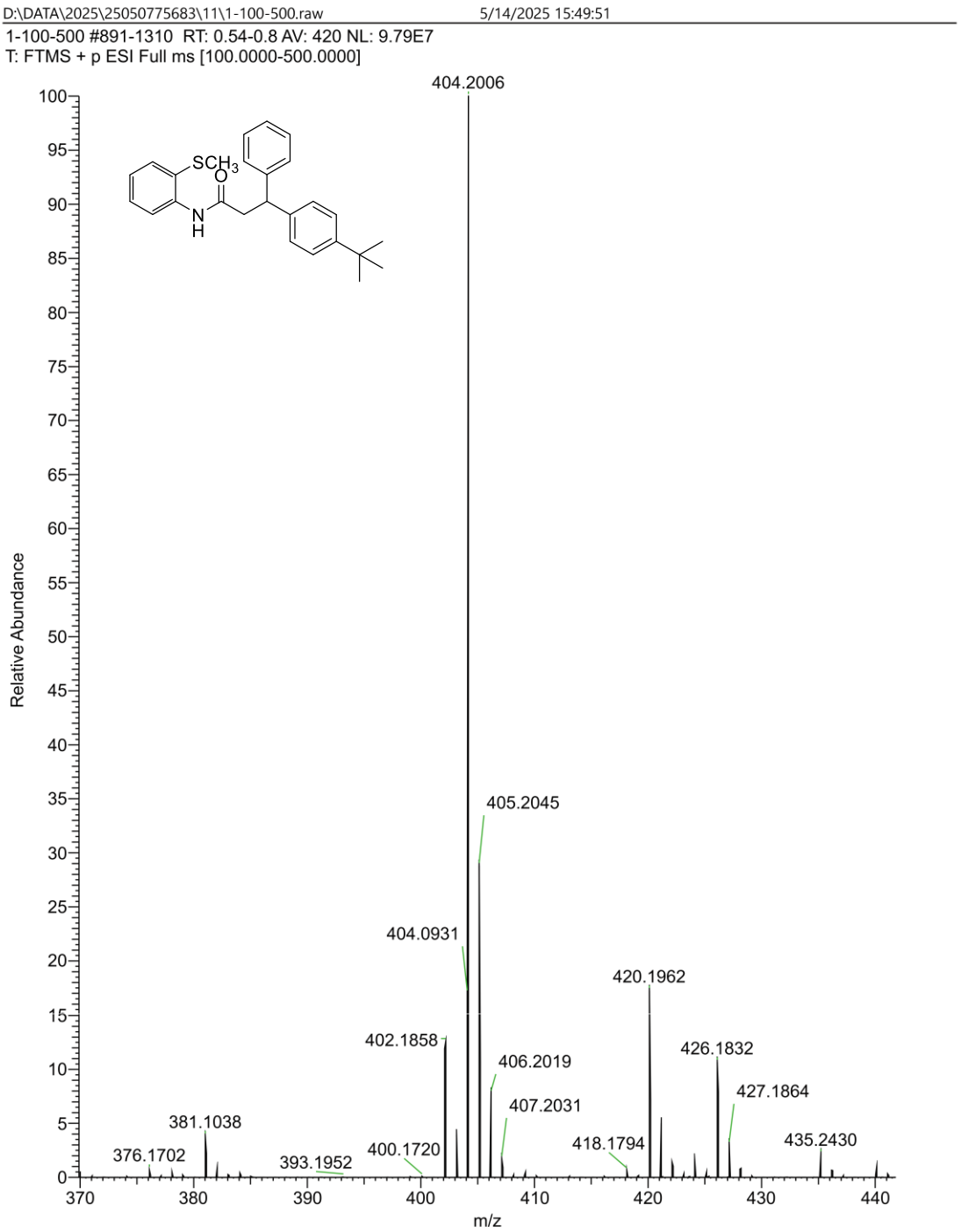
^{1}H NMR of 3-(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3be**



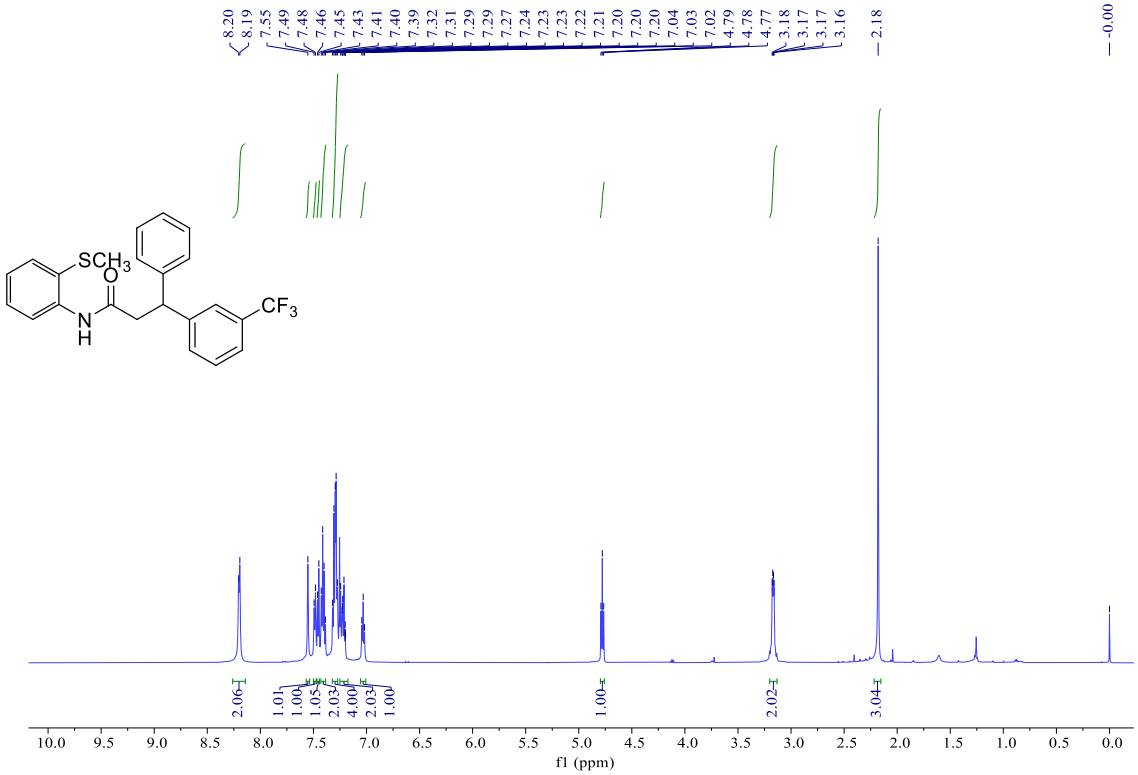
^{13}C NMR of 3-(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3be**



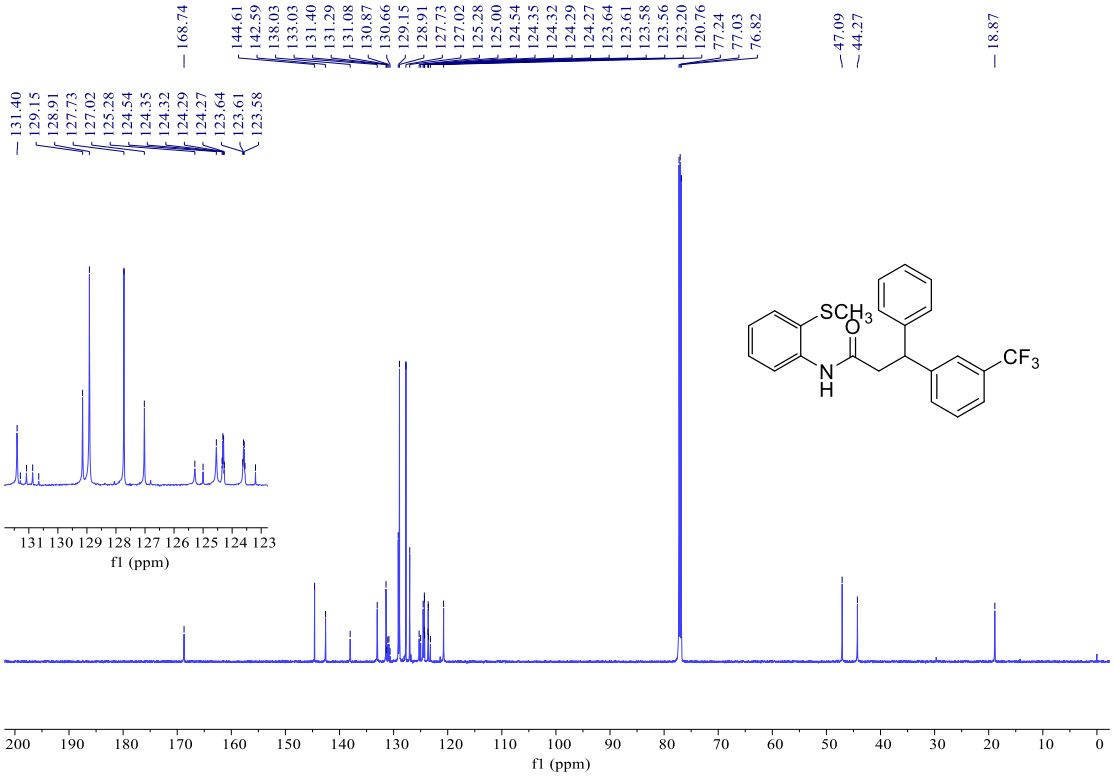
HRMS(ESI) of 3-(4-(tert-butyl)phenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3be**



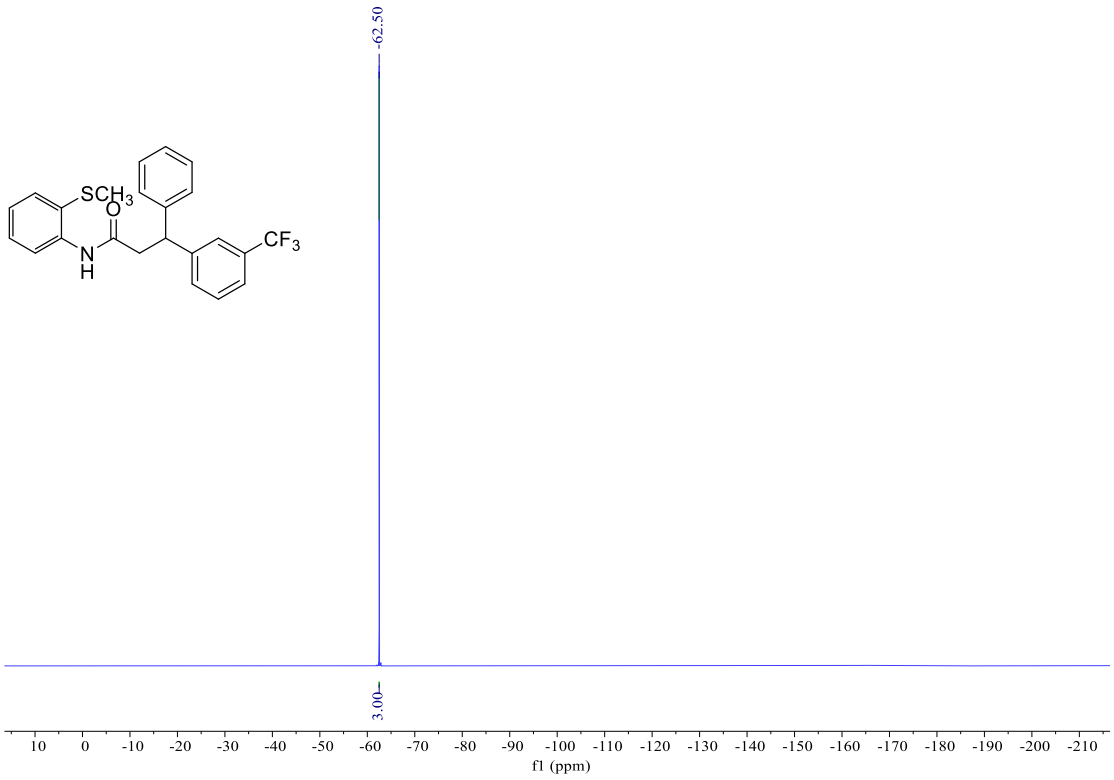
^{1}H NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(3-(trifluoromethyl)phenyl)propanamide **3bf**



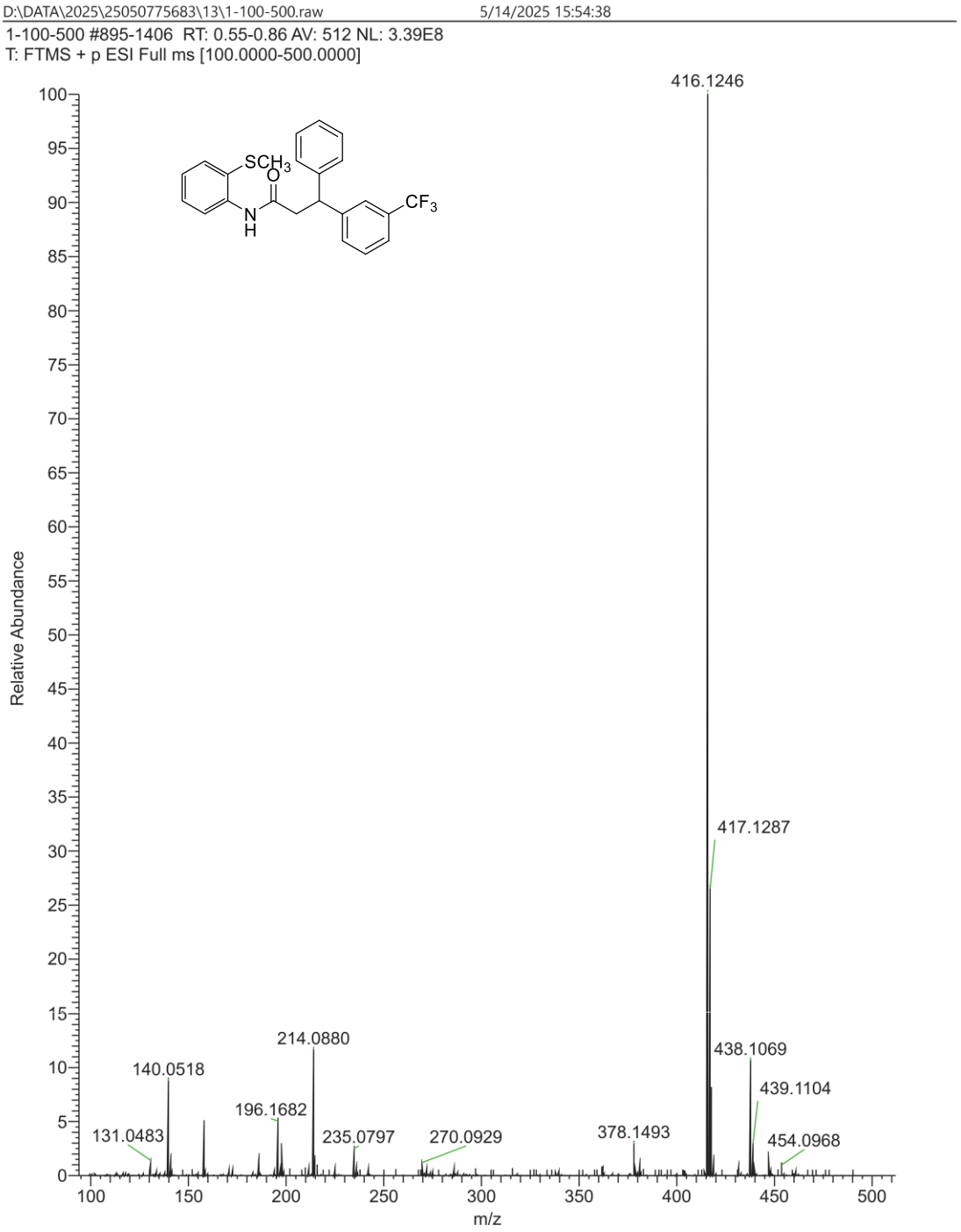
^{13}C NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(3-(trifluoromethyl)phenyl)propanamide **3bf**



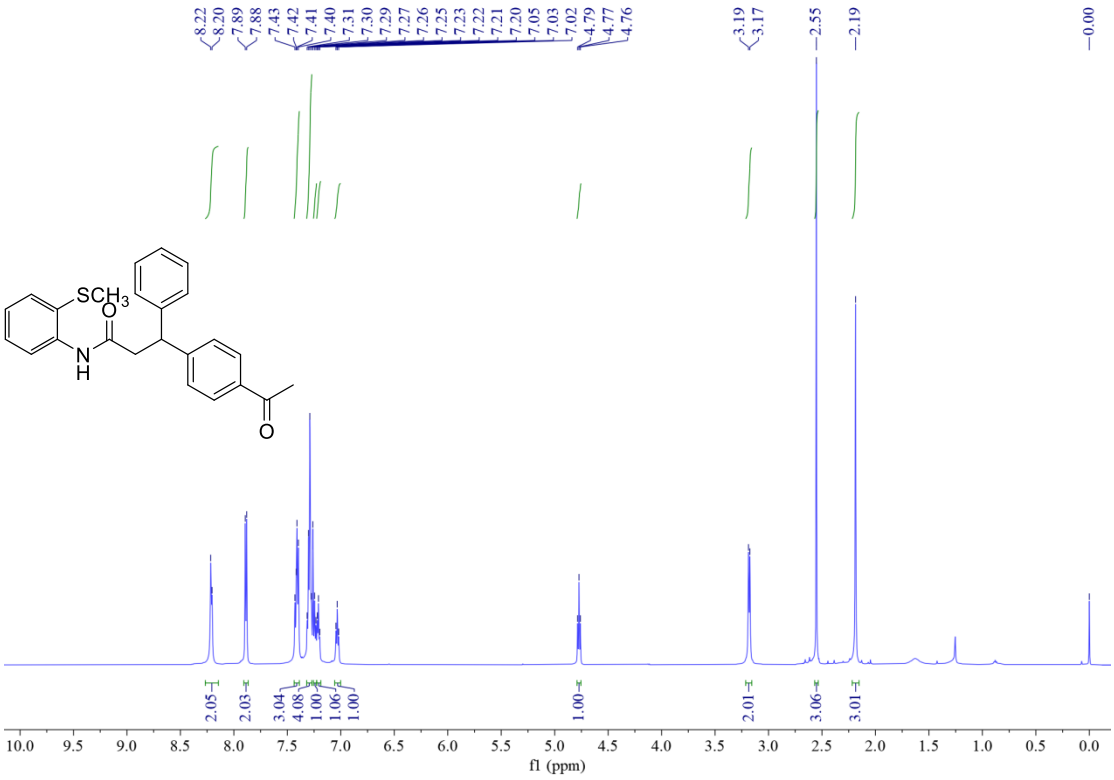
^{19}F NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(3-(trifluoromethyl)phenyl)propanamide **3bf**



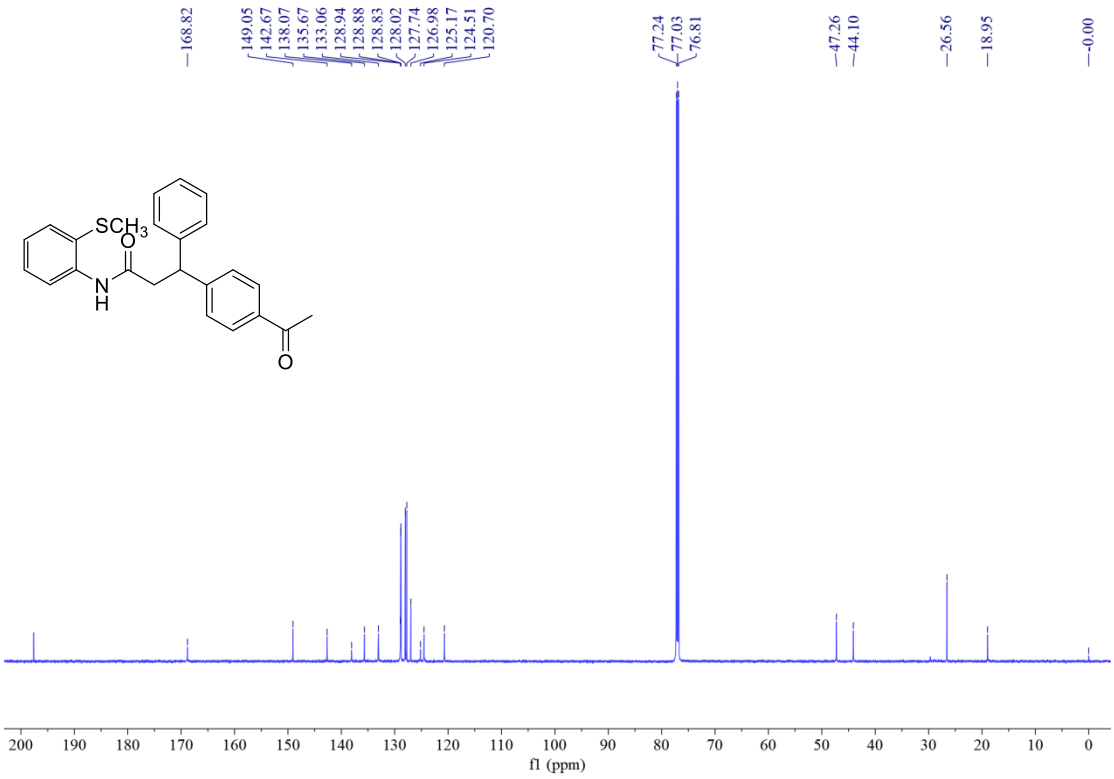
HRMS(ESI) of N-(2-(methylthio)phenyl)-3-phenyl-3-(3-(trifluoromethyl)phenyl)propanamide **3bf**



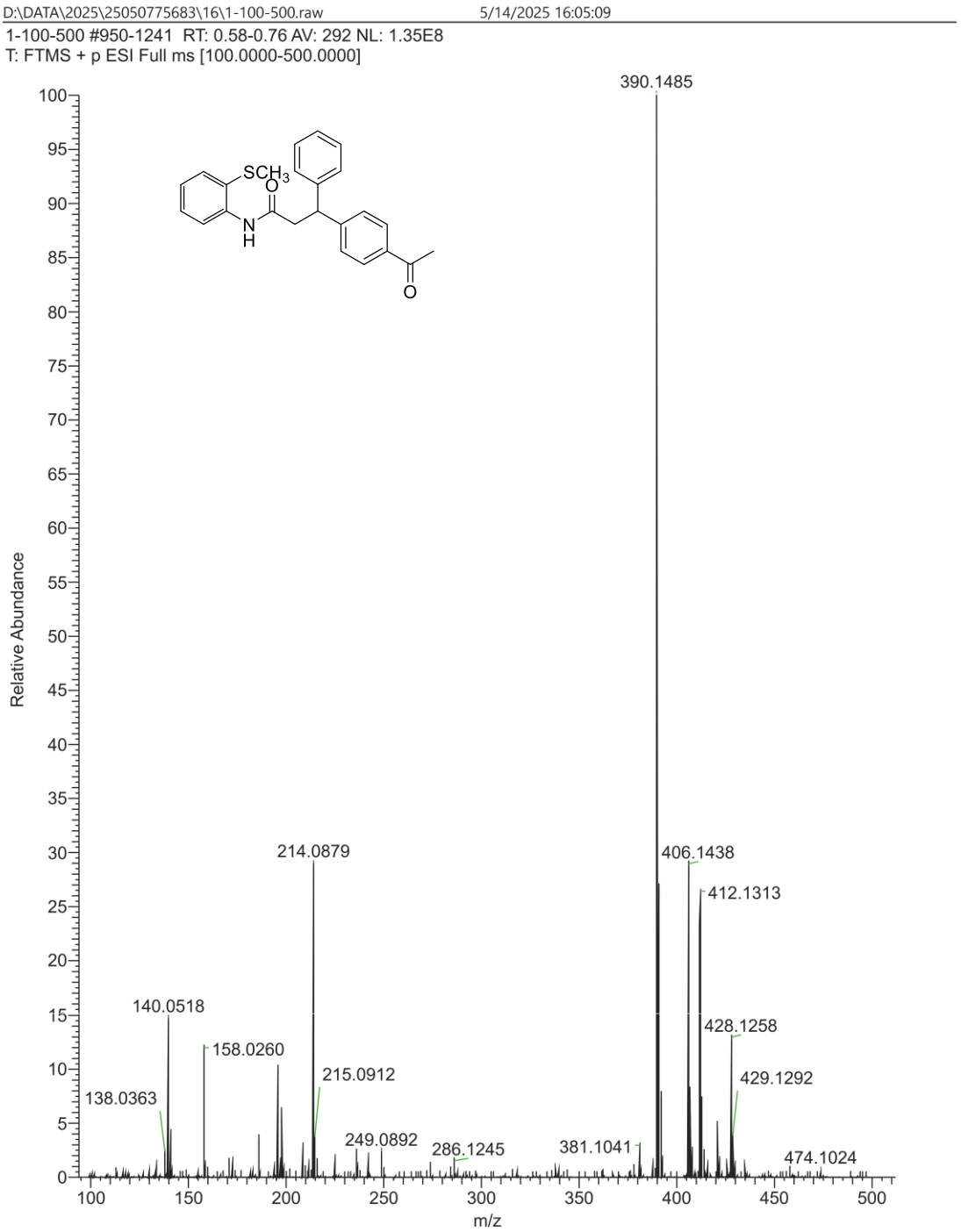
^{1}H NMR of 3-(4-acetylphenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bi**



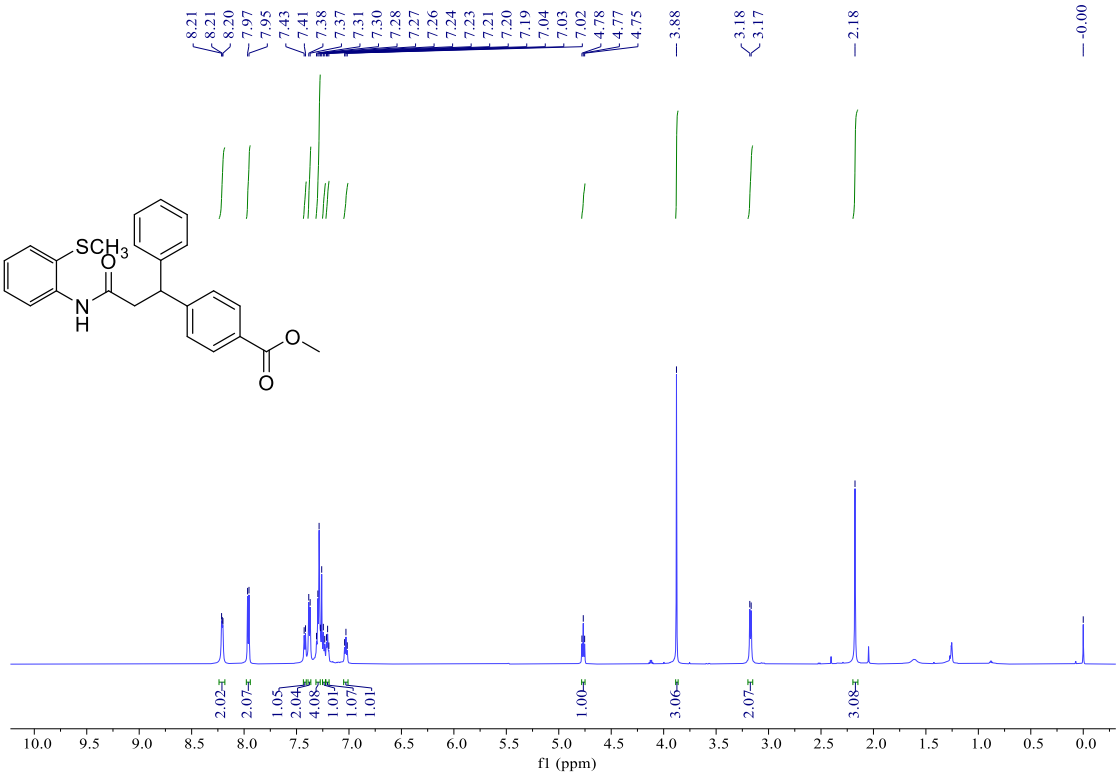
^{13}C NMR of 3-(4-acetylphenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bi**



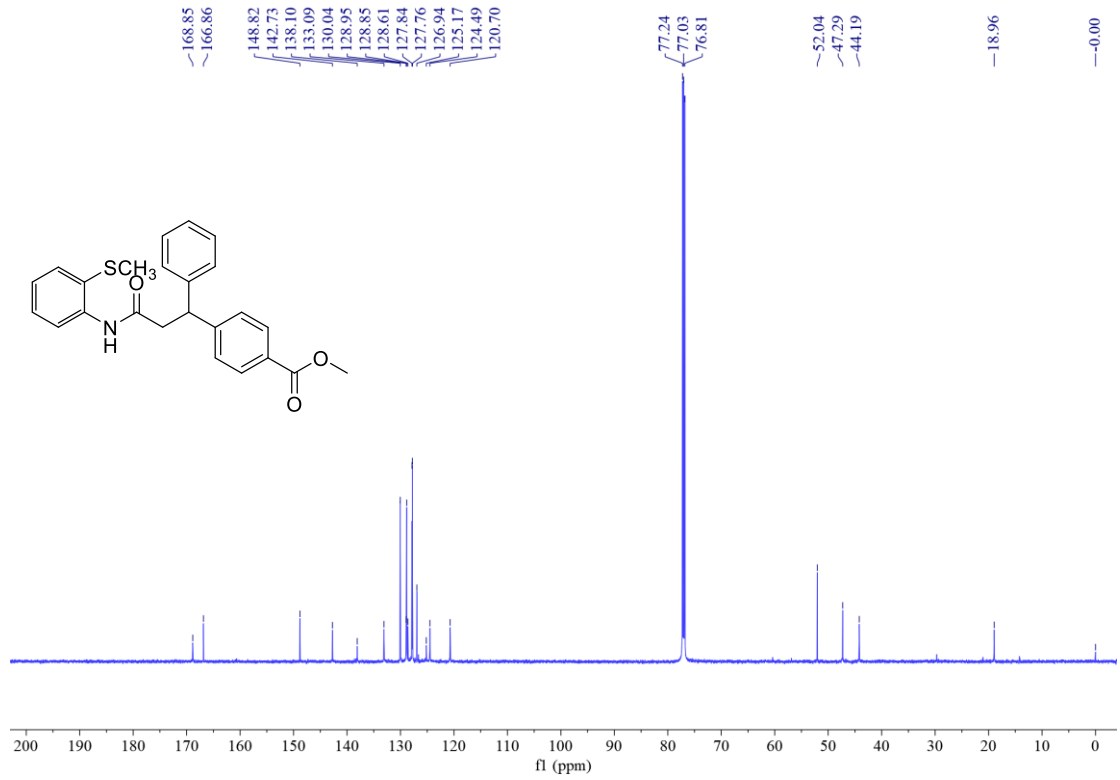
HRMS(ESI) of 3-(4-acetylphenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bi**



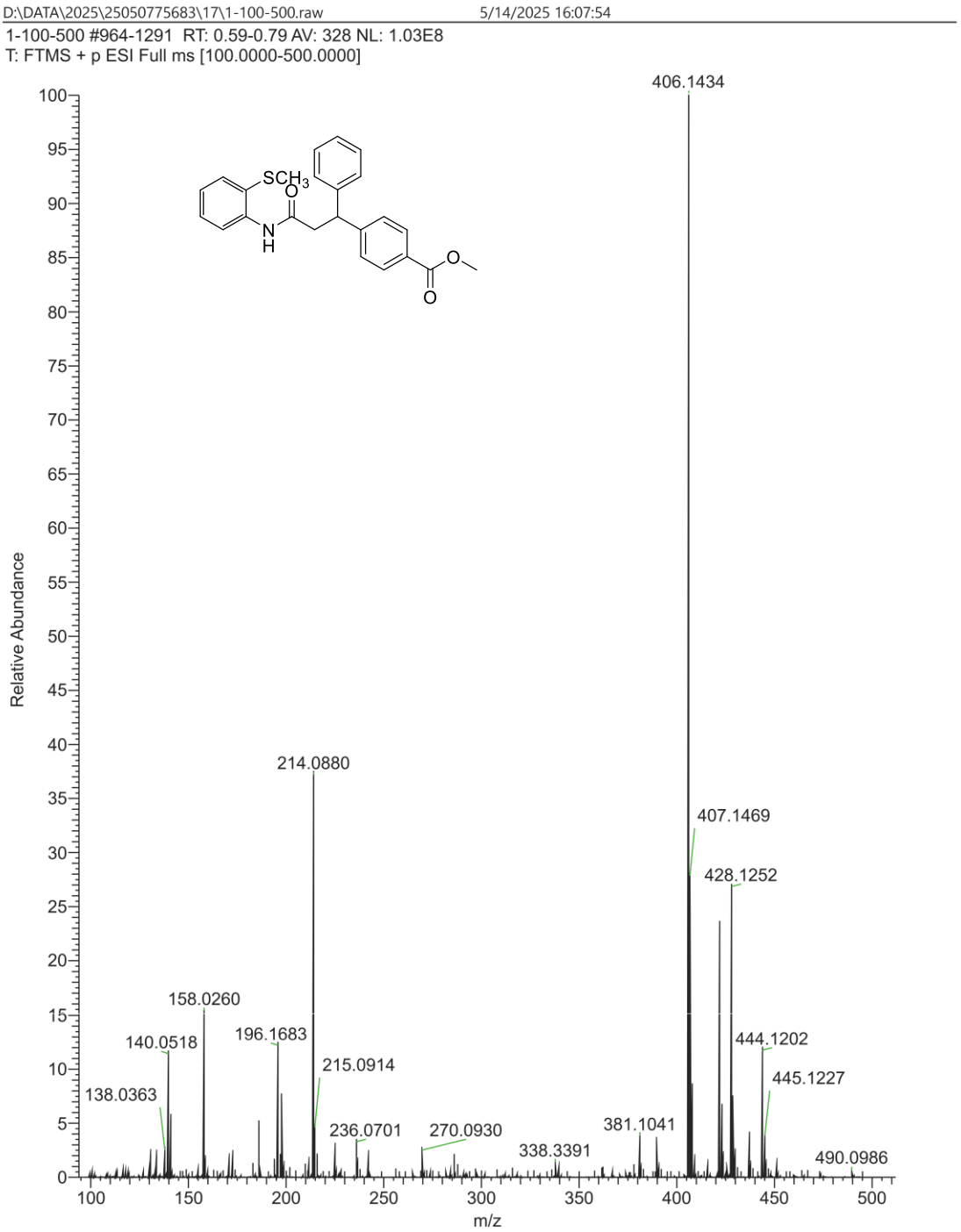
^{1}H NMR of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3bj**



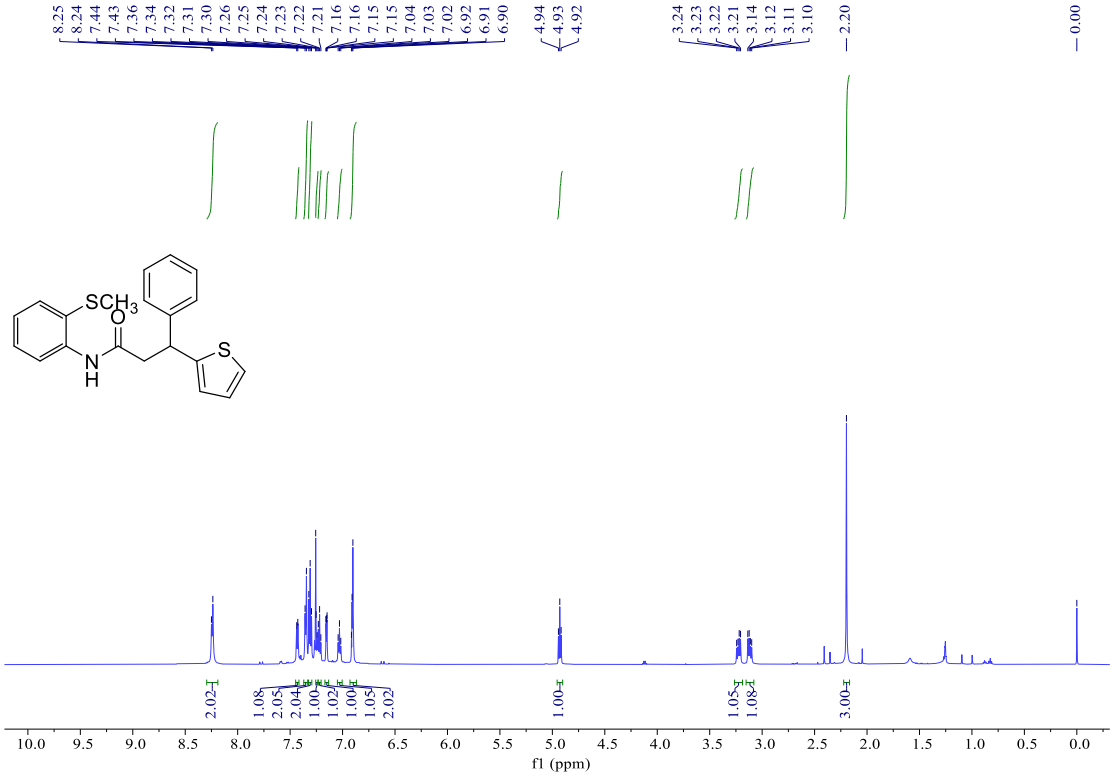
^{13}C NMR of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3bj**



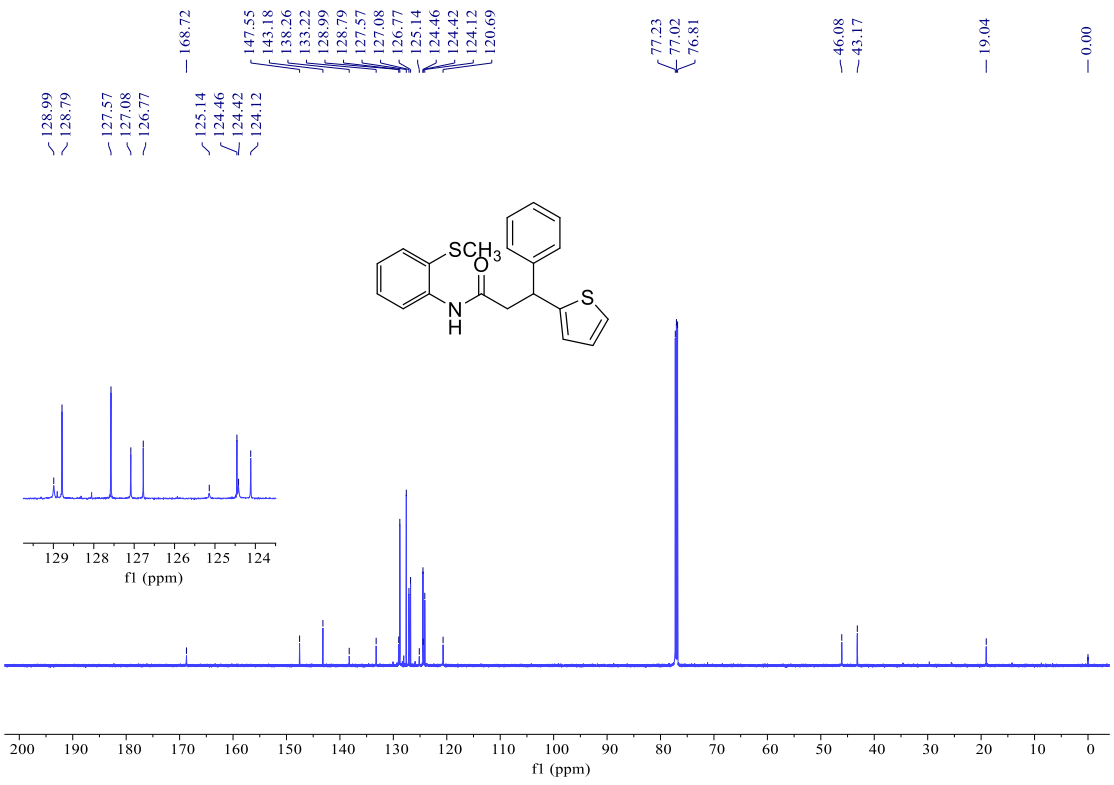
HRMS(ESI) of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3bj**



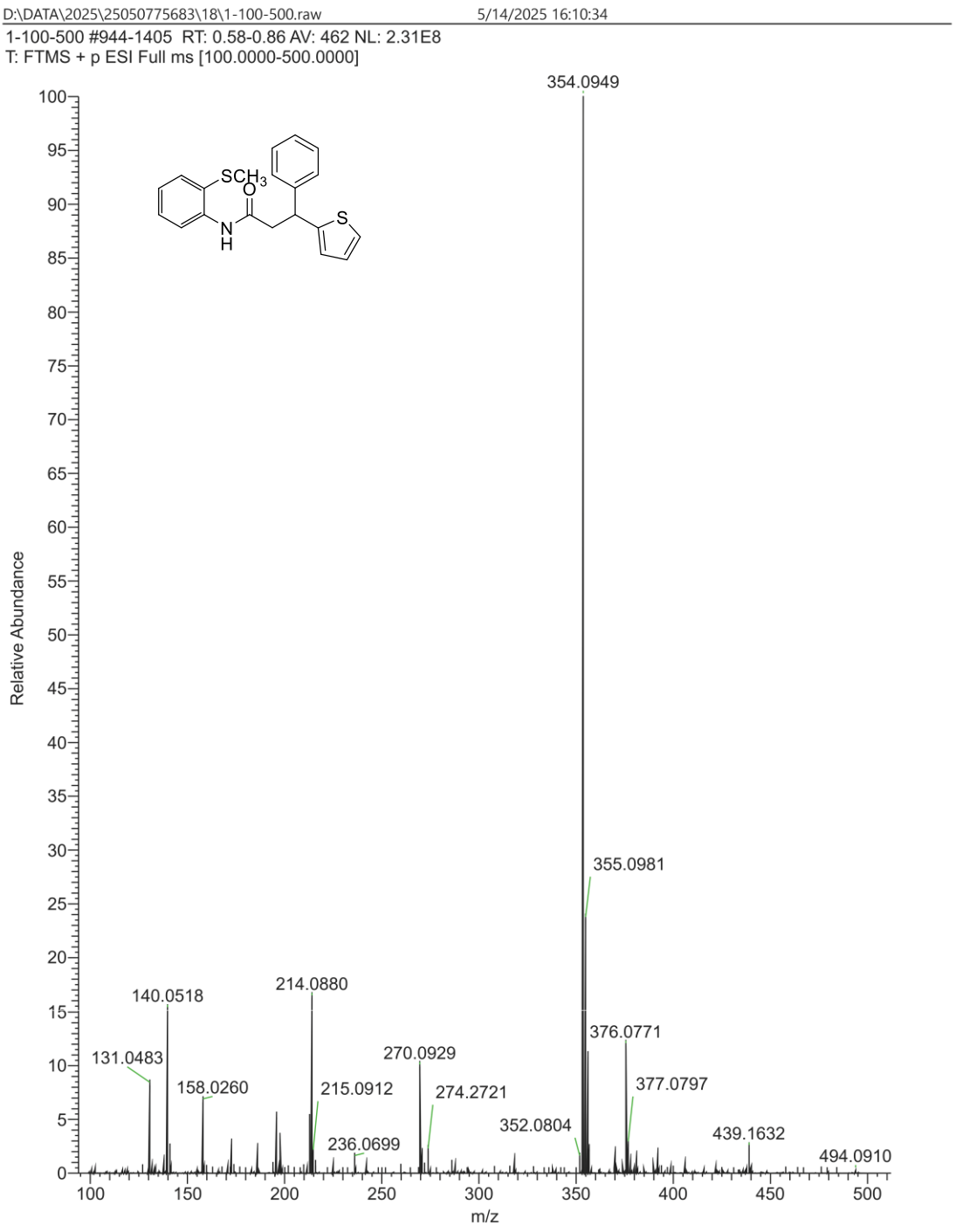
^{1}H NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(thiophen-2-yl)propanamide **3bk**



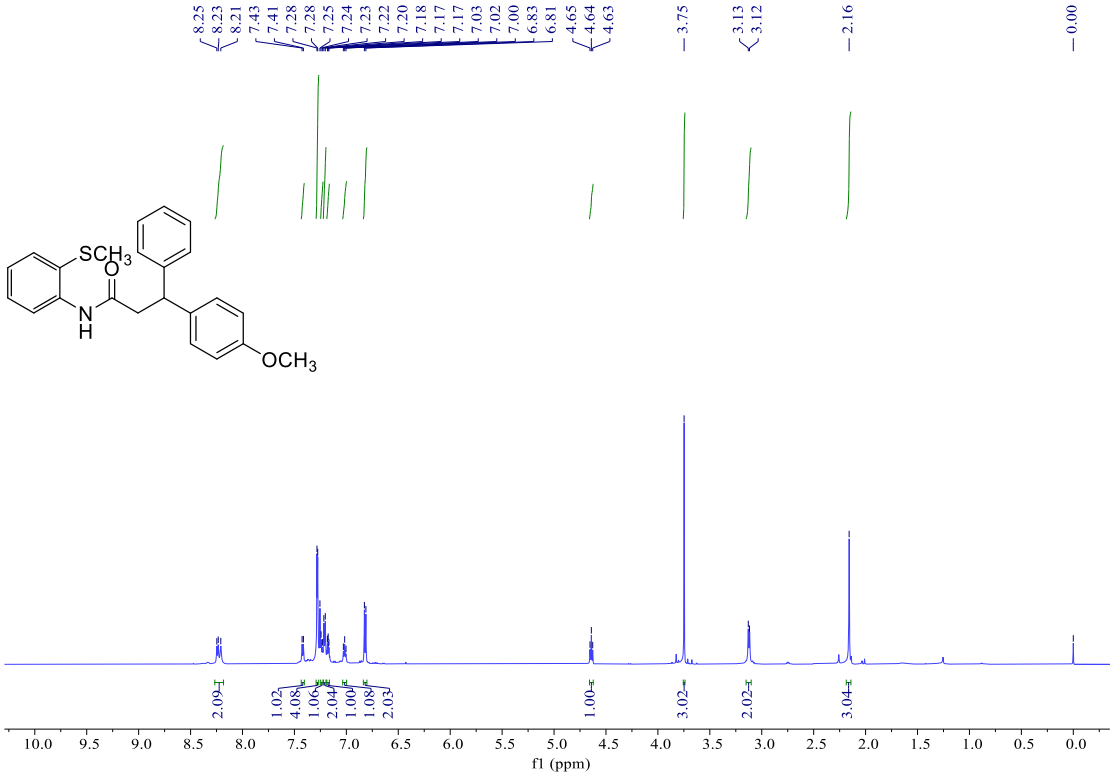
^{13}C NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(thiophen-2-yl)propanamide **3bk**



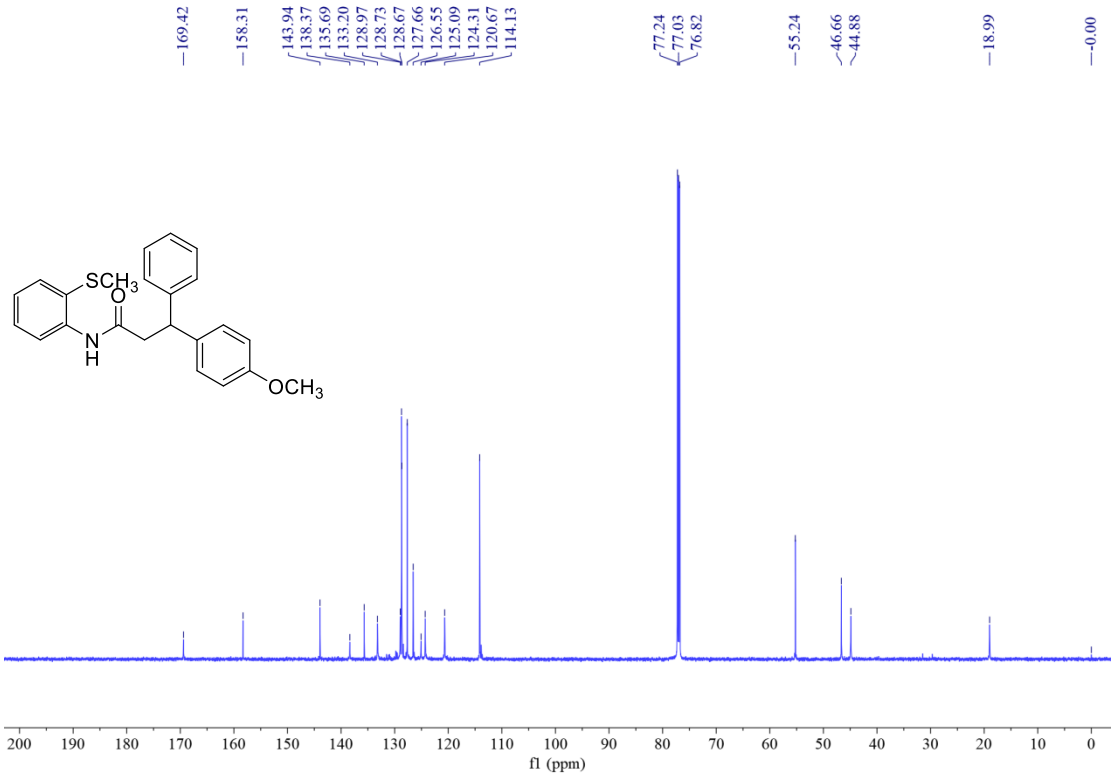
HRMS(ESI) of N-(2-(methylthio)phenyl)-3-phenyl-3-(thiophen-2-yl)propanamide **3bk**



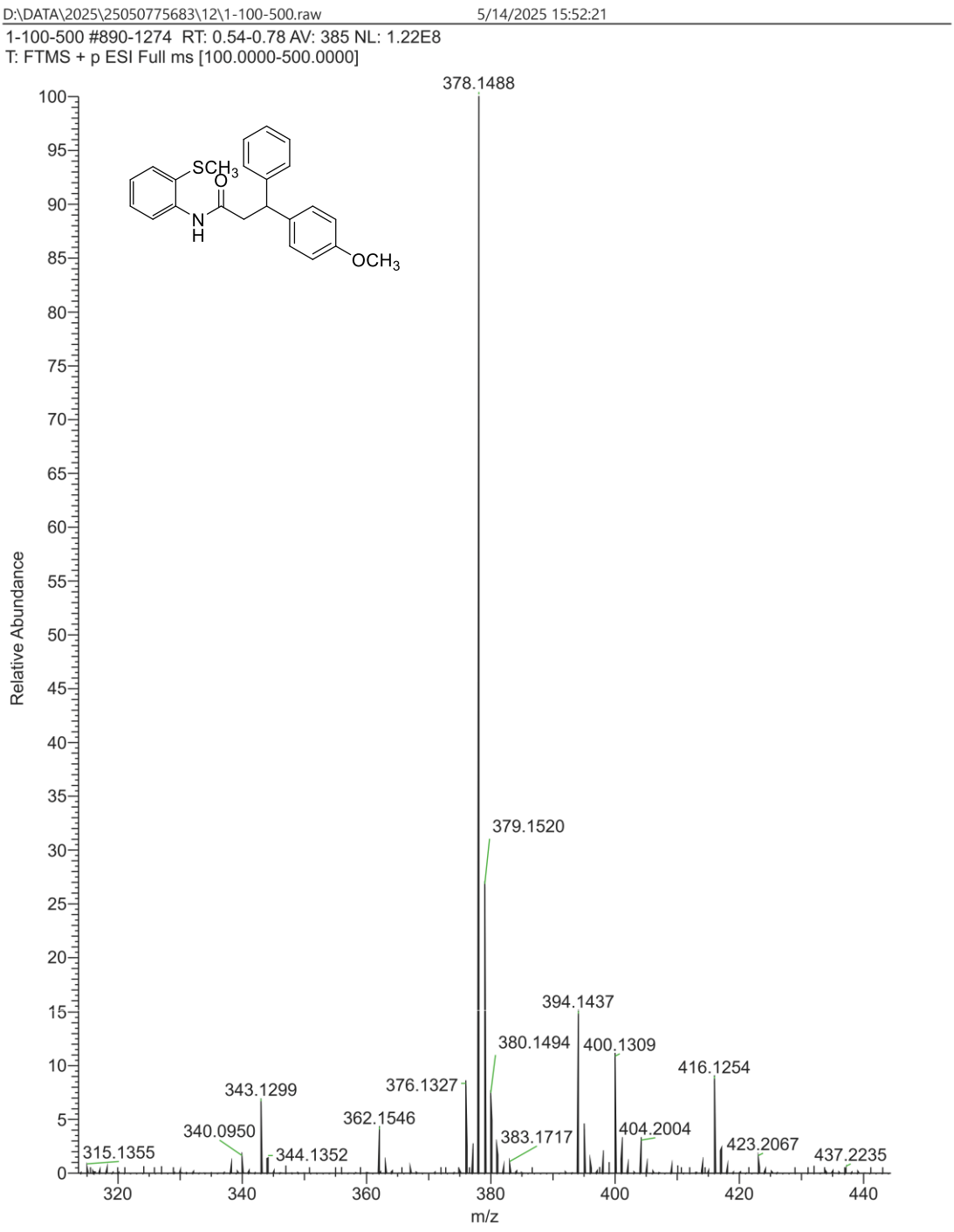
^{1}H NMR of 3-(4-methoxyphenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bl**



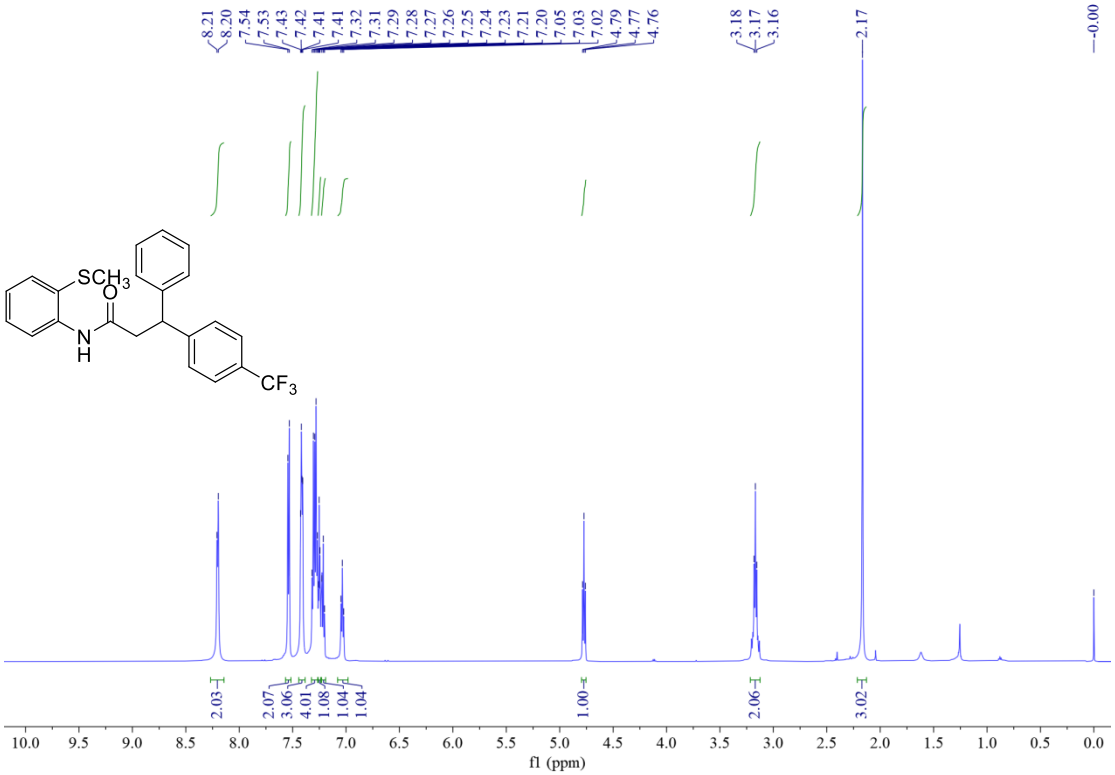
^{13}C NMR of 3-(4-methoxyphenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bl**



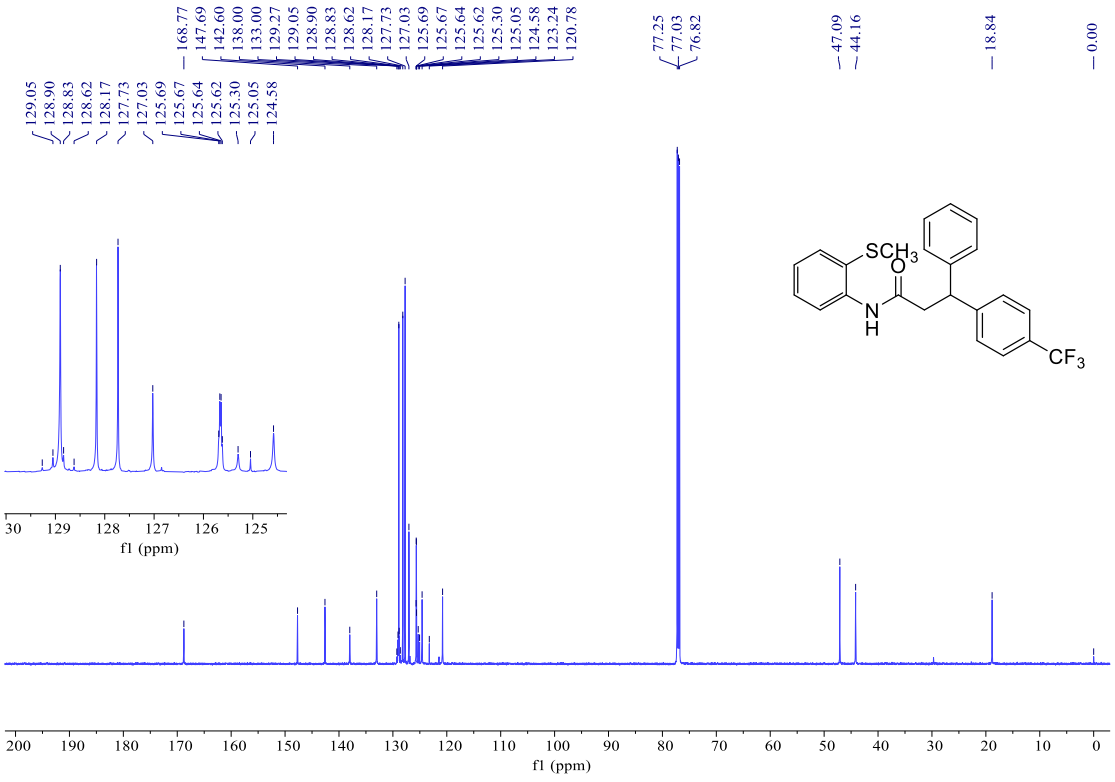
HRMS(ESI) of 3-(4-methoxyphenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bl**



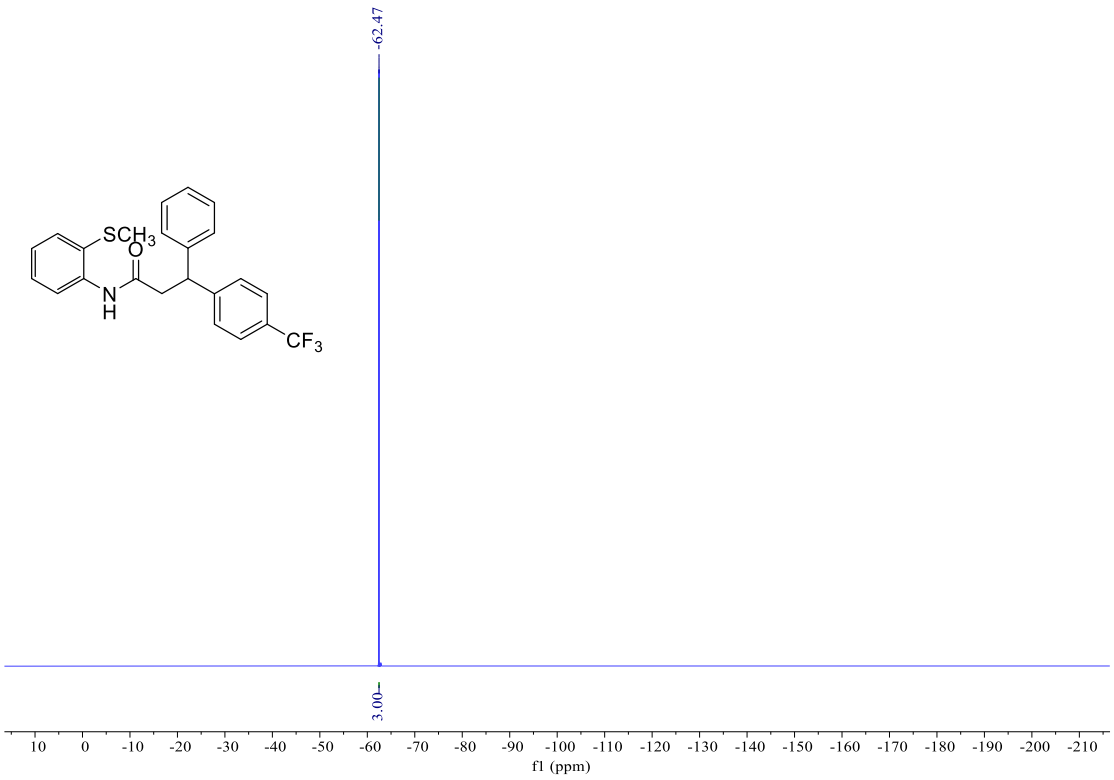
^{1}H NMR of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3bm**



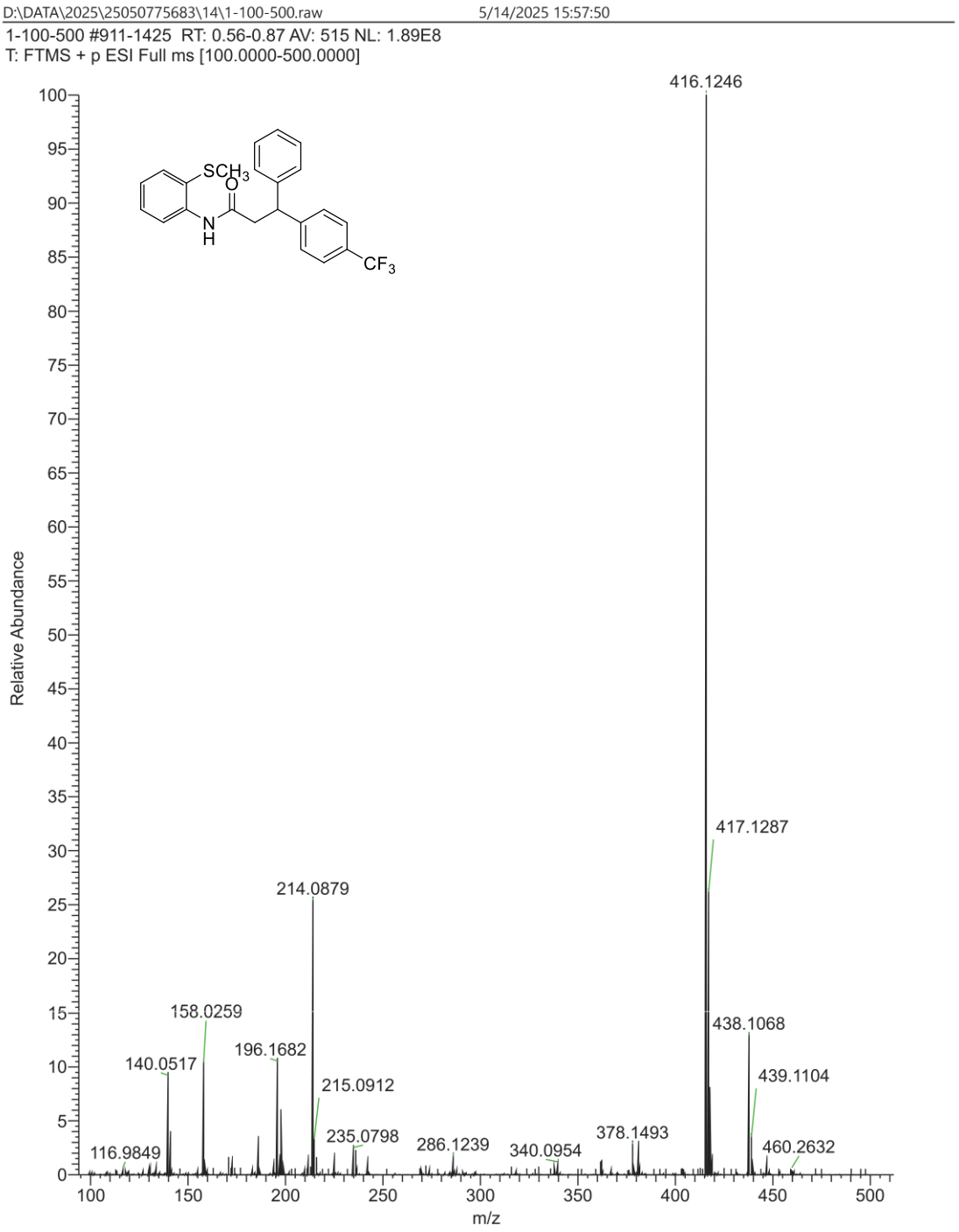
^{13}C NMR of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3bm**



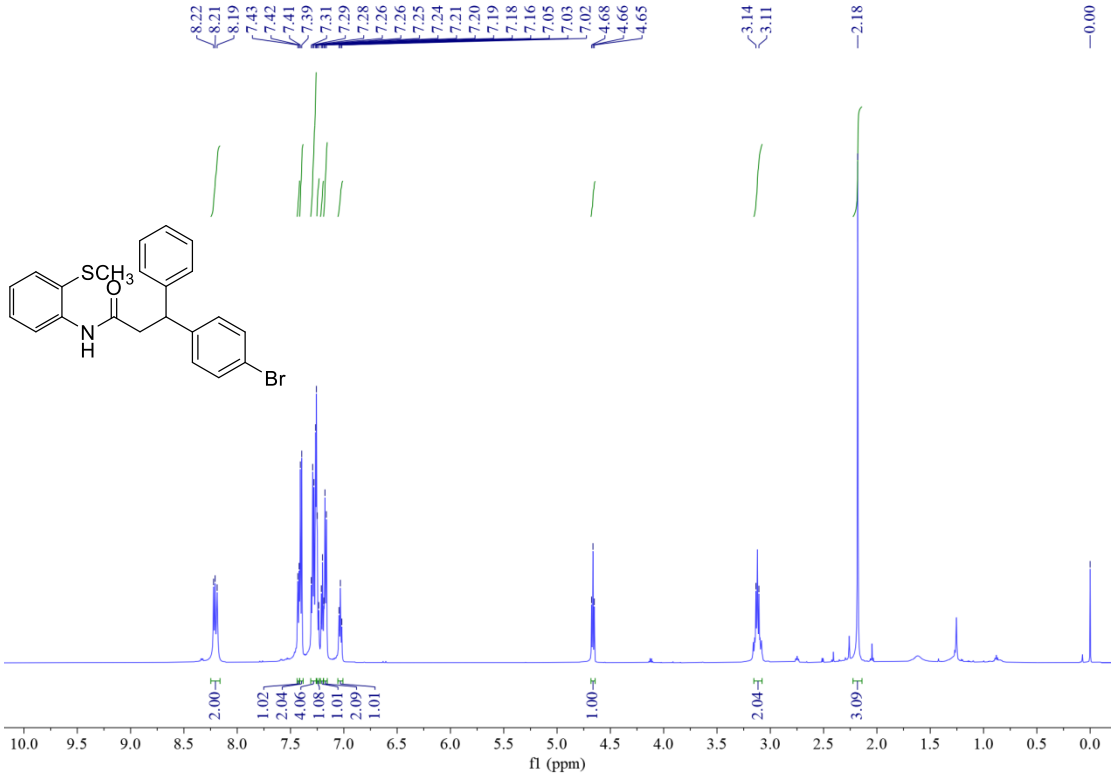
^{19}F NMR of N-(2-(methylthio)phenyl)-3-phenyl-3-(4-(trifluoromethyl)phenyl)propanamide **3bm**



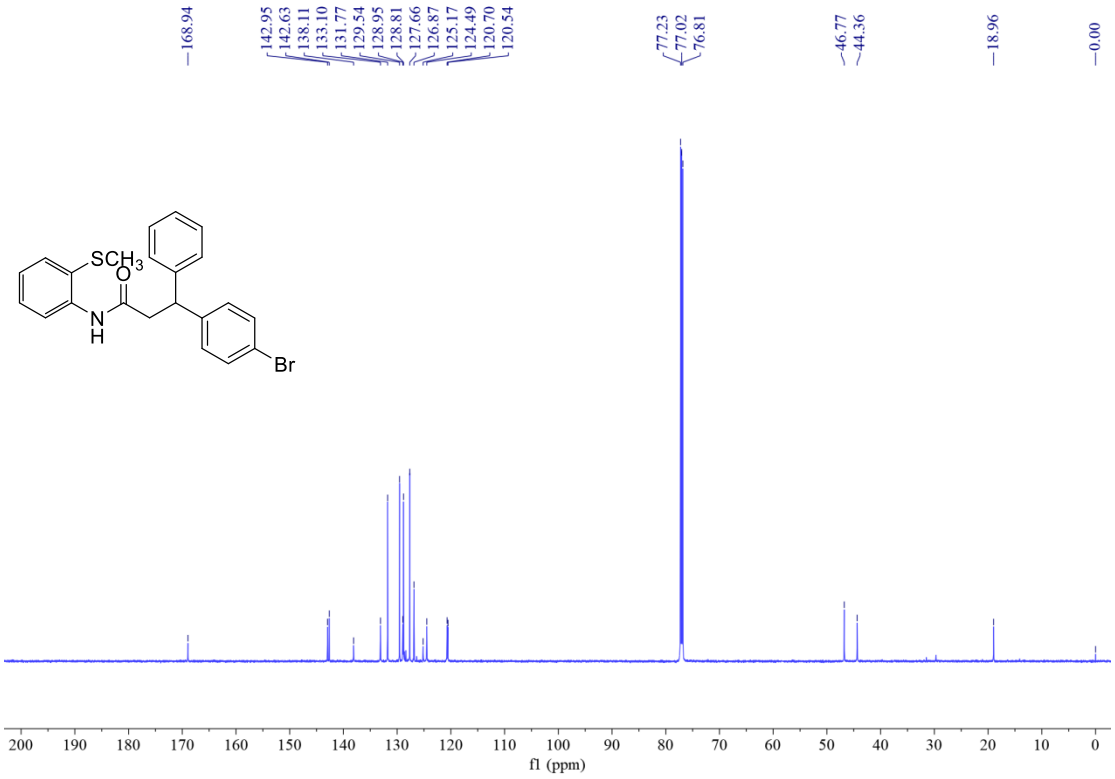
HRMS(ESI) of N-(2-(methylthio)phenyl)-3,3-diphenylpropanamide **3bm**



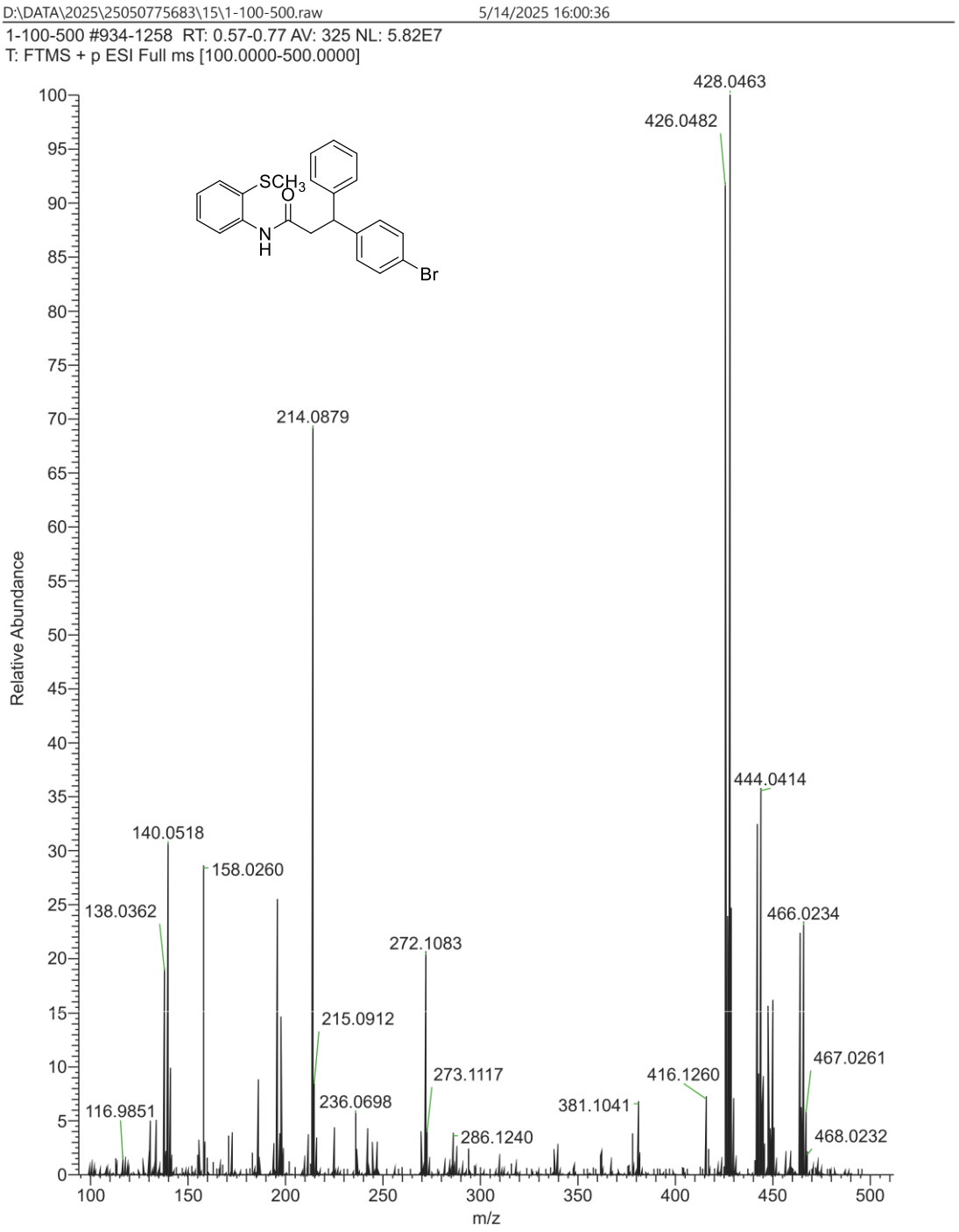
^{1}H NMR of 3-(4-bromophenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bn**



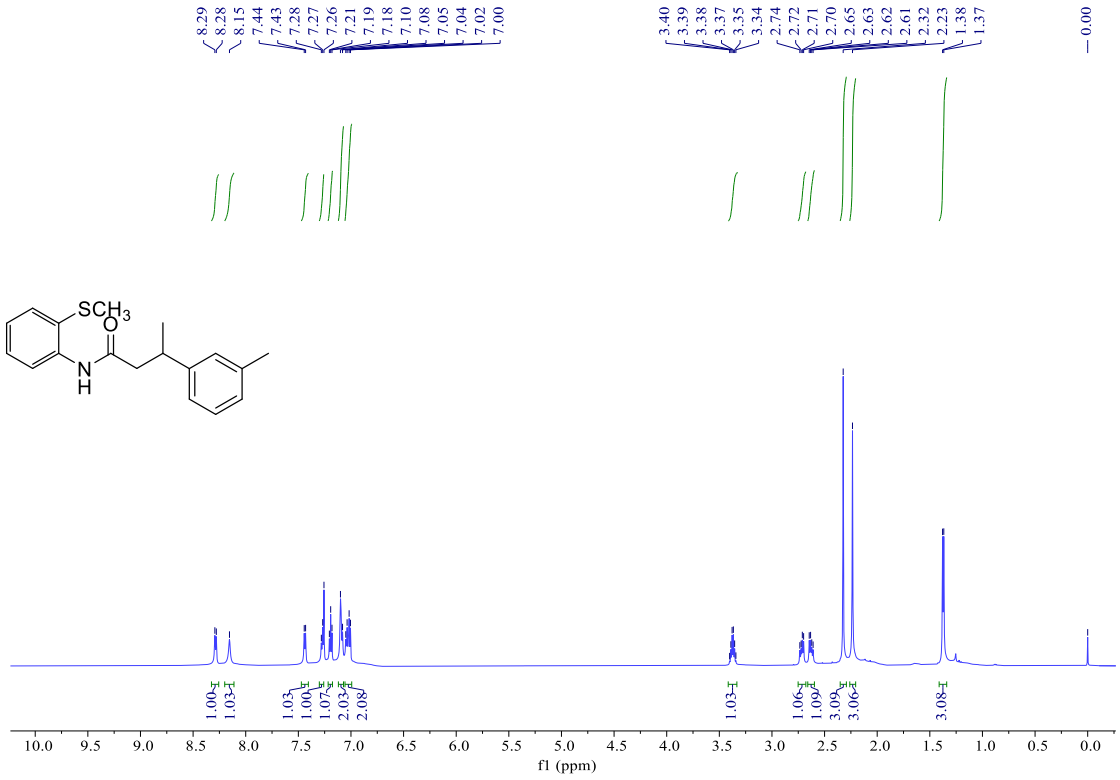
^{13}C NMR of 3-(4-bromophenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bn**



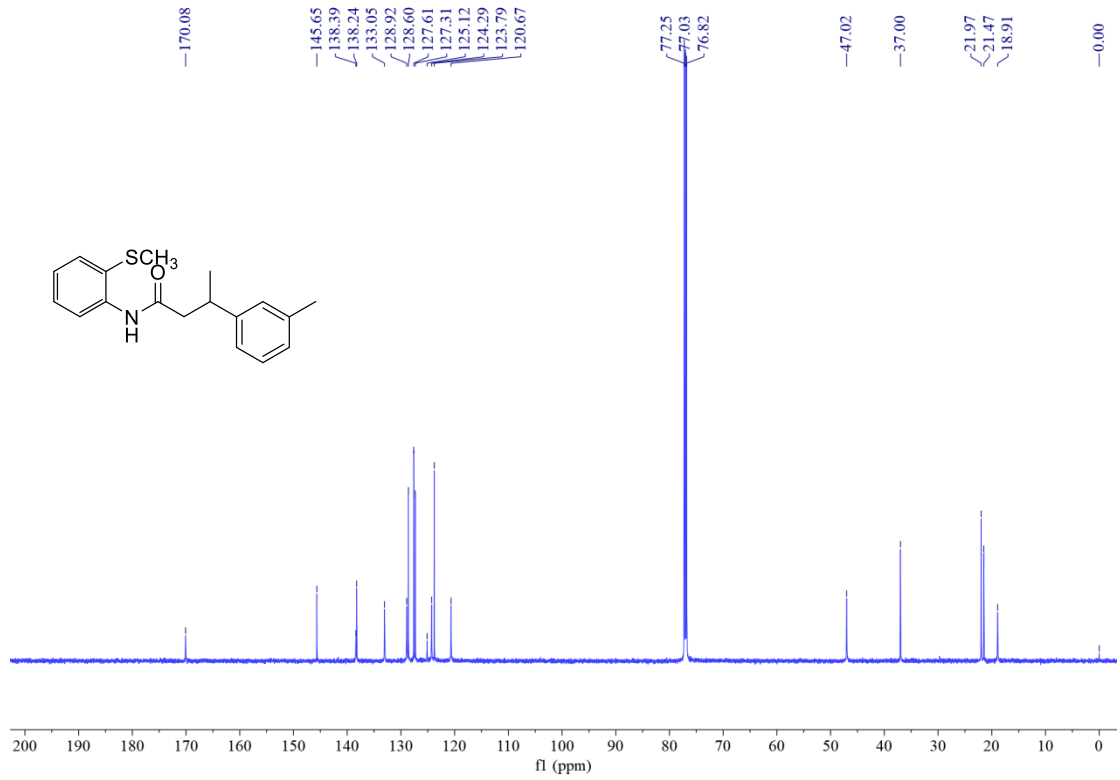
HRMS(ESI) of 3-(4-bromophenyl)-N-(2-(methylthio)phenyl)-3-phenylpropanamide **3bn**



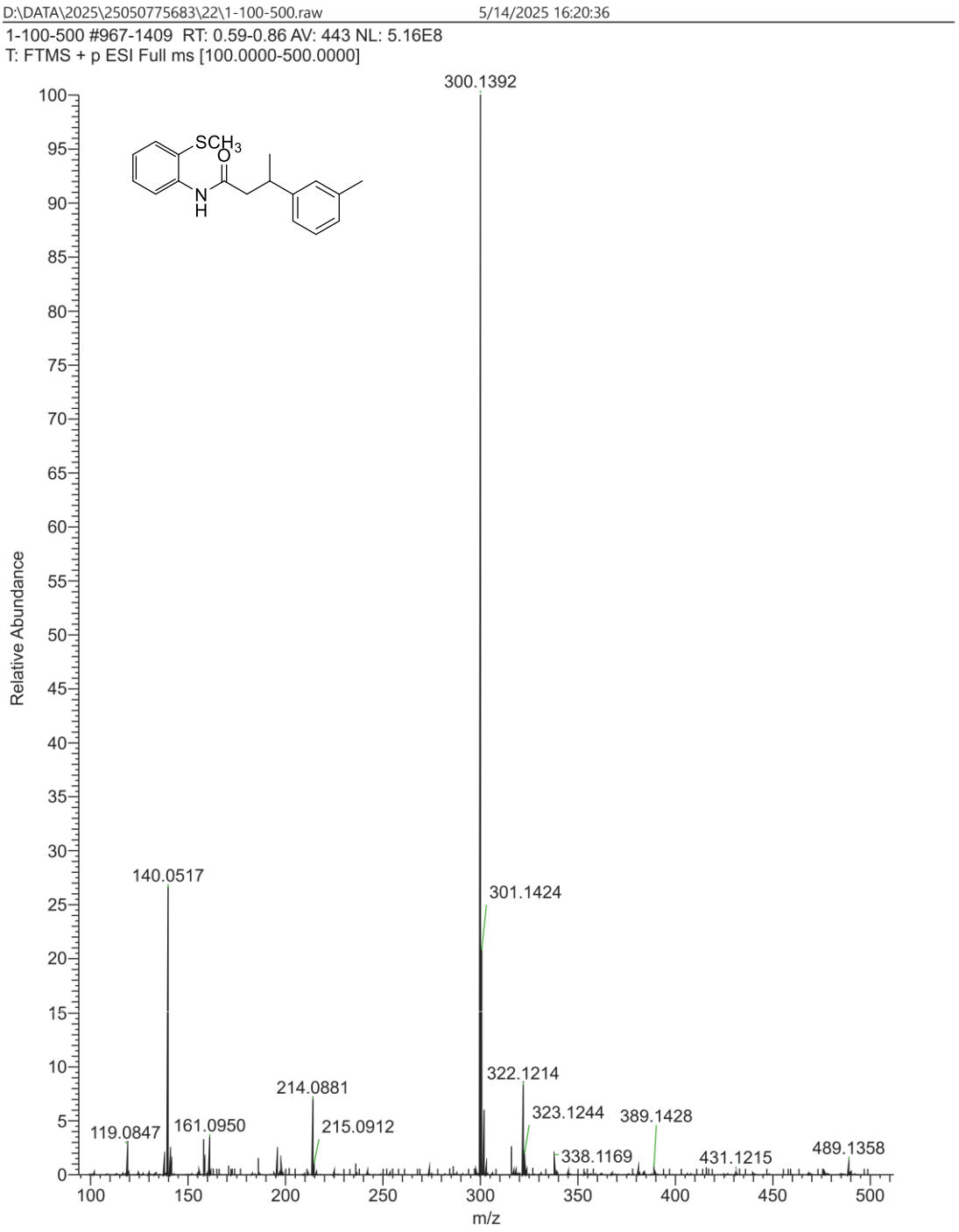
^{1}H NMR of N-(2-(methylthio)phenyl)-3-(m-tolyl)butanamide **3ca**



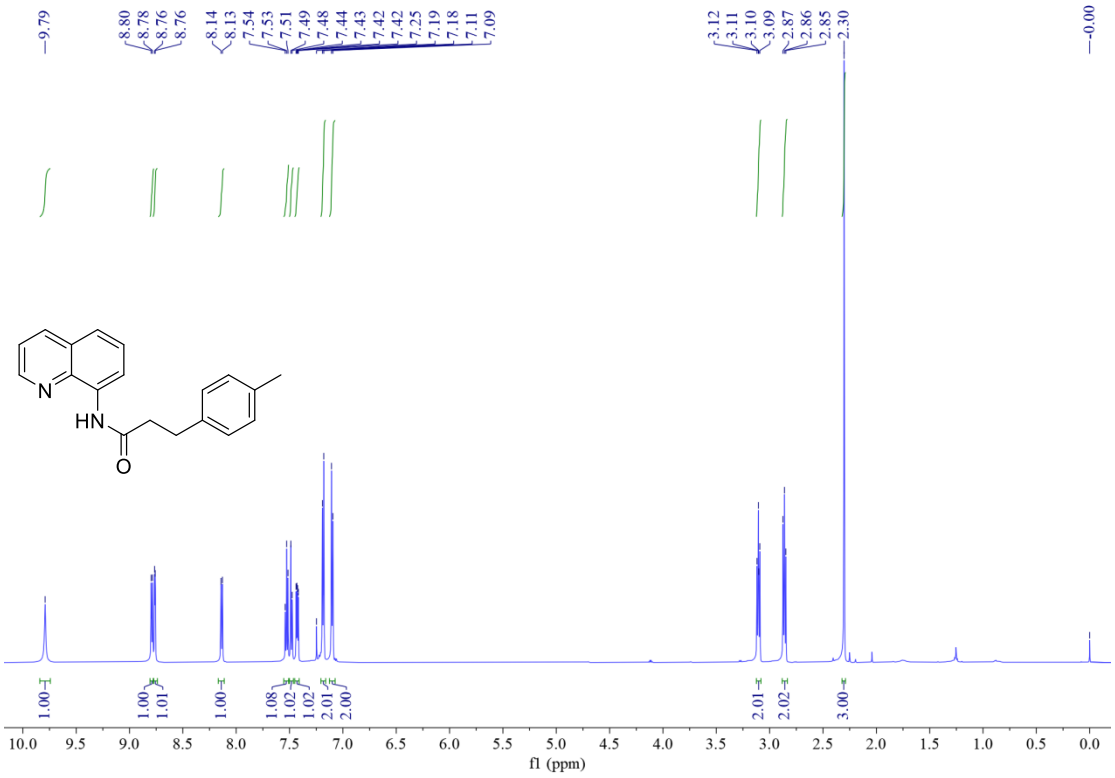
^{13}C NMR of N-(2-(methylthio)phenyl)-3-(m-tolyl)butanamide **3ca**



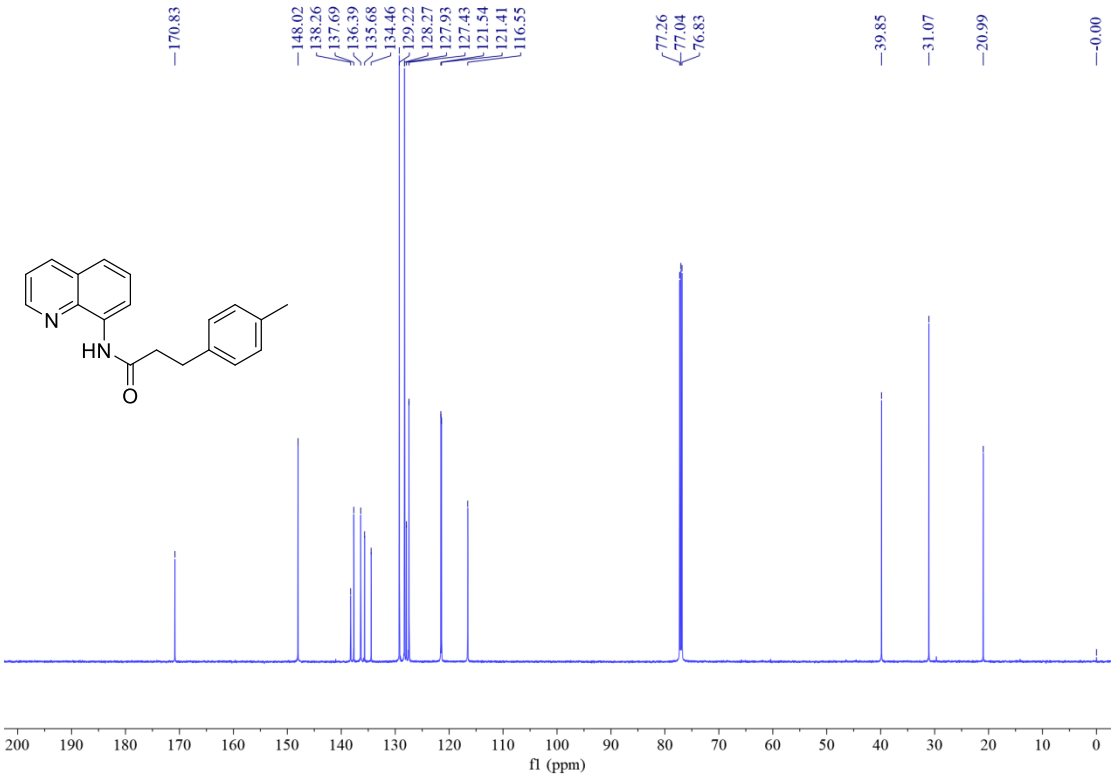
HRMS(ESI) of N-(2-(methylthio)phenyl)-3-(m-tolyl)butanamide **3ca**



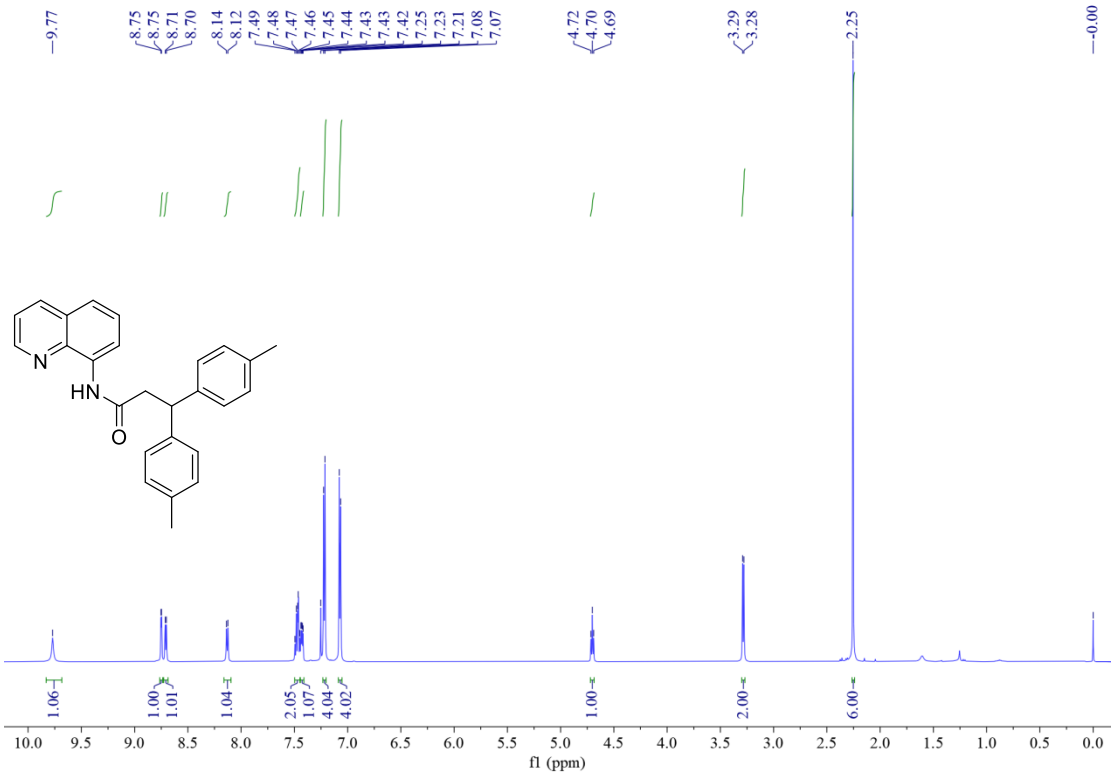
^{1}H NMR of N-(quinolin-8-yl)-3-(p-tolyl)propanamide **3ec**



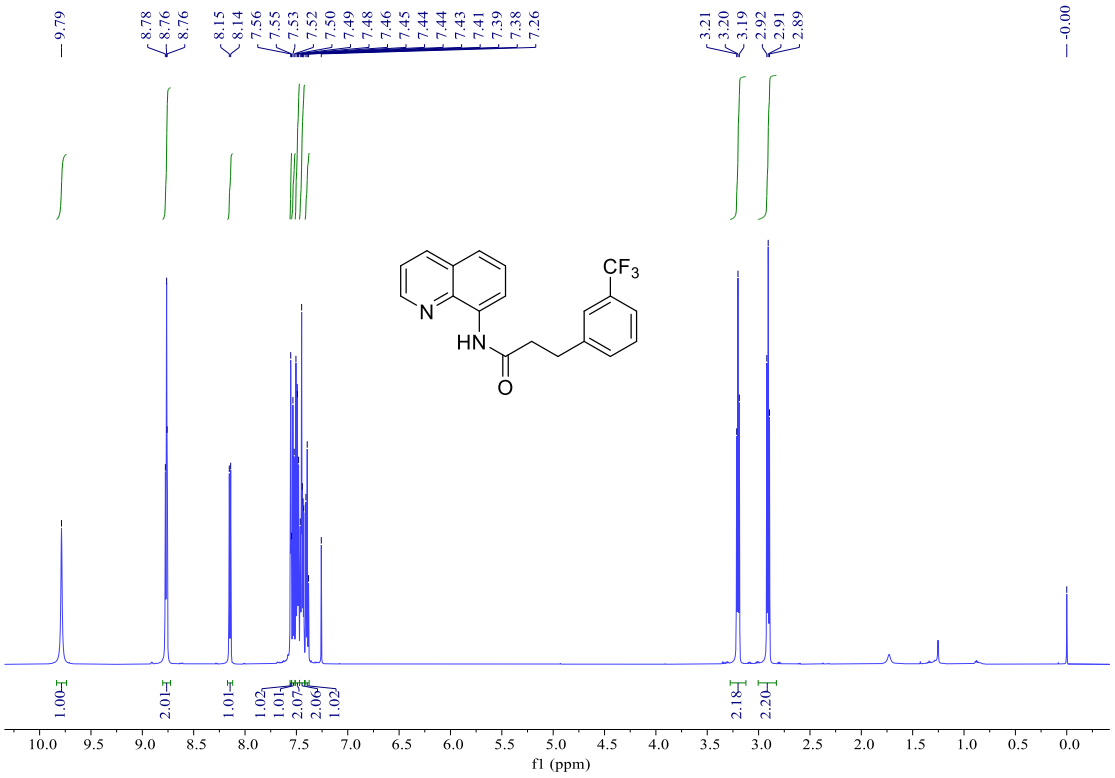
^{13}C NMR of N-(quinolin-8-yl)-3-(p-tolyl)propanamide **3ec**



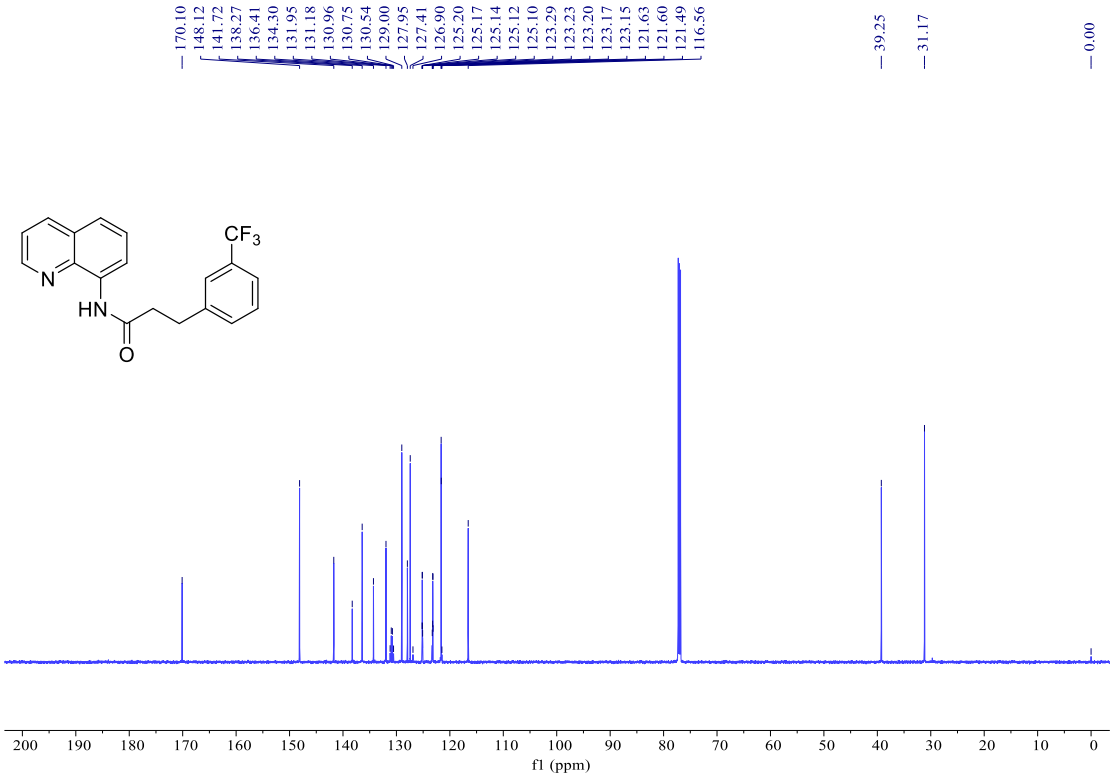
^{1}H NMR of N-(quinolin-8-yl)-3,3-di-p-tolylpropanamide **3ec'**



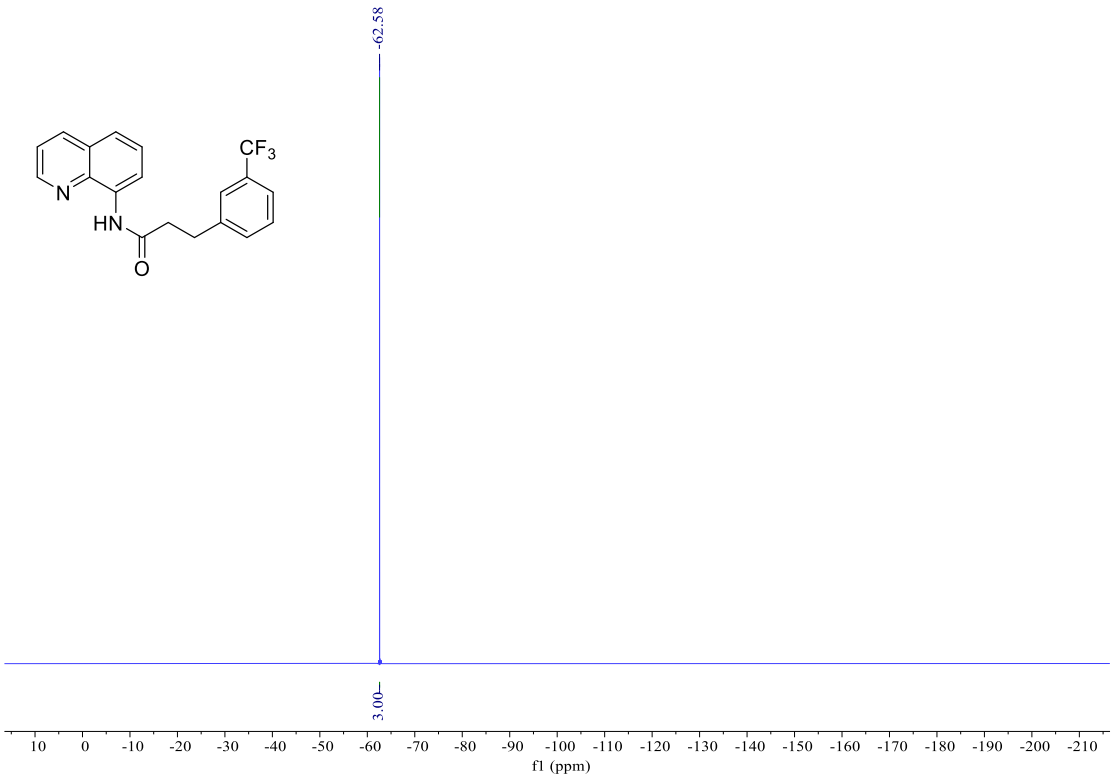
^{1}H NMR of N-(quinolin-8-yl)-3-(3-(trifluoromethyl)phenyl)propanamide **3ef**



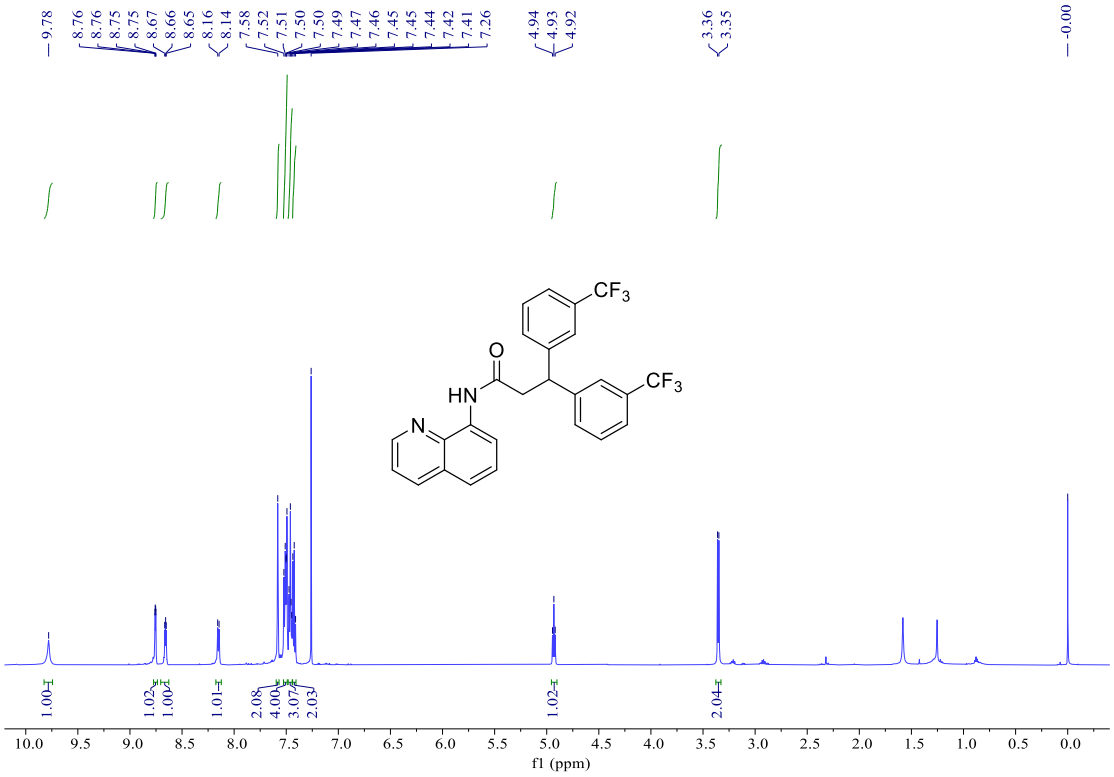
^{13}C NMR of N-(quinolin-8-yl)-3-(3-(trifluoromethyl)phenyl)propanamide **3ef**



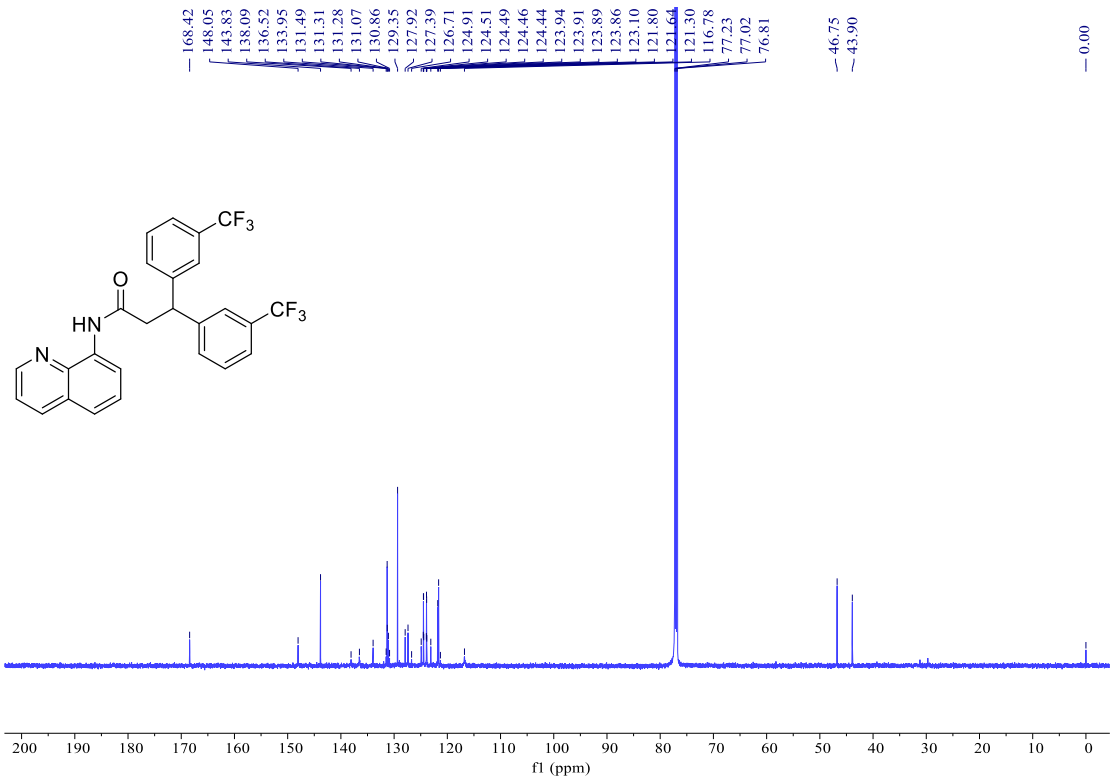
^{19}F NMR of N-(quinolin-8-yl)-3-(3-(trifluoromethyl)phenyl)propanamide **3ef**



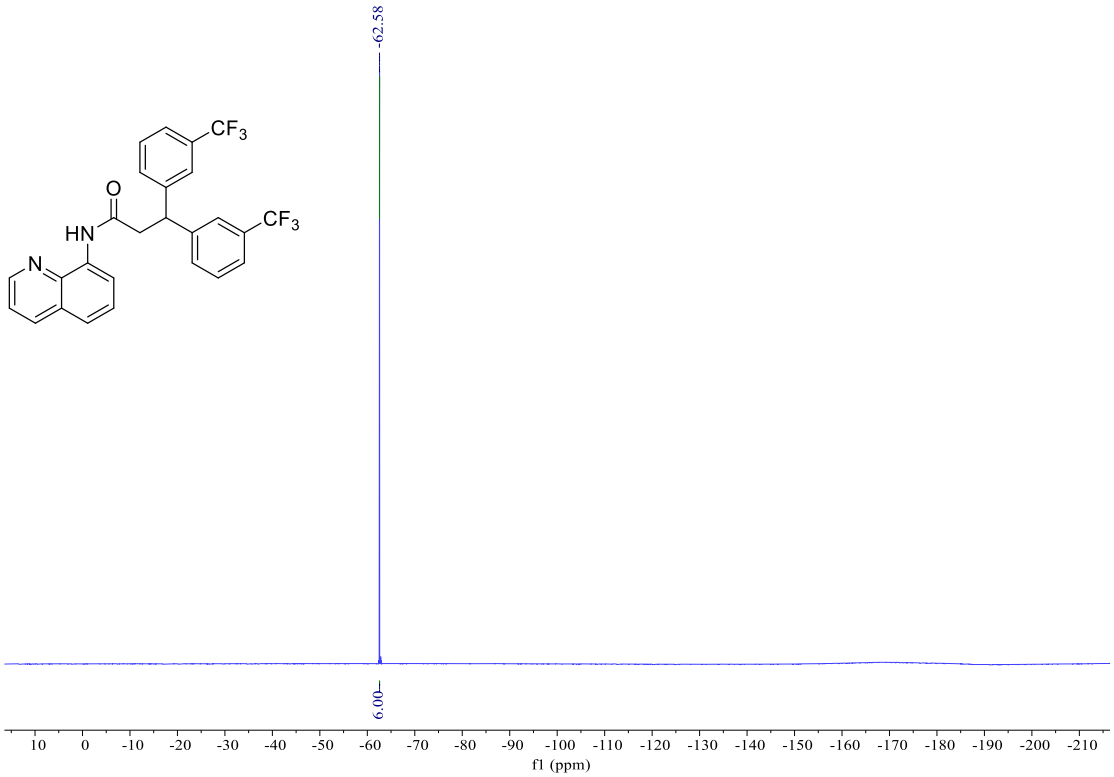
^{1}H NMR of N-(quinolin-8-yl)-3,3-bis(3-(trifluoromethyl)phenyl)propanamide **3ef'**



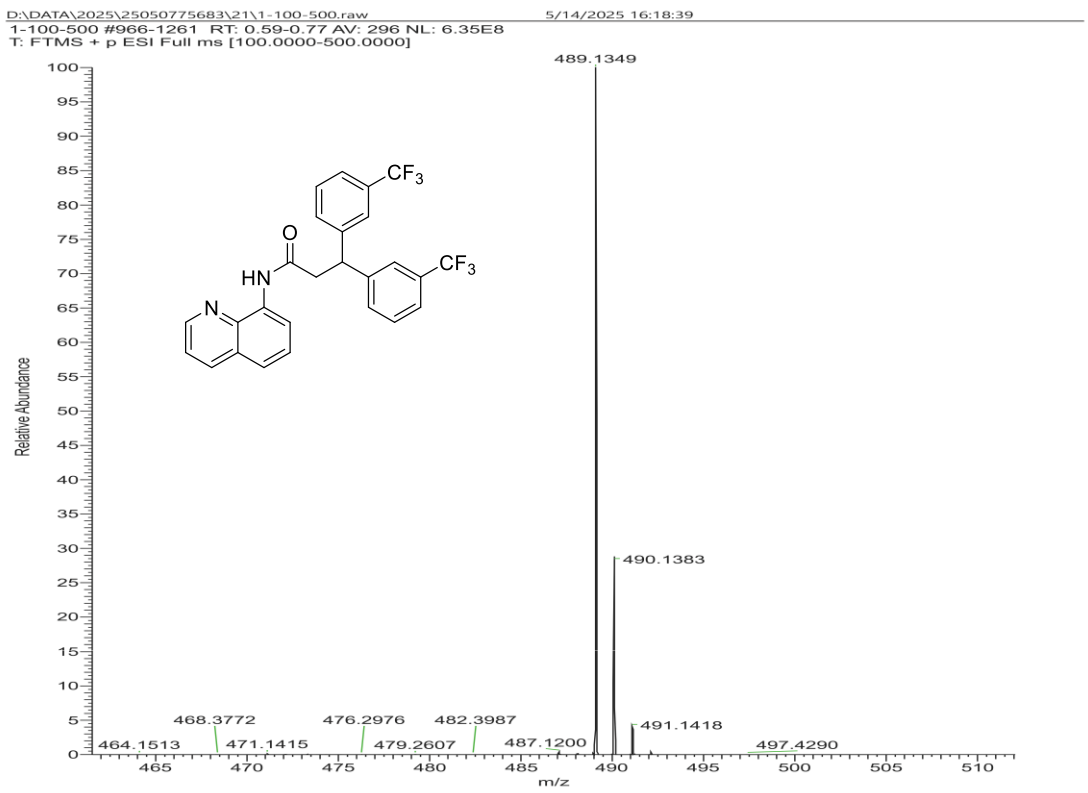
^{13}C NMR of N-(quinolin-8-yl)-3,3-bis(3-(trifluoromethyl)phenyl)propanamide **3ef'**



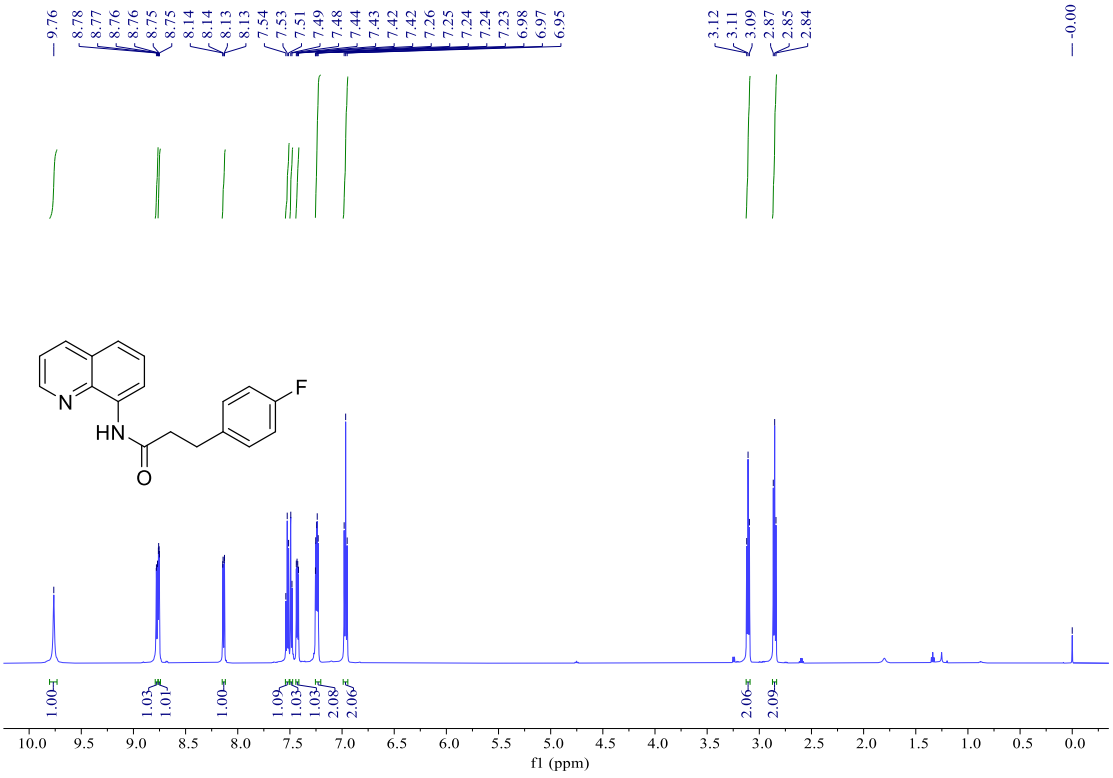
^{19}F NMR of N-(quinolin-8-yl)-3,3-bis(3-(trifluoromethyl)phenyl)propanamide **3ef'**



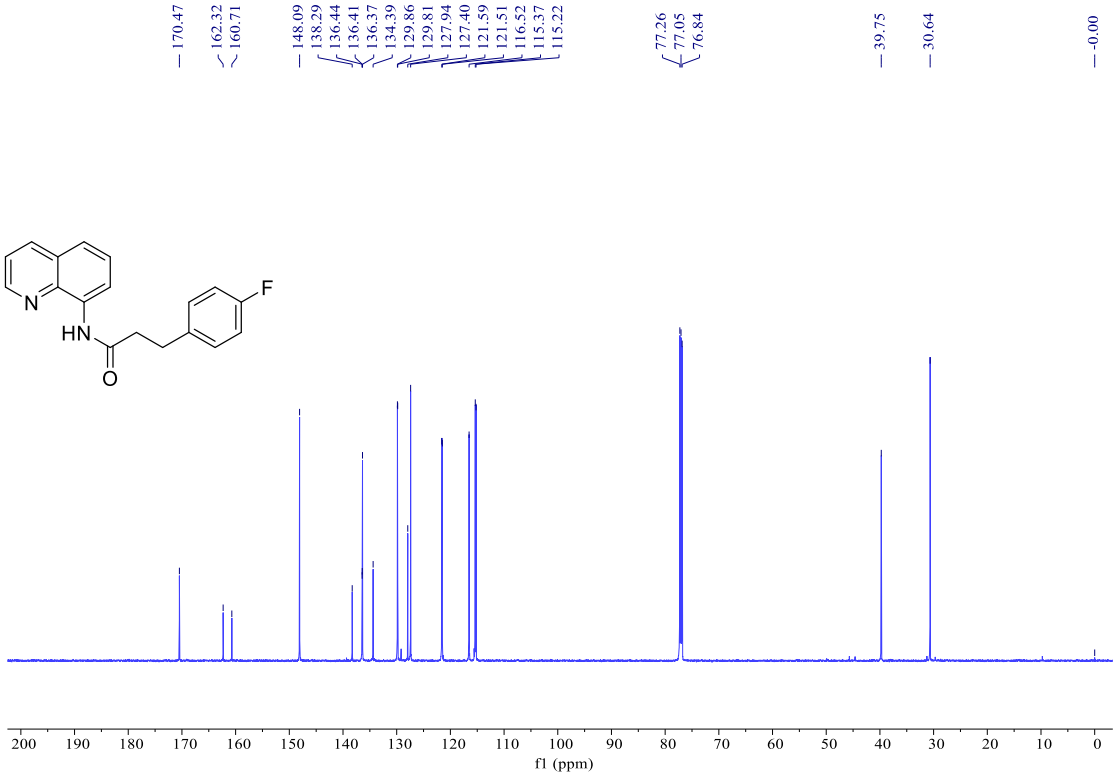
HRMS(ESI) of N-(quinolin-8-yl)-3,3-bis(3-(trifluoromethyl)phenyl)propanamide **3ef'**



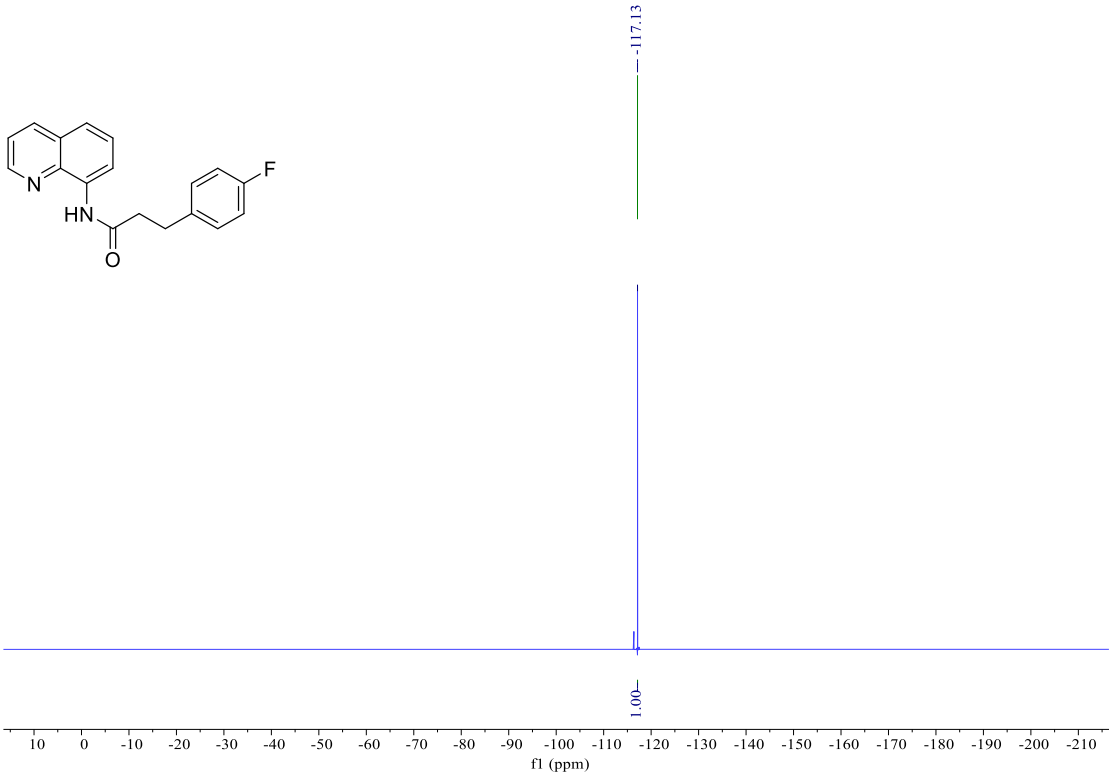
^{1}H NMR of 3-(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg**



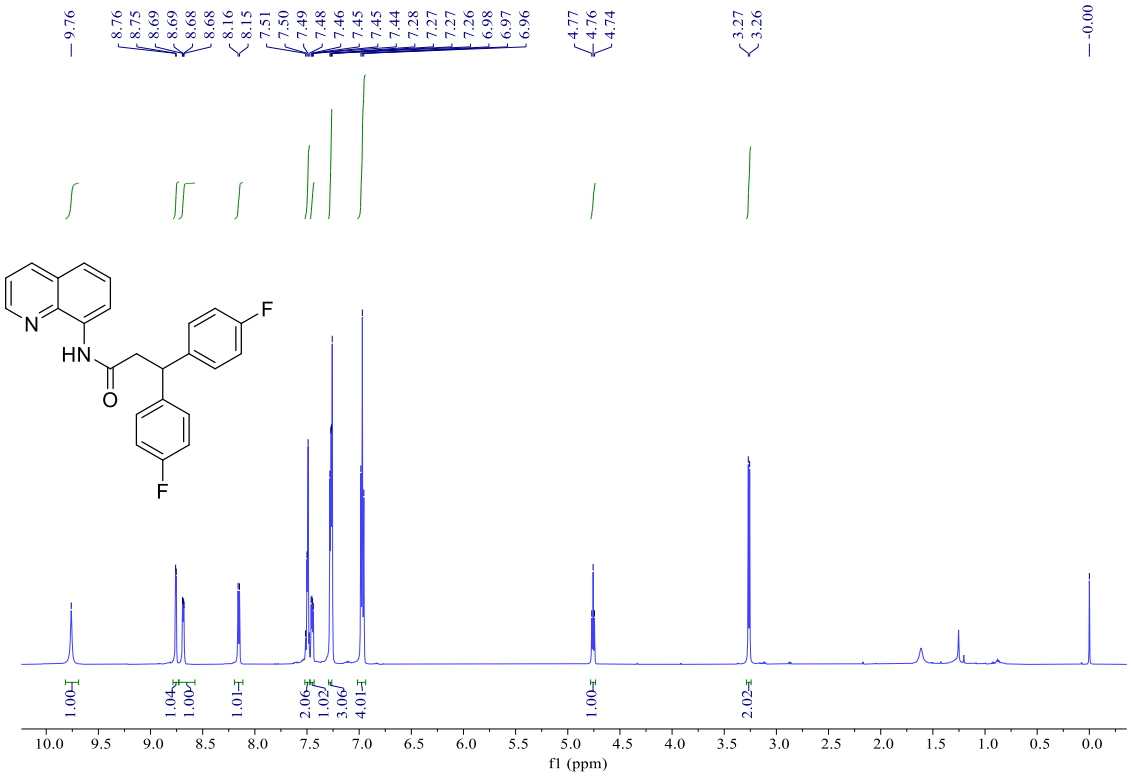
^{13}C NMR of 3-(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg**



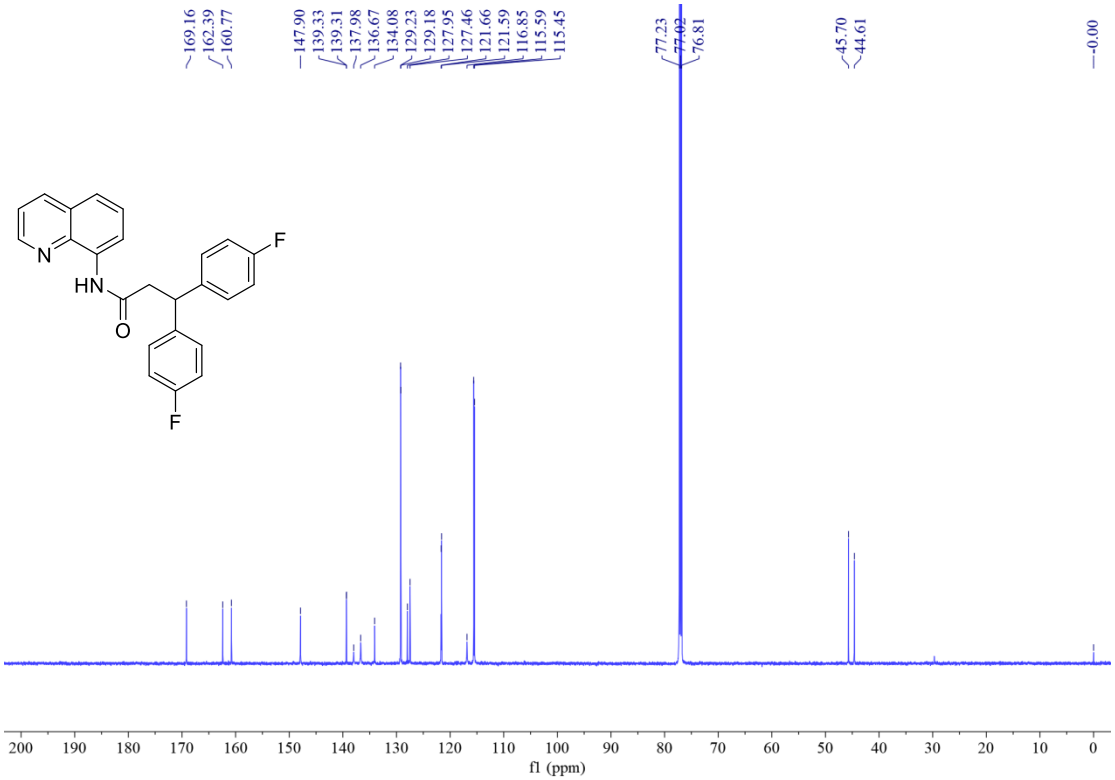
^{19}F NMR of 3-(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg**



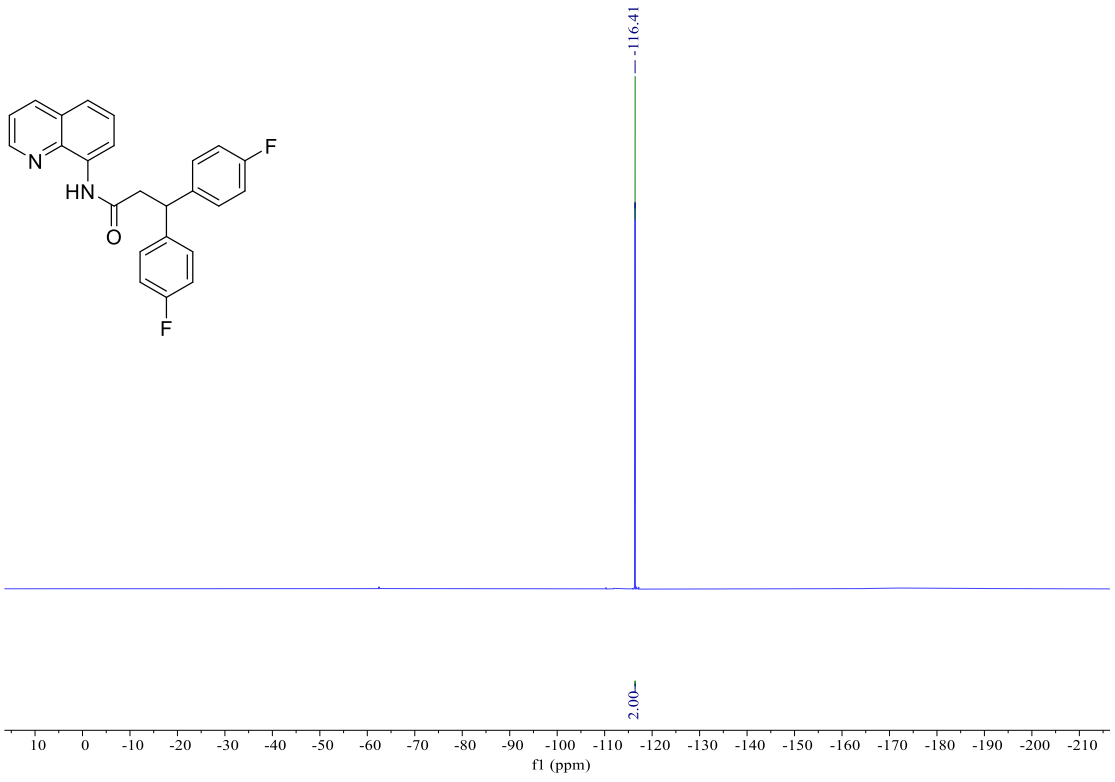
^{1}H NMR of 3,3-bis(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg'**



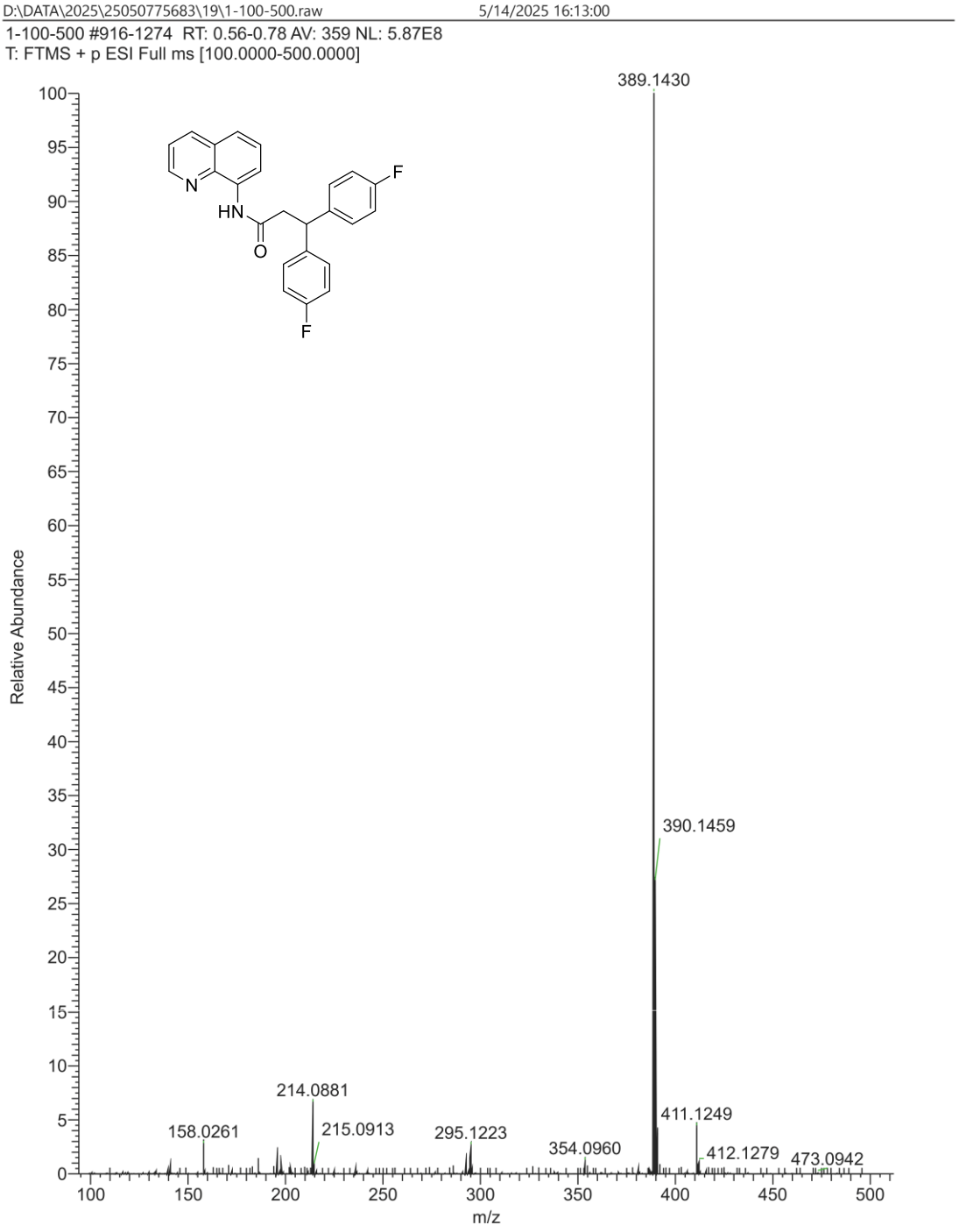
^{13}C NMR of 3,3-bis(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg'**



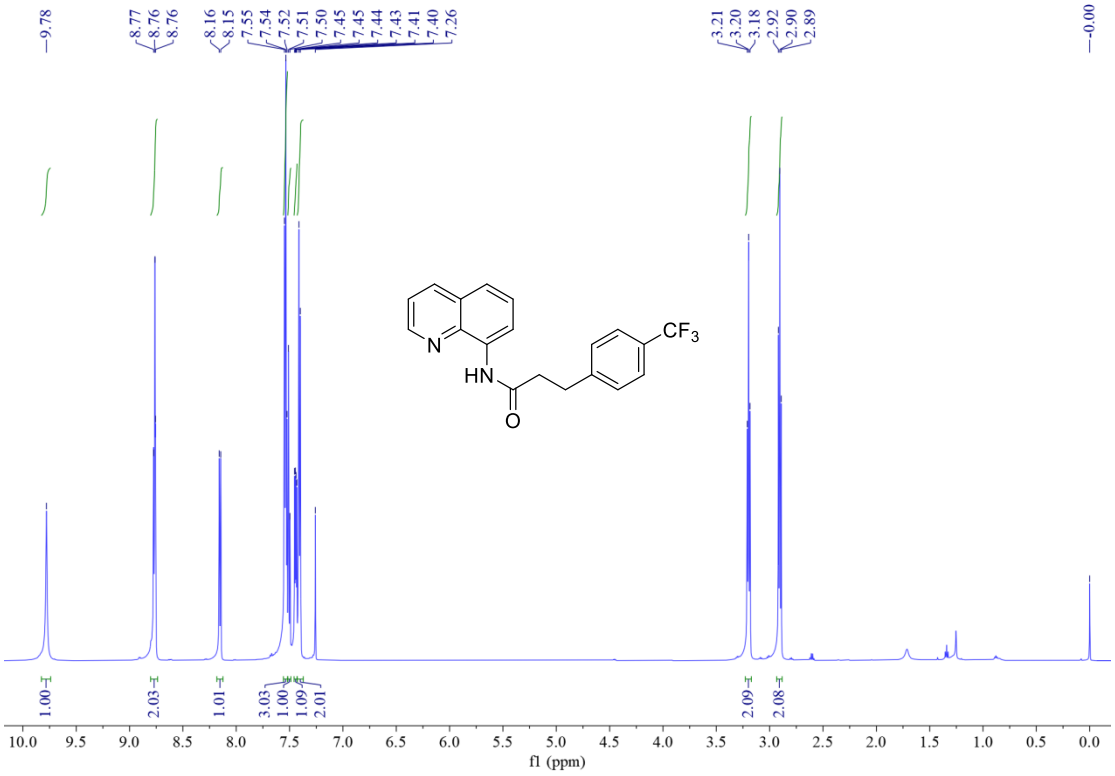
^{19}F NMR of 3,3-bis(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg'**



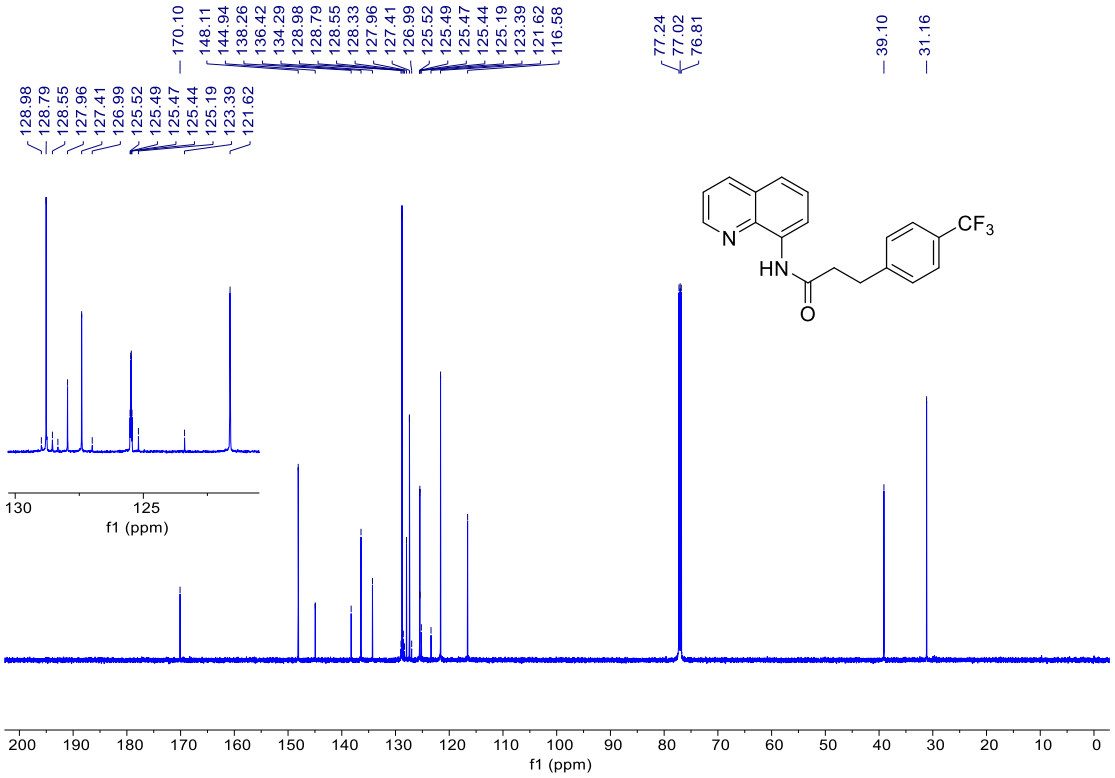
HRMS(ESI) of 3,3-bis(4-fluorophenyl)-N-(quinolin-8-yl)propanamide **3eg'**



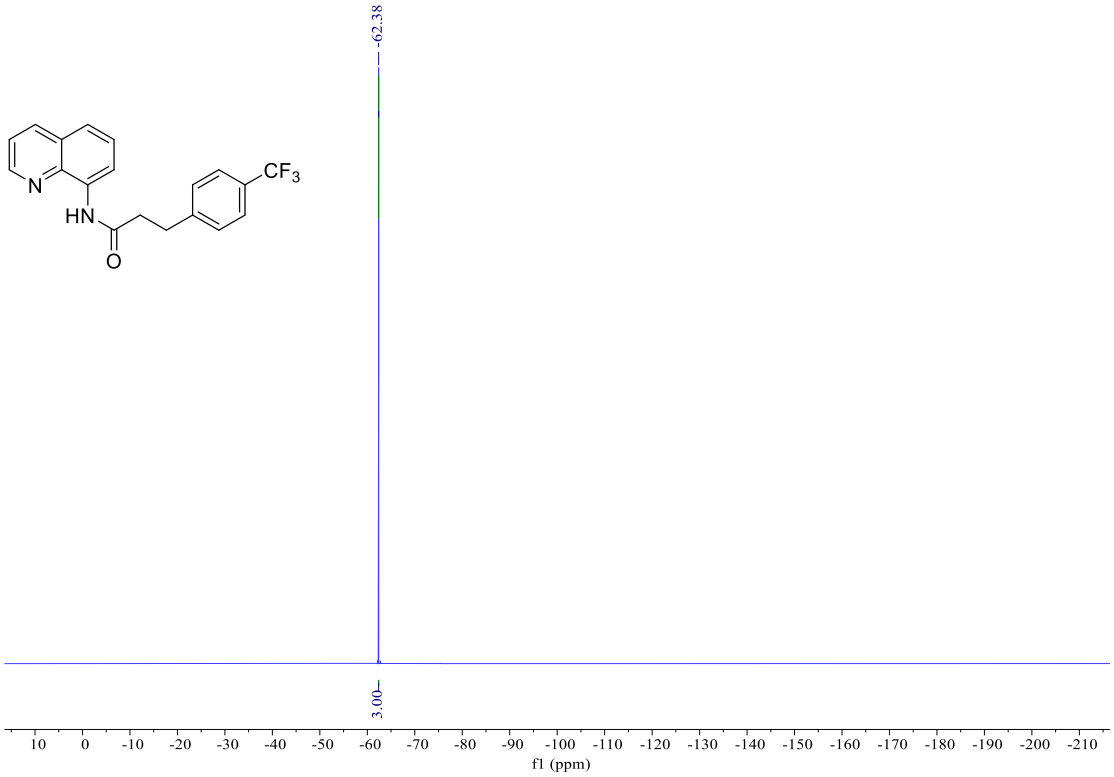
^{1}H NMR of N-(quinolin-8-yl)-3-(4-(trifluoromethyl)phenyl)propanamide **3en**



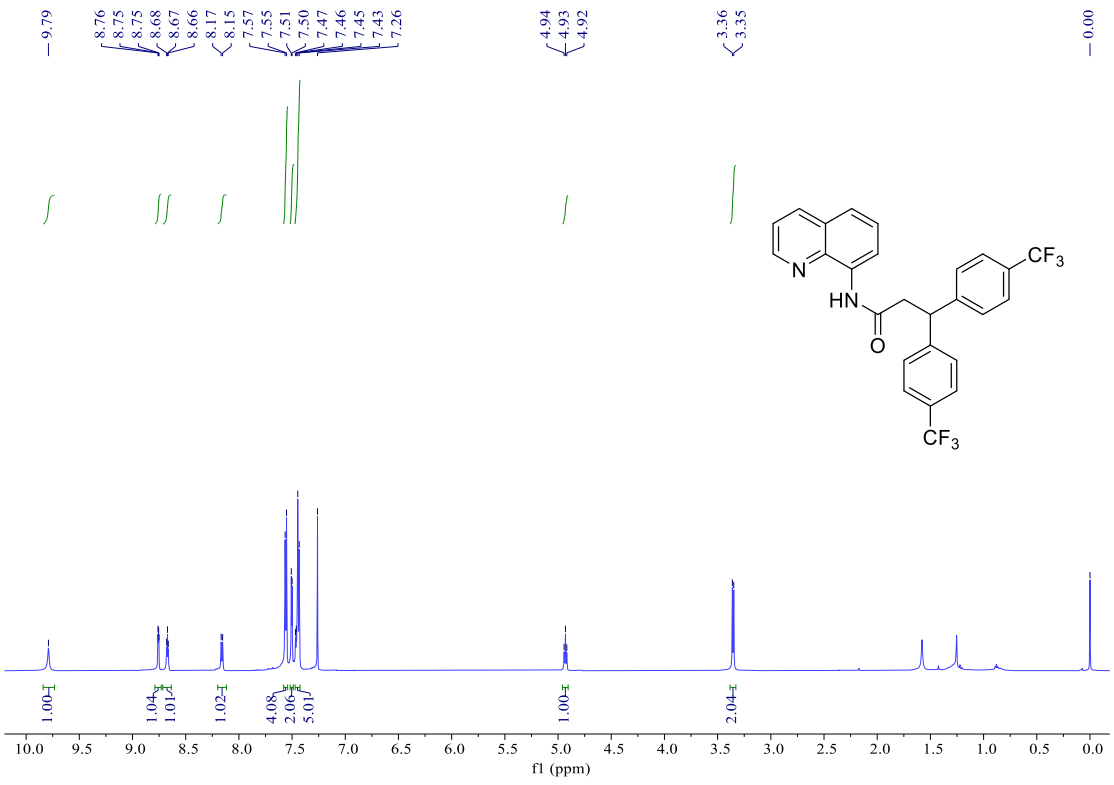
^{13}C NMR of N-(quinolin-8-yl)-3-(4-(trifluoromethyl)phenyl)propanamide **3en**



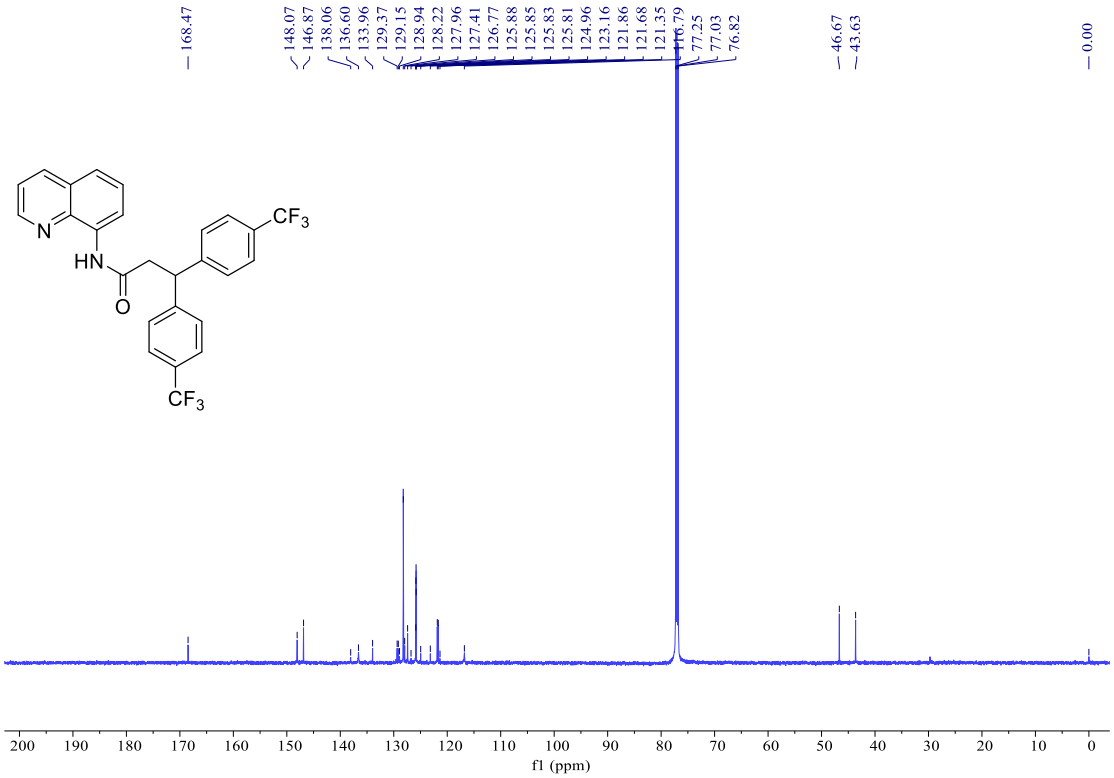
^{19}F NMR of N-(quinolin-8-yl)-3-(4-(trifluoromethyl)phenyl)propanamide **3en**



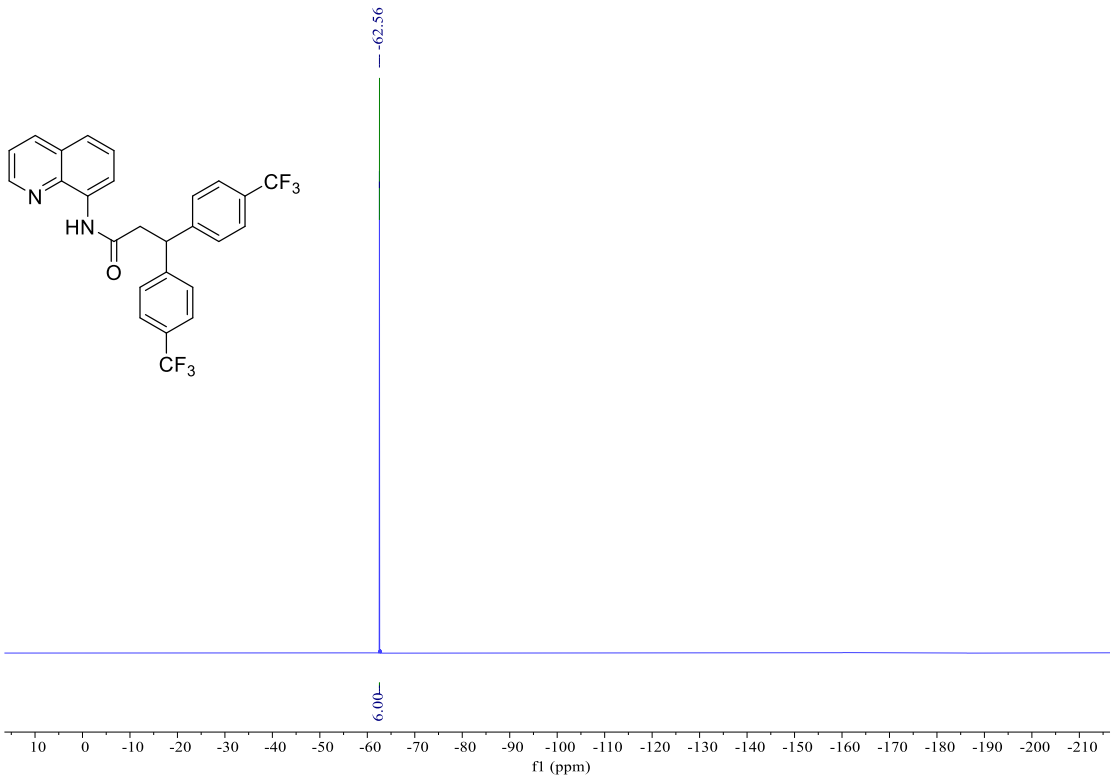
^{1}H NMR of N-(quinolin-8-yl)-3,3-bis(4-(trifluoromethyl)phenyl)propanamide **3en'**



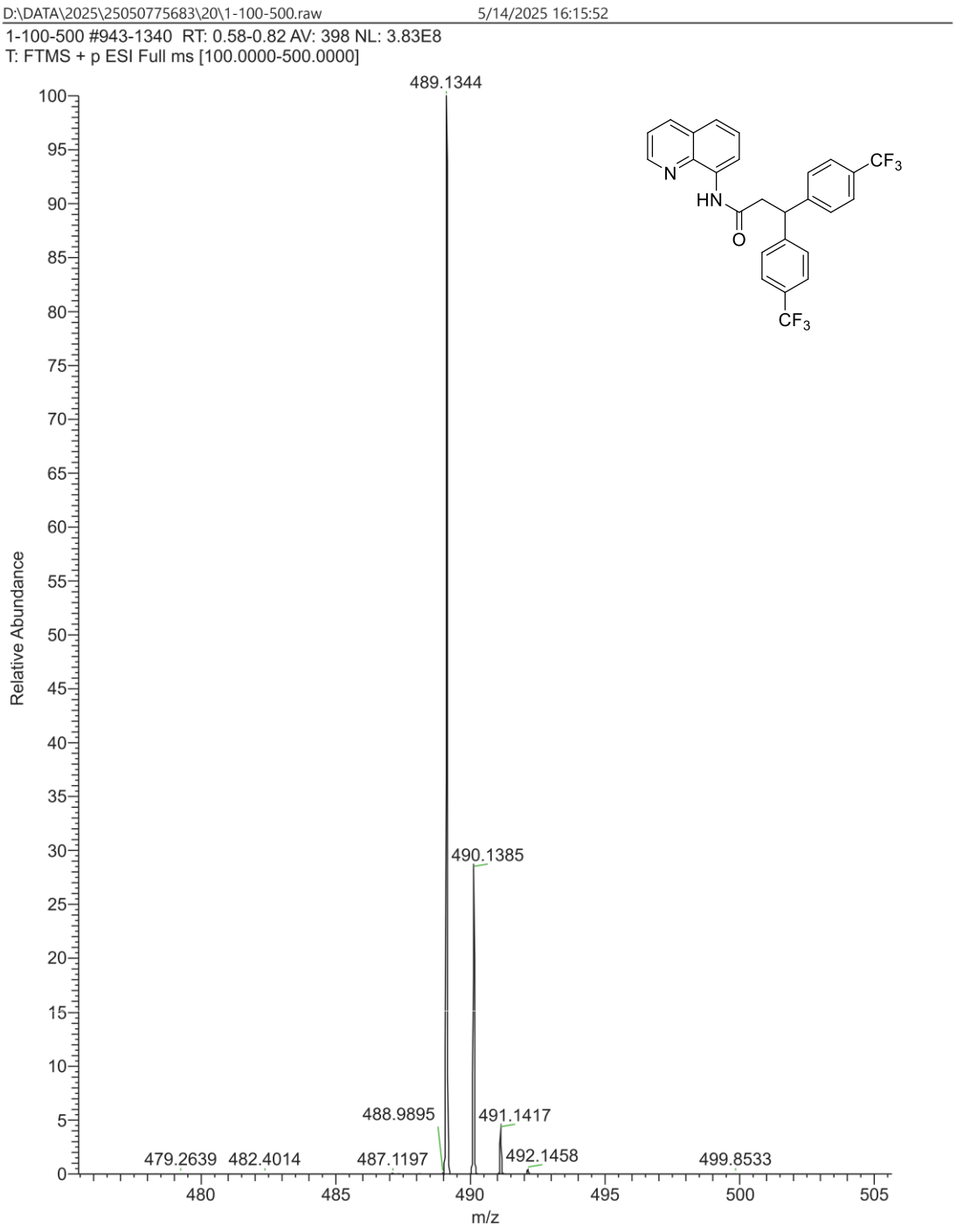
^{13}C NMR of N-(quinolin-8-yl)-3,3-bis(4-(trifluoromethyl)phenyl)propanamide **3en'**



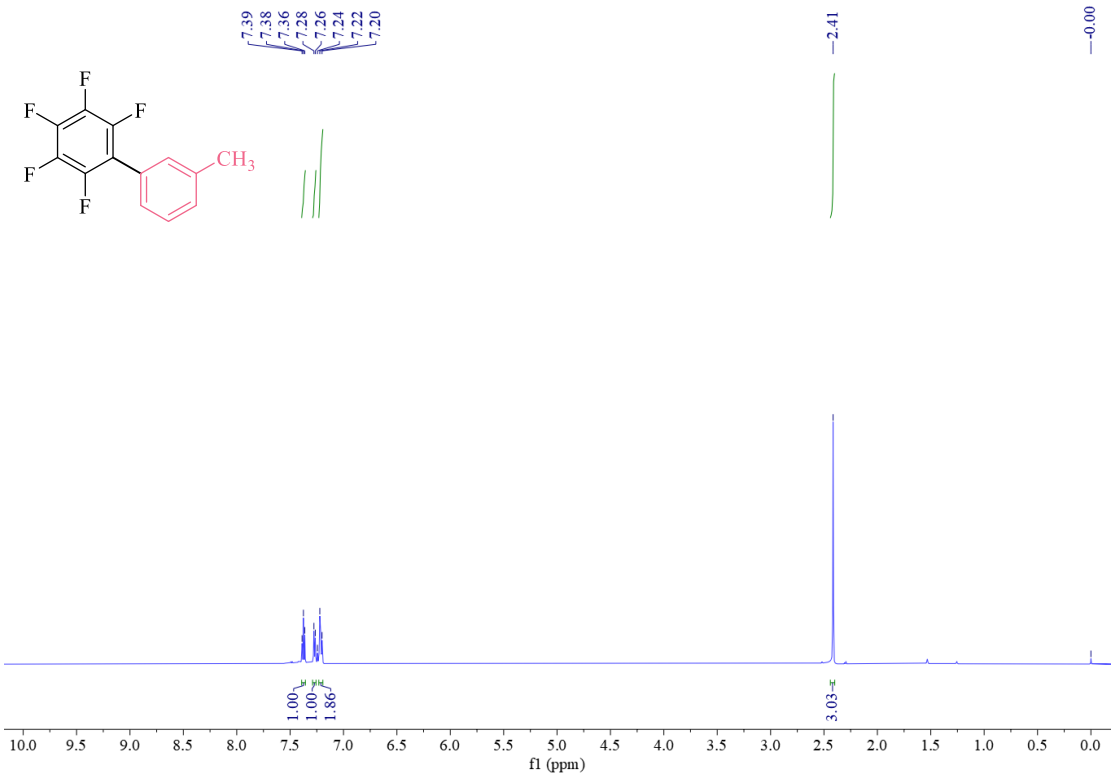
^{19}F NMR of N-(quinolin-8-yl)-3,3-bis(4-(trifluoromethyl)phenyl)propanamide **3en'**



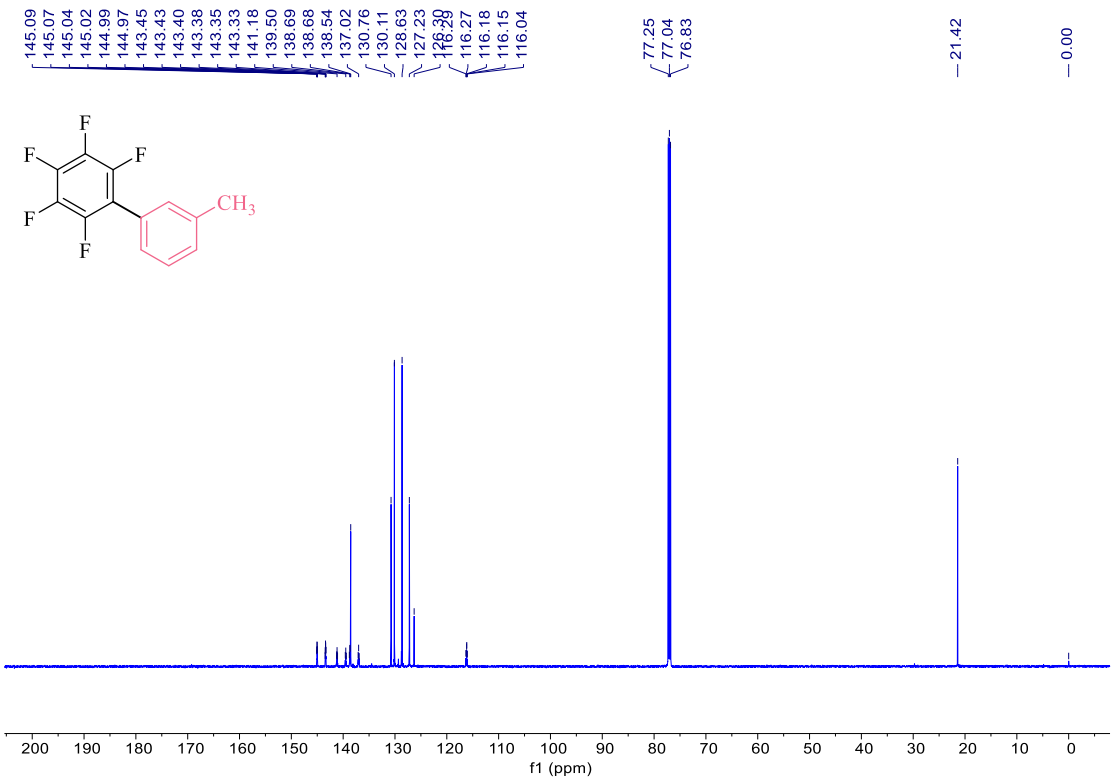
HRMS(ESI) of N-(quinolin-8-yl)-3,3-bis(4-(trifluoromethyl)phenyl)propanamide **3en'**



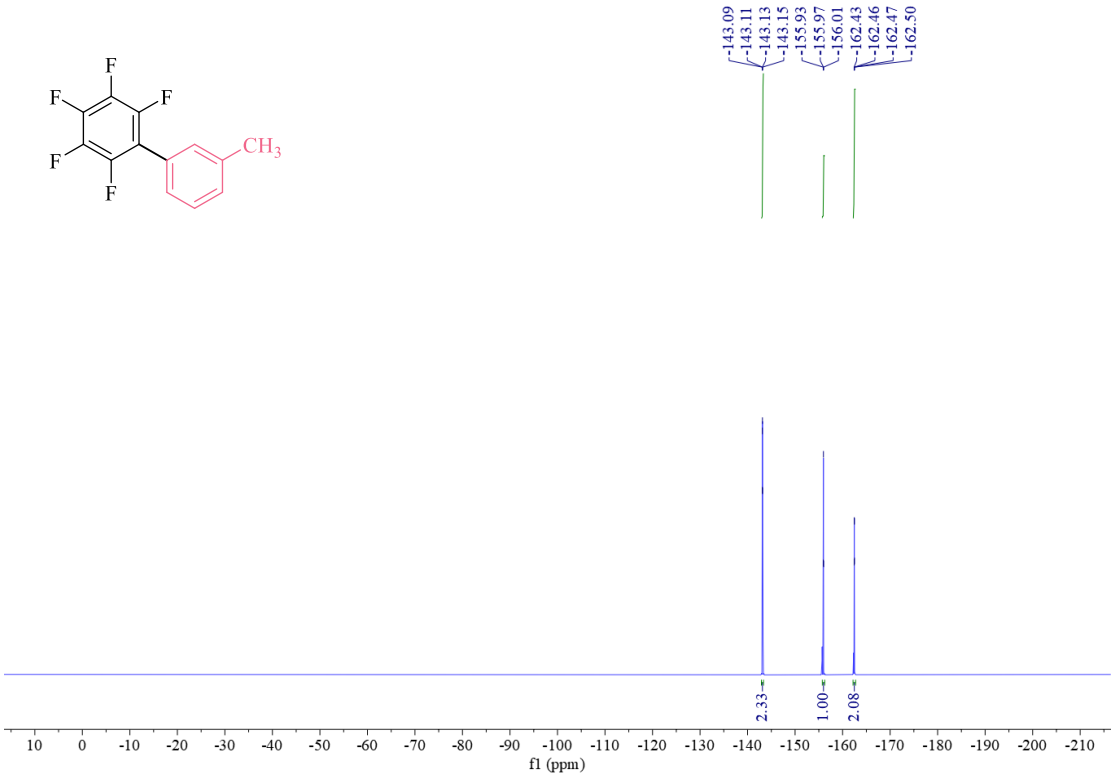
^{1}H NMR of 2,3,4,5,6-pentafluoro-3'-methyl-1,1'-biphenyl **5aa**



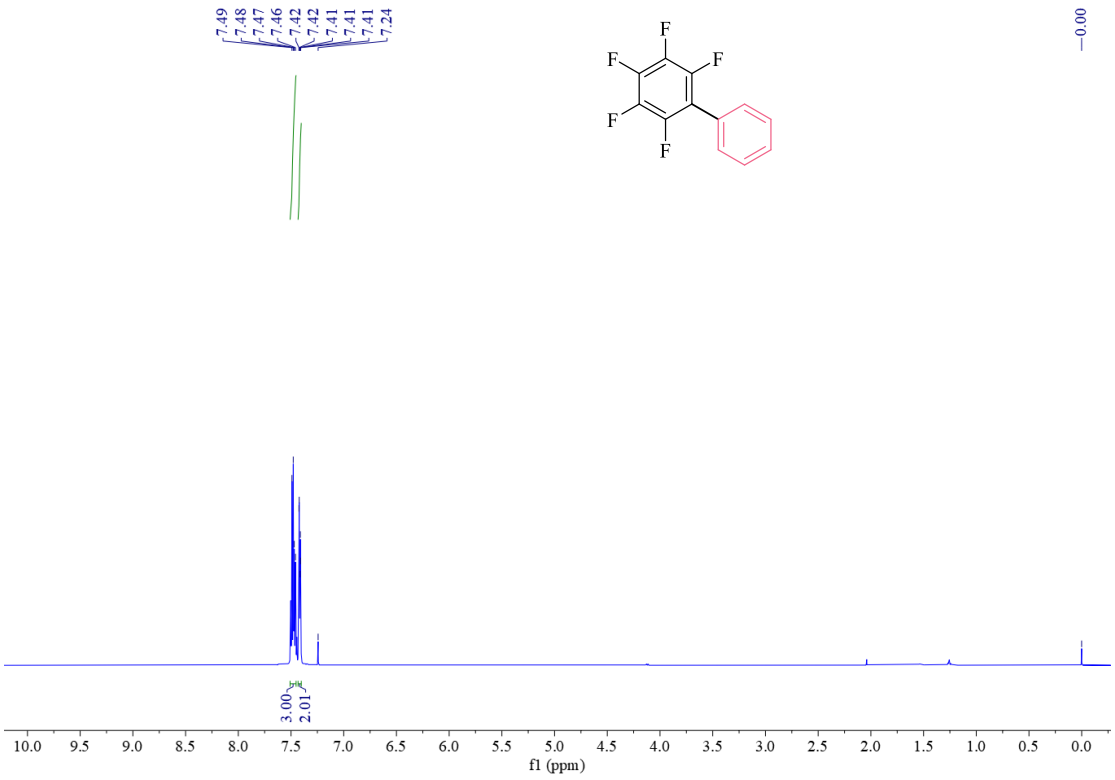
^{13}C NMR of 2,3,4,5,6-pentafluoro-3'-methyl-1,1'-biphenyl **5aa**



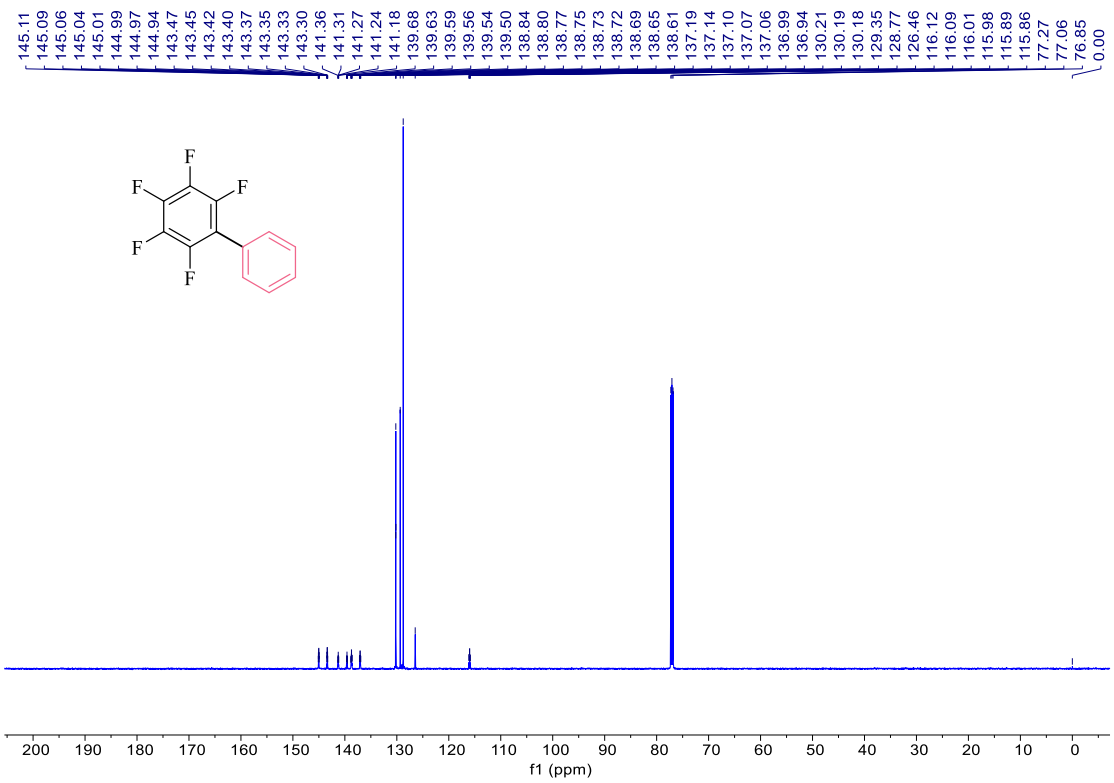
^{19}F NMR of 2,3,4,5,6-pentafluoro-3'-methyl-1,1'-biphenyl **5aa**



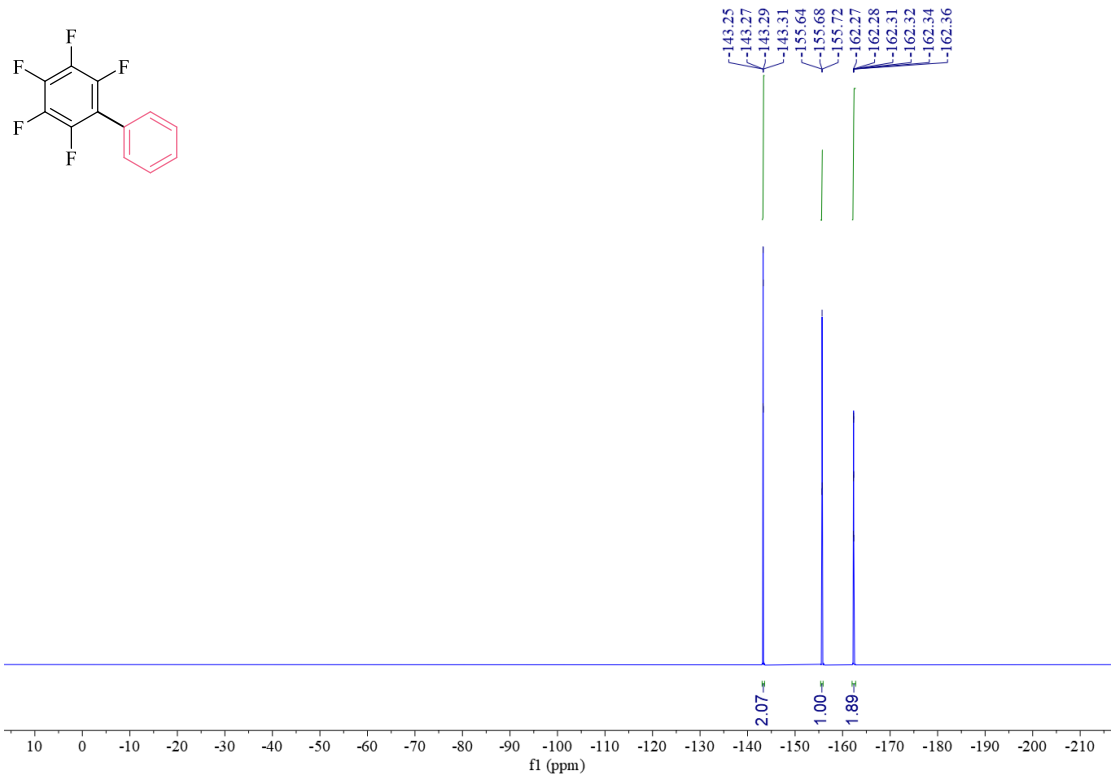
^{1}H NMR of 2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ab**



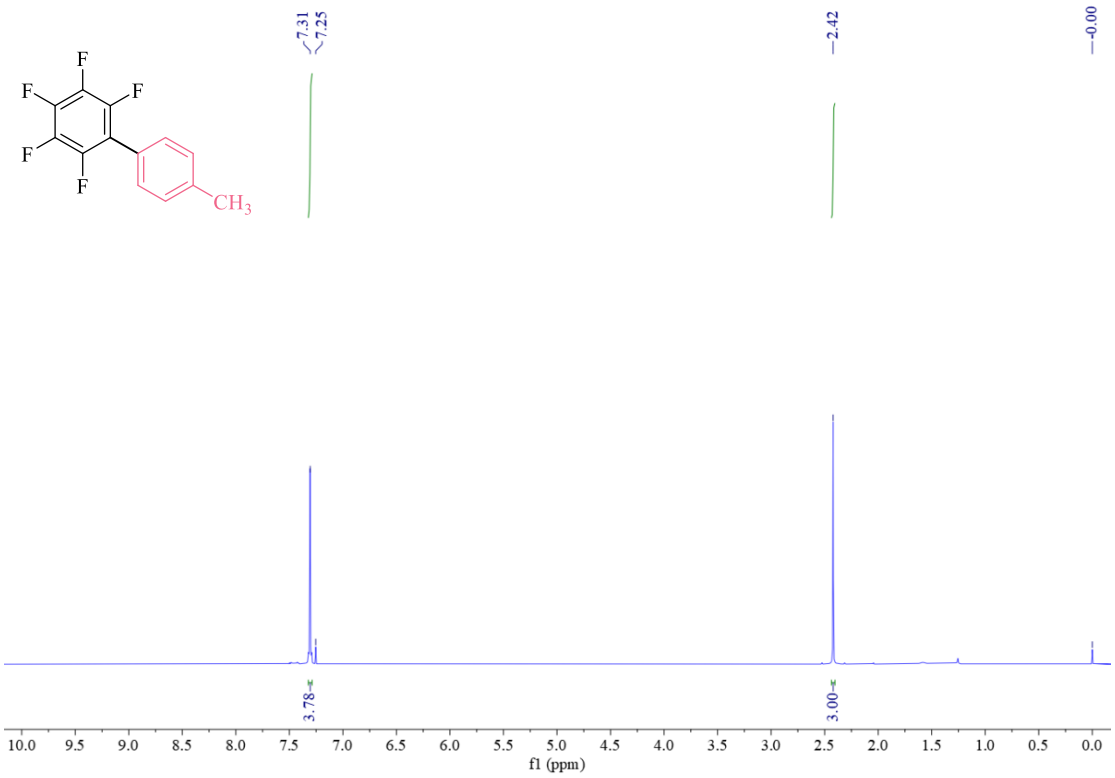
^{13}C NMR of 2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ab**



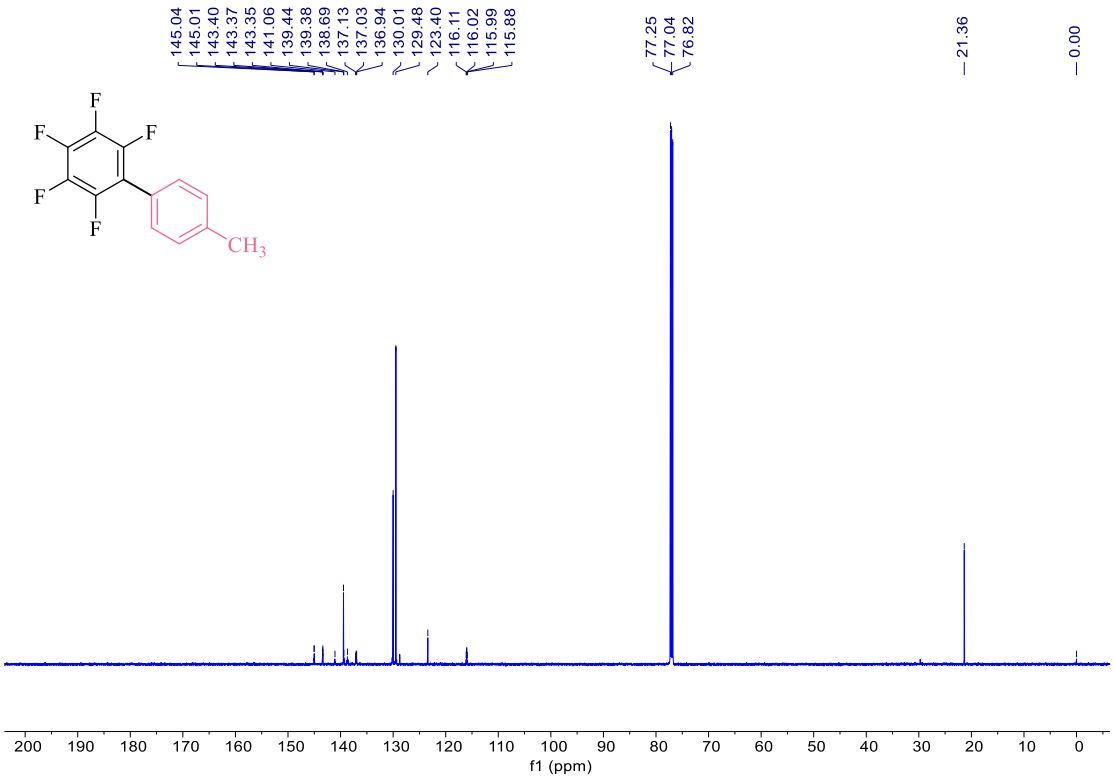
^{19}F NMR of 2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ab**



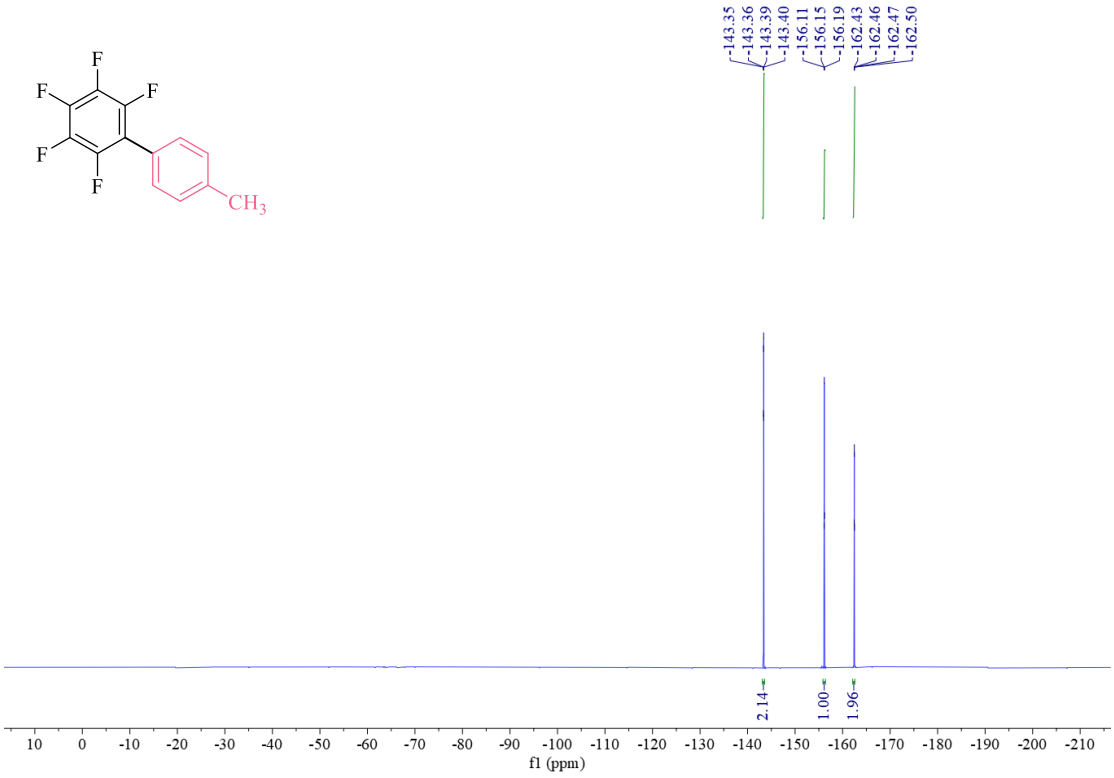
^{1}H NMR of 2,3,4,5,6-pentafluoro-4'-methyl-1,1'-biphenyl **5ac**



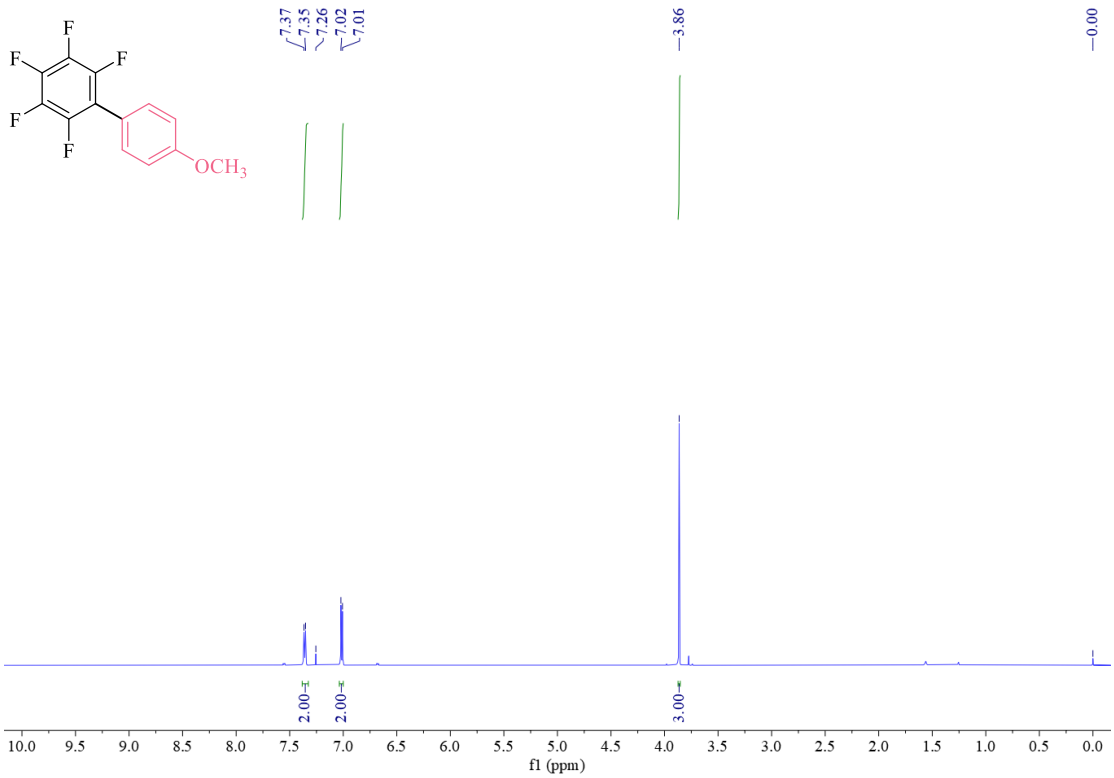
^{13}C NMR of 2,3,4,5,6-pentafluoro-4'-methyl-1,1'-biphenyl **5ac**



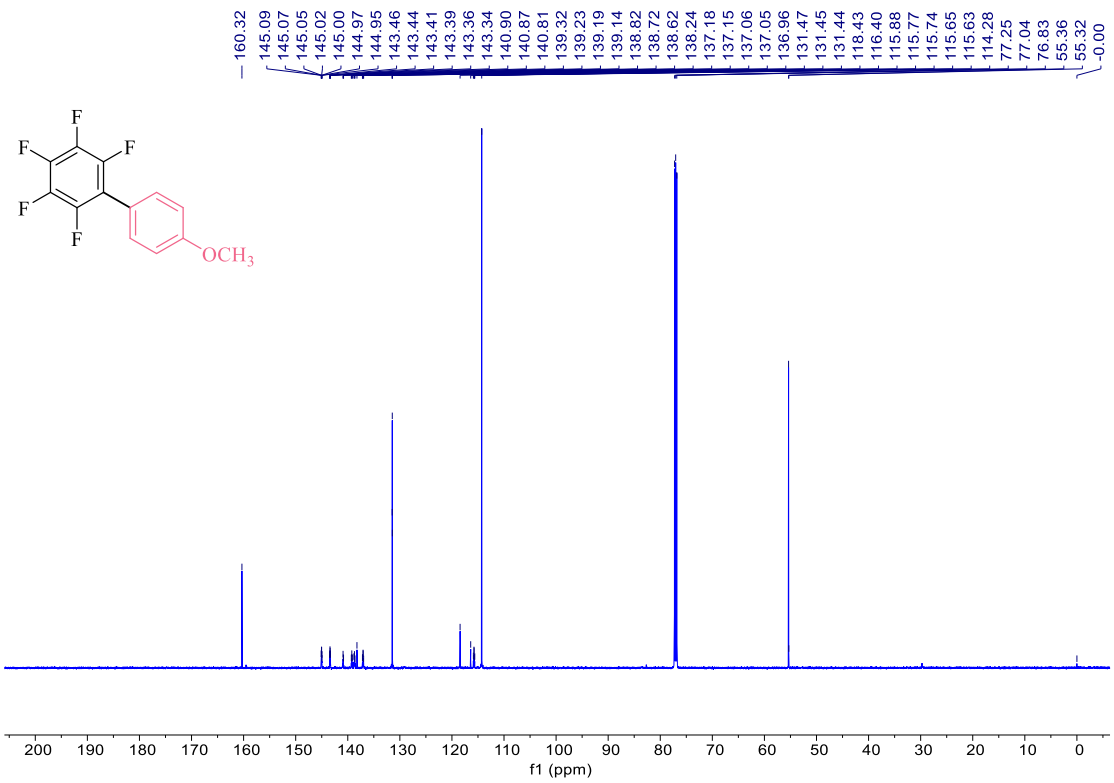
^{19}F NMR of 2,3,4,5,6-pentafluoro-4'-methyl-1,1'-biphenyl **5ac**



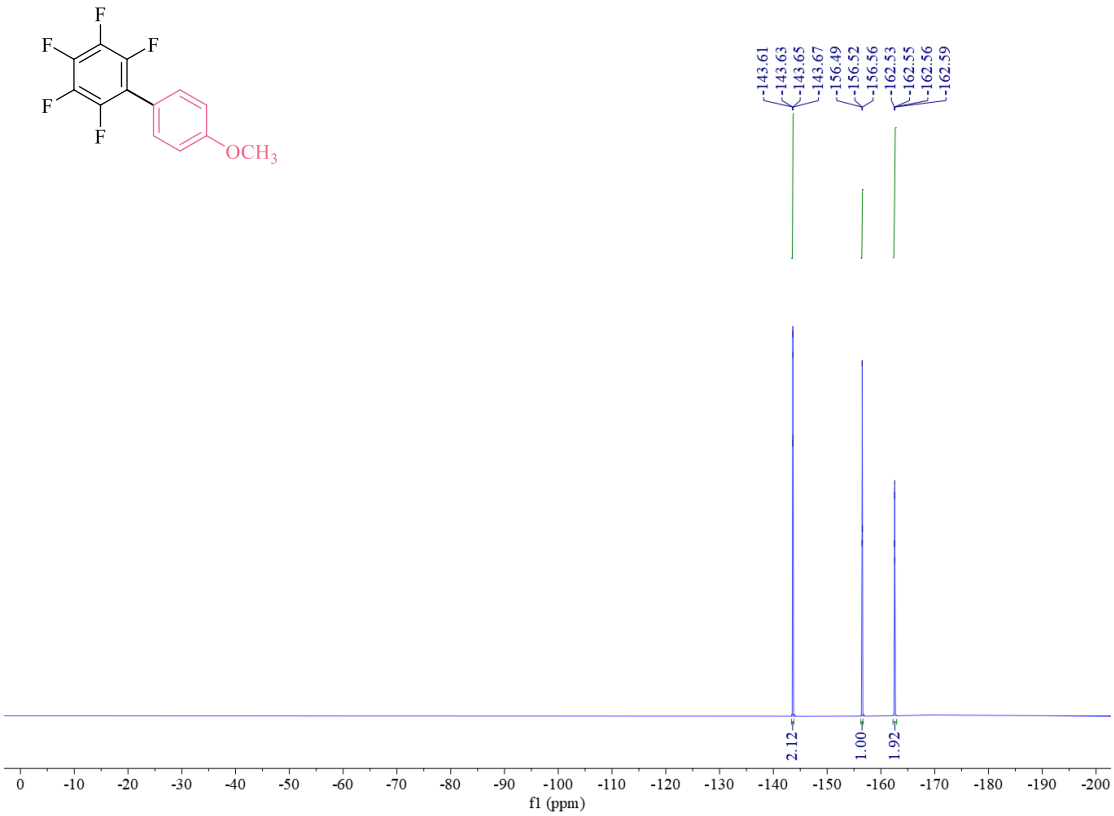
^{1}H NMR of 2,3,4,5,6-pentafluoro-4'-methoxy-1,1'-biphenyl **5ad**



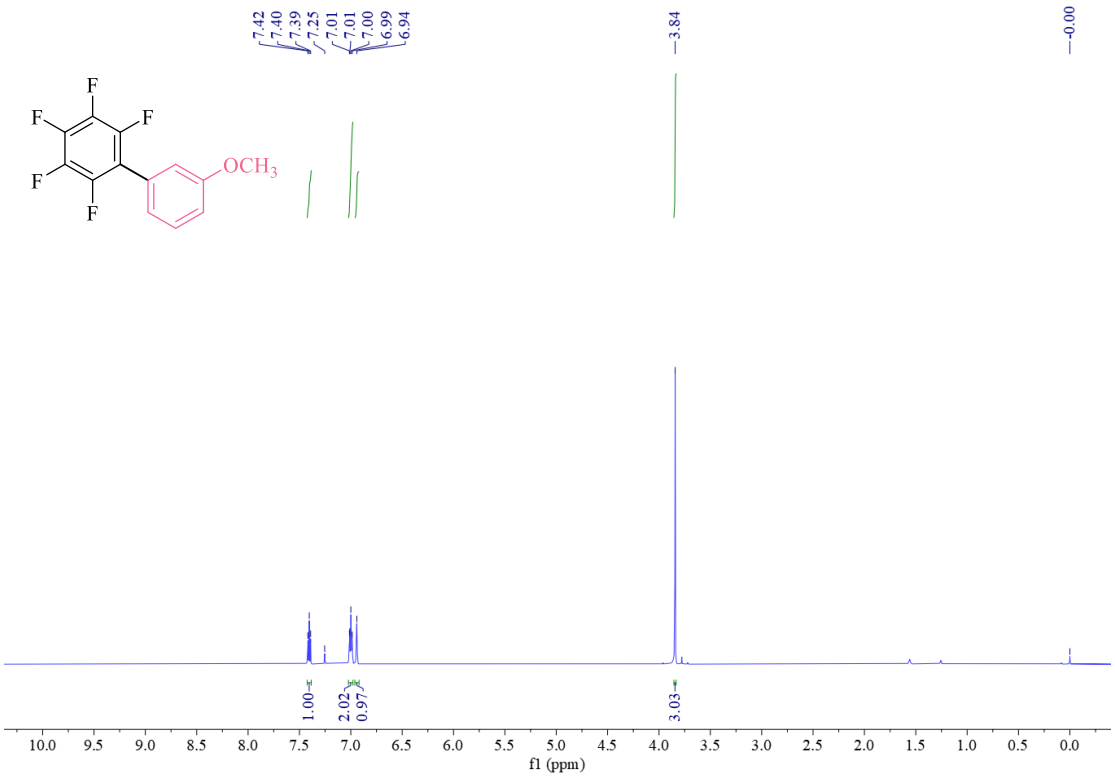
^{13}C NMR of 2,3,4,5,6-pentafluoro-4'-methoxy-1,1'-biphenyl **5ad**



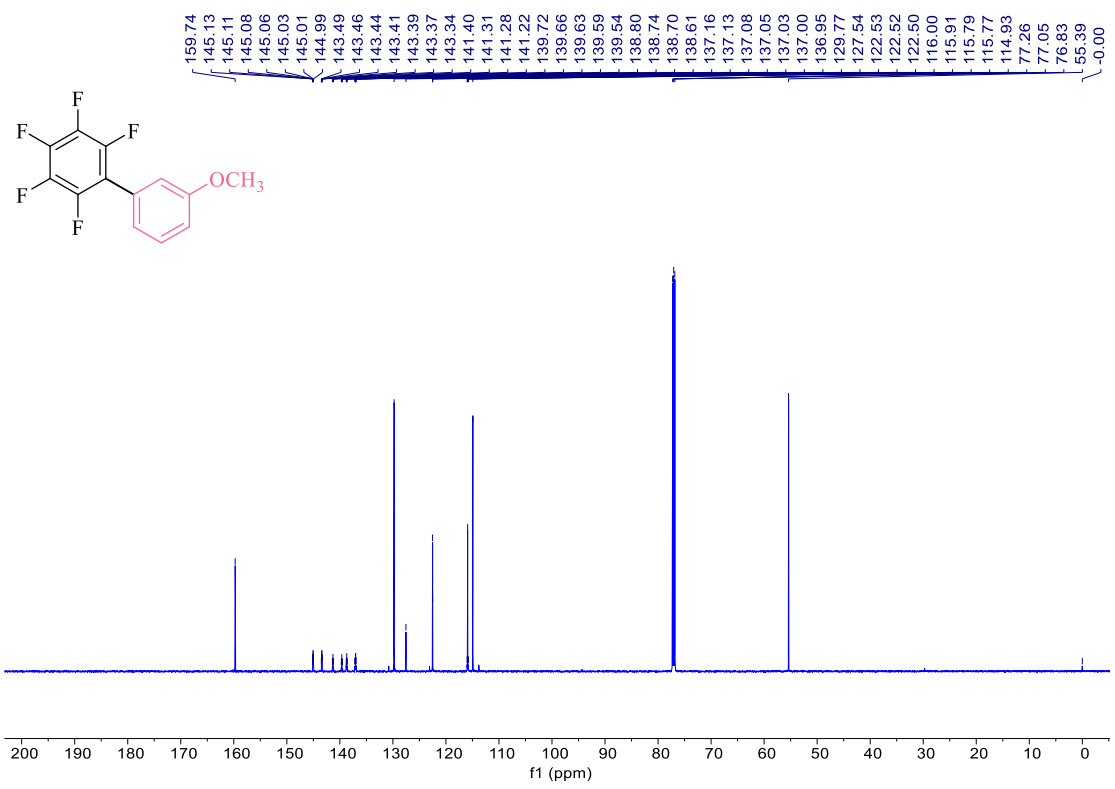
^{19}F NMR of 2,3,4,5,6-pentafluoro-4'-methoxy-1,1'-biphenyl **5ad**



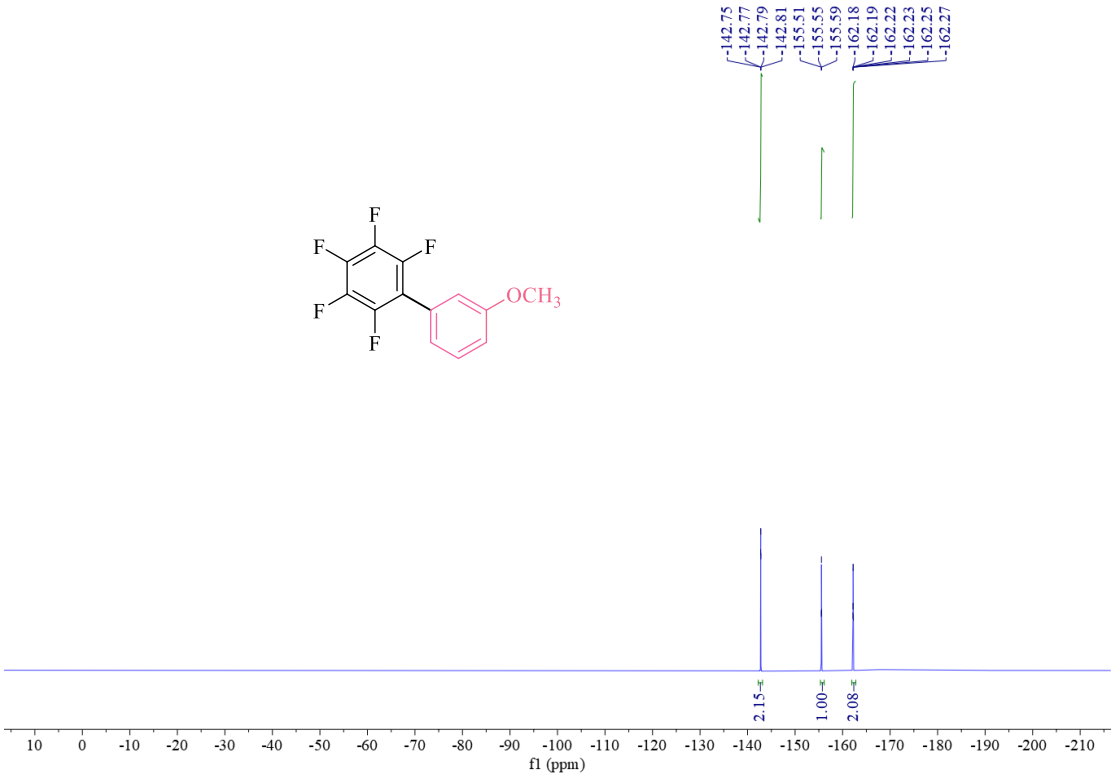
^{1}H NMR of 2,3,4,5,6-pentafluoro-3'-methoxy-1,1'-biphenyl **5ae**



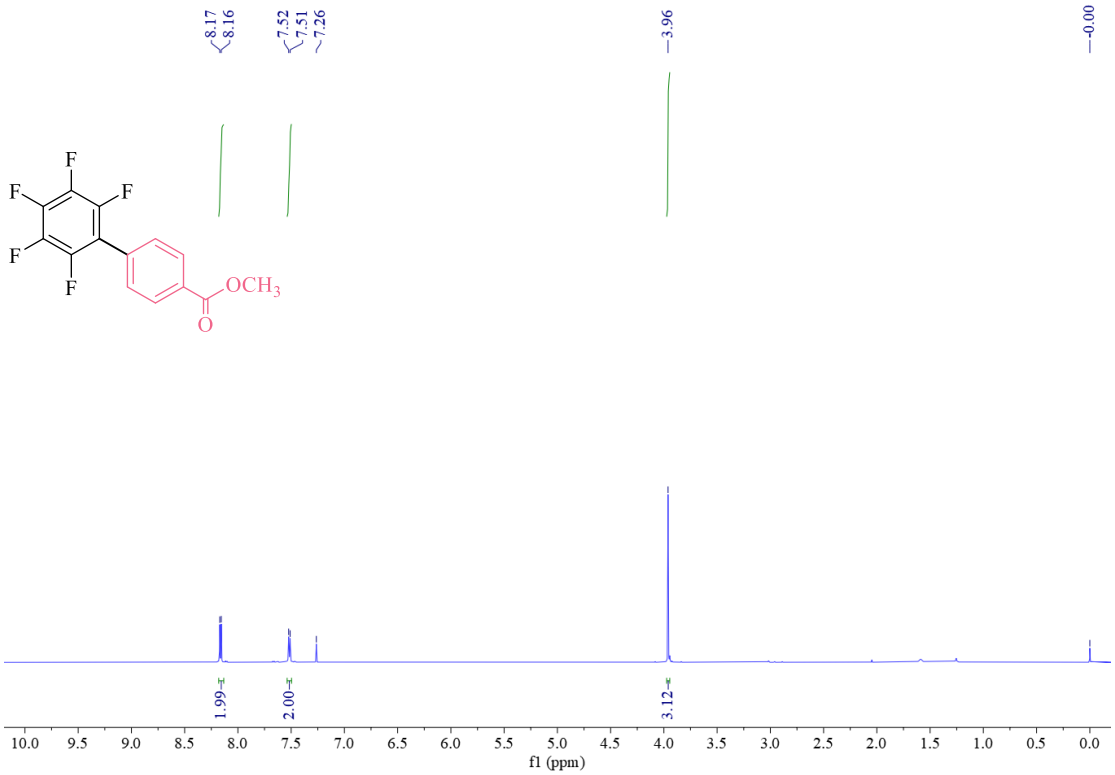
^{13}C NMR of 2,3,4,5,6-pentafluoro-3'-methoxy-1,1'-biphenyl **5ae**



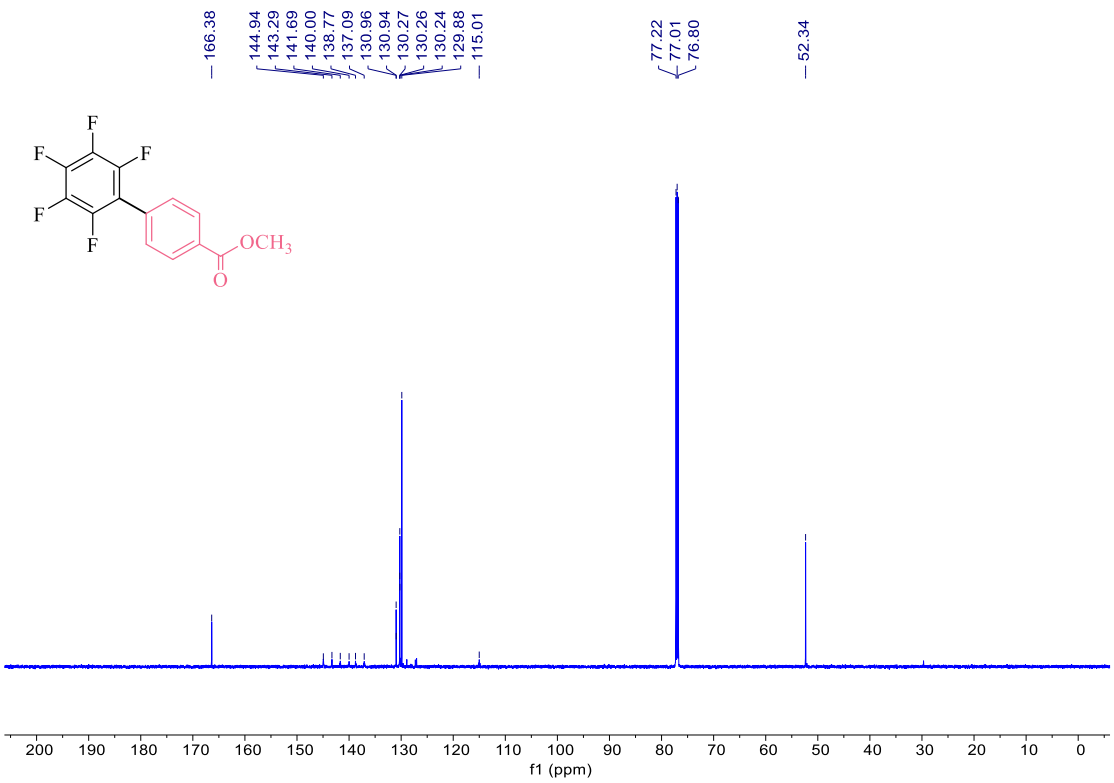
^{19}F NMR of 2,3,4,5,6-pentafluoro-3'-methoxy-1,1'-biphenyl **5ae**



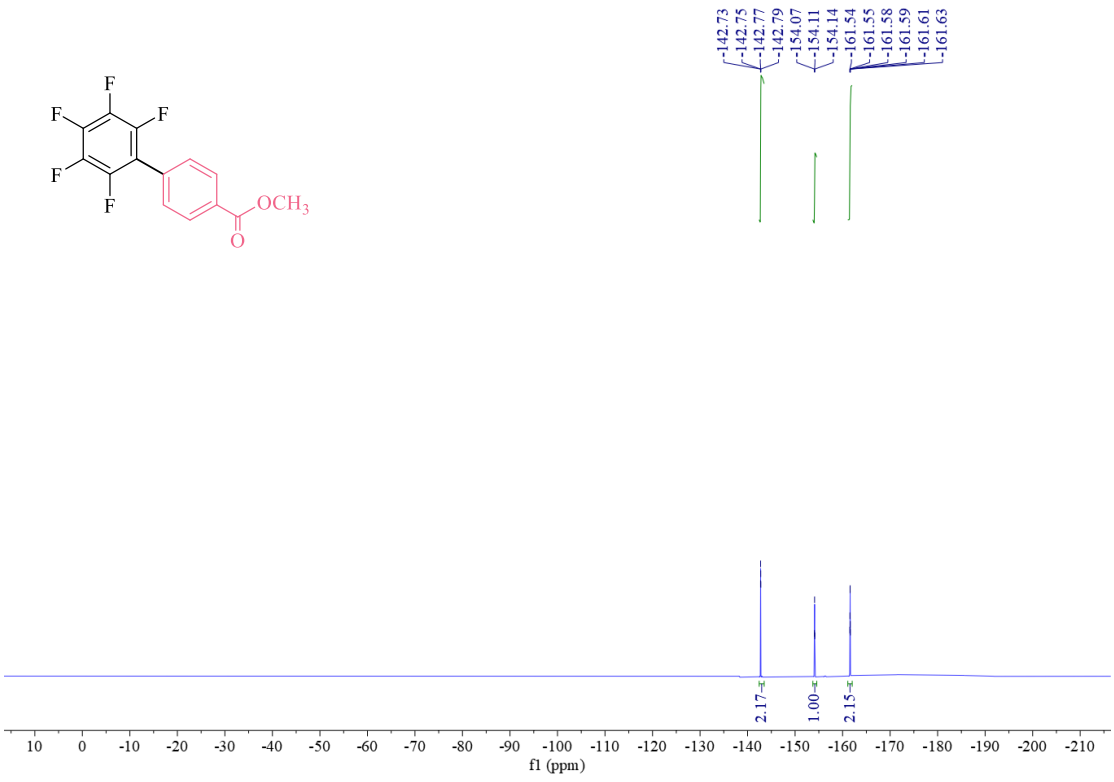
^{1}H NMR of methyl 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-3-carboxylate **5af**



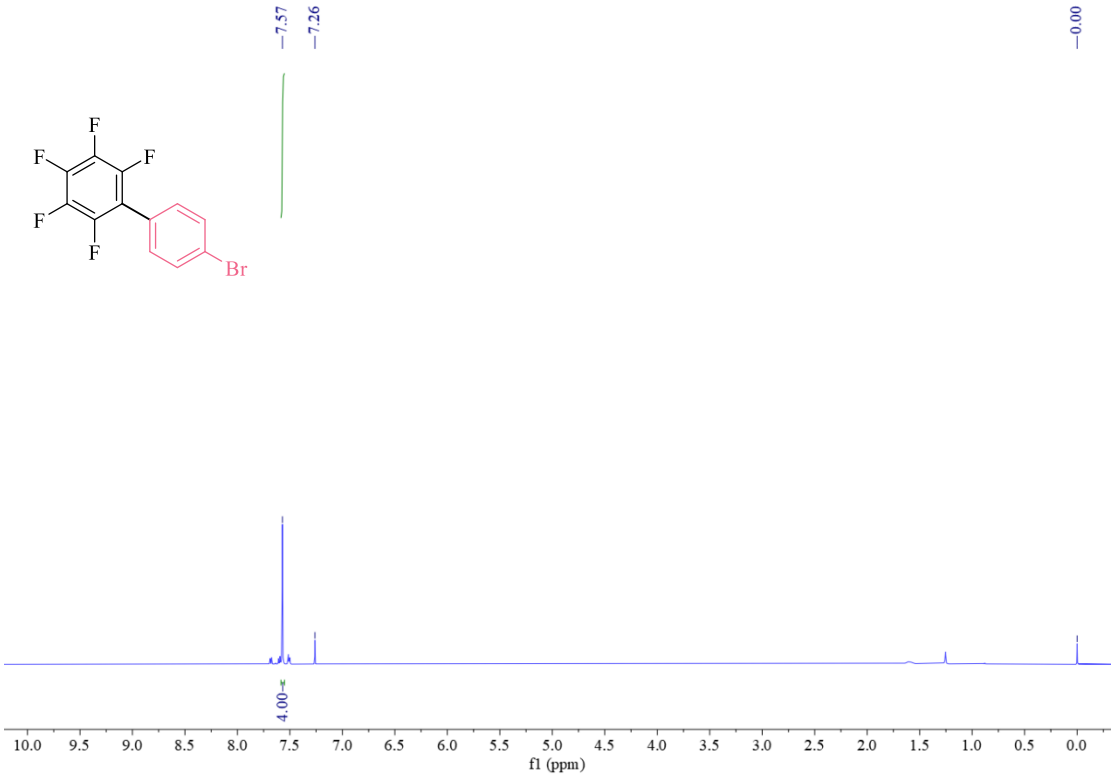
^{13}C NMR of methyl 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-3-carboxylate **5af**



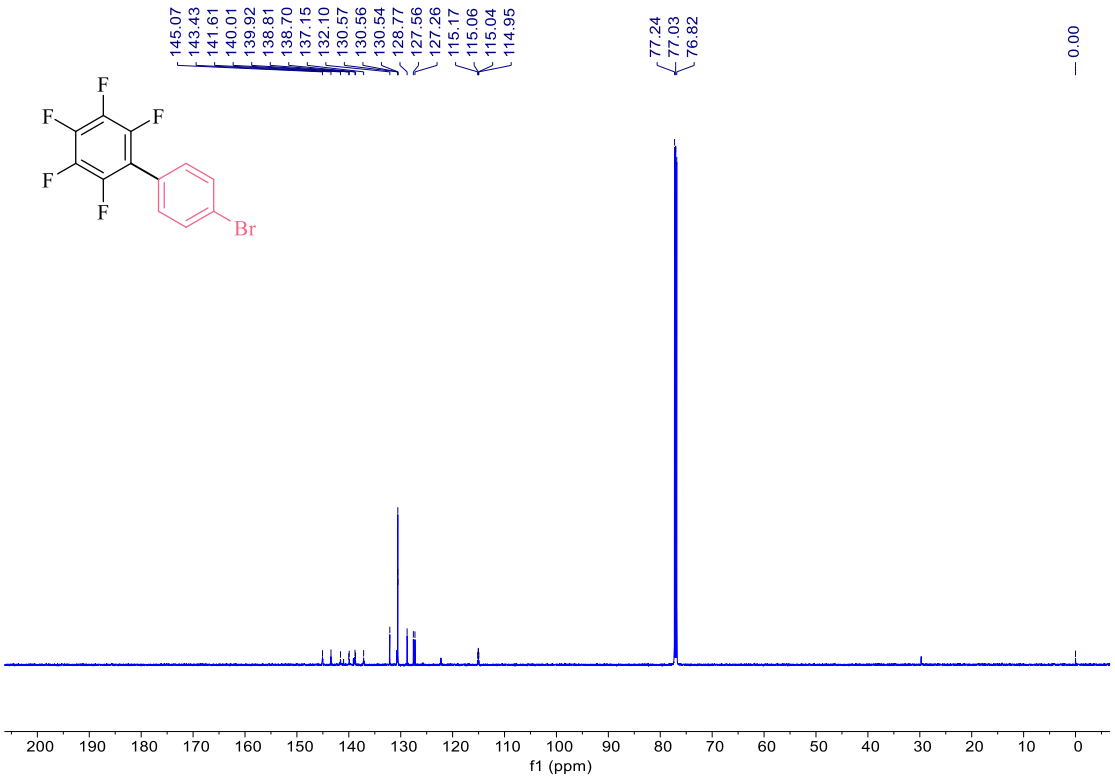
^{19}F NMR of methyl 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-3-carboxylate **5af**



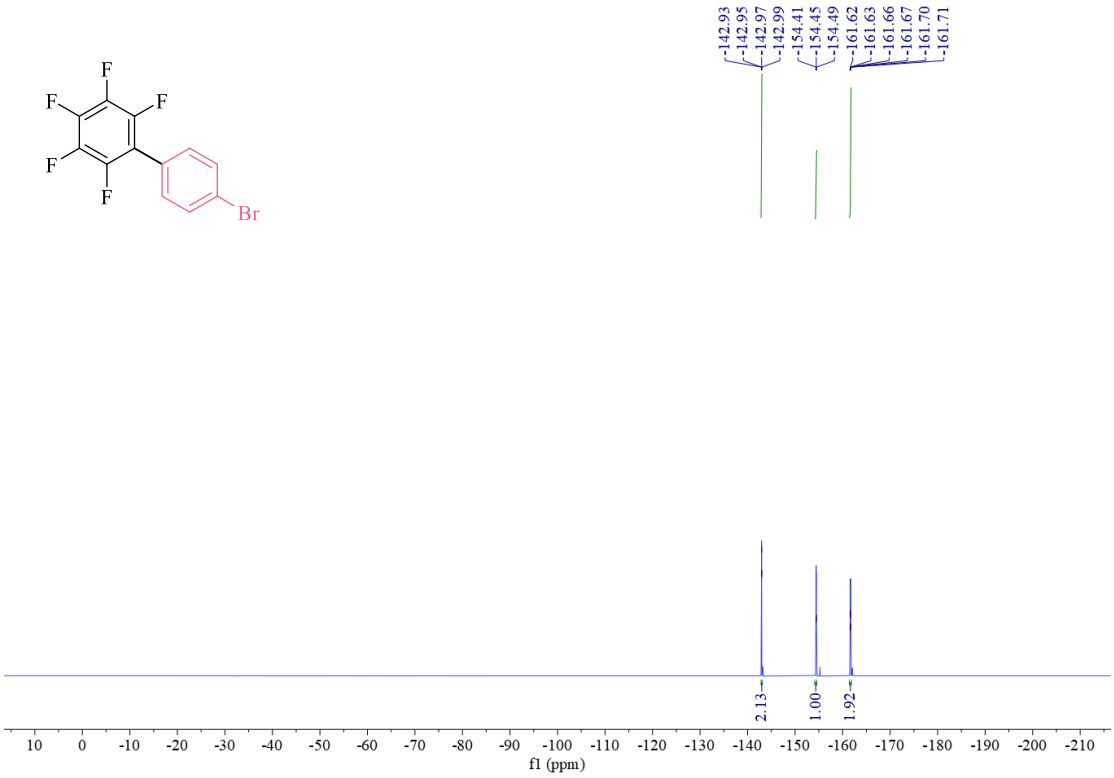
^{1}H NMR of 4'-bromo-2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ag**



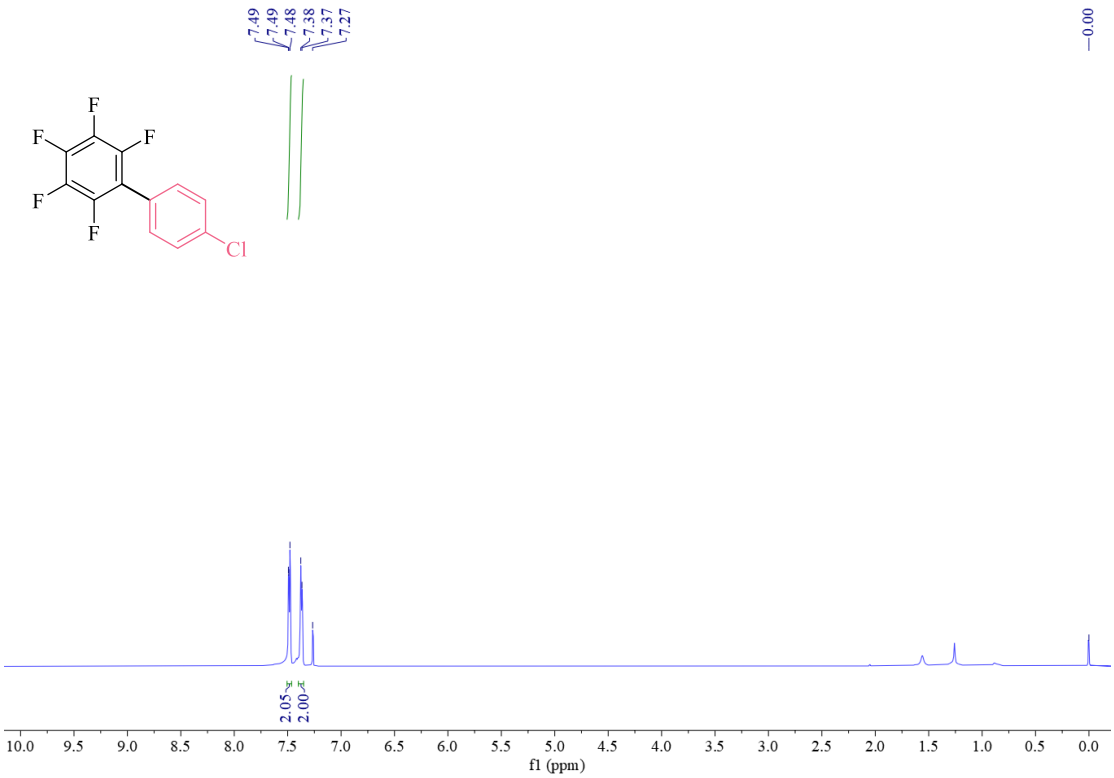
^{13}C NMR of 4'-bromo-2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ag**



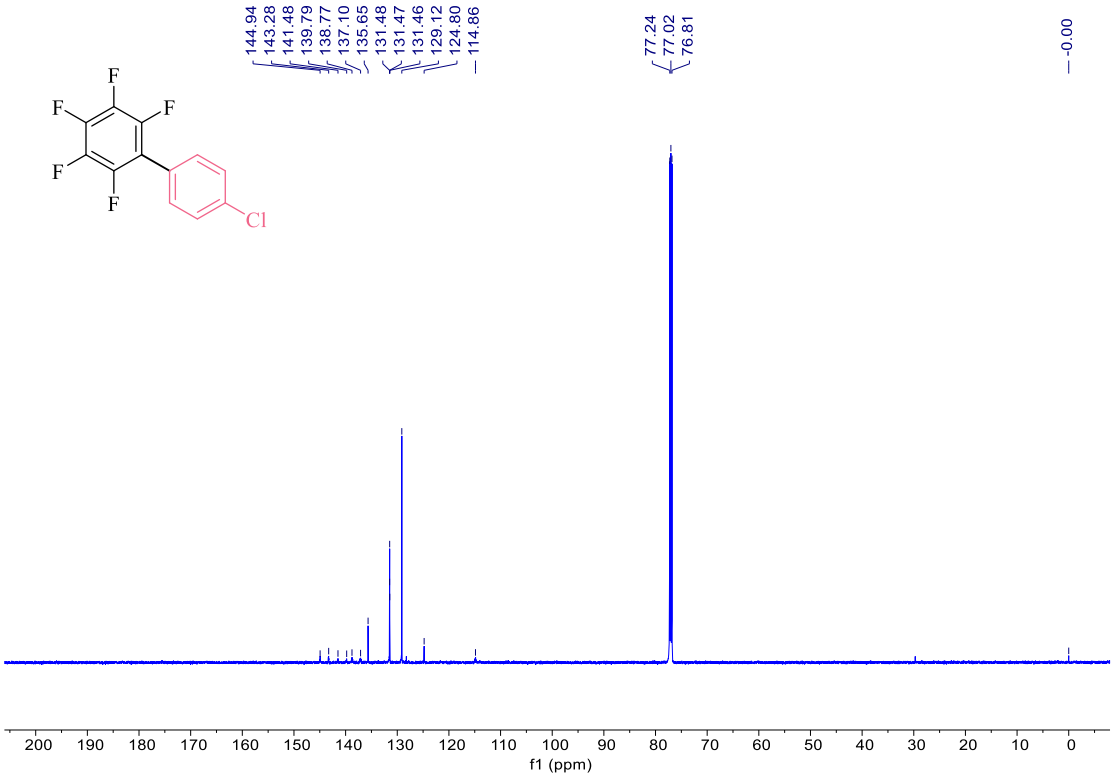
^{19}F NMR of 4'-bromo-2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ag**



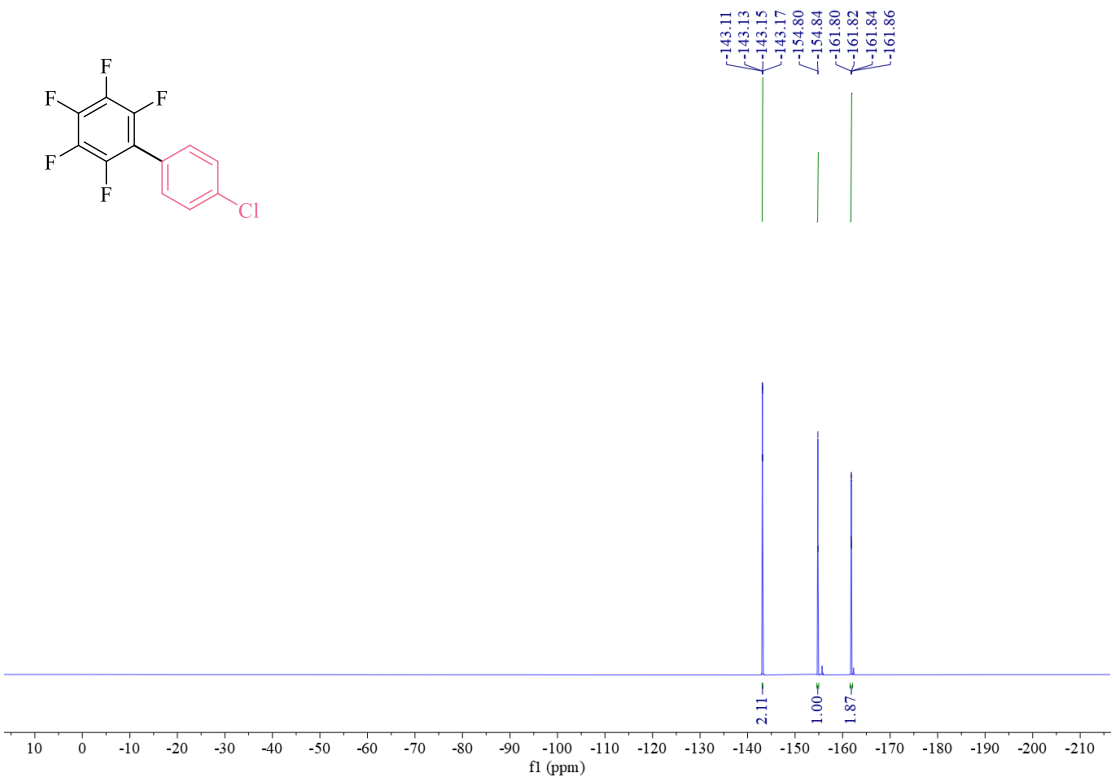
^{1}H NMR of 4'-chloro-2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ah**



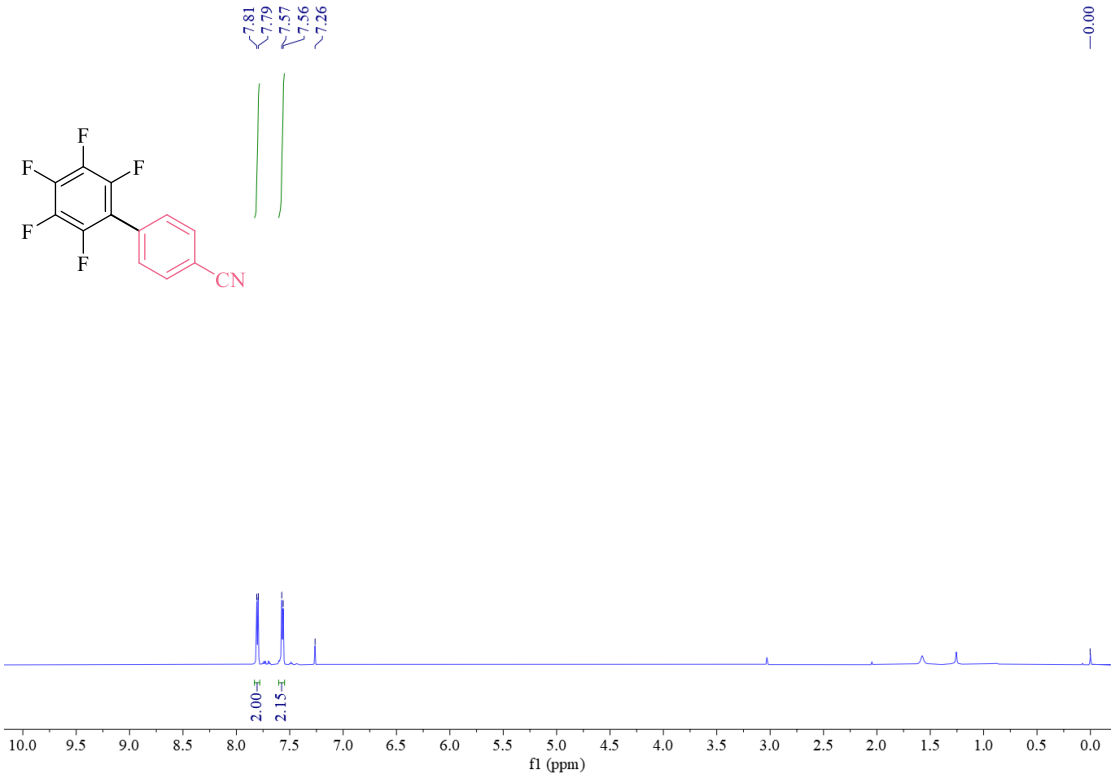
^{13}C NMR of 4'-chloro-2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ah**



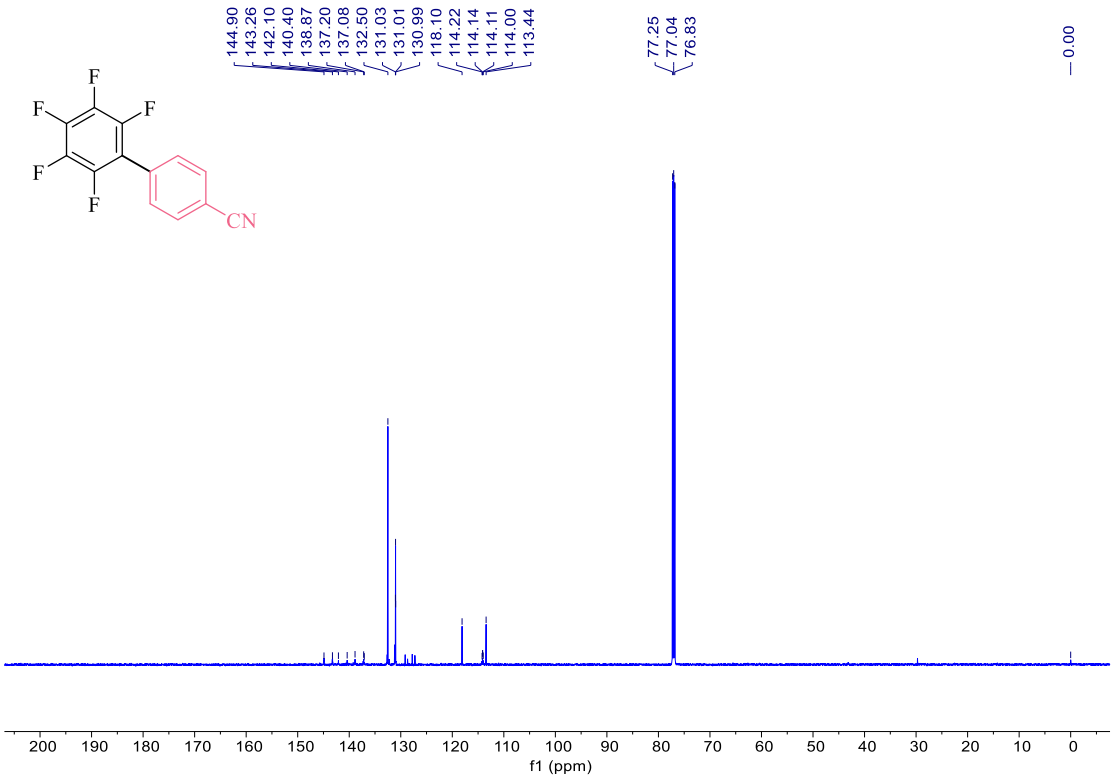
^{19}F NMR of 4'-chloro-2,3,4,5,6-pentafluoro-1,1'-biphenyl **5ah**



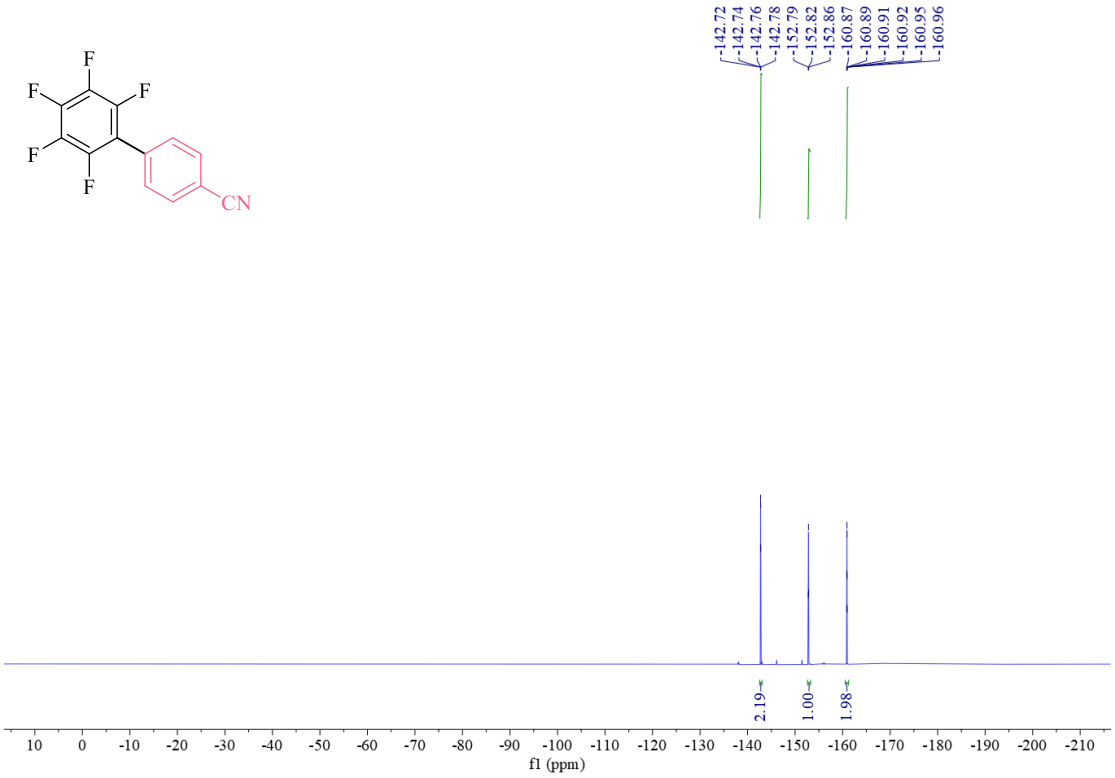
^{1}H NMR of 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-carbonitrile **5ai**



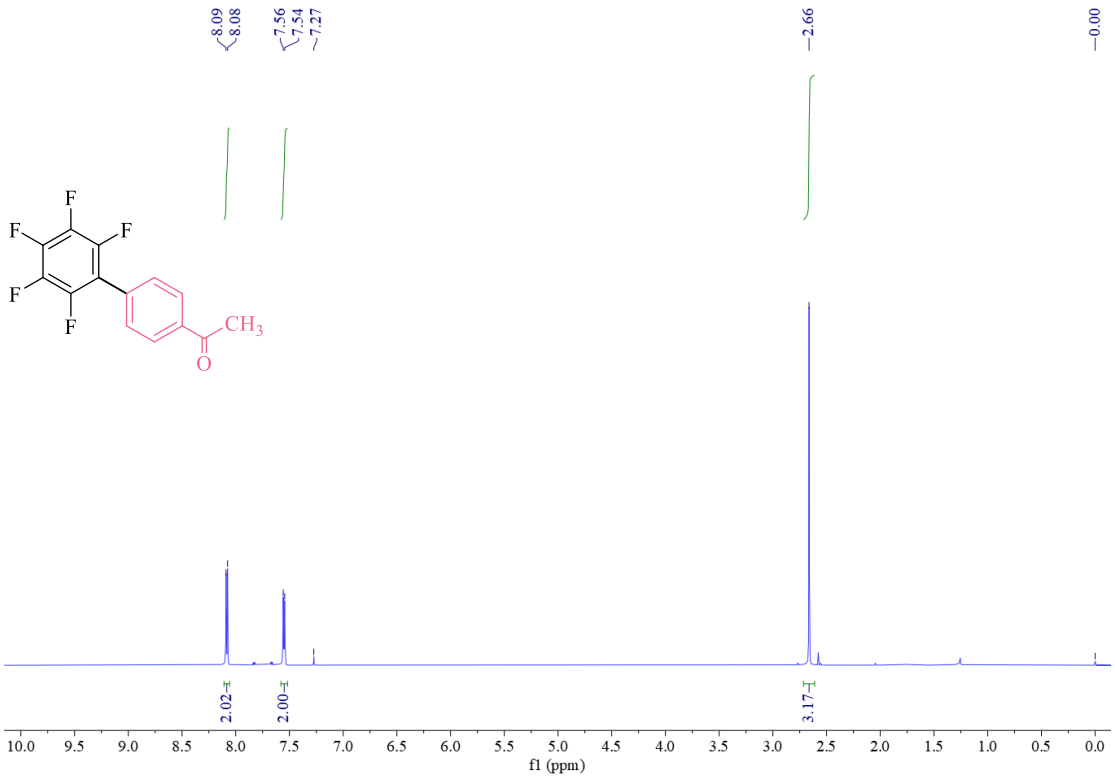
^{13}C NMR of 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-carbonitrile **5ai**



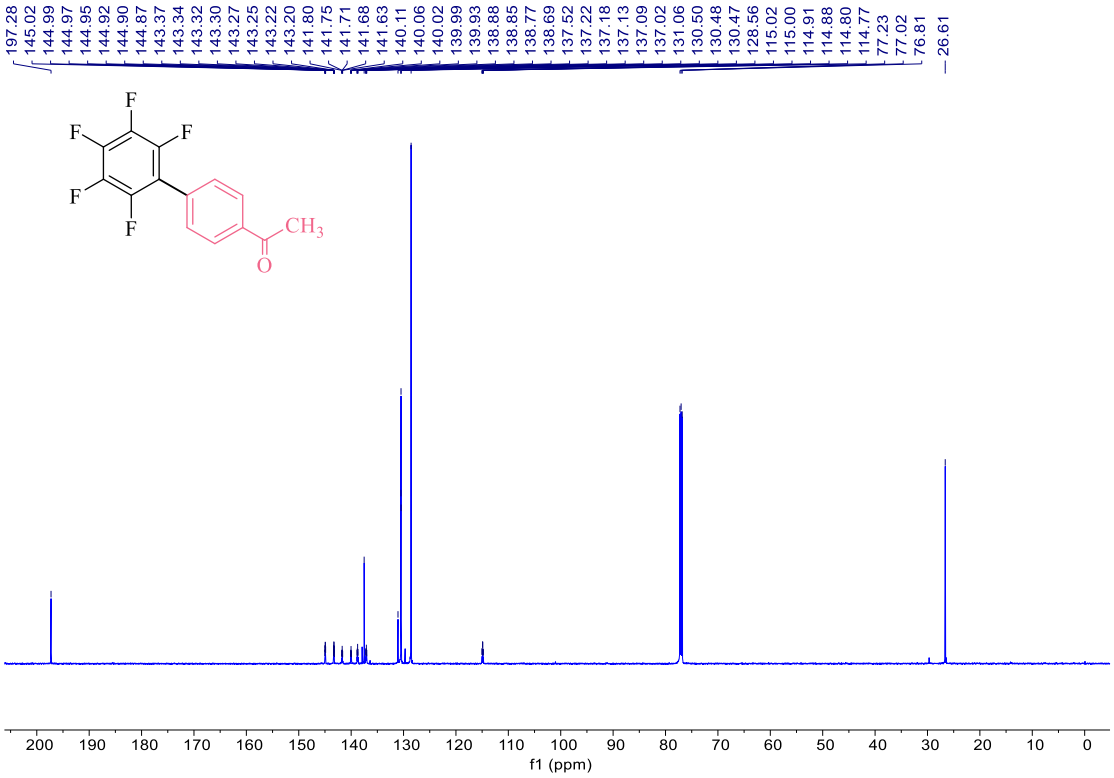
^{19}F NMR of 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-carbonitrile **5ai**



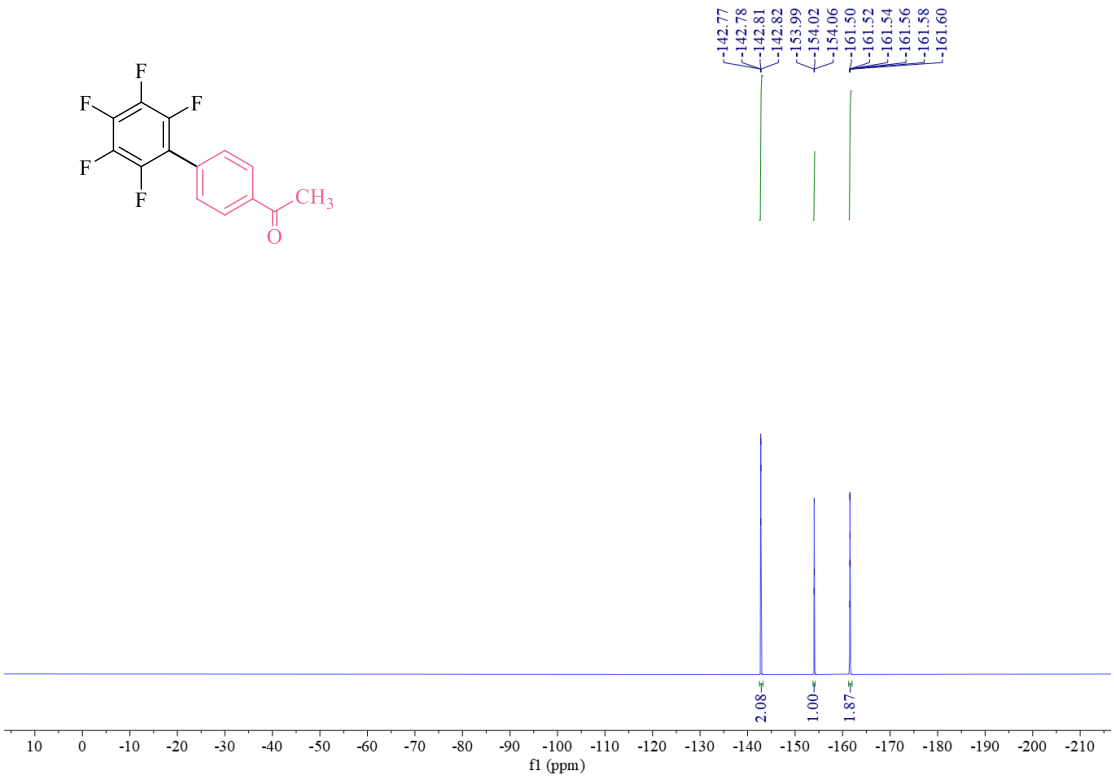
^{1}H NMR of 1-(2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-yl)ethan-1-one **5aj**



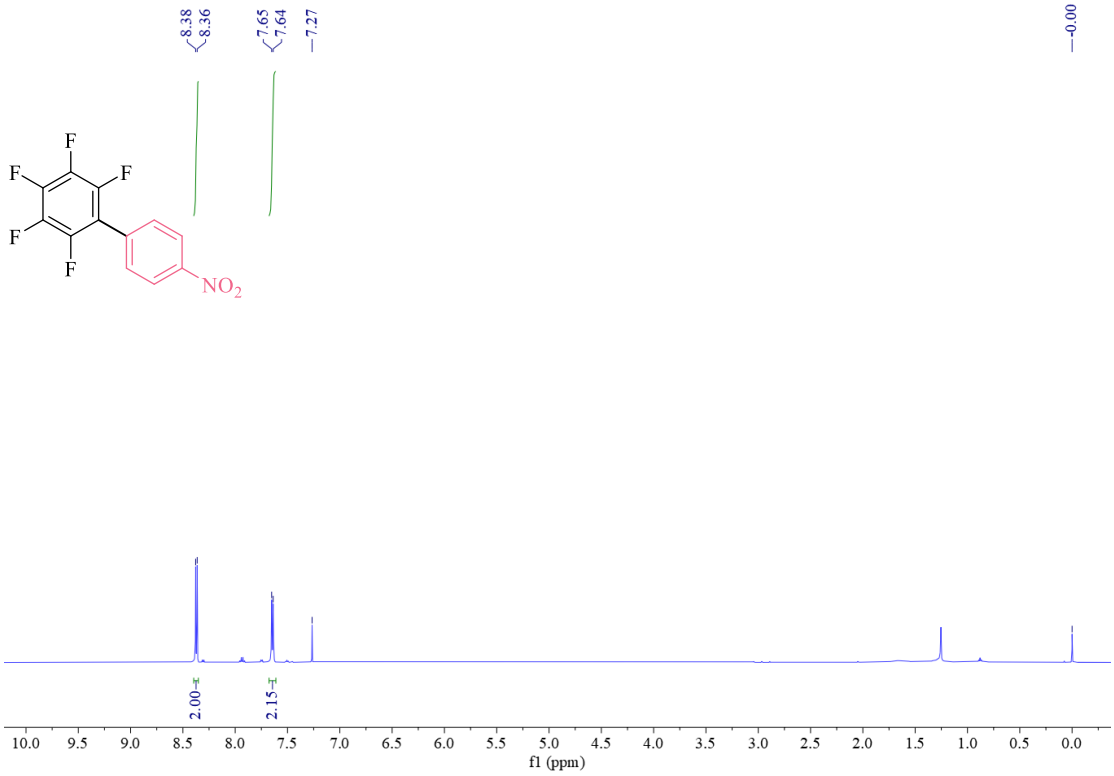
^{13}C NMR of 1-(2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-yl)ethan-1-one **5aj**



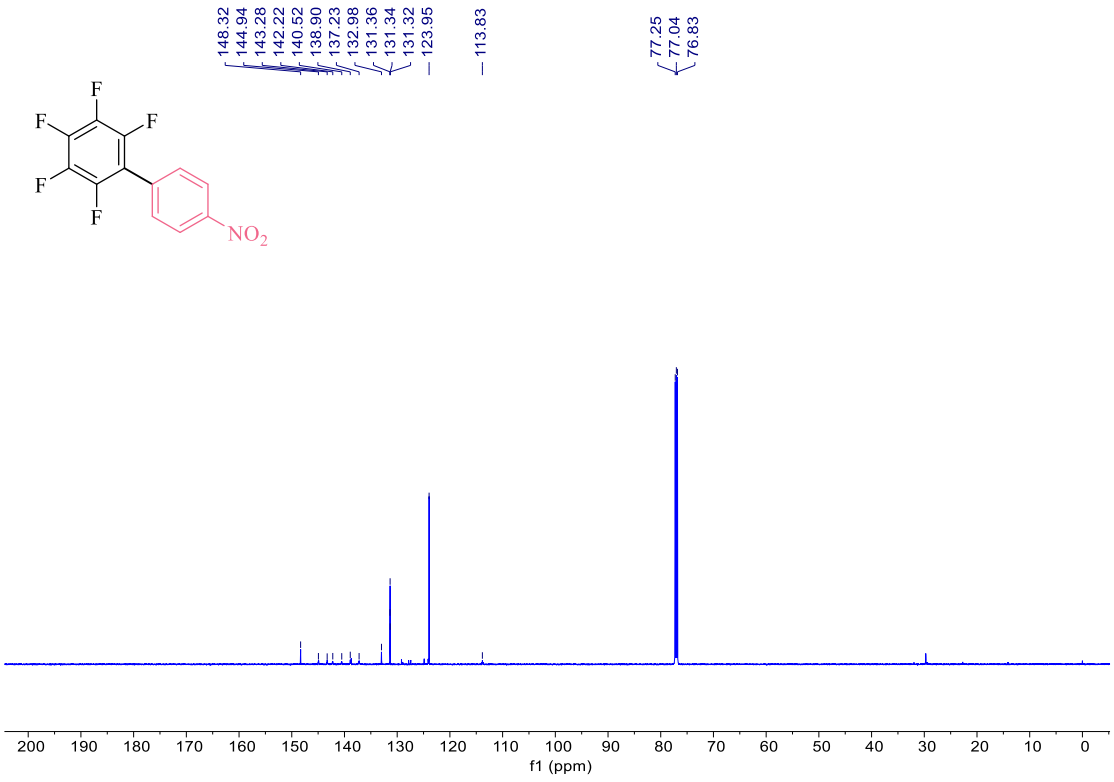
^{19}F NMR of 1-(2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-yl)ethan-1-one **5aj**



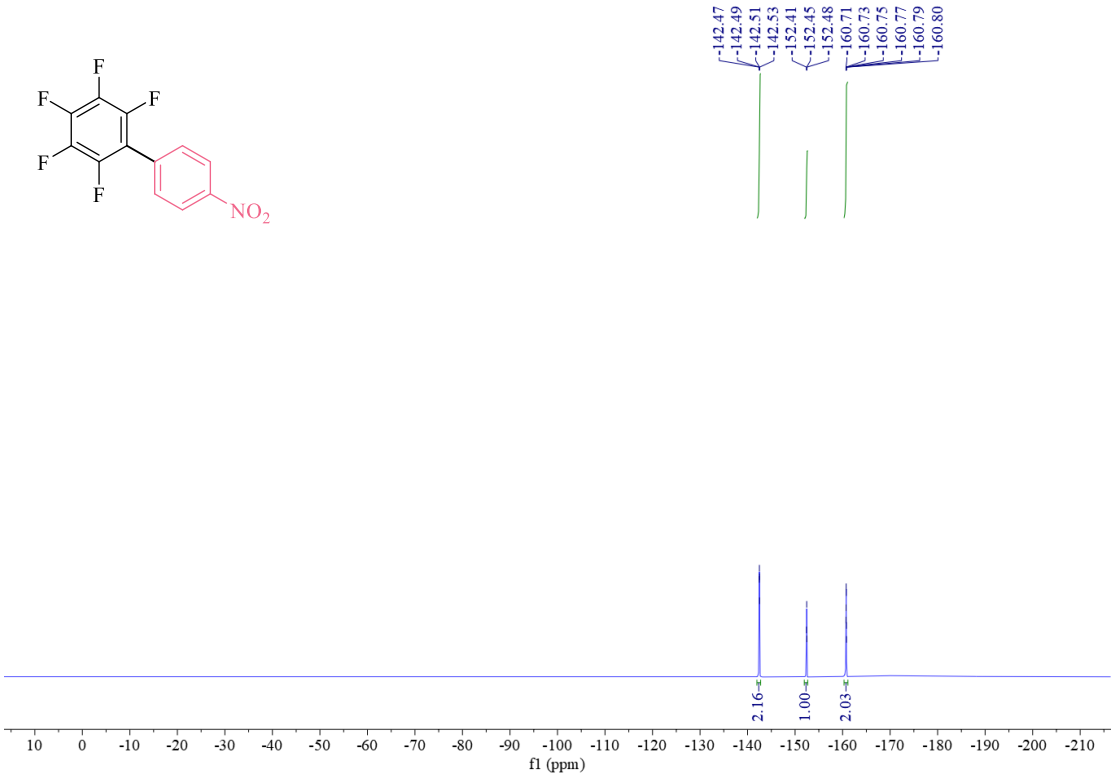
^{1}H NMR of 2,3,4,5,6-pentafluoro-4'-nitro-1,1'-biphenyl **5ak**



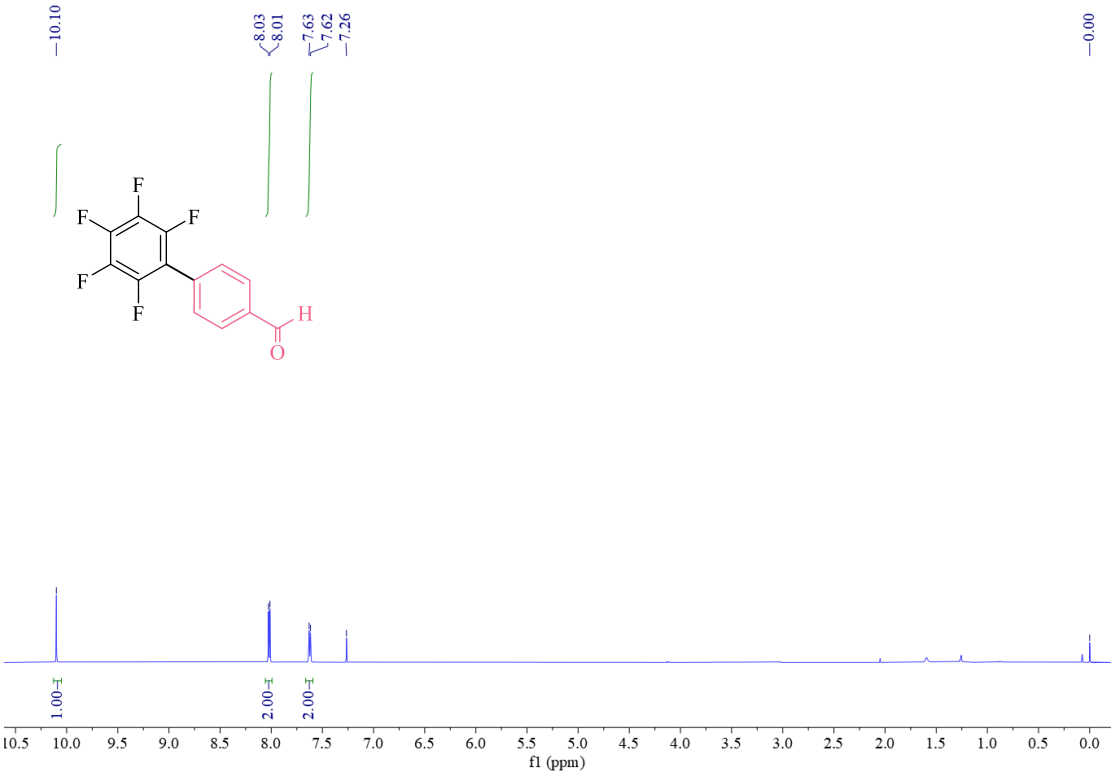
^{13}C NMR of 2,3,4,5,6-pentafluoro-4'-nitro-1,1'-biphenyl **5ak**



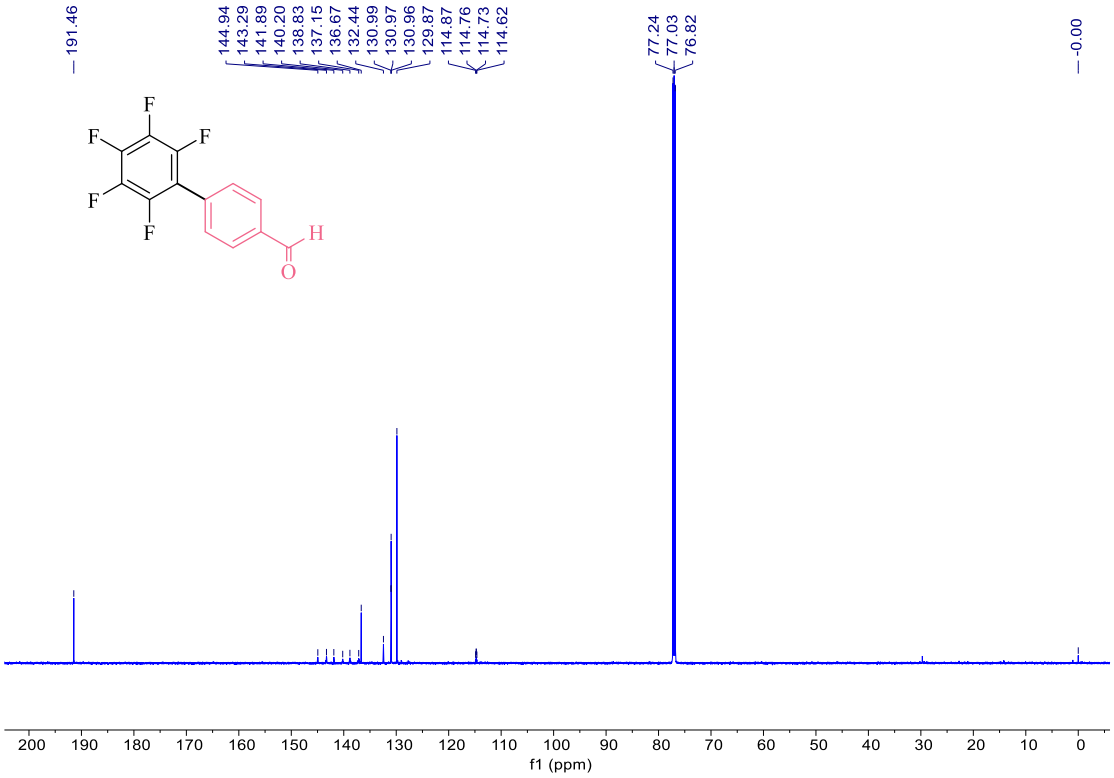
^{19}F NMR of 2,3,4,5,6-pentafluoro-4'-nitro-1,1'-biphenyl **5ak**



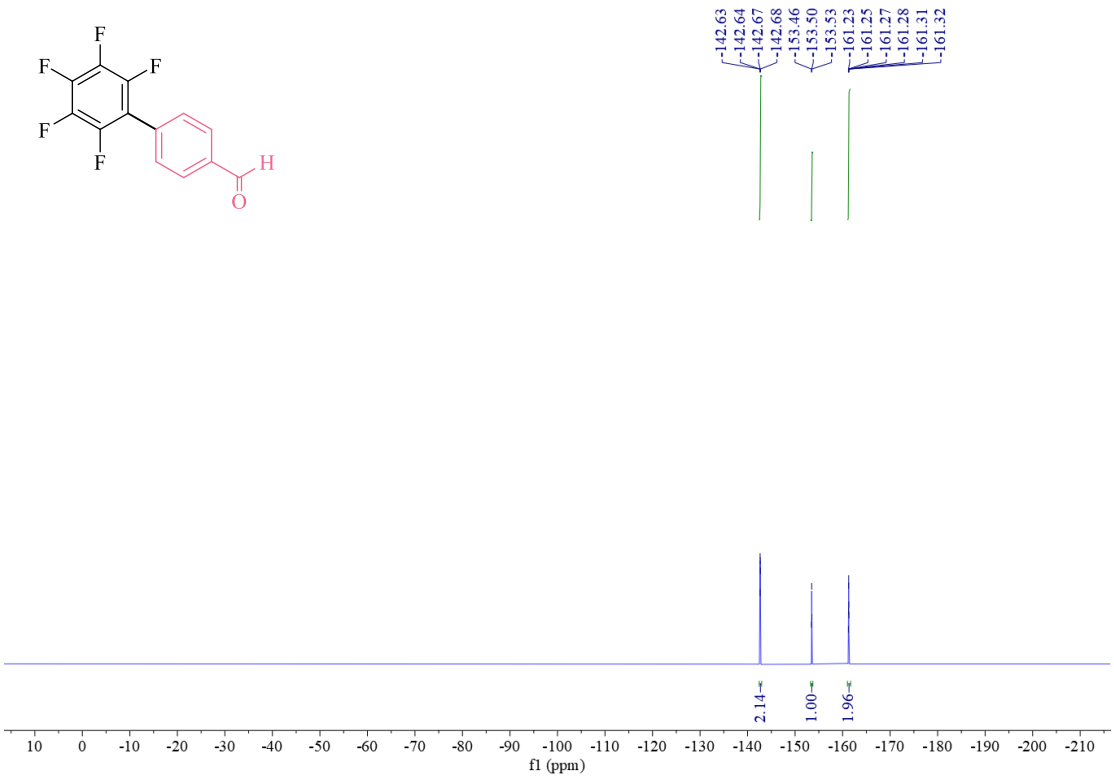
^{1}H NMR of 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-carbaldehyde **5al**



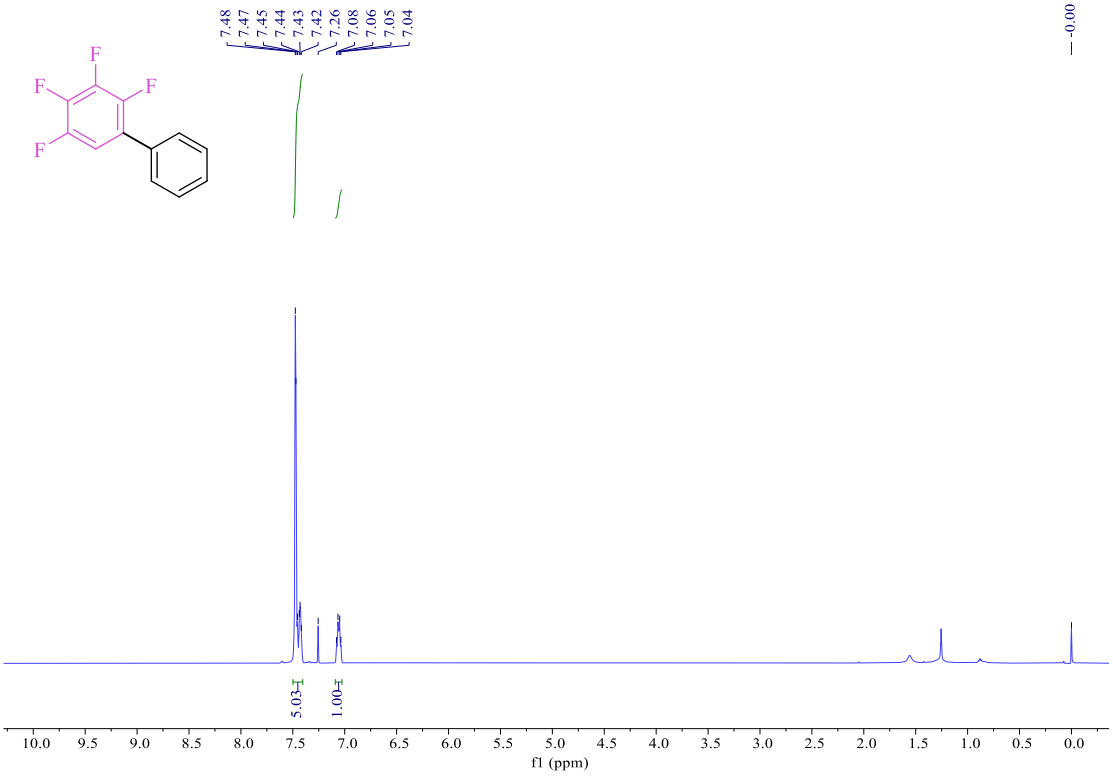
^{13}C NMR of 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-carbaldehyde **5al**



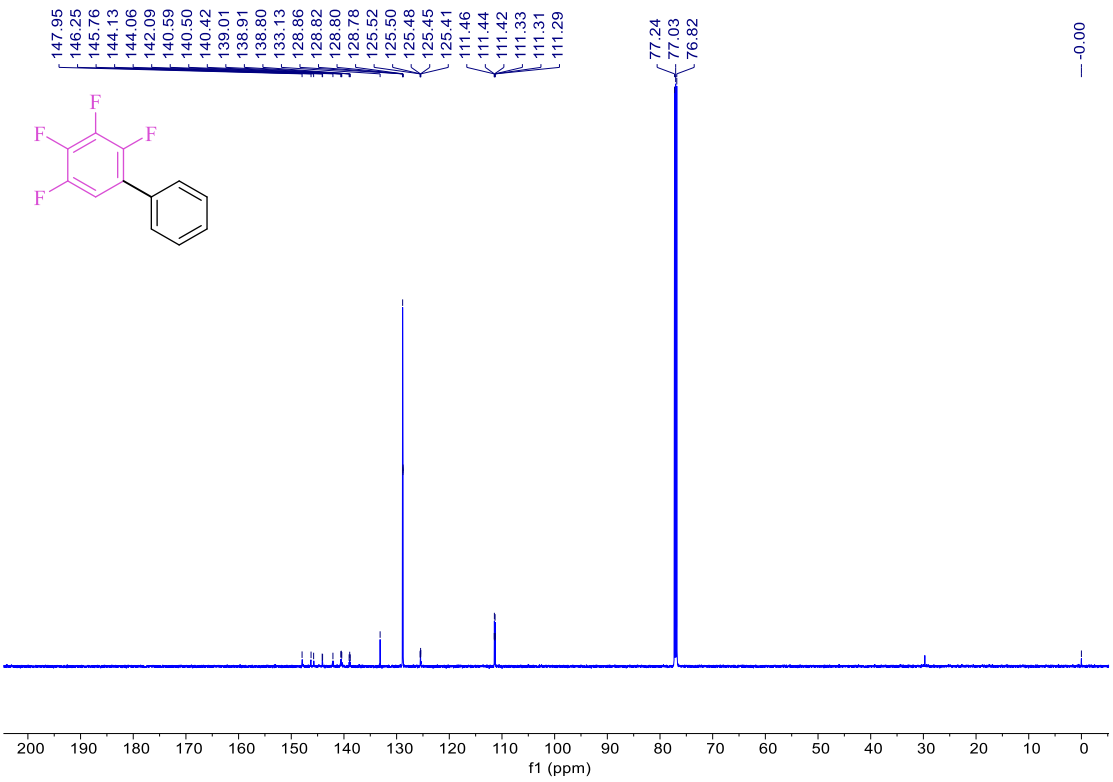
^{19}F NMR of 2',3',4',5',6'-pentafluoro-[1,1'-biphenyl]-4-carbaldehyde **5al**



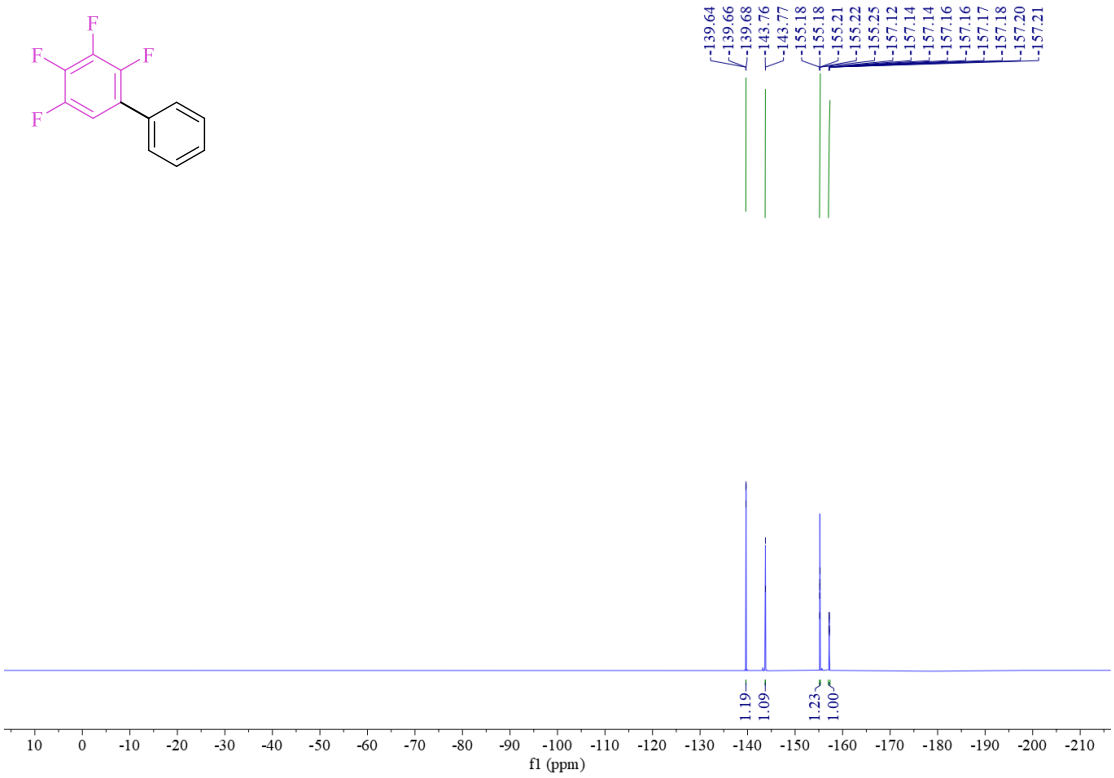
^{1}H NMR of 2,3,4,5-tetrafluoro-1,1'-biphenyl **5ba**



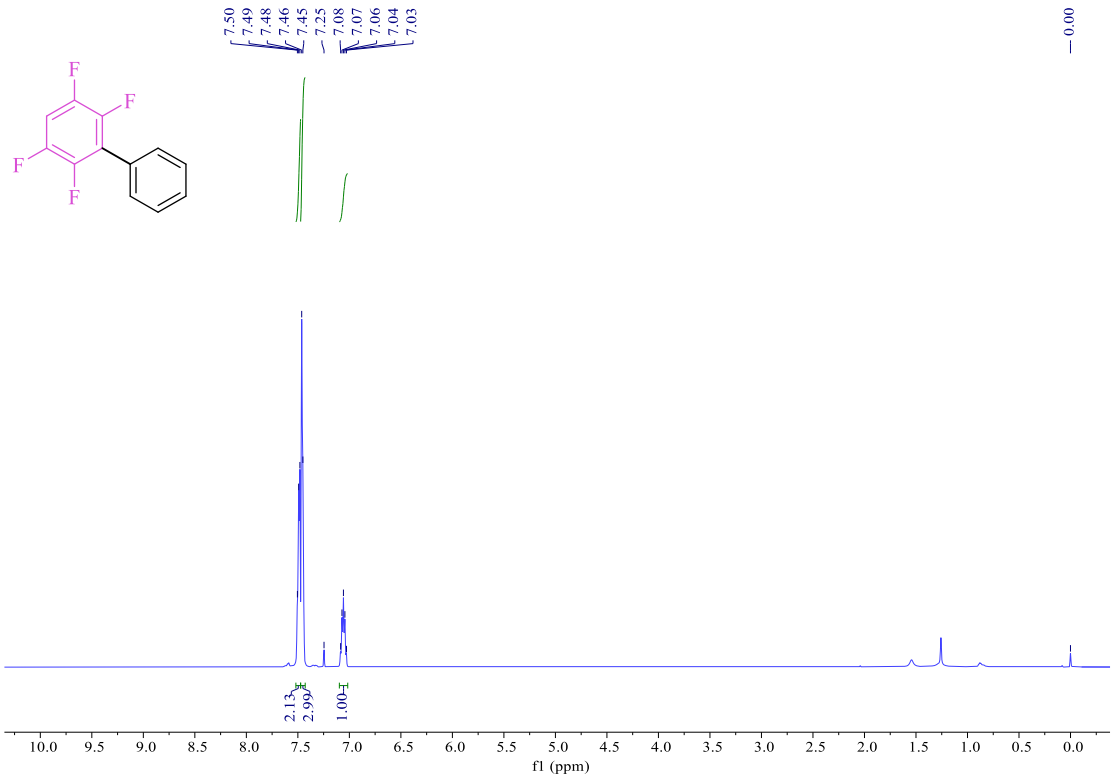
^{13}C NMR of 2,3,4,5-tetrafluoro-1,1'-biphenyl **5ba**



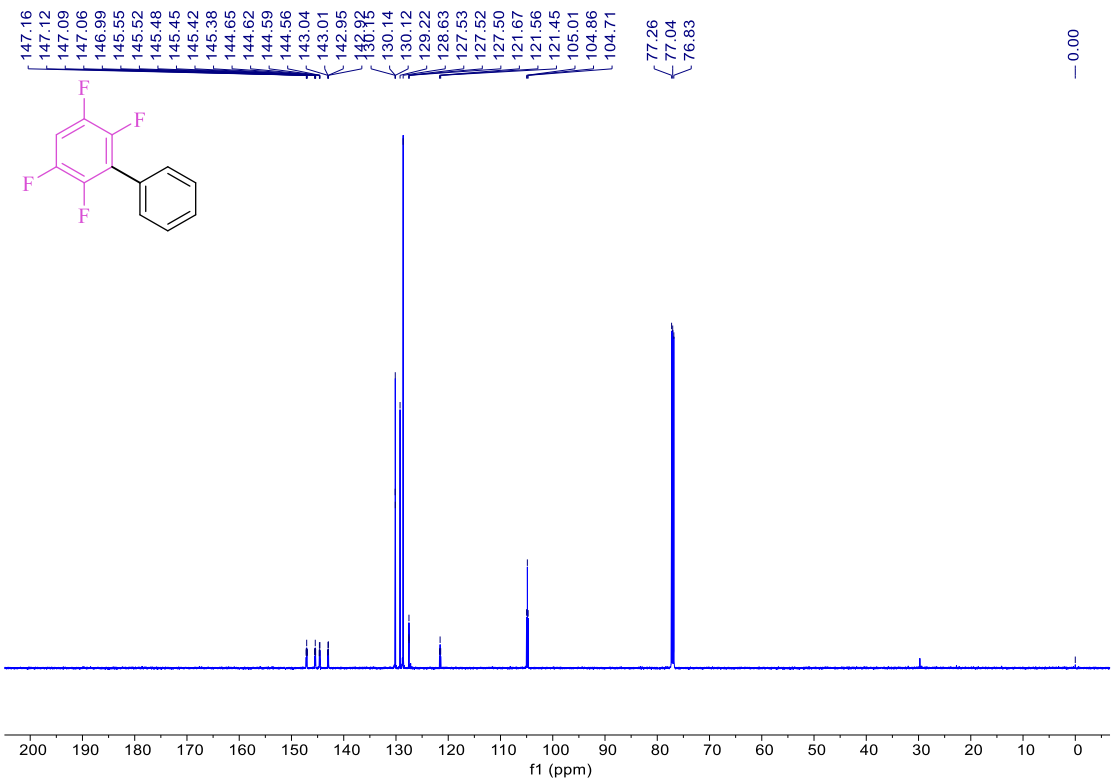
^{19}F NMR of 2,3,4,5-tetrafluoro-1,1'-biphenyl **5ba**



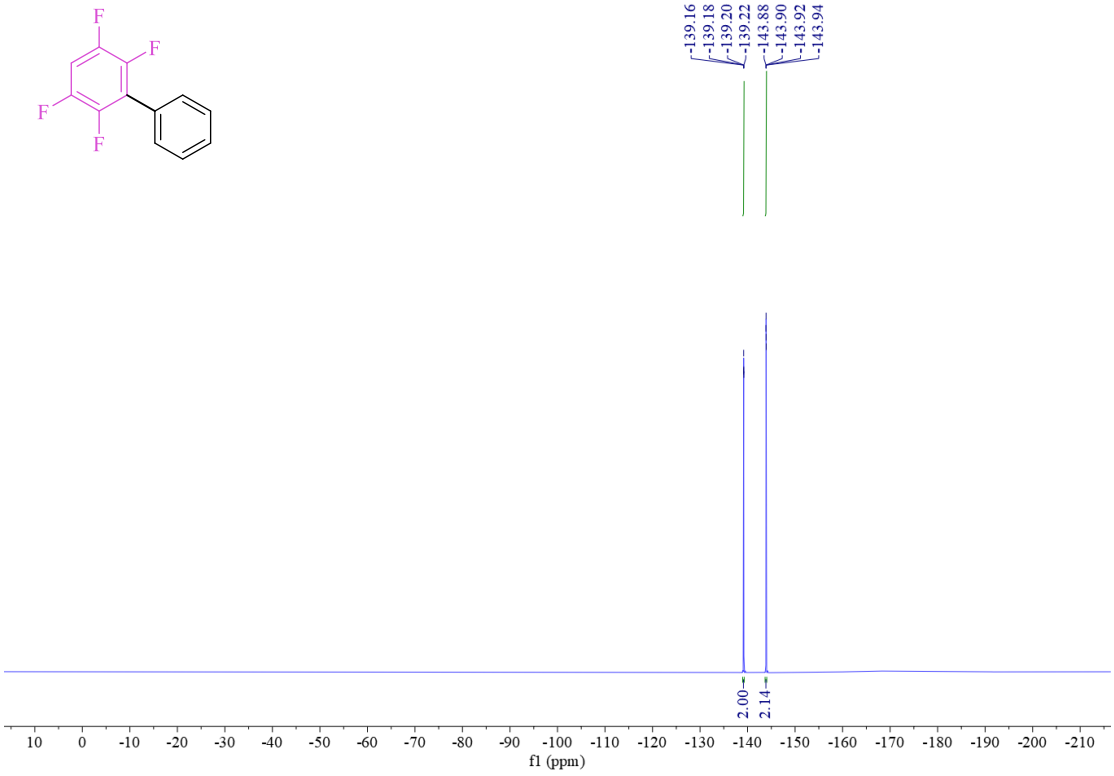
^{1}H NMR of 2,3,5,6-tetrafluoro-1,1'-biphenyl **5ca**



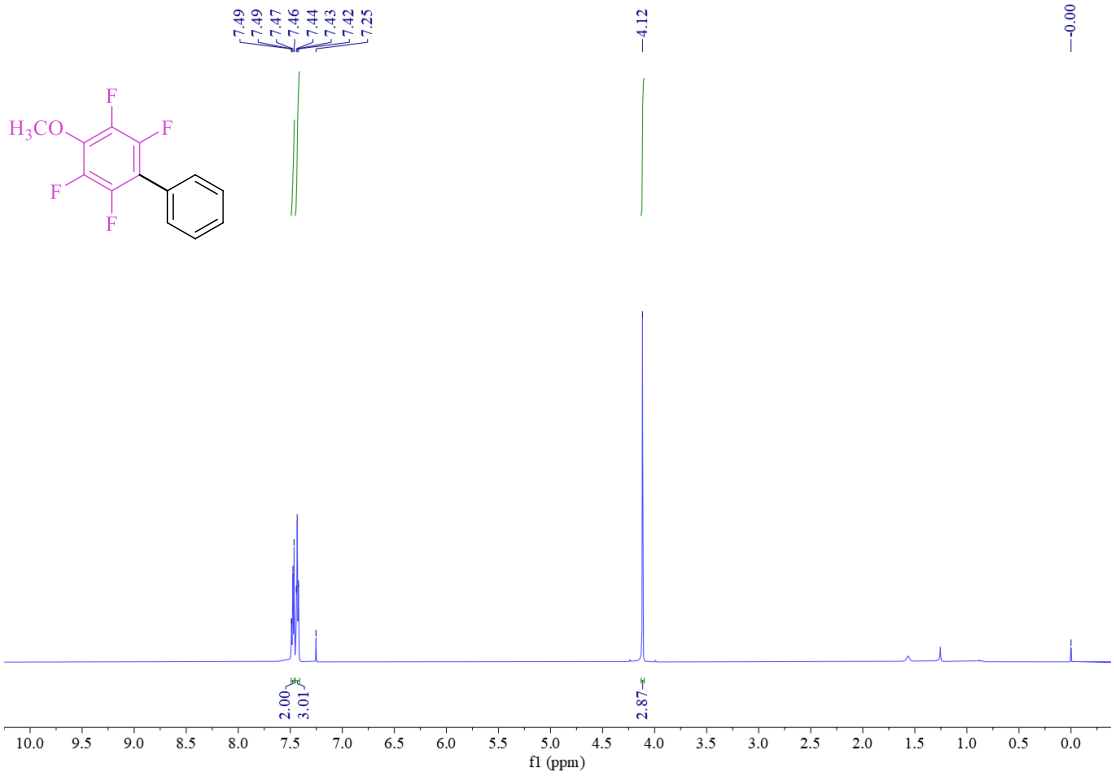
^{13}C NMR of 2,3,5,6-tetrafluoro-1,1'-biphenyl **5ca**



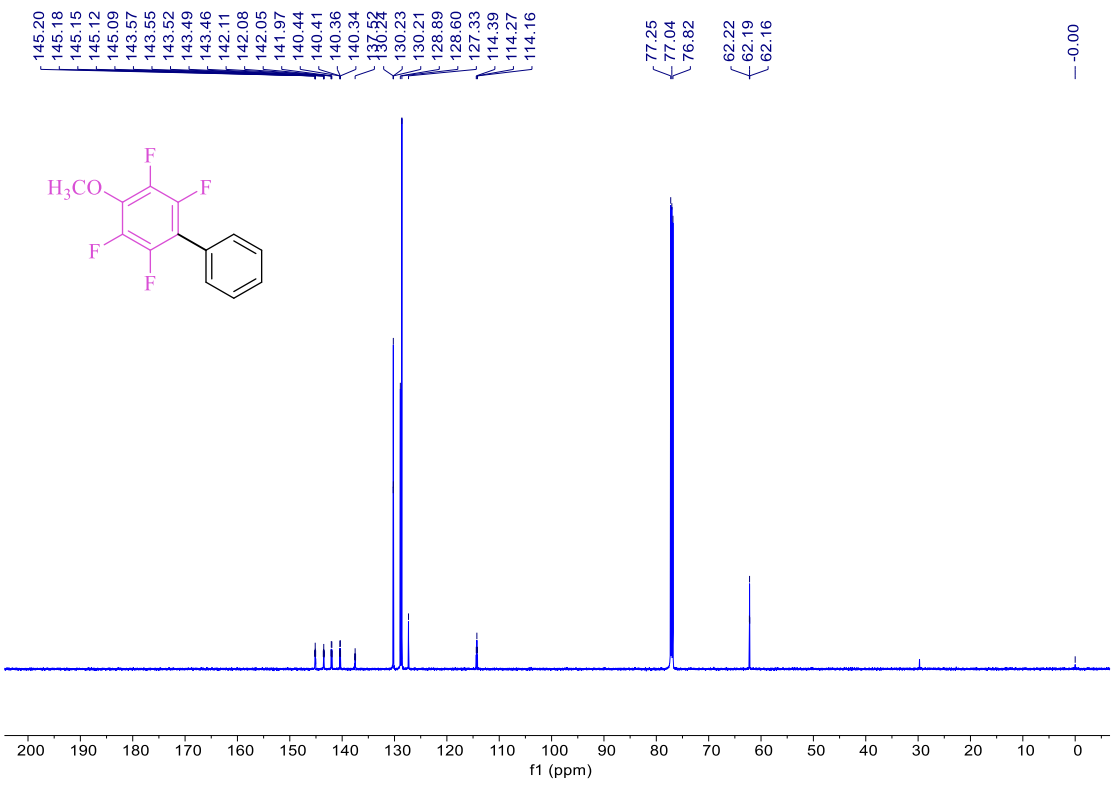
^{19}F NMR of 2,3,5,6-tetrafluoro-1,1'-biphenyl **5ca**



^{1}H NMR of 2,3,5,6-tetrafluoro-4-methoxy-1,1'-biphenyl **5da**

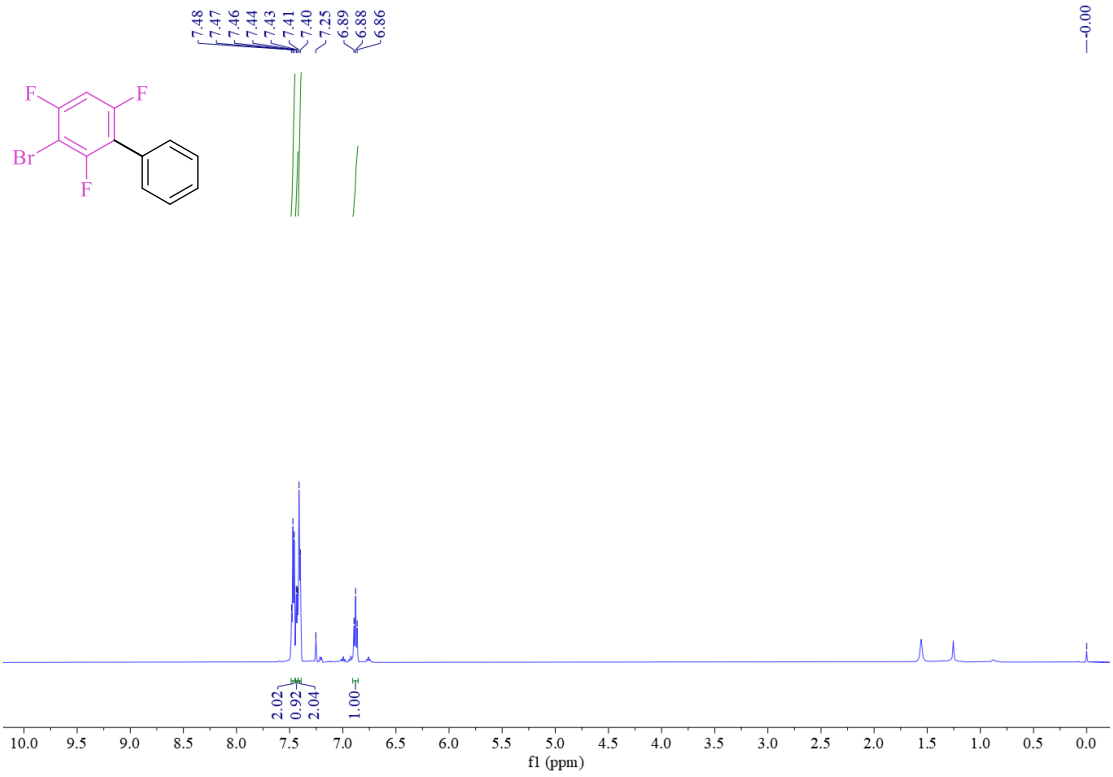


^{13}C NMR of 2,3,5,6-tetrafluoro-4-methoxy-1,1'-biphenyl **5da**

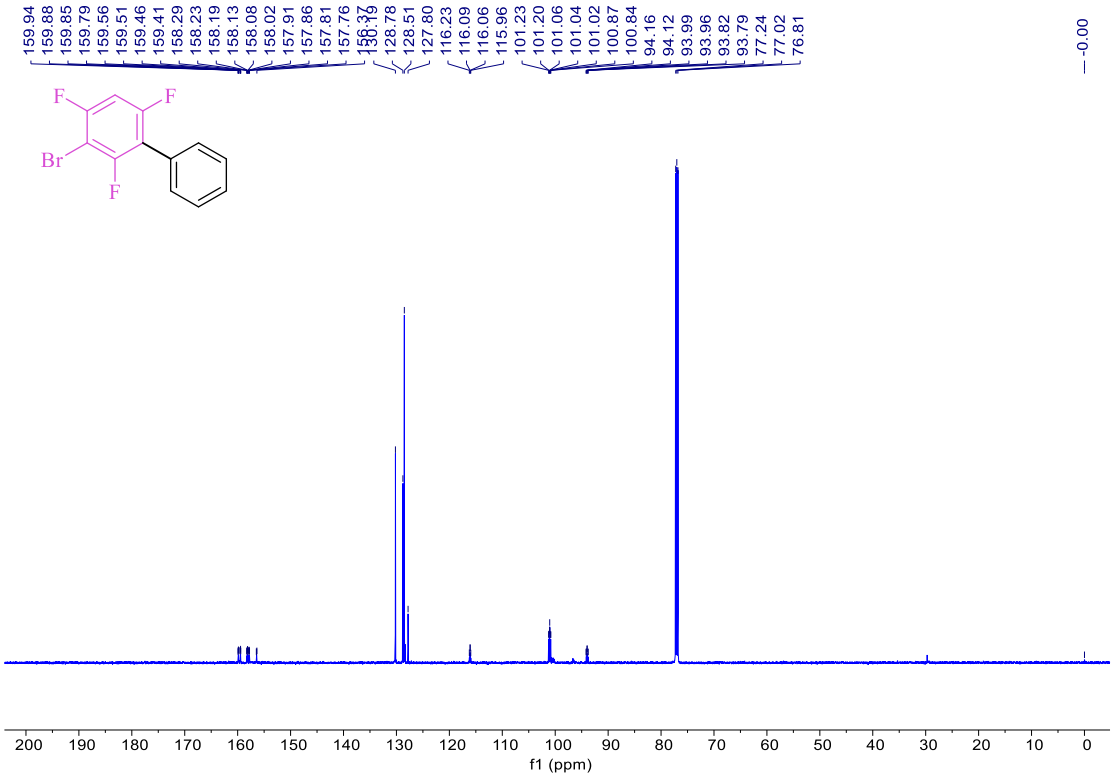


^{19}F NMR of 2,3,5,6-tetrafluoro-4-methoxy-1,1'-biphenyl **5da**

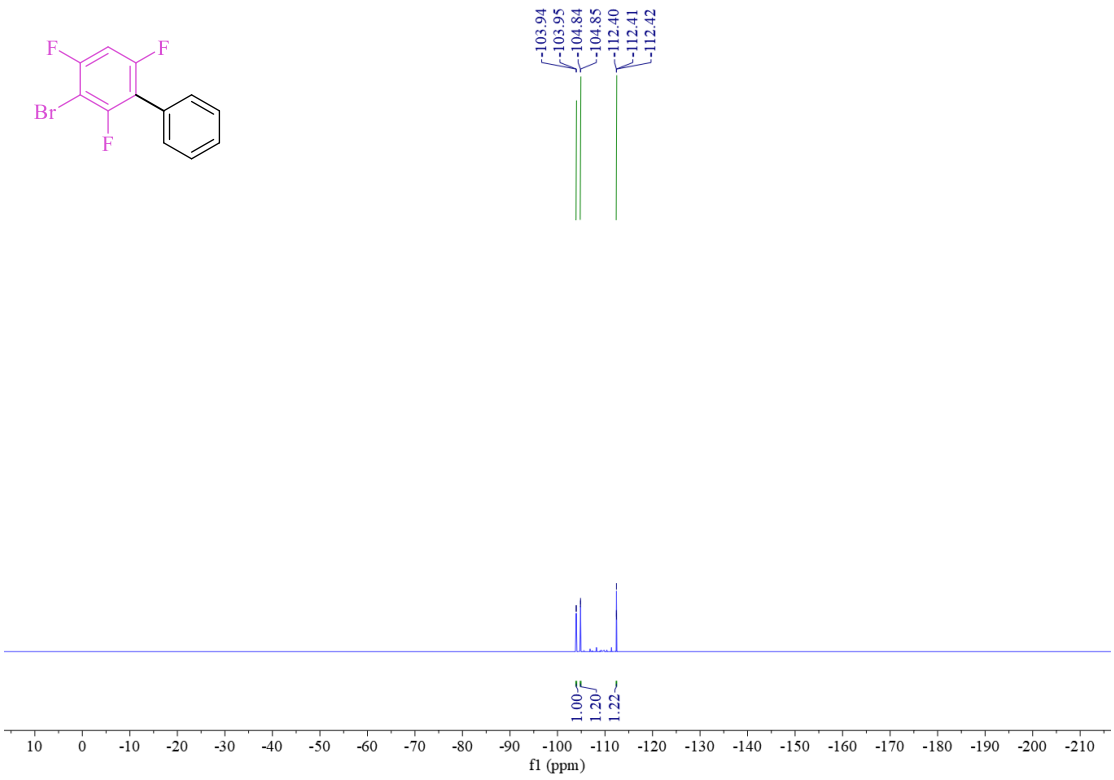
^{1}H NMR of 3-bromo-2,4,6-trifluoro-1,1'-biphenyl **5ea**



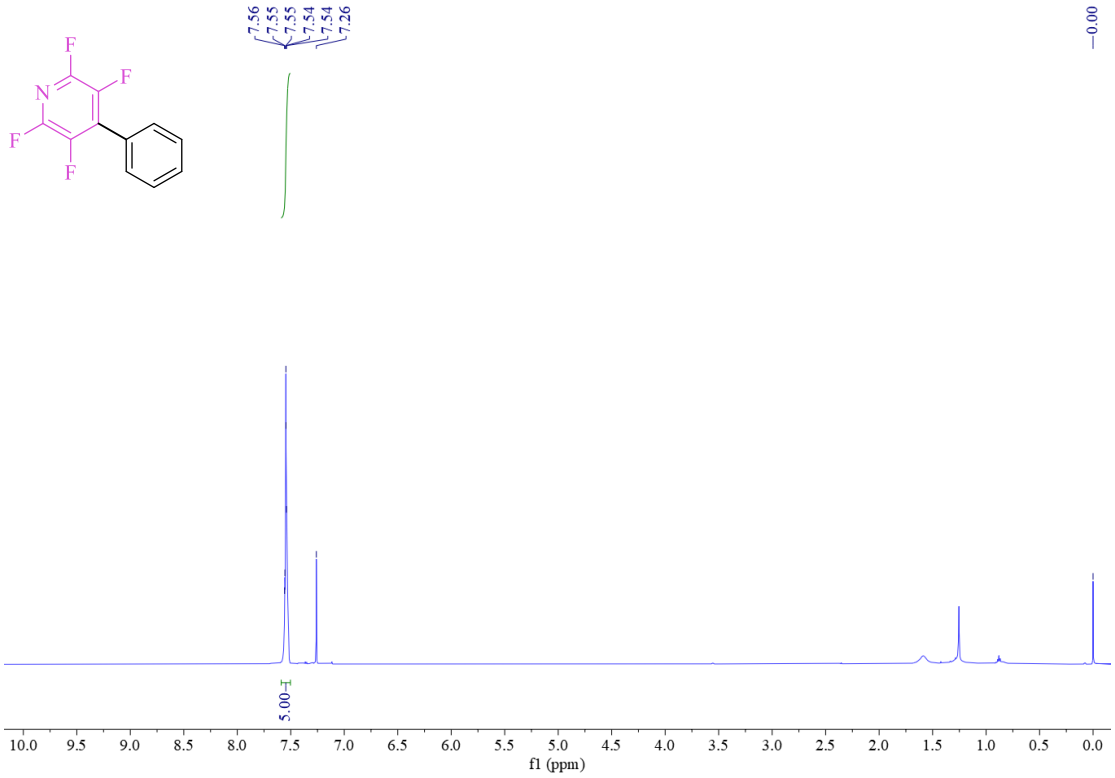
^{13}C NMR of 3-bromo-2,4,6-trifluoro-1,1'-biphenyl **5ea**



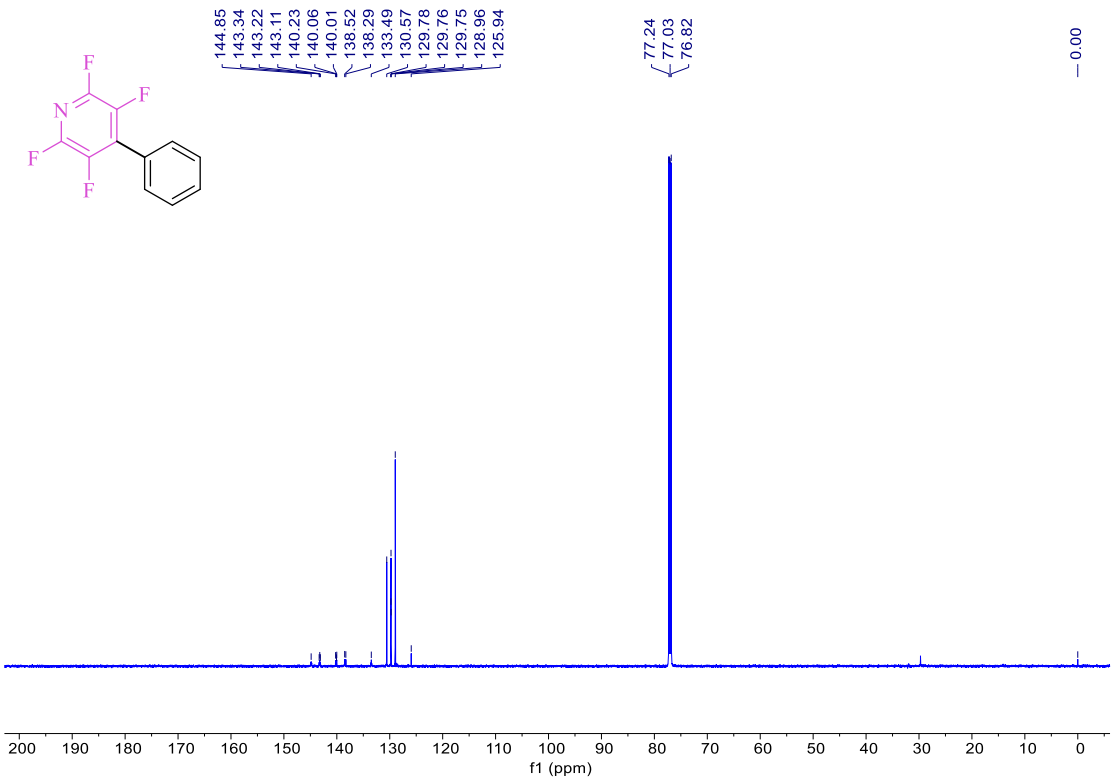
^{19}F NMR of 3-bromo-2,4,6-trifluoro-1,1'-biphenyl **5ea**



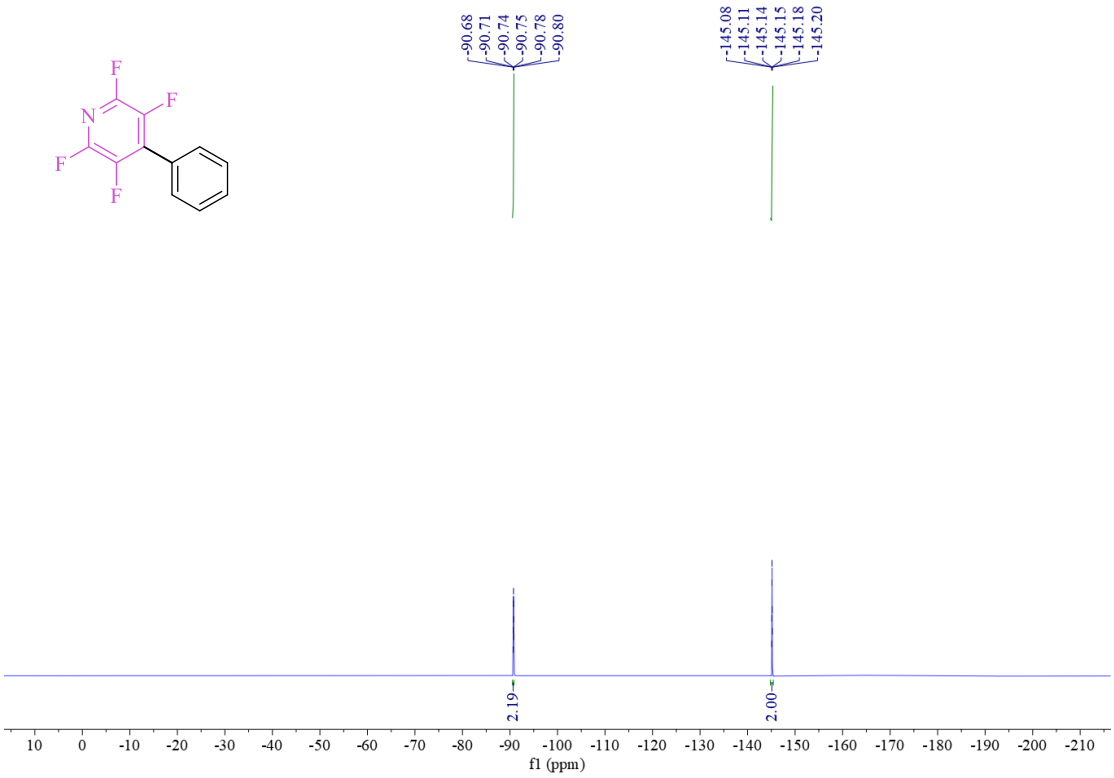
^{1}H NMR of 2,3,5,6-tetrafluoro-4-phenylpyridine **5fa**



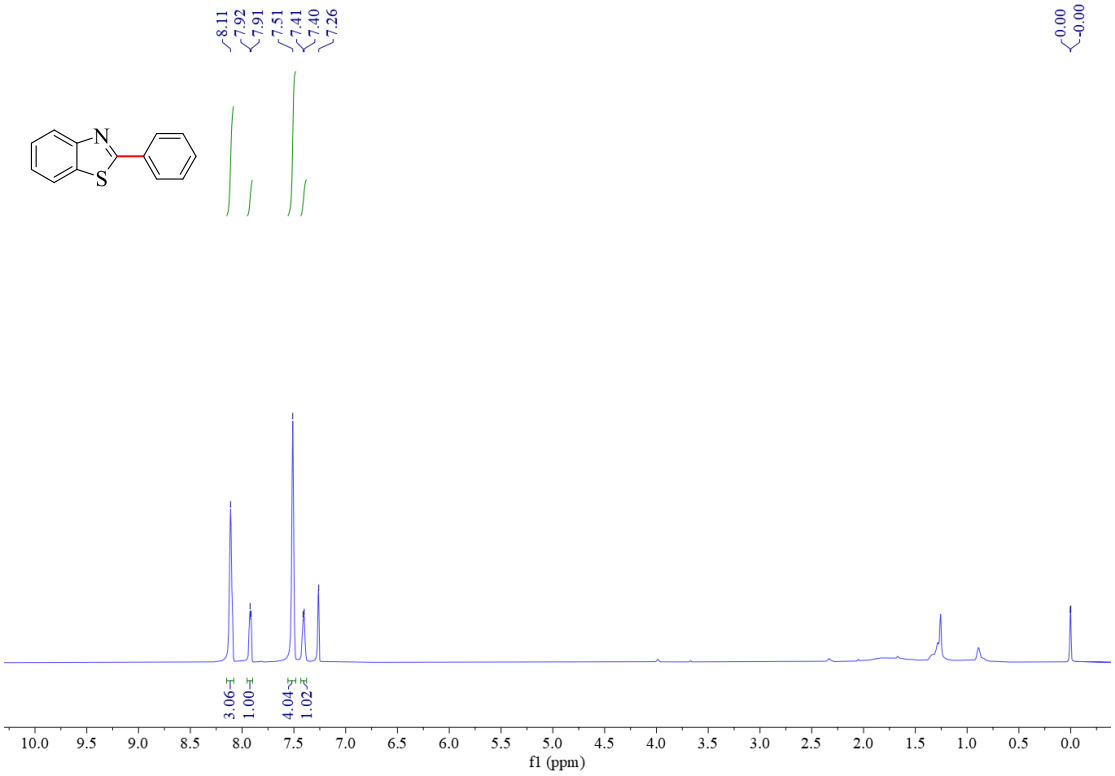
^{13}C NMR of 2,3,5,6-tetrafluoro-4-phenylpyridine **5fa**



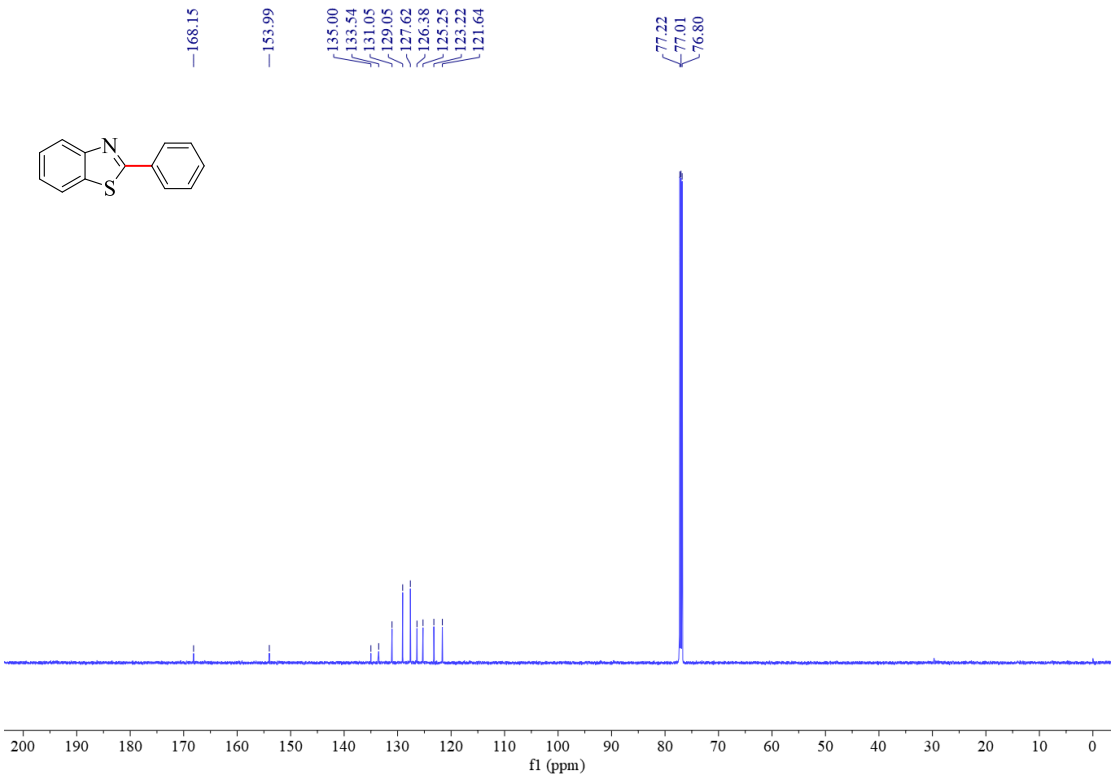
^{19}F NMR of 2,3,5,6-tetrafluoro-4-phenylpyridine **5fa**



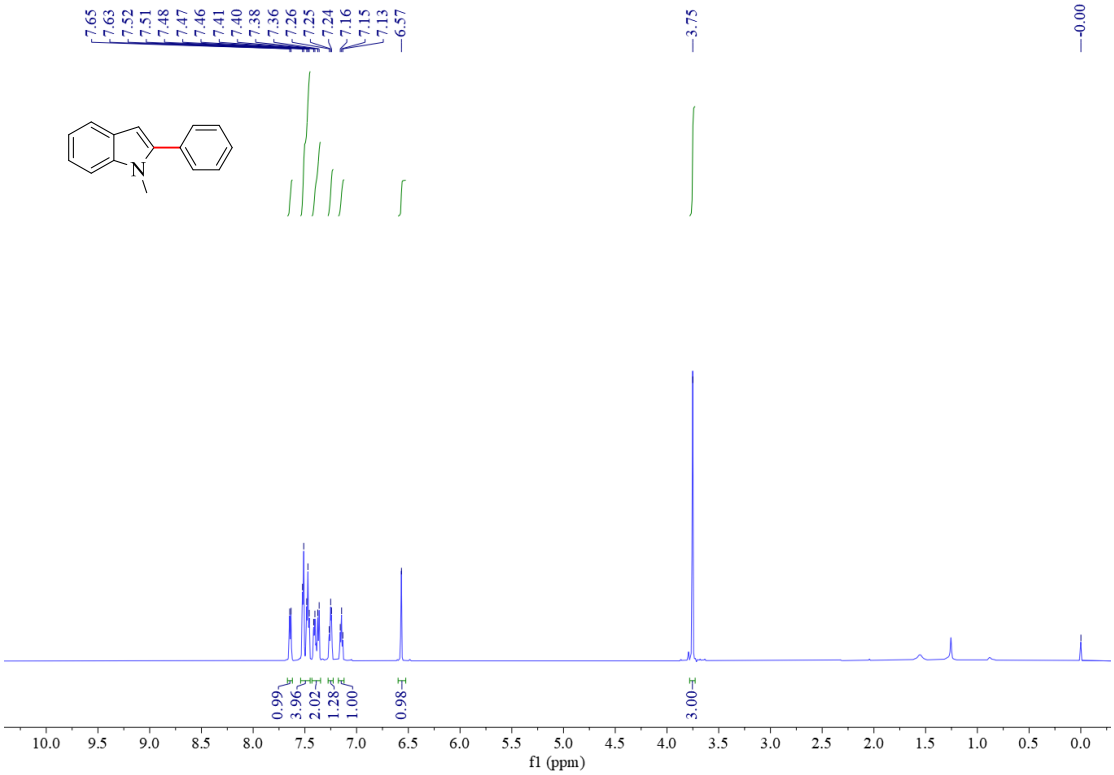
^{1}H NMR of 2-phenylbenzo[d]thiazole **6**



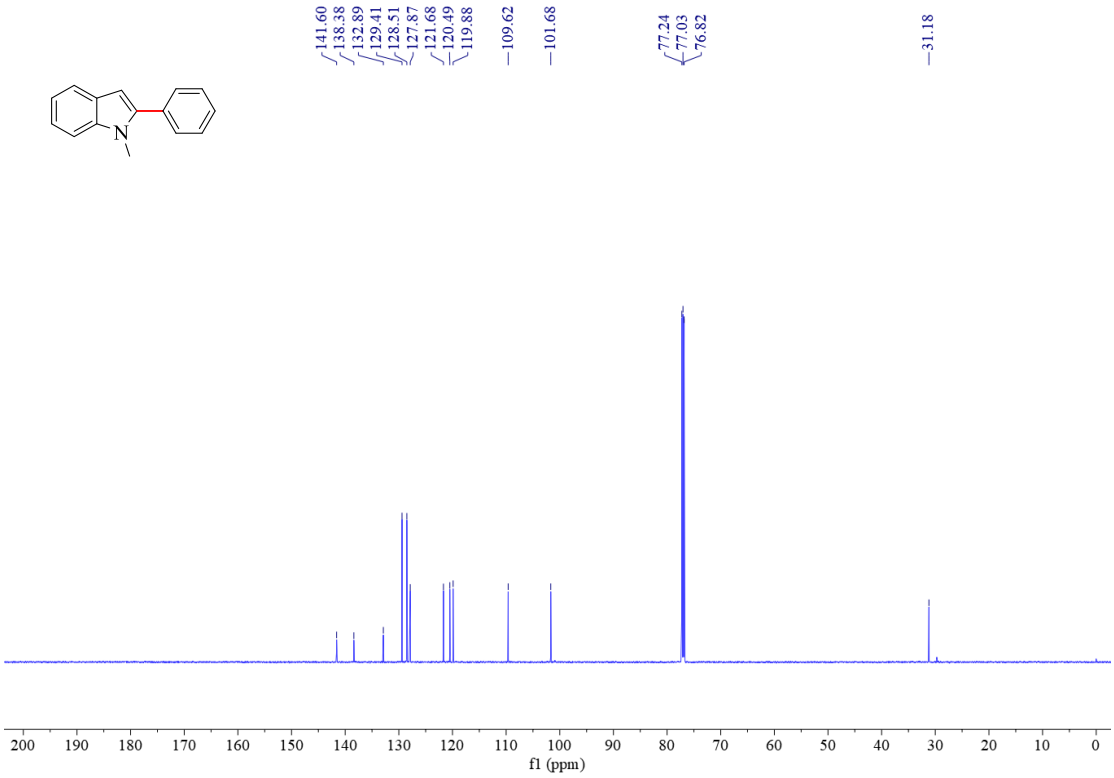
^{13}C NMR of 2-phenylbenzo[d]thiazole **6**



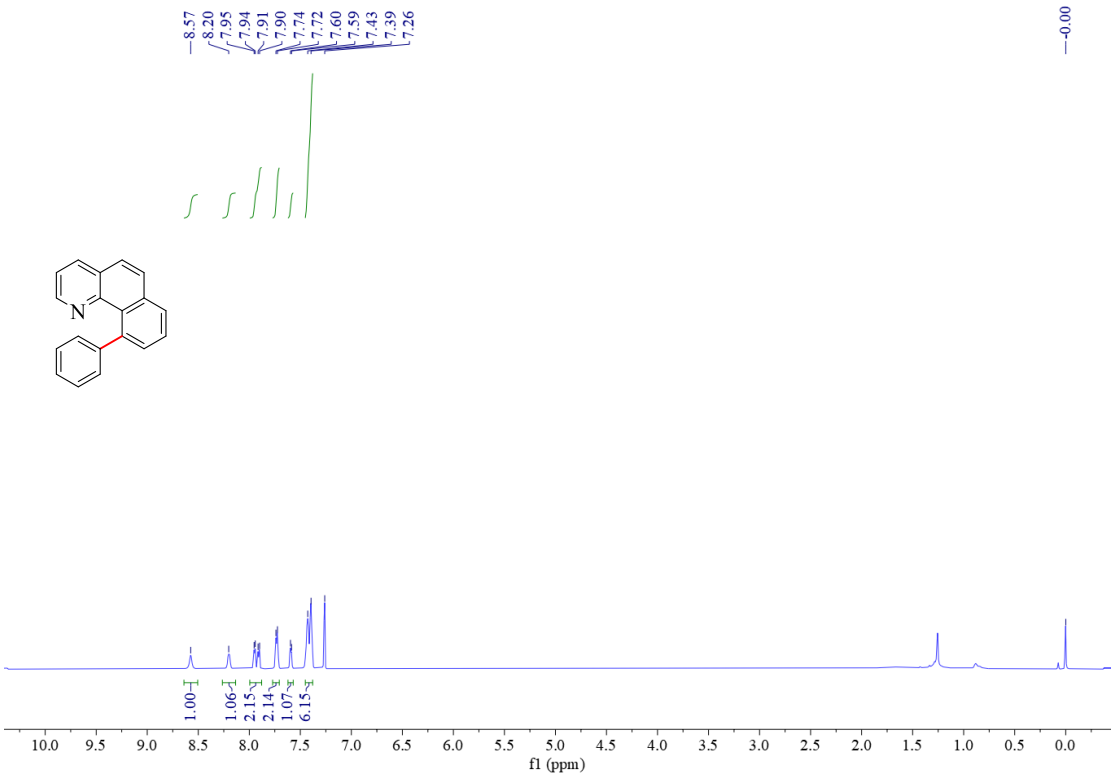
^{1}H NMR of 1-methyl-2-phenyl-1H-indole **7**



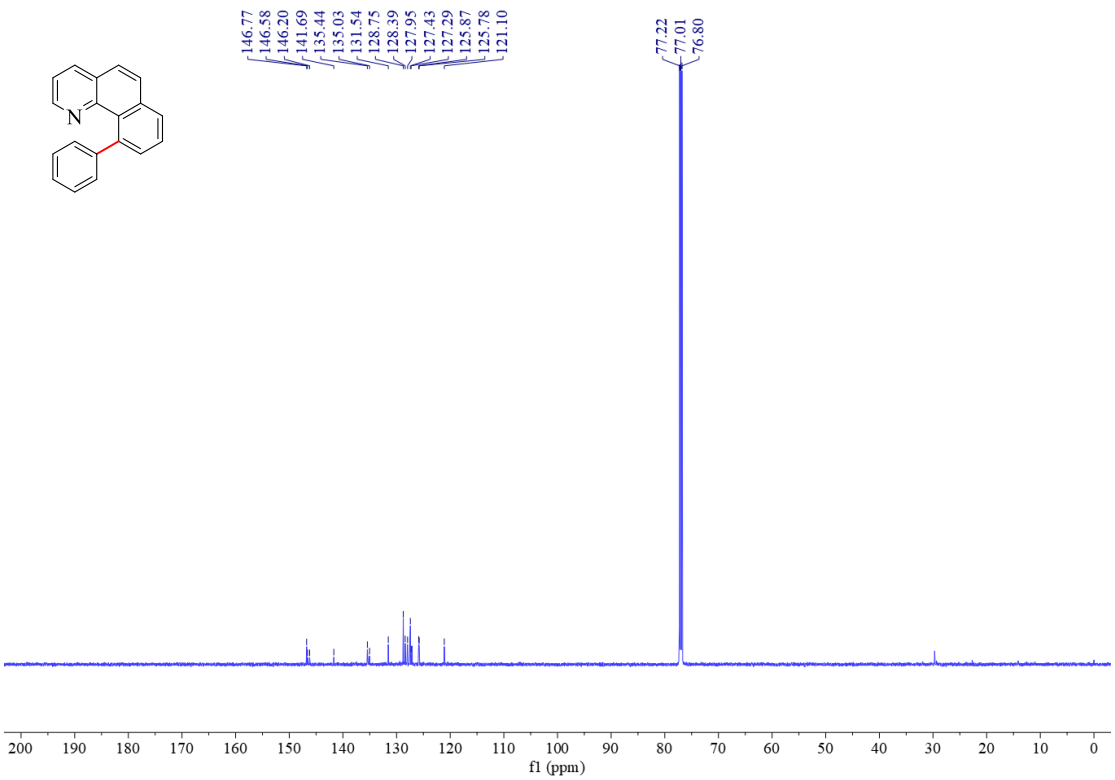
^{13}C NMR of 1-methyl-2-phenyl-1H-indole **7**



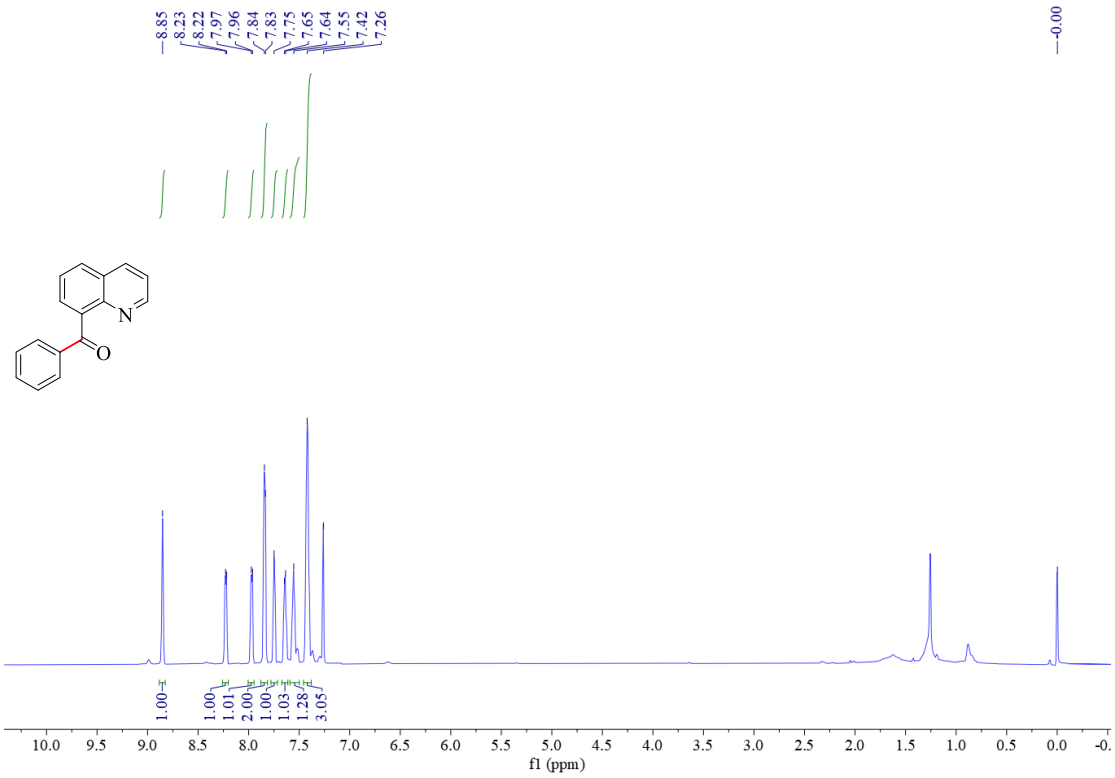
^{1}H NMR of 10-phenylbenzo[h]quinoline **8**



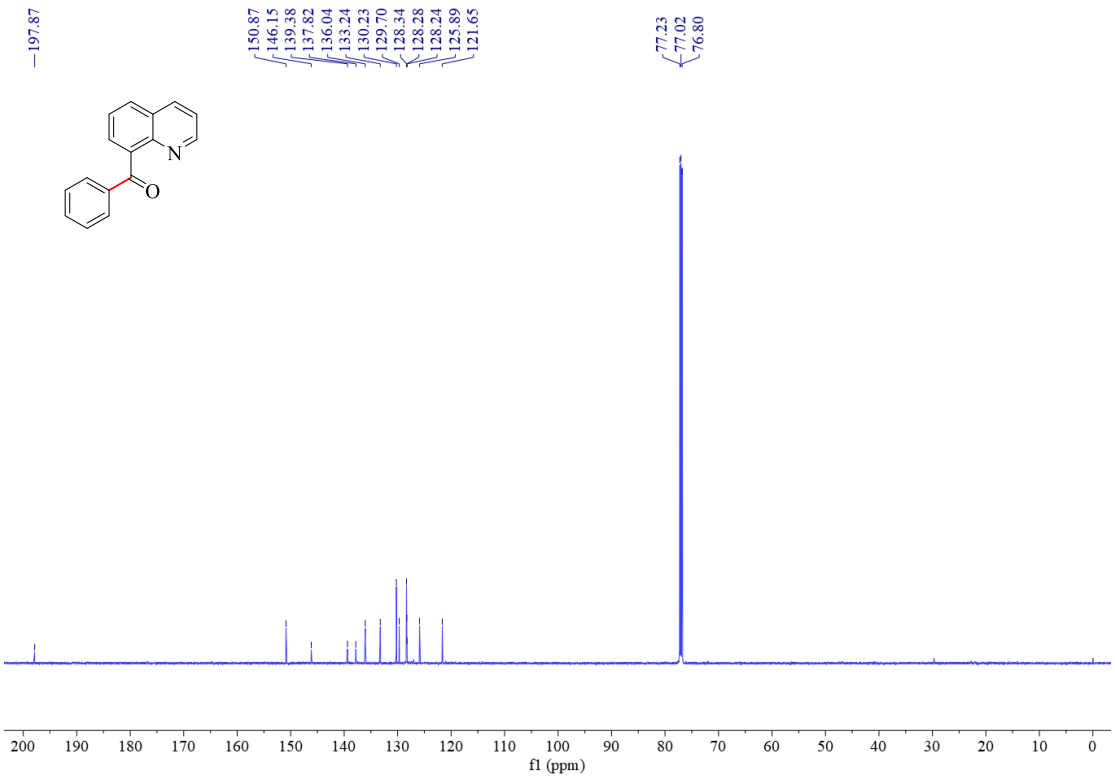
^{13}C NMR of 10-phenylbenzo[h]quinoline **8**



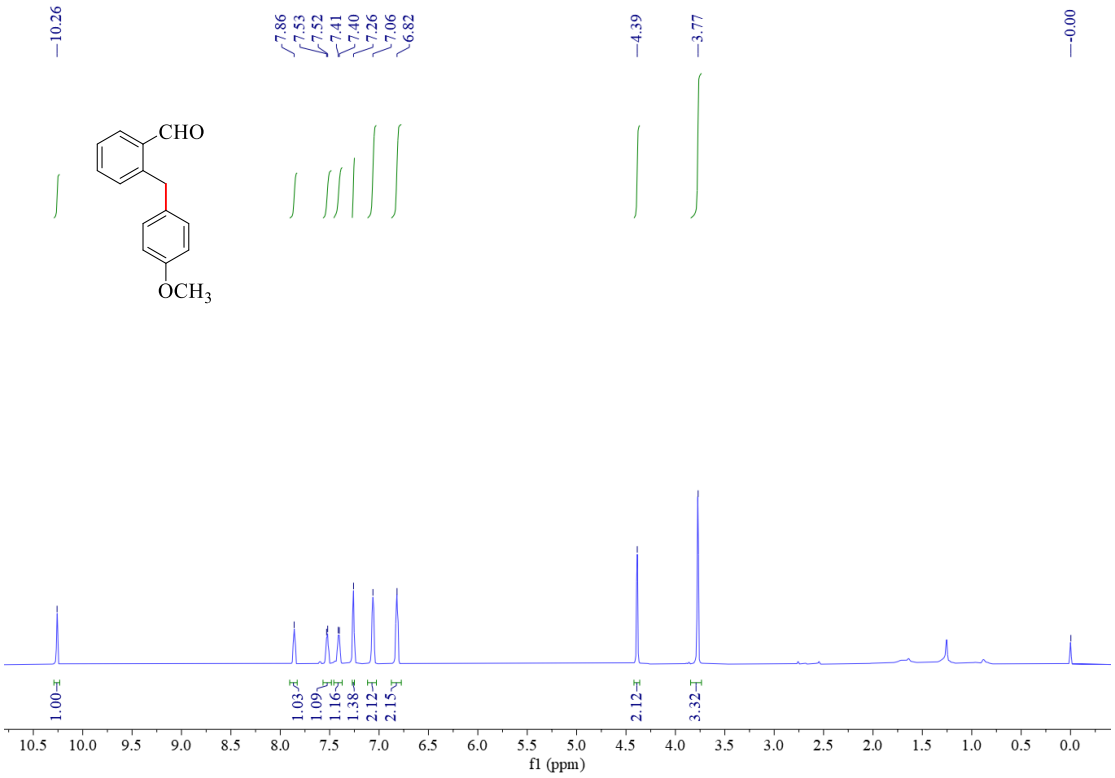
^{1}H NMR of phenyl(quinolin-8-yl)methanone **9**



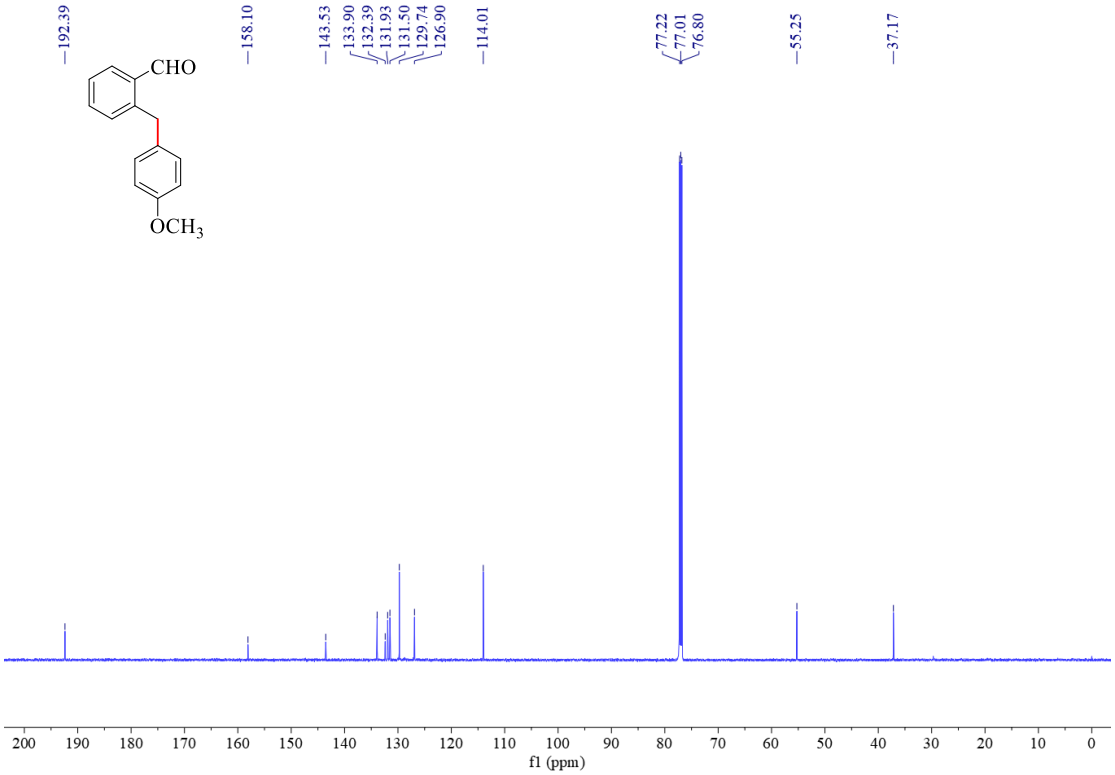
^{13}C NMR of phenyl(quinolin-8-yl)methanone **9**



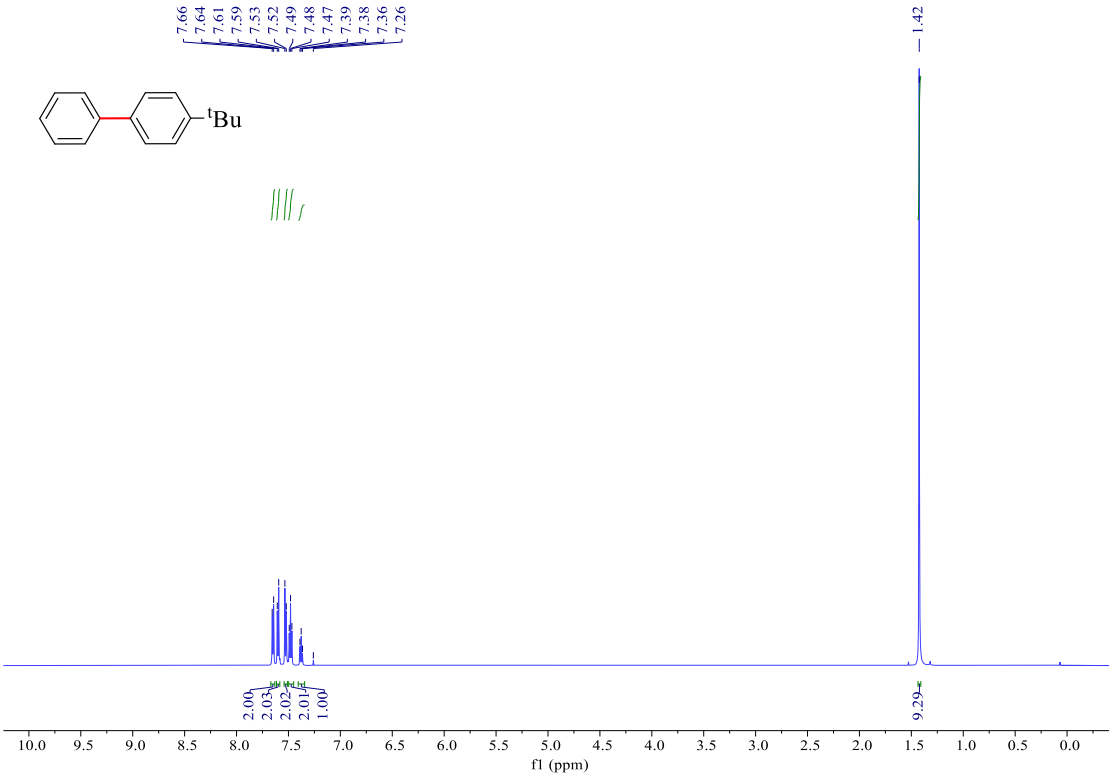
^{1}H NMR of 2-(4-methoxybenzyl)benzaldehyde **10**



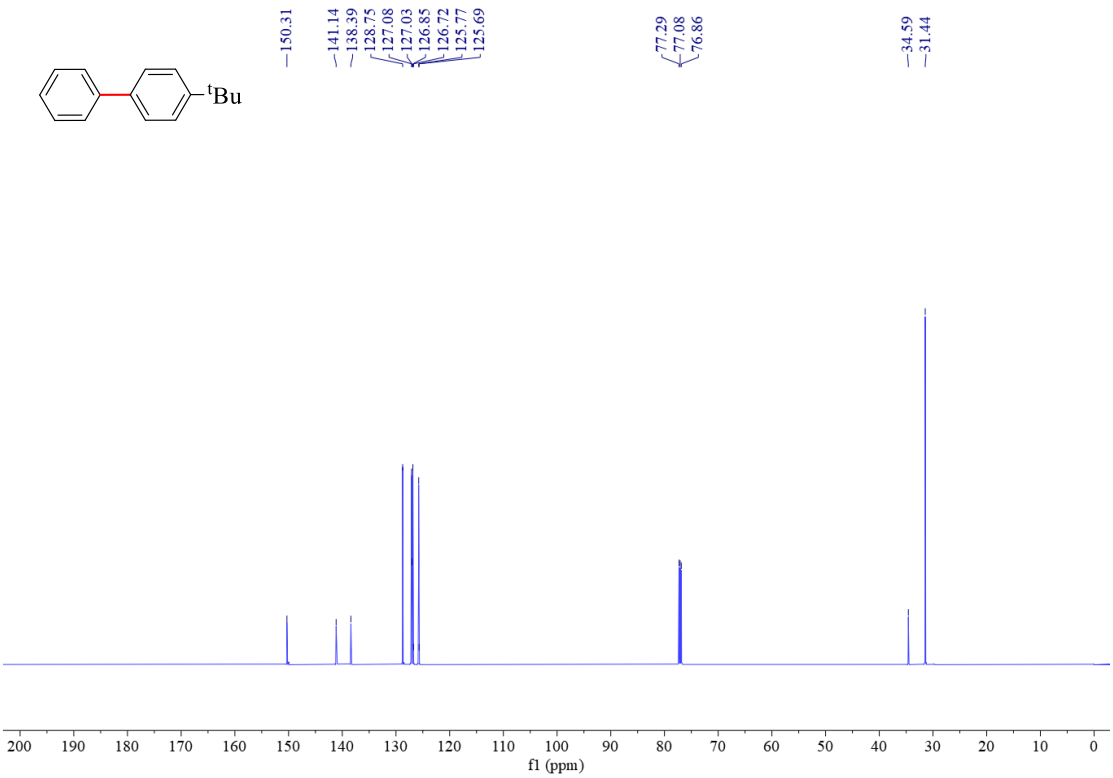
^{13}C NMR of 2-(4-methoxybenzyl)benzaldehyde **10**



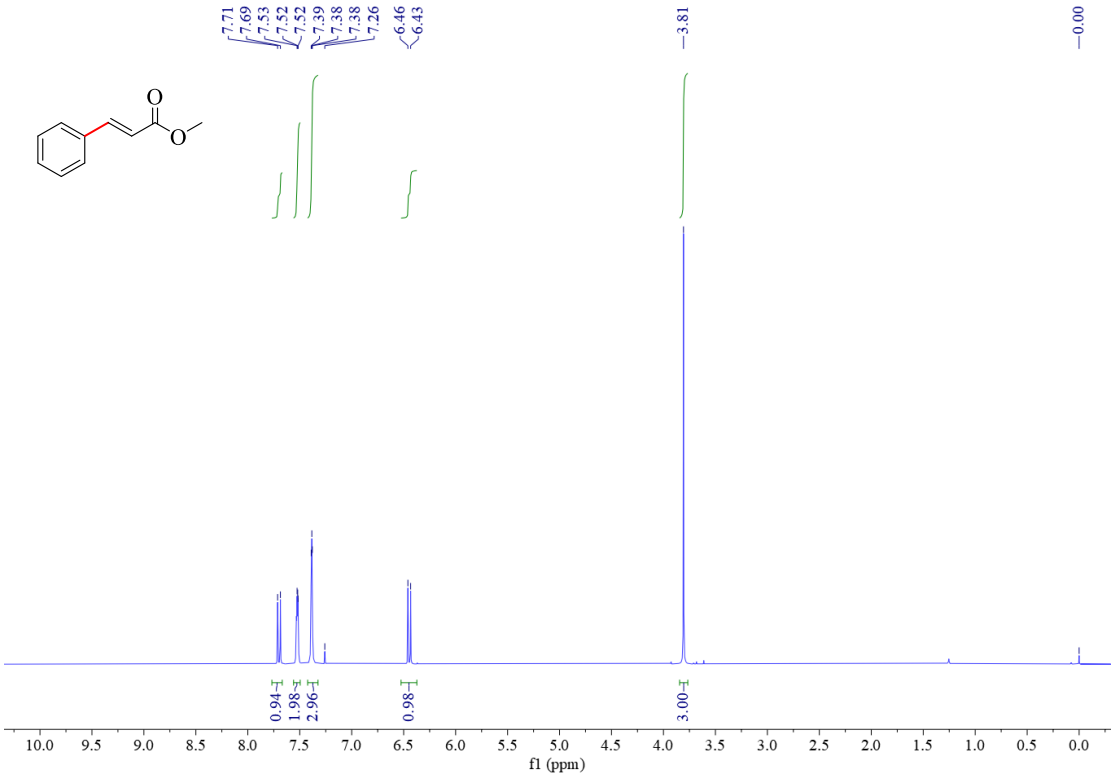
^{1}H NMR of 4-(tert-butyl)-1,1'-biphenyl **11**



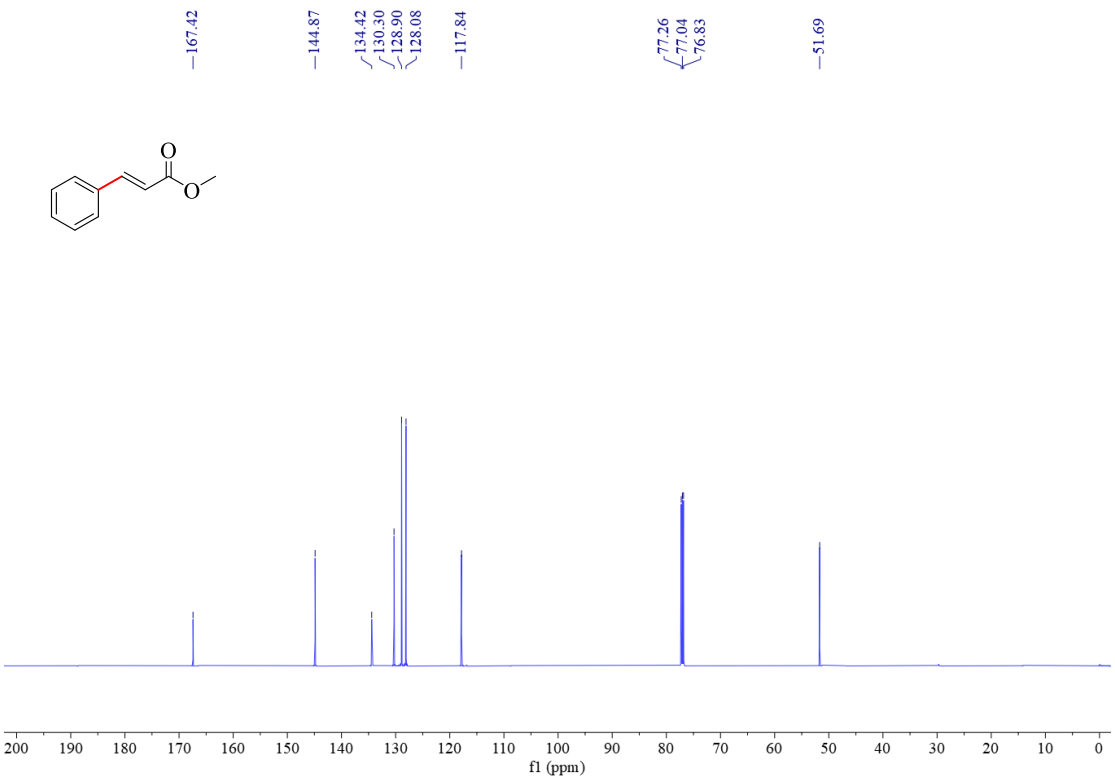
^{13}C NMR of 4-(tert-butyl)-1,1'-biphenyl **11**



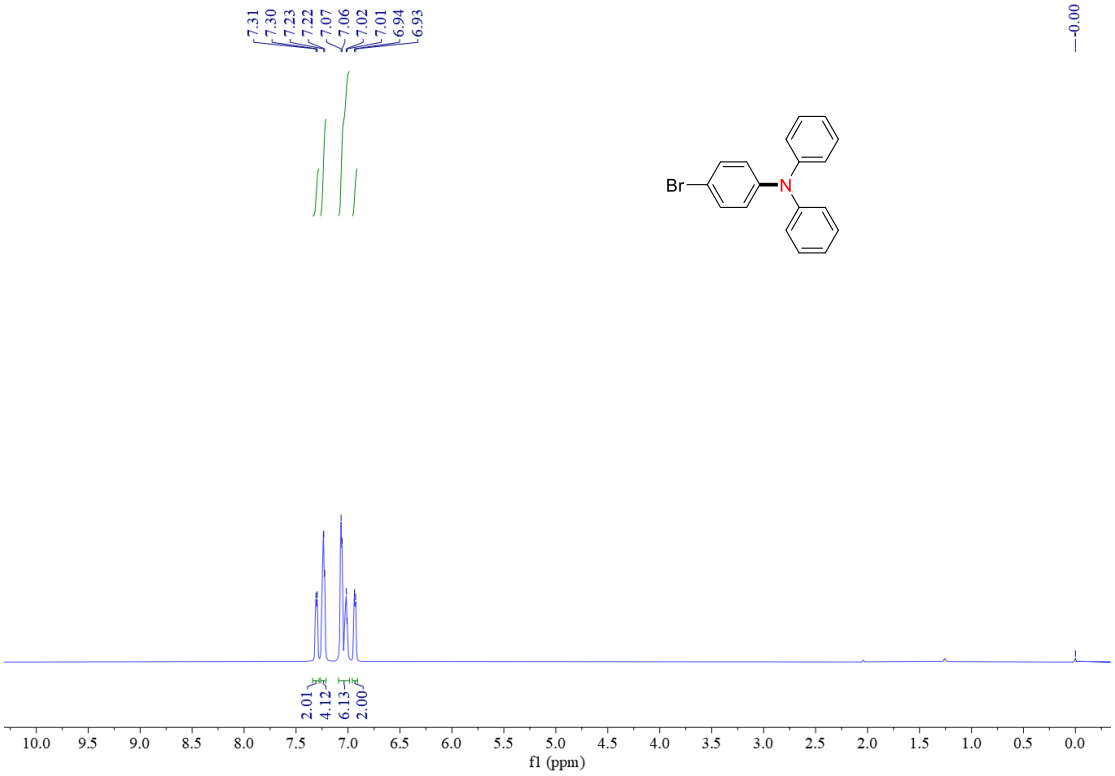
^{1}H NMR of methyl cinnamate **12**



^{13}C NMR of methyl cinnamate **12**



^{1}H NMR of 4-bromo-N,N-diphenylaniline **13**



^{13}C NMR of 4-bromo-N,N-diphenylaniline **13**