Supporting Information

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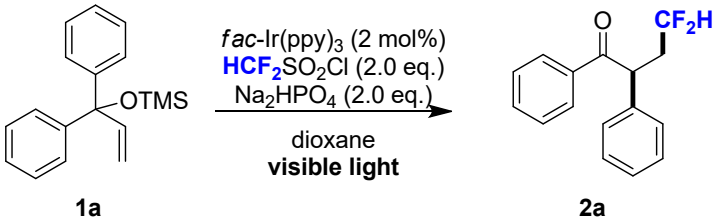
Part 1. General Information

Unless otherwise noted, materials obtained from commercial suppliers were used directly without further purification. Proton nuclear magnetic resonance (^{1}H NMR) spectra were recorded on Bruker 600 MHz spectrometer and Bruker 400 MHz spectrometer. Chemical shifts were recorded in parts per million (ppm, δ) relative to tetramethylsilane (δ = 0.00) or chloroform (δ = 7.26, singlet). ^{1}H NMR splitting patterns are designated as singlet (s), doublet (d), triplet (t), quartet (q), dd (doublet of doublets), m (multiplets), and etc. All first-order splitting patterns were assigned on the basis of the appearance of the multiplet. Splitting patterns that could not be easily interpreted are designated as multiplet (m) or broad (br). Carbon nuclear magnetic resonance (^{13}C NMR) spectra were recorded on a Bruker 600 MHz (150 MHz) spectrometer and Bruker 400 MHz (100 MHz) spectrometer. High-resolution mass spectrometry (HRMS) analysis was carried out using a MS instrument with ESI source.

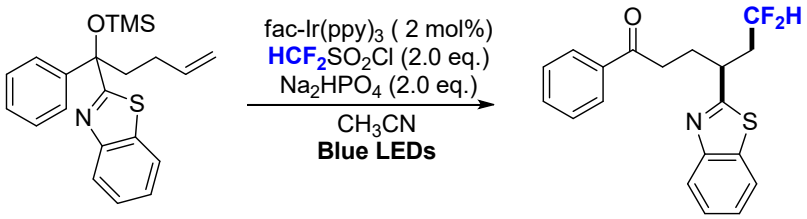
Part 2. General procedure for the synthesis of products



1a **2a**

Method A

To an oven-dried Schlenk tube equipped with a magnetic stirrer, were added **1a** (56.4 mg, 0.2 mmol), *fac*-Ir(ppy)$_3$ (2.4 mg, 0.004 mmol, 0.02 equiv.) and Na_2HPO_4 (56 mg, 0.4 mmol, 2.0 eq.). To this mixture were added 2 mL dioxane, CF_2HSO_2Cl (60 mg, 0.4 mmol, 2.0 eq.) under a blanket of nitrogen. The vial was sealed, and stirred under visible light at room temperature for overnight. After 16 hours, the dioxane was removed in vacuo, and the residue purified by column chromatography on silica gel. This gave product **2a** as colorless liquid (43.0 mg, 82% yield).



3a **4a**

Method B

To an oven-dried Schlenk tube equipped with a magnetic stirrer, were added **3a** (73.4 mg, 0.2 mmol), *fac*-Ir(ppy)$_3$ (2.4 mg, 0.004 mmol, 0.02 equiv.) and Na_2HPO_4 (56 mg, 0.4 mmol, 2.0 eq.). To this mixture were added 2 mL CH_3CN, CF_2HSO_2Cl (60 mg, 0.4 mmol, 2.0 eq.) under a blanket of nitrogen. The vial was sealed, and stirred under blue light at room temperature for overnight. After 16 hours, the CH_3CN was removed in vacuo, and the residue purified by column chromatography on silica gel. This gave product **4a** as colorless liquid (59.3 mg, 86% yield).

Part 3. Mechanistic Studies

Quantum Yield Measurements

BESTLLON® LED lamps (λmax = 456 nm) was used with 100% intensity for measurement of quantum yield. According to the procedure of Hong [1] the photon flux of the LED was determined by standard ferrioxalate actinometry. A 0.15 M solution of ferrioxalate was prepared by dissolving potassium ferrioxalate hydrate (0.737 g) in H_2SO_4 (10 mL of a 0.05 M solution). A buffered solution of 1,10-phenanthroline was prepared by dissolving 1,10-phenanthroline (5.0 mg) and sodium acetate (1.13 g) in H_2SO_4 (5.0 mL of a 0.5 M solution). Both solutions were stored in the dark. To determine the photon flux of the LED, the ferrioxalate solution (2.0 mL) was placed in a cuvette and irradiated for 90 seconds. After irradiation, the phenanthroline solution (0.35 mL) was added to the cuvette and the mixture was allowed to stir in the dark for 1 h to allow the ferrous ions to completely coordinate to the phenanthroline. The absorbance of the solution was measured at 510 nm. A non-irradiated sample was also prepared and the absorbance at 510 nm was measured. Conversion was calculated using eq 1.

	Non-irrad	Irrad
A_{510}	0.527	1.114

$$mol\ of\ Fe^{2+} = \frac{V\Delta_{510nm}}{l \cdot \varepsilon} = \frac{0.00235L \times 0.587}{1\ cm \times 11100\frac{L}{mol}cm} = 1.24 \times 10^{-7} mol \quad (1)$$

V is the total volume (0.00235 L) of the solution after addition of phenanthroline, ΔA is the difference in absorbance at 510 nm between the irradiated and non-irradiated solutions, l is the path length (1.00 cm), and ε is the molar absorptivity of the ferrioxalate actinometer at 510 nm (11,100 $Lmol^{-1}$ cm^{-1}). The photon flux can be calculated using eq 2.

$$Photon\ flux = \frac{mol\ of\ Fe^{2+}}{\emptyset \cdot t \cdot f} = \frac{1.24 \times 10^{-7} mol}{0.84 \times 90s \times 0.908} = 1.80 \times 10^{-9} einsein/s$$

(2)

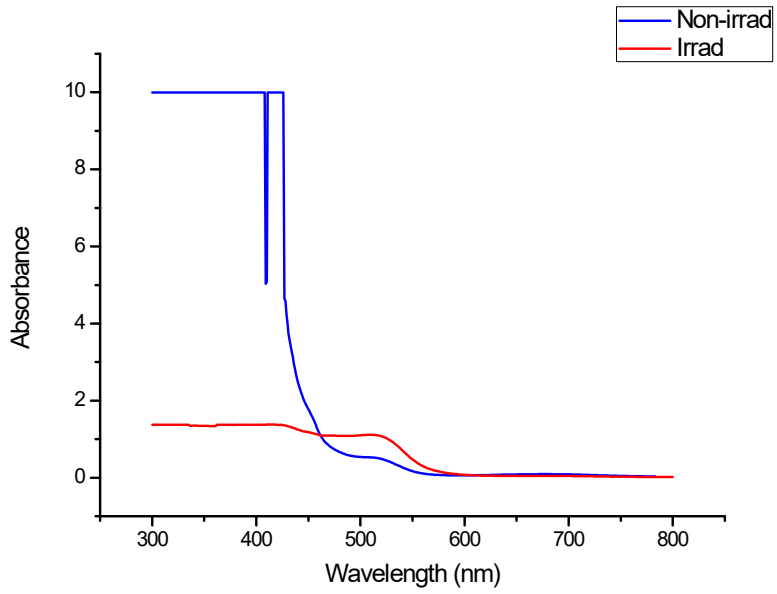


Figure 1 Absorption spectra of irradiation experiment and non-irradiation experiment

Where Φ is the quantum yield for the ferrioxalate actinometer (0.84 at λ = 456 nm) is the irradiation time (90 s), and f is the fraction of light absorbed at 456 nm by the ferrioxalate actinometer. This value is calculated using eq 2 where A_{456} nm is the absorbance of the ferrioxalate solution at 456 nm. An absorption spectrum gave an A_{456nm} value of 1.037, indicating that the fraction of absorbed light (f) is 0.908. The photon flux was thus calculated to be 1.80×10^{-9} einsteins s^{-1}.

$$f_{Fe} = 1 - 10^{-A_{456nm}} = 1 - 10^{-1.037} = 0.908 \quad (3)$$

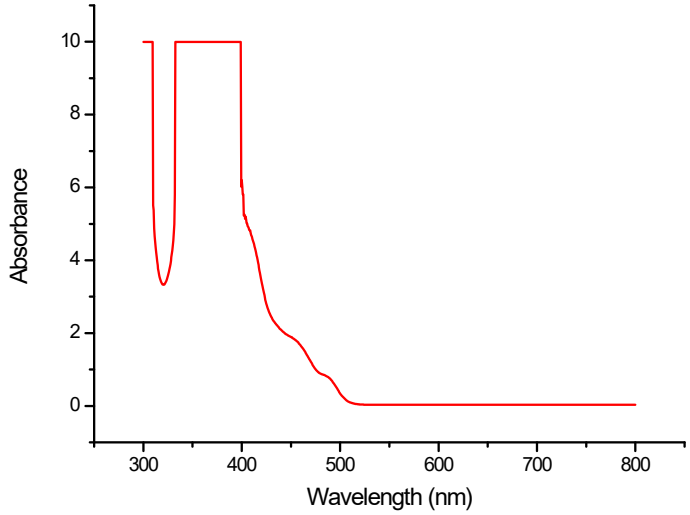


Figure 2 Absorption spectra of 0.001 M solution of *fac*-Ir(ppy)$_3$ in dioxane

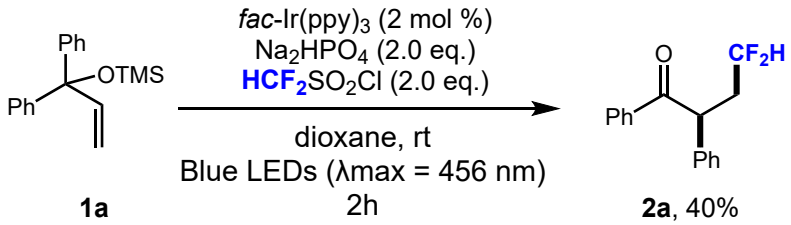


Figure 3 Determination of the reaction quantum yield

The reaction mixture was stirred and irradiated by BESTLLON® LED lamps (λmax = 456 nm) for 7200 s. The yield of product was determined by ^{1}H NMR analysis using dibromomethane as an internal standard. The yield of **2a** was determined to be 40% (0.08 × 10^{-3} mol of **2a**). The reaction quantum yield (Φ) was determined using eq 5 where the photon flux is 1.80 × 10^{-9} einsteins s^{-1} (determined by actinometry as described above), t is the reaction time (2 h) and f is the fraction of incident light absorbed by the catalyst, determined using eq 4. An absorption spectrum of the catalyst (0.001 M) gave an absorbance value of 1.777 at 456 nm, indicating that the fraction of light absorbed by the photocatalyst (f) is 0.980.

$$f_{Ir} = 1 - 10^{-A_{456nm}} = 1 - 10^{-1.777} = 0.980 \quad (4)$$

$$\emptyset = \frac{mol\ of\ product}{flux \cdot t \cdot f} = \frac{0.08 \times 10^{-3} mol}{1.80 \times 10^{-9} einsein/s \times 7200s \times 0.9800} = 6.29 \quad (5)$$

The reaction quantum yield (Φ) was calculated to be 6.29.

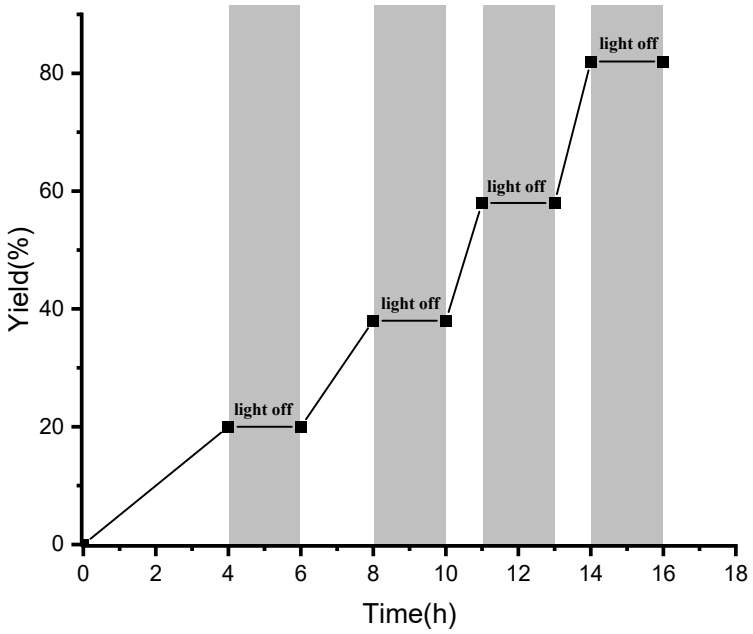
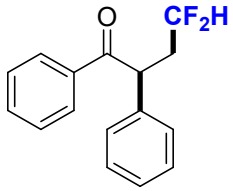


Figure 4. Light on/off experiments of the model reaction delivering, detected by ^{1}H NMR.

Part 3. Characterizations of products

4,4-difluoro-1,2-diphenylbutan-1-one (2a)



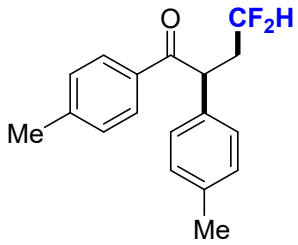
Prepared according to general method A and isolated in 82% yield after chromoatography as colorless liquid (43.0 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 – 7.92 (m, 2H), 7.49 (t, *J* = 7.4 Hz, 1H), 7.39 (t, *J* = 7.6 Hz, 2H), 7.35 – 7.28 (m, 5H), 5.73 (tt, *J* = 56.8, 4.8 Hz, 1H), 4.80 (t, *J* = 7.3 Hz, 1H), 2.85 – 2.68 (m, 1H), 2.43 – 2.26 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.93, 137.91, 135.93, 133.41, 129.54, 128.99, 128.76, 128.22, 127.85, 116.30 (t, *J* = 238.7 Hz), 47.84 (t, *J* = 5.5 Hz), 38.06 (t, *J* = 21.7 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.64 – -117.91 (m).

HRMS (ESI) for $C_{16}H_{15}F_2O^+$ $[M+H]^+$ m/z: calcd 261.1085, found 261.1109.

4,4-difluoro-1,2-di-p-tolylbutan-1-one (2b)



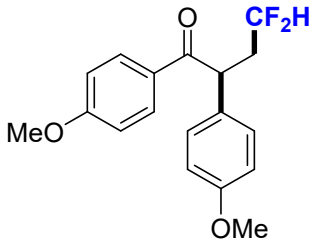
Prepared according to general method A and isolated in 62% yield after chromoatography as colorless liquid (35.7 mg)

1H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 8.2 Hz, 2H), 7.20 (d, *J* = 8.2 Hz, 4H), 7.13 (d, *J* = 8.0 Hz, 2H), 5.75 (tt, J = 56.9, 4.9 Hz, 1H), 4.76 (t, *J* = 7.4 Hz, 1H), 2.86 – 2.63 (m, 1H), 2.45 – 2.24 (m, 7H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.63, 144.21, 137.48, 135.08, 133.45, 130.17, 129.42, 129.11, 128.04, 116.46 (t, *J* = 238.6 Hz), 47.33 (t, *J* = 5.5 Hz), 38.05 (t, *J* = 21.6 Hz), 21.73, 21.14.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.62 – -117.93 (m).

HRMS (ESI) for $C_{18}H_{19}F_2O^+$ $[M+H]^+$ m/z: calcd 289.1398, found 289.1407.

4,4-difluoro-1,2-bis(4-methoxyphenyl)butan-1-one (2c)



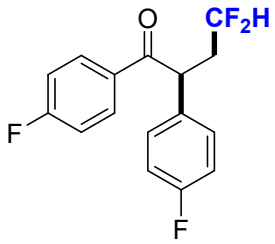
Prepared according to general method A and isolated in 71% yield after chromoatography as colorless liquid (45.4mg)

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.9 Hz, 2H), 7.23 (d, *J* = 8.7 Hz, 2H), 6.88 – 6.81 (m, 4H), 5.74 (tt, *J* = 56.9, 4.8 Hz, 1H), 4.72 (t, *J* = 7.4 Hz, 1H), 3.84 (s, 3H), 3.78 (s, 3H), 2.78 – 2.65 (m, 1H), 2.78 – 2.65 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.58, 163.65, 159.08, 131.30, 130.26, 129.21, 128.89, 116.53 (t, *J* = 238.5 Hz), 114.86, 113.92, 55.58, 55.37, 46.64 (t , *J* = 5.5 Hz), 38.12 (t, *J* = 21.4 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.63 – -117.98 (m).

HRMS (ESI) for $C_{18}H_{19}F_2O_3^+$ $[M+H]^+$ m/z: calcd 321.1297, found 321.1271.

4,4-difluoro-1,2-bis(4-fluorophenyl)butan-1-one (2d)



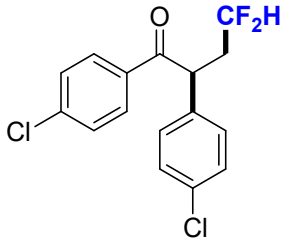
Prepared according to general method A and isolated in 67% yield after chromoatography as colorless liquid (39.6 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 – 7.91 (m, 2H), 7.30 – 7.21 (m, 2H), 7.10 – 6.97 (m, 4H), 5.74 (tt, *J* = 56.7, 4.7 Hz, 1H), 4.75 (t, *J* = 7.4 Hz, 1H), 2.84 – 2.66 (m, 1H), 2.41 – 2.21 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.25, δ 165.93 (d, *J* = 256.0 Hz), 162.37 (d, *J* = 247.4 Hz), 133.54 (d, *J* = 3.4 Hz), 132.15 (d, *J* = 2.7 Hz), 131.63 (d, *J* = 9.4 Hz), 129.77 (d, *J* = 8.1 Hz), 116.62 (d, *J* = 21.6 Hz), 116.06 (t, *J* = 239.0 Hz) 116.03 (d, *J* = 22.0 Hz), 46.88 (t, *J* = 5.4 Hz), 38.07 (t, *J* = 21.6 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -104.20, -114.02, -115.70 – -118.01(m).

HRMS (ESI) for $C_{16}H_{13}F_4O^+$ $[M+H]^+$ m/z: calcd 297.0897, found 297.0901

1,2-bis(4-chlorophenyl)-4,4-difluorobutan-1-one (2e)



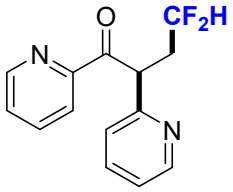
Prepared according to general method A and isolated in 71% yield after chromoatography as colorless liquid (46.6 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 8.6 Hz, 2H), 7.37 (d, *J* = 8.6 Hz, 2H), 7.30 (d, *J* = 8.5 Hz, 2H), 7.21 (d, *J* = 8.5 Hz, 2H), 5.74 (tt, *J* = 56.6, 4.6 Hz, 1H), 4.73 (t, *J* = 7.3 Hz, 1H), 2.85 – 2.67 (m, 1H), 2.40 – 2.21 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.40, 140.16, 136.11, 134.08, 133.97, 130.32, 129.85, 129.48, 129.21, 115.93 (t, *J* = 239.1 Hz), 47.07 (t, *J* = 5.5 Hz), 37.86 (t, *J* = 21.7 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ-115.65 – -117.96. (m).

HRMS (ESI) for $C_{16}H_{13}Cl_2F_2O^+$ $[M+H]^+$ m/z: calcd 329.0306, found 329.0312.

4,4-difluoro-1,2-di(pyridin-2-yl)butan-1-one (2f)



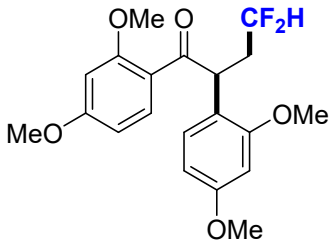
Prepared according to general method A and isolated in 76% yield after chromoatography as colorless liquid (39.8 mg)

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.59 (d, *J* = 4.2 Hz, 1H), 8.47 (d, *J* = 4.0 Hz, 1H), 8.04 (d, *J* = 7.8 Hz, 1H), 7.77 (td, *J* = 7.7, 1.1 Hz, 1H), 7.59 (td, *J* = 7.7, 1.3 Hz, 1H), 7.48 (d, *J* = 7.8 Hz, 1H), 7.38 (dd, *J* = 6.4, 5.0 Hz, 1H), 7.08 (dd, *J* = 6.5, 5.2 Hz, 1H), 5.85 (tt, *J* = 56.8, 4.6 Hz, 1H), 5.71 (t, *J* = 7.3 Hz, 1H), 2.90 – 2.74 (m, 1H), 2.64 – 2.49 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 198.18, 157.90, 152.44, 149.81, 148.95, 137.02, 136.88, 127.27, 124.72, 123.08, 122.10, 116.52 (t, *J* = 238.9 Hz), 48.01 (t, *J* = 5.3 Hz), 35.78 (t, *J* = 21.8 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.09 – -116.71(m).

HRMS (ESI) for $C_{14}H_{13}F_2N_2O^+$ $[M+H]^+$ m/z: calcd 263.0990, found 263.0994.

1,2-bis(2,4-dimethoxyphenyl)-4,4-difluorobutan-1-one (2g)



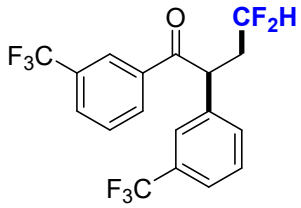
Prepared according to general method A and isolated in 78% yield after chromoatography as colorless liquid (59.2 mg)

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.65 (d, *J* = 8.7 Hz, 1H), 6.94 (d, *J* = 8.6 Hz, 1H), 6.42 (dd, *J* = 8.7, 2.3 Hz, 1H), 6.36 – 6.32 (m, 2H), 6.27 (d, *J* = 2.2 Hz, 1H), 5.81 (tt, *J* = 57.4, 5.0 Hz, 1H), 4.98 (t, *J* = 7.2 Hz, 1H), 3.78 (s, 3H), 3.75 (s, 3H), 3.74 (s, 3H), 3.73 (s, 3H), 2.76 – 2.62 (m, 1H), 2.19 – 2.04 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 199.83, 164.04, 160.03, 159.99, 157.84, 132.82, 129.81, 120.94, 120.01, 117.18 (t, *J* = 238.2 Hz), 104.98, 104.29, 98.69, 98.17, 55.53, 55.38, 55.31, 45.42 (t, *J* = 5.5 Hz), 36.62 (t, *J* = 21.3 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -114.28 – -117.42(m).

HRMS (ESI) for $C_{20}H_{23}F_2O_5^+$ $[M+H]^+$ m/z: calcd 381.1508, found 381.1518.

4,4-difluoro-1,2-bis(3-(trifluoromethyl)phenyl)butan-1-one (2h)



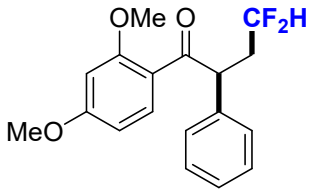
Prepared according to general method A and isolated in 76% yield after chromoatography as colorless liquid (61.7 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (s, 1H), 8.10 (d, *J* = 7.9 Hz, 1H), 7.78 (d, *J* = 7.8 Hz, 1H), 7.62 – 7.43 (m, 5H), 5.79 (tt, *J* = 56.4, 4.5 Hz, 1H), 4.90 (t, 1H), 2.96 – 2.78 (m, 1H), 2.45 – 2.28 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.10, 138.34, 136.03, 131.97, 131.55, 132.14 (q, *J* = 33.8 Hz), 131.67 (q, *J* = 33.1 Hz), 130.29, 130.18 (q, *J* = 3.5 Hz), 129.68, 125.82 (q, *J* = 3.9 Hz), 125.18 (q, *J* = 3.7 Hz), 124.94 (q, *J* = 3.8 Hz), 122.42, 122.23, 115.65 (t, *J* = 239.4 Hz), 47.42 (t, *J* = 5.2 Hz), 37.91 (t, *J* = 21.8 Hz).

^{19}F NMR (377 MHz, $CDCl_3$) δ -62.76, -63.02, -115.47 – -118.04(m).

HRMS (ESI) for $C_{18}H_{13}F_8O^+$ $[M+H]^+$ m/z: calcd 397.0833, found 397.0845

1-(2,4-dimethoxyphenyl)-4,4-difluoro-2-phenylbutan-1-one (2i)



Prepared according to general method A and isolated in 63% yield after chromoatography as colorless liquid (40.0 mg)

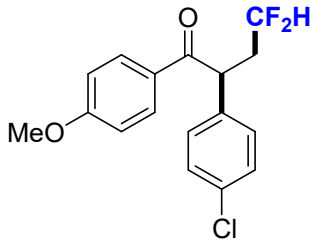
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.70 (d, *J* = 8.7 Hz, 1H), 7.29 – 7.16 (m, 5H), 6.45 (dd, *J* = 8.7, 2.3 Hz, 1H), 6.35 (d, *J* = 2.2 Hz, 1H), 5.72 (tt, *J* = 57.0, 4.9 Hz, 1H), 4.94 (t, *J* = 7.5 Hz, 1H), 3.83 (s, 3H), 3.79 (s, 3H), 2.83 – 2.65 (m, 1H), 2.34 – 2.16 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.70, 164.67, 160.31, 138.58, 133.47, 128.84, 128.56, 127.30, 120.43, 116.72 (t, *J* = 238.5 Hz), 105.43, 98.43, 55.62, 55.42, 51.24 (t, *J* = 5.5 Hz), 38.18 (t, *J* = 21.5 Hz).

^{19}F NMR (377 MHz, $CDCl_3$) δ -115.18 – -117.73 (m).

HRMS (ESI) for $C_{18}H_{19}F_2O_3^+$ $[M+H]^+$ m/z: calcd 321.1297, found 321.1286.

1-(4-chlorophenyl)-4,4-difluoro-2-(4-methoxyphenyl)butan-1-one (2j)



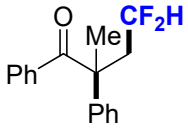
Prepared according to general method A and isolated in 65% yield after chromoatography as colorless liquid (42.1 mg)

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.93 (d, *J* = 8.9 Hz, 2H), 7.33 – 7.29 (m, 2H), 7.28 – 7.25 (m, 2H), 6.92 – 6.86 (m, 2H), 5.76 (tt, *J* = 56.7, 4.8 Hz, 1H), 4.76 (t, *J* = 7.4 Hz, 1H), 3.85 (s, 3H), 2.82 – 2.70 (m, 1H), 2.38 – 2.25 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 196.01, 163.90, 136.91, 133.73, 131.30, 129.66, 129.48, 128.61, 116.17 (t, *J* = 239.0 Hz), 114.06, 55.63, 46.67 (t, *J* = 5.4 Hz), 38.02 (t, *J* = 21.6 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.47 – -117.97 (m).

HRMS (ESI) for $C_{17}H_{16}ClF_2O_2^+$ $[M+H]^+$ m/z: calcd 325.0801, found 325.0785.

4,4-difluoro-2-methyl-1,2-diphenylbutan-1-one (2k)



Prepared according to general method A and isolated in 78% yield after chromoatography as colorless liquid (42.8 mg)

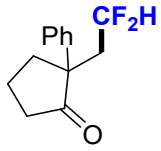
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 – 7.30 (m, 8H), 7.25-7.21 (m, 2H), 5.62 (tdd, *J* = 56.4, 5.3, 4.1 Hz, 1H), 2.74 – 2.38 (m, 2H), 1.76 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 202.06, 141.73, 135.72, 132.06, 129.67, 129.45, 128.12, 127.72, 126.13, 116.67 (t, *J* = 238.3 Hz), 52.09 (dd, *J* = 5.7, 4.1 Hz), 44.92 (t, *J* = 21.5 Hz), 22.76.

^{19}F NMR (377 MHz, $CDCl_3$) δ -109.75 – -112.62 (m).

HRMS (ESI) for $C_{17}H_{17}F_2O^+$ $[M+H]^+$ m/z: calcd 275.1253, found 275.1233.

2-(2,2-difluoroethyl)-2-phenylcyclopentan-1-one (2l)



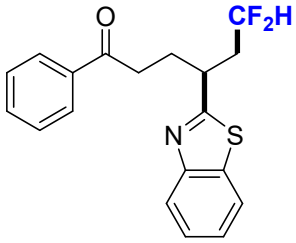
Prepared according to general method B and isolated in 83% yield after chromoatography as colorless liquid (37.2 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 – 7.33 (m, 4H), 7.32 – 7.27 (m, 1H), 5.41 (tdd, *J* = 56.2, 7.2, 2.5 Hz, 1H), 2.93 – 2.82 (m, 1H), 2.69 – 2.50 (m, 1H), 2.39 – 2.15 (m, 2H), 2.13 – 1.91 (m, 3H), 1.89 – 1.72 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 217.31, 136.44, 129.26, 127.82, 126.86, 116.51 (t, *J* = 238.7 Hz), 53.74 (t, *J* = 5.3 Hz), 42.69 (t, *J* = 21.5 Hz), 36.05, 33.85, 18.53.

^{19}F NMR (377 MHz, $CDCl_3$) δ -113.82 (d, *J* = 4.0 Hz).

HRMS (ESI) for $C_{13}H_{15}F_2O^+$ $[M+H]^+$ m/z: calcd 225.1085, found 225.1071.

4-(benzo[d]thiazol-2-yl)-6,6-difluoro-1-phenylhexan-1-one (4a)



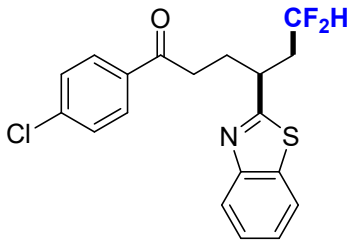
Prepared according to general method B and isolated in 86% yield after chromoatography as colorless liquid (59.3 mg)

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.1 Hz, 1H), 7.87 (m, 3H), 7.53 (t, *J* = 7.4 Hz, 1H), 7.51 – 7.47 (m, 1H), 7.44 – 7.37 (m, 3H), 5.89 (tdd, *J* = 56.5, 6.0, 3.5 Hz, 1H), 3.61 – 3.53 (m, 1H), 3.07 – 2.95 (m, 2H), 2.65 – 2.52 (m, 1H), 2.42 – 2.27 (m, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 198.95, 172.90, 153.18, 136.70, 134.78, 133.34, 128.72, 128.11, 126.36, 125.37, 123.11, 121.87, 115.96 (t, *J* = 239.6 Hz), 39.85 (t, *J* = 21.7 Hz), 38.62 (dd, *J* = 7.0, 3.9 Hz), 35.61, 30.22.

^{19}F NMR (565 MHz, $CDCl_3$) δ -114.69 – -117.12 (m).

HRMS (ESI) for $C_{19}H_{18}F_2OS^+$ $[M+H]^+$ m/z: calcd 346.1072, found 346.1079.

4-(benzo[d]thiazol-2-yl)-1-(4-chlorophenyl)-6,6-difluorohexan-1-one (4b)



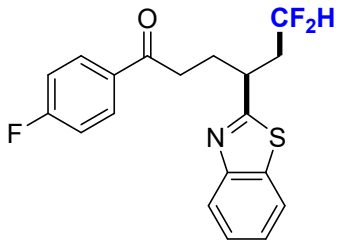
Prepared according to general method B and isolated in 88% yield after chromoatography as colorless liquid (66.7 mg)

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.99 (d, *J* = 8.2 Hz, 1H), 7.87 (d, *J* = 7.9 Hz, 1H), 7.83 – 7.79 (m, 2H), 7.52 – 7.47 (m, 1H), 7.42 – 7.36 (m, 3H), 5.89 (tdd, *J* = 56.5, 6.0, 3.5 Hz, 1H), 3.59 – 3.52 (m, 1H), 3.03 – 2.91 (m, 2H), 2.64 – 2.52 (m, 1H), 2.41 – 2.27 (m, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.72, 172.74, 153.19, 139.79, 135.02, 134.77, 129.54, 129.04, 126.41, 125.43, 123.12, 121.88, 115.91 (t, *J* = 239.6 Hz), 39.87 (t, *J* = 21.7 Hz), 38.56 (dd, *J* = 7.0, 4.2 Hz), 35.59, 30.13.

^{19}F NMR (565 MHz, $CDCl_3$) δ -114.70 – -117.14(m).

HRMS (ESI) for $C_{19}H_{17}ClF_2OS^+$ $[M+H]^+$ m/z: calcd 380.0682, found 380.0663.

4-(benzo[d]thiazol-2-yl)-6,6-difluoro-1-(4-fluorophenyl)hexan-1-one (4c)



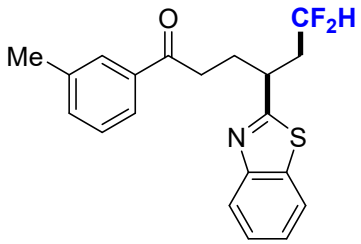
Prepared according to general method B and isolated in 91% yield after chromoatography as colorless liquid (66.0 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.99 (d, *J* = 7.9 Hz, 1H), 7.93 – 7.83 (m, 3H), 7.53 – 7.46 (m, 1H), 7.44 – 7.37 (m, 1H), 7.11 – 7.04 (m, 2H), 5.89 (tdd, *J* = 56.5, 6.0, 3.5 Hz, 1H), 3.61 – 3.51 (m, 1H), 3.06 – 2.89 (m, 2H), 2.68 – 2.48 (m, 1H), 2.45 – 2.25 (m, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.18, 172.69, 165.77 (d, *J* = 255.0 Hz), 153.02, 134.63, 133.03 (d, *J* = 2.9 Hz), 130.62 (d, *J* = 9.3 Hz), 126.27, 125.29, 122.97, 121.74, 115.79 (t, *J* = 239.5 Hz), 115.68 (d, *J* = 21.9 Hz), 39.73 (t, *J* = 21.8 Hz), 38.45 (dd, *J* = 6.8, 4.2 Hz), 35.39, 30.05.

^{19}F NMR (377 MHz, $CDCl_3$) δ -104.95, -114.52 – -117.29 (m).

HRMS (ESI) for $C_{19}H_{17}F_3OS^+$ $[M+H]^+$ m/z: calcd 364.0977, found 364.0960.

4-(benzo[d]thiazol-2-yl)-6,6-difluoro-1-(m-tolyl)hexan-1-one (4d)



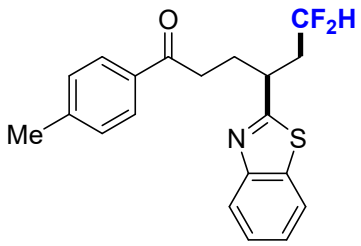
Prepared according to general method B and isolated in 56% yield after chromoatography as colorless liquid (40.0 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.0 Hz, 1H), 7.87 (d, *J* = 7.6 Hz, 1H), 7.66 (d, *J* = 8.4 Hz, 2H), 7.52 – 7.46 (m, 1H), 7.43 – 7.37 (m, 1H), 7.36 – 7.27 (m, 2H), 5.89 (tdd, *J* = 56.5, 6.0, 3.5 Hz, 1H), 3.63 – 3.50 (m, 1H), 3.07 – 2.92 (m, 2H), 2.67 – 2.49 (m, 1H), 2.44 – 2.27 (m, 6H).^{13}C NMR (101 MHz, $CDCl_3$) δ 199.19, 172.97, 153.17, 138.52, 136.74, 134.79, 134.09, 128.62, 128.59, 126.35, 125.36, 125.33, 123.10, 121.87, 115.97 (t, *J* = 239.5 Hz), 39.84 (t, *J* = 21.8 Hz), 38.63 (dd, *J* = 7.0, 4.2 Hz), 35.65, 30.29, 21.45.

^{19}F NMR (377 MHz, $CDCl_3$) δ -114.51 – -117.27 (m).

HRMS (ESI) for $C_{20}H_{20}F_2OS^+$ $[M+H]^+$ m/z: calcd 360.1228, found 360.1221.

4-(benzo[d]thiazol-2-yl)-6,6-difluoro-1-(p-tolyl)hexan-1-one (4e)



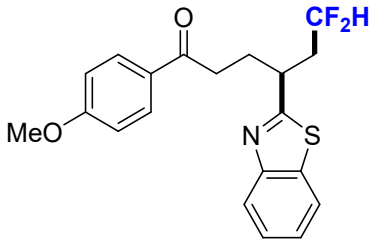
Prepared according to general method B and isolated in 83% yield after chromoatography as colorless liquid (59.6 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.1 Hz, 1H), 7.87 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 8.1 Hz, 2H), 7.49 (t, *J* = 7.7 Hz, 1H), 7.39 (t, *J* = 7.9 Hz, 1H), 7.21 (d, *J* = 7.9 Hz, 2H), 5.89 (tdd, *J* = 56.6, 5.7, 3.6 Hz, 1H), 3.64 – 3.49 (m, 1H), 3.07 – 2.91 (m, 2H), 2.69 – 2.46 (m, 1H), 2.44 – 2.24 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 198.61, 172.98, 153.21, 144.14, 134.81, 134.28, 129.39, 128.23, 126.34, 125.35, 123.11, 121.86, 115.98 (t, *J* = 239.4 Hz), 39.84 (t, *J* = 21.7 Hz), 38.66 (dd, *J* = 7.0, 4.3 Hz), 35.49, 30.32, 21.76.

^{19}F NMR (377 MHz, $CDCl_3$) δ -114.50 – -117.24 (m).

HRMS (ESI) for $C_{20}H_{20}F_2OS^+$ $[M+H]^+$ m/z: calcd 360.1228, found 360.1219.

4-(benzo[d]thiazol-2-yl)-6,6-difluoro-1-(4-methoxyphenyl)hexan-1-one (4f)



Prepared according to general method B and isolated in 67% yield after chromoatography as colorless liquid (50.2 mg)

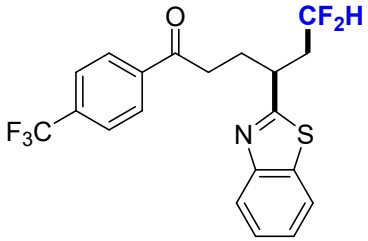
^{1}H NMR (600 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.1 Hz, 1H), 7.89 – 7.83 (m, 3H), 7.52 – 7.45 (m, 1H), 7.41 – 7.37 (m, 1H), 6.91 – 6.86 (m, 2H), 5.89 (tdd, *J* = 56.5, 6.0, 3.6 Hz, 1H), 3.85 (d, *J* = 3.3 Hz, 3H), 3.59 – 3.52 (m, 1H), 3.01 – 2.89 (m, 2H), 2.64 – 2.51 (m, 1H), 2.43 – 2.26 (m, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.50, 173.03, 163.68, 153.23, 134.83, 130.41, 129.87, 126.34, 125.34, 123.12, 121.87, 116.00 (t, *J* = 239.4 Hz), 113.85, 55.60, 39.87 (t, *J* = 21.6 Hz), 38.72 (dd, *J* = 6.7, 4.1 Hz), 35.26,

30.45.

^{19}F NMR (565 MHz, $CDCl_3$) δ -114.69 – -117.09 (m).

HRMS (ESI) for $C_{20}H_{20}F_2O_2S^+$ $[M+H]^+$ m/z: calcd 376.1177, found 376.1166.

4-(benzo[d]thiazol-2-yl)-6,6-difluoro-1-(4-(trifluoromethyl)phenyl)hexan-1-one (4g)



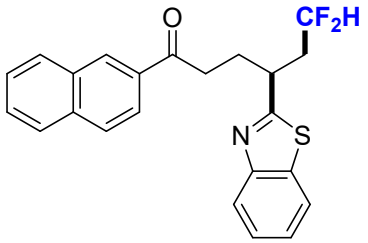
Prepared according to general method B and isolated in 70% yield after chromoatography as colorless liquid (57.8 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 – 7.92 (m, 3H), 7.89 (d, *J* = 7.9 Hz, 1H), 7.70 (d, *J* = 8.1 Hz, 2H), 7.52 (t, *J* = 7.7 Hz, 1H), 7.42 (t, *J* = 7.6 Hz, 1H), 5.91 (tdd, *J* = 9.2, 5.7, 3.5 Hz, 1H), 3.65 – 3.54 (m, 1H), 3.14 – 2.98 (m, 2H), 2.71 – 2.51 (m, 1H), 2.48 – 2.29 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 197.86, 172.49, 153.06, 134.63, 134.49 (q, *J* = 32.6 Hz), 128.33, 126.33, 125.69 (q, *J* = 3.6 Hz), 125.35, 123.54 (q, *J* = 272.6 Hz), 123.01, 121.77, 115.76 (t, *J* = 239.5 Hz), 39.74 (t, *J* = 21.8 Hz), 38.44 (dd, *J* = 6.9, 4.1 Hz), 35.80, 29.88.

^{19}F NMR (377 MHz, $CDCl_3$) δ -63.15, -114.51 – -117.30 (m).

HRMS (ESI) for $C_{20}H_{17}F_5NOS^+$ $[M+H]^+$ m/z: calcd 414.0946, found 414.0938.

4-(benzo[d]thiazol-2-yl)-6,6-difluoro-1-(naphthalen-2-yl)hexan-1-one (4h)



Prepared according to general method B and isolated in 50% yield after chromoatography as colorless liquid (39.5 mg)

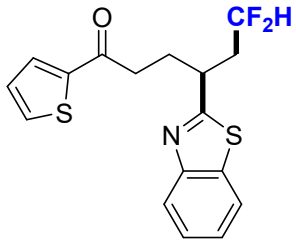
^{1}H NMR (600 MHz, $CDCl_3$) δ 8.36 (s, 1H), 8.01 (d, *J* = 8.1 Hz, 1H), 7.96 (dd, *J* = 8.6, 1.3 Hz, 1H), 7.91 – 7.82 (m, 4H), 7.58 (t, *J* = 7.4 Hz, 1H), 7.53 (t, *J* = 7.4 Hz, 1H), 7.49 (t, *J* = 7.7 Hz, 1H), 7.40 (t, *J* = 7.6 Hz, 1H), 5.92 (tdd, *J* = 56.4, 5.9, 3.5 Hz, 1H),

3.66 – 3.57 (m, 1H), 3.22 – 3.09 (m, 2H), 2.68 – 2.55 (m, 1H), 2.47 – 2.34 (m, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 198.92, 172.97, 153.22, 135.75, 134.83, 134.04, 132.56, 129.84, 129.69, 128.64, 128.61, 127.89, 126.91, 126.38, 125.40, 123.84, 123.13, 121.90, 115.98 (t, *J* = 239.5 Hz), 39.90 (t, *J* = 21.7 Hz), 38.70 (dd, *J* = 6.8, 4.2 Hz), 35.68, 30.44.

^{19}F NMR (565 MHz, $CDCl_3$) δ -114.66 – -117.08 (m).

HRMS (ESI) for $C_{23}H_{20}F_2OS^+$ $[M+H]^+$ m/z: calcd 396.1228, found 396.1220.

4-(benzo[d]thiazol-2-yl)-6,6-difluoro-1-(thiophen-2-yl)hexan-1-one (4i)



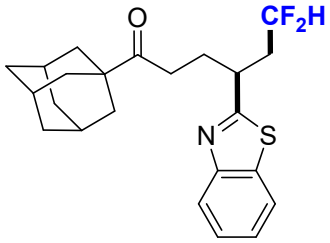
Prepared according to general method B and isolated in 85% yield after chromoatography as colorless liquid (59.7 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.1 Hz, 1H), 7.90 (d, *J* = 8.0, 0.5 Hz, 1H), 7.67 – 7.60 (m, 2H), 7.54 – 7.48 (m, 1H), 7.45 – 7.39 (m, 1H), 7.10 – 7.05 (m, 1H), 5.91 (tdd, *J* = 56.5, 6.0, 3.5 Hz, 1H), 3.63 – 3.53 (m, 1H), 3.03 – 2.93 (m, 2H), 2.69 – 2.51 (m, 1H), 2.46 – 2.29 (m, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 191.87, 172.73, 153.20, 143.98, 134.80, 133.88, 132.09, 128.21, 126.37, 125.39, 123.12, 121.87, 115.93 (t, *J* = 239.6 Hz), 39.78 (t, *J* = 21.8 Hz), 38.60 (dd, *J* = 6.9, 4.1 Hz), 36.29, 30.41.

^{19}F NMR (565 MHz, $CDCl_3$) δ -114.67 – -117.08 (m).

HRMS (ESI) for $C_{16}H_{17}F_2NOS_2^+$ $[M+H]^+$ m/z: calcd 352.0636, found 352.0629.

1-(adamantan-1-yl)-4-(benzo[d]thiazol-2-yl)-6,6-difluorohexan-1-one (4j)



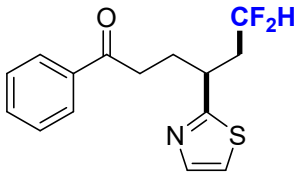
Prepared according to general method B and isolated in 41% yield after chromoatography as colorless liquid (33.0 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 8.1 Hz, 1H), 7.90 (d, *J* = 8.0 Hz, 1H), 7.52 (dt, *J* = 8.2, 2.7 Hz, 1H), 7.41 (dt, *J* = 20.2, 6.5 Hz, 1H), 5.88 (tdd, *J* = 56.5, 6.0, 3.5 Hz, 1H), 3.50 – 3.38 (m, 1H), 2.66 – 2.43 (m, 3H), 2.37 – 2.21 (m, 1H), 2.20 – 2.08 (m, 2H), 2.02 (s, 3H), 1.74 – 1.60 (m, 12H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 214.60, 173.17, 153.18, 134.79, 126.32, 125.31, 123.08, 121.87, 116.00 (t, *J* = 239.4 Hz), 46.45, 39.84 (t, *J* = 21.7 Hz), 38.57 (dd, *J* = 7.0, 4.1 Hz), 38.37, 36.62, 33.08, 29.88, 28.02.

^{19}F NMR (377 MHz, $CDCl_3$) δ -114.47 – -117.22(m).

HRMS (ESI) for $C_{23}H_{28}F_2NOS^+$ $[M+H]^+$ m/z: calcd 404.1854, found 404.1844.

6,6-difluoro-1-phenyl-4-(thiazol-2-yl)hexan-1-one (4k)



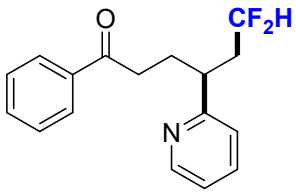
Prepared according to general method B and isolated in 89% yield after chromoatography as colorless liquid (52.5 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 7.3 Hz, 2H), 7.74 (d, *J* = 3.3 Hz, 1H), 7.54 (t, *J* = 7.4 Hz, 1H), 7.43 (t, *J* = 7.7 Hz, 2H), 7.25 (s, 1H), 5.80 (tdd, *J* = 56.5, 6.0, 3.5 Hz, 1H), 3.55 – 3.45 (m, 1H), 3.05 – 2.83 (m, 2H), 2.57 – 2.39 (m, 1H), 2.37 – 2.17 (m, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.07, 172.07, 142.81, 136.77, 133.32, 128.74, 128.09, 118.71, 116.05 (t, *J* = 239.2 Hz), 40.09(t, *J* = 21.5 Hz), 37.59 (dd, *J* = 7.1, 4.3 Hz), 35.57, 30.51.

^{19}F NMR (377 MHz, $CDCl_3$) δ - 114.67 – -117.37 (m).

HRMS (ESI) for $C_{15}H_{16}F_2NOS^+$ $[M+H]^+$ m/z: calcd 296.0915, found 296.0916.

6,6-difluoro-1-phenyl-4-(pyridin-2-yl)hexan-1-one (4l)



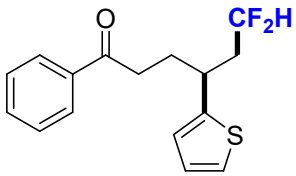
Prepared according to general method B and isolated in 61% yield after chromoatography as colorless liquid (35.3 mg)

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.59 (d, *J* = 4.4 Hz, 1H), 7.84 (d, *J* = 7.4 Hz, 2H), 7.62 (td, *J* = 7.6, 1.7 Hz, 1H), 7.53 (t, *J* = 7.4 Hz, 1H), 7.41 (t, *J* = 7.7 Hz, 2H), 7.19 – 7.13 (m, 2H). 5.62 (tdd, *J* = 56.8, 6.2, 3.5 Hz, 1H), 3.20 – 3.04 (m, 1H), 2.89 – 2.74 (m, 2H), 2.59 – 2.38 (m, 1H), 2.32 – 2.11 (m, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 199.62, 161.94, 149.91, 136.87, 136.85, 133.18, 128.68, 128.09, 123.56, 122.16, 116.60 (t, *J* = 238.9 Hz), 41.18 (dd, *J* = 7.0, 3.6 Hz), 39.46 (t, *J* = 20.9 Hz), 35.92, 29.98.

^{19}F NMR (377 MHz, $CDCl_3$) δ -114.45 – -117.25 (m).

HRMS (ESI) for $C_{17}H_{18}F_2NO^+$ $[M+H]^+$ m/z: calcd 290.1351, found 290.1365.

6,6-difluoro-1-phenyl-4-(thiophen-2-yl)hexan-1-one (4m)



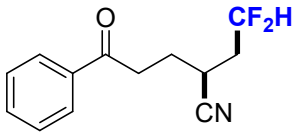
Prepared according to general method B and isolated in 34% yield after chromoatography as colorless liquid (19.9 mg)

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.89 – 7.84 (m, 2H), 7.57 – 7.51 (m, 1H), 7.43 (t, *J* = 7.6 Hz, 2H), 7.21 (d, *J* = 5.1 Hz, 1H), 6.97 – 6.92 (m, 1H), 6.87 – 6.84 (m, 1H), 5.64 (tdd, J = 56.8, 6.8, 3.2 Hz, 1H), 3.32 – 3.22 (m, 1H), 3.01 – 2.78 (m, 2H), 2.34 – 2.09 (m, 3H), 2.05 – 1.92 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 199.50, 146.19, 136.91, 133.24, 128.71, 128.09, 127.06, 125.17, 124.20, 116.41 (t, *J* = 238.9 Hz), 42.37 (t, *J* = 21.3 Hz), 36.03, 35.50 (dd, *J* = 8.1, 3.6 Hz), 32.03.

^{19}F NMR (377 MHz, $CDCl_3$) δ -115.51 – -118.28(m).

HRMS (ESI) for $C_{16}H_{17}F_2OS_2^+$ $[M+H]^+$ m/z: calcd 295.0963, found 295.0959

2-(2,2-difluoroethyl)-5-oxo-5-phenylpentanenitrile (4n)



Prepared according to general method B and isolated in 96% yield after chromoatography as colorless liquid (45.5 mg)

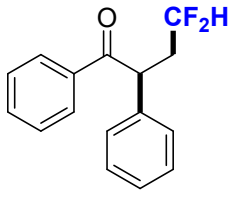
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.97 (dd, *J* = 8.2, 1.0 Hz, 2H), 7.64 – 7.56 (m, 1H), 7.49 (t, *J* = 7.8 Hz, 2H), 6.04 (tdd, *J* = 55.6, 5.3, 3.6 Hz, 1H), 3.32 – 3.19 (m, 2H),

3.07 – 2.98 (m, 1H), 2.35 – 2.11 (m, 3H), 2.08 – 1.98 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 197.92, 136.36, 133.74, 128.90, 128.12, 120.25, 114.83 (t, J = 240.6 Hz), δ 36.82 (t, J = 22.7 Hz), 35.31, 26.50, 25.25 (dd, J = 6.5, 4.9 Hz).

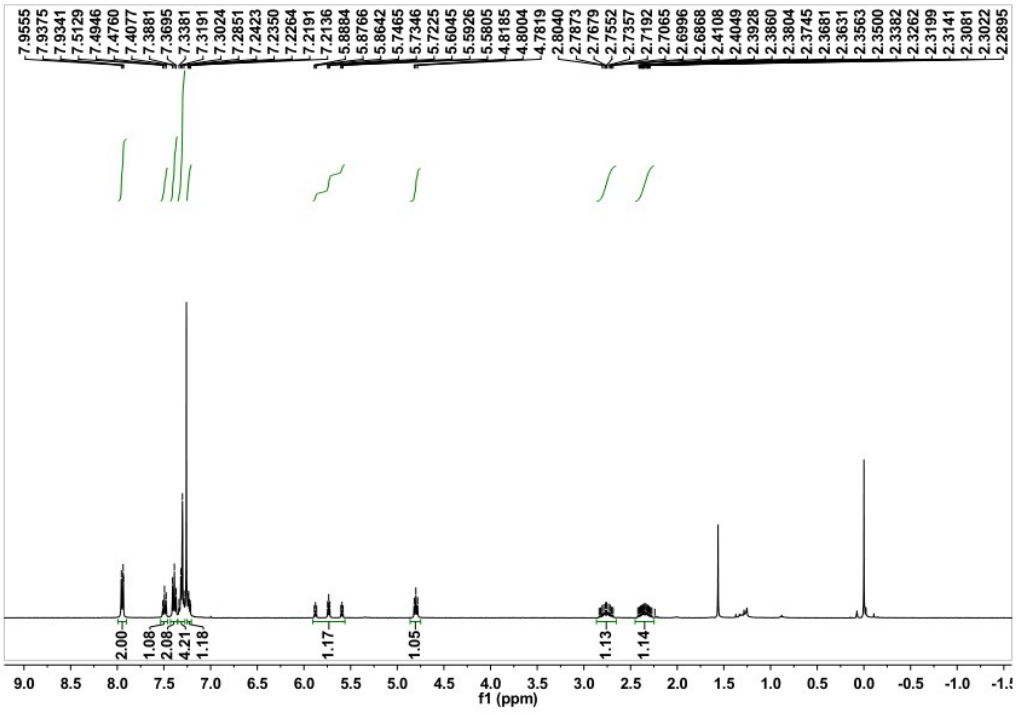
^{19}F NMR (565 MHz, $CDCl_3$) δ -115.91 – -117.33(m).

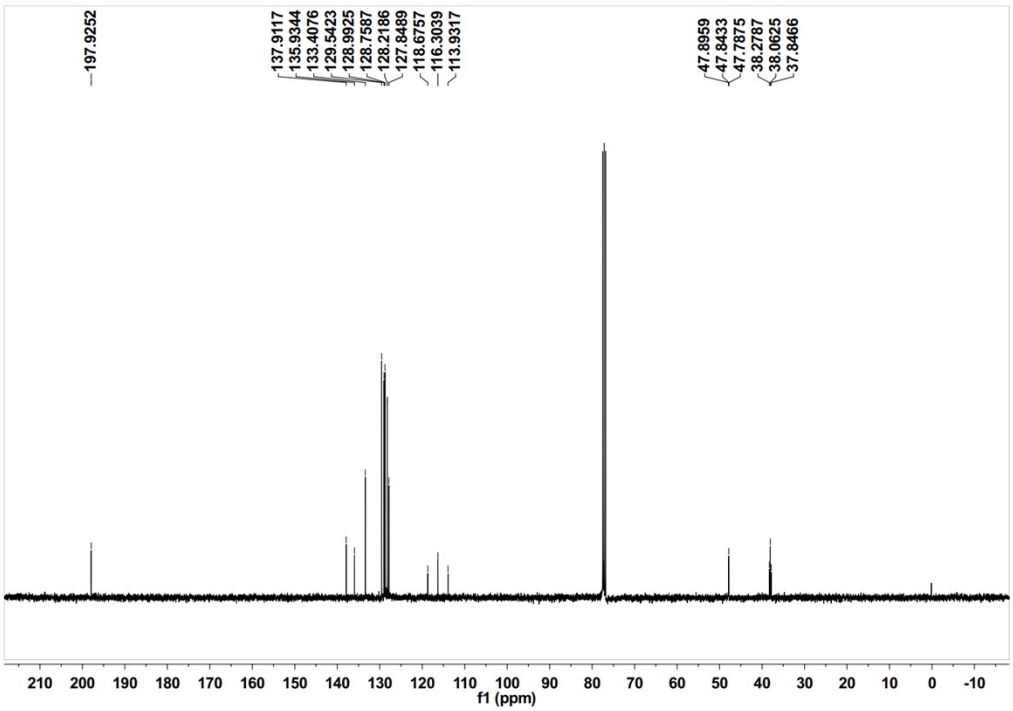
HRMS (ESI) for $C_{13}H_{14}F_2NO^+$ $[M+H]^+$ m/z: calcd 238.1038, found 238.1028.

Part 4. ^{1}H NMR, ^{13}C NMR and ^{19}F NMR Spectra



2a

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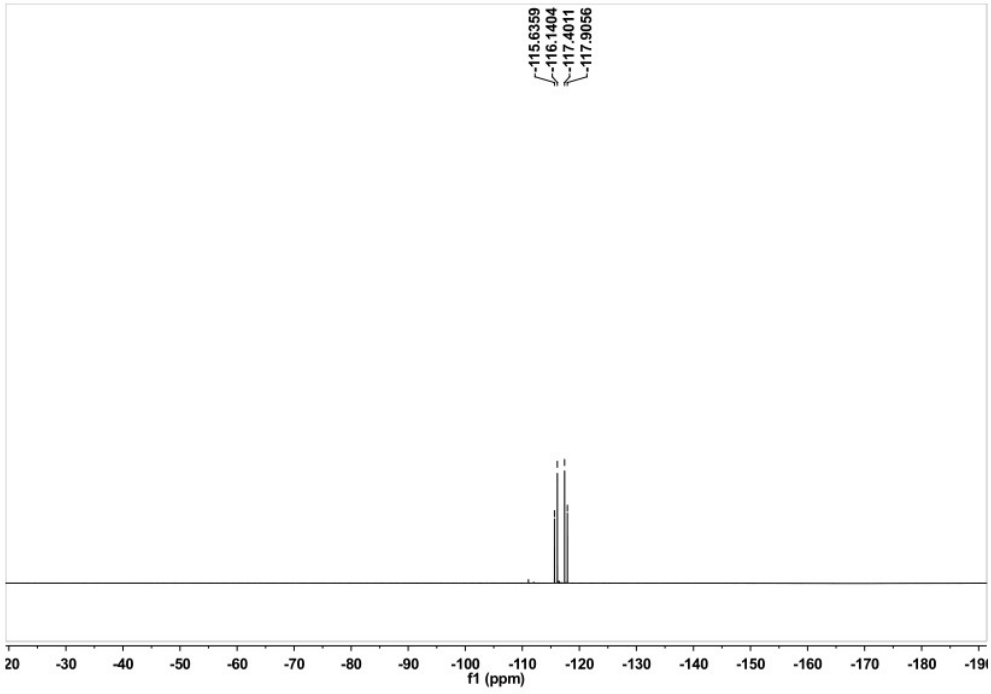
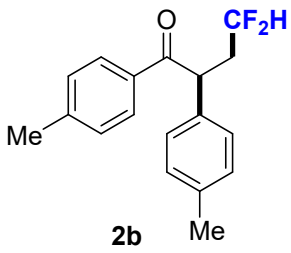
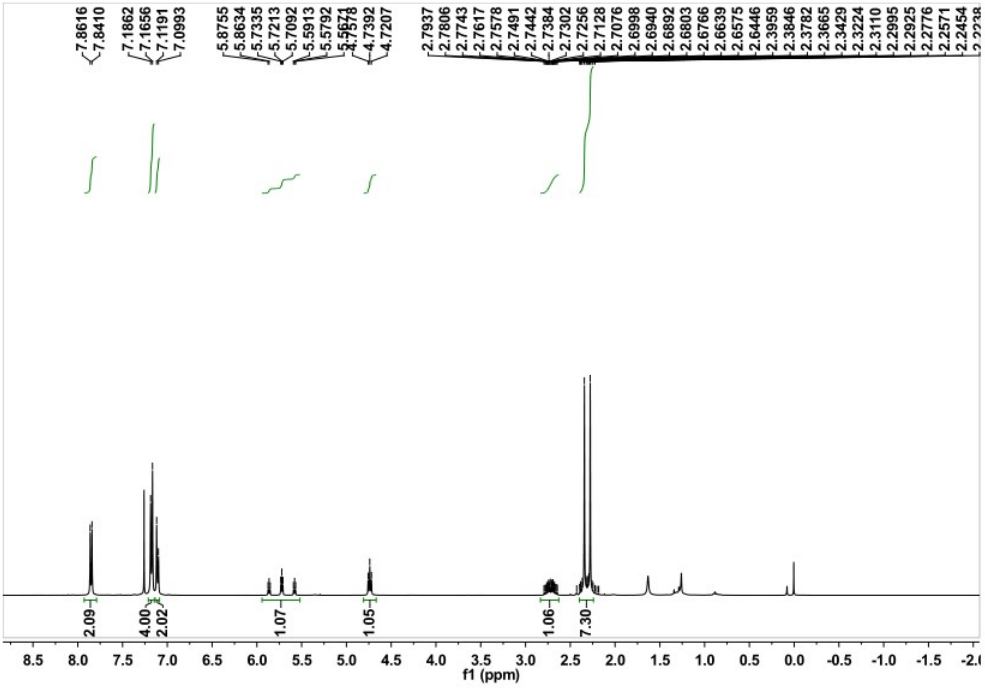
135.9344
133.4076
129.5423
128.9925
128.7587
128.2186
127.8489
118.6757
116.3039
113.9317
47.8959
47.8433
47.7875
38.2787
38.0625
37.8466
f1 (ppm)


115.6359
116.1404
117.4011
117.9056
f1 (ppm)


O
CF2H
Me
Me

2b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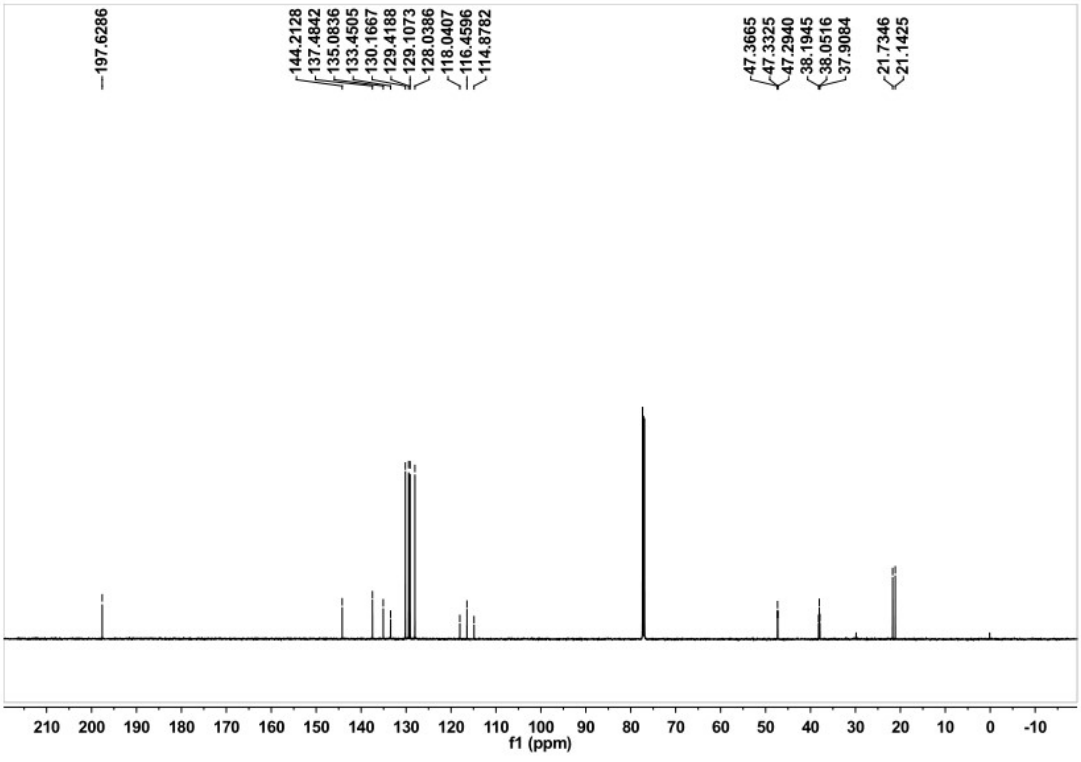
7.8410
7.1862
7.1656
7.1191
7.0993
5.8755
5.8634
5.7335
5.7213
5.7092
5.5913
5.5792
4.7578
4.7392
4.7207
2.7937
2.7806
2.7743
2.7617
2.7578
2.7491
2.7442
2.7384
2.7302
2.7256
2.7128
2.7076
2.6998
2.6940
2.6892
2.6803
2.6766
2.6639
2.6575
2.6446
2.3959
2.3846
2.3782
2.3665
2.3429
2.3224
2.3110
2.2995
2.2925
2.2776
2.2571
2.2454
2.09
4.00
2.02
1.07
1.05
1.06
7.30
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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133.4505
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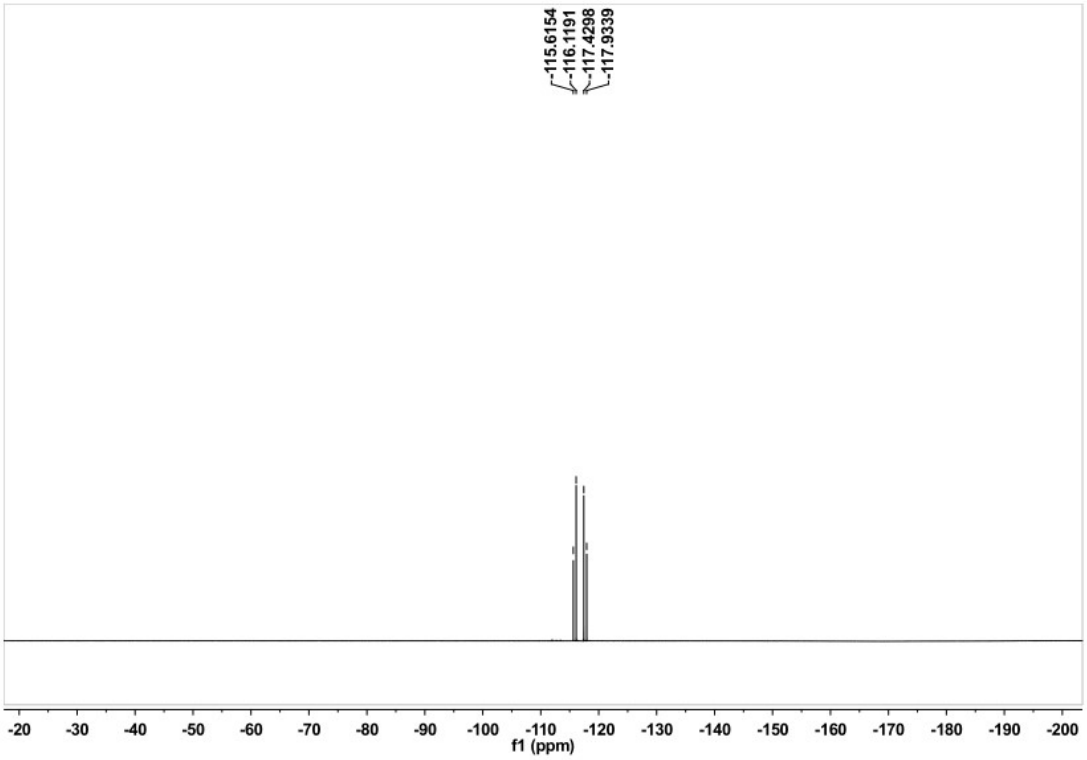
129.4188
129.1073
128.0386
118.0407
116.4596
114.8782
47.3665
47.3325
47.2940
38.1945
38.0516
37.9084
21.7346
21.1425
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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-117.4298
-117.9339
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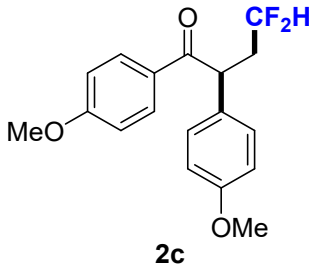
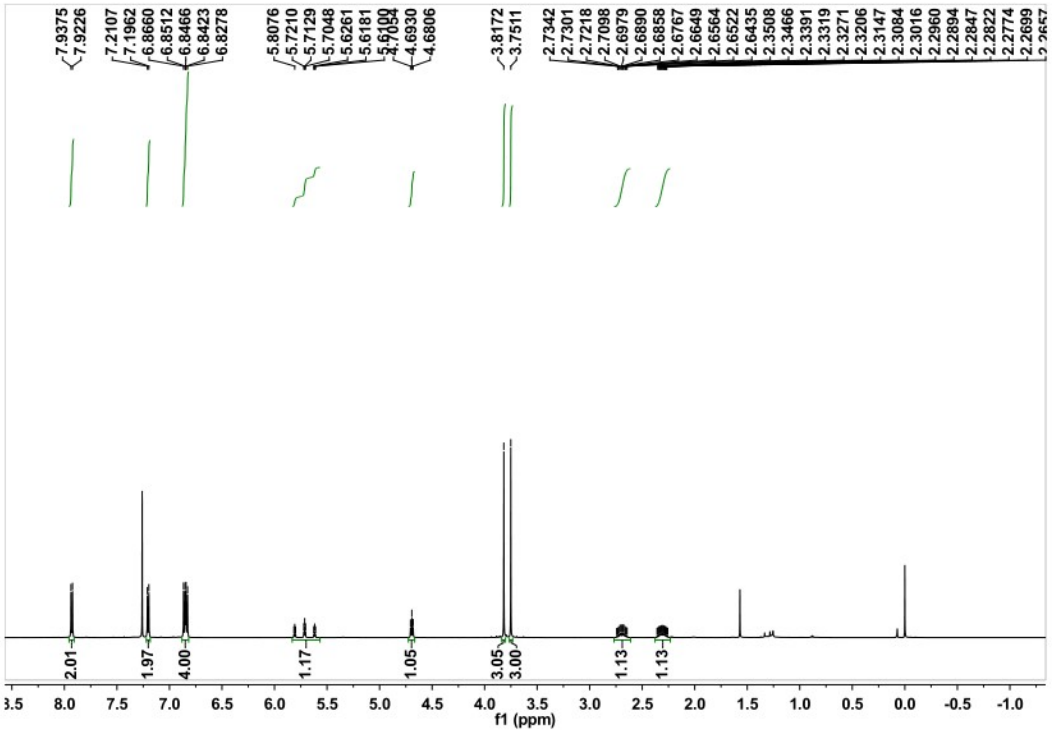
f1 (ppm)


O
CF2H
MeO
OMe

2c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7.9226
7.2107
7.1962
6.8660
6.8512
6.8466
6.8423
6.8278
5.8076
5.7210
5.7129
5.7048
5.6261
5.6181
4.6930
4.6806
3.8172
3.7511
2.7342
2.7301
2.7218
2.7098
2.6979
2.6890
2.6858
2.6767
2.6649
2.6564
2.6522
2.6435
2.3508
2.3466
2.3391
2.3319
2.3271
2.3206
2.3147
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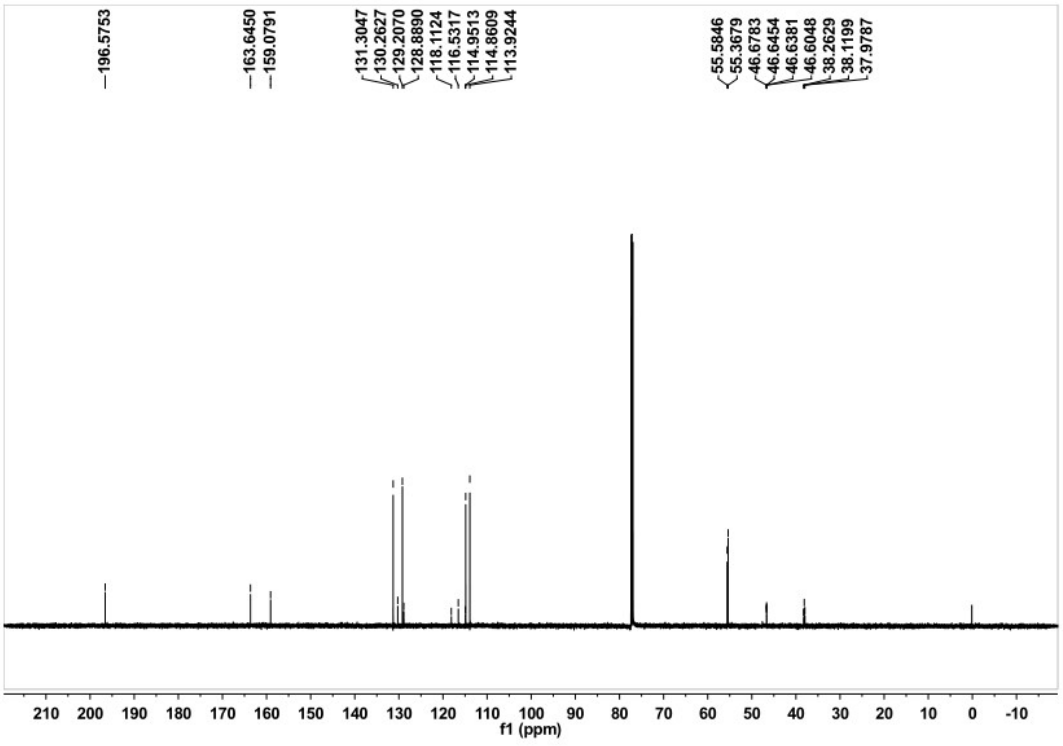
2.3016
2.2960
2.2894
2.2847
2.2822
2.2774
2.2699
2.01
1.97
4.00
1.17
1.05
3.05
3.00
1.13
1.13
f1 (ppm)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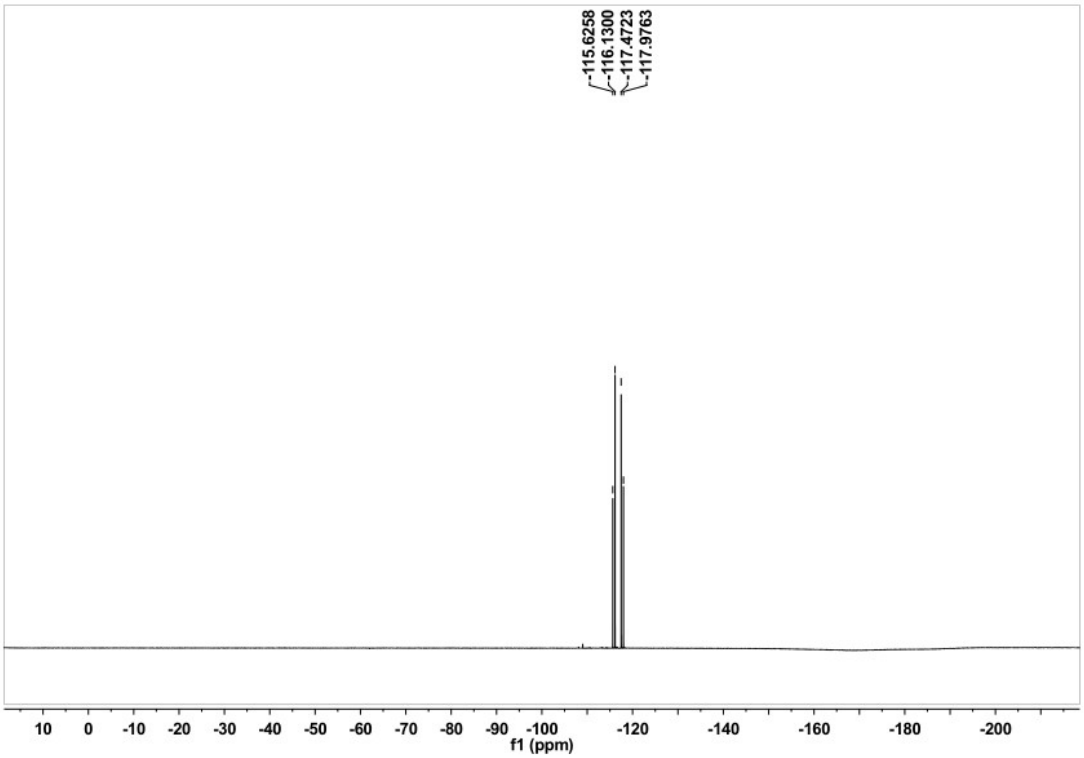
159.0791
131.3047
130.2627
129.2070
128.8890
118.1124
116.5317
114.9513
114.8609
113.9244
55.5846
55.3679
46.6783
46.6454
46.6381
46.6048
38.2629
38.1199
37.9787
f1 (ppm)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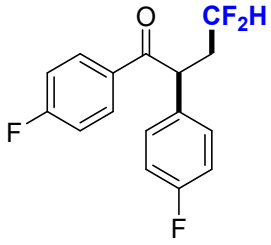
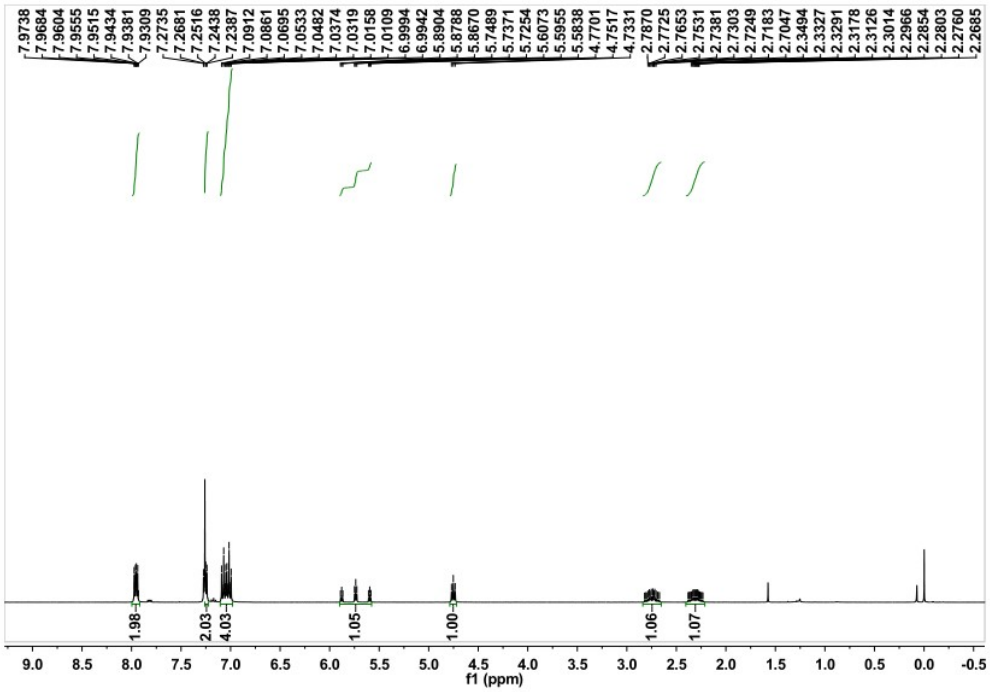
-116.1300
-117.4723
-117.9763
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)


O
CF2H
F
F

2d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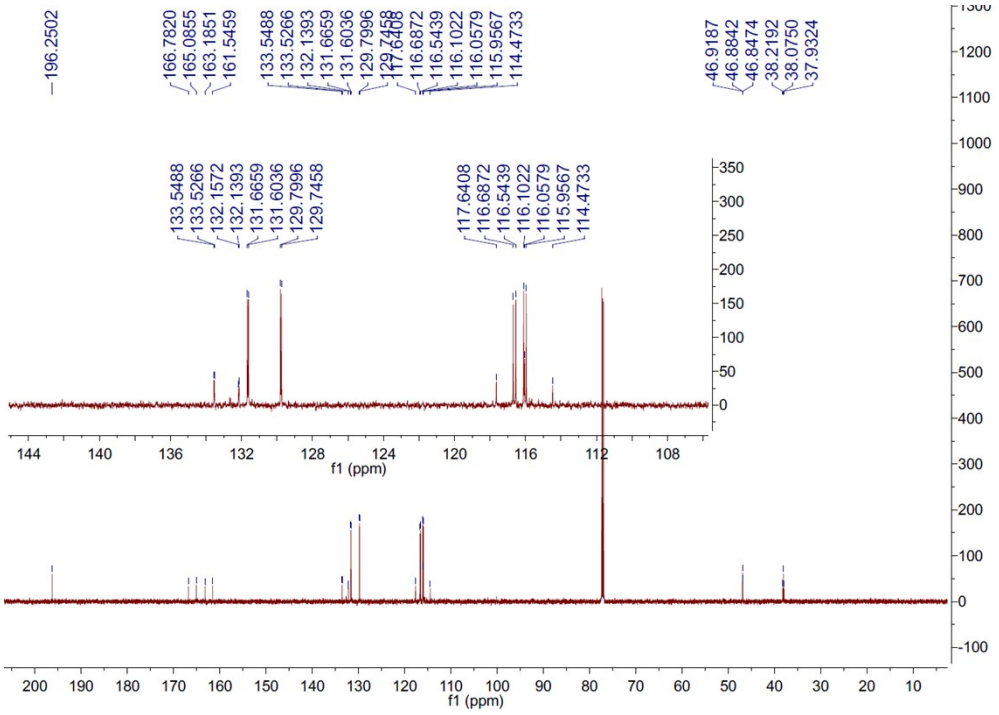
1.98 2.03 4.03 1.05 1.00 1.06 1.07
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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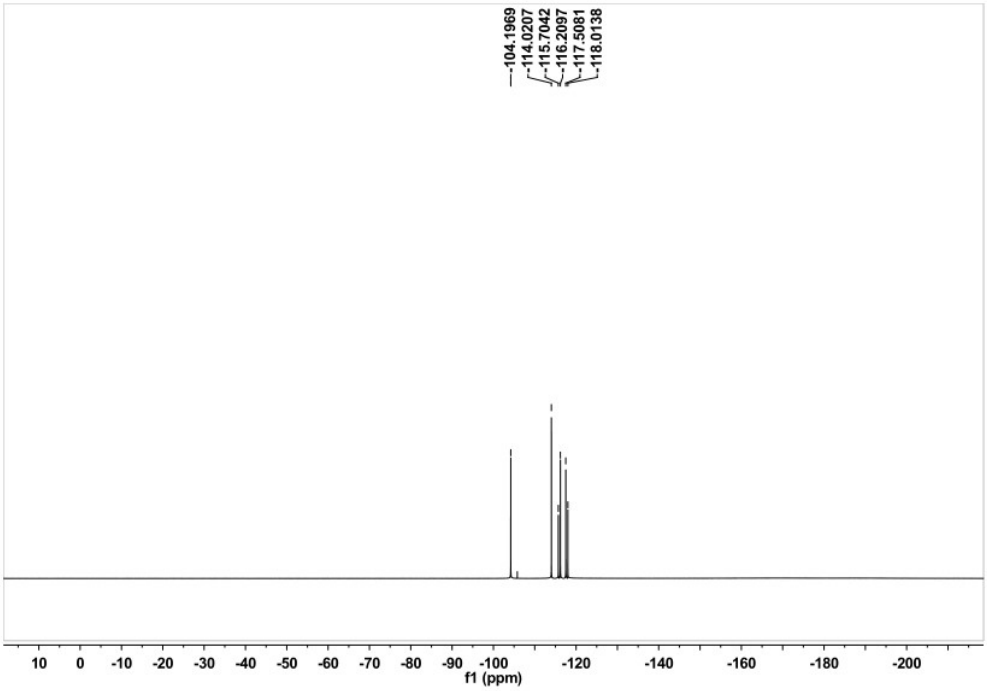
161.5459
133.5488
133.5266
132.1393
131.6659
131.6036
129.7996
129.7458
117.6408
116.6872
116.5439
116.1022
116.0579
115.9567
114.4733
46.9187
46.8842
46.8474
38.2192
38.0750
37.9324
f1 (ppm)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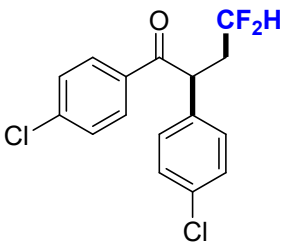
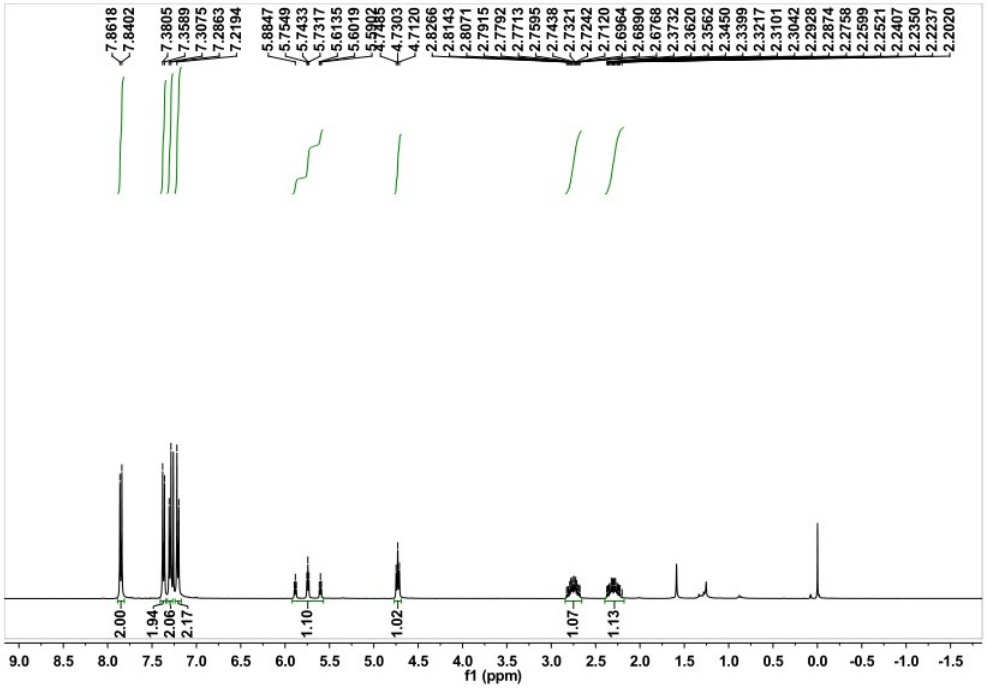
f1 (ppm)


O
CF2H
Cl
Cl

2e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7.2194
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5.7433
5.7317
5.6135
5.6019
4.7303
4.7120
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2.8143
2.8071
2.7915
2.7792
2.7713
2.7595
2.7438
2.7321
2.7242
2.7120
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2.6890
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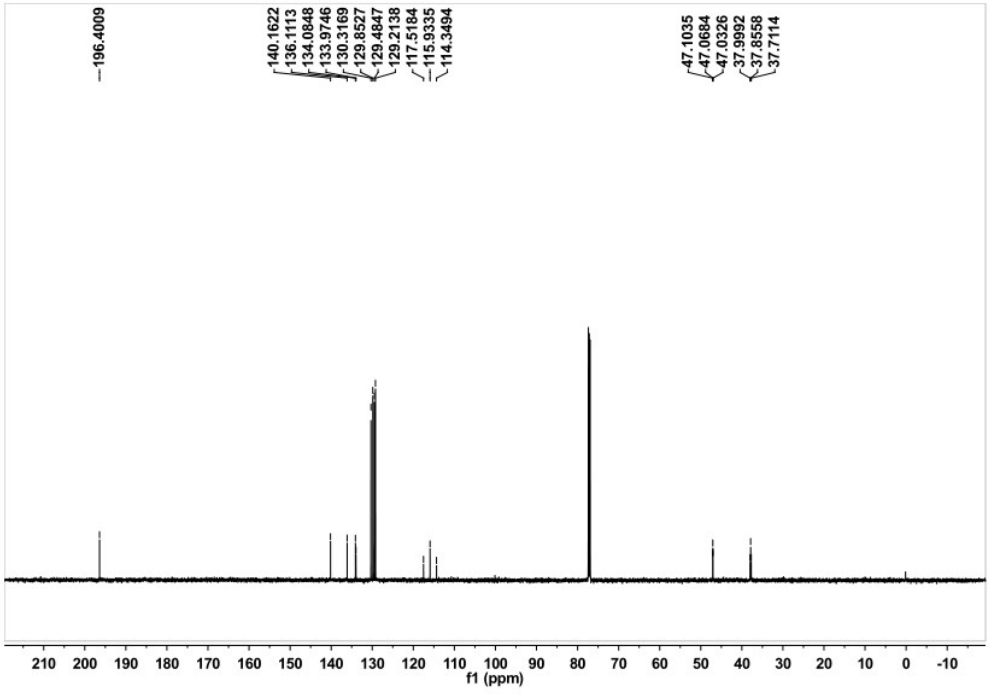
2.3620
2.3562
2.3450
2.3399
2.3217
2.3101
2.3042
2.2928
2.2874
2.2758
2.2599
2.2521
2.2407
2.2350
2.2237
2.2020
2.00
1.94
2.06
2.17
1.10
1.02
1.07
1.13
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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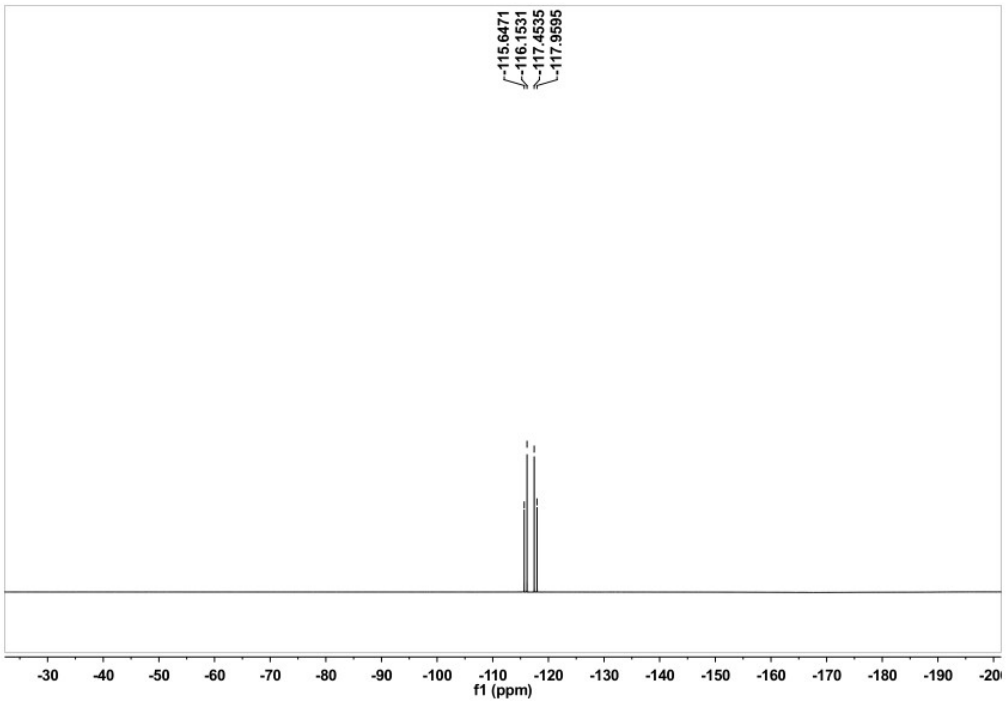
129.8527
129.4847
129.2138
117.5184
115.9335
114.3494
47.1035
47.0684
47.0326
37.9992
37.8558
37.7114
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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-117.9595
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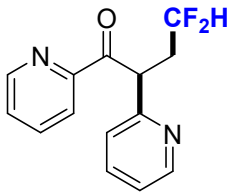
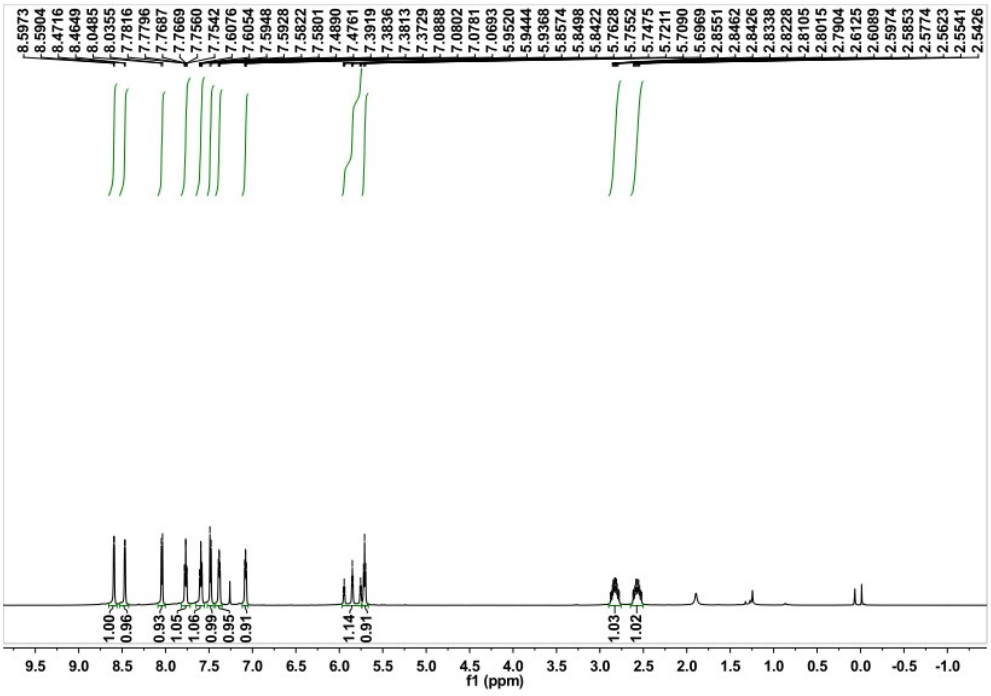
f1 (ppm)


O
CF2H
N
N

2f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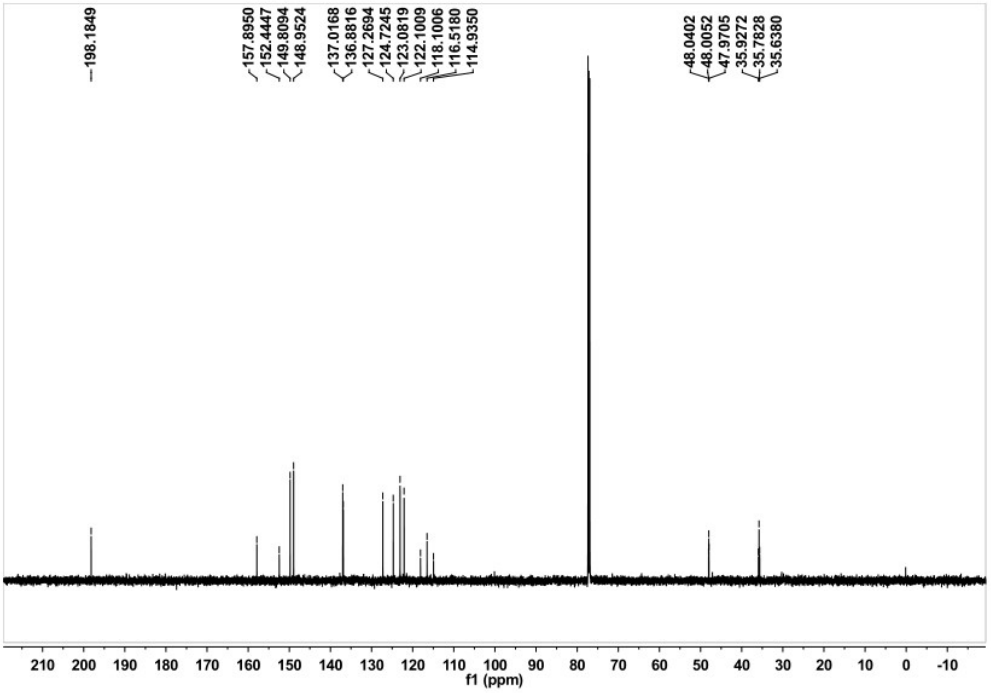
1.00 0.96 0.93 1.05 1.06 0.99 0.95 0.91 1.14 0.91 1.03 1.02
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)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118.1006
116.5180
114.9350
48.0402
48.0052
47.9705
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35.7828
35.6380
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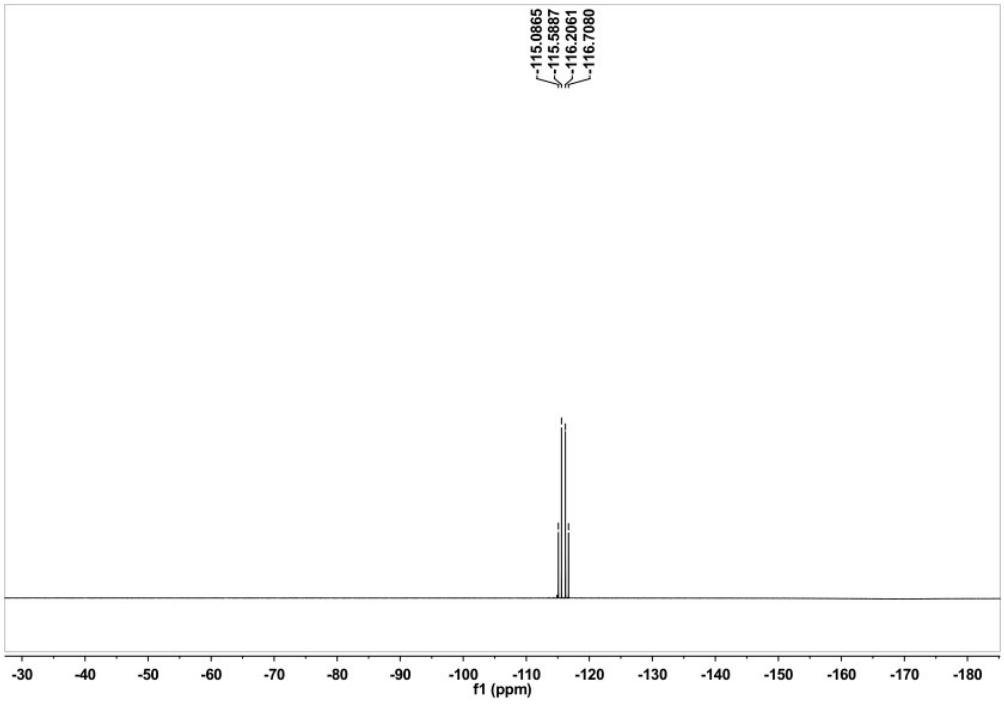
f1 (ppm)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116.7080
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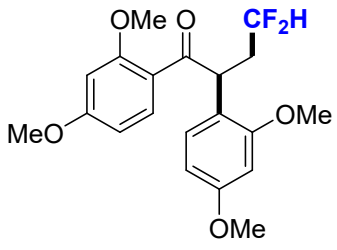
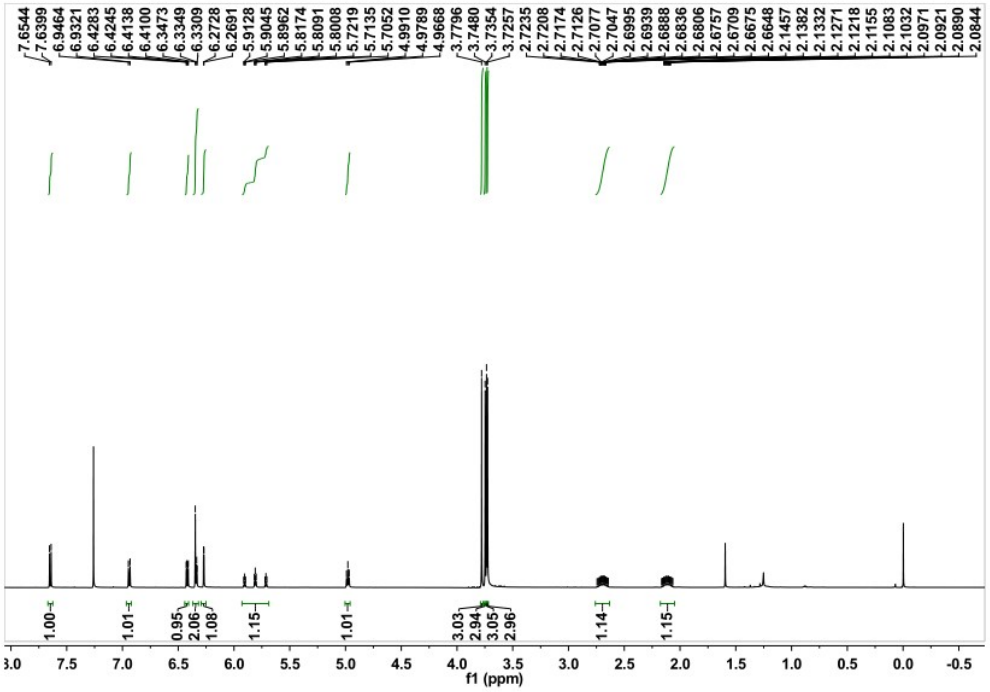
f1 (ppm)


OMe
O
CF2H
MeO
OMe
OMe

2g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6.4283
6.4245
6.4138
6.4100
6.3473
6.3349
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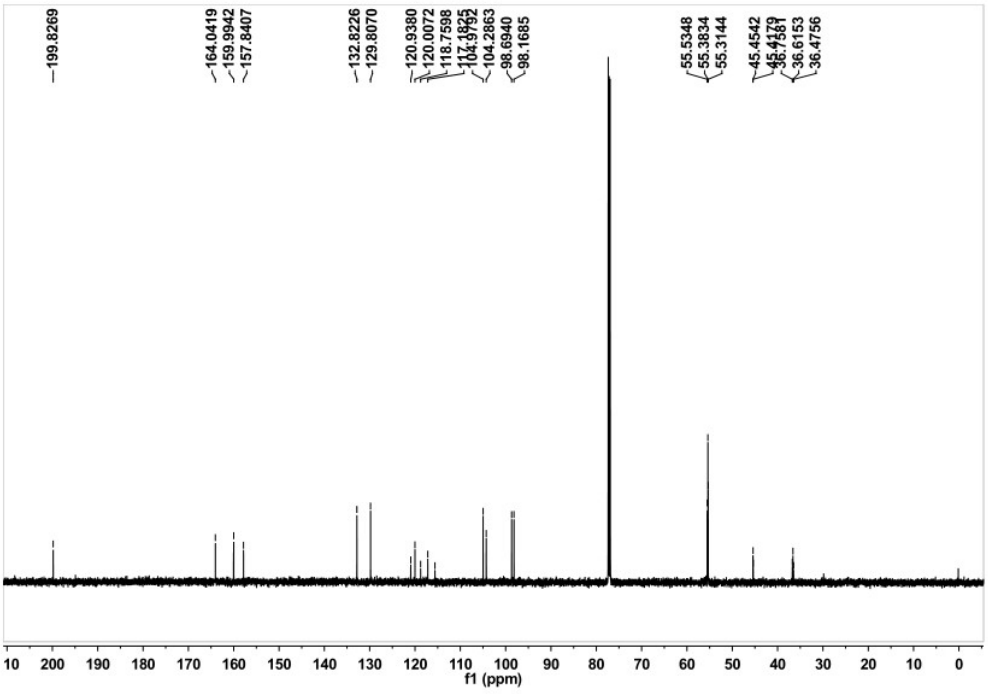
6.2728
6.2691
5.9128
5.9045
5.8962
5.8174
5.8091
5.8008
5.7219
5.7135
5.7052
4.9910
4.9789
4.9668
3.7796
3.7480
3.7354
3.7257
2.7235
2.7208
2.7174
2.7126
2.7077
2.7047
2.6995
2.6939
2.6888
2.6836
2.6806
2.6757
2.6709
2.6675
2.6648
2.1457
2.1382
2.1332
2.1271
2.1218
2.1155
2.1083
2.1032
2.0971
2.0921
2.0890
2.0844
1.00
1.01
0.95
2.06
1.08
1.15
1.01
3.03
2.94
3.05
2.96
1.14
1.15
f1 (ppm)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132.8226
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120.9380
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117.1825
104.9792
104.2863
98.6940
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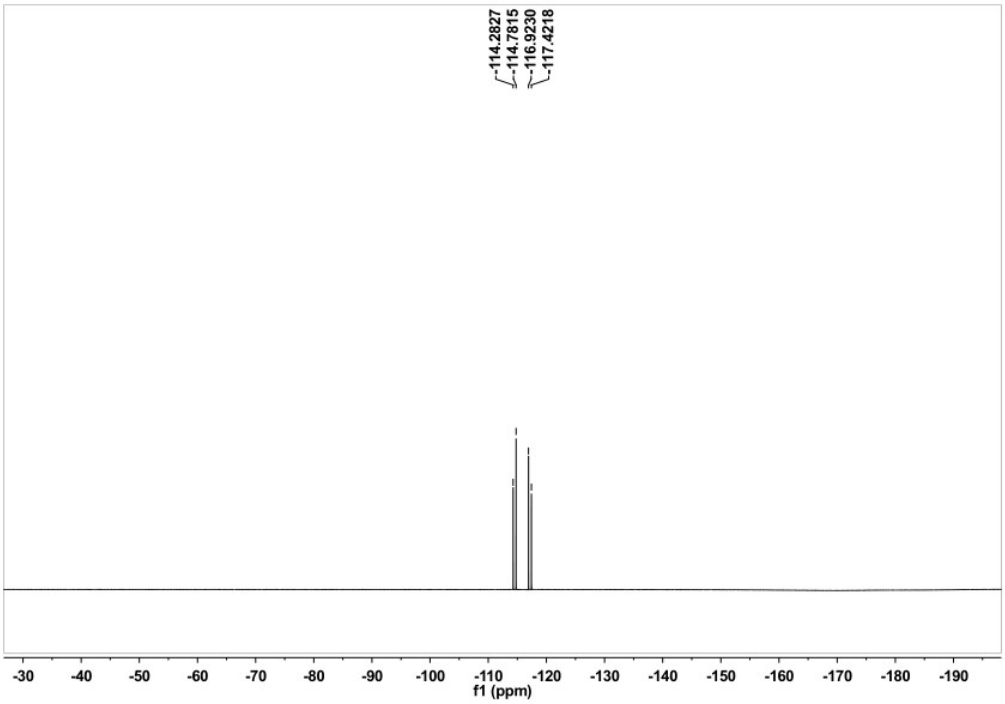
55.3834
55.3144
45.4542
45.4179
36.7581
36.6153
36.4756
f1 (ppm)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-114.7815
-116.9230
-117.4218
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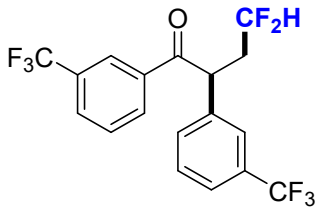
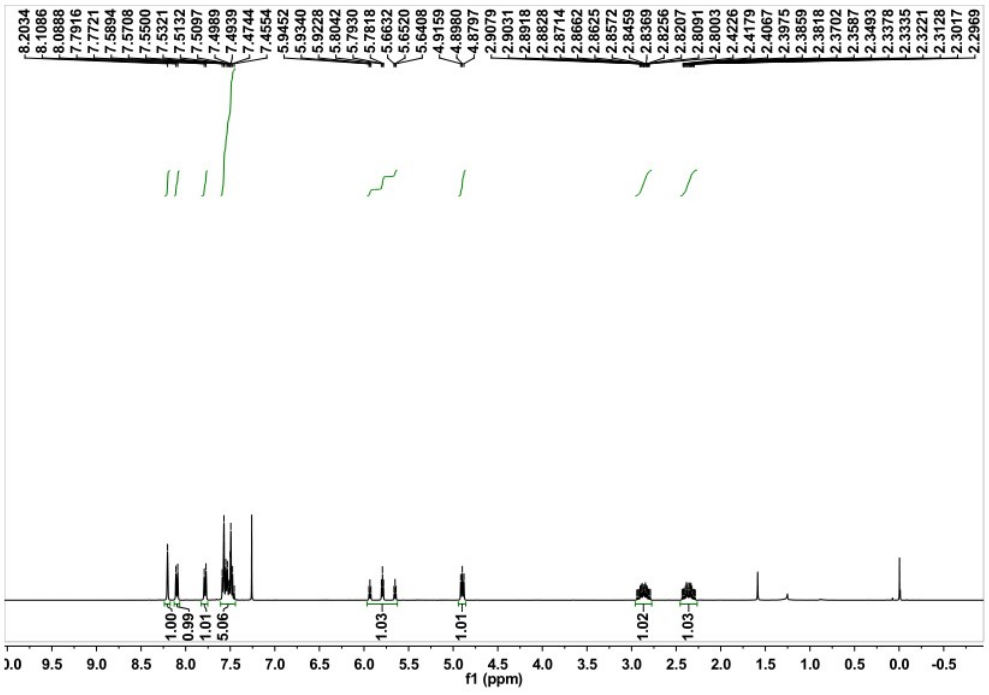
f1 (ppm)


O
CF2H
F3C
CF3

2h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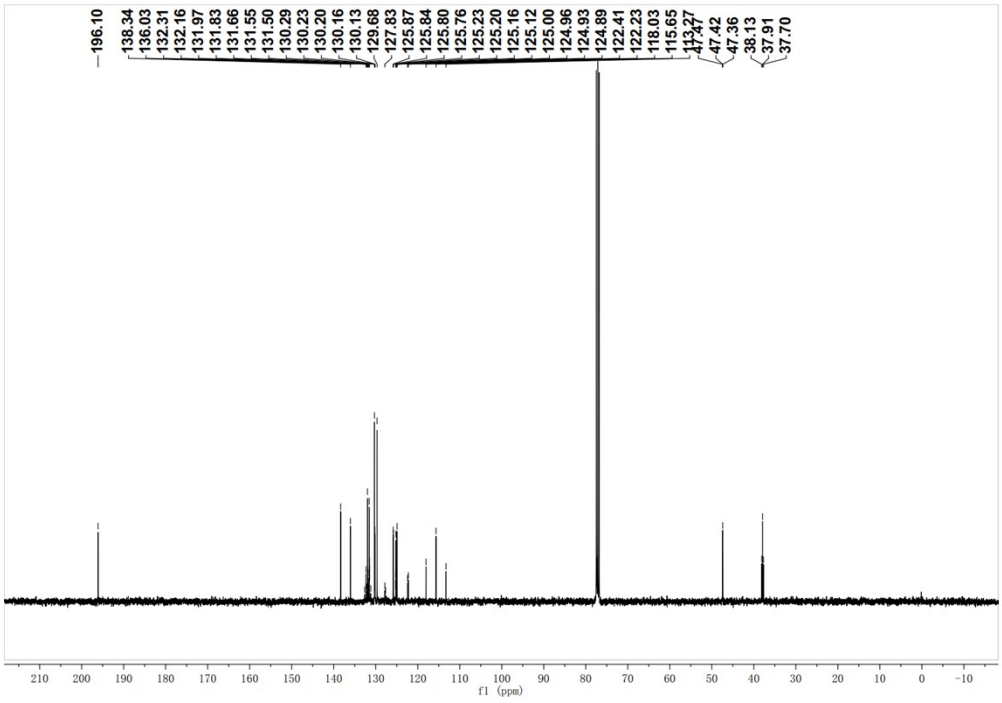
1.00 0.99 1.01 5.06 1.03 1.01 1.02 1.03
f1 (ppm)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132.16
131.97
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131.66
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131.50
130.29
130.23
130.20
130.16
130.13
129.68
127.83
125.87
125.84
125.80
125.76
125.23
125.20
125.16
125.12
125.00
124.96
124.93
124.89
122.41
122.23
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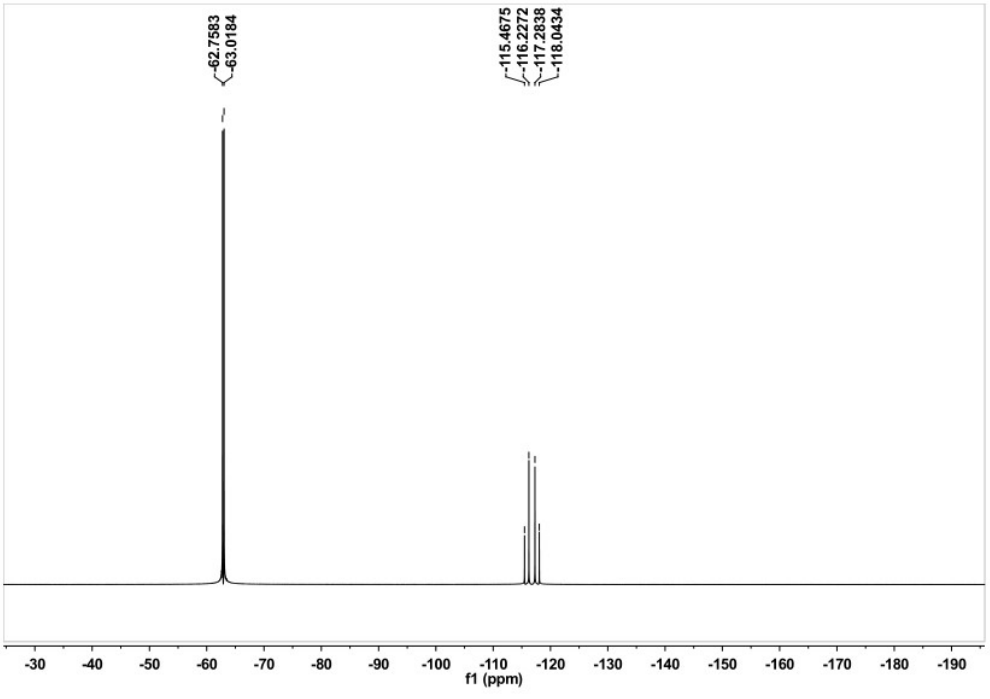
115.65
113.27
47.47
47.42
47.36
38.13
37.91
37.70
f1 (ppm)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115.4675
116.2272
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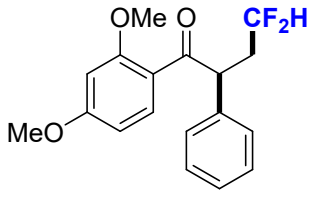
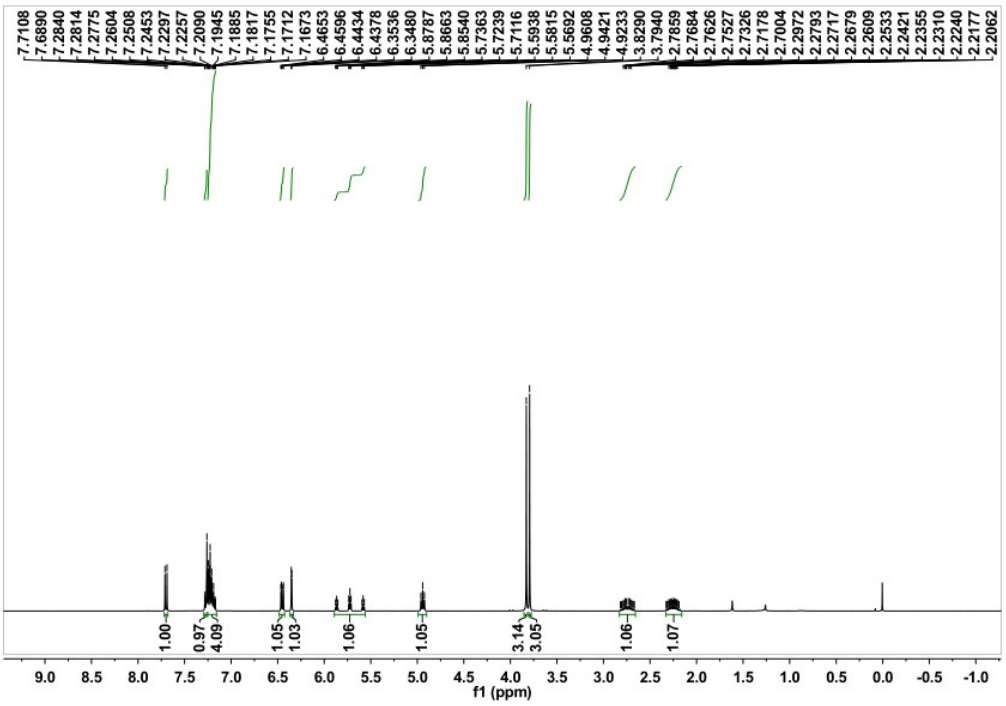
118.0434
f1 (ppm)


OMe
O
CF2H
MeO

2i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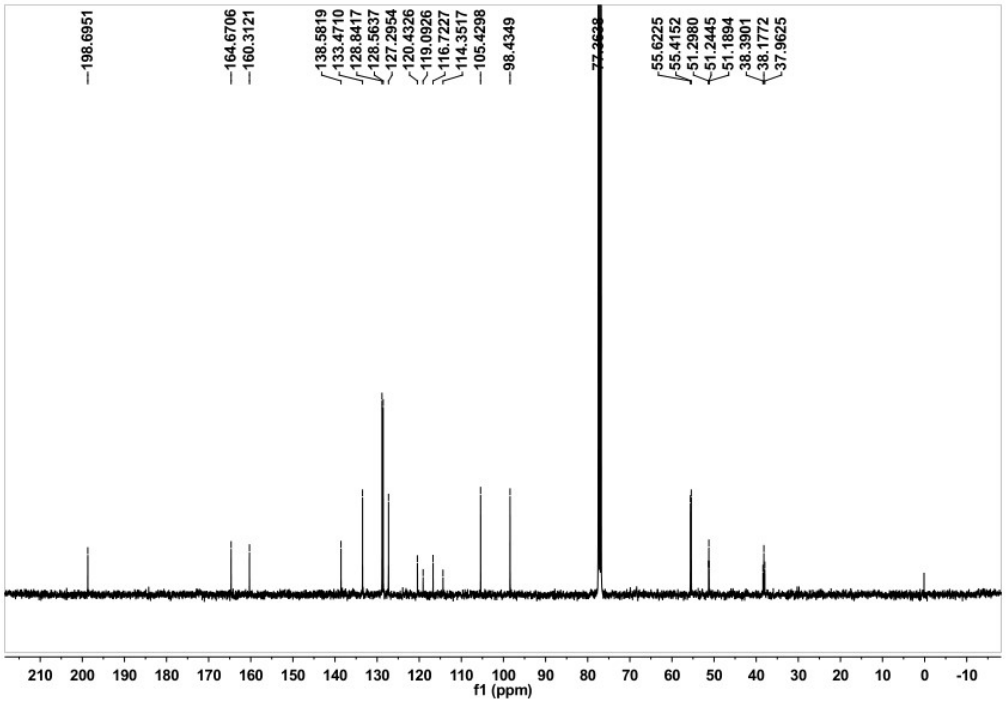
7.2814
7.2775
7.2604
7.2508
7.2453
7.2297
7.2257
7.2090
7.1945
7.1885
7.1817
7.1755
7.1712
7.1673
6.4653
6.4596
6.4434
6.4378
6.3536
6.3480
5.8787
5.8663
5.8540
5.7363
5.7239
5.7116
5.5938
5.5815
5.5692
4.9608
4.9421
4.9233
3.8290
3.7940
2.7859
2.7684
2.7626
2.7527
2.7326
2.7178
2.7004
2.2972
2.2793
2.2717
2.2679
2.2609
2.2533
2.2421
2.2355
2.2310
2.2240
2.2177
2.2062
1.00
0.97
4.09
1.05
1.03
1.06
1.05
3.14
3.05
1.06
1.07
f1 (ppm)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128.5637
127.2954
120.4326
119.0926
116.7227
114.3517
105.4298
98.4349
77.3638
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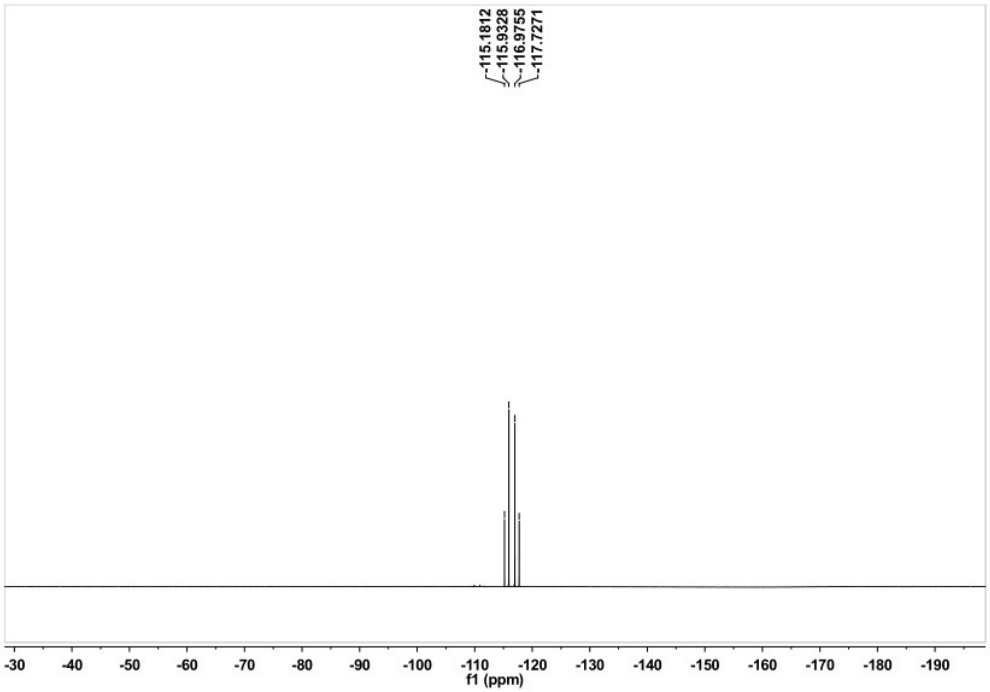
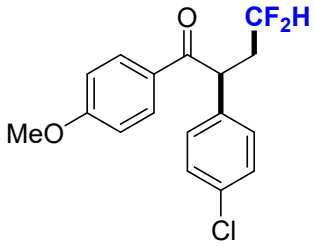
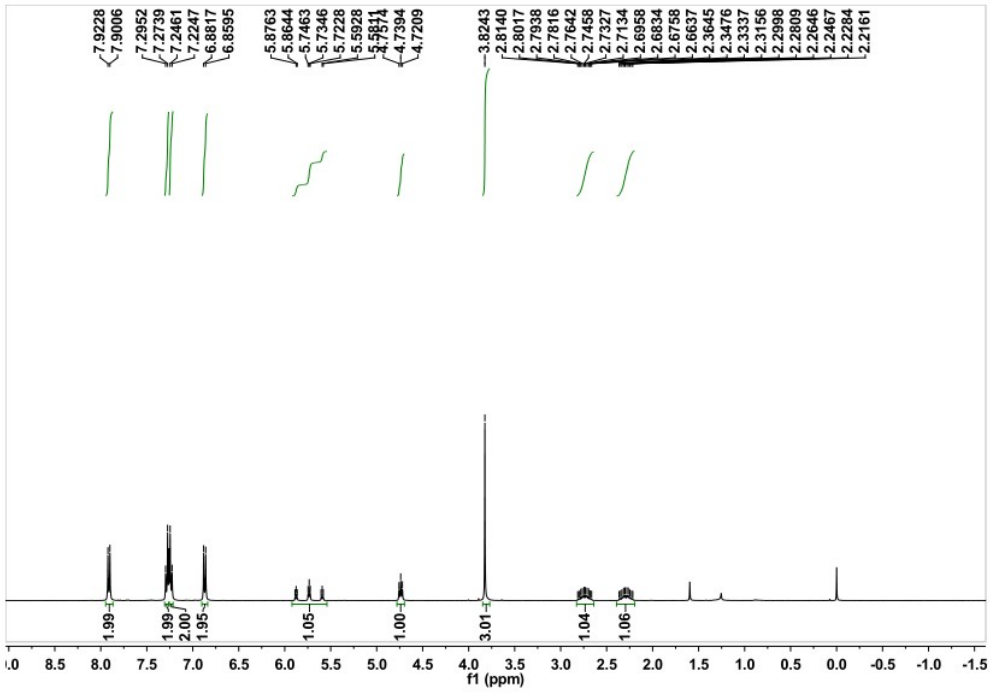
55.4152
51.2980
51.2445
51.1894
38.3901
38.1772
37.9625
f1 (ppm)


-115.1812
-115.9328
-116.9755
-117.7271
-30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190
f1 (ppm)


O
CF2H
MeO
Cl

2j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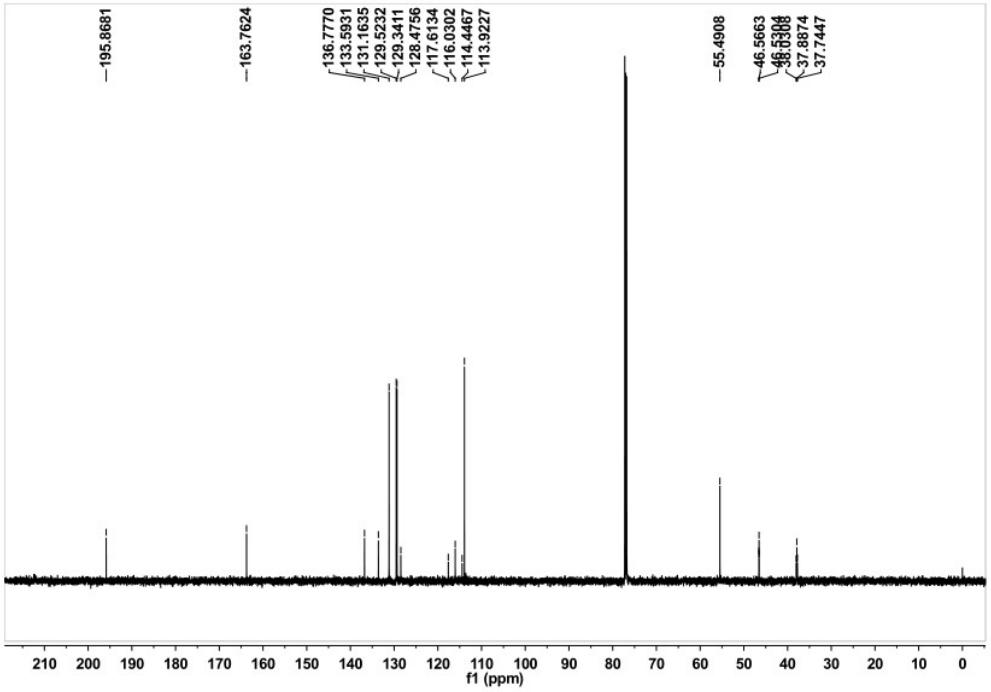
7.2247
6.8817
6.8595
5.8763
5.8644
5.7463
5.7346
5.7228
5.5928
4.7514
4.7394
4.7209
3.8243
2.8140
2.8017
2.7938
2.7816
2.7642
2.7458
2.7327
2.7134
2.6958
2.6834
2.6758
2.6637
2.3645
2.3476
2.3337
2.3156
2.2998
2.2809
2.2646
2.2467
2.2284
2.2161
1.99
1.99
2.00
1.95
1.05
1.00
3.01
1.04
1.06
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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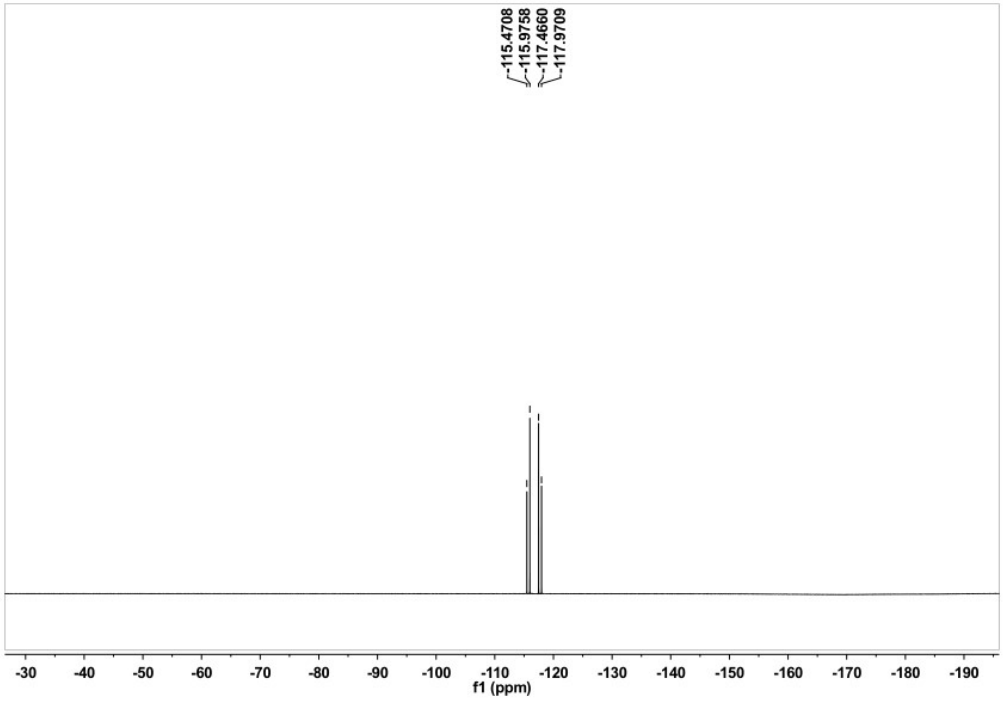
133.5931
131.1635
129.5232
129.3411
128.4756
117.6134
116.0302
114.4467
113.9227
55.4908
46.5663
37.8874
37.7447
f1 (ppm)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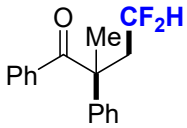
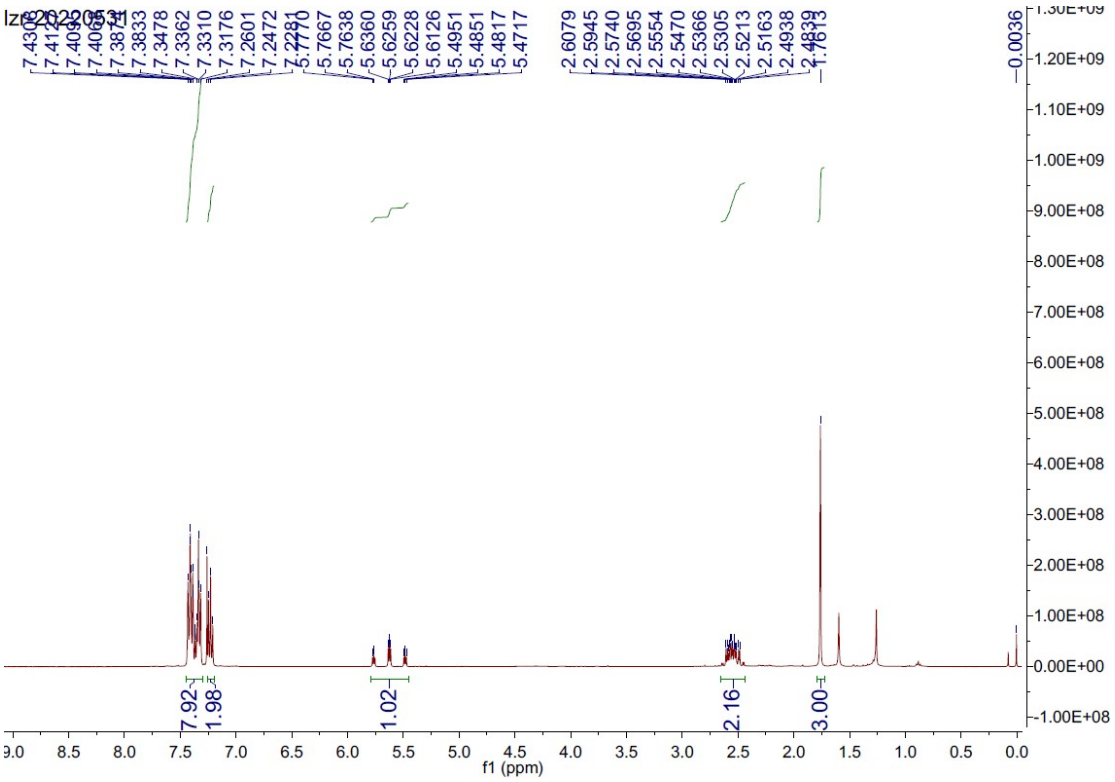
115.9758
117.4660
117.9709
f1 (ppm)


O
Me
CF2H
Ph
Ph

2k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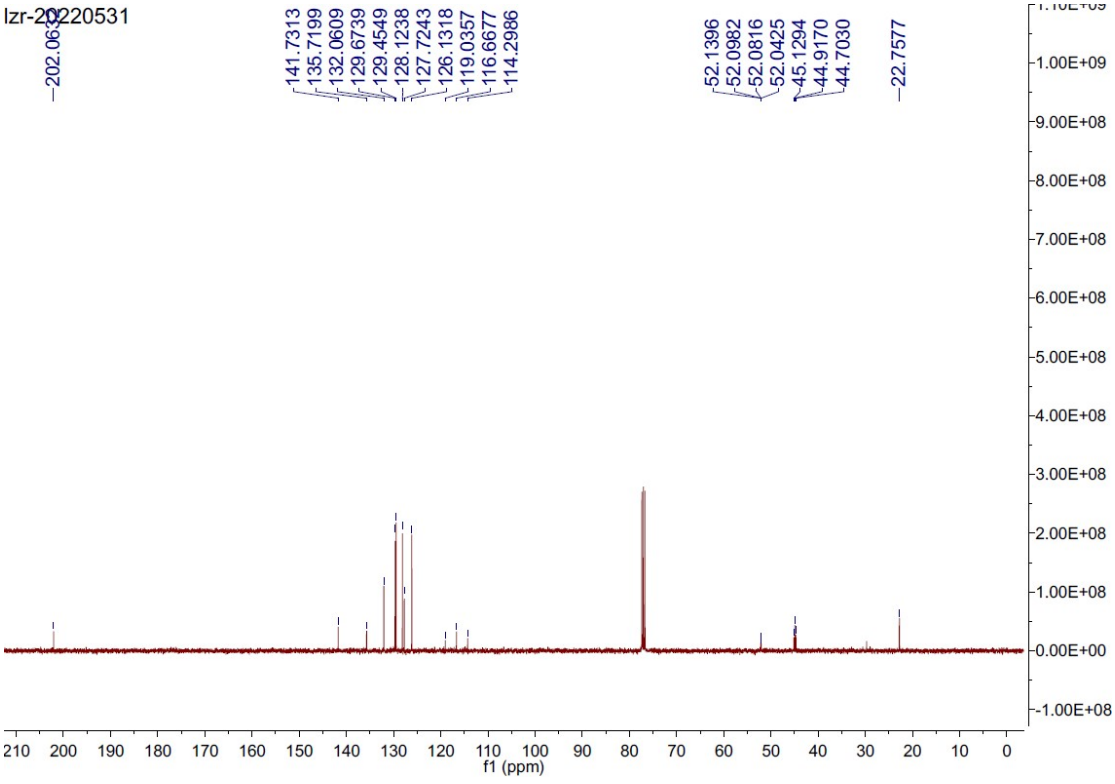
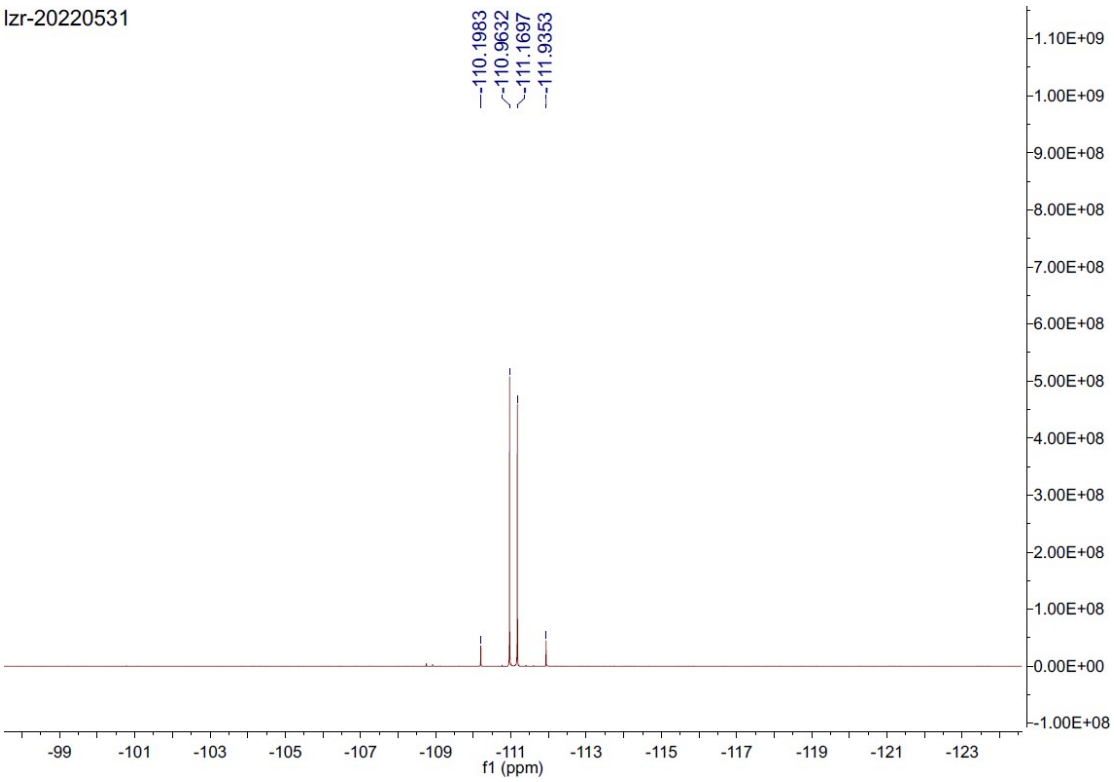
7.92
1.98
1.02
2.16
3.00
f1 (ppm)


lzr-20220531
f1 (ppm)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-111.1697
-111.9353
1.10E+09
1.00E+09
9.00E+08
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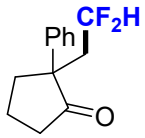
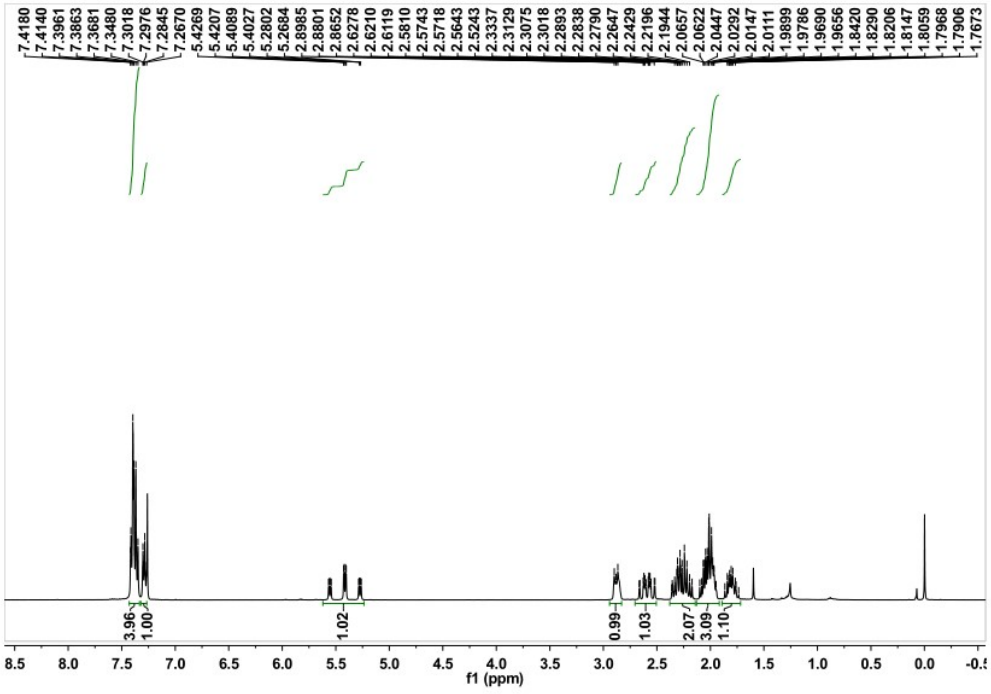
7.00E+08
6.00E+08
5.00E+08
4.00E+08
3.00E+08
2.00E+08
1.00E+08
0.00E+00
-1.00E+08
-99
-101
-103
-105
-107
-109
-111
-113
-115
-117
-119
-121
-123
f1 (ppm)


CF2H
Ph
O

2l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7.2976
7.2845
7.2670
5.4269
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5.4027
5.2802
5.2684
2.8985
2.8801
2.8652
2.6278
2.6210
2.6119
2.5810
2.5743
2.5718
2.5643
2.5243
2.3337
2.3129
2.3075
2.3018
2.2893
2.2838
2.2790
2.2647
2.2429
2.2196
2.1944
2.0657
2.0622
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2.0111
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1.9786
1.9690
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1.8420
1.8290
1.8206
1.8147
1.8059
1.7968
1.7906
1.7673
3.96
1.00
1.02
0.99
1.03
2.07
3.09
1.10
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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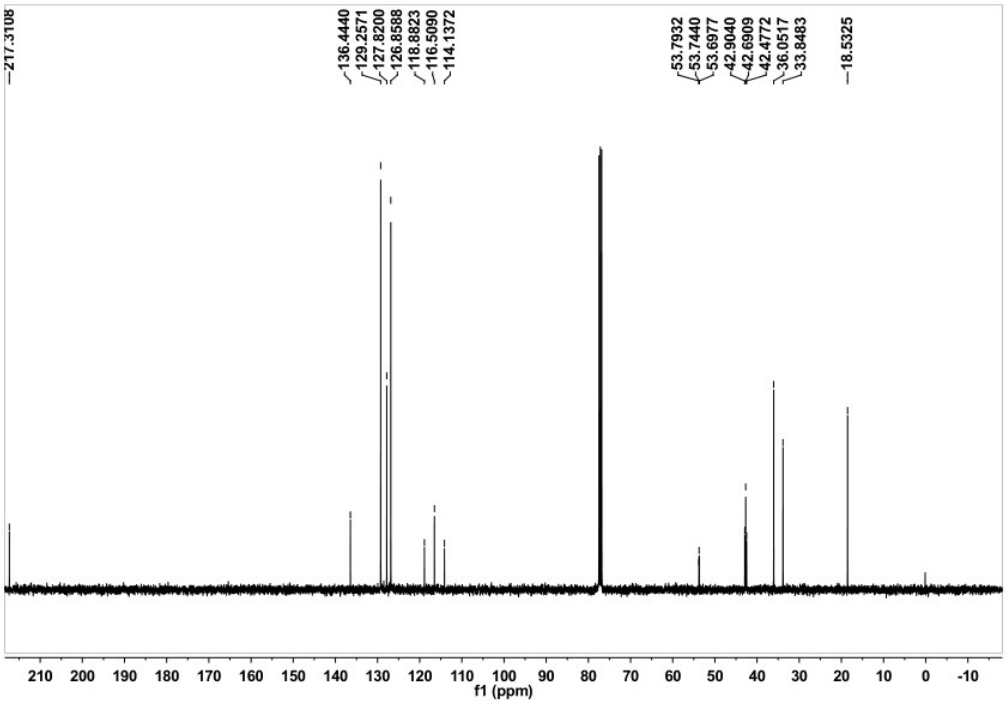
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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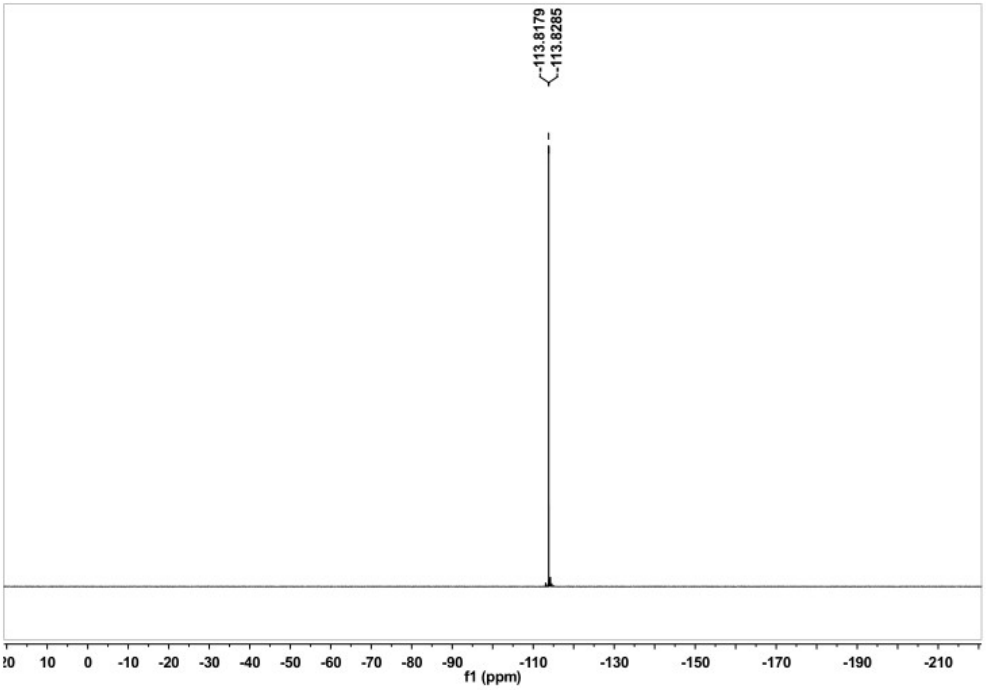
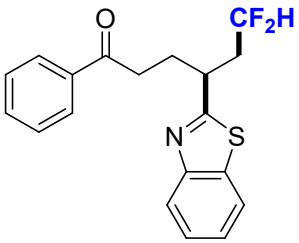
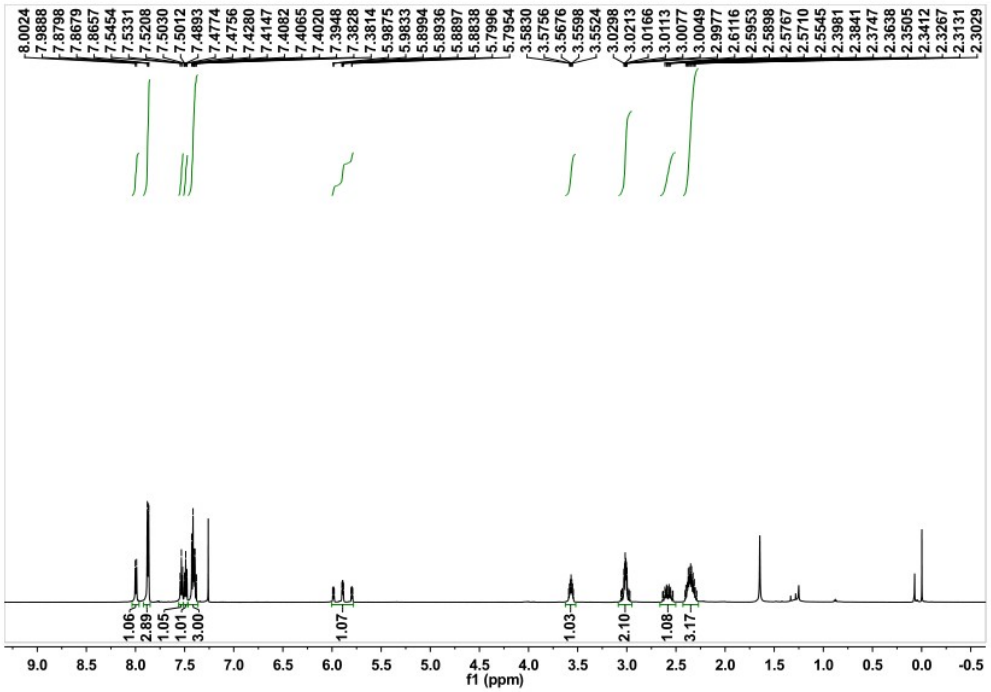
53.6977
42.9040
42.6909
42.4772
36.0517
33.8483
18.5325
f1 (ppm)


113.8179
113.8285
f1 (ppm)


O
CF2H
N
S

4a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7.4756
7.4280
7.4147
7.4082
7.4065
7.4020
7.3948
7.3828
7.3814
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5.9833
5.8994
5.8936
5.8897
5.8838
5.7996
5.7954
3.5830
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3.5676
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3.5524
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3.0213
3.0166
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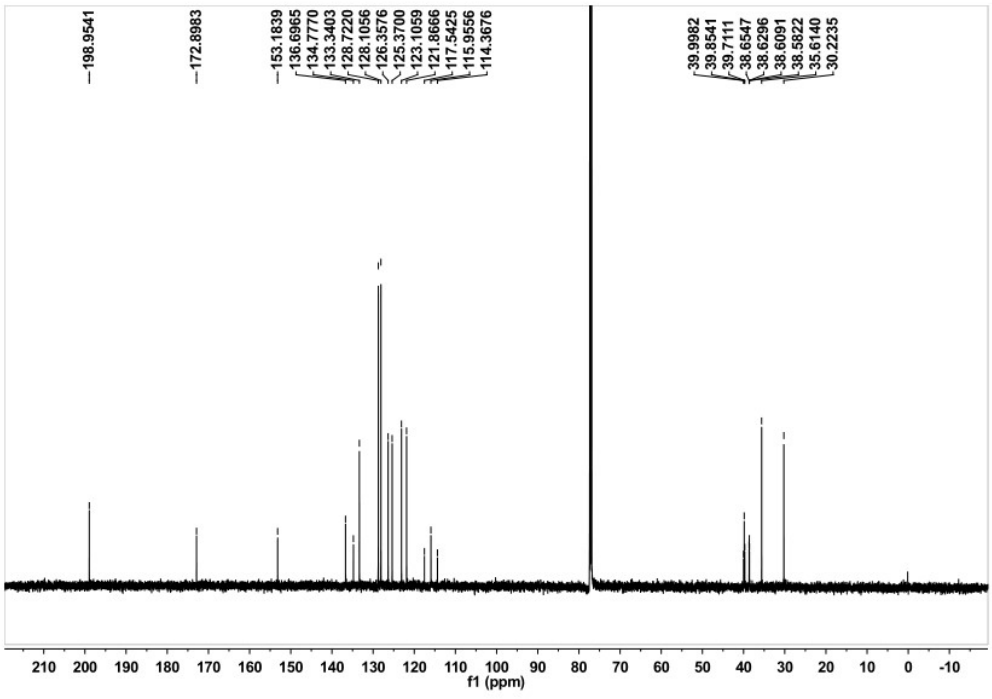
2.3412
2.3267
2.3131
2.3029
1.06
2.89
1.05
1.01
3.00
1.07
1.03
2.10
1.08
3.17
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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136.6965
134.7770
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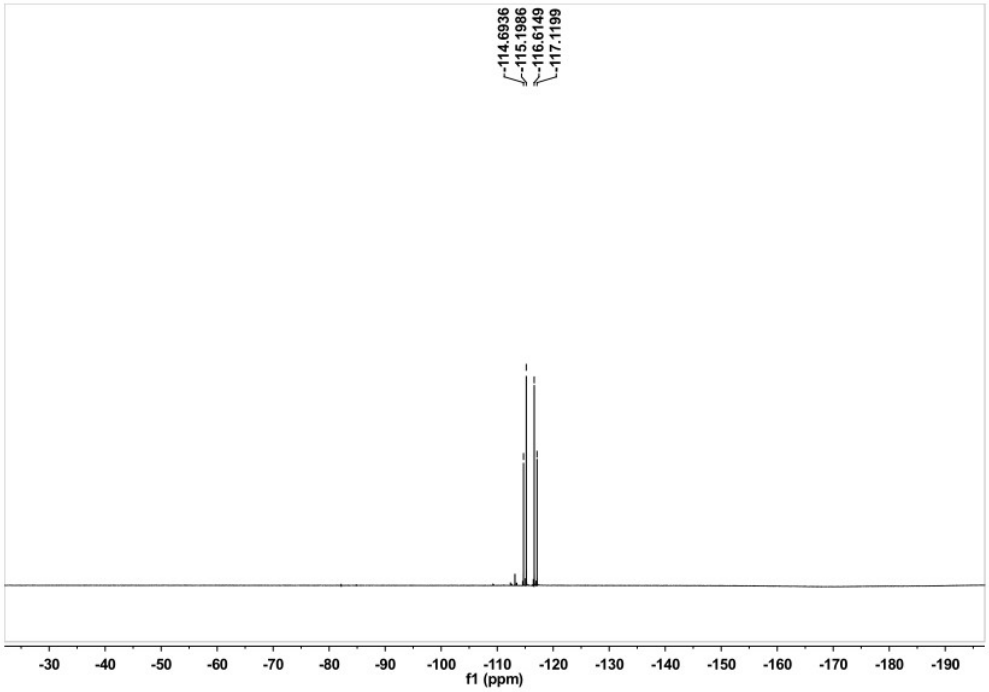
125.3700
123.1059
121.8666
117.5425
115.9556
114.3676
39.9982
39.8541
39.7111
38.6547
38.6296
38.6091
38.5822
35.6140
30.2235
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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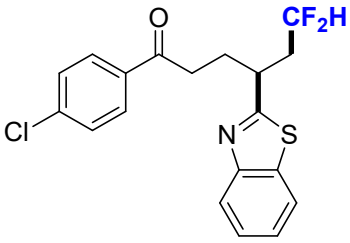
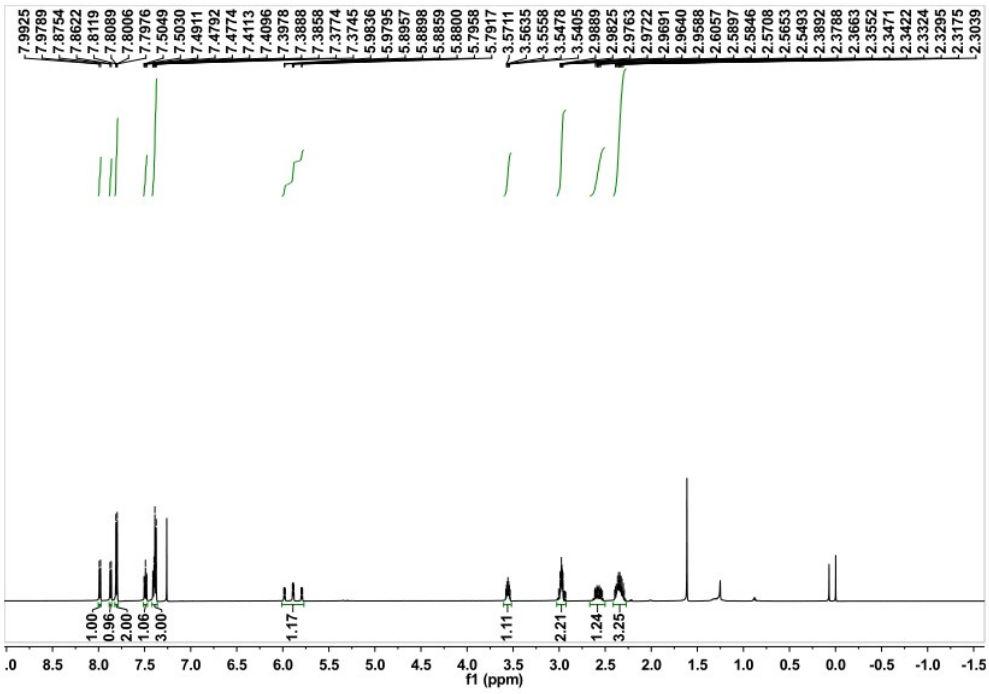
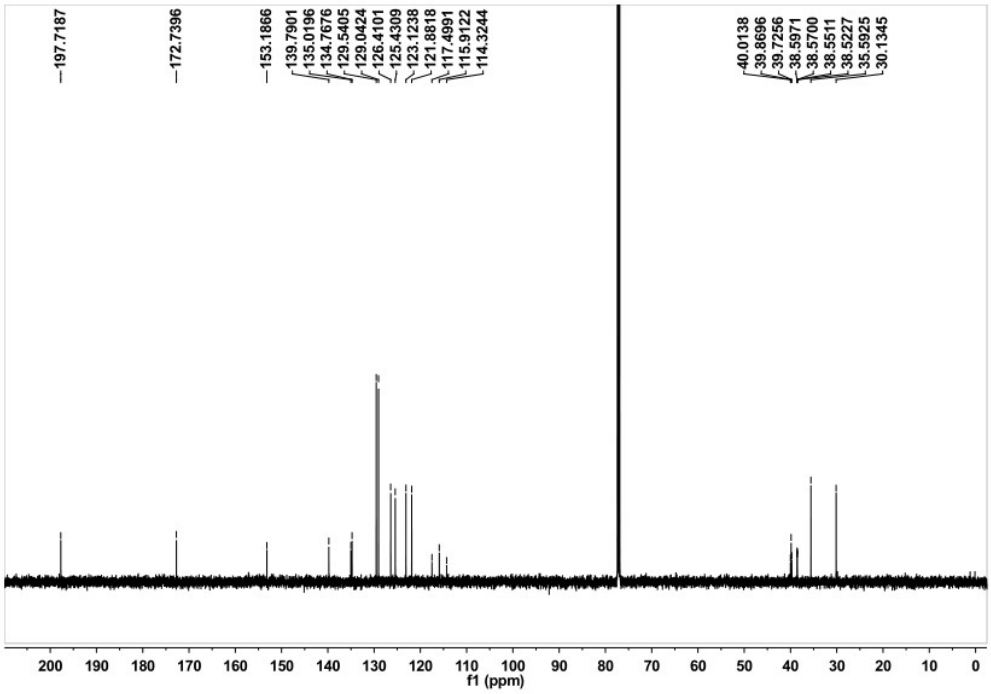
-116.6149
-117.1199
-30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190
f1 (ppm)


O
CF2H
Cl
N
S

4b


7.9925 7.9789 7.8754 7.8622 7.8119 7.8089 7.8006 7.7976 7.5049 7.5030 7.4911 7.4792 7.4774 7.4113 7.4096 7.3978 7.3888 7.3858 7.3774 7.3745 5.9836 5.9795 5.8957 5.8898 5.8859 5.8800 5.7958 5.7917 3.5711 3.5635 3.5558 3.5478 3.5405 2.9889 2.9825 2.9763 2.9722 2.9691 2.9640 2.9588 2.6057 2.5897 2.5846 2.5708 2.5653 2.5493 2.3892 2.3788 2.3663 2.3552 2.3471 2.3422 2.3324 2.3295 2.3175 2.3039
1.00 0.96 2.00 1.06 3.00 1.17 1.11 2.21 1.24 3.25
.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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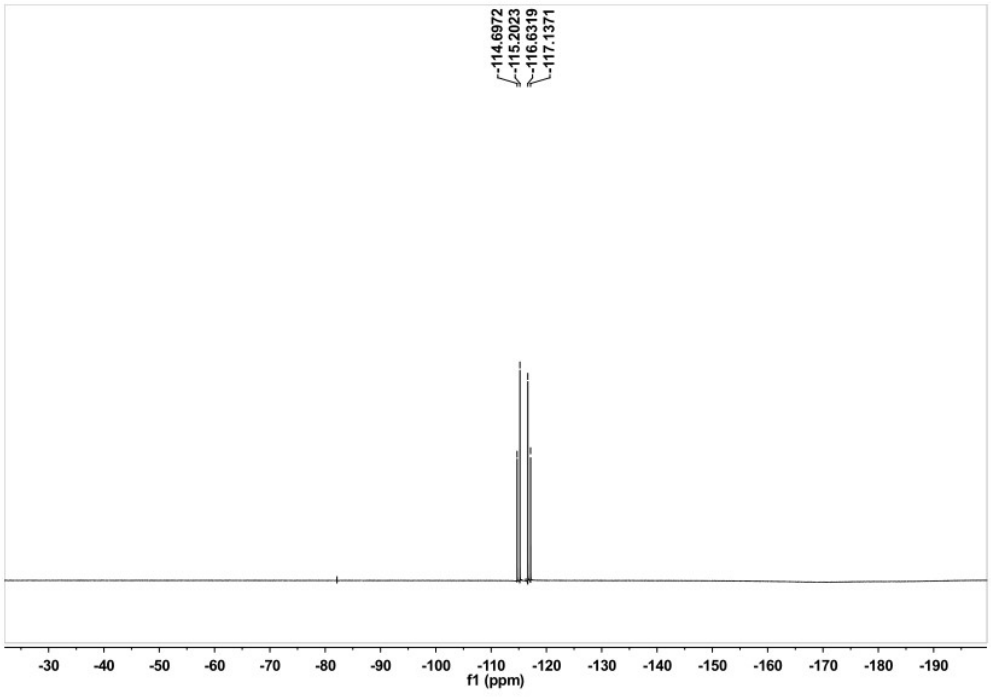
117.4991
115.9122
114.3244
40.0138
39.8696
39.7256
38.5971
38.5700
38.5511
38.5227
35.5925
30.1345
f1 (ppm)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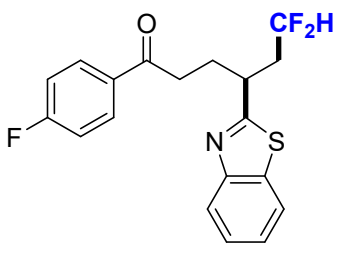
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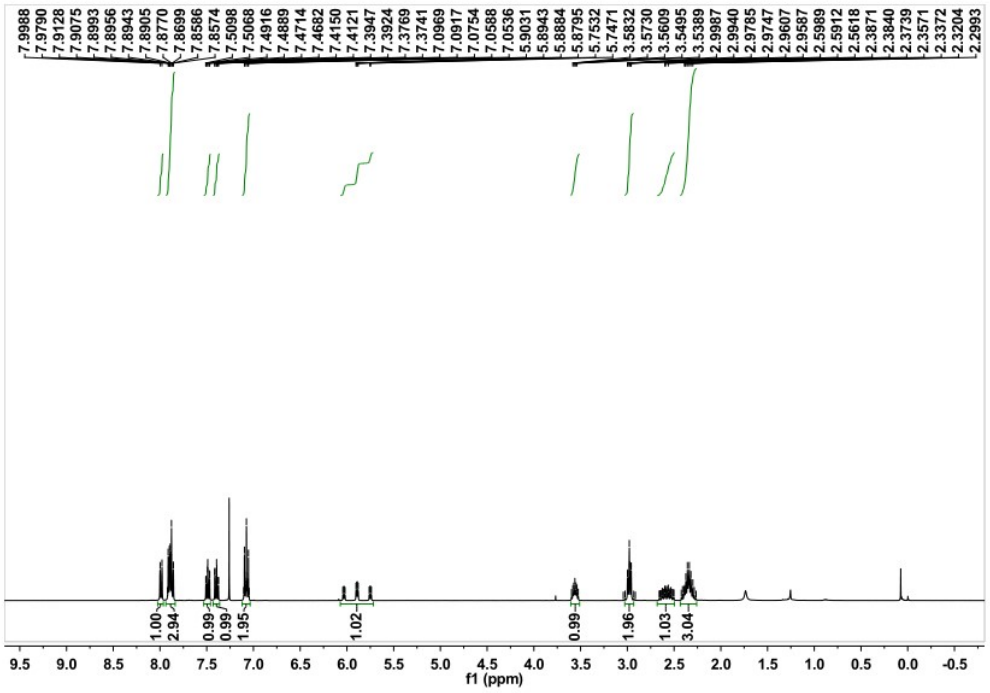
CF2H
F
N
S

4c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2.9940
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2.3739
2.3571
2.3372
2.3204
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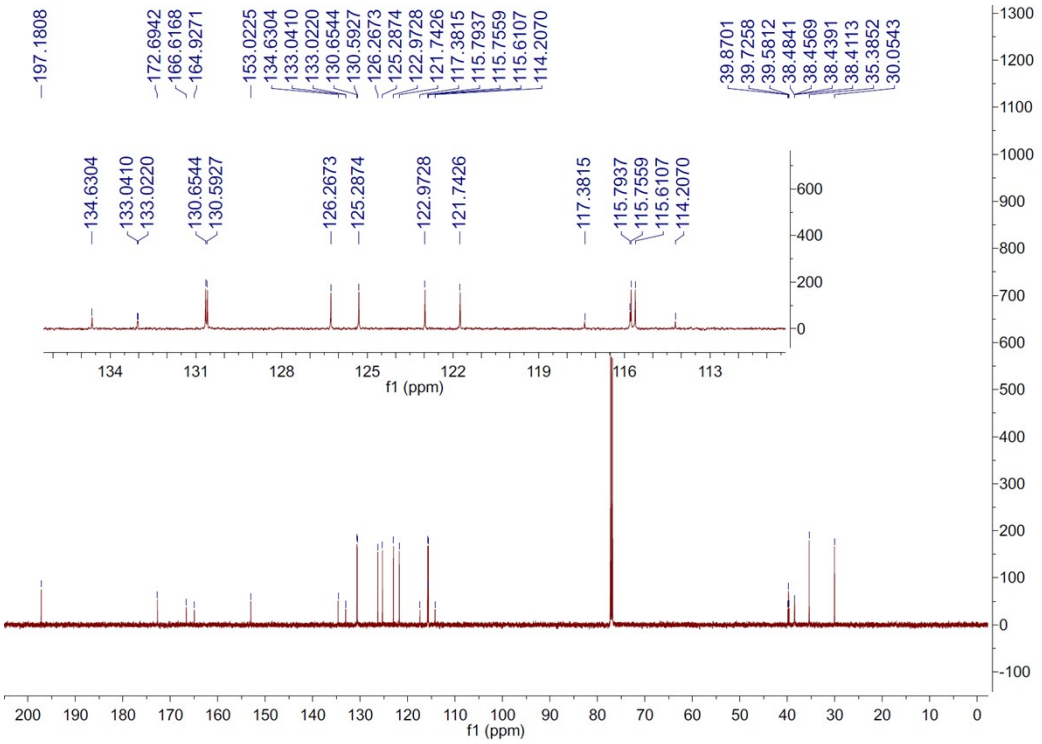
1.02
0.99
1.96
1.03
3.04
f1 (ppm)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125.2874
122.9728
121.7426
117.3815
115.7937
115.7559
115.6107
114.2070
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39.5812
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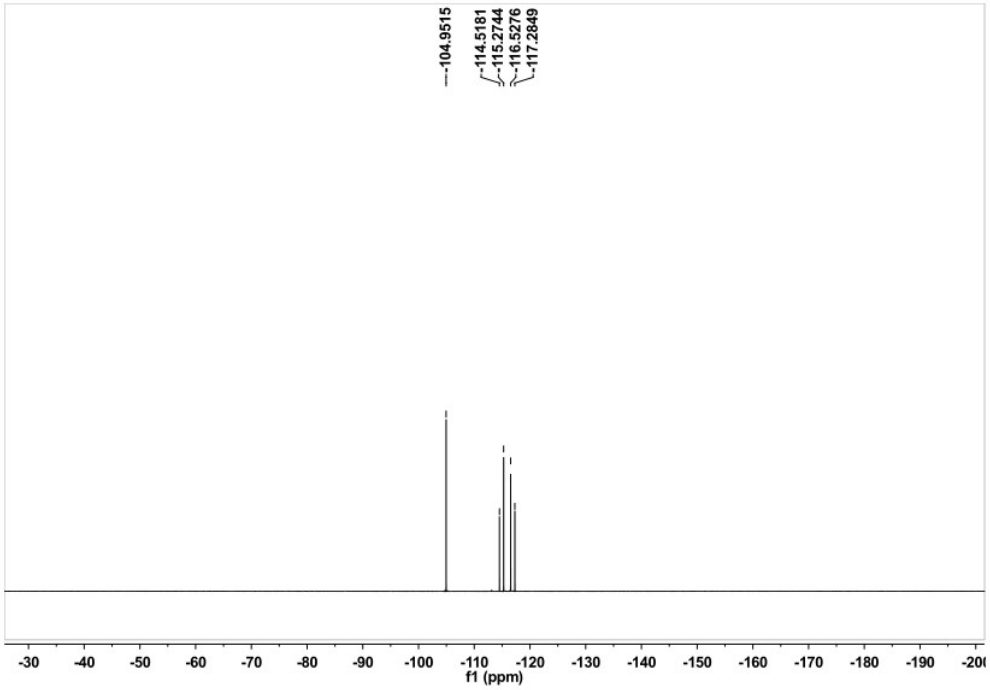
38.4391
38.4113
35.3852
30.0543
f1 (ppm)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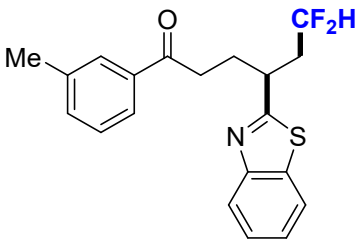
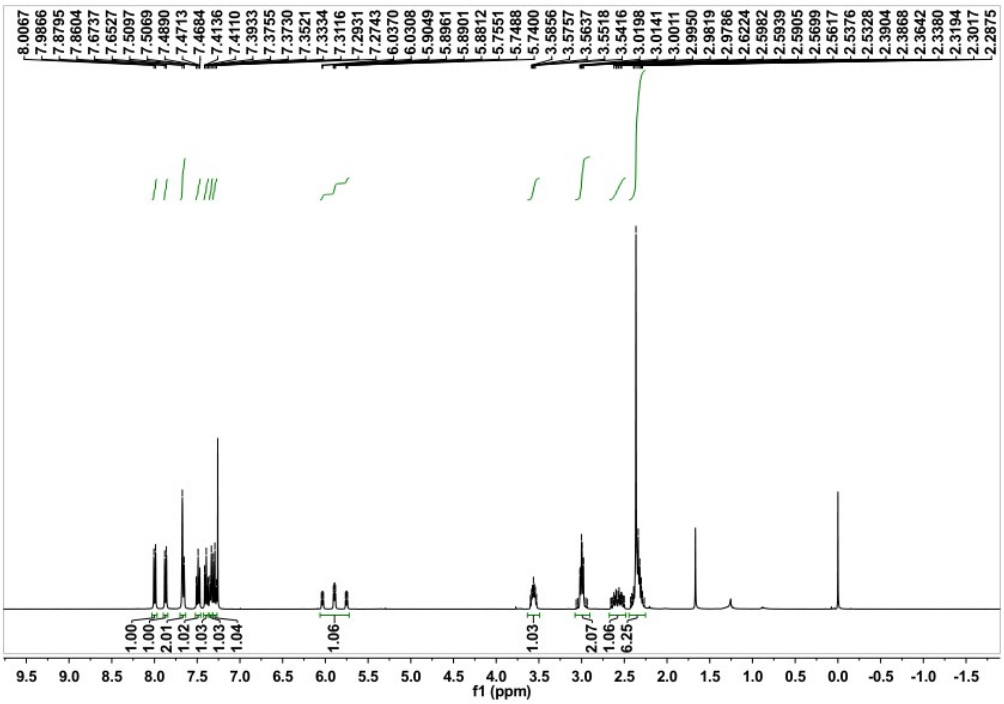
-115.2744
-116.5276
-117.2849
f1 (ppm)


O
CF2H
Me
N
S

4d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1.00
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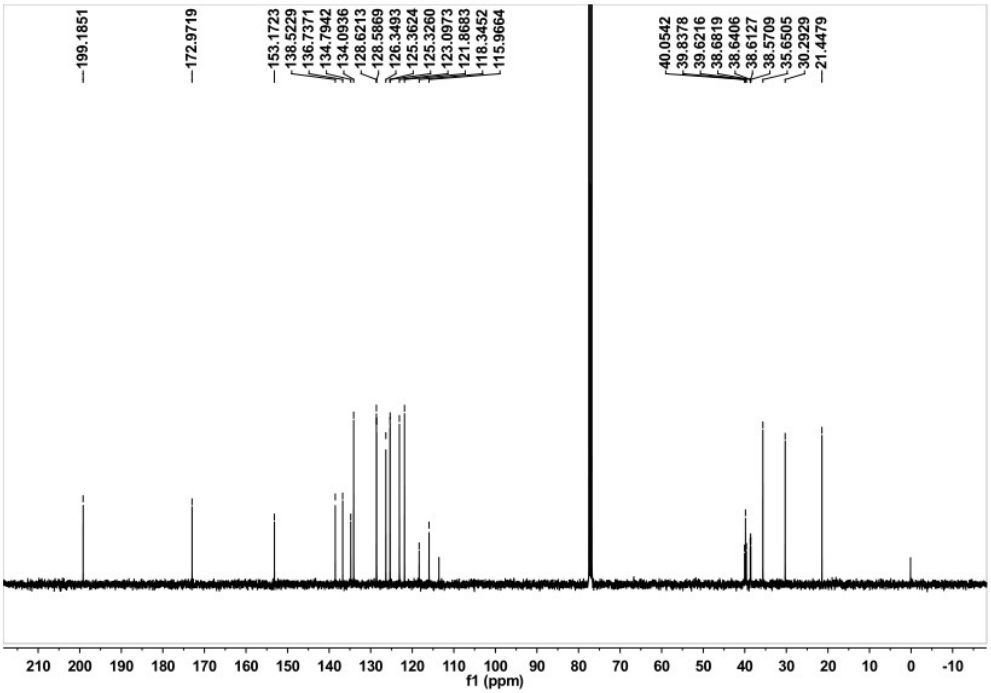
1.02
1.03
1.03
1.04
1.06
1.03
2.07
1.06
6.25
f1 (ppm)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125.3260
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118.3452
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40.0542
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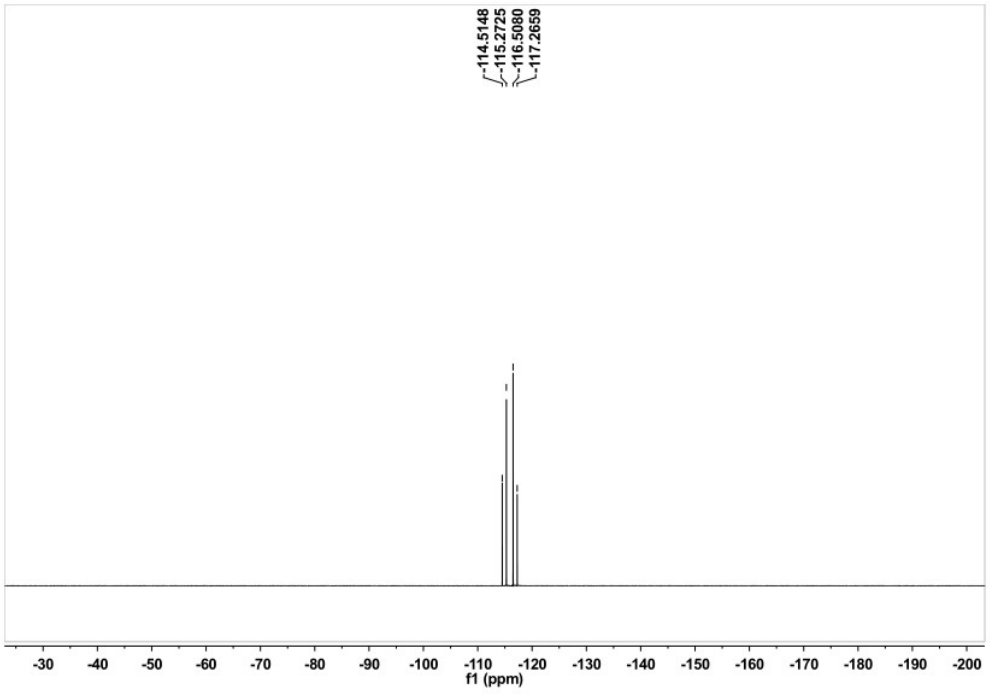
30.2929
21.4479
f1 (ppm)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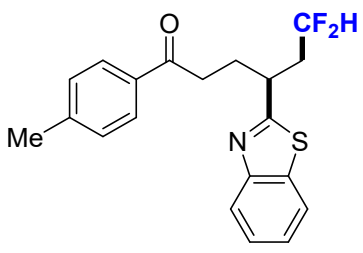
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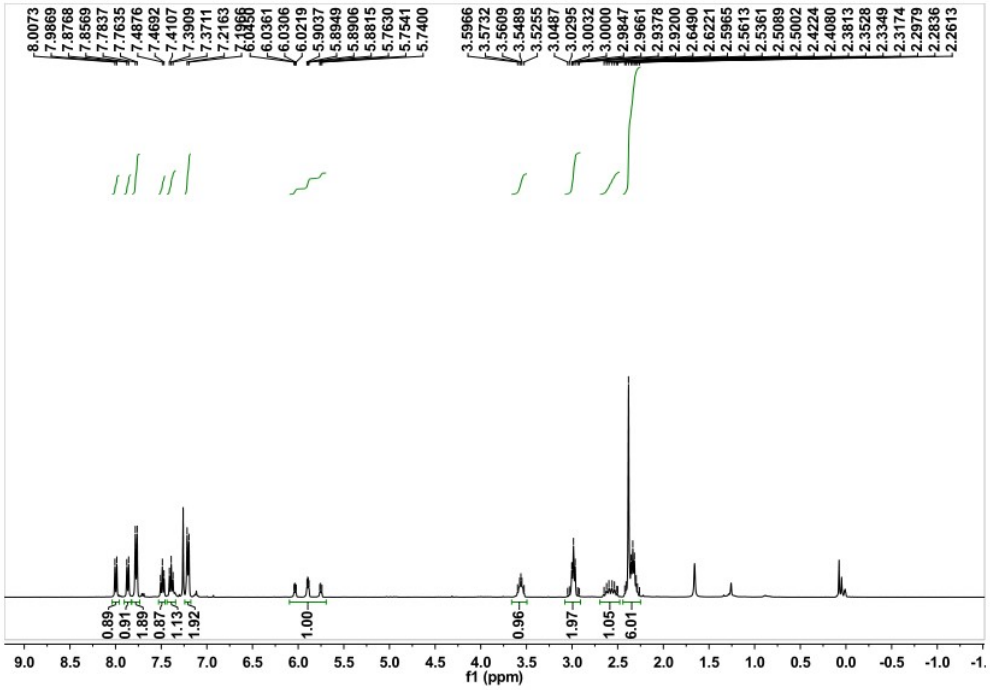
CF2H
Me
N
S

4e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6.0361
6.0306
6.0219
5.9037
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5.8906
5.8815
5.7630
5.7541
5.7400
3.5966
3.5732
3.5609
3.5489
3.5255
3.0487
3.0295
3.0032
3.0000
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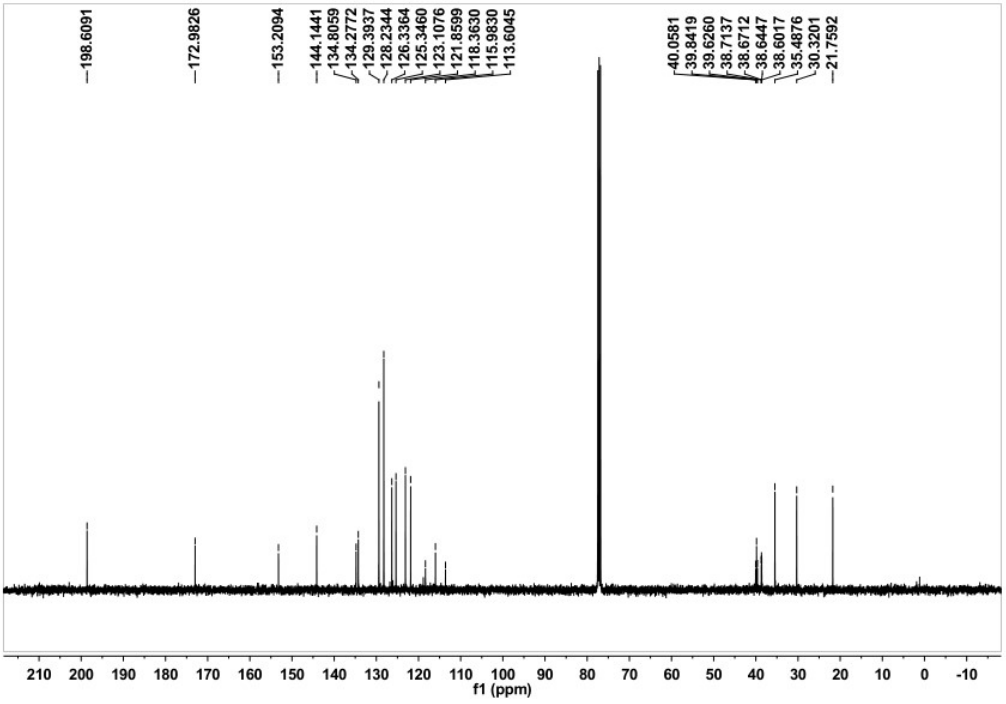
2.9661
2.9378
2.9200
2.6490
2.6221
2.5965
2.5613
2.5361
2.5089
2.5002
2.4224
2.4080
2.3813
2.3528
2.3349
2.3174
2.2979
2.2836
2.2613
0.89
0.91
1.89
0.87
1.13
1.92
1.00
0.96
1.97
1.05
6.01
f1 (ppm)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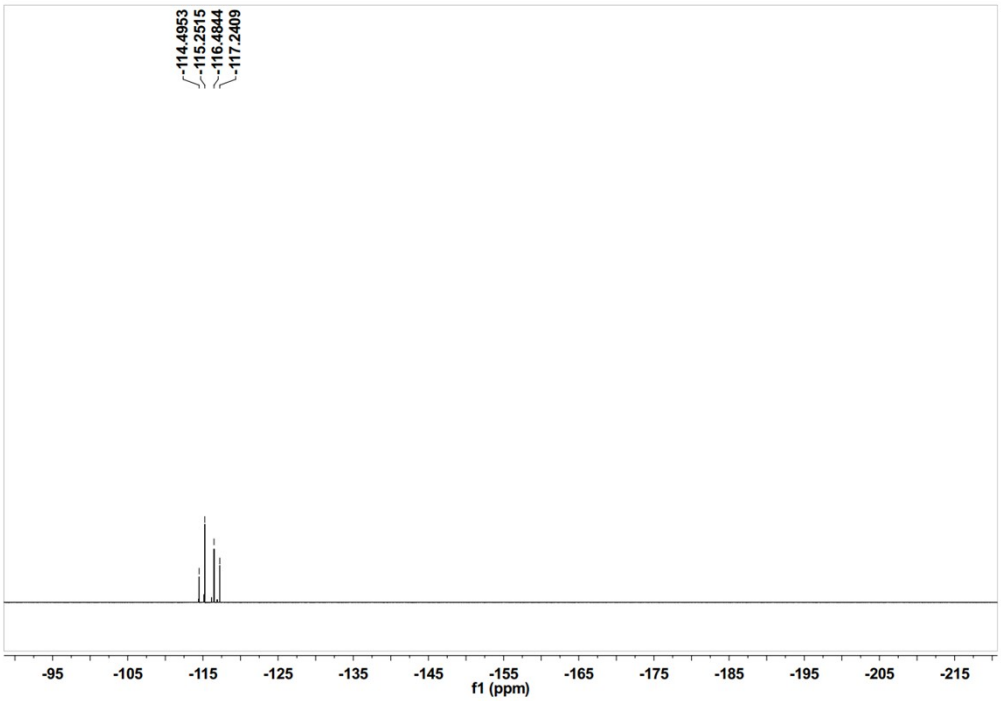
125.3460
123.1076
121.8599
118.3630
115.9830
113.6045
40.0581
39.8419
39.6260
38.7137
38.6712
38.6447
38.6017
35.4876
30.3201
21.7592
f1 (ppm)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-117.2409
-95
-105
-115
-125
-135
-145
-155
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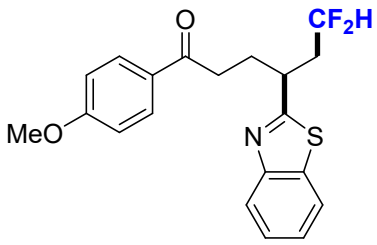
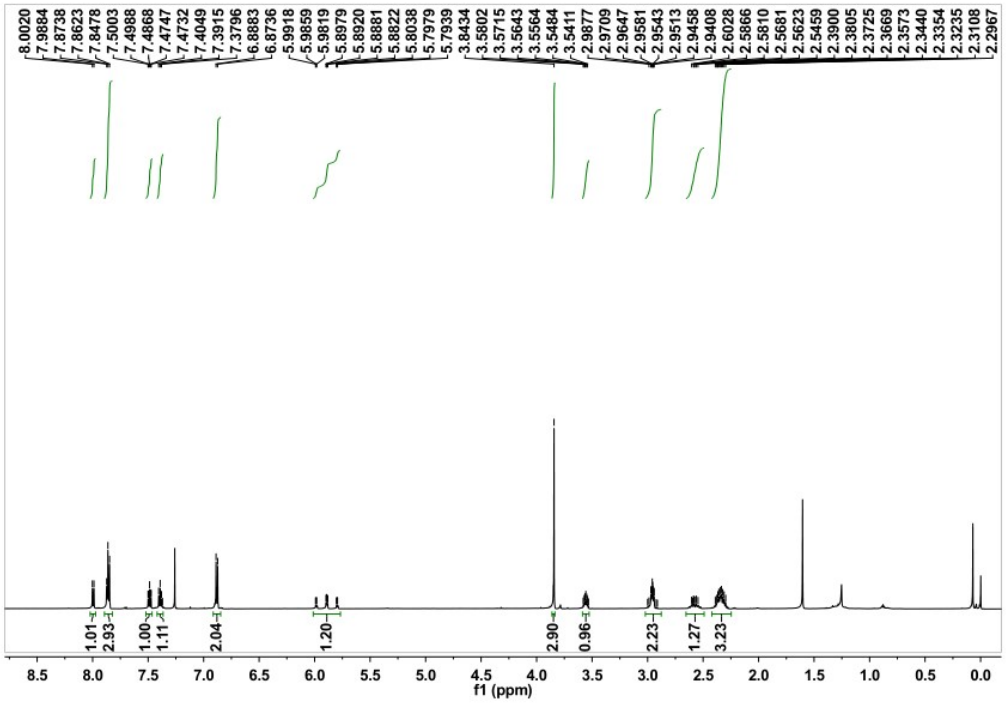
-175
-185
-195
-205
-215
f1 (ppm)


O
CF2H
MeO
N
S

4f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7.4732
7.4049
7.3915
7.3796
6.8883
6.8736
5.9918
5.9859
5.9819
5.8979
5.8920
5.8881
5.8822
5.8038
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5.7939
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2.2967
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2.93
1.00
1.11
2.04
1.20
2.90
0.96
2.23
1.27
3.23
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
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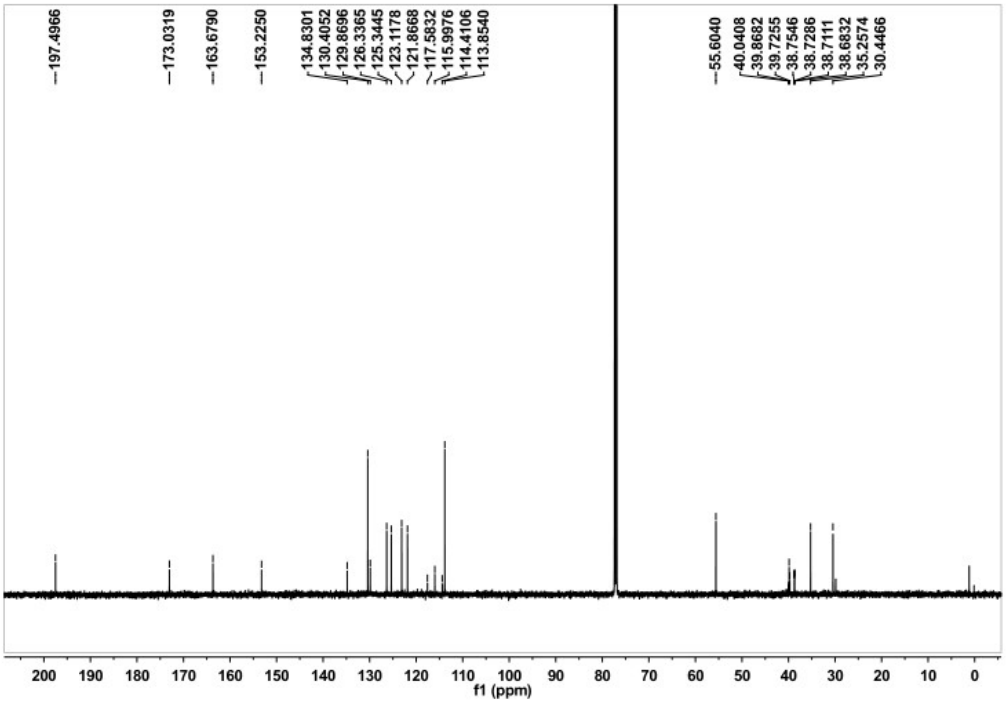
0.0
f1 (ppm)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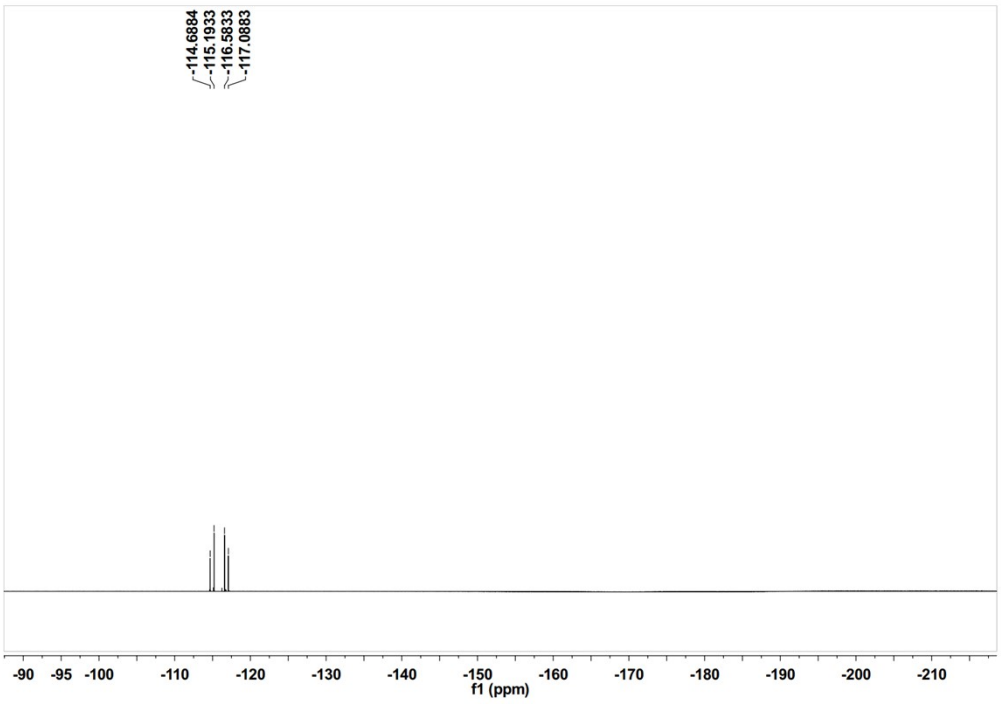
117.5832
115.9976
114.4106
113.8540
55.6040
40.0408
39.8682
39.7255
38.7546
38.7286
38.7111
38.6832
35.2574
30.4466
f1 (ppm)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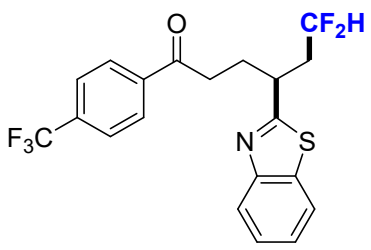
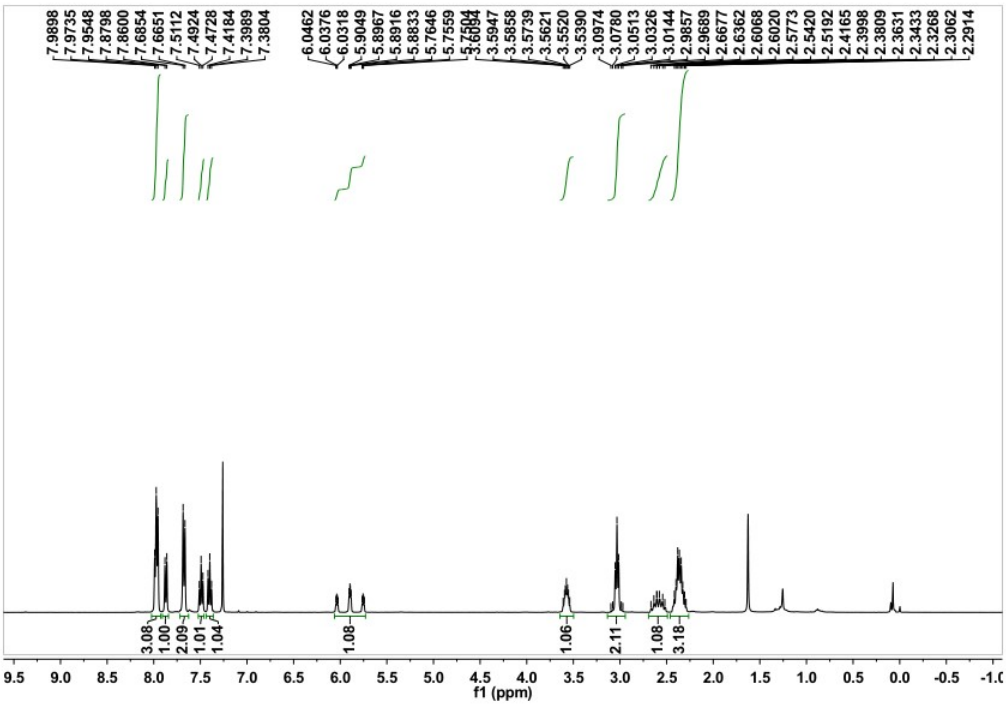

O
CF2H
F3C
N
S

4g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7.3804
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6.0376
6.0318
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5.8916
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3.5520
3.5390
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3.0780
3.0513
3.0326
3.0144
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2.6677
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2.3809
2.3631
2.3433
2.3268
2.3062
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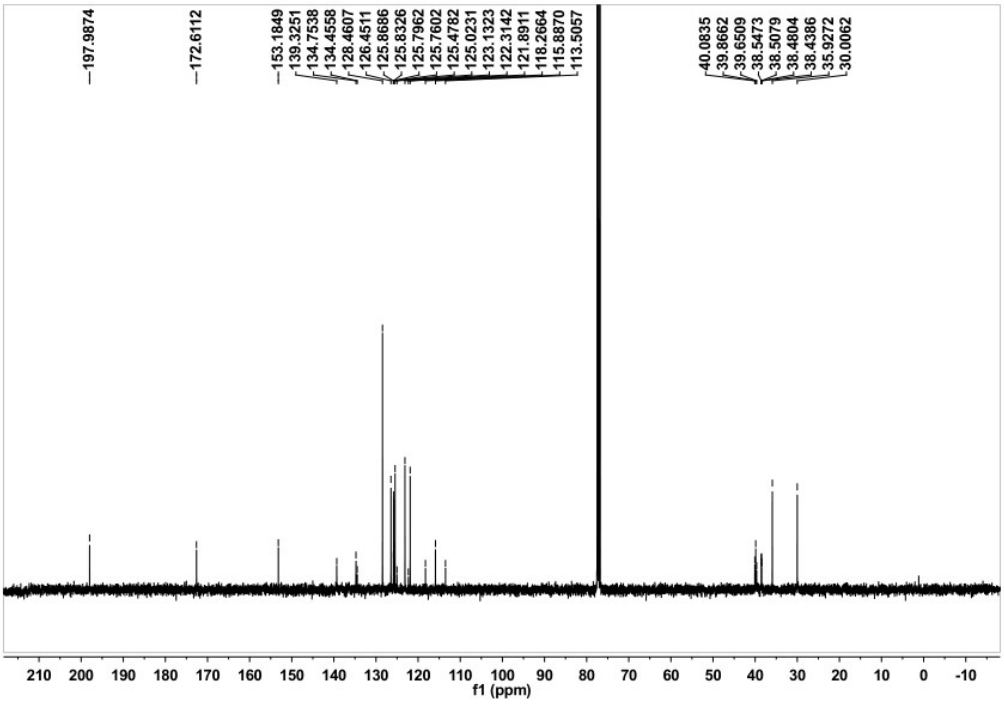
2.09
1.01
1.04
1.08
1.06
2.11
1.08
3.18
f1 (ppm)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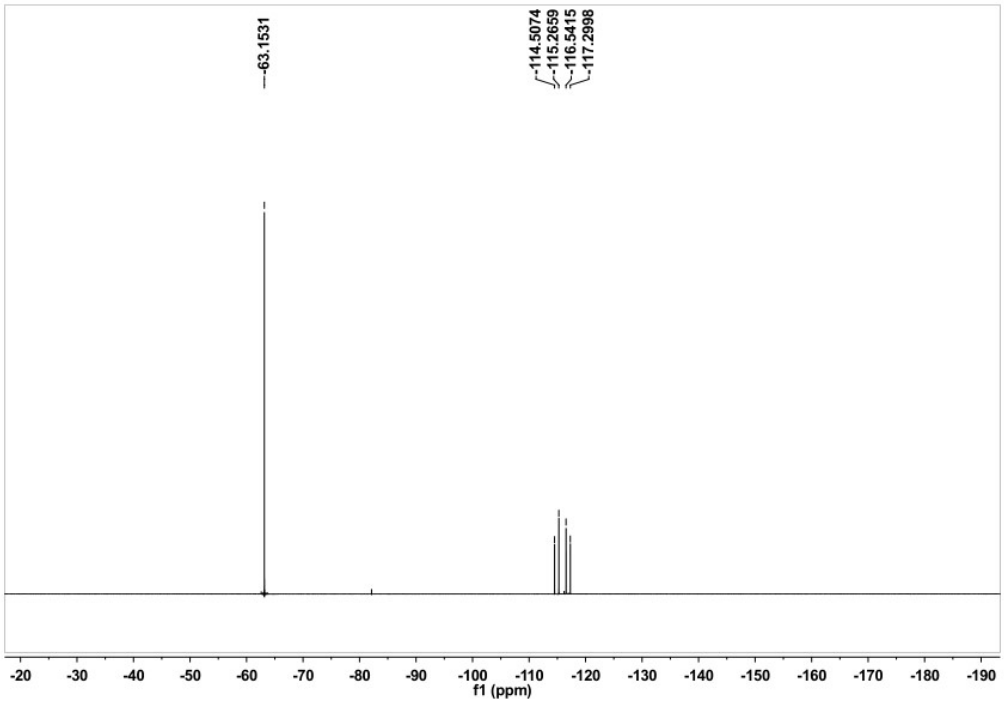
30.0062
f1 (ppm)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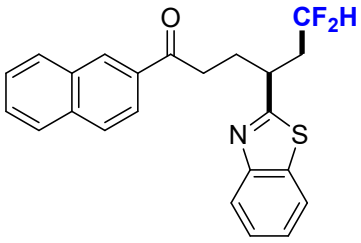
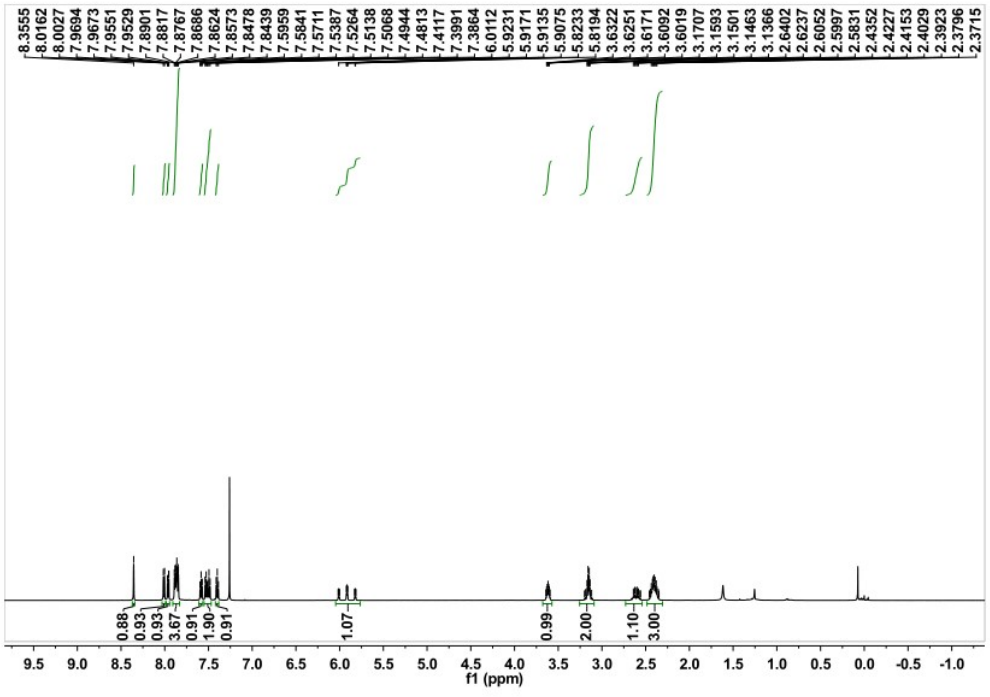
-117.2998
-20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190
f1 (ppm)


O
CF2H
N
S

4h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3.1501
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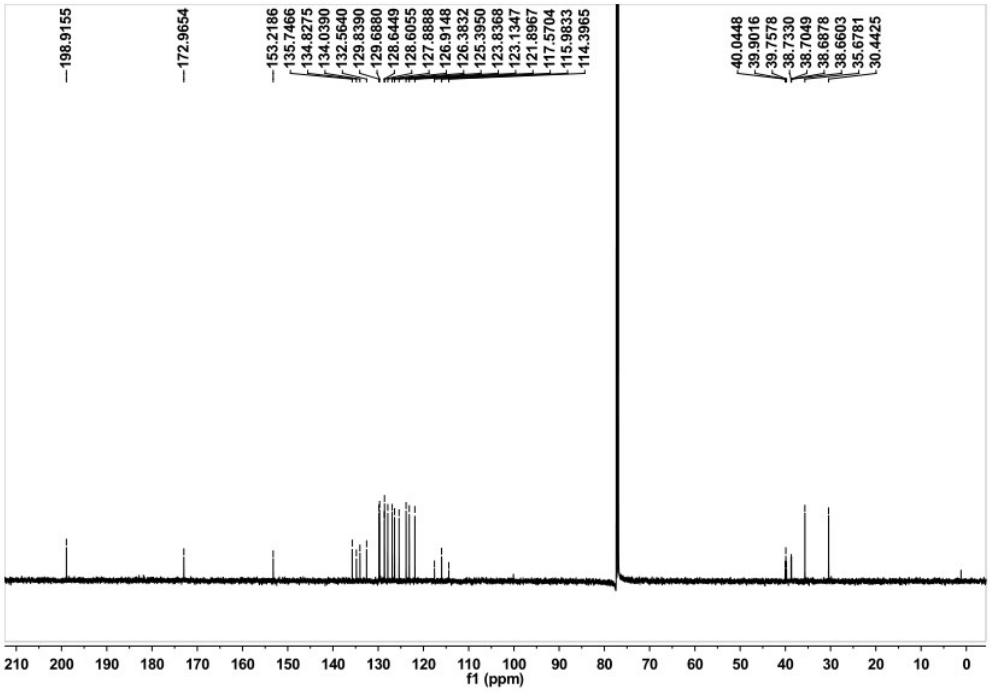
0.93
0.93
3.67
0.91
1.90
0.91
1.07
0.99
2.00
1.10
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)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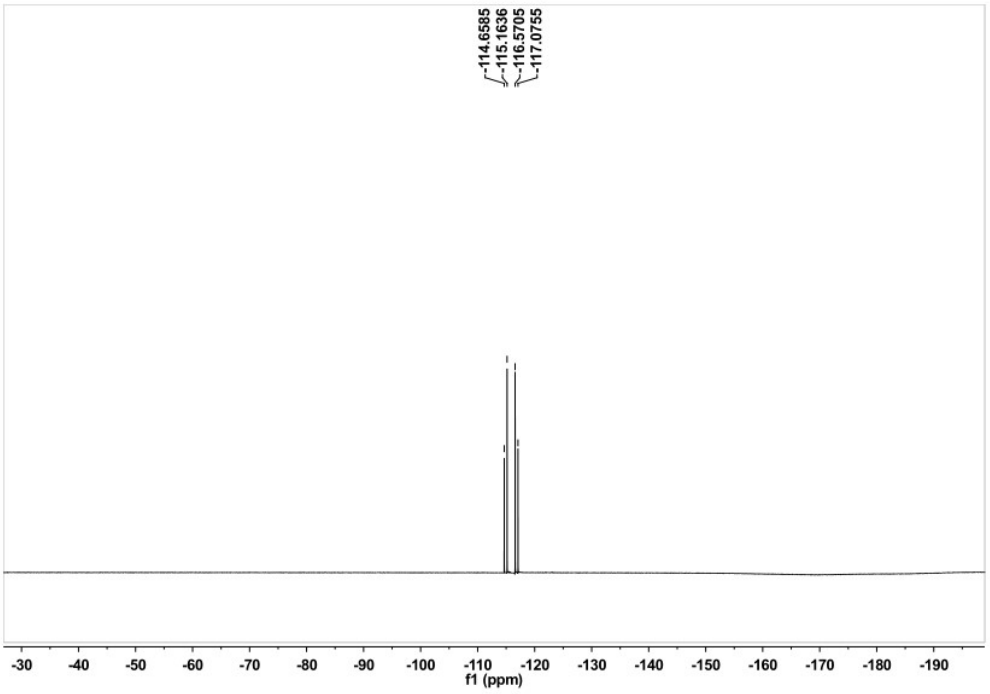
35.6781
30.4425
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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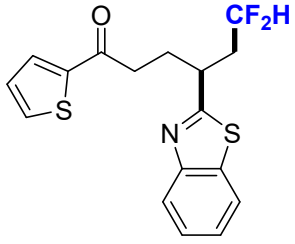
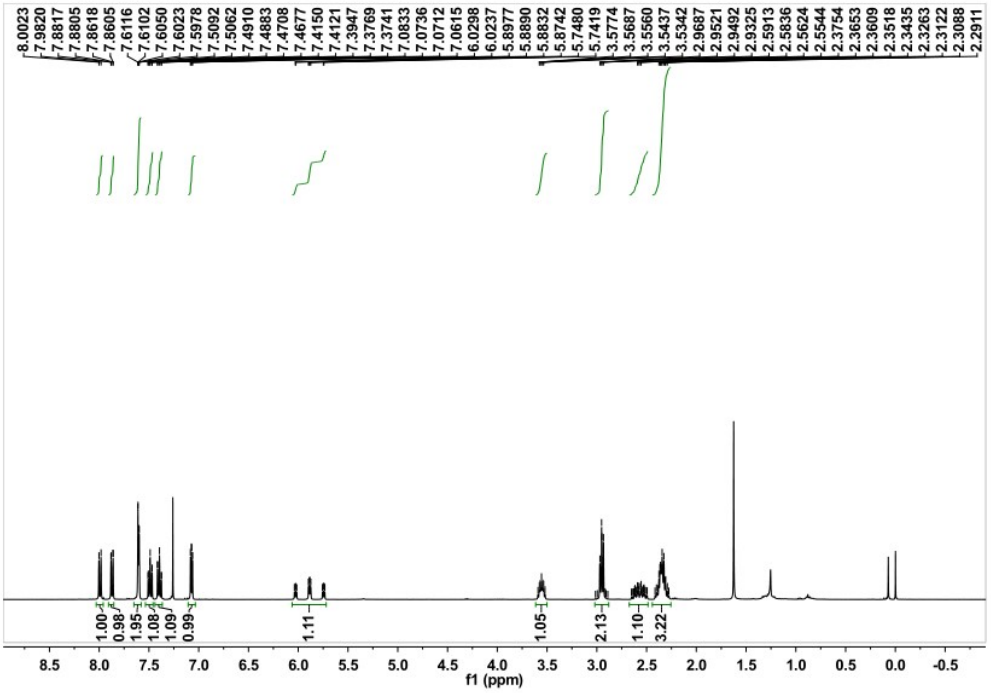
f1 (ppm)


O
CF2H
S
N
S

4i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1.09
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1.11
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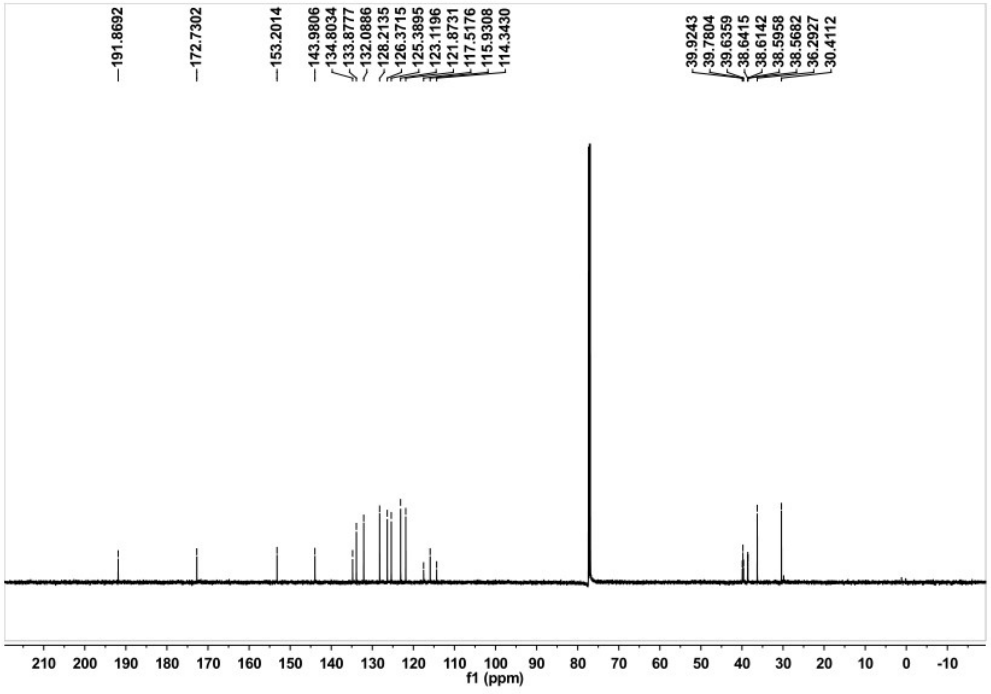
2.13
1.10
3.22
f1 (ppm)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114.3430
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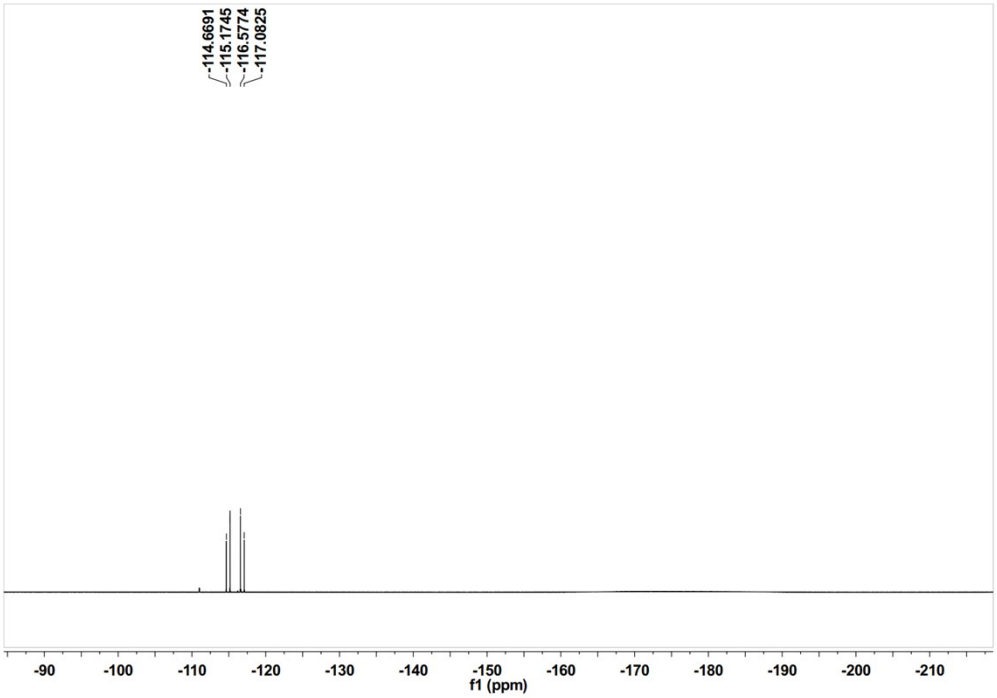
38.6142
38.5958
38.5682
36.2927
30.4112
f1 (ppm)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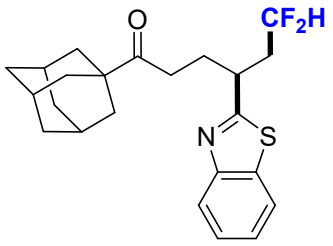
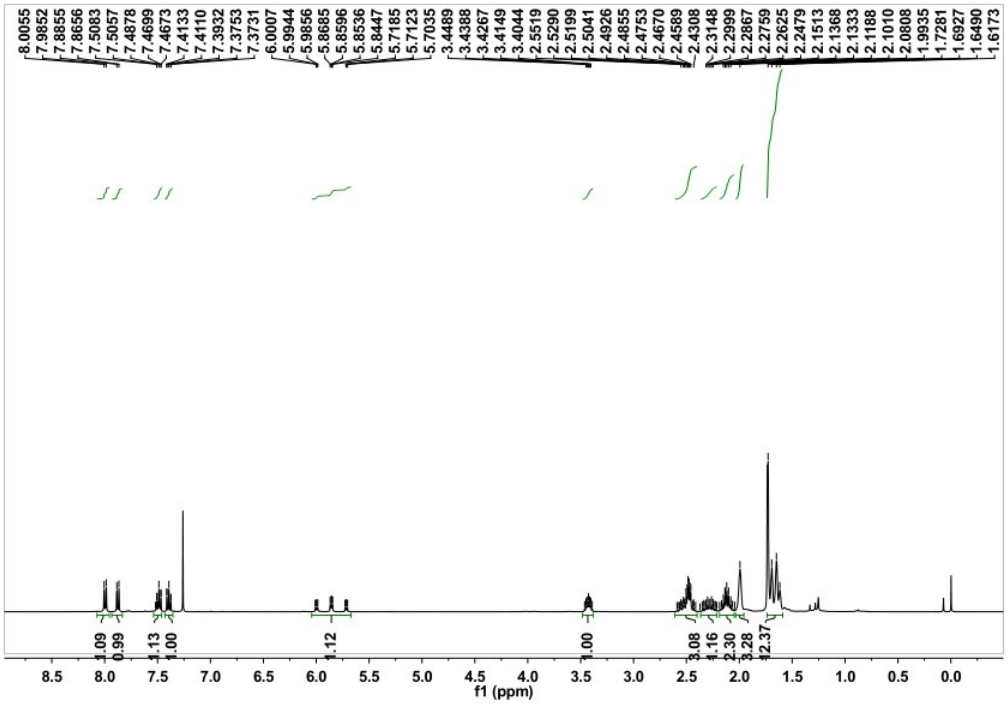
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)


O
CF2H
N
S

4j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7.8855
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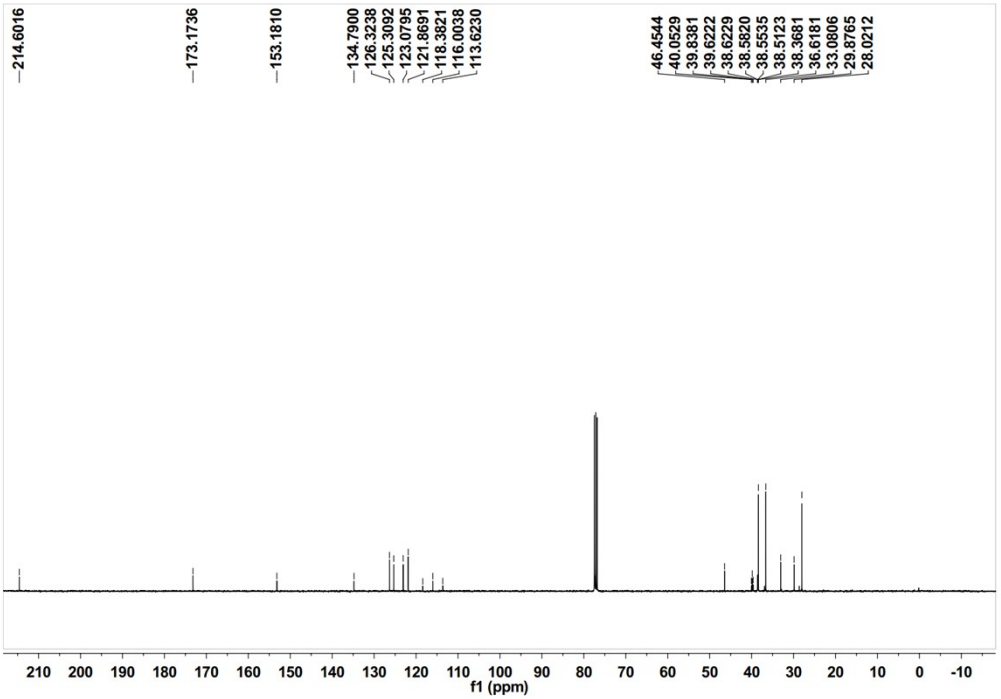
7.5083
7.5057
7.4878
7.4699
7.4673
7.4133
7.4110
7.3932
7.3753
7.3731
6.0007
5.9944
5.9856
5.8685
5.8596
5.8536
5.8447
5.7185
5.7123
5.7035
3.4489
3.4388
3.4267
3.4149
3.4044
2.5519
2.5290
2.5199
2.5041
2.4926
2.4855
2.4753
2.4670
2.4589
2.4308
2.3148
2.2999
2.2867
2.2759
2.2625
2.2479
2.1513
2.1368
2.1333
2.1188
2.1010
2.0808
1.9935
1.7281
1.6927
1.6490
1.6173
1.09
0.99
1.13
1.00
1.12
1.00
3.08
1.16
2.30
3.28
12.37
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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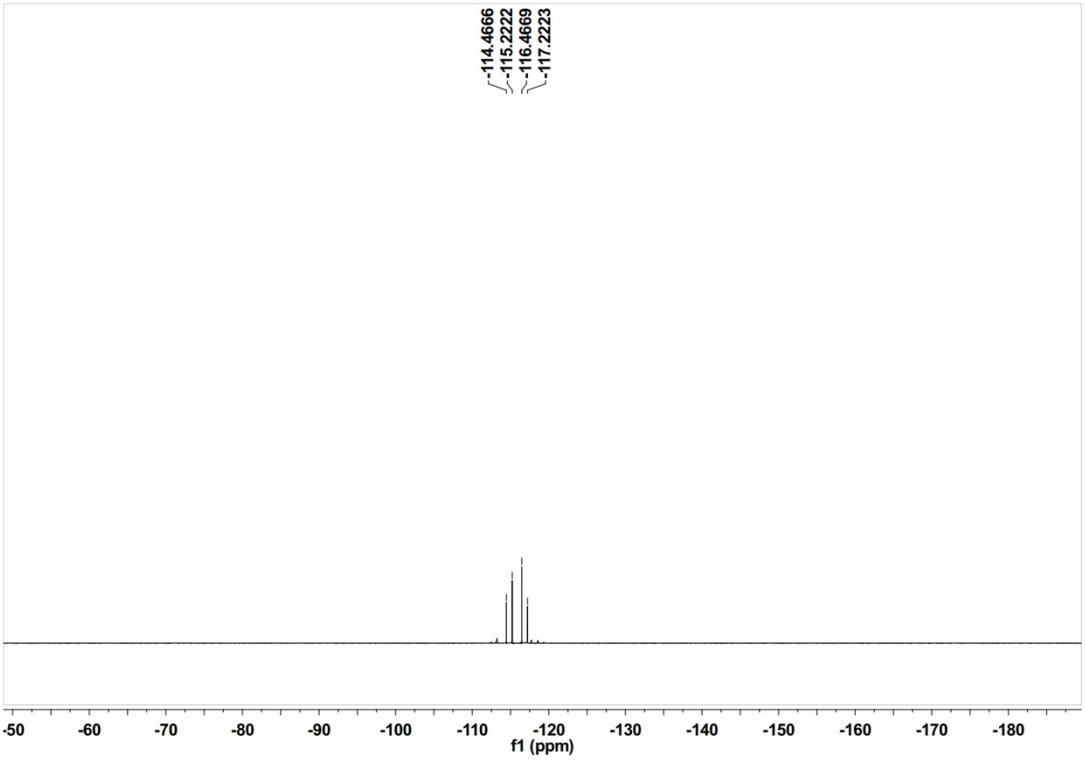
153.1810
134.7900
126.3238
125.3092
123.0795
121.8691
118.3821
116.0038
113.6230
46.4544
40.0529
39.8381
39.6222
38.6229
38.5820
38.5535
38.5123
38.3681
36.6181
33.0806
29.8765
28.0212
f1 (ppm)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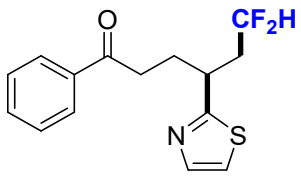
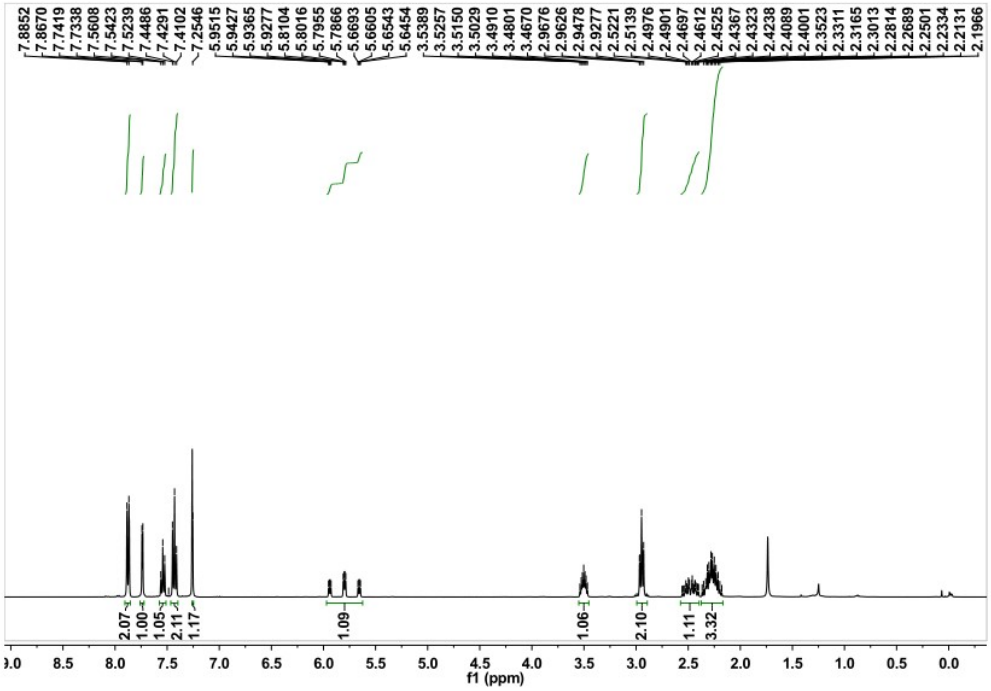
-115.2222
-116.4669
-117.2223
f1 (ppm)


O
CF2H
N
S

4k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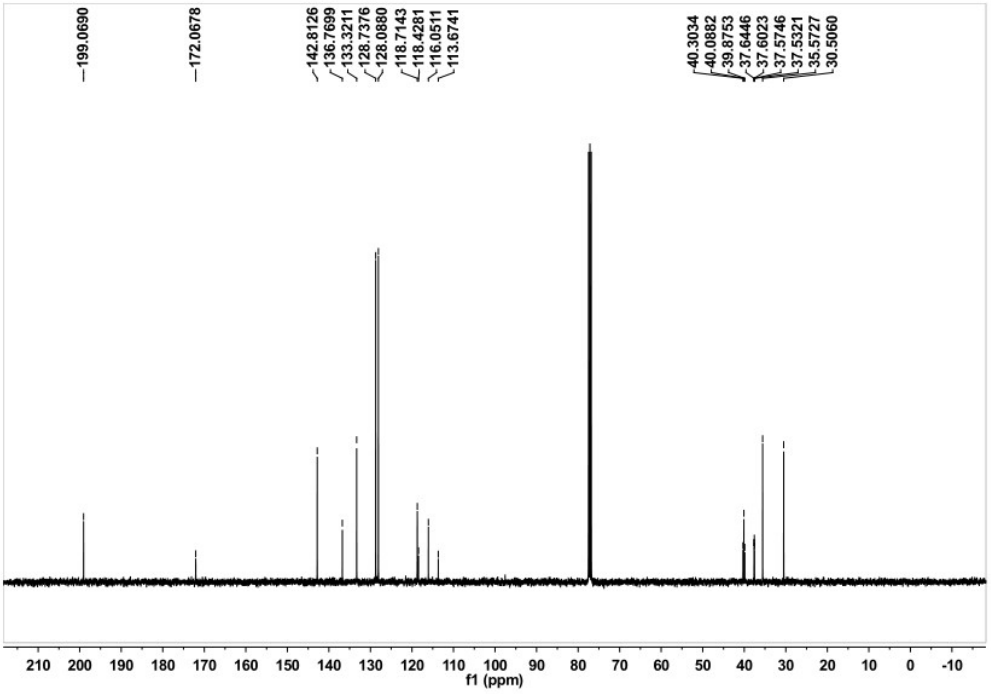
7.7419
7.7338
7.5608
7.5423
7.5239
7.4486
7.4291
7.4102
7.2546
5.9515
5.9427
5.9365
5.9277
5.8104
5.8016
5.7955
5.7866
5.6693
5.6605
5.6543
5.6454
3.5389
3.5257
3.5150
3.5029
3.4910
3.4801
3.4670
2.9676
2.9626
2.9478
2.9277
2.5221
2.5139
2.4976
2.4901
2.4697
2.4612
2.4525
2.4367
2.4323
2.4238
2.4089
2.4001
2.3523
2.3311
2.3165
2.3013
2.2814
2.2689
2.2501
2.2334
2.2131
2.1966
2.07
1.00
1.05
2.11
1.17
1.09
1.06
2.10
1.11
3.32
f1 (ppm)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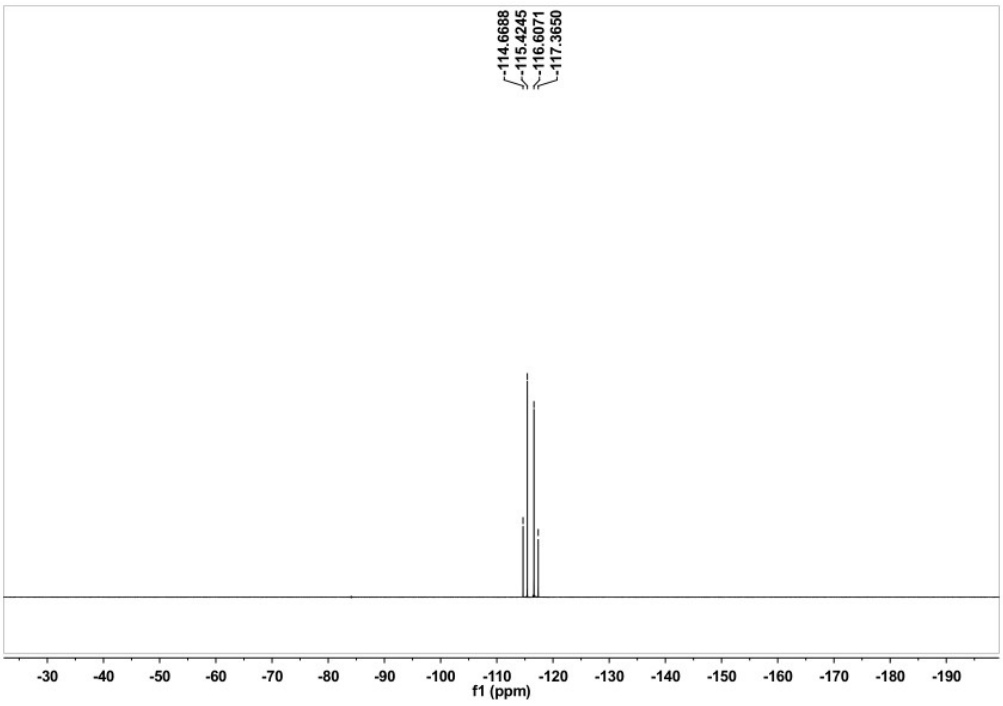
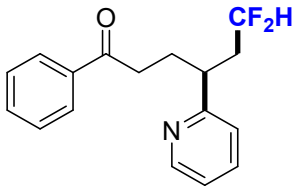
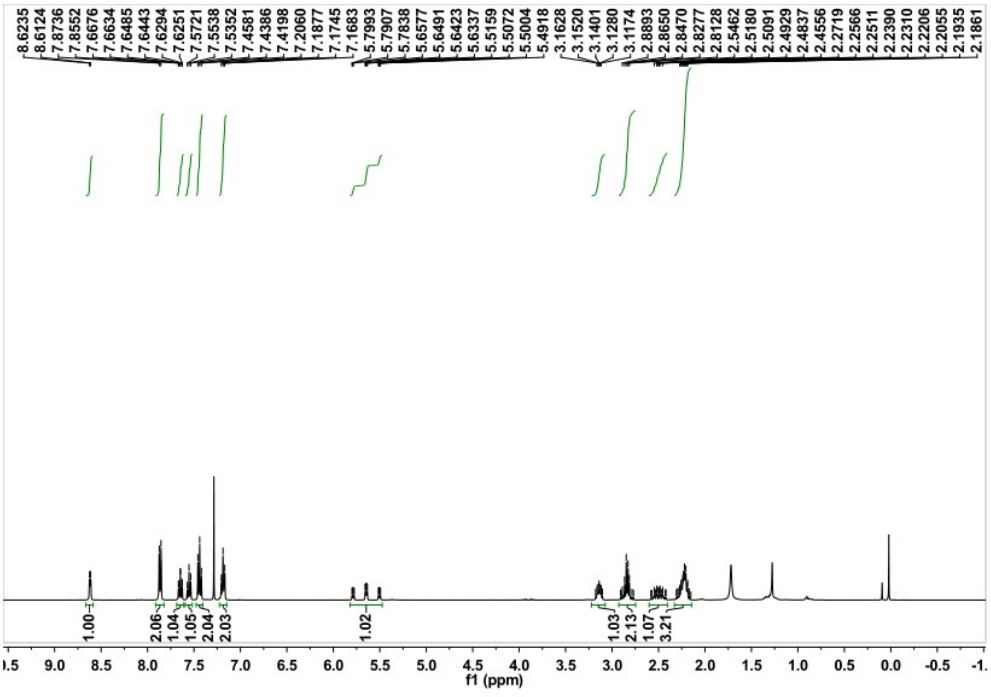
142.8126
136.7699
133.3211
128.7376
128.0880
118.7143
118.4281
116.0511
113.6741
40.3034
40.0882
39.8753
37.6446
37.6023
37.5746
37.5321
35.5727
30.5060
f1 (ppm)


-114.6688
-115.4245
-116.6071
-117.3650
-30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190
f1 (ppm)


O
CF2H
N

4l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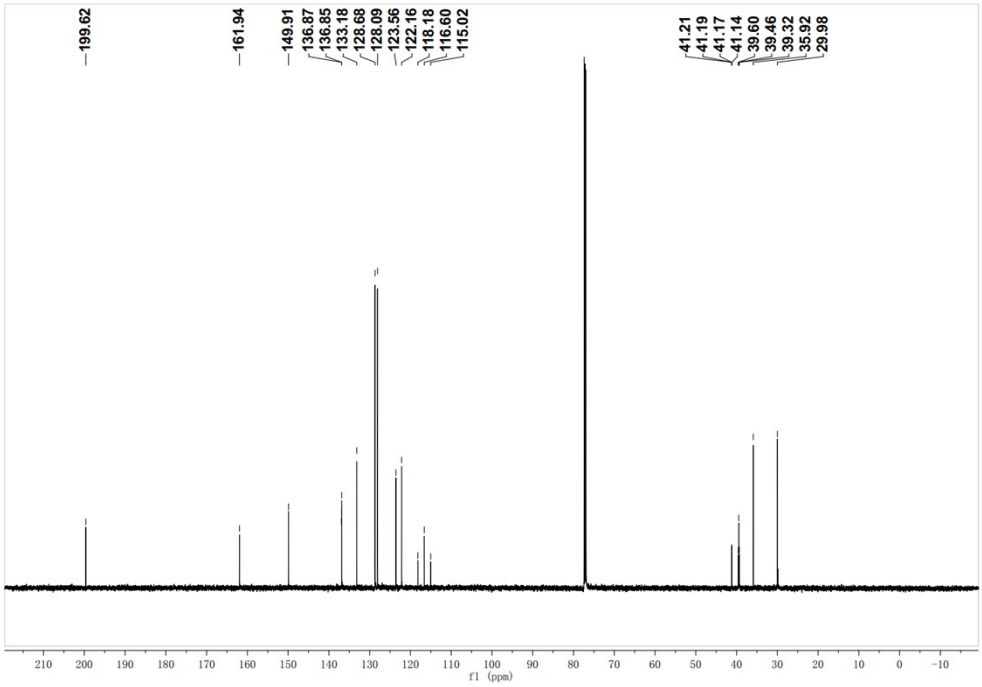
7.8736
7.8552
7.6676
7.6634
7.6485
7.6443
7.6294
7.6251
7.5721
7.5538
7.5352
7.4581
7.4386
7.4198
7.2060
7.1877
7.1745
7.1683
5.7993
5.7907
5.7838
5.6577
5.6491
5.6423
5.6337
5.5159
5.5072
5.5004
5.4918
3.1628
3.1520
3.1401
3.1280
3.1174
2.8893
2.8650
2.8470
2.8277
2.8128
2.5462
2.5180
2.5091
2.4929
2.4837
2.4556
2.2719
2.2566
2.2511
2.2390
2.2310
2.2206
2.2055
2.1935
2.1861
1.00
2.06
1.04
1.05
2.04
2.03
1.02
1.03
2.13
1.07
3.21
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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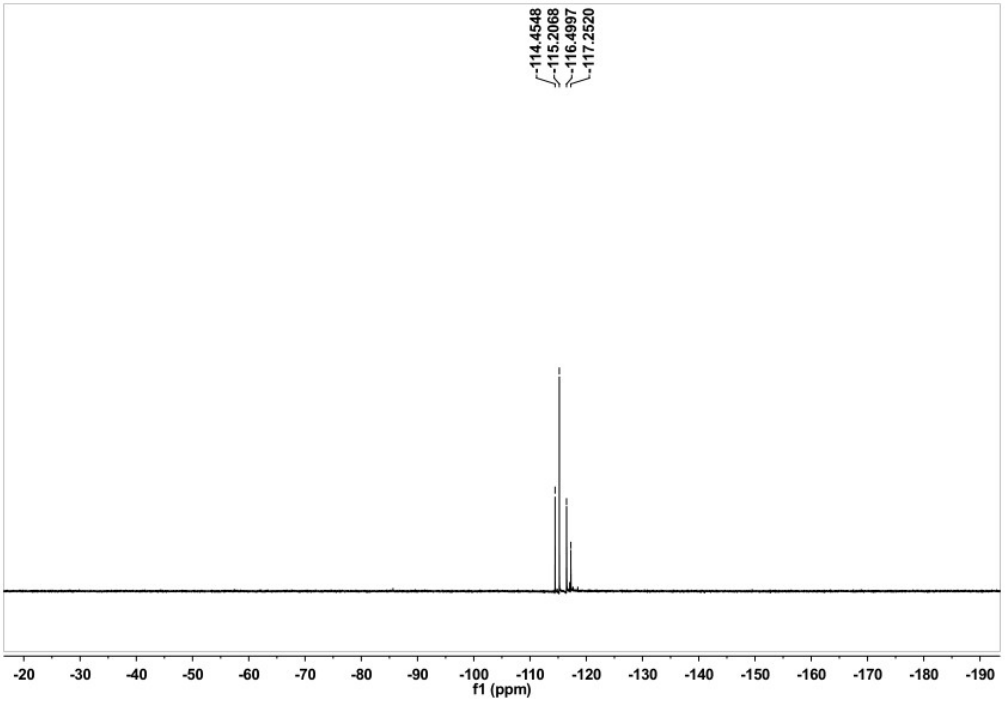
161.94
149.91
136.87
136.85
133.18
128.68
128.09
123.56
122.16
118.18
116.60
115.02
41.21
41.19
41.17
41.14
39.60
39.46
39.32
35.92
29.98
f1 (ppm)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-116.4997
-117.2520
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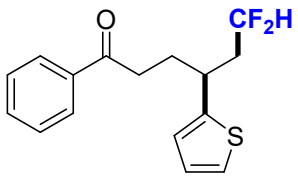
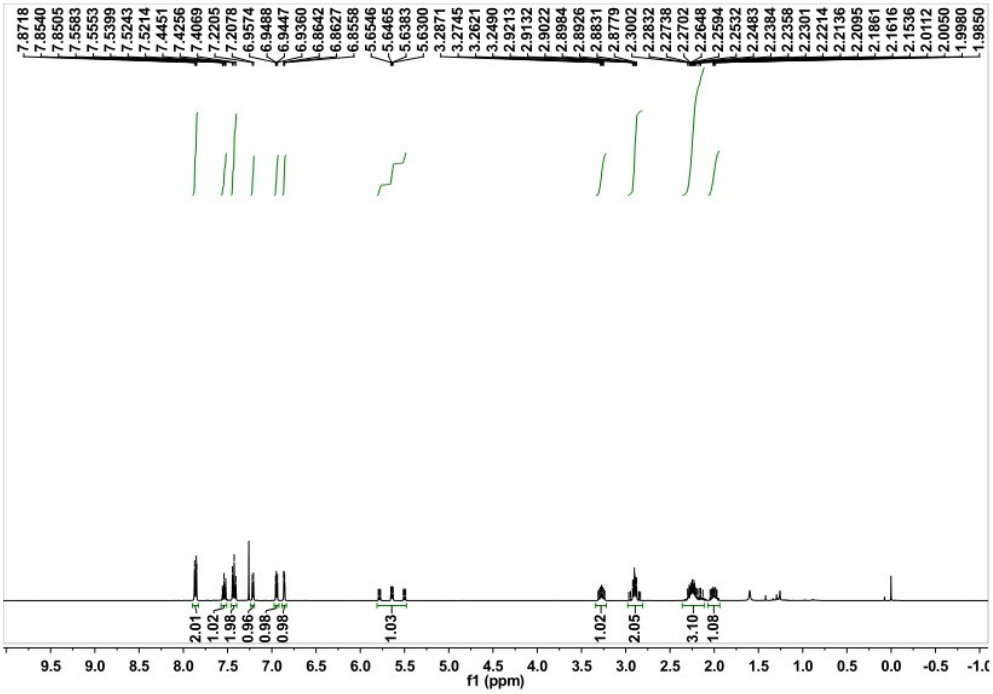

O
CF2H
S

4m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7.5243
7.5214
7.4451
7.4256
7.4069
7.2205
7.2078
6.9574
6.9488
6.9447
6.9360
6.8642
6.8627
6.8558
5.6546
5.6465
5.6383
5.6300
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3.2490
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2.9022
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2.8926
2.8831
2.8779
2.3002
2.2832
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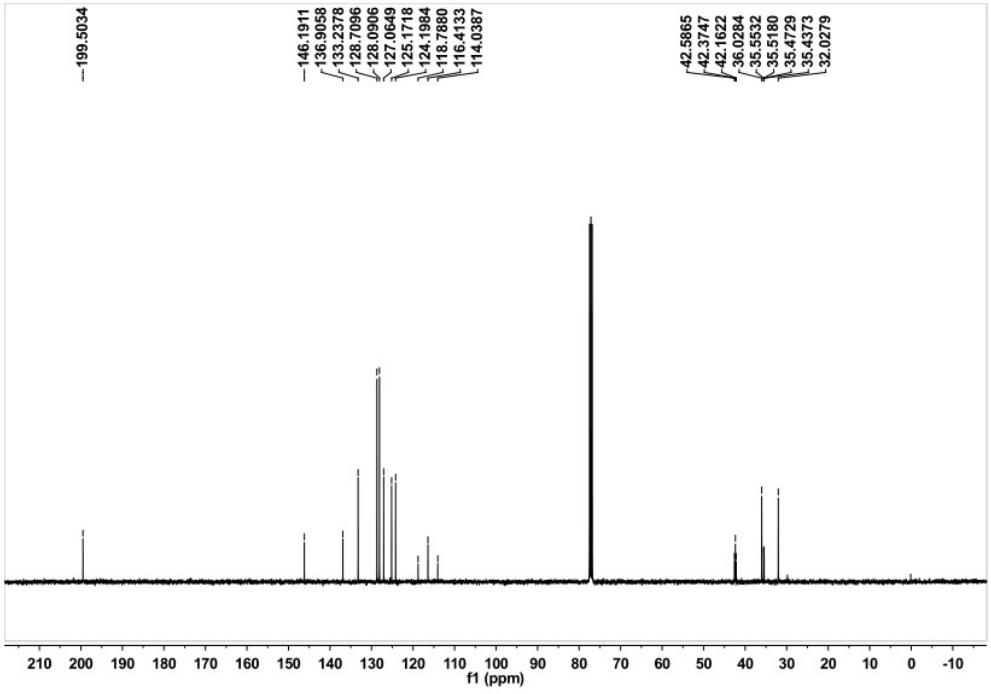
2.2702
2.2648
2.2594
2.2532
2.2483
2.2384
2.2358
2.2301
2.2214
2.2136
2.2095
2.1861
2.1616
2.1536
2.0112
2.0050
1.9980
1.9850
2.01
1.02
1.98
0.96
0.98
0.98
1.03
1.02
2.05
3.10
1.08
f1 (ppm)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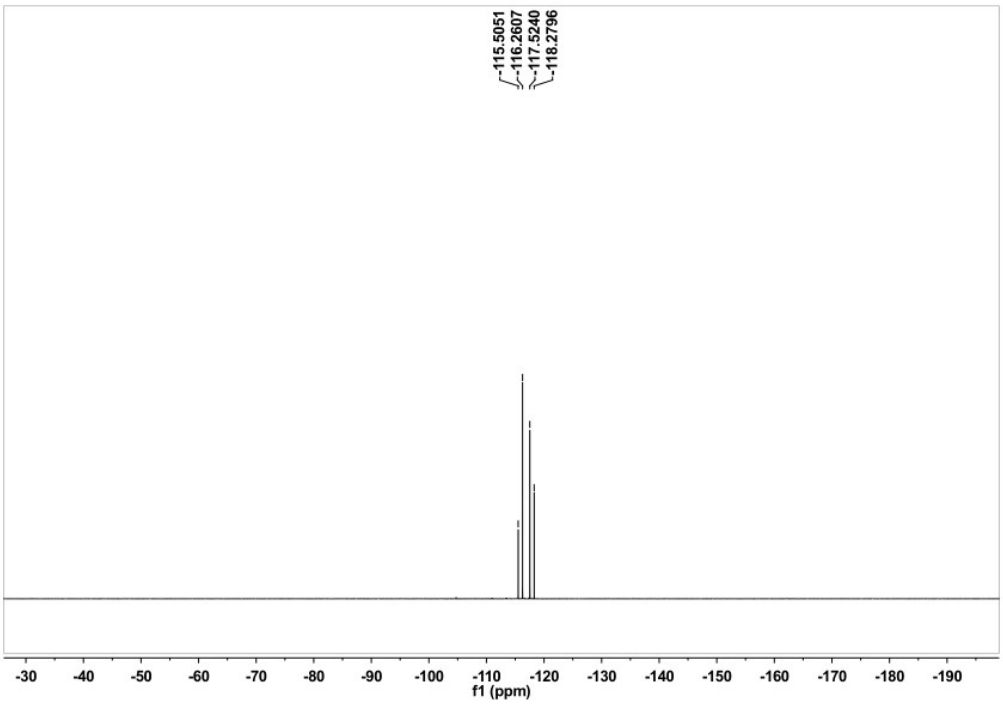
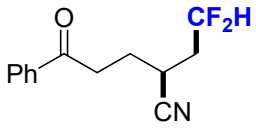
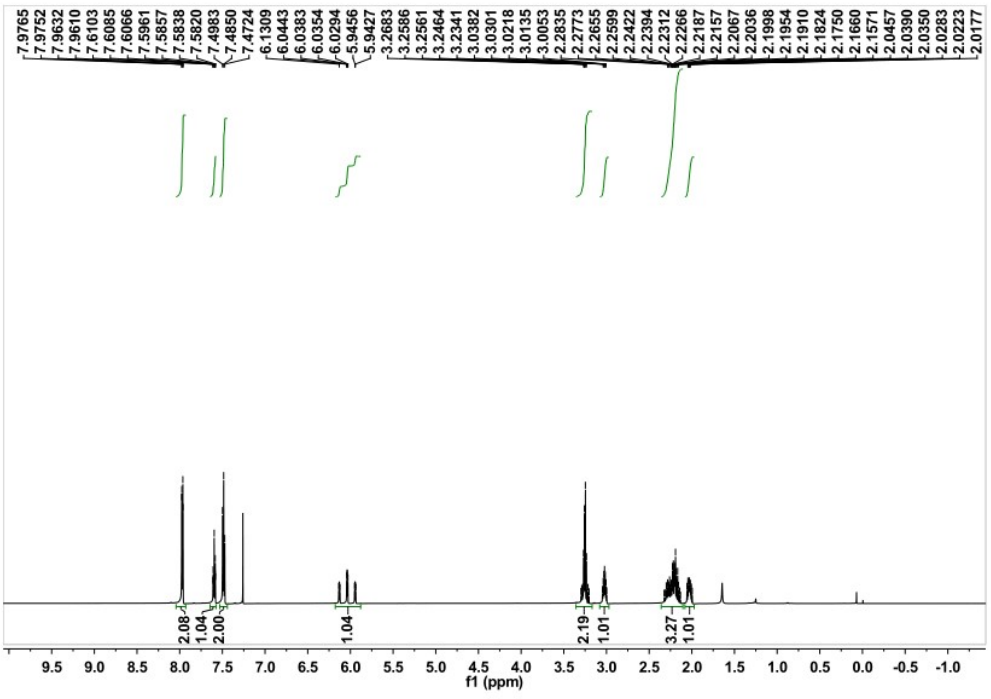
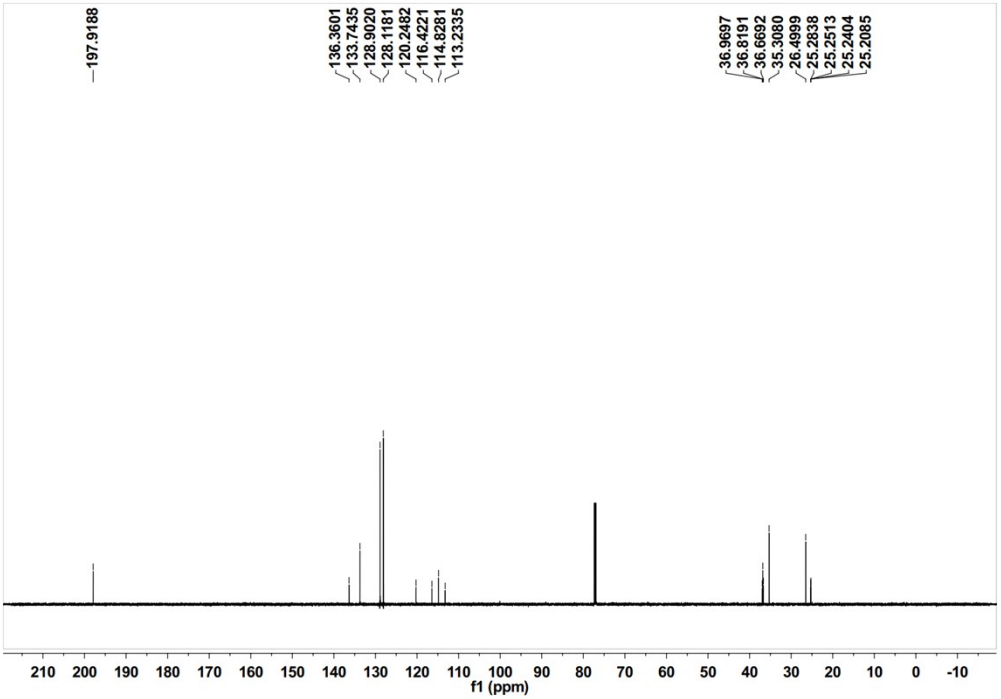
128.7096
128.0906
127.0649
125.1718
124.1984
118.7880
116.4133
114.0387
42.5865
42.3747
42.1622
36.0284
35.5532
35.5180
35.4729
35.4373
32.0279
f1 (ppm)


-115.5051
-116.2607
-117.5240
-118.2796
-30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190
f1 (ppm)


O
CF2H
Ph
CN

4n


7.9765 7.9752 7.9632 7.9610 7.6103 7.6085 7.6066 7.5961 7.5857 7.5838 7.5820 7.4983 7.4850 7.4724
6.1309 6.0443 6.0383 6.0354 6.0294 5.9456 5.9427
3.2683 3.2586 3.2561 3.2464 3.2341 3.0382 3.0301 3.0218 3.0135 3.0053 2.2835 2.2773 2.2655 2.2599 2.2422 2.2394 2.2312 2.2266 2.2187 2.2157 2.2067 2.2036 2.1998 2.1954 2.1910 2.1824 2.1750 2.1660 2.1571 2.0457 2.0390 2.0350 2.0283 2.0223 2.0177
2.08 1.04 2.00 1.04 2.19 1.01 3.27 1.01
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)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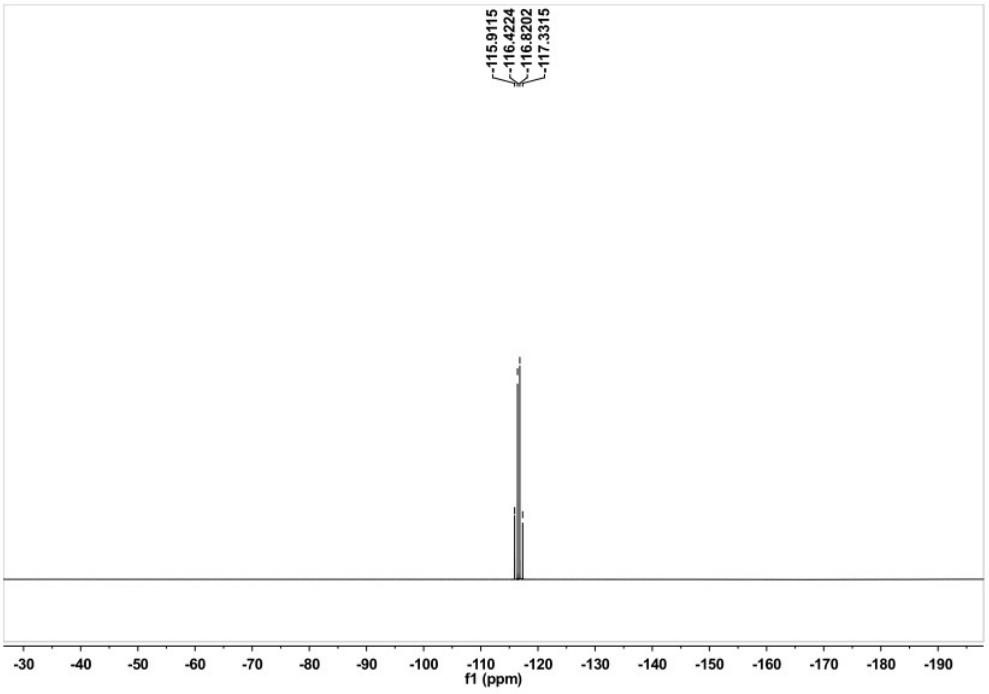
116.4221
114.8281
113.2335
36.9697
36.8191
36.6692
35.3080
26.4999
25.2838
25.2513
25.2404
25.2085
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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-116.4224
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-117.3315
-30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190
f1 (ppm)