Supporting Information

Dual Enabling Photomediated Knoevenagel Condensation and Alkene Perfluoroalkylation Reactions by a Photoresponsive Cadmium-Organic Framework

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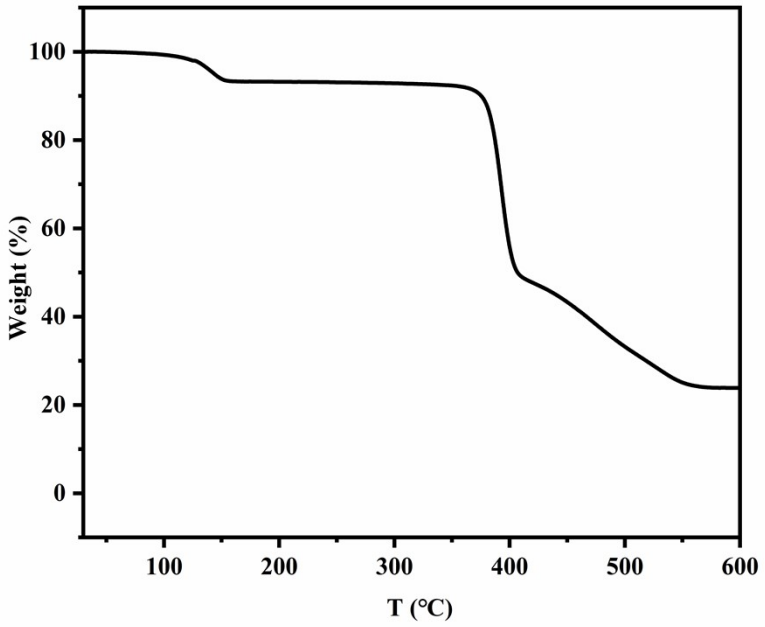


Fig. S1 Thermogravimetric curve of Cd-MOF

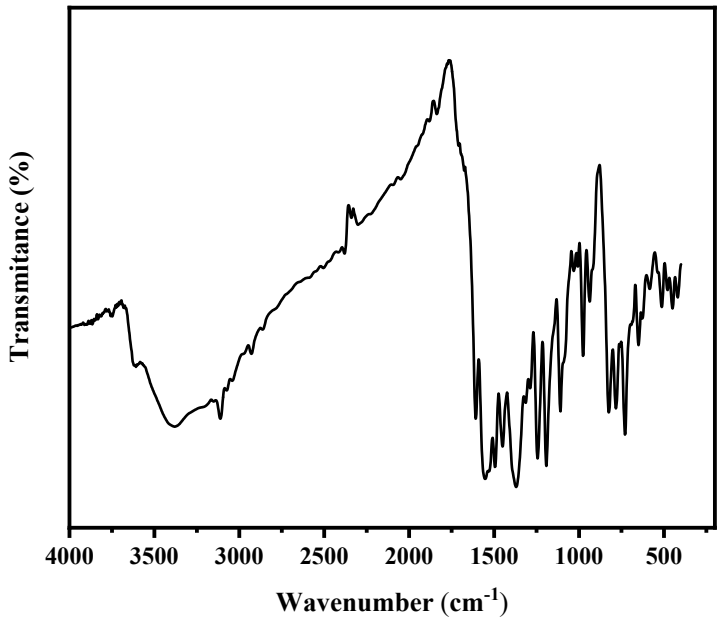


Fig. S2 Infrared spectra of Cd-MOF

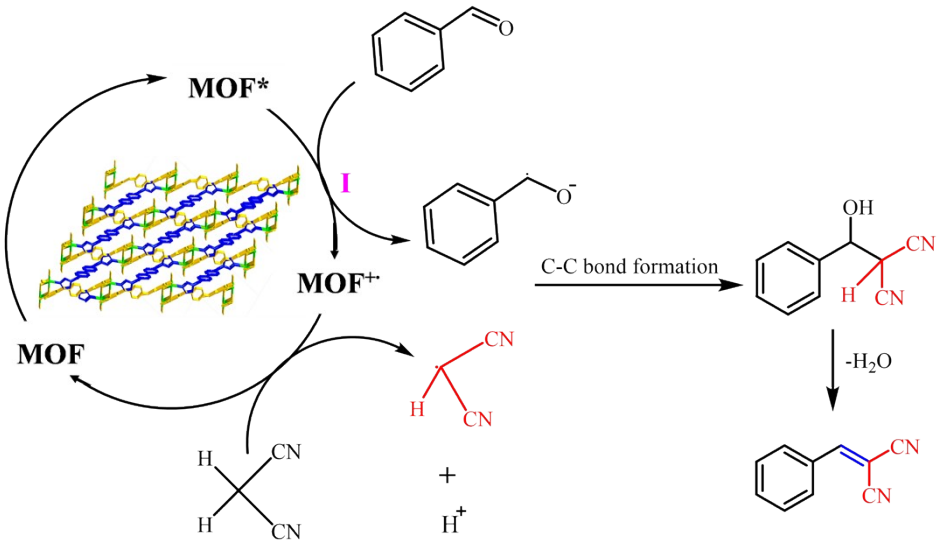


Fig. S3 Knoevenagel reaction mechanism 1

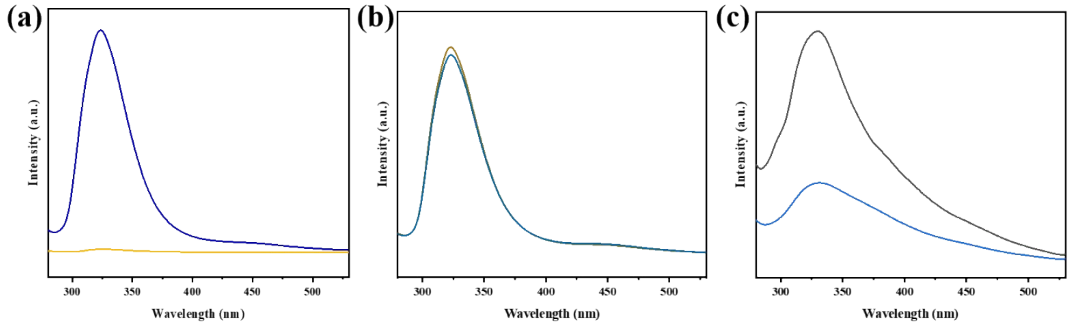


Fig. S4 fluorescence quenching experiments (a) 5mmol benzaldehyde; (b) 6mmol Malonitrile; (c) 0.4mmol C_4F_9I

Table S1: Crystallographic data of Cd-MOF

Compound	Cd-MOF
Formula	$C_{21}H_{18}N_2O_7Cd$
Formula weight	522.77
Temperature(K)	150.00
Crystal system	Triclinic
Space group	$P\bar{1}$
a (Å)	10.1022(5)
b (Å)	10.2035(4)
c (Å)	11.3950(6)
α (°)	99.416(2)
β (°)	99.647(2)
γ (°)	119.1130(10)
Volume (Å ^{3})	969.83(8)
ρ_{calc} g/cm^3	1.790
Z	2
F (000)	524.0
Goodness-of-fit on F^2	1.063
R_1,wR_2(I＞2sigmal(I))	R_1=0.0279, wR_2=0.0798
R_1,wR_2(all data)	R_1=0.0300, wR_2=0.0812

Table S2 : Bond lengths and bond angles for Cd-MOF

Cd-MOF			
Cd1-O6A	2.394(2)	O3-Cd1-O5A	136.98(7)
Cd1-O6B	2.581(2)	O3-Cd1-N2	133.51(8)
Cd1-O3	2.1824(19)	O2-Cd1-O6B	171.69(6)
Cd1-O2	2.326(2)	O2-Cd1-O6A	108.57(7)

Cd1-O5A	2.399(2)	O3-Cd1-O5A	80.19(7)
Cd1-N2	2.216(2)	O5A-Cd1-O6B	108.11(7)
O6A-Cd1-O6B	76.86(7)	N2-Cd1-O6A	128.45(8)
O6A-Cd1-O5A	54.55(7)	N2-Cd1-O6B	82.78(8)
O3-Cd1-O6A	88.56(7)	N2-Cd1-O2	98.03(8)
O3-Cd1-O6B	79.69(7)	N2-Cd1-O5A	89.40(8)
O3-Cd1-O2	93.97(8)		

1. Calculation of green indicators[1, 2]:

(1). Environmental Factor (E-Factor): The amount of waste generated in the chemical process. The higher the value, the greater the amount of waste.

$$E = \frac{Waste\ quality}{Product\ quality} = \frac{Total\ quality\ of\ raw\ materials - Product\ quality}{Product\ quality} \times 100\%$$

(2). Atom Economy (AE): Atomic economy, the number of atoms of the starting material contained in the reaction product.

$$AE = \frac{Molecular\ weight\ of\ product}{The\ sum\ of\ the\ molecular\ weights\ of\ the\ stoichiometric\ reactants} \times 100\%$$

(3). Carbon Efficiency (CE): The carbon generated in the product accounts for the percentage of carbon in the reactant.

$$CE = \frac{Carbon\ content\ in\ products}{Total\ carbon\ content\ in\ raw\ materials}$$

(4). Reaction mass efficiency (RME): Reaction quality efficiency, evaluation of reaction cleanliness. The higher the RME value, the cleaner the reaction, and the more conducive to green chemistry.

$$RME = \frac{quality\ of\ product}{Total\ mass\ of\ chemically\ measured\ reactants}$$

(5). Mass intensity (MI)：Mass Intensity, lower MI values indicate lower costs and more sustainable chemical processes (excluding solvents).

$$MI = \frac{Total\ mass\ in\ the\ chemical\ process}{Quality\ of\ products}$$

(6). Process mass intensity (PMI)：Process quality strength.

$$PMI = \frac{Total\ mass\ in\ the\ chemical\ process\ (including\ solvent)}{Total\ mass\ of\ product}$$

2. Theoretical calculations

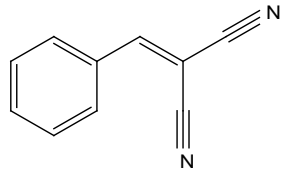
Table S3: Calculated thermodynamic data for pathway II

	ZPE	E+ZPE	G	HF	total free energy
Bn-O-radical-	0.107572	-345.313795	-345.344884	-345.6412525	-345.5647695

anion					
BOH-radical	0.121085	-345.864985	-345.896544	-346.1194585	-346.0299325
Malonitrile-anion	0.032116	-224.305214	-224.332574	-224.5174562	-224.5127002
Malonitrile	0.045441	-224.845386	-224.873072	-224.9861538	-224.9683988

	reactant		product		ΔGr
Ⅱ	Bn-O-radical-anion	Malonitrile	Malonitrile-anion	BOH-radical	-5.939000912

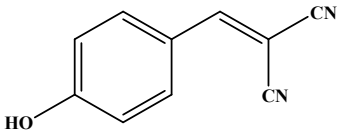
3. NMR data for the compounds:



3a: Benzalmalononitrile (PE: EA=100:1)

^{1}H NMR (400 MHz, Chloroform-d) δ 7.91 (d, J = 7.5 Hz, 2H), 7.79 (s, 1H), 7.64 (t, J = 7.5 Hz, 1H), 7.54 (t, J = 7.7 Hz, 2H)，7.26 (s, 1H).

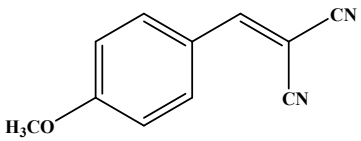
^{13}C NMR (101 MHz, CHLOROFORM-D) δ 160.11, 134.79, 131.04, 130.88, 129.77, 113.84, 112.68, 82.97。



3b: 2-(4-hydroxybenzylidene) malononitrile (PE: EA=10:1)

^{1}H NMR (400 MHz, DMSO-D6/ TMS): δ 11.07 (s, 1H), 8.30 (s, 1H), 7.89 (d, J=8Hz, 2H), 6.99-6.95 (m, 2H).

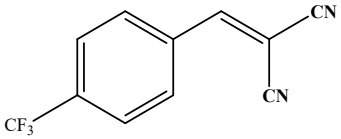
^{13}C NMR (100 MHz, CDCl3): δ 163.91, 160.52, 133.89, 122.81, 116.63, 115.11, 114.20, 75.12.[3]



3c：2-(4-methoxybenzylidene) malononitrile (PE: EA=80:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 6.7 Hz, 2H), 7.65 (s, 1H), 7.01 (d, *J* = 8.9 Hz, 2H), 3.91 (s, 3H).

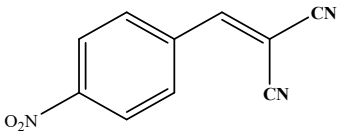
^{13}C NMR (101 MHz, CHLOROFORM-*D*) δ 164.60, 158.72, 133.26, 123.77, 114.91, 114.24, 113.16, 78.81，55.60.



3d: 2-(4-(trifluoromethyl) benzylidene) malononitrile (PE: EA=100:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.02 (d, *J* = 8.2 Hz, 2H), 7.85 (s, 1H), 7.81 (d, *J* = 8.3 Hz, 2H).

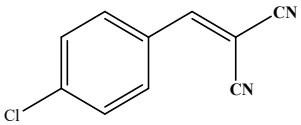
^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.20, 135.64, 133.80, 130.88, 126.79, 126.75, 126.71, 126.67, 121.84, 113.10, 112.02, 86.15.



3e: 2-(4-nitrobenzylidene)malononitrile (PE:EA=20:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.39 (d, *J* = 6.9 Hz, 2H), 8.08 (d, *J* = 6.9 Hz, 2H), 7.89 (s, 1H).

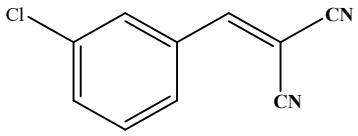
^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.33, 150.76，136.23, 131.79, 125.12, 113.08, 112.05, 87.98



3f: 2-(4-chlorobenzylidene)malononitrile (PE:EA=100:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.86 (d, *J* = 8.8 Hz, 2H), 7.74 (s, 1H), 7.52 (d, *J* = 8.7 Hz, 2H).

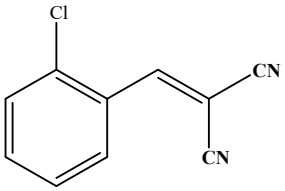
^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.14, 140.98, 131.67, 129.90, 129.06, 113.26, 112.16, 83.11



3g: 2-(3-chlorobenzylidene) malononitrile (PE: EA=100:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.84 (d, *J* = 6.8 Hz, 2H), 7.73 (s, 1H), 7.60 (d, *J* = 8.6 Hz, 1H), 7.50 (t, *J* = 8.3 Hz, 1H).

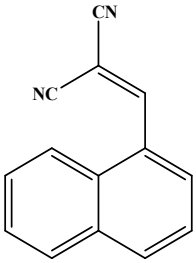
^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.05, 135.60, 134.19, 132.09, 130.71, 130.26, 128.15, 113.01, 111.84, 84.44



3h: 2-(2-chlorobenzylidene) malononitrile (PE: EA=100:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.26 (s, 1H), 8.18 (d, *J* = 7.6, 3.9 Hz, 1H), 7.55 (qd, *J* = 4.4, 3.6, 2.1 Hz, 2H), 7.48 – 7.40 (m, 1H).

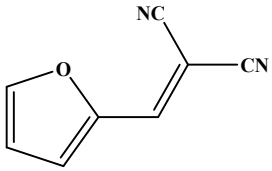
^{13}C NMR (101 MHz, Chloroform-*d*) δ 155.87, 136.09, 134.83, 130.46, 129.25, 128.78, 127.56, 112.99, 111.68, 85.47.



3j: 2-(naphthalen-1-ylmethylene) malononitrile (PE: EA=100:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.67 (s, 1H), 8.28 (d, *J* = 7.4 Hz, 1H), 8.12 (d, *J* = 8.3 Hz, 1H), 7.96 (d, *J* = 8.5 Hz, 2H), 7.69 (t, *J* = 6.9 Hz, 1H), 7.67 – 7.58 (m, 2H).

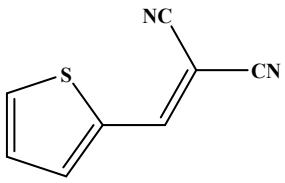
^{13}C NMR (101 MHz, Chloroform-*d*) δ 157.58, 134.77, 133.34, 130.88, 129.26, 128.40, 128.36, 127.31, 127.12, 125.22, 122.11, 113.54, 112.32, 84.97



3k: 2-(furan-2-ylmethylene) malononitrile (PE: EA=80:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.80 (d, *J* = 1.7 Hz, 1H), 7.52 (s, 1H), 7.35 (d, *J* = 3.8 Hz, 1H), 6.74 – 6.69 (m, 1H).

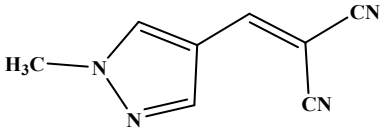
^{13}C NMR (101 MHz, CHLOROFORM-*D*) δ 149.74, 148.15, 143.22, 123.77, 114.58, 113.95, 112.74, 77.50



3l: 2-(thiophen-2-ylmethylene) malononitrile (PE: EA=60:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.92 – 7.84 (m, 2H), 7.79 (d, *J* = 4.1 Hz, 1H), 7.29 – 7.22 (m, 1H).

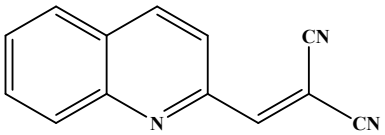
^{13}C NMR (101 MHz, Chloroform-*d*) δ 150.99, 138.11, 136.79, 135.16, 128.83, 113.60, 112.76, 77.97



3m: 2-((1-methyl-1H-pyrazol-4-yl) methylene) malononitrile (PE: EA=5:1)

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.21 (s, 1H), 7.97 (s, 1H), 7.68 (s, 1H), 3.99 (s, 3H).

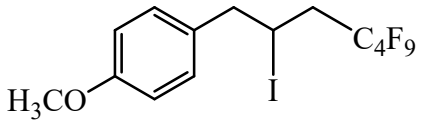
^{13}C NMR (101 MHz, Chloroform-*d*) δ 151.03, 142.63, 133.43, 116.15, 113.96, 113.83, 77.84, 39.91.



3n: 2-(quinolin-2-ylmethylene) malononitrile (PE: EA=20:1)

^{1}H NMR (400 MHz, CDCl3) δ 8.34 (d, J = 8.2 Hz, 1H), 8.24 (d, J = 7.9 Hz, 1H), 7.99 (s, 1H), 7.90 (d, J = 8.3 Hz, 1H), 7.85 (s, 1H), 7.77 (d, J = 8.4 Hz, 1H), 7.72 (d, J = 6.9 Hz, 1H);

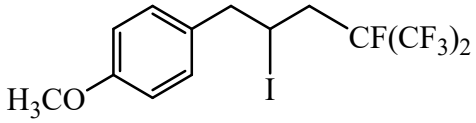
^{13}C NMR (150 MHz, CDCl3) δ 157.67, 148.52, 148.34, 137.72, 131.33, 130.67, 129.91, 129.29, 127.80, 122.33, 113.85, 112.31, 87.93;[4]



6a: 1-methoxy-4-(4,4,5,5,6,6,7,7,7-nonafluoro-2-iodoheptyl) benzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.15 – 7.08 (m, 2H), 6.91 – 6.81 (m, 2H), 4.42 (m,1H), 3.81 (s, 3H), 3.18 (m, 2H), 2.88 (m,2H).

^{13}C NMR (101 MHz, CHLOROFORM-*D*) δ 158.92, 130.78, 130.18, 114.10, 77.48, 77.16, 76.84, 55.37, 46.32, 40.58, 20.35.

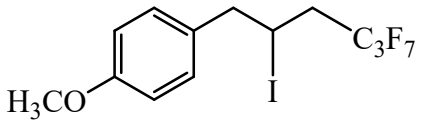
^{19}F NMR (376 MHz, Chloroform-*d*) δ -80.90 (m, 3F), -111.68 – -114.40 (m, 2F), -124.44(m, 2F)，-125.83 (m，2F).



6b: 1-methoxy-4-(4,5,5,5-tetrafluoro-2-iodo-4-(trifluoromethyl)pentyl)benzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.18 – 7.10 (m, 2H), 6.92 – 6.85 (m, 2H), 4.42 (m, 1H), 3.81 (s, 3H), 3.19 (m, 2H), 2.97 – 2.77 (m, 2H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.61, 130.46, 129.86, 117.29-108.45(m,-C_3F_7), 113.77, 55.03, 45.98, 40.30, 40.09, 39.88, 20.05.

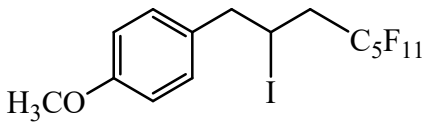
^{19}F NMR (376 MHz, Chloroform-*d*) δ -80.24(m, 3F), -112.39 – -116.82 (m,2F), -127.79(m, 2F).



6c: 1-(4,4,5,5,6,6,6-heptafluoro-2-iodohexyl)-4-methoxybenzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.13 – 7.08 (m, 2H), 6.89 – 6.85 (m, 2H), 4.41 (m, 1H), 3.81 (s, 3H), 3.21 (m, 1H), 3.09 (m, 1H), 2.98 – 2.86 (m, 2H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.61, 130.57, 129.82, 122.13-118.75(m,1C, -CF), 113.74, 93.11-90.41(m, 2C, -2CF_3), 55.03, 46.43, 46.40, 38.58, 38.40, 22.50

^{19}F NMR (376 MHz, Chloroform-*d*) δ -76.08(s,3F), -77.05(s,3F), -185.15(m,3F)

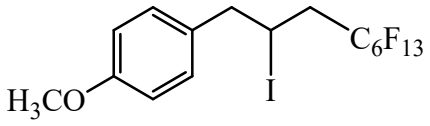


6d: 1-methoxy-4-(4,4,5,5,6,6,7,7,8,8,8-undecafluoro-2-iodooctyl) benzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.15 – 7.09 (m, 2H), 6.90 – 6.86 (m, 2H), 4.43 (m, 1H),

3.81 (s, 3H), 3.19 (m, 2H), 2.88 (m, 2H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.94, 130.80, 130.19, 120.52-110.70(m,5C, -C_5F_{11}), 114.10, 55.34, 46.33, 40.89, 40.68, 40.47, 20.40.

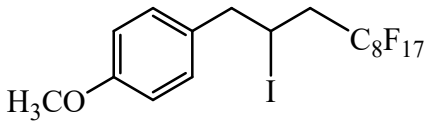
19F NMR (376 MHz, Chloroform-*d*) δ -80.73(s,3F), -111.39 – -114.25 (m,2F), -122.51(m,2F), -123.74(m,2F), -126.20(m,2F).



6e: 1-methoxy-4-(4,4,5,5,6,6,7,7,8,8,9,9,9-tridecafluoro-2-iodononyl) benzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.16 – 7.10 (m, 2H), 6.92 – 6.85 (m, 2H), 4.43 (m, 1H), 3.81 (s, 3H), 3.26 – 3.10 (m, 2H), 2.98 – 2.77 (m, 2H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.63, 130.49, 129.87, 120.25-110.46(m,6C, -C_6F_{13}), 113.78, 55.02, 46.01, 40.60, 40.39, 40.18, 20.11.

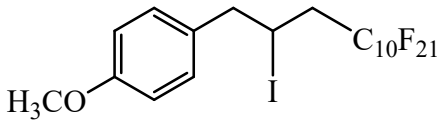
^{19}F NMR (376 MHz, Chloroform-*d*) δ -80.76, -111.41 – -114.23 (m,2F), -121.74, -122.81, -123.56, -126.09.



6f:1-(4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,11-heptadecafluoro-2-iodoundecyl)-4-methoxybenzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.18 – 7.05 (m, 2H), 6.92 – 6.84 (m, 2H), 4.42 (m, 1H), 3.81 (s, 3H), 3.18 (m, 2H), 2.88 (m, 2H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.96, 130.82, 130.19, 120.58-107.78(m, 8C, -C_8F_{17}), 114.10, 55.34, 46.34, 40.94, 40.73, 40.52, 20.44

^{19}F NMR (376 MHz, Chloroform-*d*) δ -80.76 – -81.27(m,3F), -111.41 – -114.44 (m,2F), -121.53 (m,2F), -121.87 (m,4F), -122.69 (m,2F), -123.51 (m,2F), -126.10 (m,2F).

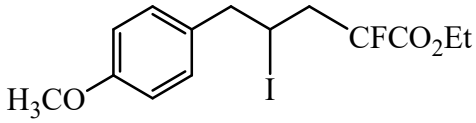


6g:1-(4,4,5,5,6,6,7,7,8,8,9,9,10,10,11,11,12,12,13,13,13-henicosafluoro-2-iodotridecyl)-4-methoxybenzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.14 – 7.11 (m, 2H), 6.89 – 6.86 (m, 2H), 4.46-4.39 (m, 1H), 3.81 (s, 3H), 3.25 – 3.10 (m, 2H), 2.96 – 2.79 (m, 2H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 158.96, 130.84, 130.19, 118.68-110.90(m,10C,

-$C_{10}F_{21}$), 114.10, 55.33, 46.32, 40.96, 40.75, 40.54, 20.48

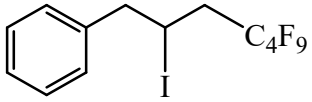
19F NMR (376 MHz, Chloroform-*d*) δ -80.83(s,3F) -111.36 – -114.21 (m,2F), -121.56 – -121.96(m,10F), -122.73, -123.56, -126.15.



6h: ethyl 2-fluoro-4-iodo-5-(4-methoxyphenyl) pentanoate ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.15 – 7.08 (m, 2H), 6.89 – 6.84 (m, 2H), 4.35 – 4.30 (m, 2H), 3.80 (s, 2H), 3.22 – 3.11 (m, 2H), 2.97 – 2.70 (m, 2H), 1.36 (t, *J* = 7.2 Hz, 3H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 163.56, 163.24, 162.92, 158.48, 130.70, 129.86, 117.52- 112.50 (t,-CF_2), 113.71, 63.08, 55.02, 46.16, 44.12, 43.89, 43.65, 22.59, 13.68.

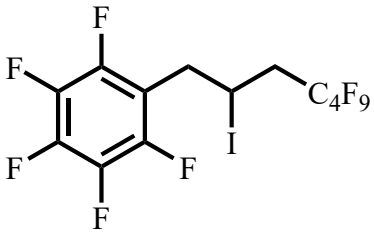
^{19}F NMR (376 MHz, Chloroform-*d*) δ -100.33 – -102.60 (m,1F), -104.87 – -107.72 (m,1F).



6i: (4,4,5,5,6,6,7,7,7-nonafluoro-2-iodoheptyl) benzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.37 (m, 1H), 7.36 – 7.29 (m, 2H), 7.24 – 7.19 (m, 2H), 4.48 (m, 1H), 3.32 (m, 1H), 3.21 (m, 1H), 3.01 – 2.79 (m, 2H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 138.40, 128.79, 128.48, 127.19, 120.10-115.69(m,4C, -C_4F_9), 46.83, 40.72, 40.52, 40.31, 19.15.

19F NMR (376 MHz, Chloroform-*d*) δ -80.45 – -80.49(m,3F), -110.93 – -114.53 (m,2F), -124.48 – -124.70 (m,2F), -124.73 – -127.11 (m,2F).



6k: 1,2,3,4,5-pentafluoro-6-(4,4,5,5,6,6,7,7,7-nonafluoro-2-iodoheptyl) benzene ^{1}H NMR (400 MHz, Chloroform-*d*) δ 4.55 – 4.47 (m, 1H), 3.45 – 3.26 (m, 2H), 3.14 – 2.79 (m, 2H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 146.21, 143.72, 139.25, 138.75, 136.23, 118.87-112.66(m, 4C, -C_4F_9), 41.83, 41.62, 41.41, 33.58, 14.35.

^{19}F NMR (376 MHz, Chloroform-*d*) δ -80.73 − -81.49(m,3F), -110.94 − -115.06 (m,2F), -124.16 − -124.40(m,2F), -125.60 − -125.88(m,2F), -142.08 − -142.49 (m,2F), -154.31 − -154.86 (m,1F), -161.44 − -161.86 (m,2F).

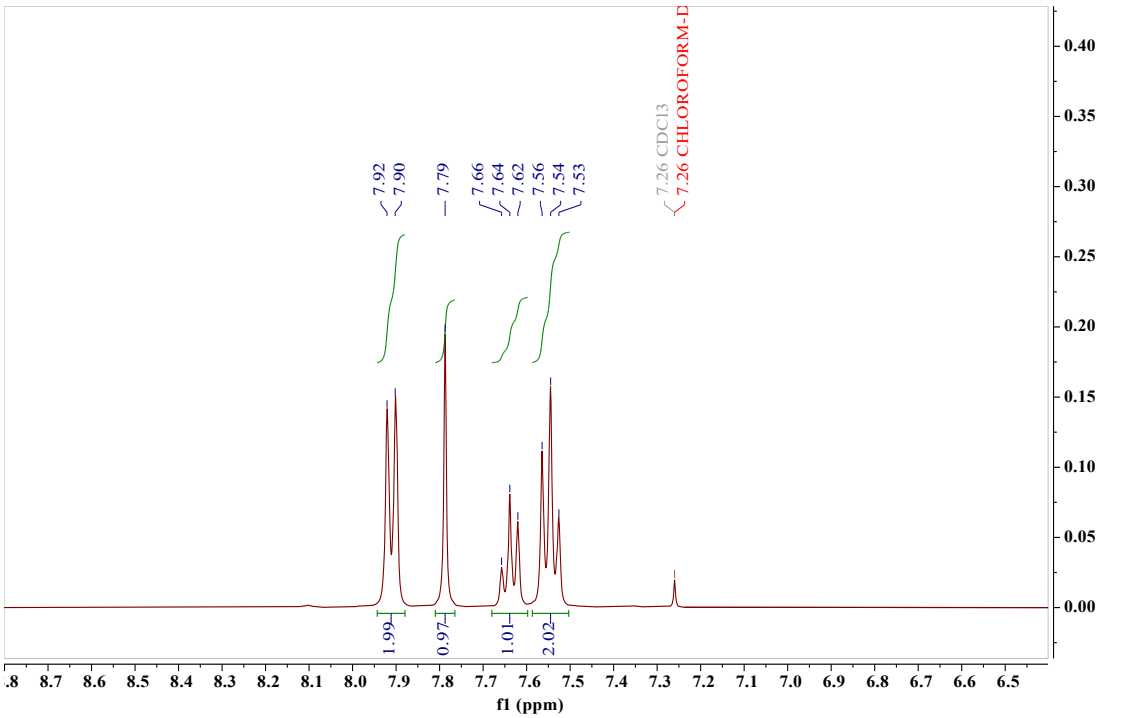


Fig.S 5 ^{1}H NMR spectra of compound 3a

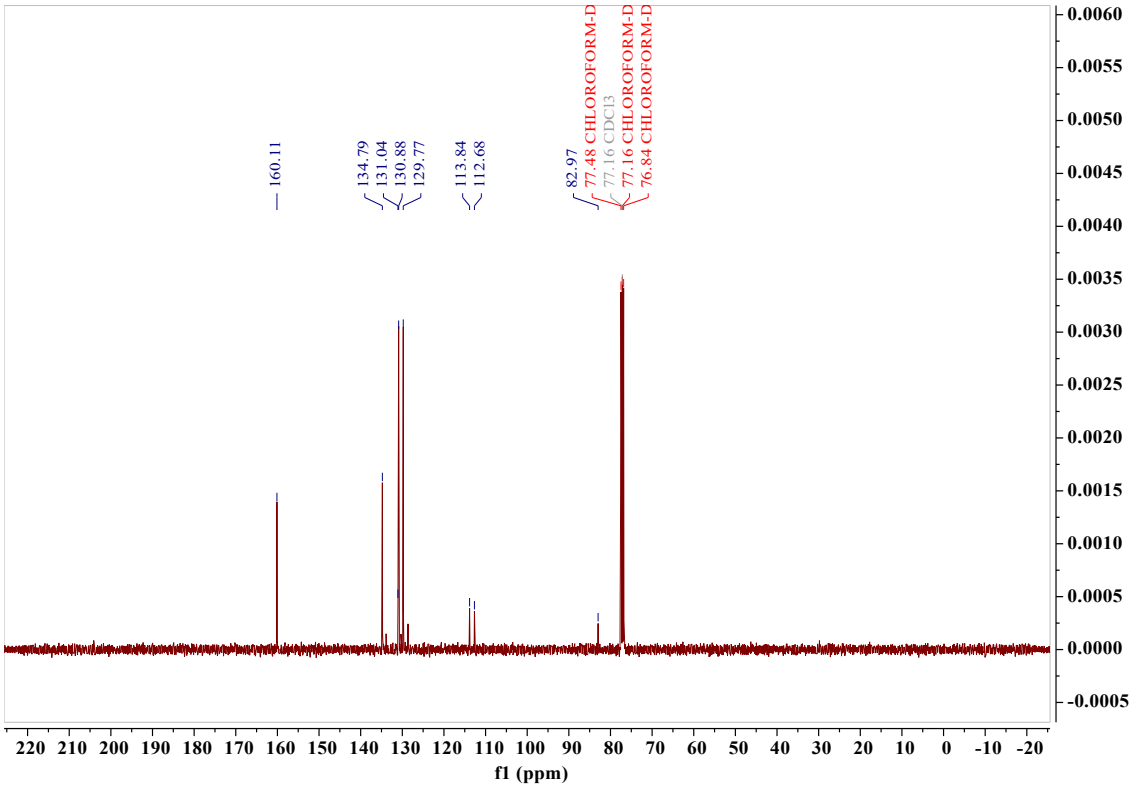


Fig.S 6 ^{13}C NMR spectra of compound 3a

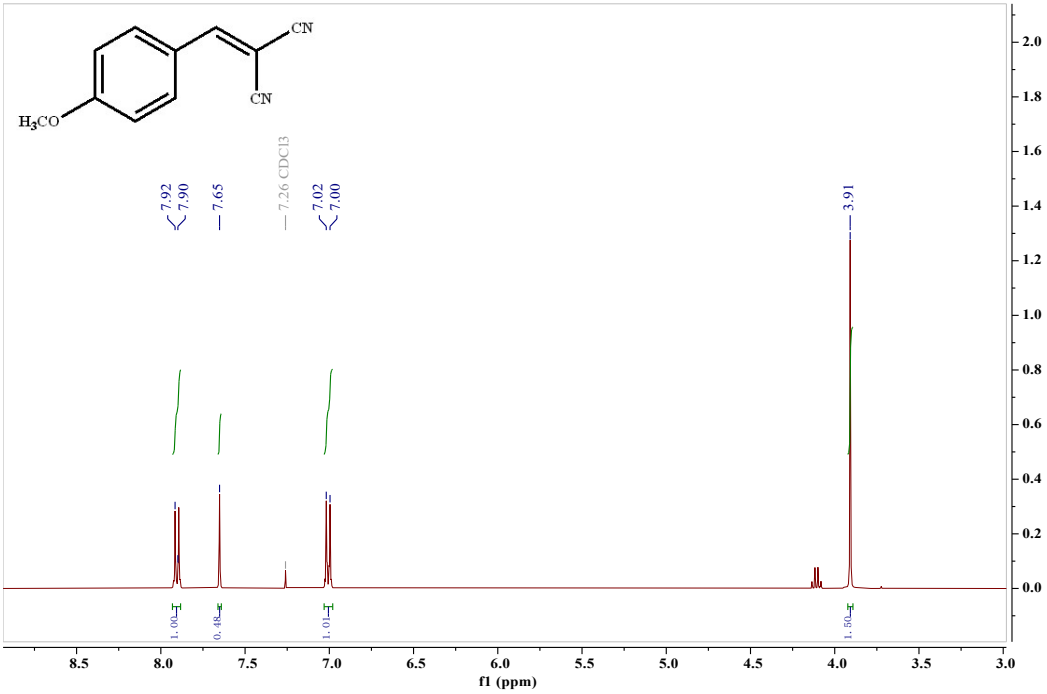


Fig.S 7 ^{1}H NMR spectra of compound 3c

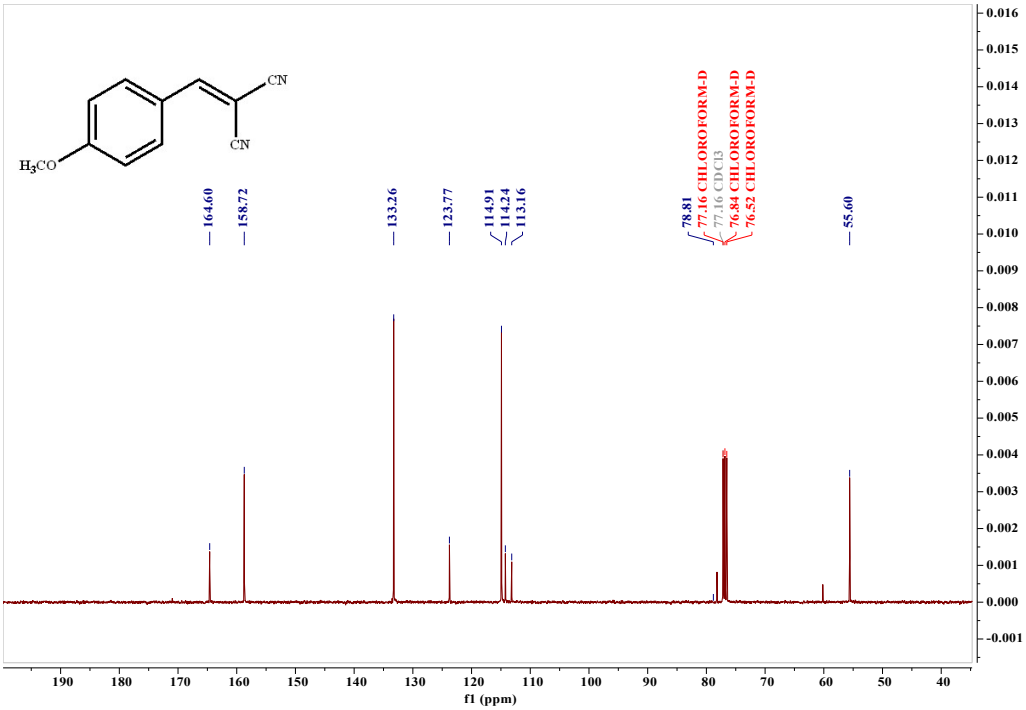


Fig.S 8 ^{13}C NMR spectra of compound 3c

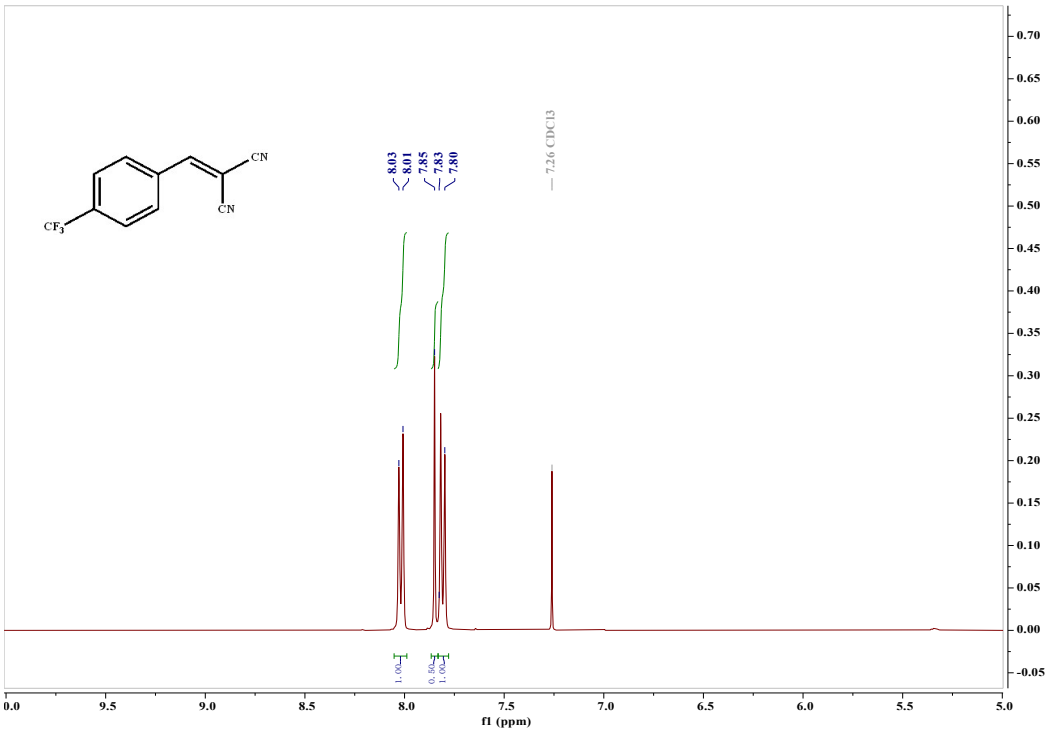


Fig.S 9 ^{1}H NMR spectra of compound 3d

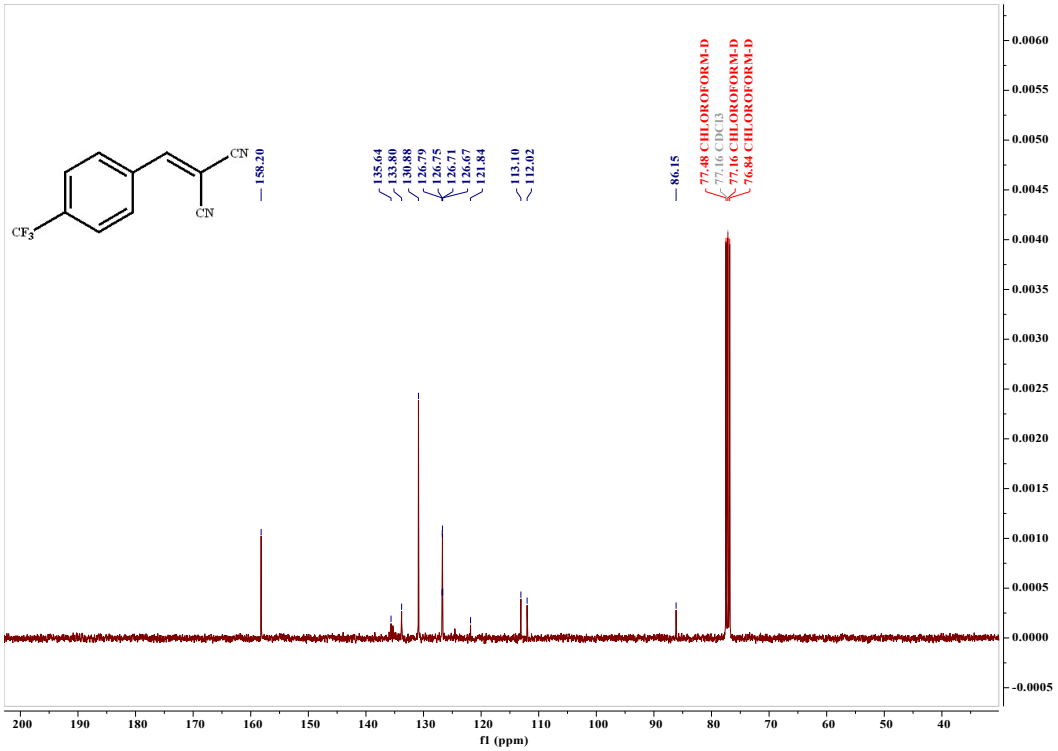


Fig.S 10 ^{13}C NMR spectra of compound 3d

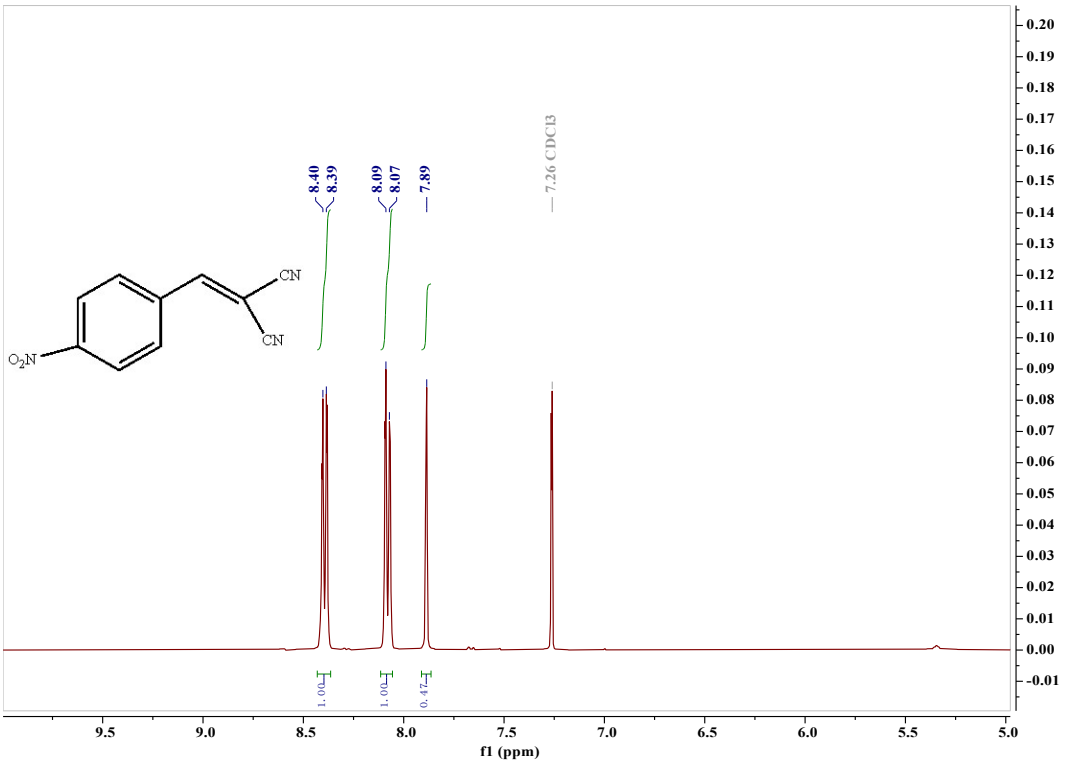


Fig.S 11 ^{1}H NMR spectra of compound 3e

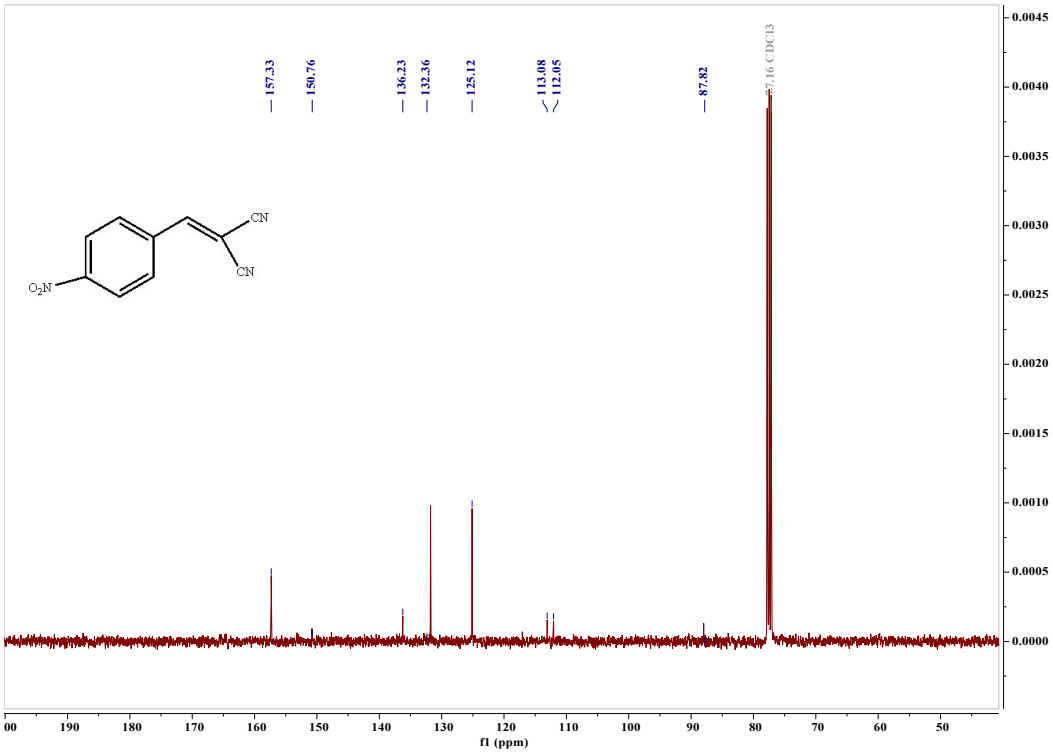


Fig.S 12 ^{13}C NMR spectra of compound 3e

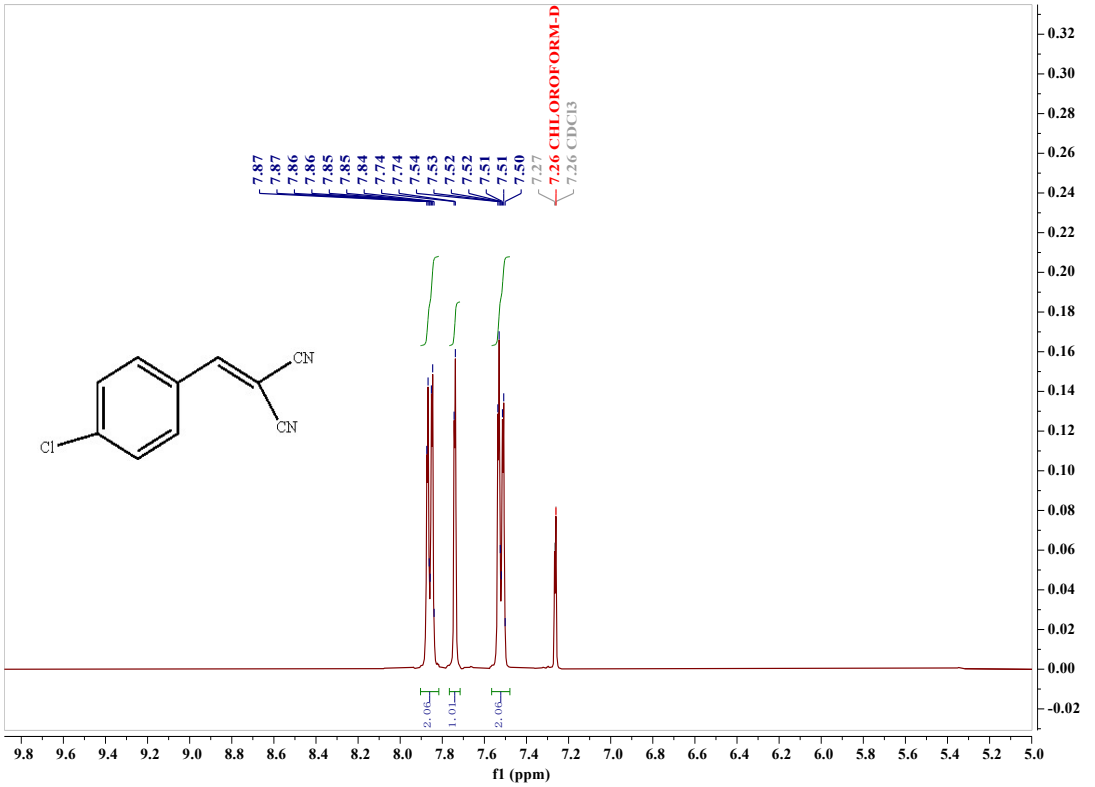


Fig.S 13 ^{1}H NMR spectra of compound 3f

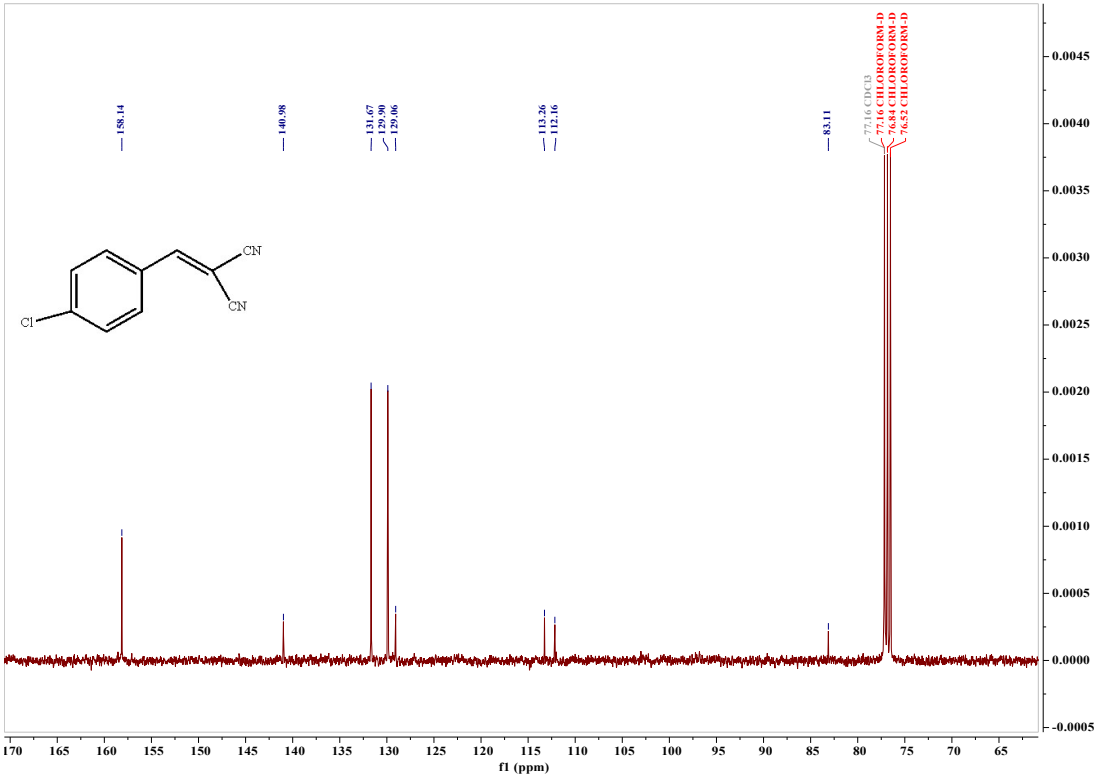


Fig.S 14 ^{13}C NMR spectra of compound 3f

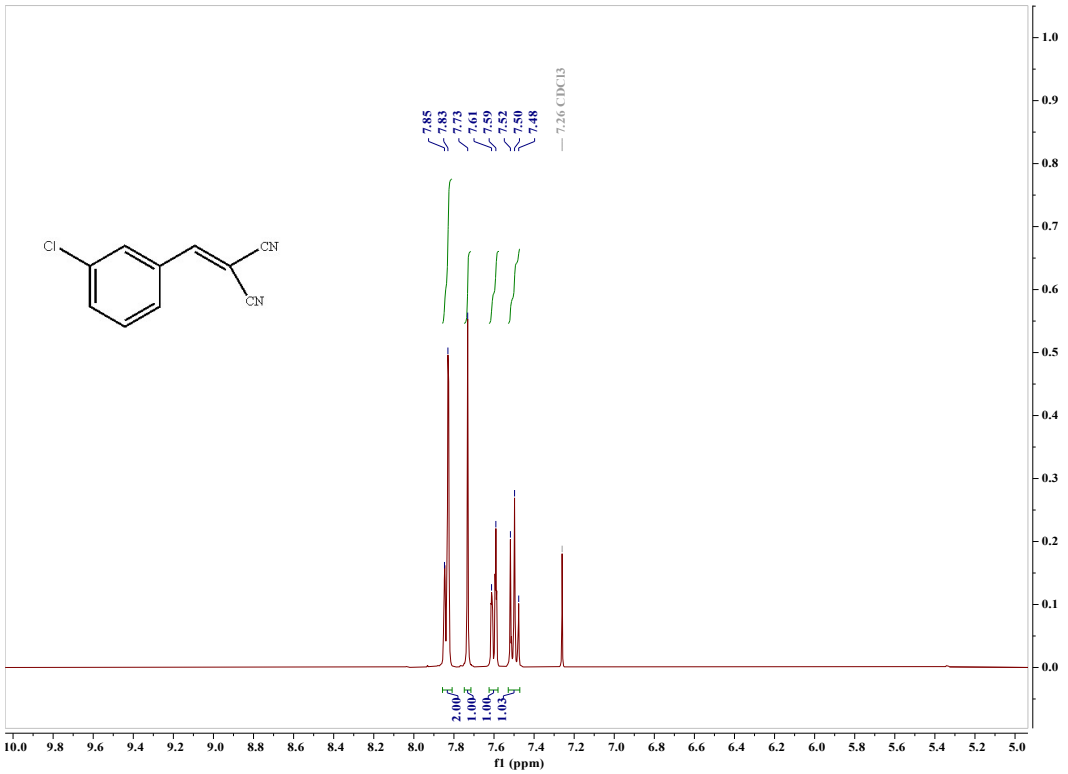


Fig.S 15 ^{1}H NMR spectra of compound 3g

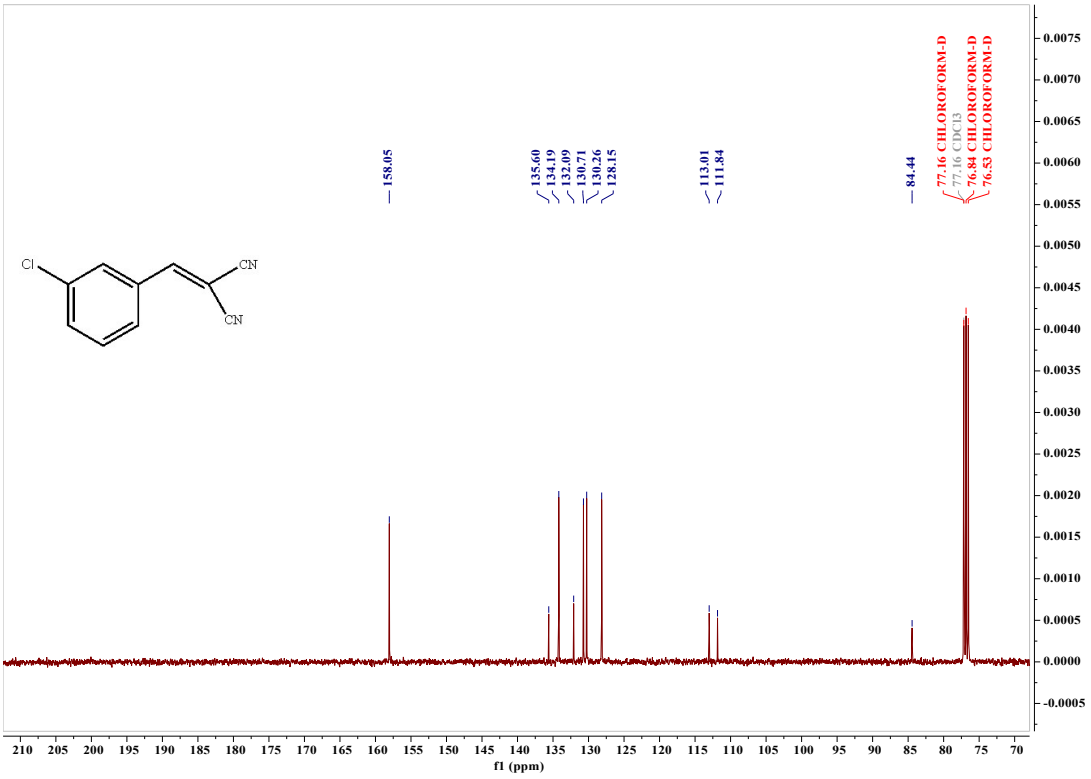


Fig.S 16 ^{13}C NMR spectra of compound 3g

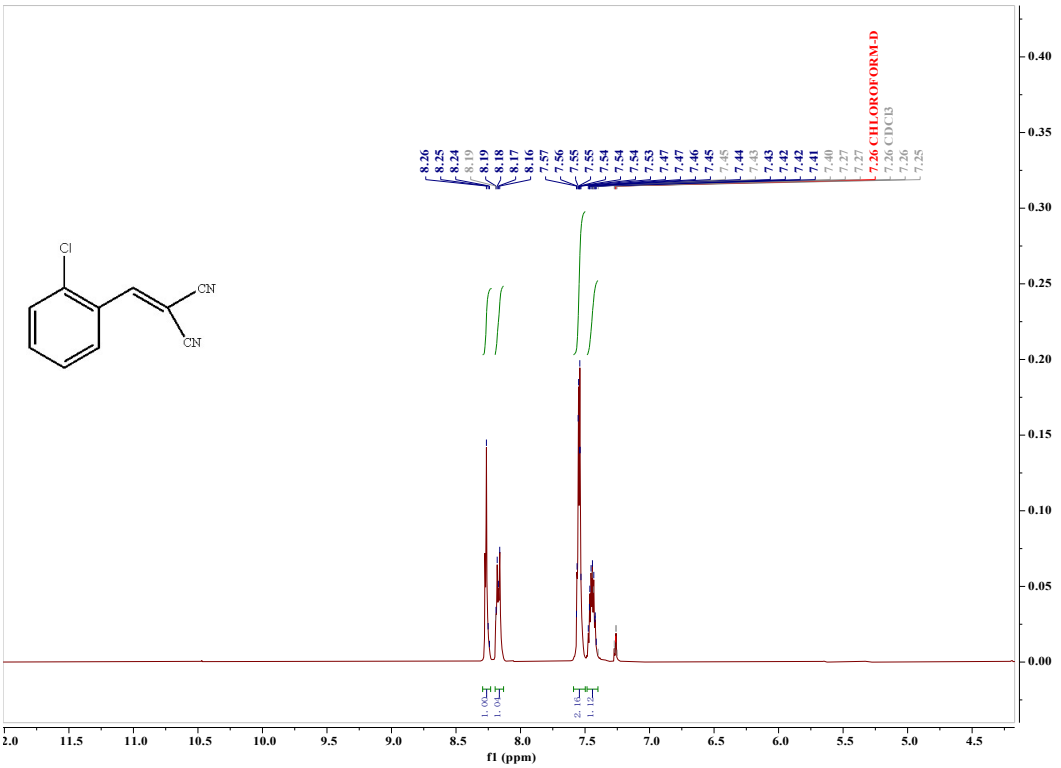


Fig.S 17 ^{1}H NMR spectra of compound 3h

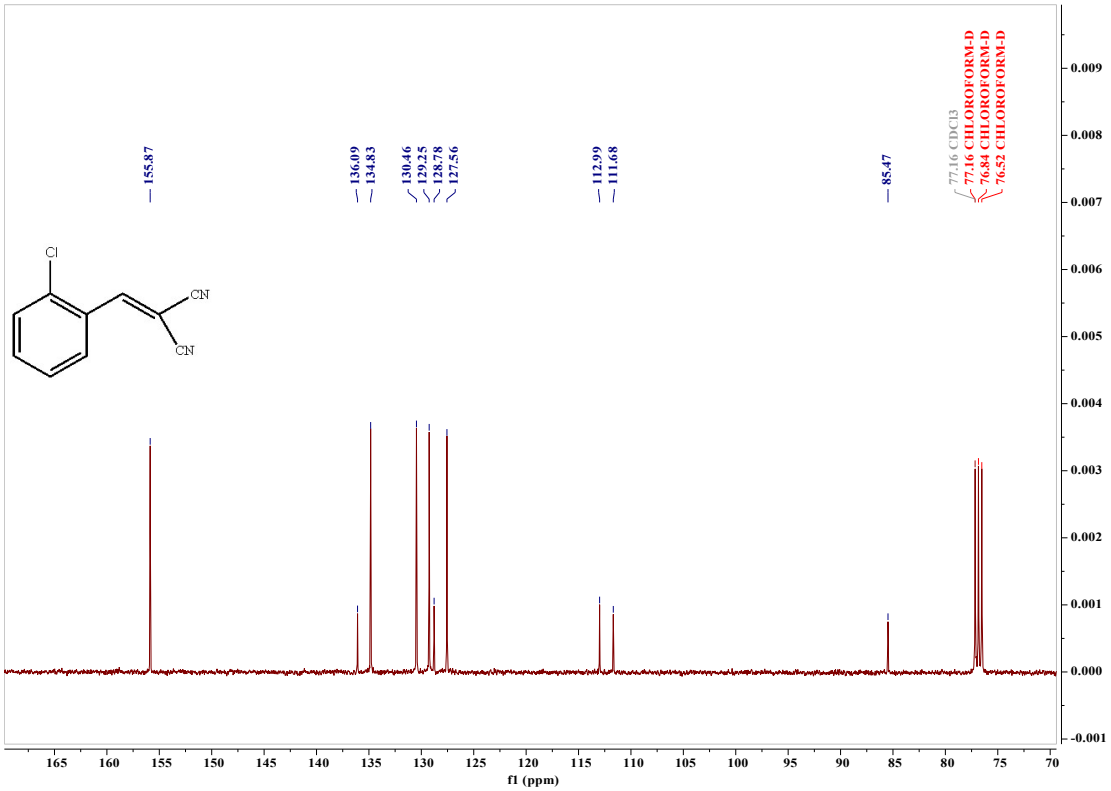


Fig.S 18 ^{13}C NMR spectra of compound 3h

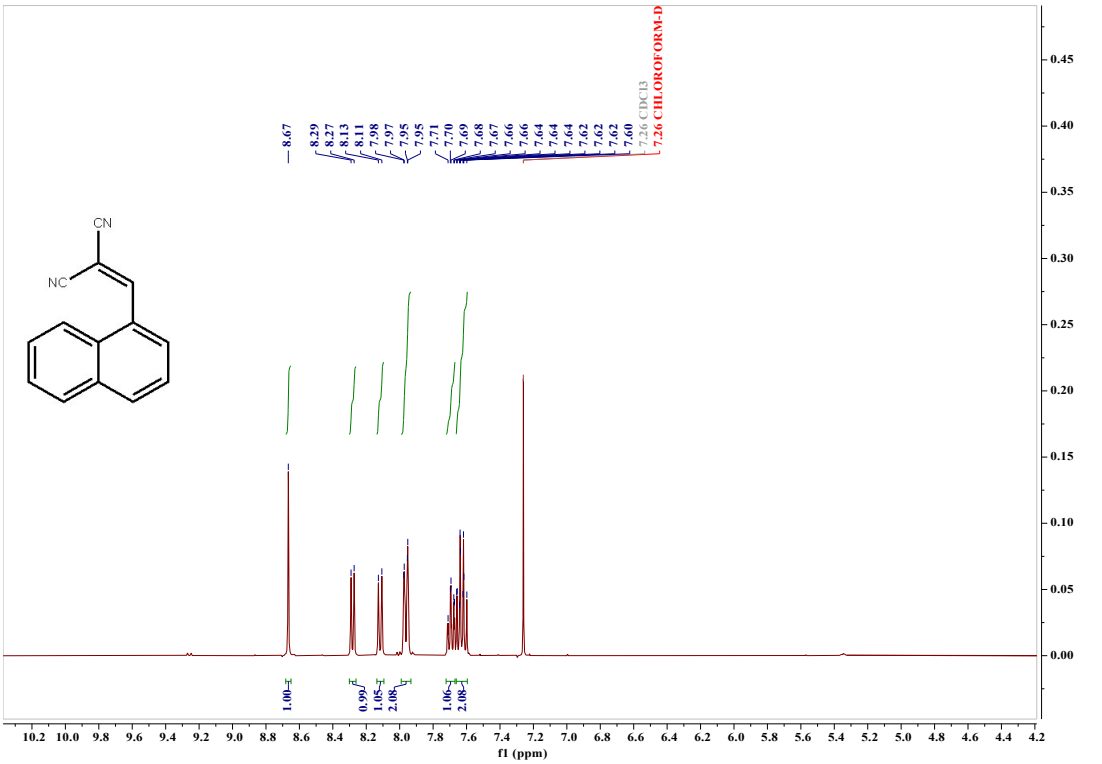


Fig.S 19 ^{1}H NMR spectra of compound 3j

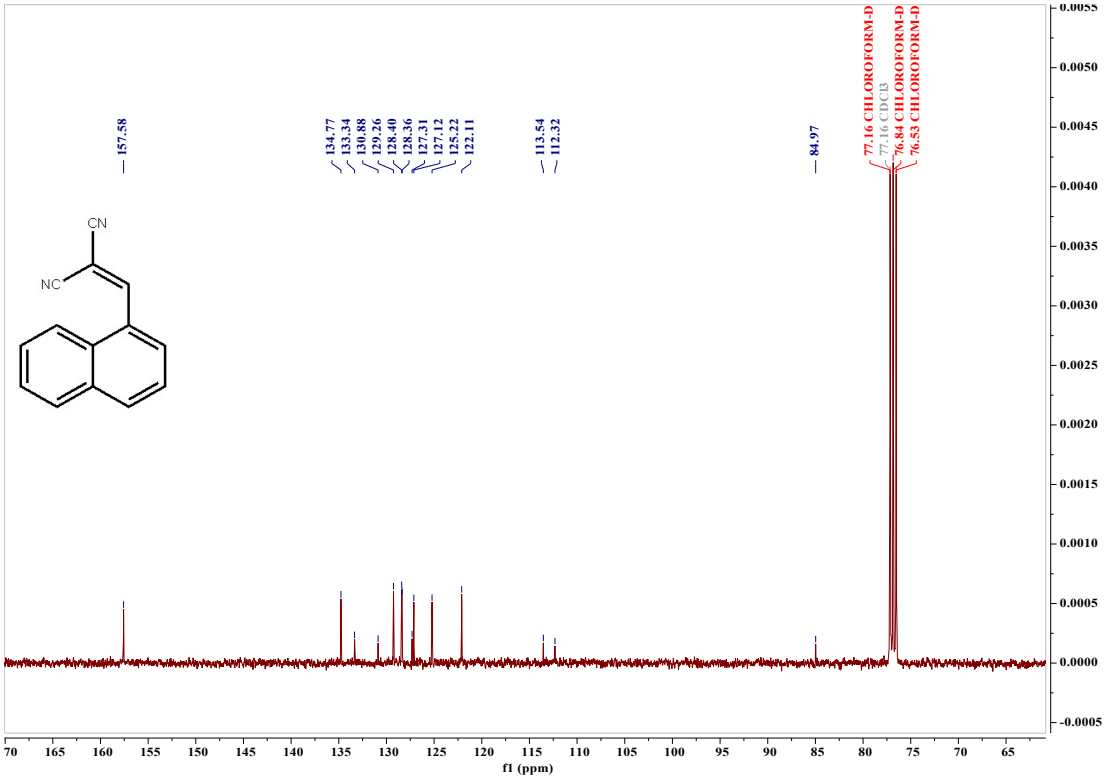


Fig.S 20 ^{13}C NMR spectra of compound 3j

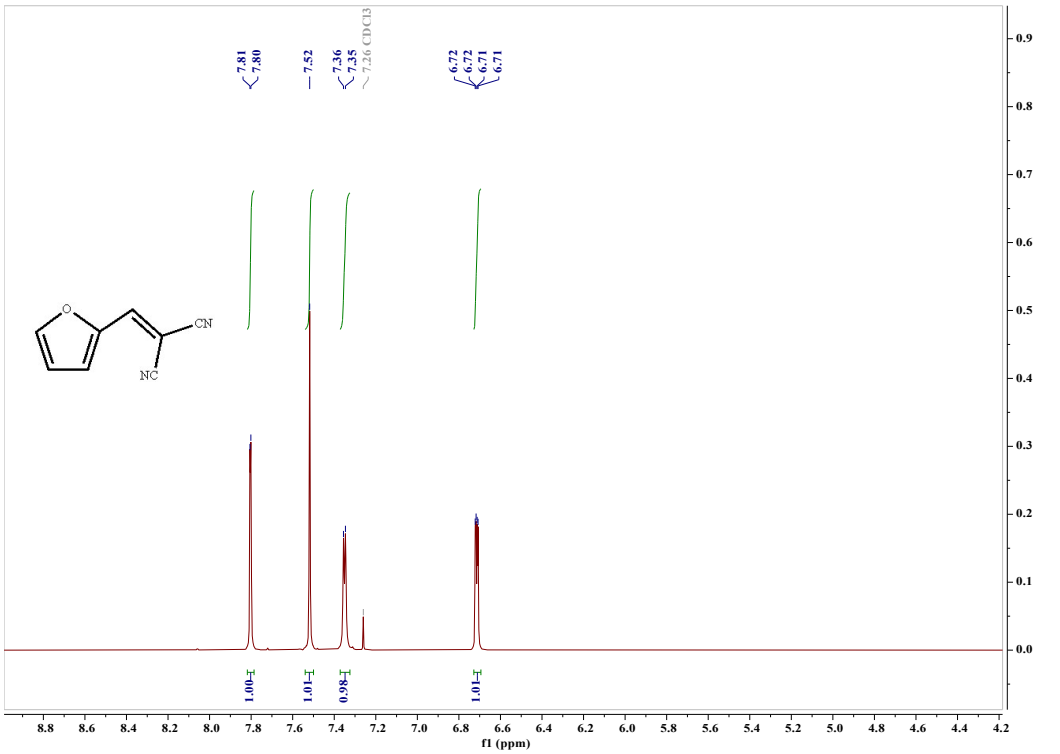


Fig.S 21 ^{1}H NMR spectra of compound 3k

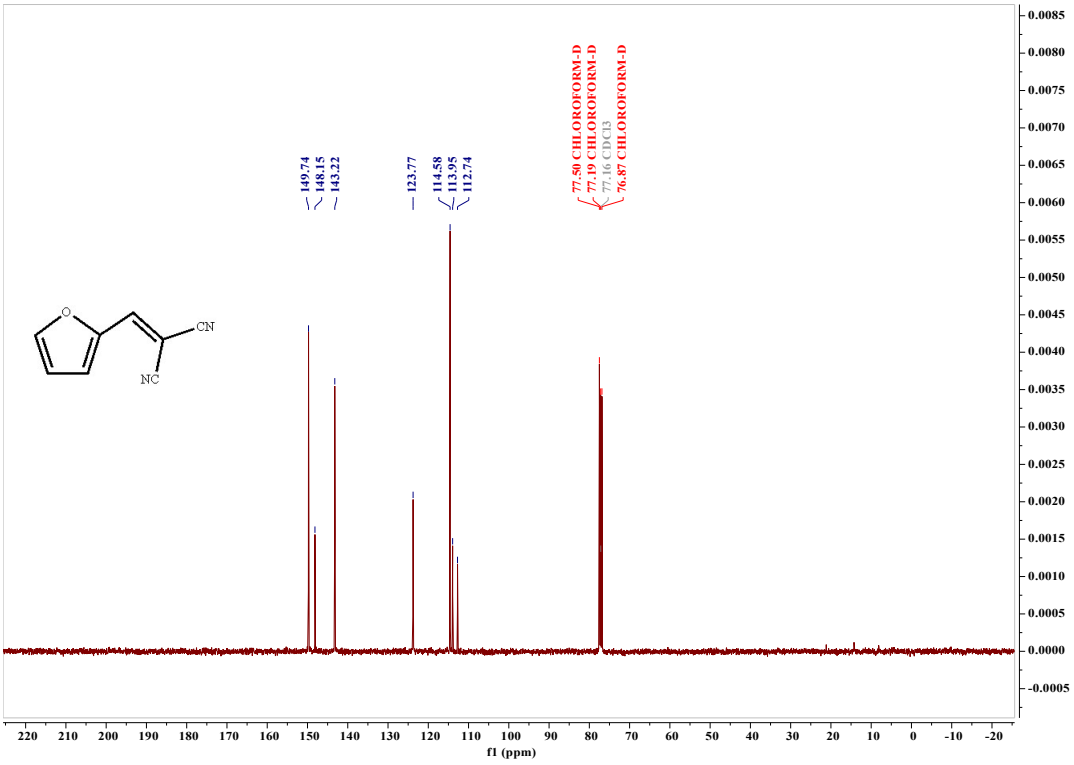


Fig.S 22 ^{13}C NMR spectra of compound 3k

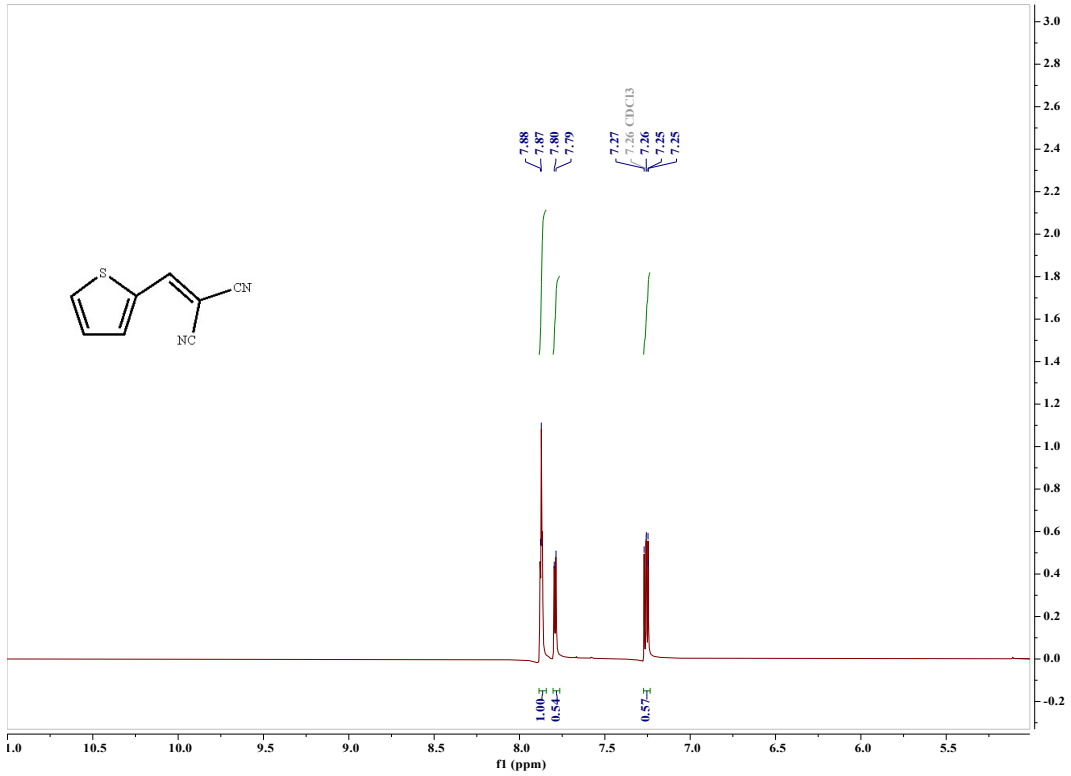


Fig.S 23 ^{1}H NMR spectra of compound 3l

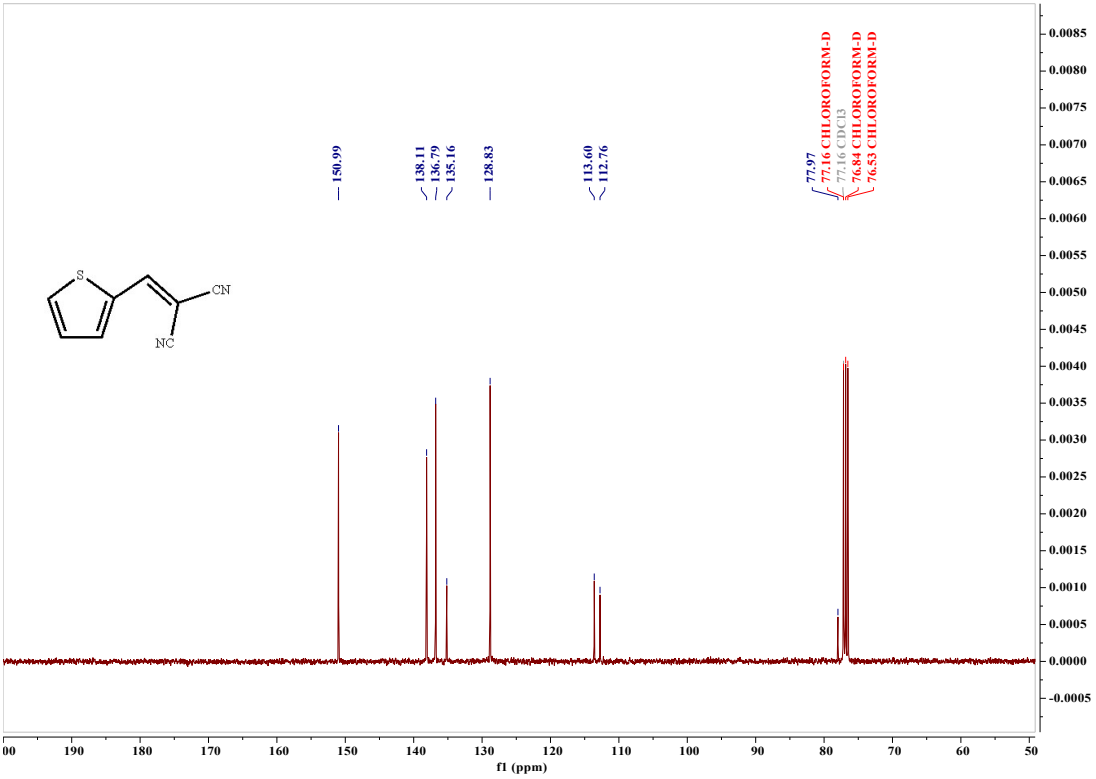


Fig.S 24 ^{13}C NMR spectra of compound 3l

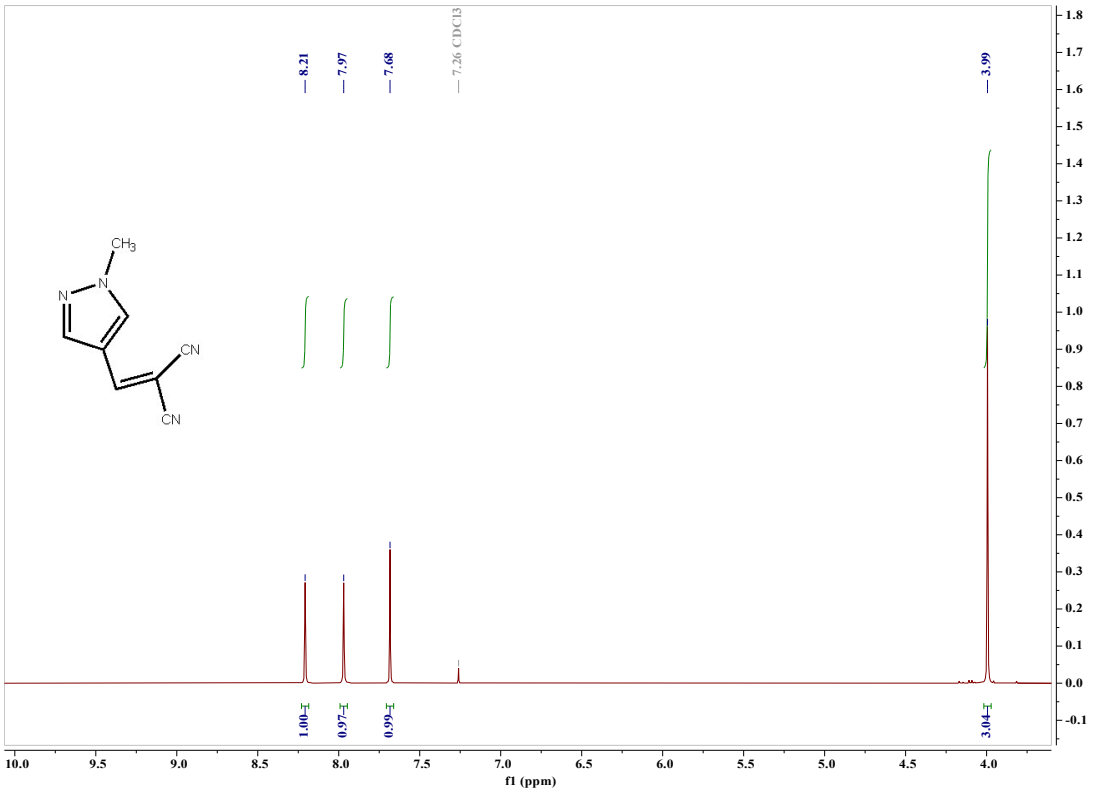


Fig.S 25 ^{1}H NMR spectra of compound 3m

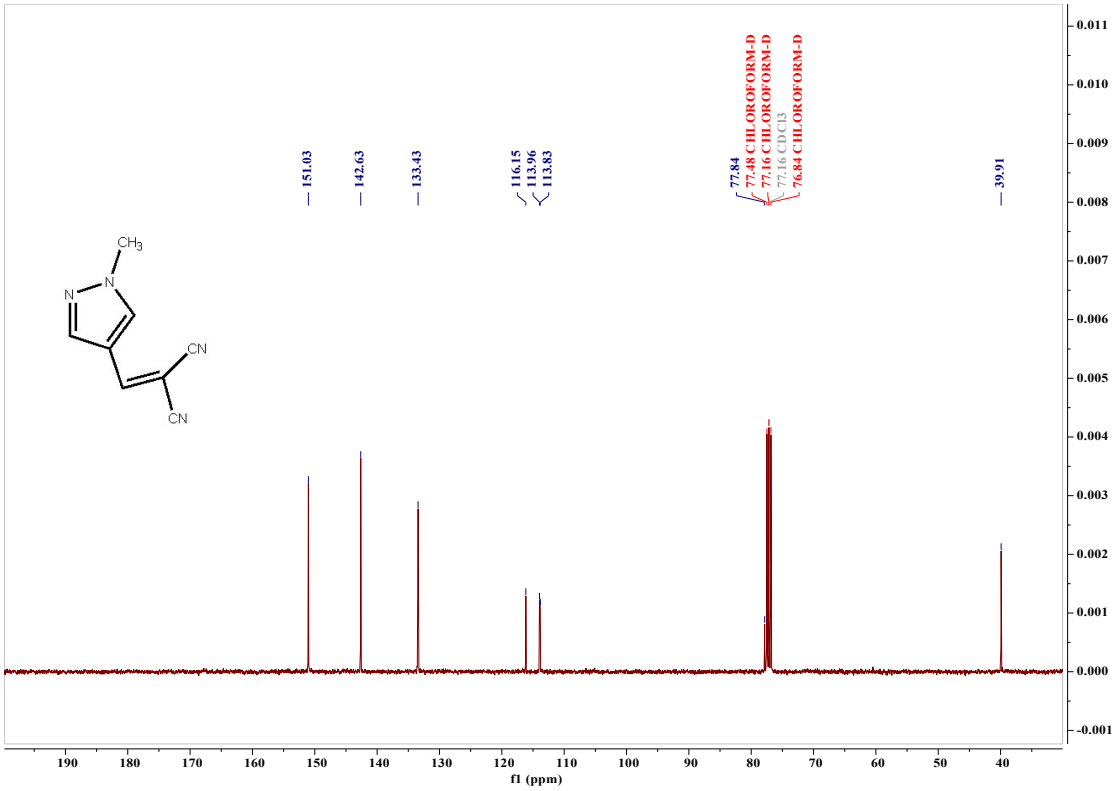


Fig.S 26 ^{13}C NMR spectra of compound 3m

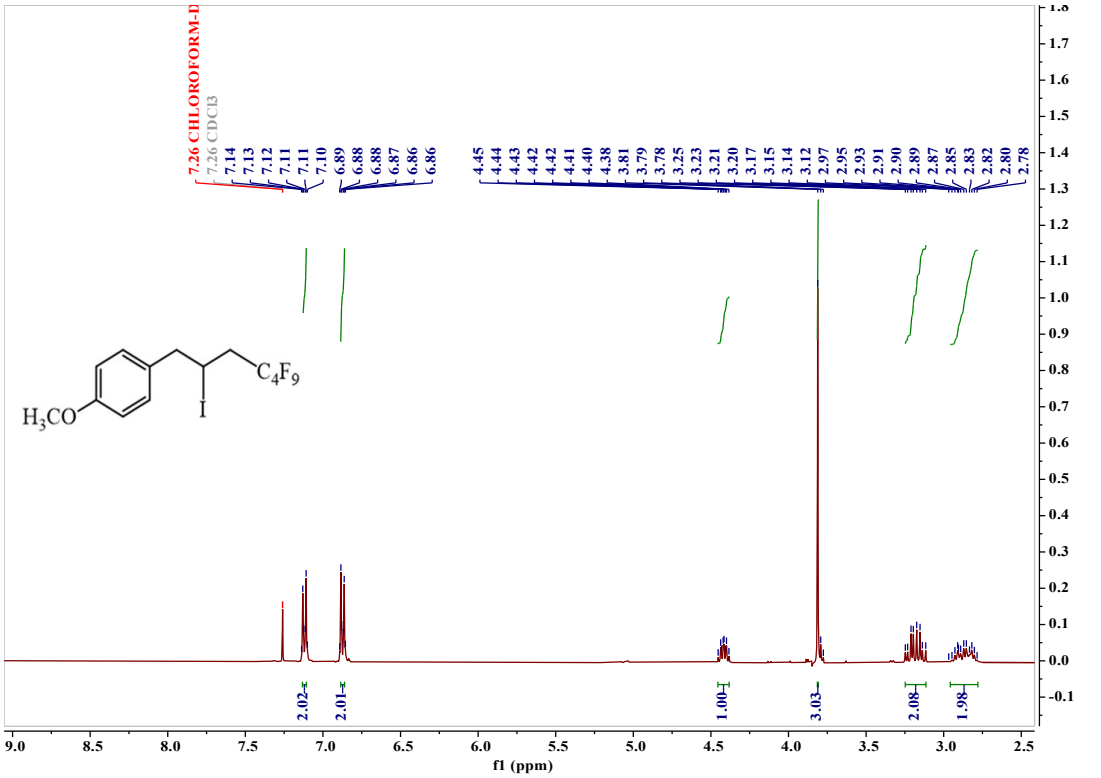


Fig.S 27 ^{1}H NMR spectra of compound 6

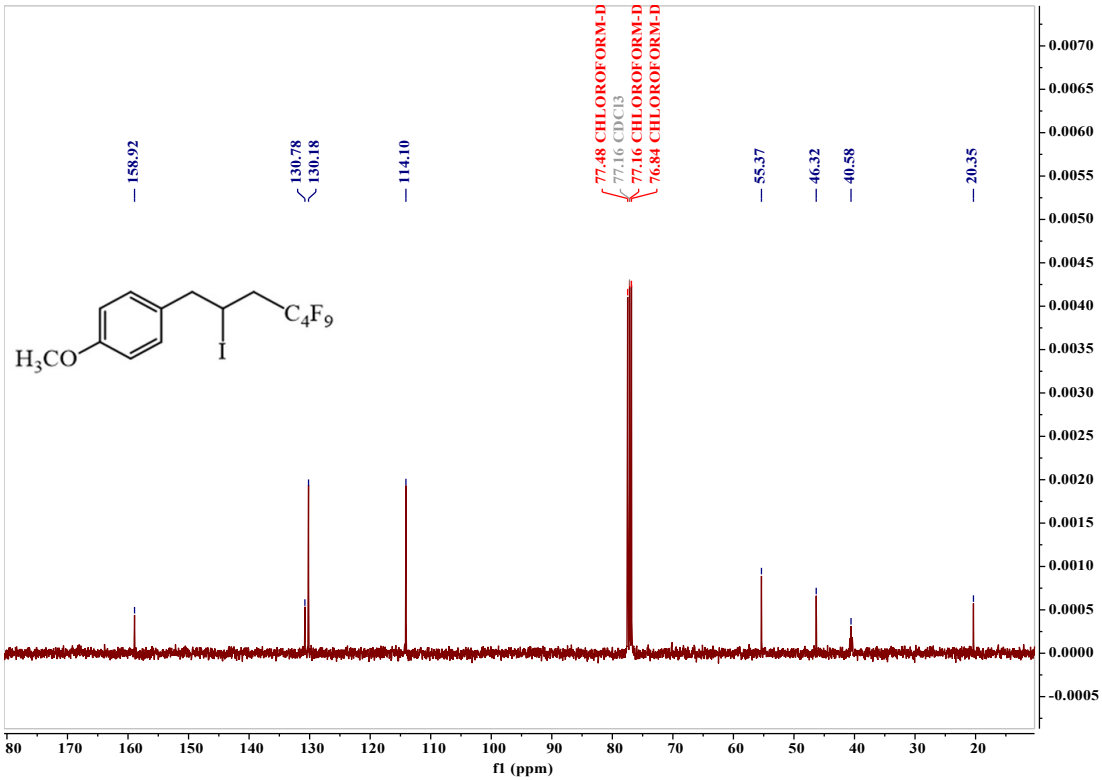


Fig.S 28 ^{13}C NMR spectra of compound 6a

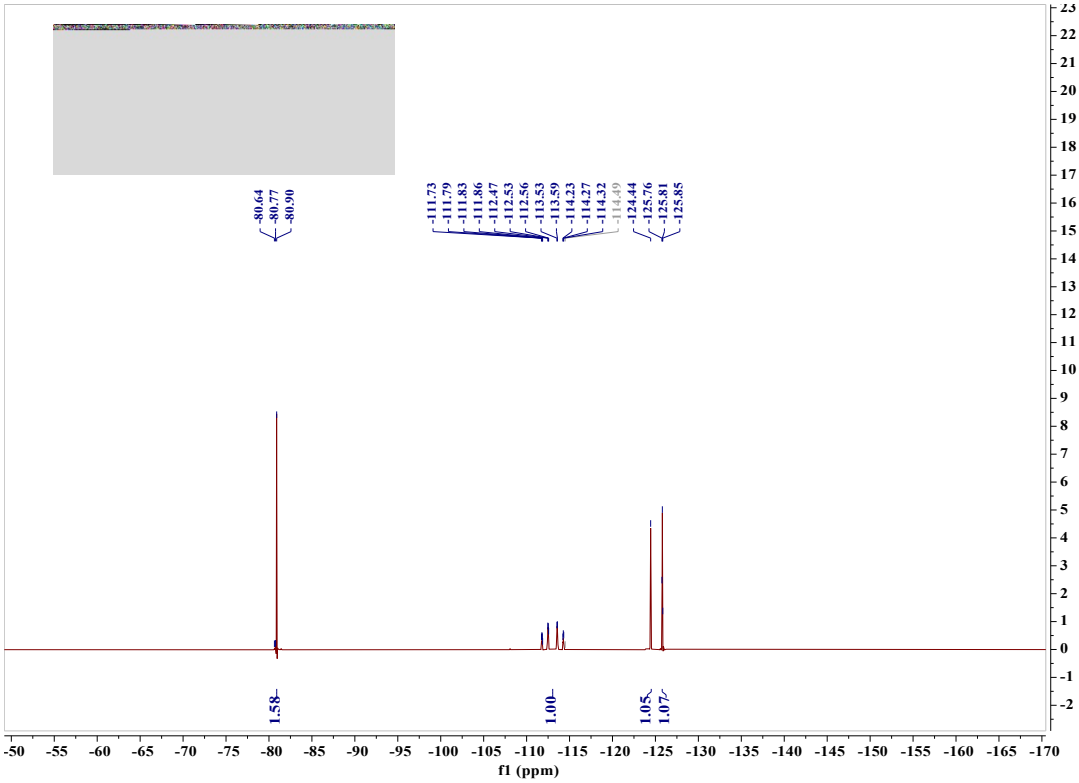


Fig.S 29 ^{19}F NMR spectra of compound 6a

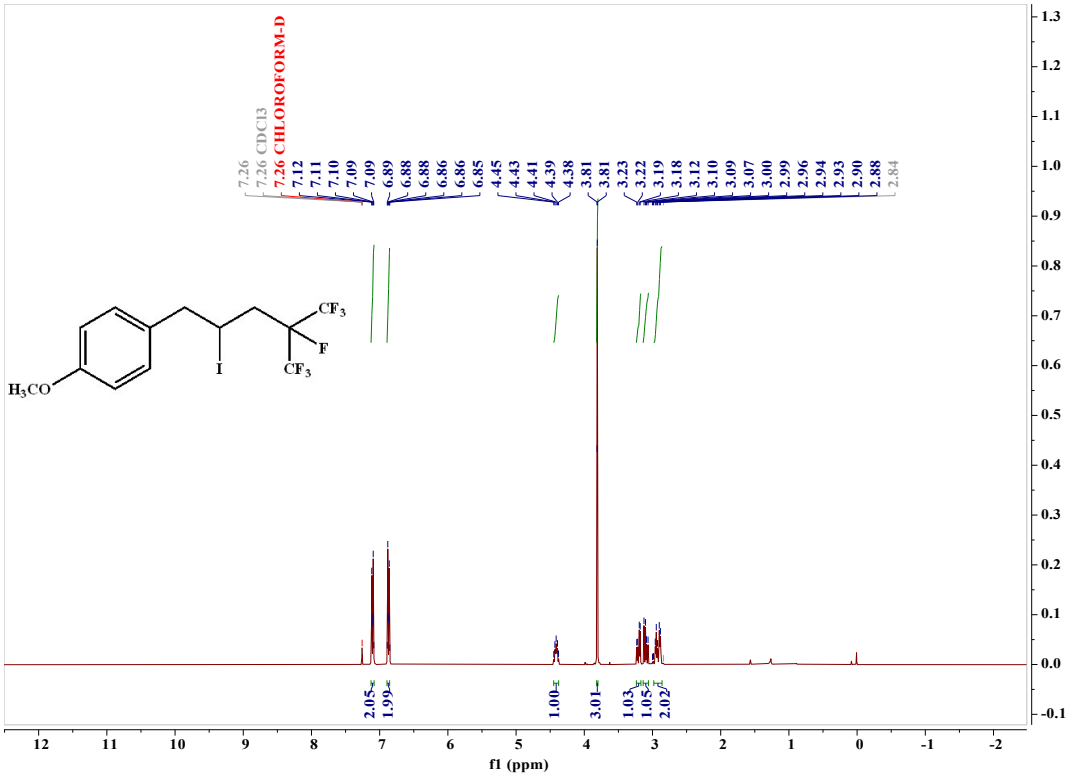


Fig.S 30 ^{1}H NMR spectra of compound 6b

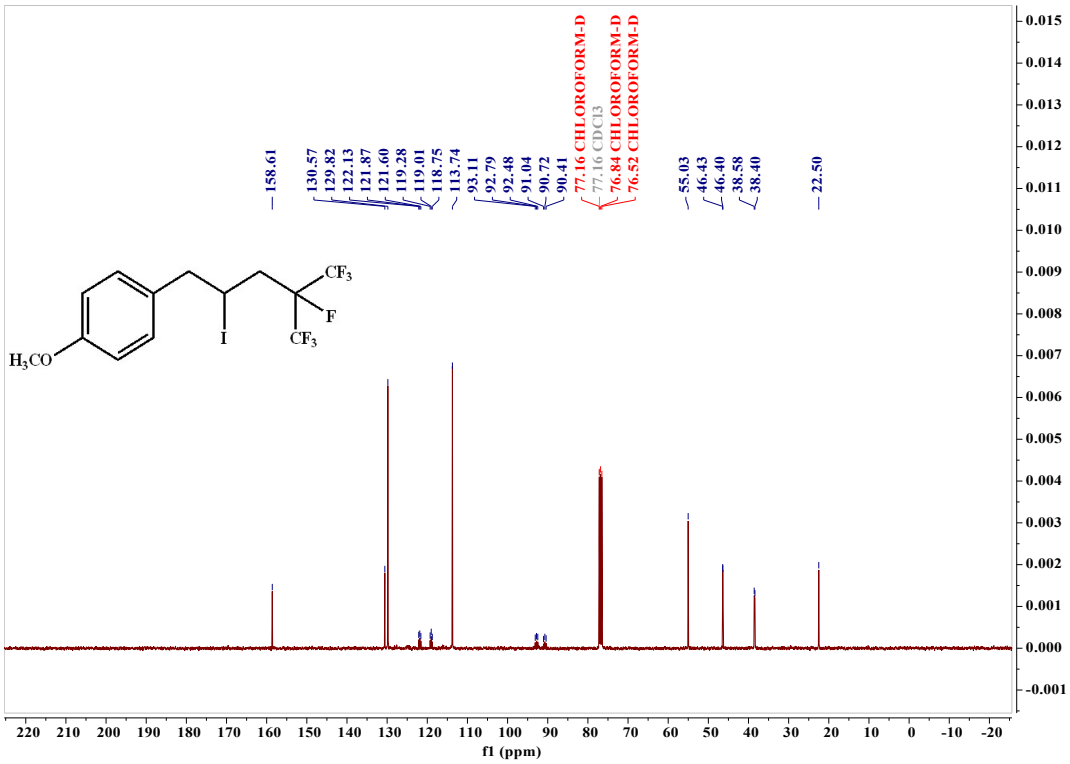


Fig.S 31 ^{13}C NMR spectra of compound 6b

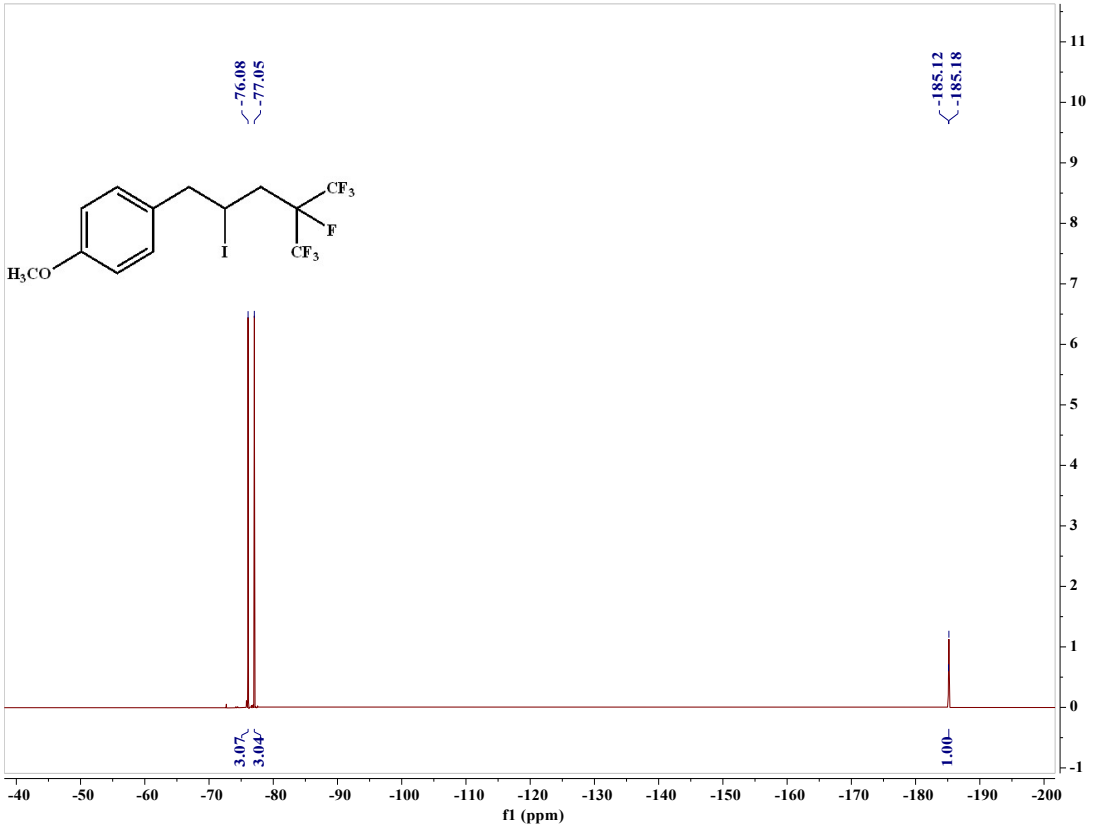


Fig.S 32 ^{19}F NMR spectra of compound 6b

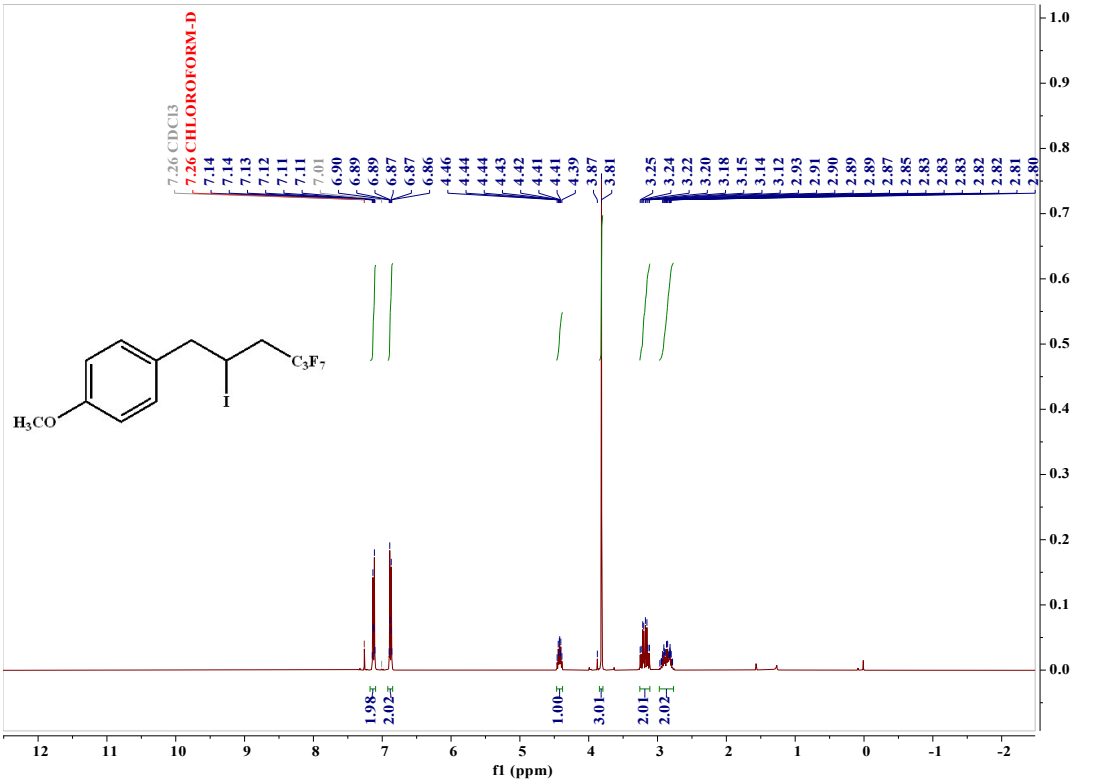


Fig.S 33 ^{1}H NMR spectra of compound 6c

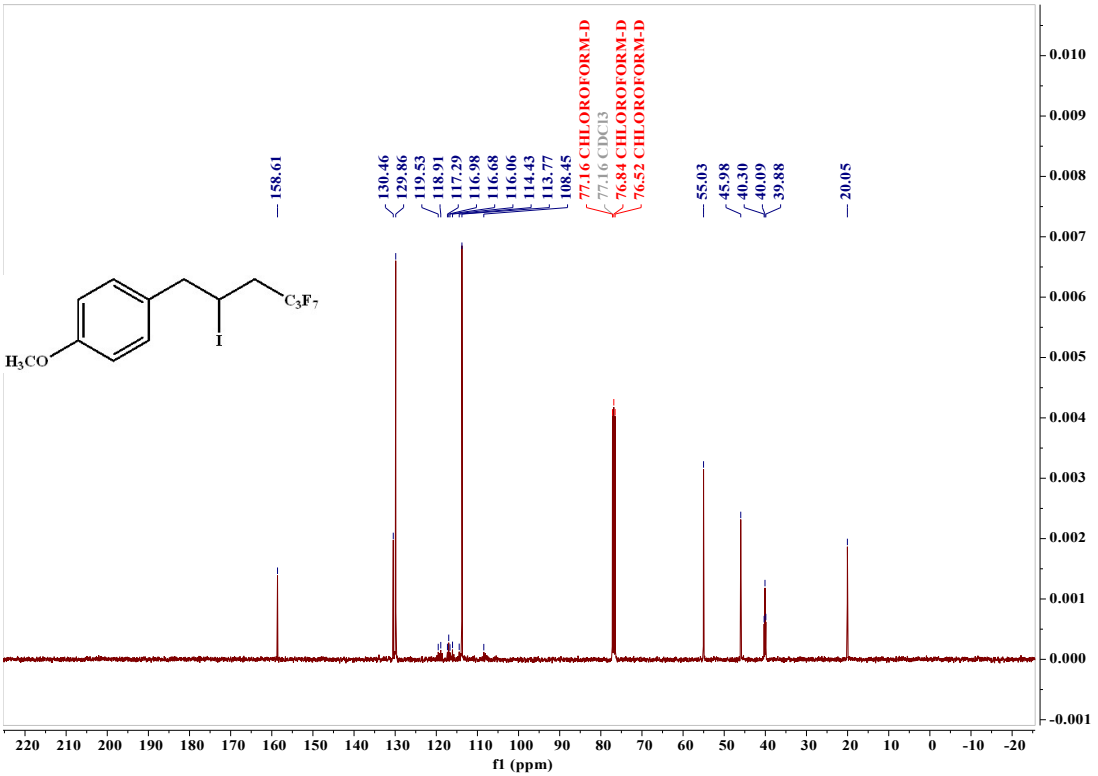


Fig.S 34 ^{13}C NMR spectra of compound 6c

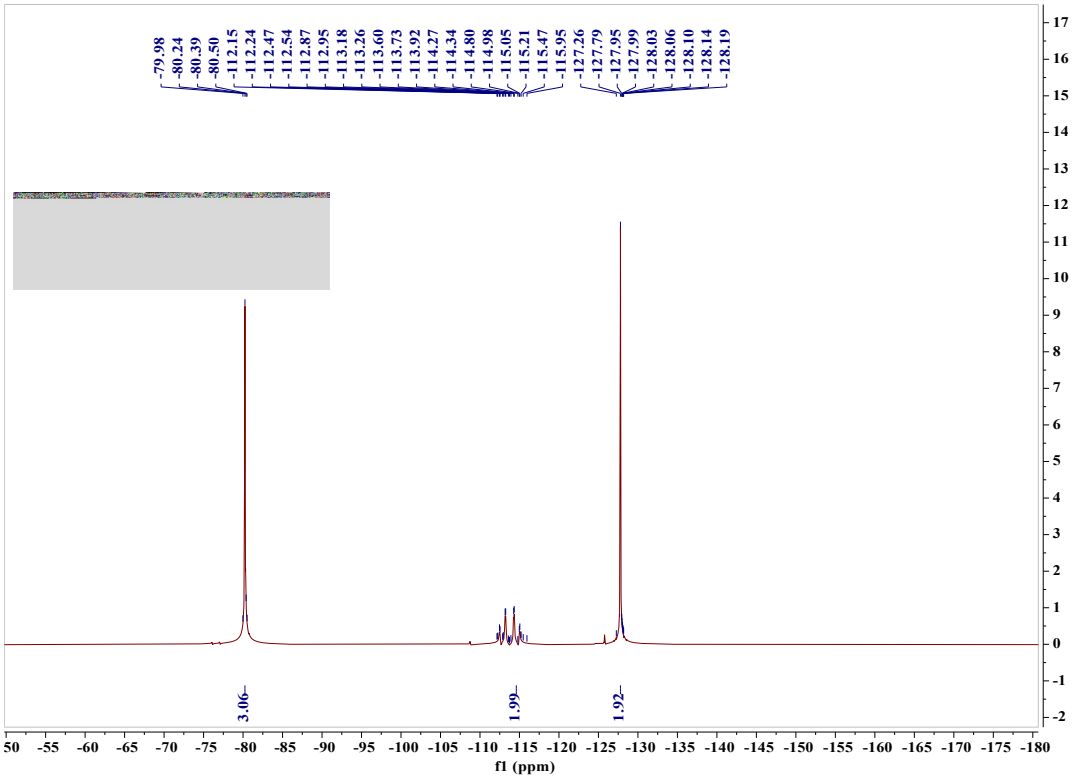


Fig.S 35 ^{19}F NMR spectra of compound 6c

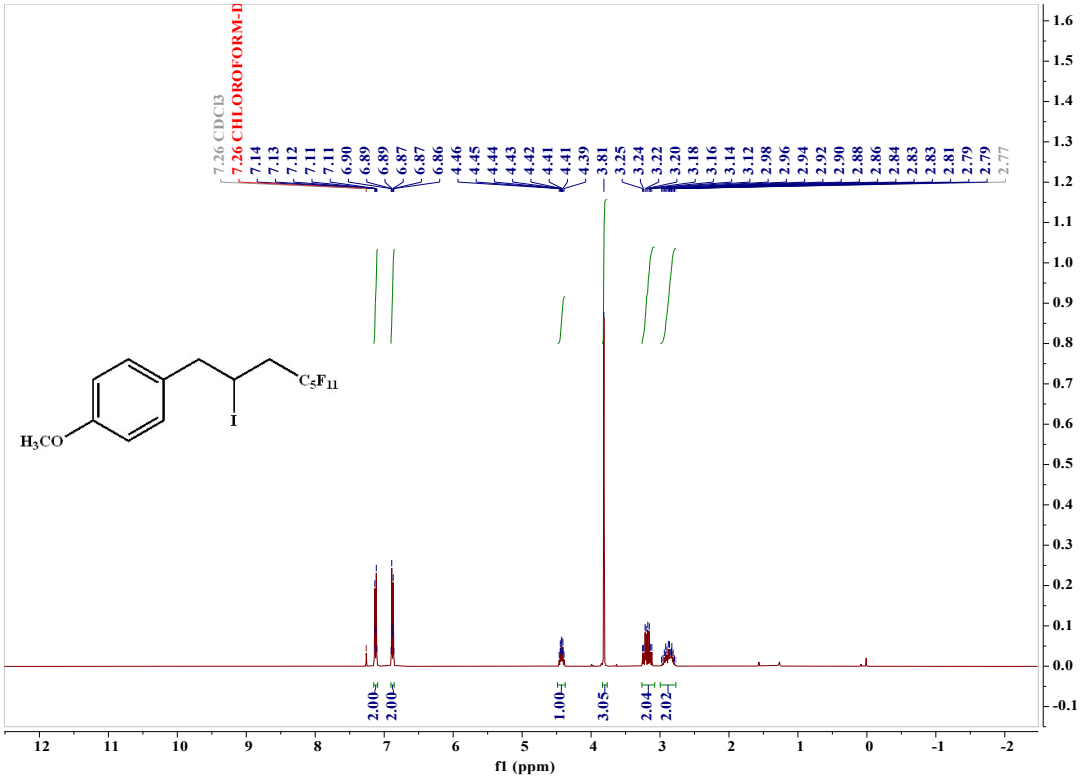


Fig.S 36 ^{1}H NMR spectra of compound 6d

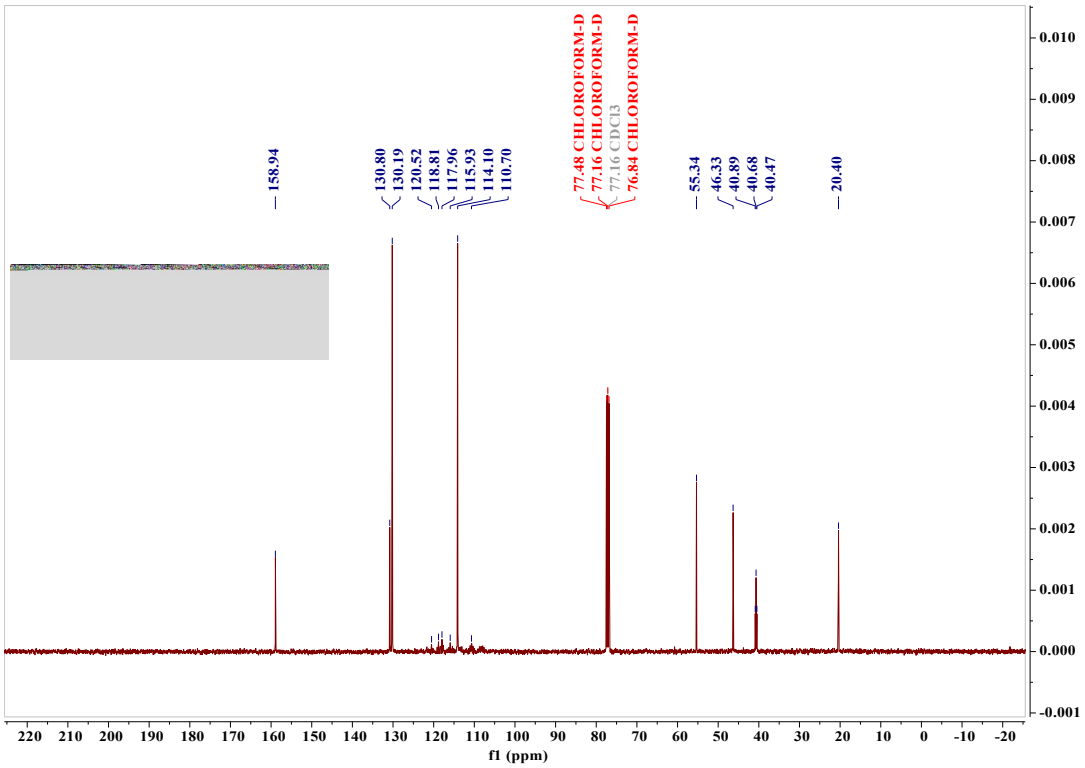


Fig.S 37 ^{13}C NMR spectra of compound 6d

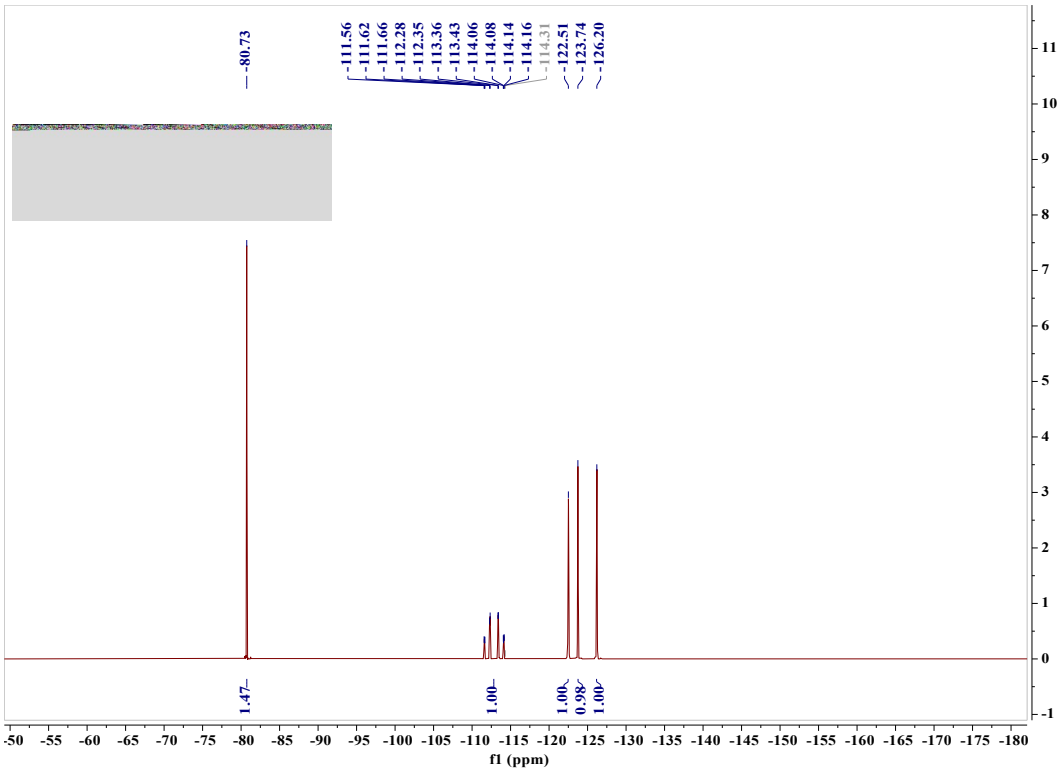


Fig.S 38 ^{19}F NMR spectra of compound 6d

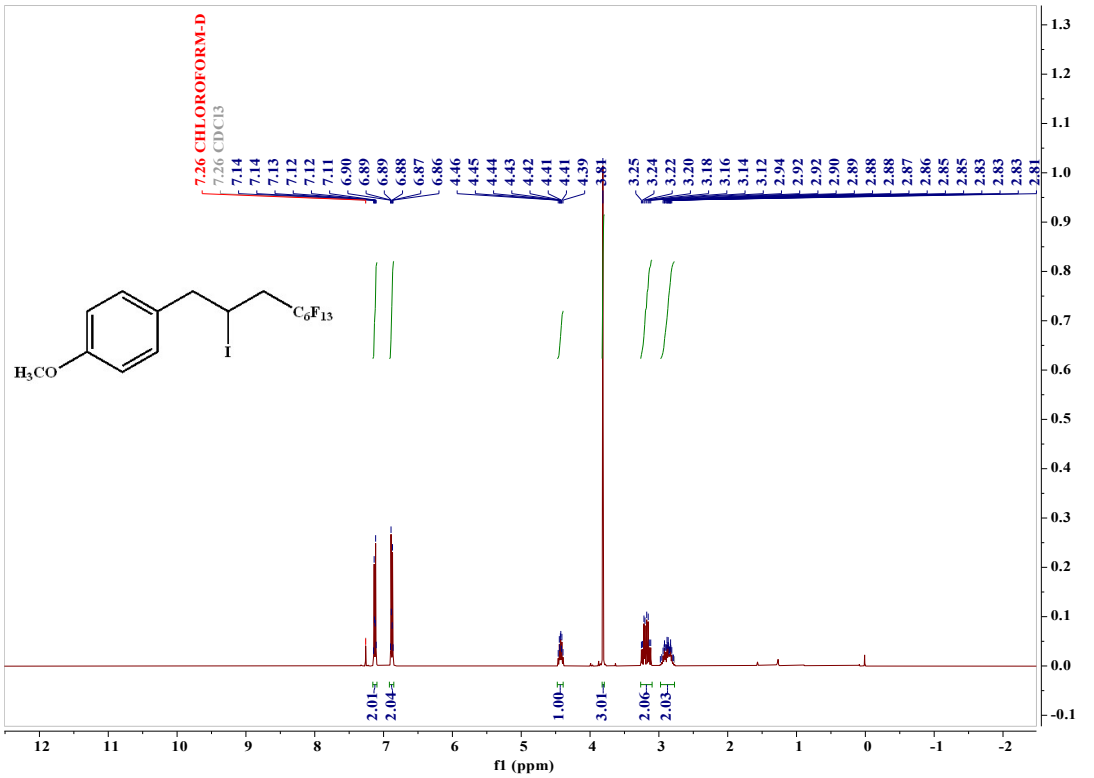


Fig.S 39 ^{1}H NMR spectra of compound 6e

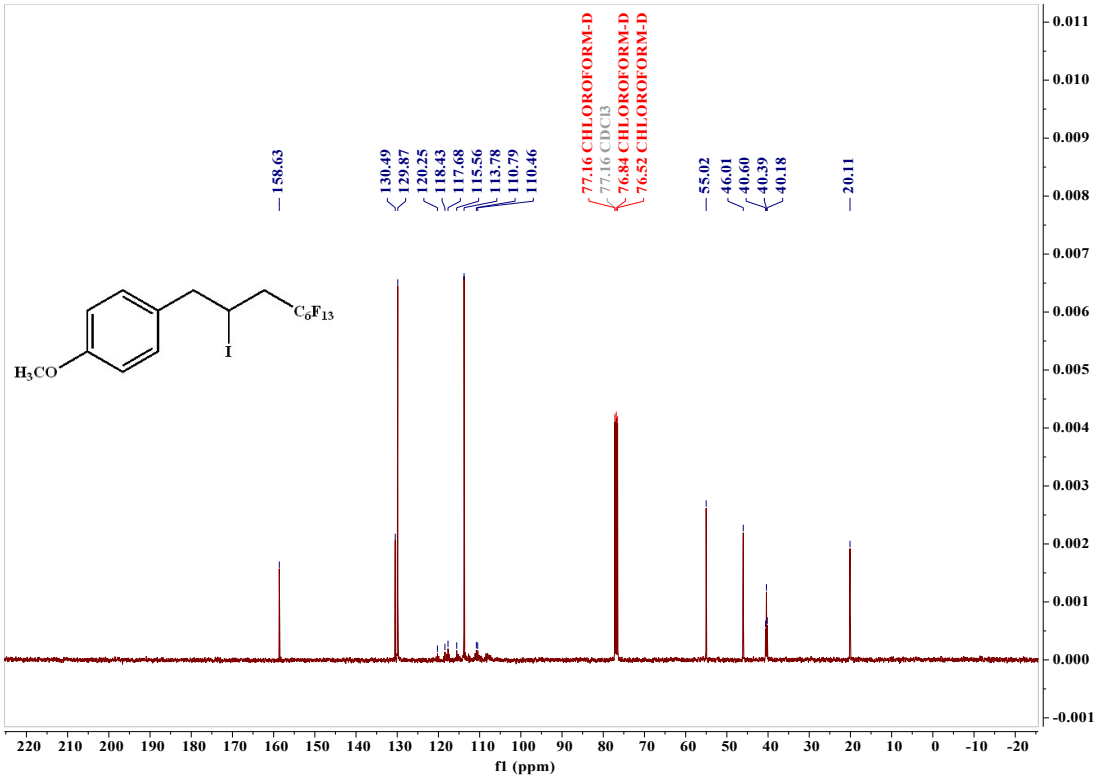


Fig.S 40 ^{13}C NMR spectra of compound 6e

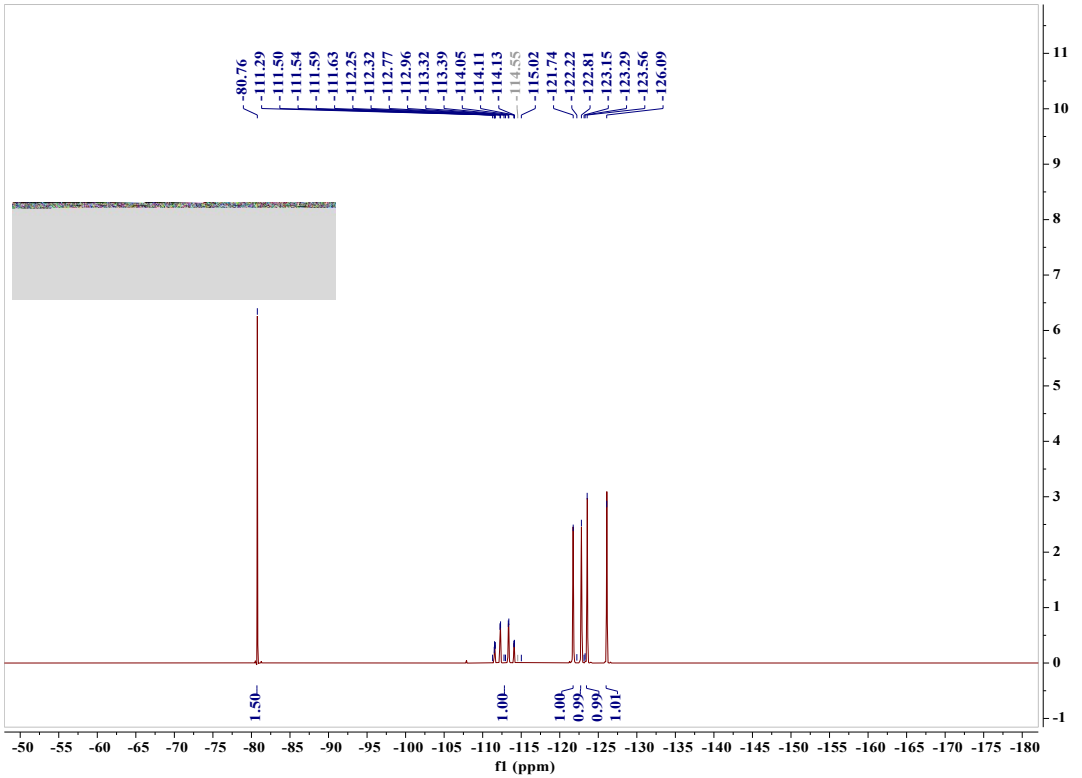


Fig.S 41 ^{19}F NMR spectra of compound 6e

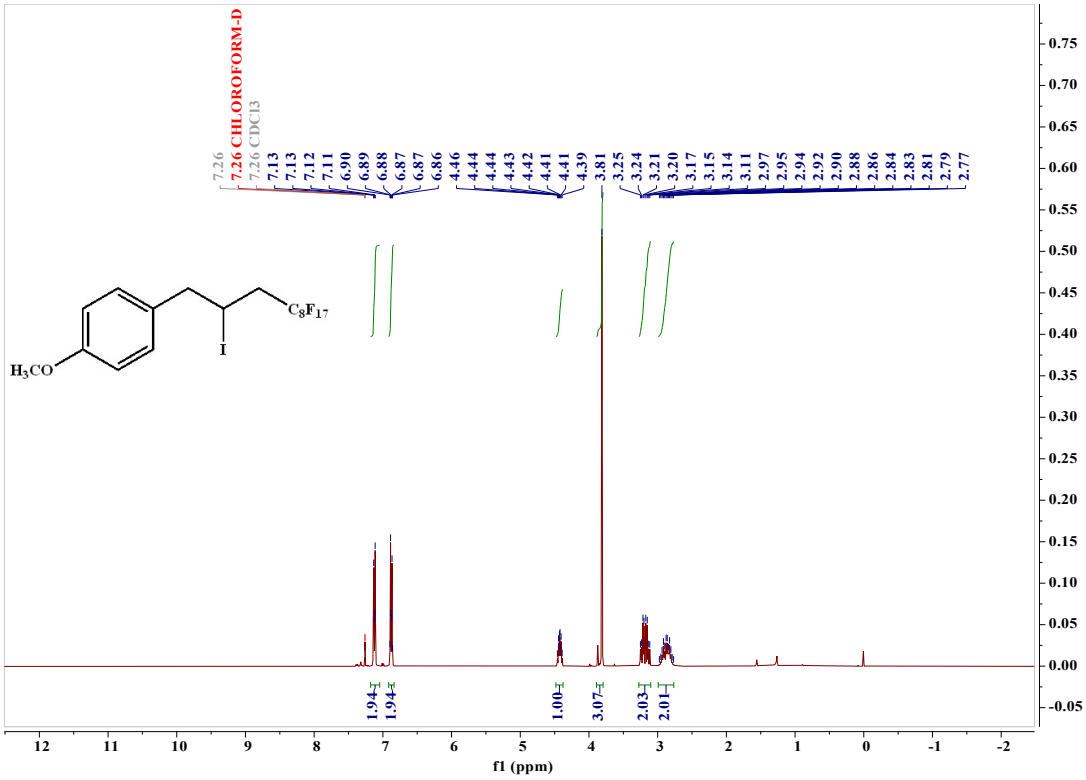


Fig.S 42 ^{1}H NMR spectra of compound 6f

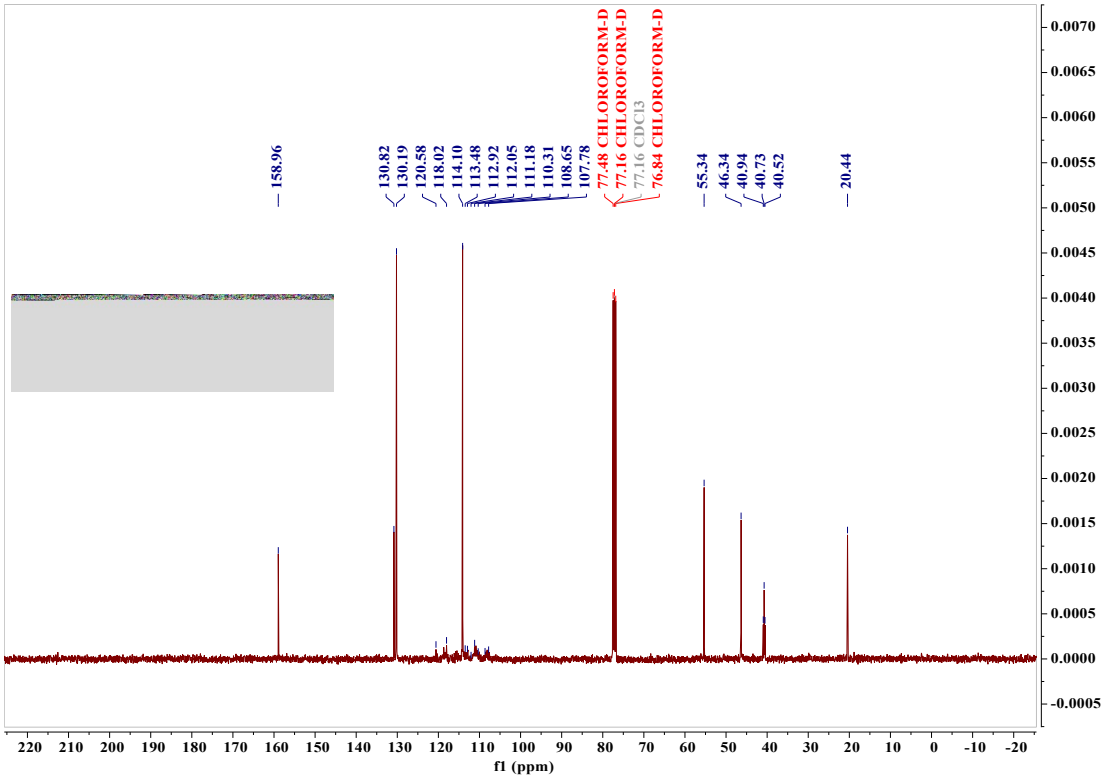


Fig.S 43 ^{13}C NMR spectra of compound 6f

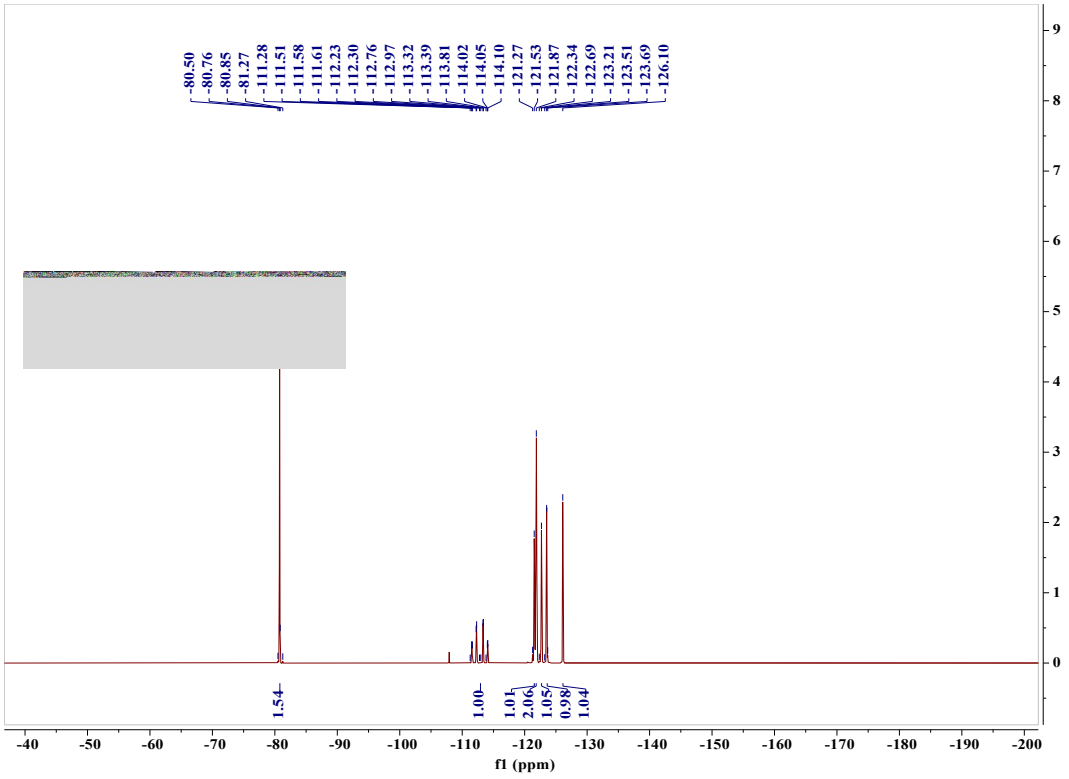


Fig.S 44 ^{19}F NMR spectra of compound 6f

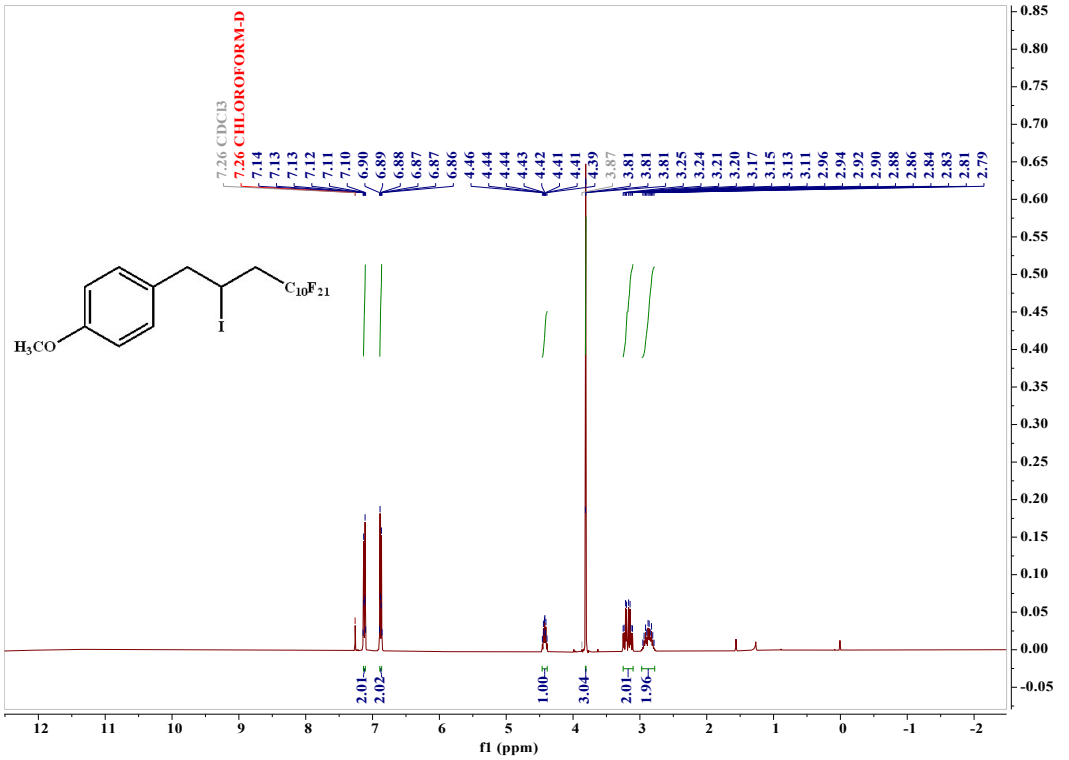


Fig.S 45 ^{1}H NMR spectra of compound 6g

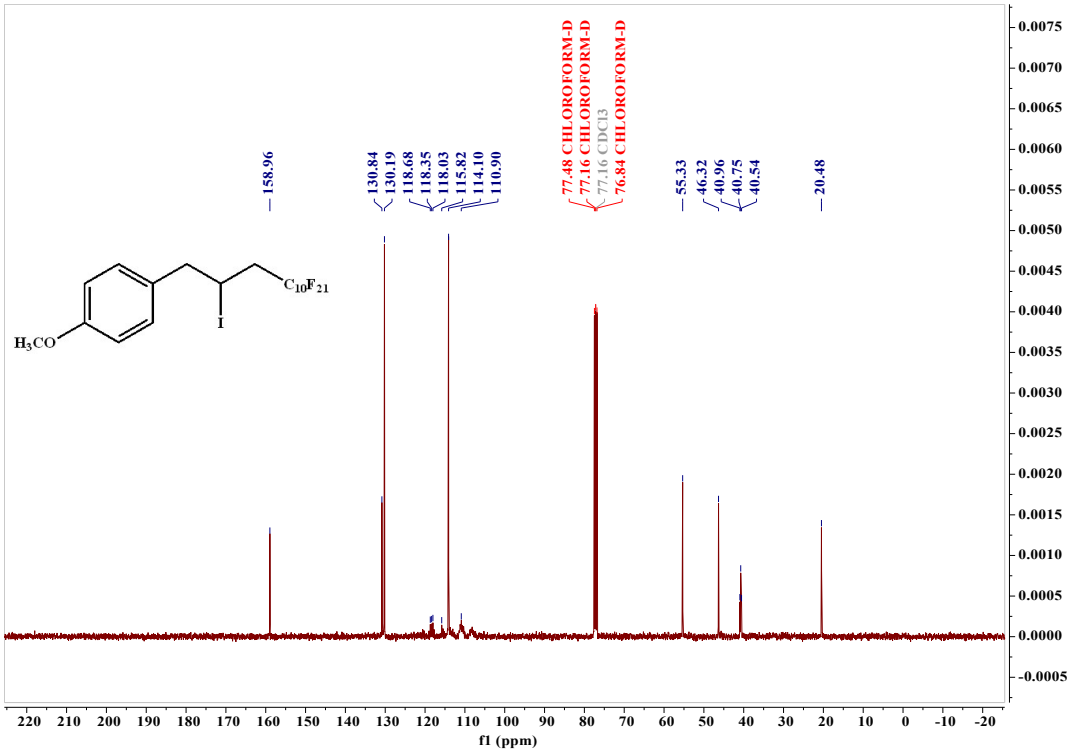


Fig.S 46 ^{13}C NMR spectra of compound 6g

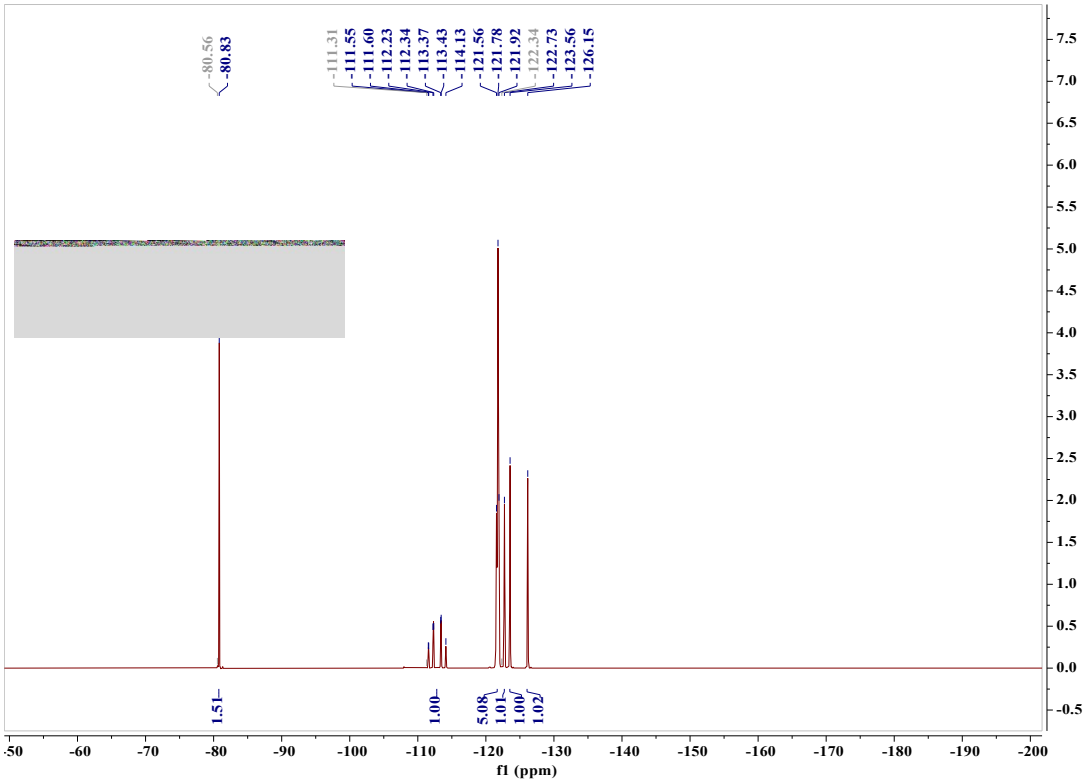


Fig.S 47 ^{19}F NMR spectra of compound 6g

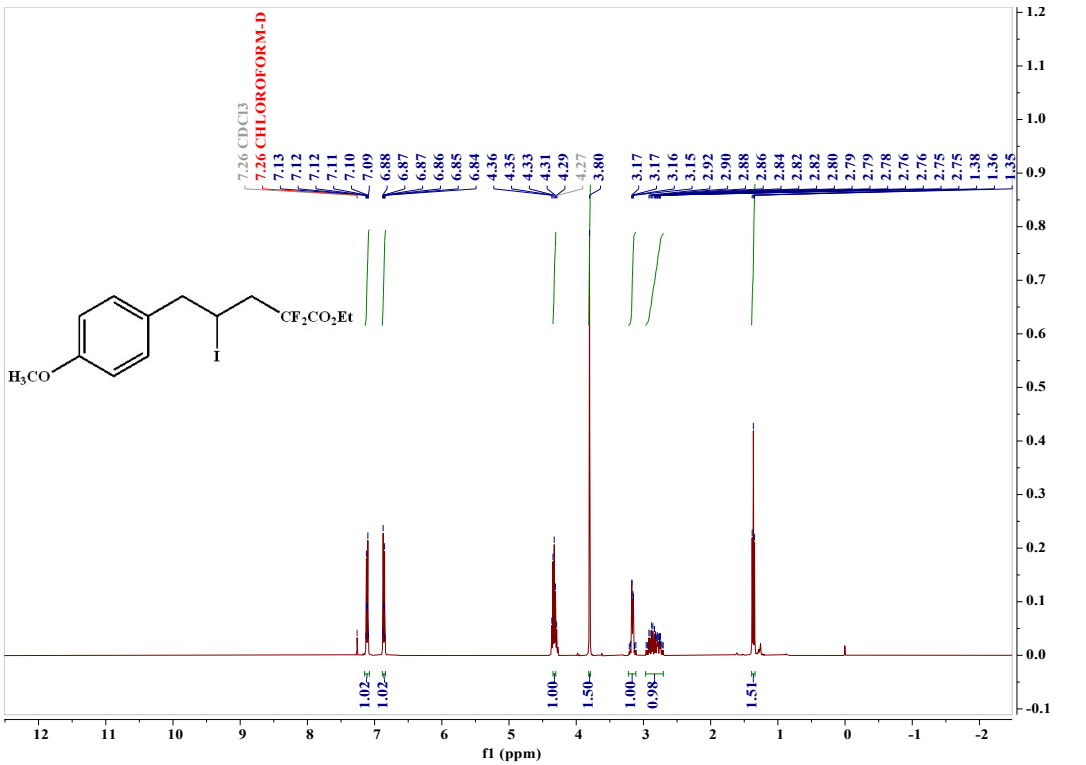


Fig.S 48 ^{1}H NMR spectra of compound 6h

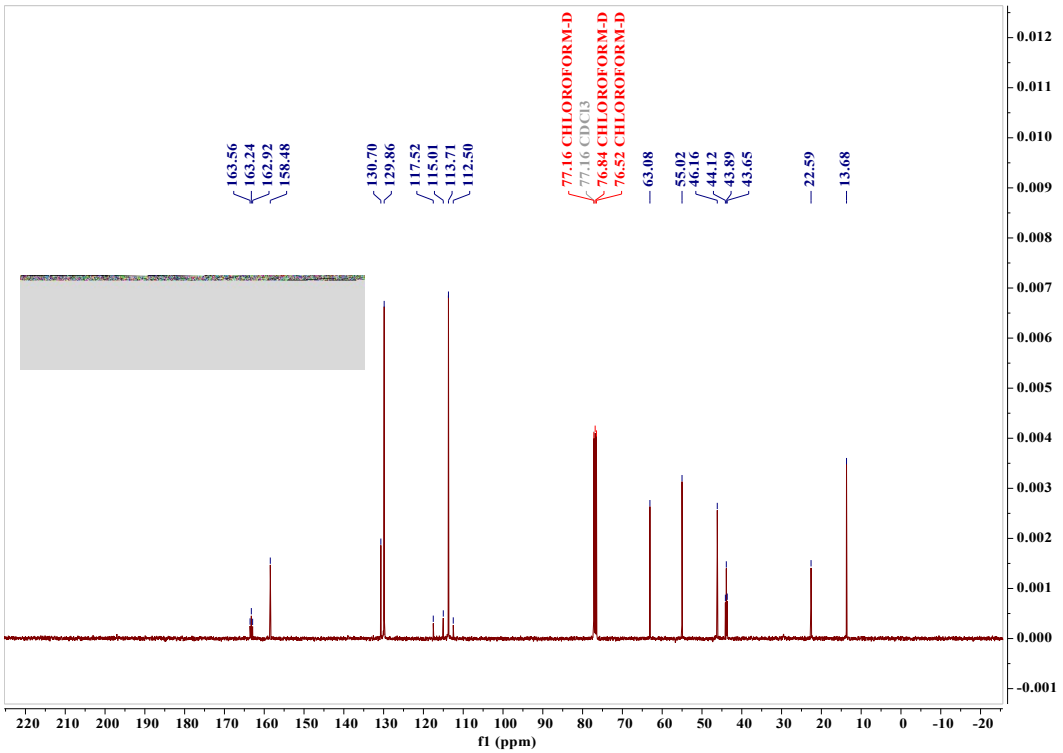


Fig.S 49 ^{13}C NMR spectra of compound 6h

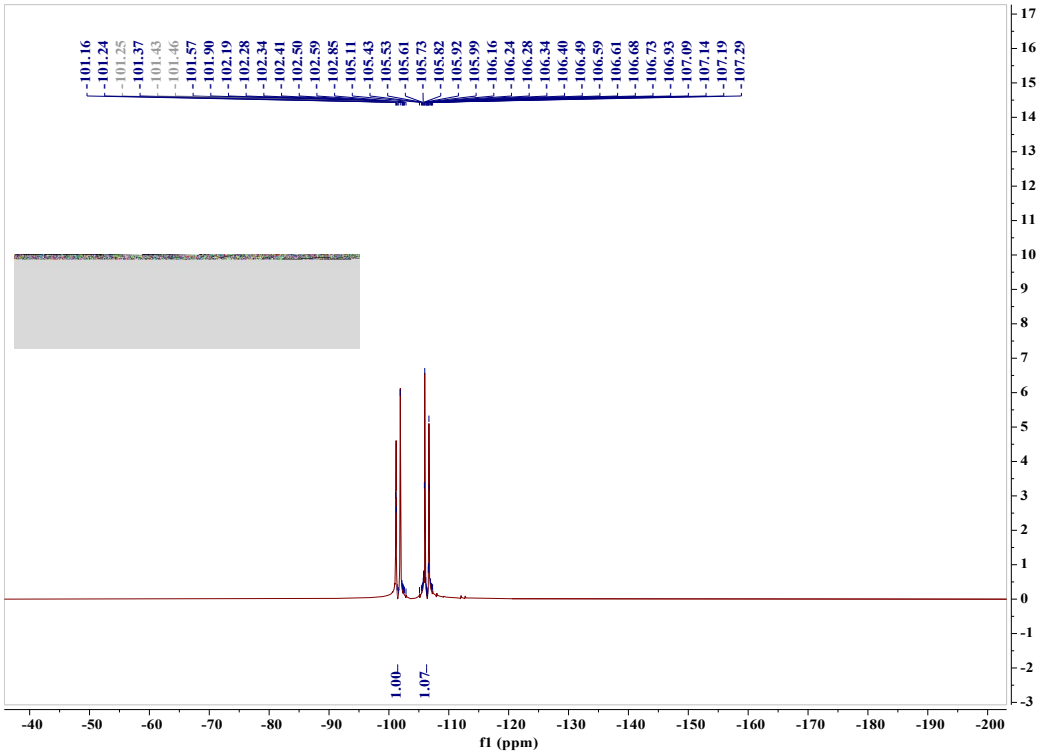


Fig.S 50 ^{19}F NMR spectra of compound 6h

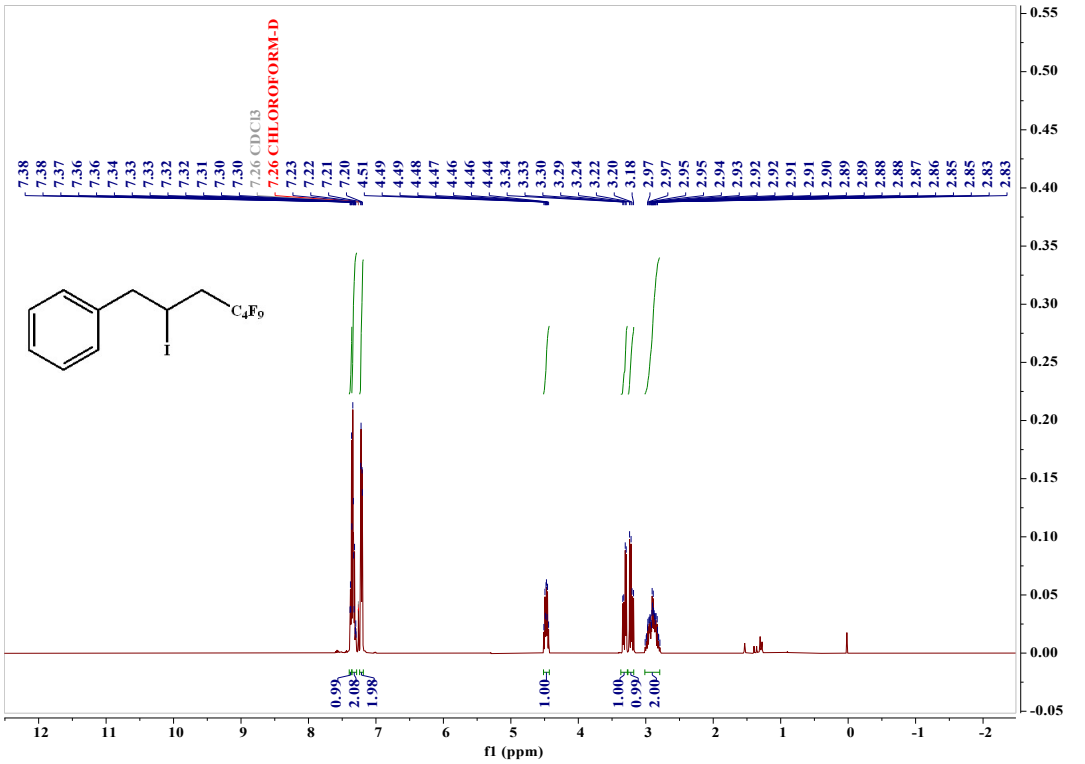


Fig.S 51 ^{1}H NMR spectra of compound 6i

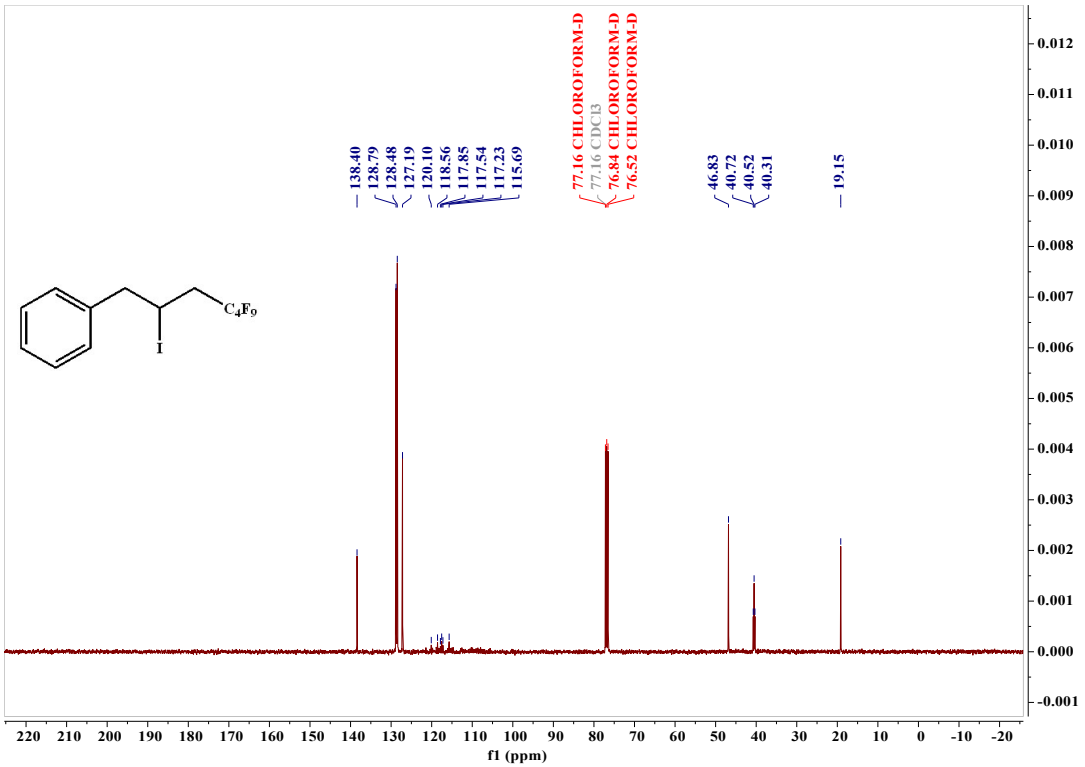


Fig.S 52 ^{13}C NMR spectra of compound 6i

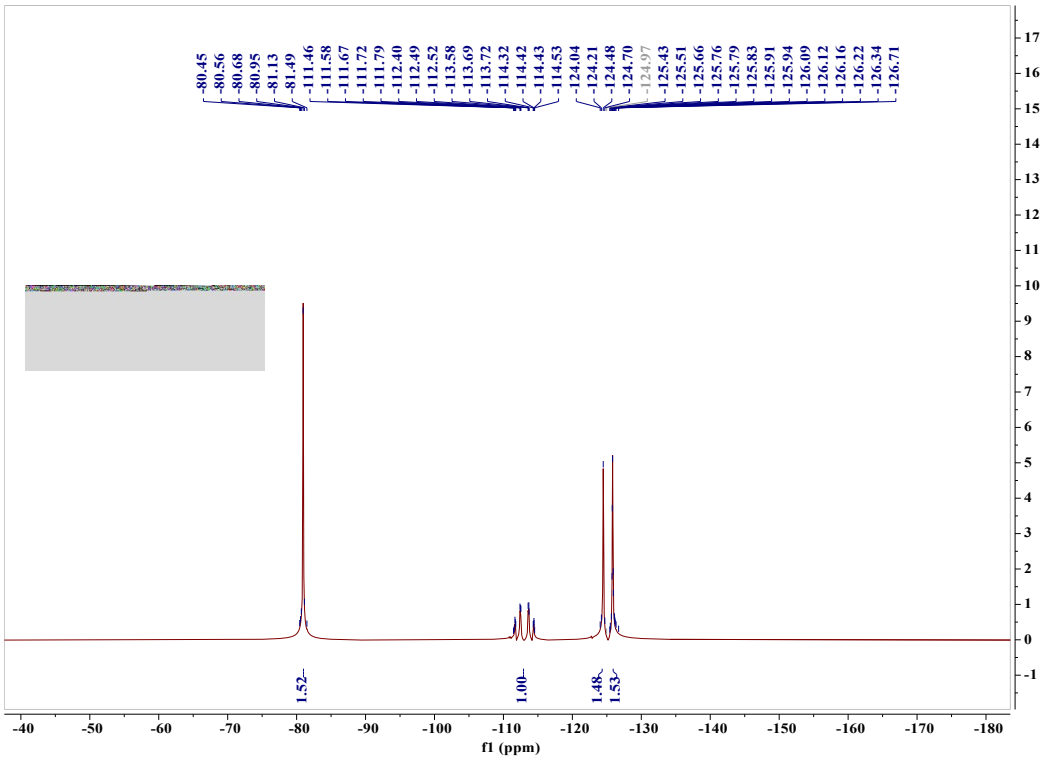


Fig.S 53 ^{19}F NMR spectra of compound 6i

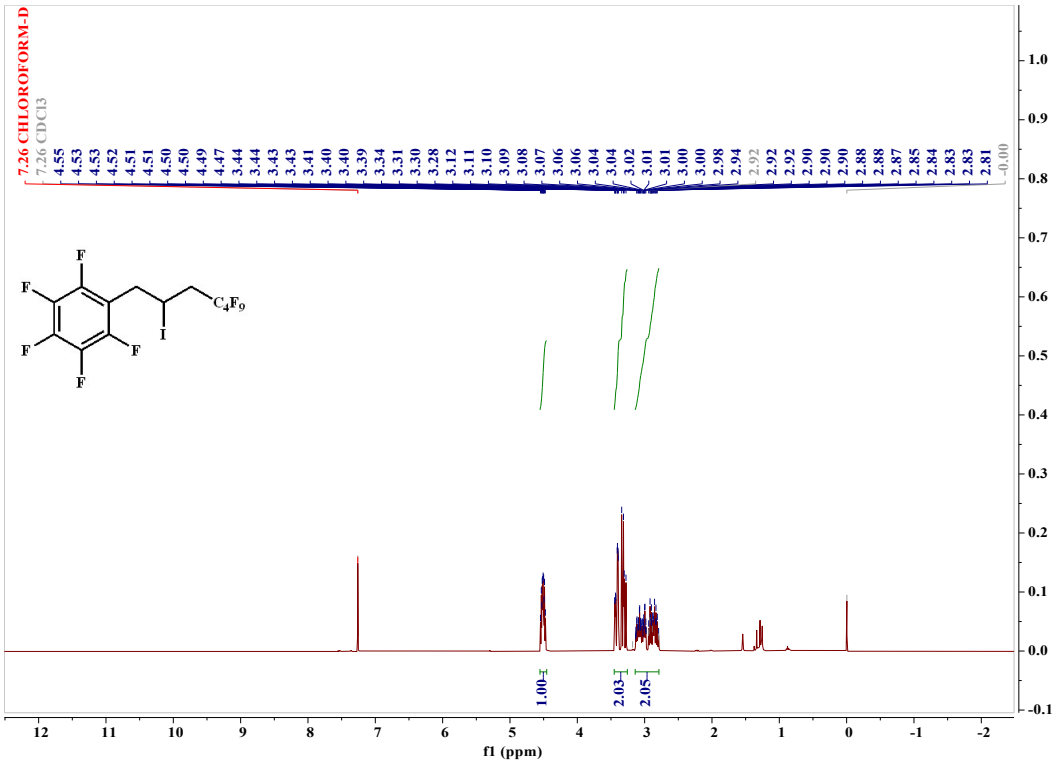


Fig.S 54 ^{1}H NMR spectra of compound 6k

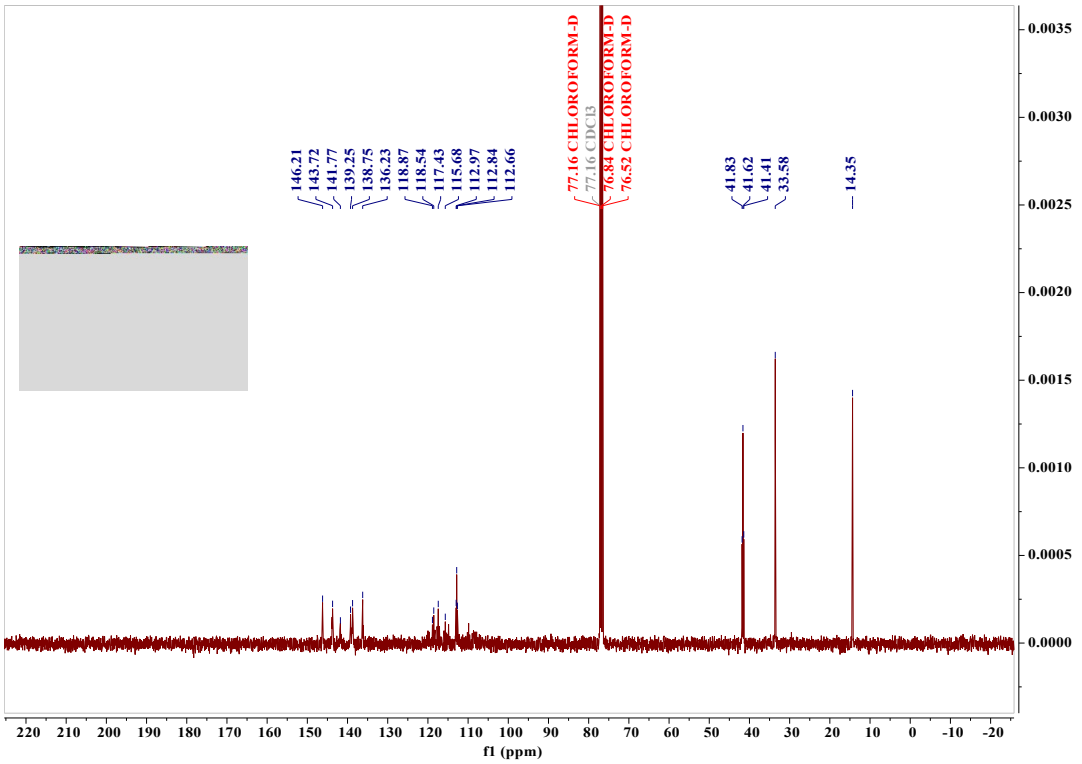


Fig.S 55 ^{13}C NMR spectra of compound 6k

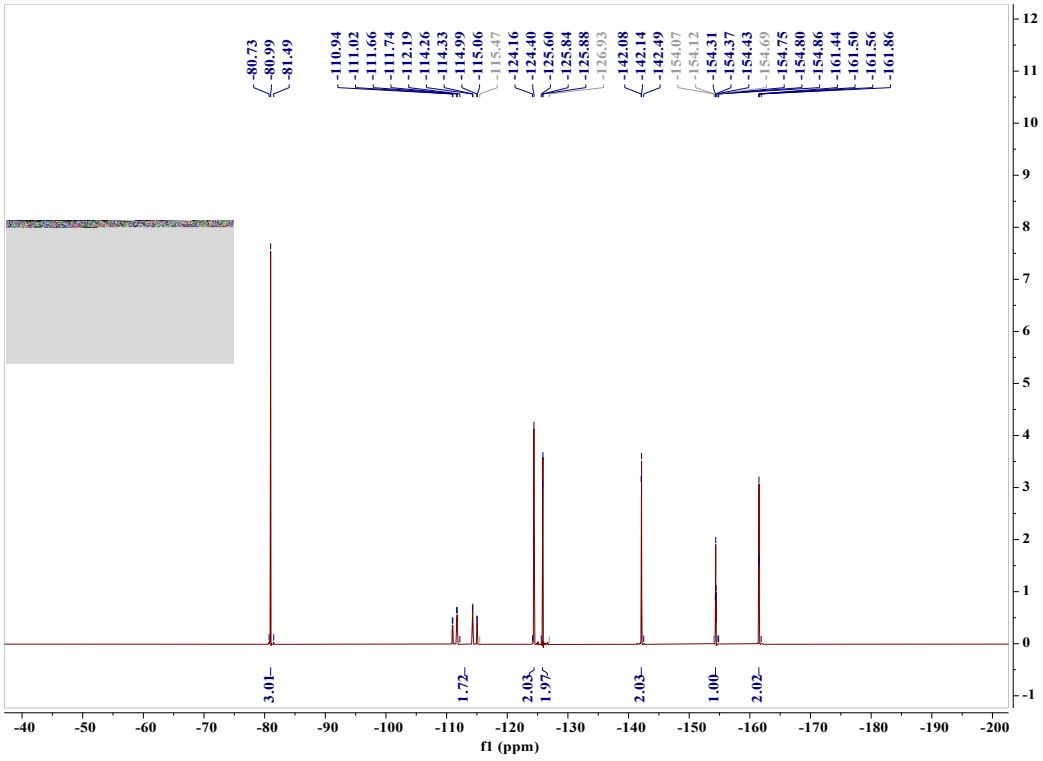


Fig. S 56 ^{19}F NMR spectra of compound 6k

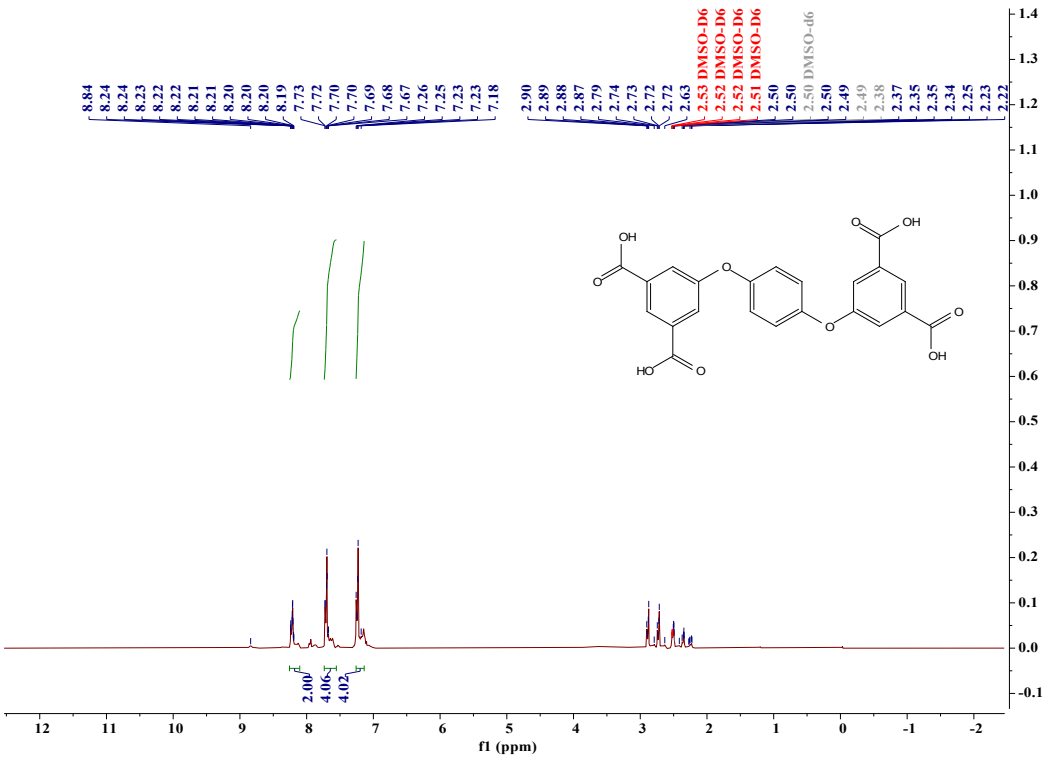


Fig. S 57 ^{1}H NMR spectra of H_4DDB

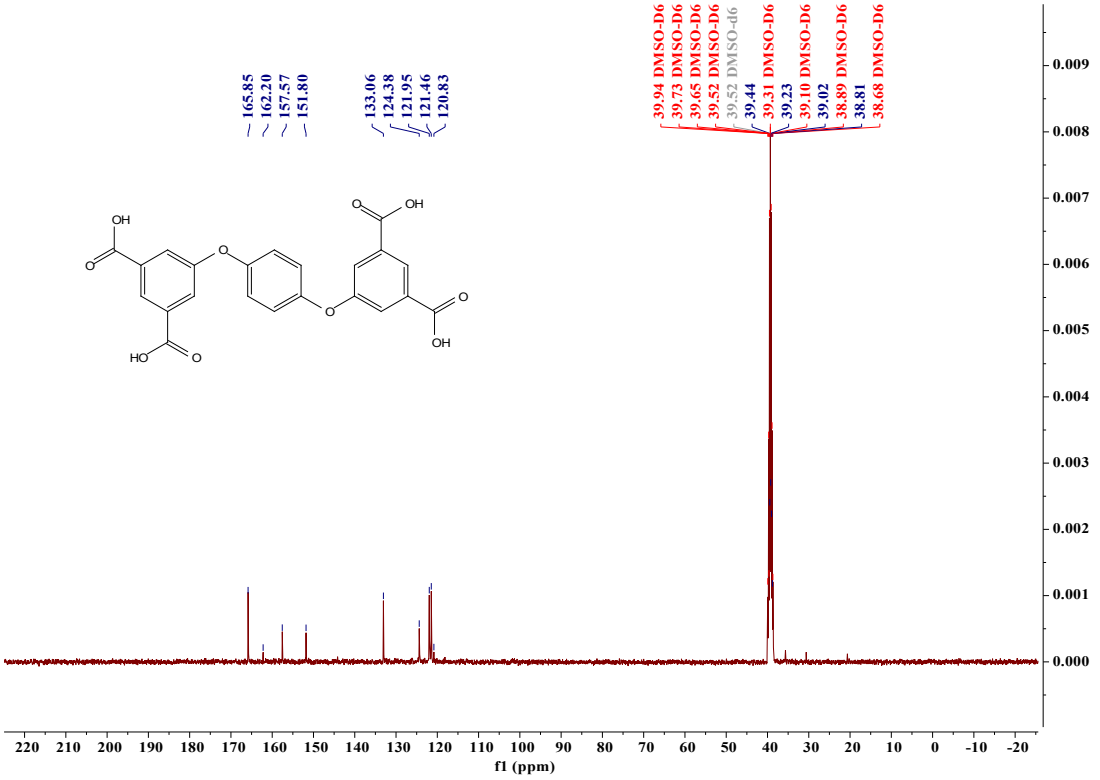


Fig. S 58 ^{13}C NMR spectra of H_4DDB

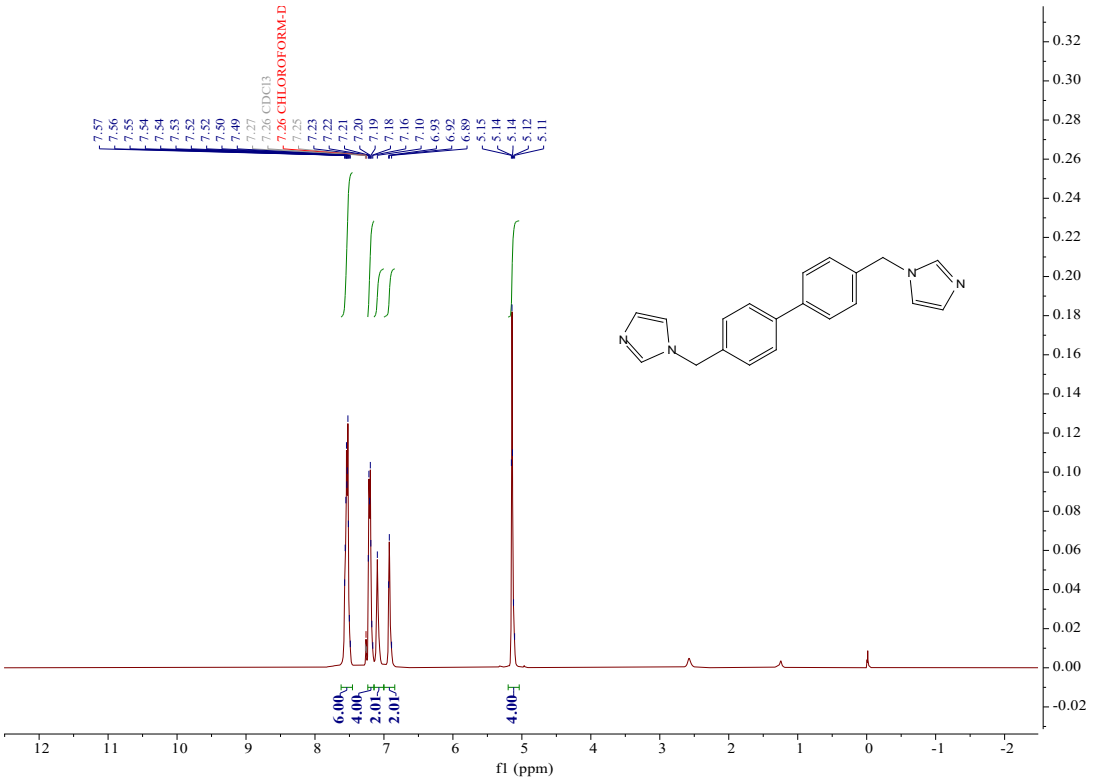


Fig. S 59 ^{1}H NMR spectra of 4,4'-bimp

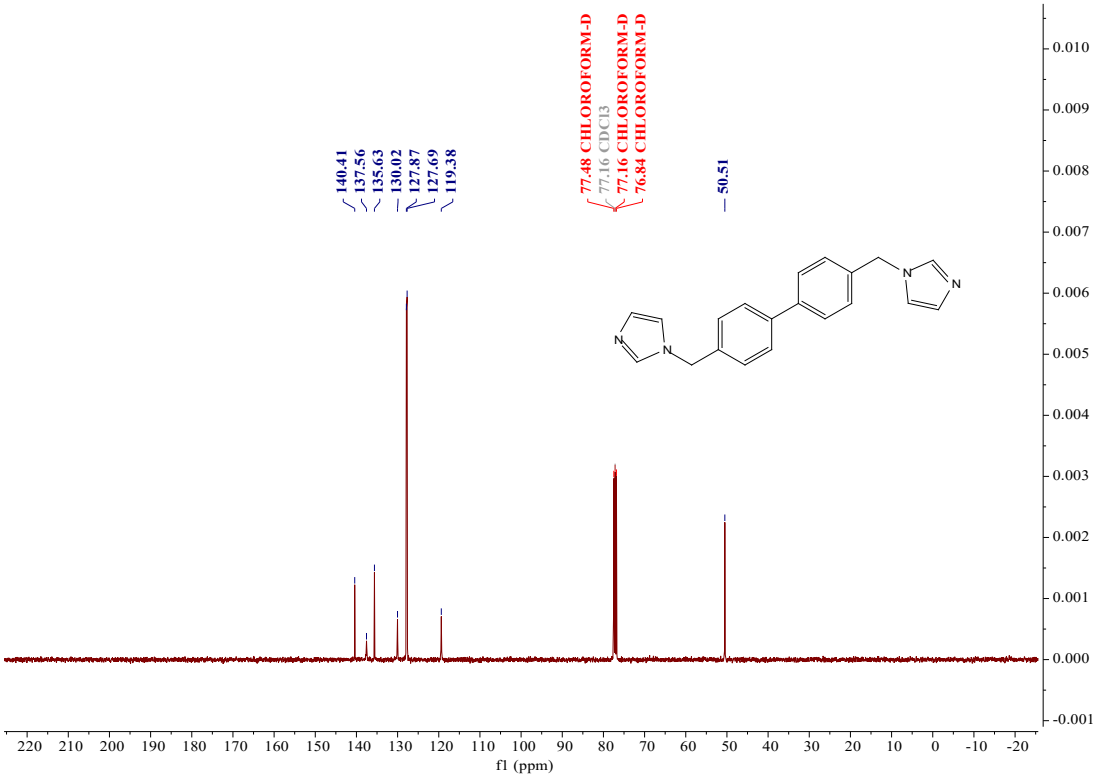


Fig. S 60 ^{13}C NMR spectra of 4,4'-bimp

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