Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Supporting Information

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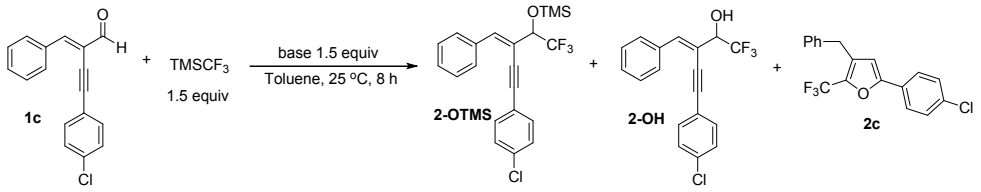
1. General information

Unless otherwise noted, all reactions were carried out under a nitrogen atmosphere; materials obtained from commercial suppliers were used directly without further purification. ^{1}H NMR spectra, ^{13}C NMR spectra, and ^{19}F NMR spectra were recorded on a Bruker 400 (or 300) MHz spectrometer in chloroform-d_3. Chemical shifts (in ppm) were referenced to tetramethylsilane (δ = 0 ppm) in $CDCl_3$ as an internal standard. ^{13}C-NMR spectra were obtained by using the same NMR spectrometers and were calibrated with $CDCl_3$ (δ = 77.00 ppm). The data is being reported as (s = singlet, d = doublet, dd = doublet of doublet, t = triplet, m = multiplet or unresolved, br = broad signal, coupling constant(s) in Hz, integration).

Trichloromethane ($CHCl_3$), dichloromethane, dichloroethane and acetonitrile were freshly distilled from CaH_2; tetrahydrofuran (THF), toluene and ether were dried with sodium benzophenone and distilled before use.

Reactions were monitored by thin layer chromatography (TLC) using silicycle pre-coated silica gel plates. Flash column chromatography was performed on silica gel 60 (particle size 200-400 mesh ASTM, purchased from Yantai, China) and eluted with petroleum ether/ethyl acetate.

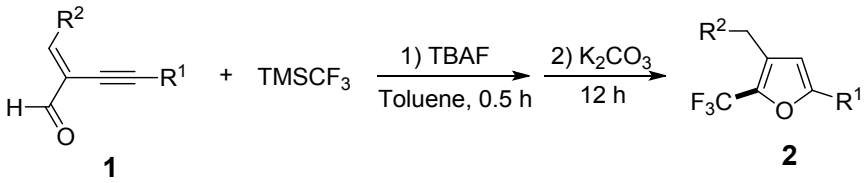
2. Optimization of the bases for the nucleophilic addition of $TMSCF_3$ with conjugated enyne aldehyde 1c.[a]



Entry	Base	Yield (%)[b] (**2-OTMS**)	Yield (%)[b] (**2-OH**)	Yield (%)[b] (**2c**)
1	LiOAc	0	0	0
2	NaOAc	0	0	0
3	KOAc	0	0	0
4	Li_2CO_3	0	0	0
5	Na_2CO_3	0	0	0
6	K_2CO_3	0	0	0
7	K_3PO_4	0	0	0
8	KF	0	0	0
9	CsF	96	0	0

Unless otherwise specified, all reactions were carried out with **1c** (0.1 mmol), $TMSCF_3$ (0.15 mmol), base (0.15 mmol), in solvent (2 mL) at 25 °C. [b] Yield of isolated products.

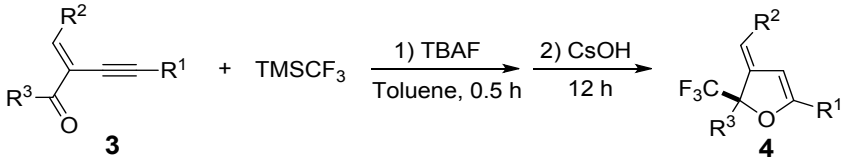
3. Typical procedure for the one pot trifluoromethylation and cyclization of conjugated enyne aldehydes



1 **2**

A stirred solution of **1**[1] (0.2 mmol) and $TMSCF_3$ (0.3 mmol) in toluene (2 mL) was cooled to 0 °C. Subsequently, TBAF (0.3 mmol) was added slowly through a syringe. The mixture was stirred at this temperature until completion of conjugated enyne aldehyde **1** as indicated by TLC. Then the reaction mixture was warmed to room temperature and K_2CO_3 (0.4 mmol) was added in one portion. The mixture was stirred at this temperature for 12 h and directly purified by silica gel chromatography using petroleum ether/EtOAc as the eluent to afford the desired product **2**.

4. Typical procedure for the one pot trifluoromethylation and cyclization of conjugated enyne ketones

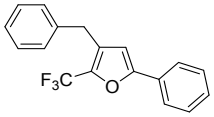


3 **4**

A stirred solution of **3**[2] (0.2 mmol) and $TMSCF_3$ (0.3 mmol) in toluene (2 mL) was cooled to 0 °C. Subsequently, TBAF (0.3 mmol) was added slowly through a syringe. The mixture was stirred at this temperature until completion of conjugated enyne ketone **3** as indicated by TLC. Then the reaction mixture was warmed to room temperature and CsOH (0.4 mmol) was added in one portion. The mixture was stirred at this temperature for 12 h and directly purified by silica gel chromatography using petroleum ether/EtOAc as the eluent to afford the desired product **4**.

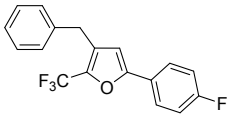
5. General datas for 2 and 4

2a 3-benzyl-5-phenyl-2-(trifluoromethyl)furan



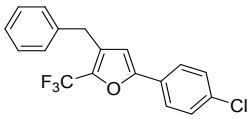
2a; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.60 (d, J = 7.6 Hz, 2H), 7.36–7.27 (m, 5H), 7.22–7.21 (m, 3H), 6.40 (s, 1H), 3.92 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 155.11, 138.75, 136.15 (q, J_{CF} = 40.1 Hz), 129.23, 128.72, 128.69, 128.67, 128.57, 128.34, 126.62, 124.39, 120.31 (q, J_{CF} = 266.2 Hz), 107.86, 30.53; ^{19}F NMR (376 MHz, $CDCl_3$), δ -60.84; HRMS (EI) m/z calcd. for $C_{18}H_{13}OF_3$ $[M]^+$ = 302.0918, found = 302.0915.

2b 3-benzyl-5-(4-fluorophenyl)-2-(trifluoromethyl)furan



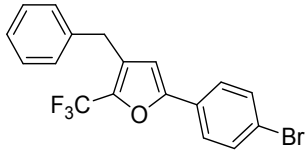
2b; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.49–7.44 (m, 2H), 7.23–7.19 (m, 2H), 7.15–7.10 (m, 3H), 6.96–6.90 (m, 2H), 6.24 (s, 1H), 3.82 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.84 (d, J_{CF} = 247.4 Hz), 154.23, 138.68, 136.16 (q, J_{CF} = 40.3 Hz), 128.72, 128.57, 128.47, 126.67, 126.31 (d, J_{CF} = 8.2 Hz), 125.61 (d, J_{CF} = 3.3 Hz), 120.26 (q, J_{CF} = 266.1 Hz), 115.84 (d, J_{CF} = 22 Hz), 107.57, 30.51; ^{19}F NMR (376 MHz, $CDCl_3$), δ -60.90, -111.91; HRMS (EI) m/z calcd. for $C_{18}H_{12}OF_4$ $[M]^+$ = 320.0824, found = 320.0822.

2c 3-benzyl-5-(4-chlorophenyl)-2-(trifluoromethyl)furan



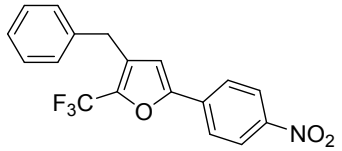
2c; white solid, m.p. = 39-41 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.54 (d, J = 8.4 Hz, 2H), 7.34–7.30 (m, 4H), 7.26–7.21 (m, 3H), 6.41 (s, 1H), 3.93 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 153.98, 138.58, 136.38 (q, J_{CF} = 40.2 Hz), 134.53, 129.00, 128.74, 128.57, 128.48, 127.71, 126.70, 125.64, 120.16 (q, J_{CF} = 266.2 Hz), 108.25, 30.50; ^{19}F NMR (376 MHz, $CDCl_3$), δ -60.96; HRMS (EI) m/z calcd. for $C_{18}H_{12}OF_3Cl$ $[M]^+$ = 336.0529, found = 336.0526.

2d 3-benzyl-5-(4-bromophenyl)-2-(trifluoromethyl)furan



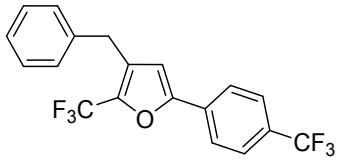
2d; white solid, m.p. = 44-46 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.47–7.42 (m, 4H), 7.33–7.29 (m, 2H), 7.25–7.20 (m, 3H), 6.40 (s, 1H), 3.91 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 153.98, 137.00, 136.40 (q, J_{CF} = 40.2 Hz), 131.90, 128.73, 128.56, 128.51, 128.10, 126.70, 125.82, 122.70, 120.16 (q, J_{CF} = 266.2 Hz), 108.33, 30.48; ^{19}F NMR (376 MHz, $CDCl_3$), δ -60.89; HRMS (EI) m/z calcd. for $C_{18}H_{12}OF_3Br$ [M] $^{+}$ = 380.0024, found = 380.0027.

2e 3-benzyl-5-(4-nitrophenyl)-2-(trifluoromethyl)furan



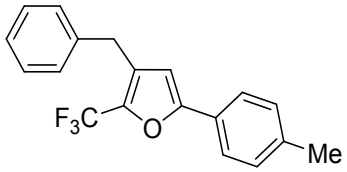
2e; white solid, m.p. = 107-109 °C; ^{1}H NMR (300 MHz, $CDCl_3$): δ 8.26 (d, J = 8.7 Hz, 2H), 7.79 (d, J = 8.7 Hz, 2H), 7.42–7.37 (m, 2H), 7.33–7.28 (m, 3H), 6.70 (s, 1H), 4.01 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 152.48, 147.27, 138.16, 137.82 (q, J_{CF} = 40.43 Hz), 134.64, 128.91, 128.79, 128.52, 126.82, 124.75, 124.17, 119.84 (q, J_{CF} = 266.7 Hz), 111.25, 30.36; ^{19}F NMR (282 MHz, $CDCl_3$), δ -61.13; HRMS (EI) m/z calcd. for $C_{18}H_{12}O_3NF_3$ [M] $^{+}$ = 347.0769, found = 347.0764.

2f 3-benzyl-2-(trifluoromethyl)-5-(4-(trifluoromethyl)phenyl)furan



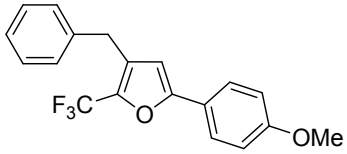
2f; white solid, m.p. = 78-80 °C; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.78–7.68 (m, 4H), 7.49–7.44 (m, 2H), 7.40–7.35 (m, 3H), 6.63 (s, 1H), 4.06 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 153.46, 138.51, 137.11 (q, J_{CF} = 40.28 Hz), 132.30, 130.33 (q, J_{CF} = 32.25 Hz), 129.38, 128.81, 128.69, 128.66, 128.60, 126.81, 125.78, 125.74, 125.69, 125.64, 124.44, 122.17, 121.92, 118.57, 118.37, 114.82, 109.63, 30.45; ^{19}F NMR (282 MHz, $CDCl_3$), δ -61.05, -62.74; HRMS (EI) m/z calcd. for $C_{19}H_{12}OF_6$ [M] $^{+}$ = 370.0792, found = 370.0789.

2g 3-benzyl-5-(p-tolyl)-2-(trifluoromethyl)furan



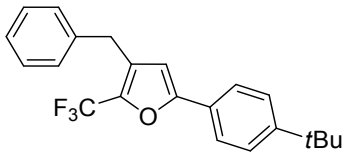
2g; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.49 (d, J = 8.0 Hz, 2H), 7.31–7.28 (m, 2H), 7.23–7.20 (m, 3H), 7.14 (d, J = 7.6 Hz, 2H), 6.34 (s, 1H), 3.90 (s, 2H), 2.32 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 155.38, 138.83, 138.73, 135.76 (q, J_{CF} = 40.1 Hz), 129.41, 128.67, 128.58, 128.32, 126.59, 124.35, 120.38 (q, J_{CF} = 266.0 Hz), 107.17, 30.54, 21.25; ^{19}F NMR (376 MHz, $CDCl_3$), δ -60.75; HRMS (EI) m/z calcd. for $C_{19}H_{15}OF_3$ [M] $^{+}$ = 316.1075, found = 316.1074.

2h 3-benzyl-5-(4-methoxyphenyl)-2-(trifluoromethyl)furan



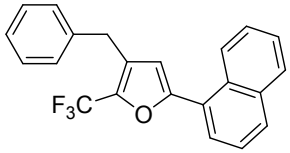
2h; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46–7.43 (m, 2H), 7.22–7.18 (m, 2H), 7.13–7.11 (m, 3H), 6.79–6.76 (m, 2H), 6.18 (s, 1H), 3.81 (s, 2H), 3.68 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 160.02, 155.24, 138.86, 135.45 (q, J_{CF} = 40.0 Hz), 128.65, 128.56, 128.37, 126.56, 125.92, 122.21, 120.42 (q, J_{CF} = 265.9 Hz), 114.17, 106.34, 55.23, 30.54; ^{19}F NMR (376 MHz, $CDCl_3$), δ -60.72; HRMS (EI) m/z calcd. for $C_{19}H_{15}O_2F_3$ [M] $^{+}$ = 332.1024, found = 332.1020.

2i 3-benzyl-5-(4-(*tert*-butyl)phenyl)-2-(trifluoromethyl)furan



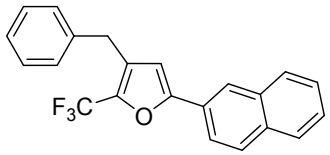
2i; white solid, m.p. = 112-114 ^{o}C; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.67 (d, J = 8.4 Hz, 2H), 7.50 (d, J = 8.4 Hz, 2H), 7.45–7.41 (m, 2H), 7.37–7.33 (m, 3H), 6.50 (s, 1H), 4.05 (s, 2H), 1.43 (s, 9H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 155.36, 151.95, 138.83, 135.85 (q, J_{CF} = 40.05 Hz), 128.66, 128.56, 128.25, 126.58, 126.53, 125.65, 124.22, 120.39 (q, J_{CF} = 265.88 Hz), 107.30, 34.67, 31.12, 30.52; ^{19}F NMR (282 MHz, $CDCl_3$), δ -60.71; HRMS (EI) m/z calcd. for $C_{22}H_{21}OF_3$ [M] $^{+}$ = 358.1545, found = 358.1542.

2j 3-benzyl-5-(naphthalen-1-yl)-2-(trifluoromethyl)furan



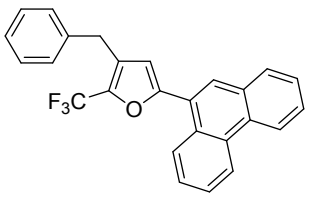
2j; white solid, m.p. = 49-51 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.24 (d, J = 8.0 Hz, 1H), 7.81–7.77 (m, 2H), 7.64 (d, J = 6.8 Hz, 1H), 7.50–7.38 (m, 3H), 7.32–7.21 (m, 5H), 6.48 (s, 1H), 3.98 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 154.85, 138.77, 136.60 (q, J_{CF} = 40.0 Hz), 133.83, 130.15, 129.72, 128.71, 128.61, 128.57, 127.99, 127.03, 126.89, 126.80, 126.62, 126.11, 125.08, 124.94, 117.74 (q, J_{CF} = 266.2 Hz), 112.14, 30.57; ^{19}F NMR (376 MHz, $CDCl_3$), δ -60.65; HRMS (EI) m/z calcd. for $C_{22}H_{15}OF_3$ $[M]^+$ = 352.1075, found = 352.1078.

2k 3-benzyl-5-(naphthalen-2-yl)-2-(trifluoromethyl)furan



2k; colourless oil; ^{1}H NMR (300 MHz, $CDCl_3$): δ 8.20 (s, 1H), 7.93–7.86 (m, 3H), 7.76–7.72 (m, 1H), 7.59–7.52 (m, 2H), 7.47–7.43 (m, 2H), 7.38–7.35 (m, 3H), 6.60 (s, 1H), 4.06 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 155.12, 138.72, 136.24 (q, J_{CF} = 39.98 Hz), 133.18, 133.17, 128.71, 128.59, 128.47, 128.29, 127.72, 126.64, 126.54, 126.44, 123.36, 122.08, 120.32 (q, J_{CF} = 263.63 Hz), 108.32, 30.52; ^{19}F NMR (282 MHz, $CDCl_3$), δ -60.66; HRMS (EI) m/z calcd. for $C_{22}H_{15}OF_3$ $[M]^+$ = 352.1075, found = 352.1072.

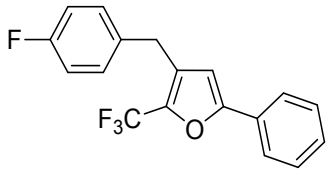
2l 3-benzyl-5-(phenanthren-9-yl)-2-(trifluoromethyl)furan



2l; colourless oil; ^{1}H NMR (300 MHz, $CDCl_3$): δ 8.76 (d, J = 8.7 Hz, 1H), 7.68 (d, J = 8.4 Hz, 1H), 8.34 (d, J = 8.7 Hz, 1H), 8.01 (s, 1H), 7.93–7.91 (m, 1H), 7.76–7.62 (m, 4H), 7.46–7.34 (m, 5H), 6.64 (s, 1H), 4.12 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 154.75, 138.77, 136.60 (q, J_{CF} = 40.20 Hz), 130.81, 130.64, 130.50, 129.06, 128.96,

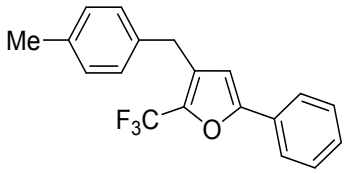
128.73, 128.59, 128.43, 127.95, 127.92, 127.58, 127.09, 126.99, 126.82, 126.64, 125.71, 125.59, 123.04, 122.50, 120.37 (q, J_{CF} = 266.24 Hz), 112.47, 30.59; ^{19}F NMR (282 MHz, $CDCl_3$), δ -60.65; HRMS (EI) m/z calcd. for $C_{26}H_{17}OF_3$ $[M]^+$ = 402.1232, found = 402.1229.

2m, 3-(4-fluorobenzyl)-5-phenyl-2-(trifluoromethyl)furan



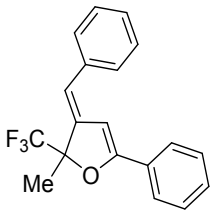
2m; white solid, m.p. = 33-35 °C; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.72–7.69 (m, 2H), 7.46–7.34 (m, 3H), 7.27–7.22 (m, 2H), 7.09–7.04 (m, 2H), 6.47 (s, 1H), 3.97 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 161.68 (d, J_{CF} = 243.23 Hz), 155.23, 136.11 (q, J_{CF} = 40.2 Hz), 134.43 (d, J_{CF} = 3.08 Hz), 134.49 (d, J_{CF} = 7.8 Hz), 129.12, 128.75, 128.19, 124.38, 120.24 (q, J_{CF} = 266.1 Hz), 115.49 (d, J_{CF} = 21.15 Hz), 107.65, 29.72; ^{19}F NMR (282 MHz, $CDCl_3$), δ -60.90, -116.32; HRMS (EI) m/z calcd. for $C_{18}H_{12}OF_4$ $[M]^+$ = 320.0824, found = 320.0823.

2n 3-(4-methylbenzyl)-5-phenyl-2-(trifluoromethyl)furan



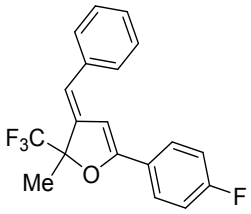
2n; colourless oil; ^{1}H NMR (300 MHz, $CDCl_3$): δ 7.73–7.70 (m, 2H), 7.47–7.35 (m, 3H), 7.22 (s, 4H), 6.51 (s, 1H), 3.99 (s, 2H), 2.42 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$): δ 155.04, 136.18, 135.94 (q, J_{CF} = 36.38 Hz), 135.70, 129.37, 129.25, 128.70, 128.62, 128.45, 124.36, 120.32 (q, J_{CF} = 266.1 Hz), 107.86, 30.08, 20.97; ^{19}F NMR (282 MHz, $CDCl_3$), δ -60.80; HRMS (EI) m/z calcd. for $C_{19}H_{15}OF_3$ $[M]^+$ = 316.1075, found = 316.1074.

4a (*E*)-3-benzylidene-2-methyl-5-phenyl-2-(trifluoromethyl)-2,3-dihydrofuran



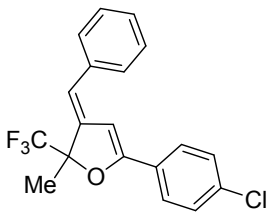
4a; yellow solid, m.p. = 50-52 °C; ^{1}H NMR (300 MHz, CD_3COCD_3): δ 7.84–7.81 (m, 2H), 8.76 (d, *J* = 7.5 Hz, 2H), 7.49–7.38 (m, 5H), 7.28–7.23 (m, 1H), 7.01 (s, 1H), 6.32 (s, 1H), 1.82 (s, 3H); ^{13}C NMR (75 MHz, CD_3COCD_3): δ 163.76, 141.85, 138.33, 130.97, 130.18, 129.57, 129.52, 129.01, 127.71, 126.60, 125.44 (q, J_{CF} = 281.4 Hz), 118.13, 100.64, 88.23 (q, J_{CF} = 29.7 Hz), 21.31; ^{19}F NMR (282 MHz, CD_3COCD_3), δ -82.74; HRMS (EI) m/z calcd. for $C_{19}H_{15}OF_3$ [M] $^{+}$ = 316.1075, found = 316.1075.

4b (*E*)-3-benzylidene-5-(4-fluorophenyl)-2-methyl-2-(trifluoromethyl)-2,3-dihydrofuran



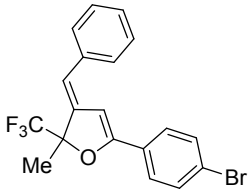
4b; yellow solid, m.p. = 86-88 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.88–7.85 (m, 2H), 7.53 (d, *J* = 7.2 Hz, 2H), 7.40–7.36 (m, 2H), 7.26–7.21 (m, 3H), 7.00 (s, 1H), 6.30 (s, 1H), 1.80 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 164.56 (d, J_{CF} = 247.4 Hz), 162.70, 141.70, 138.25, 129.53, 128.99, 128.90, 127.75, 126.72 (d, J_{CF} = 3.3 Hz), 125.39 (q, J_{CF} = 281.4 Hz), 118.22, 116.56 (d, J_{CF} = 22.1 Hz), 100.52, 88.36 (q, J_{CF} = 30.0 Hz), 21.24; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.61, -123.02; HRMS (EI) m/z calcd. for $C_{19}H_{14}OF_4$ [M] $^{+}$ = 334.0981, found = 334.0986.

4c (*E*)-3-benzylidene-5-(4-chlorophenyl)-2-methyl-2-(trifluoromethyl)-2,3-dihydrofuran



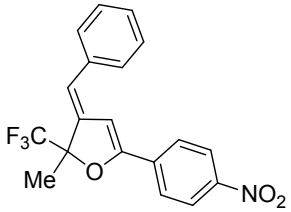
4c; yellow solid, m.p. = 83-85 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.76 (d, J = 8.4 Hz, 2H), 7.64 (d, J = 8.8 Hz, 2H), 7.55 (d, J = 7.6 Hz, 2H), 7.41–7.37 (m, 2H), 7.28–7.24 (m, 1H), 7.11 (s, 1H), 6.35 (s, 1H), 1.81 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 162.51, 141.48, 138.15, 132.73, 129.54, 129.32, 129.04, 128.37, 127.85, 125.35 (q, J_{CF} = 281.4 Hz), 124.57, 118.86, 101.52, 88.36 (q, J_{CF} = 29.8 Hz), 21.24; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.58; HRMS (EI) m/z calcd. for $C_{19}H_{14}OF_3Cl$ [M] $^{+}$ = 350.0685, found = 350.0684.

4d (*E*)-3-benzylidene-5-(4-bromophenyl)-2-methyl-2-(trifluoromethyl)-2,3-dihydrofuran



4d; yellow solid, m.p. = 132-134 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.83 (d, J = 8.4 Hz, 2H), 7.54 (d, J = 7.6 Hz, 2H), 7.49 (d, J = 8.8 Hz, 2H), 7.41–7.37 (m, 2H), 7.28–7.24 (m, 1H), 7.10 (s, 1H), 6.34 (s, 1H), 1.81 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 162.46, 141.51, 138.16, 136.21, 129.75, 129.54, 129.05, 128.95, 128.19, 127.84, 125.36 (q, J_{CF} = 281.4 Hz), 118.78, 101.43, 88.37 (q, J_{CF} = 29.9 Hz), 21.23; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.58; HRMS (EI) m/z calcd. for $C_{19}H_{14}OF_3Br$ [M] $^{+}$ = 394.0180, found = 394.0179.

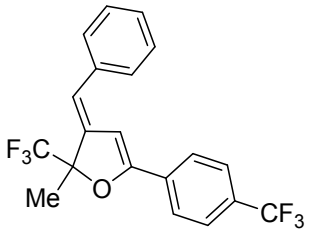
4e (*E*)-3-benzylidene-2-methyl-5-(4-nitrophenyl)-2-(trifluoromethyl)-2,3-dihydrofuran



4e; red solid, m.p. = 144-146 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 8.30 (d, J = 8.8 Hz, 2H), 8.07 (d, J = 8.8 Hz, 2H), 7.57 (d, J = 7.6 Hz, 2H), 7.42–7.38 (m, 2H), 7.34 (s, 1H), 7.31–7.27 (m, 1H), 6.47 (s, 1H), 1.85 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 161.17, 149.03, 141.00, 137.80, 135.89, 129.57, 129.18, 128.24, 127.43, 125.24 (q,

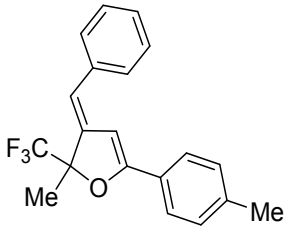
J_{CF} = 281.4 Hz), 124.74, 120.99, 104.76, 88.59 (q, J_{CF} = 30.0 Hz), 21.15; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.49; HRMS (EI) m/z calcd. for $C_{19}H_{14}O_3NF_3$ $[M]^+$ = 361.0926, found = 361.0925.

4f (*E*)-3-benzylidene-2-methyl-2-(trifluoromethyl)-5-(4-(trifluoromethyl)phenyl)-2,3-dihydrofuran



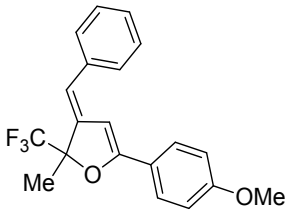
4f; yellow solid, m.p. = 103-105 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 8.04 (d, *J* = 8.8 Hz, 2H), 7.80 (d, *J* = 7.6 Hz, 2H), 7.57 (d, *J* = 7.6 Hz, 2H), 7.42–7.38 (m, 2H), 7.30–7.25 (m, 2H), 6.42 (s, 1H), 1.84 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 161.91, 141.28, 138.02, 133.87, 131.61 (q, J_{CF} = 32.1 Hz), 129.60, 129.17, 128.09, 127.16, 126.53 (q, J_{CF} = 3.8 Hz), 125.36 (q, J_{CF} = 281.3 Hz), 125.16 (q, J_{CF} = 281.0 Hz), 120.00, 103.15, 88.50 (q, J_{CF} = 29.8 Hz), 21.23; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -74.70, -94.49; HRMS (EI) m/z calcd. for $C_{20}H_{14}OF_6$ $[M]^+$ = 384.0949, found = 384.0952.

4g (*E*)-3-benzylidene-2-methyl-5-(p-tolyl)-2-(trifluoromethyl)-2,3-dihydrofuran



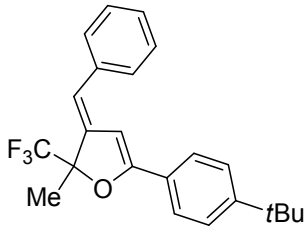
4g; yellow oil; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.70 (d, *J* = 8.4 Hz, 2H), 7.54 (d, *J* = 7.6 Hz, 2H), 7.41–7.37 (m, 2H), 7.27–7.23 (m, 3H), 6.95 (s, 1H), 6.28 (s, 1H), 2.36 (s, 2H), 1.80 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 164.05, 141.99, 141.30, 138.45, 130.23, 129.52, 128.98, 127.60, 127.48, 126.63, 125.48 (q, J_{CF} = 281.4 Hz), 117.53, 99.85, 88.19 (q, J_{CF} = 29.9 Hz), 21.52, 21.32; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.72; HRMS (EI) m/z calcd. for $C_{20}H_{17}OF_3$ $[M]^+$ = 330.1232, found = 330.1230.

4h (*E*)-3-benzylidene-5-(4-methoxyphenyl)-2-methyl-2-(trifluoromethyl)-2,3-dihydrofuran



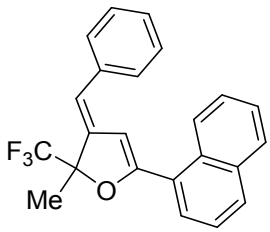
4h; yellow solid, m.p. = 74-76 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.79–7.75 (m, 2H), 7.53 (d, *J* = 7.2 Hz, 2H), 7.40–7.36 (m, 2H), 7.25–7.22 (m, 1H), 7.03–6.99 (m, 2H), 6.88 (s, 1H), 6.23 (s, 1H), 3.83 (s, 3H), 1.80 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 163.97, 162.31, 142.16, 138.57, 129.49, 128.91, 128.36, 127.46, 125.50 (q, J_{CF} = 281.5 Hz), 122.70, 116.77, 115.03, 98.76, 88.20 (q, J_{CF} = 29.5 Hz), 55.81, 21.31; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.76; HRMS (EI) m/z calcd. for $C_{20}H_{17}O_2F_3$ $[M]^+$ = 346.1181, found = 346.1175.

4i (*E*)-3-benzylidene-5-(4-(*tert*-butyl)phenyl)-2-methyl-2-(trifluoromethyl)-2,3-dihydrofuran



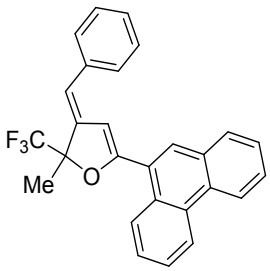
4i; yellow solid, m.p. = 81-83 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.77 (d, *J* = 8.8 Hz, 2H), 7.55–7.50 (m, 4H), 7.41–7.37 (m, 2H), 7.26–7.23 (m, 1H), 6.99 (s, 1H), 6.29 (s, 1H), 1.81 (s, 3H), 1.33 (s, 9H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 163.98, 154.32, 141.97, 138.43, 129.51, 128.96, 127.60, 127.45, 126.52, 126.49, 125.45 (q, J_{CF} = 281.4 Hz), 117.56, 117.55, 99.98, 88.17 (q, J_{CF} = 29.7 Hz), 35.46, 31.45, 21.31; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.68; HRMS (EI) m/z calcd. for $C_{23}H_{23}OF_3$ $[M]^+$ = 372.1701, found = 372.1703.

4j (*E*)-3-benzylidene-2-methyl-5-(naphthalen-1-yl)-2-(trifluoromethyl)-2,3-dihydrofuran



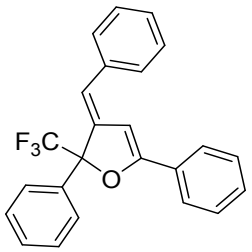
4j; yellow solid, m.p. = 74-76 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 8.45 (d, J = 8.4 Hz, 1H), 8.04–7.98 (m, 2H), 7.90–7.88 (m, 1H), 7.64–7.55 (m, 5H), 7.41–7.37 (m, 2H), 7.28–7.23 (m, 1H), 6.84 (s, 1H), 6.39 (s, 1H), 1.90 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 164.62, 141.82, 138.30, 134.88, 131.64, 131.40, 129.60, 129.55, 128.99, 128.17, 128.13, 127.97, 127.78, 127.21, 126.09, 125.51 (q, J_{CF} = 281.5 Hz), 118.42, 104.97, 88.23 (q, J_{CF} = 29.8 Hz), 21.32; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.79; HRMS (EI) m/z calcd. for $C_{23}H_{17}OF_3$ [M] $^{+}$ = 366.1232, found = 366.1236.

4k (*E*)-3-benzylidene-2-methyl-5-(phenanthren-9-yl)-2-(trifluoromethyl)-2,3-dihydrofuran



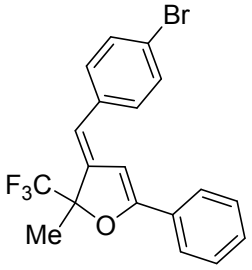
4k; yellow solid, m.p. = 145-147 °C; ^{1}H NMR (400 MHz, CD_2Cl_2): δ 8.77–8.68 (m, 2H), 8.47–8.44 (m, 1H), 8.13 (s, 1H), 7.96 (d, J = 7.6 Hz, 1H), 7.76–7.64 (m, 4H), 7.51 (d, J = 7.6 Hz, 2H), 7.44–7.40 (m, 2H), 7.30–7.27 (m, 1H), 6.77 (s, 1H), 6.34 (s, 1H), 1.94 (s, 3H); ^{13}C NMR (100 MHz, CD_2Cl_2): δ 164.07, 141.74, 137.98, 131.43, 131.26, 131.10, 129.78, 129.52, 129.18, 129.03, 128.54, 127.68, 127.53, 127.43, 126.74, 126.53, 125.03 (q, J_{CF} = 281.4 Hz), 123.63, 123.13, 117.88, 105.05, 87.83 (q, J_{CF} = 29.9 Hz), 21.55; ^{19}F NMR (376 MHz, CD_2Cl_2), δ -91.93; HRMS (EI) m/z calcd. for $C_{27}H_{19}OF_3$ [M] $^{+}$ = 416.1388, found = 416.1385.

4l (*E*)-3-benzylidene-2,5-diphenyl-2-(trifluoromethyl)-2,3-dihydrofuran



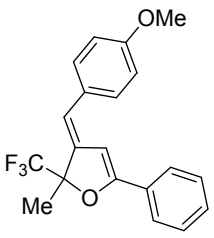
4l; yellow solid, m.p. = 146-148 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.94–7.92 (m, 2H), 7.86 (d, *J* = 7.6 Hz, 2H), 7.57–7.45 (m, 8H), 7.41–7.37 (m, 2H), 7.28–7.25 (m, 1H), 7.13 (s, 1H), 6.56 (s, 1H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 163.66, 141.50, 138.05, 136.72, 131.18, 130.33, 129.96, 129.72, 129.71, 129.57, 129.21, 127.98, 126.99, 126.98, 126.69, 125.04 (q, J_{CF} = 281.6 Hz), 120.65, 100.98, 90.53 (q, J_{CF} = 32.2 Hz); ^{19}F NMR (376 MHz, CD_3COCD_3), δ -100.03; HRMS (EI) m/z calcd. for $C_{24}H_{17}OF_3$ [M] $^{+}$ = 378.1232, found = 378.1228.

4m (*E*)-3-(4-bromobenzylidene)-2-methyl-5-phenyl-2-(trifluoromethyl)-2,3-dihydrofuran



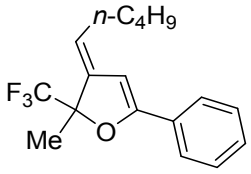
4m; yellow solid, m.p. = 55-57 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.84–7.82 (m, 2H), 7.55–7.45 (m, 7H), 7.03 (s, 1H), 6.27 (s, 1H), 1.81 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 164.33, 142.76, 137.50, 132.52, 131.16, 130.83, 130.03, 129.60, 128.09 (q, J_{CF} = 282.2 Hz), 123.87, 120.81, 116.65, 100.46, 88.36 (q, J_{CF} = 29.7 Hz), 55.60, 21.17; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.73; HRMS (EI) m/z calcd. for $C_{19}H_{14}OF_3Br$ [M] $^{+}$ = 394.0180, found = 394.0182.

4n (*E*)-3-(4-methoxybenzylidene)-2-methyl-5-phenyl-2-(trifluoromethyl)-2,3-dihydrofuran



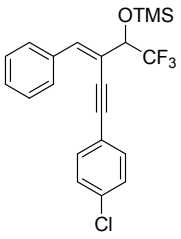
4n; yellow solid, m.p. = 79-81 °C; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.83–7.80 (m, 2H), 7.51–7.42 (m, 5H), 7.01 (s, 1H), 6.96 (d, J = 8.8 Hz, 2H), 6.26 (s, 1H), 3.81 (s, 3H), 1.79 (s, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 162.93, 159.69, 139.56, 130.94, 130.77, 130.33, 129.57, 126.46, 125.51 (q, J_{CF} = 281.5 Hz), 117.94, 117.93, 114.92, 100.74, 88.12 (q, J_{CF} = 29.6 Hz), 21.31; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.54; HRMS (EI) m/z calcd. for $C_{20}H_{17}O_2F_3$ $[M]^+$ = 346.1181, found = 346.1179.

4o (*E*)-2-methyl-3-pentylidene-5-phenyl-2-(trifluoromethyl)-2,3-dihydrofuran



4o; colorless oil; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 7.73–7.70 (m, 2H), 7.45–7.37 (m, 3H), 6.54 (s, 1H), 5.30 (t, J = 7.6 Hz, 1H), 2.29–2.23 (m, 2H), 1.65 (s, 3H), 1.48–1.34 (m, 4H), 0.92 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 160.39, 141.65, 130.72, 130.41, 129.53, 126.24, 125.56 (q, J_{CF} = 281.1 Hz), 119.88, 100.20, 88.63 (q, J_{CF} = 29.8 Hz), 32.67, 30.02, 22.89, 21.58, 14.29; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -94.06; HRMS (EI) m/z calcd. for $C_{17}H_{19}OF_3$ $[M]^+$ = 296.1388, found = 296.1392.

(*E*)-((3-benzylidene-5-(4-chlorophenyl)-1,1,1-trifluoropent-4-yn-2-yl)oxy)-trimethylsilane



colorless oil; ^{1}H NMR (400 MHz, CD_3COCD_3): δ 8.04–8.01 (m, 2H), 7.59–7.56 (m, 2H), 7.51–7.47 (m, 4H), 7.44–7.39 (m, 1H), 7.28 (s, 1H), 5.04–4.99 (m, 1H), 0.27 (s, 9H); ^{13}C NMR (100 MHz, CD_3COCD_3): δ 140.08, 136.29, 135.45, 133.85, 130.33, 130.13, 129.96, 125.38 (q, J_{CF} = 281.0 Hz), 122.66, 117.22, 97.33, 88.27, 75.26 (q, J_{CF} = 31.4 Hz), -0.09; ^{19}F NMR (376 MHz, CD_3COCD_3), δ -99.76; HRMS (EI) m/z calcd. for $C_{21}H_{20}OF_3ClSi$ $[M]^+$ = 408.0924, found = 408.0922.

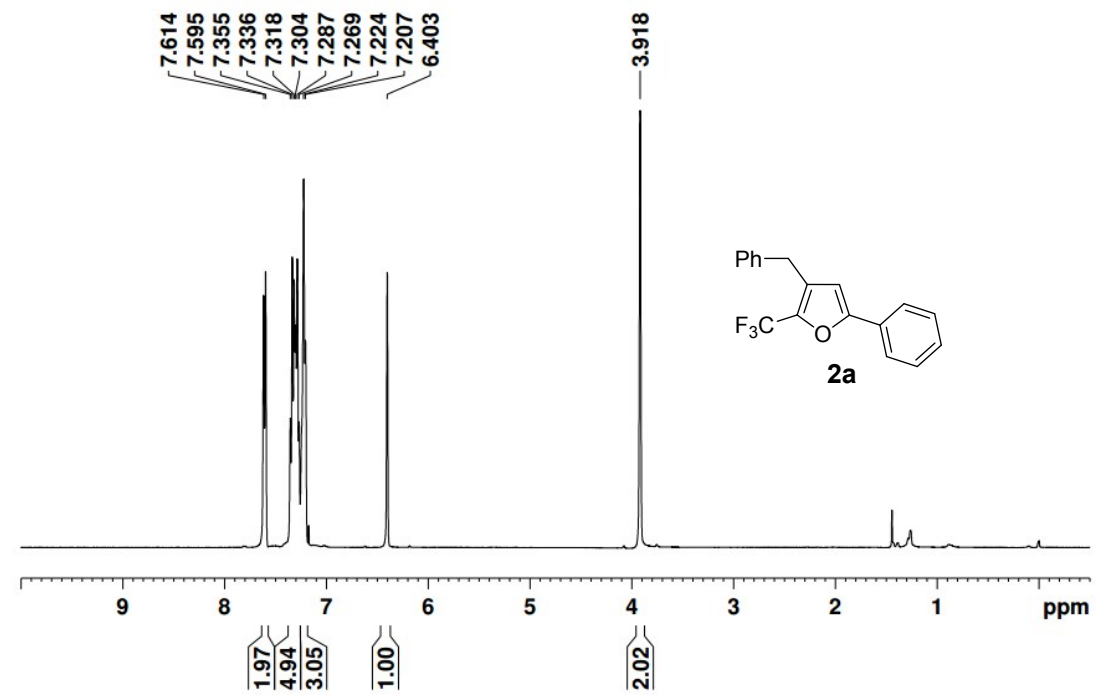
6. References

[1] a) T. Yao, X. Zhang, R. C. Larock, *J. Am. Chem. Soc*. **2004**, *126*, 11164; b) N. T. Patil, H. Wu, Y. Yamamoto, *J. Org. Chem*. **2005**, *70*, 4531; c) Y. Liu, S. Zhou, *Org. Lett*. **2005**, *7*, 4609.

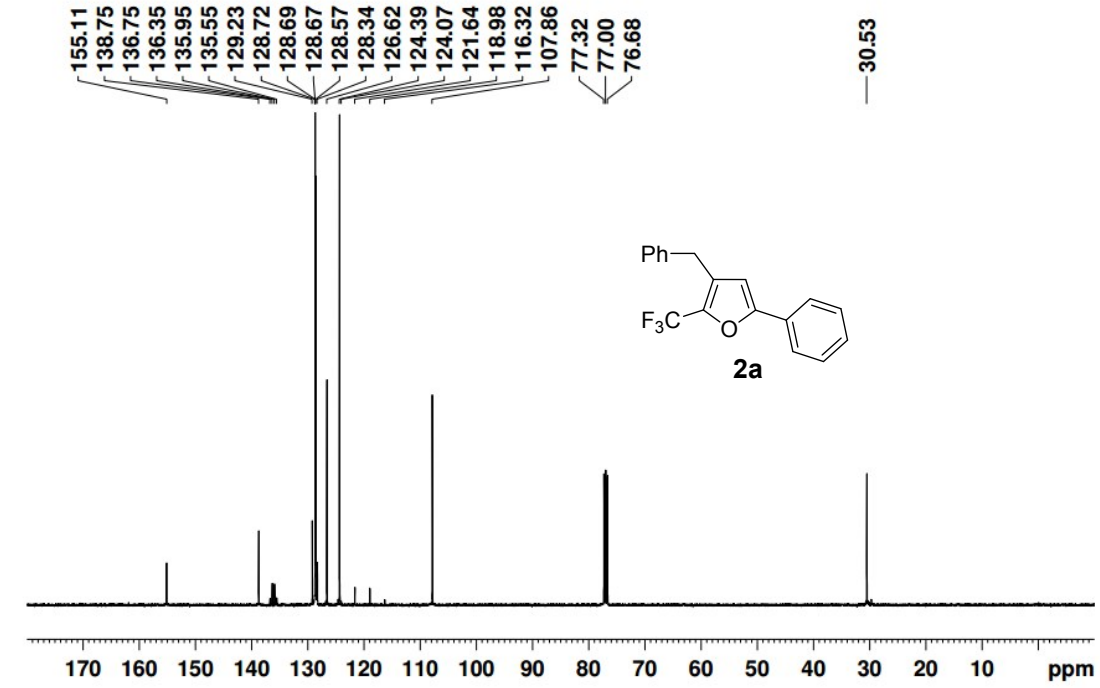
[2] a) Y. Chen, Y. Liu, *J. Org. Chem*. **2011**, *76*, 5274; b) M. Lautens, M. L. Maddess, E. L. O. Sauer, S. G. Ouellet, *Org. Lett*. **2002**, *4*, 83.

7. ^{1}H, ^{13}C, ^{19}F spectra for 2 and 4

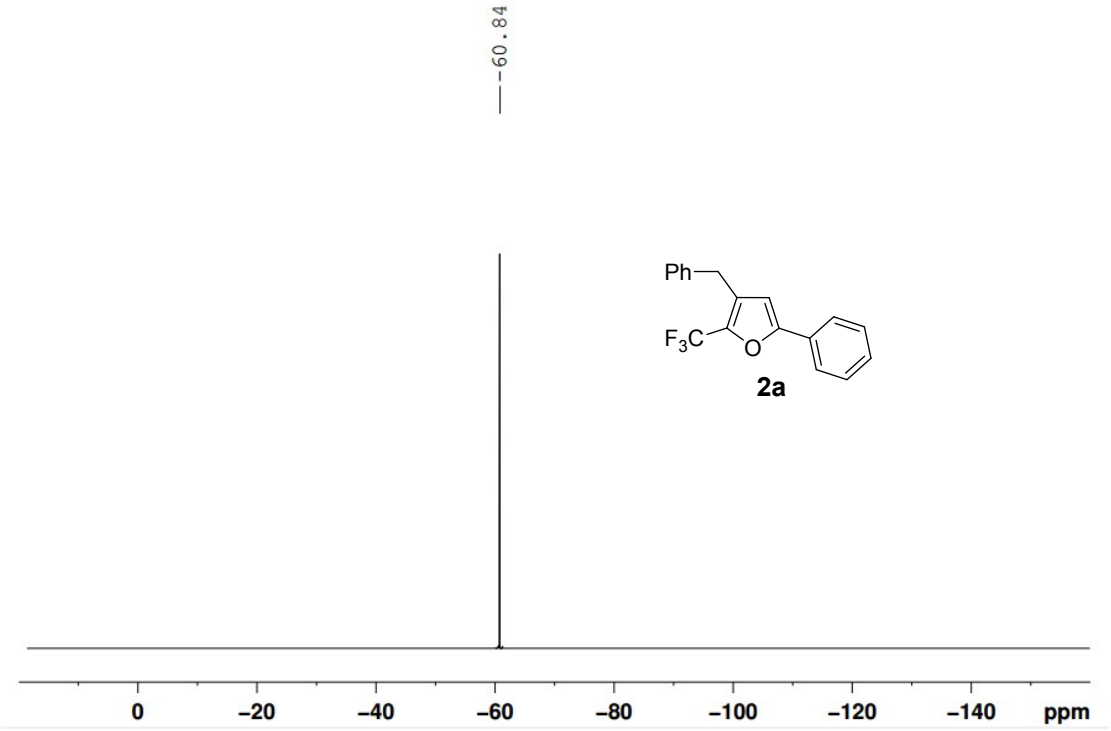
zw-3-51



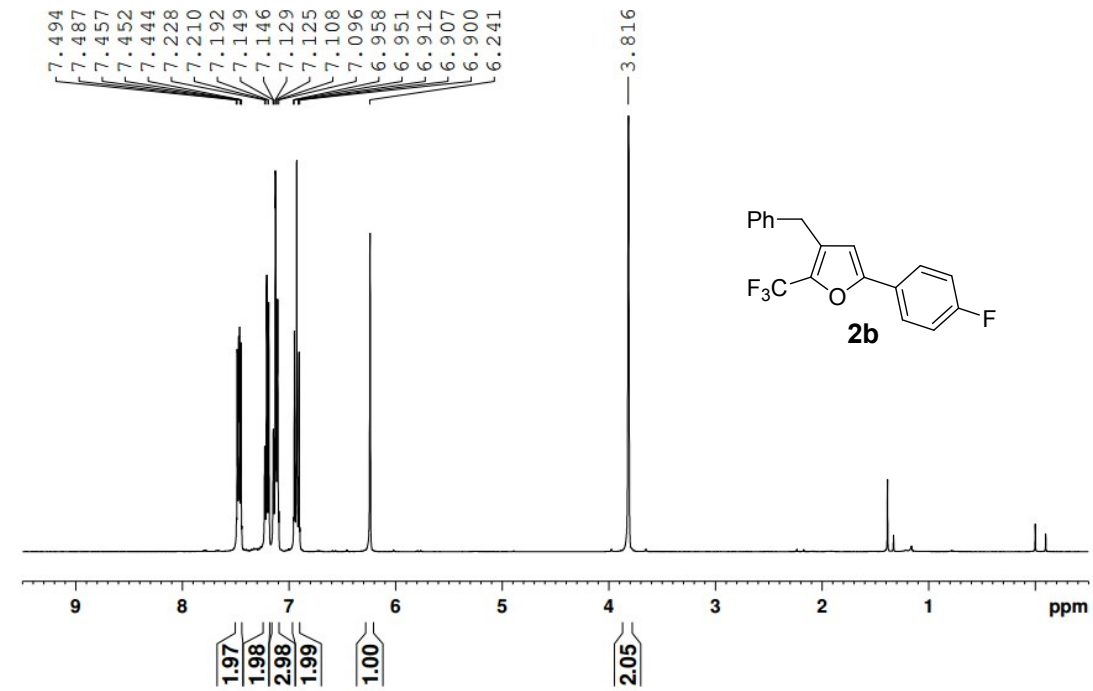
zw-3-51c



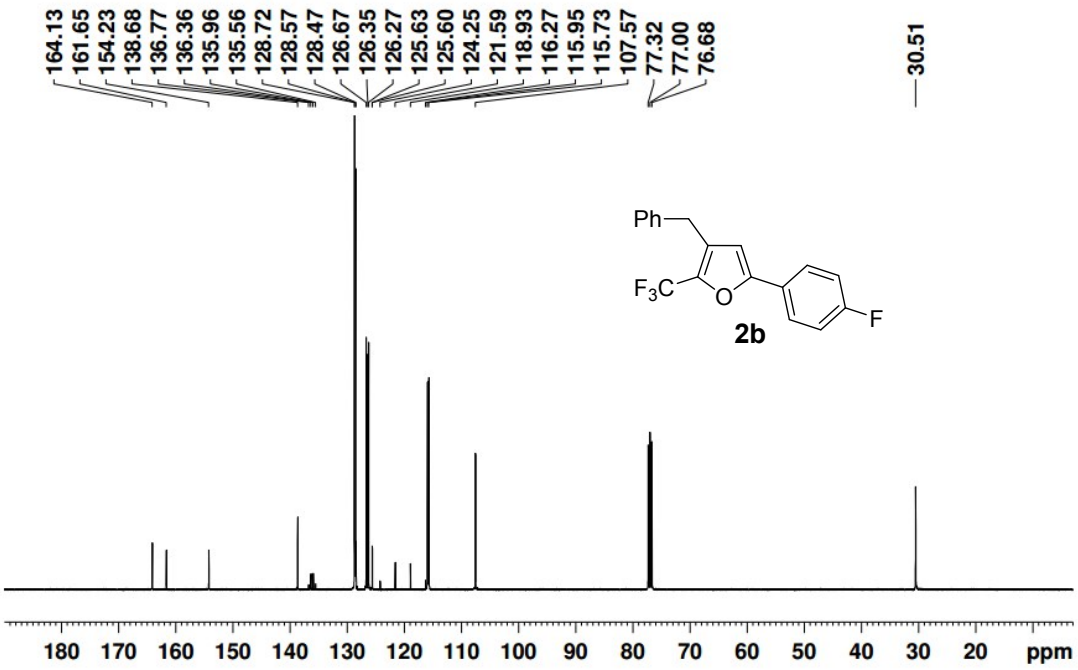
zw-3-51f



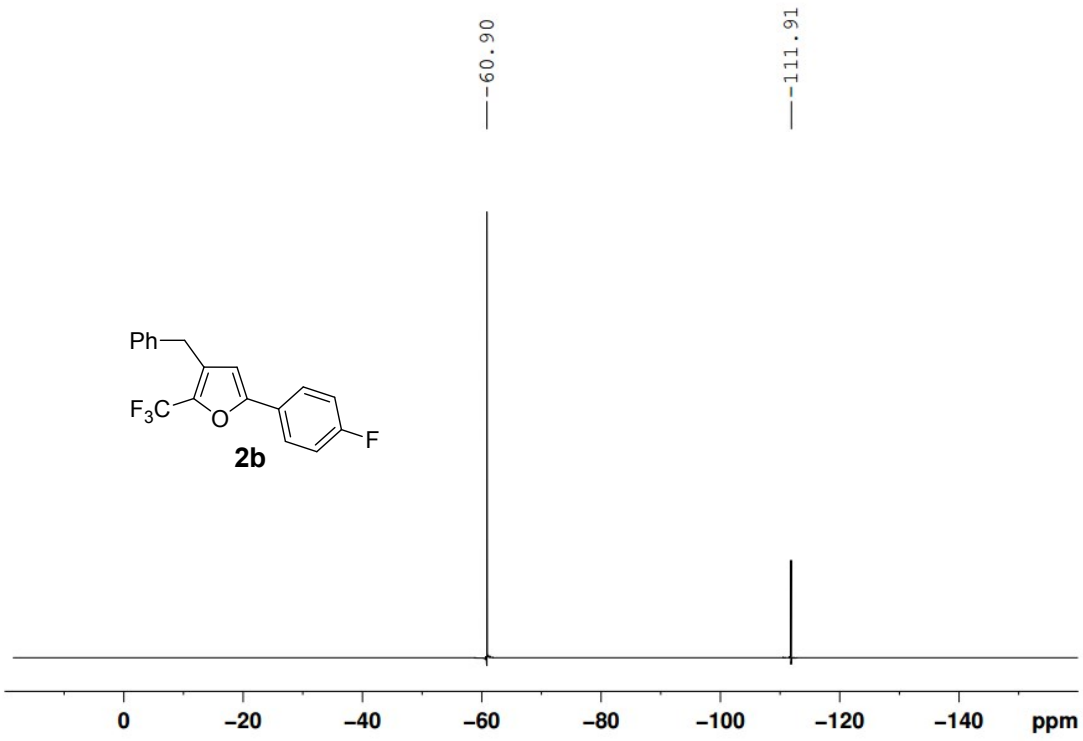
zw-3-55



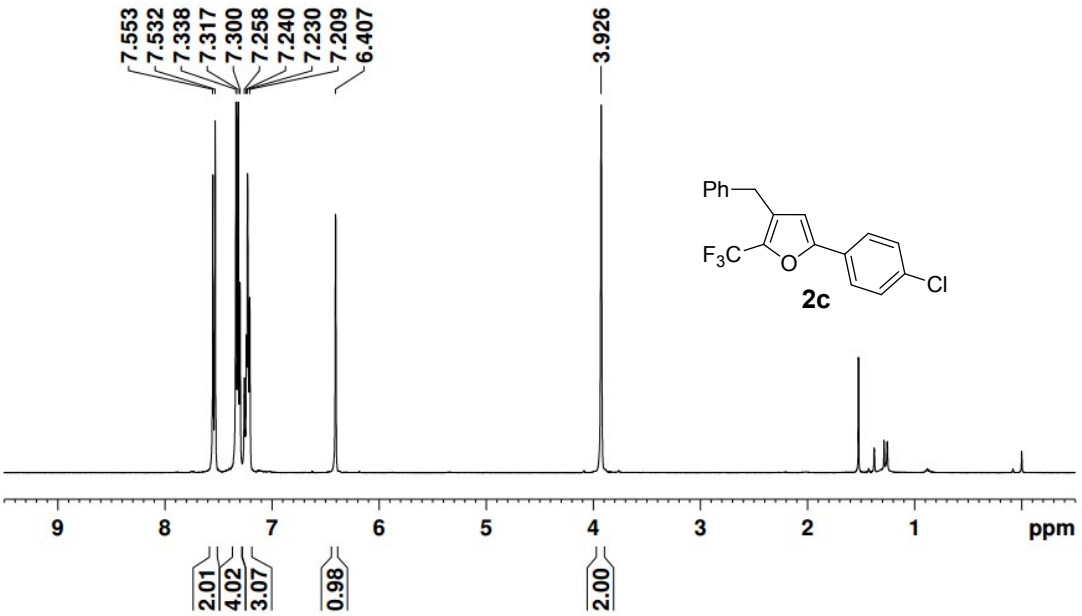
zw-3-55c



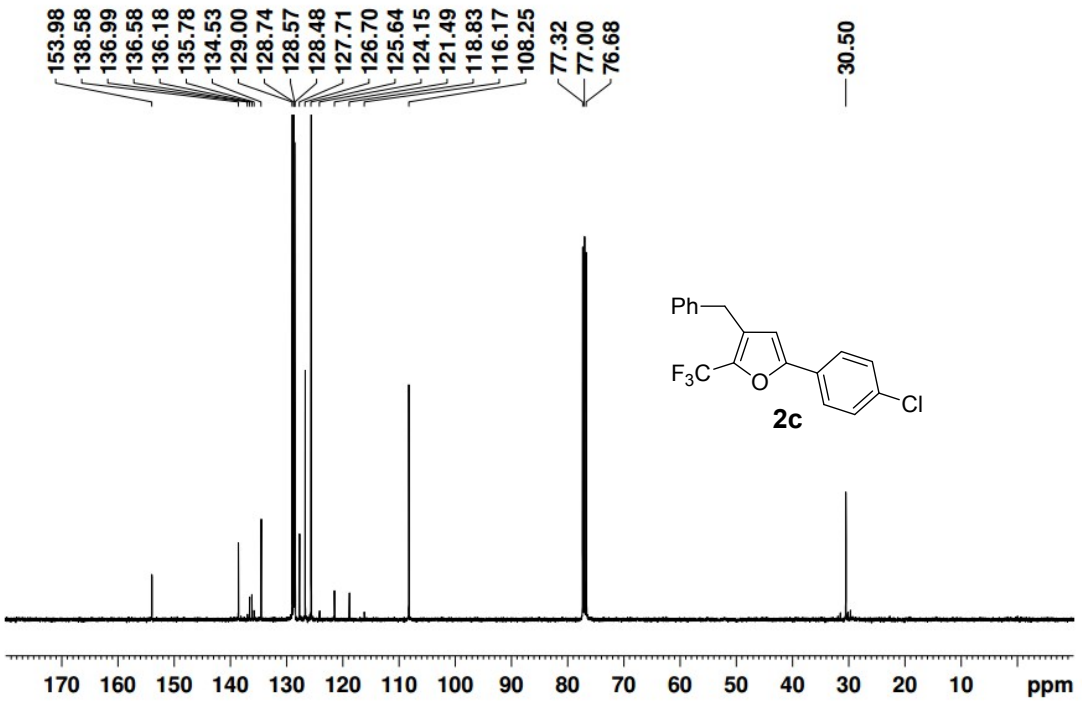
zw-3-55f



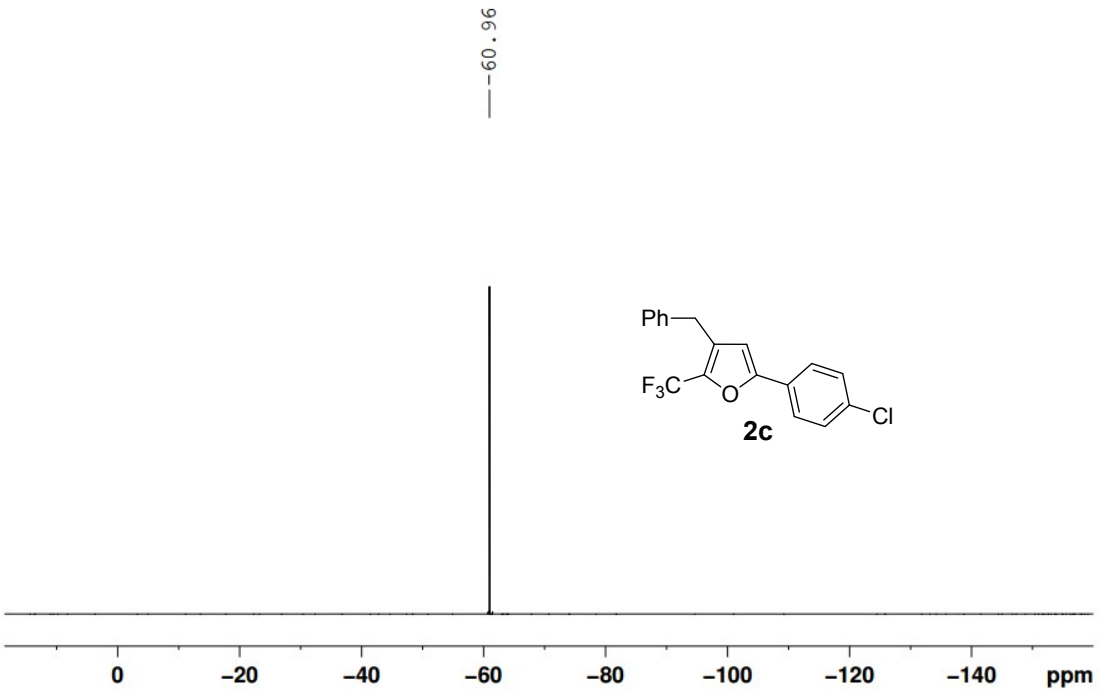
zw-3-50



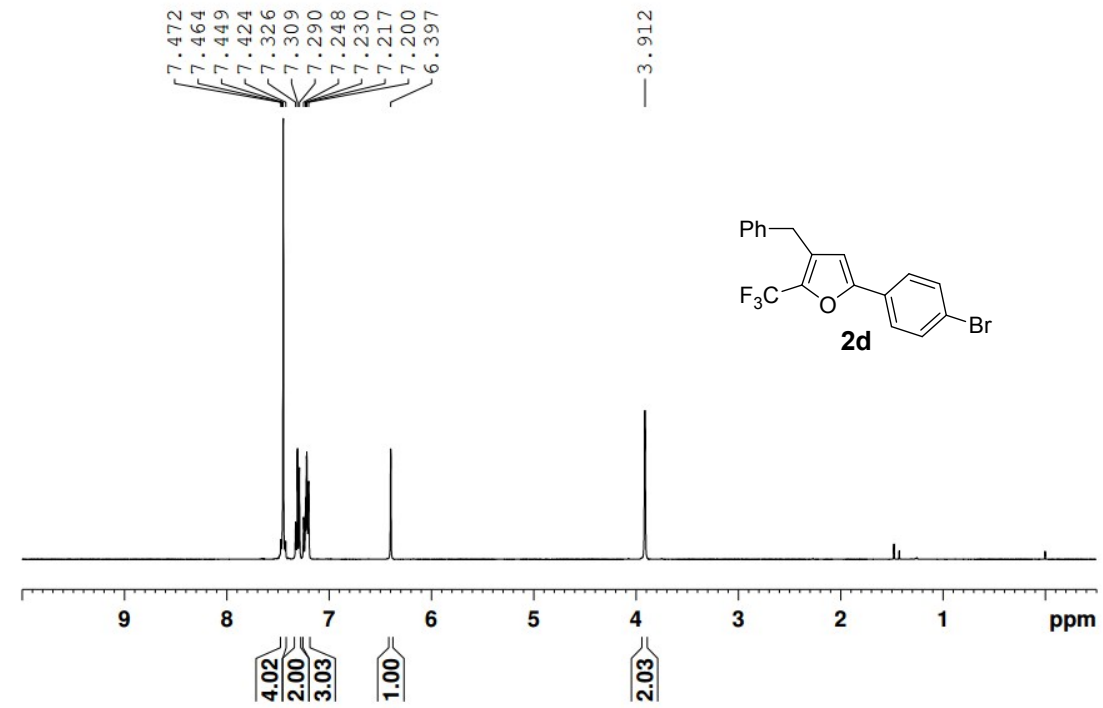
zw-3-50c



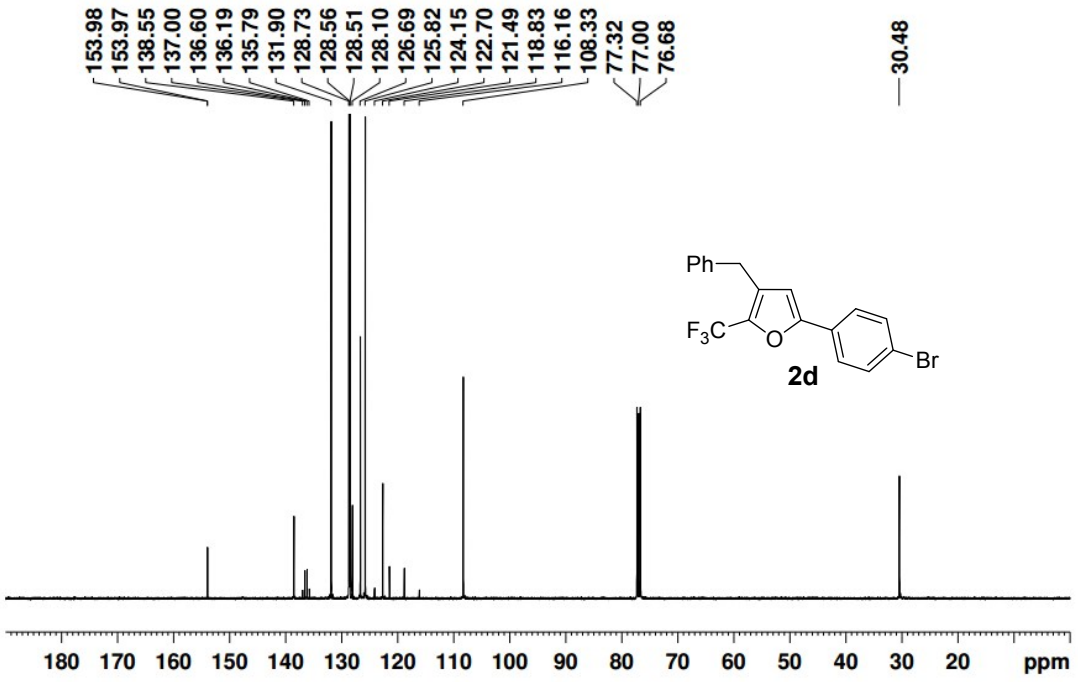
zw-3-50f



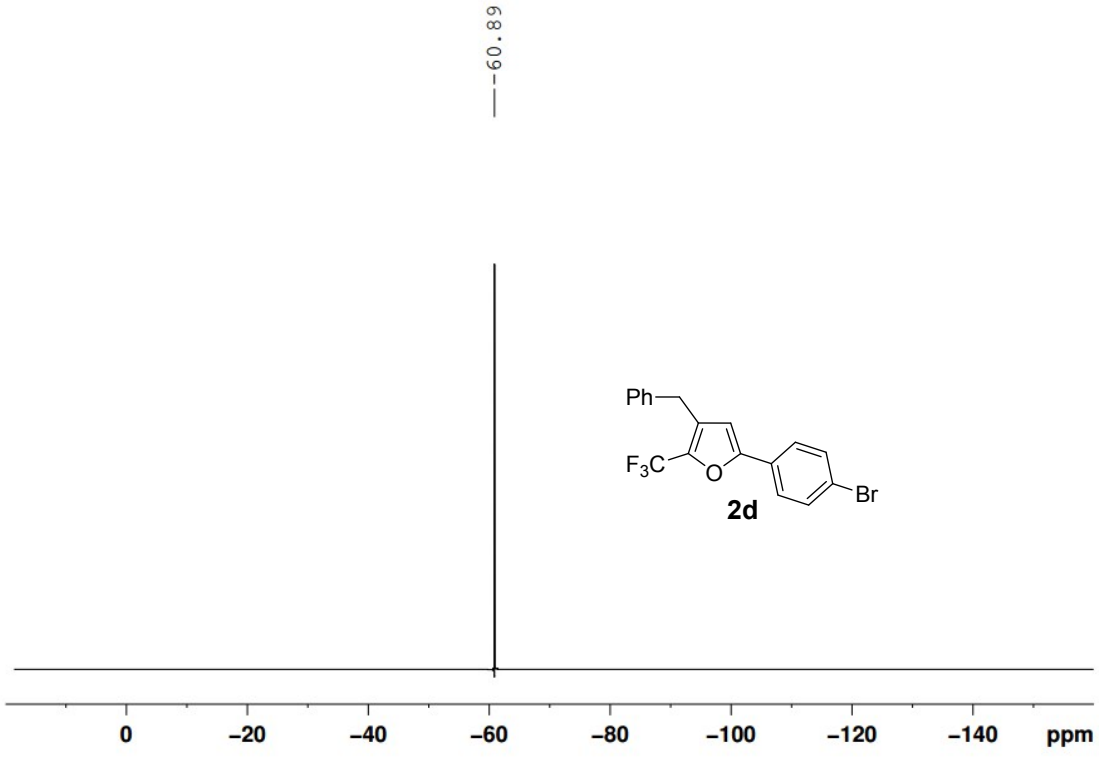
zw-3-57



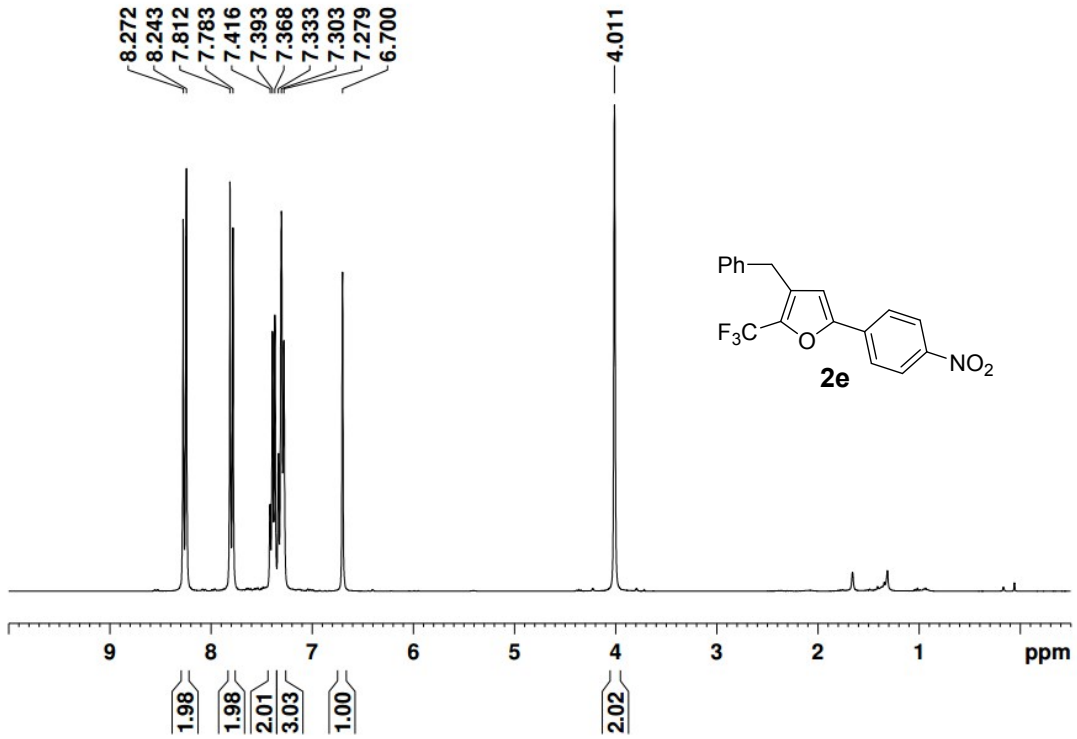
zw-3-57c



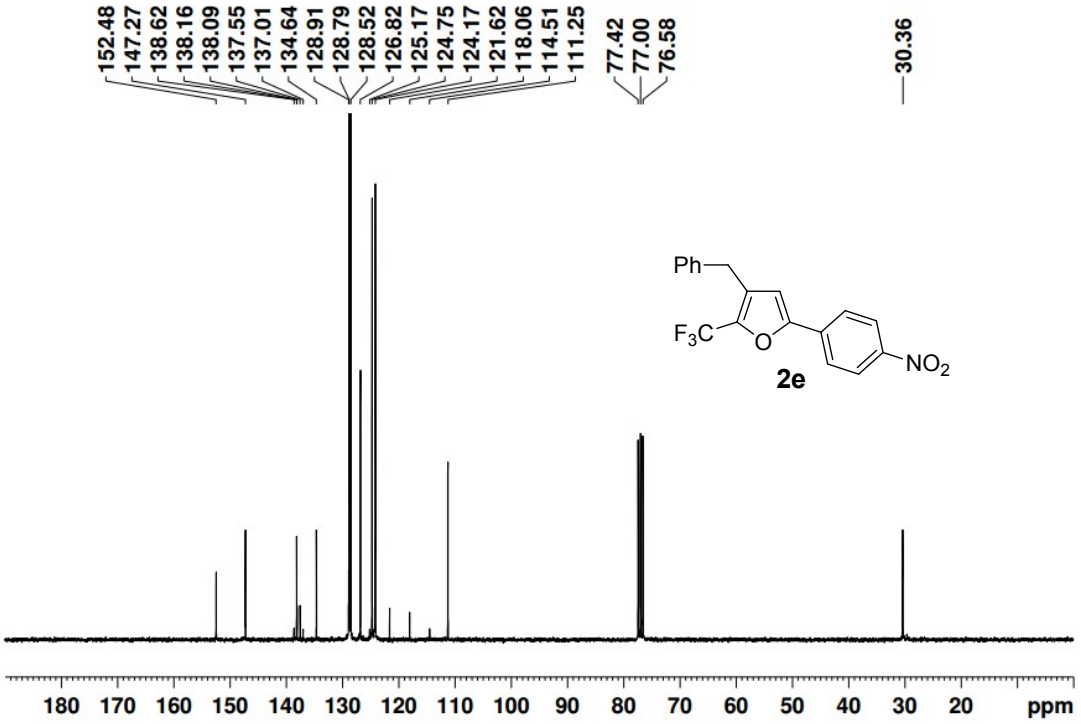
zw-3-57f



zw-3-62



zw-3-62c



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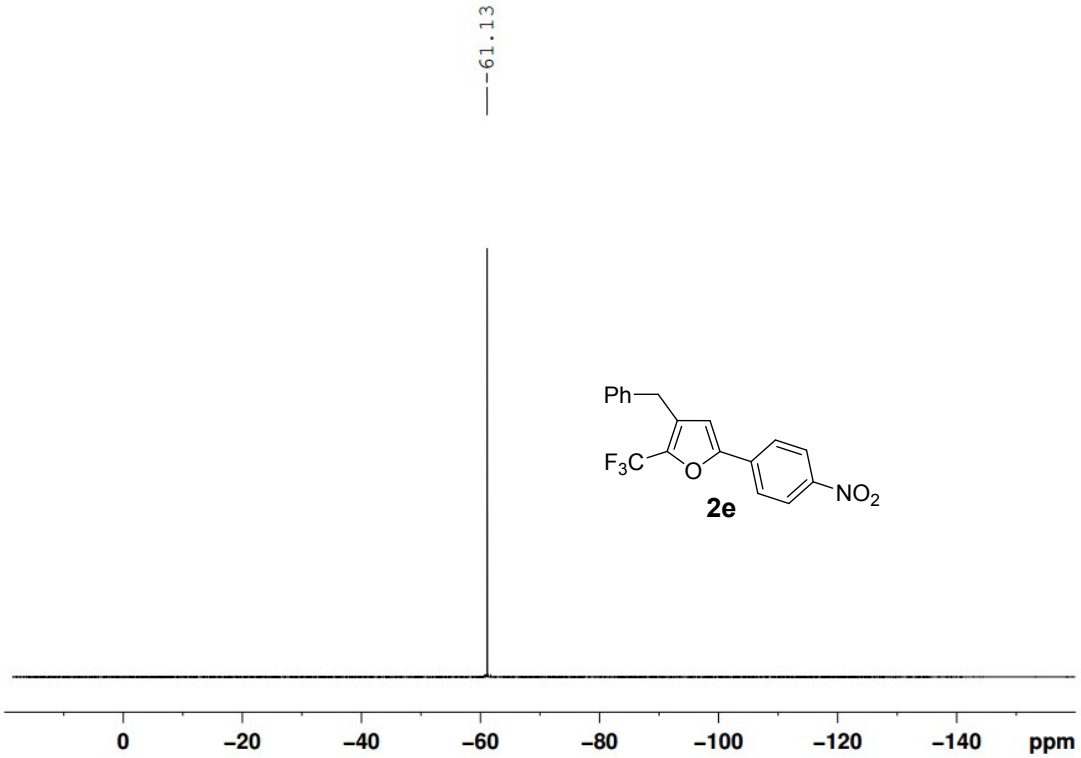
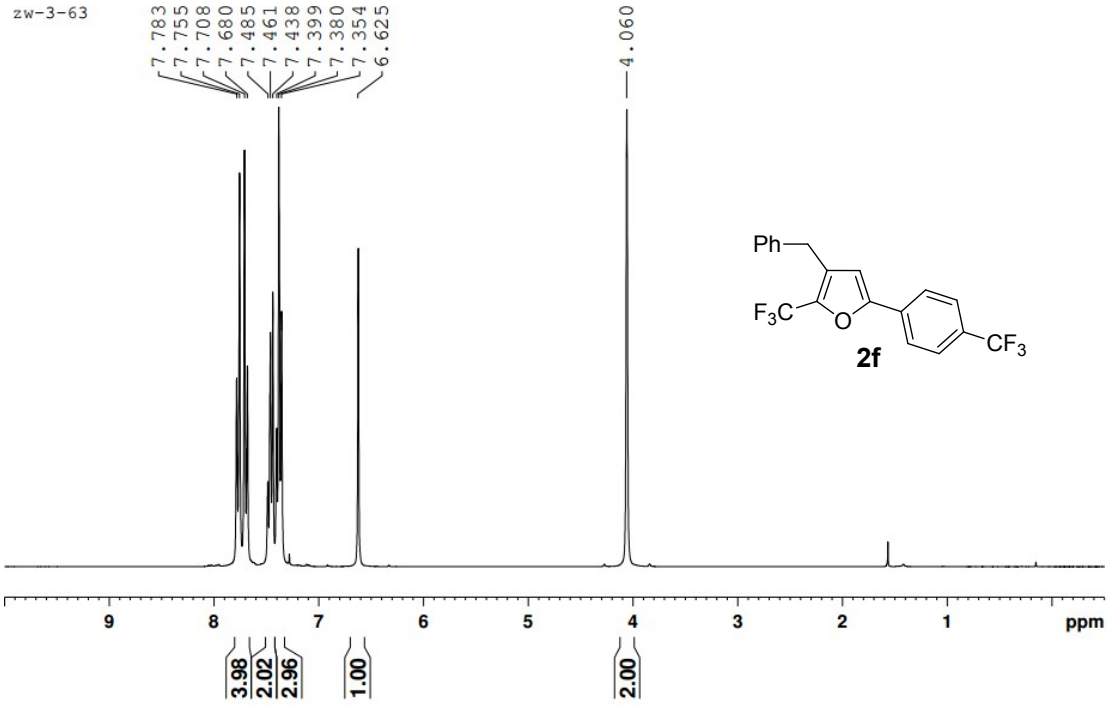


zw-3-63



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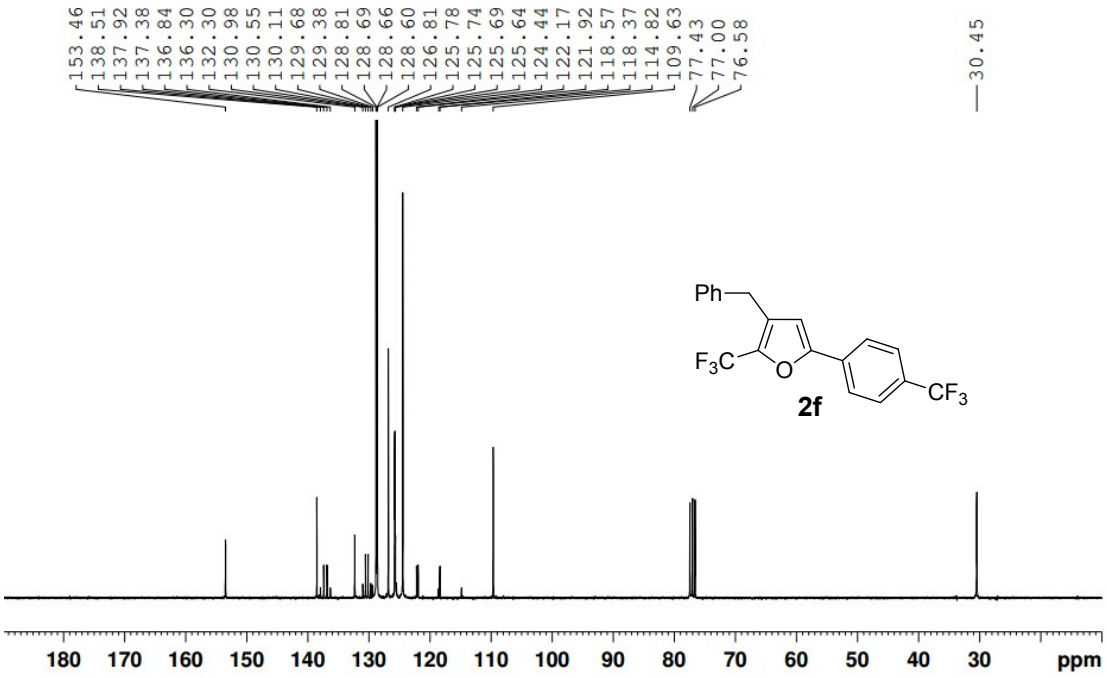

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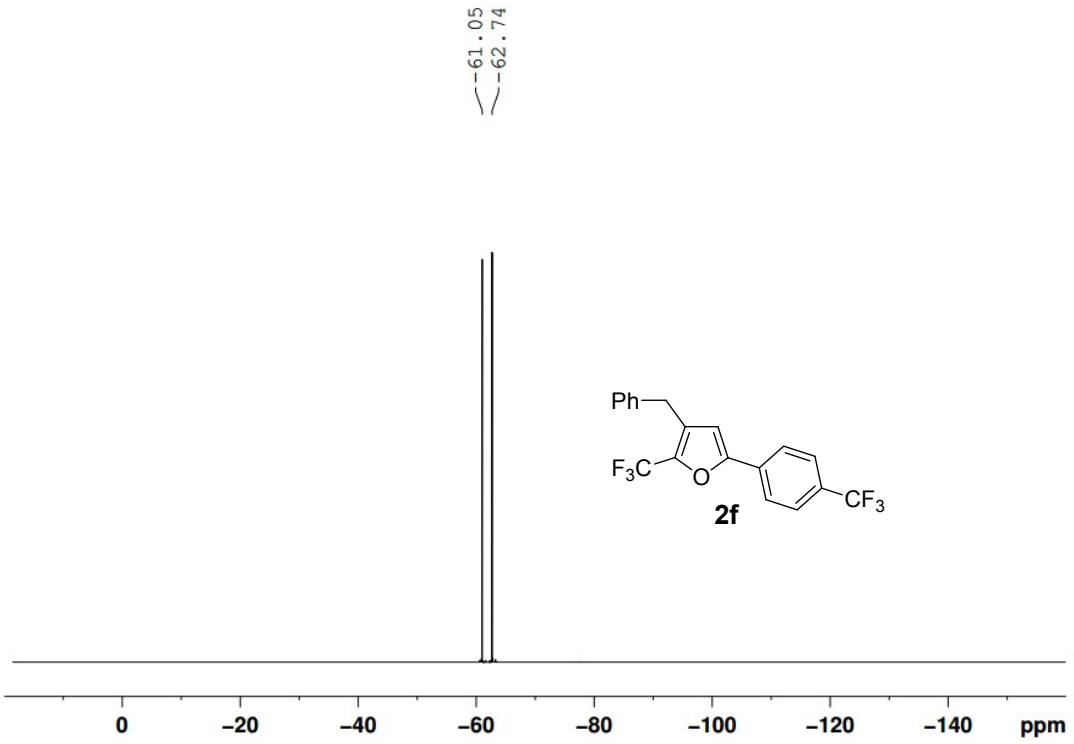
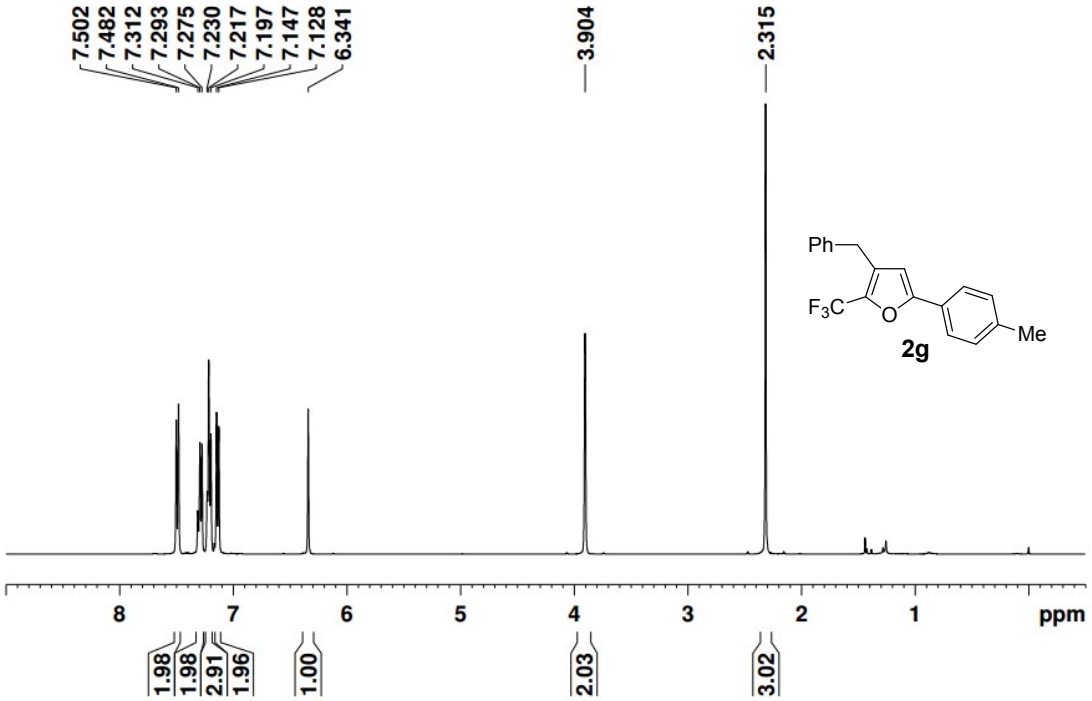
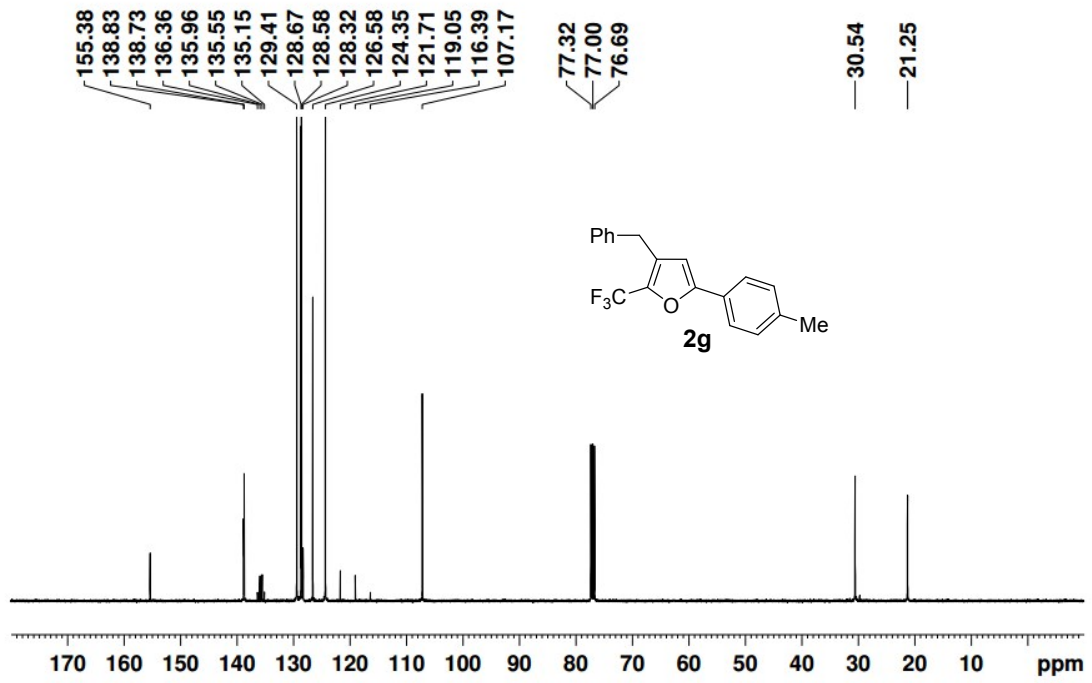


zw-3-52



zw-3-52c



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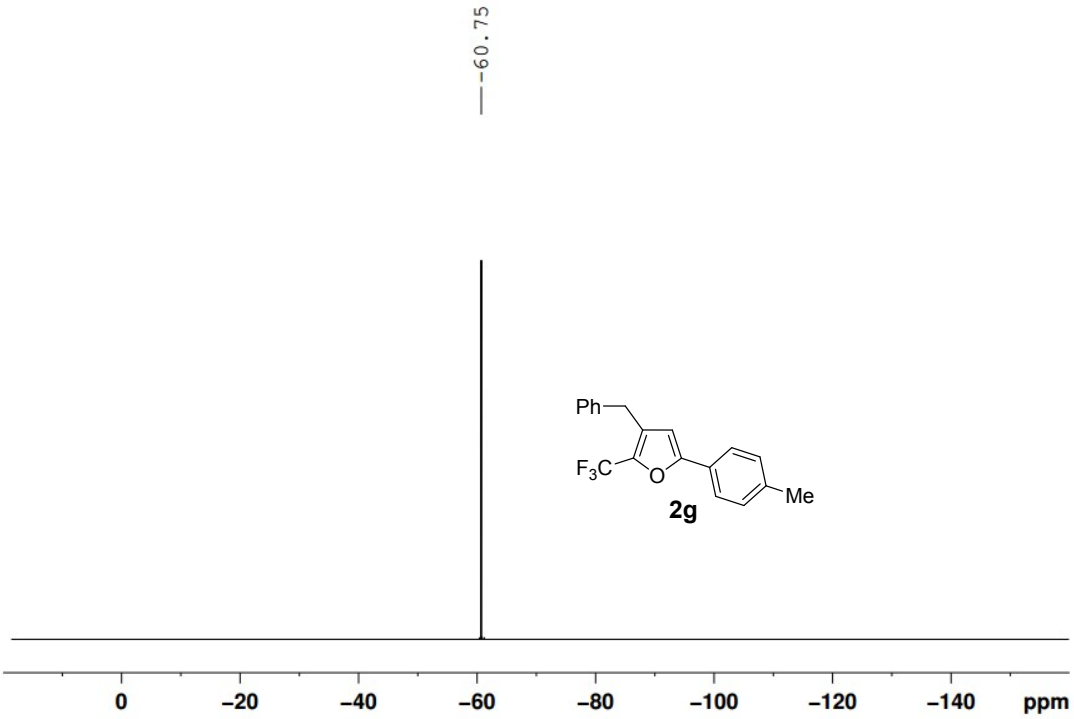
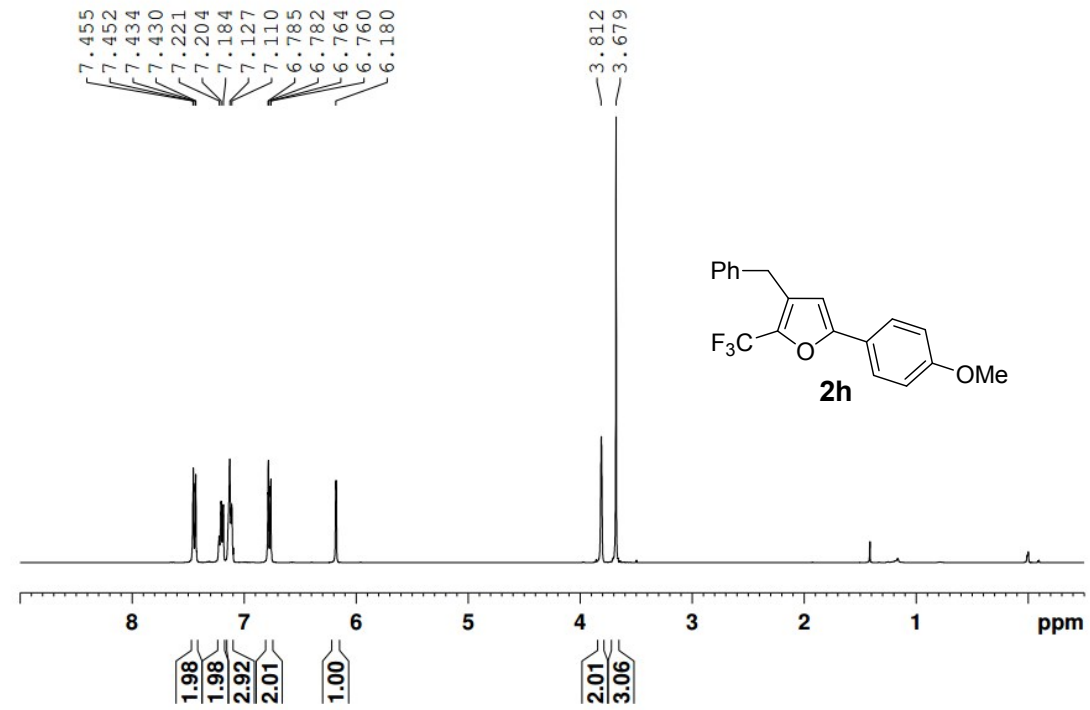
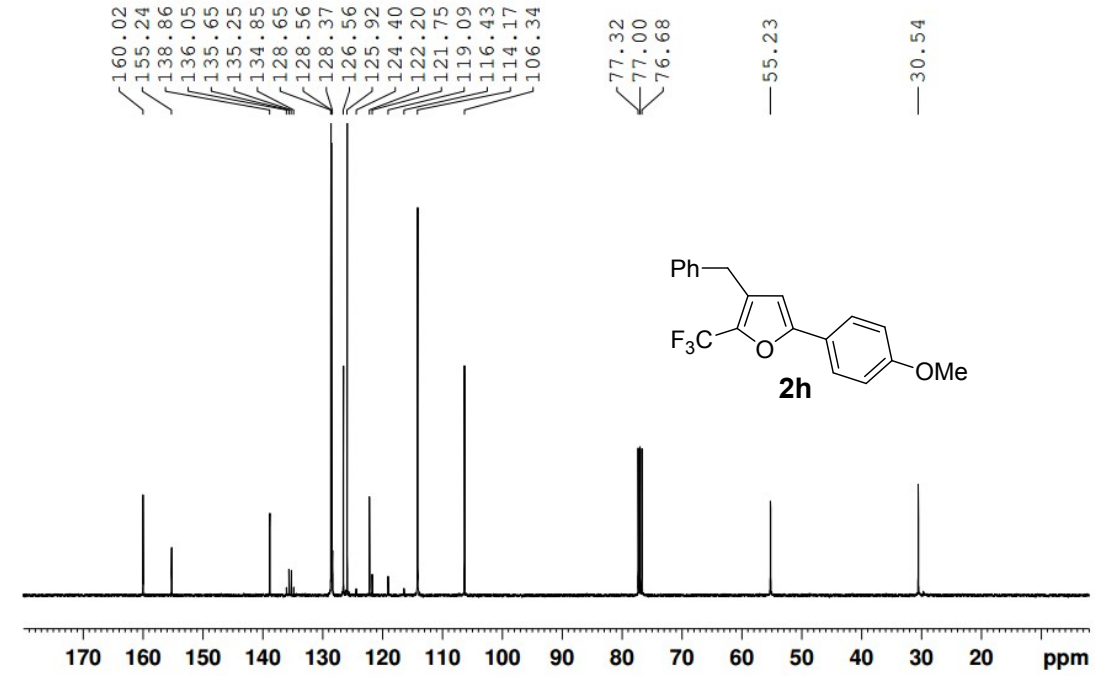


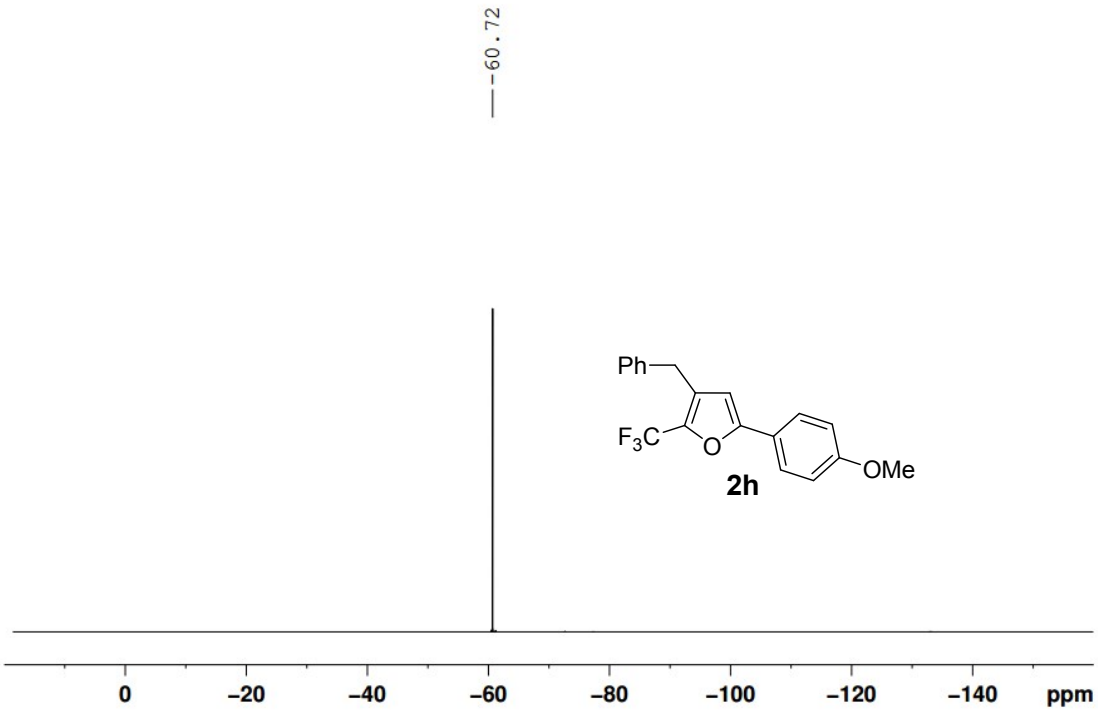
zw-3-54



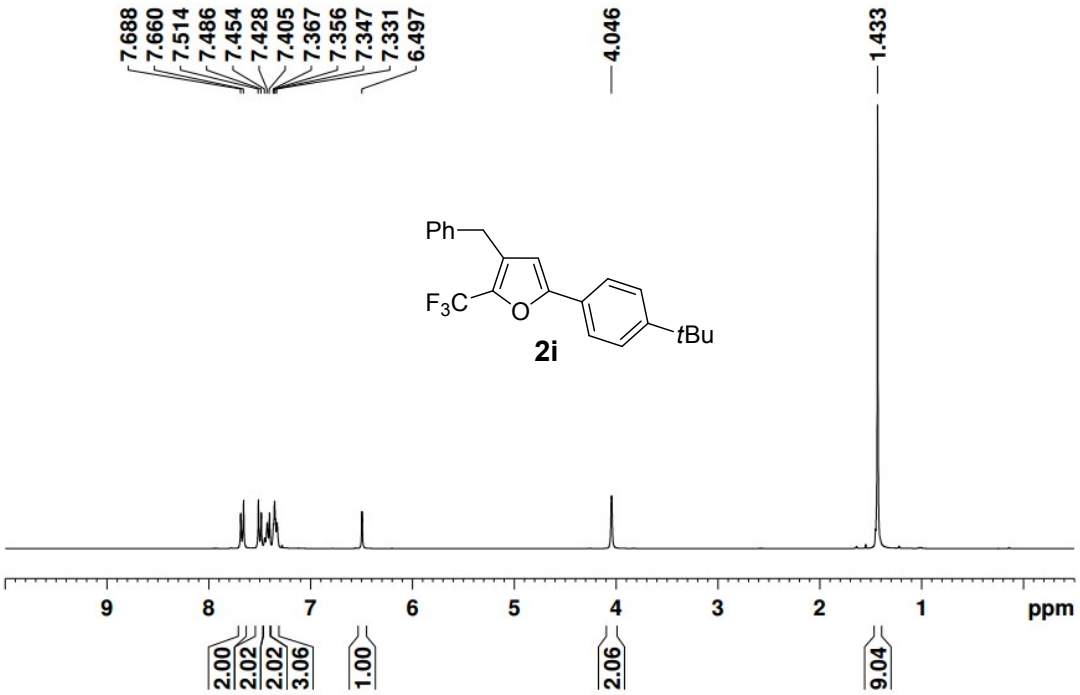
zw-3-54c



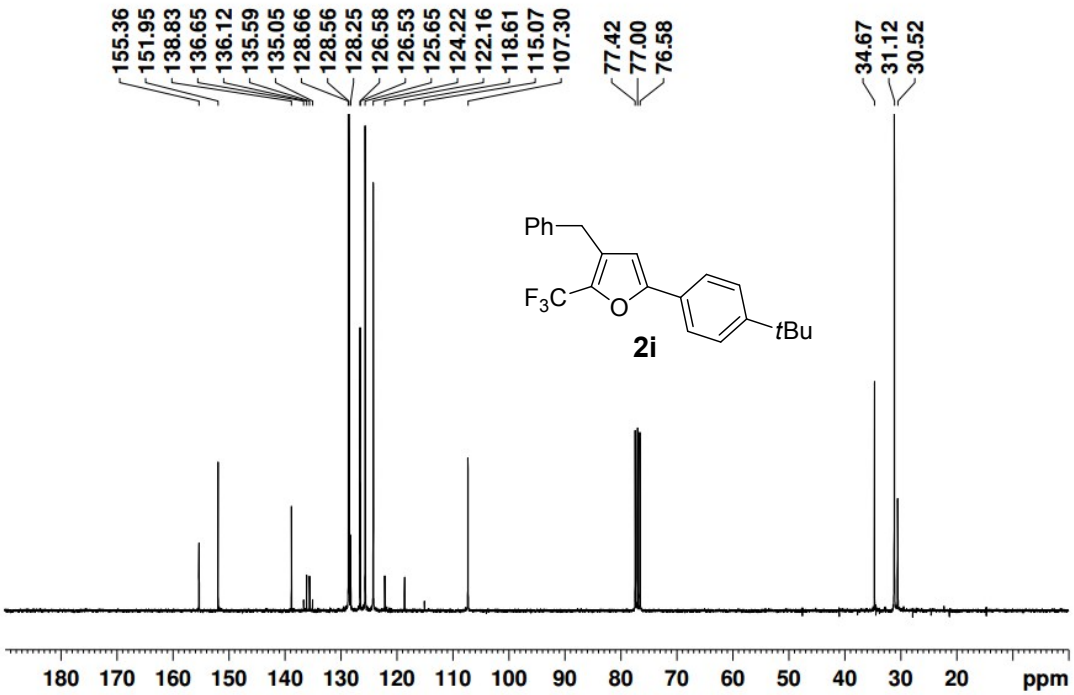
zw-3-54f



zw-3-61



zw-3-61c



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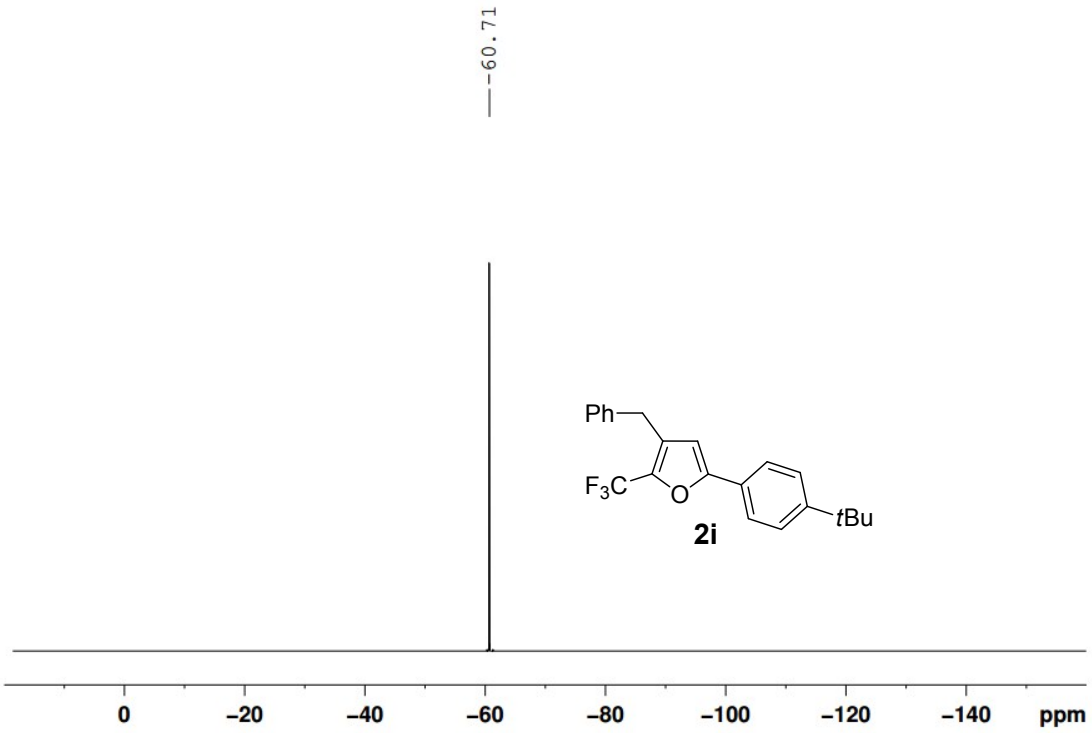
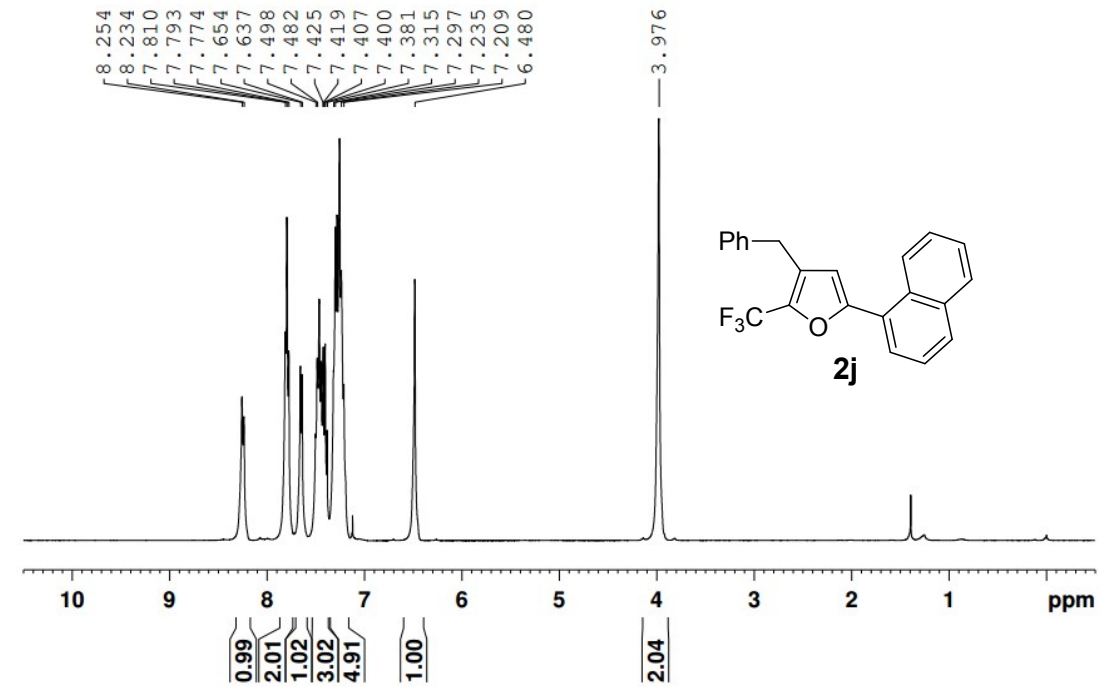
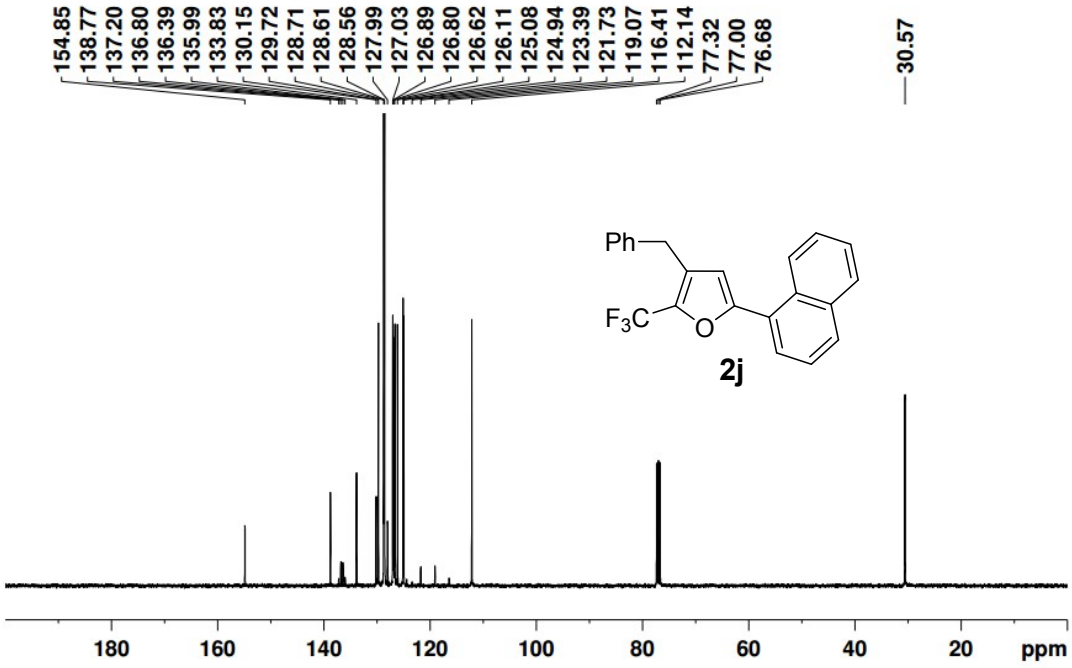


zw-3-56



zw-3-56c



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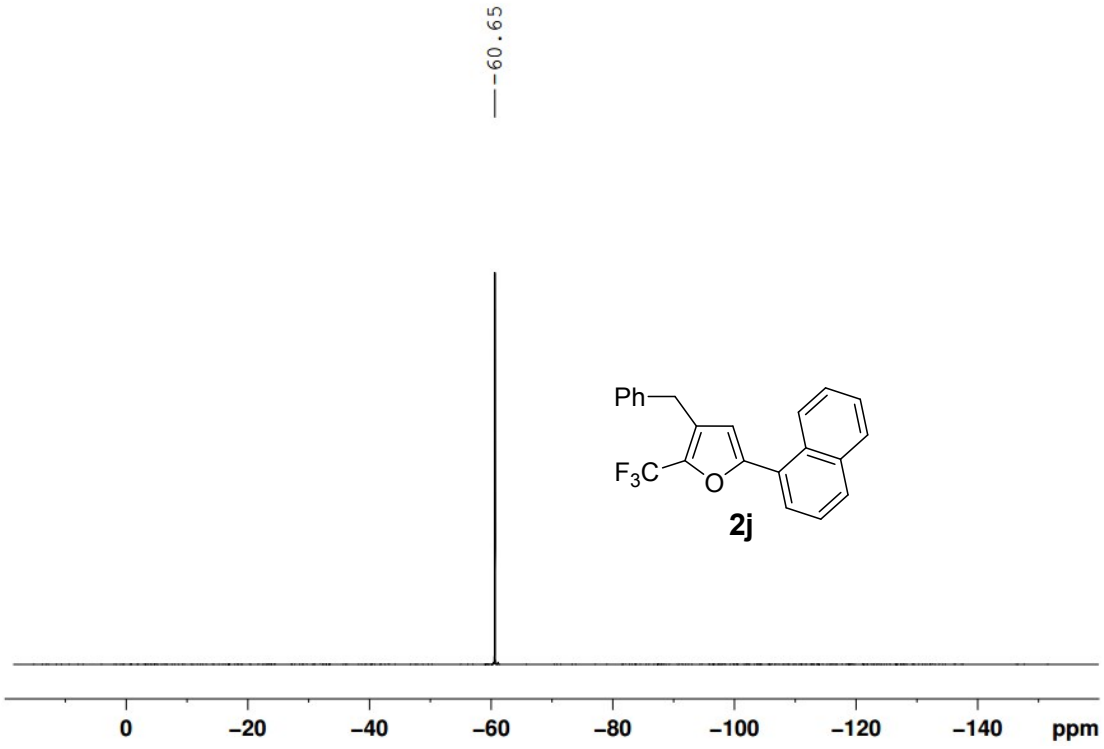
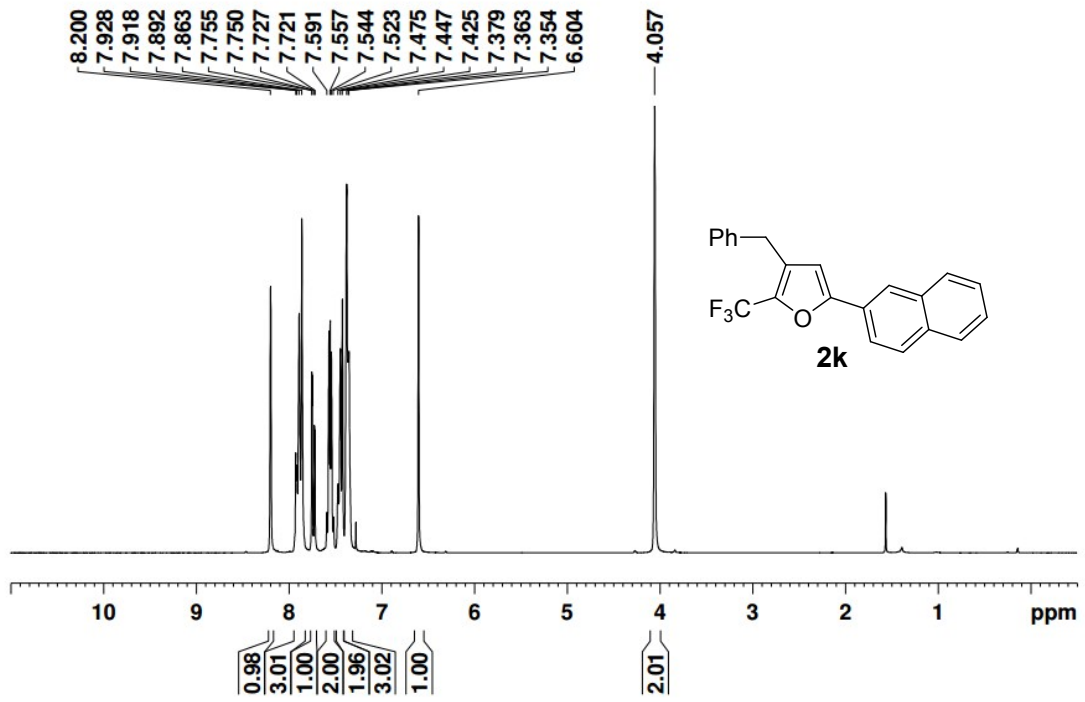
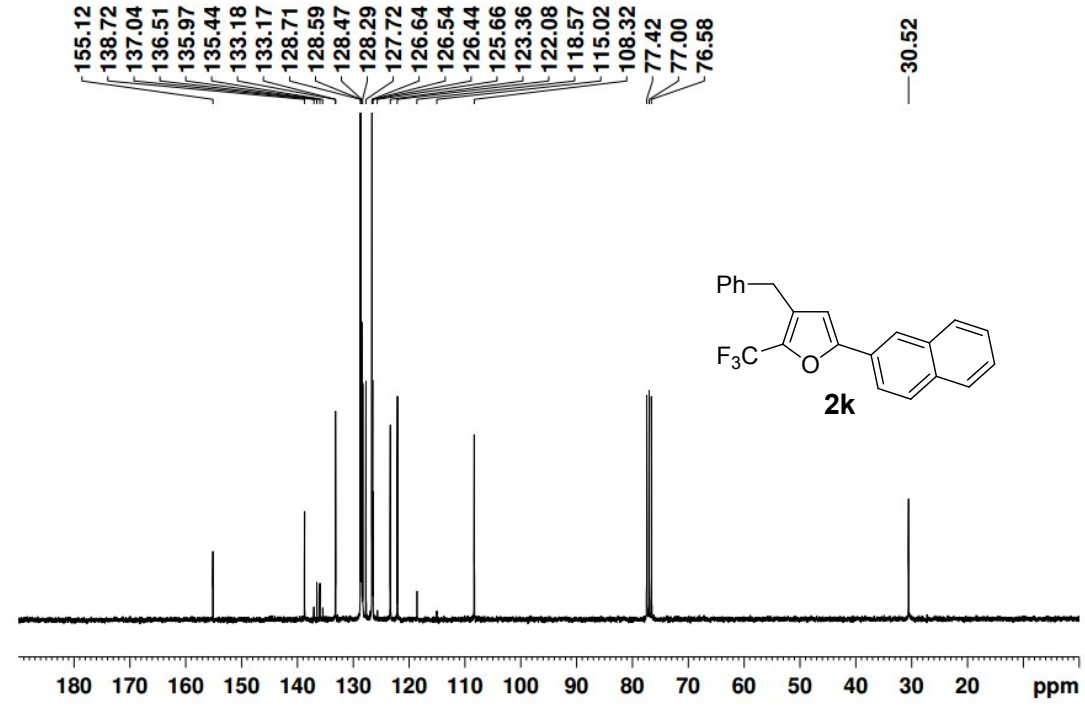


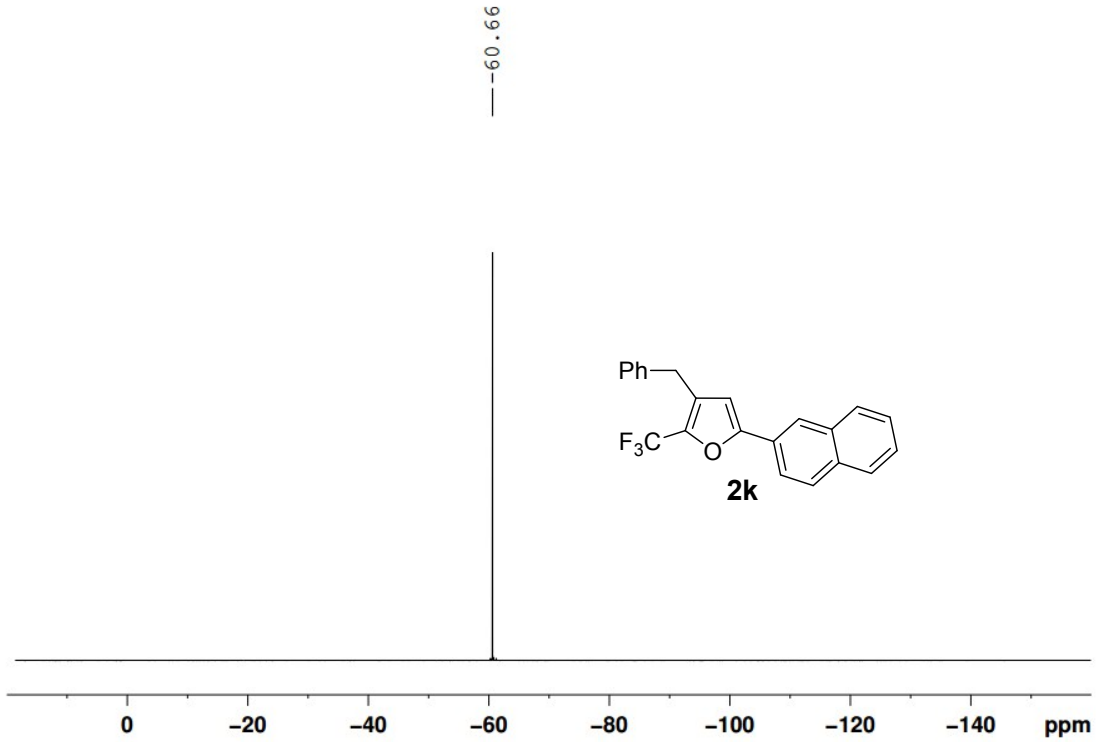
zw-3-58



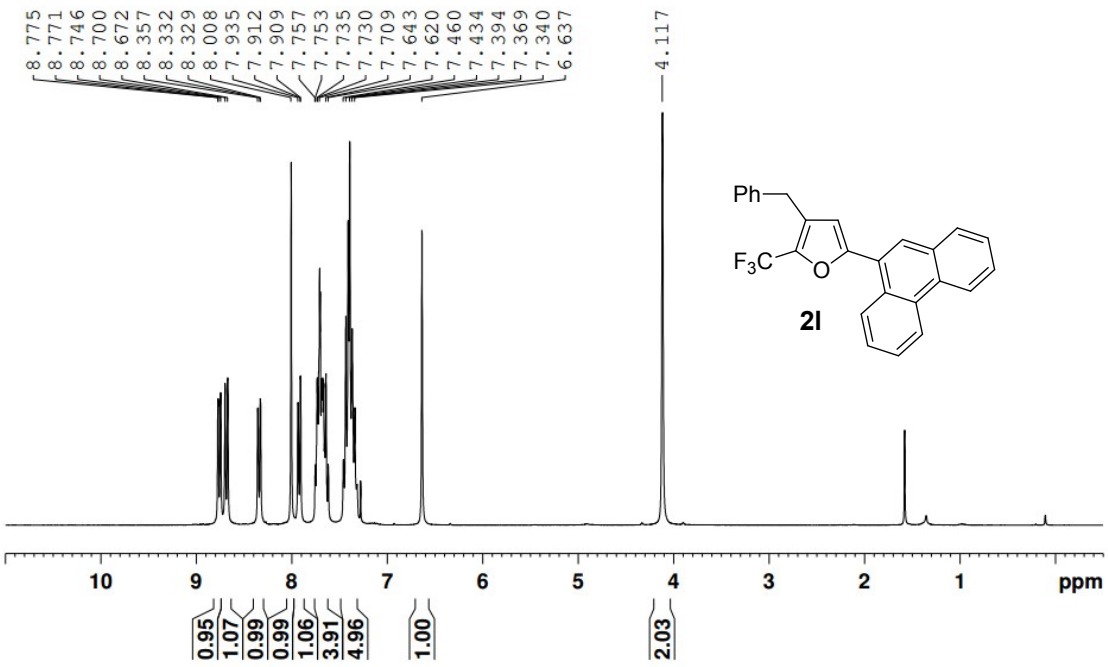
zw-3-58c



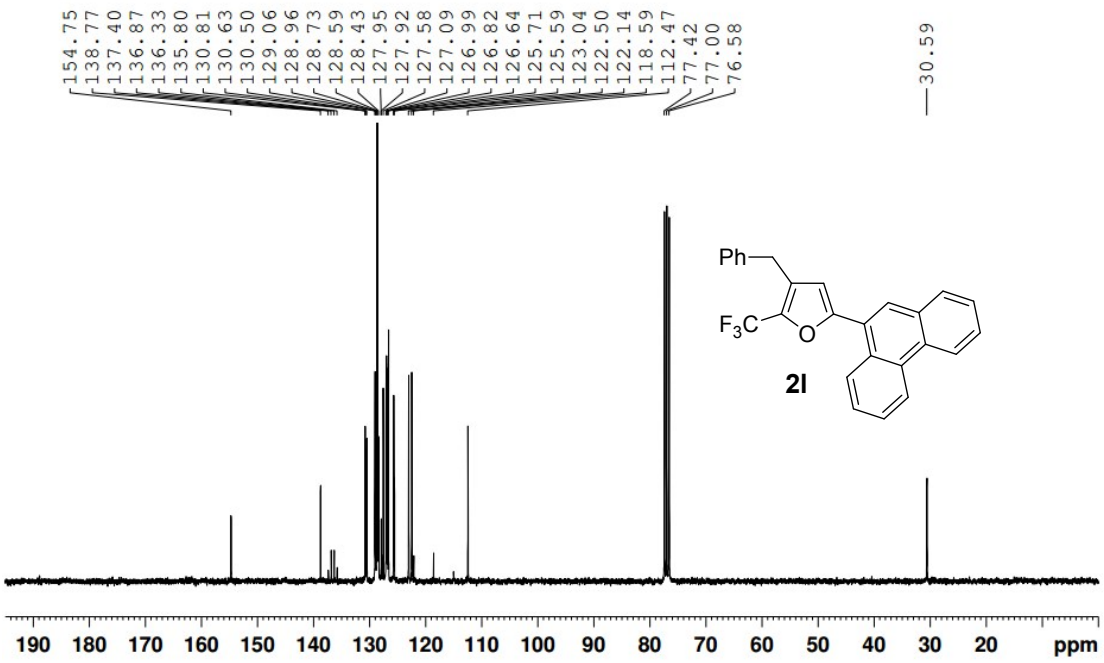
zw-3-58f



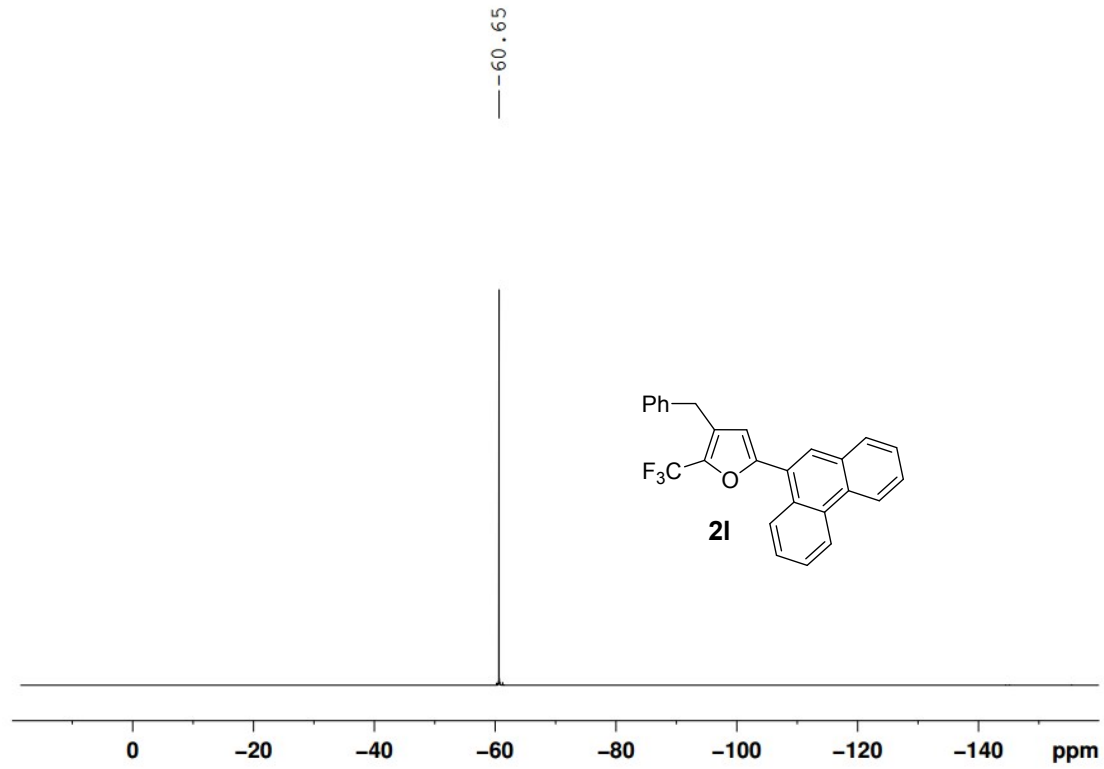
zw-3-64



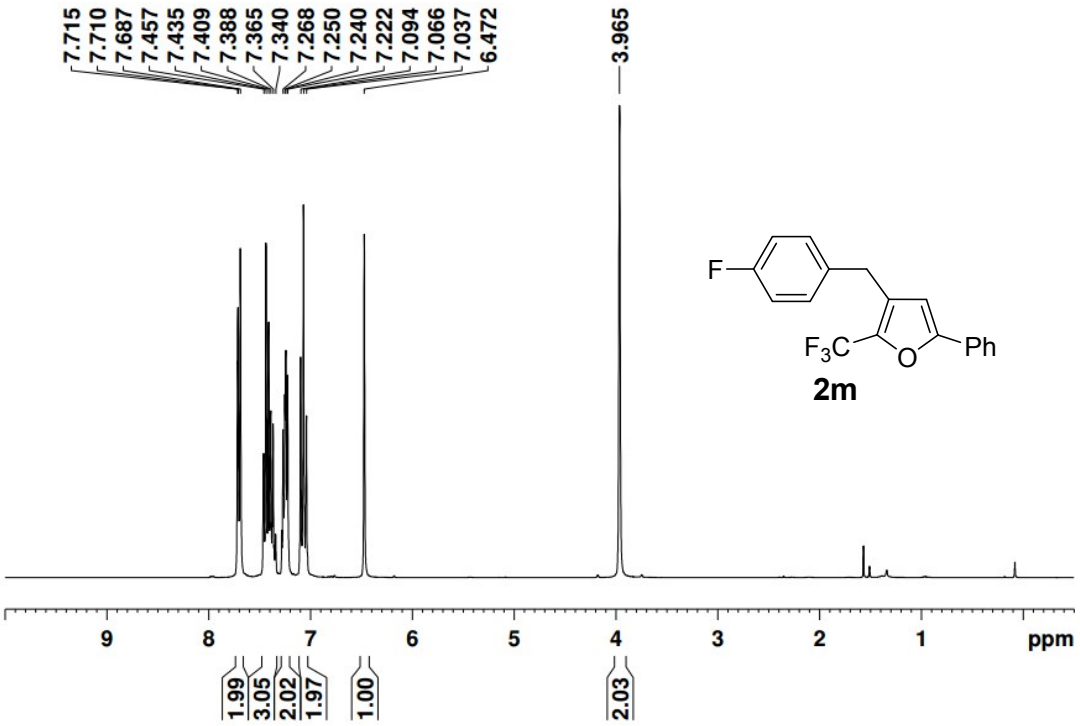
zw-3-64c



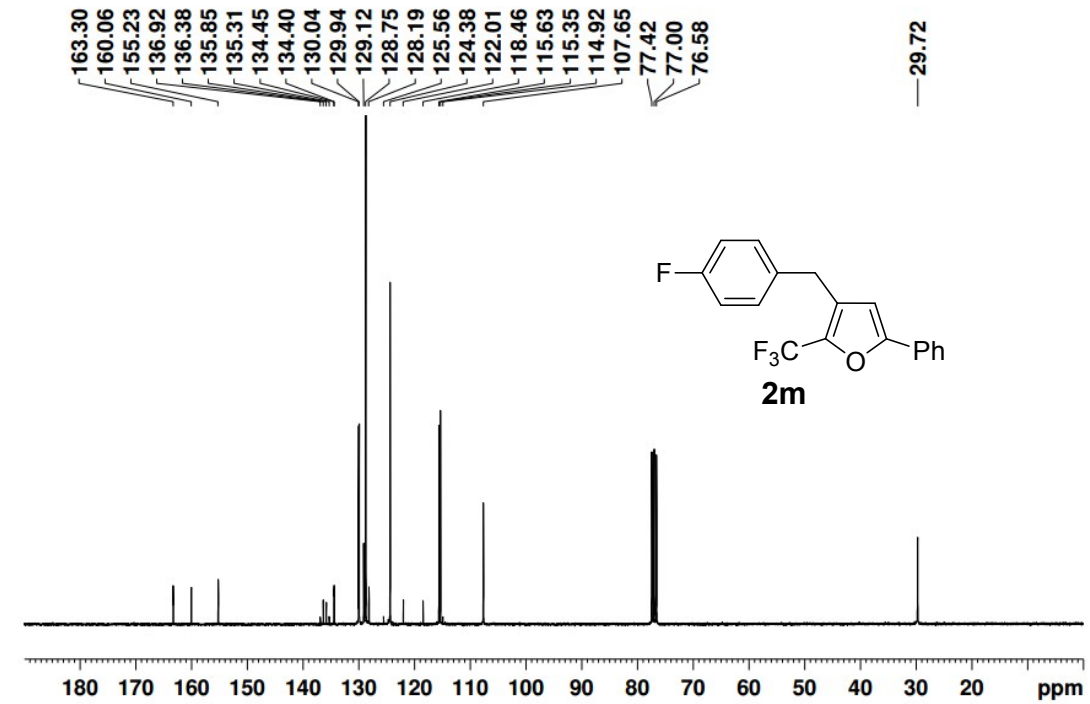
zw-3-64f



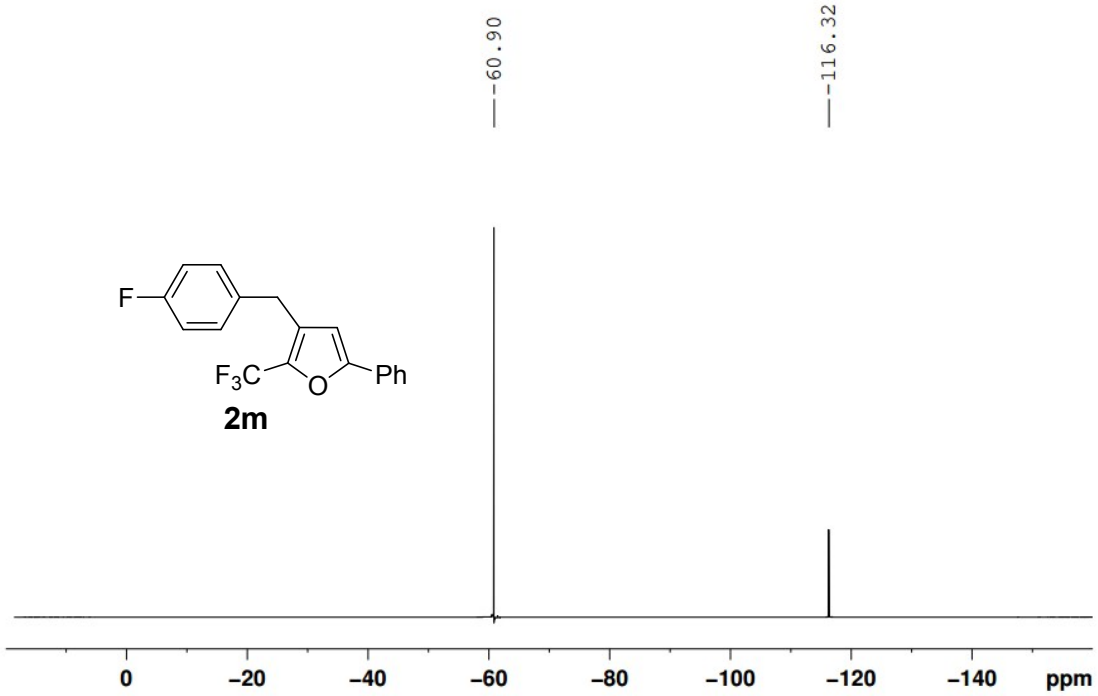
zw-3-60



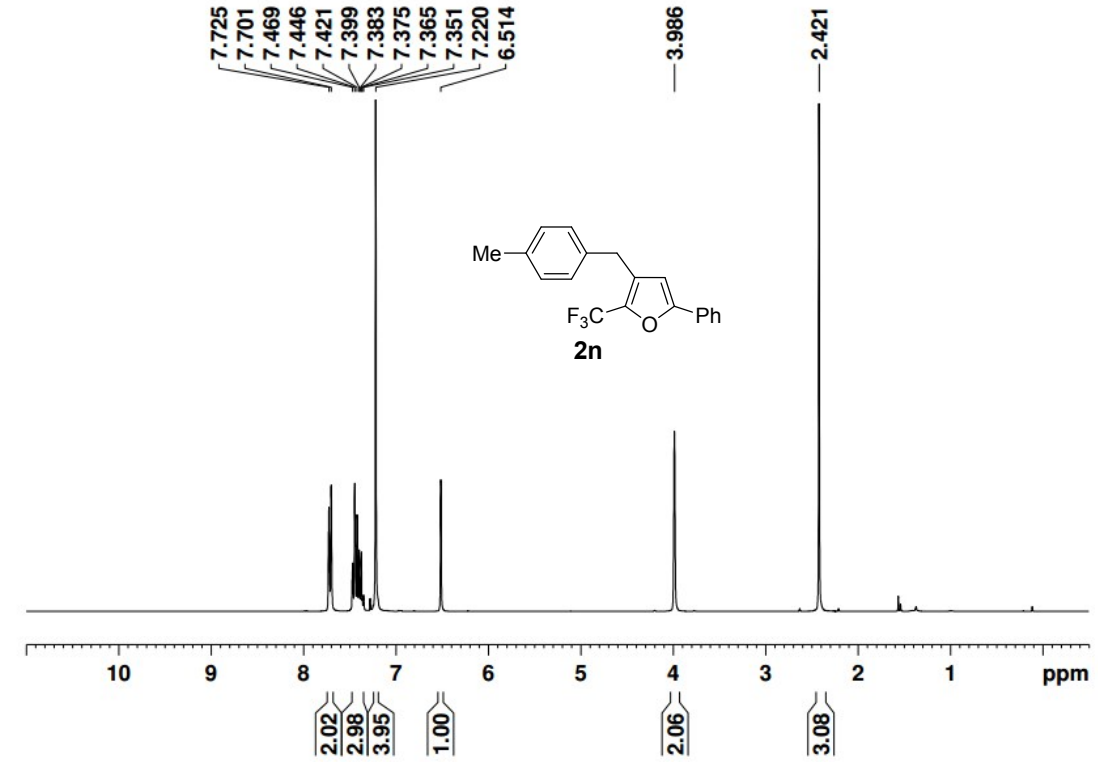
zw-3-60c



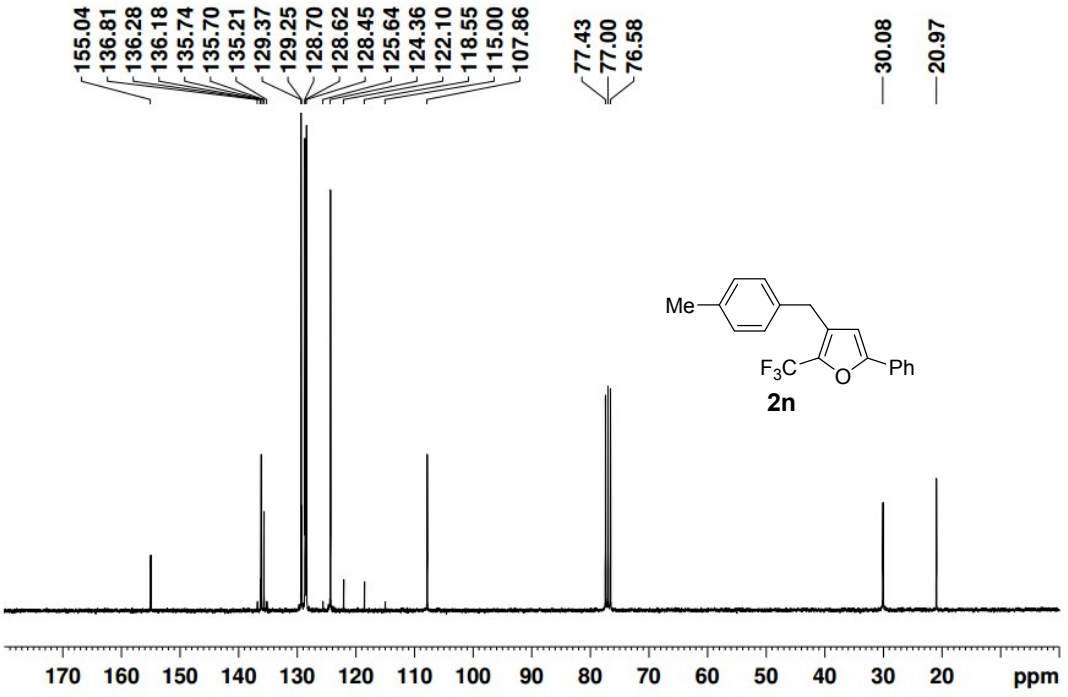
zw-3-60f



zw-3-59



zw-3-59c



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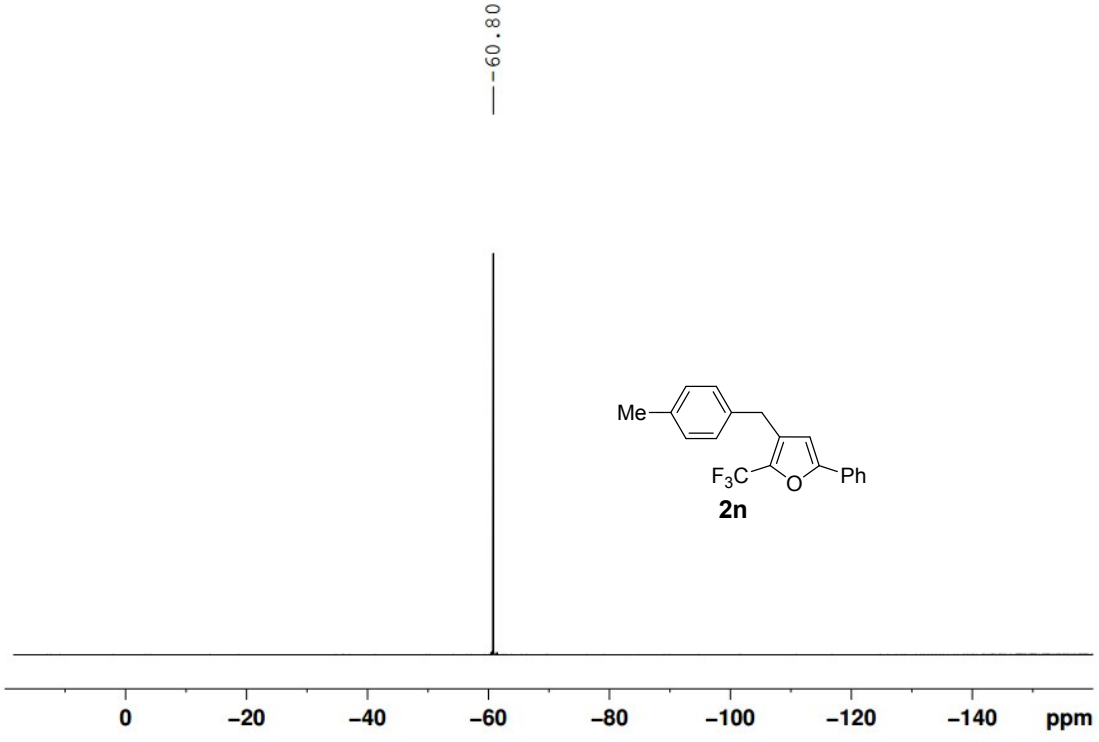

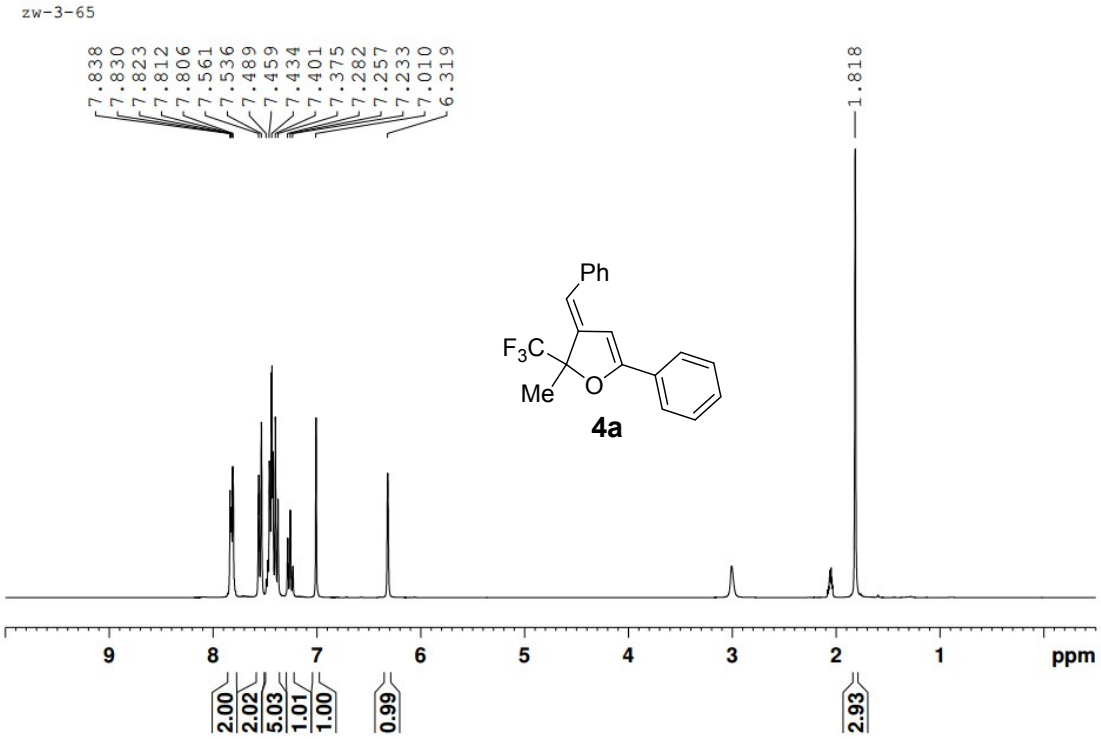
zw-3-65
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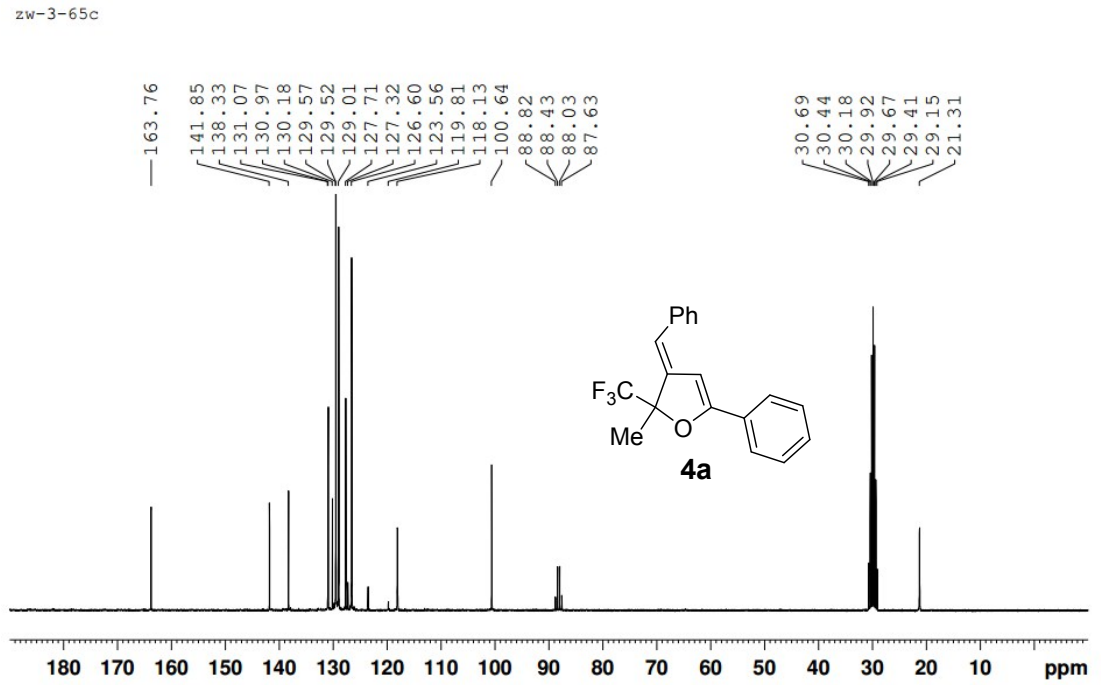
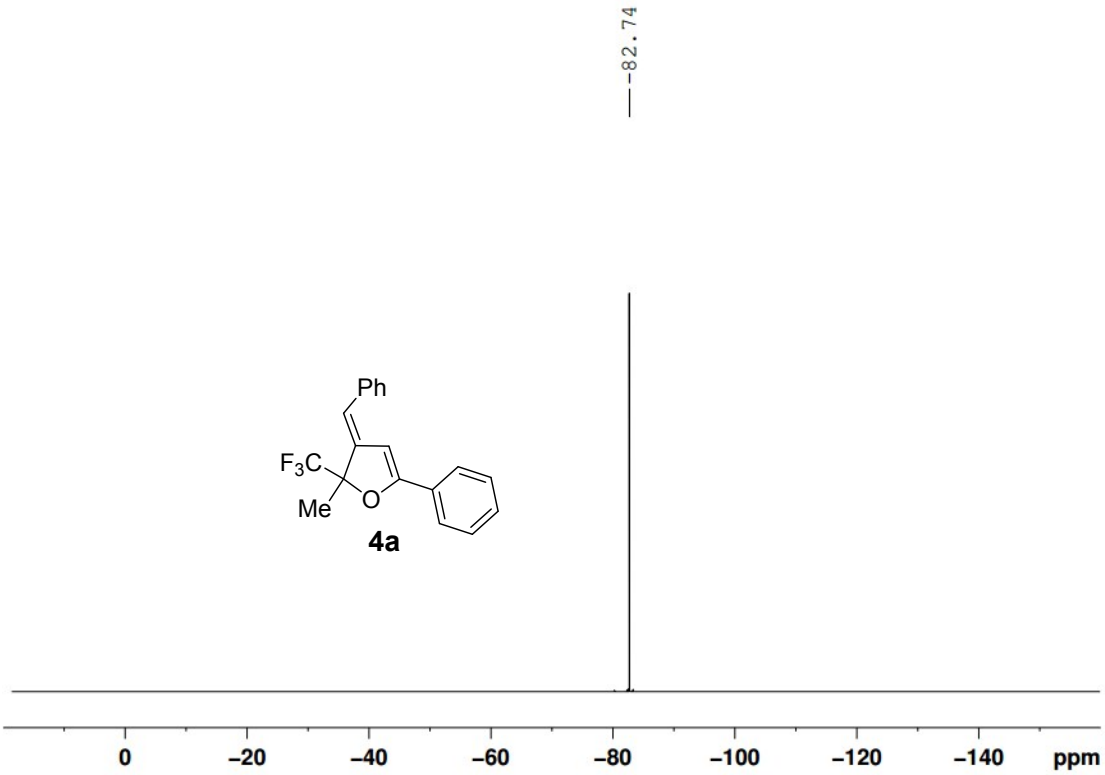
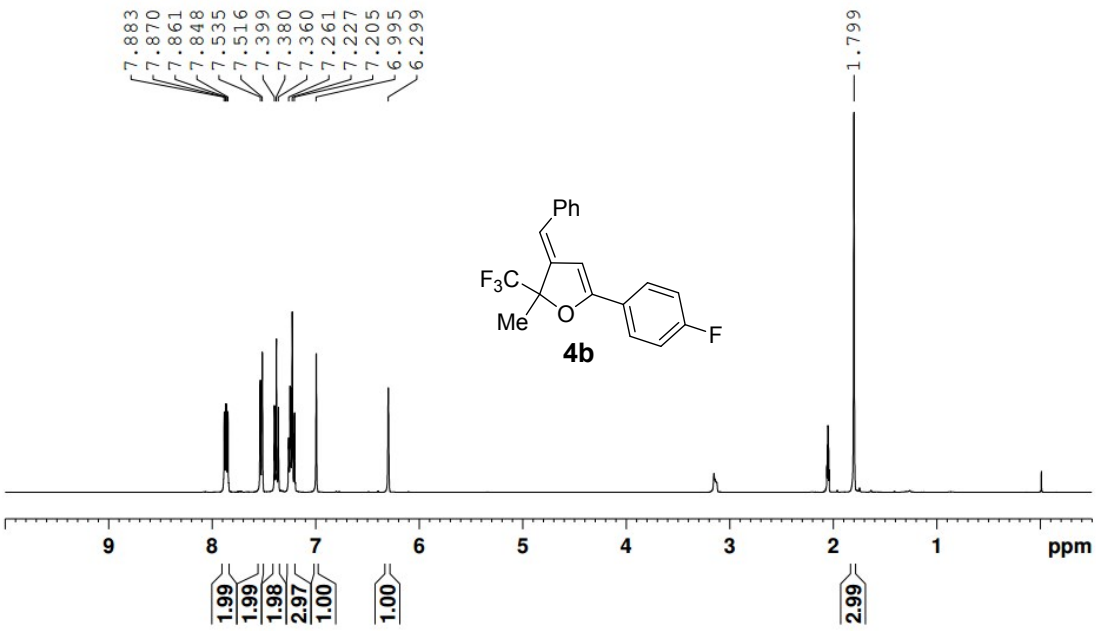
7.830
7.823
7.812
7.806
7.561
7.536
7.489
7.459
7.434
7.401
7.375
7.282
7.257
7.233
7.010
6.319
1.818
Ph
F3C
Me
O
4a
9
8
7
6
5
4
3
2
1
ppm
2.00
2.02
5.03
1.01
1.00
0.99
2.93


zw-3-65c
163.76
141.85
138.33
131.07
130.97
130.18
129.57
129.52
129.01
127.71
127.32
126.60
123.56
119.81
118.13
100.64
88.82
88.43
88.03
87.63
30.69
30.44
30.18
29.92
29.67
29.41
29.15
21.31
Ph
F3C
Me
O
4a
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

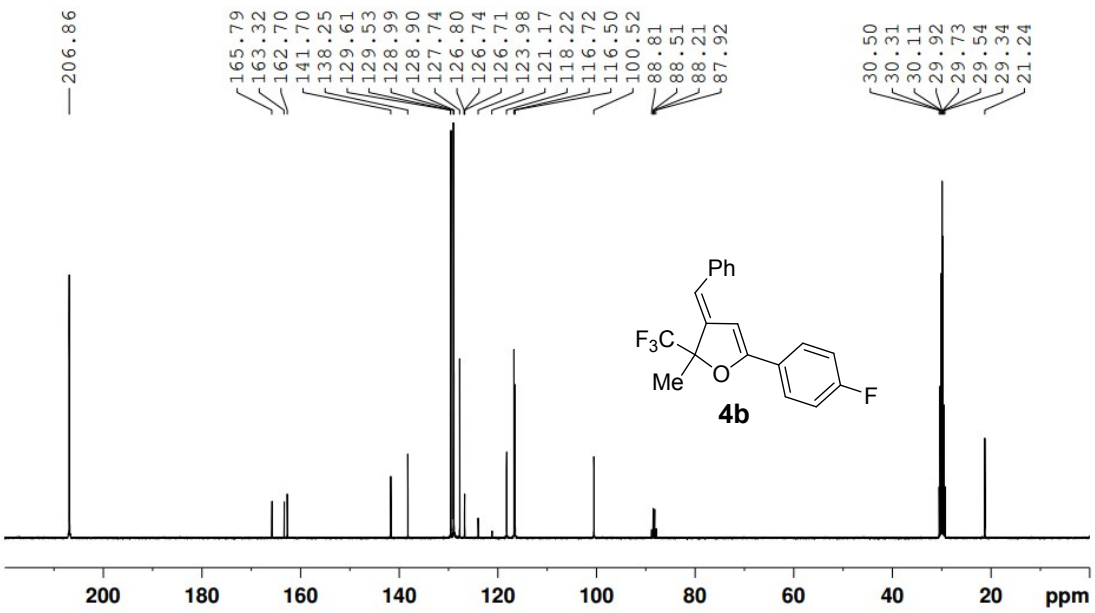
zw-3-65f



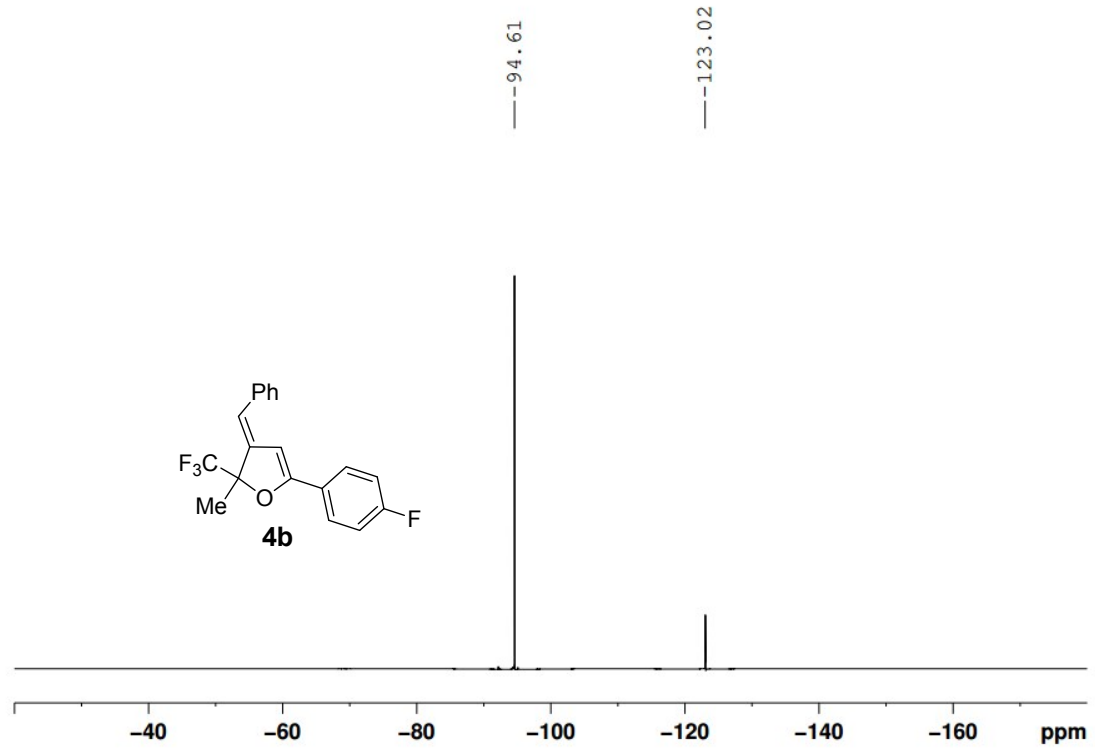
zw-3-68

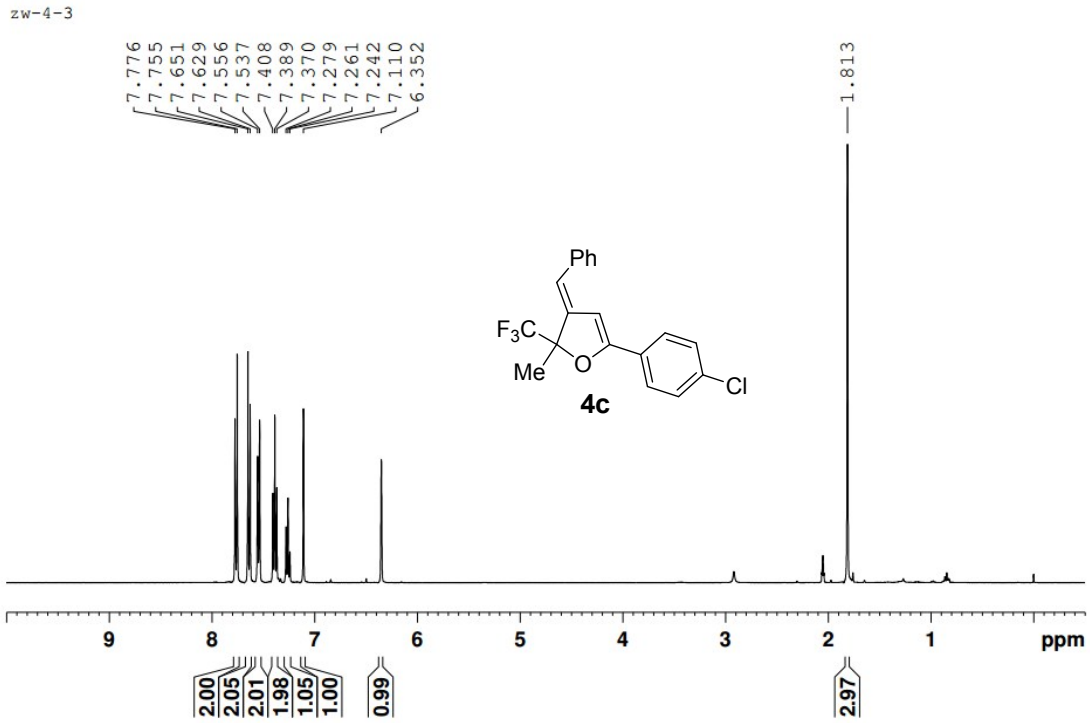


zw-3-68c



zw-3-68f




zw-4-3
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7.651
7.629
7.556
7.537
7.408
7.389
7.370
7.279
7.261
7.242
7.110
6.352
1.813
Ph
F3C
Me
O
Cl
4c
9
8
7
6
5
4
3
2
1
ppm
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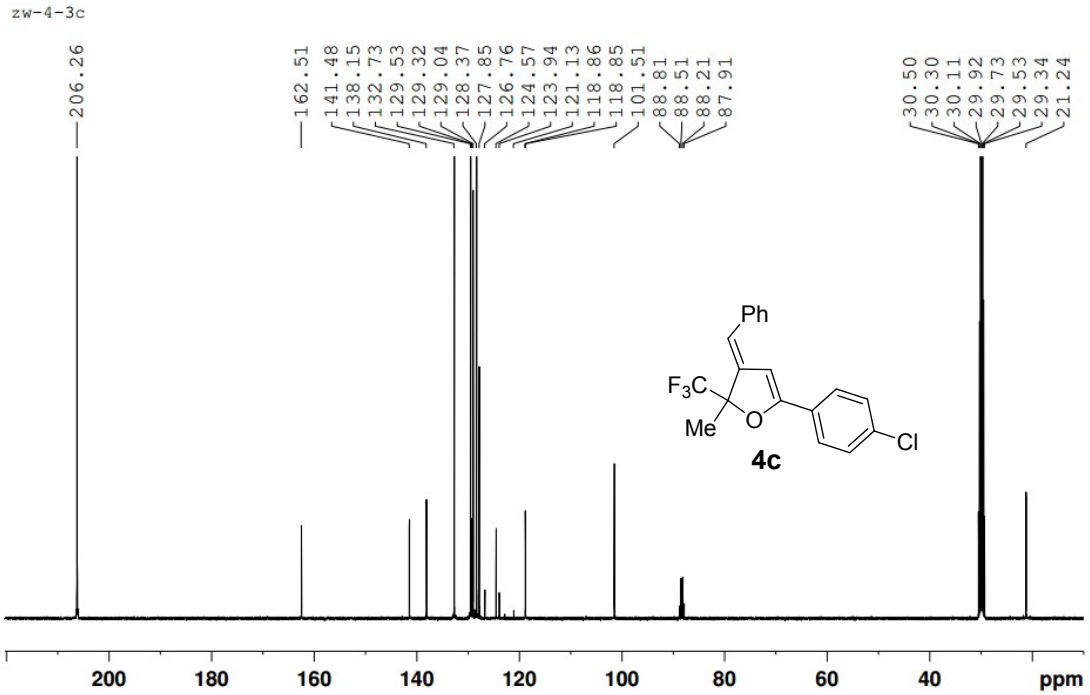
2.05
2.01
1.98
1.05
1.00
0.99
2.97


zw-4-3c
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162.51
141.48
138.15
132.73
129.53
129.32
129.04
128.37
127.85
126.76
124.57
123.94
121.13
118.86
118.85
101.51
88.81
88.51
88.21
87.91
30.50
30.30
30.11
29.92
29.73
29.53
29.34
21.24
Ph
F3C
Me
O
Cl
4c
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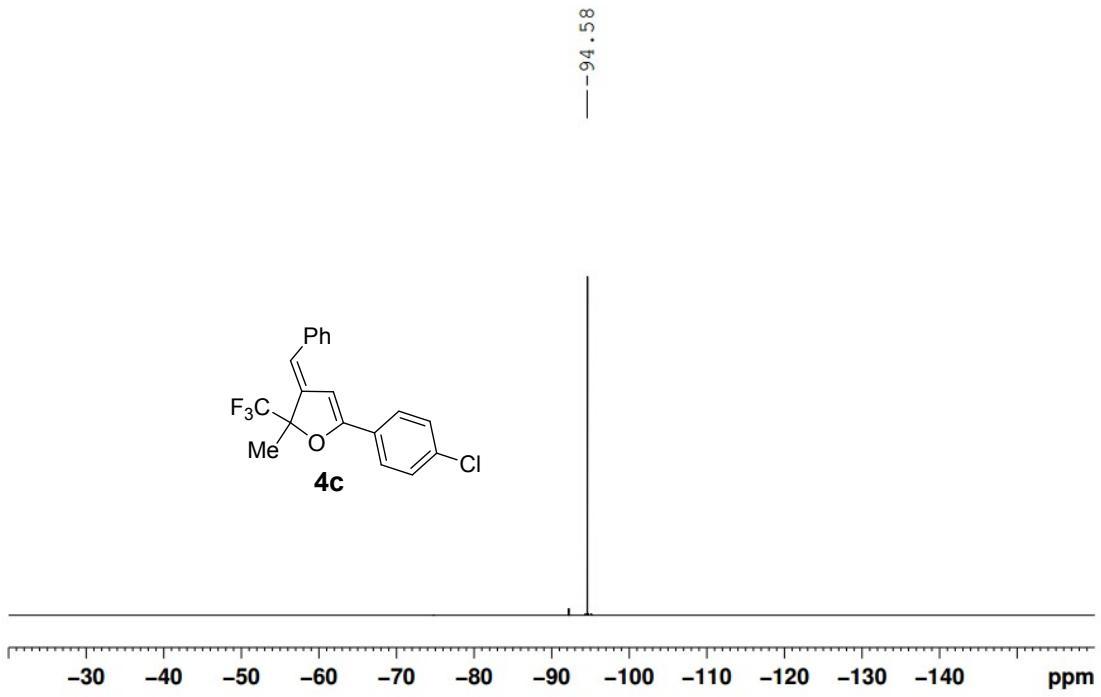
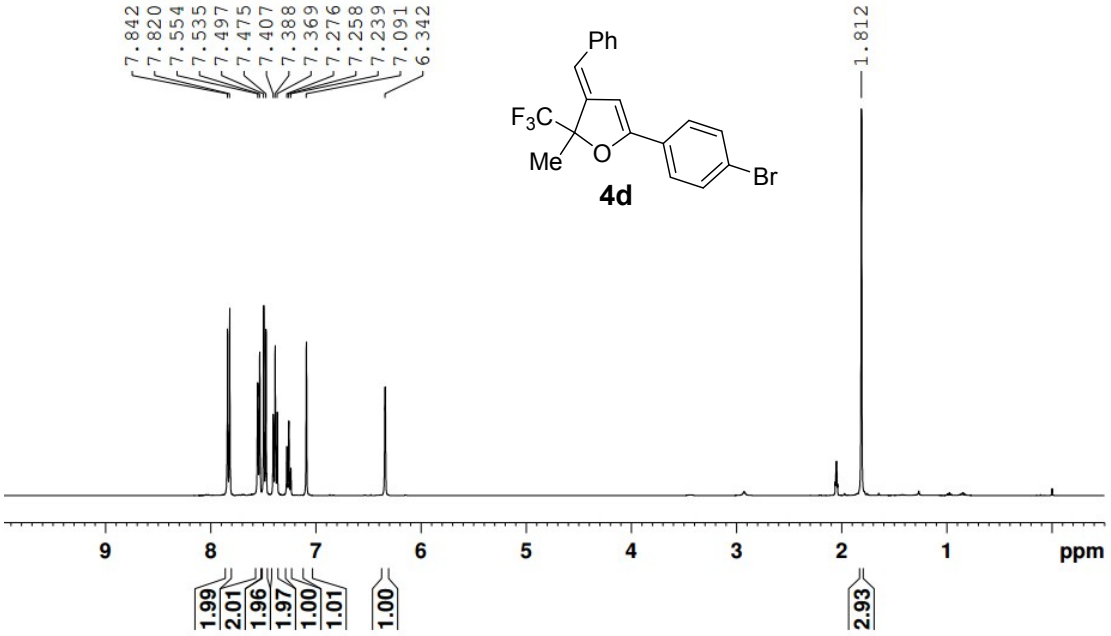
180
160
140
120
100
80
60
40
ppm

zw-4-3f


-94.58
Ph
F3C
Me
O
Cl
4c
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
ppm

zw-4-4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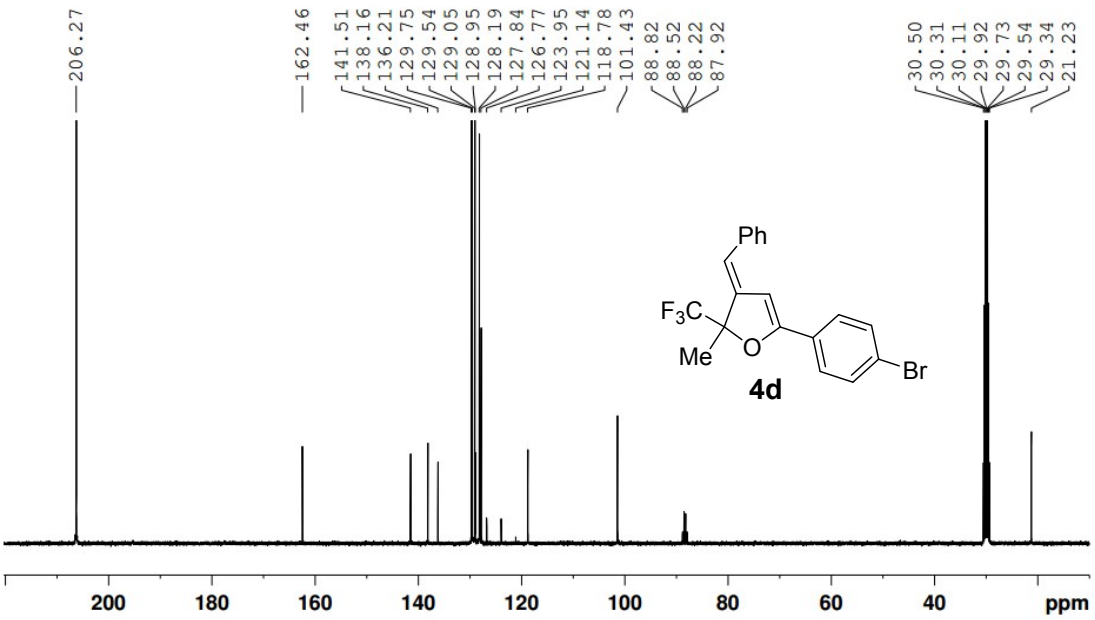
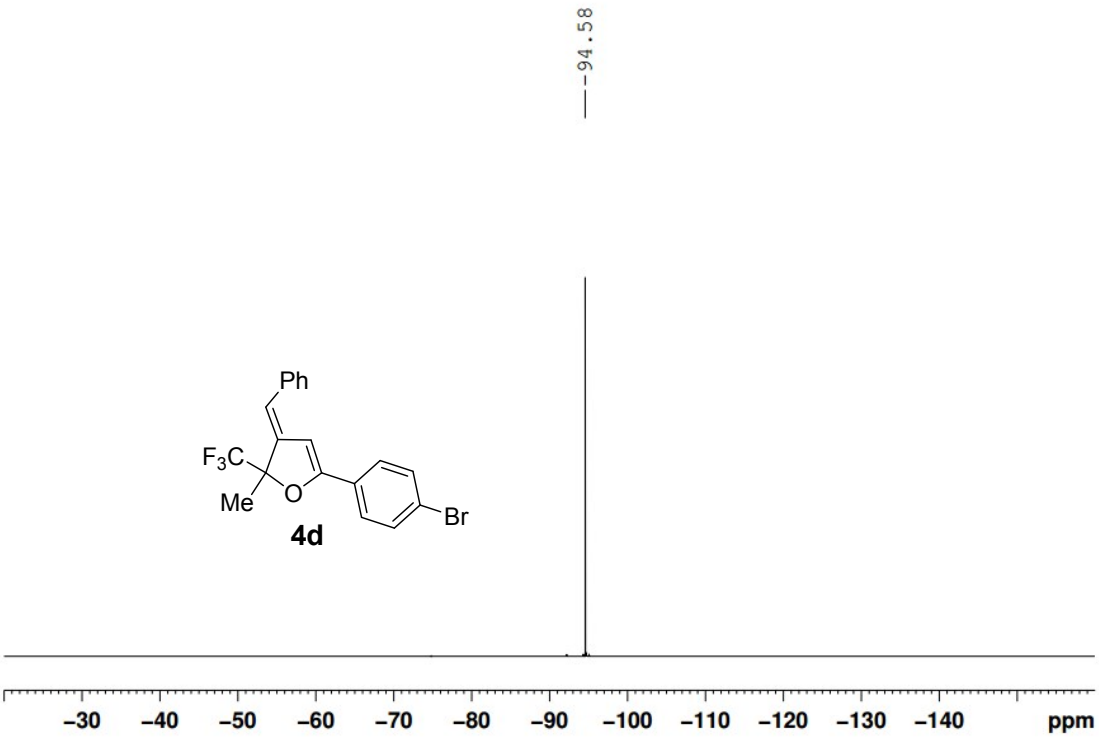
7.820
7.554
7.535
7.497
7.475
7.407
7.388
7.369
7.276
7.258
7.239
7.091
6.342
1.812
Ph
F3C
Me
O
Br
4d
9
8
7
6
5
4
3
2
1
ppm
1.99
2.01
1.96
1.97
1.00
1.01
1.00
2.93

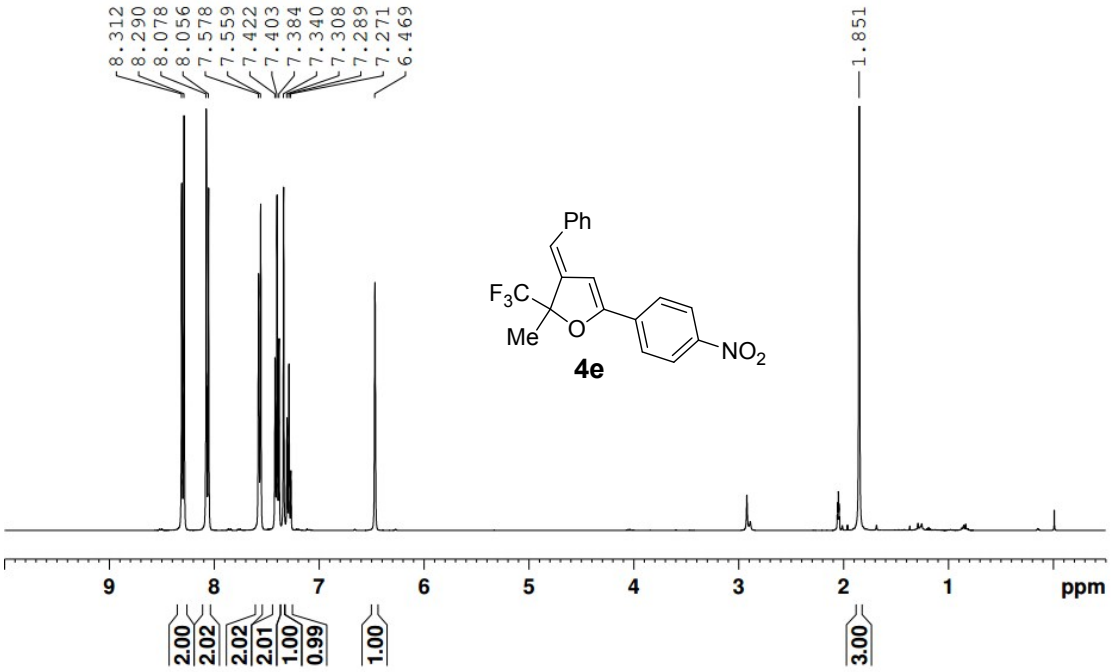
zw-4-4c


206.27
162.46
141.51
138.16
136.21
129.75
129.54
129.05
128.95
128.19
127.84
126.77
123.95
121.14
118.78
101.43
88.82
88.52
88.22
87.92
30.50
30.31
30.11
29.92
29.73
29.54
29.34
21.23
Ph
F3C
Me
O
Br
4d
200
180
160
140
120
100
80
60
40
ppm

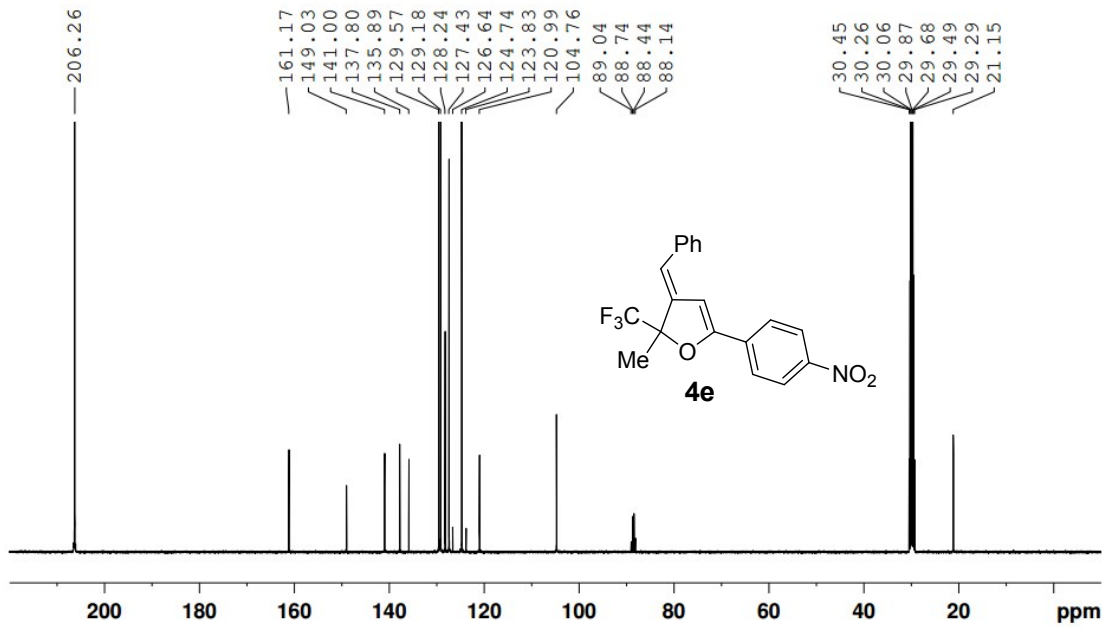
zw-4-4f


94.58
Ph
F3C
Me
O
Br
4d
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
ppm

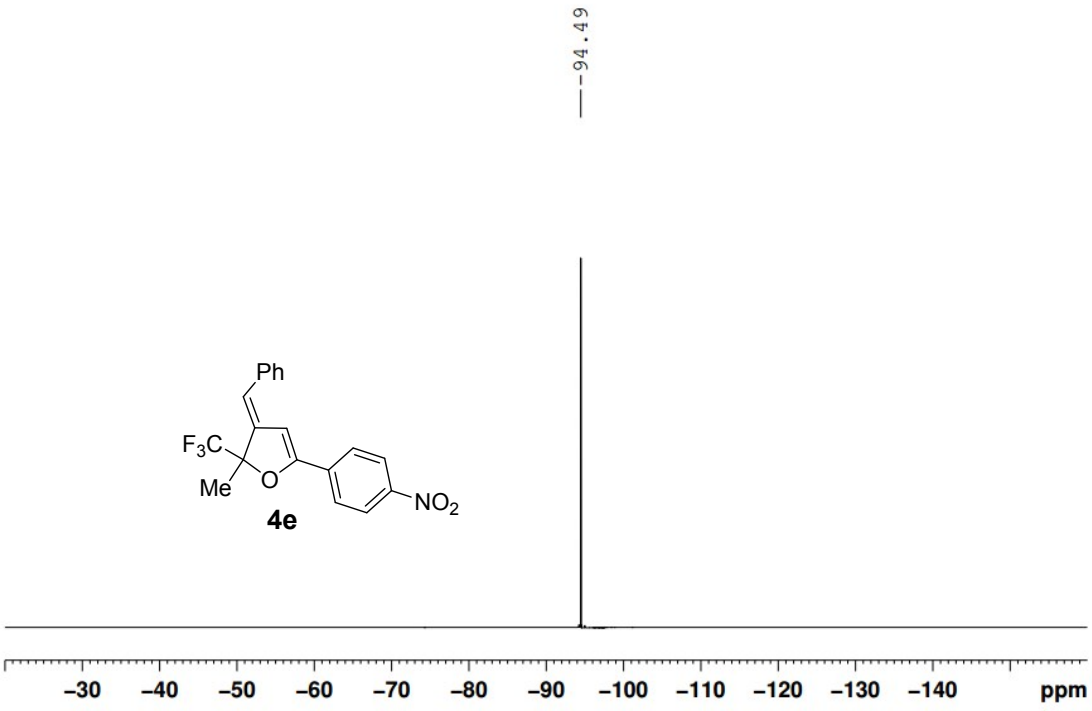
zw-4-7


8.312
8.290
8.078
8.056
7.578
7.559
7.422
7.403
7.384
7.340
7.308
7.289
7.271
6.469
1.851
Ph
F3C
Me
O
NO2
4e
9
8
7
6
5
4
3
2
1
ppm
2.00
2.02
2.02
2.01
1.00
0.99
1.00
3.00

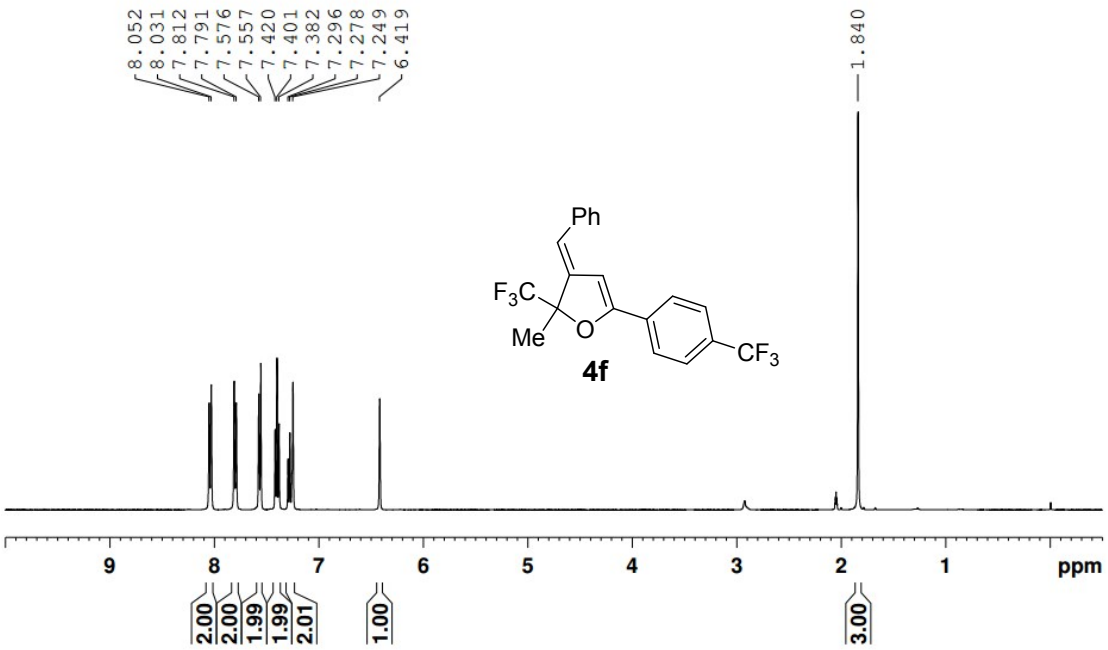
zw-4-7c


206.26
161.17
149.03
141.00
137.80
135.89
129.57
129.18
128.24
127.43
126.64
124.74
123.83
120.99
104.76
89.04
88.74
88.44
88.14
30.45
30.26
30.06
29.87
29.68
29.49
29.29
21.15
Ph
F3C
Me
O
NO2
4e
200
180
160
140
120
100
80
60
40
20
ppm

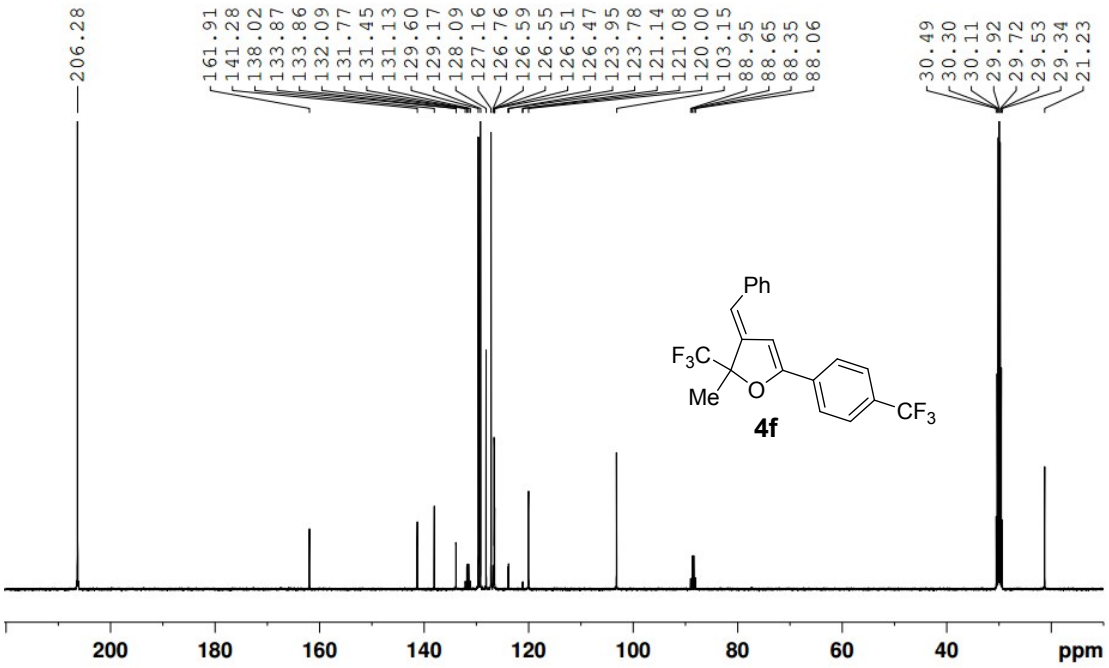
zw-4-7f


-94.49
Ph
F3C
Me
O
NO2
4e
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
ppm

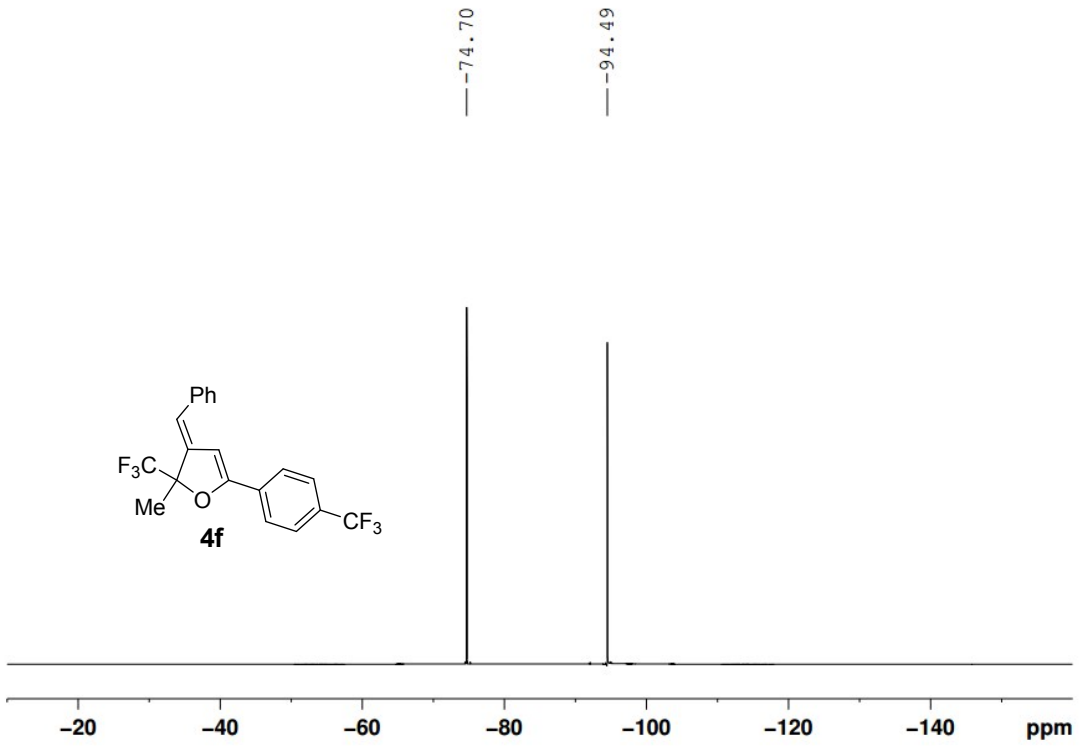
zw-4-6


8.052
8.031
7.812
7.791
7.576
7.557
7.420
7.401
7.382
7.296
7.278
7.249
6.419
1.840
Ph
F3C
Me
O
CF3
4f
9
8
7
6
5
4
3
2
1
ppm
2.00
2.00
1.99
1.99
2.01
1.00
3.00

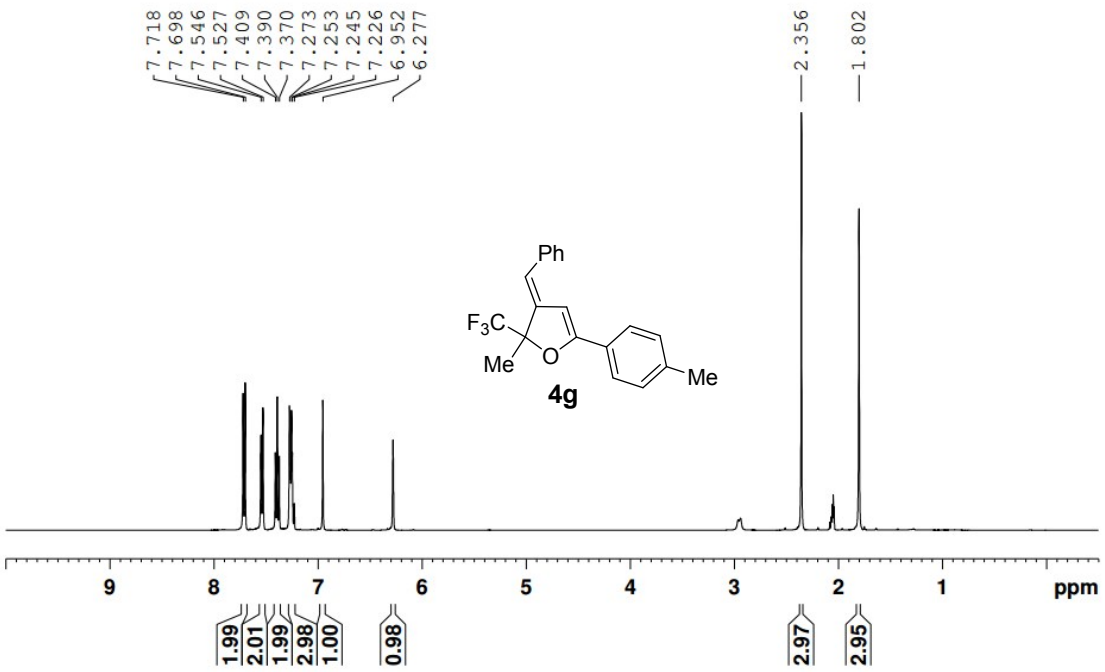
zw-4-6c


206.28
161.91
141.28
138.02
133.87
133.86
132.09
131.77
131.45
131.13
129.60
129.17
128.09
127.16
126.76
126.59
126.55
126.51
126.47
123.95
123.78
121.14
121.08
120.00
103.15
88.95
88.65
88.35
88.06
30.49
30.30
30.11
29.92
29.72
29.53
29.34
21.23
Ph
F3C
Me
O
CF3
4f
200
180
160
140
120
100
80
60
40
ppm

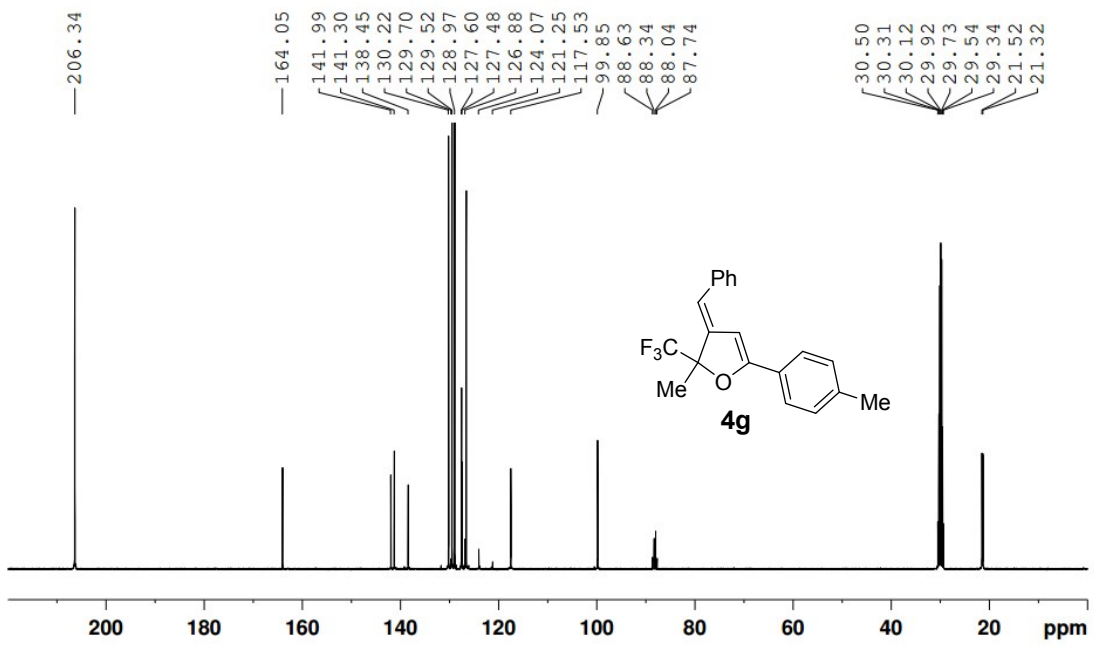
zw-4-6f


-74.70
-94.49
Ph
F3C
Me
O
CF3
4f
-20
-40
-60
-80
-100
-120
-140
ppm

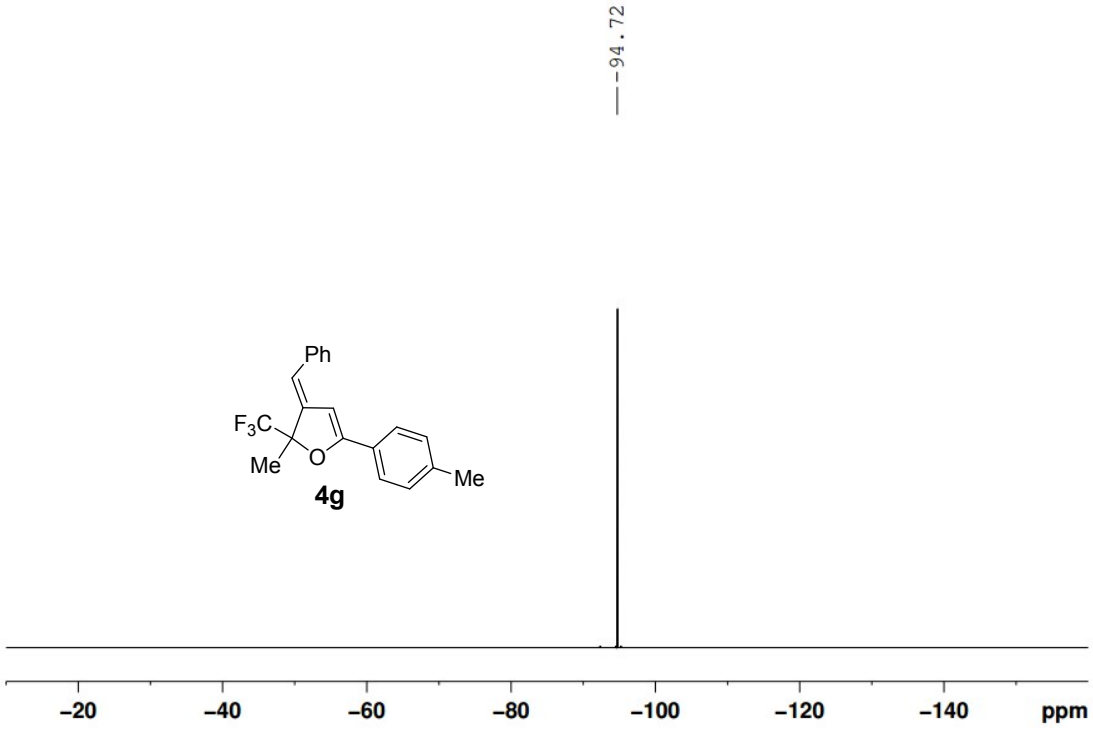
zw-3-67



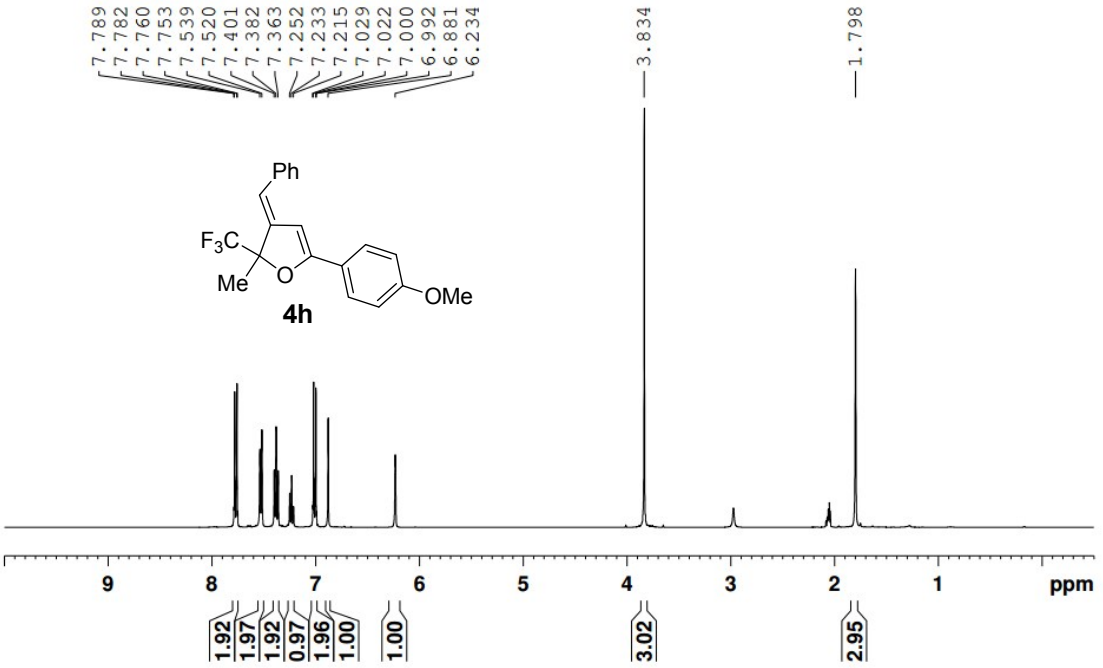
zw-3-67c



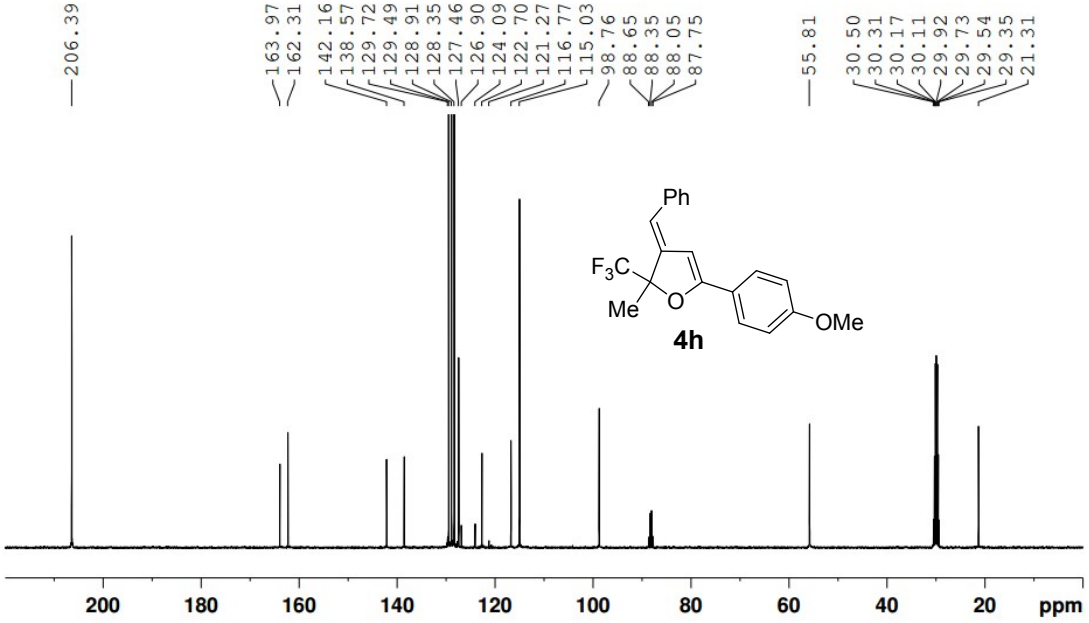
zw-3-67f



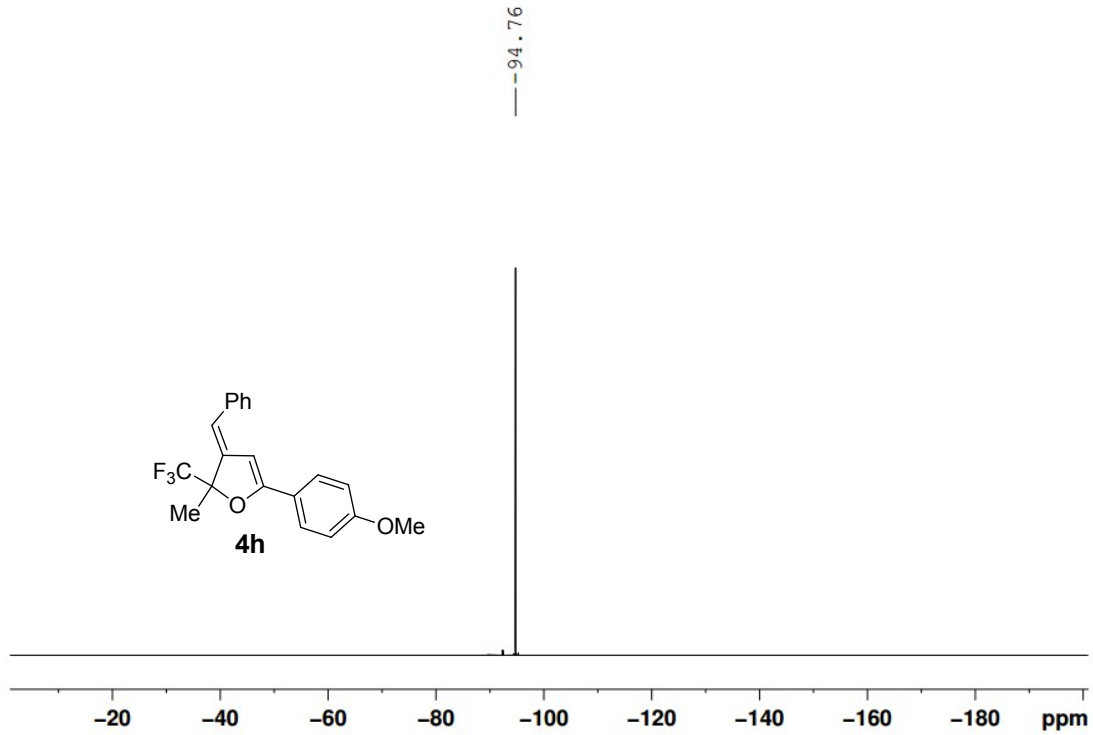
zw-3-66

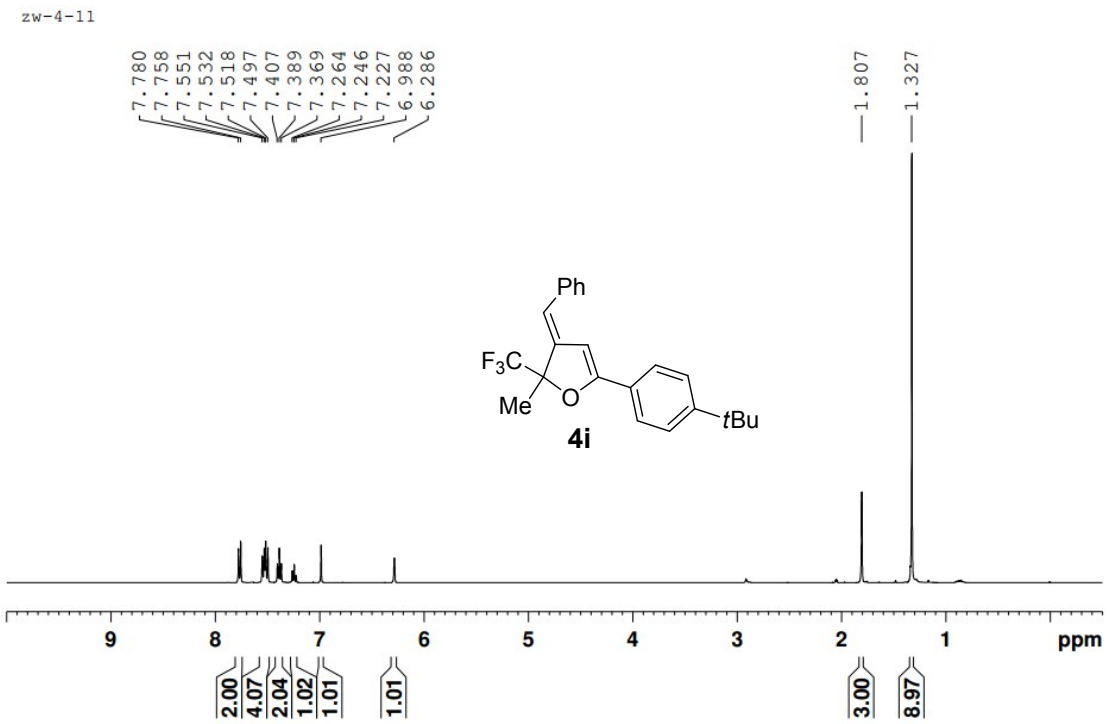


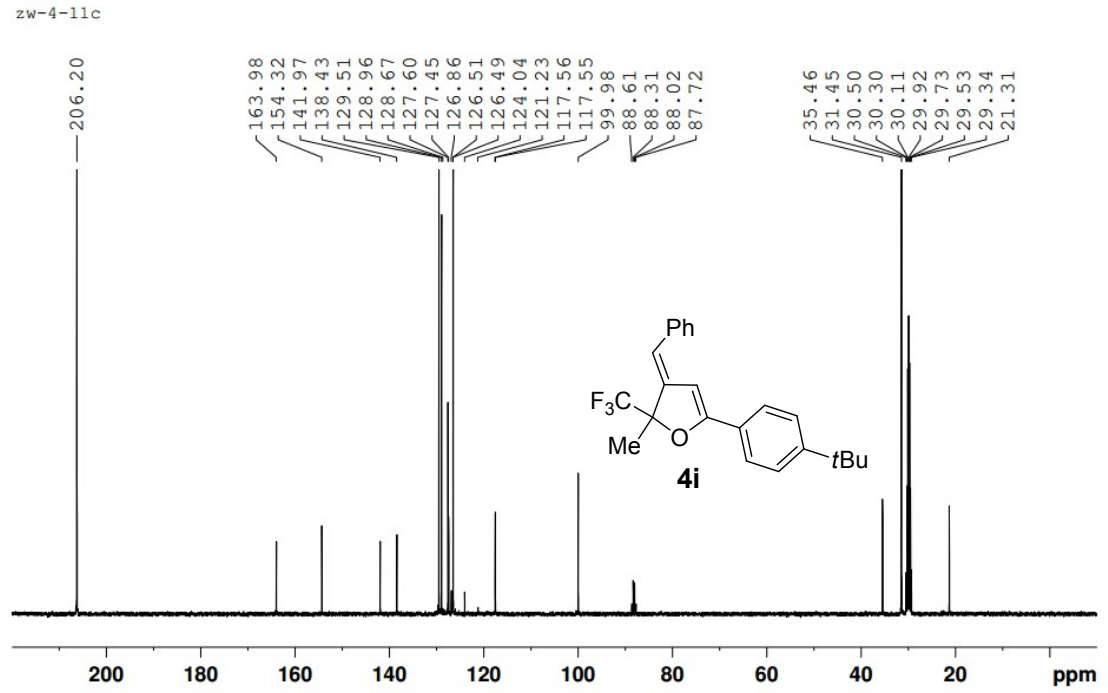
zw-3-66c



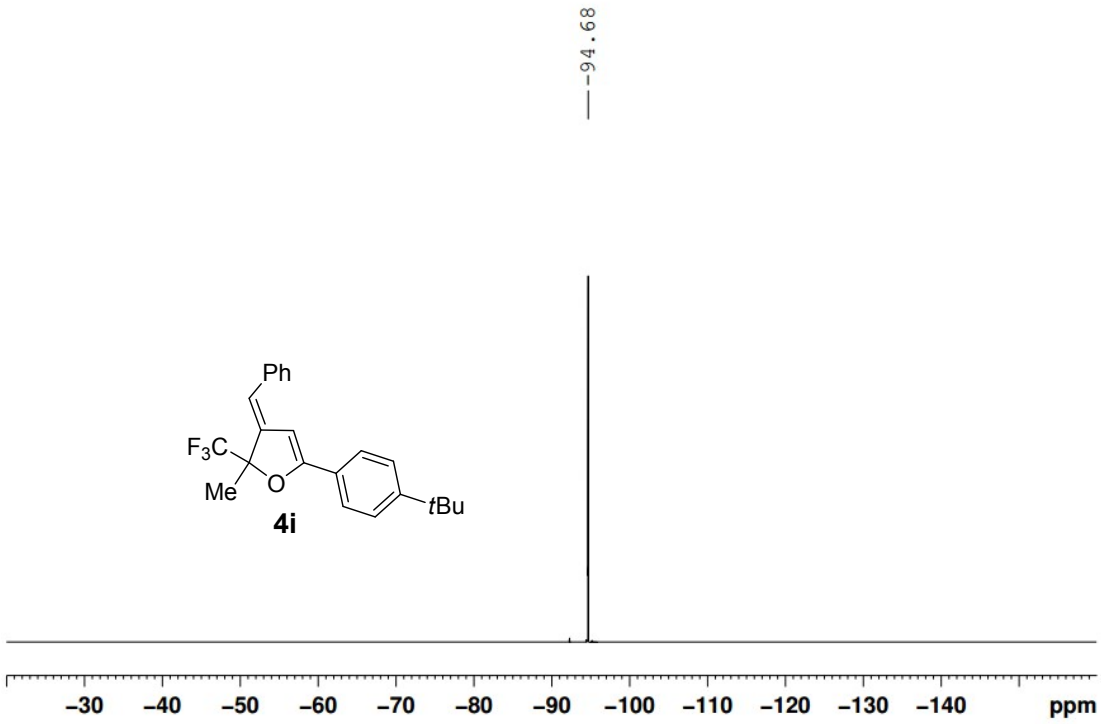
zw-3-66f



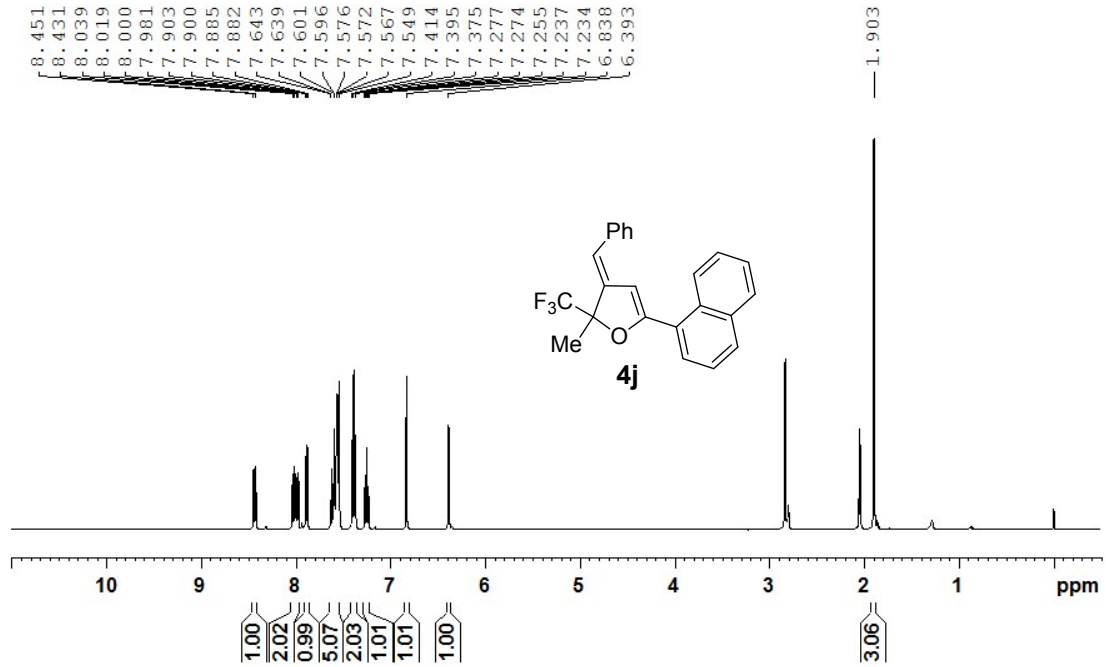

zw-4-11
7.780
7.758
7.551
7.532
7.518
7.497
7.407
7.389
7.369
7.264
7.246
7.227
6.988
6.286
1.807
1.327
Ph
F3C
Me
O
tBu
4i
9
8
7
6
5
4
3
2
1
ppm
2.00
4.07
2.04
1.02
1.01
1.01
3.00
8.97


zw-4-11c
206.20
163.98
154.32
141.97
138.43
129.51
128.96
128.67
127.60
127.45
126.86
126.51
126.49
124.04
121.23
117.56
117.55
99.98
88.61
88.31
88.02
87.72
35.46
31.45
30.50
30.30
30.11
29.92
29.73
29.53
29.34
21.31
Ph
F3C
Me
O
tBu
4i
200
180
160
140
120
100
80
60
40
20
ppm

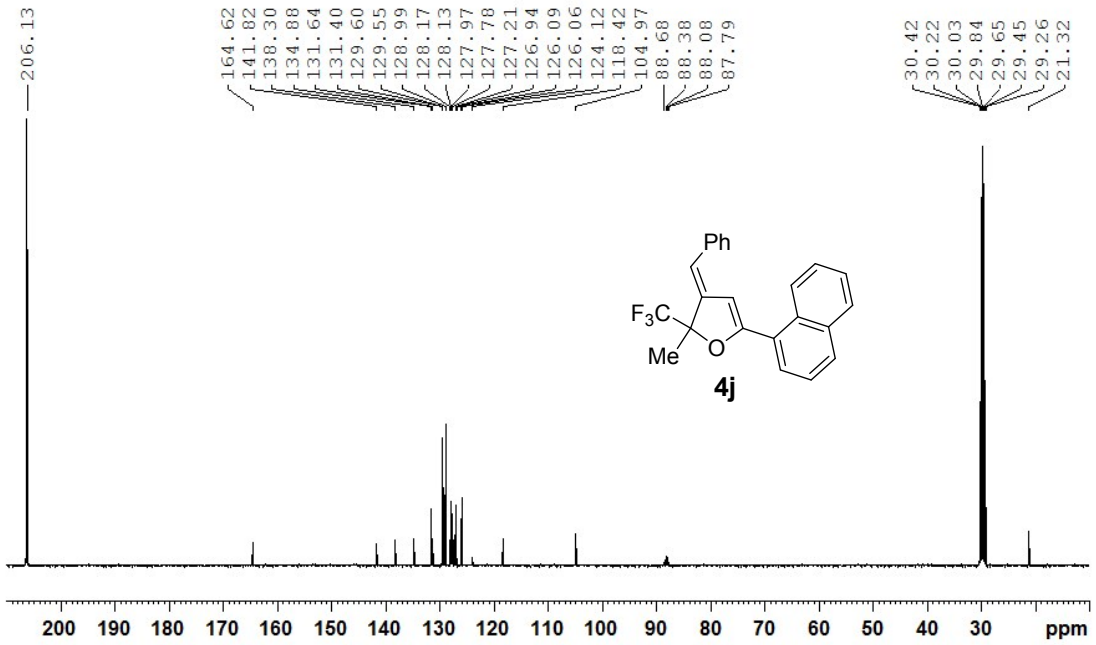
zw-4-11f



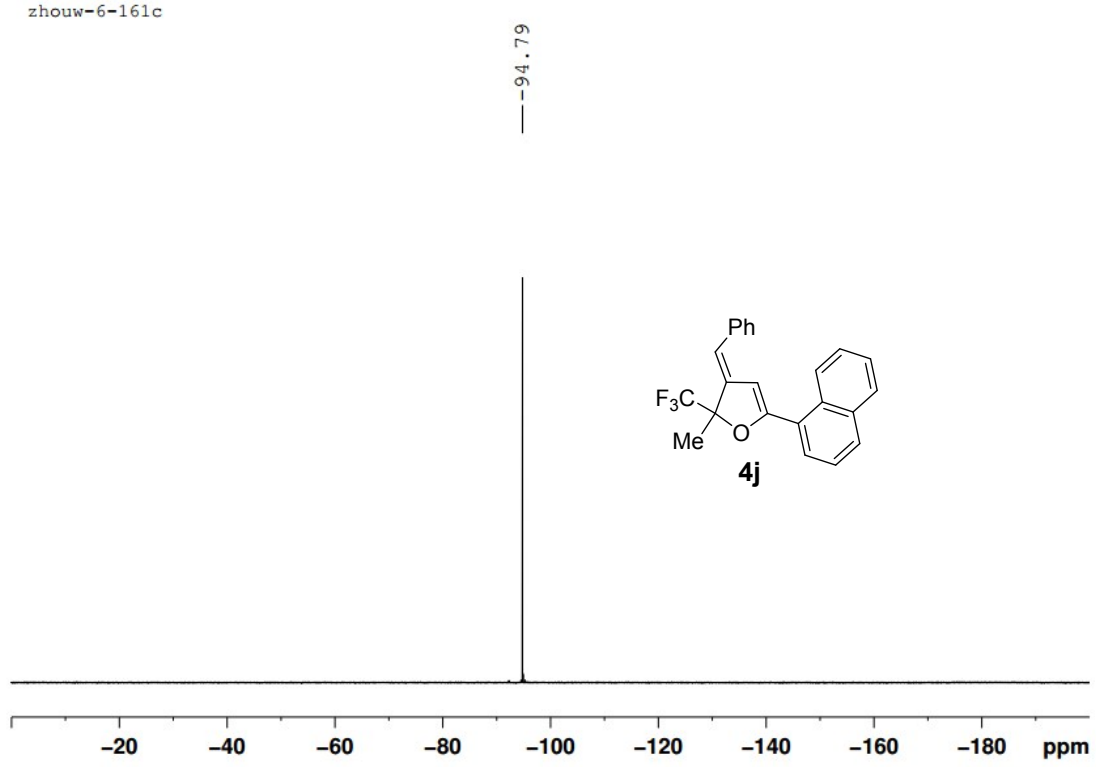
zhouw-6-161

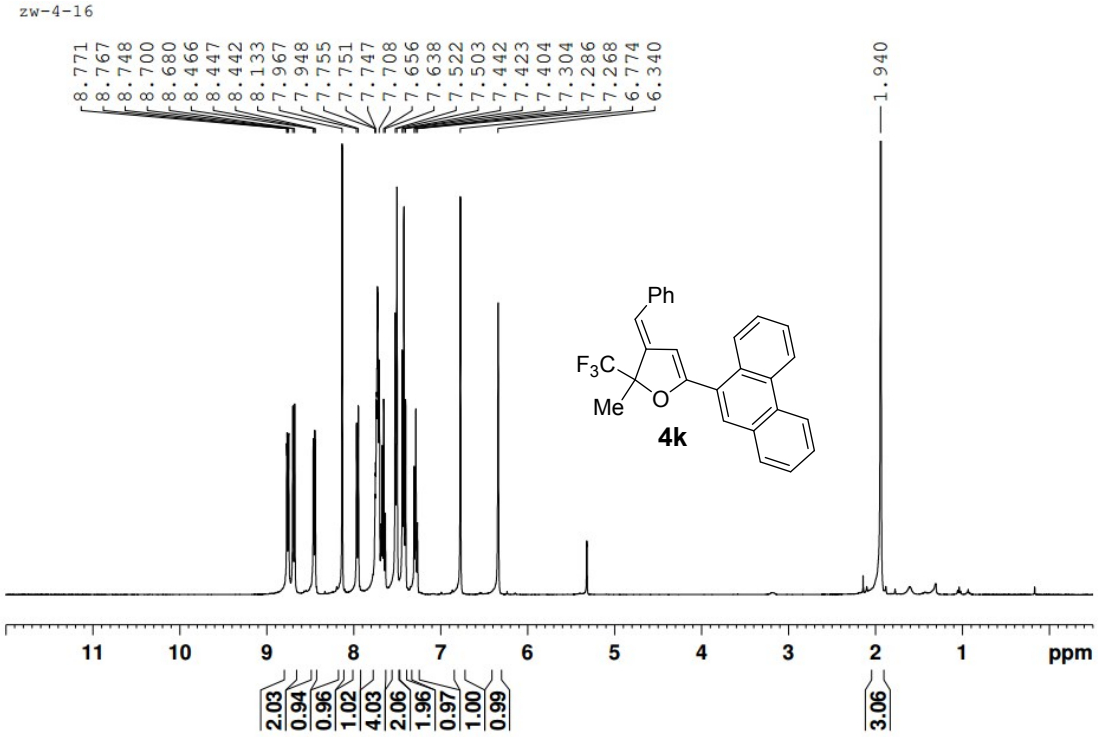


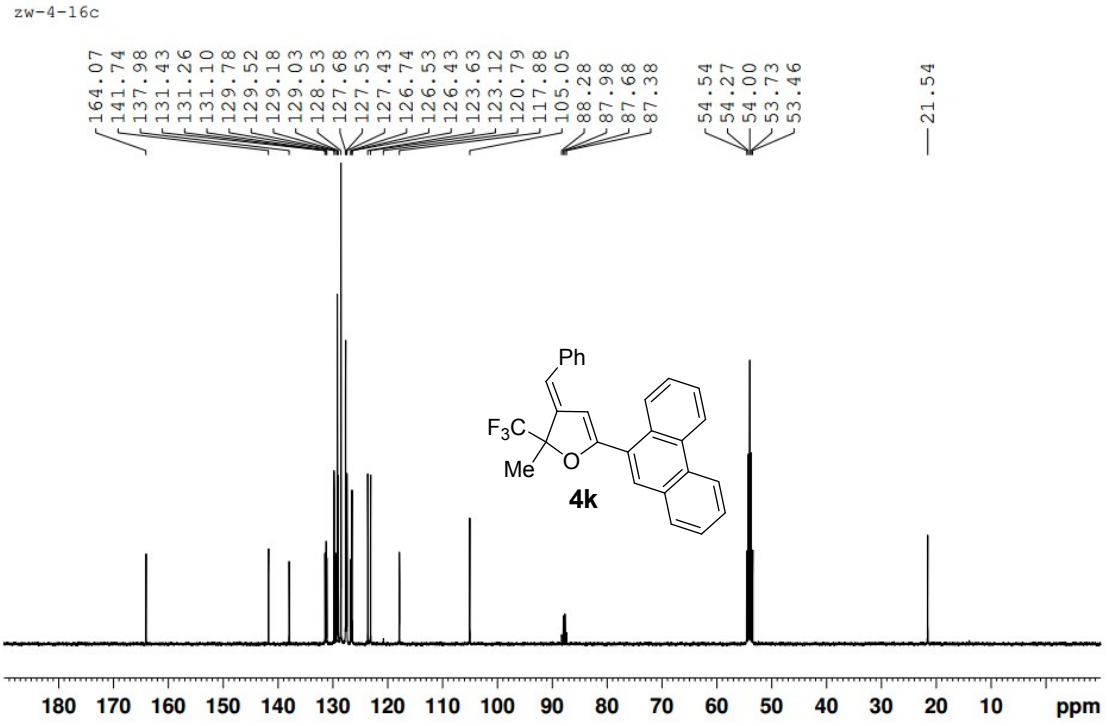
zhouw-6-161



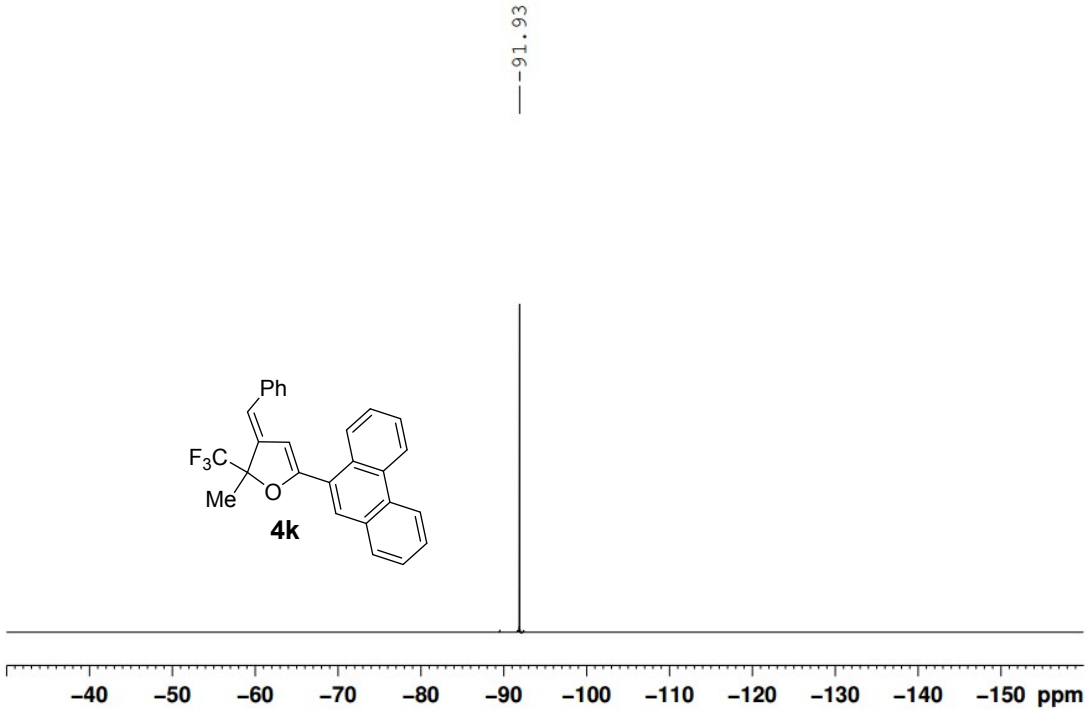
zhouw-6-161c



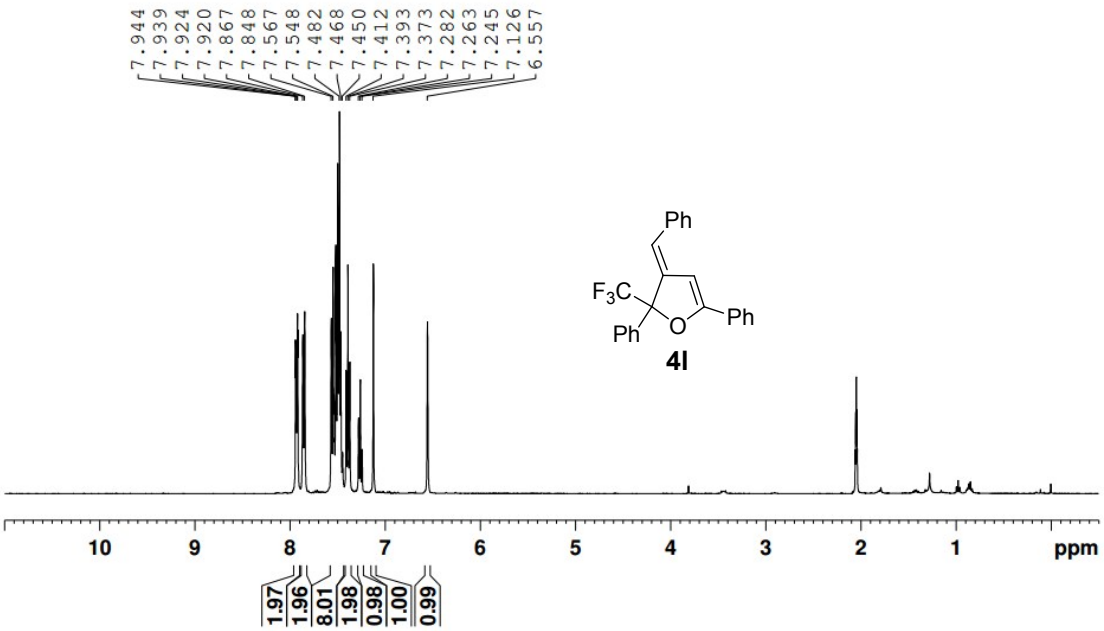

zw-4-16
8.771
8.767
8.748
8.700
8.680
8.466
8.447
8.442
8.133
7.967
7.948
7.755
7.751
7.747
7.708
7.656
7.638
7.522
7.503
7.442
7.423
7.404
7.304
7.286
7.268
6.774
6.340
1.940
Ph
F3C
Me
O
4k
11
10
9
8
7
6
5
4
3
2
1
ppm
2.03
0.94
0.96
1.02
4.03
2.06
1.96
0.97
1.00
0.99
3.06


zw-4-16c
164.07
141.74
137.98
131.43
131.26
131.10
129.78
129.52
129.18
129.03
128.53
127.68
127.53
127.43
126.74
126.53
126.43
123.63
123.12
120.79
117.88
105.05
88.28
87.98
87.68
87.38
54.54
54.27
54.00
53.73
53.46
21.54
Ph
F3C
Me
O
4k
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

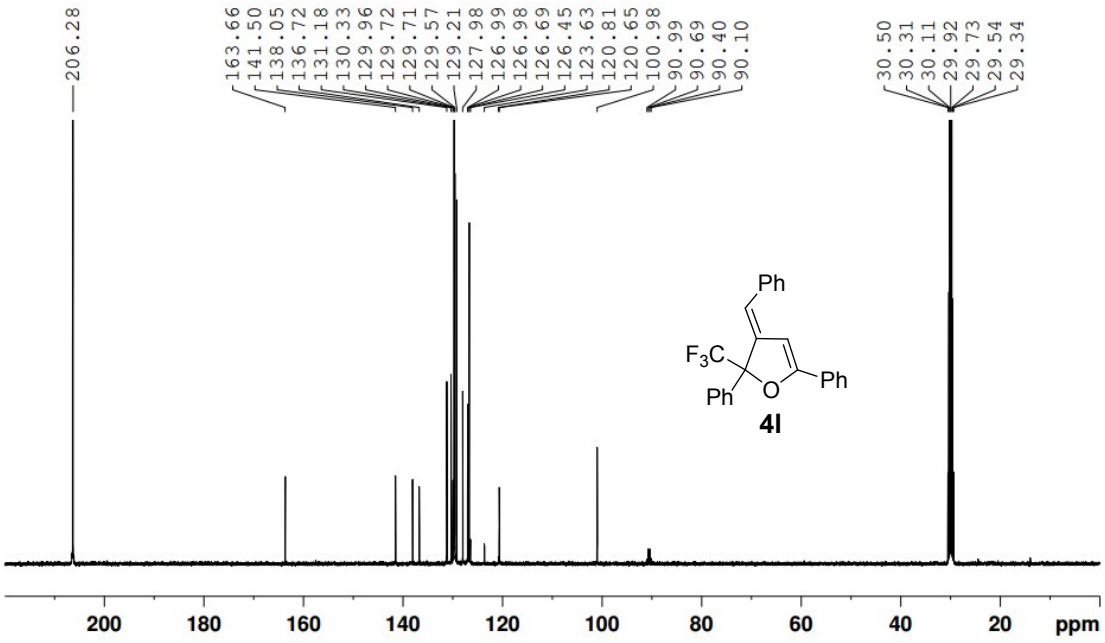
zw-4-16f



zw-4-10

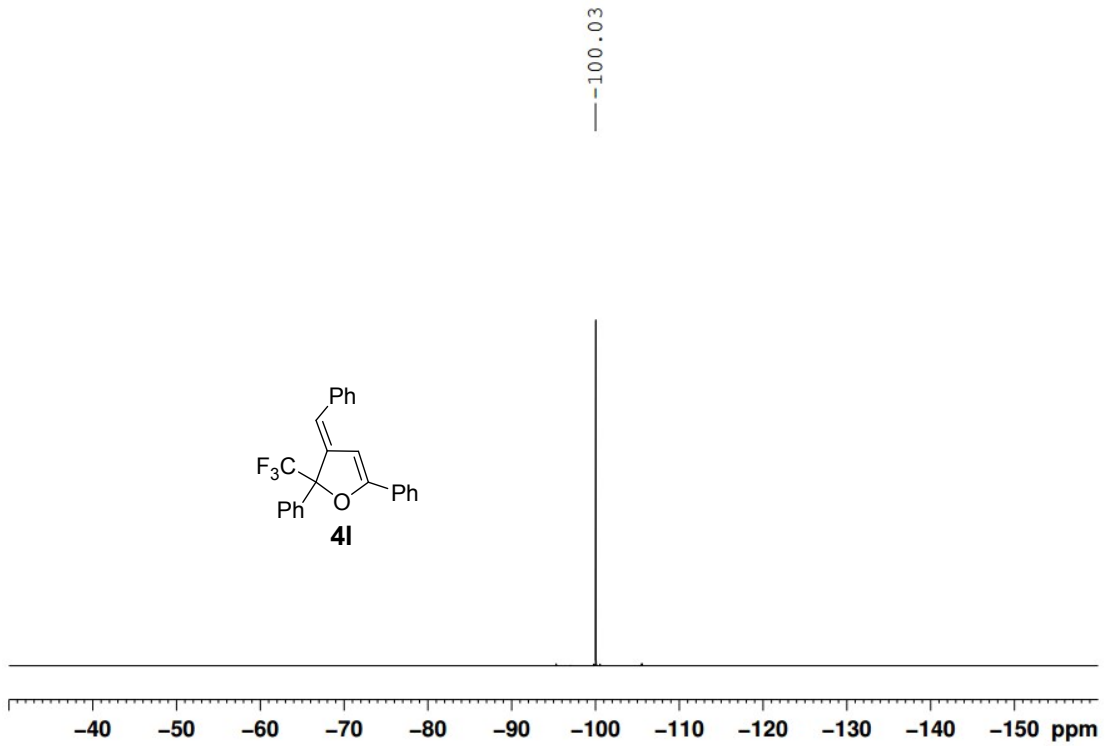


zw-4-10c

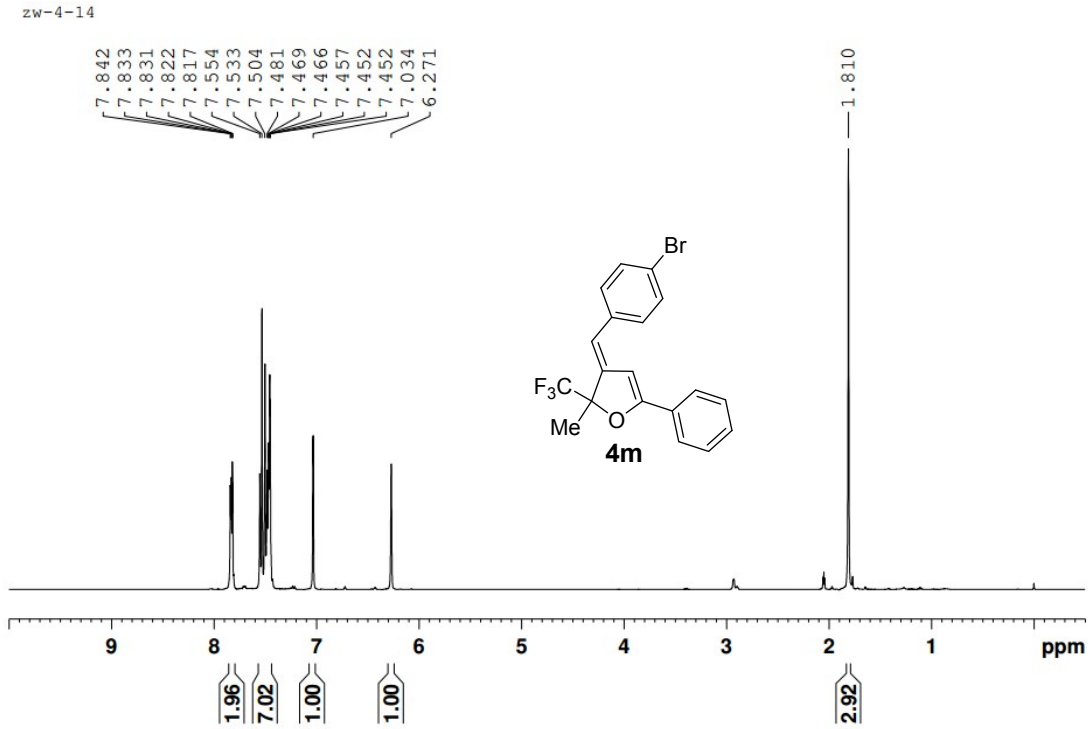


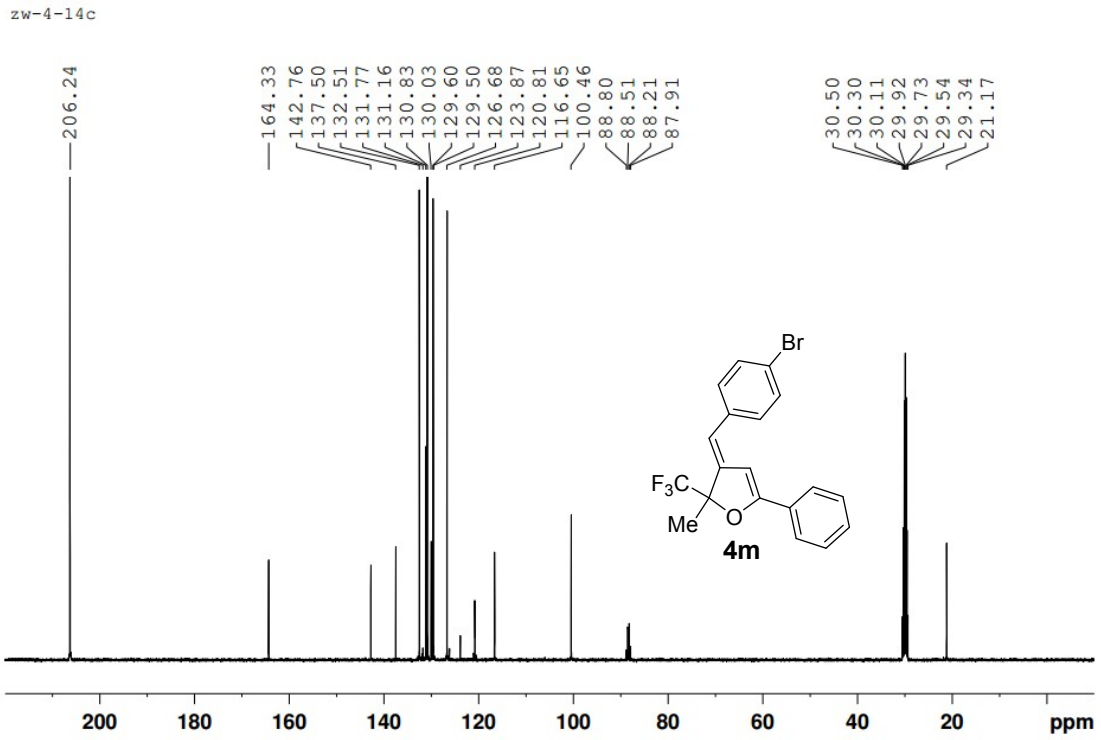
4l

zw-4-10f

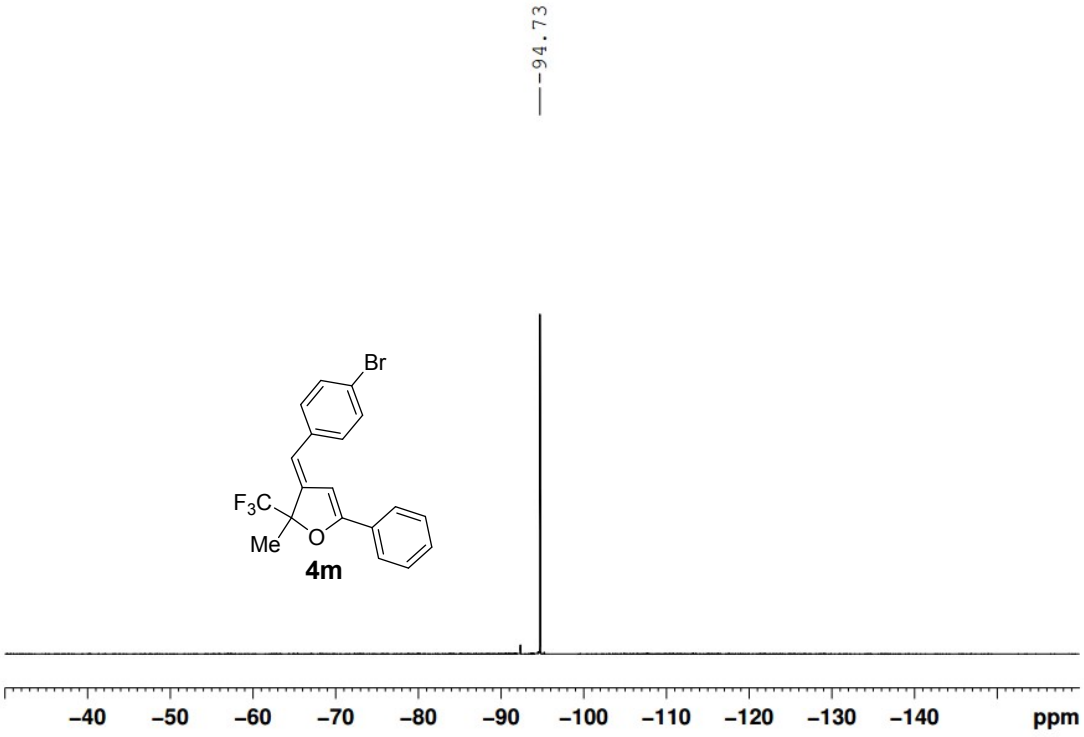


4l

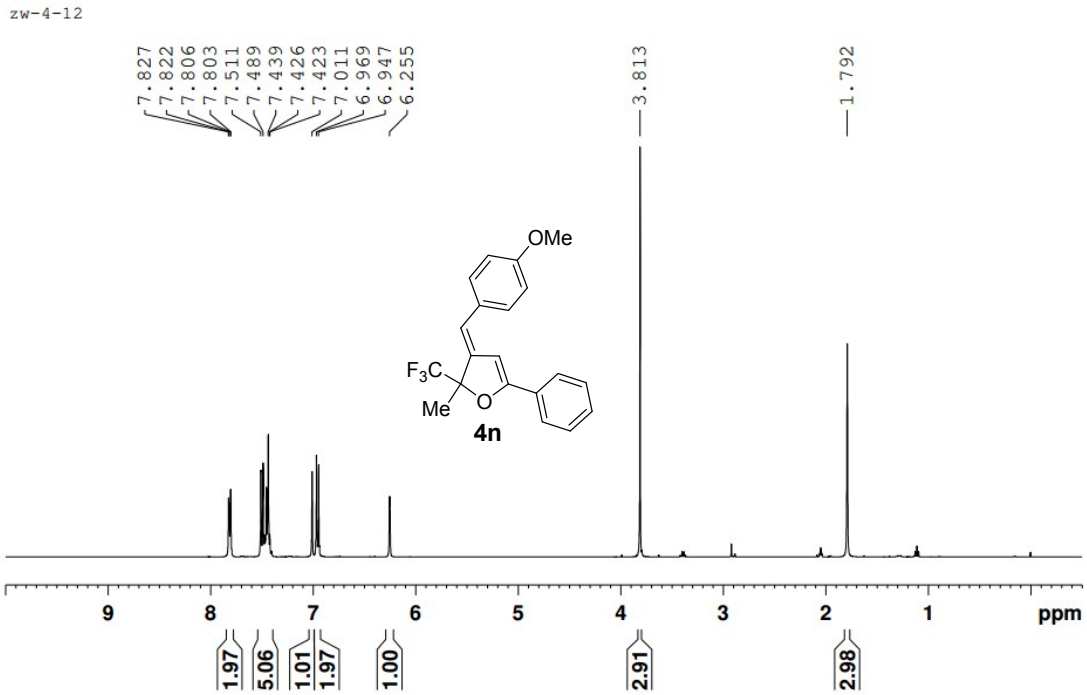

zw-4-14
7.842
7.833
7.831
7.822
7.817
7.554
7.533
7.504
7.481
7.469
7.466
7.457
7.452
7.034
6.271
1.810
Br
F3C
Me
O
4m
9
8
7
6
5
4
3
2
1
ppm
1.96
7.02
1.00
1.00
2.92


zw-4-14c
206.24
164.33
142.76
137.50
132.51
131.77
131.16
130.83
130.03
129.60
129.50
126.68
123.87
120.81
116.65
100.46
88.80
88.51
88.21
87.91
30.50
30.30
30.11
29.92
29.73
29.54
29.34
21.17
Br
F3C
Me
O
4m
200
180
160
140
120
100
80
60
40
20
ppm

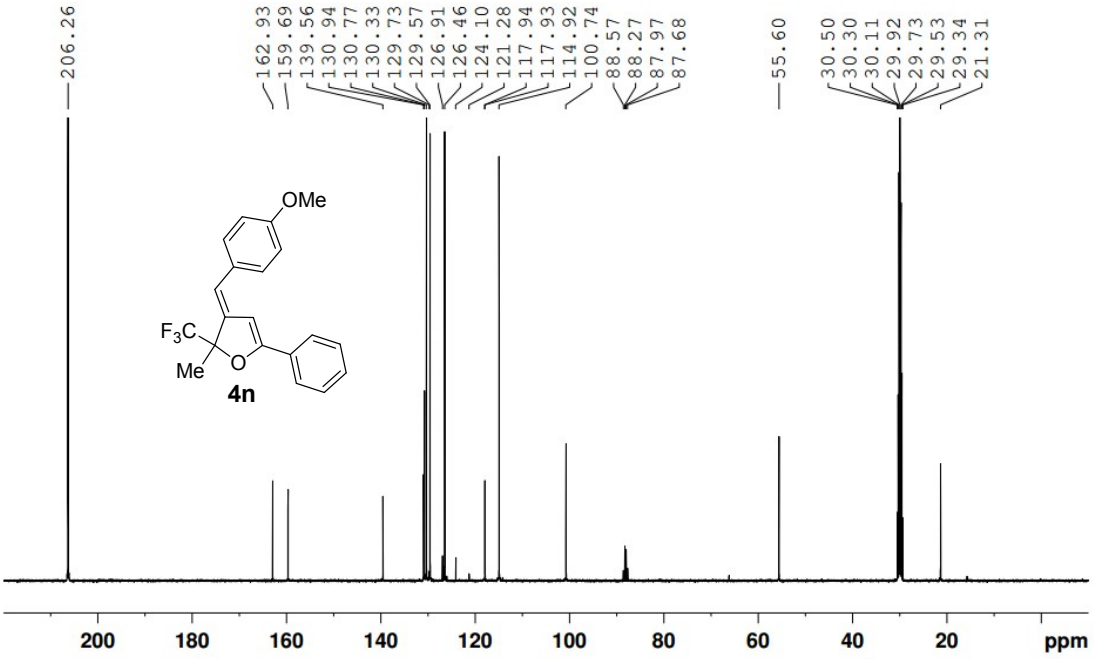
zw-4-14f



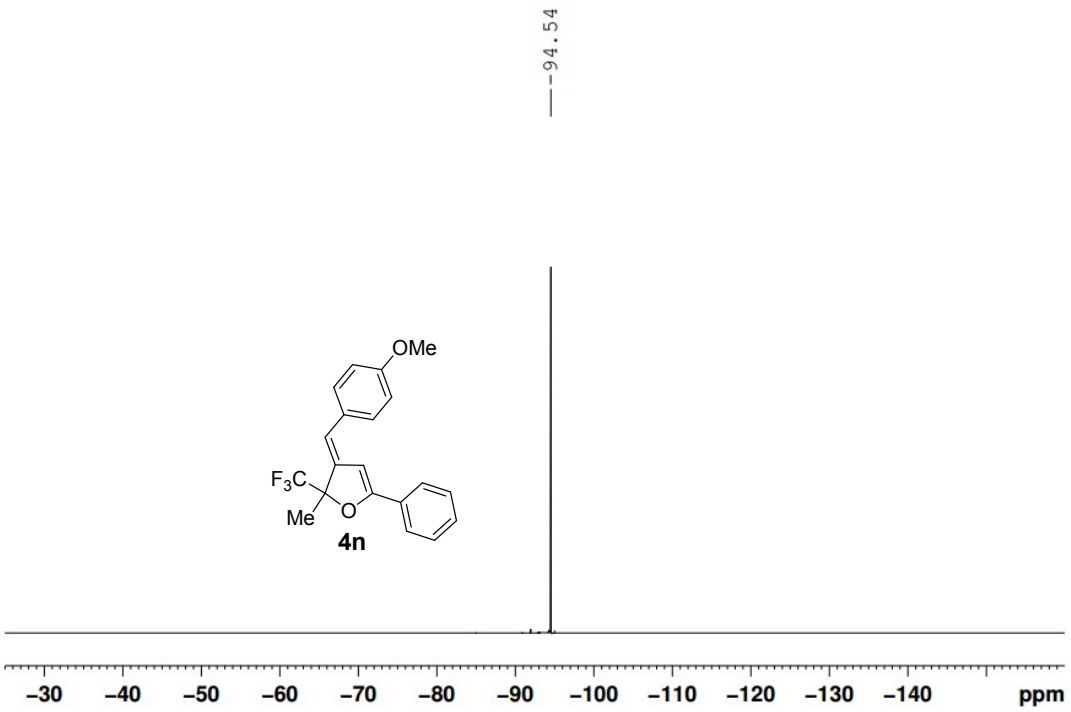
zw-4-12



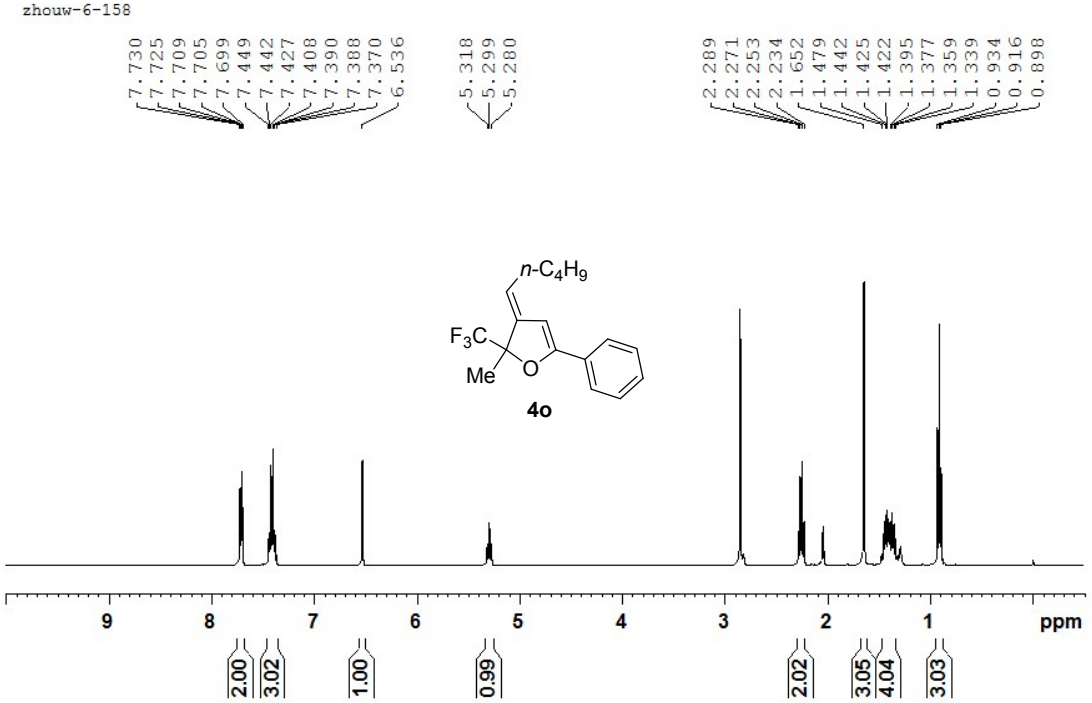
zw-4-12c



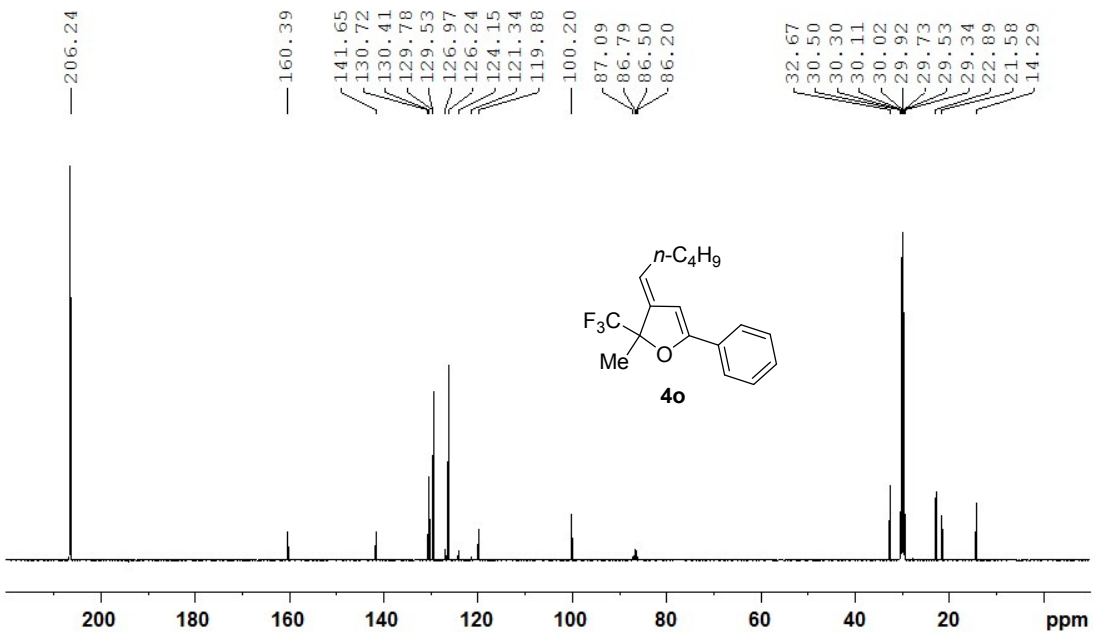
zw-4-12f



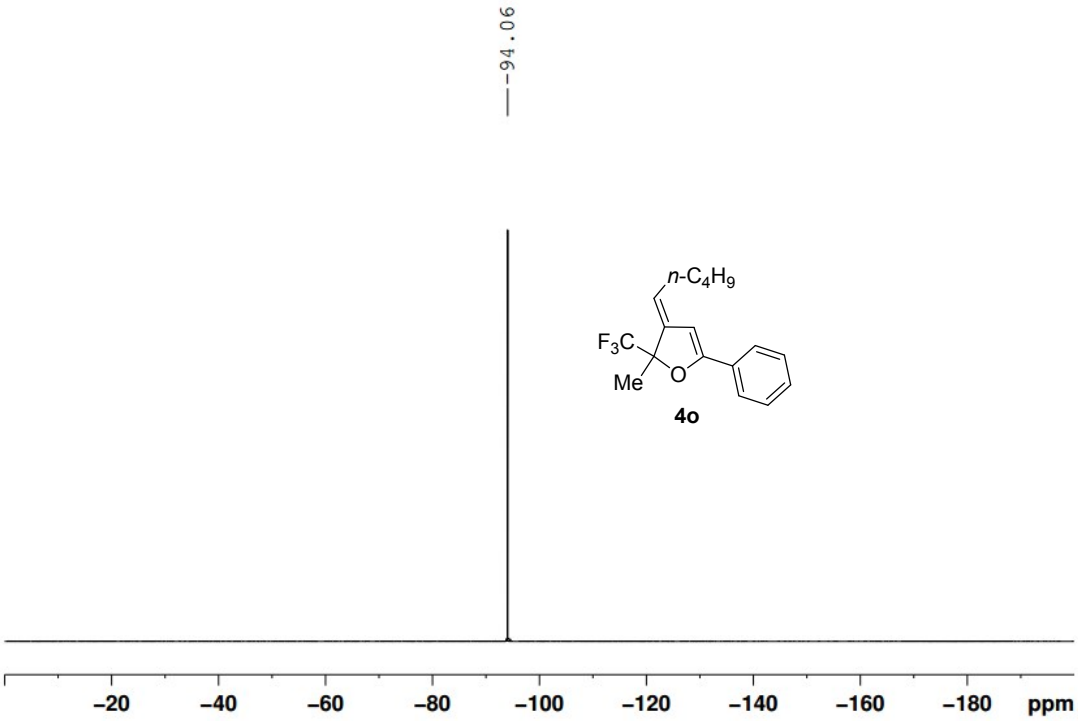
zhouw-6-158



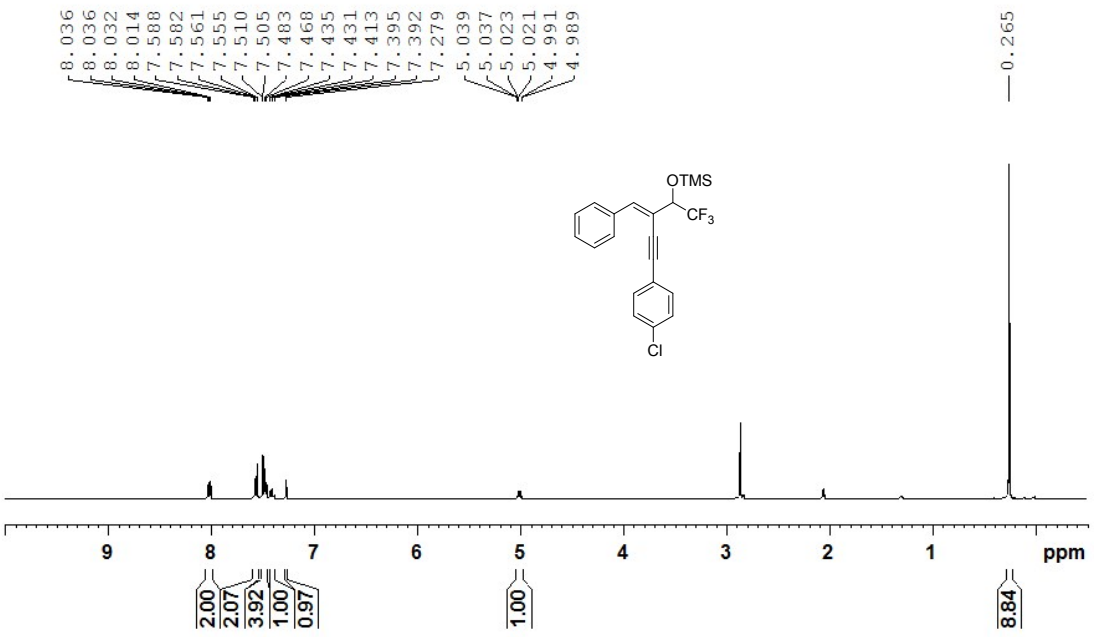
zhouw-6-158c



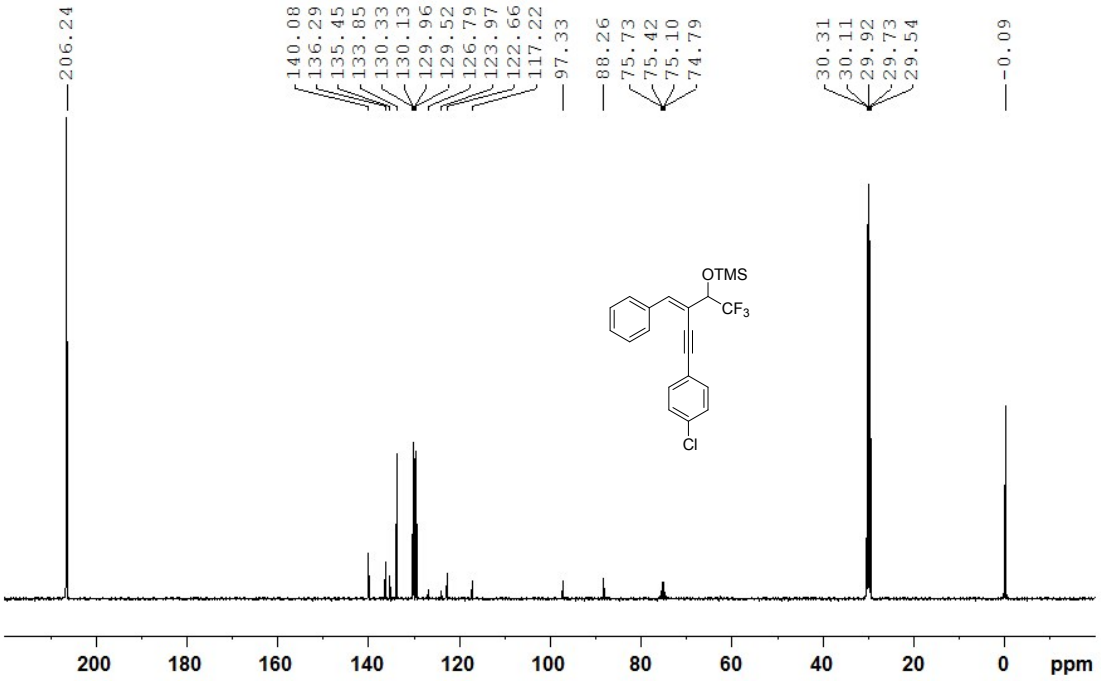
zhouw-6-158f



zhouw-6-159



zhouw-6-158c



zhouw-6-159f