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Supporting Information

Synthesis of 2-Trifluoromethyl Indoles via Visible-Light Induced Intramolecular Radical Cyclization

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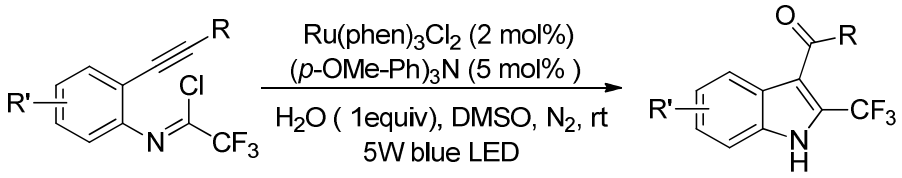
General All reactions were performed under a nitrogen atmosphere in a 10 mL schlenk tube. DMSO and MeCN were dried over CaH_2 before use. Photoirradiation was carried out with a 5W blue LED. For chromatography, 200-300 mesh silica gel (Qingdao, China) was employed. ^1H NMR and ^{13}C NMR spectra were measured in $CDCl_3$ or DMSO and recorded on Varian 300spectrometer. Mass spectra were obtained on Thermo Trace GC Ultra-DCQ, and HRMS were performed on Bruker Daltonics ESI-Q-TOF at Lenh Insititute of Functional Materials or Thermo MAT95XP mass spectrometer at analytical center of Sun Yat-Sen University. Compounds described in the literature were characterized by comparing their ^1H NMR and ^{13}C NMR to the reported values. *N*-[2-(alkynyl)phenyl]trifluoro acetimidoyl chlorides were prepared from CF_3CO_2H, CCl_4, and *o*-alkynylaniline according to the reported procedure.[1] Unless otherwise noted, materials obtained from commercial suppliers were used without further purification.

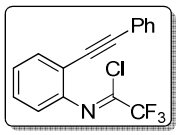
General procedure for synthesis of 2-trifluoromethyl-3-acylindoles



A 10 mL snap vial under nitrogen atmosphere was charged with $Ru(phen)_3Cl_2$ catalyst (2.6 mg, 2 mol%), *N*-[2-(alkynyl)phenyl]trifluoroacetimidoyl chloride **1** (0.2 mmol), $(p\text{-OMe-Ph})_3N$ (3.4 mg, 5 mol%) and dry DMSO (0.5 mL). The solution was stirred at room temperature with the irradiation of a 5 W blue LED. After the reaction was completed, as monitored by TLC, the resulting mixture was filtered through a short path of silica gel, eluting with ethyl acetate. The volatile compounds were removed in vacuo and the residue was purified by column chromatography (SiO_2) with hexane/ethyl acetate.

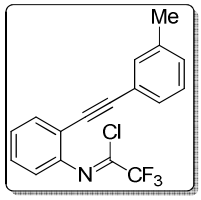
Characterization data:

2, 2, 2-trifluoro-*N*-(2-(phenylethynyl)phenyl)acetimidoyl chloride[2] (1a):



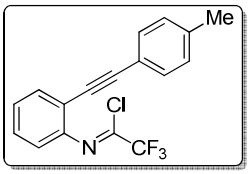
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.63 (d, J = 7.8Hz, 2H), 7.52-7.49 (m, 2H), 7.43-7.40 (m, 4H), 7.29-7.24 (m, 1H), 6.99 (d, J = 7.8Hz, 1H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 146.9, 136.2 (q, J = 43.2Hz), 134.0, 132.9, 130.4, 130.0, 129.8, 127.8, 124.2, 120.1, 118.2 (q, J = 278.5Hz), 115.6, 96.4, 86.2; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.1 (s, 3F); MS (EI): *m/z* (%): 307 $[M]^+$(90), 272(32), 252(100), 202(34), 176(44), 150(20), 126(10).

2,2,2-trifluoro-*N*-(2-(m-tolylethynyl)phenyl)acetimidoyl chloride (1b):



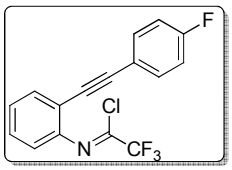
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.68-7.65 (m, 1H), 7.45-7.39 (m, 3H), 7.31-7.26 (m, 2H), 7.22-7.20 (m, 1H), 7.03-7.00 (m, 1H), 2.42 (s, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 147.0, 139.5, 136.2 (q, J = 43.2Hz), 134.0, 133.6, 131.0, 130.3, 130.1, 129.8, 127.8, 124.1, 120.1, 118.4 (q, J = 278.6Hz), 115.8, 96.8, 86.0, 22.5; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.0 (s, 3F); MS (EI): *m/z* (%): 321 $[M]^+$(88), 286(58), 266(100), 252(30), 216(66), 189(76), 163(24). HRMS(EI) calcd. For $C_{17}H_{11}F_3N_1Cl_1$ $[M]^+$: 321.0527, found: 321.0522.

2,2,2-trifluoro-*N*-(2-(p-tolylethynyl)phenyl)acetimidoyl chloride[3] (1c):



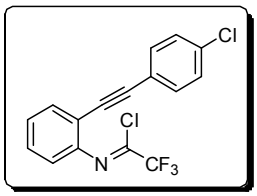
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.64 (d, J = 7.8Hz, 1H), 7.44-7.38 (m, 3H), 7.30-7.38 (m, 3H), 7.30-7.25 (m, 1H), 7.29 (d, J = 7.8Hz, 2H), 6.99 (d, J = 8.1 Hz); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 146.9, 140.3, 136.1 (q, J = 43.2Hz), 134.0, 132.9, 130.6, 130.2, 127.8, 121.2, 120.1, 118.3 (q, J = 278.5Hz), 115.9, 96.7, 85.7, 22.9; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.1 (s, 3F); MS (EI): *m/z* (%): 321 $[M]^+$(80), 285(74), 262(100), 252(16), 216(44), 189(40), 176(12), 126(10).

2,2,2-trifluoro-*N*-(2-((4-fluorophenyl)ethynyl)phenyl)acetimidoyl chloride (1d):



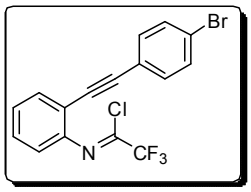
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.60 (d, J = 7.5Hz, 1H), 7.49-7.44 (m, 2H), 7.39 (t, J = 7.8Hz, 1H), 7.25 (t, J = 7.8Hz, 1H), 7.04 (t, J = 8.1Hz, 2H), 6.98 (d, J = 7.8Hz, 1H) ; ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 164.1 (d, J = 251.2Hz), 146.9, 136.2 (q, J = 43.2Hz), 134.8 (d, J = 8.5Hz), 133.9, 130.4, 127.8, 120.3 (q, J = 3.2Hz), 120.1, 118.2 (q, J = 278.5Hz), 117.1 (d, J = 22.2Hz), 115.5, 95.3, 85.9; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.1 (s, 3F), -110.5 (m, 1H); MS (EI): *m/z* (%): 325 $[M]^+$(60), 290(34), 270(100), 256(20), 221(50), 194(58), 168(24), 149(10). HRMS(EI) calcd. For $C_{16}H_8F_3N_1Cl_1$ $[M]^+$: 325.0276, found: 325.0272.

***N*-(2-((4-chlorophenyl)ethynyl)phenyl)-2,2,2-trifluoroacetimidoyl chloride[3] (1e):**



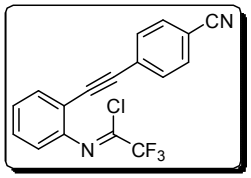
White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.60 (d, J = 7.5Hz, 1H), 7.42-7.36 (m, 3H), 7.33-7.30 (m, 3H), 7.24 (t, J = 7.8Hz, 1H), 6.98 (d, J = 8.1Hz, 1H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 146.9, 136.2 (q, J = 43.3Hz), 136.2 134.1, 134.0, 130.6, 130.2, 127.9, 120.2, 118.4 (q, J = 278.6Hz), 115.4, 95.2, 87.2; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.1 (s, 3F); MS (EI): *m/z* (%): 341 $[M]^+$(76), 306(44), 286(50), 271(100), 237(40), 201(26), 176(68), 150(24).

***N*-(2-((4-bromophenyl)ethynyl)phenyl)-2,2,2-trifluoroacetimidoyl chloride (1f):**



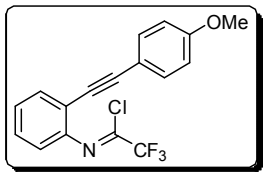
White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.61 (d, J = 7.8Hz, 1H), 7.49 (d, J = 8.1Hz, 2H), 7.41 (t, J = 7.5Hz, 1H), 7.34 (d, J = 8.1Hz, 2H), 7.26 (t, J = 7.5Hz, 1H), 6.99 (d, J = 7.8Hz, 1H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 146.9, 136.2 (q, J = 43.3Hz), 134.3, 134.0, 133.1, 130.6, 127.9, 124.4, 123.1, 120.2, 118.2 (q, J = 278.6Hz), 115.3, 95.2, 87.3; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.1 (s, 3F); MS (EI): *m/z* (%): 387 $[M]^+$(32), 350(8), 286(8), 271(100), 237(18), 202(20), 176(42), 150(22). HRMS(EI) calcd. For $C_{16}H_8F_3N_1Br_1Cl_1$ $[M]^+$: 384.9475, found: 384.9469.

***N*-(2-((4-cyanophenyl)ethynyl)phenyl)-2,2,2-trifluoroacetimidoyl chloride (1g):**



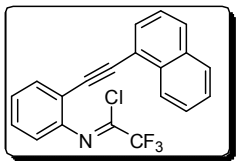
Yellow solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.64-7.61 (m, 3H), 7.54-7.52(m, 2H), 7.45 (t, J = 7.8Hz, 1H), 7.29 (t, J = 7.8Hz, 1H), 7.00 (d, J = 8.1Hz, 1H) ; ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 147.1, 136.4 (q, J = 43.4Hz), 134.2, 133.5, 133.3, 131.3, 129.0, 128.0, 120.3, 119.7, 118.1 (q, J = 278.7Hz), 114.7, 113.3, 94.4, 90.4; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -76.8 (s, 3F); MS (EI): *m/z* (%): 332 $[M]^+$(92), 297(16), 277(100), 263(50), 228(74), 201(82), 175(76), 151(32). HRMS(EI) calcd. For $C_{17}H_8F_3N_2Cl_1$ $[M]^+$: 332.0323, found: 332.0316.

2,2,2-trifluoro-*N*-(2-((4-methoxyphenyl)ethynyl)phenyl)acetimidoyl chloride (1h)



Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.64-7.60 (m, 1H), 7.50-7.45 (m, 2H), 7.38 (t, J = 7.8Hz, 1H), 7.26 (t, J = 7.8Hz, 1H), 7.00-6.97 (m, 1H), 6.92-6.89 (m, 2H), 3.82 (s, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 161.5, 146.7, 136.0 (q, J = 43.2Hz), 134.4， 133.8， 130.0， 127.8， 120.1， 118.4 (q, J = 278.5Hz), 116.3， 116.0， 115.5， 96.7， 85.1, 56.5; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.1 (s, 3F); MS (EI): *m/z* (%): 337 $[M]^+$(46), 302(100), 282(50), 239(30), 218(10), 190(22), 163(36). HRMS(EI) calcd. For $C_{17}H_{11}F_3N_1Cl_1O_1$ $[M]^+$: 337.0476, found: 337.0471.

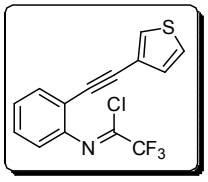
2,2,2-trifluoro-*N*-(2-(naphthalen-1-ylethynyl)phenyl)acetimidoyl chloride (1i):



Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 8.46 (d, J = 7.8Hz, 1H), 7.90-7.89 (m, 2H), 7.79-7.77 (m, 2H), 7.67-7.55 (m, 2H), 7.52-7.42 (m, 2H), 7.33 (d, J = 7.8Hz, 1H), 7.06 (d, J = 7.8Hz, 1H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 146.8, 136.1 (q, J = 43.3Hz), 134.6, 134.6, 134.4, 132.0, 130.6, 130.4, 129.7, 128.3, 128.1, 128.0, 127.6, 126.7, 121.9, 120.3, 118.4 (q, J = 278.7Hz), 116.5, 94.7, 91.2; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -76.6 (s, 3F); MS (EI): *m/z* (%): 357 $[M]^+$(52), 302(68), 282(38), 252(56), 226(28), 200(12), 151(10), 126(32), 113(100). HRMS(EI) calcd. For $C_{20}H_{11}F_3N_1Cl_1$

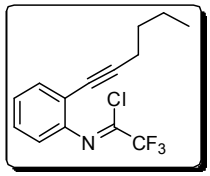
$[M]^+$: 357.0527, found: 357.0533.

2,2,2-trifluoro-*N*-(2-(thiophen-3-ylethynyl)phenyl)acetimidoyl chloride (1j):



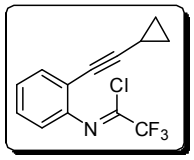
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.60 (d, J = 7.8Hz, 1H), 7.52-7.51 (m, 1H), 7.36 (d, J = 7.8Hz, 1H), 7.29-7.27 (m, 1H), 7.23 (t, J = 7.8Hz, 1H), 7.17 (d, J = 7.8Hz, 1H), 6.97 (d, J = 8.1Hz, 1H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 146.9, 136. 136.2 (q, J = 43.2Hz), 133.9, 131.1, 130.5, 130.3, 127.9, 127.0, 123.3, 120.2, 118.3 (q, J = 278.5Hz), 115.6, 91.7, 85.9; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.0 (s, 3F); MS (EI): *m/z* (%): 313 $[M]^+$(50), 278(50), 258(100), 209(32), 182(20), 139(70). HRMS(EI) calcd. For $C_{14}H_7F_3N_1Cl_1S_1$ $[M]^+$: 312.9934, found: 312.9929.

2,2,2-trifluoro-*N*-(2-(hex-1-yn-1-yl)phenyl)acetimidoyl chloride[2] (1k):



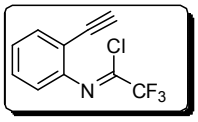
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.46 (d, J = 7.5Hz, 1H), 7.31 (t, J = 7.8Hz, 1H), 7.18 (t, J = 7.5Hz, 1H), 6.88 (d, J = 7.8Hz, 1H), 2.41 (t, J = 6.7Hz, 2H), 1.62-1.41 (m, 4H), 0.95 (t, J = 6.9Hz, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 147.1, 135.8 (q, J = 43.2Hz), 134.0, 129.5, 127.5, 119.8, 118.2 (q, J = 278.4Hz), 116.3, 97.8, 77.4, 31.9, 23.3, 20.5, 14.8; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -77.1 (s, 3F); MS (EI): *m/z* (%): 287$[M]^+$(50), 252(28), 236(36), 210(99), 183(100), 140(64), 113(74).

***N*-(2-(cyclopropylethynyl)phenyl)-2,2,2-trifluoroacetimidoyl chloride (1l):**



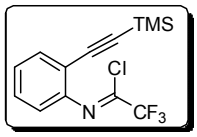
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.46 (d, J = 7.8Hz, 1H), 7.31 (t, J = 7.8Hz, 1H), 7.17 (t, J = 7.8Hz, 1H), 6.89 (d, J = 7.8Hz, 1H), 1.49-1.40 (m, 1H), 0.92-0.84 (m, 2H), 0.82-0.77 (m, 2H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 147.1, 135.7 (q, J = 43.2Hz), 134.0, 129.4, 127.6, 119.8, 118.2 (q, J = 278.4Hz), 116.1, 101.0, 72.5, 10.0, 1.5; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -72.3 (s, 3F); MS (EI): *m/z* (%): 271 $[M]^+$(14), 236(34), 216(62), 202(24), 167(100), 139(60), 113(42). HRMS(EI) calcd. For $C_{13}H_9F_3N_1Cl_1$ $[M]^+$: 271.0370, found: 271.0368.

***N*-(2-ethynylphenyl)-2,2,2-trifluoroacetimidoyl chloride**[4] **(1m):**



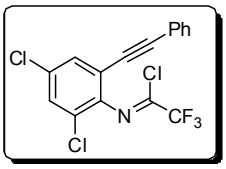
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.58 (d, J = 7.8Hz, 1H), 7.41 (t, J = 7.8Hz, 1H), 7.23 (d, J = 7.8Hz, 1H), 6.93 (d, J = 7.8Hz, 1H), 3.26 (s, 1H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 147.6, 136.6 (q, J = 43.5Hz), 134.8, 130.9, 127.7, 120.0, 118.1 (q, J = 278.6Hz), 114.4, 83.9, 80.3; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -77.1 (s, 3F); MS (EI): *m/z* (%): 231 $[M]^+$(36), 196(100), 176(26), 146(44), 127(26), 101(96).

2,2,2-trifluoro-*N*-(2-((trimethylsilyl)ethynyl)phenyl)acetimidoyl chloride[2] **(1n):**



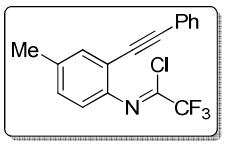
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.53 (d, J = 7.5Hz, 1H), 7.37 (t, J = 7.8Hz, 1H), 7.20 (t, J = 7.5Hz, 1H), 6.90 (d, J = 7.8Hz, 1H), 0.24 (s, 9H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 147.5, 136.1 (q, J = 42.6Hz), 134.2, 130.5, 127.5, 119.9, 118.1 (q, J = 278.5Hz), 115.2, 101.9, 101.3, 0.96; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -77.0 (s, 3F); MS (EI): *m/z* (%): 303 $[M]^+$(44), 192(40), 172(46), 152(100), 115(80).

***N*-(2,4-dichloro-6-(phenylethynyl)phenyl)-2,2,2-trifluoroacetimidoyl chloride (1o)**



White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.51-7.50 (m, 1H), 7.46-7.45 (m, 3H), 7.38-7.36 (m, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 141.9, 138.9 (q, J = 42.4Hz), 131.7, 130.6, 129.6, 129.3, 128.5, 124.3, 121.8, 116.6 (q, J = 279.1Hz), 115.9, 96.7, 82.7 ; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -76.8 (s, 3F); MS (EI): *m/z* (%): 375 $[M]^+$(60), 340(20), 320(100), 306(40), 271(50), 235(30), 201(74), 174(72), 135(22), 122(26). HRMS(EI) calcd. For $C_{16}H_7F_3N_1Cl_3$ $[M]^+$: 374.9591, found: 374.9596.

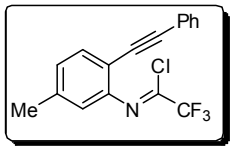
2,2,2-trifluoro-*N*-(4-methyl-2-(phenylethynyl)phenyl)acetimidoyl chloride (1p):



Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.48-7.43 (m, 3H), 7.34-7.32 (m, 3H), 7.20-7.17 (m, 1H), 6.90 (d, J = 8.1Hz, 1H), 2.38 (s, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 144.3, 137.9, 135.4 (q, J = 43.2Hz), 134.4, 132.9, 131.1, 129.9, 129.8, 124.3, 120.2, 118.2 (q, J = 278.4Hz), 115.8, 96.0, 86.5, 22.2; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -76.8 (s,

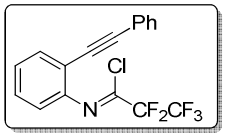
3F); MS (EI): *m/z* (%): $[M]^+$ 321, 286, 266, 252, 216, 189, 165, 94. HRMS(EI) calcd. For $C_{17}H_{11}F_3N_1Cl_1$ $[M]^+$ 321.0527 , found: 321.0526.

2,2,2-trifluoro-*N*-(5-methyl-2-(phenylethynyl)phenyl)acetimidoyl chloride (1q):



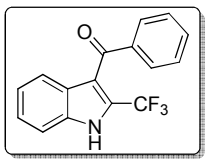
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.58-7.56 (m, 3H), 7.41-7.39(m, 3H), 7.11(d, J = 7.8Hz, 1H), 6.83 (s, 1H), 2.45(s, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 147.0, 141.1, 136.0 (q, J = 43.1Hz), 133.9, 132.9, 129.9, 129.8, 128.7, 124.5, 120.6, 118.4 (q, J = 278.5Hz), 112.5, 95.7, 86.5, 22.8; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -76.8 (s, 3F). MS (EI): *m/z* (%):$[M]^+$ 321, 286, 266, 252, 216, 189, 165, 150, 126, 94. HRMS(EI) calcd. For $C_{17}H_{11}F_3N_1Cl_1$ $[M]^+$: 321.0527, found: 321.0525.

2,2,3,3,3-pentafluoro-*N*-(2-(phenylethynyl)phenyl)propanimidoyl chloride (1r):



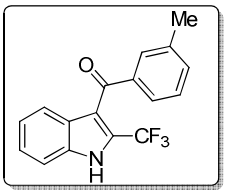
Pale yellow oil; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 7.64 (d, J = 7.8Hz, 1H), 7.51-7.49 (m, 2H), 7.43-7.37 (m, 4H), 7.30-7.25 (m, 1H), 6.99 (d, J = 7.8Hz, 1H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 146.8, 136.6 (t, J = 33.4Hz), 134.3, 132.9, 130.3, 130.0, 129.8, 129.0, 124.2, 120.1, 119.4 (tq, J = 35.1Hz, J = 288.1Hz), 116.0, 109.3 (qt, J = 38.6Hz, J = 261.2Hz), 96.3, 86.1; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -86.3 (s, 3F), -118.8 (s, 2F); MS (EI): *m/z* (%): 357 $[M]^+$(80), 322(38), 302(14), 268(30), 252(60), 238(54), 203(64), 176(82), 151(40). HRMS(EI) calcd. For $C_{17}H_9F_5N_1Cl_1$ $[M]^+$: 357.0338, found: 357.0335.

phenyl(2-(trifluoromethyl)-1H-indol-3-yl)methanone[5] (2a):



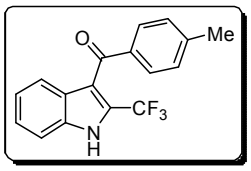
White solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 13.11 (br, 1H), 7.75 (d, J = 7.5Hz, 2H), 7.65-7.60 (m, 2H), 7.49 (t, J = 7.5Hz, 2H), 7.34-7.29 (m, 1H), 7.16 (d, J = 8.1Hz, 1H), 7.11-7.06 (m, 1H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 190.9, 139.2, 135.5, 133.6, 129.5, 129.0, 126.5 (q, J = 38.5Hz), 126.1, 125.3, 122.4, 121.4, 121.4 (q, J = 270.9Hz), 116.2, 113.5; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -57.6 (s, 3F); MS (EI): *m/z* (%): 289$[M]^+$(46), 220(10), 212(100), 164(14), 134(10), 105(26).

***m*-tolyl(2-(trifluoromethyl)-1H-indol-3-yl)methanone (2b):**



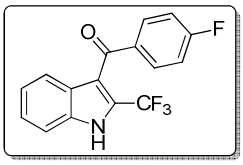
White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 10.00 (br, 1H), 7.75 (s, 1H), 6.68 (d, J = 7.5Hz, 1H), 7.50-7.30 (m, 5H), 7.16 (t, J = 7.8Hz, 1H), 2.41 (s, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 192.1, 134.6, 134.0, 130.1, 128.3, 127.2, 127.1 (q, J = 39.1Hz), 126.4, 125.2, 122.4, 121.8, 120.6 (q, J = 271.1Hz), 117.0, 112.3, 21.2; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -59.0 (s, 3F); MS (EI): *m/z* (%): 303 $[M]^+$(60), 288(10), 234(10), 212(100), 192(12), 164(20), 144(12), 119(16). HRMS (EI) calcd. For $C_{17}H_{12}F_3N_1O_1$ $[M]^+$: 303.0866, found: 303.0871.

***p*-tolyl(2-(trifluoromethyl)-1H-indol-3-yl)methanone[5] (2c):**



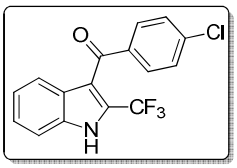
White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 10.17 (br, 1H), 7.83 (d, J = 7.5Hz, 2H), 7.48 (d, J = 8.4Hz, 1H), 7.40 (d, J = 8,1Hz, 1H), 7.33-7.26 (m, 3H), 7.15 (t, J = 7.5Hz, 1H). 2.46 (s, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 193.2, 145.7, 137.6, 136.1, 131.5, 130.6, 128.4 (q, J = 39.0Hz), 127.8, 126.6, 123.7, 123.2, 122.1 (q, J = 271.1Hz), 118.4, 113.8, 23.1; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -59.0 (s, 3F); MS (EI): *m/z* (%): 303 $[M]^+$(70), 288(12), 234(8), 212(100), 184(14), 164(24), 144(16), 119(46).

(4-fluorophenyl)(2-(trifluoromethyl)-1H-indol-3-yl)methanone[5] (2d):



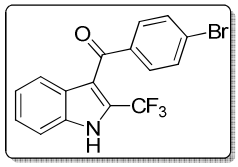
White solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 13.12 (br, 1H), 7.83-7.74 (m, 2H), 7.68 (d, J = 8.1Hz, 1H), 7.34-7.28 (m, 3H), 7.19-7.08 (m, 2H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 190.8, 166.9 (d, J = 253.1Hz), 137.1, 136.9, 133.9 (d, J = 9.5Hz), 127.9 (q, J = 38.5Hz), 127.4, 126.7, 123.9, 122.7, 122.7 (q, J = 270.7Hz), 117.5 (d, J = 22.1Hz), 117.3, 114.9; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -59.1 (s, 3F), -105.1 (m, 1F); MS (EI): *m/z* (%): 307 $[M]^+$(60), 286(10), 238(8), 212(100), 164(14), 123(58).

(4-chlorophenyl)(2-(trifluoromethyl)-1H-indol-3-yl)methanone[5] **(2e):**



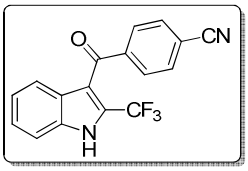
White solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 13.15 (br, 1H), 7.75-7.73 (m, 2H), 7.61-7.55 (m, 3H), 7.35-7.30 (m, 1H), 7.19-7.09 (m, 2H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 191.1， 140.0， 139.2， 136.9， 132.8， 130.1， 128.1 (q, J = 38.5Hz), 127.4， 126.8， 124.0， 122.7， 122.6 (q, J = 271.0Hz), 117.1， 115.0 ; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -59.1 (s, 3F); MS (EI): *m/z* (%): 323 $[M]^{+}$(40), 212(100), 192(18), 164(26), 139(28), 111(66).

(4-bromophenyl)(2-(trifluoromethyl)-1H-indol-3-yl)methanone (2f):



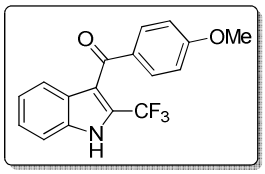
White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 9.79 (br, 1H), 7.75 (d, J = 8.4Hz, 2H), 7.61 (d, J = 8.4Hz, 2H), 7.50 (d, J = 8.1Hz, 1H), 7.38-7.32 (m, 2H), 7.18 (t, J = 7.8Hz, 1H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 191.8. 138.9, 135.9, 133.2, 132.6, 129.8, 128.6 (q, J = 39.1Hz), 127.6, 126.9, 124.1, 123.1, 121.9 (q, J = 271.1Hz), 117.8, 113.7; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -59.1 (s, 3F); MS (EI): *m/z* (%): 367 $[M]^{+}$(14), 319(22), 212(100), 192(20), 164(32), 135(48), 107(20). HRMS (EI) calcd. For $C_{16}H_9F_3N_1O_1Br_1$ $[M]^{+}$: 366.9814, found: 366.9807.

4-(2-(trifluoromethyl)-1H-indole-3-carbonyl)benzonitrile (2g):



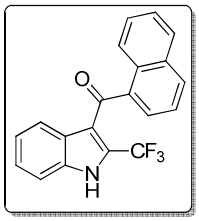
White solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 13.27 (br, 1H), 7.99 (d, J = 8.1Hz, 2H), 7.60 (d, J = 8.1Hz, 1H), 7.37-7.33 (m, 1H), 7.14-7.12 (m, 1H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 191.1, 144.2, 136.9, 134.6, 131.4, 128.9 (q, J = 38.6Hz), 127.3, 126.9, 124.4, 122.8, 122.5 (q, J = 271.4Hz), 119.9, 116.9, 116.5, 115.1; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -53.0 (s, 3F); MS (EI): *m/z* (%): 314 $[M]^{+}$(46), 212(100), 192(10), 164(30), 144(20), 102(92). HRMS(ESI) calcd. For $C_{17}H_9F_3N_2O_1$ $[M+H]^{+}$: 314.0661, found: 314.0666.

(4-methoxyphenyl)(2-(trifluoromethyl)-1H-indol-3-yl)methanone[5] **(2h):**



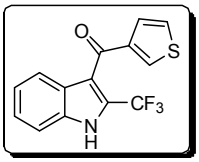
White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 10.20 (br, 1H), 7.91 (d, J = 8.7Hz, 2H), 7.48-7.40 (m, 2H), 7.30 (t, J = 7.8Hz, 1H), 7.17-7.12 (m, 1H), 6.95 (d, J = 8.7Hz, 2H), 3.89 (s, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 192.1, 165.4, 136.2, 133.8, 132.9, 128.0 (q, J = 40.0Hz), 127.7, 126.6, 126.2, 123.6, 123.1, 122.2 (q, J = 271.1Hz), 118.5, 115.2, 113.8, 56.9; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -59.0 (s, 3F); MS (EI): *m/z* (%): 319 $[M]^+$(16), 276(100), 212(30), 194(14), 164(24), 135(92).

naphthalen-1-yl(2-(trifluoromethyl)-1H-indol-3-yl)methanone (2i):



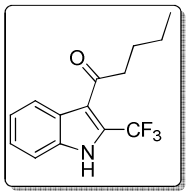
White solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 13.3 (br, 1H), 8.18-8.11 (m, 2H), 8.03-8.00 (m, 1H), 7.65-7.52 (m, 5H), 6.97 (t, J =7.8Hz, 1H), 6.78 (d, J = 8.1Hz, 1H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 193.1, 139.6, 136.8, 135.1, 133.5, 131.6, 130.3, 129.9, 129.4, 129.3 (q, J = 38.6Hz), 128.3, 127.6, 126.7, 126.6, 124.3, 122.7, 122.7 (q, J = 271.2Hz), 118.7, 115.1; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -53.4 (s, 3F); MS (EI): *m/z* (%): 339 $[M]^+$(24), 270(90), 241(14), 212(36), 192(12), 164(24), 127(100). HRMS (EI) calcd. For $C_{20}H_{12}F_3N_1O_1[M]^+$: 339.0866, found: 339.0859.

thiophen-3-yl(2-(trifluoromethyl)-1H-indol-3-yl)methanone (2j):



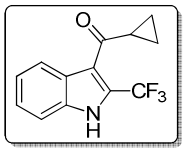
Colorless solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 12.99 (br, 1H), 8.12-8.11 (m, 1H), 7.67-7.64 (m, 1H), 7.58 (d, J = 8.4Hz, 1H), 7.37-7.31 (m, 2H), 7.17-7.12 (m, 1H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 185.8, 137.2, 136.9, 129.5, 129.0, 127.2, 127.0 (q, J = 38.4Hz), 126.7, 124.1, 123.7, 122.7, 120.1 (q, J = 271.1Hz), 118.6, 114.8; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -58.9 (s, 3F); MS (EI): *m/z* (%): 295 $[M]^+$(70), 262(18), 225(10), 212(68), 192(12), 164(20), 144(12), 111(100). HRMS (EI) calcd. For $C_{14}H_8F_3N_1O_1S_1$ $[M]^+$: 295.0273, found: 295.0270.

1-(2-(trifluoromethyl)-1H-indol-3-yl)pentan-1-one[6] (2k):



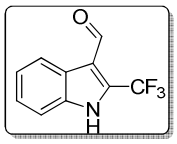
White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 12.76 (br, 1H), 7.96 (d, J = 7.8Hz, 1H), 7.52 (d, J = 8.1Hz, 1H), 7.31-7.21 (m, 2H), 2.96 (t, J = 7.2Hz, 2H), 1.70-1.60 (m, 2H), 1.43-1.30 (m, 2H), 0.90 (t, J = 7.5Hz, 3H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 198.4, 135.5, 128.6 (q, J = 38.7Hz), 127.2, 126.7, 124.7, 123.8, 122.2 (q, J = 271.0Hz), 118.9, 113.7, 44.0, 27.6, 23.7, 15.3; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -57.6 (s, 3F); MS (EI): *m/z* (%): 269$[M]^+$(5), 227(50), 212(100), 192(20).

cyclopropyl(2-(trifluoromethyl)-1H-indol-3-yl)methanone (2l):



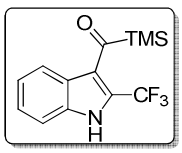
White solid; ^{1}H-NMR (300MHz, $CDCl_3$): δ (ppm): 13.00 (br, 1H), 8.05 (d, J = 8.1Hz, 1H), 7.58 (d, J = 8.1Hz, 1H), 7.38 (t, J = 7.2Hz, 1H), 7.29 (t, J = 7.2Hz, 1H), 2.65-2.57 (m, 1H), 1.12-1.10 (m, 4H); ^{13}C-NMR (101MHz, $CDCl_3$): δ (ppm): 197.3, 136.7, 127.4 (q, J = 38.7Hz), 127.0, 126.7, 124.5, 123.3, 122.8 (q, J = 271.1Hz), 118.9, 115.0, 23.1, 12.8; ^{19}F-NMR (282MHz, $CDCl_3$): δ (ppm): -63.0 (s, 3F); MS (EI): *m/z* (%): 253$[M]^+$(55), 212(100); HRMS(EI) calcd. For $C_{13}H_{10}F_3N_1O_1[M]^+$: 253.0709, found: 253.0705.

2-(trifluoromethyl)-1H-indole-3-carbaldehyde[7] (2m):



White solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 13.39 (br, 1H), 10.20 (br, 1H), 8.23 (d, J = 8.1Hz, 1H), 7.58 (d, J = 8.1Hz, 1H), 7.43-7.38 (m, 1H), 7.35-7.30 (m, 1H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 186.0, 137.2, 132.7 (q, J = 39.2Hz), 127.6, 126.2, 125.6, 123.8, 122.6 (q, J = 271.8Hz), 117.3, 115.0; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -51.6 (s, 3F); MS (EI): *m/z* (%):213 $[M]^+$(100), 192(18), 134(20), 113(22)

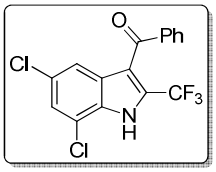
(2-(trifluoromethyl)-1H-indol-3-yl)(trimethylsilyl)methanone (2n):



White solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 7.68 (d, J = 8.1Hz, 1H), 7.53 (d, J = 8.4Hz, 1H), 7.37-7.32 (m, 1H), 7.26-7.21 (m, 1H), 0.24 (s, 9H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 184.15, 135.2, 130.9 (q, J = 36.2Hz), 125.8, 124.9, 124.0, 122.0, 121.1 (q, J = 270.4Hz),

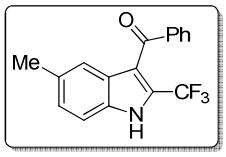
120.9, 112.9, -2.6. ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -57.3 (s, 3F); MS (EI): *m/z* (%): 285[M]$^+$(15), 284(25), 242(25), 216(70), 212(48), 165(47). HRMS (EI) calcd. For $C_{13}H_{14}F_3N_1Si_1$ [M]$^+$: 285.0791, found: 285.0781.

(5,7-dichloro-2-(trifluoromethyl)-1H-indol-3-yl)(phenyl)methanone (2o):



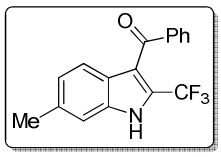
Pale yellow solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 13.6 (br, 1H), 7.75 (d, *J* = 7.5Hz, 2H), 7.67 (t, *J* = 7.8Hz, 1H), 7.58 (s, 1H), 7.53 (t, *J* = 7.5Hz, 2H), 7.21 (s, 1H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 191.7, 139.8, 135.6, 133.3, 131.1, 130.6, 129.7 (q, *J* = 39.2Hz), 129.4, 128.3, 126.5, 122.1 (q, *J* = 271.6Hz), 121.0, 120.4, 118.4; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -63.9 (s, 3F); MS (EI): *m/z* (%): 356 [M]$^+$(78), 280(98), 262(20), 217(22), 197(18), 161(16), 105(100). HRMS(EI) calcd. For $C_{16}H_8F_3N_1O_1Cl_2$ [M]$^+$: 356.9930, found: 352.9932.

(5-methyl-2-(trifluoromethyl)-1H-indol-3-yl)(phenyl)methanone[5] (2p):



Pale yellow solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 12.95 (br, 1H), 7.74-7.72(m, 2H), 7.68-7.63(m, 1H), 7.54-7.46(m, 3H), 7.16(d, *J* = 8.4Hz, 1H), 6.95 (s, 1H), 2.25 (s, 3H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 191.1, 139.2, 133.9, 133.7, 131.5, 129.6, 129.1, 127.2, 126.3, 126.3 (q, *J* = 38.3Hz), 121.4 (q, *J* = 270.7Hz), 115.7, 113.2, 21.6; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -57.5 (s, 3F); MS (EI): *m/z* (%):[M]$^+$ 303, 226, 206, 151, 105, 77. HRMS(EI) calcd. For $C_{17}H_{12}F_3N_1O_1$ [M]$^+$: 303.0866 , found: 303.0864.

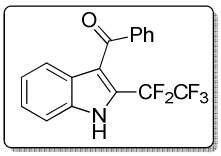
(6-methyl-2-(trifluoromethyl)-1H-indol-3-yl)(phenyl)methanone (2q):



Pale yellow solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 12.93 (br, 1H), 7.73-7.71 (m, 2H), 7.64 (dt, *J* = 7.5Hz, J = 7.2Hz, 1H), 7.49 (dt, *J* = 7.8Hz, *J* = 7.2Hz, 1H), 7.37 (s, 1H), 7.00 (d, 8.4Hz, 1H), 6.91(d, *J* = 8.4Hz, 1H), 2.39 (s, 3H); ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 190.9, 139.2, 135.9, 135.0, 133.6, 129.6, 129.0, 126.0 (q, *J* = 36.6Hz), 124.5, 124.1, 121.4 (q, *J* = 270.5Hz), 116.1, 112.9, 21.7; ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -57.5 (s, 3F); MS (EI): *m/z* (%):[M]$^+$ 303, 282, 234, 226, 206, 178, 151, 117, 105.

HRMS(EI) calcd. For $C_{17}H_{12}F_3N_1O_1$ $[M]^+$: 303.0866 , found: 303.0864.

(2-(perfluoroethyl)-1H-indol-3-yl)(phenyl)methanone (2r):



White solid; ^{1}H-NMR (300MHz, *d6*-DMSO): δ (ppm): 12.95 (br, 1H), 7.72 (d, J = 7.5Hz, 2H), 7.63-7.60 (m, 2H), 7.46 (t, J = 7.5Hz, 2H), 7.34-7.28 (m, 1H), 7.05-7.04 (m, 2H) ; ^{13}C-NMR (101MHz, *d6*-DMSO): δ (ppm): 191.2, 138.8, 136.3, 133.8, 129.7, 129.1, 126.4, 125.4, 123.0 (t, J = 29.5Hz), 122.2, 121.1, 119.0 (qt, J = 288.3Hz, J = 39.5Hz), 118.6, 113.4, 111.6 (qt, J = 40.2Hz, J = 255.7Hz); ^{19}F-NMR (282MHz, *d6*-DMSO): δ (ppm): -79.1 (s, 3F), -104.9 (s, 2F); MS (EI): *m/z* (%): 339 $[M]^+$(58), 262(100), 220(10), 165(16), 119(10), 105(30). HRMS(EI) calcd. For $C_{17}H_{10}F_5N_1O_1$ $[M]^+$: 339.0677, found: 339.0683.

Reference:

[1] K. Tamura, H. Mizukami, K. Maeda, H. Watanabe and K. Uneyama, *J. Org. Chem*. 1993, **58**, 32.

[2] Y. Li, J. Zhu, L. Zhang, Y. Wu, Y. Gong, *Chem.-Eur. J.* **2013**, *19*, 8294.

[3] J. Zhu, H. Xie, Z. Chen, S. Li, Y. Wu, *Org. Biomol. Chem.* **2012**, *10*, 516.

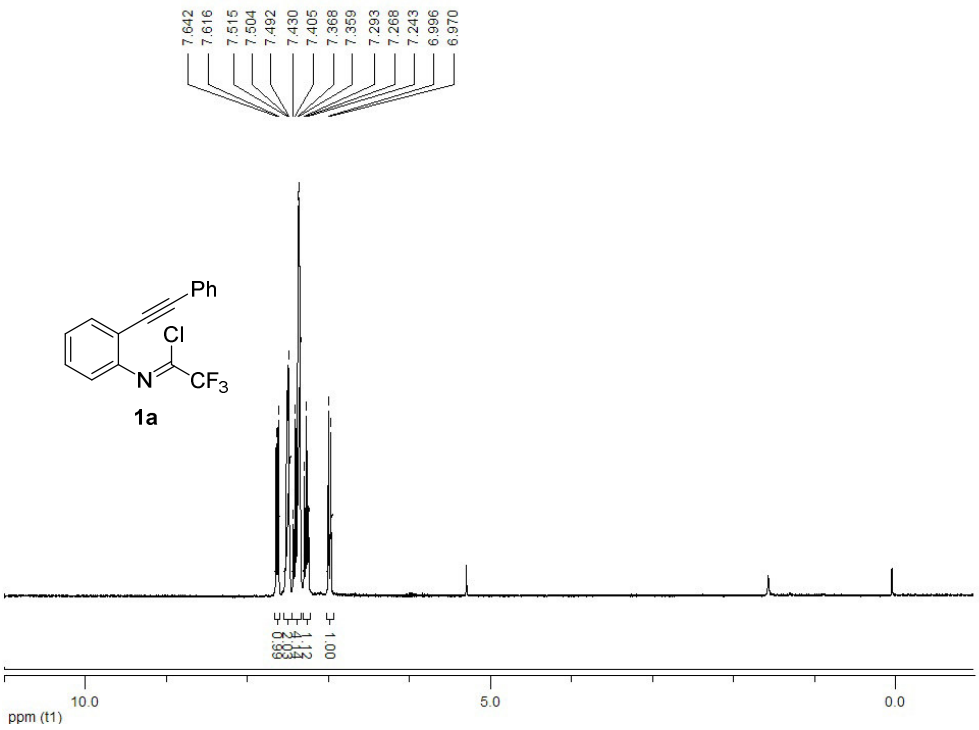
[4] A. Isobe, J. Takagi, T. Katagiri, K. Uneyama, *Org. lett. 10*, 2657.

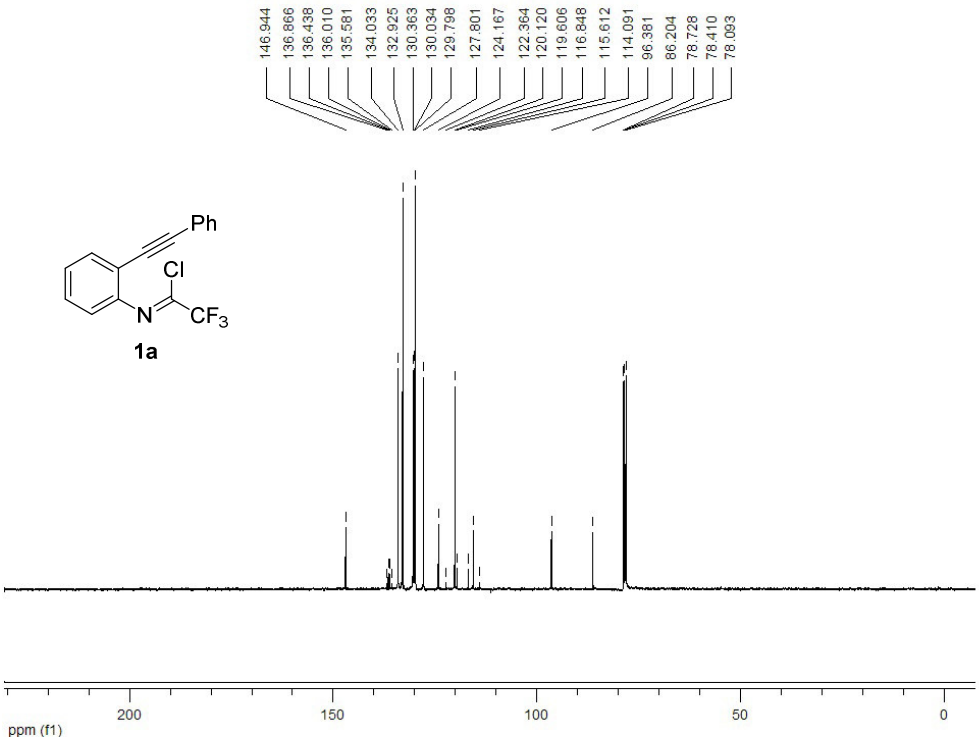
[5] Z. Chen, J. Zhu, H. Xie, S. Li, Y. Wu, Y. Gong, *Synlett* **2010**, *9*, 1418.

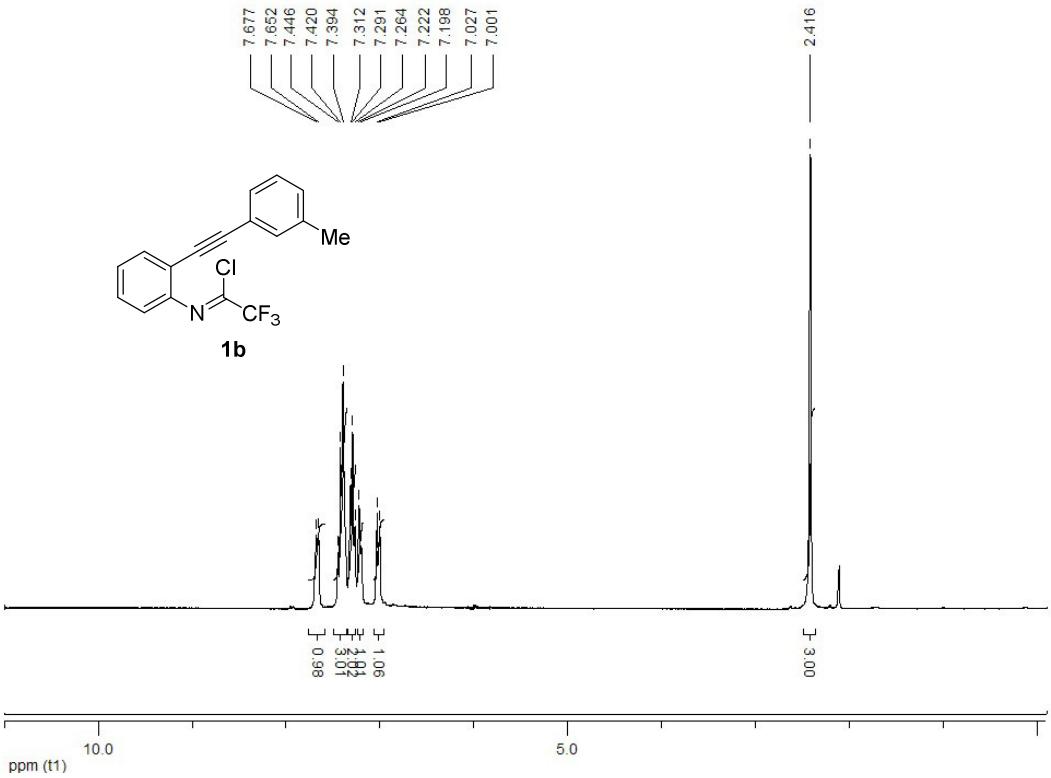
[6] Y. Ueda, H. Watanabe, J. Uemura, K. Uneyama, *Tetrahedron lett.* **1993**, *34*, 7933.

[7] J. Tessier, J. Demassey, J. Demoute, Eur. Pat. Appl. 1988, EP 261035 A1 19880323.

^{1}H and ^{13}C NMR Spectra:



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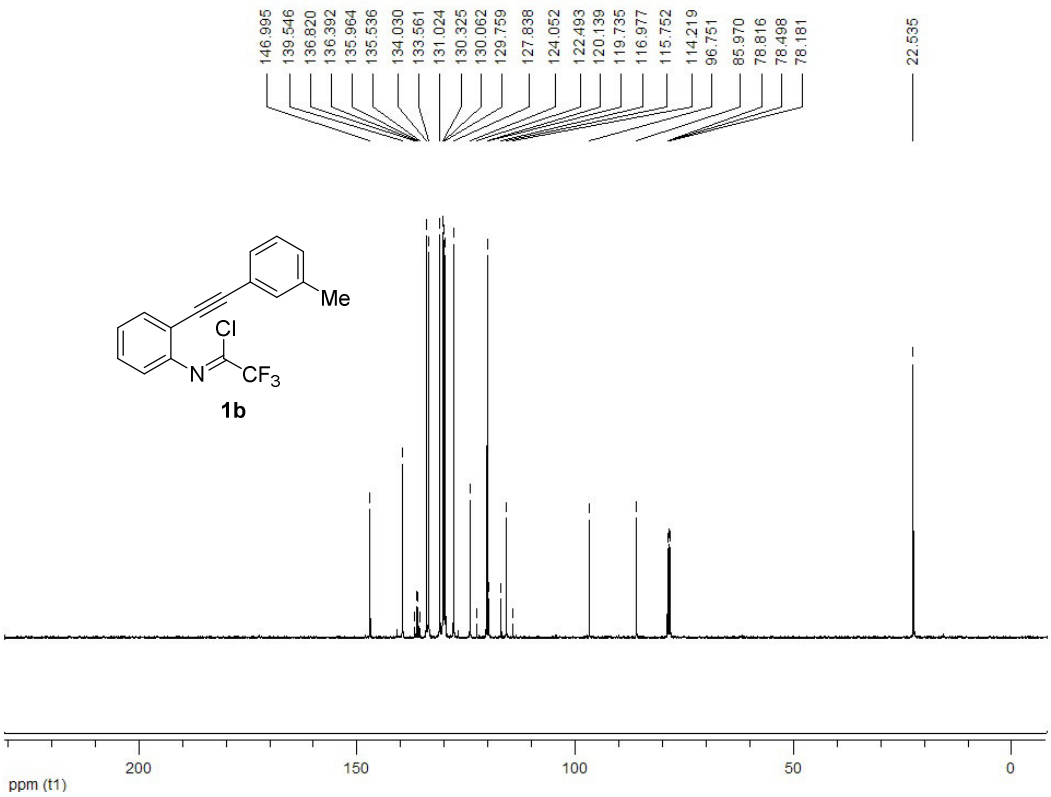
7.652
7.446
7.420
7.394
7.312
7.291
7.264
7.222
7.198
7.027
7.001
2.416
Me
Cl
N
CF3
1b
0.98
2.14
3.01
2.14
1.06
3.00
10.0
5.0
ppm (t1)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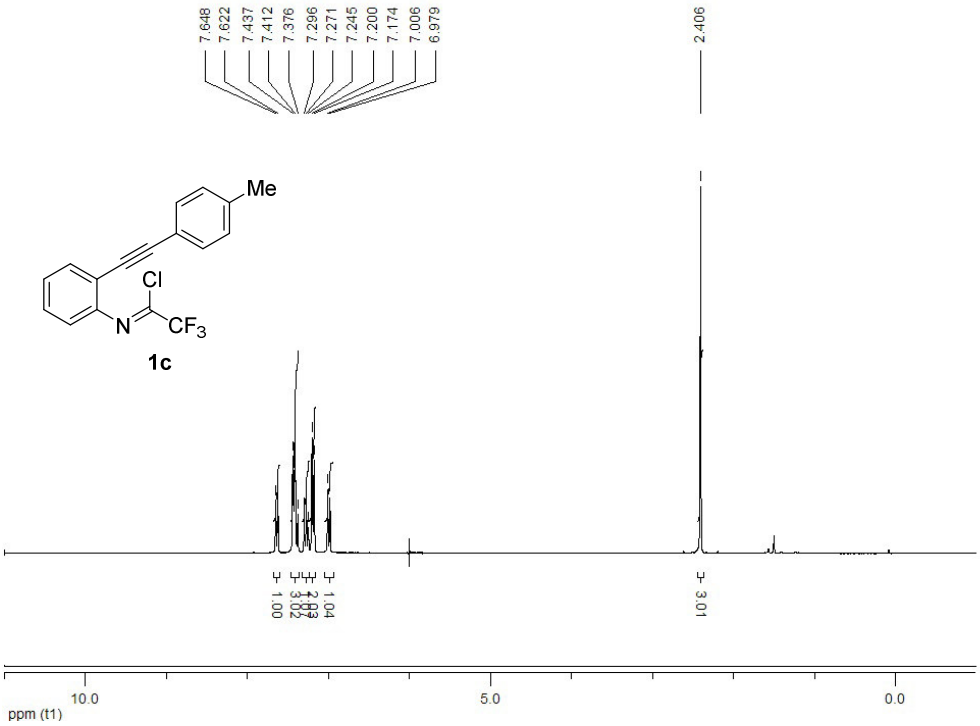
139.546
136.820
136.392
135.964
135.536
134.030
133.561
131.024
130.325
130.062
129.759
127.838
124.052
122.493
120.139
119.735
116.977
115.752
114.219
96.751
85.970
78.816
78.498
78.181
22.535
Me
Cl
N
CF3
1b
200
150
100
50
0
ppm (t1)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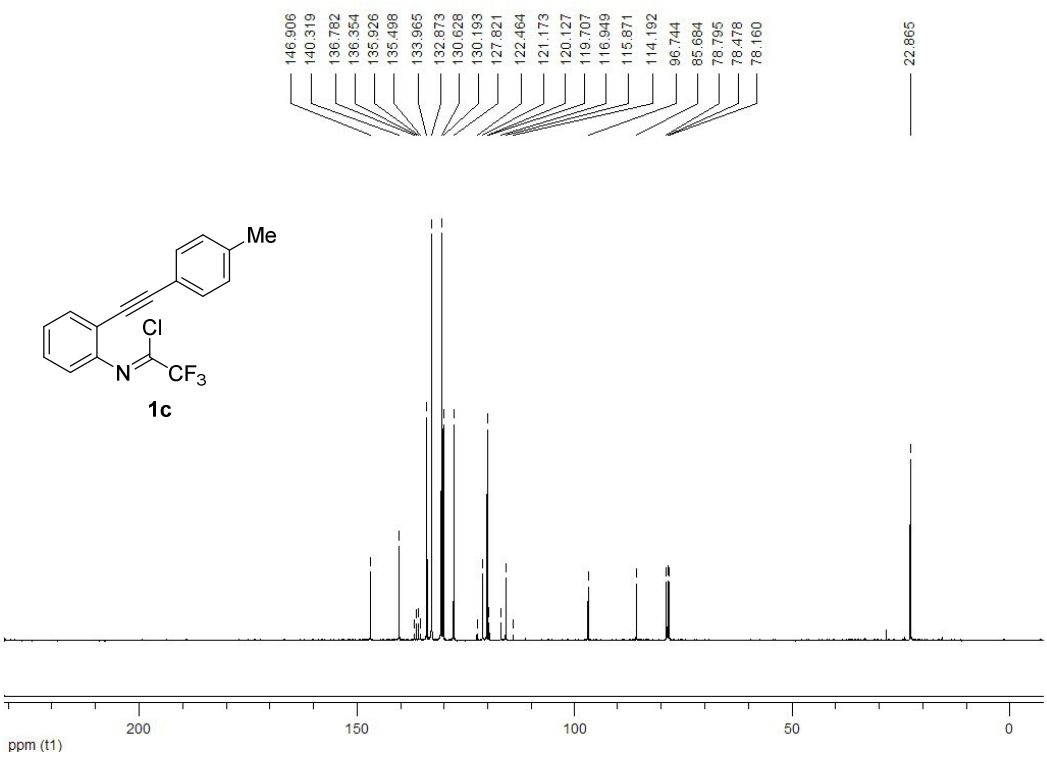
7.622
7.437
7.412
7.376
7.296
7.271
7.245
7.200
7.174
7.006
6.979
2.406
Me
Cl
N
CF3
1c
1.00
2.02
2.03
2.02
1.04
3.01
10.0
5.0
0.0
ppm (t1)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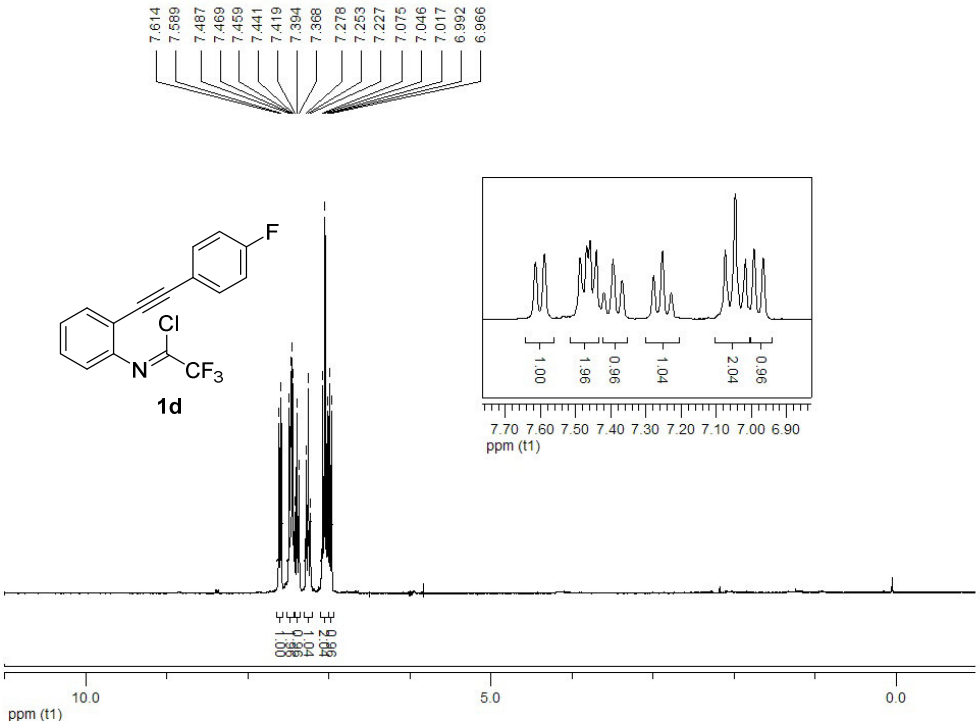
140.319
136.782
136.354
135.926
135.498
133.965
132.873
130.628
130.193
127.821
122.464
121.173
120.127
119.707
116.949
115.871
114.192
96.744
85.684
78.795
78.478
78.160
22.865
Me
Cl
N
CF3
1c
200
150
100
50
0
ppm (t1)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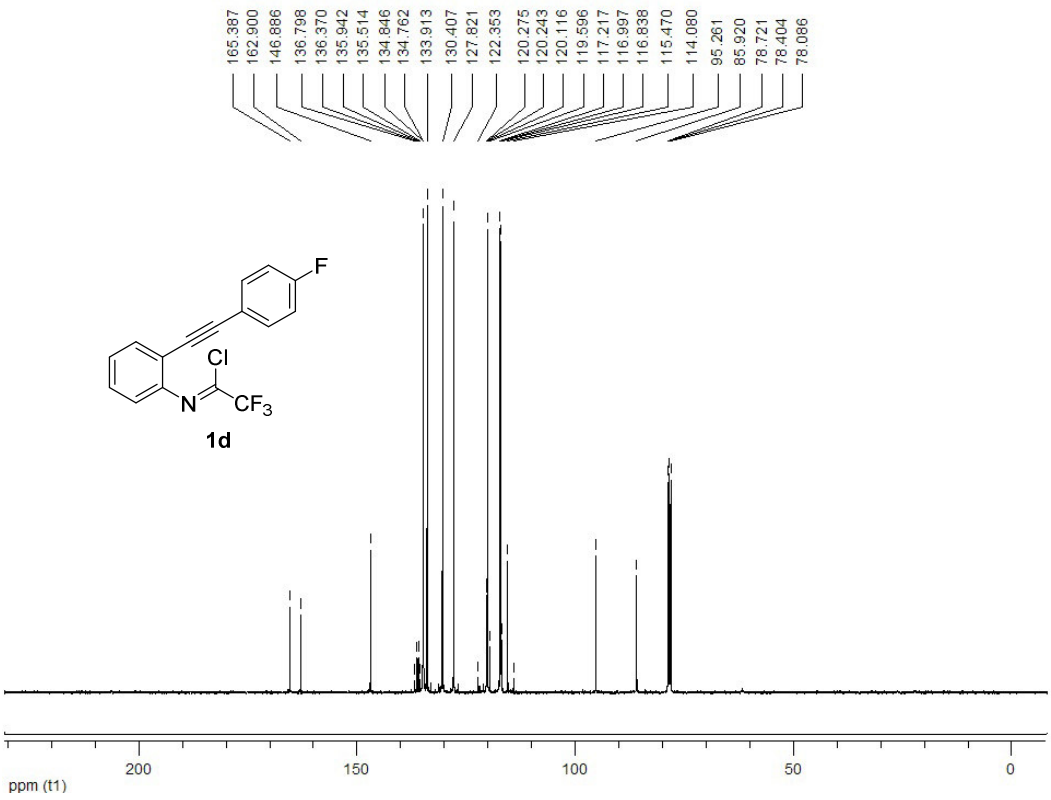
7.589
7.487
7.469
7.459
7.441
7.419
7.394
7.368
7.278
7.253
7.227
7.075
7.046
7.017
6.992
6.966
F
Cl
N
CF3
1d
1.00
1.96
0.96
1.04
2.04
0.96
7.70 7.60 7.50 7.40 7.30 7.20 7.10 7.00 6.90
ppm (t1)
10.0
5.0
0.0
ppm (t1)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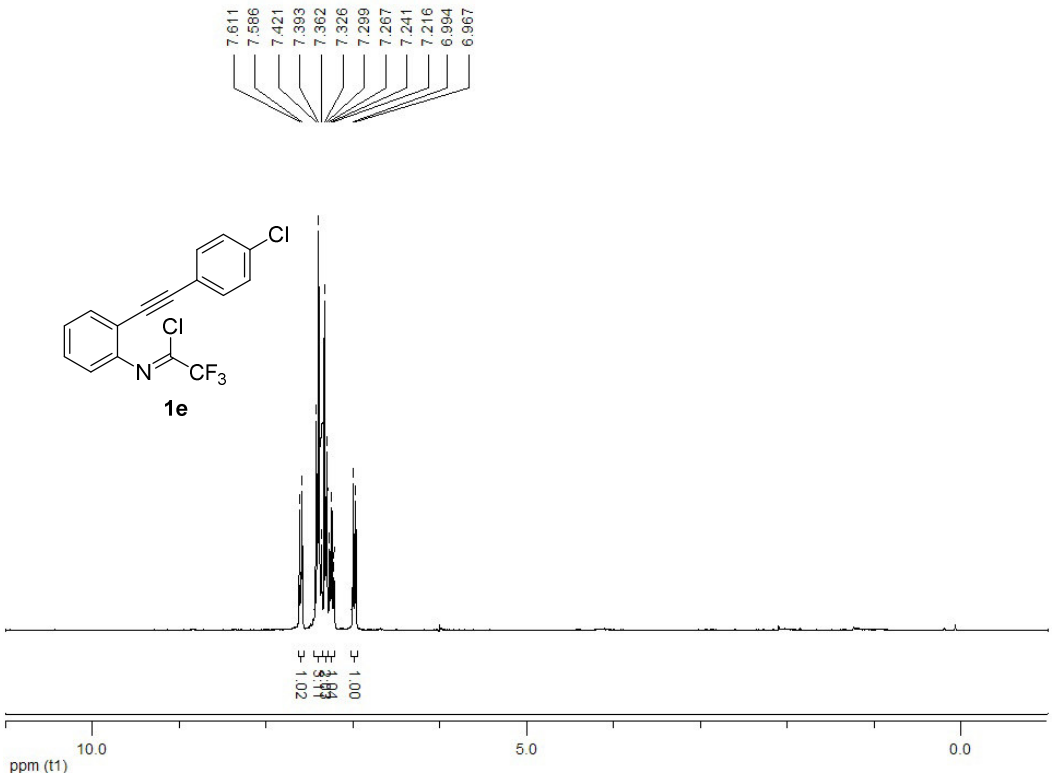
162.900
146.886
136.798
136.370
135.942
135.514
134.846
134.762
133.913
130.407
127.821
122.353
120.275
120.243
120.116
119.596
117.217
116.997
116.838
115.470
114.080
95.261
85.920
78.721
78.404
78.086
F
Cl
N
CF3
1d
200
150
100
50
0
ppm (t1)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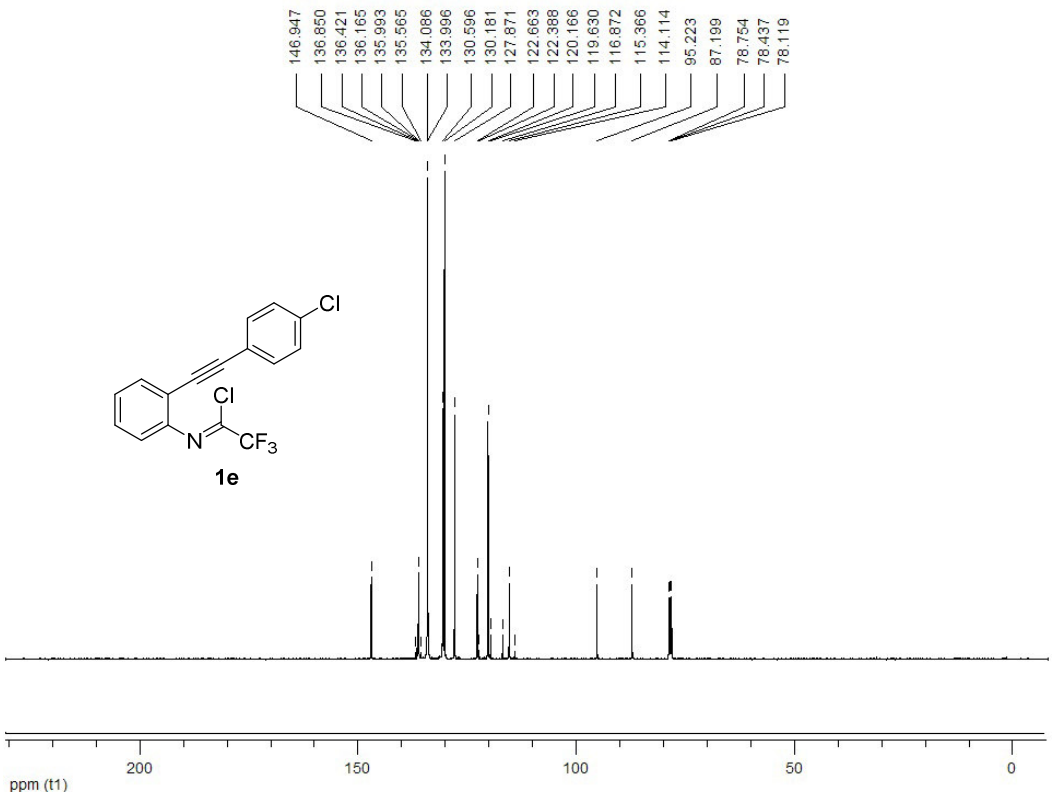
7.586
7.421
7.393
7.362
7.326
7.299
7.267
7.241
7.216
6.994
6.967
Cl
Cl
N
CF3
1e
1.02
3.17
3.04
1.00
10.0
5.0
0.0
ppm (t1)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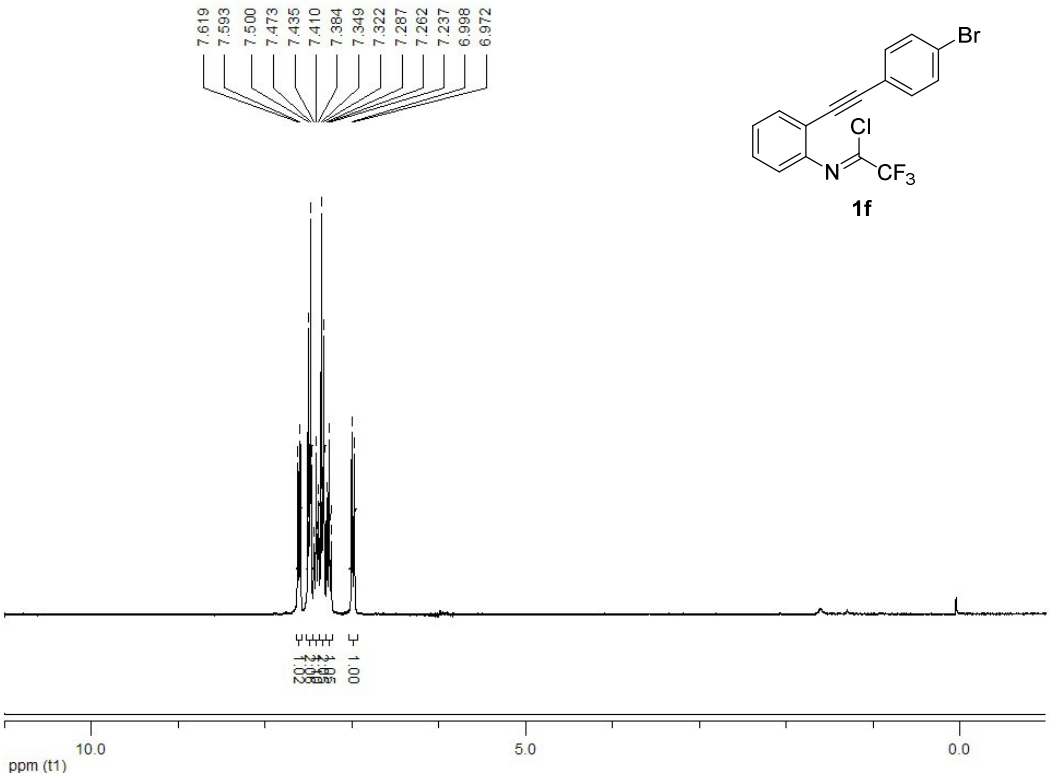
136.421
136.165
135.993
135.565
134.086
133.996
130.596
130.181
127.871
122.663
122.388
120.166
119.630
116.872
115.366
114.114
95.223
87.199
78.754
78.437
78.119
Cl
Cl
N
CF3
1e
200
150
100
50
0
ppm (t1)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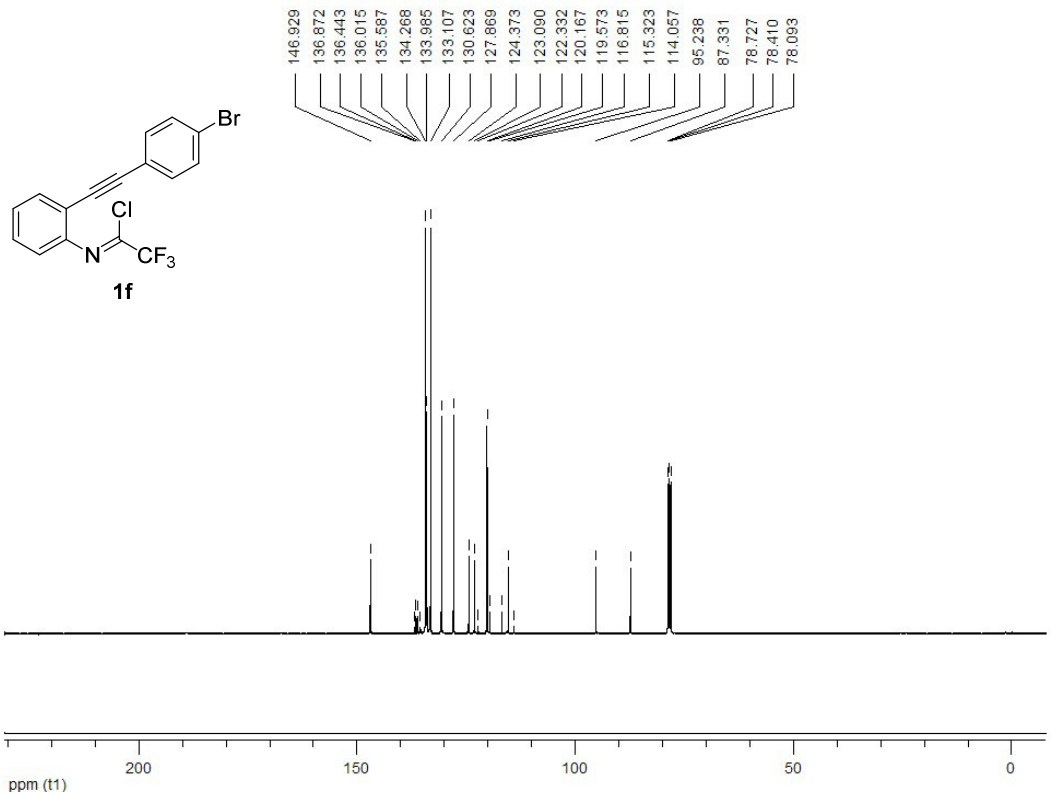
7.500
7.473
7.435
7.410
7.384
7.349
7.322
7.287
7.262
7.237
6.998
6.972
Br
Cl
N
CF3
1f
1.00
10.0
5.0
0.0
ppm (t1)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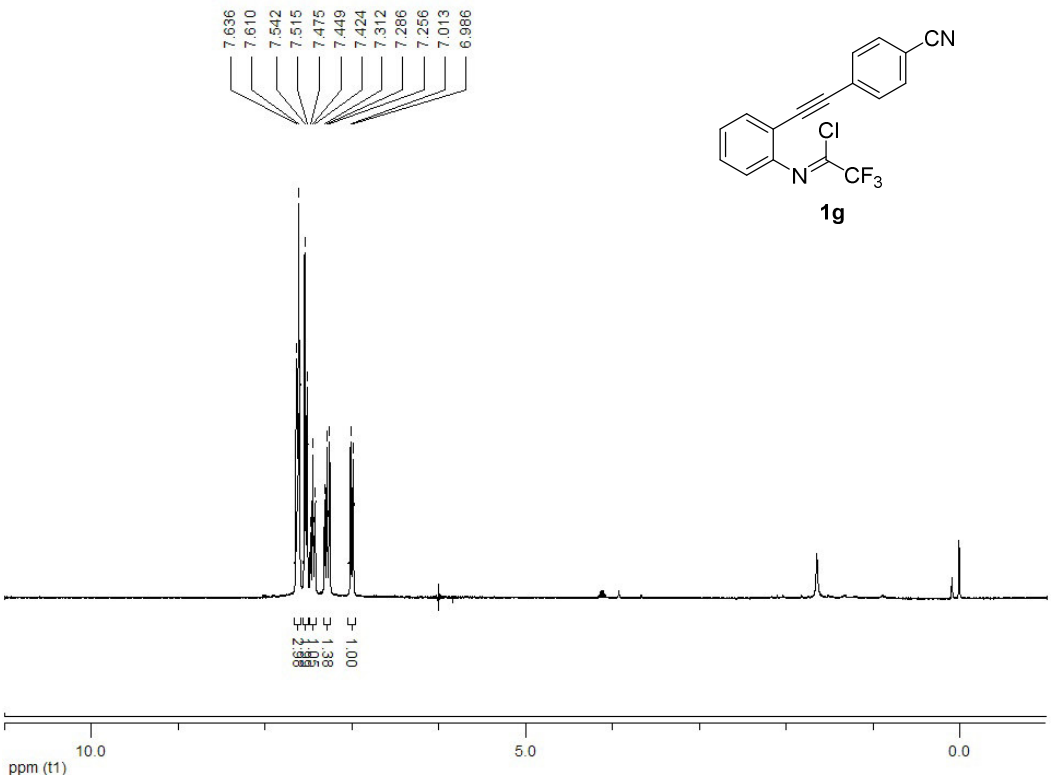
136.443
136.015
135.587
134.268
133.985
133.107
130.623
127.869
124.373
123.090
122.332
120.167
119.573
116.815
115.323
114.057
95.238
87.331
78.727
78.410
78.093
Br
Cl
N
CF3
1f
200
150
100
50
0
ppm (t1)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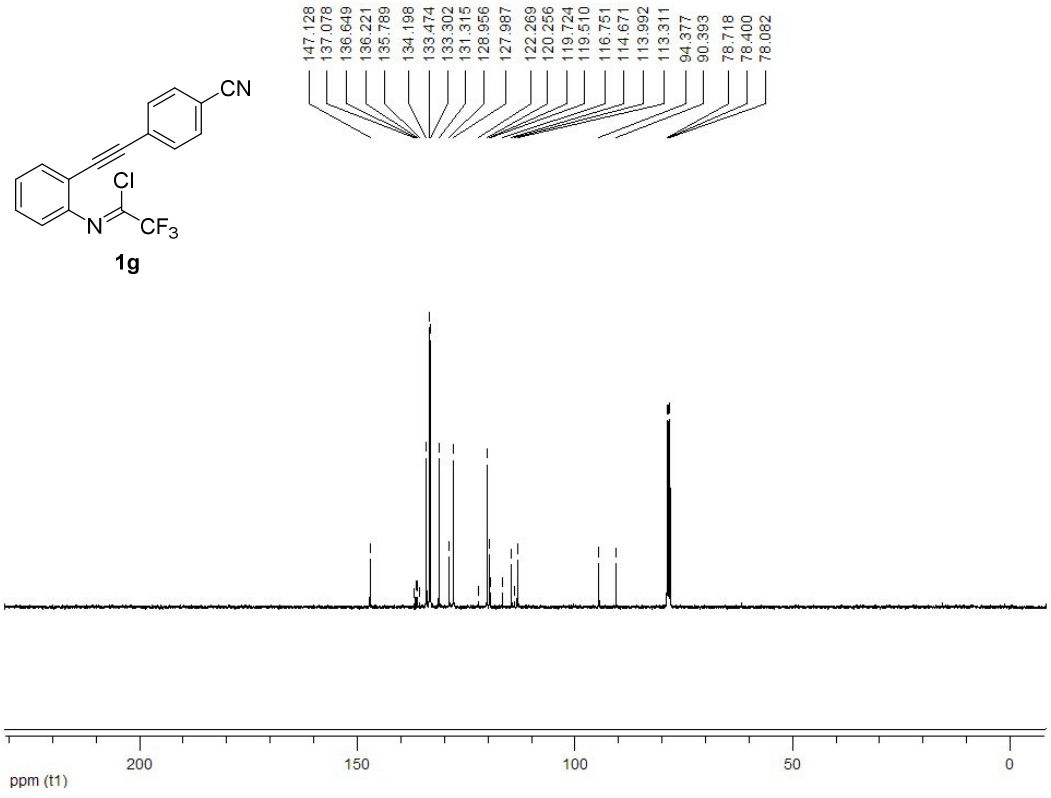
7.542
7.515
7.475
7.449
7.424
7.312
7.286
7.256
7.013
6.986
CN
Cl
N
CF3
1g
1.00
10.0
5.0
0.0
ppm (t1)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136.221
135.789
134.198
133.474
133.302
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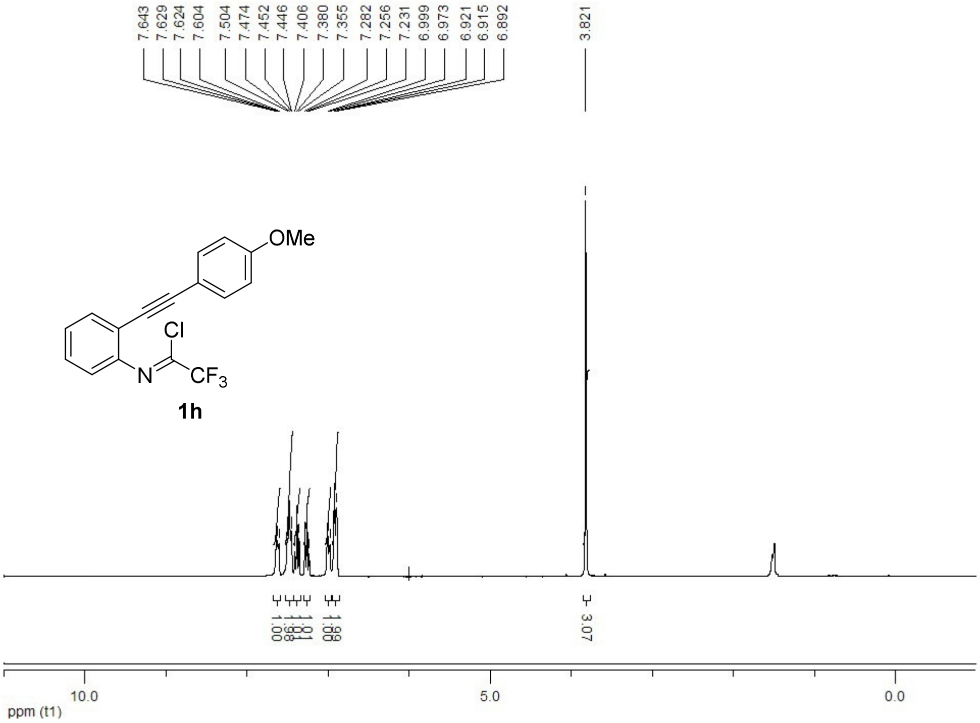
128.956
127.987
122.269
120.256
119.724
119.510
116.751
114.671
113.992
113.311
94.377
90.393
78.718
78.400
78.082
CN
Cl
N
CF3
1g
200
150
100
50
0
ppm (t1)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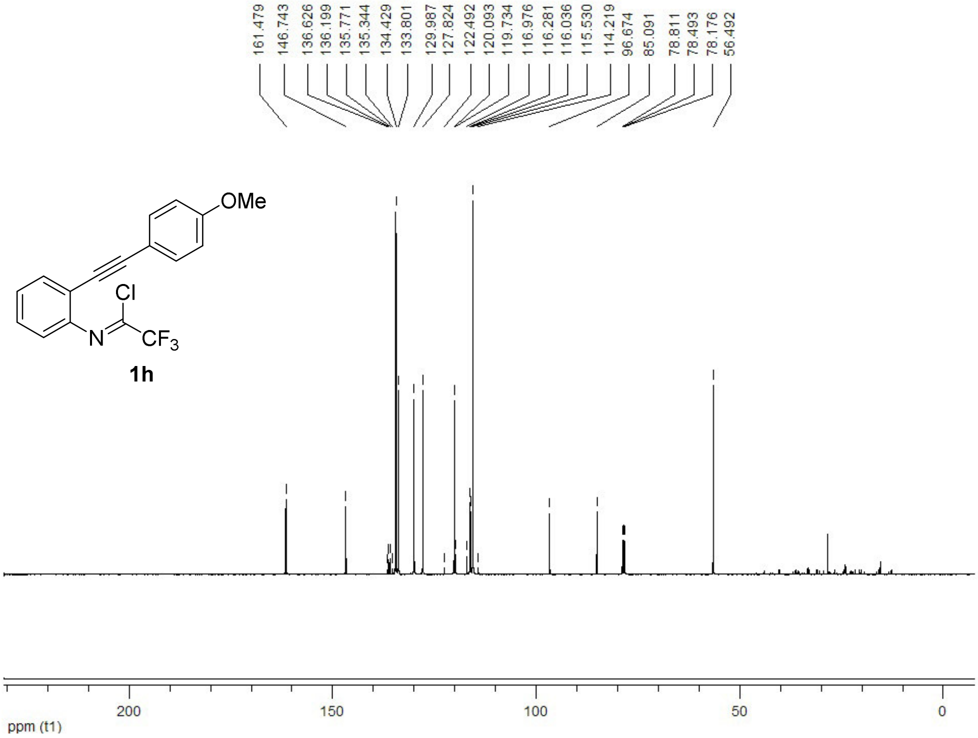
7.604
7.504
7.474
7.452
7.446
7.406
7.380
7.355
7.282
7.256
7.231
6.999
6.973
6.921
6.915
6.892
3.821
OMe
Cl
N
CF3
1h
1.00
1.98
1.01
1.99
3.07
10.0
5.0
0.0
ppm (t1)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136.199
135.771
135.344
134.429
133.801
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120.093
119.734
116.976
116.281
116.036
115.530
114.219
96.674
85.091
78.811
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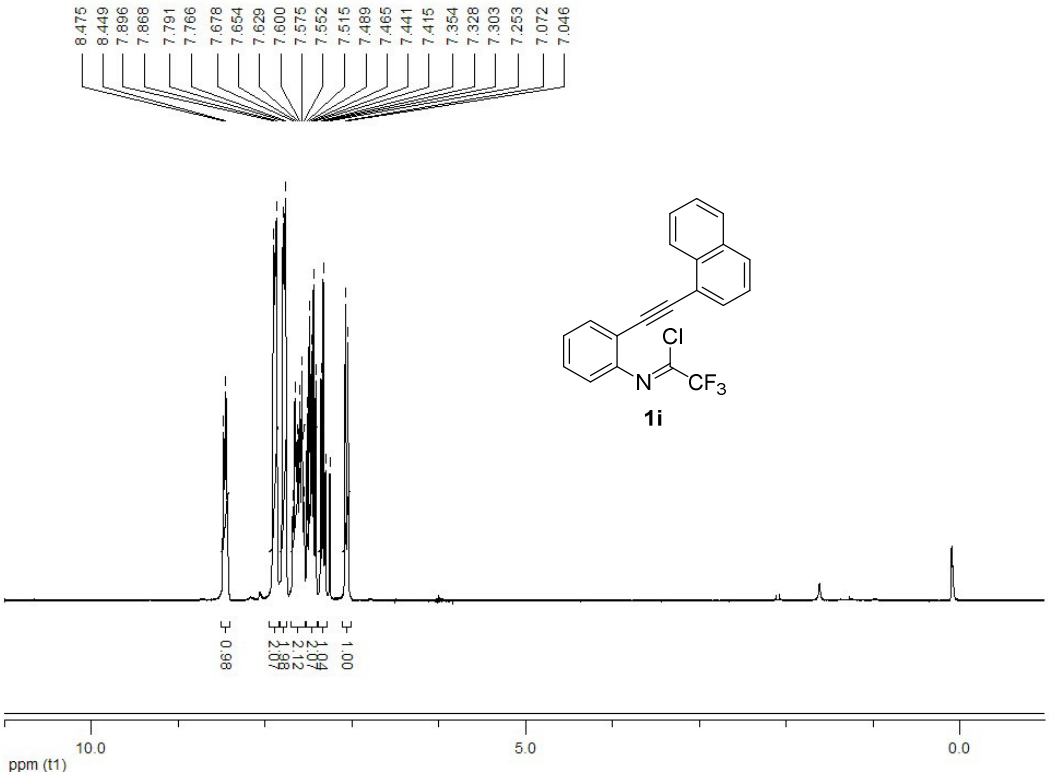
78.176
56.492
OMe
Cl
N
CF3
1h
200
150
100
50
0
ppm (t1)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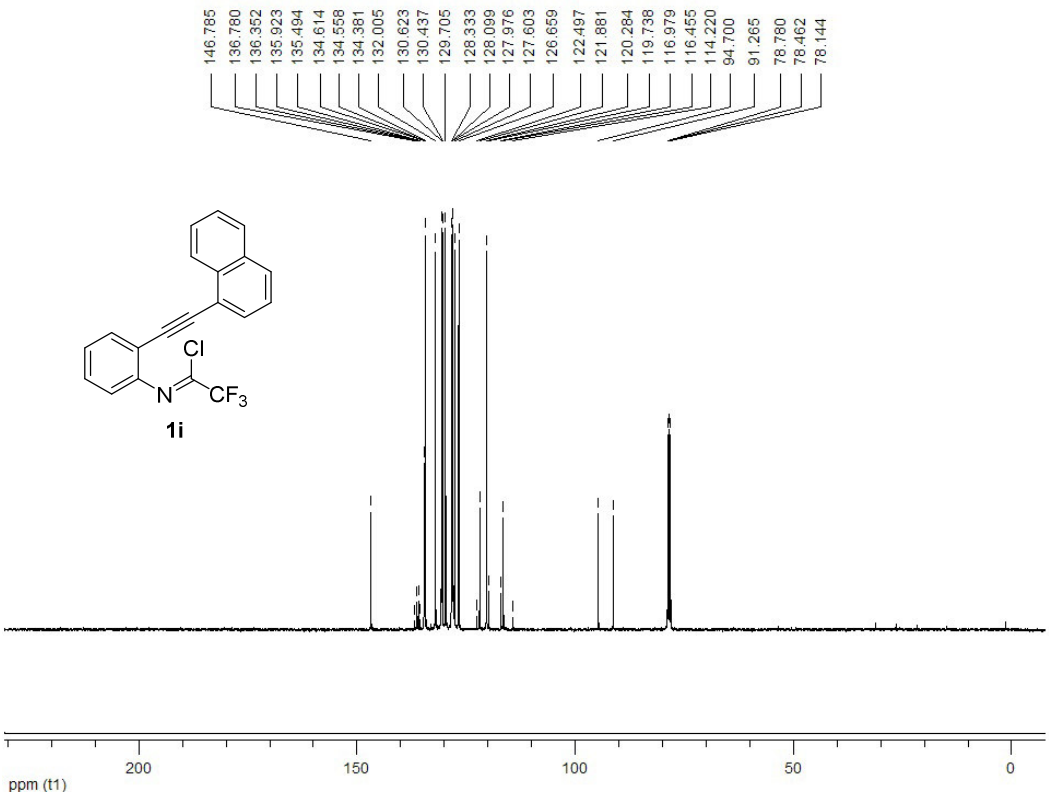
7.600
7.575
7.552
7.515
7.489
7.465
7.441
7.415
7.354
7.328
7.303
7.253
7.072
7.046
0.98
2.88
2.12
2.07
2.04
1.00
Cl
N
CF3
1i
10.0
5.0
0.0
ppm (t1)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136.780
136.352
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135.494
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134.558
134.381
132.005
130.623
130.437
129.705
128.333
128.099
127.976
127.603
126.659
122.497
121.881
120.284
119.738
116.979
116.455
114.220
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91.265
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78.462
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Cl
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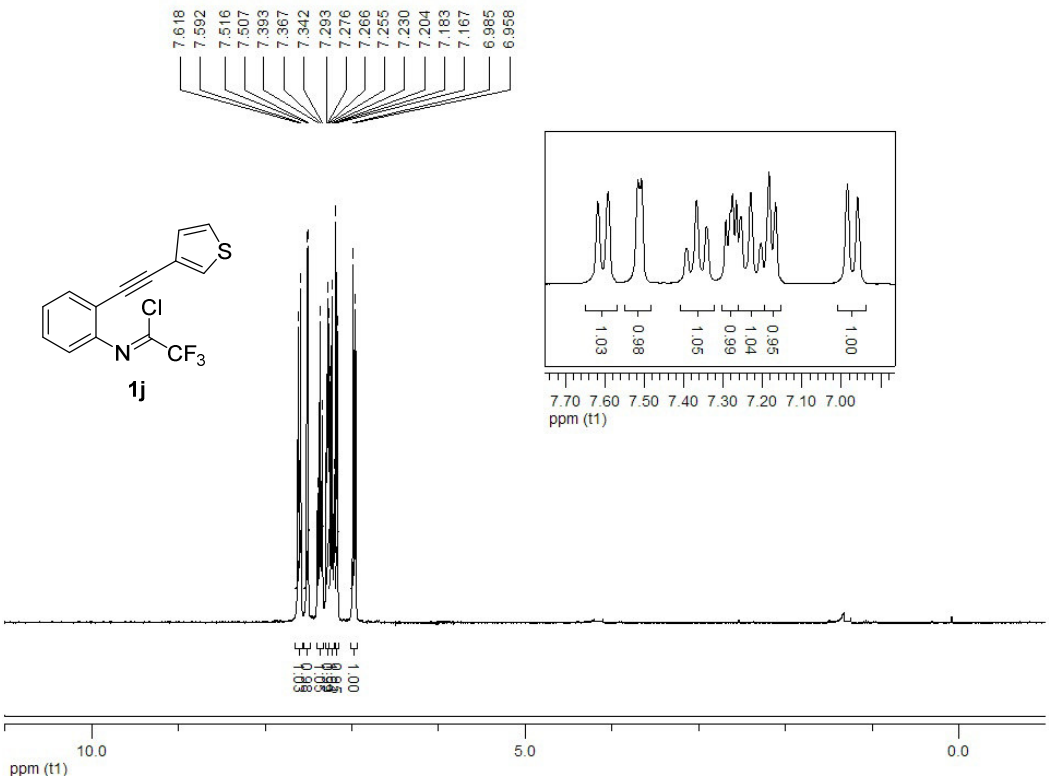
CF3
1i
200
150
100
50
0
ppm (t1)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7.367
7.342
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7.266
7.255
7.230
7.204
7.183
7.167
6.985
6.958
S
Cl
N
CF3
1j
1.03
0.98
1.05
0.99
1.04
0.95
1.00
7.70 7.60 7.50 7.40 7.30 7.20 7.10 7.00
ppm (t1)
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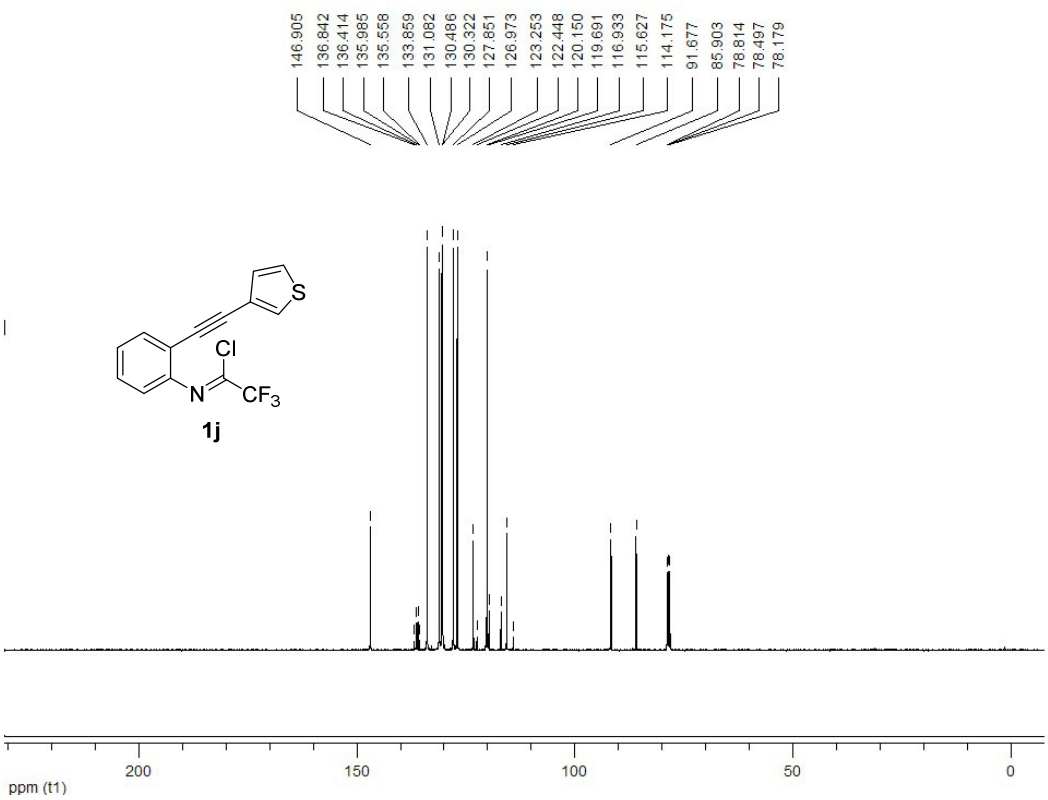
10.0
5.0
0.0
ppm (t1)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133.859
131.082
130.486
130.322
127.851
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123.253
122.448
120.150
119.691
116.933
115.627
114.175
91.677
85.903
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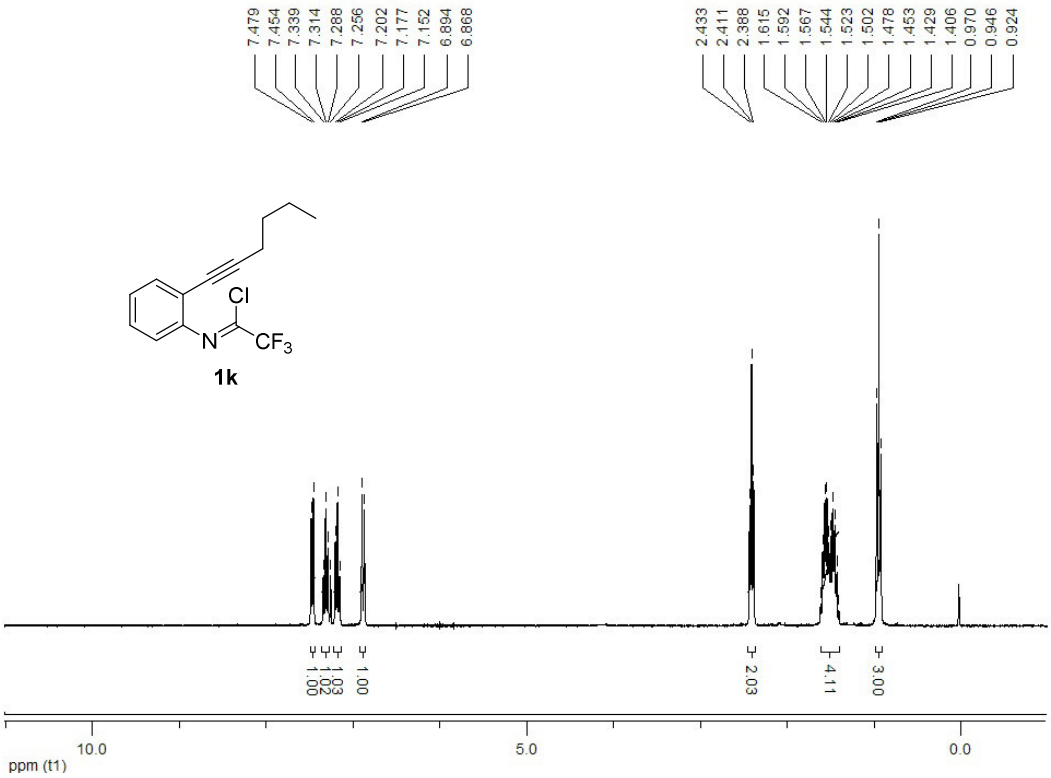
78.497
78.179
S
Cl
N
CF3
1j
200
150
100
50
0
ppm (t1)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7.177
7.152
6.894
6.868
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2.411
2.388
1.615
1.592
1.567
1.544
1.523
1.502
1.478
1.453
1.429
1.406
0.970
0.946
0.924
Cl
N
CF3
1k
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1.02
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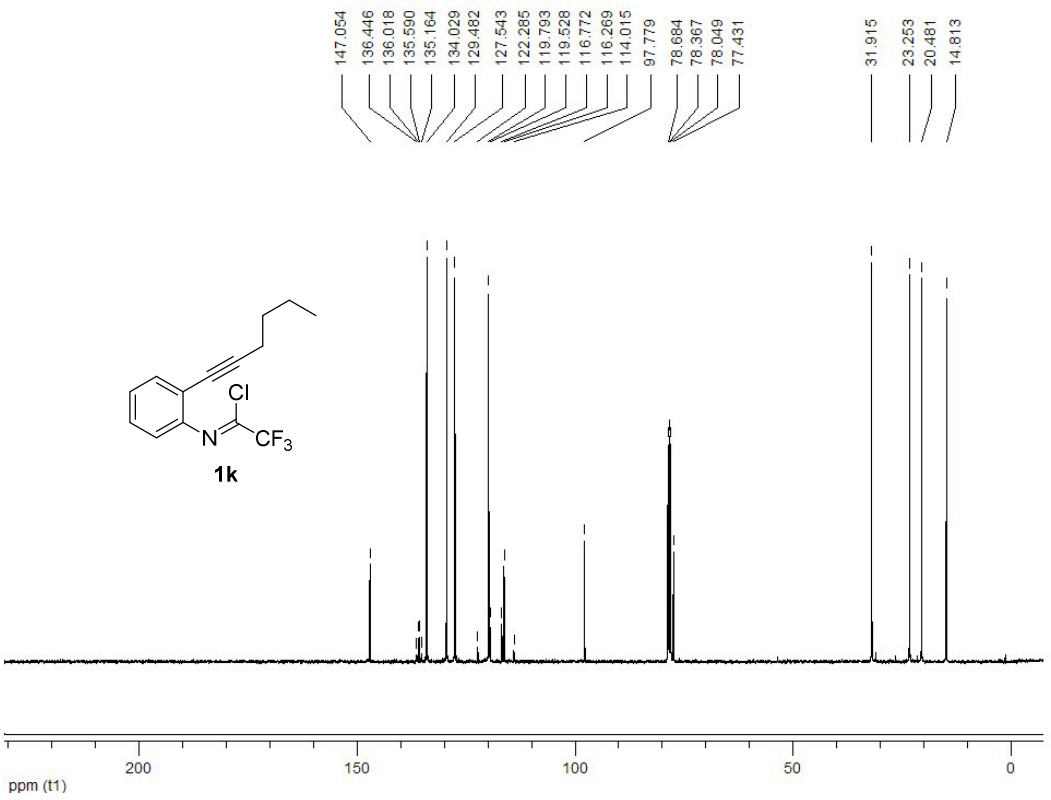
4.11
3.00
10.0
5.0
0.0
ppm (t1)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119.793
119.528
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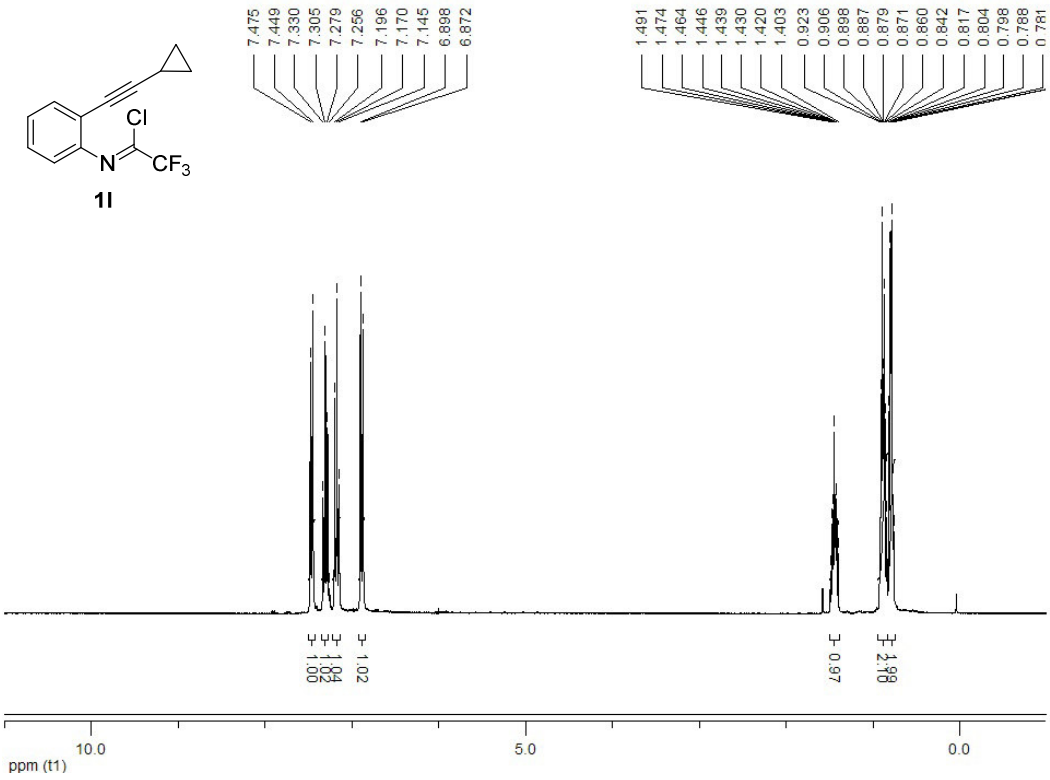
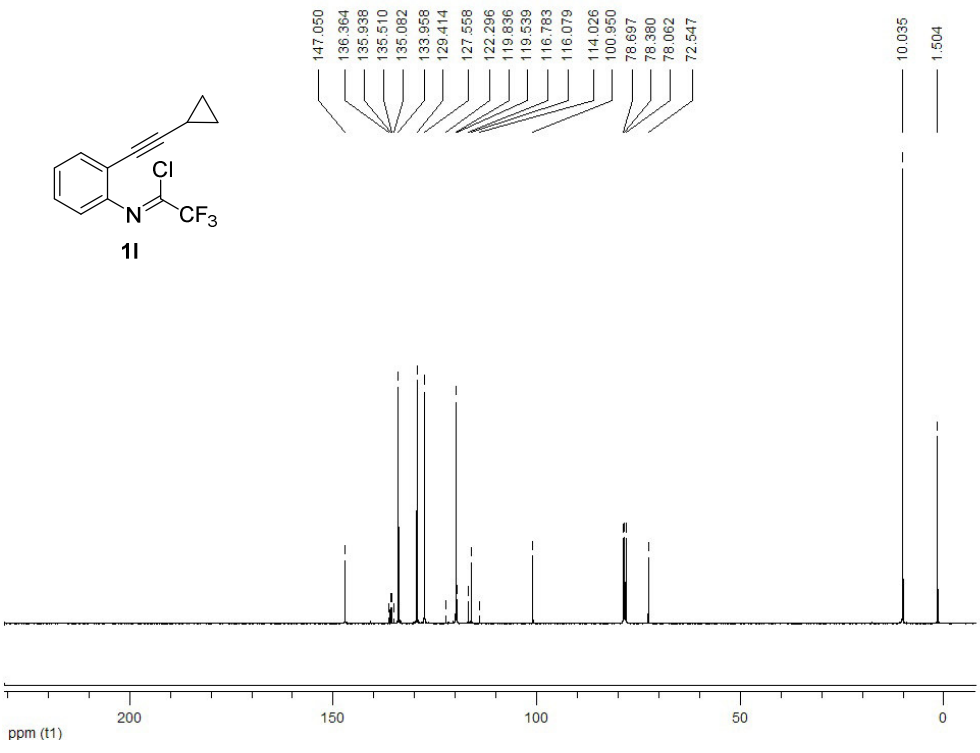
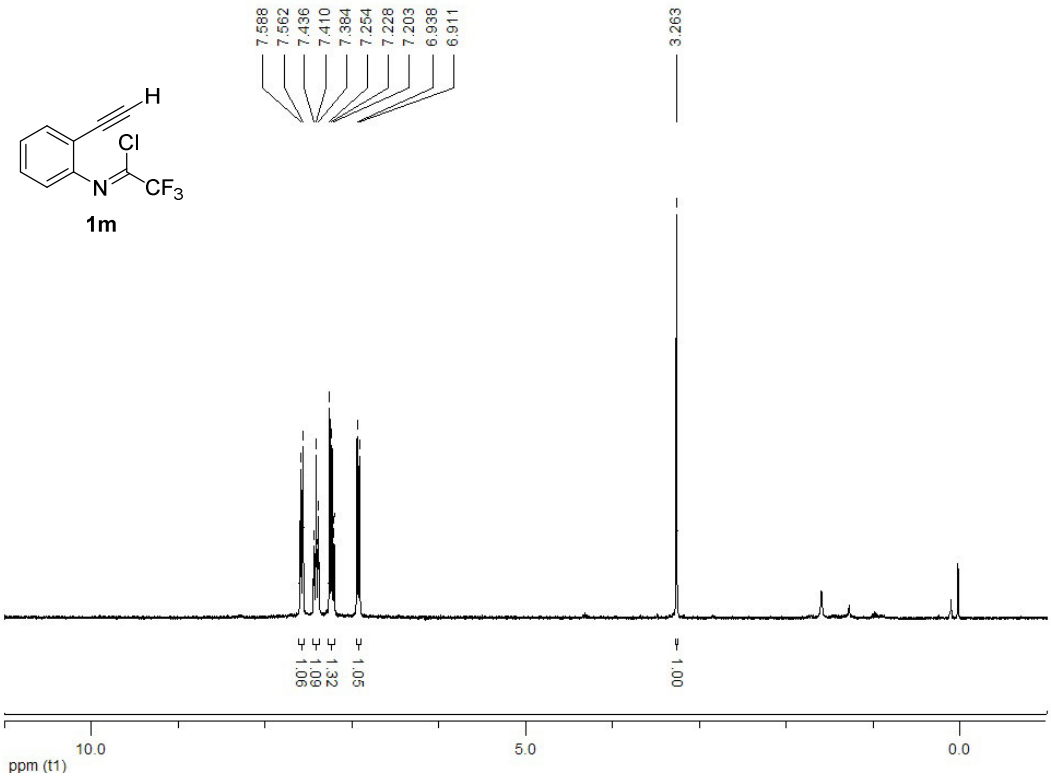
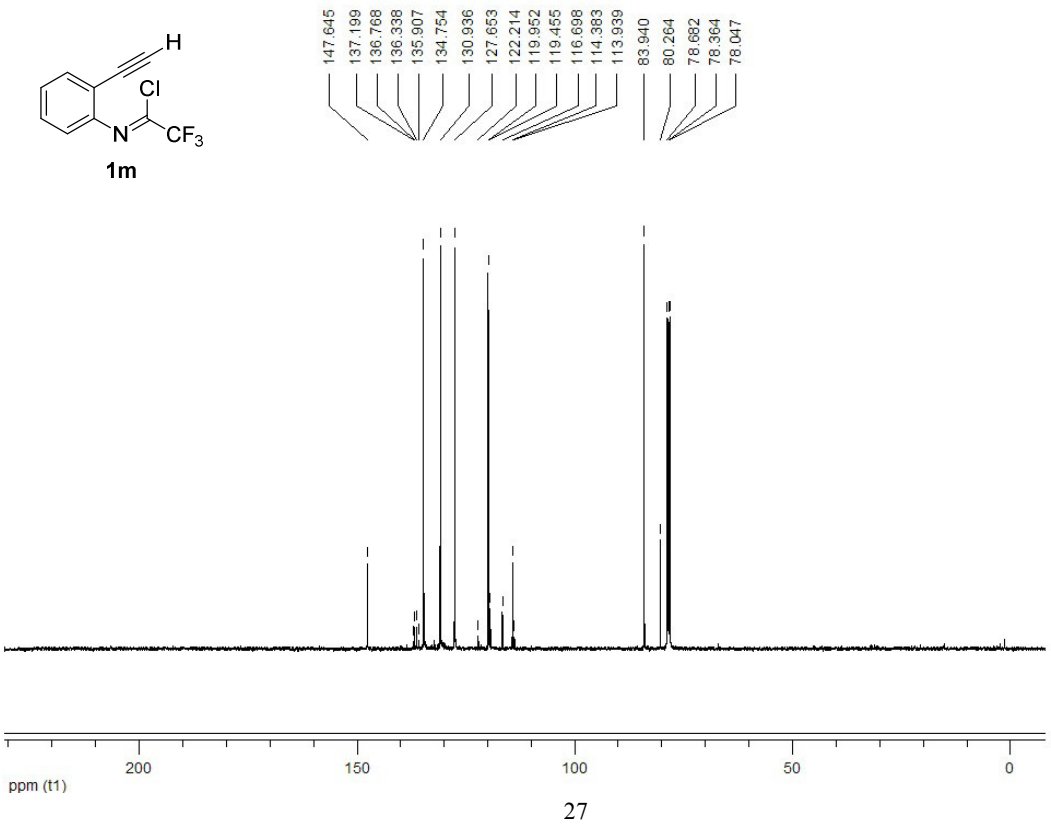
116.269
114.015
97.779
78.684
78.367
78.049
77.431
31.915
23.253
20.481
14.813
Cl
N
CF3
1k
200
150
100
50
0
ppm (t1)


7.475
7.449
7.330
7.305
7.279
7.256
7.196
7.170
7.145
6.898
6.872
1.491
1.474
1.464
1.446
1.439
1.430
1.420
1.403
0.923
0.906
0.898
0.887
0.879
0.871
0.860
0.842
0.817
0.804
0.798
0.788
0.781
Cl
N
CF3
1l
1.00
1.02
1.04
1.02
0.97
2.98
10.0
5.0
0.0
ppm (t1)

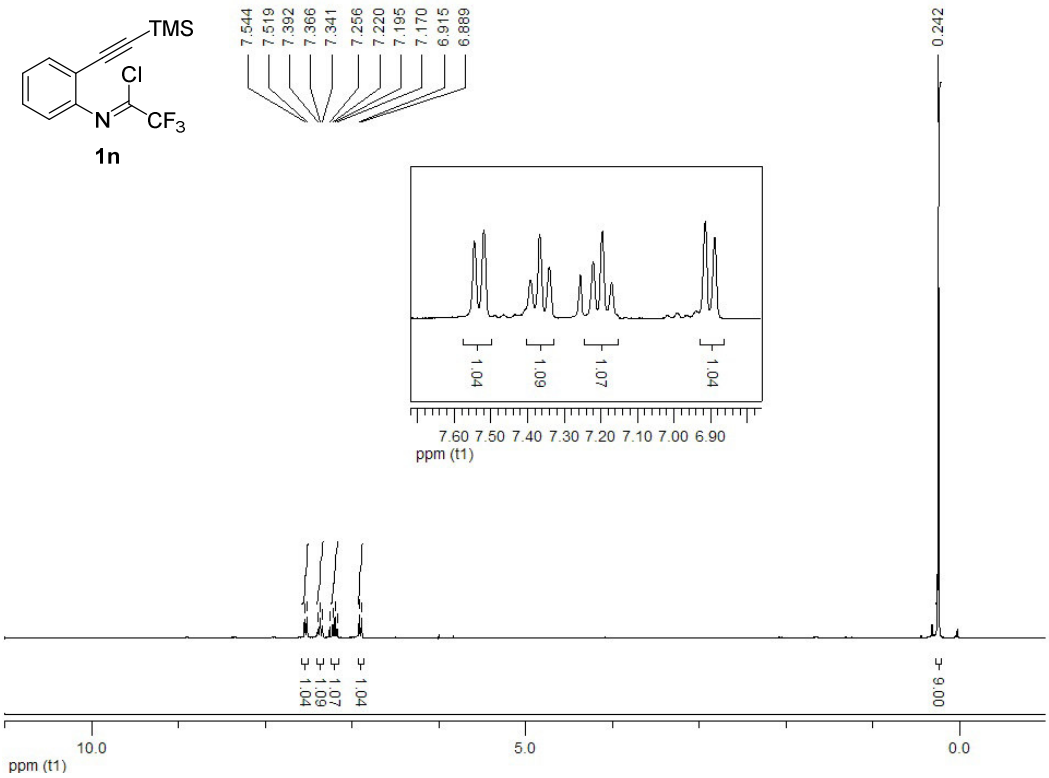

147.050
136.364
135.938
135.510
135.082
133.958
129.414
127.558
122.296
119.836
119.539
116.783
116.079
114.026
100.950
78.697
78.380
78.062
72.547
10.035
1.504
Cl
N
CF3
1l
200
150
100
50
0
ppm (t1)

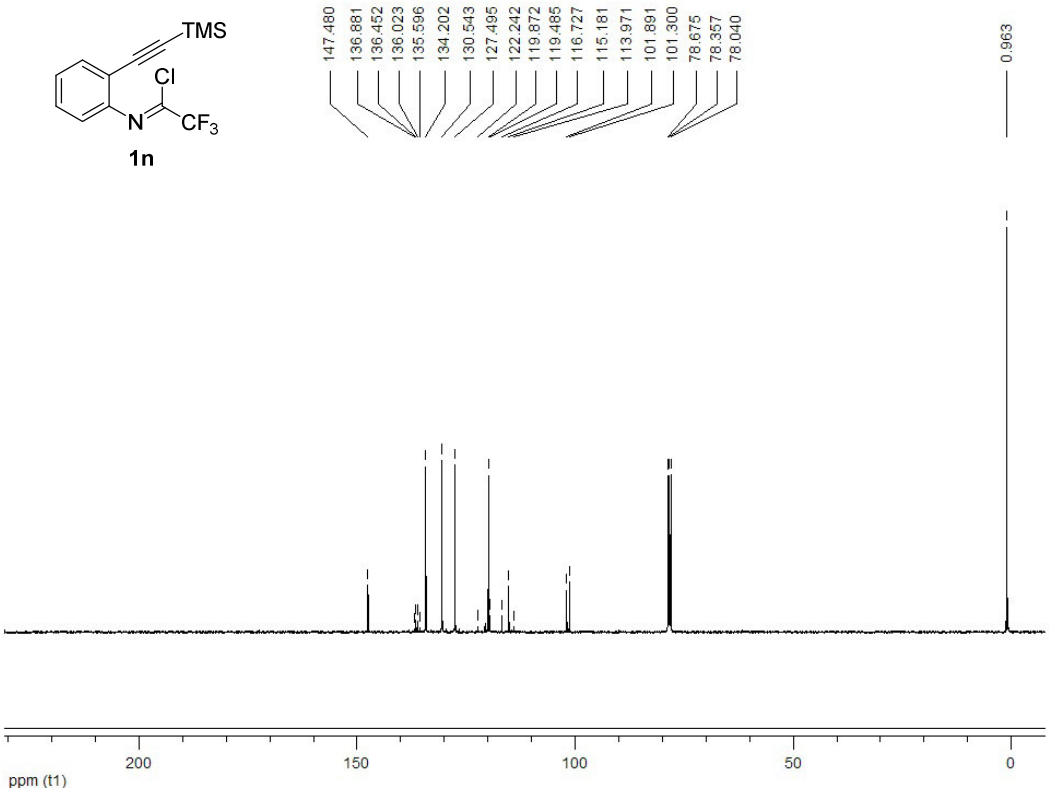

7.588
7.562
7.436
7.410
7.384
7.254
7.228
7.203
6.938
6.911
3.263
1.06
1.09
1.32
1.05
1.00
10.0
5.0
0.0
ppm (t1)

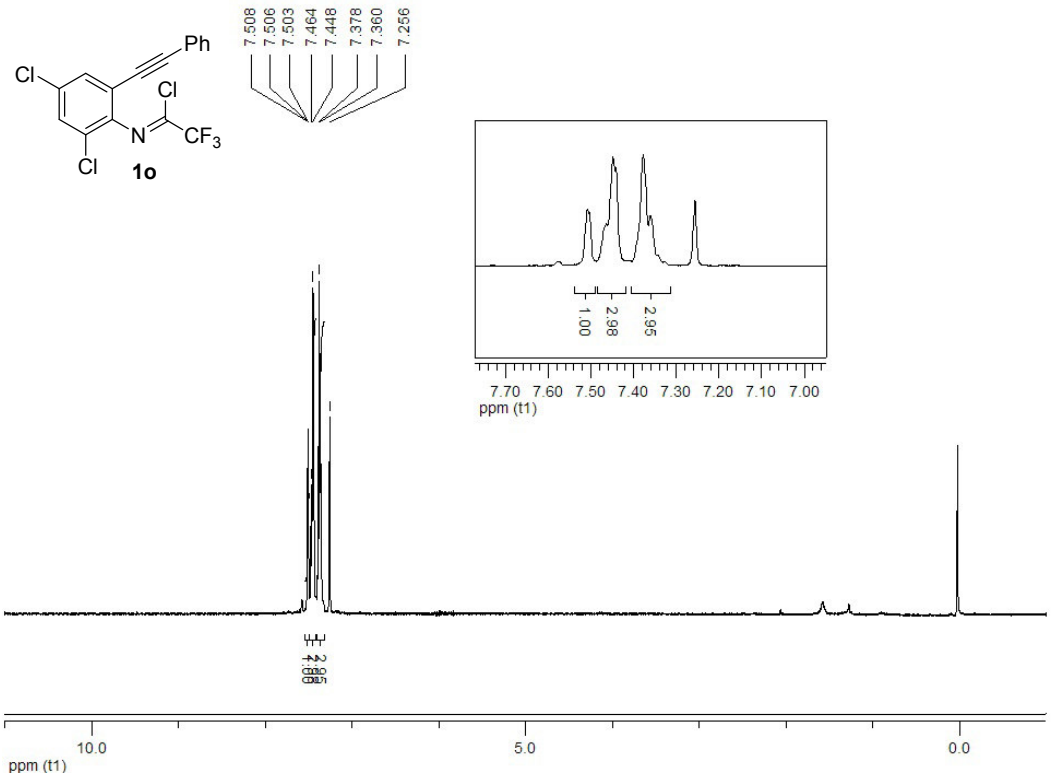
1m

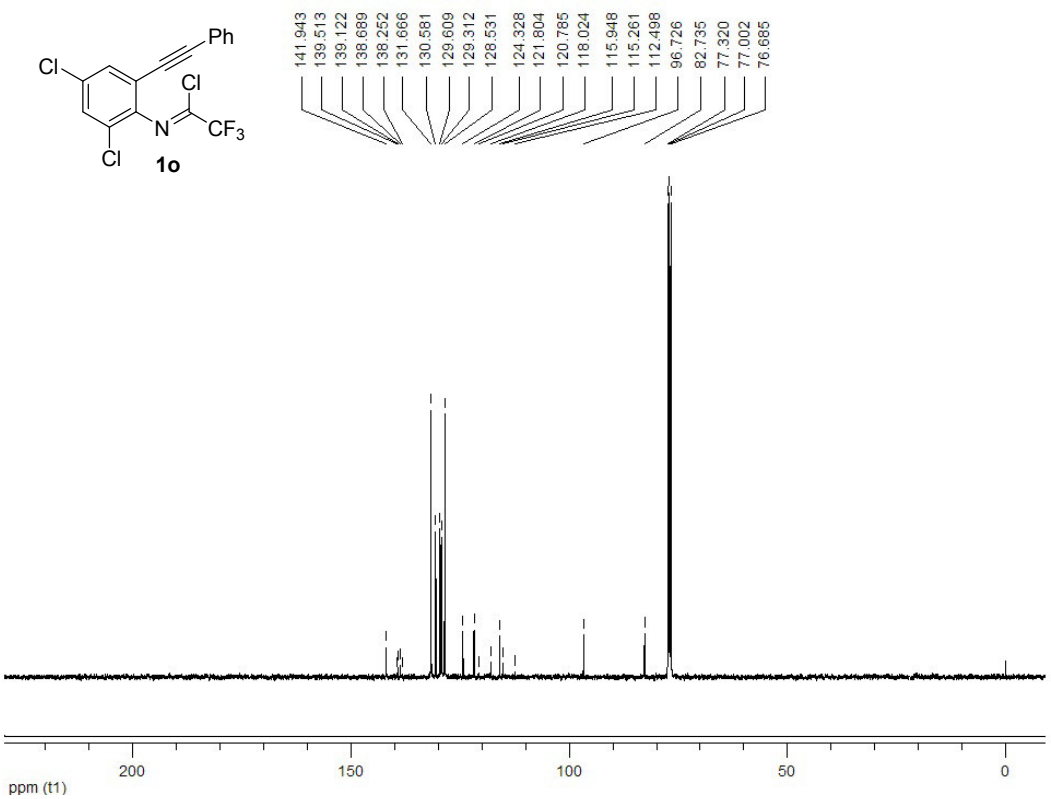

147.645
137.199
136.768
136.338
135.907
134.754
130.936
127.653
122.214
119.952
119.455
116.698
114.383
113.939
83.940
80.264
78.682
78.364
78.047
200
150
100
50
0
ppm (t1)

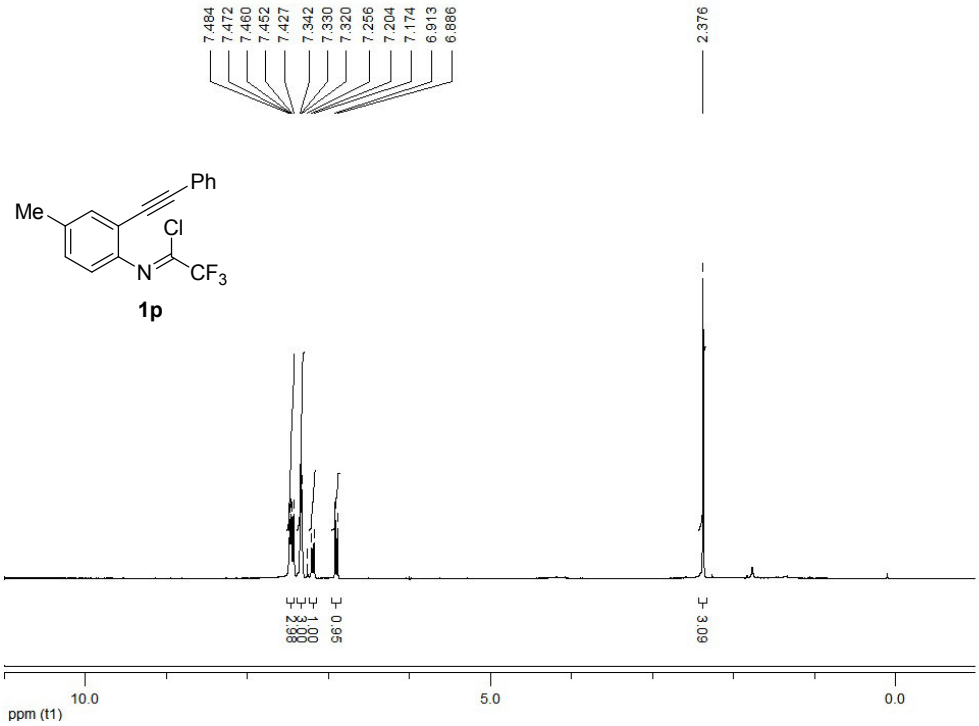
1m

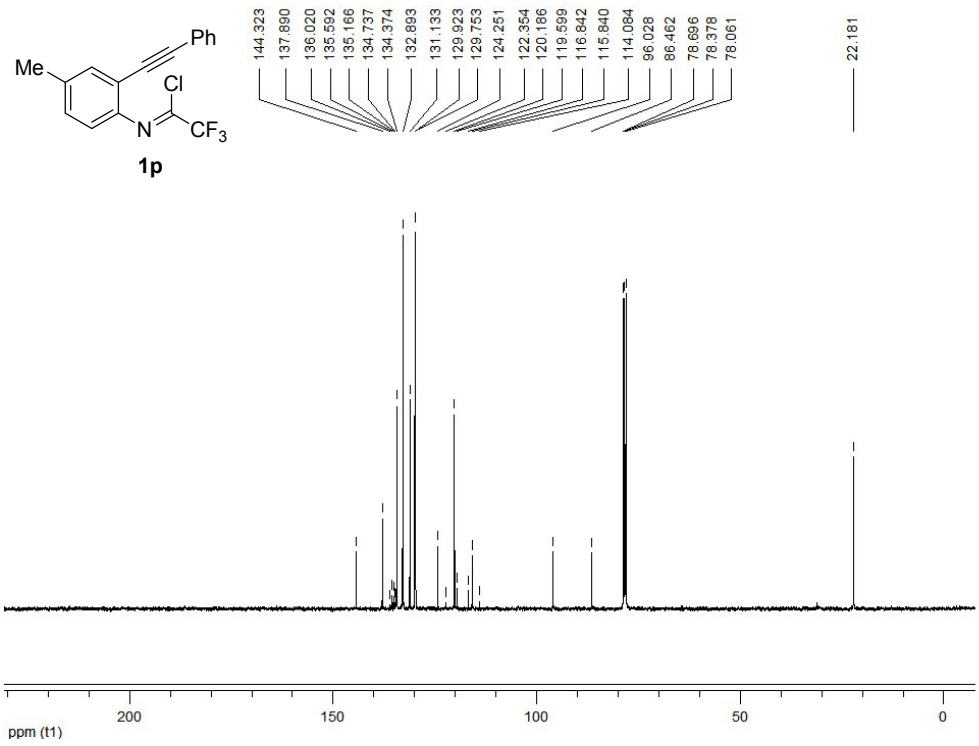

TMS
Cl
N
CF3
1n
7.544
7.519
7.392
7.366
7.341
7.256
7.220
7.195
7.170
6.915
6.889
0.242
1.04
1.09
1.07
1.04
7.60 7.50 7.40 7.30 7.20 7.10 7.00 6.90
ppm (t1)
1.04
1.09
1.07
1.04
9.00
10.0
5.0
0.0
ppm (t1)

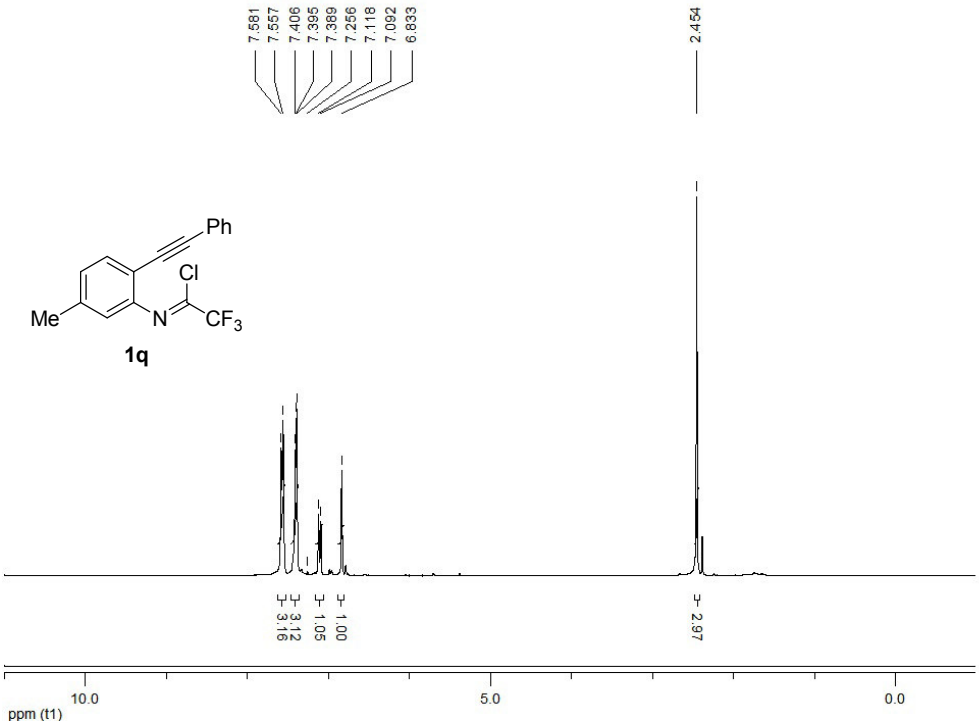

TMS
Cl
N
CF3
1n
147.480
136.881
136.452
136.023
135.596
134.202
130.543
127.495
122.242
119.872
119.485
116.727
115.181
113.971
101.891
101.300
78.675
78.357
78.040
0.963
200
150
100
50
0
ppm (t1)

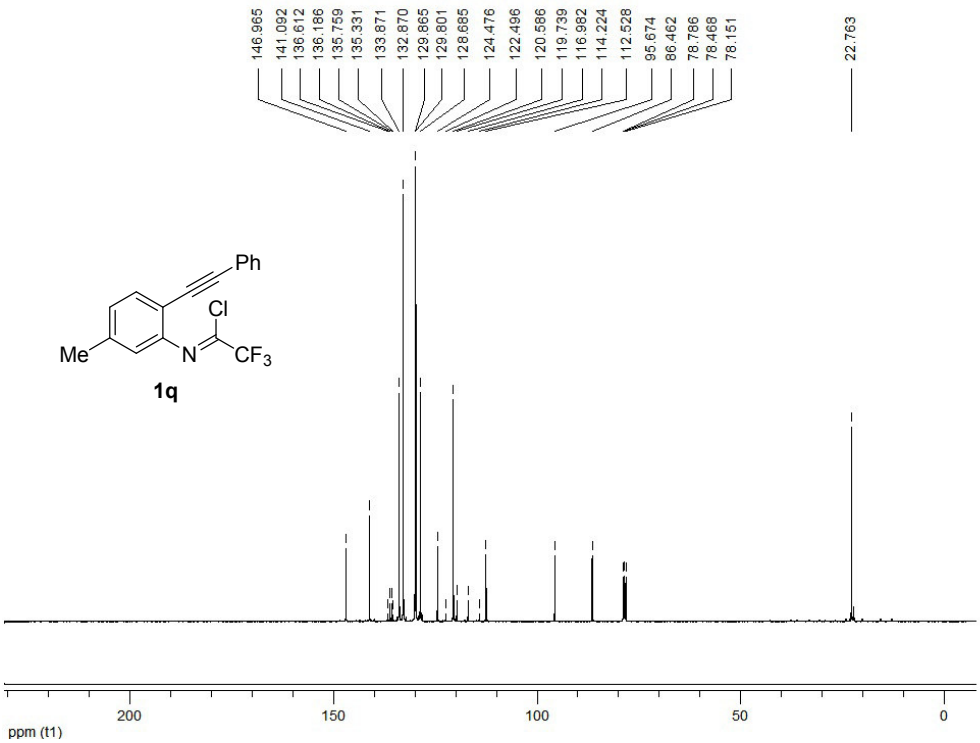

Ph
Cl
Cl
N
CF3
Cl
1o
7.508
7.506
7.503
7.464
7.448
7.378
7.360
7.256
1.00
2.98
2.95
7.70 7.60 7.50 7.40 7.30 7.20 7.10 7.00
ppm (t1)
10.0
5.0
0.0
ppm (t1)

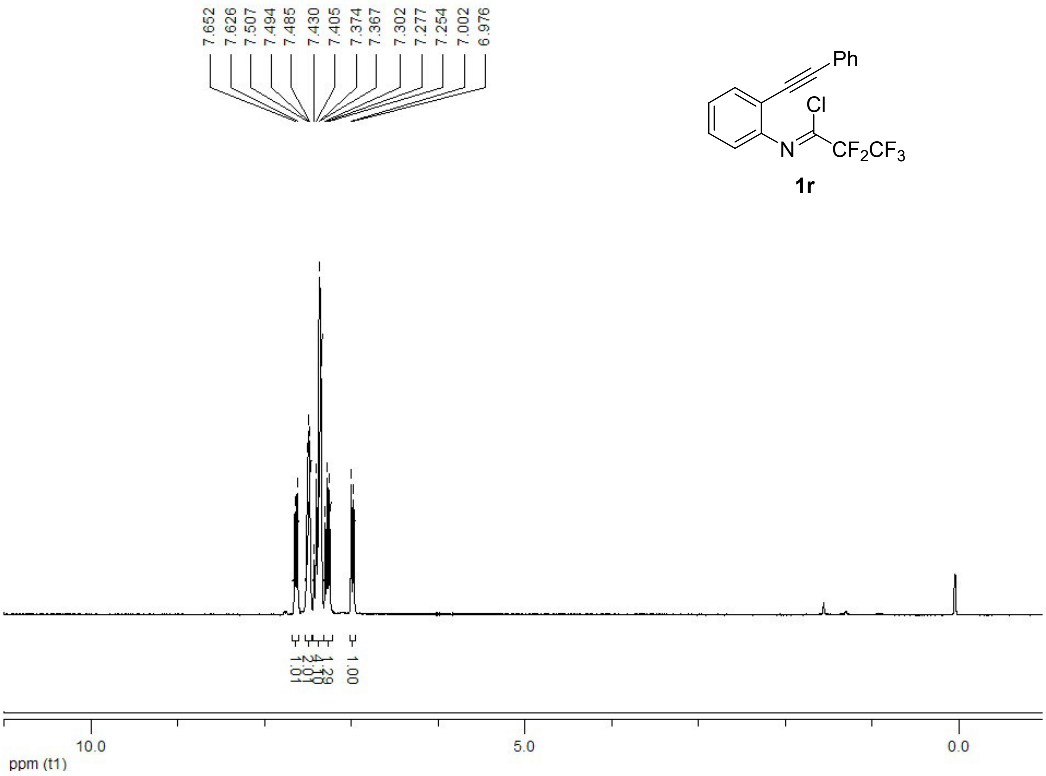

Ph
Cl
Cl
N
CF3
Cl
1o
141.943
139.513
139.122
138.689
138.252
131.666
130.581
129.609
129.312
128.531
124.328
121.804
120.785
118.024
115.948
115.261
112.498
96.726
82.735
77.320
77.002
76.685
200
150
100
50
0
ppm (t1)

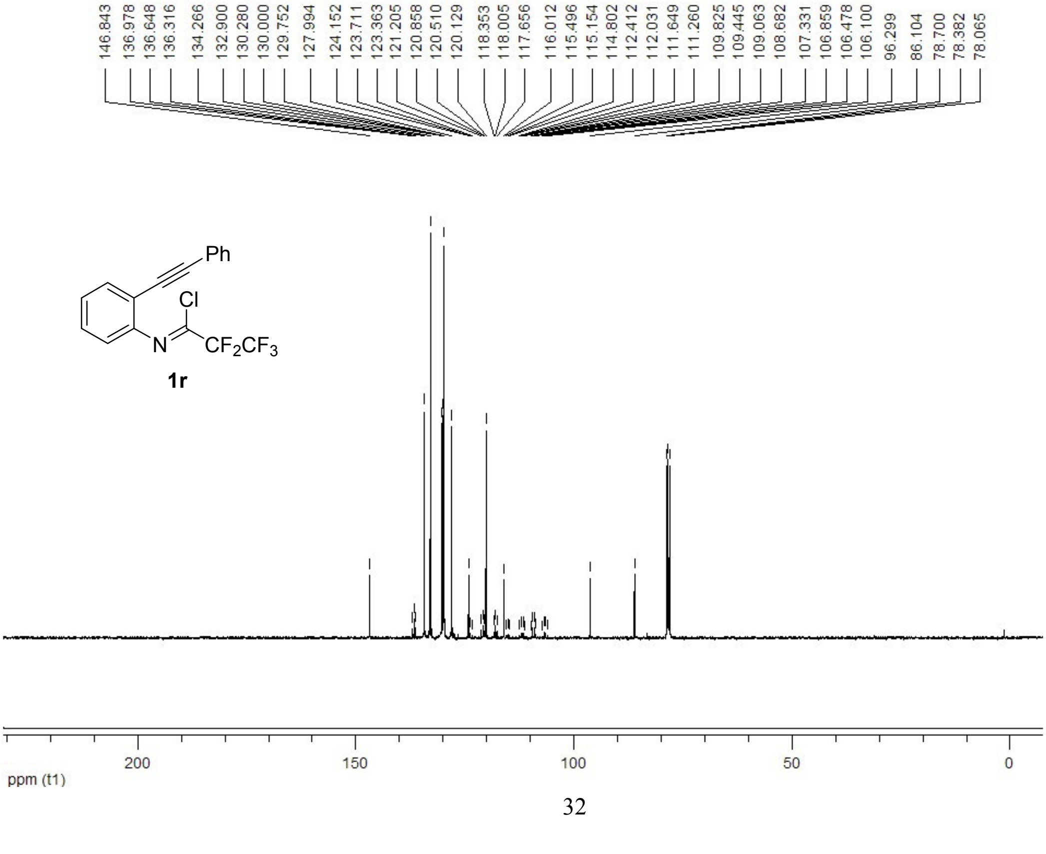

7.484
7.472
7.460
7.452
7.427
7.342
7.330
7.320
7.256
7.204
7.174
6.913
6.886
2.376
Ph
Me
Cl
N
CF3
1p
2.98
2.88
3.00
0.95
3.09
10.0
5.0
0.0
ppm (t1)

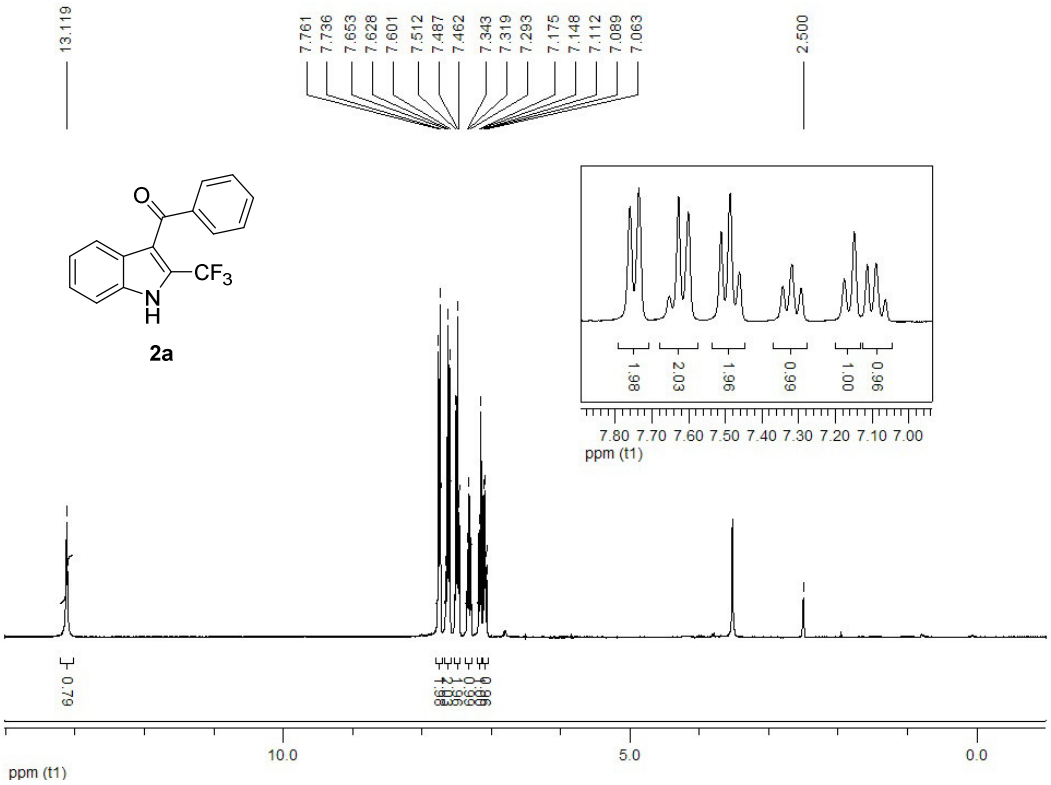

144.323
137.890
136.020
135.592
135.166
134.737
134.374
132.893
131.133
129.923
129.753
124.251
122.354
120.186
119.599
116.842
115.840
114.084
96.028
86.462
78.696
78.378
78.061
22.181
Ph
Me
Cl
N
CF3
1p
200
150
100
50
0
ppm (t1)

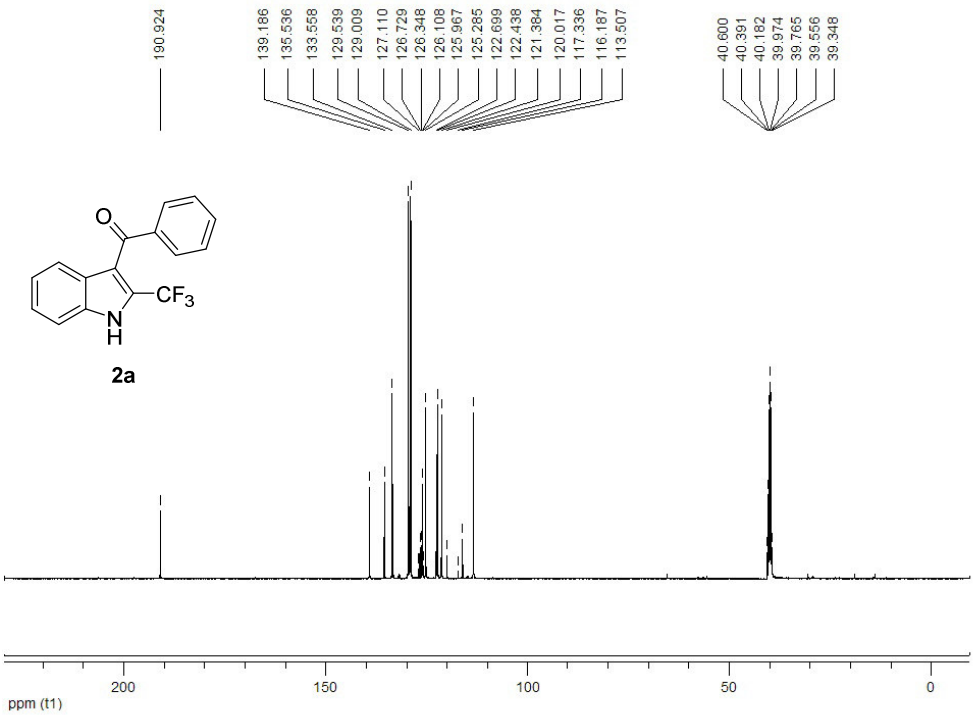

7.581
7.557
7.406
7.395
7.389
7.256
7.118
7.092
6.833
2.454
Ph
Cl
Me
N
CF3
1q
3.16
2.12
1.05
1.00
2.97
10.0
5.0
0.0
ppm (t1)

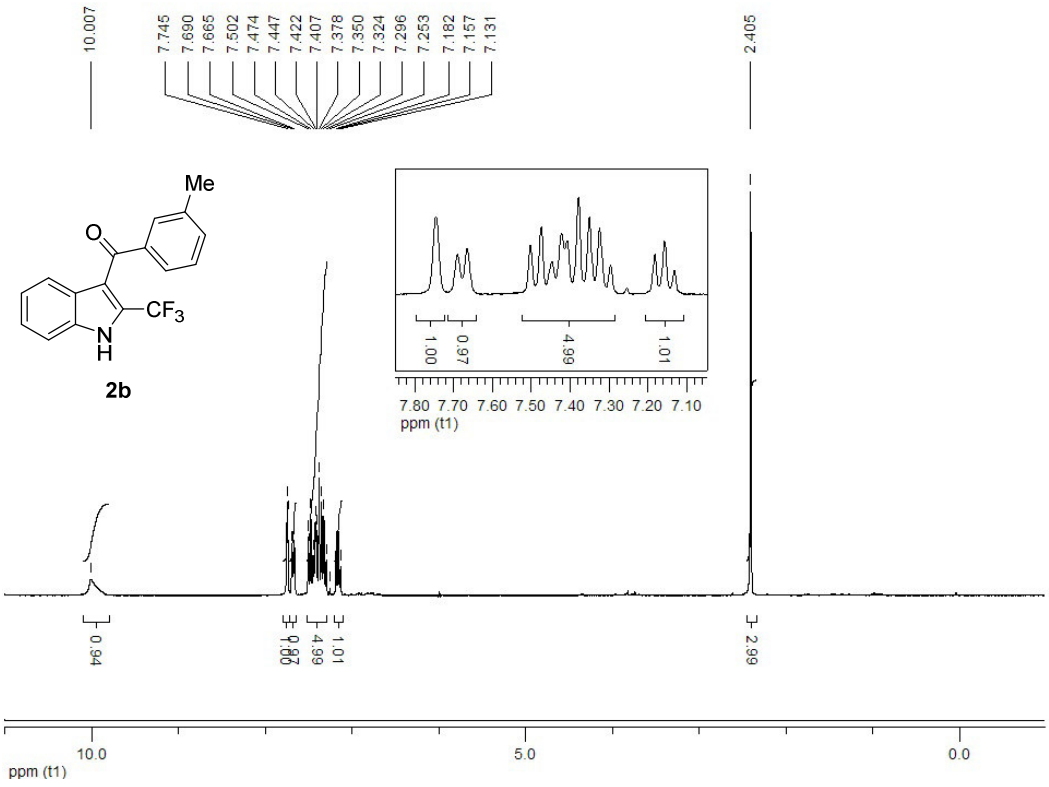

146.965
141.092
136.612
136.186
135.759
135.331
133.871
132.870
129.865
129.801
128.685
124.476
122.496
120.586
119.739
116.982
114.224
112.528
95.674
86.462
78.786
78.468
78.151
22.763
Ph
Cl
Me
N
CF3
1q
200
150
100
50
0
ppm (t1)

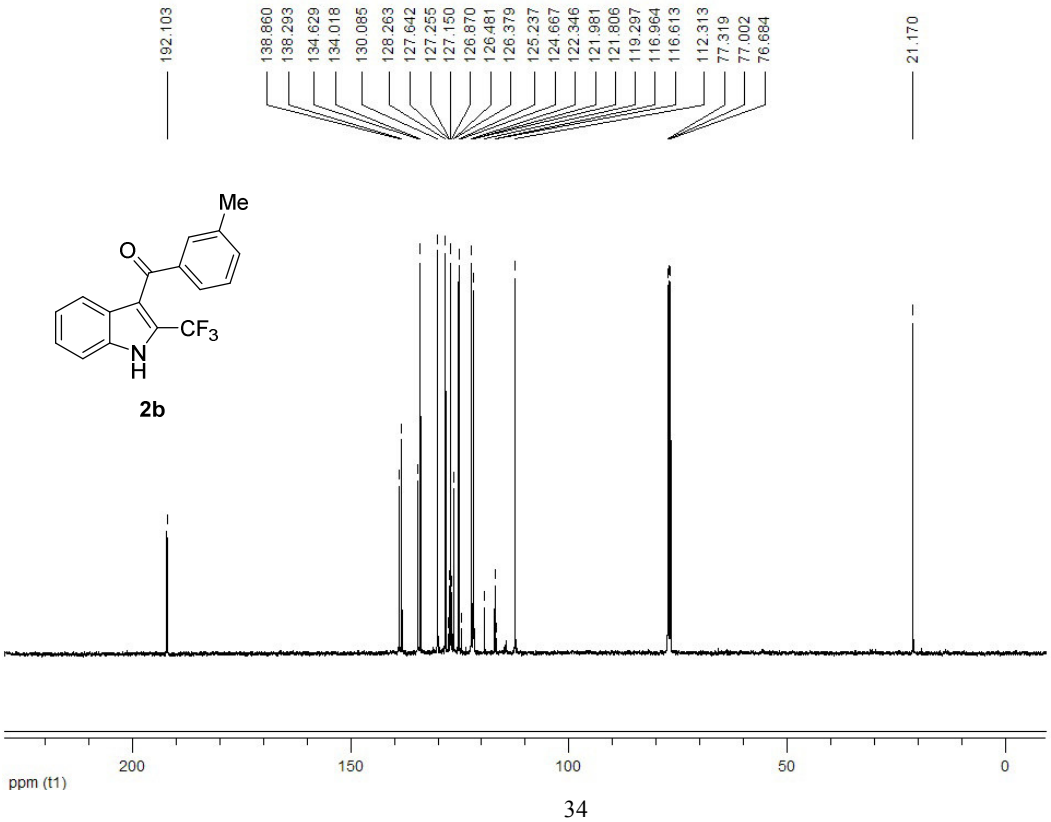

7.652 7.626 7.507 7.494 7.485 7.430 7.405 7.374 7.367 7.302 7.277 7.254 7.002 6.976
1.01 2.01 4.20 1.29 1.00
10.0
5.0
0.0
ppm (t1)
Ph
Cl
N
CF_2CF_3
1r

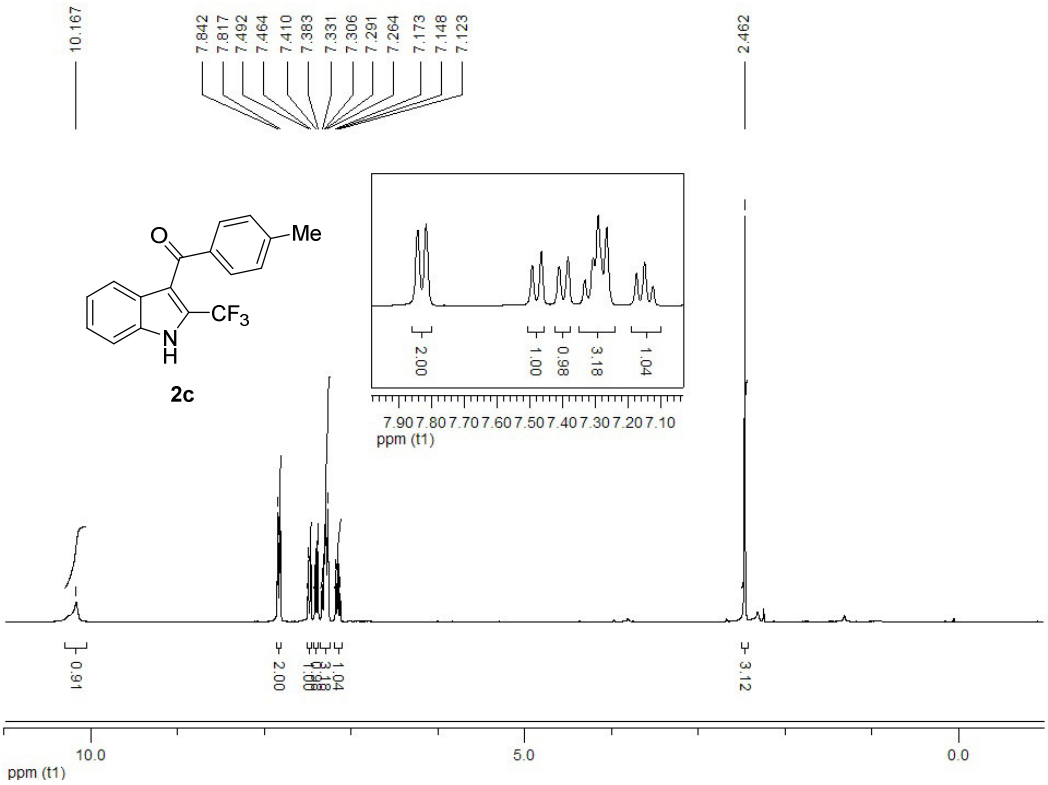

146.843 136.978 136.648 136.316 134.266 132.900 130.280 130.000 129.752 127.994 124.152 123.711 123.363 121.205 120.858 120.510 120.129 118.353 118.005 117.656 116.012 115.496 115.154 114.802 112.412 112.031 111.649 111.260 109.825 109.445 109.063 108.682 107.331 106.859 106.478 106.100 96.299 86.104 78.700 78.382 78.065
Ph
Cl
N
CF_2CF_3
1r
200
150
100
50
0
ppm (t1)

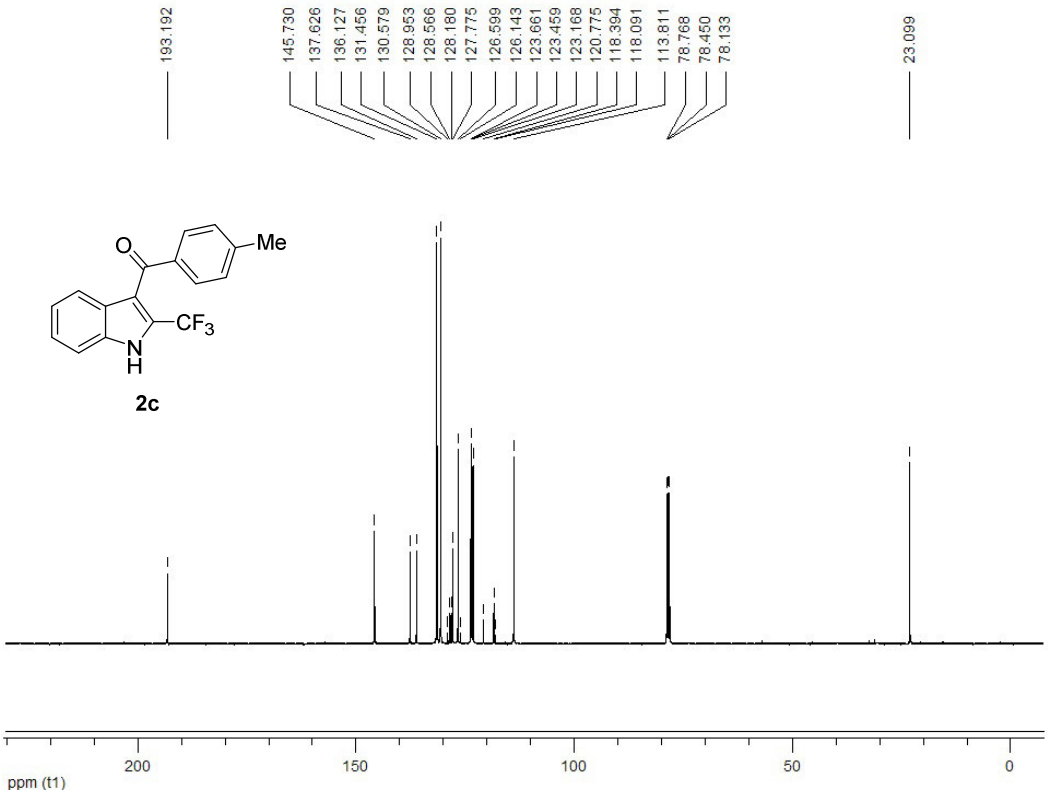

13.119
7.761
7.736
7.653
7.628
7.601
7.512
7.487
7.462
7.343
7.319
7.293
7.175
7.148
7.112
7.089
7.063
2.500
O
CF3
N
H
2a
1.98
2.03
1.96
0.99
1.00
0.96
7.80 7.70 7.60 7.50 7.40 7.30 7.20 7.10 7.00
ppm (t1)
0.79
10.0
5.0
0.0
ppm (t1)

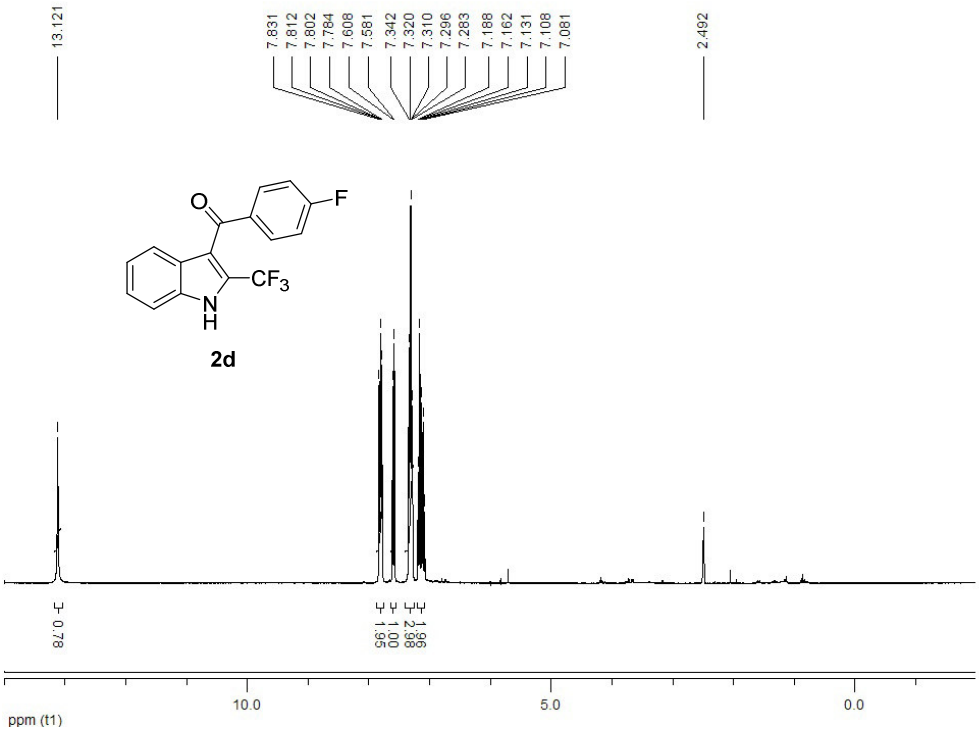

190.924
139.186
135.536
133.558
129.539
129.009
127.110
126.729
126.348
126.108
125.967
125.285
122.699
122.438
121.384
120.017
117.336
116.187
113.507
40.600
40.391
40.182
39.974
39.765
39.556
39.348
O
CF3
N
H
2a
200
150
100
50
0
ppm (t1)

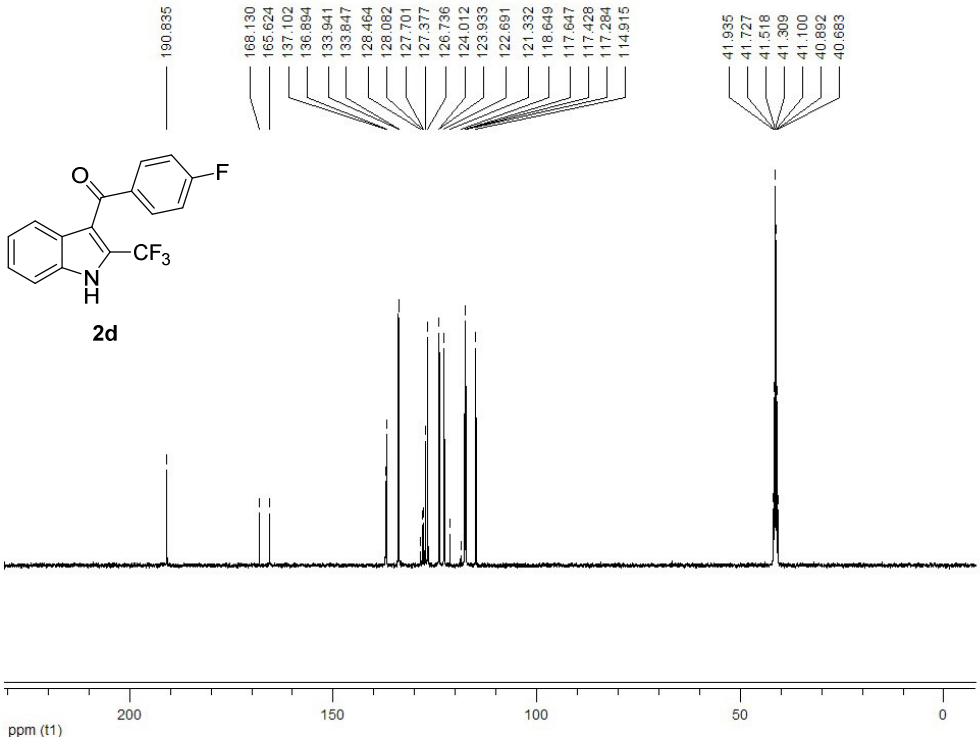

10.007
7.745
7.690
7.665
7.502
7.474
7.447
7.422
7.407
7.378
7.350
7.324
7.296
7.253
7.182
7.157
7.131
2.405
Me
O
CF3
N
H
2b
1.00
0.97
4.99
1.01
7.80 7.70 7.60 7.50 7.40 7.30 7.20 7.10
ppm (t1)
0.94
2.99
10.0
5.0
0.0
ppm (t1)

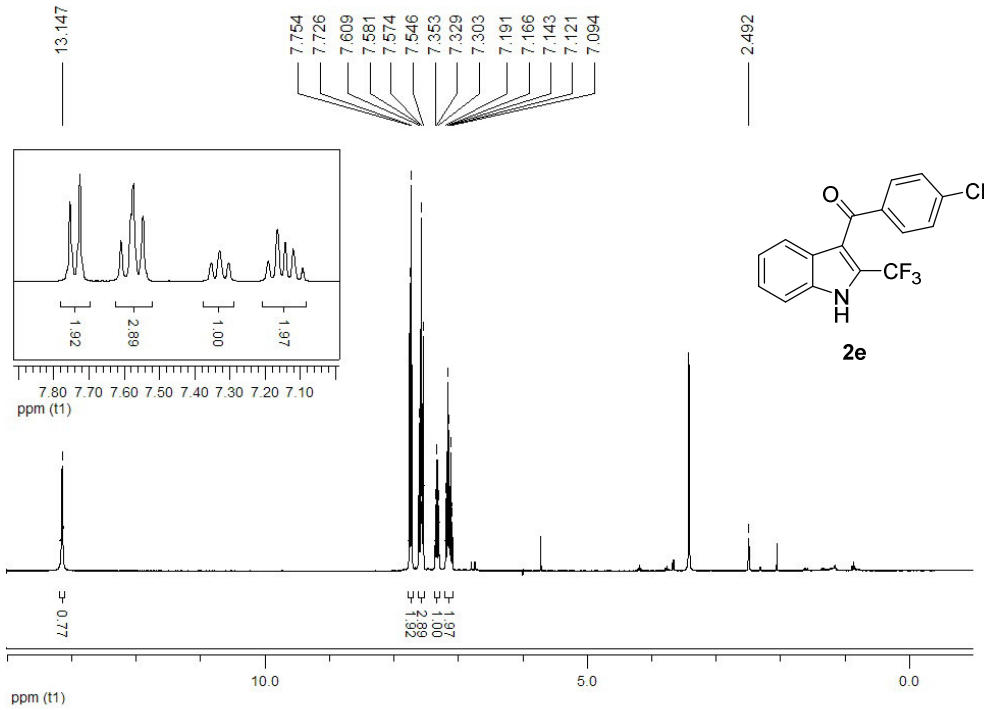

192.103
138.860
138.293
134.629
134.018
130.085
128.263
127.642
127.255
127.150
126.870
126.481
126.379
125.237
124.667
122.346
121.981
121.806
119.297
116.964
116.613
112.313
77.319
77.002
76.684
21.170
Me
O
CF3
N
H
2b
200
150
100
50
0
ppm (t1)


10.167
7.842
7.817
7.492
7.464
7.410
7.383
7.331
7.306
7.291
7.264
7.173
7.148
7.123
2.462
O
Me
CF3
N
H
2c
2.00
1.00
0.98
3.18
1.04
7.90 7.80 7.70 7.60 7.50 7.40 7.30 7.20 7.10
ppm (t1)
0.91
2.00
1.04
3.12
10.0
5.0
0.0
ppm (t1)

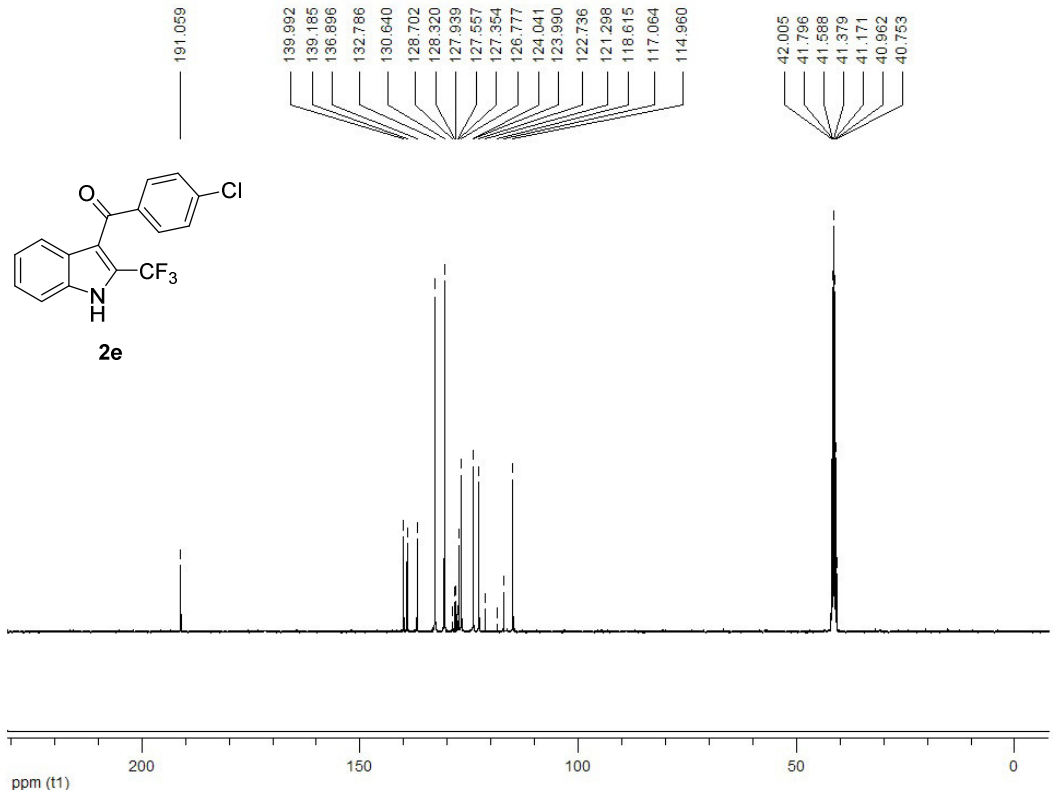

193.192
145.730
137.626
136.127
131.456
130.579
128.953
128.566
128.180
127.775
126.599
126.143
123.661
123.459
123.168
120.775
118.394
118.091
113.811
78.768
78.450
78.133
23.099
O
Me
CF3
N
H
2c
200
150
100
50
0
ppm (t1)


13.121
7.831
7.812
7.802
7.784
7.608
7.581
7.342
7.320
7.310
7.296
7.283
7.188
7.162
7.131
7.108
7.081
2.492
O
F
CF3
N
H
2d
0.78
1.95
1.00
2.98
1.96
10.0
5.0
0.0
ppm (t1)

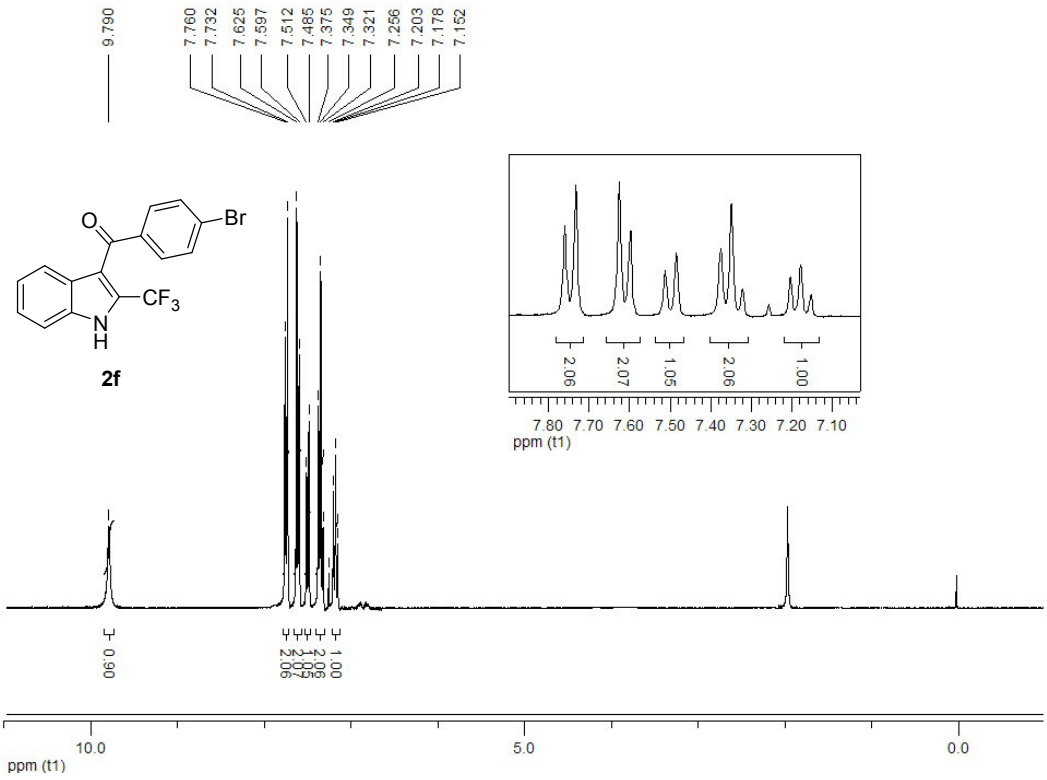

190.835
168.130
165.624
137.102
136.894
133.941
133.847
128.464
128.082
127.701
127.377
126.736
124.012
123.933
122.691
121.332
118.649
117.647
117.428
117.284
114.915
41.935
41.727
41.518
41.309
41.100
40.892
40.683
O
F
CF3
N
H
2d
200
150
100
50
0
ppm (t1)


13.147
7.754
7.726
7.609
7.581
7.574
7.546
7.353
7.329
7.303
7.191
7.166
7.143
7.121
7.094
2.492
1.92
2.89
1.00
1.97
7.80 7.70 7.60 7.50 7.40 7.30 7.20 7.10
ppm (t1)
0.77
1.92
2.89
1.00
1.97
10.0
5.0
0.0
ppm (t1)
O
Cl
CF3
N
H

2e


191.059
139.992
139.185
136.896
132.786
130.640
128.702
128.320
127.939
127.557
127.354
126.777
124.041
123.990
122.736
121.298
118.615
117.064
114.960
42.005
41.796
41.588
41.379
41.171
40.962
40.753
200
150
100
50
0
ppm (t1)
O
Cl
CF3
N
H

2e


9.790
7.760
7.732
7.625
7.597
7.512
7.485
7.375
7.349
7.321
7.256
7.203
7.178
7.152
O
Br
CF3
N
H
2f
2.06
2.07
1.05
2.06
1.00
7.80 7.70 7.60 7.50 7.40 7.30 7.20 7.10
ppm (t1)
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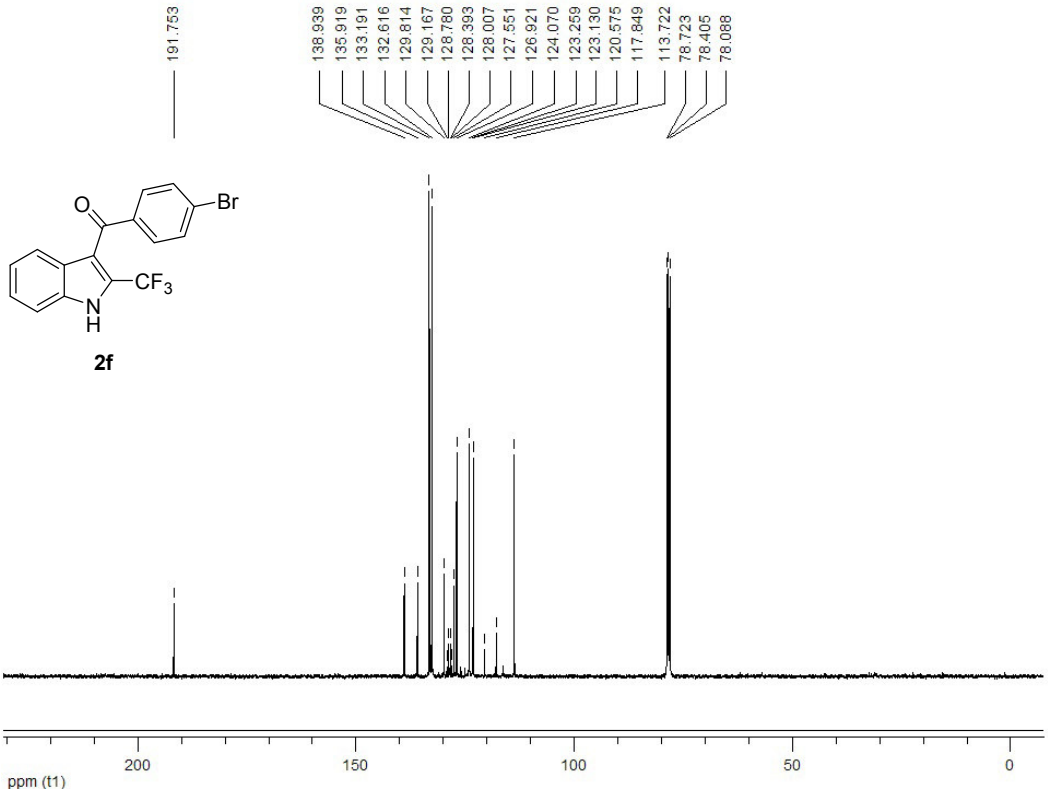
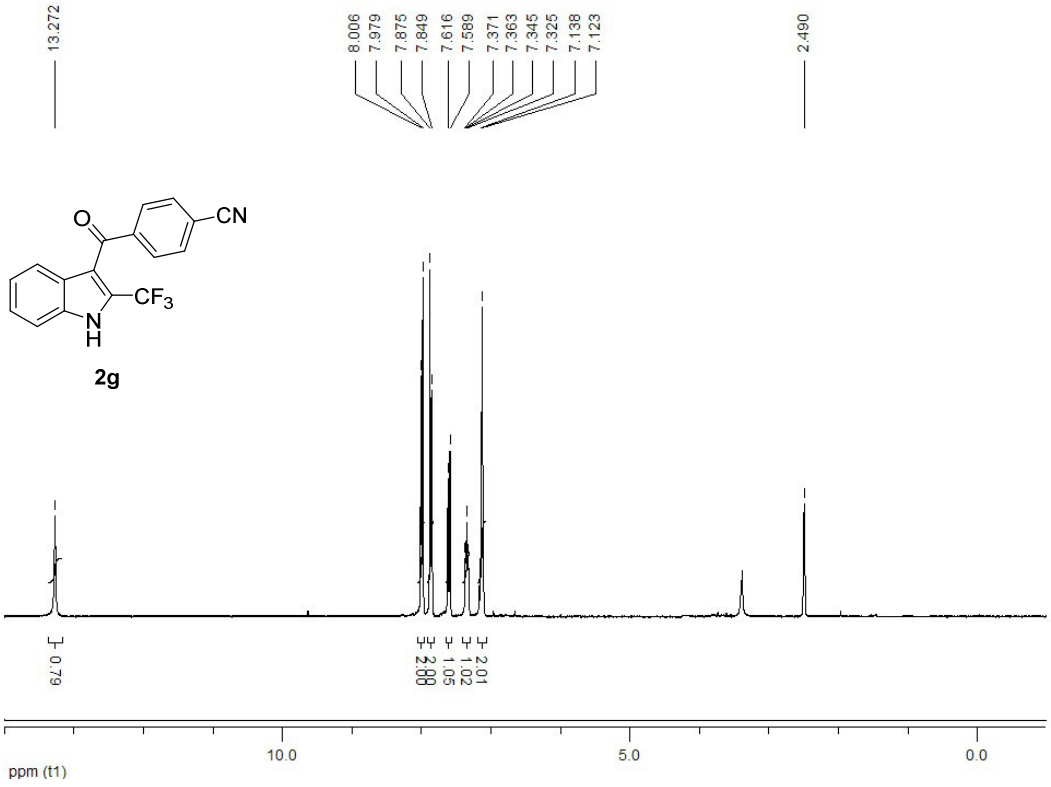
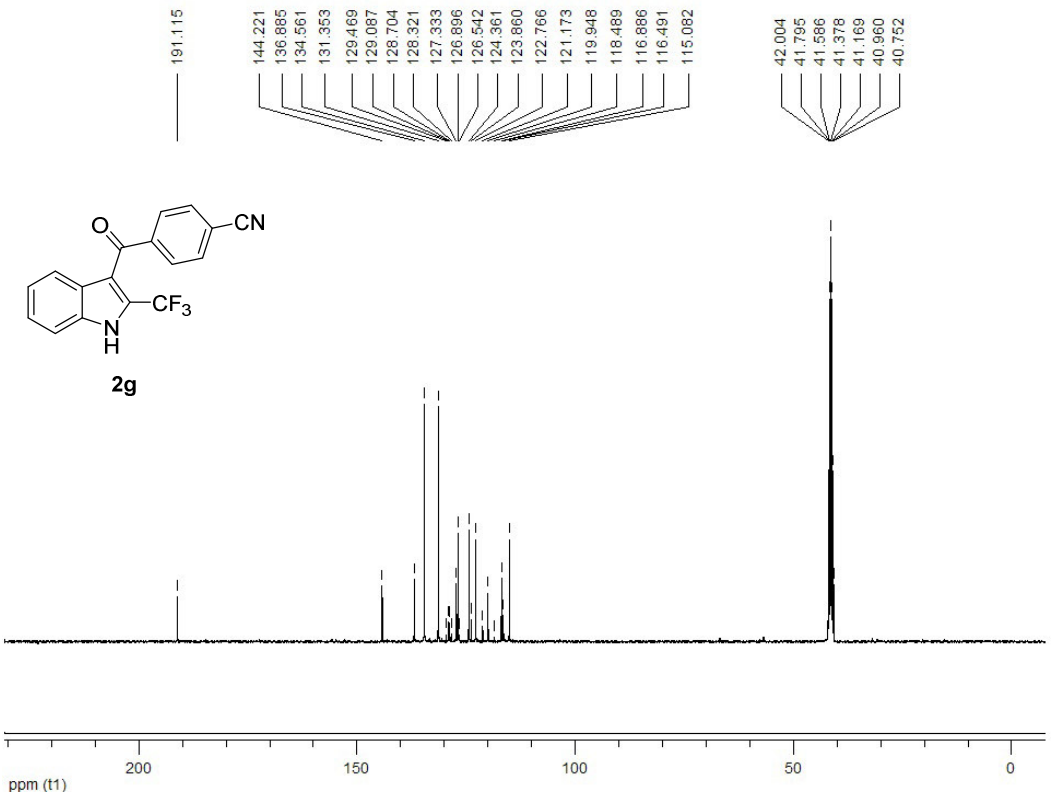
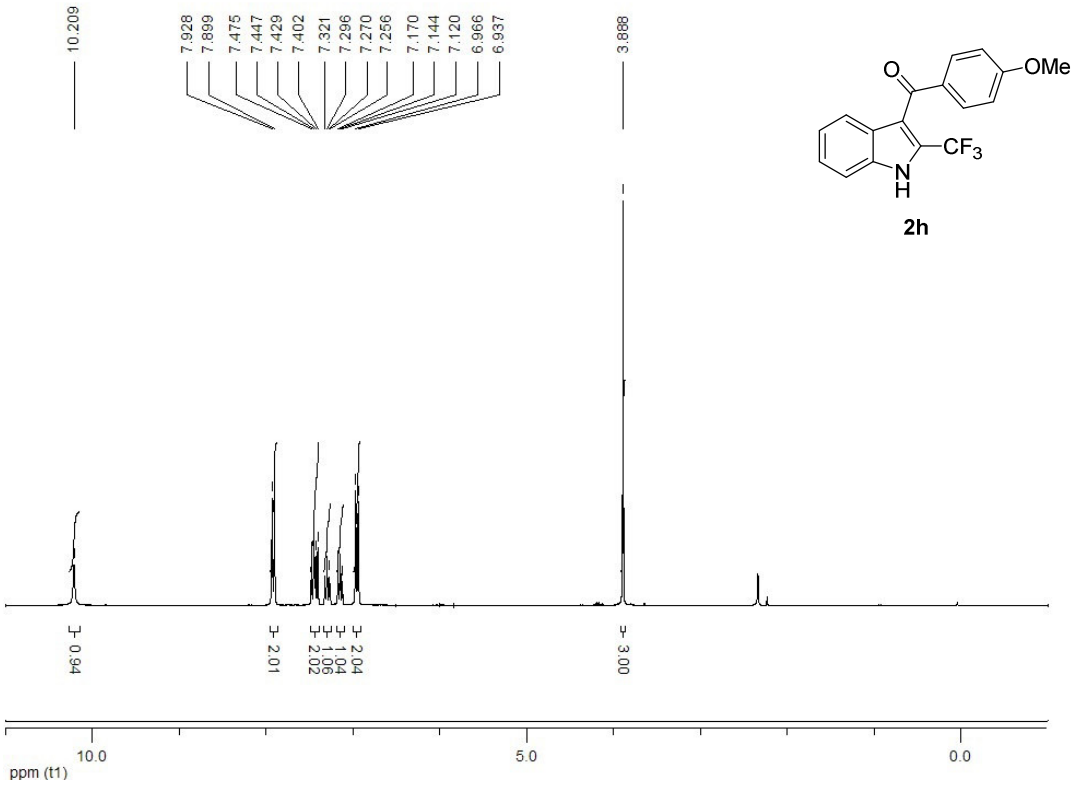
2.06
2.07
1.05
2.06
1.00
10.0
5.0
0.0
ppm (t1)


191.753
138.939
135.919
133.191
132.616
129.814
129.167
128.780
128.393
128.007
127.551
126.921
124.070
123.259
123.130
120.575
117.849
113.722
78.723
78.405
78.088
O
Br
CF3
N
H
2f
200
150
100
50
0
ppm (t1)


13.272
8.006
7.979
7.875
7.849
7.616
7.589
7.371
7.363
7.345
7.325
7.138
7.123
2.490
O
CN
CF3
N
H
2g
0.79
2.88
1.05
1.02
2.01
10.0
5.0
0.0
ppm (t1)


191.115
144.221
136.885
134.561
131.353
129.469
129.087
128.704
128.321
127.333
126.896
126.542
124.361
123.860
122.766
121.173
119.948
118.489
116.886
116.491
115.082
42.004
41.795
41.586
41.378
41.169
40.960
40.752
O
CN
CF3
N
H
2g
200
150
100
50
0
ppm (t1)


10.209
7.928
7.899
7.475
7.447
7.429
7.402
7.321
7.296
7.270
7.256
7.170
7.144
7.120
6.966
6.937
3.888
O
OMe
CF3
N
H
2h
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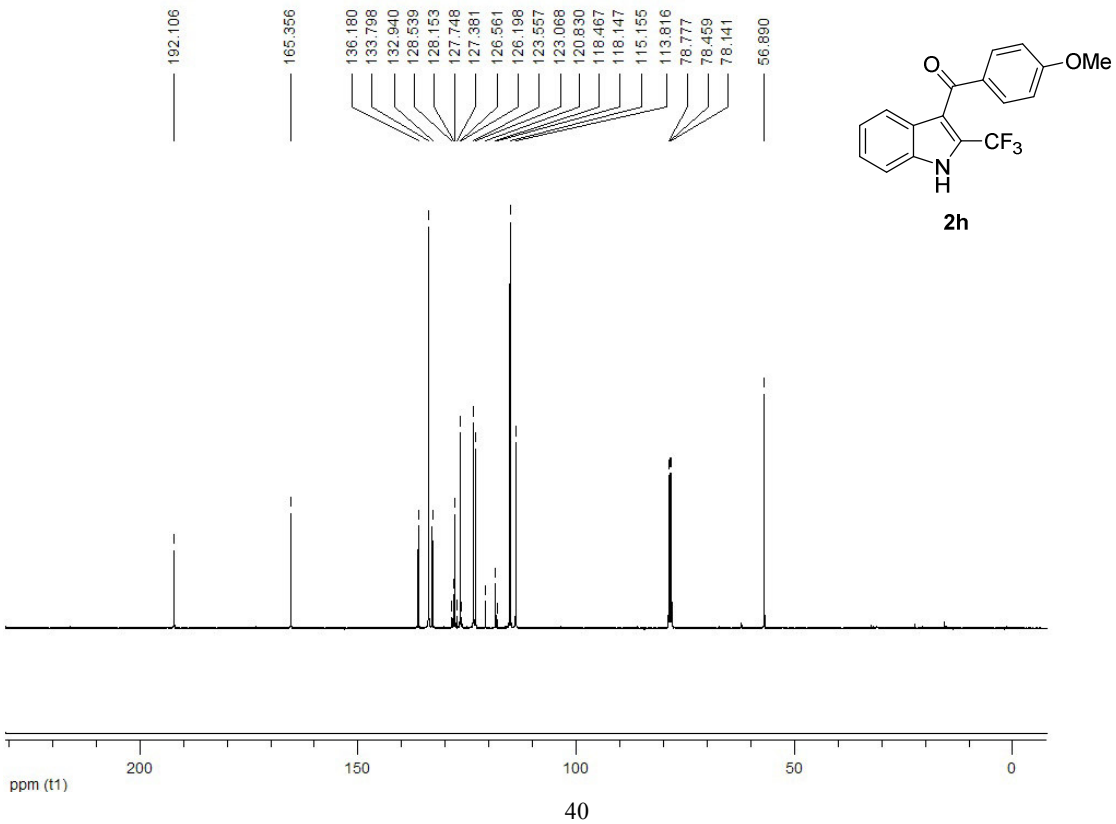
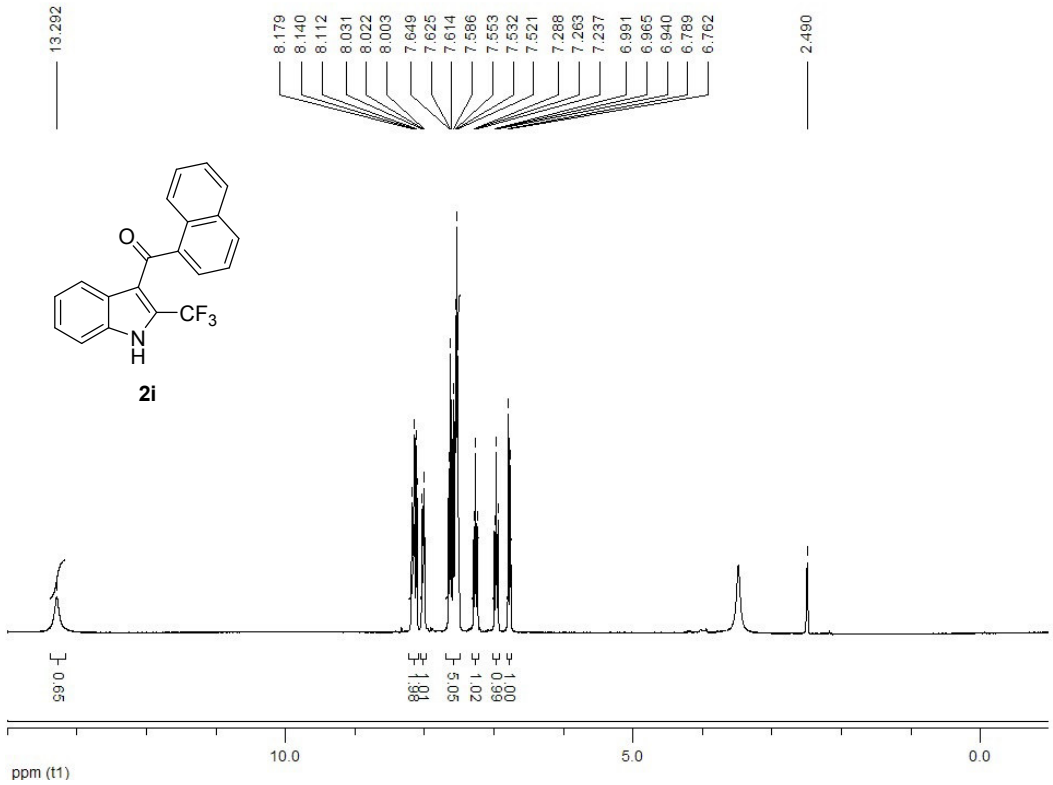
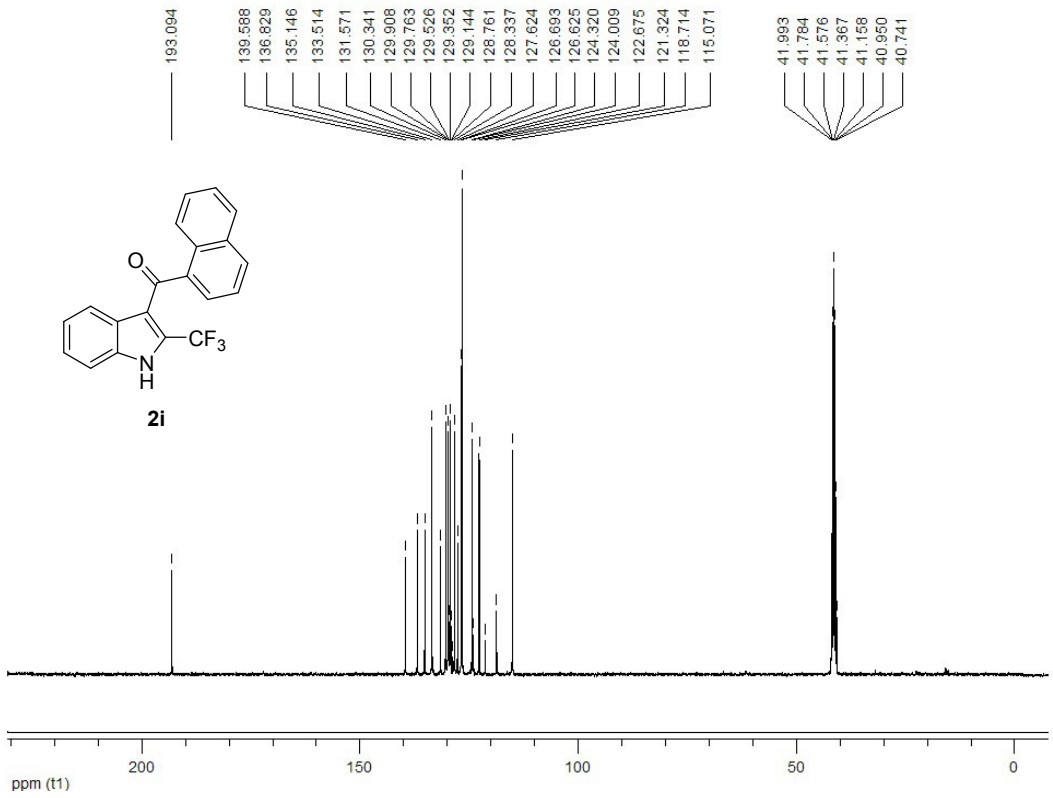
2.02
1.06
1.04
2.04
3.00
10.0
5.0
0.0
ppm (t1)


192.106
165.356
136.180
133.798
132.940
128.539
128.153
127.748
127.381
126.561
126.198
123.557
123.068
120.830
118.467
118.147
115.155
113.816
78.777
78.459
78.141
56.890
O
OMe
CF3
N
H
2h
200
150
100
50
0
ppm (t1)


13.292
8.179
8.140
8.112
8.031
8.022
8.003
7.649
7.625
7.614
7.586
7.553
7.532
7.521
7.288
7.263
7.237
6.991
6.965
6.940
6.789
6.762
2.490
O
CF3
N
H
2i
0.65
1.98
1.01
5.05
1.02
0.99
1.00
10.0
5.0
0.0
ppm (t1)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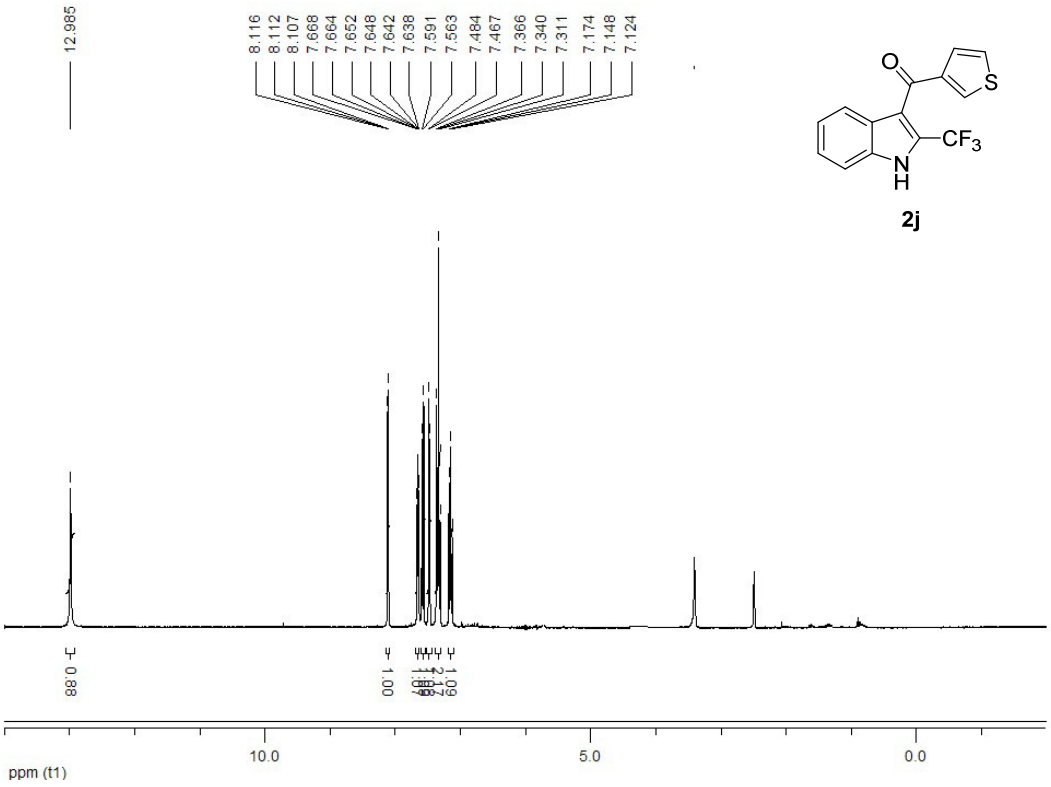
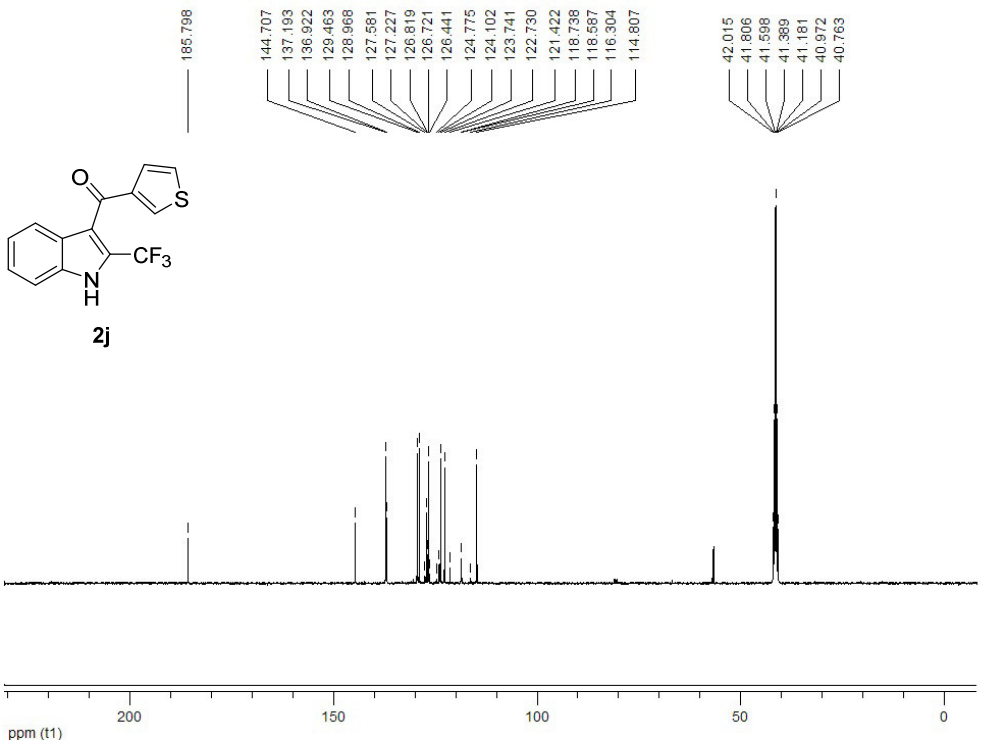
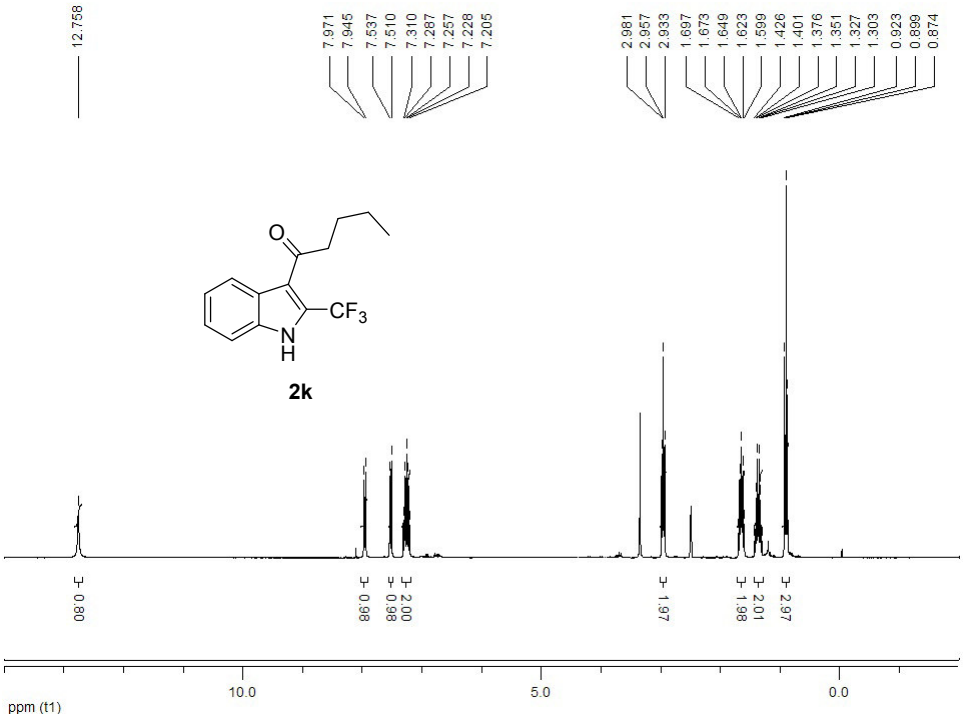
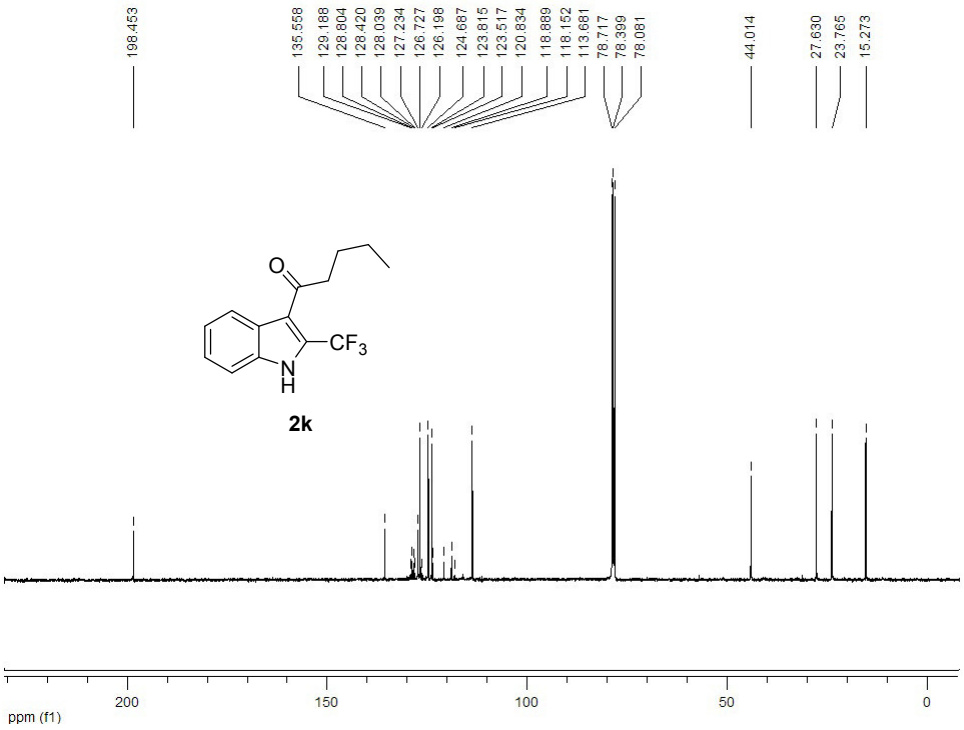
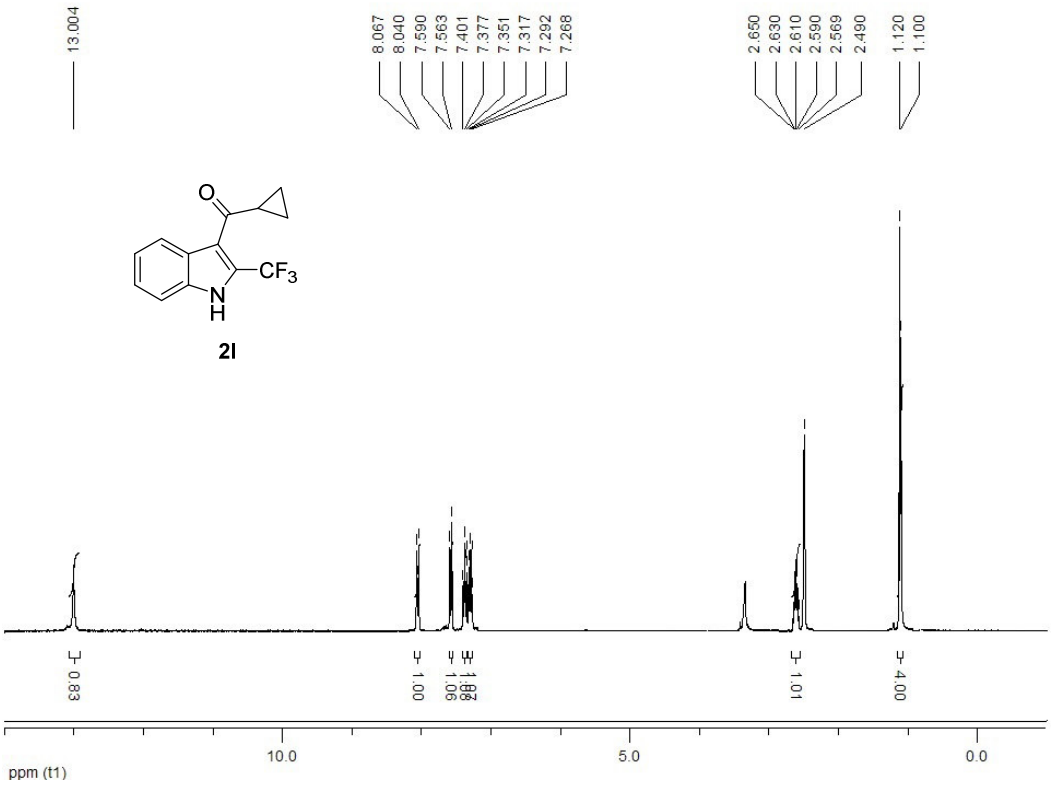
139.588
136.829
135.146
133.514
131.571
130.341
129.908
129.763
129.526
129.352
129.144
128.761
128.337
127.624
126.693
126.625
124.320
124.009
122.675
121.324
118.714
115.071
41.993
41.784
41.576
41.367
41.158
40.950
40.741
O
CF3
N
H
2i
200
150
100
50
0
ppm (t1)

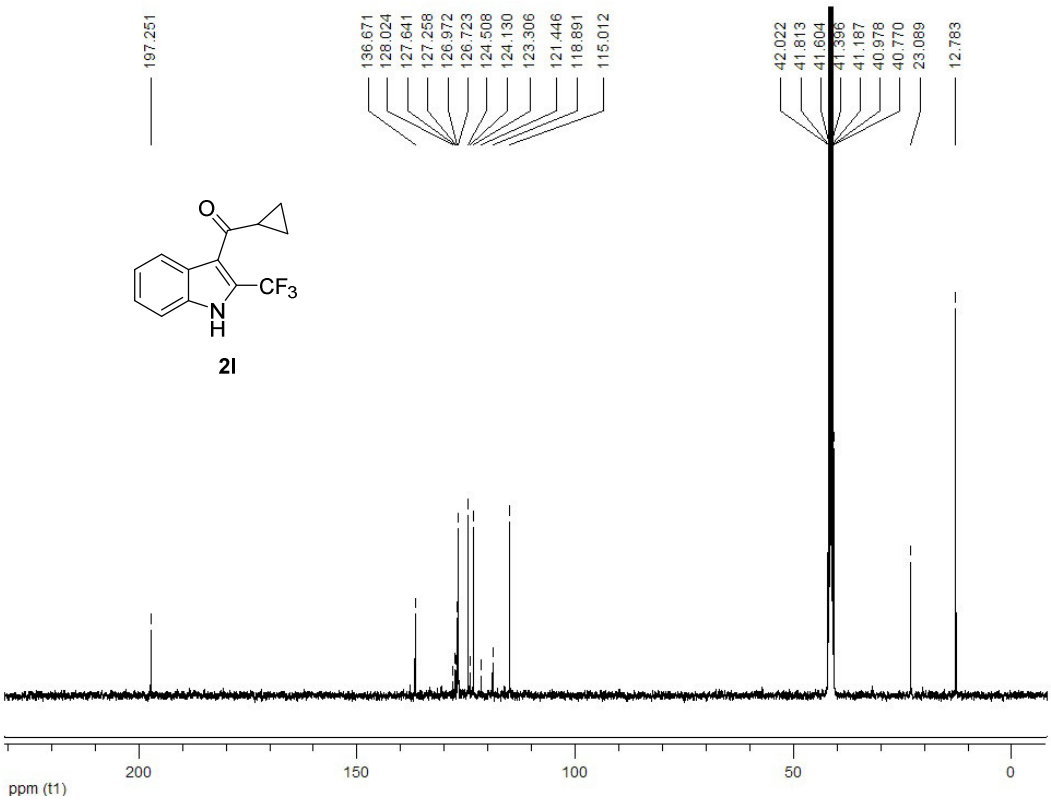

12.985
8.116
8.112
8.107
7.668
7.664
7.652
7.648
7.642
7.638
7.591
7.563
7.484
7.467
7.366
7.340
7.311
7.174
7.148
7.124
O
S
CF3
N
H
2j
0.88
1.00
1.09
10.0
5.0
0.0
ppm (t1)

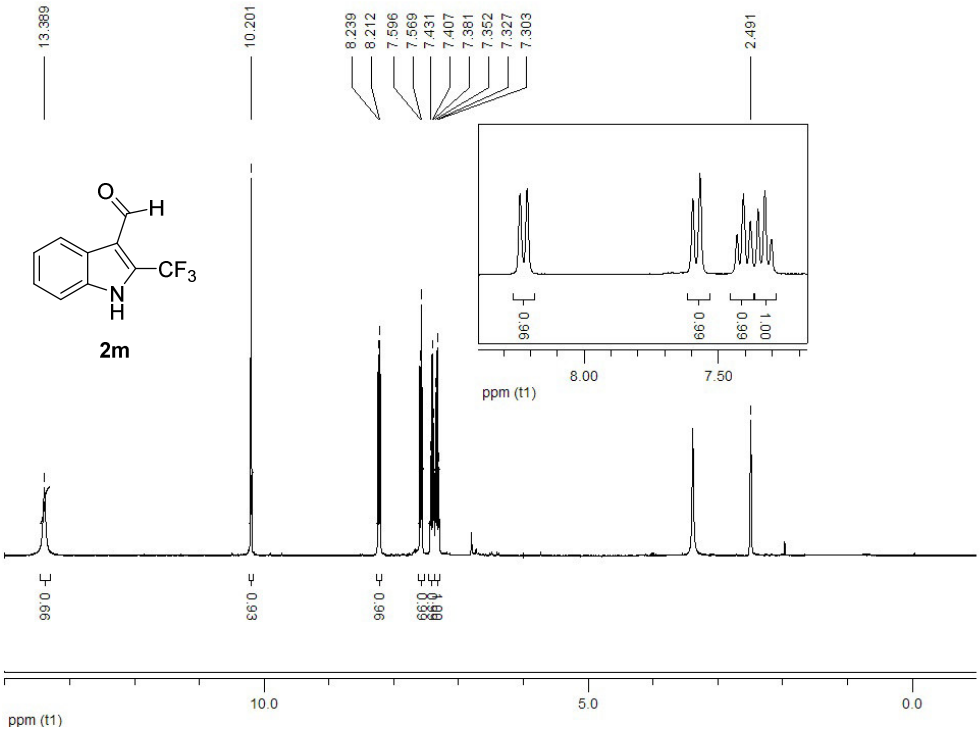

185.798
144.707
137.193
136.922
129.463
128.968
127.581
127.227
126.819
126.721
126.441
124.775
124.102
123.741
122.730
121.422
118.738
118.587
116.304
114.807
42.015
41.806
41.598
41.389
41.181
40.972
40.763
O
S
CF3
N
H
2j
200
150
100
50
0
ppm (t1)

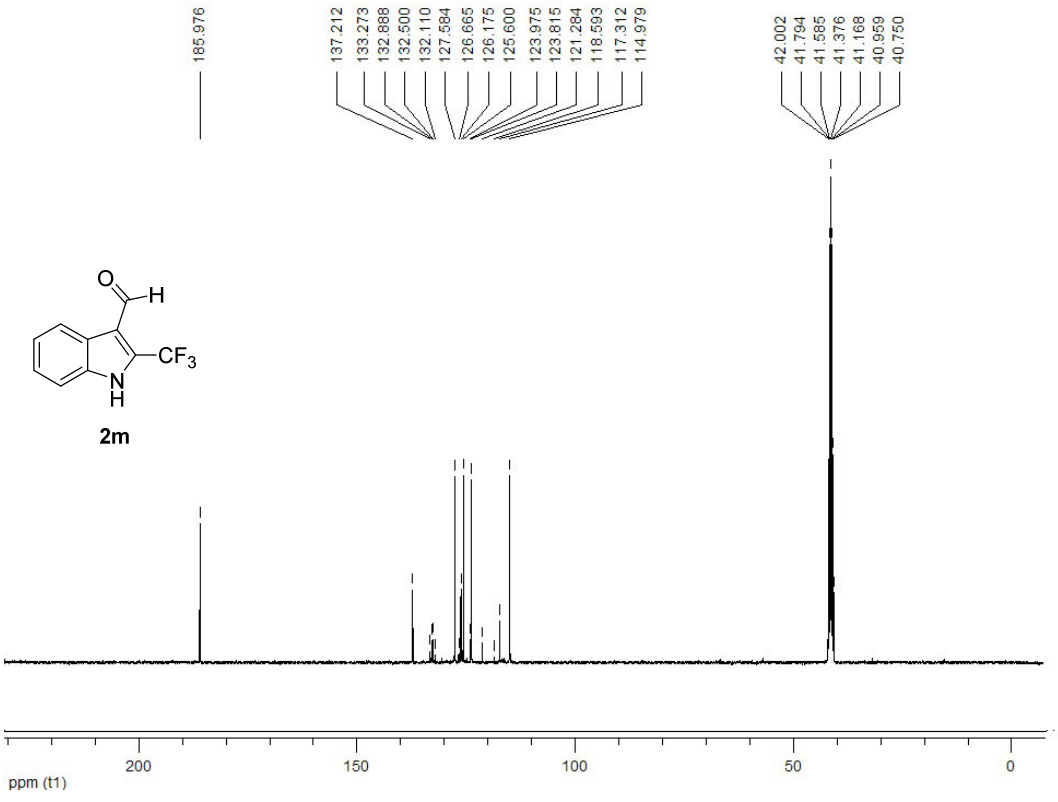

12.758
7.971
7.945
7.537
7.510
7.310
7.287
7.257
7.228
7.205
2.981
2.957
2.933
1.697
1.673
1.649
1.623
1.599
1.426
1.401
1.376
1.351
1.327
1.303
0.923
0.899
0.874
O
CF3
N
H
2k
0.80
0.98
2.00
0.98
1.97
1.98
2.01
2.97
10.0
5.0
0.0
ppm (t1)

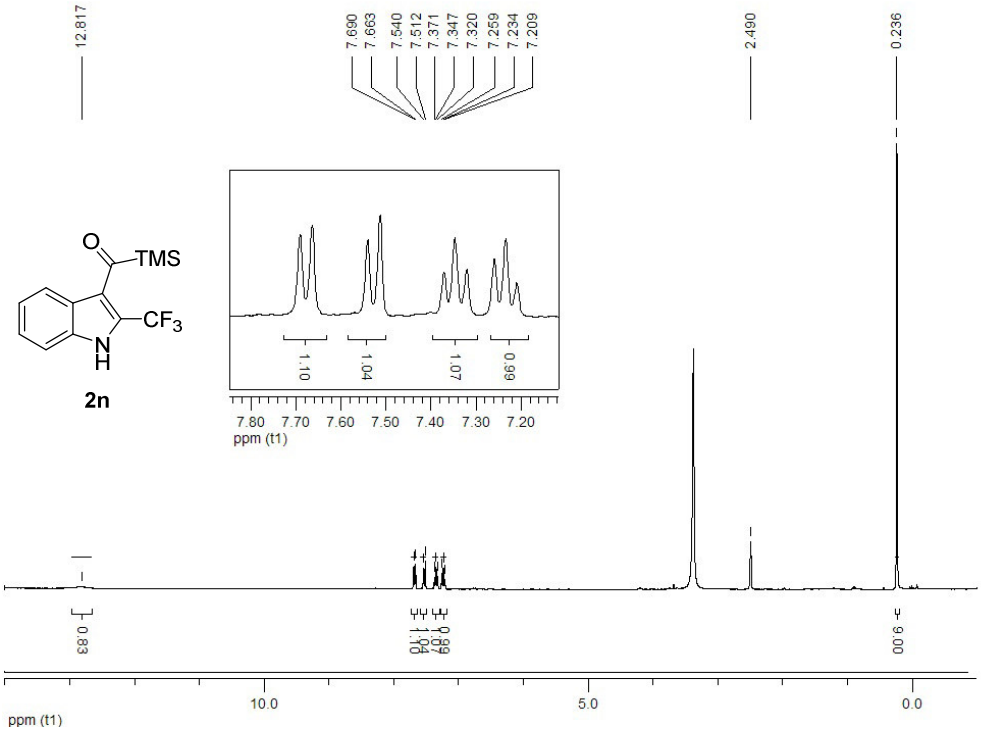

198.453
135.558
129.188
128.804
128.420
128.039
127.234
126.727
126.198
124.687
123.815
123.517
120.834
118.889
118.152
113.681
78.717
78.399
78.081
44.014
27.630
23.765
15.273
O
CF3
N
H
2k
200
150
100
50
0
ppm (f1)

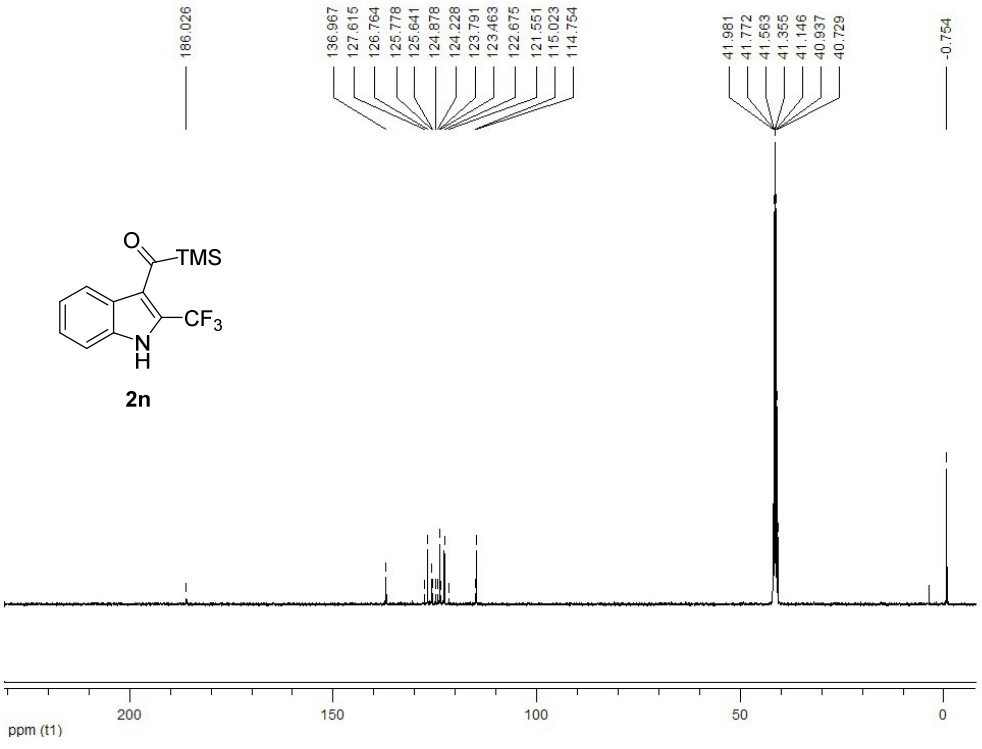

13.004
8.067
8.040
7.590
7.563
7.401
7.377
7.351
7.317
7.292
7.268
2.650
2.630
2.610
2.590
2.569
2.490
1.120
1.100
O
CF3
N
H
2l
0.83
1.00
1.06
1.08
1.01
4.00
10.0
5.0
0.0
ppm (t1)

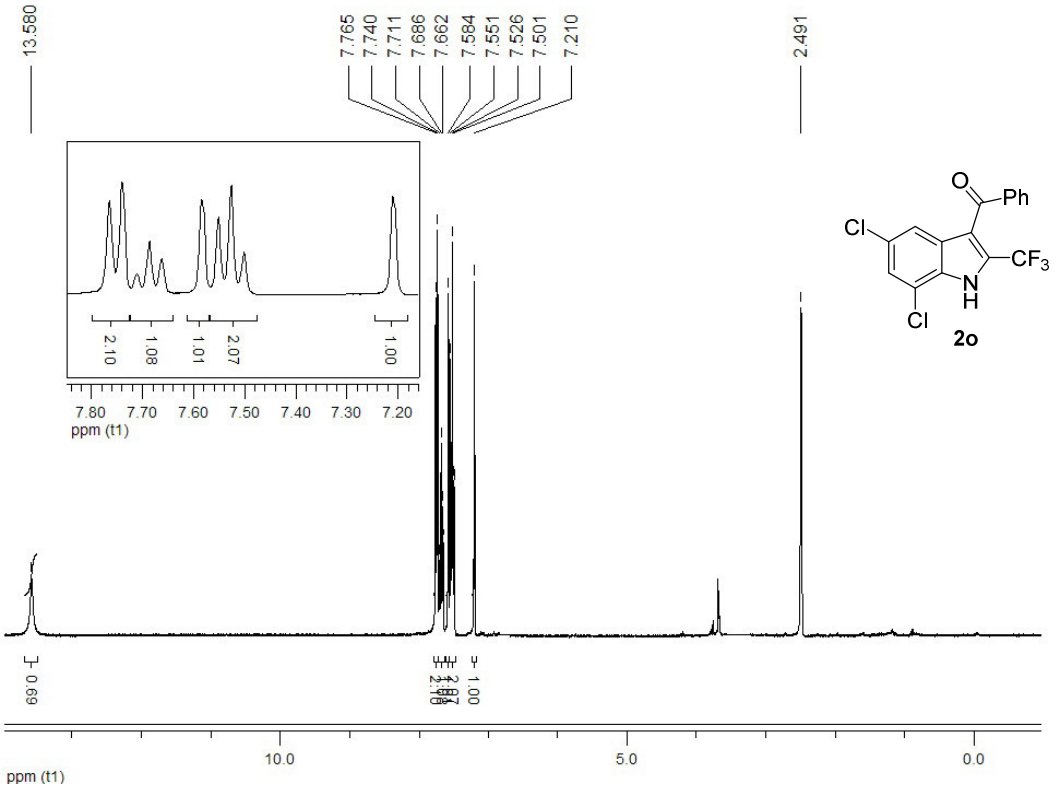

197.251
136.671
128.024
127.641
127.258
126.972
126.723
124.508
124.130
123.306
121.446
118.891
115.012
42.022
41.813
41.604
41.396
41.187
40.978
40.770
23.089
12.783
O
CF3
N
H
2l
200
150
100
50
0
ppm (t1)

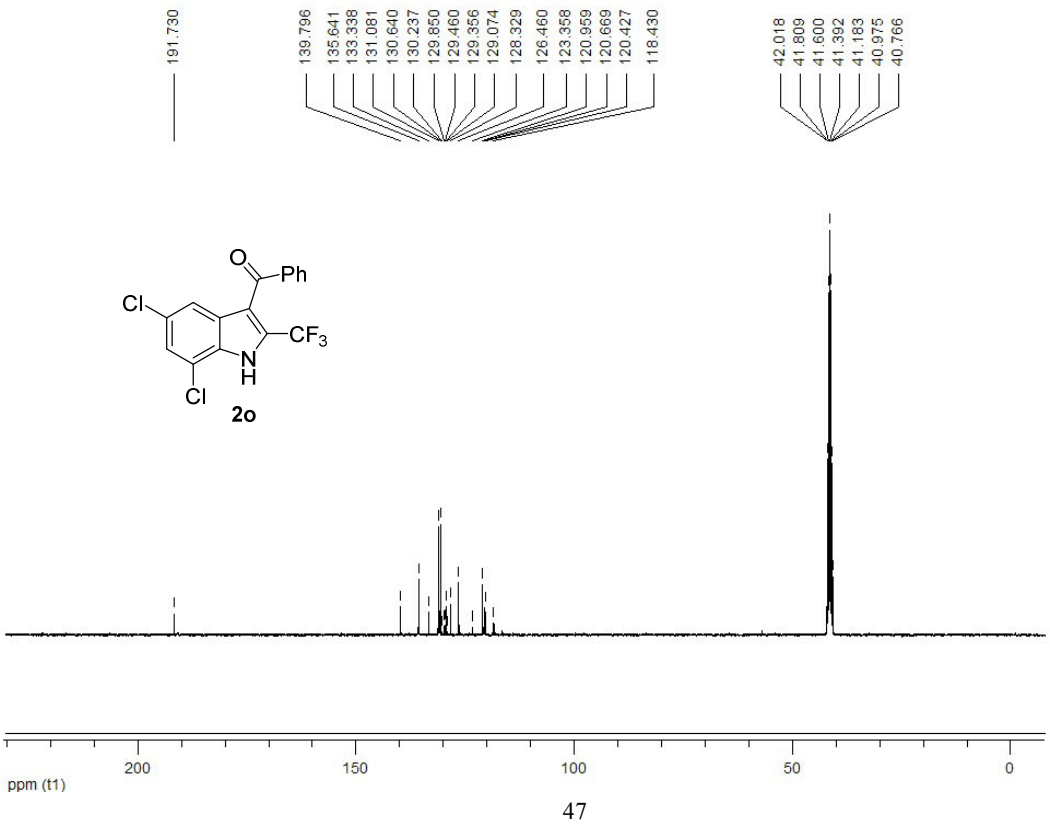

13.389
10.201
8.239
8.212
7.596
7.569
7.431
7.407
7.381
7.352
7.327
7.303
2.491
O
H
CF3
N
H
2m
0.96
0.99
0.99
1.00
8.00
7.50
ppm (t1)
0.66
0.93
0.96
10.0
5.0
0.0
ppm (t1)

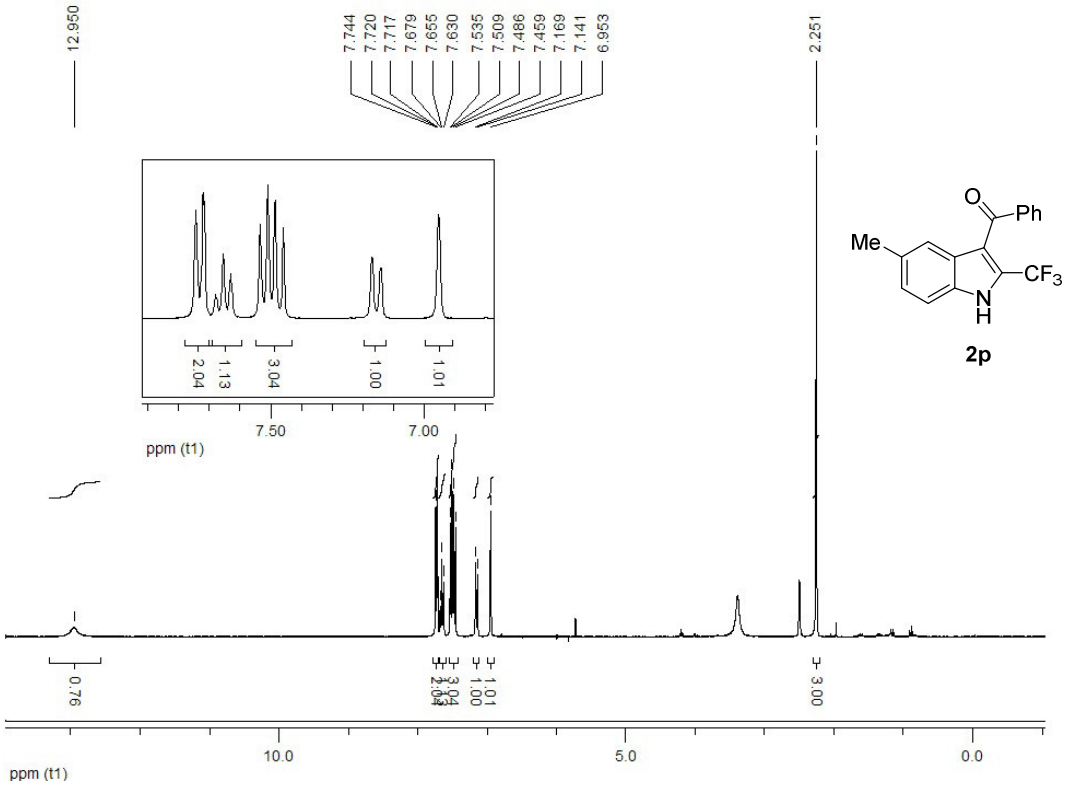

185.976
137.212
133.273
132.888
132.500
132.110
127.584
126.665
126.175
125.600
123.975
123.815
121.284
118.593
117.312
114.979
42.002
41.794
41.585
41.376
41.168
40.959
40.750
O
H
CF3
N
H
2m
200
150
100
50
0
ppm (t1)

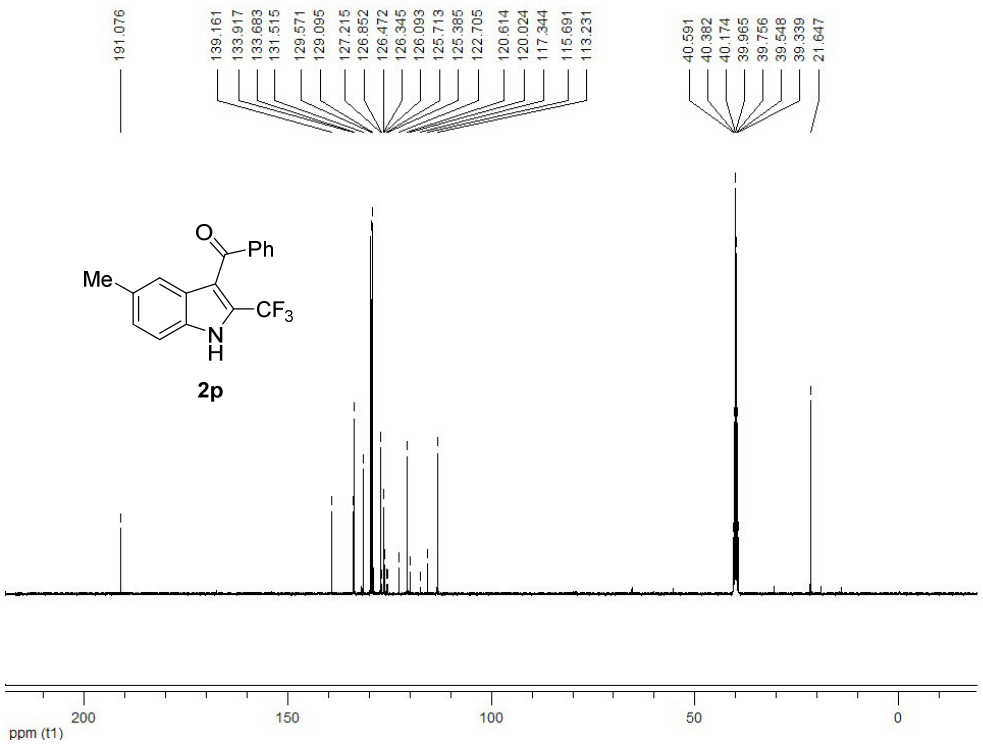

12.817
7.690
7.663
7.540
7.512
7.371
7.347
7.320
7.259
7.234
7.209
2.490
0.236
O
TMS
CF3
N
H
2n
1.10
1.04
1.07
0.99
7.80 7.70 7.60 7.50 7.40 7.30 7.20
ppm (t1)
0.83
2.14
2.10
2.04
2.09
9.00
10.0
5.0
0.0
ppm (t1)

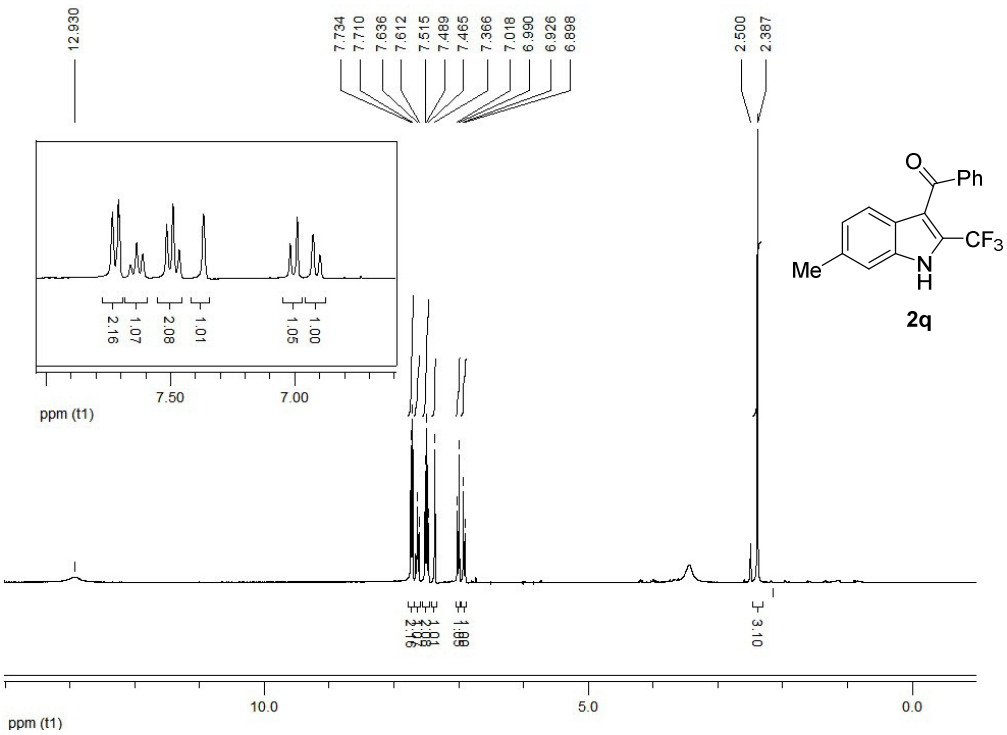

186.026
136.967
127.615
126.764
125.778
125.641
124.878
124.228
123.791
123.463
122.675
121.551
115.023
114.754
41.981
41.772
41.563
41.355
41.146
40.937
40.729
-0.754
O
TMS
CF3
N
H
2n
200
150
100
50
0
ppm (t1)


13.580
7.765
7.740
7.711
7.686
7.662
7.584
7.551
7.526
7.501
7.210
2.491
2.10
1.08
1.01
2.07
1.00
7.80 7.70 7.60 7.50 7.40 7.30 7.20
ppm (t1)
0.69
1.00
10.0
5.0
0.0
ppm (t1)
O
Ph
Cl
CF3
N
H
Cl
2o


191.730
139.796
135.641
133.338
131.081
130.640
130.237
129.850
129.460
129.356
129.074
128.329
126.460
123.358
120.959
120.669
120.427
118.430
42.018
41.809
41.600
41.392
41.183
40.975
40.766
200
150
100
50
0
ppm (t1)
O
Ph
Cl
CF3
N
H
Cl
2o


12.950
7.744
7.720
7.717
7.679
7.655
7.630
7.535
7.509
7.486
7.459
7.169
7.141
6.953
2.251
2.04
1.13
3.04
1.00
1.01
7.50
7.00
ppm (t1)
0.76
3.00
10.0
5.0
0.0
ppm (t1)
O
Ph
Me
CF3
N
H
2p


191.076
139.161
133.917
133.683
131.515
129.571
129.095
127.215
126.852
126.472
126.345
126.093
125.713
125.385
122.705
120.614
120.024
117.344
115.691
113.231
40.591
40.382
40.174
39.965
39.756
39.548
39.339
21.647
200
150
100
50
0
ppm (t1)
O
Ph
Me
CF3
N
H
2p


12.930
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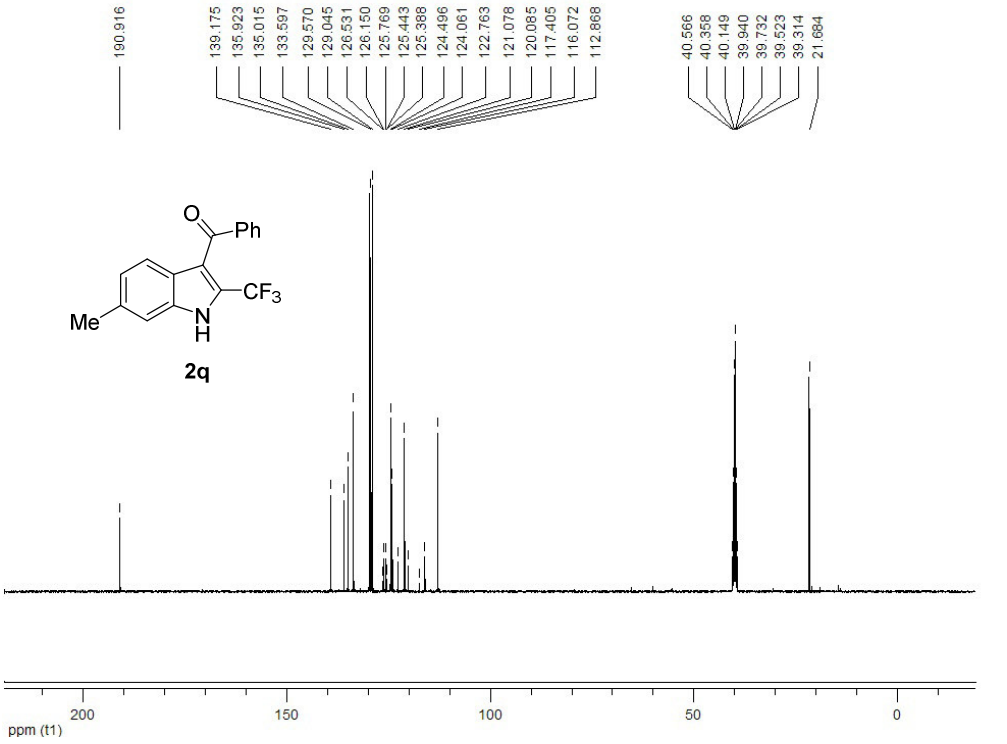
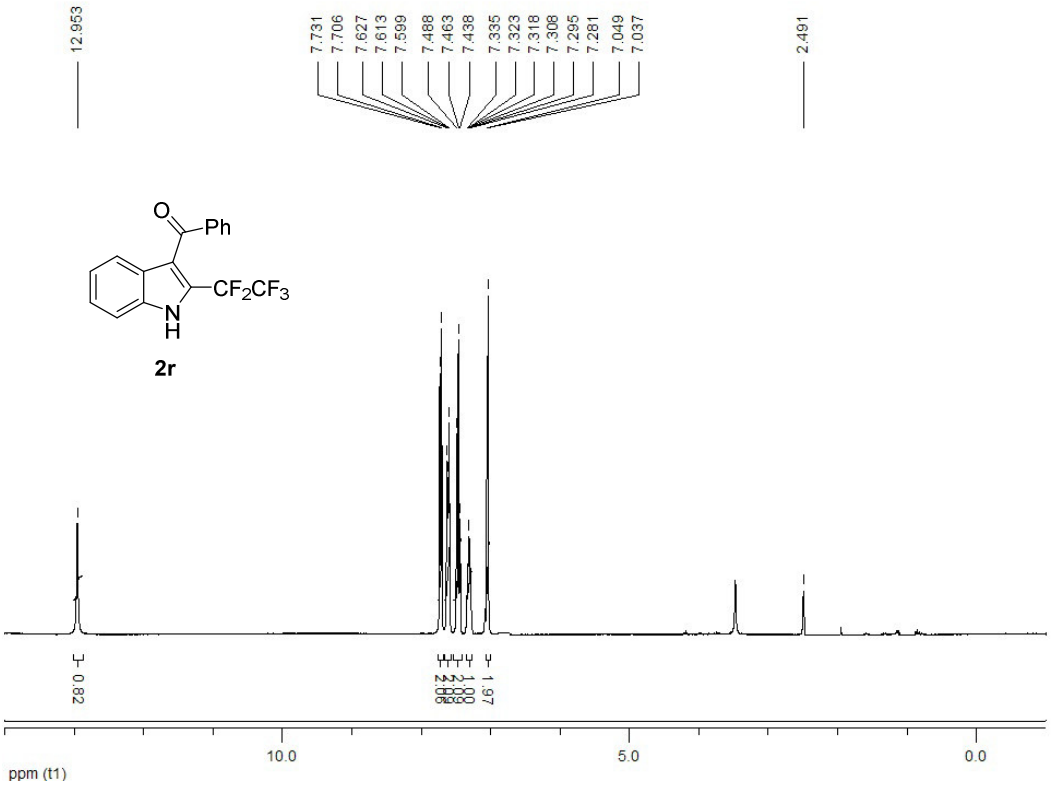
7.710
7.636
7.612
7.515
7.489
7.465
7.366
7.018
6.990
6.926
6.898
2.500
2.387
2.19
1.07
2.08
1.01
1.05
1.00
7.50
7.00
ppm (t1)
O
Ph
CF3
Me
N
H
2q
10.0
5.0
0.0
ppm (t1)


190.916
139.175
135.923
135.015
133.597
129.570
129.045
126.531
126.150
125.769
125.443
125.388
124.496
124.061
122.763
121.078
120.085
117.405
116.072
112.868
40.566
40.358
40.149
39.940
39.732
39.523
39.314
21.684
O
Ph
CF3
Me
N
H
2q
200
150
100
50
0
ppm (t1)


12.953
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7.706
7.627
7.613
7.599
7.488
7.463
7.438
7.335
7.323
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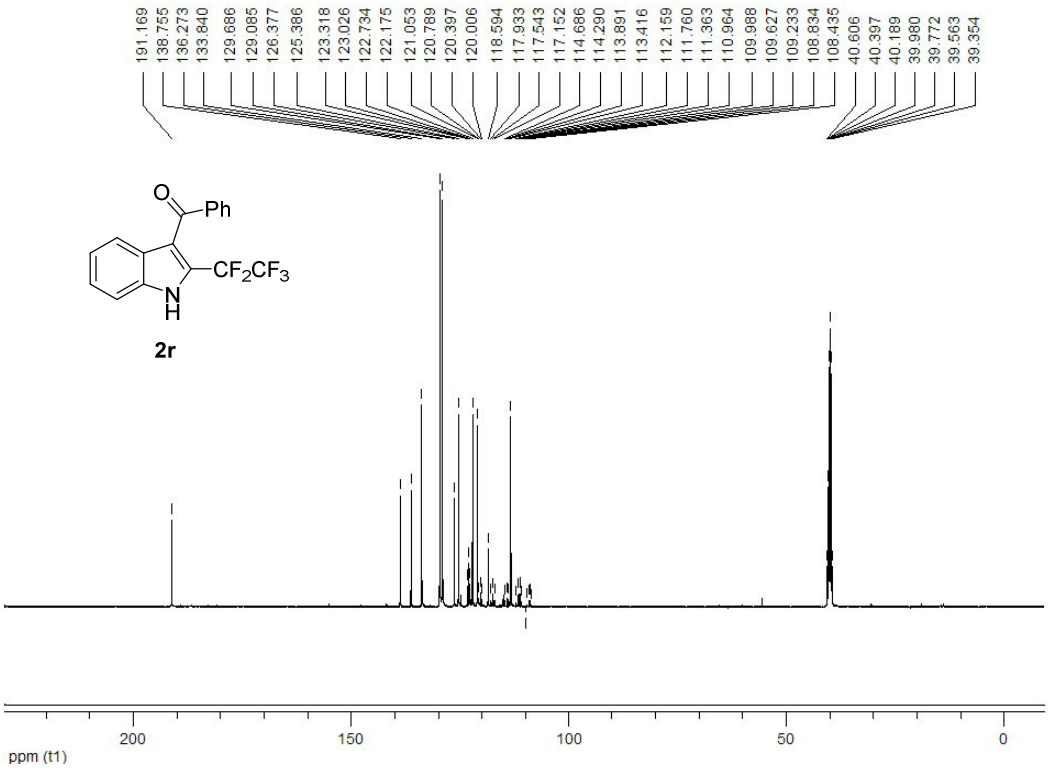
7.308
7.295
7.281
7.049
7.037
2.491
O
Ph
CF2CF3
N
H
2r
1.00
2.08
2.27
1.97
10.0
5.0
0.0
ppm (t1)


191.169
138.755
136.273
133.840
129.686
129.085
126.377
125.386
123.318
123.026
122.734
122.175
121.053
120.789
120.397
120.006
118.594
117.933
117.543
117.152
114.686
114.290
113.891
113.416
112.159
111.760
111.363
110.964
109.988
109.627
109.233
108.834
108.435
40.606
40.397
40.189
39.980
39.772
39.563
39.354
O
Ph
CF2CF3
N
H
2r
200
150
100
50
0
ppm (t1)