**Electronic Supplementary Information**

# Benzylic C–H trifluoromethylation of phenol derivatives

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## 1. General

$^{1}H$, $^{19}F$ NMR spectra were measured on a JEOL JNM-ECA-500 spectrometer at 500 and 470 MHz, respectively. $^{13}C$ NMR spectra were recorded on a JEOL JNM-ECA-500 spectrometer at 125 MHz. Chemical shifts were reported downfield from TMS ($\delta$ = 0 ppm) or $CDCl_3$ for $^{1}H$ NMR. For $^{13}C$ NMR, chemical shifts were reported in a scale relative to $CDCl_3$. For $^{19}F$ NMR, chemical shifts were reported in a scale relative to a $CFCl_3$ external standard ($\delta$ = 0 ppm). Infrared spectra were measured on a SHIMADZU IRPrestige-21 and only diagnostic absorptions are listed. ESI-MS and APCI-MS data were taken on a Bruker micrOTOF-QII$_{-RSL}$. EI-MS data were taken on a JEOL JMS-700V. Column chromatography was performed with silica gel N-60 (40-100 μm) purchased from Kanto Chemical Co., Inc. TLC analysis was performed on Silica gel 60 $F_{254}$-coated glass plates (Merck). Visualization of TLC plates was carried out by means of ultraviolet (UV) irradiation at 254 nm and/or by spraying 12-molybdo(VI)phosphoric acid ethanol solution as the developing agent.

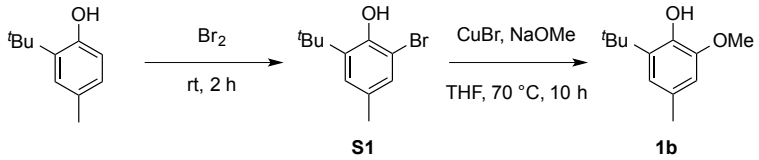
Dehydrated *N*,*N*-dimethylformamide (DMF), *N*-methylpyrrolidone (NMP), dimethylsulfoxide (DMSO), and dichloromethane ($CH_2Cl_2$) were purchased from Wako Pure Chemical Industries, Ltd. Dehydrated acetonitrile (MeCN) was purchased from Sigma-Aldrich Co. LLC., and dehydrated methanol (MeOH) was purchased from Kishida Chemical Co., Ltd. CuI, CuOAc, CuCl, $Cu(OAc)_2$, $Fe(OAc)_2$ were obtained from commercial sources, and used as received. Other reagents were purified by usual methods. Togni reagent was prepared according to literature procedures.[1]

[1] K. Stanek, R. Koller and A. Togni, *J. Org. Chem.*, 2008, **73**, 7678.

## 2. Preparation of substrates

All phenol derivatives were used as purchased from commercial sources or were prepared according to literature procedures.

### 2.1. 6-(*tert*-butyl)-2-methoxy-4-methylphenol (1b)




#### 2.1.1. Synthesis of S1[2]

To a solution of 2-*tert*-butyl-4-methylphenol (5.0 g, 30.4 mmol) in $CH_2Cl_2$ (76 mL) was added $Br_2$ (1.56 mL, 30.4 mmol, 1 equiv.) in one portion at 0 °C. After stirring for 2 h at room temperature, the reaction was quenched with aqueous $NaHCO_3$. The organic layer was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **S1** (7.42 g, quant.) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.39 (s, 9H), 2.25 (s, 3H), 5.62 (s, 1H), 7.00 (d, $J$ = 2.0 Hz, 1H), 7.15 ppm (d, $J$ = 2.0 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.5, 29.4, 35.2, 111.9, 127.3, 129.6, 130.2, 137.2, 148.1 ppm; IR ($CHCl_3$): 3512, 3007, 2965, 2922, 2870, 1570, 1474, 1447, 1393, 1364, 1329, 1277, 1196, 1175, 854, 835 cm$^{-1}$.

#### 2.1.2. Synthesis of 1b[3]

To a solution of **S1** (500 mg, 2.1 mmol) in THF (11 mL) were added CuBr (90.4 mg, 0.63 mmol, 0.3 equiv.), EtOAc (124 μL, 1.26 mmol, 0.6 equiv.), and a MeOH solution of NaOMe (0.42 mL, 5 M, 5 equiv.) at room temperature. After stirring for 10 h at 70 °C, the reaction was quenched with 1N HCl, and the organic materials were extracted with EtOAc. The organic layer

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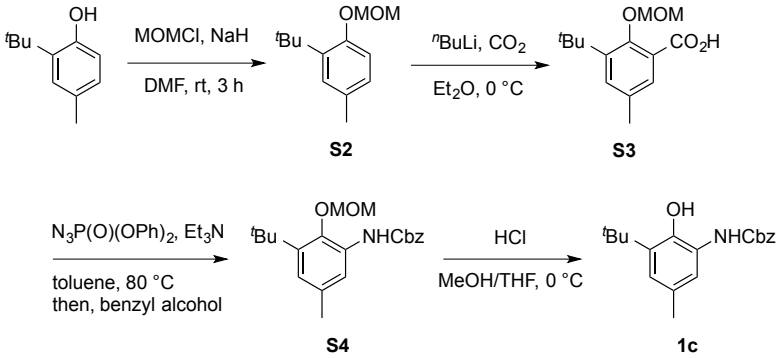
[2] M. Nabika, H. Katayama, T. Watanabe, H. Kawamura-Kuribayashi, K. Yanagi and A. Imai, *Organomet*., 2009, **28**, 3785.

[3] P. Cacioli and JA Reiss, *Australian J. Chem*., 1984, **37**, 2525.

was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 1/1) to provide **1b** (363 mg, 89%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.40 (s, 9H), 2.29 (s, 3H), 3.87 (s, 3H), 5.82 (s, 1H), 6.60 (s, 1H), 6.70 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 21.4, 29.4, 34.5, 56.1, 109.3, 119.3, 127.8, 135.1, 141.9, 146.4 ppm; IR ($CHCl_3$): 3530, 3007, 2959, 1595, 1487, 1456, 1360, 1152, 1072 cm$^{-1}$; HRMS (APCI$^-$): Calcd. for $[C_{12}H_{18}O_2–H]^-$: *m*/*z* = 193.1223, Found: 193.1230.

### 2.2. Benzyl (3-(*tert*-butyl)-2-hydroxy-5-methylphenyl) carbamate (1c)




### 2.2.1. Synthesis of S2[4]

To a suspension of NaH (1.11 g, 60% in oil, 27.7 mmol) in DMF (30 mL) was added a DMF solution (30 mL) of 2-*tert*-butyl-4-methylphenol (3.04 g, 18.5 mmol) at 0 °C. After stirring for 30 min, chloromethylmethylether (1.83 mL, 24 mmol) was added to the reaction mixture. After stirring for 3 h at room temperature, the reaction was quenched with 1N HCl at 0 °C. The mixture was extracted with *n*-hexane and the combined organic layers were dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **S2** (3.82 g, 99%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.39 (s, 9H), 2.29 (s, 3H), 3.50 (s, 3H), 5.20 (s, 2H), 6.96 (dd, *J* = 1.7, 8.5 Hz, 1H), 7.01 (d, *J* = 8.5 Hz, 1H), 7.10 ppm (d, *J* = 1.7 Hz, 1H); $^{13}$C NMR (125

[4] H. Hanaoka, Y. Imamoto, T. Hino and Y. Oda, *J. Organomet. Chem.*, 2006, **691**, 4968.

MHz, $CDCl_3$): $\delta$ = 20.8, 29.9, 34.8, 55.9, 94.2, 114.3, 127.2, 127.5, 130.3, 138.1, 154.0 ppm; IR ($CHCl_3$): 3007, 2957, 2924, 2910, 1497, 1159, 1144, 1072, 1013 $cm^{-1}$.

**2.2.3. Synthesis of S3**

To a solution of **S2** (500 mg, 2.4 mmol) in $Et_2O$ (10 mL) was added a *n*-BuLi solution in *n*-hexane (4.5 mL, 1.6 M, 7.2 mmol) at 0 °C. After stirring for 2 h, the mixture was cooled to − 78 °C. Carbon dioxide was bubbled to the reaction mixture. After stirring the reaction mixture for 20 min, the reaction was quenched with 1N HCl. The mixture was extracted with EtOAc, and the organic layer was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo*. The crude material was used without any further purification in the next step.

**2.2.3. Synthesis of S4**

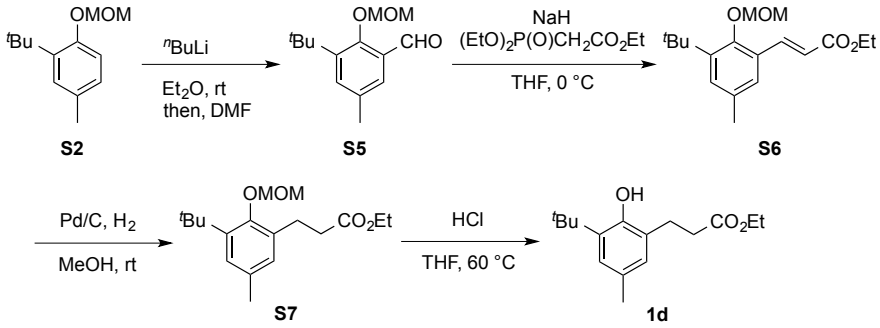
To a solution of **S3** (586 mg, 2.32 mmol) in toluene (9.9 mL) was added diphenylphosphoryl azide (0.62 mL, 2.9 mmol) over 5 min. Triethylamine (0.41 mL, 2.9 mmol) was then added to the reaction mixture over 3 min. After stirring for 30 min at 80 °C, benzyl alcohol (0.30 mL, 2.9 mmol) was added to the mixture. After stirring for 14 h at the same temperature, the reaction mixture was cooled to room temperature and concentrated *in vacuo*. The crude material was used without any further purification in the next step.

**2.2.4. Synthesis of 1c**

To a solution of **S4** (300 mg, 0.84 mmol) in THF/MeOH (2 mL/2 mL) was added 10% aqueous HCl solution (4.2 mL) at 0 °C. After stirring for 4 h at room temperature, the reaction was quenched with aqueous $NaHCO_3$. The mixture was extracted with EtOAc and the combined organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **1c** (242 mg, 98%) as a white solid.

$^1H$ NMR (500 MHz, $CDCl_3$): $\delta$ = 1.42 (s, 9H), 2.24 (s, 3H), 5.22 (s, 2H), 6.70 (brs, 1H), 6.77 (s, 1H), 6.94 (s, 1H), 7.35-7.40 ppm (m, 5H); $^{13}C$ NMR (125 MHz, $CDCl_3$): $\delta$ = 20.8, 29.8, 34.9, 68.0, 121.0, 124.9, 125.5, 128.4, 128.5, 128.6, 129.4, 135.5, 139.5, 145.3, 155.6 ppm; IR ($CHCl_3$): 3420, 3229, 2957, 2918, 1693, 1599, 1530, 1454, 1361, 1256, 1240, 1076, 961, 910, 854 $cm^{-1}$; HRMS ($ESI^+$): Calcd. for $[C_{10}H_{11}F_3O+H]^+$: $m/z$ = 314.1756, Found: 314.1748.

### 2.3. Ethyl 3-(3-(*tert*-butyl)-2-hydroxy-5-methylphenyl) propanoate (1d)




#### 2.3.1. Synthesis of S5

To a solution of **S2** (3.0 g, 14.4 mmol) in $Et_2O$ (72 mL) was added a *n*-BuLi solution in *n*-hexane (13.1 mL, 1.65 M, 21.6 mmol) at 0 °C. After stirring for 3 h at room temperature, DMF (1.37 mL, 17.3 mmol, 1.2 equiv.) was added to the reaction mixture at 0 °C. After stirring for 10 min at 0 °C, the reaction was quenched with aqueous $NH_4Cl$. The mixture was extracted with EtOAc. The organic layer was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 5/1) to provide **S5** (3.28 g, 97%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.42 (s, 9H), 2.34 (s, 3H), 3.62 (s, 3H), 5.00 (s, 2H), 7.39 (d, $J$ = 2.3 Hz, 1H), 7.51 (d, $J$ = 2.3 Hz, 1H), 10.20 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.8, 30.7, 34.8, 57.5, 102.3, 127.1, 130.5, 133.5, 134.1, 143.3, 158.0, 191.4 ppm; IR ($CHCl_3$): 3007, 2965, 2913, 2870, 1682, 1603, 1472, 1454, 1387, 1258, 1161, 1074, 953, 808 cm$^{-1}$; HRMS (ESI$^+$): Calcd. for $[C_{14}H_{20}O_3+Na]^+$: $m/z$ = 259.1310, Found: 259.1303.

#### 2.3.2. Synthesis of S6

To a suspension of NaH (406 mg, 60% in oil, 10.2 mmol, 1.2 equiv.) in THF (28 mL) was added triethyl phosphonoacetate (2.0 mL, 10.2 mmol, 1.2 equiv.) dropwise at 0 °C. After stirring for 30 min at 0 °C, a THF solution (10 mL) of **S5** (2.0 g, 8.46 mmol) was added to the reaction mixture. After additional stirring for 2 h at the same temperature, the reaction was quenched with water. The mixture was extracted with EtOAc and the combined organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **S6** (2.75 g, 88%) as a white solid.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.33 (t, $J$ = 7.5 Hz, 3H), 1.40 (s, 9H), 2.31 (s, 3H), 3.69 (s, 3H), 4.26 (q, $J$ = 7.5 Hz, 2H), 4.93 (s, 2H), 6.36 (d, $J$ = 16.0 Hz, 1H), 7.18 (s, 1H), 7.24 (s, 1H), 8.05 ppm (d, $J$ = 16.0 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 14.3, 21.0, 30.8, 34.9, 57.5, 60.3, 101.1, 118.1, 125.9, 128.7, 130.2, 133.1, 141.7, 143.2, 153.7, 167.0 ppm; IR ($CHCl_3$): 2965, 1701, 1634, 1466, 1437, 1400, 1368, 1263, 1163, 1074, 1042, 961, 860 cm$^{-1}$; HRMS (EI$^+$): Calcd. for $[C_{18}H_{26}O_4]^+$: $m/z$ = 306.1831, Found: 306.1834.

### 2.3.3. Synthesis of S7

Palladium on carbon (200 mg, 10 w/w %), ethanol (33 mL) and **S6** (2.0 g, 6.53 mmol) were added to the flask under nitrogen. After replacement of nitrogen with hydrogen, the mixture was stirred for 12 h at room temperature. Solid materials were removed by filtration and the filtrate was concentrated *in vacuo*. The residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **S7** (1.99 g, 99%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.25 (t, $J$ = 7.5 Hz, 3H), 1.39 (s, 9H), 2.27 (s, 3H), 2.61-2.64 (m, 2H), 2.99-3.02 (m, 2H), 3.64 (s, 3H), 4.14 (q, $J$ = 7.5 Hz, 2H), 4.96 (s, 2H), 6.87 (d, $J$ = 2.0 Hz, 1H), 7.01 ppm (d, $J$ = 2.0 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 14.2, 21.0, 26.7, 31.1, 34.9, 35.1, 57.1, 60.3, 100.2, 126.4, 128.9, 133.0, 134.1, 142.9, 152.9, 173.2 ppm; IR ($CHCl_3$): 2961, 1726, 1466, 1437, 1398, 1373, 974, 935 cm$^{-1}$; HRMS (ESI$^+$): Calcd. for $[C_{18}H_{28}O_4+Na]^+$: $m/z$ = 331.1885, Found: 331.1878.

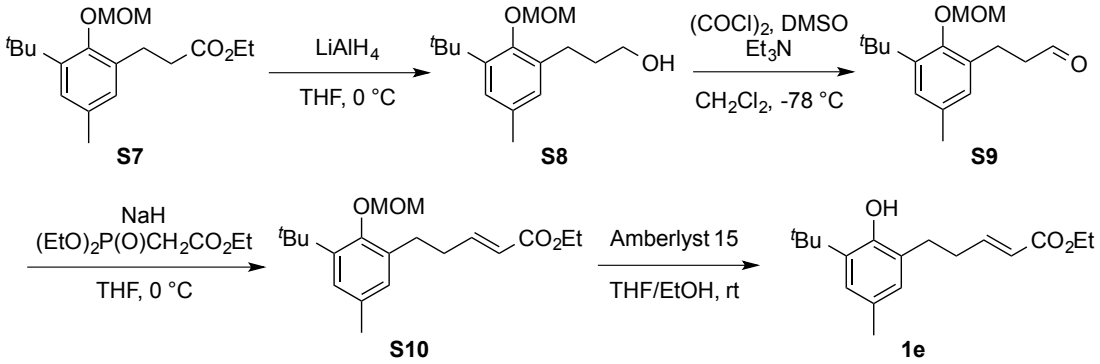
### 2.3.4. Synthesis of 1d

To a solution of **S7** (150 mg, 0.49 mmol) in THF (5 mL) was added 10% aqueous HCl solution (4.0 mL) at 0 °C. After stirring for 10 h at 60 °C, the reaction was quenched with aqueous $NaHCO_3$. The mixture was extracted with EtOAc and the combined organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **1d** (115 mg, 89%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.23 (t, $J$ = 6.8 Hz, 3H), 1.41 (s, 9H), 2.24 (s, 3H), 2.71-2.73 (m, 2H), 2.84-2.86 (m, 2H), 4.13 (q, $J$ = 6.8 Hz, 2H), 6.77 (d, $J$ = 1.8 Hz, 1H), 6.95 (d, $J$ = 1.8 Hz, 1H), 7.46 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 14.0, 20.8, 24.2, 29.8, 34.8, 35.8, 61.4, 126.0, 128.2, 128.6, 129.0, 138.1, 150.9, 176.2 ppm; IR ($CHCl_3$): 3337, 2959, 2914, 2872,

1709, 1476, 1447, 1412, 1240, 1194, 1167, 1051, 1015, 862 $cm^{-1}$; HRMS ($ESI^-$): Calcd. for $[C_{16}H_{24}O_3–H]^-$: $m/z$ = 263.1647, Found: 263.1645.

### 2.4. Ethyl (*E*)-5-(3-(*tert*-butyl)-2-hydroxy- 5-methylphenyl) pent-2-enoate (1e)




#### 2.4.1. Synthesis of S8

A solution of **S7** (1.0 g, 3.24 mmol) in THF (5 mL) was added to a suspension of $LiAlH_4$ (184 mg, 4.86 mmol, 1.5 equiv.) in THF (16 mL) at 0 °C. After stirring for 30 min at room temperature, the reaction was quenched with careful addition of $H_2O$ (0.72 mL) and 15% NaOH (0.18 mL). After filtration, the filtrate was poured into $Et_2O$ (30 mL) and washed with brine. The organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo*. The crude material was used without any further purification in the next step.

#### 2.4.2. Synthesis of S9

To a solution of $(COCl)_2$ (494 mg, 3.89 mmol) in $CH_2Cl_2$ was added DMSO (0.28mL, 3.9 mmol) at –78 °C. After stirring for 5 min, a solution of **S8** (871 mg, 3.27 mmol) in $CH_2Cl_2$ (5 mL) was added to the reaction mixture. The stirring was continued for an additional 15 min at –78 °C, followed by addition of $Et_3N$ (2.3 mL, 16.2 mmol) in one portion. After stirring for 10 min, the reaction mixture was allowed to warm up to room temperature. The reaction was quenched with aqueous $NH_4Cl$ and the mixture was extracted with EtOAc. The organic layer was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **S9** (822mg, 96% in 2 steps) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.38, (s, 9H), 2.27 (s, 3H), 2.75-2.79 (m, 2H), 3.02 (d, $J$ = 7.7 Hz, 2H), 3.61 (s, 3H), 4.95 (s, 2H), 6.86 (s, 1H), 7.02 (s, 1H), 9.82 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 21.0, 24.0, 31.2, 34.9, 44.7, 57.2, 100.3, 126.5, 129.0, 133.2, 133.9, 143.1, 153.0, 202.2 ppm; IR ($CHCl_3$): 3420, 2959, 2876, 2727, 1722, 1603, 1452, 1400, 1361, 1072, 864 cm$^{-1}$; HRMS (ESI$^+$): Calcd. for $[C_{16}H_{24}O_3+Na]^+$: $m/z$ = 287.1623, Found: 287.1616.

**2.4.3. Synthesis of S10**

To a suspension of NaH (91 mg, 60% in oil, 2.27 mmol, 1.2 equiv.) in THF (9.5 mL) was added triethyl phosphonoacetate (0.45 mL, 2.27 mmol, 1.2 equiv.) dropwise at 0 °C. After stirring for 30 min at 0 °C, a THF solution (4 mL) of **S9** (500 mg, 1.89 mmol) was added to the reaction mixture. After stirring for 5 h at 0 °C, the reaction was quenched with water. The mixture was extracted with EtOAc and the combined organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 15/1) to provide **S10** (619 mg, 98%) as a white solid.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.29 (t, $J$ = 7.5 Hz, 3H), 1.39 (s, 9H), 2.27 (s, 3H), 2.51 (dt, $J$ = 6.9, 8.0 Hz, 2H), 2.83 (t, $J$ = 8.0 Hz, 2H), 3.62 (s, 3H), 4.18 (q, $J$ = 7.5Hz, 2H), 4.94 (s, 2H), 5.86 (d, $J$ = 15.8 Hz, 1H), 6.87 (s, 1H), 7.01-7.06 ppm (m, 2H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 14.2, 21.0, 29.6, 31.1, 33.3, 34.9, 57.1, 60.1, 100.2, 121.4, 126.3, 128.9, 133.0, 134.4, 143.0, 148.6, 152.9, 166.7 ppm; IR ($CHCl_3$): 2959, 2930, 2872, 1709, 1653, 1466, 1437, 1398, 1369, 1273, 1161, 1072, 1036, 976, 935, 864 cm$^{-1}$; HRMS (ESI$^+$): Calcd. for $[C_{20}H_{30}O_4+Na]^+$: $m/z$ = 357.2042, Found: 357.2036.

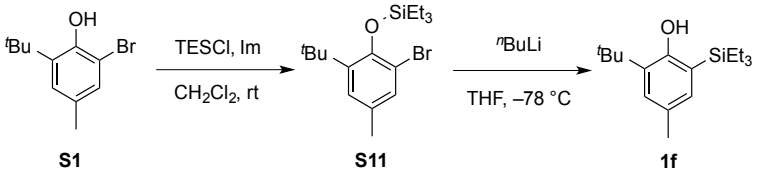
**2.4.4. Synthesis of 1e**

To a solution of **S10** (500 mg, 1.49 mmol) in THF/EtOH (4 mL/3.5 mL) was added Amberlyst 15 (100 mg) at room temperature. After stirring for 24 h at room temperature, the solid materials were removed by filtration and the filtrate was concentrated *in vacuo*. The residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 5/1) to provide **1e** (365 mg, 84%) as a white solid.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.29 (t, $J$ = 7.3 Hz, 3H), 1.41 (s, 9H), 2.26 (s, 3H), 2.49-2.54 (m, 2H), 2.69-2.73 (m, 2H), 4.19 (q, $J$ = 7.3 Hz, 2H), 4.73 (s, 1H), 5.86-5.89 (m, 1H), 6.81 (s, $J$ = 1.7 Hz, 1H), 6.96 (d, $J$ = 1.7 Hz, 1H), 7.04 ppm (td, $J$ = 6.9, 16.0 Hz, 1H); $^{13}$C NMR (125

MHz, $CDCl_3$): $\delta$ = 14.2, 20.8, 28.9, 30.0, 32.4, 34.2, 60.2, 121.9, 125.8, 126.9, 128.0, 129.2, 135.7, 148.1, 149.9, 166.6 ppm; IR ($CHCl_3$): 2959, 1709, 1456, 1447, 1369, 1317, 1271, 1172 $cm^{-1}$; HRMS ($ESI^-$): Calcd. for $[C_{18}H_{26}O_3–H]^-$: $m/z$ = 289.1804, Found: 289.1799.

### 2.5. 2-(*tert*-Butyl)-6-(triethylsilyl)-4-methylphenol (1f)




**S1** **S11** **1f**

#### 2.5.1. Synthesis of S11

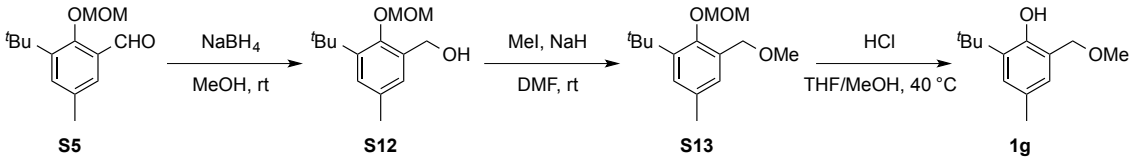
To a solution of **S1** (300 mg, 1.23 mmol) in $CH_2Cl_2$ (6.2 mL) were added chlorotriethylsilane (0.21 mL, 1.23 mmol, 1.0 equiv.) and imidazole (83.7 g, 1.23 mmol, 1.0 equiv.). After stirring for 1.5 h at room temperature, the reaction was quenched with aqueous $NH_4Cl$. The mixture was extracted with EtOAc and the combined organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo*. The crude material was used without any further purification in the next step.

#### 2.5.2. Synthesis of 1f

To a solution of **S11** (445 mg) in THF (10 mL) was added a *n*-BuLi solution in hexane (0.8 mL, 1.55 M, 1.23 mmol) at –78 °C. After stirring for 5h, the reaction was quenched with aqueous $NH_4Cl$. The mixture was extracted with EtOAc and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **1f** (305 mg, 89%, in 2 steps) as a colorless oil.

$^1H$ NMR (500 MHz, $CDCl_3$): $\delta$ = 0.83-0.89 (m, 6H), 0.98 (t, $J$ = 7.7 Hz, 9H), 1.42 (s, 9H), 2.27 (s, 3H), 4.88 (s, 1H), 6.97 (d, $J$ = 1.7 Hz, 1H), 7.09 ppm (d, $J$ = 1.7 Hz, 1H); $^{13}C$ NMR (125 MHz, $CDCl_3$): $\delta$ = 4.08, 7.61, 20.9, 30.1, 34.0, 122.8, 128.9, 129.0, 134.1, 134.4, 157.4 ppm; IR ($CHCl_3$): 3640, 3605, 3007, 2957, 2911, 2876, 1578, 1495, 1458, 1425, 1391, 1375, 1308, 1240, 1167, 1167, 1115, 1005, 931, 871, 849 $cm^{-1}$; HRMS ($ESI^-$): Calcd. for $[C_{17}H_{30}OSi–H]^-$: $m/z$ = 277.1988, Found: 277.1983.

### 2.6. 2-(*tert*-Butyl)-6-(methoxymethyl)-4-methylphenol (1g)




**S5** **S12** **S13** **1g**

#### 2.6.1. Synthesis of S12

To a solution of **S5** (500 mg, 2.12 mmol) in MeOH (11 mL) was added $NaBH_4$ (120 mg, 3.17 mmol, 1.5 equiv.) at 0 °C. After stirring for 1 h, the reaction was quenched with aqueous $NH_4Cl$. The mixture was extracted with EtOAc and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 5/1) to provide **S12** (501 mg, 99%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.38 (s, 9H), 2.30 (s, 3H), 3.69 (s, 3H), 4.56 (s, 2H), 4.97 (s, 2H), 7.10 (s, 1H), 7.11 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.9, 31.1, 34.8, 57.1, 61.5, 100.5, 128.0, 129.9, 133.7, 134.8, 142.7, 154.0 ppm; IR ($CHCl_3$): 3447, 3007, 2961, 2872, 1605, 1472, 1437, 1395, 1362, 1261, 1153, 1136, 1065, 1107, 980, 866 cm$^{-1}$; HRMS (EI$^+$): Calcd. for $[C_{14}H_{22}O_3]^+$: *m*/*z* = 238.1569, Found: 238.1565.

#### 2.6.2. Synthesis of S13

To a solution of **S12** (400 mg, 1.68 mmol) in DMF (5.6 mL) were added NaH (101 mg, 60% in oil, 2.52 mmol, 1.5 equiv.) and MeI (160 μL, 2.52 mmol, 1.5 equiv.) at 0 °C. After stirring for 2 h at room temperature, the reaction was quenched with 1N HCl. The mixture was extracted with EtOAc and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo*. The crude material was used without any further purification in the next step.

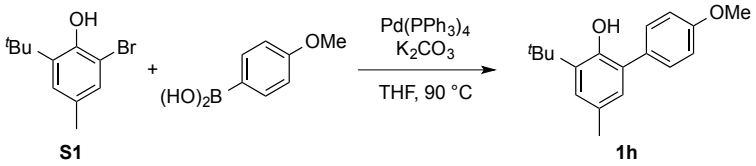
#### 2.6.3. Synthesis of 1g

To a solution of **S13** (412 mg) in THF/MeOH (4.2 mL/4.2 mL) was added 3N HCl (10 mL). After stirring for 12 h at 40 °C, the reaction mixture was neutralized with 1N NaOH. The reaction mixture was extracted with EtOAc and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column

chromatography on silica gel (*n*-hexane/EtOAc = 4/1) to provide **1g** (308 mg, 88% in 2steps) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.40 (s, 9H), 2.25 (s, 3H), 3.43 (s, 3H), 4.61 (s, 2H), 6.69 (d, *J* = 1.7 Hz, 1H), 7.04 (d, *J* = 1.7 Hz, 1H), 7.58 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.7, 29.6, 34.6 57.9, 74.7, 122.1, 126.8, 127.6, 128.0, 136.8, 153.1 ppm; IR ($CHCl_3$): 3368, 2953, 2922, 2866, 2828, 1481, 1474, 1373, 1360, 1148, 1078, 892 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{13}H_{20}O_2–H]^-$: *m*/*z* = 207.1385, Found: 207.1379.

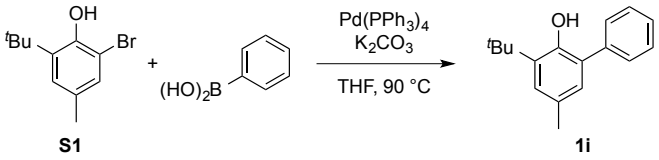
### 2.7. 2-(*tert*-Butyl)-4-methyl-6-(4'-methoxyphenyl)-phenol (1h)




To a flask containing $Pd(PPh_3)_4$ (127 mg, 0.11 mmol, 5 mol%), 4-methoxyphenylboronic acid (385 mg, 2.5 mmol, 1.2 equiv.), $Na_2CO_3$ (668 mg, 6.3 mmol, 3 equiv.) and **S1** (500 mg, 2.1 mmol) were added THF (7 mL) and $H_2O$ (2 mL). After stirring for 9 h at 90 °C, the reaction mixture was allowed to cool to room temperature and EtOAc (5 mL) was added to the reaction mixture. The reaction mixture was extracted with EtOAc, and the organic layer was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **1h** (488 mg, 86%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.43 (s, 9H), 2.30 (s. 3H), 3.86 (s, 3H), 5.26 (s, 1H), 6.87 (d, *J* = 1.7 Hz, 1H), 7.01 (d, *J* = 8.6 Hz, 2H), 7.07 (d, *J* = 1.7 Hz, 1H), 7.36 ppm (d, *J* = 8.6 Hz, 2H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.8, 29.6, 34.8, 55.2, 114.7, 126.9, 128.2, 128.4, 128.5, 129.4, 130.6, 135.8, 148.9, 159.2 ppm; IR ($CHCl_3$): 3545, 3007, 2959, 2913, 2866, 1609, 1512, 1466, 1443, 1420, 1393, 1362, 1288, 1244, 1177, 1034, 868, 837 cm$^{-1}$; HRMS (APCI$^-$): Calcd. for $[C_{18}H_{22}O_2–H]^-$: *m*/*z* = 269.1536, Found: 263.1540.

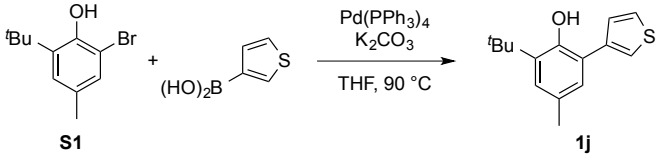
**2.8. 2-(*tert*-Butyl)-4-methyl-6-phenylphenol (1i)**




To a flask containing $Pd(PPh_3)_4$ (127 mg, 0.11 mmol, 5 mol%), phenylboronic acid (307 mg, 2.5 mmol, 1.2 equiv.), $Na_2CO_3$ (668 mg, 6.3 mmol, 3 equiv.) and **S1** (500 mg, 2.1 mmol) were added THF (7 mL) and $H_2O$ (2 mL). After stirring for 9 h at 90 °C, the reaction mixture was allowed to cool to room temperature and EtOAc (5 mL) was added to the reaction mixture. The mixture was extracted with EtOAc, and the organic layer was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **1i** (490 mg, 97%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.43 (s, 9H), 2.31 (s, 3H), 5.28 (s, 1H), 6.90 (d, $J$ = 1.7 Hz, 1H), 7.10 (d, $J$ = 1.7 Hz, 1H), 7.38-7.41 (m, 1H), 7.43-7.45 (m, 2H), 7.49 ppm (dd, $J$ = 6.9, 7.5 Hz, 2H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.8, 29.7, 34.8, 127.3, 127.9, 128.3, 128.6, 128.7, 129.4, 129.5, 136.0, 137.4, 148.7 ppm; IR ($CHCl_3$): 3551, 3007, 2961, 2918, 2870, 1601, 1497, 1468, 1454, 1429. 1362, 1329, 1256, 1194, 1163, 868, 806 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{17}H_{20}O–H]^-$: $m/z$ = 239.1436, Found: 239.1430.

**2.9. 6-(*tert*-Butyl)-4-methyl-2-(thiophen-3-yl)-phenol (1j)**




To a flask containing $Pd(PPh_3)_4$ (127 mg, 0.11 mmol, 5 mol %), 3-thienylboronic acid (320 mg, 2.5 mmol, 1.2 equiv.), $Na_2CO_3$ (668 mg, 6.3 mmol, 3 equiv.) and **S1** (500 mg, 2.1 mmol) were added THF (7 mL) and $H_2O$ (2 mL). After stirring for 9 h at 90 °C, the reaction mixture was allowed to cool to room temperature and EtOAc (5 mL) was added to the reaction mixture. The mixture was extracted with EtOAc, and the organic layer was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified

by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **1j** (373 mg, 72%) as a colorless oil.

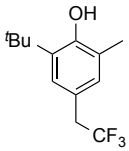
$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.44 (s, 9H), 2.31 (s, 3H), 5.45 (s, 1H), 6.96 (d, $J$ = 2.0 Hz, 1H), 7.09 (d, $J$ = 2.0 Hz, 1H), 7.21 (d, $J$ = 5.4 Hz, 1H), 7.39 (d, $J$ = 3.9 Hz, 1H), 7.50 ppm (dd, $J$ = 3.9, 5.4 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.8, 29.6, 34.8, 123.1, 123.4, 127.3, 128.0, 128.7, 128.7, 136.0, 137.8, 149.1 ppm; IR ($CHCl_3$): 3532, 3007, 2961, 2916, 1468, 1445, 1391, 1361, 1327, 1238, 1196, 1182, 864, 843 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{15}H_{18}OS–H]^-$: $m/z$ = 245.1000, Found: 245.0993.

## 3. Benzylic trifluoromethylation of phenol derivatives

### 3.1. Typical experimental procedure for the trifluoromethylation of phenol derivatives

CuI (3.8 mg, 10 mol %) and Togni reagent II (94.8 mg, 1.5 equiv.) were added to a Schlenk flask, which was flame-dried under vacuum. The flask was evacuated and back-filled with argon. DMF (1 mL) and **1a** (35.6 mg, 0.2 mmol) were then added to the flask. The reaction mixture was stirred at 40 °C and diluted with EtOAc. The solution was washed with aqueous $NaHCO_3$, and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 5/1) to provide **2a** (45.8 mg, 93%).

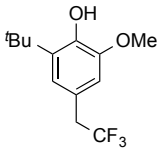
#### 3.2.1. 2-(*tert*-Butyl)-6-methyl-4-(2,2,2-trifluoroethyl)phenol (2a)




Colorless oil; 45.8 mg, 93%; $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.42 (s, 9H), 2.25 (s, 3H), 3.56 (q, $J$ = 11.1 Hz, 2H), 4.79 (s, 1H), 6.94 (s, 1H), 7.04 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 15.9, 29.6, 34.5, 39.7 (q, $J$ = 30.0 Hz), 121.3, 123.2, 126.0 (q, $J$ = 276.7 Hz) 127.0, 130.1, 135.8, 152.5 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.1 ppm (t, $J$ = 11.1 Hz); IR ($CHCl_3$): 3607,

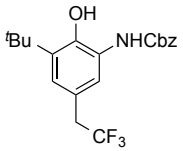
2959, 1601, 1483, 1435, 1360, 1300, 1285, 1260, 1177, 1136, 1086, 831, 696 $cm^{-1}$; HRMS ($ESI^-$): Calcd. for $[C_{13}H_{17}F_3O–H]^-$: $m/z$ = 245.1153, Found: 245.1150.

### 3.2.2. 6-(*tert*-Butyl)-2-methoxy-4-(2,2,2-trifluoroethyl)phenol (2b)



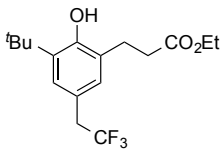

Colorless oil; 42.5 mg, 81%; $^1H$ NMR (500 MHz, $CDCl_3$): $\delta$ = 1.40 (s, 9H), 3.28 (q, $J$ = 11.1 Hz, 2H), 3.89 (s, 3H), 5.99 (s, 1H), 6.69 (s, 1H), 6.78 ppm (s, 1H); $^{13}C$ NMR (125 MHz, $CDCl_3$): $\delta$ = 29.3, 34.6, 40.2 (q, $J$ = 30.0 Hz), 56.1, 110.0, 120.2 (d, $J$ = 2.4 Hz), 121.2, 126.0 (q, $J$ = 275.0 Hz) 135.5, 144.1, 146.6 ppm; $^{19}F$ NMR (470 MHz, $CDCl_3$): $\delta$ = –66.1 ppm (t, $J$ = 11.1 Hz); IR ($CHCl_3$): 3528, 3034, 2961, 2909, 2870, 1599, 1491, 1433, 1377, 1362, 1153, 1138, 1086, 1072, 808, 691, 686 $cm^{-1}$; HRMS ($APCI^-$): Calcd. for $[C_{13}H_{17}F_3O_2–H]^-$: $m/z$ = 261.1097, Found: 261.1100.

### 3.2.3. *N*-Benzyloxycarbonyl-2-amino-6-(*tert*-butyl)-4-(2,2,2-trifluoroethyl)phenol (2c)



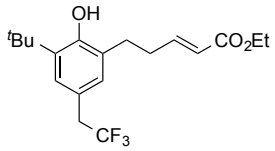

Colorless oil; 65.6 mg, 86%; $^1H$ NMR (500 MHz, $CDCl_3$): $\delta$ = 1.43 (s, 9H), 3.25 (q, $J$ = 11.1 Hz, 2H), 5.23 (s, 2H), 6.74 (s, 1 H), 6.91 (s, 1H), 7.03 (s, 1H), 7.35-7.41 ppm (m, 5H); $^{13}C$ NMR (125 MHz, $CDCl_3$): $\delta$ = 29.7, 35.0, 39.6 (q, $J$ = 30.0 Hz), 68.2, 121.7, 122.2, 125.8 (q, $J$ = 277.1 Hz) 125.8, 126.1, 128.4, 128.6, 128.7, 135.3, 139.9, 147.5, 155.7 ppm; $^{19}F$ NMR (470 MHz, $CDCl_3$): $\delta$ = –66.0 ppm (t, $J$ = 11.1 Hz); IR ($CHCl_3$): 3316, 2952, 1695, 1533, 1477, 1454, 1285, 1261, 1240, 1138, 1084 $cm^{-1}$; HRMS ($ESI^-$): Calcd. for $[C_{20}H_{22}F_3NO_3–H]^-$: $m/z$ = 380.1474, Found: 380.1466.

### 3.2.4. Ethyl 3-(3-(*tert*-butyl)-2-hydroxy-5-(2,2,2-trifluoroethyl)phenyl)propanoate (2d)



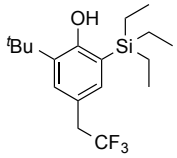
Colorless oil; 57.2 mg, 86%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.24 (t, $J$ = 7.2 Hz, 3H), 1.41 (s, 9H), 2.73-2.75 (m, 2H), 2.86-2.89 (m, 2H), 3.25 (q, $J$ = 11.1 Hz, 2H), 4.15 (q, $J$ = 7.2 Hz, 2H), 6.88 (d, $J$ = 1.7 Hz, 1H), 7.04 (d, $J$ = 1.7 Hz, 1H), 7.84 ppm (s, 1 H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 14.0, 24.3, 29.7, 34.9, 35.7, 39.7 (q, $J$ = 29.4 Hz), 61.6, 121.4, 126.0 (q, $J$ = 276.6 Hz) 127.3, 128.5, 129.9, 138.6, 153.2, 176.3 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.1 ppm (t, $J$ = 11.1 Hz); IR ($CHCl_3$): 3319, 2963, 2913, 1757, 1707, 1477, 1437, 1379, 1360, 1290, 1258, 1138, 1086, 1015 cm$^{-1}$; HRMS (ESI$^{+}$): Calcd. for $[C_{17}H_{23}F_3O_3+H]^{+}$: $m/z$ = 333.1678, Found: 333.1671.

### 3.2.5. Ethyl (*E*)-5-(3-(*tert*-butyl)-2-hydroxy-5-(2,2,2-trifluoroethyl)phenyl)pent-2-enoate (2e)




Colorless oil; 56.7 mg, 79%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.28 (t, $J$ = 7.2 Hz, 3H), 1.42 (s, 9H), 2.50-2.55 (m, 2H), 2.72-2.75 (m, 2H), 3.25 (q, $J$ = 10.5 Hz, 2H), 4.18 (q, $J$ = 7.2 Hz, 2H), 4.86 (s, 1H), 5.85 (d, $J$ = 15.5 Hz, 1H), 6.91 (s, 1H), 6.98-7.04 ppm (m, 2H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 14.2, 28.8, 29.9, 32.1, 34.3, 39.7 (q, $J$ = 29.4 Hz), 60.3, 121.6, 121.6, 122.1, 125.9 (q, $J$ = 277.1 Hz), 127.2, 129.3, 136.1, 147.7, 152.2, 166.6 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.1 ppm (t, $J$ = 10.5 Hz); IR ($CHCl_3$): 3602, 2963 ,1713, 1468, 1433, 1360, 1260, 1196, 1138, 1086 cm$^{-1}$; HRMS (ESI$^{+}$): Calcd. for $[C_{19}H_{25}F_3O_3+H]^{+}$: $m/z$ = 359.1834, Found: 359.1828.

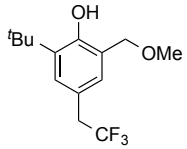
### 3.2.6. 6-(*tert*-Butyl)-2-triethylsilyl-4-(2,2,2-trifluoroethyl)phenol (2f)




Colorless oil; 40.9 mg, 59%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 0.87 (q, $J$ = 7.9 Hz, 6H), 1.00 (t, $J$ = 7.9 Hz, 9H), 1.44 (s, 9H), 3.29 (q, $J$ = 11.0 Hz, 2H), 5.10 (s, 1H), 7.09 (d, $J$ = 1.7 Hz, 1H), 7.19 ppm (d, $J$ = 1.7 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 4.0, 7.5, 30.0, 34.0, 39.8 (q, $J$ = 29.4 Hz), 121.6 (d, $J$ = 2.4 Hz), 123.3, 126.1 (q, $J$ = 276.6 Hz) 130.1, 134.8, 135.5, 159.4 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.1 ppm (t, $J$ = 11.0 Hz); IR ($CHCl_3$): 3638, 2959, 2913,

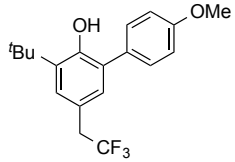
2856, 1497, 1458, 1360, 1267, 1152, 1138, 1119, 1084, 1107, 910 $cm^{-1}$; HRMS ($APCI^-$): Calcd. for $[C_{12}H_{15}F_3O–H]^-$ (The triethylsilyl group was removed by fragmentation under APCI conditions): *m*/*z* = 231.0991, Found: 231.0996.

### 3.2.7. 6-(*tert*-Butyl)-2-methoxymethyl-4-(2,2,2-trifluoroethyl)phenol (2g)



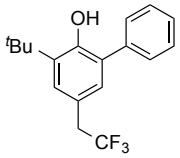

Colorless oil; 34.3 mg, 62%; $^1H$ NMR (500 MHz, $CDCl_3$): $\delta$ = 1.41 (s, 9H), 3.26 (q, *J* = 10.7 Hz, 2H), 3.45 (s, 3H), 4.64 (s, 2H), 6.82 (d, *J* = 1.2 Hz, 1H), 7.12 (d, *J* = 1.2 Hz, 1H), 7.87 ppm (s, 1H); $^{13}C$ NMR (125 MHz, $CDCl_3$): $\delta$ = 29.4, 34.7, 39.6 (q, *J* = 29.6 Hz), 58.2, 74.5, 120.5 (d, *J* = 3.6 Hz), 122.4, 125.9 (q, *J* = 277.1 Hz), 127.8, 128.9, 137.3, 155.3 ppm; $^{19}F$ NMR (470 MHz, $CDCl_3$): $\delta$ = –66.2 ppm (t, *J* = 10.7 Hz); IR ($CHCl_3$): 3356, 2957, 2870, 2830, 1605, 1481, 1437, 1360, 1298, 1141, 1088, 968, 943 $cm^{-1}$; HRMS ($ESI^-$): Calcd. for $[C_{14}H_{19}F_3O_2–H]^-$: *m*/*z* = 275.1259, Found: 275.1256.

### 3.2.8. 6-(*tert*-Butyl)-2-(4-methoxyphenyl)- 4-(2,2,2-trifluoroethyl)phenol (2h)



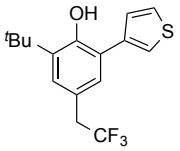

Colorless oil; 56.8 mg, 84%; $^1H$ NMR (500 MHz, $CDCl_3$): $\delta$ = 1.44 (s, 9H), 3.31 (q, *J* = 10.6 Hz, 2H), 3.87 (s, 3H), 5.46 (s, 1H), 6.99 (s, 1H), 7.04 (d, *J* = 8.6 Hz, 2H), 7.17 (s, 1H), 7.37 ppm (d, *J* = 8.6 Hz, 2H); $^{13}C$ NMR (125 MHz, $CDCl_3$): $\delta$ = 29.5, 34.9, 39.7 (q, *J* = 29.8 Hz), 55.4, 114.9, 121.2 (q, *J* = 2.4 Hz), 126.0 (q, *J* = 276.6 Hz) 128.2, 128.7 (q, *J* = 3.6 Hz), 129.6, 130.7, 136.4, 151.0, 159.6 ppm; $^{19}F$ NMR (470 MHz, $CDCl_3$): $\delta$ = –66.0 ppm (t, *J* = 10.6 Hz); IR ($CHCl_3$): 3009, 1607, 1514, 1466, 1435, 1360, 1319, 1281, 1254, 1138, 1088, 831 $cm^{-1}$; HRMS ($APCI^-$): Calcd. for $[C_{19}H_{21}F_3O_2–H]^-$: *m*/*z* = 337.1410, Found: 337.1395.

### 3.2.9. 6-(*tert*-Butyl)-2-phenyl-4-(2,2,2-trifluoroethyl)phenol (2i)



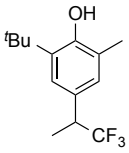

Colorless oil; 31.5 mg, 51%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.45 (s, 9H), 3.32 (q, $J$ = 11.1 Hz, 2H), 5.48 (s, 1H), 7.02 (d, $J$ = 1.4 Hz, 1H), 7.19 (d, $J$ = 1.4 Hz, 1H), 7.42-7.46 (m, 3H), 7.50-7.53 ppm (m, 2H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 29.5, 34.9, 39.7 (q, $J$ = 29.6 Hz), 121.3, 126.0 (q, $J$ = 277.1 Hz), 128.2, 128.5, 129.0, 129.3, 129.5, 129.5, 136.6, 136.7, 150.9 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.0 ppm (t, $J$ = 11.1 Hz); IR ($CHCl_3$): 3545, 2963, 2916, 2872, 1601, 1470, 1431, 1360, 1317, 1285, 1256, 1136, 1088, 1078, 908, 831, 808 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{18}H_{19}F_3O–H]^-$: $m/z$ = 307.1310, Found: 307.1305.

### 3.2.10. 6-(*tert*-Butyl)-2-(thiophen-3-yl)- 4-(2,2,2-trifluoroethyl)phenol (2j)




Colorless oil; 49.0 mg, 78%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.44 (s, 9H), 3.31 (q, $J$ = 10.9 Hz, 2H), 5.64 (s, 1H), 7.06 (d, $J$ = 2.3 Hz, 1H), 7.17 (d, $J$ = 2.3 Hz, 1H), 7.21 (dd, $J$ = 1.2, 4.9 Hz, 1H), 7.42 (dd, $J$ = 1.2, 2.9 Hz, 1H), 7.53 ppm (dd, $J$ = 2.9, 4.9 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 29.5, 34.9, 39.7 (q, $J$ = 29.4 Hz), 121.2, 121.2, 123.6, 123.8, 126.0 (q, $J$ = 275.1 Hz), 127.7, 128.6, 129.2, 136.6, 137.1, 151.2 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.1 ppm (t, $J$ = 10.9 Hz); IR ($CHCl_3$): 3526, 2923, 2914, 1468, 1137, 1362, 1283, 1258, 1138, 1182, 1088, 843 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{16}H_{17}F_3OS–H]^-$: $m/z$ = 313.0874, Found: 313.0862.

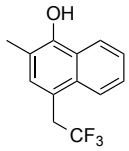
### 3.2.11. 2-(*tert*-Butyl)-6-methyl-4-(1,1,1-trifluoropropan-2-yl)phenol (2k)




Colorless oil; 27.6 mg, 53%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.41 (s, 9H), 1.47 (d, $J$ = 6.5 Hz, 3H), 2.25 (s, 3H), 3.28-3.35 (m, 1H), 4.77 (s, 1H), 6.96 (s, 1H), 7.05 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 14.8 (d, $J$ = 2.4 Hz), 16.0, 29.7, 34.5, 43.6 (q, $J$ = 27.6 Hz), 123.0, 125.5,

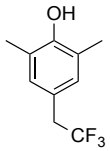
127.4 (q, $J$ = 279.5 Hz) 127.6, 128.2, 135.6, 152.4 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –71.6 ppm (d, $J$ = 8.5 Hz); IR ($CHCl_3$): 3625, 2959, 2934, 2872, 1670, 1601, 1483, 1435, 1387, 1261, 1165, 1125, 1094, 995, 880 cm$^{-1}$; HRMS (APCI$^-$): Calcd. for $[C_{14}H_{19}F_3O–H]^-$: $m/z$ = 259.1304, Found: 259.1312.

### 3.2.12. 2-Methyl-4-(2,2,2-trifluoroethyl)naphthalen-1-ol (2l)



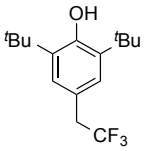

Colorless oil; 38.9 mg, 81%; $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.42 (s, 3H), 3.75 (q, $J$ = 11.0 Hz, 2H), 5.13 (s, 1H), 7.25 (s, 1H), 7.51-7.54 (m, 2H), 7.92 (d, $J$ = 8.5 Hz, 1H), 8.19-8.22 ppm (m, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 15.5, 36.3 (q, $J$ = 30.0 Hz), 115.6, 118.3, 121.7, 123.6, 124.6, 125.3, 126.1, 126.2 (q, $J$ = 277.5 Hz) 132.1, 132.6, 149.1 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –65.0 ppm (t, $J$ = 11.0 Hz); IR ($CHCl_3$): 3603, 2915, 1603, 1580, 1514, 1468, 1385, 1346, 1269, 1254, 1136, 1098, 1045, 937, 897, 833, 689, 648, 594 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{13}H_{11}F_3O–H]^-$: $m/z$ = 239.0684, Found: 239.0676.

### 3.2.13. 2,6-Dimethyl-4-(2,2,2-trifluoroethyl)phenol (2m)




Colorless oil; 29.4 mg, 72%; $^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.25 (s, 6H), 3.23 (q, $J$ = 10.9 Hz, 2H), 4.62 (s, 1H), 6.91 ppm (s, 2 H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 15.8, 39.4 (q, $J$ =28.8 Hz), 121.6 (d, $J$ = 2.4 Hz), 123.2, 125.9 (q, $J$ = 277.1 Hz) 130.3, 152.0 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.2 ppm (t, $J$ = 10.9 Hz); IR ($CHCl_3$): 3607, 2926, 1491, 1308, 1285, 1261, 1157, 1138, 1086 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{10}H_{11}F_3O–H]^-$: $m/z$ = 203.0684, Found: 203.0680.

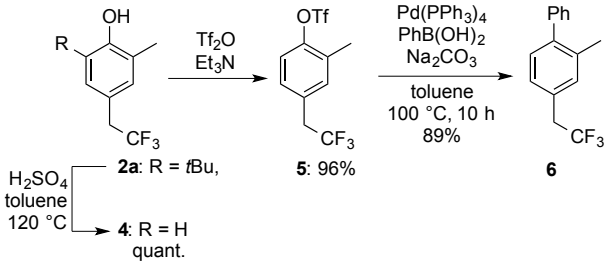
### 3.2.14. 2,6-di-*tert*-Butyl-4-(2,2,2-trifluoroethyl)phenol (2n)



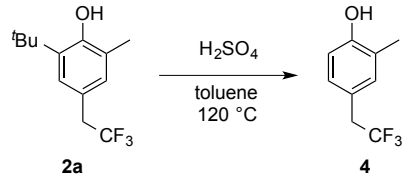
Colorless oil; 52.5 mg, 91%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.44 (s, 18H), 3.27 (q, $J$ = 11.1 Hz, 2H), 5.22 (s, 1H), 7.06 ppm (s, 2H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 30.2, 34.3, 40.1 (q, $J$ = 29.4 Hz), 120.9 (d, $J$ = 3.6 Hz), 126.1 (q, $J$ = 276.6 Hz), 126.8, 136.1, 153.6 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.1 ppm (t, $J$ = 11.1 Hz); IR ($CHCl_3$): 3690, 3640, 2961, 1601, 1437, 1358, 1285, 1260, 1138, 1086 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{16}H_{23}F_3O–H]^-$: $m/z$ = 287.1623, Found: 287.1618.

## 4. Applications of trifluoromethylated products

### 4.1. Further transformations of 2a




### 4.1.1. Removal of *tert*-butyl group

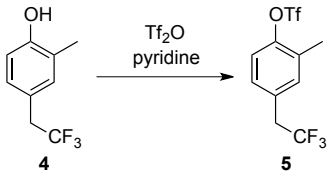



To a solution of **2a** (100 mg, 0.41 mmol) in toluene (4 mL) was added $H_2SO_4$ (1 drop). After stirring for 12 h at 120 °C, the mixture was cooled to room temperature. The reaction was quenched with saturated aqueous $Na_2CO_3$, and the reaction mixture was extracted with EtOAc

and the combined organic layers were dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 5/1) to provide **4** (78 mg, quant.) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.25 (s, 3H), 3.25 (q, $J$ = 10.9 Hz, 2H), 6.75 (d, $J$ = 7.9 Hz, 1H), 7.00 (d, $J$ = 7.9 Hz, 1H), 7.05 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 15.6, 29.8 (q, $J$ = 29.8 Hz), 115.1, 122.2, 124.1, 125.9 (q, $J$ = 277.0), 128.8, 132.8, 153.6 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.3 ppm (t, $J$ = 10.9 Hz); IR ($CHCl_3$): 3599, 3326, 2943, 1616, 1514, 1456, 1431, 1327, 1306, 1263, 1240, 1196, 1180, 1138, 1082, 949, 907, 810 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_9H_9F_3O–H]^-$: $m/z$ = 189.0527, Found: 189.0520.

### 4.1.2. Triflation of 4 to provide 5

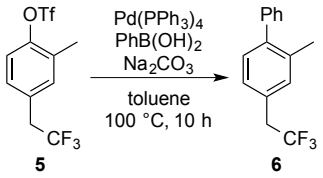


**4** **5**

To a solution of **4** (60 mg, 0.32 mmol) in $CH_2Cl_2$ (3.2 mL) was added pyridine (51 μL, 2.0 equiv.) and $Tf_2O$ (81 μL, 1.5 equiv.) at 0 °C. After stirring for 2 h, the reaction was quenched with water, followed by extraction of the reaction mixture with EtOAc and the combined organic layers were dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 20/1) to provide **5** (101 mg, 98%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.39 (s, 3H), 3.36 (q, $J$ = 11.0 Hz, 2H), 7.19-7.21 (m, 1H), 7.23-7.45 ppm (m, 2H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 16.3, 39.5 (q, $J$ = 31.0 Hz), 118.6 (q, $J$ = 320.7 Hz), 121.6, 125.4 (q, $J$ = 276.6 Hz), 129.4, 130.5 (d, $J$ = 2.4 Hz), 131.4, 133.9, 148.3 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –65.6 (t, $J$ = 11.0 Hz), –73.7 ppm (s); IR ($CHCl_3$): 1497, 1422, 1360, 1261, 1244, 1140, 1094, 949, 910, 880, 817 cm$^{-1}$; HRMS (EI$^+$): Calcd. for $[C_{10}H_8F_6O_3S]^+$: $m/z$ = 322.0098, Found: 322.0101.

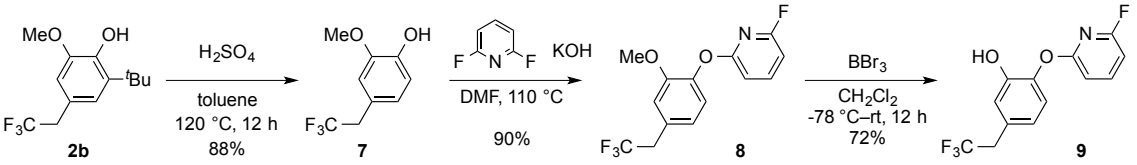
### 4.1.3. Suzuki-Miyaura coupling reaction of 5 to provide 6




$Pd(PPh_3)_4$ (11.6 mg, 5 mol%), phenylboronic acid (29.3 mg, 0.24 mmol), $Na_2CO_3$ (63.6 mg, 0.60 mmol) and **5** (64 mg, 0.20 mmol) were placed in a Schlenk flask. Toluene (2 mL) was added to the flask under an atmosphere of argon. After stirring for 10 h at 100 °C, the reaction mixture was allowed to cool to room temperature and EtOAc was added to the mixture. The reaction mixture was extracted with EtOAc, and the organic layer was washed with brine and dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 20/1) to provide **6** (101 mg, 98%) as a colorless oil.

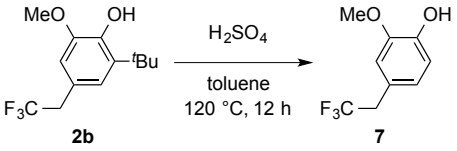
$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.29 (s, 3H), 3.39 (q, $J$ = 11.0 Hz, 2H), 7.18-7.24 (m, 3H), 7.32-7.38 (m, 3H), 7.41-7.44 ppm (m, 2H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 20.4, 39.9 (q, $J$ = 29.8 Hz), 125.8 (q, $J$ = 273.0 Hz), 126.9, 127.5, 128.1, 129.0 (d, $J$ = 3.6 Hz), 129.1, 130.1, 132.1, 135.8, 141.3, 141.8 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –65.6 ppm (t, $J$ = 11.0 Hz); IR ($CHCl_3$): 3032, 2011, 1485, 1443, 1433, 1358, 1260, 1138, 1084, 1011, 822 cm$^{-1}$; HRMS (EI$^+$): Calcd. for $[C_{15}H_{13}F_3]^+$: $m/z$ = 250.0969, Found: 250.0961.

### 4.2. Synthesis of compound 9[5]




[5] V. Gerusz, A. Denis, F. Faivre, Y. Bonvin, M. Oxoby, S. Briet, G. LeFralliec, C. Oliveira, N. Desroy, C. Raymond, L. Peltier, F. Moreau, S. Escaich, M. Vongsouthi, S. Floquet, E. Drocourt, A. Walton, L. Prouvensier, M. Saccomani, L. Durant, J.-M. Genevard, V. Sam-Sambo and C. Soulama-Mouze, *J. Med. Chem.*, 2012, **55**, 9914.

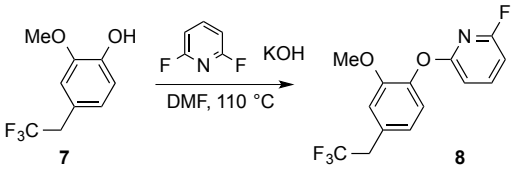
### 4.2.1. Removal of *tert*-butyl group of 2b




To a solution of **2b** (150 mg, 0.57 mmol) in toluene (5 mL) was added $H_2SO_4$ (1 drop). After stirring for 12 h at 120 °C, the mixture was cooled to room temperature. The reaction was quenched with saturated aqueous $Na_2CO_3$, followed by extraction of the reaction mixture with EtOAc and the combined organic layers were dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 5/1) to provide **7** (103 mg, 88%) as a colorless oil.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 3.29 (q, $J$ = 11.0 Hz, 2H), 3.90 (s, 3H), 5.60 (s, 1 H), 6.78-6.80 (m, 2H), 6.89 ppm (d, $J$ = 7.9 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 39.8 (q, $J$ = 28.6 Hz), 55.9, 112.4, 114.5, 121.8, 123.3, 125.9 (q, $J$ = 276.6 Hz), 145.6, 146.5 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –66.2 ppm (t, $J$ = 11.0 Hz); IR ($CHCl_3$): 3543, 2941, 2849, 1609, 1518, 1464, 1454, 1435, 1376, 1302, 1277, 1261, 1155, 1138, 1128, 1084, 1036 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_9H_9F_3O_2–H]^-$: $m/z$ = 205.0476, Found: 205.0472.

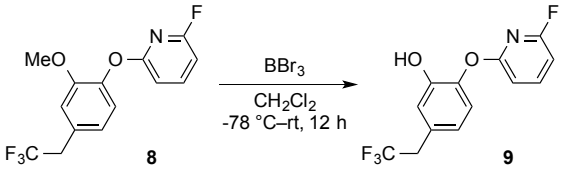
### 4.2.2. Reaction of 7 with 2,6-difluoropyridine to provide 8




To a solution of **7** (50 mg, 0.24 mmol) in DMF (2 mL) was added KOH (13.6 mg, 0.24 mmol, 1.0 equiv.) at ambient temperature. After stirring for 30 min. at 0 °C, 2,6-difluoropyridine (18.9 μL, 0.26 mmol, 1.1 equiv.) was added to the reaction mixture. After stirring for 12 h at 110 °C, the reaction was quenched with aqueous $NH_4Cl$ at room temperature. The reaction mixture was extracted with EtOAc, and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (hexane/ethyl acetate = 5/1) to provide **8** (64 mg, 90%) as a colorless solid.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 3.38 (q, $J$ = 10.9 Hz, 2H), 3.77 (s, 3H), 6.57 (dd, $J$ = 2.8, 7.9 Hz, 1H), 6.74 (dd, $J$ = 1.7, 7.9 Hz, 1H), 6.91-6.92 (m, 2H), 7.11 (d, $J$ = 8.5 Hz, 1H), 7.73 ppm (dd, $J$ = 7.9, 15.9 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 40.0 (q, $J$ = 29.8 Hz), 55.9, 102.1 (d, $J$ = 35.8 Hz), 106.6 (d, $J$ = 4.8 Hz), 114.7, 122.9 (d, $J$ = 14.3 Hz), 125.7 (q, $J$ = 277.8 Hz), 128.3 (d, $J$ = 2.4 Hz), 141.8, 143.2 (d, $J$ = 8.3 Hz), 151.6, 161.1, 162.3 (d, $J$ = 13.1 Hz), 163.0 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –65.7 (t, $J$ = 10.9 Hz, 3F), –68.5 ppm (d, $J$ = 7.3 Hz, 1F); IR ($CHCl_3$): 1605, 1578, 1512, 1441, 1360, 1312, 1275, 1260, 1157, 1128, 1086, 1005 cm$^{-1}$; HRMS (ESI$^+$): Calcd. for $[C_{14}H_{11}F_4NO_2+H]^+$: $m/z$ = 302.0804, Found: 302.0794.

### 4.2.3. Demethylation of 8

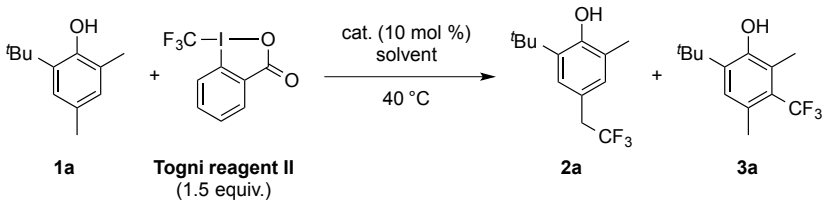



To a solution of **8** (50 mg, 0.17 mmol) in $CH_2Cl_2$ (1 mL) was added a $BBr_3$ solution in $CH_2Cl_2$ (1.7 mL, 1.0 M, 10 equiv.) at −78 °C. After stirring for 12 h at 0 °C, the reaction was quenched with MeOH, and the reaction mixture was concentrated *in vacuo*. The crude residue was diluted with EtOAc, washed with aqueous $NaHCO_3$, and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (*n*-hexane/EtOAc = 7/1) to provide **9** (35.2 mg, 72%) as a colorless solid.

$^1$H NMR (500 MHz, $CDCl_3$): $\delta$ = 3.34 (q, $J$ = 10.9 Hz, 2H), 6.06 (s, 1 H), 6.68 (dd, $J$ = 2.8, 7.9 Hz, 1H), 6.82-6.86 (m, 2H), 7.03 (d, $J$ = 1.7 Hz, 1H), 7.10 (d, $J$ = 7.9 Hz, 1H), 7.81 ppm (dd, $J$ = 7.9, 15.9 Hz, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 39.7 (q, $J$ = 29.8 Hz), 103.4 (d, $J$ = 33.4 Hz), 107.3 (d, $J$ = 4.8 Hz), 119.6, 121.9, 122.6, 125.6 (q, $J$ = 277.6 Hz), 128.6, 140.9, 144.1 (d, $J$ = 8.3 Hz), 148.0, 161.0, 161.5 (d, $J$ = 13.1 Hz) 163.0 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –65.7 (t, $J$ = 10.9 Hz, 3F), –67.6 ppm (d, $J$ = 7.3 Hz, 1F); IR ($CHCl_3$): 3566, 2945, 1607, 1582, 1508, 1441, 1362, 1310, 1260, 1238, 1140, 1121, 1003 cm$^{-1}$; HRMS (ESI$^+$): Calcd. for $[C_{13}H_9F_4NO_2+H]^+$: $m/z$ = 288.0648, Found: 288.0641.

## 5. Aromatic trifluoromethylation of phenol derivatives

### 5.1. Screening of reaction conditions



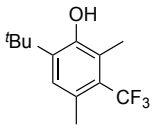

**1a** **Togni reagent II** (1.5 equiv.) **2a** **3a**

| Entry | Catalyst | Solvent | Yield of **2a** [%] | Yield of **3a** [%] | Recovery of **1a** [%] |
|---|---|---|---|---|---|
| 1 | CuI | MeOH | 5 | 23 | 53 |
| 2 | CuOAc | MeOH | 16 | 26 | 58 |
| 3 | $[(MeCN)_4Cu]PF_6$ | MeOH | <5 | 32 | 60 |
| 4 | $Cu(OAc)_2$ | MeOH | 18 | 28 | 47 |
| 5 | $[(MeCN)_4Cu]PF_6$ | *i*-PrOH | trace | 6 | 89 |
| **6** | **$[(MeCN)_4Cu]PF_6$** | ***t*-BuOH** | **6** | **54** | **34** |

### 5.2. Typical experimental procedure for aromatic trifluoromethylation

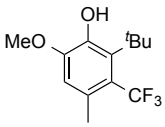
$[(MeCN)_4Cu]PF_6$ (7.5 mg, 10 mol %) and Togni reagent II (94.8 mg, 1.5 equiv.) were added to a Schlenk flask, which was flame-dried under vacuum. The flask was evacuated and back-filled with argon. *t*-BuOH (1 mL) and **1a** (35.6 mg, 0.2 mmol) were then added to the reaction mixture. The reaction mixture was stirred at 40 °C and diluted with EtOAc. The solution was washed with aqueous $NaHCO_3$, and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was purified by column chromatography on silica gel (hexane/ethyl acetate = 5/1) to provide **3a** (26.6 mg, 54%) as a colorless oil.

#### 5.3.1. 6-(*tert*-butyl)-2,4-dimethyl-3-(trifluoromethyl)phenol (3a)



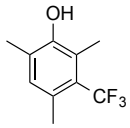
Colorless oil; 26.6 mg, 54%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.41 (s, 9H), 2.33 (q, $J$ = 2.3 Hz, 3H), 2.41 (q, $J$ = 4.0 Hz, 3H), 6.99 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 12.5 (d, $J$ = 3.6 Hz), 21.7 (d, $J$ = 4.8 Hz), 29.5, 34.5, 122.8, 125.8 (q, $J$ = 275.9 Hz), 125.9 (q, $J$ = 28.8 Hz), 128.1, 128.7, 138.7, 151.2 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –52.9 ppm (m); IR ($CHCl_3$): 3611, 2961, 2874, 1483, 1456, 1435, 1410, 1391, 1304, 1288, 1165, 1134, 1115, 1024, 978 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{13}H_{17}F_3O–H]^-$: $m/z$ = 245.1153, Found: 245.1147. HSQC and HMBC spectra were attached in section 7.

**5.3.2. 2-(*tert*-butyl)-6-methoxy-4-methyl-3-(trifluoromethyl)phenol (3b)**



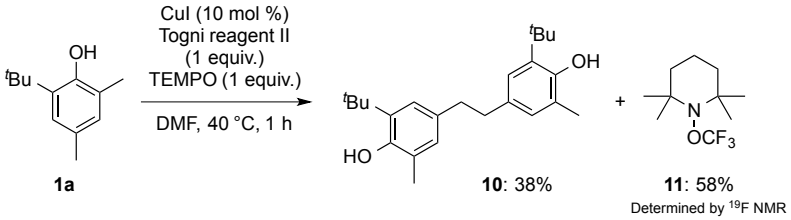

Colorless oil; 25.2 mg, 48%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 1.53 (s, 9H), 2.41 (q, $J$ = 4.0 Hz, 3H), 3.90 (s, 3H), 6.09 (s, 1H), 6.53 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 21.8 (q, $J$ = 4.8 Hz), 31.0 (d, $J$ = 2.4 Hz), 38.3, 56.1, 110.3, 121.2 (q, $J$ = 30.2 Hz), 125.7 (q, $J$ = 275.0 Hz), 130.3 (d, $J$ = 2.4 Hz), 136.6, 143.8, 147.6 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –46.8 ppm (m); IR ($CHCl_3$): 3609, 2961, 1410, 1304, 1288, 1165, 1134, 1115, 1024 cm$^{-1}$; Anal. Calcd for $C_{13}H_{17}F_3O_2$: C, 59.53%; H, 6.53%. Found: C, 59.66%; H, 6.56%. HSQC and HMBC spectra were attached in section 7.

**5.3.3. 2,4,6-trimethyl-3-(trifluoromethyl)phenol (3m)**




Colorless oil; 20.4 mg, 50%; $^{1}$H NMR (500 MHz, $CDCl_3$): $\delta$ = 2.24 (s, 3H), 2.34 (q, $J$ = 2.3 Hz, 3H), 2.38 (q, $J$ = 3.6 Hz, 3H), 4.64 (s, 1H), 6.85 ppm (s, 1H); $^{13}$C NMR (125 MHz, $CDCl_3$): $\delta$ = 12.5 (q, $J$ = 3.6 Hz), 16.0, 21.1 (q, $J$ = 4.8 Hz), 123.1, 125.8 (q, J = 275.9 Hz), 126.1, 126.2 (q, $J$ = 28.8 Hz), 128.5, 132.0, 150.7 ppm; $^{19}$F NMR (470 MHz, $CDCl_3$): $\delta$ = –52.9 ppm (m); IR ($CHCl_3$): 3609, 1487, 1456, 1315, 1254, 114, 1115, 1001 cm$^{-1}$; HRMS (ESI$^-$): Calcd. for $[C_{10}H_{11}F_3O–H]^-$: $m/z$ = 203.0684, Found: 203.0679.

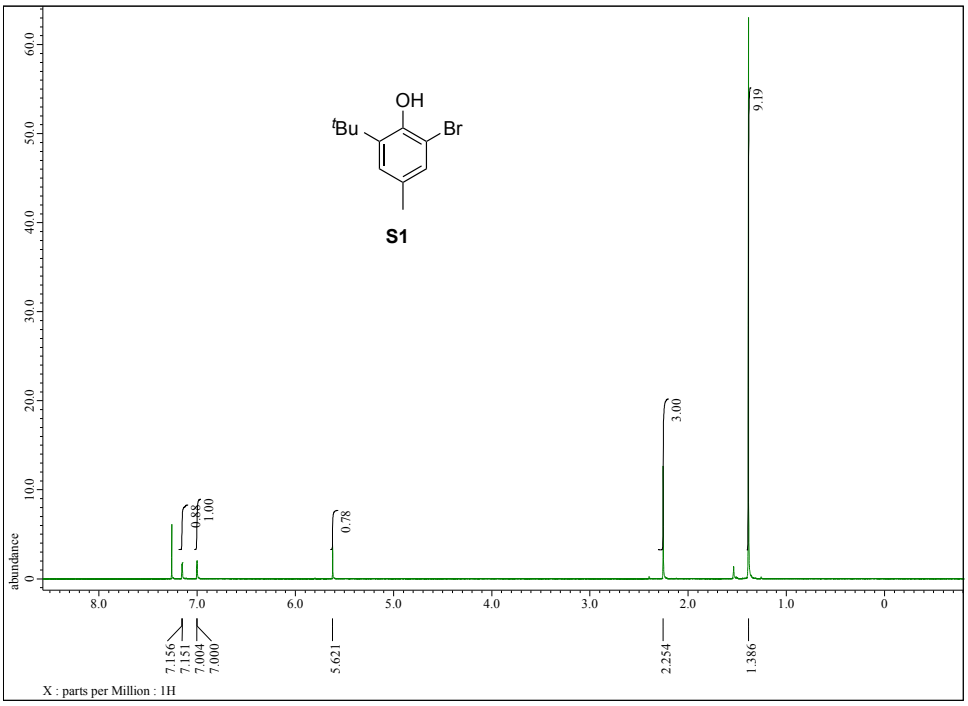
## 7. The reaction in the presence of TEMPO

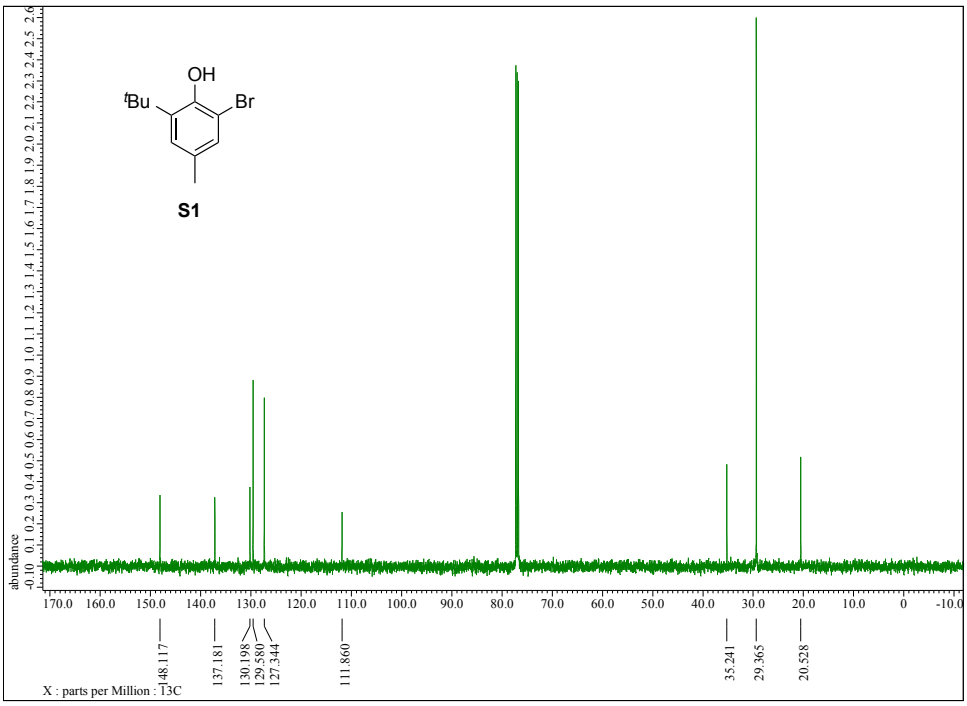


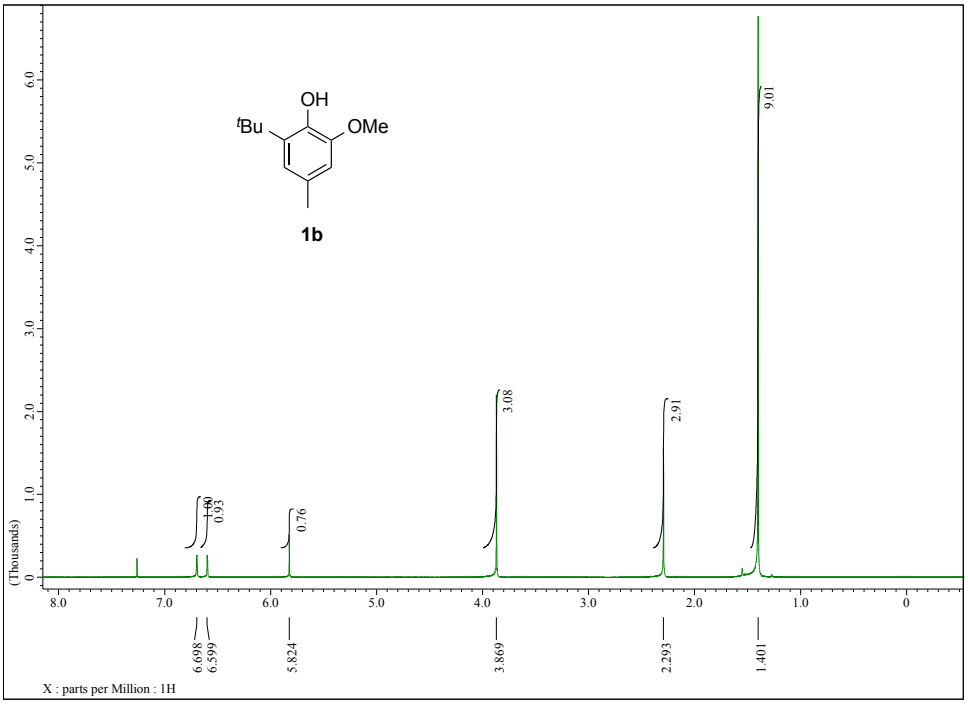

CuI (3.8 mg, 10 mol %), Togni reagent II (63.2 mg, 1.0 equiv.) and TEMPO (31.3 mg, 1.0 equiv.) were added to a Schlenk flask, which was flame-dried under vacuum. The flask was evacuated and back-filled with argon. DMF (1 mL) and **1a** (35.6 mg, 0.2 mmol) were then added to the reaction mixture. The reaction mixture was stirred at 40 °C for 1 h and diluted with EtOAc. The solution was washed with aqueous $NaHCO_3$, and the organic layer was dried over $MgSO_4$. After filtration, the filtrate was concentrated *in vacuo* and the residue was submitted to $^{19}F$ NMR analysis to determine the yield of **11** using α,α,α-trifluorotoluene as an internal standard. The residue was then purified by column chromatography on silica gel (*n*-hexane/EtOAc = 10/1) to provide **10** (13.5 mg, 38%).

Colorless oil; $^1H$ NMR (500 MHz, $CDCl_3$): $\delta$ = 1.40 (s, 18H), 2.23 (s, 6H), 2.76 (s, 4H), 4.61 (s, 2H), 6.84 (d, $J$ = 2.0 Hz, 2H), 6.93 ppm (d, $J$ = 2.0 Hz, 2H); $^{13}C$ NMR (125 MHz, $CDCl_3$): $\delta$ = 16.0, 29.8, 34.5, 37.9, 122.8, 125.1, 128.4, 133.3, 135.3, 150.7 ppm; IR ($CHCl_3$): 3609, 2957, 2860, 1601, 1481, 1435, 1362, 1196 $cm^{-1}$; HRMS ($ESI^-$): Calcd. for $[C_{24}H_{34}O_2–H]^-$: $m/z$ = 353.2481, Found: 353.2477.

## 7. NMR spectra

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tBu
OMe
1b
9.01
3.08
2.91
1.00
0.93
0.76
(Thousands)
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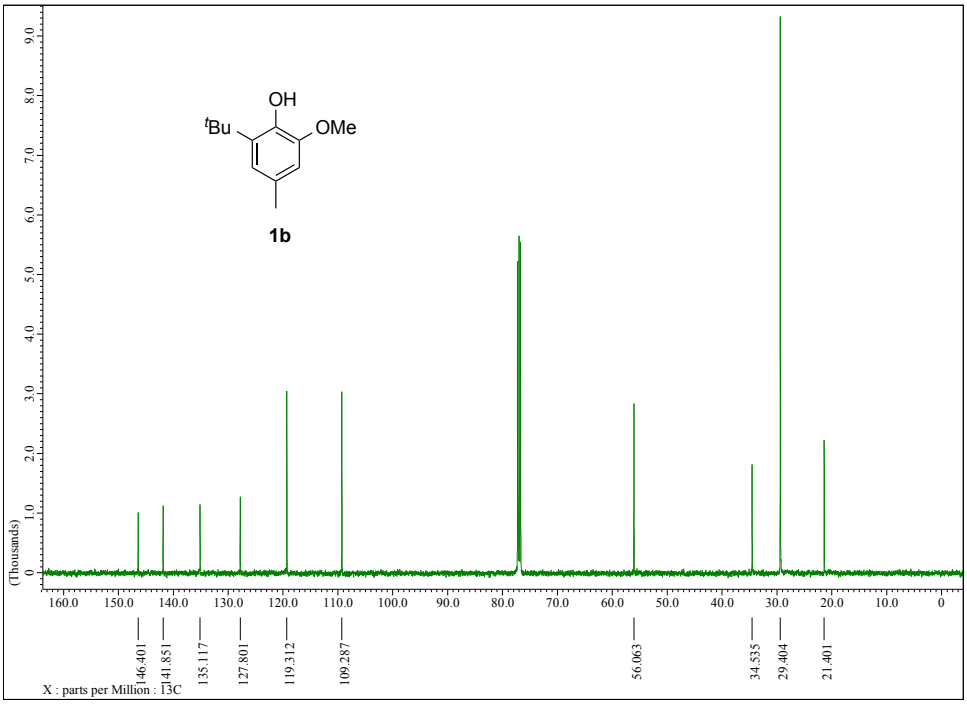
6.599
5.824
3.869
2.293
1.401
X : parts per Million : 1H


OH
tBu
OMe
1b
(Thousands)
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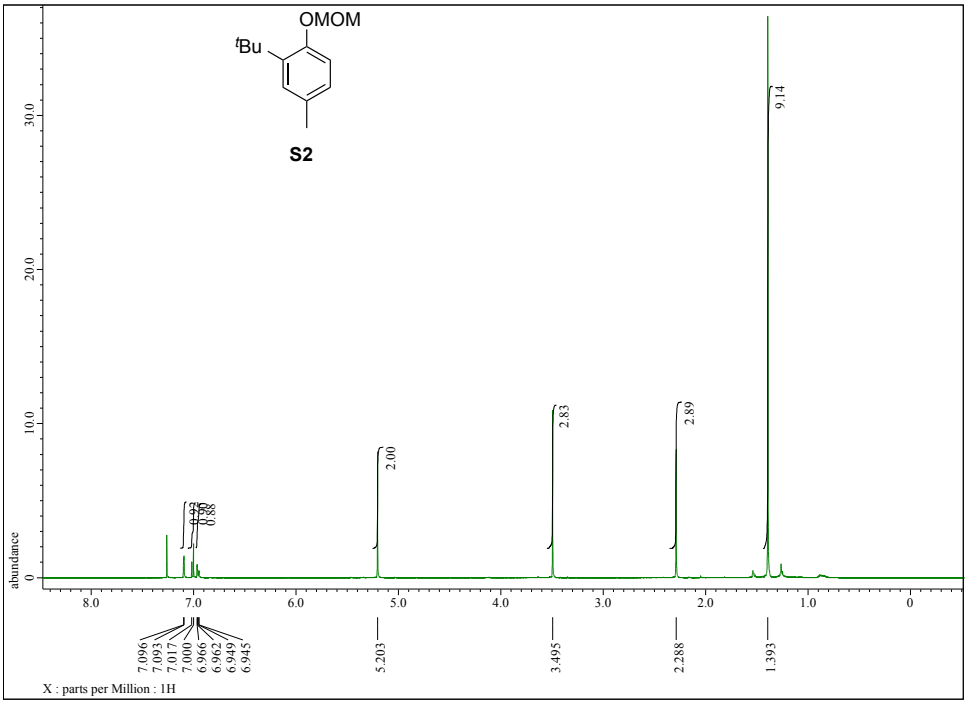
109.287
56.063
34.535
29.404
21.401
X : parts per Million : 13C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tBu
S2
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2.83
2.00
7.096
7.093
7.017
7.000
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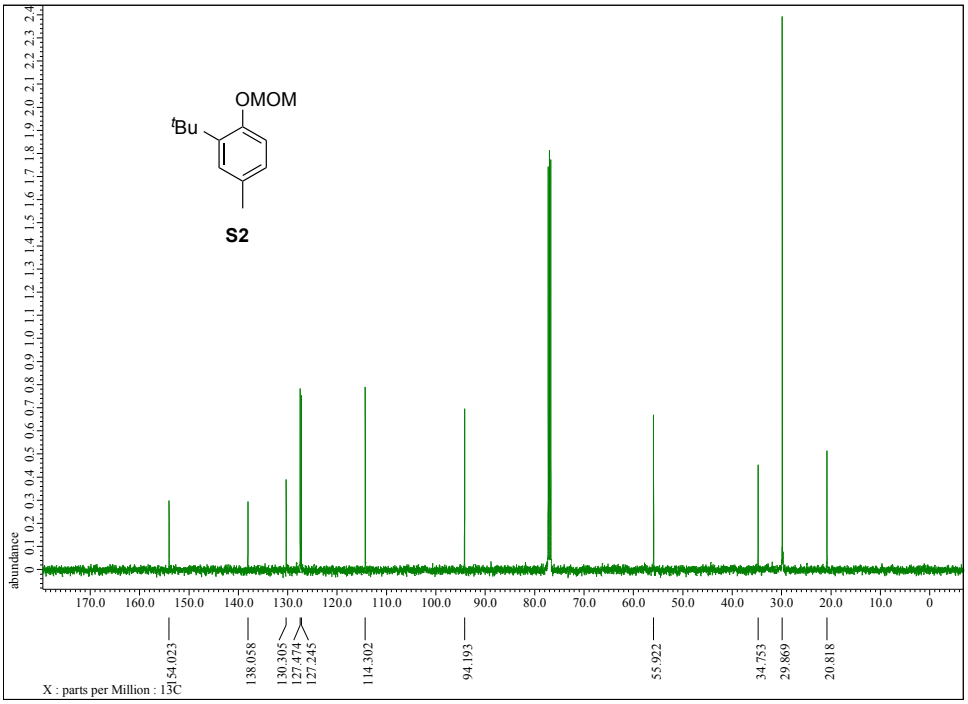
6.962
6.949
6.945
5.203
3.495
2.288
1.393
X : parts per Million : 1H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tBu
S2
abundance
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130.305
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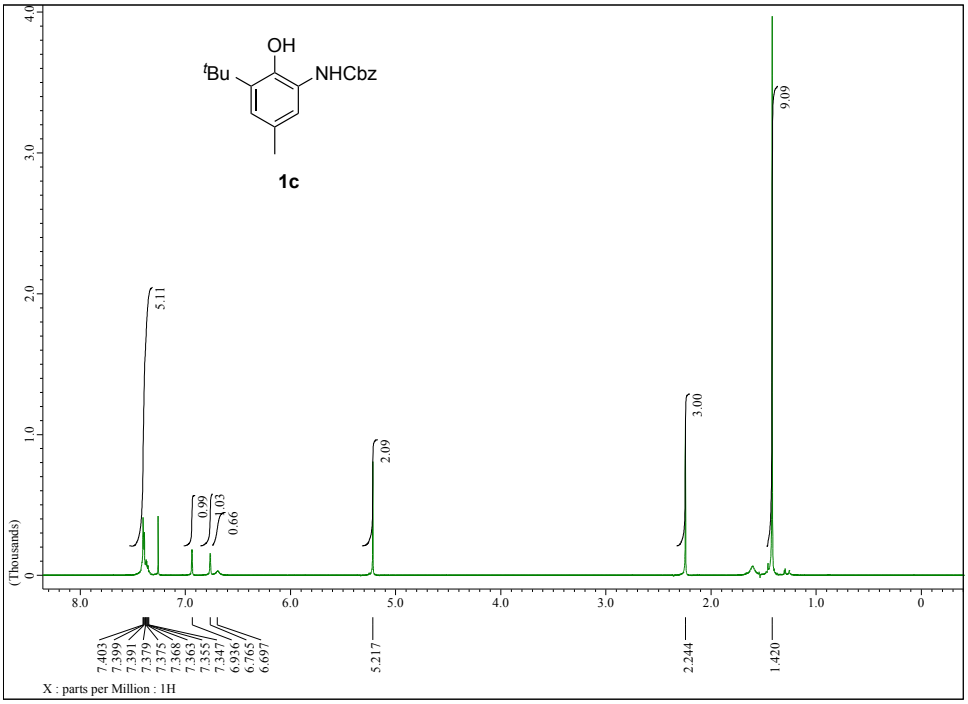
127.245
114.302
94.193
55.922
34.753
29.869
20.818
X : parts per Million : 13C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tBu
NHCbz
1c
(Thousands)
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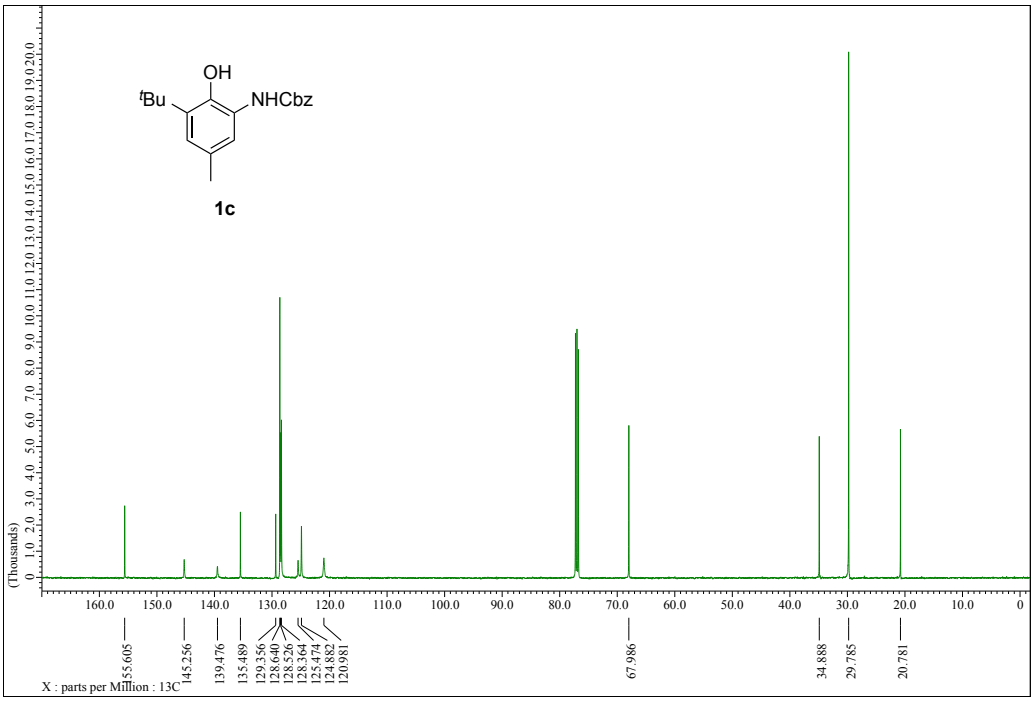
0.99
1.03
0.66
2.09
3.00
9.09
7.403
7.399
7.391
7.379
7.375
7.368
7.363
7.355
7.347
6.936
6.765
6.697
5.217
2.244
1.420
X : parts per Million : 1H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NHCbz
1c
(Thousands)
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135.489
129.356
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128.526
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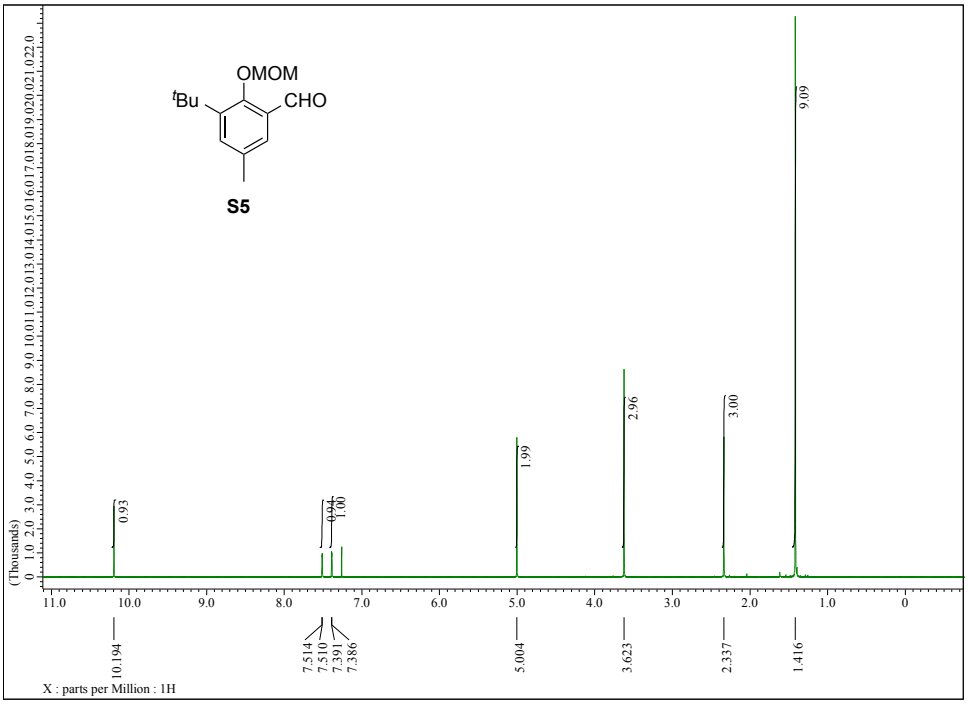
125.474
124.882
120.981
67.986
34.888
29.785
20.781
X : parts per Million : 13C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CHO
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(Thousands)
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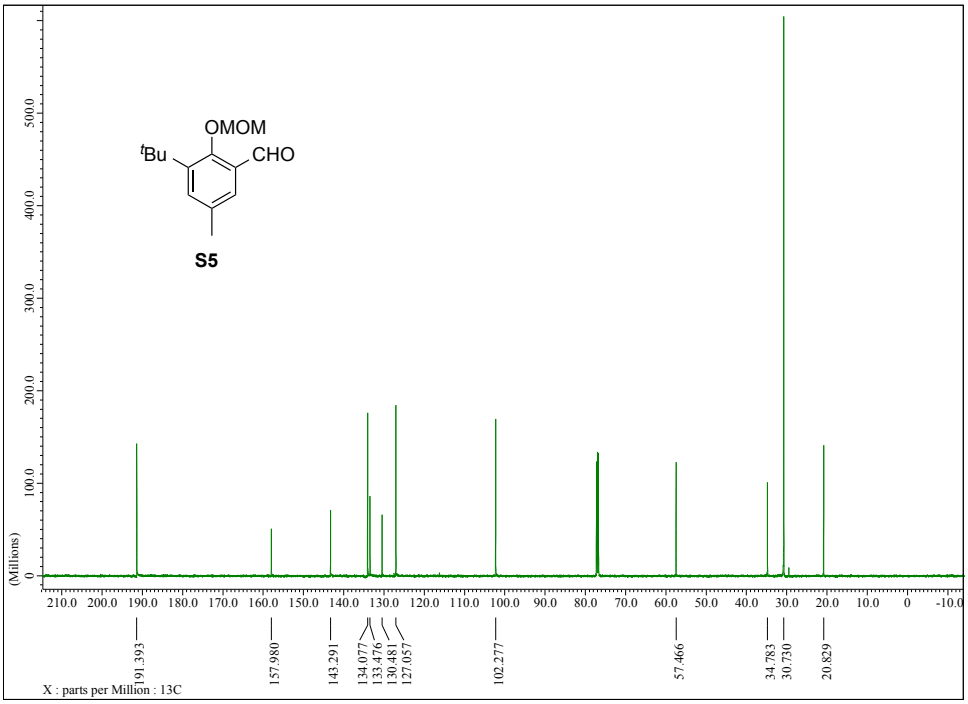
X : parts per Million : 1H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CHO
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(Millions)
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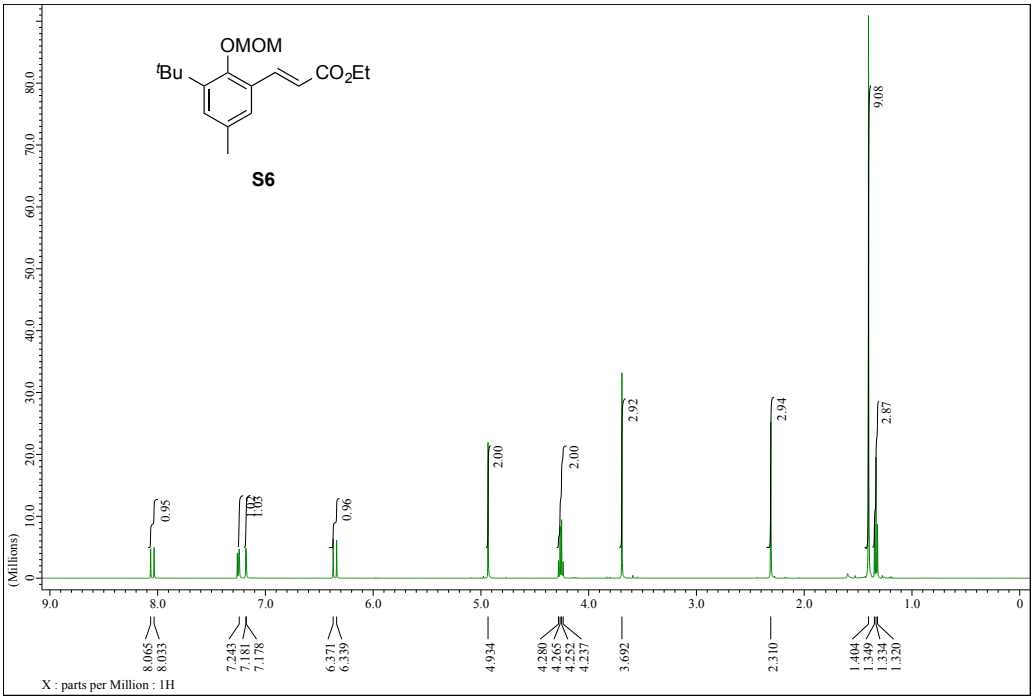
57.466
34.783
30.730
20.829
X : parts per Million : 13C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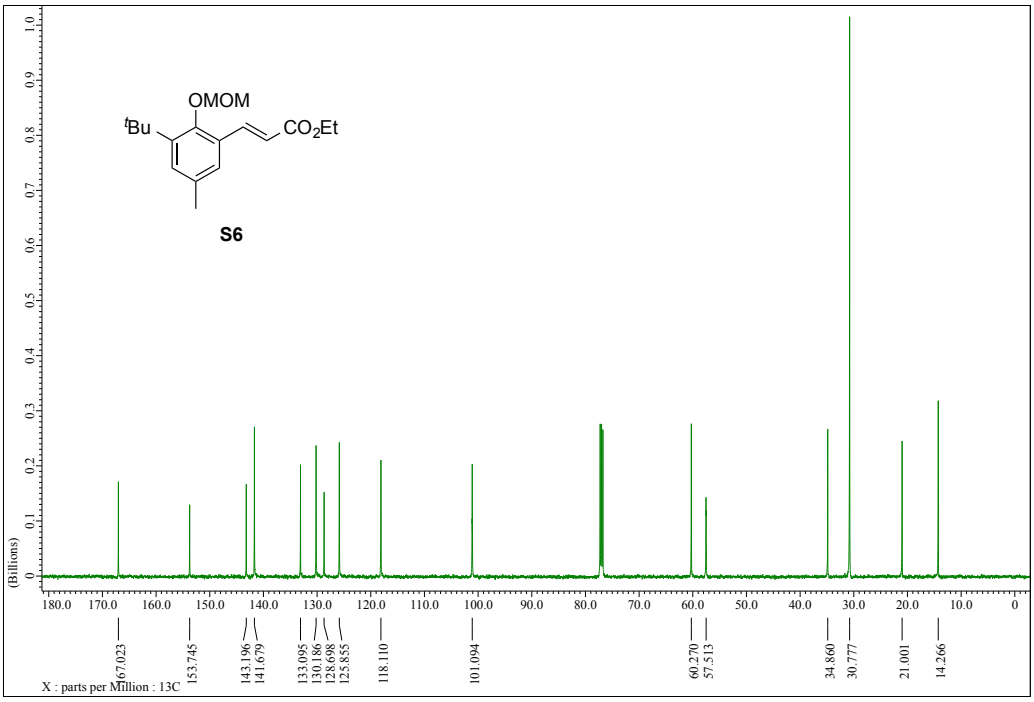
tBu
CO2Et
S6
(Millions)
X : parts per Million : 1H


OMOM
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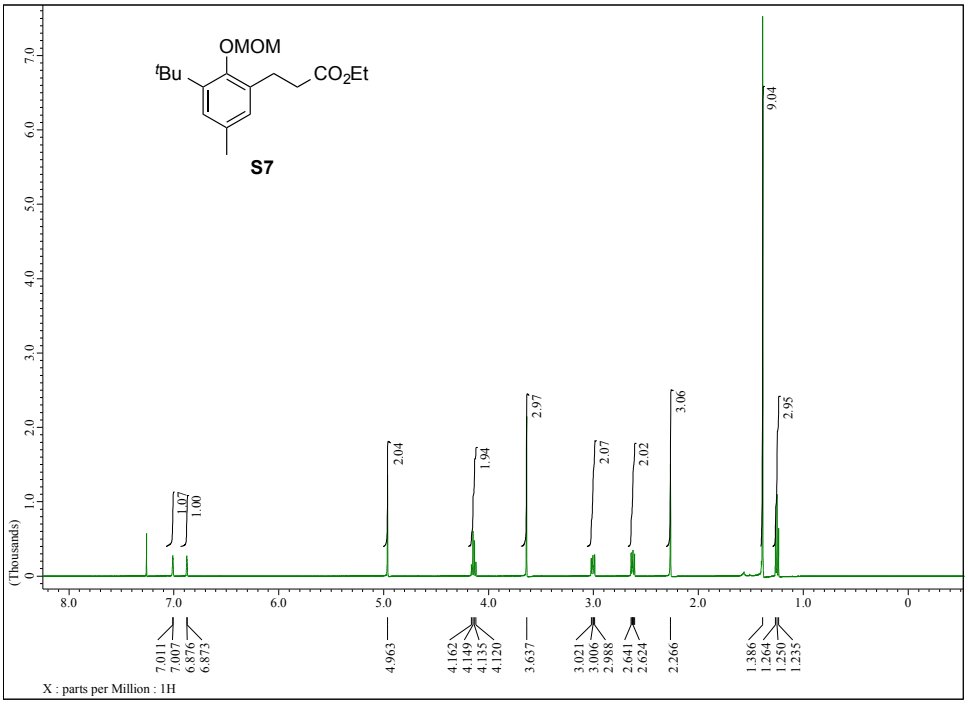
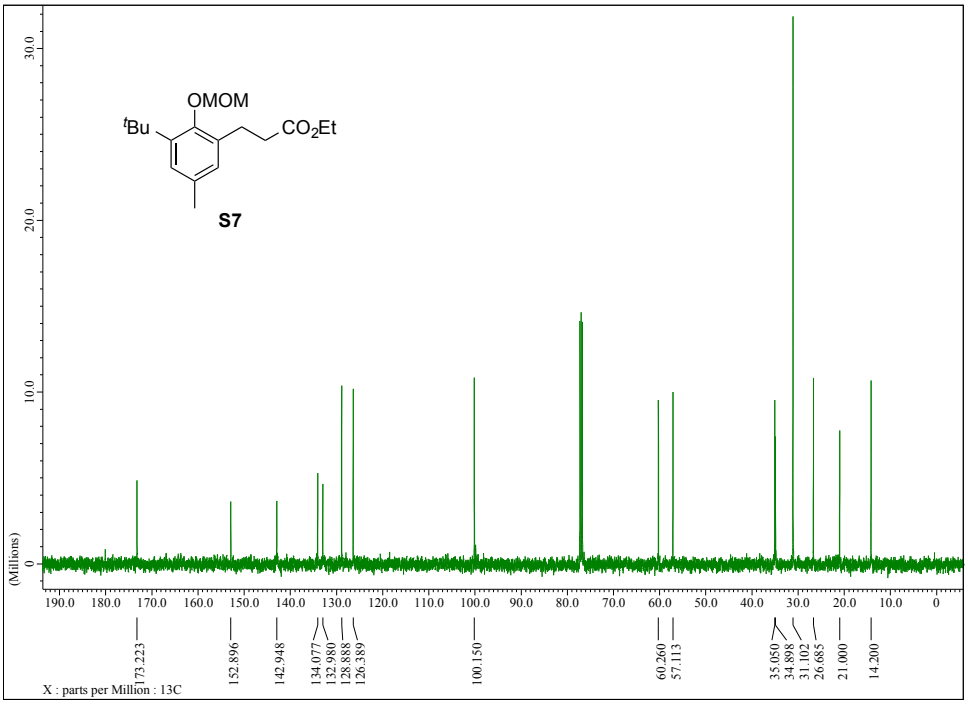
CO2Et
S6
(Billions)
X : parts per Million : 13C


OMOM
tBu
CO2Et
S7
(Thousands)
9.04
2.97
3.06
2.95
2.04
1.94
2.07
2.02
1.07
1.00
7.011
7.007
6.876
6.873
4.963
4.162
4.149
4.135
4.120
3.637
3.021
3.006
2.988
2.641
2.624
2.266
1.386
1.264
1.250
1.235
X : parts per Million : 1H


OMOM
tBu
CO2Et
S7
(Millions)
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152.896
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134.077
132.980
128.888
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35.050
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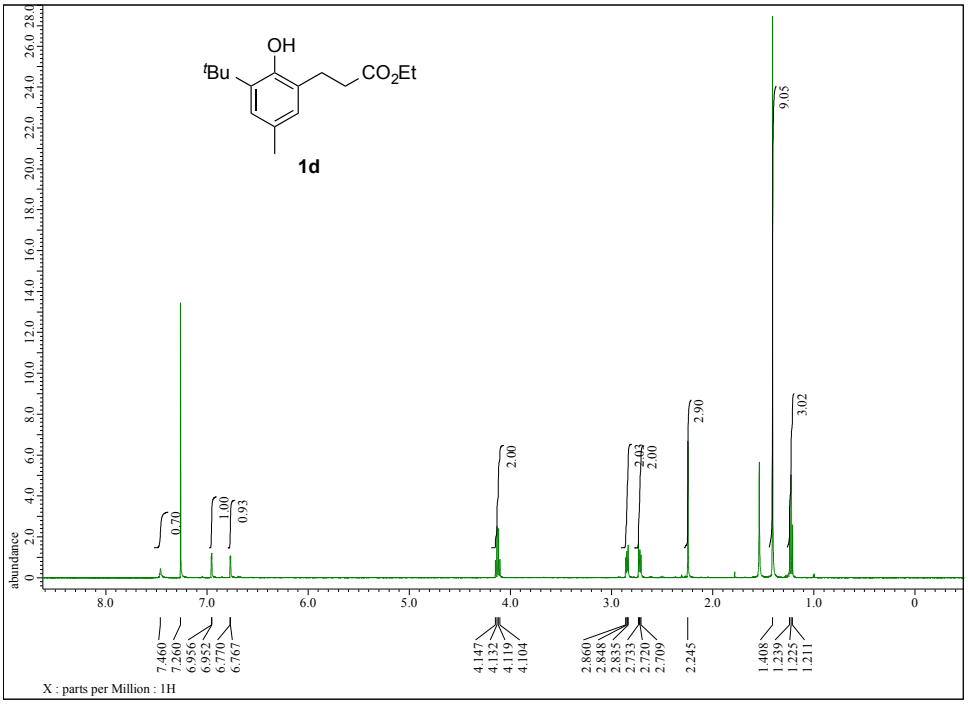
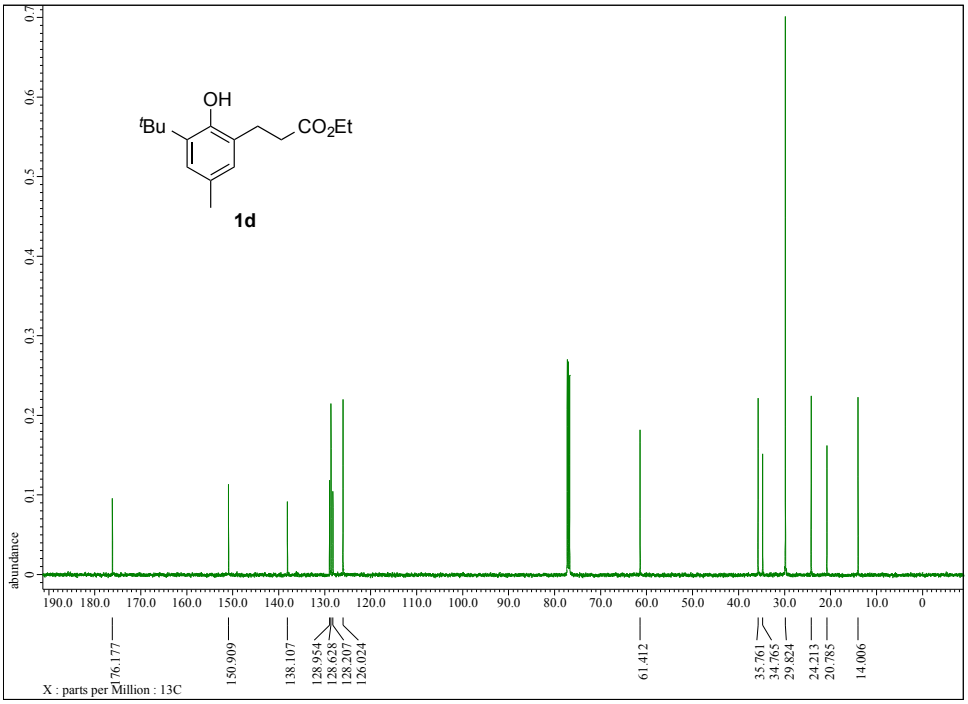
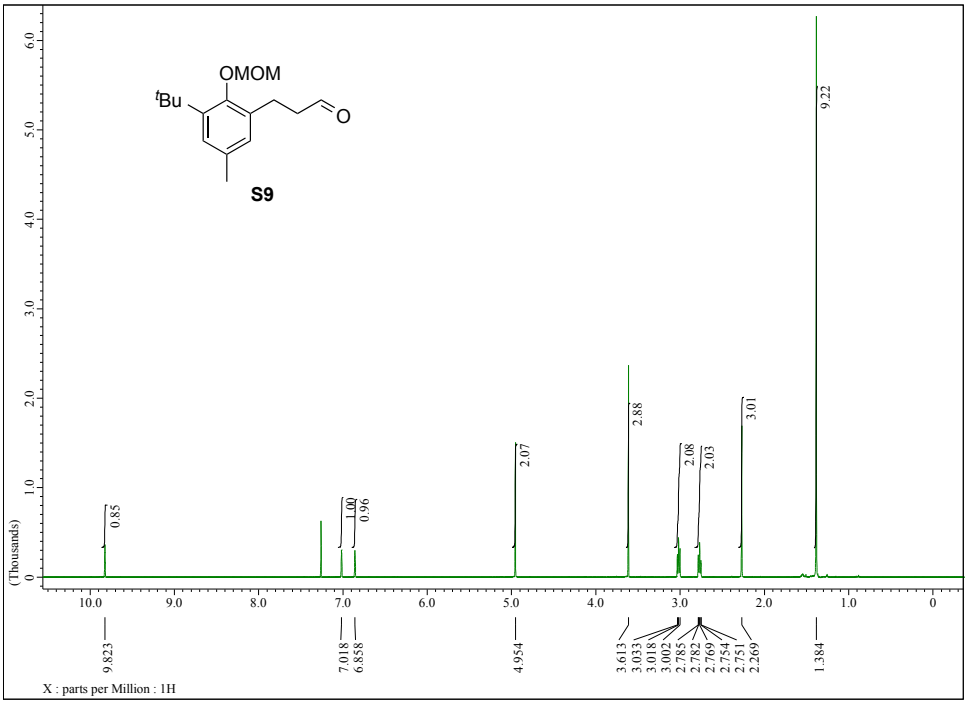
31.102
26.685
21.000
14.200
X : parts per Million : 13C


OH
tBu
CO2Et
1d
abundance
X : parts per Million : 1H


OH
tBu
CO2Et
1d
abundance
X : parts per Million : 13C


OMOM
tBu
O
S9
(Thousands)
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0.96
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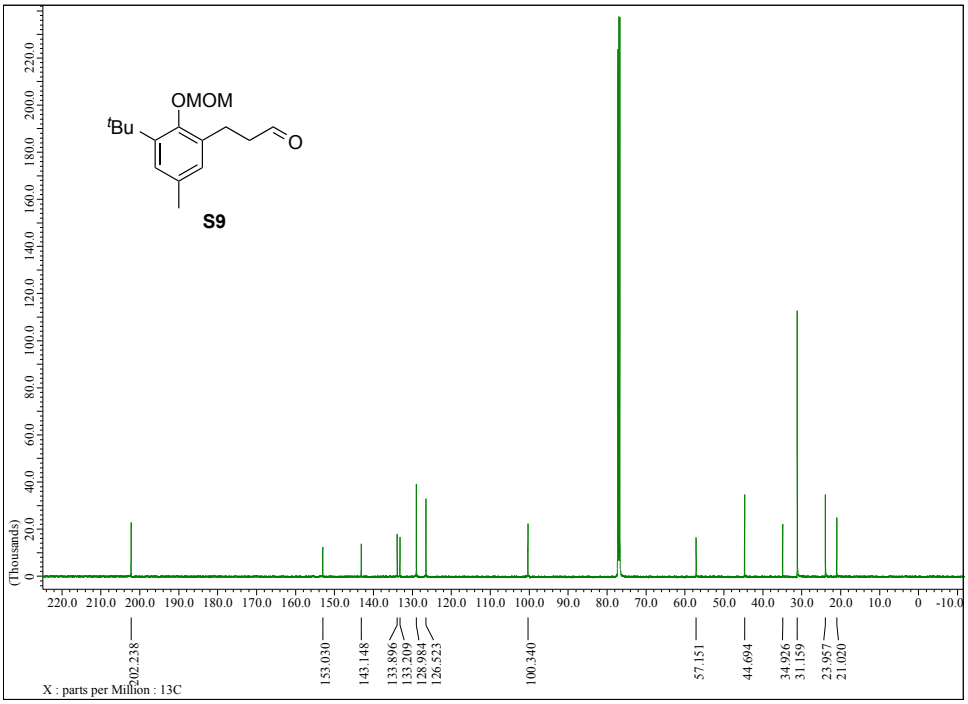
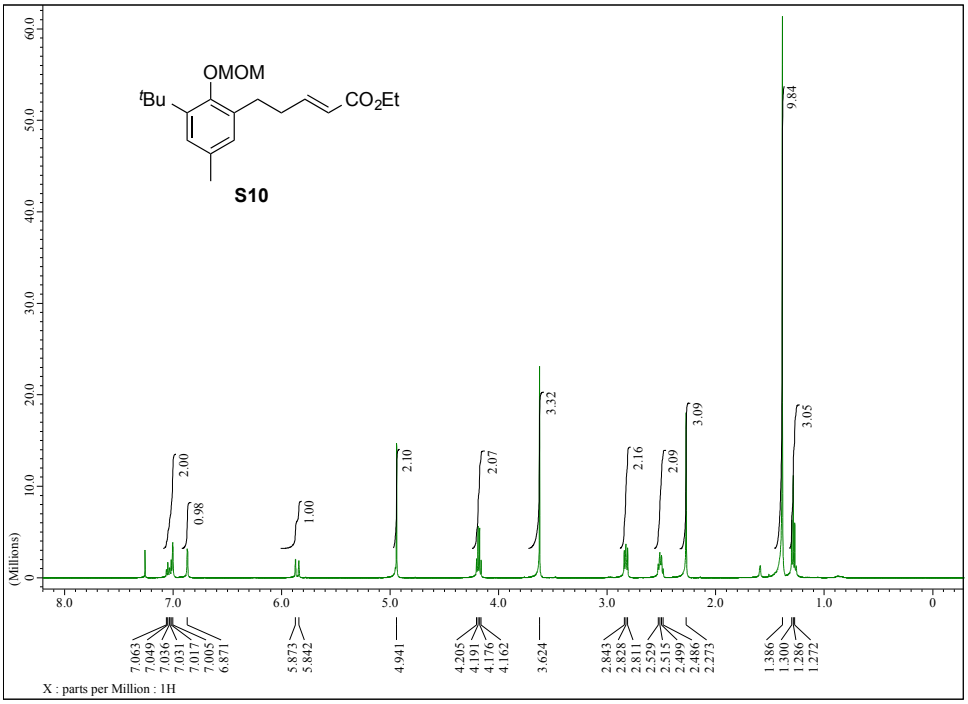
2.88
2.08
2.03
3.01
9.22
X : parts per Million : 1H


OMOM
tBu
O
S9
(Thousands)
X : parts per Million : 13C


OMOM
tBu
CO2Et
S10
(Millions)
9.84
3.32
3.09
3.05
2.16
2.10
2.09
2.07
2.00
1.00
0.98
7.063
7.049
7.036
7.031
7.017
7.005
6.871
5.873
5.842
4.941
4.205
4.191
4.176
4.162
3.624
2.843
2.828
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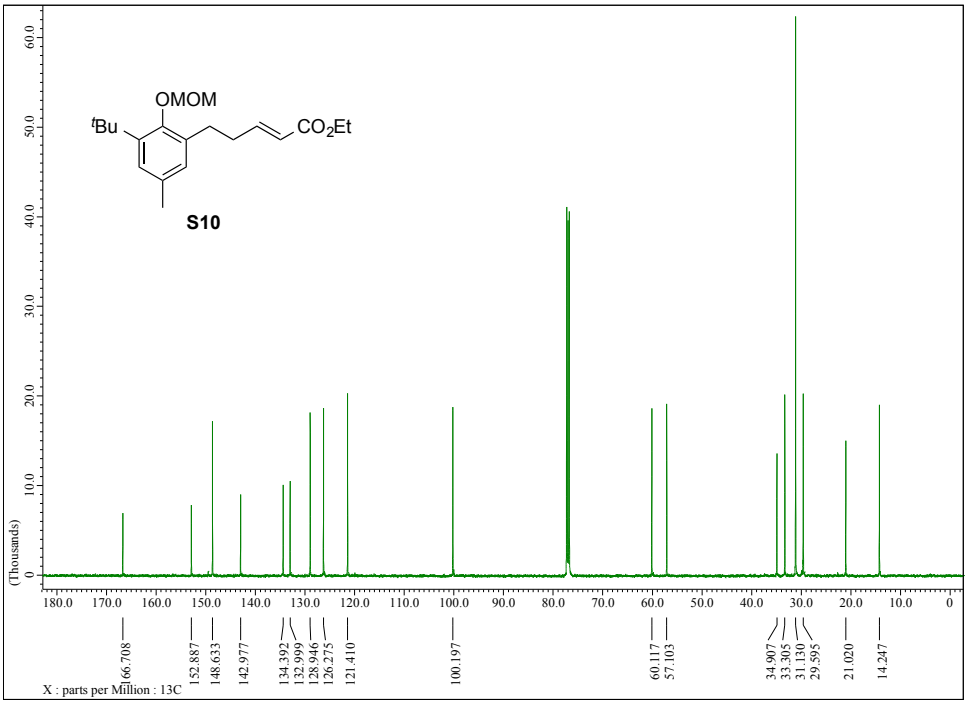
1.386
1.300
1.286
1.272
X : parts per Million : 1H


OMOM
tBu
CO2Et
S10
(Thousands)
66.708
152.887
148.633
142.977
134.392
132.999
128.946
126.275
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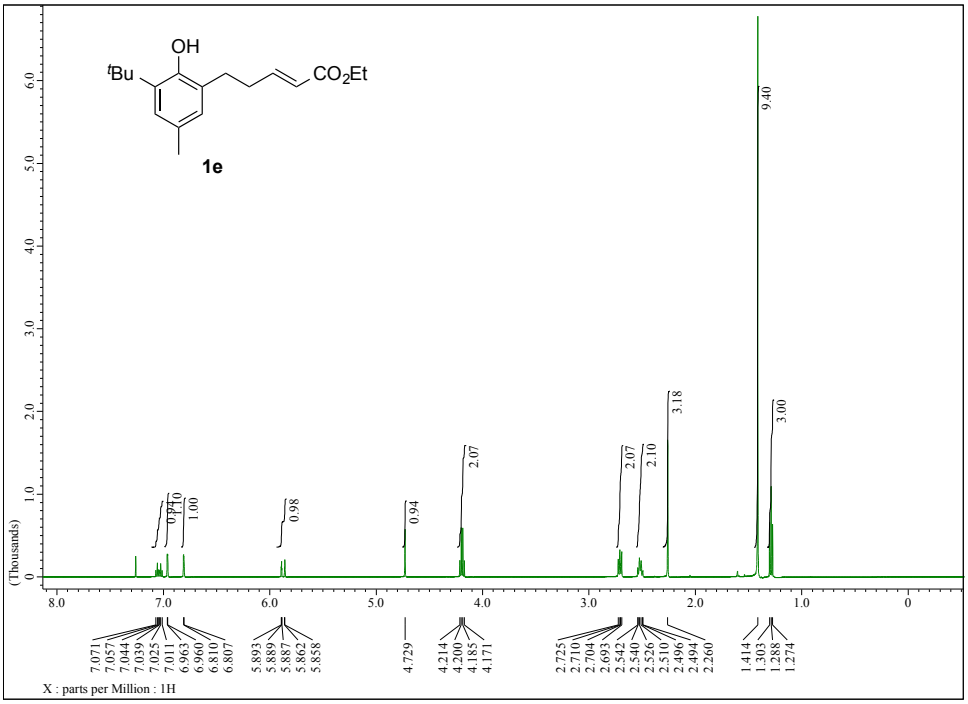
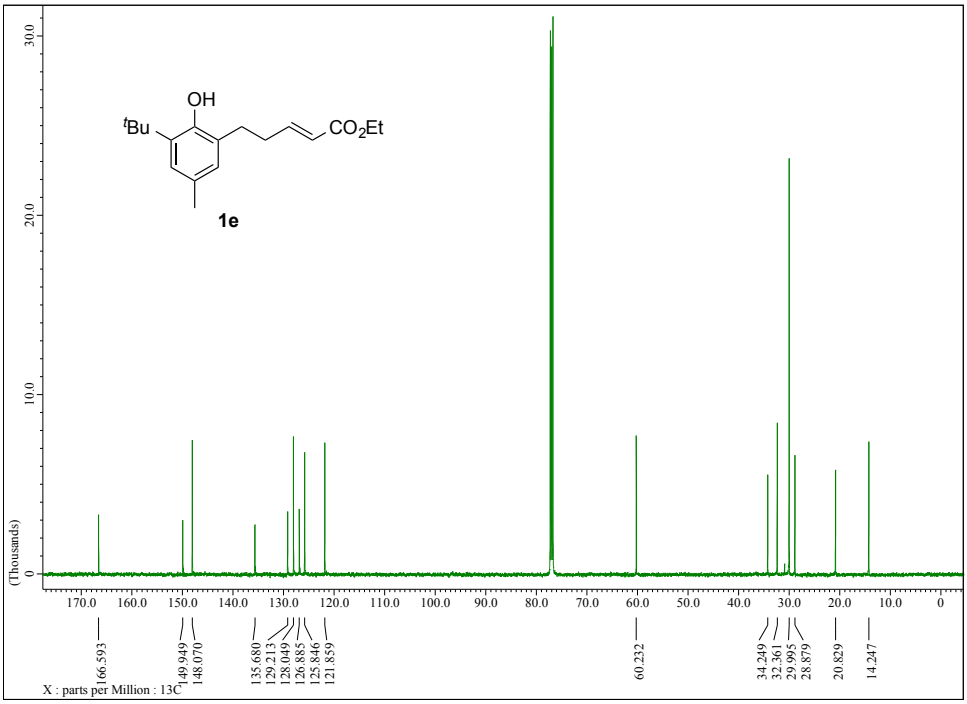
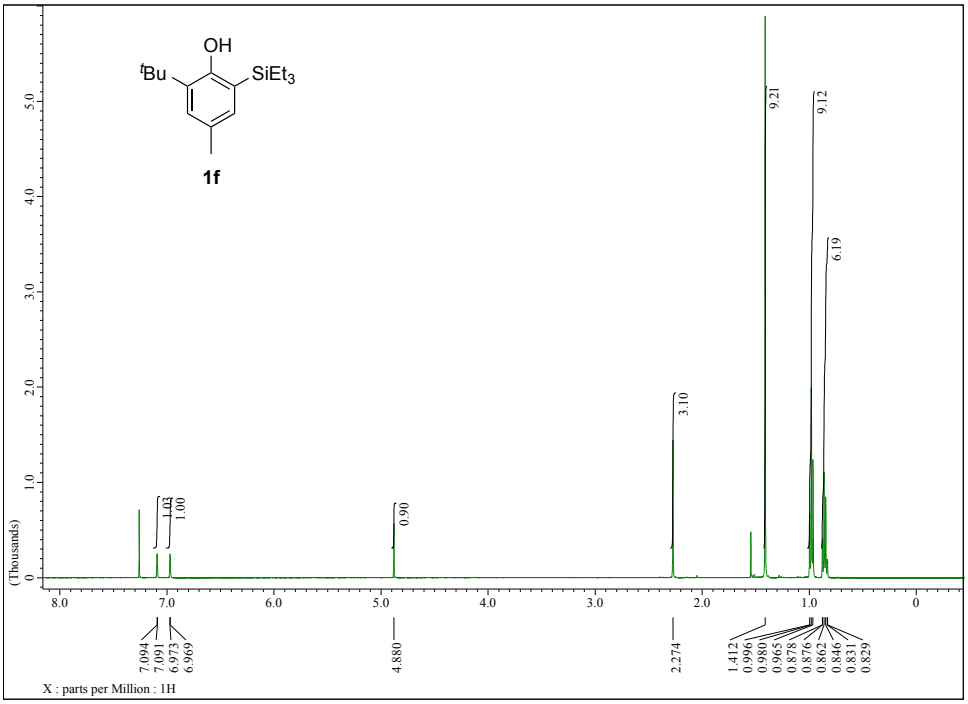
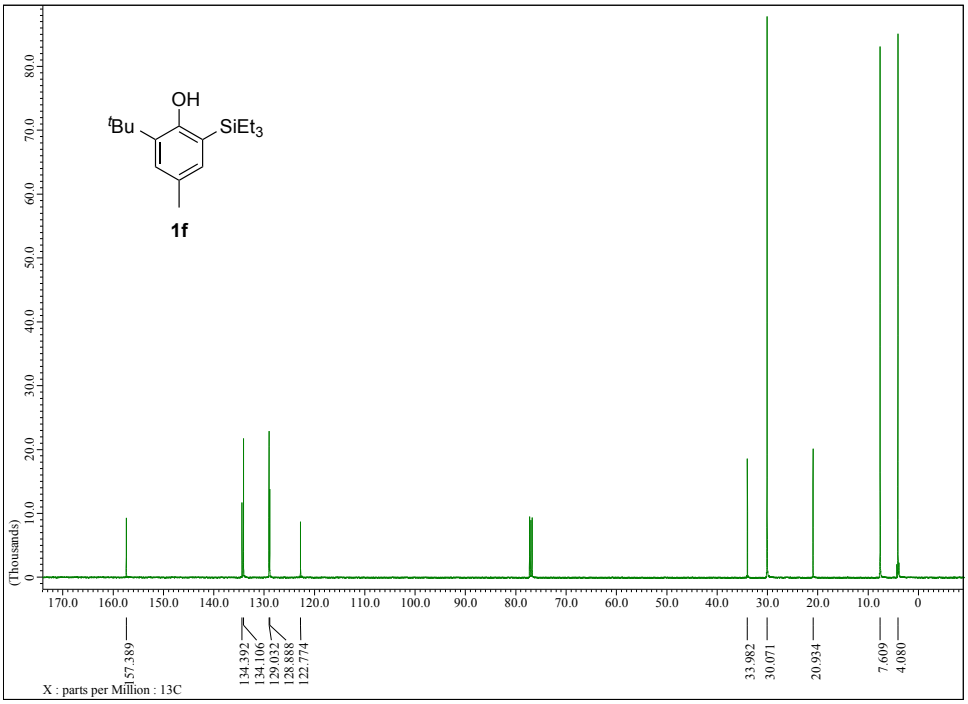
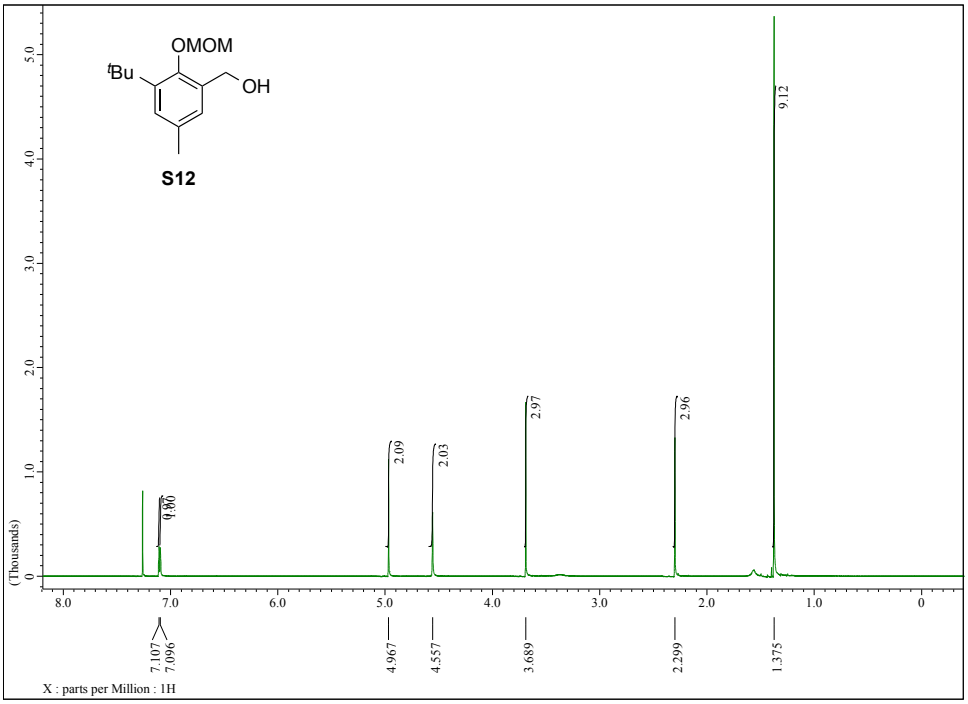
31.130
29.595
21.020
14.247
X : parts per Million : 13C

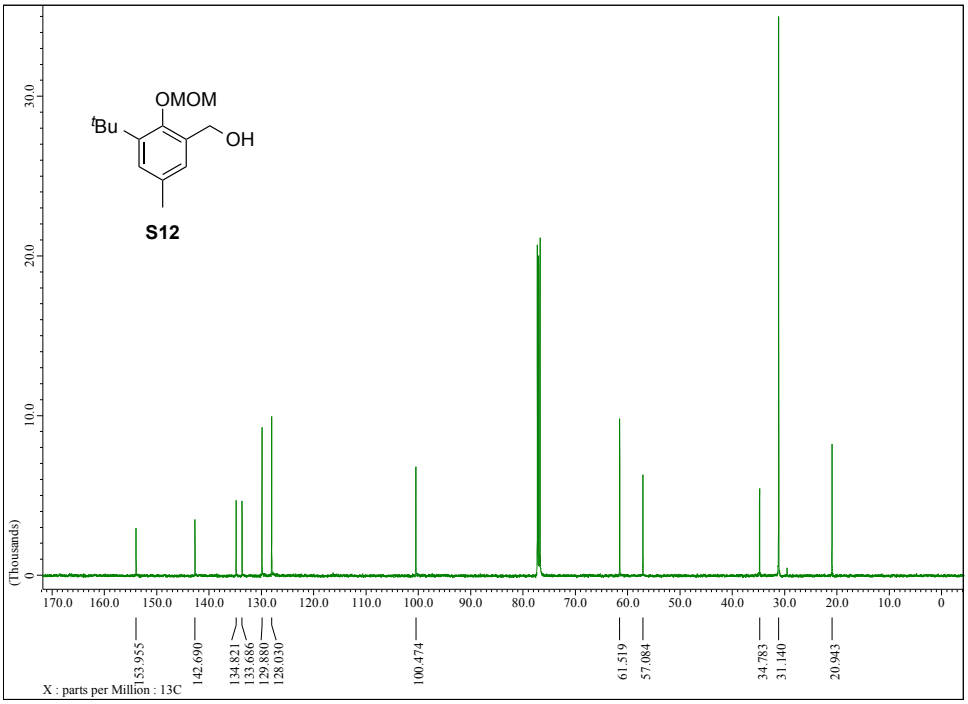

OH
tBu
CO2Et
1e
(Thousands)
X : parts per Million : 1H

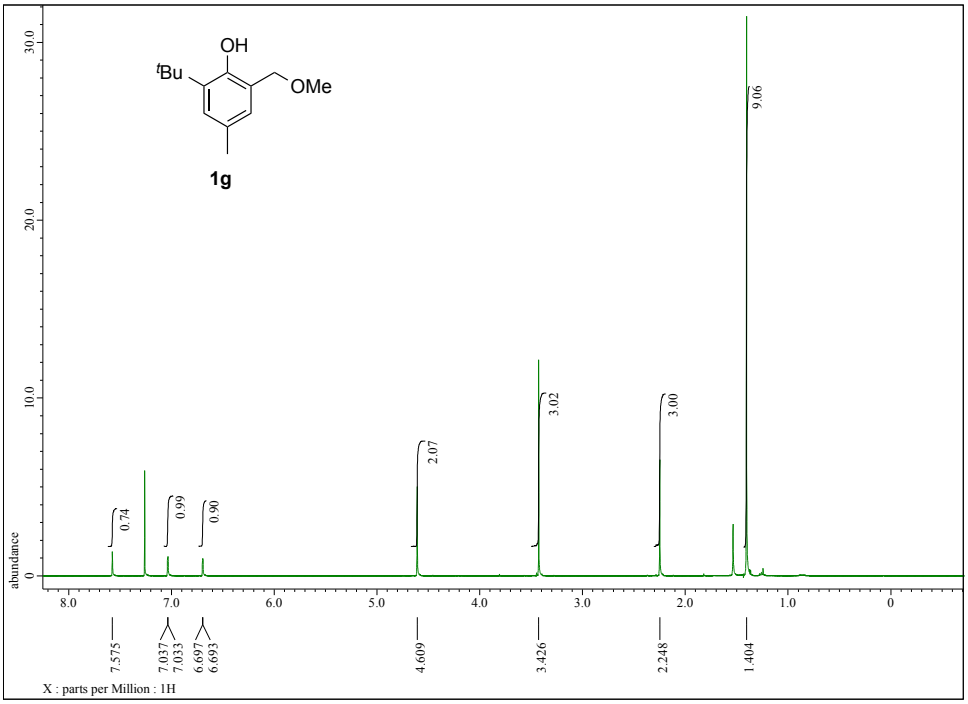

OH
tBu
CO2Et
1e
(Thousands)
X : parts per Million : 13C

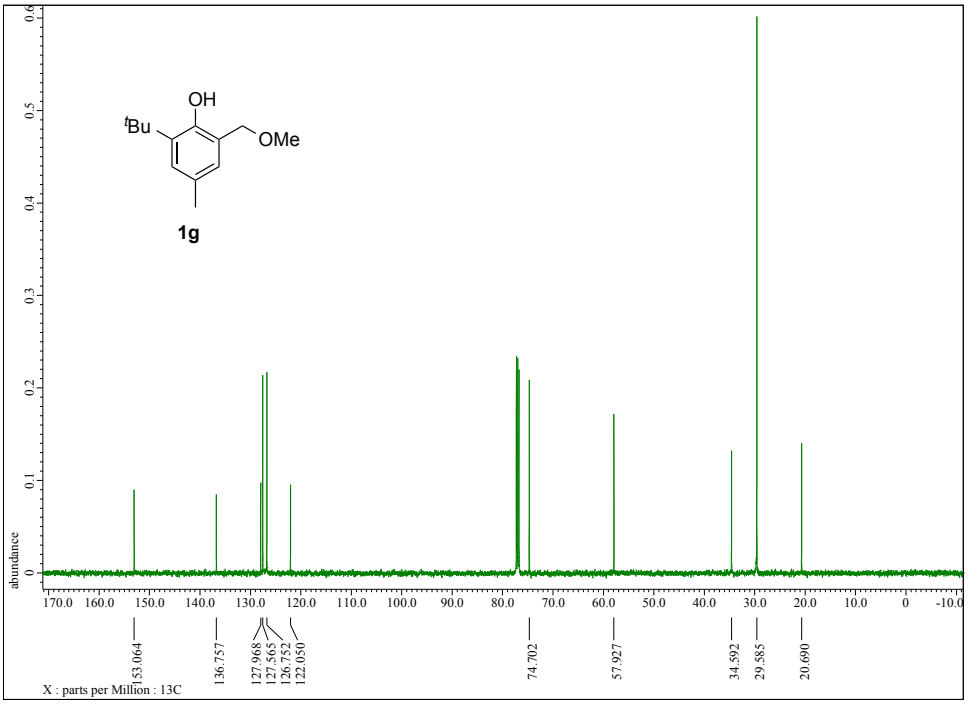

OH
tBu
SiEt3
1f
(Thousands)
9.21
9.12
6.19
3.10
1.03
1.00
0.90
7.094
7.091
6.973
6.969
4.880
2.274
1.412
0.996
0.980
0.965
0.878
0.876
0.862
0.846
0.831
0.829
X : parts per Million : 1H

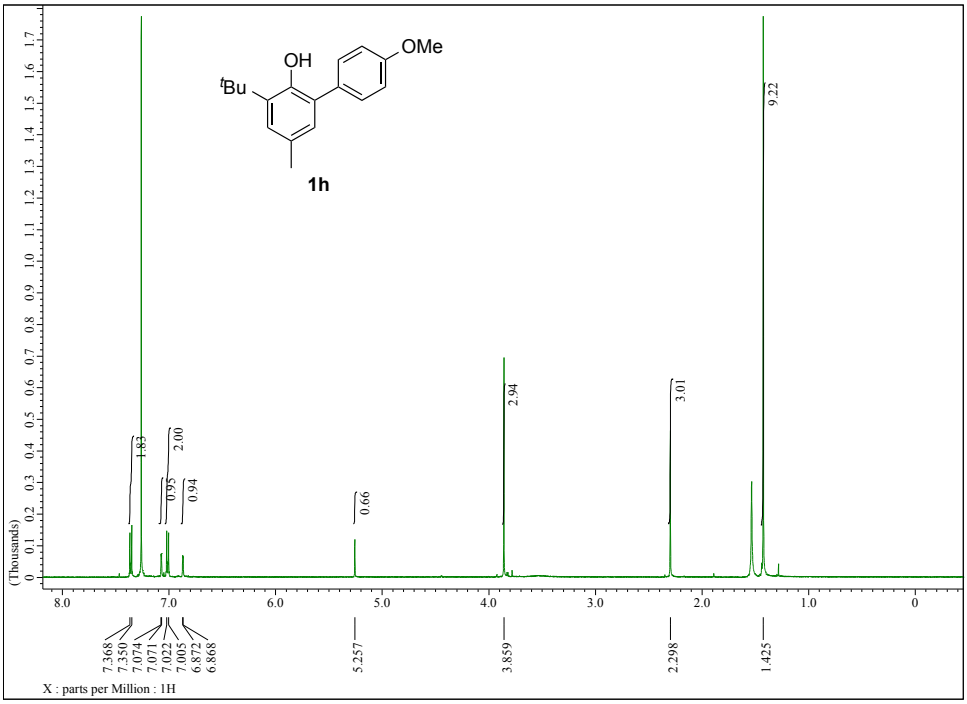

OH
tBu
SiEt3
1f
(Thousands)
57.389
134.392
134.106
129.032
128.888
122.774
33.982
30.071
20.934
7.609
4.080
X : parts per Million : 13C

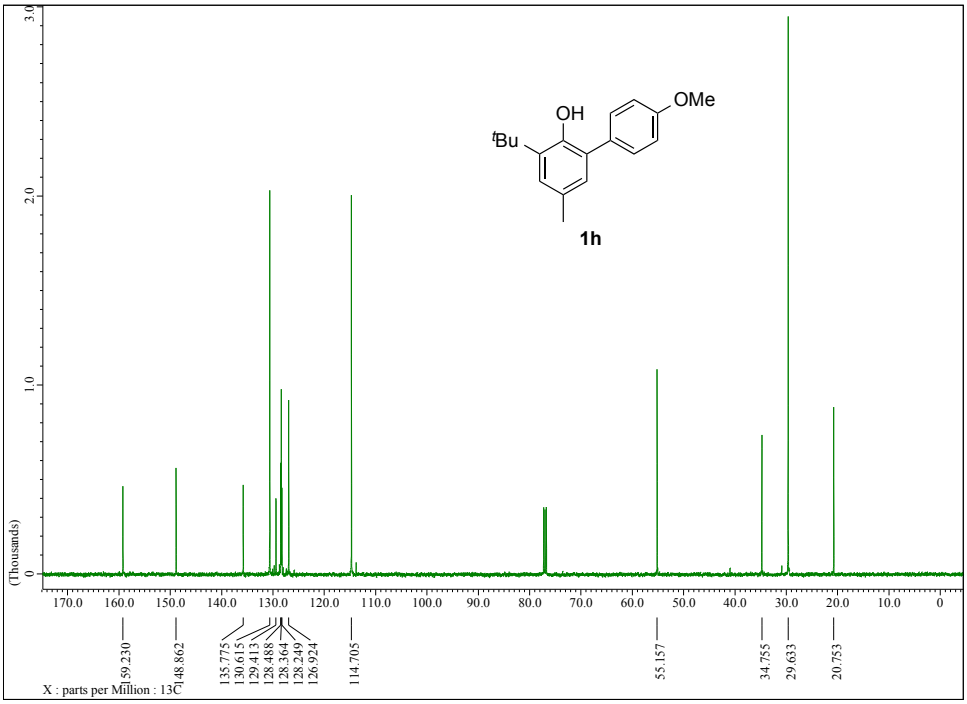

OMOM
tBu
OH
S12
(Thousands)
9.12
2.97
2.96
2.09
2.03
7.107
7.096
4.967
4.557
3.689
2.299
1.375
X : parts per Million : 1H

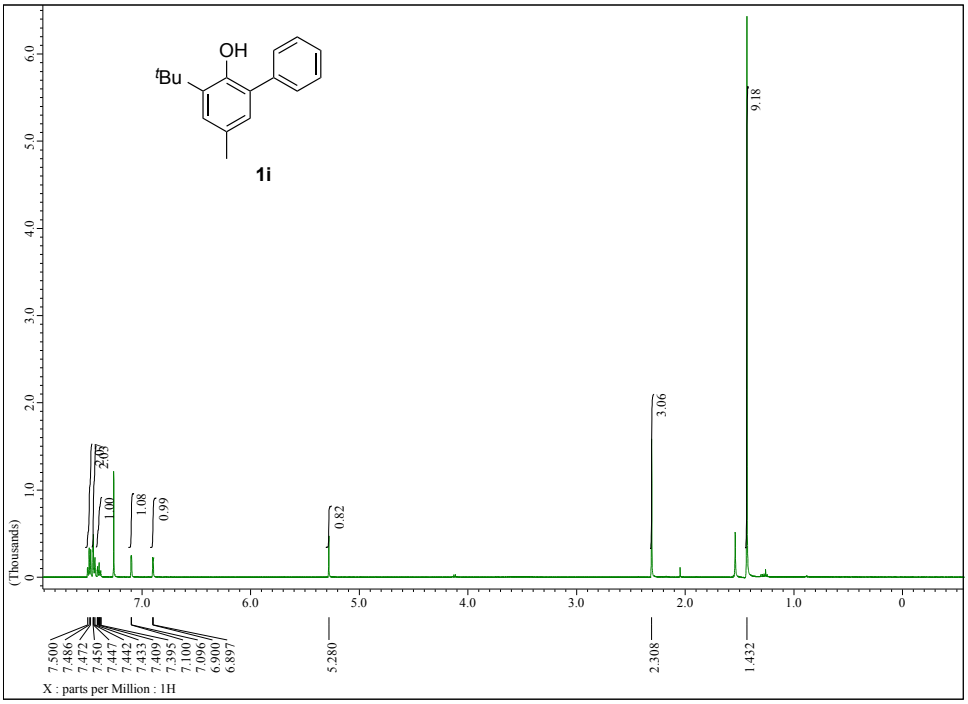

OMOM
tBu
OH
S12
(Thousands)
153.955
142.690
134.821
133.686
129.880
128.030
100.474
61.519
57.084
34.783
31.140
20.943
X : parts per Million : 13C

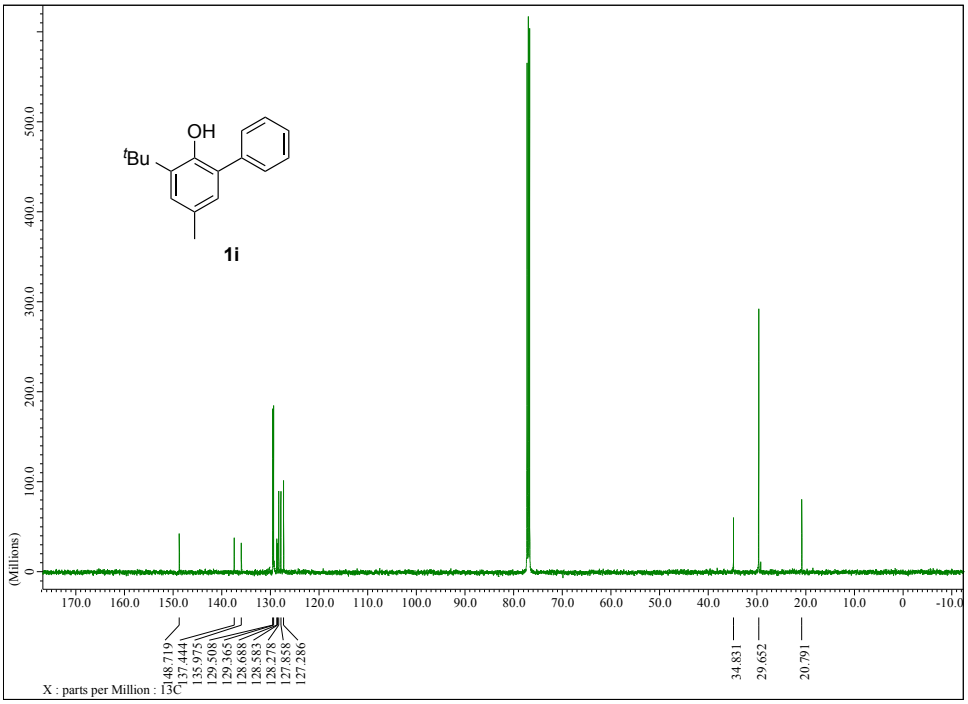

OH
tBu
OMe
1g
abundance
30.0
20.0
10.0
0
0.74
0.99
0.90
2.07
3.02
3.00
9.06
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
7.575
7.037
7.033
6.697
6.693
4.609
3.426
2.248
1.404
X : parts per Million : 1H

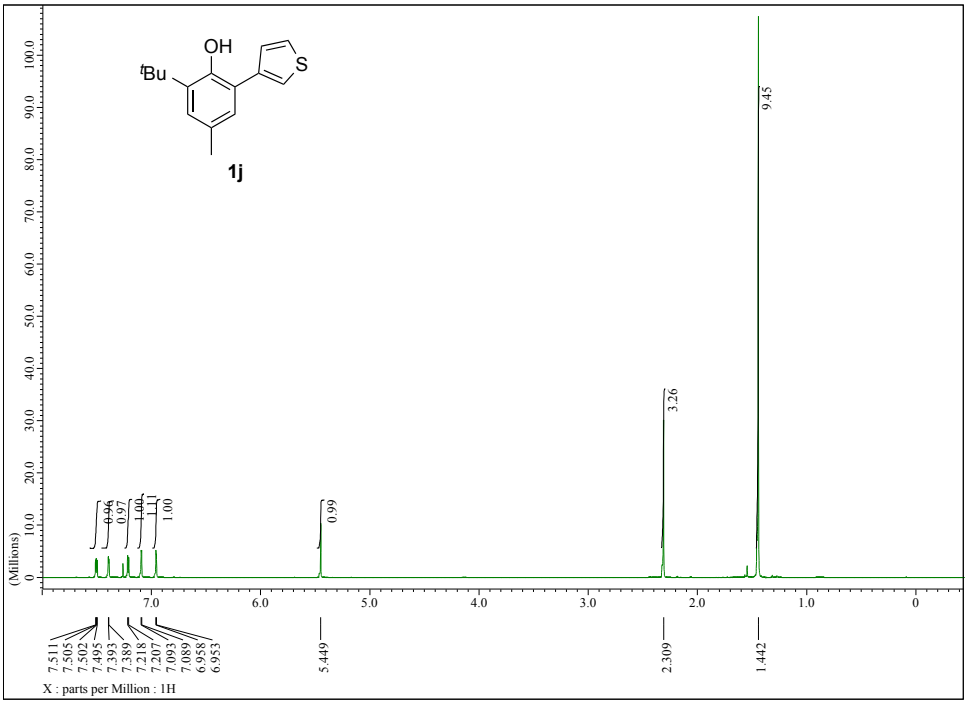

OH
tBu
OMe
1g
abundance
0.6
0.5
0.4
0.3
0.2
0.1
0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
153.064
136.757
127.968
127.565
126.752
122.050
74.702
57.927
34.592
29.585
20.690
X : parts per Million : 13C

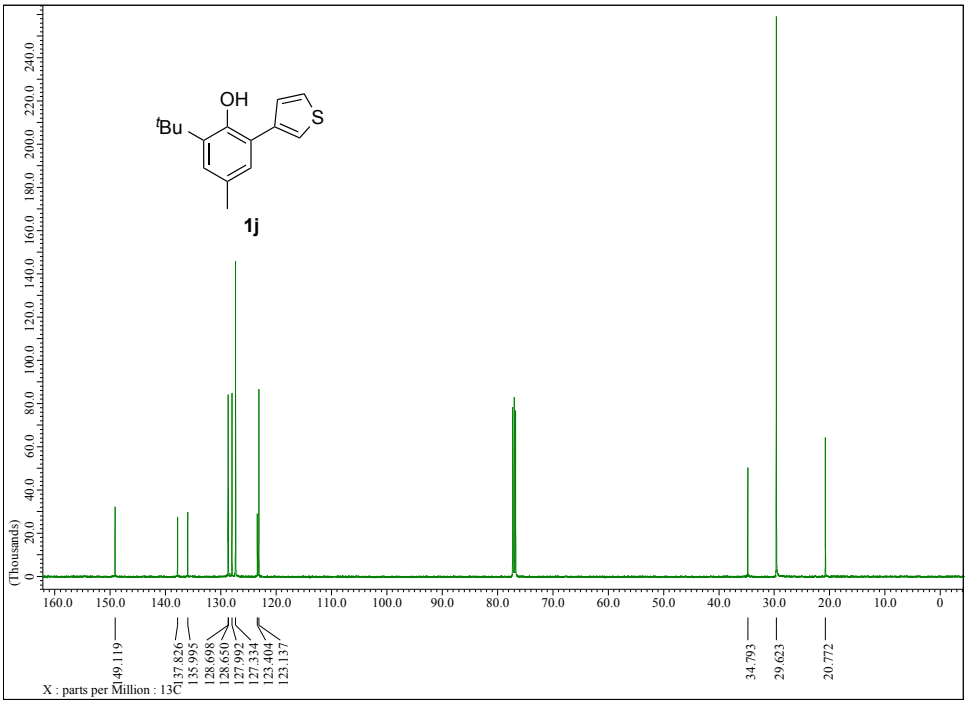

OH
OMe
tBu
1h
(Thousands)
X : parts per Million : 1H

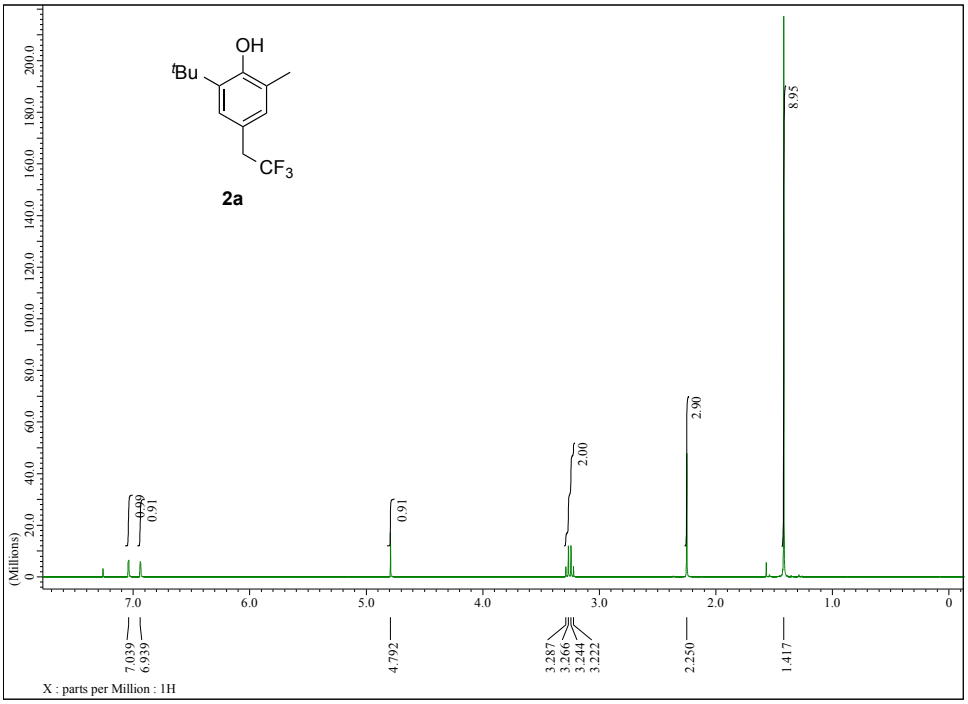

OH
OMe
tBu
1h
(Thousands)
X : parts per Million : 13C

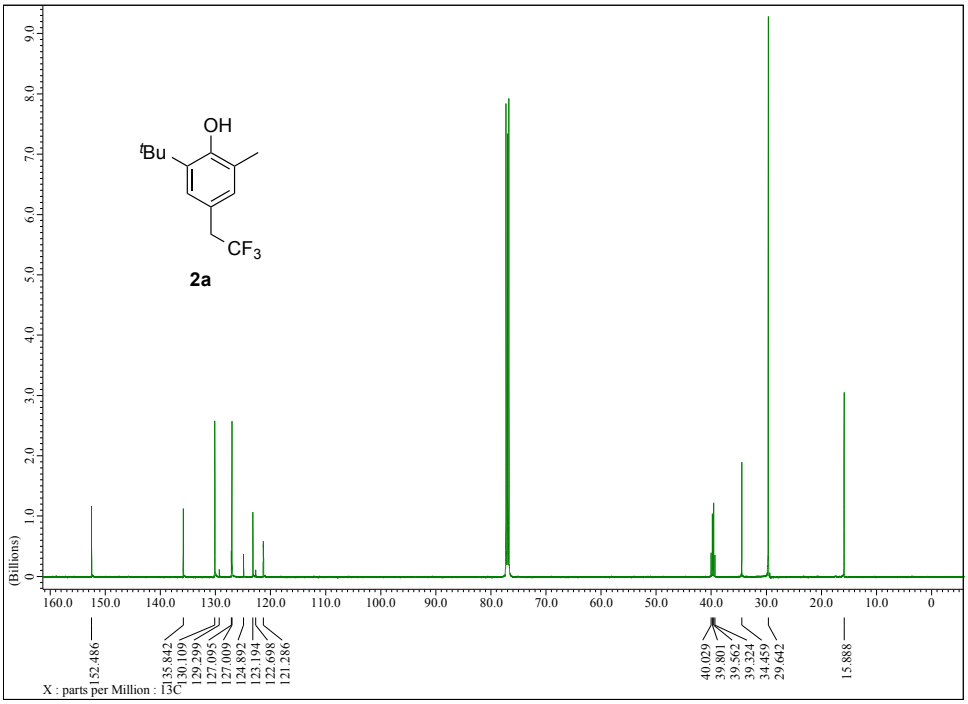

OH
tBu
1i
(Thousands)
9.18
3.06
2.09
1.00
1.08
0.99
0.82
7.500
7.486
7.472
7.450
7.447
7.442
7.433
7.409
7.395
7.100
7.096
6.900
6.897
5.280
2.308
1.432
X : parts per Million : 1H

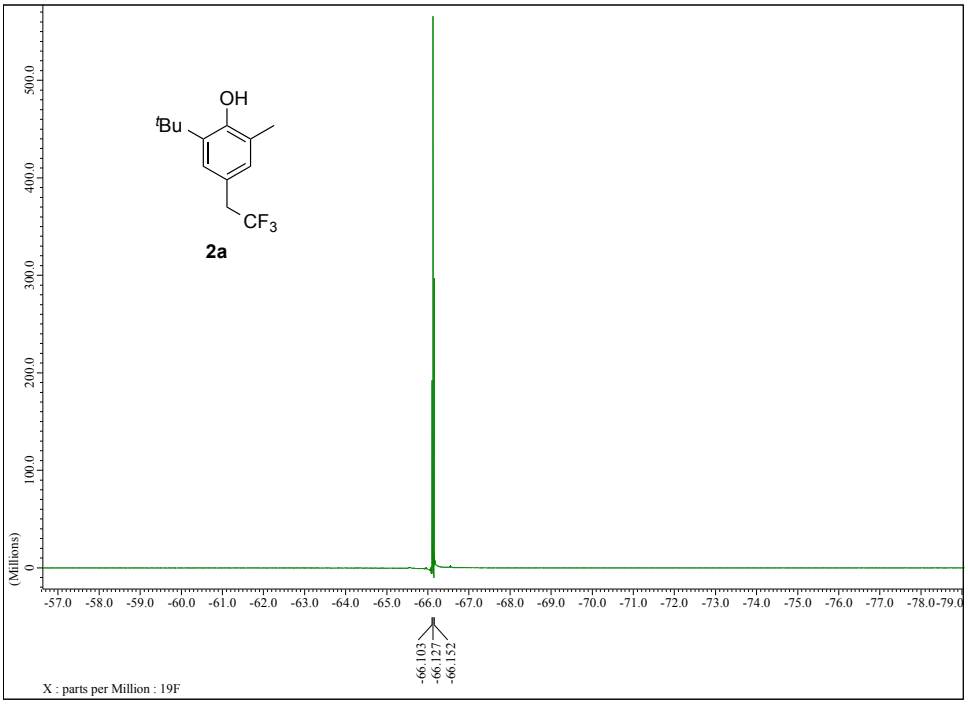

OH
tBu
1i
(Millions)
148.719
137.444
135.975
129.508
129.365
128.688
128.583
128.278
127.858
127.286
34.831
29.652
20.791
X : parts per Million : 13C

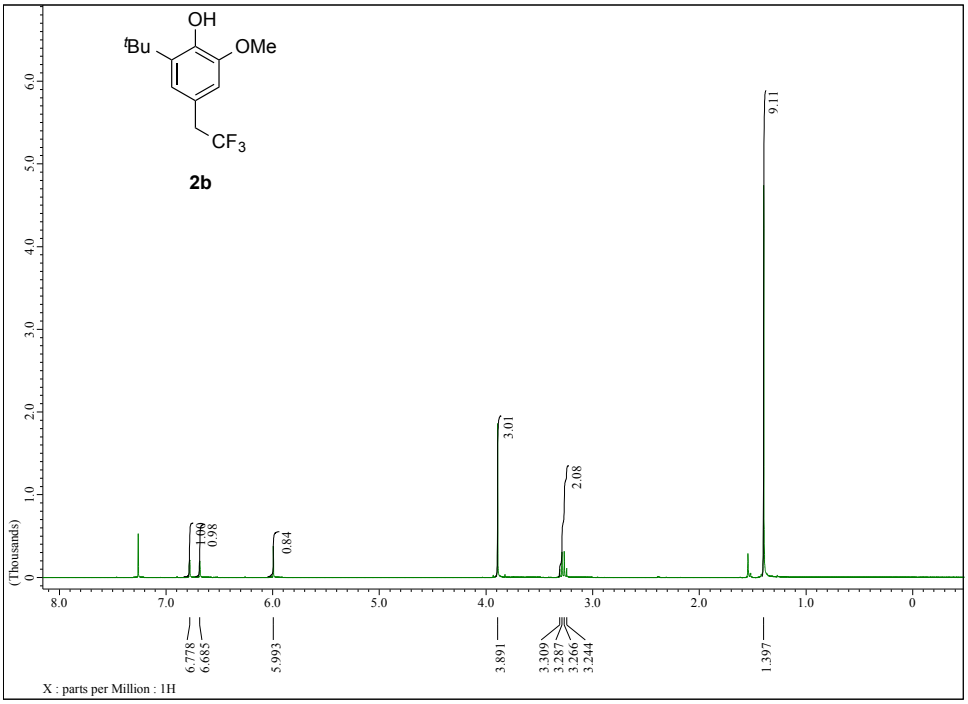

OH
tBu
S
1j
9.45
3.26
0.99
1.00
(Millions)
7.511
7.505
7.502
7.495
7.393
7.389
7.218
7.207
7.093
7.089
6.958
6.953
5.449
2.309
1.442
X : parts per Million : 1H

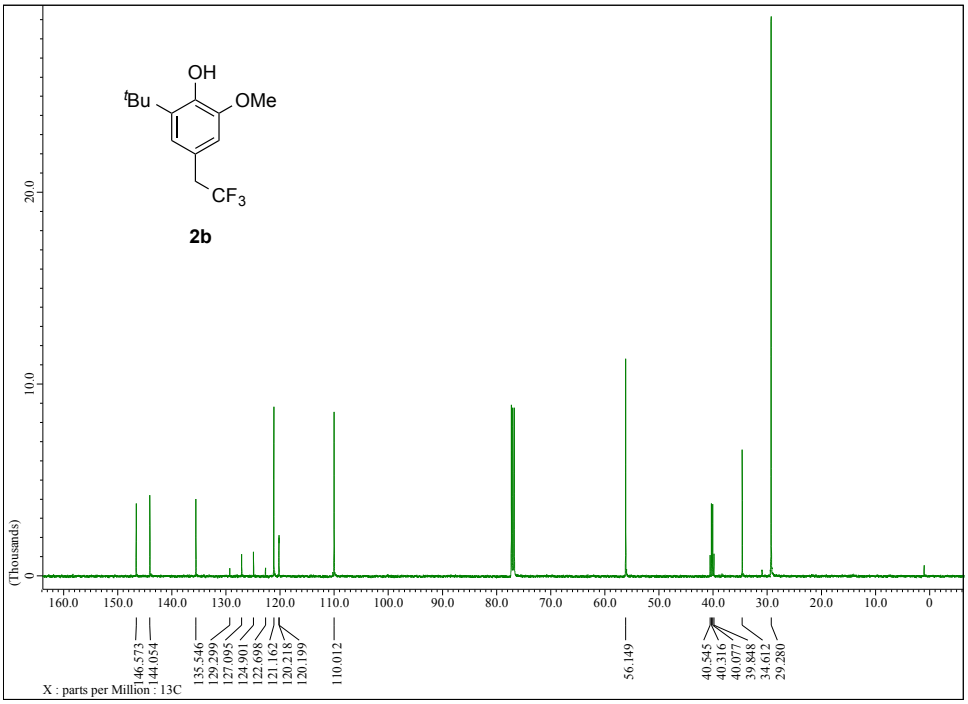

OH
tBu
S
1j
(Thousands)
149.119
137.826
135.995
128.698
128.650
127.992
127.334
123.404
123.137
34.793
29.623
20.772
X : parts per Million : 13C

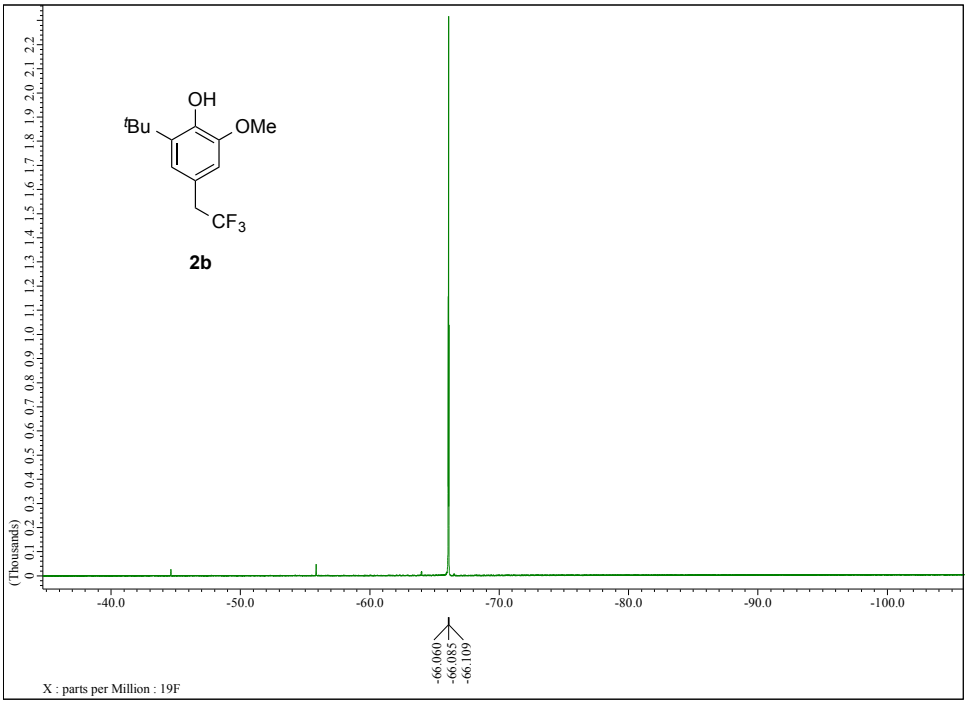

OH
tBu
CF3
2a
8.95
2.90
2.00
0.91
0.99
0.91
(Millions)
7.039
6.939
4.792
3.287
3.266
3.244
3.222
2.250
1.417
X : parts per Million : 1H

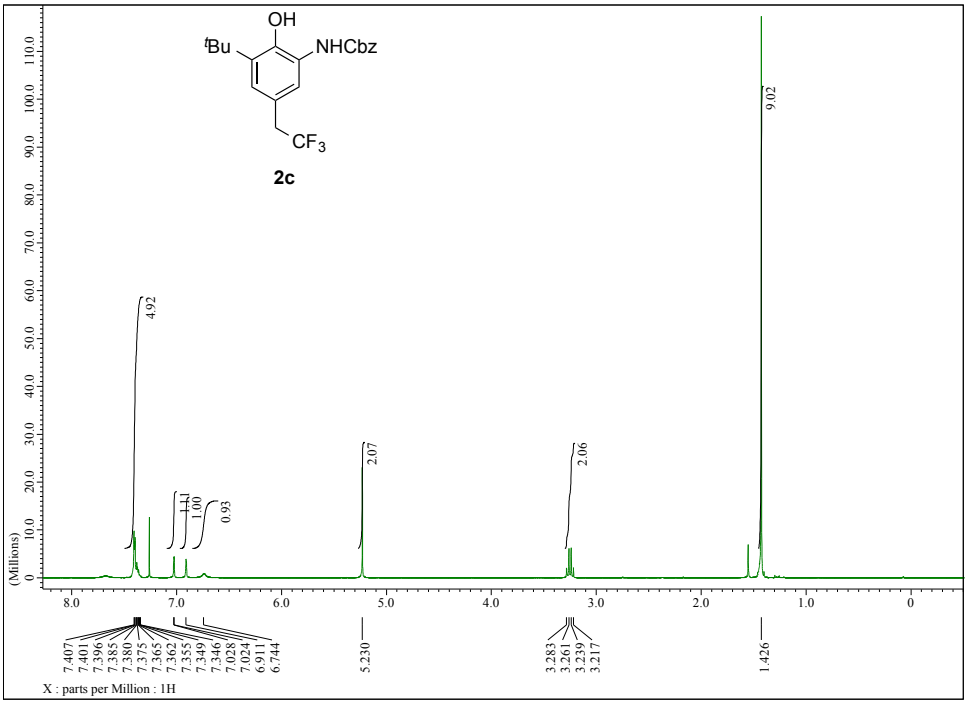

OH
tBu
CF3
2a
(Billions)
152.486
135.842
130.109
129.299
127.095
127.009
124.892
123.194
122.698
121.286
40.029
39.801
39.562
39.324
34.459
29.642
15.888
X : parts per Million : 13C

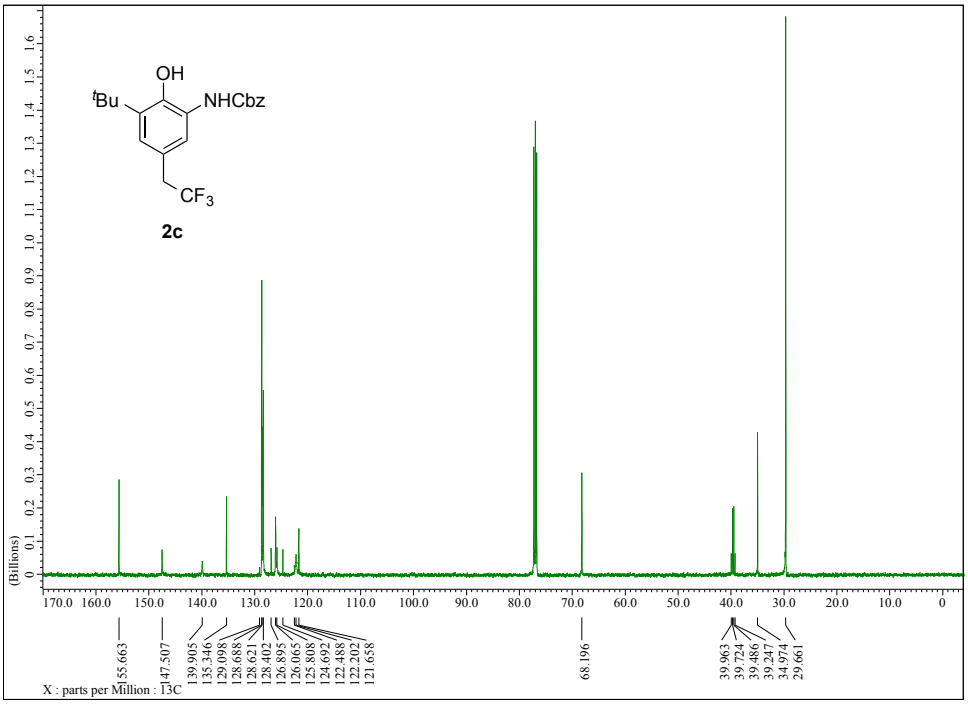

OH
tBu
CF3
2a
500.0
400.0
300.0
200.0
100.0
0
(Millions)
-57.0 -58.0 -59.0 -60.0 -61.0 -62.0 -63.0 -64.0 -65.0 -66.0 -67.0 -68.0 -69.0 -70.0 -71.0 -72.0 -73.0 -74.0 -75.0 -76.0 -77.0 -78.0 -79.0
-66.103
-66.127
-66.152
X : parts per Million : 19F

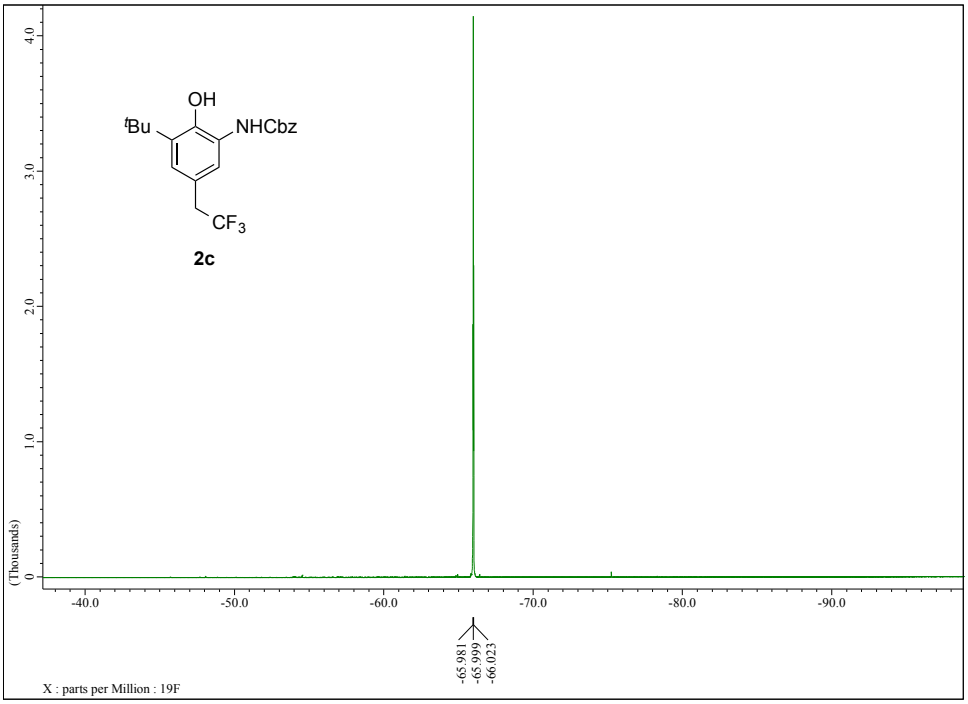

OH
tBu
OMe
CF3
2b
9.11
3.01
2.08
1.09
0.98
0.84
(Thousands)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
6.778
6.685
5.993
3.891
3.309
3.287
3.266
3.244
1.397
X : parts per Million : 1H

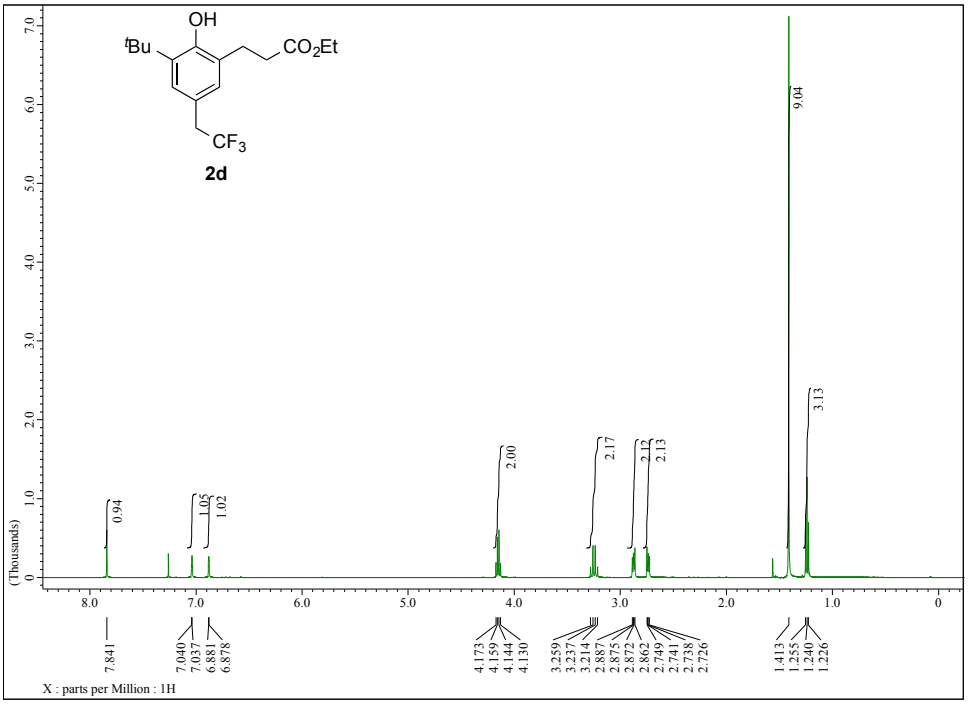

OH
tBu
OMe
CF3
2b
(Thousands)
20.0
10.0
0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
146.573
144.054
135.546
129.299
127.095
124.901
122.698
121.162
120.218
120.199
110.012
56.149
40.545
40.316
40.077
39.848
34.612
29.280
X : parts per Million : 13C

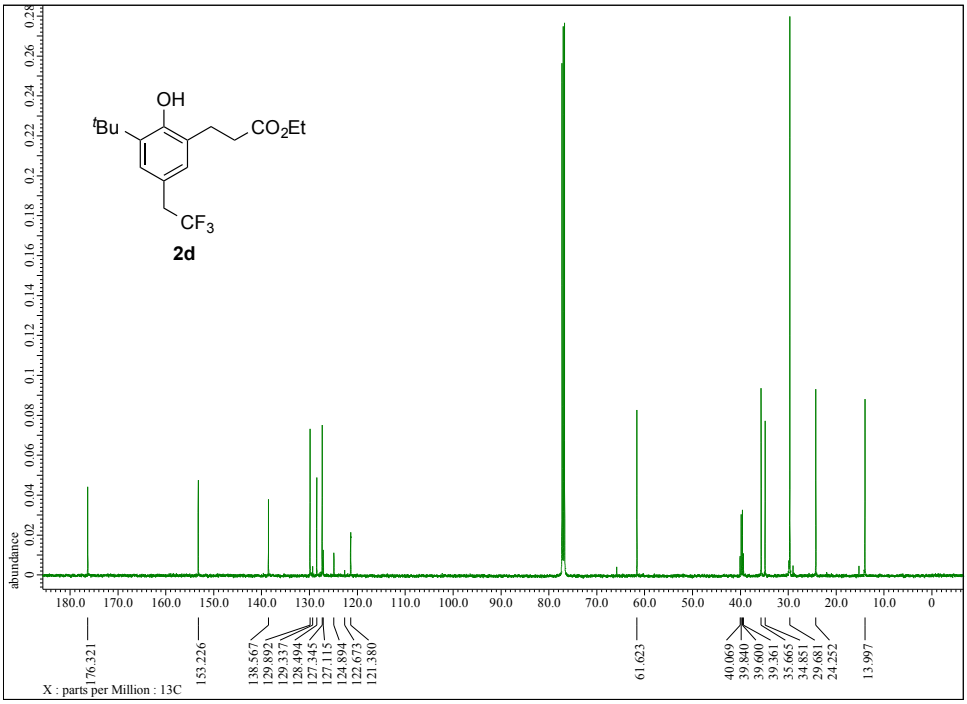

OH
tBu
OMe
CF3
2b
(Thousands)
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-66.060
-66.085
-66.109
X : parts per Million : 19F

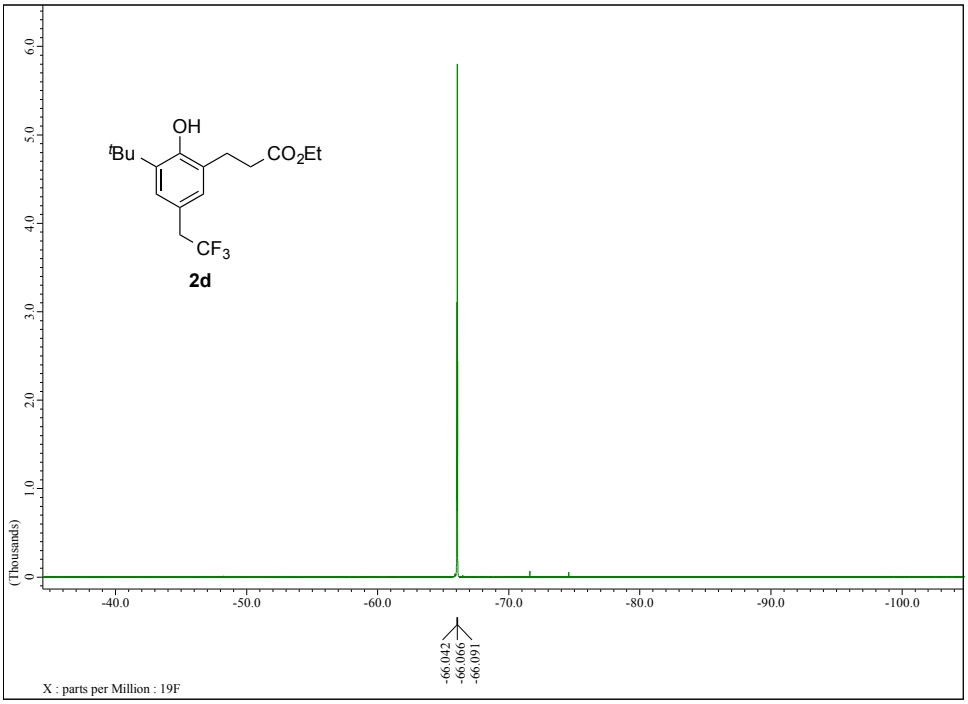

OH
tBu
NHCbz
CF3
2c
(Millions)
4.92
1.11
1.00
0.93
2.07
2.06
9.02
7.407
7.401
7.396
7.385
7.380
7.375
7.365
7.362
7.355
7.349
7.346
7.028
7.024
6.911
6.744
5.230
3.283
3.261
3.239
3.217
1.426
X : parts per Million : 1H

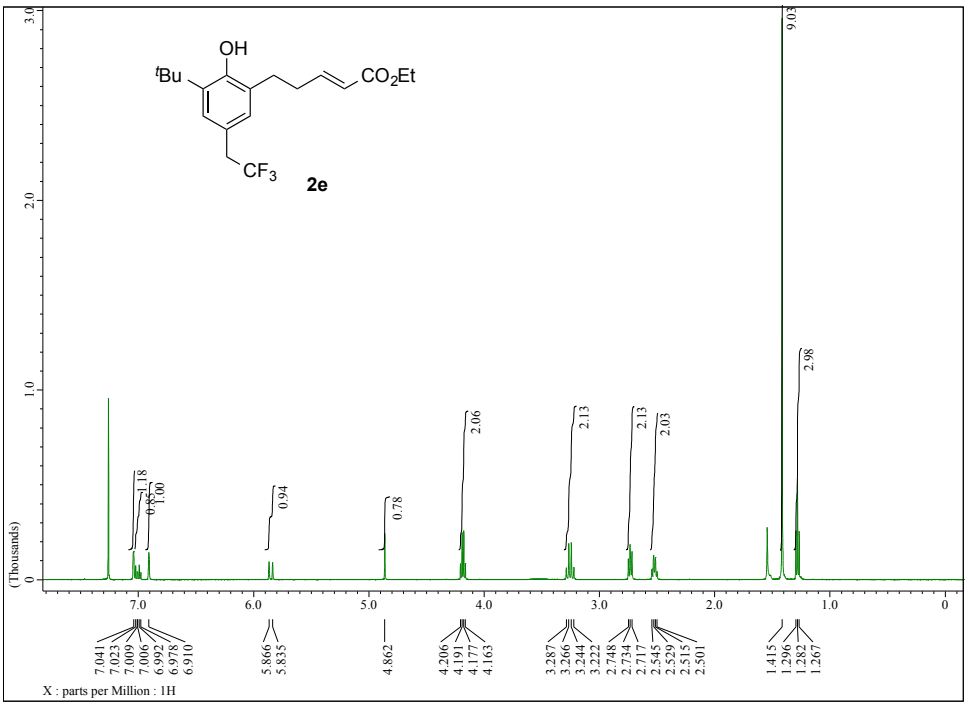

OH
tBu
NHCbz
CF3
2c
(Billions)
55.663
47.507
139.905
135.346
129.098
128.688
128.621
128.402
126.895
126.065
125.808
124.692
122.488
122.202
121.658
68.196
39.963
39.724
39.486
39.247
34.974
29.661
X : parts per Million : 13C

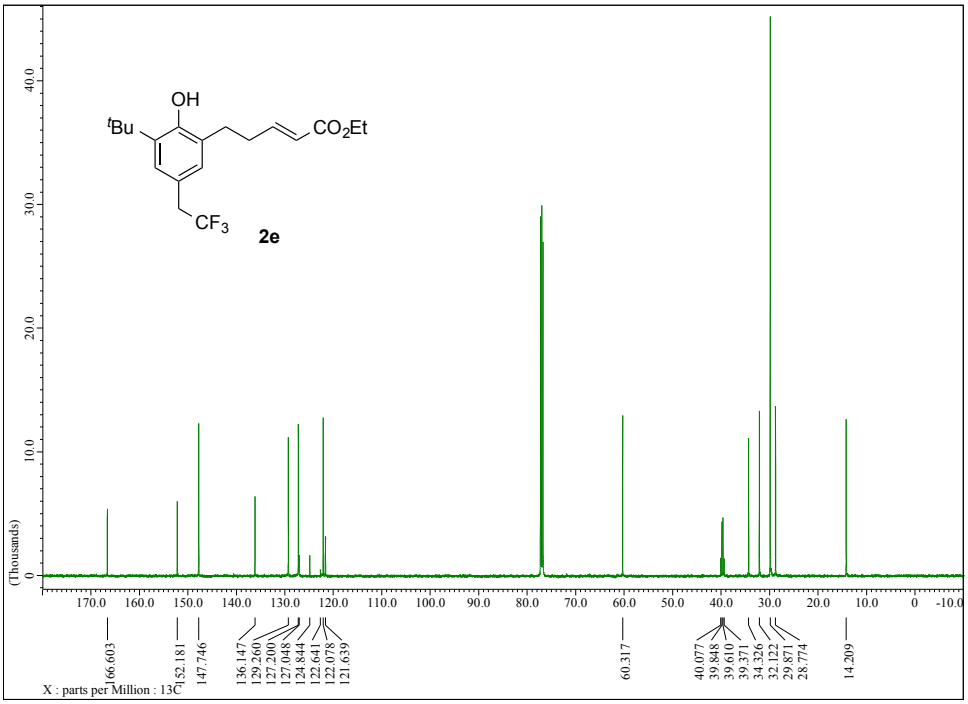

OH
tBu
NHCbz
CF3
2c
(Thousands)
4.0
3.0
2.0
1.0
0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-65.981
-65.999
-66.023
X : parts per Million : 19F

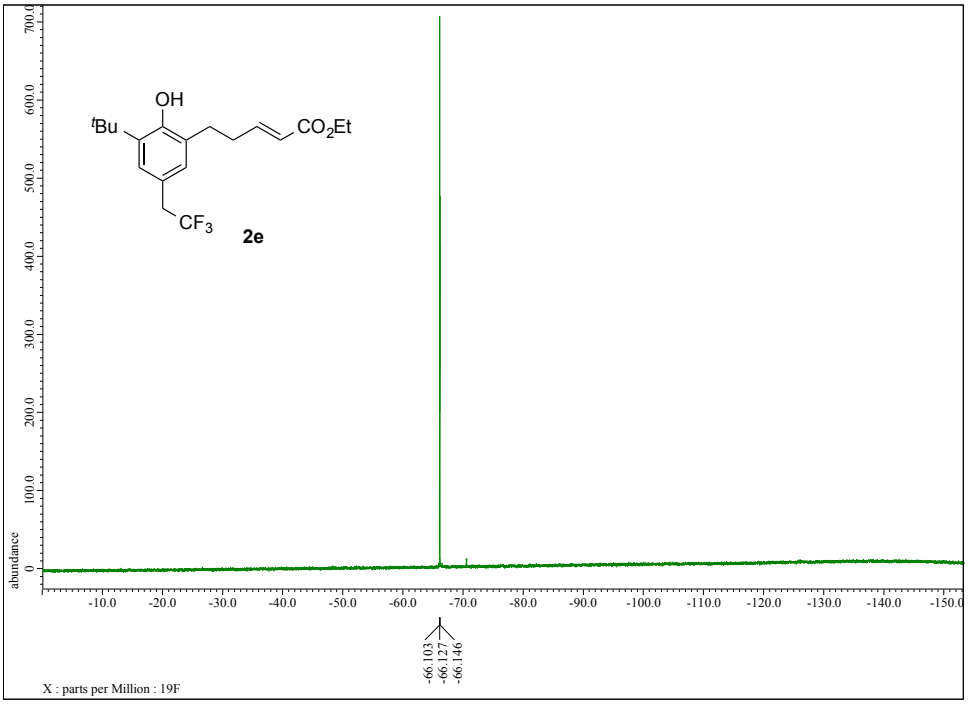

OH
tBu
CO2Et
CF3
2d
(Thousands)
9.04
3.13
2.00
2.17
2.12
2.13
1.05
1.02
0.94
X : parts per Million : 1H

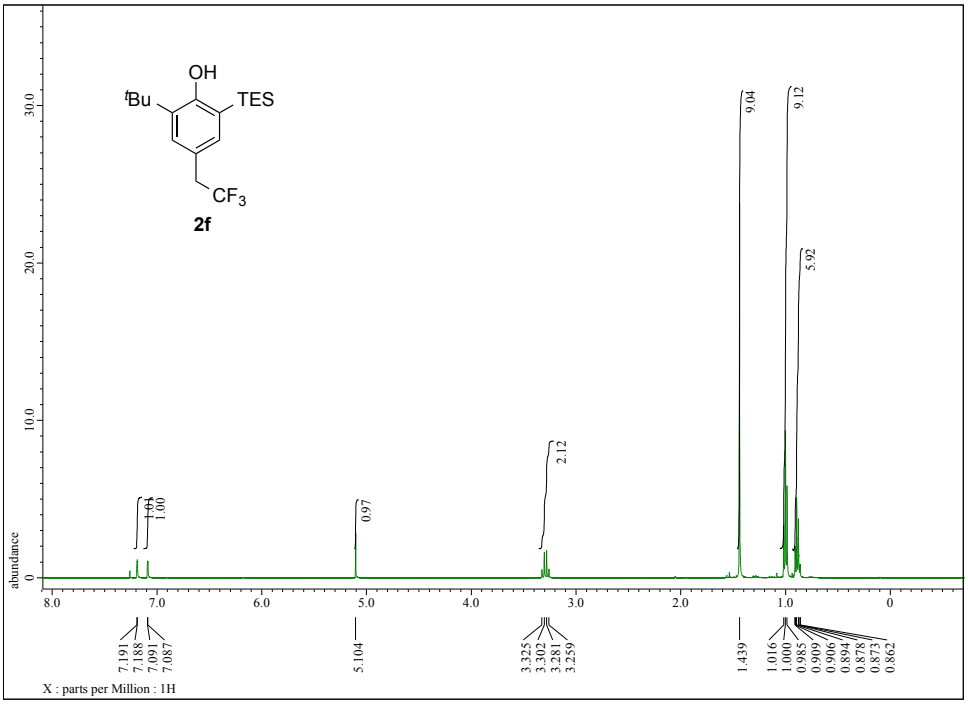

OH
tBu
CO2Et
CF3
2d
abundance
X : parts per Million : 13C

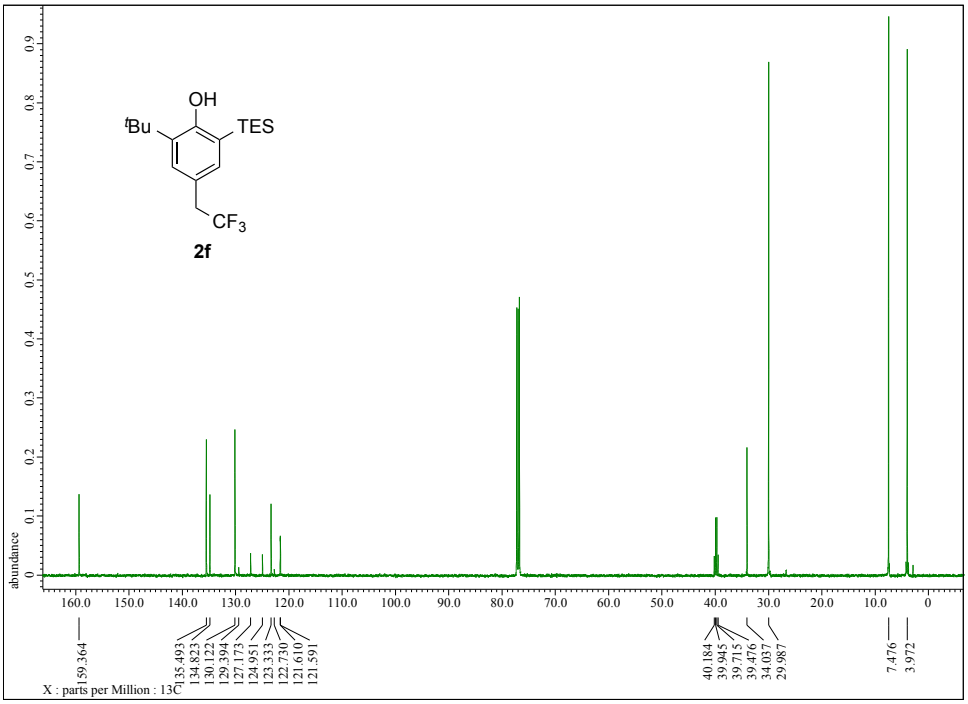

OH
tBu
CO2Et
CF3
2d
(Thousands)
6.0
5.0
4.0
3.0
2.0
1.0
0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-66.042
-66.066
-66.091
X : parts per Million : 19F

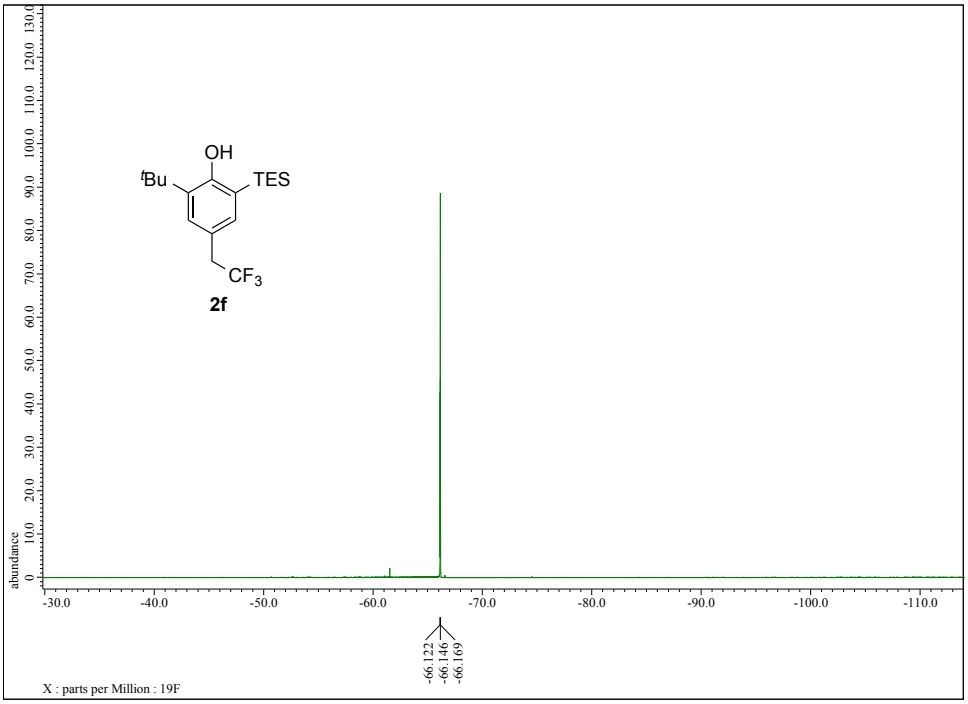

OH
tBu
CO2Et
CF3
2e
(Thousands)
X : parts per Million : 1H

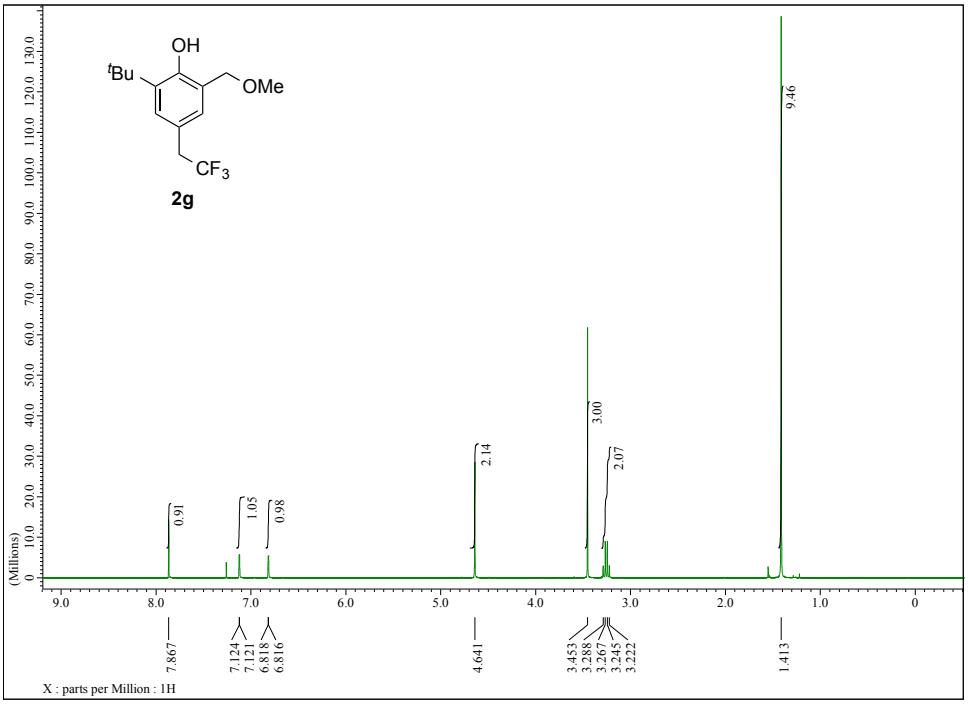

OH
tBu
CO2Et
CF3
2e
(Thousands)
X : parts per Million : 13C

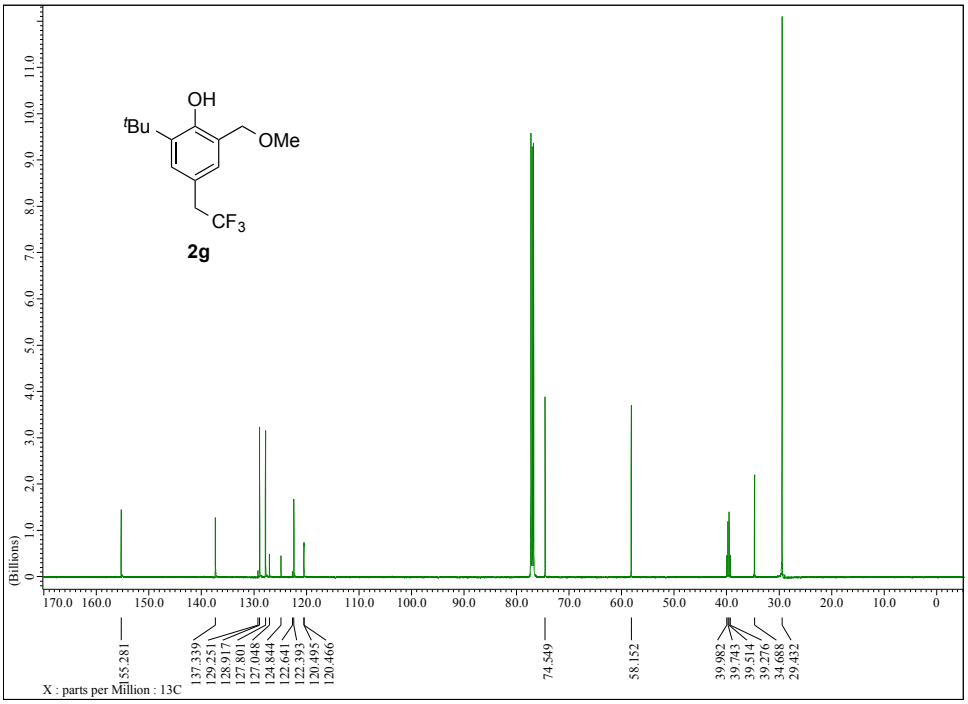

OH
tBu
CO2Et
CF3
2e
abundance
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
-120.0
-130.0
-140.0
-150.0
-66.103
-66.127
-66.146
X : parts per Million : 19F

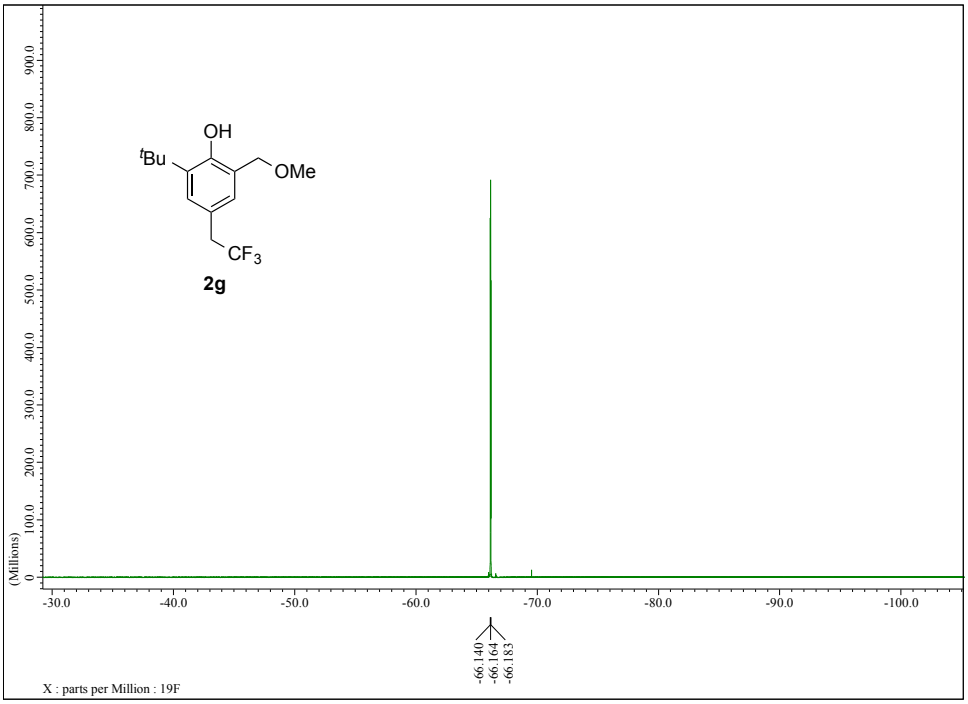

OH
tBu
TES
CF3
2f
abundance
9.04
9.12
5.92
2.12
1.00
0.97
7.191
7.188
7.091
7.087
5.104
3.325
3.302
3.281
3.259
1.439
1.016
1.000
0.985
0.909
0.906
0.894
0.878
0.873
0.862
X : parts per Million : 1H

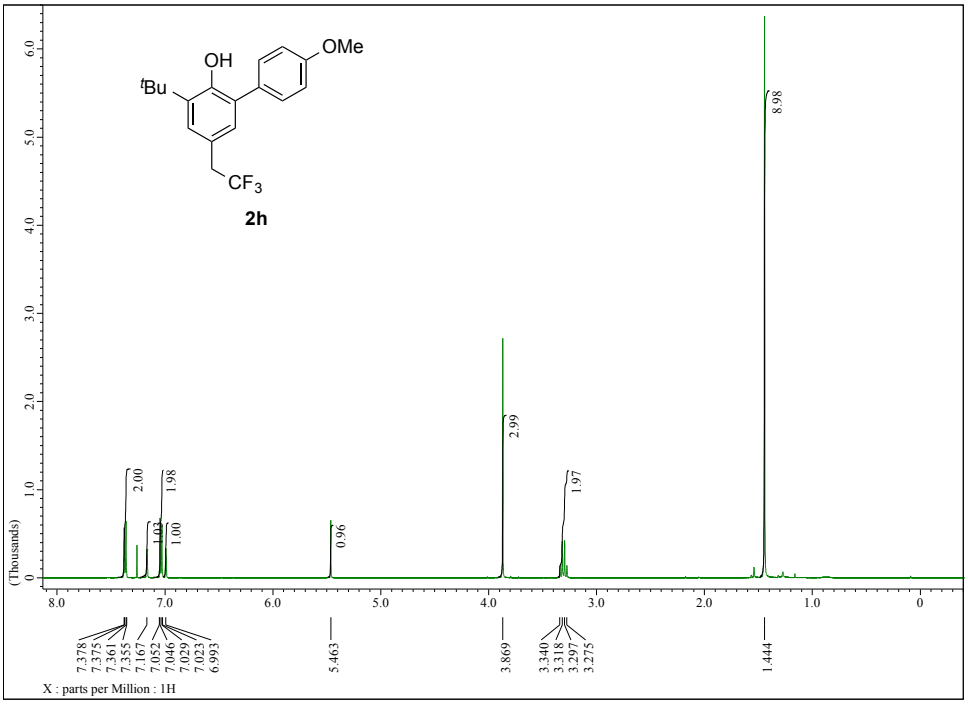

OH
tBu
TES
CF3
2f
abundance
159.364
135.493
134.823
130.122
129.394
127.173
124.951
123.333
122.730
121.610
121.591
40.184
39.945
39.715
39.476
34.037
29.987
7.476
3.972
X : parts per Million : 13C

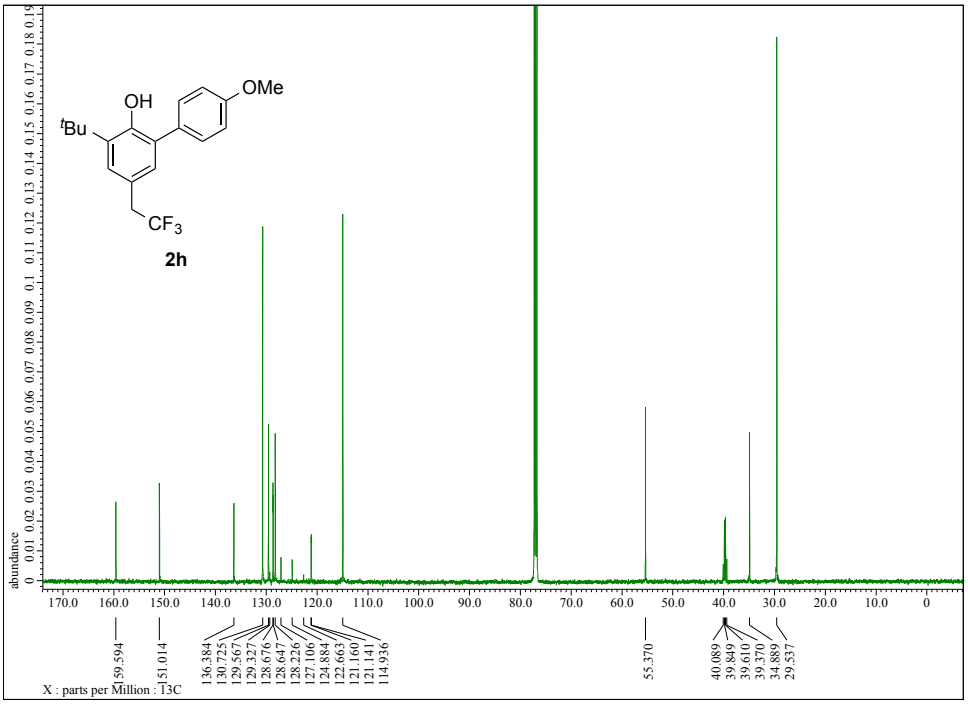

OH
tBu
TES
CF3
2f
abundance
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
-66.122
-66.146
-66.169
X : parts per Million : 19F

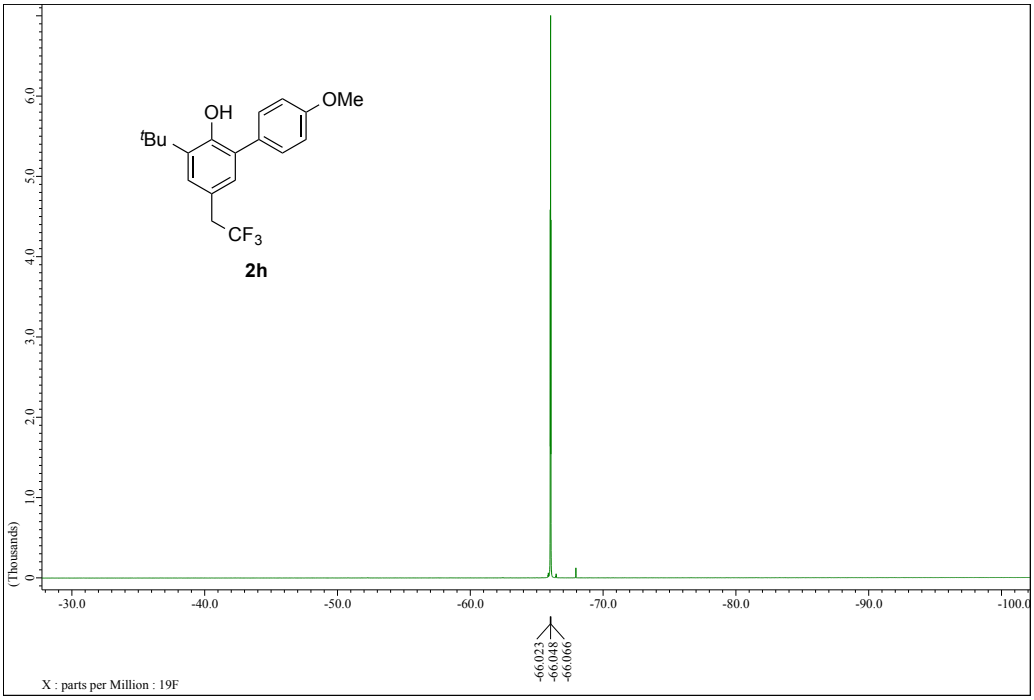

OH
tBu
OMe
CF3
2g
(Millions)
9.46
3.00
2.14
2.07
0.91
1.05
0.98
7.867
7.124
7.121
6.818
6.816
4.641
3.453
3.288
3.267
3.245
3.222
1.413
X : parts per Million : 1H

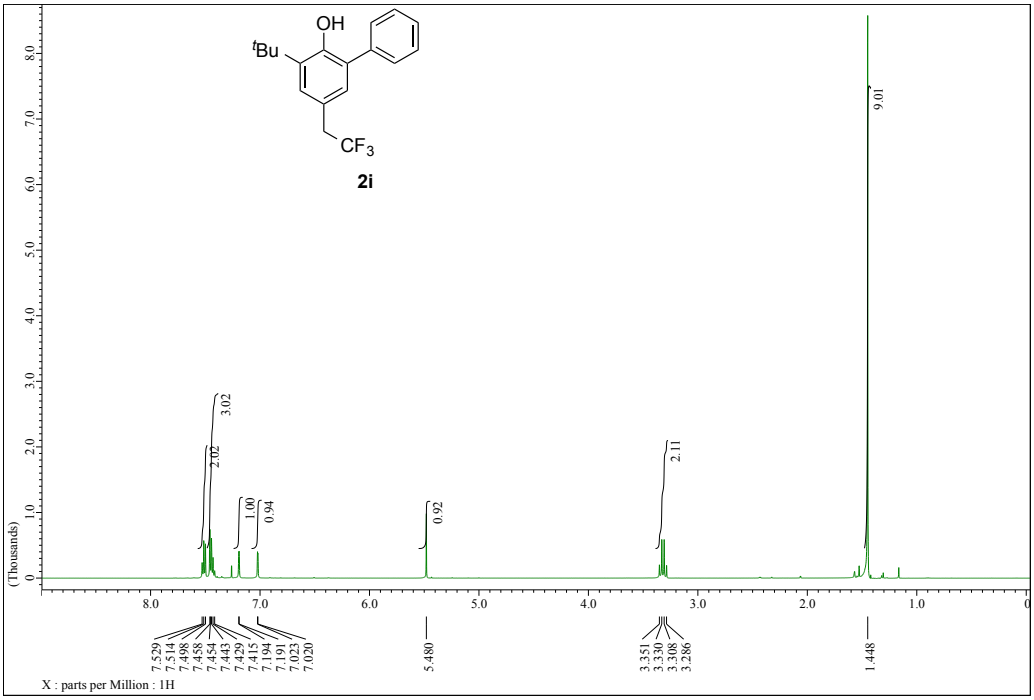

OH
tBu
OMe
CF3
2g
(Billions)
55.281
137.339
129.251
128.917
127.801
127.048
124.844
122.641
122.393
120.495
120.466
74.549
58.152
39.982
39.743
39.514
39.276
34.688
29.432
X : parts per Million : 13C

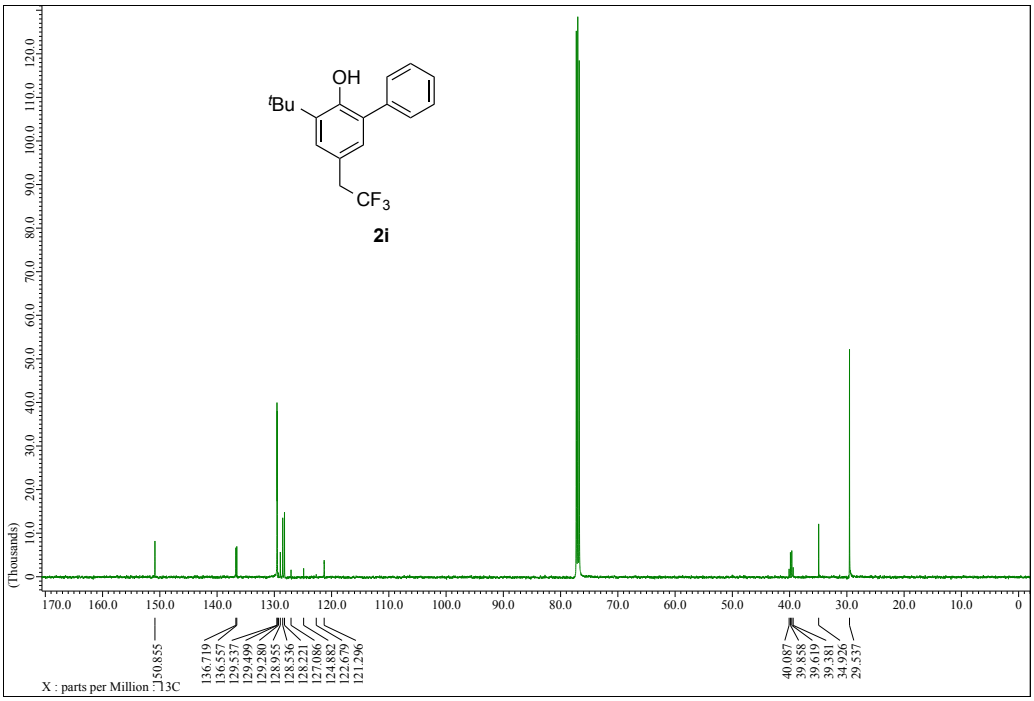

OH
tBu
OMe
CF3
2g
(Millions)
900.0
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-66.140
-66.164
-66.183
X : parts per Million : 19F

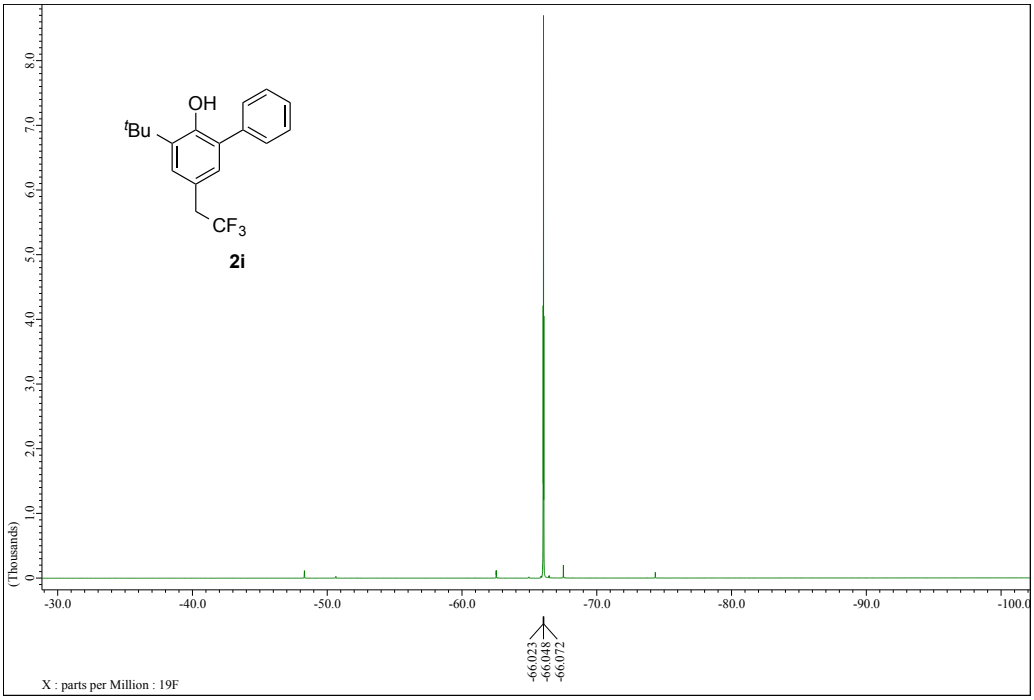

OH
OMe
tBu
CF3
2h
(Thousands)
X : parts per Million : 1H

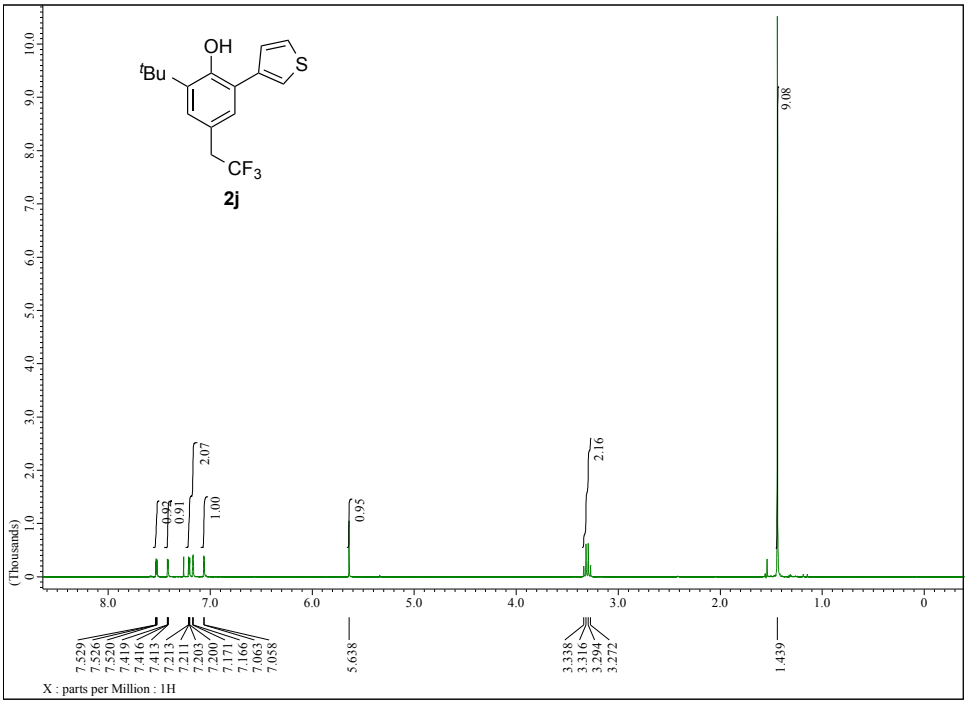

OH
OMe
tBu
CF3
2h
abundance
X : parts per Million : 13C

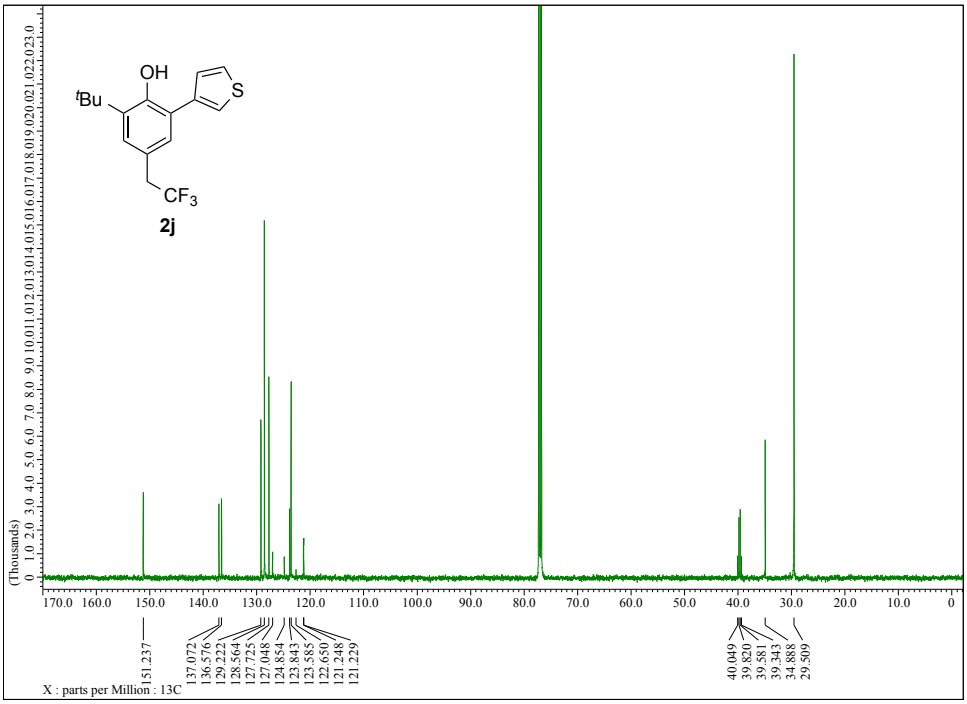

OH
OMe
tBu
CF3
2h
( Thousands)
6.0
5.0
4.0
3.0
2.0
1.0
0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-66.023
-66.048
-66.066
X : parts per Million : 19F

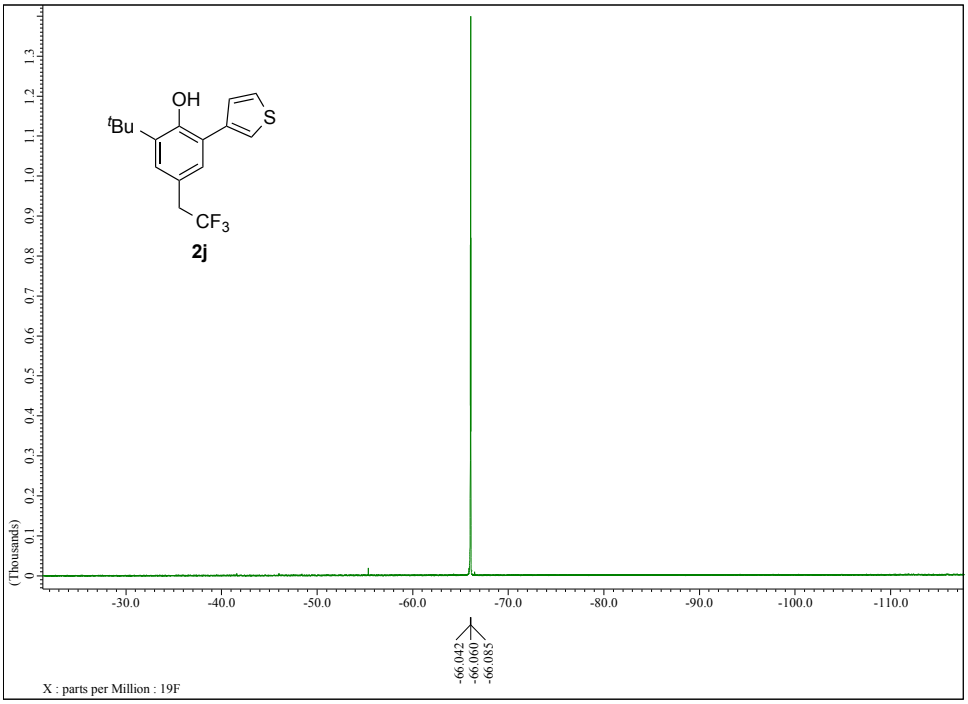

OH
tBu
CF3
2i
9.01
3.02
2.02
1.00
0.94
0.92
2.11
(Thousands)
7.529
7.514
7.498
7.458
7.454
7.443
7.429
7.415
7.194
7.191
7.023
7.020
5.480
3.351
3.330
3.308
3.286
1.448
X : parts per Million : 1H

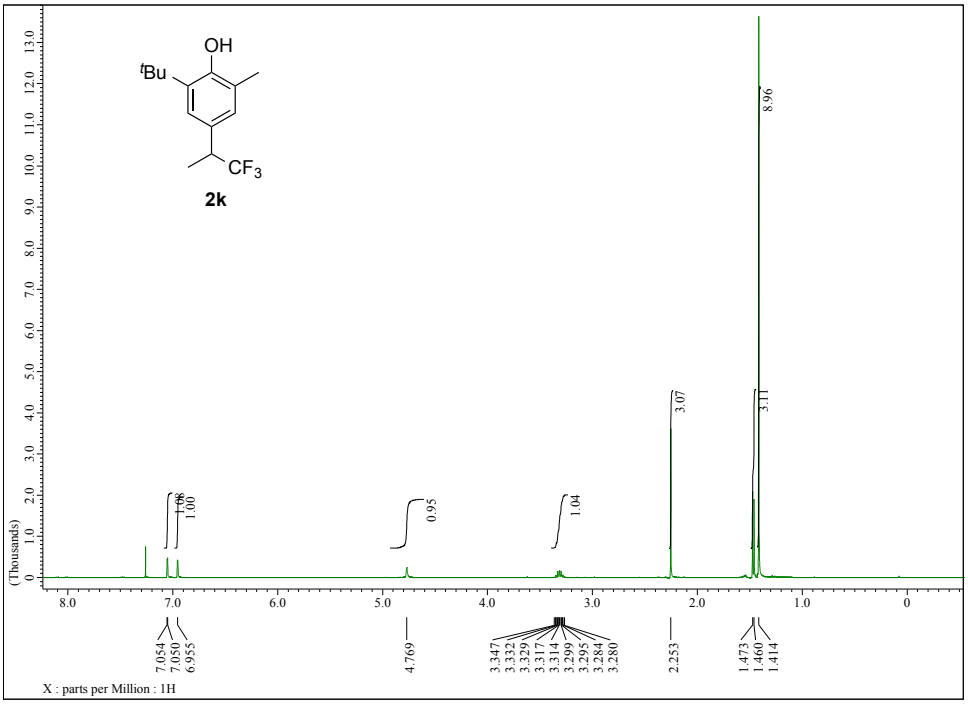

OH
tBu
CF3
2i
(Thousands)
150.855
136.719
136.537
129.597
129.490
129.280
128.955
128.526
128.221
127.086
124.882
122.679
121.296
40.087
39.858
39.619
39.381
34.926
29.537
X : parts per Million : 13C

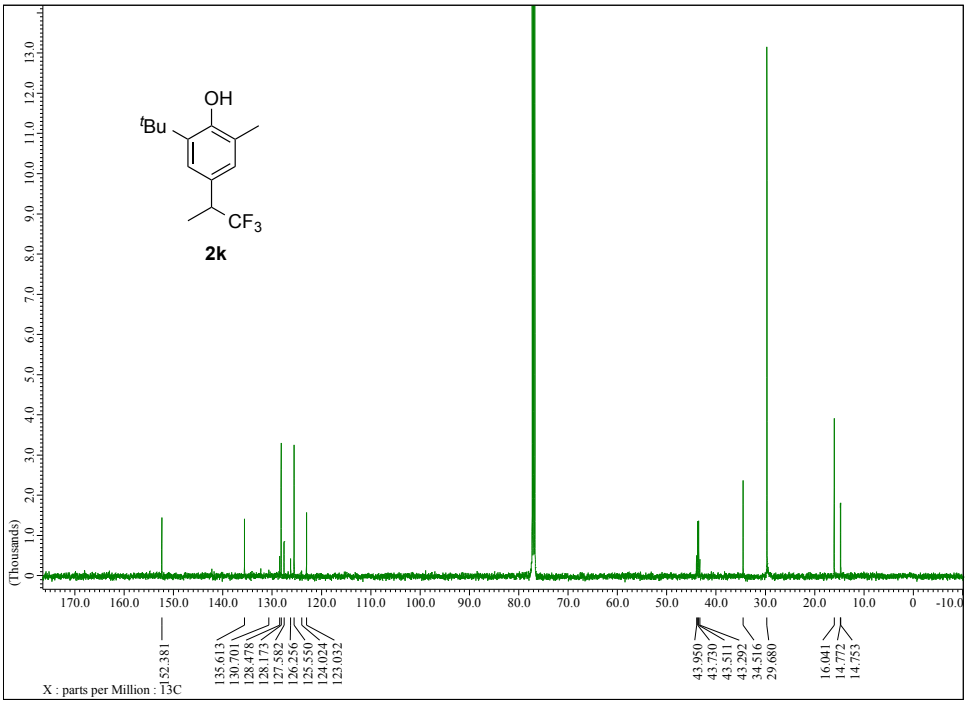

OH
tBu
CF3
2i
( Thousands)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-66.023
-66.048
-66.072
X : parts per Million : 19F

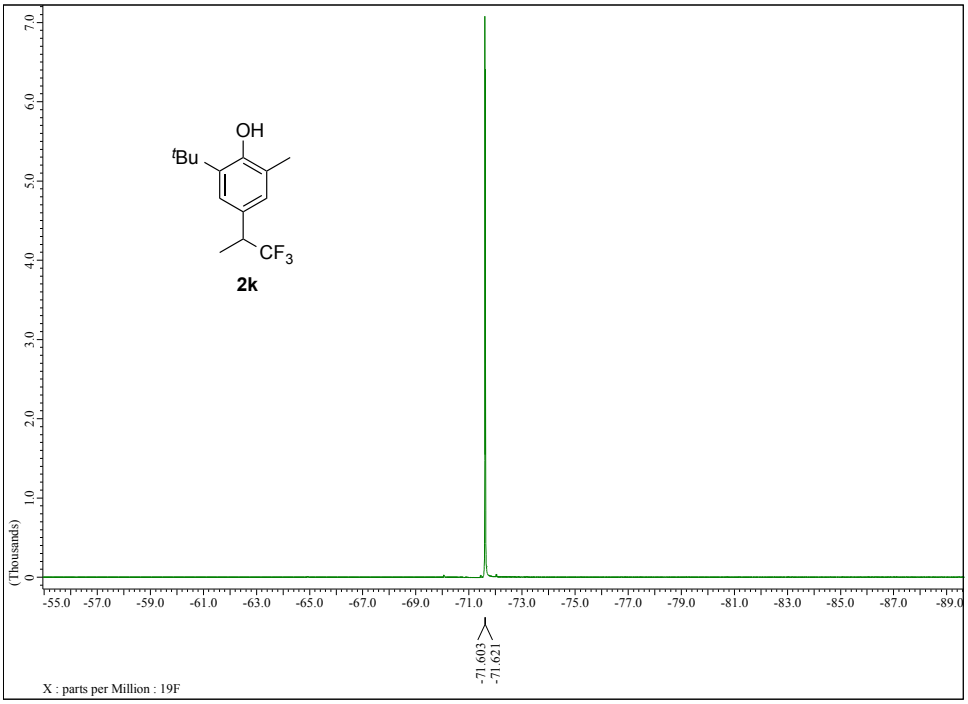

OH
tBu
S
CF3
2j
(Thousands)
9.08
2.16
2.07
1.00
0.95
0.92
0.91
7.529
7.526
7.520
7.419
7.416
7.413
7.213
7.211
7.203
7.200
7.171
7.166
7.063
7.058
5.638
3.338
3.316
3.294
3.272
1.439
X : parts per Million : 1H

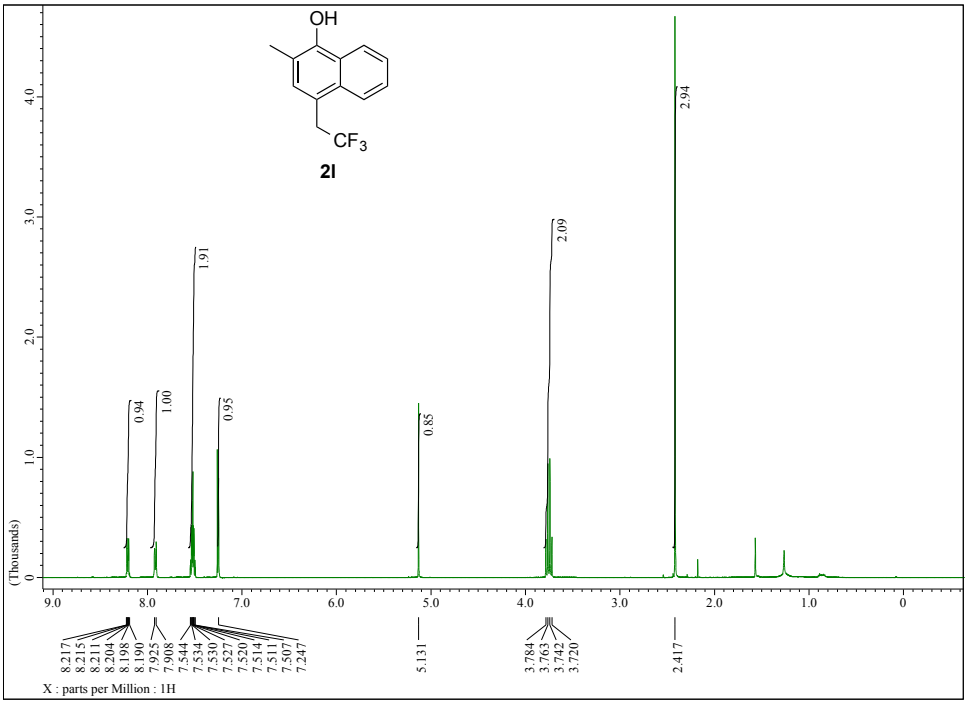

OH
tBu
S
CF3
2j
(Thousands)
151.237
137.072
136.576
129.222
128.564
127.725
127.048
124.854
123.843
123.585
122.650
121.248
121.229
40.049
39.820
39.581
39.343
34.888
29.509
X : parts per Million : 13C

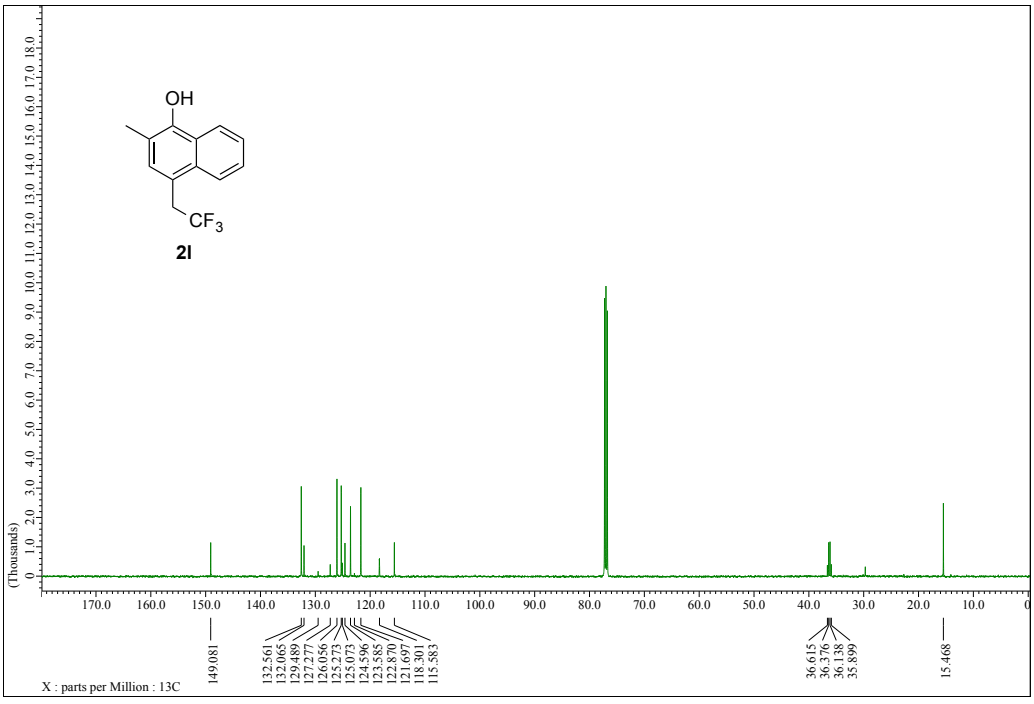

OH
tBu
S
CF3
2j
(Thousands)
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
-66.042
-66.060
-66.085
X : parts per Million : 19F

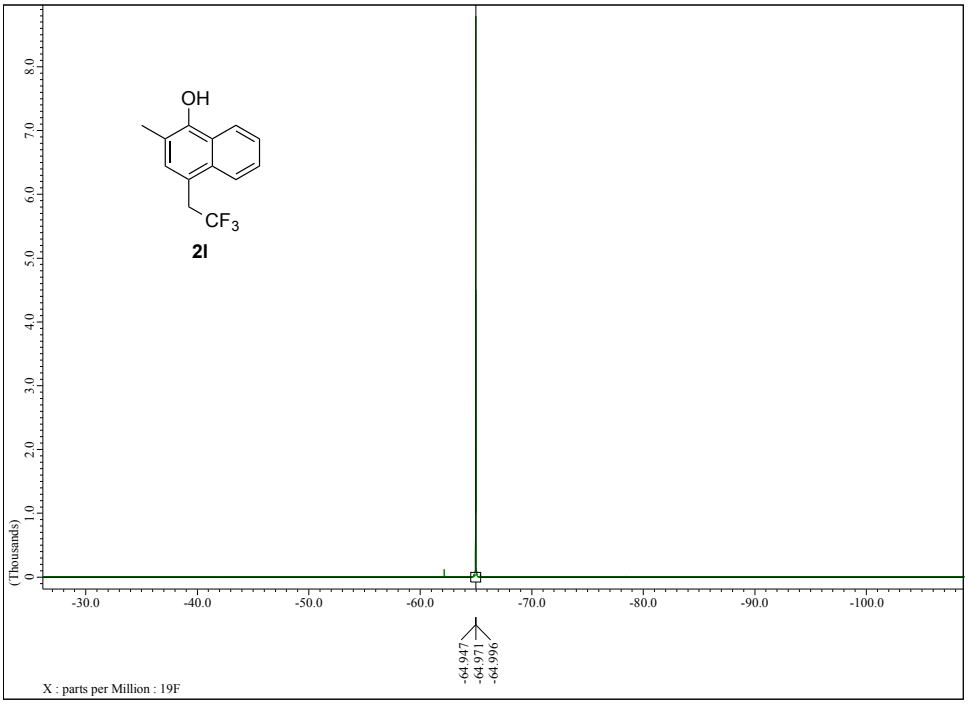

OH
tBu
CF3
2k
8.96
3.07
3.11
1.00
1.00
0.95
1.04
(Thousands)
7.054
7.050
6.955
4.769
3.347
3.332
3.329
3.317
3.314
3.299
3.295
3.284
3.280
2.253
1.473
1.460
1.414
X : parts per Million : 1H

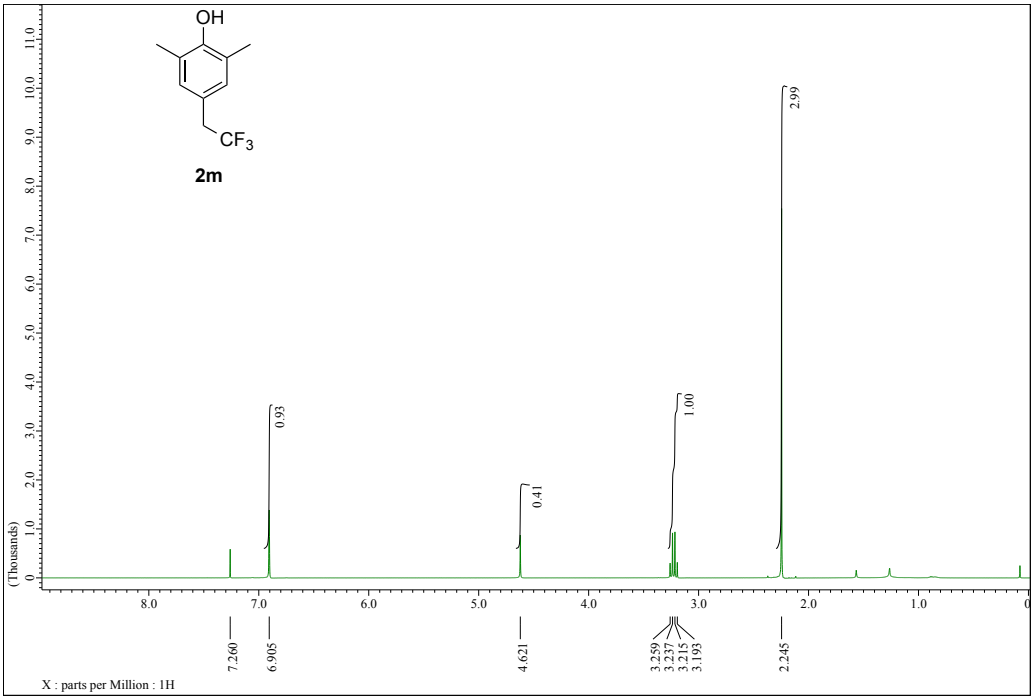

OH
tBu
CF3
2k
(Thousands)
152.381
135.613
130.701
128.478
128.173
127.582
126.256
125.550
124.024
123.032
43.950
43.730
43.511
43.292
34.516
29.680
16.041
14.772
14.753
X : parts per Million : 13C

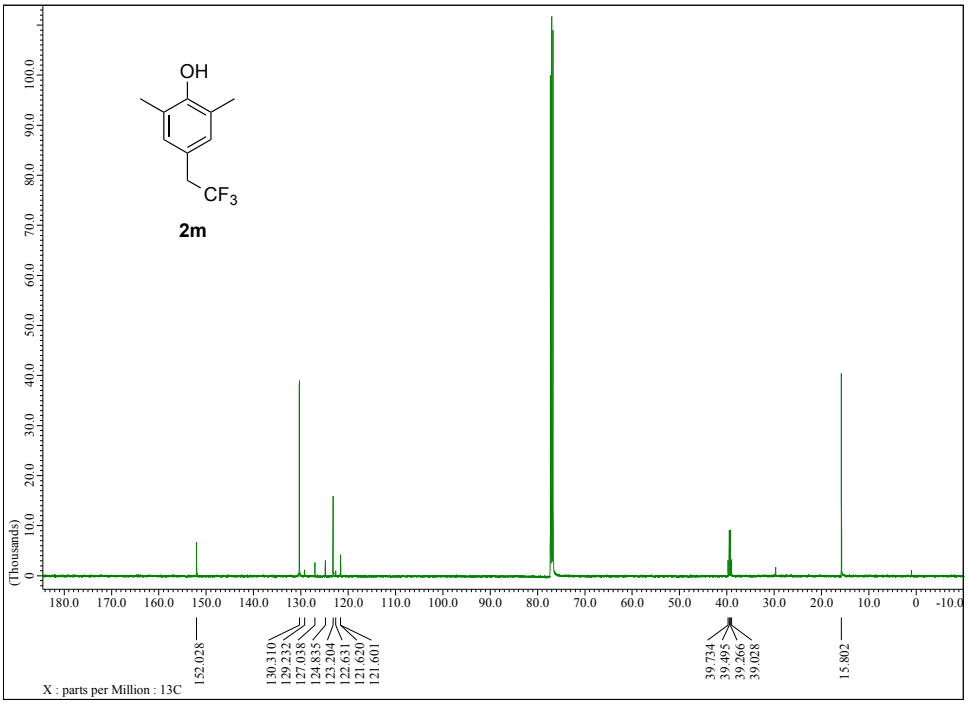

OH
tBu
CF3
2k
(Thousands)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
-55.0 -57.0 -59.0 -61.0 -63.0 -65.0 -67.0 -69.0 -71.0 -73.0 -75.0 -77.0 -79.0 -81.0 -83.0 -85.0 -87.0 -89.0
-71.603
-71.621
X : parts per Million : 19F

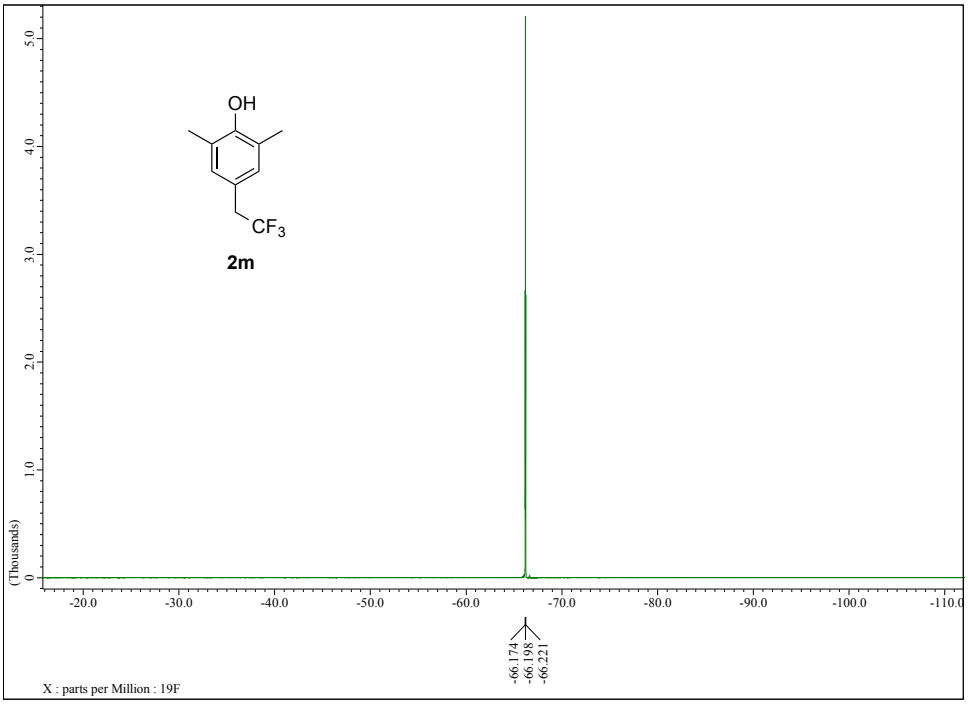

OH
CF3
2l
(Thousands)
X : parts per Million : 1H

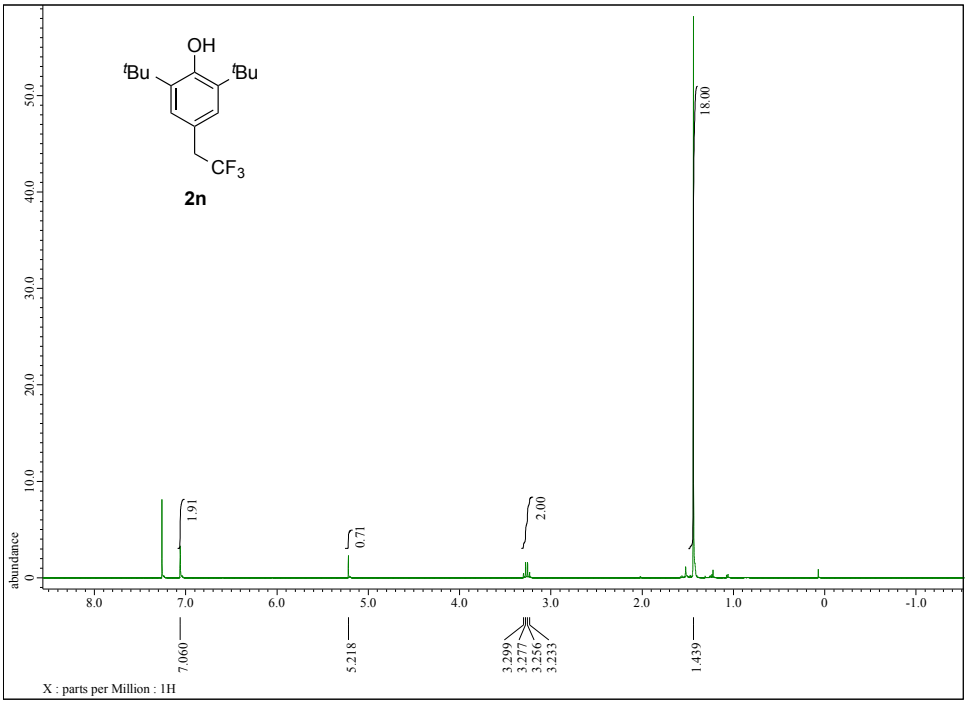

OH
CF3
2l
(Thousands)
X : parts per Million : 13C

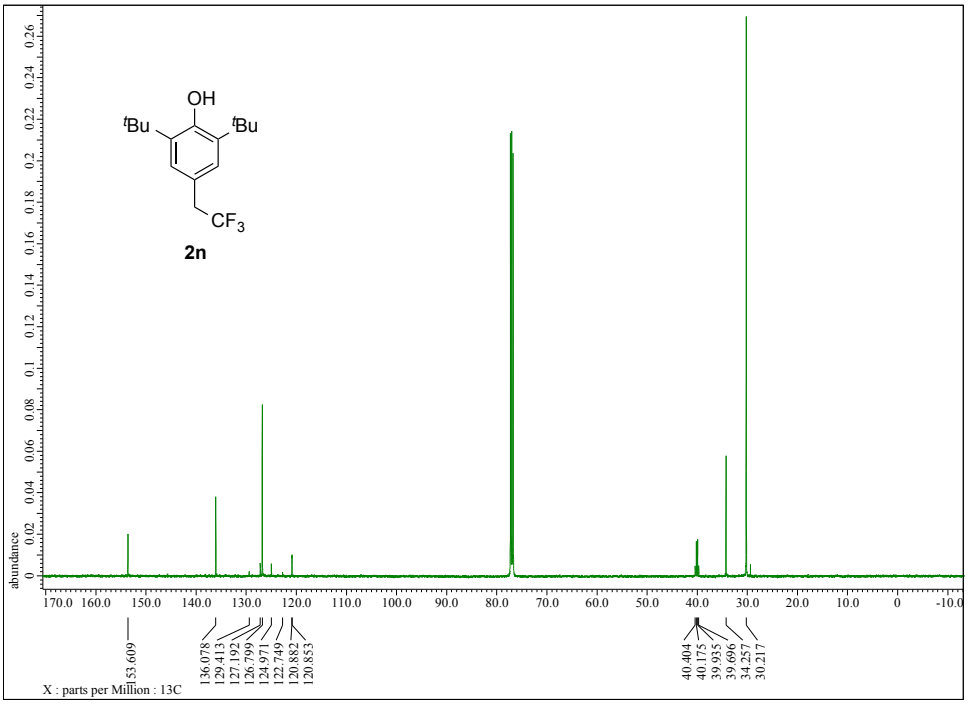

OH
CF3
2l
(Thousands)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-64.947
-64.971
-64.996
X : parts per Million : 19F

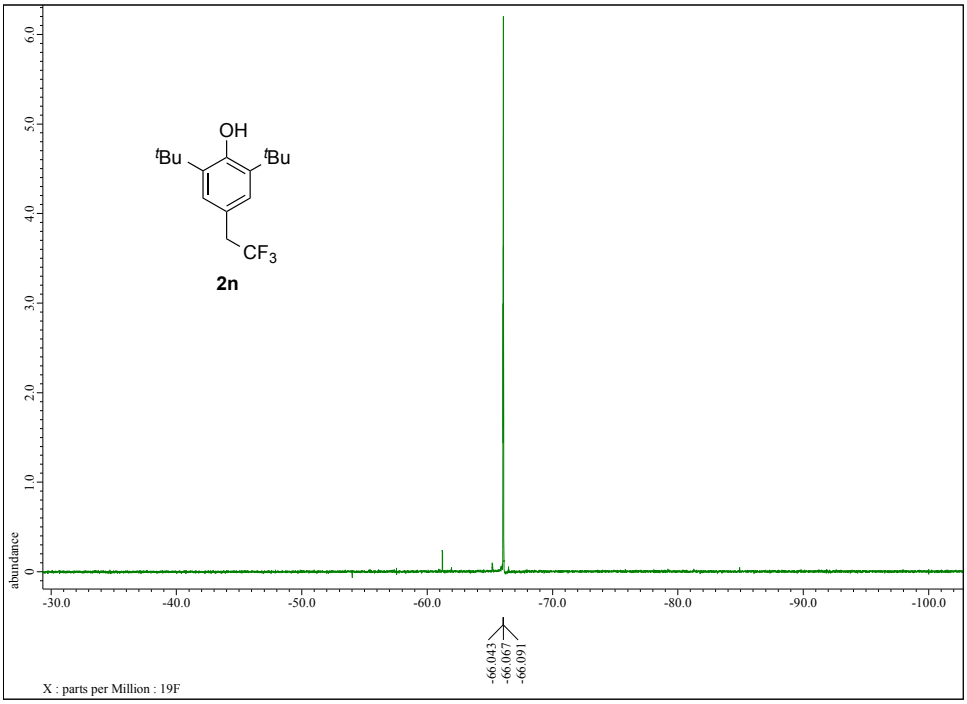

OH
CF3
2m
(Thousands)
X : parts per Million : 1H
7.260
6.905
4.621
3.259
3.237
3.215
3.193
2.245
0.93
0.41
1.00
2.99

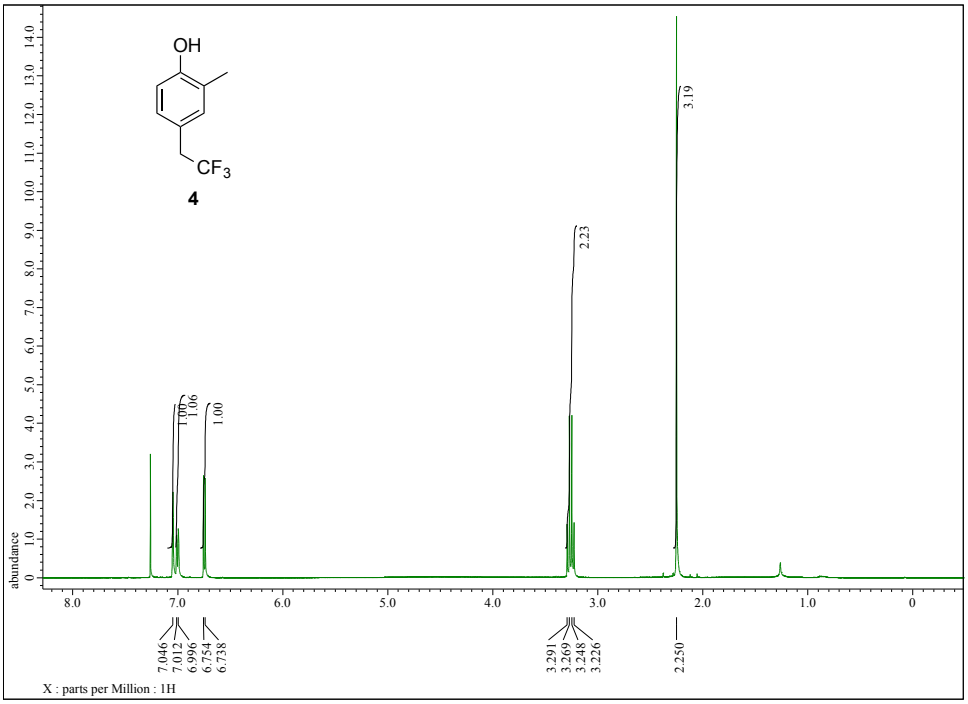

OH
CF3
2m
(Thousands)
X : parts per Million : 13C
152.028
130.310
129.232
127.038
124.835
123.204
122.631
121.620
121.601
39.734
39.495
39.266
39.028
15.802

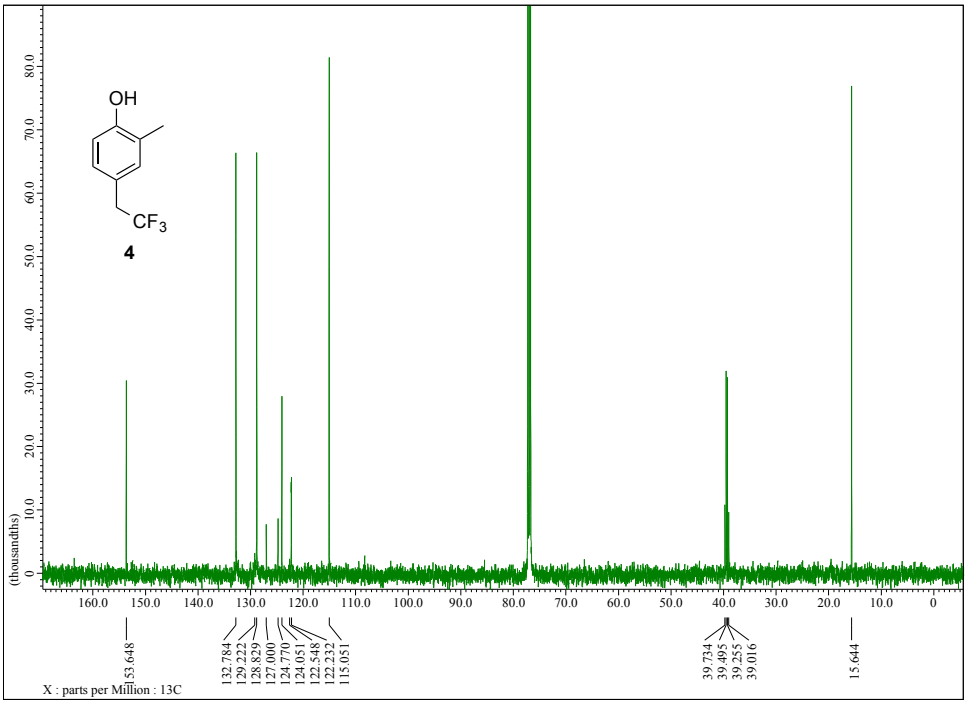

OH
CF3
2m
(Thousands)
5.0
4.0
3.0
2.0
1.0
0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
-66.174
-66.198
-66.221
X : parts per Million : 19F

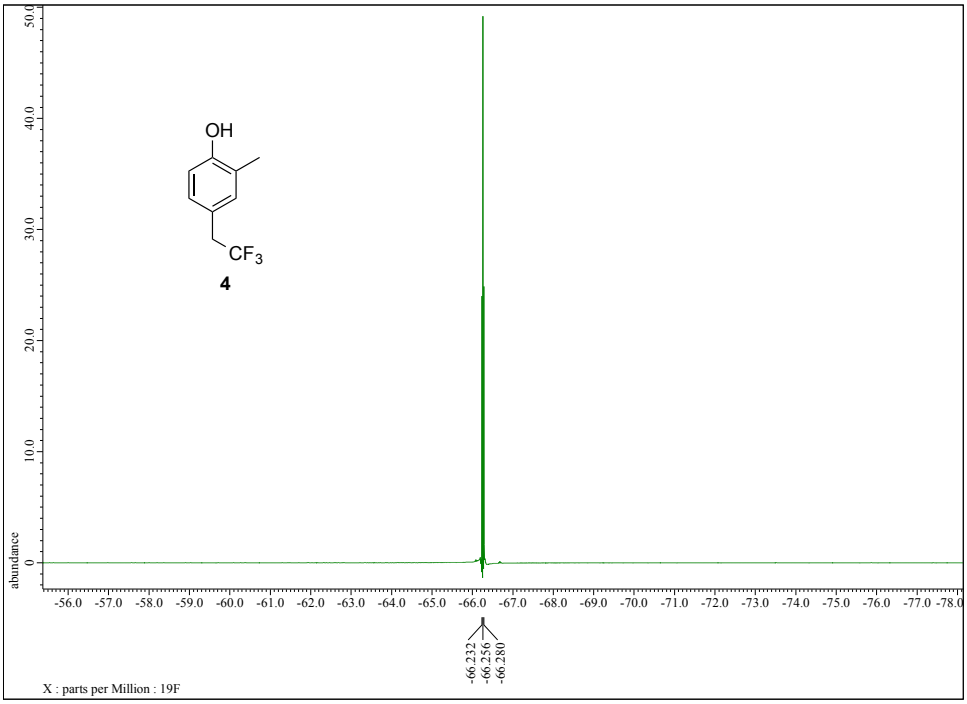

OH
tBu
tBu
CF3
2n
abundance
X : parts per Million : 1H
7.060
5.218
3.299
3.277
3.256
3.233
1.439
1.91
0.71
2.00
18.00

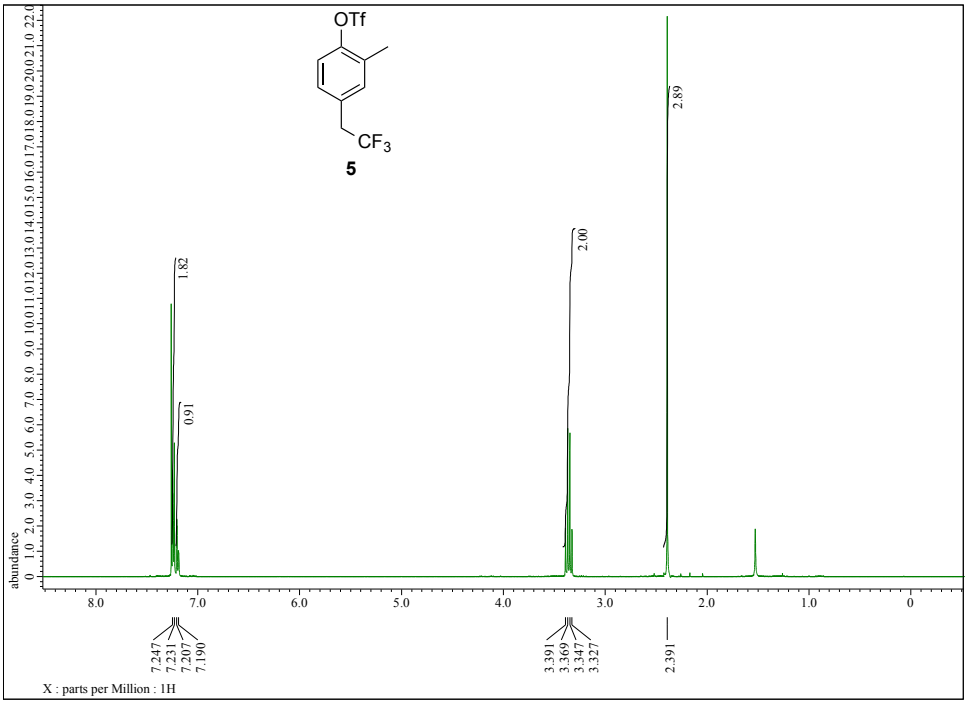

OH
tBu
tBu
CF3
2n
abundance
X : parts per Million : 13C
153.609
136.078
129.413
127.192
126.799
124.971
122.749
120.882
120.853
40.404
40.175
39.935
39.696
34.257
30.217

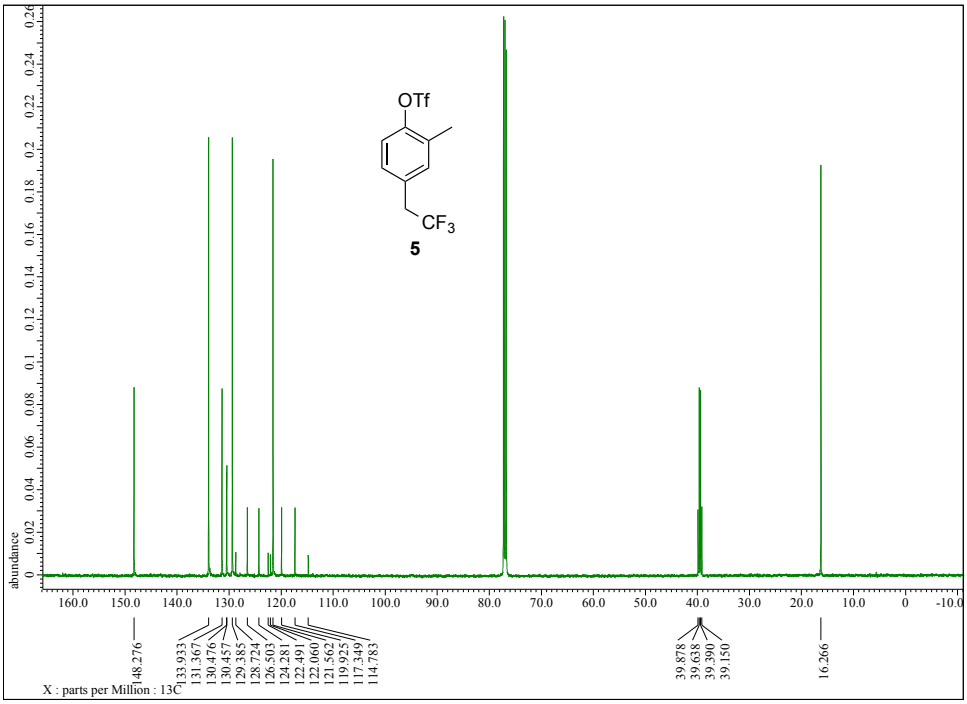

OH
tBu
tBu
CF3
2n
abundance
6.0
5.0
4.0
3.0
2.0
1.0
0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-66.043
-66.067
-66.091
X : parts per Million : 19F

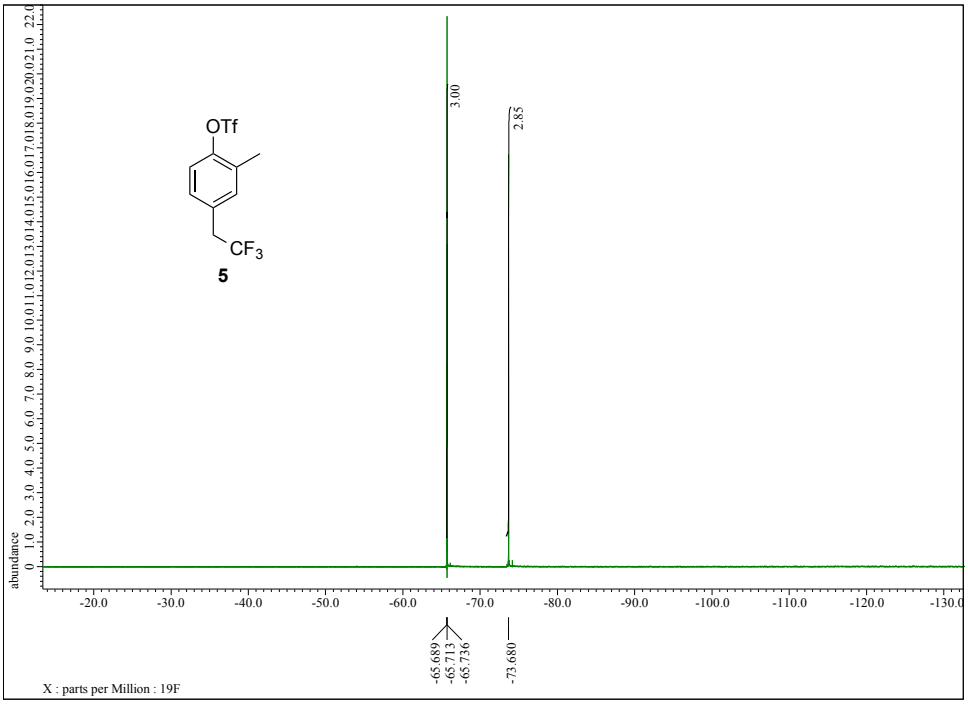

OH
CF3
4
abundance
3.19
2.23
1.00
1.06
1.00
7.046
7.012
6.996
6.754
6.738
3.291
3.269
3.248
3.226
2.250
X : parts per Million : 1H

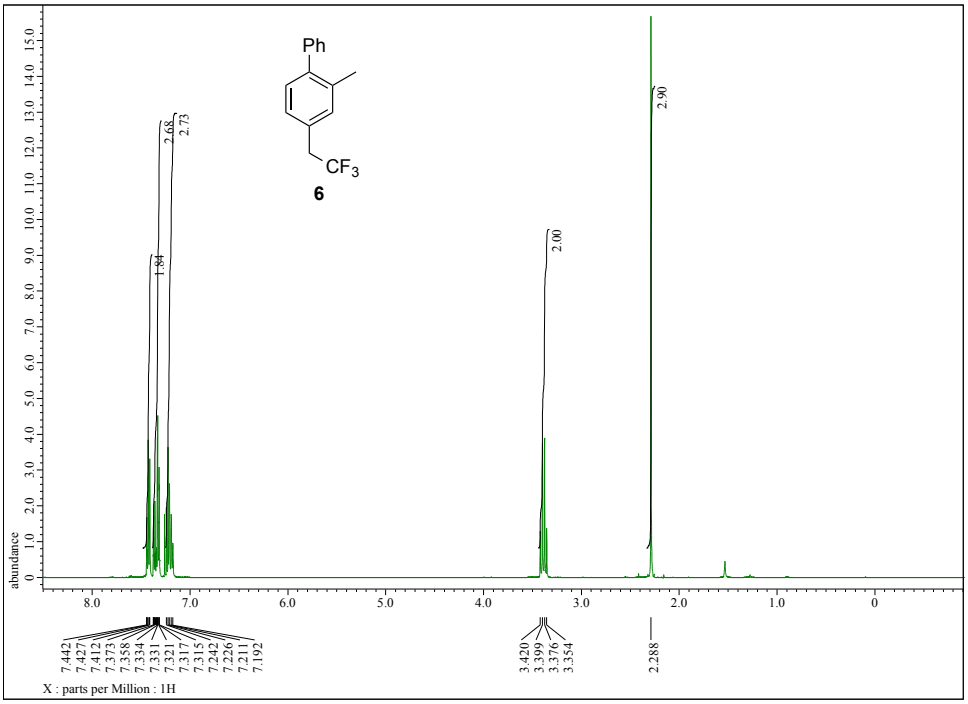

OH
CF3
4
(thousandths)
53.648
132.784
129.222
128.829
127.000
124.770
124.051
122.548
122.232
115.051
39.734
39.495
39.255
39.016
15.644
X : parts per Million : 13C

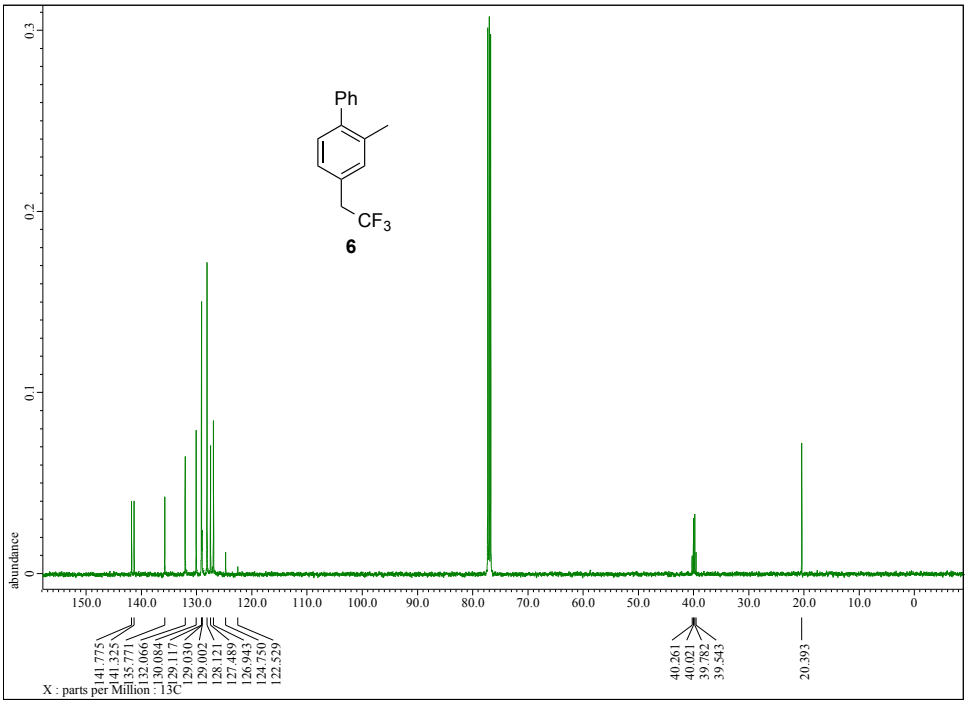

OH
CF3
4
abundance
50.0
40.0
30.0
20.0
10.0
0
-56.0 -57.0 -58.0 -59.0 -60.0 -61.0 -62.0 -63.0 -64.0 -65.0 -66.0 -67.0 -68.0 -69.0 -70.0 -71.0 -72.0 -73.0 -74.0 -75.0 -76.0 -77.0 -78.0
-66.232
-66.256
-66.280
X : parts per Million : 19F

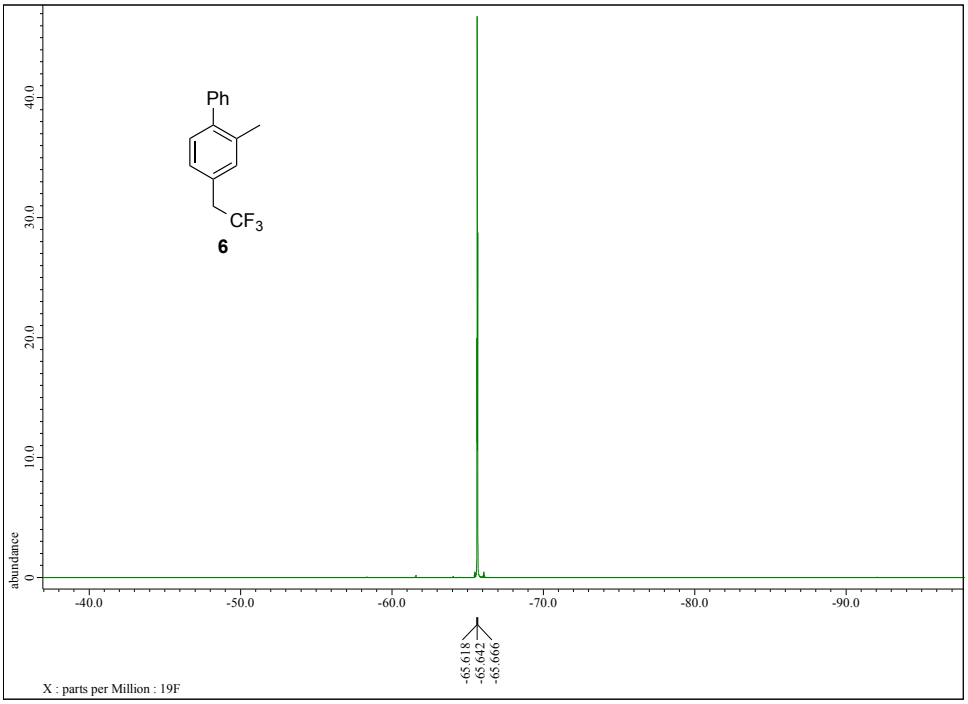

OTf
CF3
5
abundance
X : parts per Million : 1H
1.82
0.91
2.00
2.89
7.247
7.231
7.207
7.190
3.391
3.369
3.347
3.327
2.391

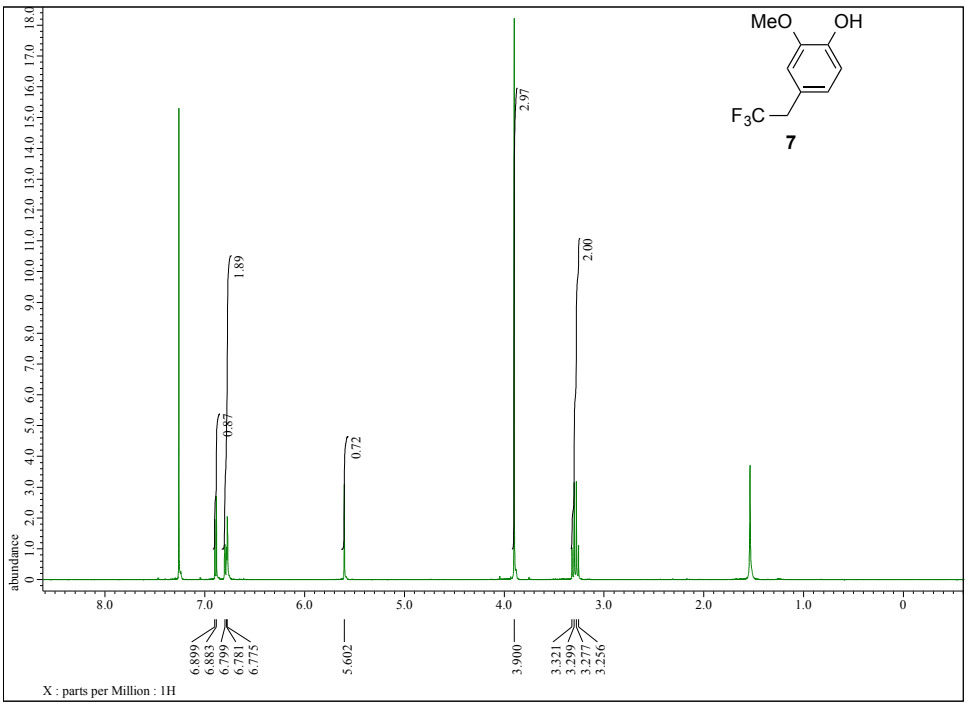

OTf
CF3
5
abundance
X : parts per Million : 13C
148.276
133.933
131.367
130.476
130.457
129.385
128.724
126.503
124.281
122.491
122.060
121.562
119.925
117.349
114.783
39.878
39.638
39.390
39.150
16.266

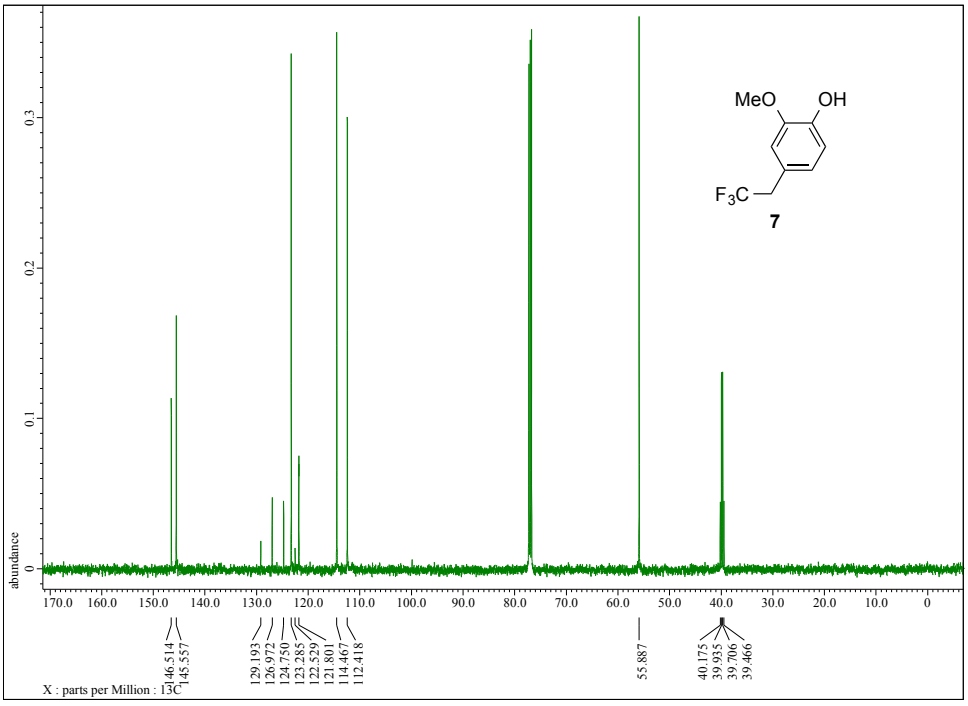

OTf
CF3
5
3.00
2.85
abundance
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
-120.0
-130.0
-65.689
-65.713
-65.736
-73.680
X : parts per Million : 19F

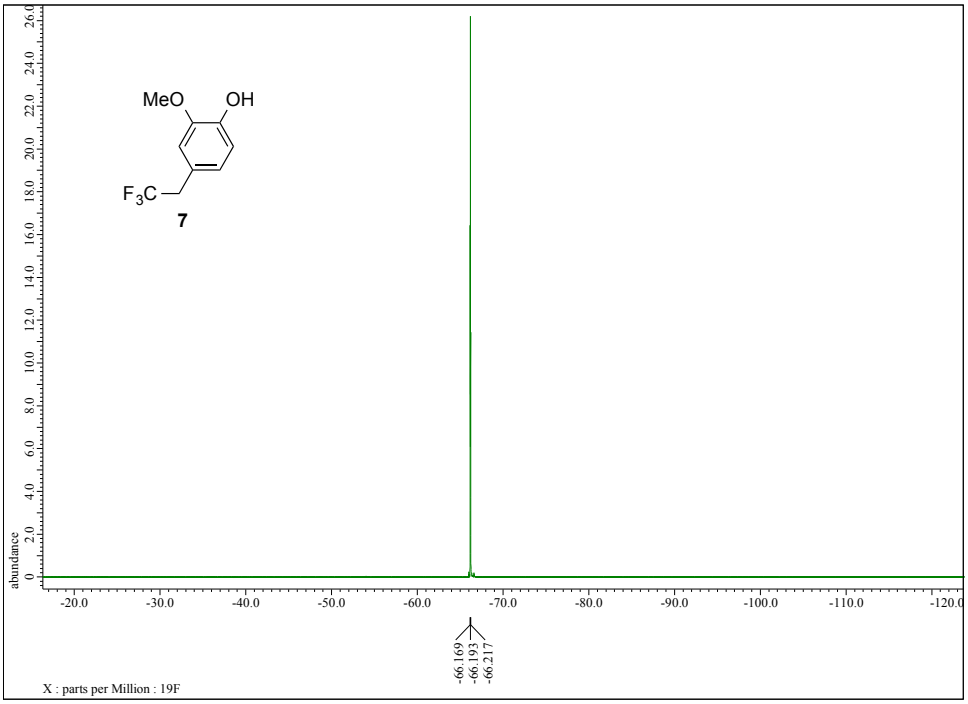

Ph
CF3
6
2.90
2.73
2.68
2.00
1.84
abundance
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
7.442
7.427
7.412
7.373
7.358
7.334
7.331
7.321
7.317
7.315
7.242
7.226
7.211
7.192
3.420
3.399
3.376
3.354
2.288
X : parts per Million : 1H

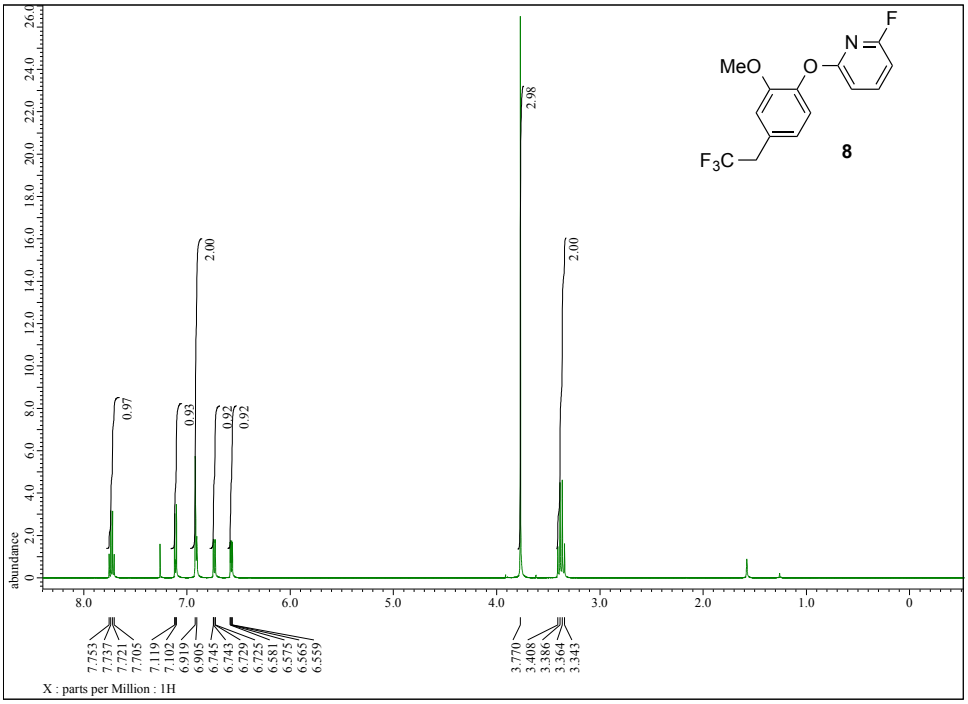

Ph
CF3
6
abundance
0.3
0.2
0.1
0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
141.775
141.325
135.771
132.066
130.084
129.117
129.030
129.002
128.121
127.489
126.943
124.759
122.529
40.261
40.021
39.782
39.543
20.393
X : parts per Million : 13C

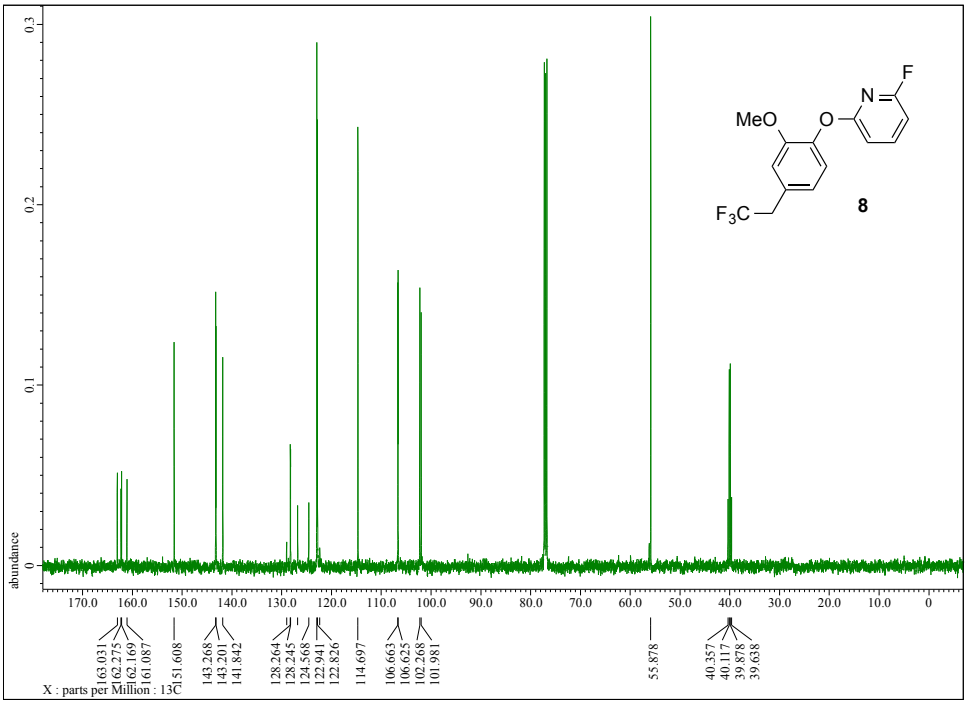

Ph
CF3
6
abundance
40.0
30.0
20.0
10.0
0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-65.618
-65.642
-65.666
X : parts per Million : 19F

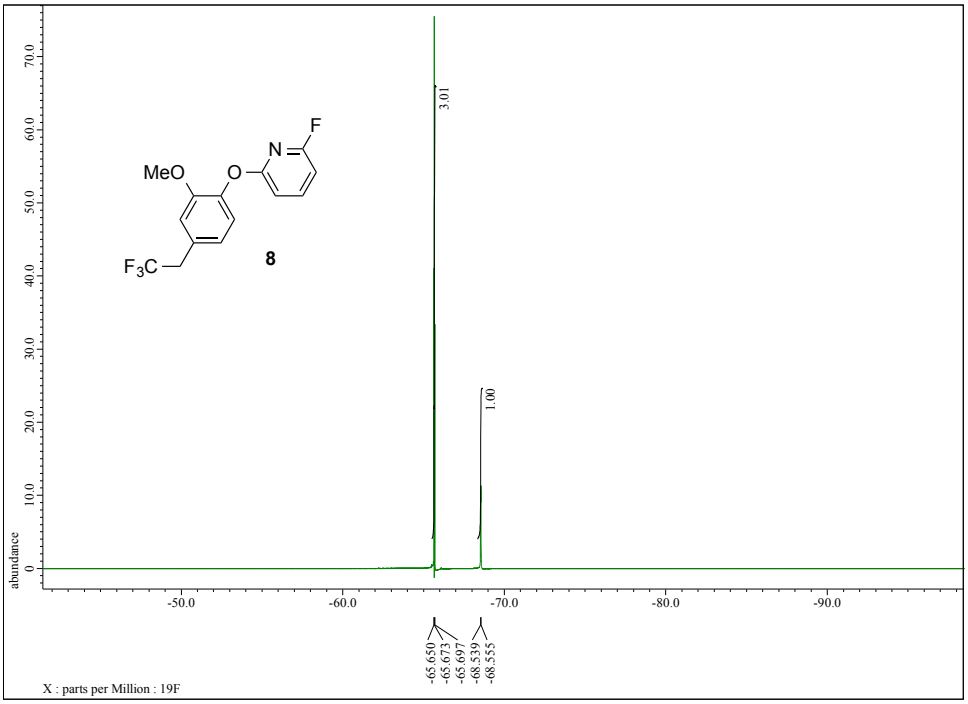

MeO
OH
F3C
7
abundance
2.97
1.89
2.00
0.87
0.72
6.899
6.883
6.799
6.781
6.775
5.602
3.900
3.321
3.299
3.277
3.256
X : parts per Million : 1H

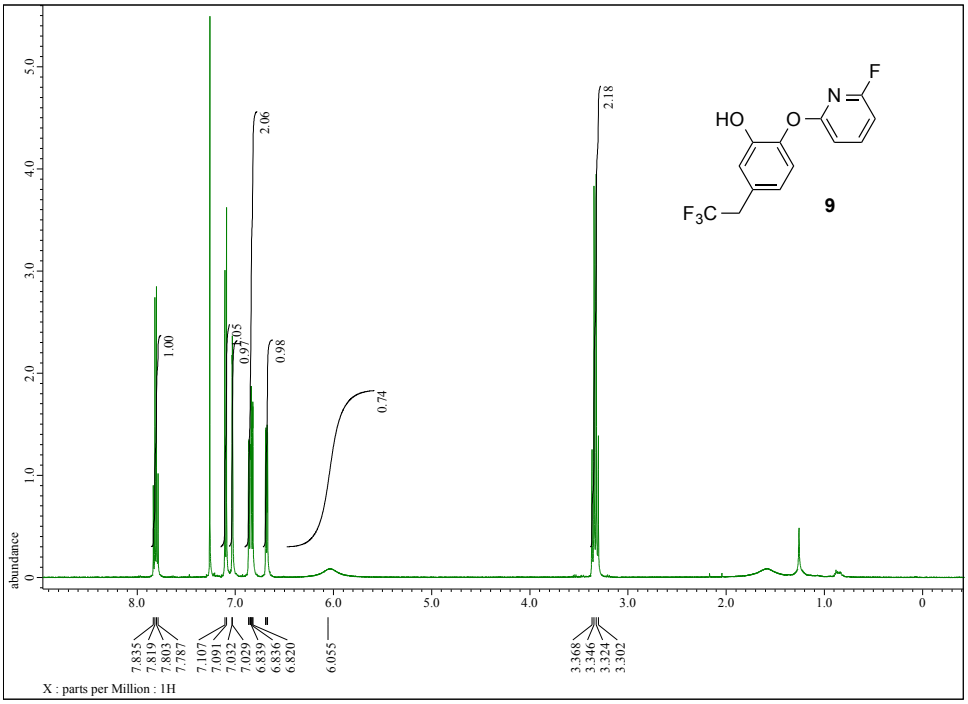

MeO
OH
F3C
7
abundance
146.514
145.557
129.193
126.972
124.750
123.285
122.529
121.801
114.467
112.418
55.887
40.175
39.935
39.706
39.466
X : parts per Million : 13C

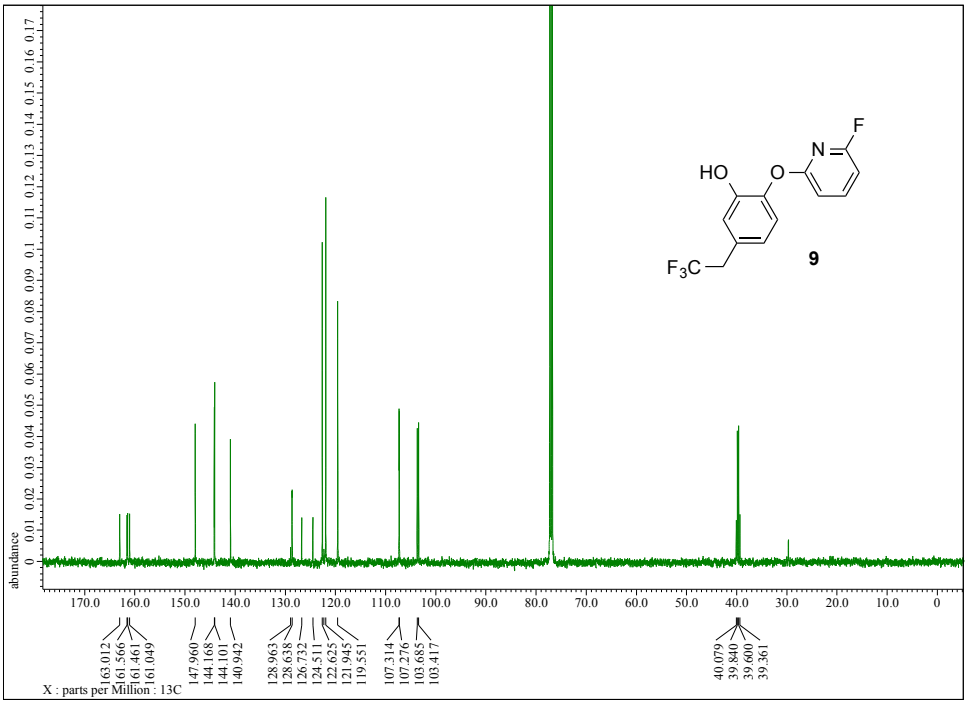

MeO
OH
F3C
7
abundance
26.0
24.0
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
-120.0
-66.169
-66.193
-66.217
X : parts per Million : 19F

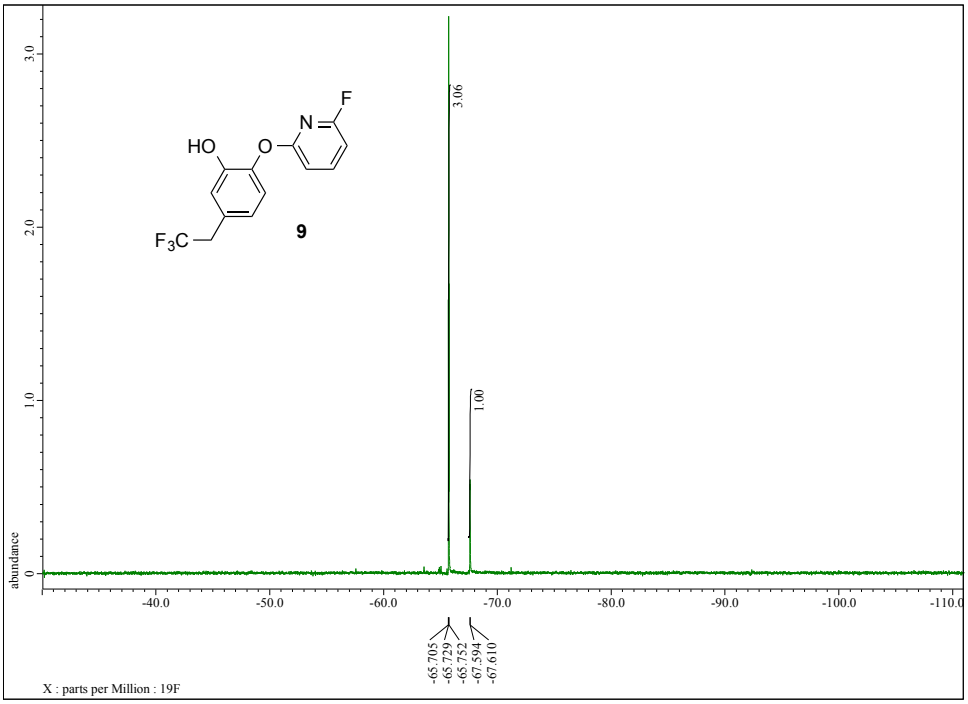

F
N
MeO
O
F3C
8
2.98
2.00
2.00
0.97
0.93
0.92
0.92
abundance
X : parts per Million : 1H

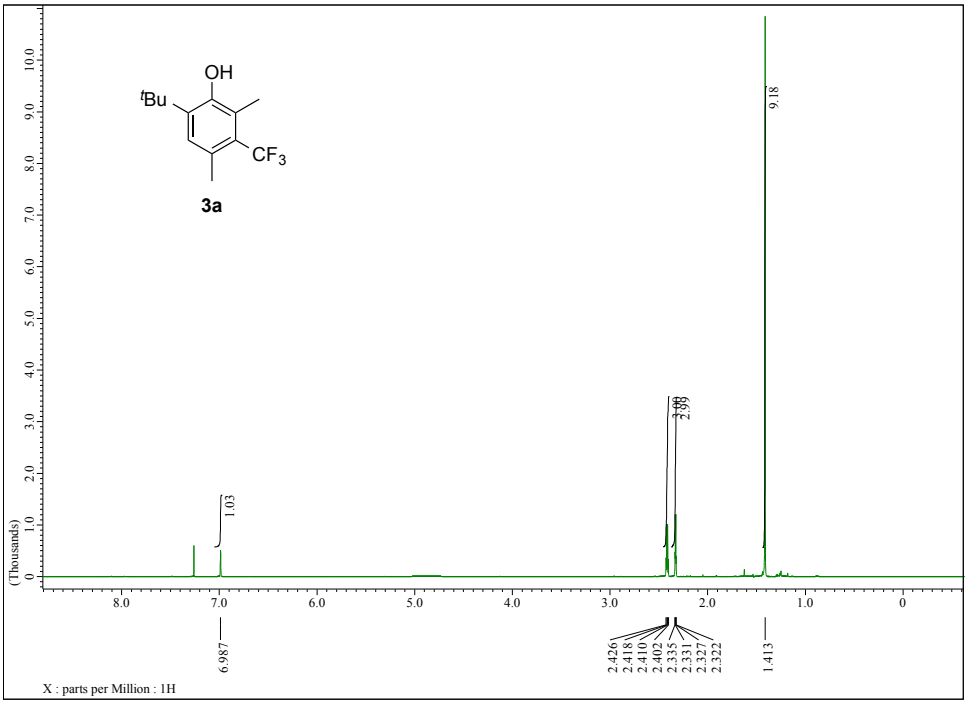

F
N
MeO
O
F3C
8
abundance
X : parts per Million : 13C

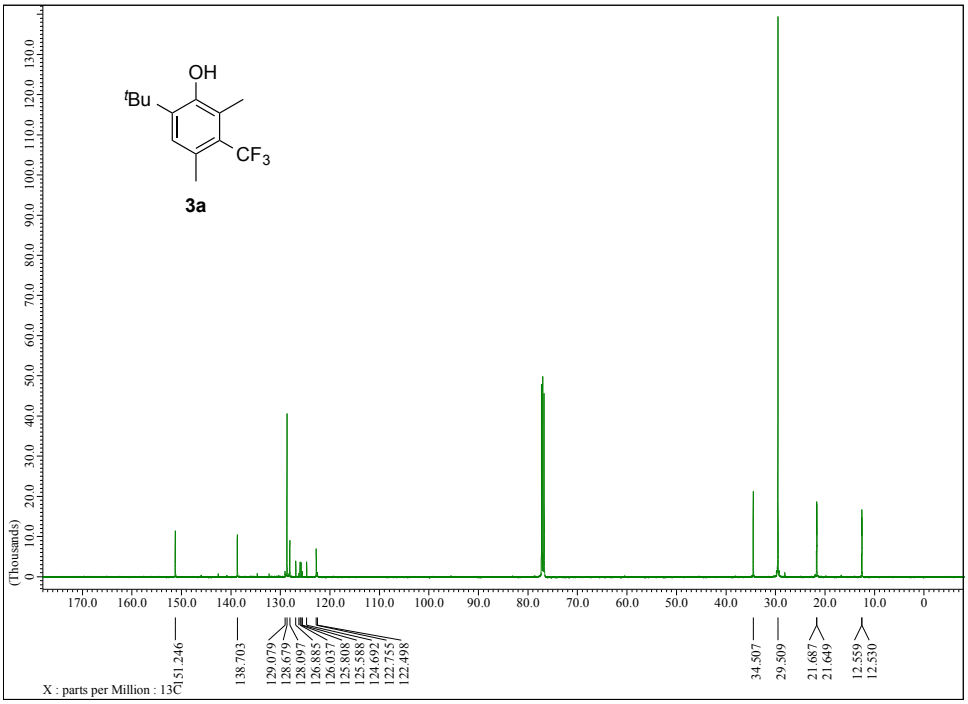

F
N
MeO
O
F3C
8
3.01
1.00
abundance
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-50.0
-60.0
-70.0
-80.0
-90.0
-65.650
-65.673
-65.697
-68.539
-68.555
X : parts per Million : 19F

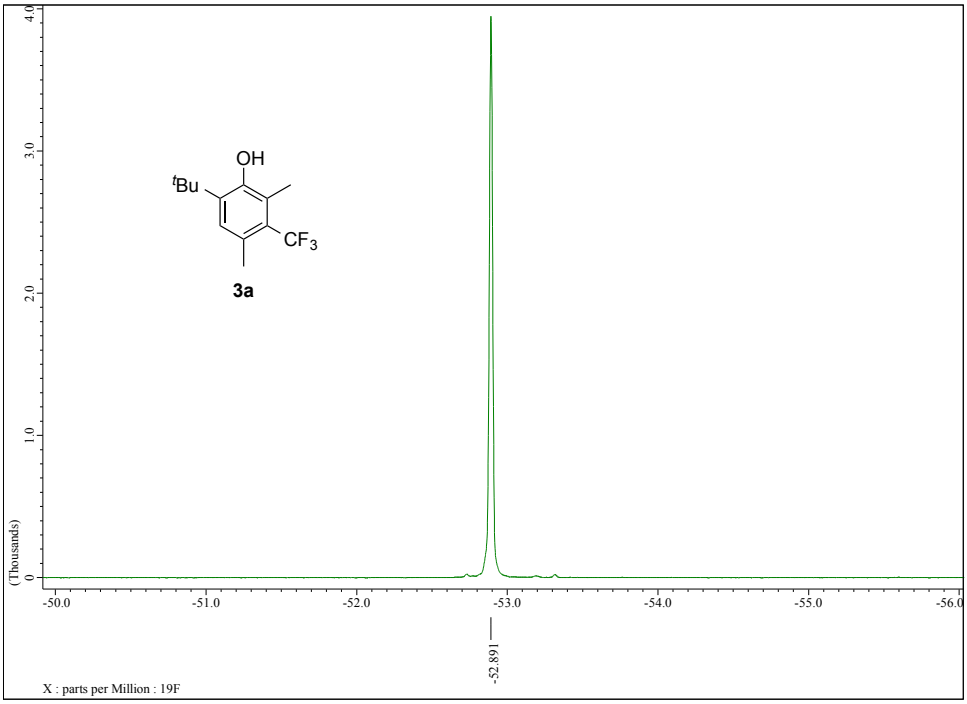

abundance
X : parts per Million : 1H
9
F
N
HO
O
F3C
1.00
1.05
0.97
2.06
0.98
0.74
2.18
7.835
7.819
7.803
7.787
7.107
7.091
7.032
7.029
6.839
6.836
6.820
6.055
3.368
3.346
3.324
3.302

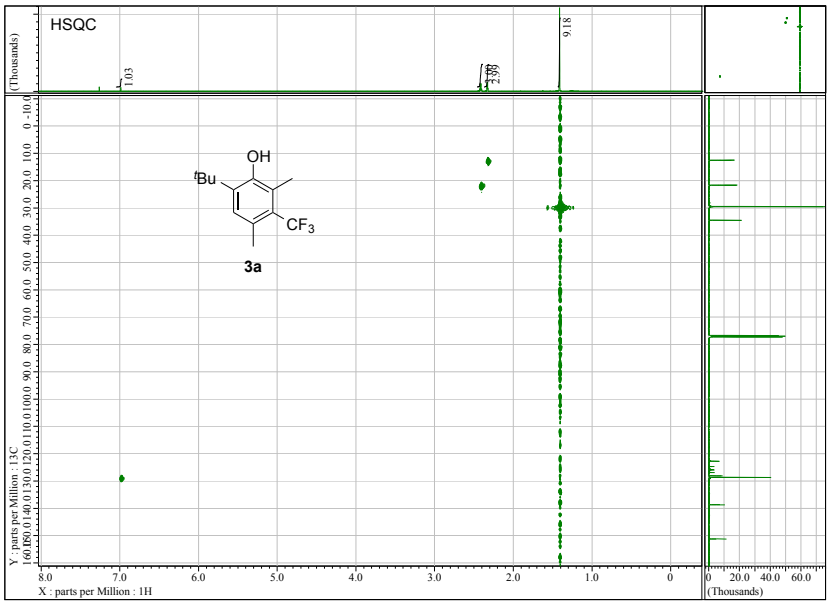

abundance
X : parts per Million : 13C
9
F
N
HO
O
F3C
163.012
161.566
161.461
161.049
147.960
144.168
144.101
140.942
128.963
128.638
126.732
124.511
122.625
121.945
119.551
107.314
107.276
103.685
103.417
40.079
39.840
39.600
39.361

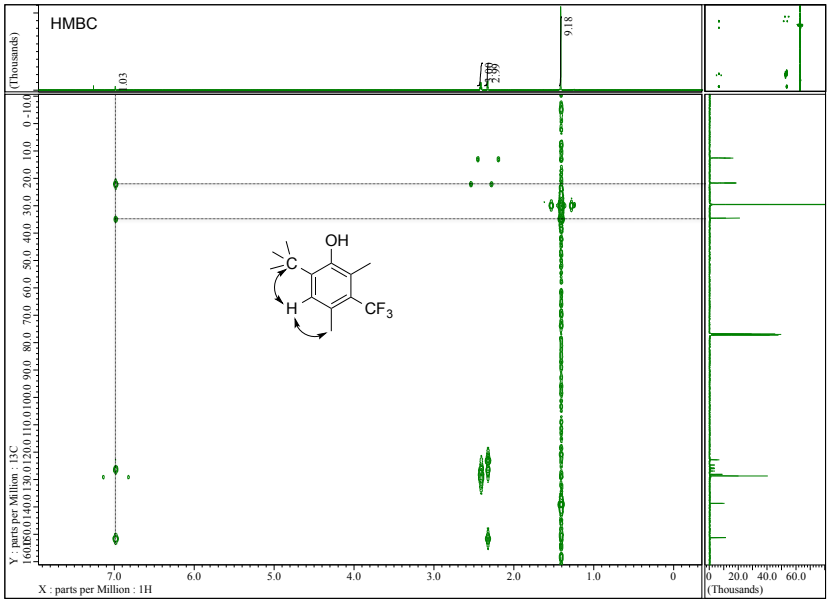

F
N
HO
O
F3C
9
3.06
1.00
abundance
3.0
2.0
1.0
0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
-100.0
-110.0
-65.705
-65.729
-65.752
-67.594
-67.610
X : parts per Million : 19F

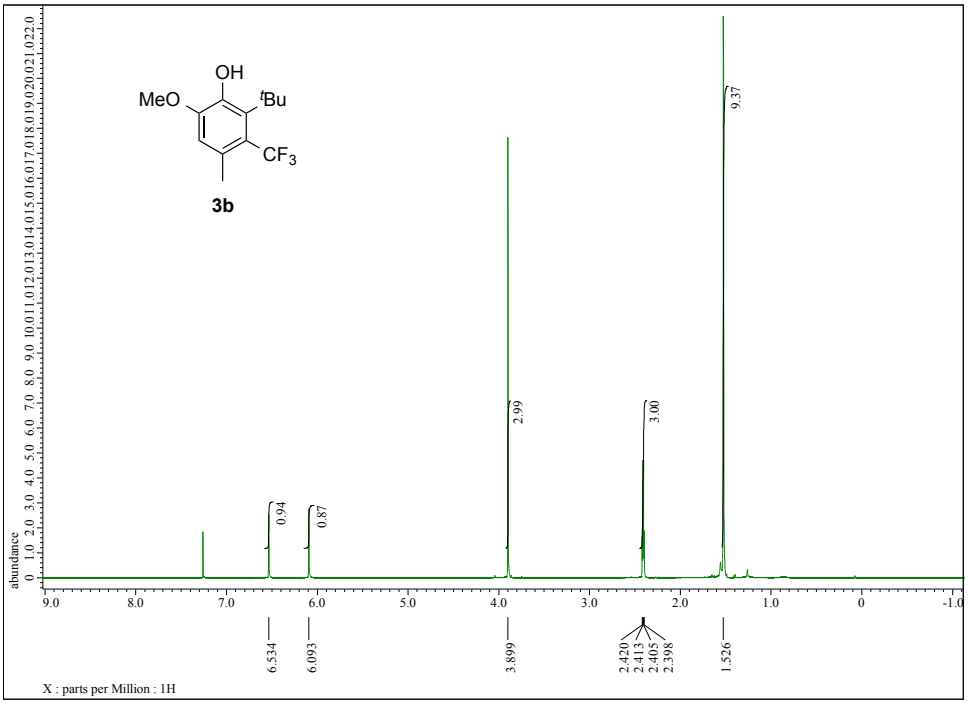

OH
tBu
CF3
3a
9.18
1.03
2.99
(Thousands)
6.987
2.426
2.418
2.410
2.402
2.335
2.331
2.327
2.322
1.413
X : parts per Million : 1H

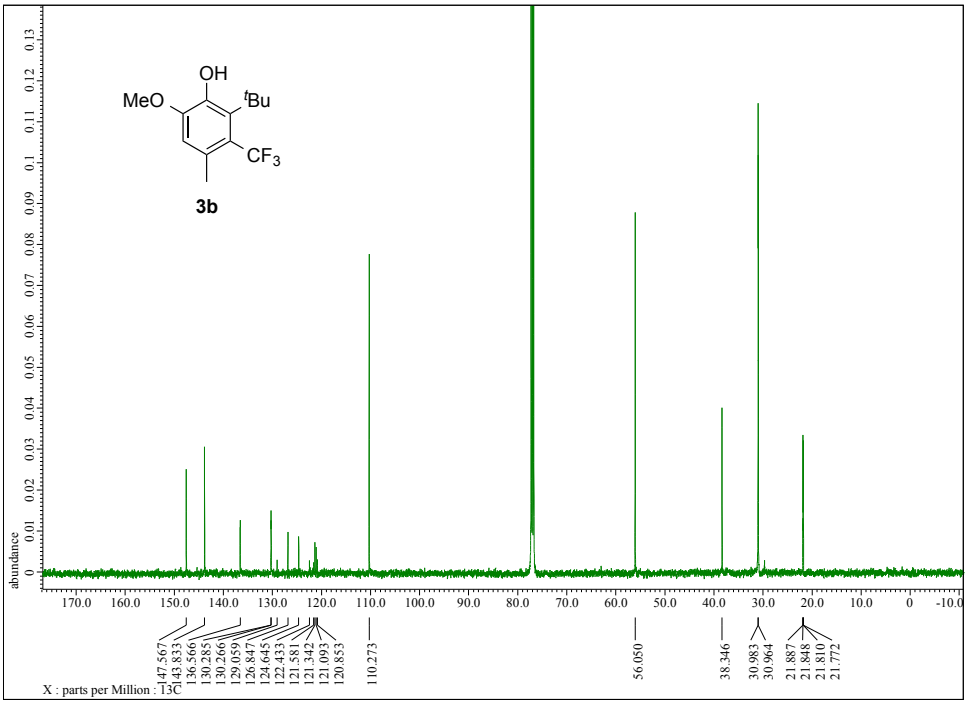

OH
tBu
CF3
3a
(Thousands)
151.246
138.703
129.079
128.679
128.097
126.885
126.037
125.808
125.588
124.692
122.755
122.498
34.507
29.509
21.687
21.649
12.559
12.530
X : parts per Million : 13C

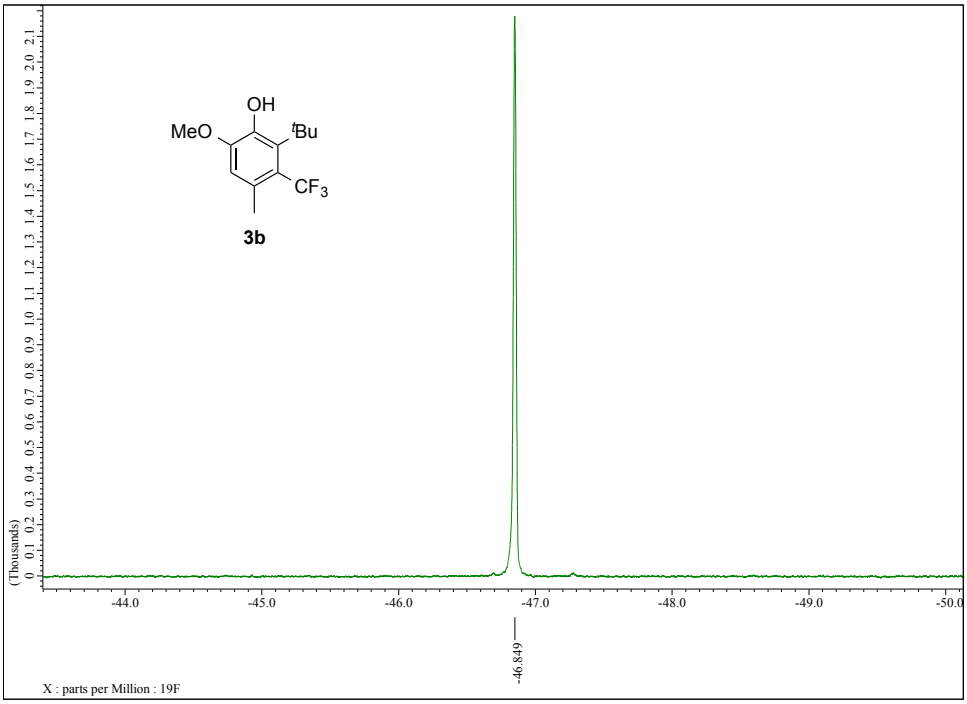

OH
tBu
CF3
3a
(Thousands)
-52.891
X : parts per Million : 19F

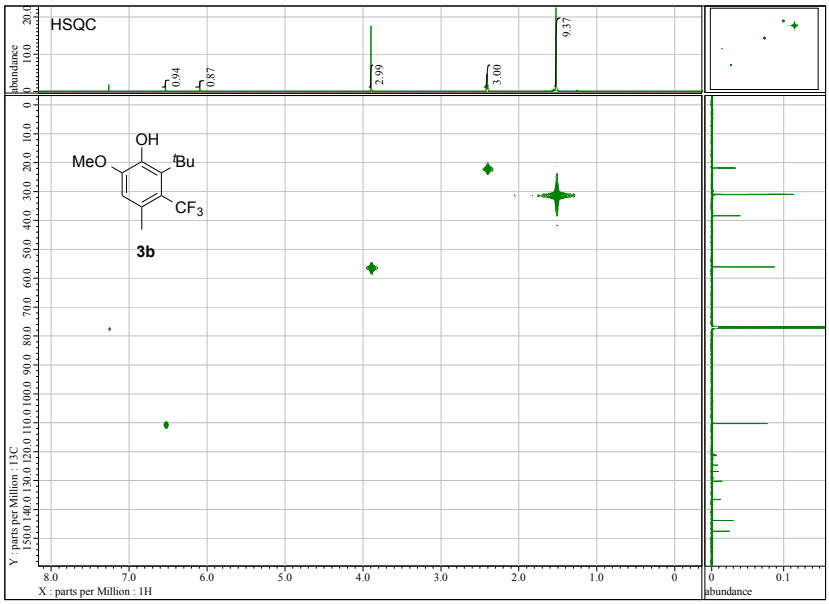

HSQC
9.18
1.03
OH
tBu
CF3
3a
Y : parts per Million : 13C
X : parts per Million : 1H
(Thousands)

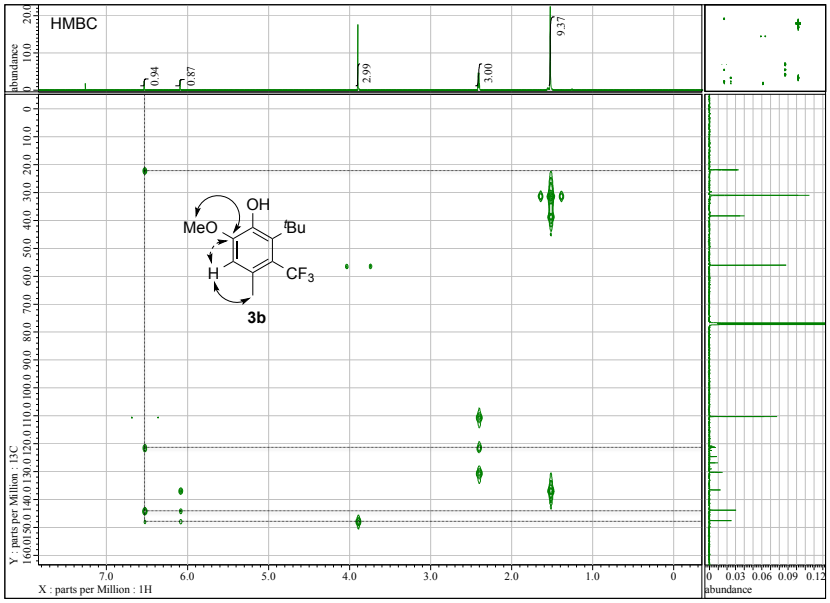

HMBC
9.18
OH
C
H
CF3
Y : parts per Million : 13C
X : parts per Million : 1H
(Thousands)

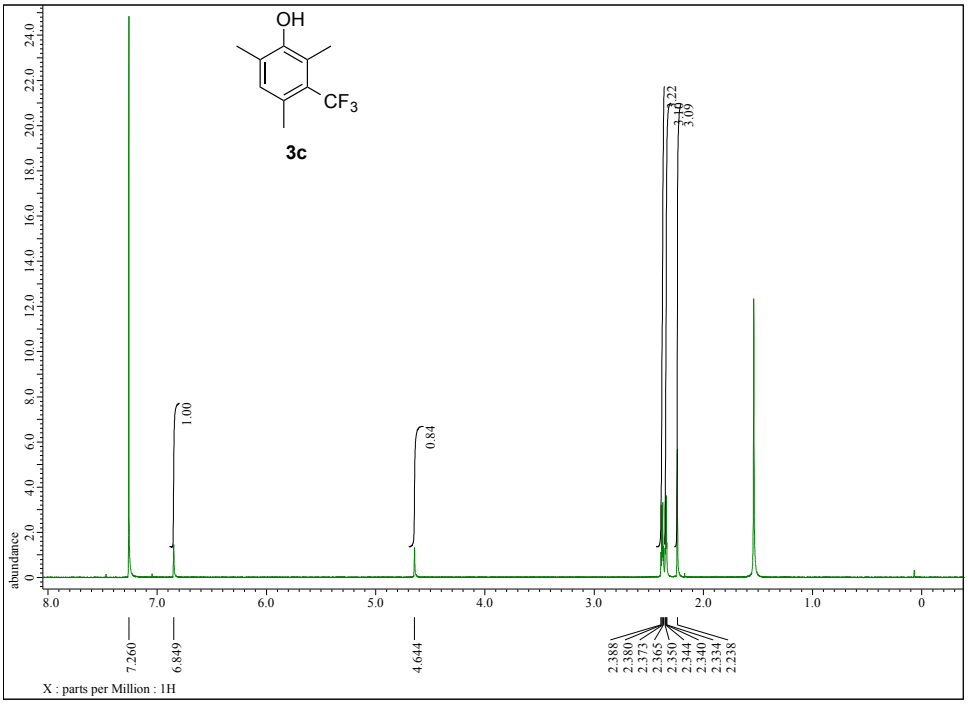

OH
MeO
tBu
CF3
3b
abundance
9.37
2.99
3.00
0.94
0.87
6.534
6.093
3.899
2.420
2.413
2.405
2.398
1.526
X : parts per Million : 1H

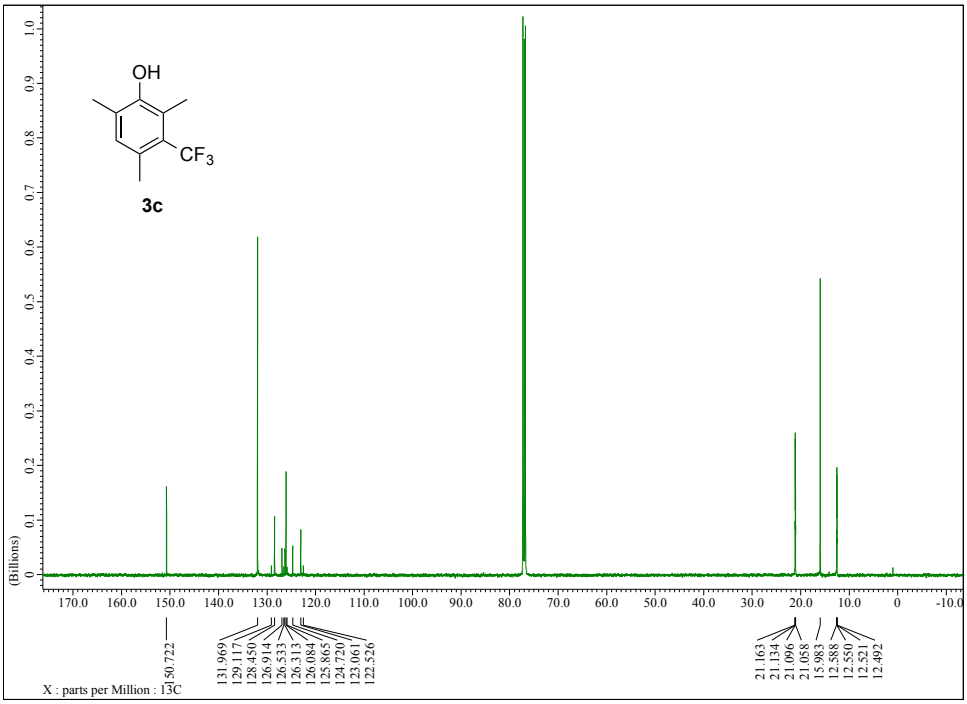

OH
MeO
tBu
CF3
3b
abundance
147.567
143.833
136.566
130.285
130.266
129.059
126.847
124.645
122.433
121.581
121.342
121.093
120.853
110.273
56.050
38.346
30.983
30.964
21.887
21.848
21.810
21.772
X : parts per Million : 13C

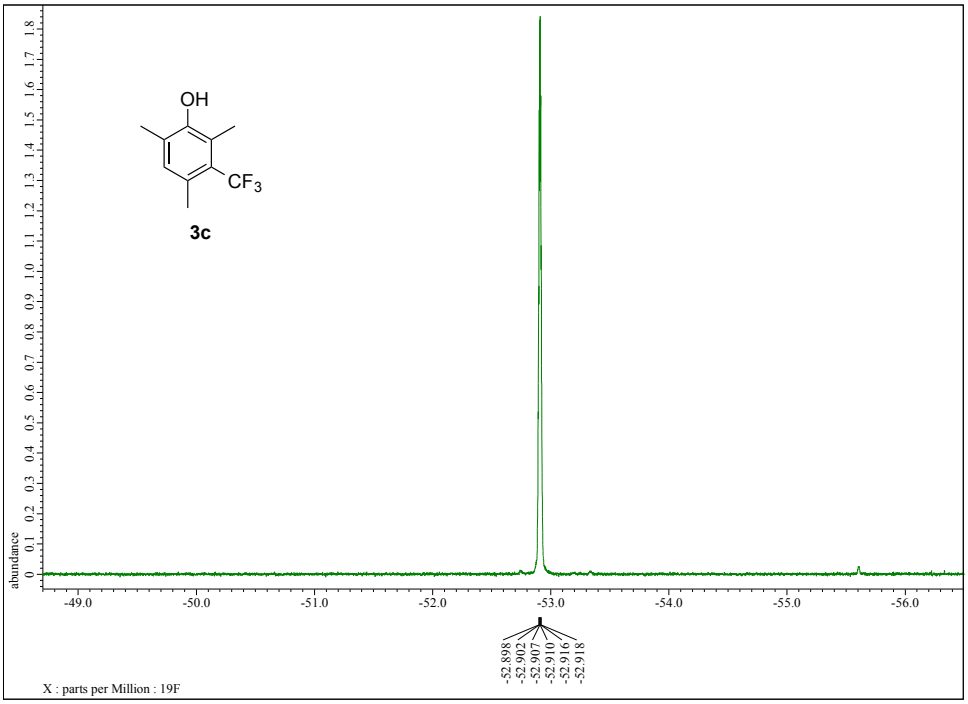

OH
MeO
tBu
CF3
3b
(Thousands)
-46.849
X : parts per Million : 19F

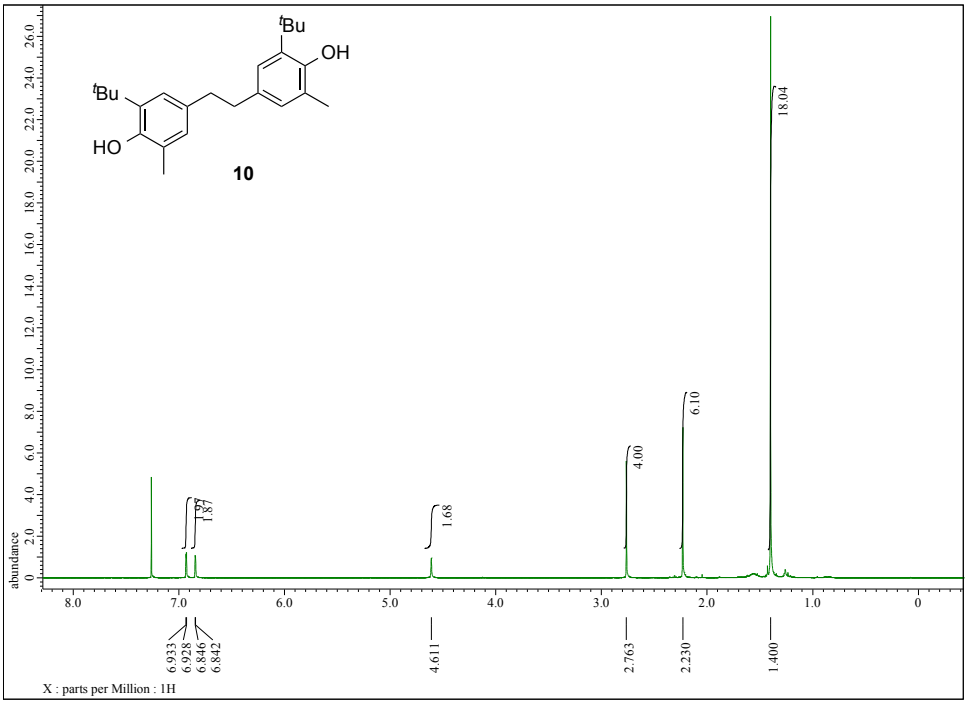

HSQC
abundance
0.94
0.87
2.99
3.00
9.37
OH
MeO
tBu
CF3
3b
Y : parts per Million : 13C
X : parts per Million : 1H
abundance

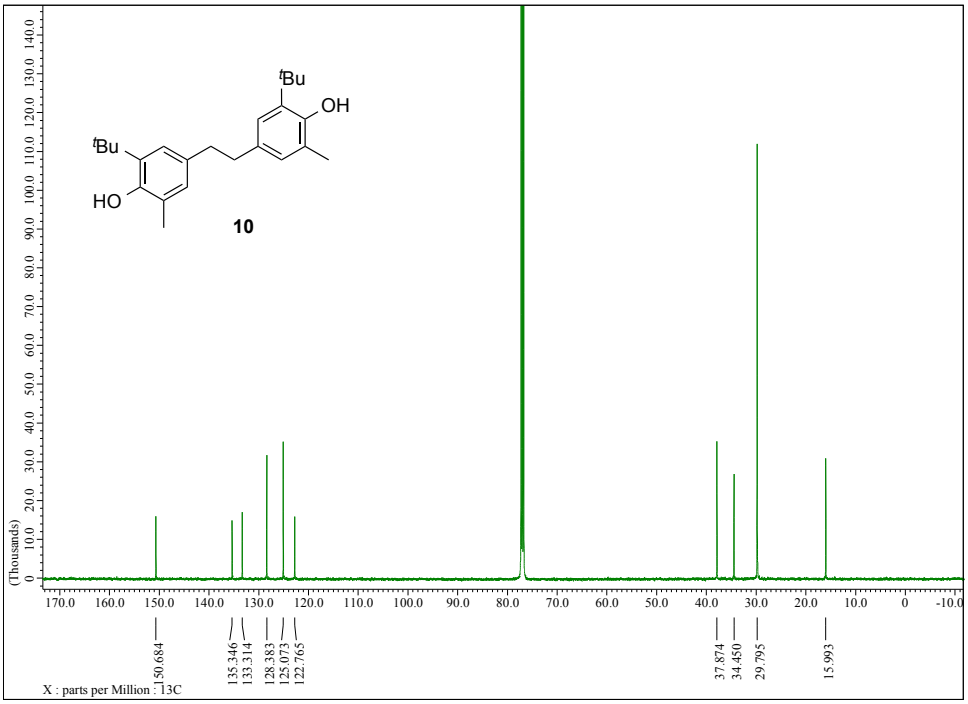

HMBC
abundance
0.94
0.87
2.99
3.00
9.37
OH
MeO
tBu
H
CF3
3b
Y : parts per Million : 13C
X : parts per Million : 1H
abundance


OH
CF3
3c
abundance
1.00
0.84
7.260
6.849
4.644
2.388
2.380
2.373
2.365
2.350
2.344
2.340
2.334
2.238
X : parts per Million : 1H


OH
CF3
3c
(Billions)
150.722
131.969
129.117
128.450
126.914
126.533
126.313
126.084
125.865
124.720
123.061
122.526
21.163
21.134
21.096
21.058
15.983
12.588
12.550
12.521
12.492
X : parts per Million : 13C


OH
CF3
3c
abundance
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
-49.0
-50.0
-51.0
-52.0
-53.0
-54.0
-55.0
-56.0
-52.898
-52.902
-52.907
-52.910
-52.916
-52.918
X : parts per Million : 19F


tBu
OH
tBu
HO
10
abundance
18.04
6.10
4.00
1.97
1.87
1.68
6.933
6.928
6.846
6.842
4.611
2.763
2.230
1.400
X : parts per Million : 1H


tBu
OH
tBu
HO
10
(Thousands)
150.684
135.346
133.314
128.383
125.073
122.765
37.874
34.450
29.795
15.993
X : parts per Million : 13C