Supporting Information

Synthesis of (2-hydroxyphenyl) (fusedphenyl)methanones *via* photo-induced rearrangement of 2'-arylisoflavones

Pei Wang, Jin Zhang, Tao Wang, Yong Liang[†], Zunting Zhang*

Key Laboratory of the Ministry of Education for Medicinal Resources and Natural Pharmaceutical Chemistry, National Engineering Laboratory for Resource Development of Endangered Crude Drugs in Northwest of China, and School of Chemistry and Chemical Engineering, Shaanxi Normal University, Xi'an 710119, People's Republic of China. E-mail: zhangzt@snnu.edu.cn *Fax: (+86)-29-81530727; Tel: (+86)-29-85303940.*

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1. General Information for photochemical reactor

All the irradiation experiments were performed in a BL-GHX-V photo-chemical reactorequipped with a 500 W high-pressure mercury lamp. The cooling liquid circulating pump was purchased from xi'an Bilang company .(**Figure 1**). The emission spectrum of the 500 W high-pressure mercury lamp （Figure 2）

Figure 1. Photochemical reactor

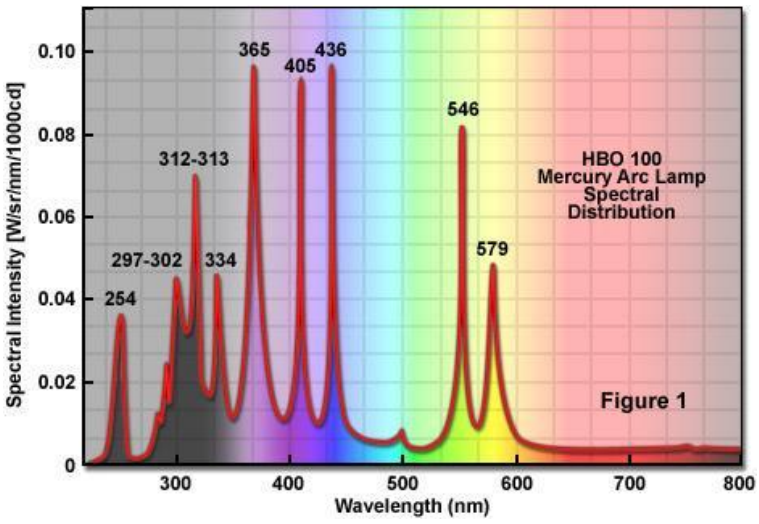
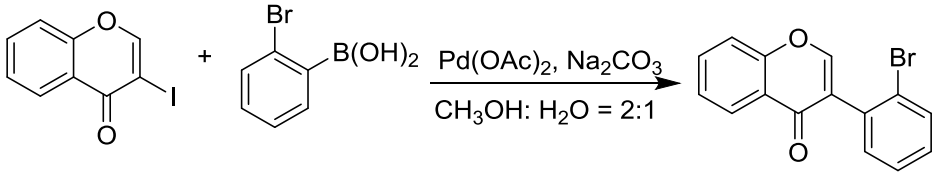


Figure 2. emission spectrum of the lamp

2. Synthetic Schemes.

Procedure for 3-(2-bromophenyl)-4*H*-chromen-4-one (4a) [3]

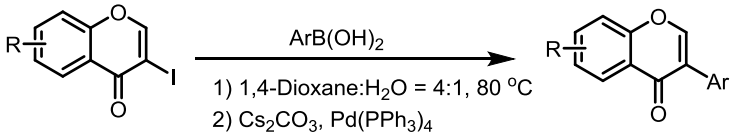
3-Iodo-4*H*-chromen-4-one (1 mmol, 272 mg), Na_2CO_3 (2 mmol, 212 mg), boronic acid (1.5 mmol) and $Pd(OAc)_2$ (5% mmol, 11.2 mg) were placed in a round-bottom flask followed by the addition of CH_3OH/CH_3CN (4 ml, 2:1, v/v). The reaction mixture was heated at 50 ^oC for 3 h under Ar atmosphere. Then, the mixture reaction was concentrated under reduced pressure, the residue was dissolved in CH_2Cl_2 (30 ml), washed with water (3×10 ml) and dried over Na_2SO_4 and the Solvent was evaporated under reduced pressure. The residue was purified by silica gel flash chromatography (ethyl acetate/petroleum ether, 1:50) to give the corresponding product **4a** (80%).



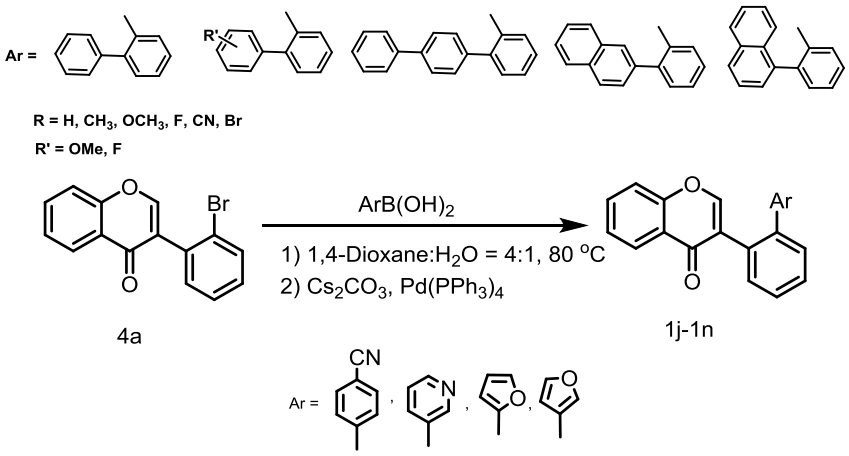
4a

Procedures for Synthesis of 3-([1,1'-Biphenyl]-2-yl)-4*H*-chromen-4-ones (1a-1u)[1,2]

3-Iodo-4*H*-chromen-4-one (1 mmol, 272 mg), Cs_2CO_3 (2 mmol, 648 mg), boronic acid (1.2 mmol) and $Pd(PPh_3)_4$ (1% mmol, 11.55 mg) were placed in a round-bottom flask followed by the addition of dioxane/water (10 ml, 3:1, v/v). The reaction mixture was heated at 80 ^oC for 4.5 h under Ar atmosphere. Then, the crude reaction mixture was quenched by the addition of water (20 ml), extracted with CH_2Cl_2 (20 ml×3). Organic layer was combined, dried over anhydrous Na_2SO_4 and concentrated under reduced pressure. The residue was purified by silica gel flash chromatography (ethyl acetate/petroleum ether, 1:20) to give the corresponding product **1a** (88%). Substrates **1b-1i, 1o-1aa** were prepared with the procedure described above. Similarly, the 3-([1,1'-Biphenyl]-2-yl)-4*H*-chromen-4-ones (**1j-1n**) were obetained via 4a



1a-1i, 1o-1aa



3. Spectroscopic data of 1,4a

3-([1,1'-Biphenyl]-2-yl)-4*H*-chromen-4-one (1a)

Yield: 88%, 262 mg. White soild. m.p. 185.8-186.7 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (dd, *J* = 8.2, 1.5 Hz, 1H), 7.67-7.62 (m, 1H), 7.58 (s, 1H), 7.48-7.43 (m, 4H), 7.41-7.37 (m, 2H), 7.31-7.21 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.7, 156.3, 154.8, 142.5, 141.4, 133.6, 131.8, 130.6, 130.2, 129.3, 128.8, 128.3, 127.5, 127.0, 126.5, 125.7, 125.3, 124.5, 118.2; IR (KBr), *ν* (cm^{-1}) 3416, 2812, 2723, 1936, 1823, 1595, 1462, 1350,1217, 1101, 847, 760, 615, 530; HRMS (ESI) m/z calcd for. $C_{18}H_{14}O_3$ $[M + Na]^+$ 321.0886, found 312.0887.

3-([1,1'-Biphenyl]-2-yl)-6-fluoro-4*H*-chromen-4-one (1b)

Yield: 70%, 221 mg. White soild. m.p. 200.3-201.4 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (dd, *J* = 2.8 Hz, *J* = 8.2 Hz, 1H), 7.60 (s, 1H), 7.48-7.44 (m, 2H), 7.42-7.40 (m, 2H), 7.38-7.31 (m, 2H), 7.25-7.24 (m, 4H), 7.22-7.19 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.7, 156.3, 154.7, 140.8 (d, ^{1}J = 250.1 Hz), 140.53 (d, ^{2}J = 29.9 Hz), 133.6, 131.8, 130.5, 130.2, 129.7, 128.9, 128.8, 127.5 (d, ^{2}J = 14.0 Hz), 127.0 (d, ^{3}J = 8.9 Hz), 126.5, 125.8, 125.3, 124.5, 118.2; ^{19}F NMR (376 MHz, $CDCl_3$), δ (ppm) -115.01; IR (KBr), ν (cm^{-1}) 2924, 1597, 1461, 1352, 1254, 1096, 1030, 883, 750, 567; HRMS (ESI) m/z calcd for. $C_{18}H_{14}O_3$ $[M + Na]^+$ 339.0792, found 339.0803.

3-([1,1'-Biphenyl]-2-yl)-7-methoxy-4*H*-chromen-4-one (1c)

Yield: 80%, 262 mg. White soild. m.p. 129.3-130.6 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (d, *J* = 8.9 Hz, 1H), 7.44-7.35 (m, 5H), 7.28-7.27 (m, 2H), 7.21-7.20 (m, 2H), 7.17-7.14 (m, 1H), 6.88 (dd, *J* = 8.8, 1.9 Hz, 1H), 6.69-6.68 (m, 1H), 3.77 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.8, 163.9, 157.8, 154.0, 142.3, 141.3, 131.6, 130.3, 130.2, 129.1, 128.4, 128.1, 127.6, 127.2, 126.7, 125.4, 118.1, 114.4, 100.1, 55.7; IR (KBr), *v* (cm^{-1}) 3423, 3071, 2924, 2837, 1946, 1823, 1634, 1441, 1261, 1038, 1015, 883, 833, 698, 619, 523; HRMS (ESI) m/z calcd for. $C_{22}H_{16}O_3$ $[M + Na]^+$ 351.0992 found 351.0990.

3-([1,1'-Biphenyl]-2-yl)-6,7-dimethoxy-4*H*-chromen-4-one (1d)

Yield: 61%, 214 mg. White solid. m.p. 171.8-173.0 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (d, *J* = 10.9 Hz, 2H), 7.45-7.42 (m, 3H), 7.30-7.20 (m, 6H), 6.78 (s, 1H), 3.96 (s, 3H), 3.95(s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.7, 154.4, 153.9, 152.3, 147.7, 142.5, 141.5, 131.8, 130.5, 129.3, 128.6, 128.3, 127.4, 126.9, 125.1, 117.9, 105.0, 100.0, 56.5, 56.4; IR (KBr), *v* (cm^{-1}) 3423, 2959, 2831, 1603, 1502, 1423, 1271, 1167, 1036, 901, 744, 706, 497; HRMS (ESI) m/z calcd for. $C_{23}H_{18}O_4$ $[M + Na]^+$ 381.1097, found 381.1098.

3-([1,1'-biphenyl]-2-yl)-4-oxo-4*H*-chromene-6-carbonitrile (1e)

Yield: 81%, 261 mg. White soild. m.p. 205.6-206.9 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.51 (d, *J* = 1.7 Hz, 1H), 7.85-7.82 (m, 1H), 7.64 (s, 1H), 7.51-7.45 (m, 3H), 7.43-7.40 (m, 2H), 7.27 – 7.20 (m, 5H);^{13}C NMR (100 MHz, $CDCl_3$) δ 174.7, 157.9, 154.7, 142.5, 141.1, 135.8, 132.2, 131.4, 130.6, 129.1, 129.0, 128.4, 127.6, 127.1, 126.8, 124.7, 119.9, 117.6, 109.5; IR (KBr), *v* (cm^{-1}) 3450, 2813, 2705, 1591, 1350, 761; HRMS (ESI) m/z calcd for. $C_{22}H_{13}NO_2$ $[M + Na]^+$ 346.0838, found 346.0823.

3-([1,1':4',1''-terphenyl]-2-yl)-4*H*-chromen-4-one (1f)

Yield: 80%, 299 mg. White soild. m.p. 203.2-203.9 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (dd, *J* = 7.1, 2.3 Hz, 1H), 7.64-7.60 (m, 2H), 7.56-7.54 (m, 2H), 7.49-7.47 (m,

4H), 7.46-7.43 (m, 2H), 7.40-7.35 (m, 6H), 7.31-7.28 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.6, 156.3, 154.7, 142.1, 140.7, 140.4, 139.6, 133.6, 131.8, 130.5, 130.2, 129.7, 128.9, 128.8, 127.5, 127.4, 127.1, 127.0, 126.5, 125.8, 125.3, 124.5, 118.2; IR (KBr), *v* (cm^{-1}) 3431, 3057, 2820, 2725, 1738, 1643, 1464, 1348,1217, 1115, 1009, 843, 760, 617; 492; HRMS (ESI) m/z calcd for. $C_{27}H_{18}O_2$ $[M + Na]^+$ 397.1199, found 397.1196.

3-([1,1':4',1''-Terphenyl]-2-yl)-7-methoxy-4*H*-chromen-4-one (1g)

Yield: 82%, 331 mg. White soild. m.p. 190.8-192.0 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (d, *J* = 9.1 Hz, 1H), 7.58-7.53 (m, 4H), 7.50-7.48 (m, 3H), 7.46-7.44 (m, 2H), 7.43-7.37 (m, 4H), 7.33-7.30 (m, 1H), 6.96 (dd, *J* = 8.9, 2.4 Hz, 1H), 6.77 (d, *J* = 2.2 Hz, 1H), 3.87 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.1, 164.1, 158.1, 154.2, 142.0, 140.7, 140.4, 139.5, 131.9, 130.5, 130.3, 129.7, 128.9, 128.7, 127.9, 127.4, 127.1, 127.0, 126.9, 125.6, 118.4, 114.6, 100.3, 55.9; IR (KBr), *v* (cm^{-1}) 3416, 2924, 2812, 2719, 1593, 1350, 1246, 1034, 800; HRMS (ESI) m/z calcd for. $C_{28}H_{20}O_3$ $[M + Na]^+$ 437.1305, found 427.1305.

3-(4'-Fluoro-[1,1'-biphenyl]-2-yl)-4*H*-chromen-4-one (1h)

Yield: 61%, 192 mg. White solid. m.p. 142.8-144.1 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (d, *J* = 7.8 Hz, 1H), 7.67-7.62 (m, 2H), 7.47-7.37 (m, 6H), 7.27-7.24 (m, 2H), 7.00-6.92 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.5, 162.0 (d, ^1J = 244.6 Hz), 156.3, 154.6, 141.5, 137.4 (d, ^4J = 3.2 Hz), 133.7, 131.7, 130.7 (d, ^3J = 8.0 Hz), 130.4, 130.3, 128.8, 127.6, 126.4, 125.7, 125.3, 124.3, 118.2, 115.2 (d, ^2J = 21.2 Hz); ^{19}F NMR (376 MHz, $CDCl_3$), δ (ppm) -115.93; IR (KBr), *v* (cm^{-1}) 3420, 2924, 2816, 2721, 1595, 1464, 1350, 1221, 1117, 1011, 762, 615, 534; HRMS (ESI) m/z calcd for. $C_{21}H_{13}FO_2$ $[M + Na]^+$ 339.0792, found 339.0792.

3-([1,1'-Biphenyl]-2-yl)-6-bromo-4*H*-chromen-4-one (1i)

Yield: 82%, 308 mg. White soild. m.p. 184.3-184.6 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ

8.33 (d, *J* = 2.4 Hz, 1H), 7.71 (dd, *J* = 8.9, 2.5 Hz, 1H), 7.58 (s, 1H), 7.47-7.45 (m, 2H), 7.43-7.42 (m, 2H), 7.29-7.23 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.1, 154.9, 154.6, 142.4, 141.1, 136.5, 131.5, 130.5, 129.6, 129.1, 128.9, 128.8, 128.2, 127.4, 126.9, 125.9, 125.6, 120.0, 118.6; IR (KBr), *v* (cm^{-1}) 3468, 1641, 1400, 1006, 827, 702; HRMS (ESI) m/z calcd for. $C_{21}H_{13}B_rO_2$ [M + Na] $^+$ 398.9991, found 398.9985.

3-(4'-Methoxy-[1,1'-biphenyl]-2-yl)-4*H*-chromen-4-one (1j)

Yield: 75%, 246 mg. Yellow soild. m.p. 61.8-62.7 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (dd, *J* = 8.5, 1.2 Hz, 1H), 7.67 – 7.62 (m, 1H), 7.59 (s, 1H), 7.45 – 7.37 (m, 6H), 7.22-7.20 (m, 2H), 6.8-6.78 (m, 2H), 3.76 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.5, 158.4, 156.1, 154.6, 142.0, 133.7, 133.4, 131.5, 130.4, 130.2, 130.1, 128.6, 127.0, 126.3, 125.7, 125.1, 124.4, 118.1, 113.6, 55.3; IR (KBr), *v* (cm^{-1}) 3462, 3062, 2931, 2835, 1645, 1461, 1377, 1244, 1035, 833, 761; HRMS (ESI) m/z calcd for. $C_{22}H_{16}O_3$ [M + Na] $^+$ 351.0992, found 351.0986.

2'-(4-Oxo-4*H*-chromen-3-yl)-[1,1'-biphenyl]-4-carbonitrile (1k)

Yield: 95%, 306 mg. Yellow soild. m.p. 165.8-166.3 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (dd, *J* = 8.0, 1.4 Hz, 1H), 7.72 (s, 1H), 7.69-7.65 (m, 1H), 7.54-7.50 (m, 2H), 7.49-7.48 (m, 2H), 7.44-7.39 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.0, 156.2, 154.3, 146.3, 140.7, 133.9, 132.0, 131.7, 130.1, 130.0, 129.7, 129.0, 128.5, 126.3, 125.5, 125.5, 124.1, 118.9, 118.2, 110.7; IR (KBr), *v* (cm^{-1}) 3464, 2222, 1641, 1400, 1009, 839, 760, 526; HRMS (ESI) m/z calcd for. $C_{22}H_{13}NO_2$ [M + Na] $^+$ 346.0838, found 346.0834.

3-(2-(Pyridin-3-yl)phenyl)-4*H*-chromen-4-one (1l)

Yield: 74%, 221 mg. White soild. m.p. 99.5-99.9 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.54 (s, 1H), 8.44 (d, *J* = 4.0 Hz, 1H), 8.14 (d, *J* = 7.9 Hz, 1H), 7.72 (s, 1H), 7.67-7.60 (m, 2H), 7.52-7.34 (m, 6H), 7.21-7.18 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.0,

156.2, 154.4, 149.5, 148.1, 138.9, 137.1, 136.4, 133.7, 131.7, 130.5, 130.4, 129.0, 128.2, 126.3, 125.5, 125.28, 124.2, 123.1, 118.1; IR (KBr), *v* (cm^{-1}) 3454, 1639, 1400, 1007, 831, 704; HRMS (ESI) m/z calcd for. $C_{20}H_{13}NO_2$ $[M + Na]^+$ 322.0838, found 351.0829.

3-(2-(Furan-2-yl)phenyl)-4*H*-chromen-4-one (1m)

Yield: 52%, 149 mg. White soild. m.p. 129.4-129.7 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 8.26 (d, *J* = 7.9 Hz, 1H), 7.87 (s, 1H), 7.78 (d, *J* = 7.8 Hz, 1H), 7.70 (t, *J* = 7.6 Hz, 1H), 7.51-7.47 (m, 1H), 7.45-7.40 (m, 2H), 7.37-7.34 (m, 1H), 7.31-7.30 (m, 2H), 6.32 (d, *J* = 8.2 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.4, 156.6, 153.4, 153.3, 142.1, 133.7, 132.0, 131.4, 128.9, 127.7, 127.6, 126.9, 126.6, 125.3, 124.5, 118.2, 111.5, 108.2; IR (KBr), *v* (cm^{-1}) 3475, 3063, 2924, 1636, 1460, 1377, 1157, 1101, 1007, 881, 762, 615, 534; HRMS (ESI) m/z calcd for. $C_{19}H_{12}O_3$ $[M + Na]^+$ 311.0679, found 311.0676.

3-(2-(Furan-3-yl)phenyl)-4*H*-chromen-4-one (1n)

Yield: 75%, 216 mg. Yellow soild. m.p. 99.1-100.3 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 8.26 (d, *J* = 7.8 Hz, 1H), 7.78 (s, 1H), 7.69 (t, *J* = 7.7 Hz, 1H), 7.48 – 7.37 (m, 7H), 7.31 (s, 1H), 6.38 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.5, 156.5, 154.1, 142.9, 139.9, 133.8, 133.4, 131.8, 130.4, 129.8, 128.9, 127.5, 126.6, 126.1, 125.7, 125.4, 124.5, 118.3, 111.3; IR (KBr), *v* (cm^{-1}) 3468, 3105,1819, 1641, 1466, 1350, 1159, 1040, 1009, 870, 760, 700, 598, 509; HRMS (ESI) m/z calcd for. $C_{19}H_{12}O_3$ $[M + Na]^+$ 311.0679, found 311.0670.

3-(2-(Naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1o)

Yield: 88%, 306 mg. White soild. m.p. 138.4-140.0 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 8.28-8.26 (m, 1H), 7.85 (s, 1H), 7.80-7.77 (m, ,2H), 7.71 (d, *J* = 8.4 Hz, 1H), 7.62-7.58 (m, 3H), 7.54-7.50 (m, 3H), 7.46-7.41 (m, 3H), 7.39-7.31 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.7, 156.2, 154.8, 142.3, 139.0, 133.5, 133.4, 132.3,

131.9, 130.8, 130.3, 128.7, 128.1, 127.9, 127.7, 127.6, 127.5, 126.4, 126.1, 126.0, 125.5, 125.2, 124.4, 118.1; IR (KBr), *v* (cm^{-1}) 3423, 2924, 2824, 2721, 1593, 1464, 1350, 1163, 1013, 852, 762, 615, 469; HRMS (ESI) m/z calcd for. $C_{25}H_{16}O_2$ $[M + Na]^+$ 371.1043, found 371.1045.

6-Fluoro-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1p)

Yield: 81%, 296 mg. White soild. m.p. 189.9-190.6 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 7.9 Hz, 1H), 7.81-7.78 (m, 3H), 7.71 (d, *J* = 8.4 Hz, 1H), 7.60-7.44 (m, 7H), 7.38-7.32 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.96, 159.6 (d, ^1J = 245.2 Hz), 155.0, 152.5, 142.4, 138.9, 133.4, 132.3, 131.8, 130.9, 130.0, 128.9, 128.1, 128.0, 127.8, 127.7, 127.6, 127.5, 126.2, 126.0, 125.6 (d, ^3J = 7.7 Hz), 125.0, 121.9 (d, ^2J = 25.4 Hz), 120.3 (d, ^3J = 8.0 Hz), 111.2 (d, ^2J = 23.0 Hz); ^{19}F NMR (376 MHz, $CDCl_3$), δ (ppm) -115.09; IR (KBr), *v* (cm^{-1}) 3408, 3057, 2924, 2812, 2721, 1593, 1479, 1350, 1248, 1138, 883, 770, 710, 617, 474; HRMS (ESI) m/z calcd for. $C_{25}H_{15}FO_2$ $[M + Na]^+$ 389.0948, found 389.0953.

7-Methoxy-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1q)

Yield: 56%, 211 mg. White soild. m.p. 184.7-185.3 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 8.14 (d, *J* = 8.9 Hz, 1H), 7.81 (s, 1H), 7.78-7.76 (m, 2H), 7.69 (d, *J* = 8.4 Hz, 1H), 7.56 - 7.54 (m, 1H), 7.51-7.42 (m, 6H), 7.39-7.37 (m, 1H), 6.94 (dd, *J* = 8.9, 2.2 Hz, 1H), 6.70 (d, *J* = 2.2 Hz, 1H), 3.84 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.2, 164.1, 158.0, 154.4, 142.3, 140.0, 139.1, 133.5, 132.4, 132.0, 130.8, 130.4, 128.7, 128.2, 128.0, 127.9, 127.8, 127.7, 127.5, 126.2, 126.0, 125.4, 118.4, 114.6, 100.3, 55.9; IR (KBr), *v* (cm^{-1}) 3416, 2924, 2702, 1599, 1379, 1350, 1265, 1034, 766, 471; HRMS (ESI) m/z calcd for. $C_{26}H_{18}O_3$ $[M + Na]^+$ 401.1148, found 401.1150.

6,7-Dimethoxy-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1r)

Yield: 44%, 176 mg. Yellow solid. m.p. 96.3-98.1 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 7.80-7.76 (m, 3H), 7.69 (d, *J* = 8.5 Hz, 1H), 7.56-7.54 (m, 2H), 7.52-7.47 (m, 4H),

7.46-7.42 (m, 2H), 7.38 (dd, *J* = 8.5, 1.7 Hz, 1H), 6.72 (s, 1H), 3.95 (s, 3H), 3.91 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.9, 154.4, 154.1, 152.3, 147.7, 142.3, 139.1, 133.4, 132.3, 132.0, 130.8, 130.6, 128.6, 128.2, 127.9, 127.8, 127.8, 127.7, 127.6, 126.1, 126.0, 125.0, 117.9, 105.0, 99.7, 56.5, 56.4; IR (KBr), *v* (cm^{-1}) 3429, 2926, 2831, 1603, 1429, 1273, 1036, 903, 744, 478; HRMS (ESI) m/z calcd for. $C_{27}H_{20}O_4$ $[M + Na]^+$ 431.1254, found 431.1257.

8-Methyl-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1s)

Yield: 61%, 220 mg. White solid. m.p. 79.8-80.7 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 7.9 Hz, 1H), 7.87-7.82 (m, 1H), 7.79-7.74 (m, 2H), 7.68 (d, *J* = 8.5 Hz, 1H), 7.60 (s, 1H), 7.56-7.53 (m, 1H), 7.49-7.47 (m, 3H), 7.43-7.41 (m, 3H), 7.39-7.35 (m, 1H), 7.26-7.22 (m, 1H), 2.33 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 177.2, 154.8, 154.7, 142.2, 139.0, 134.6, 133.4, 132.3, 131.9, 130.9, 130.4, 128.7, 128.2, 127.9, 127.8, 127.7, 127.6, 127.5, 126.1, 126.0, 125.3, 124.8, 124.3, 124.0, 15.5; IR (KBr), *v* (cm^{-1}) 3053, 2924, 1643, 1481, 1344, 1211, 1159, 1065, 889, 764, 592, 478; HRMS (ESI) m/z calcd for. $C_{26}H_{18}O_2$ $[M + Na]^+$ 385.1199, found 385.1202.

6,8-Difluoro-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1t)

Yield: 30%, 115 mg. White soild. m.p. 156.7-157.8 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78-7.16 (m, 3H), 7.71 (d, *J* = 8.5 Hz, 1H), 7.67-7.61 (m, 2H), 7.56-7.44 (m, 6H), 7.36-7.33 (m, 1H), 7.20-7.15 (m, 1H). ^{13}C NMR (150 MHz, $CDCl_3$) δ 174.8, 158.4 (dd, ^1J = 247.5 Hz, ^3J = 9.4 Hz) 154.4, 151.5 (dd, ^1J = 255.9 Hz, ^3J = 11.4 Hz), 142.5, 141.9 (dd, ^4J = 1.8 Hz, ^2J = 11.0 Hz), 138.7, 133.4, 132.4, 131.6, 131.0, 129.5, 129.1, 128.2, 128.0, 127.9, 127.8, 127.7, 127.5, 126.5 (d, ^3J = 7.98 Hz), 126.3, 126.2, 125.7, 109.1 (dd, ^2J = 20.0 Hz, ^2J = 28.6 Hz), 106.6 (dd, ^2J = 23.3 Hz, ^4J = 4.2 Hz); ^{19}F NMR (376 MHz, $CDCl_3$), δ (ppm) -111.46, -128.07; IR (KBr), *v* (cm^1) 3416, 2812, 2721, 1589, 1346, 1238, 1111, 1001, 795, 771, 600, 480; HRMS (ESI) m/z calcd for. $C_{25}H_{14}F_2O_2$ $[M + Na]^+$ 407.0854, found 407.0856.

3-(2-(naphthalen-2-yl)phenyl)-4-oxo-4*H*-chromene-6-carbonitrile (1u)

Yield: 78%, 290 mg.White solid. m.p. 216.0-217.6 ℃. ^{1}H NMR (300 MHz, $CDCl_3$) δ

8.53 (s, 1H), 7.83-7.70 (m, 5H), 7.64 (s, 1H), 7.55-7.52 (m, 2H), 7.45-7.42 (m, 5H), 7.34 (d, *J* = 8.3 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.9, 157.9, 154.9, 142.4, 138.7, 135.9, 133.4, 132.4, 132.2, 131.5, 131.0, 129.2, 128.1, 128.0, 127.9, 127.8, 127.7, 127.5, 126.7, 126.4, 126.2, 124.7, 119.9, 117.6, 109.5; IR (KBr), *v* (cm^{-1}) 3416, 2814, 2710, 2229, 1595, 1350, 1228, 1118, 764; HRMS (ESI) m/z calcd for. $C_{25}H_{16}NO_2$ $[M + Na]^+$ 396.0995, found 396.0982.

3-(2-(Naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1v)

Yield: 79%, 274 mg. White soild. m.p. 51.8-52.5 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.16 (d, *J* = 7.9 Hz, 1H), 7.77 (d, *J* = 7.5 Hz, 1H), 7.73-7.71 (m, 1H), 7.63-7.56 (m, 2H), 7.54-7.42 (m, 4H), 7.40 (s, 1H), 7.37-7.31 (m, 4H), 7.30-7.24 (m, 1H), 7.15 (d, *J* = 8.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.5, 155.9, 153.6, 140.3, 138.8, 133.5, 133.3, 132.2, 131.7, 131.6, 131.5, 128.2, 127.7, 127.6, 126.3, 126.2, 126.1, 125.8, 125.3, 125.0, 124.9, 124.4, 118.0; IR (KBr), *v* (cm^{-1}) 3410, 2924, 2812, 2721, 1593, 1464, 1348, 1103, 1015, 885, 762,617; HRMS (ESI) m/z calcd for. $C_{25}H_{16}O_2$ $[M + Na]^+$ 371.1043, found 371.1042.

6-Fluoro-3-(2-(naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1w)

Yield: 82%, 300 mg. White solid. m.p. 63.9-65.2 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.1 Hz, 2H), 7.75 (d, *J* = 7.7 Hz, 1H), 7.61-7.50 (m, 4H), 7.46-7.33 (m, 6H), 7.28-7.12 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.8, 159.5 (d, ^1J = 245.2 Hz), 153.8, 152.1, 140.4, 138.7, 133.5, 132.1, 131.6 (d, ^3J = 3.0 Hz), 131.1, 128.4, 128.2, 127.8, 127.6, 126.3, 126.1, 125.9, 125.5 (d, ^3J = 7.2 Hz), 125.3, 124.2, 121.7 (d, ^2J = 25.4 Hz), 120.1 (d, ^3J = 8.0 Hz), 111.0 (d, ^2J = 23.5 Hz); ^{19}F NMR (376 MHz, $CDCl_3$), δ (ppm) -115.65; IR (KBr), *v* (cm^{-1}) 3423, 3059, 2924, 2822, 2723, 1634, 1477, 1350, 1271, 1138, 883, 779, 725, 619; HRMS (ESI) m/z calcd for. $C_{25}H_{15}FO_2$ $[M + Na]^+$ 389.0948, found 389.0951.

7-Methoxy-3-(2-(naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1x)

Yield: 72%, 272 mg. White soild. m.p.73.3-74.6 ℃. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 8.9 Hz, 1H), 7.81-7.74 (m, 2H), 7.63-7.57 (m, 2H), 7.54-7.51 (m, 2H), 7.45-7.35 (m, 5H), 7.32 (s, 1H), 6.89 (dd, *J* = 9.0, 1.6 Hz, 1H), 6.57 (s, 1H), 3.80 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.9, 163.7, 157.6, 153.1, 140.2, 138.8, 133.4,

132.1, 131.8, 131.5, 131.4, 128.2, 128.1, 127.6, 127.5, 126.2, 126.1, 125.8, 125.2, 124.6, 118.2, 114.4, 100.0, 55.7; IR (KBr), *v* (cm^{-1}) 3441, 3057, 2924, 1927, 1645, 1439, 1248, 1034, 887, 781, 619, 528; HRMS (ESI) m/z calcd for. $C_{26}H_{18}O_3$ $[M + Na]^+$ 401.1148, found 401.1148.

6,7-Dimethoxy-3-(2-(naphthalen-1-yl)phenyl)-4H-chromen-4-one (1y)

Yield: 47%, 191 mg. White solid. m.p. 225.2-227.1 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 7.7 Hz, 1H), 7.74 (dd, *J* = 6.4, 2.6 Hz, 1H), 7.64-7.62 (m, 1H), 7.59-7.57 (m, 1H), 7.55-7.47 (m, 3H), 7.45-7.35 (m, 6H), 6.58 (s, 1H), 3.93 (s, 3H), 3.85 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.7, 154.2, 153.0, 152.0, 147.6, 140.4, 139.0, 133.5, 132.3, 131.9, 131.8, 131.6, 128.2, 128.1, 127.7, 127.6, 126.3, 126.2, 125.8, 125.3, 124.3, 117.9, 104.9, 99.6, 56.4, 56.3; IR (KBr), *v* (cm^{-1}) 3422, 2816, 2723, 1587, 1485, 1348, 1236, 1121, 1001, 862, 777, 598; HRMS (ESI) m/z calcd for. $C_{27}H_{20}O_4$ $[M + Na]^+$ 421.1254, found 431.1254.

8-Methyl-3-(2-(naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1z)

Yield: 73%, 264 mg. White soild. m.p. 111.4-112.3 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.0 Hz, 1H), 7.81 (d, *J* = 7.8 Hz, 1H), 7.77-7.74 (m, 1H), 7.65 (d, *J* = 8.0 Hz, 1H), 7.59-7.48 (m, 4H), 7.45-7.36 (m, 6H), 7.22-7.12 (m, 1H), 2.26 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 176.9, 154.6, 153.5, 140.3, 138.8, 134.3, 133.5, 132.2, 131.8, 131.7, 131.6, 128.2, 128.1, 127.8, 127.7, 127.6, 127.5, 126.3, 126.2, 125.8, 125.3, 124.7, 124.6, 124.3, 123.9, 15.5; IR (KBr), *v* (cm^{-1}) 3684, 2787, 2704,1634, 1479, 1350, 1211, 1161, 1061, 885, 764, 723, 592; HRMS (ESI) m/z calcd for. $C_{26}H_{18}O_2$ $[M + Na]^+$ 385.1199, found 385.1202.

6,8-Difluoro-3-(2-(naphthalen-1-yl)phenyl)-4H-chromen-4-one (1aa)

Yield: 52%, 199 mg. White solid. m.p. 129.2-130.8 ℃. ^1H NMR (400 MHz, $CDCl_3$) δ 7.78 (dd, *J* = 15.1, 7.9 Hz, 2H), 7.61-7.52 (m, 5H), 7.48-7.46 (m, 2H), 7.43-7.33 (m, 4H), 7.12-7.07 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 174.7, 158.4 (d, ^1J = 247.4 Hz,

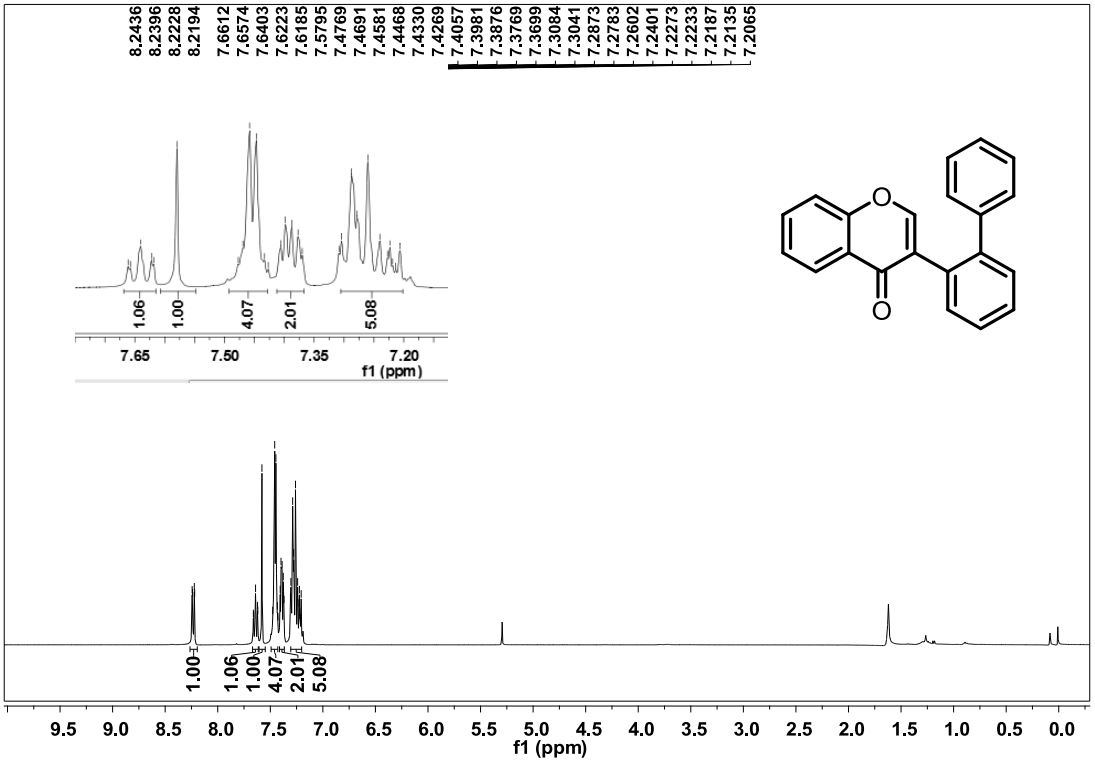
^{3}J = 9.5 Hz), 153.4, 151.3 (d, ^{1}J = 256.0 Hz, ^{3}J = 11.7 Hz), 141.7 (d, ^{2}J = 11.6 Hz, ^{4}J = 2.6 Hz), 140.5, 138.5, 133.5, 132.1, 131.7, 131.5, 130.7, 128.7, 128. 3, 127.9, 127.8, 127.6, 126.5 (d, ^{3}J =8.3 Hz), 126.4, 126.0, 125.9, 125.3, 124.9, 109.0 (d, ^{2}J = 20.0 Hz, ^{2}J = 28.6 Hz), 106.4 (d, ^{2}J = 20.0 Hz, ^{2}J = 28.6 Hz); ^{19}F NMR (376 MHz, $CDCl_3$), δ (ppm) -112.07, -128.34; IR (KBr), *v* (cm^{-1}) 3422, 2816, 2723, 1587, 1485, 1348, 1236, 1121, 1001, 862, 777, 598; HRMS (ESI) m/z calcd for. $C_{25}H_{14}FO_2$ $[M + Na]^+$ 407.0854, found 407.0852.

3-(2-Bromophenyl)-4*H*-chromen-4-one (4a)

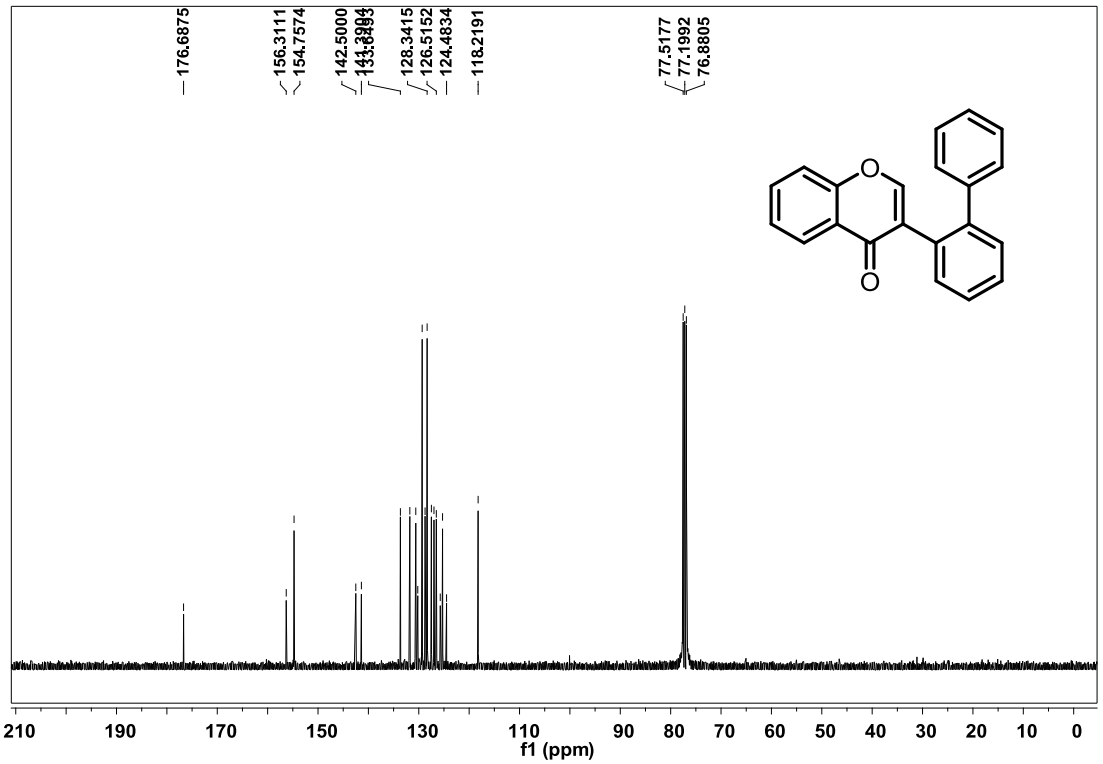
Yield: 70%, 209 mg. Yellow soild. . m.p. 147.7-181.9 ℃ ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.30 (dd, *J* = 7.9, 1.0 Hz, 1H), 7.93 (s, 1H), 7.60-7.66 (m, 2H), 7.49 (d, *J* = 8.4 Hz, 1H), 7.42 (t, *J* = 7.5 Hz, 1H), 7.37-7.33 (m, 2H), 7.26-7.23 (m, 1H); ^{13}C NMR (150 MHz, $CDCl_3$) δ 175.5, 156.4, 154.5, 133.8, 133.0, 133.0, 132.3, 130.1, 127.5, 126.5, 125.9, 125.4, 124.9, 124.5, 118.2; IR (KBr), *v* (cm^{-1}) 3431, 2361, 1637, 1462, 1382, 1292, 1223, 1153, 1003, 1016; HRMS (ESI) m/z calcd for. $C_{15}H_9BrO_2$ $[M + Na]^+$ 322.9678, found 322.9680.

4. ^{1}H NMR ^{13}C NMR Spectra of 1, 2 and 3,4a

3-([1,1'-Biphenyl]-2-yl)-4*H*-chromen-4-one (1a)

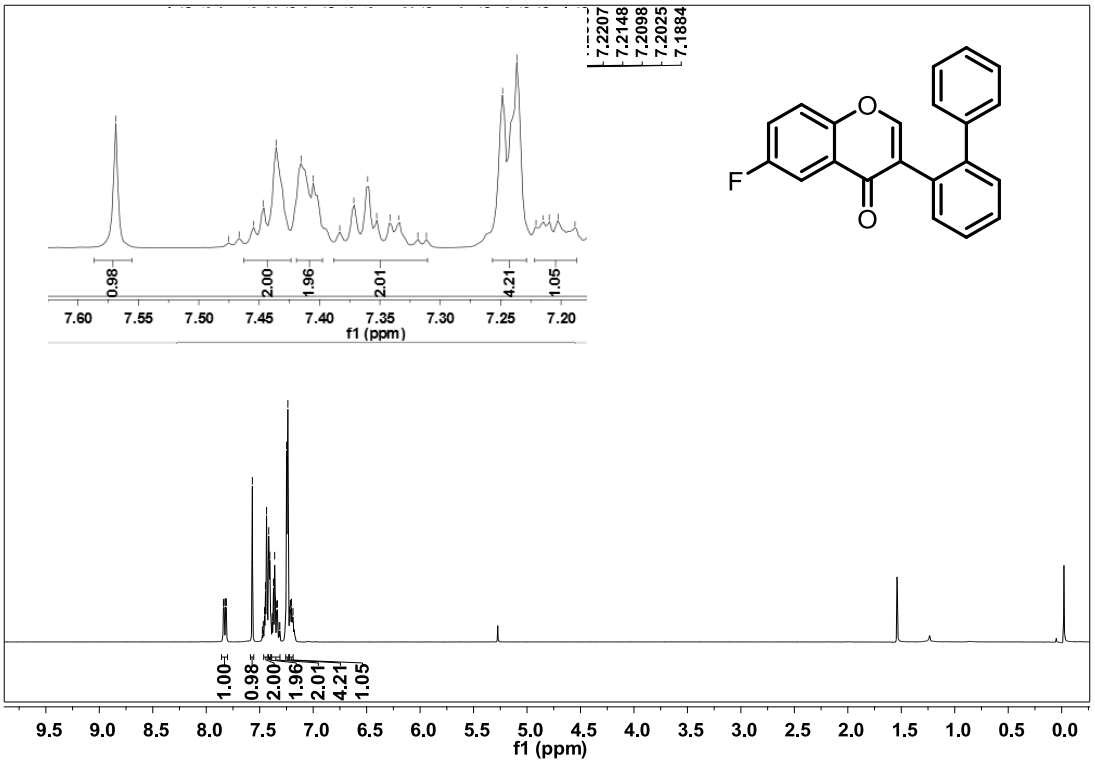


400 MHz, ^{1}H NMR in $CDCl_3$

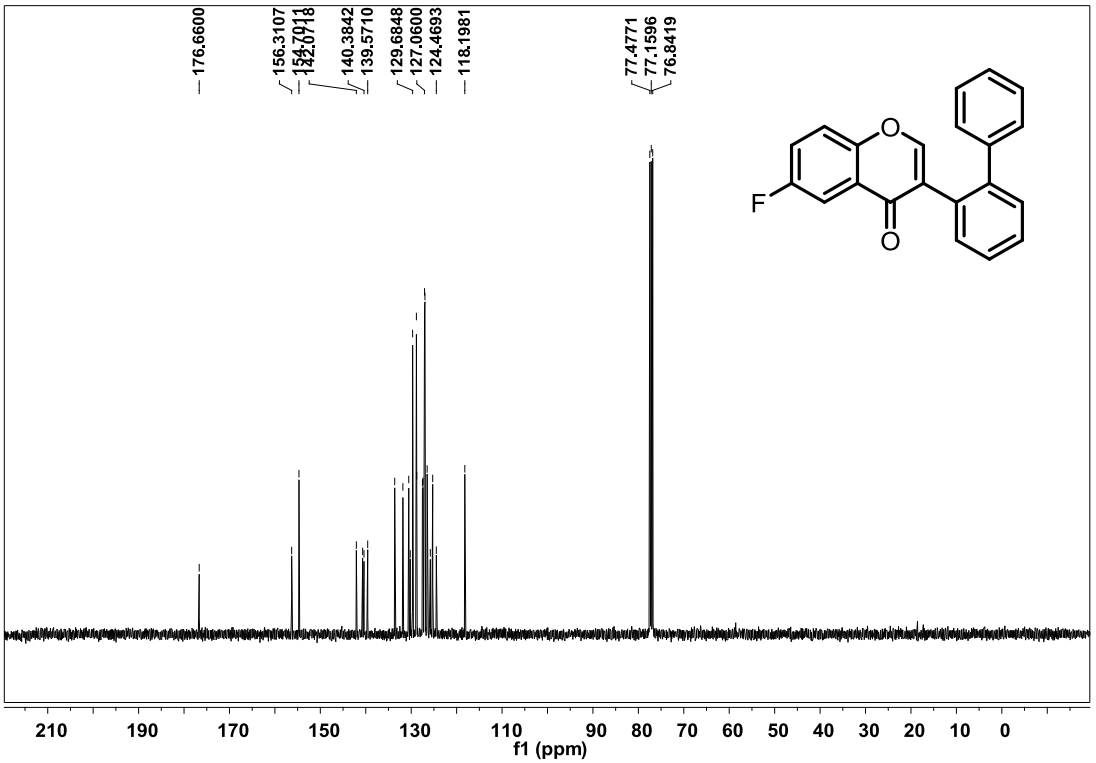


100 MHz, ^{13}C NMR in $CDCl_3$

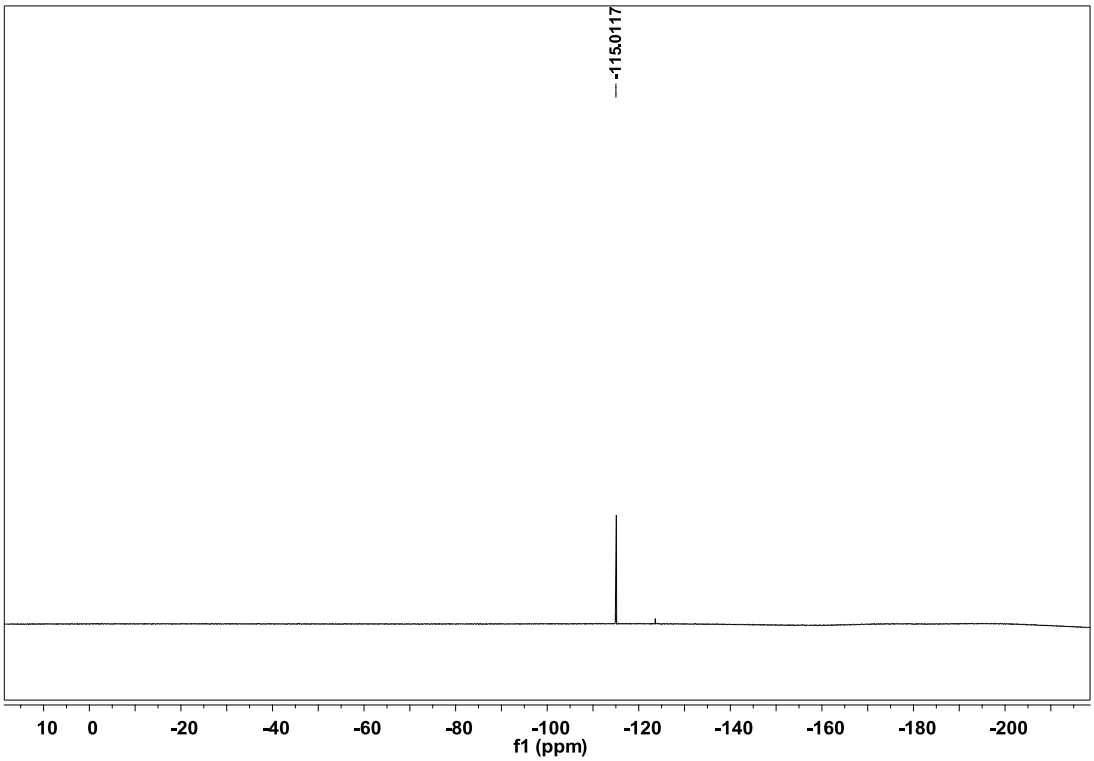
3-([1,1'-Biphenyl]-2-yl)-6-fluoro-4*H*-chromen-4-one (1b)



400 MHz, ^{1}H NMR in $CDCl_3$

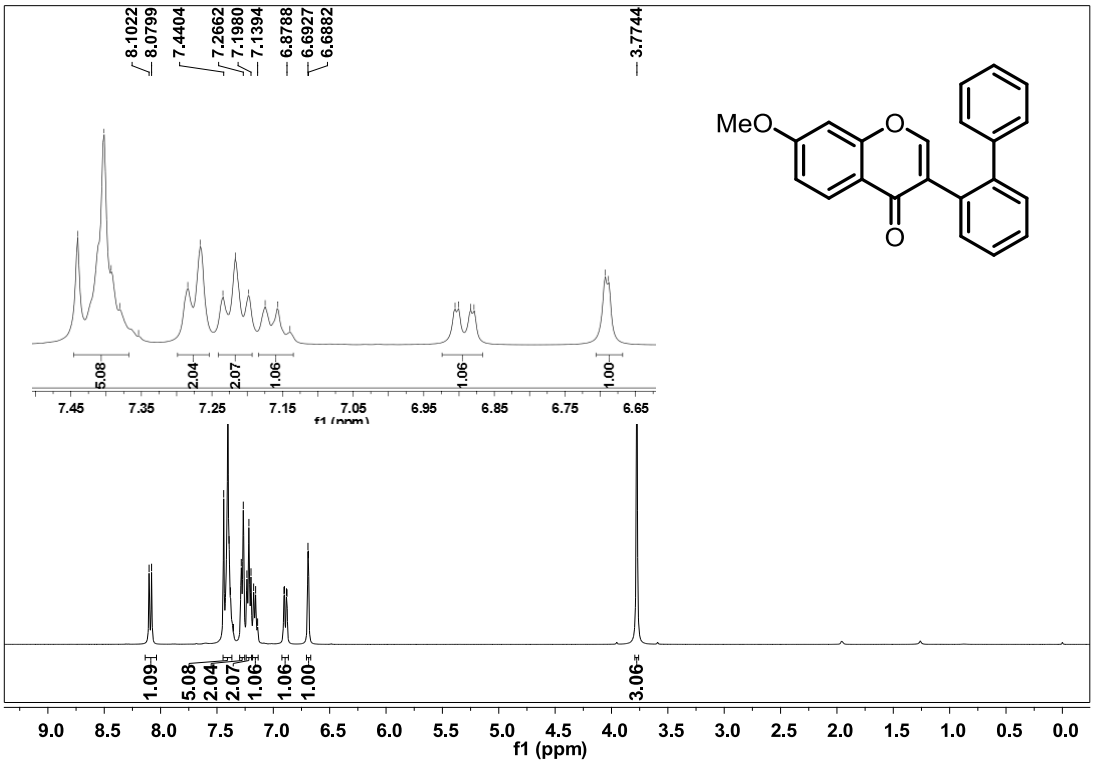


100 MHz, ^{13}C NMR in $CDCl_3$

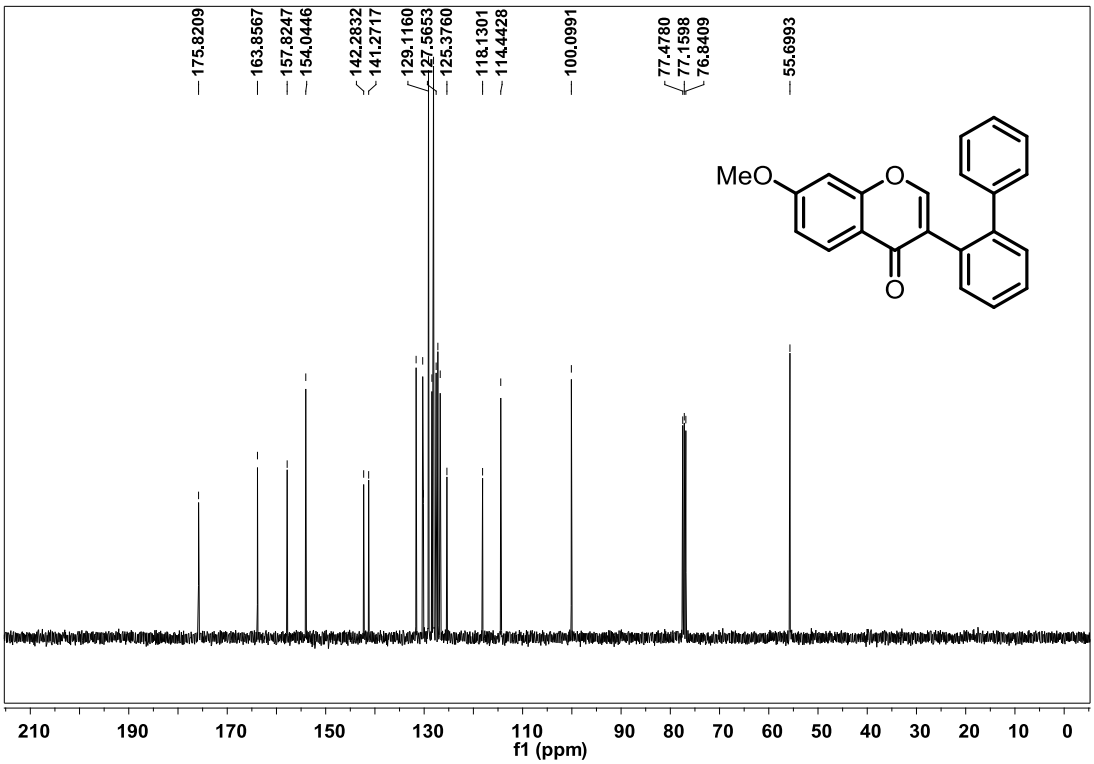


376 MHz, ^{19}F NMR in $CDCl_3$

3-([1,1'-Biphenyl]-2-yl)-7-methoxy-4*H*-chromen-4-one (1c)

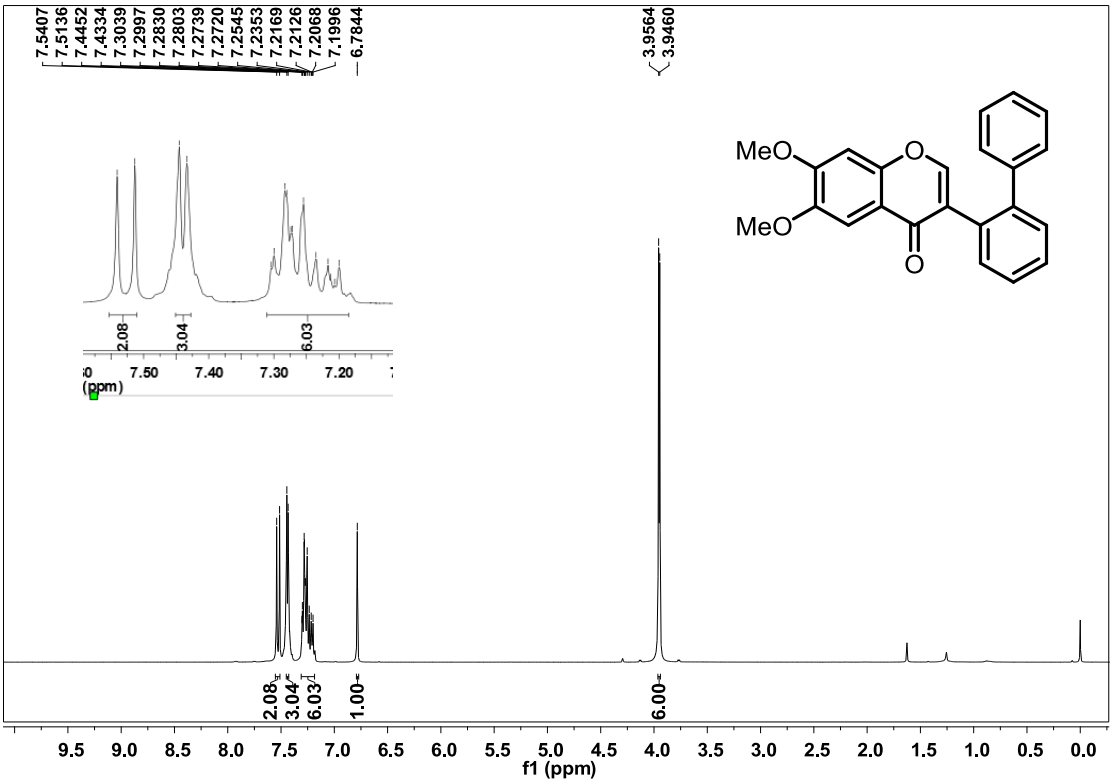


400 MHz, ^{1}H NMR in $CDCl_3$

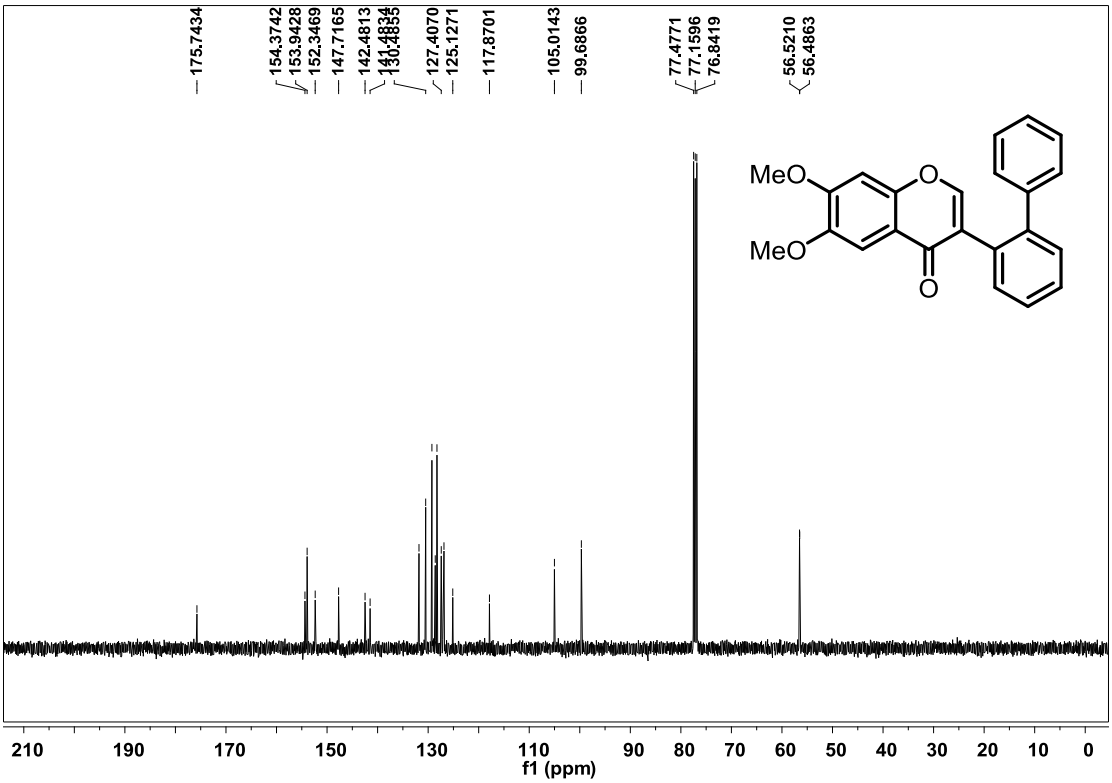


100 MHz, ^{13}C NMR in $CDCl_3$

3-([1,1'-Biphenyl]-2-yl)-6,7-dimethoxy-4*H*-chromen-4-one (1d)

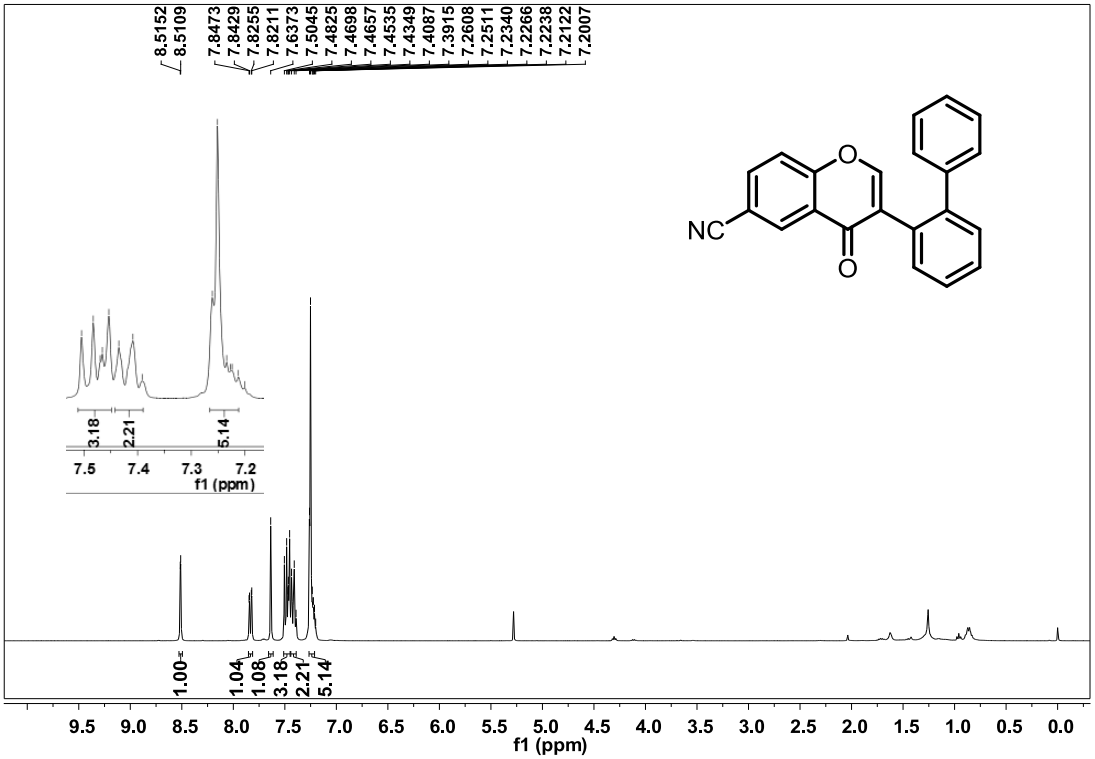


400 MHz, ^{1}H NMR in $CDCl_3$

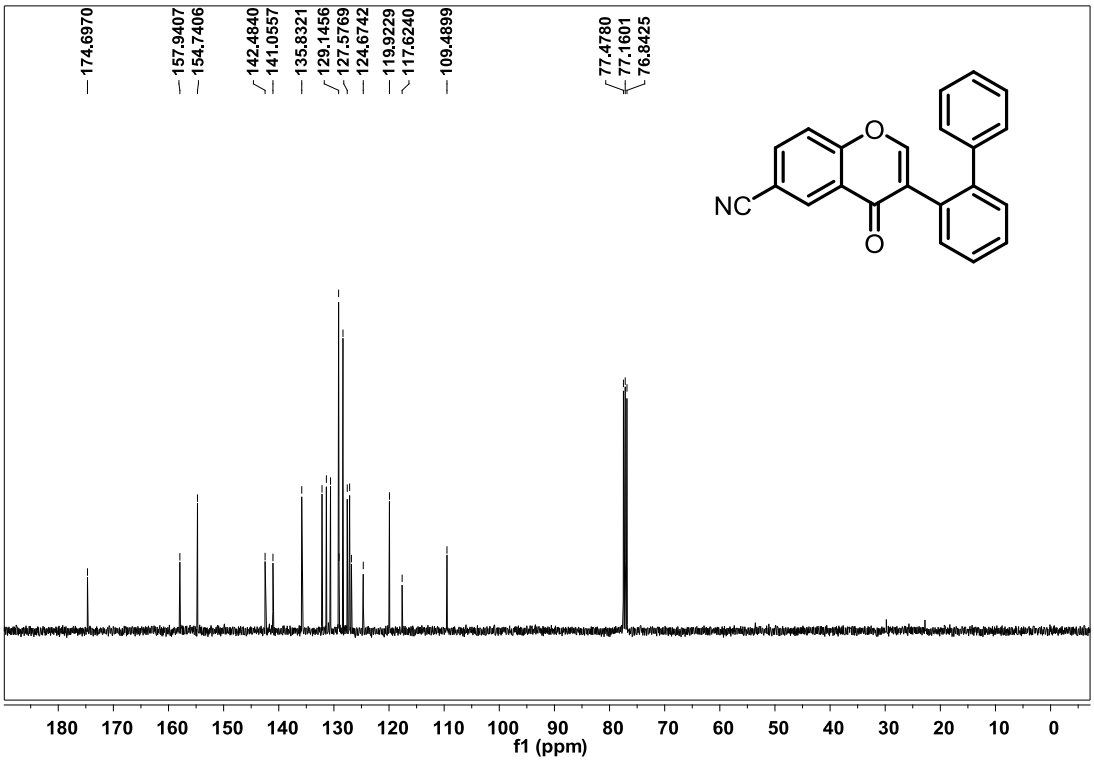


100 MHz, ^{13}C NMR in $CDCl_3$

3-([1,1'-biphenyl]-2-yl)-4-oxo-4*H*-chromene-6-carbonitrile(1e)

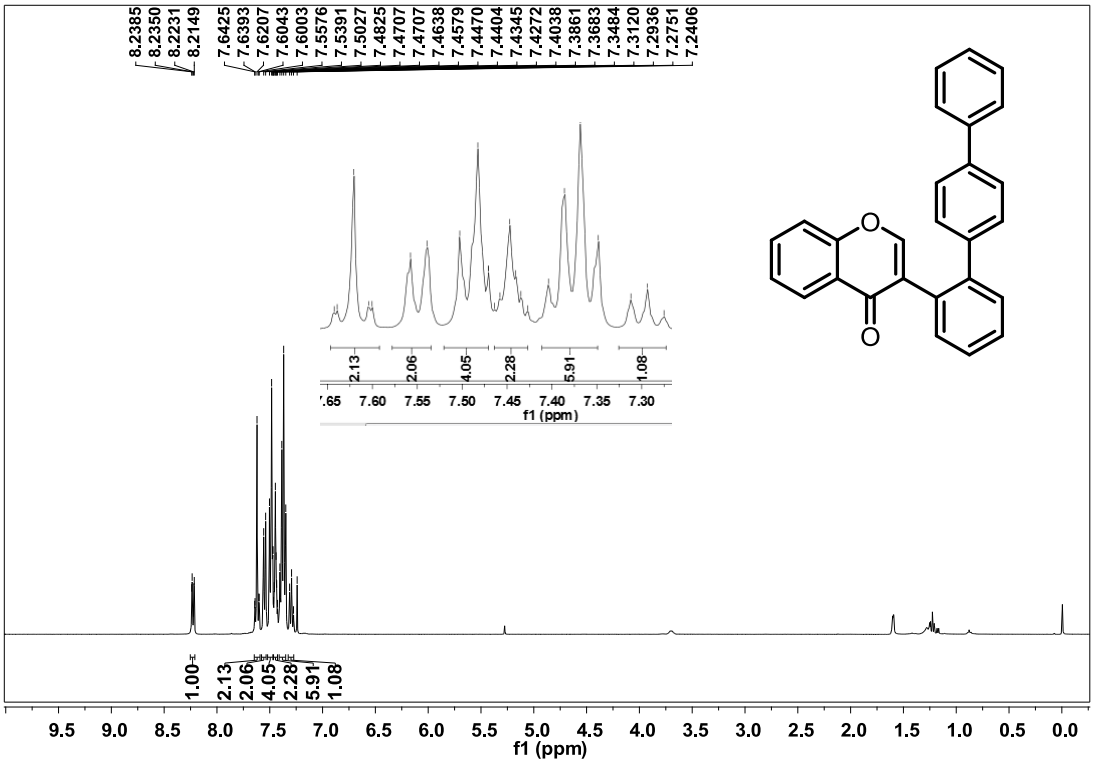


400 MHz, ^{1}H NMR in $CDCl_3$

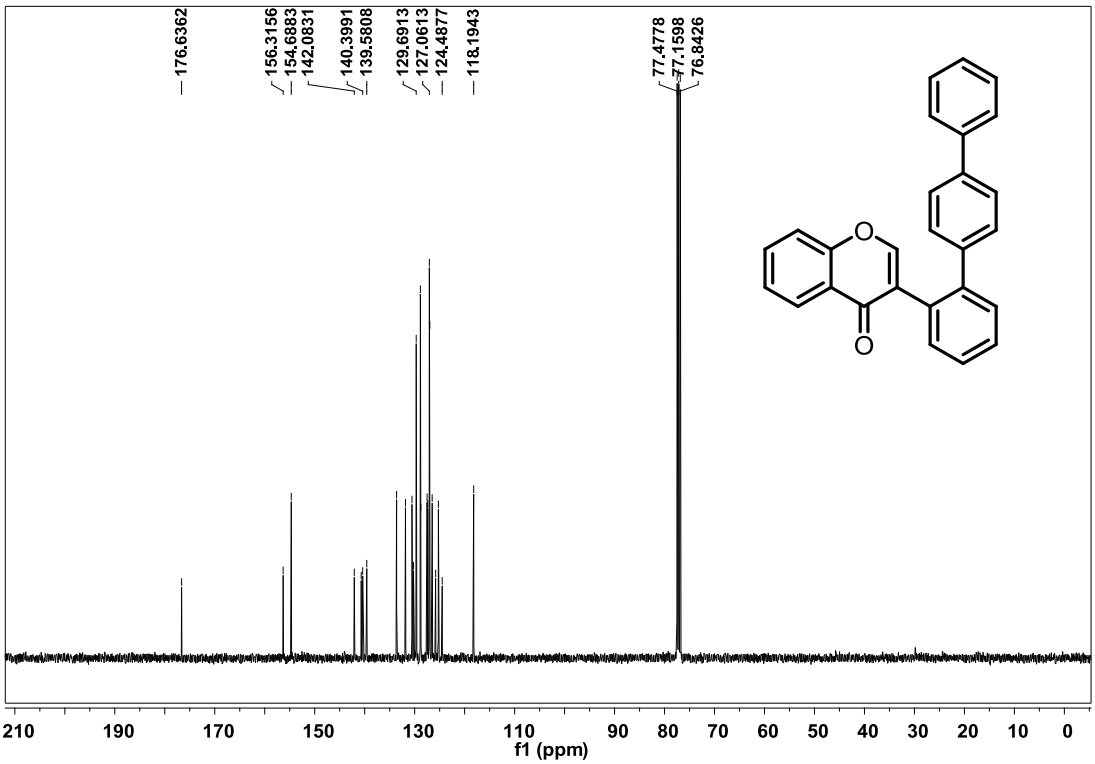


100 MHz, ^{13}C NMR in $CDCl_3$

3-([1,1':4',1''-terphenyl]-2-yl)-4*H*-chromen-4-one (1f)

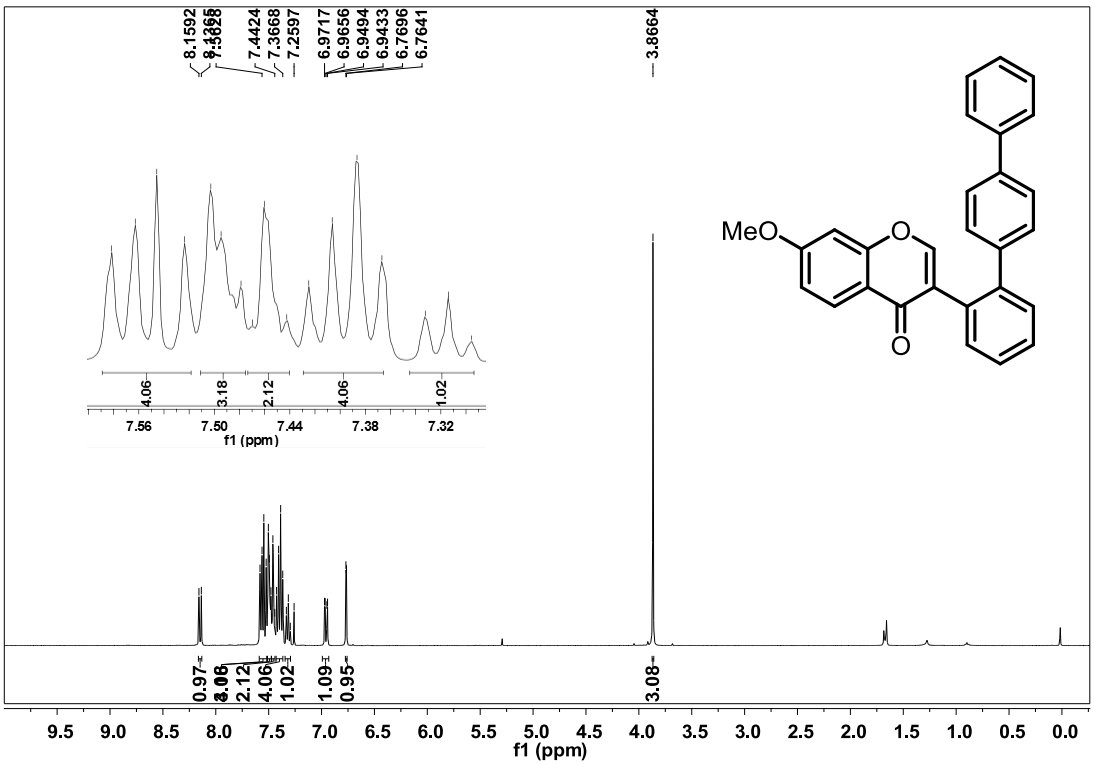


400 MHz, ^{1}H NMR in $CDCl_3$

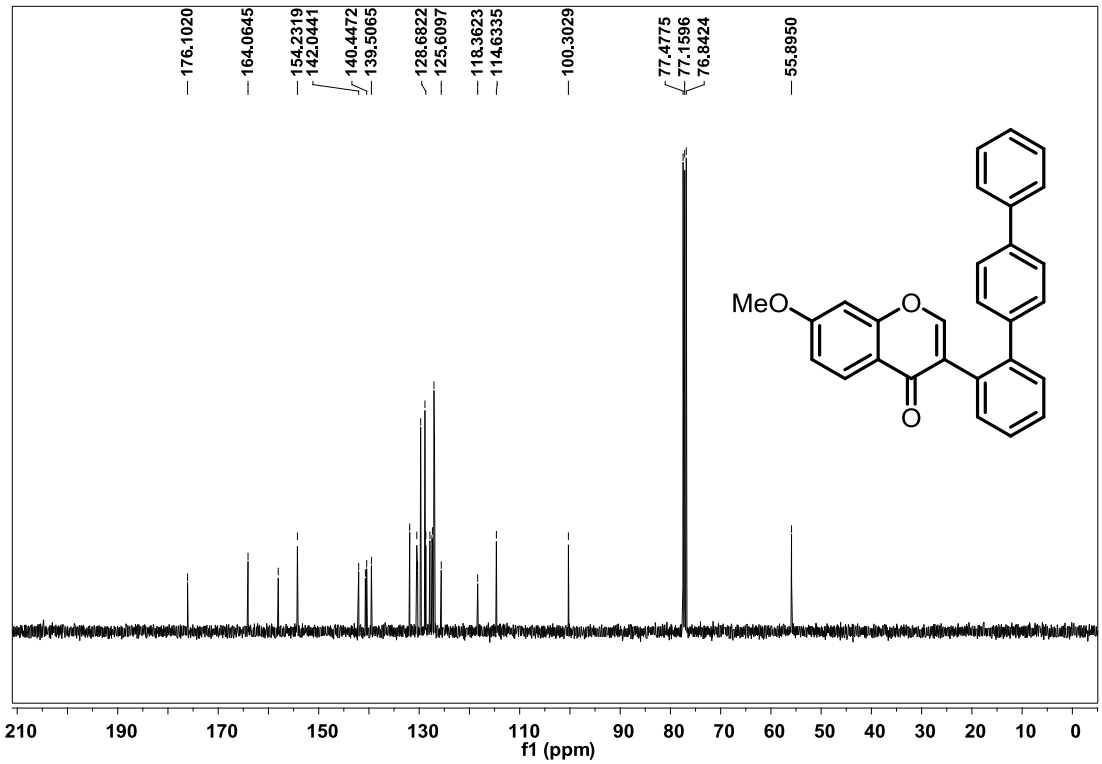


100 MHz, ^{13}C NMR in $CDCl_3$

3-([1,1':4',1''-Terphenyl]-2-yl)-7-methoxy-4*H*-chromen-4-one (1g)

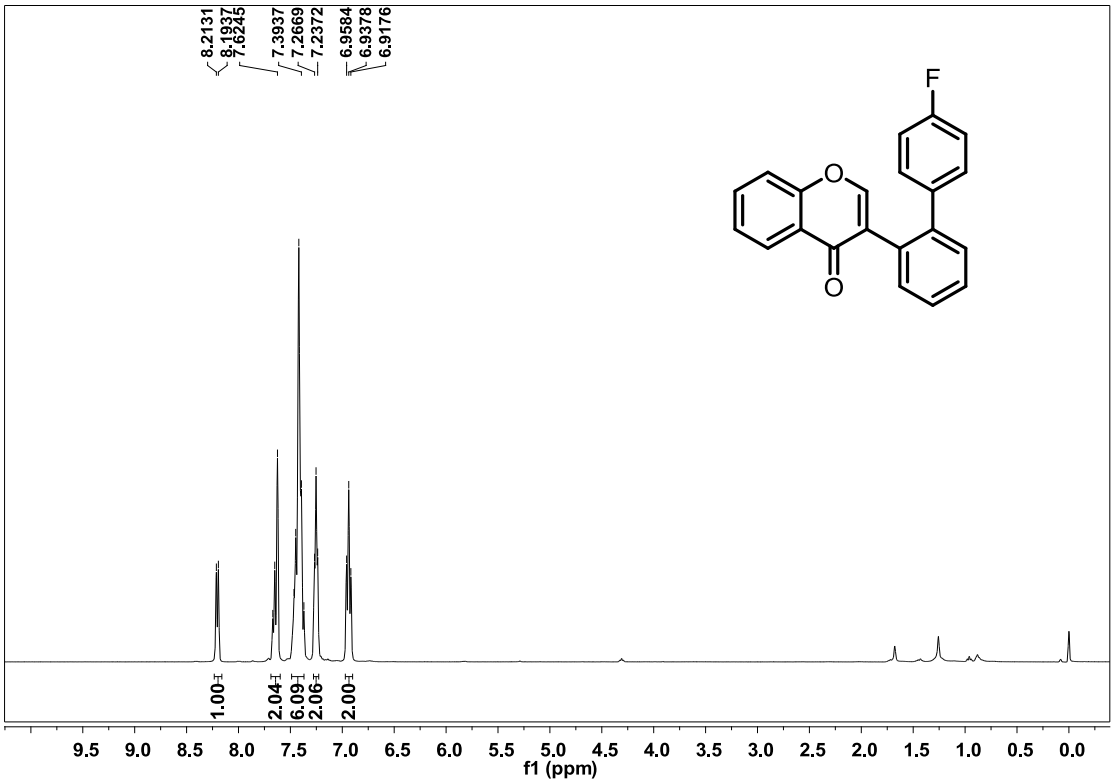


400 MHz, ^{13}H NMR in $CDCl_3$

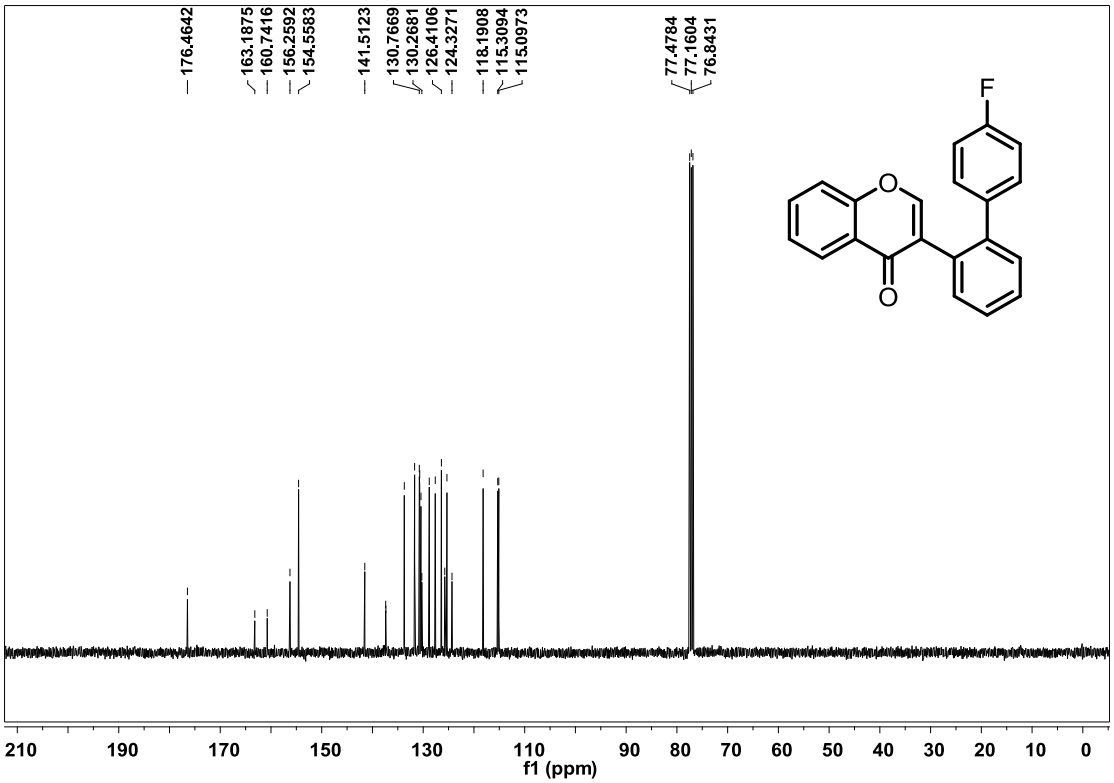


100 MHz, ^{13}C NMR in $CDCl_3$

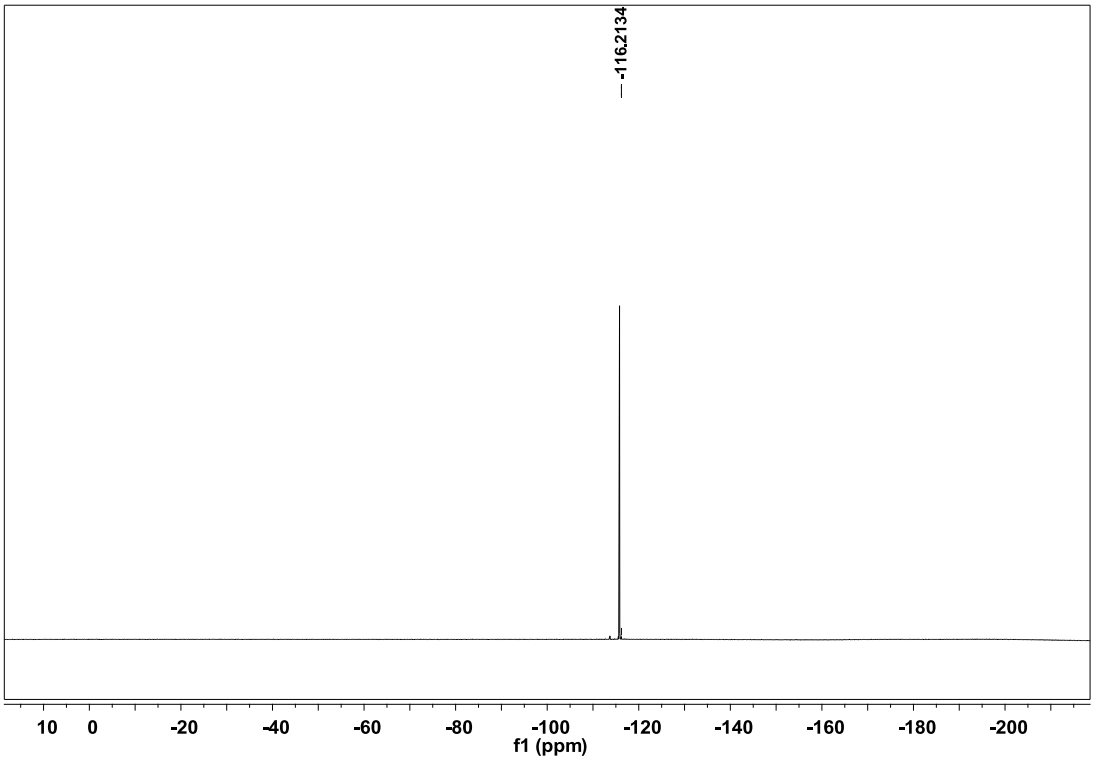
3-(4'-Fluoro-[1,1'-biphenyl]-2-yl)-4*H*-chromen-4-one (1h)



400 MHz, ^{1}H NMR in $CDCl_3$

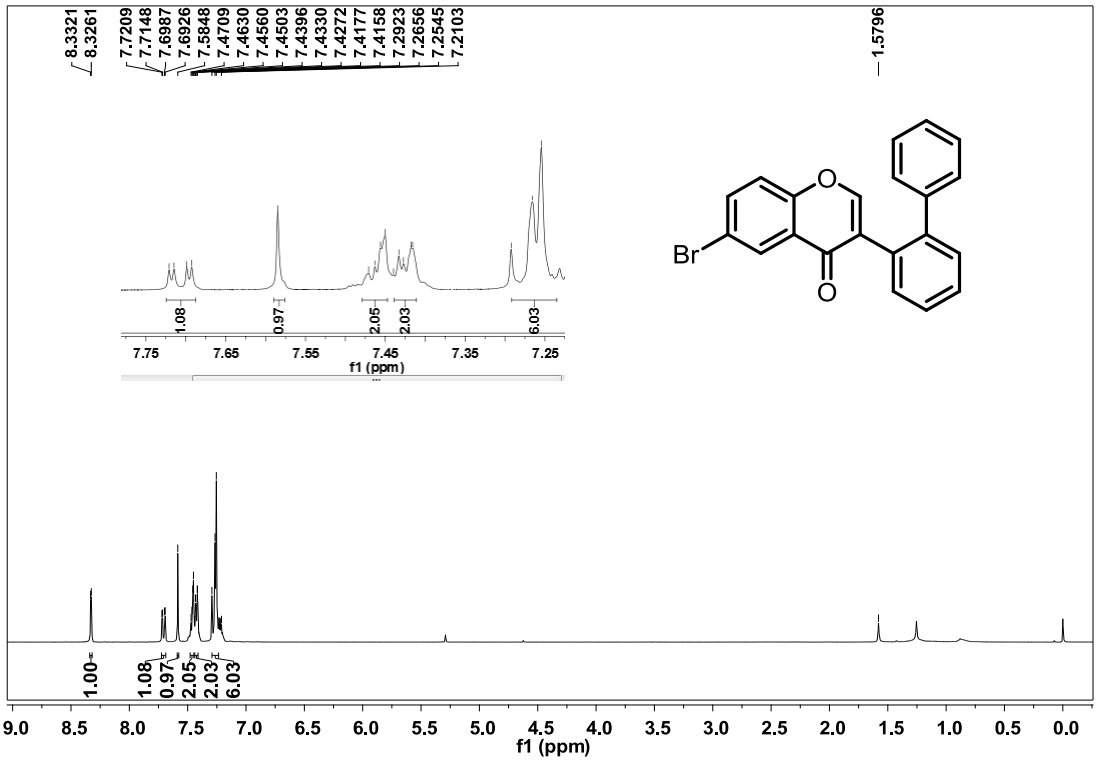


100 MHz, ^{13}C NMR in $CDCl_3$

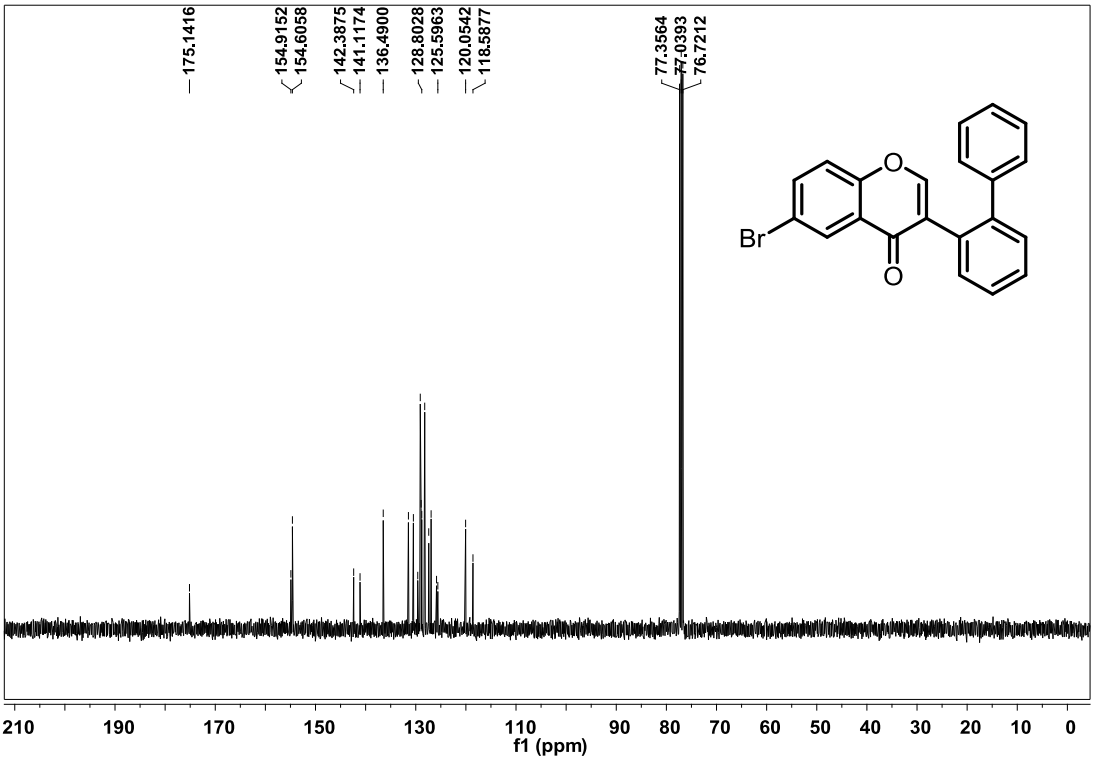


376 MHz, ^{19}F NMR in $CDCl_3$

3-([1,1'-Biphenyl]-2-yl)-6-bromo-4*H*-chromen-4-one (1i)

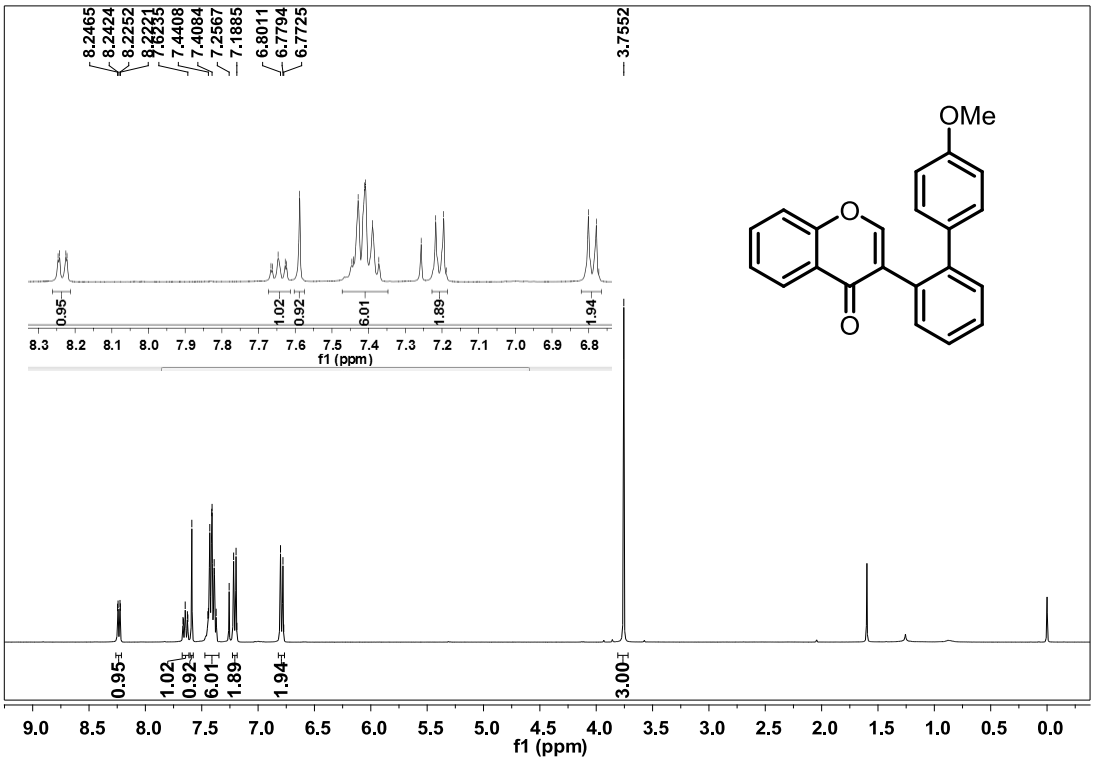


400 MHz, ^{1}H NMR in $CDCl_3$

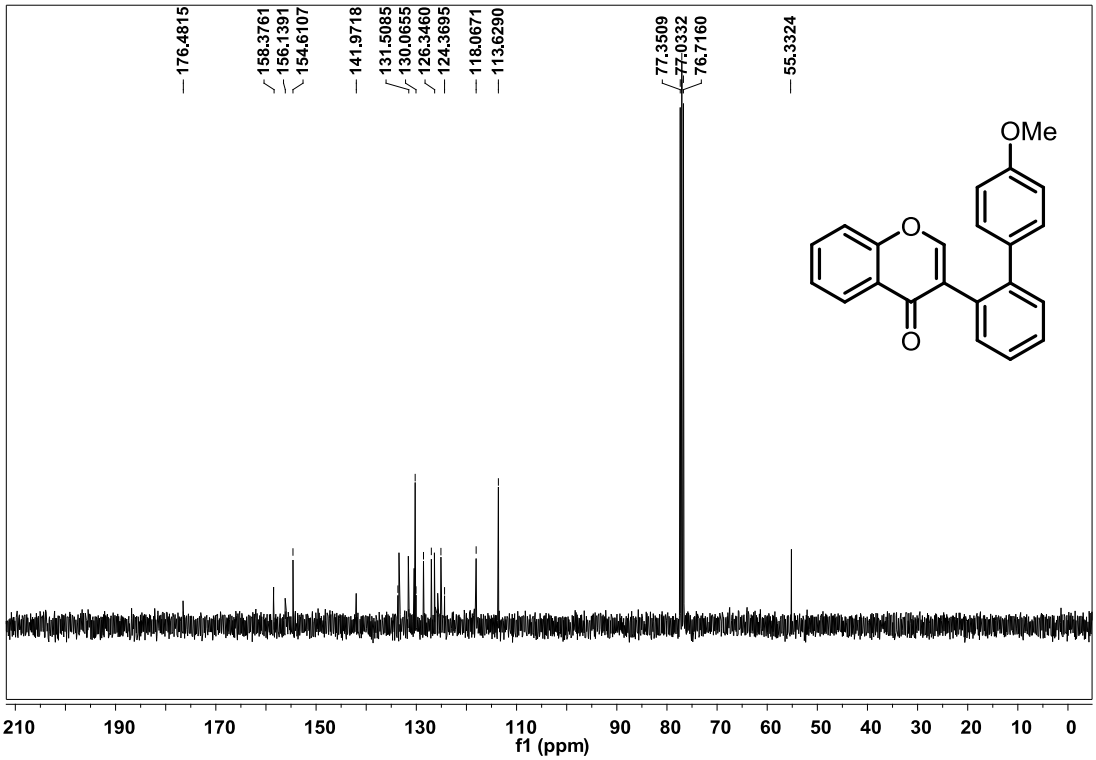


100 MHz, ^{13}C NMR in $CDCl_3$

3-(4'-Methoxy-[1,1'-biphenyl]-2-yl)-4*H*-chromen-4-one (1j)

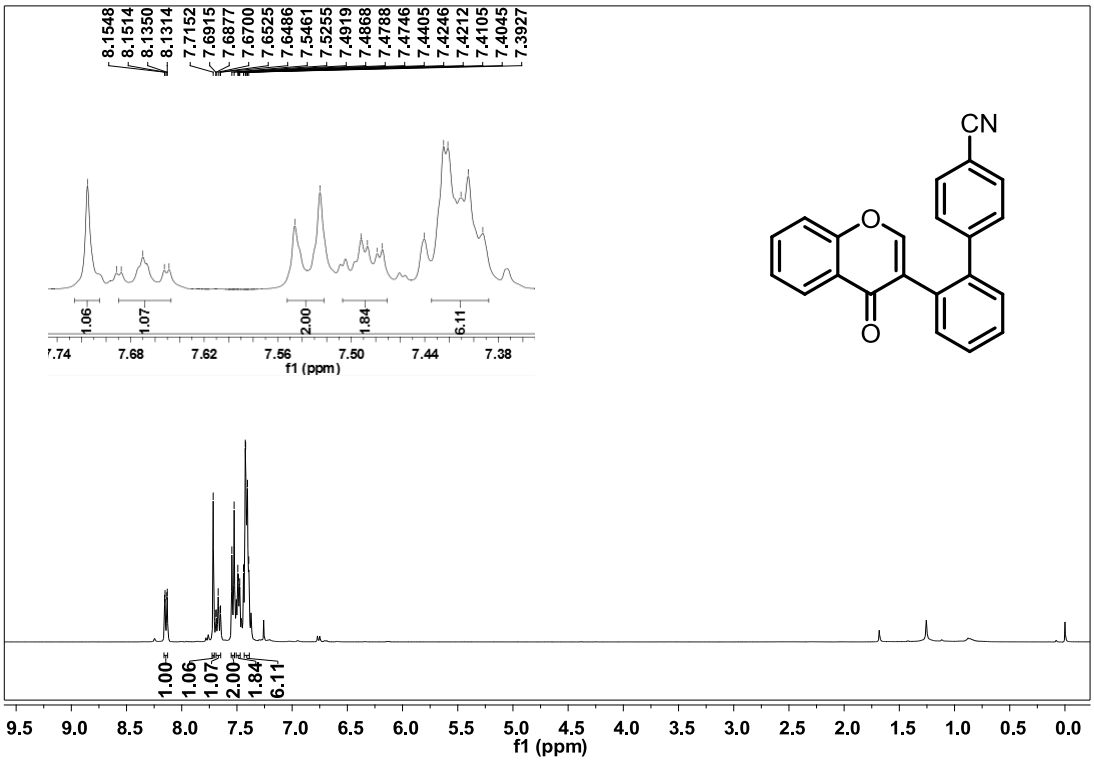


400 MHz, ^{1}H NMR in $CDCl_3$

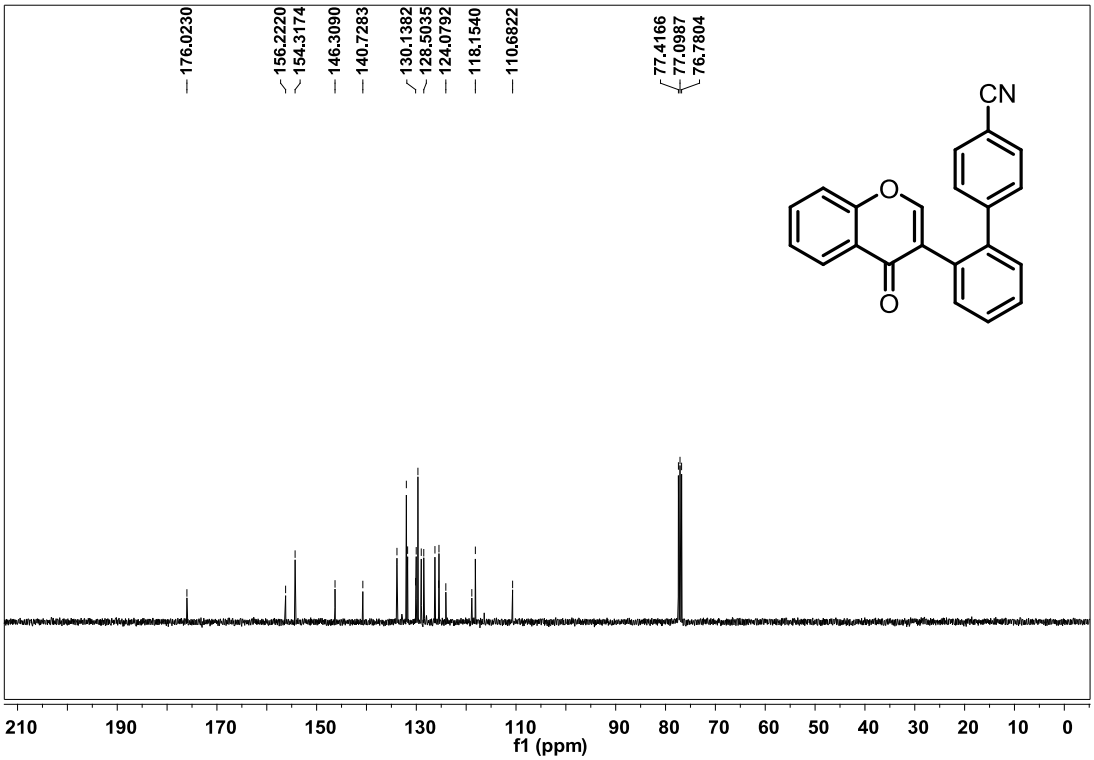


100 MHz, ^{13}C NMR in $CDCl_3$

2'-(4-Oxo-4*H*-chromen-3-yl)-[1,1'-biphenyl]-4-carbonitrile (1k)

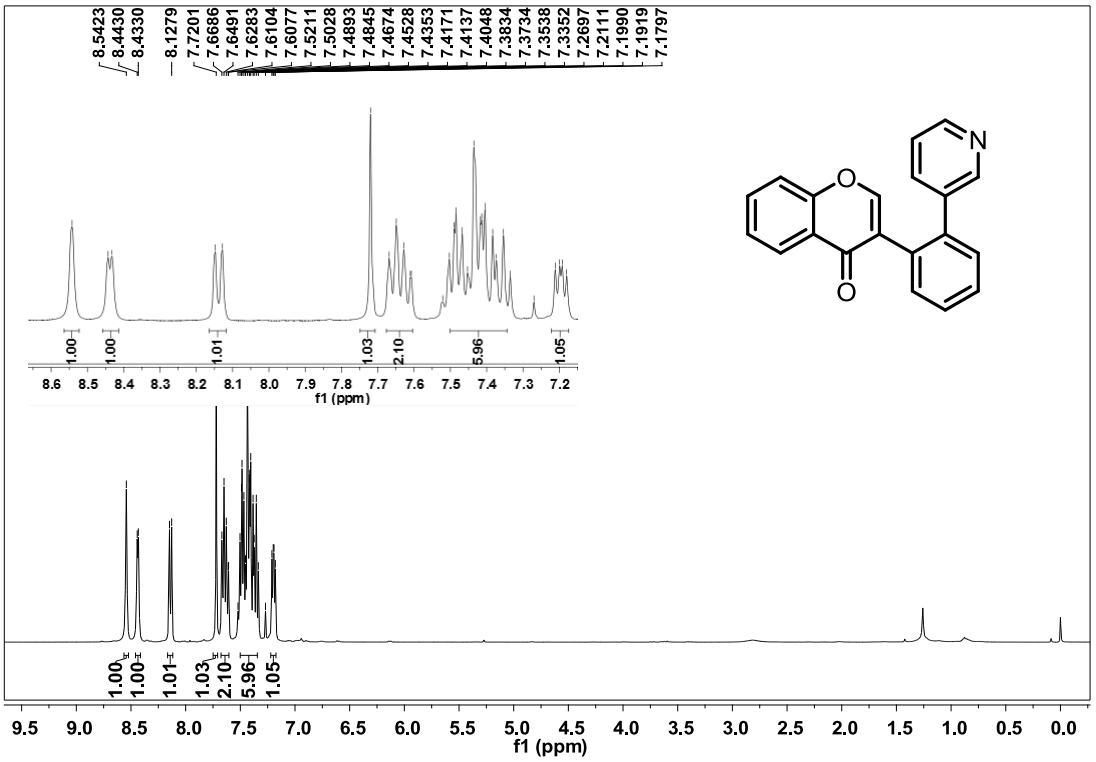


400 MHz, ^{1}H NMR in $CDCl_3$

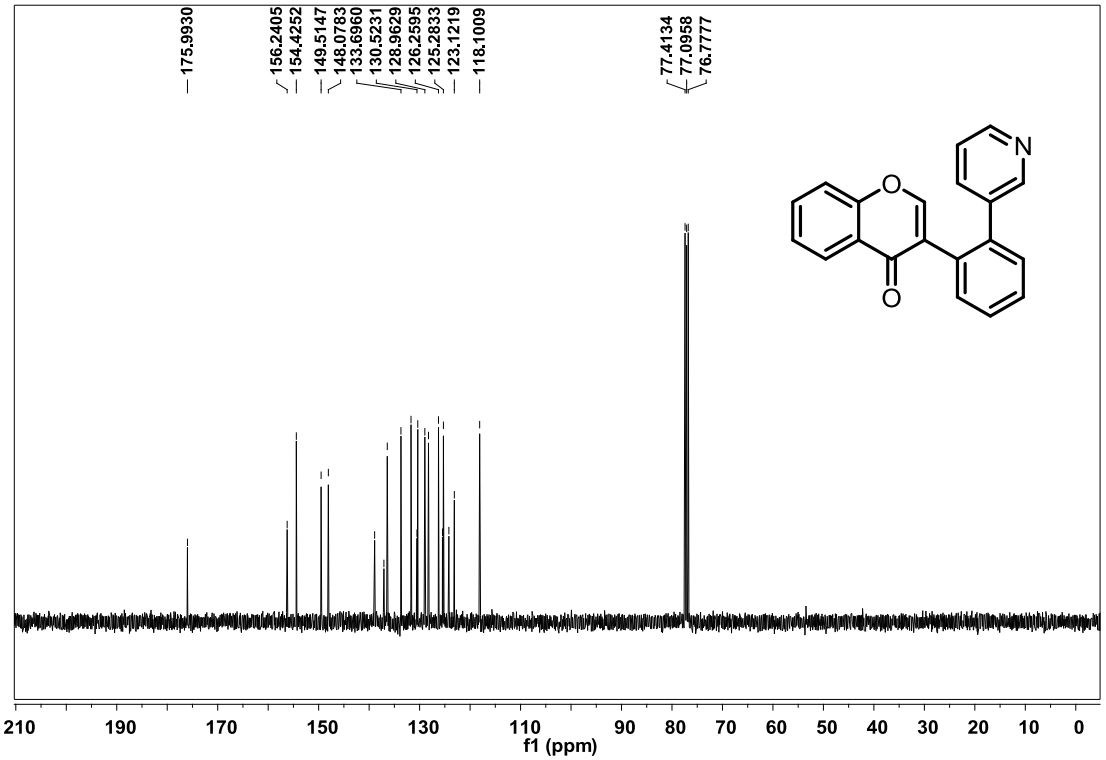


100 MHz, ^{13}C NMR in $CDCl_3$

3-(2-(Pyridin-3-yl)phenyl)-4*H*-chromen-4-one (1l)

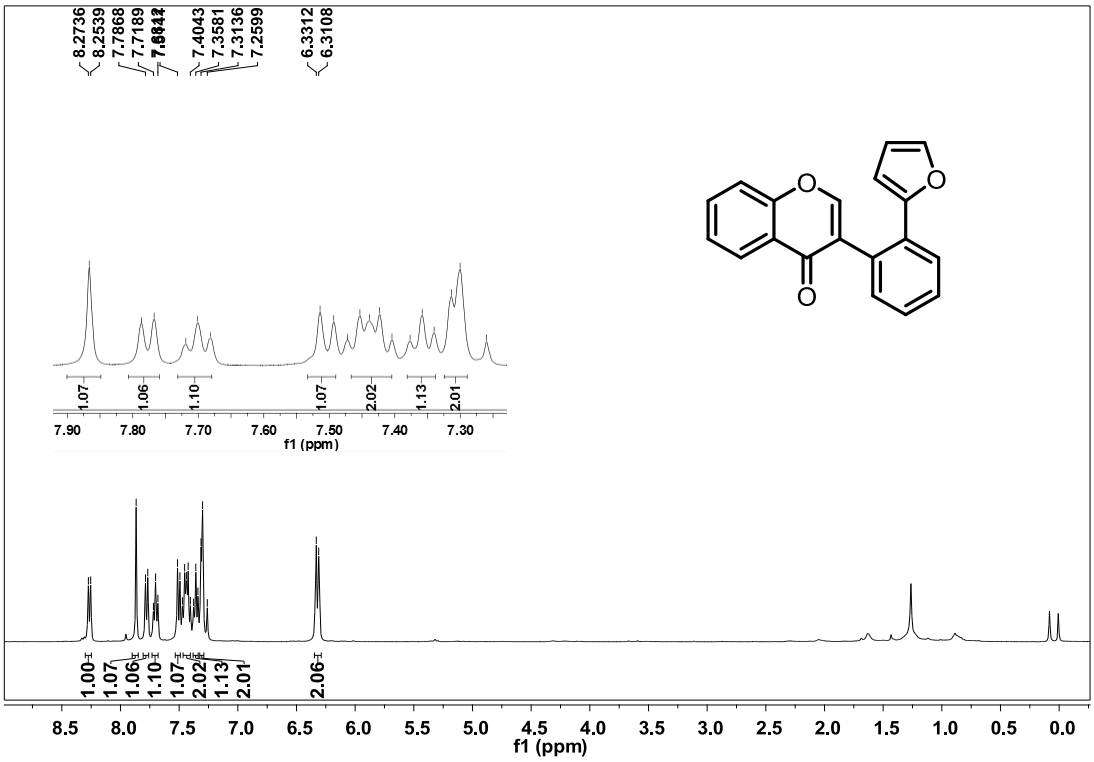


400 MHz, ^{1}H NMR in $CDCl_3$

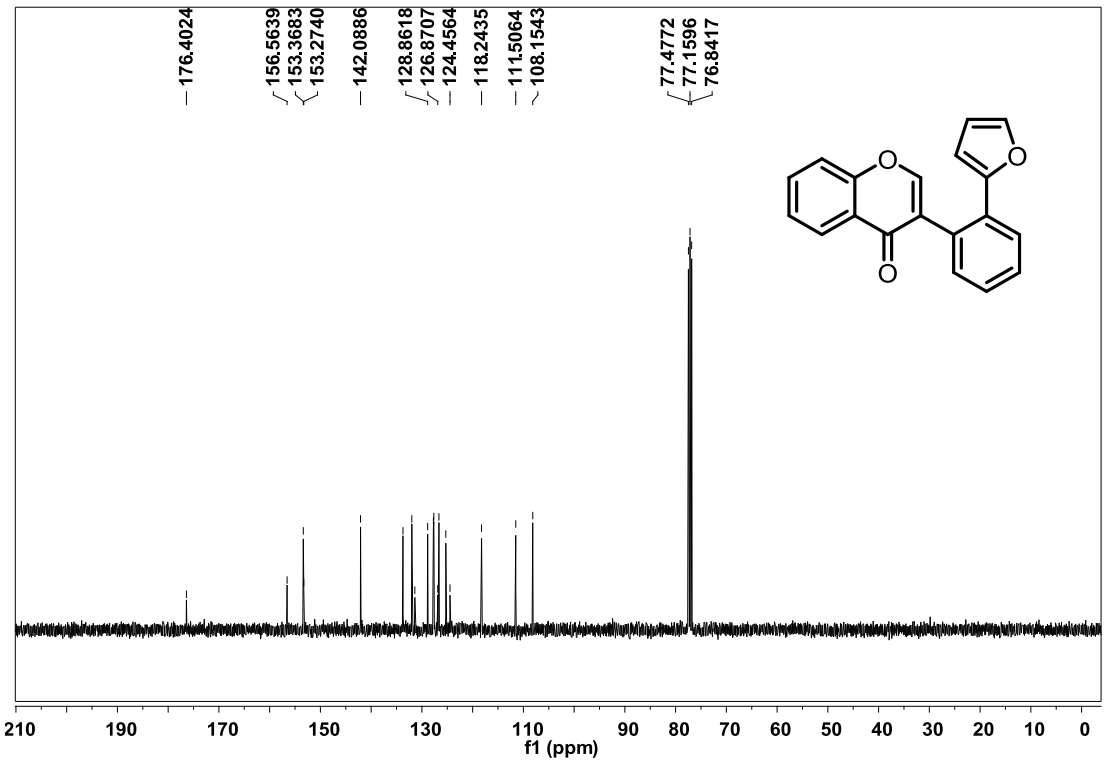


100 MHz, ^{13}C NMR in $CDCl_3$

3-(2-(Furan-2-yl)phenyl)-4*H*-chromen-4-one（1m）

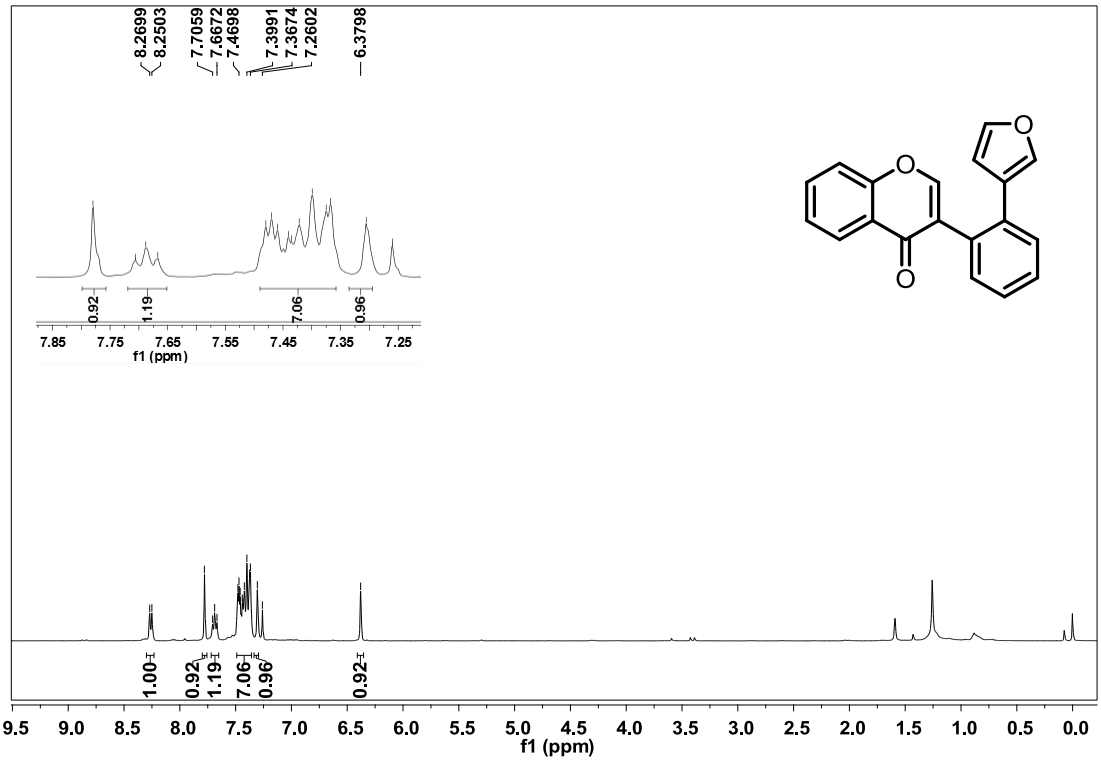


400 MHz, ^{1}H NMR in $CDCl_3$

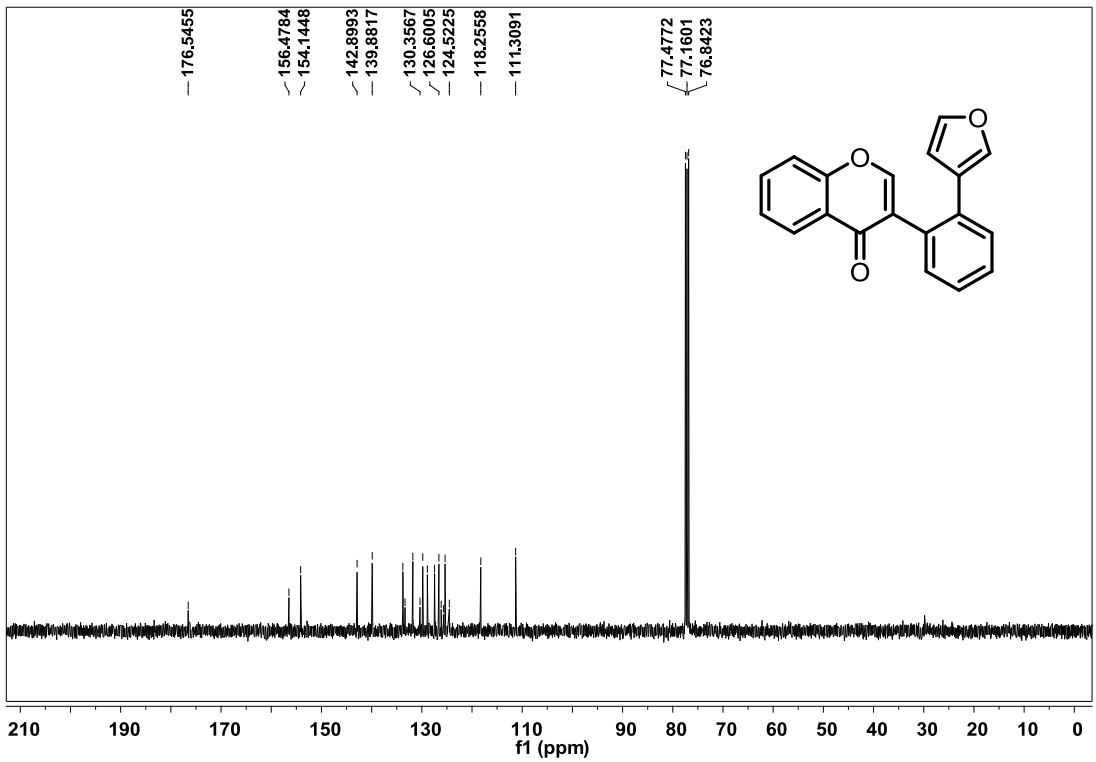


100 MHz, ^{13}C NMR in $CDCl_3$

3-(2-(Furan-3-yl)phenyl)-4*H*-chromen-4-one (1n)

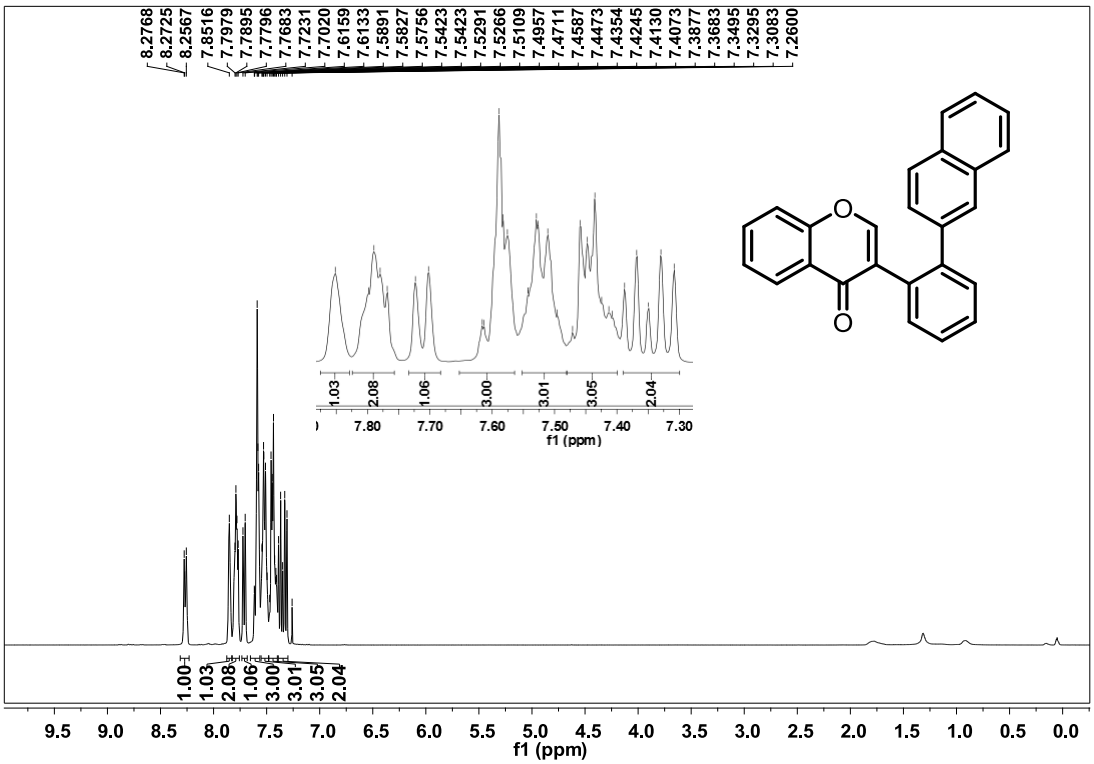


400 MHz, ^{1}H NMR in $CDCl_3$

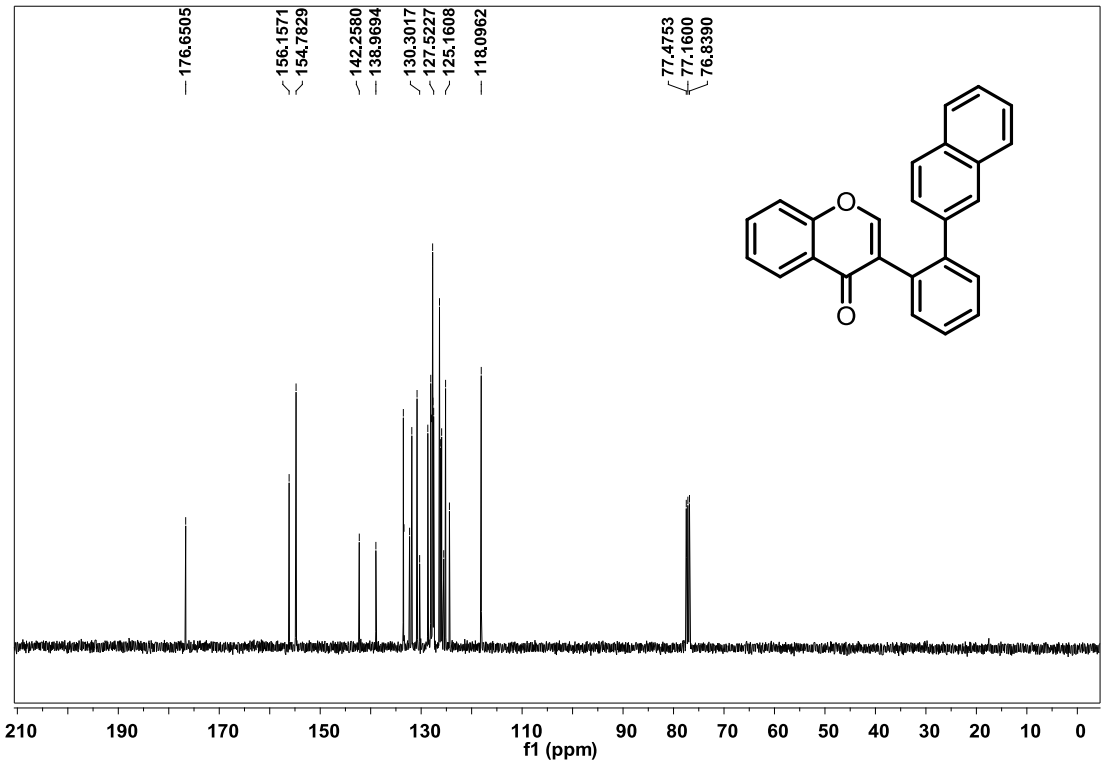


100 MHz, ^{13}C NMR in $CDCl_3$

3-(2-(Naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1o)

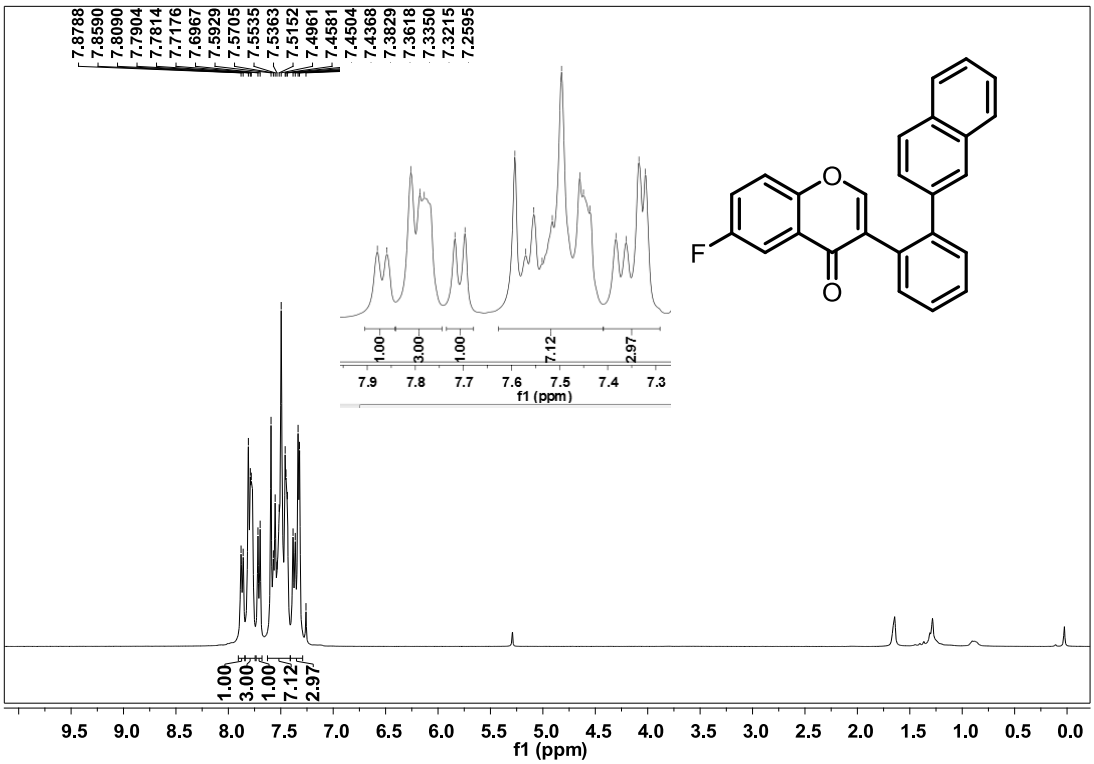


400 MHz, ^{1}H NMR in $CDCl_3$

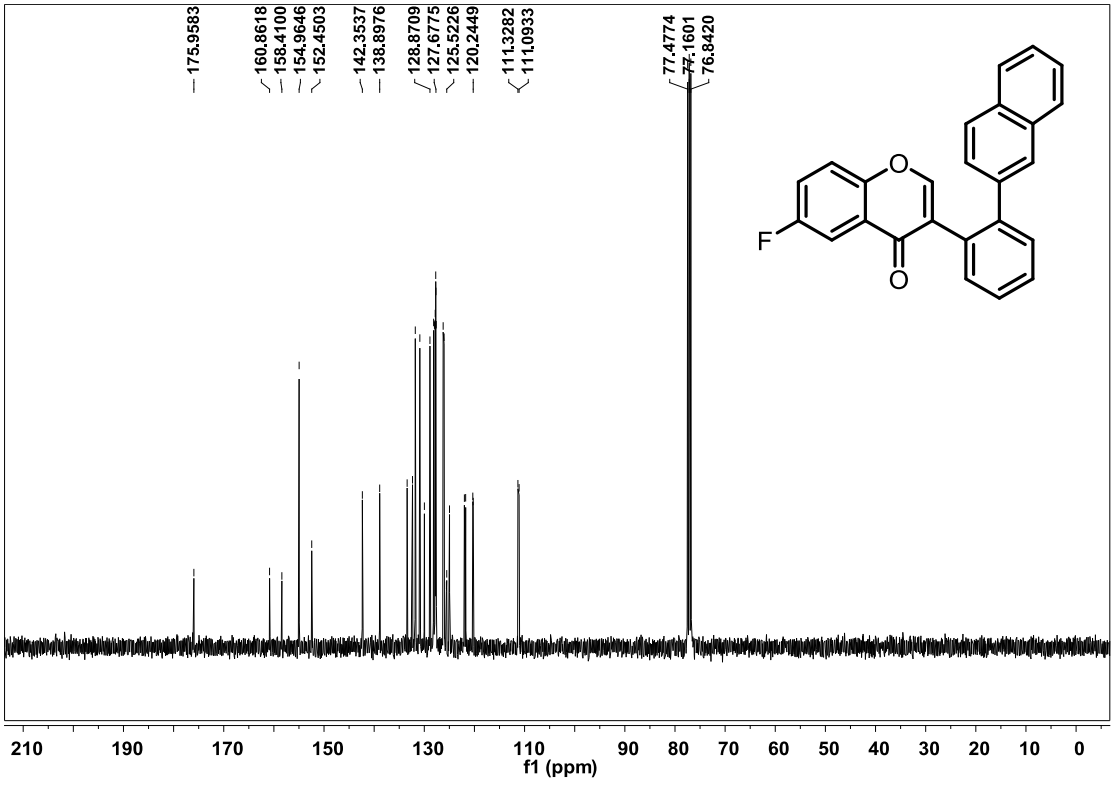


100 MHz, ^{13}C NMR in $CDCl_3$

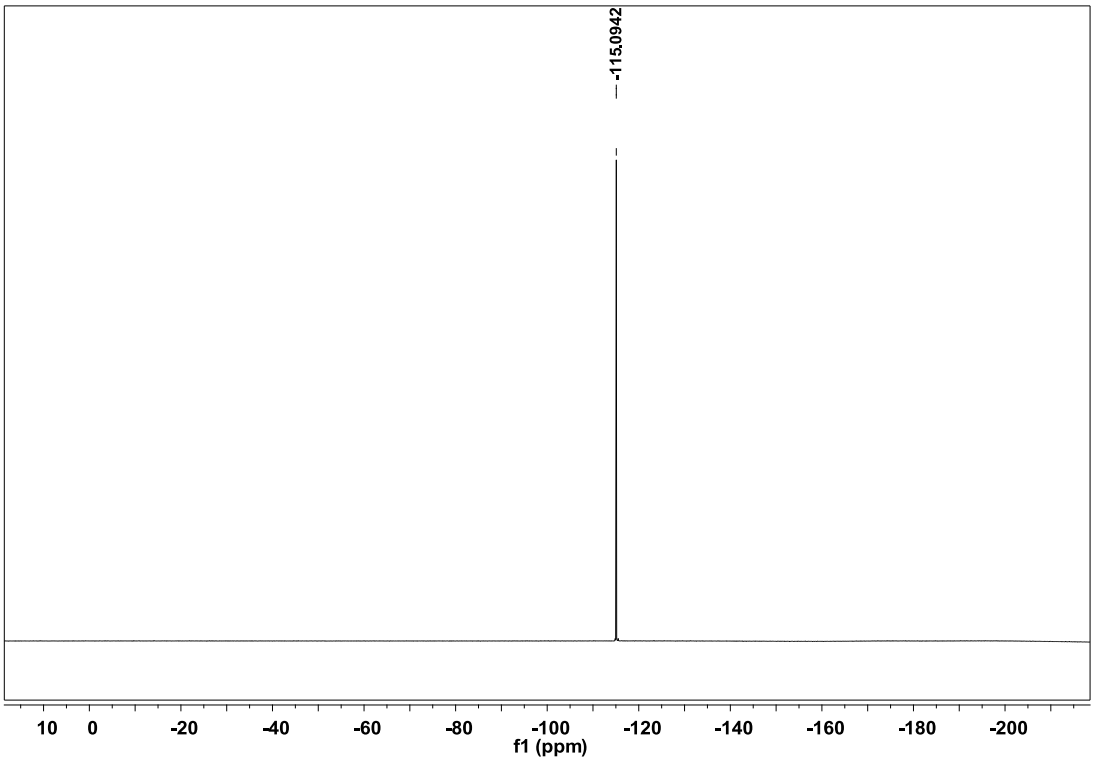
6-Fluoro-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1p)



400 MHz, ^{1}H NMR in $CDCl_3$

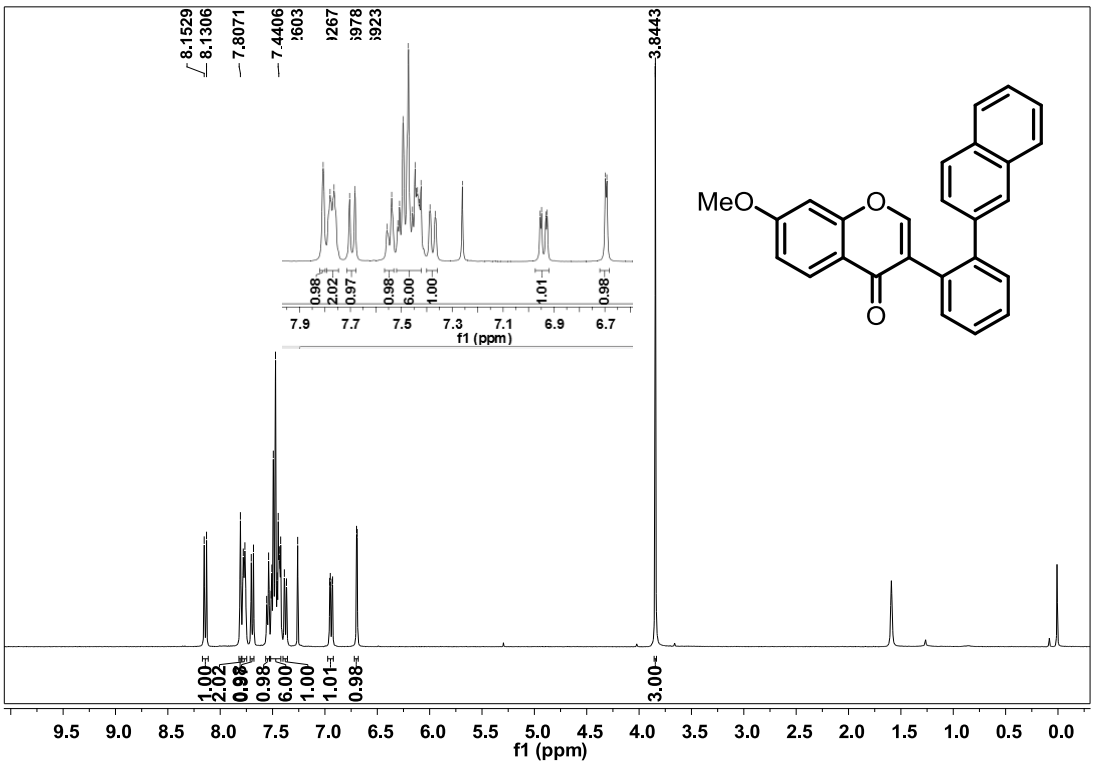


100 MHz, ^{13}C NMR in $CDCl_3$

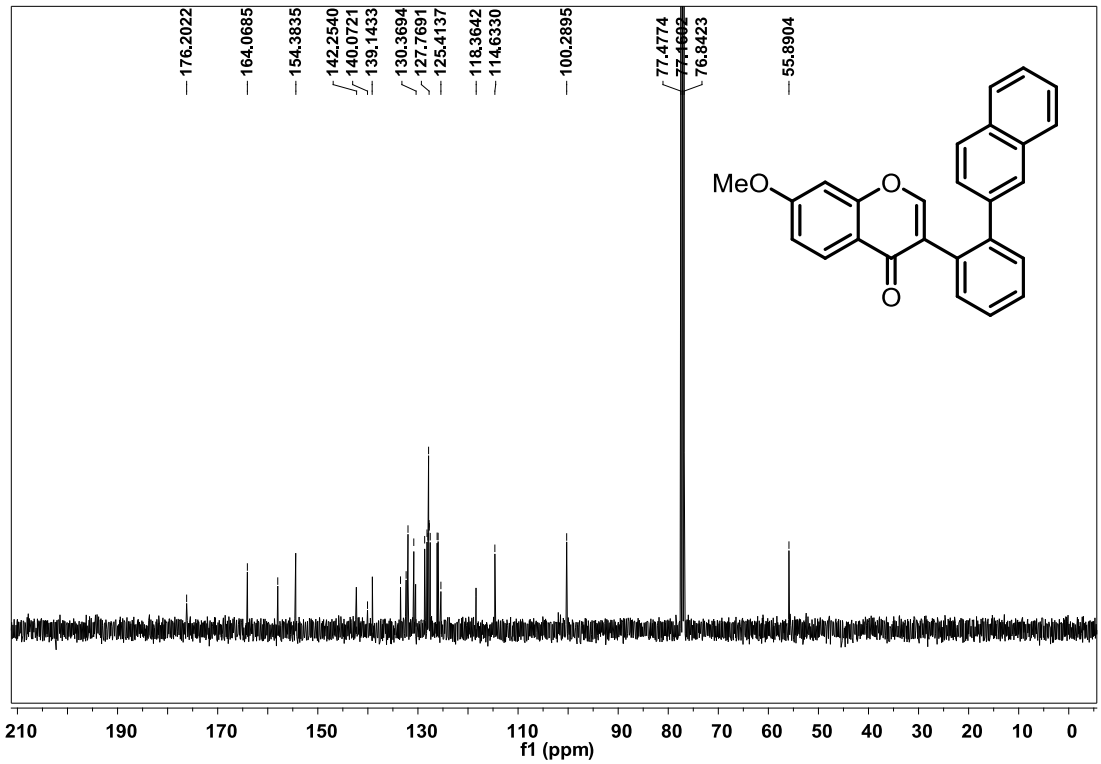


376 MHz, ^{19}F NMR in $CDCl_3$

7-Methoxy-3-(2-(naphthalen-2-yl)phenyl)-4H-chromen-4-one (1q)

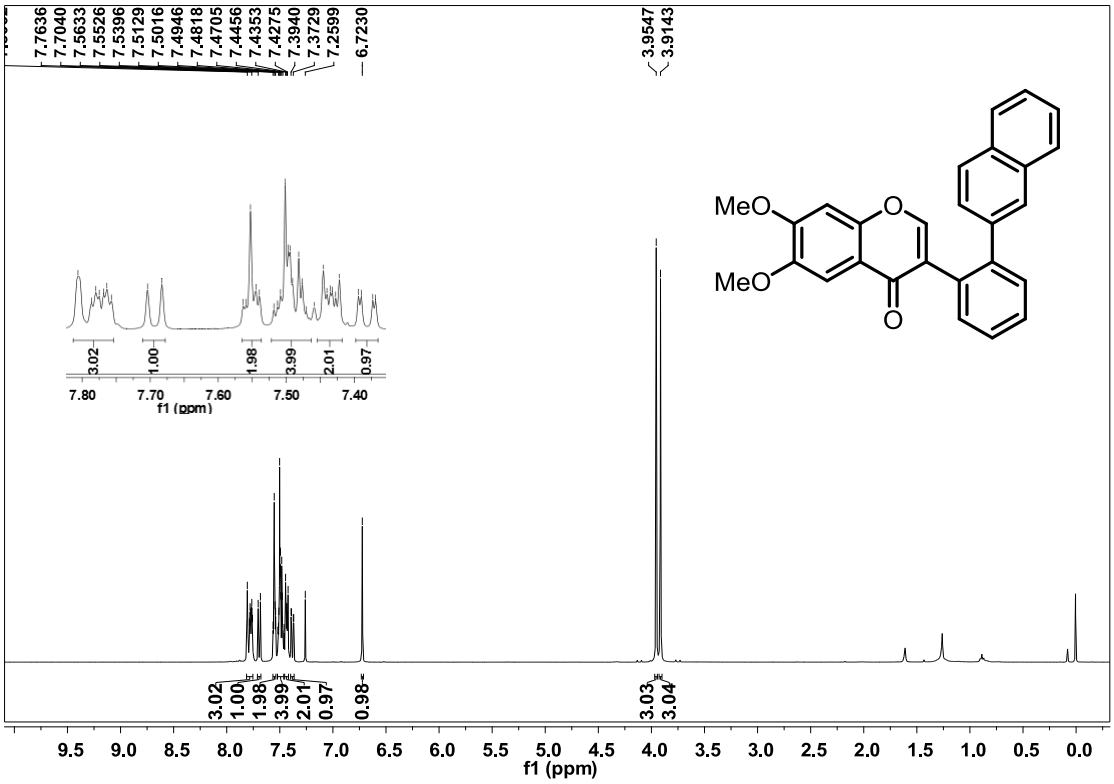


400 MHz, ^{1}H NMR in $CDCl_3$

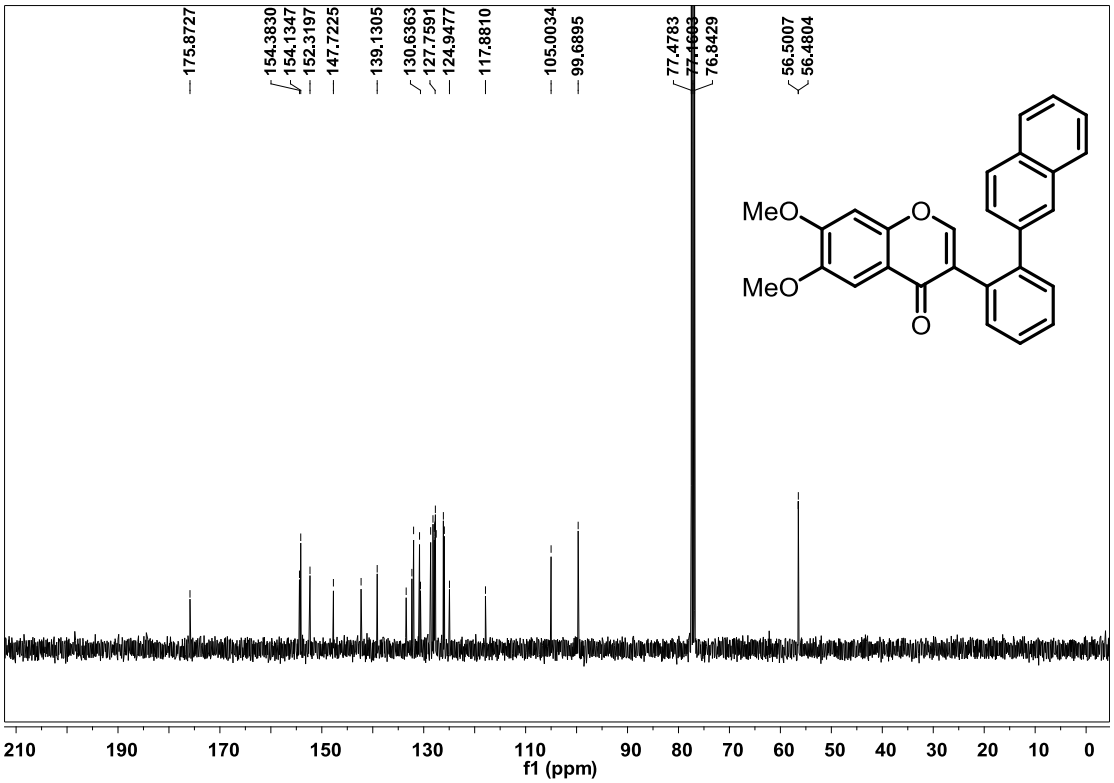


100 MHz, ^{13}C NMR in $CDCl_3$

6,7-Dimethoxy-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1r)

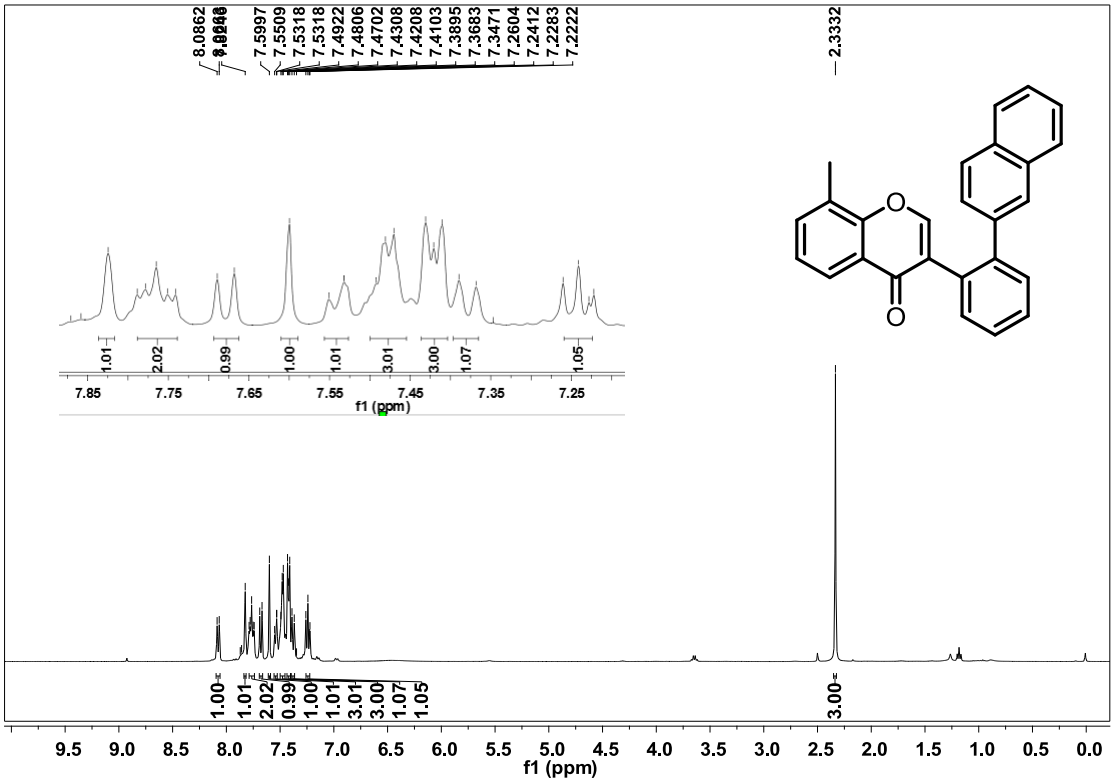


400 MHz, ^{1}H NMR in $CDCl_3$

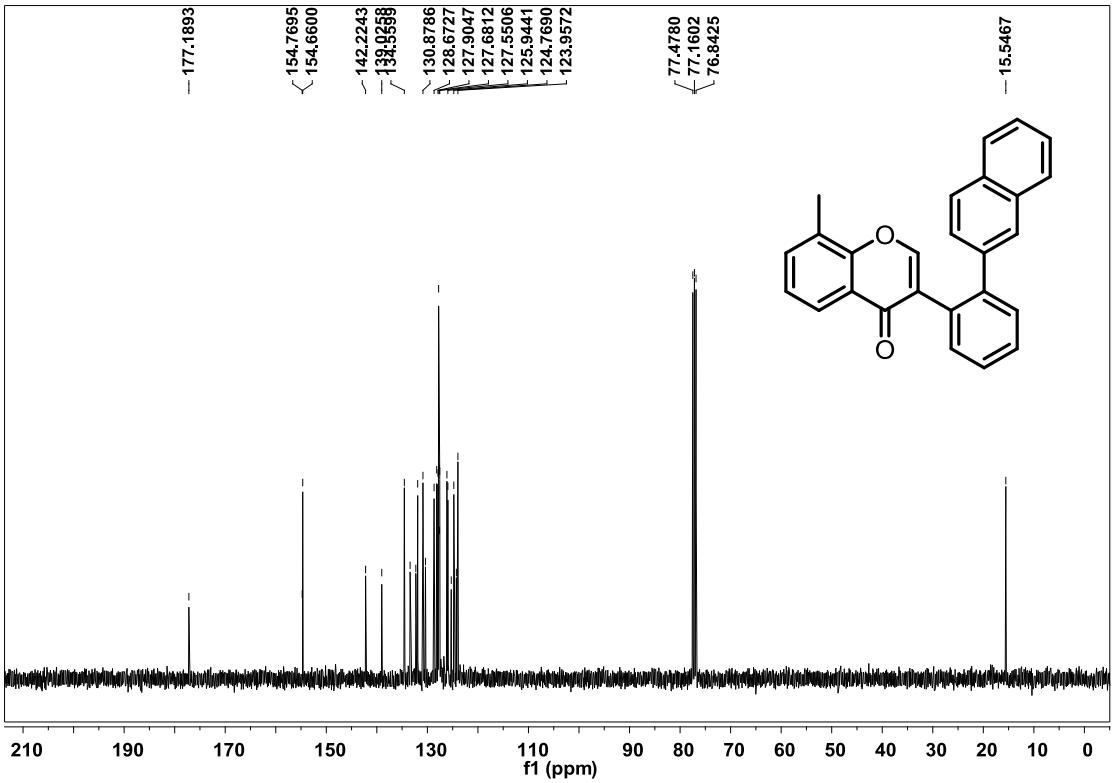


100 MHz, ^{13}C NMR in $CDCl_3$

8-Methyl-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1s)

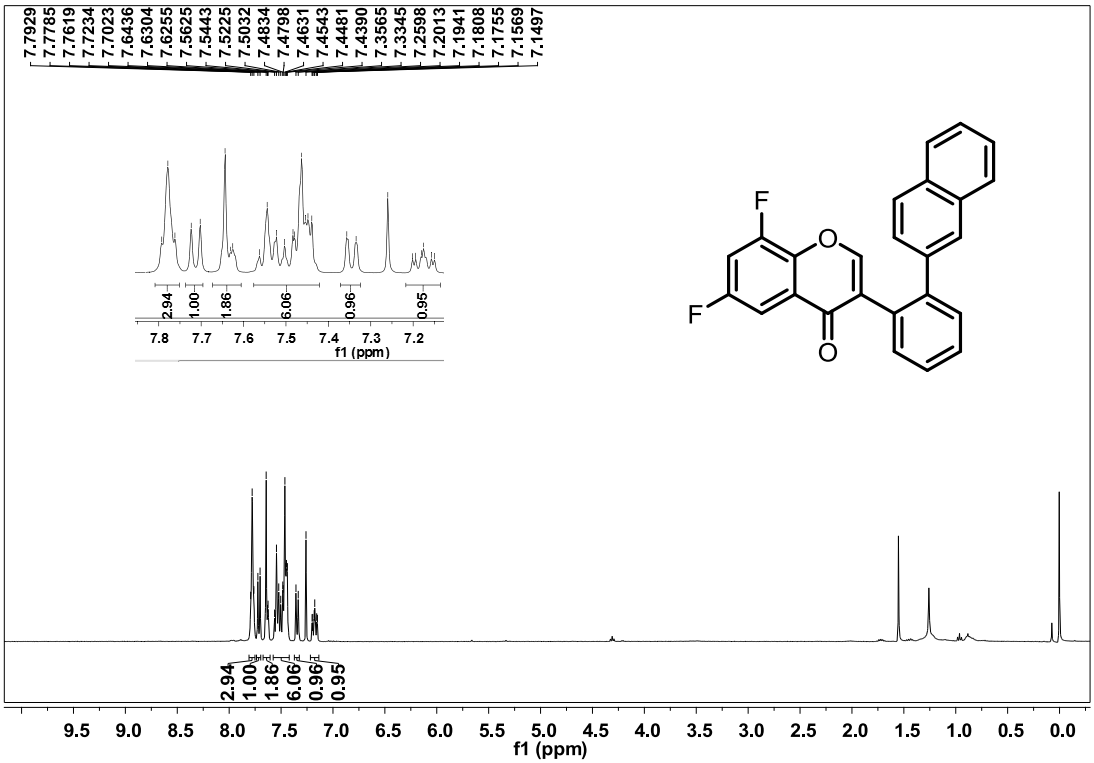


400 MHz, ^{1}H NMR in $CDCl_3$

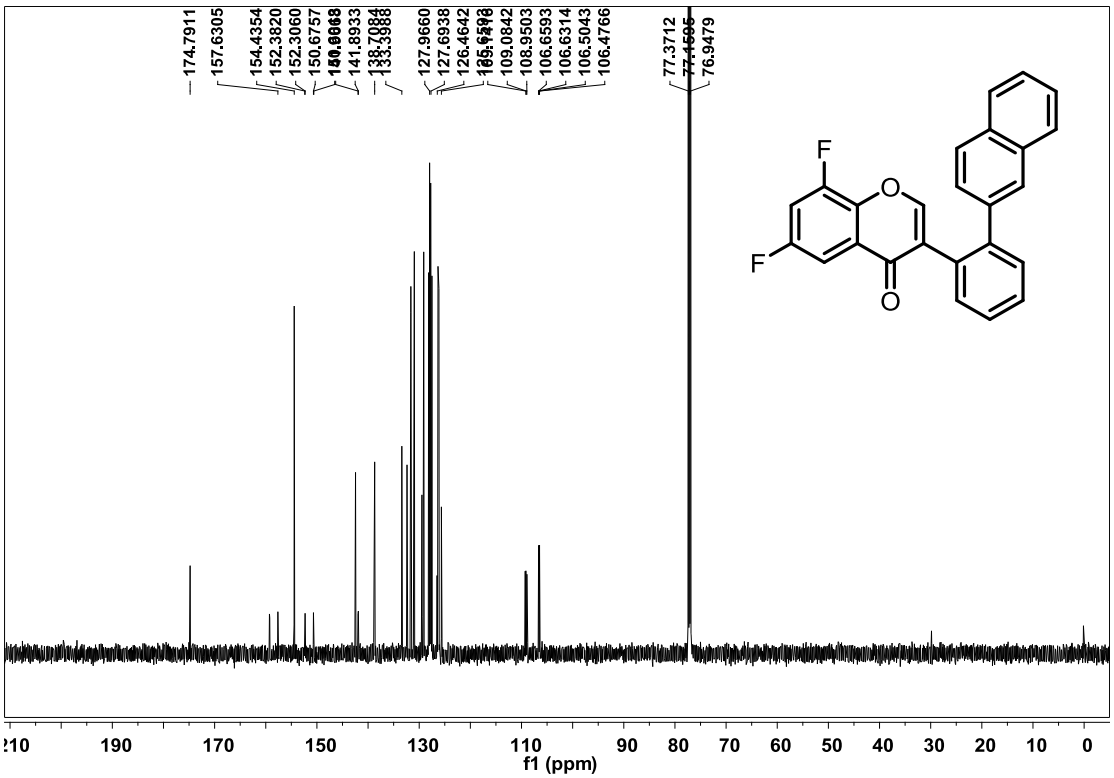


100 MHz, ^{13}C NMR in $CDCl_3$

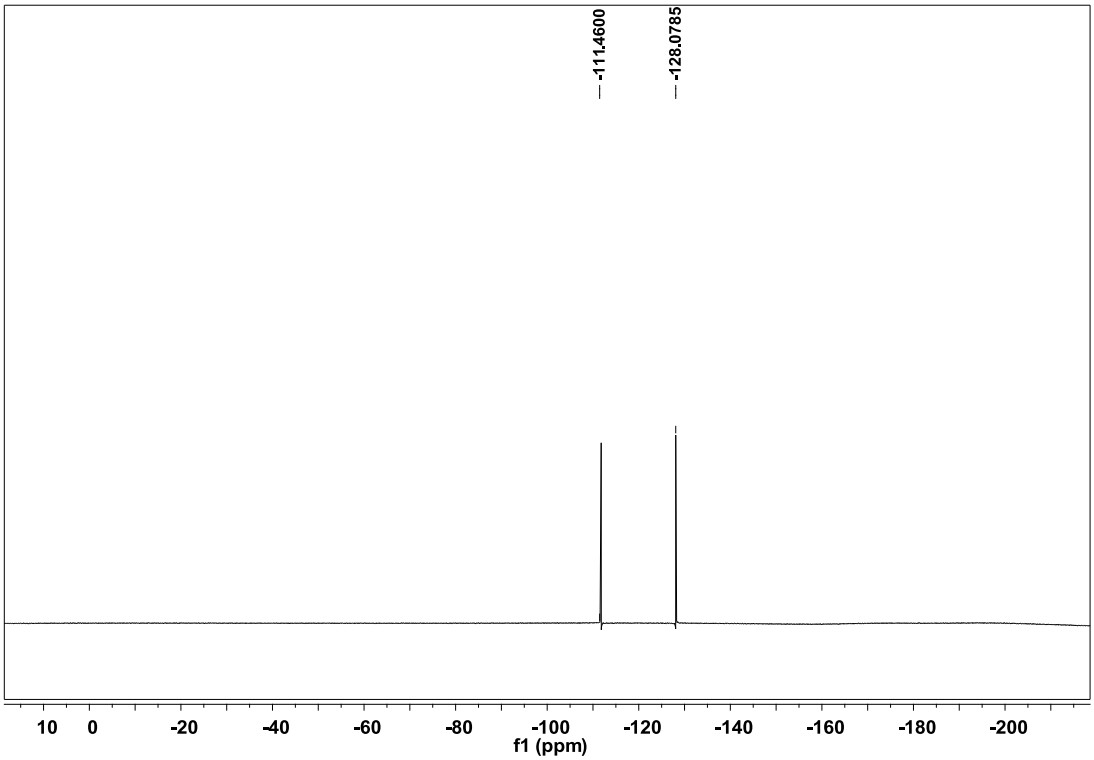
6,8-Difluoro-3-(2-(naphthalen-2-yl)phenyl)-4*H*-chromen-4-one (1t)



400 MHz, ^{1}H NMR in $CDCl_3$

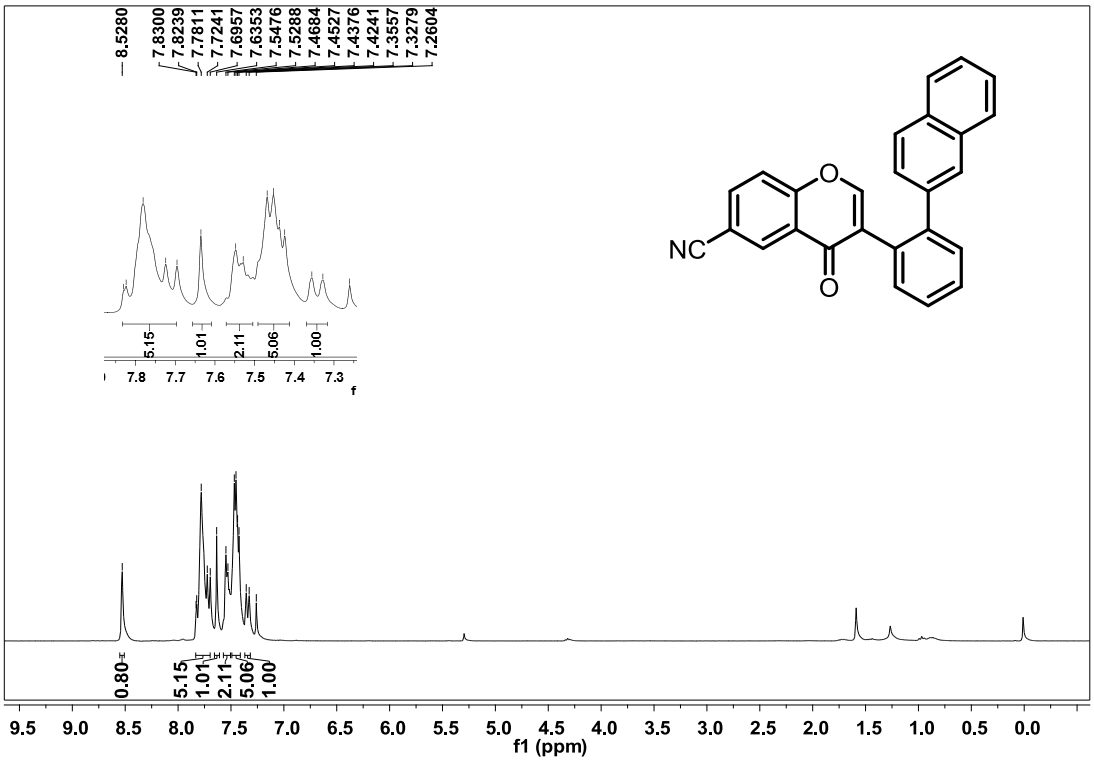


150 MHz, ^{13}C NMR in $CDCl_3$

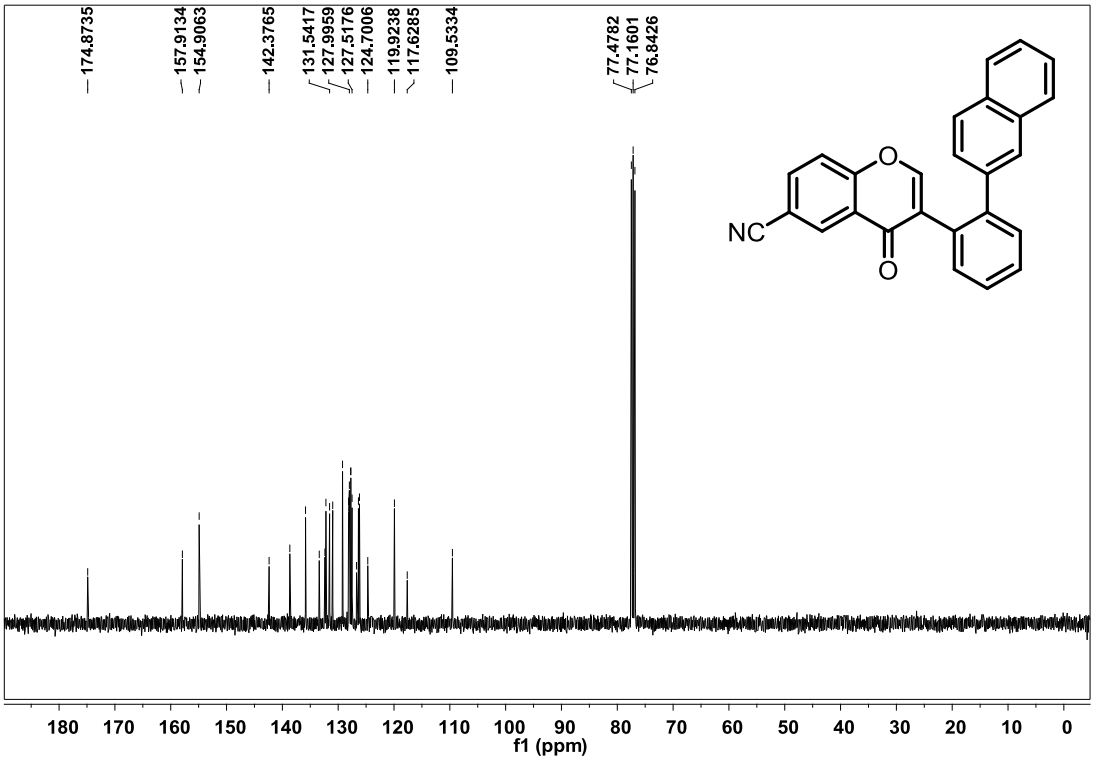


376 MHz, ^{19}F NMR in $CDCl_3$

3-(2-(naphthalen-2-yl)phenyl)-4-oxo-4*H*-chromene-6-carbonitrile (1u)

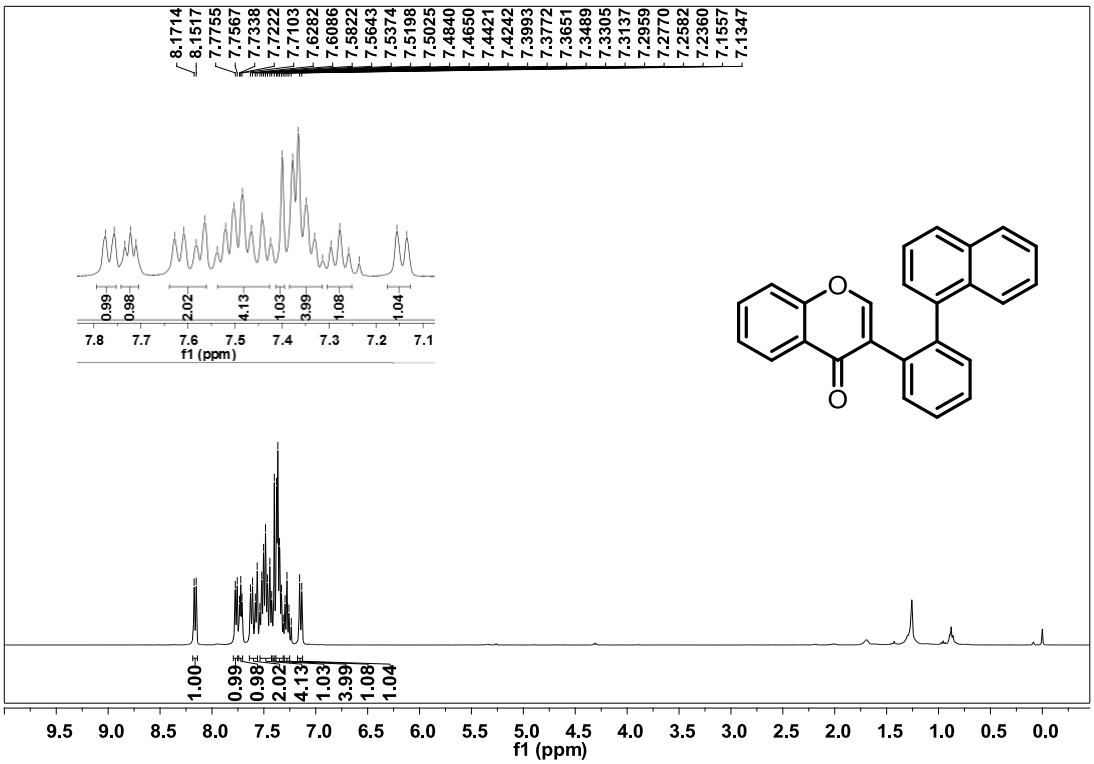


300 MHz, ^{1}H NMR in $CDCl_3$

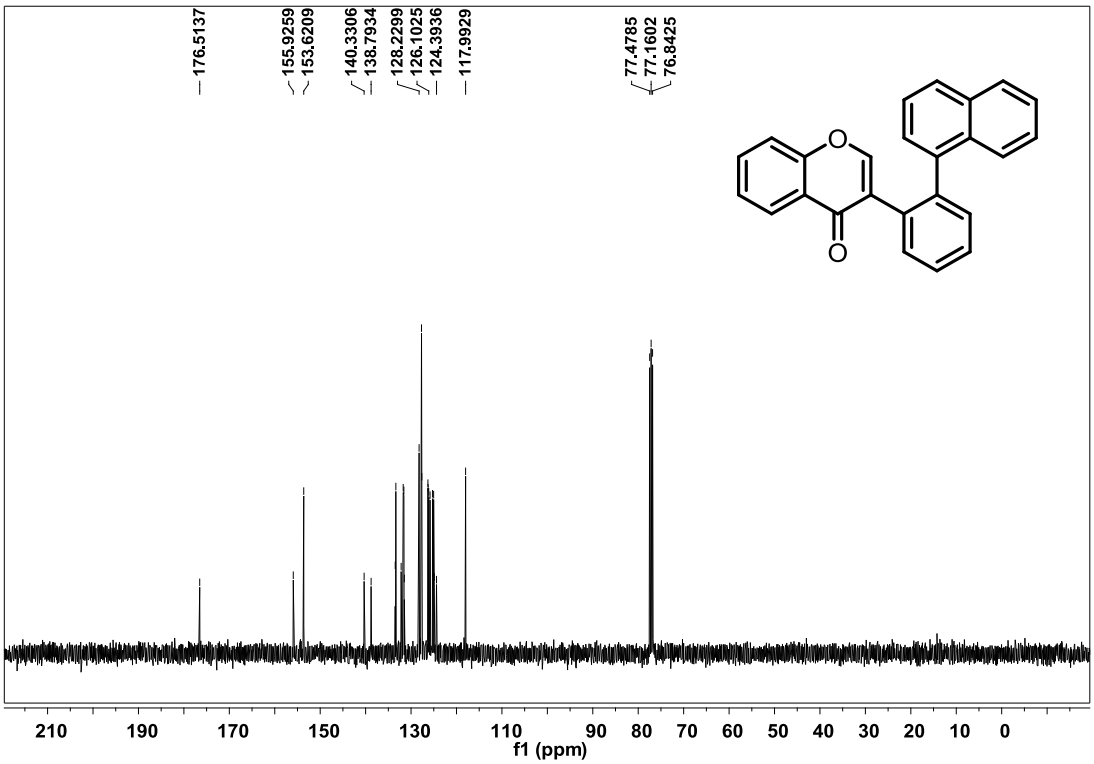


100 MHz, ^{13}C NMR in $CDCl_3$

3-(2-(Naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1v)

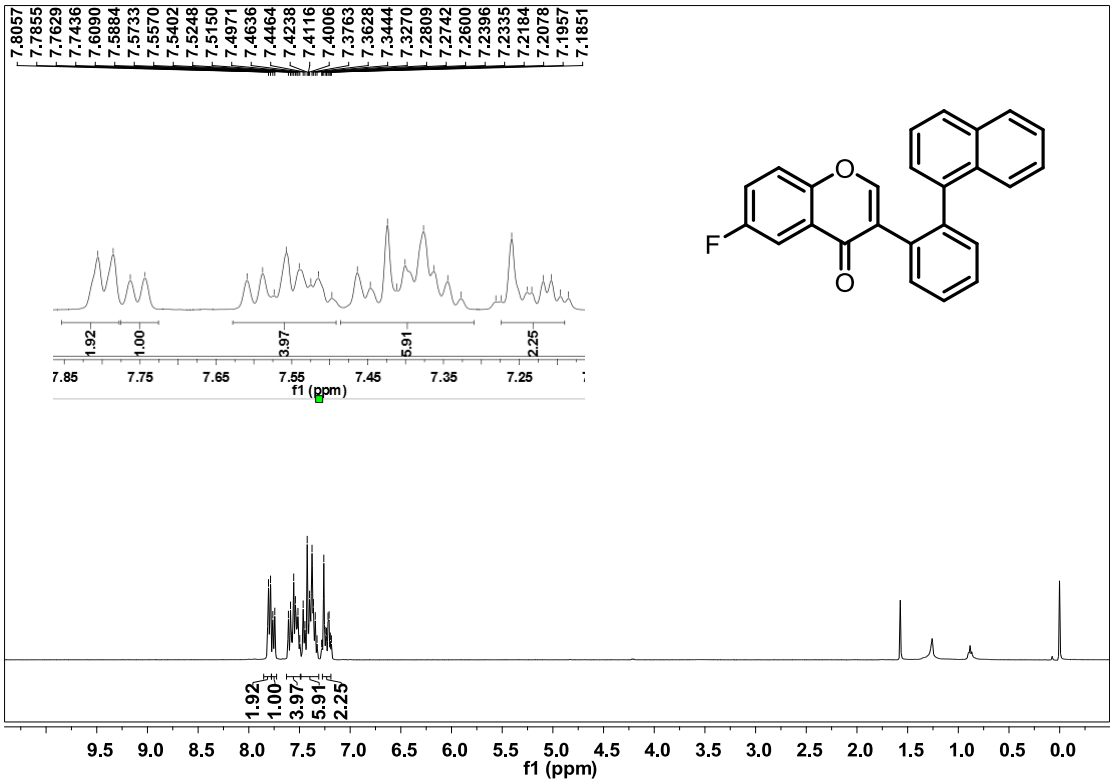


400 MHz, ^{1}H NMR in $CDCl_3$

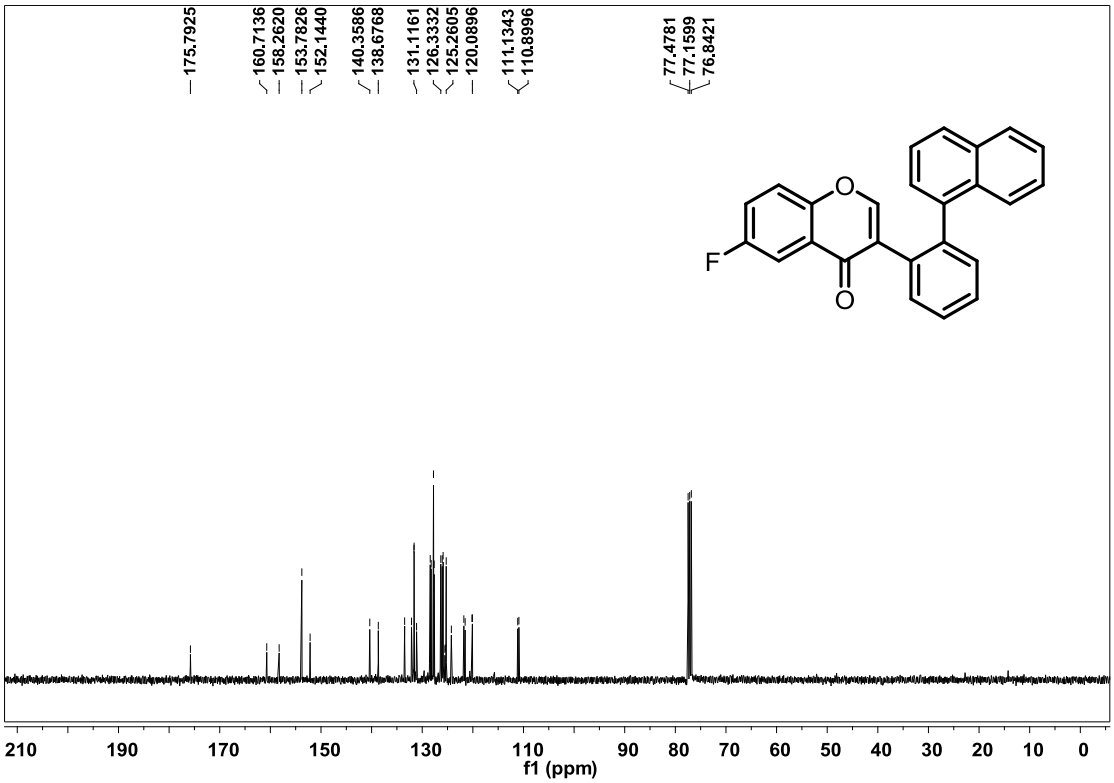


100 MHz, ^{13}C NMR in $CDCl_3$

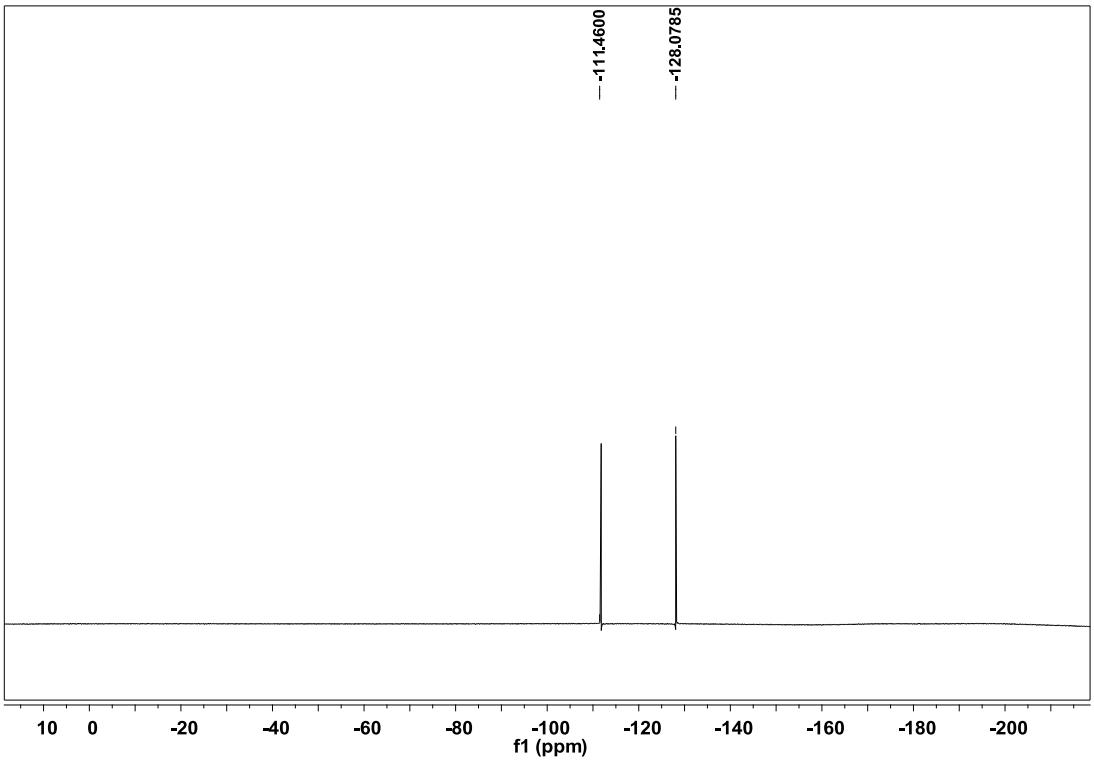
6-Fluoro-3-(2-(naphthalen-1-yl)phenyl)-4H-chromen-4-one (1w)



400 MHz, ^{1}H NMR in $CDCl_3$

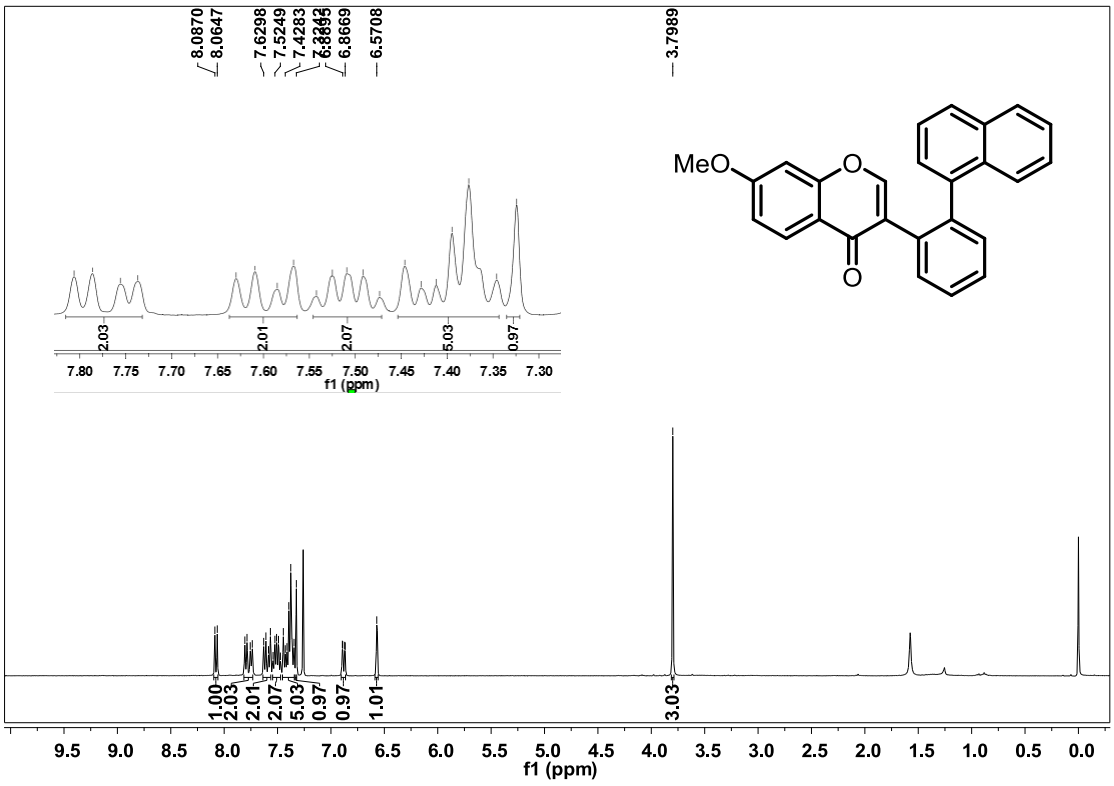


100 MHz, ^{13}C NMR in $CDCl_3$

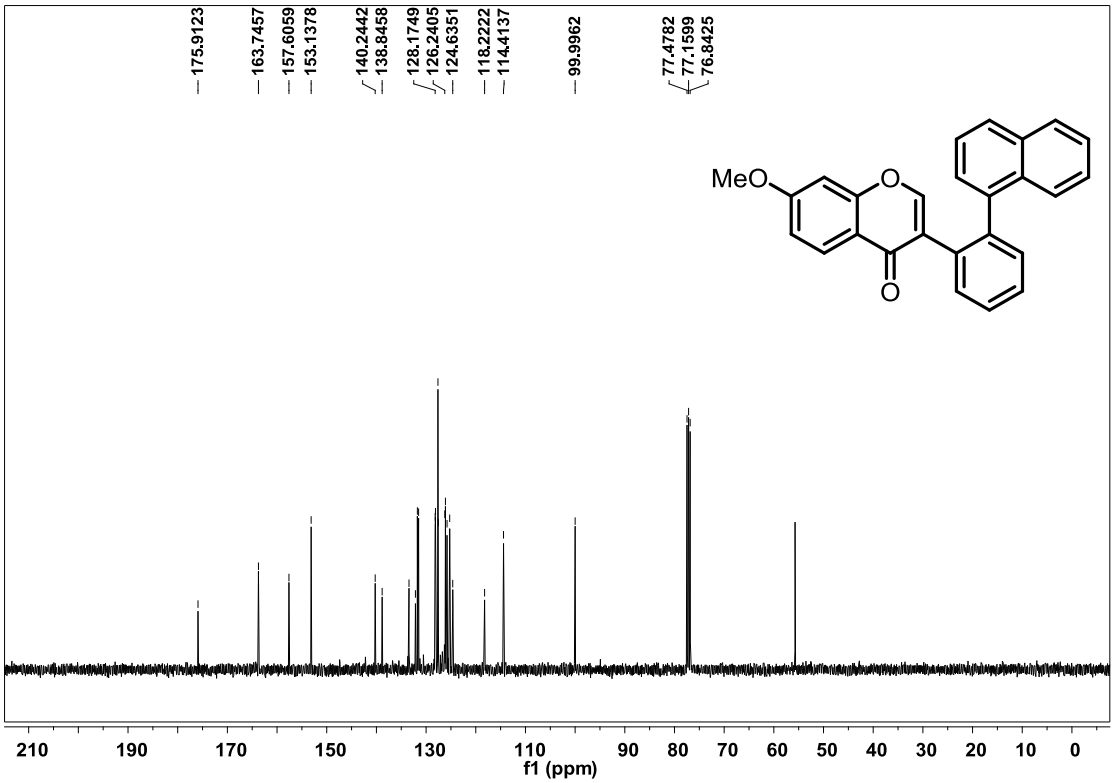


376 MHz, ^{19}F NMR in $CDCl_3$

7-Methoxy-3-(2-(naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1x)

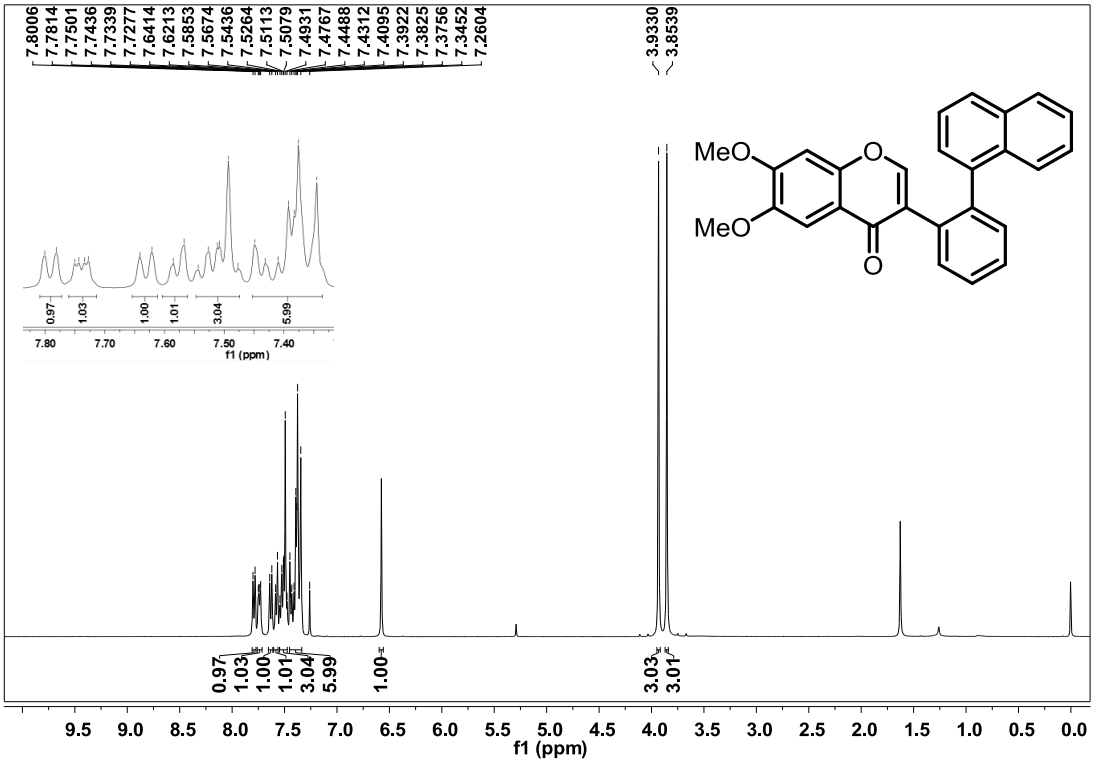


400 MHz, ^{1}H NMR in $CDCl_3$

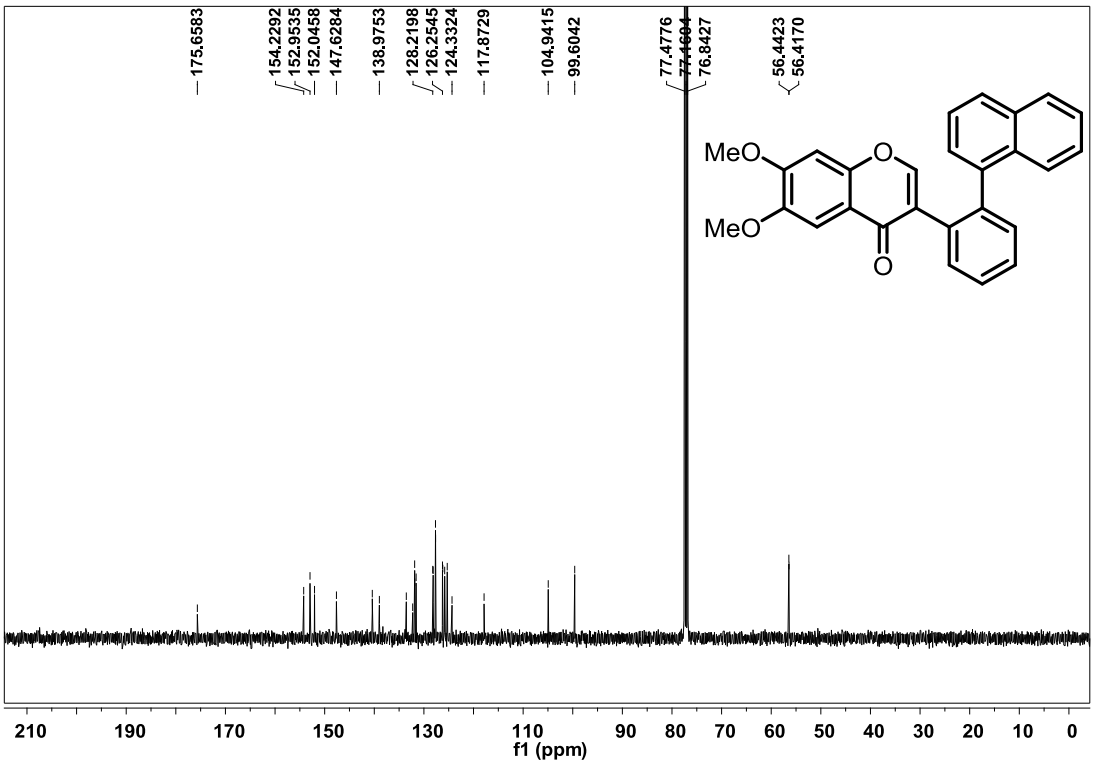


100 MHz, ^{13}C NMR in $CDCl_3$

6,7-Dimethoxy-3-(2-(naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1y)

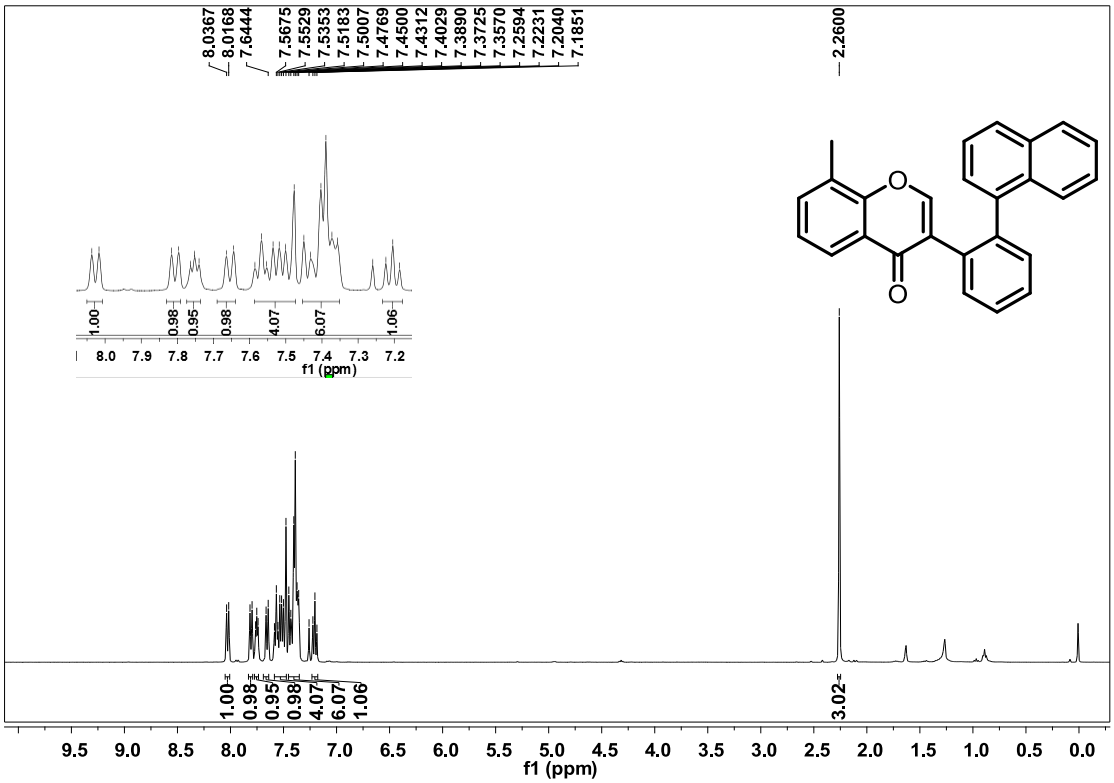


400 MHz, ^{1}H NMR in $CDCl_3$

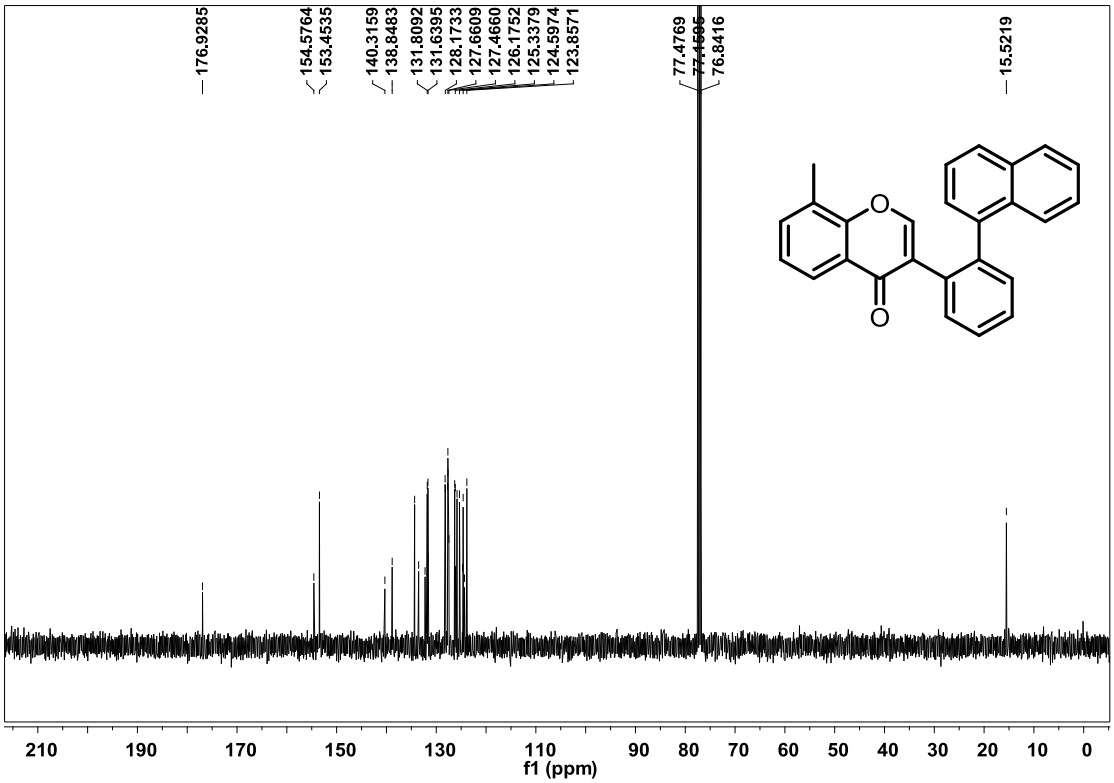


100 MHz, ^{13}C NMR in $CDCl_3$

8-Methyl-3-(2-(naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1z)

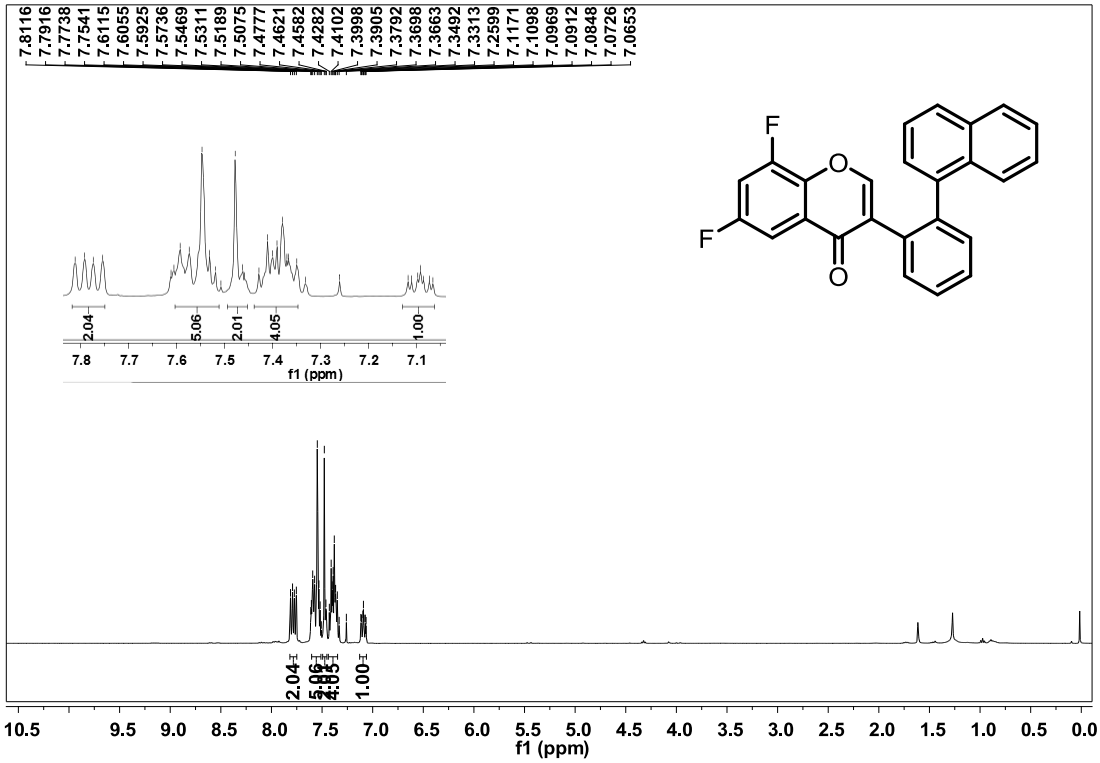


400 MHz, ^{1}H NMR in $CDCl_3$

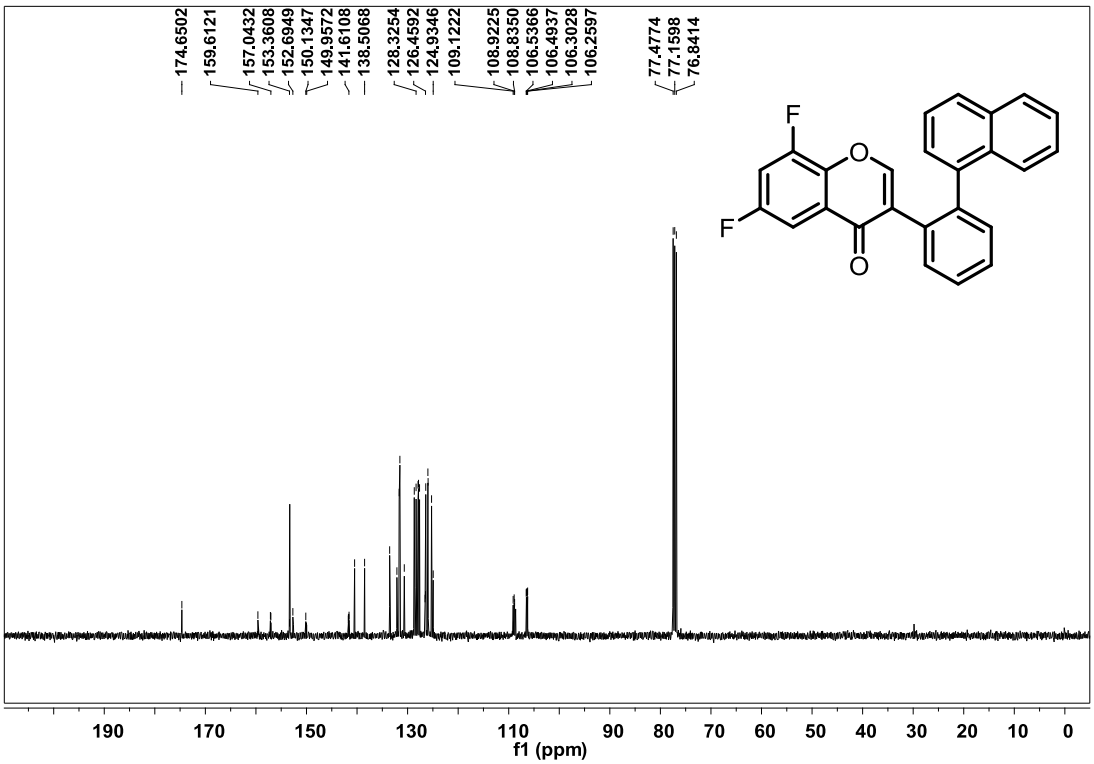


100 MHz, ^{13}C NMR in $CDCl_3$

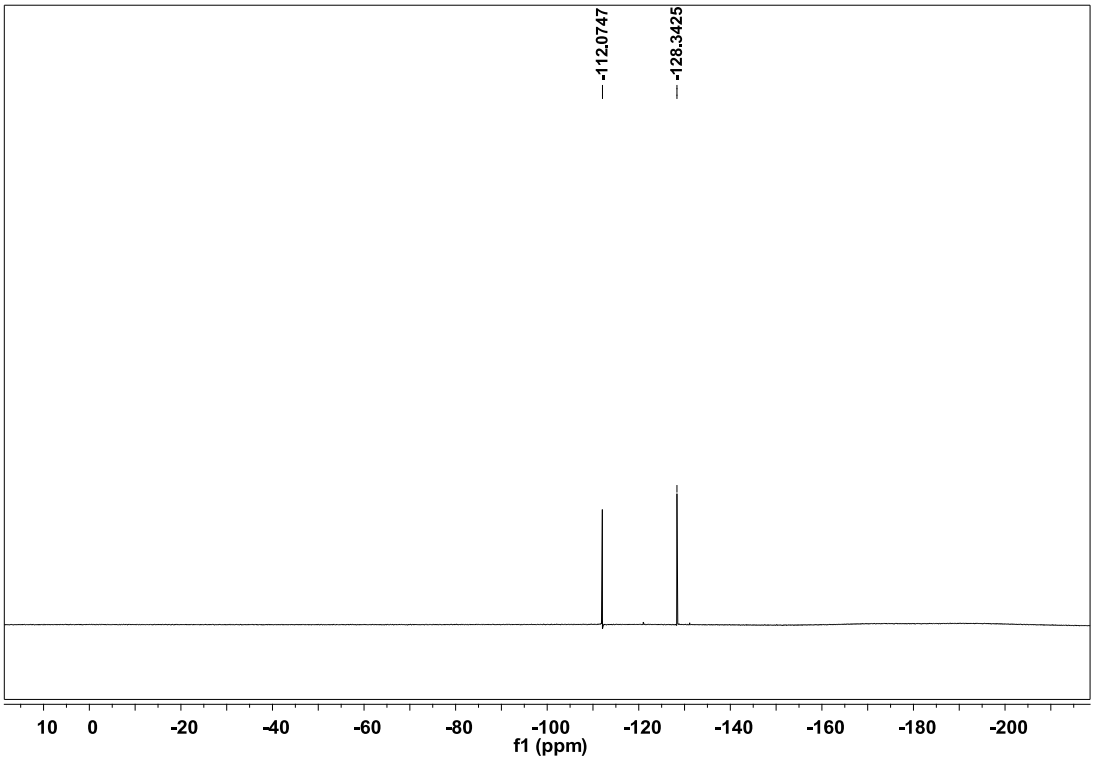
6,8-Difluoro-3-(2-(naphthalen-1-yl)phenyl)-4*H*-chromen-4-one (1aa)



400 MHz, ^{1}H NMR in $CDCl_3$

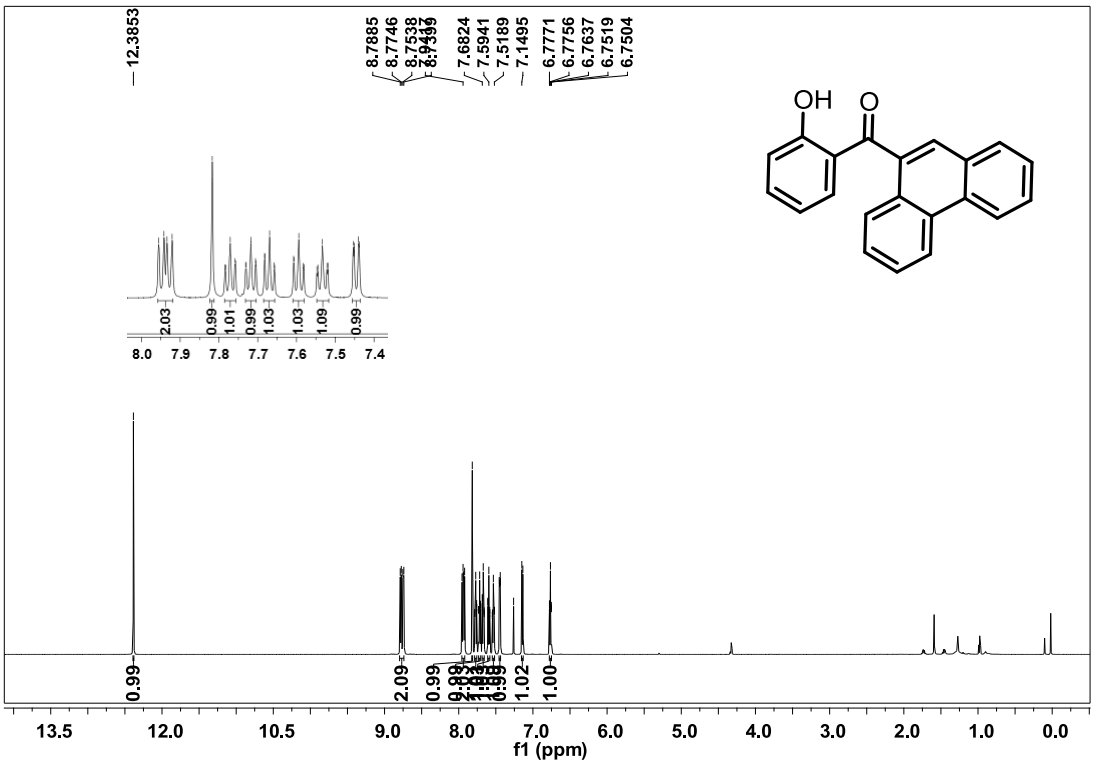


100 MHz, ^{13}C NMR in $CDCl_3$

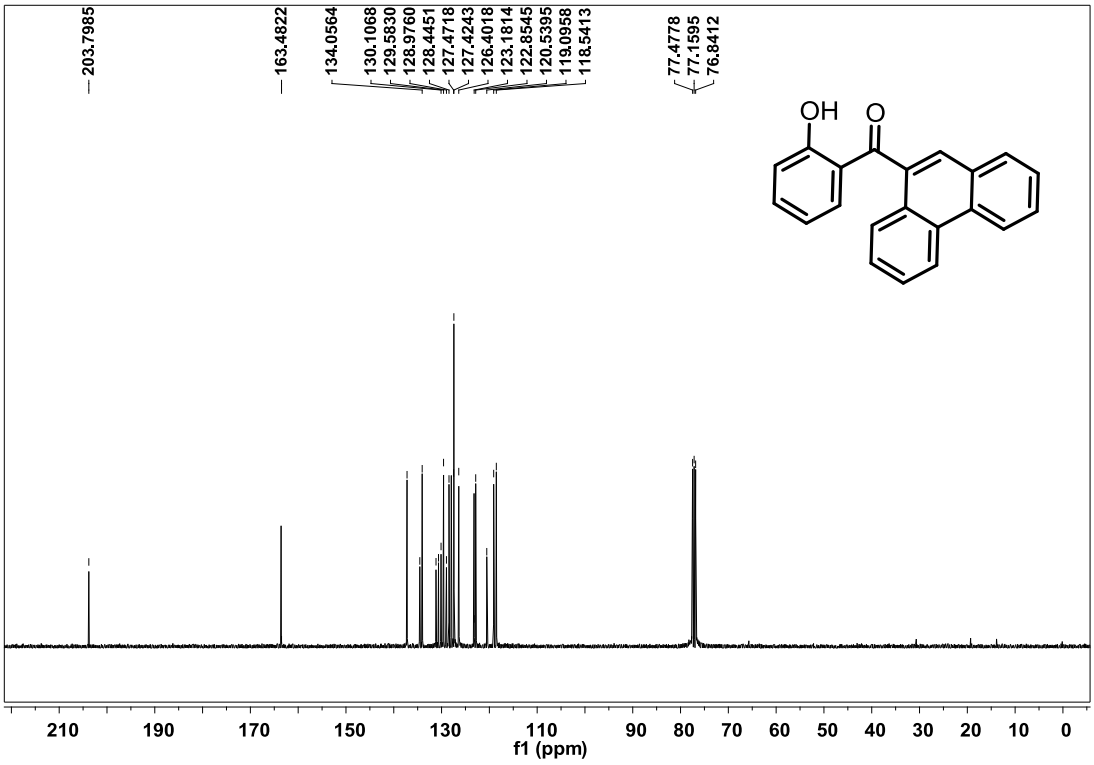


376 MHz, ^{19}F NMR in $CDCl_3$

(2-Hydroxyphenyl)(phenanthren-9-yl)methanone (2a)

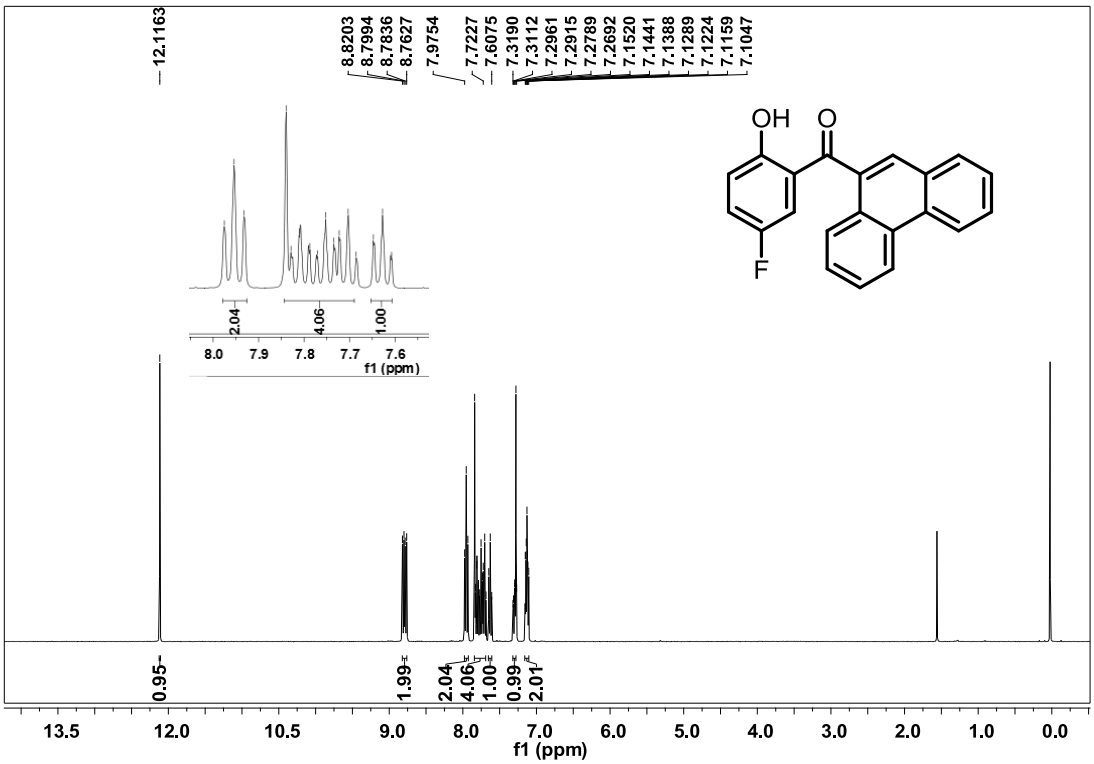


600 MHz, ^{1}H NMR in $CDCl_3$

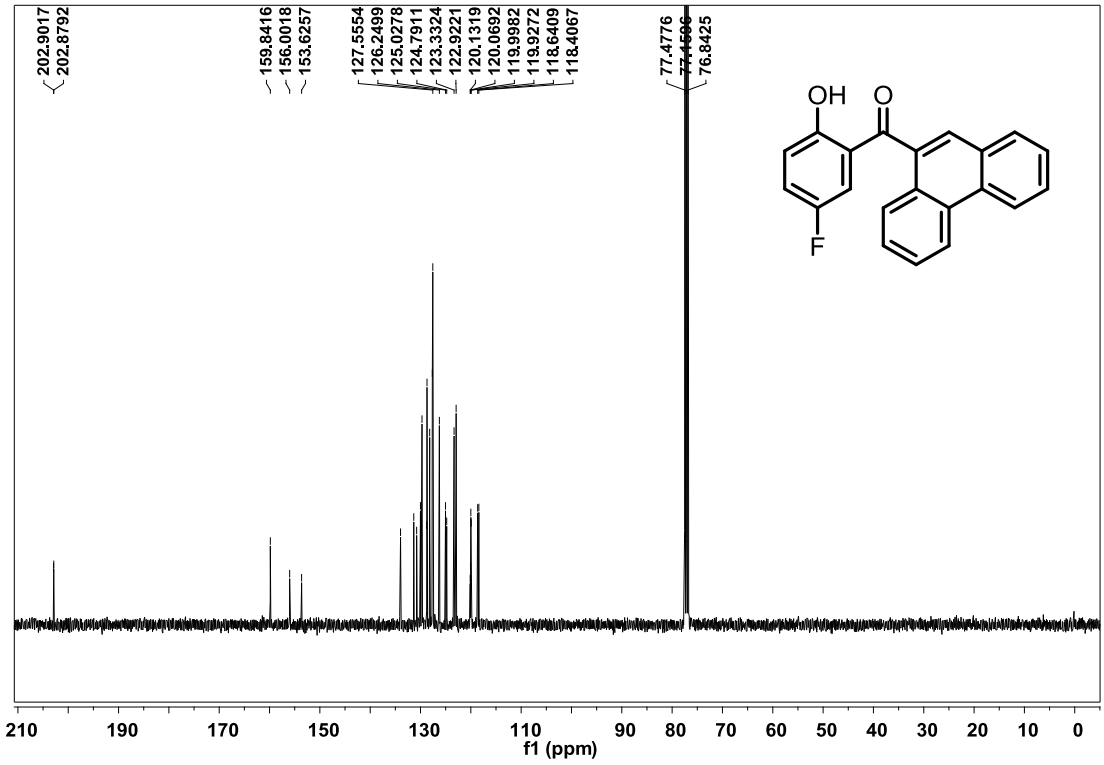


100 MHz, ^{13}C NMR in $CDCl_3$

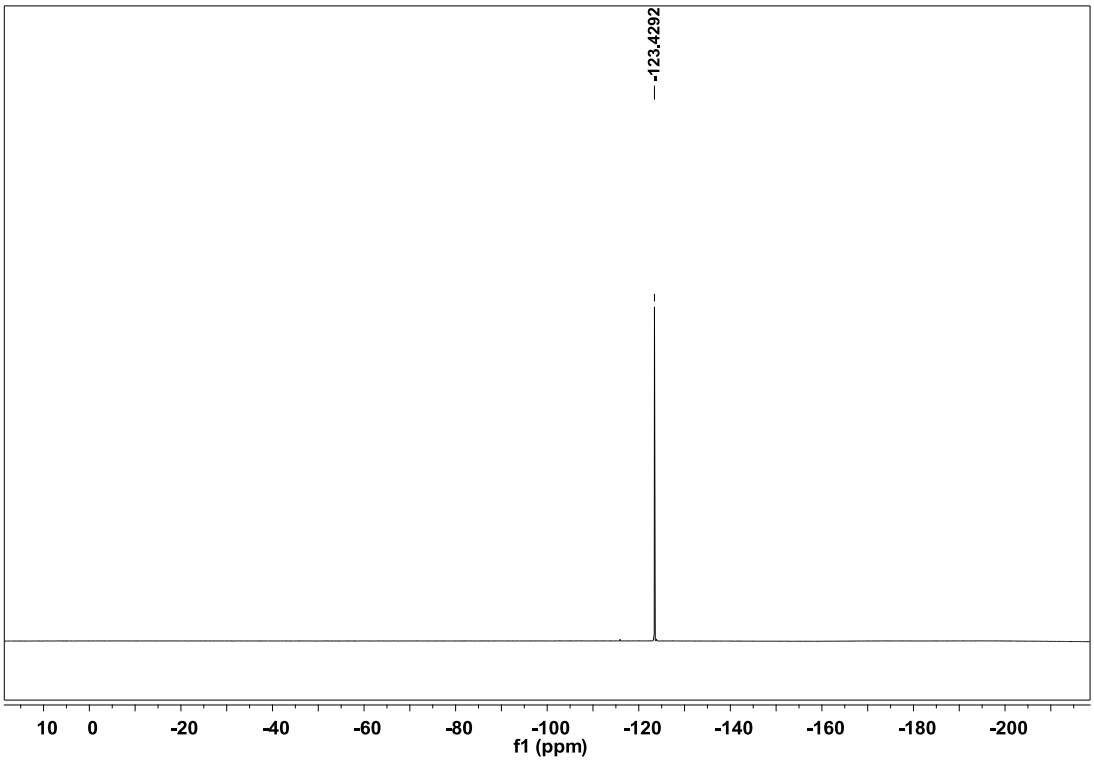
(5-Fluoro-2-hydroxyphenyl)(phenanthren-9-yl)methanone (2b)



400 MHz, ^{1}H NMR in $CDCl_3$

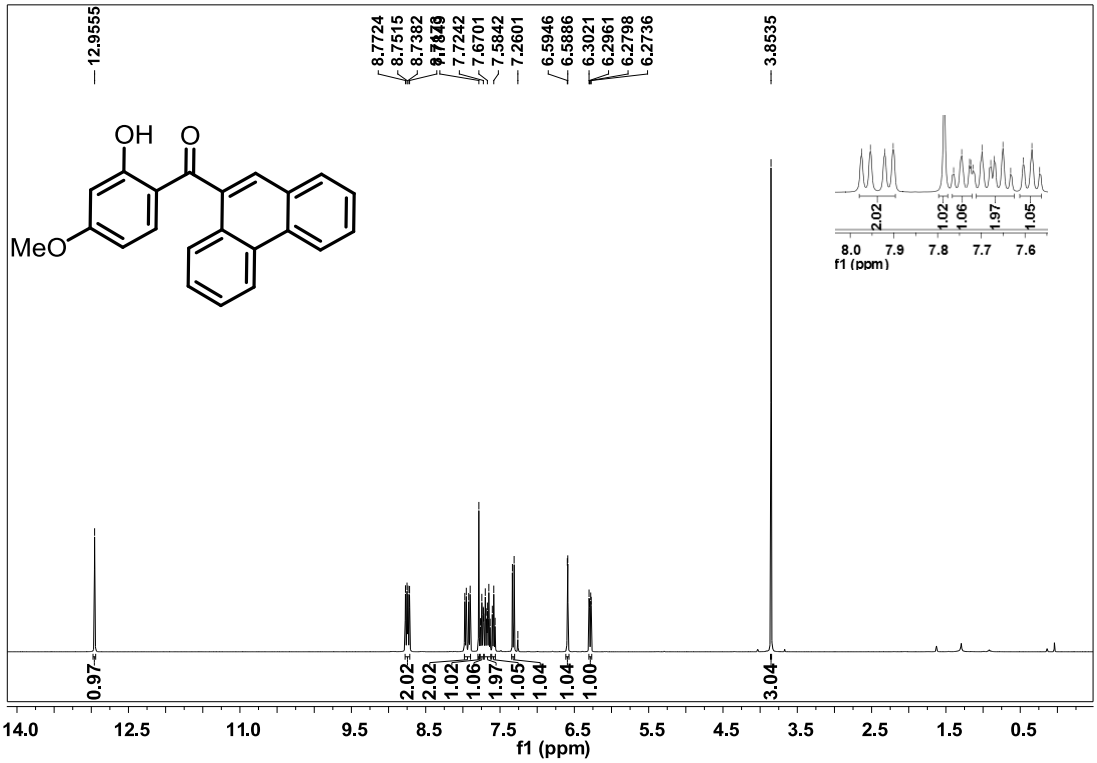


100 MHz, ^{13}C NMR in $CDCl_3$

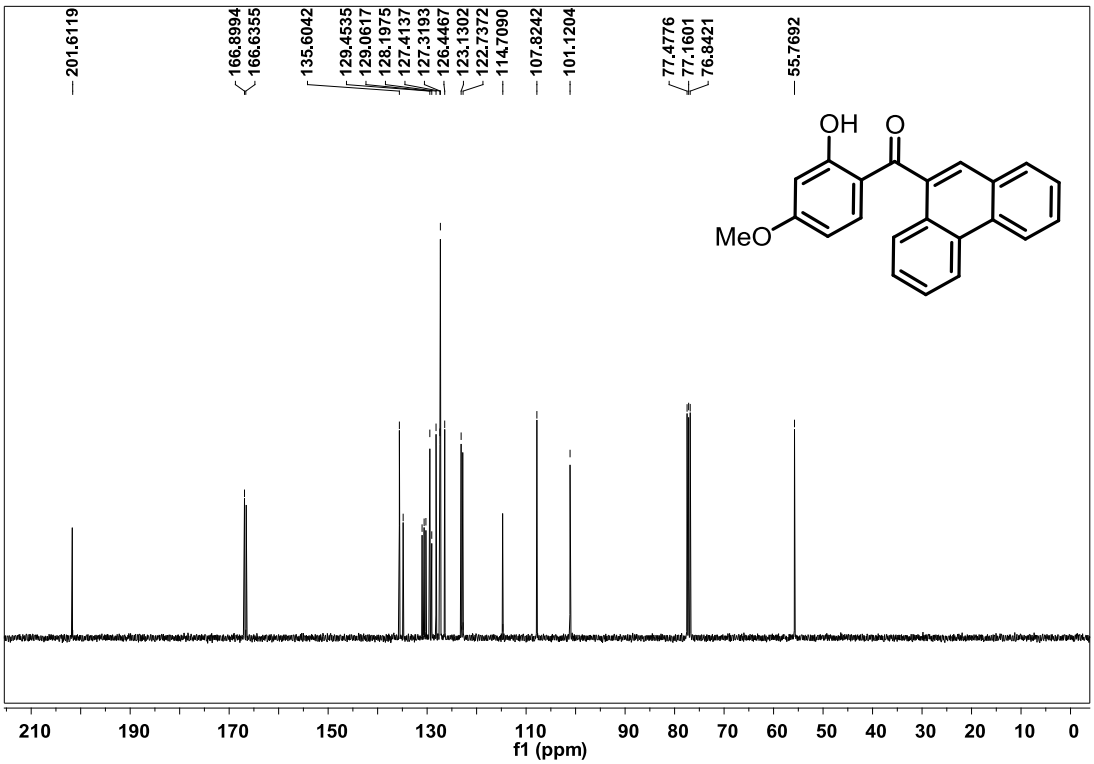


376 MHz, ^{19}F NMR in $CDCl_3$

(2-Hydroxy-4-methoxyphenyl)(phenanthren-9-yl)methanone (2c)

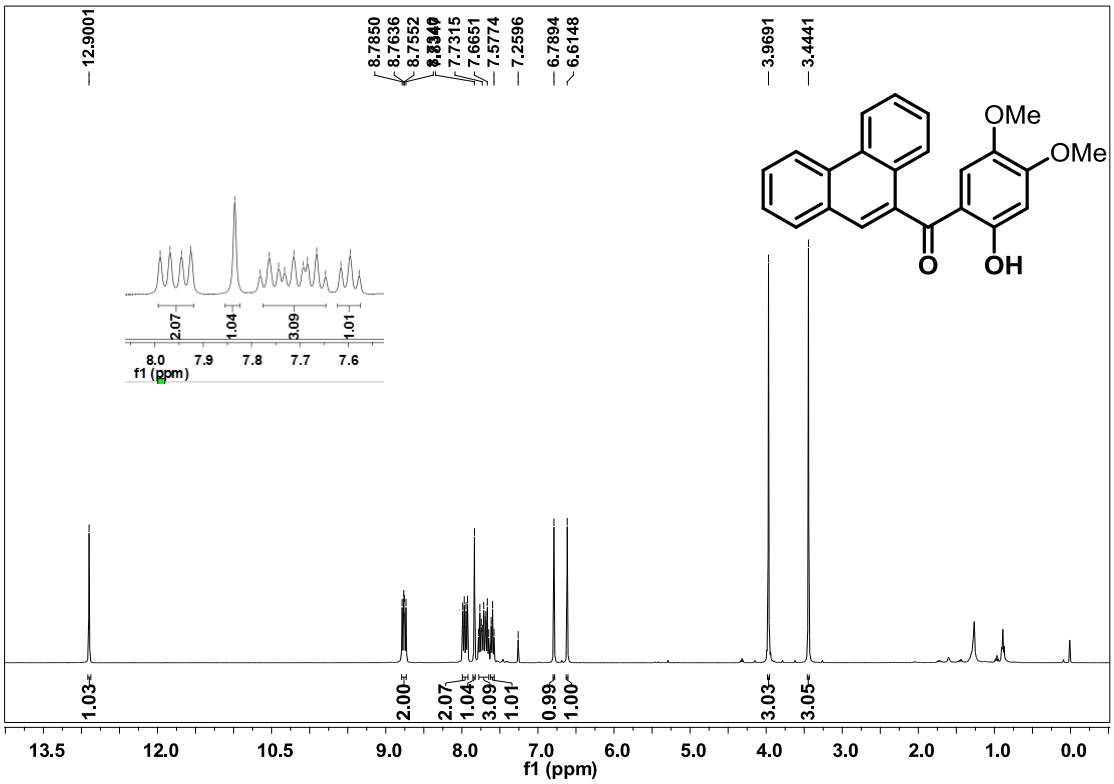


400 MHz, ^{1}H NMR in $CDCl_3$

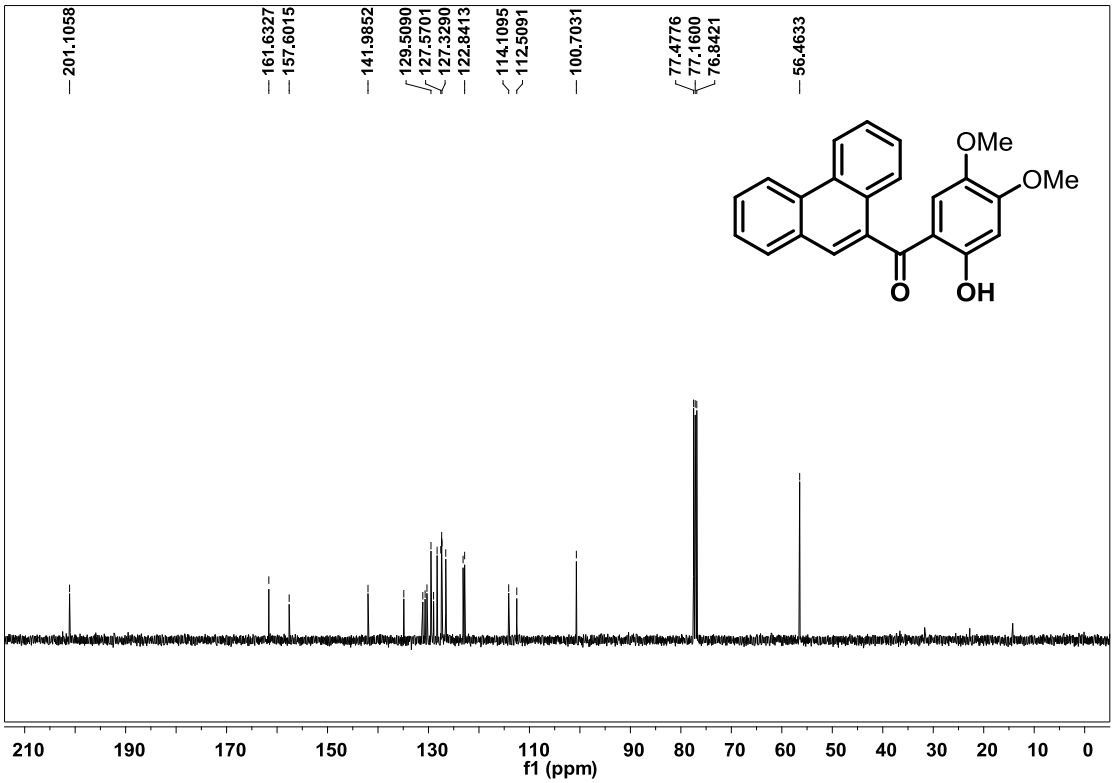


100 MHz, ^{13}C NMR in $CDCl_3$

(2-Hydroxy-4,5-dimethoxyphenyl)(phenanthren-9-yl)methanone (2d)

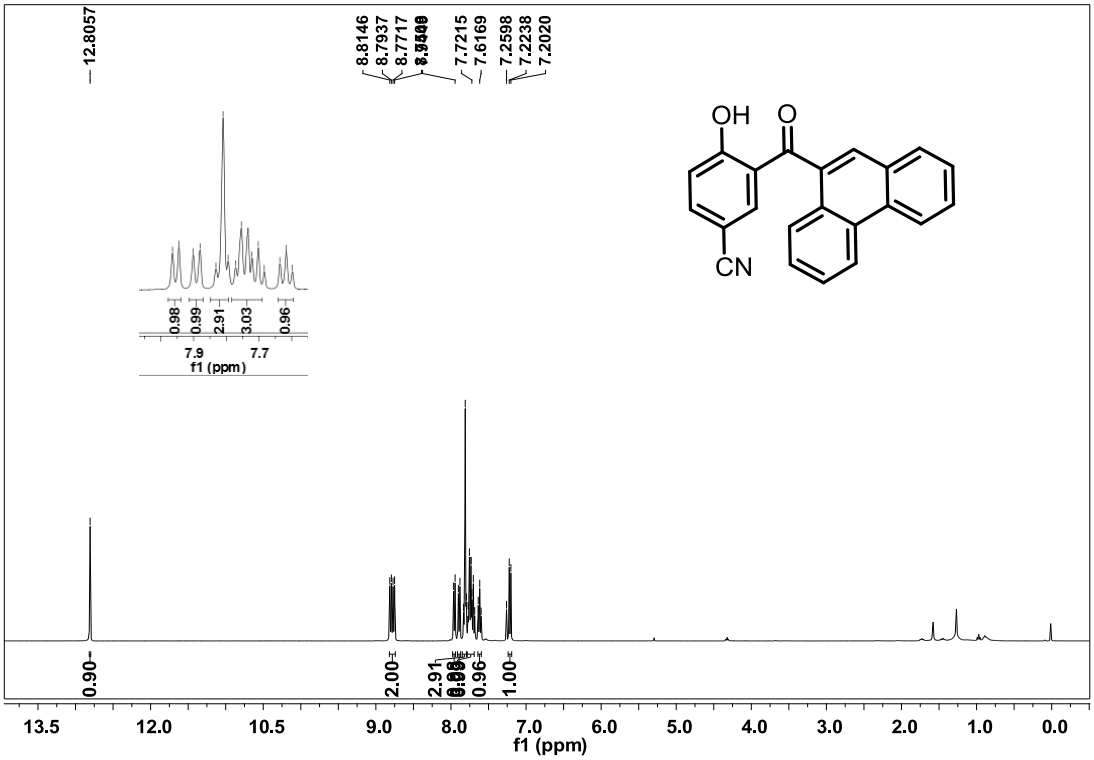


400 MHz, ^{1}H NMR in $CDCl_3$

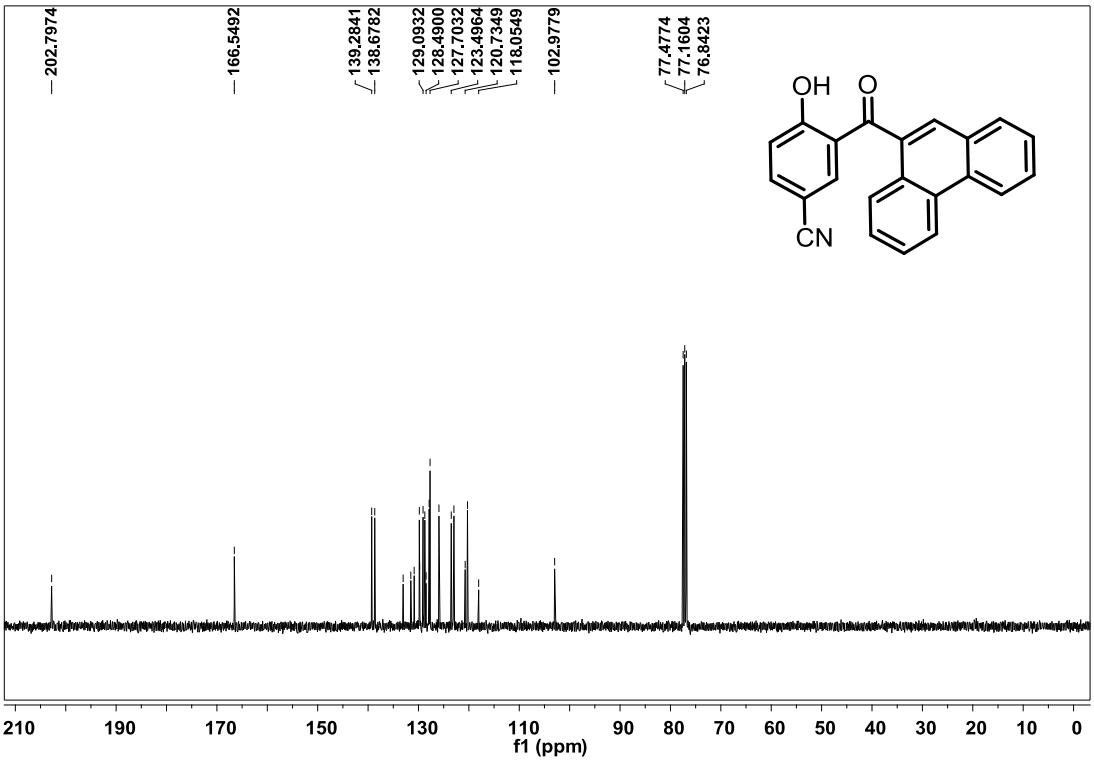


100 MHz, ^{13}C NMR in $CDCl_3$

4-Hydroxy-3-(phenanthrene-9-carbonyl)benzonitrile (2e)

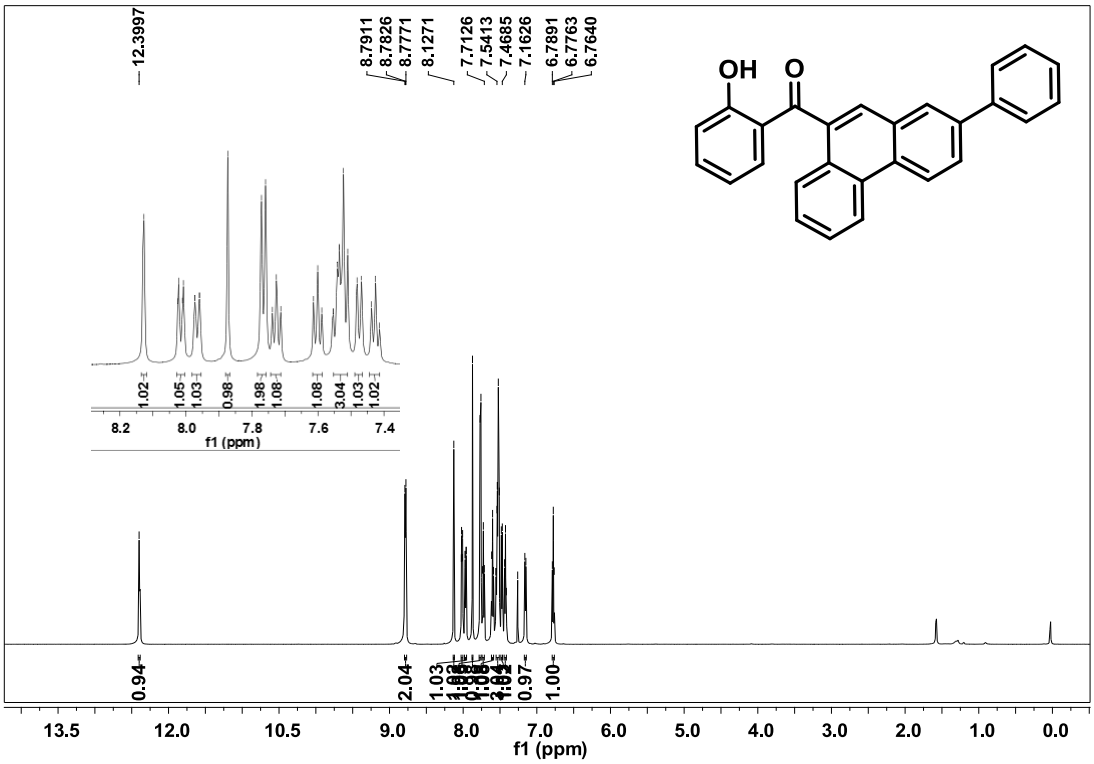


400 MHz, ^{1}H NMR in $CDCl_3$

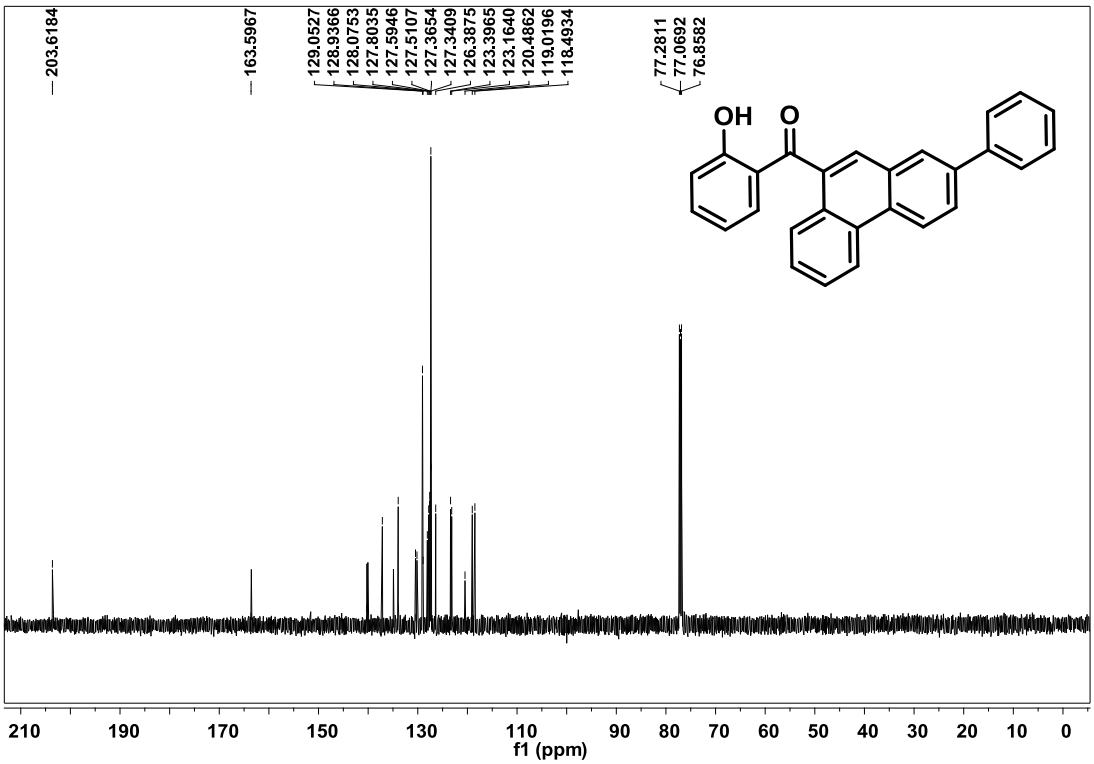


100 MHz, ^{13}C NMR in $CDCl_3$

(2-Hydroxyphenyl)(2-phenylphenanthren-9-yl)methanone (2f)

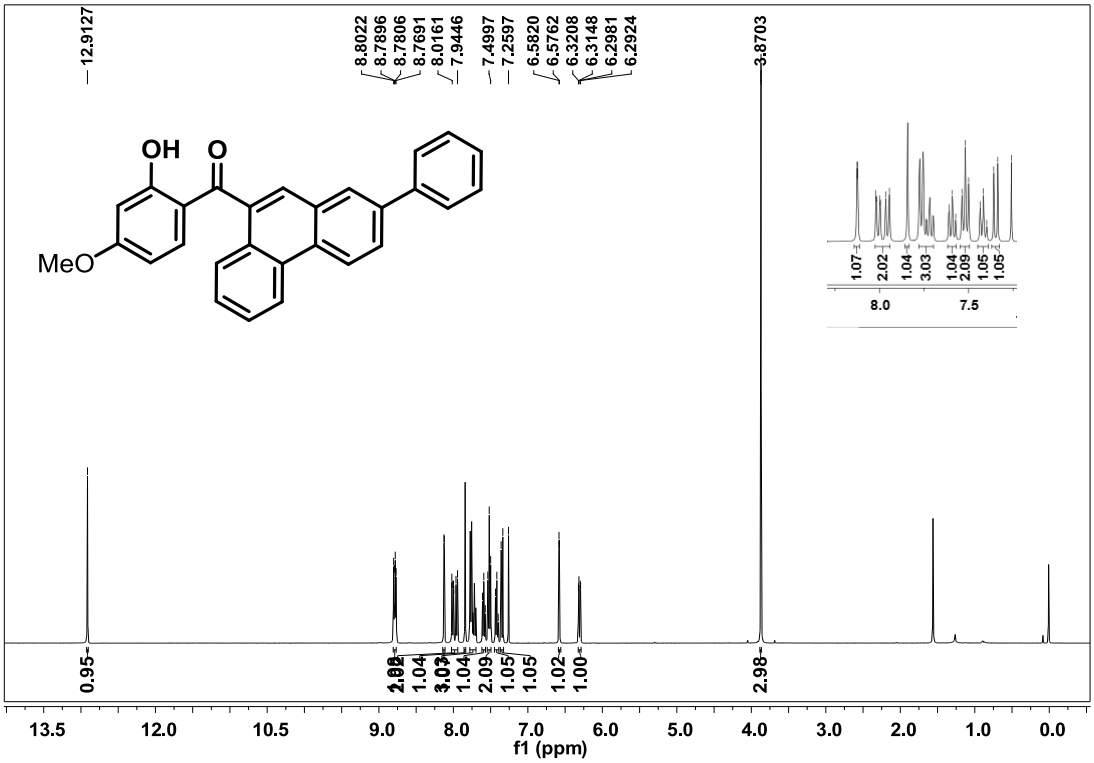


600 MHz, ^{1}H NMR in $CDCl_3$

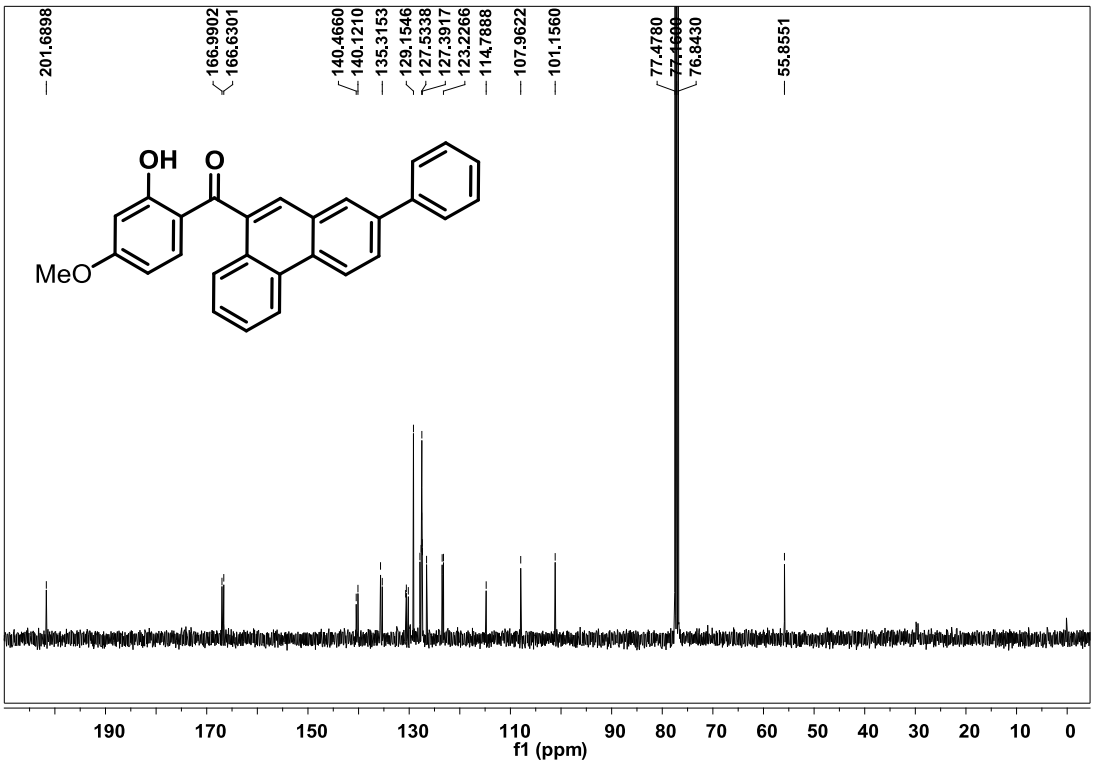


150 MHz, ^{13}C NMR in $CDCl_3$

(2-Hydroxy-4-methoxyphenyl)(2-phenylphenanthren-9-yl)methanone (2g)

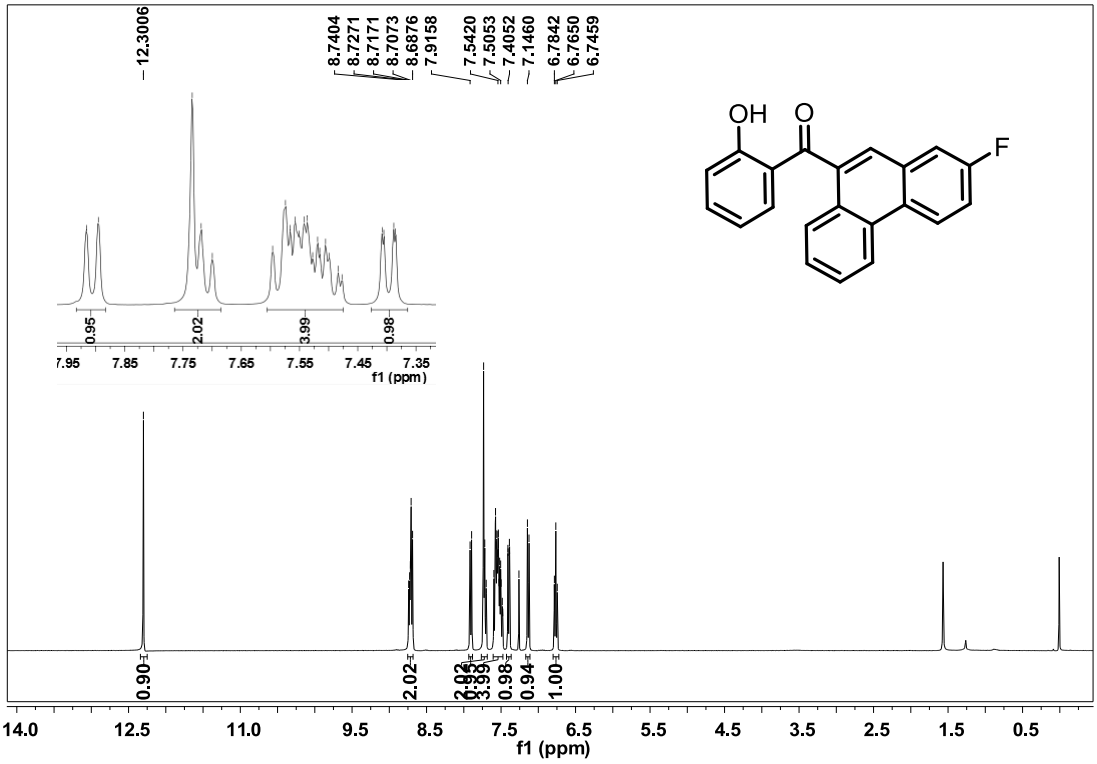


400 MHz, ^{1}H NMR in $CDCl_3$

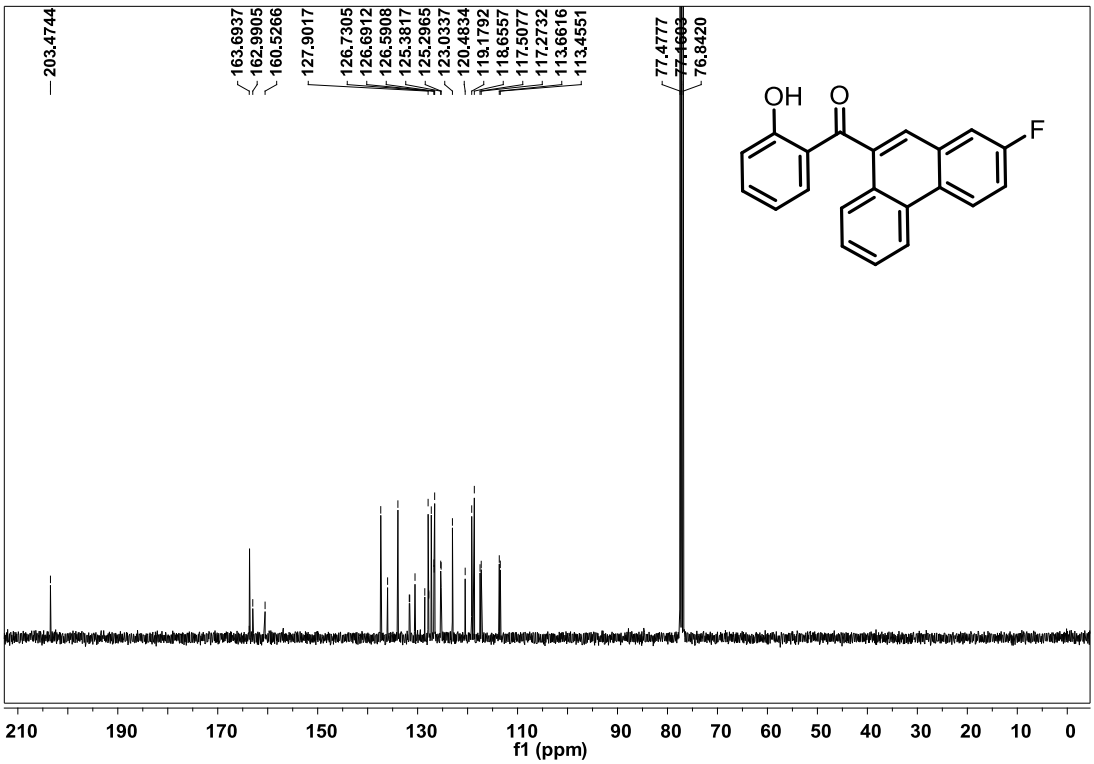


100 MHz, ^{13}C NMR in $CDCl_3$

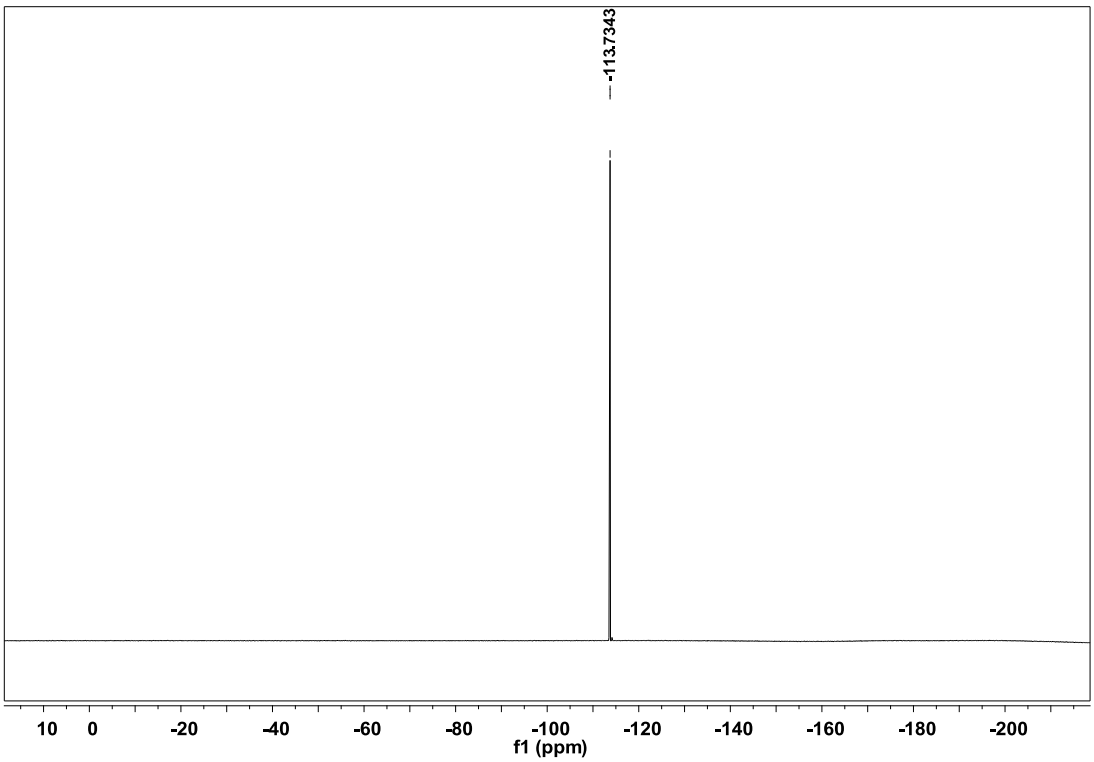
(2-Fluorophenanthren-9-yl)(2-hydroxyphenyl)methanone (2h)



400 MHz, ^{1}H NMR in $CDCl_3$

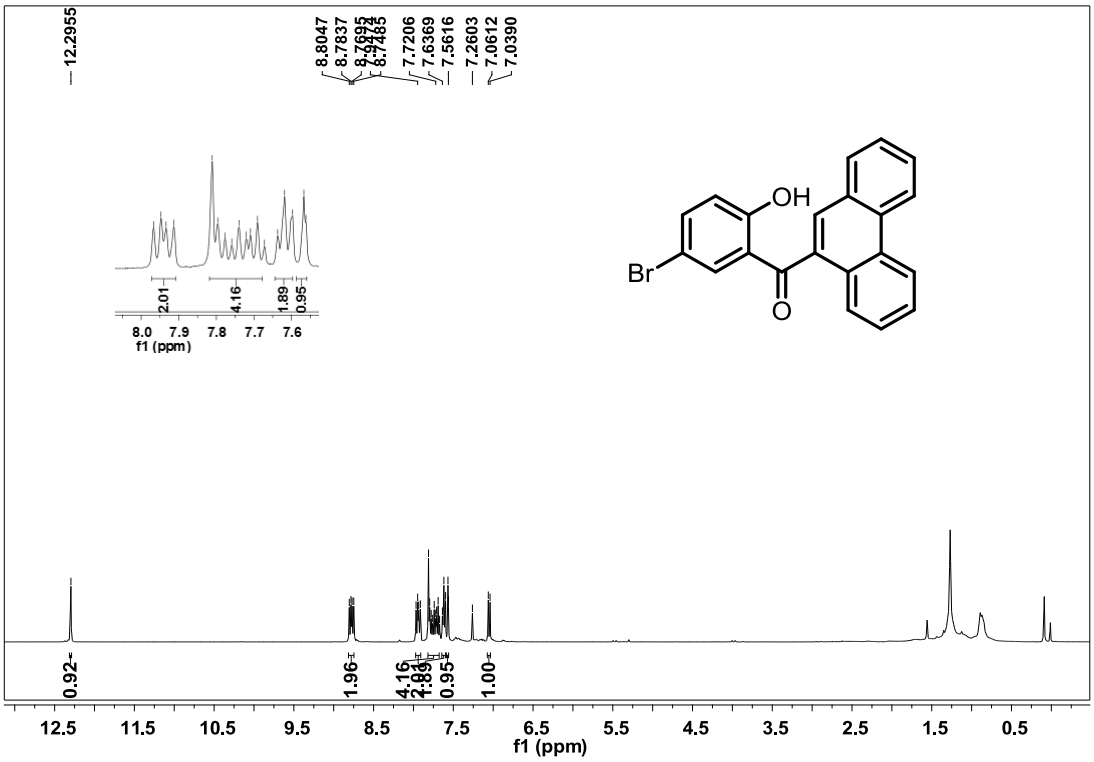


100 MHz, ^{13}C NMR in $CDCl_3$

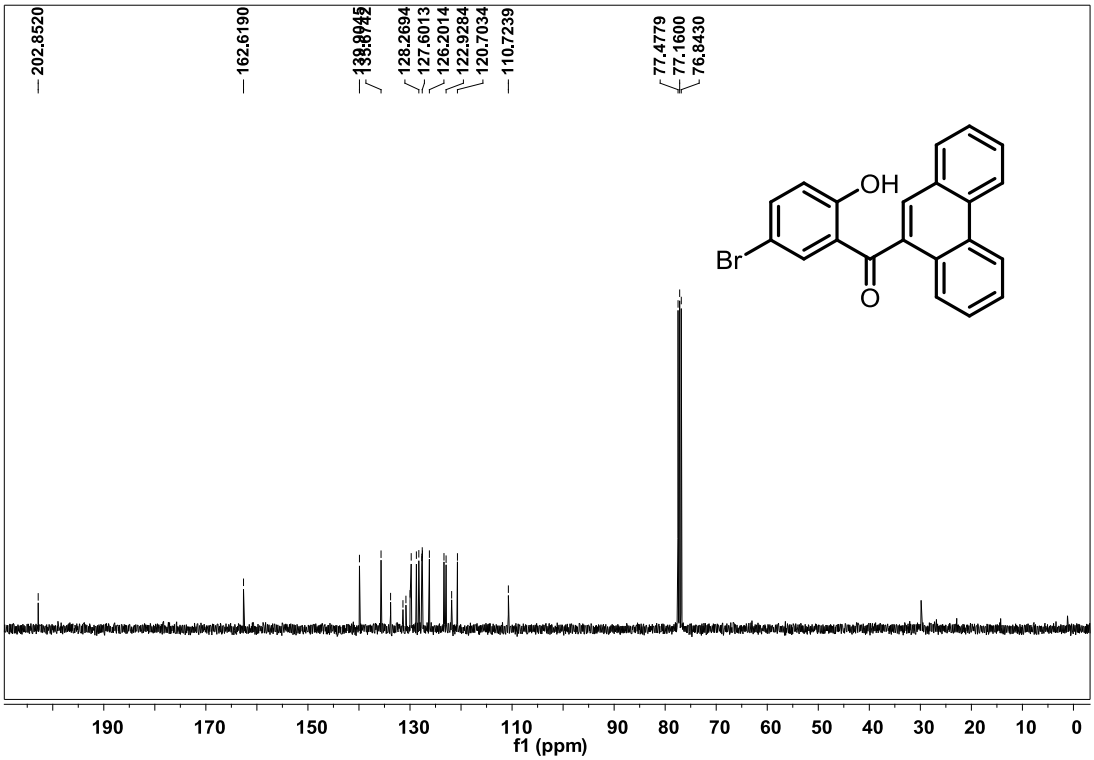


376 MHz, ^{19}F NMR in $CDCl_3$

(5-Bromo-2-hydroxyphenyl)(phenanthren-9-yl)methanone (2i)

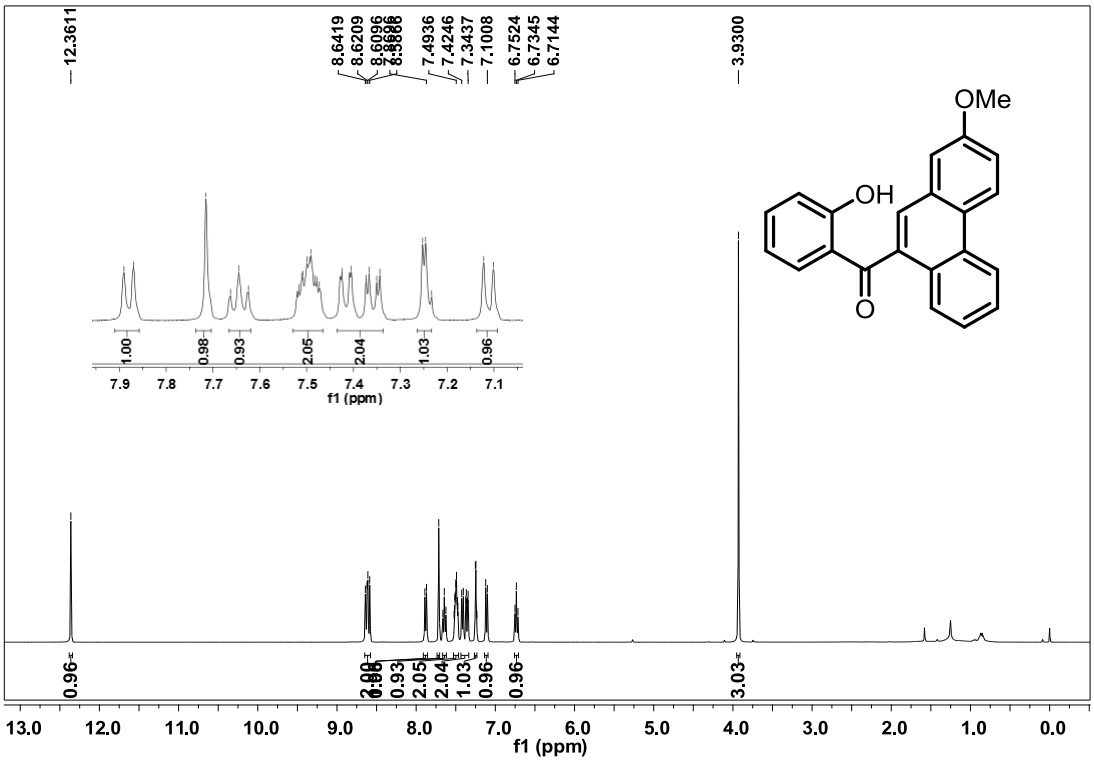


400 MHz, ^{1}H NMR in $CDCl_3$

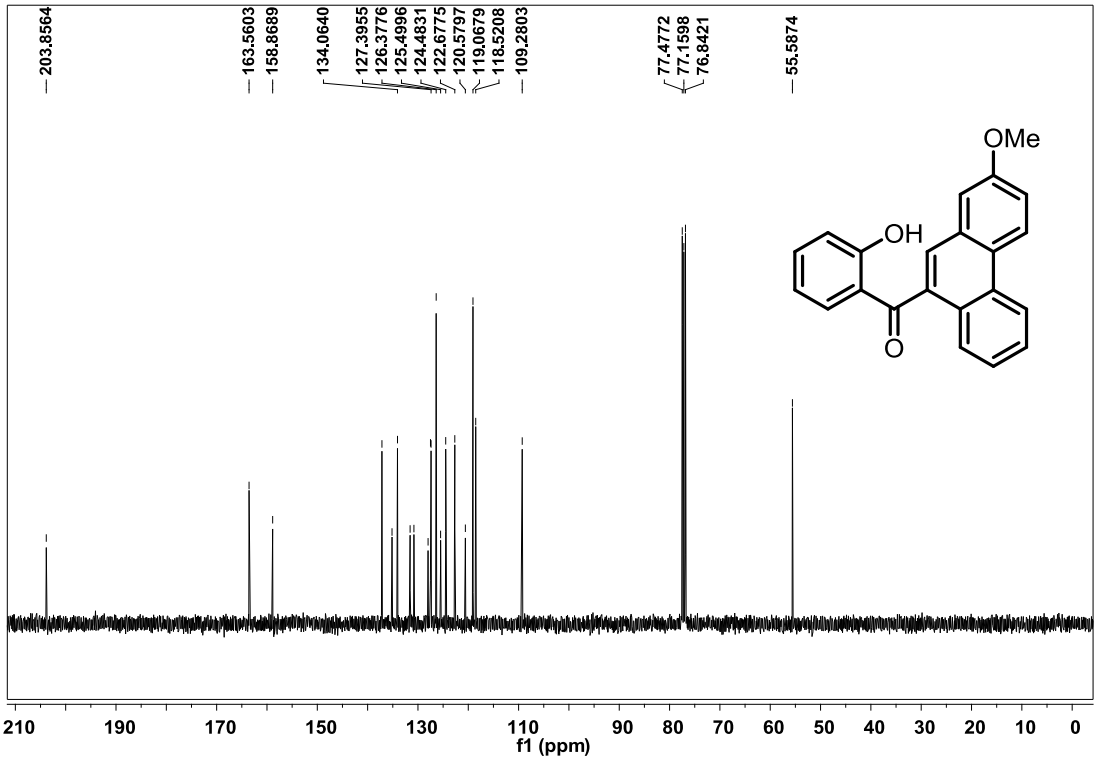


100 MHz, ^{13}C NMR in $CDCl_3$

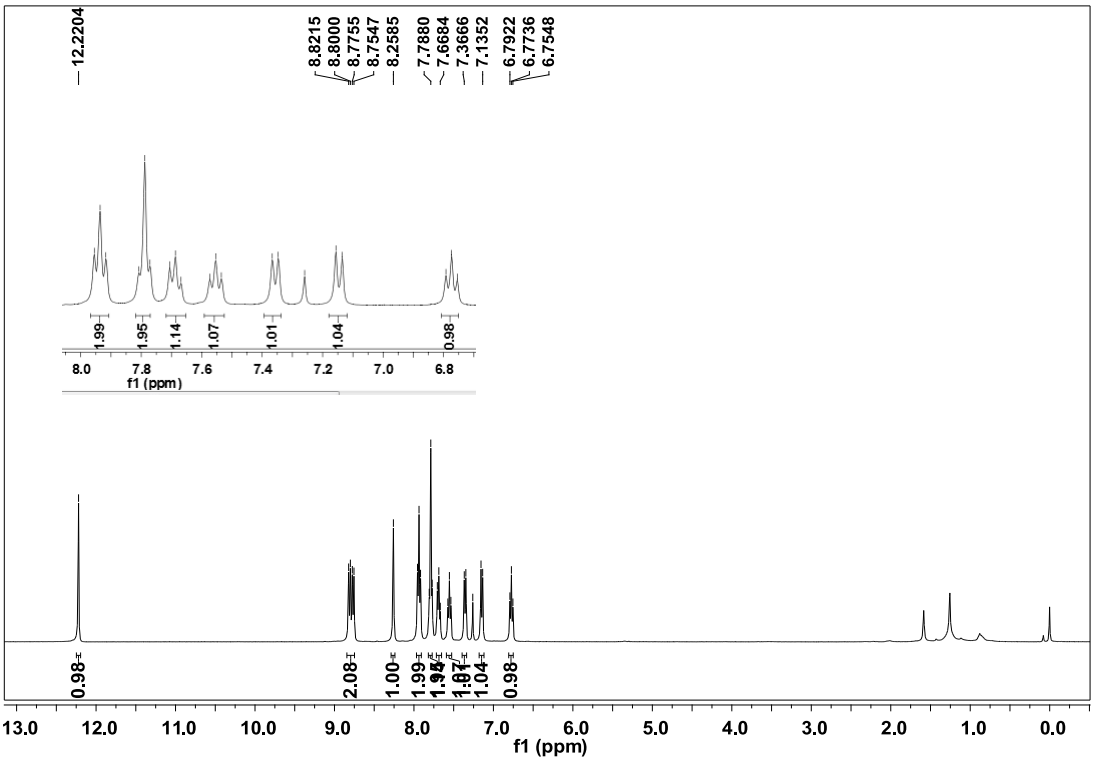
(2-Hydroxyphenyl)(2-methoxyphenanthren-9-yl)methanone (2j)



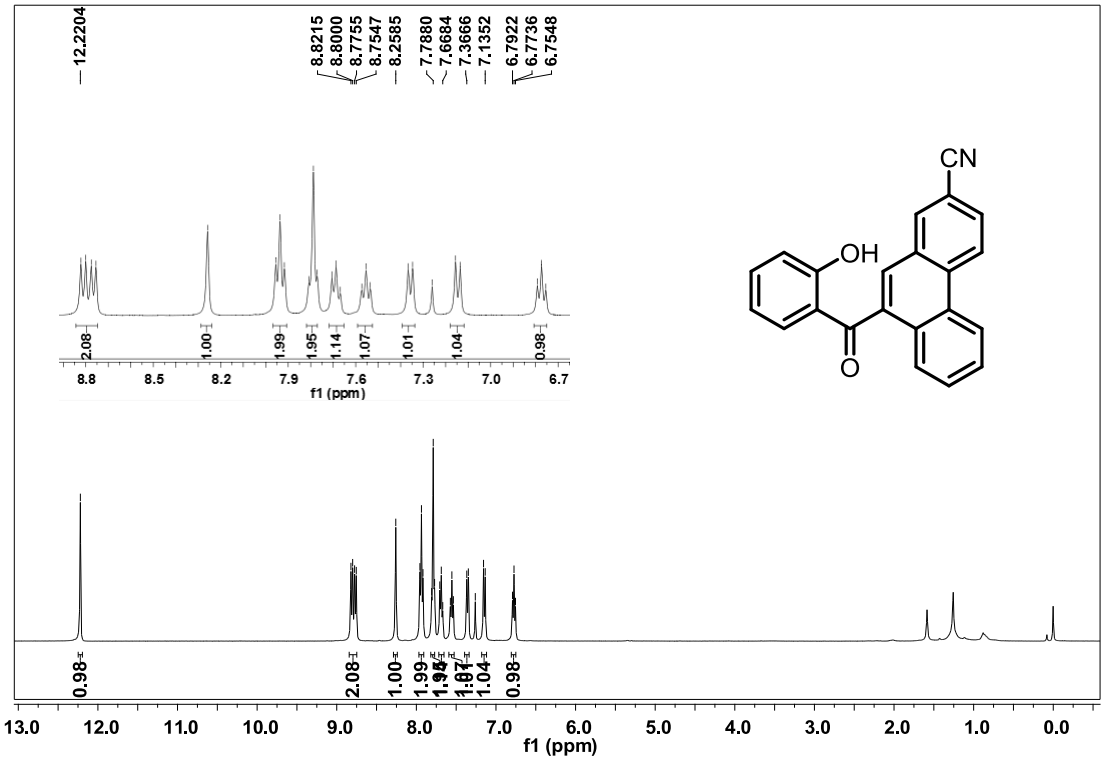
400 MHz, ^{1}H NMR in $CDCl_3$



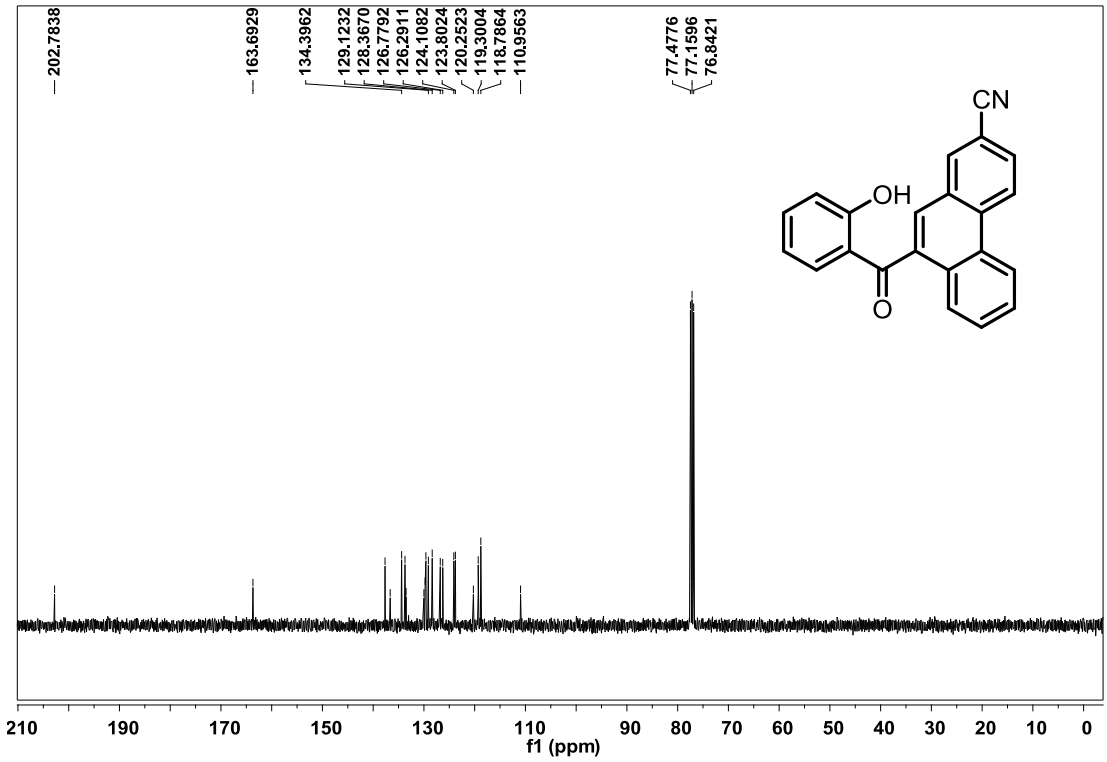
100 MHz, ^{13}C NMR in $CDCl_3$



9-(2-Hydroxybenzoyl)phenanthrene-2-carbonitrile (2k)

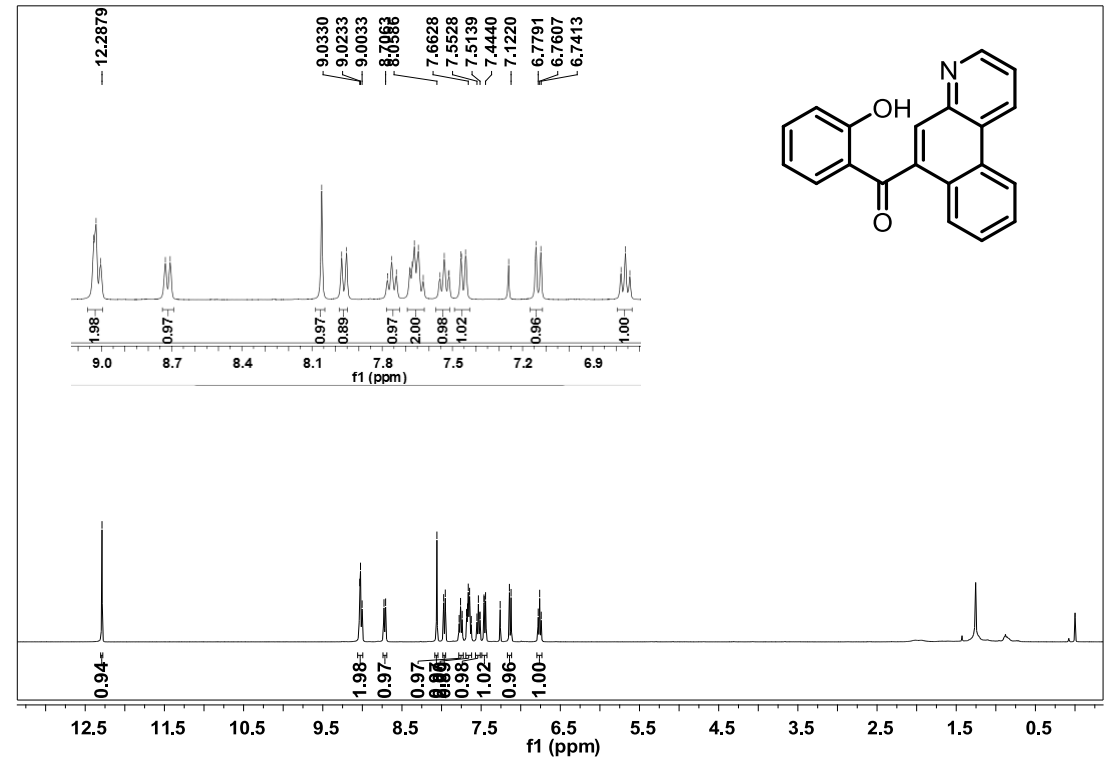


400 MHz, ^{1}H NMR in $CDCl_3$

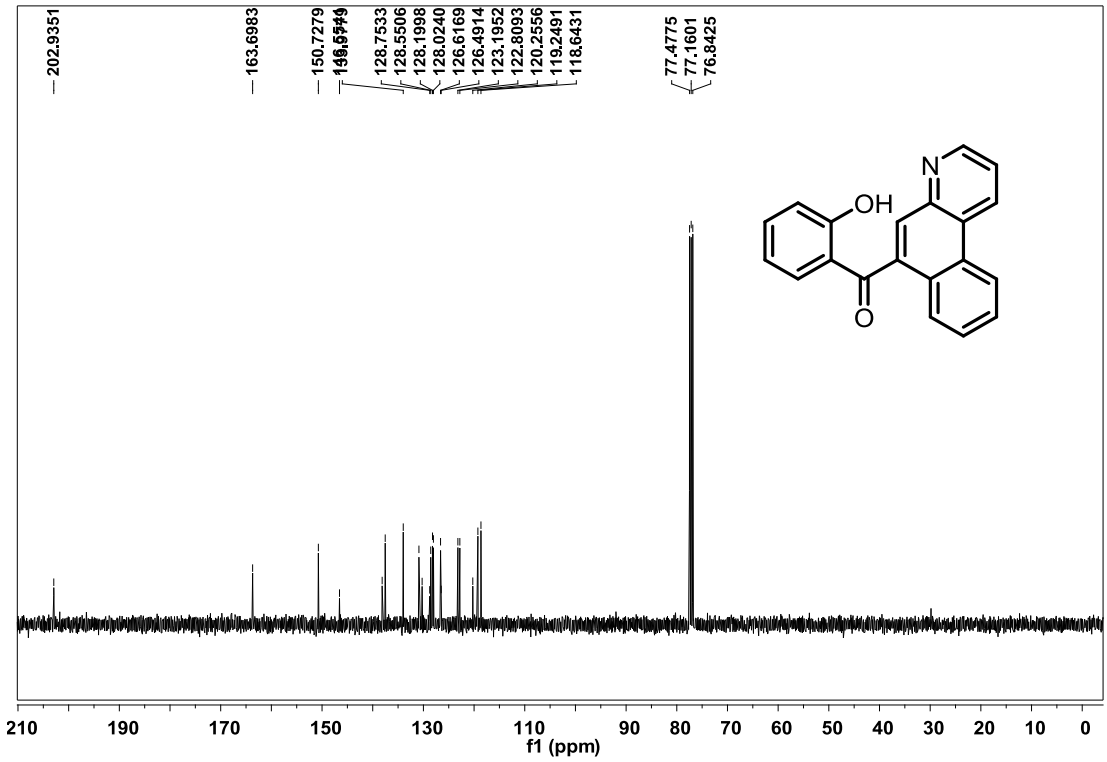


100 MHz, ^{13}C NMR in $CDCl_3$

Benzo[f]quinolin-6-yl(2-hydroxyphenyl)methanone (2l)

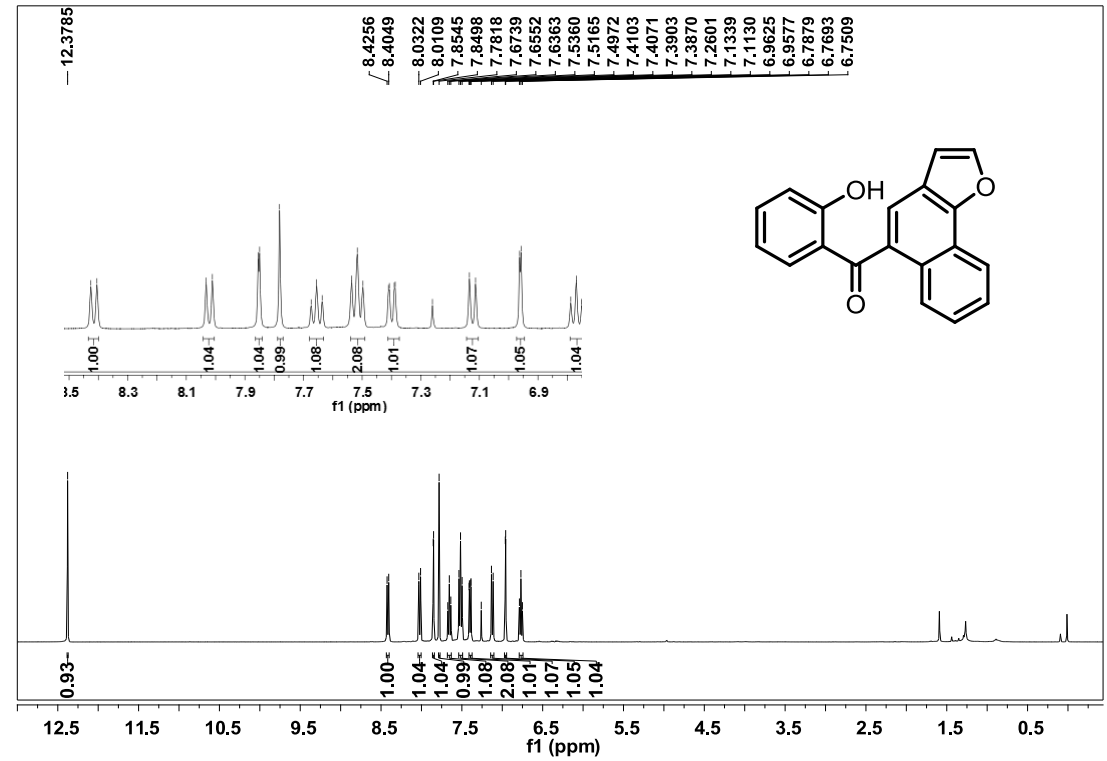


400 MHz, ^{1}H NMR in $CDCl_3$

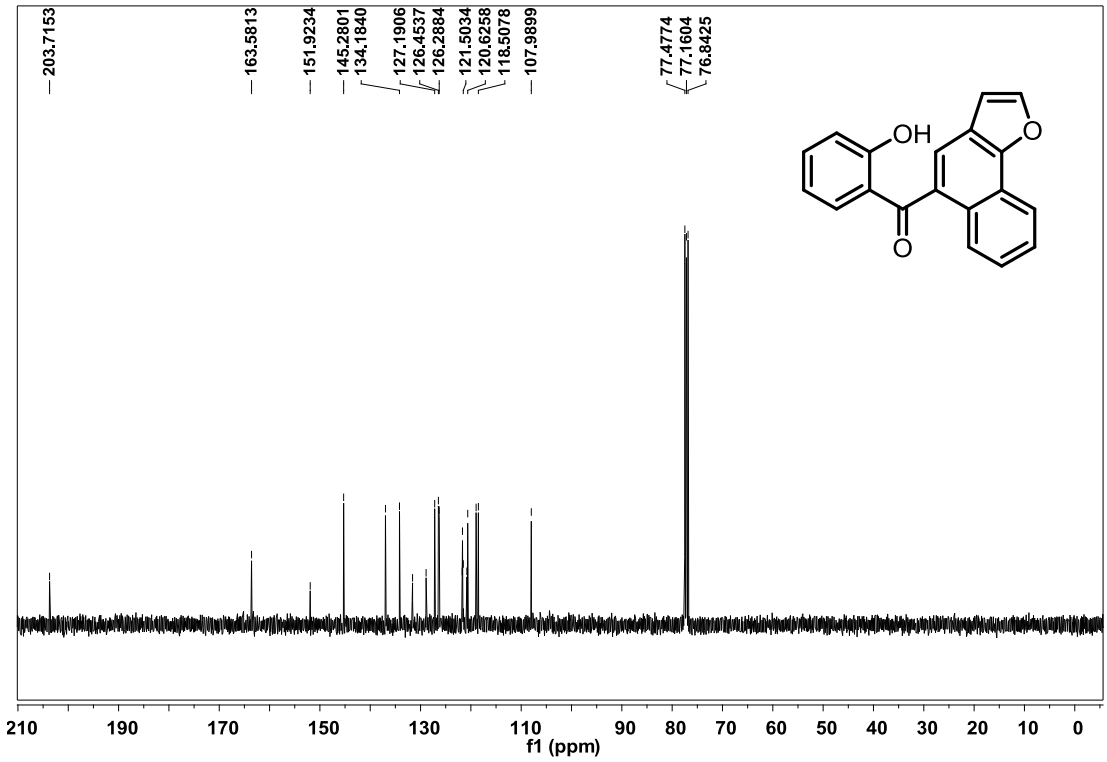


100 MHz, ^{13}C NMR in $CDCl_3$

(2-Hydroxyphenyl)(naphtho[1,2-b]furan-5-yl)methanone (2m)

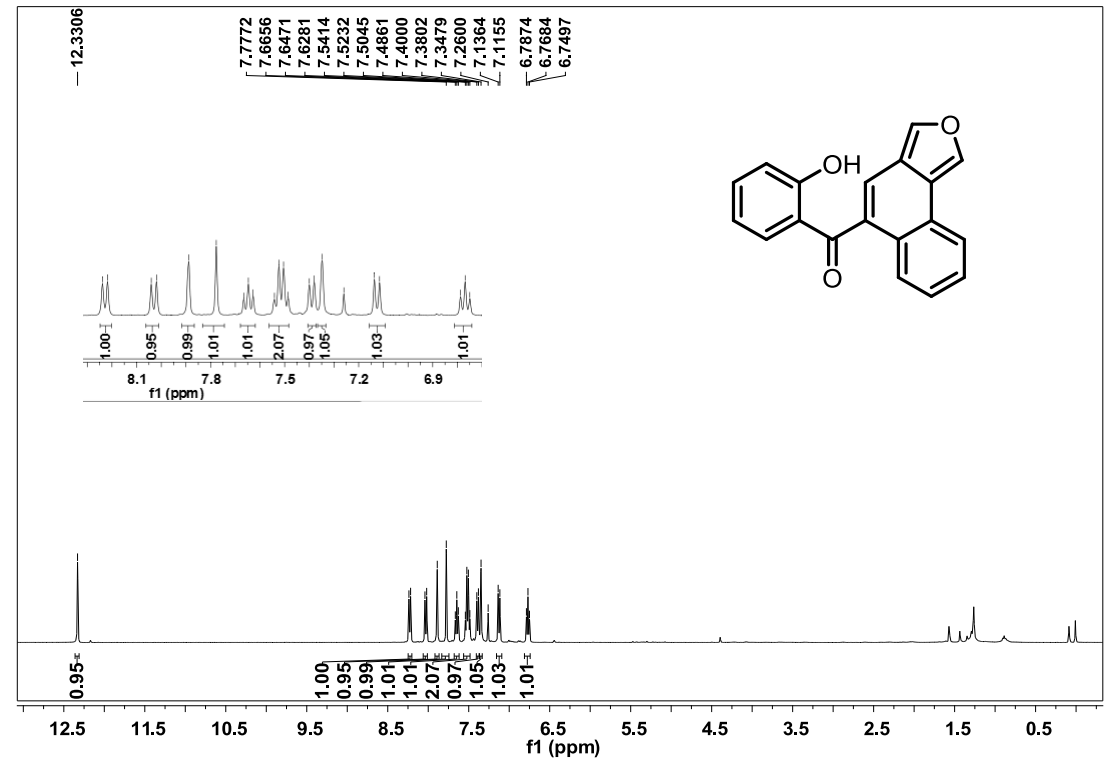


400 MHz, ^{1}H NMR in $CDCl_3$

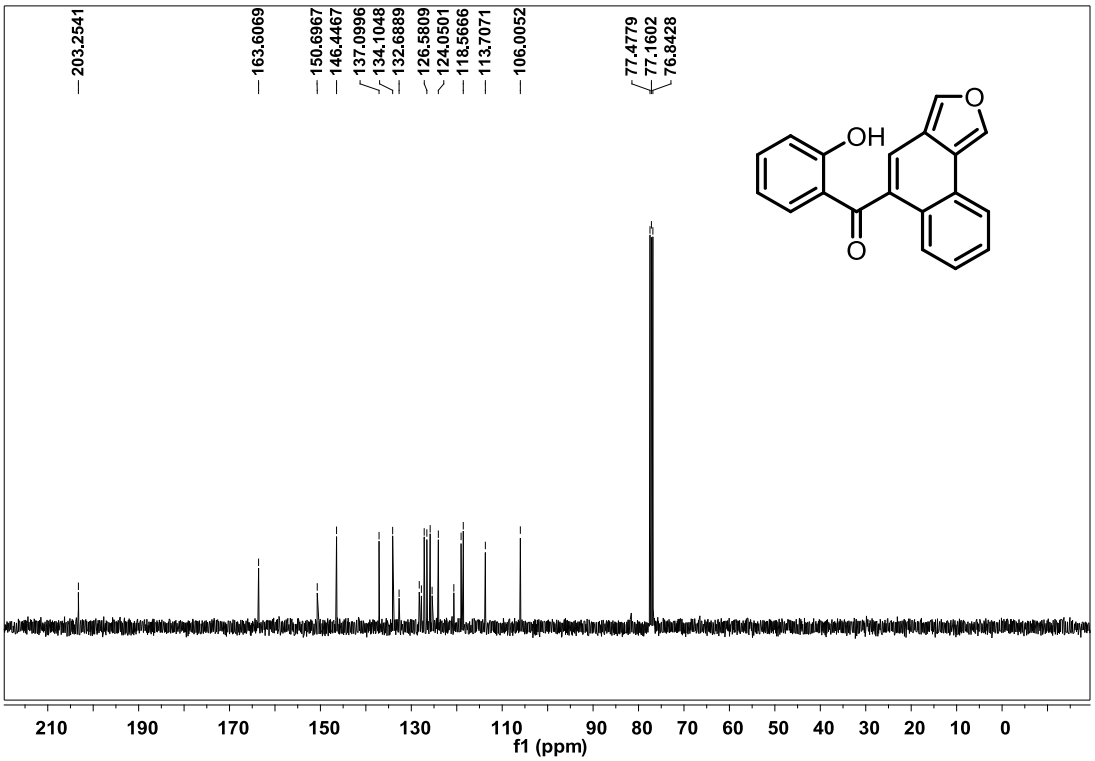


100 MHz, ^{13}C NMR in $CDCl_3$

(2-hydroxyphenyl)(naphtho[2,1-b]furan-5-yl)methanone (2n)

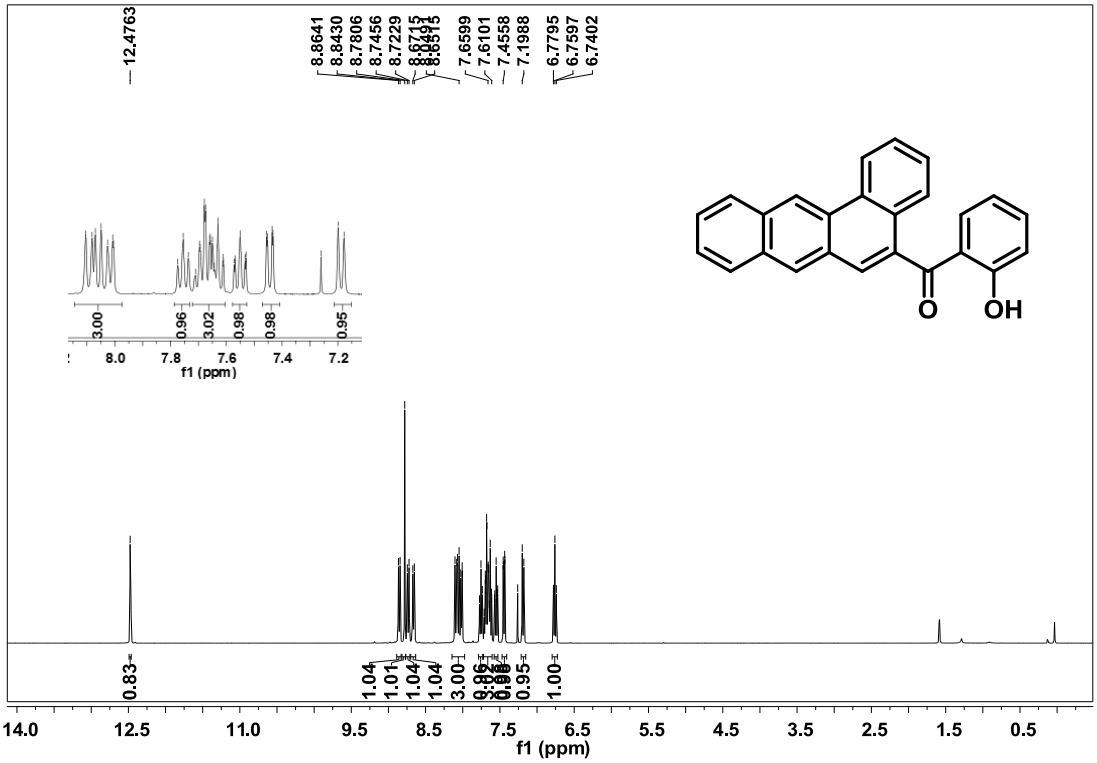


400 MHz, ^{1}H NMR in $CDCl_3$

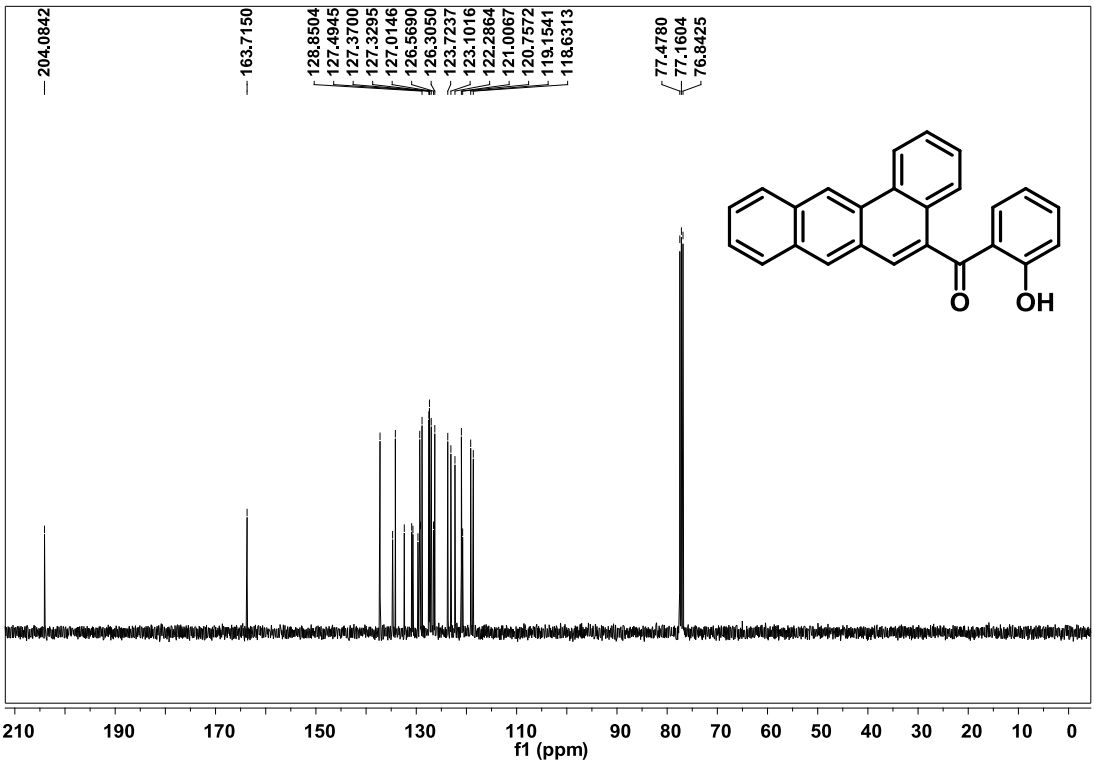


100 MHz, ^{13}C NMR in $CDCl_3$

(2-Hydroxyphenyl)(tetraphen-5-yl)methanone (2o)

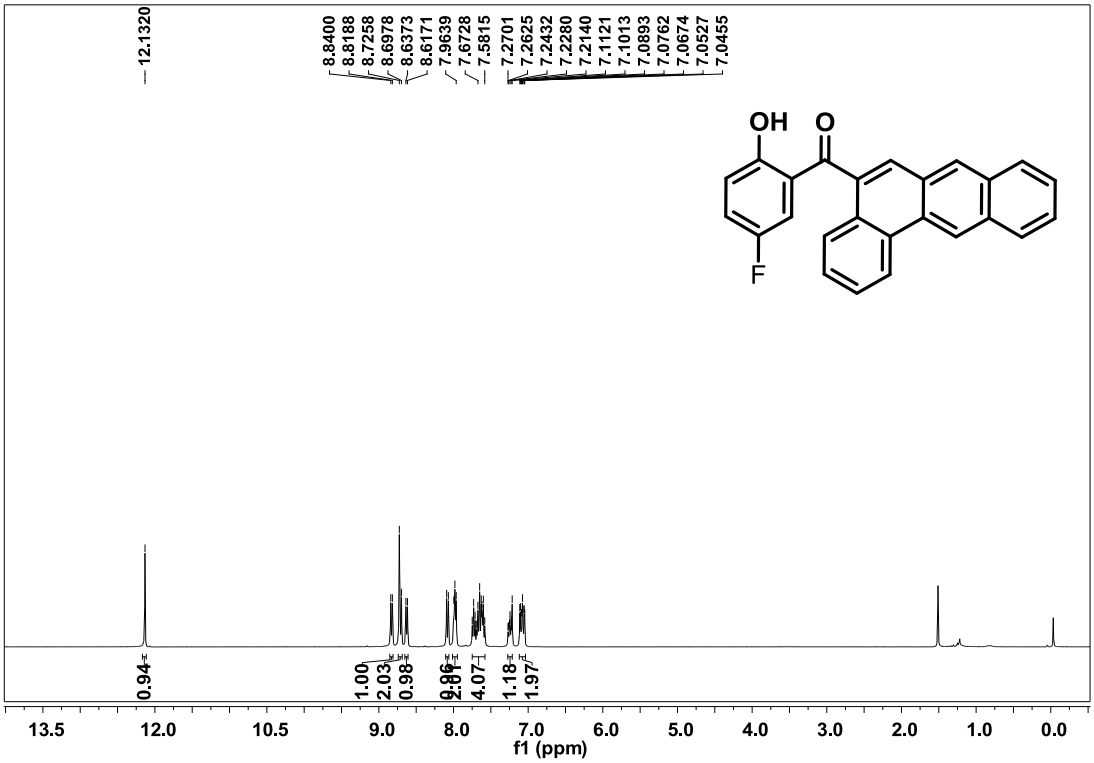


400 MHz, ^{1}H NMR in $CDCl_3$

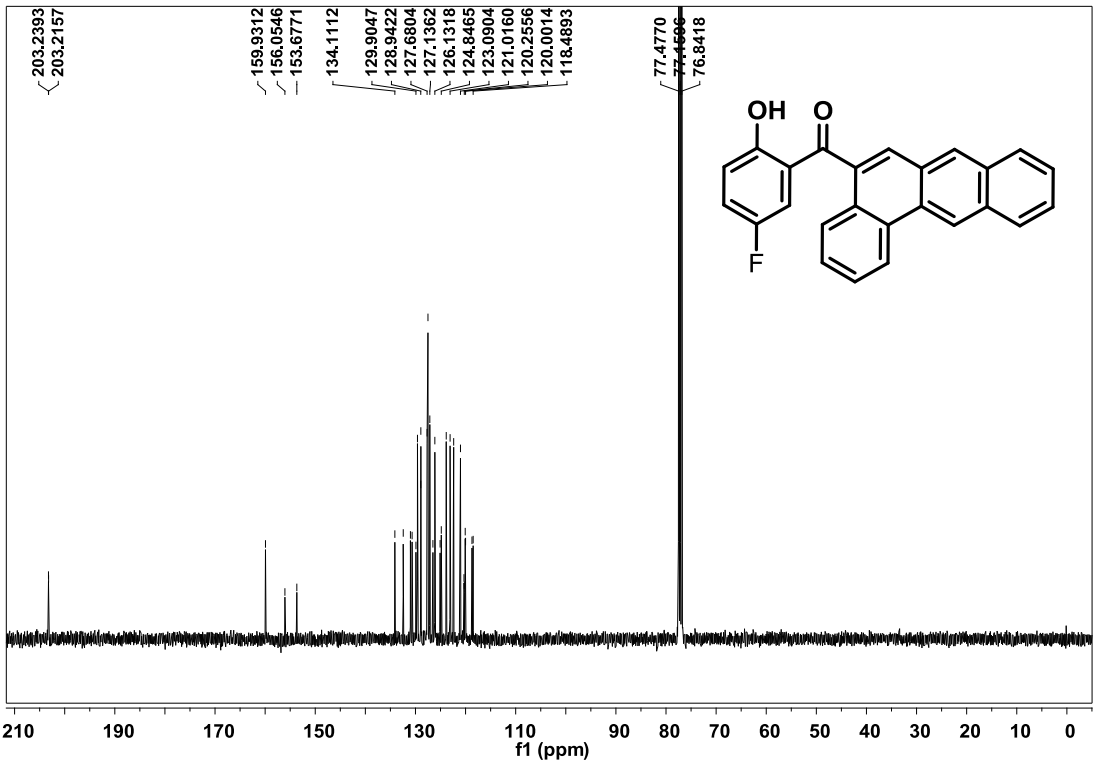


100 MHz, ^{13}C NMR in $CDCl_3$

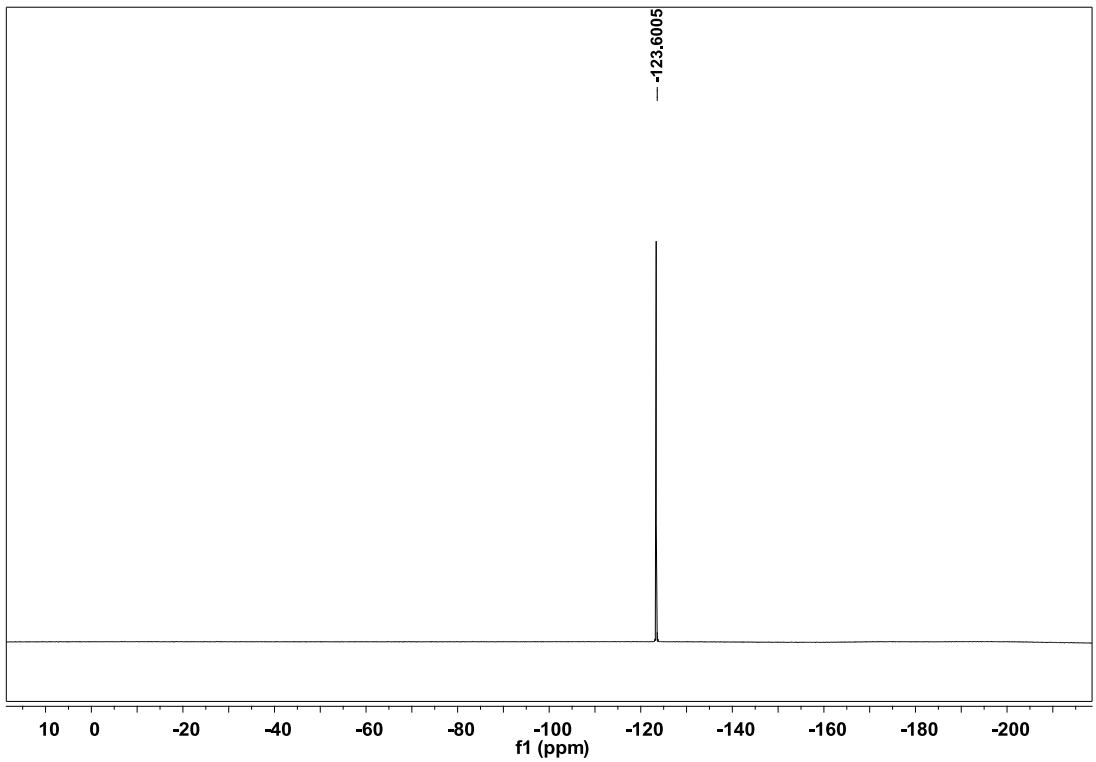
(5-Fluoro-2-hydroxyphenyl)(tetraphen-5-yl)methanone (2p)



400 MHz, ^{1}H NMR in $CDCl_3$

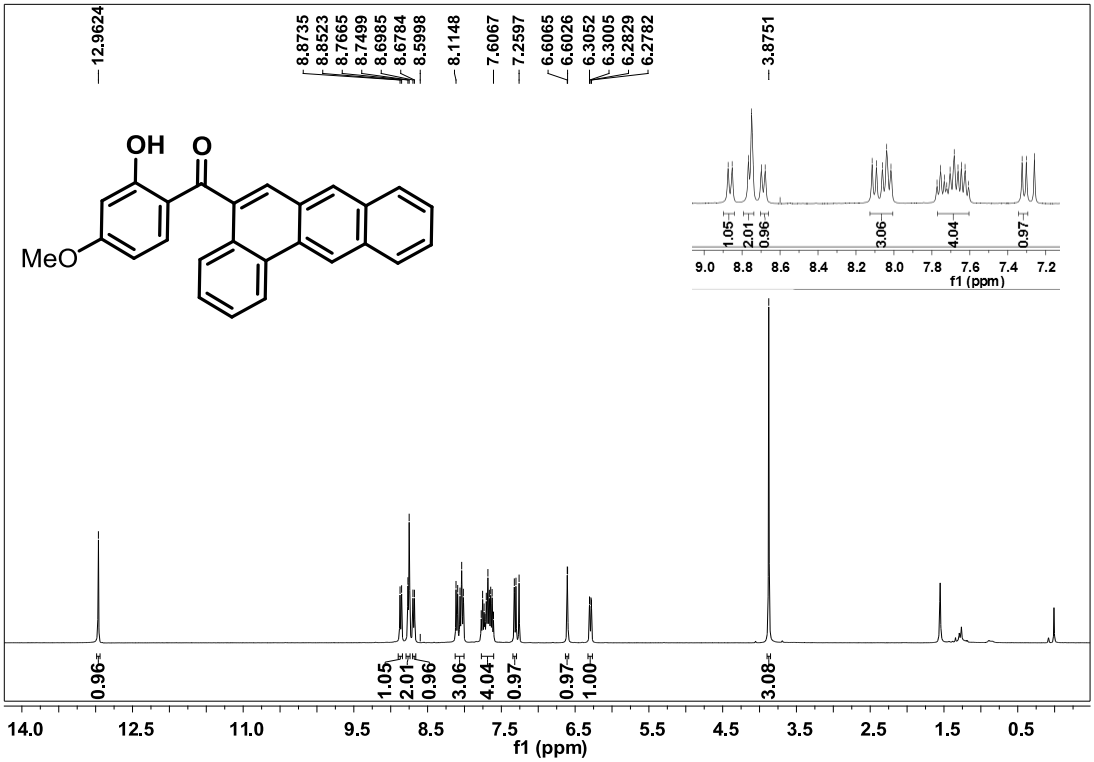


100 MHz, ^{13}C NMR in $CDCl_3$

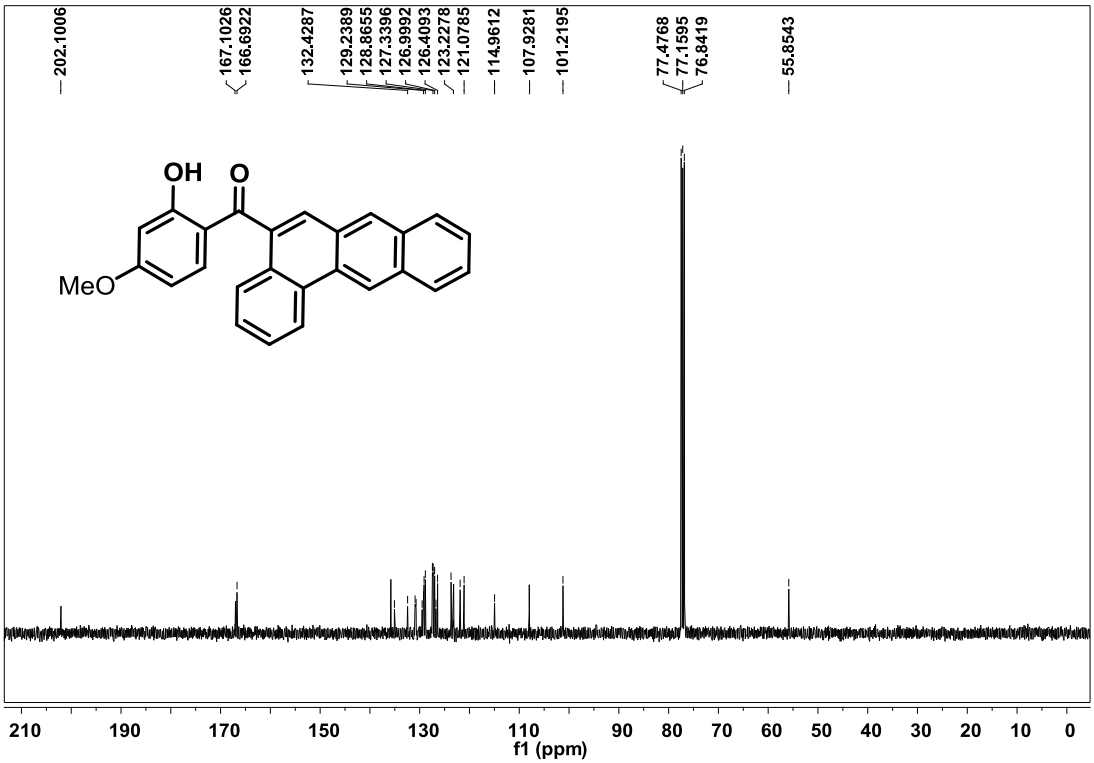


376 MHz, ^{19}F NMR in $CDCl_3$

(2-Hydroxy-4-methoxyphenyl)(tetaphen-5-yl)methanone (2q)

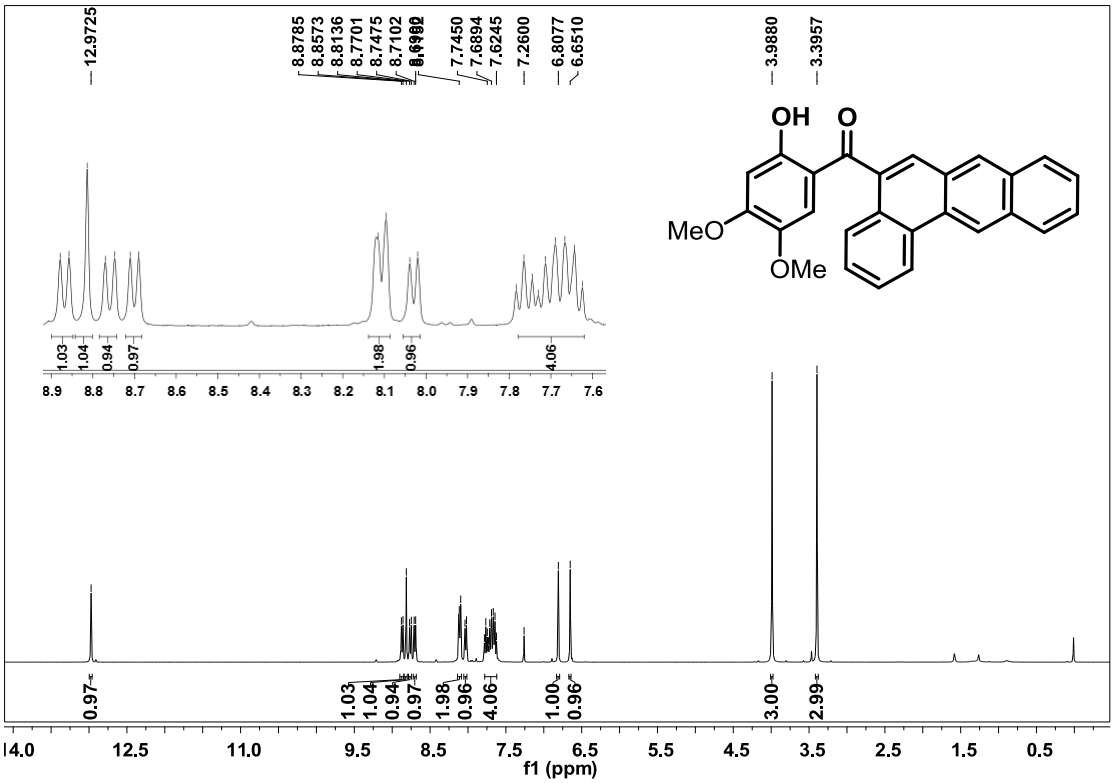


400 MHz, ^{1}H NMR in $CDCl_3$

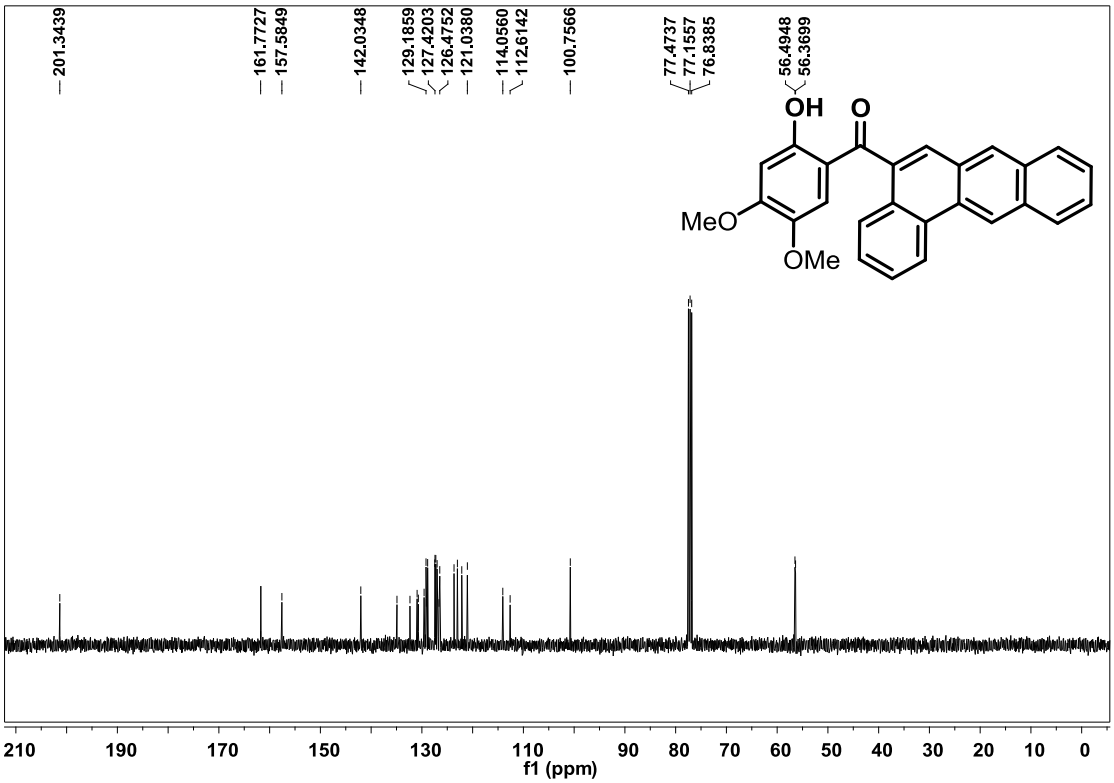


100 MHz, ^{13}C NMR in $CDCl_3$

(2-Hydroxy-4,5-dimethoxyphenyl)(tetraphen-5-yl)methanone (2r)

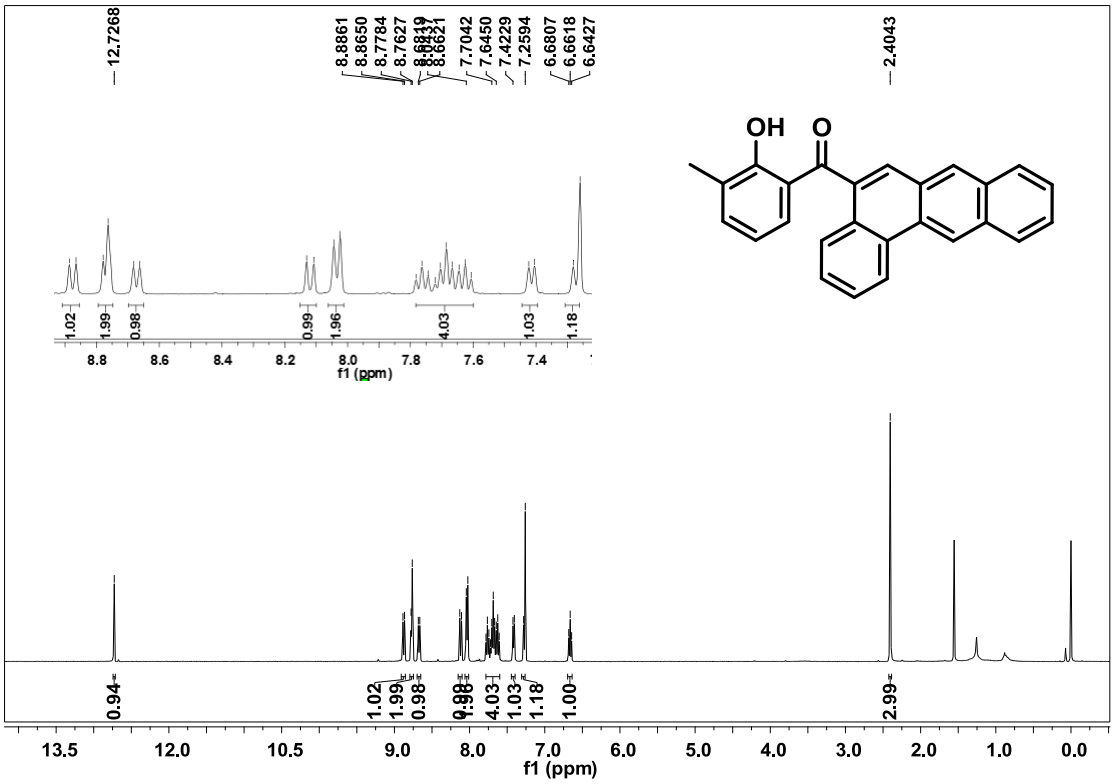


400 MHz, ^{1}H NMR in $CDCl_3$

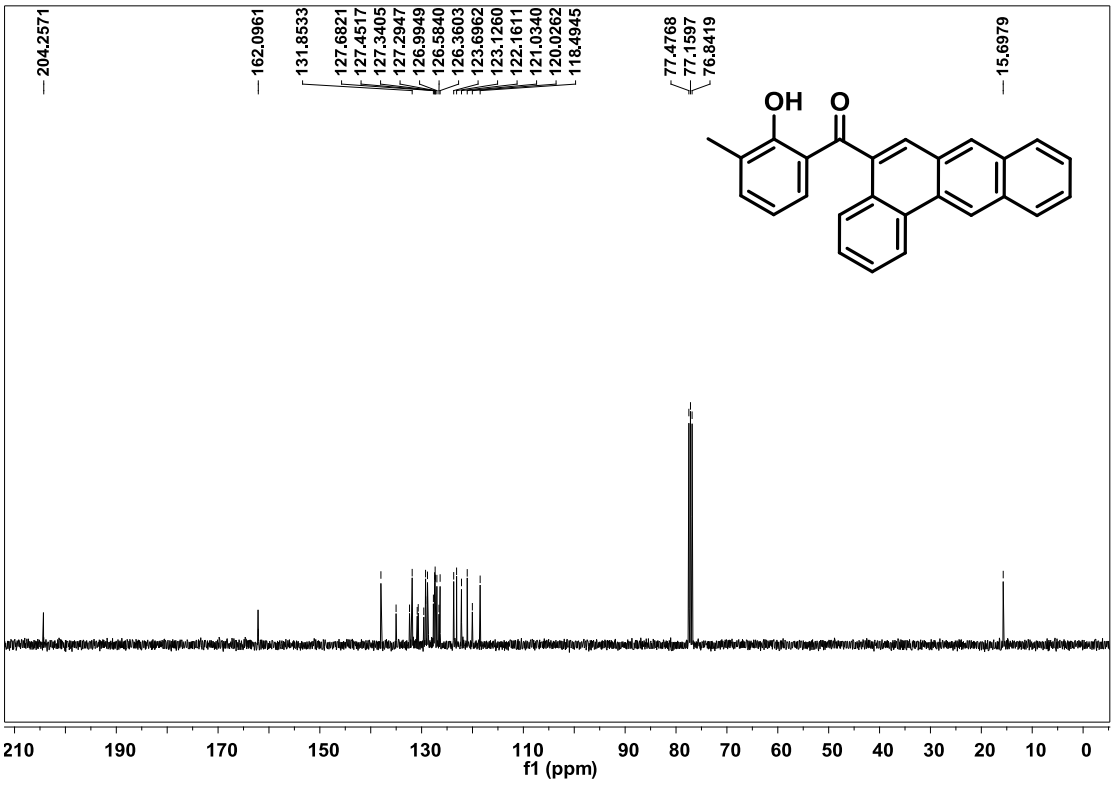


100 MHz, ^{13}C NMR in $CDCl_3$

(2-Hydroxy-3-methylphenyl)(tetraphen-5-yl)methanone (2s)

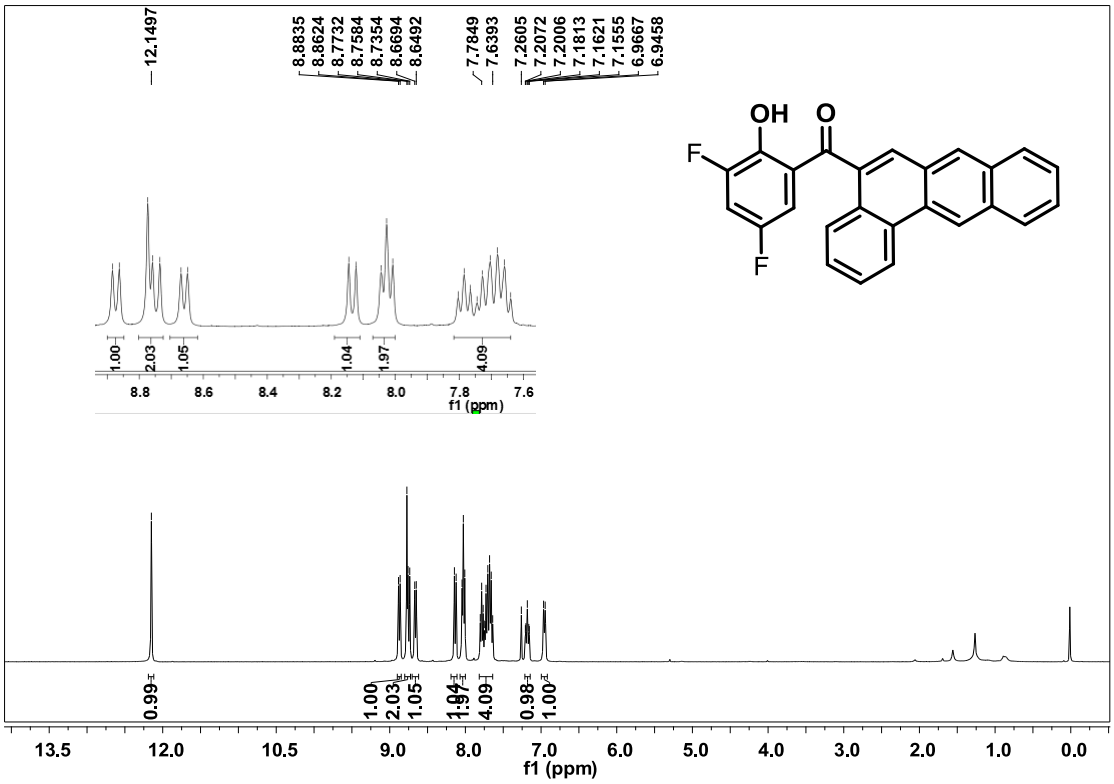


400 MHz, ^{1}H NMR in $CDCl_3$

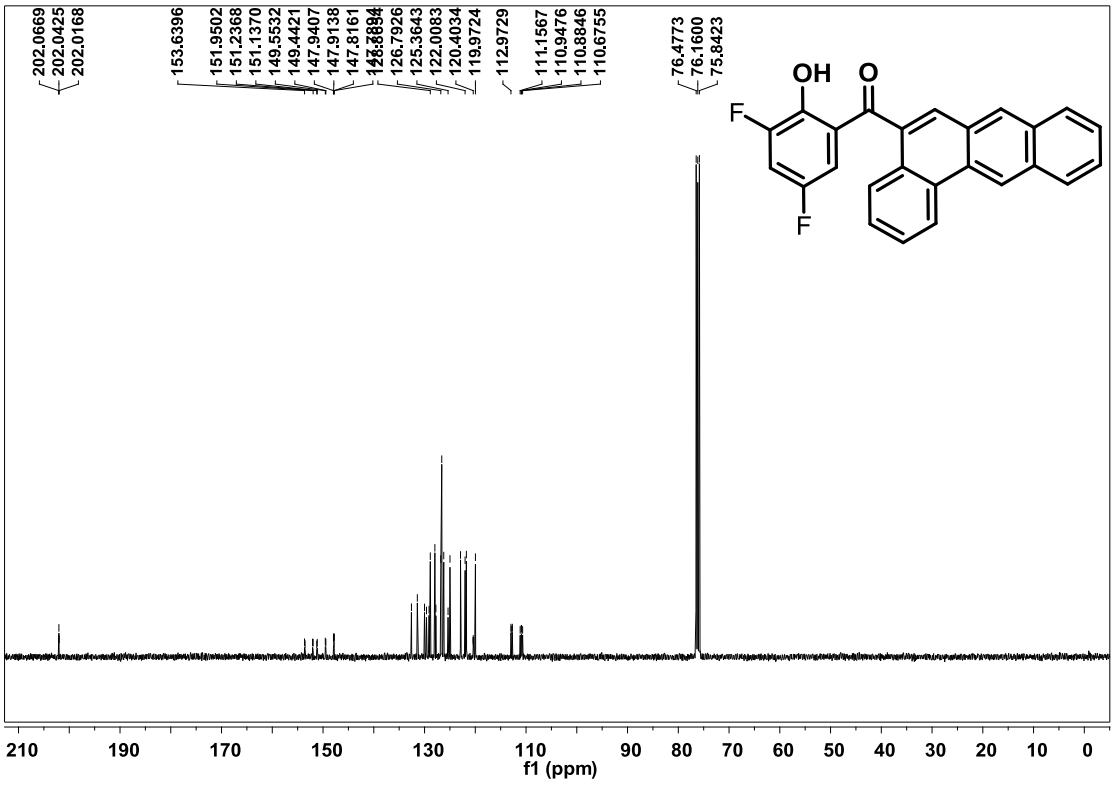


100 MHz, ^{13}C NMR in $CDCl_3$

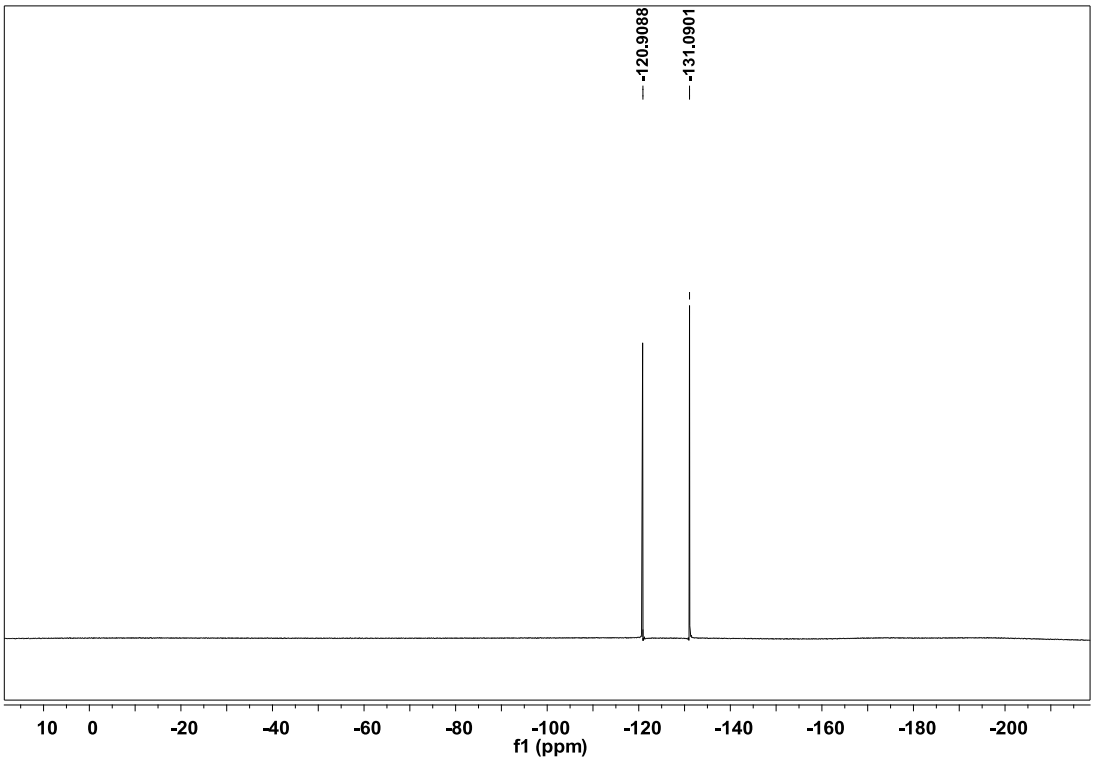
(3,5-Fifluoro-2-hydroxyphenyl)(tetraphen-5-yl)methanone (2t)



400 MHz, ^{1}H NMR in $CDCl_3$

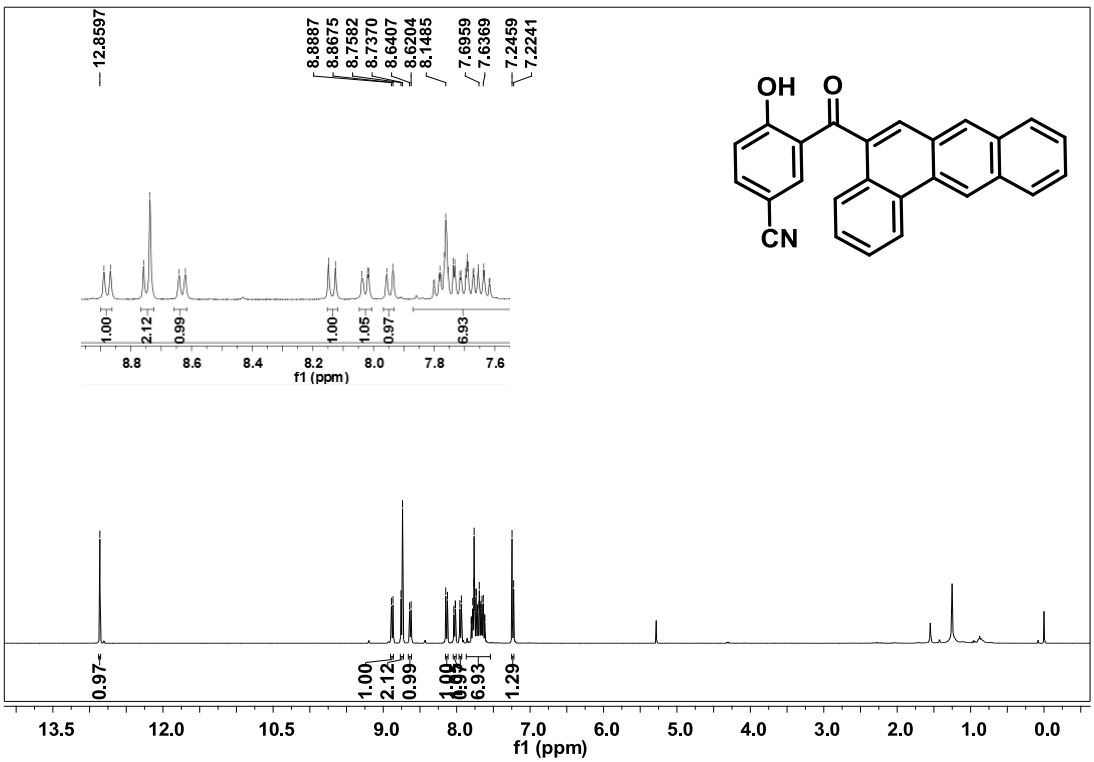


100 MHz, ^{13}C NMR in $CDCl_3$

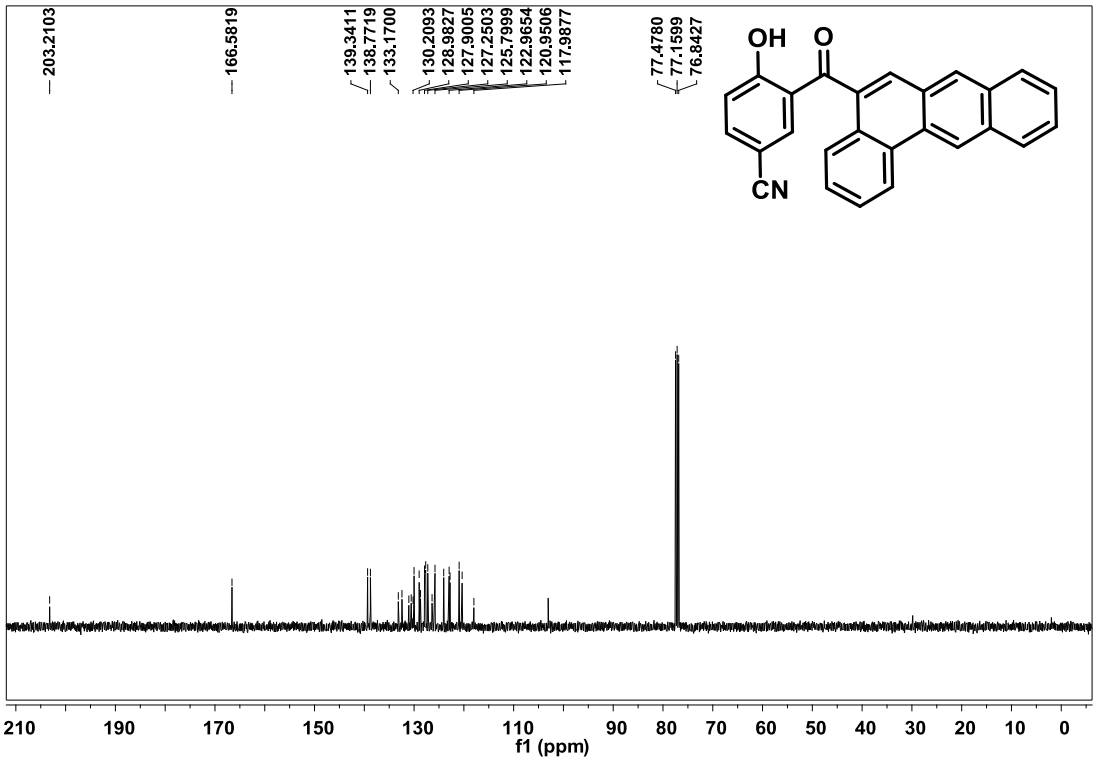


376 MHz, ^{19}F NMR in $CDCl_3$

4-Hydroxy-3-(tetraphene-5-carbonyl)benzonitrile (2u)

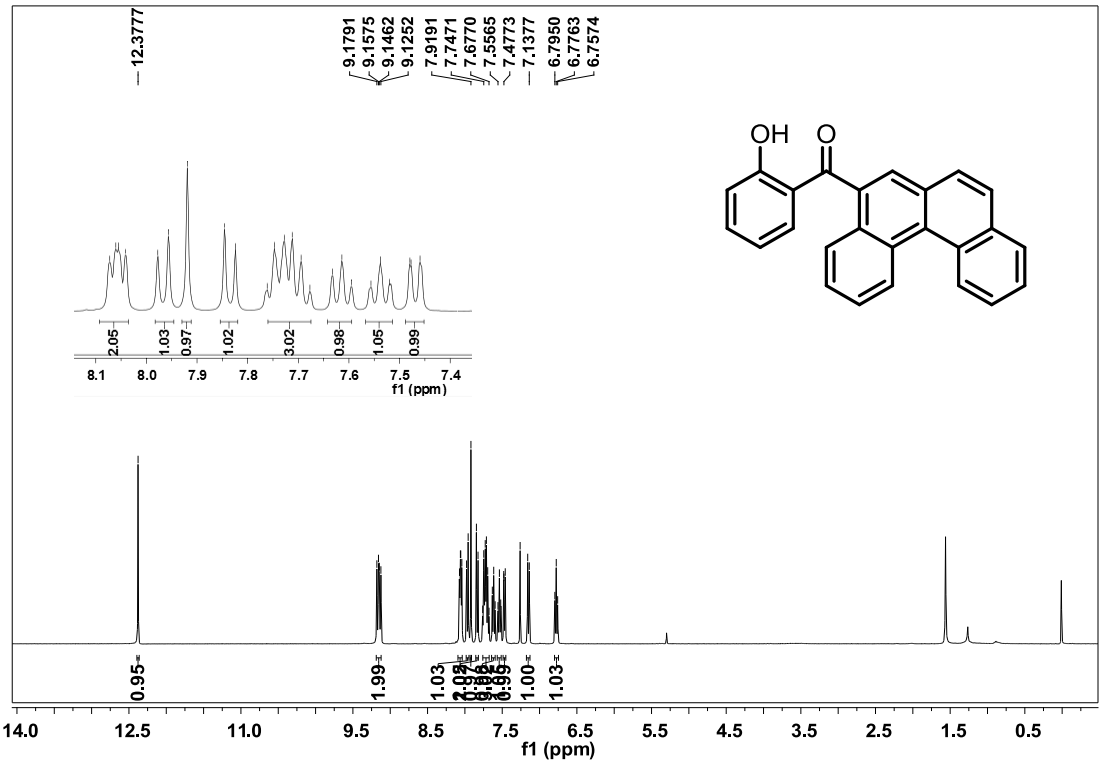


400 MHz, ^{1}H NMR in $CDCl_3$

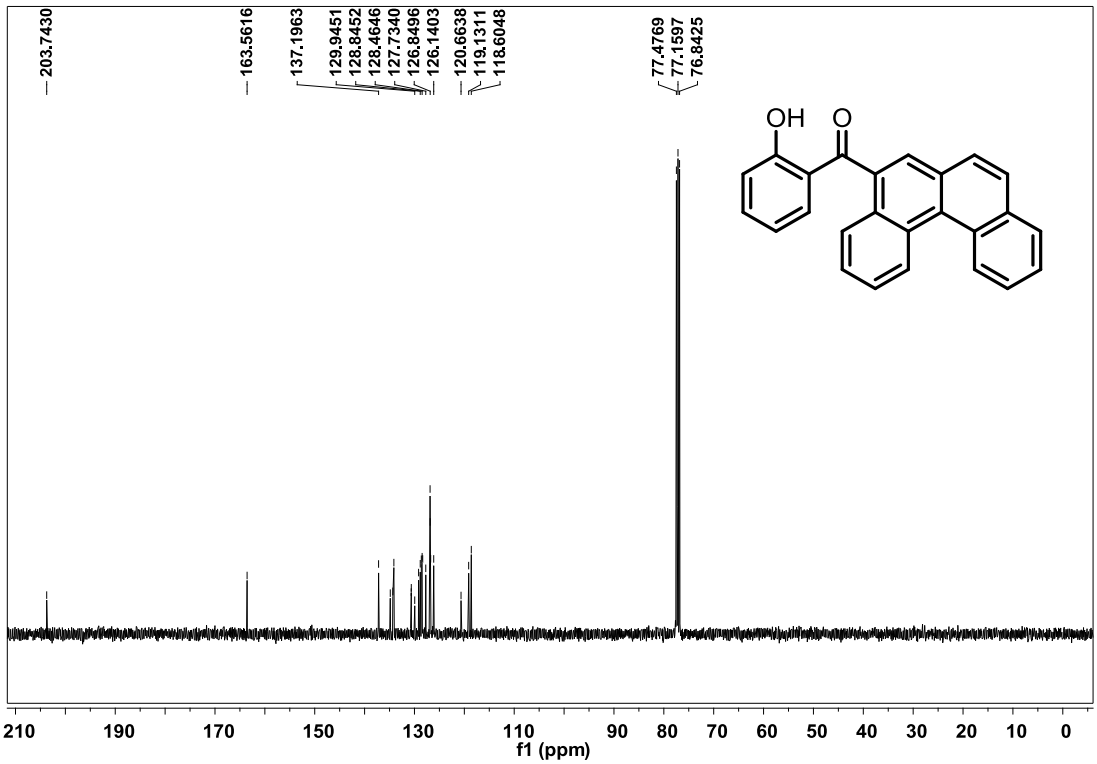


100 MHz, ^{13}C NMR in $CDCl_3$

Benzo[c]phenanthren-5-yl(2-hydroxyphenyl)methanone (2v)

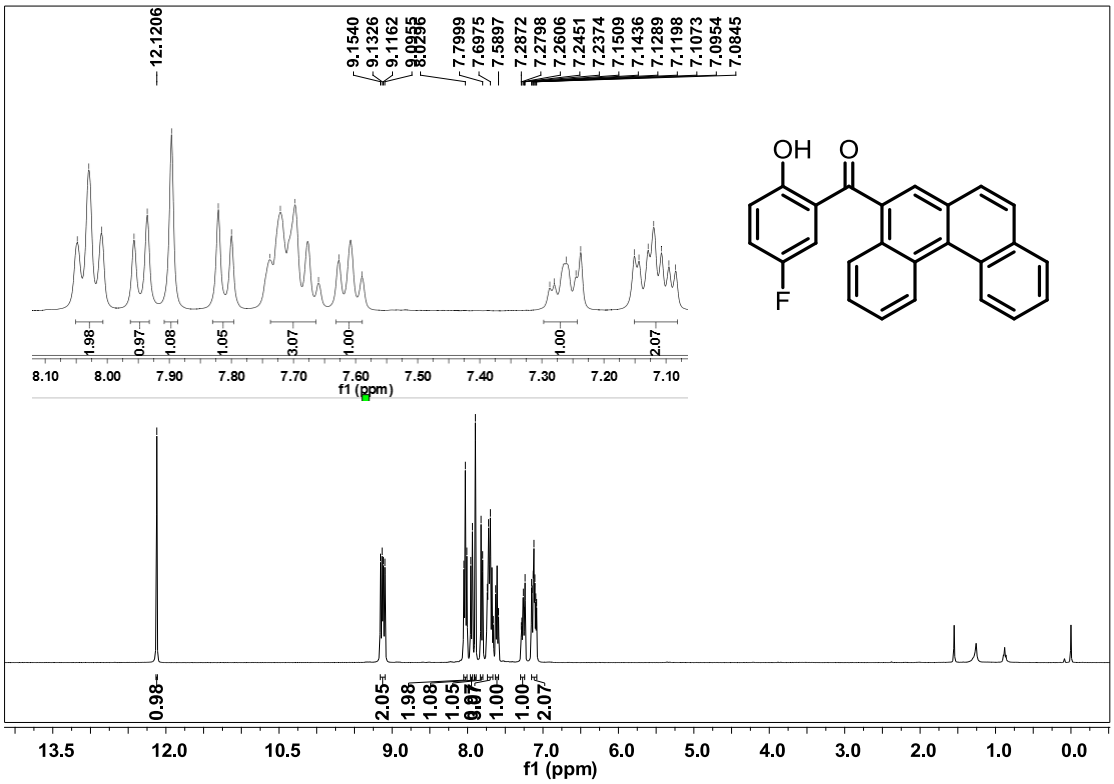


400 MHz, ^{1}H NMR in $CDCl_3$

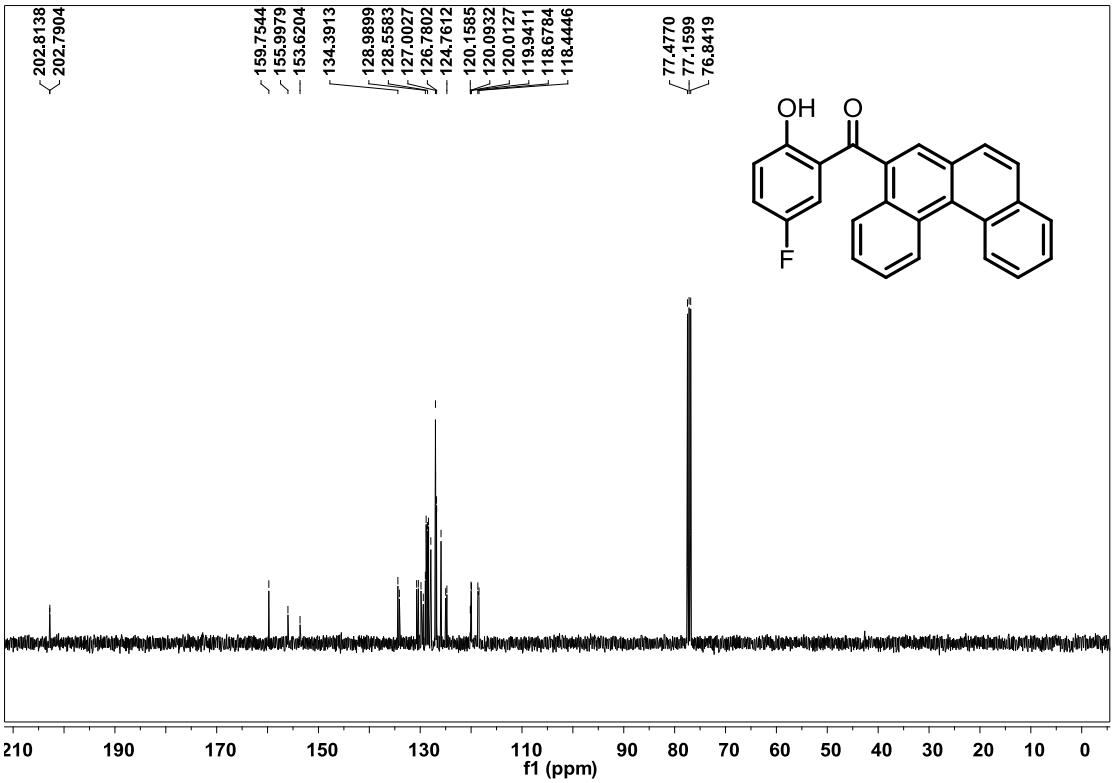


100 MHz, ^{13}C NMR in $CDCl_3$

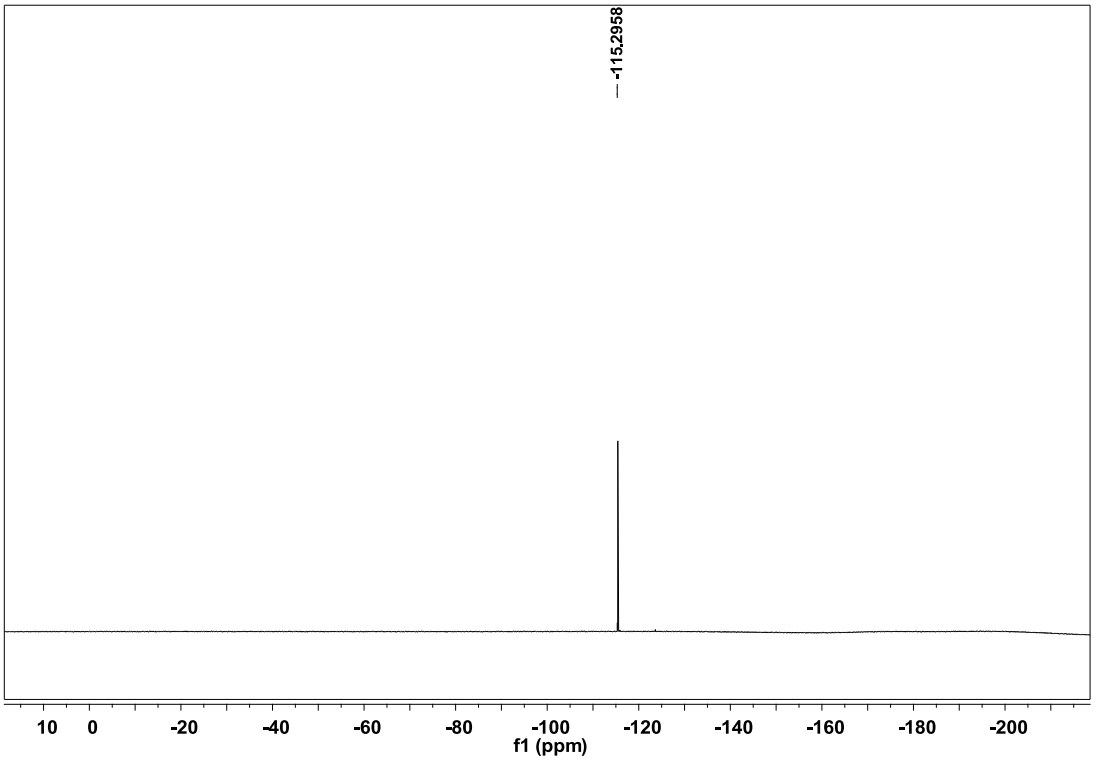
Benzo[c]phenanthren-5-yl(5-fluoro-2-hydroxyphenyl)methanone (2w)



400 MHz, ^{1}H NMR in $CDCl_3$

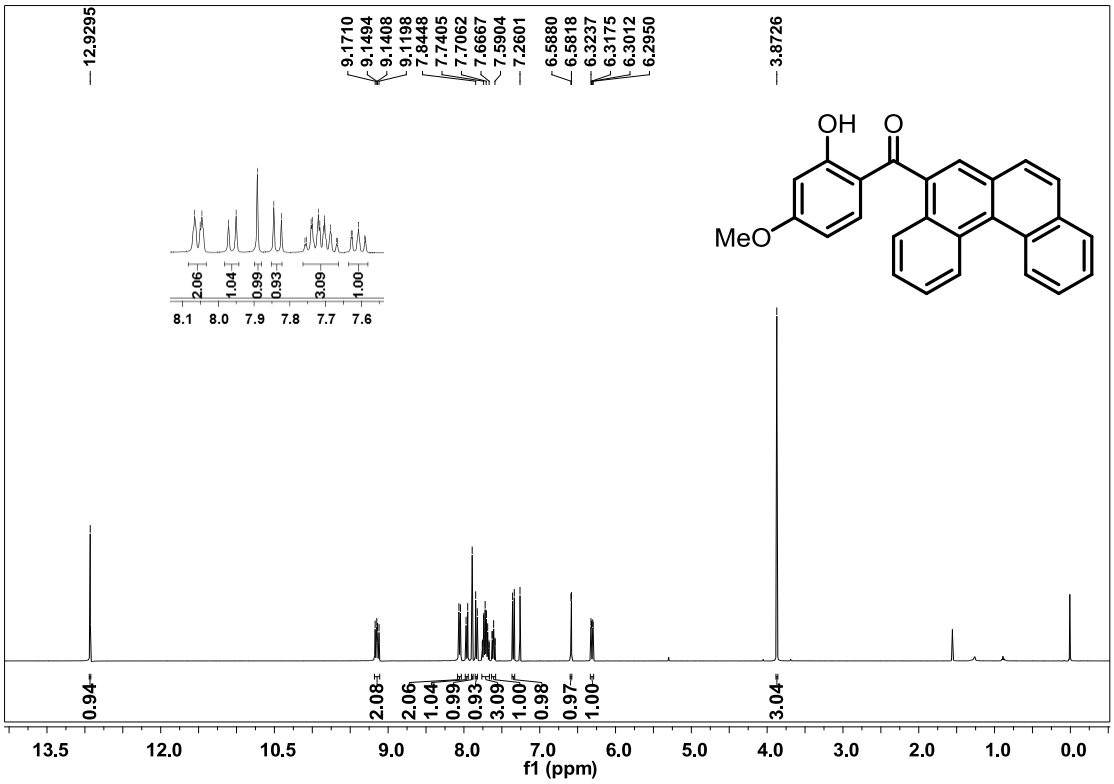


100 MHz, ^{13}C NMR in $CDCl_3$

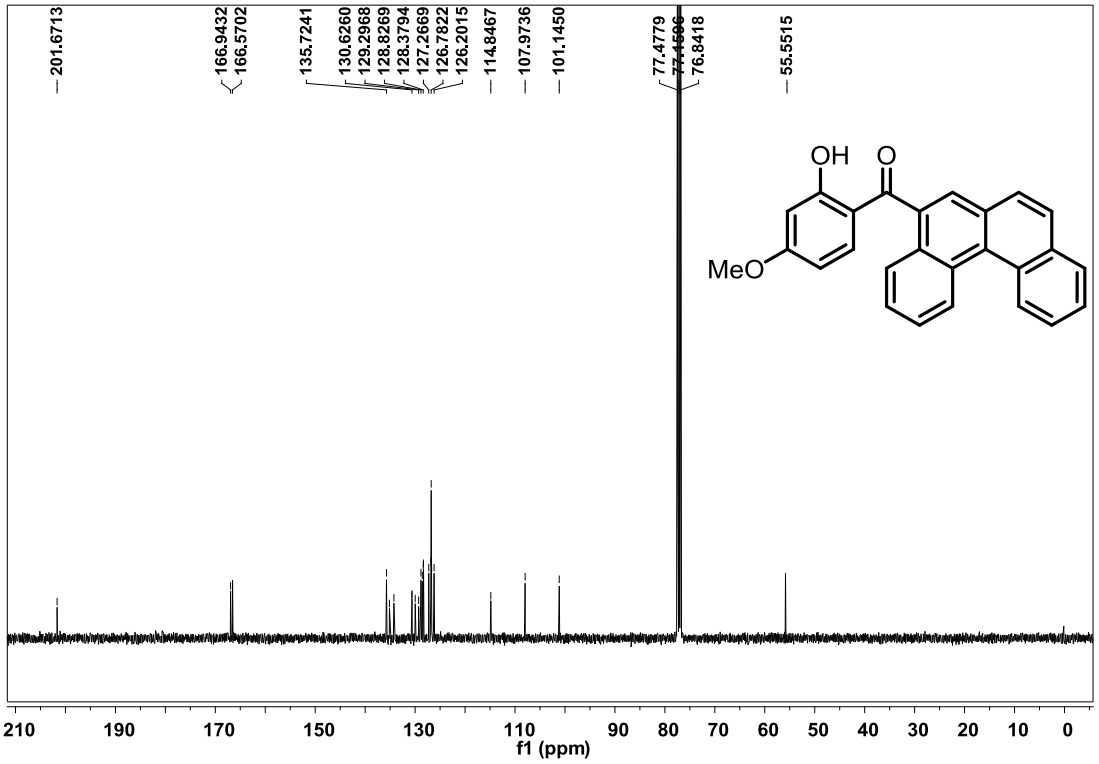


376 MHz, ^{19}F NMR in $CDCl_3$

Benzo[c]phenanthren-5-yl(2-hydroxy-4-methoxyphenyl)methanone (2x)

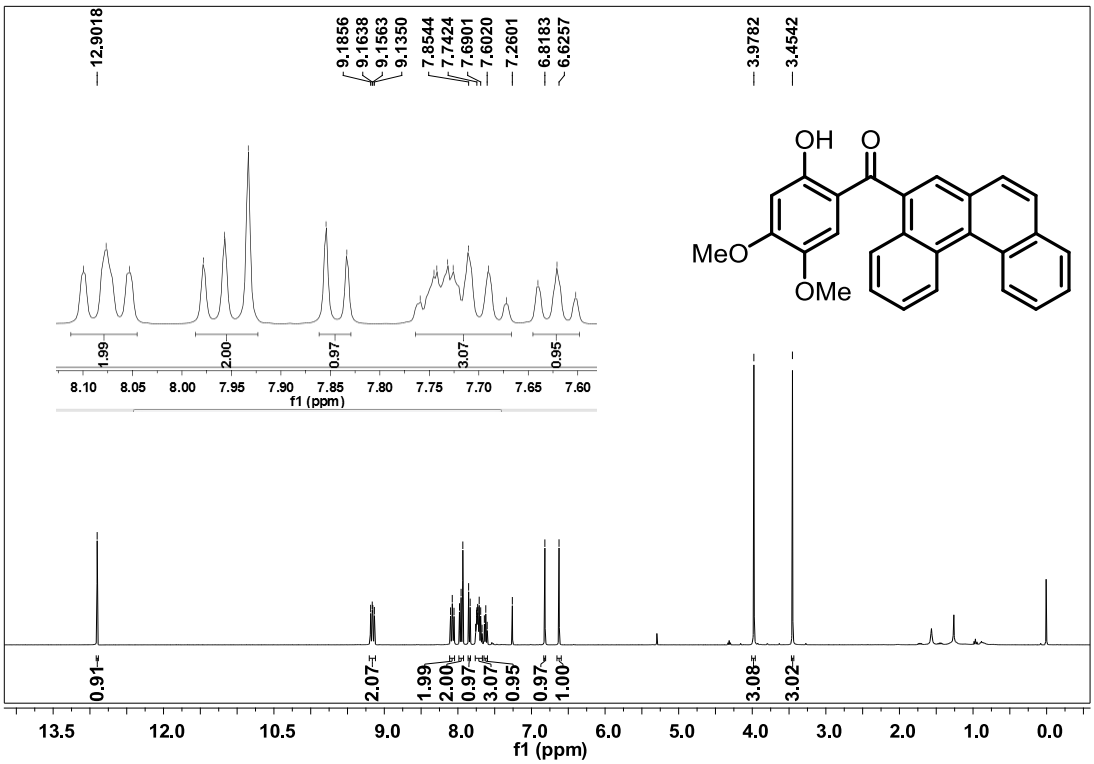


400 MHz, ^{1}H NMR in $CDCl_3$

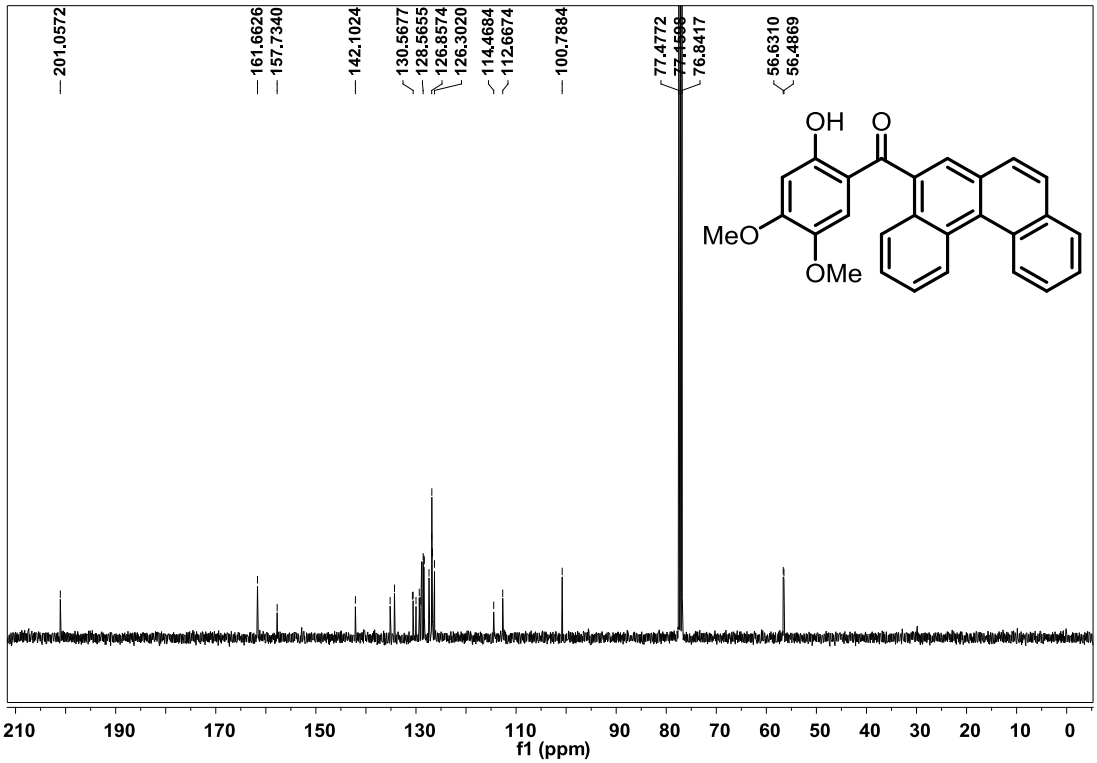


100 MHz, ^{13}C NMR in $CDCl_3$

Benzo[c]phenanthren-5-yl(2-hydroxy-4,5-dimethoxyphenyl)methano (2y)

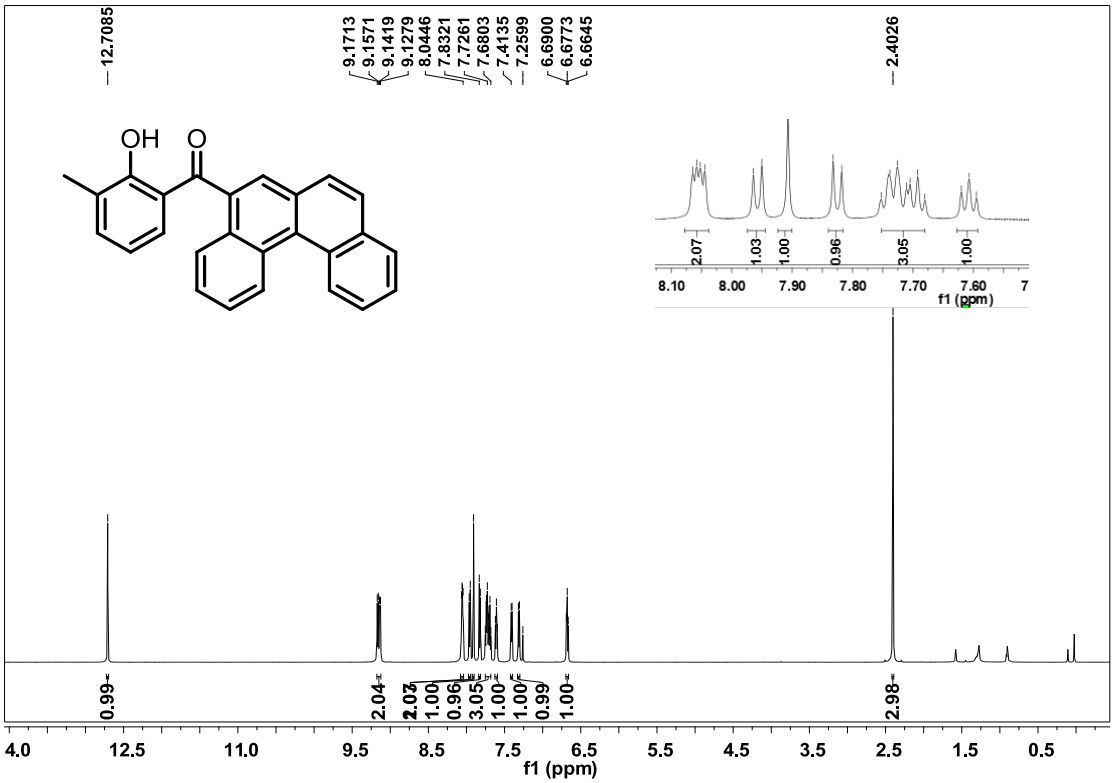


400 MHz, ^{1}H NMR in $CDCl_3$

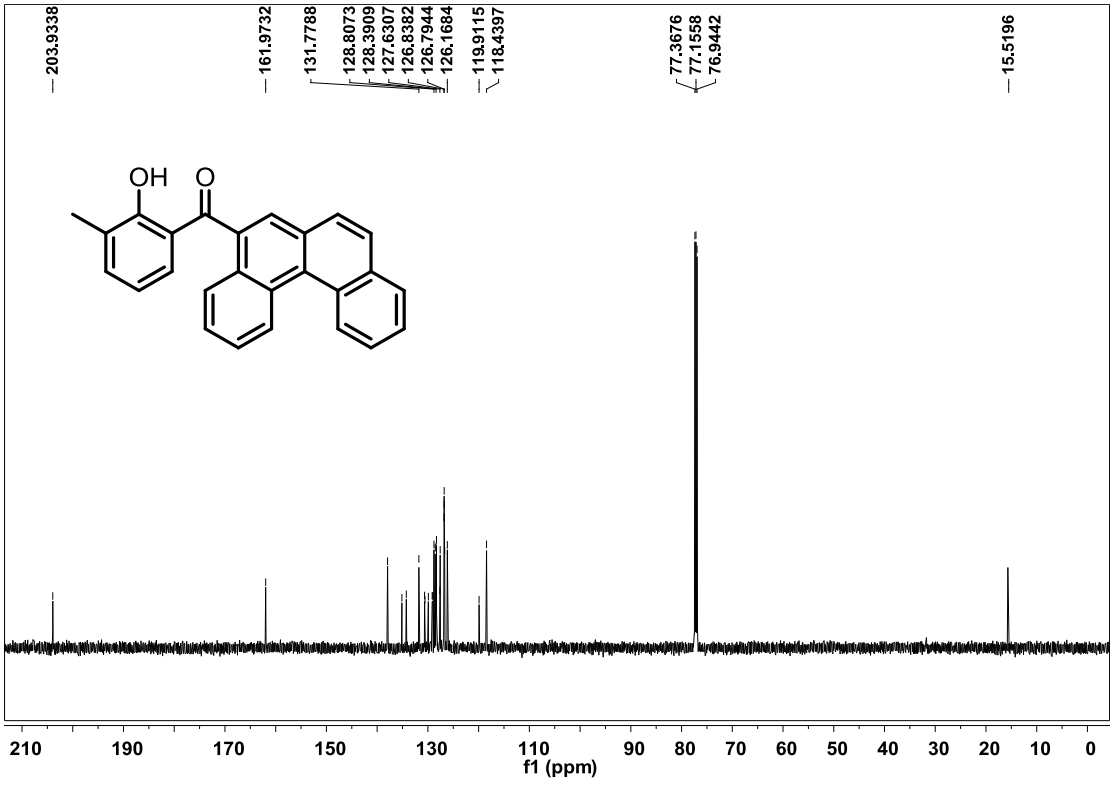


100 MHz, ^{13}C NMR in $CDCl_3$

Benzo[c]phenanthren-5-yl(2-hydroxy-3-methylphenyl)methanone (2z)

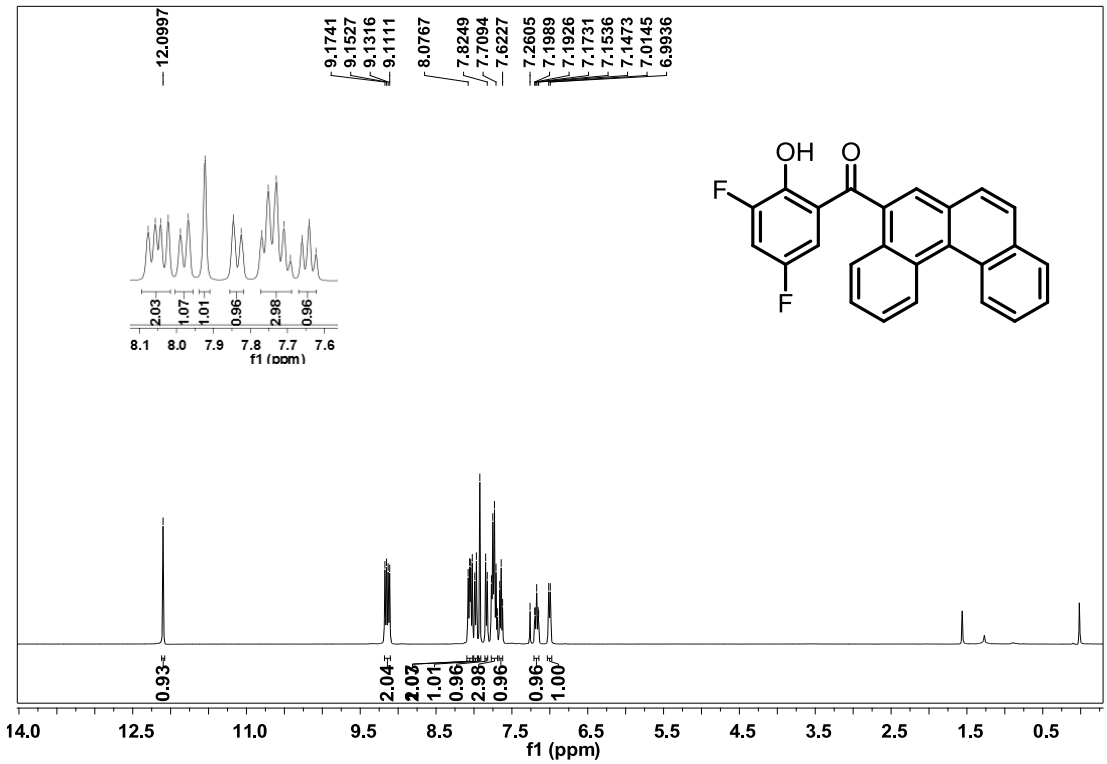


600 MHz, ^{1}H NMR in $CDCl_3$

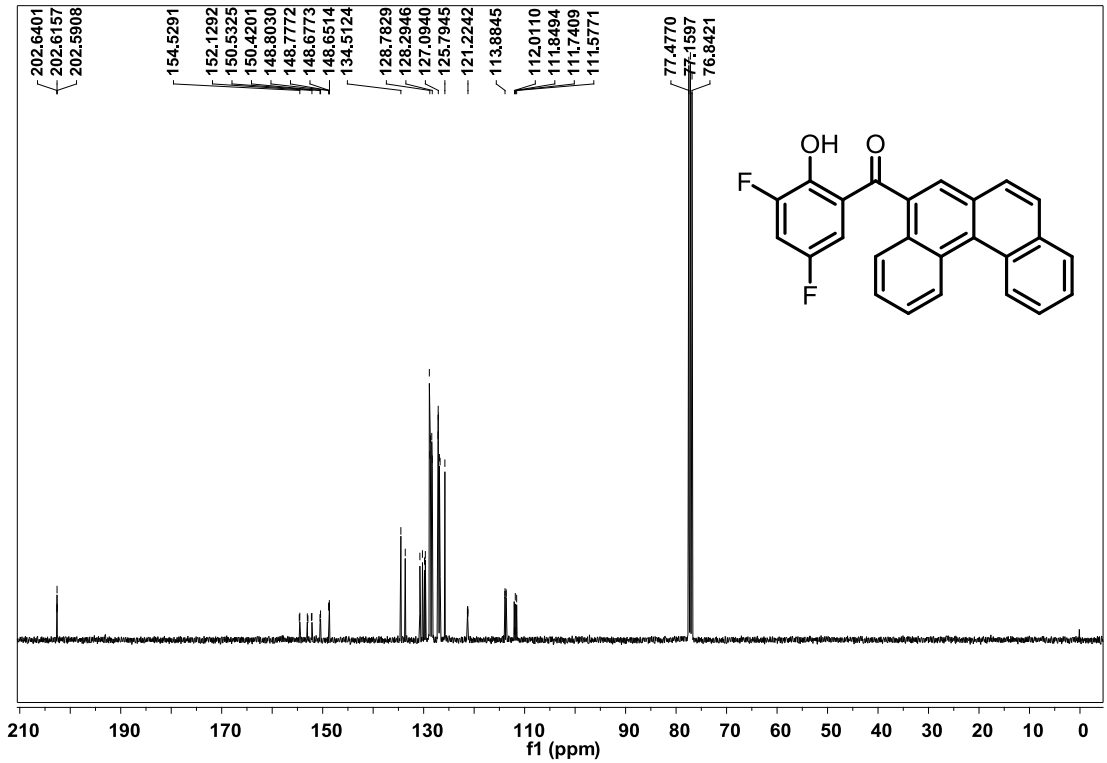


150 MHz, ^{13}C NMR in $CDCl_3$

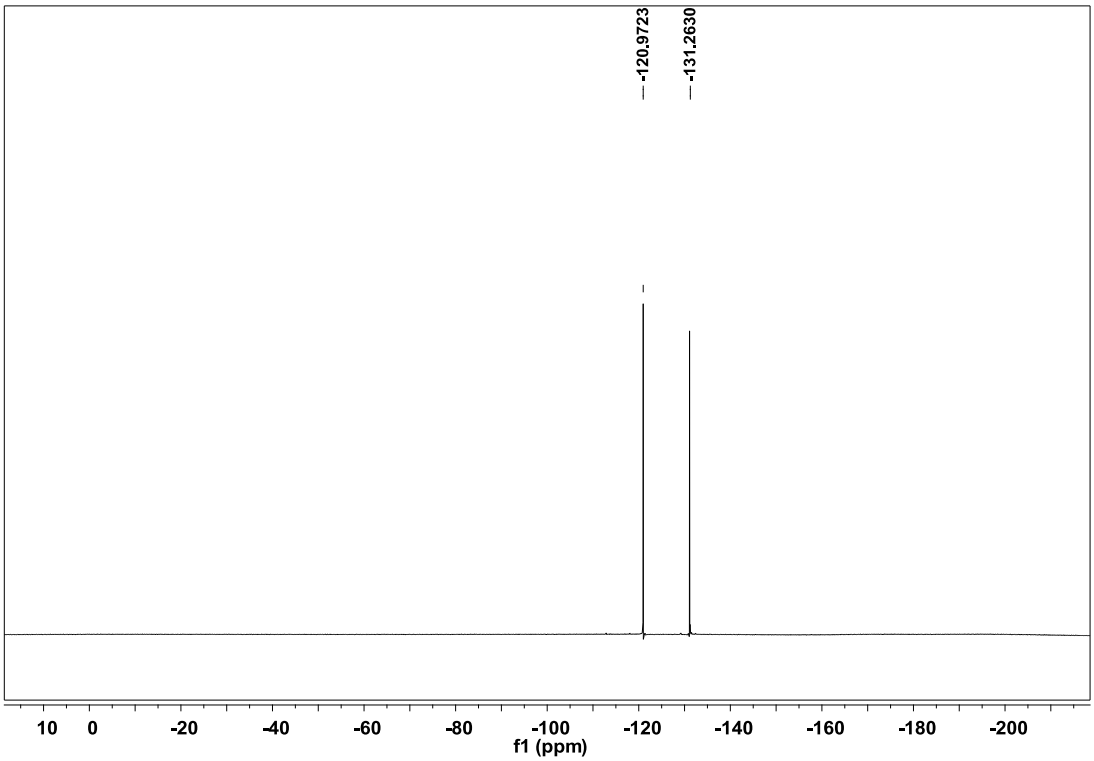
Benzo[c]phenanthren-5-yl(3,5-difluoro-2-hydroxyphenyl)methanone (2aa)



400 MHz, ^{1}H NMR in $CDCl_3$

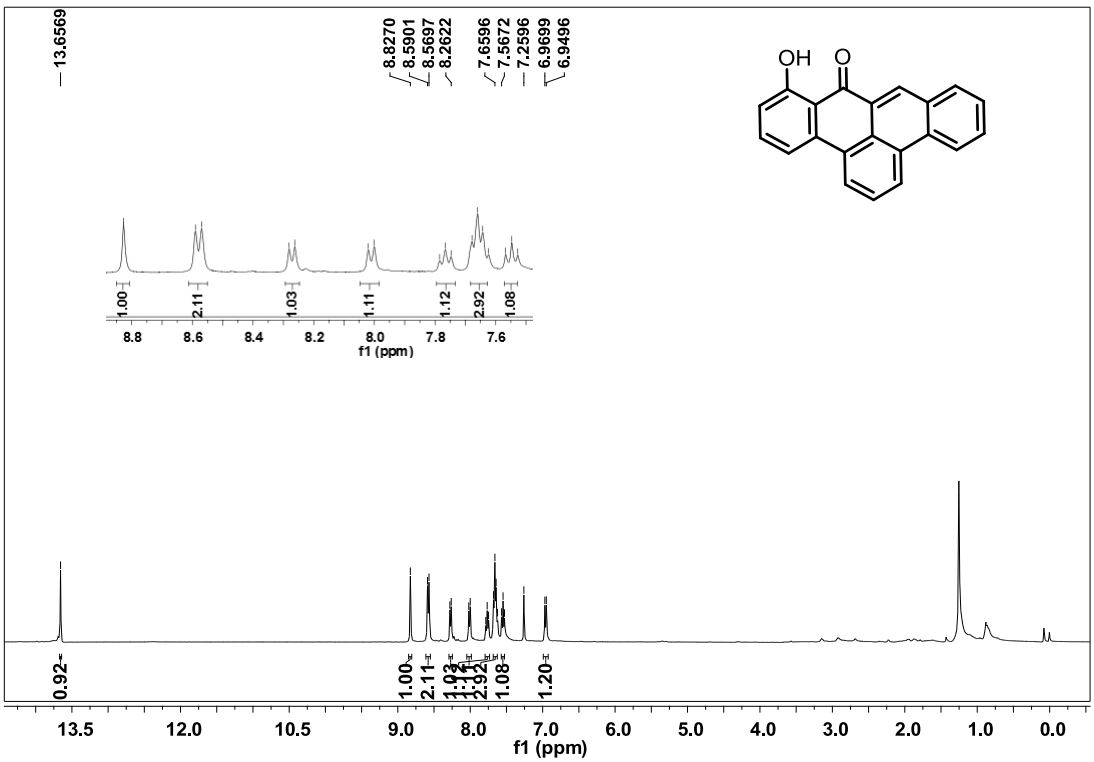


100 MHz, ^{13}C NMR in $CDCl_3$

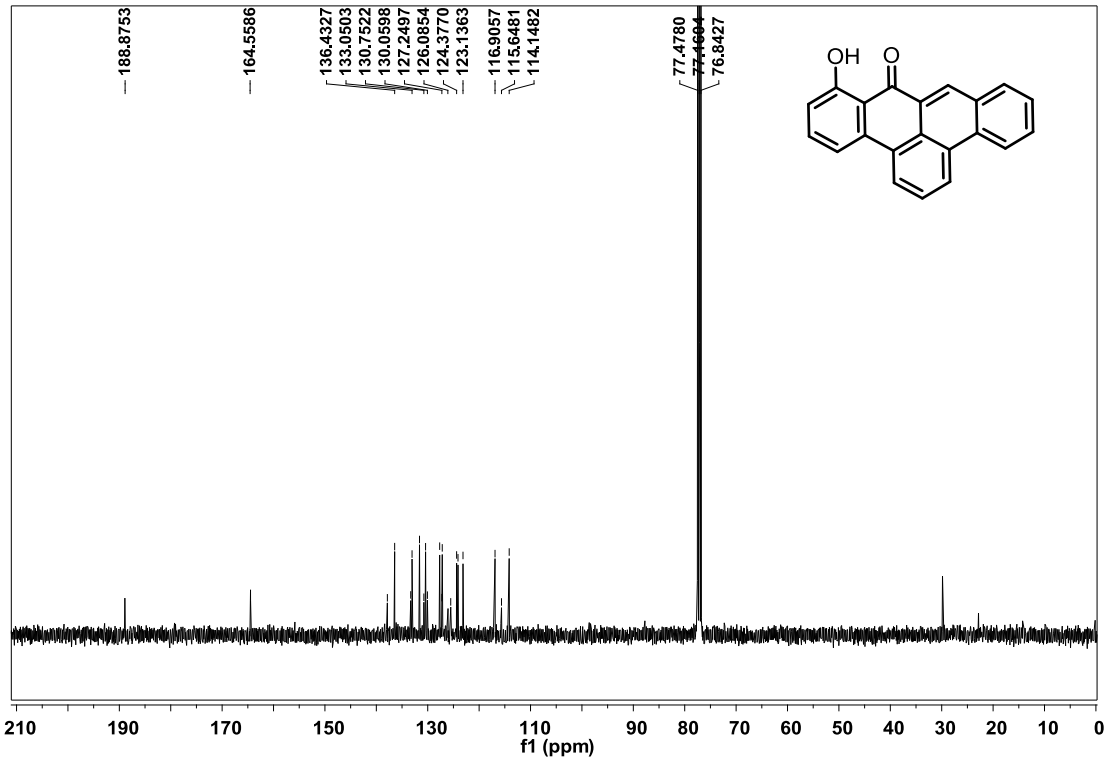


376 MHz, ^{19}F NMR in $CDCl_3$

7-Hydroxy-8*H*-benzo[fg]tetracen-8-one(3a)

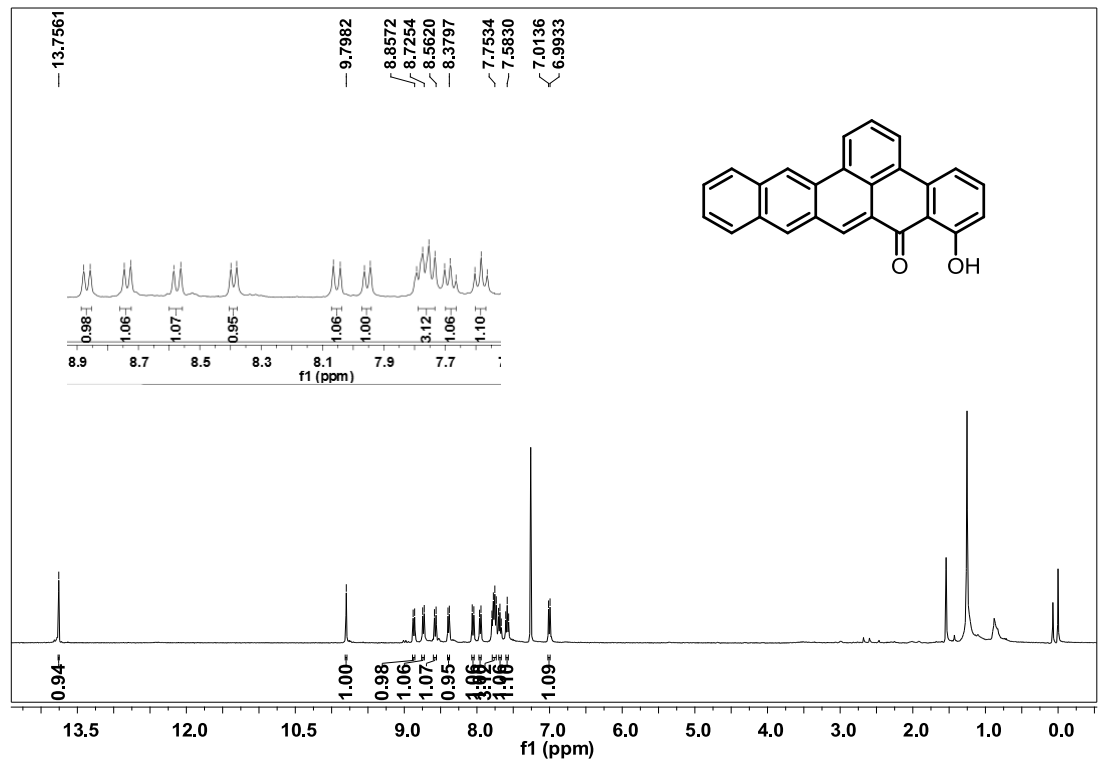


400 MHz, ^{1}H NMR in $CDCl_3$

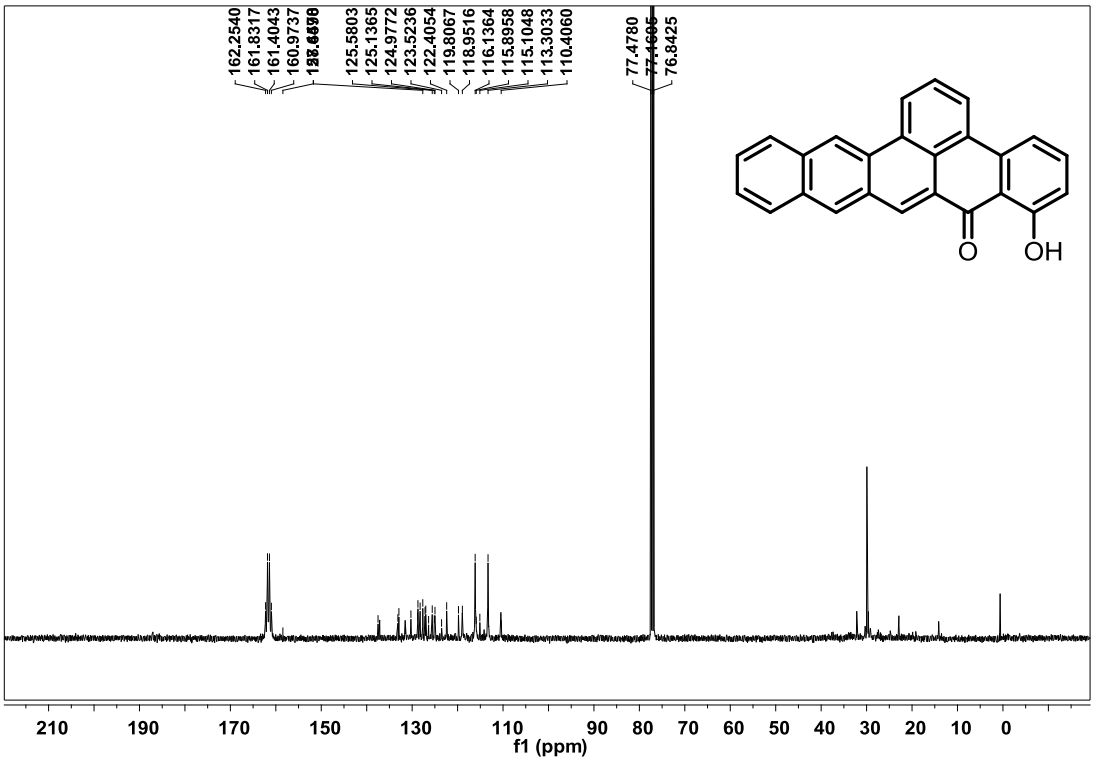


100 MHz, ^{13}C NMR in CDCl

7-hydroxy-8*H*-benzo[fg]pentacen-8-one(3b)

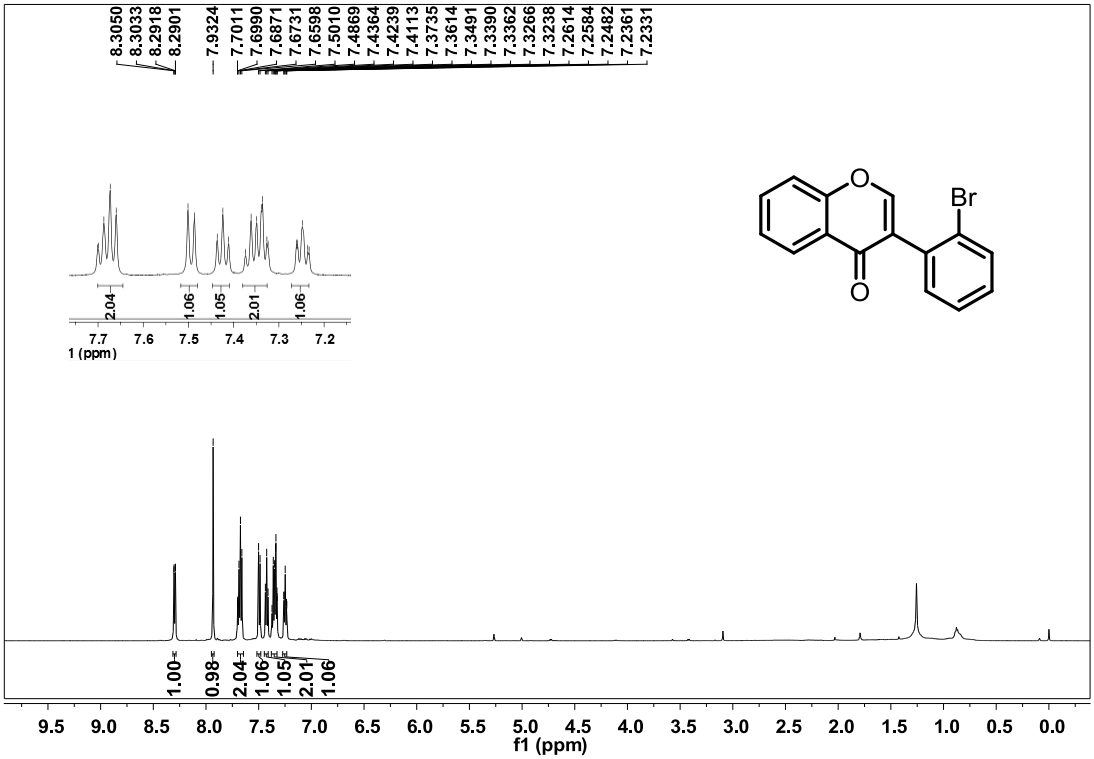


400 MHz, ^{1}H NMR in $CDCl_3$

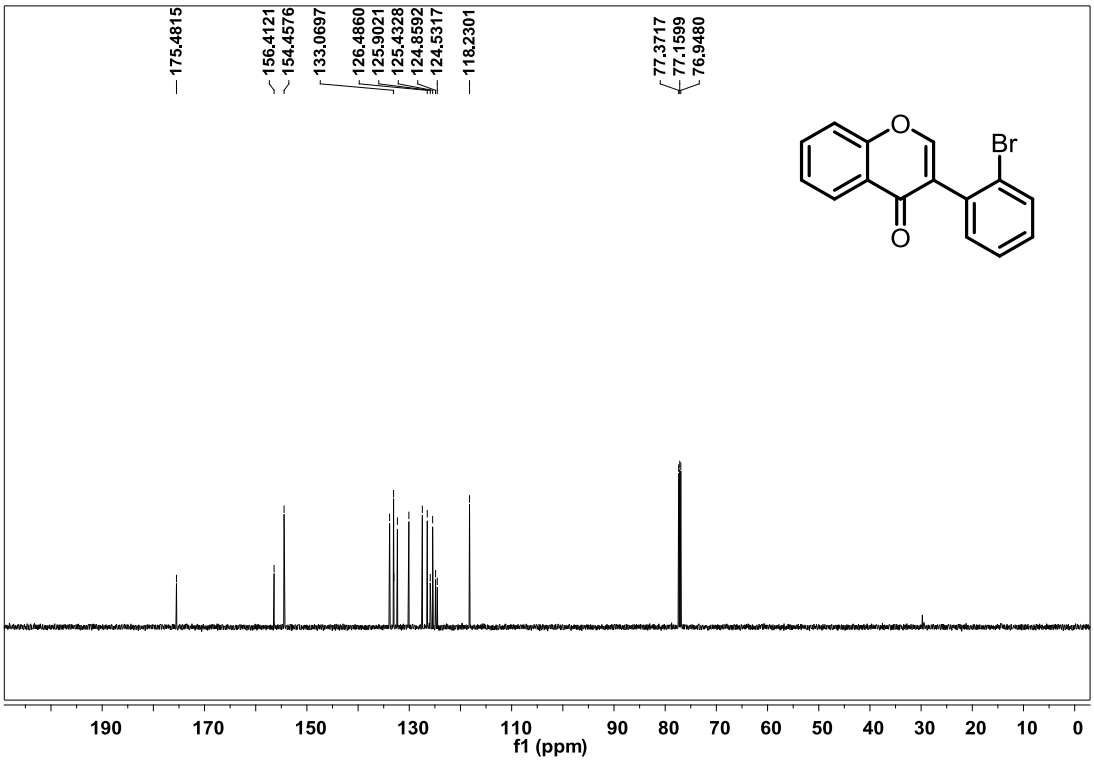


100 MHz, ^{13}C NMR in $CDCl_3$

3-(2-bromophenyl)-4H-chromen-4-one (4a)



600 MHz, ^{1}H NMR in $CDCl_3$



150 MHz, ^{13}C NMR in $CDCl_3$

5. Reference

(1) Y. Kang, T. Wang, Y. Liang, Y. Zhang, R. Wang and Z. Zhang, *RSC Adv.* 2017, **7**, 44333-44339.

(2) G. Priyadarshani and S. Amrutkar, *Eur. J. Med. Chem.* 2016, **122**, 43-54.

(3) N. S. Aleksandr and S. P.Alena, *Chem. Heterocycl. Compd.* 2017, **53**, 1103-1113.