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Supporting Information for

Synthesis of Spiroindolenine Bearing Chroman Scaffolds Based on Cyclization Reaction to *para*-Methylated Methides

Hongmei Qin,[a] Qimei Xie,[b] Long He*[a,b]

a. College of Chemistry and Materials Engineering, Guiyang University, Guiyang, 550005, P. R. China.

b. College of Chemistry and Chemical Engineering, China West Normal University, Nanchong, 637009, P. R. China.

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E-mail: longhe@cwnu.edu.cn

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Experimental Section

General Information:

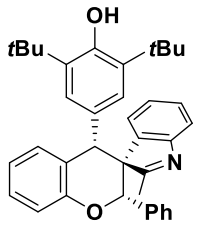
Unless otherwise noted, all the reagents were obtained from commercial supplier and used without further purification. Solvents used in the reactions were distilled from appropriate drying agents prior to use. ^{1}H NMR spectra and ^{13}C NMR spectra were recorded in $CDCl_3$ on a spectrometer operating at 400 and 100 MHz, respectively. Chemical shifts are reported in parts per million relative to the appropriate standard: TMS for ^{1}H and ^{13}C NMR spectra. IR was recorded on the Nicolet 6700. High resolution mass spectra were obtained on Bruker Daltonics micrOTOF-Q II spect-rometer in ESI mode. Flash column chromatography was performed using 200-300 mesh silica gel. *ortho*-hydroxyphenyl-substituted *para*-quinone methides **1** with aryl sulfonyl indoles **2** used here are known compounds and prepared according to the reported procedure. [1,2]

General procedure for the Oxa-Michael/1,6-Conjugated Addition Reaction:

To a solution of *ortho*-hydroxyphenyl-substituted *para*-quinone methides **1** (0.1 mmol) and aryl sulfonyl indoles **2** (0.12 mmol) in CH_3CN (2 mL) was added Cs_2CO_3 (0.3 mmol). The reaction mixture was stirred under argon atmosphere at room temperature until the reaction completed (monitored by TLC), the reaction mixture was extracted with ethyl acetate (2 × 10 mL). The combined organic layers were washed twice by saturated sodium chloride solution and then dried over anhydrous Na_2SO_4. After the removal of solvent under the reduced pressure, the residue was purified through flash column chromatography on silica gel (petroleum ether: ethyl acetate = 10:1 - 6:1) to afford the desired cyclization products **3 or 4.**

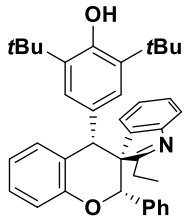
Spectra data for compounds 3-4

2,6-di-tert-butyl-4-(2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol



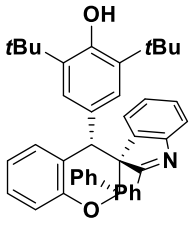
(3a), (petroleum ether/ethyl acetate = 10:1), 49.5 mg, yield: 94%, white solid, mp 199-200 ℃, dr >19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.37 (d, *J* = 7.45 Hz, 1H), 7.30-7.26 (m, 1H), 7.24-7.22 (m, 1H), 7.16-7.11 (m, 3H), 7.09-7.03 (m, 3H), 6.91-6.87 (m, 3H), 6.78 (d, *J* = 7.71 Hz, 1H), 5.97 (brs, 1H), 5.69 (s, 1H), 4.97 (s, 1H), 4.93 (s, 1H), 2.39 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.7, 156.1, 155.0, 152.9, 130.1, 128.8, 128.4, 128.3, 127.7, 127.1, 126.9, 126.0, 124.9, 124.5, 121.2, 119.8, 116.3, 82.6, 65.1, 50.3, 34.0, 30.2, 17.8; **IR (KBr):** γ 3435, 2954, 1625, 1484, 1435, 1376, 1230, 1050, 875, 769, 702; **HRMS (ESI):** calcd for $C_{37}H_{39}NO_2$ $[M+H]^+$: 530.3053, found: 530.3051.

2,6-di-tert-butyl-4-(2'-ethyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (3b),



(petroleum ether/ethyl acetate= 10:1), 45.6 mg, yield: 84%, white solid, mp 200-201 ℃, dr > 19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.38 (d, *J* = 7.47Hz, 1H), 7.29-7.24 (m, 2H), 7.21-7.12 (m, 3H), 7.08-7.02 (m, 3H), 6.90-6.84 (m, 4H), 6.77 (d, *J* = 7.71 Hz, 1H), 5.95 (brs, 1H), 5.68 (s, 1H), 4.98 (s, 1H), 4.93 (s, 1H), 2.88-2.62 (m, 2H), 1.38 (s, 9H), 1.20-1.17 (m, 3H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 183.9, 156.2, 155.0, 153.0, 136.5, 135.7, 130.1, 128.9, 128.4, 128.3, 127.8, 127.2, 127.1, 126.0, 124.8, 124.8, 121.1, 120.0, 116.3, 83.0, 65.0, 50.7, 34.0, 30.1, 24.1, 9.8; **IR (KBr):** γ 3434, 2955, 1622, 1453, 1384, 1231, 1058, 763, 763, 700, 603; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_2$ $[M+H]^+$:544.3210, found: 544.3214.

2,6-di-tert-butyl-4-(2,2'-diphenylspiro[chromane-3,3'-indol]-4-yl)phenol (3c),

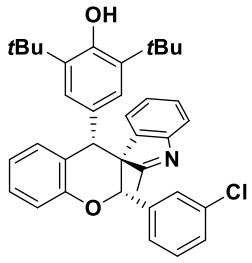


(petroleum ether/ethyl acetate= 10:1), 54.9 mg, yield: 93%, white solid, mp 218-219 ℃, dr > 19:1, **^{1}H NMR 600 MHz, $CDCl_3$):** δ (ppm) 8.20 (d, *J* = 6.26 Hz, 2H), 7.57-7.52 (m, 2H), 7.47 (d, *J* = 7.45 Hz, 1H), 7.33-7.30 (m, 1H), 7.23 (d, *J* = 7.44 Hz, 1H), 7.20-7.14 (m, 3H), 7.02-6.99 (m, 1H), 6.93 (d, *J* = 4.32 Hz, 2H), 6.91-6.88 (m, 2H), 6.84 (d, *J* = 7.80 Hz, 2H), 6.39 (s, 1H), 6.28 (brs, 1H), 6.03 (brs, 1H), 5.42 (s, 1H), 4.83 (s, 1H), 1.04 (s, 9H), 0.94 (s, 9H); **^{13}CNMR (150 MHz, $CDCl_3$):** δ (ppm) 175.9, 155.4, 155.3, 152.6, 137.6, 135.7, 134.4, 130.5, 130.2, 128.8, 128.3, 128.3, 128.1,

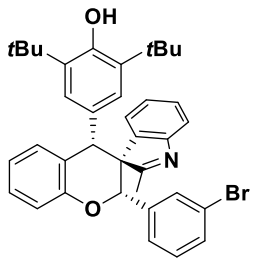
127.3, 126.8, 126.6, 126.5, 125.2, 124.4, 121.3, 120.7, 116.7, 81.4, 66.6, 50.2, 33.8, 29.9; **IR (KBr):** γ 3436, 2955, 2921, 2860, 1630, 1443, 1385, 1234, 1114, 1027, 762, 700; **HRMS (ESI):** calcd for $C_{42}H_{41}NO_2$ $[M+H]^+$: 592.3210, found: 592.3212.

2,6-di-tert-butyl-4-(2-(2-chlorophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl) phenol (3d), (petroleum ether/ethyl acetate= 10:1), 42.8 mg, yield: 76%, white solid, mp 223-224 ℃, dr > 19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.35-7.26 (m, 2H), 7.17-7.12 (m, 3H), 7.10-7.07 (m, 2H), 6.99-6.96 (m, 2H), 6.93-6.89 (m, 1H), 6.85-6.84 (m, 1H), 6.79-6.76 (m, 2H), 5.97 (brs, 1H), 5.65 (s, 1H), 4.98 (s, 1H), 4.91 (s, 1H), 2.39 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.3, 156.0, 154.6, 153.0, 137.5, 135.9, 133.5, 130.1, 128.9, 128.6, 128.4, 127.2, 126.9, 125.9, 125.1, 125.0, 124.3, 121.4, 120.0, 116.3, 81.8, 65.1, 50.0, 34.0, 30.1, 17.7; **IR (KBr):** γ 3436, 2956, 1628, 1435, 1382, 1231, 1116, 1054, 860, 772, 701; **HRMS (ESI):** calcd for $C_{37}H_{38}ClNO_2$ $[M+H]^+$: 564.2664, found: 564.2661.

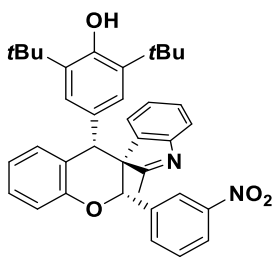
4-(2-(2-bromophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl)-2,6-di-tert-butyl phenol (3e), (petroleum ether/ethyl acetate= 7:1), 48 mg, yield: 79%, white solid, mp 210-211 ℃, dr > 19:1, **^{1}H NMR (600 MHz, $CDCl_3$):** δ (ppm) 7.51-7.49 (m, 1H), 7.39 (d, *J* = 7.52 Hz, 1H), 7.32-7.26 (m, 2H), 7.21 (d, *J* = 7.62 Hz, 1H), 7.18-7.15 (m, 1H), 7.07- 6.98 (m, 3H), 6.92-6.89 (m, 1H), 6.84-6.79 (m, 2H), 6.36-6.32 (m, 2H), 5.95 (brs, 1H), 5.03 (s, 1H), 4.97 (s, 1H), 2.41 (s, 3H), 1.39 (s, 9H), 0.94 (s, 9H); **^{13}C NMR (150 MHz, $CDCl_3$):** δ (ppm) 180.4, 156.2, 155.5, 153.0, 136.8, 134.8, 132.9, 130.5, 130.4, 128.6, 128.3, 127.4, 126.8, 126.1, 125.1, 124.6, 124.1, 121.3, 120.0, 116.4, 80.4, 64.7, 51.7, 34.0, 30.2, 18.1; **IR (KBr):** γ 3433, 2953, 1622, 1436, 1380, 1230, 1115, 882, 764, 730; **HRMS (ESI):** calcd for $C_{37}H_{38}BrNO_2$ $[M+H]^+$:608.2159, found: 608.2156.

2,6-di-tert-butyl-4-(2-(3-chlorophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl) phenol (3f), 

(petroleum ether/ethyl acetate= 8:1), 51 mg, yield: 91%, white solid, mp 226-227 ℃, dr = 10:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.35-7.30 (m, 1H), 7.29-7.26 (m, 1H), 7.17-7.12 (m, 3H), 7.10-7.07 (m, 2H), 6.99-6.96 (m, 2H), 6.93-6.89 (m, 1H), 6.85-6.84 (m, 1H), 6.79-6.76 (m, 2H), 5.98 (brs, 1H), 5.65 (s, 1H), 4.98 (s, 1H), 4.91 (s, 1H), 2.39 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.3, 156.0, 154.6, 153.0, 137.5, 130.1, 128.9, 128.6, 128.4, 127.2, 126.9, 125.9, 125.1, 125.0, 124.3, 121.4, 120.0, 116.3, 81.8, 65.1, 50.0, 34.0, 30.1, 17.7; **IR (KBr):** γ 3431, 2924, 2856, 1627, 1434, 1382, 1232, 1052, 772, 702; **HRMS (ESI):** calcd for $C_{37}H_{38}ClNO_2$ $[M+H]^+$:564.2664, found: 564.2667.

4-(2-(3-bromophenyl)-2'-methylspiro[chromane-3,3'-8indol]-4-yl)-2,6-di-tert-but ylphenol (3g), 

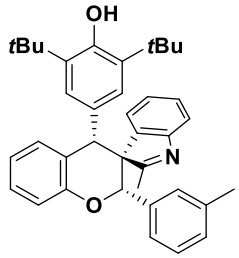
(petroleum ether/ethyl acetate= 10:1), 54 mg, yield: 89%, white solid, mp 234-235 ℃, dr = 11:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.34-7.30 (m, 1H), 7.28-7.24 (m, 3H), 7.16-7.13 (m, 2H), 7.07 (d, *J* = 8.06 Hz, 1H), 7.00 (s, 1H), 6.93-6.89 (m, 3H), 6.82-6.77 (m, 2H), 5.99 (brs, 1H), 5.63 (s, 1H), 4.98 (s, 1H), 4.90 (s, 3H), 2,39 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.2, 155.0, 154.7, 153.0, 137.8, 135.9, 131.8, 130.2, 130.1, 129.1, 128.6, 128.4, 126.9, 125.9, 125.4, 125.0, 124.3, 121.7, 121.4, 120.0, 116.3, 81.7, 65.1, 49.9, 34.0, 30.1, 17.7; **IR (KBr):** γ 3434, 2955, 1629, 1434, 1383, 1232, 1052, 762; **HRMS (ESI):** calcd for $C_{37}H_{38}BrNO_2$ $[M+H]^+$: 608.2159, found: 608.2162.

2,6-di-tert-butyl-4-(2'-methyl-2-(3-nitrophenyl)spiro[chromane-3,3'-indol]-4-yl)p henol (3h), 

(petroleum ether/ethyl acetate= 7:1), 47mg, yield: 82%, white solid, mp 222-223 ℃, dr = 15:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.99-7.69 (m, 1H), 7.81 (s, 1H), 7.38-7.28 (m, 2H), 7.24-7.21 (m, 2H), 7.19-7.16 (m, 2H), 7.11-7.06 (m, 2H), 6.99-6.91 (m, 2H), 6.80 (d, *J* = 7.74 Hz, 1H), 5.98 (brs, 1H), 5.79 (s, 1H), 5.11 (s, 1H), 4.93 (s, 1H), 2.45 (s, 3H), 1.38 (s, 9H), 0.89 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.1,

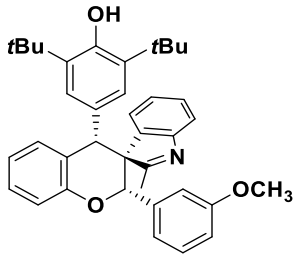
155.7, 154.2, 153.1, 147.3, 137.6, 135.4, 132,7, 130.1, 128.9, 128.6, 128.6, 126.7, 125.9, 125.3, 124.2, 123.6, 122.0, 121.7, 120.0, 116.2, 81.0, 65.1, 49.5, 34.0, 30.0, 17.9; **IR (KBr):** γ 3438, 2955, 2923, 2858, 1626, 1532, 1437, 1351, 1234, 1055, 804, 757, 715; **HRMS (ESI):** calcd for $C_{37}H_{38}N_2O_4$ $[M+H]^+$: 575.2904, found: 575.2909.

2,6-di-tert-butyl-4-(2'-methyl-2-(m-tolyl)spiro[chromane-3,3'-indol]-4-yl)phenol



(3i), (petroleum ether/ethyl acetate= 7:1), 43.8 mg, yield: 81%, white solid, mp 228-230 ℃, dr = 9:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.38-7.36 (m ,1H), 7.29-7.26 (m, 1H), 7.24-7.22 (m, 1H), 7.15-7.12 (m, 2H), 7.09-7.07 (m, 1H), 6.96-6.92 (m, 3H), 6.91-6.87 (m, 1H), 6.78 (d, *J* = 7.74 Hz, 1H), 6.68-6.66 (m, 1H), 6.62 (s, 1H), 5.99 (brs, 1H), 5.64 (m, 1H), 4.96 (s, 1H), 4.92 (s, 1H), 2.37 (s, 3H), 2.09 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.8, 156.1, 155.1, 152.9, 137.3, 136.5, 135.4, 130.1, 129.6, 128.3, 127.7, 127.6, 127.2, 126.0, 124.8, 124.5, 124.1, 121.1, 119.7, 116.3, 82.8, 65.1, 50.3, 34.0, 30.1, 21.2, 17.7; **IR (KBr):** γ 3434, 2953, 1580, 1434, 1374, 1231, 1116, 1052, 836, 773, 713; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_2$ $[M+H]^+$: 544.3210, found: 544.3213.

2,6-di-tert-butyl-4-(2-(3-methoxyphenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl)phenol



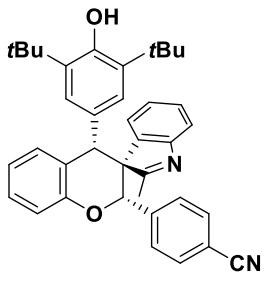
(3j), (petroleum ether/ethyl acetate= 10:1), 52.9 mg, yield: 95%, white solid, mp 221-222 ℃, dr > 19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.39 (d, *J* = 7.38 Hz, 1H), 7.29 (d, 1H), 7.17-7.13(m, 2H), 7.09 (d, *J* = 7.71 Hz, 1H), 7.04-6.96 (m, 2H), 6.92-6.88 (m, 1H), 6.79 (d, *J* = 7.71 Hz, 1H), 6.71-6.69 (m, 1H), 6.62 (d, *J* = 7.60 Hz, 1H), 6.24 (s, 1H) ,5.97 (brs, 1H), 5.66 (s, 1H), 4.98 (s, 1H), 4.93 (s, 1H), 3.38 (s, 3H), 2.37 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.9, 158.8, 156.2, 155.0, 152.9, 136.9, 136.6, 130.2, 128.6, 128.3, 127.1, 126.0, 124.8, 124.5, 121.2, 119.9, 119.6, 116.3, 115.7, 111.2, 82.5, 65.1, 54.8, 50.4, 34.0, 30.3, 17.7; **IR (KBr):** γ 3433, 2953, 1604, 1434, 1375, 1232, 1161, 1645, 863, 777, 661; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_3$ $[M+H]^+$: 560.3108, found: 560.3104.

2,6-di-tert-butyl-4-(2-(4-fluorophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl) phenol (3k), (petroleum ether/ethyl acetate= 8:1), 52.1mg, yield: 95%, white solid, mp 224-225 ℃, dr > 19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.35-7.33 (m, 1H), 7.30-7.23 (m, 2H), 7.15-7.12 (m, 2H), 7.08-6.97 (m, 2H), 6.92-6.84 (m, 3H), 6.79-6.71 (m, 3H), 5.97 (brs, 1H), 5.68 (s, 1H), 4.99 (s, 1H), 4.91 (s, 1H), 2.39 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.5, 164.0, 161.5, 156.0, 154.8, 153.0, 136.1, 131.6, 131.5, 130.1, 128.7, 128.6, 128.5, 128.4, 127.0, 125.9, 124.9, 124.4, 119.9, 116.2, 114.8, 114.5, 81.8, 65.2, 50.1, 34.0, 30.1, 17.7; **IR (KBr):** γ 3433, 2956, 1607, 1512, 1435, 1377, 1228, 1157, 1052, 839, 768, 657; **HRMS (ESI):** calcd for $C_{37}H_{38}FNO_2$ $[M+H]^+$: 548.2959, found: 548.2956.

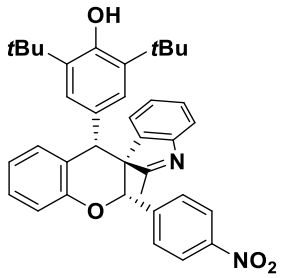
2,6-di-tert-butyl-4-(2-(4-chlorophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl) phenol (3l), (petroleum ether/ethyl acetate= 8:1), 51.2 mg, yield: 91%, white solid, mp 209-210 ℃, dr = 8:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.35-7.26 (m, 2H), 7.25-7.23 (m, 1H), 7.15-7.11 (m, 2H), 7.08-7.06 (m, 1H), 7.03-6.96 (m, 3H), 6.92-6.88 (m, 1H), 6.83-6.77 (m, 3H), 5.96 (brs, 1H), 5.67 (s, 1H), 4.99 (s, 1H), 4.91 (s, 1H), 2.39 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.4, 156.0, 154.7, 153.0, 136.0, 134.6, 134.1, 130.1, 128.5, 128.4, 128.2, 127.9, 126.9, 125.9, 125.0, 124.4, 121.4, 120.0, 116.2, 81.8, 65.1, 50.0, 34.0, 30.0, 17.7; **IR (KBr):** γ 3431, 2956, 2924, 2858, 1627, 1436, 1381, 1231, 1114, 1052, 802, 766; **HRMS (ESI):** calcd for $C_{37}H_{38}ClNO_2$ $[M+H]^+$: 564.2664, found: 564.2668.

4-(2-(4-bromophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl)-2,6-di-tert-butyl phenol (3m), (petroleum ether/ethyl acetate= 8:1), 56.2 mg, yield: 93%, white solid, mp 230-231 ℃, dr = >19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.37-7.33 (m, 1H), 7.31-7.26 (m, 2H), 7.21-7.14 (m, 4H), 7.09 (d, *J* = 7.70 Hz, 1H), 6.99-6.91 (m, 2H), 6.82-6.77 (m, 3H), 5.99 (brs, 1H), 5.68 (s, 1H), 5.04 (s, 1H), 4.93 (s, 1H), 2.42 (s, 3H), 1.42 (s, 9H), 0.94 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.3, 156.0, 154.7, 153.0, 136.0, 134.7, 130.8, 130.1, 128.5, 128.5, 128.4, 126.9, 125.9, 125.0, 124.4, 122.9, 121.4, 120.0, 116.2, 81.8, 65.0,

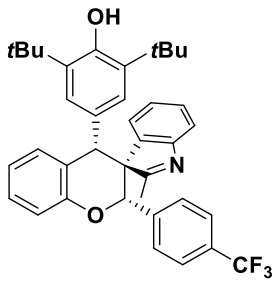
50.0, 34.0, 30.1, 17.7; **IR (KBr):** γ 3436, 2957, 1581, 1484, 1436, 1231, 1113, 1052, 877, 766, 658; **HRMS (ESI):** calcd for $C_{37}H_{38}BrNO_2$ $[M+H]^+$: 608.2159, found: 608.2163.

4-(4-(3,5-di-tert-butyl-4-hydroxyphenyl)-2'-methylspiro[chromane-3,3'-indol]-2-yl)benzonitrile (3n), 

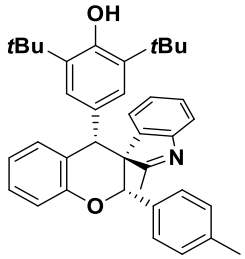
(petroleum ether/ethyl acetate= 7:1), 52.6 mg, yield: 95%, white solid, mp 231-232 ℃, dr > 19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.34-7.28 (m, 4H), 7.24-7.22 (m, 1H), 7.16-7.12 (m, 2H), 7.10-7.07 (m, 2H), 7.30 (d, *J* = 8.37 Hz, 2H), 6.94-6.90 (m, 1H), 6.79 (d, *J* = 7.77 Hz, 1H), 5.97 (brs, 1H), 5.74 (s, 1H), 5.01 (s, 1H), 4.92 (s, 1H), 2.44 (s, 3H), 1.39 (s, 9H), 0.91 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.0, 155.8, 154.3, 153.1, 140.7, 135.6, 131.3, 130.1, 128.7, 128.5, 127.5, 126.6, 125.8, 125.1, 124.2, 121.6, 120.1, 118.3, 116.2, 112.4, 81.4, 65.1, 49.6, 34.0, 30.1, 17.9; **IR (KBr):** γ 3433, 2957, 2875, 2231, 1616, 1435, 1382, 1232, 1114, 1057, 805, 761, 694; **HRMS (ESI):** calcd for $C_{38}H_{38}N_2O_2$ $[M+H]^+$: 555.3006, found: 555.3002.

2,6-di-tert-butyl-4-(2'-methyl-2-(4-nitrophenyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3o), 

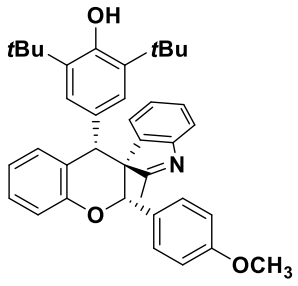
(petroleum ether/ethyl acetate= 10:1), 55.1 mg, yield: 96%, white solid, mp 243-244 ℃, dr > 19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.91-7.89 (m, 2H), 7.34-7.29 (m, 2H), 7.25-7.23 (m, 1H), 7.17-7.13 (m, 1H), 7.12-7.08 (m, 4H), 6.99-6.92 (m, 2H), 6.80 (d, *J* = 7.74 Hz, 1H), 5.98 (brs, 1H), 5.81 (s, 1H), 4.99 (s, 1H), 4.94 (s, 1H), 2.46 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 178.9, 155.8, 154.2, 153.1, 147.8, 142.6, 135.5, 130.1, 128.8, 127.7, 126.6, 125.8, 125.2, 124.2, 122.7, 121.7, 120.1, 116.2, 81.1, 65.1, 49.6, 34.0, 30.0, 17.9; **IR (KBr):** γ 3435, 2958, 1607, 1526, 1435, 1346, 1231, 1057, 860, 761, 708; **HRMS (ESI):** calcd for $C_{37}H_{38}N_2O_4$ $[M+H]^+$: 575.2904, found: 575.2907.

2,6-di-tert-butyl-4-(2'-methyl-2-(4-(trifluoromethyl)phenyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3p), 

(petroleum ether/ethyl acetate= 10:1), 56.6 mg, yield: 95%, white solid, mp 216-217℃, dr >19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.25-7.22 (m, 1H), 7.18-7.16 (m, 1H), 7.14-7.04 (m, 7H), 6.91 (d, *J* = 8.66 Hz, 1H), 6.69 (d, *J* = 2.33 Hz, 1H), 6.57-6.53 (m, 2H), 6.15 (brs, 1H), 5.67 (s, 1H), 5.01 (s, 1H), 4.99 (s, 1H), 3.85 (s, 3H), 1.39 (s, 9H), 0.99 (s, 9H). **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 175.9, 159.9, 155.7, 153.2, 153.0, 135.3, 135.1, 130.9, 128.9, 128.7, 127.8, 127.3, 126.9, 126.8, 124.6, 124.6, 123.6, 115.1, 110.0, 108.6, 101.2, 81.8, 57.9, 55.3, 55.3, 34.0, 30.1; **IR (KBr):** γ 3436, 2959, 1626, 1435, 1382, 1326, 1232, 1127, 1068, 764; **HRMS (ESI):** calcd for $C_{38}H_{38}F_3NO_2$ $[M+H]^+$: 598.2927, found: 598.2924.

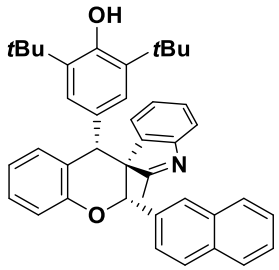
2,6-di-tert-butyl-4-(2'-methyl-2-(p-tolyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3q), 

(petroleum ether/ethyl acetate= 10:1), 49.3 mg, yield: 91%, white solid, mp 225-226 ℃, dr > 19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.37 (d, *J* = 7.04 Hz, 1H), 7.28 (d, 1H), 7.24 (s, 1H), 7.16-7.12 (m, 2H), 7.07 (d, *J* = 7.60 Hz, 1H), 6.97 (s, 1H), 6.91-6.84 (m, 3H), 6.78-6.74 (m, 3H), 5.96 (brs, 1H), 5.66 (s, 1H), 4.97 (s, 1H), 4.92 (s, 1H), 2.38 (s, 1H), 2.19 (s, 3H), 1.39 (s, 9H), 0.91 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.9, 156.1, 155.1, 152.9, 138.6, 136.5, 132.6, 130.1, 128.5, 128.3, 128.3, 172.2, 126.8, 126.0, 124.9, 124.5, 121.1, 119.7, 116.3, 82.6, 65.1, 50.4, 34.0, 30.0, 21.1, 17.7; **IR (KBr):** γ 3430, 2968, 1633, 1435, 1382, 1232, 1050, 880, 769, 659; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_2$ $[M+K]^+$: 582.3120, found: 582.3118.

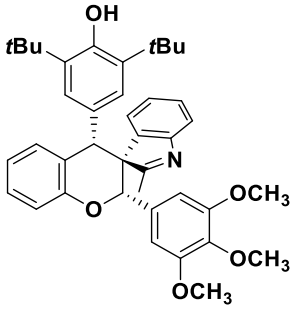
2,6-di-tert-butyl-4-(2-(4-methoxyphenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl)phenol (3r), 

(petroleum ether/ethyl acetate= 8:1), 48.6 mg, yield: 87%, white solid, mp 221-222℃, dr = 9:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.36 (d, *J* = 7.38 Hz, 1H), 7.29-7.24 (m, 2H), 7.16-7.12 (m, 2H), 7.08-7.06 (m, 1H), 6.97-6.87 (m, 2H), 6.79-6.77 (m, 3H), 6.57 (d, *J* = 8.72 Hz, 2H), 5.96 (brs, 1H), 5.64 (s, 1H), 4.97 (s, 1H), 4.91 (s, 1H), 3.67 (s, 3H), 2.37 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.9, 159.8, 156.1, 155.1, 152.9, 136.5, 130.1, 128.3, 128.3, 128.2, 127.8,

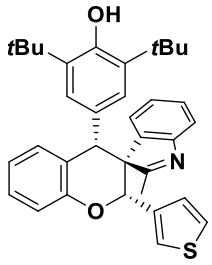
127.2, 126.0, 124.5, 121.1, 119.8, 116.3, 113.2, 82.3, 65.1, 55.0, 50.4, 34.0, 30.0, 17.7; **IR (KBr):** γ 3434, 2957, 1612, 1515, 1436, 1376, 1230, 1178, 1044, 835, 766, 606; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_3$ $[M+H]^+$: 560.3159, found: 560.3162.

2,6-di-tert-butyl-4-(2'-methyl-2-(naphthalen-2-yl)spiro[chromane-3,3'-indol]-4-yl)phenol (3s), 

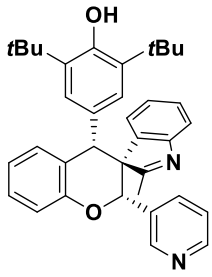
(petroleum ether/ethyl acetate= 7:1), 49.8 mg, yield: 86%, white solid, mp 222-223 ℃, dr = 7:1, **^{1}H NMR (600 MHz, $CDCl_3$):** δ (ppm) 7.66-7.64 (m, 1H), 7.58-7.56 (m, 1H), 7.48-7.43 (m, 2H), 7.39-7.34 (m, 3H), 7.30-7.22 (m, 1H), 7.25-7.23 (m, 1H), 7.19-7.15 (m, 1H), 7.11-7.05 (m, 2H), 6.98-6.88 (m, 3H), 6.81 (d, *J* = 7.67 Hz, 1H), 5.99 (brs, 1H), 5.82 (s, 1H), 4.99 (s, 1H), 4.95 (s, 1H), 2.39 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (150 MHz, $CDCl_3$):** δ (ppm) 179.6, 156.1, 155.1, 153.0, 136.5, 133.5, 133.2, 132.6, 130.2, 128.4, 128.4, 128.1, 127.4, 127.4, 127.1, 126.7, 126.2, 126.1, 125.9, 124.9, 124.6, 124.4, 121.2, 119.9, 116.4, 82.8, 65.2, 50.4, 34.0, 30.2, 17.7; **IR (KBr):** γ 3433, 2955, 2922, 2860, 1580, 1454, 1381, 1230, 1158, 1053, 817, 753, 661; **HRMS (ESI):** calcd for $C_{41}H_{41}NO_2$ $[M+H]^+$: 580.3210, found: 580.3213.

2,6-di-tert-butyl-4-(2'-methyl-2-(3,4,5-trimethoxyphenyl)spiro[chromane-3,3'-ind ol]-4-yl)phenol (3t), 

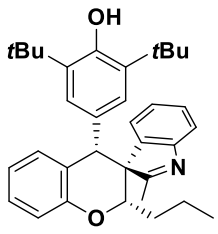
(petroleum ether/ethyl acetate= 3:1), 60.5 mg, yield: 98%, white solid, mp 168-169℃, dr = 8:1, **^{1}H NMR (600 MHz, $CDCl_3$):** δ (ppm) 7.38 (d, *J* = 7.44 Hz, 1H), 7.29-7.23 (m, 2H), 7.19 -7.13 (m, 2H), 7.09-7.08 (m, 1H), 6.96-6.88 (m, 2H), 6.81 (d, *J* = 7.78 Hz, 1H), 6.07 (s, 2H), 5.99 (brs, 1H), 5.57 (s, 1H), 5.01 (s, 1H), 4.91 (s, 1H), 3.72 (s, 3H), 3.49 (s, 6H), 2.36 (s, 3H), 1.39 (s, 9H), 0.93 (s, 9H); **^{13}C NMR (150 MHz, $CDCl_3$):** δ (ppm) 179.8, 156.4, 155.0, 153.0, 152.5, 138.4, 136.9, 130.8, 130.2, 128.3, 127.0, 126.0, 124.8, 124.4, 121.3, 120.1, 116.4, 104.5, 82.8, 65.1, 60.6, 55.8, 50.6, 34.0, 30.1, 17.6; **IR (KBr):** γ 3436, 2956, 2923, 1623, 1433, 1380, 1326.48, 1232, 846, 765； **HRMS (ESI):** calcd for $C_{40}H_{45}NO_5$ $[M+H]^+$: 620.3370, found: 620.3374.

2,6-di-tert-butyl-4-(2'-methyl-2-(thiophen-3-yl)spiro[chromane-3,3'-indol]-4-yl)phenol (3u), 

(petroleum ether/ethyl acetate= 8:1), 45.9 mg, yield: 86%, white solid, mp 219-220℃, dr = 10:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.35 (d, *J* = 7.3 Hz, 1H), 7.29-7.25 (m, 2H), 7.19-7.06 (m, 3H), 6.99-6.97 (m, 2H), 6.91-6.87 (m, 1H), 6.83-6.77 (m, 2H), 6.40-6.39 (m, 1H), 5.96 (brs, 1H), 5.82 (s, 1H), 4.99 (s, 1H), 4.88 (s, 1H), 2.35 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.8, 156.1, 154.8, 152.9, 136.8, 136.7, 130.1, 128.5, 128.3, 127.0, 126.0, 125.7, 125.0, 124.4, 123.7, 121.2, 119.9, 116.3, 78.3, 64.6, 50.2, 34.0, 30.3, 17.4; **IR (KBr):** γ 3438, 2957, 1629, 1436, 1382, 1230, 1118, 1050, 867, 767, 661; **HRMS (ESI):** calcd for $C_{35}H_{37}NO_2S$ $[M+H]^+$: 536.2618, found: 536.2620.

2,6-di-tert-butyl-4-(2'-methyl-2-(pyridin-3-yl)spiro[chromane-3,3'-indol]-4-yl)phenol (3v), 

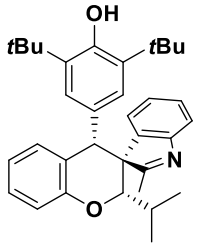
(petroleum ether/ethyl acetate= 2:1), 49.6 mg, yield: 94%, white solid, mp 231-232℃, dr > 19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 8.38-8.33 (m, 2 H), 7.35 (d, *J* = 7.34 Hz, 1H), 7.32-7.24 (m, 2H), 7.17-7.12 (m, 2H), 7.07 (d, *J* = 8.00 Hz, 1 H), 7.01-6.89 (m, 4H), 6.81 (d, *J* = 7.72 Hz, 1H), 5.98 (brs, 1H), 5.73 (s, 1H), 5.04 (s, 1H), 4.94 (s, 1H), 2.42 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.2, 155.9, 154.6, 153.0, 150.1, 148.3, 135.7, 134.1, 131.4, 130.2, 128.7, 128.5, 126.8, 125.1, 124.3, 122.6, 121.5, 120.1, 116.2, 80.1, 65.0, 49.8, 34.0, 30.1, 17.7; **IR (KBr):** γ 3431, 2959, 1579, 1484, 1435, 1373, 1231, 1116, 1056, 941, 890, 767, 658； **HRMS (ESI):** calcd for $C_{36}H_{38}N_2O_2$ $[M+H]^+$: 531.3006, found: 531.3002.

2,6-di-tert-butyl-4-(2'-methyl-2-propylspiro[chromane-3,3'-indol]-4-yl)phenol (3w), 

(petroleum ether/ethyl acetate= 7:1), 29.6 mg, yield: 60%, white solid, mp 204-205℃, dr = 8:1, **^{1}H NMR (600 MHz, $CDCl_3$):** δ (ppm) 7.29 (d, *J* = 7.63 Hz, 1H), 7.25-7.21 (m, 2H), 7.10 (d, *J* = 7.09 Hz, 1H), 7.07-7.01 (m, 2H), 6.90 (s, 1H), 6.84-6.81 (m, 1H), 6.74 (d, *J* = 7.67 Hz, 1H), 5.87 (brs, 1H), 4.94 (s, 1H), 4.71 (s, 1H), 4.62-4.59 (m, 1H), 2.35 (s, 3H), 1.65-1.59 (m, 2H), 1.39 (s, 9H), 1.03-0.97 (m, 2H), 0.92 (s, 9H), 0.85-0.83 (m, 3H); **^{13}C NMR (150 MHz, $CDCl_3$):** δ (ppm) 180.9, 155.9, 154.7, 152.8, 137.3, 130.0, 128.1, 128.0, 127.1, 125.2, 125.0, 124.3, 120.6, 119.7, 116.0, 79.0, 64.4, 49.9, 34.0, 32.2, 30.2, 18.8, 17.0, 13.7; **IR (KBr):** γ 3439, 2958,

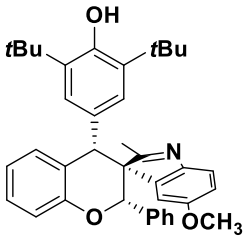
2873, 1581, 1437, 1379, 1234, 1122, 882, 766, 660; **HRMS (ESI):** calcd for $C_{34}H_{41}NO_2$ $[M+H]^+$: 496.3372, found: 496.3375.

2,6-di-tert-butyl-4-(2-isopropyl-2'-methylspiro[chromane-3,3'-indol]-4-yl)phenol

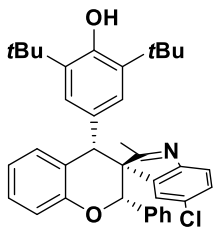


(3x), (petroleum ether/ethyl acetate= 10:1), 34.5 mg, yield: 70%, white solid, mp 211-212 ℃, dr = 14:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.27-7.19 (m, 3H), 7.11 (d, *J* = 7.40Hz, 1H), 7.05-6.99 (m, 2H), 6.90 (s, 1H), 6.83-6.79 (m, 1H), 6.72 (d, *J* = 7.69 Hz, 1H), 5.80 (brs, 1H), 5.03 (s, 1H), 4.71 (s, 1H), 4.55 (d, *J* = 2.96 Hz, 1H), 2.37 (s, 3H), 1.51-1.46 (m, 1H), 1.39 (s, 9H), 0.98 (d, *J* = 6.81 Hz, 3H), 0.91 (s, 9H), 0.36 (d, *J* = 6.81 Hz, 3H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 181.2, 155.7, 155.1, 152.9, 137.8, 134.5, 130.0, 128.1, 128.0, 127.1, 126.8, 125.8, 124.8, 124.5, 124.3, 120.6, 119.7, 116.0, 80.0, 77.4, 77.0, 76.7, 63.8, 51.1, 34.1, 33.8, 30.6, 30.0, 29.9, 22.0, 17.5, 16.9; **IR (KBr):** γ 3434, 2960, 1579, 1437, 1387, 1234, 1120, 1038, 892, 762; **HRMS (ESI):** calcd for $C_{34}H_{41}NO_2$ $[M+H]^+$: 496.3372, found: 496.3370.

2,6-di-tert-butyl-4-(5'-methoxy-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (3y), (petroleum ether/ethyl acetate= 5:1), 46.8 mg, yield: 84%, white solid, mp 214-215 ℃, dr >19:1, **^{1}H NMR (600 MHz, $CDCl_3$):** δ (ppm) 7.27-7.25 (m, 1H), 7.17-7.14 (m, 1H), 7.08-7.05 (m, 3H), 7.02 (d, *J* = 8.59 Hz, 1H), 6.97-6.93 (m, 4H), 6.89-6.87 (m, 1H), 6.79-6.76 (m, 2H), 6.07 (brs, 1H), 5.67 (s, 1H), 4.96 (s, 1H), 4.91 (s, 1H), 3.70 (s, 3H), 2.36 (s, 3H), 1.39 (s, 9H), 0.96 (s, 9H); **^{13}C NMR (150 MHz, $CDCl_3$):** δ (ppm) 177.4, 157.4, 155.0, 152.9, 150.1, 137.9, 135.7, 130.2, 128.8, 128.4, 127.7, 127.2, 127.0, 124.3, 121.2, 119.8, 116.3, 112.9, 112.9, 82.5, 65.2, 55.4, 50.2, 34.0, 30.1, 17.6; **IR (KBr):** γ 3436, 2954, 2923, 2855.73, 1623, 1465, 1379, 1231, 1157, 1038, 807, 761, 699; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_3$ $[M+H]^+$: 560.3159, found: 560.3155.

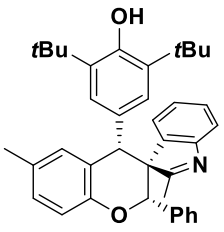


2,6-di-tert-butyl-4-(5'-chloro-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl) phenol (3z), (petroleum ether/ethyl acetate= 7:1), 44.9 mg, yield: 80%, white solid, mp 206-207 ℃, dr >19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.35-7.28 (m, 2H), 7.22-7.15 (m, 2H), 7.11-7.07 (m, 3H), 7.01 (d, *J* = 8.29 Hz, 1H), 6.95-6.91 (m, 4H), 6.83 (d, *J* = 7.71 Hz, 1H), 6.07 (brs, 1H), 5.64 (s, 1H), 4.98 (s, 1H), 4.93 (s,



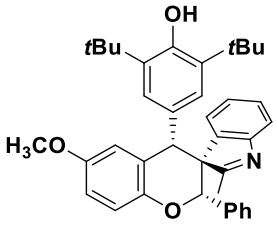
1H), 2.42 (s, 3H), 1.38 (s, 9H), 0.99 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 180.4, 154.8, 154.5, 153.0, 138.5, 135.3, 130.6, 130.2, 128.9, 128.6, 128.4, 127.9, 126.9, 126.8, 126.2, 123.8, 121.5, 120.5, 116.6, 82.1, 66.1, 49.9, 34.0, 30.1, 17.8; **IR (KBr):** γ 3430, 2950, 2924, 2855, 1628, 1436, 1381, 1230, 1055, 781, 765; **HRMS (ESI):** calcd for $C_{37}H_{38}ClNO_2$ $[M+H]^+$: 564.2664, found: 564.2661.

2,6-di-tert-butyl-4-(2',6-dimethyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)pheno

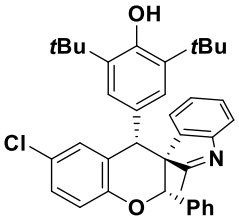


l (4a), (petroleum ether/ethyl acetate= 7:1), 52.6 mg, yield: 97%, white solid, mp 218-229 ℃, dr >19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.38 (d, *J* = 7.30 Hz, 1H), 7.25-7.21 (m, 1H), 7.15-7.11 (m, 3H), 7.09-7.05 (m, 2H), 7.04-6.96 (m, 3H), 6.87 (d, *J* = 7.44 Hz, 2H), 6.59 (s, 1H), 5.98 (brs, 1H), 5.65 (s, 1H), 4.96 (s, 1H), 4.89 (s, 1H), 2.39 (s, 3H), 2.19 (s, 3H), 1.40 (s, 9H), 0.93 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.8, 156.0, 152.9, 136.4, 135.7, 130.4, 130.2, 129.0, 128.8, 128.3, 127.7, 127.1, 126.9, 126.1, 124.8, 124.0, 119.7, 116.1, 82.5, 65.4, 50.3, 34.0, 30.1, 20.6, 17.7; **IR (KBr):** γ 3438, 2954, 2923, 2856, 1628, 1496, 1459, 1376, 1240, 814, 769, 700; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_2$ $[M+H]^+$: 544.3210 found: 544.3213.

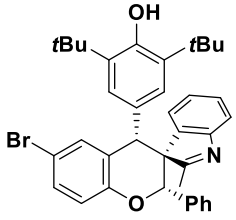
2,6-di-tert-butyl-4-(6-methoxy-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-y



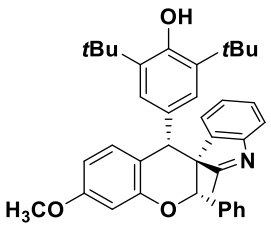
l)phenol (4b), (petroleum ether/ethyl acetate= 7:1), 50.2 mg, yield: 90%, white solid, mp 208-209 ℃, dr = 12:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.38 (d, *J* = 7.26 Hz, 1H), 7.25-7.22 (m, 1H), 7.16-7.11 (m, 3H), 7.05-7.01 (m, 3H), 6.95 (s, 1H), 6.88-6.83 (m, 3H), 6.30 (d, *J* = 2.24 Hz, 1H), 5.98 (brs, 1H), 5.64 (s, 1H), 4.97 (s, 1H), 4.89 (s, 1H), 3.63 (s, 3H), 2.38 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.7, 156.1, 153.8, 153.0, 149.1, 136.4, 135.8, 128.8, 128.3, 127.7, 127.2, 126.9, 126.0, 125.3, 124.8, 119.8, 116.9, 115.1, 114.1, 82.6, 65.2, 55.7, 50.5, 34.0, 30.2, 17.7; **IR (KBr):** γ 3436, 2956, 2923, 1618.42, 1501, 1437, 1377, 1237, 1160, 1037, 835, 768, 702; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_3$ $[M+H]^+$: 560.3159, found: 560.3163.

2,6-di-tert-butyl-4-(6-chloro-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl) phenol (4c), 

(petroleum ether/ethyl acetate= 7:1), 45.5 mg, yield: 81%, white solid, mp 199-200 ℃, dr >19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.34 (d, *J* = 7.38 Hz, 1H), 7.27-7.22 (m, 2H), 7.17-7.11 (m, 3H), 7.06-7.00 (m, 3H), 6.95-6.85 (m, 3 H), 6.77 (d, *J* = 1.49 Hz, 1H), 5.94 (brs, 1H), 5.66 (s, 1H), 5.03 (s, 1H), 4.86 (s, 1H), 2.37 (s, 3H), 1.39 (s, 9H), 0.93 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm)** 179.3, 156.1, 153.6, 153.2, 136.0, 135.2, 129.6, 129.0, 128.6, 128.4, 127.8, 127.2, 126.9, 126.4, 126.2, 126.1, 125.8, 125.0, 124.3, 119.9, 117.7, 82.8, 64.7, 50.25, 34.0, 30.1, 17.7; **IR (KBr):** γ 3428, 2921, 2852, 1632, 1473, 1382, 1234, 1118, 815, 770, 701; **HRMS (ESI):** calcd for $C_{37}H_{38}ClNO_2$ $[M+H]^+$: 564.2664, found: 564.2668.

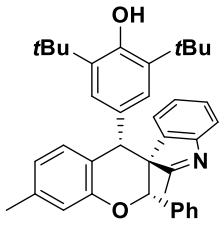
4-(6-bromo-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)-2,6-di-tert-butyl phenol (4d), 

(petroleum ether/ethyl acetate= 7:1), 50.1 mg, yield: 83%, white solid, mp 205-206 ℃, dr >19:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm) 7.38-7.32 (m, 2H), 7.27-7.23 (m, 1H), 7.17-7.10 (m, 3H), 7.06-7.02 (m, 2H), 6.97-6.91 (m, 3H), 6.86 (d, *J* = 7.32 Hz, 2H), 5.94 (brs, 1H), 5.65 (s, 1H), 5.04 (s, 1H), 4.86 (s, 1H), 2.37 (s, 3H), 1.39 (s, 9H), 0.93 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.2, 156.1, 154.2, 153.2, 136.0, 135.2, 132.5, 131.4, 129.0, 128.6, 127.8, 127.2, 126.9, 126.8, 126.2, 125.7, 125.0, 124.4, 120.0, 118.2, 113.4, 82.8, 64.7, 50.1, 34.0, 30.1, 17.7; **IR (KBr):** γ 3438, 2954, 2921, 2853, 1634, 1471, 1381, 1235, 1117, 885, 818, 768, 703; **HRMS (ESI):** calcd for $C_{37}H_{38}BrNO_2$ $[M+H]^+$: 608.2159, found: 608.2155.

2,6-di-tert-butyl-4-(7-methoxy-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (4e), 

(petroleum ether/ethyl acetate= 5:1), 47.9 mg, yield: 86%, white solid, mp 227-228 ℃, dr = 10:1, **^{1}H NMR (600 MHz, $CDCl_3$):** δ (ppm) 7.38 (d, *J* = 7.37 Hz, 1 H), 7.24-7.22 (m, 1H).7.16-7.11 (m, 3H), 7.06-7.02 (m, 2H), 6.95-6.86 (m, 3H), 6.68-6.64 (m, 2H), 6.49-6.47 (m, 1H), 5.97 (brs, 1H), 5.67 (s, 1H), 4.94 (s, 1H), 4.86 (s, 1H), 3.83 (s, 3H), 2.38 (s, 3H), 1.39 (s, 9H), 0.93 (s, 9H); **^{13}C NMR (150 MHz, $CDCl_3$):** δ (ppm) 179.7, 159.8, 156.1, 155.8, 152.9, 136.3, 135.6, 130.8, 128.8, 128.3, 127.7, 127.3, 126.9, 126.0, 124.8, 119.8, 116.6, 108.2, 100.9, 82.9, 65.4, 55.3, 49.90, 34.0, 30.1, 17.7; **IR (KBr):** γ 3431, 2955,

2922, 2855, 1619, 1438, 1379, 1238, 1160, 1038, 836, 735, 702; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_3$ $[M+H]^+$: 560.3159, found: 560.3104.

2,6-di-tert-butyl-4-(2',7-dimethyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (4f), 

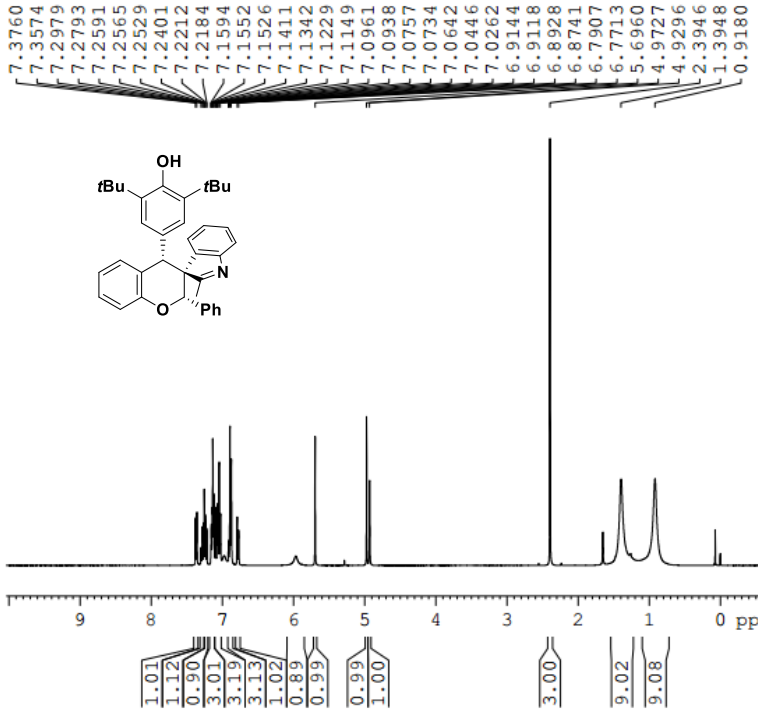
(petroleum ether/ethyl acetate= 7:1), 44.3 mg, yield: 82%, white solid, mp 236-237 ℃, dr = 10:1, **^{1}H NMR (400 MHz, $CDCl_3$):** δ (ppm); 7.38 (d, *J* = 7.35 Hz, 1 H), 7.24-7.21 (m, 1H), 7.16-7.10 (m, 3H), 7.06-6.96 (m, 3H), 6.91-6.86 (m, 3H), 6.71-6.63 (m, 2H), 5.97 (brs, 1H), 5.66 (s, 1H), 4.97 (s, 1H), 4.88 (s, 1H), 2.38 (s, 3H), 2.37 (s, 3H), 1.39 (s, 9H), 0.92 (s, 9H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ (ppm) 179.8, 156.09, 154.7, 152.9, 138.3, 136.4, 135.7, 129.9, 128.8, 128.2, 127.7, 127.2, 126.9, 126.0, 124.8, 122.1, 121.4, 119.7, 116.7, 82.6, 65.3, 50.1, 34.0, 30.2, 21.2, 17.8; **IR (KBr):** γ 3435, 2956, 2920, 2870, 1621, 1436, 1378, 1244, 892, 1124, 1049, 802, 736, 700; **HRMS (ESI):** calcd for $C_{38}H_{41}NO_2$ $[M+H]^+$: 544.3210, found: 544.3218.

Reference

1. Zhao, K.; Zhi. Y.; Shu T.; Valkonen, A.; Rissanen, K.; Enders, D. *Angew. Chem. Int. Ed*. **2016**, *55*, 12104.
2. Liu, Z. S.; Li, W. K.; Kang, T. R.; He, L.; Liu Q.-Z. *Org. Lett*. **2015**, *17*, 150.

NMR spectra for compounds 3-4

2,6-di-tert-butyl-4-(2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (3a)



BRUKER

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PROCNO                             1
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TD                             65536
SOLVENT                        CDCl3
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DS                                 2
SWH                         8012.820 Hz
FIDRES                         0.244532 Hz
AQ                          4.0894966 sec
RG                                76.1
DW                            62.400 usec
DE                             6.50 usec
TE                             295.1 K
D1                          1.00000000 sec
TD0                                1
SFO1                      400.1324708 MHz
NUC1                              1H
P1                            14.33 usec
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LB                              0.30 Hz
GB                                 0
PC                              1.00
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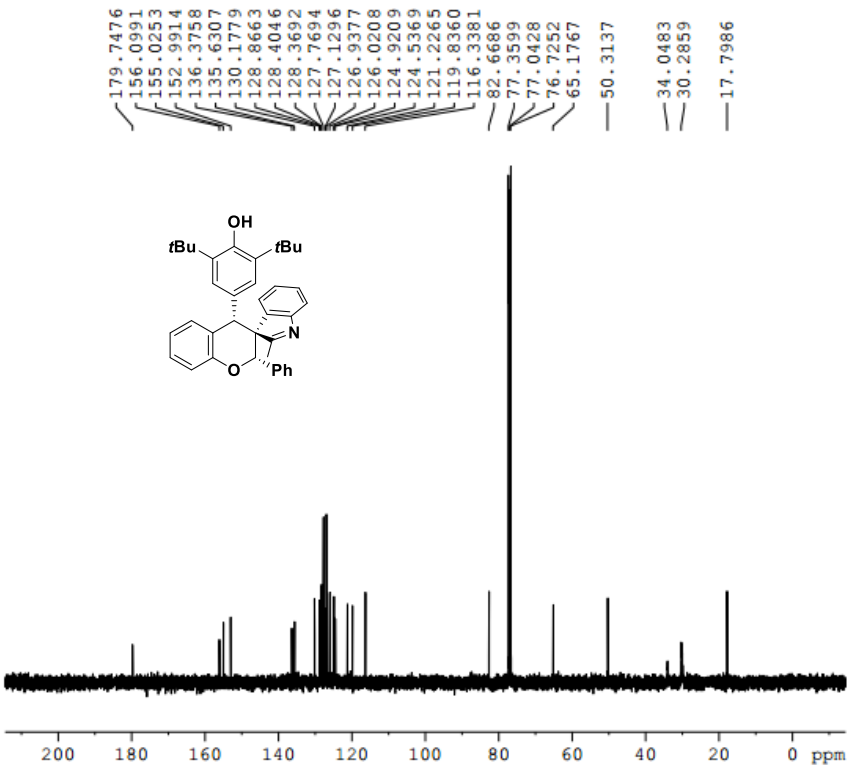

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PROCNO                             1
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Time                           17.42 h
INSTRUM                        spect
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PULPROG                      zgpg30
TD                             65536
SOLVENT                        CDCl3
NS                                60
DS                                 4
SWH                        24038.461 Hz
FIDRES                         0.733596 Hz
AQ                          1.3631988 sec
RG                                211.8
DW                            20.800 usec
DE                             6.50 usec
TE                             295.7 K
D1                          2.00000000 sec
D11                         0.03000000 sec
TD0                                1
SFO1                      100.6228298 MHz
NUC1                              13C
P1                             9.43 usec
SI                             32768
SF                        100.6127690 MHz
WDW                               EM
SSB                                0
LB                              1.00 Hz
GB                                 0
PC                              1.40
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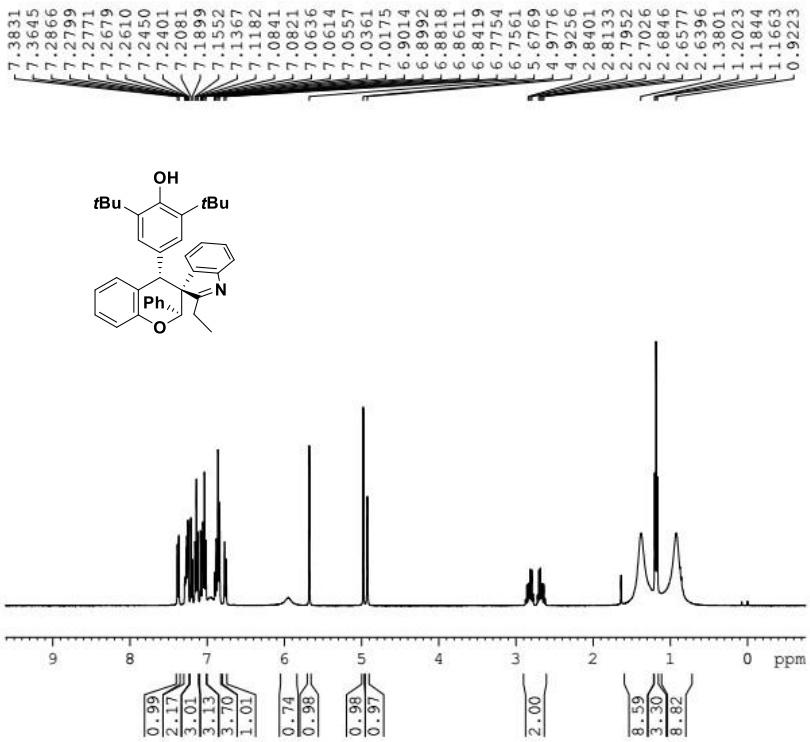
2,6-di-tert-butyl-4-(2'-ethyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (3b)

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PROCNO                     1
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PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                        8
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                      203
DW                   60.800 usec
DE                    6.50 usec
TE                   296.5 K
D1                1.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     13.00 usec
PL1                    -2.60 dB
PL1W              17.82643890 W
SFO1              400.1524711 MHz
SI                       32768
SF                400.1500148 MHz
WDW                       EM
SSB                        0
LB                      0.30 Hz
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PC                      1.00
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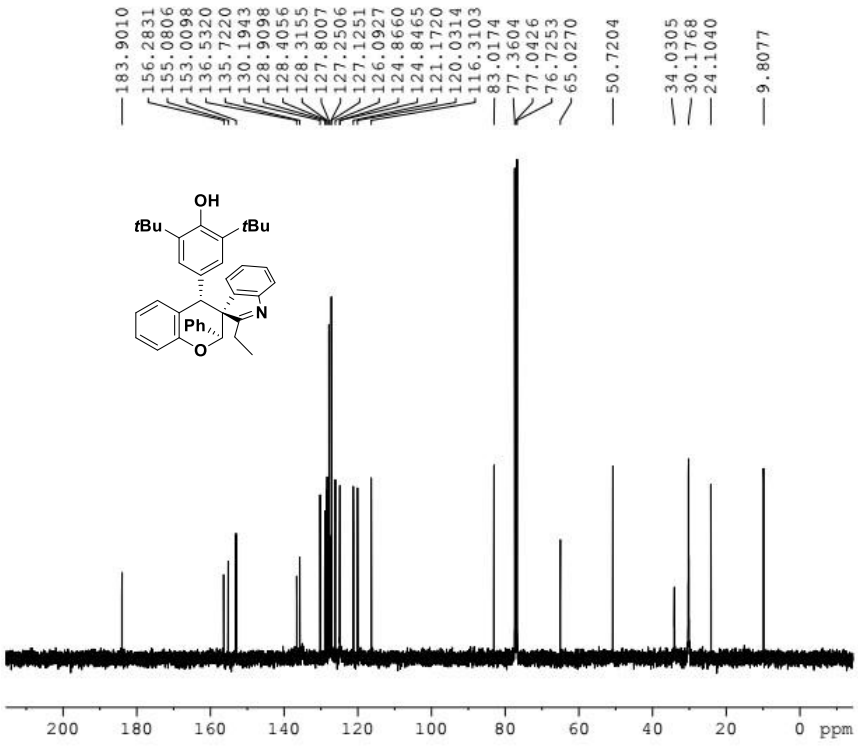


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PROCNO                     1
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INSTRUM                spect
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SOLVENT               CDCl3
NS                       81
DS                        4
SWH               24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                      203
DW                   20.800 usec
DE                    6.50 usec
TE                   297.9 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      13C
P1                     11.50 usec
PL1                    -3.00 dB
PL1W              68.16146088 W
SFO1              100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                      1H
PCPD2                  90.00 usec
PL2                    -2.60 dB
PL12                   13.88 dB
PL13                   14.50 dB
PL2W              17.82643890 W
PL12W             0.40092635 W
PL13W             0.34758785 W
SFO2              400.1516006 MHz
SI                       32768
SF                100.6177980 MHz
WDW                       EM
SSB                        0
LB                      1.00 Hz
GB                         0
PC                      1.40
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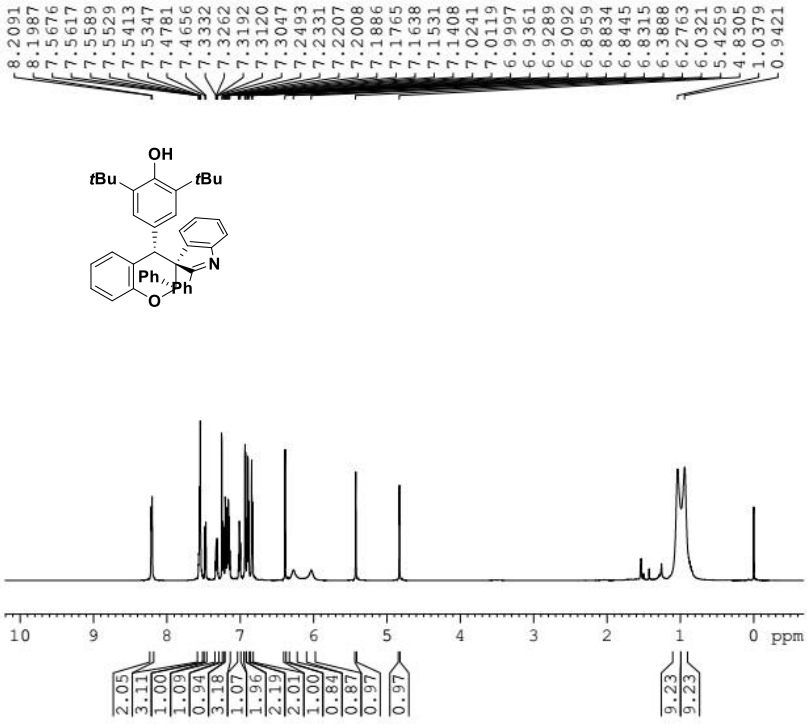
2,6-di-tert-butyl-4-(2,2'-diphenylspiro[chromane-3,3'-indol]-4-yl)phenol (3c)

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PROCNO               1
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PULPROG          zg30
TD              65536
SOLVENT         CDCl3
NS                 16
DS                  2
SWH         12019.230 Hz
FIDRES        0.183399 Hz
AQ          2.7263477 sec
RG               69.12
DW              41.600 usec
DE               6.50 usec
TE              302.0 K
D1          1.00000000 sec
TD0                 1

======== CHANNEL f1 ========
SFO1      600.1337060 MHz
NUC1              1H
P1             12.36 usec
SI             65536
SF        600.1300219 MHz
WDW               EM
SSB                0
LB              0.30 Hz
GB                 0
PC              1.00
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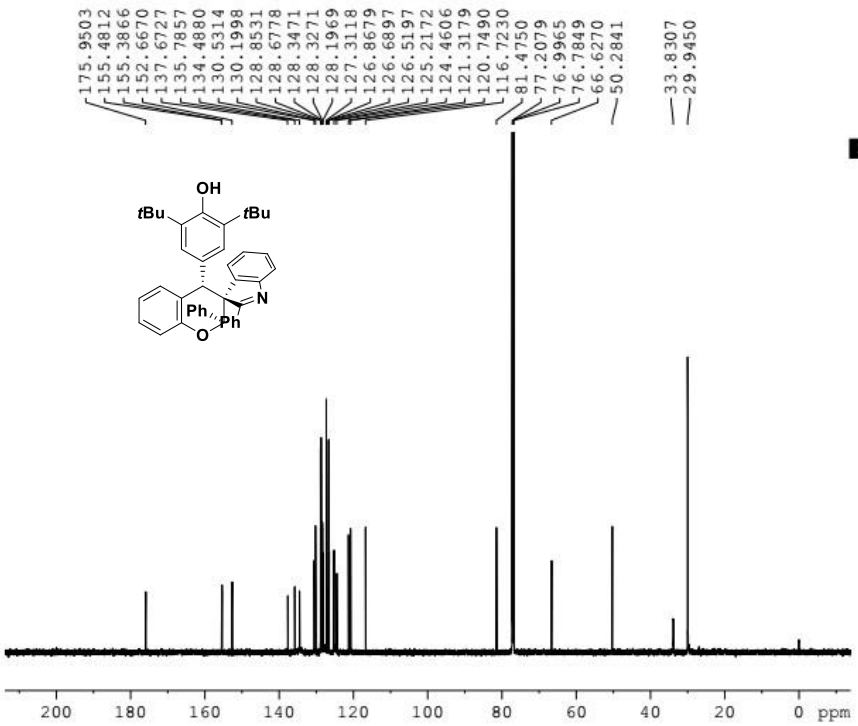


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PROCNO               1
Date_         20170730
Time_            21.07
INSTRUM          spect
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PULPROG       zgpg30
TD              65536
SOLVENT         CDCl3
NS               1024
DS                  4
SWH         36057.691 Hz
FIDRES        0.550197 Hz
AQ          0.9088159 sec
RG              188.59
DW              13.867 usec
DE               6.50 usec
TE              302.8 K
D1          2.00000000 sec
D11         0.03000000 sec
TD0                 1

======== CHANNEL f1 ========
SFO1      150.9178981 MHz
NUC1              13C
P1             13.76 usec
SI             32768
SF        150.9028090 MHz
WDW               EM
SSB                0
LB              1.00 Hz
GB                 0
PC              1.40
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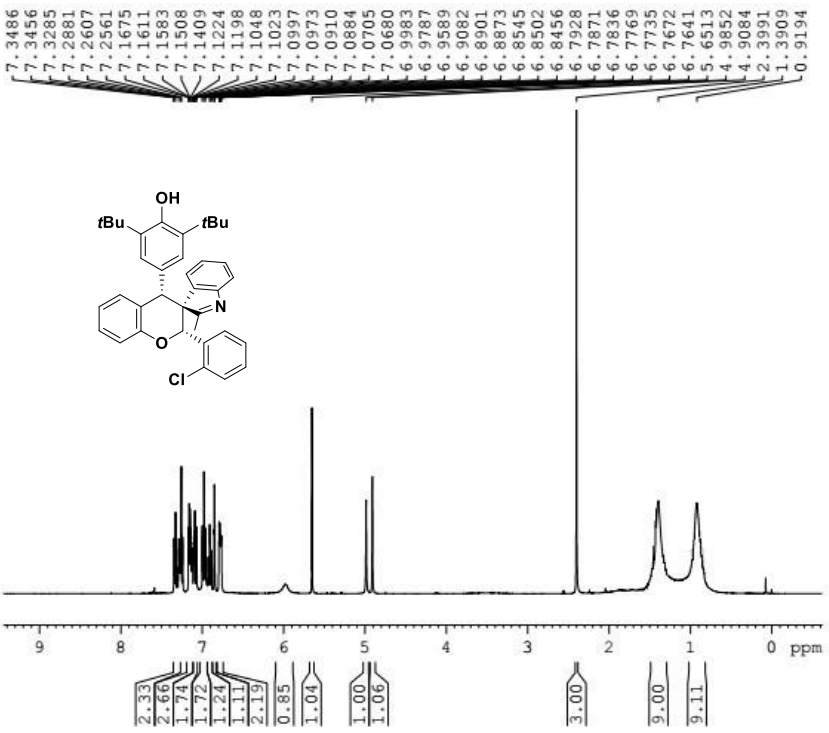
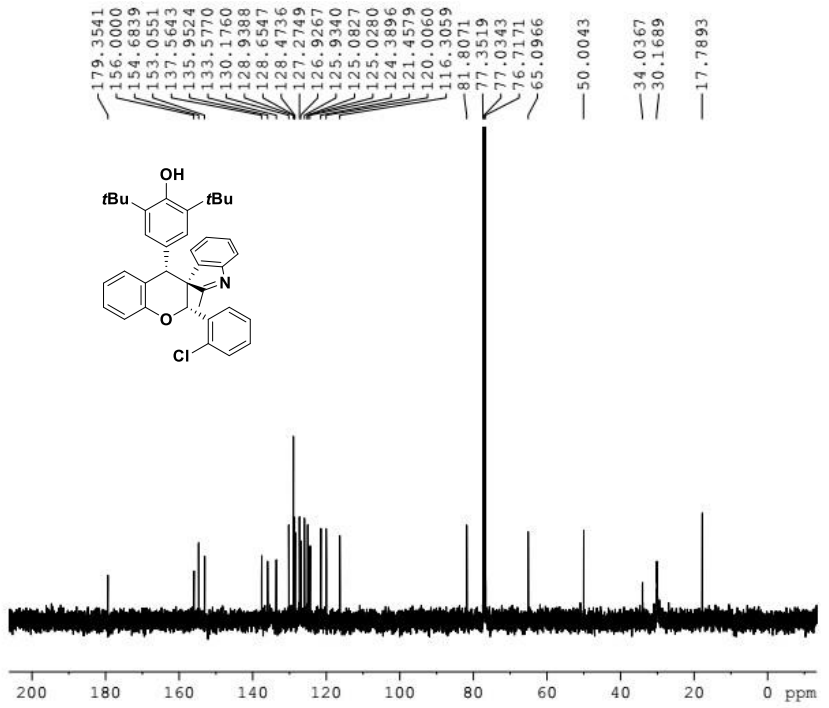
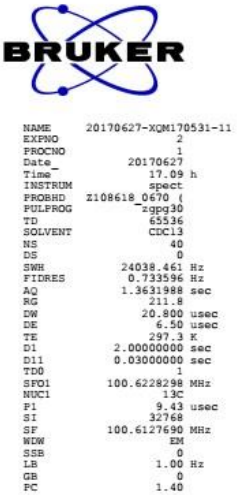
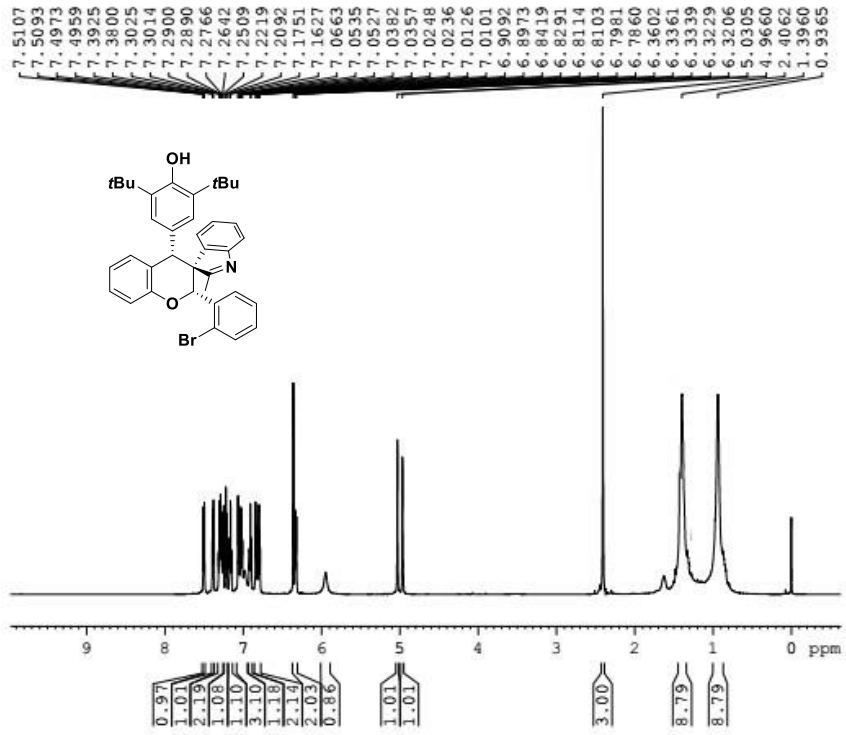
2,6-di-tert-butyl-4-(2-(2-chlorophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl) phenol (3d)



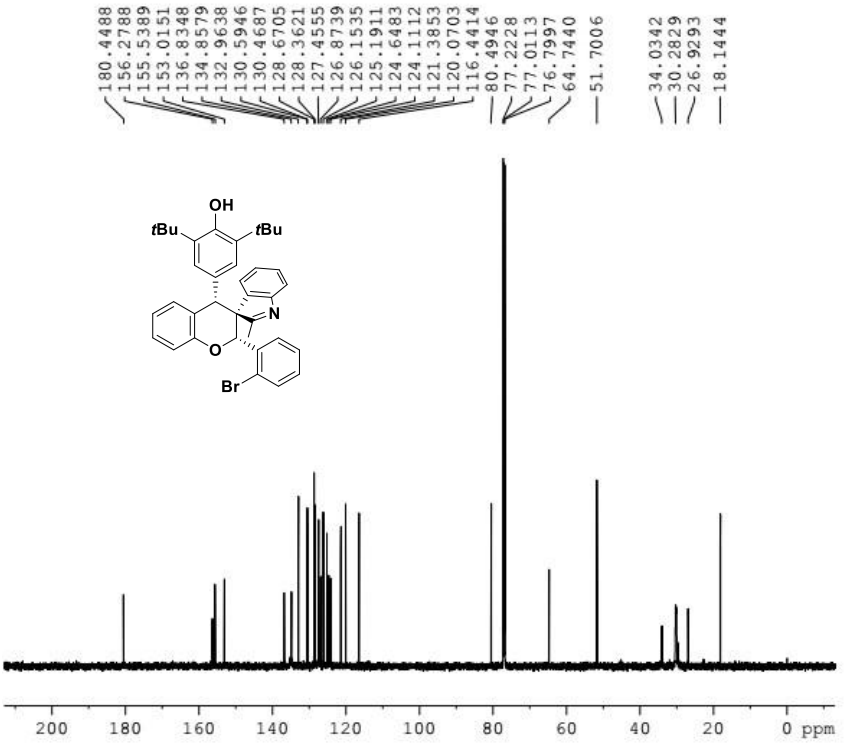




4-(2-(2-bromophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl)-2,6-di-tert-butyl phenol (3e)

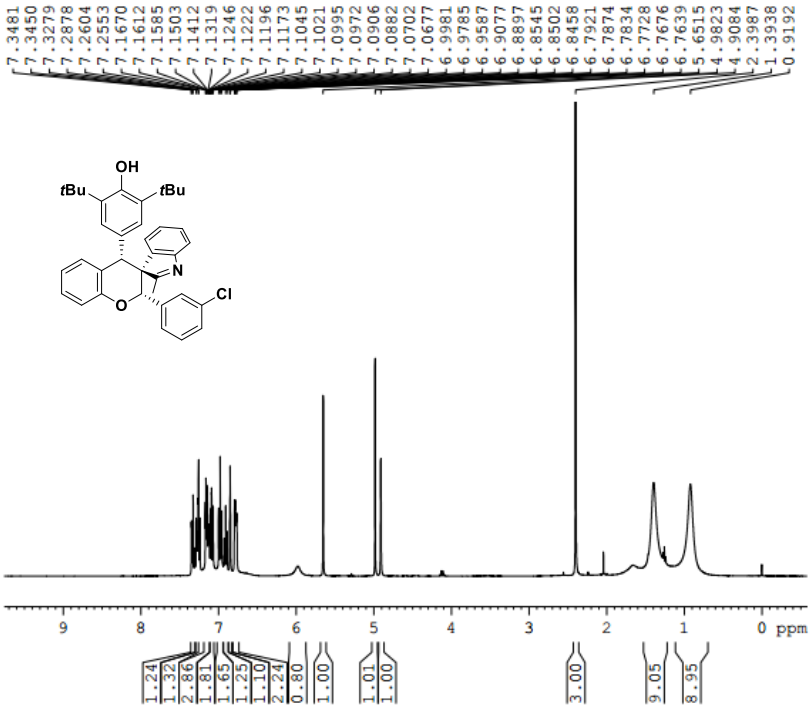



```
NAME                  XQM-1H
EXPNO                     35
PROCNO                     1
Date_               20170917
Time_                  20.01
INSTRUM                spect
PROBHD   5 mm PABBO BB/
PULPROG                zg30
TD                     65536
SOLVENT                CDCl3
NS                        16
DS                         2
SWH                12019.230 Hz
FIDRES             0.183399 Hz
AQ                 2.7263477 sec
RG                     49.16
DW                    41.600 usec
DE                     6.50 usec
TE                    301.9 K
D1                 1.00000000 sec
TD0                        1

======== CHANNEL f1 ========
SFO1              600.1337060 MHz
NUC1                      1H
P1                     12.36 usec
SI                     65536
SF                600.1300213 MHz
WDW                       EM
SSB                        0
LB                      0.30 Hz
GB                         0
PC                      1.00
```

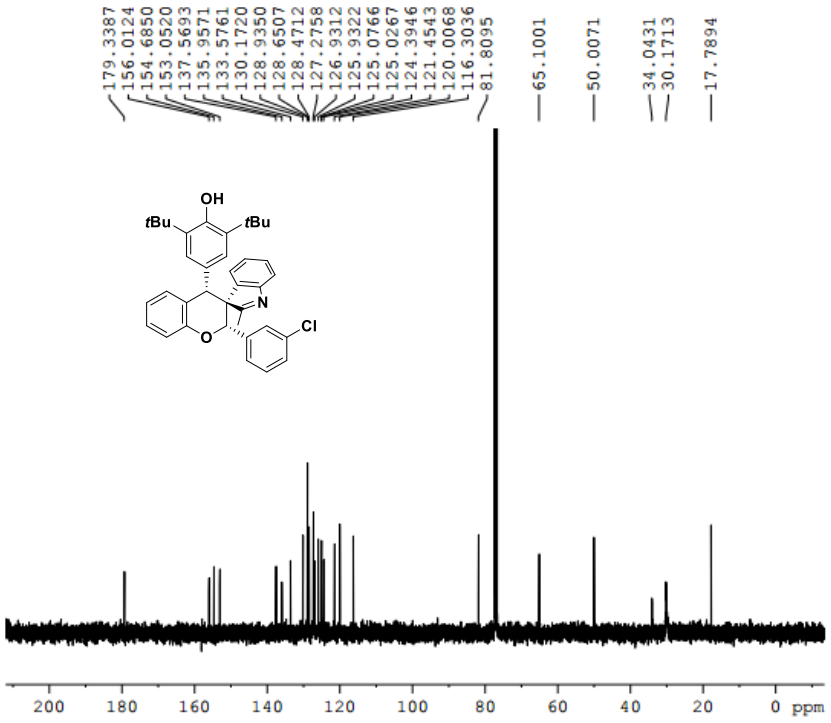



```
NAME                  XQM-13C
EXPNO                       8
PROCNO                      1
Date_               20170917
Time_                  20.12
INSTRUM                spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                     65536
SOLVENT                CDCl3
NS                        512
DS                          4
SWH                36057.691 Hz
FIDRES             0.550197 Hz
AQ                 0.9088159 sec
RG                     188.59
DW                   13.867 usec
DE                     6.50 usec
TE                    302.6 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                         1

======== CHANNEL f1 ========
SFO1              150.9178981 MHz
NUC1                      13C
P1                     13.76 usec
SI                     32768
SF                150.9028090 MHz
WDW                       EM
SSB                        0
LB                      1.00 Hz
GB                         0
PC                      1.40
```

2,6-di-tert-butyl-4-(2-(3-chlorophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl) phenol (3f)

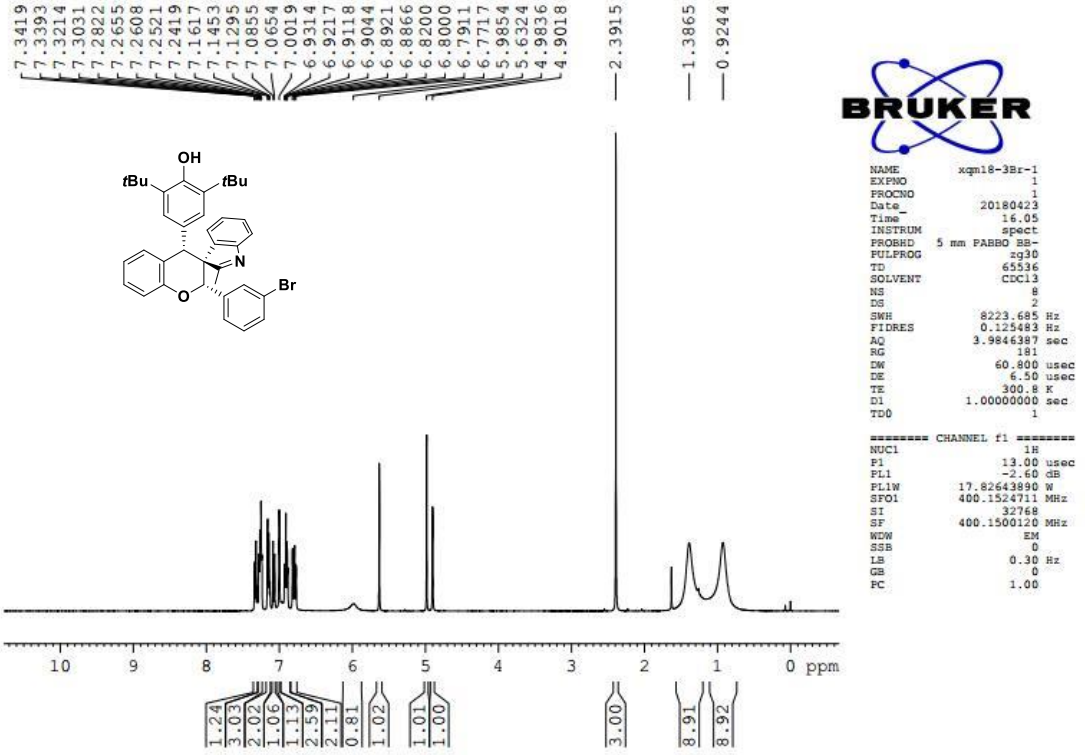


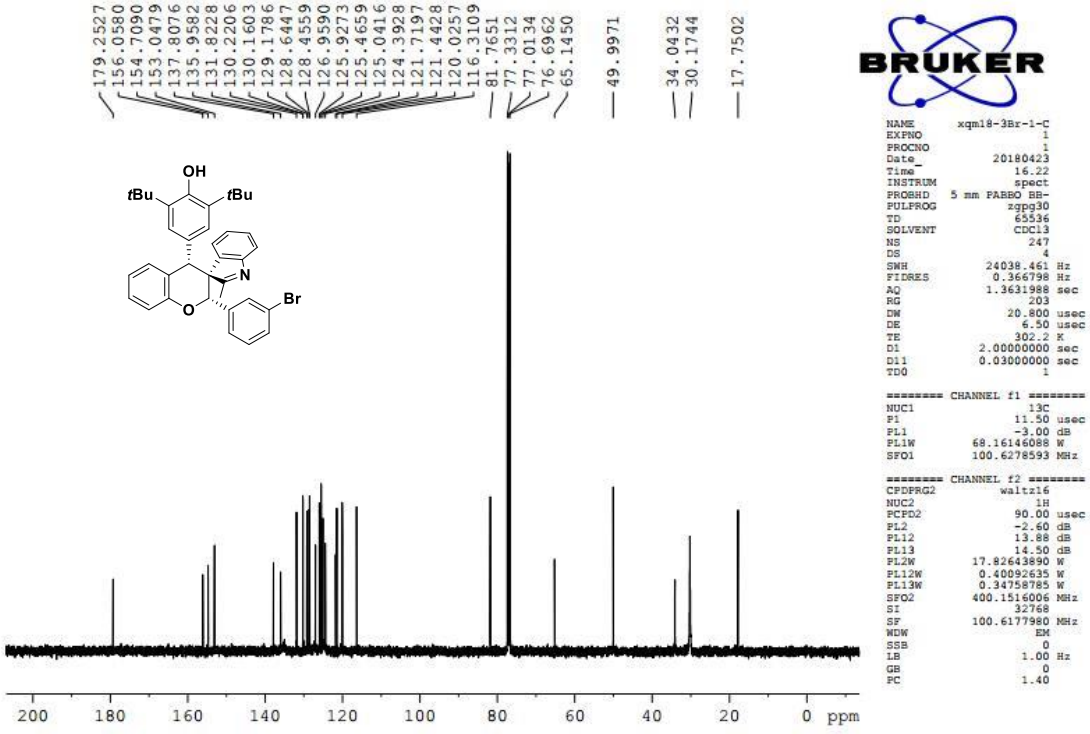

```
NAME          20170605-XQM170525-2
EXPNO                1
PROCNO               1
Date_         20170605
Time              17.00 h
INSTRUM           spect
PROBHD   2108618_0670 (
PULPROG          zg30
TD              65536
SOLVENT          CDCl3
NS                  17
DS                   0
SWH            8012.820 Hz
FIDRES         0.244532 Hz
AQ             4.0894966 sec
RG                83.48
DW              62.400 usec
DE               6.50 usec
TE              297.0 K
D1             1.00000000 sec
TD0                  1
SFO1         400.1324708 MHz
NUC1                 1H
P1              14.33 usec
SI                65536
SF           400.1300117 MHz
WDW                  EM
SSB                  0
LB              0.30 Hz
GB                   0
PC                1.00
```



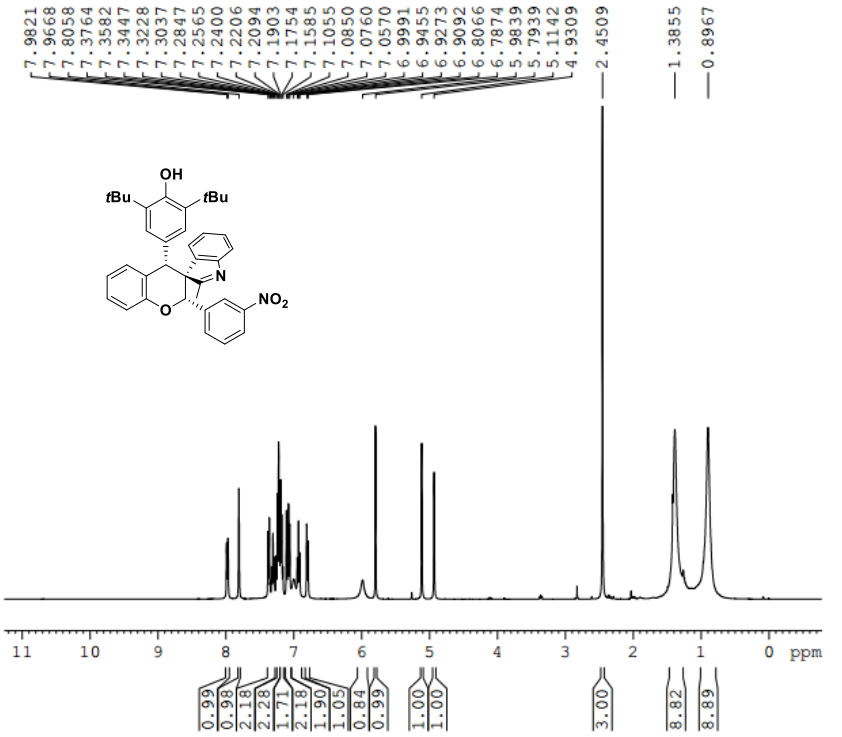

```
NAME          20170605-XQM170525-2
EXPNO                2
PROCNO               1
Date_         20170605
Time              17.07 h
INSTRUM           spect
PROBHD   2108618_0670 (
PULPROG        zgpg30
TD              65536
SOLVENT          CDCl3
NS                  80
DS                   0
SWH           24038.461 Hz
FIDRES         0.733596 Hz
AQ             1.3631988 sec
RG                211.8
DW              20.800 usec
DE               6.50 usec
TE              297.8 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                  1
SFO1         100.6228298 MHz
NUC1                 13C
P1               9.43 usec
SI                32768
SF           100.6127690 MHz
WDW                  EM
SSB                  0
LB              1.00 Hz
GB                   0
PC                1.40
```

4-(2-(3-bromophenyl)-2'-methylspiro[chromane-3,3'-8indol]-4-yl)-2,6-di-tert-butylphenol (3g)



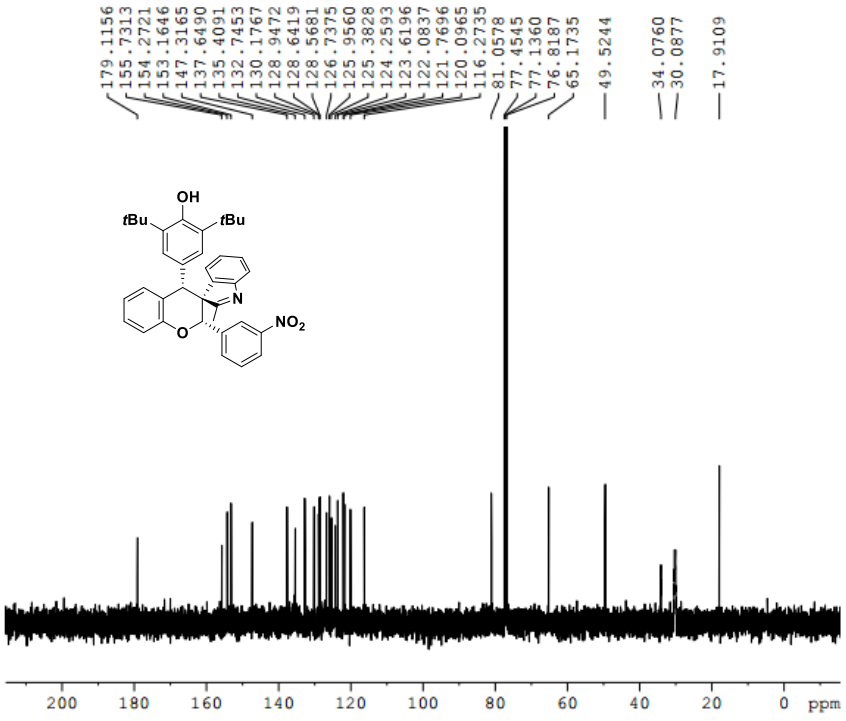


2,6-di-tert-butyl-4-(2'-methyl-2-(3-nitrophenyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3h)



BRUKER

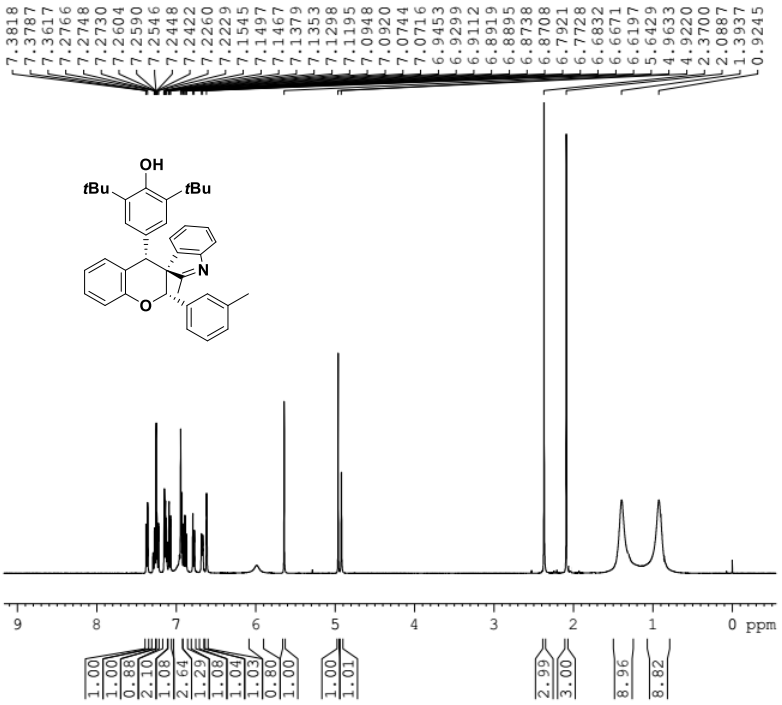
```
NAME                xqm170608
EXPNO                        1
PROCNO                       1
Date_                 20171221
Time_                    11.05
INSTRUM                  spect
PROBHD     5 mm PABBO BB-
PULPROG                  zg30
TD                      65536
SOLVENT                 CDCl3
NS                           8
DS                           2
SWH                 8223.685 Hz
FIDRES              0.125483 Hz
AQ                  3.9846387 sec
RG                        28.5
DW                    60.800 usec
DE                     6.50 usec
TE                     291.8 K
D1                  1.00000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                        1H
P1                    13.00 usec
PL1                   -2.60 dB
PL1W               17.82643890 W
SFO1               400.1524711 MHz
SI                       32768
SF                 400.1500101 MHz
WDW                         EM
SSB                          0
LB                    0.30 Hz
GB                           0
PC                    1.00
```



BRUKER

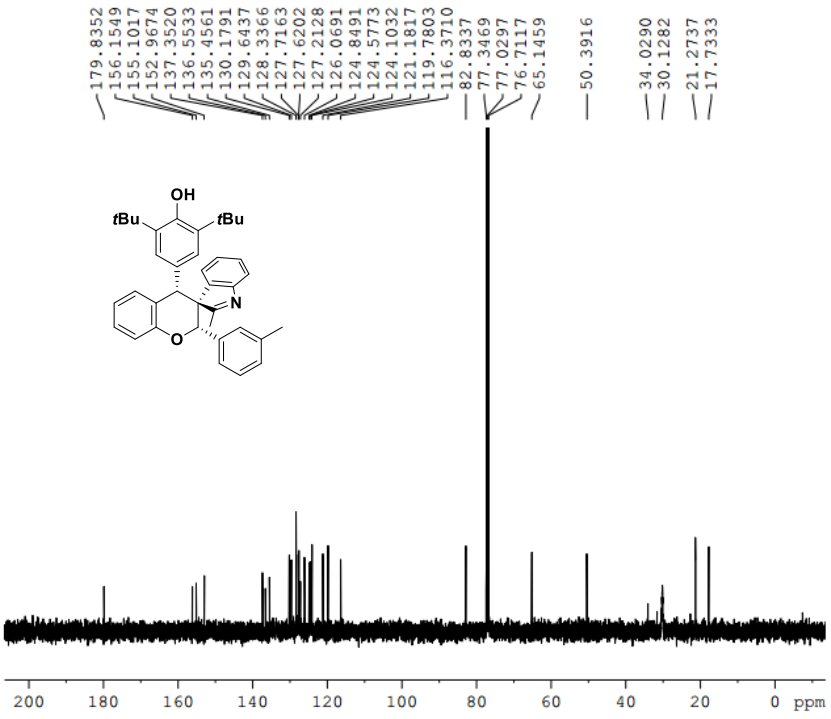
```
NAME             xqm170608-c1
EXPNO                        1
PROCNO                       1
Date_                 20171221
Time_                    11.15
INSTRUM                  spect
PROBHD     5 mm PABBO BB-
PULPROG               zgpg30
TD                      65536
SOLVENT                 CDCl3
NS                         159
DS                           4
SWH                24038.461 Hz
FIDRES              0.366798 Hz
AQ                  1.3631988 sec
RG                         203
DW                    20.800 usec
DE                     6.50 usec
TE                     293.0 K
D1                  2.00000000 sec
D11                 0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                       13C
P1                    11.50 usec
PL1                   -3.00 dB
PL1W               68.16146088 W
SFO1               100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                        1H
PCPD2                 90.00 usec
PL2                   -2.60 dB
PL12                  13.88 dB
PL13                  14.50 dB
PL2W               17.82643890 W
PL12W               0.40092635 W
PL13W               0.34758785 W
SFO2               400.1516006 MHz
SI                       32768
SF                 100.6177980 MHz
WDW                         EM
SSB                          0
LB                    1.00 Hz
GB                           0
PC                    1.40
```

2,6-di-tert-butyl-4-(2'-methyl-2-(m-tolyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3i)



BRUKER

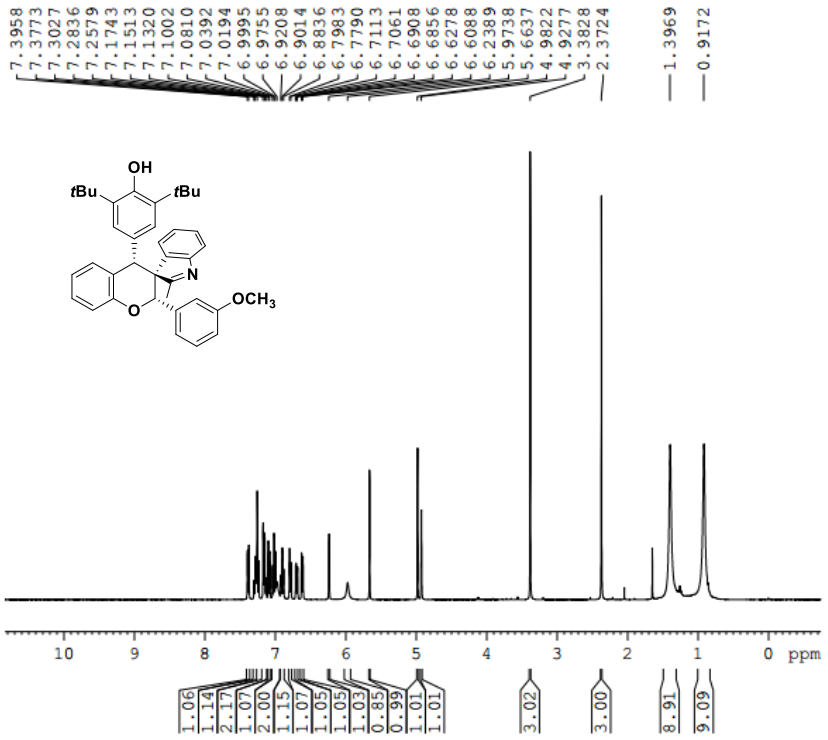
NAME	20170606-XQM170531-15
EXPNO	1
PROCNO	1
Date_	20170606
Time	17.59 h
INSTRUM	spect
PROBHD	Z108618_0670 (
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	8
DS	0
SWH	8012.820 Hz
FIDRES	0.244532 Hz
AQ	4.0894966 sec
RG	83.48
DW	62.400 usec
DE	6.50 usec
TE	297.5 K
D1	1.00000000 sec
TD0	1
SFO1	400.1324708 MHz
NUC1	1H
P1	14.33 usec
SI	65536
SF	400.1300118 MHz
WDW	EM
SSB	0
LB	0.30 Hz
GB	0
PC	1.00



BRUKER

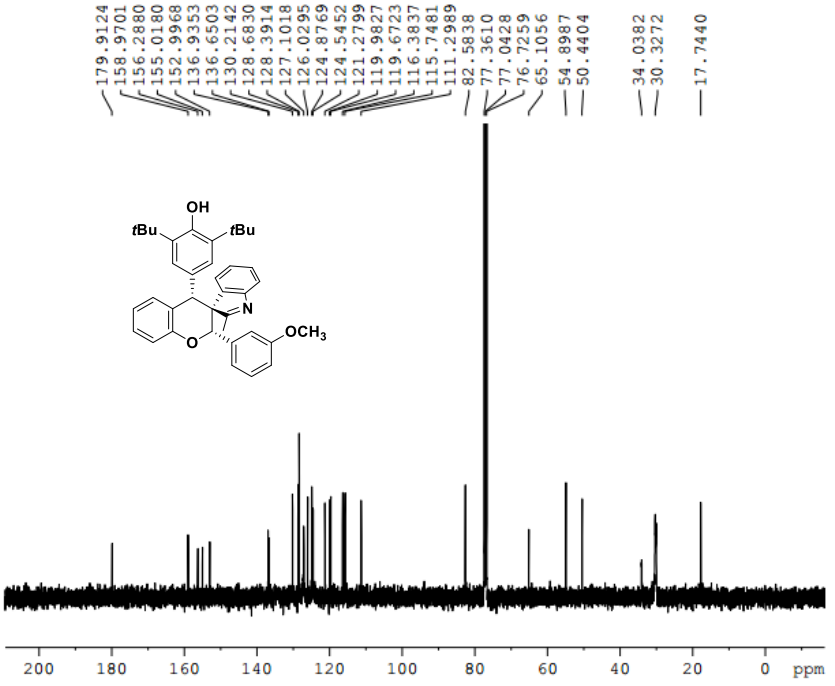
NAME	20170606-XQM170531-15
EXPNO	2
PROCNO	1
Date_	20170606
Time	18.05 h
INSTRUM	spect
PROBHD	Z108618_0670 (
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	55
DS	0
SWH	24038.461 Hz
FIDRES	0.733596 Hz
AQ	1.3631988 sec
RG	211.8
DW	20.800 usec
DE	6.50 usec
TE	298.0 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
SFO1	100.6228298 MHz
NUC1	13C
P1	9.43 usec
SI	32768
SF	100.6127690 MHz
WDW	EM
SSB	0
LB	1.00 Hz
GB	0
PC	1.40

2,6-di-tert-butyl-4-(2-(3-methoxyphenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl)phenol (3j)



BRUKER

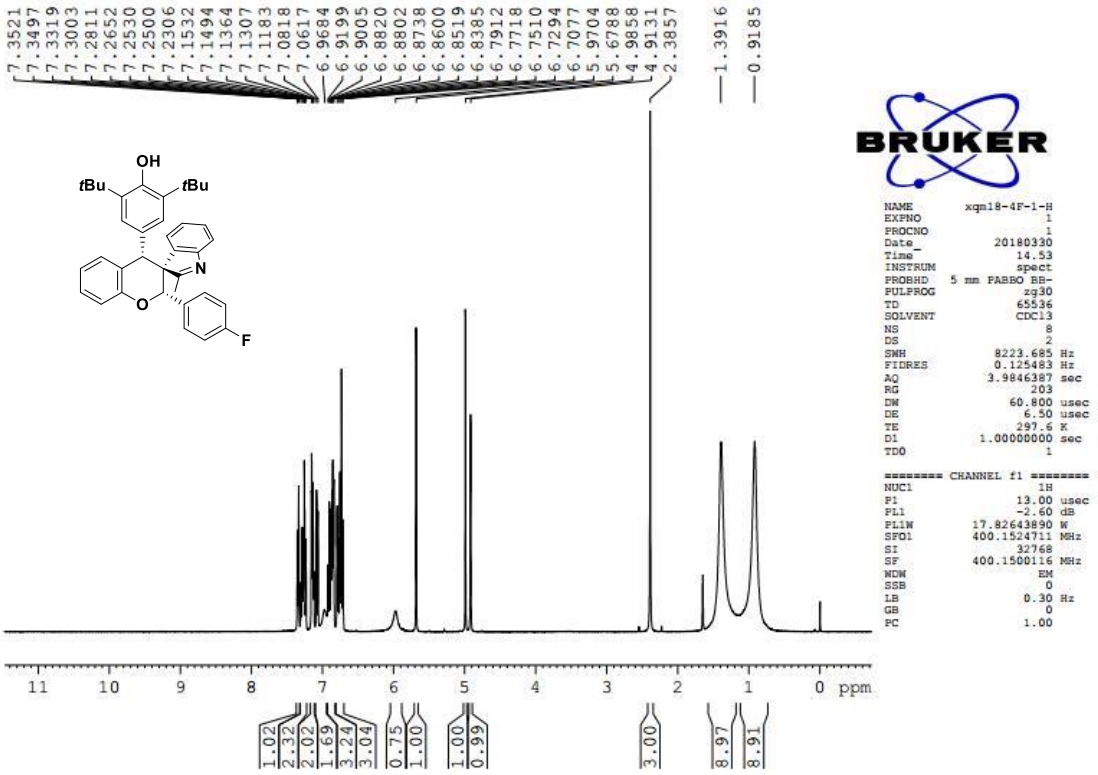
```
NAME          XQM1801226-3OCH3
EXPNO                        1
PROCNO                       1
Date_                 20180126
Time                     15.21
INSTRUM                  spect
PROBHD   5 mm PABBO BB-
PULPROG                  zg30
TD                      65536
SOLVENT                 CDCl3
NS                           8
DS                           2
SWH                   8223.685 Hz
FIDRES                0.125483 Hz
AQ                    3.9846387 sec
RG                        90.5
DW                      60.800 usec
DE                       6.50 usec
TE                      290.8 K
D1                    1.00000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                        1H
P1                      13.00 usec
PL1                     -2.60 dB
PL1W                18.28352737 W
SFO1                400.1524711 MHz
SI                         32768
SF                  400.1500097 MHz
WDW                         EM
SSB                          0
LB                      0.30 Hz
GB                           0
PC                        1.00
```



BRUKER

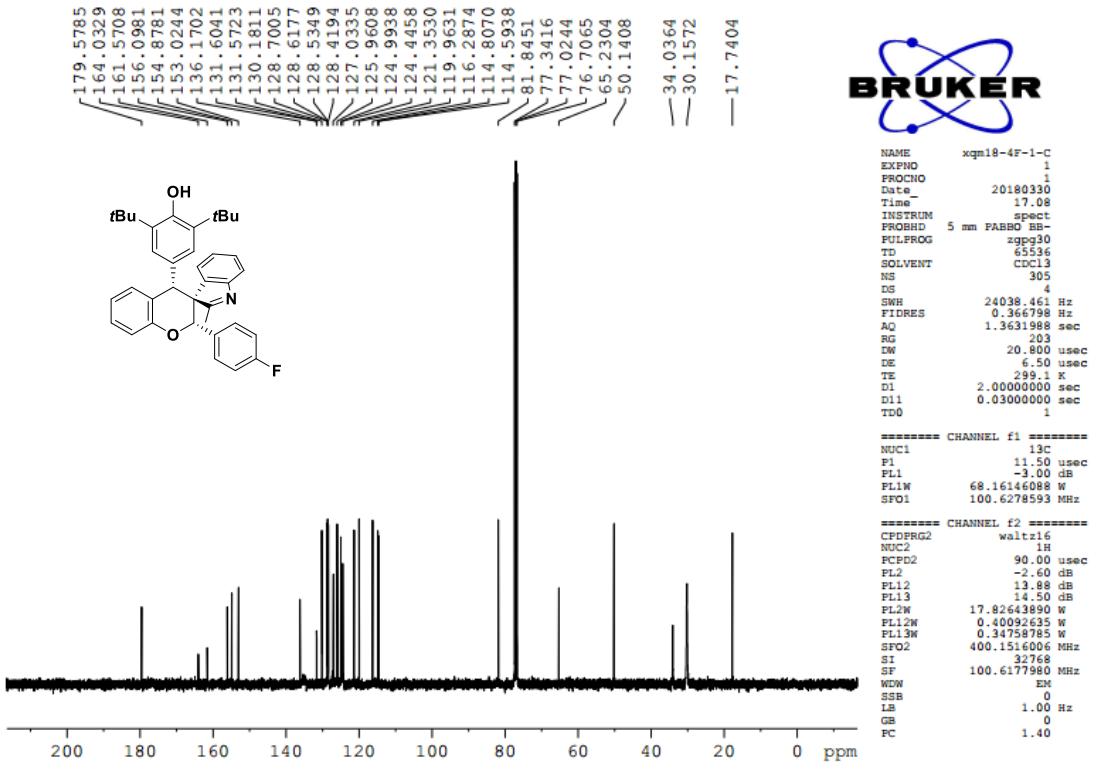
```
NAME          XQM180126-3OCH3-C
EXPNO                        1
PROCNO                       1
Date_                 20180126
Time                     17.19
INSTRUM                  spect
PROBHD   5 mm PABBO BB-
PULPROG                zgpg30
TD                      65536
SOLVENT                 CDCl3
NS                         176
DS                           4
SWH                  24038.461 Hz
FIDRES                0.366798 Hz
AQ                    1.3631988 sec
RG                         203
DW                      20.800 usec
DE                       6.50 usec
TE                      294.8 K
D1                    2.00000000 sec
D11                   0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                       13C
P1                      11.50 usec
PL1                     -3.00 dB
PL1W                68.16146088 W
SFO1                100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                        1H
PCPD2                   90.00 usec
PL2                     -2.60 dB
PL12                    13.88 dB
PL13                    14.50 dB
PL2W                17.82643890 W
PL12W                0.40092635 W
PL13W                0.34758785 W
SFO2                400.1516006 MHz
SI                         32768
SF                  100.6177980 MHz
WDW                         EM
SSB                          0
LB                      1.00 Hz
GB                           0
PC                        1.40
```

2,6-di-tert-butyl-4-(2-(4-fluorophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl) phenol (3k)



BRUKER

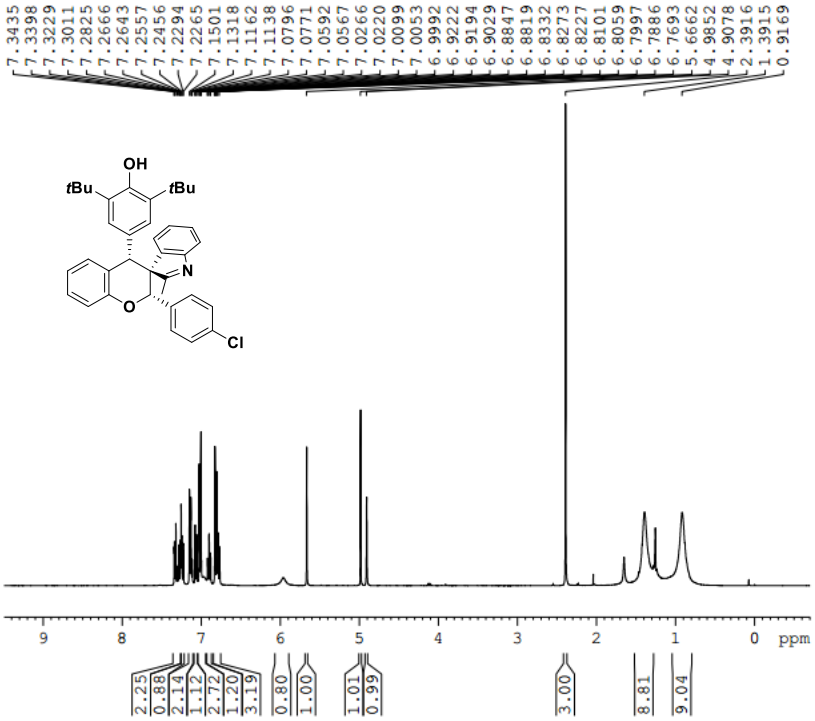
```
NAME          xqm18-4F-1-H
EXPNO                    1
PROCNO                   1
Date_         20180330
Time_            14.53
INSTRUM          spect
PROBHD   5 mm PABBO BB-
PULPROG          zg30
TD              65536
SOLVENT          CDCl3
NS                   8
DS                   2
SWH           8223.685 Hz
FIDRES        0.125483 Hz
AQ            3.9846387 sec
RG                 203
DW              60.800 usec
DE               6.50 usec
TE              297.6 K
D1            1.00000000 sec
TD0                  1

======== CHANNEL f1 ========
NUC1               1H
P1              13.00 usec
PL1             -2.60 dB
PL1W        17.82643890 W
SFO1        400.1524711 MHz
SI               32768
SF          400.1500116 MHz
WDW                EM
SSB                 0
LB               0.30 Hz
GB                  0
PC               1.00
```

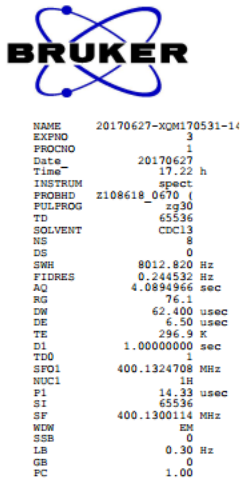


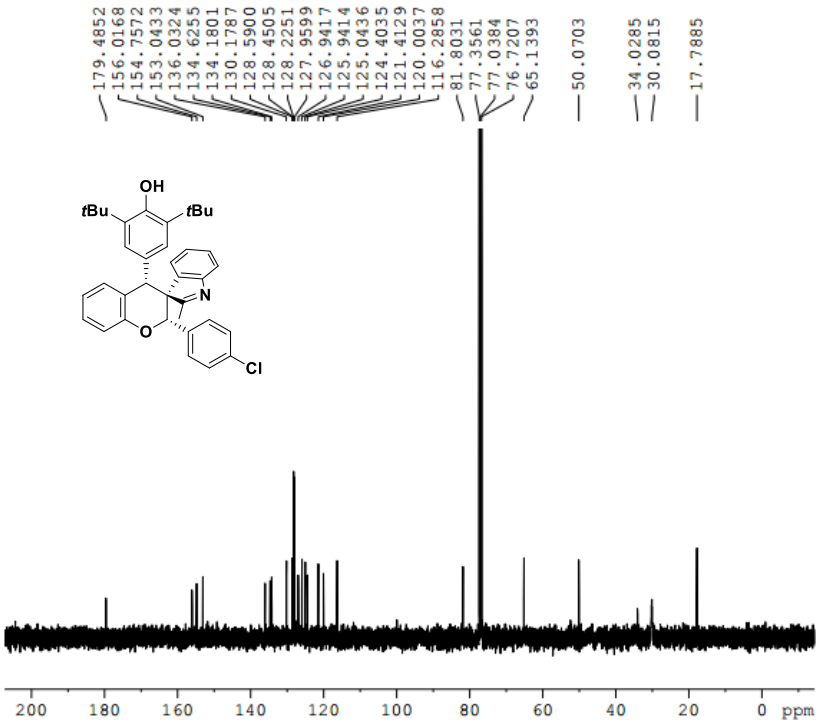
BRUKER

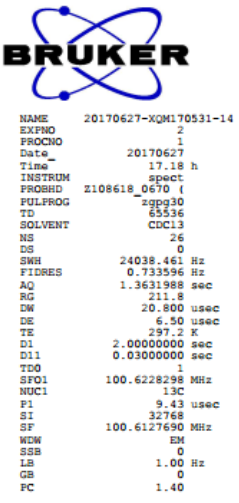
```
NAME          xqm18-4F-1-C
EXPNO                    1
PROCNO                   1
Date_         20180330
Time_            17.08
INSTRUM          spect
PROBHD   5 mm PABBO BB-
PULPROG          zgpg30
TD              65536
SOLVENT          CDCl3
NS                 305
DS                   4
SWH          24038.461 Hz
FIDRES        0.366798 Hz
AQ            1.3631988 sec
RG                 203
DW              20.800 usec
DE               6.50 usec
TE              299.1 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
NUC1               13C
P1              11.50 usec
PL1             -3.00 dB
PL1W        68.16146088 W
SFO1        100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2         waltz16
NUC2               1H
PCPD2           90.00 usec
PL2             -2.60 dB
PL12            13.88 dB
PL13            14.50 dB
PL2W        17.82643890 W
PL12W        0.40092635 W
PL13W        0.34758785 W
SFO2        400.1516006 MHz
SI               32768
SF          100.6177980 MHz
WDW                EM
SSB                 0
LB               1.00 Hz
GB                  0
PC               1.40
```

2,6-di-tert-butyl-4-(2-(4-chlorophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl) phenol (3l)

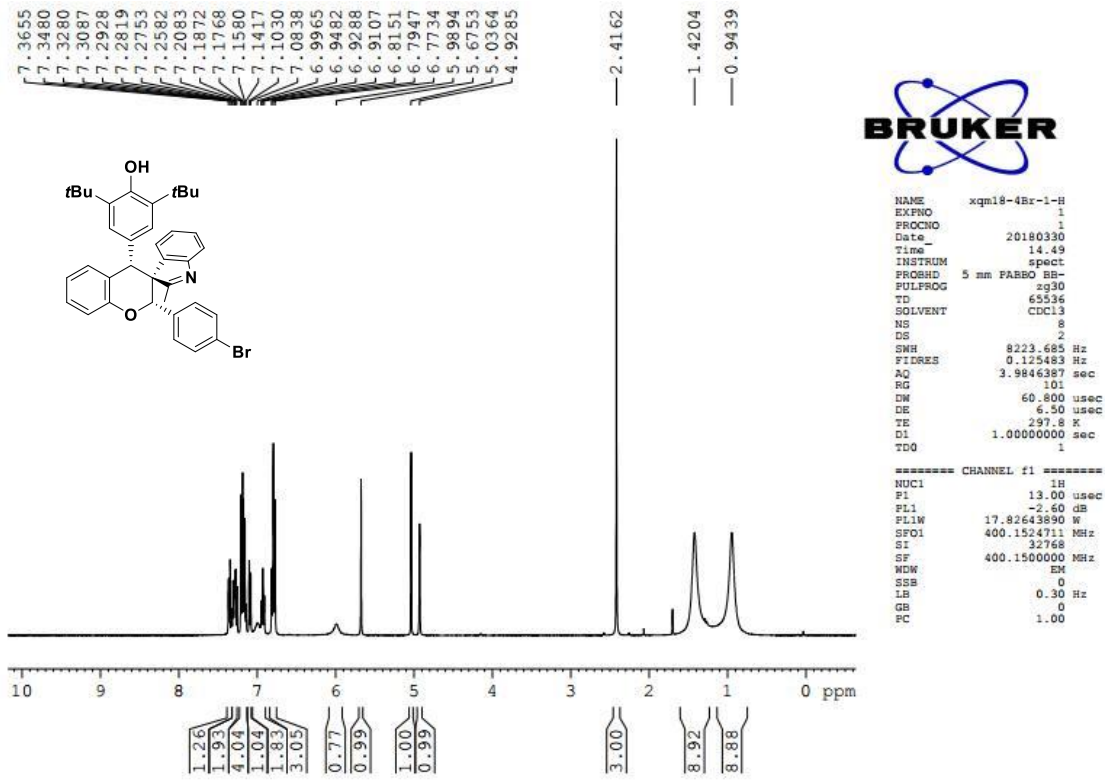






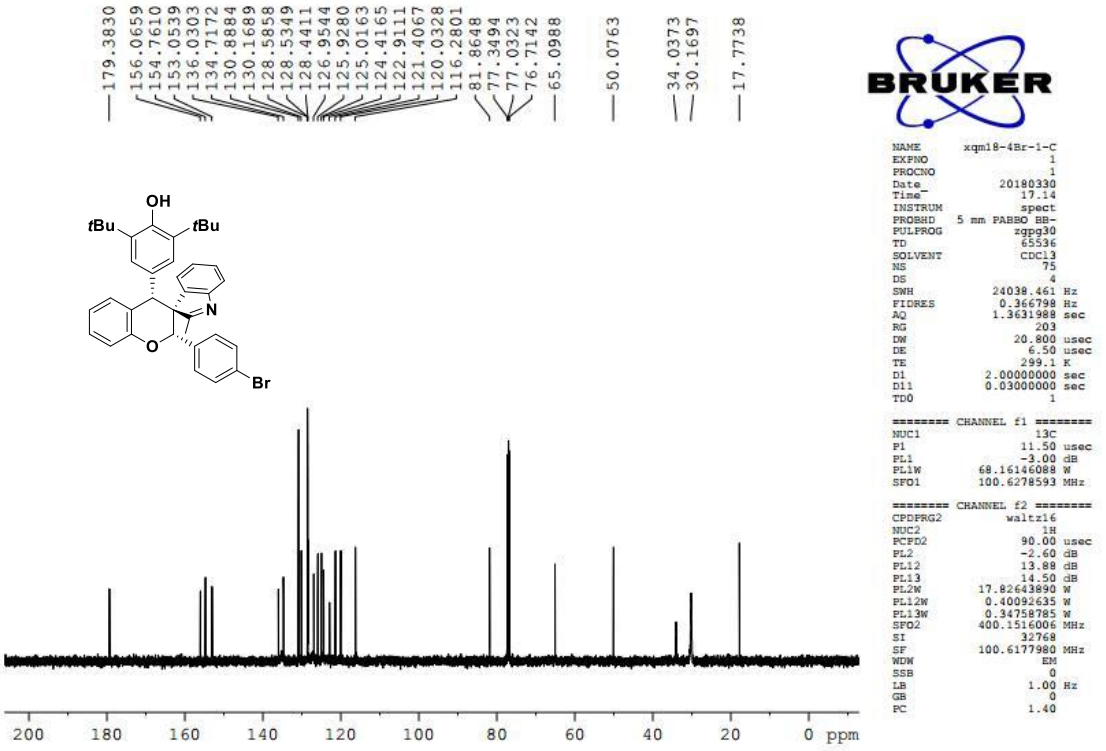


4-(2-(4-bromophenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl)-2,6-di-tert-butyl phenol (3m)



BRUKER

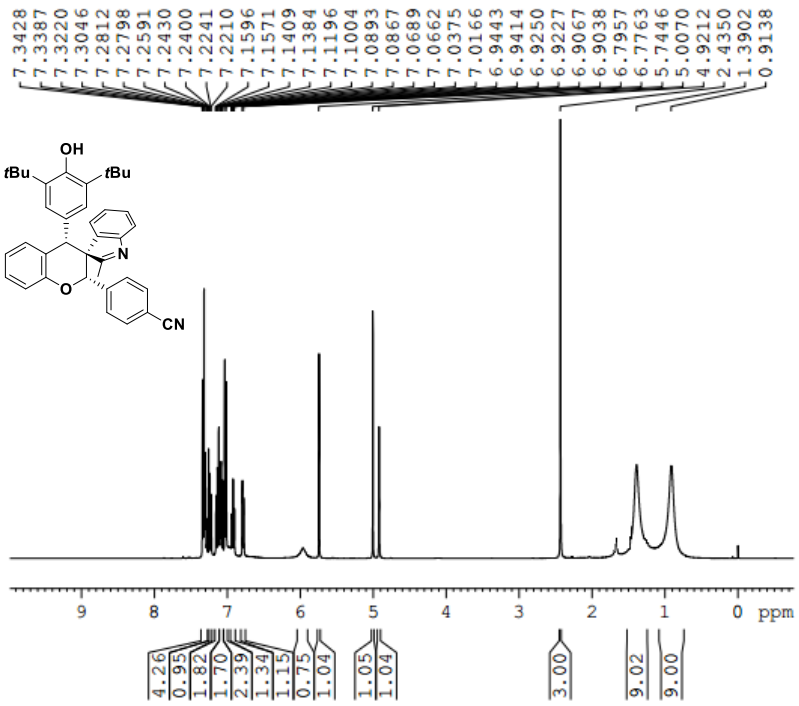
```
NAME          xqm18-4Br-1-H
EXPNO                    1
PROCNO                   1
Date_             20180330
Time                 14.49
INSTRUM              spect
PROBHD   5 mm PABBO BB-
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                       8
DS                       2
SWH               8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                     101
DW                  60.800 usec
DE                   6.50 usec
TE                  297.8 K
D1                1.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   1H
P1                  13.00 usec
PL1                 -2.60 dB
PL1W           17.82643890 W
SFO1           400.1524711 MHz
SI                   32768
SF             400.1500000 MHz
WDW                    EM
SSB                     0
LB                   0.30 Hz
GB                      0
PC                   1.00
```

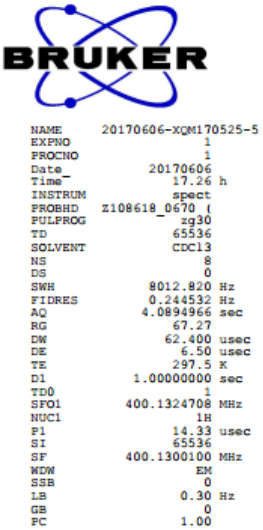


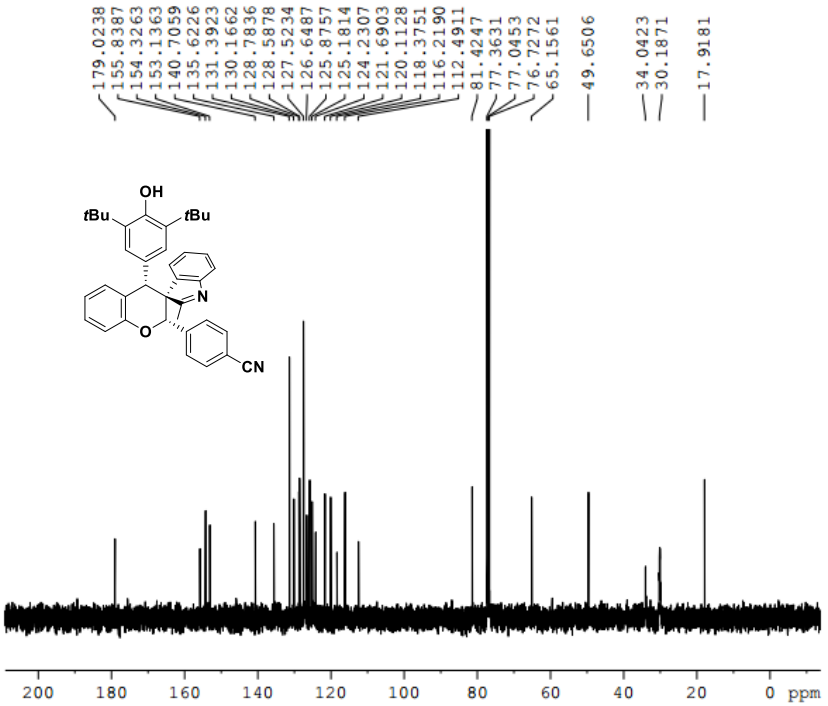
BRUKER

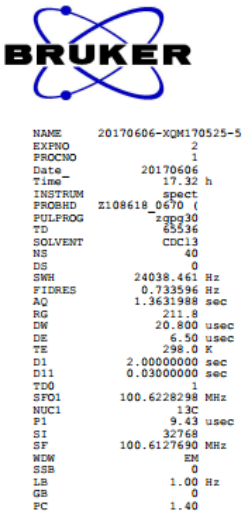
```
NAME          xqm18-4Br-1-C
EXPNO                    1
PROCNO                   1
Date_             20180330
Time                 17.14
INSTRUM              spect
PROBHD   5 mm PABBO BB-
PULPROG           zgpg30
TD                  65536
SOLVENT             CDCl3
NS                      75
DS                       4
SWH              24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                     203
DW                  20.800 usec
DE                   6.50 usec
TE                  299.1 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                  11.50 usec
PL1                 -3.00 dB
PL1W           68.16146088 W
SFO1           100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2             waltz16
NUC2                   1H
PCPD2               90.00 usec
PL2                 -2.60 dB
PL12                13.88 dB
PL13                14.50 dB
PL2W           17.82643890 W
PL12W           0.40092635 W
PL13W           0.34758785 W
SFO2           400.1516006 MHz
SI                   32768
SF             100.6177980 MHz
WDW                    EM
SSB                     0
LB                   1.00 Hz
GB                      0
PC                   1.40
```

4-(4-(3,5-di-tert-butyl-4-hydroxyphenyl)-2'-methylspiro[chromane-3,3'-indol]-2-yl)benzonitrile (3n)

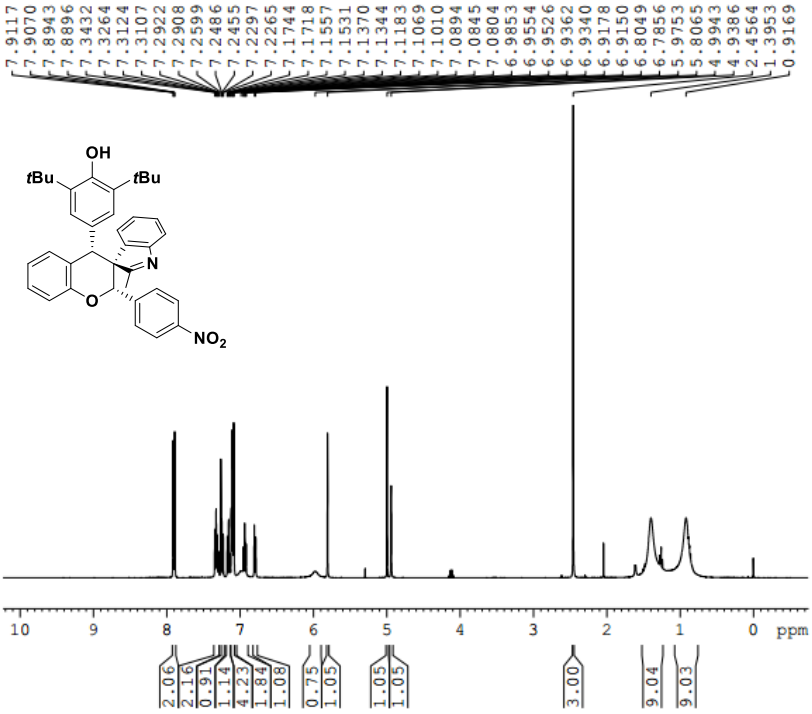


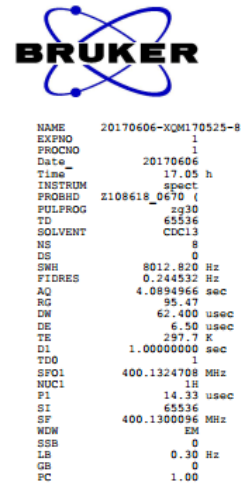




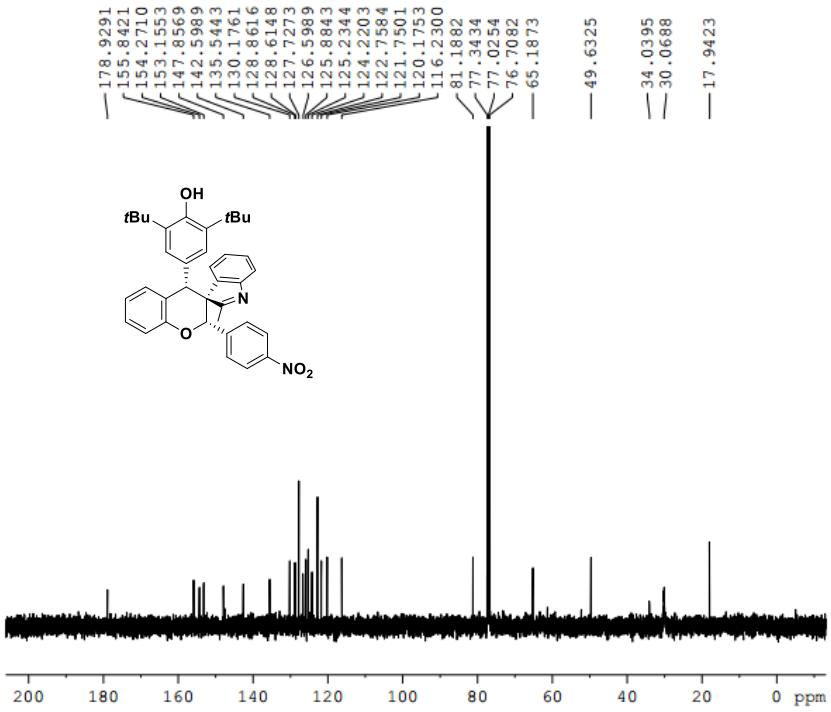


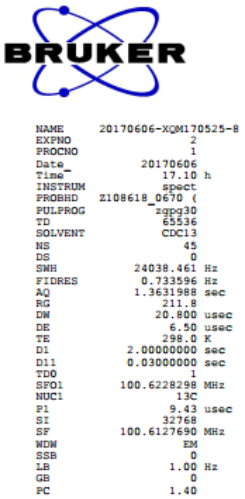
2,6-di-tert-butyl-4-(2'-methyl-2-(4-nitrophenyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3o)





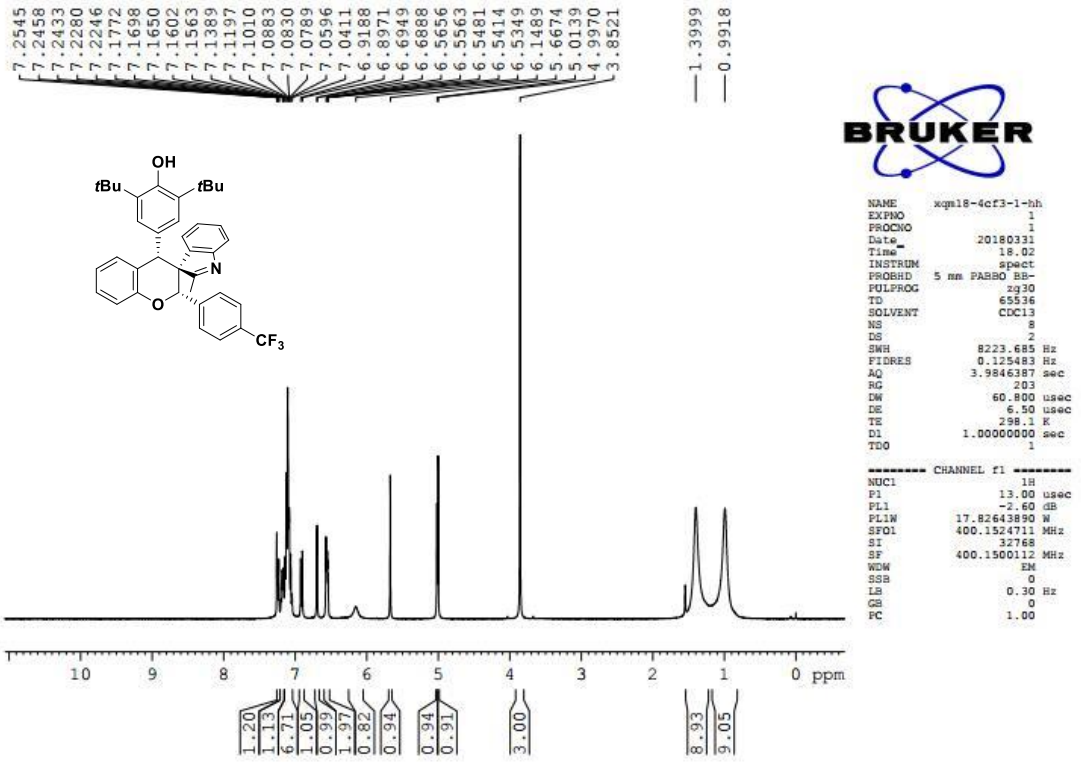

```
NAME          20170606-XQM170525-8
EXPNO                1
PROCNO               1
Date_         20170606
Time_            17.05 h
INSTRUM          spect
PROBHD    Z108618_0670 (
PULPROG          zg30
TD               65536
SOLVENT          CDCl3
NS                   8
DS                   0
SWH           8012.820 Hz
FIDRES        0.244532 Hz
AQ            4.0894966 sec
RG                95.47
DW               62.400 usec
DE                6.50 usec
TE                297.7 K
D1            1.00000000 sec
TD0                  1
SFO1        400.1324708 MHz
NUC1               1H
P1               14.33 usec
SI               65536
SF          400.1300096 MHz
WDW                EM
SSB                  0
LB                0.30 Hz
GB                   0
PC                1.00
```





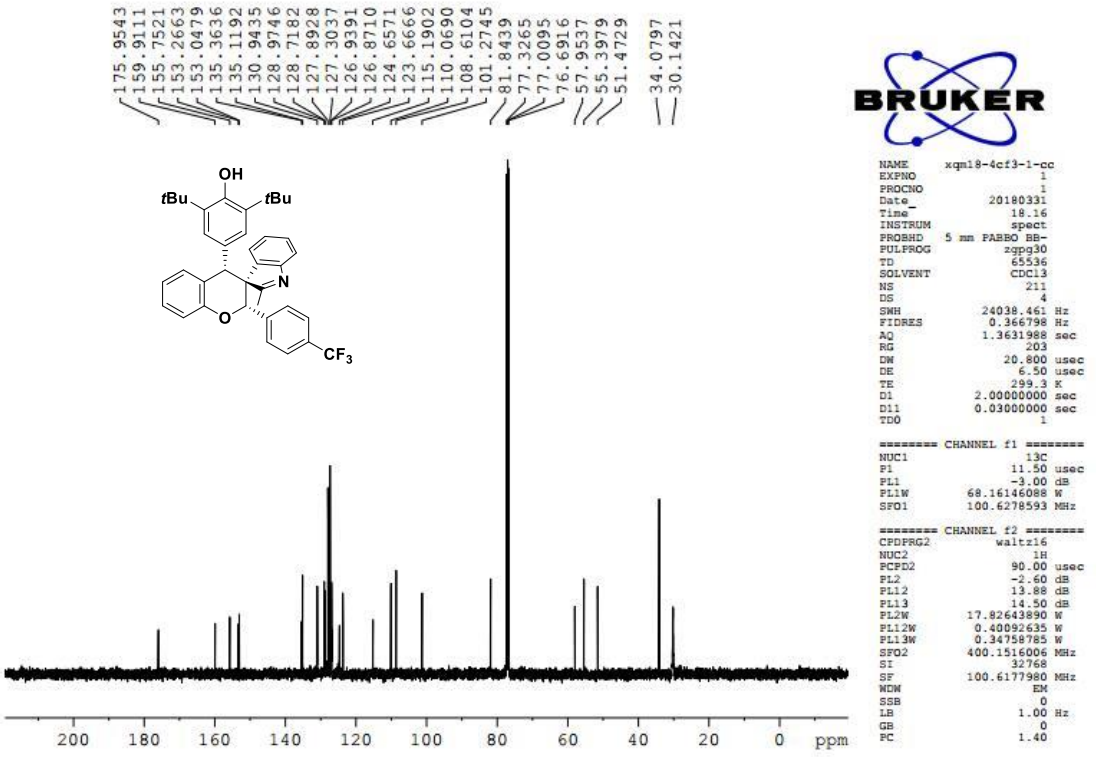

```
NAME          20170606-XQM170525-8
EXPNO                2
PROCNO               1
Date_         20170606
Time_            17.10 h
INSTRUM          spect
PROBHD    Z108618_0670 (
PULPROG          zgpg30
TD               65536
SOLVENT          CDCl3
NS                  45
DS                   0
SWH          24038.461 Hz
FIDRES        0.733596 Hz
AQ            1.3631988 sec
RG                211.8
DW               20.800 usec
DE                6.50 usec
TE                298.0 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                  1
SFO1        100.6228298 MHz
NUC1               13C
P1                9.43 usec
SI               32768
SF          100.6127690 MHz
WDW                EM
SSB                  0
LB                1.00 Hz
GB                   0
PC                1.40
```

2,6-di-tert-butyl-4-(2'-methyl-2-(4-(trifluoromethyl)phenyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3p)



BRUKER

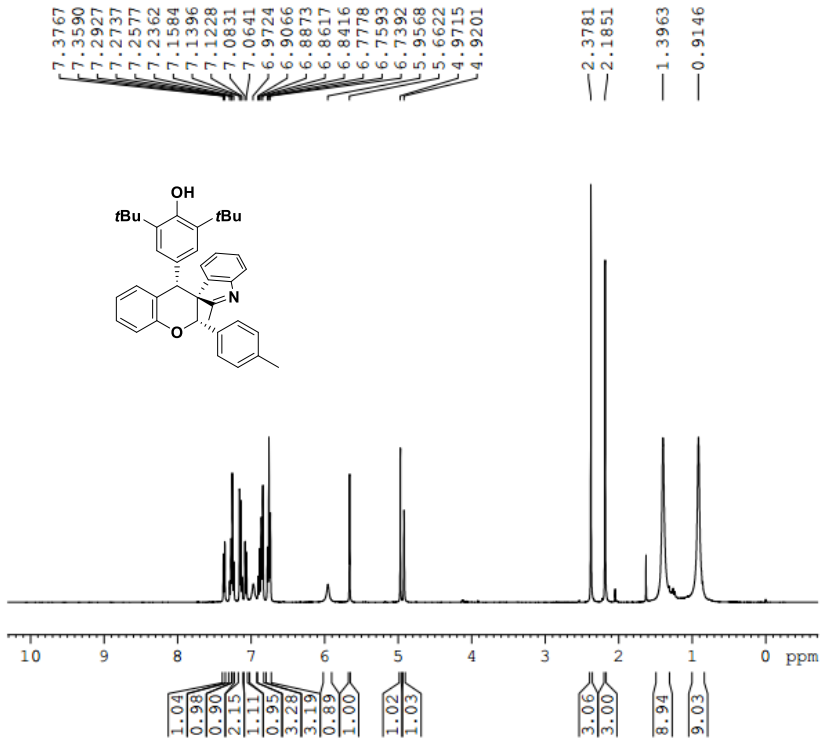
```
NAME          xqm18-4cf3-1-hh
EXPNO                      1
PROCNO                     1
Date_               20180331
Time                   18.02
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                         8
DS                         2
SWH                 8223.685 Hz
FIDRES              0.125483 Hz
AQ                  3.9846387 sec
RG                       203
DW                    60.800 usec
DE                     6.50 usec
TE                   298.1 K
D1                  1.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     13.00 usec
PL1                    -2.60 dB
PL1W               17.82643890 W
SFO1              400.1524711 MHz
SI                        32768
SF                400.1500112 MHz
WDW                       EM
SSB                        0
LB                      0.30 Hz
GB                         0
PC                      1.00
```



BRUKER

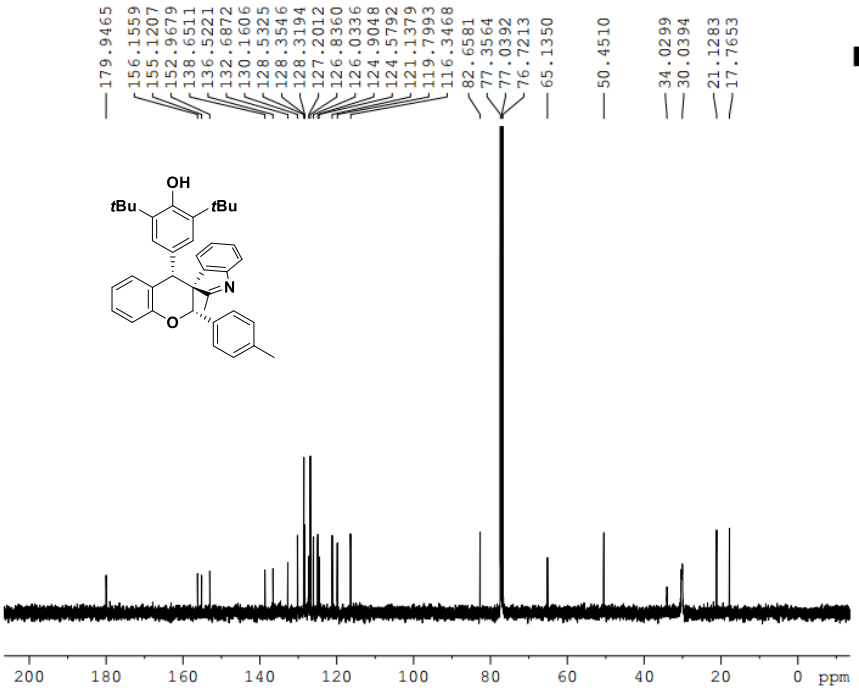
```
NAME          xqm18-4cf3-1-cc
EXPNO                      1
PROCNO                     1
Date_               20180331
Time                   18.16
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG             zgpg30
TD                    65536
SOLVENT               CDCl3
NS                       211
DS                         4
SWH                24038.461 Hz
FIDRES              0.366798 Hz
AQ                  1.3631988 sec
RG                       203
DW                    20.800 usec
DE                     6.50 usec
TE                   299.3 K
D1                  2.00000000 sec
D11                 0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      13C
P1                     11.50 usec
PL1                    -3.00 dB
PL1W               68.16146088 W
SFO1              100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                      1H
PCPD2                  90.00 usec
PL2                    -2.60 dB
PL12                   13.88 dB
PL13                   14.50 dB
PL2W               17.82643890 W
PL12W               0.40092635 W
PL13W               0.34758785 W
SFO2              400.1516006 MHz
SI                        32768
SF                100.6177980 MHz
WDW                       EM
SSB                        0
LB                      1.00 Hz
GB                         0
PC                      1.40
```

2,6-di-tert-butyl-4-(2'-methyl-2-(p-tolyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3q)



BRUKER

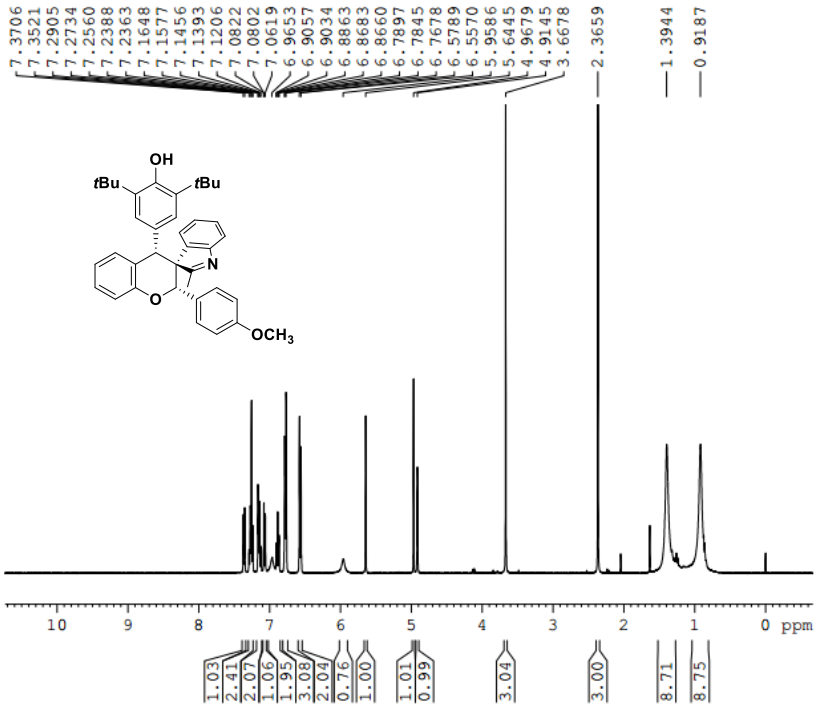
```
NAME          XQM1801226-4CH3
EXPNO                      1
PROCNO                     1
Date_               20180126
Time                   15.16
INSTRUM                spect
PROBHD    5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                        8
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                     90.5
DW                   60.800 usec
DE                    6.50 usec
TE                   290.5 K
D1                1.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    13.00 usec
PL1                   -2.60 dB
PL1W           18.28352737 W
SFO1           400.1524711 MHz
SI                    32768
SF             400.1500100 MHz
WDW                      EM
SSB                       0
LB                     0.30 Hz
GB                        0
PC                     1.00
```



BRUKER

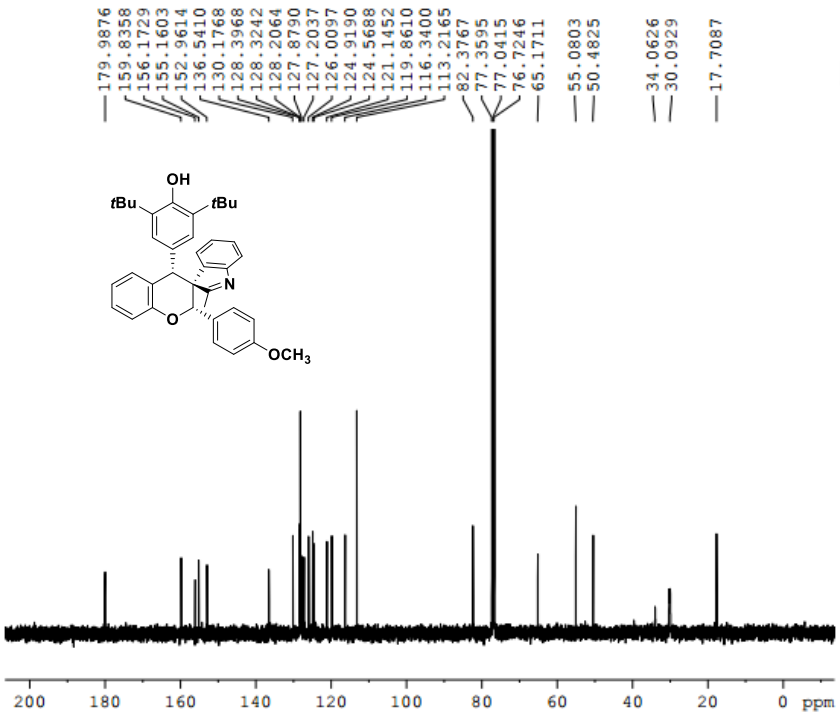
```
NAME          xqm180126-4CH3-c
EXPNO                      1
PROCNO                     1
Date_               20180126
Time                   17.01
INSTRUM                spect
PROBHD    5 mm PABBO BB-
PULPROG             zgpg30
TD                    65536
SOLVENT               CDCl3
NS                      195
DS                        4
SWH               24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                      203
DW                   20.800 usec
DE                    6.50 usec
TE                   294.5 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                     13C
P1                    11.50 usec
PL1                   -3.00 dB
PL1W           68.16146088 W
SFO1           100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2             waltz16
NUC2                      1H
PCPD2                 90.00 usec
PL2                   -2.60 dB
PL12                  13.88 dB
PL13                  14.50 dB
PL2W           17.82643890 W
PL12W           0.40092635 W
PL13W           0.34758785 W
SFO2           400.1516006 MHz
SI                    32768
SF             100.6177980 MHz
WDW                      EM
SSB                       0
LB                     1.00 Hz
GB                        0
PC                     1.40
```

2,6-di-tert-butyl-4-(2-(4-methoxyphenyl)-2'-methylspiro[chromane-3,3'-indol]-4-yl)phenol (3r)



BRUKER

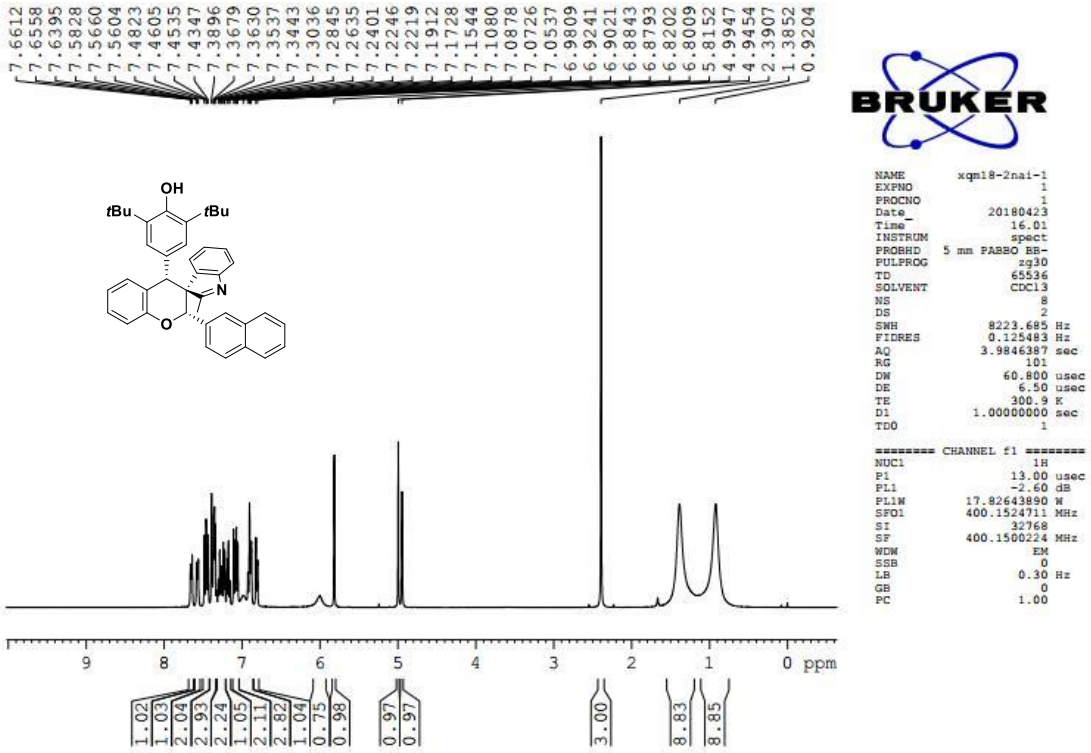
```
NAME          xqm180127-4OCH3
EXPNO                       1
PROCNO                      1
Date_              20180127
Time_                 16.32
INSTRUM               spect
PROBHD   5 mm PABBO BB-
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                       8
DS                       2
SWH               8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                     203
DW                  60.800 usec
DE                   6.50 usec
TE                  294.7 K
D1                1.00000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                    1H
P1                   13.00 usec
PL1                  -2.60 dB
PL1W            17.82643890 W
SFO1           400.1524711 MHz
SI                   32768
SF             400.1500105 MHz
WDW                     EM
SSB                      0
LB                    0.30 Hz
GB                       0
PC                    1.00
```

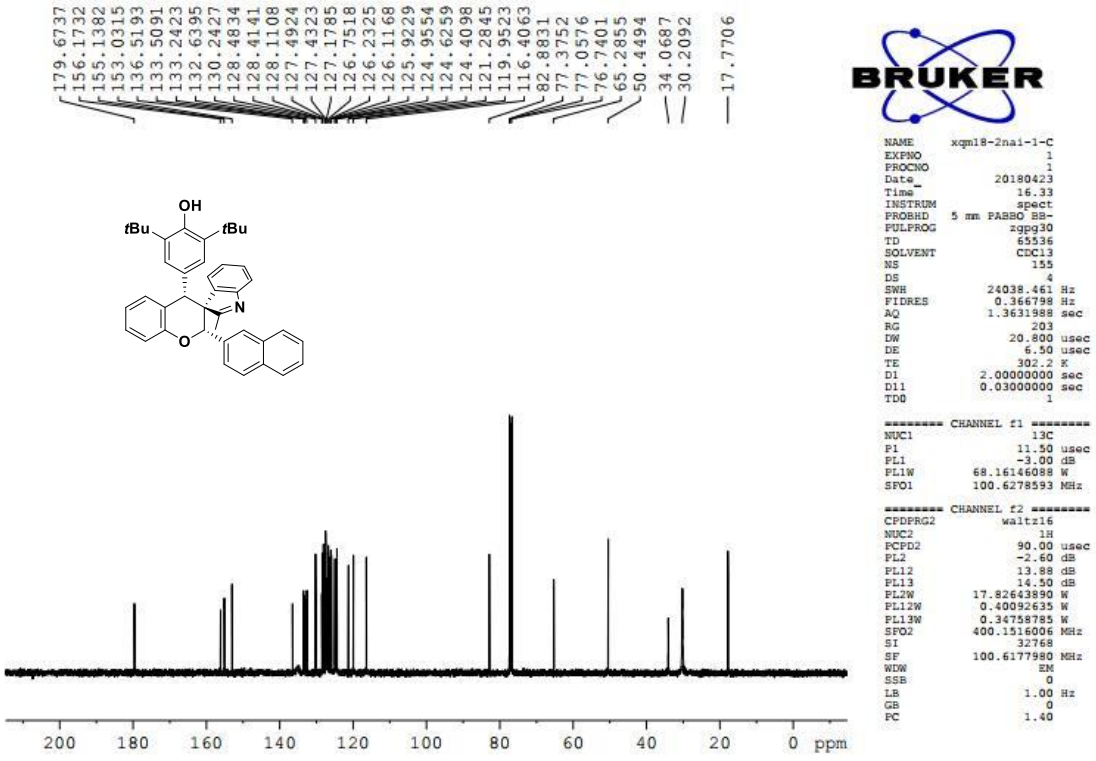


BRUKER

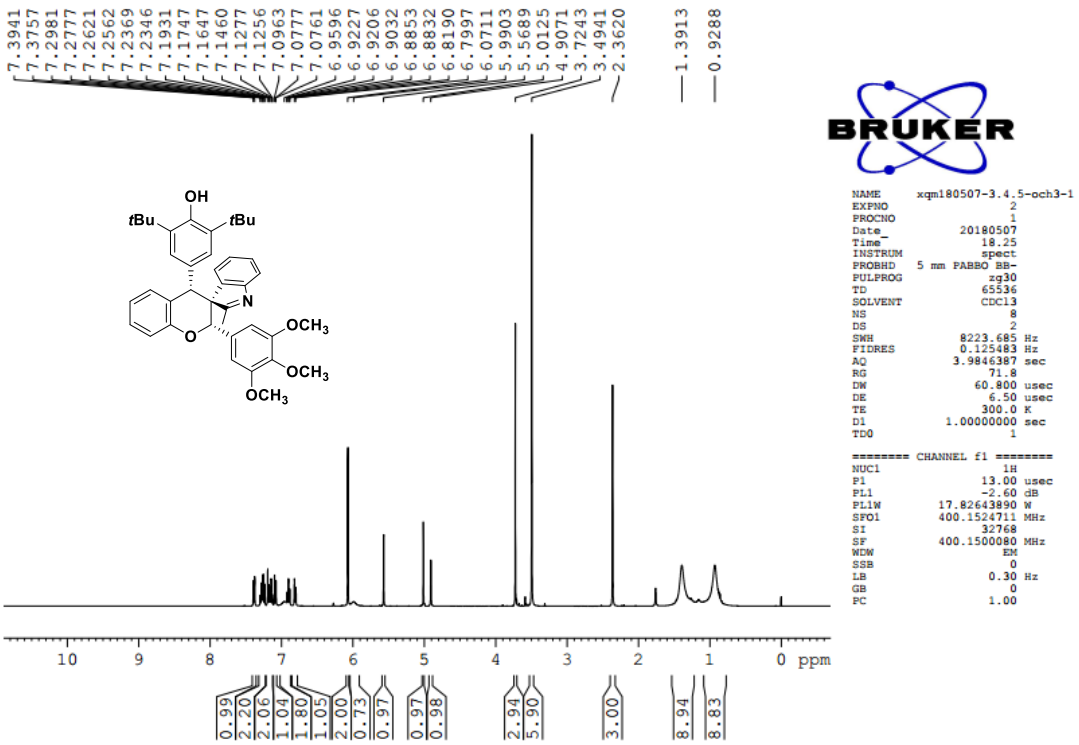
```
NAME          xqm180127-4OCH3-c
EXPNO                       1
PROCNO                      1
Date_              20180127
Time                  17.19
INSTRUM               spect
PROBHD   5 mm PABBO BB-
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     103
DS                       4
SWH              24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                     203
DW                  20.800 usec
DE                   6.50 usec
TE                  295.9 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
NUC1                   13C
P1                   11.50 usec
PL1                  -3.00 dB
PL1W            68.16146088 W
SFO1           100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2             waltz16
NUC2                    1H
PCPD2                90.00 usec
PL2                  -2.60 dB
PL12                 13.88 dB
PL13                 14.50 dB
PL2W            17.82643890 W
PL12W            0.40092635 W
PL13W            0.34758785 W
SFO2           400.1516006 MHz
SI                   32768
SF             100.6177980 MHz
WDW                     EM
SSB                      0
LB                    1.00 Hz
GB                       0
PC                    1.40
```

2,6-di-tert-butyl-4-(2'-methyl-2-(naphthalen-2-yl)spiro[chromane-3,3'-indol]-4-yl)phenol (3s)



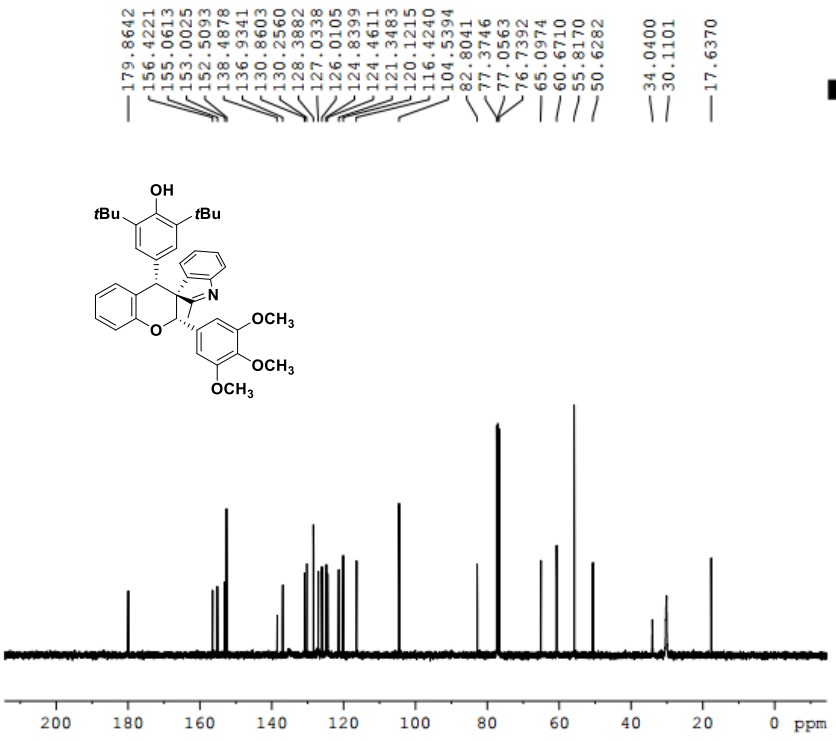


2,6-di-tert-butyl-4-(2'-methyl-2-(3,4,5-trimethoxyphenyl)spiro[chromane-3,3'-indol]-4-yl)phenol (3t)



BRUKER

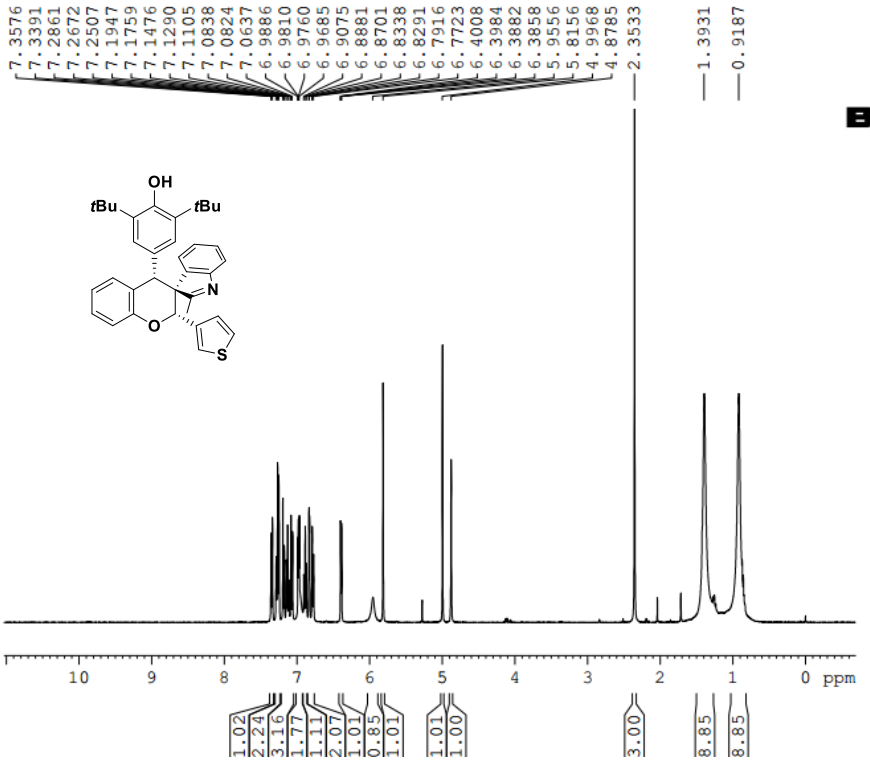
```
NAME          xqm180507-3.4.5-och3-1
EXPNO                              2
PROCNO                             1
Date_                       20180507
Time                           18.25
INSTRUM                        spect
PROBHD     5 mm PABBO BB-
PULPROG                         zg30
TD                             65536
SOLVENT                        CDCl3
NS                                 8
DS                                 2
SWH                       8223.685 Hz
FIDRES                    0.125483 Hz
AQ                        3.9846387 sec
RG                             71.8
DW                           60.800 usec
DE                            6.50 usec
TE                           300.0 K
D1                        1.00000000 sec
TD0                                1

======== CHANNEL f1 ========
NUC1                             1H
P1                           13.00 usec
PL1                          -2.60 dB
PL1W                    17.82643890 W
SFO1                    400.1524711 MHz
SI                             32768
SF                      400.1500080 MHz
WDW                               EM
SSB                                0
LB                            0.30 Hz
GB                                 0
PC                              1.00
```



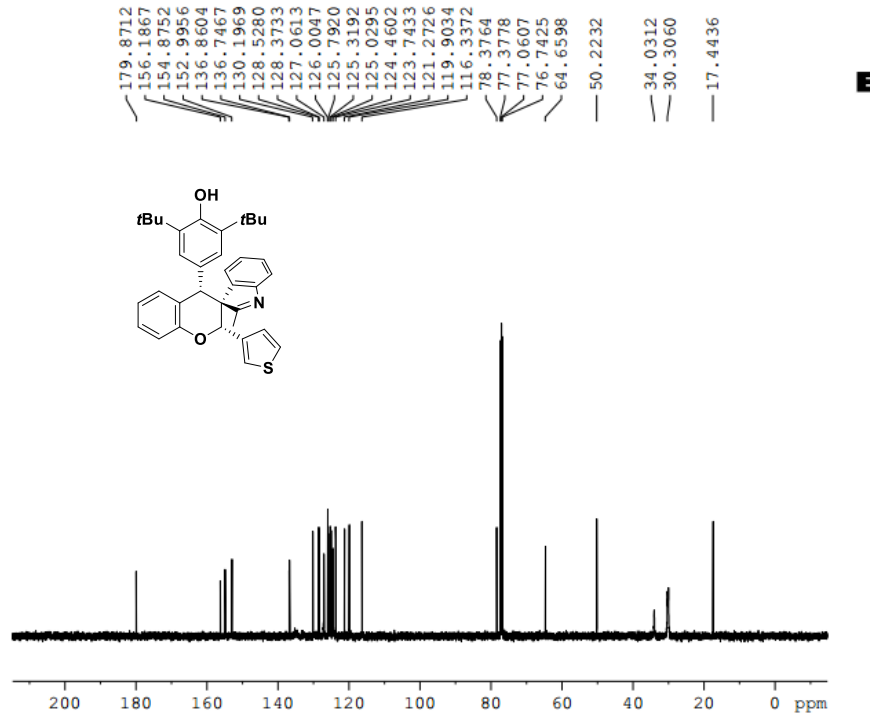
BRUKER

```
NAME          xqm180507-3.4.5-och3-1-c
EXPNO                              2
PROCNO                             1
Date_                       20180507
Time                           18.46
INSTRUM                        spect
PROBHD     5 mm PABBO BB-
PULPROG                       zgpg30
TD                             65536
SOLVENT                        CDCl3
NS                               116
DS                                 4
SWH                      24038.461 Hz
FIDRES                    0.366798 Hz
AQ                        1.3631988 sec
RG                               203
DW                           20.800 usec
DE                            6.50 usec
TE                           301.2 K
D1                        2.00000000 sec
D11                       0.03000000 sec
TD0                                1

======== CHANNEL f1 ========
NUC1                             13C
P1                           11.50 usec
PL1                          -3.00 dB
PL1W                    68.16146088 W
SFO1                    100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2                     waltz16
NUC2                             1H
PCPD2                        90.00 usec
PL2                          -2.60 dB
PL12                         13.88 dB
PL13                         14.50 dB
PL2W                    17.82643890 W
PL12W                    0.40092635 W
PL13W                    0.34758785 W
SFO2                    400.1516006 MHz
SI                             32768
SF                      100.6177980 MHz
WDW                               EM
SSB                                0
LB                            1.00 Hz
GB                                 0
PC                              1.40
```

2,6-di-tert-butyl-4-(2'-methyl-2-(thiophen-3-yl)spiro[chromane-3,3'-indol]-4-yl)phenol (3u)

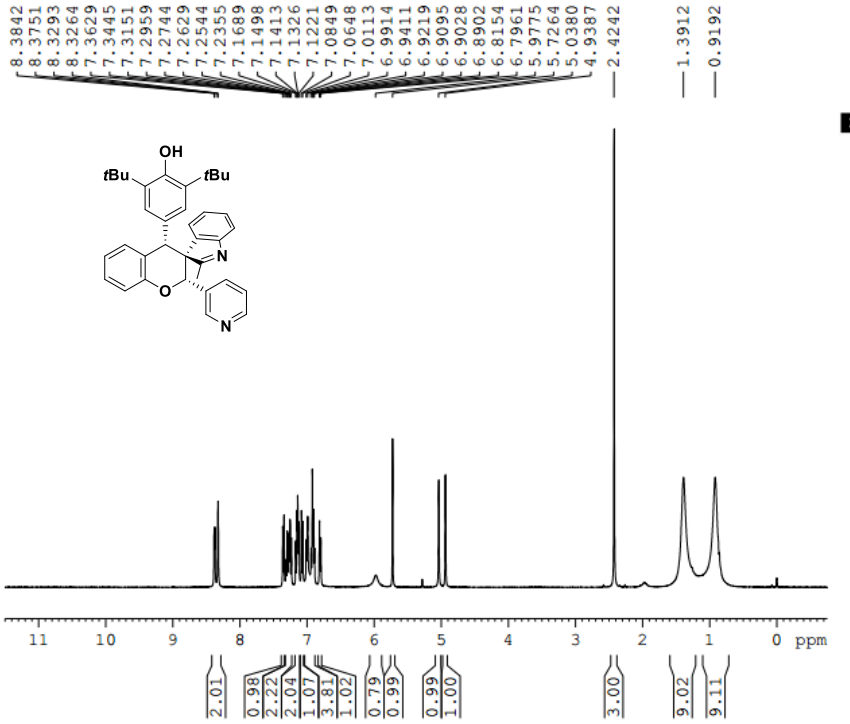


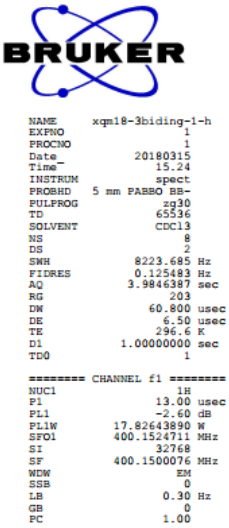

```
NAME          xqm18-3saifen-2
EXPNO                      1
PROCNO                     1
Date_               20180306
Time                   20.27
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                        8
DS                        2
SWH                8223.685 Hz
FIDRES             0.125483 Hz
AQ                 3.9846387 sec
RG                      203
DW                   60.800 usec
DE                    6.50 usec
TE                   294.7 K
D1                1.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                    13.00 usec
PL1                   -2.60 dB
PL1W              17.82643890 W
SFO1              400.1524711 MHz
SI                       32768
SF                400.1500123 MHz
WDW                        EM
SSB                         0
LB                     0.30 Hz
GB                          0
PC                     1.00
```

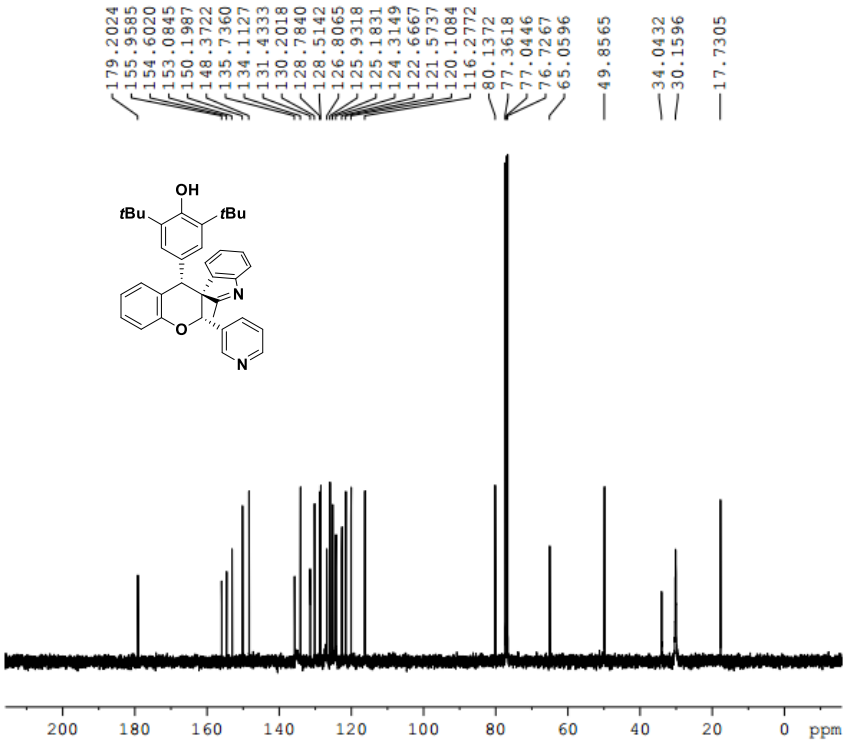


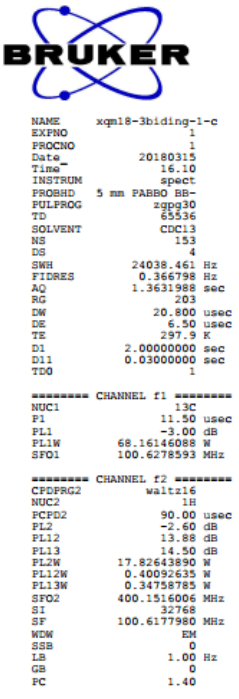

```
NAME          xqm18-3saifen-2-c
EXPNO                      1
PROCNO                     1
Date_               20180306
Time                   20.50
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG              zgpg30
TD                    65536
SOLVENT               CDCl3
NS                       94
DS                        4
SWH               24038.461 Hz
FIDRES             0.366798 Hz
AQ                 1.3631988 sec
RG                      203
DW                   20.800 usec
DE                    6.50 usec
TE                   295.7 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                     13C
P1                    11.50 usec
PL1                   -3.00 dB
PL1W              68.16146088 W
SFO1              100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2              waltz16
NUC2                      1H
PCPD2                 90.00 usec
PL2                   -2.60 dB
PL12                  13.88 dB
PL13                  14.50 dB
PL2W              17.82643890 W
PL12W              0.40092635 W
PL13W              0.34758785 W
SFO2              400.1516006 MHz
SI                       32768
SF                100.6177980 MHz
WDW                        EM
SSB                         0
LB                     1.00 Hz
GB                          0
PC                     1.40
```

2,6-di-tert-butyl-4-(2'-methyl-2-(pyridin-3-yl)spiro[chromane-3,3'-indol]-4-yl)phenol (3v)

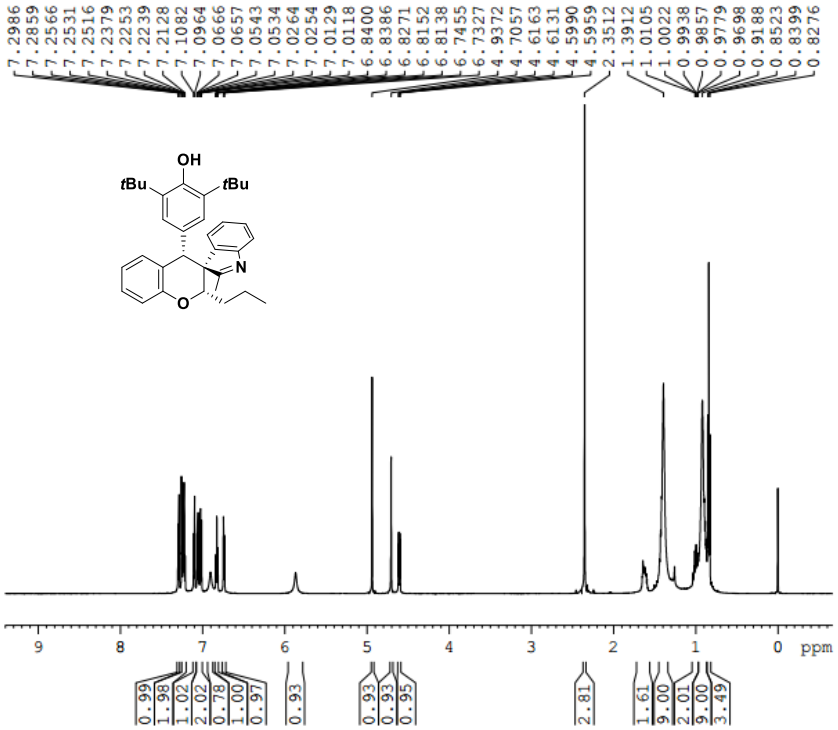




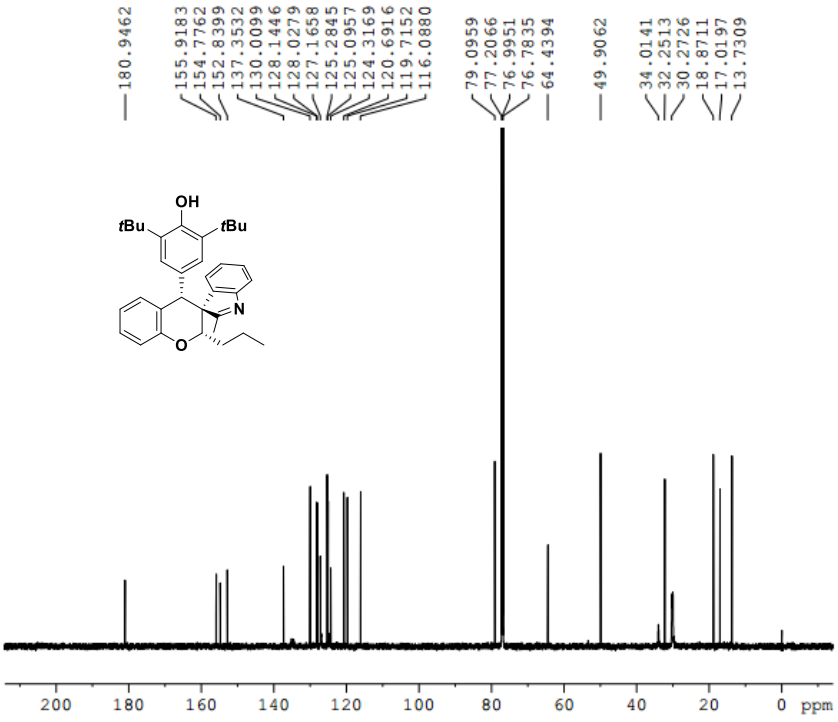




2,6-di-tert-butyl-4-(2'-methyl-2-propylspiro[chromane-3,3'-indol]-4-yl)phenol (3w)

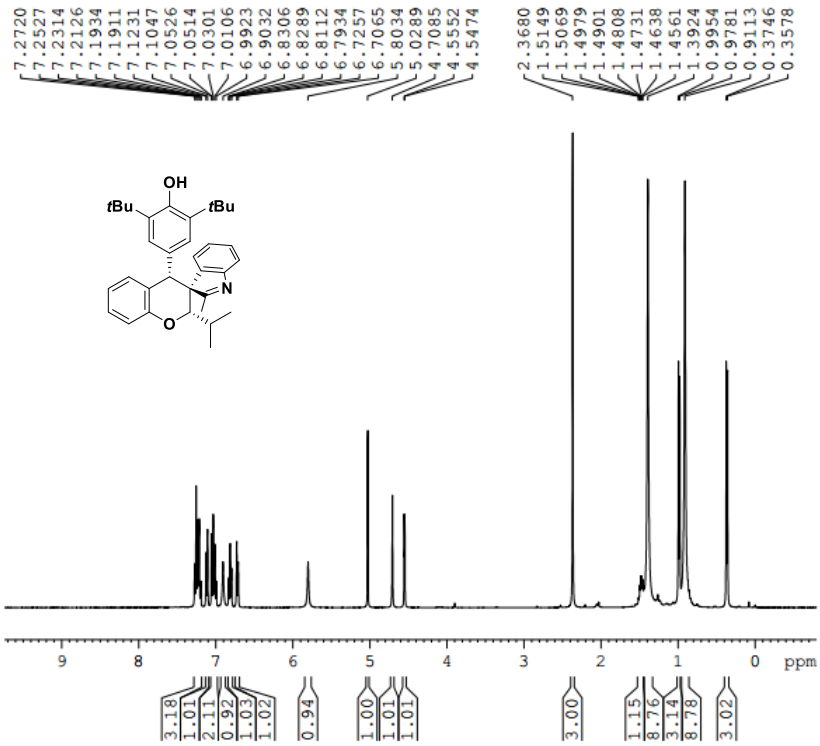



```
NAME          GQX-1H (38-48)
EXPNO                 38
PROCNO                 1
Date_           20170730
Time                18.24
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    16
DS                     2
SWH           12019.230 Hz
FIDRES        0.183399 Hz
AQ            2.7263477 sec
RG                 54.75
DW                41.600 usec
DE                 6.50 usec
TE                300.5 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         600.1337060 MHz
NUC1                   1H
P1                 12.36 usec
SI                 65536
SF           600.1300178 MHz
WDW                   EM
SSB                    0
LB                0.30 Hz
GB                     0
PC                 1.00
```

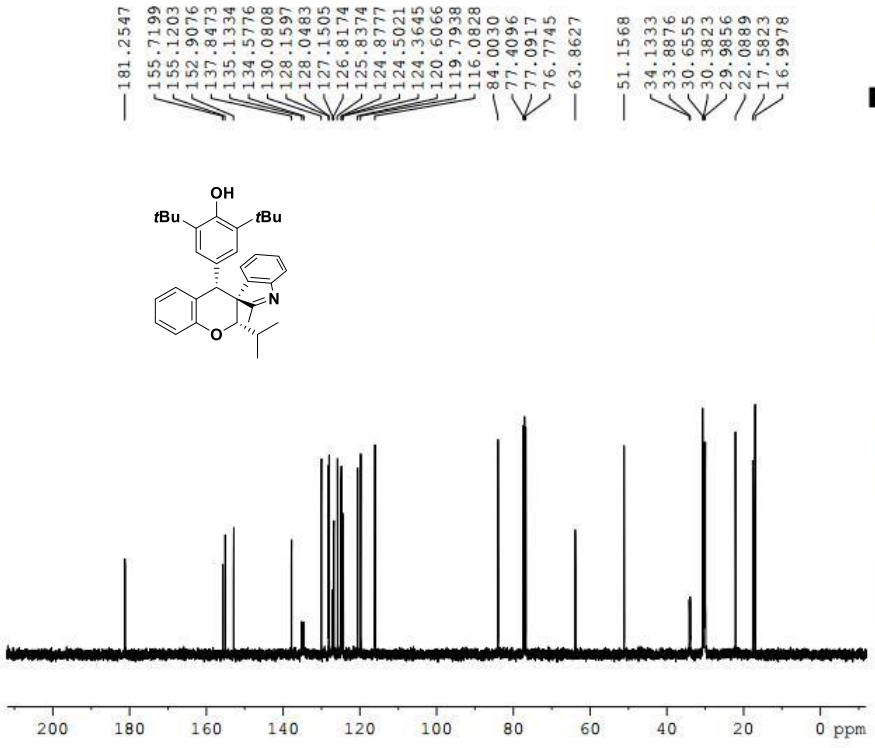



```
NAME          GQX-13C (38-48)
EXPNO                 38
PROCNO                 1
Date_           20170730
Time                19.16
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG           zgpg30
TD                 65536
SOLVENT            CDCl3
NS                  1024
DS                     4
SWH           36057.691 Hz
FIDRES        0.550197 Hz
AQ            0.9088159 sec
RG                188.59
DW                13.867 usec
DE                 6.50 usec
TE                302.7 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         150.917898l MHz
NUC1                  13C
P1                 13.76 usec
SI                 32768
SF           150.9028090 MHz
WDW                   EM
SSB                    0
LB                1.00 Hz
GB                     0
PC                 1.40
```

2,6-di-tert-butyl-4-(2-isopropyl-2'-methylspiro[chromane-3,3'-indol]-4-yl)phenol (3x)

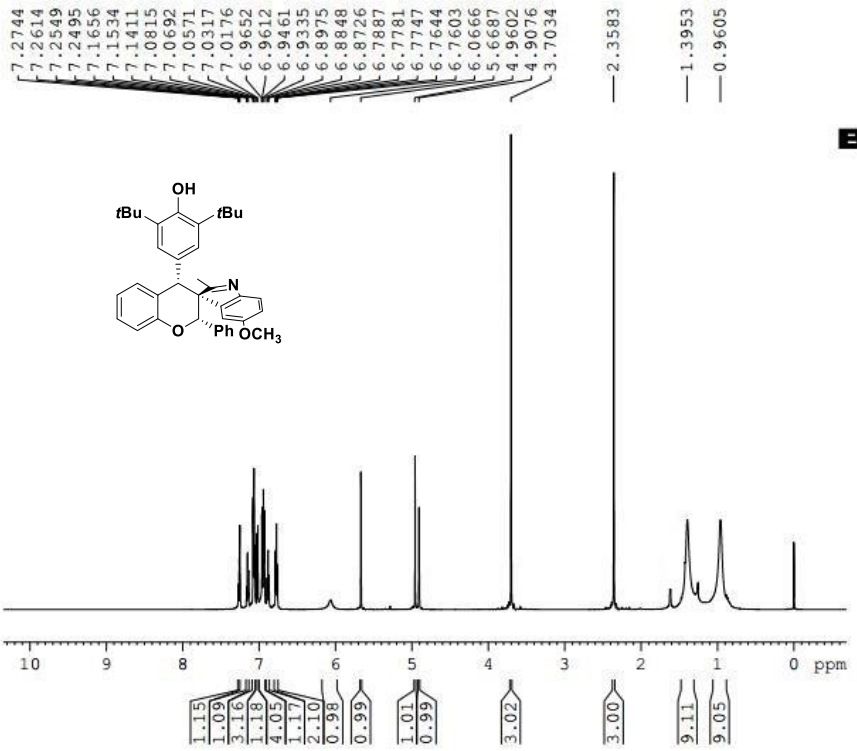


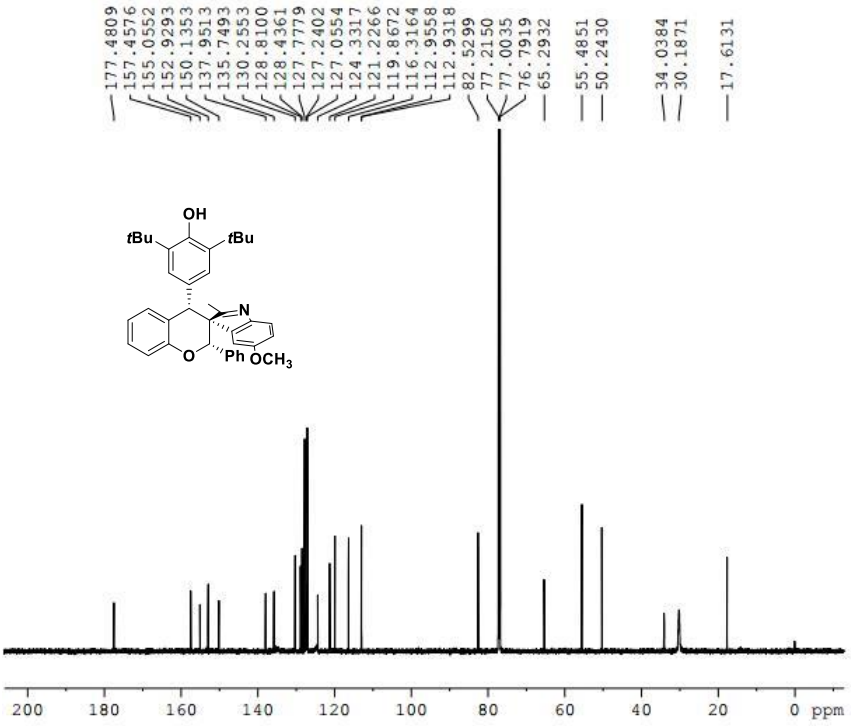

```
NAME          xqm180104-1-HH
EXPNO                      1
PROCNO                     1
Date_               20180315
Time_                  15.29
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                        8
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                       64
DW                  60.800 usec
DE                   6.50 usec
TE                  296.6 K
D1                1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                     1H
P1                   13.00 usec
PL1                  -2.60 dB
PL1W            17.82643890 W
SFO1           400.1524711 MHz
SI                    32768
SF             400.1500122 MHz
WDW                      EM
SSB                       0
LB                   0.30 Hz
GB                        0
PC                     1.00
```



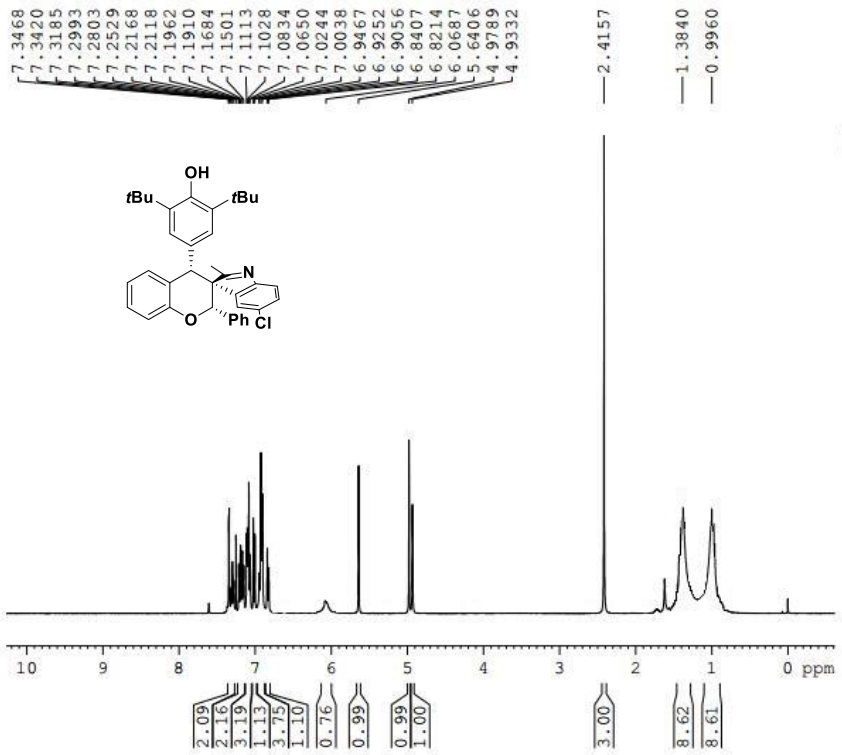

```
NAME          xqm180104-1-cc
EXPNO                      1
PROCNO                     1
Date_               20180315
Time_                  16.00
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG             zgpg30
TD                    65536
SOLVENT               CDCl3
NS                       38
DS                        4
SWH               24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                      203
DW                  20.800 usec
DE                   6.50 usec
TE                  297.3 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                    13C
P1                   11.50 usec
PL1                  -3.00 dB
PL1W            68.16146088 W
SFO1           100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2             waltz16
NUC2                     1H
PCPD2                90.00 usec
PL2                  -2.60 dB
PL12                 13.88 dB
PL13                 14.50 dB
PL2W            17.82643890 W
PL12W            0.40092635 W
PL13W            0.34758785 W
SFO2           400.1516006 MHz
SI                    32768
SF             100.6177980 MHz
WDW                      EM
SSB                       0
LB                   1.00 Hz
GB                        0
PC                     1.40
```

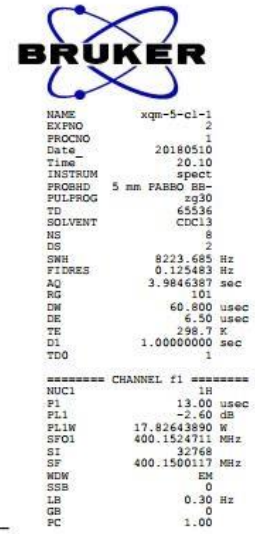
2,6-di-tert-butyl-4-(5'-methoxy-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (3y)

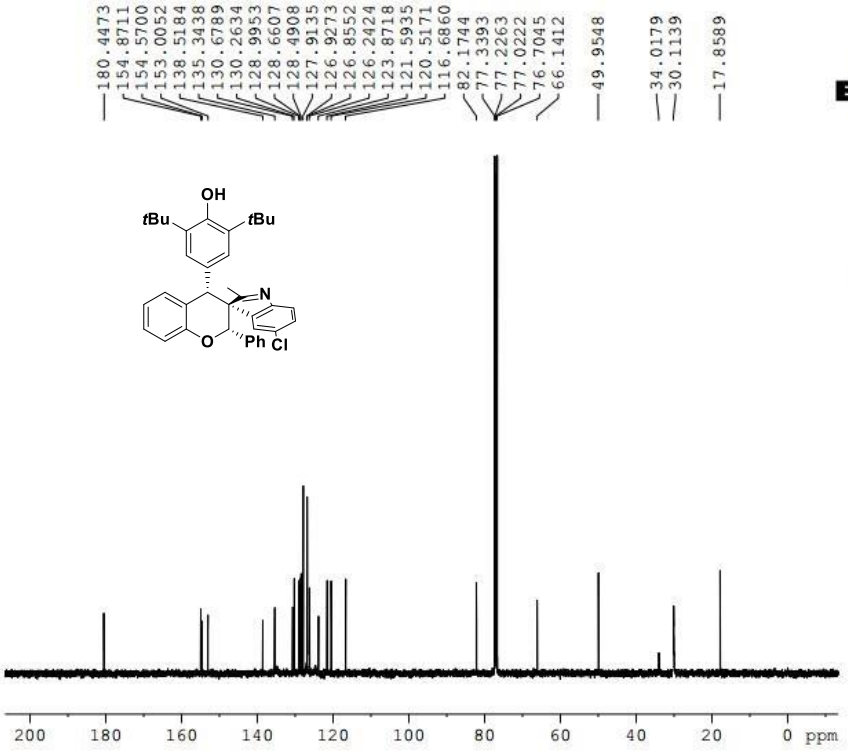


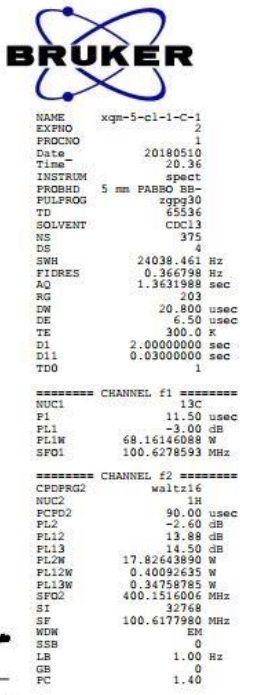


2,6-di-tert-butyl-4-(5'-chloro-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl) phenol (3z)

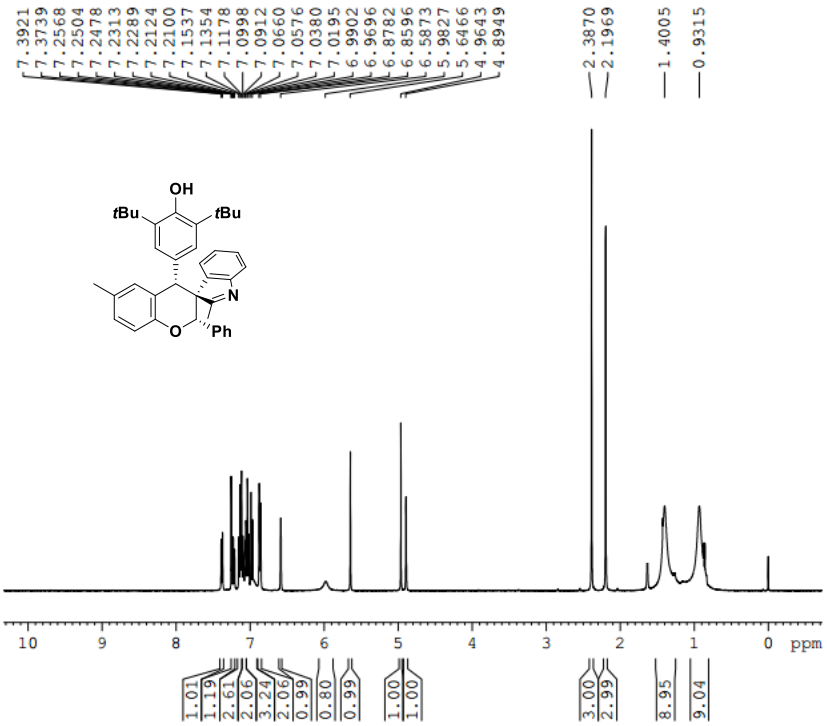






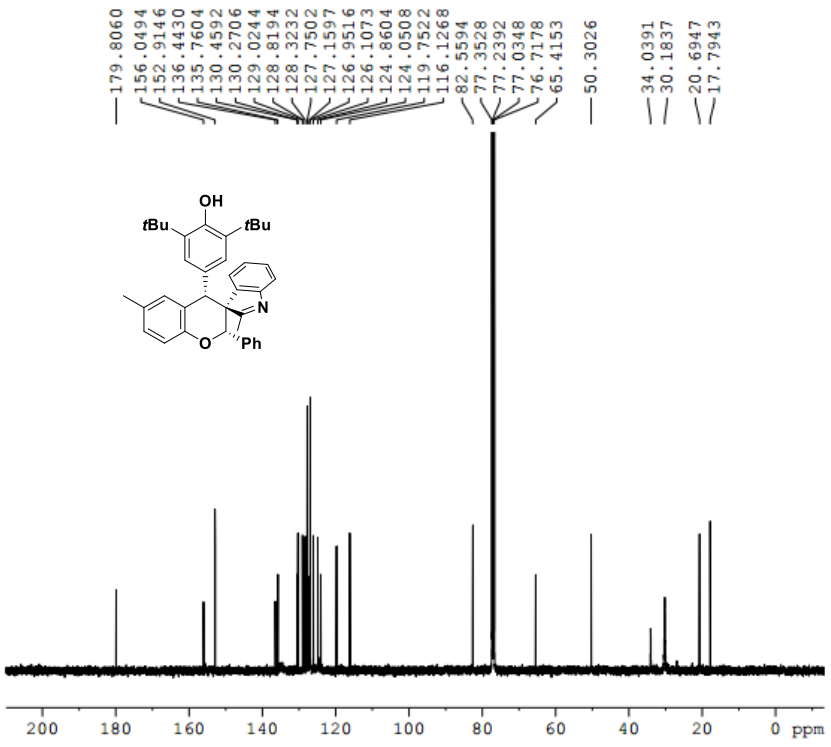


2,6-di-tert-butyl-4-(2',6-dimethyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (4a)



BRUKER

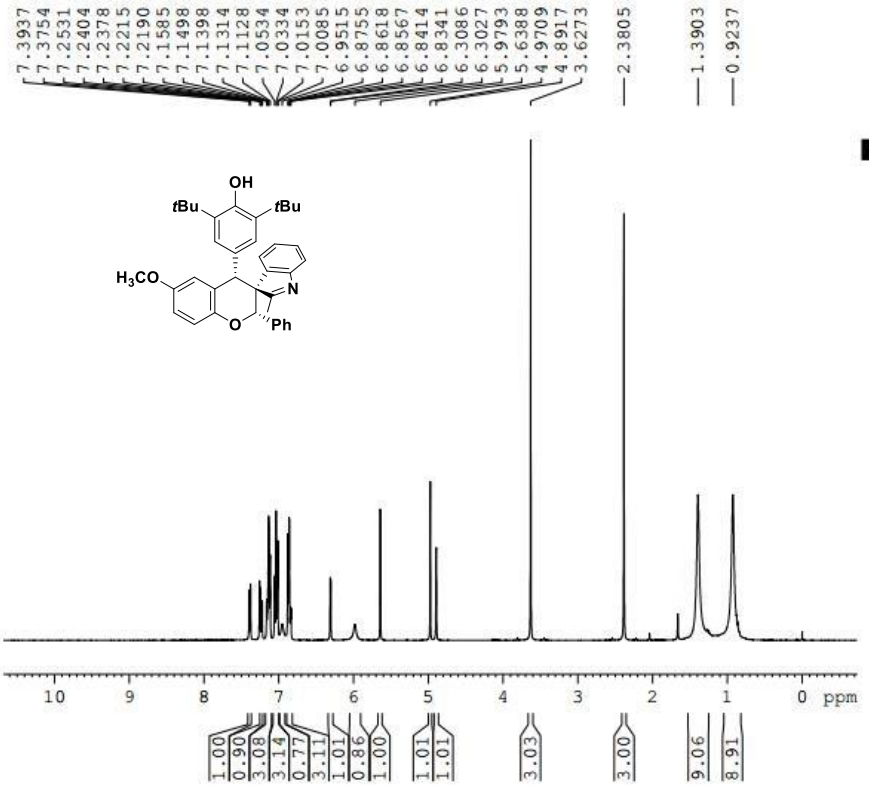
```
NAME          xqm18-5ch3-p-1
EXPNO                      1
PROCNO                     1
Date_               20180306
Time                  20.31
INSTRUM               spect
PROBHD   5 mm PABBO BB-
PULPROG                zg30
TD                    65536
SOLVENT               CDCl3
NS                        8
DS                        2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                      203
DW                 60.800 usec
DE                  6.50 usec
TE                  294.8 K
D1                1.00000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                      1H
P1                  13.00 usec
PL1                 -2.60 dB
PL1W             17.82643890 W
SFO1             400.1524711 MHz
SI                      32768
SF               400.1500100 MHz
WDW                      EM
SSB                       0
LB                  0.30 Hz
GB                        0
PC                     1.00
```



BRUKER

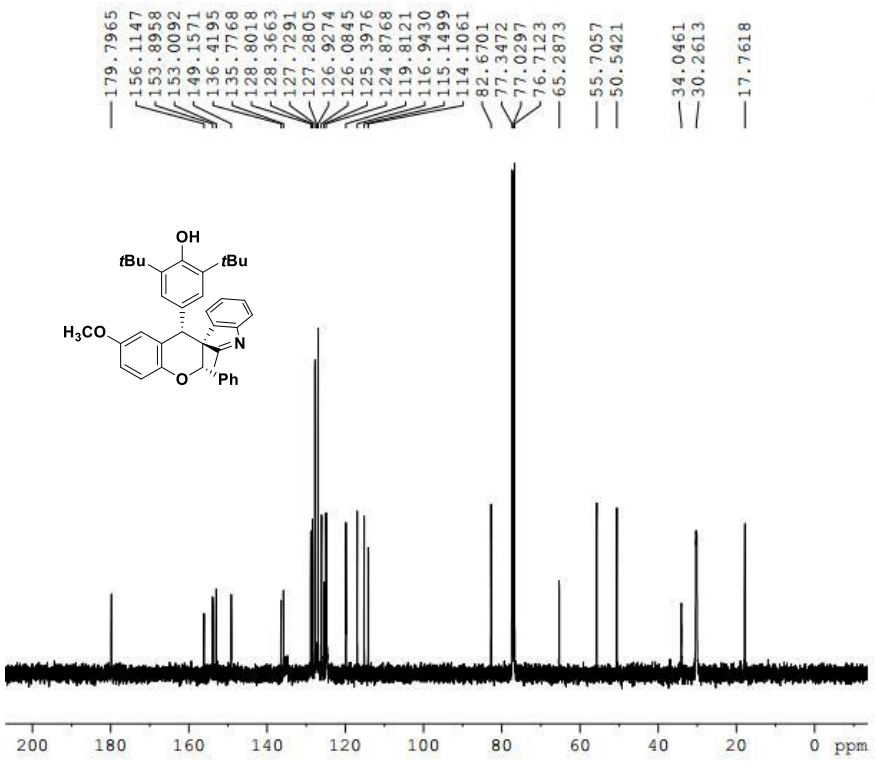
```
NAME          xqm18-5ch3-p-1-c
EXPNO                      1
PROCNO                     1
Date_               20180306
Time                  21.35
INSTRUM               spect
PROBHD   5 mm PABBO BB-
PULPROG             zgpg30
TD                    65536
SOLVENT               CDCl3
NS                      751
DS                        4
SWH               24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                      203
DW                 20.800 usec
DE                  6.50 usec
TE                  296.0 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                       1

======== CHANNEL f1 ========
NUC1                     13C
P1                  11.50 usec
PL1                 -3.00 dB
PL1W             68.16146088 W
SFO1             100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2              waltz16
NUC2                      1H
PCPD2               90.00 usec
PL2                 -2.60 dB
PL12                13.88 dB
PL13                14.50 dB
PL2W             17.82643890 W
PL12W             0.40092635 W
PL13W             0.34758785 W
SFO2             400.1516006 MHz
SI                      32768
SF               100.6177980 MHz
WDW                      EM
SSB                       0
LB                  1.00 Hz
GB                        0
PC                     1.40
```

2,6-di-tert-butyl-4-(6-methoxy-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (4b)



BRUKER

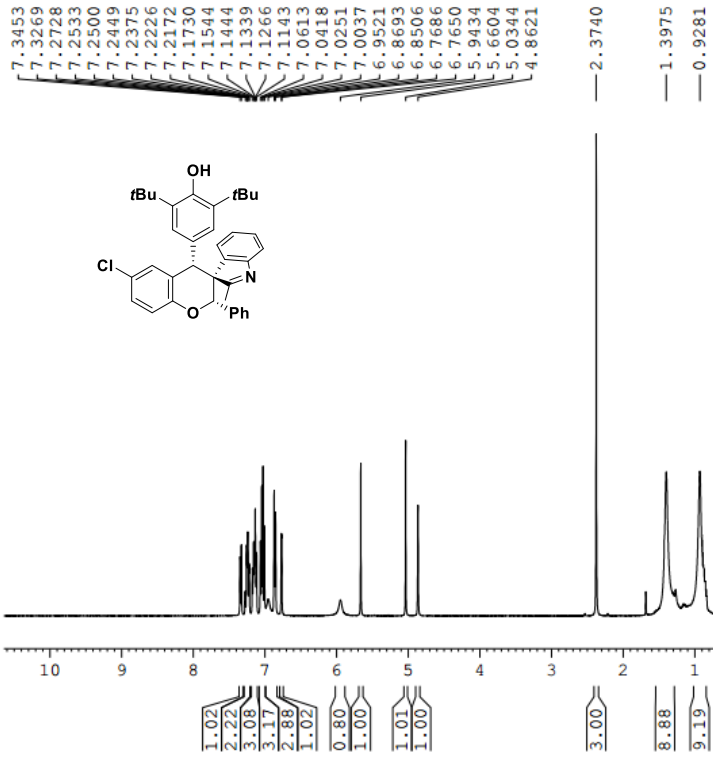
```
NAME          xqm18-5och3-p-1-h
EXPNO                        1
PROCNO                       1
Date_                 20180331
Time                     17.57
INSTRUM                  spect
PROBHD    5 mm PABBO BB-
PULPROG                  zg30
TD                      65536
SOLVENT                 CDCl3
NS                           8
DS                           2
SWH                   8223.685 Hz
FIDRES                0.125483 Hz
AQ                    3.9846387 sec
RG                         203
DW                      60.800 usec
DE                       6.50 usec
TE                      298.2 K
D1                    1.00000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                        1H
P1                       13.00 usec
PL1                      -2.60 dB
PL1W                 17.82643890 W
SFO1                400.1524711 MHz
SI                       32768
SF                  400.1500118 MHz
WDW                         EM
SSB                          0
LB                        0.30 Hz
GB                           0
PC                        1.00
```



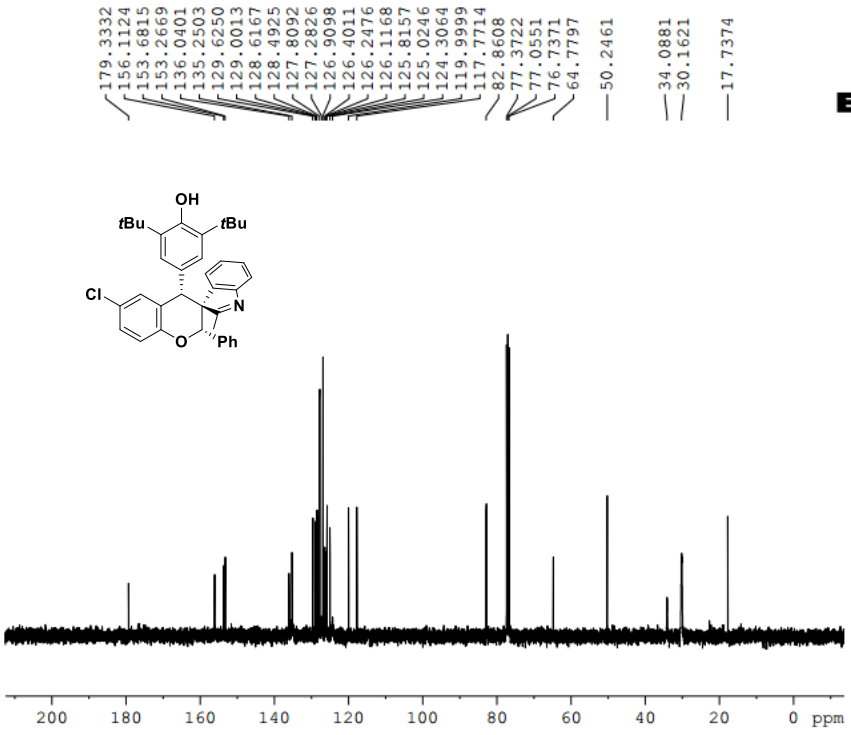
BRUKER

```
NAME          xqm18-5och3-p-1-c
EXPNO                        1
PROCNO                       1
Date_                 20180331
Time                     18.33
INSTRUM                  spect
PROBHD    5 mm PABBO BB-
PULPROG                zgpg30
TD                      65536
SOLVENT                 CDCl3
NS                         271
DS                           4
SWH                  24038.461 Hz
FIDRES                0.366798 Hz
AQ                    1.3631988 sec
RG                         203
DW                      20.800 usec
DE                       6.50 usec
TE                      299.5 K
D1                    2.00000000 sec
D11                   0.03000000 sec
TD0                          1

======== CHANNEL f1 ========
NUC1                       13C
P1                       11.50 usec
PL1                      -3.00 dB
PL1W                68.16146088 W
SFO1               100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                        1H
PCPD2                    90.00 usec
PL2                      -2.60 dB
PL12                     13.88 dB
PL13                     14.50 dB
PL2W                17.82643890 W
PL12W                0.40092635 W
PL13W                0.34758785 W
SFO2               400.1516006 MHz
SI                       32768
SF                 100.6177980 MHz
WDW                         EM
SSB                          0
LB                        1.00 Hz
GB                           0
PC                        1.40
```

2,6-di-tert-butyl-4-(6-chloro-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl) phenol (4c)

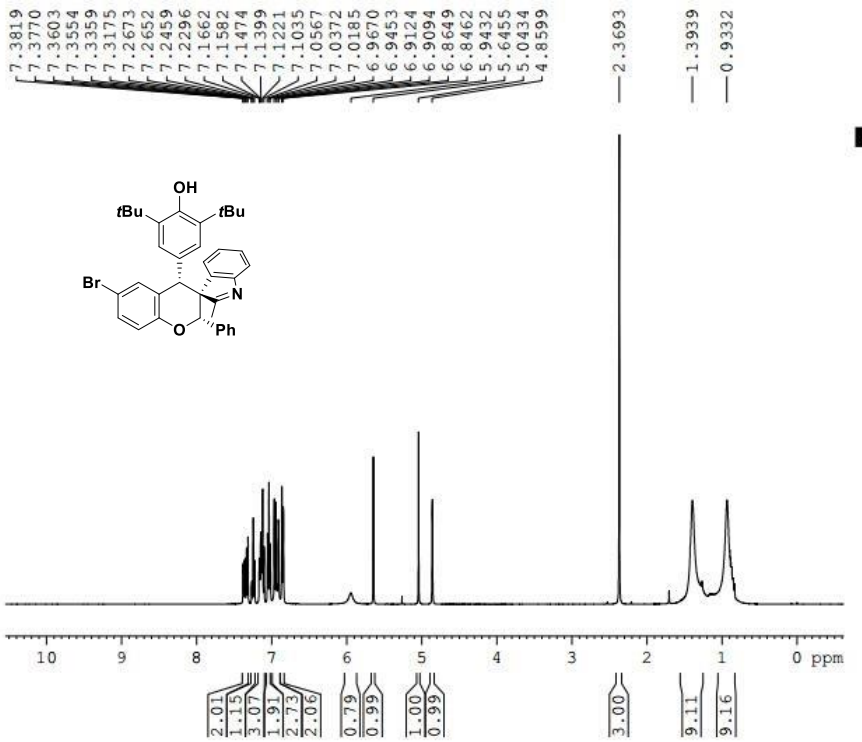



```
NAME          xqm18-5cl-p-1-H
EXPNO                       1
PROCNO                      1
Date_                20180309
Time                    16.24
INSTRUM                 spect
PROBHD   5 mm PABBO BB-
PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                         8
DS                         2
SWH                 8223.685 Hz
FIDRES              0.125483 Hz
AQ                  3.9846387 sec
RG                       203
DW                    60.800 usec
DE                     6.50 usec
TE                    295.8 K
D1                  1.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     13.00 usec
PL1                    -2.60 dB
PL1W               17.82643890 W
SFO1               400.1524711 MHz
SI                       32768
SF                 400.1500129 MHz
WDW                        EM
SSB                         0
LB                       0.30 Hz
GB                          0
PC                       1.00
```



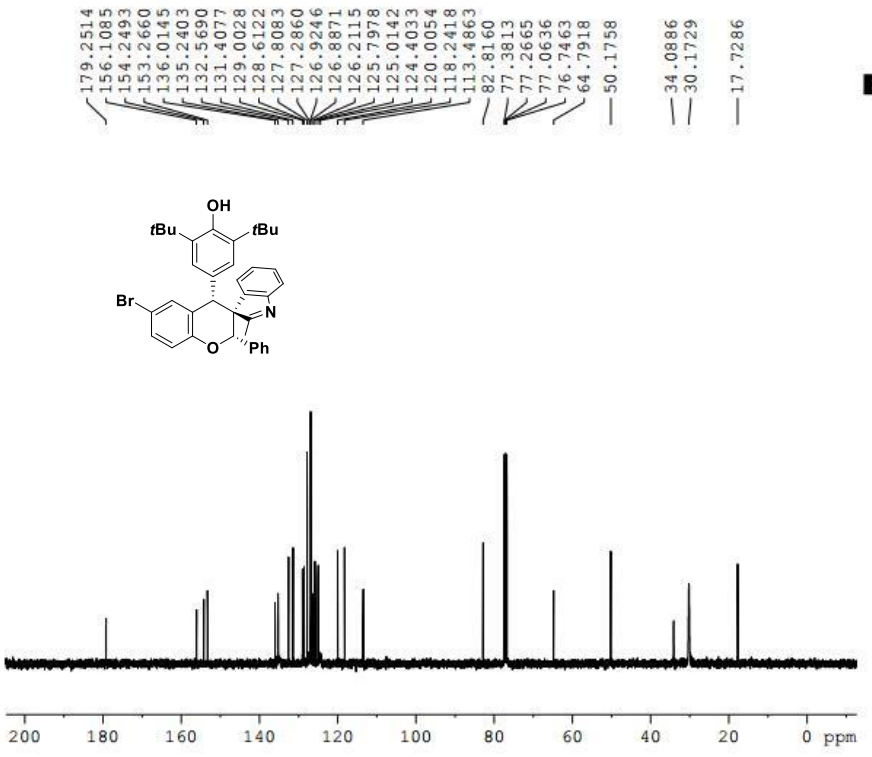

```
NAME          xqm18-5cl-p-1-C
EXPNO                       1
PROCNO                      1
Date_                20180309
Time                    17.22
INSTRUM                 spect
PROBHD   5 mm PABBO BB-
PULPROG                 zgpg30
TD                     65536
SOLVENT                CDCl3
NS                        54
DS                         4
SWH                24038.461 Hz
FIDRES              0.366798 Hz
AQ                  1.3631988 sec
RG                       203
DW                    20.800 usec
DE                     6.50 usec
TE                    296.8 K
D1                  2.00000000 sec
D11                 0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      13C
P1                     11.50 usec
PL1                    -3.00 dB
PL1W               68.16146088 W
SFO1               100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                      1H
PCPD2                  90.00 usec
PL2                    -2.60 dB
PL12                   13.88 dB
PL13                   14.50 dB
PL2W               17.82643890 W
PL12W              0.40092635 W
PL13W              0.34758785 W
SFO2               400.1516006 MHz
SI                       32768
SF                 100.6177980 MHz
WDW                        EM
SSB                         0
LB                       1.00 Hz
GB                          0
PC                       1.40
```

4-(6-bromo-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)-2,6-di-tert-butyl phenol (4d)



BRUKER

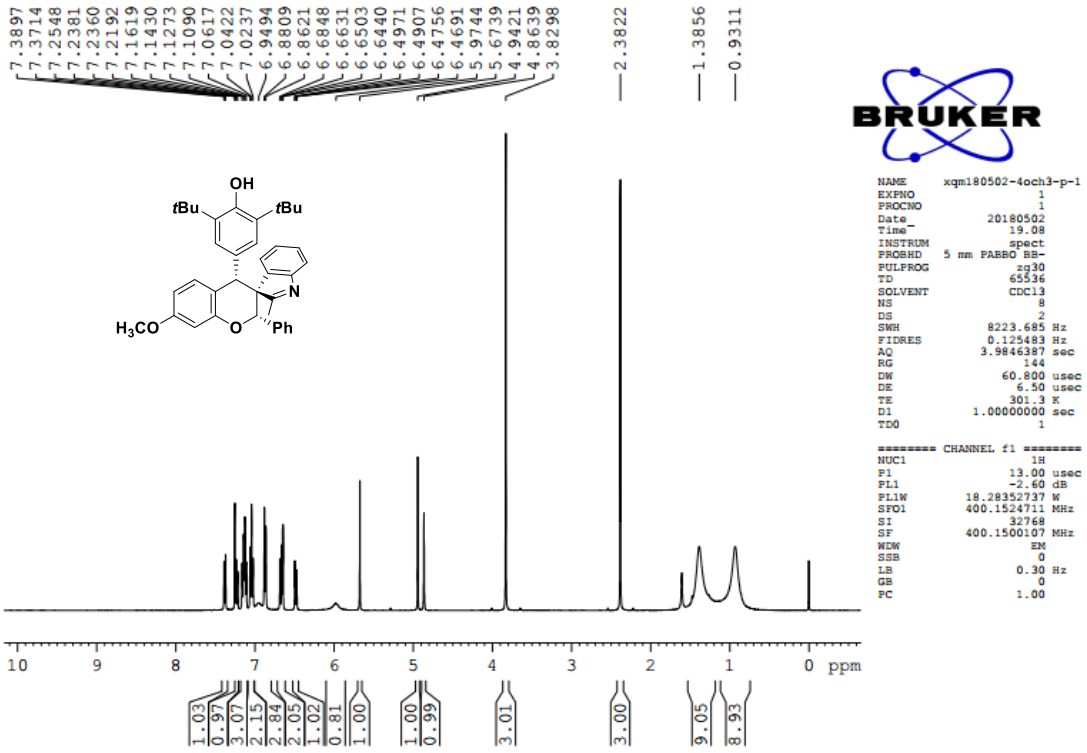
```
NAME          xqm18-5Br-p-1-H
EXPNO                       1
PROCNO                      1
Date_            20180330
Time                   15.01
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG                 zg30
TD                     65536
SOLVENT                CDCl3
NS                         8
DS                         2
SWH                8223.685 Hz
FIDRES            0.125483 Hz
AQ                3.9846387 sec
RG                       114
DW                  60.800 usec
DE                   6.50 usec
TE                   297.6 K
D1                1.00000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      1H
P1                     13.00 usec
PL1                    -2.60 dB
PL1W              17.82643890 W
SFO1             400.1524711 MHz
SI                       32768
SF               400.1500145 MHz
WDW                        EM
SSB                         0
LB                     0.30 Hz
GB                          0
PC                       1.00
```

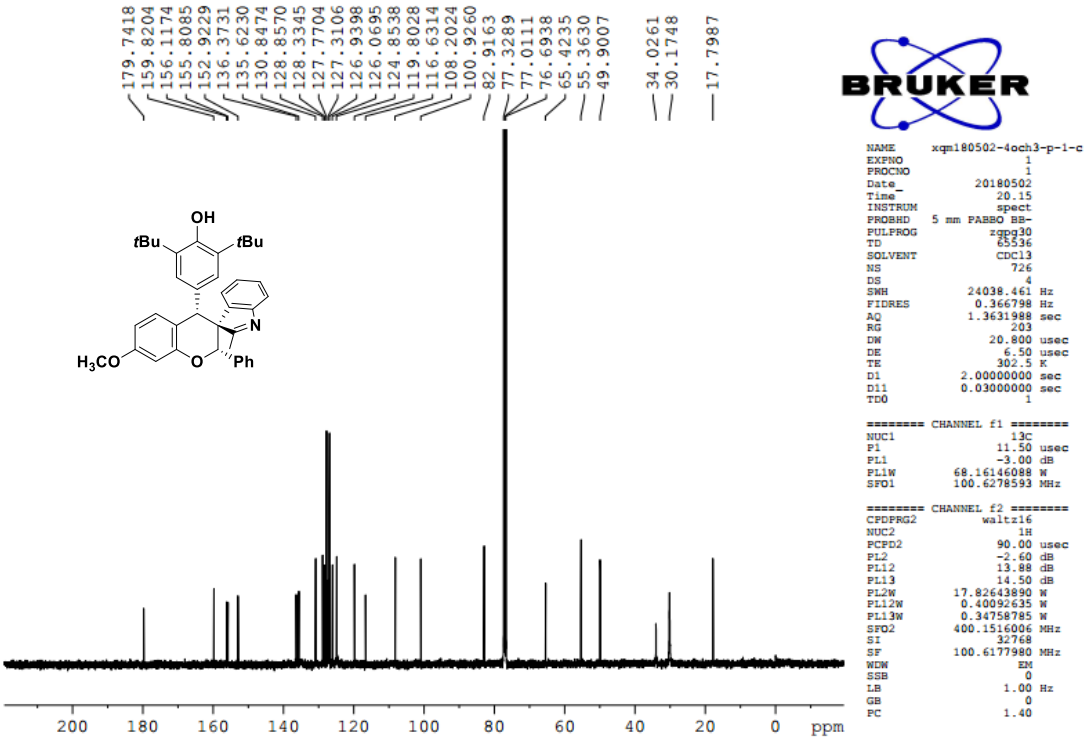


BRUKER

```
NAME          xqm18-5Br-p-1-Cc
EXPNO                       1
PROCNO                      1
Date_            20180330
Time                   16.43
INSTRUM                spect
PROBHD   5 mm PABBO BB-
PULPROG              zgpg30
TD                     65536
SOLVENT                CDCl3
NS                        71
DS                         4
SWH               24038.461 Hz
FIDRES            0.366798 Hz
AQ                1.3631988 sec
RG                       203
DW                  20.800 usec
DE                   6.50 usec
TE                   298.8 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                        1

======== CHANNEL f1 ========
NUC1                      13C
P1                     11.50 usec
PL1                    -3.00 dB
PL1W              68.16146088 W
SFO1             100.6278593 MHz

======== CHANNEL f2 ========
CPDPRG2                waltz16
NUC2                      1H
PCPD2                  90.00 usec
PL2                    -2.60 dB
PL12                   13.88 dB
PL13                   14.50 dB
PL2W              17.82643890 W
PL12W              0.40092635 W
PL13W              0.34758785 W
SFO2             400.1516006 MHz
SI                       32768
SF               100.6177980 MHz
WDW                        EM
SSB                         0
LB                     1.00 Hz
GB                          0
PC                       1.40
```

2,6-di-tert-butyl-4-(7-methoxy-2'-methyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (4e)





2,6-di-tert-butyl-4-(2',7-dimethyl-2-phenylspiro[chromane-3,3'-indol]-4-yl)phenol (4f)