Highly Efficient Synthesis of Enantioenriched Vicinal Halohydrins via Ir-Catalyzed Asymmetric Hydrogenation Using Dynamic Kinetic Resolution

Bin He[b], Gen-Qiang Chen[c,]*, Xumu Zhang[a,]*

[a]Medi-X Pingshan and Department of Chemistry, Southern University of Science and Technology, Shenzhen 518000, People's Republic of China;
[b]Institute of Zhejiang University-Quzhou, Quzhou, 324000, China;
[c]Academy for Advanced Interdisciplinary Studies and Guangdong Provincial Key Laboratory of Catalysis, Southern University of Science and Technology, Shenzhen 518055, People's Republic of China;
*Email: chengq@sustech.edu.cn; zhangxm@sustech.edu.cn

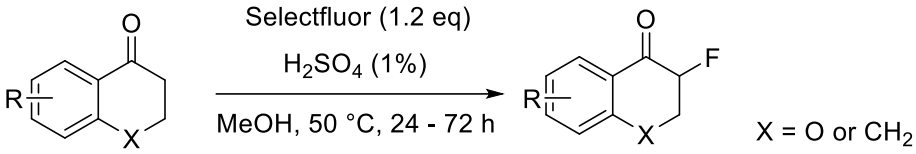
Content

1. General remarks

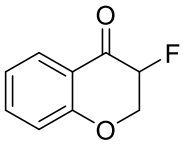
All reactions and manipulations which are sensitive to moisture or air were performed in an argon-filled glove box or using standard Schlenk techniques. Anhydrous ^{i}PrOH, EtOH, CH_2Cl_2, THF, dioxane, EtOAc, hexane and toluene purchased from J&K were treated with bubbled argon before used; anhydrous toluene was prepared by treating the commercially available toluene with Na and distillation. K_2CO_3, Cs_2CO_3, NaOH, NaO^{t}Bu, KO^{t}Bu and LiO^{t}Bu was purchased from Sinopharm Chemical Reagent Co., Ltd. ^{1}H, ^{13}C and ^{19}F NMR spectra were recorded with a Bruker ADVANCE III (400 MHz) spectrometer with $CDCl_3$ or D_2O as the solvent. NMR chemical shifts are listed in ppm relative to $CHCl_3$ (7.26 ppm for ^{1}H, and 77.0 ppm for ^{13}C) or H_2O (4.79 ppm for ^{1}H). Data are reported as: multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constant in hertz (Hz) and signal area integration in natural numbers. ^{13}C NMR analyses were run with decoupling. HPLC analyses were performed by Agilent 1290 UPLC using Daicel chiral column, the racemates of products were prepared by reduction of the substrates with $NaBH_4$.

2. General procedure for the preparation of substrate compounds

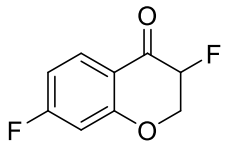
Synthesis of Compounds **1a**−**1q**.



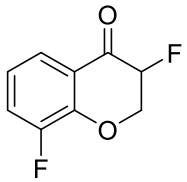
According to the reported procedure,[1] to a 50 mL-round-bottom flask fitted with a stirrer and a condenser and set under argon were added ketone (4.0 mmol, 1.0 equiv), SelectFluor (1.70 g, 4.8 mmol, 1.2 equiv), MeOH (7 mL), and conc. H_2SO_4 (20 μL, 0.4 mmol, 0.1 equiv). The resulting suspension was heated at 50 °C (oil bath) for 24−72 h (completion of the reaction was monitored by TLC; petroleum ether/ ethyl acetate 80:20). After the reaction mixture was cooled, the slurry was diluted with 3 mL of methanol and filtered. The obtained solid was washed with MeOH (2 × 3 mL), and the filtrate was concentrated under reduced pressure. The resulting mixture was dissolved in CH_2Cl_2 (20 mL), washed with brine, dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The crude product was purified by flash column chromatography on silica gel (petroleum ether/ethyl acetate from 95:5 to 85:15) to yield **1a**−**1r** as a white crystalline solid.



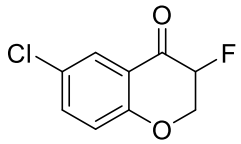
3-Fluorochroman-4-one (**1a**):[1a] White solid, 7.5 g, 90% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.91 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.53 (ddd, *J* = 8.7, 7.2, 1.8 Hz, 1H), 7.08 (t, *J* = 7.5 Hz, 1H), 7.00 (d, *J* = 8.4 Hz, 1H), 5.16 (ddd, *J* = 47.0, 9.2, 4.7 Hz, 1H), 4.70-4.47 (m, 2H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -204.05 (ddd, *J* = 47.0, 15.9, 7.5 Hz).



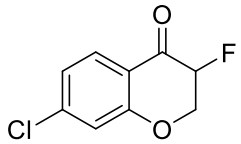
3,7-Difluorochroman-4-one (**1b**):[1b] White solid, 200 mg, 72% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.95 (dd, *J* = 8.8, 6.5 Hz, 1H), 6.82 (ddd, *J* = 8.8, 8.0, 2.4 Hz, 1H), 6.71 (dd, *J* = 9.6, 2.4 Hz, 1H), 5.13 (ddd, *J* = 46.9, 8.5, 4.7 Hz, 1H), 4.75-4.40 (m, 2H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -98.49 (m), -203.59 (ddd, *J* = 46.9, 17.3, 8.5 Hz).



3,8-Difluorochroman-4-one (**1c**):[2] White solid, 193 mg, 70% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.71 (dt, *J* = 8.0, 1.5 Hz, 1H), 7.35 (ddd, *J* = 10.5, 8.0, 1.6 Hz, 1H), 7.04 (td, *J* = 8.0, 4.3 Hz, 1H), 5.19 (ddd, *J* = 46.8, 8.9, 4.6 Hz, 1H), 4.93-4.45 (m, 2H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -134.31 (dd, *J* = 10.1, 4.5 Hz), -203.63 (ddd, *J* = 47.2, 17.1, 7.9 Hz).

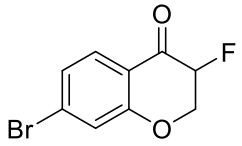


6-Chloro-3-fluorochroman-4-one (**1d**):[1b] White solid, 480 mg, 80% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.87 (d, *J* = 2.7 Hz, 1H), 7.47 (dd, *J* = 8.9, 2.7 Hz, 1H), 6.98 (d, *J* = 8.9 Hz, 1H), 5.14 (ddd, *J* = 46.9, 8.8, 4.7 Hz, 1H), 4.77-4.48 (m, 2H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -203.73 (ddd, *J* = 47.2, 17.4, 8.4 Hz).

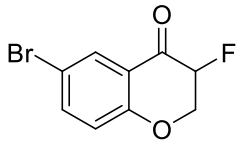


7-Chloro-3-fluorochroman-4-one (**1e**):[2] White solid, 213 mg, 76% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.84 (d, *J* = 8.4 Hz, 1H), 7.10-6.93 (m, 2H), 5.13 (ddd, *J* = 46.9,

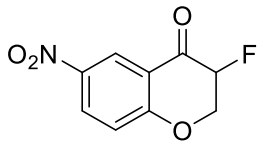
8.7, 4.6 Hz, 1H), 4.70-4.42 (m, 2H). ^{19}F NMR (376 MHz, $CDCl_3$): -203.50 (ddd, *J* = 46.6, 16.9, 8.3 Hz).



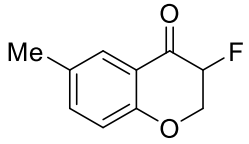
7-Bromo-3-fluorochroman-4-one (**1f**):[3] White solid, 200 mg, 75% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.77 (d, *J* = 8.9 Hz, 1H), 7.25-7.20 (m, 2H), 5.13 (ddd, *J* = 46.9, 8.7, 4.7 Hz, 1H), 4.75-4.47 (m, 2H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -203.50 (ddd, *J* = 46.4, 17.5, 7.9 Hz).



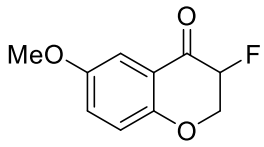
6-Bromo-3-fluorochroman-4-one (**1g**):[2] White solid, 430 mg, 68% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.20-7.89 (m, 1H), 7.70-7.46 (m, 1H), 6.99-6.85 (m, 1H), 5.26-4.92 (m, 1H), 4.76-4.44 (m, 2H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -203.71 (m).



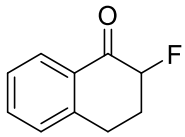
3-Fluoro-7-nitrochroman-4-one (**1h**):[3] White solid, 430 mg, 78% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.80 (d, J = 2.8 Hz, 1H), 8.39 (dd, *J* = 9.2, 2.8 Hz, 1H), 7.18 (d, *J* = 9.2 Hz, 1H), 5.30-5.03 (m, 1H), 4.80-4.71 (m, 2H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -202.73 (ddd, *J* = 46.0, 16.4, 11.9 Hz).



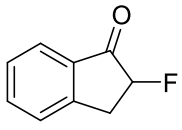
3-Fluoro-6-methylchroman-4-one (**1i**):[1b] White solid, 405 mg, 75% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.70 (s, 1H), 7.34 (d, *J* = 8.5 Hz, 1H), 6.91 (d, *J* = 8.5 Hz, 1H), 5.14 (dddd, *J* = 47.1, 9.3, 4.7, 2.5 Hz, 1H), 4.72-4.34 (m, 2H), 2.32 (s, 3H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -204.07 (ddd, *J* = 47.2, 16.5, 7.4 Hz).



3-Fluoro-6-methoxychroman-4-one (**1j**):[3] White solid, 178 mg, 65% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.31 (d, *J* = 3.2 Hz, 1H), 7.14 (dd, *J* = 9.1, 3.2 Hz, 1H), 6.95 (d, *J* = 9.1 Hz, 1H), 5.14 (ddd, *J* = 47.0, 9.1, 4.7 Hz, 1H), 4.74-4.41 (m, 2H), 3.81 (s, 3H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -203.86 (ddd, *J* = 47.2, 16.8, 8.1 Hz).

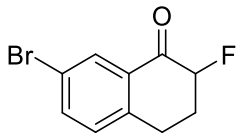


2-Fluoro-3,4-dihydronaphthalen-1(2H)-one (**1k**):[1b] Colourless crystal, 697 mg, 85% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.07 (dd, *J* = 7.8, 1.4 Hz, 1H), 7.53 (td, *J* = 7.5, 1.5 Hz, 1H), 7.36 (t, *J* = 7.5 Hz, 1H), 7.27 (d, *J* = 7.7 Hz, 1H), 5.15 (ddd, *J* = 47.9, 12.7, 5.1 Hz, 1H), 3.13 (dd, *J* = 9.5, 4.1 Hz, 2H), 2.58 (dddt, *J* = 12.5, 10.3, 5.1, 4.2 Hz, 1H), 2.36 (tddd, *J* = 12.6, 9.3, 7.8, 6.7 Hz, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -190.32 (dt, *J* = 48.1, 9.1 Hz).

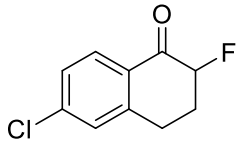


2-Fluoro-2,3-dihydro-1H-inden-1-one (**1l**):[1b] Colourless crystal, 2.8 g, 92% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.80 (d, *J* = 7.7 Hz, 1H), 7.67 (t, *J* = 7.5 Hz, 1H), 7.46 (d, *J* = 7.7 Hz, 1H), 7.44 (t, *J* = 7.5 Hz, 1H), 5.27 (ddd, *J* = 51.1, 7.8, 4.4 Hz, 1H), 3.63 (dt,

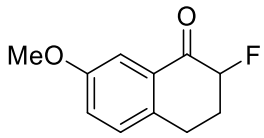
J = 16.9, 7.5 Hz, 1H), 3.23 (ddd, *J* = 22.2, 16.9, 4.4 Hz, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -193.99 (ddd, *J* = 51.1, 23.9, 7.2 Hz).



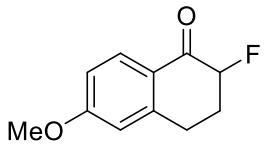
7-Bromo-2-fluoro-3,4-dihydronaphthalen-1(2H)-one (**1m**):[1b] Colourless crystal, 968 mg, 80% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.18 (dt, *J* = 5.5, 2.3 Hz, 1H), 7.63 (ddd, *J* = 8.2, 3.0, 1.7 Hz, 1H), 7.16 (d, *J* = 8.2 Hz, 1H), 5.14 (dddt, *J* = 47.7, 12.6, 5.1, 1.2 Hz, 1H), 3.21-3.03 (m, 2H), 2.67-2.49 (m, 1H), 2.42-2.22 (m, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -190.70 (ddd, J = 48.3, 11.2, 6.9 Hz).



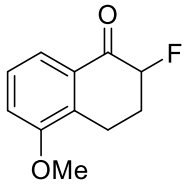
6-Chloro-2-fluoro-3,4-dihydronaphthalen-1(2H)-one (**1n**):[4] Colourless crystal, 842 mg, 85% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.00 (d, *J* = 8.4 Hz, 1H), 7.33 (dd, *J* = 8.4, 2.0 Hz, 1H), 7.28 (br, 1H), 5.12 (ddd, *J* = 47.7, 12.5, 5.1 Hz, 1H), 3.21-2.99 (m, 2H), 2.66-2.49 (m, 1H), 2.44-2.24 (m, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -190.70 (ddd, *J* = 48.3, 11.2, 6.9 Hz).



2-Fluoro-7-methoxy-3,4-dihydronaphthalen-1(2H)-one (**1o**):[5] Colourless crystal, 737 mg, 76% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.52 (d, *J* = 2.8 Hz, 1H), 7.18 (d, *J* = 8.5 Hz, 1H), 7.10 (dd, *J* = 8.5, 2.8 Hz, 1H), 5.13 (ddd, *J* = 47.9, 12.8, 5.1 Hz, 1H), 3.85 (s, 3H), 3.06 (dd, *J* = 9.4, 4.2 Hz, 2H), 2.63-2.49 (m, 1H), 2.43-2.26 (m, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -190.41 (m).

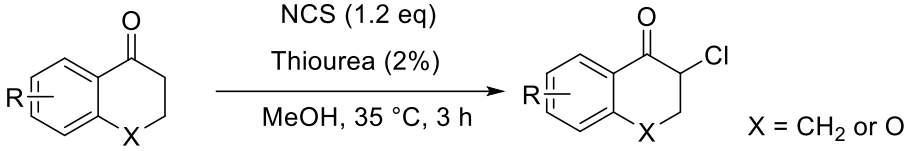


2-Fluoro-6-methoxy-3,4-dihydronaphthalen-1(2H)-one (**1p**):[5] Colourless crystal, 819 mg, 84% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.04 (d, *J* = 8.8 Hz, 1H), 6.87 (dd, *J* = 8.8, 2.5 Hz, 1H), 6.70 (d, *J* = 2.5 Hz, 1H), 5.09 (ddd, *J* = 48.0, 12.4, 5.1 Hz, 1H), 3.86 (s, 3H), 3.08 (dd, *J* = 9.2, 4.2 Hz, 2H), 2.61-2.47 (m, 1H), 2.41-2.24 (m, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -190.37 (ddd, J = 47.7, 10.2, 6.7 Hz).



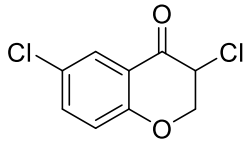
2-Fluoro-5-methoxy-3,4-dihydronaphthalen-1(2H)-one (**1q**):[1a] Colourless crystal, 719 mg, 74% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.65 (dd, *J* = 7.9, 1.1 Hz, 1H), 7.32 (t, *J* = 8.0 Hz, 1H), 7.05 (dd, *J* = 8.1, 1.0 Hz, 1H), 5.15 (ddd, *J* = 48.3, 13.1, 5.2 Hz, 1H), 3.87 (s, 3H), 3.27 (dtd, *J* = 18.0, 4.9, 3.3 Hz, 1H), 2.95-2.70 (m, 1H), 2.65-2.50 (m, 1H), 2.39-2.18 (m, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -191.03 (ddt, *J* = 47.3, 10.2, 5.4 Hz).

Synthesis of Compounds **1r−1x**.

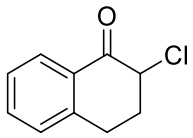


According to the reported procedure,[6] a MeOH solution (100 mL) containing ketone (10 mmol), thiourea (15 mg, 0.2 mmol), and N-chlorosuccinimide (1.60 g, 12 mmol) was heated by oil bath under N_2 atmosphere at 35 °C, for 3 h. The solution was concentrated under a reduced pressure, then AcOEt (50 mL) and H_2O (20 mL) were added and stirred for 10 min. The organic layer was separated, and the aqueous phase was extracted with AcOEt (2 × 50 mL). The combined organic portions were dried over

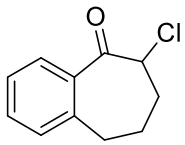
$MgSO_4$ and concentrated to give a crude product. Purification by silica gel column chromatography (eluent: Hexane/AcOEt = 5/1) gave the product **1r**−**1x**.



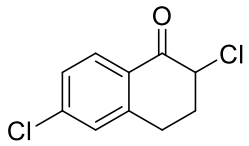
3,6-Dichlorochroman-4-one (**1r**): White solid, 480 mg, 45% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.89 (d, *J* = 2.6 Hz, 1H), 7.48 (dd, *J* = 8.9, 2.7 Hz, 1H), 7.00 (d, *J* = 8.8 Hz, 1H), 4.67 (dd, *J* = 11.4, 3.1 Hz, 1H),4.61-4.50 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 184.5, 159.4, 136.8, 128.0, 127.4, 119.9, 119.8, 71.2, 54.8. HRMS (ESI/ion trap): m/z $[M + H]^+$ calcd for $C_9H_7Cl_2O_2$ 216.9823, found 216.9814.



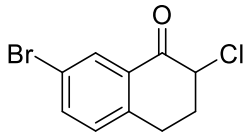
2-Chloro-3,4-dihydronaphthalen-1(2H)-one (**1s**):[6] Light yellow liquid, 5.8 g, 95% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.07 (dd, *J* = 7.9, 1.4 Hz, 1H), 7.51 (td, *J* = 7.5, 1.5 Hz, 1H), 7.33 (td, *J* = 7.6, 1.1 Hz, 1H), 7.26 (d, *J* = 7.7 Hz, 1H), 4.62 (dd, *J* = 7.8, 3.9 Hz, 1H), 3.27 (ddd, *J* = 17.1, 8.0, 4.6 Hz, 1H), 2.98 (ddd, *J* = 17.1, 7.0, 4.7 Hz, 1H), 2.63-2.51 (m, 1H), 2.50-2.39 (m, 1H).



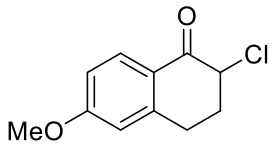
6-Chloro-6,7,8,9-tetrahydro-5H-benzo[7]annulen-5-one (**1t**):[7] Light yellow liquid, 834 g, 86% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.64 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.41 (td, *J* = 7.5, 1.5 Hz, 1H), 7.30 (td, *J* = 7.6, 1.2 Hz, 1H), 7.20 (dd, *J* = 7.5, 1.1 Hz, 1H), 4.80 (dd, *J* = 8.7, 4.7 Hz, 1H), 3.02 (ddd, *J* = 15.8, 7.7, 3.4 Hz, 1H), 2.92 (ddd, *J* = 15.8, 9.6, 3.4 Hz, 1H), 2.39 (dddd, *J* = 14.3, 9.7, 6.1, 4.7 Hz, 1H), 2.20 (ddt, *J* = 14.0, 8.7, 5.3 Hz, 1H), 2.11-1.87 (m, 2H).



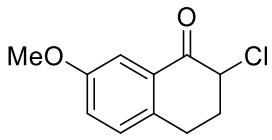
2,6-Dichloro-3,4-dihydronaphthalen-1(2H)-one (**1u**): White solid, 952 mg, 89% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.02 (d, *J* = 8.4 Hz, 1H), 7.51-7.09 (m, 2H), 4.61 (dd, *J* = 7.3, 3.8 Hz, 1H), 3.27 (ddd, *J* = 17.3, 8.4, 4.6 Hz, 1H), 2.95 (ddd, *J* = 17.0, 6.6, 5.0 Hz, 1H), 2.63-2.50 (m, 1H), 2.52-2.39 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 189.9, 144.8, 140.8, 130.3, 129.0, 128.8, 127.9, 59.3, 32.1, 26.1.



7-Bromo-2-chloro-3,4-dihydronaphthalen-1(2H)-one (**1v**):[7] White solid, 908 mg, 88% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.19 (d, *J* = 2.2 Hz, 1H), 7.62 (dd, *J* = 8.2, 2.2 Hz, 1H), 7.17 (d, *J* = 8.2 Hz, 1H), 4.61 (dd, *J* = 7.3, 3.8 Hz, 1H), 3.24 (ddd, *J* = 17.3, 8.3, 4.6 Hz, 1H), 2.94 (ddd, *J* = 17.3, 6.5, 4.7 Hz, 1H), 2.63-2.50 (m, 1H), 2.52-2.39 (m, 1H).



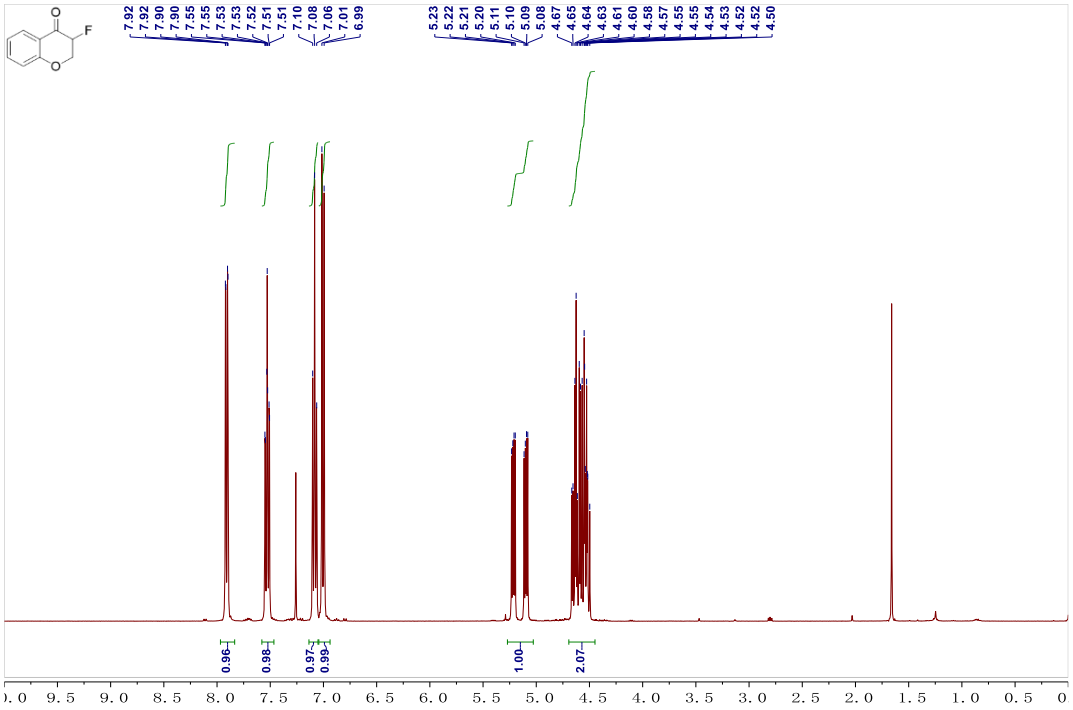
2-Chloro-6-methoxy-3,4-dihydronaphthalen-1(2H)-one (**1w**):[6] White solid, 952 mg, 89% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.05 (d, *J* = 8.8 Hz, 1H), 6.86 (dd, *J* = 8.8, 2.5 Hz, 1H), 6.70 (dd, *J* = 2.4, 1.1 Hz, 1H), 4.58 (dd, *J* = 7.4, 3.9 Hz, 1H), 3.86 (s, 3H), 3.25 (ddd, *J* = 17.1, 8.4, 4.5 Hz, 1H), 2.93 (ddd, *J* = 17.0, 6.7, 4.6 Hz, 1H), 2.61-2.48 (m, 1H), 2.49-2.33 (m, 1H).



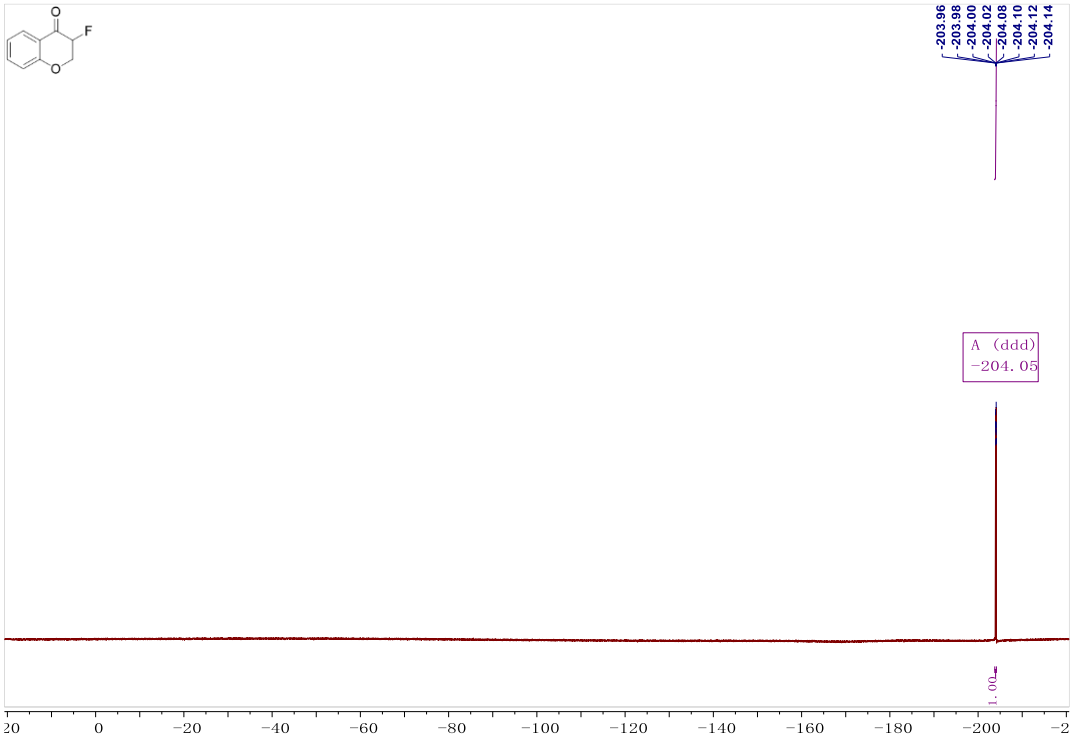
2-Chloro-7-methoxy-3,4-dihydronaphthalen-1(2H)-one (**1x**):[7] White solid, 1.5 g, 90% yield. ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.53 (d, *J* = 2.8 Hz, 1H), 7.17 (d, *J* = 8.4 Hz, 1H), 7.09 (dd, *J* = 8.5, 2.8 Hz, 1H), 4.61 (dd, *J* = 7.6, 3.8 Hz, 1H), 3.83 (s, 3H), 3.20 (ddd, *J* = 16.9, 8.0, 4.5 Hz, 1H), 2.92 (ddd, *J* = 16.9, 6.8, 4.6 Hz, 1H), 2.63-2.49 (m, 1H), 2.49-2.32 (m, 1H).

3. NMR spectra of substrates 1a-1x.

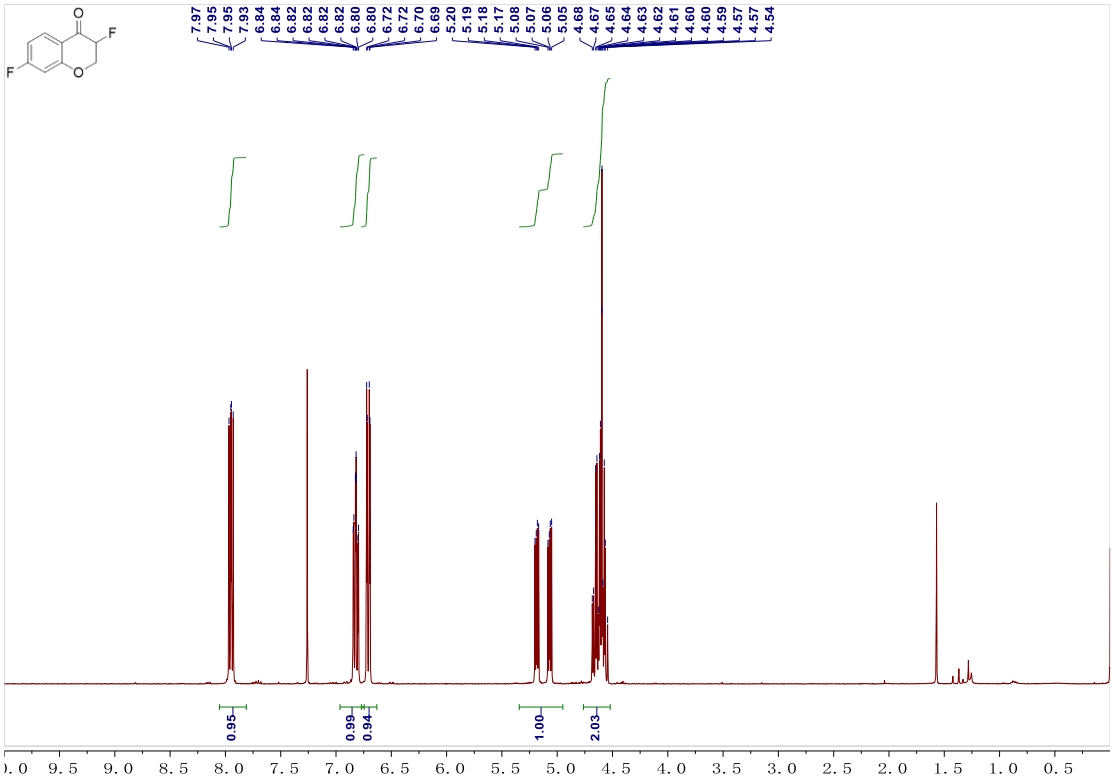
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1a**



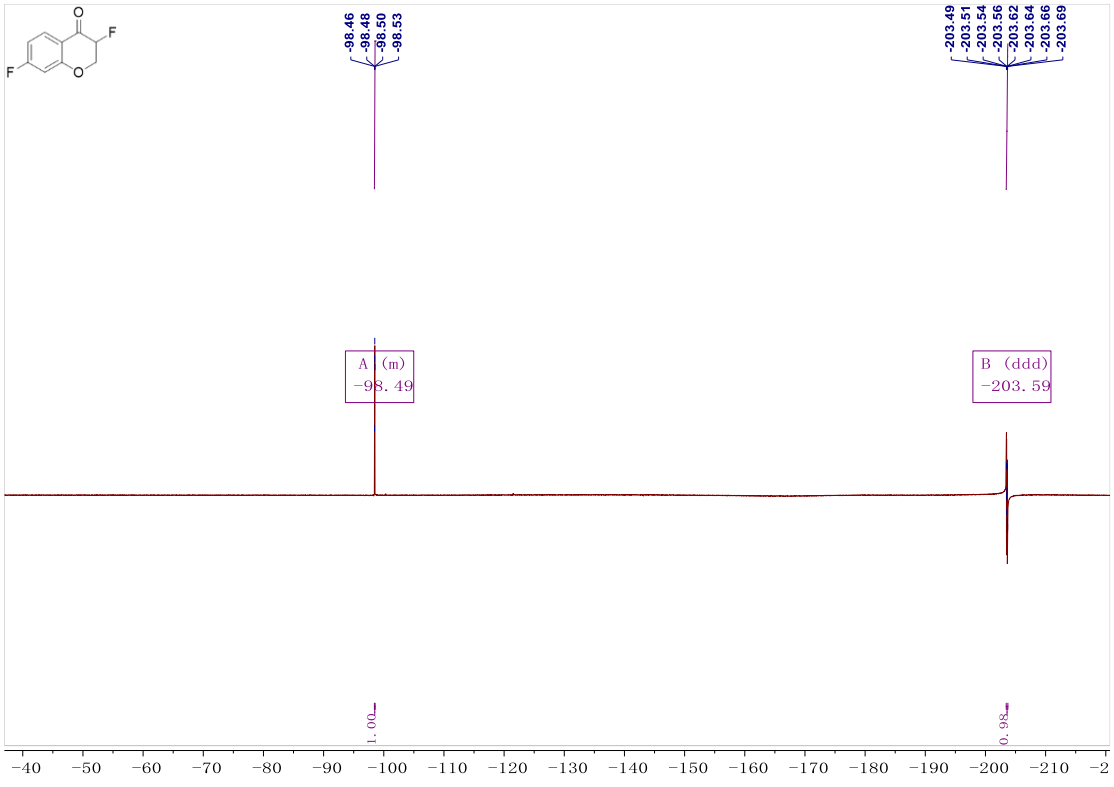
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1a**



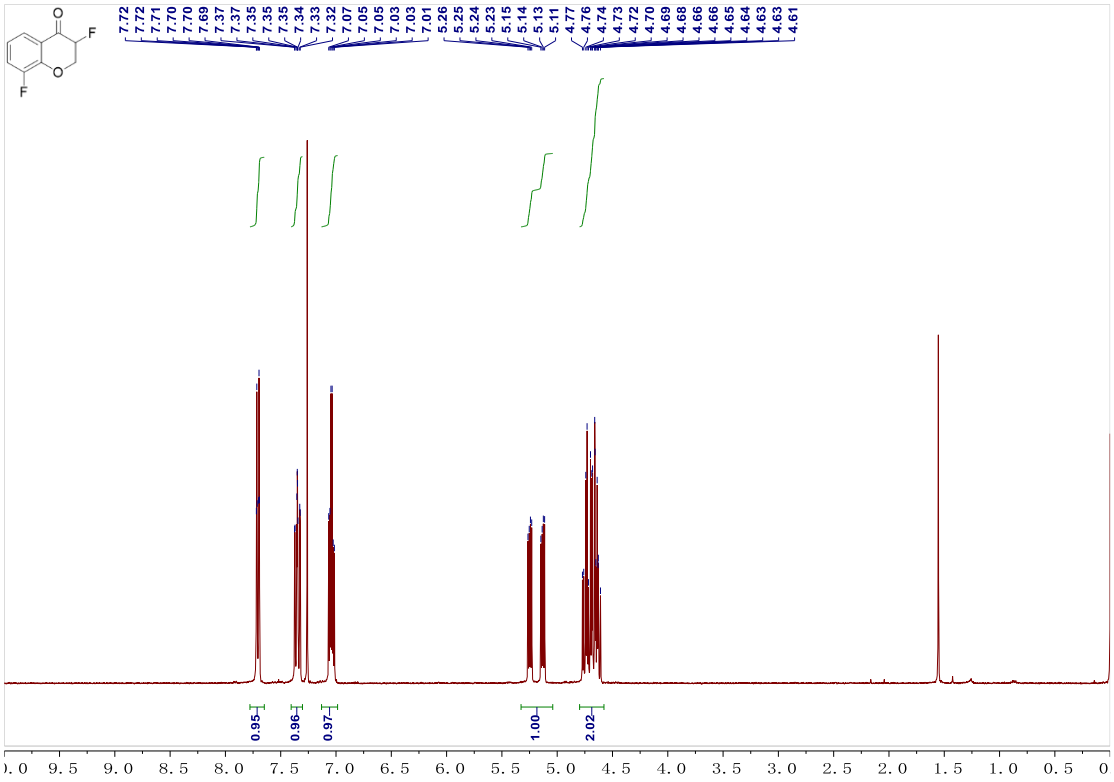
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1b**



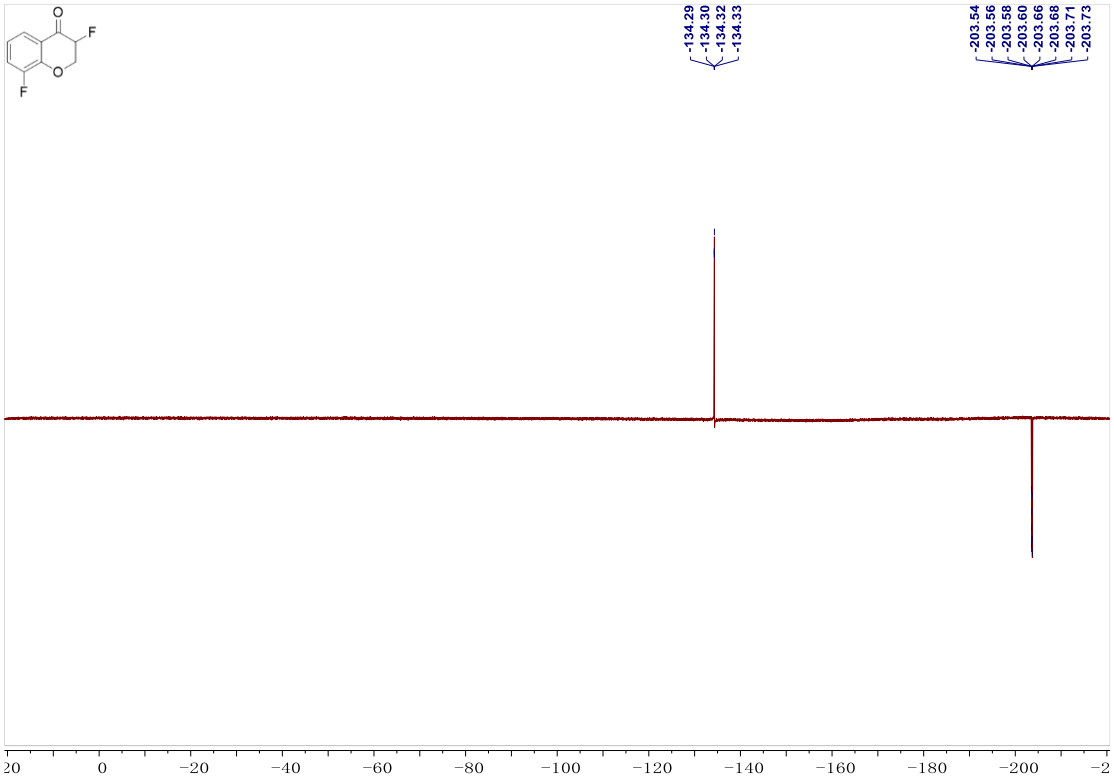
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1b**



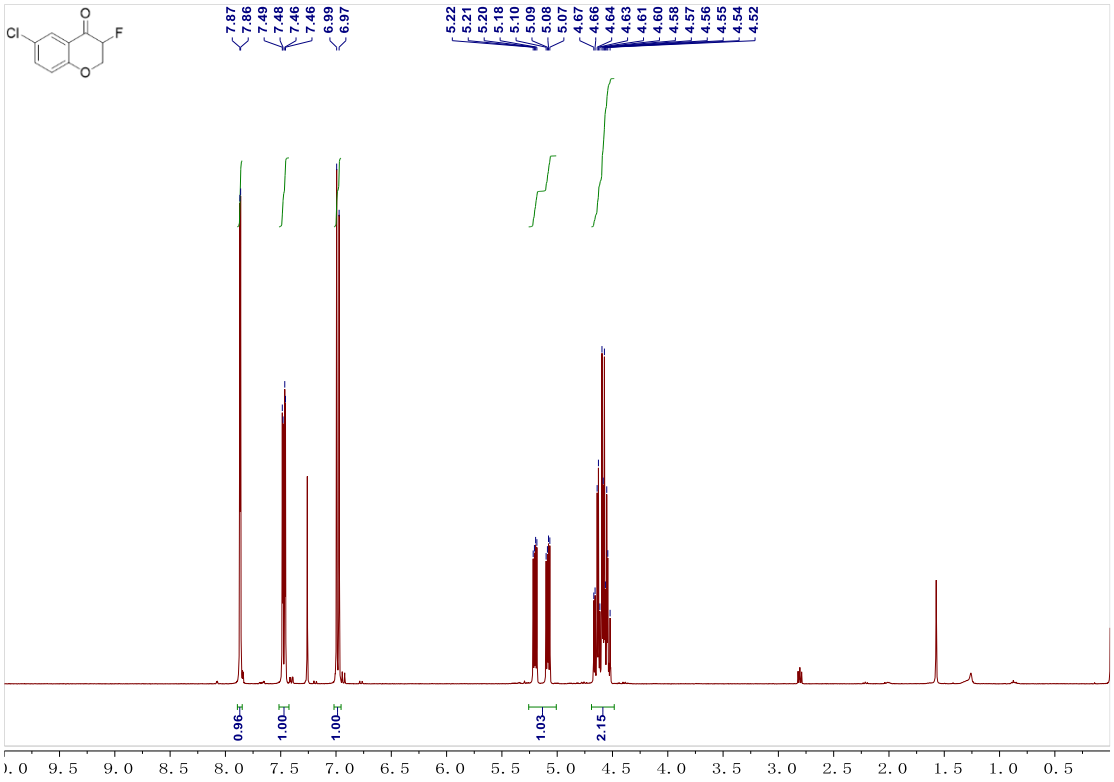
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1c**



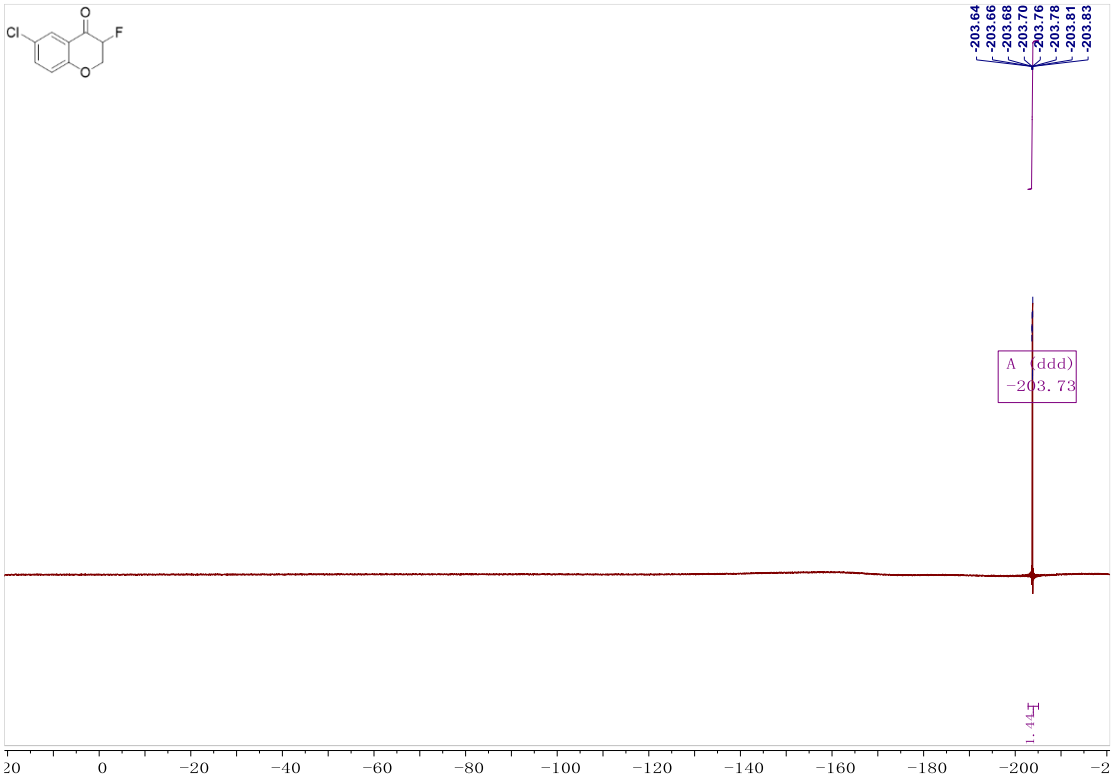
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1c**



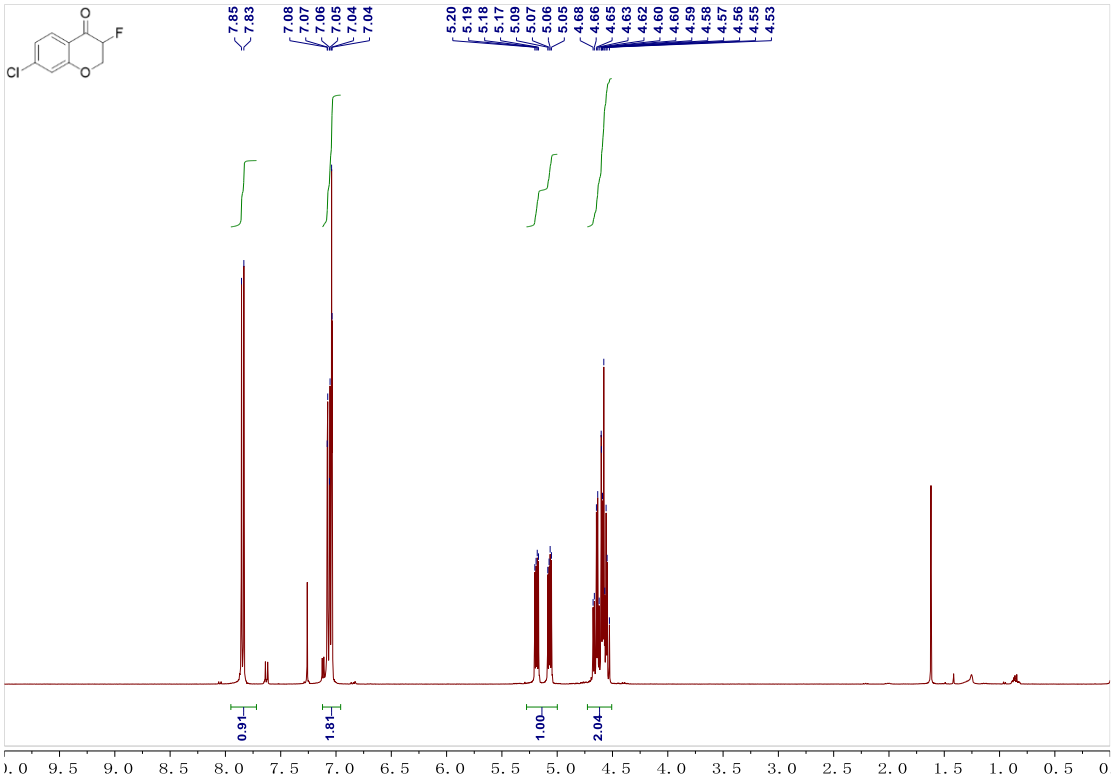
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1d**



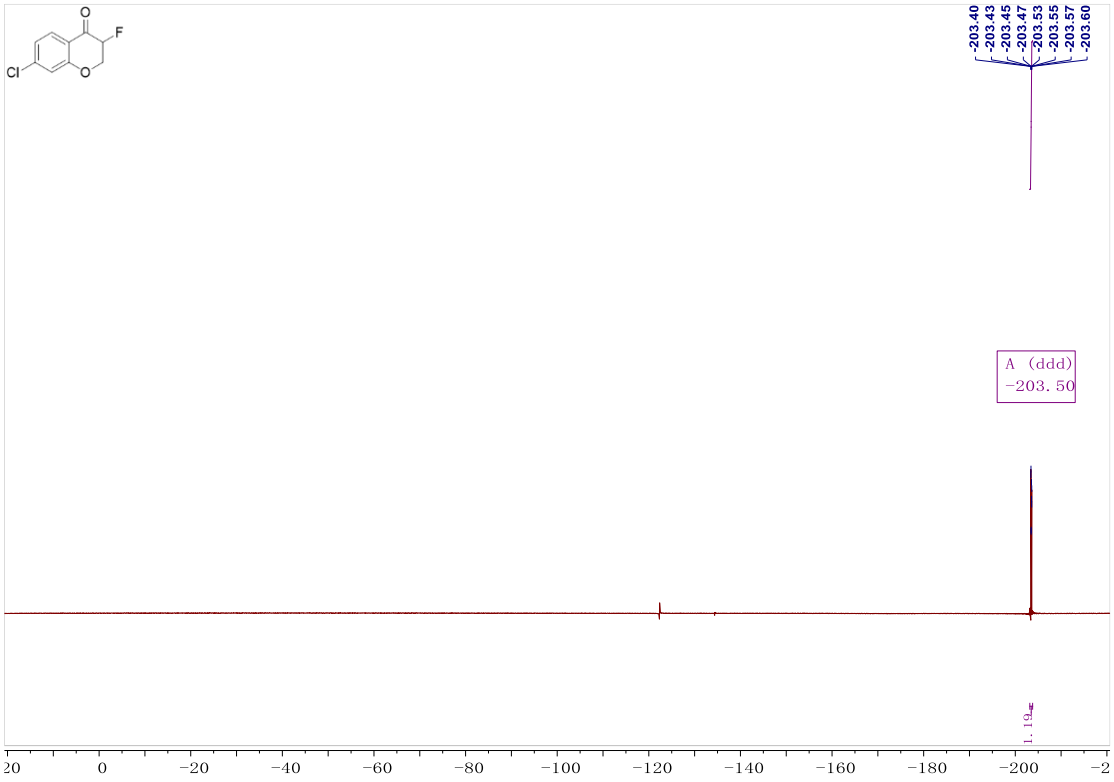
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1d**



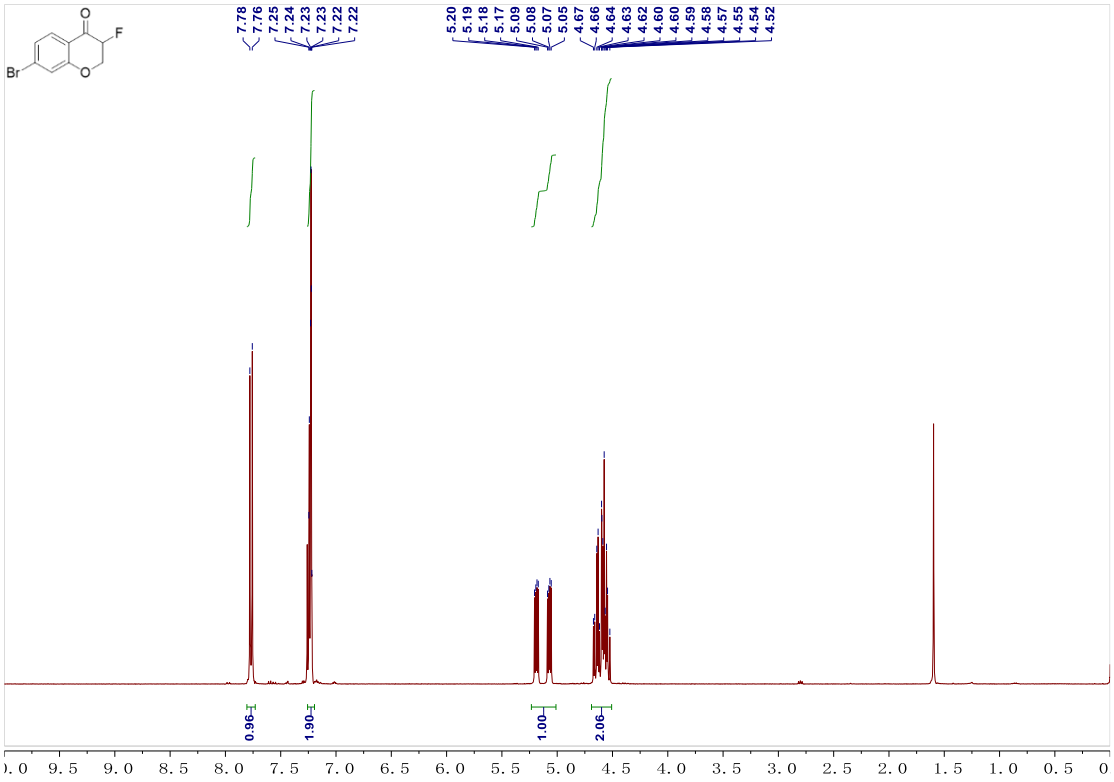
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1e**



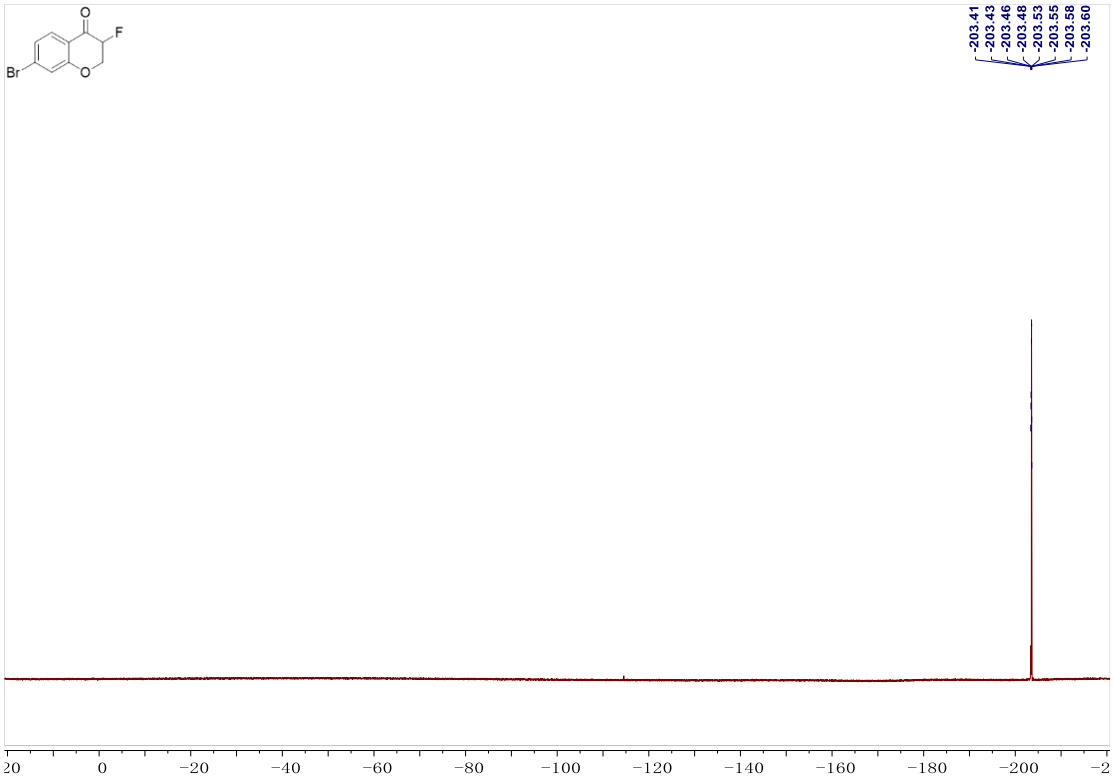
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1e**



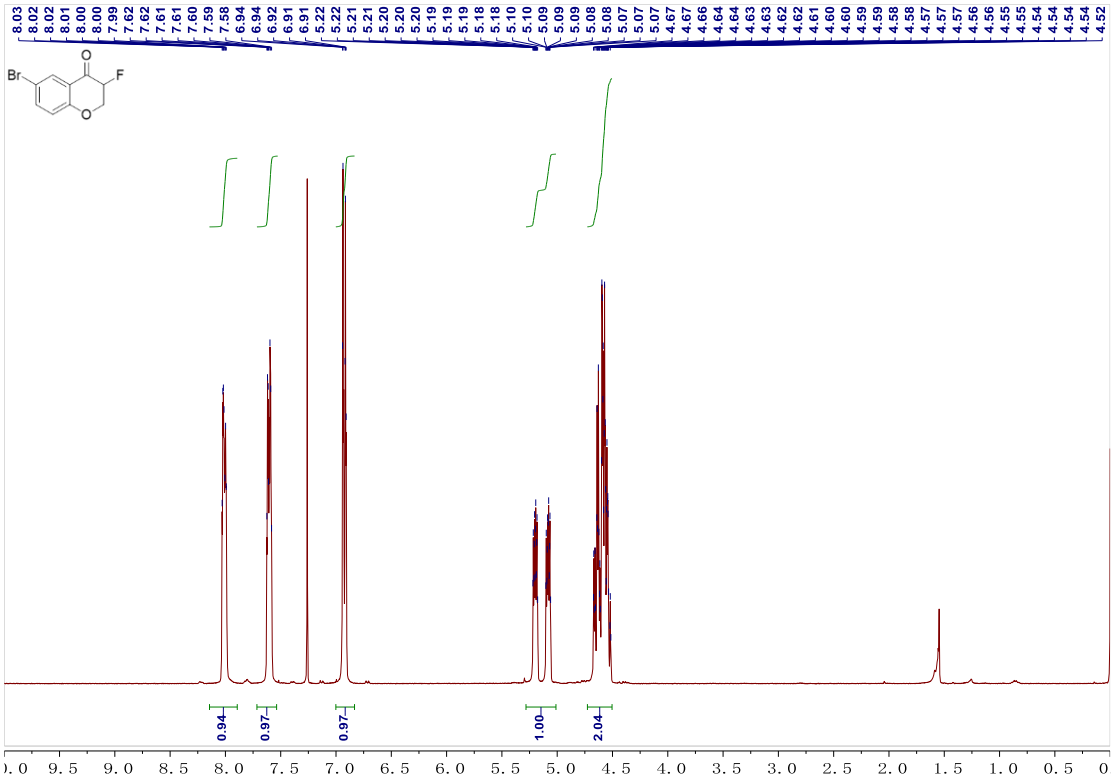
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1f**



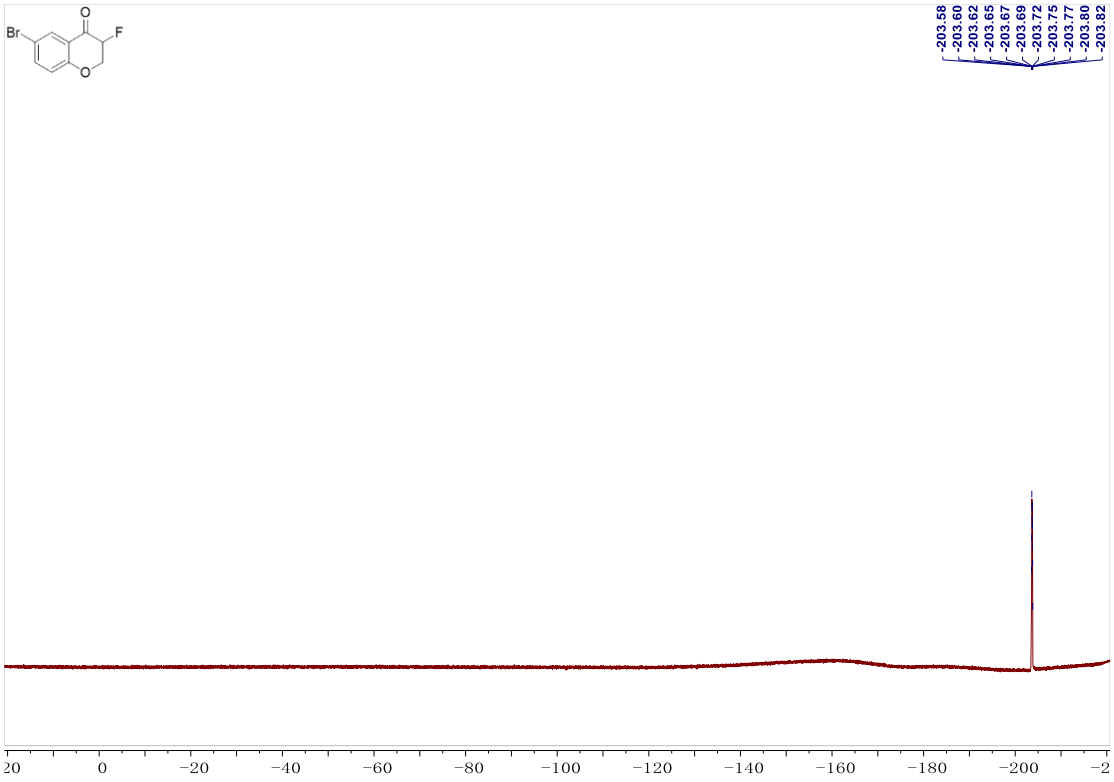
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1f**



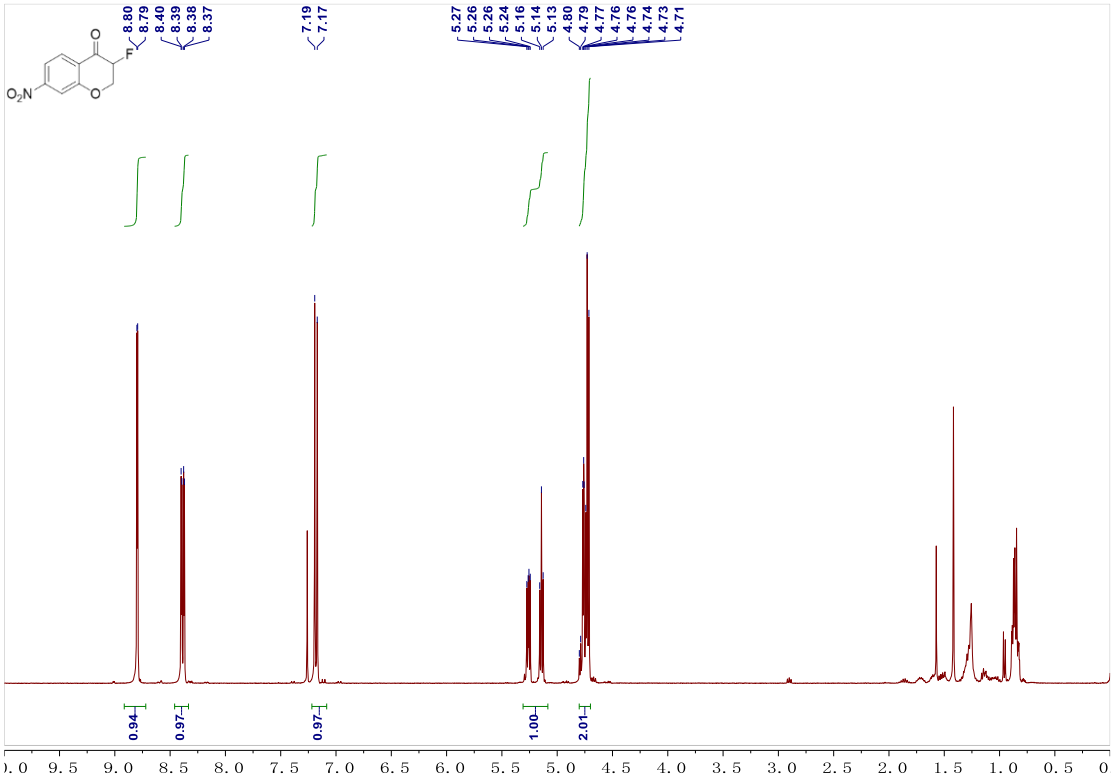
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1g**



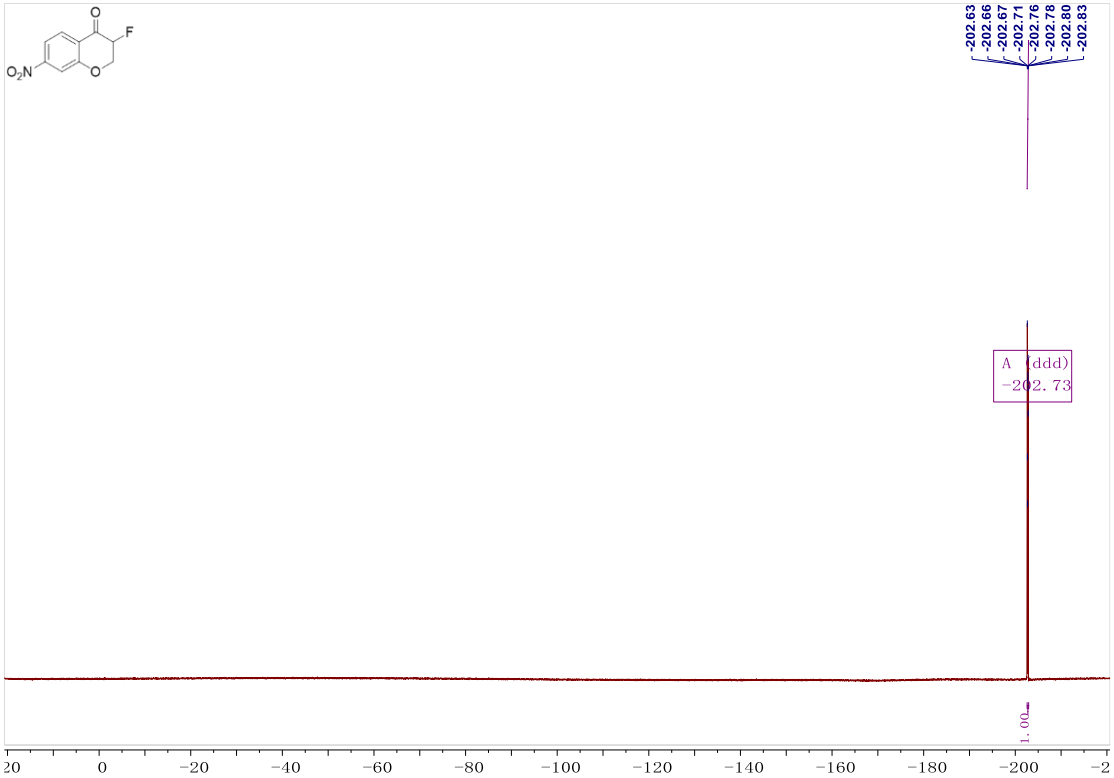
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1g**



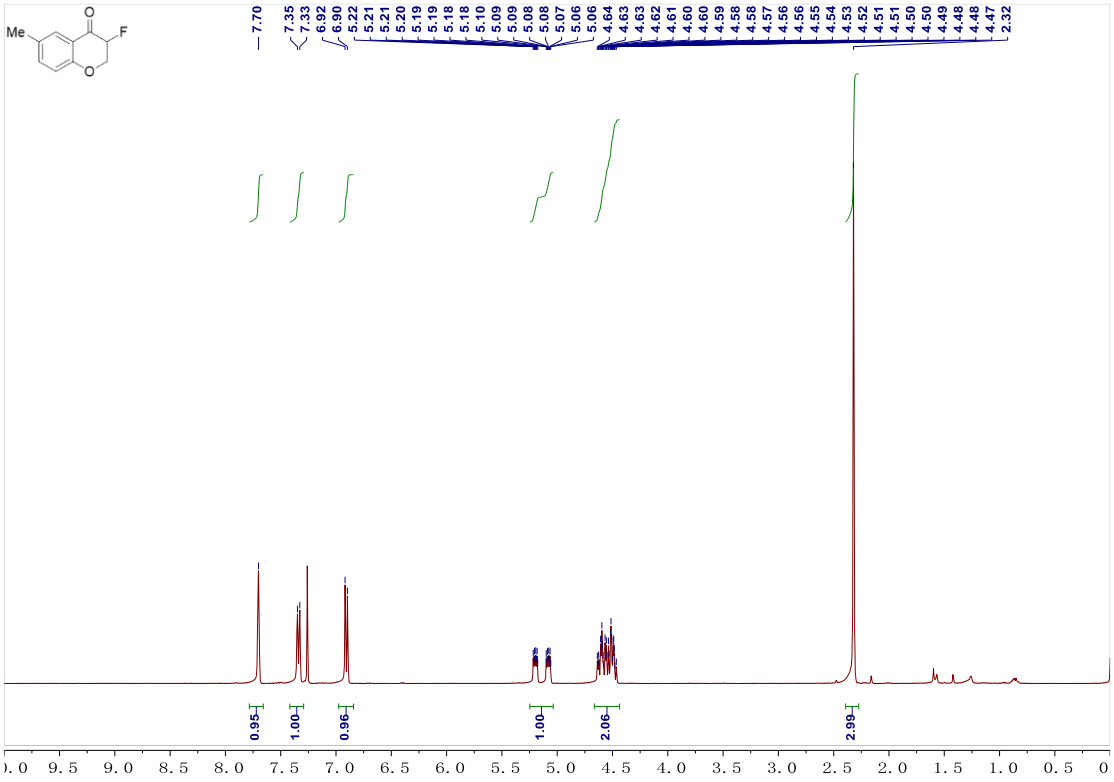
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1h**



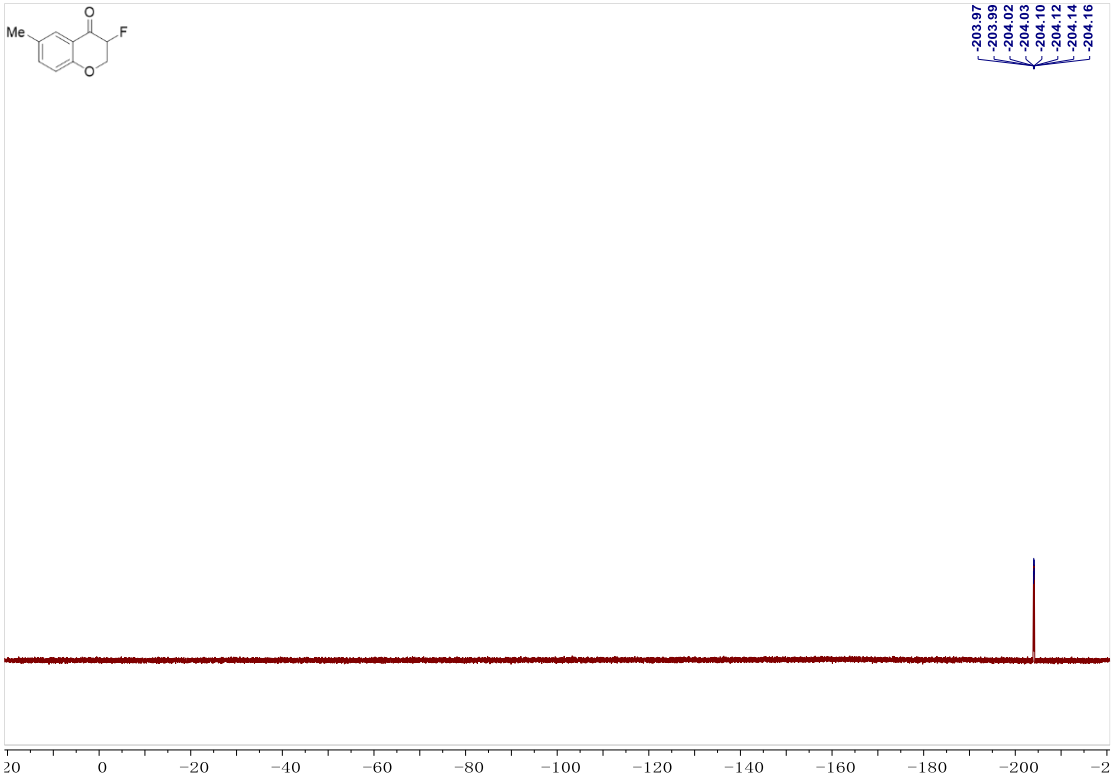
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1h**



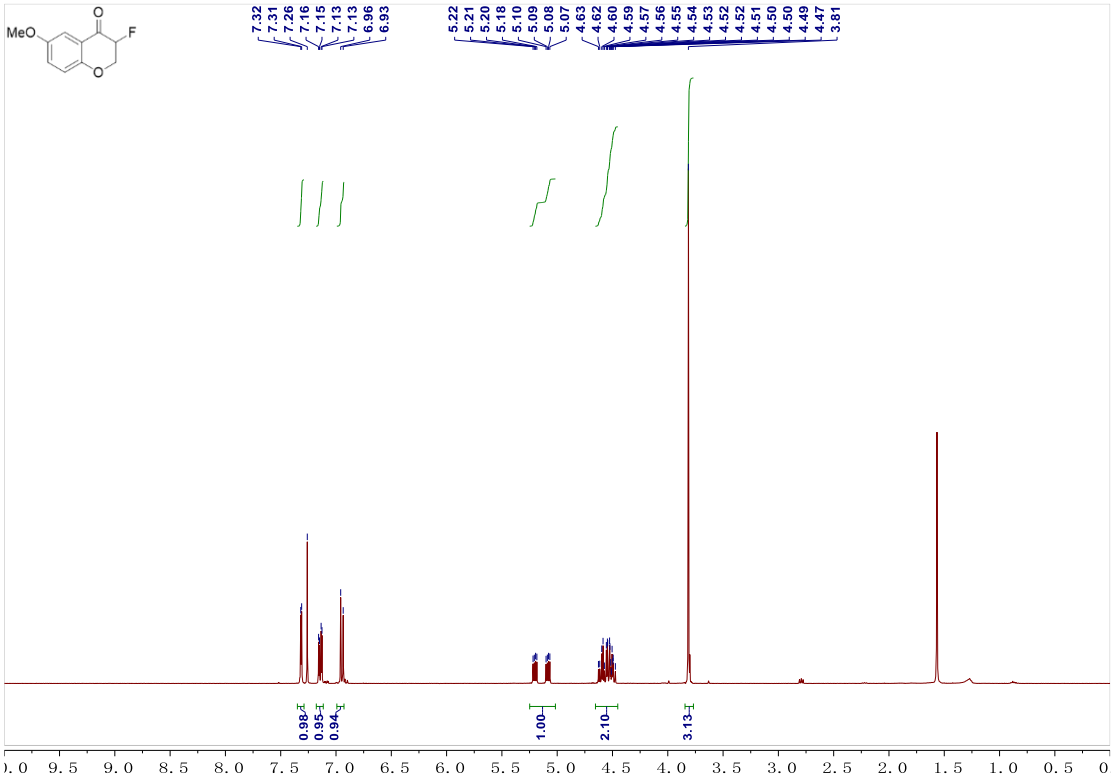
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1i**



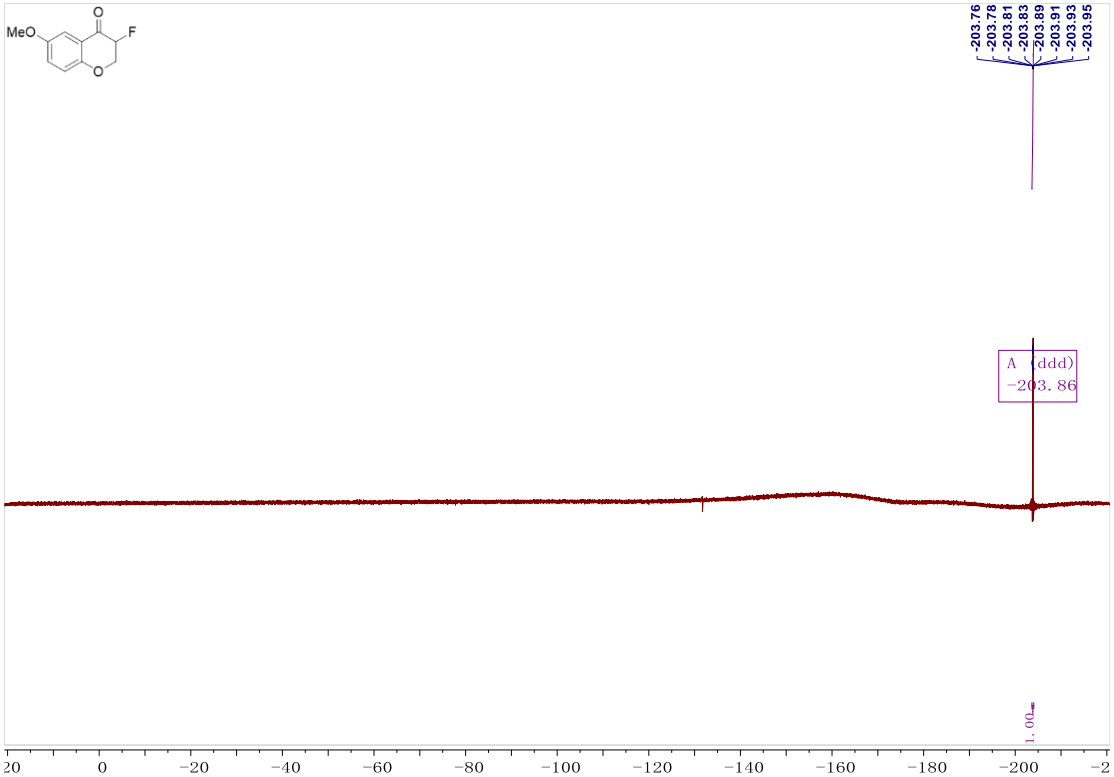
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1i**



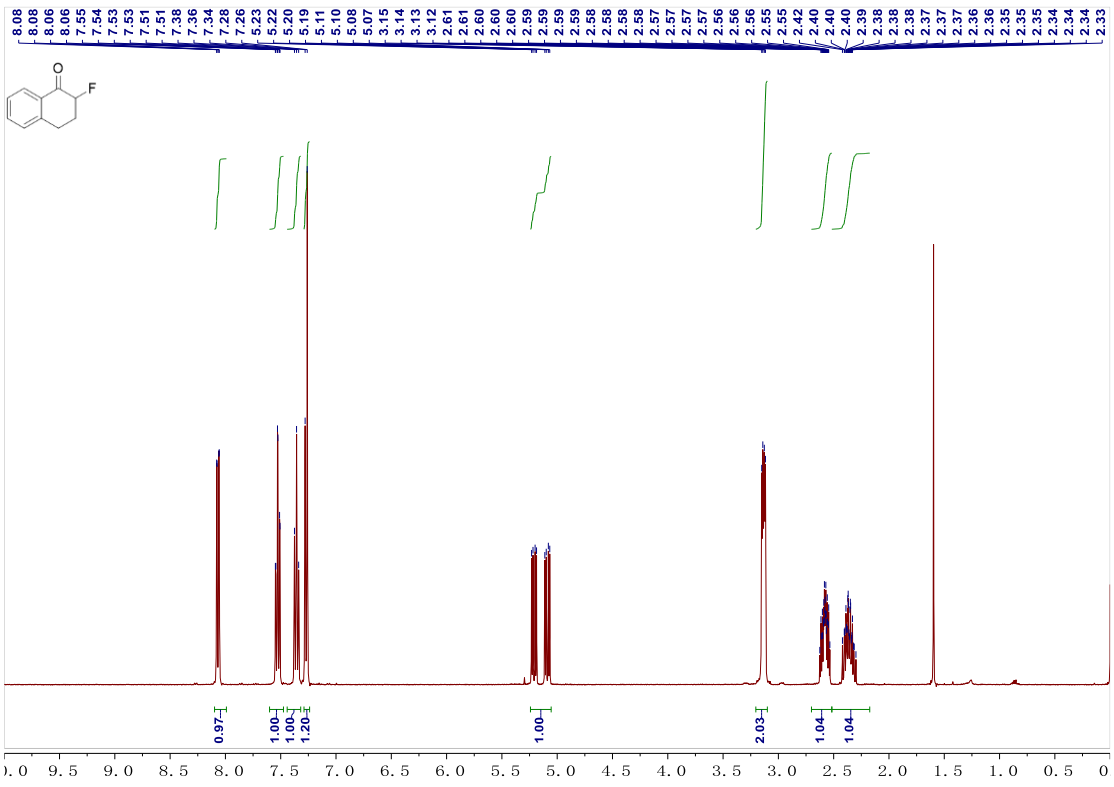
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1j**



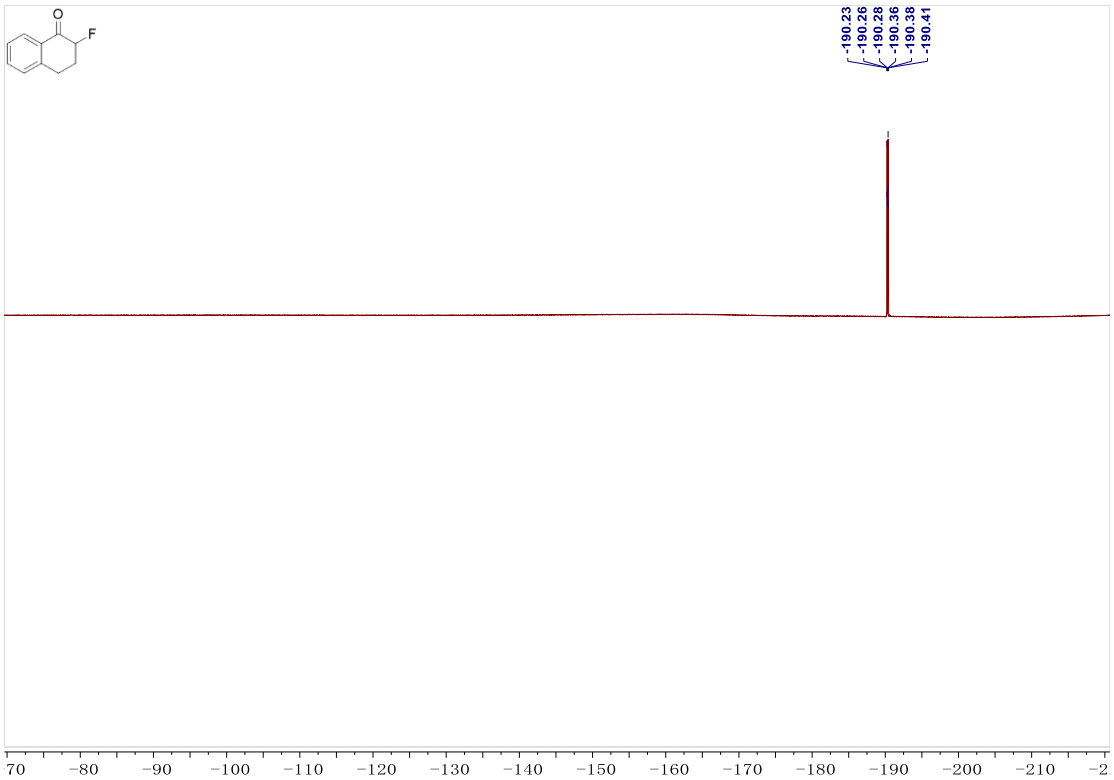
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1j**



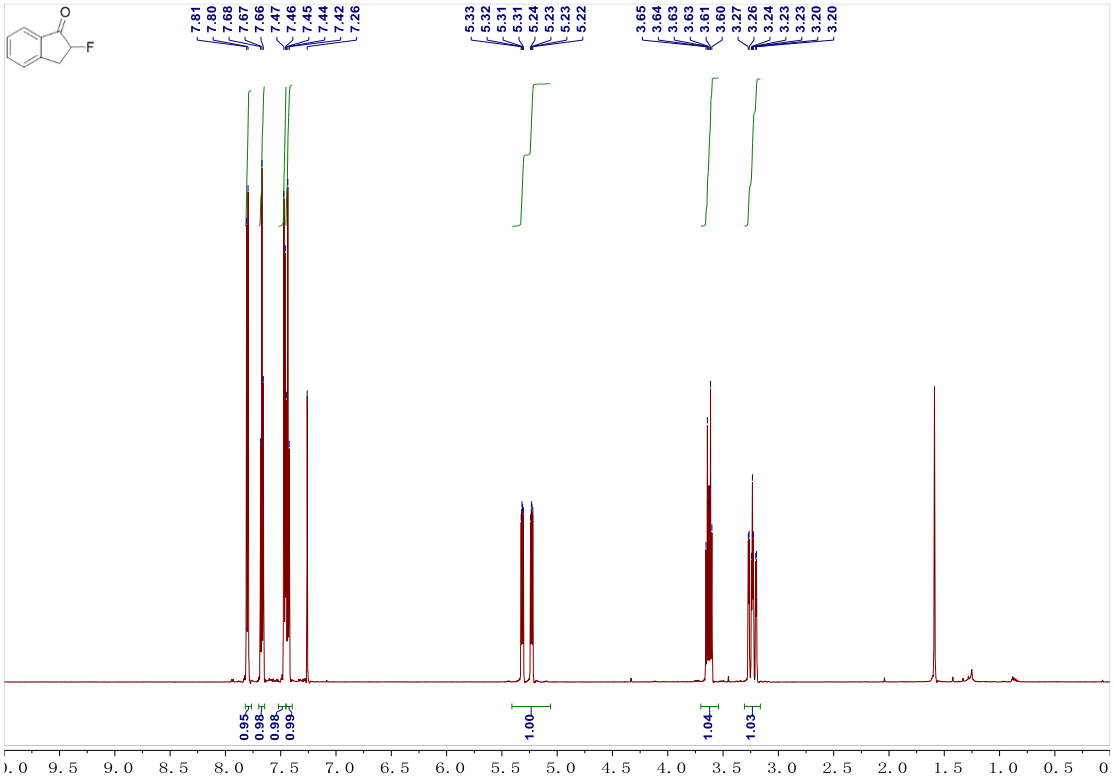
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1k**



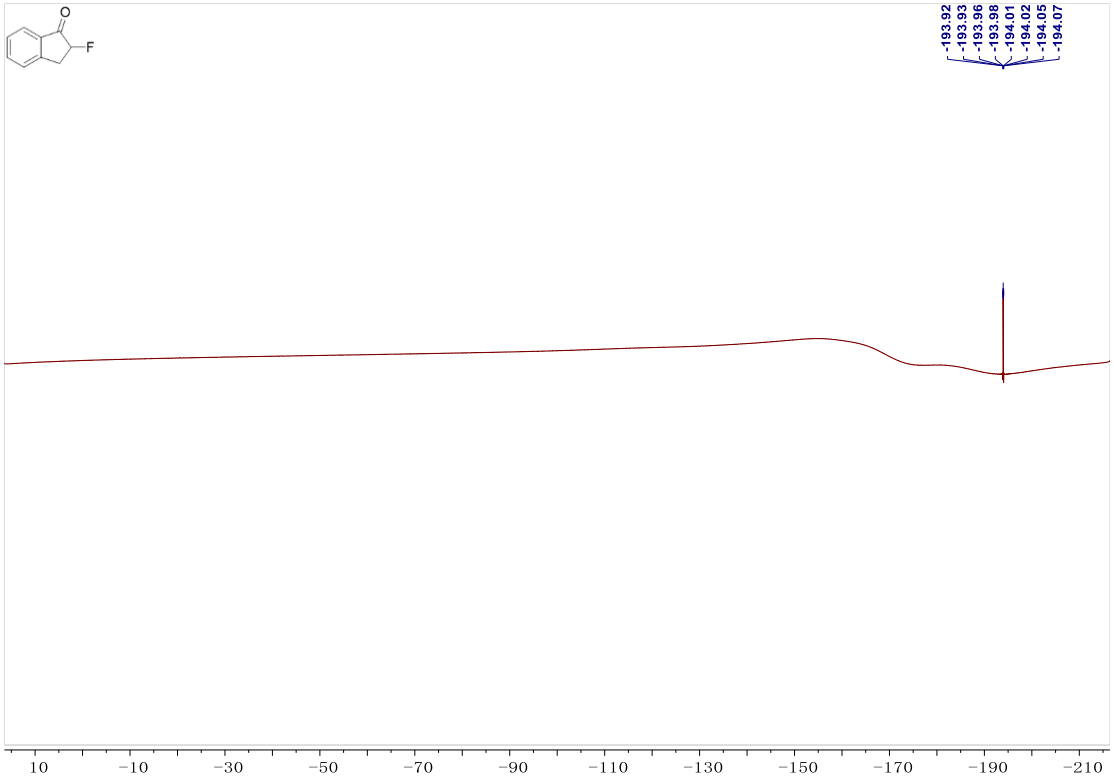
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1k**



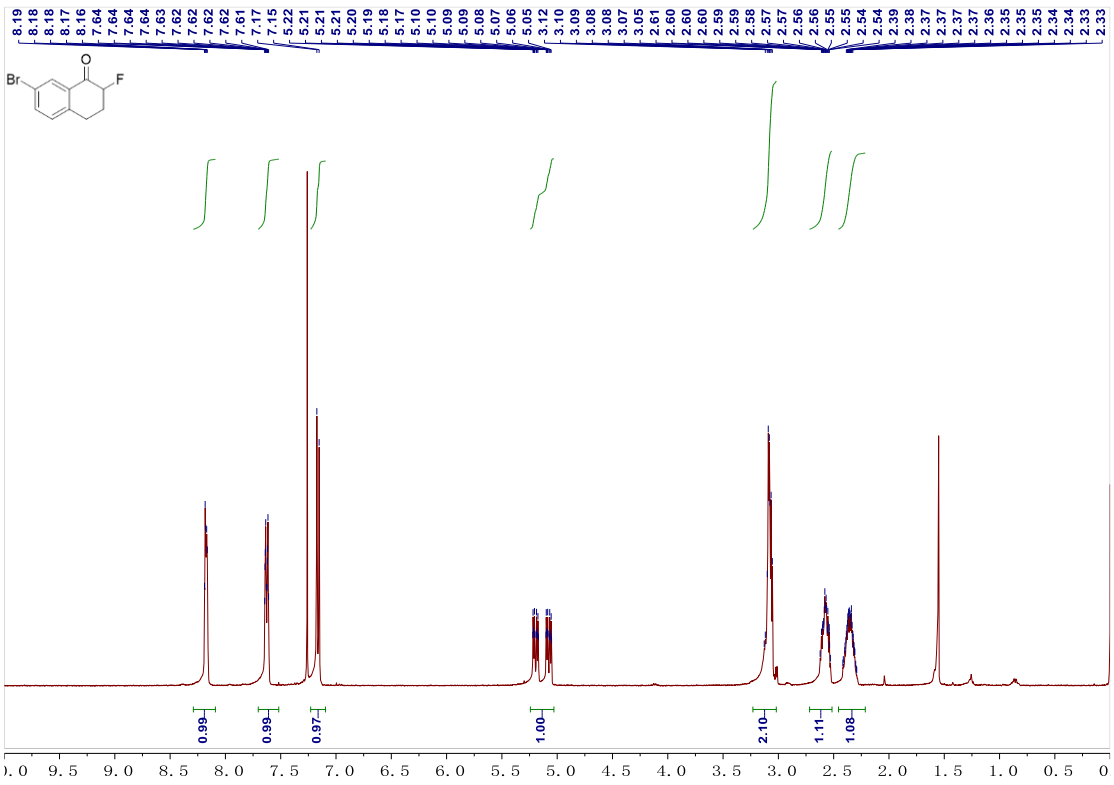
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1l**



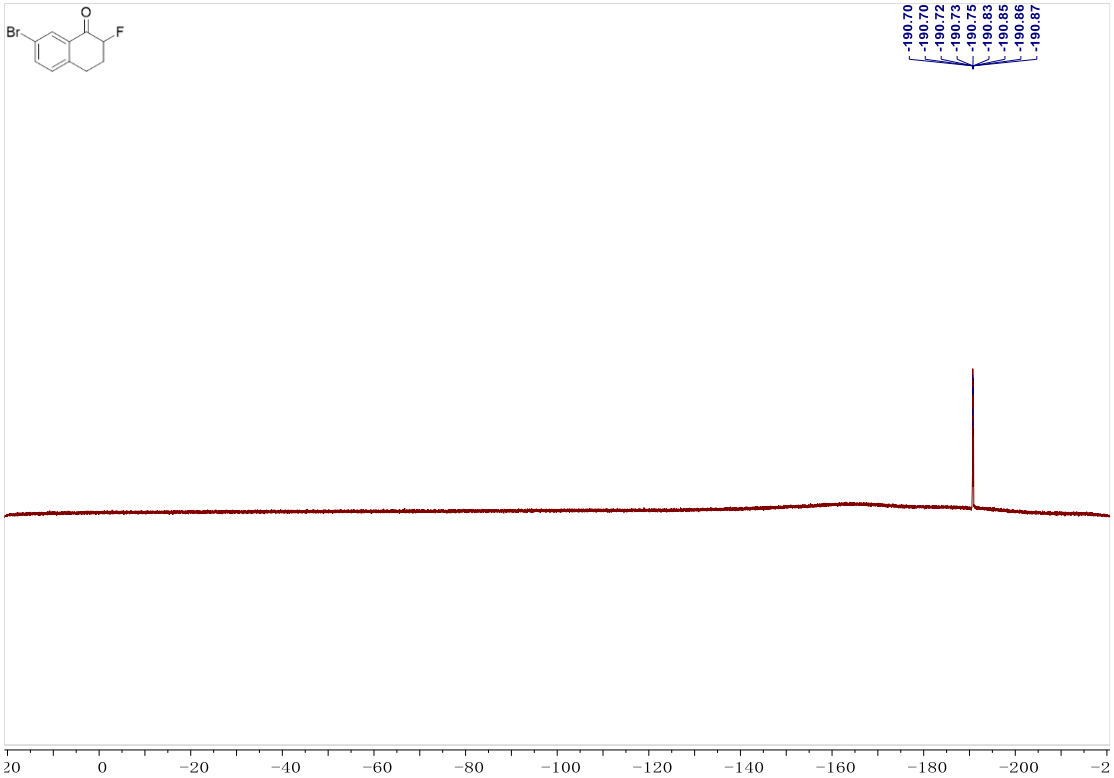
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1l**



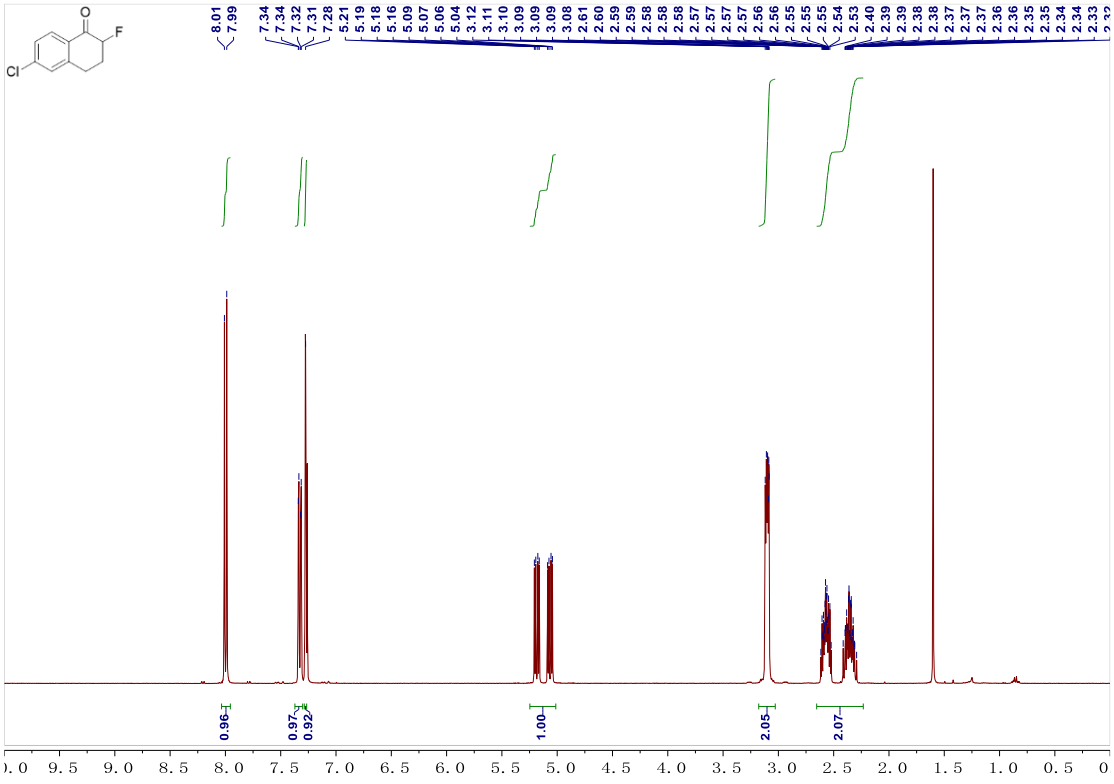
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1m**



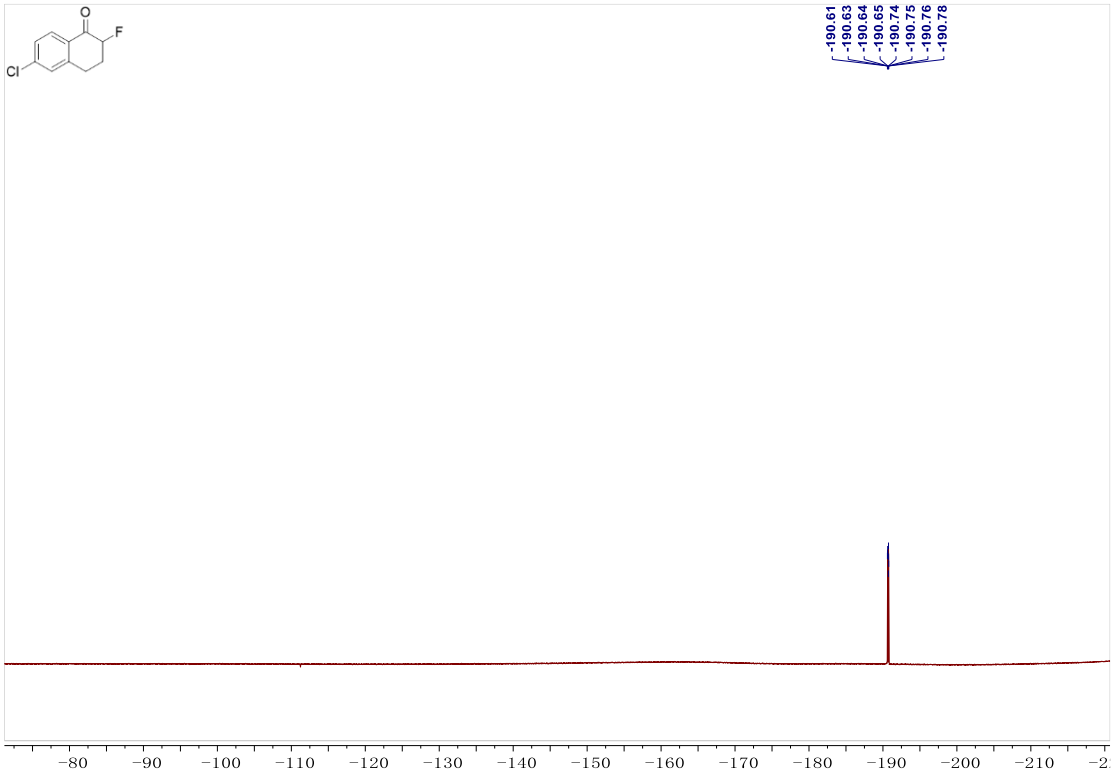
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1m**



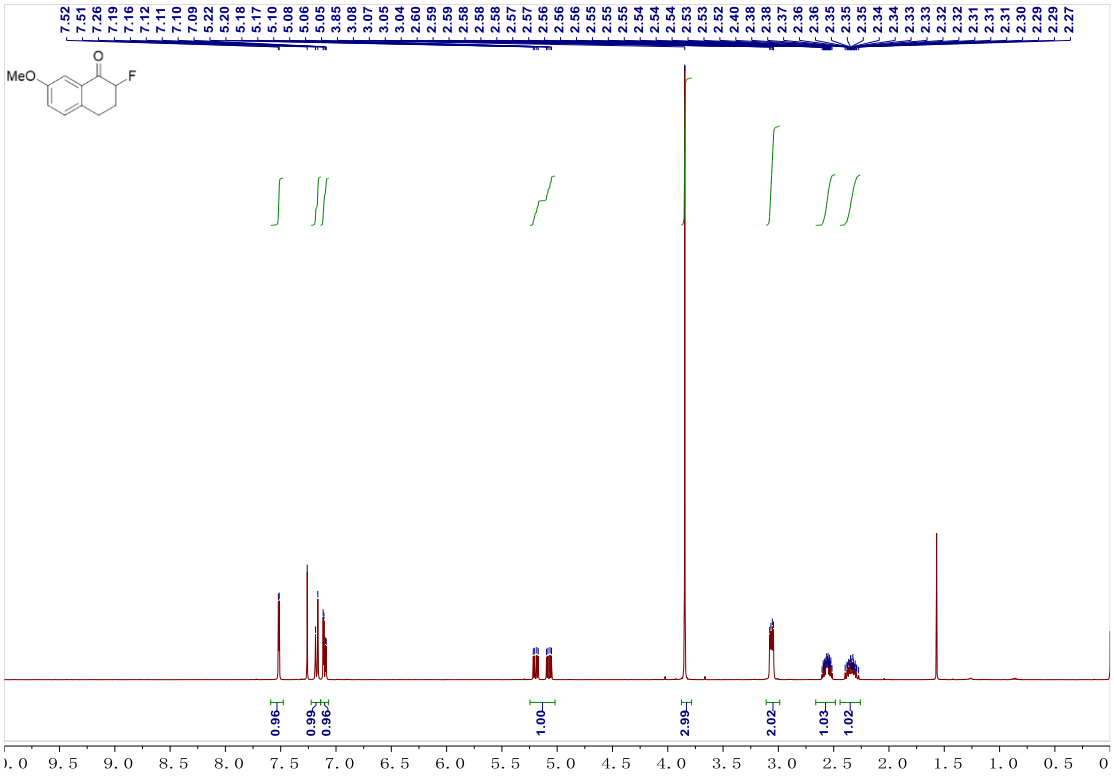
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1n**



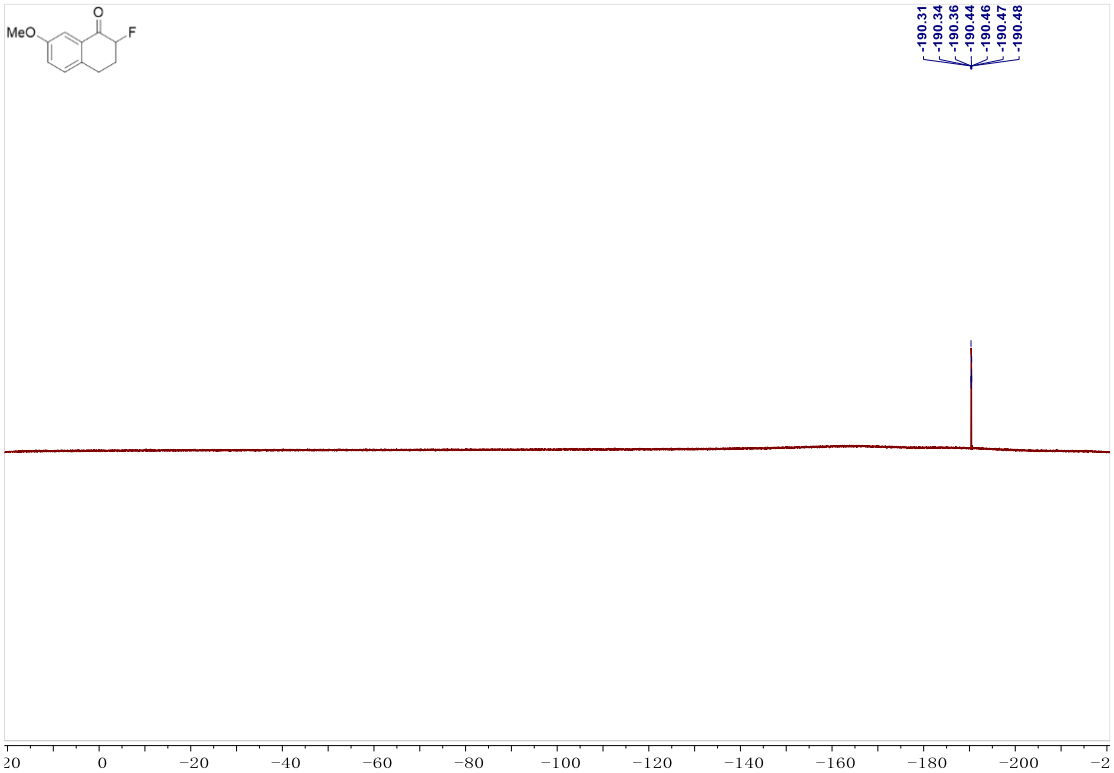
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1n**



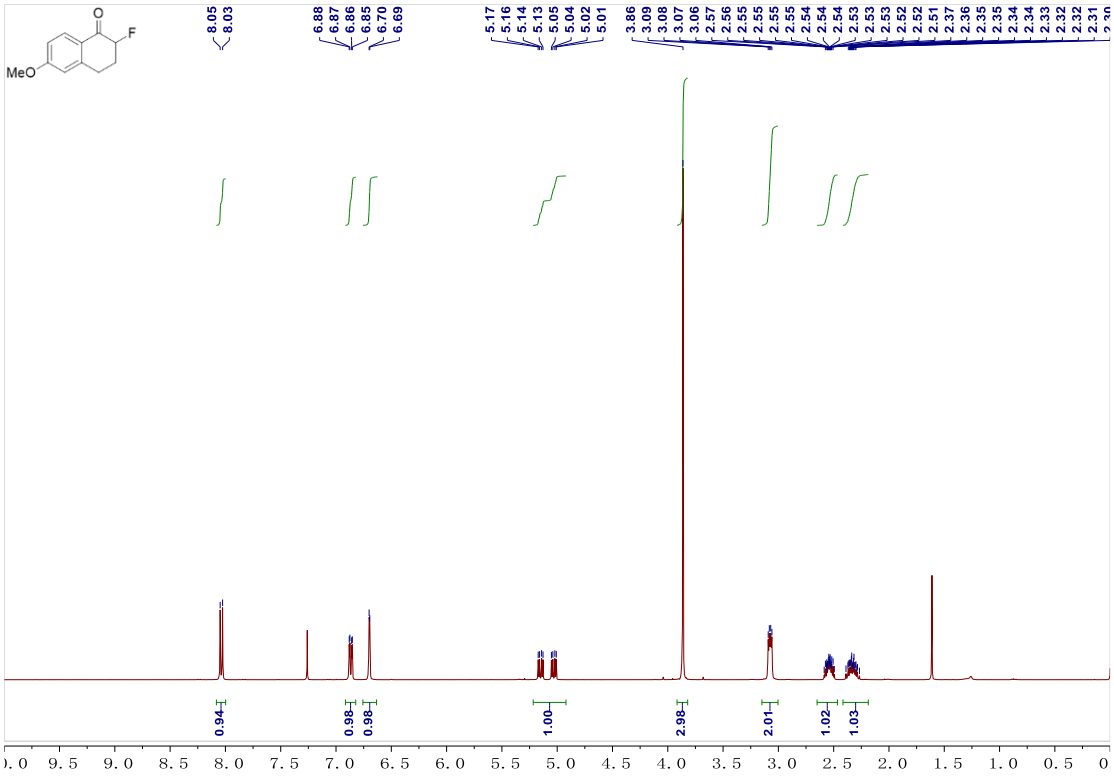
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1o**



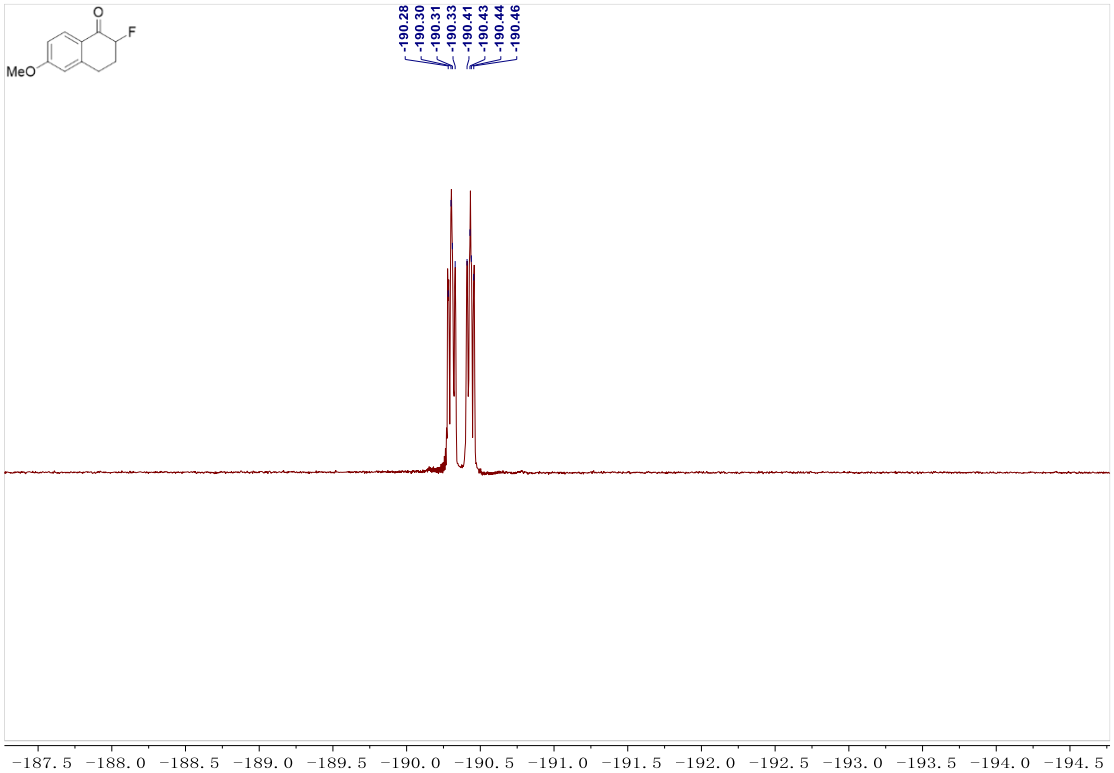
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1o**



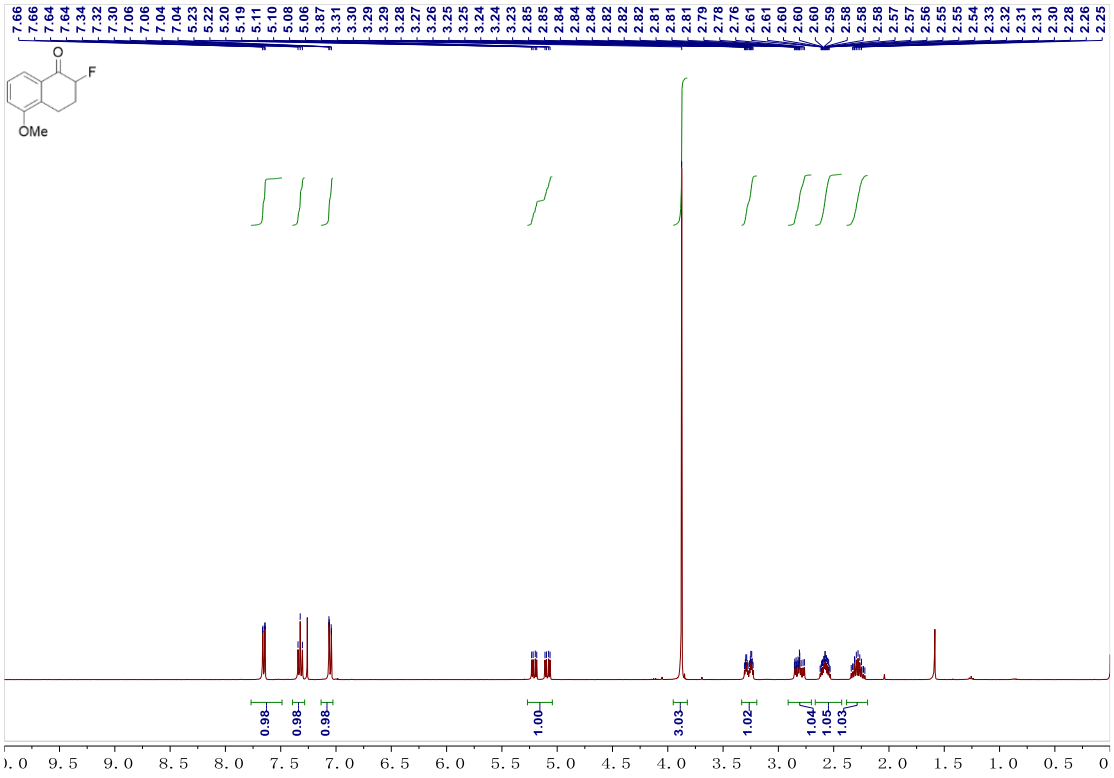
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1p**



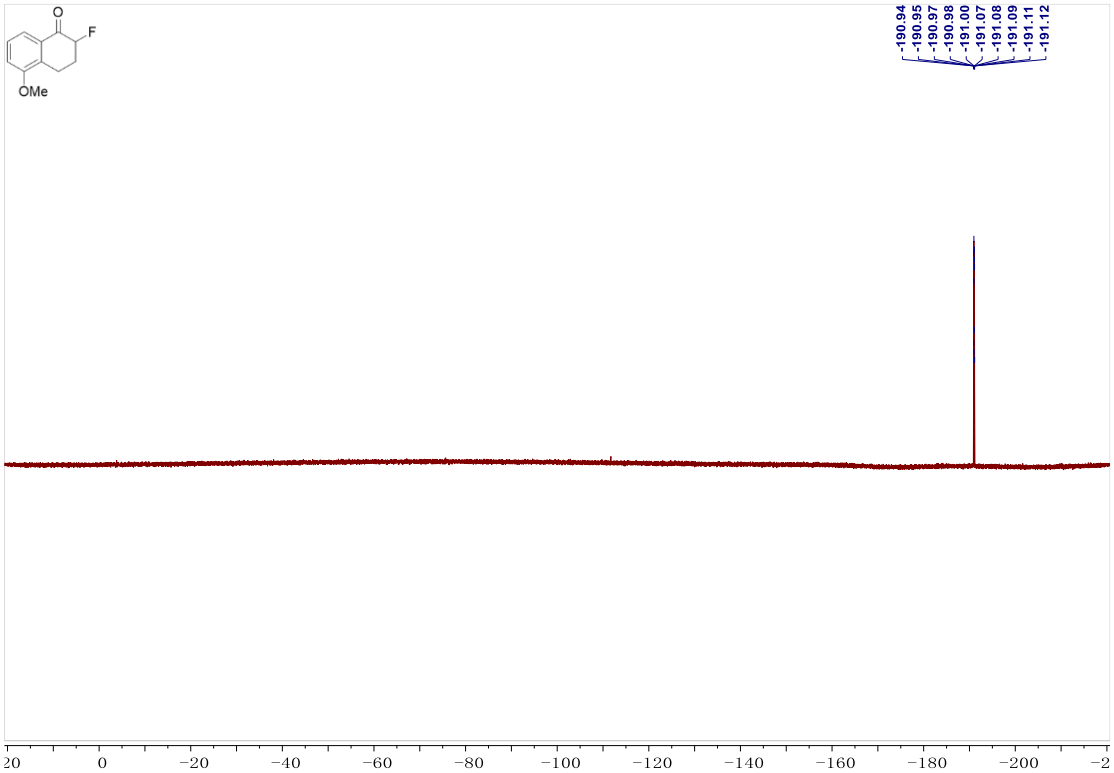
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1p**



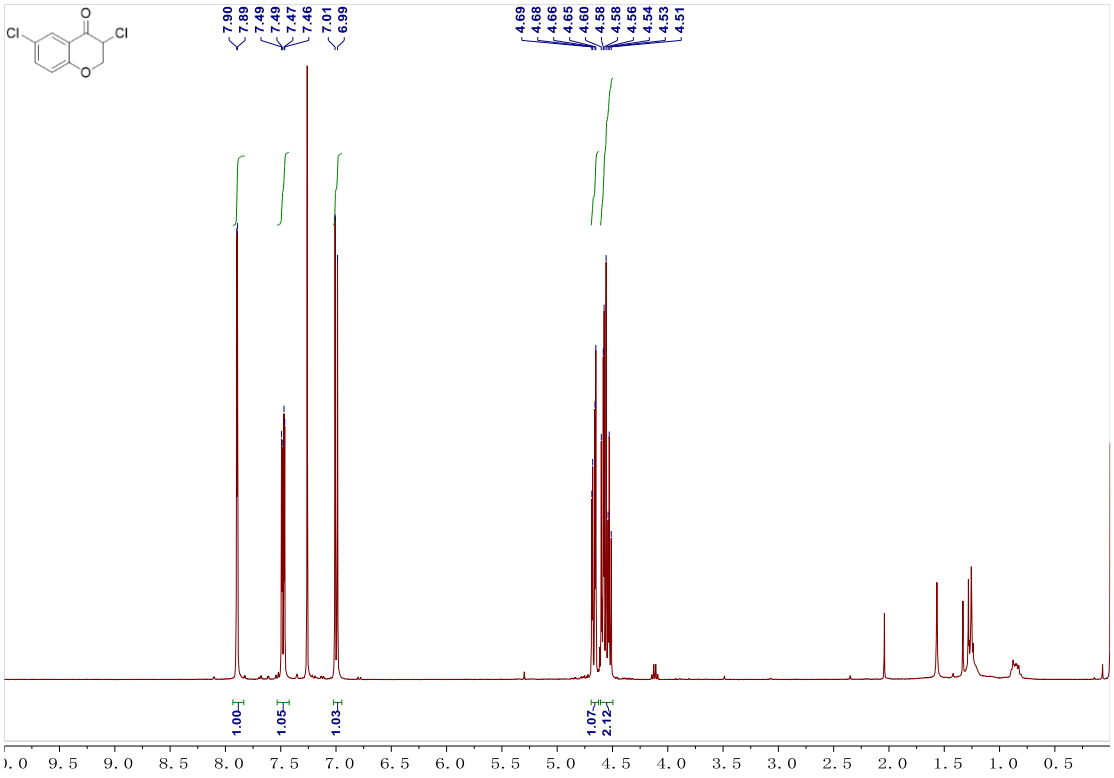
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1q**



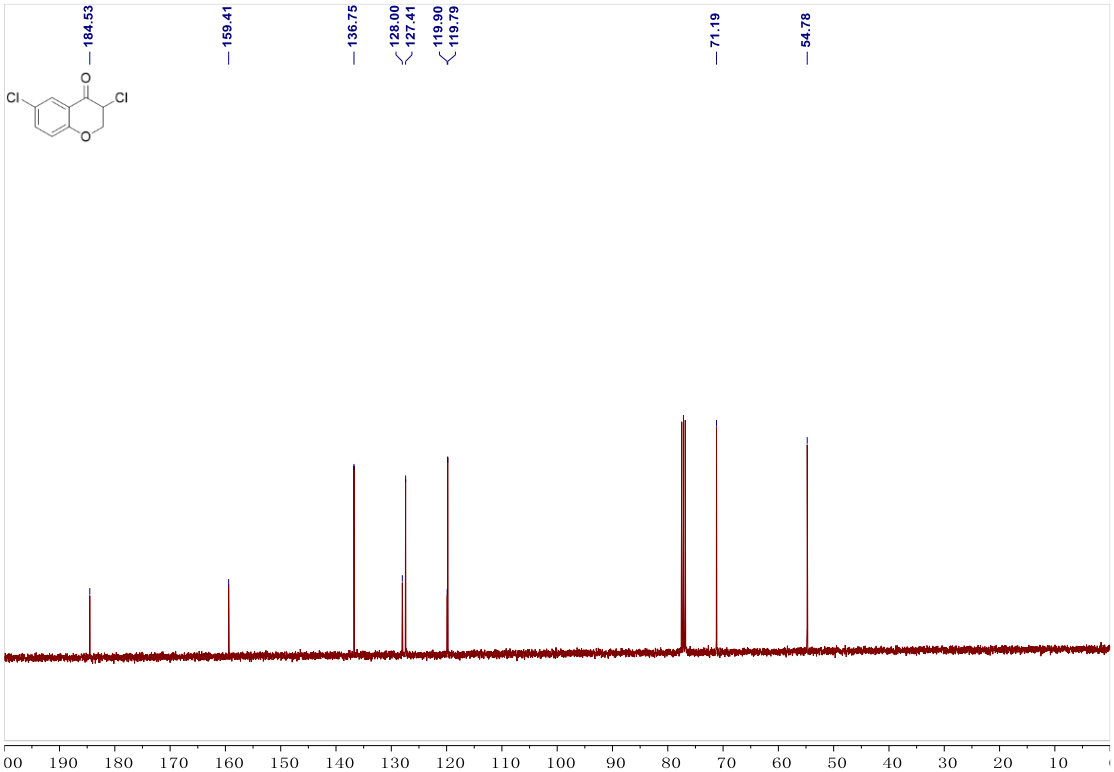
^{19}F NMR (400 MHz, $CDCl_3$) of compound **1q**



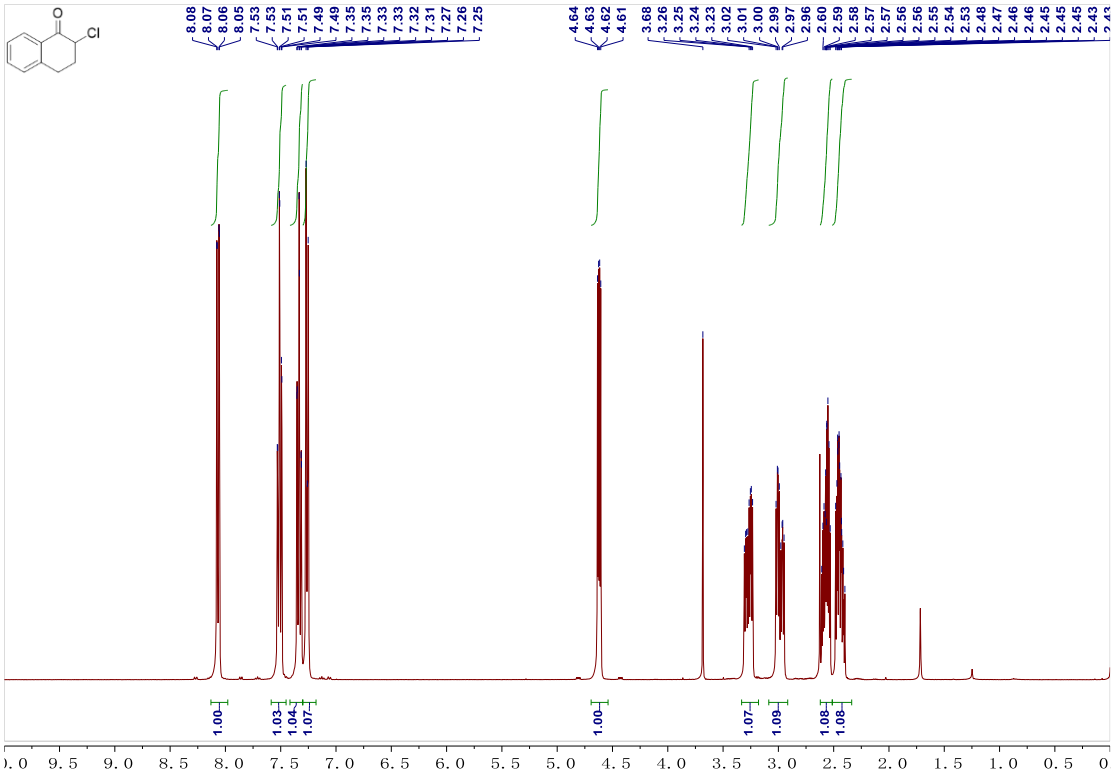
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1r**



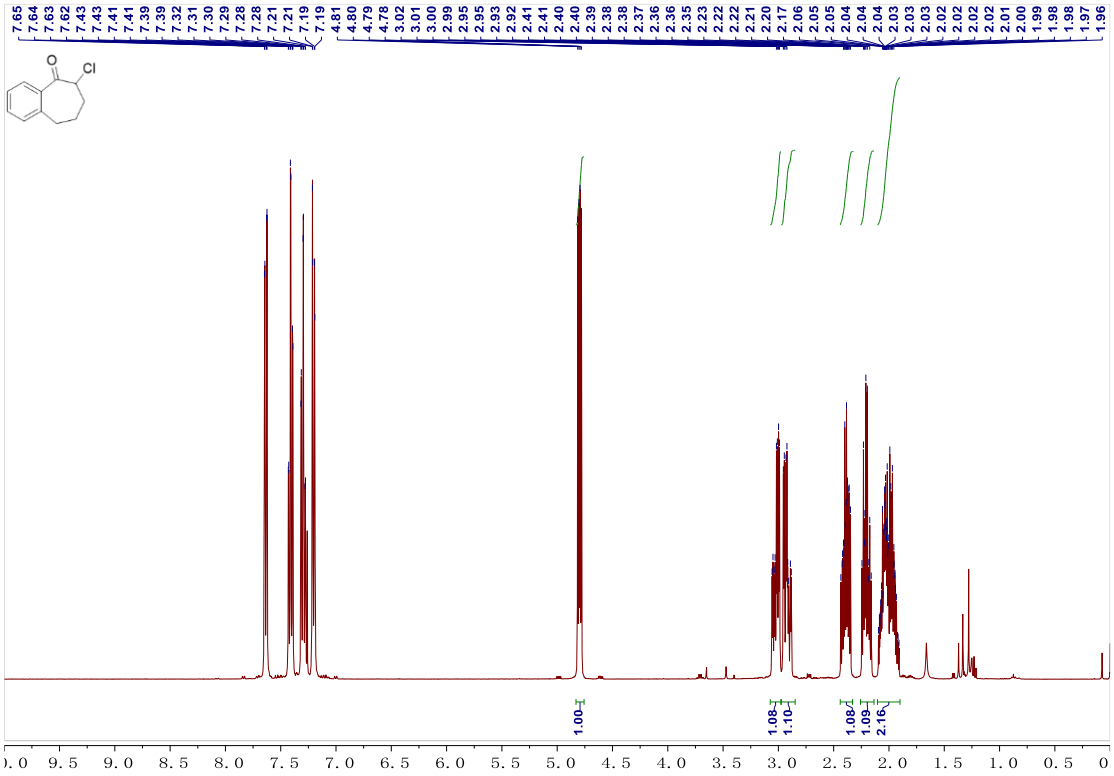
^{13}C NMR (100 MHz, $CDCl_3$) of compound **1r**



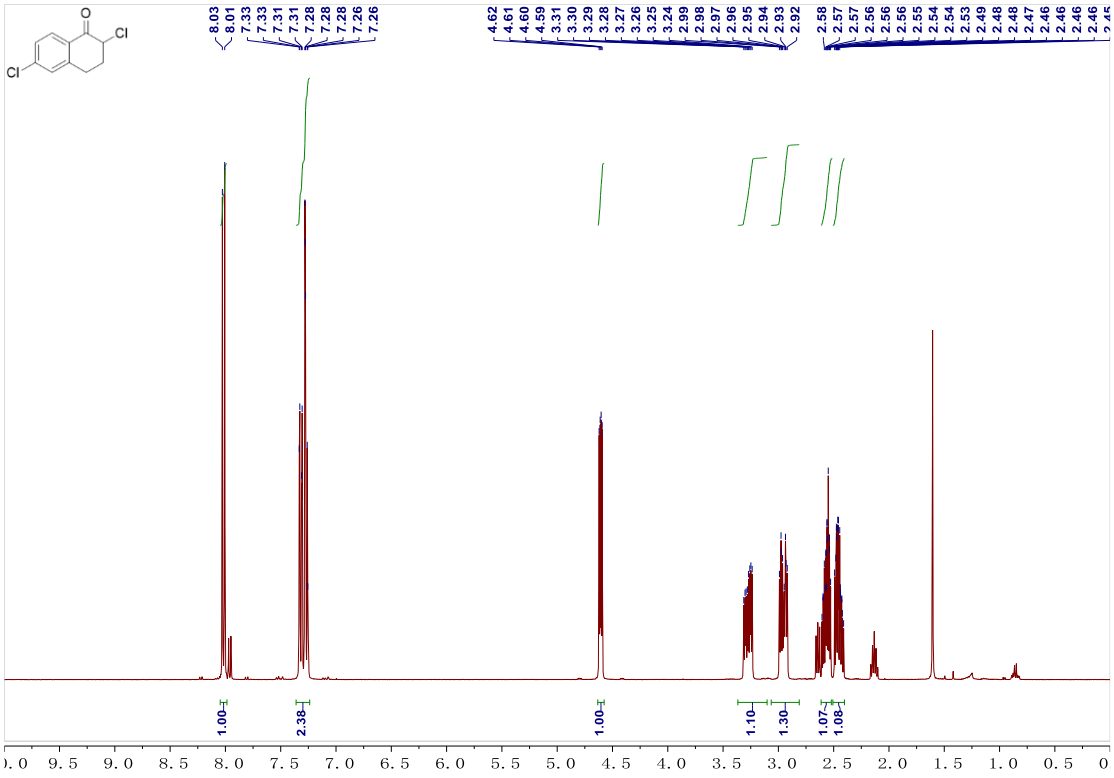
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1s**



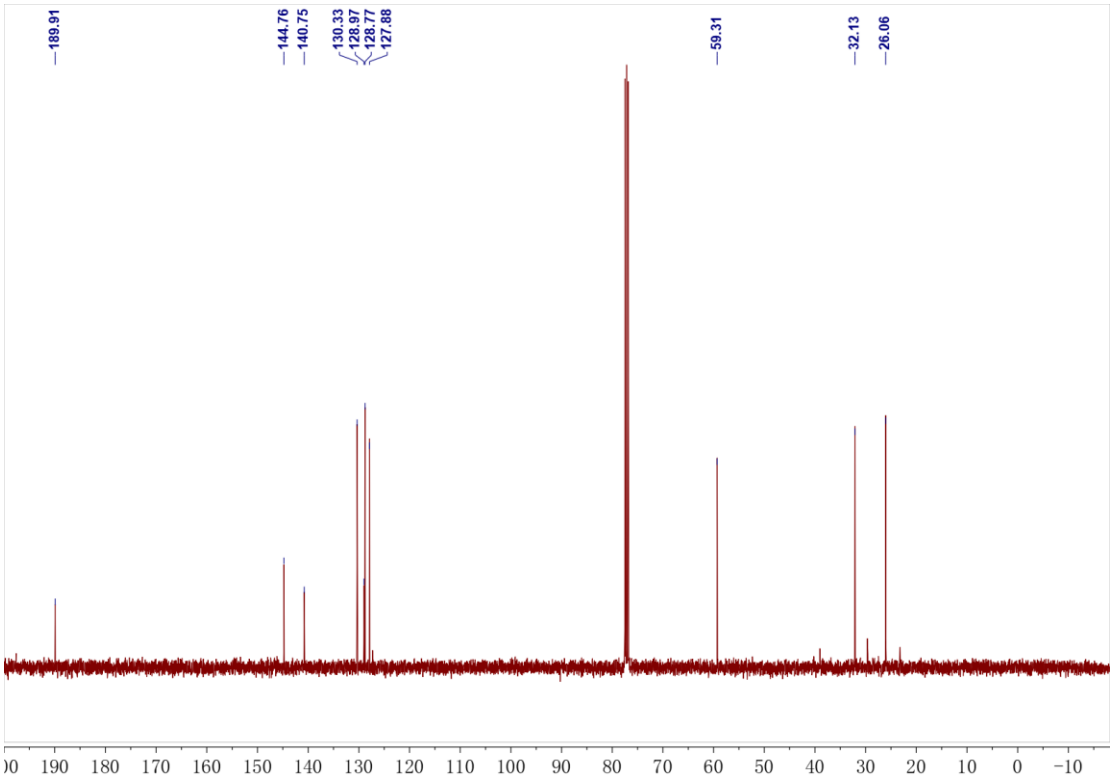
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1t**



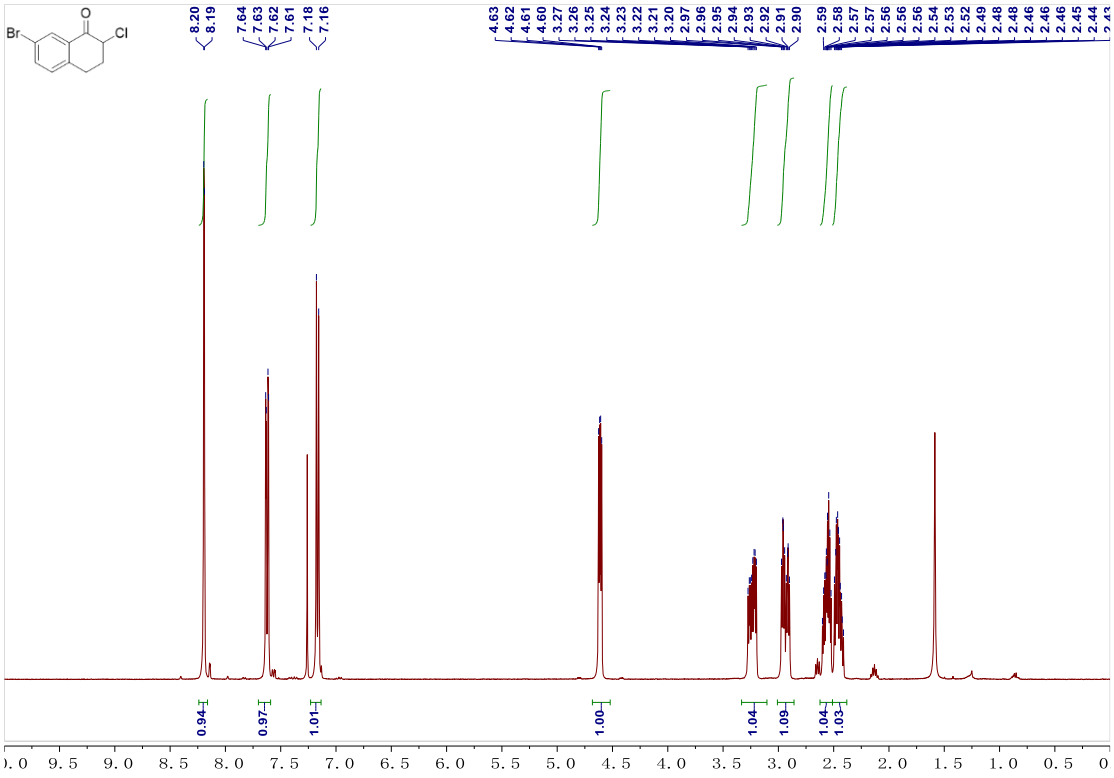
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1u**



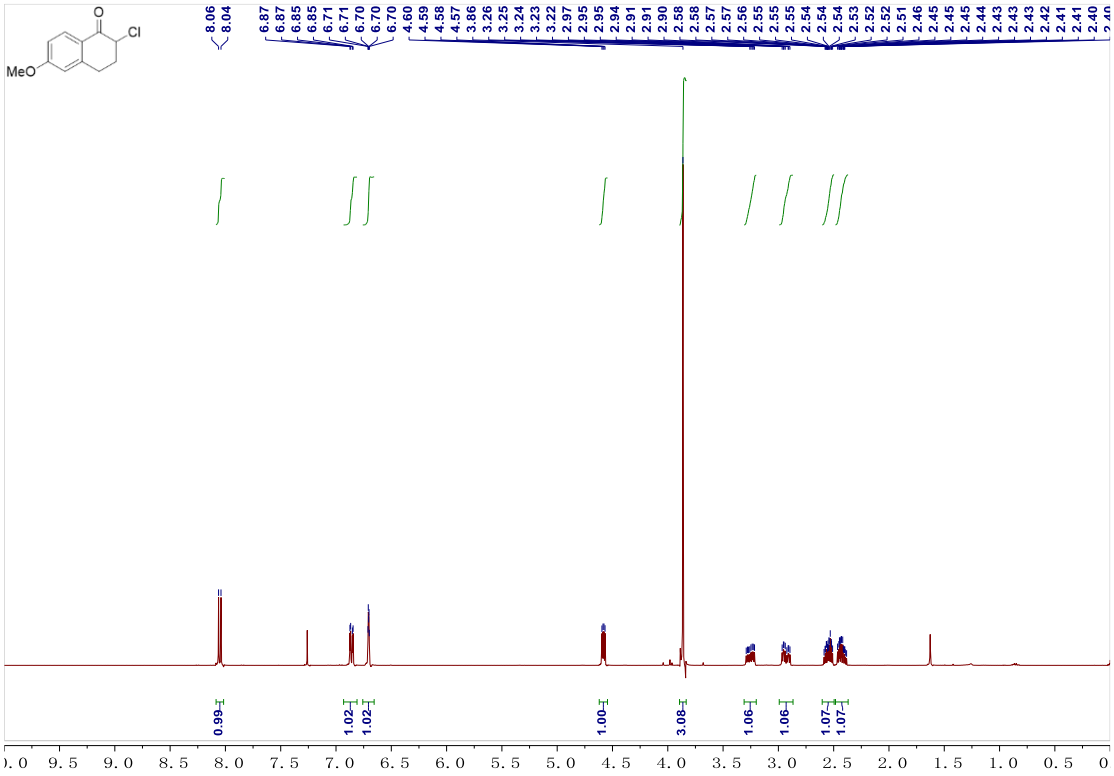
^{13}C NMR (100 MHz, $CDCl_3$) of compound **1u**



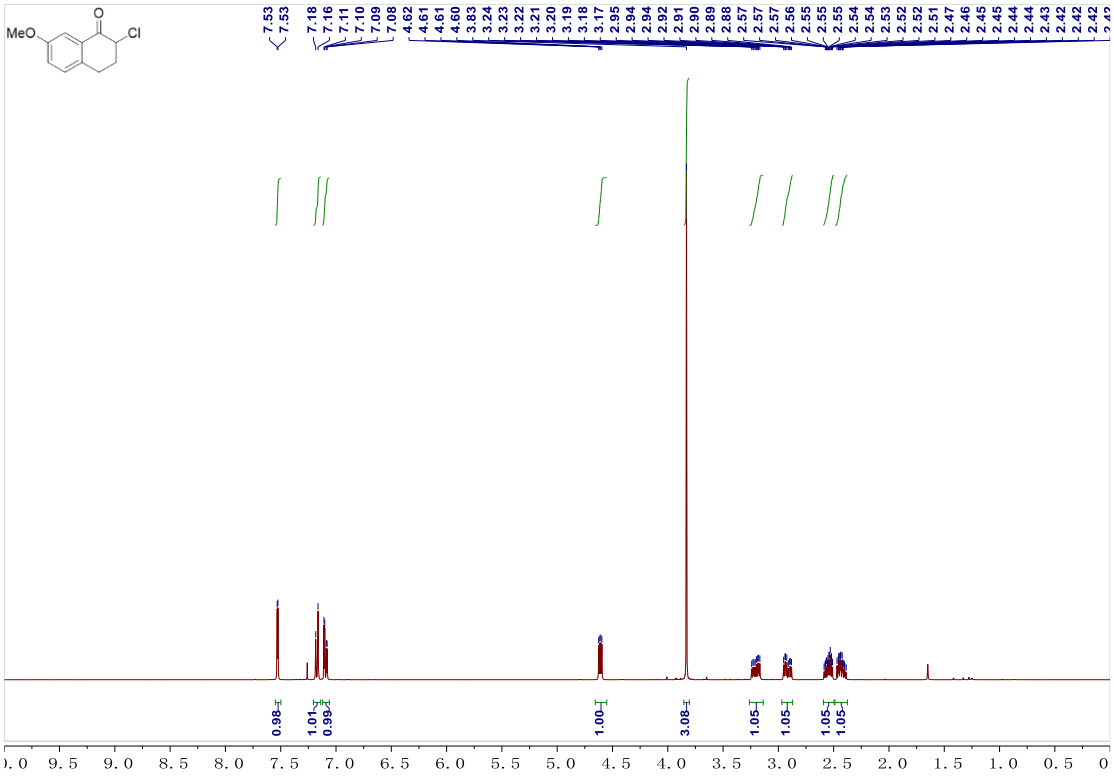
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1v**



^{1}H NMR (400 MHz, $CDCl_3$) of compound **1w**



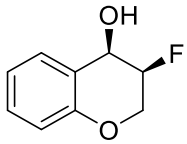
^{1}H NMR (400 MHz, $CDCl_3$) of compound **1x**



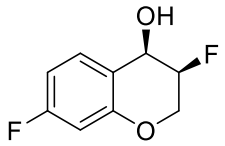
4. General procedure for Asymmetric hydrogenation of cyclic α-halogenated ketones

Prepared the [Ir-f-phamidol] solution: in a 5 ml vial was charged with [Ir-f phamidol] complexes 19.6 mg and anhydrous toluene 2 ml to make a 0.0125M [Ir-f- phamidol] solution.

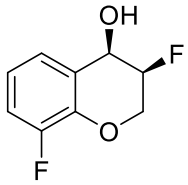
General procedure for S/C = 1000: In an argon-filled glove box, the prepared [Ir-f-phamidol] solution (32 μL), KOH (2.2 mg, 0.04 mmol) and ketones (0.4 mmol) in were charged in a 5 ml vial in 1.0 mL anhydrous toluene. The vial was transferred to an autoclave, which was then pressurized with 5 atm of H_2 and stirred at room temperature for 16 h. The hydrogen gas was released slowly in a well-ventilated hood and the crude reaction mixture was evaporated under reduced pressure. The dr values were measured by ^{1}H NMR from the crude product, after that, purified by flash column chromatography on silica gel using petroleum ether/ethyl acetate (80:20, v/v) afforded the reduced product, then the product was analyzed by chiral HPLC for ee.



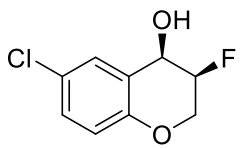
(3*S*,4*R*)-3-Fluorochroman-4-ol (**2a**):[3] Colourless crystal, 67 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 42.7 (c 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.47 (d, *J* = 7.6 Hz, 1H), 7.23 (dddd, *J* = 8.0, 7.3, 1.7, 0.6 Hz, 1H), 6.99 (td, *J* = 7.5, 1.2 Hz, 1H), 6.85 (dd, *J* = 8.2, 0.9 Hz, 1H), 5.00 (dddd, *J* = 48.3, 5.6, 3.6, 2.0 Hz, 1H), 4.90 (dd, *J* = 20.0, 4.0 Hz, 1H), 4.48 (ddd, *J* = 12.2, 7.8, 5.6 Hz, 1H), 4.21 (dddd, *J* = 28.5, 12.2, 2.0, 1.2 Hz, 1H), 2.37 (d, *J* = 7.8 Hz, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -209.40 (dddd, *J* = 48.1, 28.4, 20.0, 7.9 Hz).



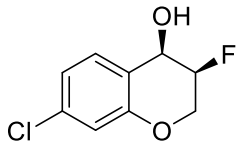
(3*S*,4*R*)-3,7-Difluorochroman-4-ol (**2b**):[3] Colourless crystal, 72 mg, 97% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 96%, $[\alpha]_D^{23}$ = 46.8 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.42 (dd, *J* = 8.6, 6.4 Hz, 1H), 6.71 (td, *J* = 8.4, 2.5 Hz, 1H), 6.57 (dd, *J* = 10.0, 2.5 Hz, 1H), 4.99 (dddd, *J* = 48.1, 5.6, 3.6, 2.0 Hz, 1H), 4.86 (ddd, *J* = 19.6, 8.9, 3.5 Hz, 1H), 4.48 (ddd, *J* = 12.3, 7.9, 5.6 Hz, 1H), 4.22 (ddt, *J* = 28.2, 12.2, 1.6 Hz, 1H), 2.34 (dd, *J* = 8.9, 2.3 Hz, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -111.52 (q, *J* = 8.2 Hz), -209.63 (dddd, *J* = 48.0, 28.1, 19.5, 8.1 Hz).



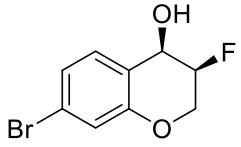
(3*S*,4*R*)-3,8-Difluorochroman-4-ol (**2c**): Colourless crystal, 73 mg, 98% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 93%, $[\alpha]_D^{23}$ = 33.6 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.25 (d, *J* = 8.4 Hz, 1H), 7.03 (ddd, *J* = 10.5, 8.2, 1.6 Hz, 1H), 6.91 (td, *J* = 8.0, 4.7 Hz, 1H), 5.02 (dddd, *J* = 48.0, 5.4, 3.6, 1.9 Hz, 1H), 4.90 (dd, *J* = 20.6, 3.6 Hz, 1H), 4.57 (ddd, *J* = 12.4, 8.3, 5.2 Hz, 1H), 4.28 (ddt, *J* = 29.9, 12.5, 1.5 Hz, 1H), 2.45 (br, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 150.9 (d, *J* = 246.1 Hz), 141.8 (d, *J* = 11.6 Hz), 124.3, 123.7 (d, *J* = 3.6 Hz), 121.2 (d, *J* = 7.1 Hz), 116.4 (d, *J* = 17.6 Hz), 85.9 (d, *J* = 178.2 Hz), 65.1 (d, *J* = 22.3 Hz), 64.9 (dd, *J* = 19.7 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ -136.26 (dd, *J* = 10.7, 4.5 Hz), -209.43 (dddd, J = 48.7, 29.5, 20.8, 8.3 Hz). HRMS (ESI/ion trap): m/z $[M + H - H_2O]^+$ calcd for $C_9H_7F_2O$ 169.0465, found 169.0456.



(3*S*,4*R*)-6-Chloro-3-fluorochroman-4-ol (**2d**): Colourless crystal, 80 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 96%, $[\alpha]_D^{23}$ = 58.3 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.46 (s, 1H), 7.17 (dd, *J* = 8.6, 2.4 Hz, 1H), 6.78 (d, *J* = 8.6 Hz, 1H), 4.99 (d, *J* = 48.3 Hz, 1H), 4.84 (dd, *J* = 21.4, 3.5 Hz, 1H), 4.49 (ddd, *J* = 13.1, 8.6, 4.8 Hz, 1H), 4.20 (dd, *J* = 31.6, 12.6 Hz, 1H), 2.40 (br, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 152.0, 129.9, 128.4, 126.5, 123.5, 117.9, 85.8 (d, *J* = 178.1 Hz), 65.1 (d, *J* = 21.7 Hz), 65.0 (d, *J* = 19.8 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ -209.50 (dddd, *J* = 48.5, 30.7, 21.3, 8.5 Hz). HRMS (ESI/ion trap): m/z $[M + H - H_2O]^+$ calcd for C_9H_7ClFO 185.0169, found 185.0161.

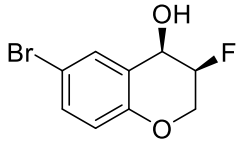


(3*S*,4*R*)-7-Chloro-3-fluorochroman-4-ol (**2e**): Colourless crystal, 80 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 93%, $[\alpha]_D^{23}$ = 45.9 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.40 (d, *J* = 8.3 Hz, 1H), 6.97 (dd, *J* = 8.3, 2.1 Hz, 1H), 6.87 (d, *J* = 2.1 Hz, 1H), 4.99 (dddd, *J* = 48.2, 5.4, 3.6, 1.9 Hz, 1H), 4.85 (d, *J* = 20.3 Hz, 1H), 4.49 (ddd, *J* = 12.4, 8.3, 5.3 Hz, 1H), 4.21 (ddt, *J* = 29.8, 12.4, 1.5 Hz, 1H), 2.34 (br, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 154.0, 135.2, 129.8, 121.9, 120.4, 116.6, 86.0 (d, *J* = 178.6 Hz), 65.0 (d, *J* = 22.3 Hz), 64.9 (d, *J* = 19.8 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ -209.56 (dddd, *J* = 56.4, 30.1, 21.0, 7.5 Hz). HRMS (ESI/ion trap): m/z $[M + H - H_2O]^+$ calcd for C_9H_7ClFO 185.0169, found 185.0161.

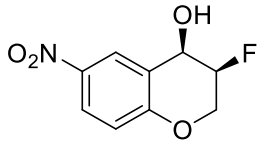


(3*S*,4*R*)-7-Bromo-3-fluorochroman-4-ol (**2f**):[3] Colourless crystal, 96 mg, 98% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 98%, $[\alpha]_D^{23}$ = 38.6 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.33 (d, *J* = 8.2 Hz, 1H), 7.11 (dd, *J* = 8.2, 1.6 Hz, 1H), 7.03 (d, *J* = 1.6 Hz, 1H), 4.99 (d, *J* = 48.4 Hz, 1H), 4.83 (d, *J* = 20.5 Hz, 1H), 4.48 (ddd, *J* = 13.1, 8.3, 5.1

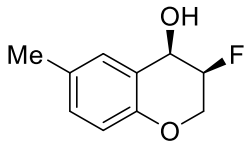
Hz, 1H), 4.21 (dd, *J* = 30.1, 12.4 Hz, 1H), 2.41 (br, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -209.50 (dddd, *J* = 49.8, 30.0, 20.7, 8.3 Hz).



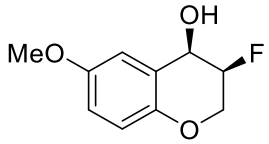
(3*S*,4*R*)-6-Bromo-3-fluorochroman-4-ol (**2g**): Colourless crystal, 96 mg, 98% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 27.3 (c 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.61 (d, *J* = 2.5 Hz, 1H), 7.30 (dd, *J* = 8.7, 2.4 Hz, 1H), 6.73 (d, *J* = 8.7 Hz, 1H), 4.99 (d, *J* = 48.3 Hz, 1H), 4.85 (d, *J* = 21.1 Hz, 1H), 4.49 (ddd, *J* = 13.1, 8.6, 4.8 Hz, 1H), 4.20 (dd, *J* = 31.6, 12.6 Hz, 1H), 2.43 (br, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 152.5, 132.8, 131.3, 124.0, 118.3, 113.7, 85.8 (d, *J* = 178.5 Hz), 65.1 (d, *J* = 21.8 Hz), 65.0 (d, *J* = 19.8 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ -209.61 (dddd, *J* = 47.6, 30.6, 21.4, 8.5 Hz). HRMS (ESI/ion trap): m/z $[M + H - H_2O]^+$ calcd for C_9H_7BrFO 228.9664, found 228.9654.



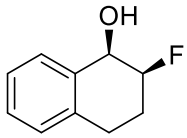
(*3S*,4*R*)-3-Fluoro-6-nitrochroman-4-ol (**2h**):[3] Colourless crystal, 79 mg, 93% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = %, $[\alpha]_D^{23}$ = 195.5 (c 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.46 (d, *J* = 2.7 Hz, 1H), 8.10 (dd, *J* = 9.1, 2.7 Hz, 1H), 6.93 (d, *J* = 9.1 Hz, 1H), 5.09 (dt, *J* = 48.3, 3.9 Hz, 1H), 4.93 (dd, *J* = 23.0, 6.9 Hz, 1H), 4.63 (ddd, *J* = 13.5, 9.5, 4.3 Hz, 1H), 4.34 (dd, *J* = 33.7, 13.0 Hz, 1H), 2.62 (d, *J* = 9.2 Hz, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -209.30 (dddd, *J* = 48.3, 33.1, 23.1, 9.6 Hz).



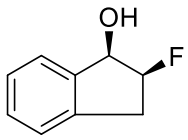
(3*S*,4*R*)-3-Fluoro-6-methylchroman-4-ol (**2i**):[3] Colourless crystal, 71 mg, 98% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 94%, $[\alpha]_D^{23}$ = 31.0 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.26 (br, 1H), 7.03 (dd, *J* = 8.4, 2.2 Hz, 1H), 6.75 (d, *J* = 8.3 Hz, 1H), 4.99 (dddd, *J* = 48.2, 5.8, 3.6, 2.1 Hz, 1H), 4.87 (d, *J* = 18.8, 1H), 4.44 (ddd, *J* = 12.1, 7.6, 5.8 Hz, 1H), 4.16 (ddt, *J* = 27.7, 12.1, 1.5 Hz, 1H), 2.32 (br, 1H), 2.29 (s, 3H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -209.72 (m).



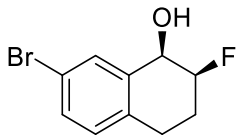
(3*S*,4*R*)-3-Fluoro-6-methoxychroman-4-ol (**2j**):[3] Colourless crystal, 78 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 91%, $[\alpha]_D^{23}$ = 44.3 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.01 (d, *J* = 2.3 Hz, 1H), 6.86-6.73 (m, 2H), 4.99 (dddd, *J* = 48.3, 5.3, 3.7, 1.8 Hz, 1H), 4.87 (dd, *J* = 20.8, 3.7 Hz, 1H), 4.45 (ddd, *J* = 12.4, 8.1, 5.2 Hz, 1H), 4.16 (ddt, *J* = 30.3, 12.4, 1.5 Hz, 1H), 3.77 (s, 3H), 2.38 (br, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -209.44 (dddd, *J* = 48.7, 29.7, 20.8, 8.3 Hz).



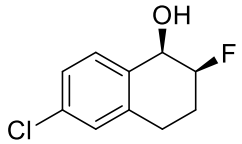
(1*R*,2*S*)-2-Fluoro-1,2,3,4-tetrahydronaphthalen-1-ol (**2k**):[8] Colourless crystal, 66 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 21.2 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.52 (dd, *J* = 5.5, 3.7 Hz, 1H), 7.30-.21 (m, 2H), 7.17-7.09 (m, 1H), 5.00 (ddt, *J* = 49.7, 8.7, 3.0 Hz, 1H), 4.81 (ddd, *J* = 17.8, 7.2, 3.3 Hz, 1H), 3.04 (ddd, *J* = 15.9, 9.7, 3.8 Hz, 1H), 2.80 (dt, *J* = 17.1, 6.7 Hz, 1H), 2.49-2.29 (m, 2H), 2.02 (ddtd, *J* = 27.1, 13.6, 6.9, 2.6 Hz, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -197.58 (dddd, *J* = 50.1, 25.1, 17.6, 5.9 Hz).



(1*R*,2*S*)-2-Fluoro-2,3-dihydro-1H-inden-1-ol (**2l**):[8] Colourless crystal, 60 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 96%, $[\alpha]_D^{23}$ = 53 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.48 (dd, *J* = 5.1, 3.6 Hz, 1H), 7.34-7.22 (m, 3H), 5.32 (dtd, *J* = 53.8, 4.3, 1.5 Hz, 1H), 5.13 (ddd, *J* = 18.2, 10.4, 4.2 Hz, 1H), 3.33-3.02 (m, 2H), 2.39 (dd, *J* = 10.4, 4.4 Hz, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -201.51 (m).



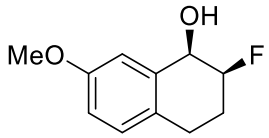
(1*R*,2*S*)-7-Bromo-2-fluoro-1,2,3,4-tetrahydronaphthalen-1-ol (**2m**): Colourless crystal, 96 mg, 98% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 43.4 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.68 (d, *J* = 2.1 Hz, 1H), 7.34 (dd, *J* = 8.2, 2.2 Hz, 1H), 6.99 (d, *J* = 8.2 Hz, 1H), 5.00 (ddt, *J* = 49.9, 7.8, 2.7 Hz, 1H), 4.72 (ddd, *J* = 20.1, 8.3, 3.3 Hz, 1H), 2.97 (dt, *J* = 17.4, 7.2 Hz, 1H), 2.72 (dt, *J* = 17.2, 6.2 Hz, 1H), 2.45 (dd, *J* = 8.2, 2.6 Hz, 1H), 2.44-2.29 (m, 1H), 2.10-1.85 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 138.0 (d, *J* = 3.6 Hz), 134.6, 131.8, 131.2, 130.1, 120.2, 90.6 (d, *J* = 173.6 Hz), 68.8 (d, *J* = 19.6 Hz), 24.8 (d, *J* = 6.6 Hz), 24.7 (d, *J* = 18.8 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ -200.28 (dddd, *J* = 50.2, 30.3, 20.4, 6.4 Hz). HRMS (ESI/ion trap): m/z $[M + Na]^+$ calcd for $C_{10}H_{10}BrFNaO$ 266.9797, found 266.9786.



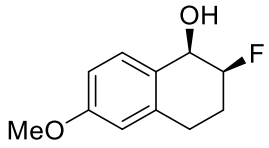
(1*R*,2*S*)-6-Chloro-2-fluoro-1,2,3,4-tetrahydronaphthalen-1-ol (**2n**): Colourless crystal, 79 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 58.4 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.44 (d, *J* = 8.3 Hz, 1H), 7.21 (dd, *J* = 8.3, 2.1 Hz, 1H), 7.11 (d, J = 2.1 Hz, 1H), 4.98 (ddt, *J* = 49.8, 8.2, 2.9 Hz, 1H), 4.73 (ddd, *J* = 18.9, 7.7,

3.3 Hz, 1H), 3.00 (dt, *J* = 15.5, 7.1 Hz, 1H), 2.75 (dt, *J* = 17.3, 6.4 Hz, 1H), 2.45 (dd, *J* = 7.7, 2.7 Hz, 1H), 2.41-2.30 (m, 1H), 2.07-1.90 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 137.6, 134.2 (d, *J* = 4.2 Hz), 133.9, 130.6, 128.2, 127.0, 90.8 (d, *J* = 173.7 Hz), 68.7 (d, *J* = 19.5 Hz), 25.4 (d, *J* = 8.7 Hz), 24.5 (d, *J* = 20.2 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ -199.05 (m).

HRMS (ESI/ion trap): m/z $[M + Na]^+$ calcd for $C_{10}H_{10}ClFNaO$ 223.0302, found 223.0292.

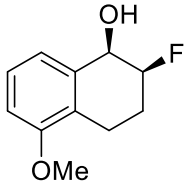


(1*R*,2*S*)-2-Fluoro-7-methoxy-1,2,3,4-tetrahydronaphthalen-1-ol (**2o**):[9] Colourless crystal, 78 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 43.6 (c 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.06 (d, *J* = 2.8 Hz, 1H), 7.04 (d, *J* = 8.4 Hz, 1H), 6.81 (dd, *J* = 8.4, 2.8 Hz, 1H), 4.99 (ddt, *J* = 49.9, 8.3, 2.9 Hz, 1H), 4.75 (dd, *J* = 18.9, 3.3 Hz, 1H), 3.80 (s, 3H), 2.96 (dt, *J* = 15.3, 7.0 Hz, 1H), 2.72 (dt, *J* = 16.7, 7.0 Hz, 1H), 2.42-2.30 (m, 1H), 2.27 (br, 1H), 2.09-1.89 (m, 1H). ^{19}F NMR (376 MHz, $CDCl_3$): δ -198.97 (dddd, *J* = 48.5, 28.0, 18.6, 6.0 Hz).

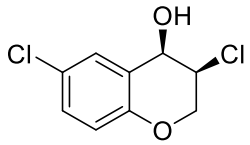


(1*R*,2*S*)-2-Fluoro-6-methoxy-1,2,3,4-tetrahydronaphthalen-1-ol (**2p**):[9] Colourless crystal, 78 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 18.3 (c 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.40 (d, *J* = 8.5 Hz, 1H), 6.81 (dd, *J* = 8.6, 2.7 Hz, 1H), 6.64 (d, *J* = 2.7 Hz, 1H), 4.94 (ddt, *J* = 49.4, 9.2, 3.1 Hz, 1H), 4.78 (ddd, *J* = 16.1, 6.7, 3.4 Hz, 1H), 3.79 (s, 3H), 3.08-2.91 (m, 1H), 2.78 (dt, *J* = 17.1, 7.1 Hz, 1H), 2.43 -2.33 (m, 1H), 2.31 (dd, *J* = 6.6, 2.8 Hz, 1H), 2.10-1.91 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.6, 137.2, 130.9, 127.9 (d, *J* = 4.9 Hz), 113.1, 113.0, 91.4 (d, *J* = 174.3 Hz), 68.7 (d, *J* = 19.0 Hz), 55.4, 26.4 (d, *J* = 9.5 Hz), 24.2 (d, *J* = 19.7 Hz). ^{19}F NMR (376 MHz,

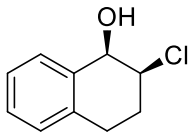
$CDCl_3$): δ -195.87 (m). HRMS (ESI/ion trap): m/z $[M + Na]^+$ calcd for $C_{11}H_{13}FNaO_2$ 219.0797, found 219.0787.



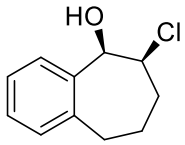
(1*R*,2*S*)-2-Fluoro-5-methoxy-1,2,3,4-tetrahydronaphthalen-1-ol (**2q**): Colourless crystal, 78 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 10.4 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.24 (t, *J* = 8.4 Hz, 1H), 7.12 (d, *J* = 7.7 Hz, 1H), 6.79 (d, *J* = 8.1 Hz, 1H), 4.96 (ddt, *J* = 49.7, 8.9, 3.0 Hz, 1H), 4.79 (ddd, *J* = 17.3, 7.1, 3.3 Hz, 1H), 3.83 (s, 3H), 2.91 (dtd, *J* = 18.0, 6.6, 2.1 Hz, 1H), 2.68 (dt, *J* = 18.0, 6.9 Hz, 1H), 2.49-2.23 (m, 2H), 1.99 (ddtd, *J* = 26.9, 13.6, 6.8, 2.6 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 156.8, 136.8 (d, *J* = 4.3 Hz), 127.3, 124.9, 121.1, 109.3, 91.2 (d, *J* = 173.6 Hz), 69.0 (d, *J* = 19.1 Hz), 55.50, 23.69 (d, *J* = 19.7 Hz), 20.24 (d, *J* = 8.8 Hz). ^{19}F NMR (376 MHz, $CDCl_3$): δ -197.72 (m). HRMS (ESI/ion trap): m/z $[M + Na]^+$ calcd for $C_{11}H_{13}FNaO_2$ 219.0797, found 219.0787.



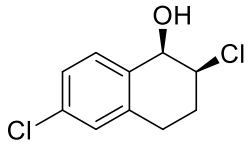
(3*S*,4*R*)-3,6-Dichlorochroman-4-ol (**2r**): Colourless crystal, 83 mg, 95% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 45.9 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.38 (d, *J* = 2.5 Hz, 1H), 7.19 (dd, *J* = 8.8, 2.6 Hz, 1H), 6.80 (d, *J* = 8.8 Hz, 1H), 4.88 (dd, *J* = 7.2, 3.7 Hz, 1H), 4.46 (dt, *J* = 6.9, 3.4 Hz, 1H), 4.41-4.26 (m, 2H), 2.49 (d, *J* = 7.2 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 151.8, 130.3, 129.2, 126.4, 123.3, 118.2, 66.1, 66.0, 57.3. HRMS (ESI/ion trap): m/z $[M + H - H_2O]^+$ calcd for $C_9H_7ClO_2$ 200.9874, found 200.9865.



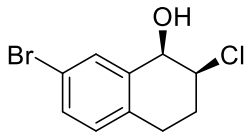
(1*R*,2*S*)-2-Chloro-1,2,3,4-tetrahydronaphthalen-1-ol (**2s**):[7] Colourless crystal, 70 mg, 96% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 97%, $[\alpha]_D^{23}$ = 22.2 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.55-7.44 (m, 1H), 7.30-7.19 (m, 2H), 7.17-7.06 (m, 1H), 4.86 (dd, *J* = 7.5, 3.4 Hz, 1H), 4.55 (dt, *J* = 8.7, 3.1 Hz, 1H), 3.12 (dt, *J* = 17.3, 6.5 Hz, 1H), 2.85 (dt, *J* = 17.3, 6.6 Hz, 1H), 2.56-2.33 (m, 2H), 2.26-2.14 (m, 1H).



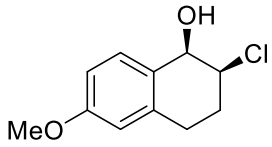
(5*R*,6*S*)-6-Chloro-6,7,8,9-tetrahydro-5H-benzo[7]annulen-5-ol (**2t**):[7] Colourless crystal, 78 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = %, $[\alpha]_D^{23}$ = -170.0 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.33-7.27 (m, 1H), 7.25-7.17 (m, 2H), 7.13-7.07 (m, 1H), 5.08 (s, 1H), 4.40 (dd, *J* = 9.2, 3.0 Hz, 1H), 3.27-3.00 (m, 1H), 2.64 (dd, *J* = 14.2, 8.6 Hz, 1H), 2.57-2.43 (m, 2H), 2.25 (ddt, *J* = 14.2, 7.3, 3.4 Hz, 1H), 1.97-1.83 (m, 1H), 1.71-1.54 (m, 1H).



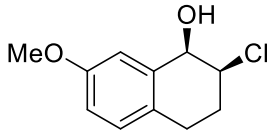
(1*R*,2*S*)-2,6-Dichloro-1,2,3,4-tetrahydronaphthalen-1-ol (**2u**):[10] Colourless crystal, 85 mg, 98% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 14.6 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.43 (d, *J* = 8.3 Hz, 1H), 7.20 (dd, *J* = 8.4, 2.2 Hz, 1H), 7.11 (d, *J* = 2.2 Hz, 1H), 4.81 (dd, *J* = 8.0, 3.4 Hz, 1H), 4.53 (dt, *J* = 8.2, 3.0 Hz, 1H), 3.09 (dt, *J* = 17.4, 6.9 Hz, 1H), 2.80 (dt, *J* = 17.4, 6.3 Hz, 1H), 2.49 (d, *J* = 8.0 Hz, 1H), 2.39 (ddt, *J* = 14.2, 8.1, 6.1 Hz, 1H), 2.19 (dddd, *J* = 13.9, 8.3, 6.4, 2.7 Hz, 1H).



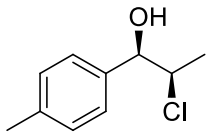
(1*R*,2*S*)-7-Bromo-2-chloro-1,2,3,4-tetrahydronaphthalen-1-ol (**2v**):[7] Colourless crystal, 103 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 21.2 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.67 (d, *J* = 2.1 Hz, 1H), 7.35 (dd, *J* = 8.2, 2.1 Hz, 1H), 6.99 (d, *J* = 8.2 Hz, 1H), 4.81 (dd, *J* = 8.6, 3.5 Hz, 1H), 4.56 (dt, *J* = 7.6, 3.0 Hz, 1H), 3.14-2.98 (m, 1H), 2.76 (dt, *J* = 17.4, 6.0 Hz, 1H), 2.48 (d, *J* = 8.5 Hz, 1H), 2.39 (ddt, *J* = 13.52, 7.4, 5.8 Hz, 1H), 2.20 (dddd, *J* = 14.3, 8.6, 6.3, 2.6 Hz, 1H).



(1*R*,2*S*)-2-Chloro-6-methoxy-1,2,3,4-tetrahydronaphthalen-1-ol (**2w**):[10] Colourless crystal, 84 mg, 99% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 21.5 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.38 (d, *J* = 8.5 Hz, 1H), 6.80 (dd, *J* = 8.5, 2.6 Hz, 1H), 6.64 (d, *J* = 2.6 Hz, 1H), 4.80 (dd, *J* = 7.0, 3.3 Hz, 1H), 4.49 (dt, *J* = 9.1, 3.1 Hz, 1H), 3.79 (s, 3H), 3.07 (dt, *J* = 17.3, 6.3 Hz, 1H), 2.81 (dt, *J* = 17.3, 6.9 Hz, 1H), 2.45 (d, *J* = 6.9 Hz, 1H), 2.43-2.36 (m, 1H), 2.16 (dtd, *J* = 13.3, 6.4, 2.8 Hz, 1H).



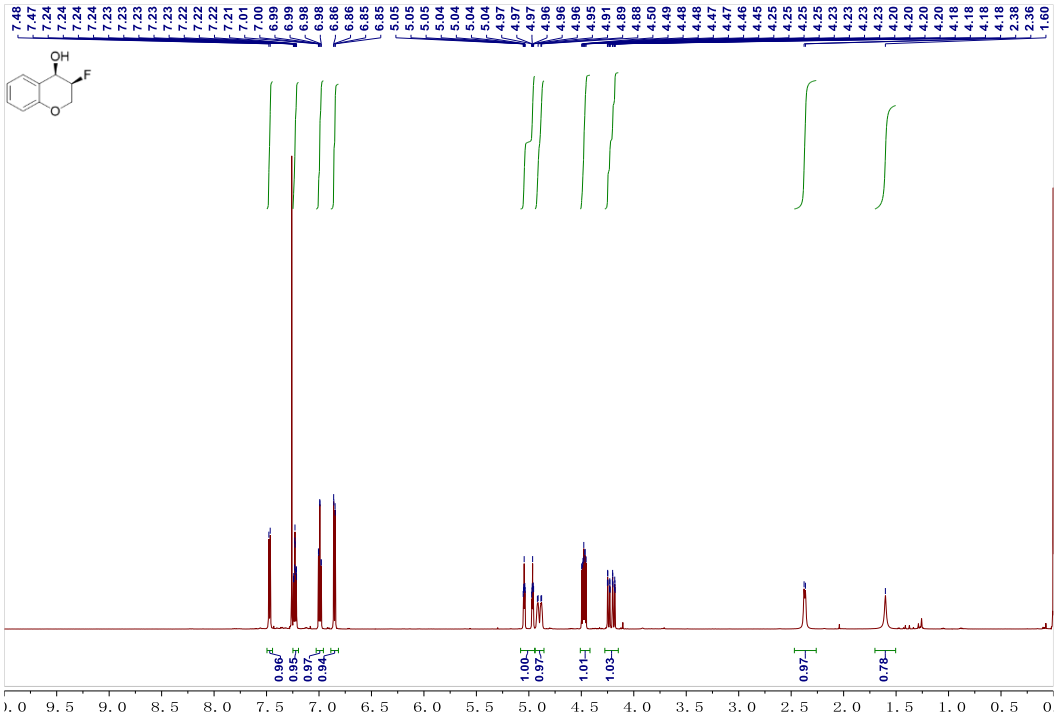
(1*R*,2*S*)-2-Chloro-7-methoxy-1,2,3,4-tetrahydronaphthalen-1-ol (**2x**):[10] Colourless crystal, 83 mg, 98% yield, dr (*cis*/*trans*) > 20:1, ee_{cis} = 99%, $[\alpha]_D^{23}$ = 31.4 (c 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ 7.07-6.98 (m, 2H), 6.82 (dd, *J* = 8.5, 2.8 Hz, 1H), 4.82 (dd, *J* = 8.2, 3.4 Hz, 1H), 4.56 (dt, *J* = 8.1, 3.0 Hz, 1H), 3.80 (s, 3H), 3.02 (dt, *J* = 17.0, 6.9 Hz, 1H), 2.76 (dt, *J* = 16.9, 6.2 Hz, 1H), 2.44 (d, *J* = 8.1 Hz, 1H), 2.46-2.33 (m, 1H), 2.18 (dddd, *J* = 13.9, 8.4, 6.3, 2.6 Hz, 1H).



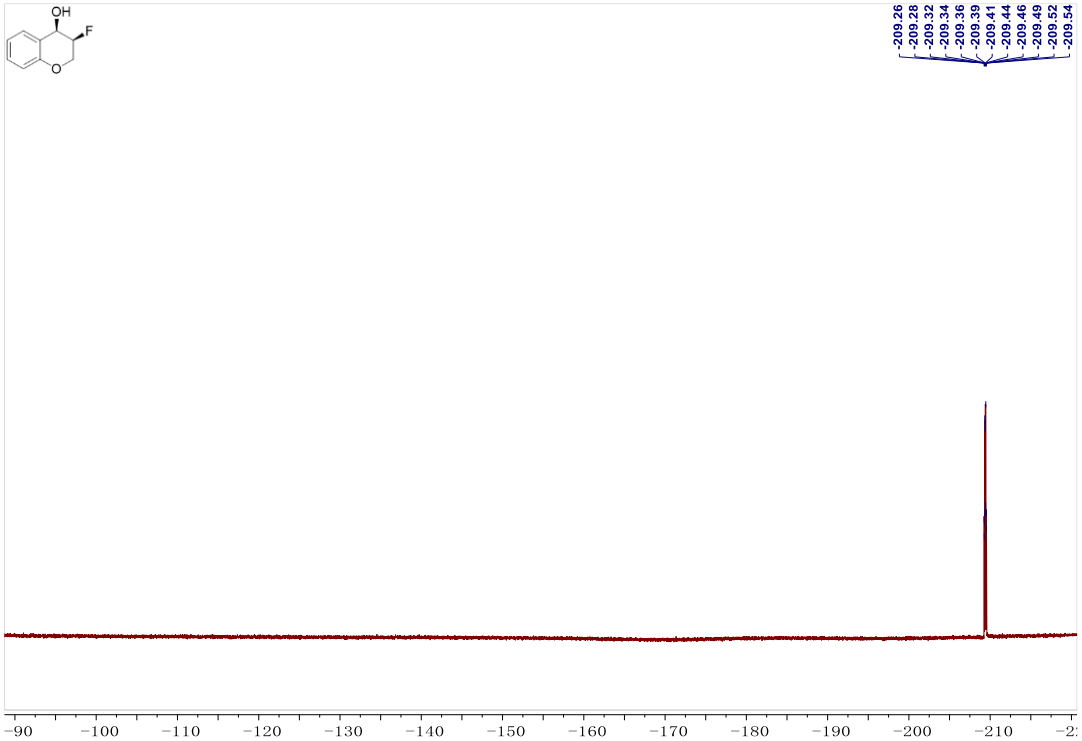
(1*R*,2*R*)-2-Chloro-1-(p-tolyl)propan-1-ol (**2y**):[11] Colourless oil, 83 mg, 80% yield, dr (*cis*/*trans*) = 15:1, ee_{cis} = 98%, $[\alpha]_D^{23}$ = -29.8 (c 1.0, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ 7.24-7.22 (m, 2H), 7.17-7.16 (m, 2H), 4.54 (d, *J* = 7.6 Hz, 1H), 4.19 (m, 1H), 2.79 (s, 1H), 2.34 (s, 3H), 1.35 (d, *J* = 6.7 Hz, 3H).

5. NMR spectra of compounds 2a-2x.

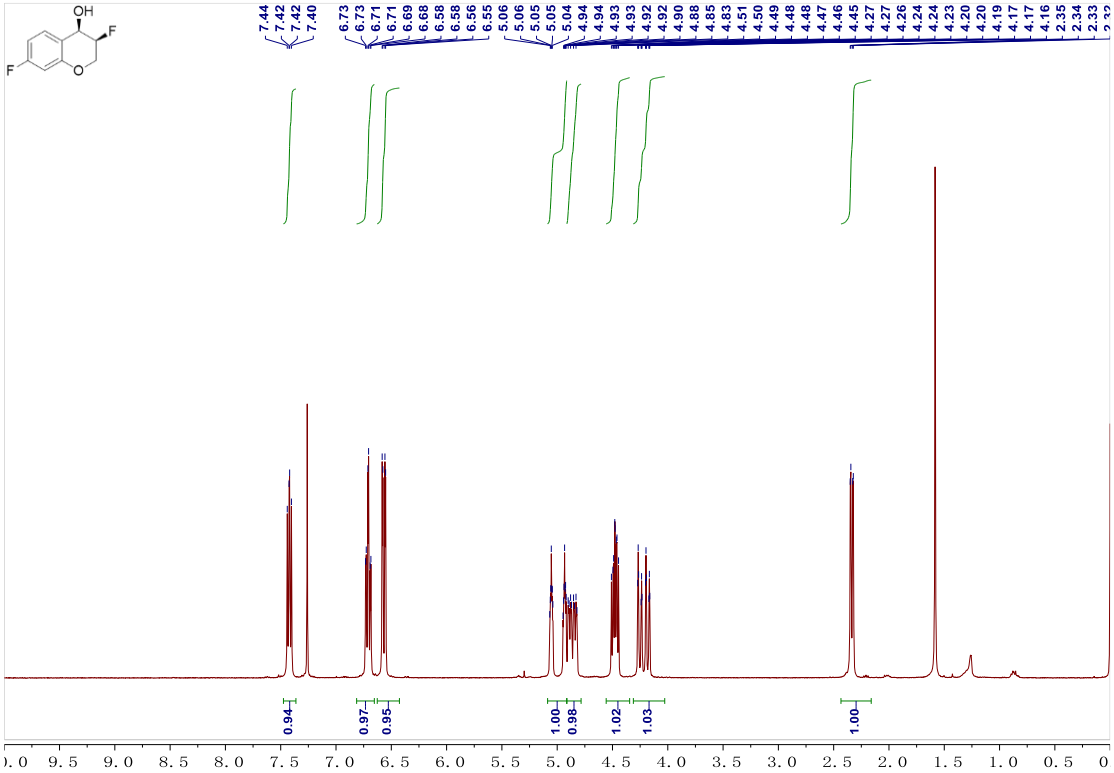
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2a**



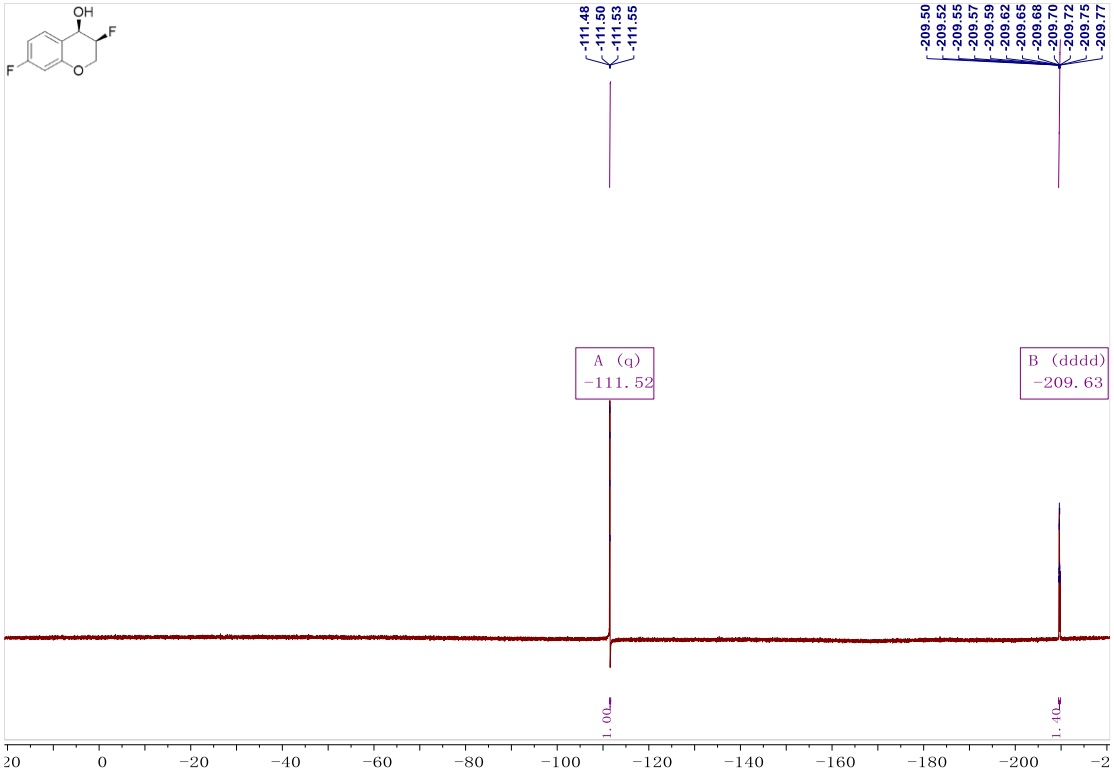
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2a**



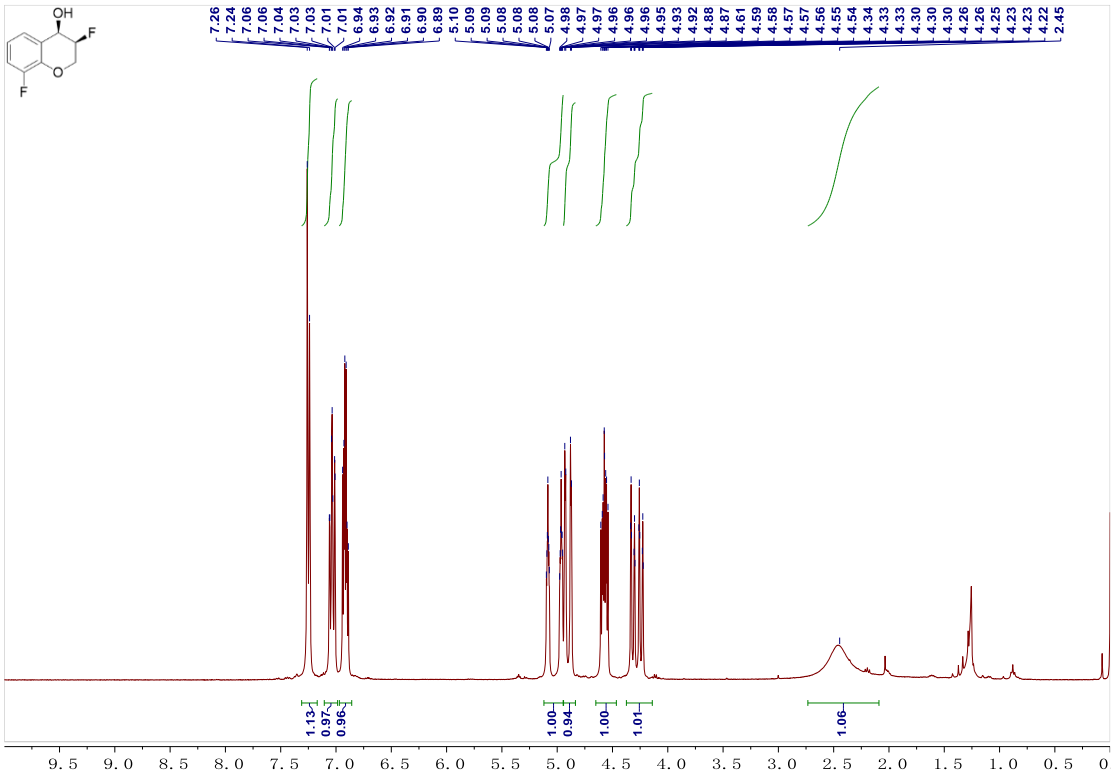
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2b**



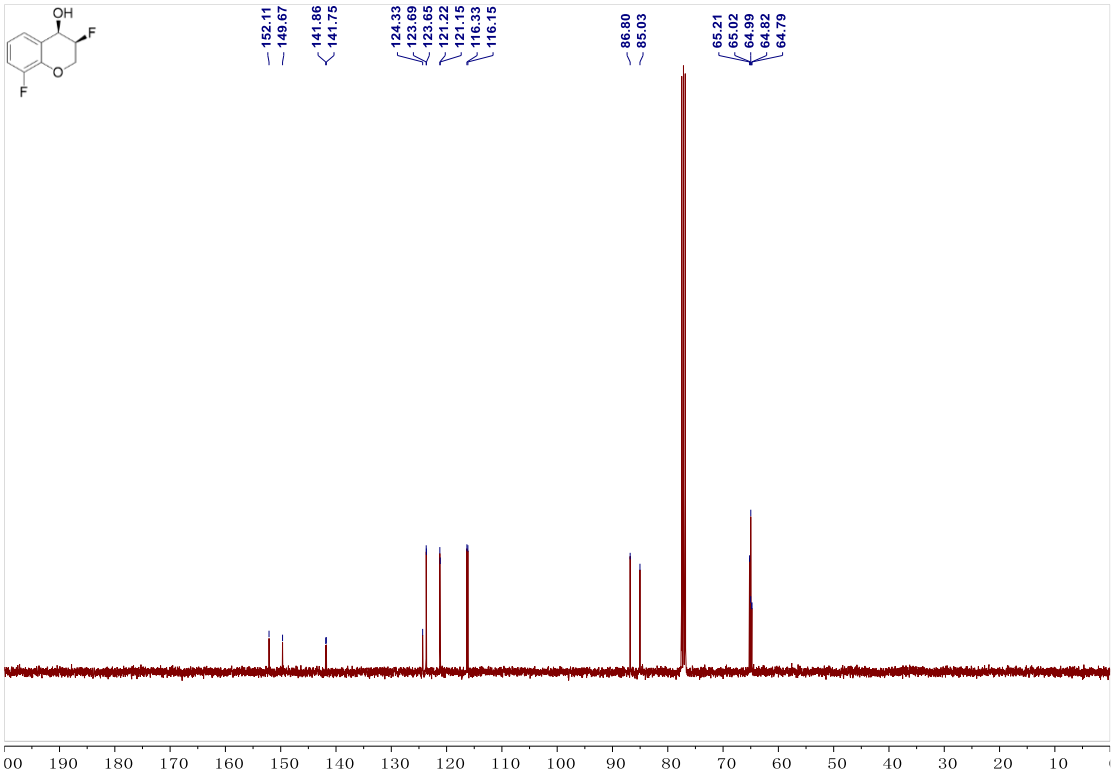
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2b**



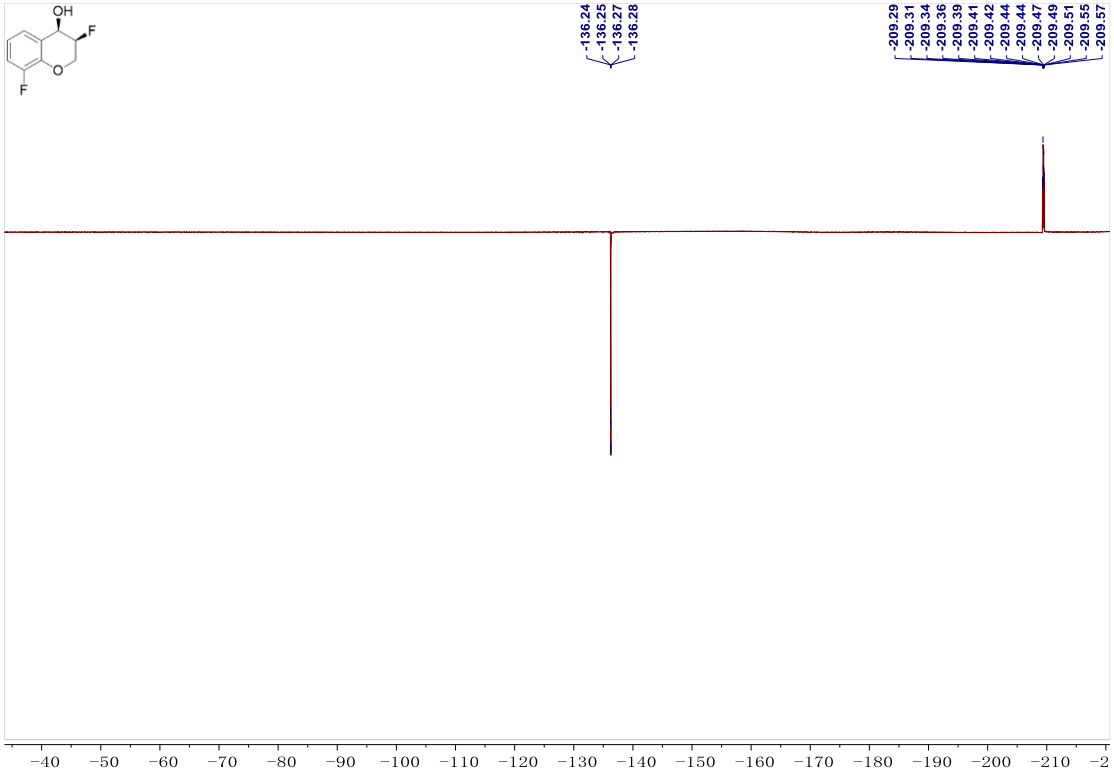
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2c**



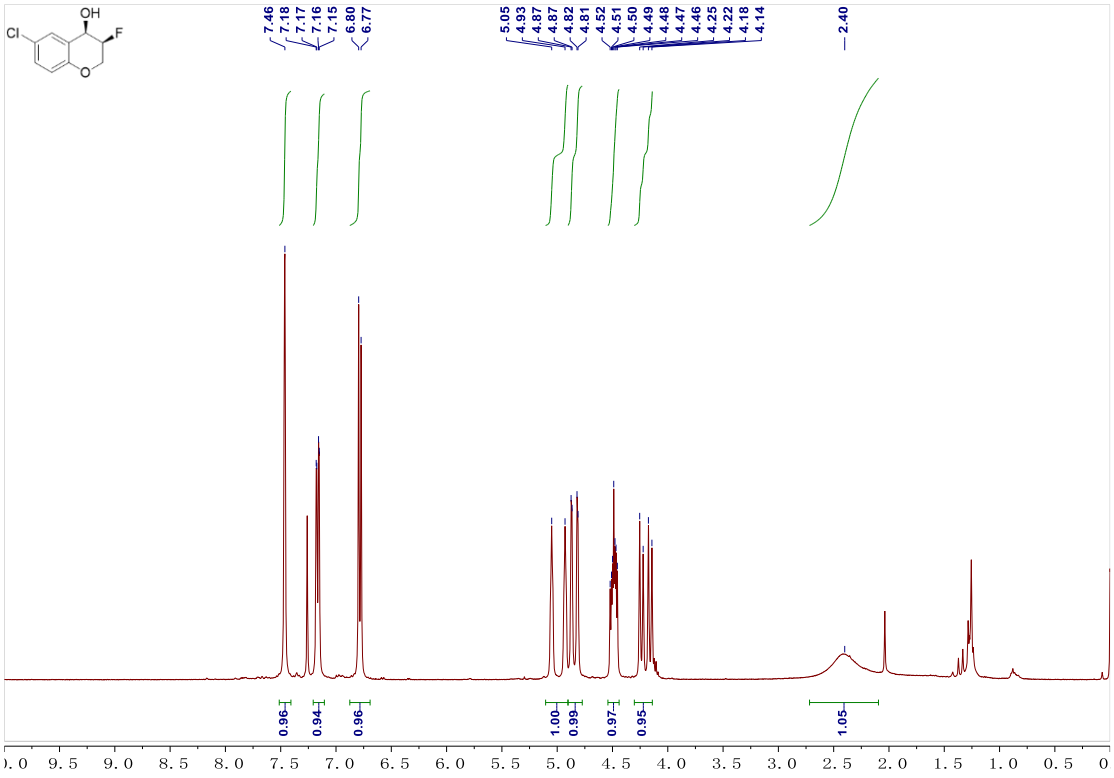
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2c**



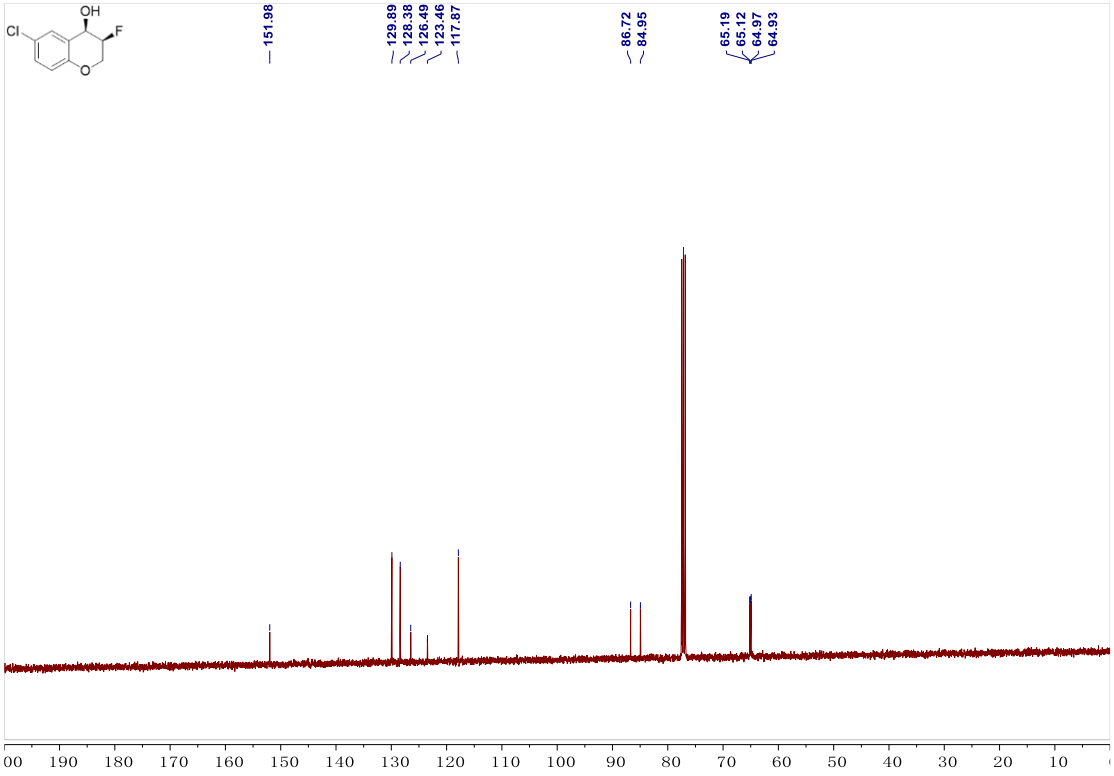
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2c**



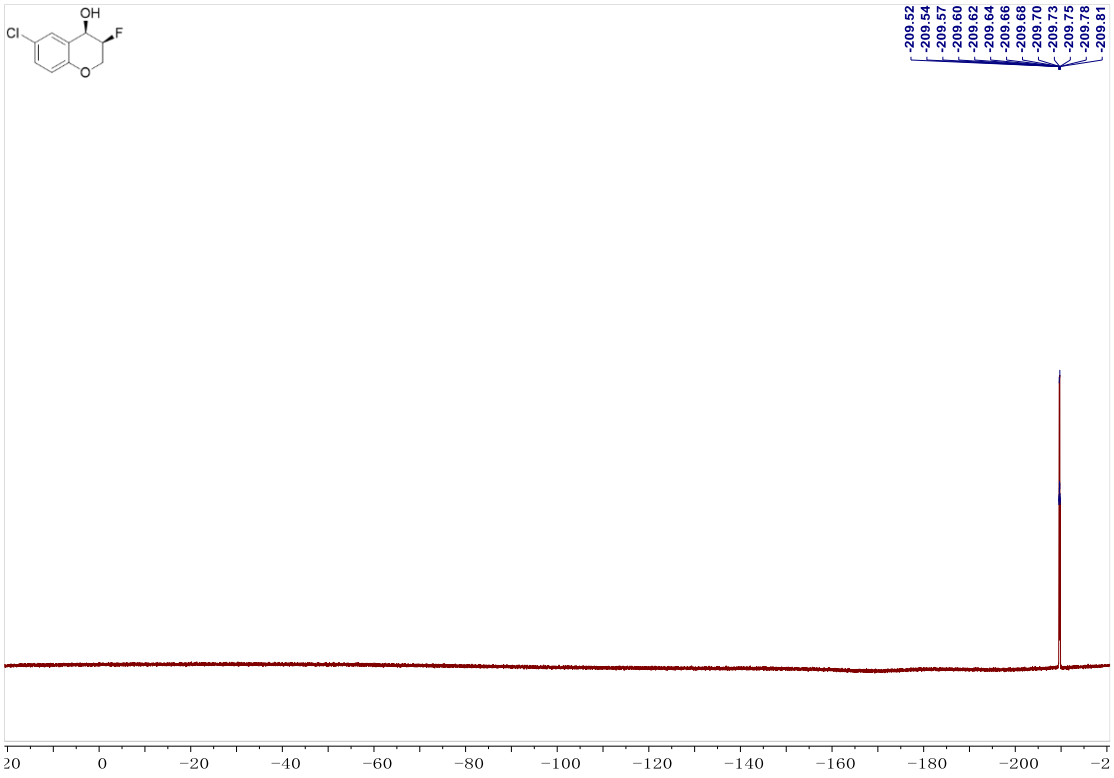
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2d**



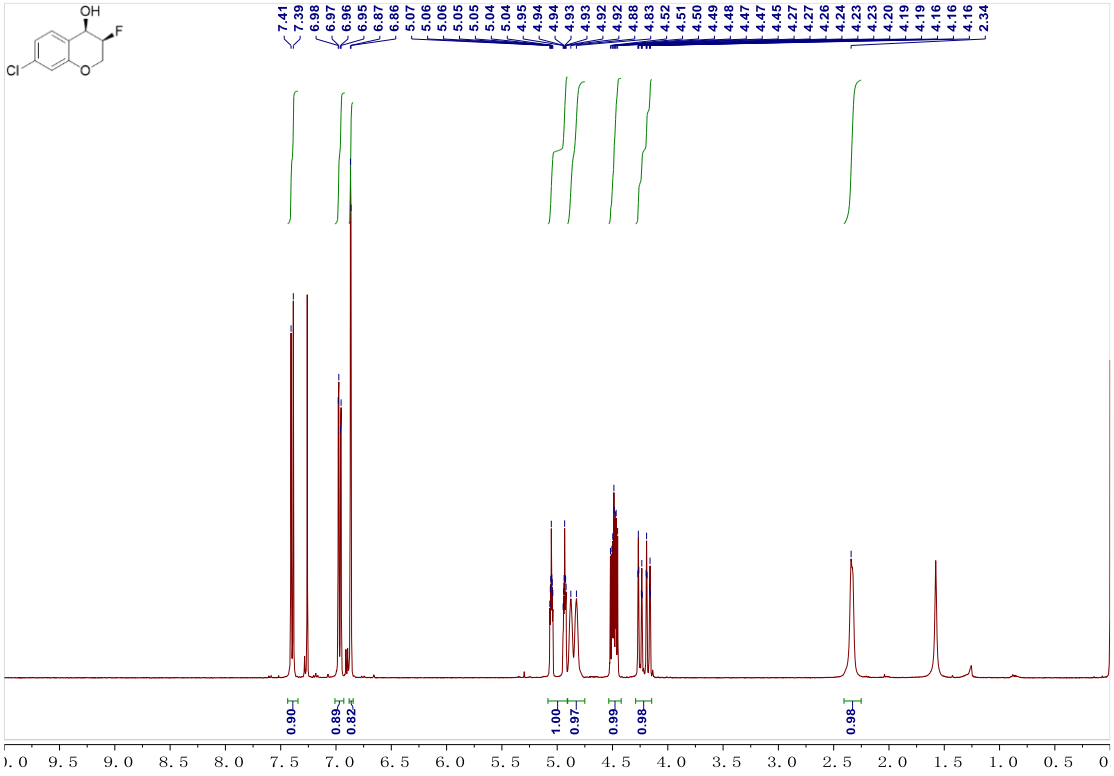
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2d**



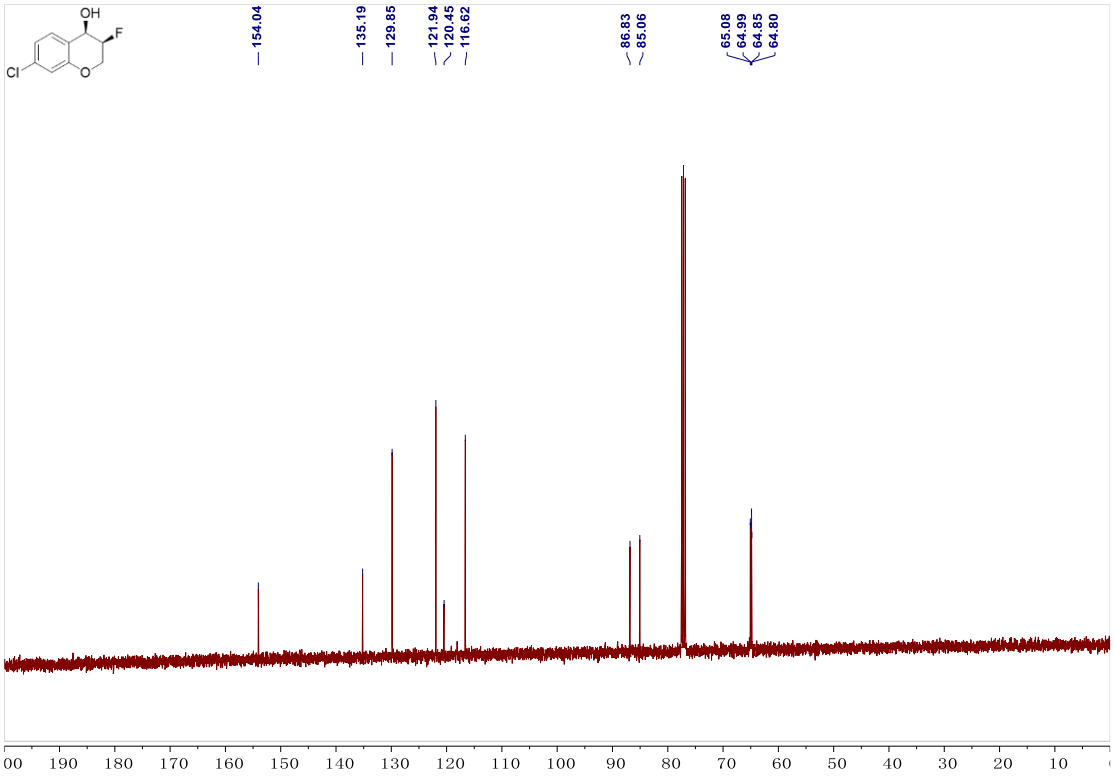
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2d**



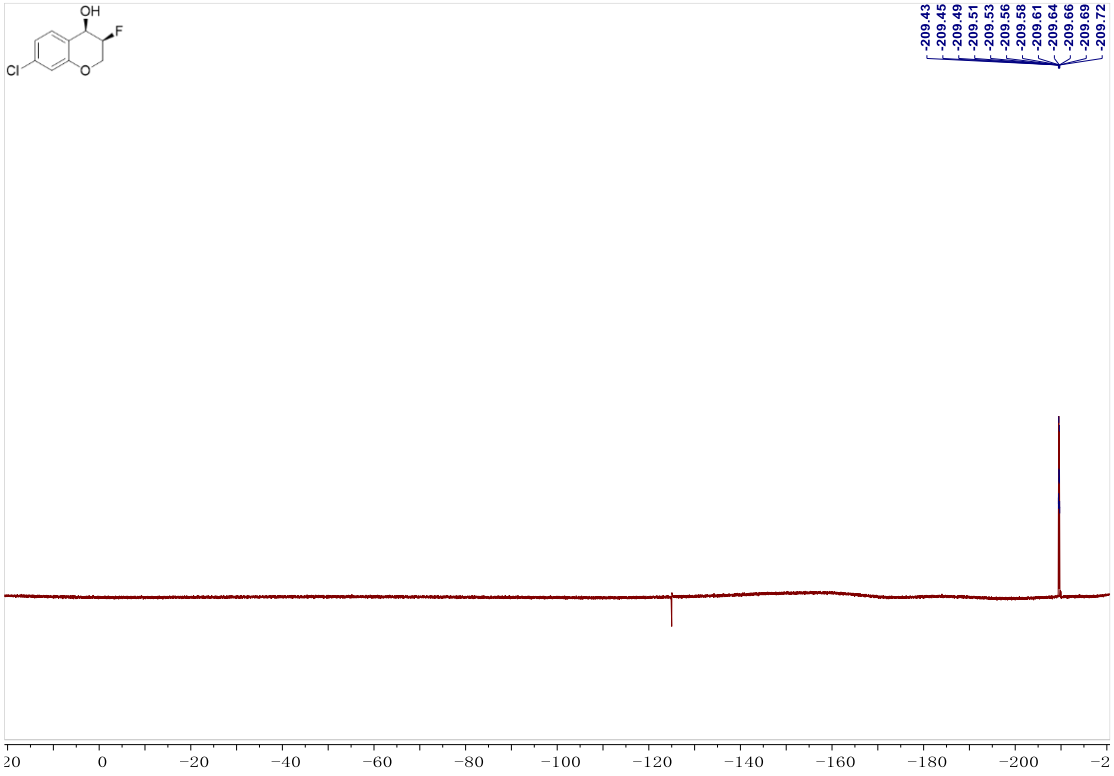
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2e**



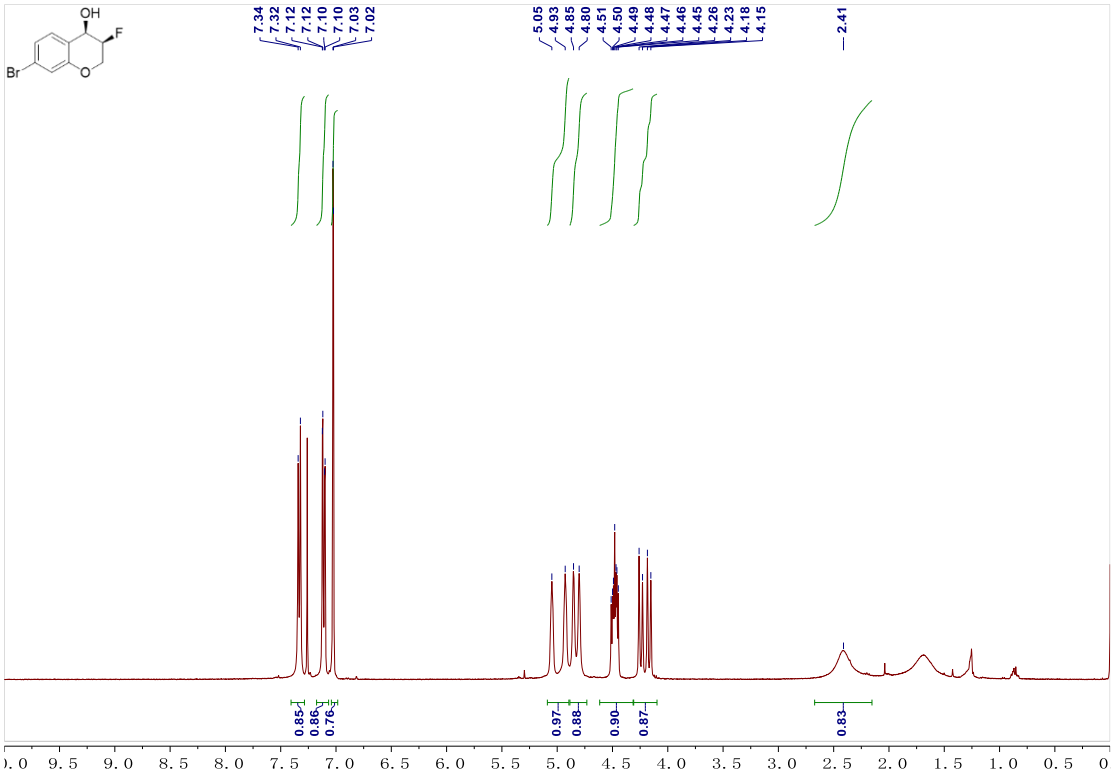
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2e**



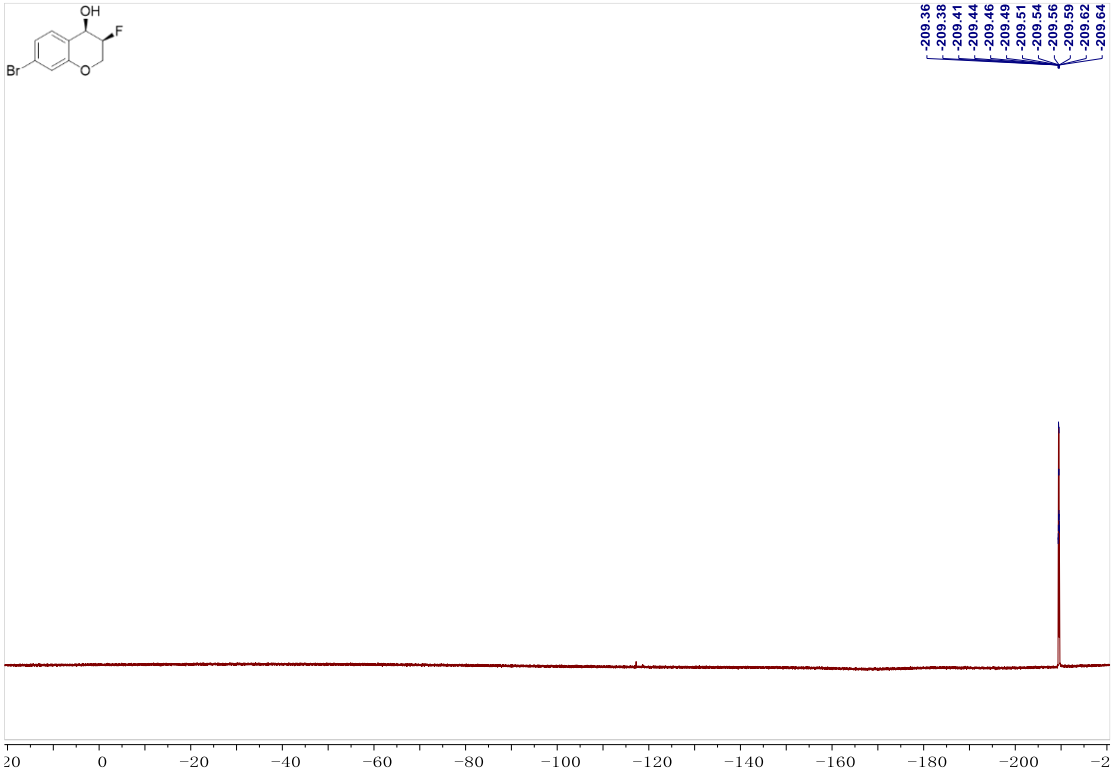
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2e**



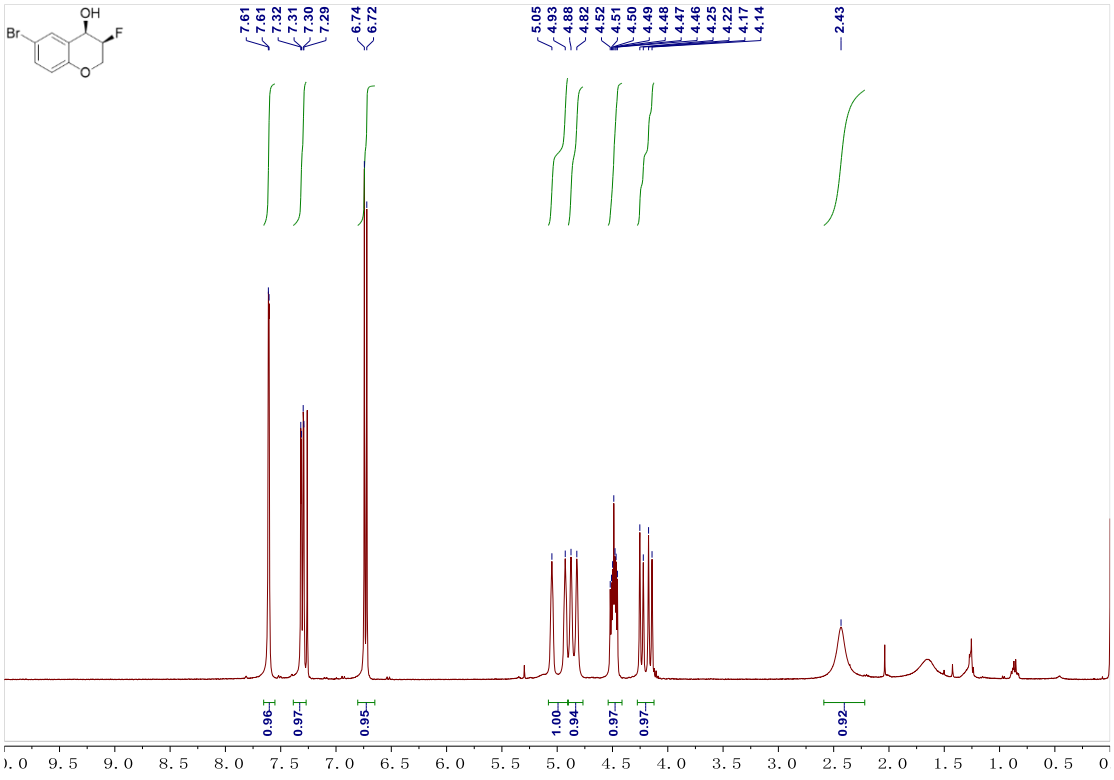
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2f**



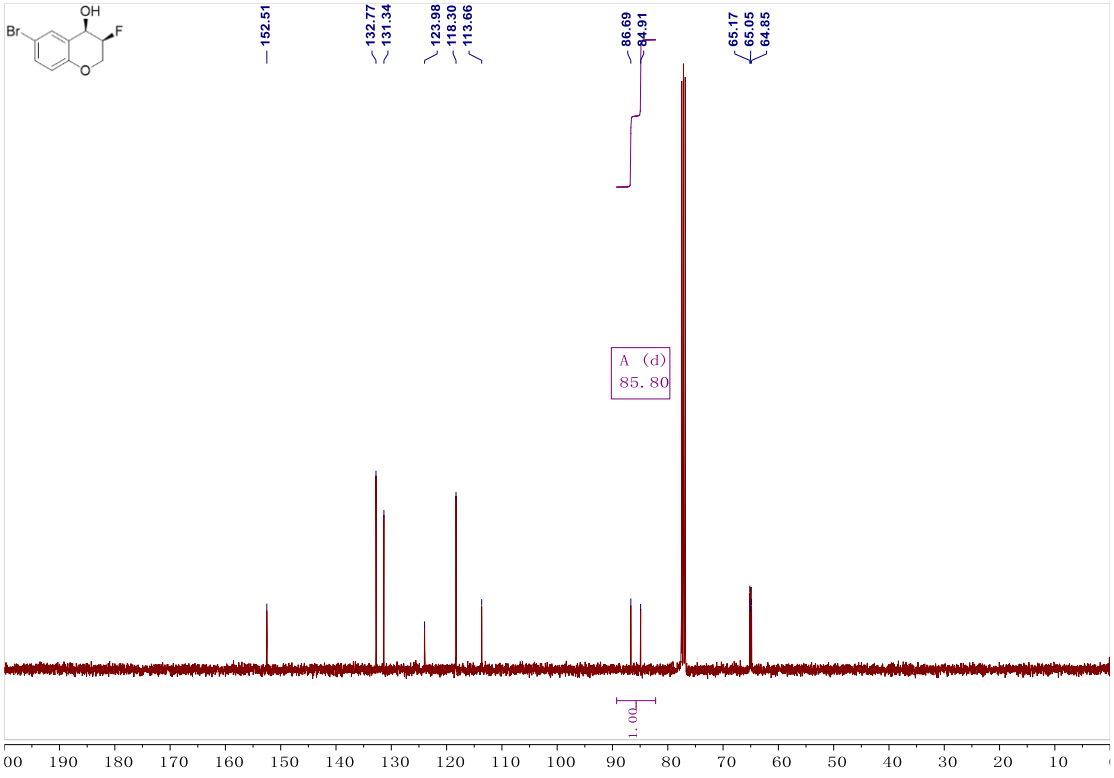
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2f**



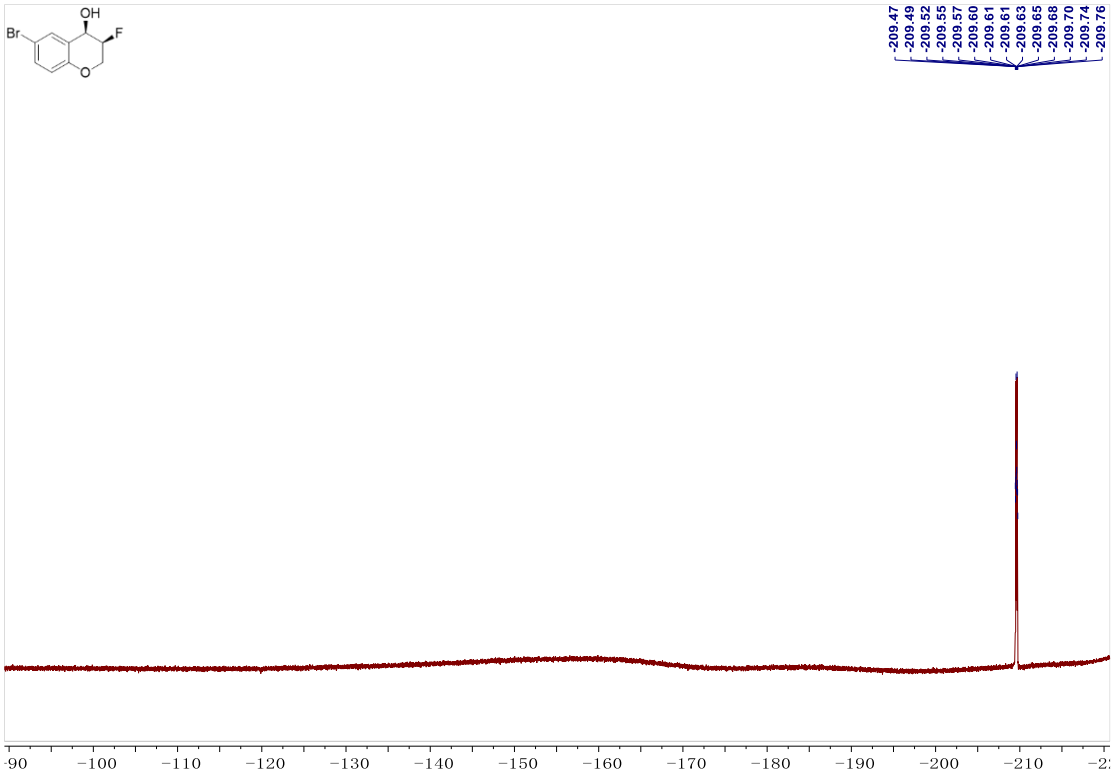
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2g**



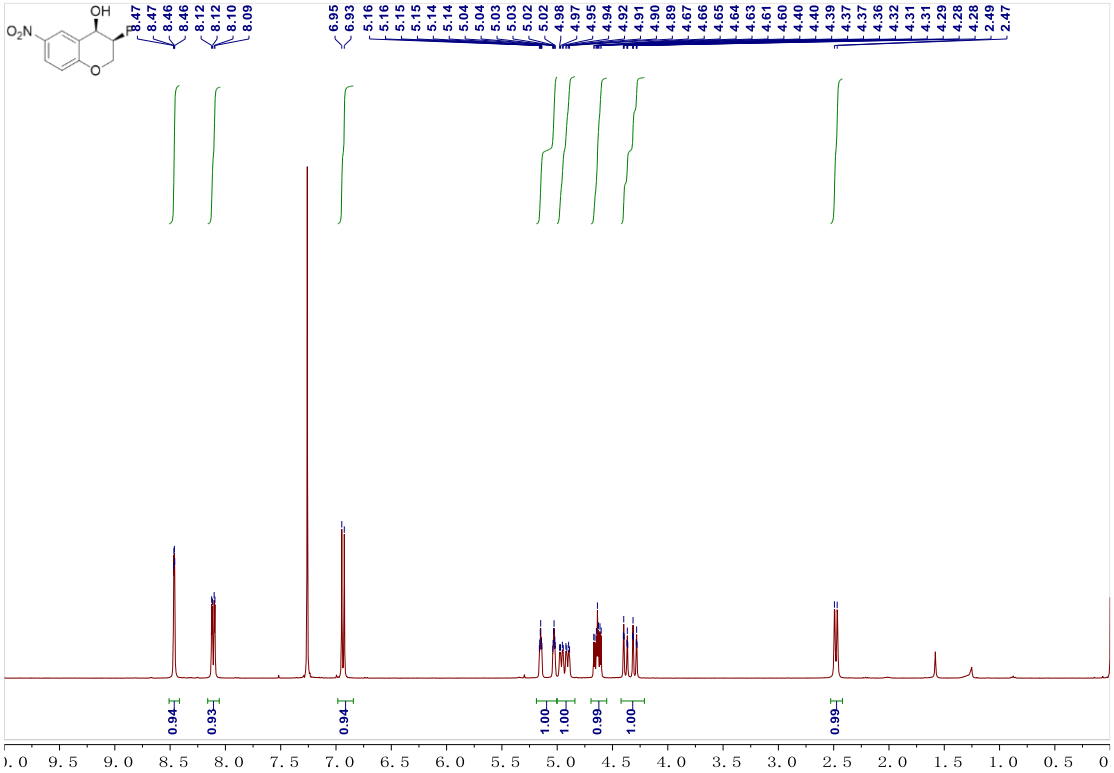
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2g**



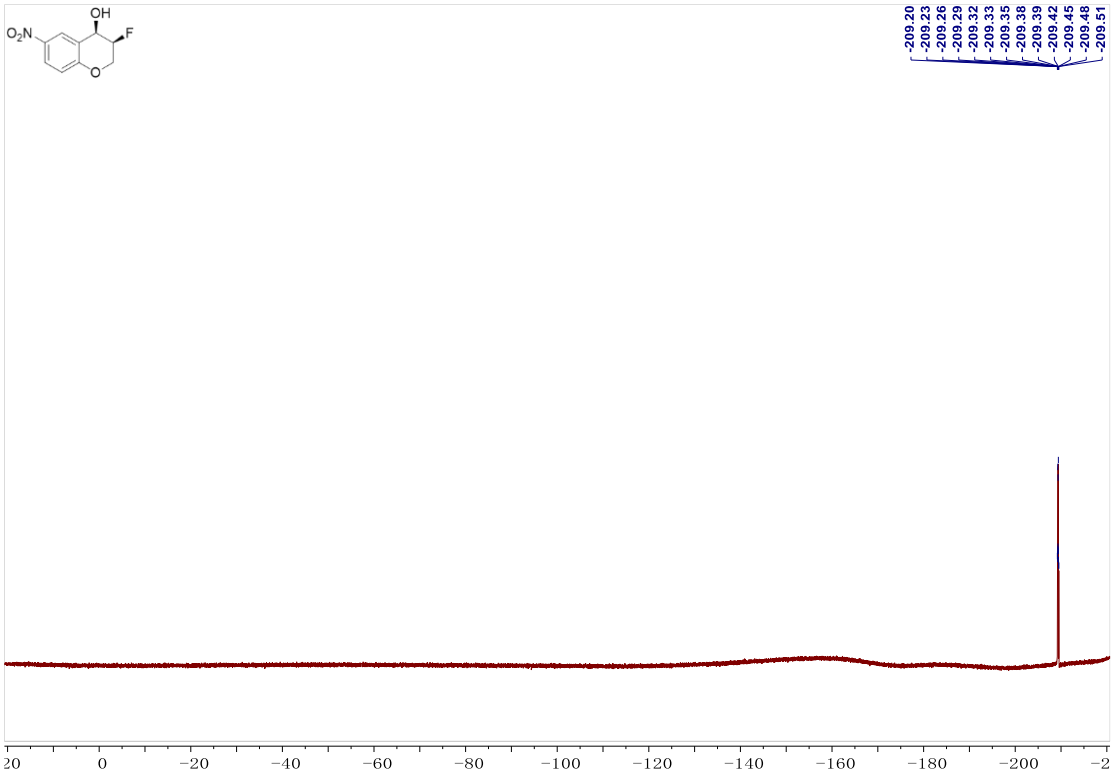
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2g**



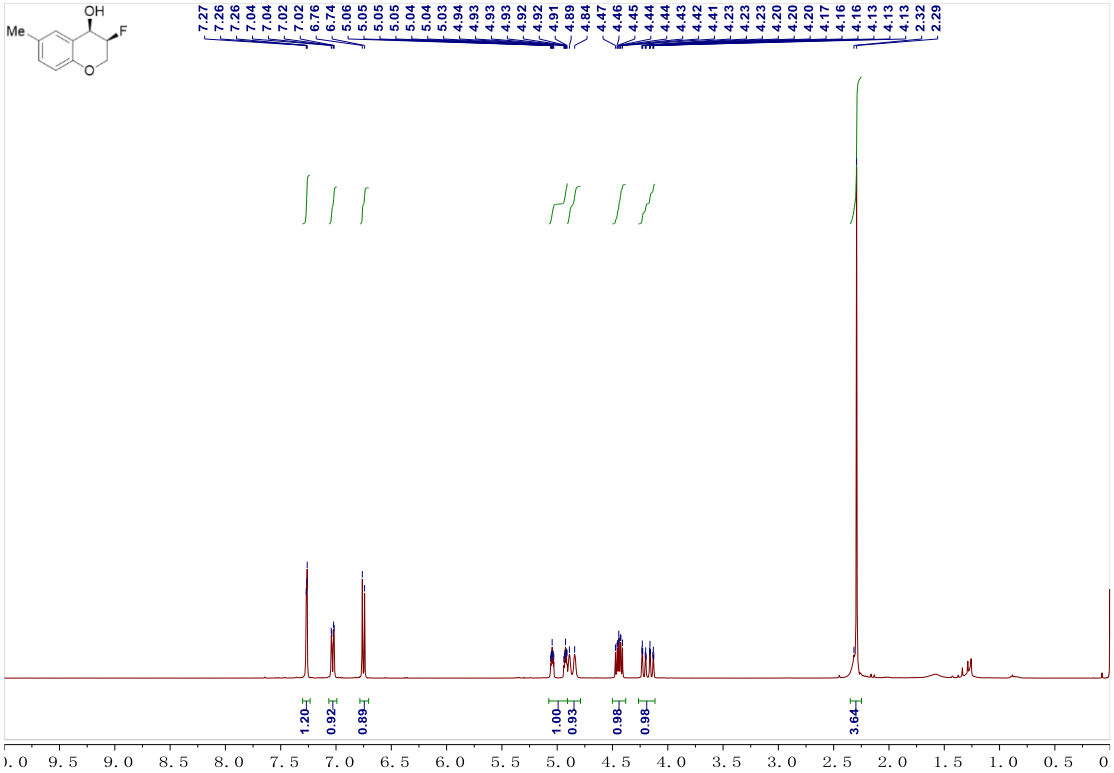
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2h**



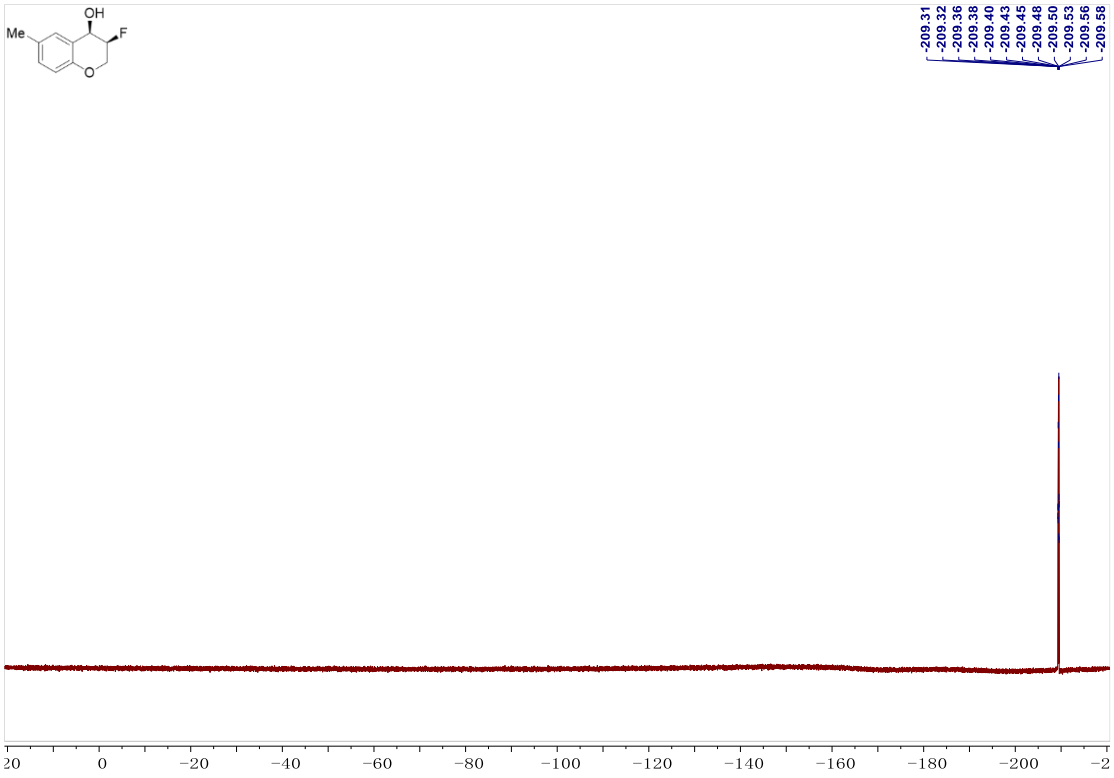
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2h**



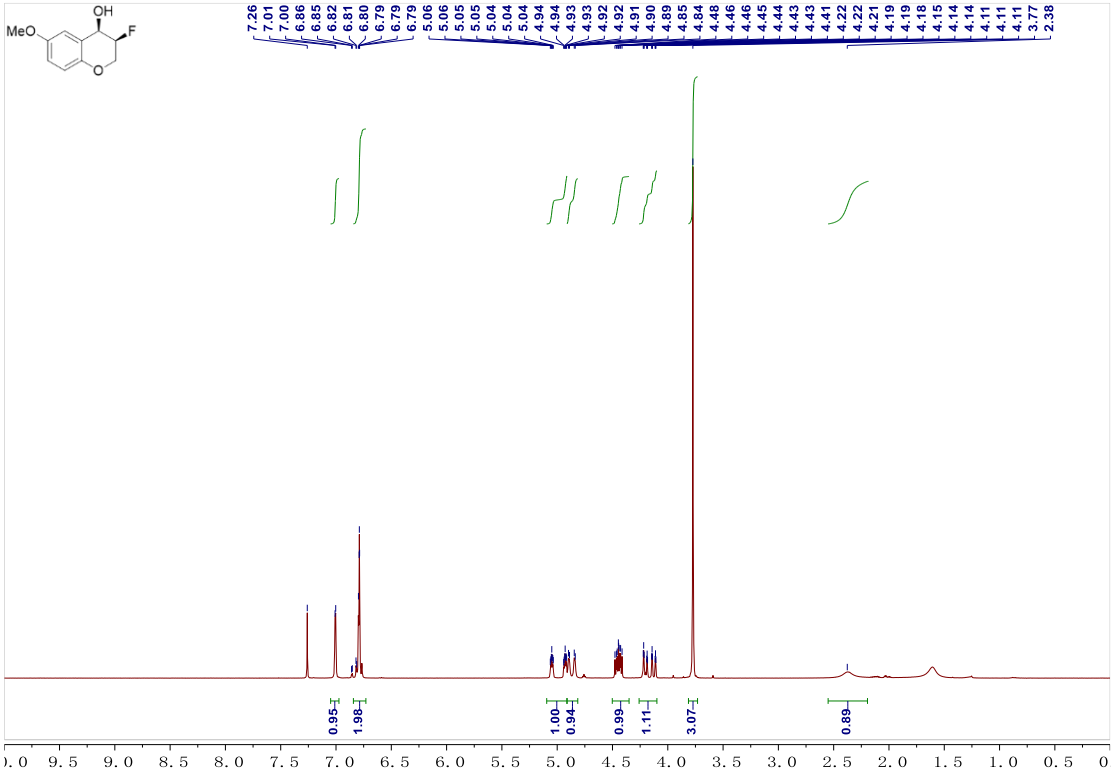
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2i**



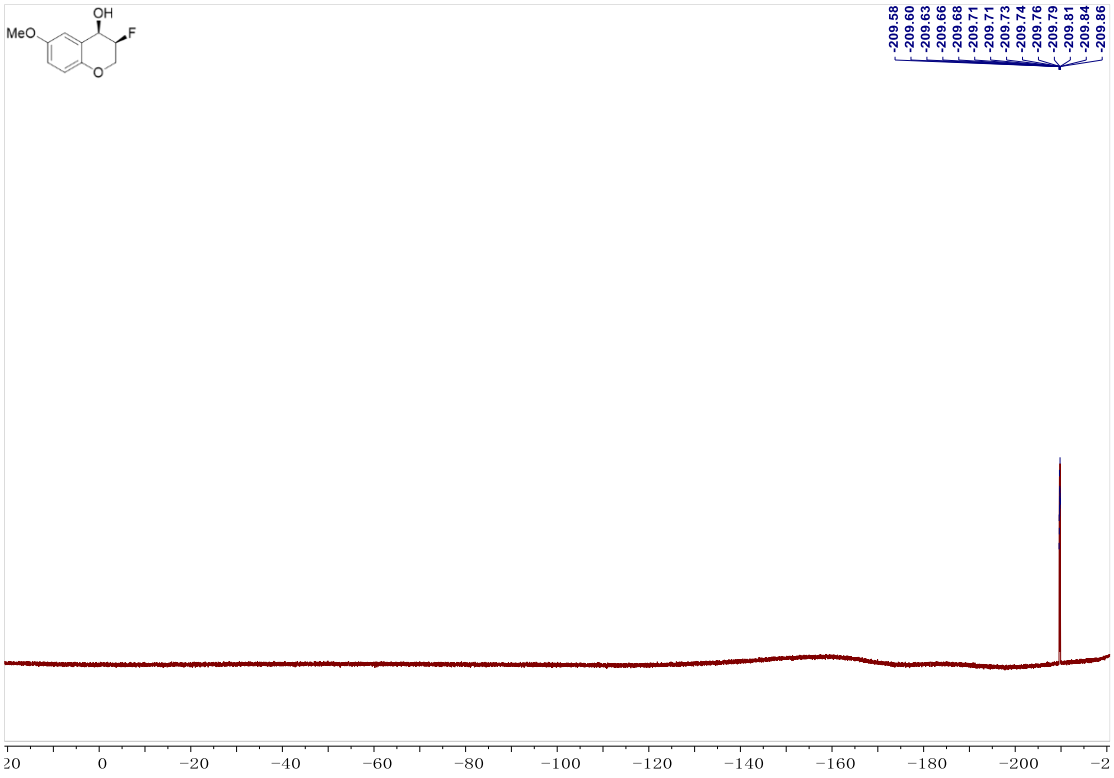
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2i**



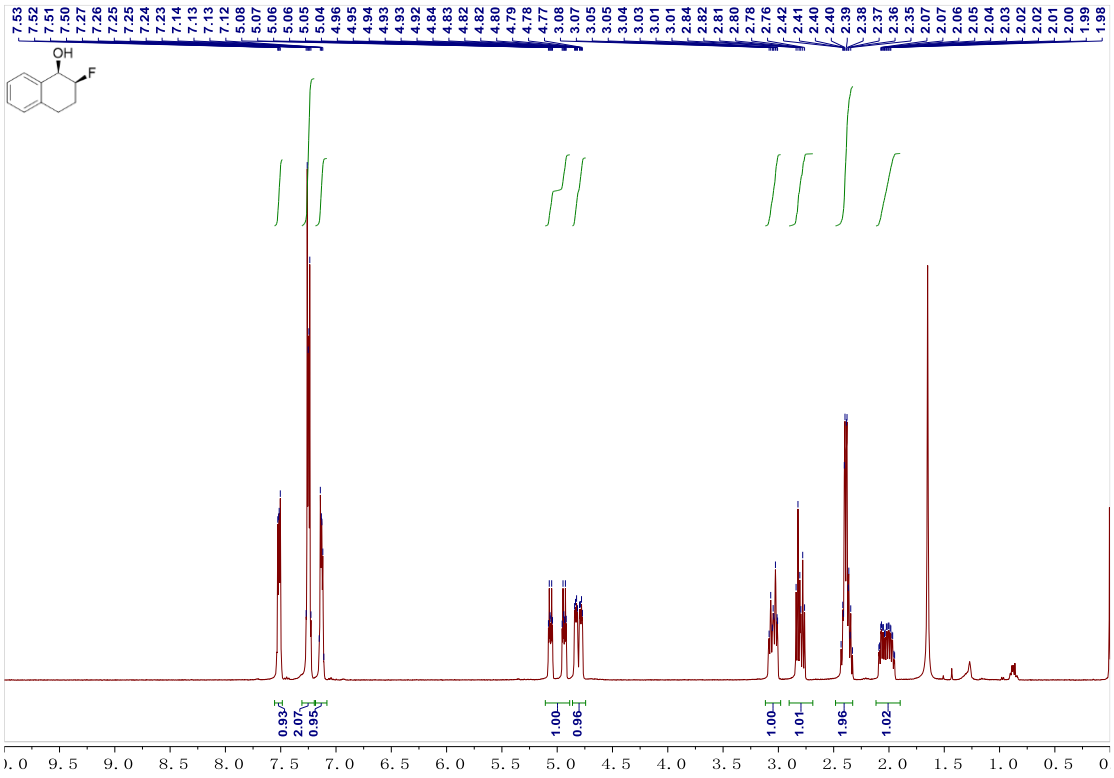
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2j**



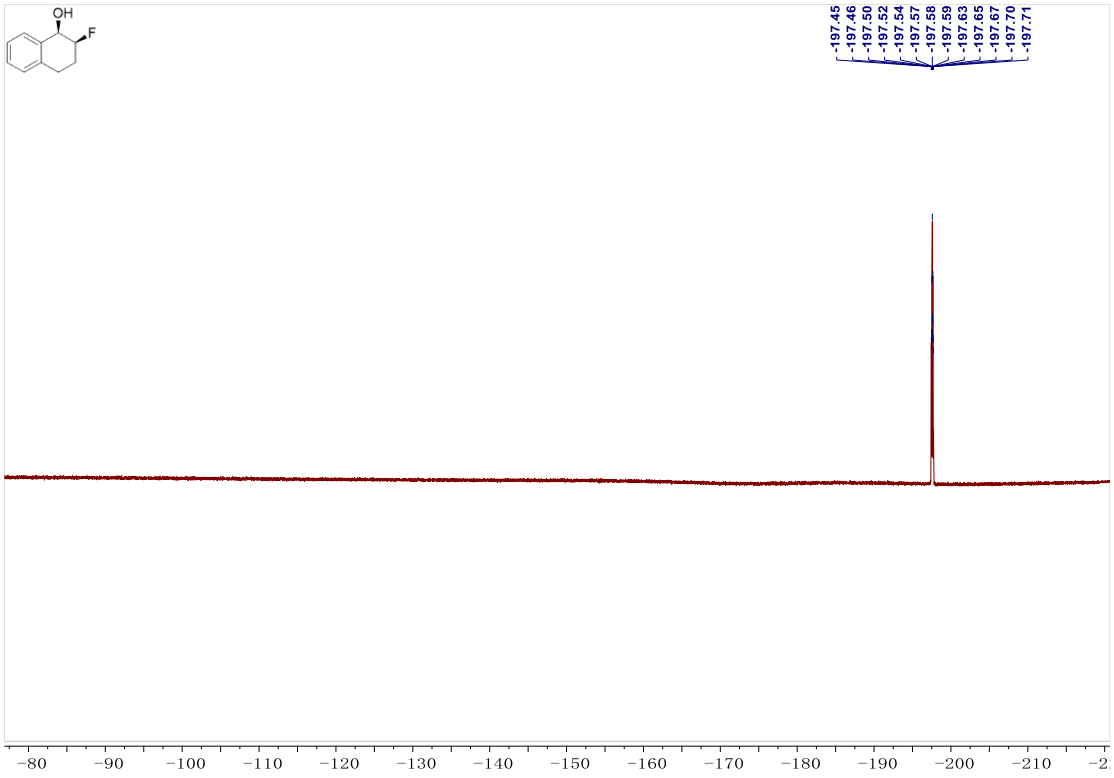
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2j**



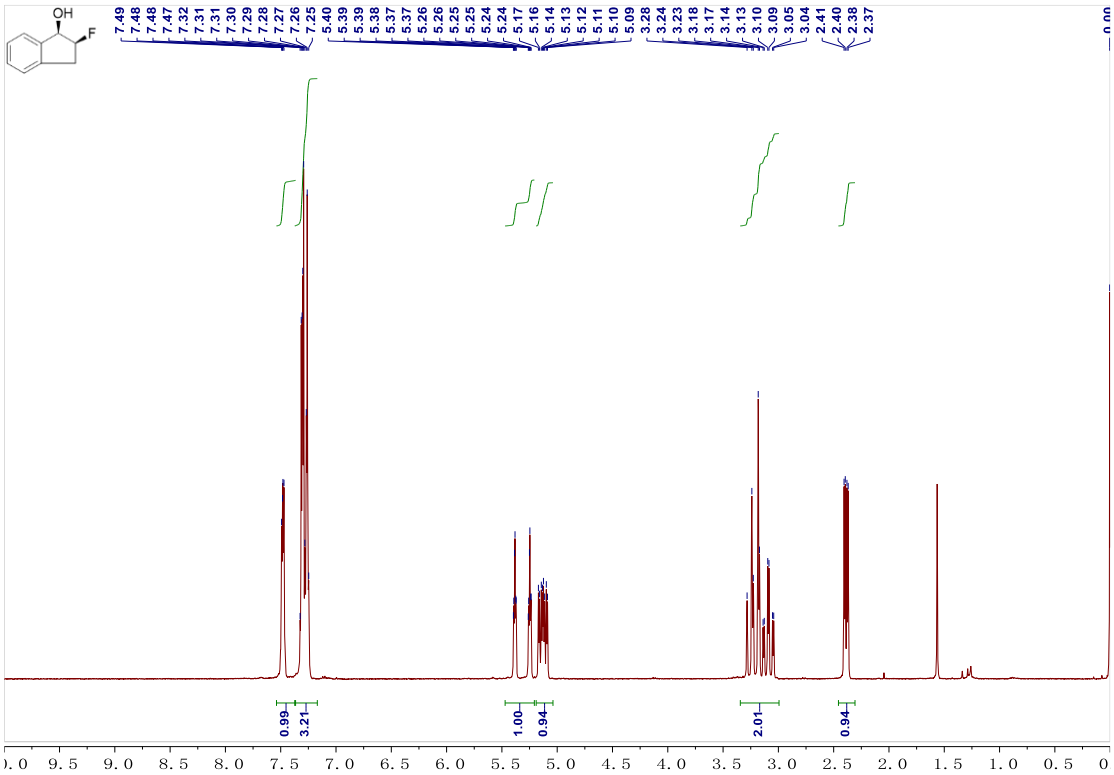
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2k**



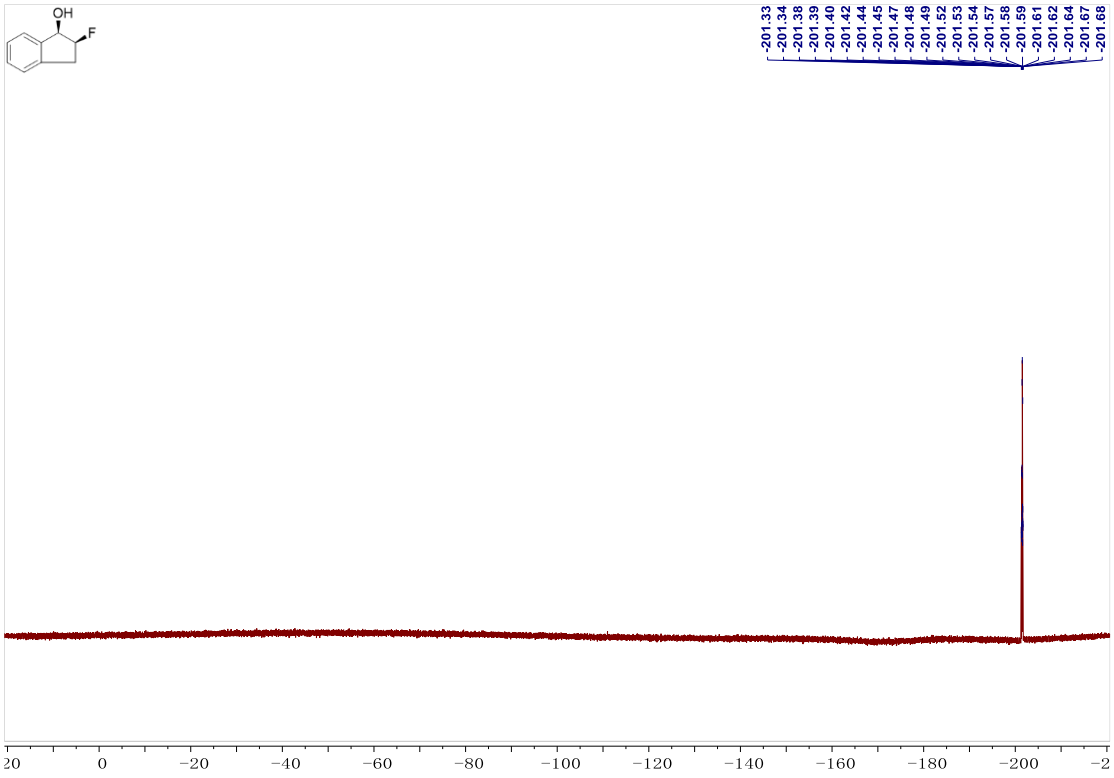
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2k**



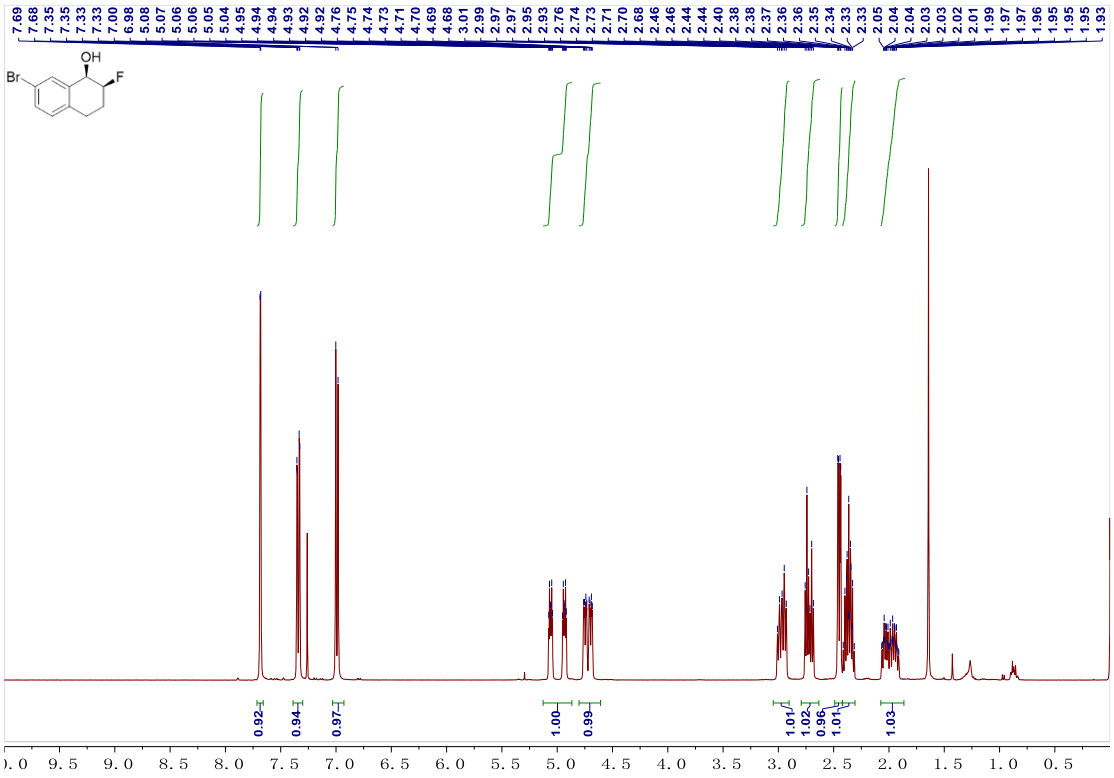
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2l**



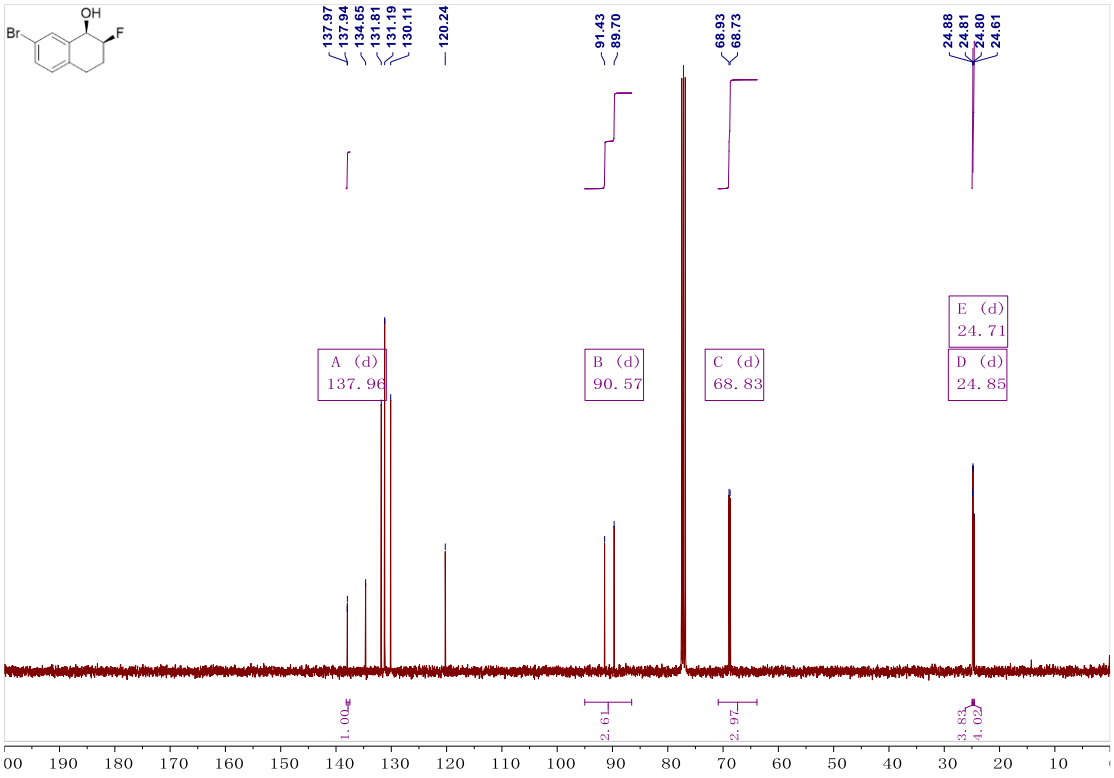
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2l**



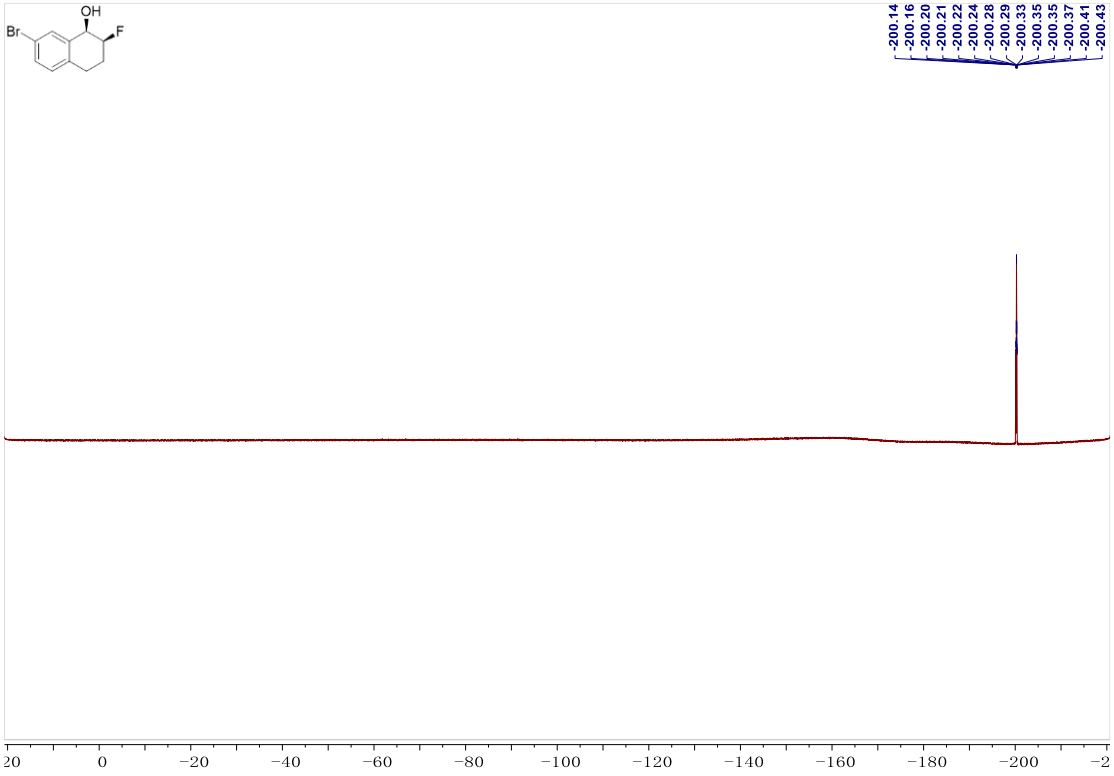
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2m**



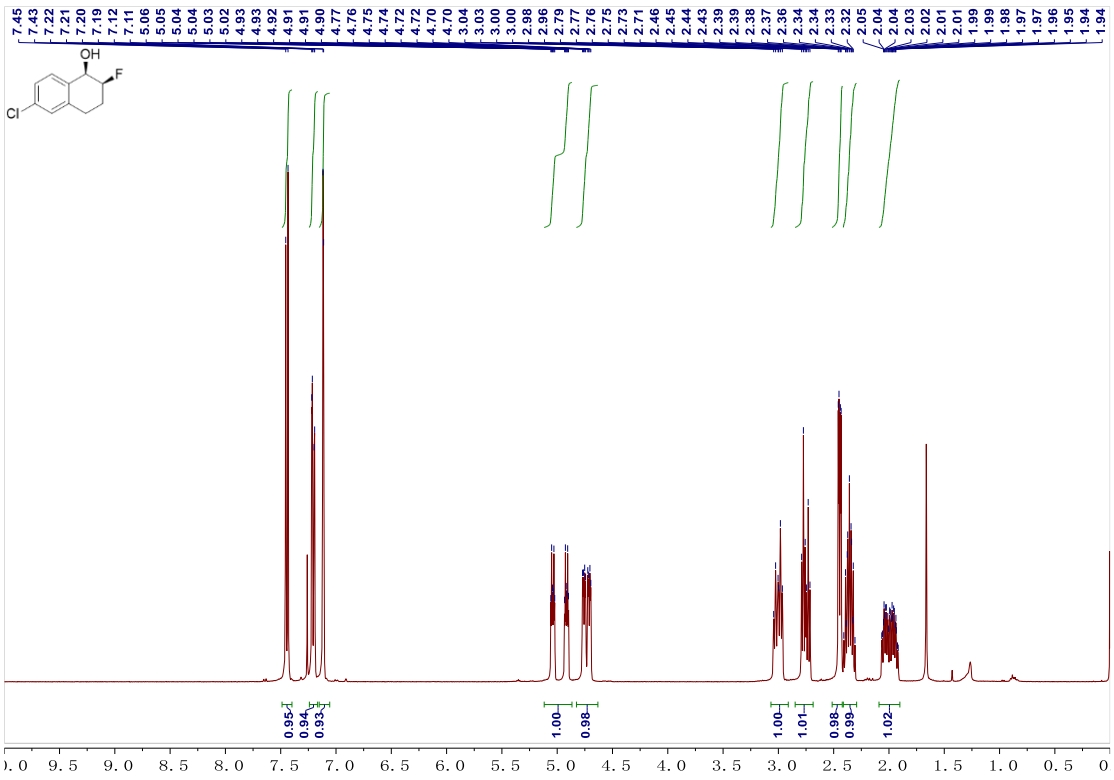
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2m**



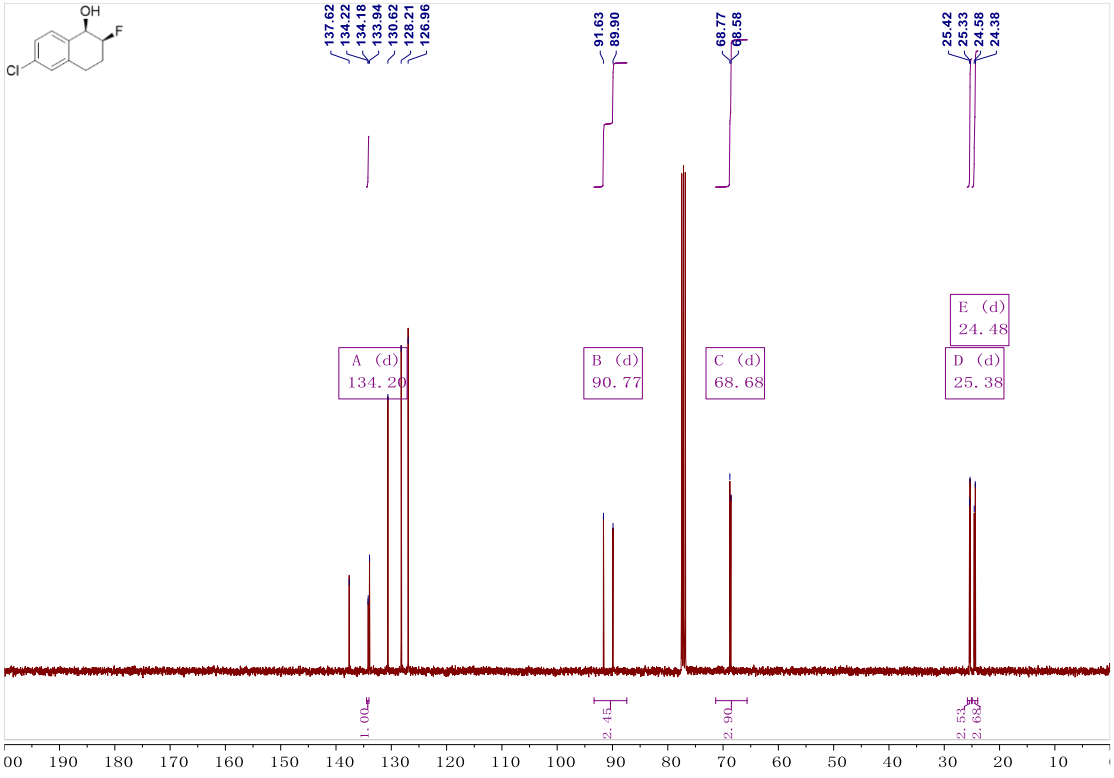
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2m**



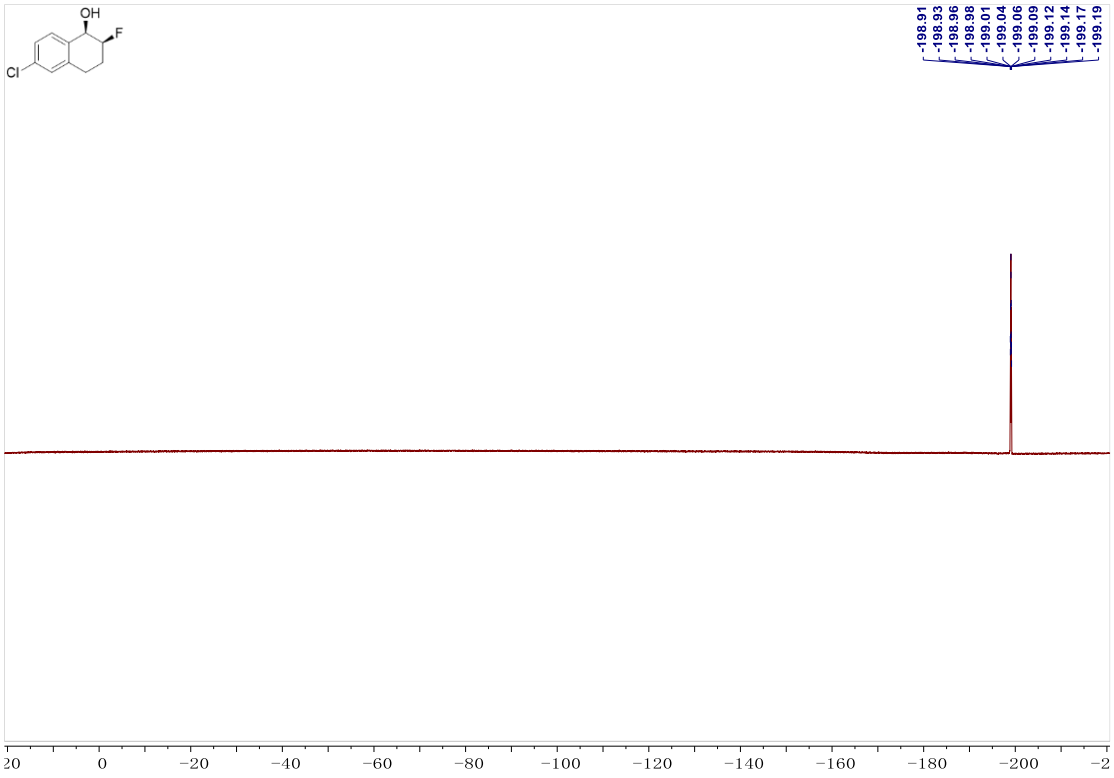
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2n**



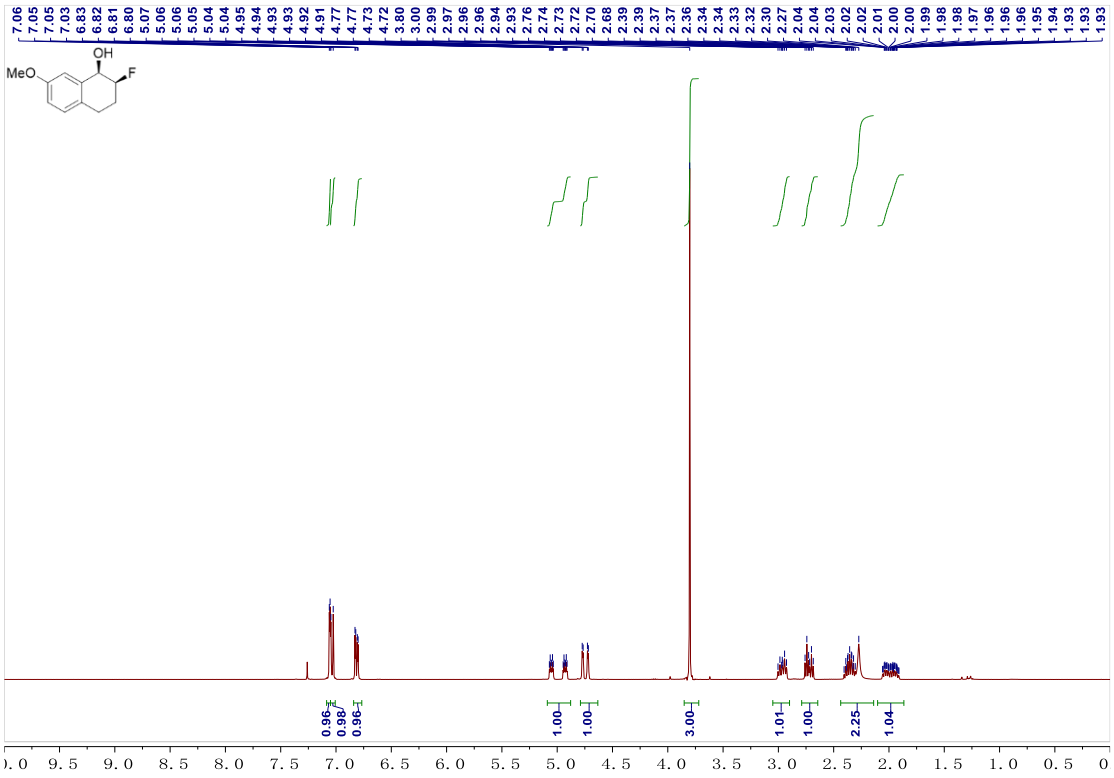
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2n**



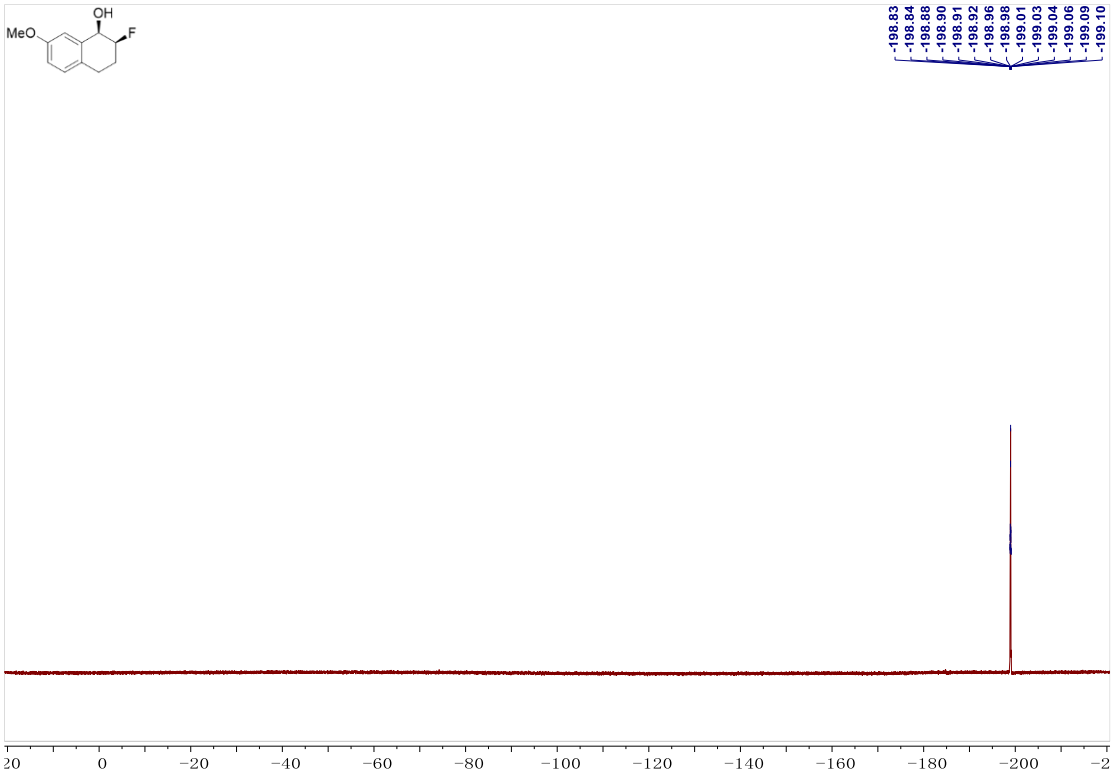
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2n**



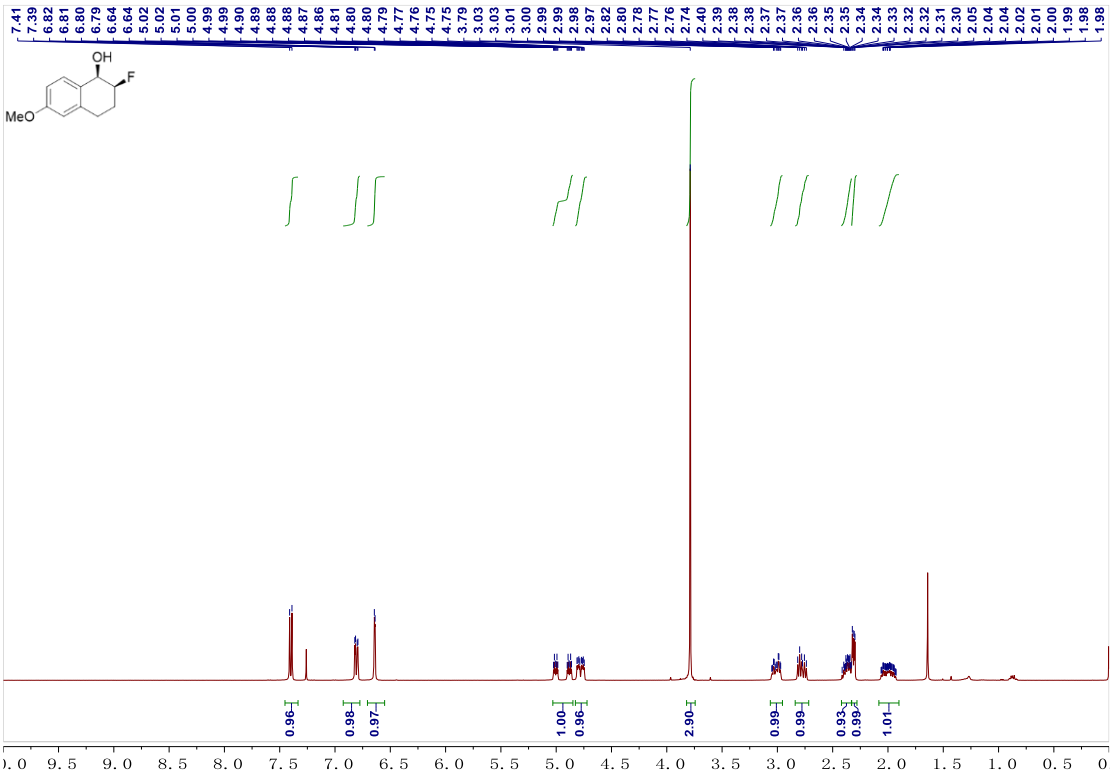
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2o**



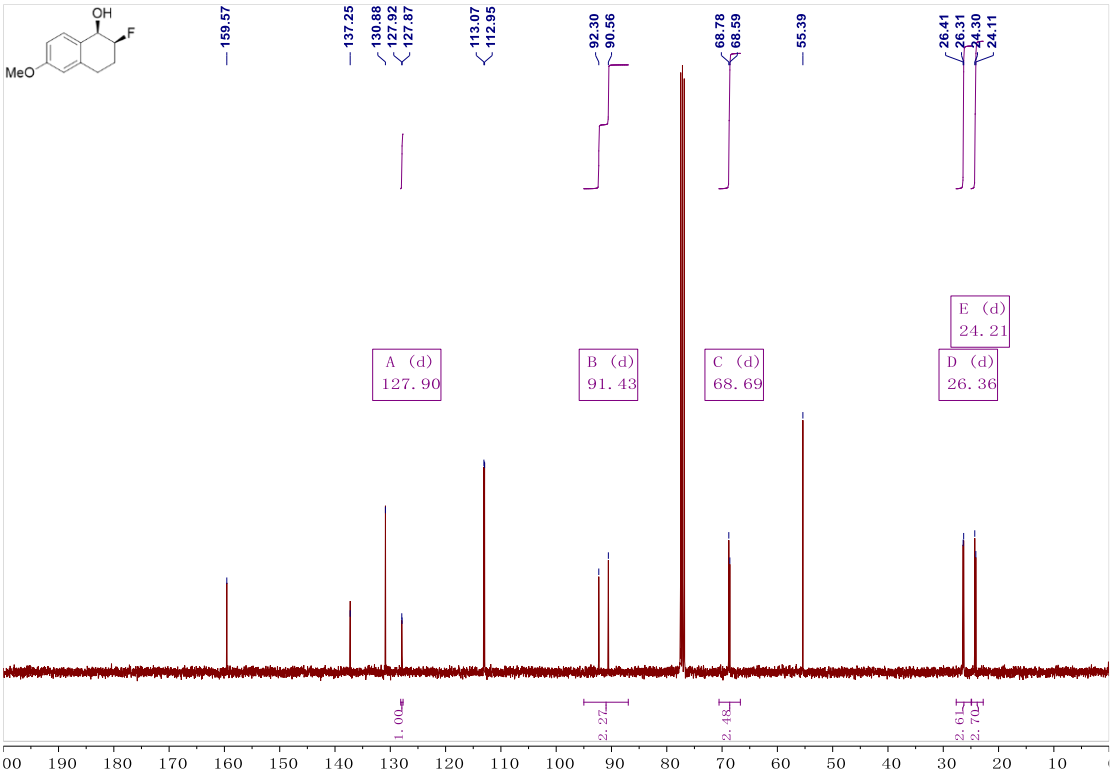
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2o**



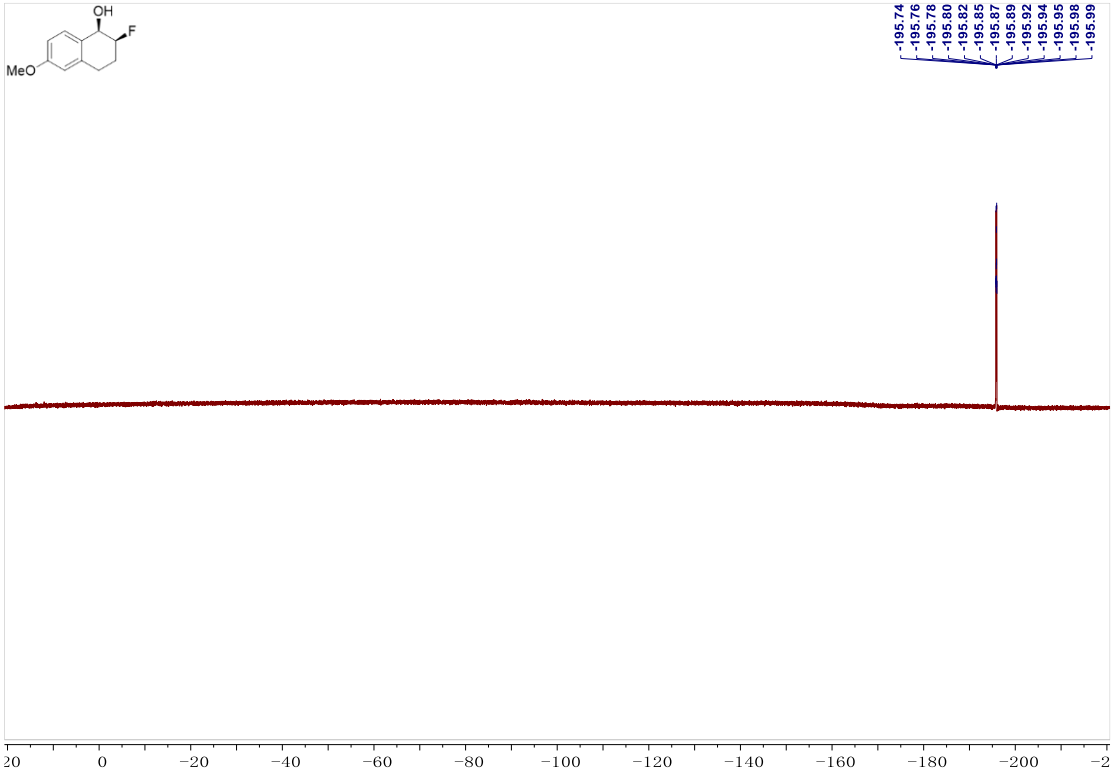
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2p**



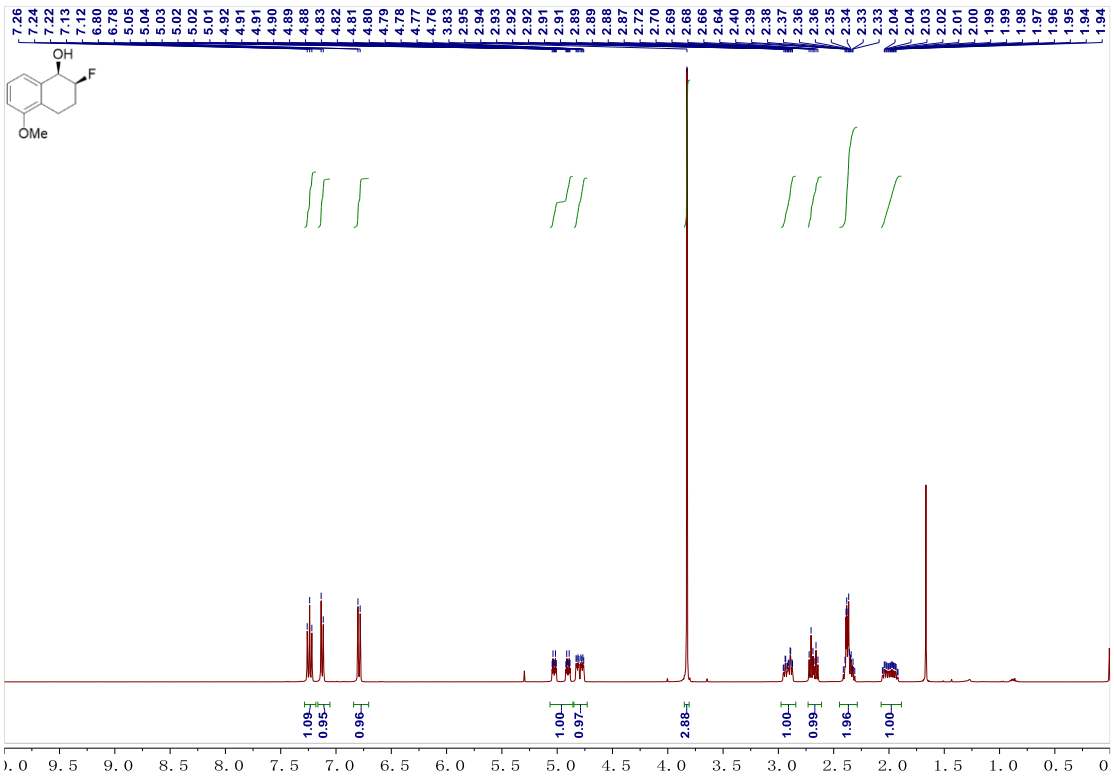
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2p**



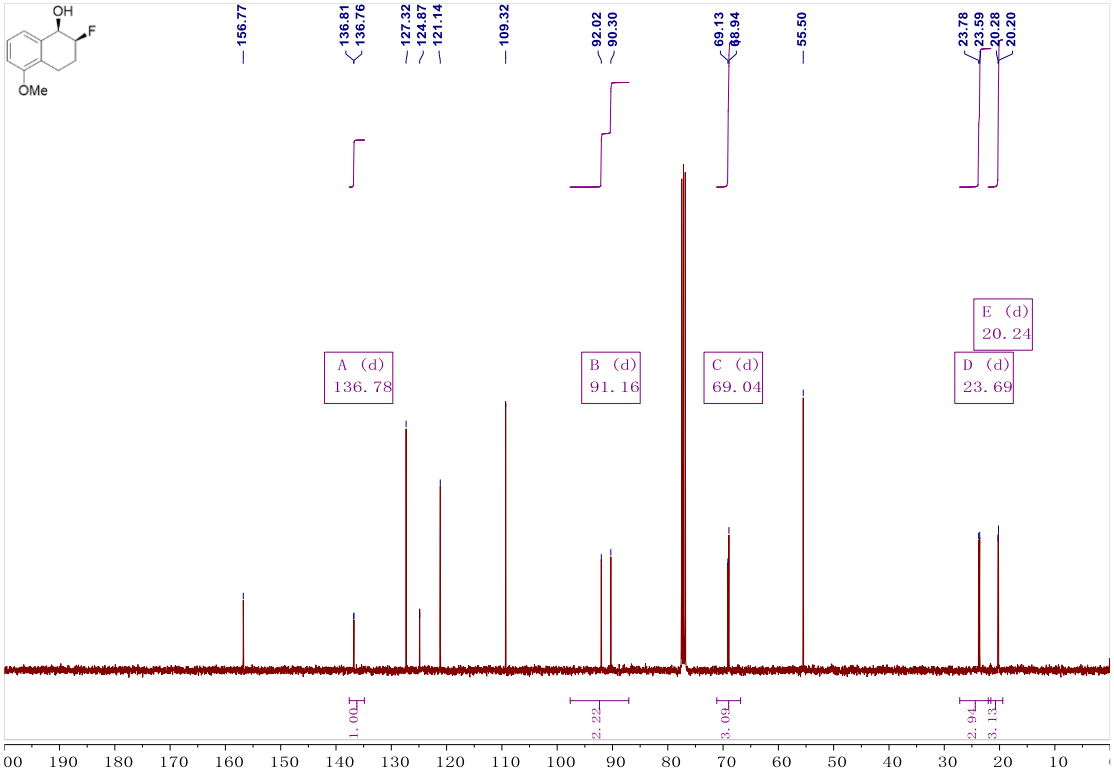
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2p**



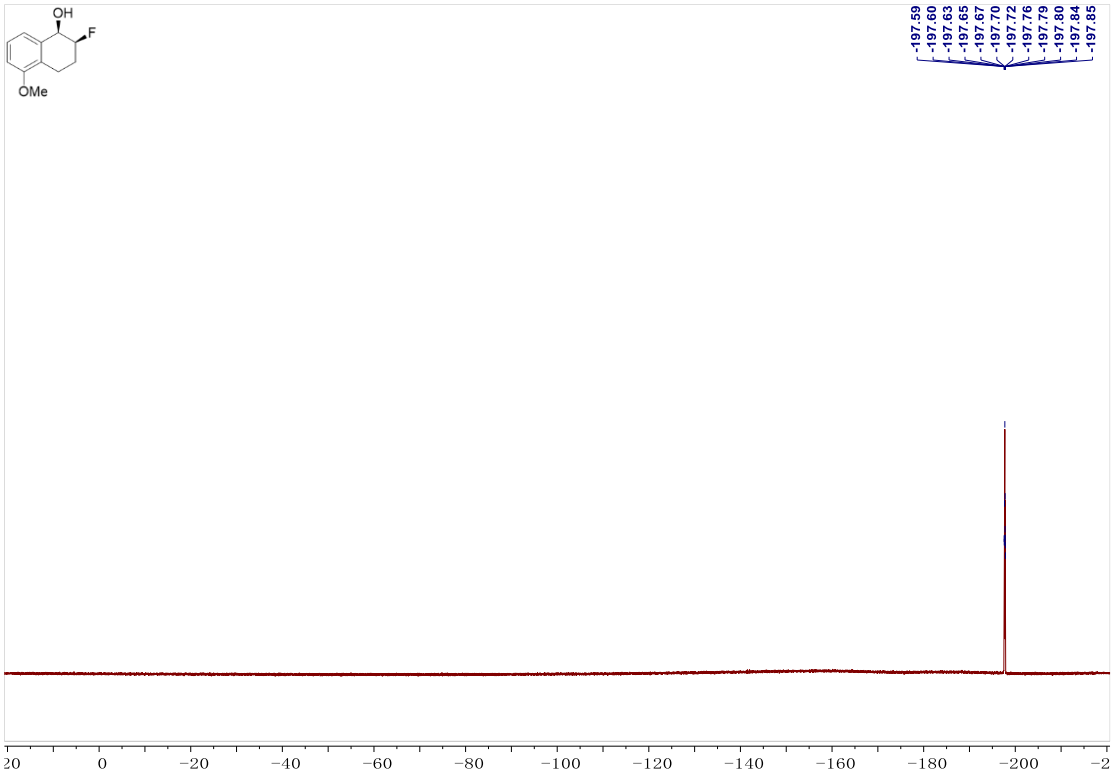
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2q**



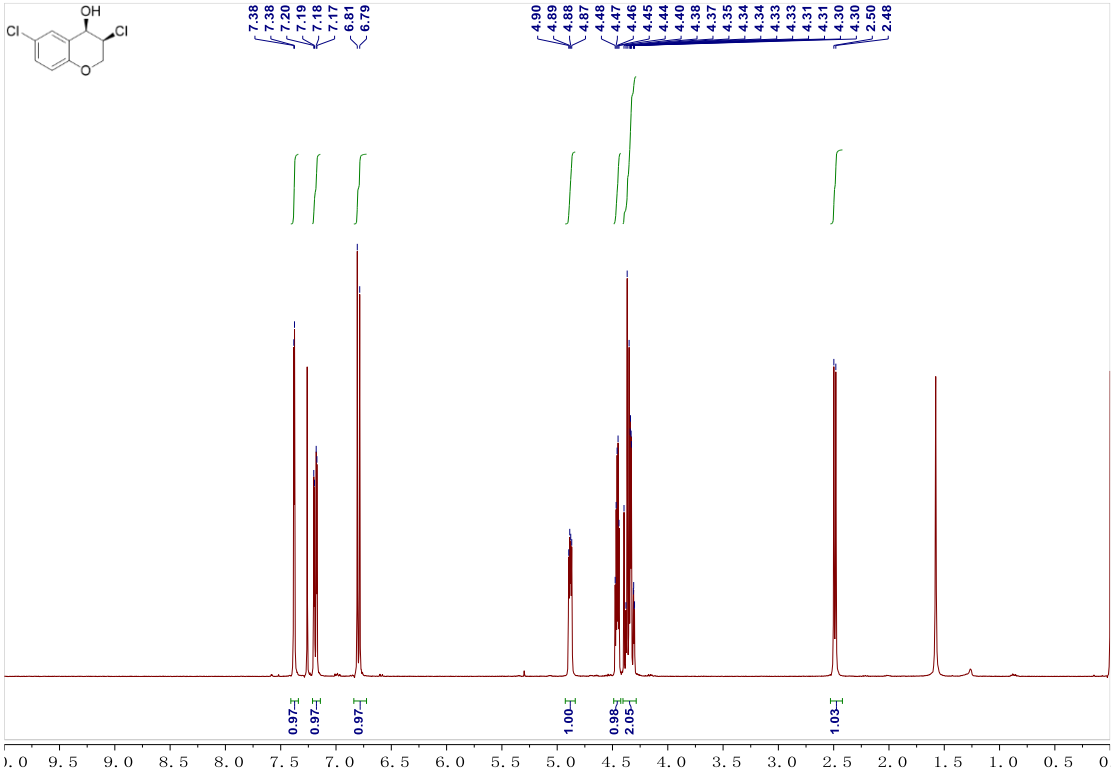
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2q**



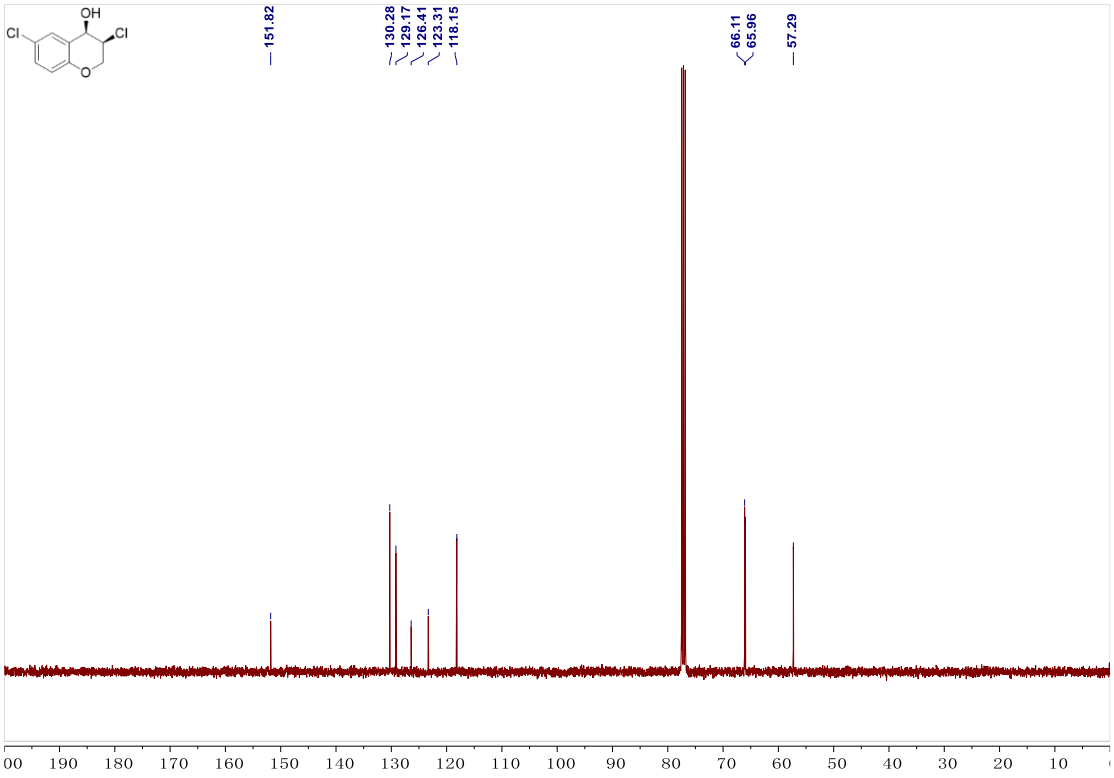
^{19}F NMR (400 MHz, $CDCl_3$) of compound **2q**



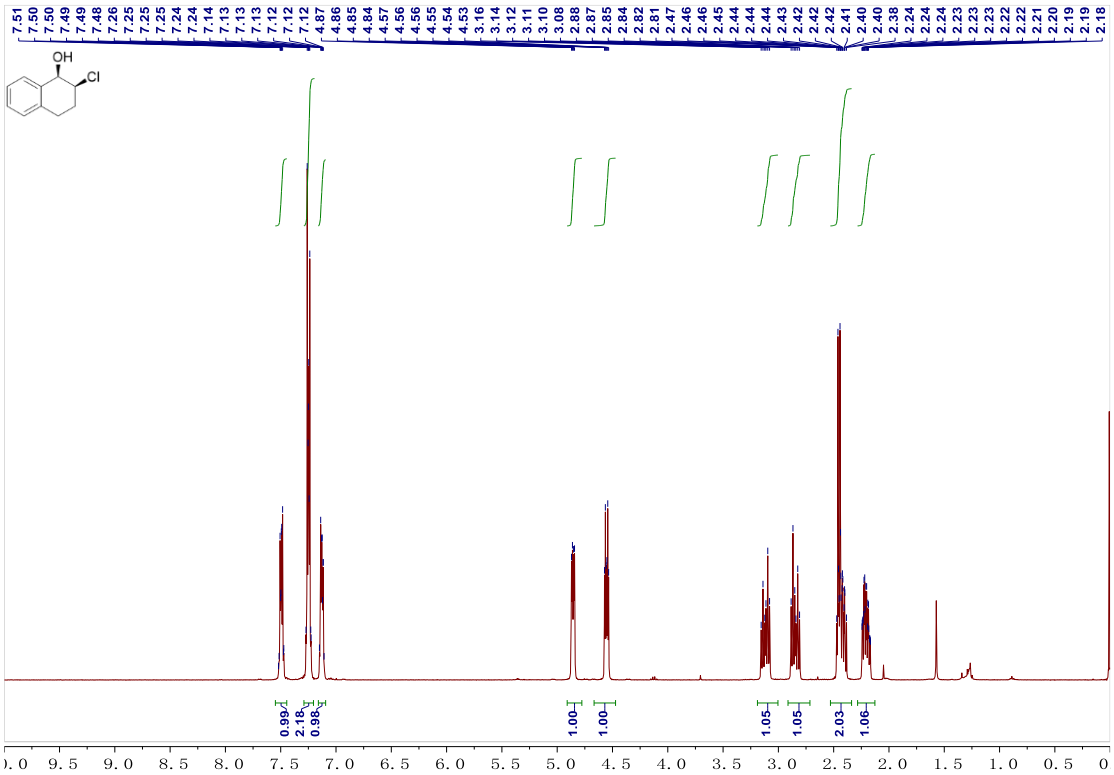
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2r**



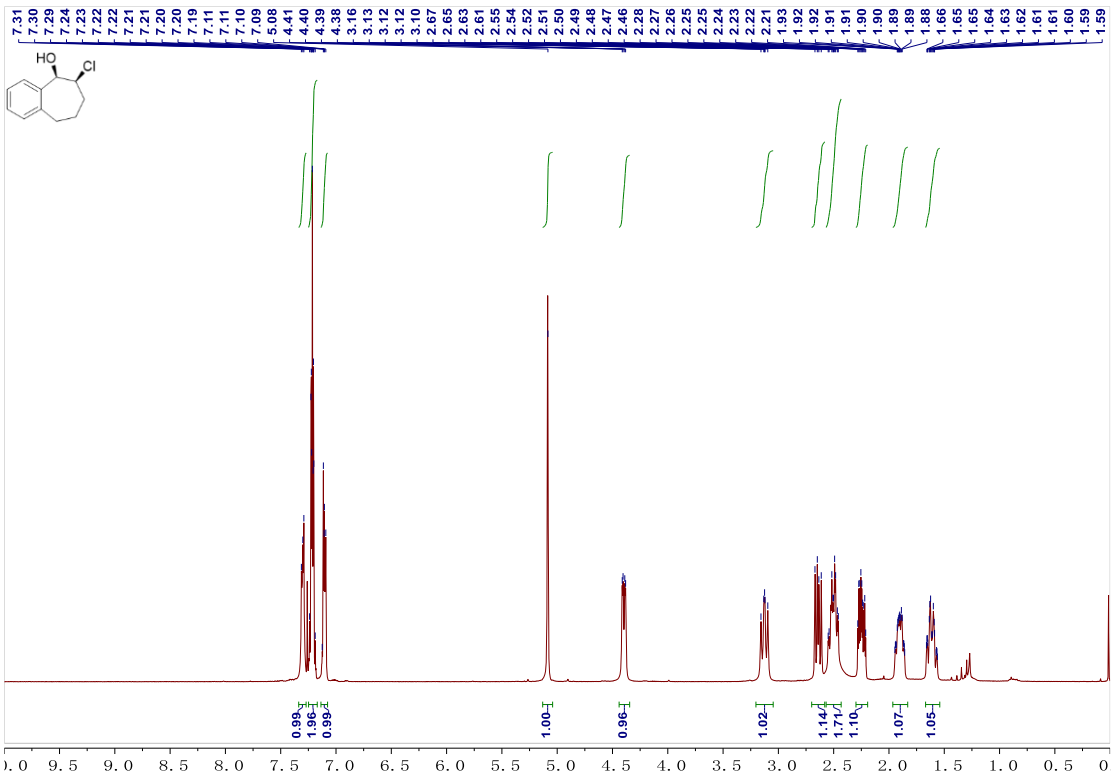
^{13}C NMR (100 MHz, $CDCl_3$) of compound **2r**



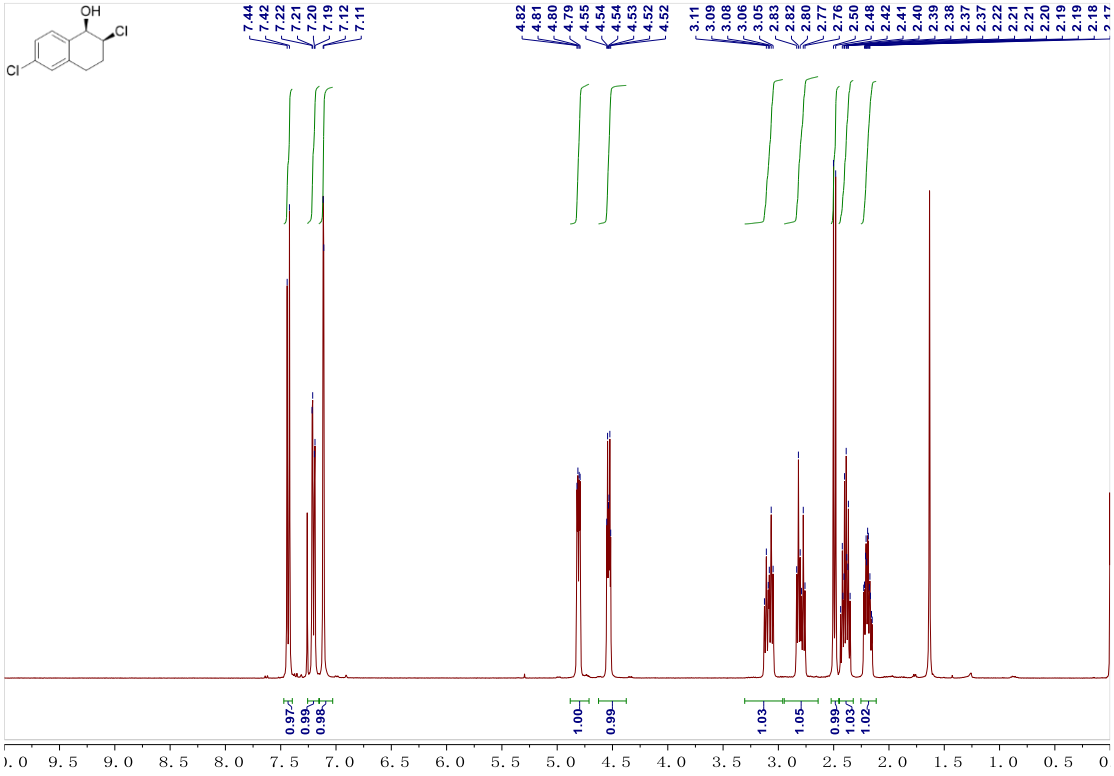
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2s**



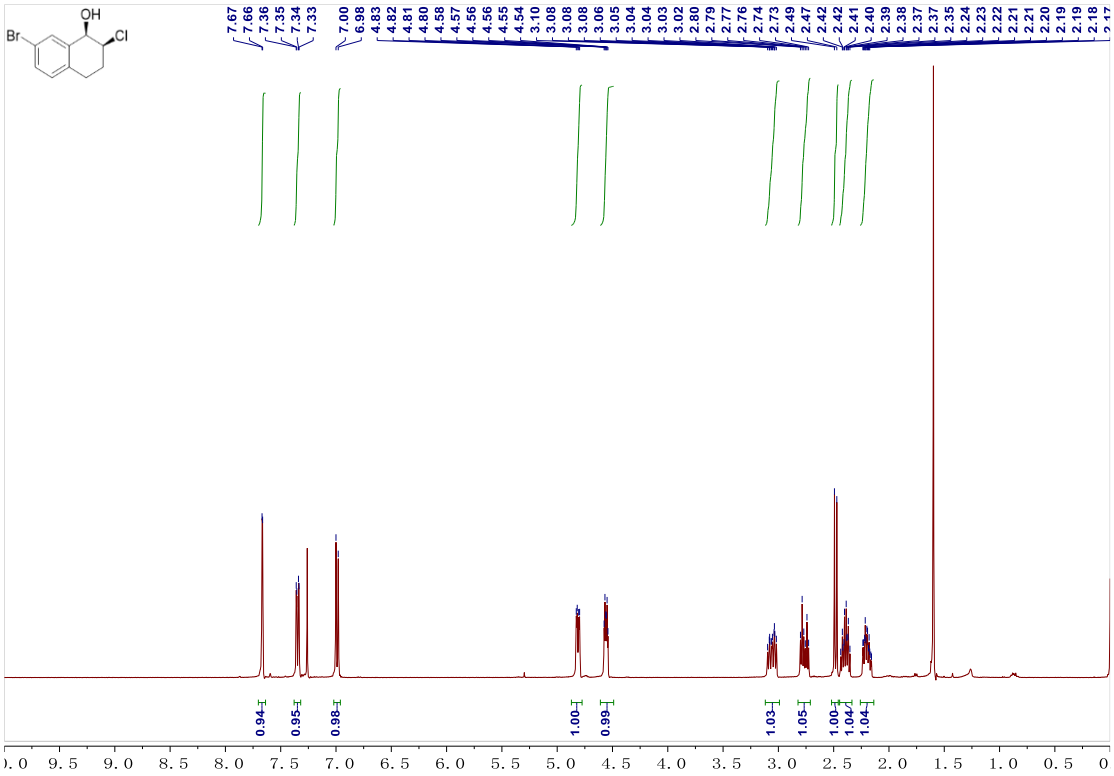
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2t**



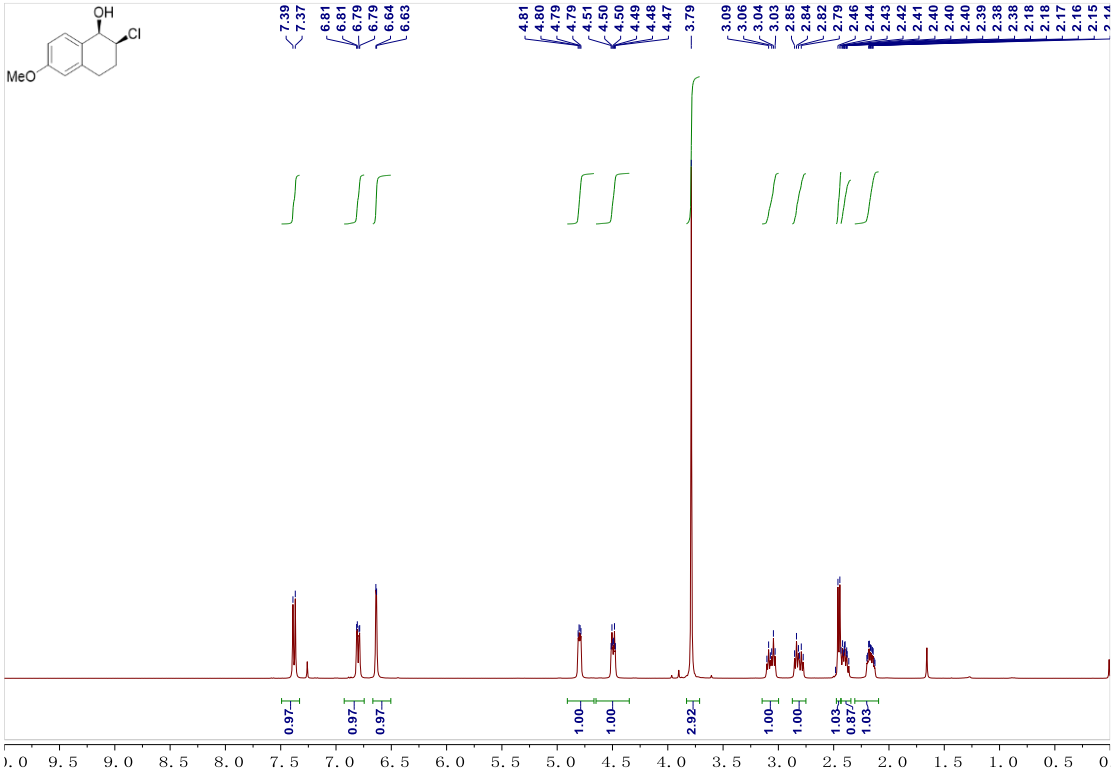
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2u**



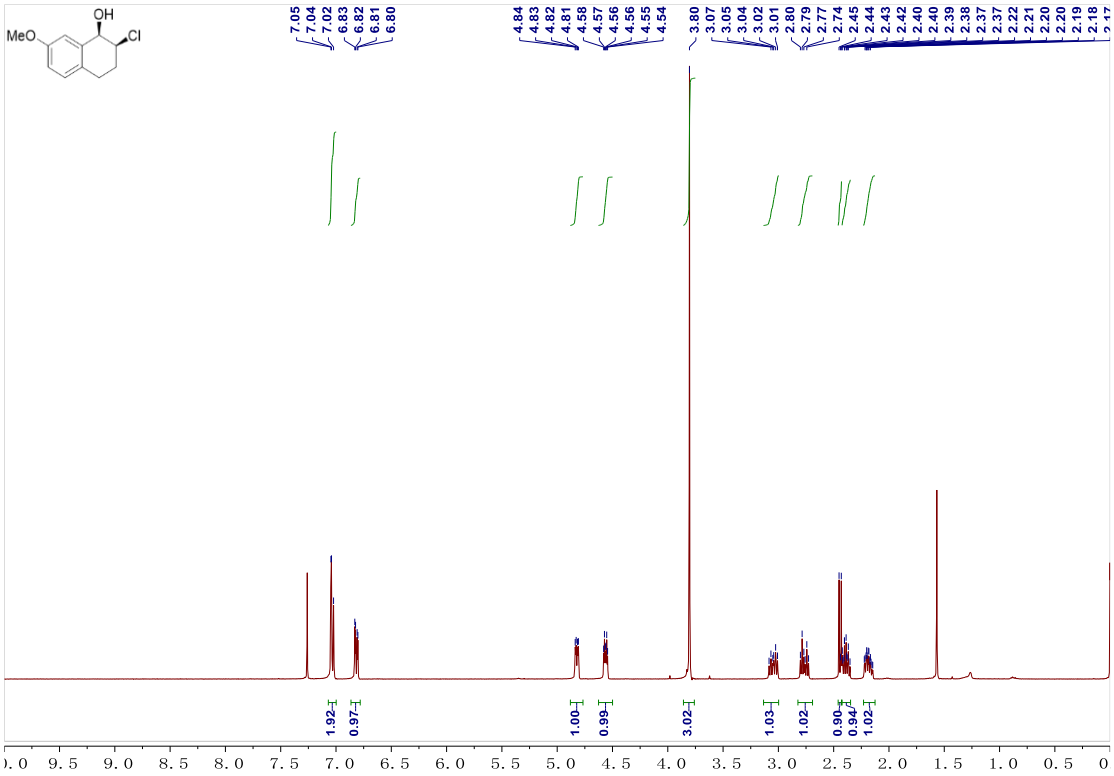
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2v**



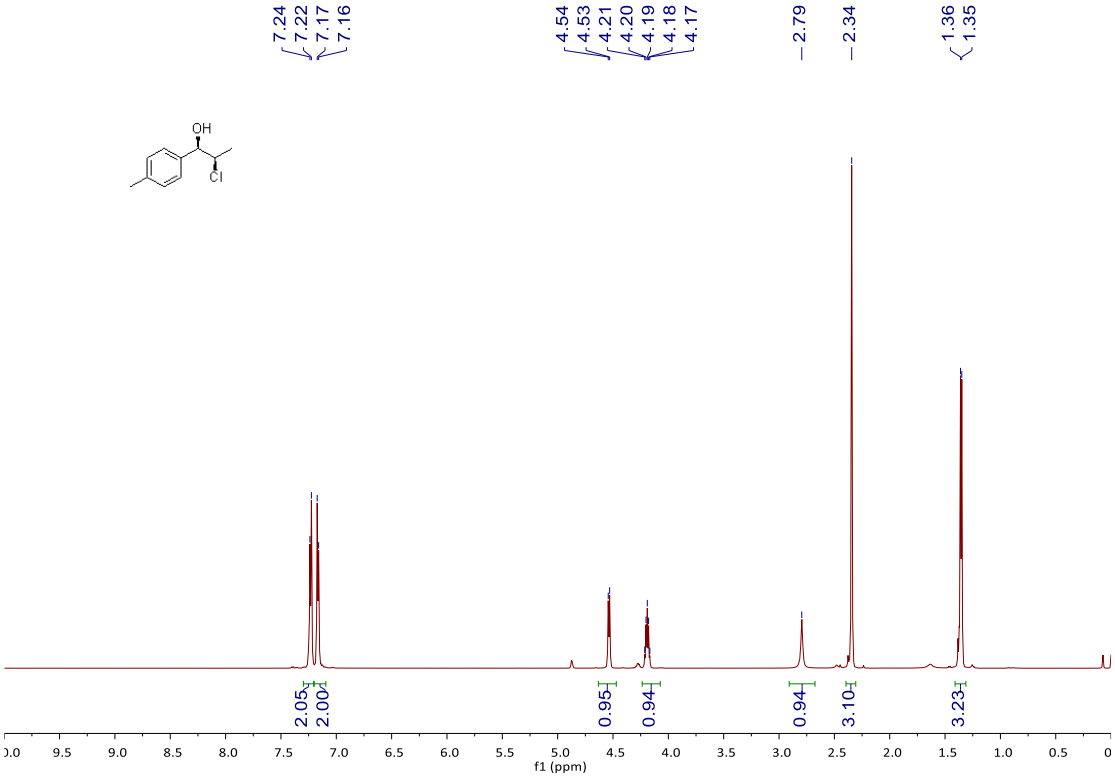
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2w**



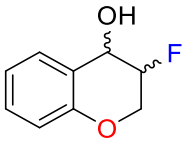
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2x**



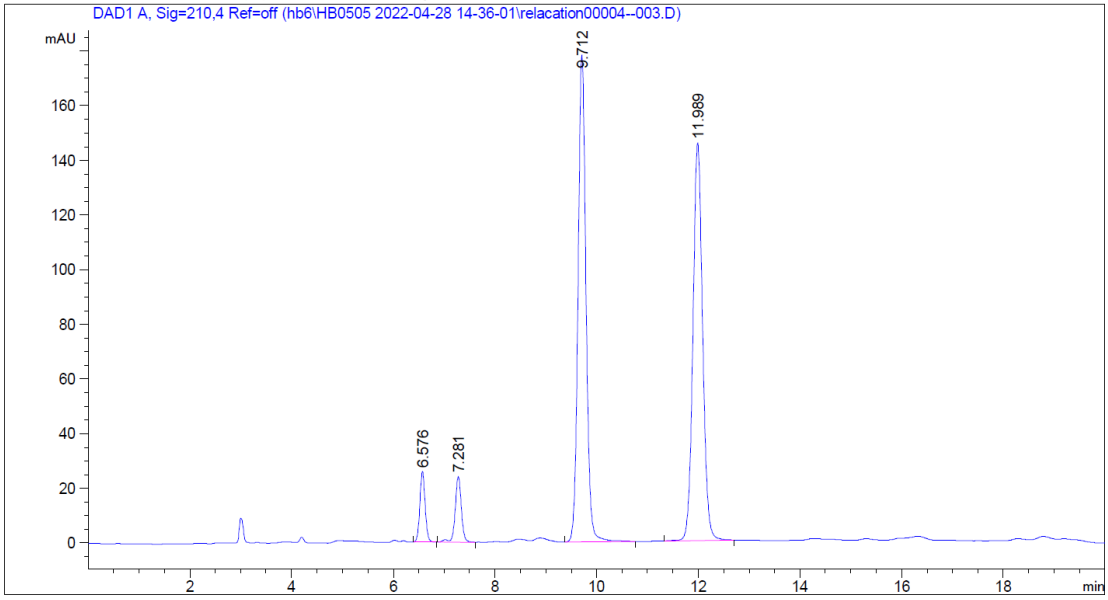
^{1}H NMR (400 MHz, $CDCl_3$) of compound **2y**



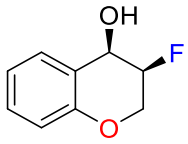
6. HPLC chromatograms




```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   3
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P1-F-05
Injection Date  : 4/28/2022 3:12:47 PM               Inj :   1
                                                Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0505 2022-04-28 14-36-01\hb6_IF-3-90-10-1ML-
                  13min.M
Last changed    : 4/28/2022 2:53:43 PM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\HB0505 2022-04-28 14-36-01\hb6_IF-3-90-10-1ML-
                  13min.M (Sequence Method)
Last changed    : 4/28/2022 3:34:10 PM by SYSTEM
Additional Info : Peak(s) manually integrated
```

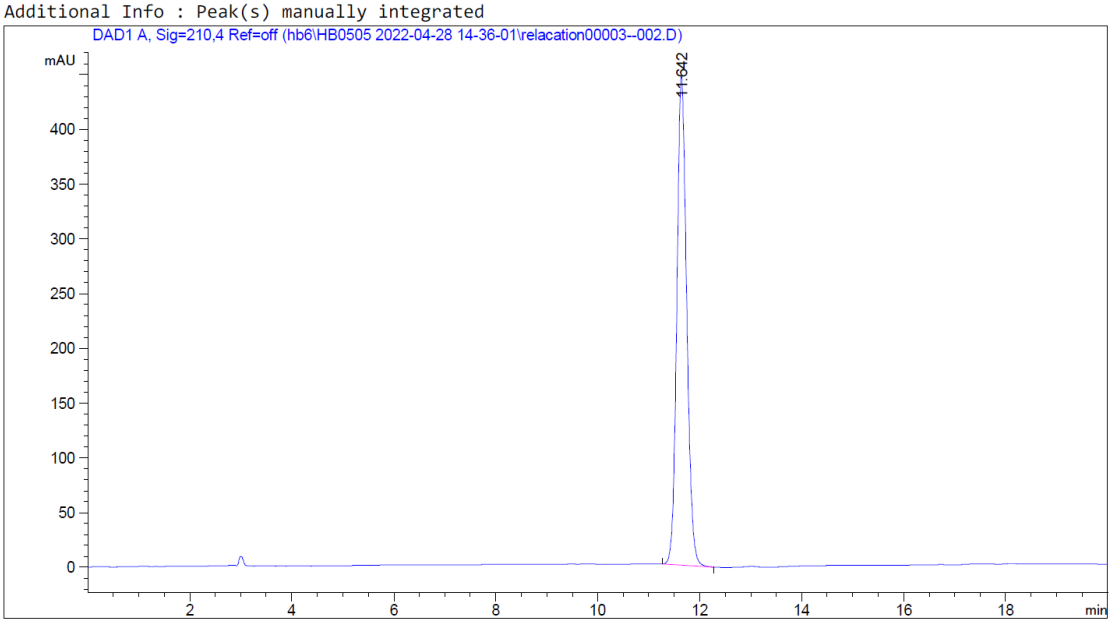



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]       [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.576 BB    0.1101  185.82097   25.78374   4.3882
   2   7.281 VB R  0.1313  204.27399   23.99939   4.8240
   3   9.712 BB    0.1664 1931.38953  178.29167  45.6103
   4  11.989 BB    0.2036 1913.06653  145.33151  45.1776
```

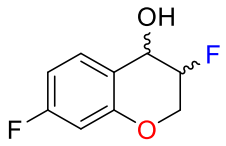


2a

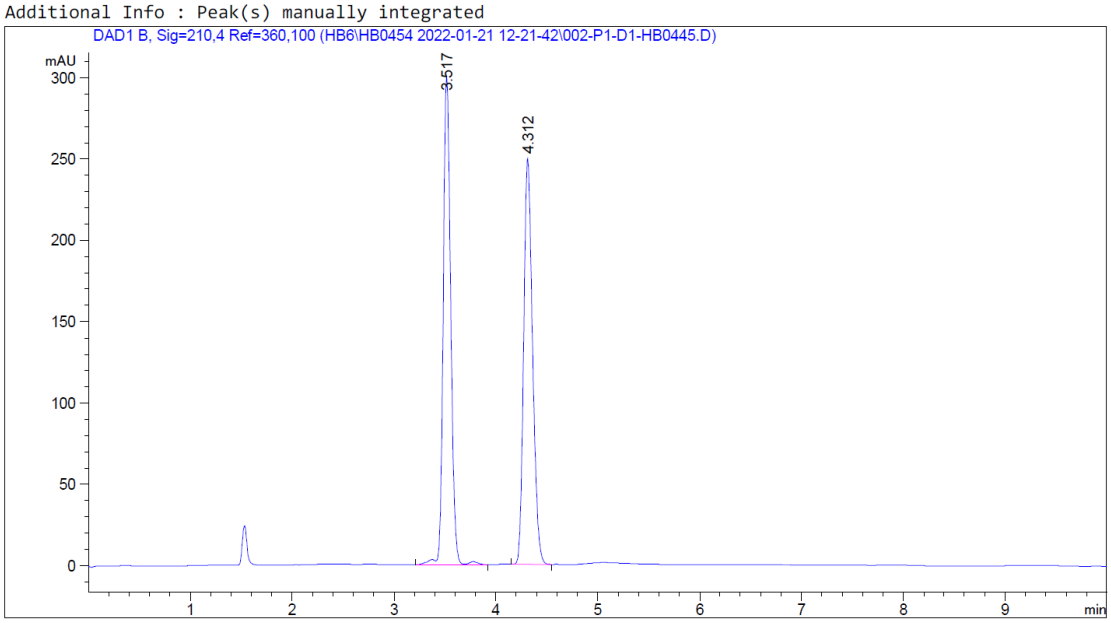
```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P1-F-04
Injection Date  : 4/28/2022 2:51:53 PM               Inj :   1
                                                Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0505 2022-04-28 14-36-01\hb6_IF-3-90-10-1ML-
                  13min.M
Last changed    : 4/28/2022 2:53:43 PM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0505 2022-04-28 14-36-01\hb6_IF-3-90-10-1ML-
                  13min.M (Sequence Method)
Last changed    : 4/28/2022 3:31:17 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



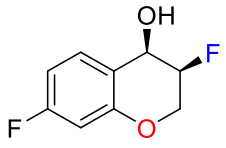

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  11.642 BB    0.2066 5992.00977  446.31683 100.0000

Totals :                  5992.00977  446.31683
```




```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   2
Acq. Instrument : 1290-DAD                      Location :   P1-D-01
Injection Date  : 1/21/2022 12:33:02 PM              Inj :   1
                                               Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0454 2022-01-21 12-21-42\IE-3-90-10-0.45-0.5UL-10MIN
                  .M
Last changed    : 1/21/2022 11:27:03 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0454 2022-01-21 12-21-42\IE-3-90-10-0.45-0.5UL-10MIN
                  .M (Sequence Method)
Last changed    : 4/15/2022 2:17:23 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

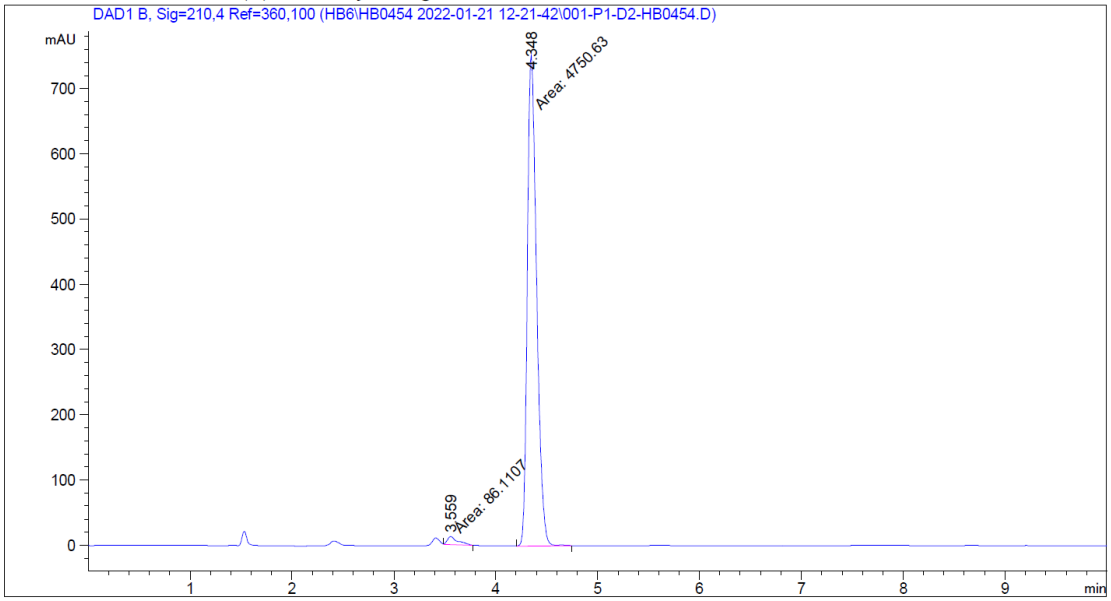



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   3.517 VV R  0.0786 1542.66687  300.86826  50.4892
   2   4.312 BB    0.0946 1512.77258  250.03011  49.5108

Totals :                  3055.43945  550.89836
```

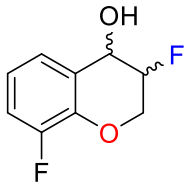


2b

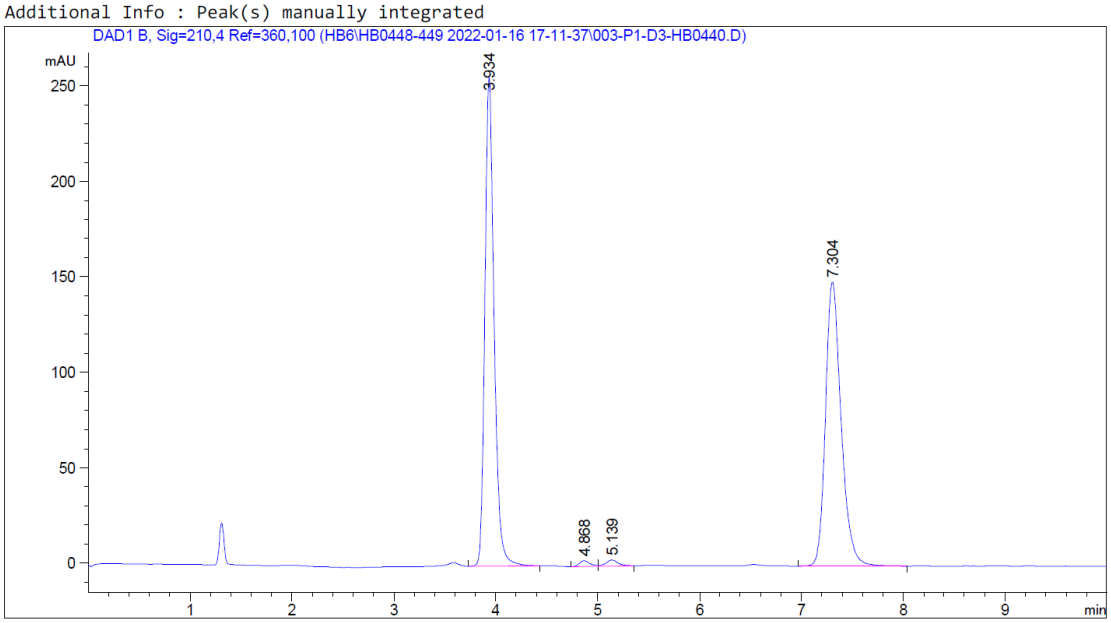
```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   1
Acq. Instrument : 1290-DAD                      Location :   P1-D-02
Injection Date  : 1/21/2022 12:22:36 PM              Inj :   1
                                              Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0454 2022-01-21 12-21-42\IE-3-90-10-0.45-0.5UL-10MIN
                  .M
Last changed    : 1/21/2022 11:27:03 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0454 2022-01-21 12-21-42\IE-3-90-10-0.45-0.5UL-10MIN
                  .M (Sequence Method)
Last changed    : 4/15/2022 2:17:23 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



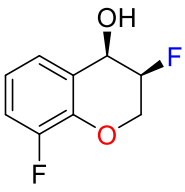

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   3.559 MM    0.1177   86.11067   12.19253   1.7803
   2   4.348 MM    0.1052 4750.62891  752.53674  98.2197

Totals :                  4836.73958  764.72928
```




```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   3
Acq. Instrument : 1290-DAD                       Location :   P1-D-03
Injection Date  : 1/16/2022 5:33:22 PM               Inj :   1
                                                Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0448-449 2022-01-16 17-11-37\IF-3-90-10-0.5-0.5UL-
                  10MIN.M
Last changed    : 1/16/2022 4:48:35 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0448-449 2022-01-16 17-11-37\IF-3-90-10-0.5-0.5UL-
                  10MIN.M (Sequence Method)
Last changed    : 4/15/2022 1:09:22 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

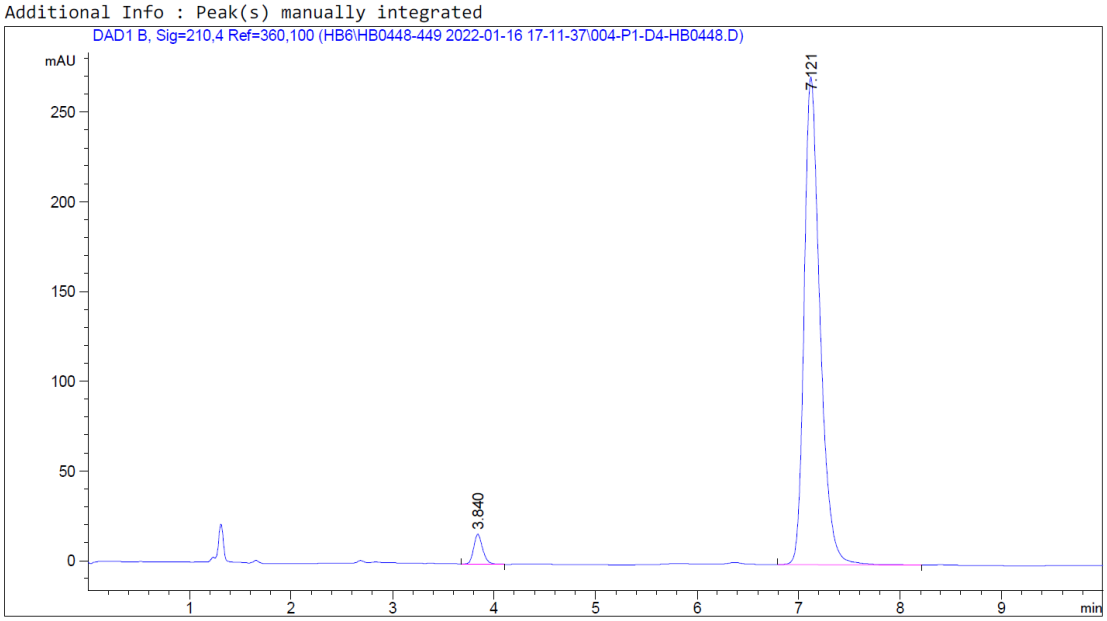



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   3.934 VB    0.0954 1610.66064  256.16379  49.6485
   2   4.868 BV    0.1063   21.01318    2.97911   0.6477
   3   5.139 VB    0.1232   25.90921    3.17523   0.7986
   4   7.304 BB    0.1603 1586.54370  148.95432  48.9051
```

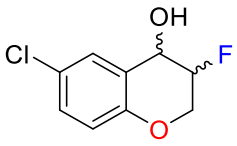


2c

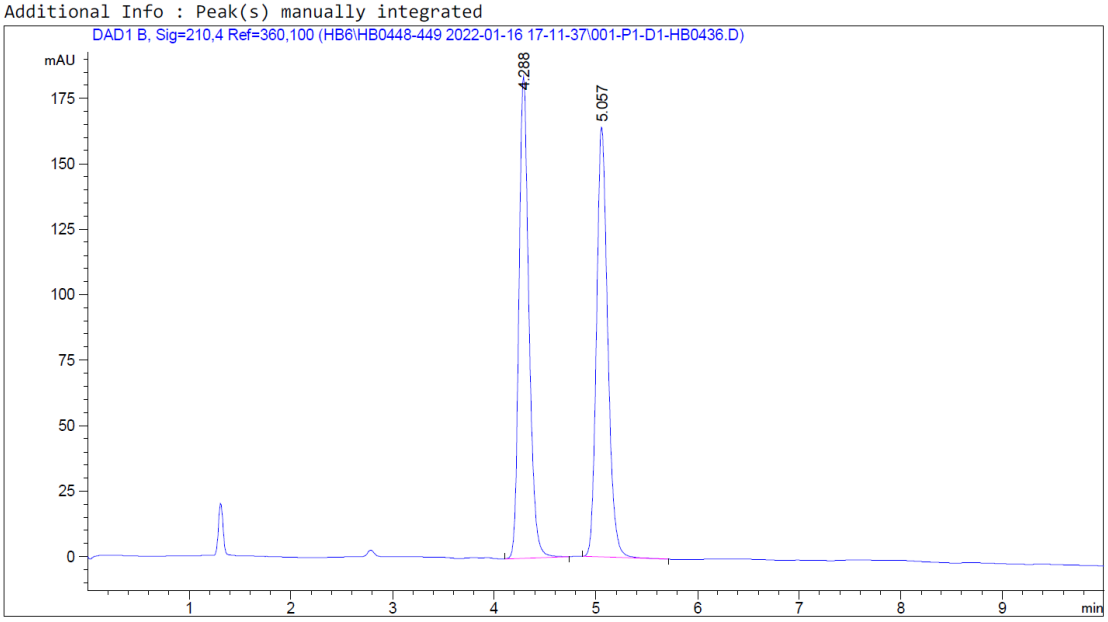
```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   4
Acq. Instrument : 1290-DAD                       Location :   P1-D-04
Injection Date  : 1/16/2022 5:43:48 PM               Inj :   1
                                                Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0448-449 2022-01-16 17-11-37\IF-3-90-10-0.5-0.5UL-
                  10MIN.M
Last changed    : 1/16/2022 4:48:35 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0448-449 2022-01-16 17-11-37\IF-3-90-10-0.5-0.5UL-
                  10MIN.M (Sequence Method)
Last changed    : 4/15/2022 1:09:22 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



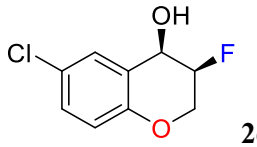

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   3.840 BB    0.0937  102.69276   16.69804   3.3677
   2   7.121 BB    0.1645 2946.64453  271.72641  96.6323

Totals :                  3049.33730  288.42445
```




```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   1
Acq. Instrument : 1290-DAD                       Location :   P1-D-01
Injection Date  : 1/16/2022 5:12:30 PM                Inj :   1
                                               Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0448-449 2022-01-16 17-11-37\IF-3-90-10-0.5-0.5UL-
                  10MIN.M
Last changed    : 1/16/2022 4:48:35 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0448-449 2022-01-16 17-11-37\IF-3-90-10-0.5-0.5UL-
                  10MIN.M (Sequence Method)
Last changed    : 4/15/2022 1:09:22 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

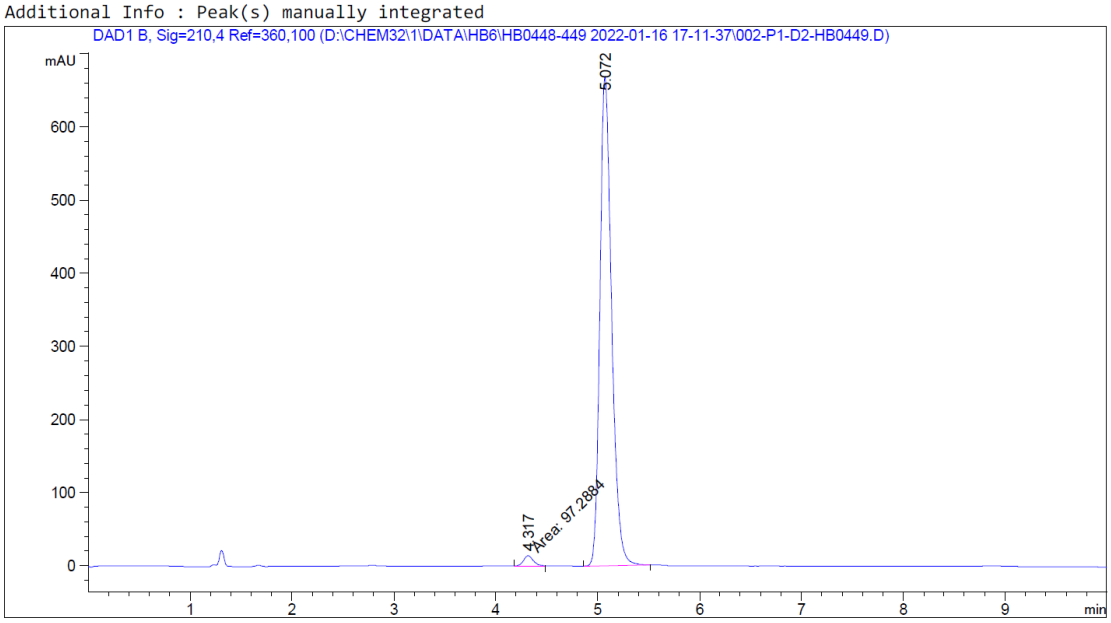



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   4.288 BB    0.1057 1255.98950  183.95157  50.0653
   2   5.057 BB    0.1169 1252.71411  164.35622  49.9347

Totals :                  2508.70361  348.30779
```

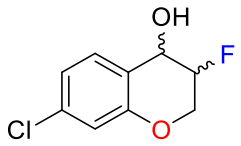


2d

```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Acq. Instrument : 1290-DAD                       Location :   P1-D-02
Injection Date  : 1/16/2022 5:22:56 PM               Inj :   1
                                                Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0448-449 2022-01-16 17-11-37\IF-3-90-10-0.5-0.5UL-
                  10MIN.M
Last changed    : 1/16/2022 4:48:35 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0448-449 2022-01-16 17-11-37\IF-3-90-10-0.5-0.5UL-
                  10MIN.M (Sequence Method)
Last changed    : 4/15/2022 1:09:22 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

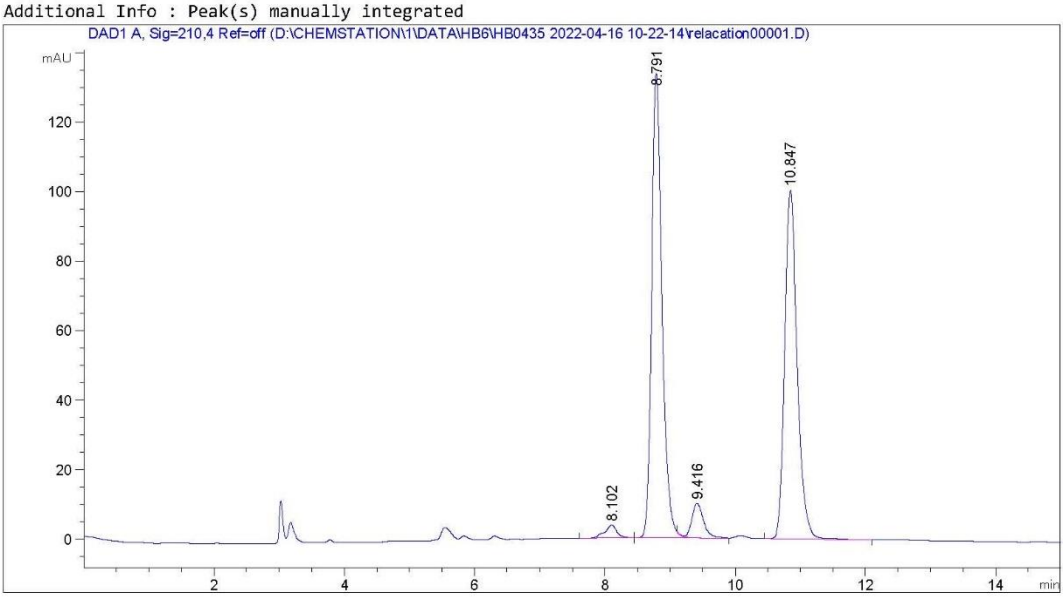



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   4.317 MM    0.1132   97.28838   14.32150   1.7920
   2   5.072 BB    0.1210 5331.71826  669.17145  98.2080

Totals :                  5429.00665  683.49295
```



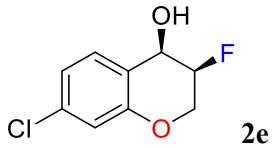
Data File D:\CHEMSTATION\1\DATA\HB6\HB0435 2022-04-16 10-22-14\relacation00001.D
Sample Name: HB0435

```
==========================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-09
Injection Date  : 4/16/2022 10:23:03 AM              Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0435 2022-04-16 10-22-14\hb6_IE-3-90-10-1ML-
                  10min.M
Last changed    : 4/16/2022 10:22:53 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\hb0435 2022-04-16 10-22-14\hb6_IE-3-90-10-1ML-
                  10min.M (Sequence Method)
Last changed    : 4/16/2022 10:58:03 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



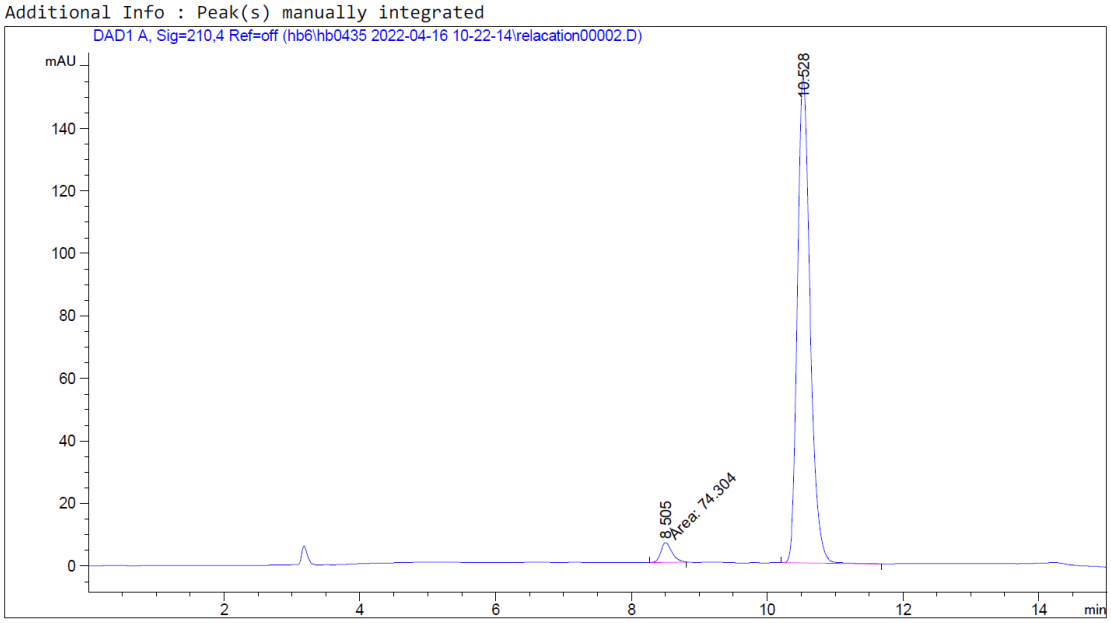

```
==========================================================================
                        Area Percent Report
==========================================================================
Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: DAD1 A, Sig=210,4 Ref=off
```

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.102	BB	0.1901	49.39766	3.74002	1.6609
2	8.791	BV R	0.1664	1472.49548	133.76942	49.5103
3	9.416	VB E	0.1846	121.44904	9.93720	4.0835
4	10.847	BB	0.2027	1330.77722	100.38687	44.7453
Totals :				2974.11941	247.83352	

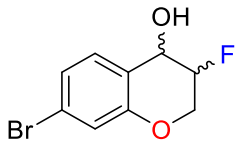


2e

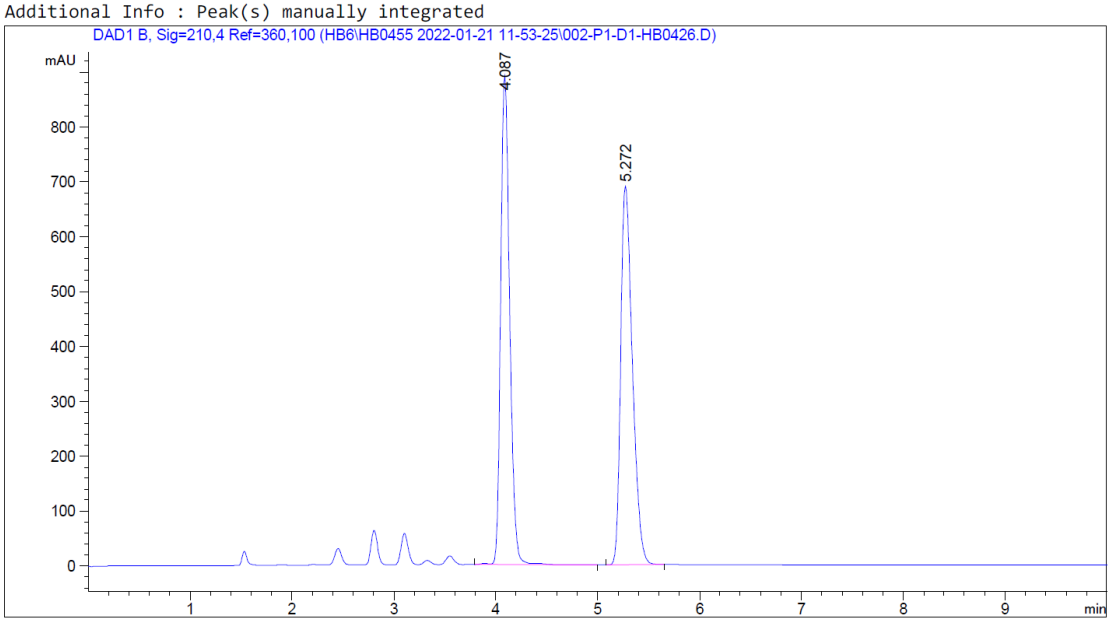
```
=====================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-10
Injection Date  : 4/16/2022 10:38:53 AM              Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0435 2022-04-16 10-22-14\hb6_IE-3-90-10-1ML-
                  10min.M
Last changed    : 4/16/2022 10:22:53 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0435 2022-04-16 10-22-14\hb6_IE-3-90-10-1ML-
                  10min.M (Sequence Method)
Last changed    : 4/16/2022 10:58:03 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



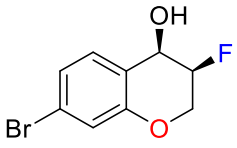

```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.505 MM    0.1935   74.30401    6.40093   3.5543
   2  10.528 BB    0.1992 2016.22791  155.59818  96.4457
```




```
==========================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Acq. Instrument : 1290-DAD                       Location :   P1-D-01
Injection Date  : 1/21/2022 12:04:46 PM               Inj :   1
                                                Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0455 2022-01-21 11-53-25\IE-3-90-10-0.45-0.5UL-10MIN
                  .M
Last changed    : 1/21/2022 11:27:03 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0455 2022-01-21 11-53-25\IE-3-90-10-0.45-0.5UL-10MIN
                  .M (Sequence Method)
Last changed    : 4/15/2022 1:17:13 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

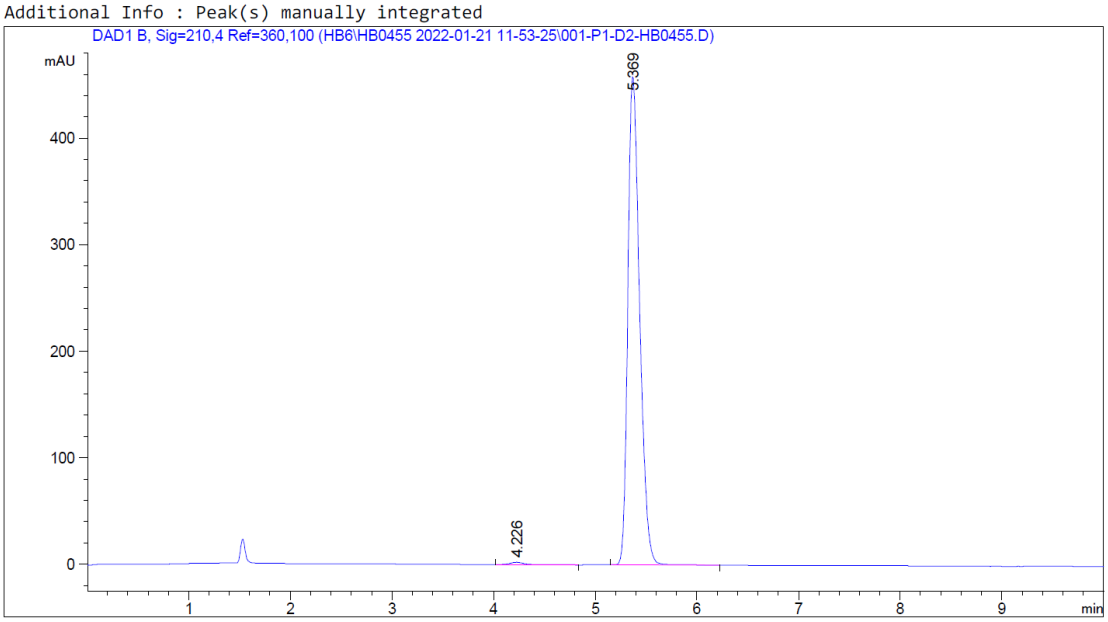



```
==========================================================================
                        Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   4.087 VV R  0.0933 5463.86475  889.47711  49.8246
   2   5.272 BB    0.1230 5502.33984  690.20117  50.1754

Totals :                 1.09662e4  1579.67828
```

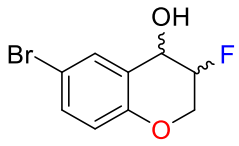


2f

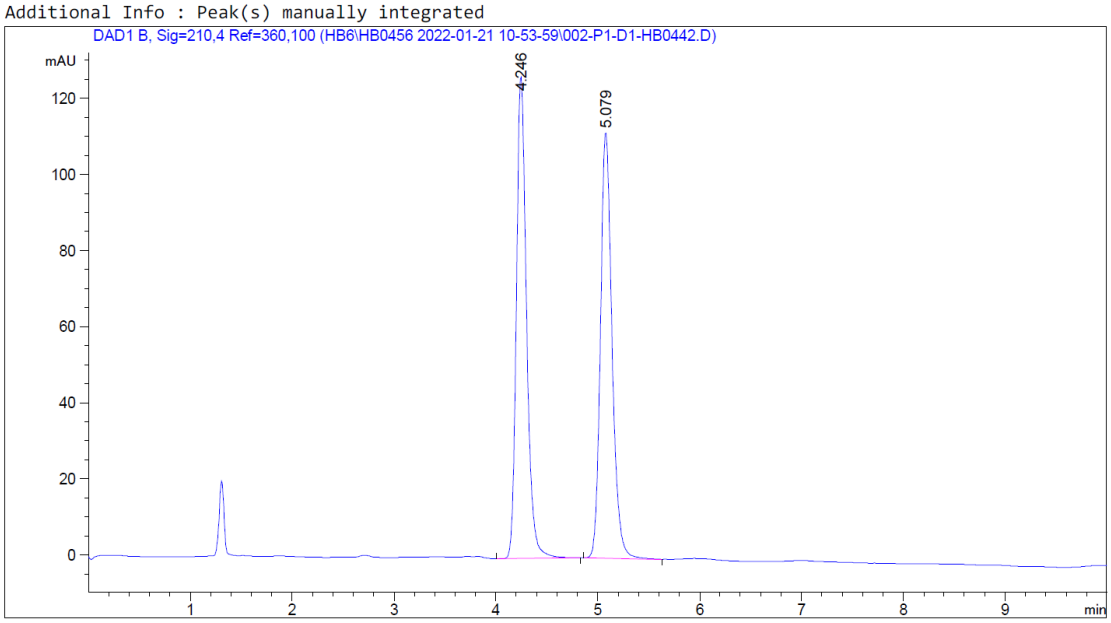
```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   1
Acq. Instrument : 1290-DAD                      Location :   P1-D-02
Injection Date  : 1/21/2022 11:54:20 AM              Inj :   1
                                               Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0455 2022-01-21 11-53-25\IE-3-90-10-0.45-0.5UL-10MIN
                  .M
Last changed    : 1/21/2022 11:27:03 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0455 2022-01-21 11-53-25\IE-3-90-10-0.45-0.5UL-10MIN
                  .M (Sequence Method)
Last changed    : 4/15/2022 1:17:13 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



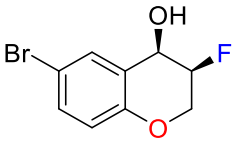

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   4.226 BB    0.1483   24.88840    2.41460   0.6706
   2   5.369 BB    0.1238 3686.73096  458.62585  99.3294

Totals :                  3711.61935  461.04045
```




```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   2
Acq. Instrument : 1290-DAD                      Location :   P1-D-01
Injection Date  : 1/21/2022 11:05:19 AM              Inj :   1
                                               Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0456 2022-01-21 10-53-59\IF-3-90-10-0.5-0.5UL-10MIN.
                  M
Last changed    : 1/16/2022 4:48:35 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0456 2022-01-21 10-53-59\IF-3-90-10-0.5-0.5UL-10MIN.
                  M (Sequence Method)
Last changed    : 4/15/2022 1:15:18 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

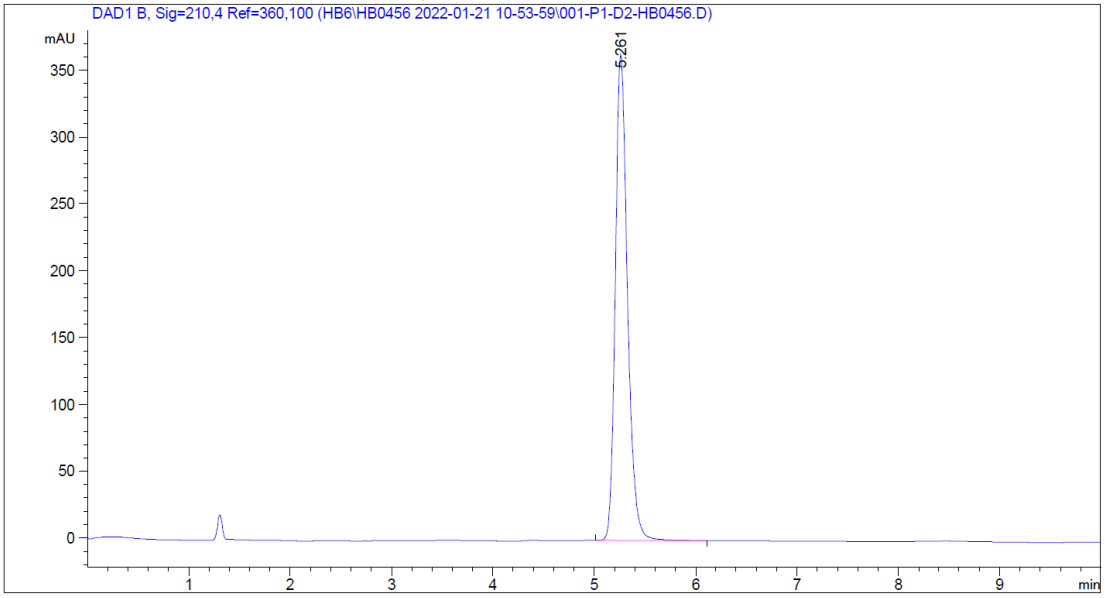



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   4.246 BB    0.1049  878.08563  126.65380  49.9226
   2   5.079 BB    0.1198  880.80896  111.95924  50.0774

Totals :                  1758.89459  238.61304
```

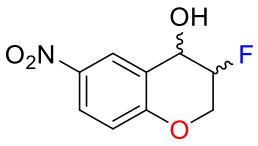


2g

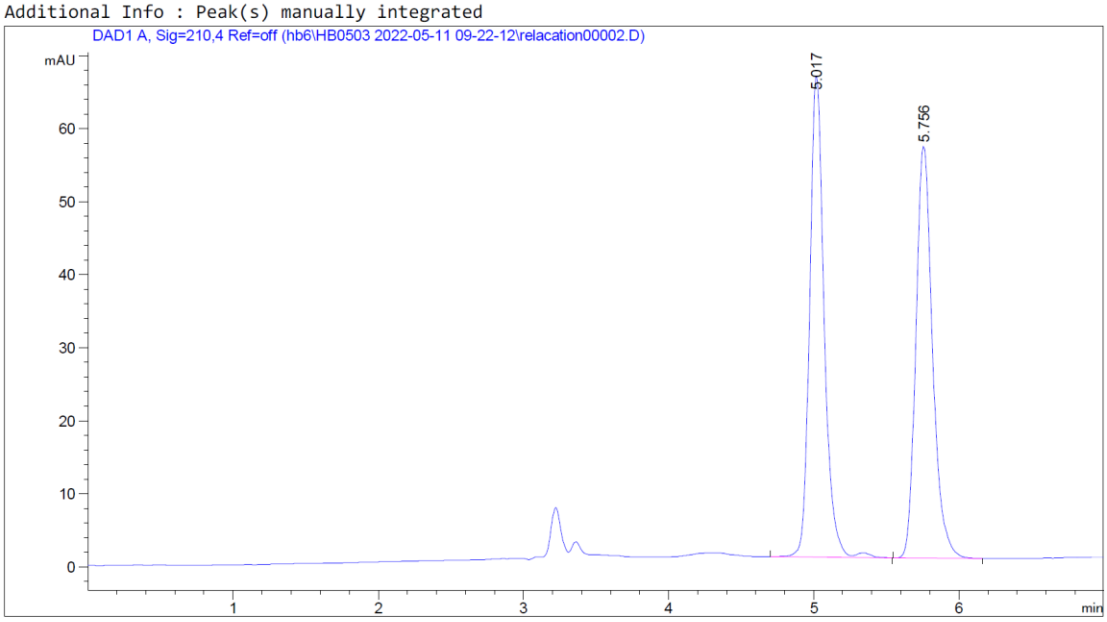
```
==================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   1
Acq. Instrument : 1290-DAD                       Location :   P1-D-02
Injection Date  : 1/21/2022 10:54:53 AM               Inj :   1
                                                Inj Volume : 0.500 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0456 2022-01-21 10-53-59\IF-3-90-10-0.5-0.5UL-10MIN.
                  M
Last changed    : 1/16/2022 4:48:35 PM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0456 2022-01-21 10-53-59\IF-3-90-10-0.5-0.5UL-10MIN.
                  M (Sequence Method)
Last changed    : 4/15/2022 1:15:18 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



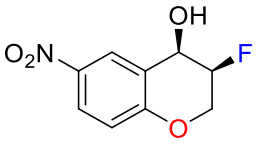

```
==================================================================
                        Area Percent Report
==================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   5.261 BB    0.1274 3033.09717  363.48572 100.0000

Totals :                  3033.09717  363.48572
```




```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-A-02
Injection Date  : 5/11/2022 9:30:54 AM                Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0503 2022-05-11 09-22-12\hb6_IE-3-50-50-1ML-
                  30min.M
Last changed    : 5/11/2022 9:22:21 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\HB0503 2022-05-11 09-22-12\hb6_IE-3-50-50-1ML-
                  30min.M (Sequence Method)
Last changed    : 5/11/2022 9:43:57 AM by SYSTEM
Additional Info : Peak(s) manually integrated
```

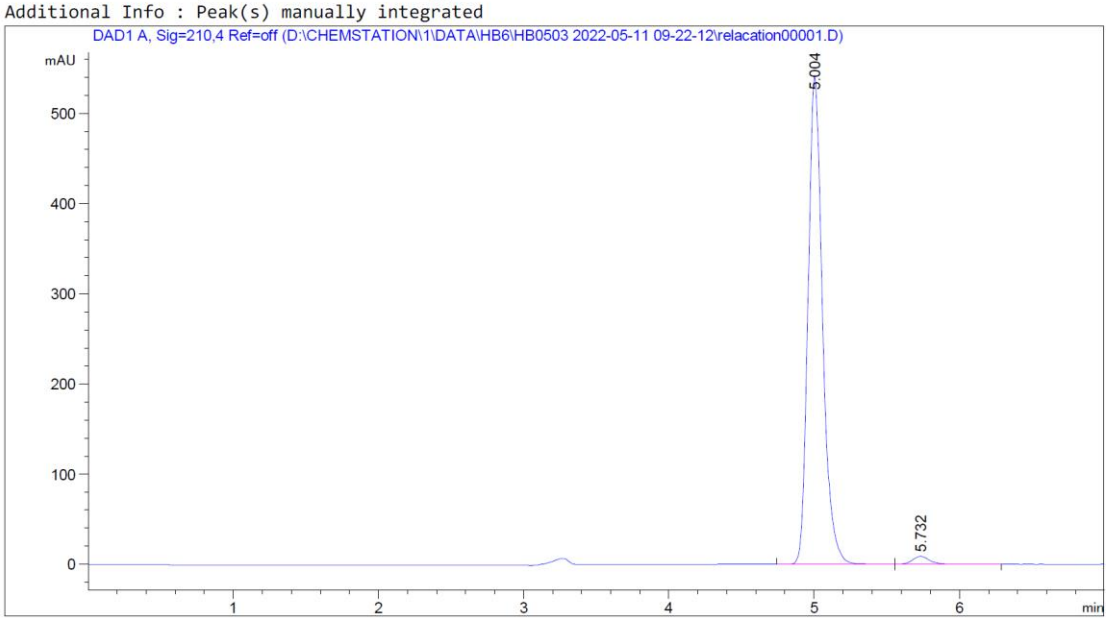



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   5.017 BV R  0.1050  457.99380   66.00484  50.4161
   2   5.756 BB    0.1231  450.43417   56.44759  49.5839

Totals :                  908.42798  122.45243
```

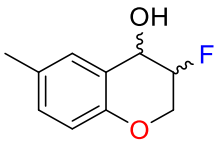


2h

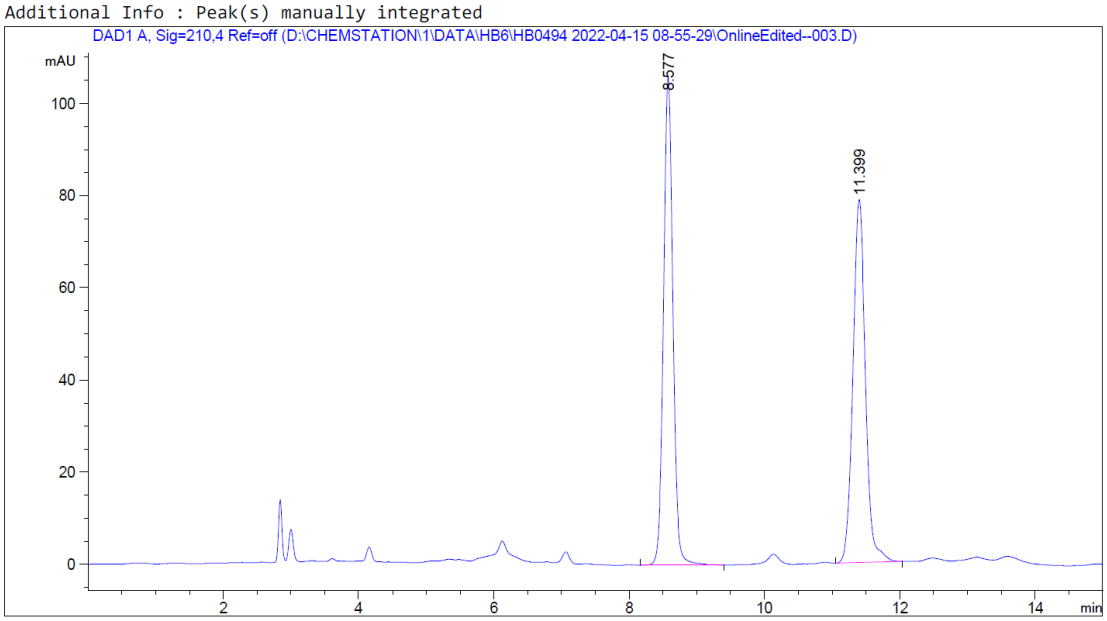
```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-A-01
Injection Date  : 5/11/2022 9:23:03 AM                Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 5.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0503 2022-05-11 09-22-12\hb6_IE-3-50-50-1ML-
                  30min.M
Last changed    : 5/11/2022 9:22:21 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0503 2022-05-11 09-22-12\hb6_IE-3-50-50-1ML-
                  30min.M (Sequence Method)
Last changed    : 5/11/2022 9:42:58 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



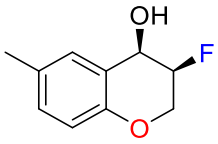

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   5.004 BV    0.1067 3738.42480  540.69000  98.0800
   2   5.732 VB    0.1274   73.18188    8.76197   1.9200
```




```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   3
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-D-09
Injection Date  : 4/15/2022 9:32:58 AM               Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0494 2022-04-15 08-55-29\hb6_IF-3-90-10-1ML-
                  30min.M
Last changed    : 4/15/2022 9:33:34 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0494 2022-04-15 08-55-29\hb6_IF-3-90-10-1ML-
                  30min.M (Sequence Method)
Last changed    : 4/15/2022 9:51:51 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

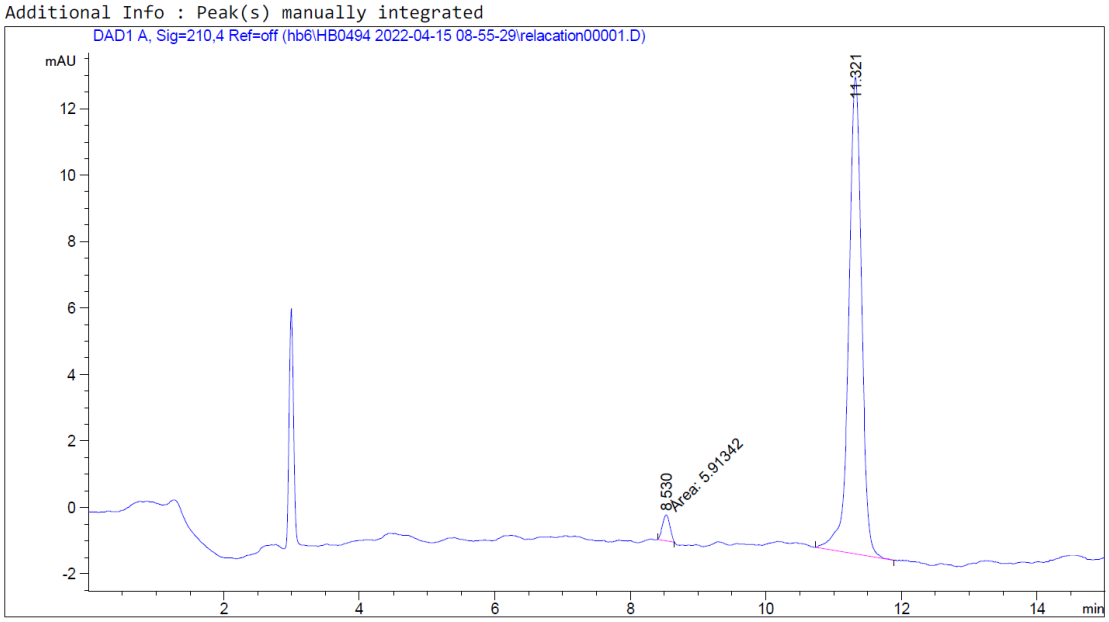



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.577 BB    0.1454 1010.66382  105.88894  50.0347
   2  11.399 BB    0.1974 1009.26031   78.83788  49.9653
```

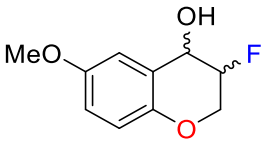


2i

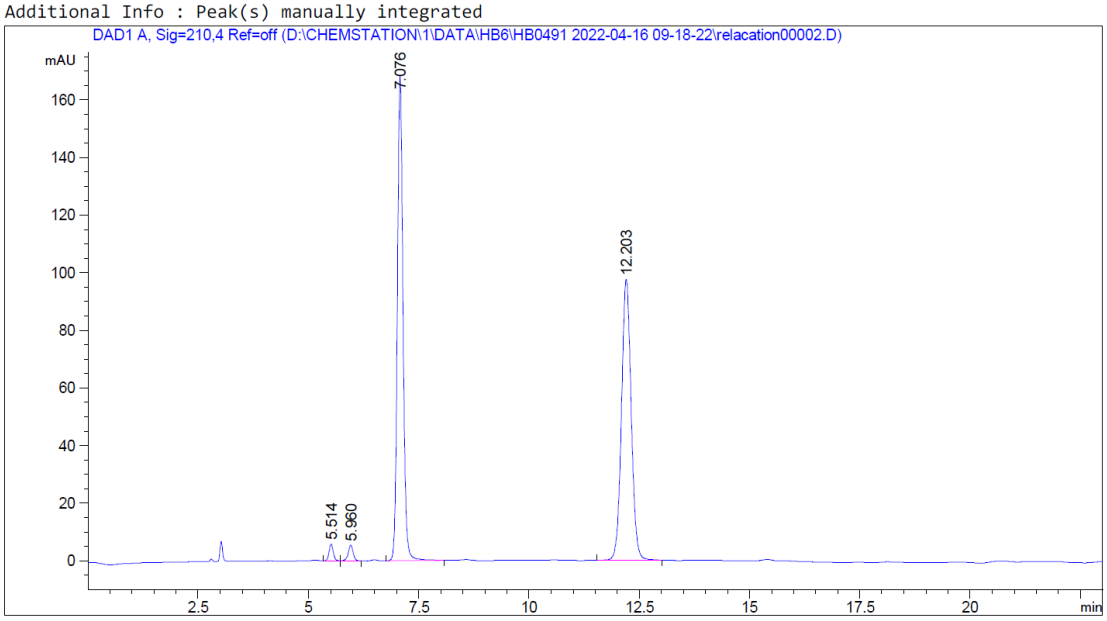
```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-06
Injection Date  : 4/15/2022 8:56:18 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0494 2022-04-15 08-55-29\hb6_IF-3-90-10-1ML-
                  30min.M
Last changed    : 4/15/2022 8:56:40 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0494 2022-04-15 08-55-29\hb6_IF-3-90-10-1ML-
                  30min.M (Sequence Method)
Last changed    : 4/15/2022 9:51:51 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



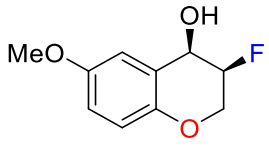

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.530 MM    0.1260    5.91342 7.82083e-1   3.0564
   2  11.321 BB    0.2005  187.56075   14.34489  96.9436
```




```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-08
Injection Date  : 4/16/2022 9:43:01 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0491 2022-04-16 09-18-22\hb6_IF-3-70-30-1ML-
                  30min.M
Last changed    : 4/16/2022 9:41:34 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0491 2022-04-16 09-18-22\hb6_IF-3-70-30-1ML-
                  30min.M (Sequence Method)
Last changed    : 4/16/2022 10:12:12 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

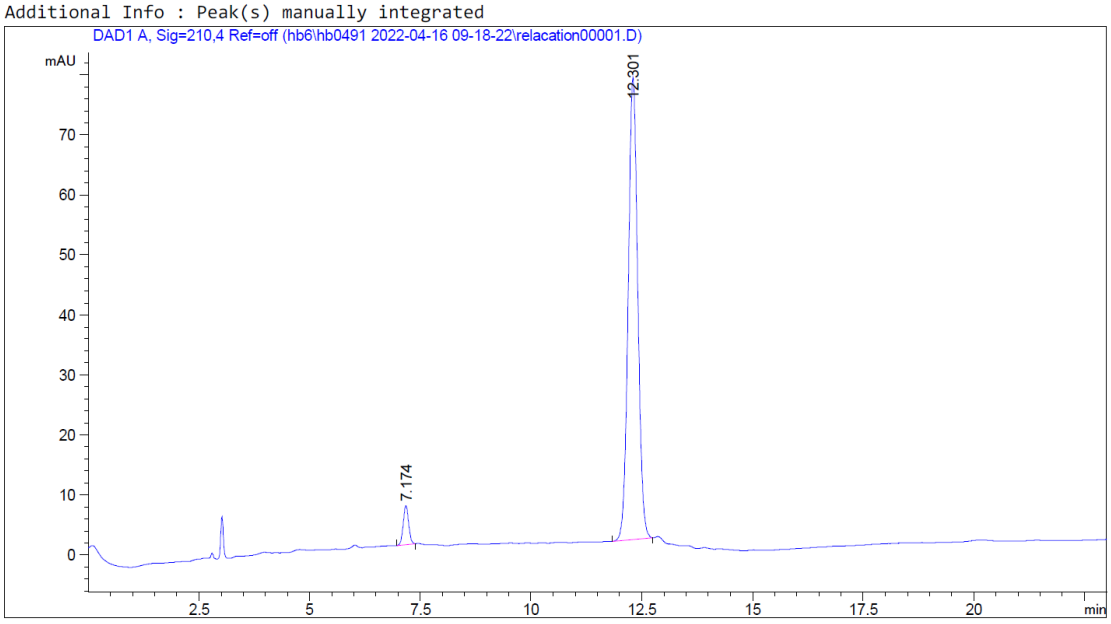



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   5.514 BB    0.1000   37.78038    5.80128   1.2369
   2   5.960 BB    0.1128   40.48632    5.44117   1.3254
   3   7.076 BB    0.1351 1488.45520  168.39778  48.7289

   4  12.203 BB    0.2361 1487.83911   97.46669  48.7088

Totals :                  3054.56101  277.10693
```

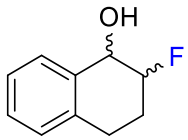


2j

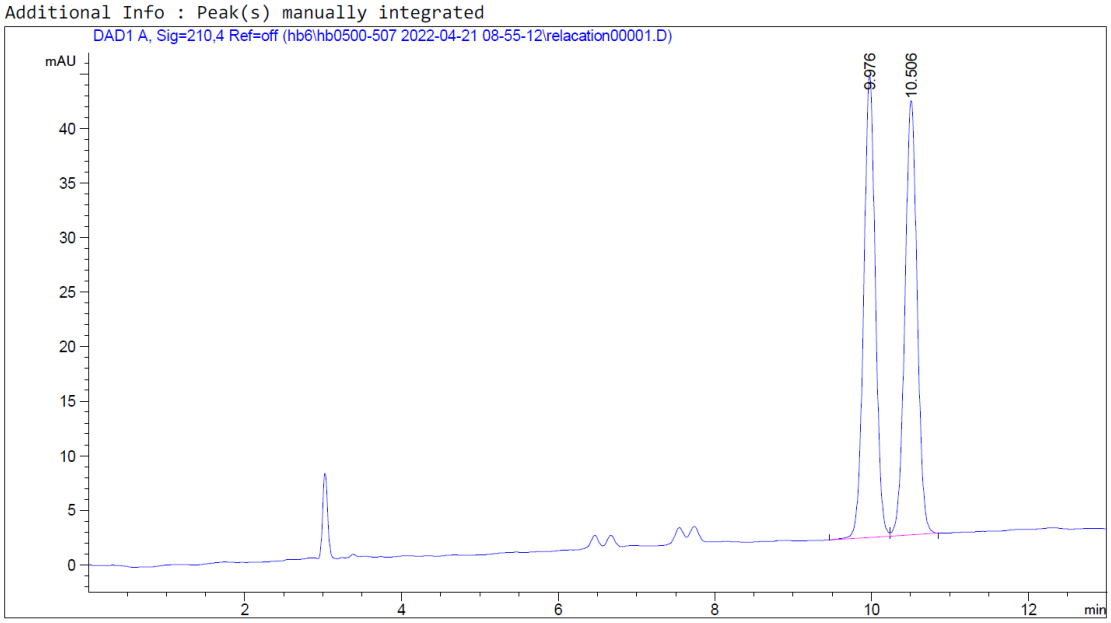
```
==================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-07
Injection Date  : 4/16/2022 9:19:12 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0491 2022-04-16 09-18-22\hb6_IF-3-70-30-1ML-
                  30min.M
Last changed    : 4/16/2022 9:41:34 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\hb0491 2022-04-16 09-18-22\hb6_IF-3-70-30-1ML-
                  30min.M (Sequence Method)
Last changed    : 4/16/2022 10:12:12 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



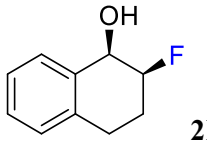

```
==================================================================
                        Area Percent Report
==================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   7.174 BB    0.1309   54.90629    6.47710   4.5483
   2  12.301 BB    0.2325 1152.27161   77.02238  95.4517
```




```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-D-01
Injection Date  : 4/21/2022 8:56:04 AM                Inj :   1
                                                 Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 1/12/2022 9:06:58 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:09:25 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

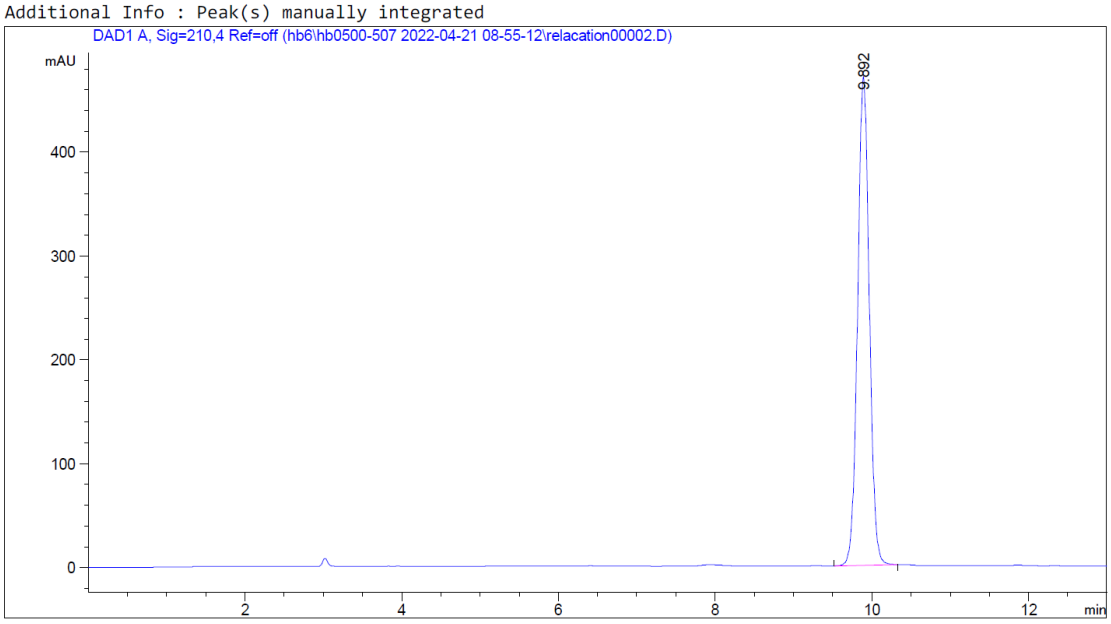



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   9.976 BV    0.1606  436.86185   42.25964  50.1593
   2  10.506 VB    0.1692  434.08661   39.80902  49.8407
```

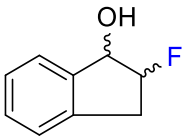


2k

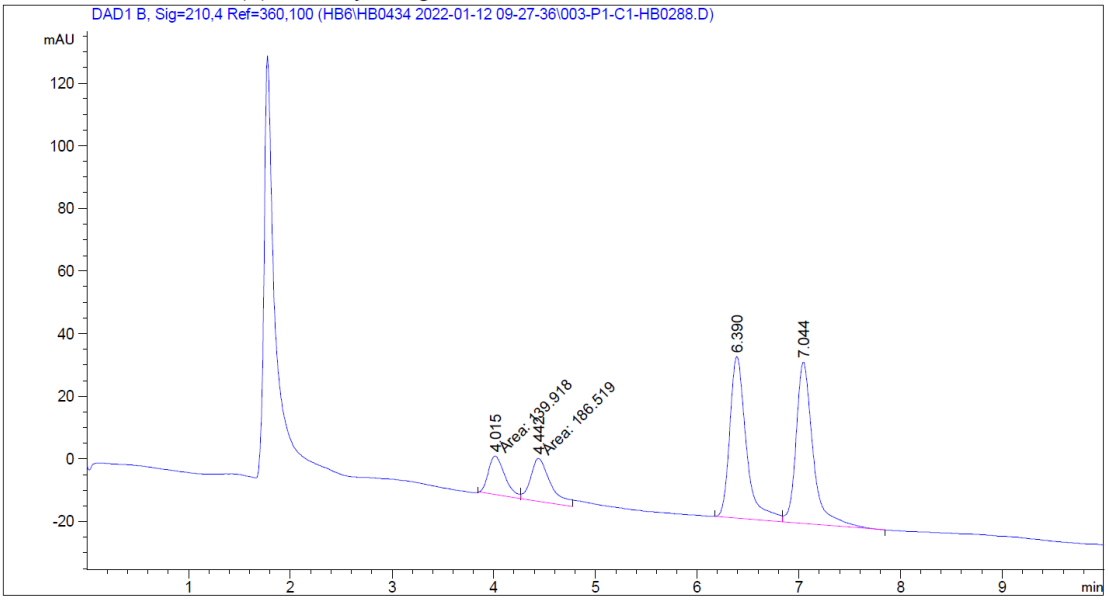
```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-D-02
Injection Date  : 4/21/2022 9:09:54 AM                Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 1/12/2022 9:06:58 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:09:25 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



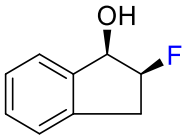

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   9.892 BB    0.1587 4864.91992  470.38858 100.0000

Totals :                  4864.91992  470.38858
```




```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   3
Acq. Instrument : 1290-DAD                       Location :   P1-C-01
Injection Date  : 1/12/2022 9:47:35 AM                Inj :   1
                                                Inj Volume : 0.500 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0434 2022-01-12 09-27-36\IE-3-95-5-0.4-0.5UL-8MIN.M
Last changed    : 1/12/2022 9:38:12 AM by SYSTEM
Analysis Method : d:\Chem32\1\Data\HB6\HB0434 2022-01-12 09-27-36\IE-3-95-5-0.4-0.5UL-8MIN.M
                  (Sequence Method)
Last changed    : 4/15/2022 2:22:07 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

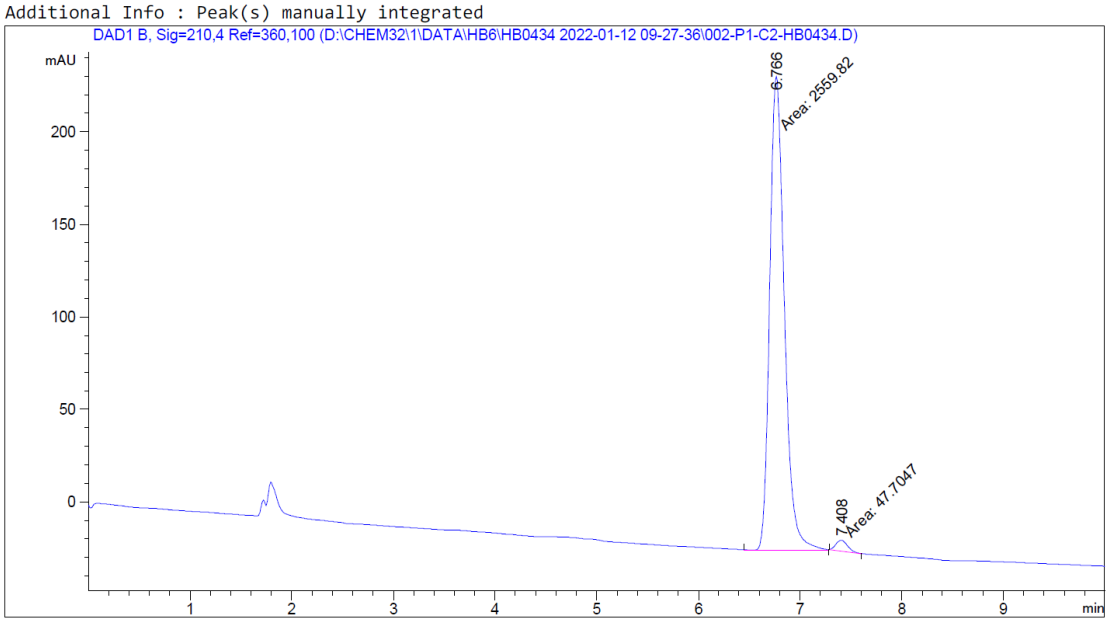



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   4.015 MF    0.1895  139.91812   12.30830   9.3194
   2   4.442 FM    0.2277  186.51871   13.65295  12.4233
   3   6.390 BV    0.1699  582.71686   51.55563  38.8127
   4   7.044 VB    0.1720  592.20355   51.54663  39.4445
```

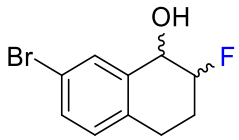


21

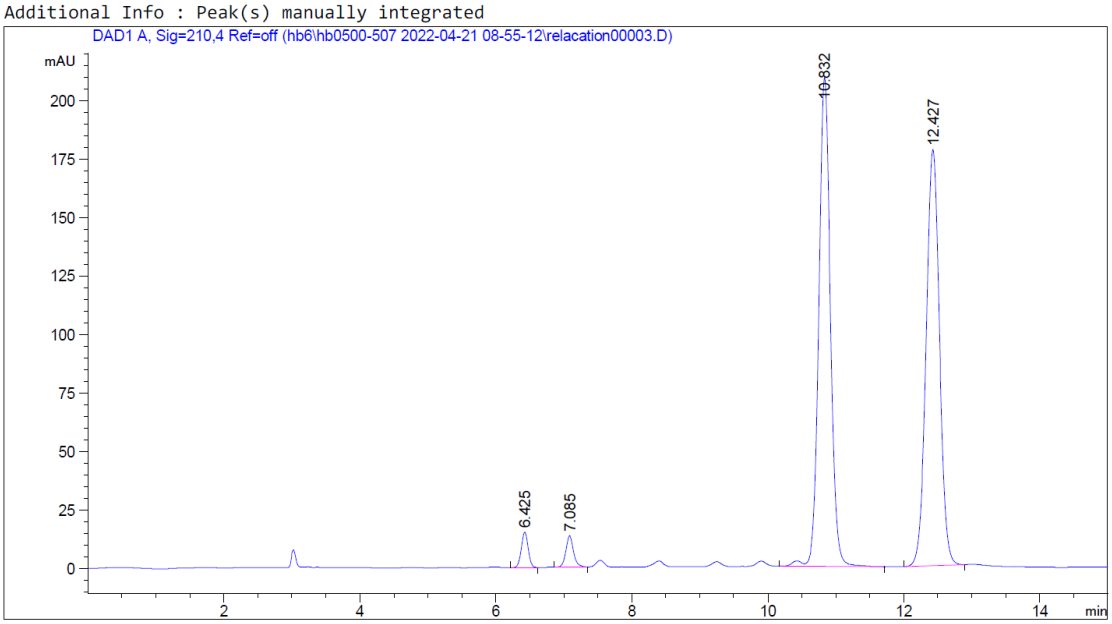
```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   2
Acq. Instrument : 1290-DAD                      Location :   P1-C-02
Injection Date  : 1/12/2022 9:36:48 AM               Inj :   1
                                              Inj Volume : 0.500 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 1.000 µl
Acq. Method     : d:\Chem32\1\Data\HB6\HB0434 2022-01-12 09-27-36\IE-3-95-5-0.4-0.5UL-8MIN.M
Last changed    : 1/12/2022 9:38:12 AM by SYSTEM
                  (modified after loading)
Analysis Method : d:\Chem32\1\Data\HB6\HB0434 2022-01-12 09-27-36\IE-3-95-5-0.4-0.5UL-8MIN.M
                  (Sequence Method)
Last changed    : 4/15/2022 2:22:07 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



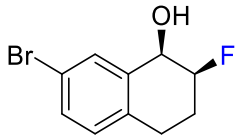

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 B, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.766 MM    0.1667 2559.81787  255.96498  98.1705
   2   7.408 MM    0.1339   47.70472    5.93678   1.8295

Totals :                  2607.52259  261.90176
```




```
=====================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   3
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-D-03
Injection Date  : 4/21/2022 9:23:42 AM                Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/21/2022 9:24:16 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:09:25 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

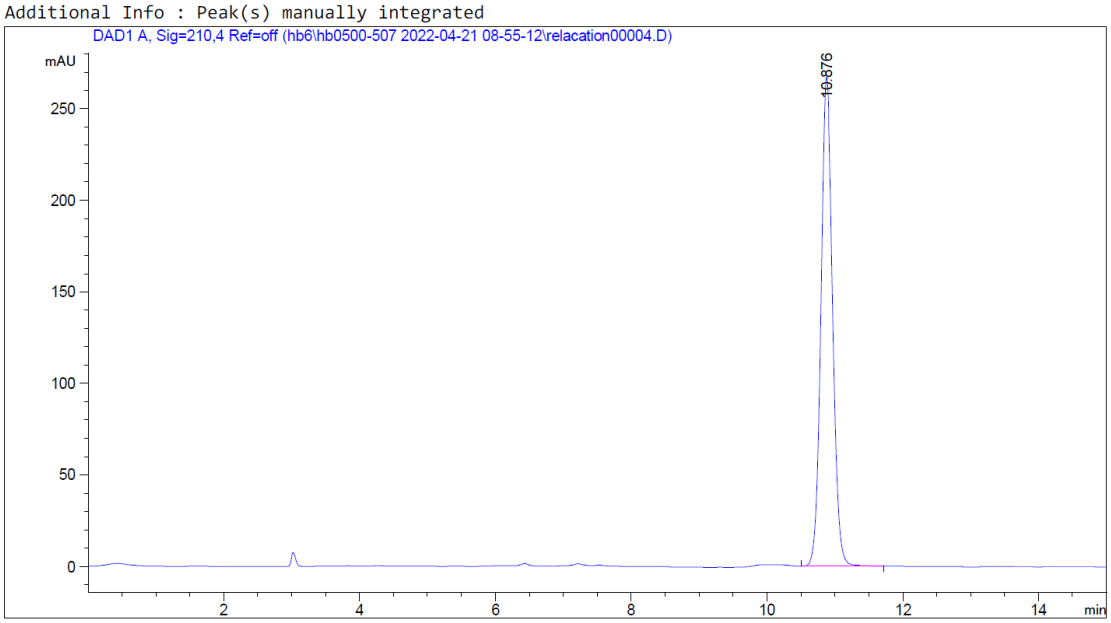



```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.425 BB    0.1057  103.16124   15.10779   2.0211
   2   7.085 BB    0.1200  106.25610   13.47160   2.0818

   3  10.832 VB R  0.1810 2477.78882  209.00507  48.5447
   4  12.427 BB    0.2106 2416.93628  177.82518  47.3524

Totals :                  5104.14244  415.40964
```

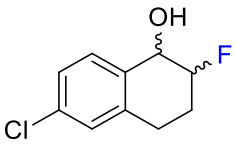


2m

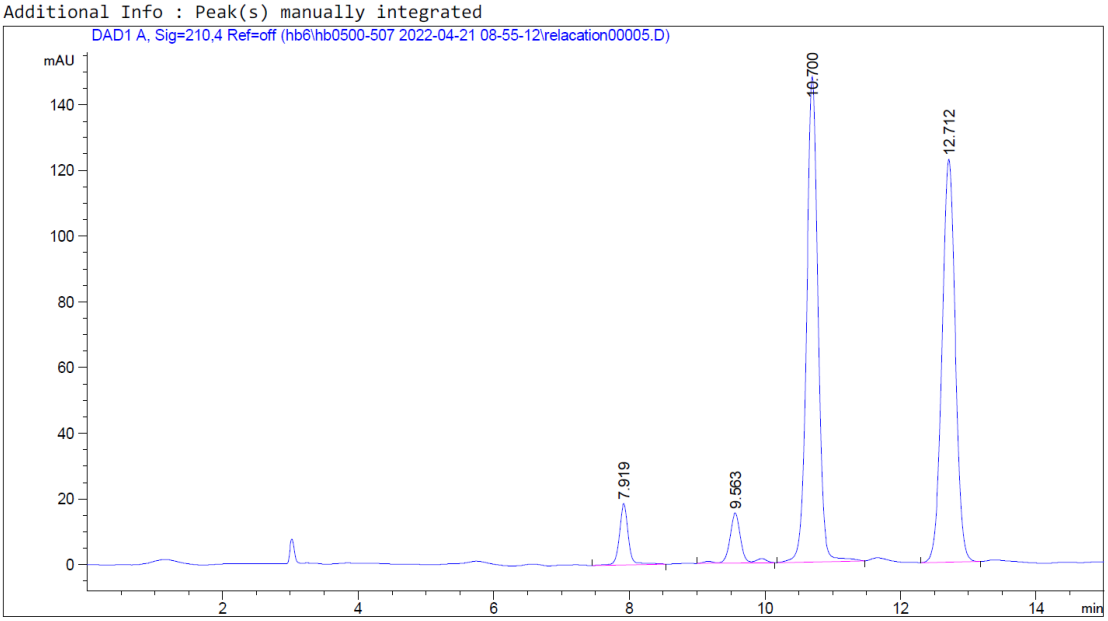
```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   4
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-04
Injection Date  : 4/21/2022 9:39:31 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/21/2022 9:24:16 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:09:25 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



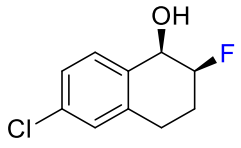

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.876 BB    0.1825 3174.99268  267.35388 100.0000

Totals :                  3174.99268  267.35388
```




```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   5
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-05
Injection Date  : 4/21/2022 9:55:20 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/21/2022 9:24:16 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:09:25 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

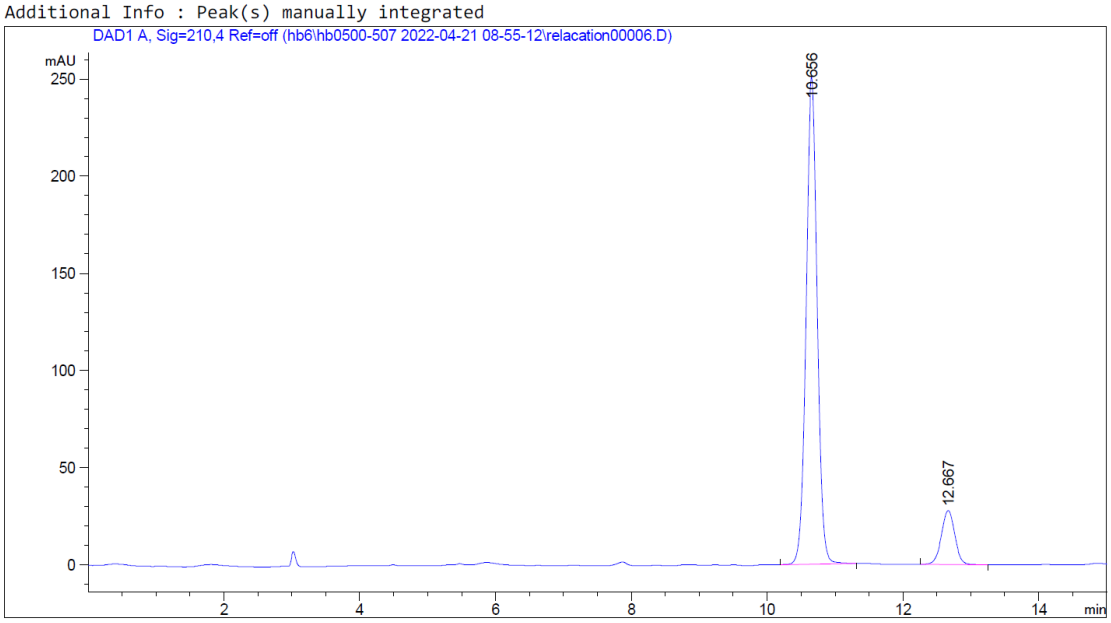



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   7.919 BB    0.1396  172.13202   18.66072   4.6121
   2   9.563 VV R  0.1662  178.40820   15.26559   4.7803
   3  10.700 BB    0.1776 1716.37402  147.72502  45.9888

   4  12.712 BB    0.2105 1665.24536  122.61124  44.6188

Totals :                  3732.15961  304.26257
```

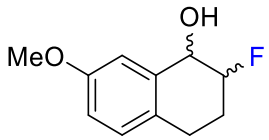


2n

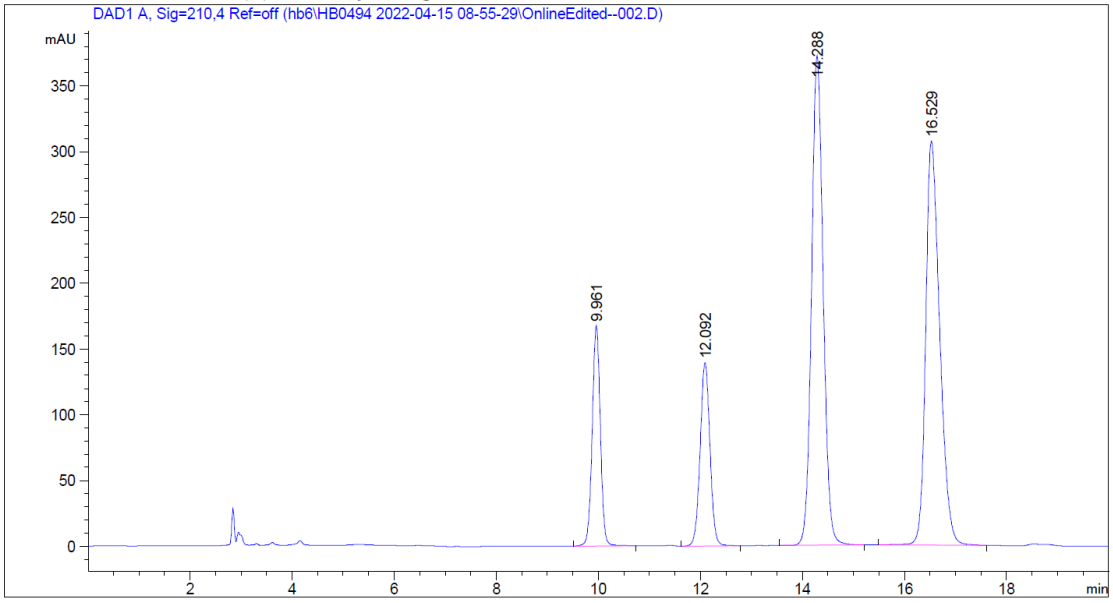
```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   6
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-06
Injection Date  : 4/21/2022 10:11:09 AM              Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/21/2022 9:24:16 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:09:25 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



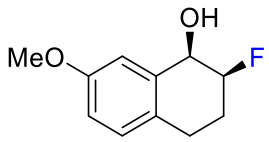

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.656 BB    0.1743 2843.49219  250.78300  88.2430
   2  12.667 BB    0.2110  378.85104   27.80083  11.7570
```




```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-05
Injection Date  : 4/15/2022 9:12:08 AM               Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0494 2022-04-15 08-55-29\hb6_IF-3-90-10-1ML-
                  30min.M
Last changed    : 4/15/2022 9:24:17 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0494 2022-04-15 08-55-29\hb6_IF-3-90-10-1ML-
                  30min.M (Sequence Method)
Last changed    : 4/15/2022 9:51:51 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

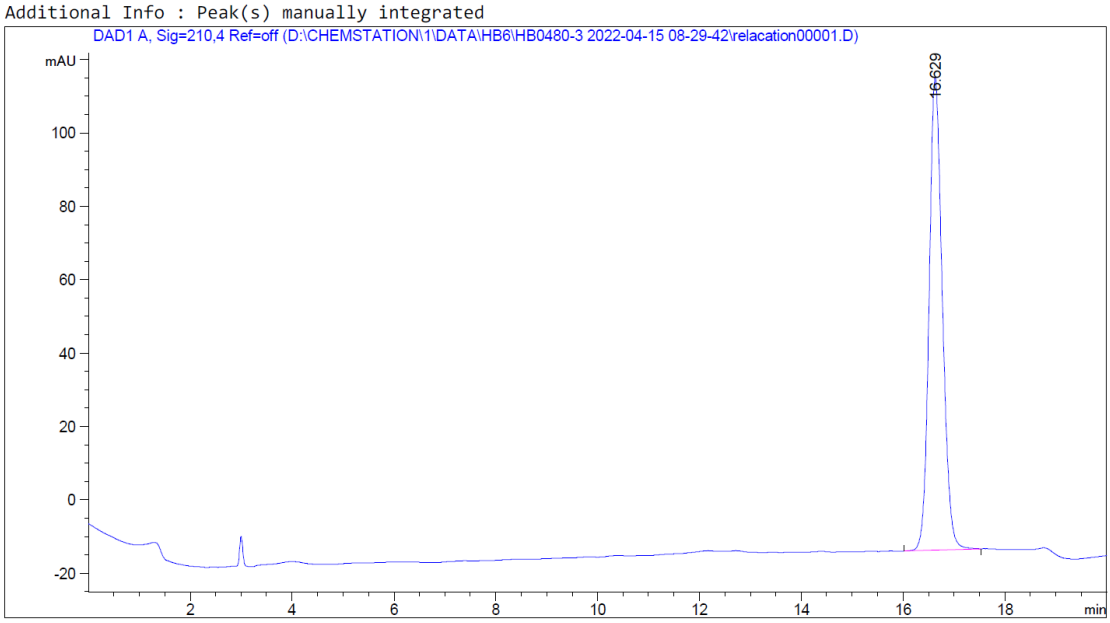



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   9.961 BB    0.1709 1853.91919  167.73854  11.9943
   2  12.092 BB    0.2062 1868.16284  139.51624  12.0865
   3  14.288 BB    0.2419 5870.72070  372.39542  37.9819
   4  16.529 BB    0.2906 5863.83984  307.29147  37.9373

Totals :                 1.54566e4   986.94167
```

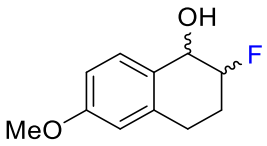


2o

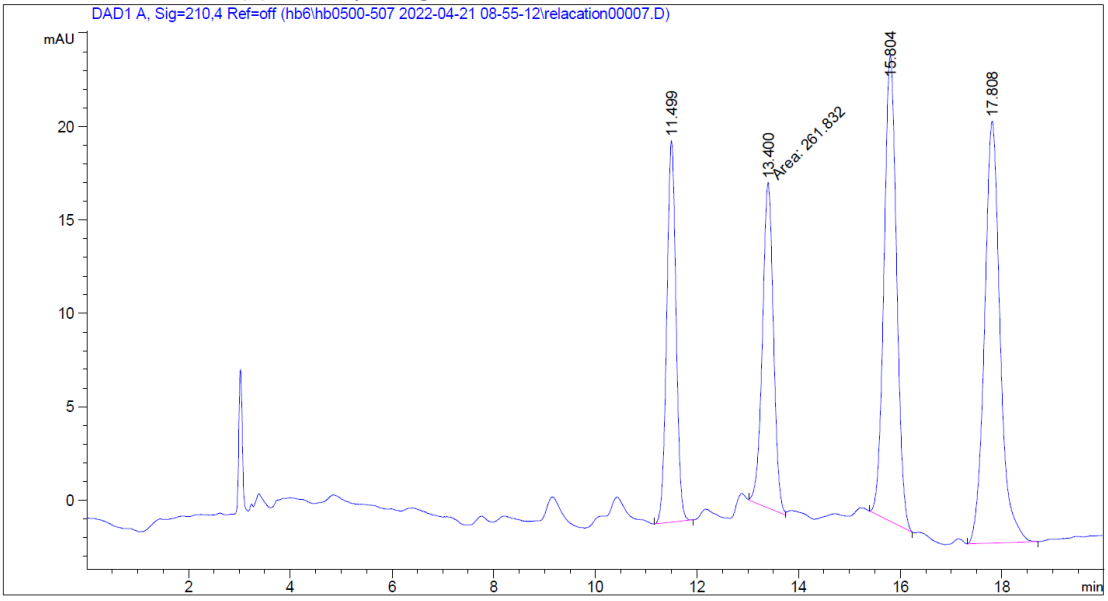
```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-05
Injection Date  : 4/15/2022 8:30:32 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0480-3 2022-04-15 08-29-42\hb6_IF-3-90-10-1ML-
                  30min.M
Last changed    : 4/15/2022 8:29:53 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0480-3 2022-04-15 08-29-42\hb6_IF-3-90-10-1ML-
                  30min.M (Sequence Method)
Last changed    : 4/15/2022 9:57:44 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



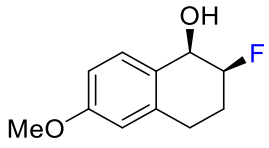

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  16.629 BB    0.2765 2322.59009  128.73792 100.0000
```




```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   7
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-D-07
Injection Date  : 4/21/2022 10:26:58 AM               Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/21/2022 10:26:59 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:09:25 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

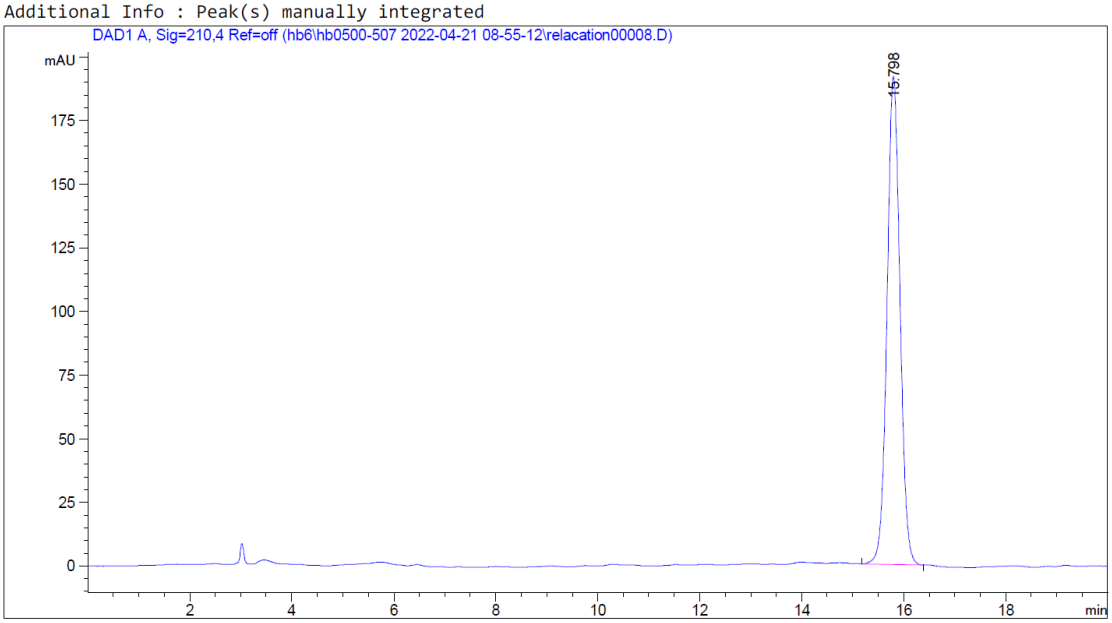



```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  11.499 BB    0.1956  258.59717   20.43511  18.1188
   2  13.400 MM    0.2506  261.83215   17.41634  18.3455

   3  15.804 BB    0.2662  427.71014   24.92516  29.9679
   4  17.808 BB    0.3195  479.09048   22.57970  33.5679

Totals :                  1427.22995   85.35631
```

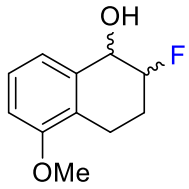


2p

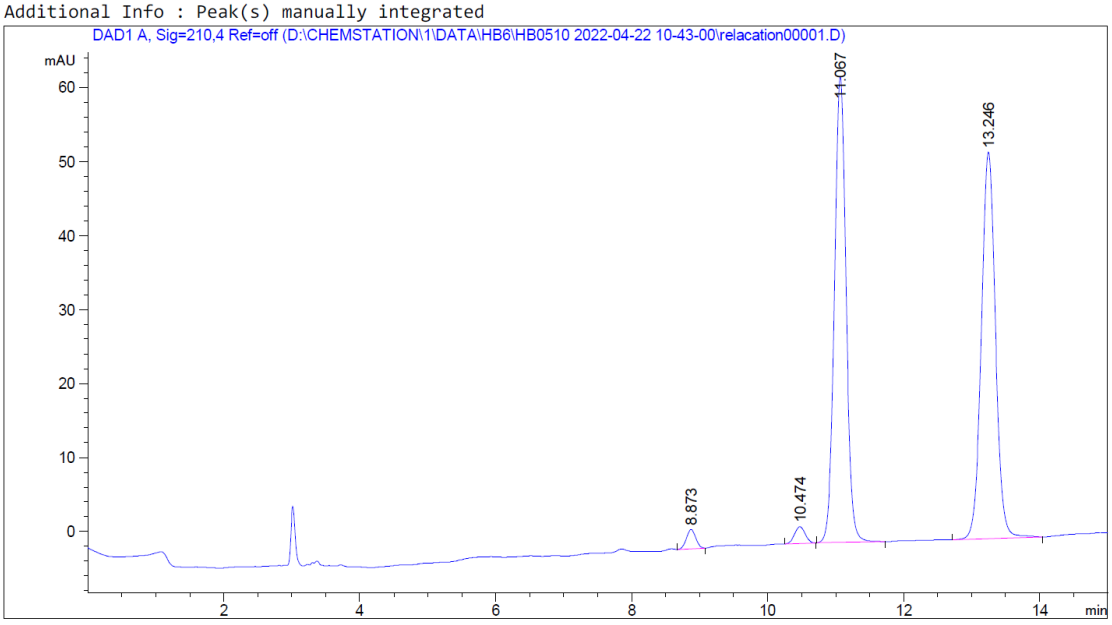
```
======================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   8
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-08
Injection Date  : 4/21/2022 10:47:48 AM              Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/21/2022 10:26:59 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:09:25 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  15.798 BB    0.2714 3376.19116  191.74646 100.0000

Totals :                  3376.19116  191.74646
```



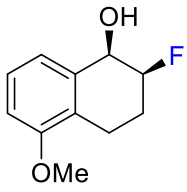

```
======================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-D-06
Injection Date  : 4/22/2022 10:43:49 AM               Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0510 2022-04-22 10-43-00\hb6_IF-3-90-10-1ML-
                  13min.M
Last changed    : 4/22/2022 10:43:37 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0510 2022-04-22 10-43-00\hb6_IF-3-90-10-1ML-
                  13min.M (Sequence Method)
Last changed    : 4/22/2022 11:45:29 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```




```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.873 BB    0.1448   24.19081    2.59424   1.5681
   2  10.474 BB    0.1685   24.03299    2.25277   1.5579
```

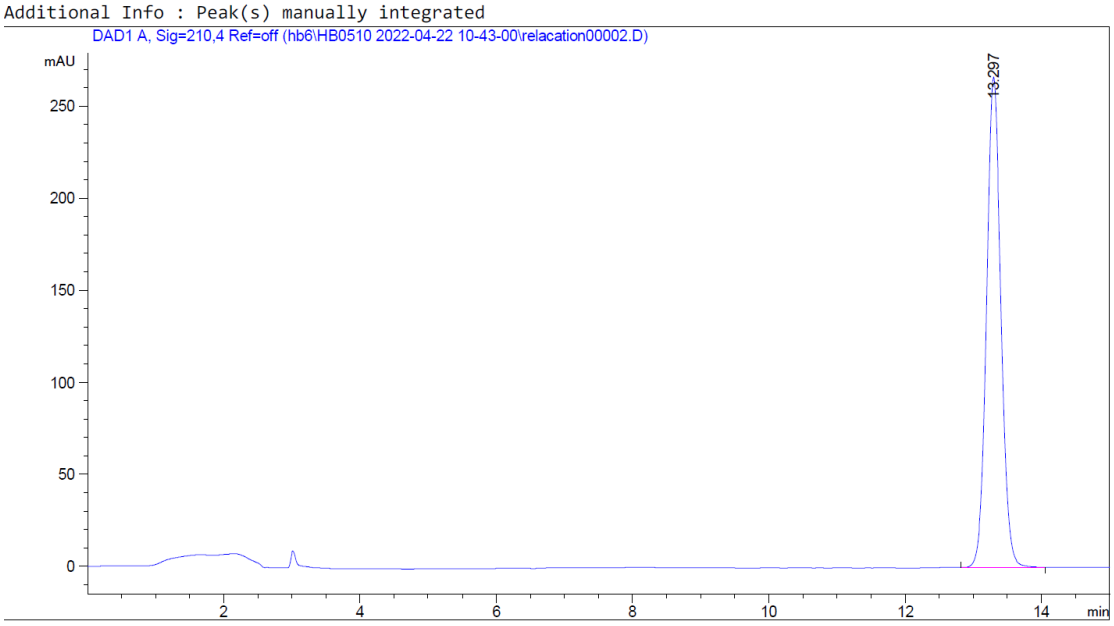
3	11.067	BB	0.1816	743.15253	62.99266	48.1724
4	13.246	BB	0.2197	751.31750	52.26147	48.7017

Totals : 1542.69382 120.10114

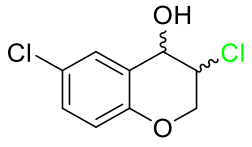


2q

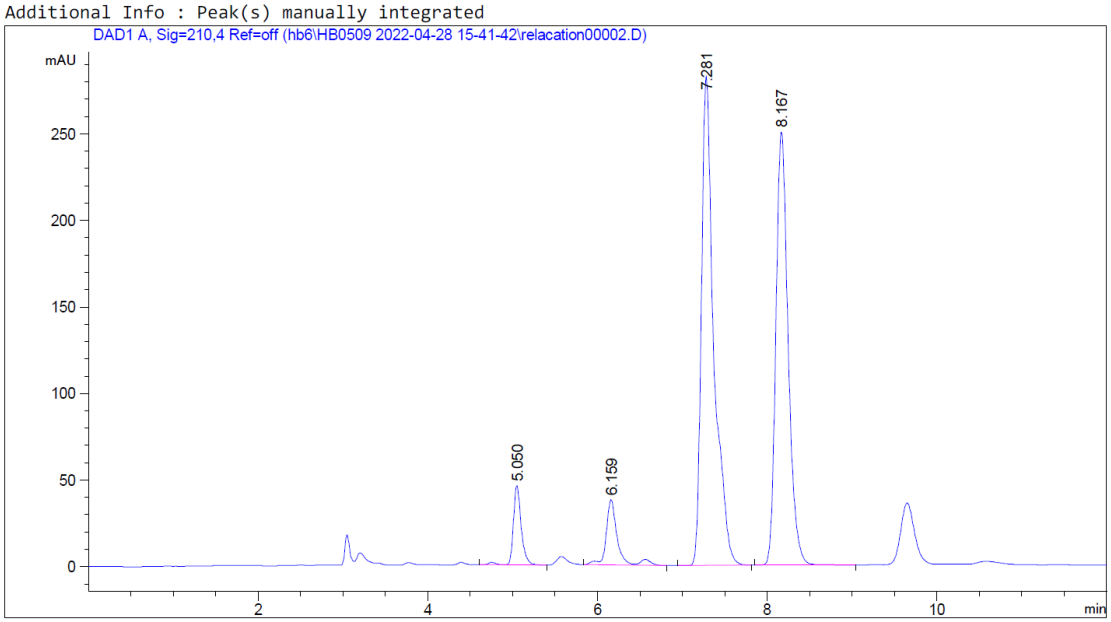
```
==================================================================
Acq. Operator   : SYSTEM                      Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                          Location :   P2-D-07
Injection Date  : 4/22/2022 10:59:38 AM            Inj :   1
                                             Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0510 2022-04-22 10-43-00\hb6_IF-3-90-10-1ML-
                  13min.M
Last changed    : 4/22/2022 10:43:37 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\HB0510 2022-04-22 10-43-00\hb6_IF-3-90-10-1ML-
                  13min.M (Sequence Method)
Last changed    : 4/22/2022 11:45:29 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



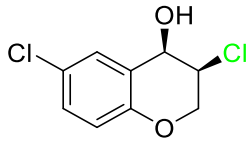

```
==================================================================
                        Area Percent Report
==================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  13.297 BB    0.2244 3886.76196  266.11545 100.0000

Totals :                  3886.76196  266.11545
```



```
==========================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P1-F-03
Injection Date  : 4/28/2022 3:55:29 PM              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0509 2022-04-28 15-41-42\hb6_IE-3-90-10-1ML-
                  10min.M
Last changed    : 4/28/2022 3:41:56 PM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\HB0509 2022-04-28 15-41-42\hb6_IE-3-90-10-1ML-
                  10min.M (Sequence Method)
Last changed    : 4/28/2022 4:09:10 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

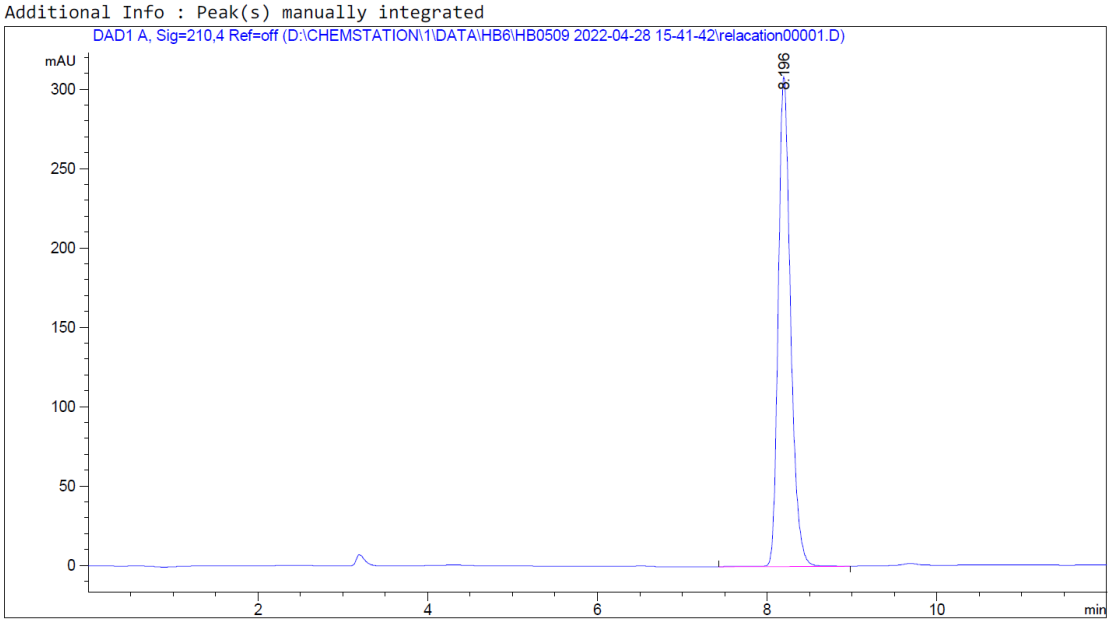



```
==========================================================================
                        Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   5.050 VB R  0.0957  297.97076   45.73538   4.9404
   2   6.159 VV R  0.1221  352.60867   37.67241   5.8463
   3   7.281 BB    0.1490 2881.44800  282.57953  47.7751
   4   8.167 BB    0.1524 2499.24805  250.47849  41.4381
```

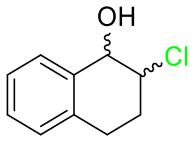


2r

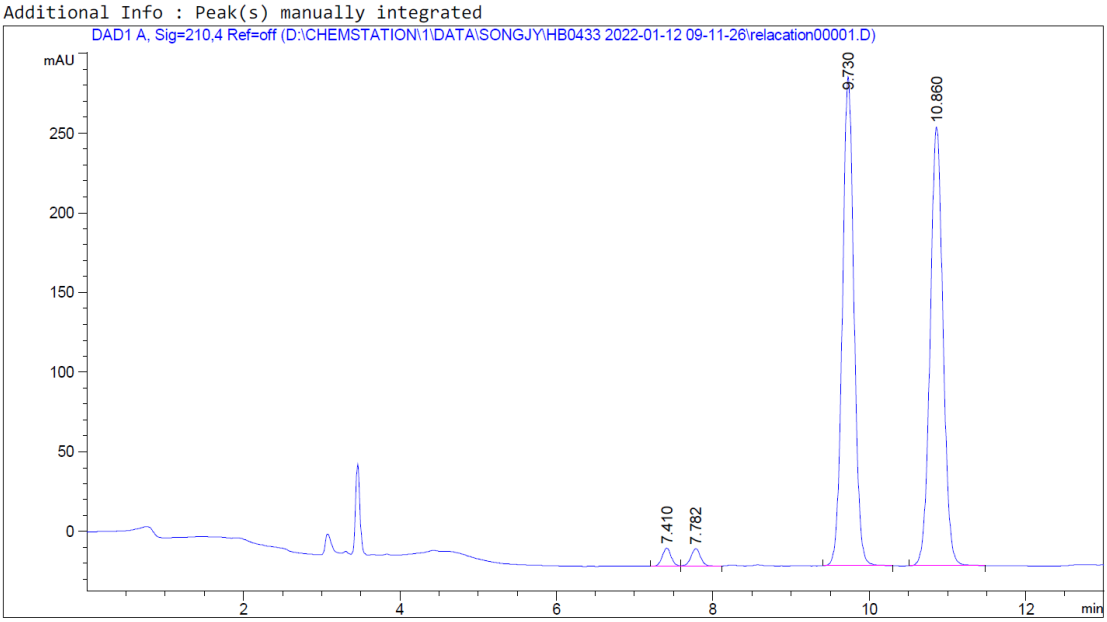
```
==========================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P1-F-02
Injection Date  : 4/28/2022 3:42:35 PM               Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0509 2022-04-28 15-41-42\hb6_IE-3-90-10-1ML-
                  10min.M
Last changed    : 4/28/2022 3:41:56 PM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0509 2022-04-28 15-41-42\hb6_IE-3-90-10-1ML-
                  10min.M (Sequence Method)
Last changed    : 4/28/2022 4:09:10 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



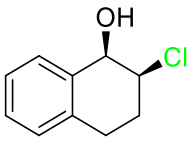

```
==========================================================================
                        Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.196 BB    0.1533 3099.71191  308.38446 100.0000

Totals :                  3099.71191  308.38446
```



```
==========================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P1-A-01
Injection Date  : 1/12/2022 9:12:18 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\SongJY\HB0433 2022-01-12 09-11-26\hb6_IF-3-90-10-1ML-
                  13min.M
Last changed    : 1/12/2022 9:06:58 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\SongJY\HB0433 2022-01-12 09-11-26\hb6_IF-3-90-10-1ML-
                  13min.M (Sequence Method)
Last changed    : 4/15/2022 12:03:38 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

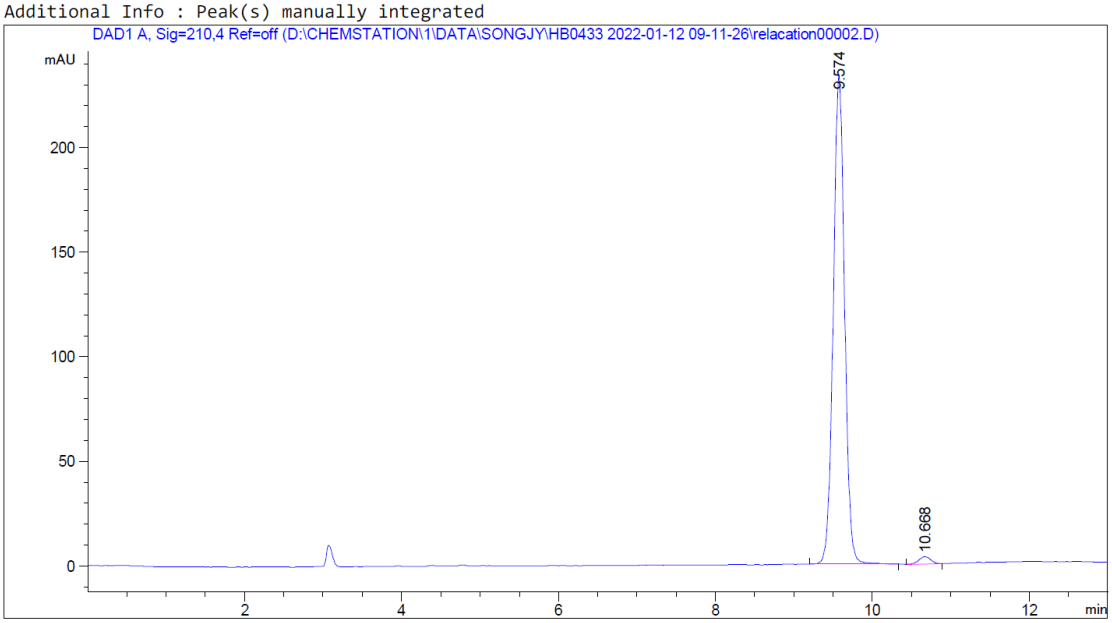



```
==========================================================================
                      Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   7.410 BV    0.1256   91.02695   11.34294   1.4042
   2   7.782 VV    0.1324   94.88305   11.02155   1.4637
   3   9.730 BB    0.1596 3148.05786  307.07074  48.5631
   4  10.860 BB    0.1753 3148.43286  275.60364  48.5689
```

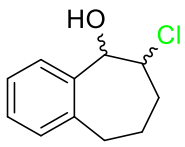


2s

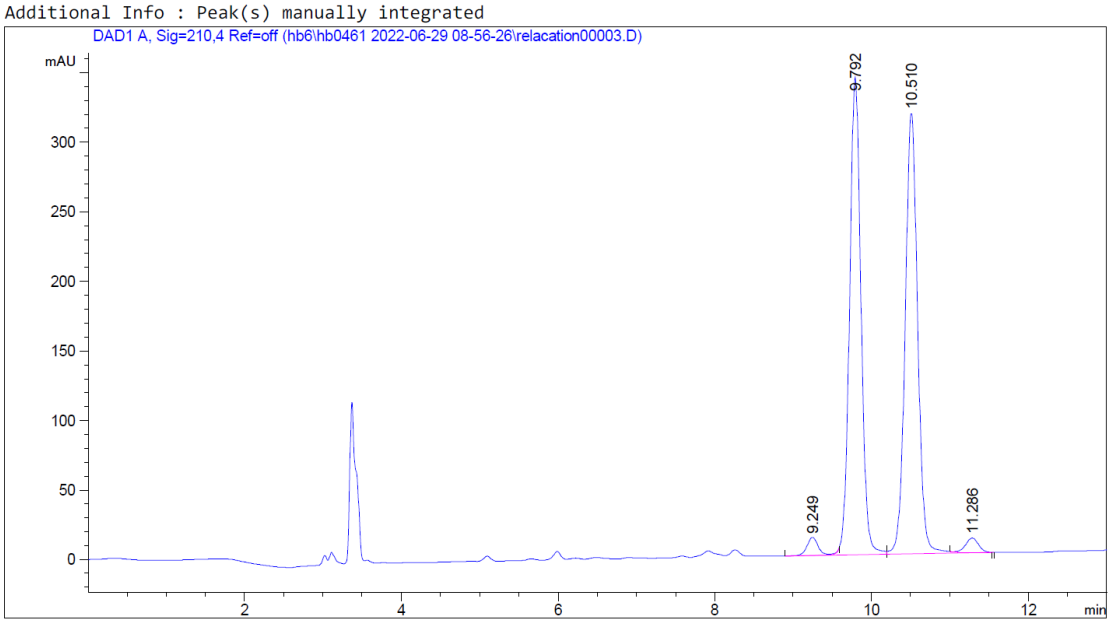
```
==========================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P1-A-02
Injection Date  : 1/12/2022 9:26:09 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\SongJY\HB0433 2022-01-12 09-11-26\hb6_IF-3-90-10-1ML-
                  13min.M
Last changed    : 1/12/2022 9:06:58 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\SongJY\HB0433 2022-01-12 09-11-26\hb6_IF-3-90-10-1ML-
                  13min.M (Sequence Method)
Last changed    : 4/15/2022 12:01:16 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



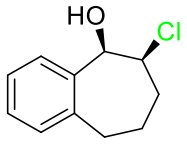

```
==========================================================================
                      Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   9.574 BB    0.1546 2335.41016  233.63559  98.4418
   2  10.668 BB    0.1607   36.96539    3.51414   1.5582

Totals :                  2372.37554  237.14973
```



```
=====================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   3
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P1-F-02
Injection Date  : 6/29/2022 9:27:14 AM               Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0461 2022-06-29 08-56-26\hb6_IF-3-95-5-1ML-
                  20min.M
Last changed    : 6/29/2022 9:24:07 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0461 2022-06-29 08-56-26\hb6_IF-3-95-5-1ML-
                  20min.M (Sequence Method)
Last changed    : 6/29/2022 11:24:12 AM by SYSTEM
Additional Info : Peak(s) manually integrated
```

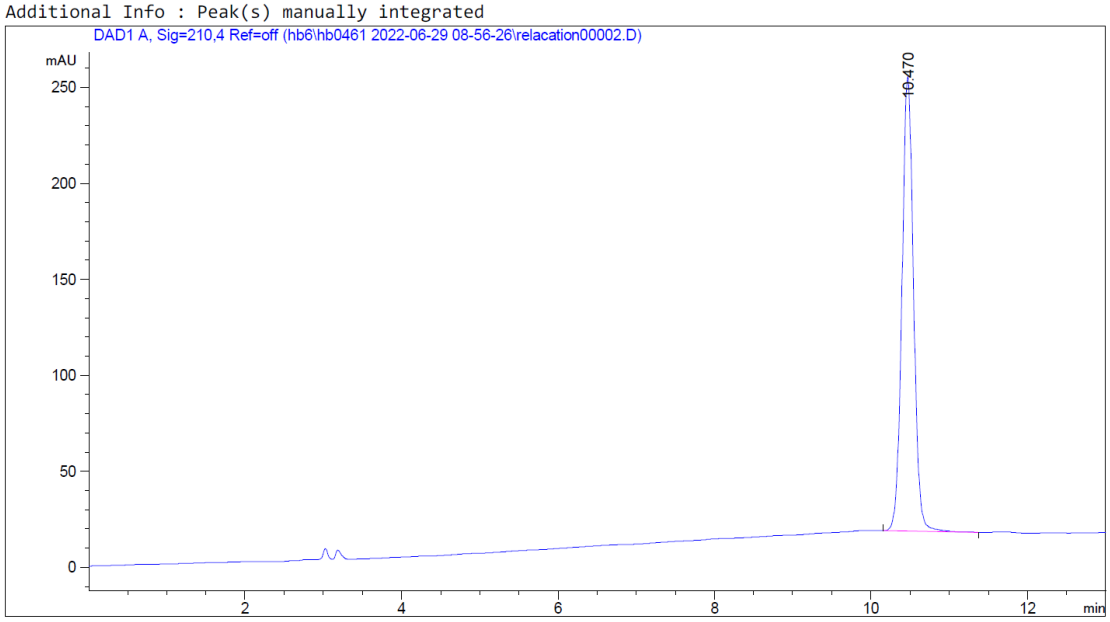



```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   9.249 BV E  0.1549  133.74602   13.11970   1.8528
   2   9.792 VV R  0.1559 3470.34570  343.31000  48.0744
   3  10.510 VV R  0.1688 3497.50146  316.83517  48.4506
   4  11.286 VB E  0.1742  117.10435   10.33564   1.6222
```

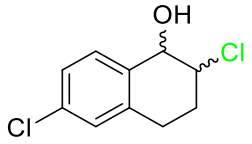


2t

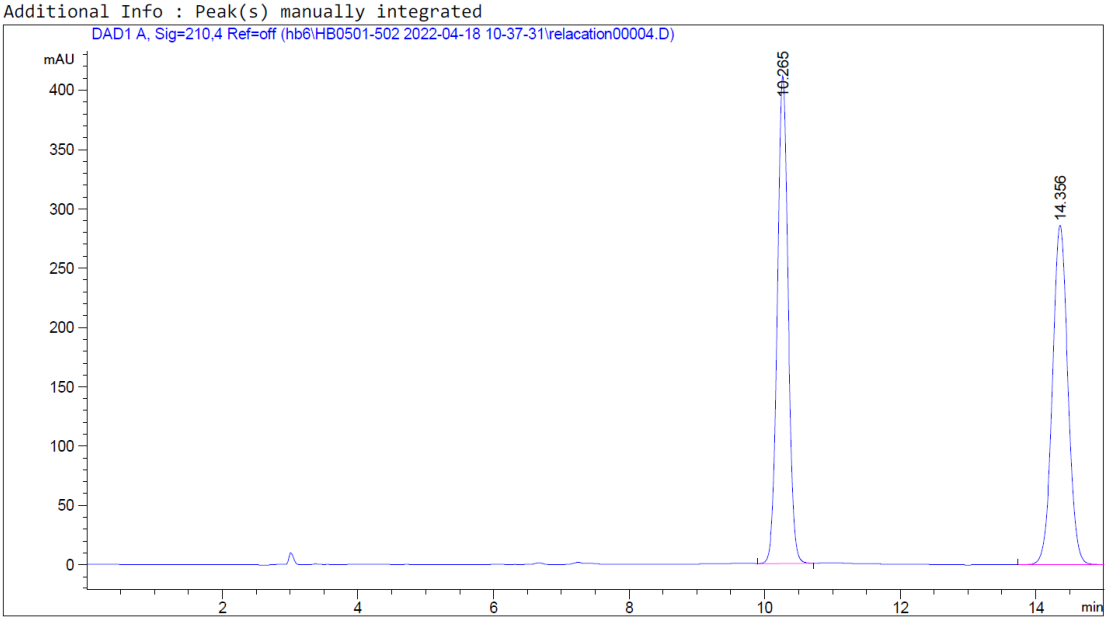
```
=====================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P1-F-01
Injection Date  : 6/29/2022 9:13:21 AM               Inj :   1
                                                Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0461 2022-06-29 08-56-26\hb6_IF-3-95-5-1ML-
                  20min.M
Last changed    : 6/29/2022 9:24:07 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\hb0461 2022-06-29 08-56-26\hb6_IF-3-95-5-1ML-
                  20min.M (Sequence Method)
Last changed    : 6/29/2022 10:04:20 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



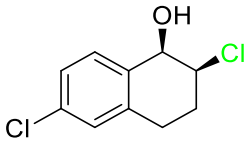

```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.470 BB    0.1581 2437.30005  236.78580 100.0000
```



```
=====================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   4
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-10
Injection Date  : 4/18/2022 11:35:50 AM              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/18/2022 11:21:39 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/18/2022 11:51:59 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

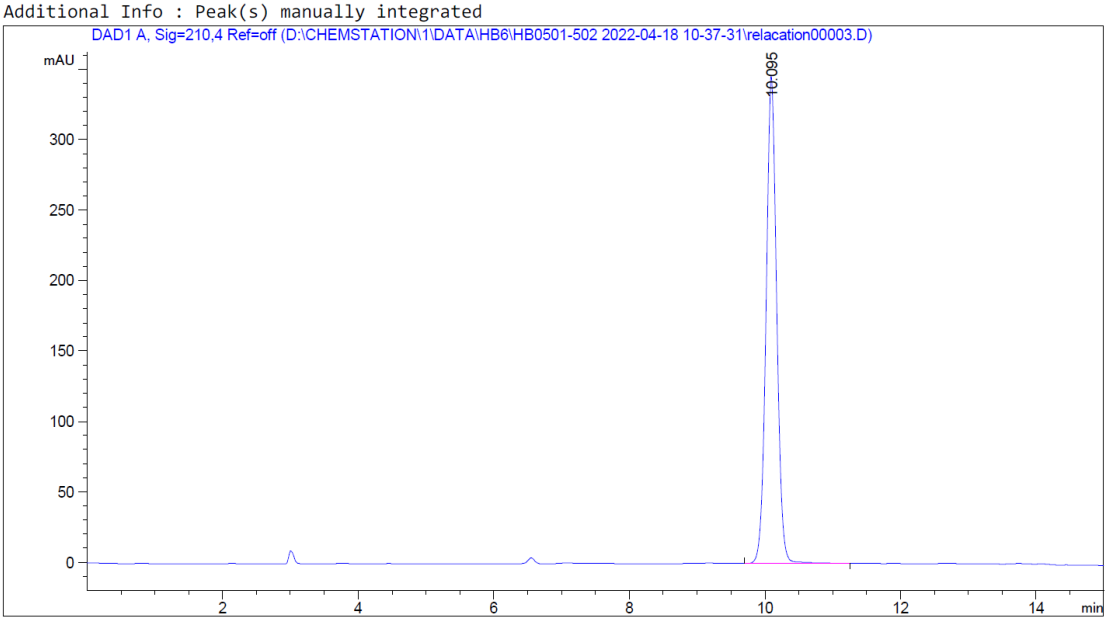



```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.265 BB    0.1681 4514.69922  411.14957  49.9390
   2  14.356 BBA   0.2444 4525.73145  286.30136  50.0610

Totals :                  9040.43066  697.45093
```

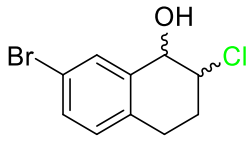


2u

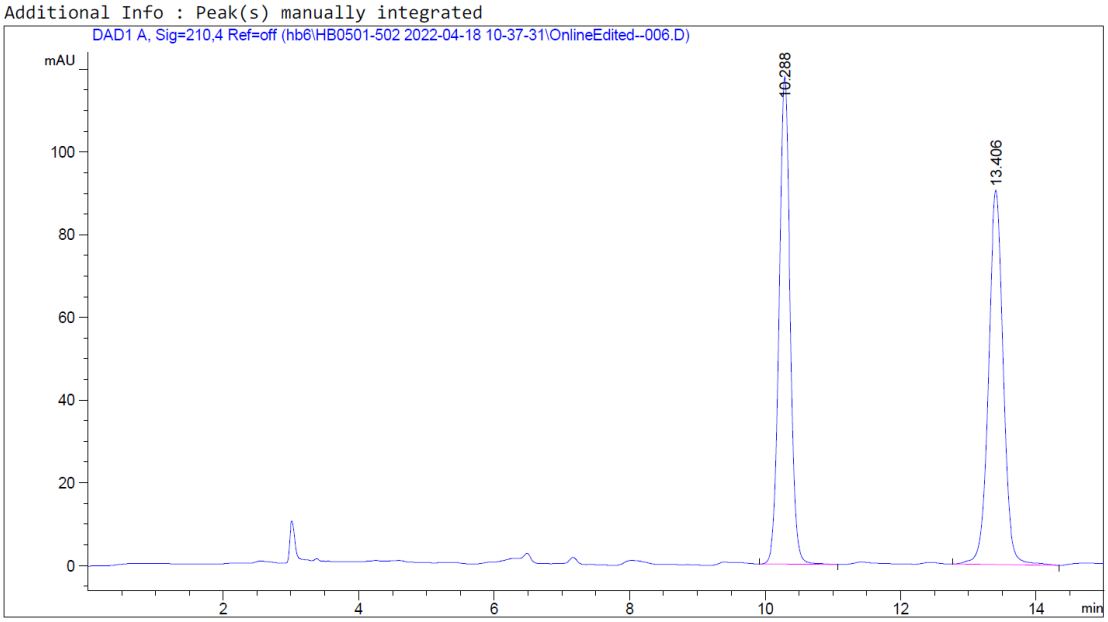
```
=====================================================================
Acq. Operator   : SYSTEM                       Seq. Line :   3
Sample Operator : SYSTEM
Acq. Instrument : LC                           Location :   P2-D-09
Injection Date  : 4/18/2022 11:19:59 AM             Inj :   1
                                              Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/18/2022 11:21:39 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/18/2022 11:51:59 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



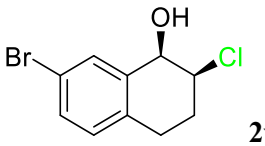

```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.095 BB    0.1699 3791.14063  345.81458 100.0000

Totals :                  3791.14063  345.81458
```



```
=====================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   6
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-E-01
Injection Date  : 4/18/2022 12:07:33 PM              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/18/2022 11:21:39 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/18/2022 12:29:43 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

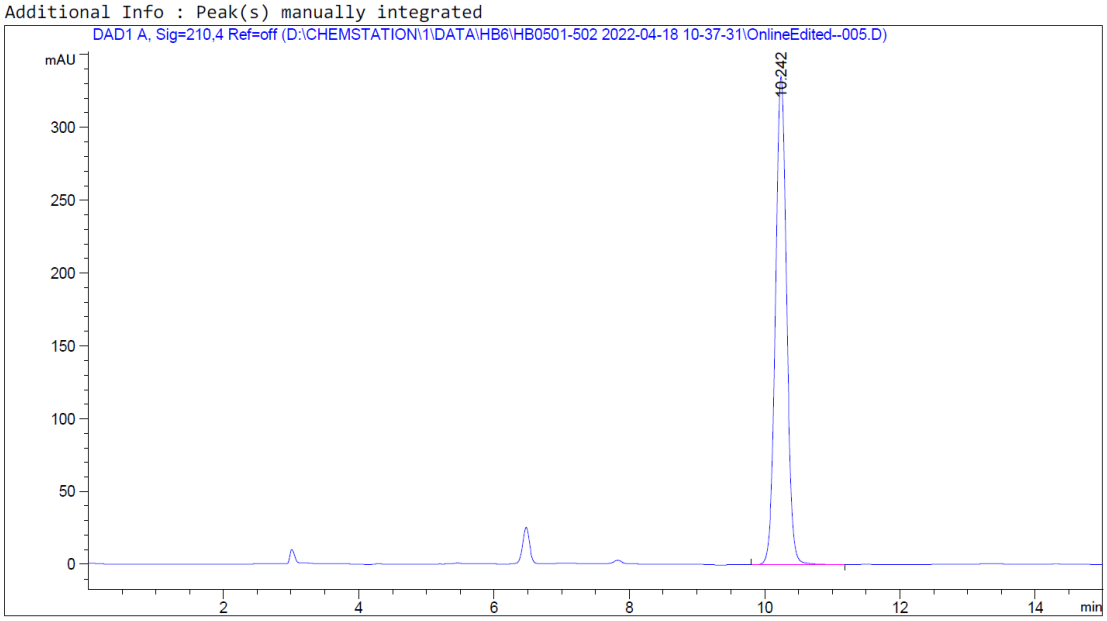



```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.288 BB    0.1737 1329.18738  117.76014  49.3727
   2  13.406 BB    0.2298 1362.96106   90.44734  50.6273

Totals :                  2692.14844  208.20748
```

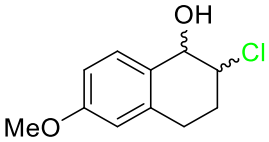


2v

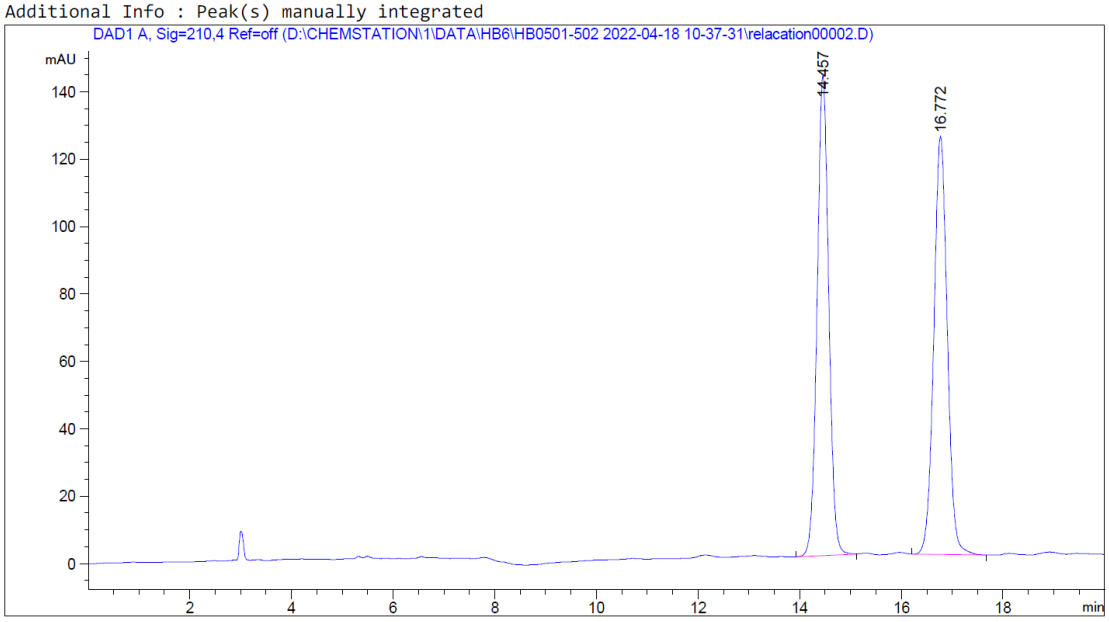
```
================================================================================
Acq. Operator   : SYSTEM                          Seq. Line :   5
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-D-11
Injection Date  : 4/18/2022 11:51:41 AM               Inj :   1
                                                 Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/18/2022 11:21:39 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/18/2022 12:29:43 PM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



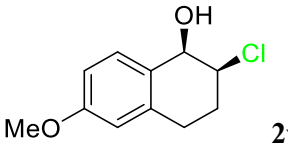

```
================================================================================
                          Area Percent Report
================================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.242 BB    0.1744 3807.09180  335.41757 100.0000

Totals :                  3807.09180  335.41757
```



```
==========================================================================
Acq. Operator   : SYSTEM                        Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-08
Injection Date  : 4/18/2022 10:59:10 AM              Inj :   1
                                               Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/18/2022 10:38:11 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/18/2022 11:20:02 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

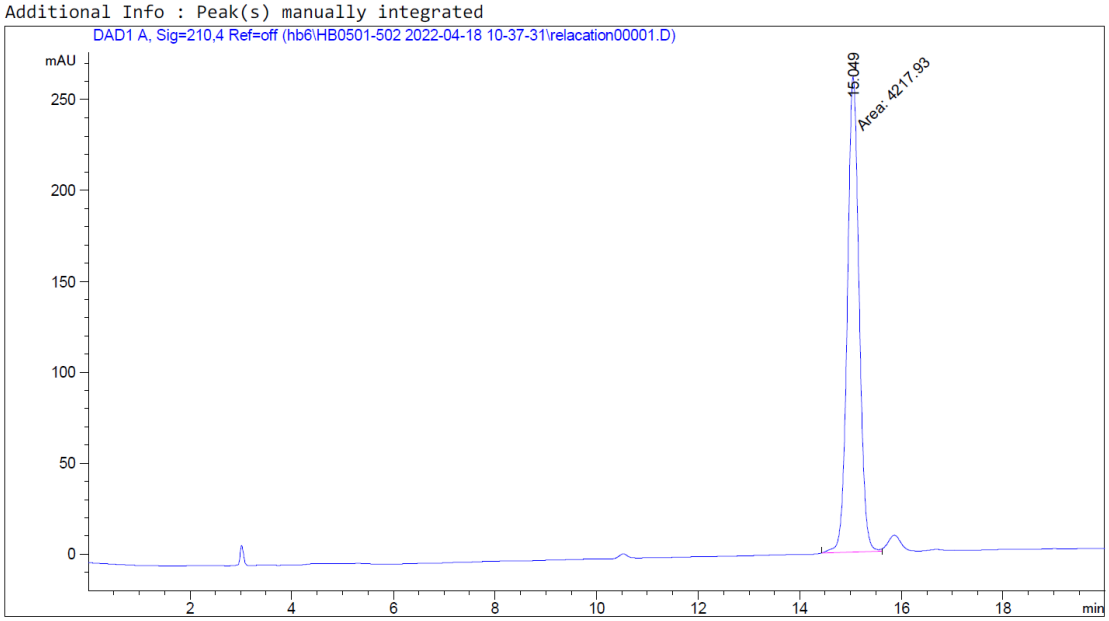



```
==========================================================================
                        Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  14.457 BB    0.2451 2257.44897  142.31580  49.7195
   2  16.772 BB    0.2848 2282.92114  124.00315  50.2805

Totals :                 4540.37012  266.31895
```

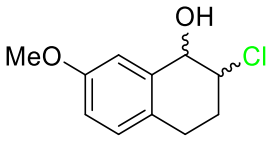


2w

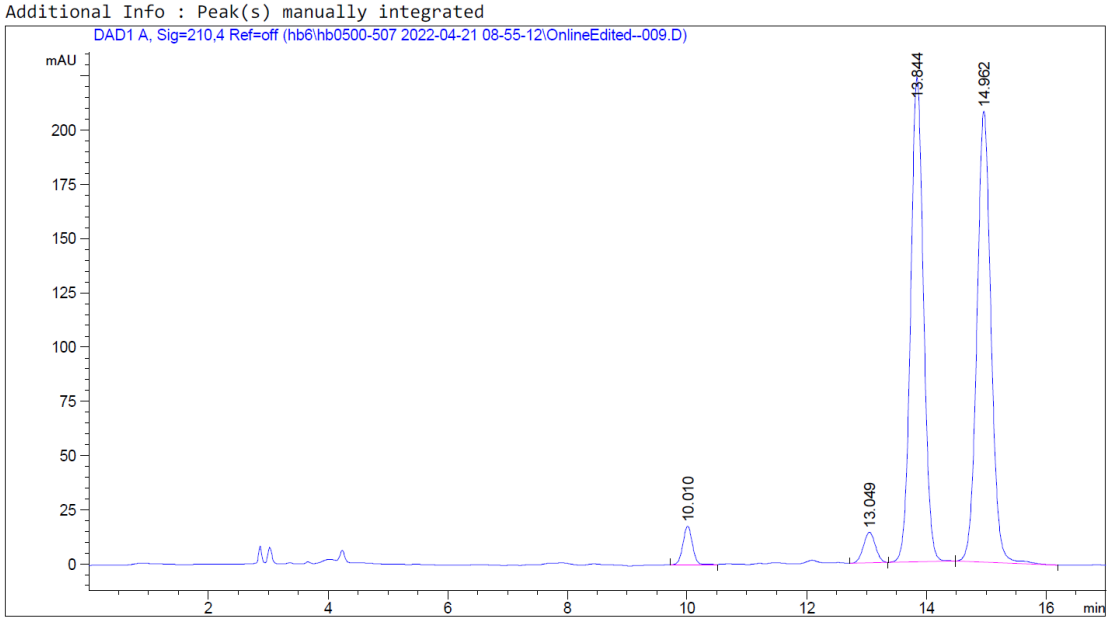
```
=====================================================================
Acq. Operator   : SYSTEM                      Seq. Line :   1
Sample Operator : SYSTEM
Acq. Instrument : LC                          Location :   P2-D-07
Injection Date  : 4/18/2022 10:38:21 AM            Inj :   1
                                             Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/18/2022 10:38:11 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\HB0501-502 2022-04-18 10-37-31\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/18/2022 11:20:02 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



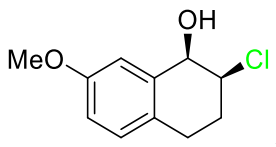

```
=====================================================================
                        Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  15.049 MM    0.2687 4217.93457  261.65979 100.0000

Totals :                  4217.93457  261.65979
```



```
==========================================================================
Acq. Operator   : SYSTEM                          Seq. Line :   9
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-D-09
Injection Date  : 4/21/2022 11:08:36 AM               Inj :   1
                                                 Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/21/2022 11:25:25 AM by SYSTEM
                  (modified after loading)
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:49:00 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

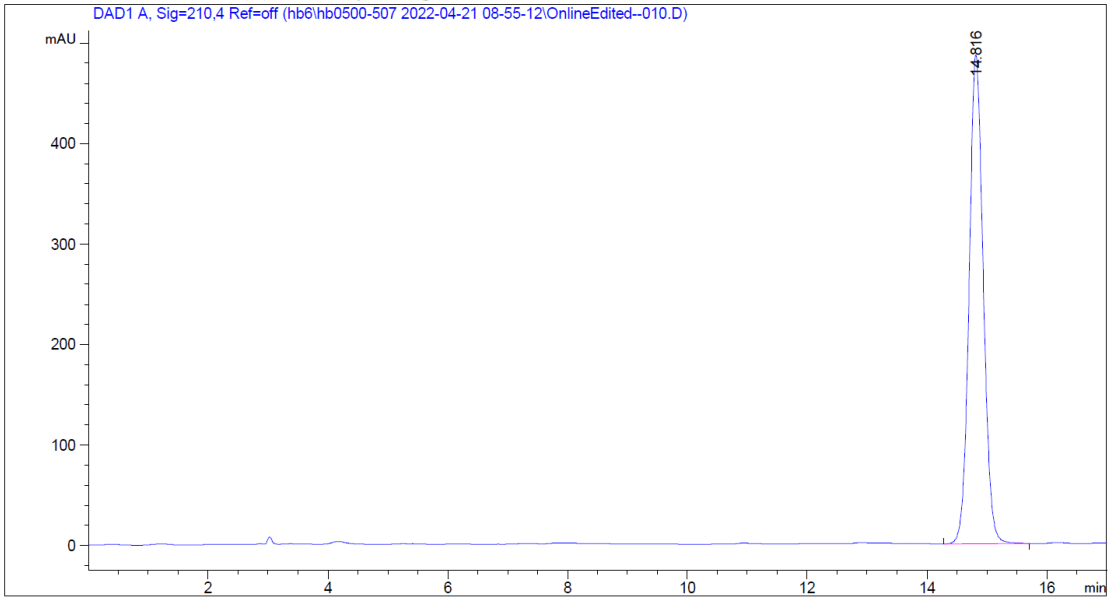



```
==========================================================================
                          Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  10.010 BB    0.1689  193.66286   17.80045   2.7251
   2  13.049 BB    0.2161  195.89513   14.09885   2.7565

   3  13.844 BB    0.2294 3323.16797  223.61839  46.7612
   4  14.962 BB    0.2505 3393.94580  207.81985  47.7572

Totals :                  7106.67175  463.33755
```

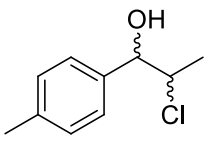


2x

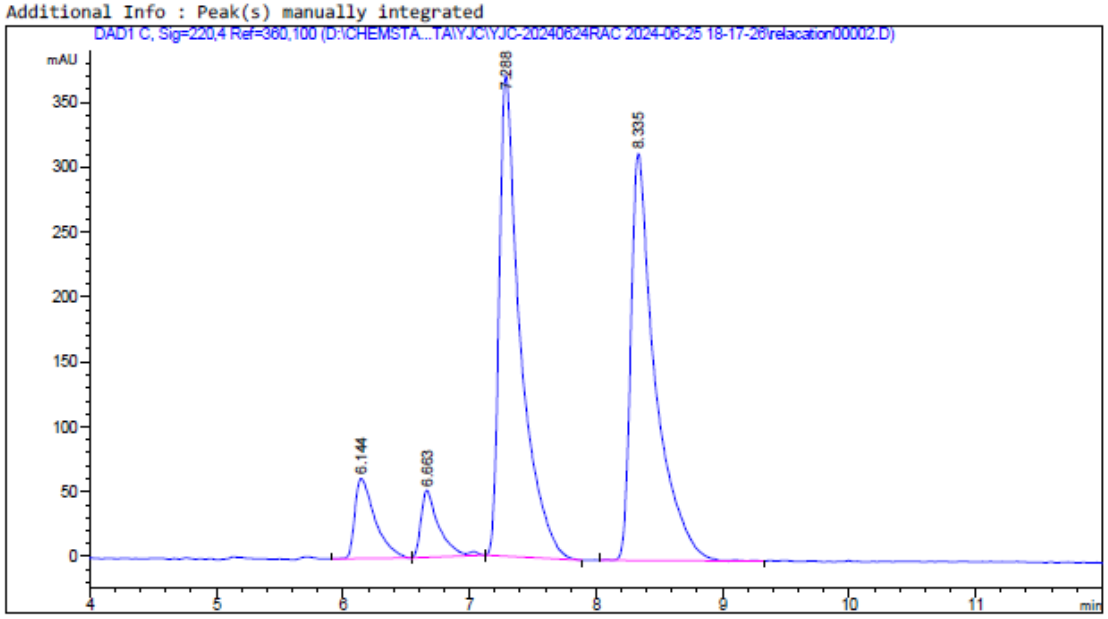
```
==========================================================================
Acq. Operator   : SYSTEM                        Seq. Line :  10
Sample Operator : SYSTEM
Acq. Instrument : LC                            Location :   P2-D-02
Injection Date  : 4/21/2022 11:26:26 AM              Inj :   1
                                               Inj Volume : 1.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 0.500 µl
Acq. Method     : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M
Last changed    : 4/21/2022 11:25:25 AM by SYSTEM
Analysis Method : D:\ChemStation\1\Data\hb6\hb0500-507 2022-04-21 08-55-12\hb6_IF-3-90-10-1ML
                  -13min.M (Sequence Method)
Last changed    : 4/21/2022 11:49:00 AM by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



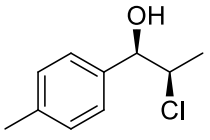

```
==========================================================================
                        Area Percent Report
==========================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 A, Sig=210,4 Ref=off

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  14.816 BB    0.2508 7959.64355  486.61734 100.0000

Totals :                  7959.64355  486.61734
```



```
Acq. Operator   : SYSTEM                        Seq. Line :   2
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-E-01
Injection Date  : 25/06/2024 18:34:25                 Inj :   1
                                                Inj Volume : 0.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\YJC\YJC-20240624rac 2024-06-25 18-17-26\4-AD3-90-10-
                  1ml-15min.M
Last changed    : 20/06/2024 17:14:50 by SYSTEM
Analysis Method : D:\ChemStation\1\Data\YJC\YJC-20240624rac 2024-06-25 18-17-26\4-AD3-90-10-
                  1ml-15min.M (Sequence Method)
Last changed    : 25/06/2024 19:05:08 by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```

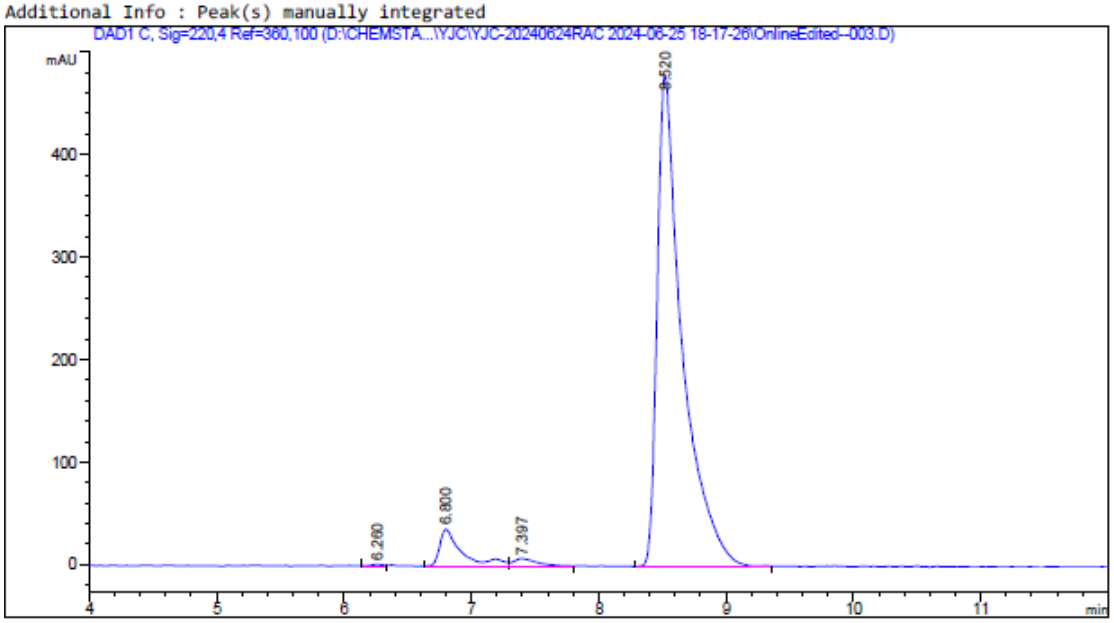



```
=====================================================================
                      Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.144 BB    0.1631  683.14813   61.71976   7.0686
   2   6.663 BV R  0.1414  512.81720   51.46768   5.3062
   3   7.288 BB    0.1634 4298.92236  370.34396  44.4815
----|-------|----|-------|----------|----------|--------|
   4   8.335 VV R  0.1892 4169.62061  313.35358  43.1436

Totals :                   9664.50830  796.88498
```



2y

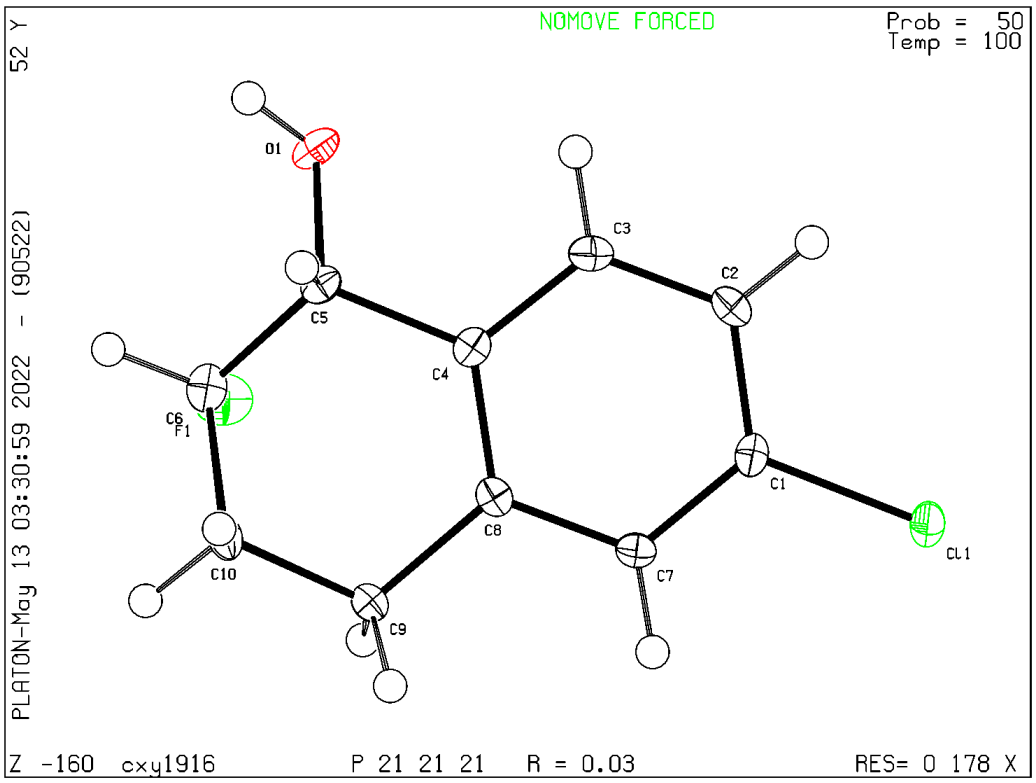
```
Acq. Operator   : SYSTEM                        Seq. Line :   3
Sample Operator : SYSTEM
Acq. Instrument : LC                             Location :   P2-E-02
Injection Date  : 25/06/2024 18:50:17                 Inj :   1
                                                Inj Volume : 0.000 µl
Different Inj Volume from Sample Entry!  Actual Inj Volume : 1.000 µl
Acq. Method     : D:\ChemStation\1\Data\YJC\YJC-20240624rac 2024-06-25 18-17-26\4-AD3-90-10-
                  1ml-15min.M
Last changed    : 20/06/2024 17:14:50 by SYSTEM
Analysis Method : D:\ChemStation\1\Data\YJC\YJC-20240624rac 2024-06-25 18-17-26\4-AD3-90-10-
                  1ml-15min.M (Sequence Method)
Last changed    : 25/06/2024 19:07:50 by SYSTEM
                  (modified after loading)
Additional Info : Peak(s) manually integrated
```



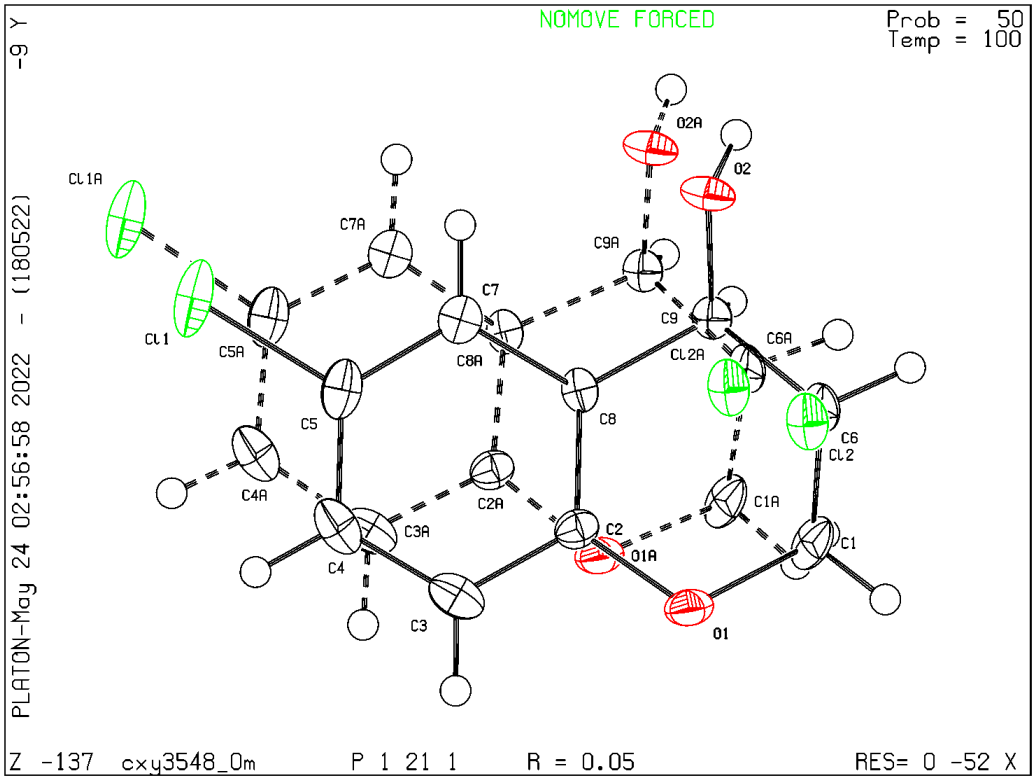

```
=====================================================================
                      Area Percent Report
=====================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 C, Sig=220,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   6.260 VV    0.0833   10.48709    1.71503   0.1474
   2   6.800 BV R  0.1499  441.87781   36.02962   6.2097
   3   7.397 VB    0.1664   97.88736    7.69455   1.3756

   4   8.520 BV R  0.1922 6565.67871  478.25006  92.2673

Totals :                  7115.93097  523.68927
```

7. Crystallographic Information

The Crystallographic data of compound **2n** has been deposited in CCDC with number 2175167 and has been displayed at 50% ellipsoid contour probability level.



The Crystallographic data of compound **2r** has been deposited in CCDC with number 2175166 and has been displayed at 50% ellipsoid contour probability level.



8. References

1. (a) Stavber, S.; Jereb, M.; Zupan, M. Direct α-Fluorination of Ketones Using N-F Reagents. *Synthesis* **2002**, 2609. (b) Zhao, Y.; Pan, Y.; Liu, H.; Yang, Y.; Jiang, Z.; Tan, C.-H. Fluorinated Aromatic Ketones as Nucleophiles in the Asymmetric Organocatalytic Formation of C-C and C-N Bonds: A Facile Route to the Construction of Fluorinated Quaternary Stereogenic Centers. *Chem. - Eur. J.* **2011**, *17*, 3571.

2. Dai, Y.; Meng, W.; Feng, X.; Du, H. Chiral FLP-catalyzed asymmetric hydrogenation of 3-fluorinated chromones. *Chem. Commun*., **2022**, *58*, 1558.

3. Molina-Betancourt, R.; Phansavath, P.; Ratovelomanana-Vidal, V. Ru(II)-Catalyzed Asymmetric Transfer Hydrogenation of 3-Fluorochromanone Derivatives to Access Enantioenriched cis-3-Fluorochroman-4-ols through Dynamic Kinetic Resolution. *J. Org. Chem*. **2021**, *86*, 12054.

4. Wood, S. H.; Etridge, S.; Kennedy, A. R.; Percy, J. M.; Nelson, D. J. The Electrophilic Fluorination of Enol Esters Using SelectFluor: A Polar Two-Electron Process. *Chem. Eur. J*. **2019**, *25*, 5574.

5. Bacheley, L.; Molina-Betancourt, R.; Ravindra, R.; Guillamot, G.; Phansavath, P.; Ratovelomanana-Vidal, V. AsymmetricSynthesisof Monofluorinated Carbocyclic Alcohols and Vicinal Difluorinated Heterocycles and Carbocycles.

6. Mei, Y.; Bentley, P. A.; Du, J. Thiourea catalysis of NCS in the synthesis of a-chloroketones. *Tetrahedron Lett*. **2008**, *49*, 3802.

7. Touge, T.; Nara, H.; Kida, M.; Matsumura, K.; Kayaki, Y. Convincing Catalytic Performance of Oxo-Tethered Ruthenium Complexes for Asymmetric Transfer Hydrogenation of Cyclic α-Halogenated Ketones through Dynamic Kinetic Resolution. *Org. Lett.* **2021**, *23*, 3070.

8. Ros, A.; Magriz, A.; Dietrich, H.; Fernández, R.; Alvarez, E.; Lassaletta, J. M. Enantioselective Synthesis of Vicinal Halohydrins via Dynamic Kinetic Resolution. *Org. Lett*. **2006**, *8*, 127.

9. Bacheley, L.; Molina-Betancourt, R.; Ravindra, R.; Guillamot, G.; Phansavath, P.;

Ratovelomanana-Vidal, V. Asymmetric Synthesis of Monofluorinated Carbocyclic Alcohols and Vicinal Difluorinated Heterocycles and Carbocycles. *Eur. J. Org. Chem*. **2023**, *26*, e2023003.

10. Hou, M.; Lin, L.; Chai, X.; Zhao, X.; Qiao, B.; Jiang, Z. Enantioselective photoredox dehalogenative protonation. *Chem. Sci*., **2019**, *10*, 6629.

11. Li, Z.; Wang, B.; Zhang, C.; Lo, W. Y.; Yang, L; Sun, J. Catalytic Enantioselective Nucleophilic α-Chlorination of Ketones with NaCl. *J. Am. Chem. Soc*. **2024**, *146*, 2779.