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Supporting Information

Transfer-Catalyst-Free Biomimetic Asymmetric Reduction of 3-Sulfonyl Coumarins with Regenerable NAD(P)H Model

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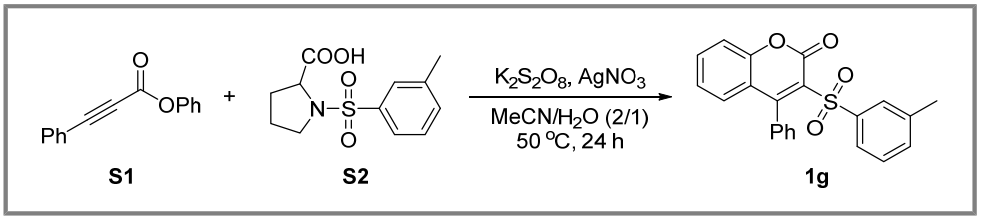
1. General and Materials

General: All reactions were carried out under an atmosphere of nitrogen using the standard Schlenk techniques, unless otherwise noted. ^{1}H NMR, ^{13}C NMR spectra were recorded at 400 MHz and 100 MHz with Brucker spectrometer. ^{19}F was recorded at 376 MHz with Brucker spectrometer. Chemical shifts are reported in ppm using tetramethylsilane (0) as internal standard when using $CDCl_3$ as solvent for ^{1}H NMR spectra. The following abbreviations were used to symbolize the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad. Flash column chromatography was performed on silica gel (200-300 mesh). All reactions were monitored by TLC analysis. Optical rotations were measured by polarimeter. Enantiomeric excess was determined by HPLC analysis using chiral column described below in detail. High resolution mass spectra were recorded using Q-TOF time-of-flight mass spectrometer. X-ray crystallography data were collected using a Bruker D8 Venture with 3.0 ius cu and 3.0 ius mo.

Materials: Commercially available reagents and solvents were used throughout without further purification. The NAD(P)H Models CYNAMs **3a-3c** could be synthesized according to the known literature procedure.[1]

2. Synthesis of Substrate 3-Sulfonyl Coumarins

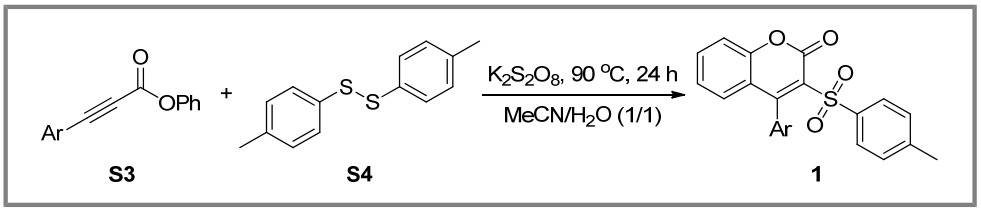
3-Sulfonyl coumarins **1** could be conveniently prepared from aryl alkynoate and *N*-tosylproline according to the known literature procedure with minor modification.[2-3] Among them, compounds **1g**, **1l**, **1n**, **1p** and **1t** are the unknown compounds.



To a 250 mL Schlenk flask were added phenyl 3-phenylpropiolate **S1** (1.111 g, 5.0 mmol), *N*-tosylproline **S2** (1.616 g, 6.0 mmol), potassium persulfate ($K_2S_2O_8$, 2.703 g, 10.0 mmol), silver nitrate (0.043 g, 0.25 mmol, 5 mol%) and acetonitrile/water (2:1, 90 mL). Then the bottle was charged with nitrogen, and the reaction mixture was stirred at 50 °C for 24 hours. The resulting mixture was extracted with ethyl acetate. The combined organic layers were dried over anhydrous sodium sulfate, filtered, and concentrated under the reduced pressure. The resulting residue was purified by column chromatography on silica gel using petroleum ether and ethyl acetate as eluent to afford the desired product 3-sulfonyl coumarin **1g**.

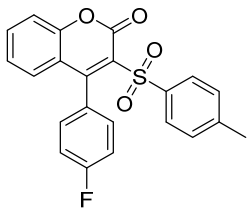
4-Phenyl-3-(*m*-tolylsulfonyl)-2*H*-chromen-2-one (**1g**):

0.928 g, 49% yield, white solid, new compound, mp = 166-167 °C, R_f = 0.51 (hexanes/ethyl acetate 3/1). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (s, 1H), 7.79-7.70 (m, 1H), 7.63-7.56 (m, 4H), 7.41-7.31 (m, 5H), 7.22-7.16 (m, 1H), 7.05-6.99 (m, 1H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.4, 155.6, 153.9, 140.1, 138.8, 134.7, 134.5, 132.6, 130.0, 129.4, 129.3, 128.5, 128.2, 127.5, 126.2, 126.0, 124.9, 120.3, 116.8, 21.4. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{22}H_{17}O_4S$ 377.0842, found: 377.0846.



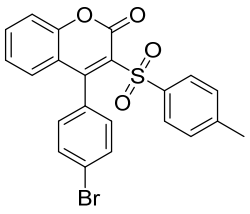
To a 100 mL flask were added aryl alkynoate **S3** (5.0 mmol), bis(4-methylphenyl) disulfide **S4** (7.5 mmol), potassium persulfate (4.055 g, 15.0 mmol) and acetonitrile/water (1:1, 30 mL). Then the bottle was charged with nitrogen, and the reaction mixture was stirred at 90 °C for 24 h. The resulting mixture was extracted with ethyl acetate. The combined organic layers were dried over anhydrous sodium sulfate, filtered, and concentrated under the reduced pressure. The residue was purified by column chromatography (hexanes and ethyl acetate) to afford the products **1**.

4-(4-Fluorophenyl)-3-tosyl-2*H*-chromen-2-one (**1l**):



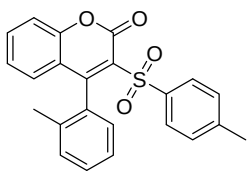
0.763 g, 39% yield, white solid, new compound, mp = 165-166 °C, R_f = 0.37 (hexanes/ethyl acetate 5/1). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.3 Hz, 2H), 7.65-7.60 (m, 1H), 7.38-7.27 (m, 7H), 7.24-7.19 (m, 1H), 7.04-7.01 (m, 1H), 2.42 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.2 (d, $^1J_{F\text{-}C}$= 247.9 Hz), 158.2, 155.5, 153.9, 145.0, 137.1, 134.8, 129.6 (d, $^3J_{F\text{-}C}$= 13.1 Hz), 129.5, 129.4, 129.3, 128.4 (d, $^4J_{F\text{-}C}$= 3.7 Hz), 126.6, 125.0, 120.2, 116.9, 115.6 (d, $^2J_{F\text{-}C}$= 21.8 Hz), 21.7. ^{19}F NMR (376 MHz, $CDCl_3$) δ -111.27. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{22}H_{16}FO_4S$ 395.0748, found: 395.0747.

4-(4-Bromophenyl)-3-tosyl-2*H*-chromen-2-one (**1n**):



1.590 g, 40% yield, white solid, new compound, mp = 237-238 °C, R_f = 0.36 (hexanes/ethyl acetate 5/1). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.2 Hz, 2H), 7.72 (d, *J* = 8.3 Hz, 2H), 7.65-7.59 (m, 1H), 7.36-7.28 (m, 3H), 7.25-7.18 (m, 3H), 7.03-6.98 (m, 1H), 2.42 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.8, 155.4, 153.9, 145.0, 137.0, 134.8, 131.6, 131.6, 129.6, 129.4, 129.3, 129.1, 126.5, 125.0, 123.7, 119.9, 117.0, 21.7. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{22}H_{16}BrO_4S$ 454.9947 (^{79}Br) and 456.9934 (^{81}Br), found: 454.9945 (^{79}Br) and 456.9925 (^{81}Br).

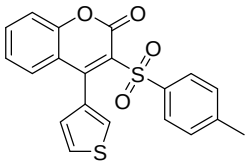
4-(*o*-Tolyl)-3-tosyl-2*H*-chromen-2-one (**1p**):



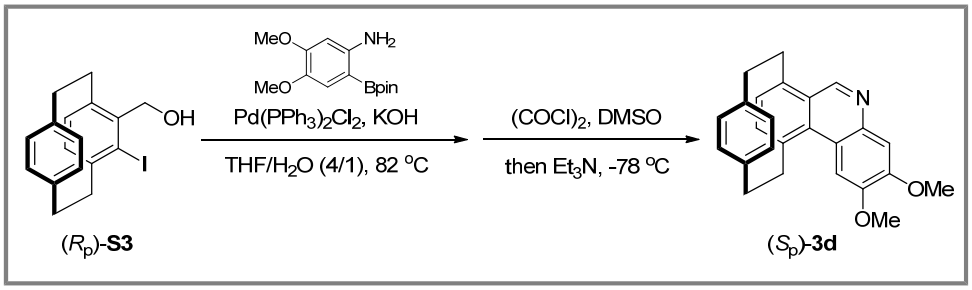
2.956 g, 41% yield, orange solid, new compound, mp = 122-123 °C, R_f = 0.25 (hexanes/ethyl acetate 5/1). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.3 Hz, 2H), 7.63-7.58 (m, 1H), 7.49-7.45 (m, 1H), 7.41-7.33 (m, 3H), 7.30 (d, *J* = 8.2 Hz, 2H), 7.17 (t, *J* = 7.7 Hz, 1H), 7.11 (d, *J* = 7.4 Hz, 1H), 6.91 (dd, *J* = 8.1, 1.2 Hz, 1H), 2.41 (s, 3H), 2.21 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.4, 155.7, 154.0, 144.9, 137.2, 135.1, 134.7, 132.7, 130.1, 129.4, 129.4, 129.3, 129.3, 126.6, 126.4, 125.6, 125.1, 119.5, 116.9, 21.7, 20.0. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{19}O_4S$ 391.0999, found: 391.1000.

4-(Thiophen-3-yl)-3-tosyl-2*H*-chromen-2-one (**1t**):

0.207 g, 11% yield, brown solid, new compound, mp = 157-158 ^{o}C, R_f = 0.35 (hexanes/ethyl acetate 5/1). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 8.2 Hz, 2H), 7.64-7.55 (m, 2H), 7.41-7.37 (m, 1H), 7.34-7.27 (m, 3H), 7.25-7.14 (m, 3H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 155.5, 155.4, 153.7, 144.8, 137.3, 134.6, 131.5, 129.5, 129.3, 129.2, 128.3, 127.1, 126.2, 124.9, 120.2, 116.8, 21.7. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{15}O_4S_2$ 383.0406, found: 383.0405.



3. Synthesis of the New NAD(P)H Model CYNAM



Under nitrogen, a solution of the alcohol (R_p)-**S3** (1.275 g, 3.5 mmol), bis(triphenylphosphine)palladium(II) chloride (491 mg, 0.7 mmol), potassium hydroxide (589 mg, 10.5 mmol) and the 2-aminoarylboronic acid pinacolate ester (1.954 g, 7.0 mmol) in tetrahydrofuran (52 mL) and water (13 mL) was heated at 82 °C for 24 h. The mixture was cooled to room temperature and extracted with ethyl acetate (20 mL×3). The combined organic layer was dried over anhydrous sodium sulfate and concentrated in *vacuo*. The residue was purified by flash column chromatography on silica gel using hexanes and ethyl acetate as eluent to achieve the intermedaite (S_p)-**S4** (0.792 g, 58% yield).

Then, under nitrogen, to a solution of oxalyl chloride (0.434 g, 3.4 mmol, 0.29 mL) in dichloromethane (10 mL) at -78°C was slowly added a solution of dimethyl sulfoxide (0.534 g, 6.8 mmol, 0.49 mL) in dichloromethane (5 mL). After stirring for 5 min, a solution of (S_p)-**S4** (0.666 g, 1.7 mmol) in dichloromethane (5 mL) was added dropwise. After the mixture was stirred for 15 min, triethylamine (1.730 g, 17.1 mmol, 2.4 mL) was then added dropwise. 10 min later, the mixture was warmed to room temperature and stirred for 3 h. The reaction mixture was quenched with water (10 mL). After being extracted with dichloromethane and washed with water twice, the combined organic layer was dried over anhydrous sodium sulfate and concentrated in *vacuo*. The residue was purified by flash column chromatography using hexanes and ethyl acetate as eluent to achieve the product NAD(P)H model (S_p)-**3d** (0.224 g, 39% yield).

(S_p)-2,3-Dimethoxy[2]paracyclo[2](7,10)phenanthridinophane (**3d**):
0.244 g**,** 39% yield, yellow solid, new compound, mp = 86-87 °C, R_f = 0.15 (hexanes/ethyl acetate 1/1), >99% ee, $[\alpha]^{20}_D$ = +254.23 (*c* 0.80, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.07 (s, 1H), 7.89 (s, 1H), 7.60 (s, 1H), 7.06 (d, *J* = 7.4 Hz, 1H), 6.87 (d, *J* = 7.4 Hz, 1H), 6.56-6.47 (m, 2H), 5.92-5.71 (m, 1H), 5.37-5.29 (m, 1H), 4.35-4.28 (m, 1H), 4.12 (s, 3H), 4.10 (s, 3H), 4.05-3.97 (m, 1H), 3.37-3.25 (m, 2H), 3.20-3.03 (m, 3H), 2.85-2.76 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.2, 148.7, 148.3, 141.0, 138.4, 138.3, 138.0, 137.8, 134.6, 134.4, 132.2, 132.1, 131.8, 130.0, 128.1, 128.0, 119.3, 109.6, 106.1, 56.2, 56.1, 38.7, 34.7, 34.1, 32.5. HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{25}H_{24}NO_2$ 370.1802, found: 370.1801.

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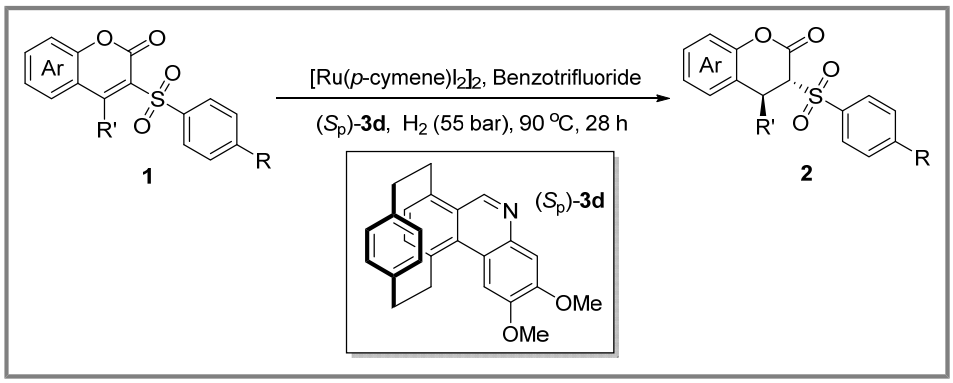
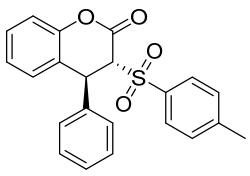
4. Biomimetic Asymmetric Reduction of 3-Sulfonyl Coumarins



A mixture of [Ru(*p*-cymene)I_2]$_2$ (2.2 mg, 0.00225 mmol), chiral NAD(P)H model (S_p)-**3d** (5.5 mg, 0.015 mmol) and 3-sulfonyl coumarins **1** (0.15 mmol) in benzotrifluoride (3.0 mL) was stirred at room temperature for 5 min in glove box and then the mixture was transferred to an autoclave. The hydrogenation was performed at 90 °C under hydrogen gas (55 bar) for 28 h. After carefully release of the hydrogen gas, the autoclave was opened. The mixture was concentrated under the reduced pressure, and then purified by column chromatography on silica gel using hexanes and ethyl acetate as eluent to give the biomimetic reductive products **2**.

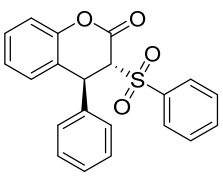
The enantiomeric excesses of the reductive products **2** were determined by chiral HPLC. The racemates could be synthesized under the above condition with readily available phenanthridine instead of chiral NAD(P)H model.

(+)-4-Phenyl-3-tosylchroman-2-one (**2a**):



56 mg, 99% yield, colorless oil, new compound, R_f = 0.51 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +160.08 (*c* 1.12, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71-7.64 (m, 2H), 7.35-7.26 (m, 7H), 7.21-7.16 (m, 1H), 7.09-7.04 (m, 2H), 7.00-6.94 (m, 1H), 5.17 (s, 1H), 4.41 (s, 1H), 2.43 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.9, 150.9, 146.0, 139.4, 133.9, 129.9, 129.6, 129.4, 129.2, 129.1, 128.2, 127.1, 125.7, 120.9, 116.9, 72.1, 42.3, 21.8. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 7.4 min (minor) and 10.5 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{22}H_{22}NO_4S$ 396.1264, found: 396.1265.

(+)-4-Phenyl-3-(phenylsulfonyl)chroman-2-one (**2b**):

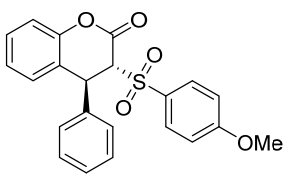


54 mg, 99% yield, colorless oil, new compound, R_f = 0.51 (hexanes/ethyl acetate 5/1), d.r. = 32:1, 98% ee, $[\alpha]^{20}_D$ = +145.18 (*c* 1.08, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.96-7.92 (m, 0.06H), 7.83-7.76 (m, 1.94H), 7.67-7.61 (m, 1H), 7.53-7.46 (m, 2H), 7.34-7.24 (m, 5H), 7.23-7.16 (m, 1H), 7.16-7.13 (m, 0.06H), 7.09-7.05 (m, 1.94H), 7.03-6.88 (m, 1H), 5.19 (s, 0.97H), 5.15 (d, *J* = 6.0 Hz, 0.03H), 4.66 (d, *J* = 5.9 Hz, 0.03H), 4.45 (d, *J* = 0.6 Hz, 0.97H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.8, 150.9, 139.3, 136.9, 134.7, 129.7, 129.6, 129.3, 129.2, 129.1, 128.2, 127.1, 125.8, 120.8, 117.0, 72.0, 42.2. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane

/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 6.9 min (minor) and 11.4 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{21}H_{20}NO_4S$ 382.1108, found: 382.1108.

(+)-3-((4-Methoxyphenyl)sulfonyl)-4-phenylchroman-2-one (**2c**):

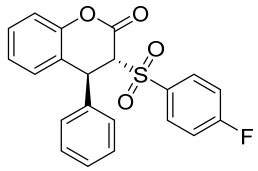
58 mg, 98% yield, colorless oil, new compound, R_f = 0.37 (hexanes/ethyl acetate 5/1), d.r. > 20:1,



98% ee, $[\alpha]^{20}_D$ = +161.71 (*c* 1.16, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75-7.62 (m, 2H), 7.33-7.24 (m, 5H), 7.20-7.15 (m, 1H), 7.09-7.04 (m, 2H), 6.99-6.94 (m, 1H), 6.93-6.88 (m, 2H), 5.16 (s, 1H), 4.42 (d, *J* = 0.5 Hz, 1H), 3.87 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.5, 160.1, 150.8, 139.5, 131.3, 129.6, 129.5, 129.2, 128.1, 128.1, 127.1, 125.7, 121.0, 116.9, 114.5, 72.2, 55.8, 42.4. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 9.0 min (minor) and 13.7 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{22}H_{22}NO_5S$ 412.1213, found: 412.1213.

(+)-3-((4-Fluorophenyl)sulfonyl)-4-phenylchroman-2-one (**2d**):

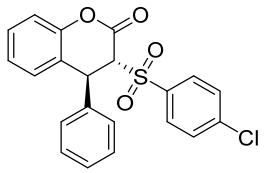
57 mg, 99% yield, pale yellow solid, new compound, mp = 118-119 °C, R_f = 0.52 (hexanes/ethyl



acetate 5/1), d.r. = 32:1, 98% ee, $[\alpha]^{20}_D$ = +131.83 (*c* 1.14, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.91-7.86 (m, 0.06H), 7.84-7.73 (m, 1.94H), 7.35-7.25 (m, 5H), 7.23-7.18 (m, 1H), 7.14 (t, *J* = 8.5 Hz, 2H), 7.07 (d, *J* = 7.1 Hz, 2H), 6.97 (d, *J* = 8.2 Hz, 1H), 5.19 (s, 0.97H), 5.11 (d, *J* = 6.0 Hz, 0.03H), 4.67 (d, *J* = 6.0 Hz, 0.03H), 4.44 (s, 0.97H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.4 (d, $^1J_{F\text{-}C}$= 257.0 Hz), 159.8, 150.8, 139.1, 132.8 (d, $^4J_{F\text{-}C}$= 3.1 Hz), 132.1 (d, $^3J_{F\text{-}C}$= 9.8 Hz), 129.7, 129.6, 129.2, 128.3, 127.0, 125.9, 120.8, 116.8 (d, $^2J_{F\text{-}C}$= 19.5 Hz), 116.5, 72.2, 42.3. ^{19}F NMR (376 MHz, $CDCl_3$) δ -101.16, -102.69. HPLC (Chiralpak IA, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 6.8 min (minor) and 9.7 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{21}H_{19}FNO_4S$ 400.1013, found: 400.1018.

(+)-3-((4-Chlorophenyl)sulfonyl)-4-phenylchroman-2-one (**2e**):

59 mg, 99% yield, colorless oil, new compound, R_f = 0.42 (hexanes/ethyl acetate 5/1), d.r. = 32:1,

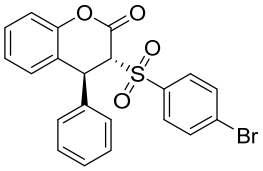


98% ee, $[\alpha]^{20}_D$ = +149.90 (*c* 1.18, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 8.6 Hz, 0.06H), 7.68 (d, *J* = 8.6 Hz, 1.94H), 7.41 (d, *J* = 8.6 Hz, 2H), 7.35-7.23 (m, 5H), 7.21-7.15 (m, 1H), 7.13 (d, *J* = 7.9 Hz, 0.06H), 7.04 (d, *J* = 7.0 Hz, 1.94H), 6.98 (d, *J* = 8.0 Hz, 0.03H), 6.94 (d, *J* = 8.1 Hz, 0.97H), 5.15 (s, 0.97H), 5.08 (d, *J* = 6.0 Hz, 0.03H), 4.64 (d, *J* = 6.0 Hz, 0.03H), 4.40 (s, 0.97H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.7, 150.7, 141.7, 139.1, 135.2, 130.5, 129.7, 129.7, 129.6, 129.2, 128.3, 127.0, 125.9, 120.7, 117.0, 72.1, 42.2. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 7.3 min (minor) and 10.2 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{21}H_{19}ClNO_4S$ 416.0718 (^{35}Cl) and 418.0700 (^{37}Cl), found: 416.0715 (^{35}Cl) and 418.0689 (^{37}Cl).

(+)-3-((4-Bromophenyl)sulfonyl)-4-phenylchroman-2-one (**2f**):

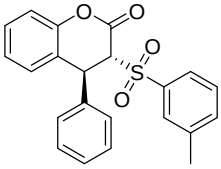
65 mg, 98% yield, colorless solid, new compound, mp = 127-128 °C, R_f = 0.43 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +145.22 (*c* 1.30, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66-7.56 (m, 4H), 7.36-7.26 (m, 5H), 7.23-7.18 (m, 1H), 7.07 (d, *J* = 7.0 Hz, 2H), 6.96 (d, *J* = 8.2

Hz, 1H), 5.17 (s, 1H), 4.43 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.7, 150.7, 139.0, 135.7, 132.6, 130.5, 129.7, 129.7, 129.2, 128.3, 127.0, 125.9, 120.7, 117.0, 72.1, 42.2. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 7.7 min (minor) and 10.8 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{21}H_{19}BrNO_4S$ 460.0213 (^{79}Br) and 462.0200 (^{81}Br), found: 460.0214 (^{79}Br) and 462.0196 (^{81}Br).



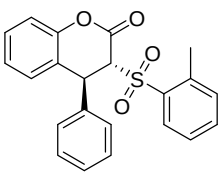
(+)-4-Phenyl-3-(*m*-tolylsulfonyl)chroman-2-one (**2g**):

56 mg, 99% yield, colorless oil, new compound, R_f = 0.51 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +147.85 (*c* 1.12, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (d, *J* = 7.6 Hz, 1H), 7.52 (s, 1H), 7.42-7.32 (m, 2H), 7.32-7.27 (m, 2H), 7.26-7.20 (m, 3H), 7.17-7.13 (m, 1H), 7.04 (d, *J* = 7.1 Hz, 2H), 6.92 (d, *J* = 8.1 Hz, 1H), 5.15 (s, 1H), 4.41 (s, 1H), 2.34 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.8, 150.9, 139.7, 139.4, 136.7, 135.5, 129.6, 129.6, 129.3, 129.2, 129.1, 128.2, 127.1, 126.3, 125.6, 120.9, 116.9, 72.1, 42.4, 21.3. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 80/20, flow rate = 0.8 mL/min) retention time = 9.2 min (minor) and 12.8 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{22}H_{22}NO_4S$ 396.1264, found: 396.1263.



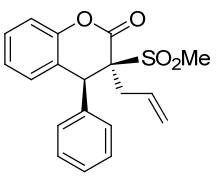
(+)-4-Phenyl-3-(*o*-tolylsulfonyl)chroman-2-one (**2h**):

40 mg, 70% yield, colorless oil, new compound, R_f = 0.51 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +178.71 (*c* 0.78, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90-7.82 (m, 1H), 7.54-7.49 (m, 1H), 7.36-7.22 (m, 7H), 7.20-7.15 (m, 1H), 7.14-7.09 (m, 1H), 7.06-7.01 (m, 2H), 5.17 (s, 1H), 4.40 (d, *J* = 0.9 Hz, 1H), 2.69 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.8, 151.1, 139.6, 138.6, 135.5, 134.8, 133.1, 131.5, 129.7, 129.7, 129.2, 128.2, 127.0, 126.8, 125.8, 121.0, 117.0, 71.2, 41.8, 20.8. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 80/20, flow rate = 0.8 mL/min) retention time = 8.8 min (minor) and 18.6 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{22}H_{22}NO_4S$ 396.1264, found: 396.1266.



(+)-3-Allyl-3-(methylsulfonyl)-4-phenylchroman-2-one (**2i**):

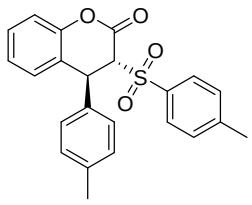
Procedure for allyl alkylation: Sodium carbonate (63.6 mg, 0.60 mmol), allyl iodide (100.8 mg, 54.8 μL, 0.60 mmol) and 18-crown-6 (11.8 mg, 10.2 μL, 0.045 mmol) were added to the stirred solution of the reductive product of **1i** (45 mg, 0.15 mmol) in tetrahydrofuran (3.0 mL). The mixture was stirred at ambient temperature for 24 h. The mixture was concentrated under the reduced pressure, and then purified by column chromatography on silica gel using hexanes and ethyl acetate as eluent to afford the product (+)-**2i**, 47 mg, 91% yield, white solid, new compound, mp = 63-64 °C, R_f = 0.61 (hexanes/ethyl acetate 10/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +250.09 (*c* 0.94, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.79-6.87 (m, 9H), 6.16-5.97 (m, 1H), 5.19 (d, *J* = 10.0 Hz, 1H), 4.80 (d, *J* = 17.0 Hz, 1H), 4.53 (s, 1H), 3.06-2.97 (m, 1H), 2.86-2.77 (m, 1H), 2.16 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.3, 149.6, 137.1, 130.6, 129.5, 129.2, 128.8, 126.0, 124.8, 121.3, 116.9, 73.6, 49.2, 41.4, 35.8. HPLC (Chiralpak AD-H column, λ = 230 nm, 30 °C,



n-Hexane/*i*-PrOH = 80/20, flow rate = 1.0 mL/min) retention time = 9.0 min (major) and 10.2 min (minor). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{19}H_{22}NO_4S$ $[M+NH_4]^+$ 360.1264, found: 360.1262.

(+)-4-(*p*-Tolyl)-3-tosylchroman-2-one (**2j**):

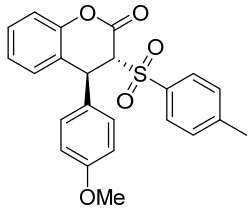
56 mg, 95% yield, colorless oil, new compound, R_f = 0.37 (hexanes/ethyl acetate 5/1), d.r. > 20:1,



98% ee, $[\alpha]^{20}_D$ = +158.56 (*c* 1.05, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.3 Hz, 2H), 7.28-7.21 (m, 4H), 7.16-7.12 (m, 1H), 7.08 (d, *J* = 8.0 Hz, 2H), 6.95-6.88 (m, 3H), 5.10 (s, 1H), 4.37 (s, 1H), 2.40 (s, 3H), 2.27 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.0, 150.8, 145.9, 138.0, 136.5, 133.9, 130.2, 129.9, 129.3, 129.2, 129.1, 126.9, 125.6, 121.2, 116.9, 72.2, 41.9, 21.7, 21.0. HPLC (Chiralpak ID column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 14.9 min (major) and 18.0 min (minor). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{23}H_{24}NO_4S$ 410.1421, found: 410.1423.

(+)-4-(4-Methoxyphenyl)-3-tosylchroman-2-one (**2k**):

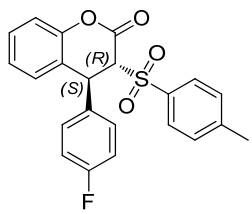
55 mg, 90% yield, pale yellow solid, new compound, mp = 132-133 °C, R_f = 0.30 (hexanes/ethyl



acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +156.08 (*c* 1.10, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (d, *J* = 8.1 Hz, 2H), 7.28-7.20 (m, 4H), 7.17-7.12 (m, 1H), 7.00-6.89 (m, 3H), 6.79 (d, *J* = 8.6 Hz, 2H), 5.08 (s, 1H), 4.36 (s, 1H), 3.72 (s, 3H), 2.39 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.0, 159.3, 150.8, 145.9, 133.9, 131.4, 129.9, 129.3, 129.1, 129.0, 128.2, 125.7, 121.3, 116.9, 114.9, 72.3, 55.3, 41.6, 21.7. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 70/30, flow rate =1.0 mL/min) retention time = 11.1 min (minor) and 13.5 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{23}H_{24}NO_5S$ 426.1370, found: 426.1370.

(+)-(3*R*,4*S*)-4-(4-Fluorophenyl)-3-tosylchroman-2-one (**2l**):

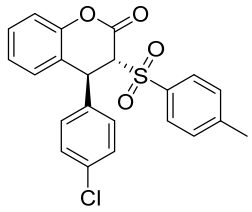
59 mg, 99% yield, pale yellow solid, new compound, mp = 117-118 °C, R_f = 0.37 (hexanes/ethyl



acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +151.60 (*c* 1.18, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.3 Hz, 2H), 7.31-7.22 (m, 4H), 7.19-7.14 (m, 1H), 7.03-6.93 (m, 5H), 5.13 (s, 1H), 4.34 (s, 1H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.3 (d, $^1J_{F-C}$= 246.3 Hz), 159.8, 150.8, 146.1, 135.2 (d, $^4J_{F-C}$= 3.5 Hz), 133.8, 129.9, 129.6, 129.1, 129.1, 128.8 (d, $^3J_{F-C}$= 8.1 Hz), 125.8, 120.8, 117.0, 116.5 (d, $^2J_{F-C}$= 21.6 Hz), 72.1, 41.6, 21.7. ^{19}F NMR (376 MHz, $CDCl_3$) δ -113.53. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 7.8 min (minor) and 10.2 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{22}H_{21}FNO_4S$ 414.1170, found: 414.1165.

(+)-4-(4-Chlorophenyl)-3-tosylchroman-2-one (**2m**):

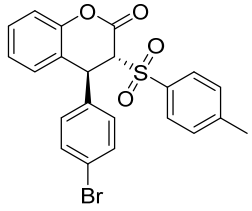
61 mg, 99% yield, colorless oil, new compound, R_f = 0.50 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +147.37 (*c* 1.22, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.2 Hz, 2H),



7.32-7.21 (m, 6H), 7.19-7.14 (m, 1H), 7.00-6.93 (m, 3H), 5.12 (s, 1H), 4.33 (s, 1H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.7, 150.8, 146.1, 137.9, 134.2, 133.7, 129.9, 129.7, 129.1, 129.1, 128.5, 125.8, 120.5, 117.0, 71.8, 41.6, 21.8. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 75/25, flow rate = 1.0 mL/min) retention time = 10.1 min (minor) and 13.0 min (major). HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{22}H_{18}ClO_4S$ 413.0609 (^{35}Cl) and 415.0592 (^{37}Cl), found:413.0609 (^{35}Cl) and 415.0576 (^{37}Cl).

(+)-4-(4-Bromophenyl)-3-tosylchroman-2-one (**2n**):

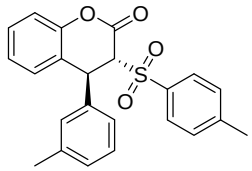
68 mg, 99% yield, colorless oil, new compound, R_f = 0.54 (hexanes/ethyl acetate 5/1), d.r. > 20:1,



98% ee, $[\alpha]^{20}_D$ = +135.43 (*c* 1.36, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 7.9 Hz, 2H), 7.41 (d, *J* = 8.0 Hz, 2H), 7.31-7.20 (m, 4H), 7.19-7.14 (m, 1H), 6.97-6.86 (m, 3H), 5.11 (s, 1H), 4.34 (s, 1H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.7, 150.8, 146.1, 138.4, 133.7, 132.7, 129.9, 129.7, 129.1, 129.1, 128.8, 125.8, 122.3, 120.4, 117.0, 71.7, 41.7, 21.8. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 75/25, flow rate = 1.0 mL/min) retention time = 10.6 min (minor) and 14.0 min (major). HRMS (ESI) m/z: $[M+Na]^+$ Calcd for $C_{22}H_{17}BrNaO_4S$ 478.9923 (^{79}Br) and 480.9910 (^{81}Br), found: 478.9923 (^{79}Br) and 480.9894 (^{81}Br).

(+)-4-(*m*-Tolyl)-3-tosylchroman-2-one (**2o**):

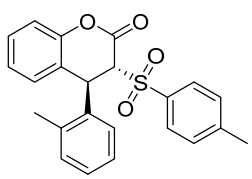
58 mg, 99% yield, pale yellow oil, new compound, R_f = 0.54 (hexanes/ethyl acetate 5/1), d.r. > 20:1,



98% ee, $[\alpha]^{20}_D$ = +160.25 (*c* 1.16, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.2 Hz, 2H), 7.29-7.21 (m, 4H), 7.17-7.12 (m, 2H), 7.03 (d, *J* = 7.5 Hz, 1H), 6.93 (d, *J* = 8.1 Hz, 1H), 6.85 (s, 1H), 6.80 (d, *J* = 7.7 Hz, 1H), 5.10 (s, 1H), 4.38 (s, 1H), 2.39 (s, 3H), 2.26 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.0, 150.8, 146.0, 139.4, 139.4, 133.9, 129.9, 129.4, 129.4, 129.2, 129.1, 128.9, 127.7, 125.7, 124.1, 121.0, 116.9, 72.1, 42.2, 21.8, 21.5. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 75/25, flow rate = 1.0 mL/min) retention time = 7.0 min (minor) and 8.4 min (major). HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{21}O_4S$ 393.1155, found: 393.1154.

(+)-4-(*o*-Tolyl)-3-tosylchroman-2-one (**2p**):

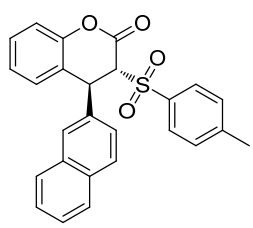
14 mg, 24% yield, colorless oil, new compound, R_f = 0.52 (hexanes/ethyl acetate 5/1), d.r. > 20:1,



98% ee, $[\alpha]^{20}_D$ = +113.92 (*c* 0.28, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 (d, *J* = 8.2 Hz, 2H), 7.33-7.26 (m, 2H), 7.25-7.21 (m, 2H), 7.20-7.11 (m, 3H), 7.04-6.97 (m, 2H), 6.55 (d, *J* = 7.7 Hz, 1H), 5.39 (s, 1H), 4.21 (s, 1H), 2.54 (s, 3H), 2.41 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.8, 151.5, 146.0, 137.1, 134.9, 133.9, 131.5, 129.9, 129.4, 129.3, 129.0, 128.1, 127.3, 127.2, 125.8, 121.1, 116.8, 70.7, 38.7, 21.8, 19.4. HPLC (Chiralpak IA column, λ = 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 75/25, flow rate = 1.0 mL/min) retention time = 6.7 min (minor) and 8.4 min (major). HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{21}O_4S$ 393.1155, found: 393.1152.

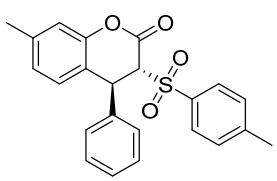
(+)-4-(Naphthalen-2-yl)-3-tosylchroman-2-one (**2q**):

64 mg, 99% yield, pale yellow oil, new compound, R_f = 0.55 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 97% ee, $[\alpha]^{20}_D$ = +156.55 (*c* 1.28, $CHCl_3$),^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80-7.73 (m, 2H), 7.70-7.63 (m, 3H), 7.46-7.41 (m, 2H), 7.37 (s, 1H), 7.33-7.25 (m, 2H), 7.22 (d, *J* = 8.5 Hz, 3H), 7.18-7.13 (m, 1H), 6.98 (d, *J* = 8.0 Hz, 1H), 5.31 (s, 1H), 4.50 (s, 1H), 2.37 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.0, 151.0, 146.1, 136.7, 133.8, 133.4, 132.8, 129.9, 129.8, 129.6, 129.4, 129.1, 128.0, 127.7, 126.8, 126.7, 126.1, 125.8, 124.7, 120.9, 117.0, 71.9, 42.4, 21.8. HPLC: (Chiralpak IA column, λ = 230 nm, 30 ^{o}C, *n*-Hexane/*i*-PrOH = 75/25, flow rate = 1.0 mL/min) retention time = 12.2 min (minor) and 14.7 min (major). HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{26}H_{21}O_4S$ 429.1155, found: 429.1151.



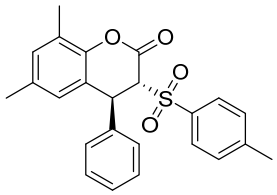
(+)-7-Methyl-4-phenyl-3-tosylchroman-2-one (**2r**):

49 mg, 83% yield, colorless oil, new compound, R_f = 0.50 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +156.62 (*c* 0.98, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (d, *J* = 7.9 Hz, 2H), 7.31-7.18 (m, 5H), 7.14-6.94 (m, 4H), 6.73 (s, 1H), 5.09 (s, 1H), 4.36 (s, 1H), 2.40 (s, 3H), 2.32 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.2, 150.8, 145.9, 140.0, 139.6, 134.0, 129.8, 129.5, 129.1, 128.9, 128.1, 127.1, 126.5, 117.8, 117.3, 72.2, 42.0, 21.8, 21.2. HPLC (Chiralpak IA column, λ = 230 nm, 30 ^{o}C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 7.5 min (minor) and 9.9 min (major). HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{23}H_{21}O_4S$ 393.1155, found: 393.1152.



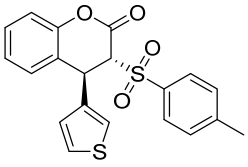
(+)-6,8-Dimethyl-4-phenyl-3-tosylchroman-2-one (**2s**):

58 mg, 95% yield, colorless oil, new compound, R_f = 0.53 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 99% ee, $[\alpha]^{20}_D$ = +128.61 (*c* 1.16, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (d, *J* = 8.2 Hz, 2H), 7.30-7.16 (m, 5H), 7.03 (d, *J* = 7.3 Hz, 2H), 6.86 (d, *J* = 4.3 Hz, 2H), 5.03 (s, 1H), 4.39 (s, 1H), 2.38 (s, 3H), 2.24 (s, 3H), 2.09 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.3, 147.1, 145.8, 139.5, 134.9, 133.9, 131.6, 129.6, 129.5, 129.0, 128.1, 127.1, 127.0, 125.9, 120.1, 72.5, 42.8, 21.7, 20.7, 15.4. HPLC (Chiralpak IA column, λ = 230 nm, 30 ^{o}C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 1.0 mL/min) retention time = 5.9 min (minor) and 7.4 min (major). HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{24}H_{23}O_4S$ 407.1312, found: 407.1305.



(+)-4-(Thiophen-3-yl)-3-tosylchroman-2-one (**2t**):

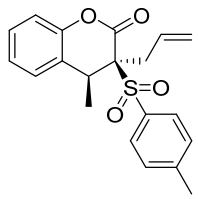
50 mg, 87% yield, colorless oil, new compound, R_f = 0.53 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 98% ee, $[\alpha]^{20}_D$ = +128.47 (*c* 0.92, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64-7.59 (m, 2H), 7.30-7.21 (m, 5H), 7.18-7.13 (m, 1H), 6.91-6.86 (m, 2H), 6.84-6.76 (m, 1H), 5.17 (s, 1H), 4.46 (s, 1H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.1, 150.5, 146.0, 139.6, 134.0, 129.9, 129.4, 129.0, 128.9, 127.9, 125.9, 125.6, 122.4, 121.4, 117.0, 71.2, 38.1, 21.7. HPLC (Chiralpak AD-H column, λ = 230 nm, 30 ^{o}C, *n*-Hexane/*i*-PrOH = 70/30, flow rate = 0.8 mL/min) retention time =



13.5 min (minor) and 19.1 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{20}H_{20}NO_4S_2$ 402.0828, found: 402.0829.

(-)-3-Allyl-4-methyl-3-tosylchroman-2-one (**2u**):

Procedure for allyl alkylation: Potassium carbonate (82.8 mg, 0.60 mmol), allyl iodide (100.8 mg, 54.8 μL, 0.60 mmol), 18-crown-6 (11.8 mg, 10.2 μL, 0.045 mmol) and tetrahydrofuran (3.0 mL) were added to the mixture of the reduction system. The mixture was stirred at ambient temperature for 48 h. The mixture was concentrated under the reduced pressure, and then purified by column chromatography on silica gel using hexanes and ethyl acetate as eluent to afford the product (-)-**2u**, 30 mg, 56% yield, colorless oil, new compound, R_f = 0.60 (hexanes/ethyl acetate 5/1), d.r. > 20:1, 93% ee, $[\alpha]^{20}_D$ = -22.25 (*c* 0.40, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.3 Hz, 2H), 7.30-7.26 (m, 2H), 7.25-7.20 (m, 2H), 7.19-7.14 (m, 1H), 6.87 (dd, *J* = 7.9, 1.1 Hz, 1H), 5.65-5.49 (m, 1H), 5.19-5.10 (m, 2H), 3.65 (q, *J* = 7.1 Hz, 1H), 3.02 (dd, *J* = 14.4, 5.7 Hz, 1H), 2.78 (dd, *J* = 14.4, 8.8 Hz, 1H), 2.41 (s, 3H), 1.76 (d, *J* = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.6, 150.1, 145.6, 134.0, 130.2, 130.1, 129.5, 128.4, 126.1, 125.5, 125.3, 121.6, 115.8, 73.2, 35.3, 34.6, 21.7, 13.4. HPLC (Chiralpak AD-H column, λ = 230 nm, 30 ^{o}C, *n*-Hexane/*i*-PrOH = 90/10, flow rate = 1.0 mL/min) retention time = 12.4 min (minor) and 13.2 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{20}H_{24}NO_4S$ 374.1421, found: 374.1413.



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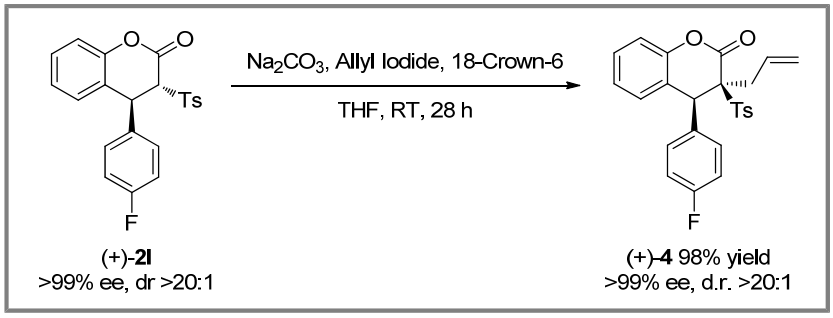
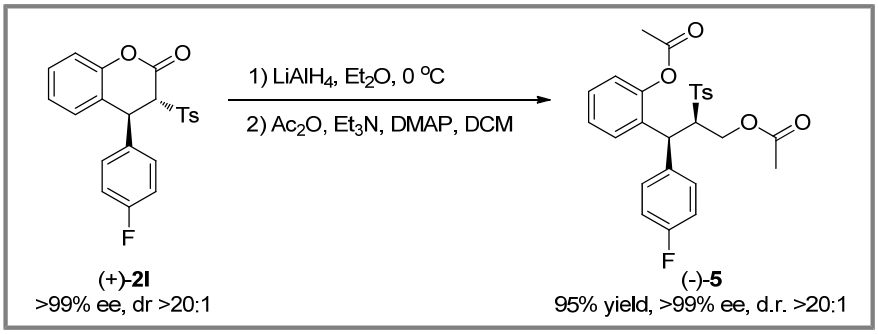
5. Transformation of the Biomimetic Reductive Products



Sodium carbonate (42.4 mg, 0.40 mmol), allyl iodide (67.2 mg, 36.5 μL, 0.40 mmol) and 18-crown-6 (7.9 mg, 6.8 μL, 0.03 mmol) were added to the stirred solution of (+)-**2l** (39.6 mg, 0.10 mmol, 99% ee) in tetrahydrofuran (2.0 mL). The mixture was stirred at ambient temperature for 28 hours. The mixture was concentrated under the reduced pressure, and then purified by column chromatography on silica gel using hexanes and ethyl acetate as eluent to afford the desirable alkylation product (+)-**4**.

(+)-(3*S*,4*S*)-3-Allyl-4-(4-fluorophenyl)-3-tosylchroman-2-one (**4**):
43 mg, 98% yield, colorless oil, new compound, R_f = 0.41 (hexanes/ethyl acetate 5/1), >99% ee, $[\alpha]^{20}_D$ = +176.03 (*c* 0.86, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 (d, *J* = 8.1 Hz, 2H), 7.30 (t, *J* = 7.2 Hz, 3H), 7.20 (d, *J* = 8.1 Hz, 2H), 7.15-7.05 (m, 3H), 6.91 (t, *J* = 8.3 Hz, 2H), 5.83-5.68 (m, 7.3 Hz, 1H), 5.15 (d, *J* = 10.0 Hz, 1H), 4.79 (d, *J* = 16.9 Hz, 1H), 4.70 (s, 1H), 2.84-2.72 (m, 2H), 2.39 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.5, 162.5 (d, $^1J_{F\text{-}C}$= 246.2 Hz), 149.4, 145.2, 134.8, 133.1 (d, $^4J_{F\text{-}C}$= 3.1 Hz), 131.3 (d, $^3J_{F\text{-}C}$= 6.7 Hz), 131.1, 130.0, 129.2, 129.2, 128.7, 125.6, 125.0, 121.7, 116.7, 115.7 (d, $^2J_{F\text{-}C}$= 21.3 Hz), 74.6, 48.0, 37.5, 21.7. ^{19}F NMR (376 MHz, $CDCl_3$) δ -113.68. HPLC (Chiralpak IC column, 230 nm, 30 °C, *n*-Hexane/*i*-PrOH = 80/20, flow = 1.0 mL/min) retention time = 14.9 min (minor) and 16.2 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{25}H_{25}FNO_4S$ 454.1483, found: 454.1486.



To a solution of (+)-**2l** (39.6 mg, 0.10 mmol, 99% ee) in ethyl ether (3.0 mL) was added lithium aluminium tetrahydride (5.7 mg, 0.15 mmol) at 0 °C. The reaction mixture was stirred for 3 h. The solution was quenched with water (3.0 mL) and 1N HCl (3.0 mL). The aqueous layer was extracted with ethyl acetate (10 mL×3), washed with brine, dried over anhydrous sodium sulfate, and concentrated under the reduced pressure. Then, to the solution of the concentrated mixture above in dichloromethane (3.0 mL) was added triethylamine (101 mg, 0.14 mL, 1.0 mmol), 4-

dimethylaminopyridine (6.1 mg, 0.05 mmol) and acetic anhydride (51.1 mg, 47.3 μL, 0.5 mmol) at ambient temperature. The reaction mixture was stirred overnight. The solution was quenched with saturated ammonium chloride aqueous solution (10 mL). The aqueous layer was extracted with dichloromethane, washed with brine, dried over anhydrous sodium sulfate, and concentrated under the reduced pressure. The residue was purified by silica gel column chromatography using hexanes and ethyl acetate as eluent to afford the desirable product (-)-**5**.

(-)-2-((1*S*,2*R*)-3-Acetoxy-1-(4-fluorophenyl)-2-tosylpropyl)phenyl acetate (**5**):

46 mg, 95% yield, colorless oil, new compound, R_f = 0.31 (hexanes/ethyl acetate 2/1), >99% ee, $[\alpha]^{20}_D$ = -44.45 (*c* 0.92, $CHCl_3$), ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.2 Hz, 2H), 7.26-7.12 (m, 7H), 7.03 (d, *J* = 8.0 Hz, 1H), 6.81 (t, *J* = 8.6 Hz, 2H), 4.94 (d, *J* = 9.8 Hz, 1H), 4.55-4.47 (m, 1H), 4.30-4.21 (m, 2H), 2.39 (s, 3H), 2.38 (s, 3H), 1.84 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.1, 169.1, 161.7 (d, $^1J_{F\text{-}C}$= 244.8 Hz), 148.1, 144.5, 137.0, 135.4 (d, $^4J_{F\text{-}C}$= 2.9 Hz), 132.1, 130.0 (d, $^3J_{F\text{-}C}$= 8.1 Hz), 129.5, 128.7, 128.4, 128.3, 126.5, 123.4, 115.3 (d, $^2J_{F\text{-}C}$= 21.5 Hz), 66.2, 60.9, 41.0, 21.6, 21.1, 20.4. ^{19}F NMR (376 MHz, $CDCl_3$) δ -115.37. HPLC (Chiralpak AD-H column, 230 nm, 30 ^{o}C, *n*-Hexane/*i*-PrOH = 60/40, flow = 1.0 mL/min) retention time = 9.7 min (minor) and 15.2 min (major). HRMS (ESI) m/z: $[M+NH_4]^+$ Calcd for $C_{26}H_{29}FNO_6S$ 502.1694, found: 502.1696.

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6. Determination of the Absolute Configuration

To determine the absolute configuration of (+)-4-(4-fluorophenyl)-3-tosylchroman-2-one (**2l**) (98% ee)**:** firstly, (+)-**2l** was upgraded to >99% ee by recrystallization with *n*-hexane/dichloromethane and completely dissolved in dichloromethane (2 mL). Then part of dichloromethane was evaporated and *n*-hexane (3 mL) was added slowly at ambient temperature. The solvent was slowly evaporated and the single crystal of was obtained after one day. The structure in **Figure S1** showed the absolute configuration of (+)-**2l** is (3*R*,4*S*). The CCDC number is 2069554. These details can be obtained free of charge *via* www.ccdc.com.ac.uk/data_request/cif from the Cambridge Crystallographic Data Centre.

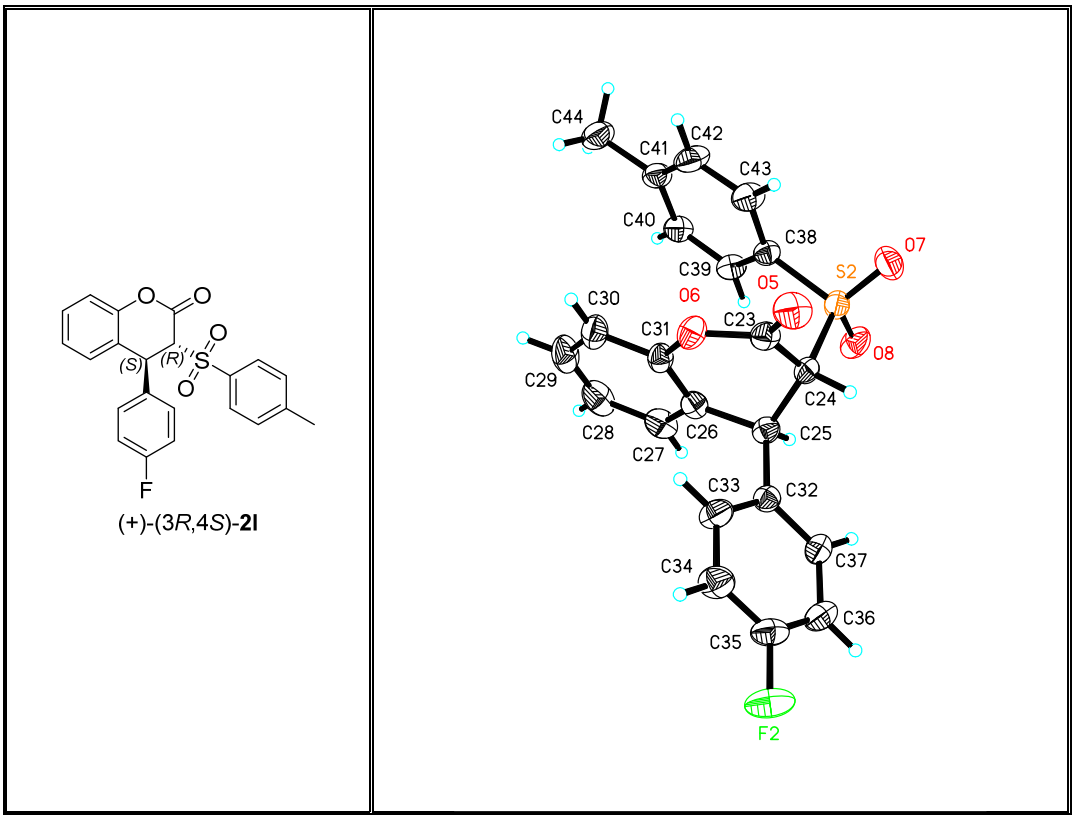


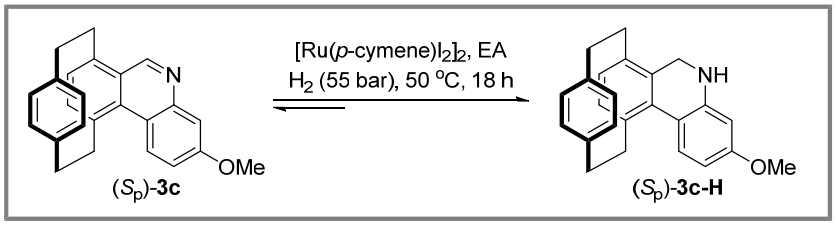
Figure S1. X-ray Crystallographic Analysis of (+)-(3*R*,4*S*)-**2l**

Crystal Data and Structure Refinement for mo_d8v21165_0m for (+)-(3*R*,4*S*)-**2l**

Identification code	mo_d8v21165_0m	
Empirical formula	$C_{22}\ H_{17}\ F\ O_4\ S$	
Formula weight	396.41	
Temperature	293(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	P 21	
Unit cell dimensions	a = 8.3425(2) Å	α = 90°
	b = 24.9386(7) Å	β = 99.1170(10)°
	c = 9.4740(3) Å	γ = 90°
Volume	1946.17(9) $Å^3$	
Z	4	
Density (calculated)	1.353 Mg/m^3	
Absorption coefficient	0.201 mm^{-1}	
F(000)	824	
Crystal size	0.200 x 0.150 x 0.120 mm^3	
Theta range for data collection	2.473 to 25.999°.	
Index ranges	-10<=h<=10, -30<=k<=30, -9<=l<=11	
Reflections collected	20019	
Independent reflections	7567 [R(int) = 0.0238]	
Completeness to theta = 25.242°	99.1 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.7456 and 0.6411	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	7567 / 1 / 508	
Goodness-of-fit on F2	1.020	
Final R indices [I>2sigma(I)]	R_1 = 0.0333, wR_2 = 0.0780	
R indices (all data)	R_1 = 0.0404, wR_2 = 0.0838	
Absolute structure parameter	0.020(18)	
Extinction coefficient	0.018(4)	
Largest diff. peak and hole	0.157 and -0.165 e.$Å^{-3}$	

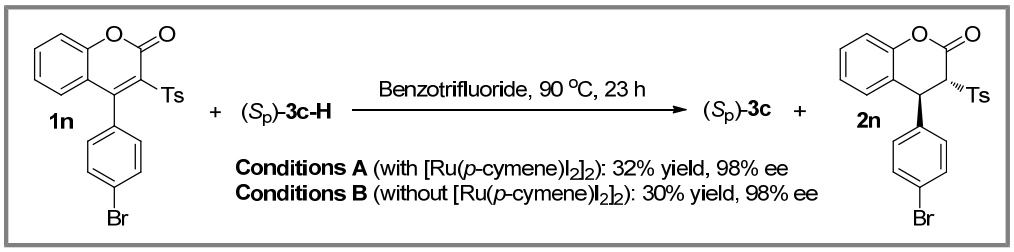
7. Mechanistic Investigation

7.1 The Reduction of NAD(P)H Model (S_p)-3c with Hydrogen Gas



A mixture of [Ru(*p*-cymene)I_2]$_2$ (4.9 mg, 0.005 mmol), (S_p)-**3c** (33.9 mg, 0.10 mmol) in ethyl acetate (2 mL) was stirred at room temperature for 5 min in glove box and then the mixture was transferred to an autoclave. The hydrogenation was performed at 50 °C under hydrogen gas (55 bar) for 18 h. After careful release of the gas, the autoclave was opened, and it gave the reductive (S_p)-**3c**-H (about 95% yield). Because (S_p)-**3c**-H was unstable (easy rearomatization to **3c**), it directly participated in the next reaction without further separation.

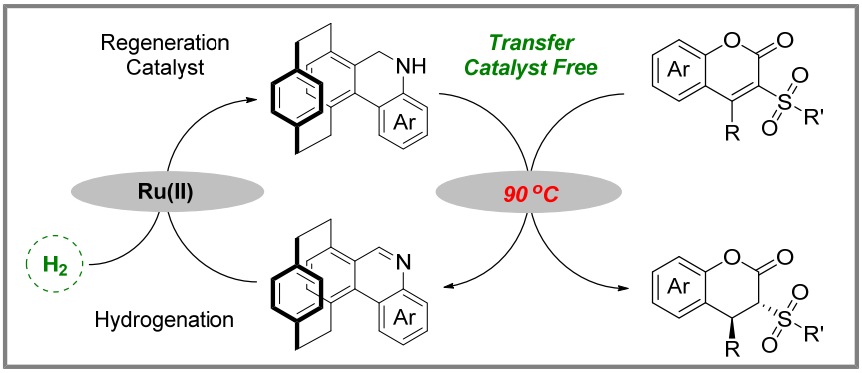
7.2 Control Experiments of Ruthenium Complex



Conditions A: in a 10 mL sealed tube, a mixture of (S_p)-**3c**-H (34.2 mg, 0.10 mmol), [Ru(p-cymene)I_2]$_2$ (1.5 mg, 0.0015 mmol) and substrate **1n** (45.5, 0.10 mmol) in benzotrifluoride (3.0 mL) was stirred at 90 °C for 23 h. The final reaction mixture was concentrated in vacuo and gave product **2n** with 32% yield and 98% ee.

Conditions B: in a 10 mL sealed tube, a mixture of (S_p)-**3c**-H (34.2 mg, 0.10 mmol) and substrate **1n** (45.5, 0.10 mmol) in benzotrifluoride (3.0 mL) was stirred at 90 °C for 23 h. The final reaction mixture was concentrated in vacuo and gave product **2n** with 30% yield and 98% ee.

Similar results could be achieved for conditions A and B, which indicated that reduced (S_p)-**3c**-H reagent participated in the hydrogenation process without the ruthenium complex. Based on the experimental results and our previous work[1,4-5], a plausible mechanism for the biomimetic asymmetric reduction of 3-sulfonyl coumarins was illustrated in the scheme below.



8. References

1) Zhu, Z.-H.; Ding, Y.-X.; Wu, B.; Zhou, Y.-G. Design and Synthesis of Chiral and Regenerable [2.2]Paracyclophane-Based NAD(P)H Models and Application in Biomimetic Reduction of Flavonoids. *Chem. Sci.* **2020**, *11*, 10220-10224.

2) Ren, H.; Zhang, M; Zhang, A. Q. Synthesis of 3-Sulfonyl Coumarins through Radical Sulfonylation with Disulfides under Catalyst-Free Conditions. *Tetrahedron* **2018**, *74*, 4435-4444.

3) Kanyiva, K. S.; Hamada, D.; Makino, S.; Takano, H.; Shibata, T. α-Amino Acid Sulfonamides as Versatile Sulfonylation Reagents: Silver-Catalyzed Synthesis of Coumarins and Oxindoles by Radical Cyclization. *Eur. J. Org. Chem.* **2018**, *43*, 5905-5909.

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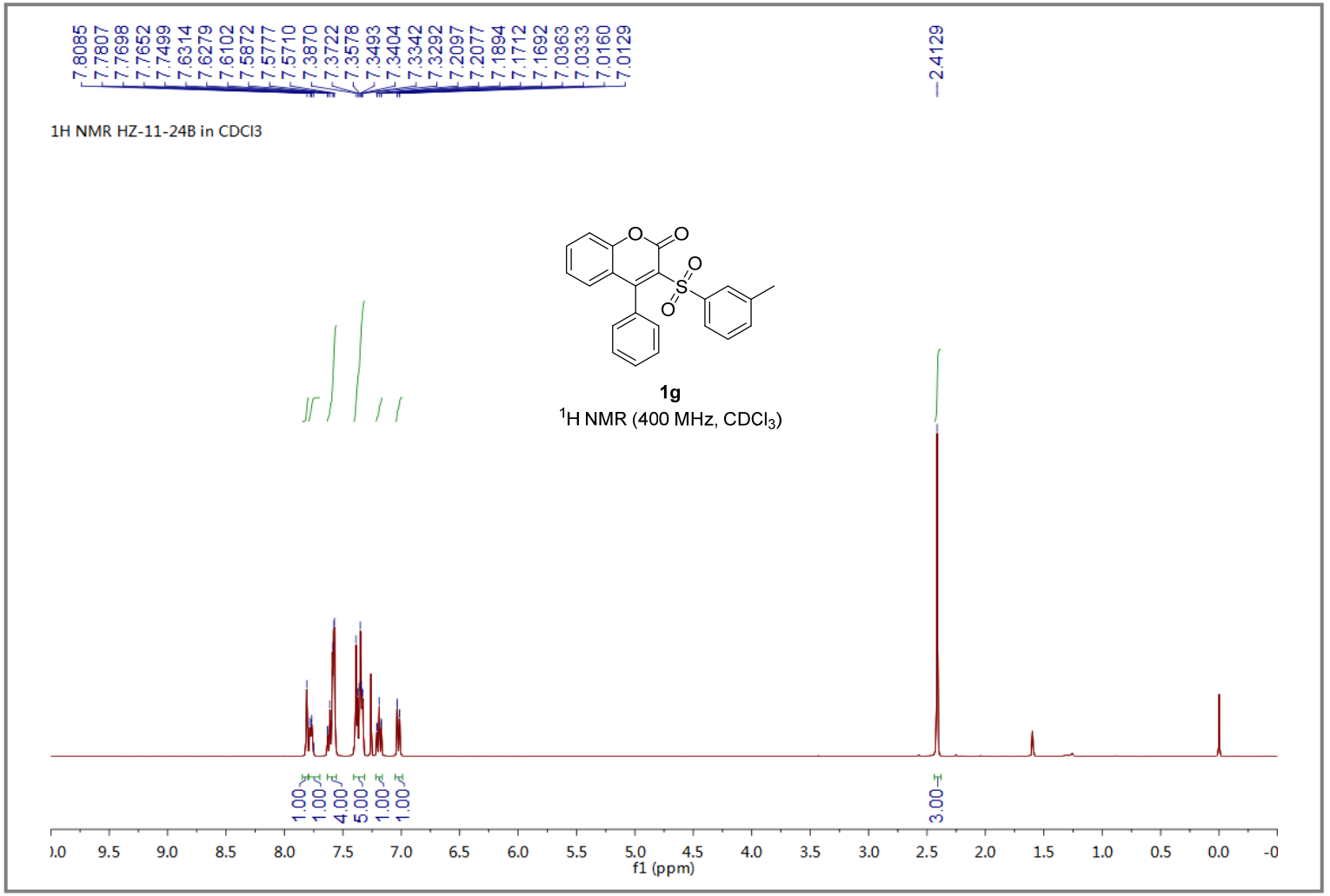
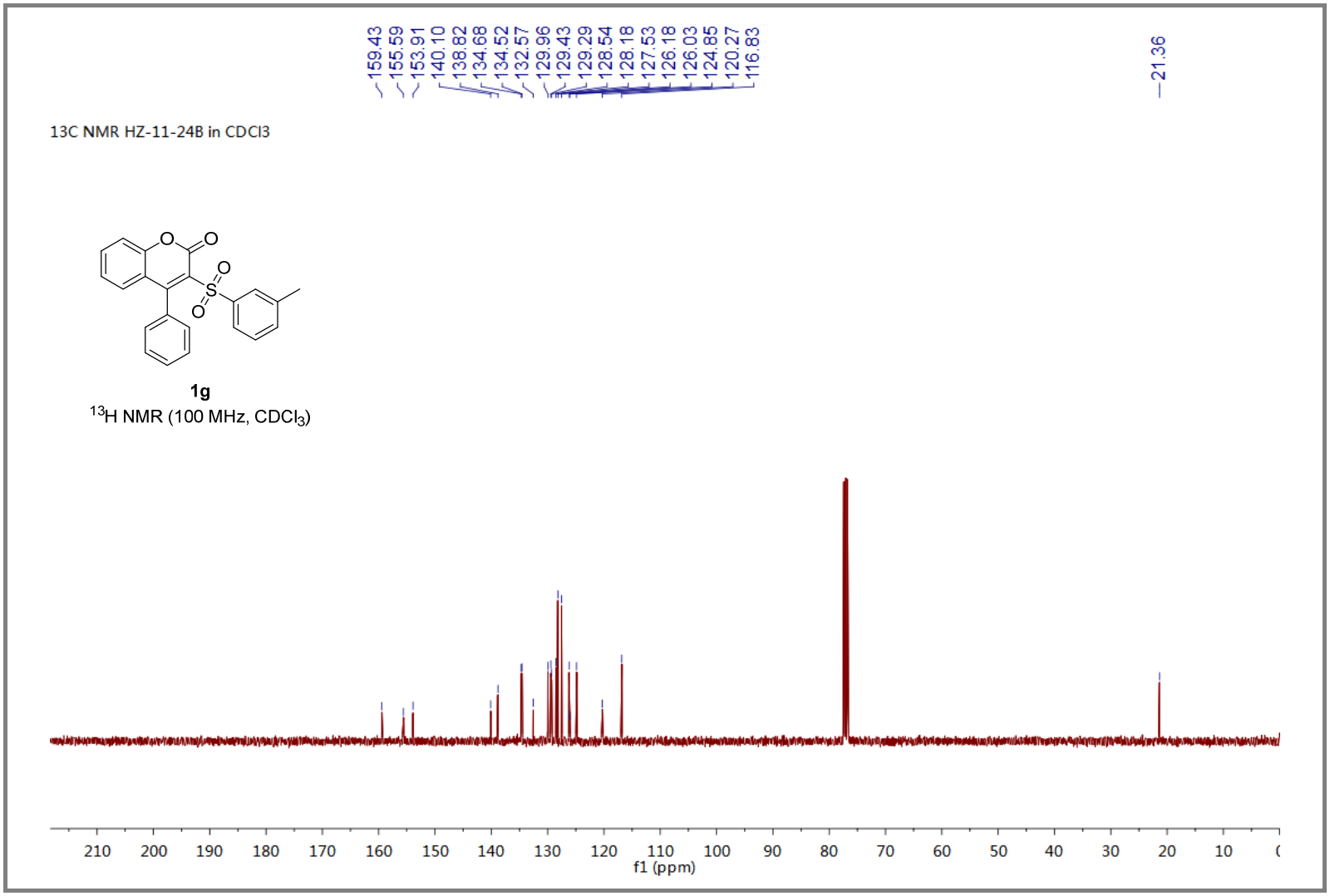
5) Wang, J.; Zhao, Z.-B.; Zhao, Y. Luo, G.; Zhu, Z.-H.; Luo, Y; Zhou, Y.-G. Chiral and Regenerable NAD(P)H Models Enabled Biomimetic Asymmetric Reduction: Design, Synthesis, Scope, and Mechanistic Studies. *J. Org. Chem*. **2020**, *85*, 2355-2368.

9. Copy of NMR and HPLC Spectra

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155.59
153.91
140.10
138.82
134.68
134.52
132.57
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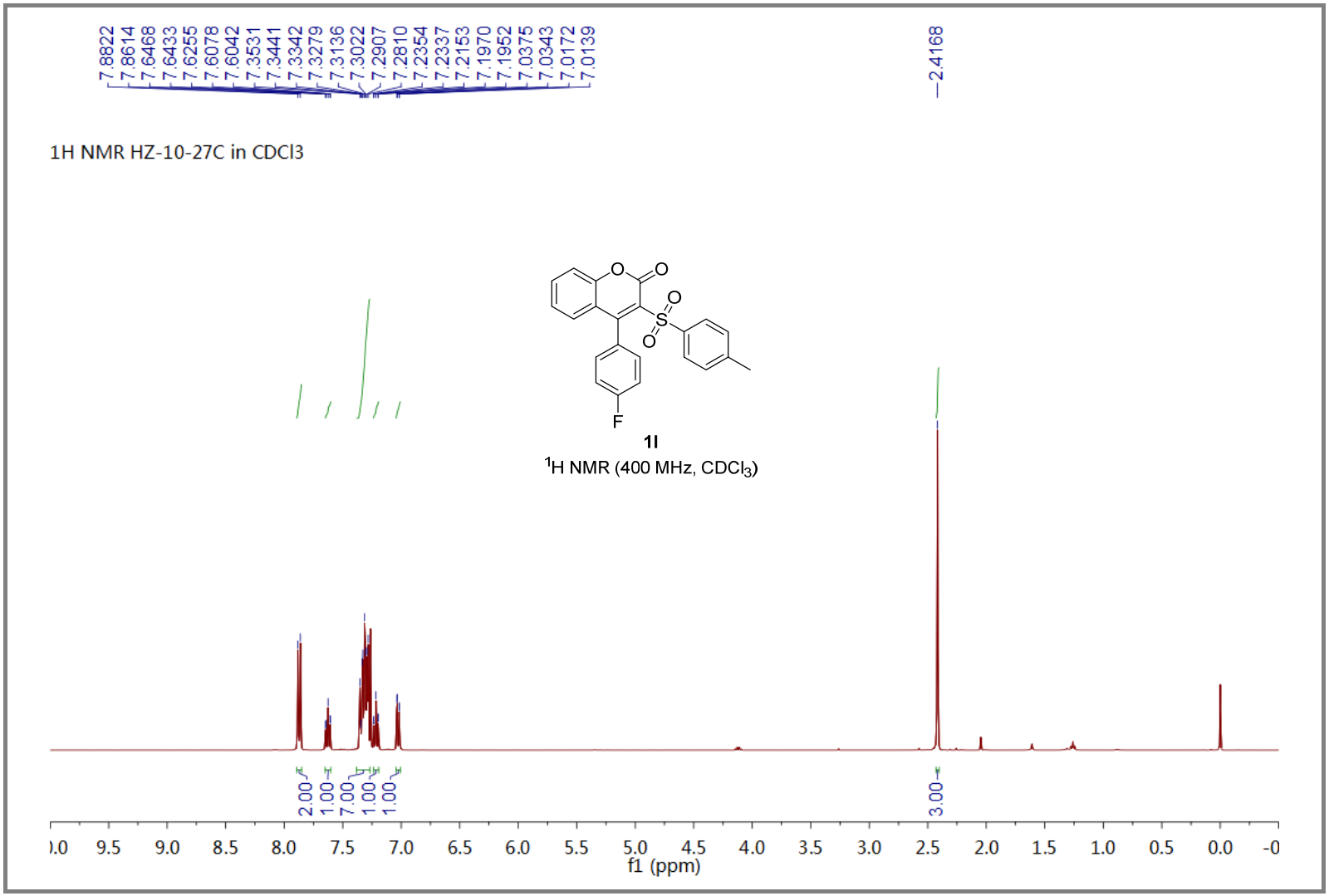
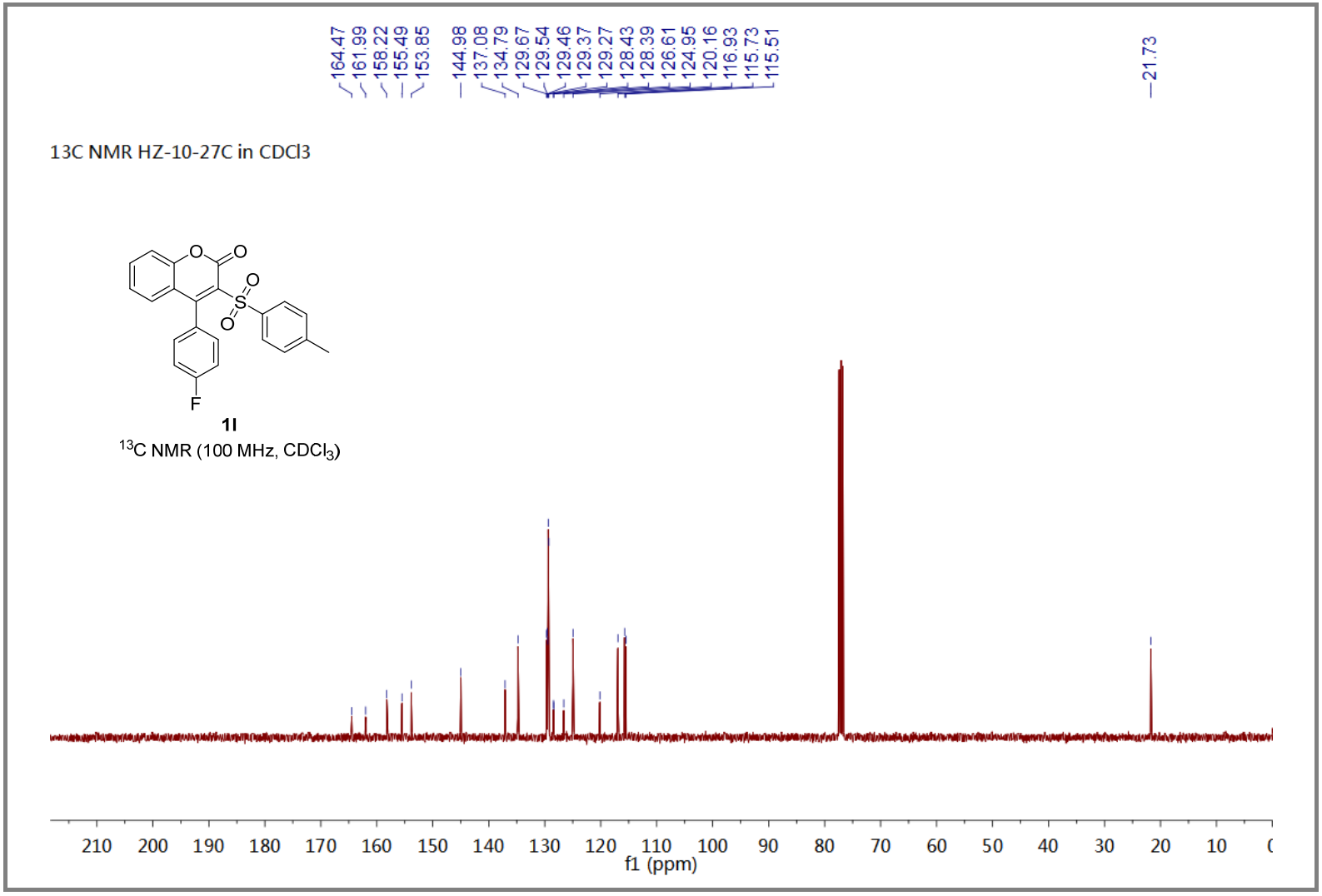
129.43
129.29
128.54
128.18
127.53
126.18
126.03
124.85
120.27
116.83
21.36
13C NMR HZ-11-24B in CDCl3
1g
13H NMR (100 MHz, CDCl3)
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)



1l

^{1}H NMR (400 MHz, $CDCl_3$)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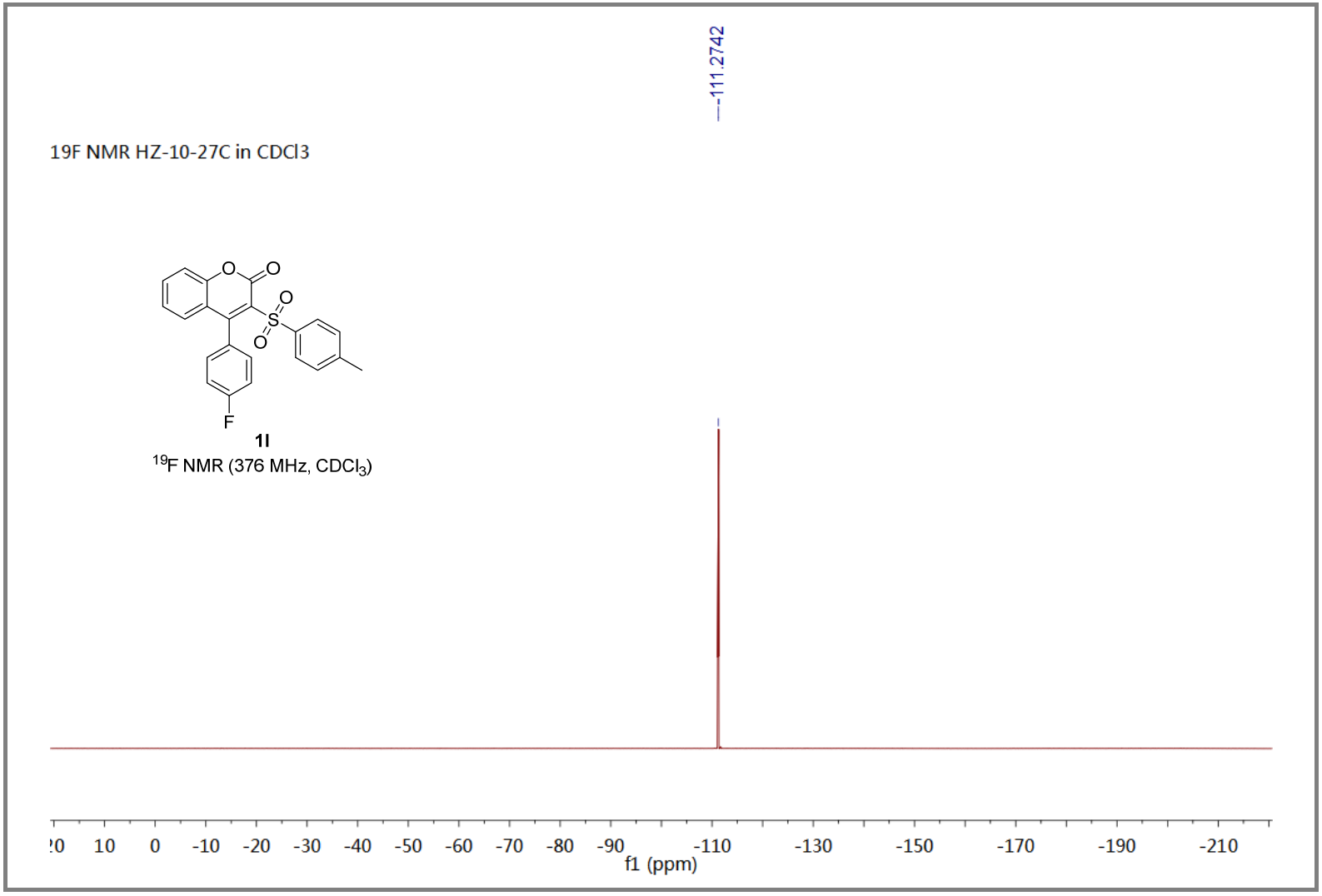
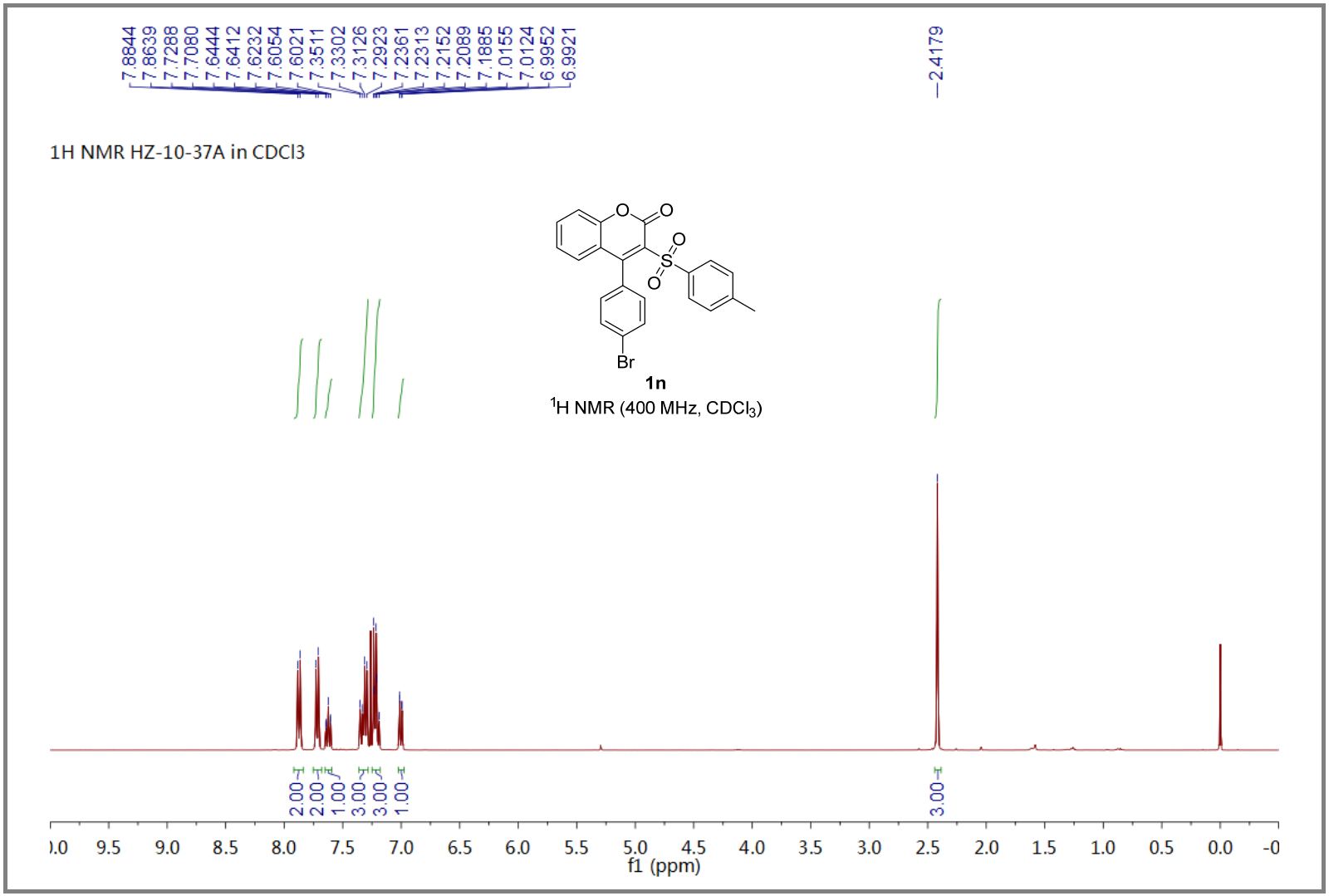
161.99
158.22
155.49
153.85
144.98
137.08
134.79
129.67
129.54
129.46
129.37
129.27
128.43
128.39
126.61
124.95
120.16
116.93
115.73
115.51
21.73
13C NMR HZ-10-27C in CDCl3
O
O
O
S
O
F
1l
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)


19F NMR HZ-10-27C in CDCl3
-111.2742
O
O
O
S
O
F
1l
19F NMR (376 MHz, CDCl3)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-110
-130
-150
-170
-190
-210
f1 (ppm)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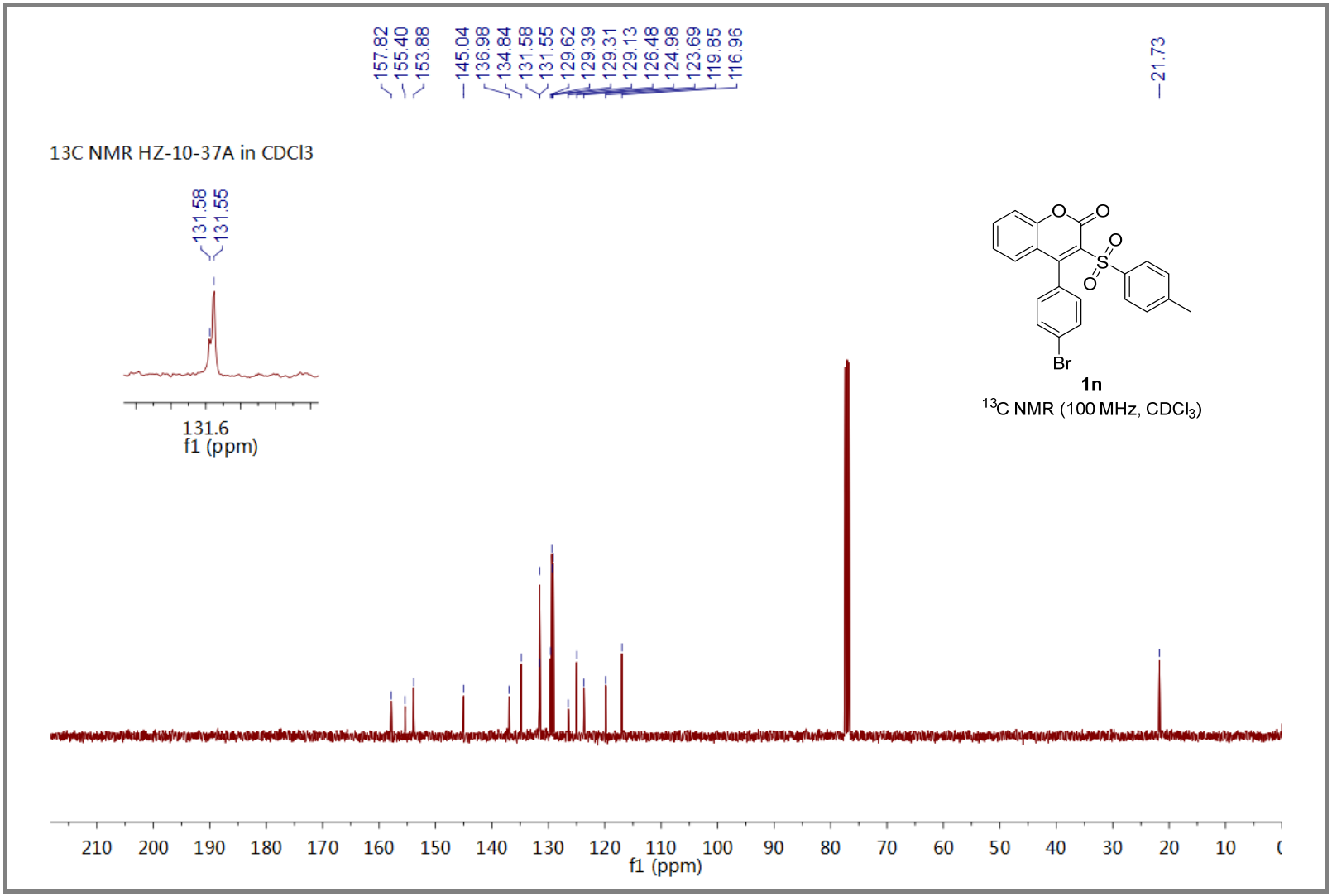
7.8639
7.7288
7.7080
7.6444
7.6412
7.6232
7.6054
7.6021
7.3511
7.3302
7.3126
7.2923
7.2361
7.2313
7.2152
7.2089
7.1885
7.0155
7.0124
6.9952
6.9921
2.4179
1H NMR HZ-10-37A in CDCl3
O
O
O
S
O
Br
1n
1H NMR (400 MHz, CDCl3)
2.00
2.00
1.00
3.00
3.00
1.00
3.00
f1 (ppm)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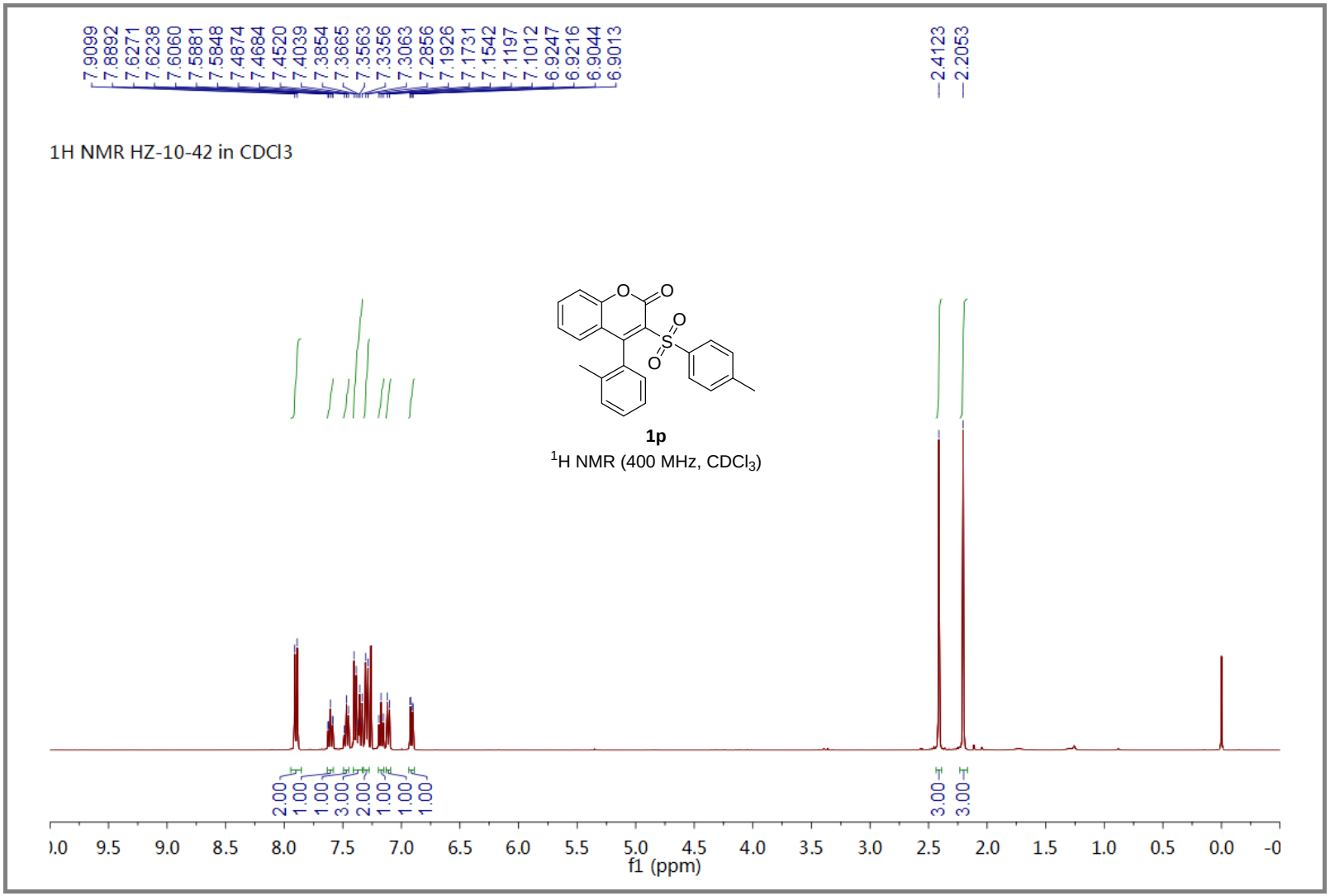
155.40
153.88
145.04
136.98
134.84
131.58
131.55
129.62
129.39
129.31
129.13
126.48
124.98
123.69
119.85
116.96
21.73
13C NMR HZ-10-37A in CDCl3
131.58
131.55
131.6
f1 (ppm)
O
O
O
S
O
Br
1n
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)


7.9099
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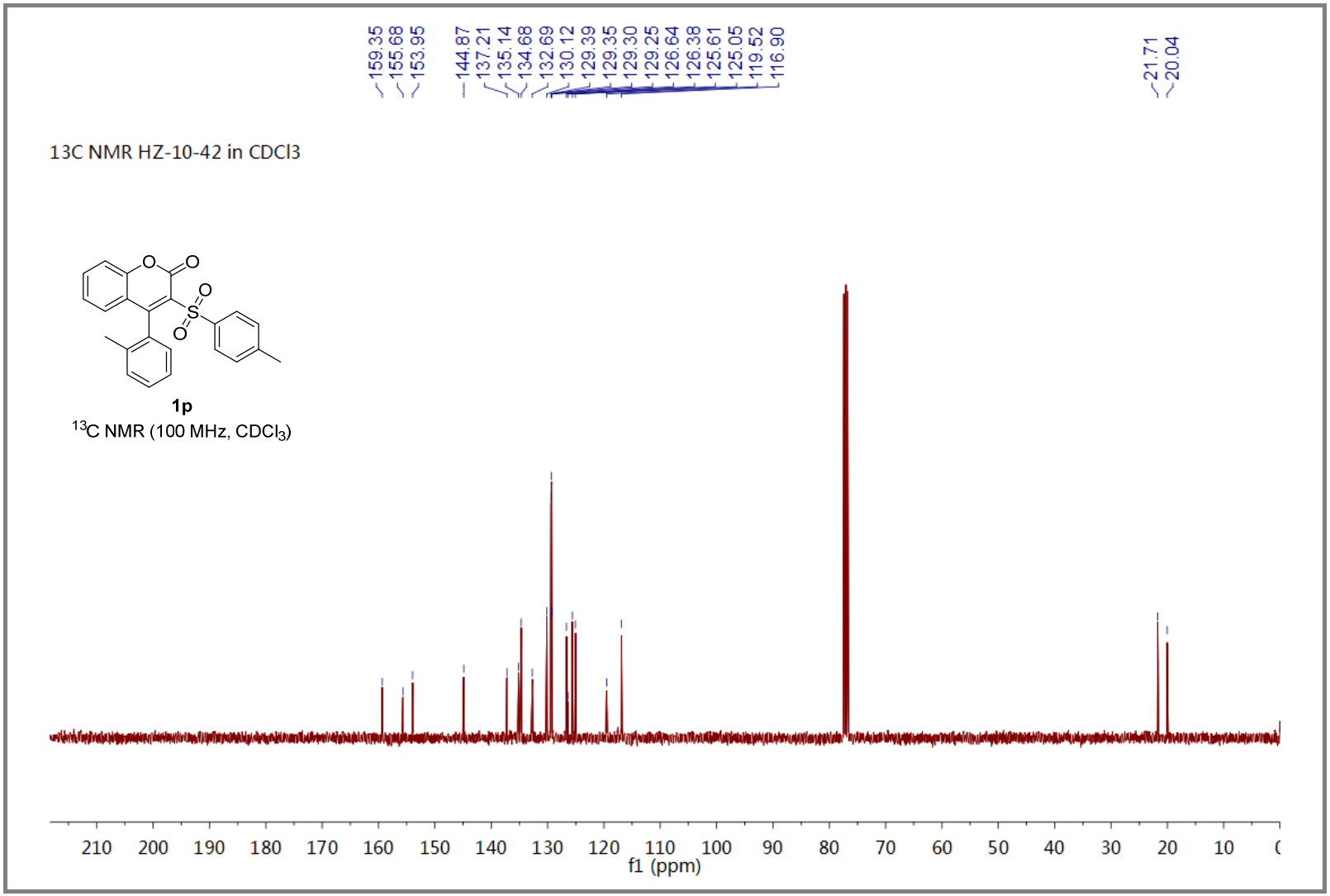
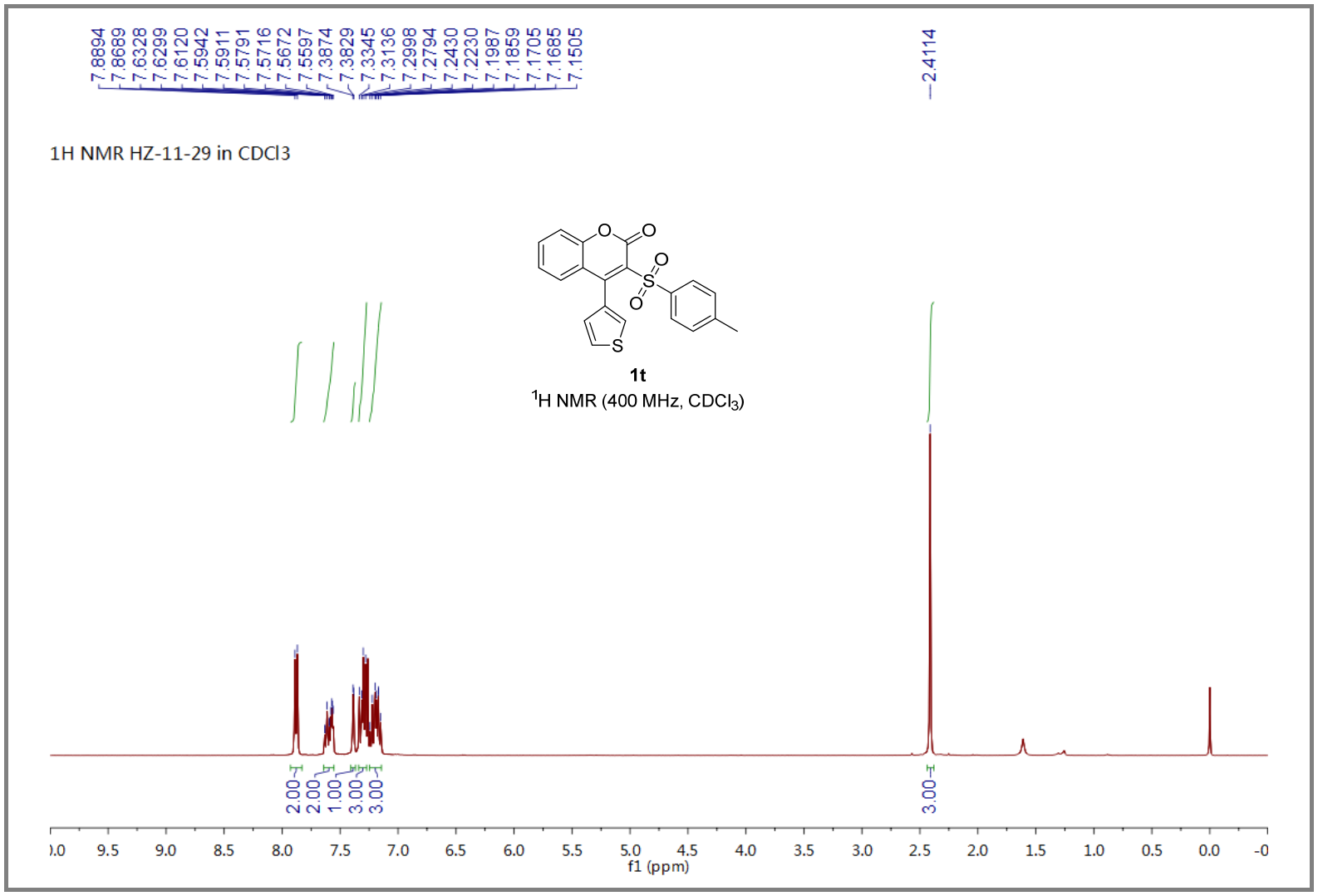
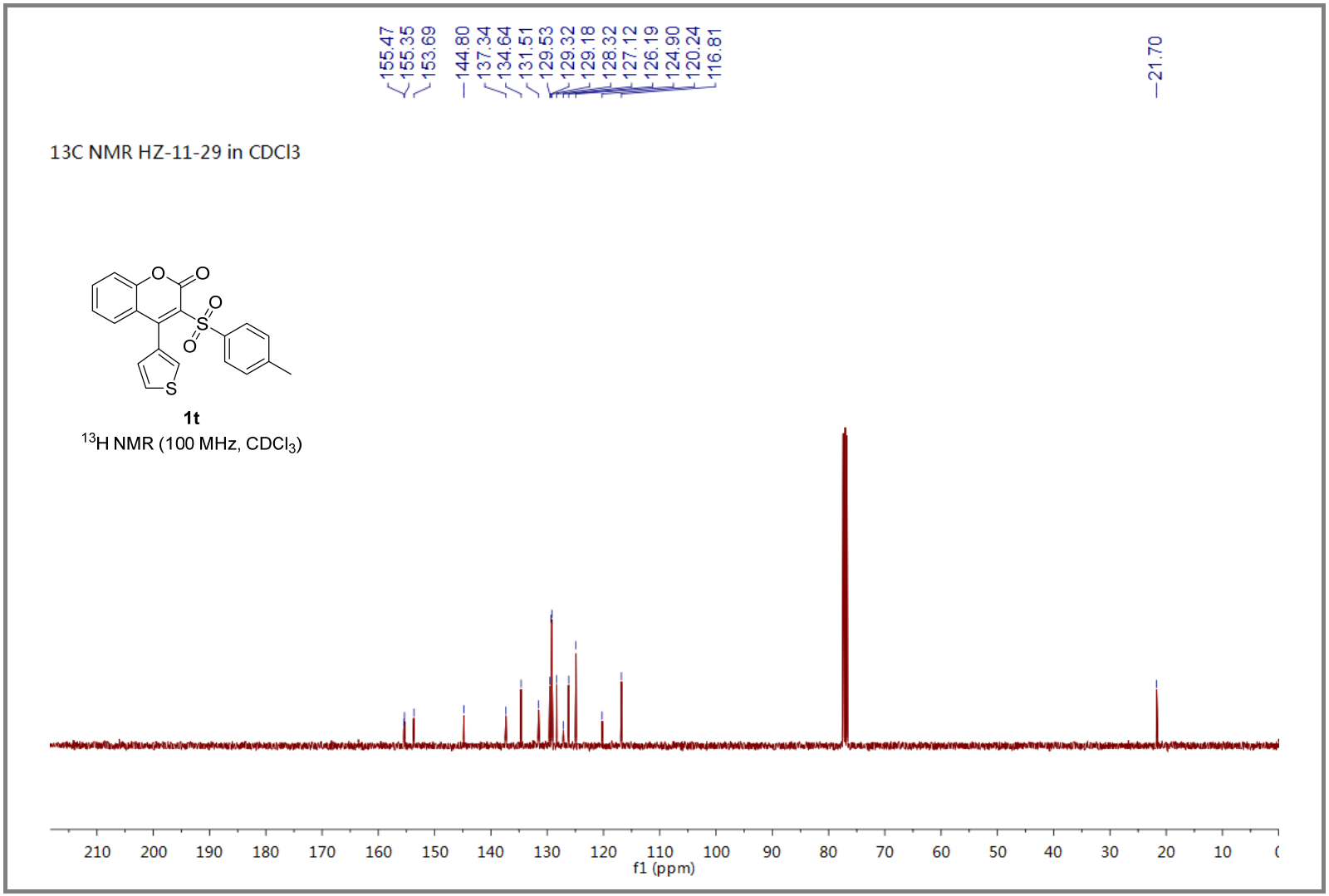
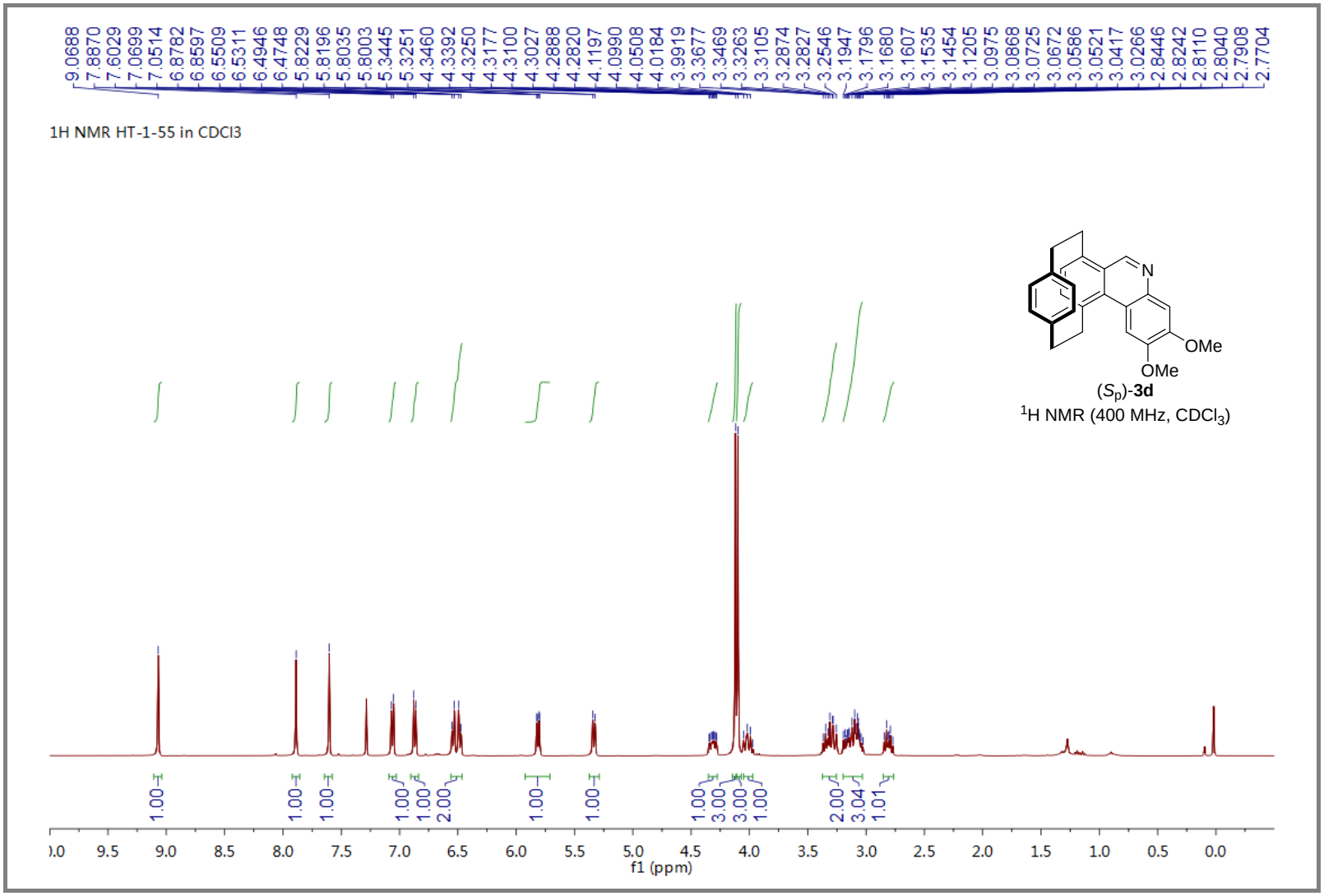
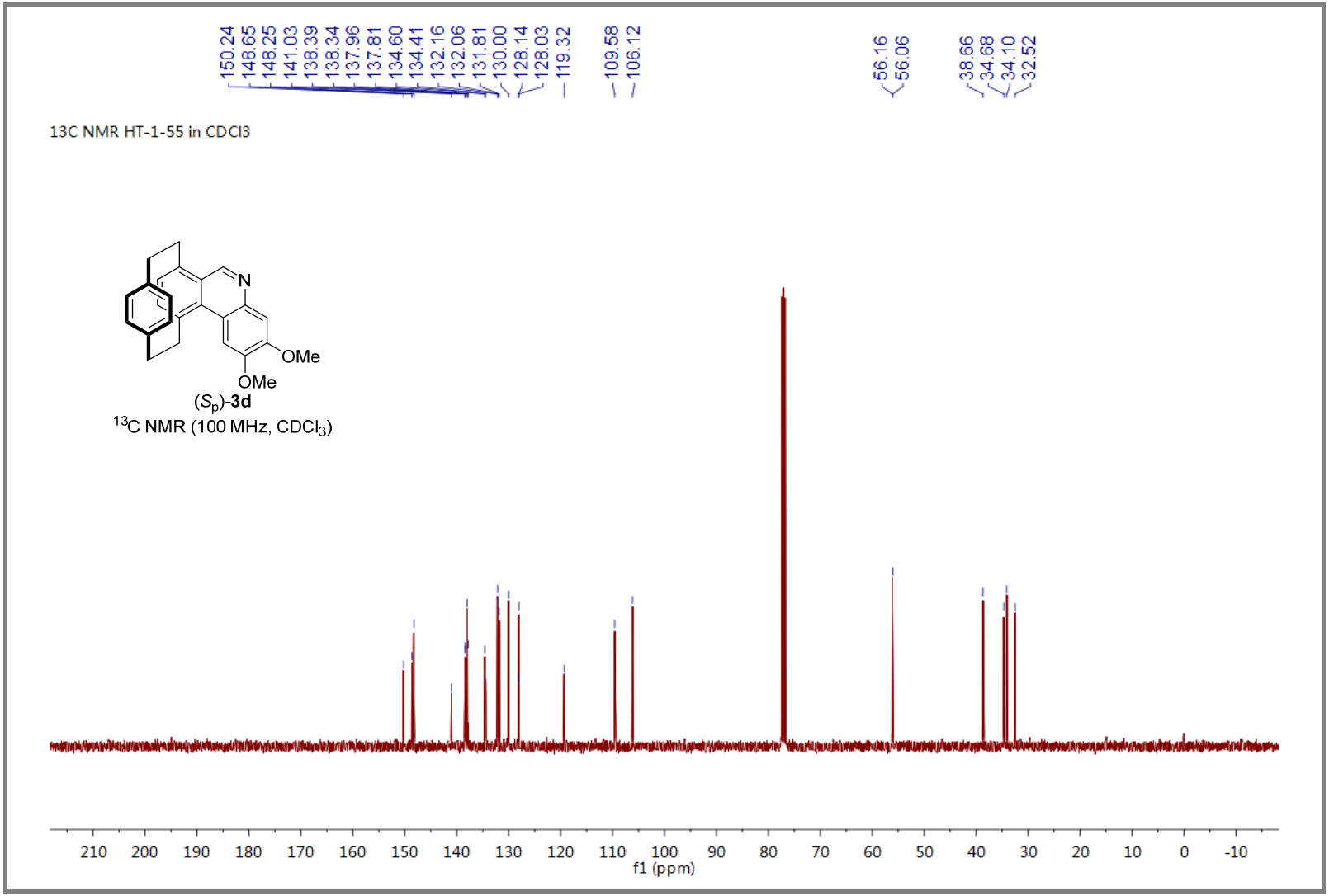
7.6271
7.6238
7.6060
7.5881
7.5848
7.4874
7.4684
7.4520
7.4039
7.3854
7.3665
7.3563
7.3356
7.3063
7.2856
7.1926
7.1731
7.1542
7.1197
7.1012
6.9247
6.9216
6.9044
6.9013
2.4123
2.2053
1H NMR HZ-10-42 in CDCl3
1p
1H NMR (400 MHz, CDCl3)
2.00
1.00
1.00
3.00
2.00
1.00
1.00
1.00
3.00
3.00
f1 (ppm)

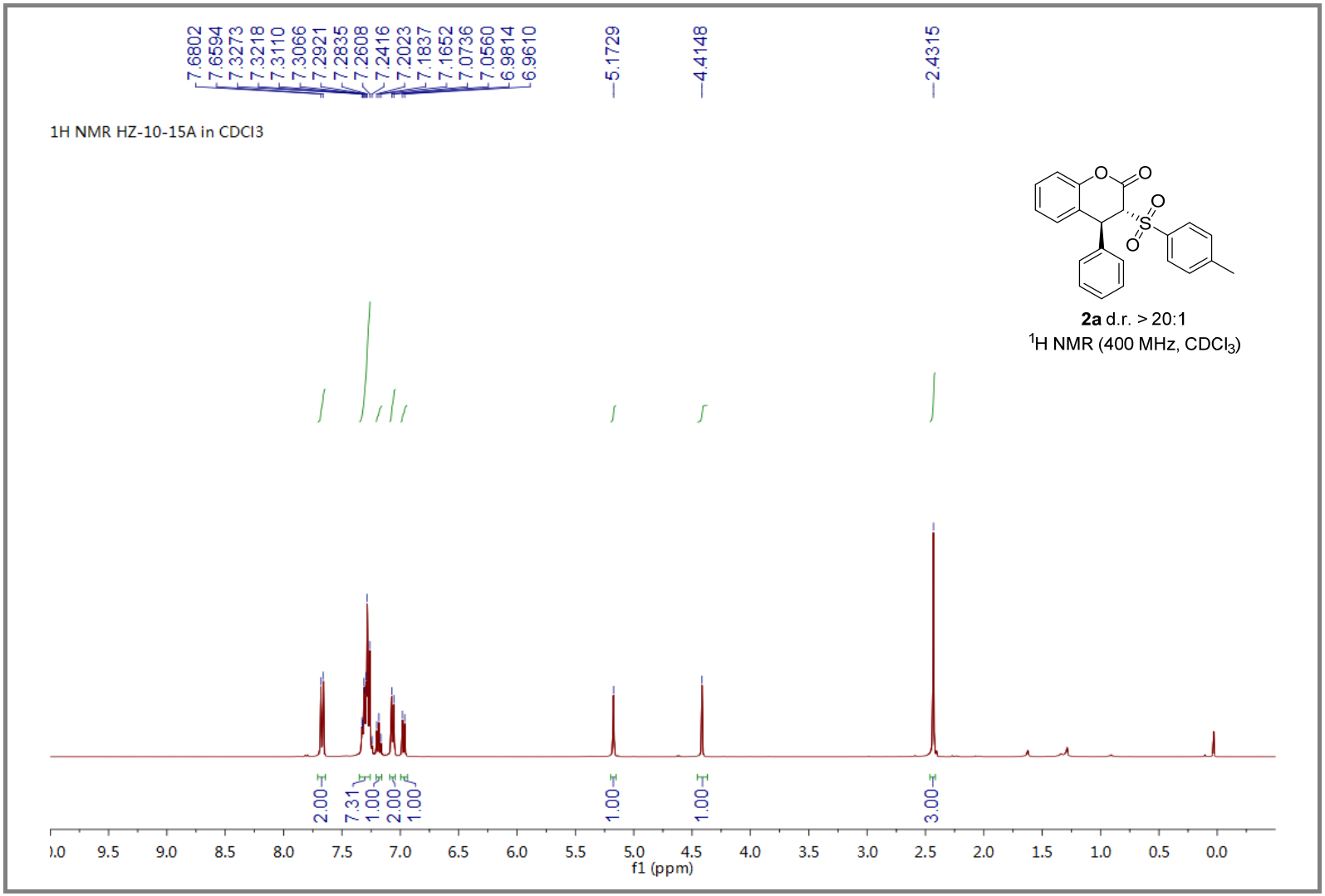

159.35
155.68
153.95
144.87
137.21
135.14
134.68
132.69
130.12
129.39
129.35
129.30
129.25
126.64
126.38
125.61
125.05
119.52
116.90
21.71
20.04
13C NMR HZ-10-42 in CDCl3
1p
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

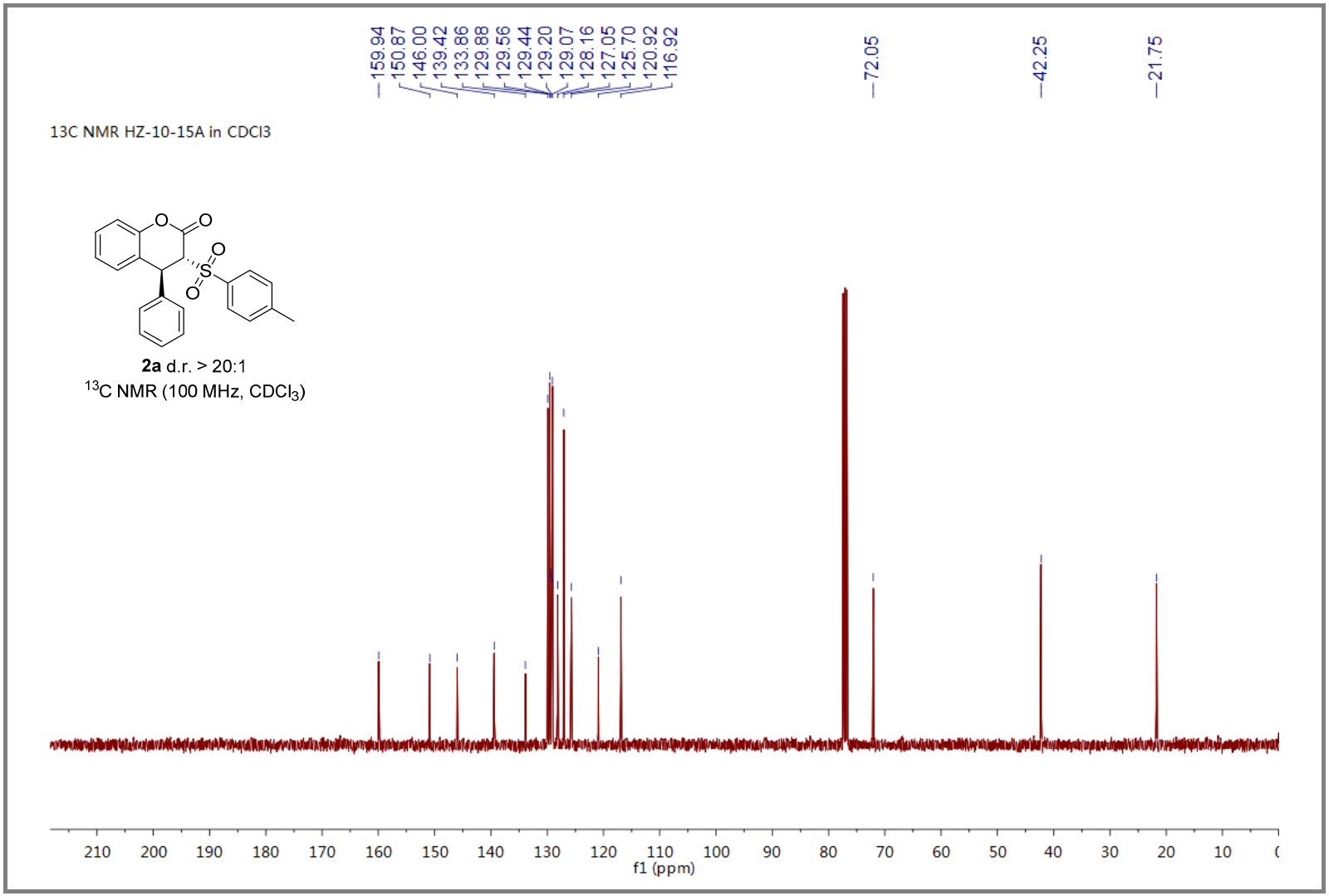

7.8894
7.8689
7.6328
7.6299
7.6120
7.5942
7.5911
7.5791
7.5716
7.5672
7.5597
7.3874
7.3829
7.3345
7.3136
7.2998
7.2794
7.2430
7.2230
7.1987
7.1859
7.1705
7.1685
7.1505
2.4114
1H NMR HZ-11-29 in CDCl3
1t
1H NMR (400 MHz, CDCl3)
2.00
2.00
1.00
3.00
3.00
3.00
f1 (ppm)

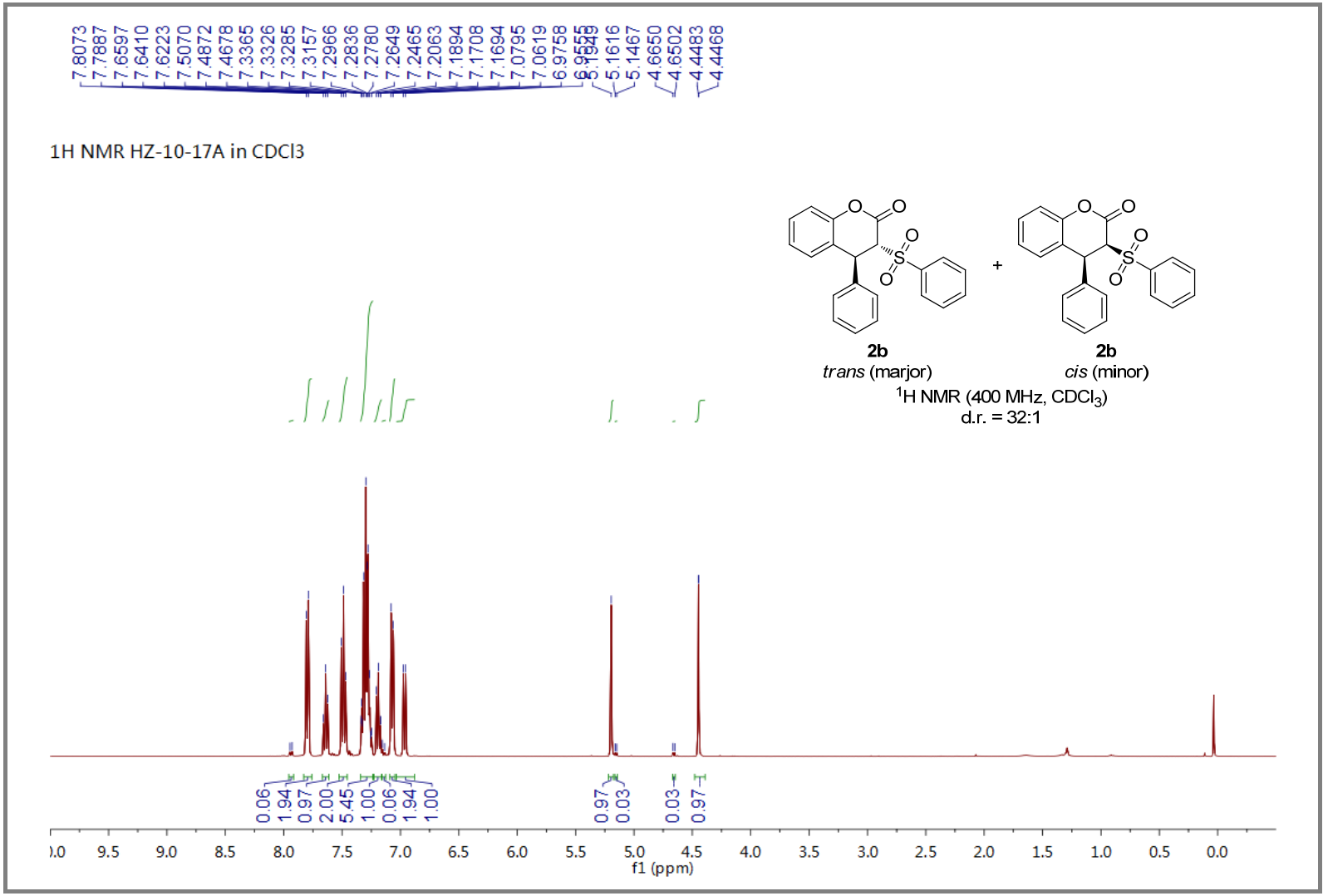

155.47
155.35
153.69
144.80
137.34
134.64
131.51
129.53
129.32
129.18
128.32
127.12
126.19
124.90
120.24
116.81
21.70
13C NMR HZ-11-29 in CDCl3
O
O
O
S
O
S
1t
13H NMR (100 MHz, CDCl3)
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

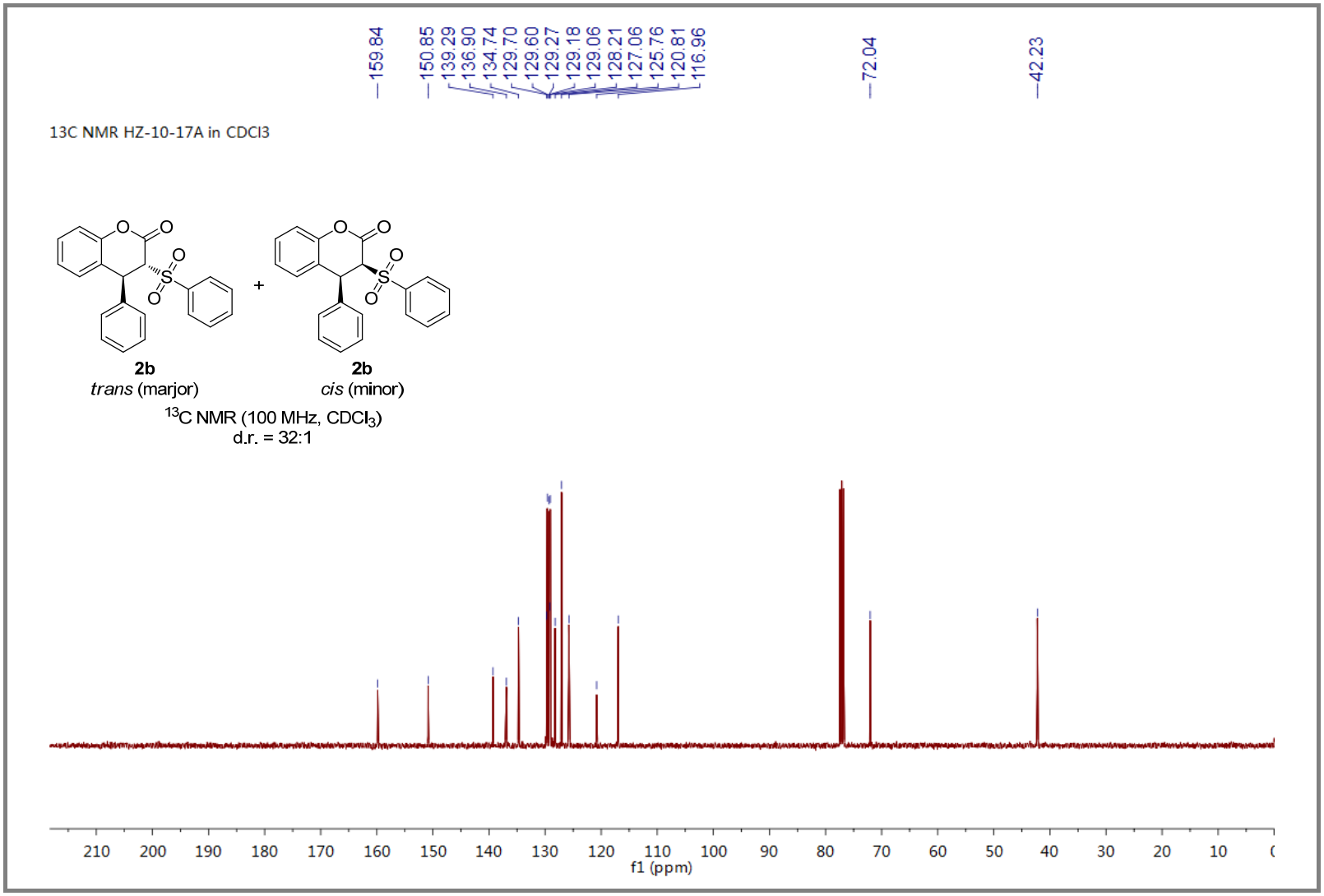

1H NMR HT-1-55 in CDCl3
N
OMe
OMe
(Sp)-3d
1H NMR (400 MHz, CDCl3)
f1 (ppm)

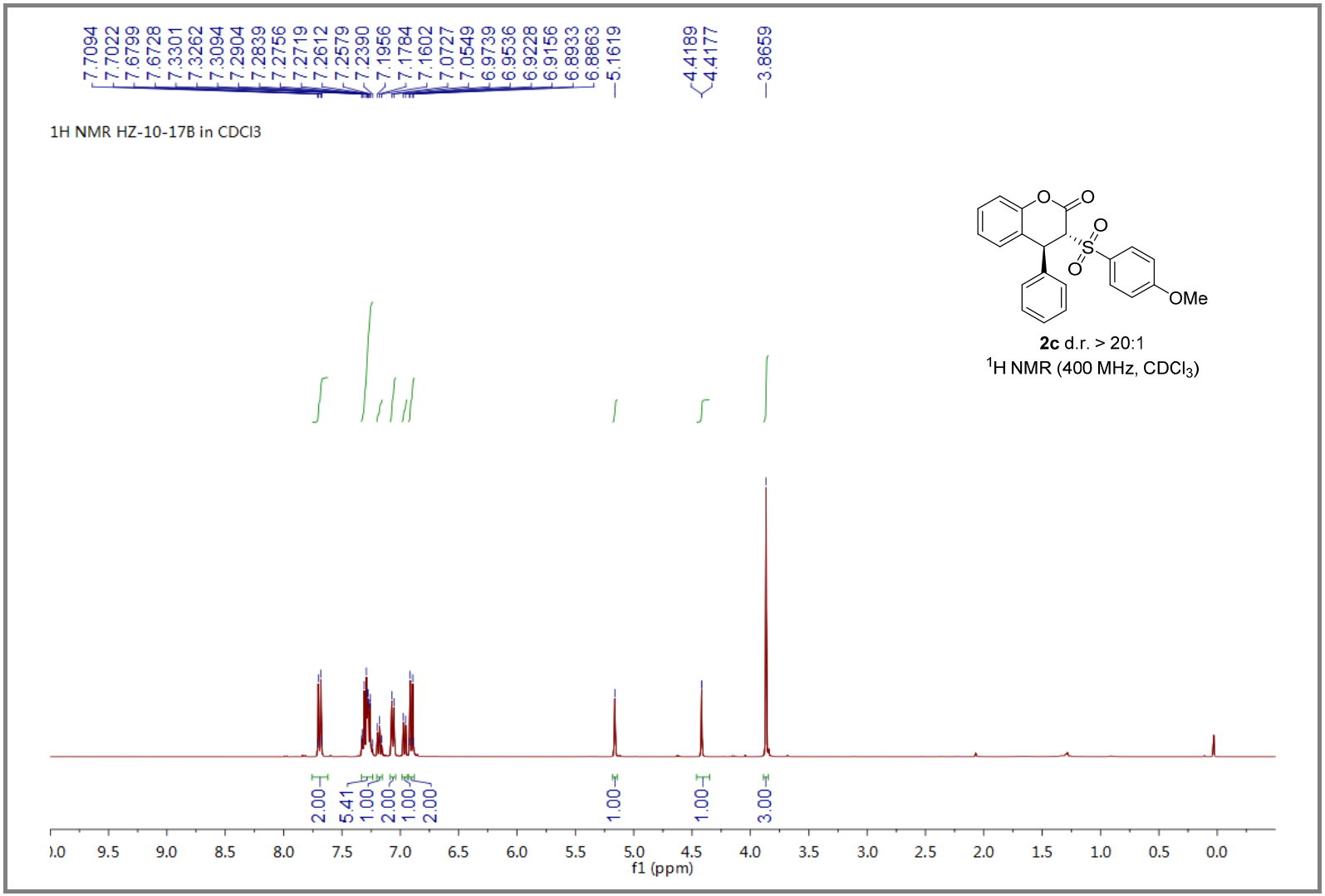

150.24
148.65
148.25
141.03
138.39
138.34
137.96
137.81
134.60
134.41
132.16
132.06
131.81
130.00
128.14
128.03
119.32
109.58
106.12
56.16
56.06
38.66
34.68
34.10
32.52
13C NMR HT-1-55 in CDCl3
N
OMe
OMe
(Sp)-3d
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

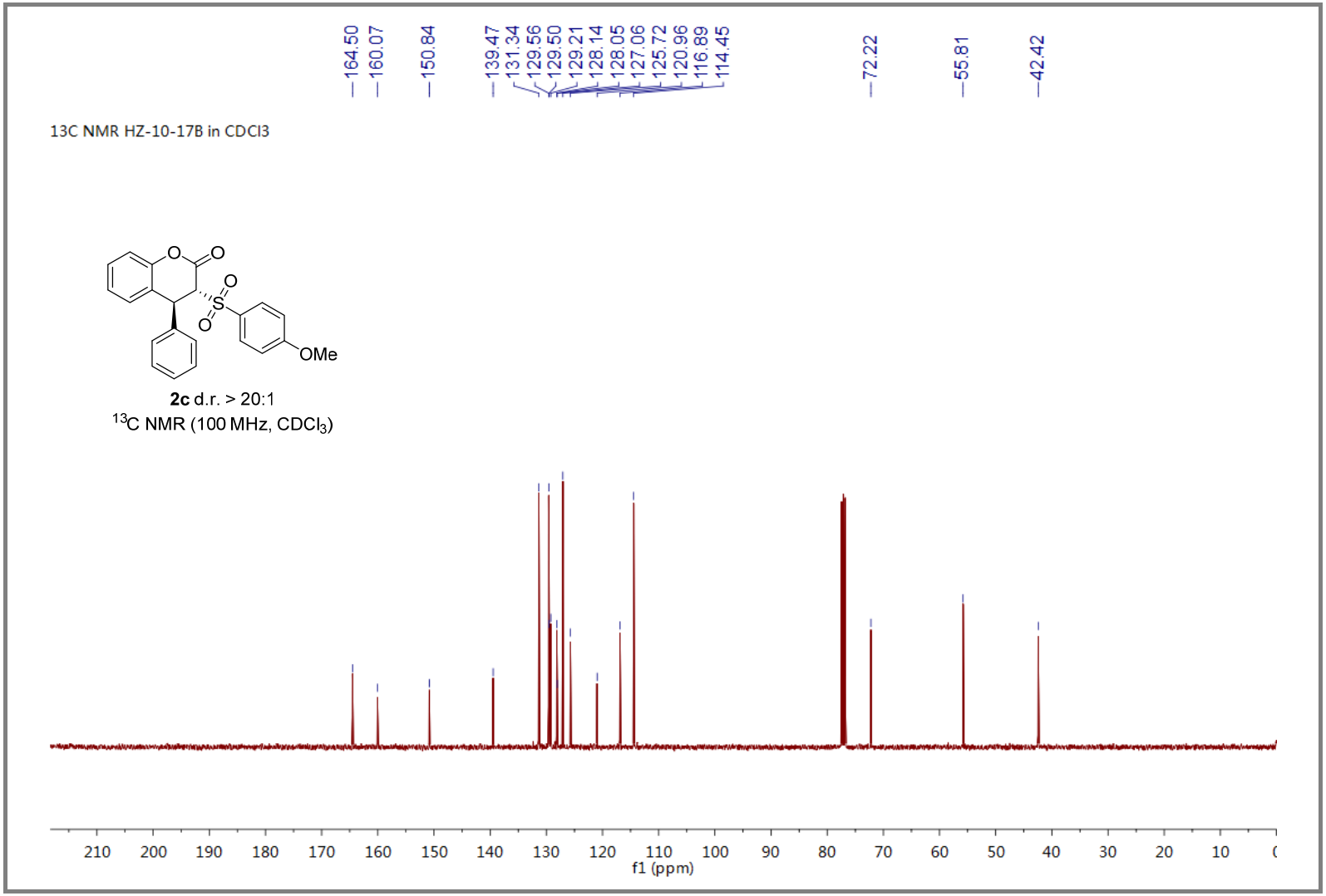

7.6802
7.6594
7.3273
7.3218
7.3110
7.3066
7.2921
7.2835
7.2608
7.2416
7.2023
7.1837
7.1652
7.0736
7.0560
6.9814
6.9610
5.1729
4.4148
2.4315
1H NMR HZ-10-15A in CDCl3
2a d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
7.31
1.00
2.00
1.00
1.00
1.00
3.00
f1 (ppm)

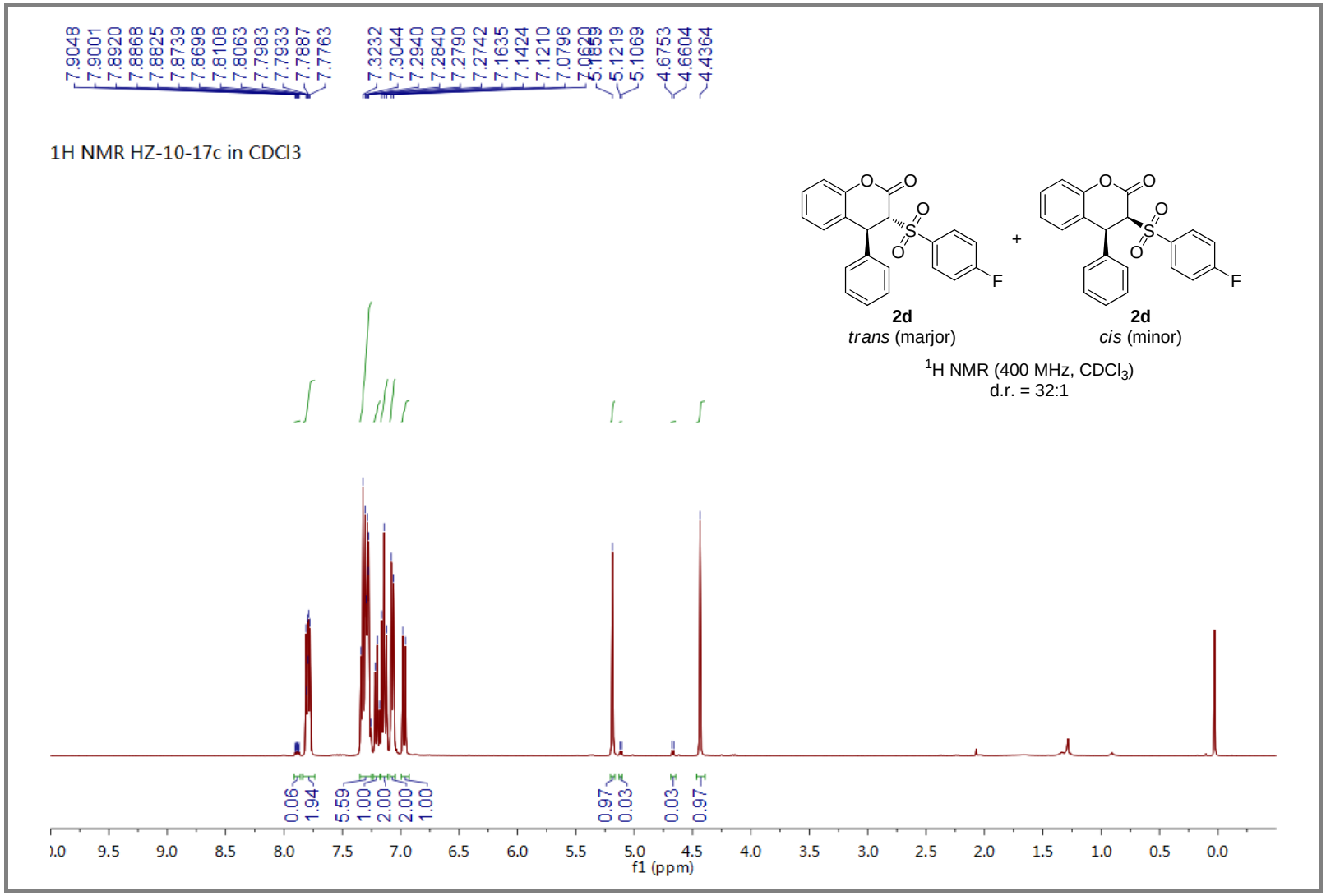

159.94
150.87
146.00
139.42
133.86
129.88
129.56
129.44
129.20
129.07
128.16
127.05
125.70
120.92
116.92
72.05
42.25
21.75
13C NMR HZ-10-15A in CDCl3
2a d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

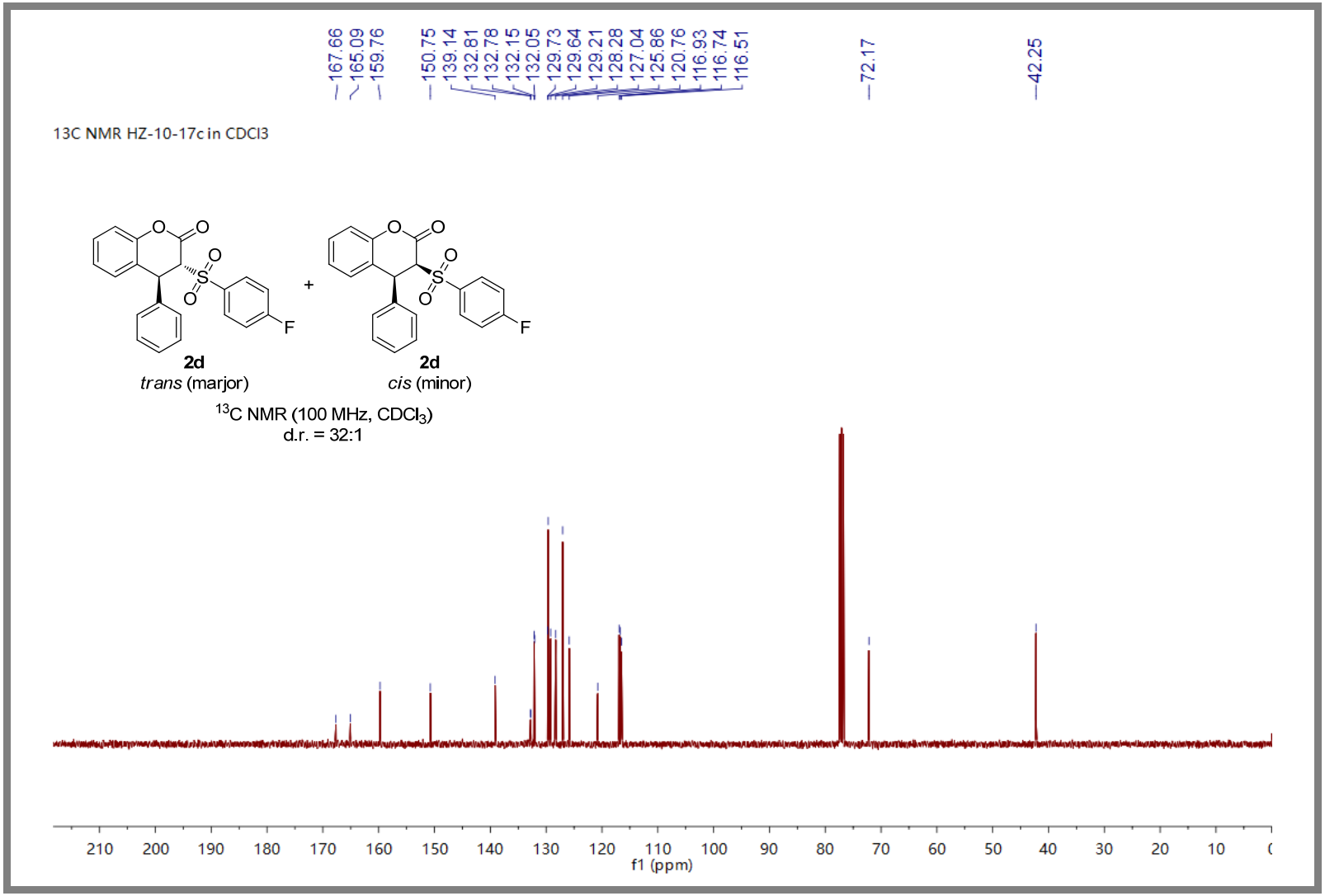

7.8073
7.7887
7.6597
7.6410
7.6223
7.5070
7.4872
7.4678
7.3365
7.3326
7.3285
7.3157
7.2966
7.2836
7.2780
7.2649
7.2465
7.2063
7.1894
7.1708
7.1694
7.0795
7.0619
6.9758
5.1616
5.1467
4.6650
4.6502
4.4483
4.4468
1H NMR HZ-10-17A in CDCl3
2b
trans (marjor)
2b
cis (minor)
1H NMR (400 MHz, CDCl3)
d.r. = 32:1
0.06
1.94
0.97
2.00
5.45
1.00
0.06
1.94
1.00
0.97
0.03
0.03
0.97
f1 (ppm)

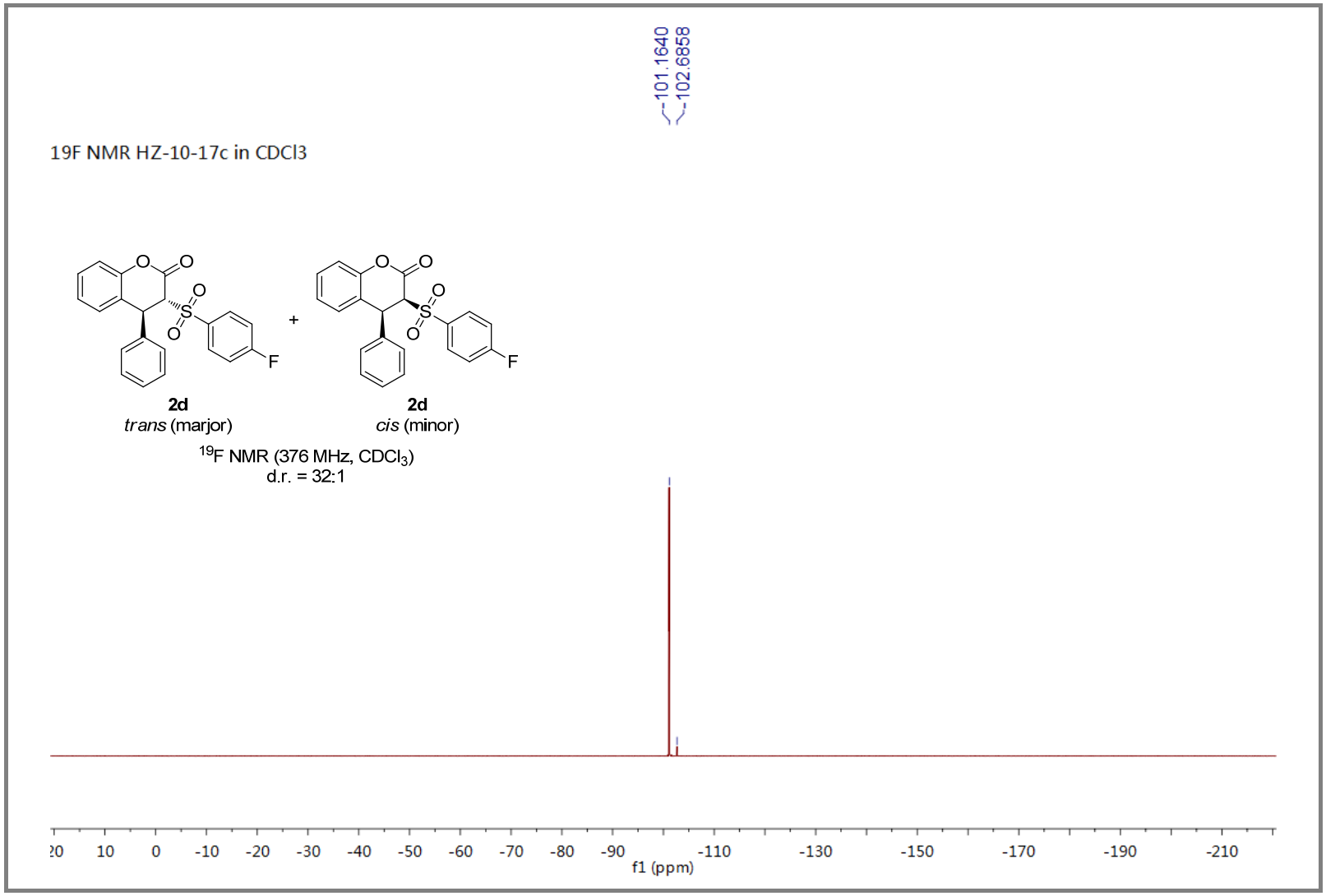

159.84
150.85
139.29
136.90
134.74
129.70
129.60
129.27
129.18
129.06
128.21
127.06
125.76
120.81
116.96
72.04
42.23
13C NMR HZ-10-17A in CDCl3
2b
trans (marjor)
+
2b
cis (minor)
13C NMR (100 MHz, CDCl3)
d.r. = 32:1
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

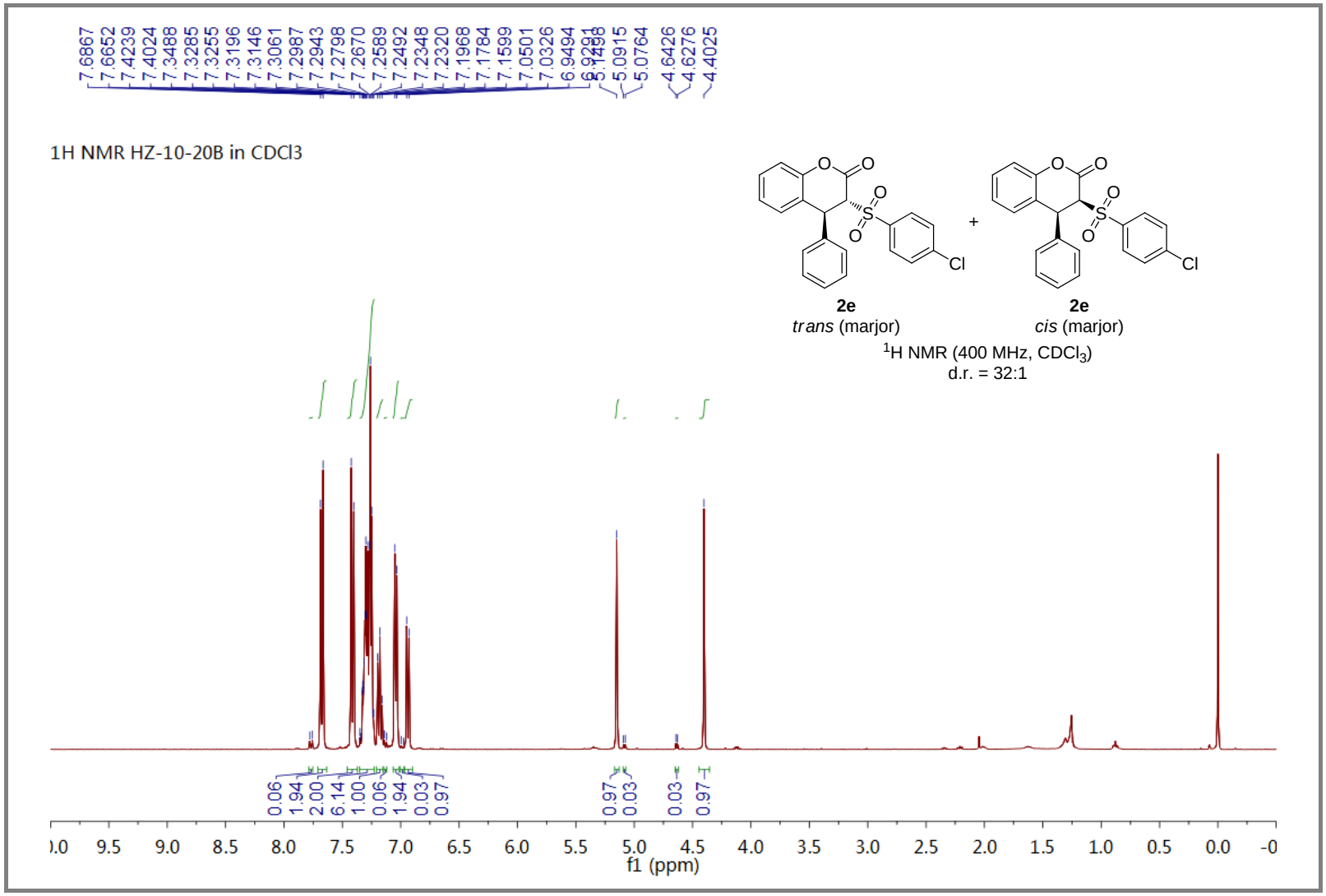

7.7094
7.7022
7.6799
7.6728
7.3301
7.3262
7.3094
7.2904
7.2839
7.2756
7.2719
7.2612
7.2579
7.2390
7.1956
7.1784
7.1602
7.0727
7.0549
6.9739
6.9536
6.9228
6.9156
6.8933
6.8863
5.1619
4.4189
4.4177
3.8659
1H NMR HZ-10-17B in CDCl3
OMe
2c d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
5.41
1.00
2.00
1.00
2.00
1.00
1.00
3.00
f1 (ppm)

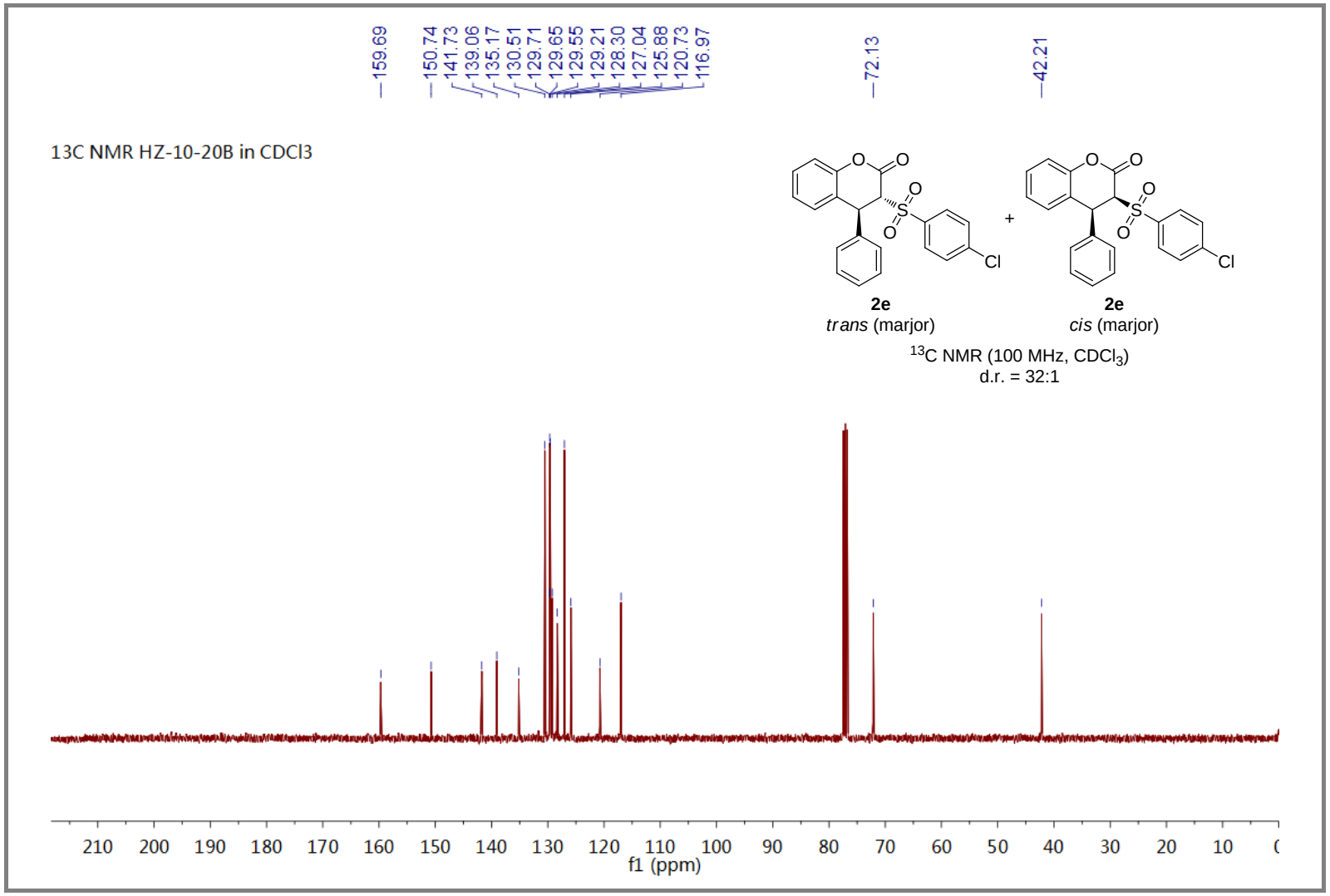

164.50
160.07
150.84
139.47
131.34
129.56
129.50
129.21
128.14
128.05
127.06
125.72
120.96
116.89
114.45
72.22
55.81
42.42
13C NMR HZ-10-17B in CDCl3
OMe
2c d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

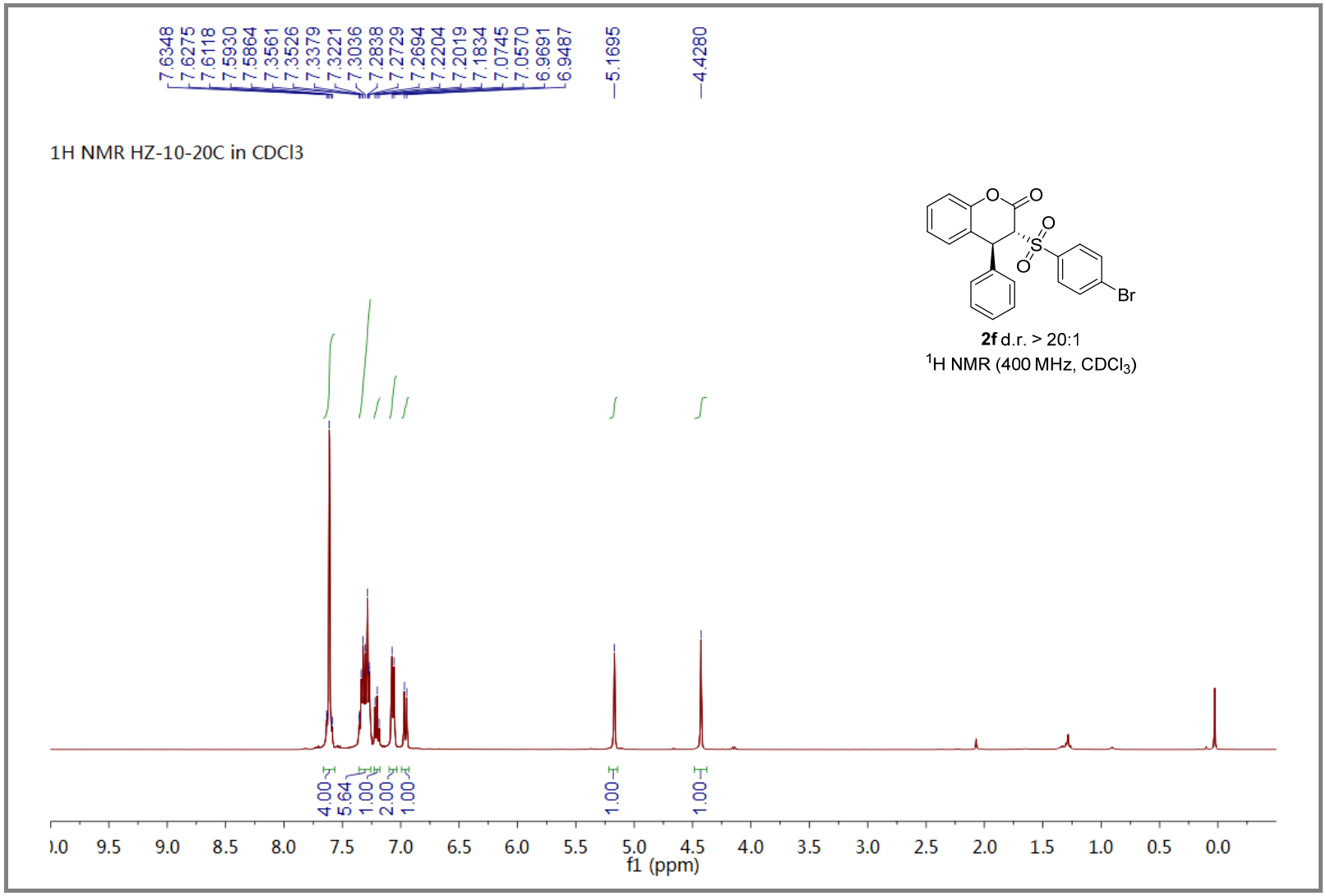

7.9048
7.9001
7.8920
7.8868
7.8825
7.8739
7.8698
7.8108
7.8063
7.7983
7.7933
7.7887
7.7763
7.3232
7.3044
7.2940
7.2840
7.2790
7.2742
7.1635
7.1424
7.1210
7.0796
5.1219
5.1069
4.6753
4.6604
4.4364
1H NMR HZ-10-17c in CDCl3
2d
trans (marjor)
2d
cis (minor)
1H NMR (400 MHz, CDCl3)
d.r. = 32:1
0.06
1.94
5.59
1.00
2.00
2.00
1.00
0.97
0.03
0.03
0.97
f1 (ppm)

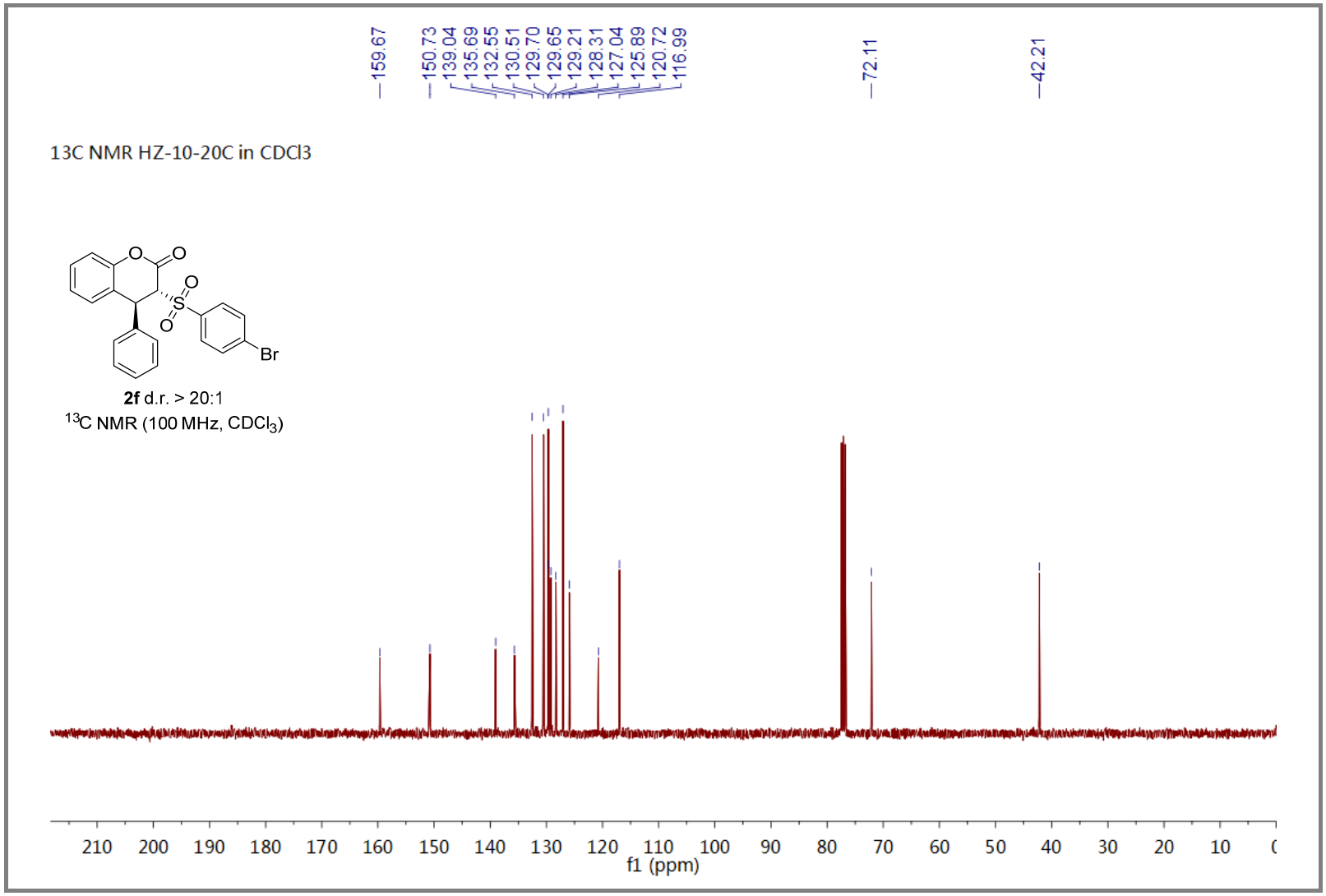

167.66
165.09
159.76
150.75
139.14
132.81
132.78
132.15
132.05
129.73
129.64
129.21
128.28
127.04
125.86
120.76
116.93
116.74
116.51
72.17
42.25
13C NMR HZ-10-17c in CDCl3
2d
trans (marjor)
2d
cis (minor)
13C NMR (100 MHz, CDCl3)
d.r. = 32:1
f1 (ppm)

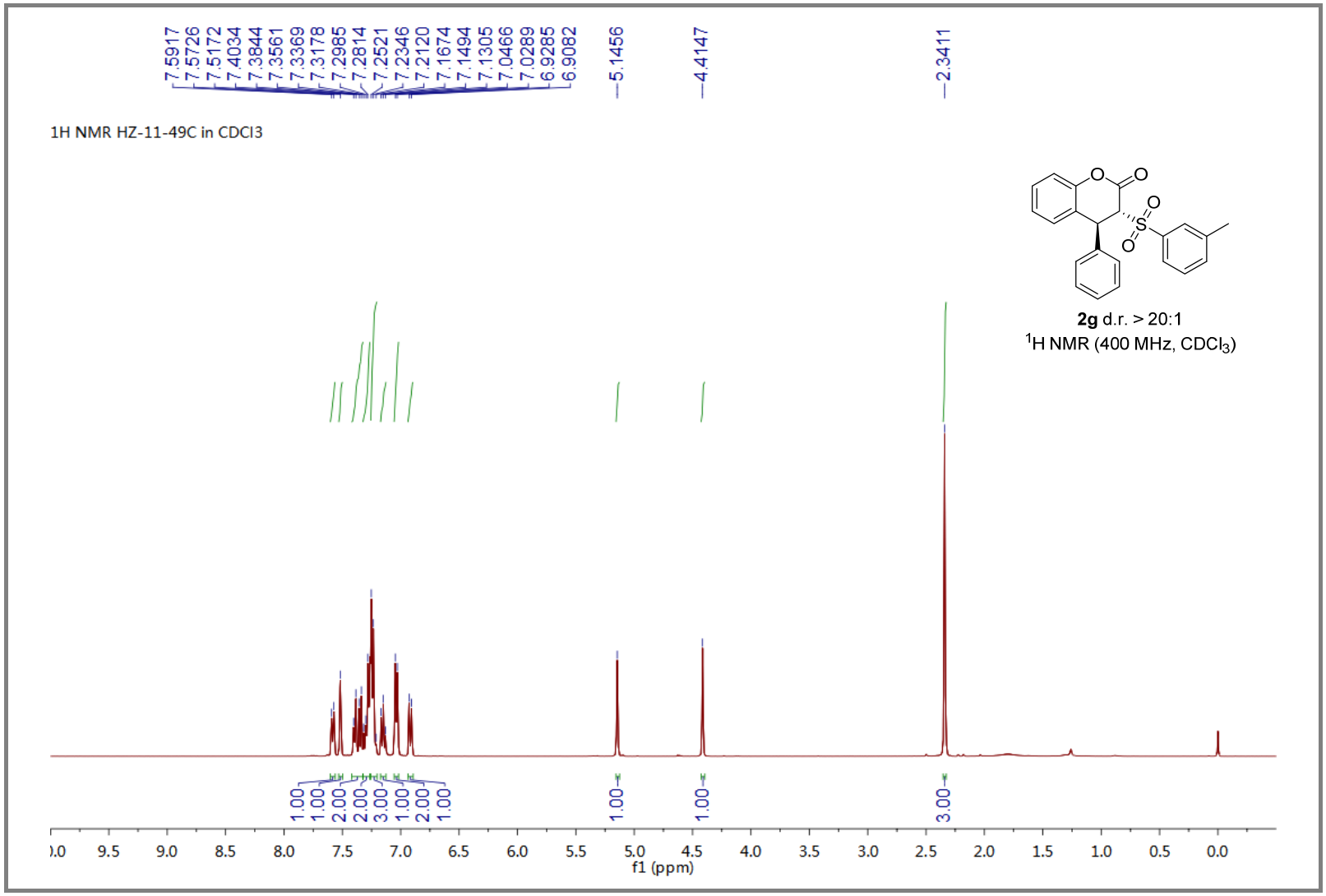

101.1640
102.6858
19F NMR HZ-10-17c in CDCl3
2d
trans (marjor)
+
2d
cis (minor)
19F NMR (376 MHz, CDCl3)
d.r. = 32:1
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -110 -130 -150 -170 -190 -210
f1 (ppm)

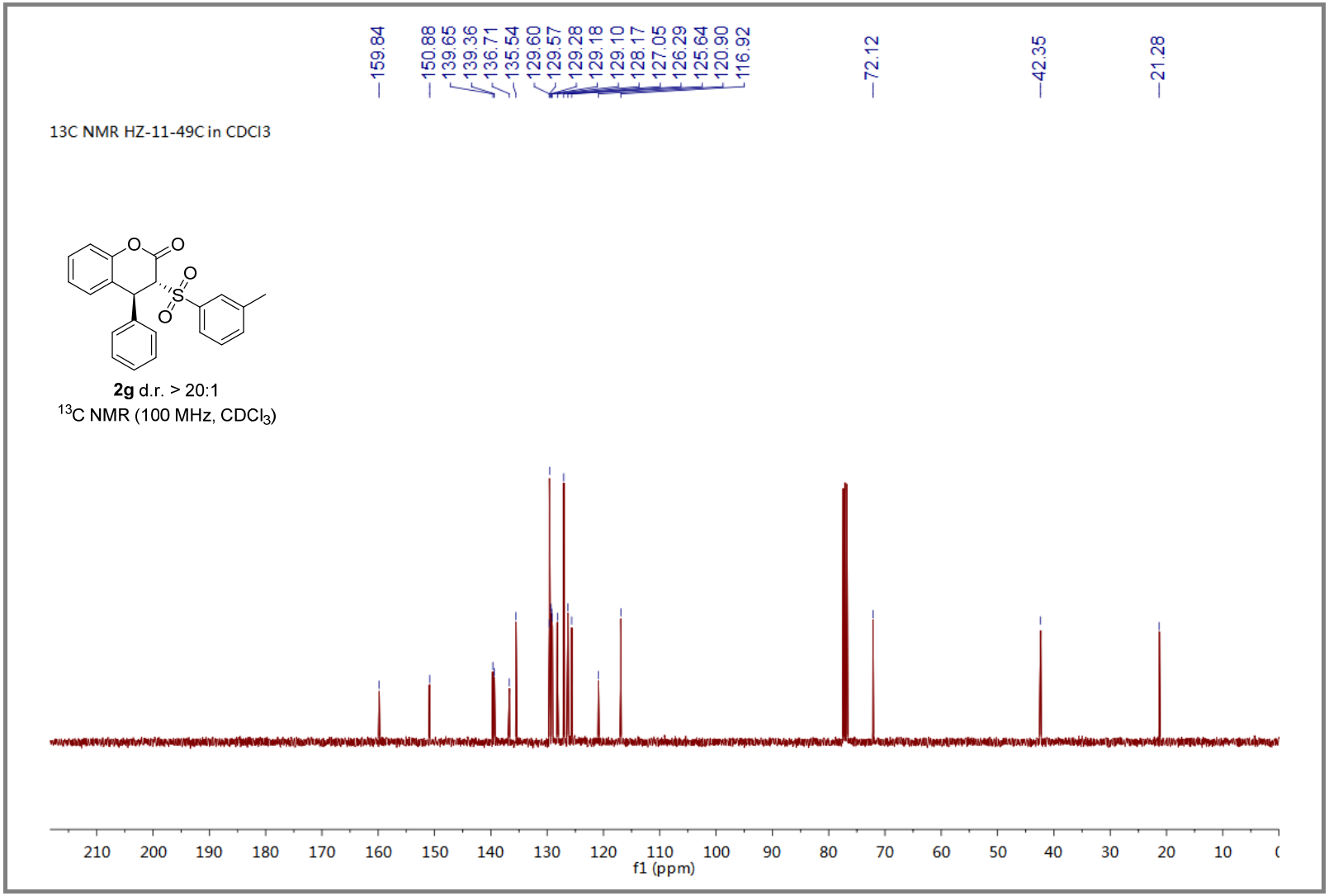

7.6867
7.6652
7.4239
7.4024
7.3488
7.3285
7.3255
7.3196
7.3146
7.3061
7.2987
7.2943
7.2798
7.2670
7.2589
7.2492
7.2348
7.2320
7.1968
7.1784
7.1599
7.0501
7.0326
6.9494
5.0915
5.0764
4.6426
4.6276
4.4025
1H NMR HZ-10-20B in CDCl3
Cl
Cl
2e
trans (marjor)
2e
cis (marjor)
1H NMR (400 MHz, CDCl3)
d.r. = 32:1
0.06
1.94
2.00
6.14
1.00
0.06
1.94
0.03
0.97
0.97
0.03
0.03
0.97
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

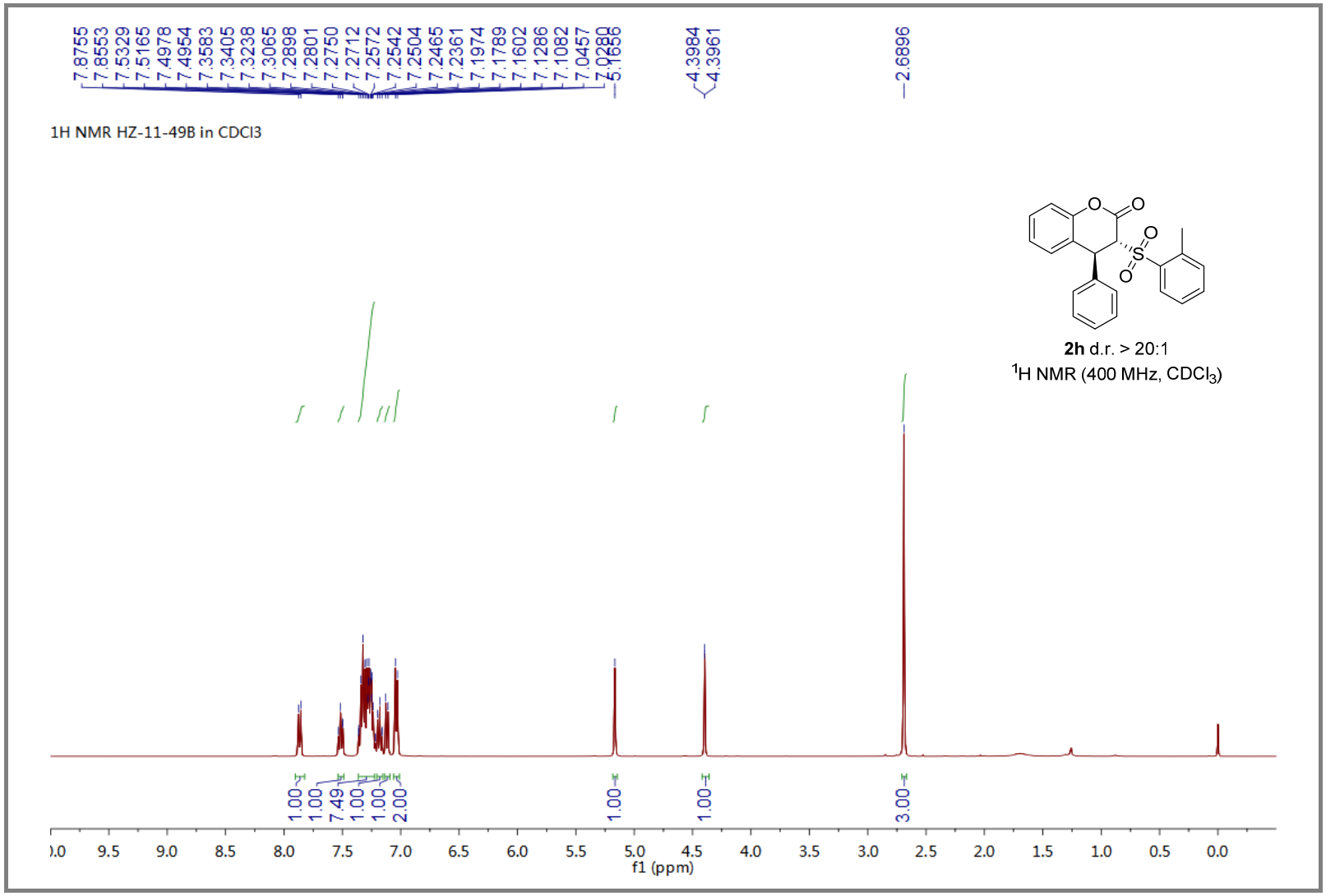

159.69
150.74
141.73
139.06
135.17
130.51
129.71
129.65
129.55
129.21
128.30
127.04
125.88
120.73
116.97
72.13
42.21
13C NMR HZ-10-20B in CDCl3
2e
trans (marjor)
2e
cis (marjor)
13C NMR (100 MHz, CDCl3)
d.r. = 32:1
f1 (ppm)

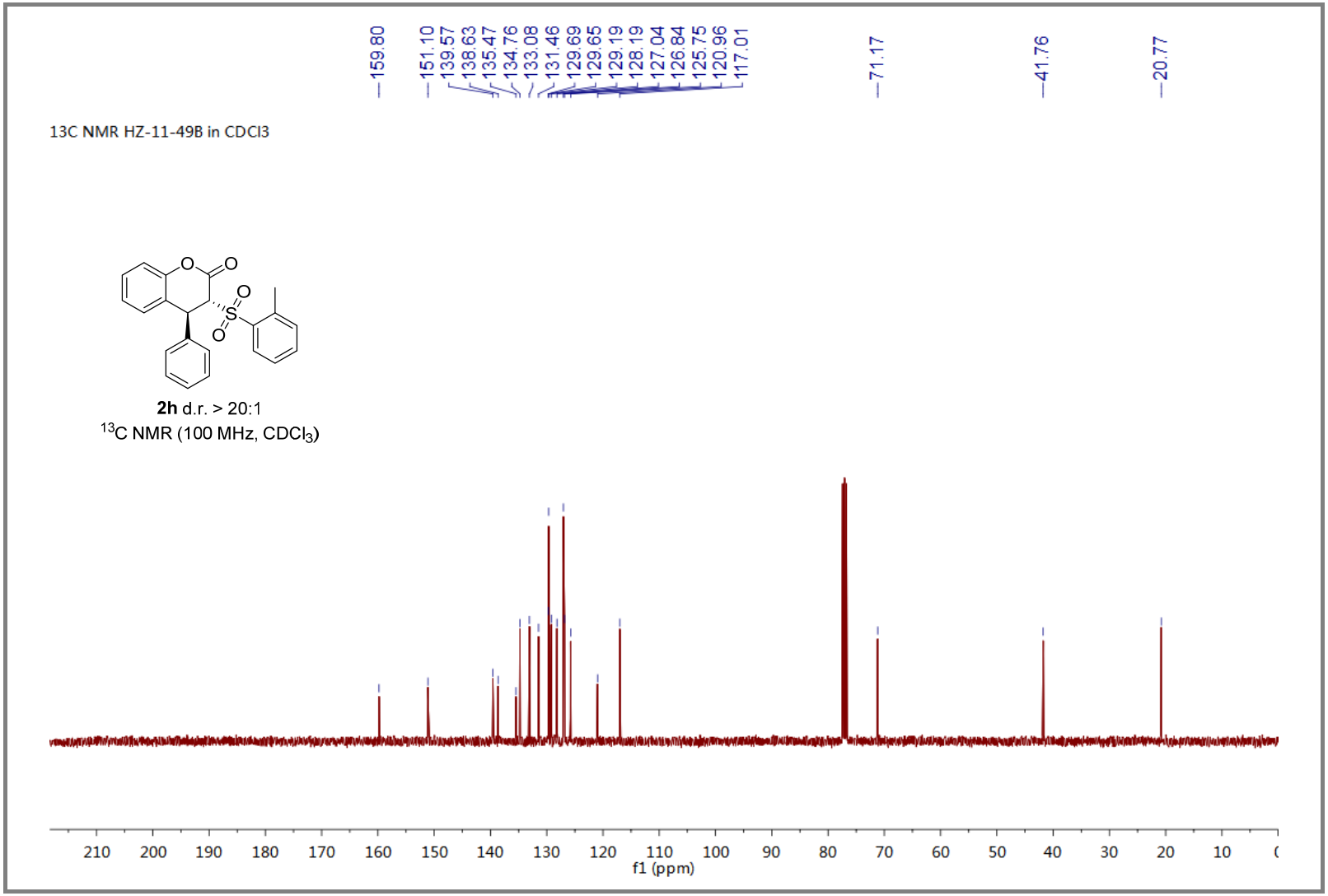

7.6348
7.6275
7.6118
7.5930
7.5864
7.3561
7.3526
7.3379
7.3221
7.3036
7.2838
7.2729
7.2694
7.2204
7.2019
7.1834
7.0745
7.0570
6.9691
6.9487
5.1695
4.4280
1H NMR HZ-10-20C in CDCl3
O
O
O
S
O
O
Br
2f d.r. > 20:1
1H NMR (400 MHz, CDCl3)
4.00
5.64
1.00
2.00
1.00
1.00
1.00
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

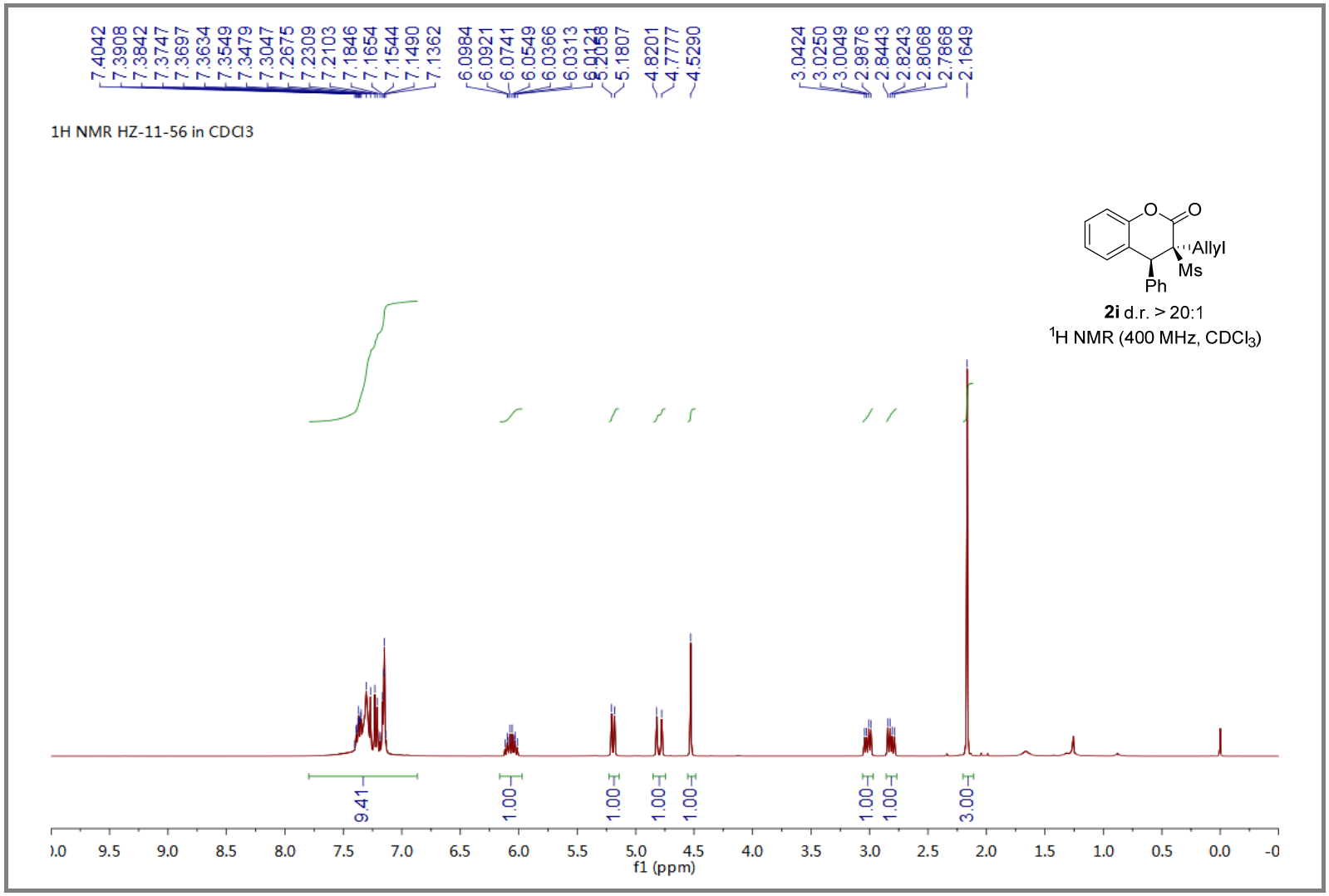

159.67
150.73
139.04
135.69
132.55
130.51
129.70
129.65
129.21
128.31
127.04
125.89
120.72
116.99
72.11
42.21
13C NMR HZ-10-20C in CDCl3
Br
2f d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

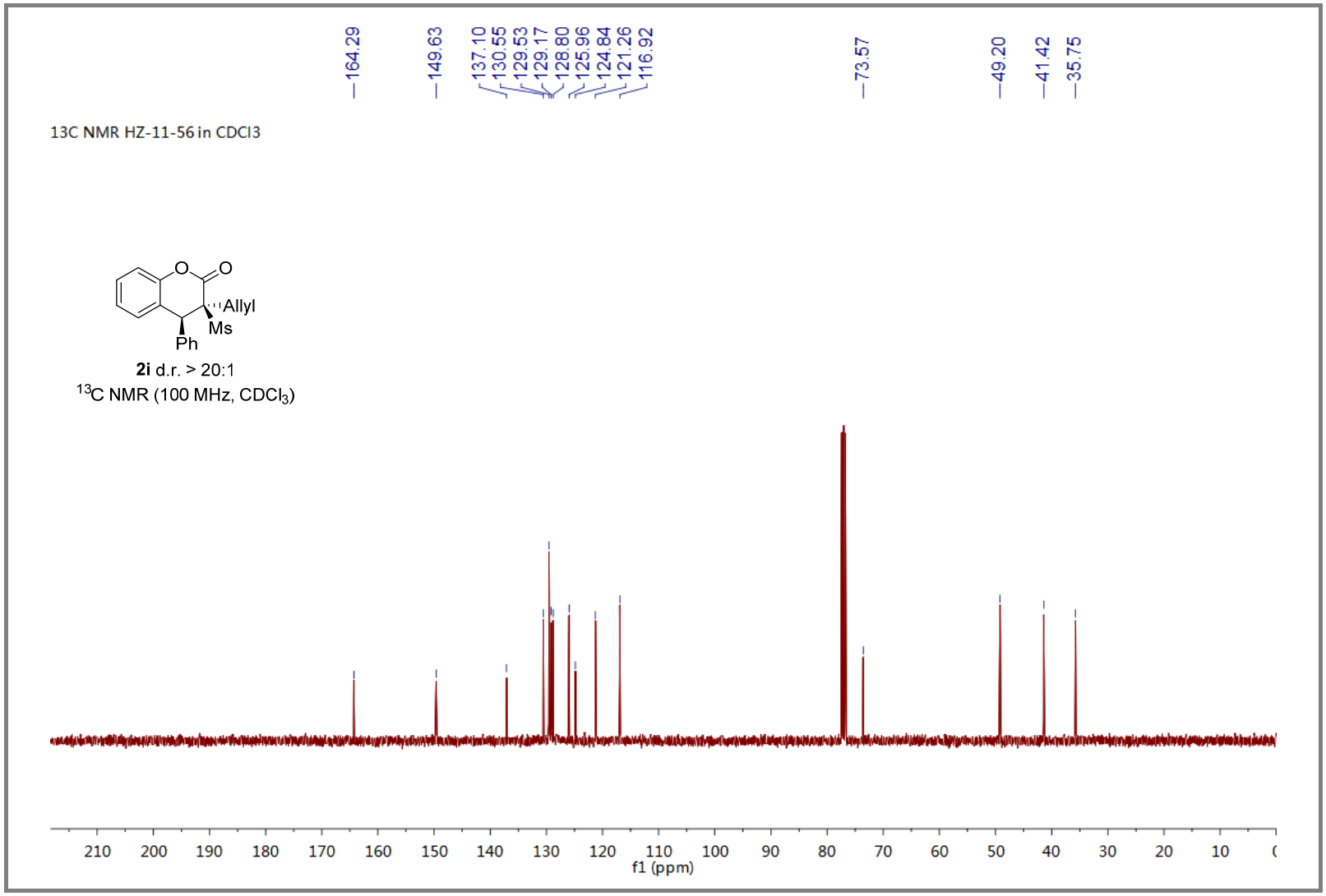

7.5917
7.5726
7.5172
7.4034
7.3844
7.3561
7.3369
7.3178
7.2985
7.2814
7.2521
7.2346
7.2120
7.1674
7.1494
7.1305
7.0466
7.0289
6.9285
6.9082
5.1456
4.4147
2.3411
1H NMR HZ-11-49C in CDCl3
2g d.r. > 20:1
1H NMR (400 MHz, CDCl3)
1.00
1.00
2.00
2.00
3.00
1.00
2.00
1.00
1.00
1.00
3.00
f1 (ppm)

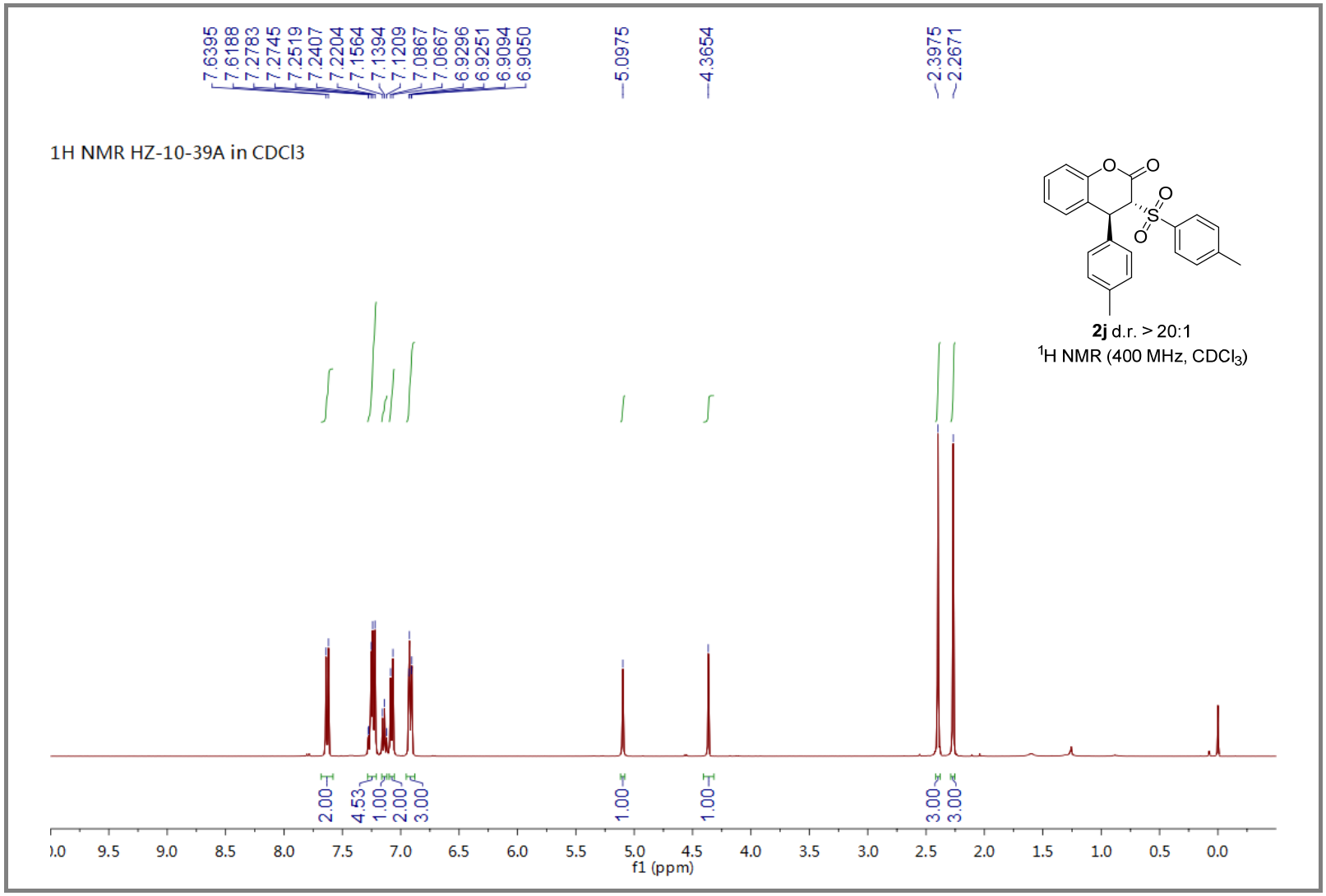

159.84
150.88
139.65
139.36
136.71
135.54
129.60
129.57
129.28
129.18
129.10
128.17
127.05
126.29
125.64
120.90
116.92
72.12
42.35
21.28
13C NMR HZ-11-49C in CDCl3
2g d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

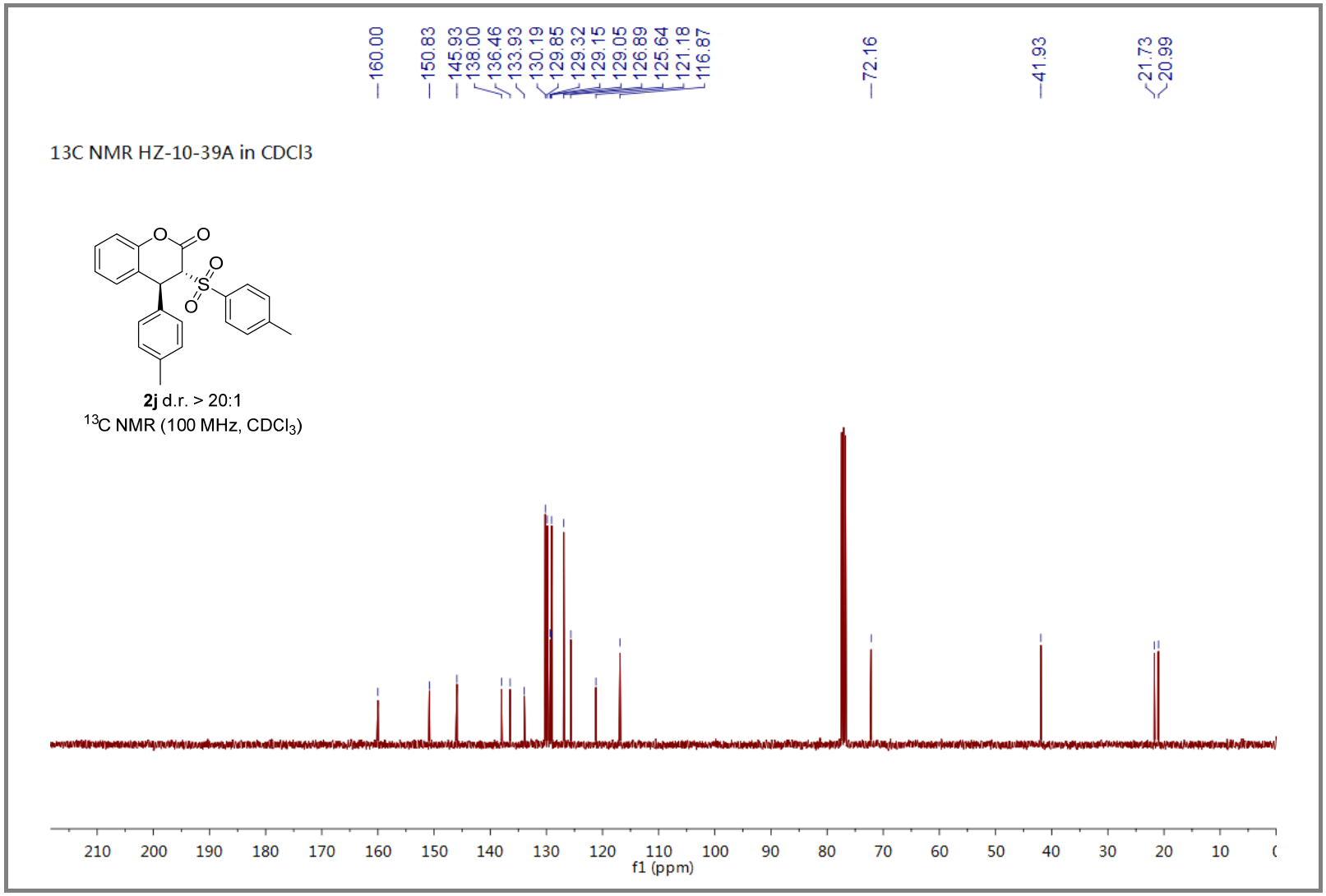

7.8755
7.8553
7.5329
7.5165
7.4978
7.4954
7.3583
7.3405
7.3238
7.3065
7.2898
7.2801
7.2750
7.2712
7.2572
7.2542
7.2504
7.2465
7.2361
7.1974
7.1789
7.1602
7.1286
7.1082
7.0457
4.3984
4.3961
2.6896
1H NMR HZ-11-49B in CDCl3
2h d.r. > 20:1
1H NMR (400 MHz, CDCl3)
1.00
1.00
7.49
1.00
1.00
2.00
1.00
1.00
3.00
f1 (ppm)

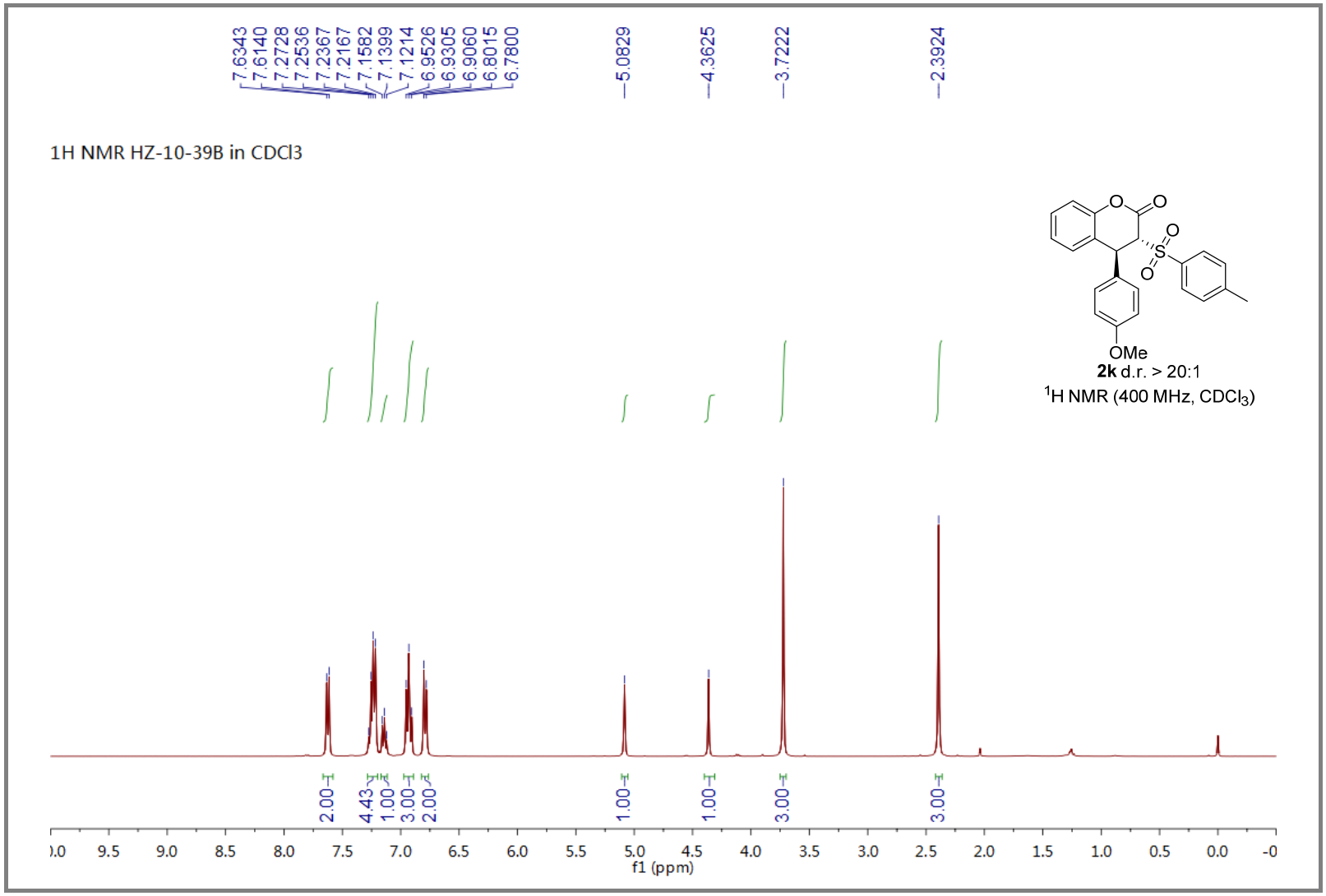

159.80
151.10
139.57
138.63
135.47
134.76
133.08
131.46
129.69
129.65
129.19
128.19
127.04
126.84
125.75
120.96
117.01
71.17
41.76
20.77
13C NMR HZ-11-49B in CDCl3
2h d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

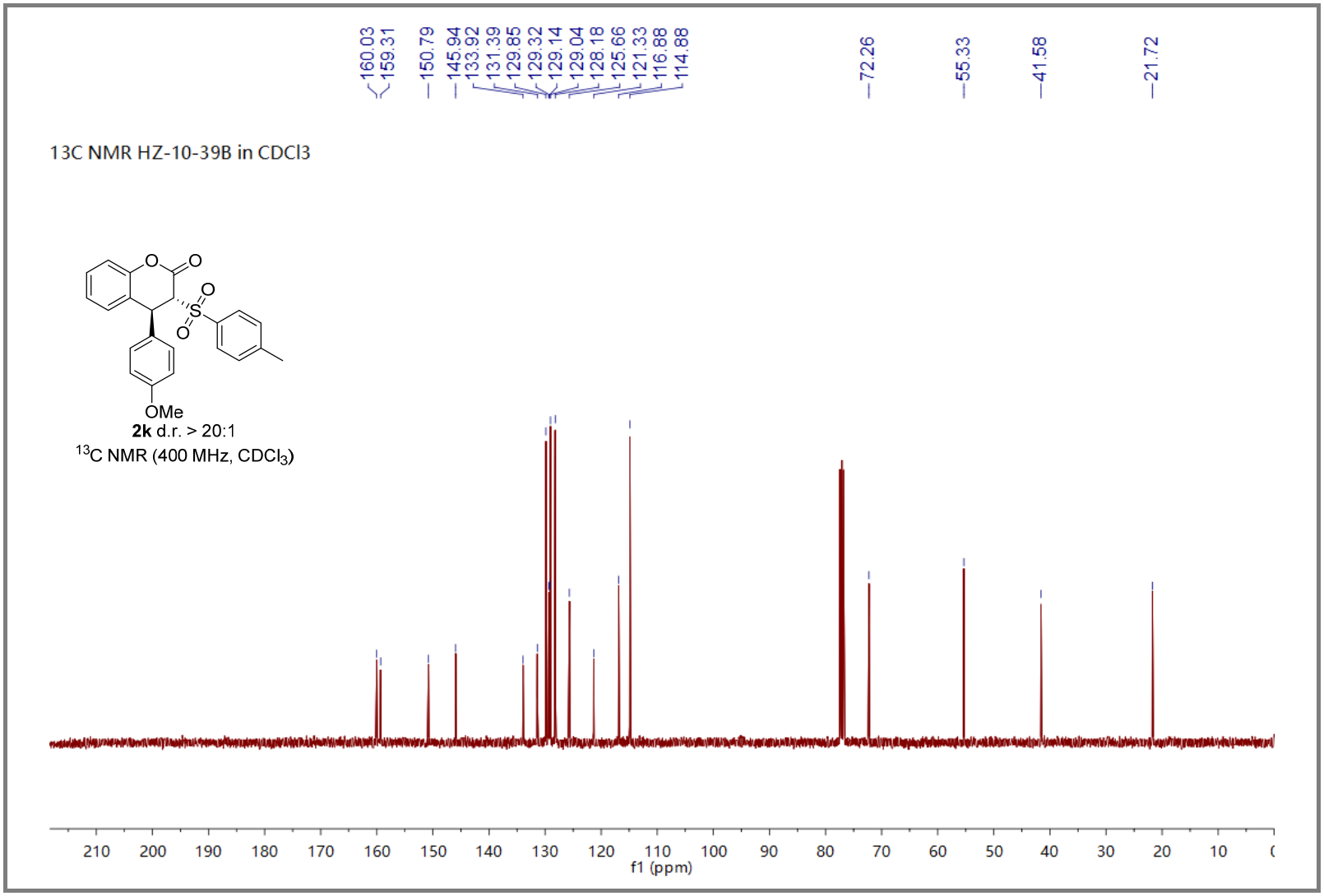

7.4042
7.3908
7.3842
7.3747
7.3697
7.3634
7.3549
7.3479
7.3047
7.2675
7.2309
7.2103
7.1846
7.1654
7.1544
7.1490
7.1362
6.0984
6.0921
6.0741
6.0549
6.0366
6.0313
5.1807
4.8201
4.7777
4.5290
3.0424
3.0250
3.0049
2.9876
2.8443
2.8243
2.8068
2.7868
2.1649
1H NMR HZ-11-56 in CDCl3
O
O
Allyl
Ms
Ph
2i d.r. > 20:1
1H NMR (400 MHz, CDCl3)
9.41
1.00
1.00
1.00
1.00
1.00
3.00
f1 (ppm)

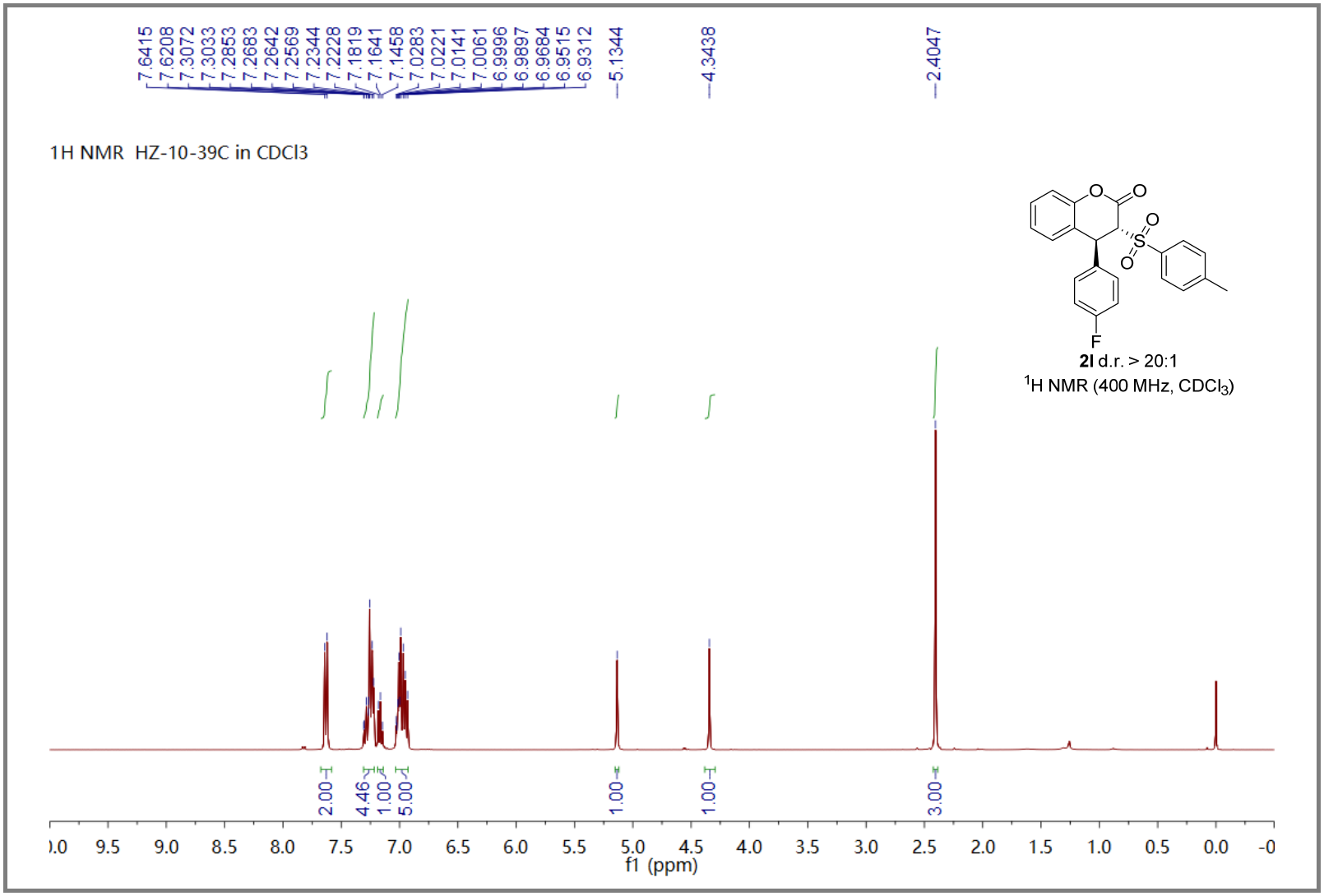

164.29
149.63
137.10
130.55
129.53
129.17
128.80
125.96
124.84
121.26
116.92
73.57
49.20
41.42
35.75
13C NMR HZ-11-56 in CDCl3
O
O
Allyl
Ms
Ph
2i d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

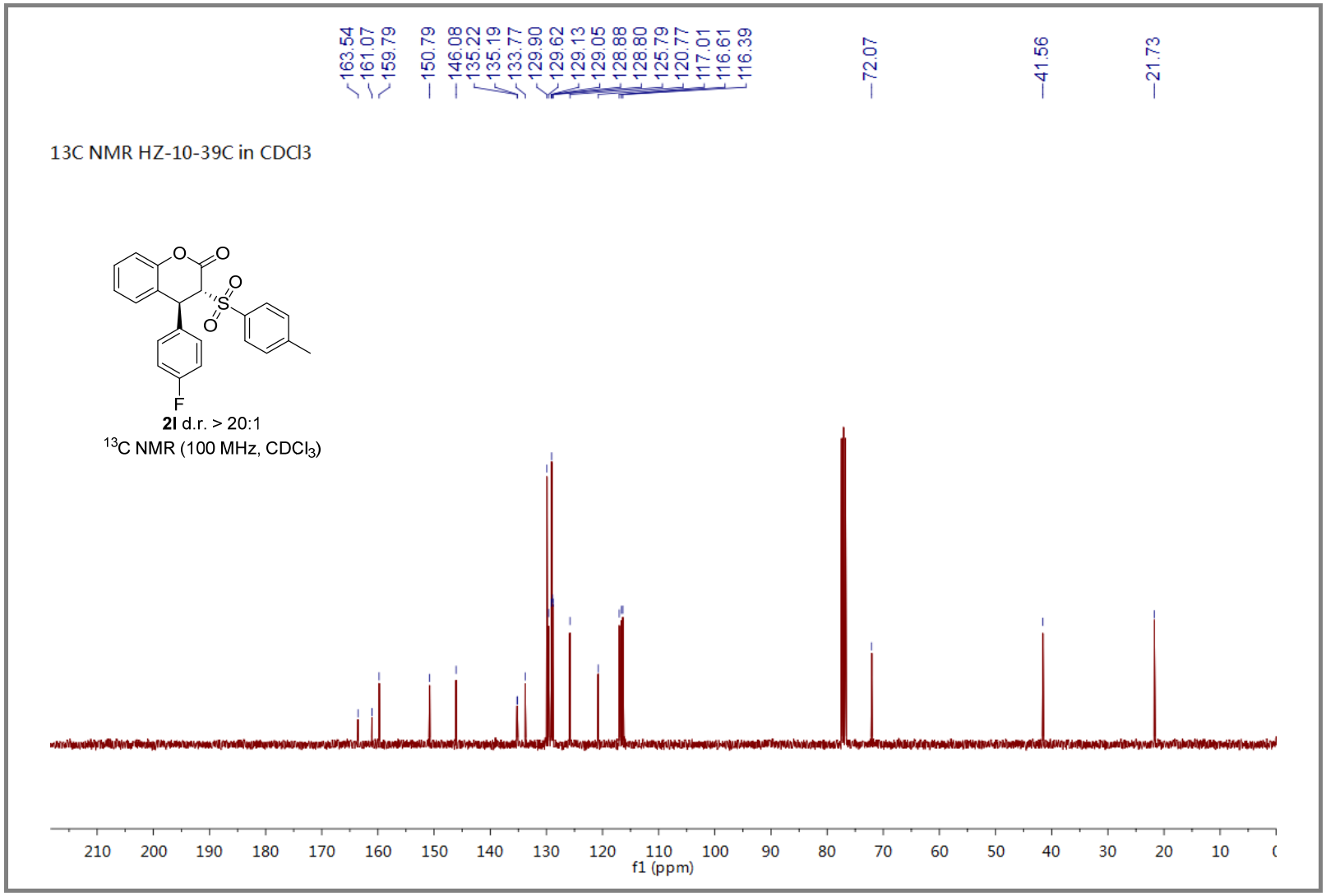

7.6395
7.6188
7.2783
7.2745
7.2519
7.2407
7.2204
7.1564
7.1394
7.1209
7.0867
7.0667
6.9296
6.9251
6.9094
6.9050
5.0975
4.3654
2.3975
2.2671
1H NMR HZ-10-39A in CDCl3
2j d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
4.53
1.00
2.00
3.00
1.00
1.00
3.00
3.00
f1 (ppm)

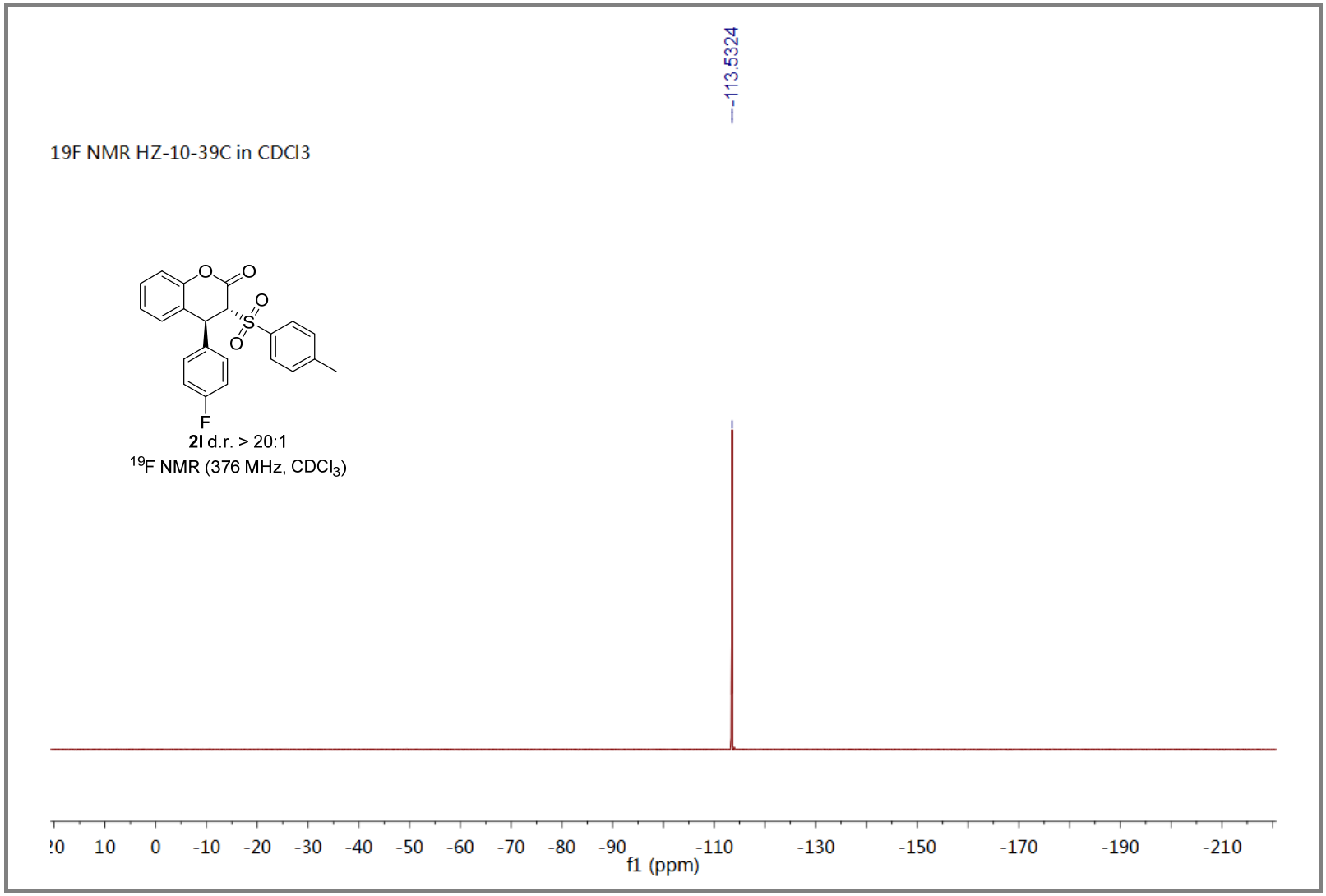

160.00
150.83
145.93
138.00
136.46
133.93
130.19
129.85
129.32
129.15
129.05
126.89
125.64
121.18
116.87
72.16
41.93
21.73
20.99
13C NMR HZ-10-39A in CDCl3
2j d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

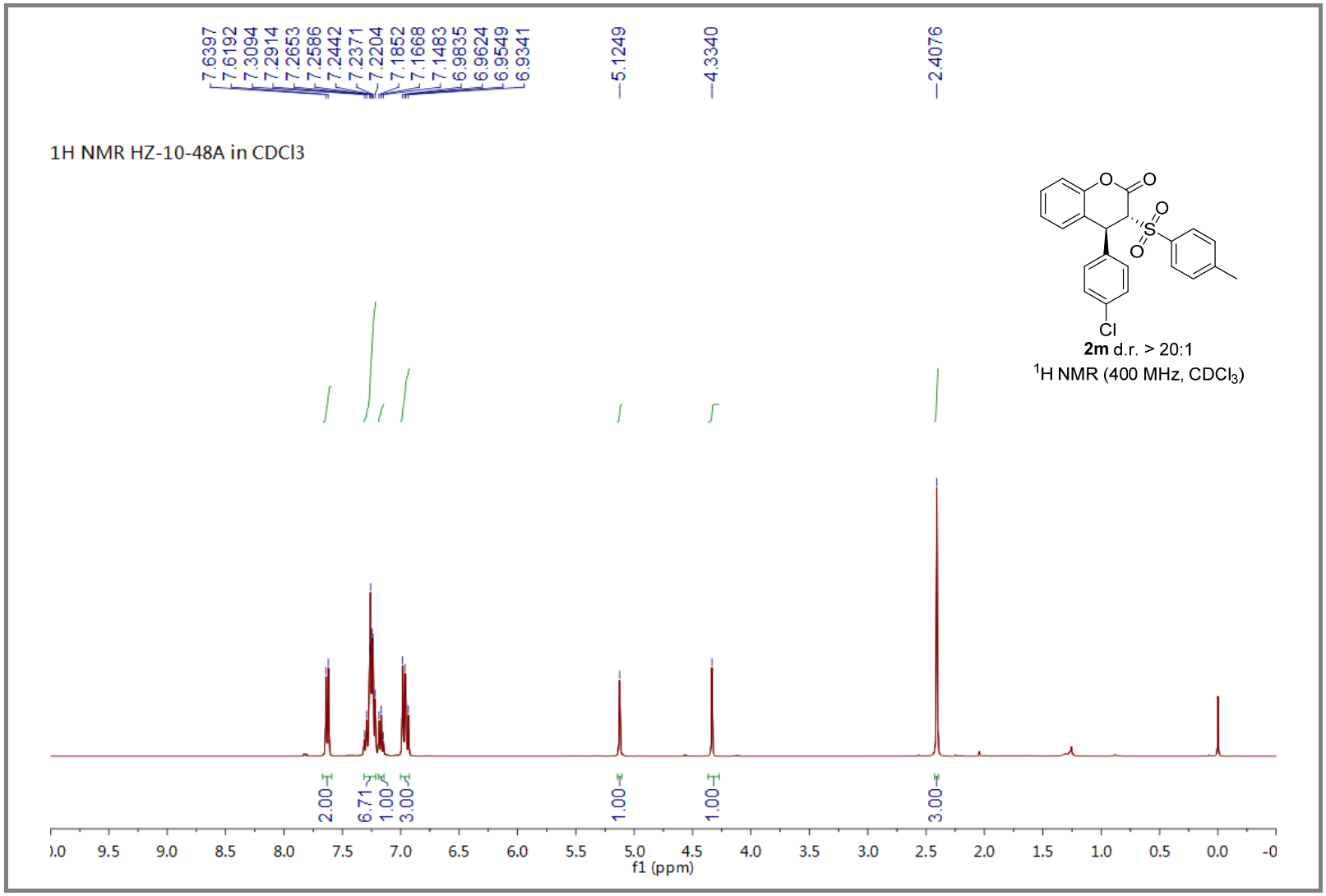

7.6343
7.6140
7.2728
7.2536
7.2367
7.2167
7.1582
7.1399
7.1214
6.9526
6.9305
6.9060
6.8015
6.7800
5.0829
4.3625
3.7222
2.3924
1H NMR HZ-10-39B in CDCl3
OMe
2k d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
4.43
1.00
3.00
2.00
1.00
1.00
3.00
3.00
f1 (ppm)

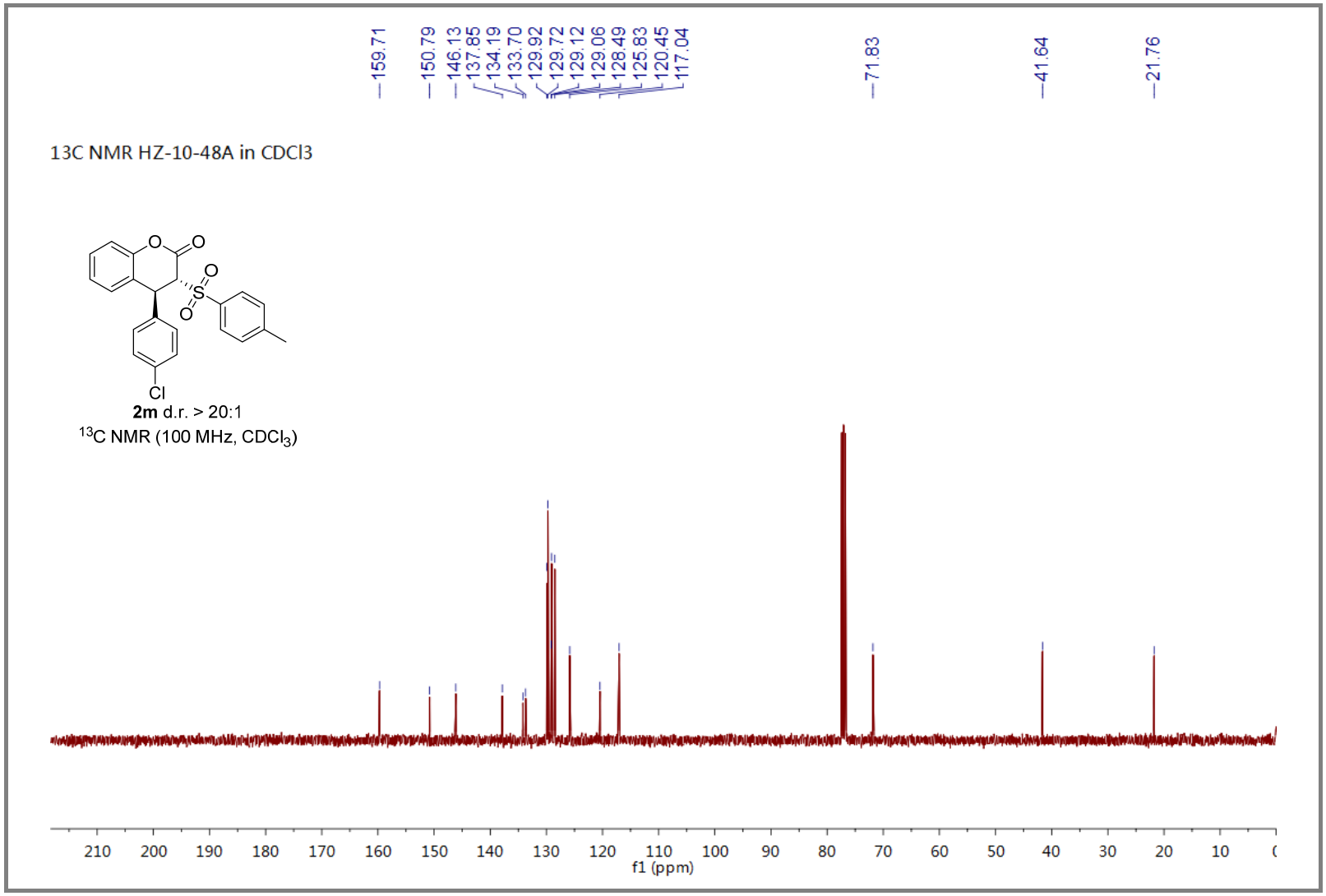

160.03
159.31
150.79
145.94
133.92
131.39
129.85
129.32
129.14
129.04
128.18
125.66
121.33
116.88
114.88
72.26
55.33
41.58
21.72
13C NMR HZ-10-39B in CDCl3
OMe
2k d.r. > 20:1
13C NMR (400 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

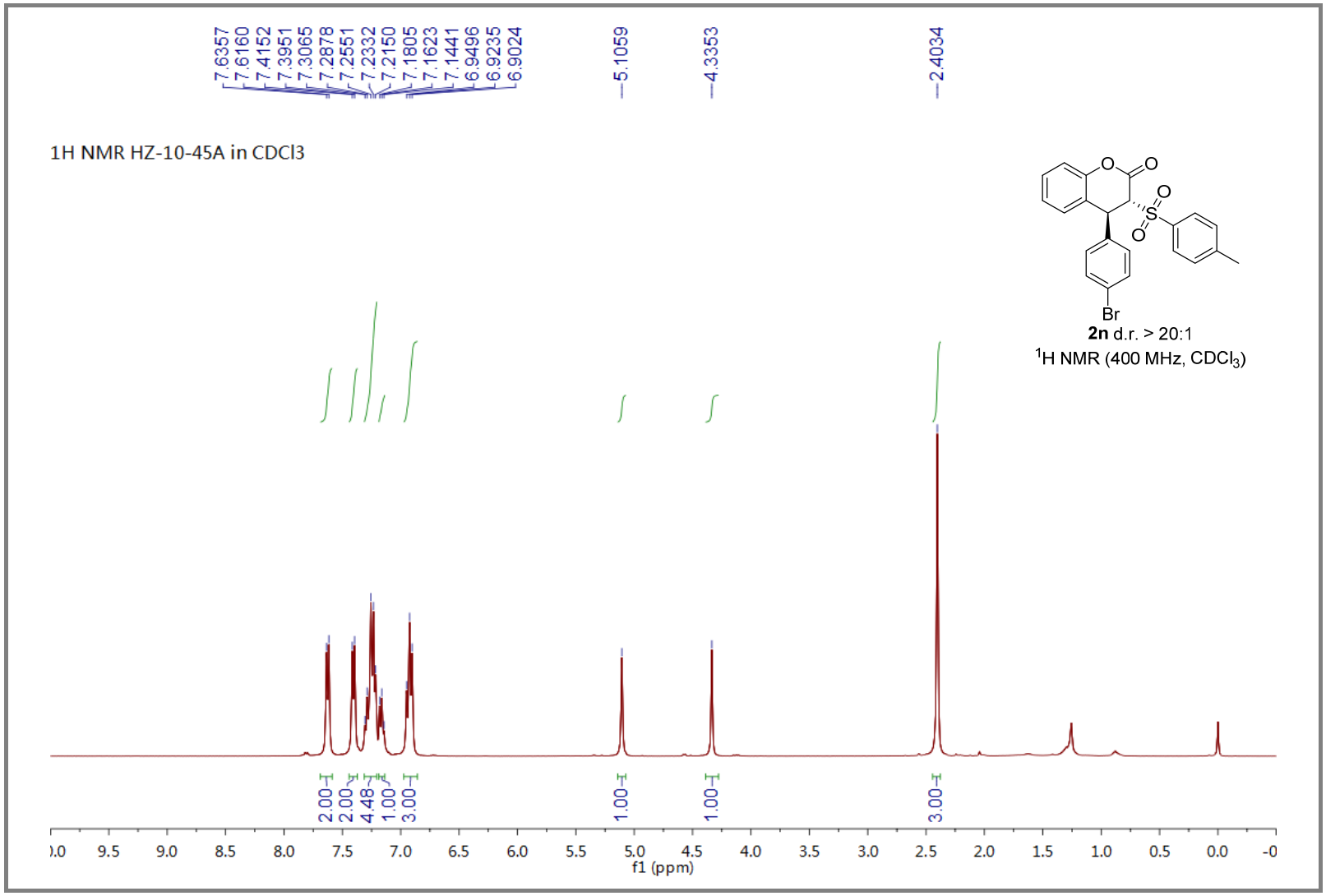

7.6415
7.6208
7.3072
7.3033
7.2853
7.2683
7.2642
7.2569
7.2344
7.2228
7.1819
7.1641
7.1458
7.0283
7.0221
7.0141
7.0061
6.9996
6.9897
6.9684
6.9515
6.9312
5.1344
4.3438
2.4047
1H NMR HZ-10-39C in CDCl3
2I d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
4.46
1.00
5.00
1.00
1.00
3.00
f1 (ppm)

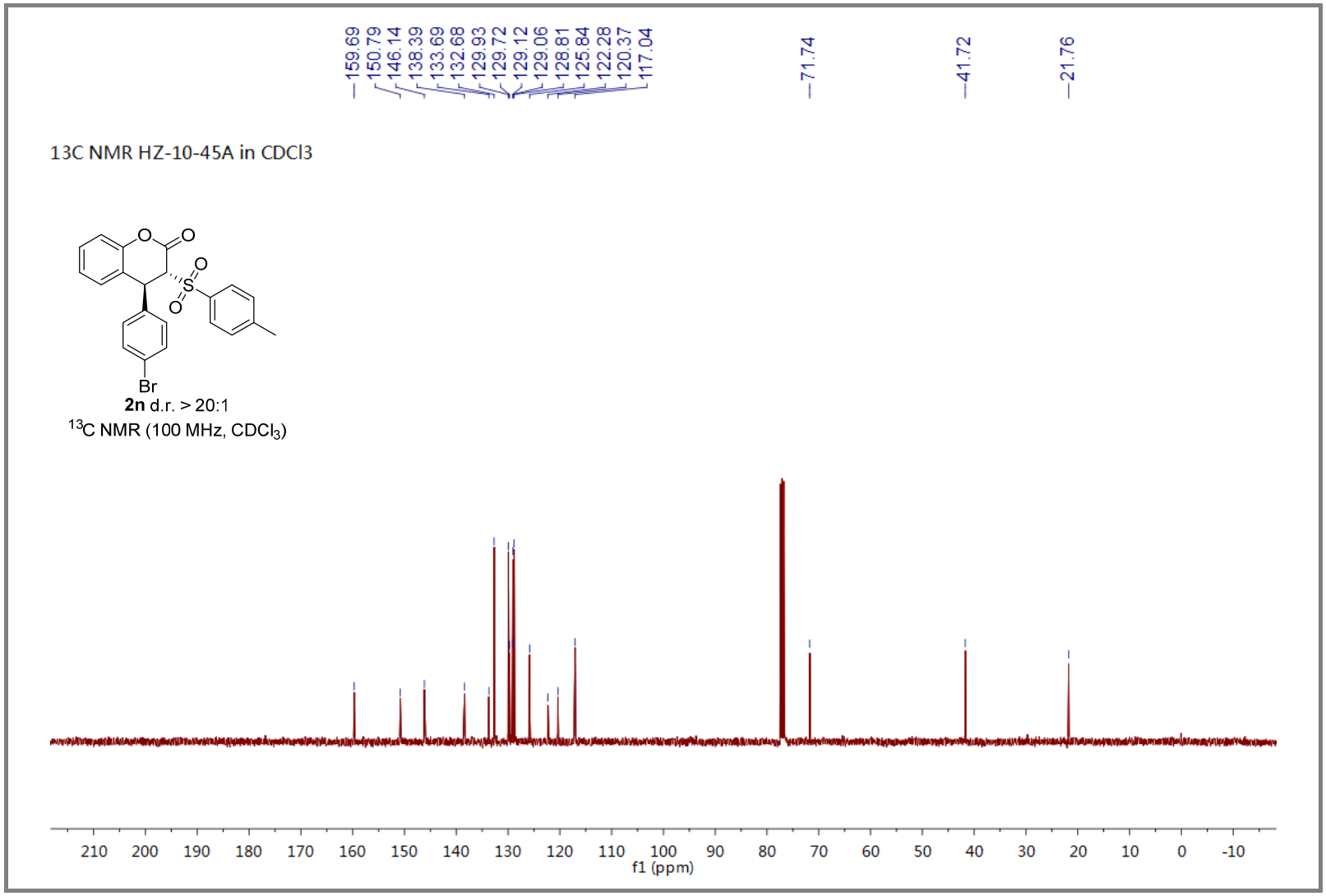

163.54
161.07
159.79
150.79
146.08
135.22
135.19
133.77
129.90
129.62
129.13
129.05
128.88
128.80
125.79
120.77
117.01
116.61
116.39
72.07
41.56
21.73
13C NMR HZ-10-39C in CDCl3
O
O
O
S
O
F
2l d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

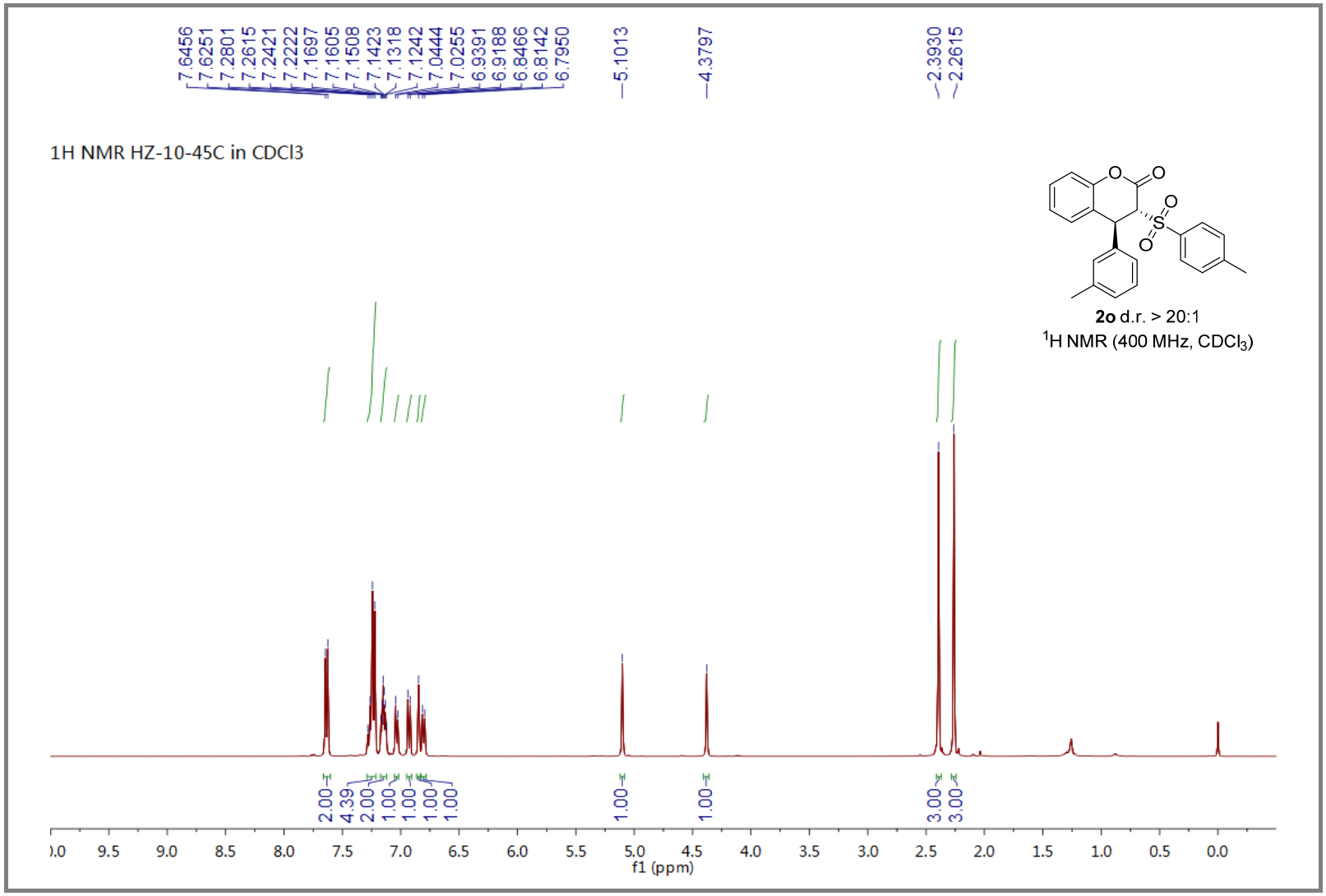

19F NMR HZ-10-39C in CDCl3
-113.5324
O
O
O
O
S
F
2l d.r. > 20:1
19F NMR (376 MHz, CDCl3)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-110
-130
-150
-170
-190
-210
f1 (ppm)

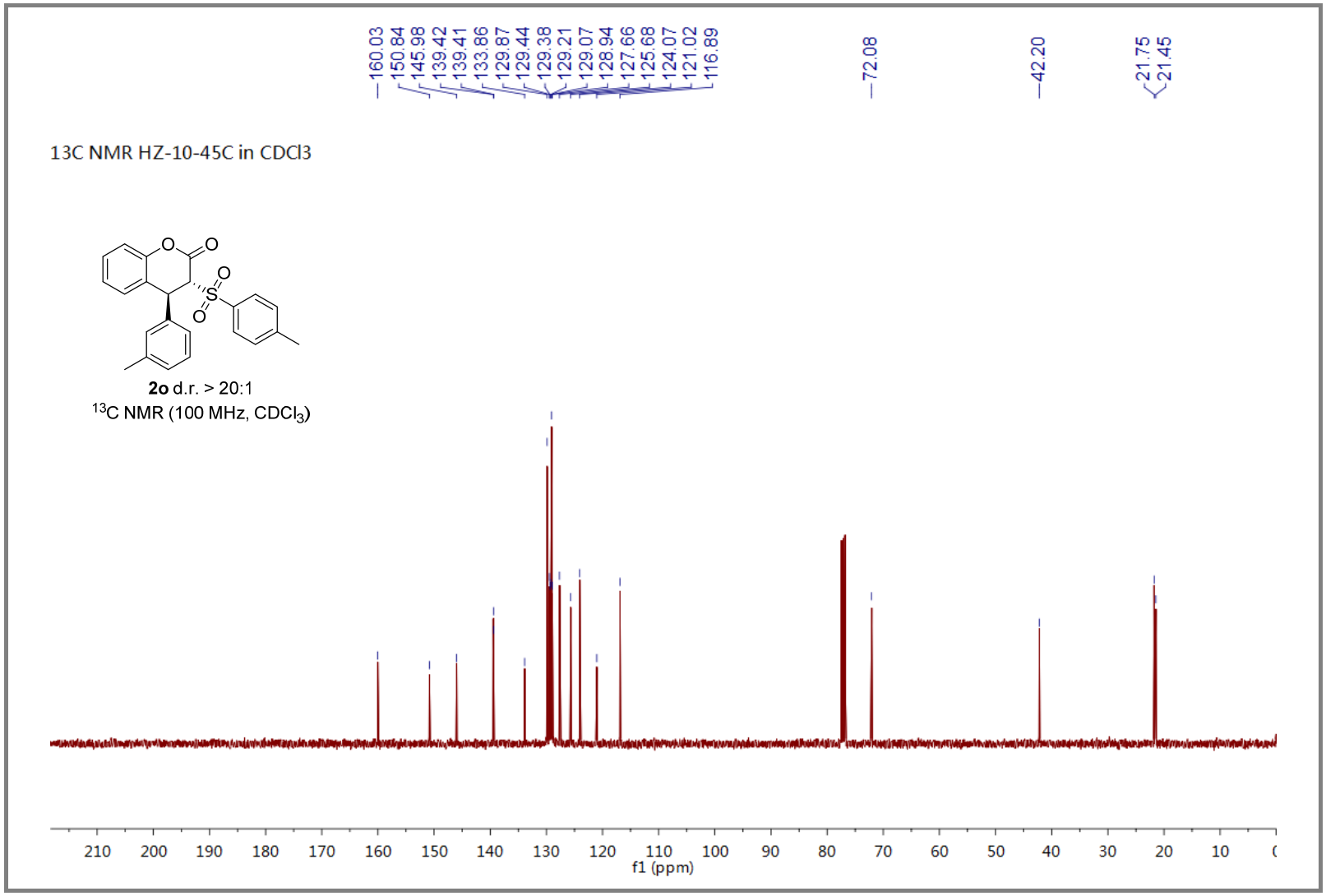

7.6397
7.6192
7.3094
7.2914
7.2653
7.2586
7.2442
7.2371
7.2204
7.1852
7.1668
7.1483
6.9835
6.9624
6.9549
6.9341
5.1249
4.3340
2.4076
1H NMR HZ-10-48A in CDCl3
O
O
O
S
O
Cl
2m d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
6.71
1.00
3.00
1.00
1.00
3.00
f1 (ppm)

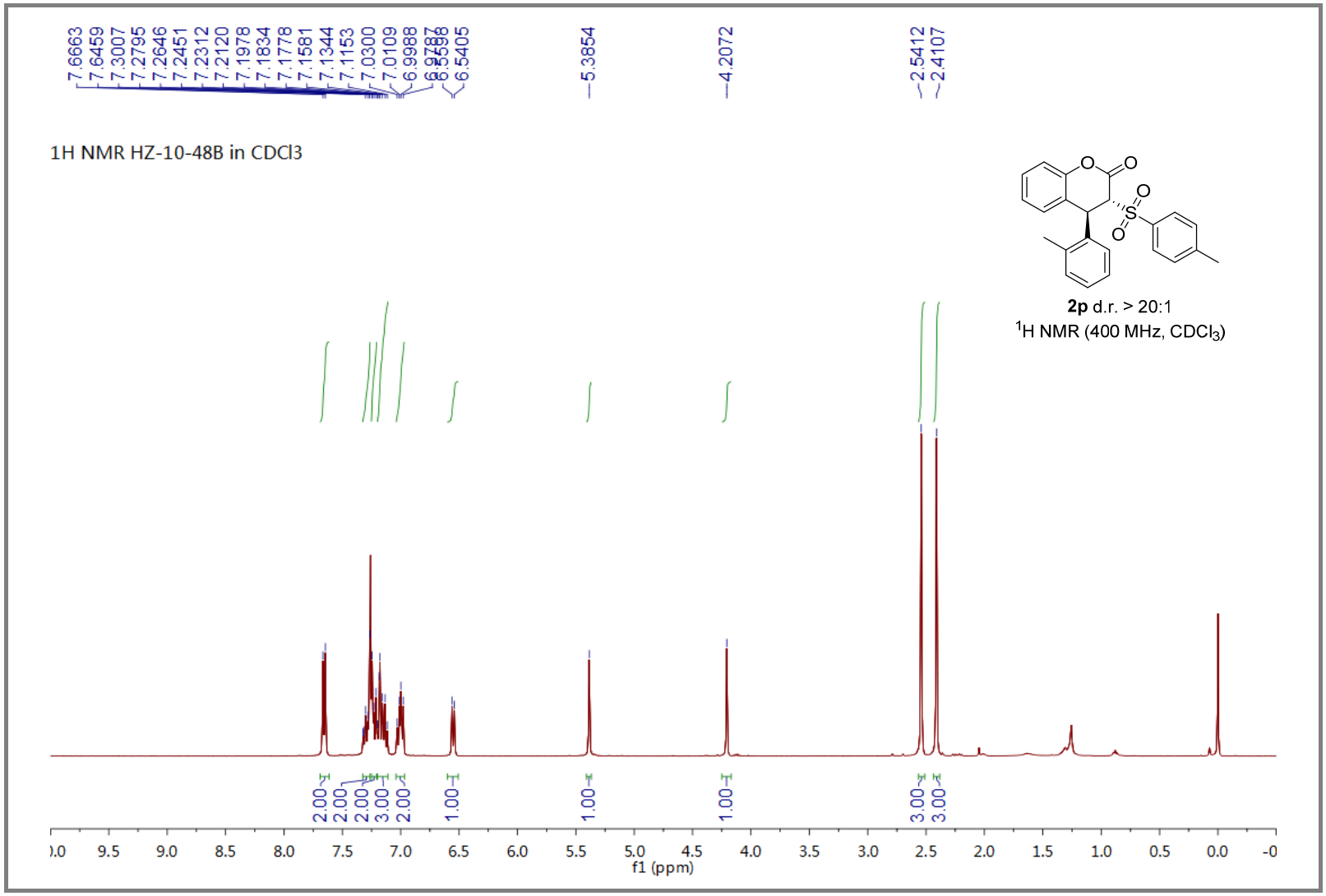

159.71
150.79
146.13
137.85
134.19
133.70
129.92
129.72
129.12
129.06
128.49
125.83
120.45
117.04
71.83
41.64
21.76
13C NMR HZ-10-48A in CDCl3
Cl
2m d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

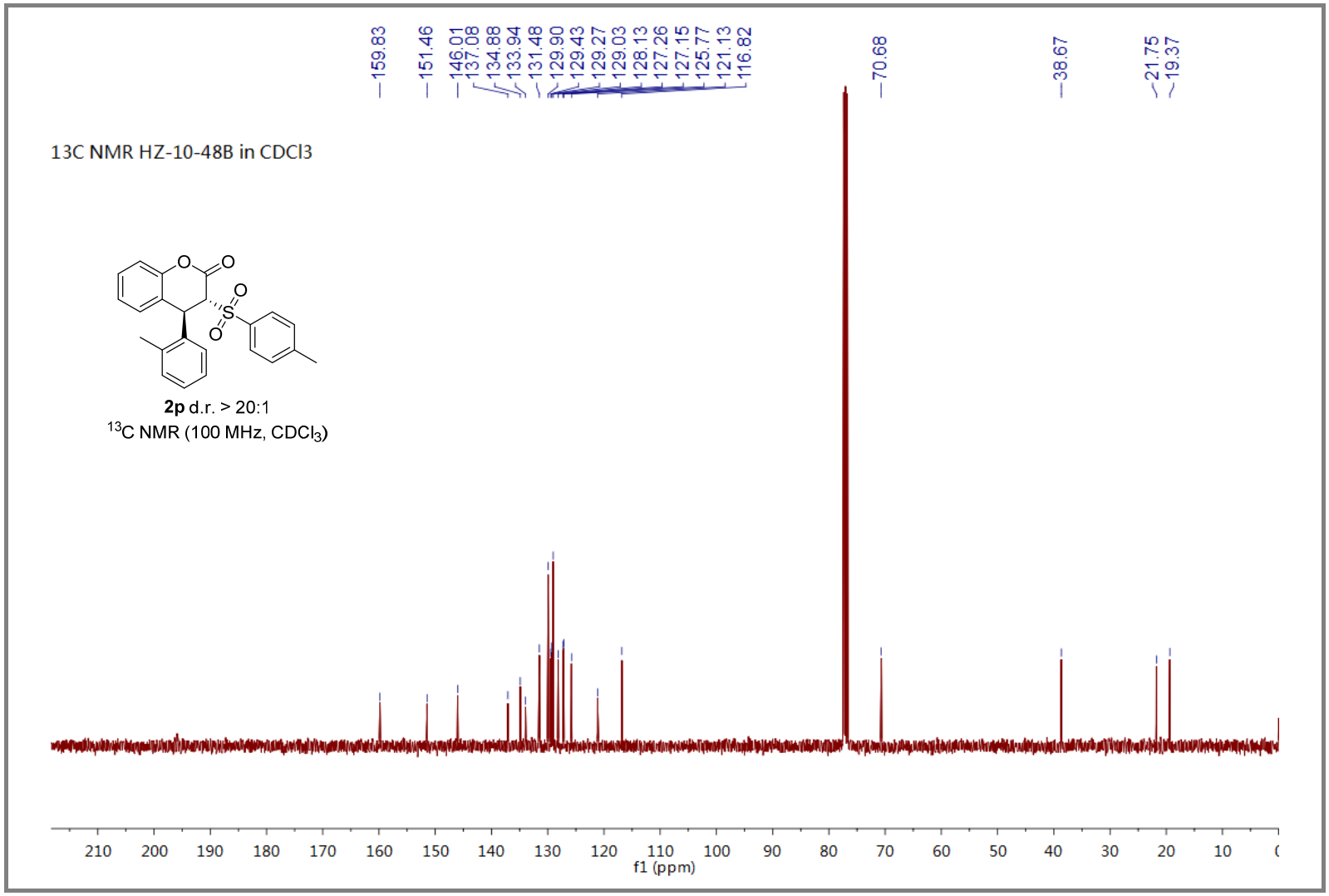

7.6357
7.6160
7.4152
7.3951
7.3065
7.2878
7.2551
7.2332
7.2150
7.1805
7.1623
7.1441
6.9496
6.9235
6.9024
5.1059
4.3353
2.4034
1H NMR HZ-10-45A in CDCl3
O
O
O
S
O
Br
2n d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
2.00
4.48
1.00
3.00
1.00
1.00
3.00
f1 (ppm)

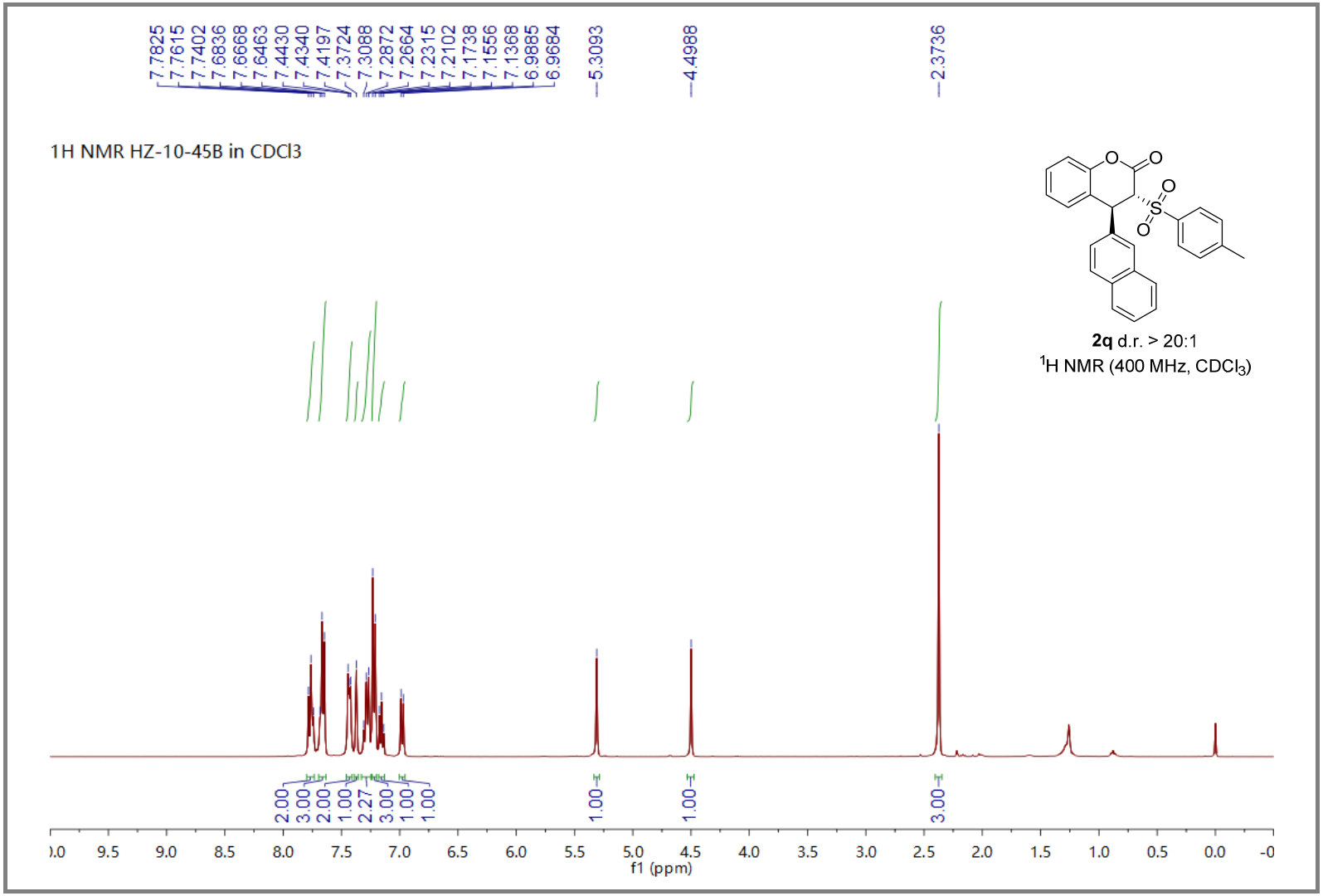

159.69
150.79
146.14
138.39
133.69
132.68
129.93
129.72
129.12
129.06
128.81
125.84
122.28
120.37
117.04
71.74
41.72
21.76
13C NMR HZ-10-45A in CDCl3
Br
2n d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.6456
7.6251
7.2801
7.2615
7.2421
7.2222
7.1697
7.1605
7.1508
7.1423
7.1318
7.1242
7.0444
7.0255
6.9391
6.9188
6.8466
6.8142
6.7950
5.1013
4.3797
2.3930
2.2615
1H NMR HZ-10-45C in CDCl3
2o d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
4.39
2.00
1.00
1.00
1.00
1.00
1.00
3.00
3.00
f1 (ppm)


160.03
150.84
145.98
139.42
139.41
133.86
129.87
129.44
129.38
129.21
129.07
128.94
127.66
125.68
124.07
121.02
116.89
72.08
42.20
21.75
21.45
13C NMR HZ-10-45C in CDCl3
2o d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

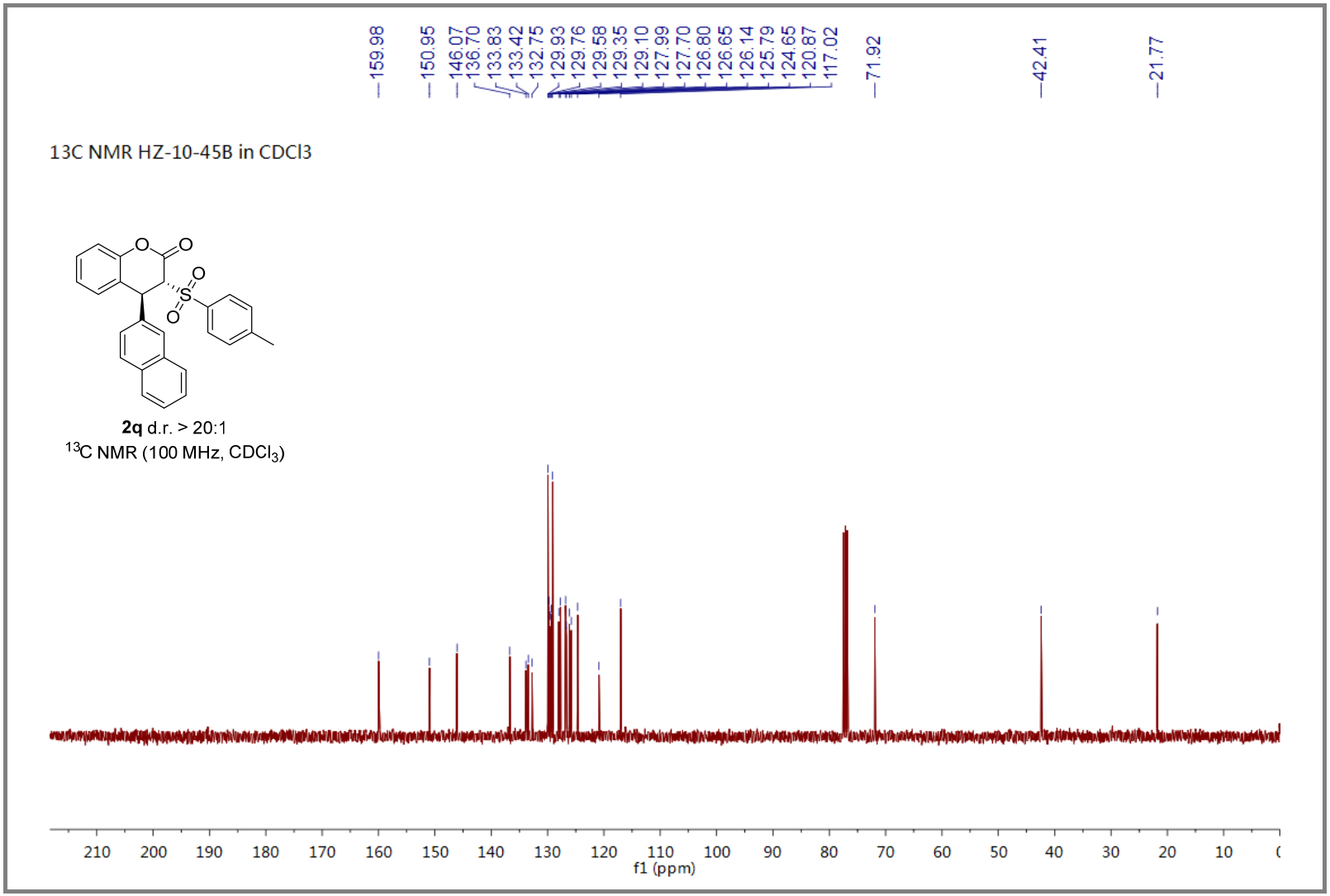

7.6663
7.6459
7.3007
7.2795
7.2646
7.2451
7.2312
7.2120
7.1978
7.1834
7.1778
7.1581
7.1344
7.1153
7.0300
7.0109
6.9988
6.5405
5.3854
4.2072
2.5412
2.4107
1H NMR HZ-10-48B in CDCl3
2p d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
2.00
2.00
3.00
2.00
1.00
1.00
1.00
3.00
3.00
f1 (ppm)

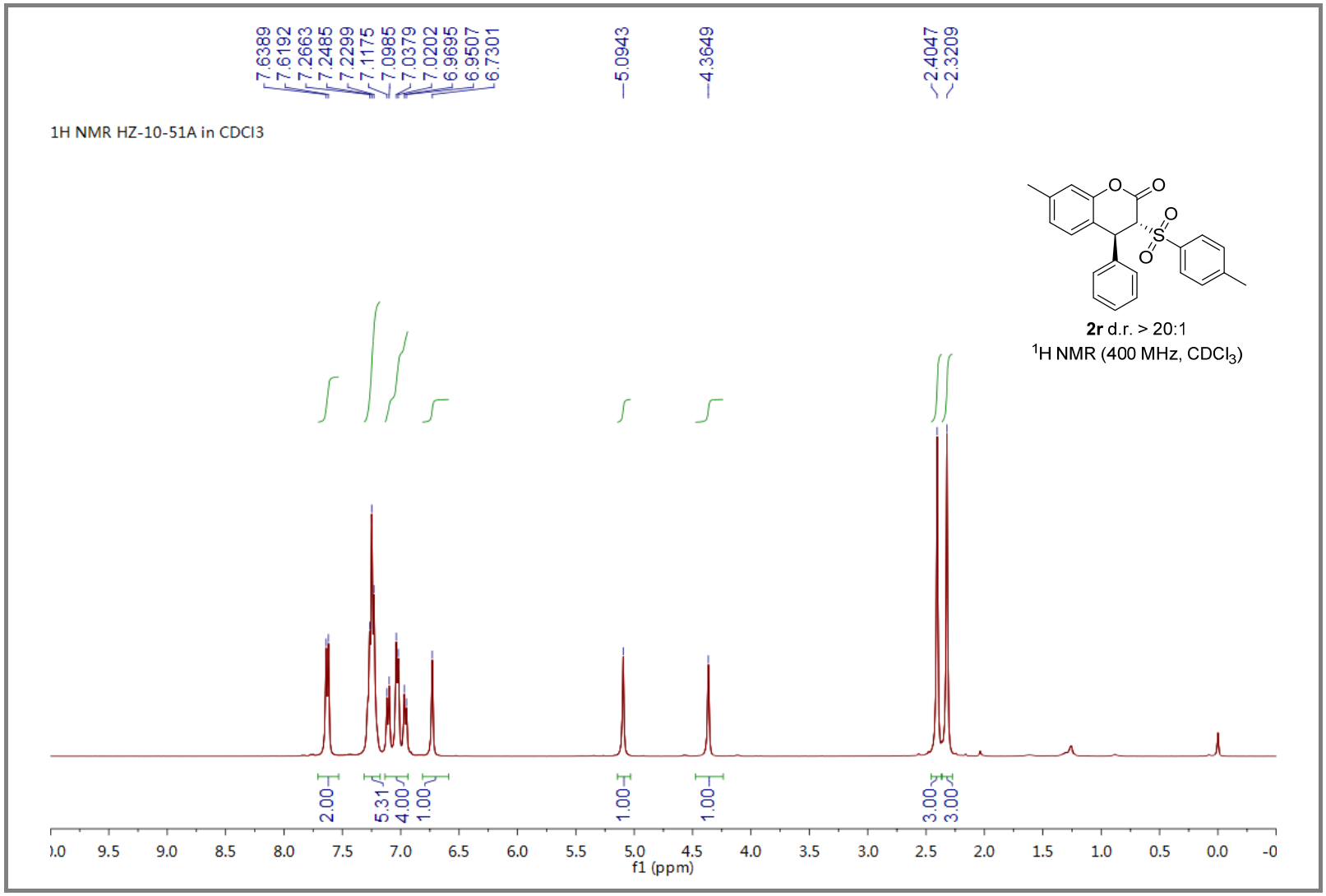

159.83
151.46
146.01
137.08
134.88
133.94
131.48
129.90
129.43
129.27
129.03
128.13
127.26
127.15
125.77
121.13
116.82
70.68
38.67
21.75
19.37
13C NMR HZ-10-48B in CDCl3
2p d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

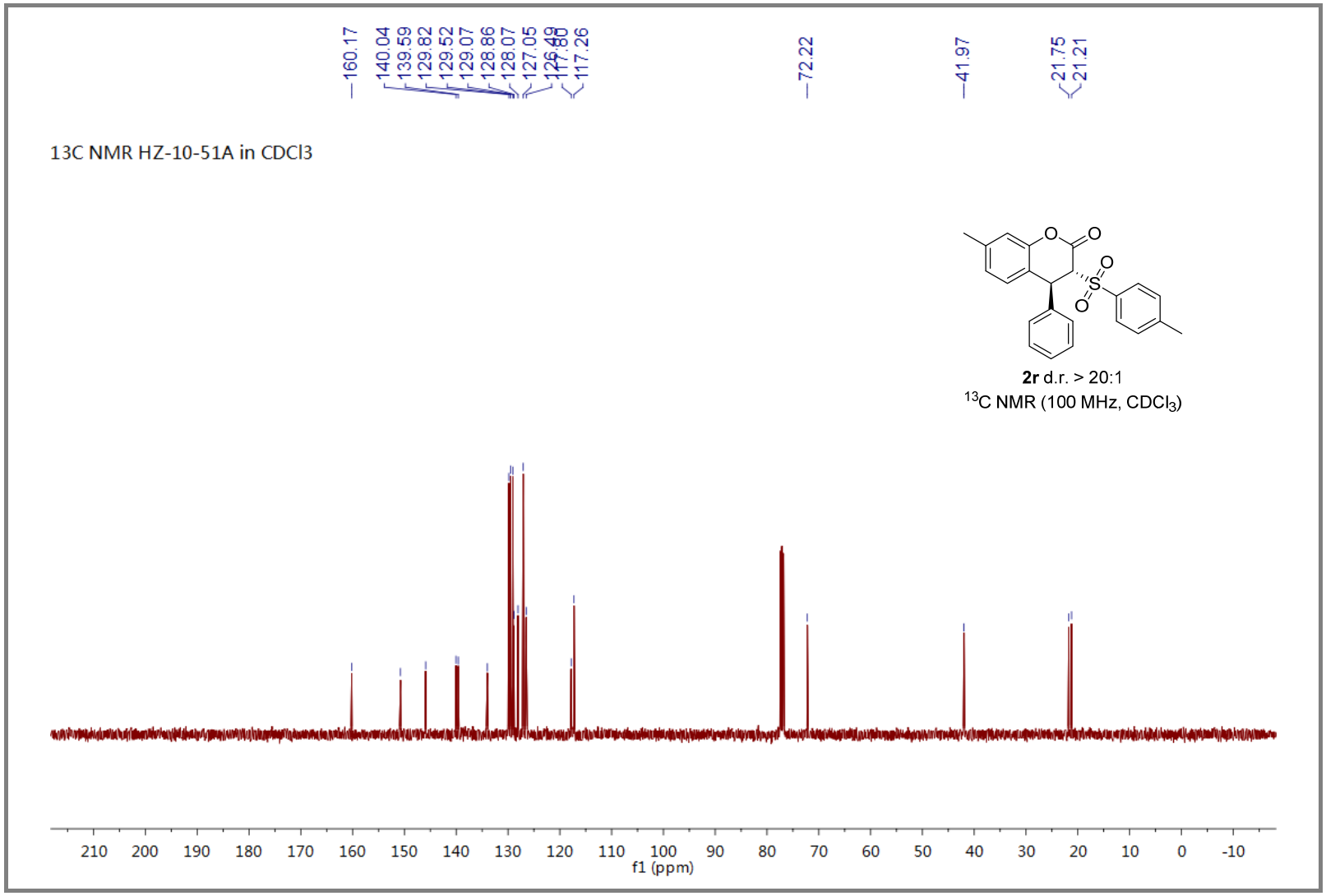


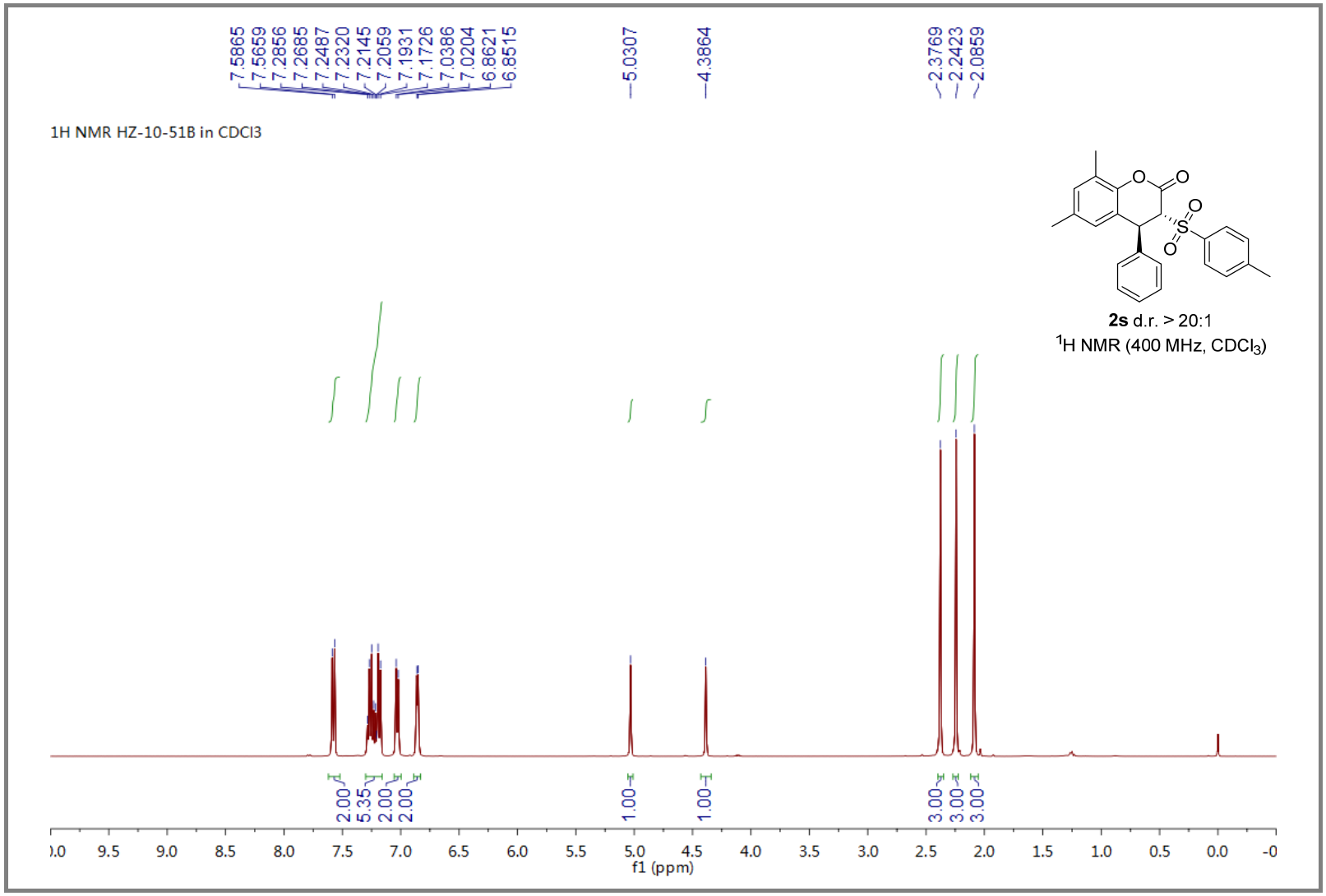
2q d.r. > 20:1

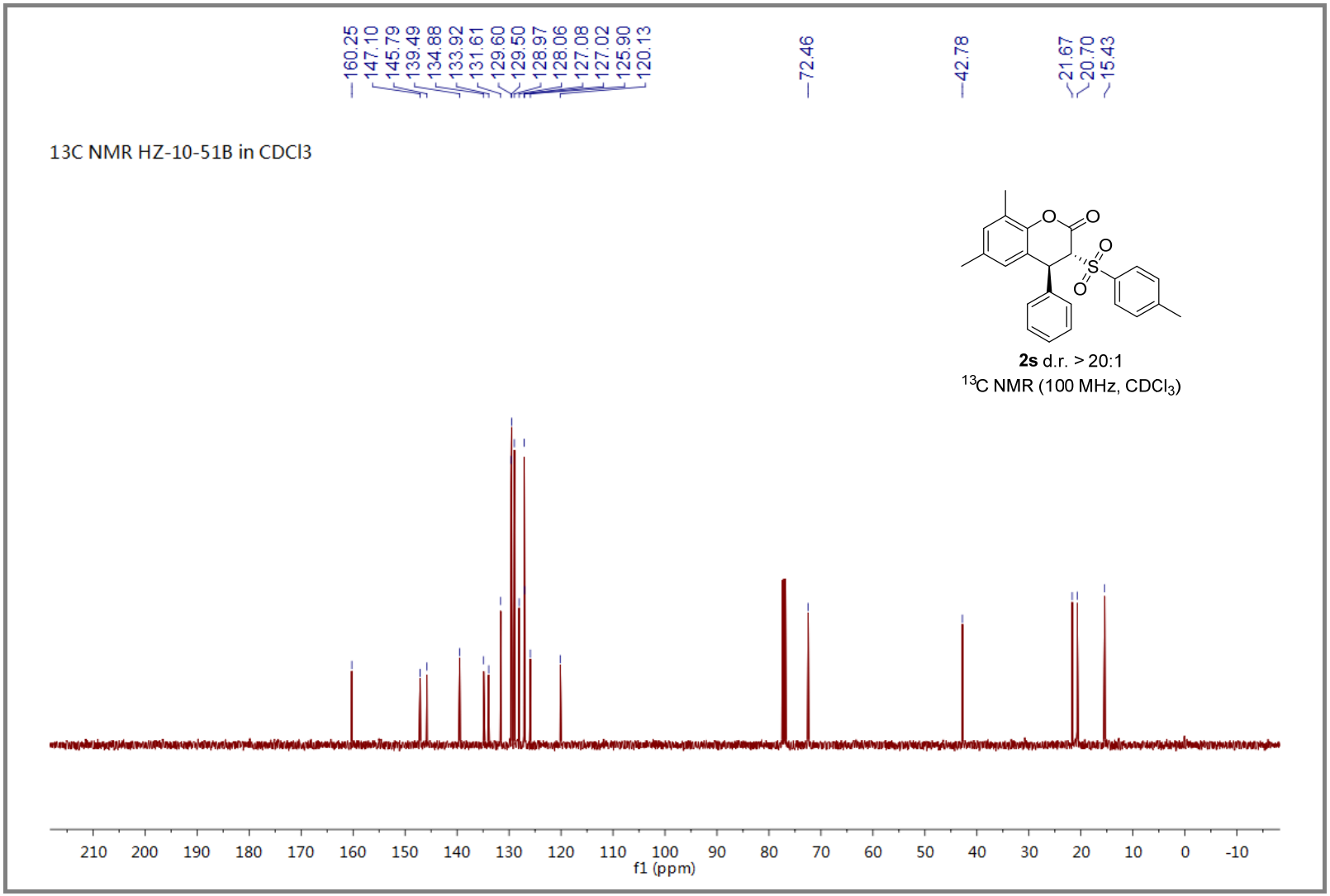
^{1}H NMR (400 MHz, $CDCl_3$)

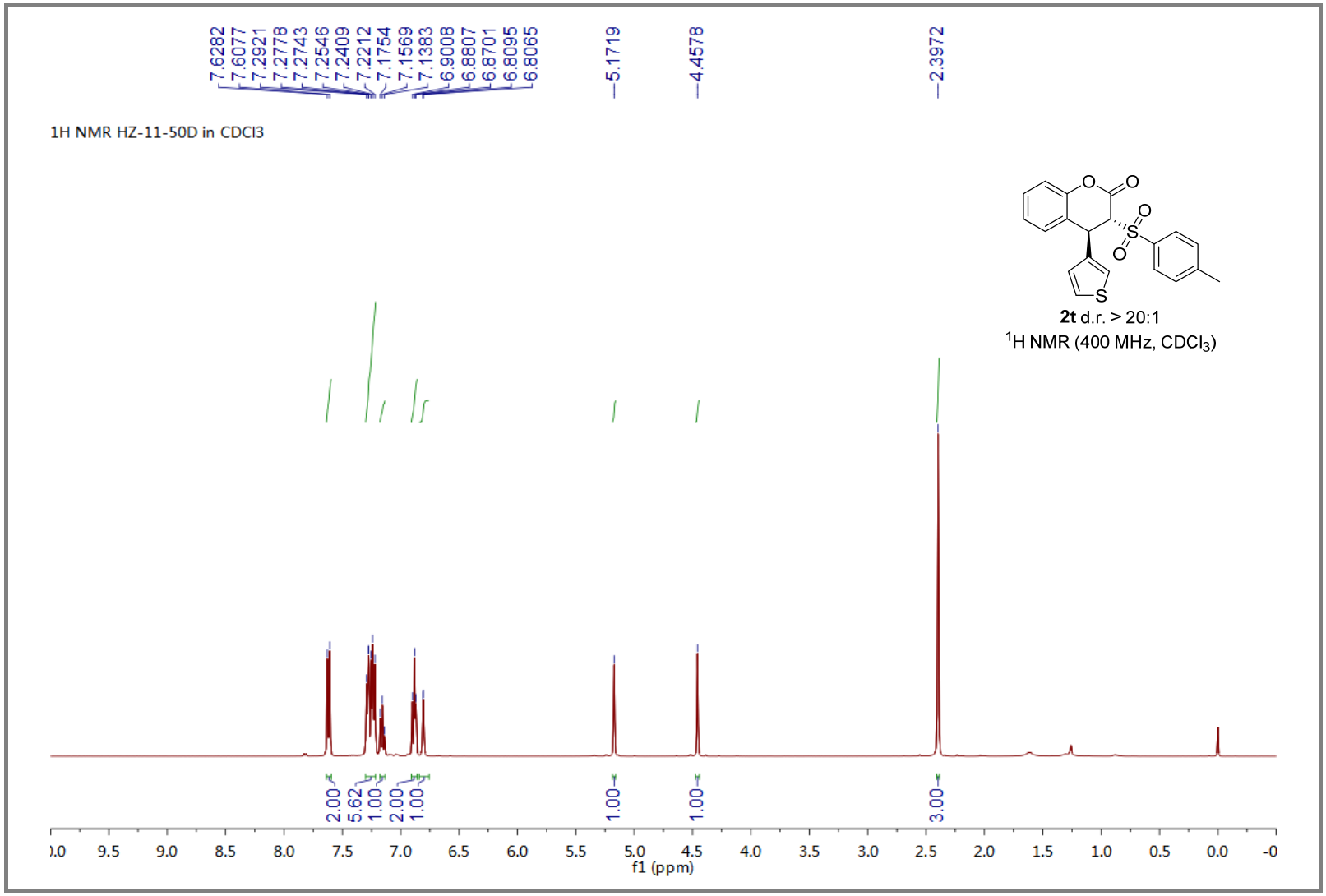

159.98
150.95
146.07
136.70
133.83
133.42
132.75
129.93
129.76
129.58
129.35
129.10
127.99
127.70
126.80
126.65
126.14
125.79
124.65
120.87
117.02
71.92
42.41
21.77
13C NMR HZ-10-45B in CDCl3
2q d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

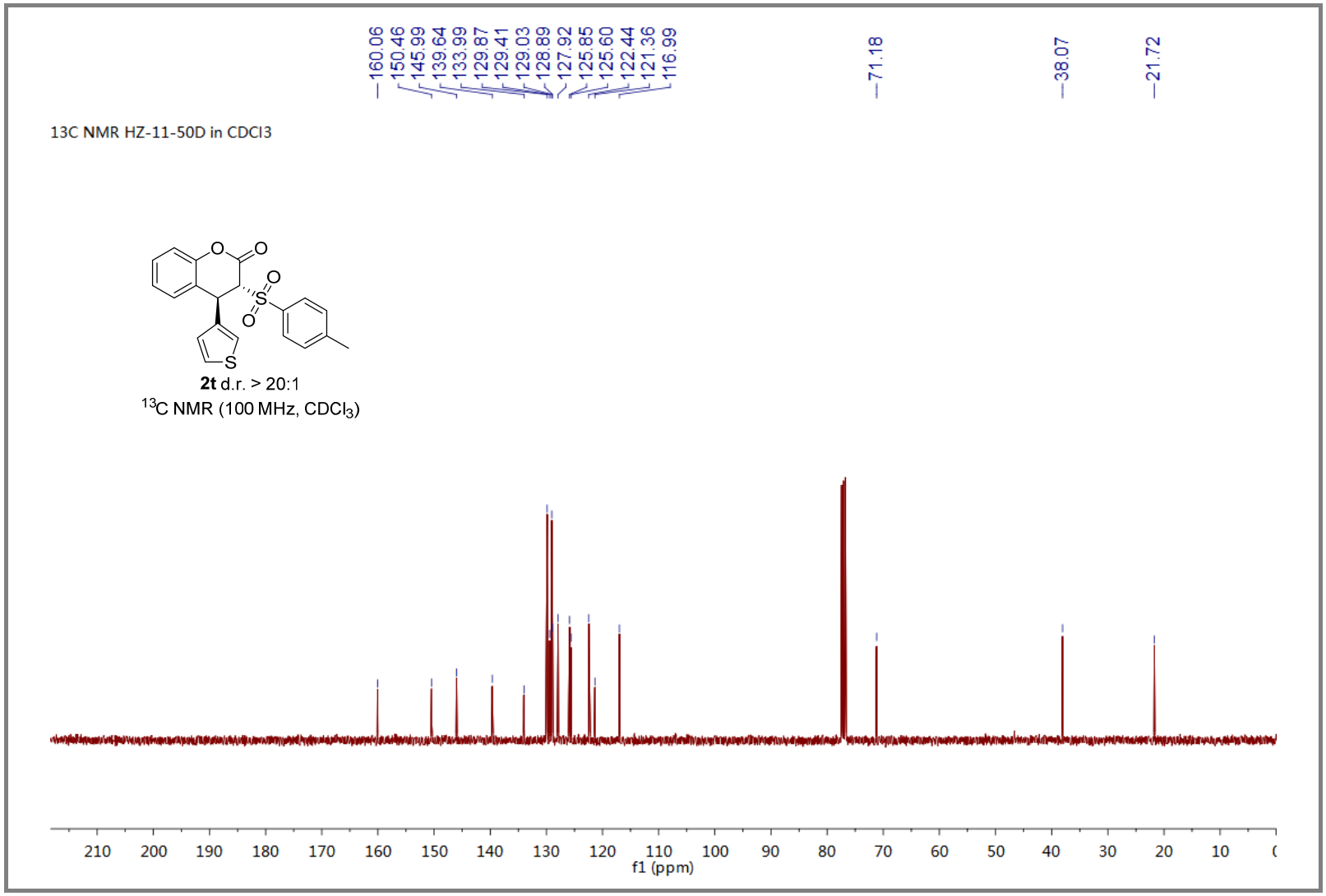

7.6389
7.6192
7.2663
7.2485
7.2299
7.1175
7.0985
7.0379
7.0202
6.9695
6.9507
6.7301
5.0943
4.3649
2.4047
2.3209
1H NMR HZ-10-51A in CDCl3
2r d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
5.31
4.00
1.00
1.00
1.00
3.00
3.00
f1 (ppm)

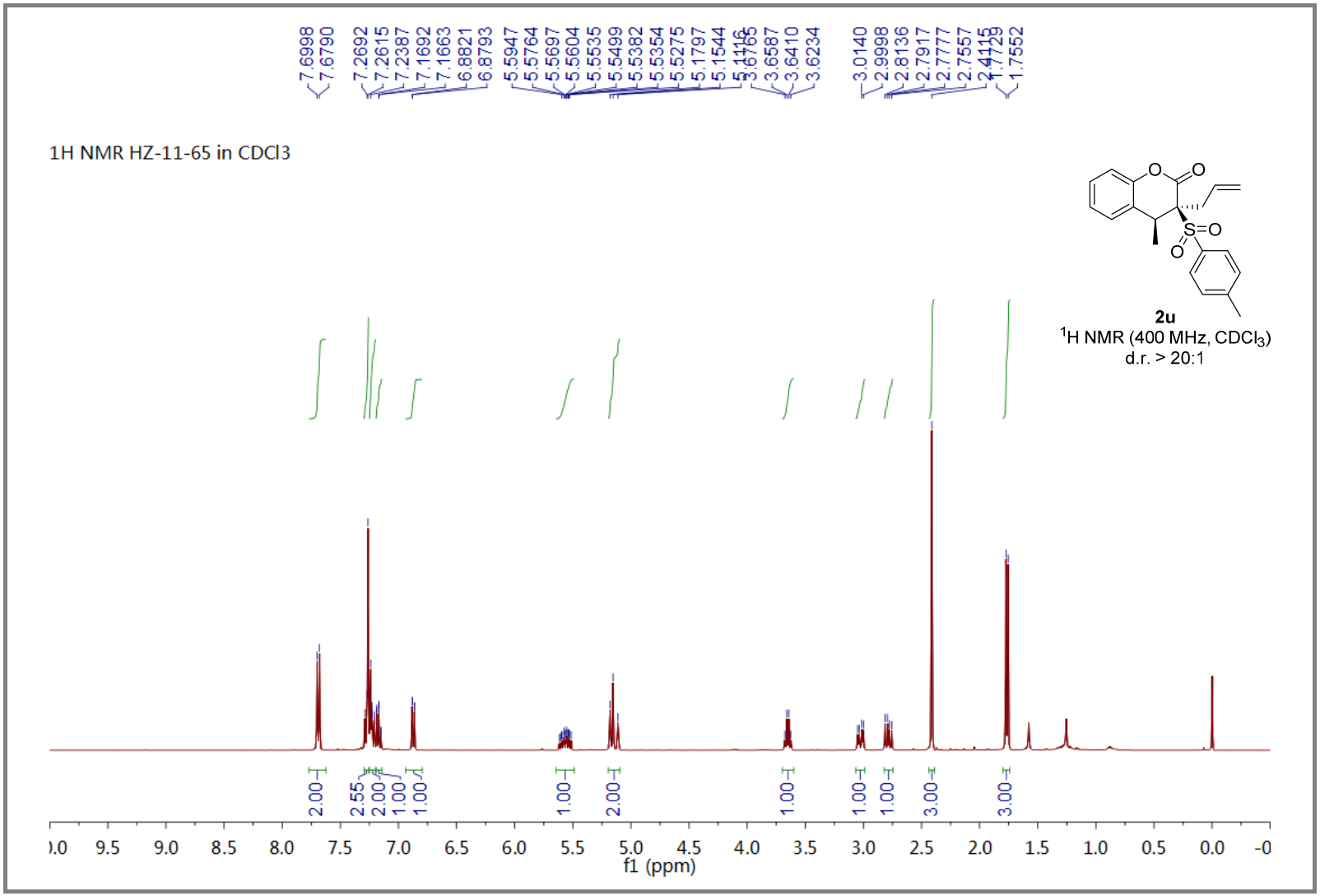

160.17
140.04
139.59
129.82
129.52
129.07
128.86
128.07
127.05
126.49
117.80
117.26
72.22
41.97
21.75
21.21
13C NMR HZ-10-51A in CDCl3
2r d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

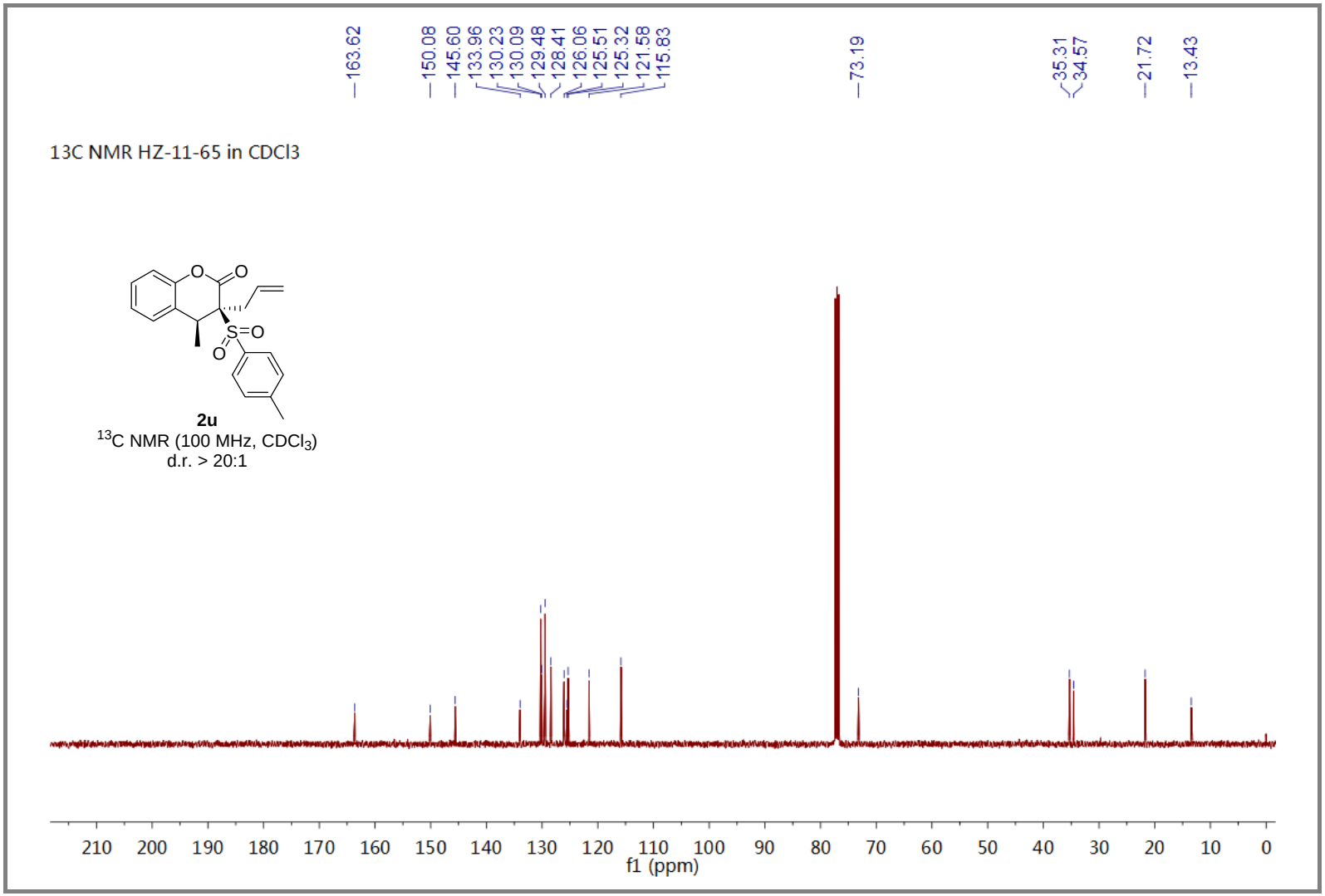

7.5865
7.5659
7.2856
7.2685
7.2487
7.2320
7.2145
7.2059
7.1931
7.1726
7.0386
7.0204
6.8621
6.8515
5.0307
4.3864
2.3769
2.2423
2.0859
1H NMR HZ-10-51B in CDCl3
2s d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
5.35
2.00
2.00
1.00
1.00
3.00
3.00
3.00
f1 (ppm)

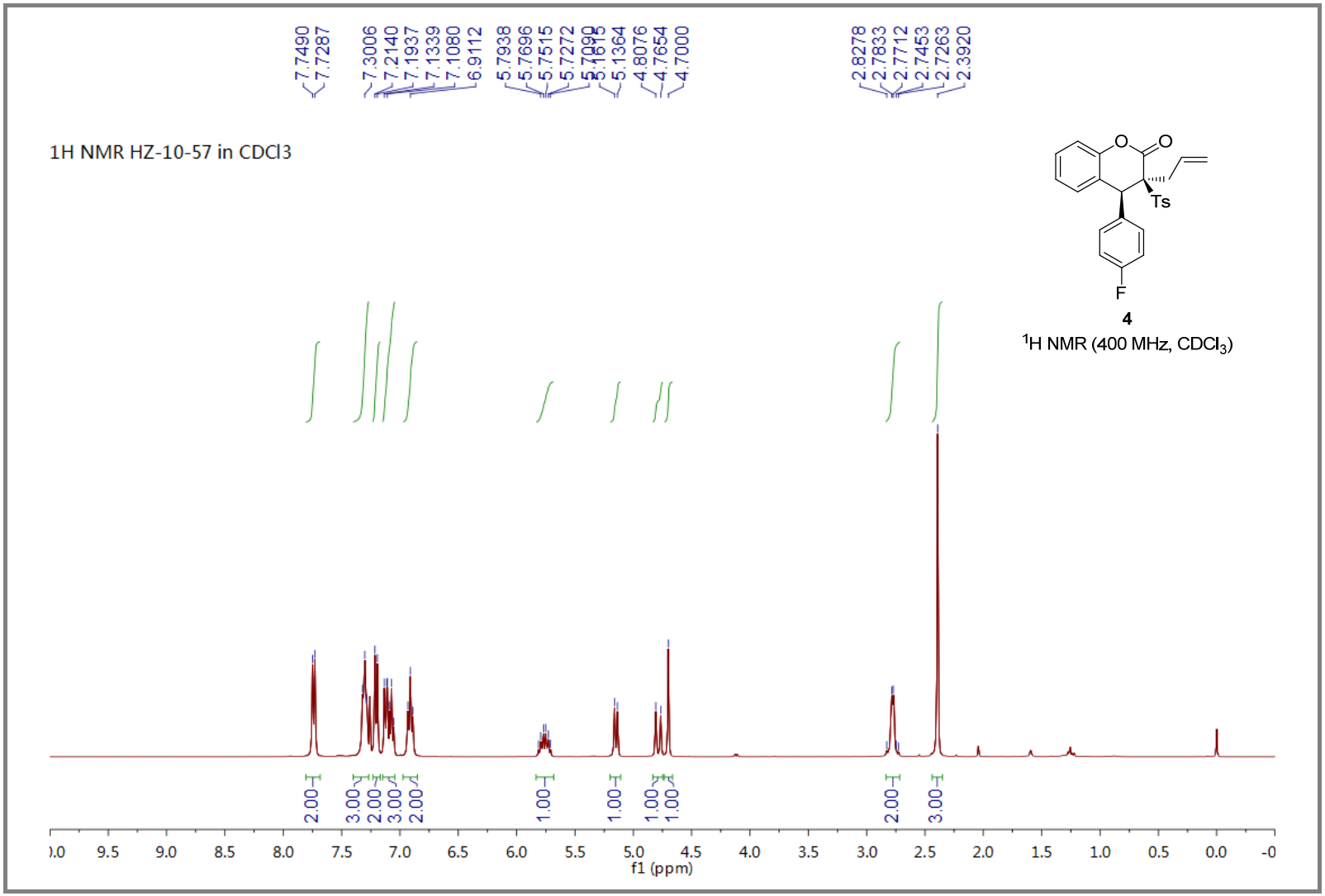

160.25
147.10
145.79
139.49
134.88
133.92
131.61
129.60
129.50
128.97
128.06
127.08
127.02
125.90
120.13
72.46
42.78
21.67
20.70
15.43
13C NMR HZ-10-51B in CDCl3
2s d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

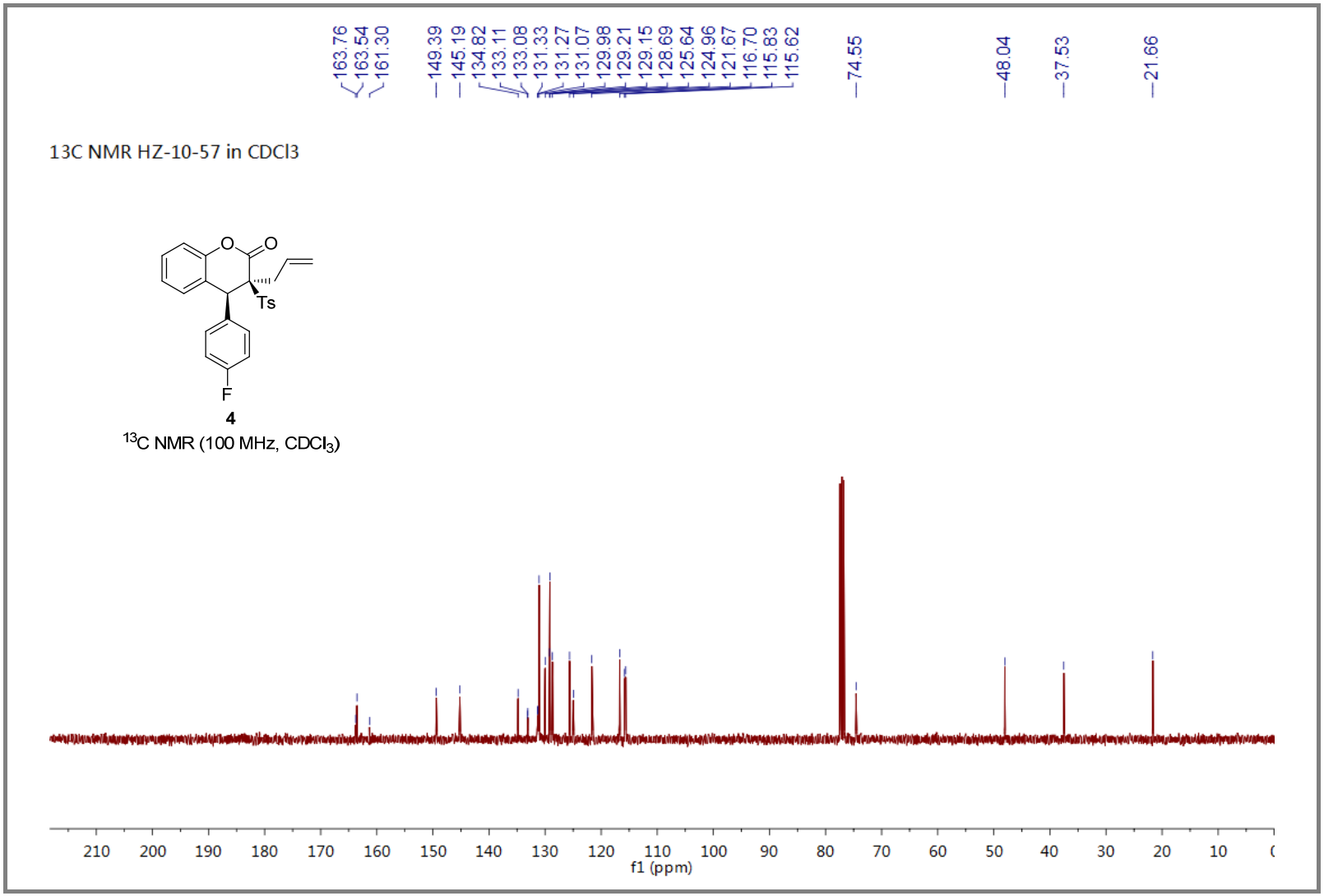

7.6282
7.6077
7.2921
7.2778
7.2743
7.2546
7.2409
7.2212
7.1754
7.1569
7.1383
6.9008
6.8807
6.8701
6.8095
6.8065
5.1719
4.4578
2.3972
1H NMR HZ-11-50D in CDCl3
2t d.r. > 20:1
1H NMR (400 MHz, CDCl3)
2.00
5.62
1.00
2.00
1.00
1.00
1.00
3.00
f1 (ppm)

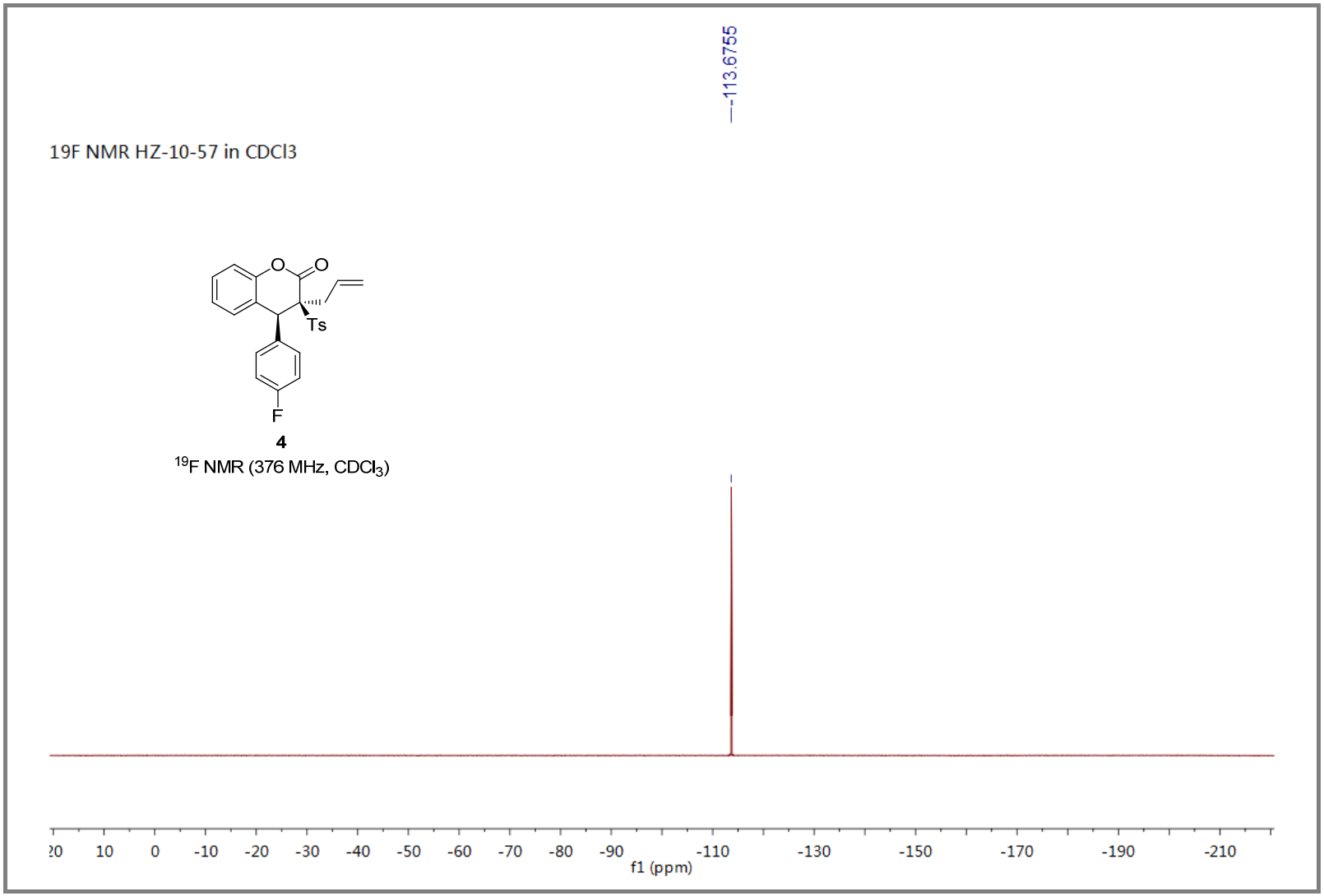

160.06
150.46
145.99
139.64
133.99
129.87
129.41
129.03
128.89
127.92
125.85
125.60
122.44
121.36
116.99
71.18
38.07
21.72
13C NMR HZ-11-50D in CDCl3
2t d.r. > 20:1
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

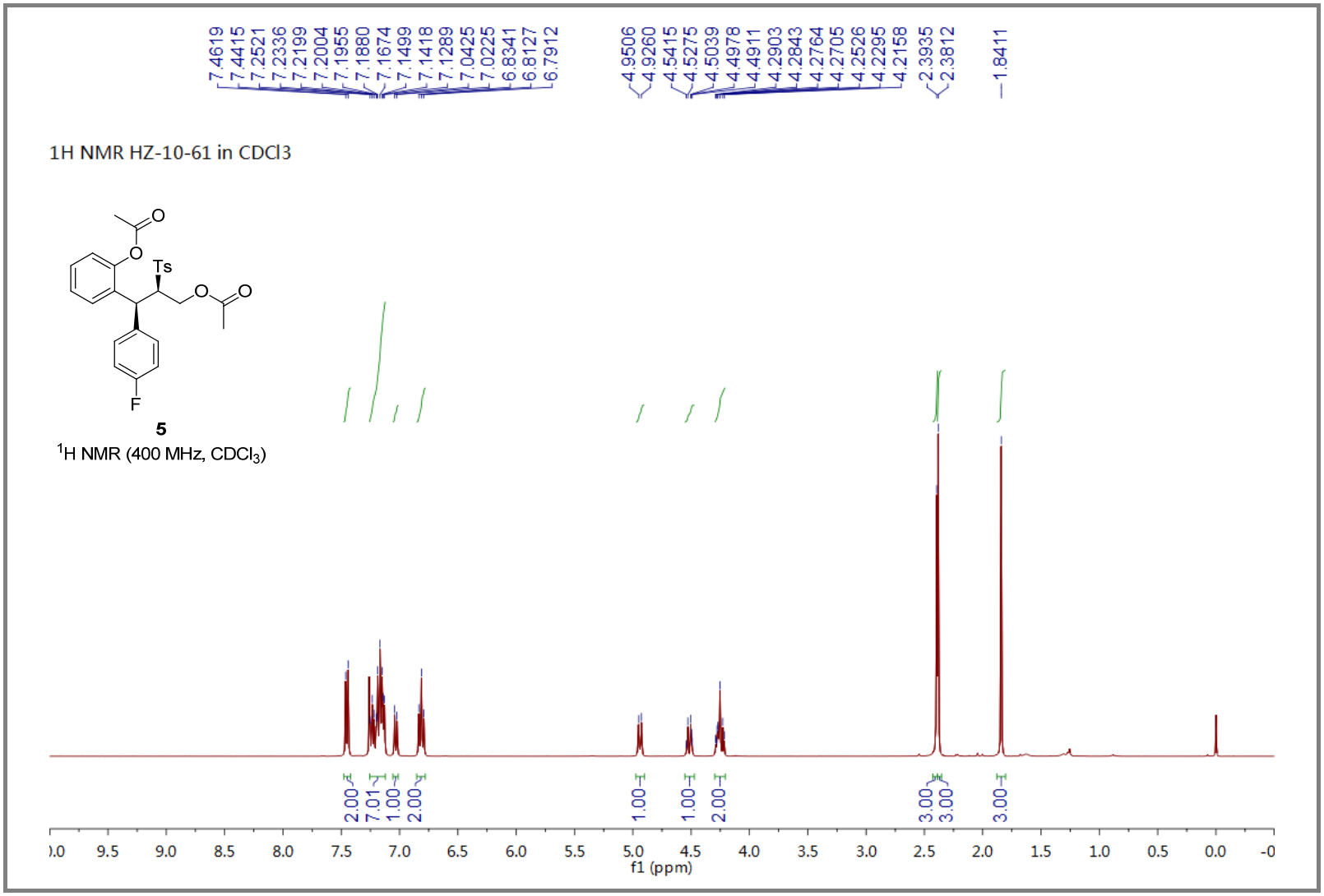

1H NMR HZ-11-65 in CDCl3
7.6998
7.6790
7.2692
7.2615
7.2387
7.1692
7.1663
6.8821
6.8793
5.5947
5.5764
5.5697
5.5604
5.5535
5.5499
5.5382
5.5354
5.5275
5.1797
5.1544
3.6587
3.6410
3.6234
3.0140
2.9998
2.8136
2.7917
2.7777
2.7557
1.7552
2u
1H NMR (400 MHz, CDCl3)
d.r. > 20:1
2.00
2.55
2.00
1.00
1.00
1.00
2.00
1.00
1.00
1.00
3.00
3.00
f1 (ppm)

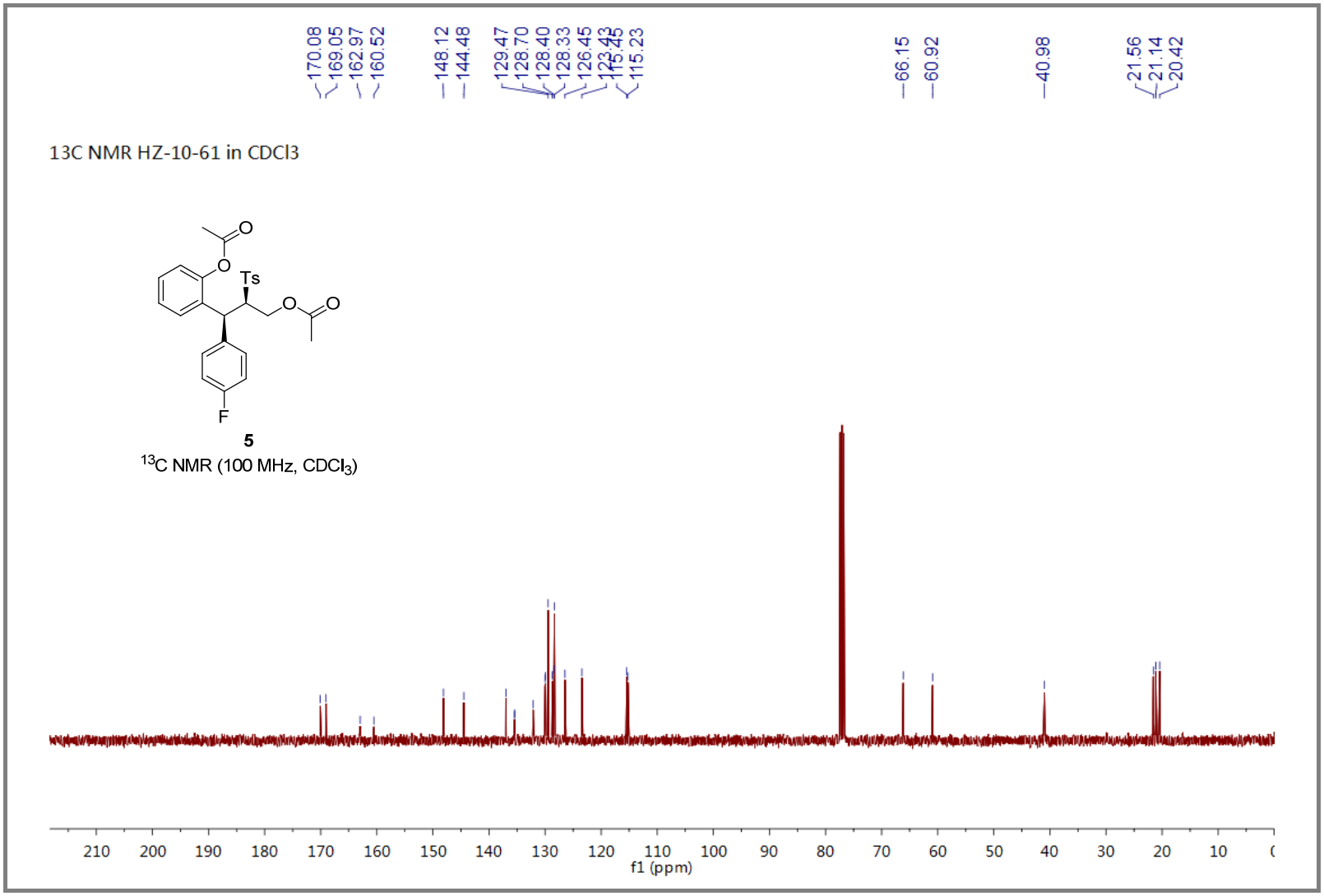

163.62
150.08
145.60
133.96
130.23
130.09
129.48
128.41
126.06
125.51
125.32
121.58
115.83
73.19
35.31
34.57
21.72
13.43
13C NMR HZ-11-65 in CDCl3
2u
13C NMR (100 MHz, CDCl3)
d.r. > 20:1
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

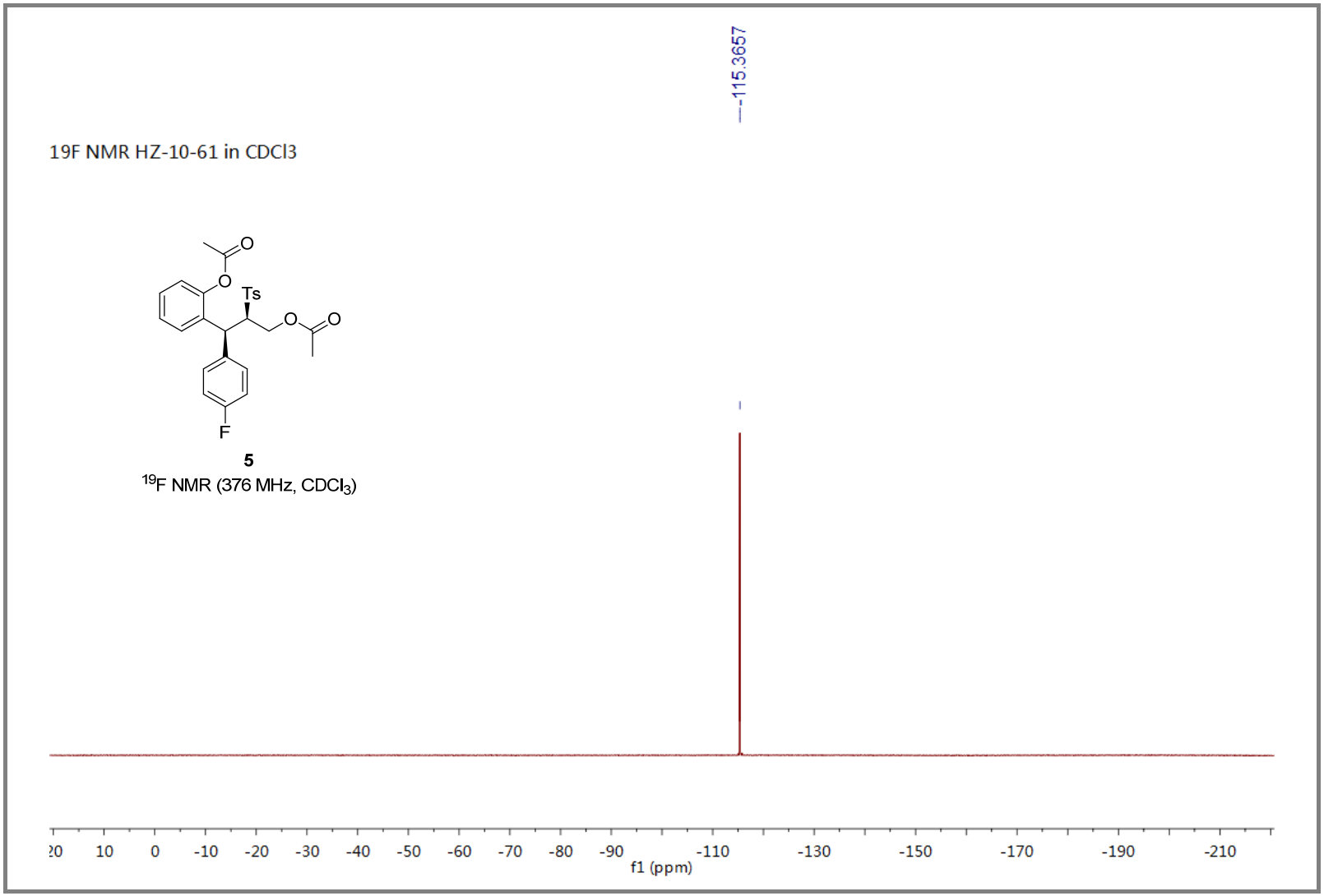

7.7490
7.7287
7.3006
7.2140
7.1937
7.1339
7.1080
6.9112
5.7938
5.7696
5.7515
5.7272
5.1364
4.8076
4.7654
4.7000
2.8278
2.7833
2.7712
2.7453
2.7263
2.3920
1H NMR HZ-10-57 in CDCl3
O
O
Ts
F
4
1H NMR (400 MHz, CDCl3)
2.00
3.00
2.00
3.00
2.00
1.00
1.00
1.00
1.00
2.00
3.00
f1 (ppm)


163.76
163.54
161.30
149.39
145.19
134.82
133.11
133.08
131.33
131.27
131.07
129.98
129.21
129.15
128.69
125.64
124.96
121.67
116.70
115.83
115.62
74.55
48.04
37.53
21.66
13C NMR HZ-10-57 in CDCl3
O
O
Ts
F
4
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)


19F NMR HZ-10-57 in CDCl3
-113.6755
O
O
Ts
F
4
19F NMR (376 MHz, CDCl3)
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-110
-130
-150
-170
-190
-210
f1 (ppm)


7.4619
7.4415
7.2521
7.2336
7.2199
7.2004
7.1955
7.1880
7.1674
7.1499
7.1418
7.1289
7.0425
7.0225
6.8341
6.8127
6.7912
4.9506
4.9260
4.5415
4.5275
4.5039
4.4978
4.4911
4.2903
4.2843
4.2764
4.2705
4.2526
4.2295
4.2158
2.3935
2.3812
1.8411
1H NMR HZ-10-61 in CDCl3
O
O
Ts
O
O
F
5
1H NMR (400 MHz, CDCl3)
2.00
7.01
1.00
2.00
1.00
1.00
2.00
3.00
3.00
3.00
f1 (ppm)


170.08
169.05
162.97
160.52
148.12
144.48
129.47
128.70
128.40
128.33
126.45
115.45
115.23
66.15
60.92
40.98
21.56
21.14
20.42
13C NMR HZ-10-61 in CDCl3
O
O
Ts
O
O
F
5
13C NMR (100 MHz, CDCl3)
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

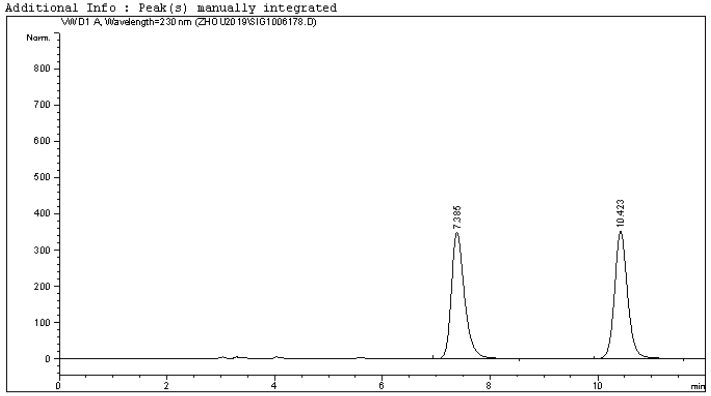


5

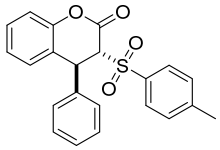
^{19}F NMR (376 MHz, $CDCl_3$)

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006178.D
Sample Name: HZ-10-15B+-

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 12/25/20 20:03:41
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/25/20 19:56:53
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/25/20 20:45:15
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



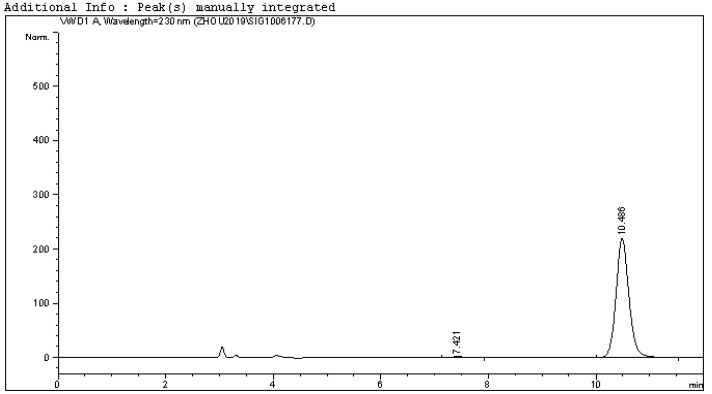

```
    ======================================================================
                              Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.385 BB    0.2555 5882.63135  349.26910  49.9647
       2  10.423 BB    0.2544 5890.93848  351.73358  50.0353
```



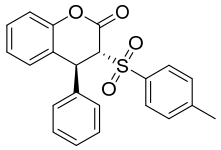
(+/-)-**2a**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006177.D
Sample Name: HZ-10-15A

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 12/25/20 19:42:47
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/25/20 19:17:08
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/25/20 20:47:41
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



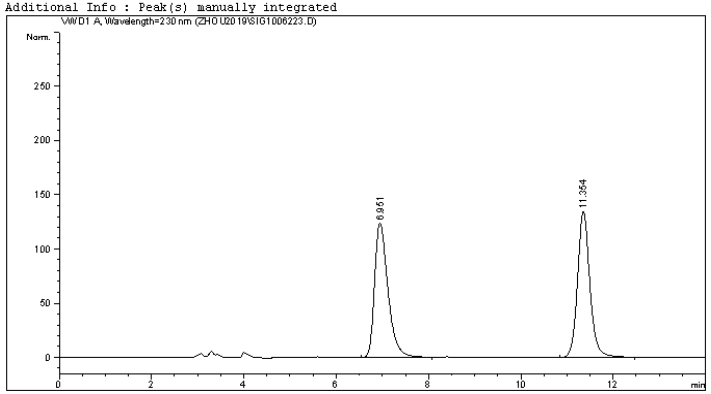

```
    ======================================================================
                              Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.421 BB    0.2578   32.00377    1.86918   0.8641
       2  10.486 BB    0.2538 3671.84814  219.95047  99.1359
```



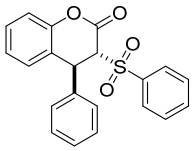
(+)-**2a**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006223.D
Sample Name: HZ-10-18A+-

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 12/29/20 22:04:14
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/29/20 22:03:16
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/29/20 22:23:04
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



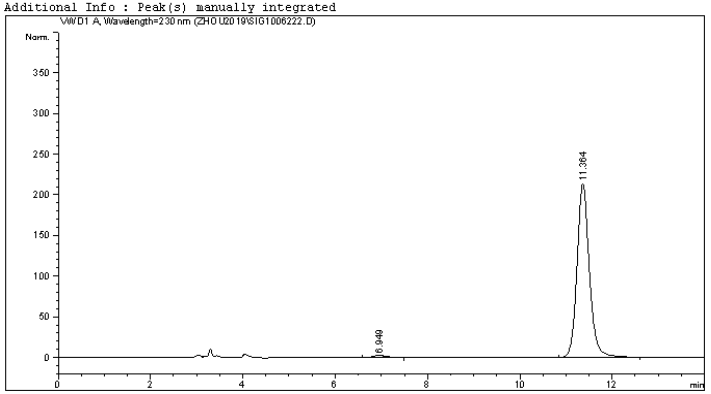

```
    ======================================================================
                              Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|------|----|-------|---------|---------|-------|
       1   6.951 BB    0.3062 2492.81250  124.18739  49.9379
       2  11.354 BB    0.2813 2499.00806  134.76805  50.0621
```



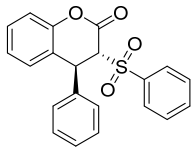
(+/-)-**2b**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006222.D
Sample Name: HZ-10-17A

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 12/29/20 21:44:49
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/29/20 21:42:31
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/29/20 22:06:03
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    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: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|------|----|-------|---------|---------|-------|
       1   6.949 BB    0.3208   47.95851    2.30435   1.1954
       2  11.364 BB    0.2805 3963.91797  213.60262  98.8046
```

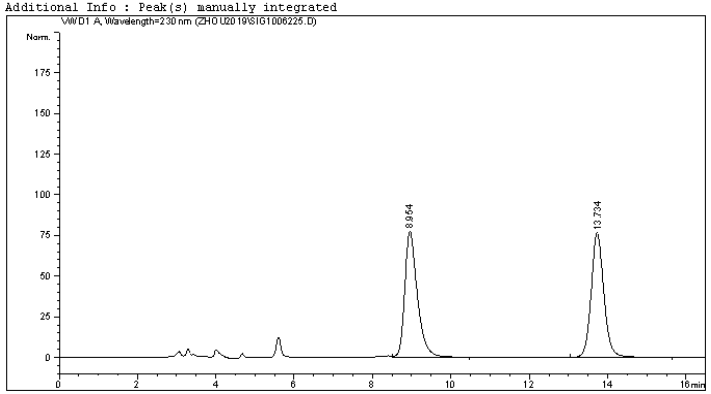


(+)-**2b**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006225.D
Sample Name: HZ-10-18B+-

Acq. Operator :
Acq. Instrument : 仪器 1 Location : Vial 1
Injection Date : 12/29/20 22:41:28
Inj Volume : 5.000 µl
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 12/29/20 22:40:12
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 12/29/20 22:58:57
(modified after loading)
Sample Info : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated

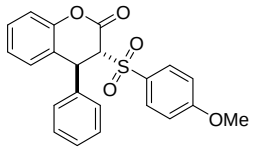


Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.954	VB	0.3343	1729.60388	77.51499	50.1036
2	13.734	BB	0.3400	1722.45288	76.69793	49.8964

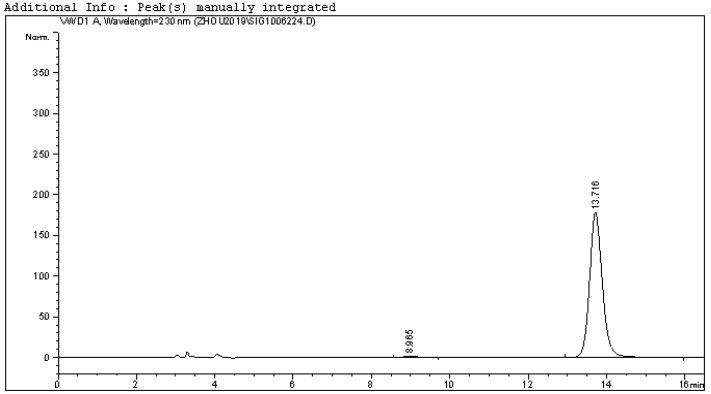


(+/-)-**2c**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006224.D
Sample Name: HZ-10-17B

Acq. Operator :
Acq. Instrument : 仪器 1 Location : Vial 1
Injection Date : 12/29/20 22:22:37
Inj Volume : 5.000 µl
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 12/29/20 22:20:48
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 12/29/20 22:44:27
(modified after loading)
Sample Info : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated

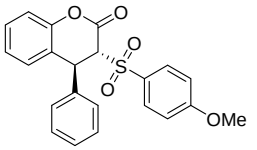


Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

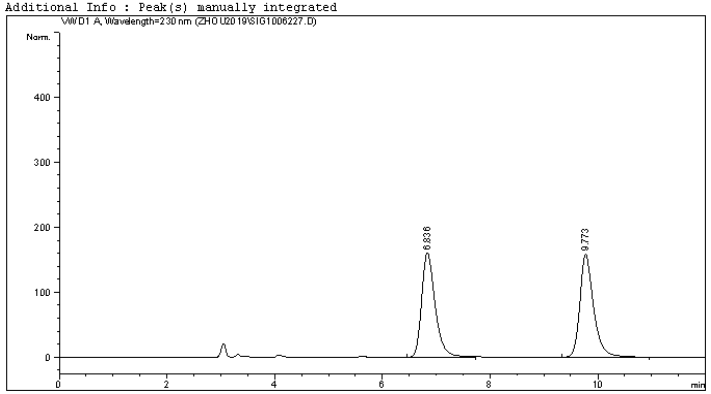
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.965	BB	0.3329	34.26607	1.55608	0.8440
2	13.716	BB	0.3411	4025.63892	178.51363	99.1560



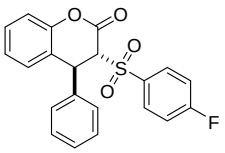
(+)-**2c**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006227.D
Sample Name: HZ-10-18C+-

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                        Location : Vial 1
    Injection Date  : 12/29/20 23:16:15
                                                  Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/29/20 23:15:21
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/29/20 23:17:59
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



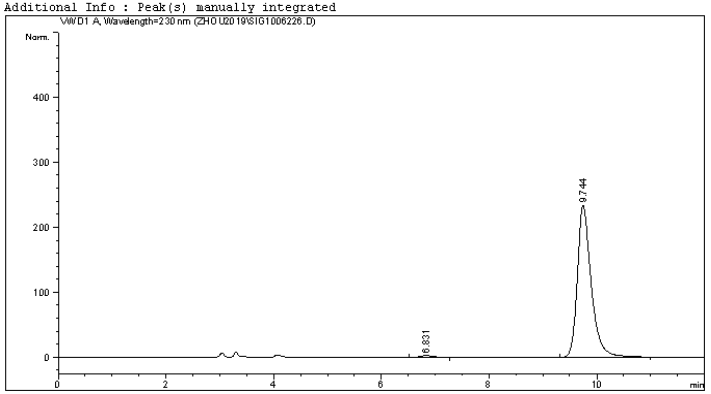

```
    ======================================================================
                               Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|---------|---------|--------|
       1   6.836 BB    0.2653 2793.39331  160.29990  49.8917
       2   9.773 BB    0.2635 2805.52563  158.52328  50.1083
```



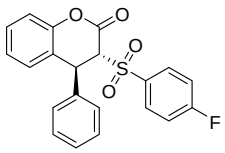
(+/-)-**2d**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006226.D
Sample Name: HZ-10-17C

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                        Location : Vial 1
    Injection Date  : 12/29/20 23:00:53
                                                  Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/29/20 22:58:13
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/29/20 23:17:59
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



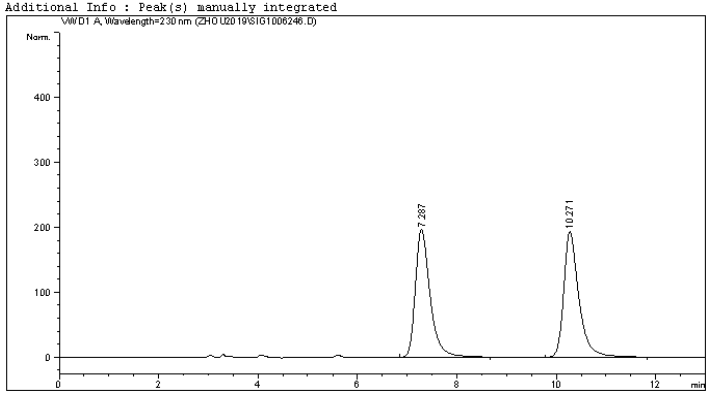

```
    ======================================================================
                               Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|---------|---------|--------|
       1   6.831 BB    0.2616   40.42218    2.37487   0.9646
       2   9.744 BB    0.2643 4150.32227  233.60210  99.0354
```



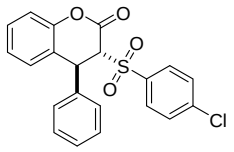
(+)-**2c**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006246.D
Sample Name: HZ-10-21B+-

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 12/30/20 20:20:06
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/30/20 20:16:27
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/30/20 20:37:24
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



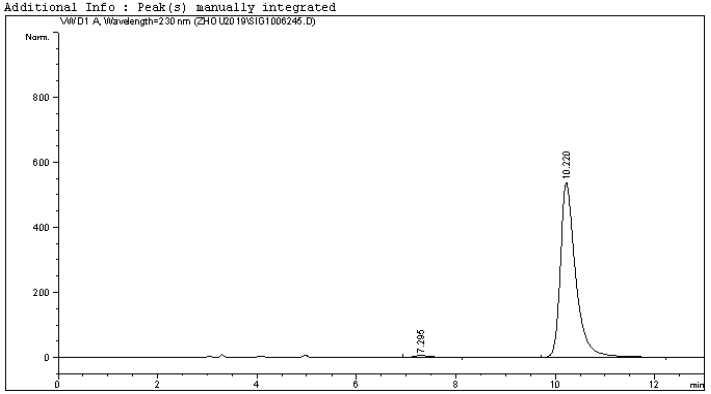

```
    ======================================================================
                               Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.287 BB    0.3106 4033.83936  196.38701  49.7976
       2  10.271 BB    0.3128 4066.63696  193.04802  50.2024
```



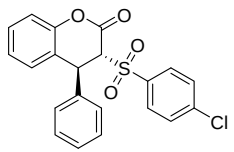
(+/-)-**2e**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006245.D
Sample Name: HZ-10-20B

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 12/30/20 20:00:59
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/30/20 19:59:11
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/30/20 20:26:50
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



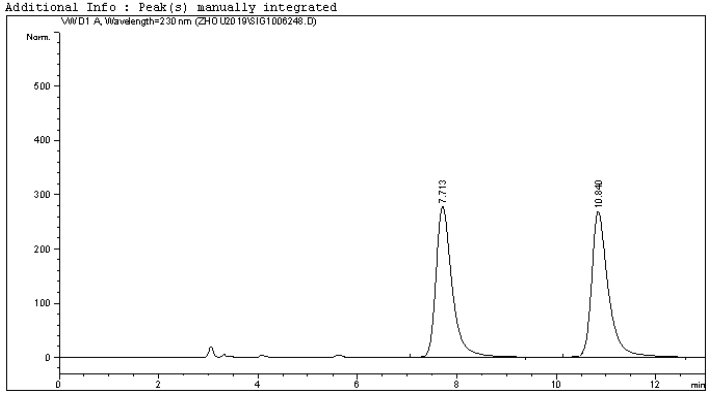

```
    ======================================================================
                               Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.295 BB    0.3394  123.07564    5.32936   1.0742
       2  10.220 BB    0.3114 1.13343e4   536.60602  98.9258
```



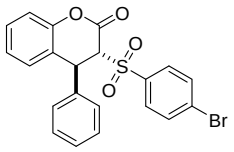
(+)-**2e**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006248.D
Sample Name: HZ-10-21C+-

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 12/30/20 20:58:43
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/30/20 20:57:21
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/30/20 21:13:55
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



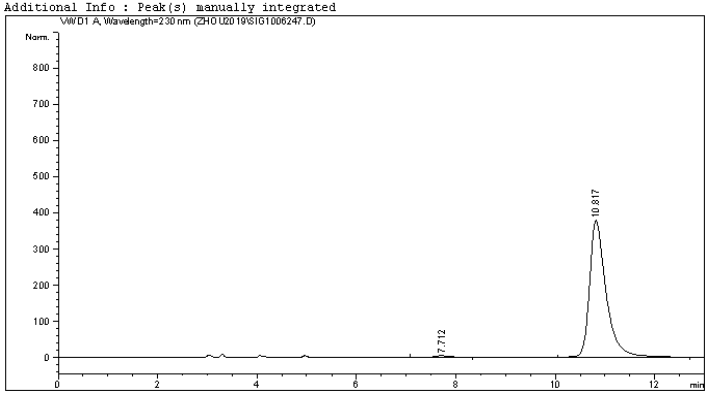

```
    ======================================================================
                              Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.713 BB    0.3360 6209.98340  278.64737  50.0357
       2  10.840 BB    0.3414 6201.12549  268.58310  49.9643
```



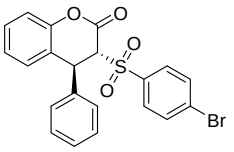
(+/-)-**2f**

Data File C:\CHEM32\1\DATA\ZHOU2019\SIG1006247.D
Sample Name: HZ-10-20C

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 12/30/20 20:40:09
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/30/20 20:36:51
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 12/30/20 21:01:32
                      (modified after loading)
    Sample Info     : IA, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



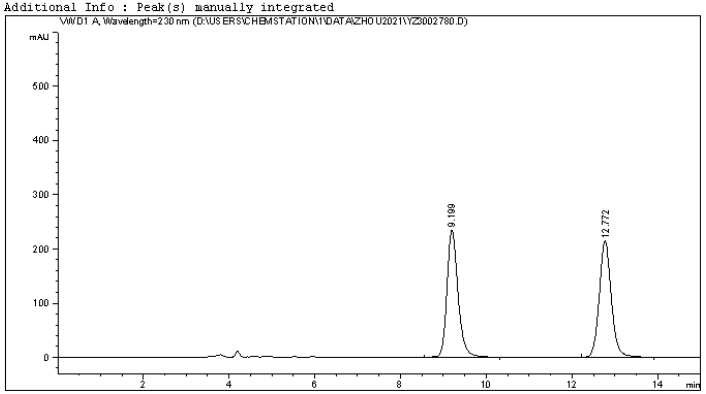

```
    ======================================================================
                              Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.712 BB    0.3526   95.74295    4.05339   1.0826
       2  10.817 BB    0.3413 8747.65625  379.03619  98.9174
```



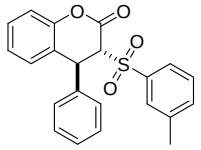
(+)-**2f**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3002780.D
Sample Name: HZ-11-49C+-

```
Acq. Operator   : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : 1260II                        Location :     -
Injection Date  : 7/10/2021 4:05:38 PM             Inj :    1
                                                Inj Volume : No inj
Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 7/10/2021 2:44:54 PM by SYSTEM
                  (modified after loading)
Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 7/10/2021 4:26:06 PM by SYSTEM
                  (modified after loading)
Sample Info     : IA,  n-Hexane/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated
```



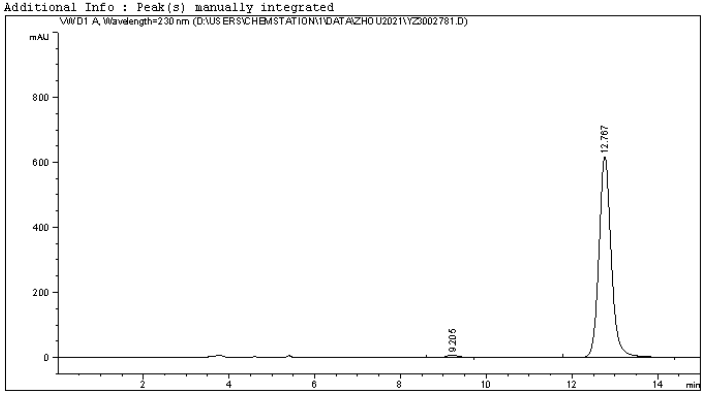

```
                          Area Percent Report

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|------|----|-------|----------|----------|--------|
   1   9.199 VB    0.2713 4202.14648  235.38873  50.1100
   2  12.772 BB    0.2974 4183.70264  214.61815  49.8900
```



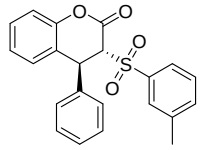
(+/-)-**2g**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3002781.D
Sample Name: HZ-11-49C

```
Acq. Operator   : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : 1260II                        Location :     -
Injection Date  : 7/10/2021 4:25:38 PM             Inj :    1
                                                Inj Volume : No inj
Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 7/10/2021 2:44:54 PM by SYSTEM
                  (modified after loading)
Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 7/10/2021 4:44:46 PM by SYSTEM
                  (modified after loading)
Sample Info     : IA,  n-Hexane/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated
```



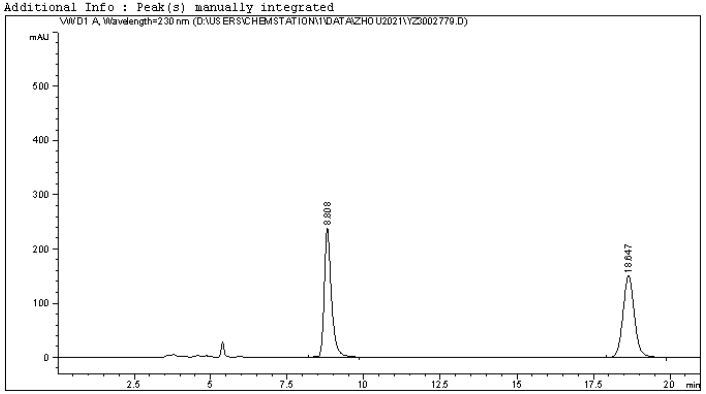

```
                          Area Percent Report

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|------|----|-------|----------|----------|--------|
   1   9.205 BB    0.2738  124.24998    6.84344   1.0057
   2  12.767 VB R  0.3013 1.22303e4   616.87054  98.9943
```



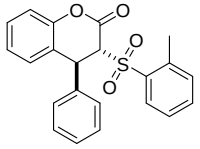
(+)-**2g**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3002779.D
Sample Name: HZ-11-49B+-

```
    ====================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 7/10/2021 3:41:22 PM             Inj :    1
                                                   Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 7/10/2021 2:44:54 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 7/10/2021 4:04:02 PM by SYSTEM
                      (modified after loading)
    Sample Info     : IA,  n-Hexane/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



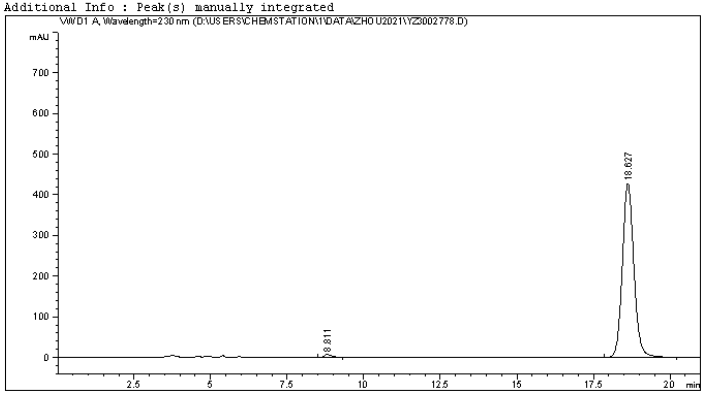

```
    ====================================================================
                            Area Percent Report
    ====================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|------|----|-------|----------|----------|--------|
       1   8.808 VB R  0.2371 3811.44092  237.67677  49.7203
       2  18.647 BB    0.3927 3854.32495  150.54021  50.2797
```



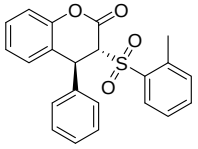
(+/-)-**2h**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3002778.D
Sample Name: HZ-11-49B

```
    ====================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 7/10/2021 3:17:09 PM             Inj :    1
                                                   Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 7/10/2021 2:44:54 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 7/10/2021 3:44:38 PM by SYSTEM
                      (modified after loading)
    Sample Info     : IA,  n-Hexane/i-PrOH = 80/20, 0.8 mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



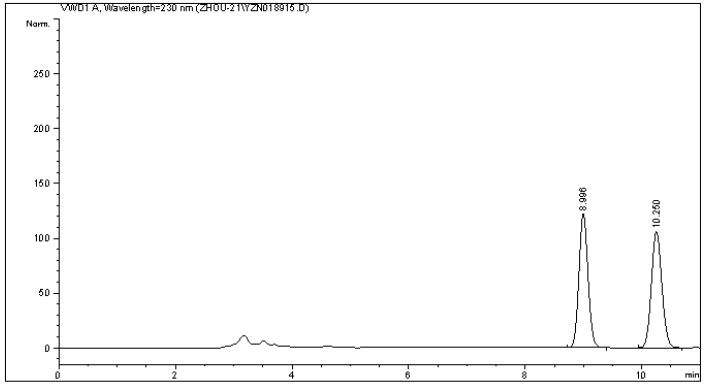

```
    ====================================================================
                            Area Percent Report
    ====================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|------|----|-------|----------|----------|--------|
       1   8.811 VB    0.2342  110.96770    7.02949   0.9892
       2  18.627 BB    0.3992 1.11067e4   427.37448  99.0108
```



(+)-**2h**

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN018915.D
Sample Name: HZ-11-56+-

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 7/15/2021 3:34:41 AM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 7/15/2021 3:16:11 AM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 7/15/2021 5:05:12 AM
(modified after loading)
Sample Info : AD-H, Hexane/i-PrOH = 80/20, 1.0 mL/min, 30 oC, 230 nm



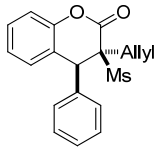
Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.996	BB	0.1669	1323.21594	122.38219	50.0224
2	10.250	BB	0.1936	1322.02893	105.98039	49.9776

Totals : 2645.24487 228.36259



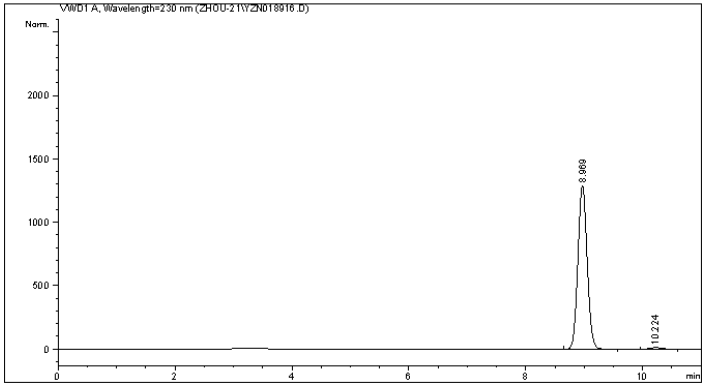
(+/-)-**2i**

*** End of Report ***

Instrument 1 7/15/2021 5:05:14 AM Page 1 of 1

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN018916.D
Sample Name: HZ-11-56

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 7/15/2021 4:01:58 AM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 7/15/2021 4:01:01 AM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 7/15/2021 5:04:47 AM
(modified after loading)
Sample Info : AD-H, Hexane/i-PrOH = 80/20, 1.0 mL/min, 30 oC, 230 nm



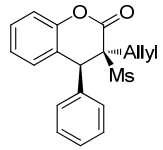
Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	8.969	BB	0.1705	1.41857e4	1290.67273	98.9766
2	10.224	BB	0.1945	146.67892	11.80422	1.0234

Totals : 1.43324e4 1302.47695



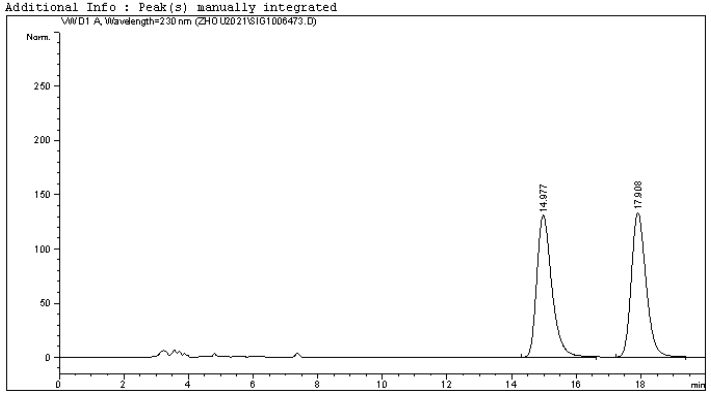
(+)-**2i**

*** End of Report ***

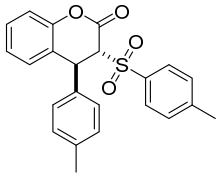
Instrument 1 7/15/2021 5:04:53 AM Page 1 of 1

Data File C:\CHEM32\1\DATA\ZHOU2021\SIG1006473.D
Sample Name: HZ-10-40A+-

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 1/20/21 17:11:39
                                                  Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 1/20/21 17:09:32
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 1/20/21 17:33:49
                      (modified after loading)
    Sample Info     : ID, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



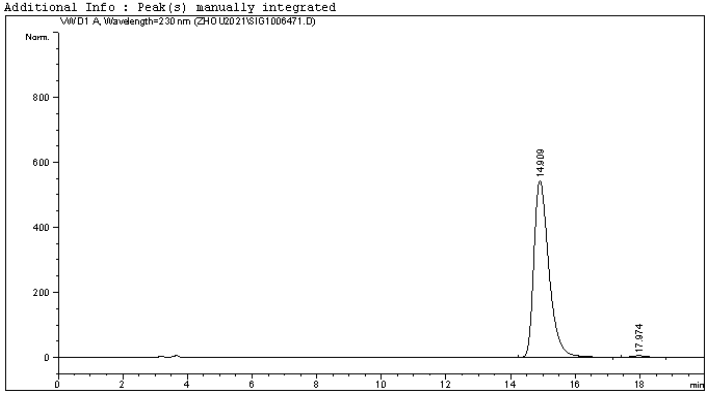

```
    ======================================================================
                              Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|------|----|-------|---------|---------|--------|
       1  14.977 BB    0.4917 4211.36475  130.79126  50.1334
       2  17.908 BB    0.4853 4188.95752  133.05103  49.8666
```



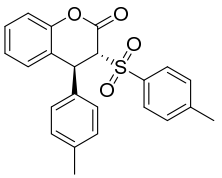
(+/-)-**2j**

Data File C:\CHEM32\1\DATA\ZHOU2021\SIG1006471.D
Sample Name: HZ-10-39A

```
    ======================================================================
    Acq. Operator   :
    Acq. Instrument : 仪器 1                         Location : Vial 1
    Injection Date  : 1/20/21 16:23:56
                                                  Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 1/20/21 16:22:56
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
    Last changed    : 1/20/21 17:14:13
                      (modified after loading)
    Sample Info     : ID, n-hexane/i-PrOH = 70/30, 1.0 mL/min, 30 oC, 230 nm


    Additional Info : Peak(s) manually integrated
```



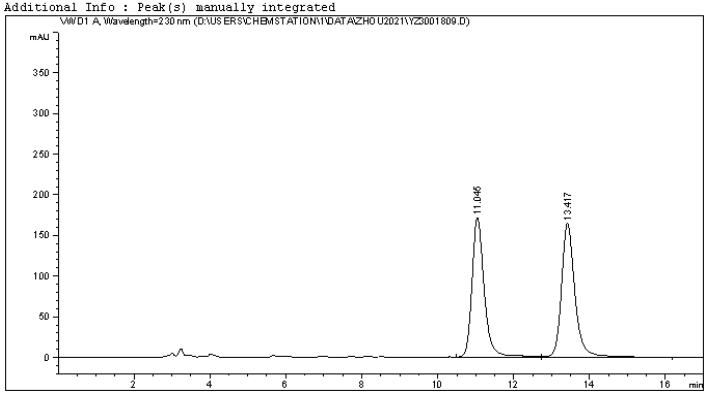

```
    ======================================================================
                              Area Percent Report
    ======================================================================

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


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|------|----|-------|---------|---------|--------|
       1  14.909 BB    0.4912 1.74835e4   543.64801  99.1906
       2  17.974 BB    0.4807  142.66333    4.60158   0.8094
```



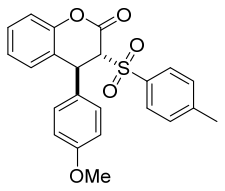
(+)-**2j**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001809.D
Sample Name: HZ-10-40B+-

```
    ====================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 1/20/2021 10:29:25 AM             Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 1/20/2021 9:30:44 AM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 1/20/2021 11:38:37 AM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 70/30, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



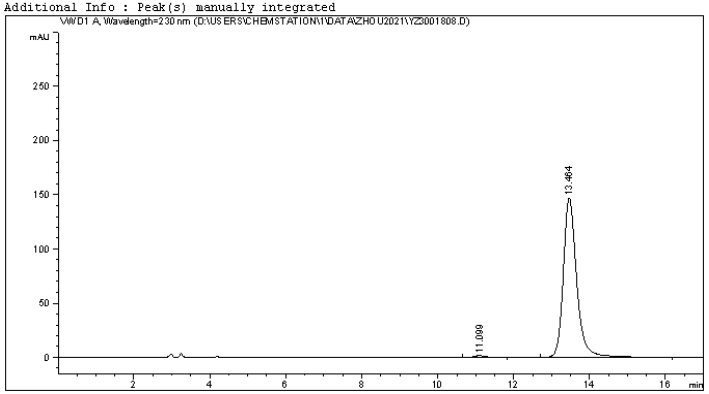

```
    ====================================================================
                            Area Percent Report
    ====================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|---------|--------|
       1  11.045 VV    0.3379 3859.35303  171.94897  48.8985
       2  13.417 VB    0.3696 4033.22485  164.74094  51.1015
```



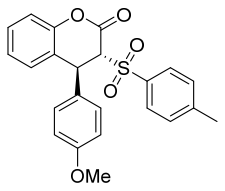
(+/-)-**2k**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001808.D
Sample Name: HZ-10-39B

```
    ====================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 1/20/2021 10:06:47 AM             Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 1/20/2021 9:30:44 AM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 1/20/2021 11:30:22 AM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 70/30, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



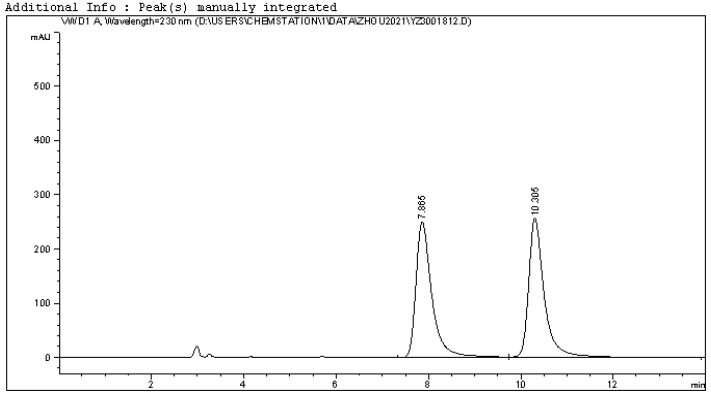

```
    ====================================================================
                            Area Percent Report
    ====================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|---------|--------|
       1  11.099 VB    0.3320   33.14118    1.52216   0.9149
       2  13.464 VB    0.3688 3589.38306  147.04446  99.0851
```



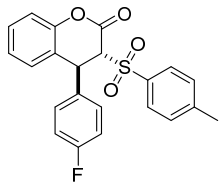
(+)-**2k**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001812.D
Sample Name: HZ-10-40C+-

```
    ======================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 1/20/2021 2:46:14 PM                Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 1/20/2021 2:31:05 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 1/20/2021 4:24:19 PM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 70/30, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



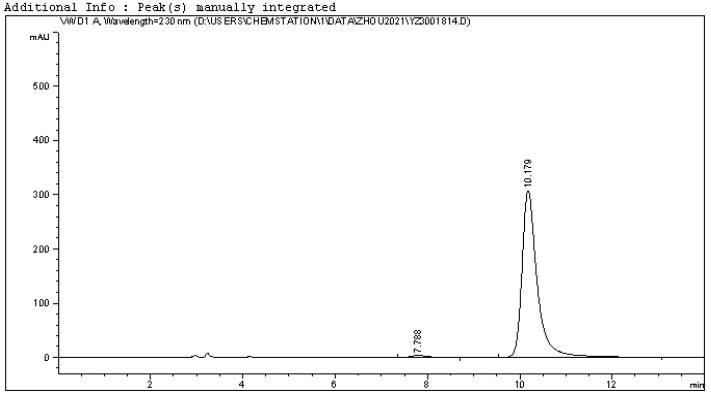

```
    ======================================================================
                               Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.865 BB    0.3547 5918.61426  250.46056  49.9198
       2  10.305 BB    0.3443 5937.62744  256.29160  50.0802
```



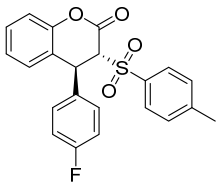
(+/-)-**2l**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001814.D
Sample Name: HZ-10-39C

```
    ======================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 1/20/2021 3:35:36 PM                Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 1/20/2021 2:31:05 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 1/20/2021 4:24:19 PM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 70/30, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



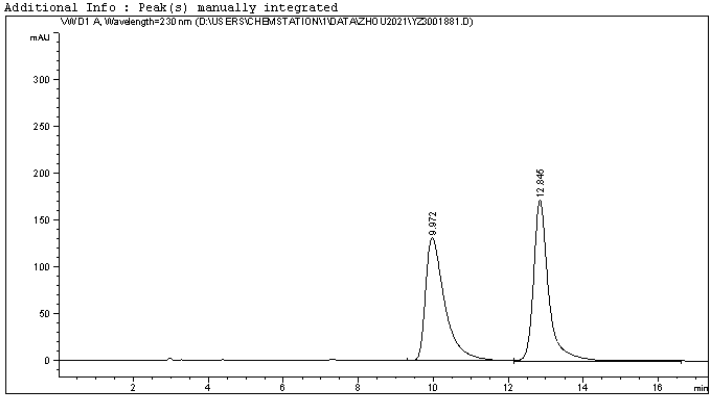

```
    ======================================================================
                               Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.788 BB    0.3403   78.16211    3.45025   1.1065
       2  10.179 BB    0.3369 6985.46826  307.70099  98.8935
```



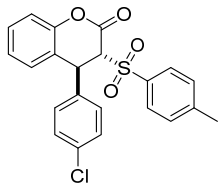
(+)-**2l**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001881.D
Sample Name: HZ-10-49A+-

```
    ======================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 3/6/2021 9:17:11 AM              Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/6/2021 8:34:16 AM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/6/2021 9:37:31 AM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 75/25, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



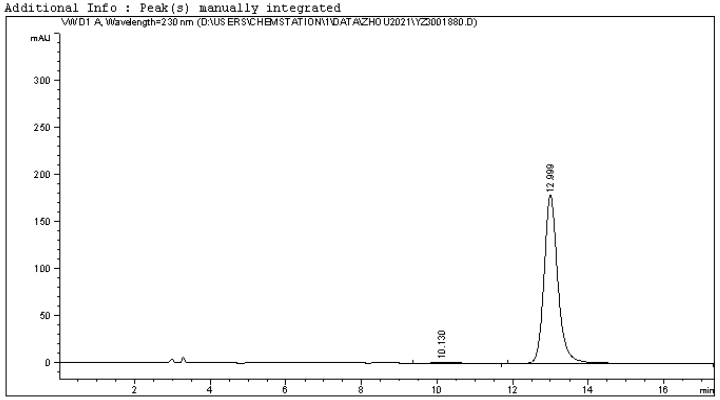

```
    ======================================================================
                               Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]       [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   9.972 BV    0.5349 4712.80469  131.24069  49.7285
       2  12.845 VB    0.4117 4764.25977  171.70033  50.2715
```



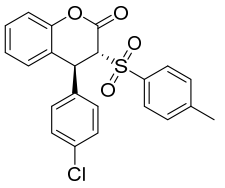
(+/-)-**2m**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001880.D
Sample Name: HZ-10-48A

```
    ======================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 3/6/2021 8:58:21 AM              Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/6/2021 8:34:16 AM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/6/2021 9:22:28 AM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 75/25, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



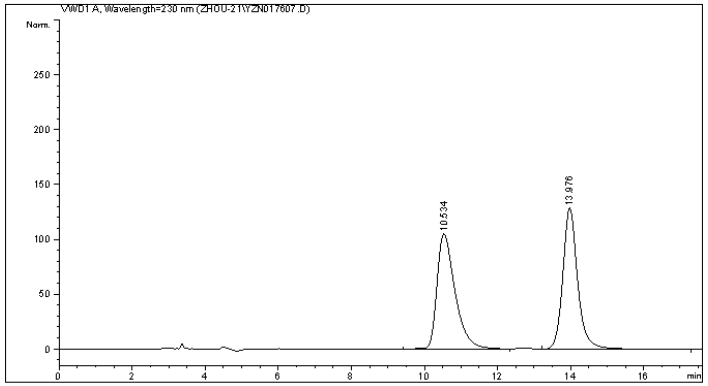

```
    ======================================================================
                               Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]       [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1  10.130 BB    0.5048   47.87781    1.43659   1.0438
       2  12.999 BBA   0.3823 4539.12305  178.74617  98.9562
```



(+)-**2m**

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN017607.D
Sample Name: HZ-10-46A+-

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 3/3/2021 8:29:25 AM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 8:22:25 AM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 8:48:57 AM
(modified after loading)
Sample Info : IA, Hexane/i-PrOH = 75/25, 1.0 mL/min, 30 oC, 230 nm



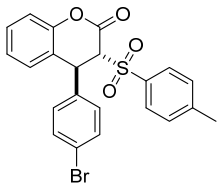
Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU*s	Height [mAU]	Area %
1	10.534	BB	0.5203	3629.71680	105.24075	50.0134
2	13.976	BB	0.4222	3627.77002	128.62926	49.9866

Totals : 7257.48682 233.87000



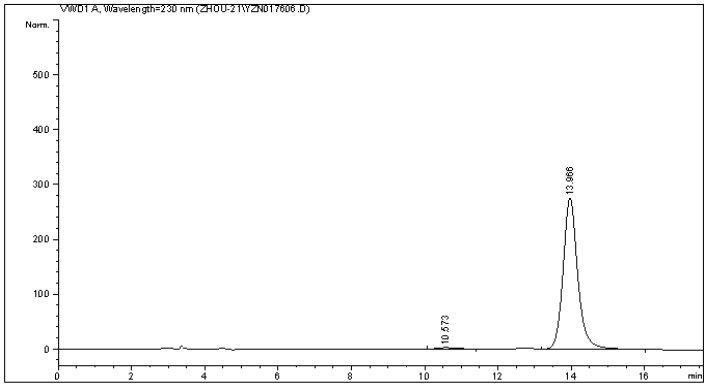
(+/-)-**2n**

*** End of Report ***

Instrument 1 3/3/2021 8:49:04 AM Page 1 of 1

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN017606.D
Sample Name: HZ-10-45A

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 3/3/2021 8:03:11 AM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 7:09:43 AM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 8:50:30 AM
(modified after loading)
Sample Info : IA, Hexane/i-PrOH = 75/25, 1.0 mL/min, 30 oC, 230 nm



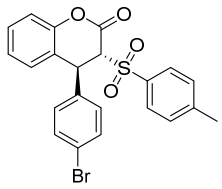
Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU*s	Height [mAU]	Area %
1	10.573	BB	0.4862	79.73492	2.49610	1.0263
2	13.966	VB	0.4187	7689.28369	275.56104	98.9737

Totals : 7769.01862 278.05713



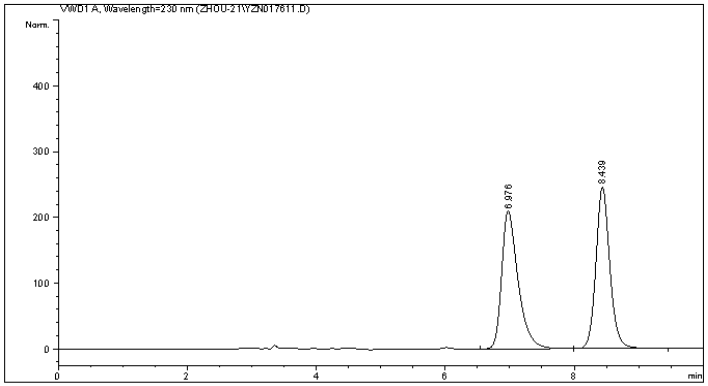
(+)-**2n**

*** End of Report ***

Instrument 1 3/3/2021 8:50:39 AM Page 1 of 1

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN017611.D
Sample Name: HZ-10-46C+-

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 3/3/2021 9:13:49 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 8:16:42 PM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 9:58:39 PM
(modified after loading)
Sample Info : IA, Hexane/i-PrOH = 75/25, 1.0 mL/min, 30 oC, 230 nm

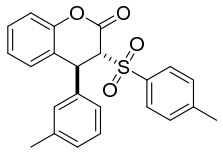


Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.976	BB	0.2656	3693.31323	209.25581	50.0762
2	8.439	BB	0.2274	3682.07446	245.50769	49.9238
Totals :				7375.38770	454.76350	



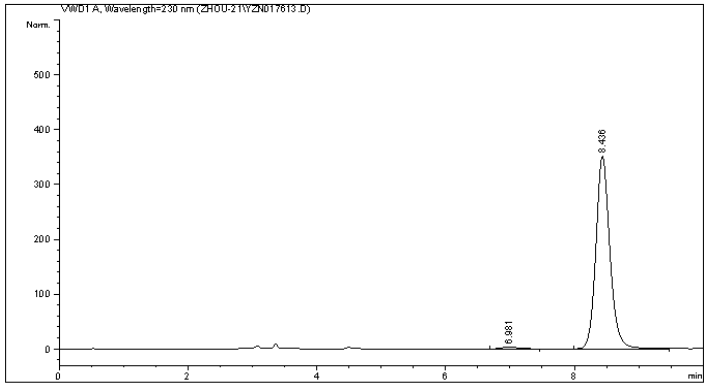
(+/-)-**2o**

*** End of Report ***

Instrument 1 3/3/2021 9:58:43 PM Page 1 of 1

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN017613.D
Sample Name: HZ-10-45C

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 3/3/2021 9:41:12 PM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 9:39:40 PM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 9:59:28 PM
(modified after loading)
Sample Info : IA, Hexane/i-PrOH = 75/25, 1.0 mL/min, 30 oC, 230 nm

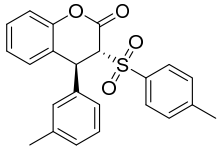


Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	6.981	BB	0.2631	57.65787	3.26101	1.0773
2	8.436	BB	0.2281	5294.17480	351.50778	98.9227
Totals :				5351.83268	354.76879	



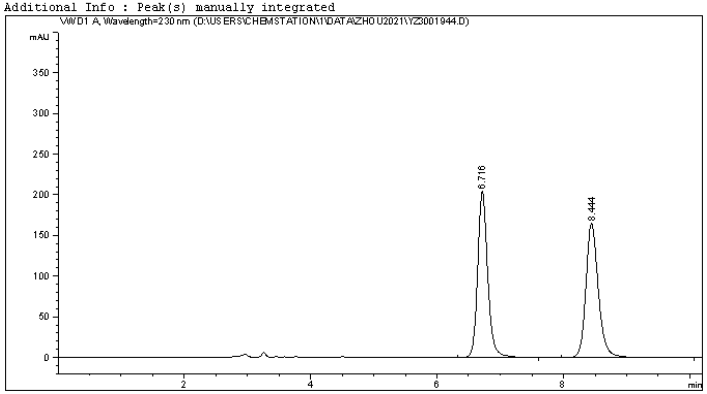
(+)-**2o**

*** End of Report ***

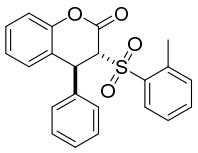
Instrument 1 3/3/2021 9:59:31 PM Page 1 of 1

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001944.D
Sample Name: HZ-10-49B+-

```
======================================================================
Acq. Operator   : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : 1260II                    Location :     -
Injection Date  : 3/17/2021 9:07:53 PM           Inj :    1
                                           Inj Volume : No inj
Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 3/17/2021 8:34:34 PM by SYSTEM
                  (modified after loading)
Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 3/17/2021 9:48:47 PM by SYSTEM
                  (modified after loading)
Sample Info     : IA, n-Hexane/i-PrOH = 75/25, 1.0  mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated
```



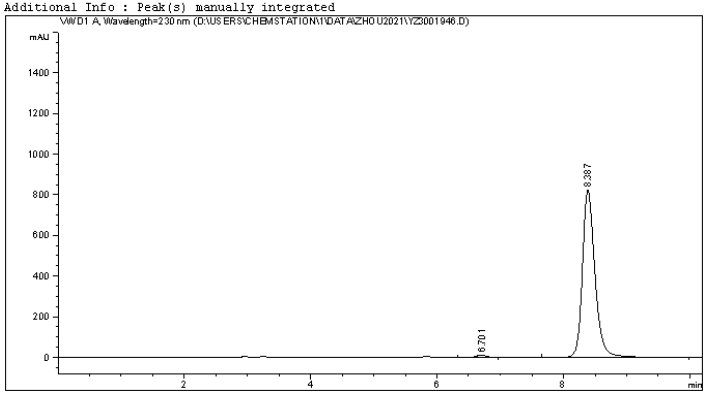

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|---------|---------|--------|
   1   6.716 VV    0.1703 2283.18652  204.36960  49.9067
   2   8.444 VV    0.2098 2291.72192  165.20837  50.0933
```



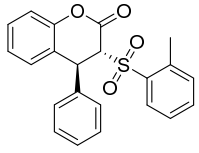
(+/-)-**2p**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001946.D
Sample Name: HZ-10-48B

```
======================================================================
Acq. Operator   : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : 1260II                    Location :     -
Injection Date  : 3/17/2021 9:35:34 PM           Inj :    1
                                           Inj Volume : No inj
Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 3/17/2021 8:34:34 PM by SYSTEM
                  (modified after loading)
Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 3/17/2021 9:47:39 PM by SYSTEM
                  (modified after loading)
Sample Info     : IA, n-Hexane/i-PrOH = 75/25, 1.0  mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated
```



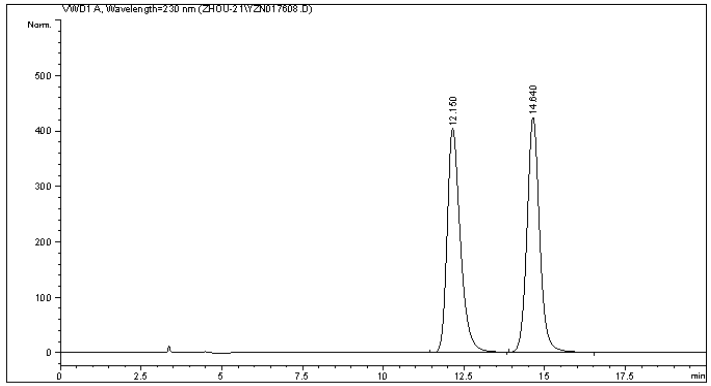

```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|---------|---------|--------|
   1   6.701 BV    0.1743  124.88231   10.53310   1.0933
   2   8.387 BB    0.2083 1.12981e4   822.26489  98.9067
```



(+)-**2p**

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN017608.D
Sample Name: HZ-10-46B+-

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 3/3/2021 8:53:07 AM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 8:47:44 AM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 10:09:41 AM
(modified after loading)
Sample Info : IA, Hexane/i-PrOH = 75/25, 1.0 mL/min, 30 oC, 230 nm



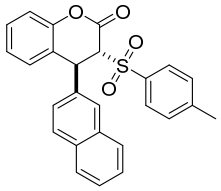
Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.150	VB	0.4303	1.15187e4	403.88596	50.0197
2	14.640	BB	0.4130	1.15097e4	423.76575	49.9803

Totals : 2.30284e4 827.65170



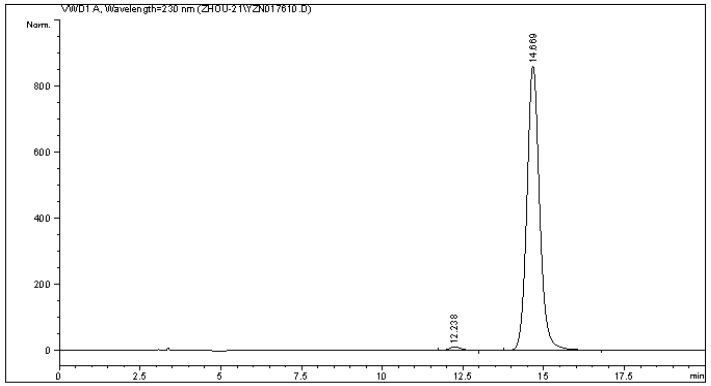
(+/-)-**2q**

*** End of Report ***

Instrument 1 3/3/2021 10:09:48 AM Page 1 of 1

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN017610.D
Sample Name: HZ-10-45B

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 3/3/2021 9:37:40 AM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 9:36:32 AM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/3/2021 10:07:55 AM
(modified after loading)
Sample Info : IA, Hexane/i-PrOH = 75/25, 1.0 mL/min, 30 oC, 230 nm



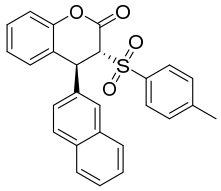
Area Percent Report

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

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	12.238	BB	0.4192	327.90085	11.89184	1.3732
2	14.669	VB	0.4151	2.35505e4	861.26312	98.6268

Totals : 2.38784e4 873.15496



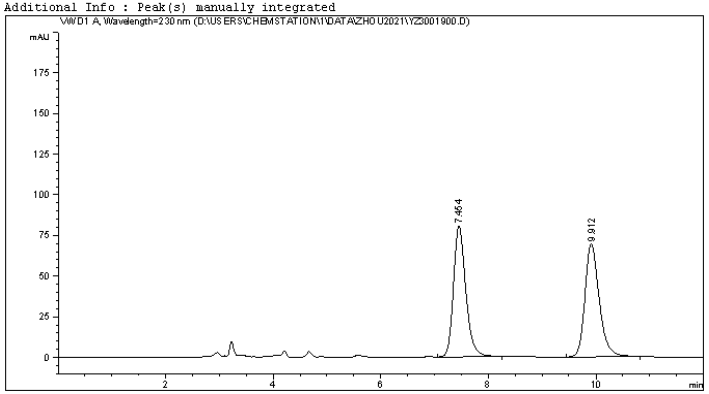
(+)-**2q**

*** End of Report ***

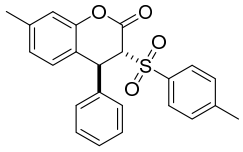
Instrument 1 3/3/2021 10:07:57 AM Page 1 of 1

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001900.D
Sample Name: HZ-10-52A+-

```
    ====================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 3/9/2021 4:10:51 PM              Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/9/2021 3:43:59 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/9/2021 4:47:03 PM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 70/30, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



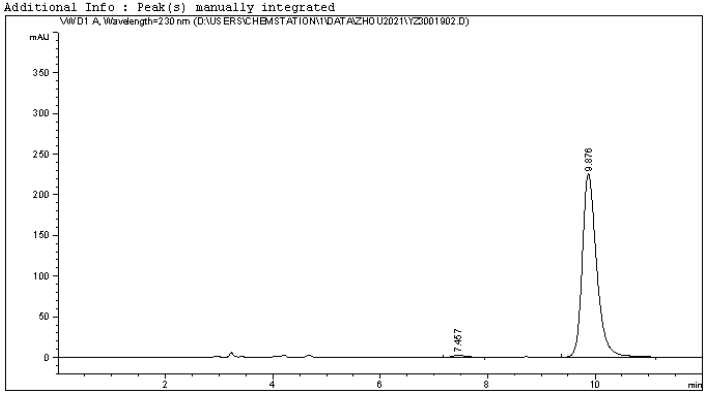

```
    ====================================================================
                            Area Percent Report
    ====================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|---------|--------|
       1   7.454 VB    0.2440 1280.01025   80.30379  49.9102
       2   9.912 BB    0.2807 1284.61511   69.49427  50.0898
```



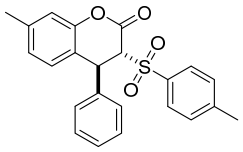
(+/-)-**2r**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001902.D
Sample Name: HZ-10-51A

```
    ====================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 3/9/2021 4:42:52 PM              Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/9/2021 3:43:59 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/9/2021 5:00:16 PM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 70/30, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



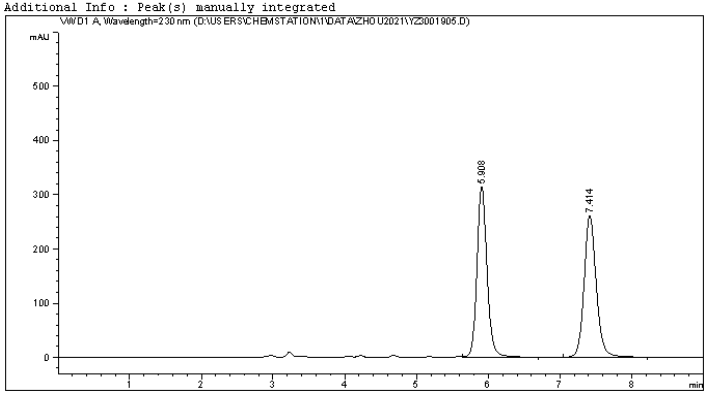

```
    ====================================================================
                            Area Percent Report
    ====================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|---------|--------|
       1   7.457 BB    0.2563   43.01477    2.51864   1.0222
       2   9.876 BB    0.2806 4165.18164  225.33815  98.9778
```



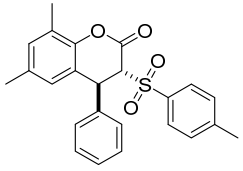
(+)-**2r**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001905.D
Sample Name: HZ-10-52B+-

```
    ======================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 3/9/2021 8:25:21 PM              Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/9/2021 8:00:56 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/9/2021 9:22:36 PM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 70/30, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



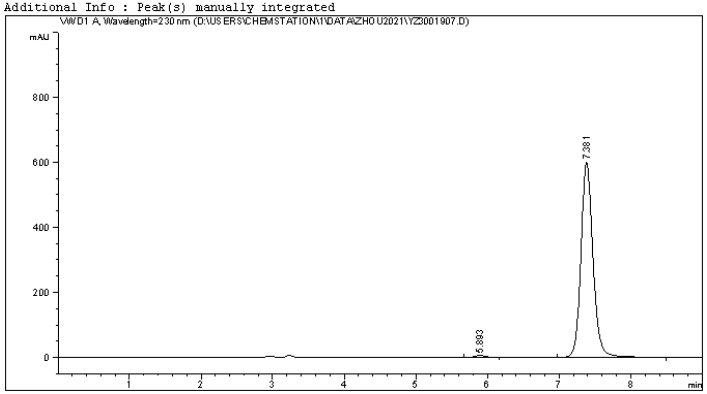

```
    ======================================================================
                               Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   5.908 VB    0.1484 3068.82397  315.68811  50.0283
       2   7.414 BB    0.1790 3065.34766  260.96362  49.9717
```



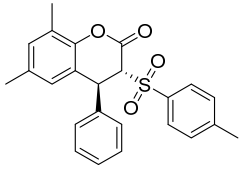
(+/-)-**2s**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001907.D
Sample Name: HZ-10-51B

```
    ======================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 3/9/2021 8:59:09 PM              Inj :    1
                                                  Inj Volume : No inj
    Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/9/2021 8:00:56 PM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
    Last changed    : 3/9/2021 9:23:02 PM by SYSTEM
                      (modified after loading)
    Sample Info     : IA, n-Hexane/i-PrOH = 70/30, 1.0  mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```




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

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   5.893 BB    0.1456   49.95801    5.26856   0.7086
       2   7.381 BB    0.1781 7000.13770  600.20129  99.2914
```

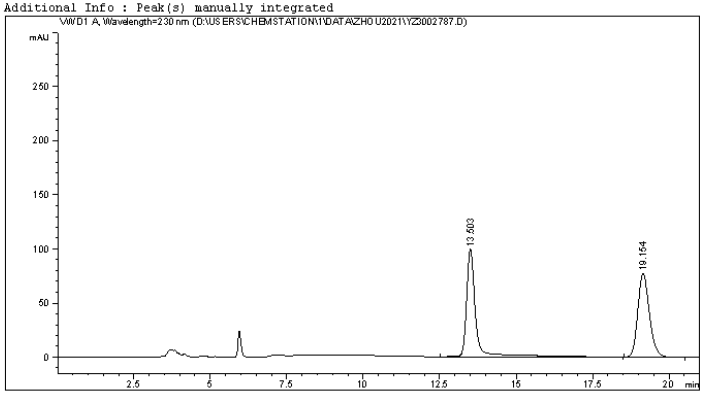


(+)-**2s**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3002787.D
Sample Name: HZ-11-50D+-

Acq. Operator : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : 1260II Location : -
Injection Date : 7/10/2021 8:06:50 PM Inj : 1
Inj Volume : No inj
Acq. Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed : 7/10/2021 7:55:29 PM by SYSTEM
(modified after loading)
Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed : 7/10/2021 9:00:48 PM by SYSTEM
(modified after loading)
Sample Info : AD-H, n-Hexane/i-PrOH = 70/30, 0.8 mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated

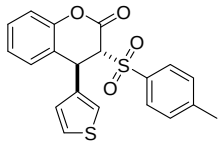


Area Percent Report

Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.503	BB	0.3102	2101.04419	99.55585	50.8429
2	19.154	BB	0.4036	2031.38196	77.30142	49.1571

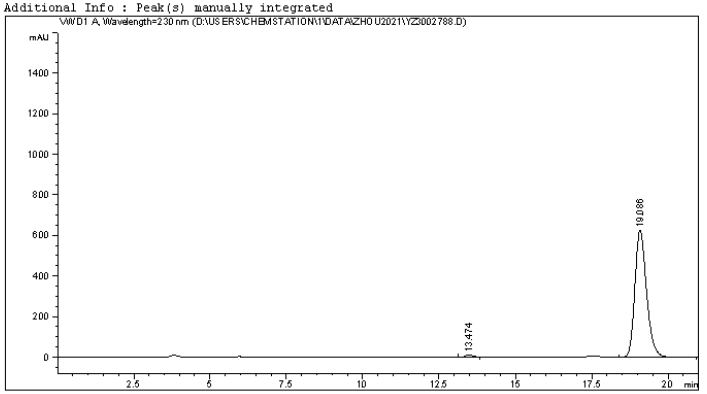


(+/-)-**2t**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3002788.D
Sample Name: HZ-11-50D

Acq. Operator : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : 1260II Location : -
Injection Date : 7/10/2021 8:39:50 PM Inj : 1
Inj Volume : No inj
Acq. Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed : 7/10/2021 7:55:29 PM by SYSTEM
(modified after loading)
Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed : 7/10/2021 9:03:26 PM by SYSTEM
(modified after loading)
Sample Info : AD-H, n-Hexane/i-PrOH = 70/30, 0.8 mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated

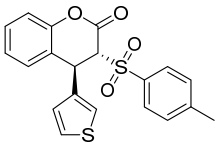


Area Percent Report

Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: VWD1 A, Wavelength=230 nm

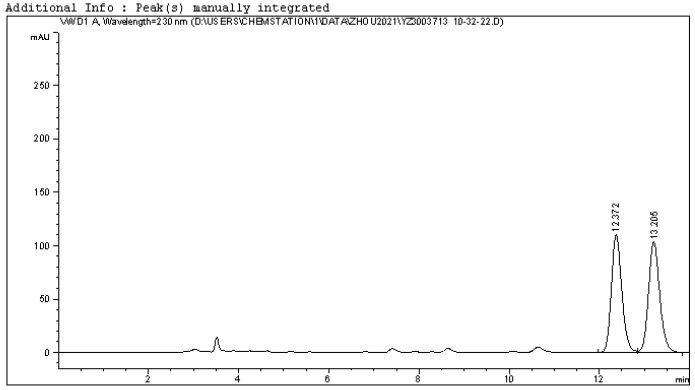
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.474	BB	0.2551	145.20985	8.91110	0.8698
2	19.086	BB	0.4058	1.65496e4	625.28168	99.1302



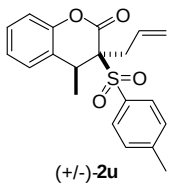
(+)-**2t**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3003713 10-32-22.D
Sample Name: HZ-11-66+-

```
    ======================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 11/25/2021 10:32:22 AM             Inj :   1
                                                   Inj Volume : No inj
    Acq. Method     : C:\Users\Public\Documents\ChemStation\1\Methods\def_LC.M
    Last changed    : 11/25/2021 10:21:18 AM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Users\Public\Documents\ChemStation\1\Methods\def_LC.M
    Last changed    : 11/25/2021 10:48:35 AM by SYSTEM
                      (modified after loading)
    Sample Info     : AD-H, n-Hexane/i-PrOH = 90/10, 1.0 mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



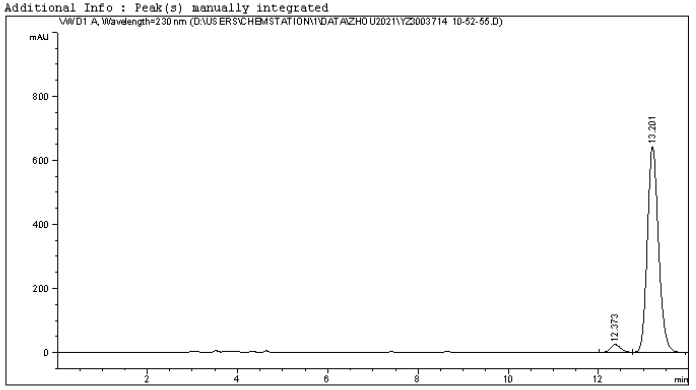

```
    ======================================================================
                               Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1  12.372 BV    0.2461 1769.60962  110.32888  49.8140
       2  13.205 VB    0.2640 1782.82239  103.49602  50.1860
```



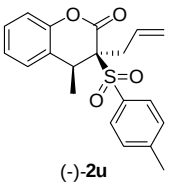
(+/-)-**2u**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3003714 10-52-55.D
Sample Name: HZ-11-65

```
    ======================================================================
    Acq. Operator   : SYSTEM
    Sample Operator : SYSTEM
    Acq. Instrument : 1260II                        Location :     -
    Injection Date  : 11/25/2021 10:52:55 AM             Inj :   1
                                                   Inj Volume : No inj
    Acq. Method     : C:\Users\Public\Documents\ChemStation\1\Methods\def_LC.M
    Last changed    : 11/25/2021 10:21:18 AM by SYSTEM
                      (modified after loading)
    Analysis Method : C:\Users\Public\Documents\ChemStation\1\Methods\def_LC.M
    Last changed    : 11/25/2021 11:09:31 AM by SYSTEM
                      (modified after loading)
    Sample Info     : AD-H, n-Hexane/i-PrOH = 90/10, 1.0 mL/min, 30 oC, 230 nm

    Additional Info : Peak(s) manually integrated
```



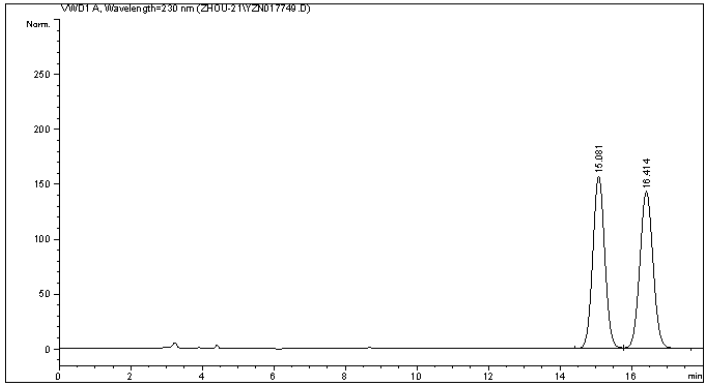

```
    ======================================================================
                               Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Do not use Multiplier & Dilution Factor with ISTDs


    Signal 1: VWD1 A, Wavelength=230 nm

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1  12.373 BV    0.2461  384.43906   23.96901   3.3590
       2  13.201 VB    0.2647 1.10607e4   643.03699  96.6410
```



(-)-**2u**

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN017749.D
Sample Name: HZ-10-55+-

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 3/20/2021 8:13:58 AM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/20/2021 8:12:39 AM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/20/2021 8:37:43 AM
(modified after loading)
Sample Info : IC, Hexane/i-PrOH = 80/20, 1.0 mL/min, 30 oC, 230 nm



Area Percent Report

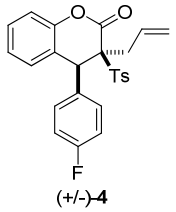
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	15.081	BV	0.3649	3653.26636	156.84169	49.8823
2	16.414	VB	0.4017	3670.50830	142.85661	50.1177

Totals : 7323.77466 299.69830

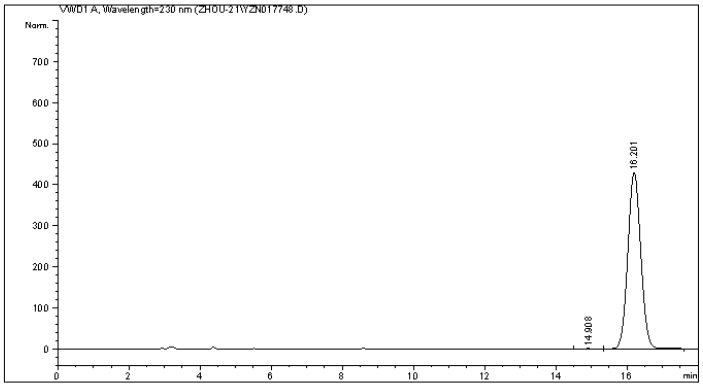
*** End of Report ***



(+/-)-4

Data File C:\CHEM32\1\DATA\ZHOU-21\YZN017748.D
Sample Name: HZ-10-57

Acq. Operator :
Acq. Instrument : Instrument 1 Location : -
Injection Date : 3/20/2021 7:51:59 AM
Acq. Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/20/2021 7:11:44 AM
(modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\DEF_LC.M
Last changed : 3/20/2021 8:36:29 AM
(modified after loading)
Sample Info : IC, Hexane/i-PrOH = 80/20, 1.0 mL/min, 30 oC, 230 nm



Area Percent Report

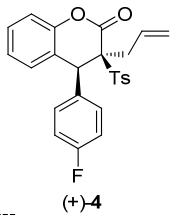
Sorted By : Signal
Multiplier: : 1.0000
Dilution: : 1.0000
Use Multiplier & Dilution Factor with ISTDs

Signal 1: VWD1 A, Wavelength=230 nm

Peak #	RetTime [min]	Type	Width [min]	Area mAU *s	Height [mAU]	Area %
1	14.908	BV	0.3201	7.16760	3.30379e-1	0.0662
2	16.201	VB	0.3931	1.08167e4	429.06293	99.9338

Totals : 1.08238e4 429.39331

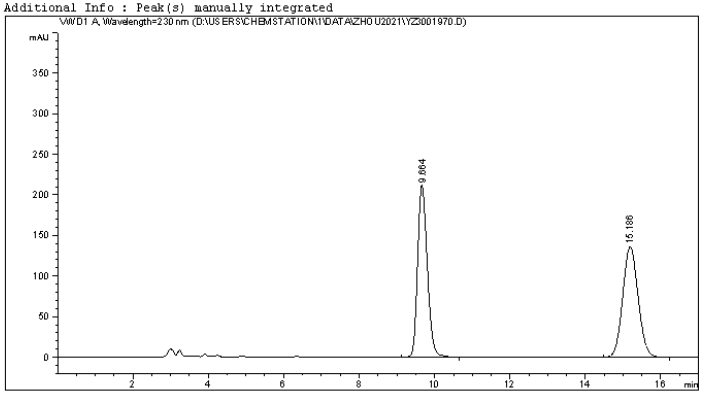
*** End of Report ***



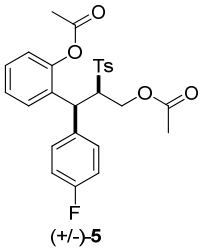
(+)-4

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001970.D
Sample Name: HZ-10-59+-

```
Acq. Operator   : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : 1260II                        Location :     -
Injection Date  : 3/20/2021 5:04:48 PM             Inj :    1
                                                Inj Volume : No inj
Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 3/20/2021 4:40:03 PM by SYSTEM
                  (modified after loading)
Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 3/22/2021 10:18:49 AM by SYSTEM
                  (modified after loading)
Sample Info     : AD-H, n-Hexane/i-PrOH = 60/40, 1.0 mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated
```



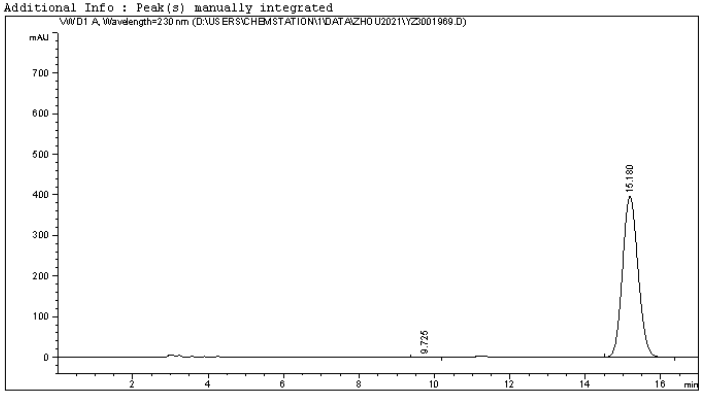

```
                        Area Percent Report

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|-------|
   1   9.664 VB    0.2783 3779.10840  211.70270  49.6477
   2  15.186 BB    0.4405 3832.73706  136.13089  50.3523
```



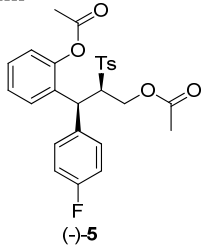
(+/-)-**5**

Data File D:\USERS\CHEMSTATION\1\DATA\ZHOU2021\YZ3001969.D
Sample Name: HZ-10-61

```
Acq. Operator   : SYSTEM
Sample Operator : SYSTEM
Acq. Instrument : 1260II                        Location :     -
Injection Date  : 3/20/2021 4:45:21 PM             Inj :    1
                                                Inj Volume : No inj
Acq. Method     : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 3/20/2021 4:40:03 PM by SYSTEM
                  (modified after loading)
Analysis Method : C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\1\METHODS\defl_LC.M
Last changed    : 3/22/2021 10:17:49 AM by SYSTEM
                  (modified after loading)
Sample Info     : AD-H, n-Hexane/i-PrOH = 60/40, 1.0 mL/min, 30 oC, 230 nm

Additional Info : Peak(s) manually integrated
```




```
                        Area Percent Report

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs


Signal 1: VWD1 A, Wavelength=230 nm

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|-------|
   1   9.725 BB    0.2672   22.31732    1.30695   0.1967
   2  15.180 VB    0.4449 1.13227e4   396.83463  99.8033
```



(-)-**5**