Supporting Information

For

O-Acylation Triggered γ-Umpolung Functionalization of Electron-poor Alkenyl Sulfoxides for the Synthesis of 3-Allyl Indoles

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1. General Experimental Methods

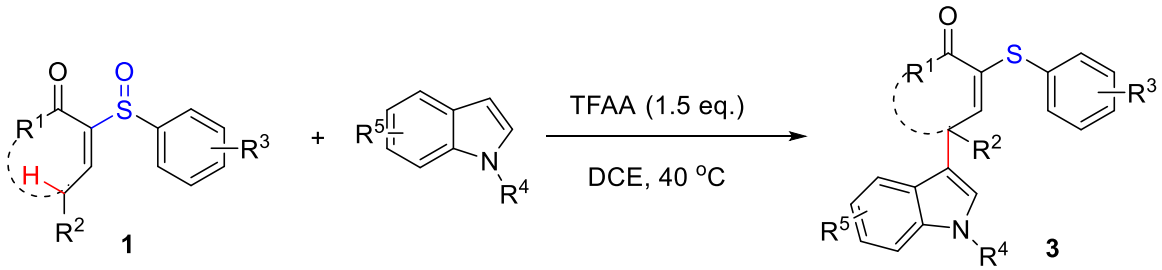
Unless otherwise noted, all the operation and reaction processes are carried out in the air environment, and the chemical reagents are from Energy Chemical, Bidepharm or Adamas. The reagents are directly used in the experiment process and have not been further purified. Thin layer chromatography was carried out on a silica gelplates and the color was developed by UV lamp 254. Column chromatography is performed on silica gel, NMR spectra were measured on a Bruker magnetic resonance spectrometer (^{1}H at 400 MHz, ^{13}C at 101 MHz and ^{19}F at 376 MHz). Chemical shifts are reported in ppm. $CDCl_3$ were used as a solvent and an internal standard, respectively. HRMS data were obtained on a VG ZAB-HS mass spectrometer, Brucker Apex IV FTMS spectrometer.

2. Typical Procedure for the Preparation of 1

Alkenyl sulfoxides **1** were prepared according to the known procedures. [1]

General Procedure for the syntheses of 2 and 3

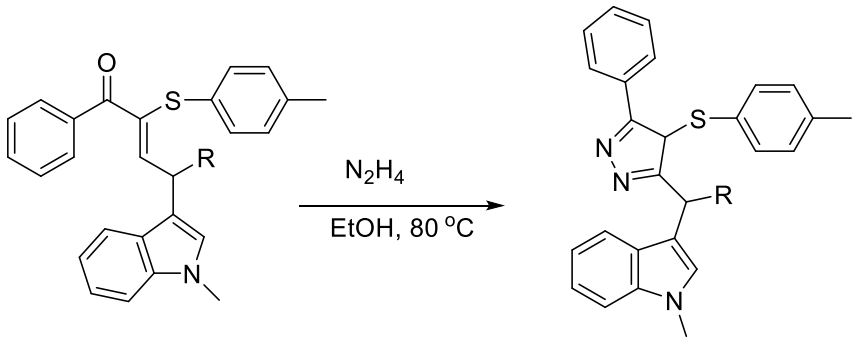
To a solution of **1** (0.3 mmol) and indole (0.45 mmol, 1.5 equiv.) in DCE (1 mL) was added TFAA (0.45 mmol, 1.5 equiv.) at 40 °C. The resulting solution was stirred and monitored by TLC. After completion, the reaction was quenched with water, extracted with DCM and dried over anhydrous Na_2SO_4. After removal of solvent, the residue left was purified by flash column chromatography with silica gel (eluent: petroleum ether/ethyl acetate = 5:1) to give desired product **2**.



To a solution of **1** (0.3 mmol) and N-Methylindole (0.45 mmol, 1.5 equiv.) in DCE (1 mL) was added TFAA (0.45 mmol, 1.5 equiv.) at 40 °C. The resulting solution was stirred and monitored by TLC. After completion,

the reaction was quenched with water, extracted with DCM and dried over anhydrous Na_2SO_4. After removal of solvent, the residue left was purified by flash column chromatography with silica gel (eluent: petroleum ether/ethyl acetate = 5:1) to give desired product **3**.

General Procedure for the syntheses of 4



R = Et, **3ab**
R = $PhCH_2$, **3ac**

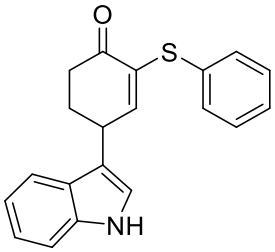
R = Et, **4a**
R = $PhCH_2$, **4b**

To a solution of **3ab** or **3ac** (1 mmol) in EtOH (10 mL) was added and N_2H_4 (5 mmol, 5 equiv.) at 80 °C. The resulting solution was stirred and monitored by TLC. After completion, the reaction was quenched with water, extracted with EtOAc and dried over anhydrous Na_2SO_4. After removal of solvent, the residue left was purified by flash column chromatography with silica gel (eluent: petroleum ether/ethyl acetate = 8:1) to give desired product **4a** or **4b**.

3. Reference.

1. L. Jiang, L. Gao, X. Li, T. Shao, J. Yao, M. Miao and H. Zhou, *Synthesis,* 2024, **56,** 47.

4. The spectroscopic data of compounds



2a

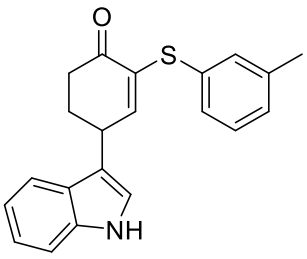
4-(1*H*-indol-3-yl)-2-(phenylthio)cyclohex-2-en-1-one (2a): Pure **2a** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow solid (77 mg, 80% yield); mp 164-166 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.13 (s, 1H), 7.61 (d, J = 7.7 Hz, 1H), 7.44 (d, J = 8.1 Hz, 1H), 7.28 – 7.24 (m, 1H), 7.18 (d, J = 7.9 Hz, 2H), 7.15 (s, 1H), 7.09 – 7.06 (m, 2H), 7.05 (s, 1H), 6.96 – 6.93 (m, 1H), 6.18 (dd, J = 10.1, 2.4 Hz, 1H), 4.51 – 4.46 (m, 1H), 2.59 – 2.53 (m, 2H), 2.34 (dd, J = 13.0, 4.9 Hz, 1H), 2.22 – 2.16 (m, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.4, 150.8, 144.1, 139.0, 135.9, 130.6, 129.9, 128.9, 125.4, 124.8, 123.0, 121.2, 119.4, 111.4, 99.6, 37.0, 34.5, 30.0;

IR (neat): 1632, 1598, 852cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{20}H_{18}NOS^{+}$: 320.1104; Found: 320.1107.



2b

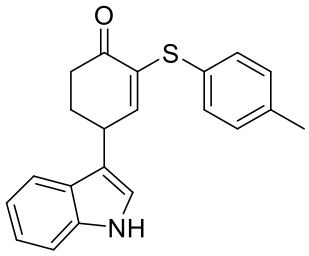
4-(1*H*-indol-3-yl)-2-(*m*-tolylthio)cyclohex-2-en-1-one (2b): Pure **2b** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow solid (85 mg, 85% yield); mp 197-199 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.02 (s, 1H), 7.61 (d, *J* = 7.7 Hz, 1H), 7.43 (d, *J* = 8.0 Hz, 1H), 7.25 (s, 1H), 7.16 (d, *J* = 7.1 Hz, 1H), 7.04 (t, *J* = 7.6 Hz, 1H), 6.94 (d, *J* = 8.1 Hz, 2H), 6.88 (d, *J* = 7.2 Hz, 1H), 6.78 (d, *J* = 7.6 Hz, 1H), 6.18 (d, *J* = 10.1 Hz, 1H), 4.50 – 4.45 (m, 1H), 2.58 – 2.53 (m, 2H), 2.33 (dt, *J* = 9.8, 5.5 Hz, 1H), 2.24 (s, 3H), 2.21 – 2.15 (m, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.3, 150.7, 144.1, 138.7, 138.6, 135.8, 130.7, 130.0, 128.8, 126.0, 125.8, 123.0, 122.4, 121.1, 119.5, 111.4, 99.7, 37.0, 34.6, 30.0, 21.4;

IR (neat): 2916, 1593, 875cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{21}H_{20}NOS^+$: 334.1260; Found: 334.1264.



2c

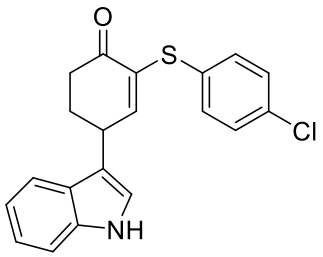
4-(1*H*-indol-3-yl)-2-(*p*-tolylthio)cyclohex-2-en-1-one (2c): Pure **2c** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow solid (91 mg, 91% yield); mp 199-200 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.05 (s, 1H), 7.63 (d, J = 7.6 Hz, 1H), 7.44 (d, J = 8.0 Hz, 1H), 7.25 (d, J = 7.2 Hz, 1H), 7.18 (t, J = 7.4 Hz, 1H), 6.97 (d, J = 8.5 Hz, 5H), 6.22 – 6.17 (m, 1H), 4.50 (dd, J = 6.6, 2.7 Hz, 1H), 2.60 – 2.54 (m, 2H), 2.35 (dd, J = 12.6, 5.1 Hz, 1H), 2.27 (s, 3H), 2.20 (dd, J = 8.5, 4.8 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.5, 150.9, 144.0, 135.9, 135.3, 134.6, 130.6, 129.9, 129.6, 125.6, 123.0, 121.1, 119.4, 111.4, 100.1, 37.0, 34.6, 30.0, 20.9;

IR (neat): 3037, 1632, 851cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{21}H_{20}NOS^{+}$: 334.1260; Found: 334.1265.



2d

2-((4-chlorophenyl)thio)-4-(1*H*-indol-3-yl)cyclohex-2-en-1-one (2d):

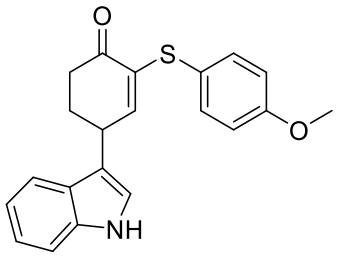
Pure **2d** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow solid (80 mg, 76% yield); mp 186-188 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.11 (s, 1H), 7.57 (d, J = 7.9 Hz, 1H), 7.45 (d, J = 8.1 Hz, 1H), 7.27 (t, J = 6.4 Hz, 1H), 7.18 (t, J = 7.4 Hz, 1H), 7.13 (d, J = 8.4 Hz, 2H), 6.95 (dd, J = 16.4, 5.7 Hz, 3H), 6.20 (d, J = 10.0 Hz, 1H), 4.49 – 4.43 (m, 1H), 2.57 (q, J = 5.0, 4.5 Hz, 2H), 2.34 (dd, J = 12.9, 5.4 Hz, 1H), 2.24 – 2.15 (m, 1H).

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.2, 150.4, 144.2, 137.6, 135.9, 130.8, 130.6, 129.6, 128.9, 126.6, 123.2, 121.3, 119.3, 111.5, 99.2, 37.0, 34.5, 30.1;

IR (neat): 1632, 1587, 851cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{20}H_{17}NOS^{+}$: 354.0714; Found: 354.0715.



2e

4-(1*H*-indol-3-yl)-2-((4-methoxyphenyl)thio)cyclohex-2-en-1-one (2e):

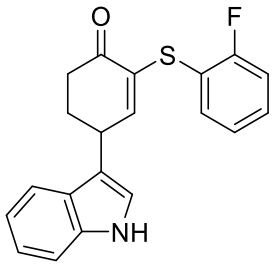
Pure **2e** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow solid (98 mg, 94% yield); mp 149-151 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.04 (s, 1H), 7.65 (d, J = 7.6 Hz, 1H), 7.42 (d, J = 7.8 Hz, 1H), 7.24 (d, J = 8.1 Hz, 1H), 7.18 (t, J = 6.8 Hz, 1H), 7.09 – 7.03 (m, 2H), 6.94 (d, J = 9.9 Hz, 1H), 6.78 – 6.72 (m, 2H), 6.18 (d, J = 10.0 Hz, 1H), 4.52 (dd, J = 6.0, 2.7 Hz, 1H), 3.74 (s, 3H), 2.58 (s, 2H), 2.36 – 2.30 (m, 1H), 2.23 – 2.14 (m, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.3, 157.7, 150.8, 143.7, 135.8, 130.6, 129.9, 129.5, 127.8, 122.9, 121.1, 119.4, 114.6, 111.4, 101.2, 55.4, 37.1, 34.6, 30.0;

IR (neat): 3045, 1632, 824cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{21}H_{20}NO_2S^+$: 350.1209; Found: 350.1212.



2f

2-((2-fluorophenyl)thio)-4-(1*H*-indol-3-yl)cyclohex-2-en-1-one (2f):

Pure **2f** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow solid (85 mg, 84% yield); mp 184-186 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.21 (s, 1H), 7.62 (d, *J* = 7.8 Hz, 1H), 7.45 (d, *J* = 8.0 Hz, 1H), 7.28 – 7.25 (m, 1H), 7.19 (t, *J* = 7.4 Hz, 1H), 7.05 (d, *J* = 7.2 Hz, 2H), 6.95 (d, *J* = 10.2 Hz, 1H), 6.88 (t, *J* = 7.0 Hz, 1H), 6.73 (t, *J* = 7.7 Hz, 1H), 6.23 – 6.17 (m, 1H), 4.52 (dd, *J* = 7.0, 4.4 Hz, 1H), 2.61 – 2.56 (m, 2H), 2.36 (dd, *J* = 13.1, 5.2 Hz, 1H), 2.20 (dd, *J* = 12.9, 8.4 Hz, 1H);

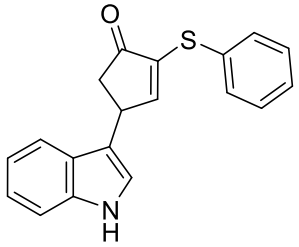
^{13}C NMR (101 MHz, $CDCl_3$) δ 199.4, 159.1 (d, *J* = 242 Hz), 150.6, 144.5, 136.0, 130.7, 129.8, 127.5, 126.4 (d, *J* = 7 Hz), 126.1 (d, *J* = 17 Hz), 124.5 (d, *J* = 4 Hz), 123.1, 121.2, 119.3, 115.3 (d, *J* = 20 Hz), 111.5, 97.5, 37.0, 34.5, 30.0;

^{19}F NMR (376 MHz, $CDCl_3$) δ -113.68;

IR (neat): 1632, 1590, 784cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{20}H_{17}FNOS^+$: 338.1009; Found:

338.1016.



2g

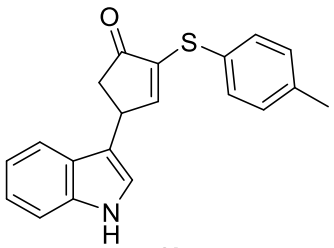
4-(1*H*-indol-3-yl)-2-(phenylthio)cyclopent-2-en-1-one (2g): Pure **2g** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as green solid (53 mg, 58% yield); mp 132-134 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.00 (s, 1H), 7.67 – 7.58 (m, 2H), 7.39 (d, *J* = 8.0 Hz, 1H), 7.26 – 7.22 (m, 1H), 7.17 (t, *J* = 7.2 Hz, 3H), 7.06 (d, *J* = 7.7 Hz, 3H), 6.38 – 6.32 (m, 1H), 4.96 – 4.91 (m, 1H), 2.86 (dd, *J* = 19.2, 7.1 Hz, 1H), 2.46 (d, *J* = 19.2 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 210.1, 165.6, 142.1, 139.1, 136.2, 134.5, 130.0, 128.9, 125.6, 125.5, 124.9, 123.1, 121.1, 119.4, 111.5, 100.4, 41.5, 38.7;

IR (neat): 3048, 1632, 823cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{19}H_{16}NOS^{+}$: 306.0947; Found: 306.0951.



2h

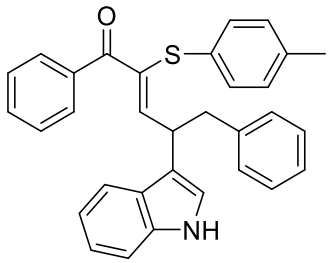
4-(1*H*-indol-3-yl)-2-(*p*-tolylthio)cyclopent-2-en-1-one (2h): Pure **2h** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as green solid (62 mg, 65% yield); mp 147-148 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.97 (s, 1H), 7.63 (t, *J* = 6.9 Hz, 2H), 7.38 (d, *J* = 8.0 Hz, 1H), 7.23 (d, *J* = 6.9 Hz, 1H), 7.16 (t, *J* = 7.4 Hz, 1H), 6.98 (s, 4H), 6.34 (d, *J* = 4.5 Hz, 1H), 4.97 – 4.91 (m, 1H), 2.86 (dd, *J* = 19.3, 7.1 Hz, 1H), 2.46 (d, *J* = 19.7 Hz, 1H), 2.26 (s, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 209.5, 165.0, 141.9, 136.0, 135.3, 134.8, 134.7, 130.0, 129.6, 125.9, 123.1, 121.1, 119.5, 111.3, 101.1, 41.5, 38.7, 20.9;

IR (neat): 3046, 1632, 829cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{20}H_{18}NOS^+$: 320.1104; Found: 320.1108.



2i

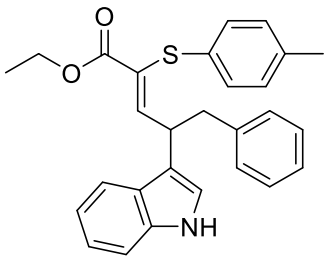
(Z)-4-(1*H*-indol-3-yl)-1,5-diphenyl-2-(*p*-tolylthio)pent-2-en-1-one (2i): Pure **2i** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (99 mg, 70% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.37 (s, 1H), 7.75 (d, J = 7.4 Hz, 2H), 7.59 – 7.53 (m, 2H), 7.42 – 7.31 (m, 4H), 7.22 – 7.16 (m, 2H), 7.14 (d, J = 5.2 Hz, 4H), 7.06 (d, J = 7.0 Hz, 2H), 6.89 (s, 3H), 6.78 (d, J = 15.2 Hz, 1H), 4.71 (q, J = 7.4 Hz, 1H), 3.21 (t, J = 6.7 Hz, 2H), 2.18 (s, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 190.9, 148.0, 143.4, 138.1, 137.2, 136.0, 135.2, 134.4, 133.2, 129.9, 129.5, 129.0, 128.6, 128.6, 128.5, 126.8, 126.6, 126.0, 122.7, 120.8, 119.4, 111.3, 100.8, 42.1, 40.5, 20.8;

IR (neat): 1632, 1564, 874cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{32}H_{28}NOS^+$: 474.1886; Found: 474.1886.



2j

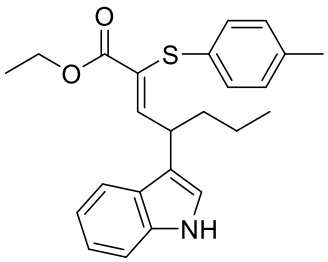
ethyl (Z)-4-(1*H*-indol-3-yl)-5-phenyl-2-(*p*-tolylthio)pent-2-enoate (2j): Pure **2j** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (95 mg, 72% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (s, 1H), 7.74 (d, J = 7.9 Hz, 1H), 7.37 (d, J = 9.3 Hz, 1H), 7.29 (s, 1H), 7.23 (s, 1H), 7.14 (d, J = 4.6 Hz, 4H), 7.00 (d, J = 3.3 Hz, 2H), 6.96 (d, J = 8.0 Hz, 2H), 6.80 (d, J = 8.0 Hz, 2H), 5.76 (d, J = 16.7 Hz, 1H), 4.35 (d, J = 7.0 Hz, 1H), 4.13 (d, J = 7.1 Hz, 2H), 3.30 (dd, J = 7.5, 3.5 Hz, 2H), 2.27 (s, 3H), 1.24 (t, J = 7.1 Hz, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 166.7, 150.1, 139.5, 137.2, 136.2, 132.4, 129.9, 129.1, 128.2, 127.9, 126.2, 126.1, 124.2, 123.2, 121.3, 121.2, 120.3, 119.9, 111.2, 60.2, 42.4, 40.1, 20.9, 14.2;

IR (neat): 3053, 1632, 804cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{28}H_{28}NO_2S^+$: 442.1835; Found: 442.1835.



2k

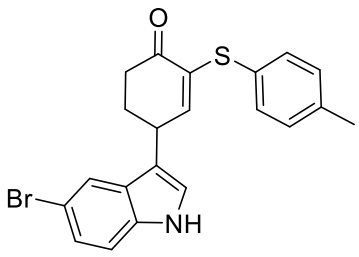
ethyl (Z)-4-(1*H*-indol-3-yl)-2-(*p*-tolylthio)hept-2-enoate (2k): Pure **2k** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (74 mg, 63% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (s, 1H), 7.67 (d, J = 8.0 Hz, 1H), 7.34 – 7.29 (m, 2H), 7.22 (d, J = 7.2 Hz, 1H), 7.12 (t, J = 7.5 Hz, 1H), 7.03 (s, 4H), 5.76 (dd, J = 15.7, 1.4 Hz, 1H), 4.14 (d, J = 7.2 Hz, 2H), 4.07 – 4.02 (m, 1H), 2.29 (s, 3H), 2.02 – 1.94 (m, 2H), 1.30 (d, J = 8.6 Hz, 2H), 1.25 (s, 3H), 0.87 (t, J = 7.3 Hz, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 167.0, 151.2, 1372, 136.1, 132.9, 129.9, 127.6, 126.3, 123.5, 123.2, 122.4, 121.9, 120.6, 120.3, 119.8, 111.2, 60.2, 40.1, 35.9, 21.0, 21.0, 14.2, 13.9;

IR (neat): 3028, 1632, 805cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{24}H_{28}NO_2S^+$: 394.1835; Found: 394.1842.



3a

4-(5-bromo-1*H*-indol-3-yl)-2-(*p*-tolylthio)cyclohex-2-en-1-one (3a):

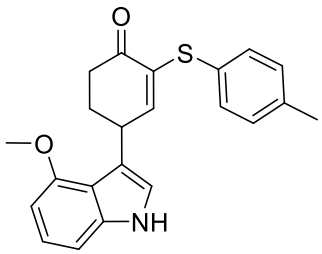
Pure **3a** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (69 mg, 56% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.93 (s, 1H), 7.74 (s, 1H), 7.35 – 7.28 (m, 2H), 7.00 (d, *J* = 7.9 Hz, 2H), 6.92 (d, *J* = 8.3 Hz, 3H), 6.19 (d, *J* = 10.0 Hz, 1H), 4.49 – 4.43 (m, 1H), 2.55 (t, *J* = 5.3 Hz, 2H), 2.33 (dd, *J* = 13.6, 5.3 Hz, 1H), 2.27 (s, 3H), 2.16 (dd, *J* = 13.9, 7.8 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.3, 150.4, 145.2, 134.9, 134.8, 134.5, 131.8, 130.7, 129.8, 125.9, 125.6, 122.0, 114.6, 112.9, 100.0, 37.0, 34.5, 29.9, 20.9;

IR (neat): 3023, 1633, 830^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For$C_{21}H_{19}BrNOS^+$: 412.0365; Found: 412.0358.



3b

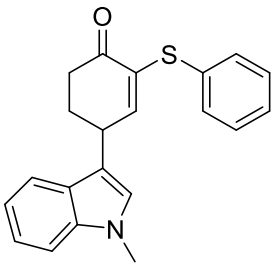
4-(4-methoxy-1*H*-indol-3-yl)-2-(*p*-tolylthio)cyclohex-2-en-1-one (3b): Pure **3b** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (62 mg, 57% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.03 (s, 1H), 7.14 (t, J = 7.9 Hz, 1H), 7.02 (d, J = 11.2 Hz, 5H), 6.91 (d, J = 9.9 Hz, 1H), 6.56 (d, J = 7.7 Hz, 1H), 6.13 (d, J = 10.1 Hz, 1H), 4.51 (d, J = 10.7 Hz, 1H), 3.73 (s, 3H), 2.55 – 2.50 (m, 2H), 2.33 – 2.28 (m, 1H), 2.26 (s, 3H), 2.17 – 2.10 (m, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 199.4, 154.4, 151.1, 142.9, 137.5, 137.0, 134.2, 130.5, 129.3, 125.9, 123.6, 119.3, 104.7, 101.9, 99.2, 55.7, 37.1, 34.3, 30.1, 20.9;

IR (neat): 3022, 1577, 830cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{22}H_{22}NO_2S^+$: 364.1366; Found: 364.1369.



3c

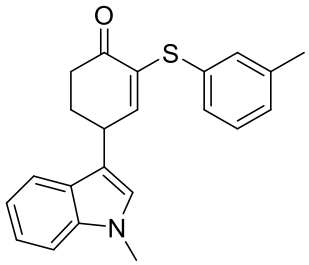
4-(1-methyl-1*H*-indol-3-yl)-2-(phenylthio)cyclohex-2-en-1-one (3c): Pure **3c** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (71 mg, 71% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (d, J = 7.8 Hz, 1H), 7.39 (d, J = 8.2 Hz, 1H), 7.31 (d, J = 7.0 Hz, 1H), 7.16 (t, J = 8.7 Hz, 3H), 7.04 (d, J = 17.7 Hz, 4H), 6.18 (dd, J = 10.1, 3.1 Hz, 1H), 4.65 – 4.60 (m, 1H), 3.83 (s, 3H), 2.58 (dd, J = 12.7, 4.8 Hz, 2H), 2.33 (dd, J = 12.1, 5.8 Hz, 1H), 2.20 (dd, J = 13.9, 3.8 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.2, 151.6, 145.3, 139.3, 137.6, 129.9, 129.3, 128.9, 125.3, 124.8, 122.9, 121.1, 119.6, 109.5, 99.5, 38.0, 35.2, 31.5, 30.1;

IR (neat): 1654, 1579, 741cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) calcd for $C_{21}H_{20}NOS^+$: 334.1260; found: 334.1268.



3d

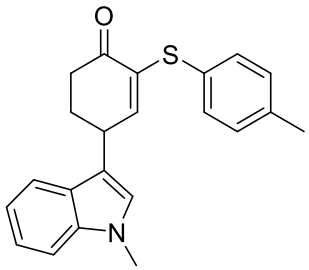
4-(1-methyl-1*H*-indol-3-yl)-2-(*m*-tolylthio)cyclohex-2-en-1-one (3d): Pure **.3d** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (78 mg, 75% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (d, J = 7.7 Hz, 1H), 7.37 (d, J = 7.9 Hz, 1H), 7.30 (d, J = 6.9 Hz, 1H), 7.17 (t, J = 7.4 Hz, 1H), 7.00 (d, J = 13.9 Hz, 2H), 6.91 (s, 1H), 6.86 (d, J = 7.3 Hz, 1H), 6.73 (d, J = 7.5 Hz, 1H), 6.18 (d, J = 10.4 Hz, 1H), 4.65 – 4.59 (m, 1H), 3.81 (s, 3H), 2.60 – 2.51 (m, 2H), 2.32 (dd, J = 12.4, 6.3 Hz, 1H), 2.23 (s, 3H), 2.18 (d, J = 4.8 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.2, 151.6, 145.2, 139.0, 138.6, 129.9, 129.4, 128.7, 125.9, 125.7, 122.8, 122.3, 121.0, 119.6, 109.4, 99.6, 38.0, 35.2, 31.5, 30.1, 21.4;

IR (neat): 3050, 1591, 744cm^{-1};

HRMS (ESI-TOF) ([M+H]$^+$) Calcd For $C_{22}H_{22}NOS^+$: 348.1417; Found: 348.1422.



3e

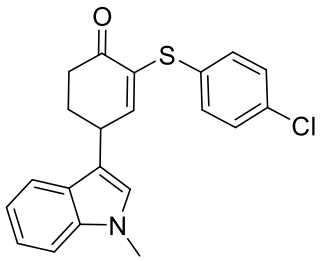
4-(1-methyl-1*H*-indol-3-yl)-2-(*p*-tolylthio)cyclohex-2-en-1-one (3e): Pure **3e** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (83 mg, 80% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (d, J = 8.3 Hz, 1H), 7.36 (d, J = 7.9 Hz, 1H), 7.29 (d, J = 7.5 Hz, 1H), 7.19 – 7.14 (m, 1H), 6.94 (dt, J = 20.7, 10.5 Hz, 5H), 6.16 (d, J = 9.6 Hz, 1H), 4.67 – 4.58 (m, 1H), 3.84 – 3.77 (m, 3H), 2.64 – 2.54 (m, 2H), 2.37 – 2.28 (m, 1H), 2.23 (s, 3H), 2.21 – 2.15 (m, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.2, 151.7, 145.1, 137.5, 135.6, 134.6, 129.9, 129.6, 129.3, 125.5, 122.8, 121.0, 119.6, 109.4, 100.0, 38.0, 35.1, 31.4, 30.1, 20.9;

IR (neat): 3041, 1591, 744cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{22}H_{22}NOS^+$: 348.1417; Found: 348.1421.



3f

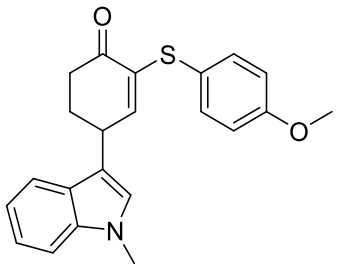
2-((4-chlorophenyl)thio)-4-(1-methyl-1*H*-indol-3-yl)cyclohex-2-en-1-one (3f): Pure **3f** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (73 mg, 66% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 (d, J = 7.8 Hz, 1H), 7.38 (d, J = 8.2 Hz, 1H), 7.31 (t, J = 7.6 Hz, 1H), 7.18 (t, J = 7.4 Hz, 1H), 7.10 (d, J = 6.9 Hz, 2H), 6.96 (d, J = 12.3 Hz, 1H), 6.91 (d, J = 6.8 Hz, 2H), 6.17 (dd, J = 10.3, 3.1 Hz, 1H), 4.57 (dd, J = 7.6, 3.8 Hz, 1H), 3.82 (d, J = 1.7 Hz, 3H), 2.58 (d, J = 18.2 Hz, 2H), 2.35 – 2.24 (m, 1H), 2.18 (d, J = 13.5 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.0, 151.3, 145.3, 137.9, 137.6, 130.5, 130.0, 129.1, 128.9, 126.5, 123.0, 121.3, 119.4, 109.5, 99.0, 38.0, 35.1, 31.5, 30.1;

IR (neat): 3052, 1682, 745, cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{21}H_{19}ClNOS^+$: 368.0870; Found: 368.0874.



3g

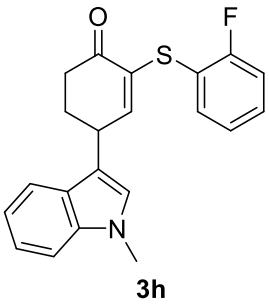
2-((4-methoxyphenyl)thio)-4-(1-methyl-1*H*-indol-3-yl)cyclohex-2-en-1-one (3g): Pure **3g** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (93 mg, 85% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, J = 7.9 Hz, 1H), 7.36 (s, 1H), 7.32 – 7.27 (m, 1H), 7.19 (t, J = 7.6 Hz, 1H), 7.01 (dt, J = 9.3, 2.1 Hz, 3H), 6.73 (dd, J = 8.7, 1.7 Hz, 2H), 6.20 (dd, J = 10.2, 3.0 Hz, 1H), 4.72 – 4.61 (m, 1H), 3.81 (d, J = 1.7 Hz, 3H), 3.73 (d, J = 1.6 Hz, 3H), 2.60 (dd, J = 12.4, 4.9 Hz, 2H), 2.31 (dd, J = 12.5, 6.3 Hz, 1H), 2.18 (d, J = 11.9 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.3, 157.6, 151.8, 144.8, 137.5, 129.9, 129.8, 129.4, 127.6, 122.8, 121.0, 119.6, 114.6, 109.4, 101.1, 55.3, 38.0, 35.2, 31.4, 30.1;

IR (neat): 2934, 1592, 1030cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{22}H_{22}NO_2S^+$: 364.1366; Found: 364.1371.



3h

2-((2-fluorophenyl)thio)-4-(1-methyl-1*H*-indol-3-yl)cyclohex-2-en-1-one (3h): Pure **3h** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (60 mg, 57% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60 (d, *J* = 7.6 Hz, 1H), 7.38 (d, *J* = 8.1 Hz, 1H), 7.31 (t, *J* = 7.6 Hz, 1H), 7.18 (t, *J* = 7.4 Hz, 1H), 7.04 (s, 1H), 7.03 – 6.96 (m, 2H), 6.85 (t, *J* = 7.2 Hz, 1H), 6.67 (t, *J* = 7.8 Hz, 1H), 6.19 (d, *J* = 10.1 Hz, 1H), 4.70 – 4.64 (m, 1H), 3.82 (s, 3H), 2.60 (dd, *J* = 11.5, 5.0 Hz, 2H), 2.33 (dd, *J* = 12.1, 6.9 Hz, 1H), 2.20 (dd, *J* = 13.3, 3.2 Hz, 1H);

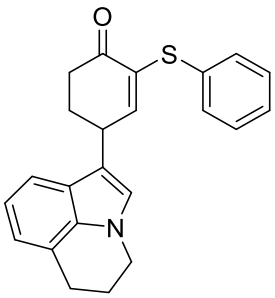
^{13}C NMR (101 MHz, $CDCl_3$) δ 198.2, 158.8 (d, *J*=243 Hz), 151.6, 145.6, 137.7, 130.1, 129.2, 127.5 (d, *J*=2 Hz), 126.4 (d, *J*=8 Hz), 124.4(d, *J*=3 Hz), 123.0, 121.2, 119.5, 115.3 (d, *J*=21 Hz), 109.4, 97.5, 38.0, 35.2, 31.5, 30.1;

^{19}F NMR (376 MHz, $CDCl_3$) δ -113.72;

IR (neat): 2891, 1632, 873cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{21}H_{19}FNOS^+$: 352.1166; Found:

352.1172.



3i

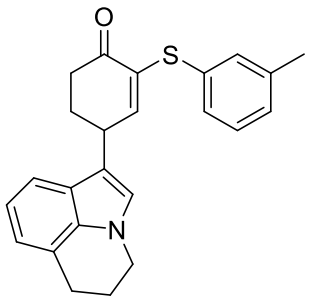
4-(5,6-dihydro-4*H*-pyrrolo[3,2,1-*ij*]quinolin-1-yl)-2-(phenylthio)cyclohex-2-en-1-one (3i): Pure **3i** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (66 mg, 61% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 (d, J = 7.8 Hz, 1H), 7.17 (d, J = 7.2 Hz, 1H), 7.14 (s, 1H), 7.08 – 6.99 (m, 5H), 6.96 (s, 1H), 6.20 – 6.14 (m, 1H), 4.59 – 4.53 (m, 1H), 4.15 (dt, J = 11.9, 5.4 Hz, 2H), 3.05 – 3.00 (m, 2H), 2.57 (dd, J = 12.4, 3.8 Hz, 2H), 2.29 (d, J = 5.7 Hz, 2H), 2.27 – 2.15 (m, 2H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.3, 151.4, 144.1, 139.5, 134.6, 130.0, 128.8, 127.6, 125.4, 124.7, 122.0, 121.1, 120.0, 116.9, 98.7, 43.8, 37.9, 34.9, 30.0, 24.5, 22.9;

IR (neat): 3051, 1632, 780cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{23}H_{22}NOS^+$: 360.1417; Found: 360.1421.



3j

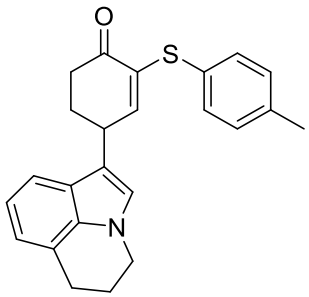
4-(5,6-dihydro-4*H*-pyrrolo[3,2,1-*ij*]quinolin-1-yl)-2-(*m*-tolylthio)cyclohex-2-en-1-one (3j): Pure **3j** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (71 mg, 63% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, *J* = 7.8 Hz, 1H), 7.06 (dd, *J* = 16.7, 8.5 Hz, 2H), 7.00 (d, *J* = 6.1 Hz, 1H), 6.96 (s, 2H), 6.87 (d, *J* = 7.2 Hz, 1H), 6.77 (d, *J* = 7.8 Hz, 1H), 6.17 (d, *J* = 10.2 Hz, 1H), 4.57 (dd, *J* = 7.6, 1.7 Hz, 1H), 4.15 (dt, *J* = 12.2, 5.8 Hz, 2H), 3.03 (s, 2H), 2.62 – 2.54 (m, 2H), 2.33 (d, *J* = 12.9 Hz, 1H), 2.30 – 2.27 (m, 2H), 2.25 (s, 3H), 2.21 (d, *J* = 12.2 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.3, 151.5, 144.0, 139.3, 138.5, 134.6, 130.0, 128.7, 127.7, 126.0, 125.7, 122.4, 121.9, 121.1, 119.9, 116.9, 98.8, 43.8, 38.0, 34.9, 30.0, 24.6, 22.9, 21.4;

IR (neat): 3047, 1632, 779cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{24}H_{24}NOS^+$: 374.1573; Found: 374.1572.



3k

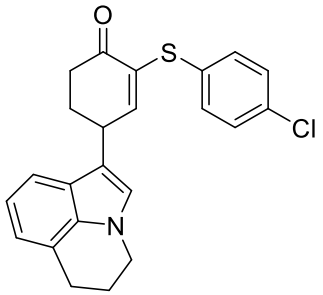
4-(5,6-dihydro-4*H*-pyrrolo[3,2,1-*ij*]quinolin-1-yl)-2-(*p*-tolylthio)cyclohex-2-en-1-one (3k): Pure **3k** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (84 mg, 75% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, J = 7.9 Hz, 1H), 7.07 (t, J = 7.5 Hz, 1H), 7.00 – 6.94 (m, 6H), 6.17 (d, J = 10.0 Hz, 1H), 4.61 – 4.55 (m, 1H), 4.15 (dq, J = 11.7, 6.1 Hz, 2H), 3.03 (t, J = 5.7 Hz, 2H), 2.61 – 2.50 (m, 2H), 2.34 – 2.30 (m, 1H), 2.28 (s, 2H), 2.25 (s, 3H), 2.20 (d, J = 11.6 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.3, 151.5, 143.9, 135.8, 134.6, 134.5, 130.0, 129.6, 127.7, 125.6, 121.9, 121.0, 120.0, 116.9, 99.3, 43.8, 38.0, 34.9, 30.0, 24.6, 22.9, 20.9;

IR (neat): 1632, 1577, 805cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{24}H_{24}NOS^+$: 374.1573; Found: 374.1572.



3l

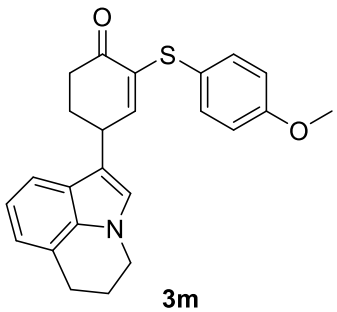
2-((4-chlorophenyl)thio)-4-(5,6-dihydro-4*H*-pyrrolo[3,2,1-*ij*]quinolin-1-yl)cyclohex-2-en-1-one (3l): Pure **3l** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (71 mg, 60% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 (d, J = 7.8 Hz, 1H), 7.12 (d, J = 8.6 Hz, 2H), 7.08 (d, J = 7.7 Hz, 1H), 7.00 (d, J = 7.1 Hz, 1H), 6.97 (s, 2H), 6.95 (s, 1H), 6.20 – 6.15 (m, 1H), 4.56 – 4.50 (m, 1H), 4.16 (dt, J = 11.6, 5.7 Hz, 2H), 3.04 (t, J = 5.9 Hz, 2H), 2.58 (dd, J = 13.3, 4.7 Hz, 2H), 2.31 (s, 1H), 2.29 (d, J = 5.5 Hz, 2H), 2.19 (d, J = 12.5 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.1, 151.1, 144.1, 138.2, 134.6, 130.4, 130.1, 128.9, 127.4, 126.6, 122.1, 121.3, 120.1, 116.7, 98.2, 43.8, 37.9, 34.8, 30.0, 24.5, 22.9;

IR (neat): 1632, 1577, 816cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{23}H_{21}ClNOS^+$: 394.1027; Found: 394.1028.



3m

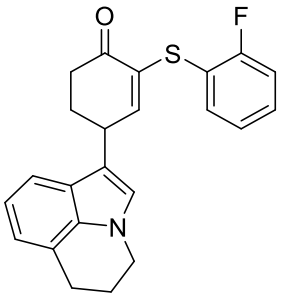
4-(5,6-dihydro-4*H*-pyrrolo[3,2,1-*ij*]quinolin-1-yl)-2-((4-methoxyphenyl)thio)cyclohex-2-en-1-one (3m): Pure **3m** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (88 mg, 75% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (d, J = 7.9 Hz, 1H), 7.09 (d, J = 7.2 Hz, 1H), 7.05 (d, J = 8.9 Hz, 2H), 6.98 (d, J = 7.6 Hz, 2H), 6.74 (d, J = 8.0 Hz, 2H), 6.18 (d, J = 10.0 Hz, 1H), 4.64 – 4.57 (m, 1H), 4.13 (tt, J = 12.1, 6.4 Hz, 2H), 3.73 (s, 3H), 3.01 (t, J = 5.5 Hz, 2H), 2.61 – 2.51 (m, 2H), 2.28 (s, 1H), 2.26 (d, J = 5.5 Hz, 2H), 2.18 (d, J = 10.9 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.3, 157.6, 151.6, 143.6, 134.5, 130.0, 127.8, 127.7, 121.9, 121.0, 119.9, 116.8, 114.6, 100.4, 55.3, 43.8, 38.0, 34.9, 30.0, 24.6, 22.9;

IR (neat): 3038, 1632, 828cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{24}H_{24}NO_2S^+$: 390.1522; Found: 390.1525.



3n

4-(5,6-dihydro-4*H*-pyrrolo[3,2,1-*ij*]quinolin-1-yl)-2-((2-fluorophenyl)thio)cyclohex-2-en-1-one (3n): Pure **3n** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (62 mg, 55% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, J = 7.9 Hz, 1H), 7.09 (t, J = 7.5 Hz, 1H), 7.07 – 7.04 (m, 1H), 7.04 – 6.99 (m, 2H), 6.97 (d, J = 10.3 Hz, 1H), 6.87 (t, J = 7.3 Hz, 1H), 6.74 (t, J = 7.7 Hz, 1H), 6.22 – 6.16 (m, 1H), 4.65 – 4.59 (m, 1H), 4.17 (dq, J = 15.5, 5.9 Hz, 2H), 3.03 (t, J = 5.8 Hz, 2H), 2.60 (dd, J = 10.8, 4.7 Hz, 2H), 2.30 (s, 1H), 2.28 (d, J = 5.4 Hz, 2H), 2.21 (dd, J = 13.0, 3.7 Hz, 1H);

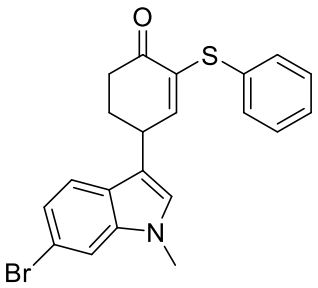
^{13}C NMR (101 MHz, $CDCl_3$) δ 198.2, 159.1 (d, J = 242 Hz), 151.1, 144.4, 134.7, 130.2, 127.6, 127.6, 126.5 (d, J = 17 Hz), 126.4 (d, J = 7 Hz), 124.4 (d, J = 3 Hz), 122.0, 121.2, 120.1, 116.8, 115.2 (d, J = 21 Hz), 96.7, 44.0, 37.9, 34.8, 29.9, 24.5, 22.9;

^{19}F NMR (376 MHz, $CDCl_3$) δ -113.81;

IR (neat): 1633, 1467, 830cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{23}H_{21}FNOS^+$: 378.1322; Found:

378.1324.



3o

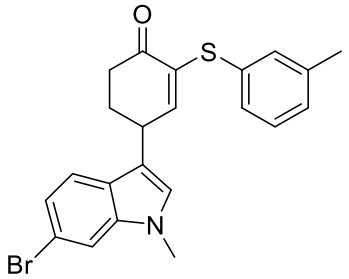
4-(6-bromo-1-methyl-1*H*-indol-3-yl)-2-(phenylthio)cyclohex-2-en-1-one (3o): Pure **3o** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (72 mg, 58% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (s, 1H), 7.44 (d, J = 8.4 Hz, 1H), 7.26 (d, J = 8.0 Hz, 1H), 7.15 (t, J = 7.5 Hz, 2H), 7.06 (t, J = 7.3 Hz, 1H), 6.98 (s, 2H), 6.96 (s, 1H), 6.17 (dd, J = 10.0, 2.5 Hz, 1H), 4.61 – 4.55 (m, 1H), 3.78 (s, 3H), 2.56 (dd, J = 13.3, 4.6 Hz, 2H), 2.30 (dq, J = 12.6, 7.6 Hz, 1H), 2.18 (d, J = 12.9 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 197.9, 150.9, 145.8, 138.7, 138.3, 130.1, 128.9, 128.2, 125.4, 125.0, 124.4, 120.8, 116.4, 112.6, 100.2, 37.9, 35.2, 31.6, 30.0;

IR (neat): 3023, 1632, 828cm^{-1};

HRMS (ESI-TOF) ([M+H]$^+$) Calcd For $C_{21}H_{19}BrNOS^+$: 412.0365; Found: 412.0367.



3p

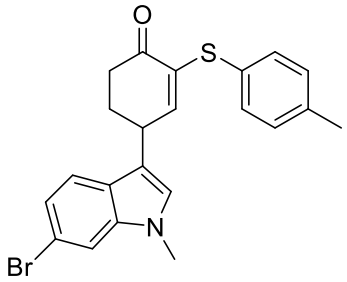
4-(6-bromo-1-methyl-1*H*-indol-3-yl)-2-(*m*-tolylthio)cyclohex-2-en-1-one (3p): Pure **3p** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (77 mg, 60% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (s, 1H), 7.44 (d, J = 8.4 Hz, 1H), 7.26 – 7.24 (m, 1H), 7.01 (d, J = 7.9 Hz, 1H), 6.97 (d, J = 10.1 Hz, 1H), 6.87 (s, 2H), 6.70 (d, J = 7.7 Hz, 1H), 6.20 – 6.15 (m, 1H), 4.61 – 4.54 (m, 1H), 3.78 (s, 3H), 2.61 – 2.53 (m, 2H), 2.30 (dd, J = 12.3, 5.2 Hz, 1H), 2.23 (s, 3H), 2.18 (d, J = 13.4 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 197.9, 151.0, 145.8, 138.7, 138.5, 138.3, 130.1, 128.8, 128.3, 126.0, 124.3, 122.4, 120.9, 116.4, 112.6, 100.3, 37.9, 35.2, 31.6, 30.0, 21.4;

IR (neat): 3050, 1632, 829 cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{22}H_{21}BrNOS^+$: 426.0522; Found: 426.0519.



3q

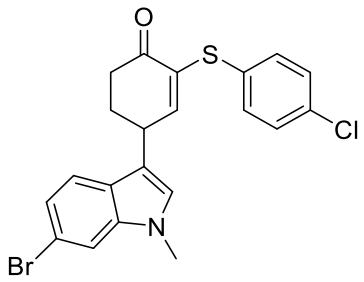
4-(6-bromo-1-methyl-1*H*-indol-3-yl)-2-(*p*-tolylthio)cyclohex-2-en-1-one (3q): Pure **3q** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as light yellow oil (83 mg, 65% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (s, 1H), 7.44 (d, J = 9.0 Hz, 1H), 7.25 (s, 1H), 6.98 (s, 1H), 6.96 (s, 2H), 6.88 (d, J = 7.4 Hz, 2H), 6.17 (d, J = 10.1 Hz, 1H), 4.62 – 4.56 (m, 1H), 3.76 (s, 3H), 2.61 – 2.52 (m, 2H), 2.29 (dd, J = 12.5, 5.5 Hz, 1H), 2.24 (s, 3H), 2.18 (d, J = 12.5 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.0, 151.1, 145.7, 138.3, 135.1, 134.9, 130.0, 129.7, 128.2, 125.6, 124.3, 120.9, 116.4, 112.6, 100.8, 37.9, 35.2, 31.6, 30.0, 20.9;

IR (neat): 3024, 1632, 823cm^{-1};

HRMS (ESI-TOF) ([M+H]$^+$) Calcd For $C_{22}H_{21}BrNOS^+$: 426.0522; Found: 426.0521.



3r

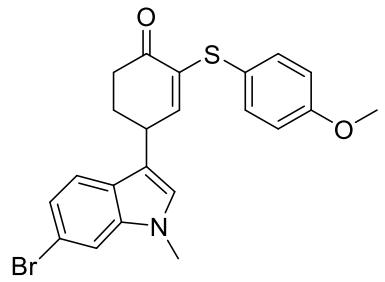
4-(6-bromo-1-methyl-1*H*-indol-3-yl)-2-((4-chlorophenyl)thio)cyclohex-2-en-1-one (3r): Pure **3r** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (68 mg, 51% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (s, 1H), 7.39 (d, J = 8.3 Hz, 1H), 7.25 (s, 1H), 7.11 (d, J = 7.2 Hz, 2H), 6.94 (d, J = 10.3 Hz, 1H), 6.88 (d, J = 7.2 Hz, 2H), 6.17 (d, J = 9.8 Hz, 1H), 4.56 – 4.50 (m, 1H), 3.78 (s, 3H), 2.61 – 2.53 (m, 2H), 2.31 (td, J = 12.7, 4.4 Hz, 1H), 2.18 (d, J = 12.7 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 197.8, 150.6, 146.0, 138.4, 137.4, 130.8, 130.2, 129.0, 128.0, 126.5, 124.5, 120.6, 116.6, 112.7, 99.7, 37.9, 35.1, 31.6, 30.0;

IR (neat): 3023, 1632, 824cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{21}H_{18}BrClNOS^+$: 445.9976; Found: 445.9974.



3s

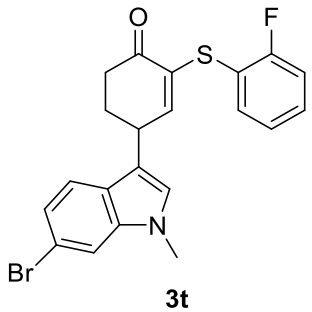
4-(6-bromo-1-methyl-1*H*-indol-3-yl)-2-((4-methoxyphenyl)thio)cyclohex-2-en-1-one (3s): Pure **3s** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (90 mg, 68% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (s, 1H), 7.47 (d, J = 8.4 Hz, 1H), 7.26 – 7.23 (m, 1H), 6.98 (s, 1H), 6.96 (s, 2H), 6.72 (d, J = 8.8 Hz, 2H), 6.18 (dd, J = 10.2, 2.7 Hz, 1H), 4.65 – 4.58 (m, 1H), 3.74 (s, 3H), 3.72 (s, 3H), 2.57 (dd, J = 13.3, 4.1 Hz, 2H), 2.27 (dt, J = 12.5, 6.2 Hz, 1H), 2.15 (d, J = 14.6 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 197.9, 157.8, 151.1, 145.4, 138.2, 130.0, 129.2, 128.2, 127.8, 124.2, 120.8, 116.3, 114.7, 112.5, 101.9, 55.3, 37.9, 35.2, 31.5, 30.0;

IR (neat): 1632, 1577, 874cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{22}H_{21}BrNO_2S^+$: 442.0471; Found: 442.0474.



3t

4-(6-bromo-1-methyl-1*H*-indol-3-yl)-2-((2-fluorophenyl)sulfinyl)cyclohex-2-en-1-one (3t): Pure **3t** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (62 mg, 48% yield);

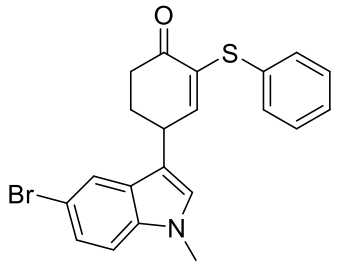
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (s, 1H), 7.44 (d, *J* = 8.4 Hz, 1H), 7.27 (d, *J* = 4.2 Hz, 1H), 7.05 (dd, *J* = 14.7, 7.8 Hz, 2H), 6.97 (d, *J* = 10.3 Hz, 1H), 6.86 (d, *J* = 7.1 Hz, 1H), 6.65 (t, *J* = 7.7 Hz, 1H), 6.21 – 6.17 (m, 1H), 4.66 – 4.61 (m, 1H), 3.79 (s, 3H), 2.59 (dd, *J* = 10.9, 3.8 Hz, 2H), 2.31 (dd, *J* = 12.2, 6.4 Hz, 1H), 2.20 (d, *J* = 11.9 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 197.8, 169.4 (d, *J* = 243 Hz), 150.7, 146.2, 138.4, 130.2, 128.1, 127.6 (d, *J* = 3 Hz), 126.7 (d, *J* = 10 Hz), 125.9 (d, *J* = 17 Hz), 124.5, 124.5, 124.4, 120.7, 116.5, 115.4 (d, *J* = 21 Hz), 112.7, 98.2, 37.9, 35.1, 31.7, 29.9;

^{19}F NMR (376 MHz, $CDCl_3$) δ -113.40;

IR (neat): 3023, 1632, 807cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{21}H_{18}BrFNOS^+$: 430.0271; Found: 430.0275.



3u

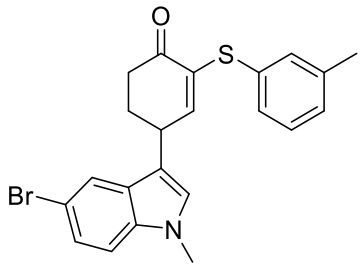
4-(5-bromo-1-methyl-1*H*-indol-3-yl)-2-(phenylthio)cyclohex-2-en-1-one (3u): Pure **3u** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (64 mg, 52% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (s, 1H), 7.36 (d, J = 8.6 Hz, 1H), 7.22 (d, J = 8.5 Hz, 1H), 7.16 (t, J = 7.4 Hz, 2H), 7.06 (t, J = 6.9 Hz, 1H), 6.97 (d, J = 7.2 Hz, 3H), 6.19 – 6.14 (m, 1H), 4.61 – 4.55 (m, 1H), 3.79 (s, 3H), 2.61 – 2.52 (m, 2H), 2.33 – 2.25 (m, 1H), 2.17 (d, J = 13.0 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 197.9, 150.9, 146.4, 138.7, 136.3, 131.1, 130.1, 128.9, 125.8, 125.3, 125.0, 122.0, 114.7, 111.0, 99.4, 37.9, 35.1, 31.6, 29.9;

IR (neat): 3023, 1632, 830cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{21}H_{19}BrNOS^{+}$: 412.0365; Found: 412.0363.



3v

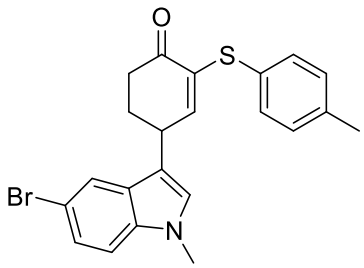
4-(5-bromo-1-methyl-1*H*-indol-3-yl)-2-(*m*-tolylthio)cyclohex-2-en-1-one (3v): Pure **3v** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (70 mg, 55% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (s, 1H), 7.36 (d, J = 8.7 Hz, 1H), 7.22 (d, J = 8.7 Hz, 1H), 7.03 (t, J = 7.6 Hz, 1H), 6.96 (d, J = 10.0 Hz, 1H), 6.88 (d, J = 7.6 Hz, 2H), 6.69 (d, J = 7.8 Hz, 1H), 6.17 (dd, J = 10.0, 2.6 Hz, 1H), 4.61 – 4.55 (m, 1H), 3.79 (s, 3H), 2.56 (dd, J = 13.4, 4.6 Hz, 2H), 2.30 (dd, J = 11.9, 5.5 Hz, 1H), 2.24 (s, 3H), 2.18 (d, J = 12.1 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.0, 151.0, 146.4, 138.7, 138.5, 136.3, 131.2, 130.1, 128.8, 126.0, 125.9, 125.8, 122.3, 122.1, 114.6, 110.9, 99.5, 37.9, 35.2, 31.6, 29.9, 21.4;

IR (neat): 2828, 1682, 778cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{22}H_{21}BrNOS^+$: 426.0522; Found: 426.0521.



3w

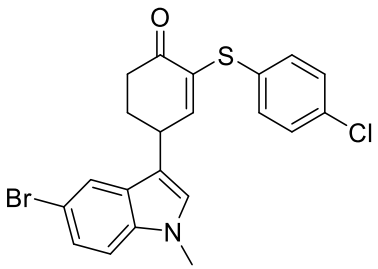
4-(5-bromo-1-methyl-1*H*-indol-3-yl)-2-(*p*-tolylthio)cyclohex-2-en-1-one (3w): Pure **3w** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (83 mg, 65% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.73 (s, 1H), 7.35 (d, J = 8.6 Hz, 1H), 7.21 (d, J = 8.6 Hz, 1H), 6.99 (s, 1H), 6.96 (d, J = 5.1 Hz, 2H), 6.88 (d, J = 7.4 Hz, 2H), 6.17 (d, J = 10.1 Hz, 1H), 4.59 (dd, J = 7.1, 2.4 Hz, 1H), 3.78 (s, 3H), 2.56 (dd, J = 13.4, 4.2 Hz, 2H), 2.32 (dd, J = 12.7, 5.2 Hz, 1H), 2.25 (s, 3H), 2.18 (d, J = 12.3 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.0, 151.0, 146.3, 136.2, 135.1, 134.9, 131.2, 130.0, 129.7, 125.7, 125.5, 122.0, 114.6, 110.9, 99.9, 37.9, 35.1, 31.6, 30.0, 20.9;

IR (neat): 2927, 1632, 872cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{22}H_{21}BrNOS^+$: 426.0522; Found: 426.0524.



3x

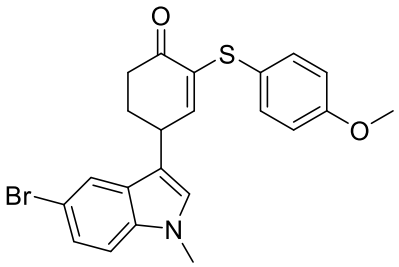
4-(5-bromo-1-methyl-1*H*-indol-3-yl)-2-((4-chlorophenyl)thio)cyclohex-2-en-1-one (3x): Pure **3x** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (68 mg, 51% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (s, 1H), 7.37 (d, J = 8.7 Hz, 1H), 7.23 (d, J = 8.8 Hz, 1H), 7.12 (d, J = 8.5 Hz, 2H), 6.93 (d, J = 10.1 Hz, 1H), 6.88 (d, J = 8.5 Hz, 2H), 6.17 (dd, J = 10.0, 2.6 Hz, 1H), 4.57 – 4.51 (m, 1H), 3.80 (s, 3H), 2.57 (dd, J = 18.8, 5.3 Hz, 2H), 2.30 (dt, J = 12.1, 6.7 Hz, 1H), 2.17 (d, J = 12.5 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 197.8, 150.6, 146.5, 137.4, 136.3, 130.9, 130.8, 130.2, 129.0, 126.5, 126.0, 121.8, 114.8, 111.1, 98.8, 37.9, 35.1, 31.6, 30.0;

IR (neat): 2911, 1646, 874cm^{-1};

HRMS (ESI-TOF) ([M+H]$^+$) Calcd For $C_{21}H_{18}BrClNOS^+$: 445.9976; Found: 445.9977.



3y

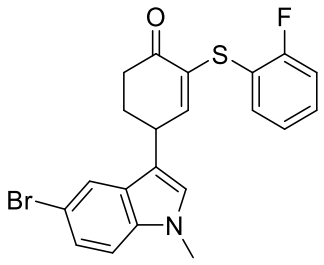
4-(5-bromo-1-methyl-1*H*-indol-3-yl)-2-((4-methoxyphenyl)thio)cyclohex-2-en-1-one (3y): Pure **3y** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (82 mg, 62% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (s, 1H), 7.34 (d, *J* = 8.1 Hz, 1H), 7.20 (d, *J* = 8.6 Hz, 1H), 6.96 (d, *J* = 8.6 Hz, 3H), 6.73 (d, *J* = 8.5 Hz, 2H), 6.18 (d, *J* = 10.1 Hz, 1H), 4.62 (dd, *J* = 8.6, 2.2 Hz, 1H), 3.76 (s, 3H), 3.72 (s, 3H), 2.61 – 2.55 (m, 2H), 2.27 (dd, *J* = 12.2, 5.2 Hz, 1H), 2.14 (d, *J* = 14.1 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 198.0, 157.8, 151.1, 146.0, 136.1, 131.2, 130.0, 129.2, 127.7, 125.7, 122.0, 114.7, 114.5, 110.9, 101.0, 55.3, 37.9, 35.1, 31.6, 29.9;

IR (neat): 3023, 1492, 825cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{22}H_{21}BrNO_2S^+$: 442.0471; Found: 442.0474.



3z

4-(5-bromo-1-methyl-1*H*-indol-3-yl)-2-((2-fluorophenyl)thio)cyclohex-2-en-1-one (3z): Pure **3z** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 5:1) as yellow oil (59 mg, 46% yield);

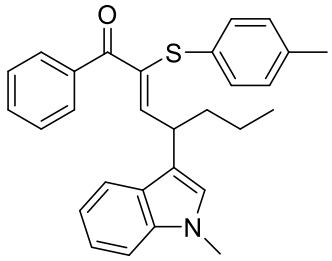
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (s, 1H), 7.35 (d, J = 8.7 Hz, 1H), 7.22 (d, J = 8.7 Hz, 1H), 7.04 (dd, J = 14.5, 7.9 Hz, 2H), 6.95 (d, J = 10.1 Hz, 1H), 6.87 (t, J = 7.4 Hz, 1H), 6.63 (t, J = 7.7 Hz, 1H), 6.18 (dd, J = 10.4, 2.2 Hz, 1H), 4.66 – 4.61 (m, 1H), 3.79 (s, 3H), 2.58 (dd, J = 11.7, 5.1 Hz, 2H), 2.30 (dd, J = 12.4, 6.5 Hz, 1H), 2.18 (d, J = 11.4 Hz, 1H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 197.8, 159.2 (d, J = 243 Hz), 150.6, 146.8, 136.4, 131.0, 130.3, 127.4 (d, J = 3 Hz), 126.7 (d, J = 7 Hz), 125.9, 125.8, 125.7, 124.6 (d, J = 4 Hz), 121.9, 115.4 (d, J = 20 Hz), 114.7, 111.1, 97.3, 97.3, 37.9, 35.1, 31.2, 29.9;

^{19}F NMR (376 MHz, $CDCl_3$) δ -113.47;

IR (neat): 1683, 1633, 791cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{21}H_{18}BrFNOS^+$: 430.0271; Found: 430.0269.



3ab

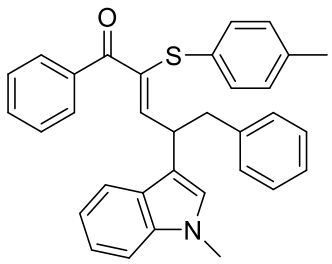
(Z)-4-(1-methyl-1*H*-indol-3-yl)-1-phenyl-2-(*p*-tolylthio)hept-2-en-1-one (3ab): Pure **3ab** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow solid (86 mg, 65% yield); mp 198-201 ^{o}C

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.79 (t, J = 6.8 Hz, 3H), 7.52 – 7.31 (m, 6H), 7.17 (t, J = 7.1 Hz, 1H), 7.00 (d, J = 7.9 Hz, 2H), 6.91 (d, J = 8.1 Hz, 2H), 6.80 (d, J = 15.3 Hz, 1H), 4.30 (q, J = 7.3 Hz, 1H), 3.75 (s, 3H), 2.24 (s, 3H), 2.08 (dt, J = 12.8, 6.7 Hz, 2H), 1.33 (dd, J = 12.7, 5.9 Hz, 2H), 0.91 (t, J = 7.3 Hz, 3H);

^{13}C NMR (101 MHz, CDCl$_3$) δ 191.0, 151.9, 138.5, 138.0, 135.5, 133.5, 132.5, 129.9, 128.5, 128.4, 126.2, 125.4, 125.4, 125.2, 123.2, 123.2, 120.6, 119.5, 110.1, 41.4, 36.4, 30.2, 21.1, 20.9, 14.0;

IR (neat): 1668, 1597, 804cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{29}H_{30}NOS^{+}$: 440.2043; Found: 440.2044.



3ac

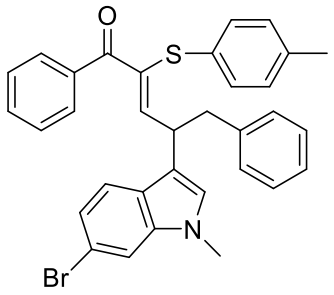
(Z)-4-(1-methyl-1*H*-indol-3-yl)-1,5-diphenyl-2-(*p*-tolylthio)pent-2-en-1-one (3ac): Pure **3ac** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (98 mg, 67% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, J = 7.8 Hz, 1H), 7.71 (d, J = 7.6 Hz, 2H), 7.52 – 7.46 (m, 2H), 7.35 (q, J = 8.5, 8.0 Hz, 5H), 7.21 (s, 1H), 7.17 (s, 1H), 7.16 (s, 1H), 7.07 (d, J = 6.4 Hz, 2H), 6.93 (d, J = 7.6 Hz, 2H), 6.74 (s, 1H), 6.71 (d, J = 7.0 Hz, 1H), 4.57 (q, J = 7.1 Hz, 1H), 3.65 (s, 3H), 3.37 (dd, J = 15.8, 7.8 Hz, 2H), 2.22 (s, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 190.9, 150.4, 139.6, 138.5, 137.9, 135.5, 133.1, 132.5, 129.9, 129.1, 128.5, 128.3, 128.3, 126.4, 126.1, 125.9, 125.9, 125.3, 123.1, 122.3, 120.6, 119.6, 110.1, 43.8, 40.8, 30.2, 30.2, 20.9;

IR (neat): 1632, 1349, 918cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{33}H_{30}NOS^{+}$: 488.2043; Found: 488.2046.



3ad

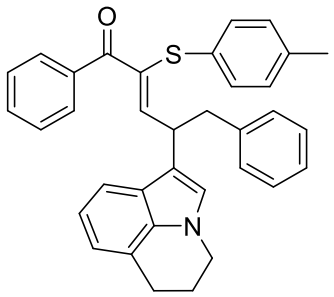
(Z)-4-(6-bromo-1-methyl-1*H*-indol-3-yl)-1,5-diphenyl-2-(*p*-tolylthio)pent-2-en-1-one (3ad): Pure **3ad** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow solid (95 mg, 56% yield); mp 188-191 ^{o}C

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, J = 7.5 Hz, 2H), 7.66 (d, J = 8.5 Hz, 1H), 7.50 (s, 2H), 7.46 – 7.41 (m, 1H), 7.39 (d, J = 7.5 Hz, 2H), 7.28 (s, 1H), 7.25 (d, J = 2.6 Hz, 1H), 7.16 (s, 1H), 7.14 (s, 2H), 7.03 (s, 1H), 7.02 (s, 1H), 6.92 (d, J = 8.0 Hz, 2H), 6.73 (s, 1H), 6.66 (s, 2H), 4.56 – 4.51 (m, 1H), 3.58 (s, 3H), 3.32 (dd, J = 15.8, 7.8 Hz, 2H), 2.21 (s, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 190.7, 150.1, 139.3, 139.2, 137.7, 135.8, 132.6, 132.5, 130.0, 128.5, 128.4, 1283, 127.1, 126.6, 126.2, 125.8, 124.1, 122.9, 122.3, 121.7, 117.1, 113.1, 43.6, 40.6, 30.36, 20.9;

IR (neat): 3024, 1632, 803cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{33}H_{29}BrNOS^+$: 566.1148; Found: 566.1151.



3ae

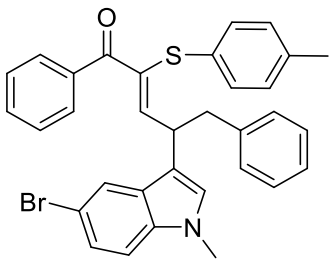
(Z)-4-(5,6-dihydro-4*H*-pyrrolo[3,2,1-*ij*]quinolin-1-yl)-1,5-diphenyl-2-(*p*-tolylthio)pent-2-en-1-one (3ae): Pure **3ae** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 15:1) as yellow oil (94 mg, 61% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.70 (d, J = 7.9 Hz, 2H), 7.64 (d, J = 8.0 Hz, 1H), 7.51 – 7.47 (m, 1H), 7.46 – 7.39 (m, 1H), 7.36 (t, J = 7.6 Hz, 2H), 7.17 (d, J = 7.1 Hz, 2H), 7.15 – 7.13 (m, 1H), 7.09 (d, J = 6.6 Hz, 2H), 7.06 (s, 1H), 6.99 (d, J = 7.1 Hz, 1H), 6.91 (d, J = 7.9 Hz, 2H), 6.72 (d, J = 6.9 Hz, 2H), 6.69 (s, 1H), 4.51 (q, J = 7.5 Hz, 1H), 3.93 (tt, J = 13.0, 6.8 Hz, 2H), 3.34 (tt, J = 13.1, 6.4 Hz, 2H), 2.96 (t, J = 5.2 Hz, 2H), 2.21 (s, 3H), 2.16 – 2.09 (m, 2H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 191.0, 150.6, 139.7, 137.9, 136.0, 135.5, 133.1, 132.5, 129.9, 129.2, 128.5, 128.3, 128.3, 126.5, 126.1, 125.7, 123.9, 123.4, 122.2, 121.6, 119.9, 119.8, 118.0, 43.6, 42.1, 40.9, 25.1, 22.7, 20.9;

IR (neat): 1632, 1560, 829cm^{-1};

HRMS (ESI-TOF) ([M+H]$^+$) Calcd For $C_{35}H_{32}NOS^+$: 514.2199; Found: 514.2201.



3af

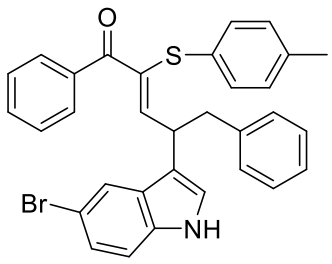
(Z)-4-(5-bromo-1-methyl-1*H*-indol-3-yl)-1,5-diphenyl-2-(*p*-tolylthio)pent-2-en-1-one (3af): Pure **3af** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow solid (86 mg, 51% yield); mp 188-191 ^{o}C

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.93 (d, J = 1.5 Hz, 1H), 7.73 (d, J = 7.2 Hz, 2H), 7.51 (t, J = 7.4 Hz, 1H), 7.39 (t, J = 7.6 Hz, 5H), 7.22 – 7.17 (m, 2H), 7.16 (s, 2H), 7.07 – 7.04 (m, 2H), 6.93 (d, J = 8.0 Hz, 2H), 6.70 – 6.68 (m, 2H), 4.55 – 4.50 (m, 1H), 3.61 (s, 3H), 3.37 – 3.27 (m, 2H), 2.21 (s, 3H);

^{13}C NMR (101 MHz, CDCl$_3$) δ 190.9, 149.8, 139.3, 137.8, 137.0, 135.9, 132.7, 132.4, 130.0, 129.1, 128.4, 128.3, 127.7, 126.8, 126.6, 126.3, 126.1, 126.0, 122.8, 121.5, 113.0, 111.6, 43.6, 40.6, 30.4, 20.9;

IR (neat): 3023, 1632, 829cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{33}H_{29}BrNOS^{+}$: 566.1148; Found: 566.1138.



3ag

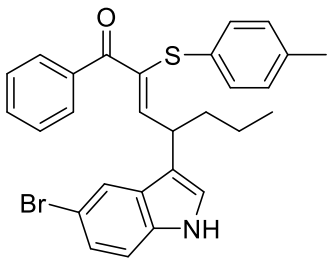
(Z)-4-(5-bromo-1*H*-indol-3-yl)-1,5-diphenyl-2-(*p*-tolylthio)pent-2-en-1-one (3ag): Pure **3ag** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as light yellow oil (116 mg, 70% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.89 (s, 1H), 7.77 (d, *J* = 7.0 Hz, 2H), 7.71 (s, 1H), 7.58 (d, *J* = 7.3 Hz, 1H), 7.44 (d, *J* = 5.6 Hz, 3H), 7.26 – 7.23 (m, 1H), 7.13 (s, 4H), 7.04 (s, 2H), 6.89 (d, *J* = 7.7 Hz, 4H), 6.81 (d, *J* = 15.8 Hz, 1H), 4.70 (d, *J* = 7.3 Hz, 1H), 3.20 (d, *J* = 7.2 Hz, 2H), 2.19 (s, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 191.2, 148.1, 144.8, 137.8, 137.1, 134.8, 134.8, 134.7, 133.5, 131.8, 129.6, 128.9, 128.7, 128.7, 128.5, 126.9, 126.7, 125.9, 125.6, 121.9, 114.2, 112.8, 100.4, 42.2, 40.5, 20.8;

IR (neat): 3023, 1491, 803cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{32}H_{27}BrNOS^+$: 552.0991; Found: 552.0997.



3ah

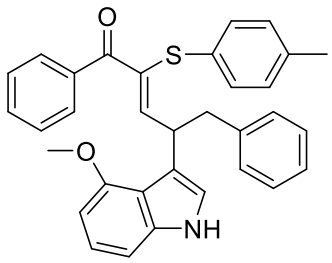
(Z)-4-(5-bromo-1*H*-indol-3-yl)-1-phenyl-2-(*p*-tolylthio)hept-2-en-1-one (3ah): Pure **3ah** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (98 mg, 65% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.67 (s, 1H), 7.79 (d, J = 8.0 Hz, 3H), 7.58 (s, 1H), 7.43 (t, J = 7.7 Hz, 3H), 7.33 – 7.27 (m, 2H), 7.17 (d, J = 8.5 Hz, 1H), 6.94 (s, 3H), 6.84 (d, J = 15.2 Hz, 1H), 4.36 (d, J = 7.7 Hz, 1H), 2.18 (s, 3H), 1.86 (d, J = 6.9 Hz, 2H), 1.27 (t, J = 7.4 Hz, 2H), 0.84 (s, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 191.1, 149.1, 145.6, 137.2, 135.0, 134.7, 134.6, 133.4, 131.9, 129.6, 128.7, 128.6, 126.1, 125.8, 125.5, 121.8, 114.2, 112.8, 100.2, 40.0, 36.0, 20.8, 20.6, 13.7;

IR (neat): 3023, 1632, 801cm^{-1};

HRMS (ESI-TOF) ([M+H]$^+$) Calcd For $C_{28}H_{27}BrNOS^+$: 504.0991; Found: 504.0984.



3ai

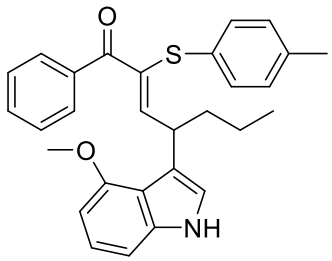
(Z)-4-(4-methoxy-1*H*-indol-3-yl)-1,5-diphenyl-2-(*p*-tolylthio)pent-2-en-1-one (3ai): Pure **3ai** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow solid (91 mg, 60% yield); mp 175-177 ^{o}C

^{1}H NMR (400 MHz, CDCl$_3$) δ 9.35 (s, 1H), 7.74 (d, *J* = 7.7 Hz, 2H), 7.54 (s, 1H), 7.40 (t, *J* = 7.7 Hz, 3H), 7.13 (s, 3H), 7.08 (d, *J* = 8.9 Hz, 3H), 6.95 – 6.93 (m, 3H), 6.89 (d, *J* = 7.8 Hz, 2H), 6.76 (d, *J* = 15.4 Hz, 1H), 6.53 (d, *J* = 7.8 Hz, 1H), 4.77 (d, *J* = 7.4 Hz, 1H), 3.72 (s, 3H), 3.18 (t, *J* = 6.7 Hz, 2H), 2.19 (s, 3H);

^{13}C NMR (101 MHz, CDCl$_3$) δ 190.9, 154.4, 148.4, 142.3, 138.1, 137.7, 137.3, 137.0, 134.0, 133.2, 129.2, 129.0, 128.6, 128.6, 128.5, 126.8, 126.5, 126.2, 123.3, 119.3, 104.7, 101.6, 55.6, 41.5, 40.4, 20.9;

IR (neat): 2831, 1585, 779cm^{-1};

HRMS (ESI-TOF) ([M+H]$^{+}$) Calcd For $C_{33}H_{30}NO_2S^{+}$: 504.1992; Found: 504.1992.



3aj

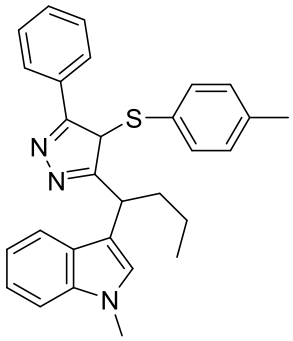
(Z)-4-(4-methoxy-1*H*-indol-3-yl)-1-phenyl-2-(*p*-tolylthio)hept-2-en-1-one (3aj): Pure **3aj** was prepared with general procedure and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (76 mg, 56% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 9.25 (s, 1H), 7.77 (d, *J* = 7.8 Hz, 2H), 7.54 (t, *J* = 7.3 Hz, 1H), 7.40 (t, *J* = 7.6 Hz, 2H), 7.25 (d, *J* = 7.5 Hz, 1H), 7.10 (s, 1H), 7.03 (d, *J* = 8.0 Hz, 2H), 6.97 (d, *J* = 8.1 Hz, 1H), 6.93 (d, *J* = 7.8 Hz, 2H), 6.80 (d, *J* = 15.3 Hz, 1H), 6.55 (d, *J* = 7.8 Hz, 1H), 4.46 – 4.40 (m, 1H), 3.74 (s, 3H), 2.19 (s, 3H), 1.84 (d, *J* = 7.6 Hz, 2H), 1.29 – 1.25 (m, 2H), 0.84 (t, *J* = 7.3 Hz, 3H);

^{13}C NMR (101 MHz, $CDCl_3$) δ 191.0, 154.3, 149.7, 143.0, 137.7, 137.4, 137.3, 133.9, 133.0, 129.2, 128.6, 128.6, 126.1, 126.0, 123.2, 119.4, 104.6, 101.6, 99.8, 55.7, 39.4, 36.0, 20.8, 20.5, 13.8;

IR (neat): 2826, 1592, 784cm^{-1};

HRMS (ESI-TOF) ($[M+H]^+$) Calcd For $C_{29}H_{30}NO_2S^+$: 456.1992; Found: 456.1994.



4a

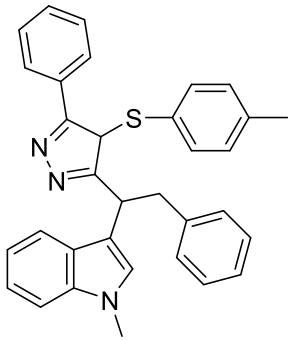
1-methyl-3-(2-phenyl-1-(5-phenyl-4-(*p*-tolylthio)-4*H*-pyrazol-3-yl)ethyl)-1*H*-indole (4a): Pure **4a** was prepared with general procedure for the further transformations and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (384 mg, 85% yield);

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (dt, J = 17.0, 8.0 Hz, 4.7H), 7.38 – 7.32 (m, 3H), 7.30 – 7.24 (m, 3H), 7.20 (t, J = 7.2 Hz, 2H), 7.08 (d, J = 11.0 Hz, 4H), 7.02 (d, J = 6.9 Hz, 1.7H), 6.92 – 6.84 (m, 3H), 6.46 (s, 1H), 4.94 (t, J = 4.5 Hz, 1H), 4.69 (t, J = 7.3 Hz, 0.6H), 3.75 (s, 3H), 3.68 (s, 2H), 2.41 (s, 1H), 2.41 (s, 0.6H), 2.26 (s, 3H), 2.26 (s, 2H), 1.62 – 1.56 (m, 2H), 1.56 – 1.51 (m, 1.2H), 1.45 – 1.51 (m, 2H), 1.38 – 1.45 (m, 1.2H), 0.88 (t, J = 7.5 Hz 3H), 0.78 (t, J = 7.3 Hz, 2)

^{13}C NMR (101 MHz, $CDCl_3$) δ 138.5, 137.1, 136.8, 135.8, 133.5, 130.1, 128.6, 127.9, 127.6, 127.6, 127.5, 127.0, 126.2, 126.0, 125.5, 125.3, 123.2, 122.6, 121.6, 121.3, 120.5, 119.7, 119.5, 119.3, 118.8, 118.6, 117.4, 116.7, 110.0, 109.1, 100.6, 74.3, 48.3, 36.0, 35.5, 34.8, 33.7, 32.8, 32.7, 31.4, 30.2, 29.7, 28.7, 22.8, 22.4, 21.0, 20.9, 14.6, 14.1, 13.9;

IR (neat): 3032, 1632, 807cm^{-1};

HRMS (ESI-TOF) ([M+H]$^+$) Calcd For $C_{29}H_{30}N_3S^+$: 452.2153; Found: 452.2162.



4b

1-methyl-3-(1-(5-phenyl-4-(*p*-tolylthio)-4*H*-pyrazol-3-yl)butyl)-1*H*-indole (4b): Pure **4b** was prepared with general procedure for the further transformations and isolated through a silica gel flash column (PE:EtOAc = 8:1) as yellow oil (399 mg, 80% yield);

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.78 (d, J = 8.0 Hz, 1H), 7.69 (d, J = 8.0 Hz, 2H), 7.34 (dd, J = 16.9, 8.0 Hz, 6H), 7.15 (d, J = 5.0 Hz, 3H), 7.07 – 7.04 (m, 2H), 6.95 (d, J = 7.9 Hz, 2H), 6.69 (d, J = 8.0 Hz, 2H), 6.48 (s, 1H), 5.06 (t, J = 8.5 Hz, 1H), 3.75 – 3.70 (m, 1H), 3.63 (s, 3H), 3.61 – 3.54 (m, 2H), 2.26 (s, 3H);

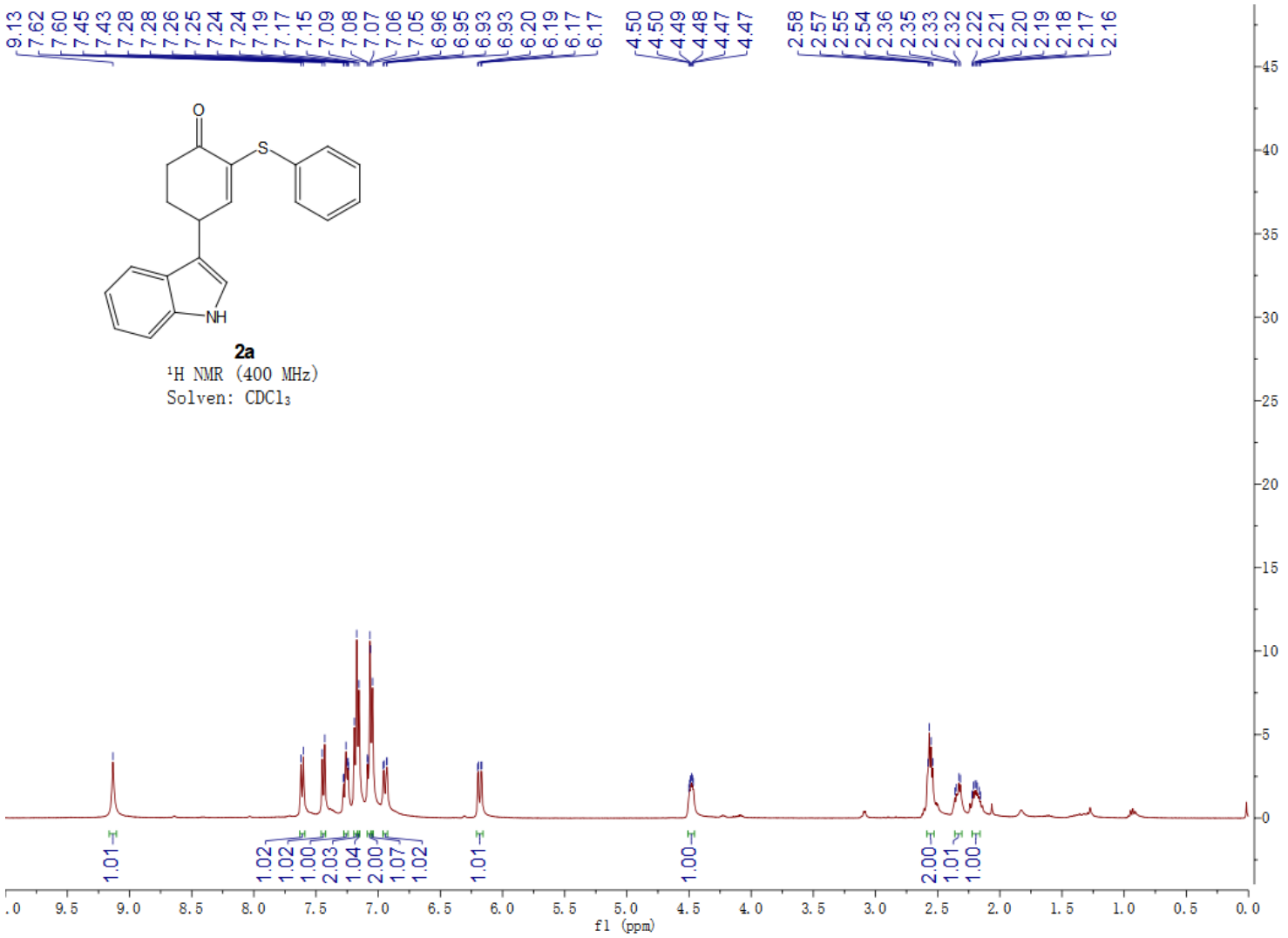
^{13}C NMR (101 MHz, CDCl$_3$) δ 139.7, 138.5, 135.7, 133.1, 132.6, 130.0, 129.1, 128.6, 128.2, 127.7, 126.6, 126.2, 1256, 125.4, 124.4, 123.1, 121.7, 120.7, 119.8, 110.0, 101.2, 63.0, 40.3, 38.2, 14.2;

IR (neat): 3046, 1461, 739cm^{-1};

HRMS (ESI-TOF) ([M+Na]$^{+}$) Calcd For $C_{33}H_{29}N_3NaS^{+}$: 522.1974;

Found: 522.1994.

5. Characterization data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2.32
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2.21
2.20
2.19
2.18
2.17
2.16
O
S
NH
2a
¹H NMR (400 MHz)
Solven: CDCl₃
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1.02
1.02
1.00
2.03
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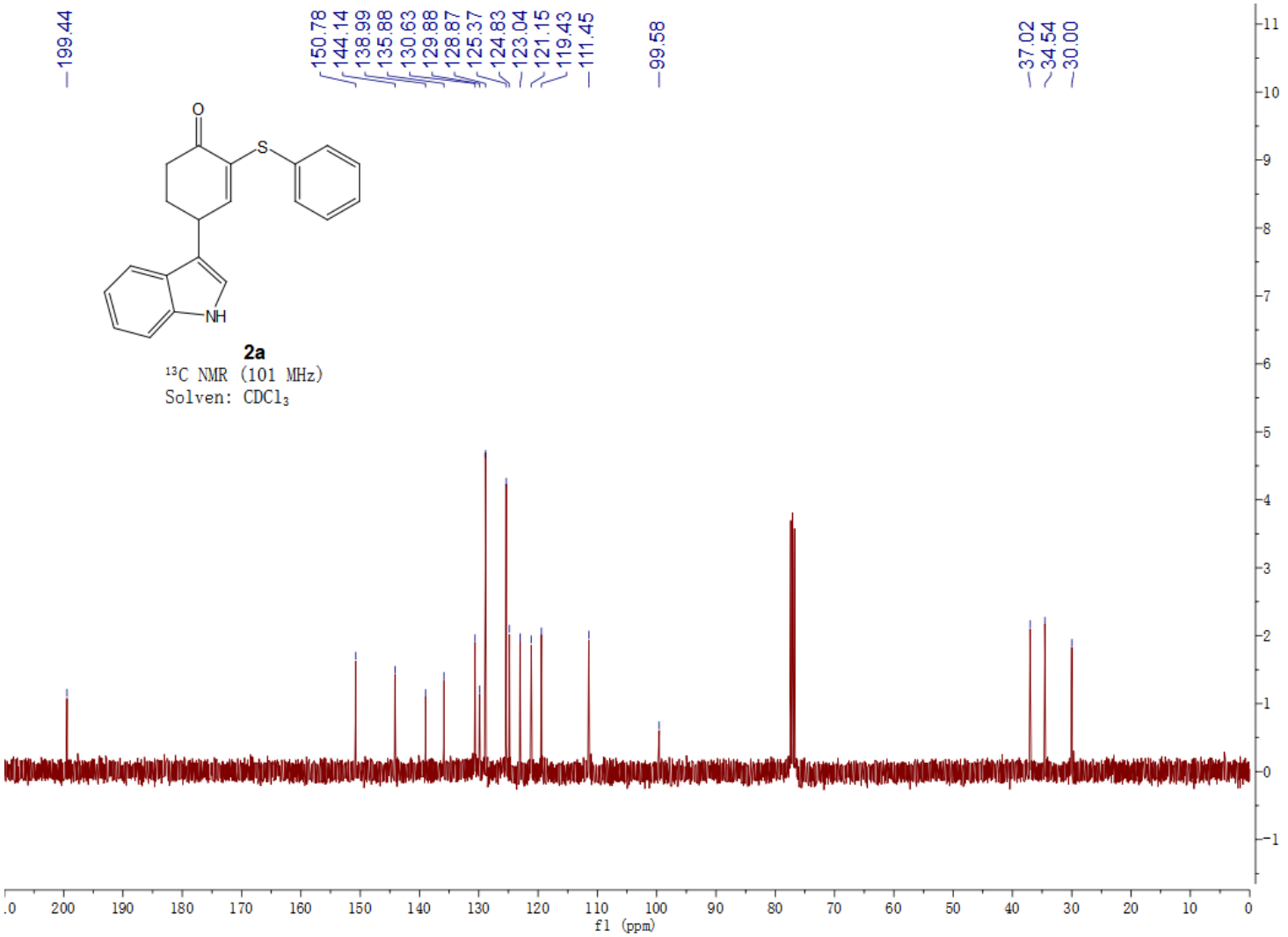
2.00
1.07
1.02
1.01
1.00
2.00
1.01
1.00
f1 (ppm)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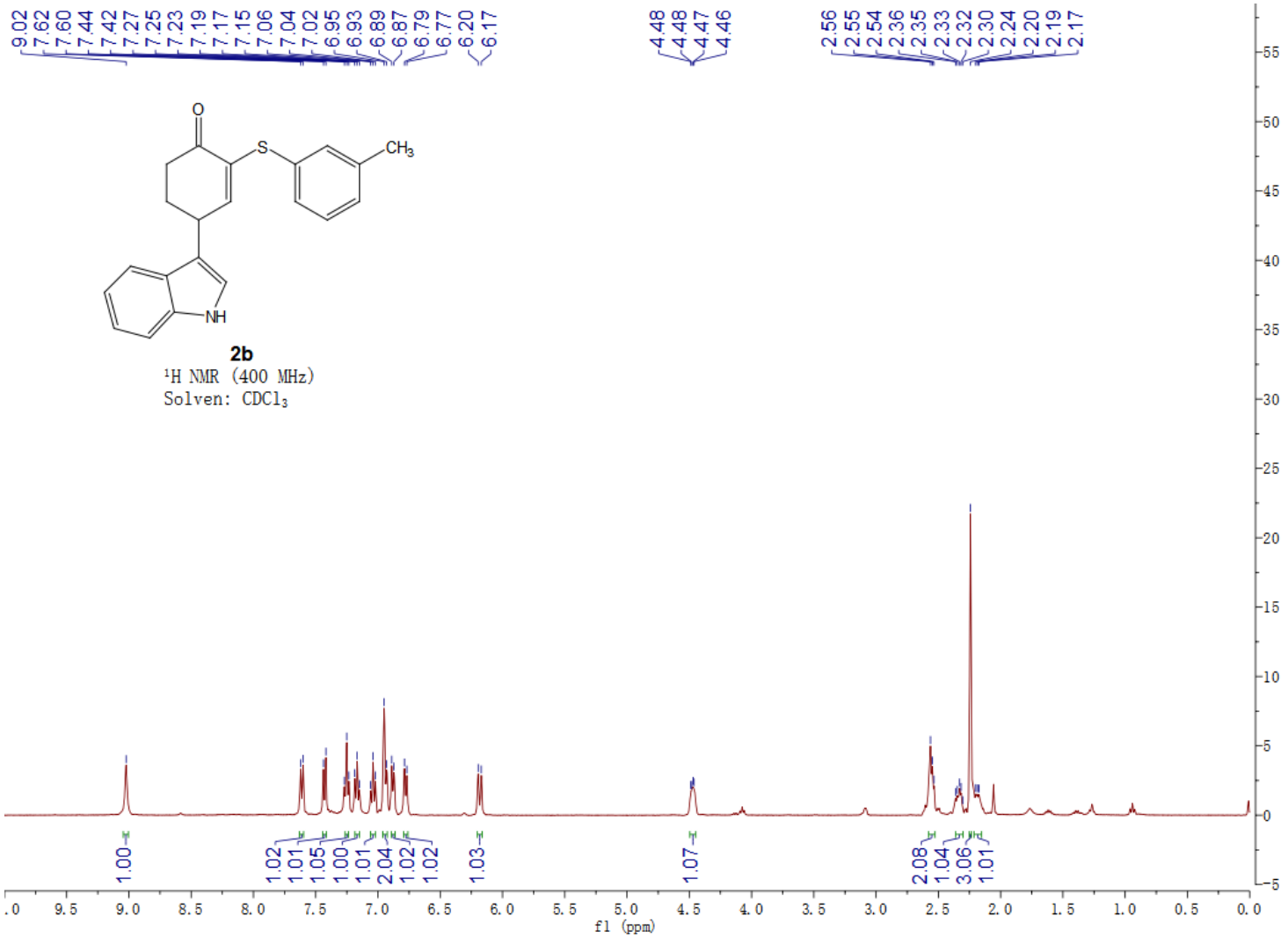
Solven: CDCl3
f1 (ppm)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6.79
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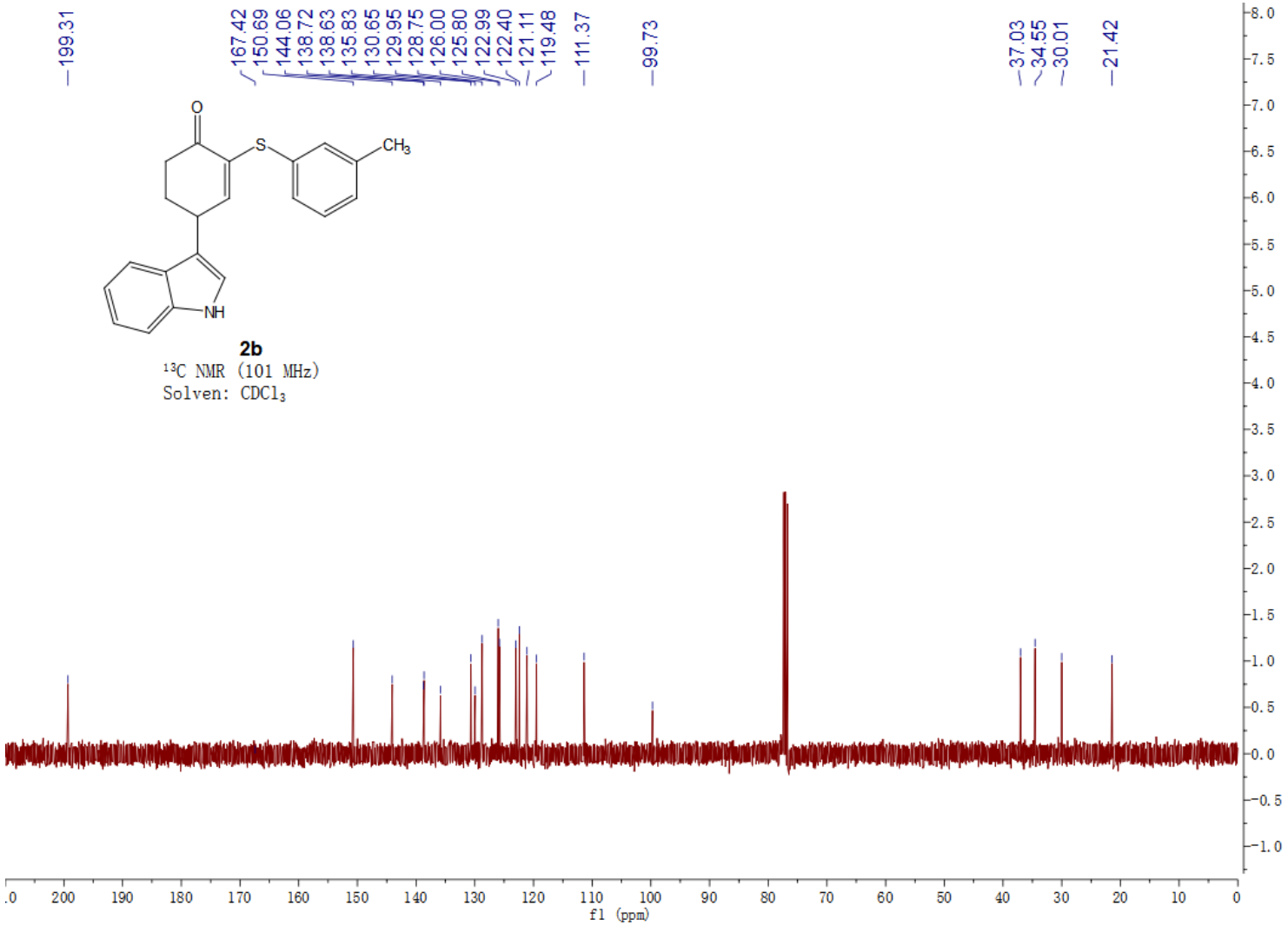
2.30
2.24
2.20
2.19
2.17
O
S
CH3
NH
2b
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.02
1.01
1.05
1.00
1.01
2.04
1.02
1.02
1.03
1.07
2.08
1.04
3.06
1.01
f1 (ppm)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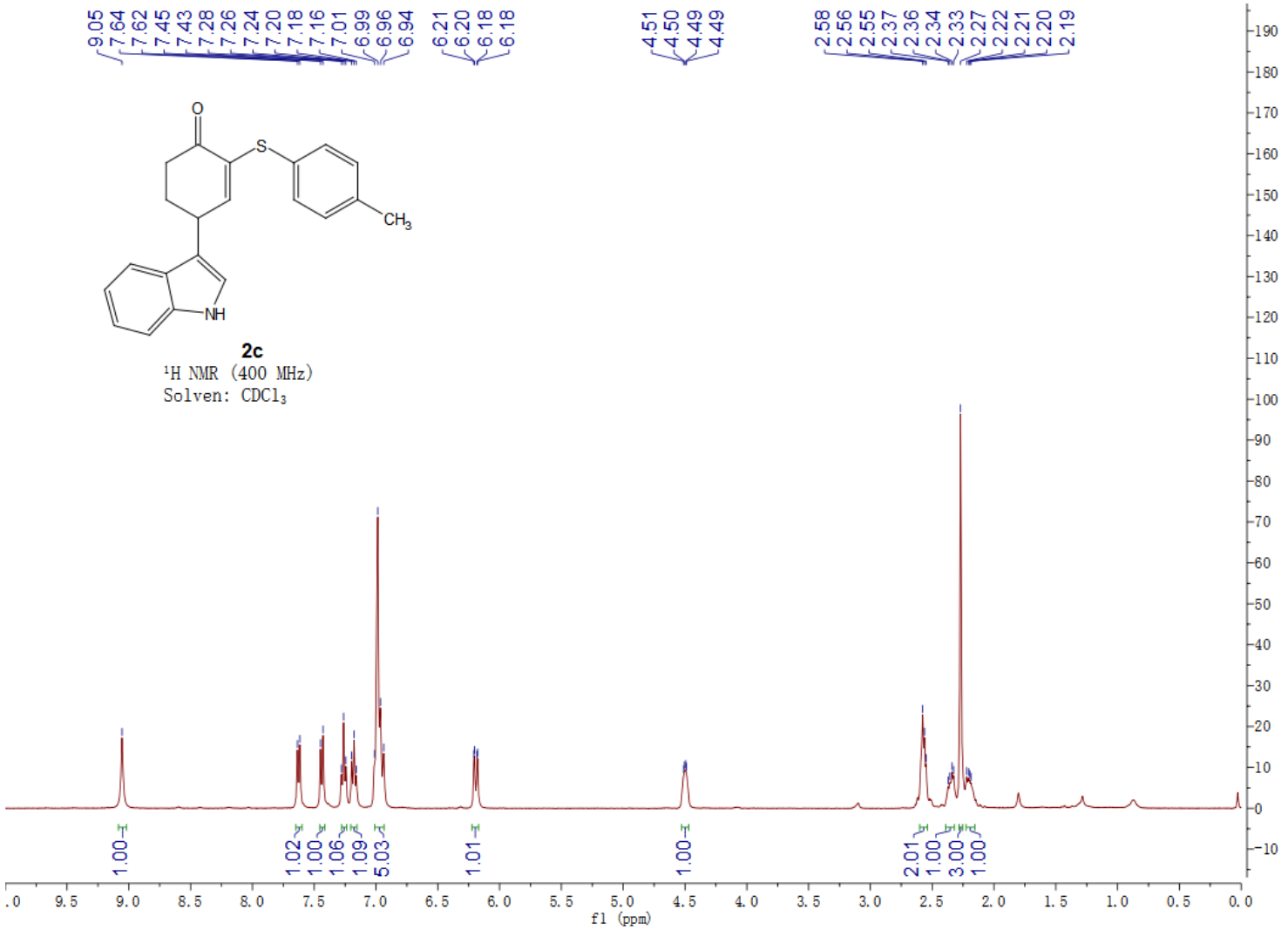
130.65
129.95
128.75
126.00
125.80
122.99
122.40
121.11
119.48
111.37
99.73
37.03
34.55
30.01
21.42
O
S
CH3
NH
2b
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.28
7.26
7.24
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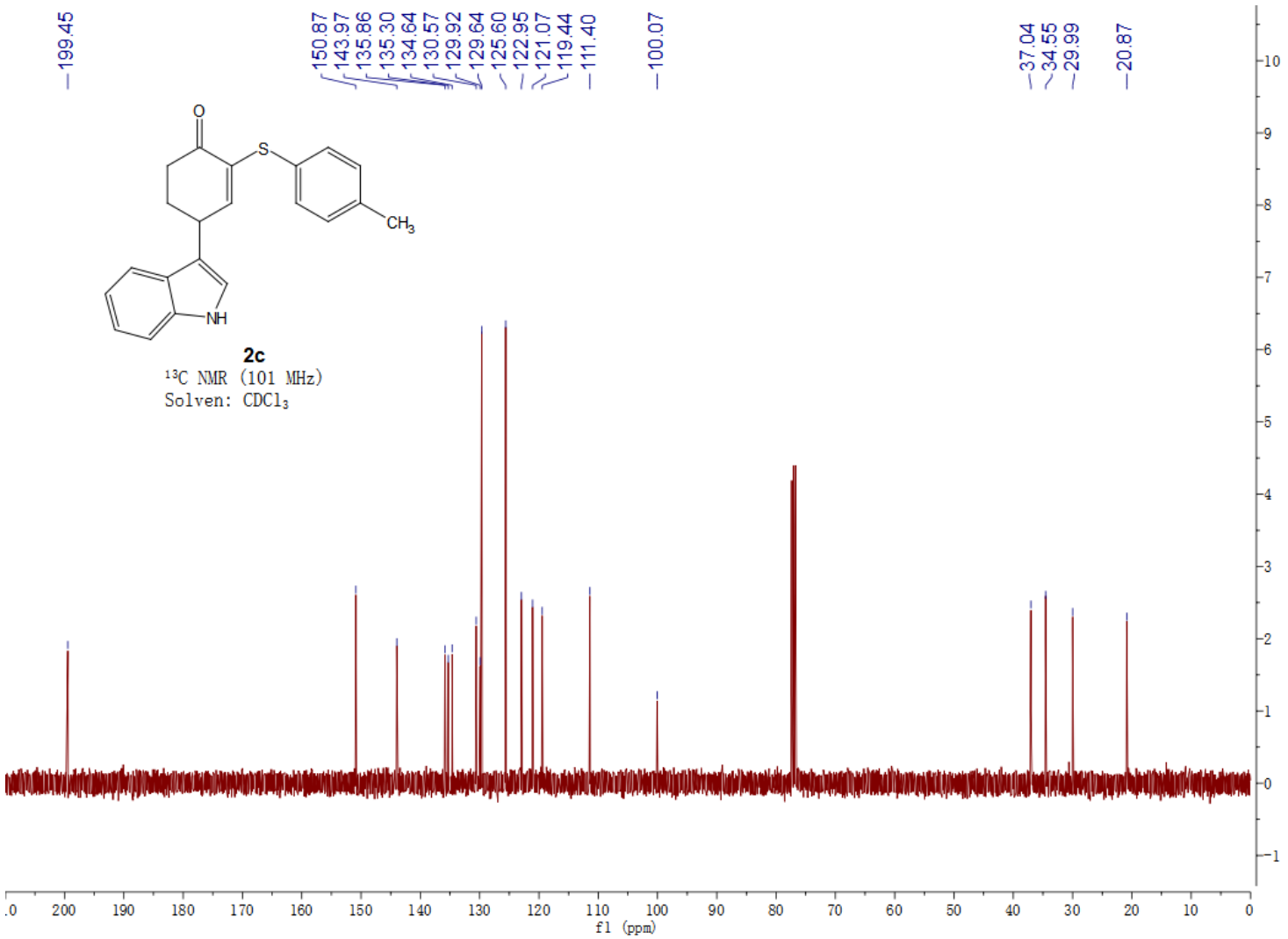
7.18
7.16
7.01
6.99
6.96
6.94
6.21
6.20
6.18
6.18
4.51
4.50
4.49
4.49
2.58
2.56
2.55
2.37
2.36
2.34
2.33
2.27
2.22
2.21
2.20
2.19
O
S
CH3
NH
2c
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.02
1.00
1.06
1.09
5.03
1.01
1.00
2.01
1.00
3.00
1.00
f1 (ppm)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150.87
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135.86
135.30
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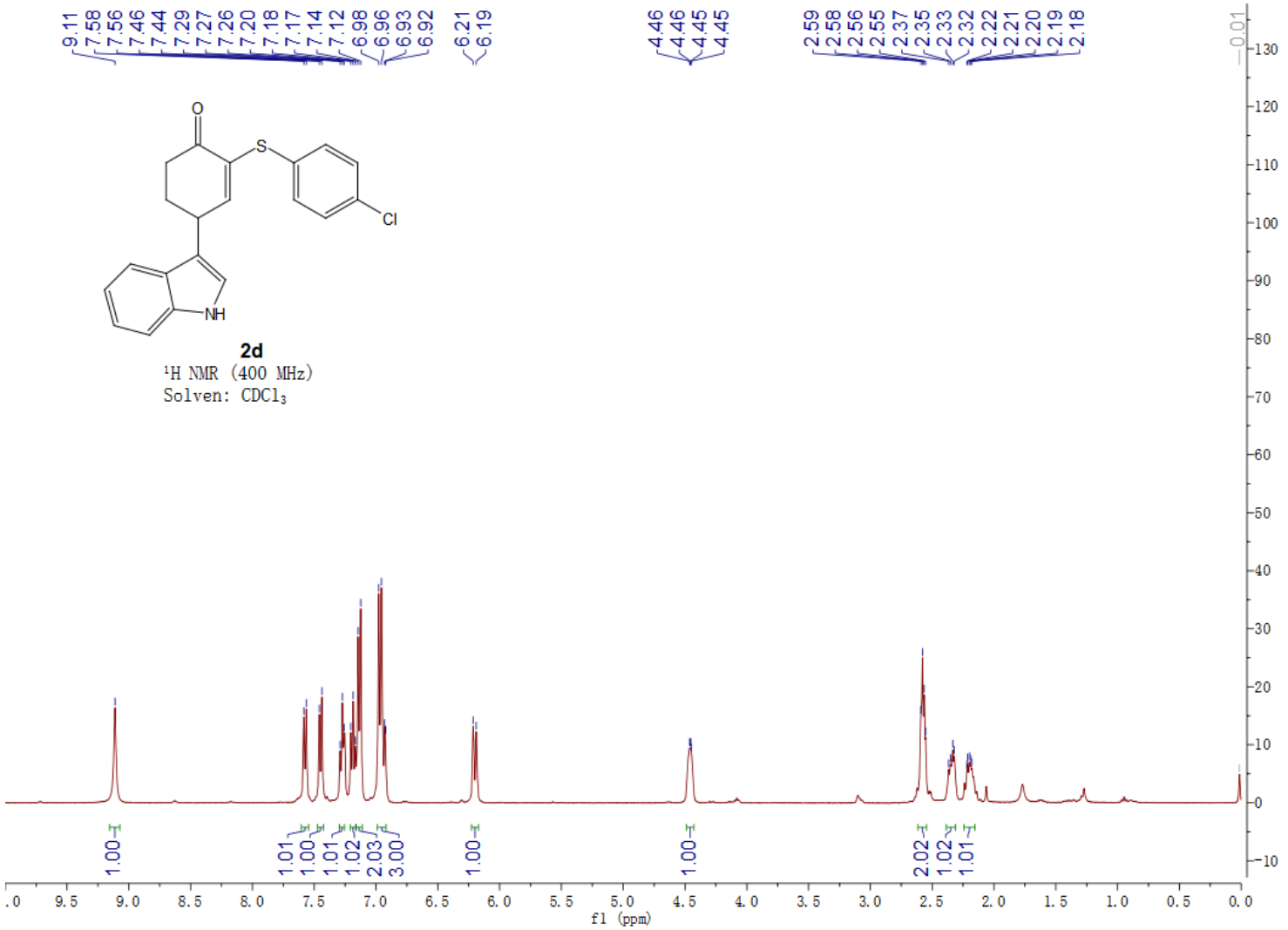
130.57
129.92
129.64
125.60
122.95
121.07
119.44
111.40
100.07
37.04
34.55
29.99
20.87
O
S
CH3
NH
2c
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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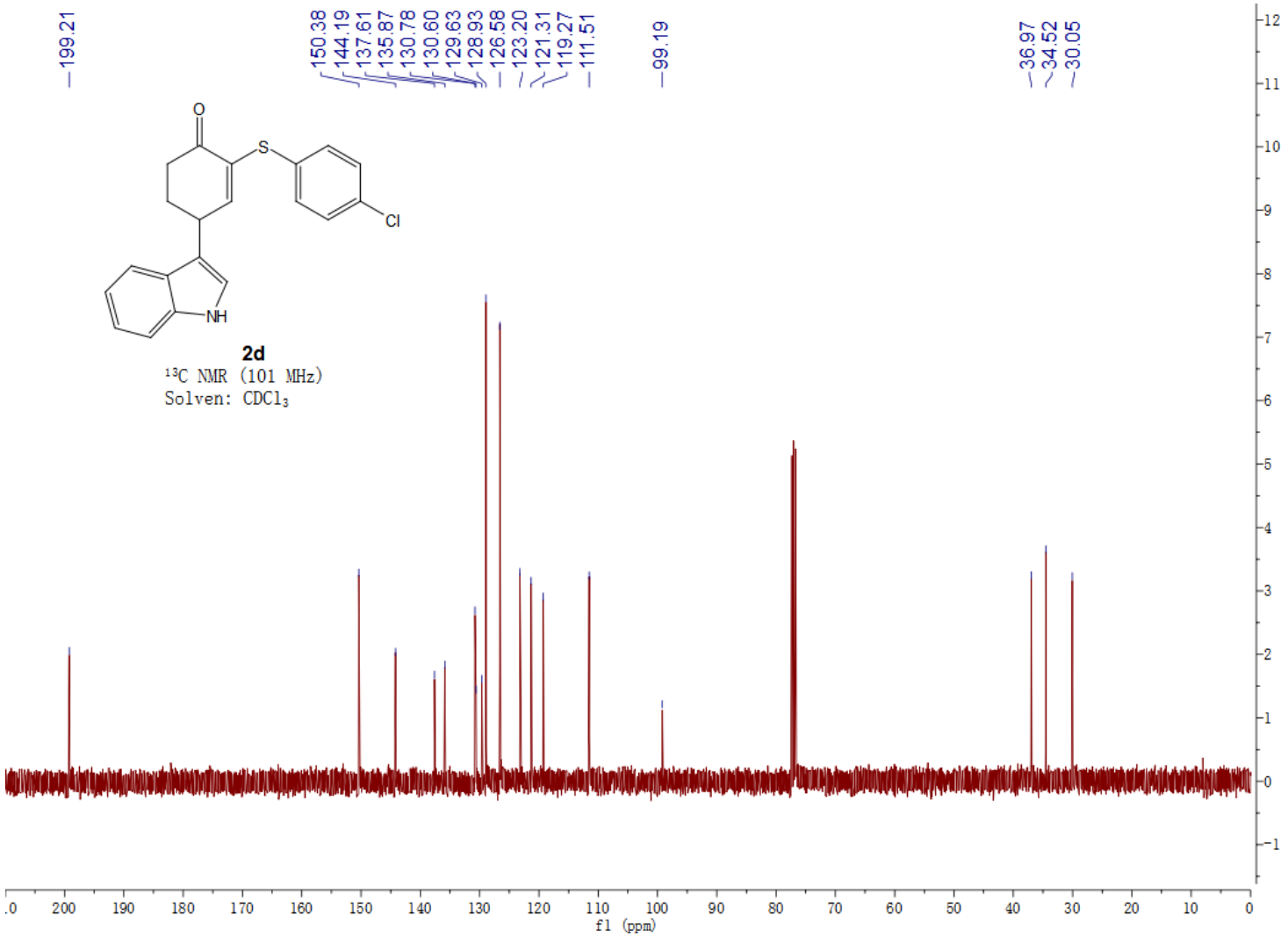
7.58
7.56
7.46
7.44
7.29
7.27
7.26
7.20
7.18
7.17
7.14
7.12
6.98
6.96
6.93
6.92
6.21
6.19
4.46
4.46
4.45
4.45
2.59
2.58
2.56
2.55
2.37
2.35
2.33
2.32
2.22
2.21
2.20
2.19
2.18
O
S
Cl
NH
2d
¹H NMR (400 MHz)
Solven: CDCl₃
1.00
1.01
1.00
1.01
1.02
2.03
3.00
1.00
1.00
2.02
1.02
1.01
f1 (ppm)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144.19
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130.78
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129.63
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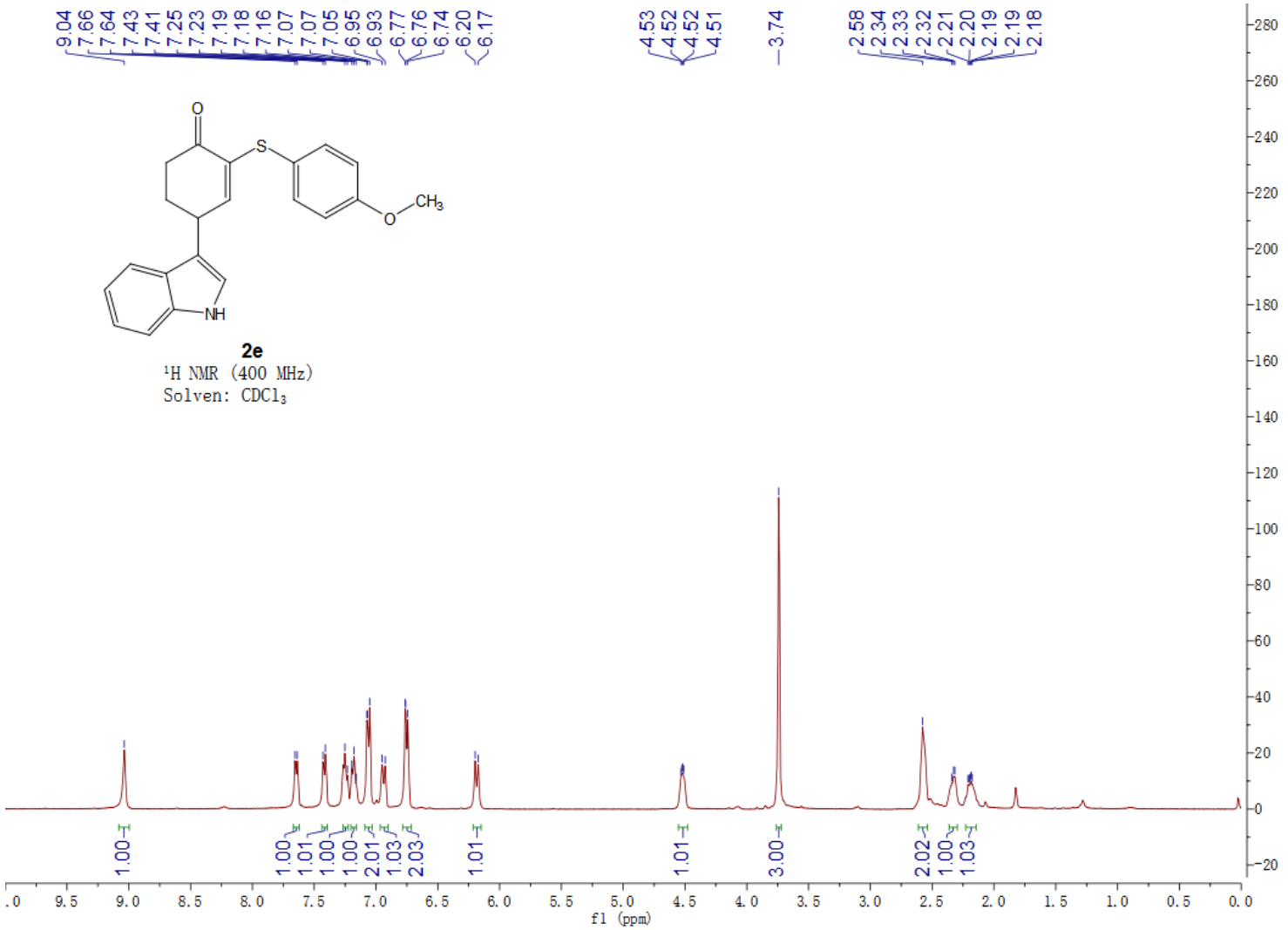
126.58
123.20
121.31
119.27
111.51
99.19
36.97
34.52
30.05
O
S
Cl
NH
2d
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.66
7.64
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7.41
7.25
7.23
7.19
7.18
7.16
7.07
7.07
7.05
6.95
6.93
6.77
6.76
6.74
6.20
6.17
4.53
4.52
4.52
4.51
3.74
2.58
2.34
2.33
2.32
2.21
2.20
2.19
2.19
2.18
O
S
O
CH3
NH
2e
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.00
1.01
1.00
1.00
2.01
1.03
2.03
1.01
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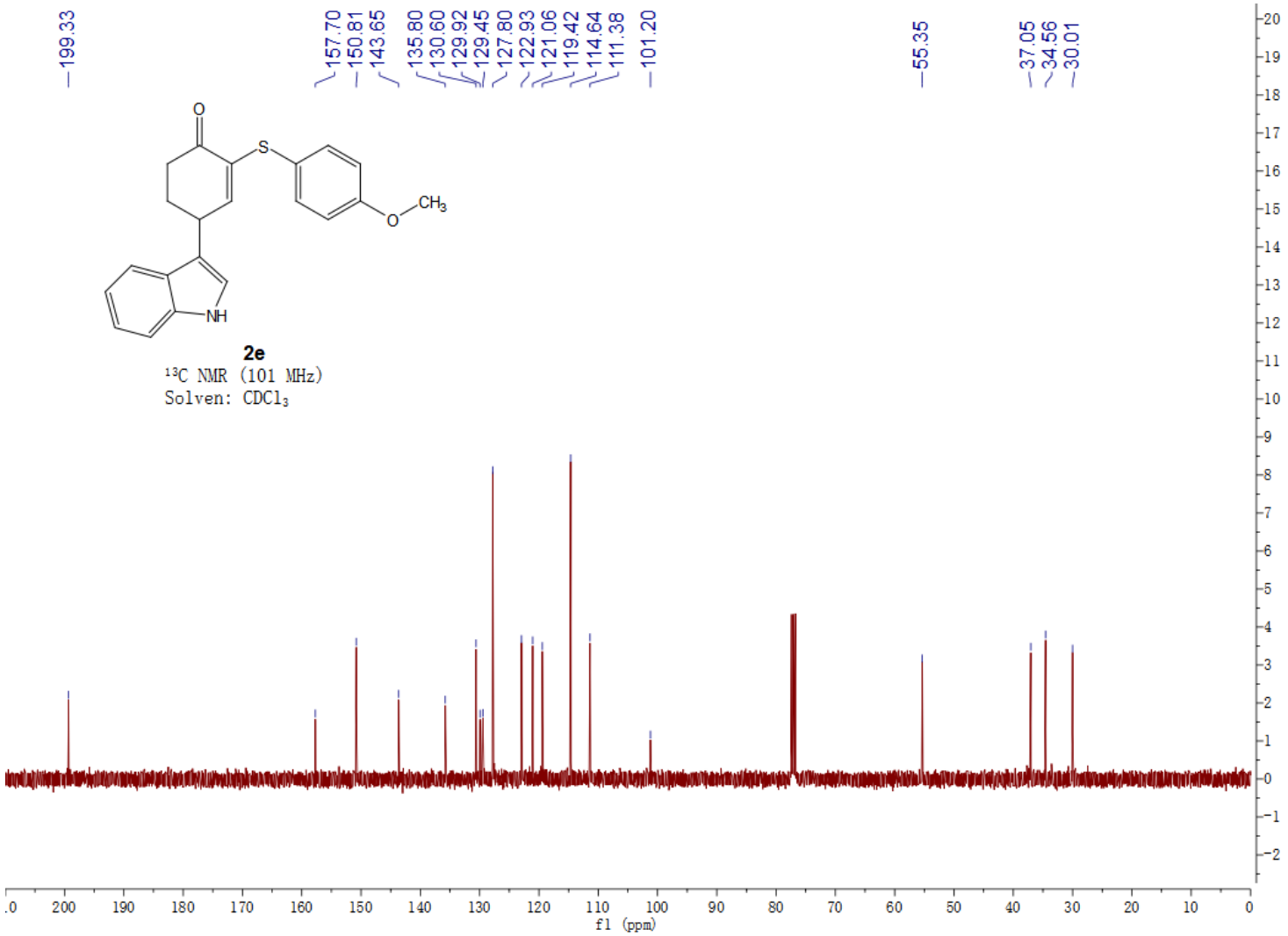
3.00
2.02
1.00
1.03
f1 (ppm)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157.70
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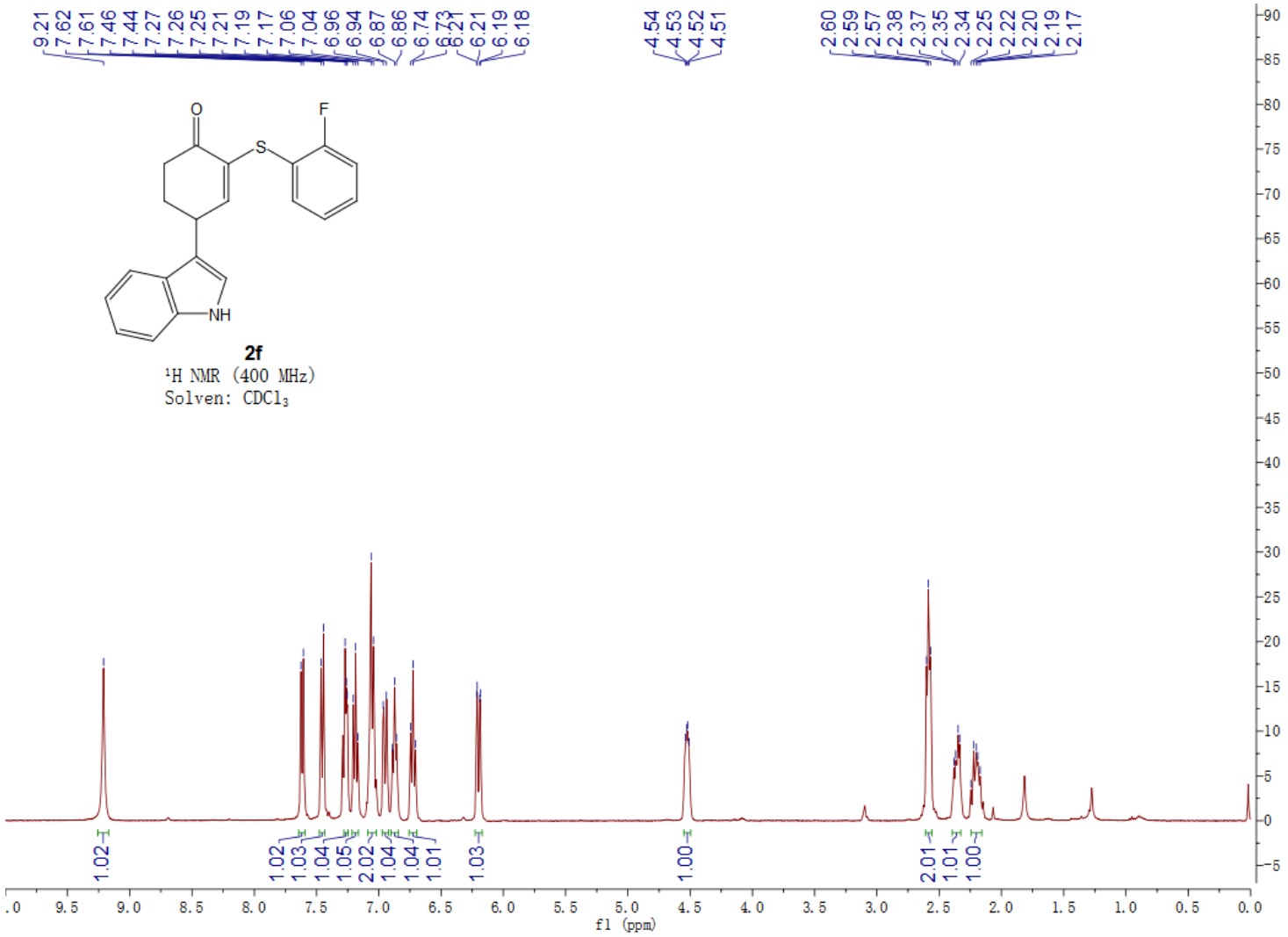
130.60
129.92
129.45
127.80
122.93
121.06
119.42
114.64
111.38
101.20
55.35
37.05
34.56
30.01
O
S
O
CH3
NH
2e
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.46
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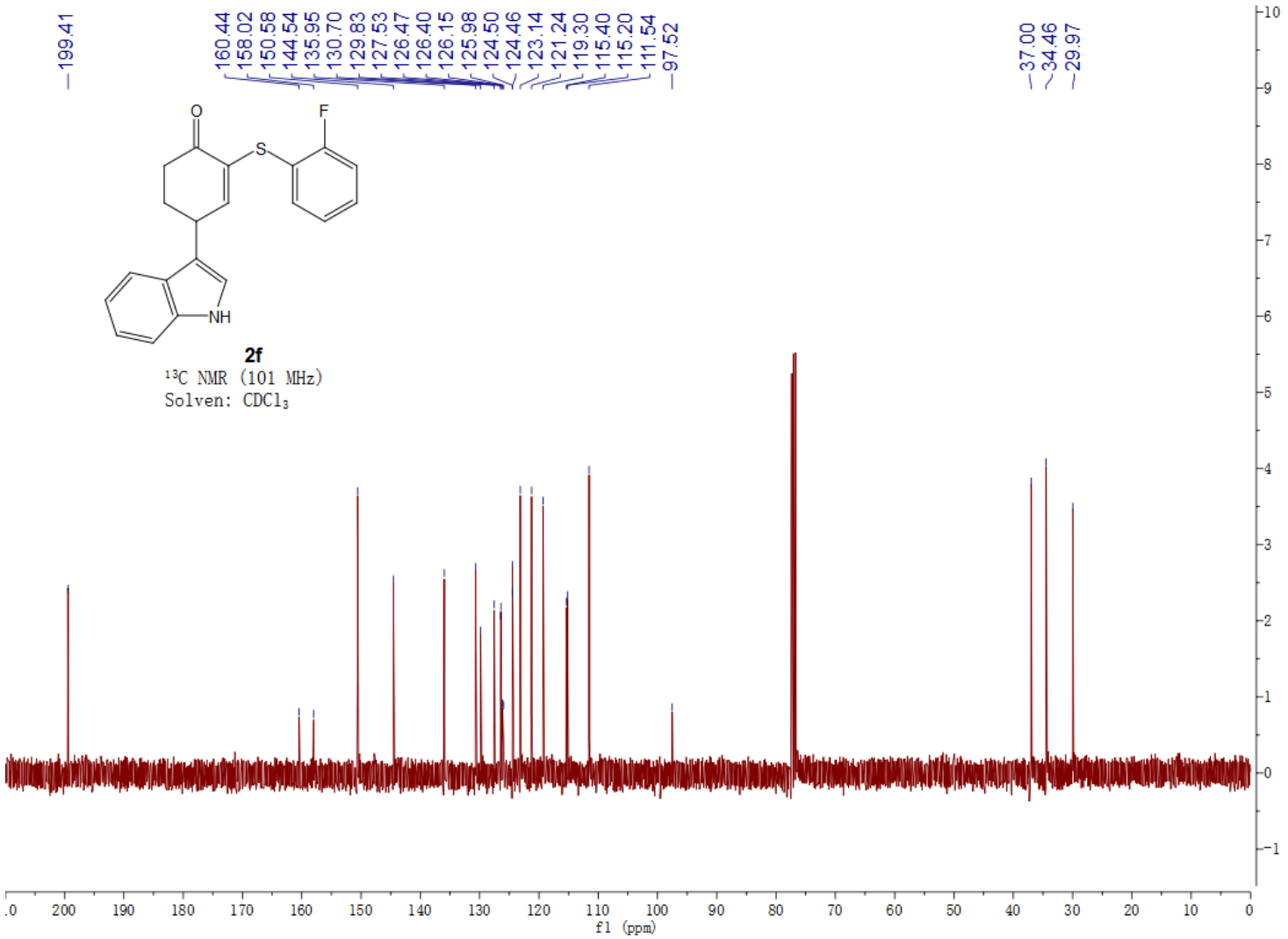
7.25
7.21
7.19
7.17
7.06
7.04
6.96
6.94
6.87
6.86
6.74
6.73
6.21
6.19
6.18
4.54
4.53
4.52
4.51
2.60
2.59
2.57
2.38
2.37
2.35
2.34
2.25
2.22
2.20
2.19
2.17
O
F
S
NH
2f
¹H NMR (400 MHz)
Solven: CDCl₃
1.02
1.02
1.03
1.04
1.05
2.02
1.04
1.04
1.01
1.03
1.00
2.01
1.01
1.00
f1 (ppm)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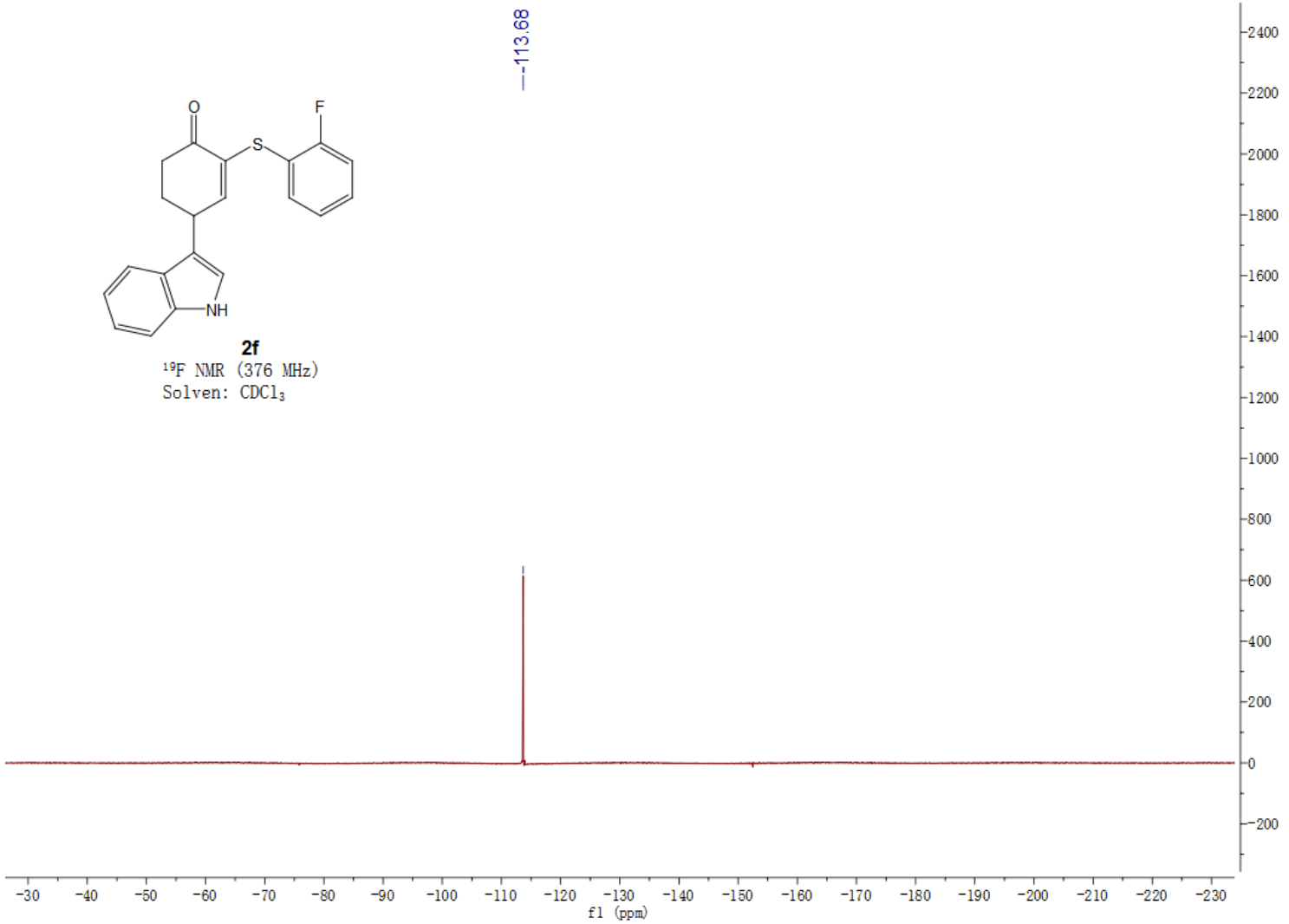
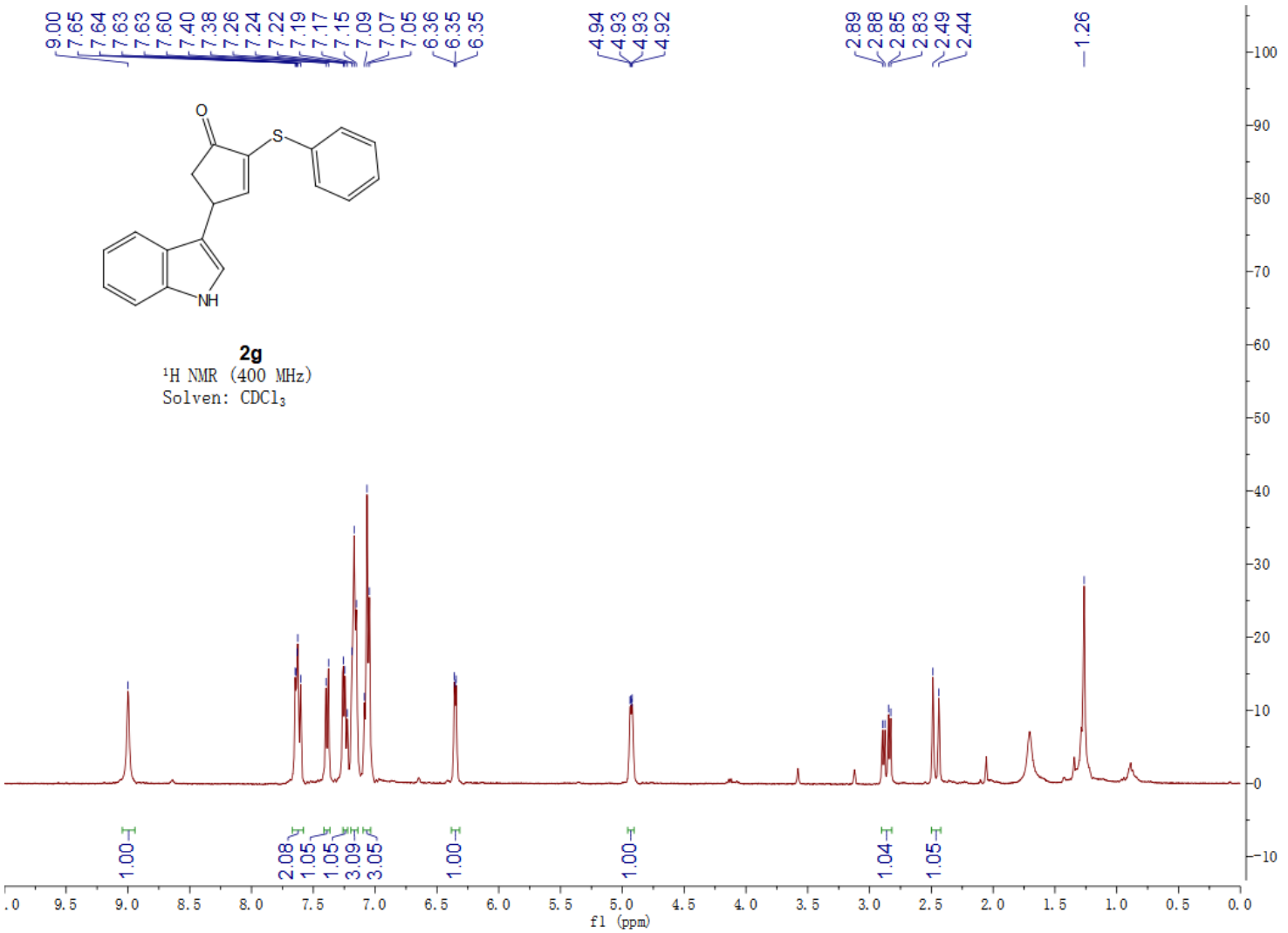
160.44
158.02
150.58
144.54
135.95
130.70
129.83
127.53
126.47
126.40
126.15
125.98
124.50
124.46
123.14
121.24
119.30
115.40
115.20
111.54
97.52
37.00
34.46
29.97
O
F
S
NH
2f
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)



2f

^{19}F NMR (376 MHz)

Solven: $CDCl_3$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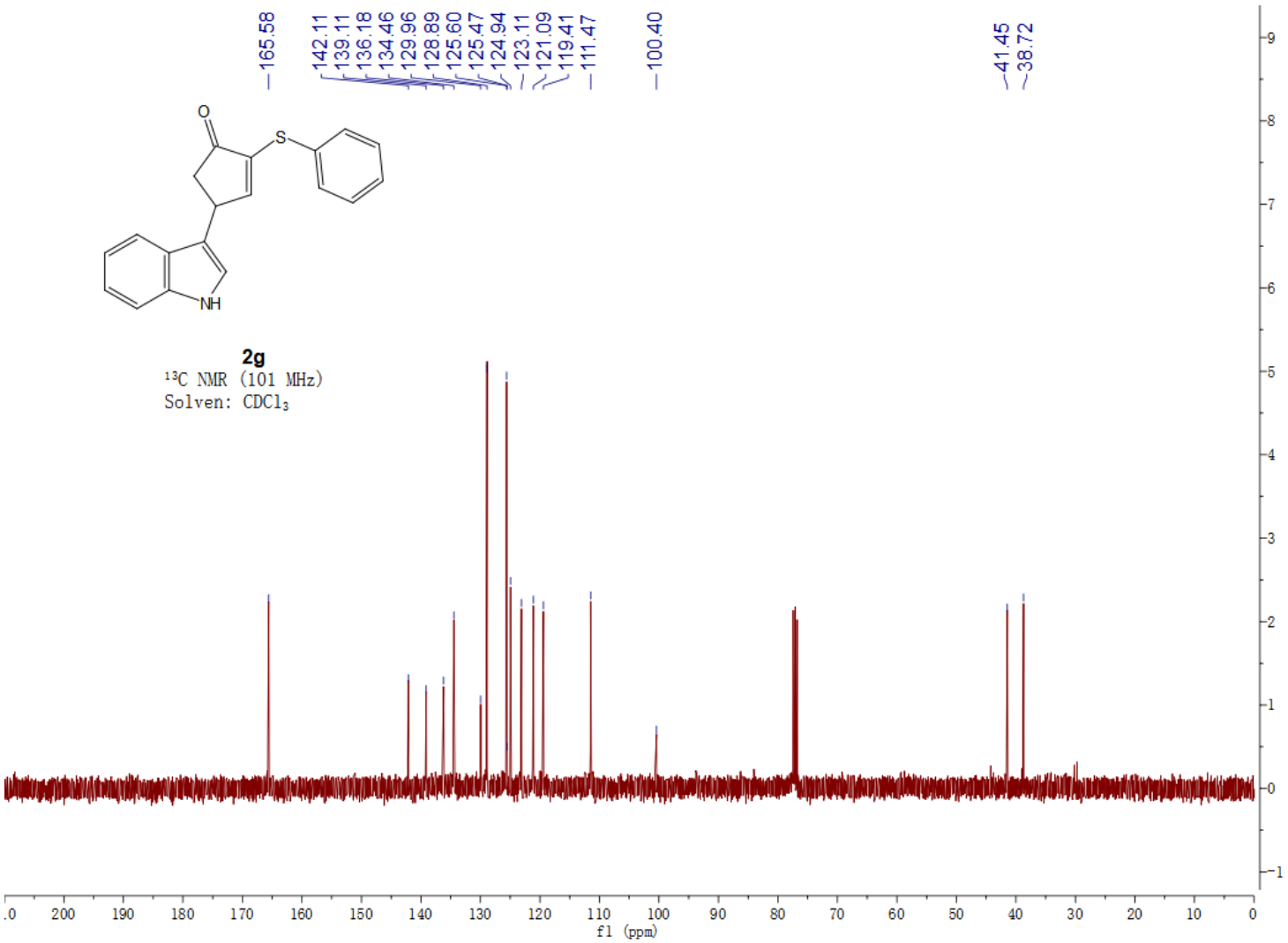
7.65
7.64
7.63
7.63
7.60
7.40
7.38
7.26
7.24
7.22
7.19
7.17
7.15
7.09
7.07
7.05
6.36
6.35
6.35
4.94
4.93
4.93
4.92
2.89
2.88
2.85
2.83
2.49
2.44
1.26
O
S
NH
2g
1H NMR (400 MHz)
Solven: CDCl3
1.00
2.08
1.05
1.05
3.09
3.05
1.00
1.00
1.04
1.05
f1 (ppm)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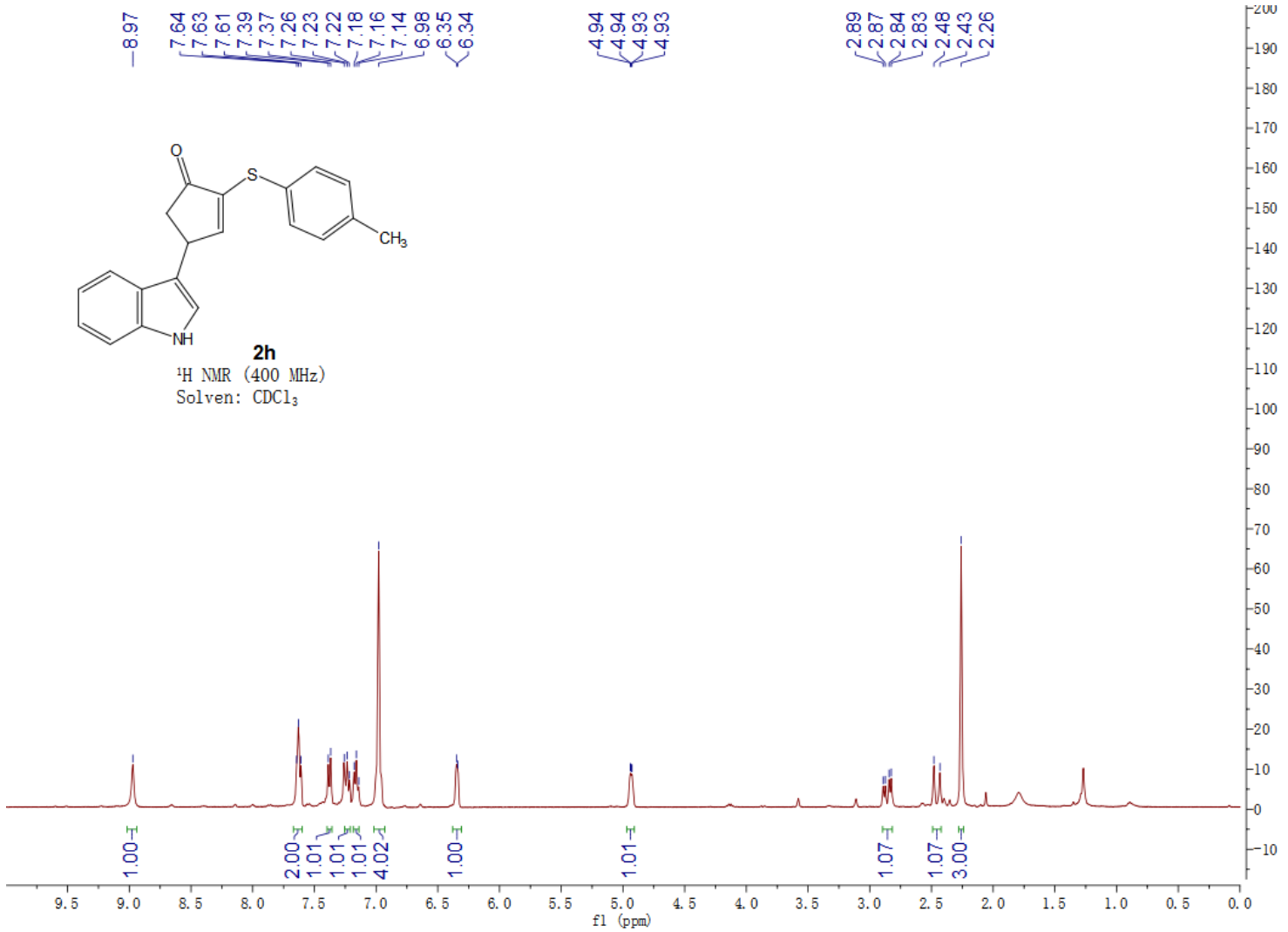
142.11
139.11
136.18
134.46
129.96
128.89
125.60
125.47
124.94
123.11
121.09
119.41
111.47
100.40
41.45
38.72
O
S
NH
2g
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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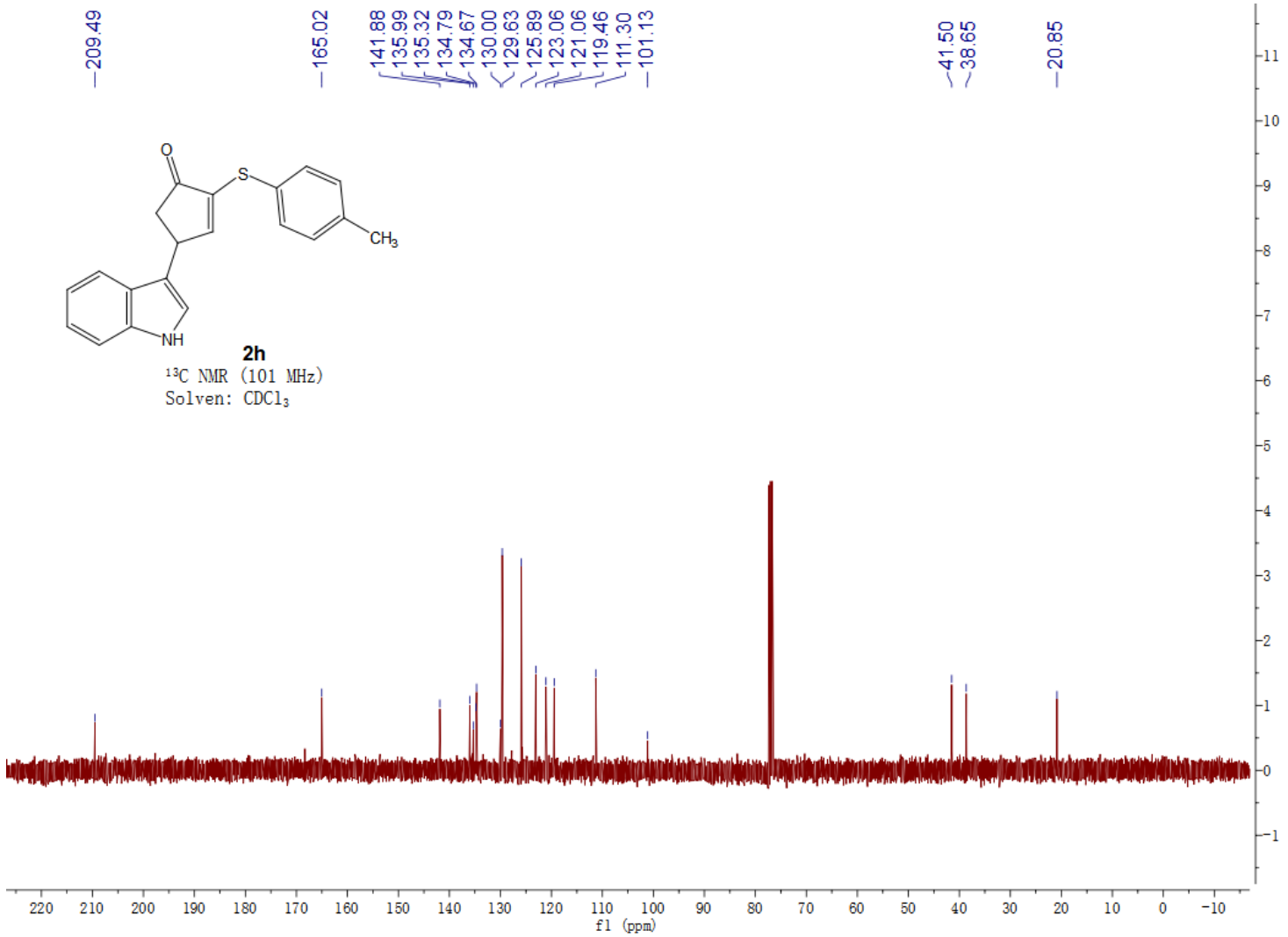
7.63
7.61
7.39
7.37
7.26
7.23
7.22
7.18
7.16
7.14
6.98
6.35
6.34
4.94
4.94
4.93
4.93
2.89
2.87
2.84
2.83
2.48
2.43
2.26
O
S
CH3
NH
2h
1H NMR (400 MHz)
Solven: CDCl3
1.00
2.00
1.01
1.01
1.01
4.02
1.00
1.01
1.07
1.07
3.00
f1 (ppm)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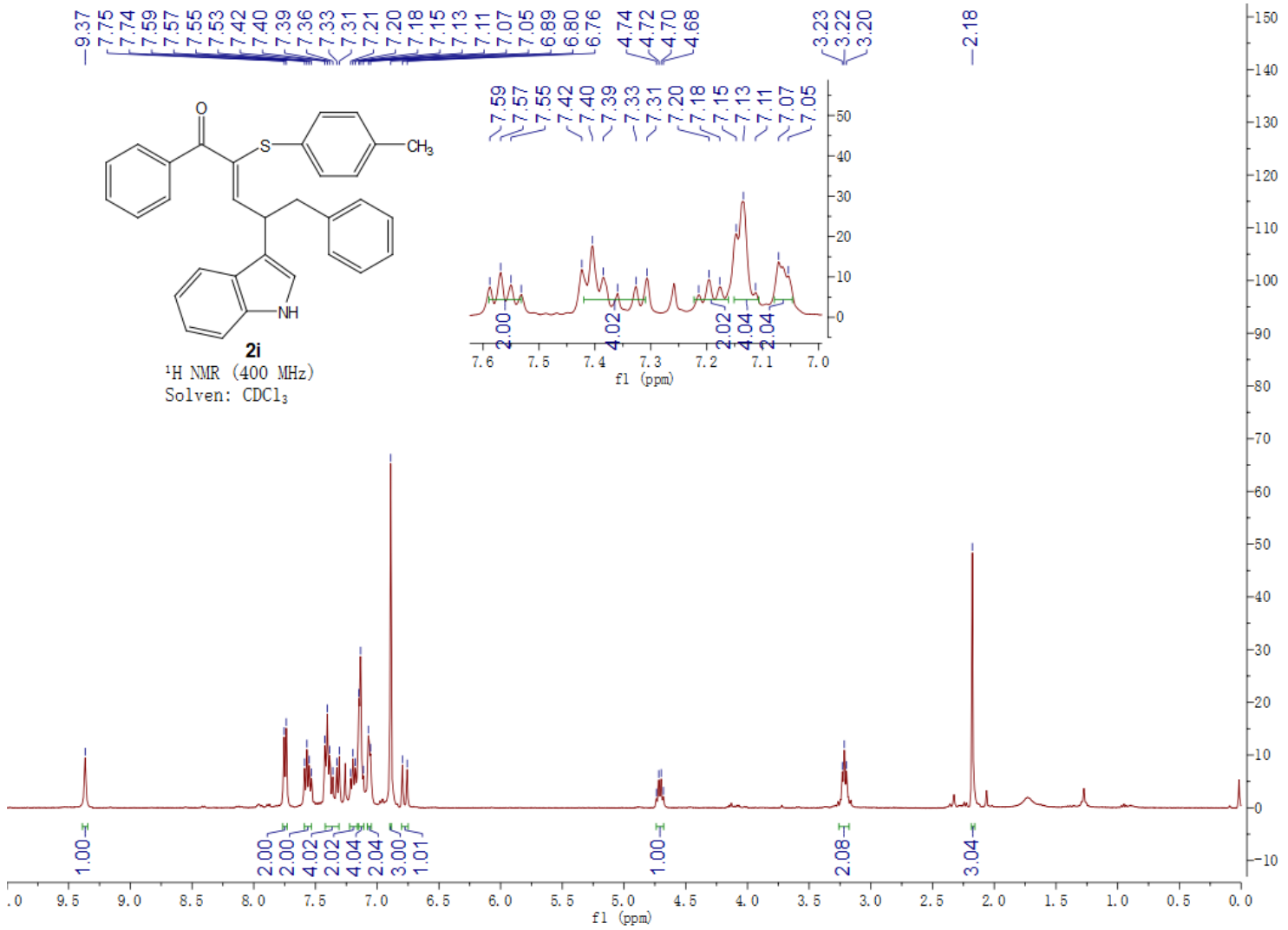
141.88
135.99
135.32
134.79
134.67
130.00
129.63
125.89
123.06
121.06
119.46
111.30
101.13
41.50
38.65
20.85
O
S
CH3
NH
2h
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.74
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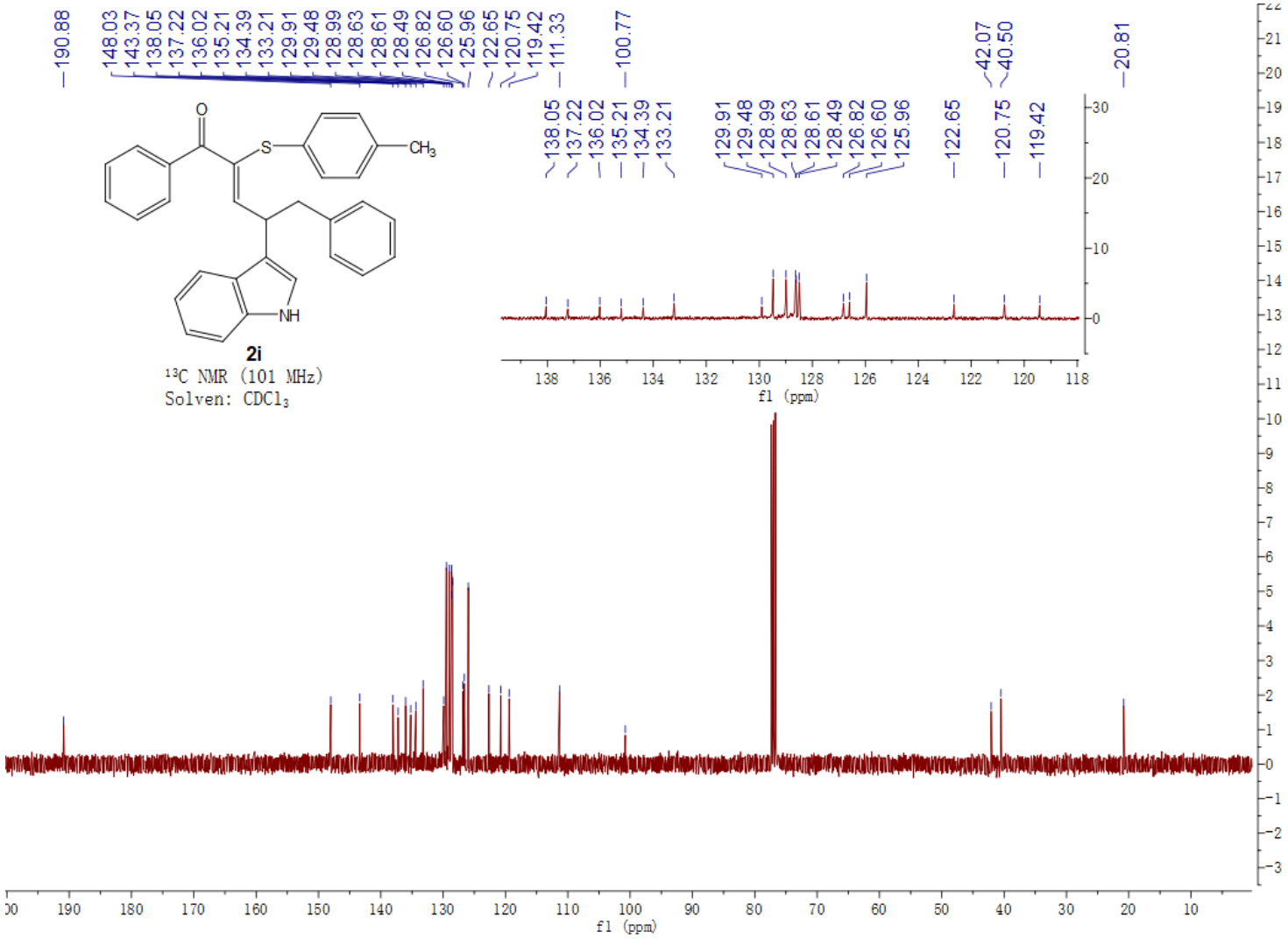
7.57
7.55
7.53
7.42
7.40
7.39
7.36
7.33
7.31
7.21
7.20
7.18
7.15
7.13
7.11
7.07
7.05
6.89
6.80
6.76
4.74
4.72
4.70
4.68
3.23
3.22
3.20
2.18
O
S
CH3
NH
2i
1H NMR (400 MHz)
Solven: CDCl3
f1 (ppm)
1.00
2.00
2.00
4.02
2.02
4.04
2.04
3.00
1.01
1.00
2.08
3.04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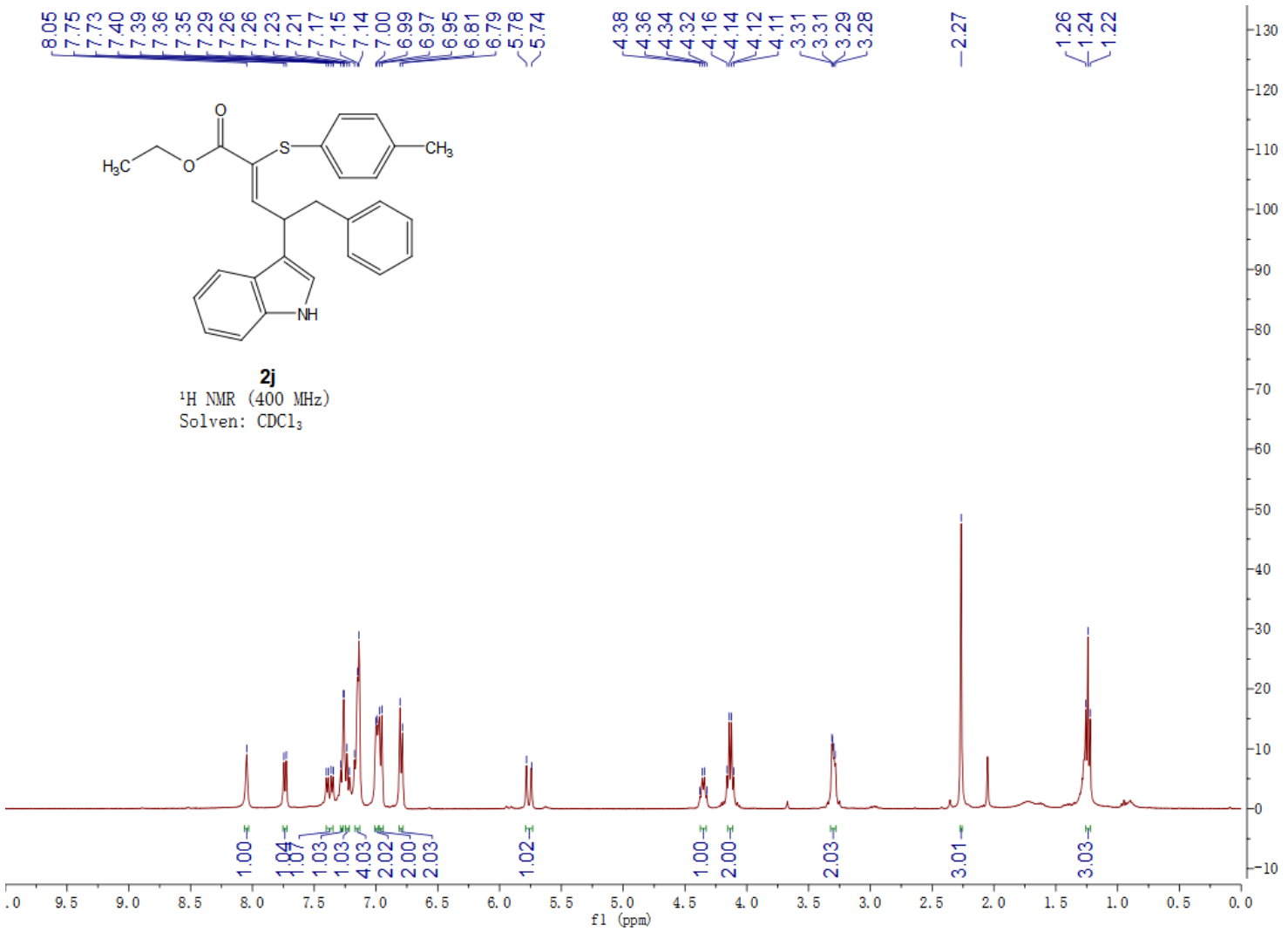
134.39
133.21
129.91
129.48
128.99
128.63
128.61
128.49
126.82
126.60
125.96
122.65
120.75
119.42
111.33
100.77
42.07
40.50
20.81
O
S
CH3
NH
2i
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)
f1 (ppm)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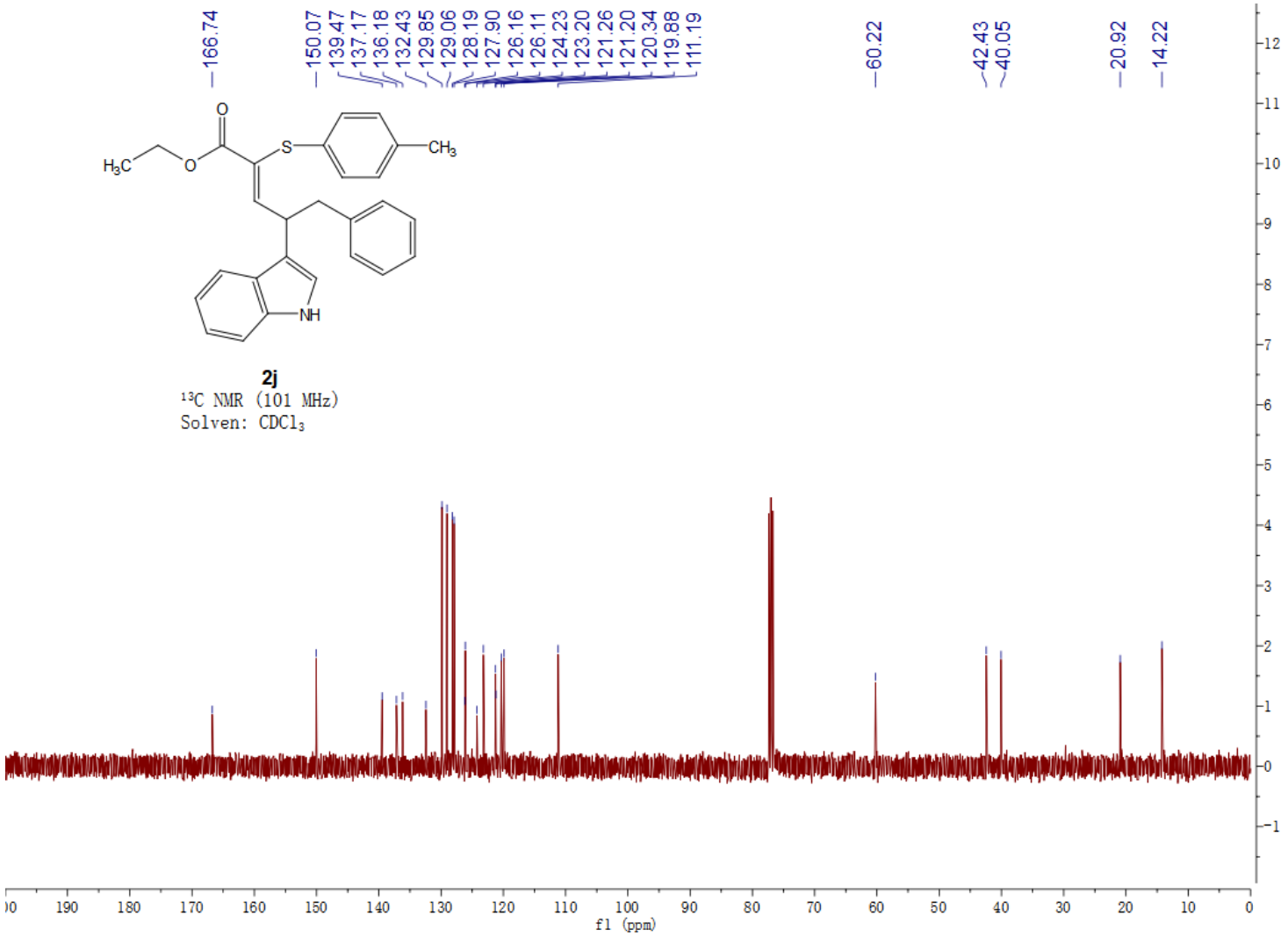
7.36
7.35
7.29
7.26
7.26
7.23
7.21
7.17
7.15
7.14
7.00
6.99
6.97
6.95
6.81
6.79
5.78
5.74
4.38
4.36
4.34
4.32
4.16
4.14
4.12
4.11
3.31
3.31
3.29
3.28
2.27
1.26
1.24
1.22
O
S
CH3
H3C
O
NH
2j
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.04
1.07
1.03
1.03
4.03
2.02
2.00
2.03
1.02
1.00
2.00
2.03
3.01
3.03
f1 (ppm)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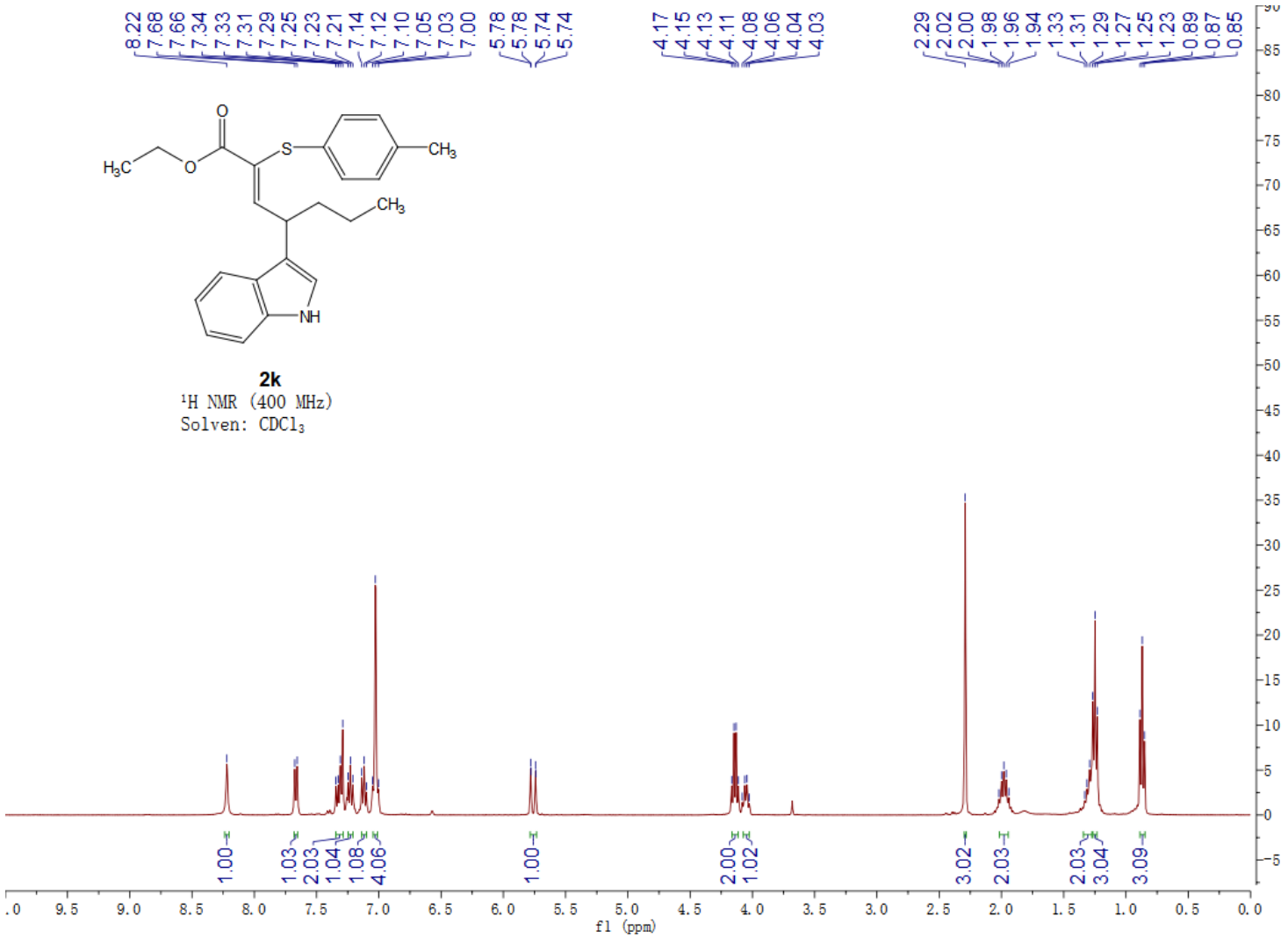
127.90
126.16
126.11
124.23
123.20
121.26
121.20
120.34
119.88
111.19
60.22
42.43
40.05
20.92
14.22
O
S
CH3
H3C
O
NH
2j
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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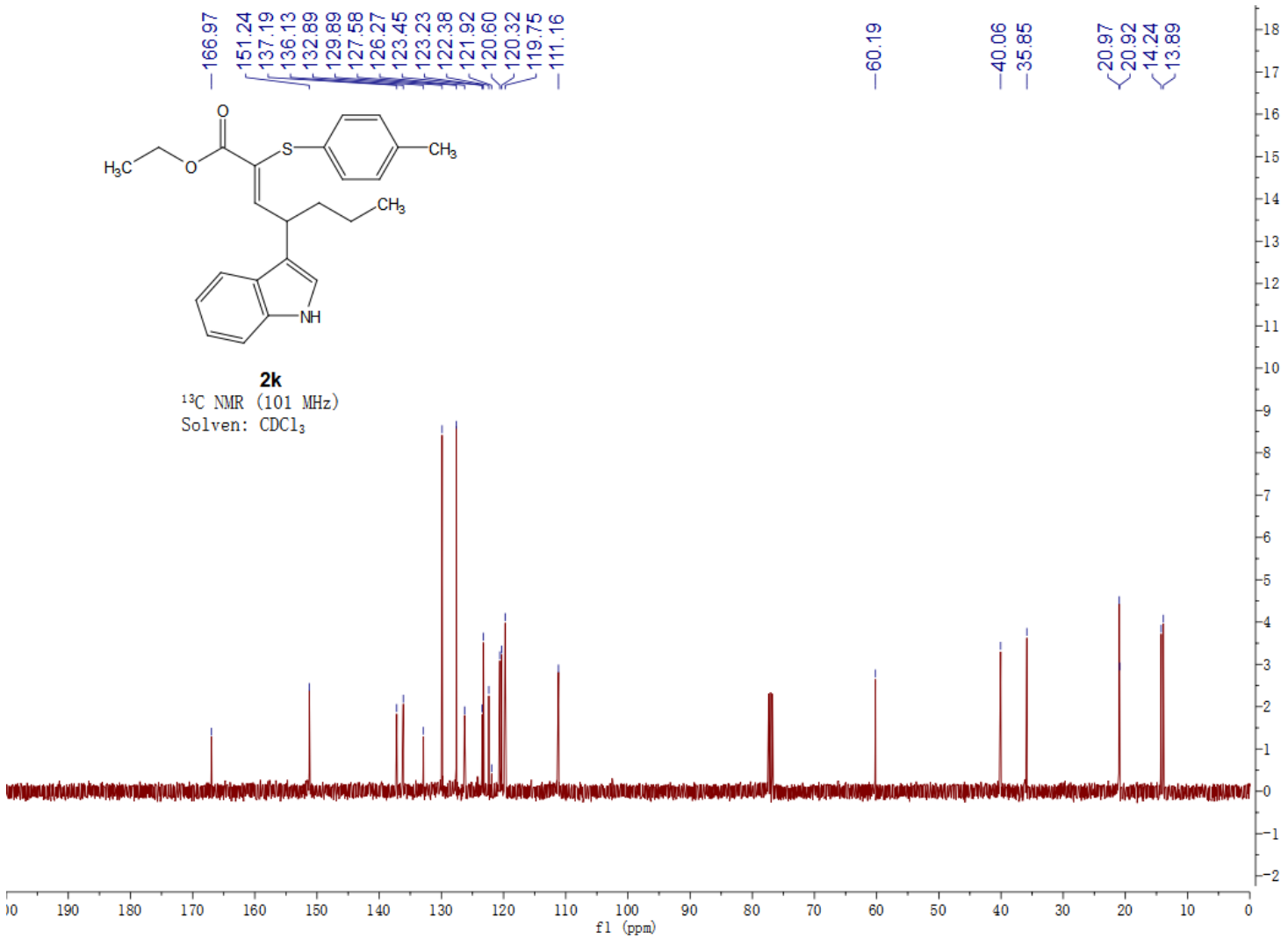
7.31
7.29
7.25
7.23
7.21
7.14
7.12
7.10
7.05
7.03
7.00
5.78
5.78
5.74
5.74
4.17
4.15
4.13
4.11
4.08
4.06
4.04
4.03
2.29
2.02
2.00
1.98
1.96
1.94
1.33
1.31
1.29
1.27
1.25
1.23
0.89
0.87
0.85
O
S
CH3
H3C
O
CH3
NH
2k
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.03
2.03
1.04
1.08
4.06
1.00
2.00
1.02
3.02
2.03
2.03
3.04
3.09
f1 (ppm)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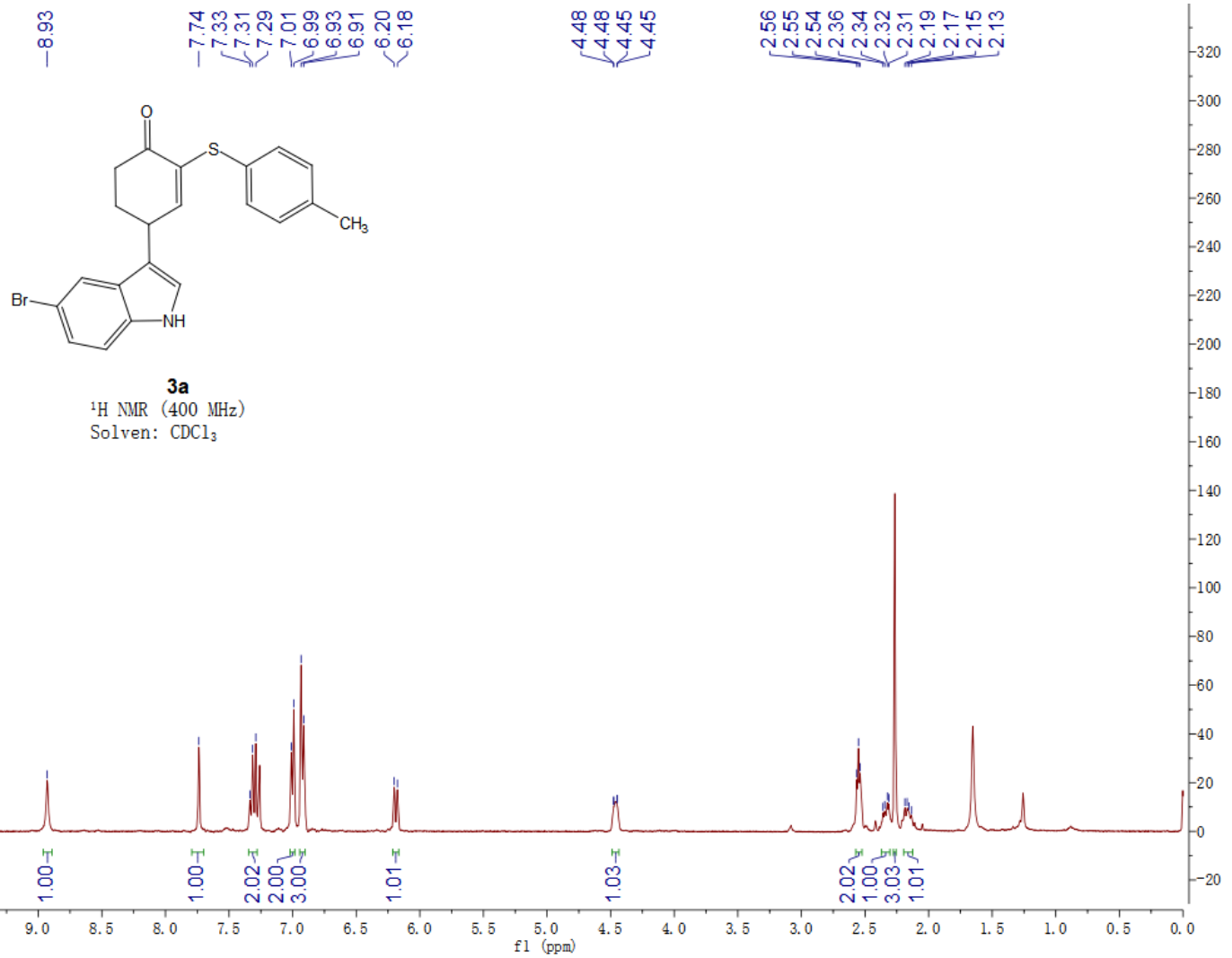
136.13
132.89
129.89
127.58
126.27
123.45
123.23
122.38
121.92
120.60
120.32
119.75
111.16
60.19
40.06
35.85
20.97
20.92
14.24
13.89
O
S
CH3
H3C
O
CH3
NH
2k
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.01
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6.93
6.91
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6.18
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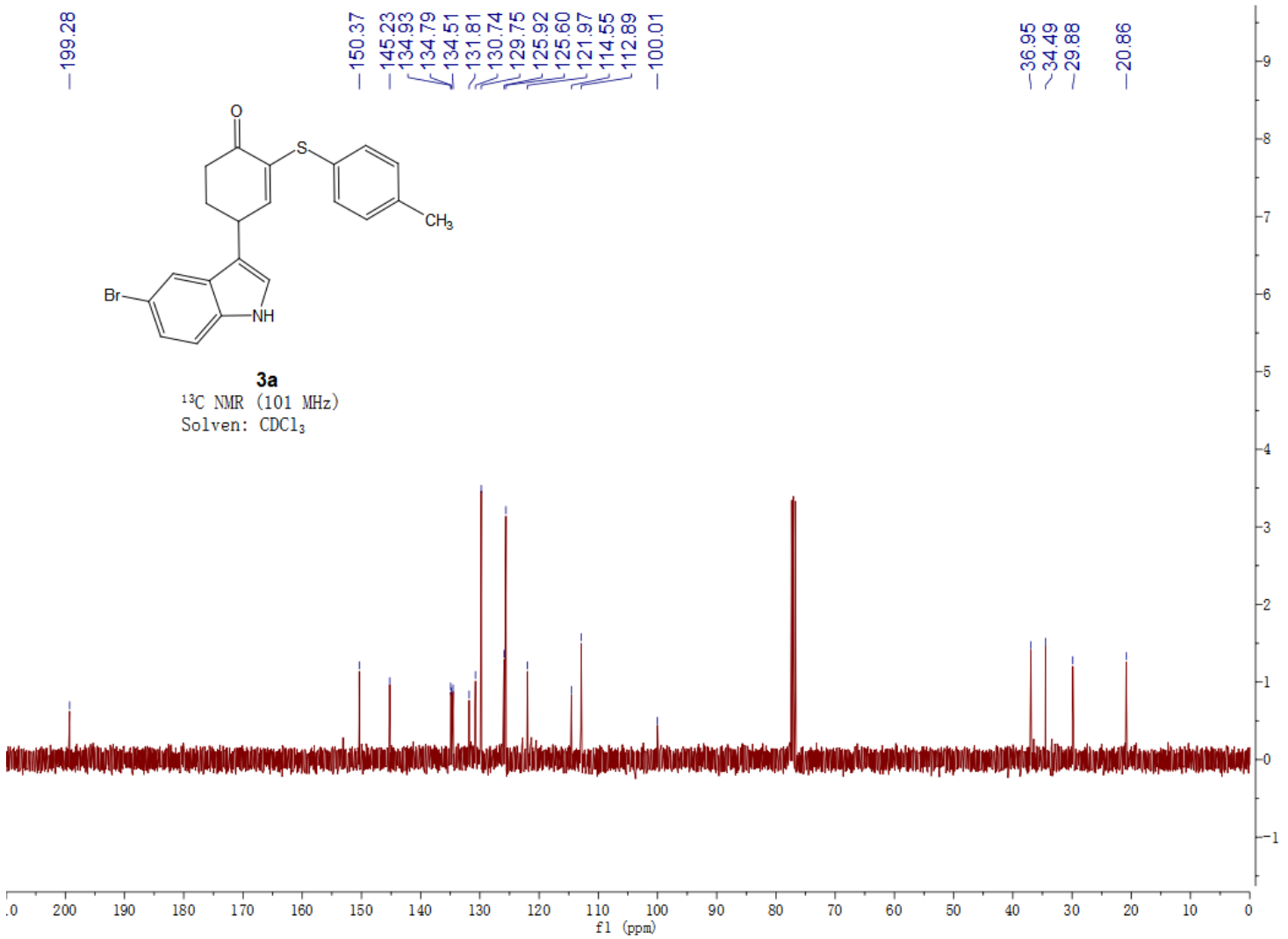
4.48
4.45
4.45
2.56
2.55
2.54
2.36
2.34
2.32
2.31
2.19
2.17
2.15
2.13
O
S
CH3
Br
NH
3a
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.00
2.02
2.00
3.00
1.01
1.03
2.02
1.00
3.03
1.01
f1 (ppm)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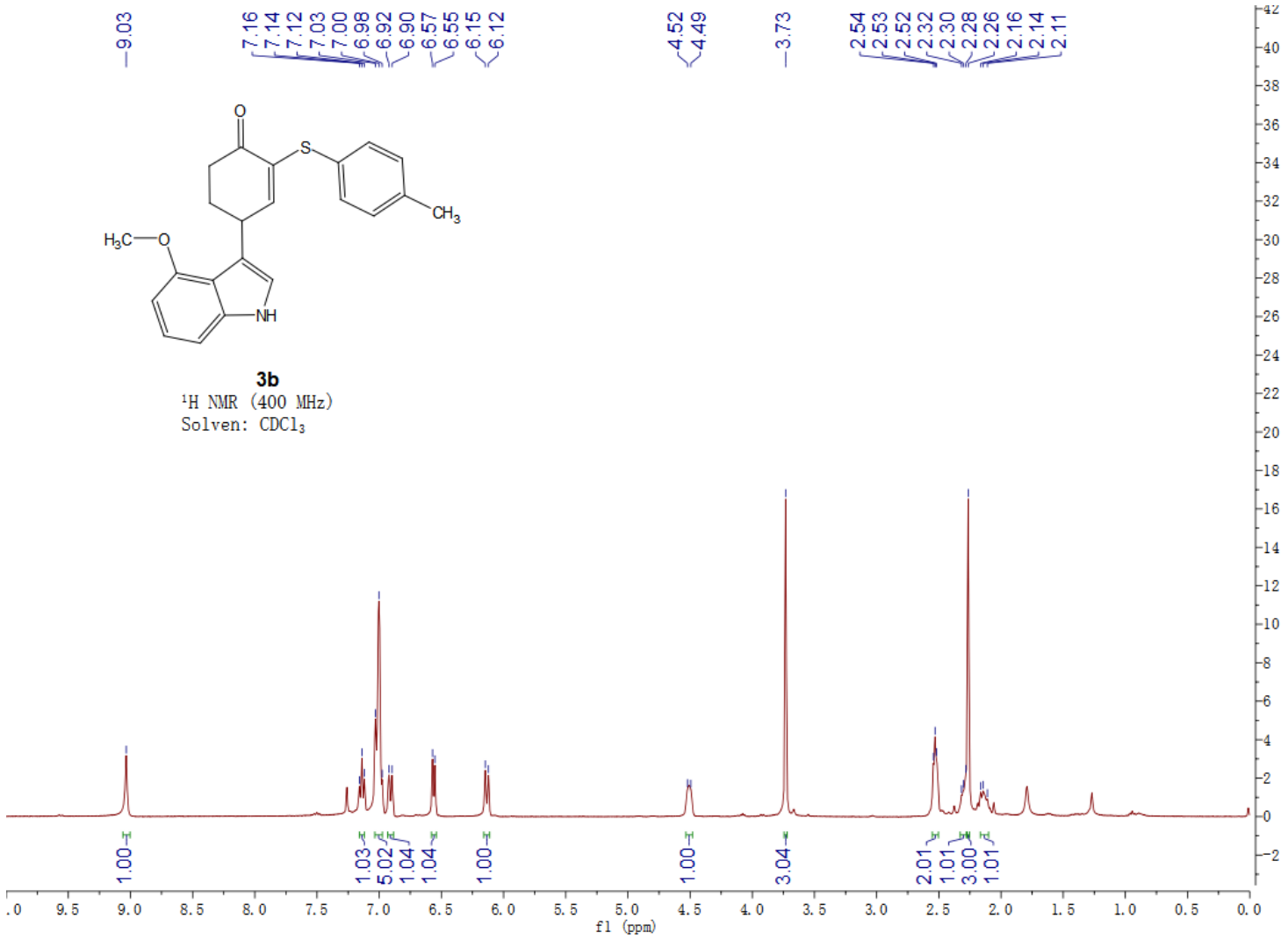
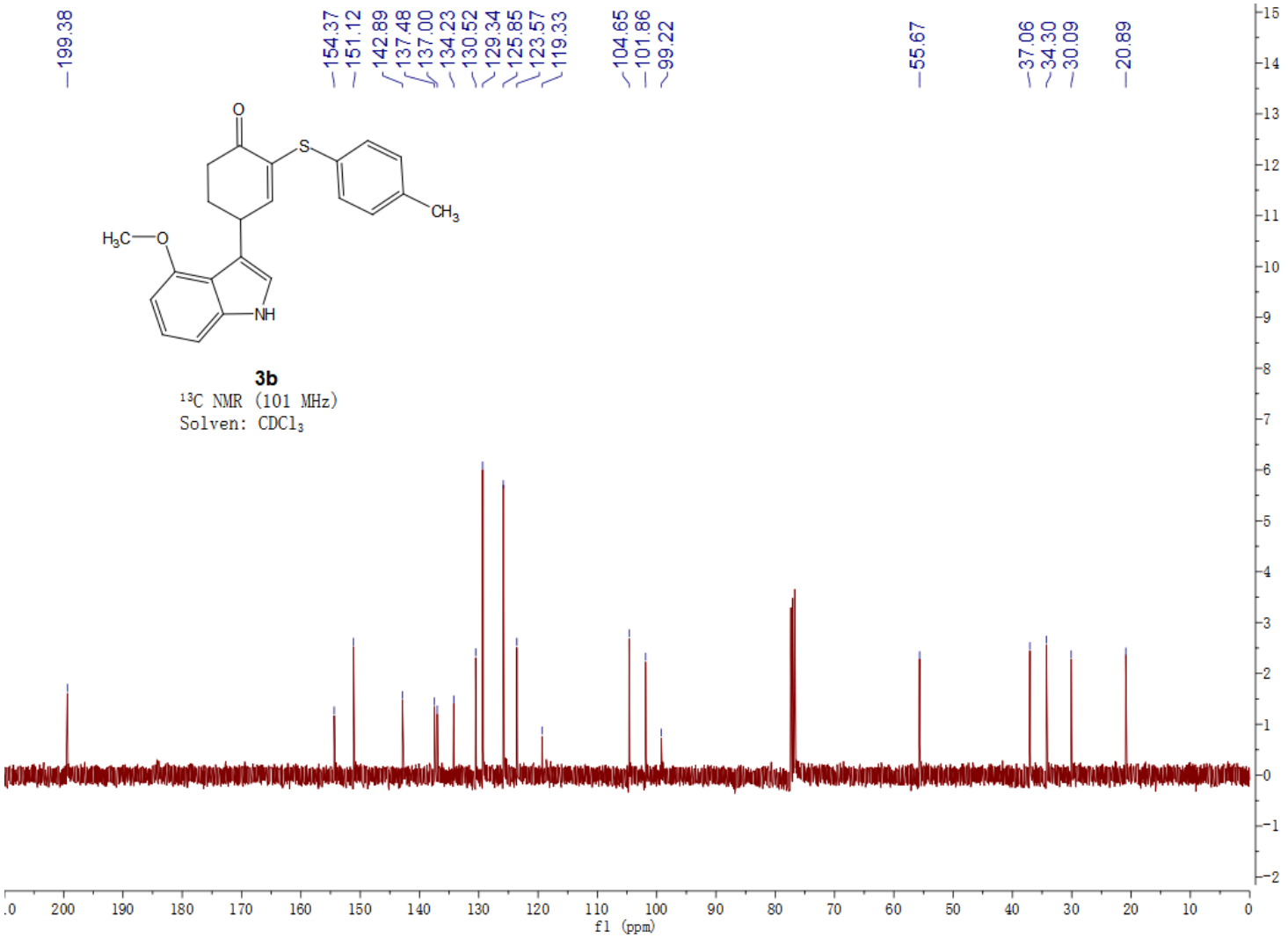
134.51
131.81
130.74
129.75
125.92
125.60
121.97
114.55
112.89
100.01
36.95
34.49
29.88
20.86
O
S
CH3
Br
NH
3a
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


9.03
7.16
7.14
7.12
7.03
7.00
6.98
6.92
6.90
6.57
6.55
6.15
6.12
4.52
4.49
3.73
2.54
2.53
2.52
2.32
2.30
2.28
2.26
2.16
2.14
2.11
O
S
CH3
H3C—O
NH
3b
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.03
5.02
1.04
1.04
1.00
1.00
3.04
2.01
1.01
3.00
1.01
f1 (ppm)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154.37
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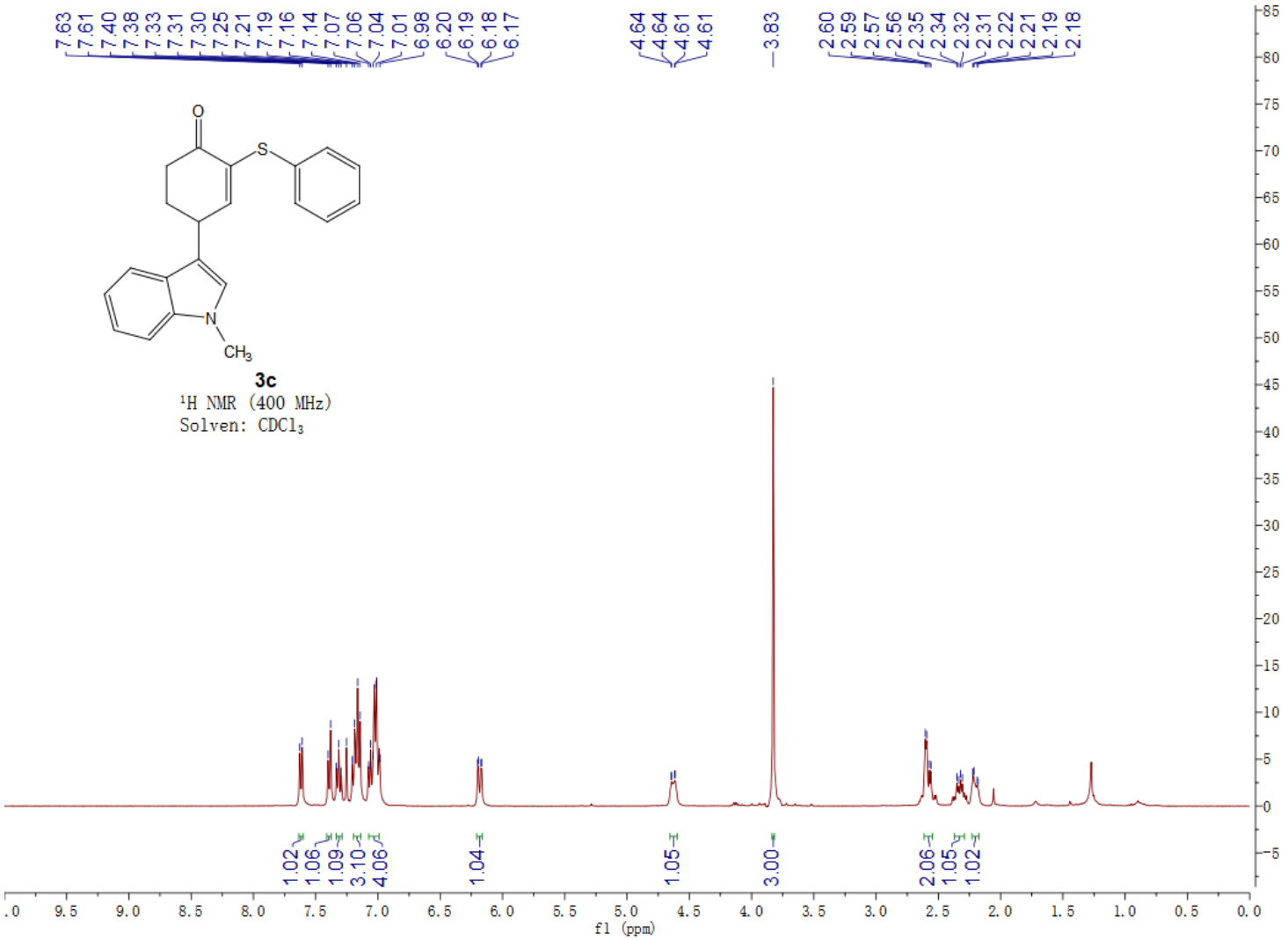
142.89
137.48
137.00
134.23
130.52
129.34
125.85
123.57
119.33
104.65
101.86
99.22
55.67
37.06
34.30
30.09
20.89
O
S
CH3
H3C—O
NH
3b
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.25
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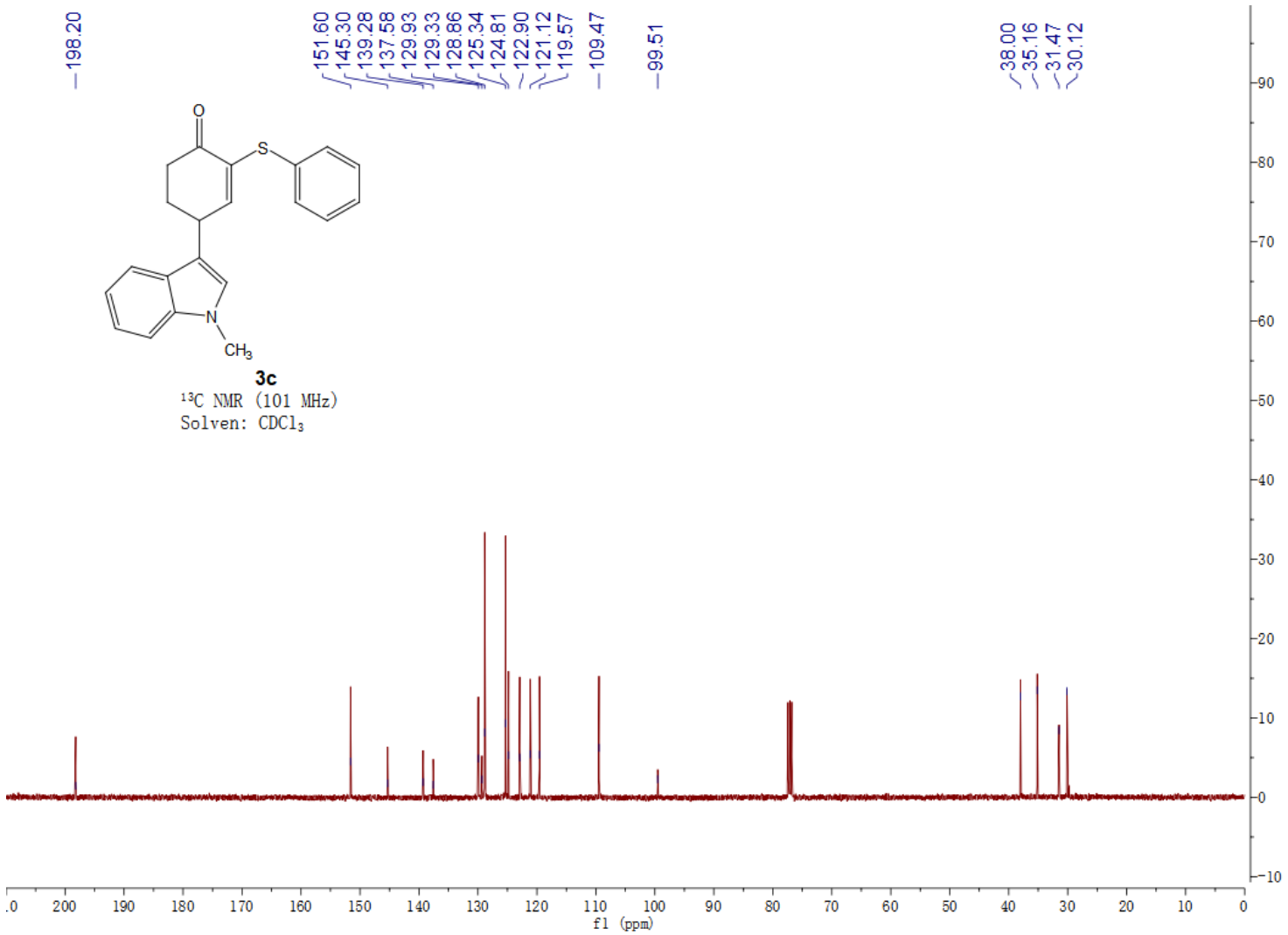
7.16
7.14
7.07
7.06
7.04
7.01
6.98
6.20
6.19
6.18
6.17
4.64
4.64
4.61
4.61
3.83
2.60
2.59
2.57
2.56
2.35
2.34
2.32
2.31
2.22
2.21
2.19
2.18
O
S
N
CH3
3c
1H NMR (400 MHz)
Solven: CDCl3
1.02
1.06
1.09
3.10
4.06
1.04
1.05
3.00
2.06
1.05
1.02
f1 (ppm)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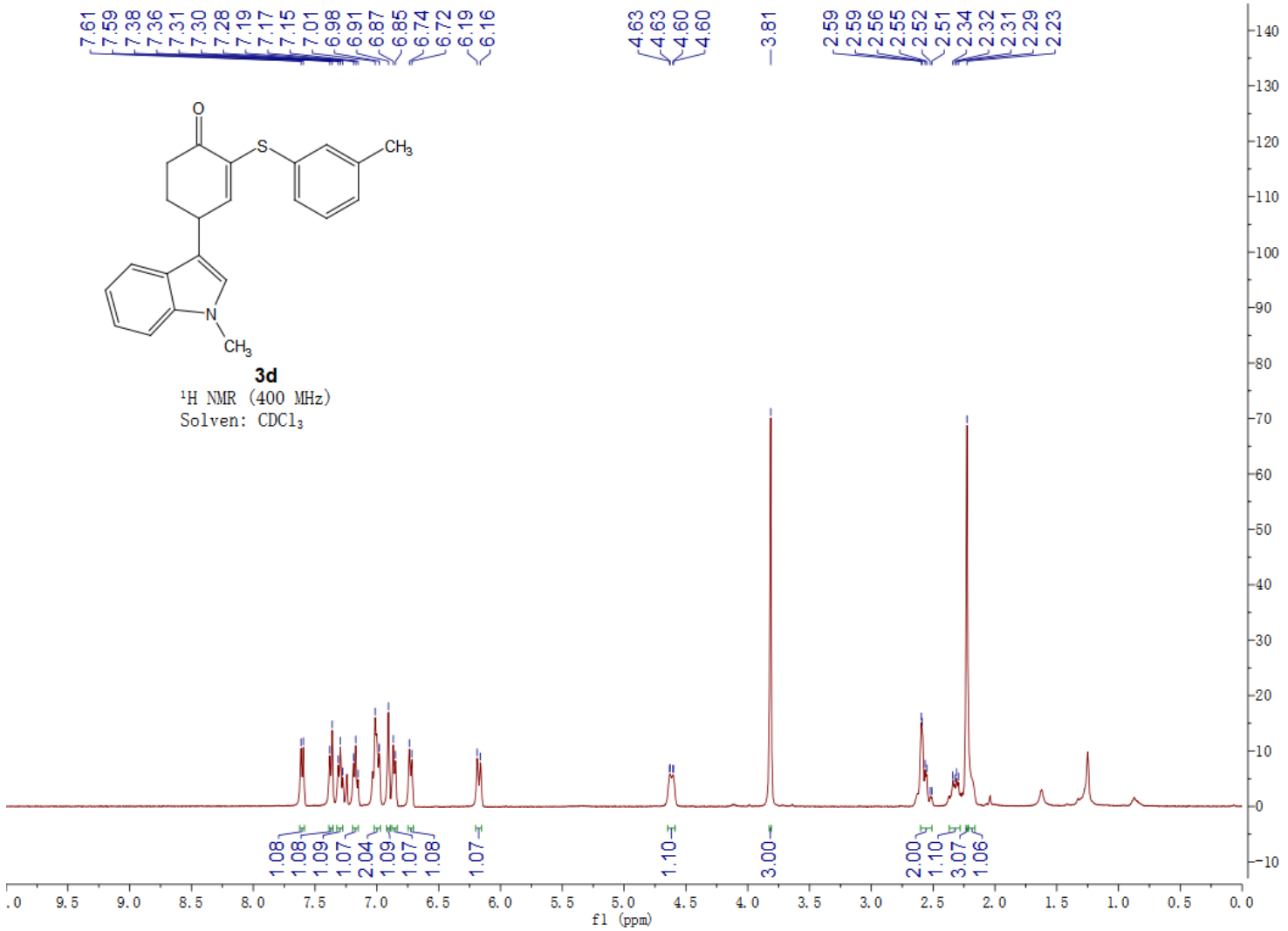
124.81
122.90
121.12
119.57
109.47
99.51
38.00
35.16
31.47
30.12
O
S
N
CH3
3c
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.28
7.19
7.17
7.15
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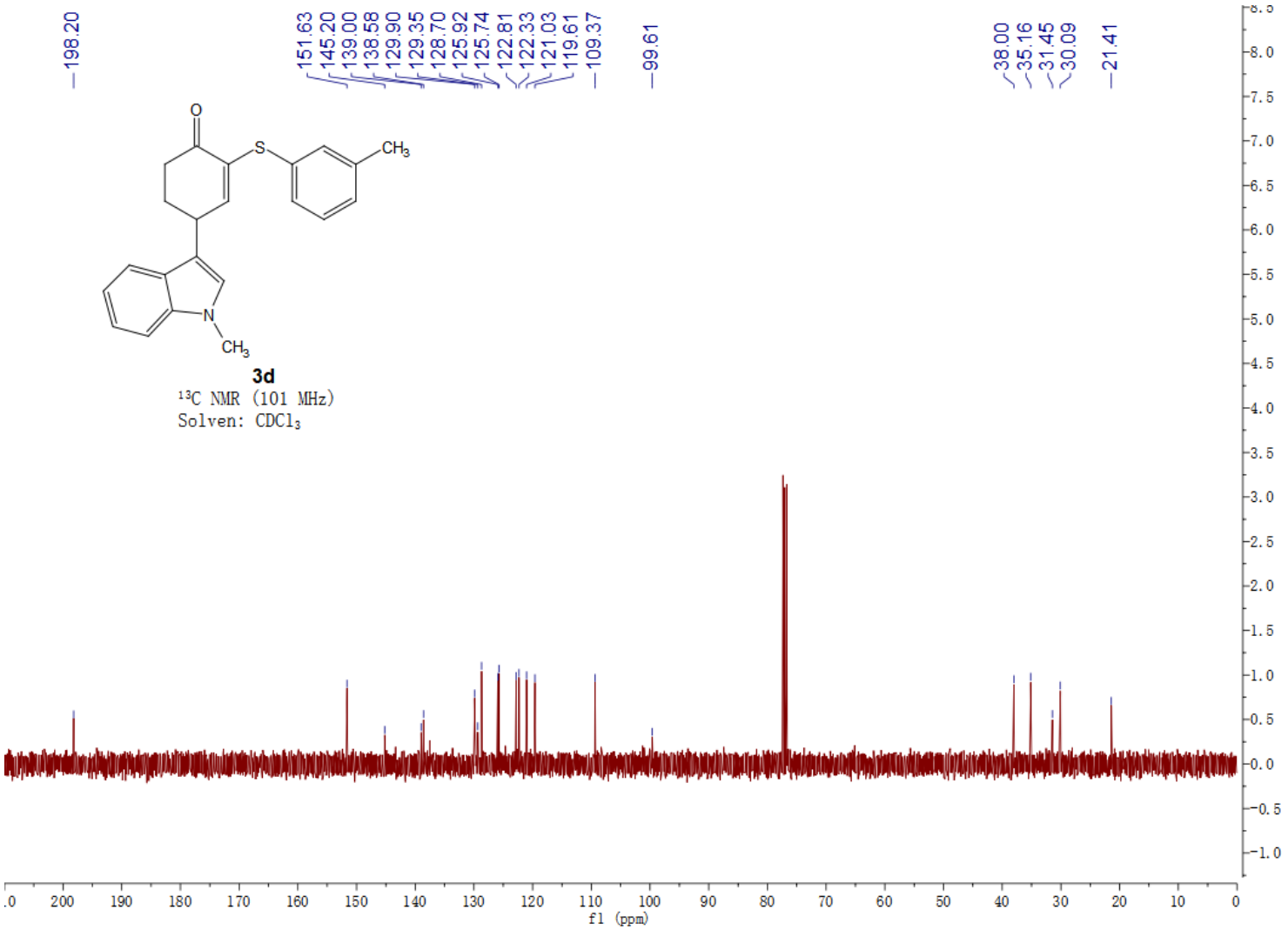
6.98
6.91
6.87
6.85
6.74
6.72
6.19
6.16
4.63
4.63
4.60
4.60
3.81
2.59
2.59
2.56
2.55
2.52
2.51
2.34
2.32
2.31
2.29
2.23
O
S
CH3
N
CH3
3d
1H NMR (400 MHz)
Solven: CDCl3
1.08
1.08
1.09
1.07
2.04
1.09
1.07
1.08
1.07
1.10
3.00
2.00
1.10
3.07
1.06
f1 (ppm)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128.70
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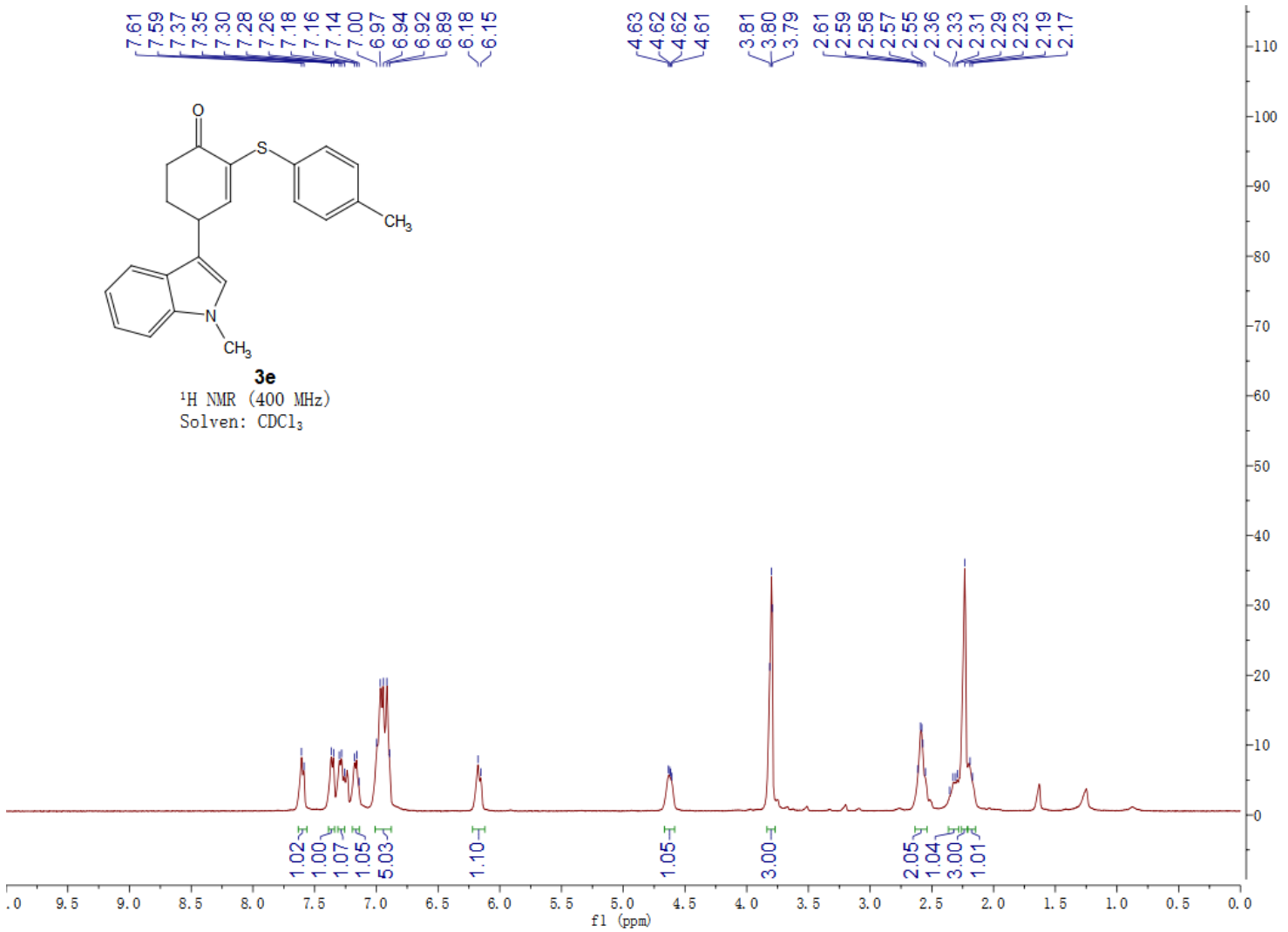
125.74
122.81
122.33
121.03
119.61
109.37
99.61
38.00
35.16
31.45
30.09
21.41
O
S
CH3
N
CH3
3d
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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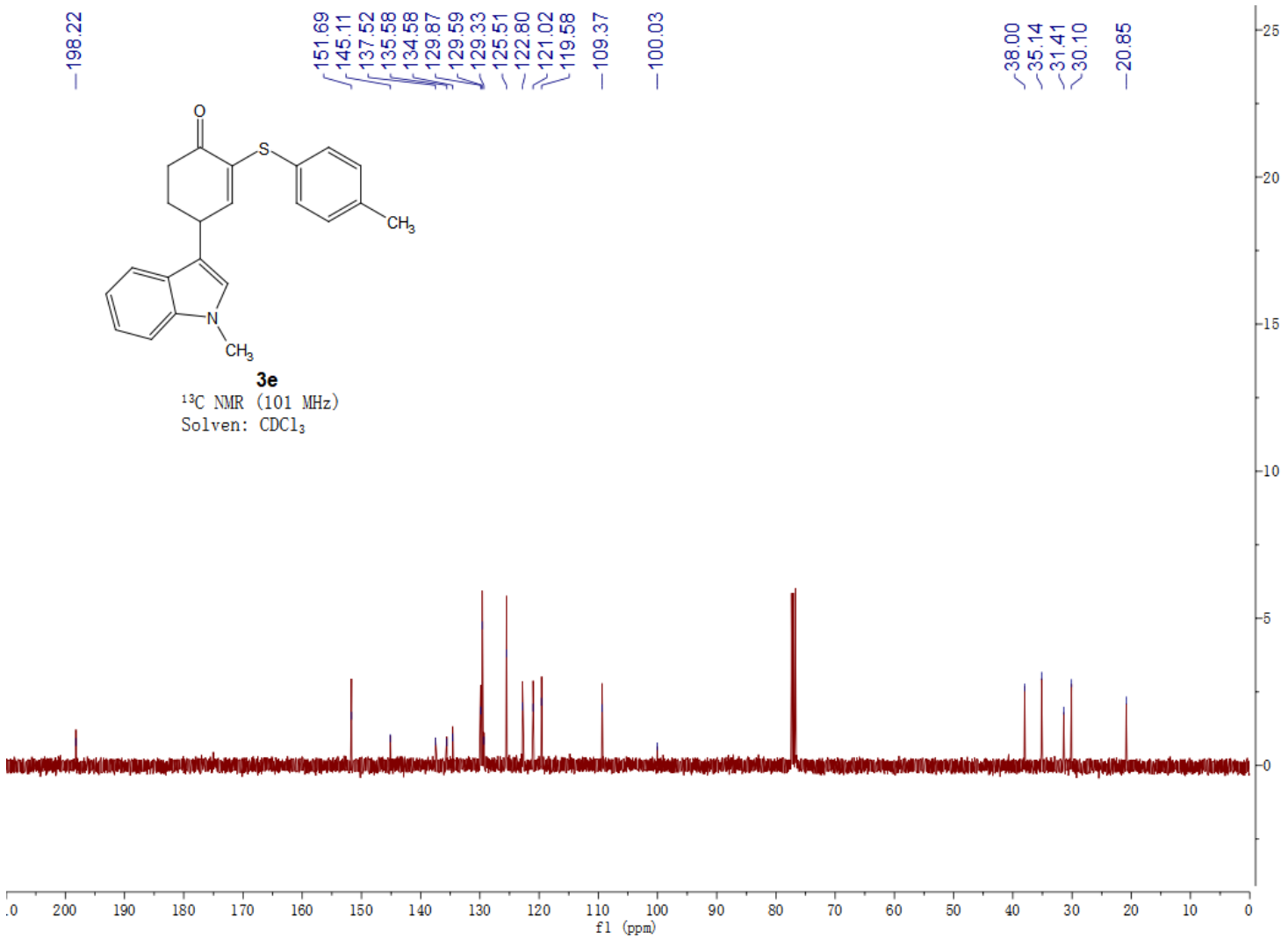
7.26
7.18
7.16
7.14
7.00
6.97
6.94
6.92
6.89
6.18
6.15
4.63
4.62
4.62
4.61
3.81
3.80
3.79
2.61
2.59
2.58
2.57
2.55
2.36
2.33
2.31
2.29
2.23
2.19
2.17
O
S
CH3
N
CH3
3e
1H NMR (400 MHz)
Solven: CDCl3
1.02
1.00
1.07
1.05
5.03
1.10
1.05
3.00
2.05
1.04
3.00
1.01
f1 (ppm)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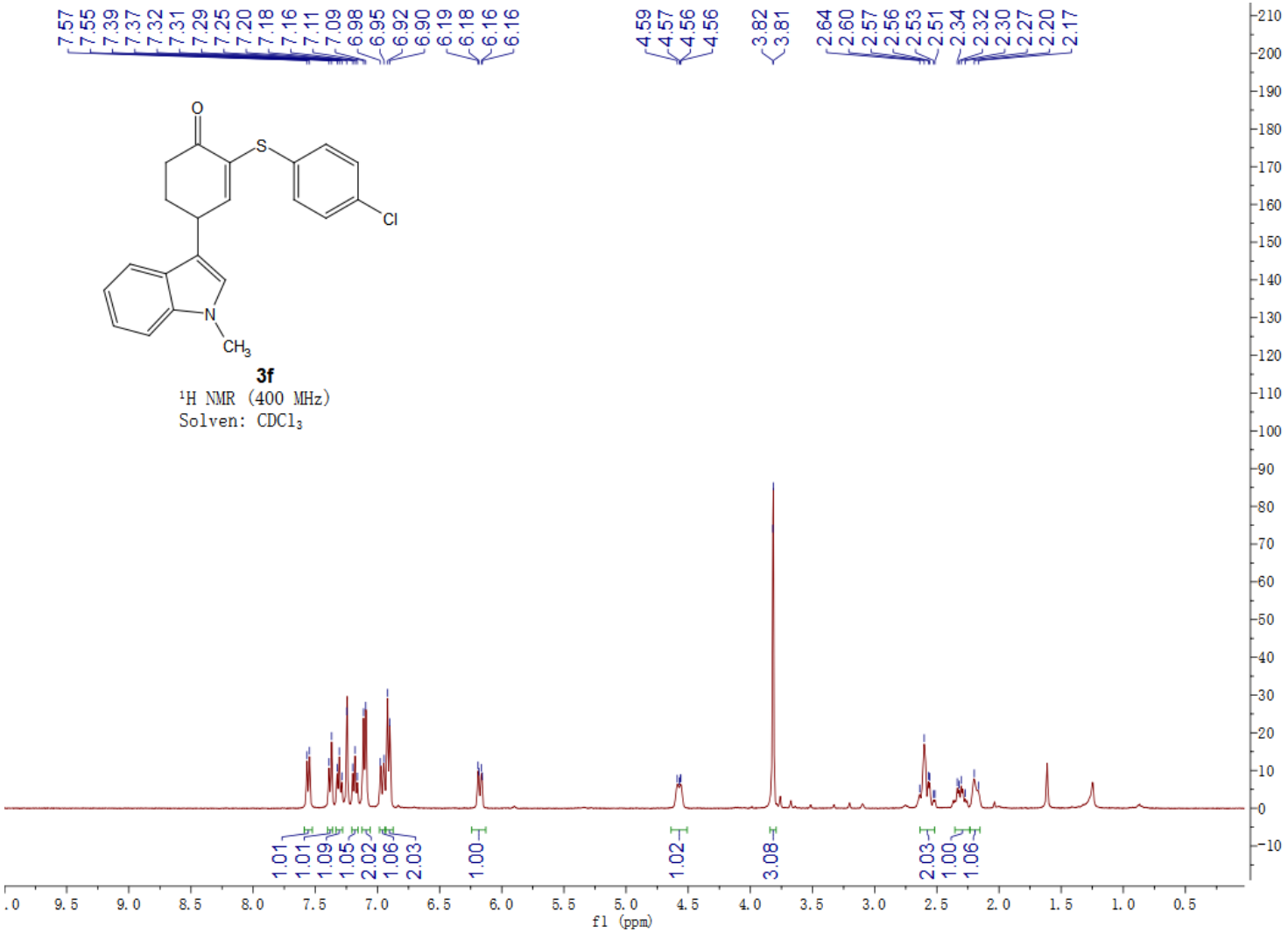
134.58
129.87
129.59
129.33
125.51
122.80
121.02
119.58
109.37
100.03
38.00
35.14
31.41
30.10
20.85
O
S
CH3
N
CH3
3e
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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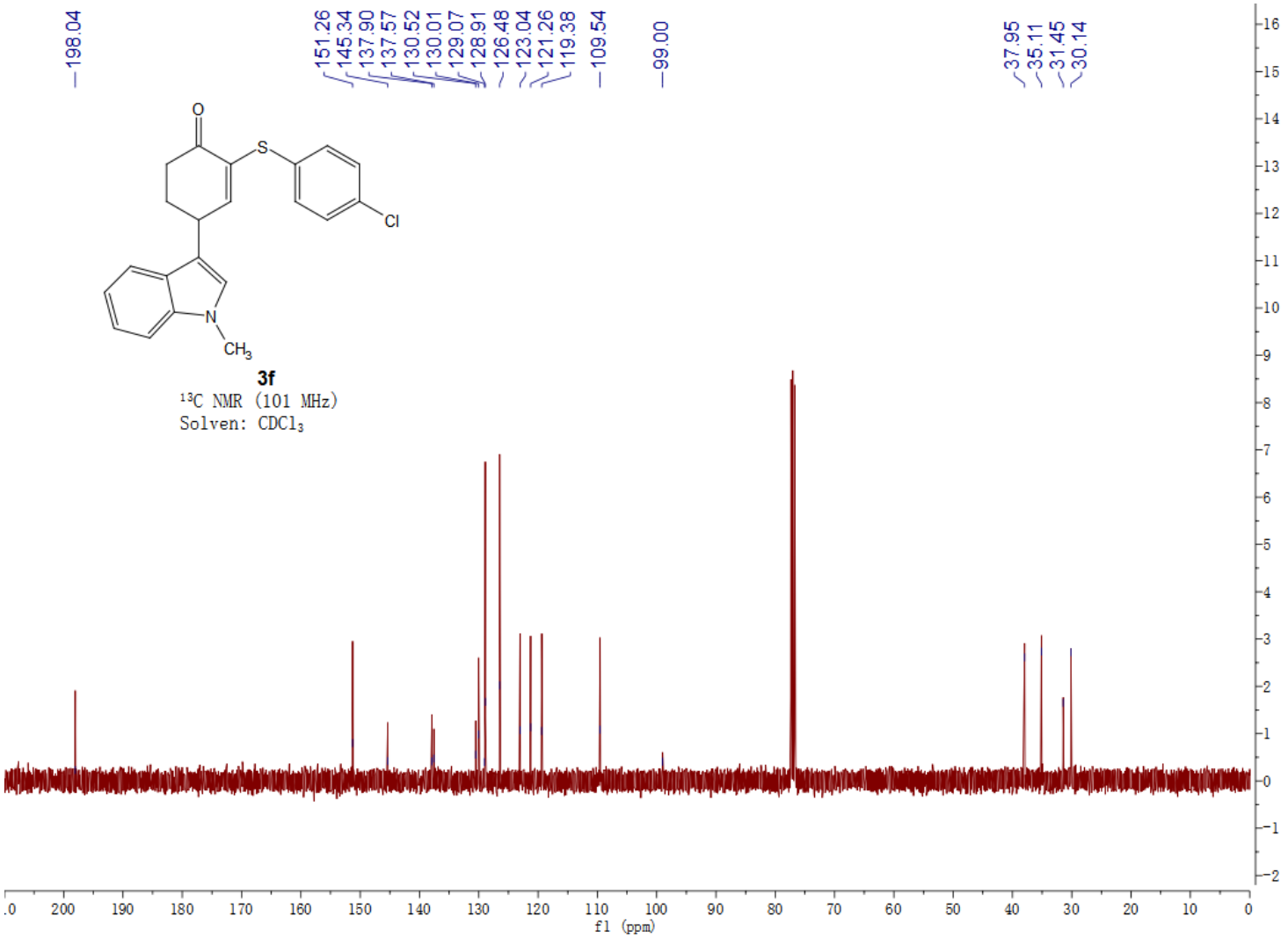
7.29
7.25
7.20
7.18
7.16
7.11
7.09
6.98
6.95
6.92
6.90
6.19
6.18
6.16
6.16
4.59
4.57
4.56
4.56
3.82
3.81
2.64
2.60
2.57
2.56
2.53
2.51
2.34
2.32
2.30
2.27
2.20
2.17
O
S
Cl
N
CH3
3f
1H NMR (400 MHz)
Solven: CDCl3
1.01
1.01
1.09
1.05
2.02
1.06
2.03
1.00
1.02
3.08
2.03
1.00
1.06
f1 (ppm)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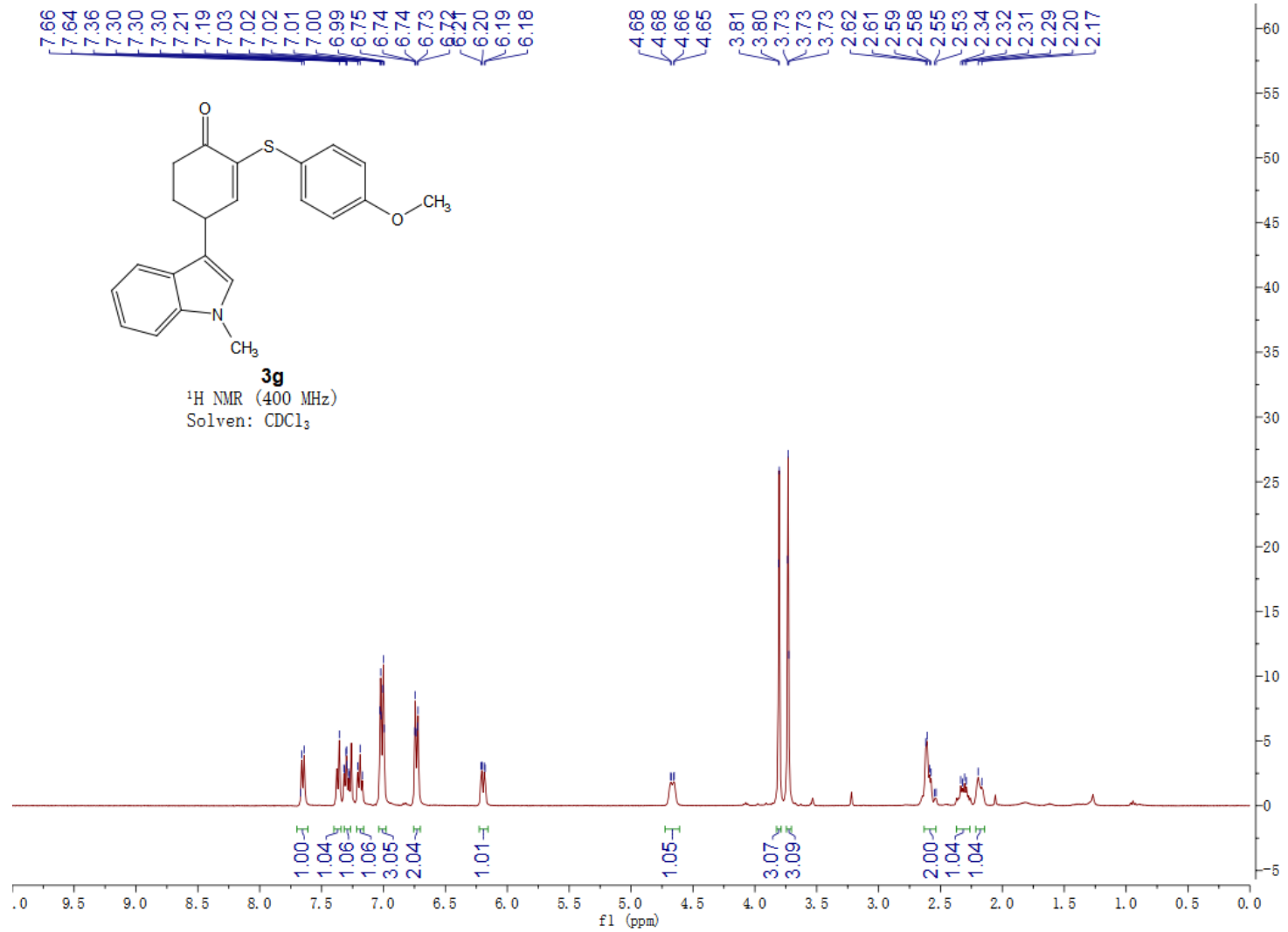
137.90
137.57
130.52
130.01
129.07
128.91
126.48
123.04
121.26
119.38
109.54
99.00
37.95
35.11
31.45
30.14
O
S
Cl
N
CH3
3f
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.64
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7.30
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7.30
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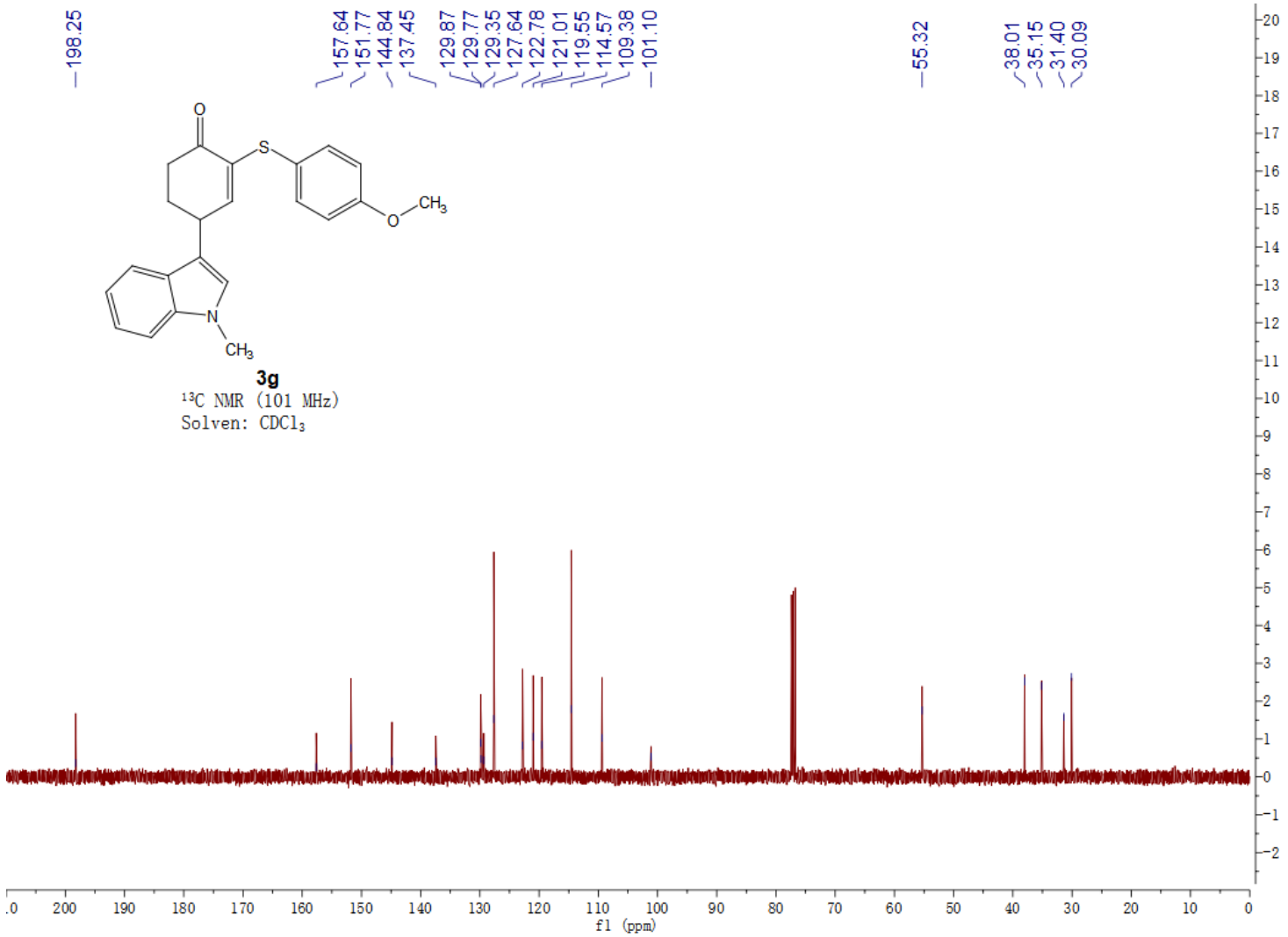
7.19
7.03
7.02
7.02
7.01
7.00
6.99
6.75
6.74
6.74
6.73
6.72
6.21
6.20
6.19
6.18
4.68
4.68
4.66
4.65
3.81
3.80
3.73
3.73
3.73
2.62
2.61
2.59
2.58
2.55
2.53
2.34
2.32
2.31
2.29
2.20
2.17
O
S
O
CH3
N
CH3
3g
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.04
1.06
1.06
3.05
2.04
1.01
1.05
3.07
3.09
2.00
1.04
1.04
f1 (ppm)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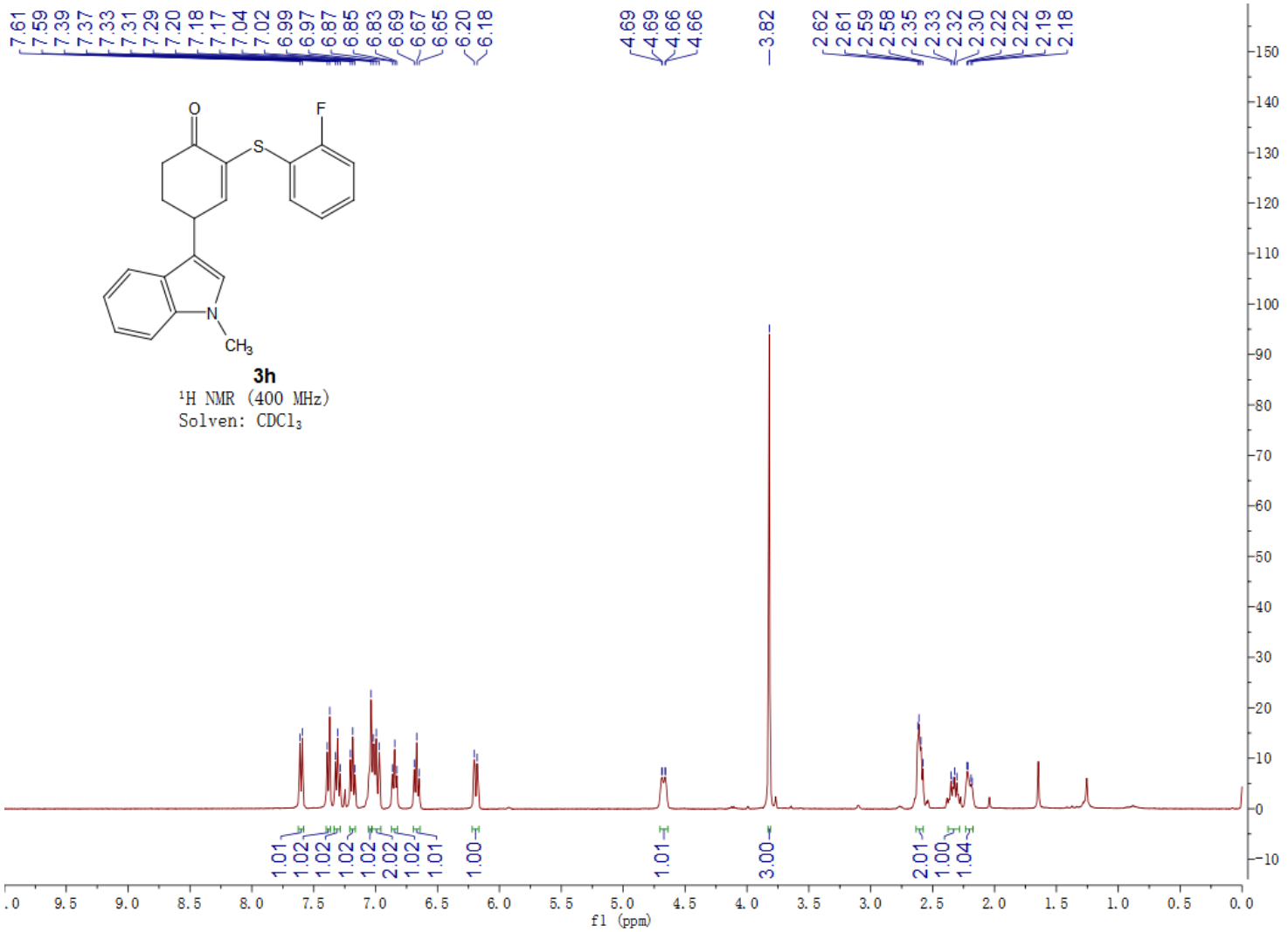
129.35
127.64
122.78
121.01
119.55
114.57
109.38
101.10
55.32
38.01
35.15
31.40
30.09
O
S
O
CH3
N
CH3
3g
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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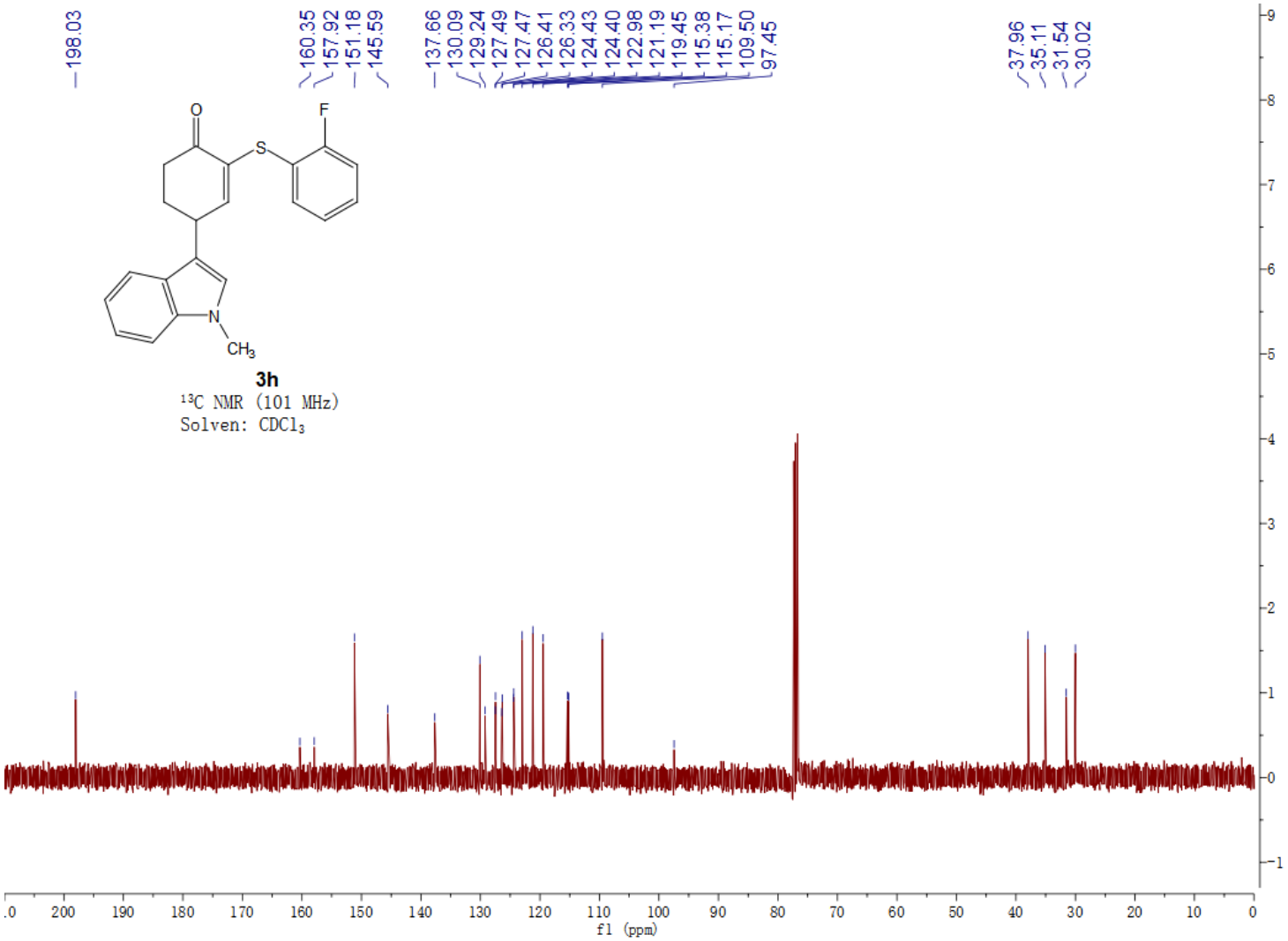
7.31
7.29
7.20
7.18
7.17
7.04
7.02
6.99
6.97
6.87
6.85
6.83
6.69
6.67
6.65
6.20
6.18
4.69
4.69
4.66
4.66
3.82
2.62
2.61
2.59
2.58
2.35
2.33
2.32
2.30
2.22
2.22
2.19
2.18
O
F
S
N
CH3
3h
1H NMR (400 MHz)
Solven: CDCl3
1.01
1.02
1.02
1.02
1.02
2.02
1.02
1.01
1.00
1.01
3.00
2.01
1.00
1.04
f1 (ppm)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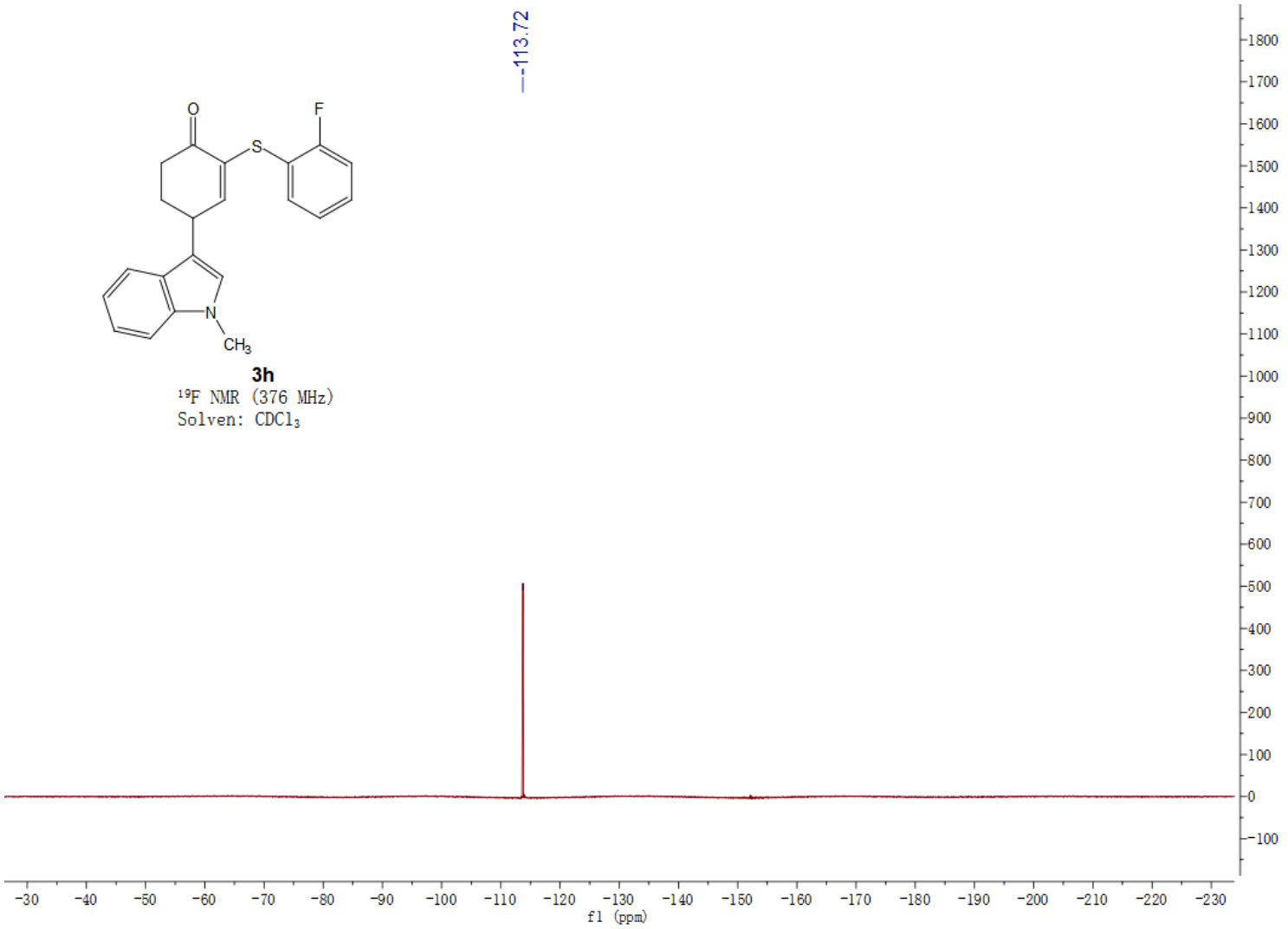
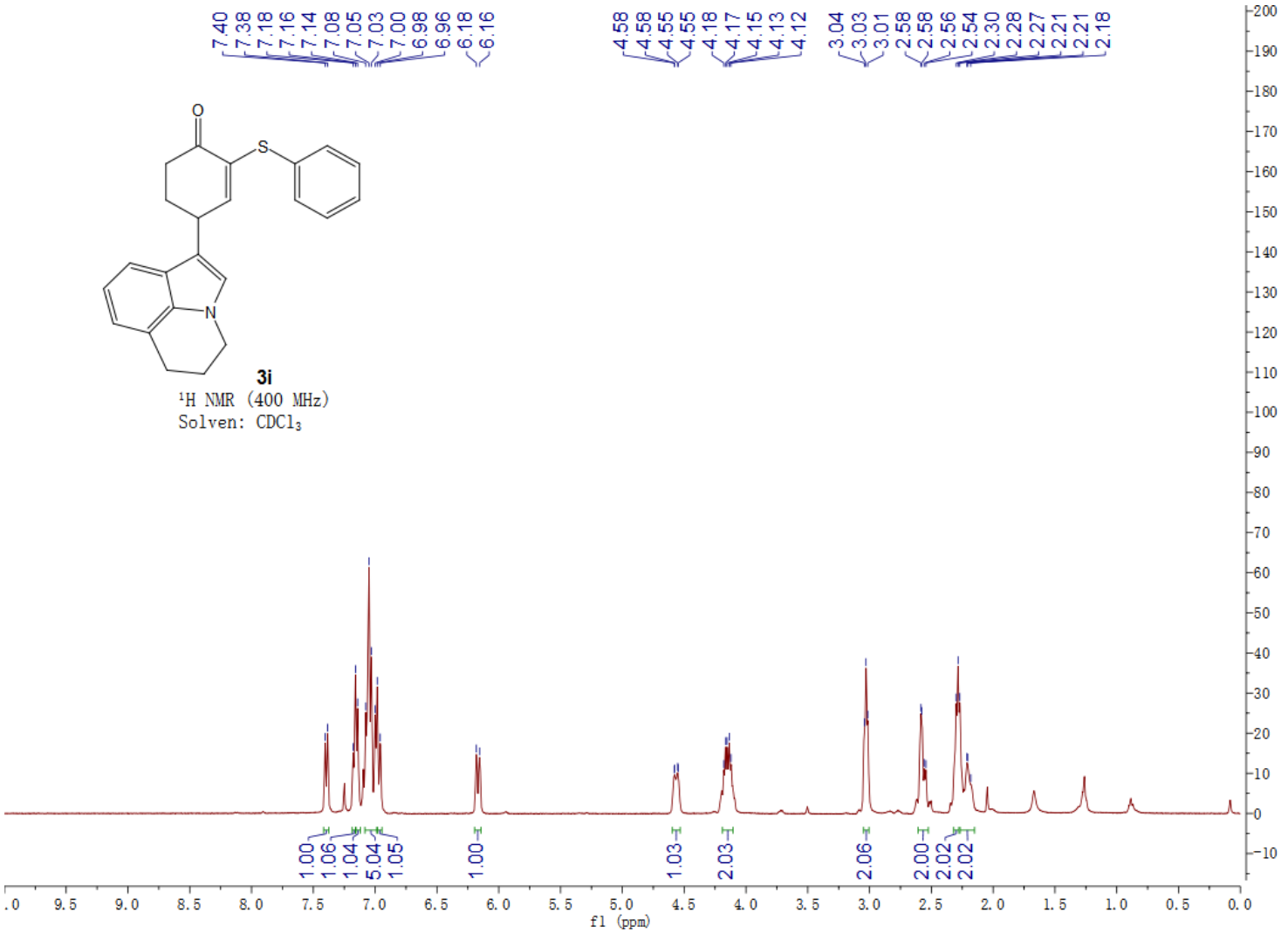
160.35
157.92
151.18
145.59
137.66
130.09
129.24
127.49
127.47
126.41
126.33
124.43
124.40
122.98
121.19
119.45
115.38
115.17
109.50
97.45
37.96
35.11
31.54
30.02
O
S
F
N
CH3
3h
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


-113.72
O
F
S
N
CH3
3h
19F NMR (376 MHz)
Solven: CDCl3
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
-30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220 -230
f1 (ppm)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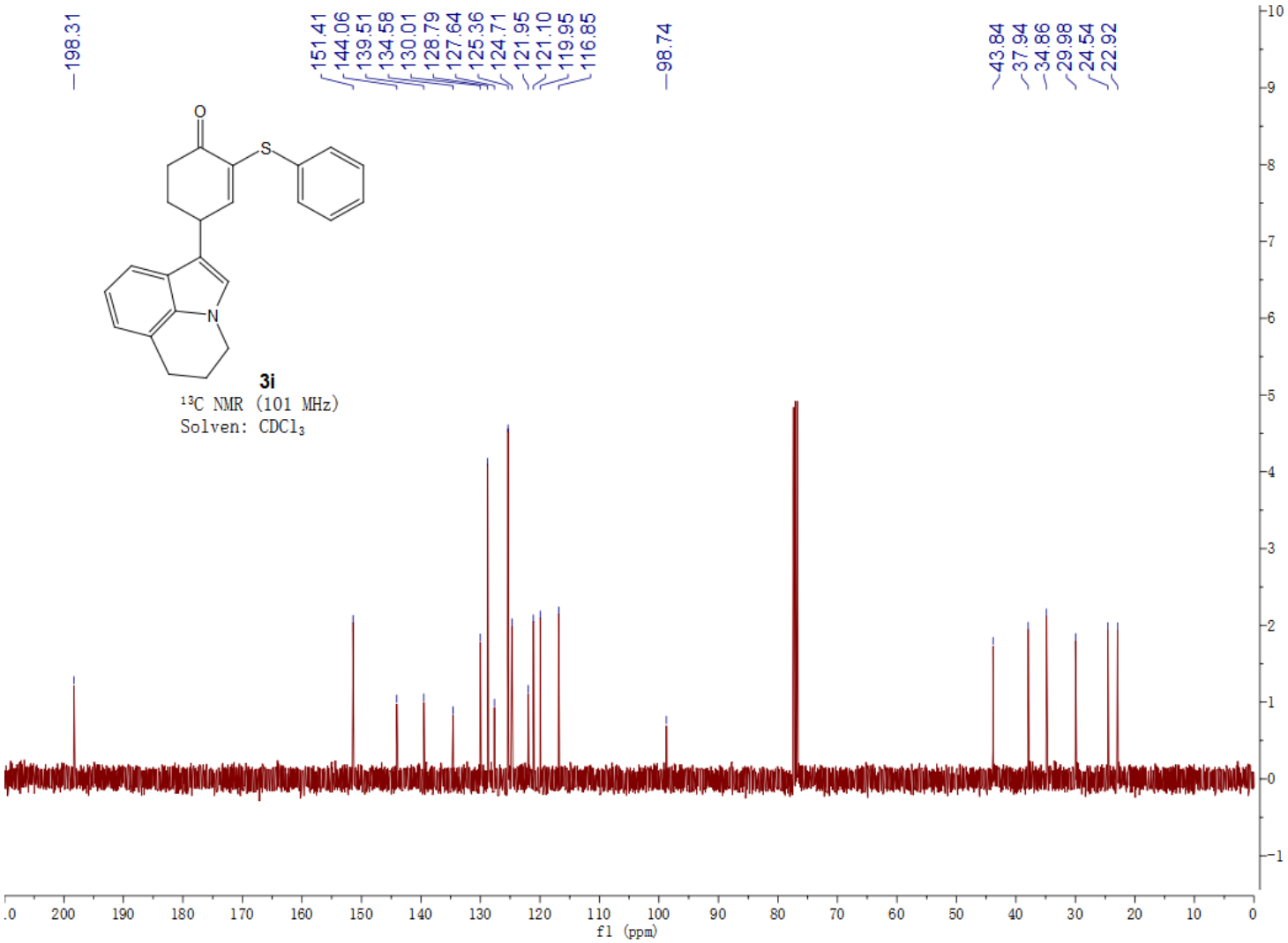
7.38
7.18
7.16
7.14
7.08
7.05
7.03
7.00
6.98
6.96
6.18
6.16
4.58
4.58
4.55
4.55
4.18
4.17
4.15
4.13
4.12
3.04
3.03
3.01
2.58
2.58
2.56
2.54
2.30
2.28
2.27
2.21
2.21
2.18
O
S
N
3i
¹H NMR (400 MHz)
Solven: CDCl₃
1.00
1.06
1.04
5.04
1.05
1.00
1.03
2.03
2.06
2.00
2.02
2.02
f1 (ppm)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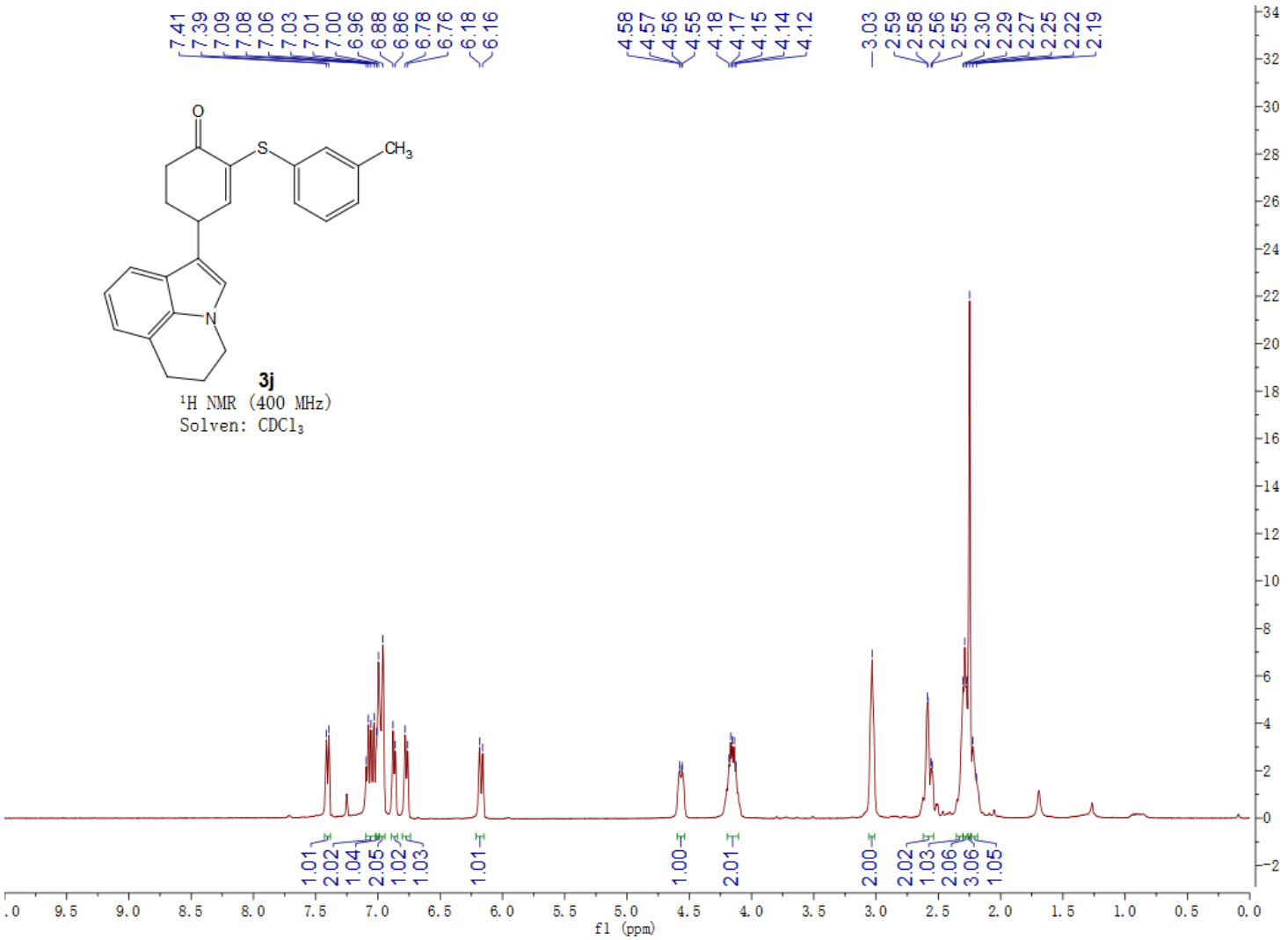
119.95
116.85
98.74
43.84
37.94
34.86
29.98
24.54
22.92
O
S
N
3i
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.39
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7.08
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7.03
7.01
7.00
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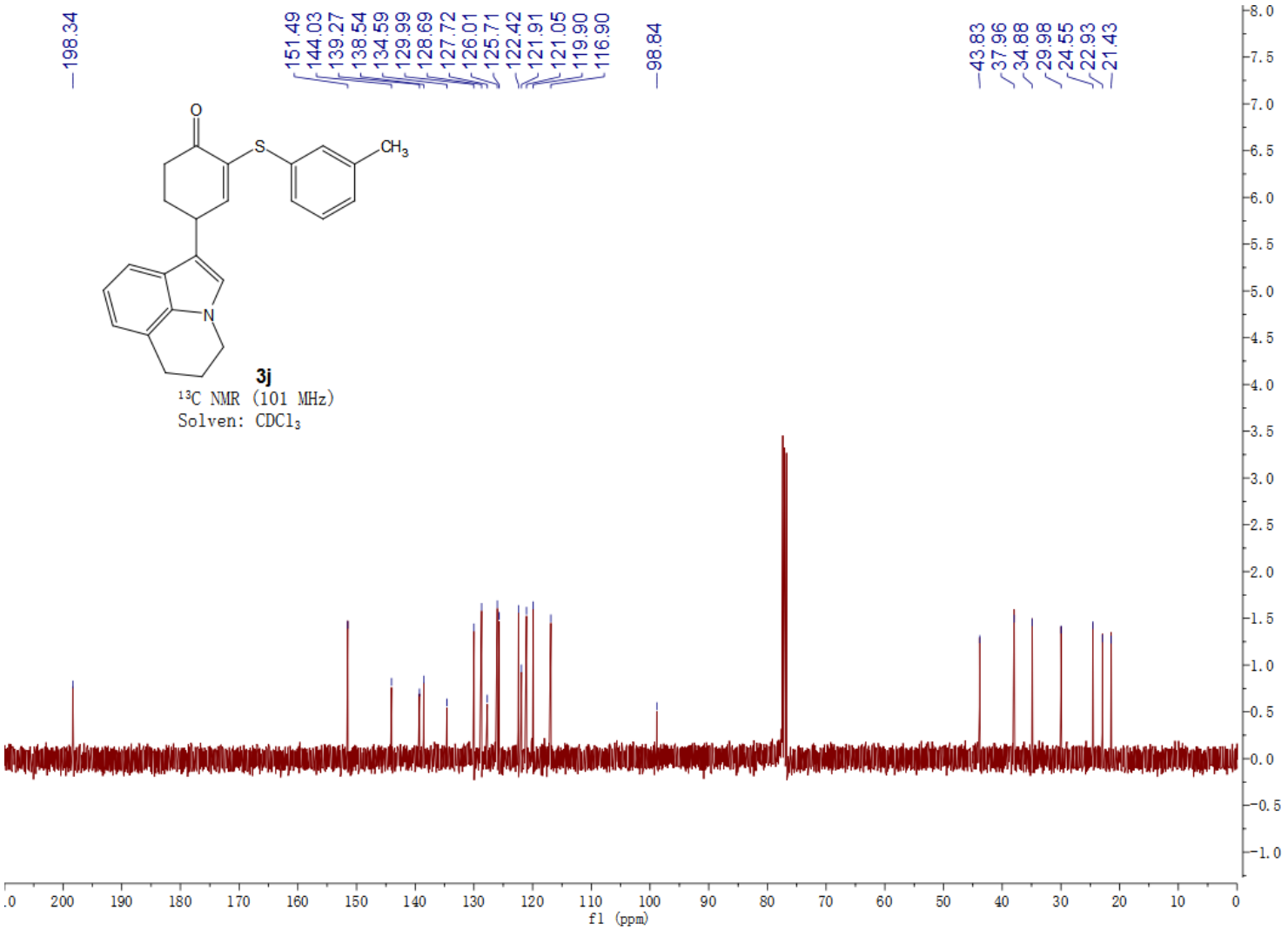
6.88
6.86
6.78
6.76
6.18
6.16
4.58
4.57
4.56
4.55
4.18
4.17
4.15
4.14
4.12
3.03
2.59
2.58
2.56
2.55
2.30
2.29
2.27
2.25
2.22
2.19
O
S
CH3
N
3j
1H NMR (400 MHz)
Solven: CDCl3
1.01
2.02
1.04
2.05
1.02
1.03
1.01
1.00
2.01
2.00
2.02
1.03
2.06
3.06
1.05
f1 (ppm)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126.01
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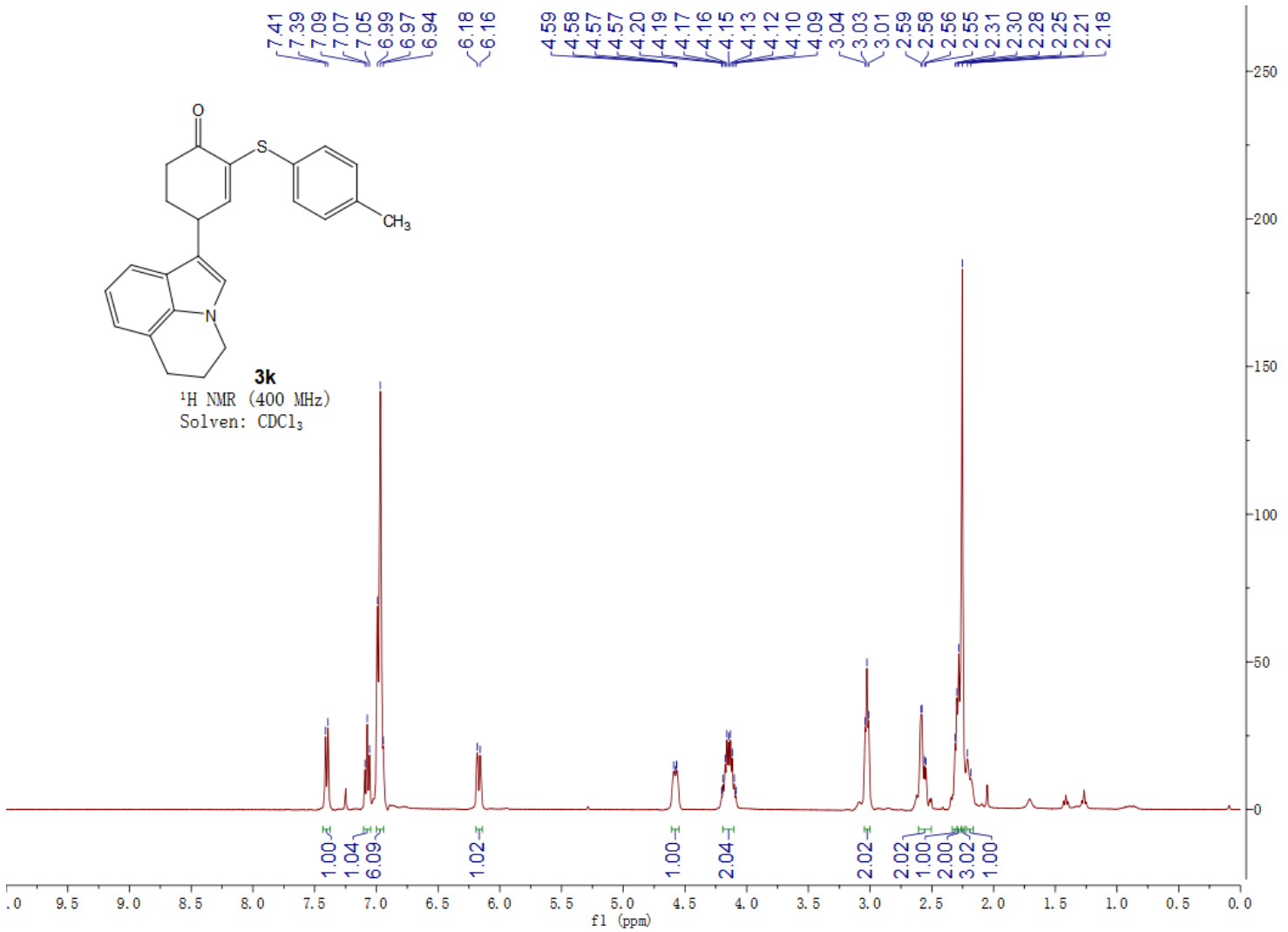
122.42
121.91
121.05
119.90
116.90
98.84
43.83
37.96
34.88
29.98
24.55
22.93
21.43
O
S
CH3
N
3j
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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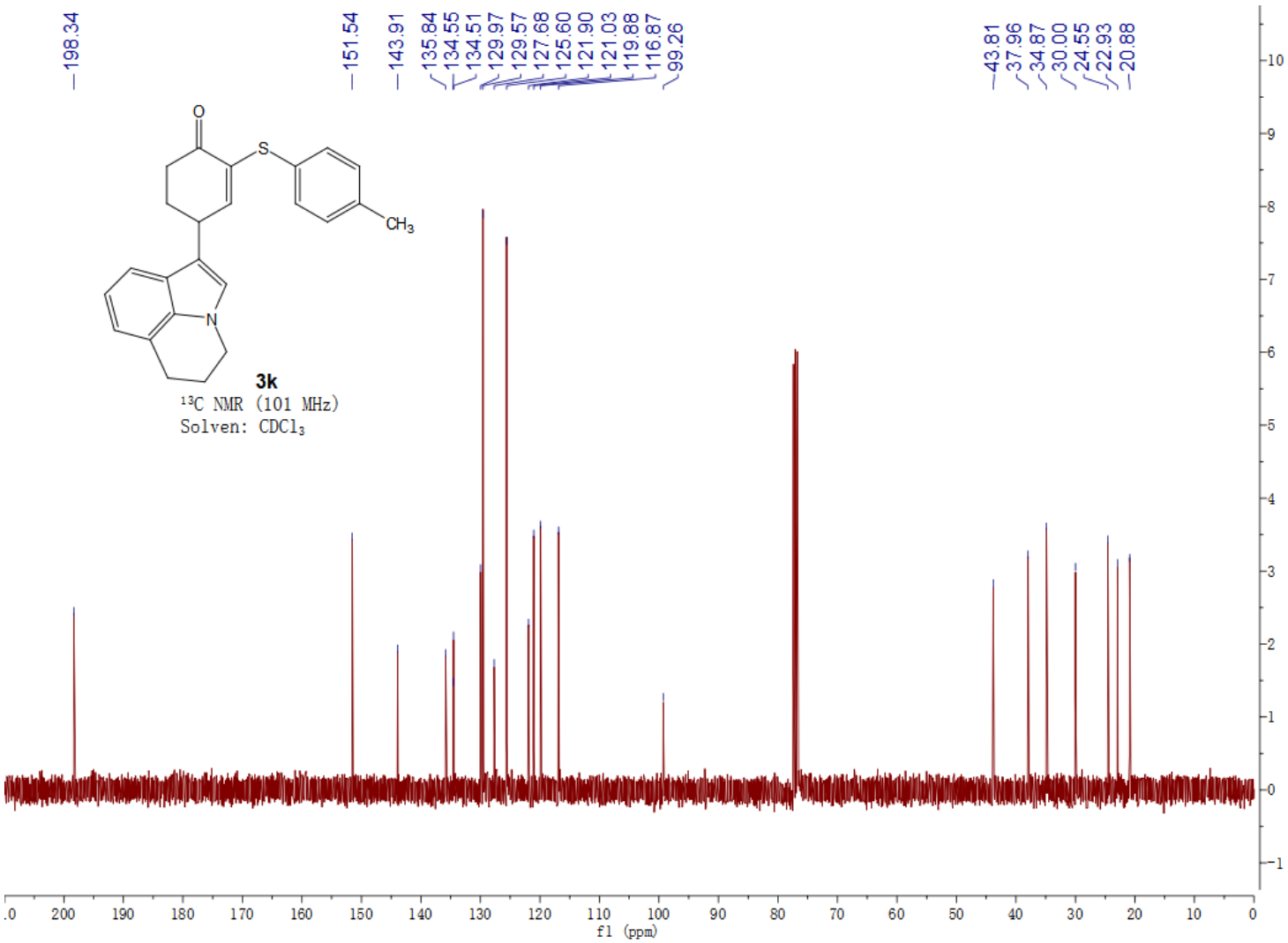
7.09
7.07
7.05
6.99
6.97
6.94
6.18
6.16
4.59
4.58
4.57
4.57
4.20
4.19
4.17
4.16
4.15
4.13
4.12
4.10
4.09
3.04
3.03
3.01
2.59
2.58
2.56
2.55
2.31
2.30
2.28
2.25
2.21
2.18
O
S
CH3
N
3k
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.04
6.09
1.02
1.00
2.04
2.02
2.02
1.00
2.00
3.02
1.00
f1 (ppm)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134.51
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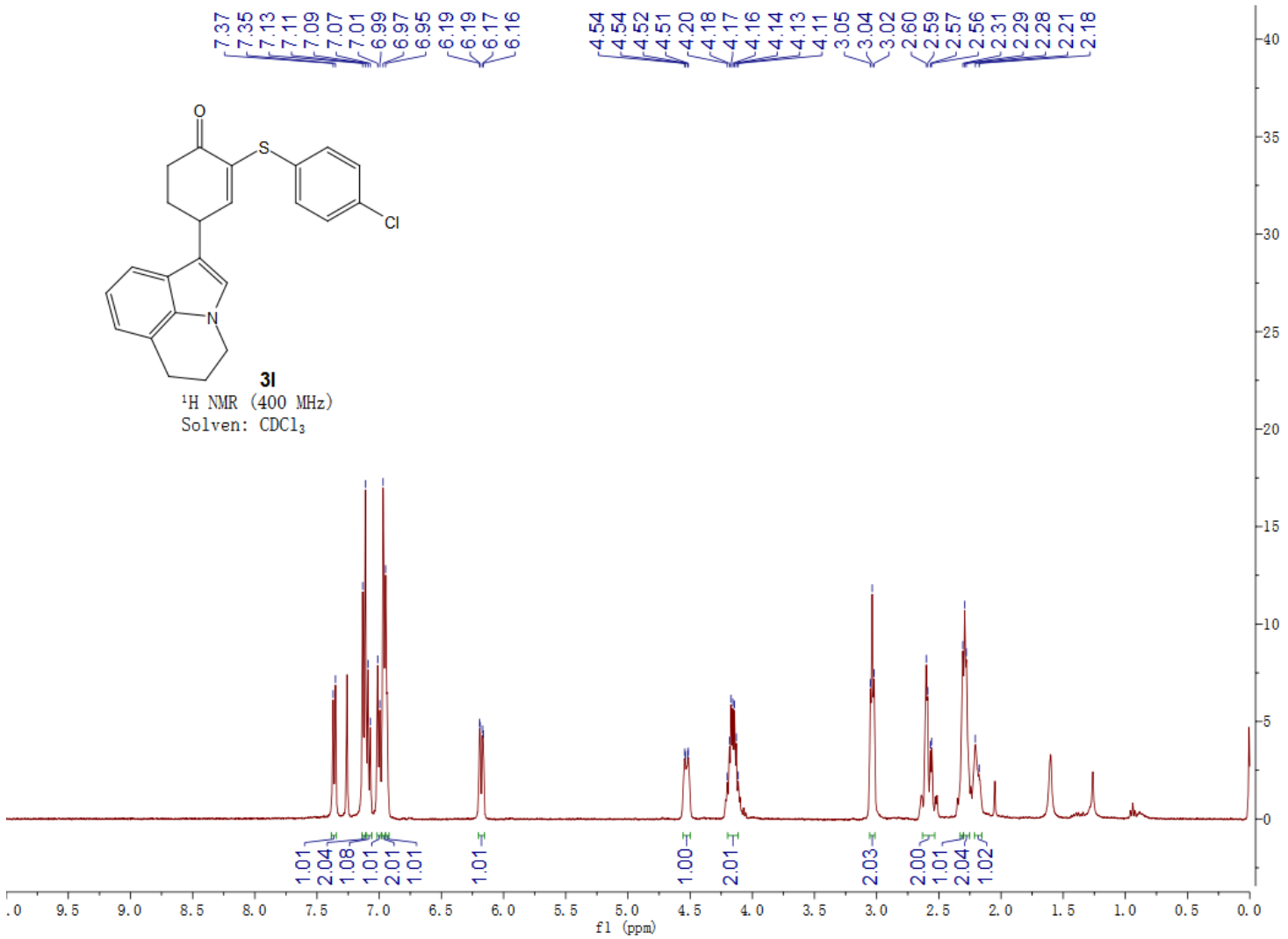
129.57
127.68
125.60
121.90
121.03
119.88
116.87
99.26
43.81
37.96
34.87
30.00
24.55
22.93
20.88
O
S
CH3
N
3k
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.35
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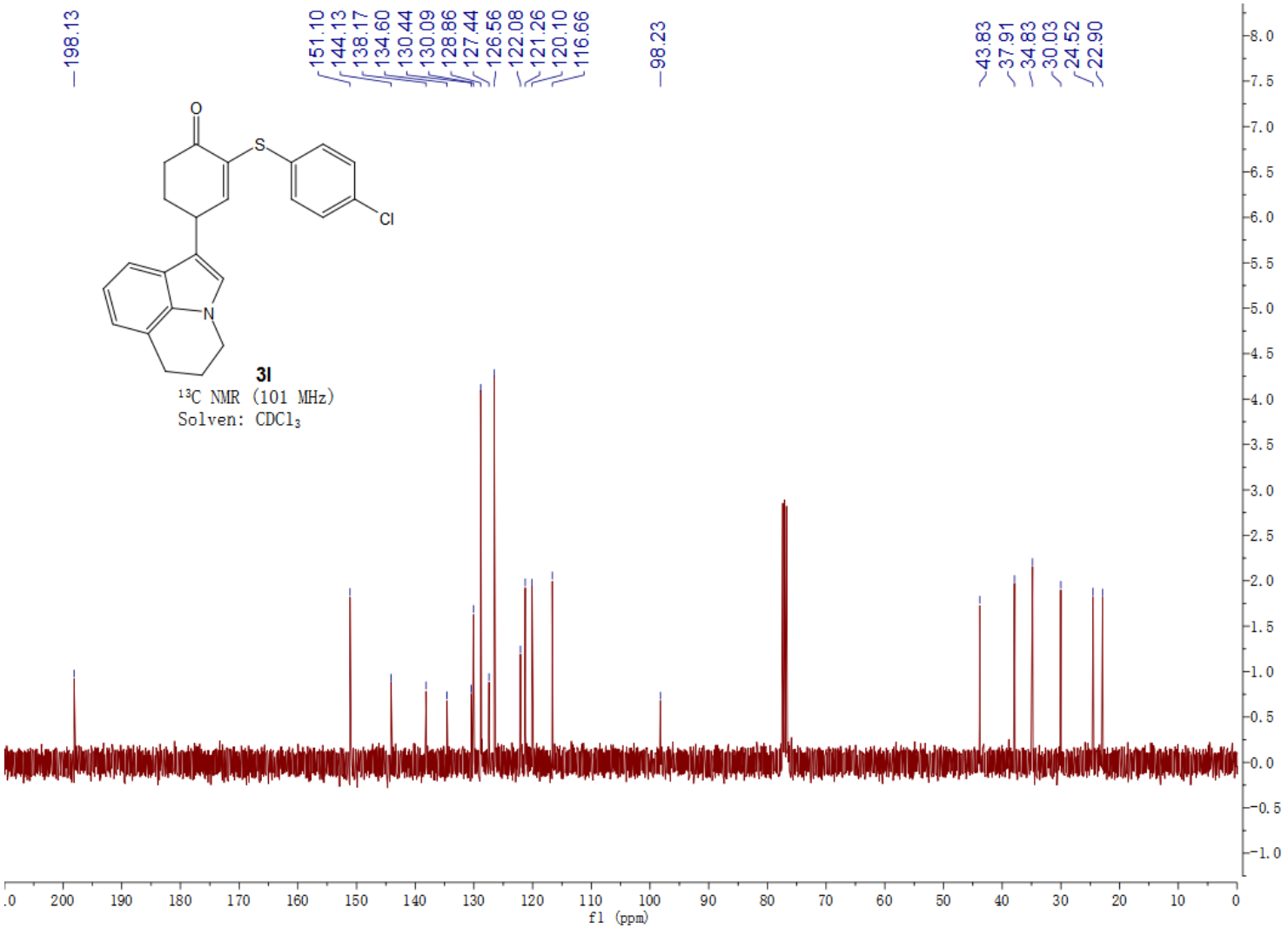
7.11
7.09
7.07
7.01
6.99
6.97
6.95
6.19
6.19
6.17
6.16
4.54
4.54
4.52
4.51
4.20
4.18
4.17
4.16
4.14
4.13
4.11
3.05
3.04
3.02
2.60
2.59
2.57
2.56
2.31
2.29
2.28
2.21
2.18
O
S
Cl
N
3l
¹H NMR (400 MHz)
Solven: CDCl₃
1.01
2.04
1.08
1.01
2.01
1.01
1.01
1.00
2.01
2.03
2.00
1.01
2.04
1.02
f1 (ppm)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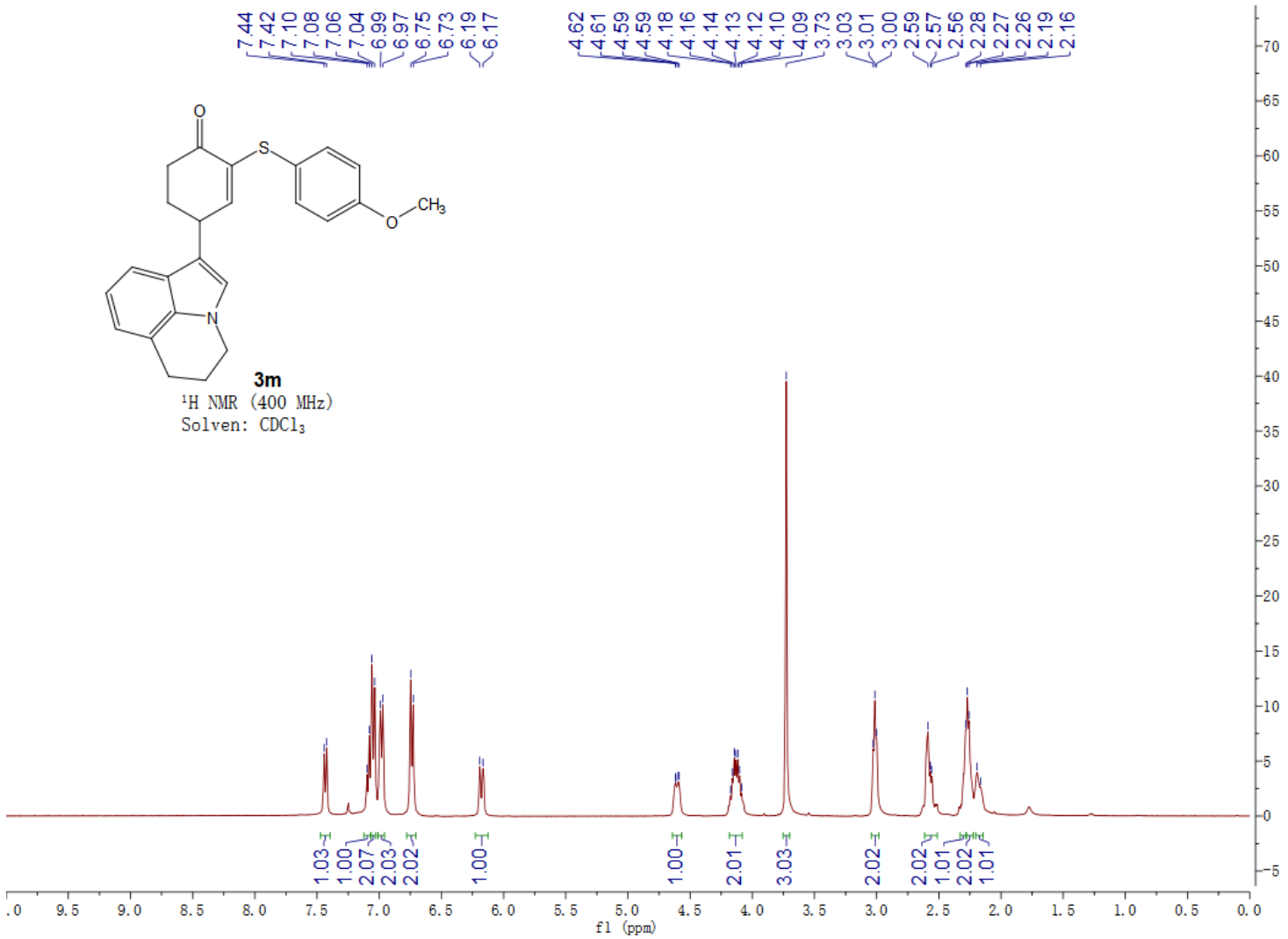
138.17
134.60
130.44
130.09
128.86
127.44
126.56
122.08
121.26
120.10
116.66
98.23
43.83
37.91
34.83
30.03
24.52
22.90
O
S
Cl
N
3l
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.04
6.99
6.97
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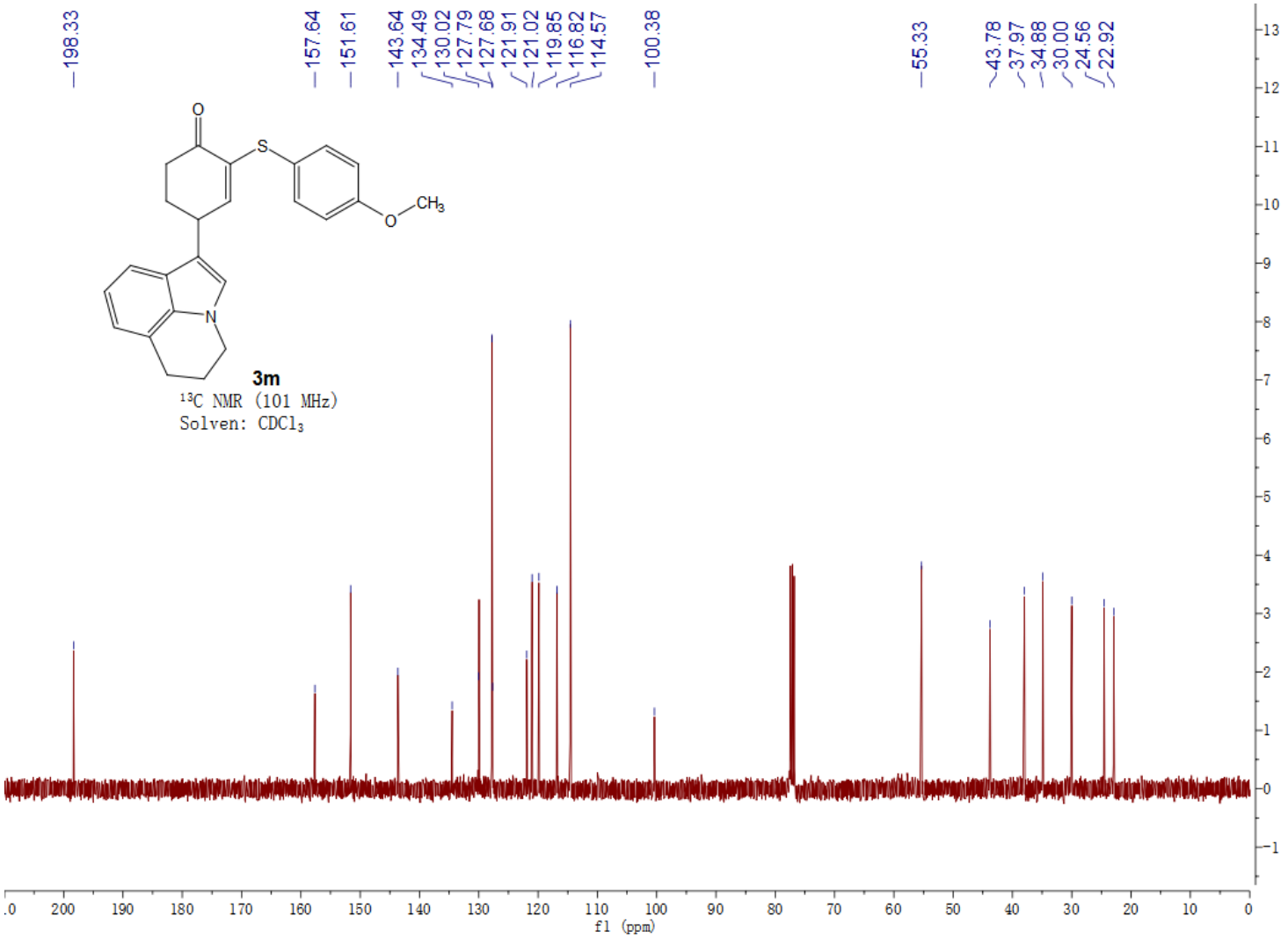
6.73
6.19
6.17
4.62
4.61
4.59
4.59
4.18
4.16
4.14
4.13
4.12
4.10
4.09
3.73
3.03
3.01
3.00
2.59
2.57
2.56
2.28
2.27
2.26
2.19
2.16
O
S
O
CH3
N
3m
1H NMR (400 MHz)
Solven: CDCl3
1.03
1.00
2.07
2.03
2.02
1.00
1.00
2.01
3.03
2.02
2.02
1.01
2.02
1.01
f1 (ppm)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134.49
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127.68
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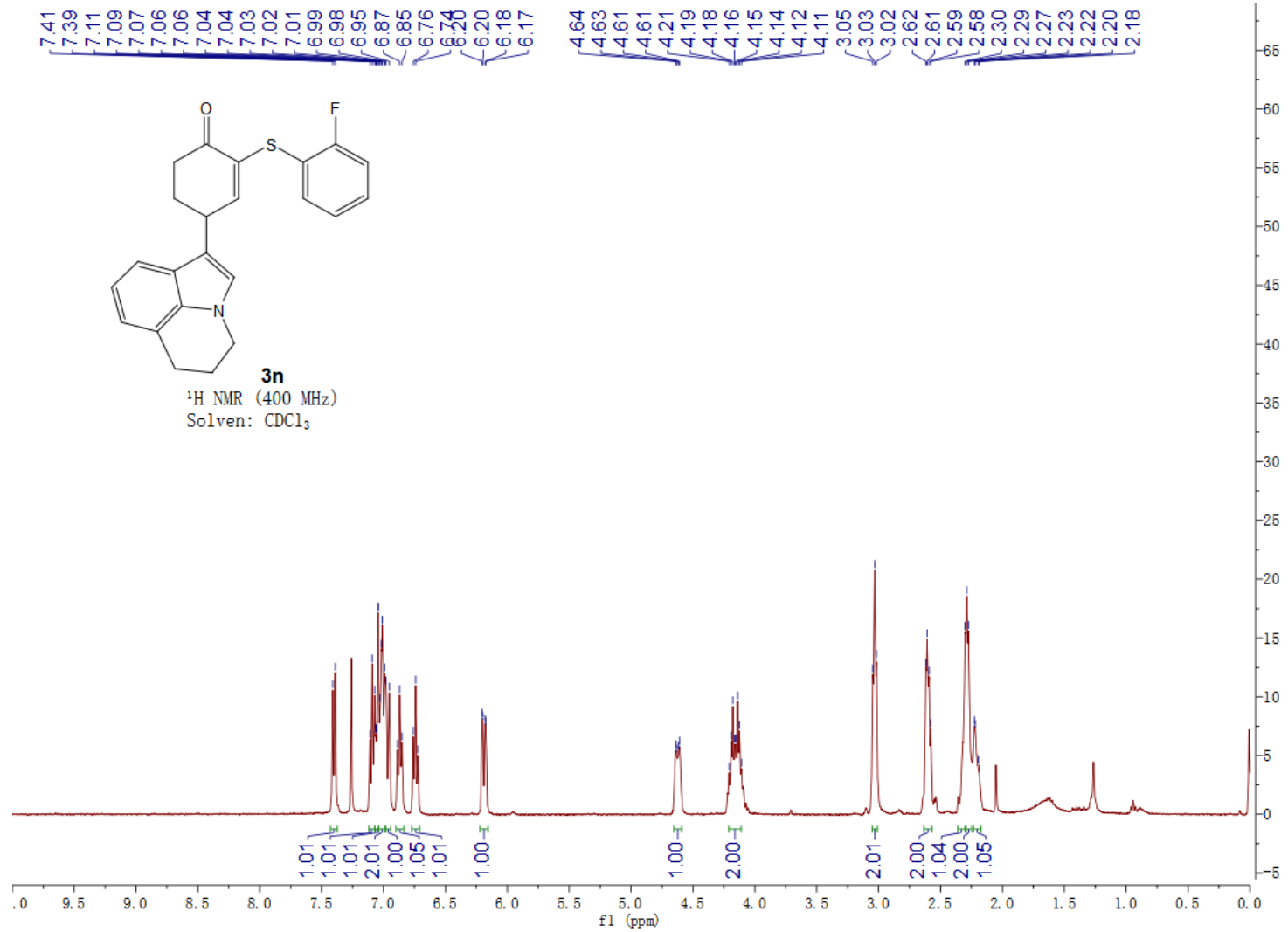
121.02
119.85
116.82
114.57
100.38
55.33
43.78
37.97
34.88
30.00
24.56
22.92
O
S
O
CH3
N
3m
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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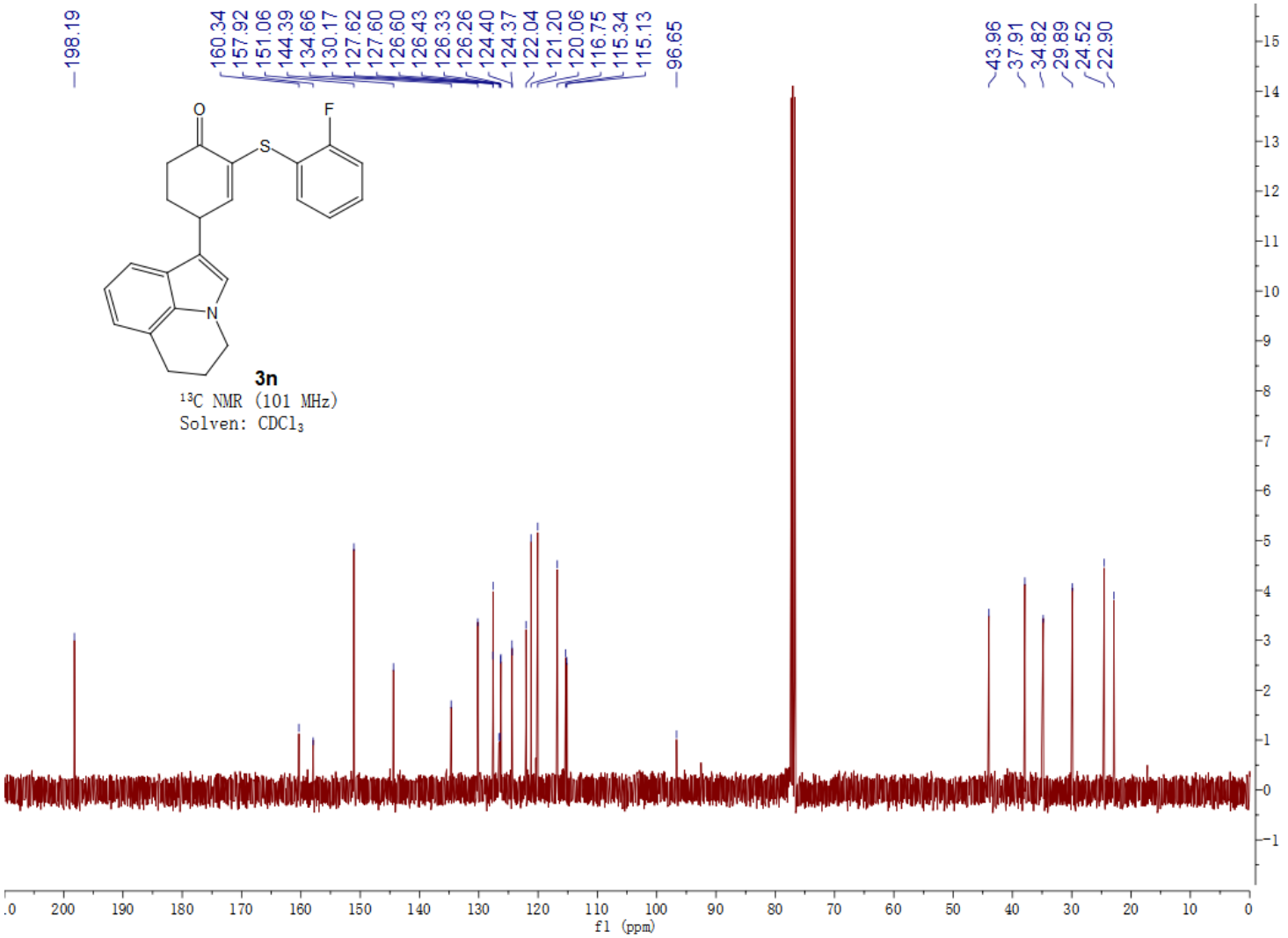
7.39
7.11
7.09
7.07
7.06
7.06
7.04
7.04
7.03
7.02
7.01
6.99
6.98
6.95
6.87
6.85
6.76
6.74
6.20
6.18
6.17
4.64
4.63
4.61
4.61
4.21
4.19
4.18
4.16
4.15
4.14
4.12
4.11
3.05
3.03
3.02
2.62
2.61
2.59
2.58
2.30
2.29
2.27
2.23
2.22
2.20
2.18
O
F
S
N
3n
¹H NMR (400 MHz)
Solven: CDCl₃
1.01
1.01
1.01
2.01
1.00
1.05
1.01
1.00
1.00
2.00
2.01
2.00
1.04
2.00
1.05
f1 (ppm)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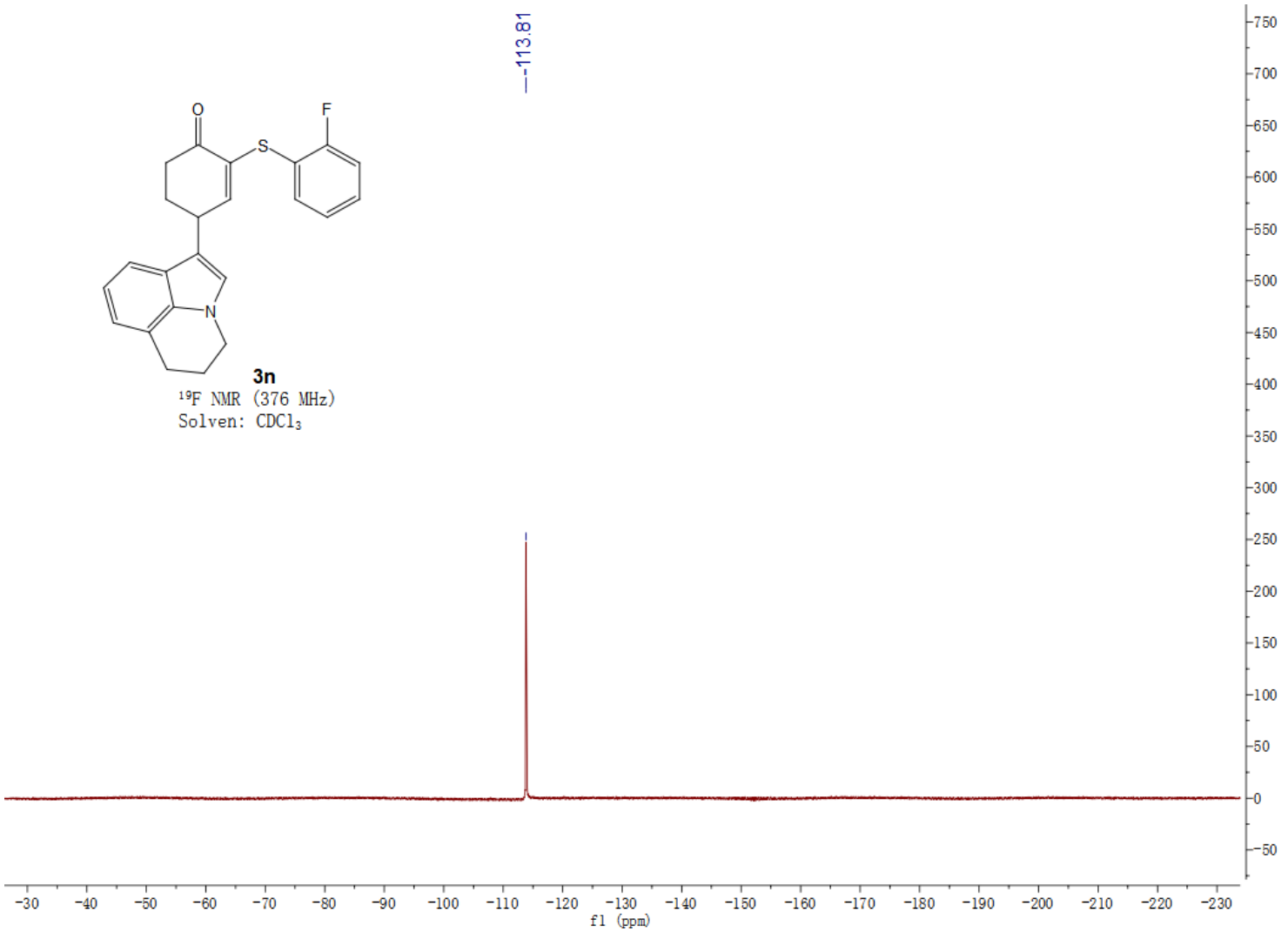
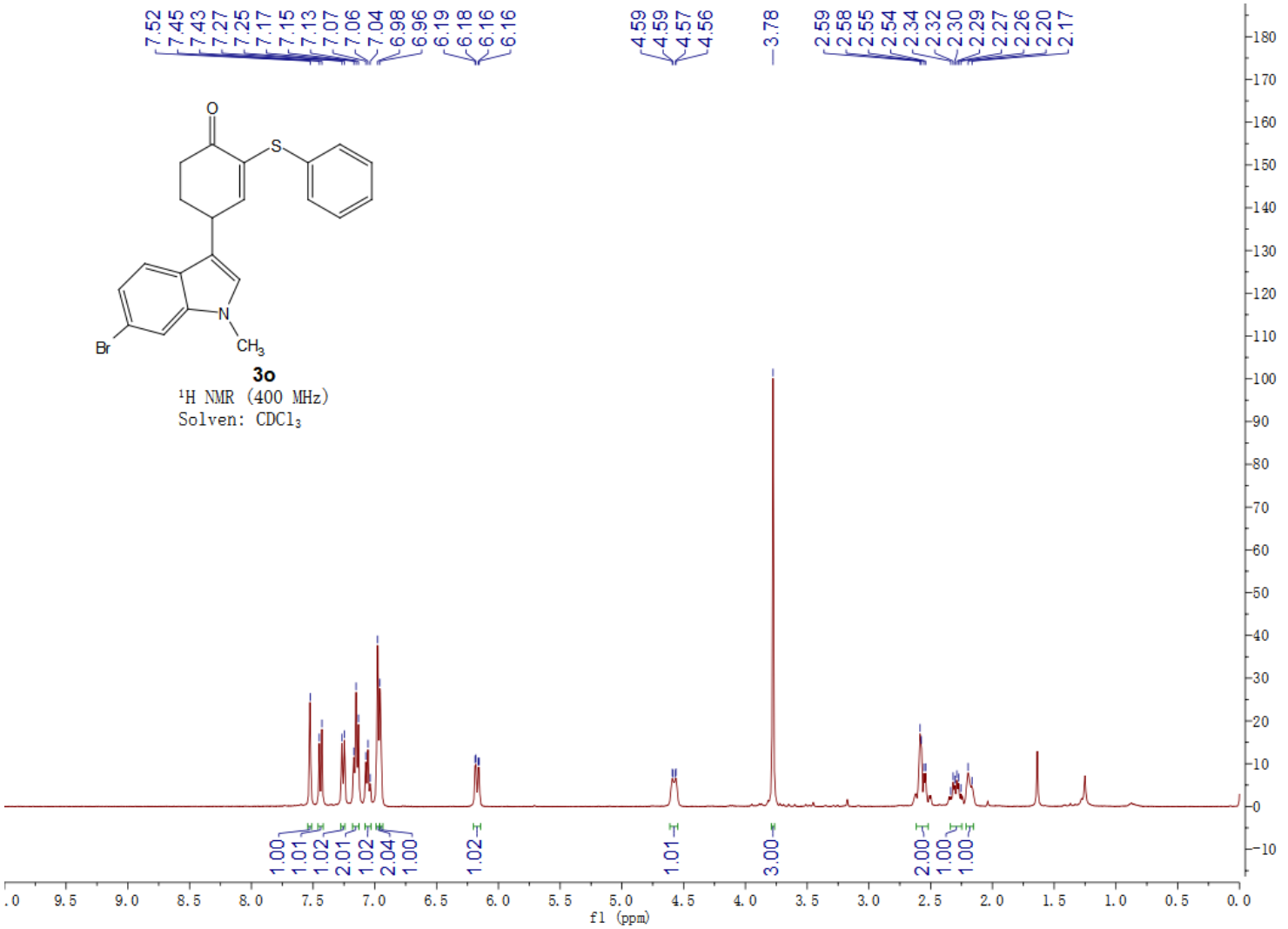
160.34
157.92
151.06
144.39
134.66
130.17
127.62
127.60
126.60
126.43
126.33
126.26
124.40
124.37
122.04
121.20
120.06
116.75
115.34
115.13
96.65
43.96
37.91
34.82
29.89
24.52
22.90
O
F
S
N
3n
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


-113.81
O
F
S
N
3n
19F NMR (376 MHz)
Solven: CDCl3
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
-50
-30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220 -230
f1 (ppm)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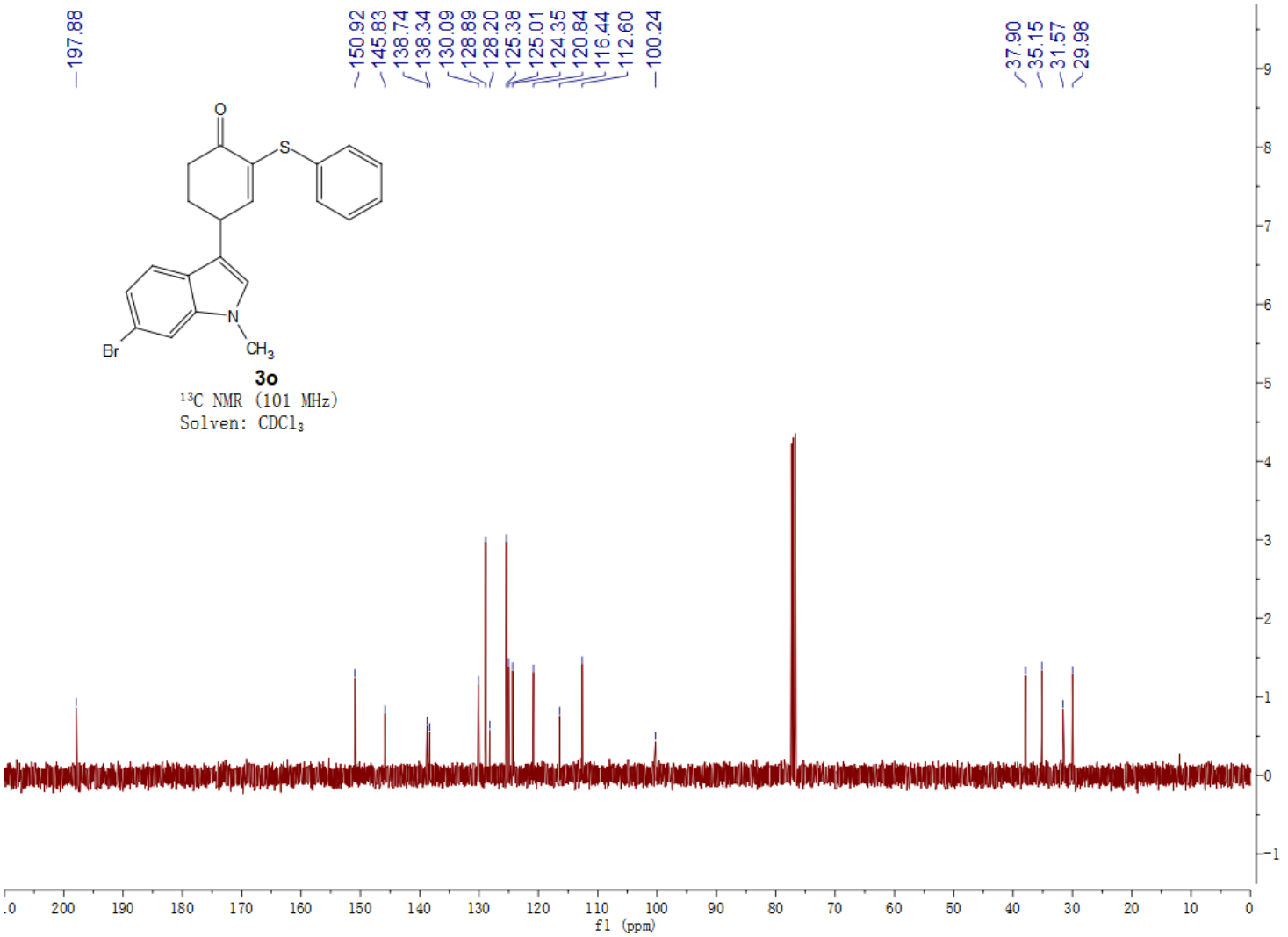
7.45
7.43
7.27
7.25
7.17
7.15
7.13
7.07
7.06
7.04
6.98
6.96
6.19
6.18
6.16
6.16
4.59
4.59
4.57
4.56
3.78
2.59
2.58
2.55
2.54
2.34
2.32
2.30
2.29
2.27
2.26
2.20
2.17
O
S
N
Br
CH3
3o
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.01
1.02
2.01
1.02
2.04
1.00
1.02
1.01
3.00
2.00
1.00
1.00
f1 (ppm)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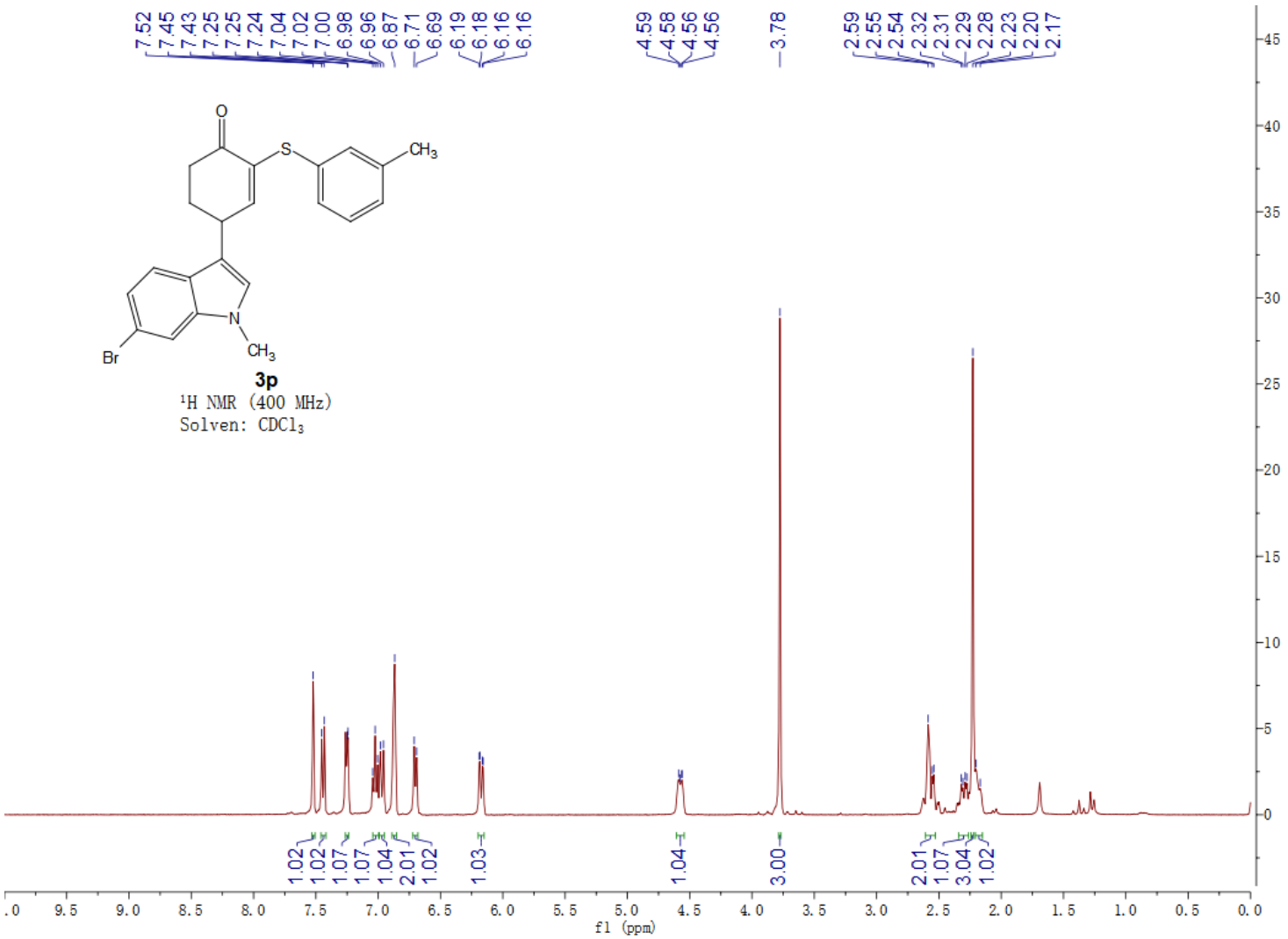
130.09
128.89
128.20
125.38
125.01
124.35
120.84
116.44
112.60
100.24
37.90
35.15
31.57
29.98
O
S
N
Br
CH3
3o
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.43
7.25
7.25
7.24
7.04
7.02
7.00
6.98
6.96
6.87
6.71
6.69
6.19
6.18
6.16
6.16
4.59
4.58
4.56
4.56
3.78
2.59
2.55
2.54
2.32
2.31
2.29
2.28
2.23
2.20
2.17
O
S
CH3
N
CH3
Br
3p
1H NMR (400 MHz)
Solven: CDCl3
1.02
1.02
1.07
1.07
1.04
2.01
1.02
1.03
1.04
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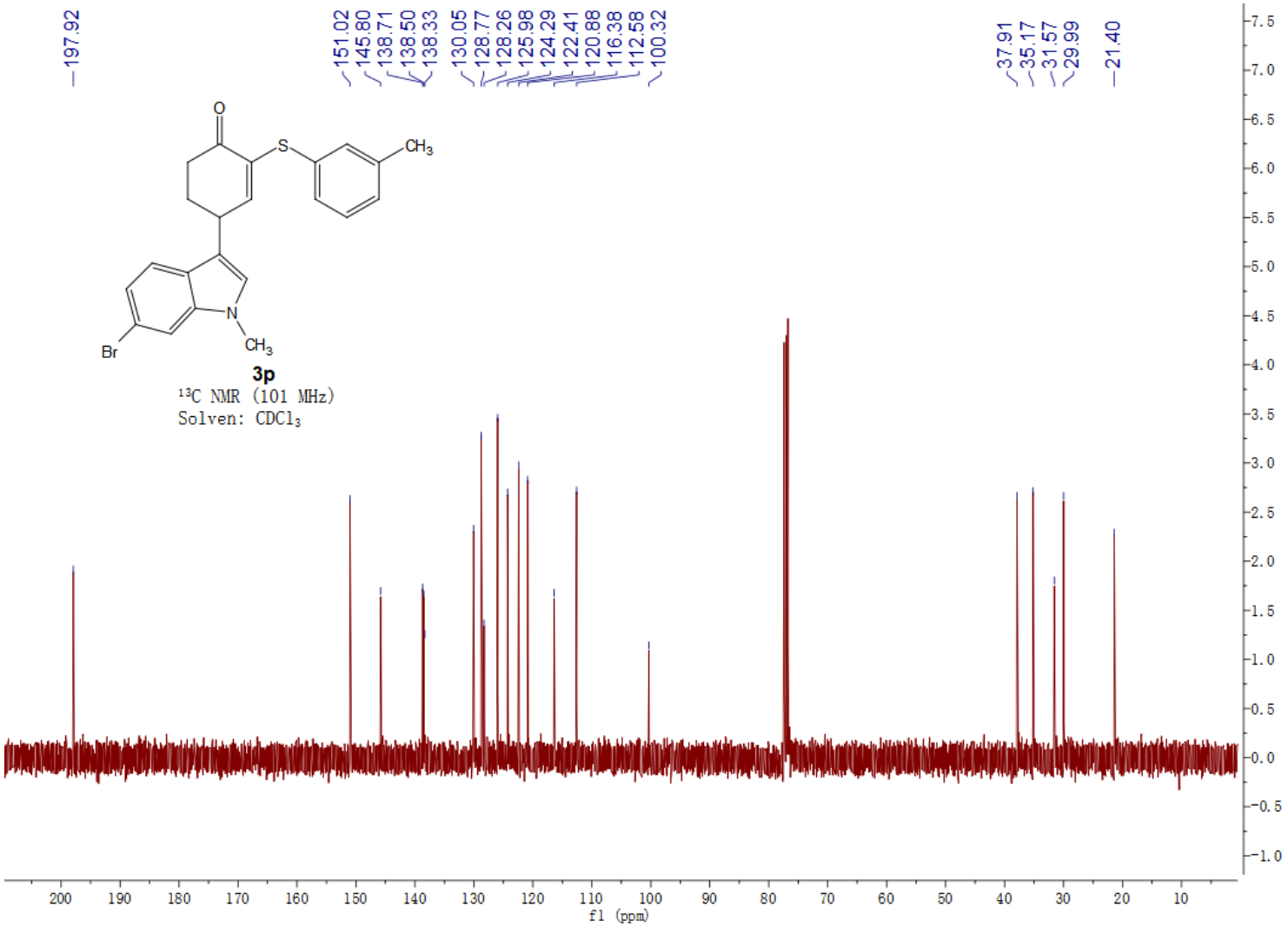
2.01
1.07
3.04
1.02
f1 (ppm)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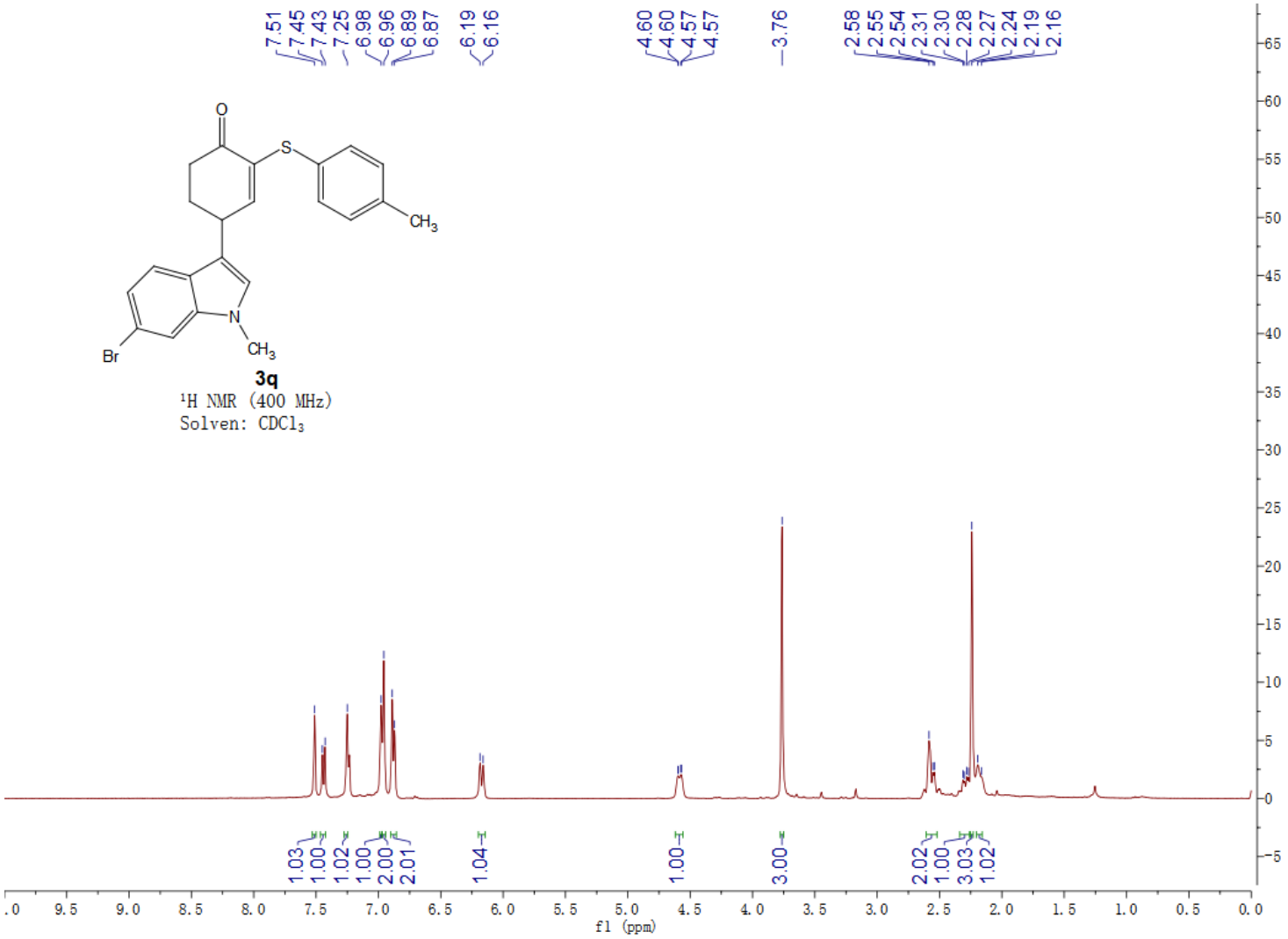
151.02
145.80
138.71
138.50
138.33
130.05
128.77
128.26
125.98
124.29
122.41
120.88
116.38
112.58
100.32
37.91
35.17
31.57
29.99
21.40
O
S
CH3
N
CH3
Br
3p
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.45
7.43
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6.96
6.89
6.87
6.19
6.16
4.60
4.60
4.57
4.57
3.76
2.58
2.55
2.54
2.31
2.30
2.28
2.27
2.24
2.19
2.16
O
S
CH3
N
CH3
Br
3q
1H NMR (400 MHz)
Solven: CDCl3
1.03
1.00
1.02
1.00
2.00
2.01
1.04
1.00
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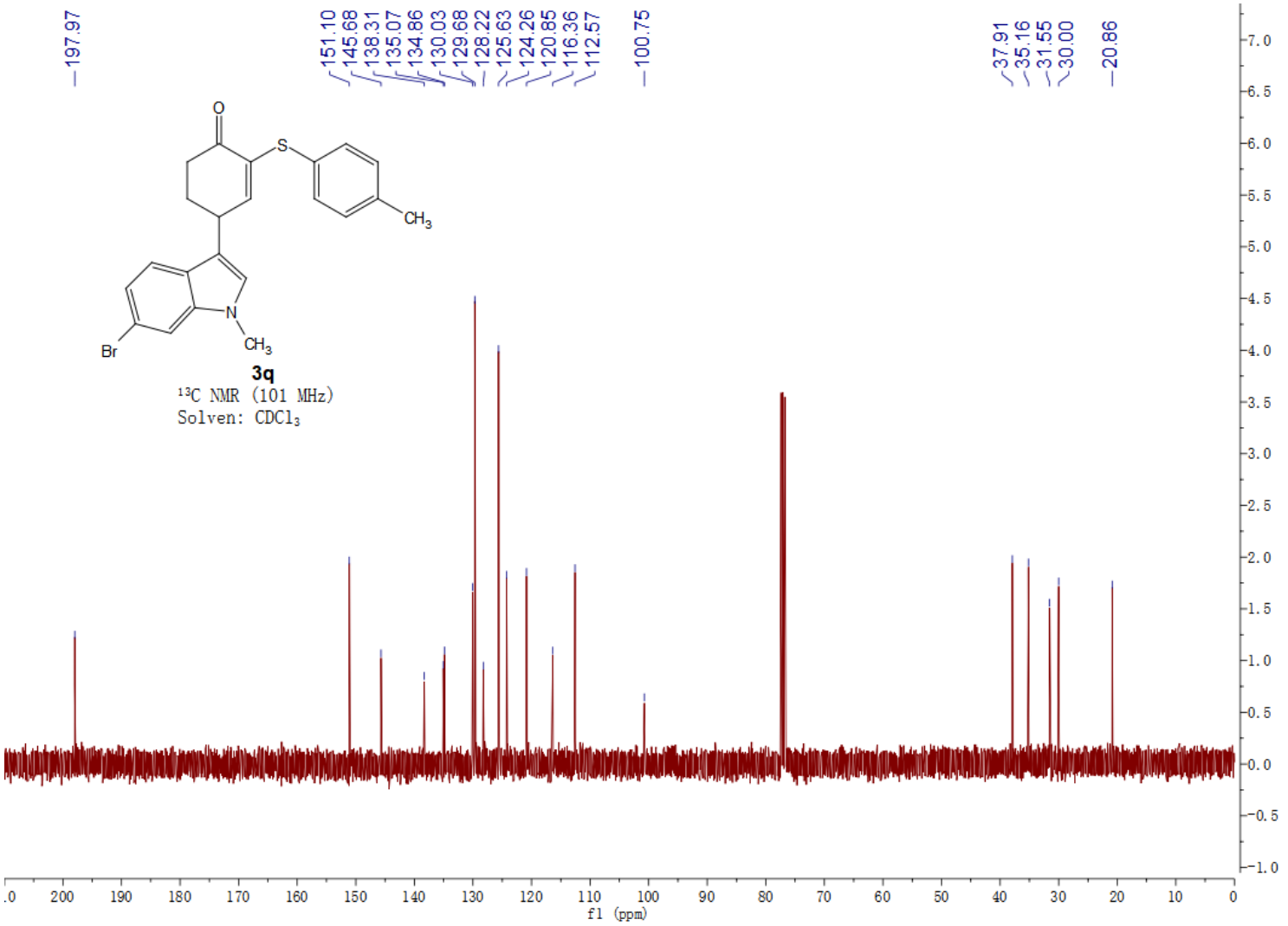
2.02
1.00
3.03
1.02
f1 (ppm)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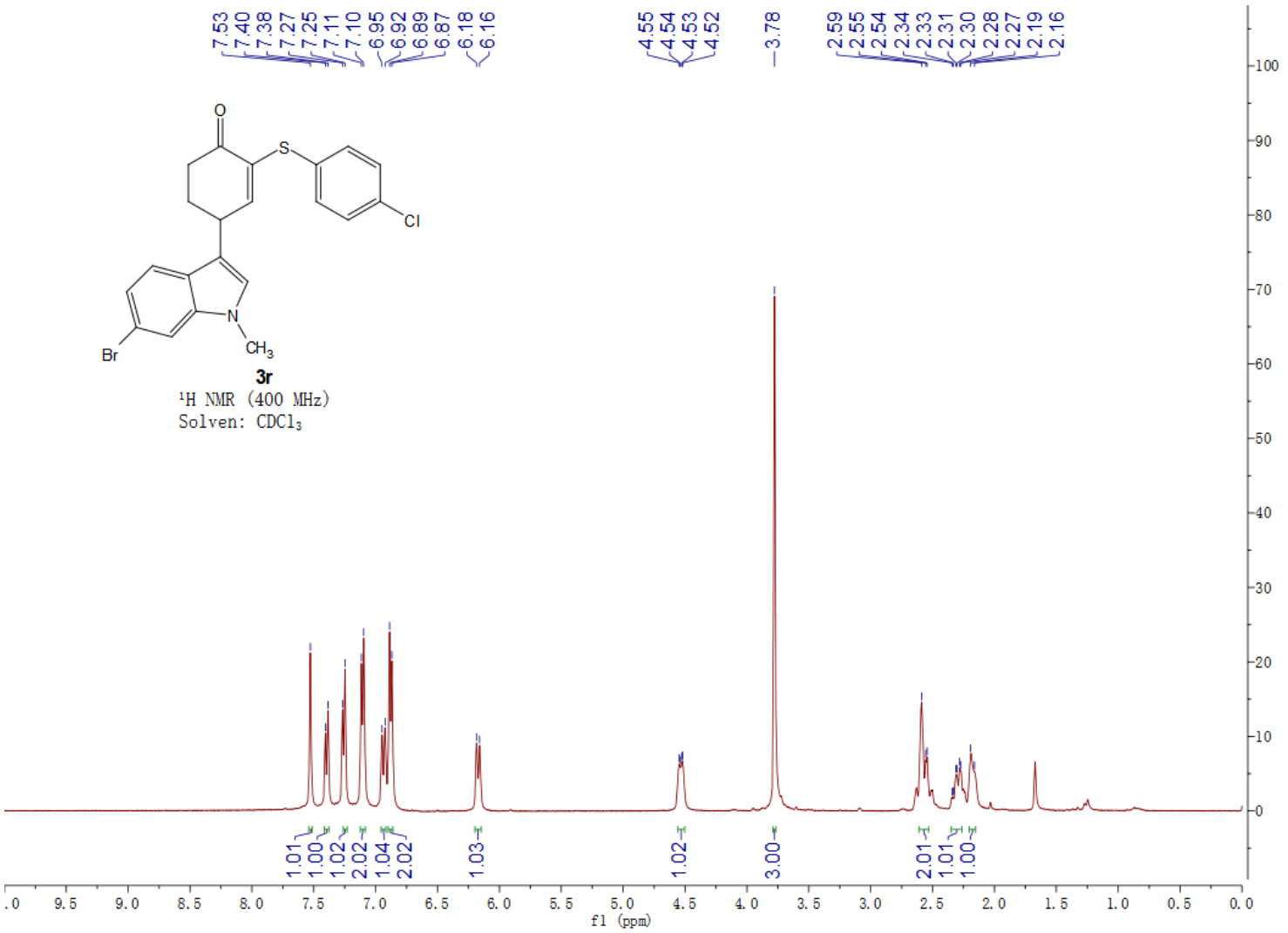
151.10
145.68
138.31
135.07
134.86
130.03
129.68
128.22
125.63
124.26
120.85
116.36
112.57
100.75
37.91
35.16
31.55
30.00
20.86
O
S
CH3
N
CH3
Br
3q
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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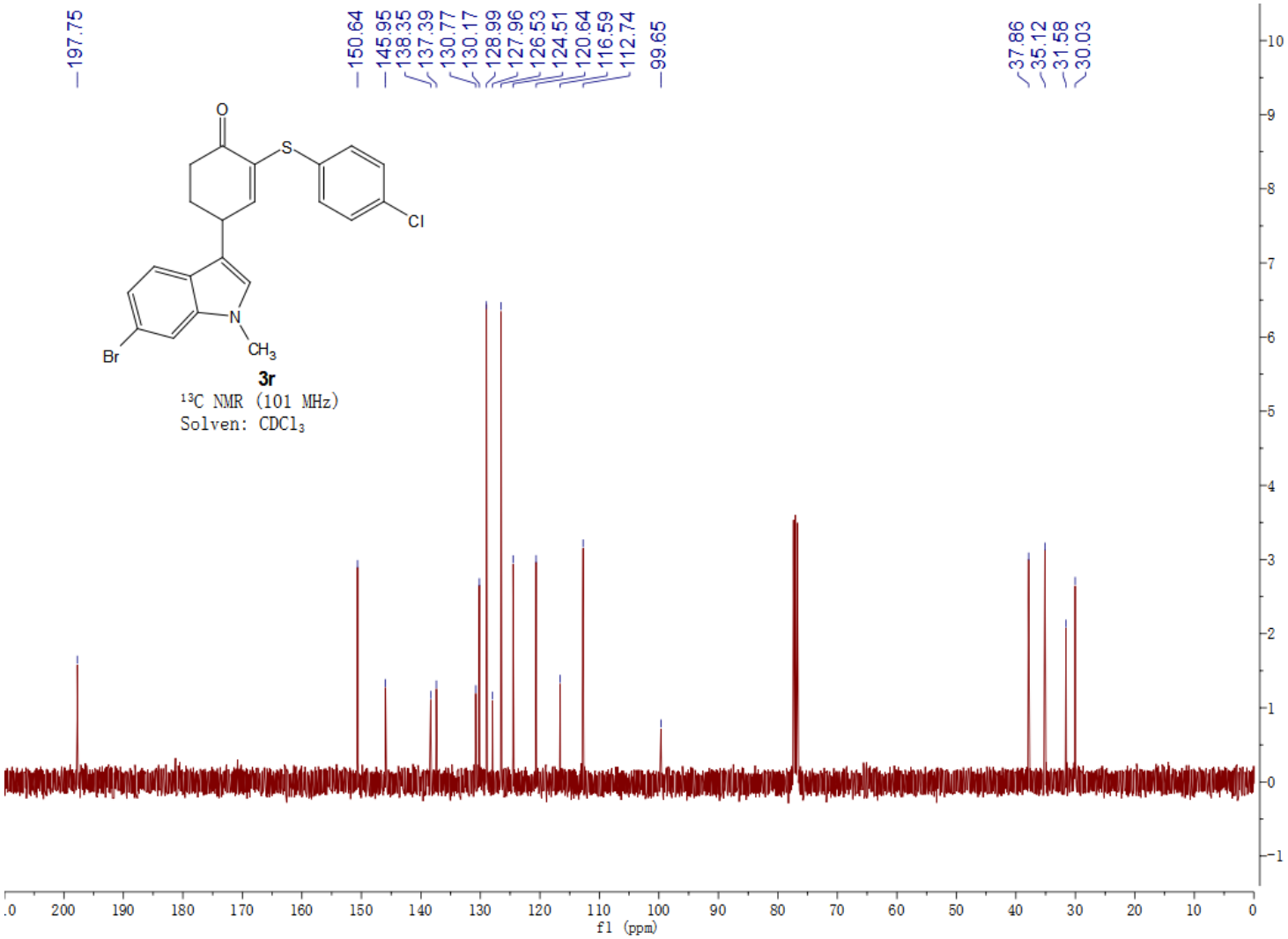
7.40
7.38
7.27
7.25
7.11
7.10
6.95
6.92
6.89
6.87
6.18
6.16
4.55
4.54
4.53
4.52
3.78
2.59
2.55
2.54
2.34
2.33
2.31
2.30
2.28
2.27
2.19
2.16
O
S
Cl
N
CH3
Br
3r
1H NMR (400 MHz)
Solven: CDCl3
1.01
1.00
1.02
2.02
1.04
2.02
1.03
1.02
3.00
2.01
1.01
1.00
f1 (ppm)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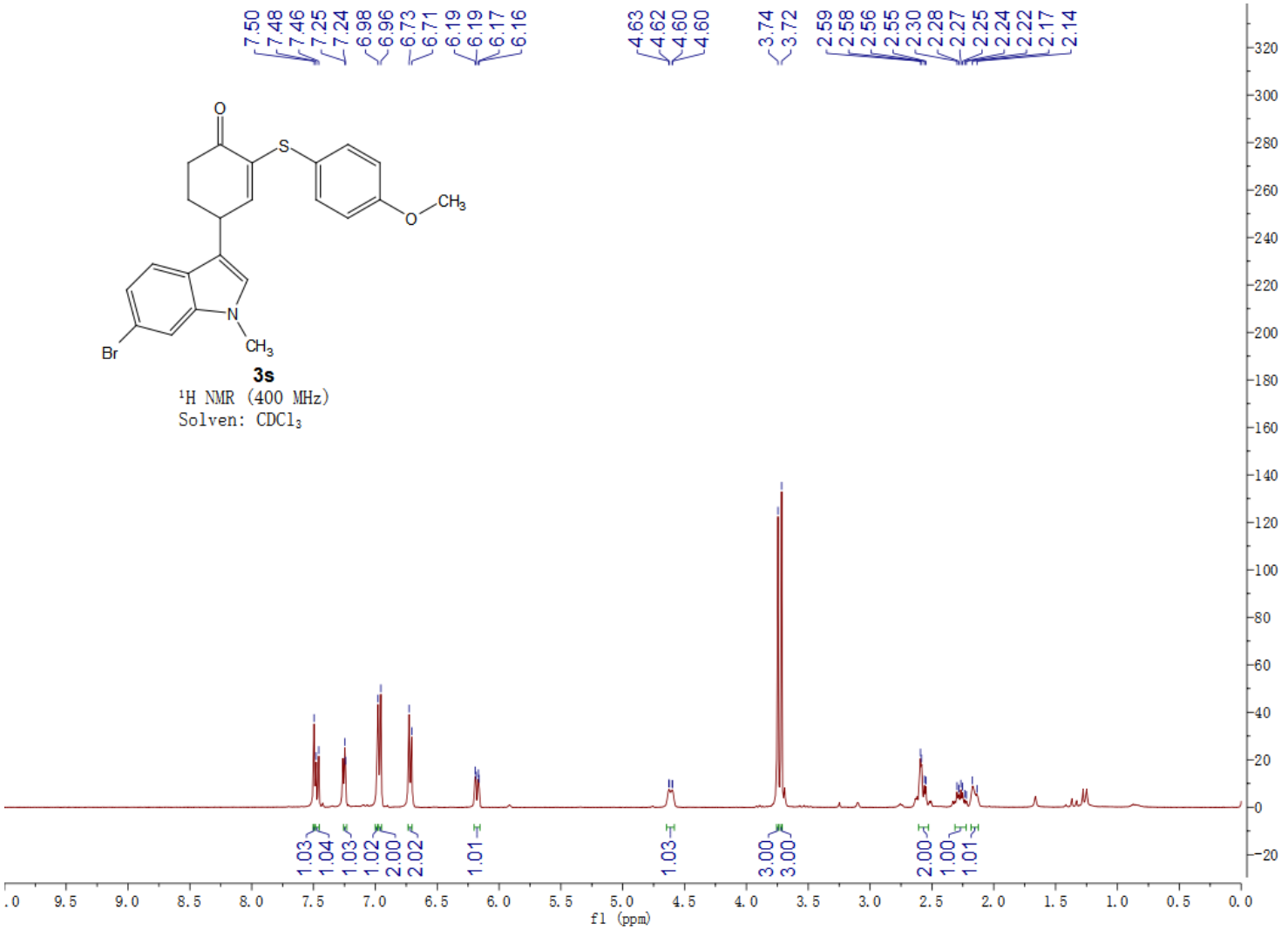
137.39
130.77
130.17
128.99
127.96
126.53
124.51
120.64
116.59
112.74
99.65
37.86
35.12
31.58
30.03
O
S
Cl
N
CH3
Br
3r
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.48
7.46
7.25
7.24
6.98
6.96
6.73
6.71
6.19
6.19
6.17
6.16
4.63
4.62
4.60
4.60
3.74
3.72
2.59
2.58
2.56
2.55
2.30
2.28
2.27
2.25
2.24
2.22
2.17
2.14
O
S
CH3
O
N
CH3
Br
3s
1H NMR (400 MHz)
Solven: CDCl3
1.03
1.04
1.03
1.02
2.00
2.02
1.01
1.03
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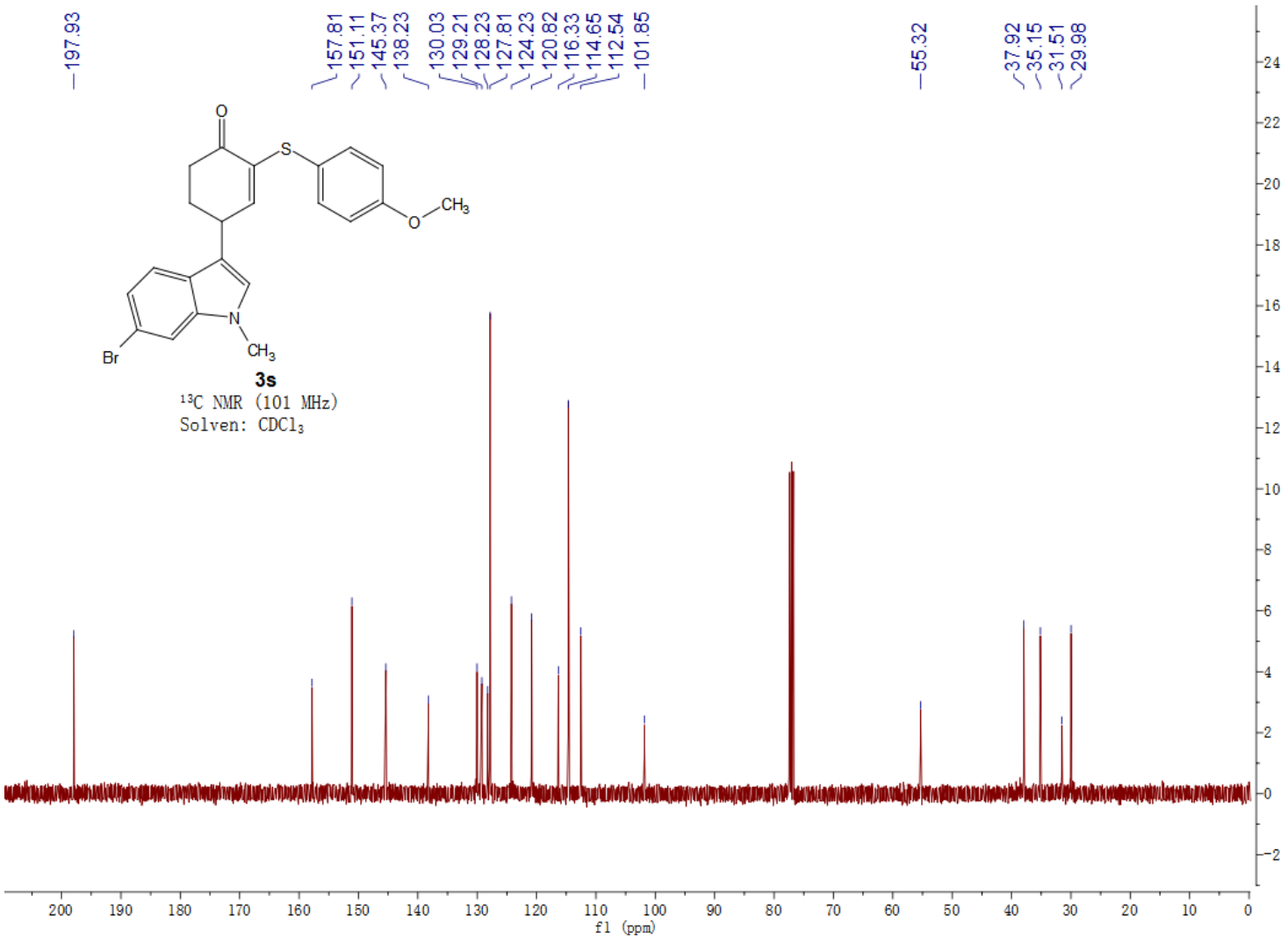
3.00
2.00
1.00
1.01
f1 (ppm)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151.11
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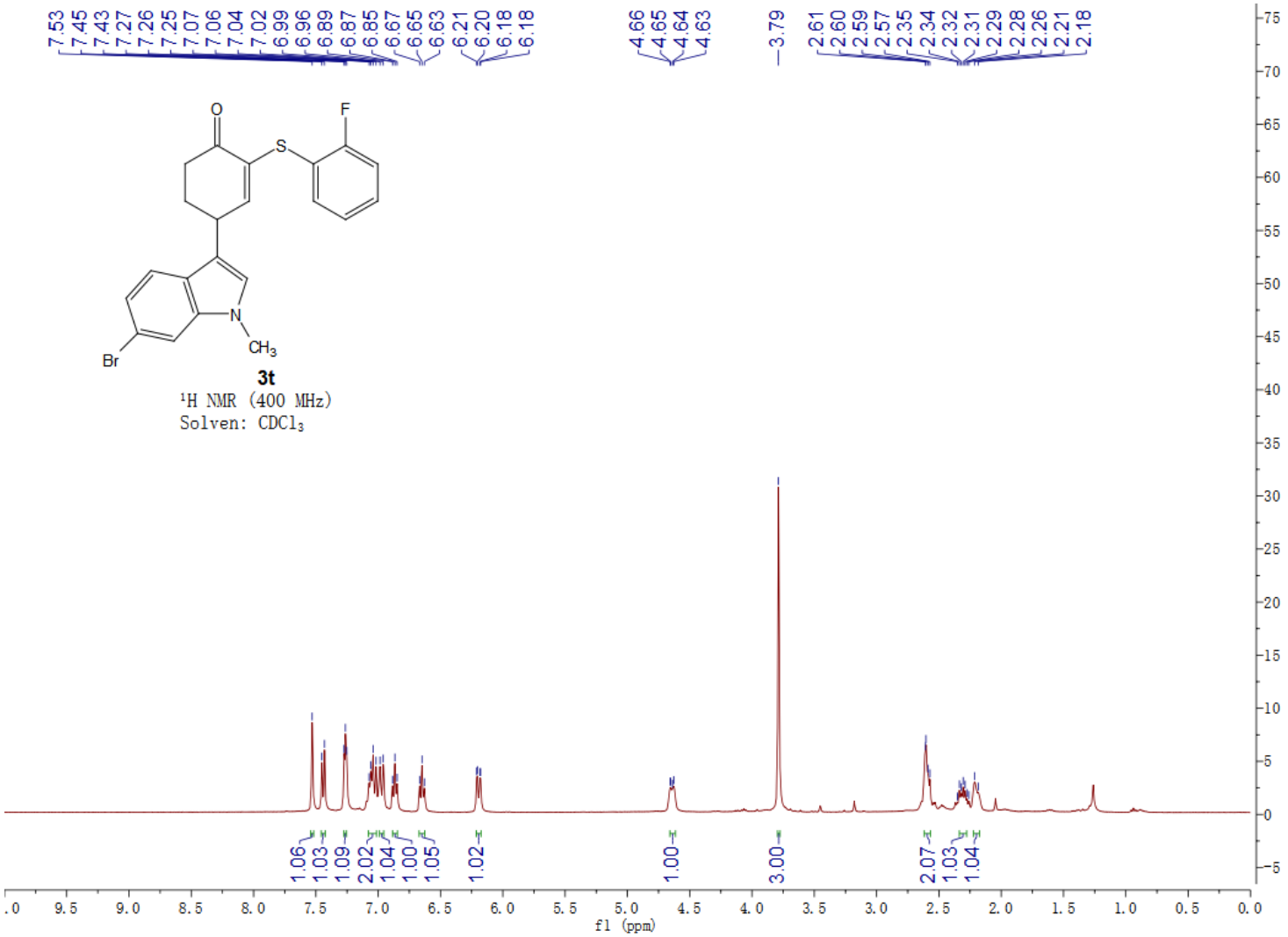
138.23
130.03
129.21
128.23
127.81
124.23
120.82
116.33
114.65
112.54
101.85
55.32
37.92
35.15
31.51
29.98
O
S
O
CH3
N
CH3
Br
3s
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.45
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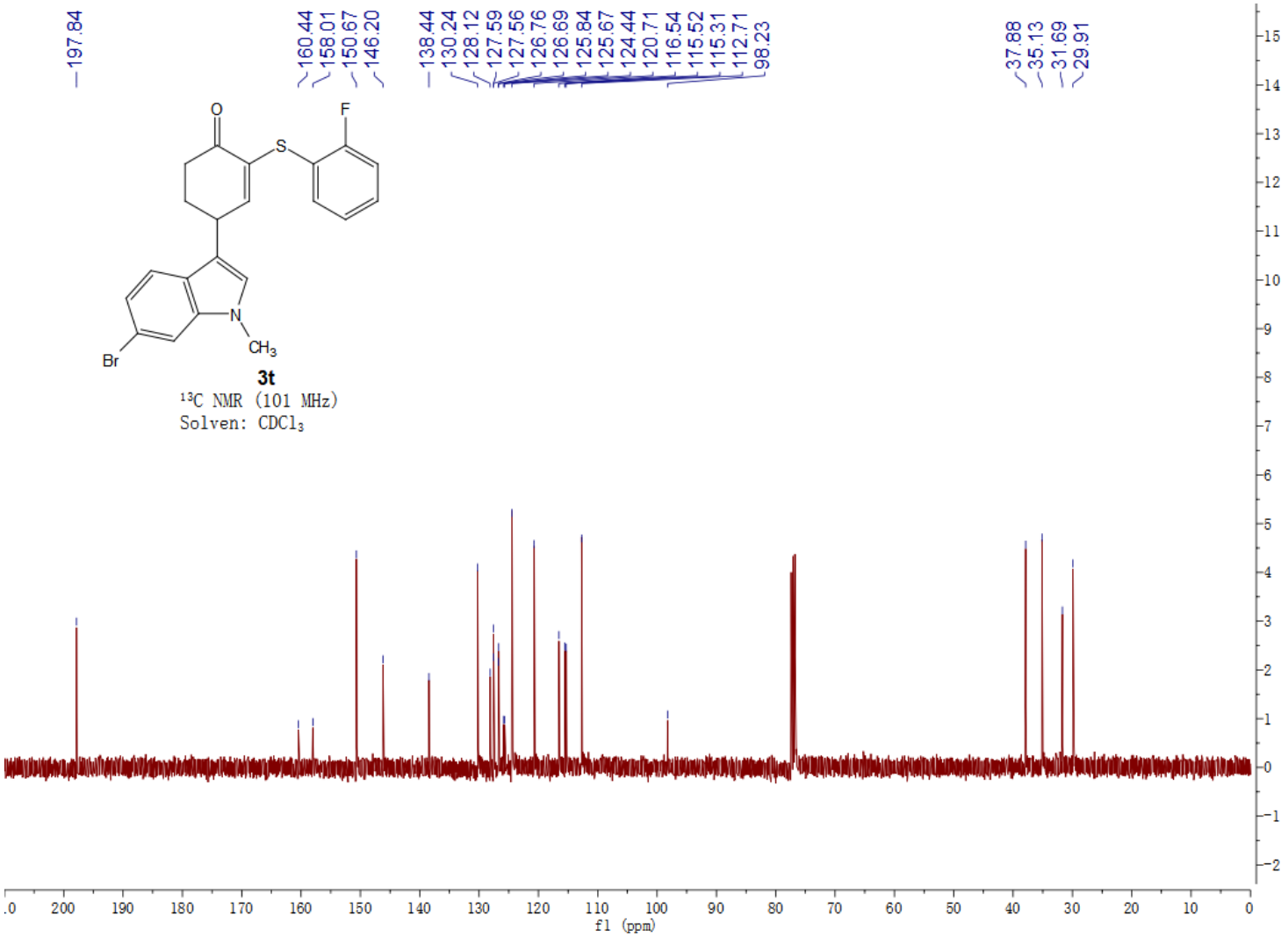
7.27
7.26
7.25
7.07
7.06
7.04
7.02
6.99
6.96
6.89
6.87
6.85
6.67
6.65
6.63
6.21
6.20
6.18
6.18
4.66
4.65
4.64
4.63
3.79
2.61
2.60
2.59
2.57
2.35
2.34
2.32
2.31
2.29
2.28
2.26
2.21
2.18
O
F
S
N
CH3
Br
3t
1H NMR (400 MHz)
Solven: CDCl3
1.06
1.03
1.09
2.02
1.04
1.00
1.05
1.02
1.00
3.00
2.07
1.03
1.04
f1 (ppm)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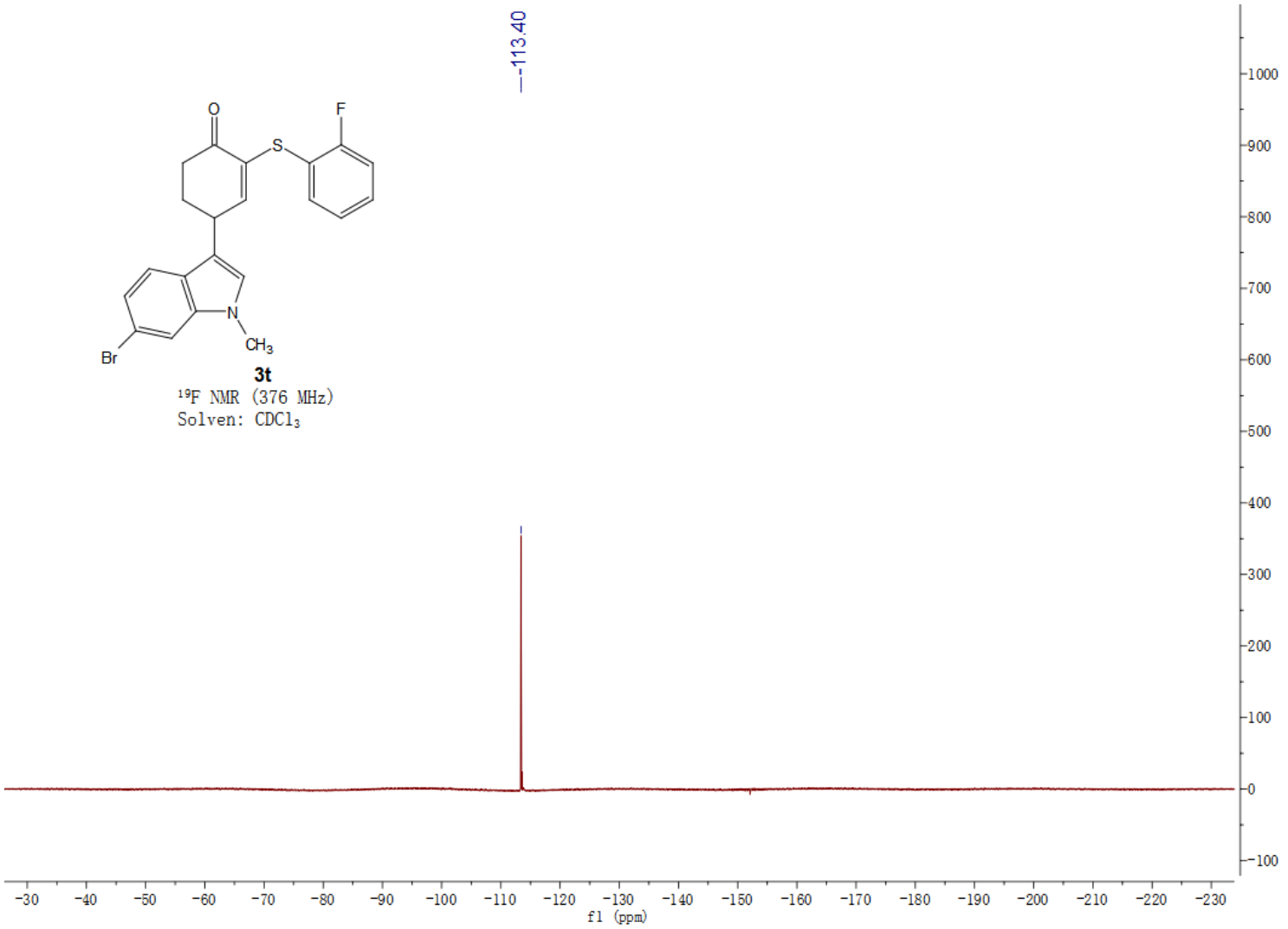
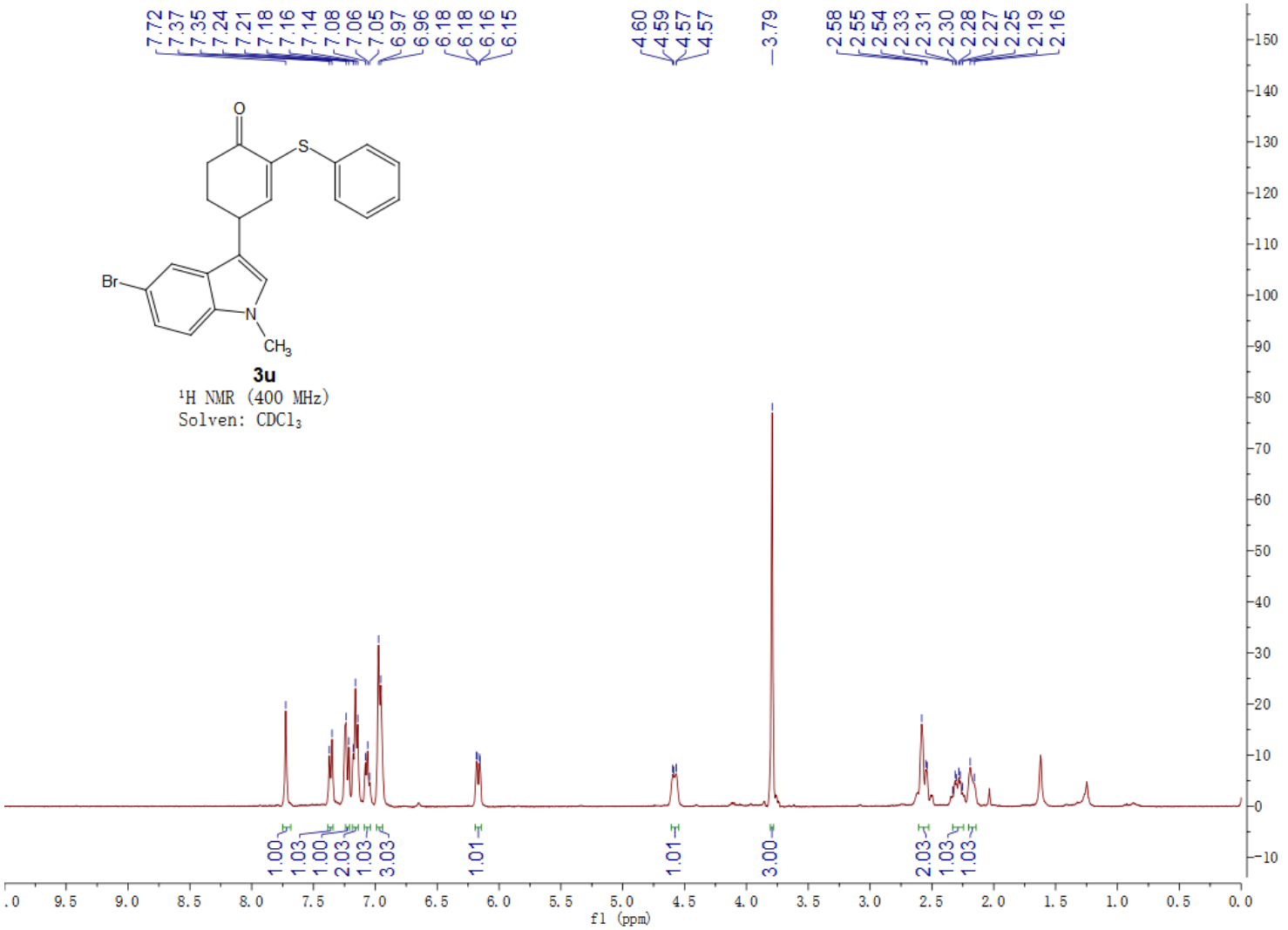
158.01
150.67
146.20
138.44
130.24
128.12
127.59
127.56
126.76
126.69
125.84
125.67
124.44
120.71
116.54
115.52
115.31
112.71
98.23
37.88
35.13
31.69
29.91
O
S
F
N
CH3
Br
3t
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


-113.40
O
F
S
N
CH3
Br
3t
19F NMR (376 MHz)
Solven: CDCl3
1000
900
800
700
600
500
400
300
200
100
0
-100
-30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220 -230
f1 (ppm)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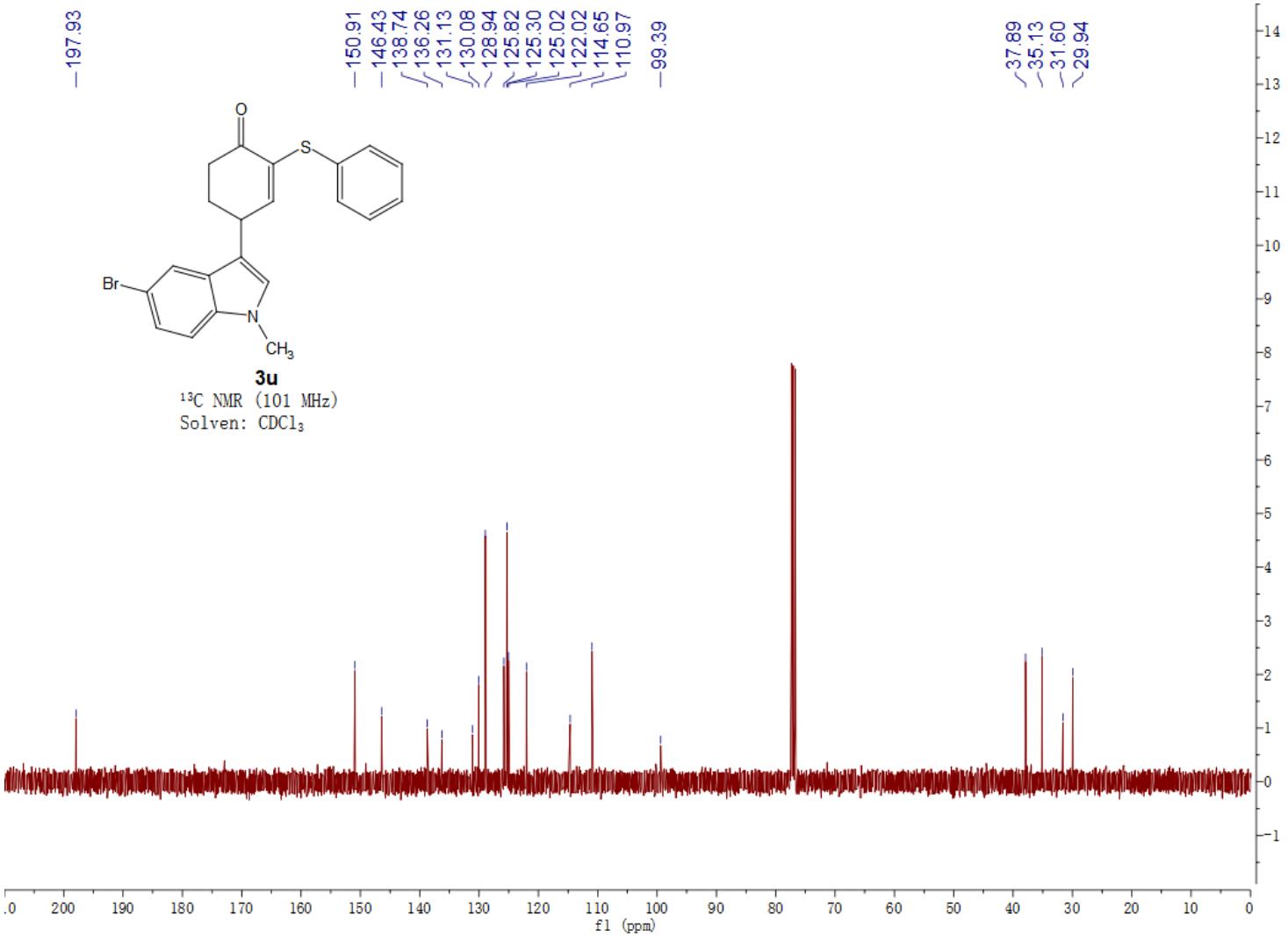
7.05
6.97
6.96
6.18
6.18
6.16
6.15
4.60
4.59
4.57
4.57
3.79
2.58
2.55
2.54
2.33
2.31
2.30
2.28
2.27
2.25
2.19
2.16
O
S
Br
N
CH3
3u
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.03
1.00
2.03
1.03
3.03
1.01
1.01
3.00
2.03
1.03
1.03
f1 (ppm)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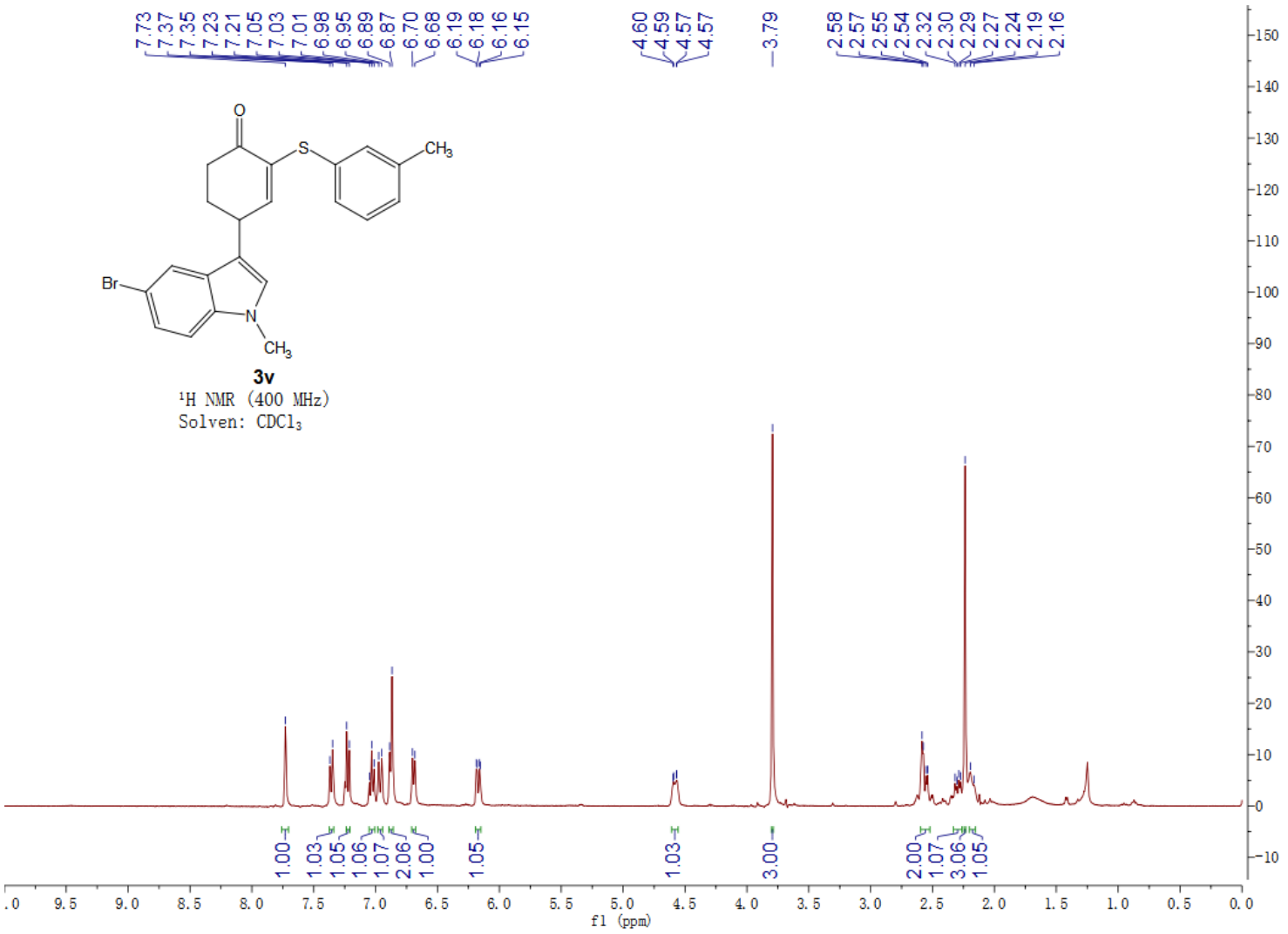
136.26
131.13
130.08
128.94
125.82
125.30
125.02
122.02
114.65
110.97
99.39
37.89
35.13
31.60
29.94
O
S
Br
N
CH3
3u
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.05
7.03
7.01
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6.95
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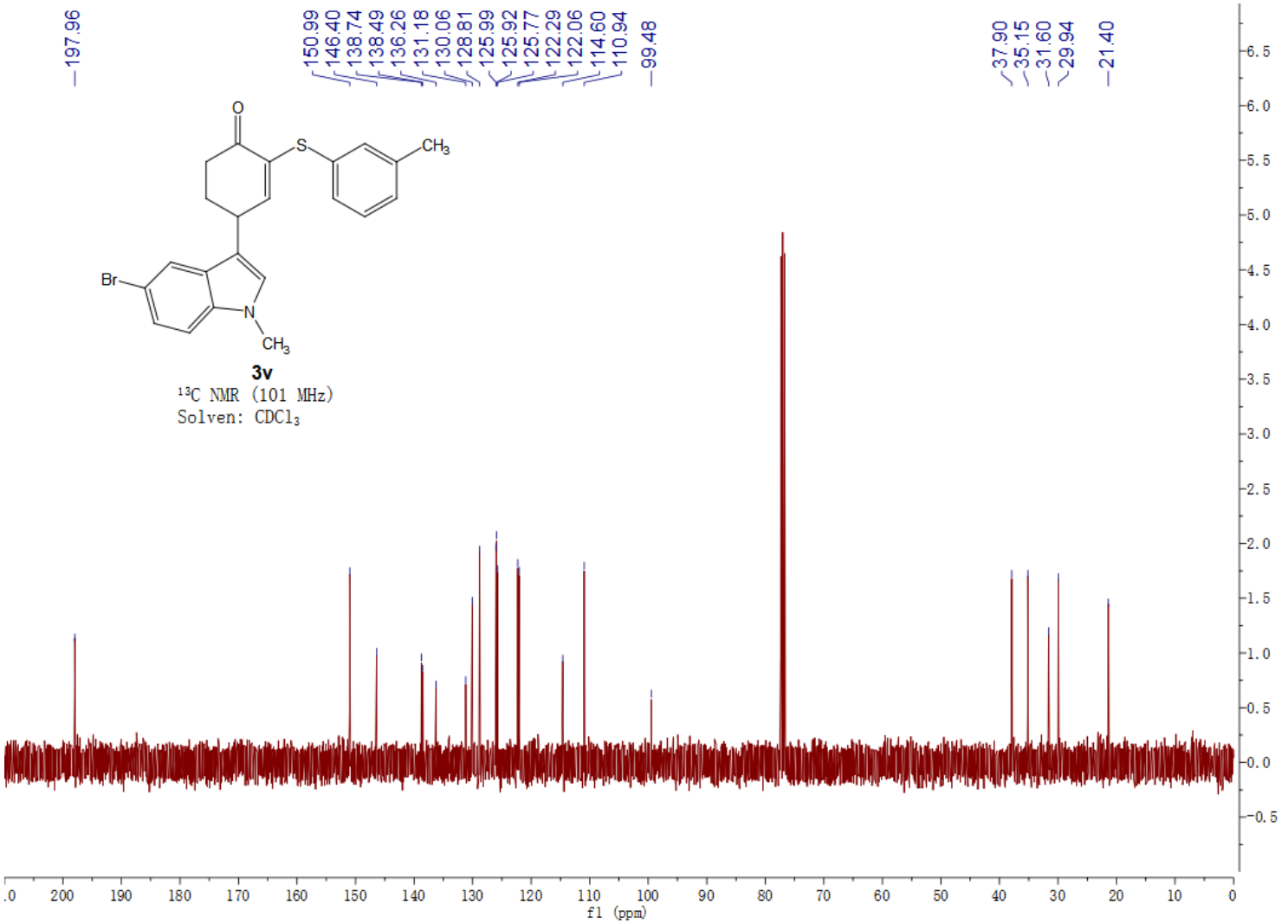
6.87
6.70
6.68
6.19
6.18
6.16
6.15
4.60
4.59
4.57
4.57
3.79
2.58
2.57
2.55
2.54
2.32
2.30
2.29
2.27
2.24
2.19
2.16
O
S
CH3
Br
N
CH3
3v
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.03
1.05
1.06
1.07
2.06
1.00
1.05
1.03
3.00
2.00
1.07
3.06
1.05
f1 (ppm)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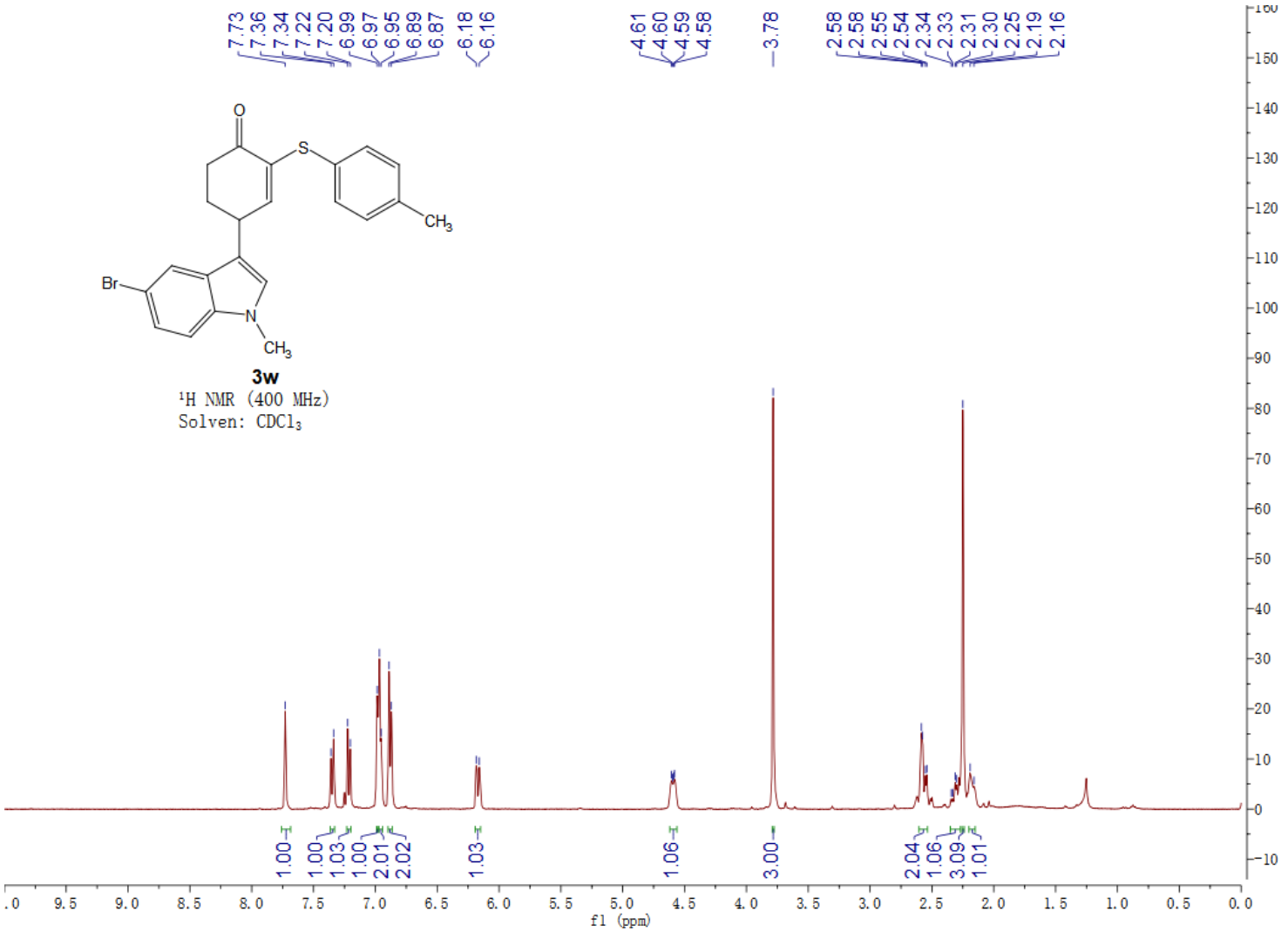
130.06
128.81
125.99
125.92
125.77
122.29
122.06
114.60
110.94
99.48
37.90
35.15
31.60
29.94
21.40
O
S
CH3
Br
N
CH3
3v
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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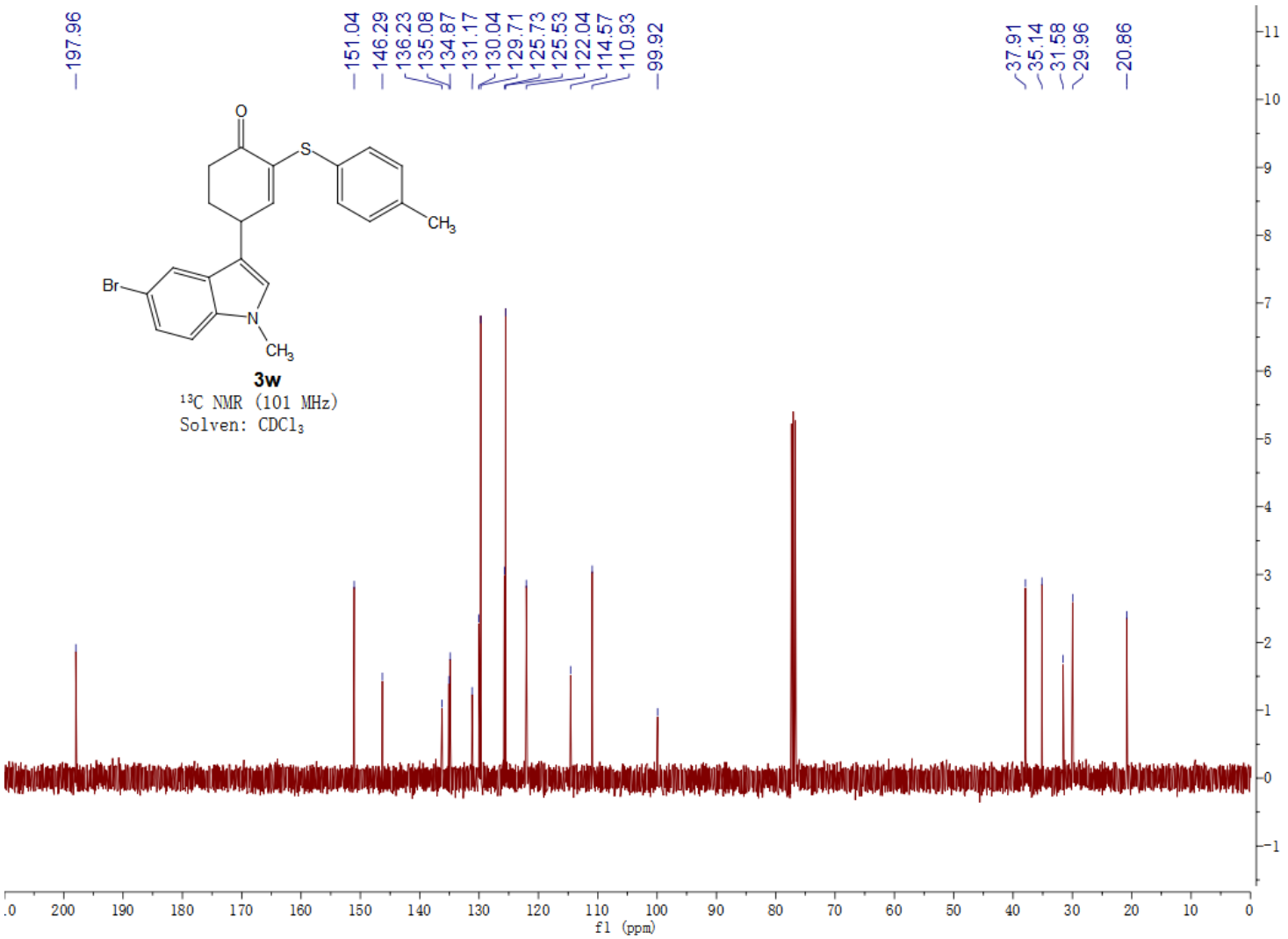
7.36
7.34
7.22
7.20
6.99
6.97
6.95
6.89
6.87
6.18
6.16
4.61
4.60
4.59
4.58
3.78
2.58
2.58
2.55
2.54
2.34
2.33
2.31
2.30
2.25
2.19
2.16
O
S
CH3
Br
N
CH3
3w
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.00
1.03
1.00
2.01
2.02
1.03
1.06
3.00
2.04
1.06
3.09
1.01
f1 (ppm)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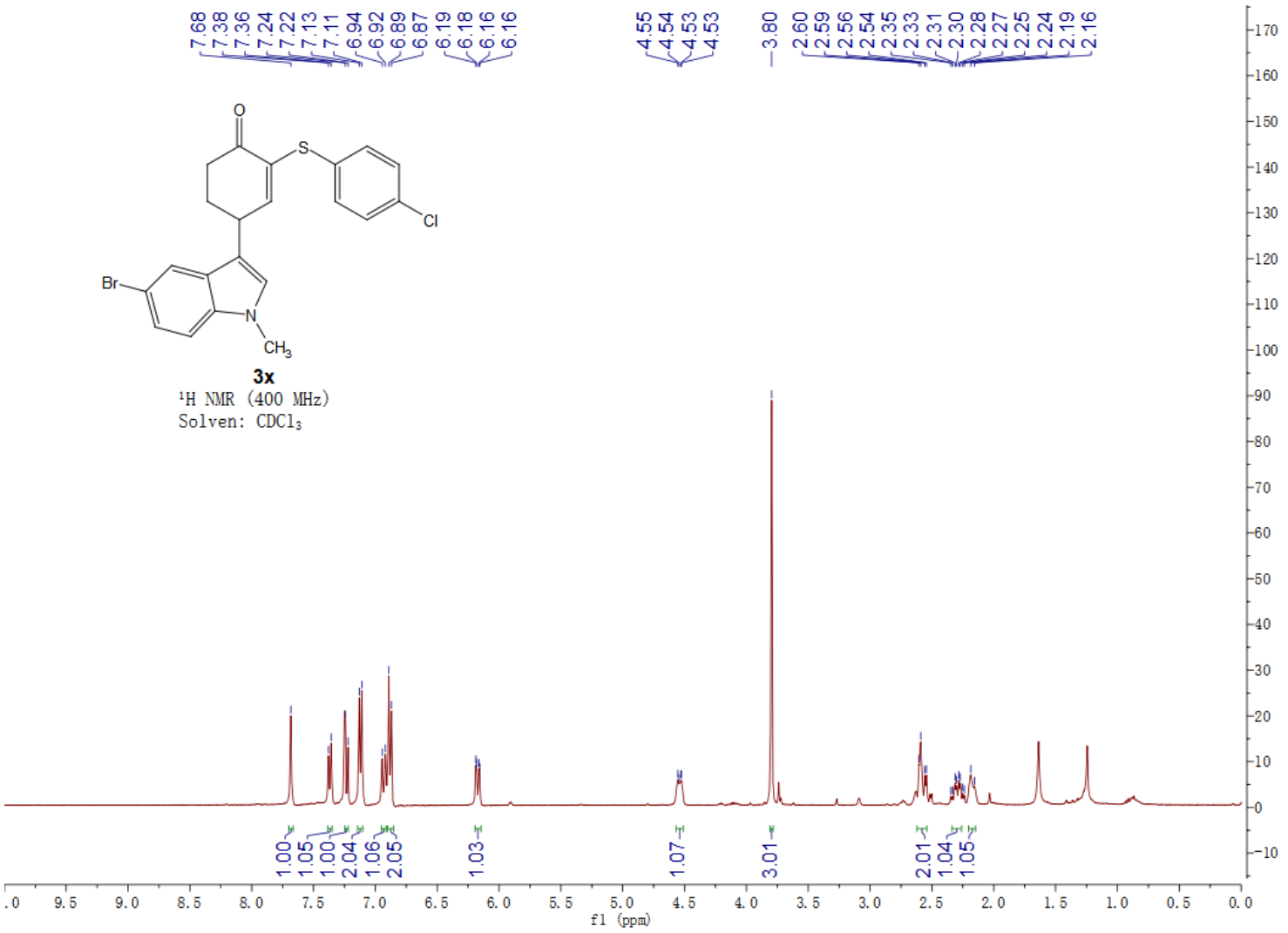
151.04
146.29
136.23
135.08
134.87
131.17
130.04
129.71
125.73
125.53
122.04
114.57
110.93
99.92
37.91
35.14
31.58
29.96
20.86
O
S
CH3
Br
N
CH3
3w
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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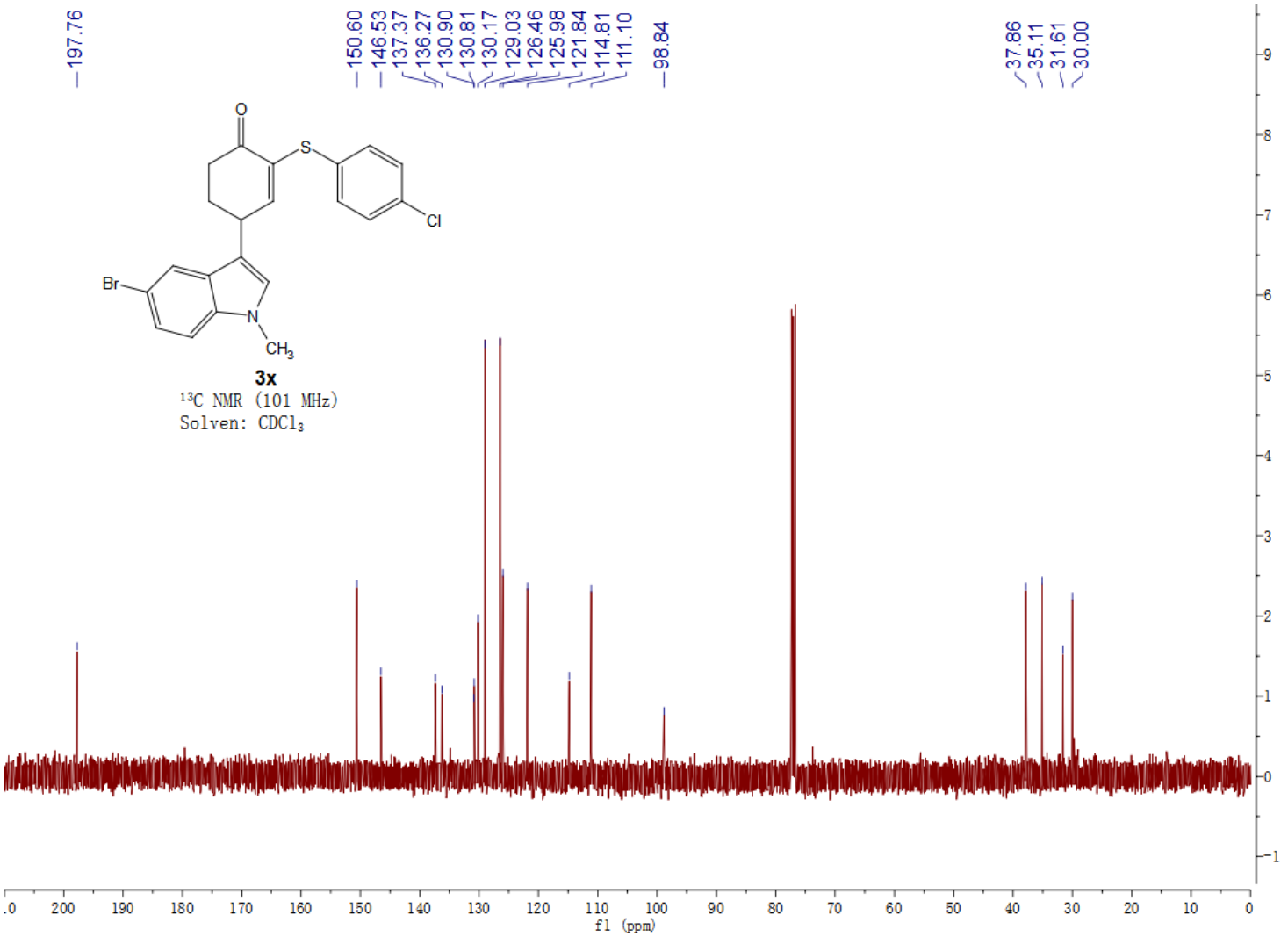
7.38
7.36
7.24
7.22
7.13
7.11
6.94
6.92
6.89
6.87
6.19
6.18
6.16
6.16
4.55
4.54
4.53
4.53
3.80
2.60
2.59
2.56
2.54
2.35
2.33
2.31
2.30
2.28
2.27
2.25
2.24
2.19
2.16
O
S
Cl
Br
N
CH3
3x
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.05
1.00
2.04
1.06
2.05
1.03
1.07
3.01
2.01
1.04
1.05
f1 (ppm)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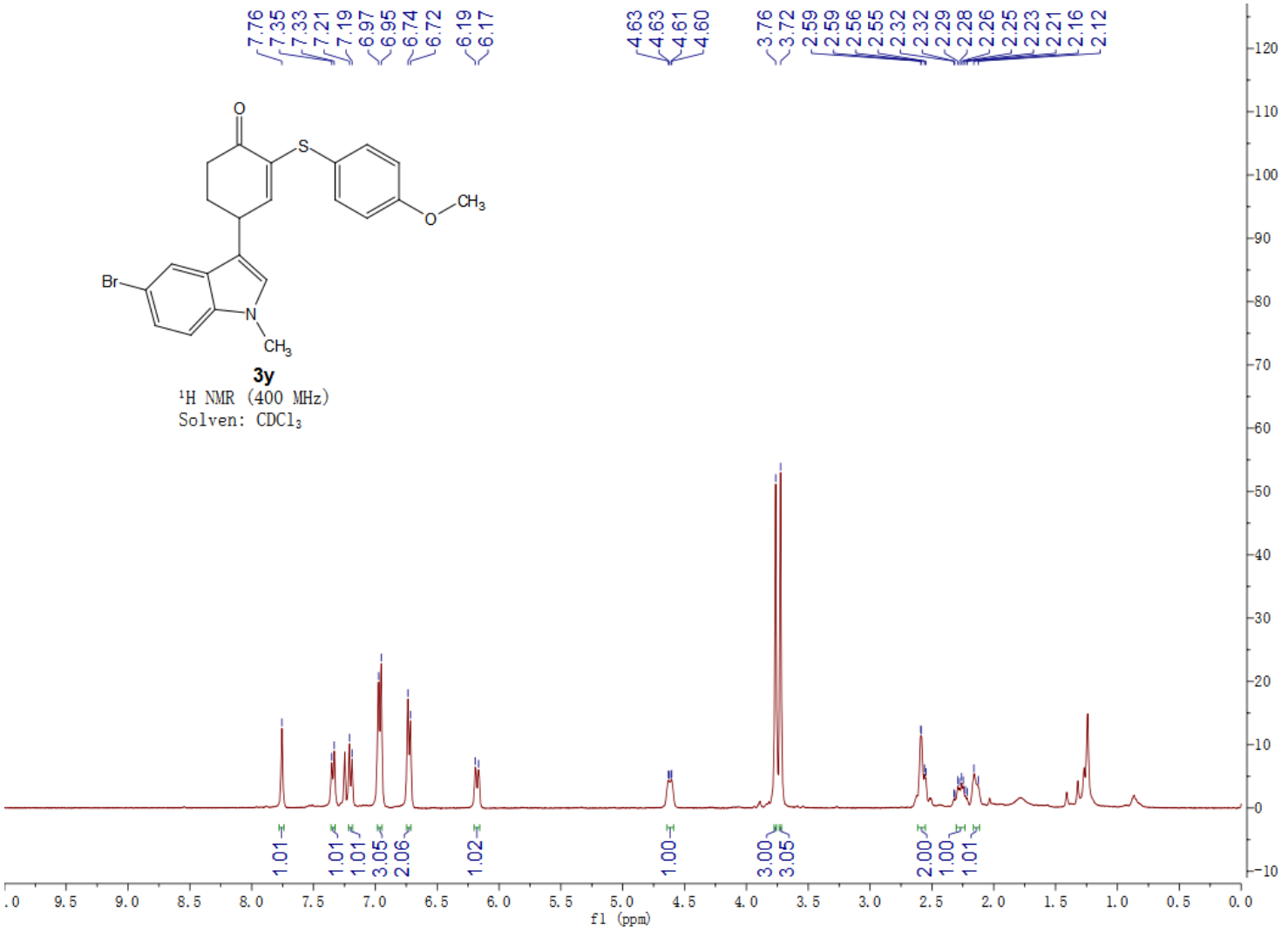
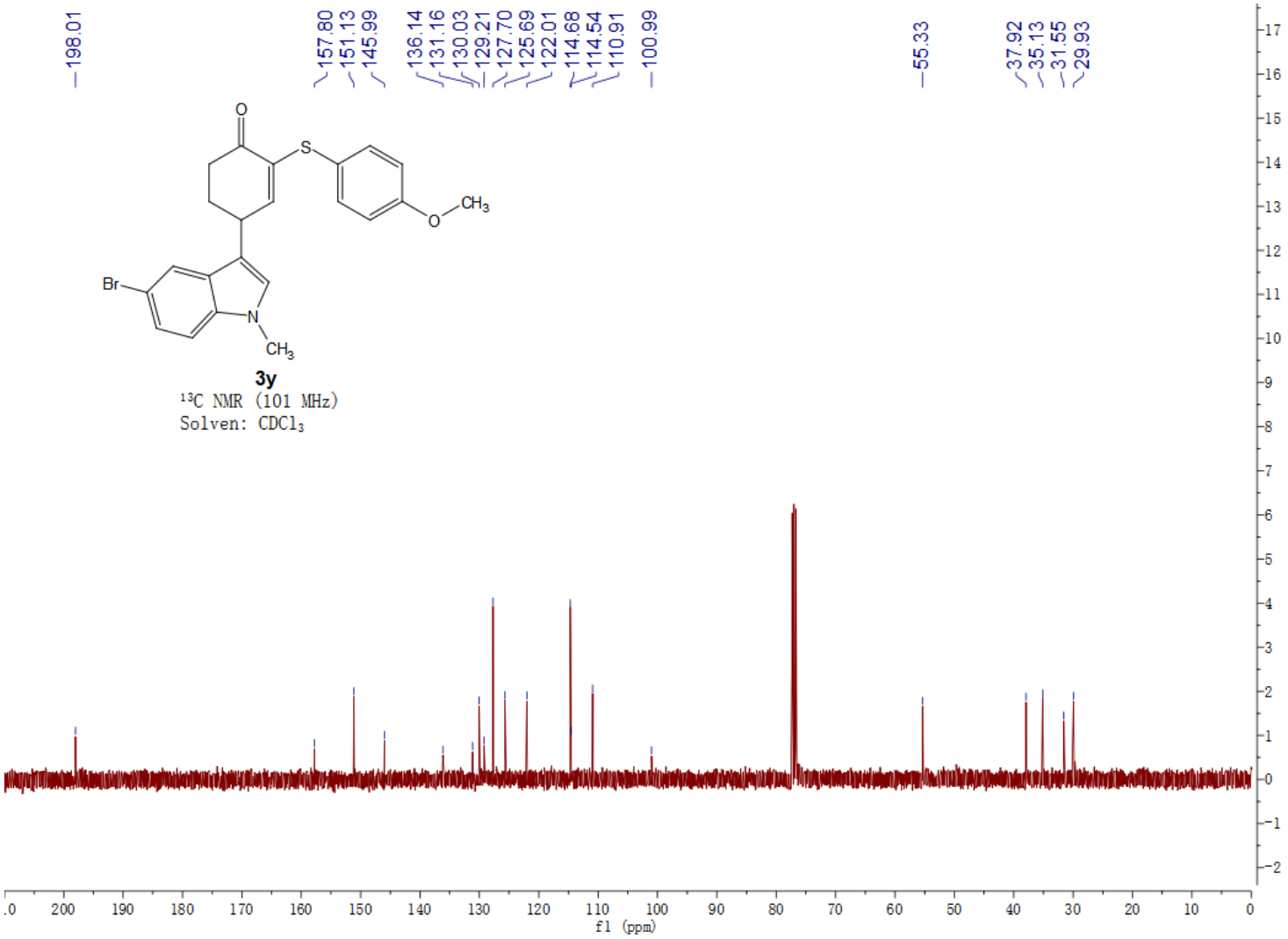
137.37
136.27
130.90
130.81
130.17
129.03
126.46
125.98
121.84
114.81
111.10
98.84
37.86
35.11
31.61
30.00
O
S
Cl
Br
N
CH3
3x
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


7.76
7.35
7.33
7.21
7.19
6.97
6.95
6.74
6.72
6.19
6.17
4.63
4.63
4.61
4.60
3.76
3.72
2.59
2.59
2.56
2.55
2.32
2.32
2.29
2.28
2.26
2.25
2.23
2.21
2.16
2.12
O
S
CH3
O
Br
N
CH3
3y
1H NMR (400 MHz)
Solven: CDCl3
1.01
1.01
1.01
3.05
2.06
1.02
1.00
3.00
3.05
2.00
1.00
1.01
f1 (ppm)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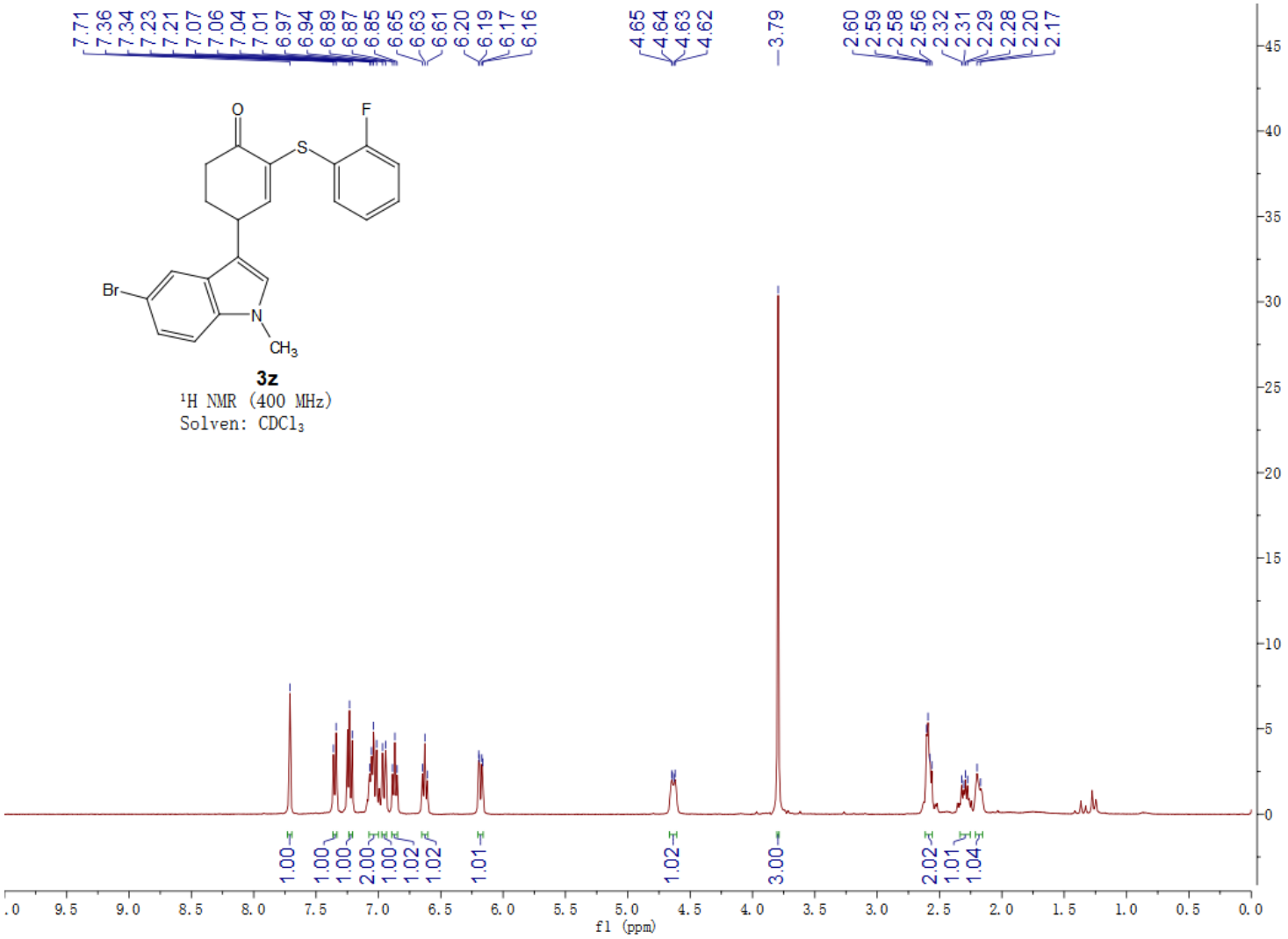
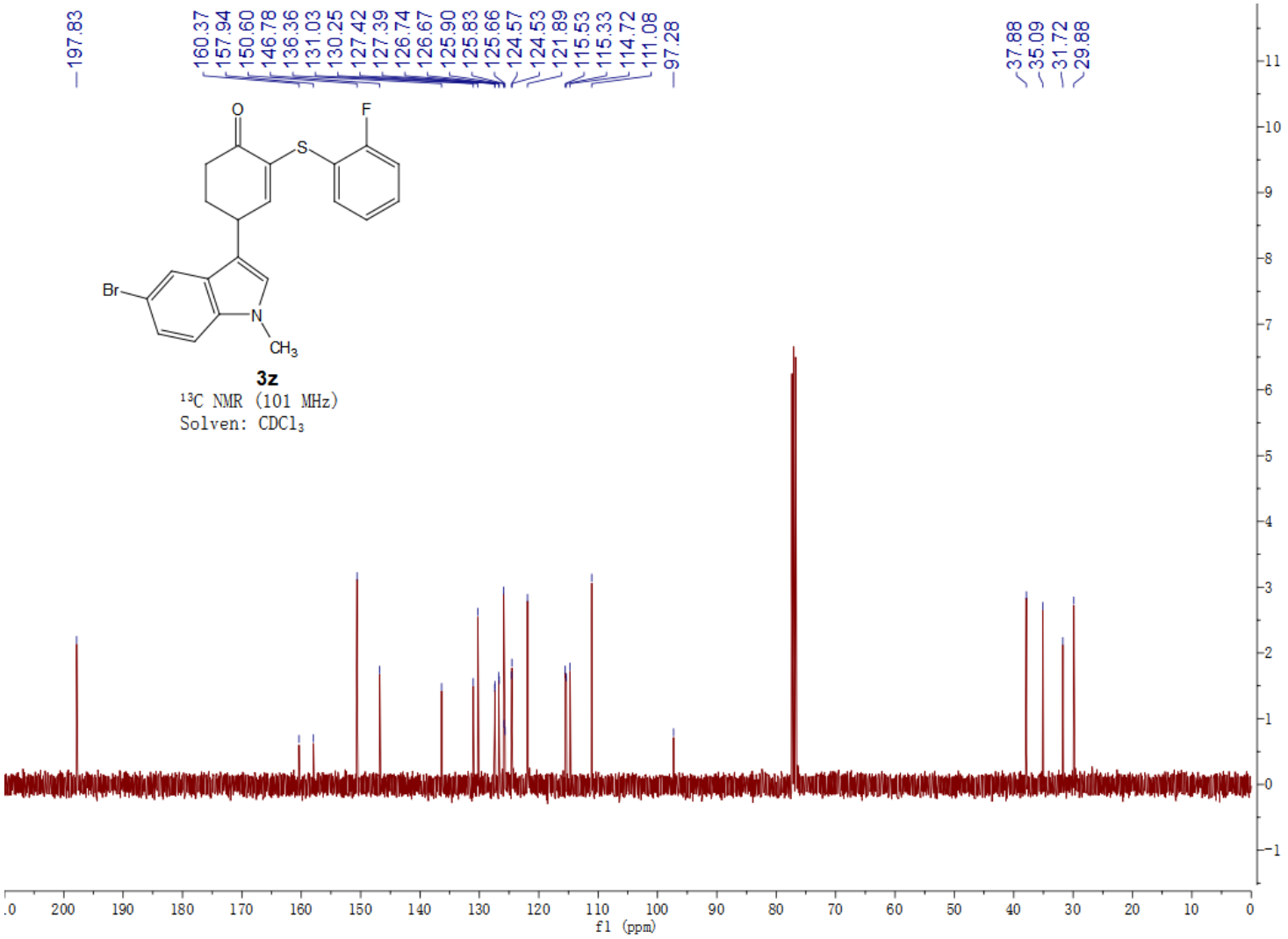
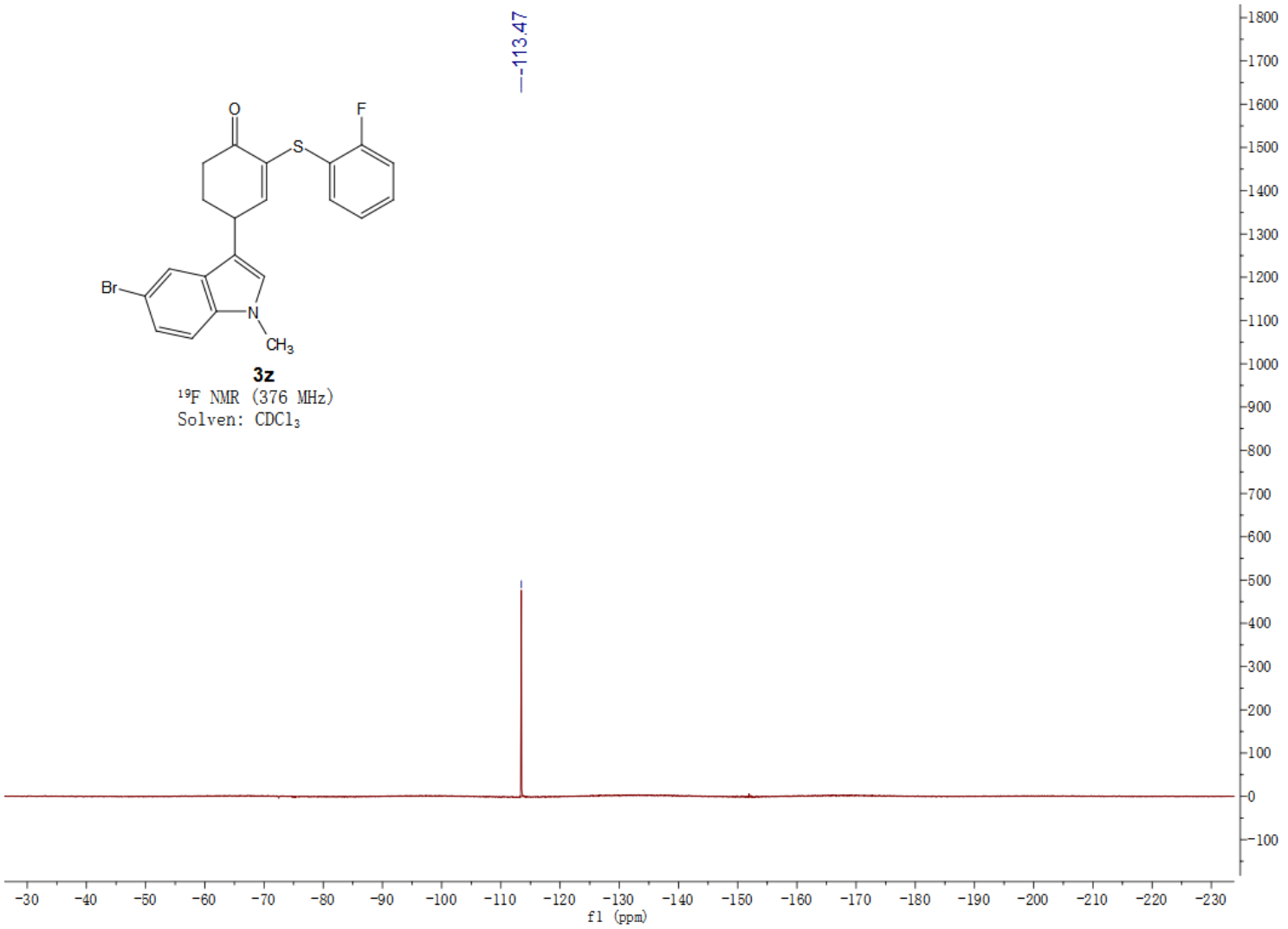
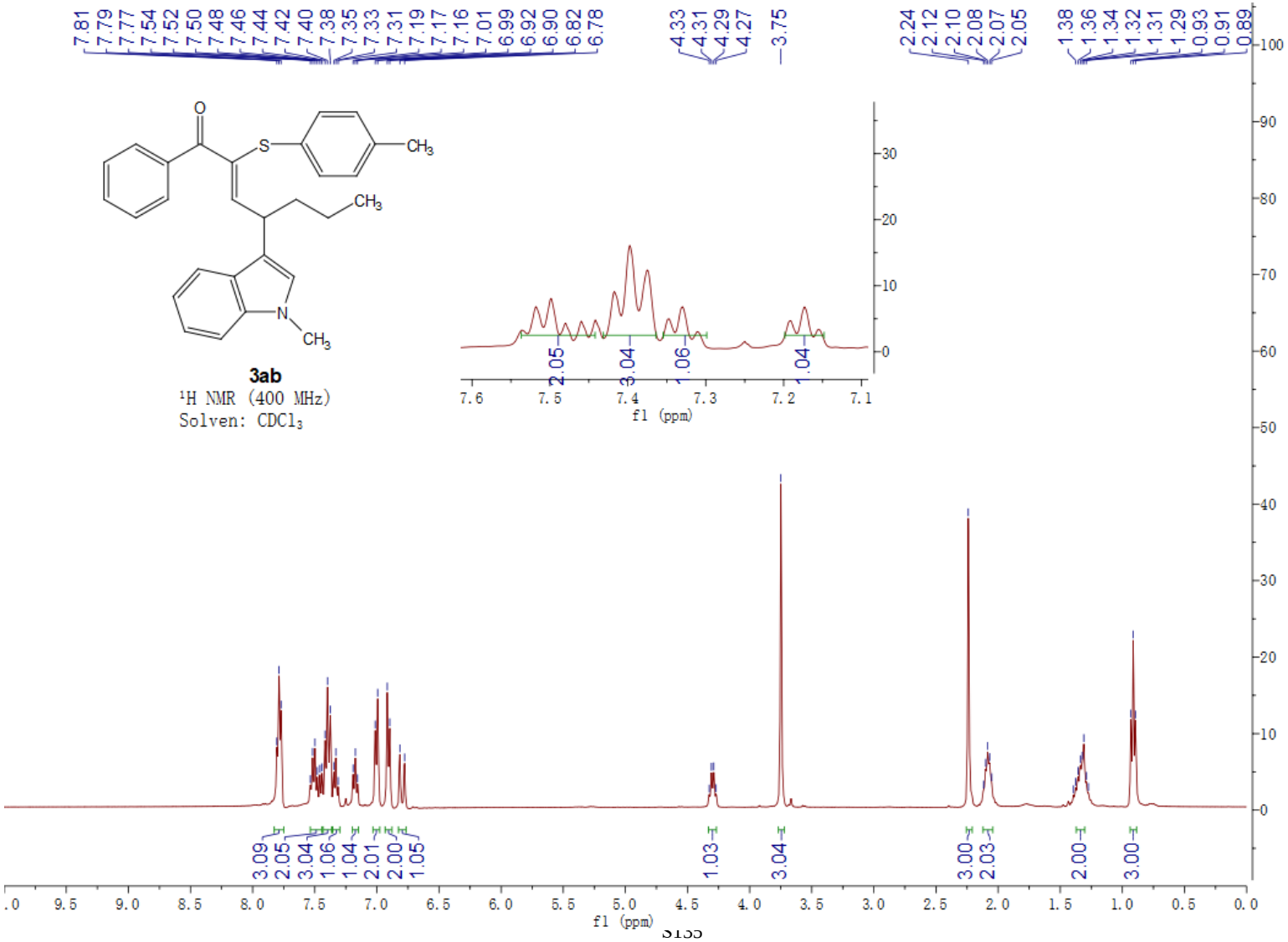
157.80
151.13
145.99
136.14
131.16
130.03
129.21
127.70
125.69
122.01
114.68
114.54
110.91
100.99
55.33
37.92
35.13
31.55
29.93
O
S
O
CH3
Br
N
CH3
3y
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


7.71
7.36
7.34
7.23
7.21
7.07
7.06
7.04
7.01
6.97
6.94
6.89
6.87
6.85
6.65
6.63
6.61
6.20
6.19
6.17
6.16
4.65
4.64
4.63
4.62
3.79
2.60
2.59
2.58
2.56
2.32
2.31
2.29
2.28
2.20
2.17
O
F
S
Br
N
CH3
3z
1H NMR (400 MHz)
Solven: CDCl3
1.00
1.00
1.00
2.00
1.00
1.02
1.02
1.01
1.02
3.00
2.02
1.01
1.04
f1 (ppm)


197.83
160.37
157.94
150.60
146.78
136.36
131.03
130.25
127.42
127.39
126.74
126.67
125.90
125.83
125.66
124.57
124.53
121.89
115.53
115.33
114.72
111.08
97.28
37.88
35.09
31.72
29.88
O
F
S
Br
N
CH3
3z
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


-113.47
O
F
S
Br
N
CH3
3z
19F NMR (376 MHz)
Solven: CDCl3
f1 (ppm)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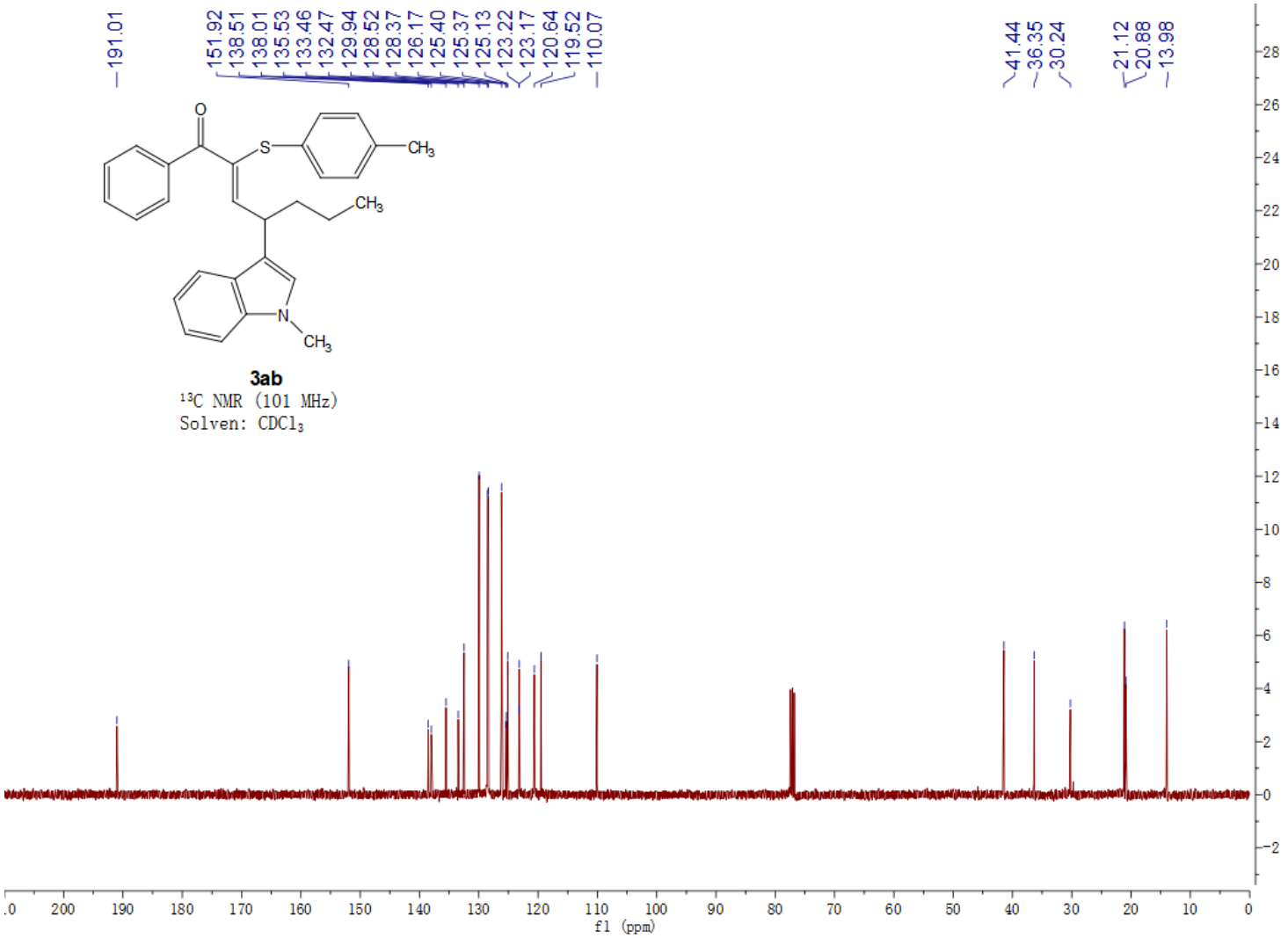
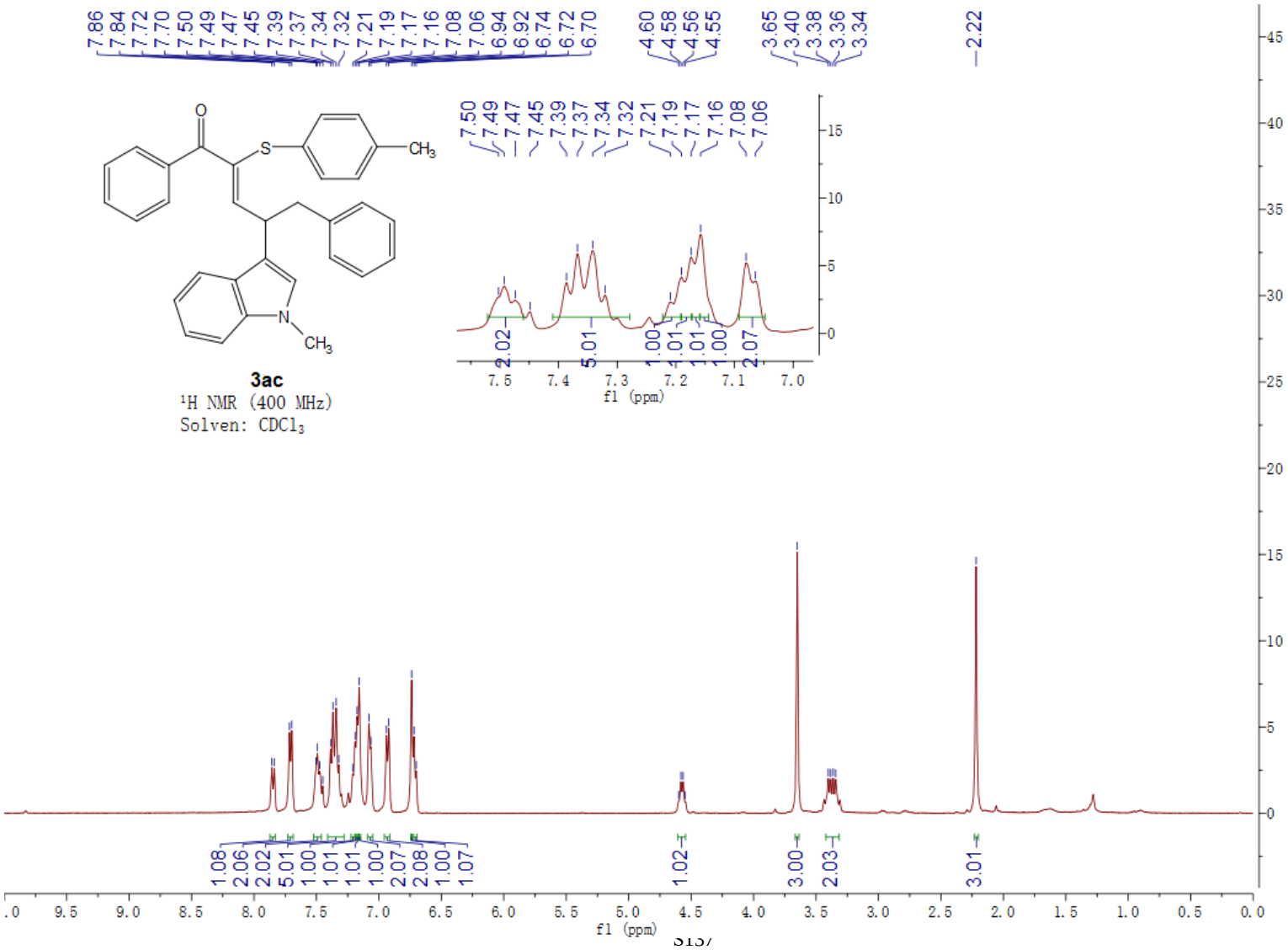
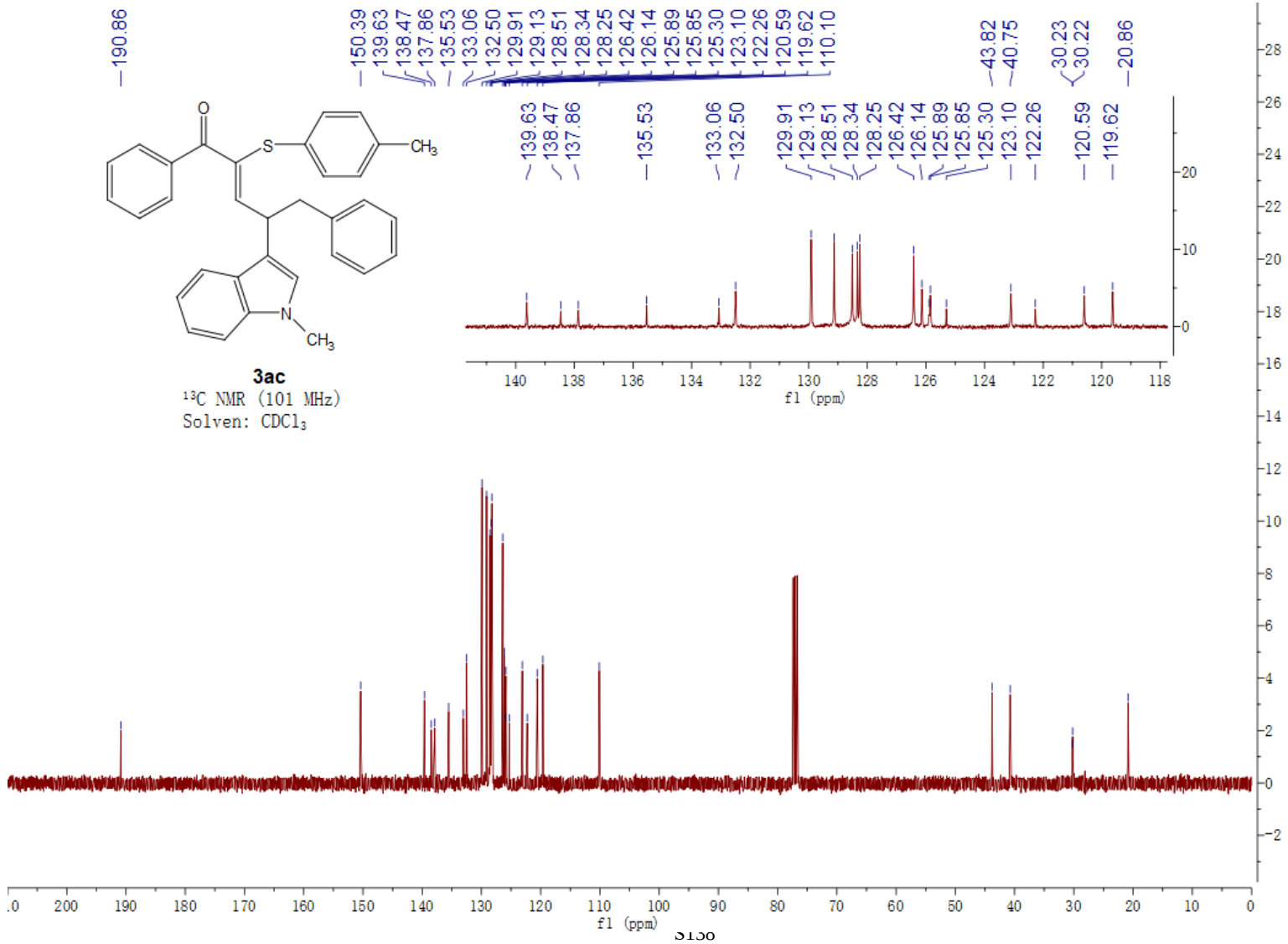
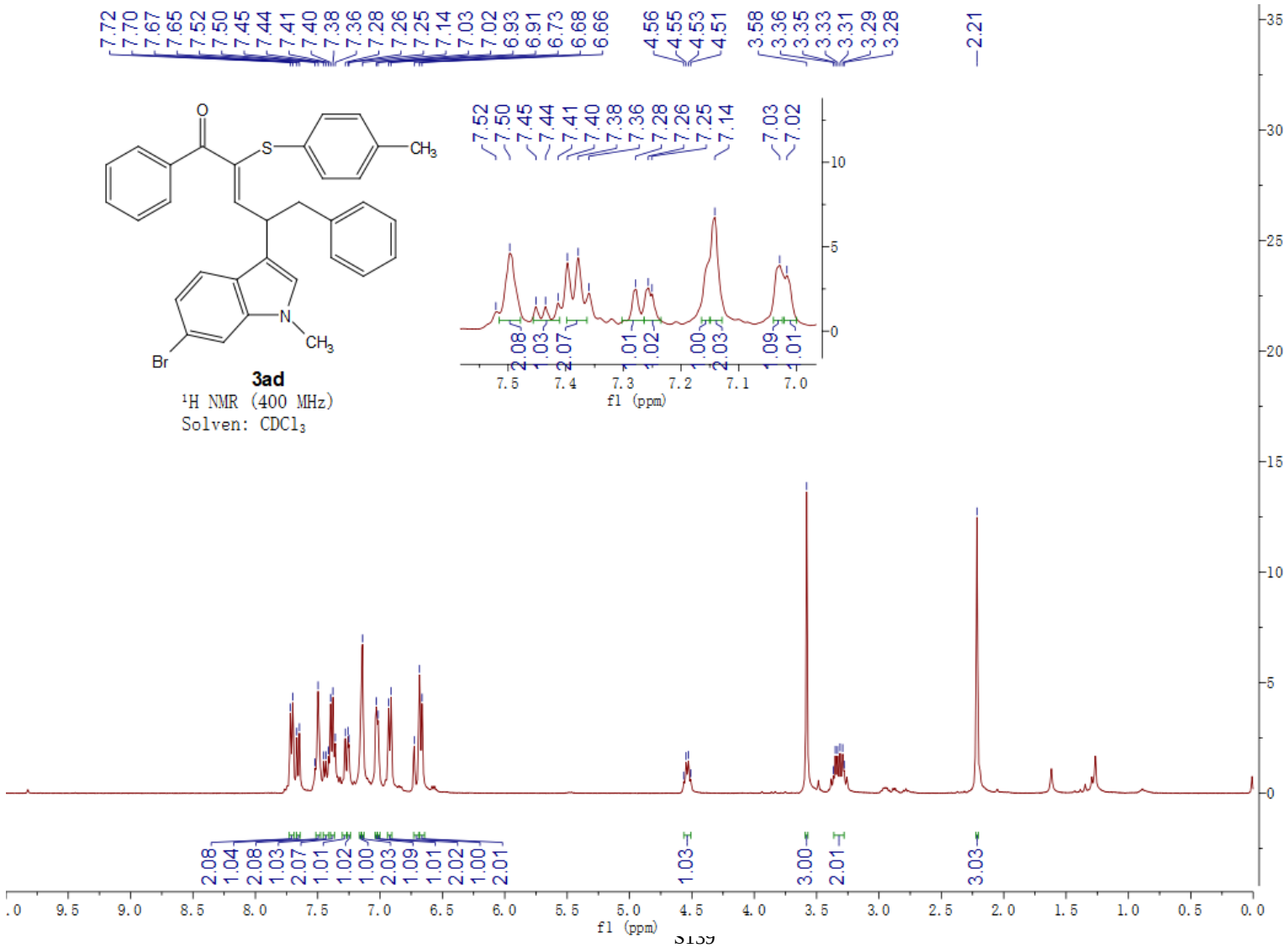
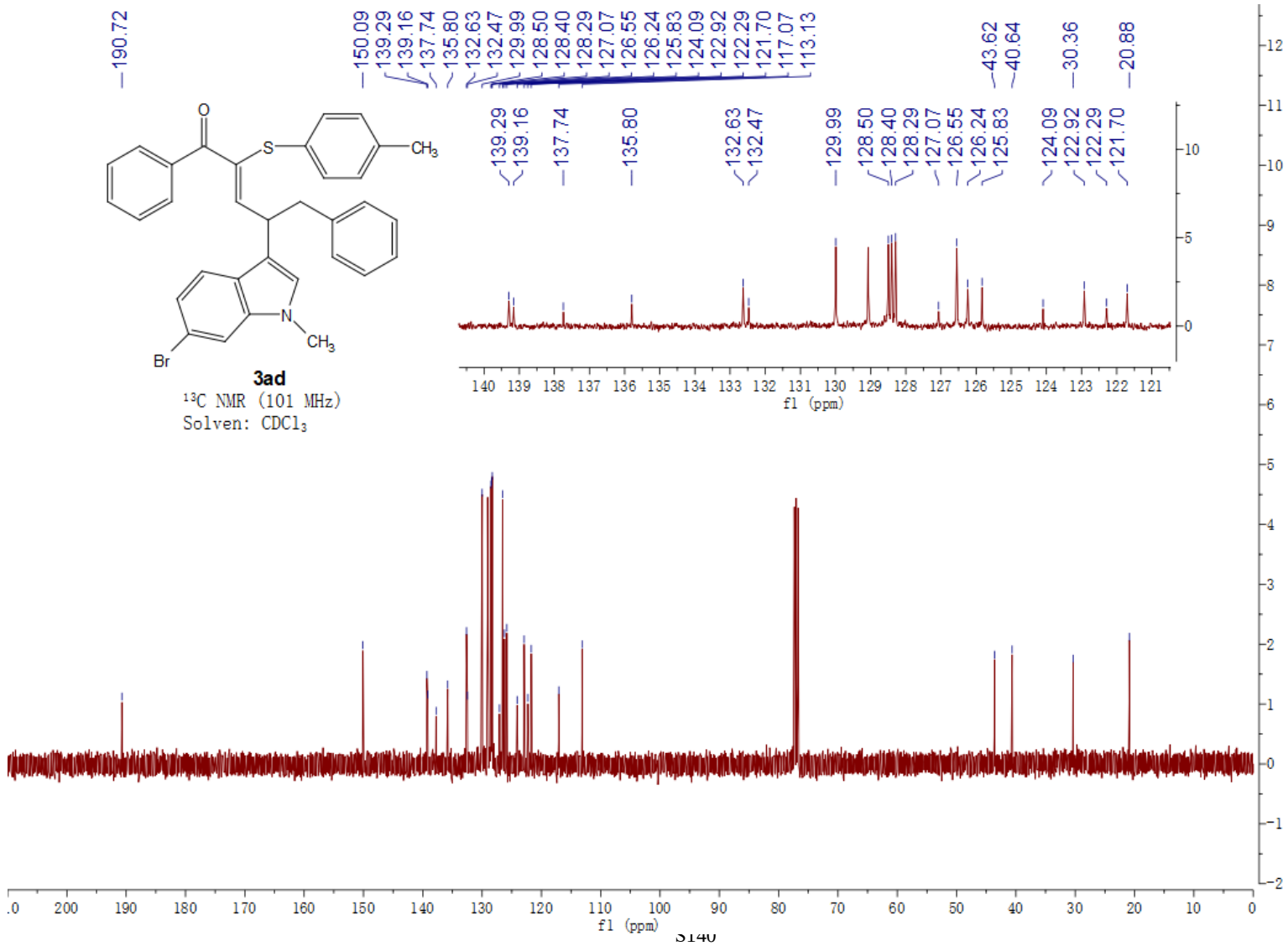
7.79
7.77
7.54
7.52
7.50
7.48
7.46
7.44
7.42
7.40
7.38
7.35
7.33
7.31
7.19
7.17
7.16
7.01
6.99
6.92
6.90
6.82
6.78
4.33
4.31
4.29
4.27
3.75
2.24
2.12
2.10
2.08
2.07
2.05
1.38
1.36
1.34
1.32
1.31
1.29
0.93
0.91
0.89
O
S
CH3
CH3
N
CH3
3ab
1H NMR (400 MHz)
Solven: CDCl3
2.05
3.04
1.06
1.04
f1 (ppm)
3.09
2.05
3.04
1.06
1.04
2.01
2.00
1.05
1.03
3.04
3.00
2.03
2.00
3.00
f1 (ppm)


191.01
151.92
138.51
138.01
135.53
133.46
132.47
129.94
128.52
128.37
126.17
125.40
125.37
125.13
123.22
123.17
120.64
119.52
110.07
41.44
36.35
30.24
21.12
20.88
13.98
O
S
CH3
CH3
N
CH3
3ab
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


7.86 7.84 7.72 7.70 7.50 7.49 7.47 7.45 7.39 7.37 7.34 7.32 7.21 7.19 7.17 7.16 7.08 7.06 6.94 6.92 6.74 6.72 6.70
4.60 4.58 4.56 4.55
3.65 3.40 3.38 3.36 3.34
2.22
O
S
CH3
N
CH3
3ac
1H NMR (400 MHz)
Solven: CDCl3
f1 (ppm)
1.08 2.06 2.02 5.01 1.00 1.01 1.01 1.00 2.07 2.08 1.00 1.07
1.02
3.00
2.03
3.01
f1 (ppm)


190.86
150.39
139.63
138.47
137.86
135.53
133.06
132.50
129.91
129.13
128.51
128.34
128.25
126.42
126.14
125.89
125.85
125.30
123.10
122.26
120.59
119.62
110.10
43.82
40.75
30.23
30.22
20.86
O
S
CH3
N
CH3
3ac
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)
f1 (ppm)


7.72 7.70 7.67 7.65 7.52 7.50 7.45 7.44 7.41 7.40 7.38 7.36 7.28 7.26 7.25 7.14 7.03 7.02 6.93 6.91 6.73 6.68 6.66
4.56 4.55 4.53 4.51
3.58 3.36 3.35 3.33 3.31 3.29 3.28
2.21
O
S
CH3
N
CH3
Br
3ad
1H NMR (400 MHz)
Solven: CDCl3
f1 (ppm)
f1 (ppm)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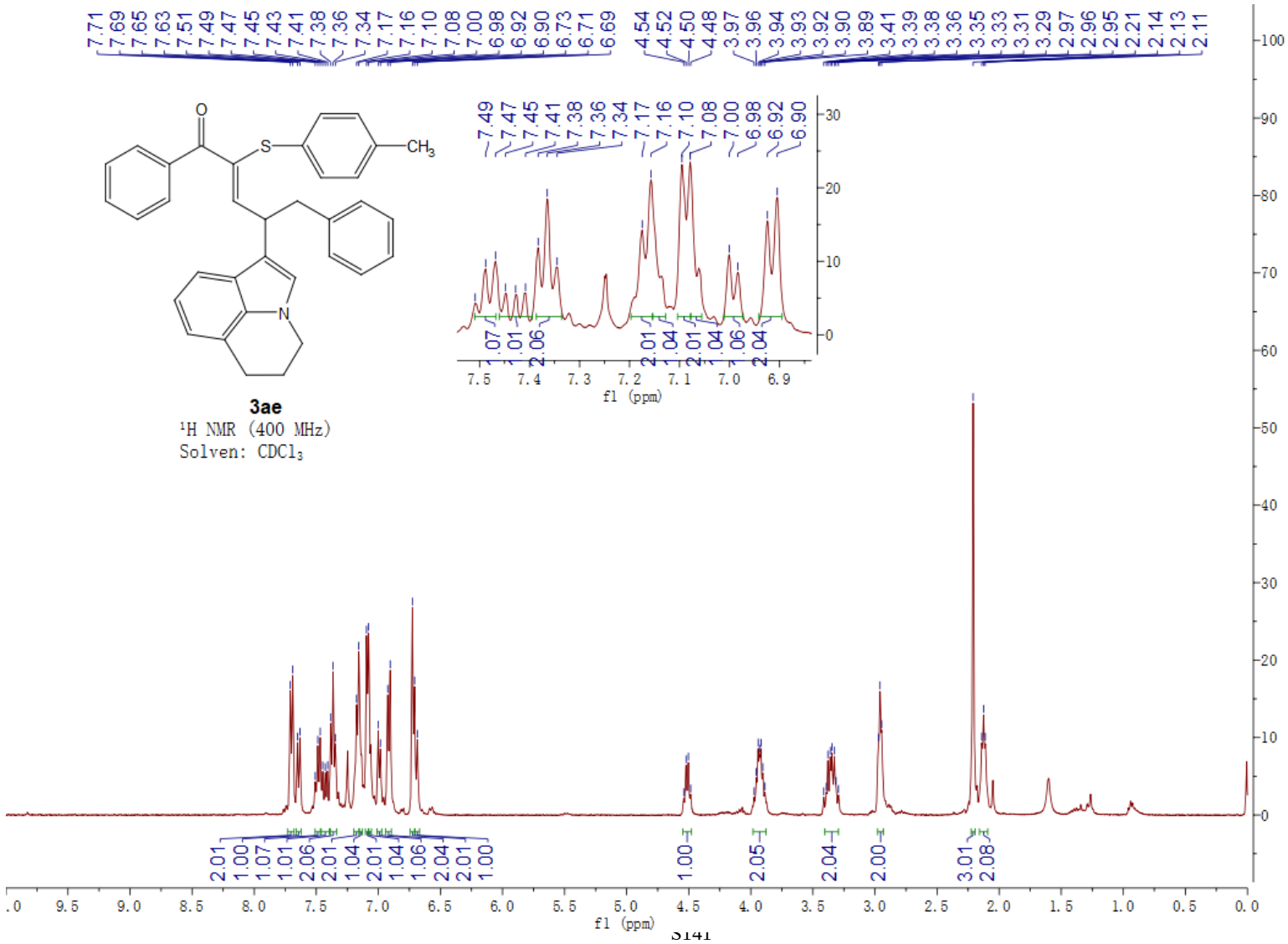
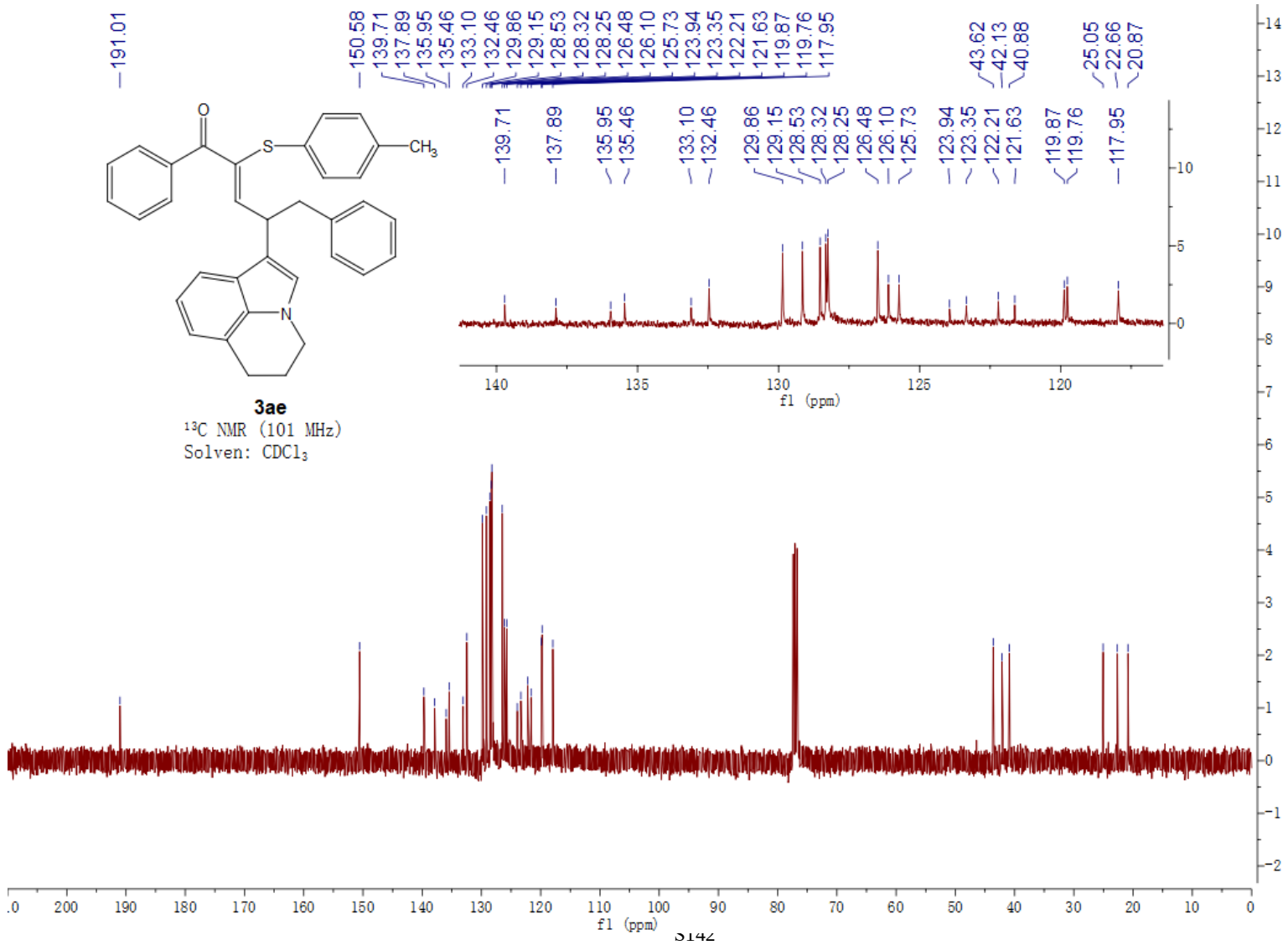
139.16
137.74
135.80
132.63
132.47
129.99
128.50
128.40
128.29
127.07
126.55
126.24
125.83
124.09
122.92
122.29
121.70
117.07
113.13
43.62
40.64
30.36
20.88
O
S
CH3
N
CH3
Br
3ad
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)
f1 (ppm)


O
S
CH3
N
3ae
1H NMR (400 MHz)
Solven: CDCl3
f1 (ppm)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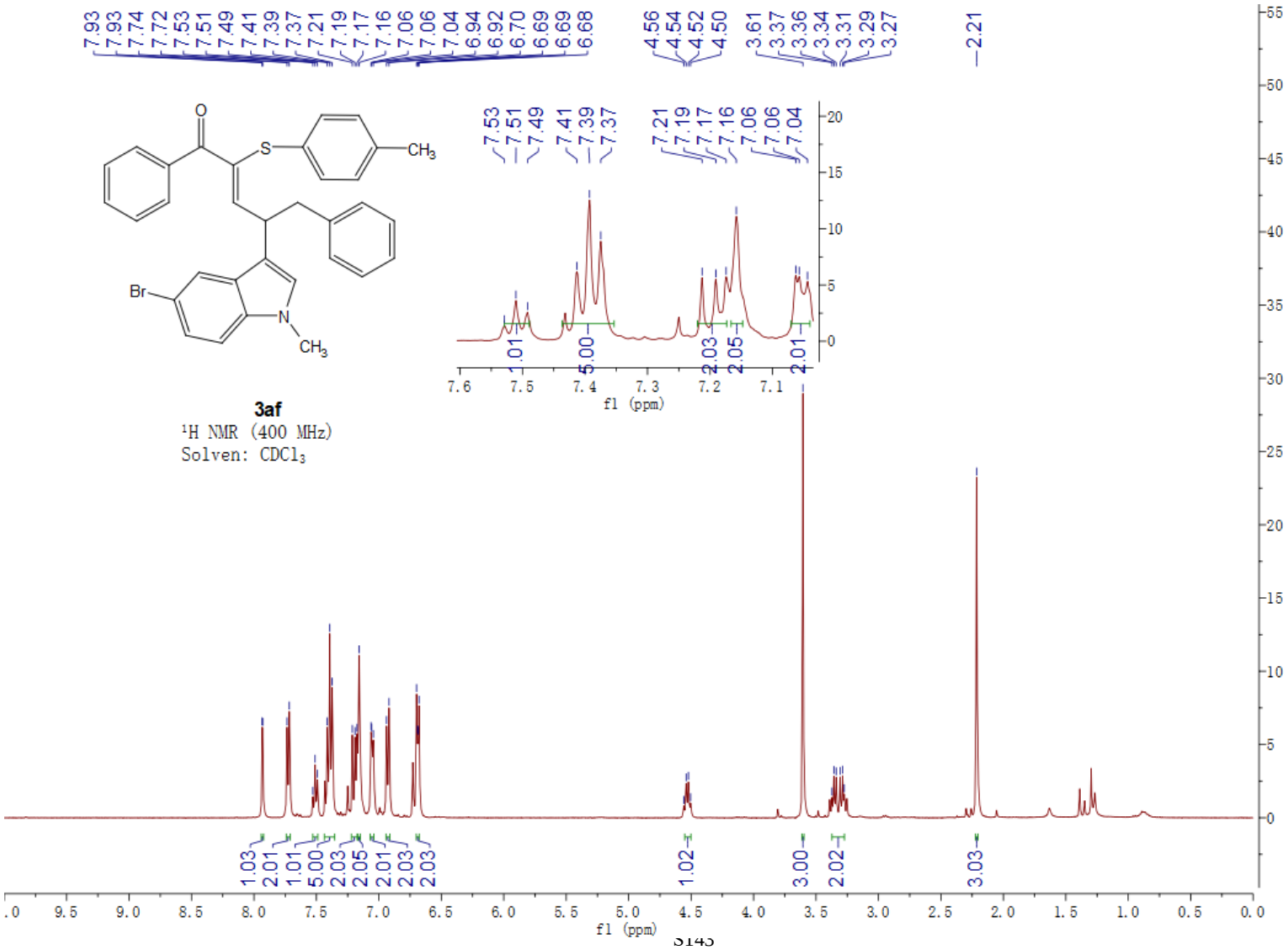
150.58
139.71
137.89
135.95
135.46
133.10
132.46
129.86
129.15
128.53
128.32
128.25
126.48
126.10
125.73
123.94
123.35
122.21
121.63
119.87
119.76
117.95
43.62
42.13
40.88
25.05
22.66
20.87
O
S
CH3
N
3ae
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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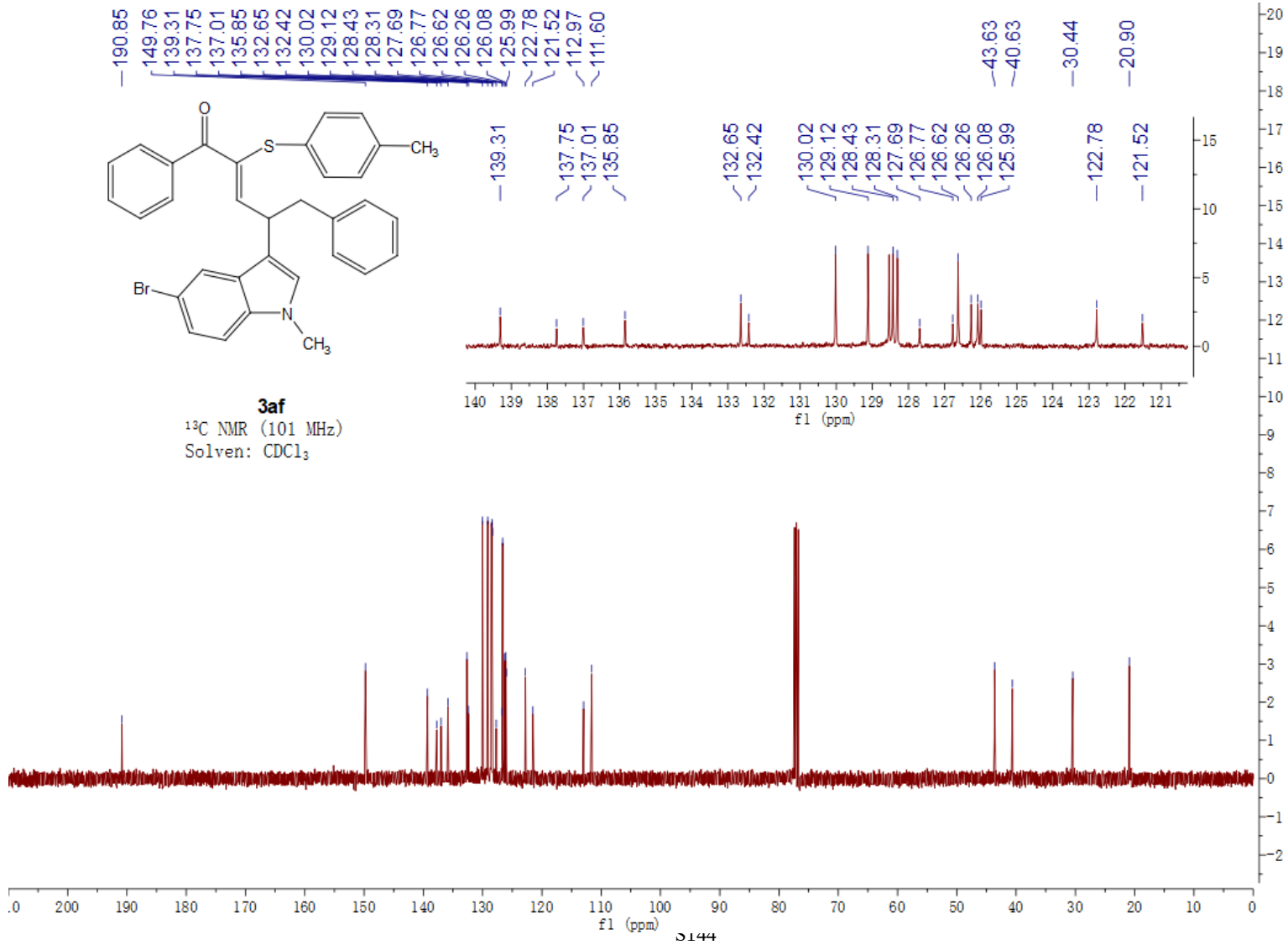
7.93
7.74
7.72
7.53
7.51
7.49
7.41
7.39
7.37
7.21
7.19
7.17
7.16
7.06
7.06
7.04
6.94
6.92
6.70
6.69
6.69
6.68
4.56
4.54
4.52
4.50
3.61
3.37
3.36
3.34
3.31
3.29
3.27
2.21
O
S
CH3
Br
N
CH3
3af
1H NMR (400 MHz)
Solven: CDCl3
f1 (ppm)
1.03
2.01
1.01
5.00
2.03
2.05
2.01
2.03
2.03
1.02
3.00
2.02
3.03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139.31
137.75
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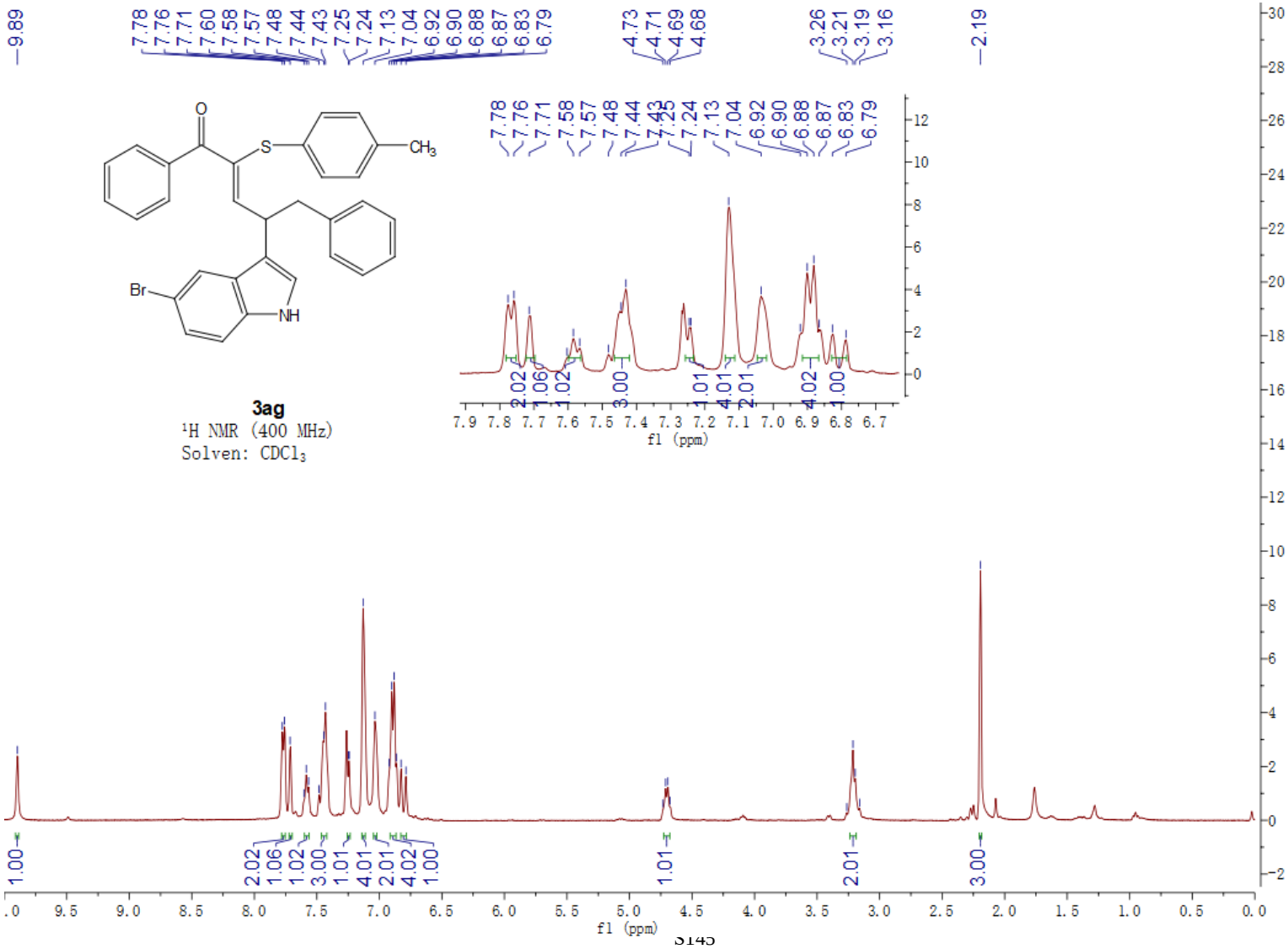
135.85
132.65
132.42
130.02
129.12
128.43
128.31
127.69
126.77
126.62
126.26
126.08
125.99
122.78
121.52
112.97
111.60
43.63
40.63
30.44
20.90
O
S
CH3
Br
N
CH3
3af
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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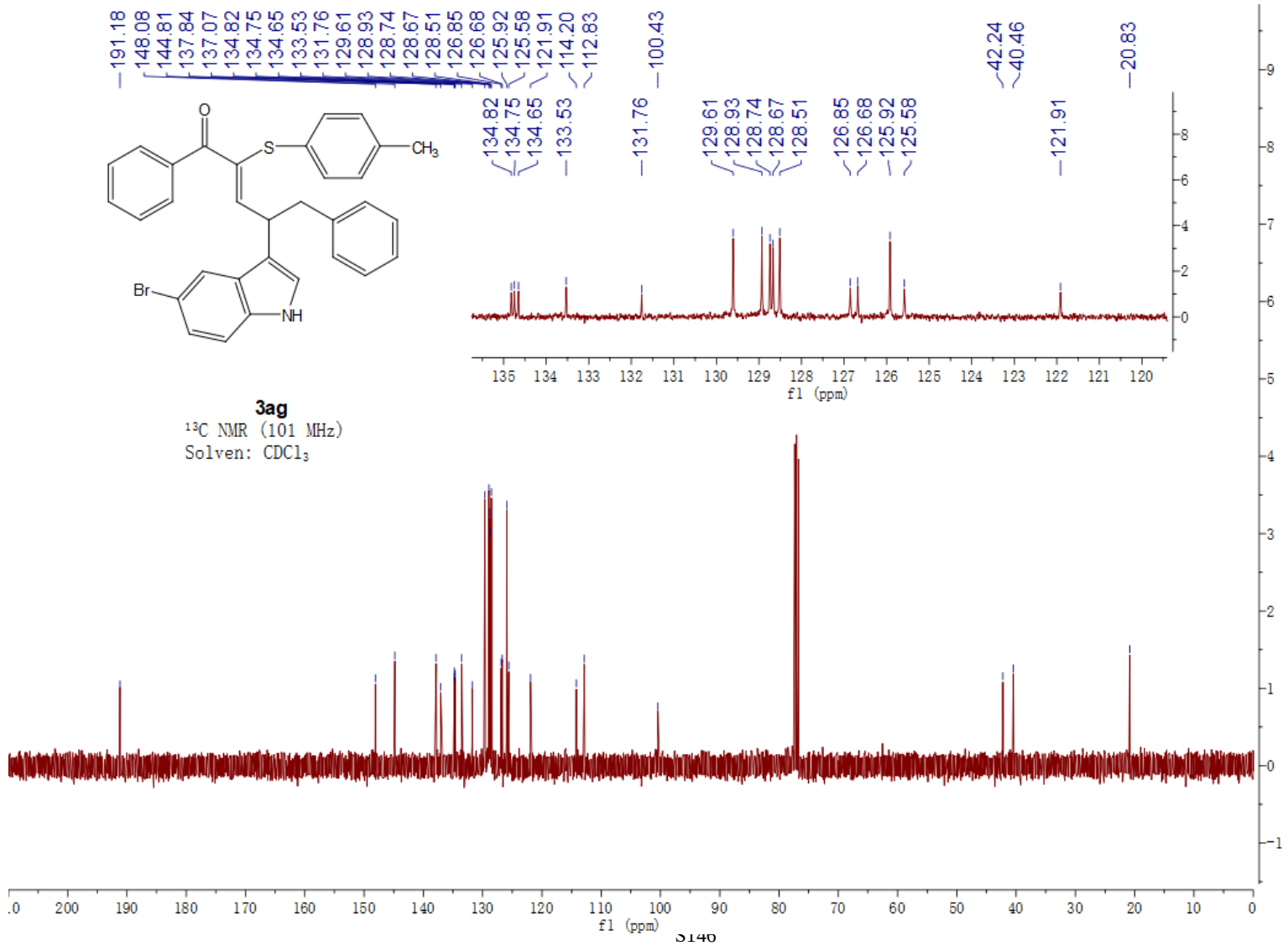
7.58
7.57
7.48
7.44
7.43
7.25
7.24
7.13
7.04
6.92
6.90
6.88
6.87
6.83
6.79
4.73
4.71
4.69
4.68
3.26
3.21
3.19
3.16
2.19
O
S
CH3
Br
NH
3ag
1H NMR (400 MHz)
Solven: CDCl3
f1 (ppm)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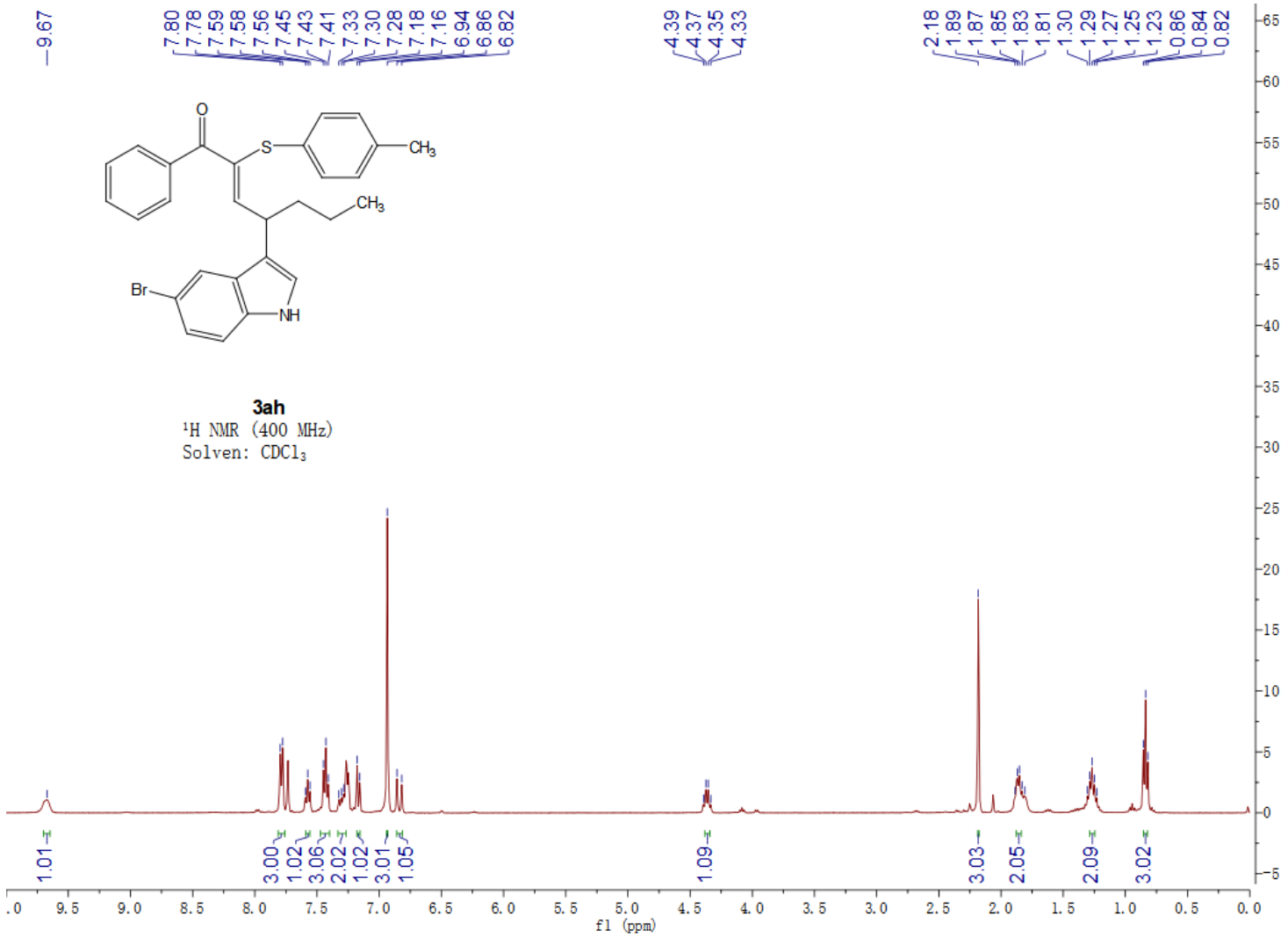
134.65
133.53
131.76
129.61
128.93
128.74
128.67
128.51
126.85
126.68
125.92
125.58
121.91
114.20
112.83
100.43
42.24
40.46
20.83
O
S
CH3
Br
NH
3ag
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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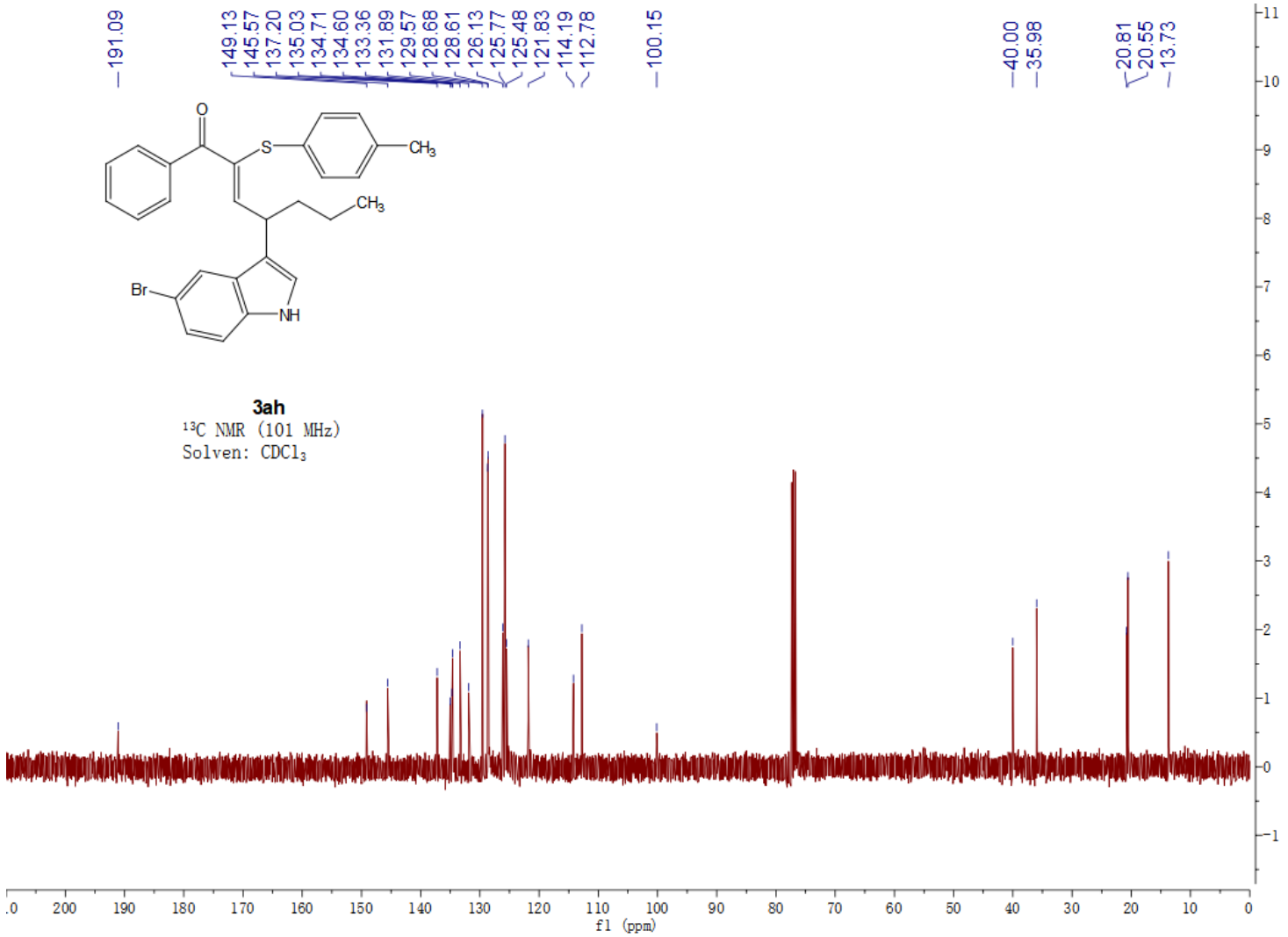
7.30
7.28
7.18
7.16
6.94
6.86
6.82
4.39
4.37
4.35
4.33
2.18
1.89
1.87
1.85
1.83
1.81
1.30
1.29
1.27
1.25
1.23
0.86
0.84
0.82
O
S
CH3
CH3
Br
NH
3ah
1H NMR (400 MHz)
Solven: CDCl3
1.01
3.00
1.02
3.06
2.02
1.02
3.01
1.05
1.09
3.03
2.05
2.09
3.02
f1 (ppm)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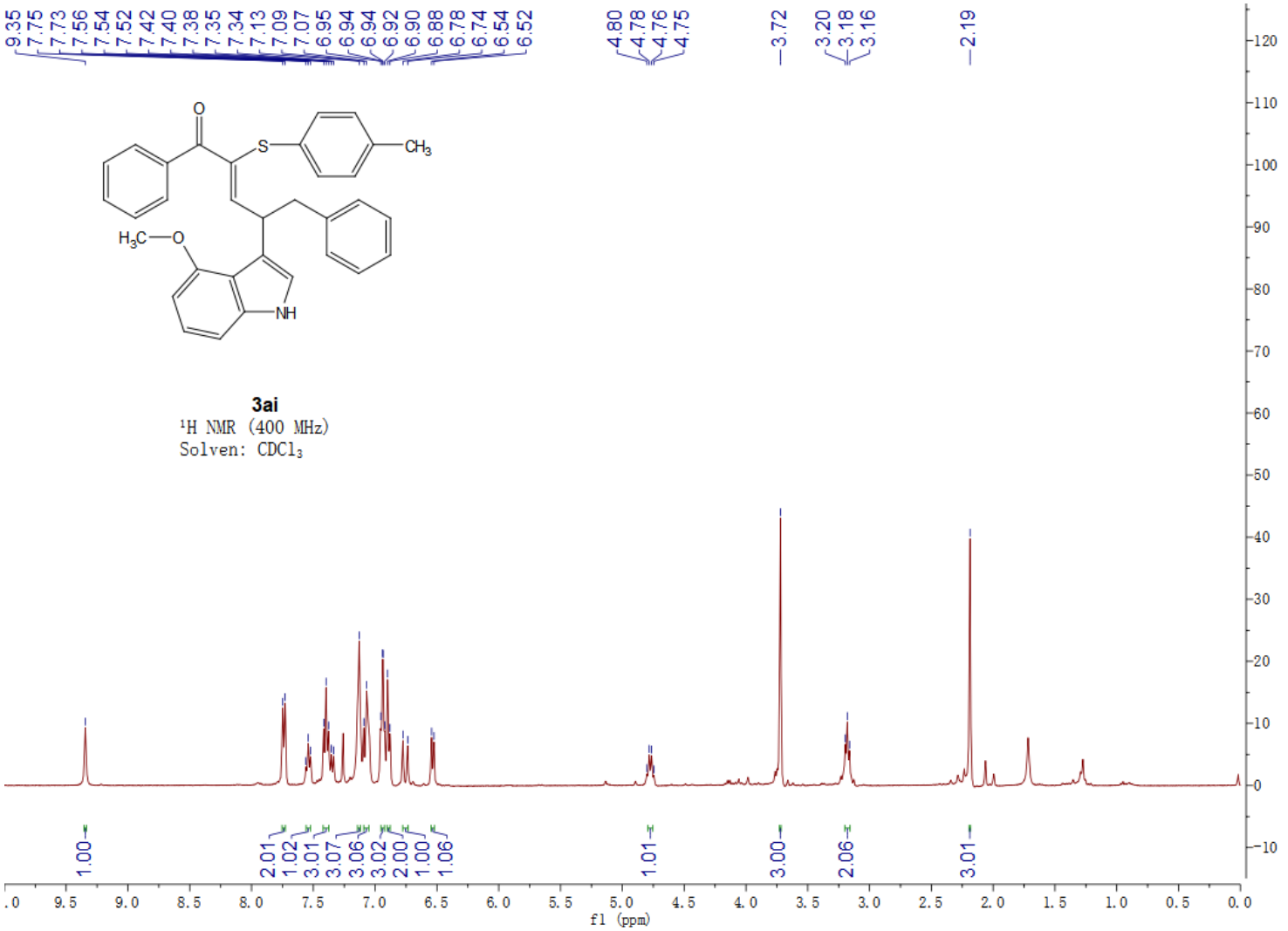
135.03
134.71
134.60
133.36
131.89
129.57
128.68
128.61
126.13
125.77
125.48
121.83
114.19
112.78
100.15
40.00
35.98
20.81
20.55
13.73
O
S
CH3
CH3
Br
NH
3ah
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)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7.75
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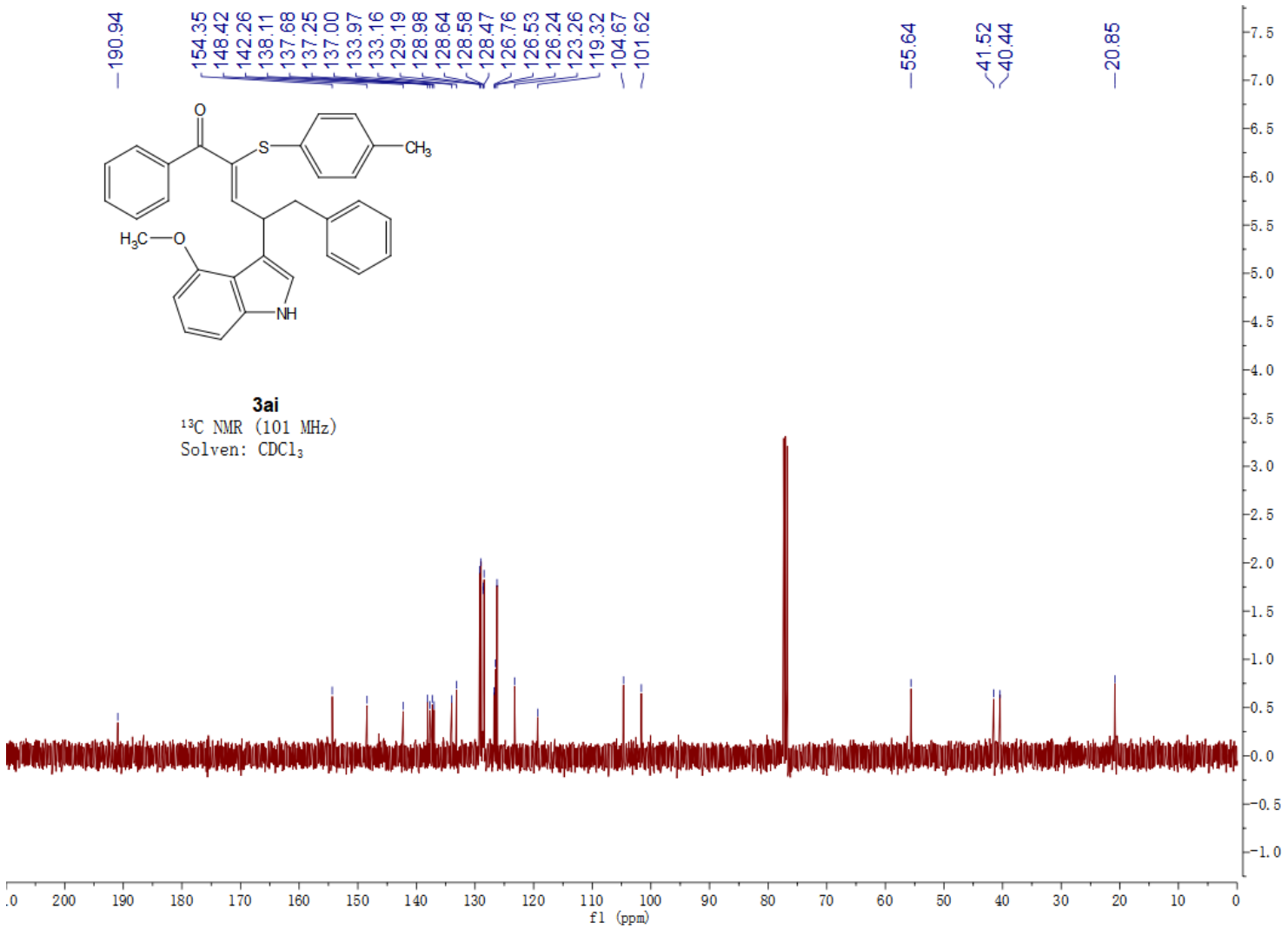
7.40
7.38
7.35
7.34
7.13
7.09
7.07
6.95
6.94
6.94
6.92
6.90
6.88
6.78
6.74
6.54
6.52
4.80
4.78
4.76
4.75
3.72
3.20
3.18
3.16
2.19
O
S
CH3
H3C—O
NH
3ai
1H NMR (400 MHz)
Solven: CDCl3
1.00
2.01
1.02
3.01
3.07
3.06
3.02
2.00
1.00
1.06
1.01
3.00
2.06
3.01
f1 (ppm)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137.68
137.25
137.00
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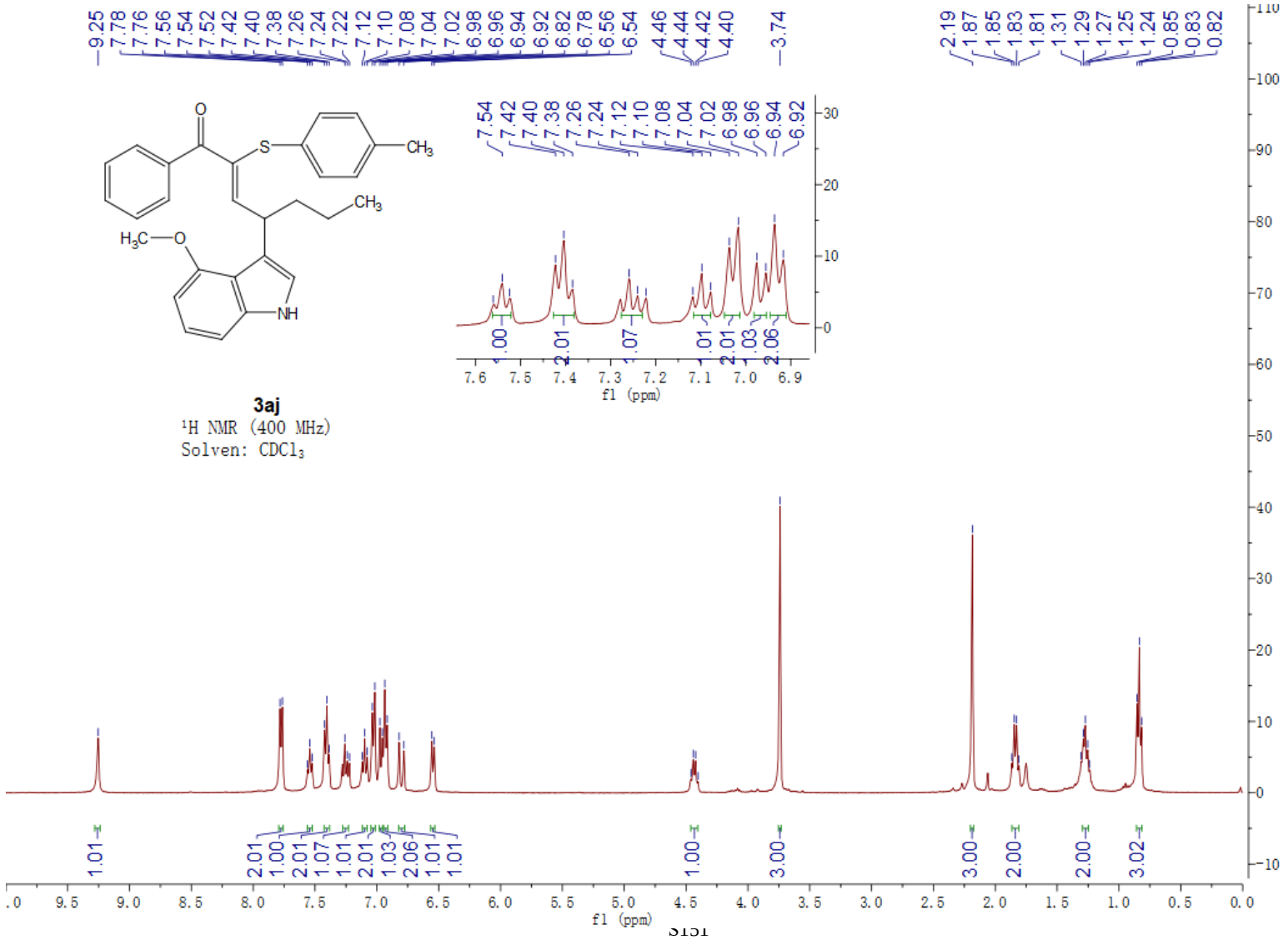
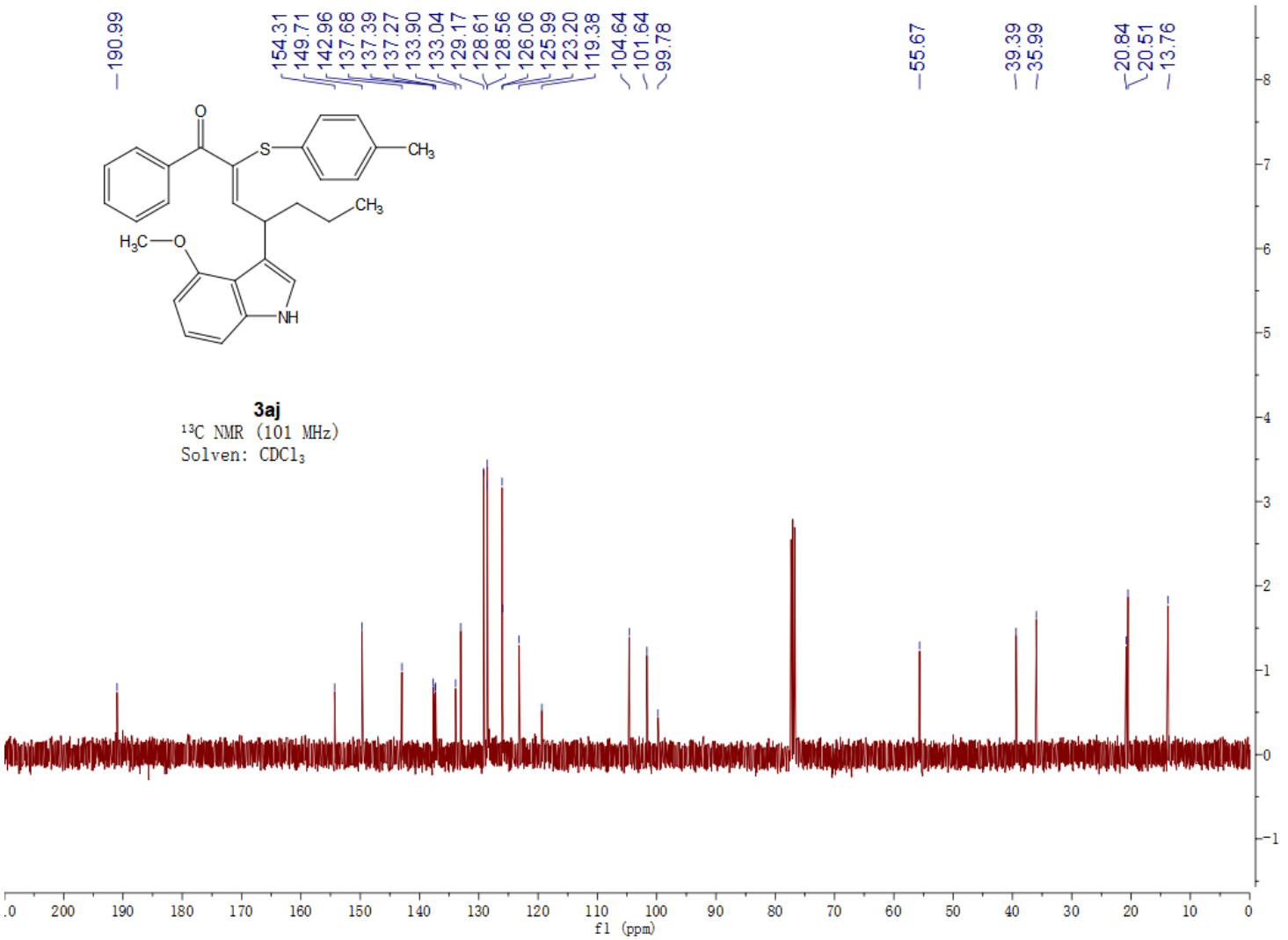
133.16
129.19
128.98
128.64
128.58
128.47
126.76
126.53
126.24
123.26
119.32
104.67
101.62
55.64
41.52
40.44
20.85
O
S
CH3
H3C—O
NH
3ai
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


9.25 7.78 7.76 7.56 7.54 7.52 7.42 7.40 7.38 7.26 7.24 7.22 7.12 7.10 7.08 7.04 7.02 6.98 6.96 6.94 6.92 6.82 6.78 6.56 6.54 4.46 4.44 4.42 4.40 3.74
2.19 1.87 1.85 1.83 1.81 1.31 1.29 1.27 1.25 1.24 0.85 0.83 0.82
O
S
CH3
CH3
H3C—O
NH
7.54 7.42 7.40 7.38 7.26 7.24 7.12 7.10 7.08 7.04 7.02 6.98 6.96 6.94 6.92
1.00 2.01 1.07 1.01 2.01 1.03 2.06
f1 (ppm)
3aj
1H NMR (400 MHz)
Solven: CDCl3
1.01 2.01 1.00 2.01 1.07 1.01 2.01 1.03 2.06 1.01 1.01 1.00 3.00 3.00 2.00 2.00 3.02
f1 (ppm)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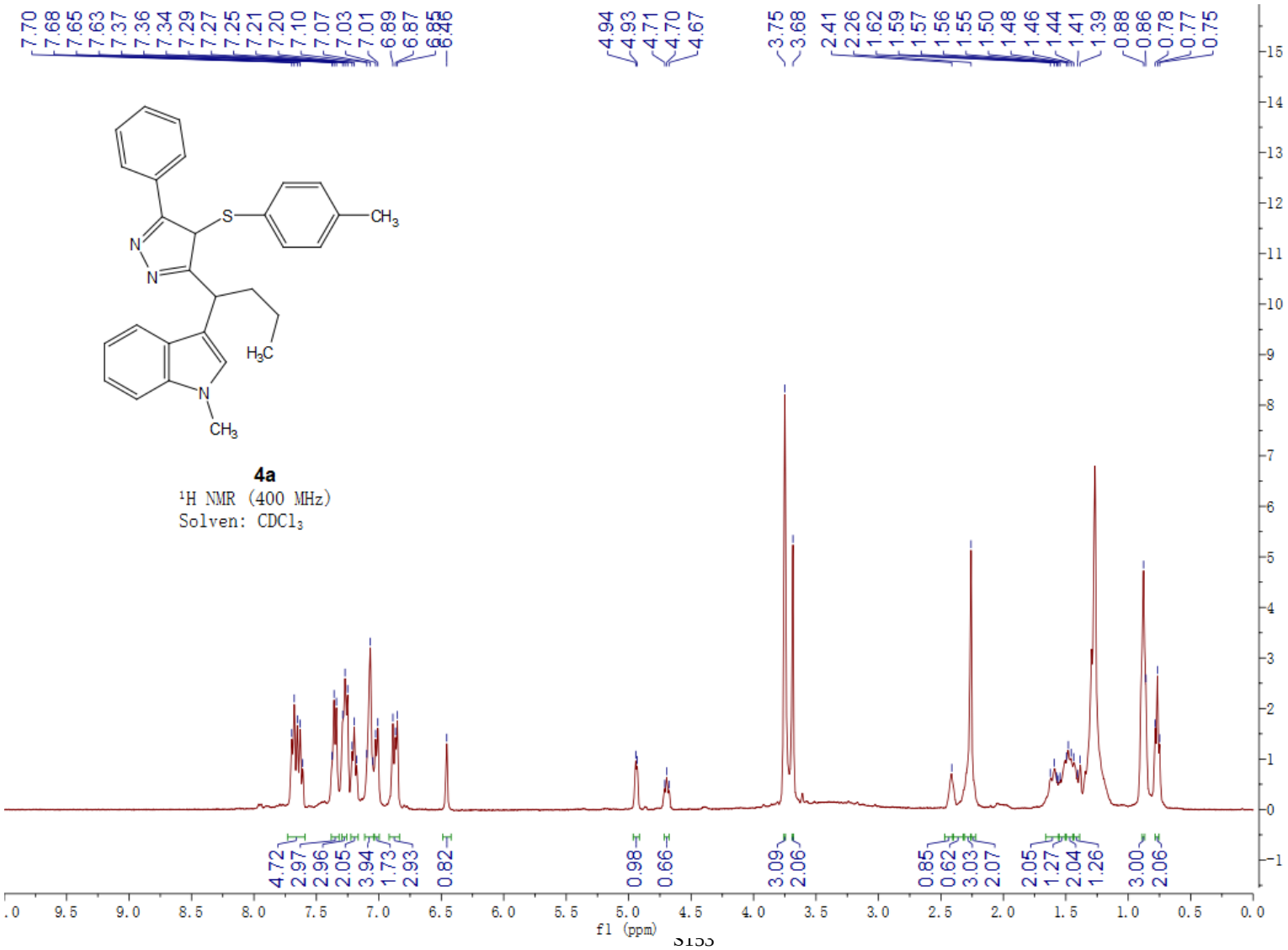
154.31
149.71
142.96
137.68
137.39
137.27
133.90
133.04
129.17
128.61
128.56
126.06
125.99
123.20
119.38
104.64
101.64
99.78
55.67
39.39
35.99
20.84
20.51
13.76
O
S
CH3
CH3
H3C—O
NH
3aj
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


7.70
7.68
7.65
7.63
7.37
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7.10
7.07
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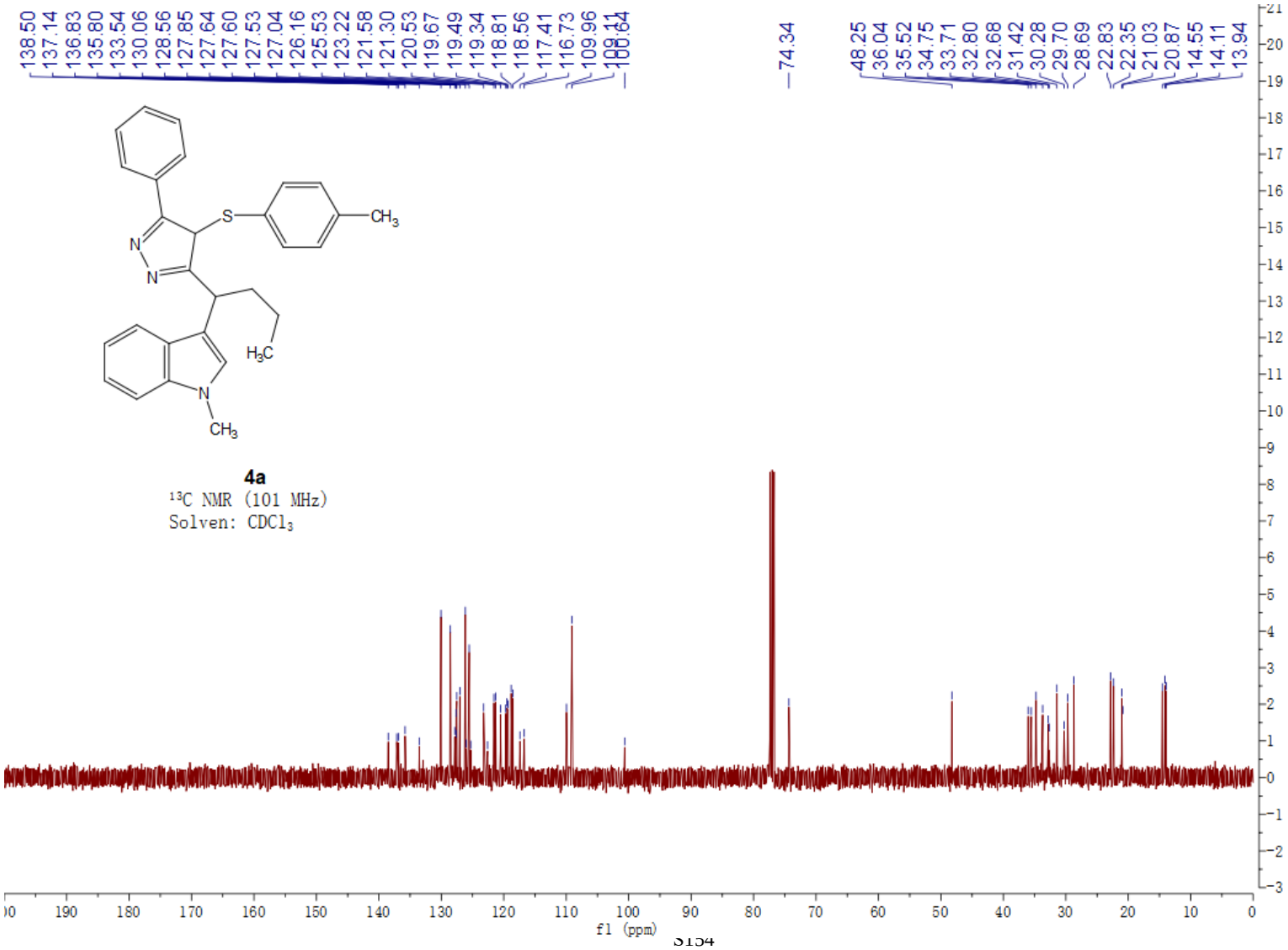
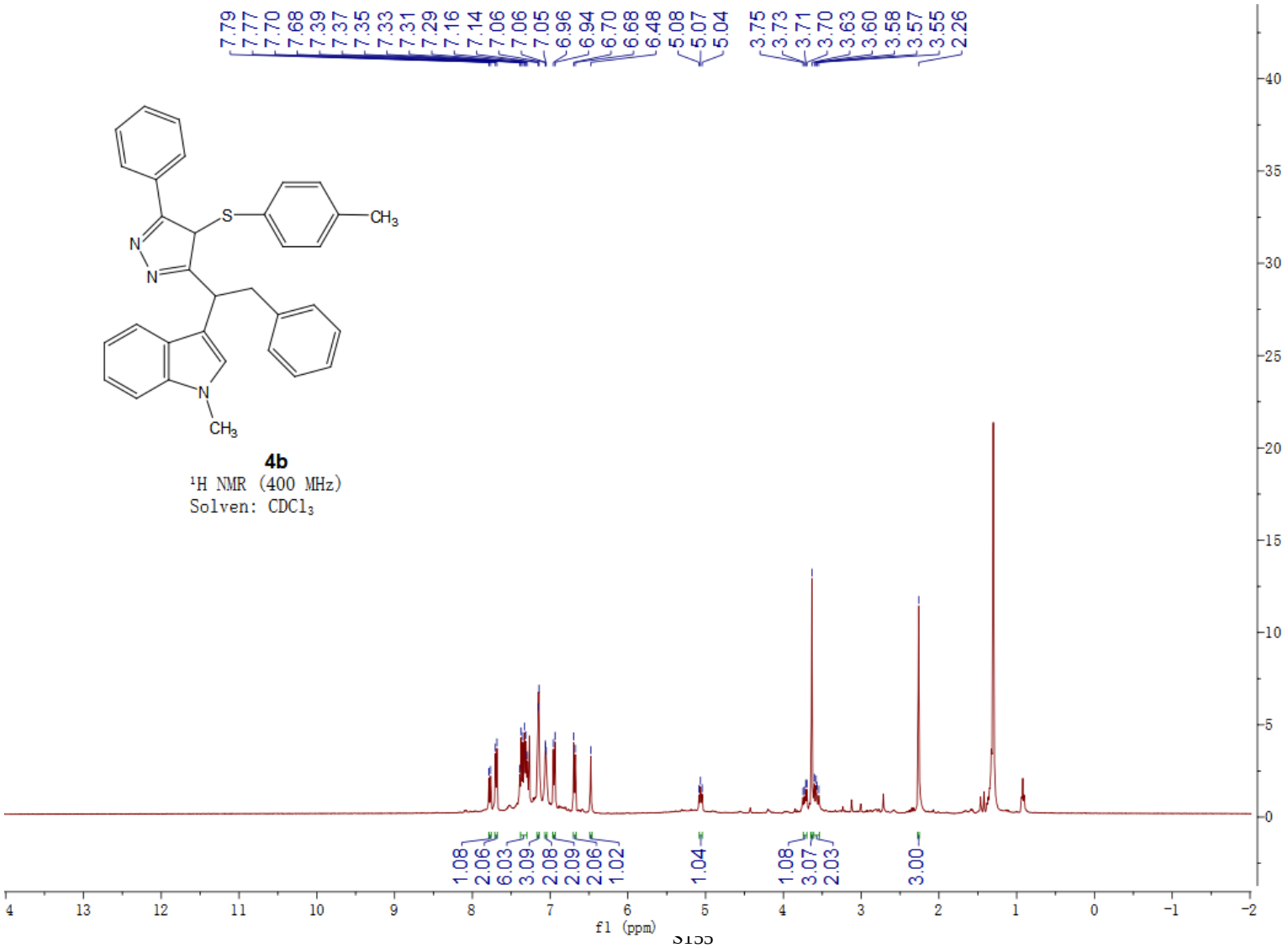
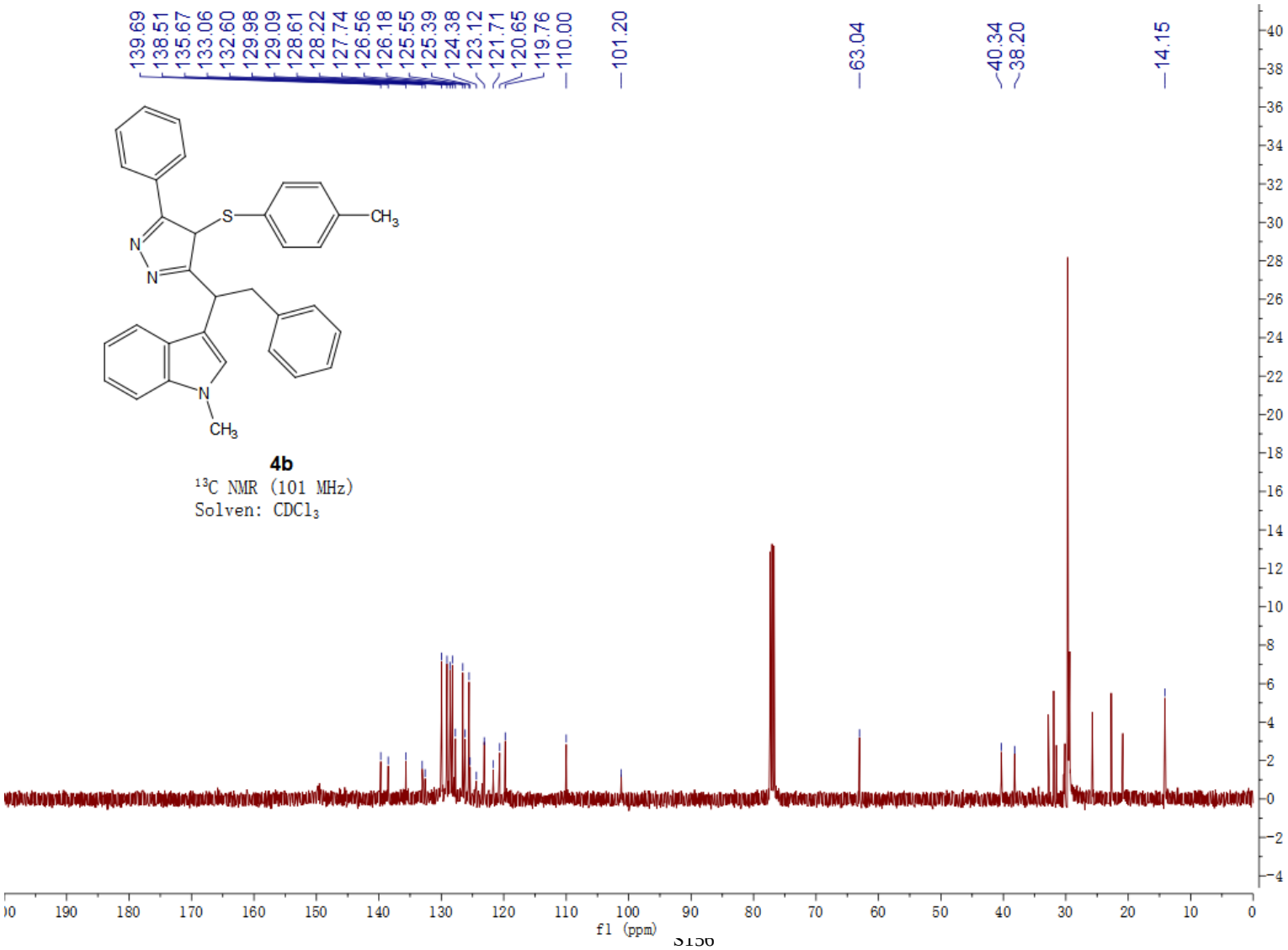
7.01
6.89
6.87
6.85
6.46
4.94
4.93
4.71
4.70
4.67
3.75
3.68
2.41
2.26
1.62
1.59
1.57
1.56
1.55
1.50
1.48
1.46
1.44
1.41
1.39
0.88
0.86
0.78
0.77
0.75
S
CH3
N
N
H3C
N
CH3
4a
1H NMR (400 MHz)
Solven: CDCl3
4.72
2.97
2.96
2.05
3.94
1.73
2.93
0.82
0.98
0.66
3.09
2.06
0.85
0.62
3.03
2.07
2.05
1.27
2.04
1.26
3.00
2.06
f1 (ppm)


138.50
137.14
136.83
135.80
133.54
130.06
128.56
127.85
127.64
127.60
127.53
127.04
126.16
125.53
123.22
121.58
121.30
120.53
119.67
119.49
119.34
118.81
118.56
117.41
116.73
109.96
74.34
48.25
36.04
35.52
34.75
33.71
32.80
32.68
31.42
30.28
29.70
28.69
22.83
22.35
21.03
20.87
14.55
14.11
13.94
S
CH3
N
N
H3C
N
CH3
4a
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)


7.79
7.77
7.70
7.68
7.39
7.37
7.35
7.33
7.31
7.29
7.16
7.14
7.06
7.06
7.05
6.96
6.94
6.70
6.68
6.48
5.08
5.07
5.04
3.75
3.73
3.71
3.70
3.63
3.60
3.58
3.57
3.55
2.26
S
CH3
N
N
N
CH3
4b
1H NMR (400 MHz)
Solven: CDCl3
1.08
2.06
6.03
3.09
2.08
2.09
2.06
1.02
1.04
1.08
3.07
2.03
3.00
f1 (ppm)


139.69
138.51
135.67
133.06
132.60
129.98
129.09
128.61
128.22
127.74
126.56
126.18
125.55
125.39
124.38
123.12
121.71
120.65
119.76
110.00
101.20
63.04
40.34
38.20
14.15
S
CH3
N
N
N
CH3
4b
13C NMR (101 MHz)
Solven: CDCl3
f1 (ppm)