SUPPORTING INFORMATION

Brønsted acid catalyzed Ficini [2 + 2] cycloaddition of ynamides with enones

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Part I Experimental Part

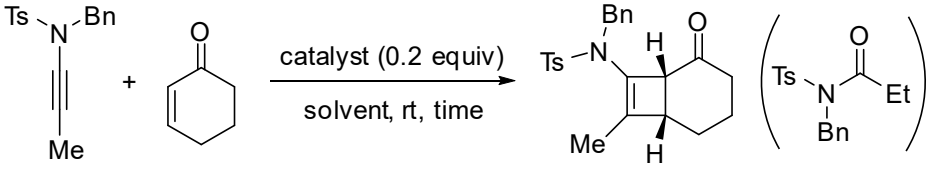
General Information

Unless otherwise indicated, all starting materials were obtained from commercial supplies and used as received. Ynamides **1a**,[1] **1b**,[2] **1c**,[3] **1d**,[4] **1e**,[5] **1f**,[6] **1g**,[7] **1h**,[6] **1i**,[8] **1j**,[8] **1k**,[1] **1l**,[1] **1m**,[9] **1n**,[1] **1o**,[10] **1p**,[11] **1q**,[1] **1r**,[12] and **1s**[13] were known compounds and synthesized according to the literature, and the data were matched with the reported values. All reactions were performed in oven-dried glassware under a nitrogen atmosphere unless otherwise stated. All catalysts were added in the glove box. Solvents were distilled prior to use. Chromatographic separations were performed using 200~300 mesh silica gel. ^{1}H NMR and ^{13}C{^{1}H} NMR spectra were obtained on a Bruker's Ascend^{TM} 400 NMR spectrometer using $CDCl_3$ as the solvent with TMS or residual solvent as standard unless otherwise noted. ABq represents the splitting of two hydrogens on the same carbon. ^{13}C{^{1}H} NMR (100 MHz) spectra were reported in ppm with the internal chloroform signal at 77.2 ppm as the standard. Infrared spectra were obtained on a PerkinElmer FT/IR spectrophotometer and relative intensities are expressed qualitatively as s (strong), m (medium), and w (weak). TLC analysis was performed using 254 nm polyester-backed plates and visualized using UV and $KMnO_4$ stain. High-resolution mass spectra (HRMS) were performed on a Bruker MicrOTOF-Q II mass spectrometer.

1.1 Optimization of the Reaction Conditions.

Entry 13 (1.0 mmol synthetic method): To an oven-dried tube was added ynamide **1a**[1] (358.9 mg, 1.20 mmol), cyclohexenone **2a** (96.13 mg, 1.00 mmol), DCE (5.0 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (56.2 mg, 0.20 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was filtered through a short pad of silica gel. Then the filtrate was concentrated in vacuo and purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether/EtOAc] to afford cyclobutenamide **3a** (356.1 mg, 0.90 mmol) in 90% yield.

Table S1. Optimization of the Reaction Conditions



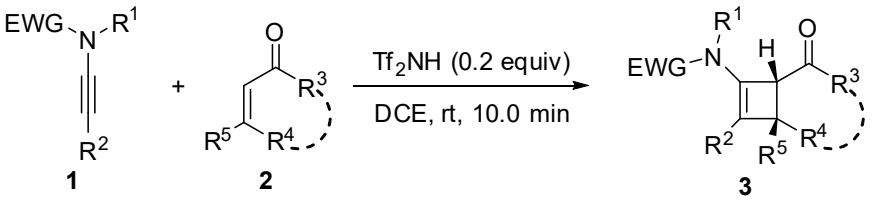
1a **2a** **3a** **3a'**

entry[a]	catalyst	solvent	time (min)	yield[b] (%)	
				3a	**3a'**
1	Tf_2O	CH_2Cl_2	10.0	55	30
2	TfOMe	CH_2Cl_2	10.0	70	0
3	TMSOTf	CH_2Cl_2	10.0	75	20
4	TBSOTf	CH_2Cl_2	10.0	75	12
5	TIPSOTf	CH_2Cl_2	10.0	74	18
6	TfOH	CH_2Cl_2	10.0	64	28
7	Tf_2NH	CH_2Cl_2	10.0	90	trace
8	BF_3•Et_2O	CH_2Cl_2	5.0	87	10
9	Tf_2NH	toluene	10.0	85	9
10	Tf_2NH	1,4-dioxane	10.0	63	13
11	Tf_2NH	THF	25.0	18	22
12	Tf_2NH	DCE	10.0	93	trace
13[c]	Tf_2NH	DCE	10.0	90	trace

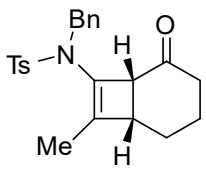
[a]Unless otherwise noted, reactions were carried out using **1a** (0.36 mmol) and **2a** (0.30 mmol) with catalyst (0.06 mmol) in solvent (1.5 mL) under N_2. [b]Isolated yields. [c]**1a** (1.20 mmol) and **2a** (1.00 mmol) were added.

1.2 Reaction Scope of the [2 + 2] Cycloaddition.

Cyclobutenamides **3a**,[2] **3b**,[2] **3d**,[2] **3e**,[2] **3u**,[14] and **3z**[2] were known compounds, the data were matched with reported values. Cyclobutenamides **3c**, **3f**, **3g**, **3h**, **3i**, **3j**, **3k**, **3l**, **3m**, **3n**, **3o-3t**, **3v-3y**, **3aa**, and **3ab** were new compounds.



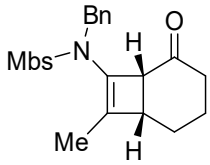
1 **2** **3**



3a

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3a** (110.1 mg, 0.28 mmol) in 93% yield.

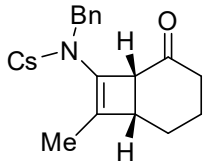
3a: R_f = 0.19 [6:1 petroleum ether/EtOAc]; white solid; mp = 114–115 ^oC;[1] H NMR (400 MHz, $CDCl_3$) δ 7.74 (d, 2H, J = 8.3 Hz), 7.34-7.27 (m, 7H), 4.63, 4.56 (ABq, 2H, J_{AB} = 15.0 Hz), 3.18 (dq, 1H, J = 4.6, 2.3 Hz), 2.75 (br, 1H), 2.45 (s, 3H), 1.81-1.77 (m, 2H), 1.68-1.67 (m, 3H), 1.45-1.39 (m, 2H), 1.33-1.22 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 210.7, 144.1, 144.0, 136.6, 136.5, 129.9, 128.6, 127.9, 127.7, 127.6, 126.7, 53.9, 51.3, 40.5, 38.6, 23.8, 21.8, 17.1, 12.6. Spectral data are in agreement with literature values[2].



3b

To an oven-dried tube was added ynamide **1b**[2] (113.5 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3b** (114.7 mg, 0.28 mmol) in 93% yield.

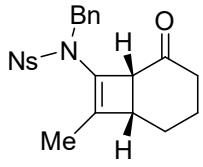
3b: R_f = 0.23 [5:1 petroleum ether/EtOAc]; white solid; mp = 128–129 ^oC; ^1H NMR (400 MHz, $CDCl_3$) 7.79 (d, 2H, J = 8.9 Hz), 7.33-7.27 (m, 5H), 7.00 (d, 2H, J = 8.9 Hz), 4.61, 4.55 (ABq, 2H, J_{AB} = 15.0 Hz), 3.89 (s, 3H), 3.19 (dq, 1H, J = 4.7, 2.3 Hz), 2.75 (br, 1H), 1.88-1.75 (m, 3H), 1.68-1.67 (m, 3H), 1.48-1.39 (m, 2H), 1.28-1.22 (m, 1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 210.7, 163.3, 144.0, 136.5, 131.2, 129.7, 128.6, 127.9, 127.7, 126.9, 114.4, 55.8, 54.0, 51.3, 40.5, 38.6, 23.8, 17.1, 12.6. Spectral data are in agreement with literature values[2].



3c

To an oven-dried tube was added ynamide **1c**[3] (114.8 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3c** (103.8 mg, 0.25 mmol) in 83% yield.

3c: R_f = 0.33 [5:1 petroleum ether/EtOAc]; white solid; mp = 114–115 ^oC; ^1H NMR (400 MHz, $CDCl_3$) δ 7.80 (d, 2H, J = 8.6 Hz), 7.51 (d, 2H, J = 8.6 Hz), 7.34-7.27 (m, 5H), 4.63, 4.56 (ABq, 2H, J_{AB} = 14.9 Hz), 3.19 (dq, 1H, J = 4.6, 2.4 Hz), 2.76 (br, 1H), 1.86-1.77 (m, 3H), 1.66-1.65 (m, 3H), 1.50-1.43 (m, 2H), 1.31-1.22 (m, 1H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 210.4, 144.9, 139.7, 138.1, 136.1, 129.5, 129.1, 128.7, 128.0, 127.9, 126.3, 53.7, 51.5, 40.7, 38.6, 23.8, 17.2, 12.6; IR (neat) (cm^{-1}) 2928m, 2865w, 1686s, 1521m, 1294w, 626s; HRMS (ESI): m/z calcd for $C_{22}H_{23}ClNO_3S$ $[M + H]^+$ 416.1082, found 416.1080.

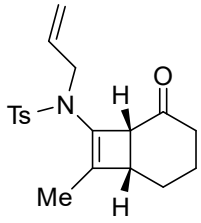


3d

To an oven-dried tube was added ynamide **1d**[4] (118.9 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3d** (98.2 mg, 0.23 mmol) in 77% yield.

3d: R_f = 0.29 [5:1 petroleum ether/EtOAc]; white solid; mp = 115–116 ^oC; ^1H NMR (400 MHz, $CDCl_3$) δ 8.39 (d, 2H, J = 8.8 Hz), 8.04 (d, 2H, J = 8.8 Hz), 7.35-7.28 (m,

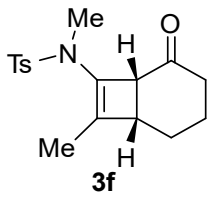
5H), 4.66, 4.58 (ABq, 2H, J_{AB} = 14.8Hz), 3.19 (br, 1H), 2.79 (br, 1H), 1.96-1.79 (m, 3H), 1.67-1.66 (m, 3H), 1.55-1.47 (m, 2H), 1.32-1.25 (m, 1H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 210.1, 150.4, 146.1, 145.5, 135.6, 128.9, 128.8, 128.2, 128.1, 125.8, 124.5, 53.4, 51.8, 41.0, 38.7, 23.8, 17.2, 12.6. Spectral data are in agreement with literature values[2].



3e

To an oven-dried tube was added ynamide **1e**[5] (89.8 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3e** (95.1 mg, 0.28 mmol) in 92% yield.

3e: R_f = 0.17 [5:1 petroleum ether/EtOAc]; white solid; mp = 100–101 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.67 (d, 2H, J = 8.3 Hz), 7.29 (d, 2H, J = 8.0 Hz), 5.82-5.72 (m, 1H), 5.26-5.14 (m, 2H), 4.13-3.97 (m, 2H), 3.28 (br, 1H), 2.88 (br, 1H), 2.43 (s, 3H), 2.15-2.09 (m, 1H), 1.97-1.87 (m, 2H), 1.74-1.73 (m, 3H), 1.65-1.53 (m, 3H); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 210.5, 143.9, 143.2, 136.8, 133.7, 129.8, 127.6, 126.9, 117.8, 53.9, 50.3, 40.6, 38.6, 23.9, 21.8, 17.3, 12.6. Spectral data are in agreement with literature values[2].

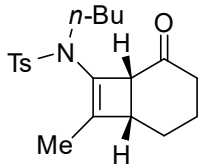


3f

To an oven-dried tube was added ynamide **1f**[6] (80.38 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic

eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3f** (80.8 mg, 0.25 mmol) in 84% yield.

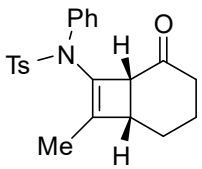
3f: R_f = 0.25 [5:1 petroleum ether/EtOAc]; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.66 (d, 2H, J = 8.3 Hz), 7.30 (d, 2H, J = 8.0 Hz), 3.32 (br, 1H), 3.02 (s, 3H), 2.88 (br, 1H), 2.43 (s, 3H), 2.19-2.14 (m, 1H), 2.01-1.88 (m, 2H), 1.77-1.76 (m, 3H), 1.73-1.53 (m, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.7, 144.0, 139.6, 135.8, 129.7, 128.2, 127.6, 53.8, 40.2, 38.7, 35.5, 24.0, 21.8, 17.4, 12.7; IR (neat) (cm^{-1}) 2932m, 2855w, 1595m, 1402w, 1013w, 887m, 675s; HRMS (ESI): m/z calcd for $C_{17}H_{21}NNaO_3S$ $[M + Na]^+$ 342.1134, found 342.1126.



3g

To an oven-dried tube was added ynamide **1g**[7] (95.5 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3g** (80.4 mg, 0.22 mmol) in 74% yield.

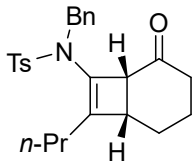
3g: R_f = 0.32 [5:1 petroleum ether/EtOAc]; white solid; mp = 61–62 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.65 (d, 2H, J = 8.3 Hz), 7.27 (d, 2H, J = 8.6 Hz), 3.48-3.33 (m, 2H), 3.31 (br, 1H), 2.90 (br, 1H), 2.42 (s, 3H), 2.12-2.06 (m, 1H), 1.98-1.89 (m, 2H), 1.75-1.74 (m, 3H), 1.64-1.60 (m, 2H), 1.52-1.44 (m, 2H), 1.37-1.25 (m, 3H), 0.91 (t, 3H, J = 7.3 Hz); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.4, 143.7, 143.5, 137.1, 129.7, 127.5, 127.0, 53.8, 47.6, 40.5, 38.6, 31.5, 24.0, 21.8, 19.6, 17.4, 13.9, 12.6; IR (neat) (cm^{-1}) 2957s, 2727m, 1693s, 1458m, 1031m, 815s, 572m; HRMS (ESI): m/z calcd for $C_{20}H_{28}NO_3S$ $[M + H]^+$ 362.1784, found 362.1784.



3h

To an oven-dried tube was added ynamide **2h**[6] (102.73 mg, 0.36 mmol), cyclohexenone **1a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3h** (81.0 mg, 0.21 mmol) in 71% yield.

3h: R_f = 0.38 [5:1 petroleum ether/EtOAc]; white solid; mp = 152–153 °C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.58 (d, 2H, J = 8.3 Hz), 7.32-7.29 (m, 3H), 7.25-7.22 (m, 4H), 3.39 (br, 1H), 2.89 (br, 1H), 2.46-2.38 (m, 4H), 2.12-2.01 (m, 1H), 1.94-1.82 (m, 2H), 1.70-1.59 (m, 5H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.9, 144.0, 142.9, 138.4, 136.8, 129.7, 129.5, 129.4, 129.0, 128.4, 128.1, 55.5, 40.1, 39.3, 24.1, 21.8, 17.7, 12.2; IR (neat) (cm^{-1}) 2966m, 2861w, 1685s, 1492m, 1226w, 1089s, 542m; HRMS (ESI): m/z calcd for $C_{22}H_{24}NO_3S$ $[M + H]^+$ 382.1471, found 382.1471.

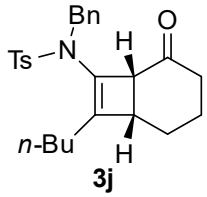


3i

To an oven-dried tube was added ynamide **2i**[8] (117.9 mg, 0.36 mmol), cyclohexenone **1a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3i** (110.2 mg, 0.26 mmol) in 87% yield.

3i: R_f = 0.28 [5:1 petroleum ether/EtOAc]; white solid; mp = 55–56 °C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.74 (d, 2H, J = 8.2 Hz), 7.34-7.25 (m, 7H), 4.69, 4.51 (ABq, 2H, J_{AB} = 14.9 Hz), 3.18 (br, 1H), 2.82 (br, 1H), 2.45 (s, 3H), 2.30-2.22 (m, 1H), 1.95-1.78 (m, 4H), 1.46-1.25 (m, 5H), 0.80 (t, 3H, J = 7.4 Hz); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.7, 148.4, 144.0, 136.8, 136.4, 129.8, 128.6, 128.1, 127.8, 127.7, 126.3, 53.6, 51.5, 40.6, 37.0, 29.1, 24.3, 21.8, 19.8, 17.3, 14.4; IR (neat) (cm^{-1}) 2925m, 2867w, 1595w, 1351m, 1070w, 856m, 556s; HRMS (ESI): m/z calcd for $C_{25}H_{30}NO_3S$ $[M + H]^+$

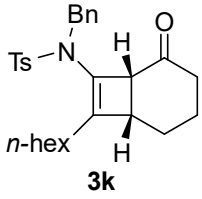
424.1941, found 424.1941.



3j

To an oven-dried tube was added ynamide **1j**[8] (122.9 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3j** (121.6 mg, 0.28 mmol) in 93% yield.

3j: R_f = 0.27 [5:1 petroleum ether/EtOAc]; white solid; mp = 57–58 °C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.73 (d, 2H, J = 8.3 Hz), 7.36-7.26 (m, 7H), 4.70, 4.49 (ABq, 2H, J_{AB} = 14.8 Hz), 3.19 (br, 1H), 2.81 (br, 1H), 2.45 (s, 3H), 2.31-2.24 (m, 1H), 1.93-1.78 (m, 4H), 1.47-1.16 (m, 7H), 0.85 (t, 3H, J = 7.0 Hz); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.6, 148.6, 144.0, 136.7, 136.4, 129.8, 128.6, 128.1, 127.8, 127.7, 126.1, 53.6, 51.5, 40.6, 37.0, 28.5, 26.8, 24.3, 22.9, 21.8, 17.3, 14.1; IR (neat) (cm^{-1}) 2925m, 2869w, 1598w, 1348m, 1090w, 832m, 557s; HRMS (ESI): m/z calcd for $C_{26}H_{32}NO_3S$ [M + H]$^+$ 438.2097, found 438.2090.

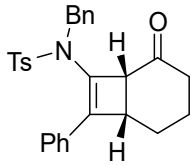


3k

To an oven-dried tube was added ynamide **1k**[1] (133.0 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3k** (118 mg, 0.25 mmol) in 85% yield.

3k: R_f = 0.29 [5:1 petroleum ether/EtOAc]; white solid; mp = 62–63 °C; ^{1}H NMR

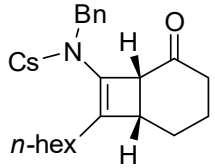
(400 MHz, $CDCl_3$), δ 7.73 (d, 2H, J = 8.3 Hz), 7.33-7.23 (m, 7H), 4.70, 4.49 (ABq, 2H, J_{AB} = 14.9 Hz), 3.19 (br, 1H), 2.81 (br, 1H), 2.45 (s, 3H), 2.29-2.23 (m, 1H), 1.93-1.77 (m, 4H), 1.46-1.33 (m, 4H), 1.31-1.13 (m, 7H), 0.89 (t, 3H, J = 7.0 Hz); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 210.7, 148.6, 144.0, 136.8, 136.4, 129.8, 128.6, 128.1, 127.8, 127.7, 126.1, 53.6, 51.5, 40.6, 37.0, 31.8, 29.6, 27.1, 26.4, 24.3, 22.8, 21.8, 17.3, 14.3; IR (neat) (cm^{-1}) 2925s, 2853m, 1594w, 1347s, 1070w, 863m, 557s; HRMS (ESI): m/z calcd for $C_{28}H_{36}NO_3S$ $[M + H]^+$ 466.2410, found 466.2410.



3l

To an oven-dried tube was added ynamide **1l**[1] (130.1 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3l** (123.9 mg, 0.27 mmol) in 90% yield.

3l: R_f = 0.20 [5:1 petroleum ether/EtOAc]; white solid; mp = 151–152 ^oC; ^1H NMR (400 MHz, $CDCl_3$) δ 7.84 (d, 2H, J = 8.3 Hz), 7.37-7.34 (m, 7H), 7.18-7.17 (m, 3H), 7.02-7.00 (m, 2H), 4.55, 4.42 (ABq, 2H, J_{AB} = 14.4 Hz), 3.29 (s, 2H), 2.46 (s, 3H), 2.18-1.93 (m, 3H), 1.61-1.48 (m, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 210.8, 144.7, 144.3, 136.3, 135.5, 132.1, 130.0, 128.9, 128.6, 128.52, 128.48, 128.1, 128.0, 127.4, 126.8, 55.5, 51.2, 40.6, 37.4, 24.9, 21.8, 17.5; IR (neat) (cm^{-1}) 2924m, 2869w, 1693s, 1368s, 1143m, 662s, 654s; HRMS (ESI): m/z calcd for $C_{28}H_{28}NO_3S$ $[M + H]^+$ 458.1784, found 458.1784.

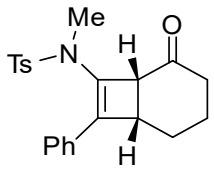


3m

To an oven-dried tube was added ynamide **1m**[9] (140.1 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*),

and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3m** (121.3 mg, 0.25mmol) in 83% yield.

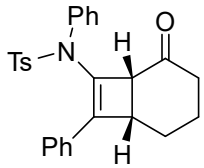
3m: R_f = 0.25 [6:1 petroleum ether/EtOAc]; yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.79 (d, 2H, J = 8.6 Hz), 7.50 (d, 2H, J = 8.6 Hz), 7.30-7.25 (m, 5H), 4.69, 4.50 (ABq, 2H, J_{AB} = 14.7 Hz), 3.20 (br, 1H), 2.82 (br, 1H), 2.26-2.19 (m, 1H), 1.94-1.77 (m, 3H), 1.50-1.42 (m, 2H), 1.34-1.26 (m, 4H), 1.25-1.12 (m, 6H), 0.89 (t, 3H, J = 7.0 Hz); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.3, 149.3, 139.7, 138.2, 136.0, 129.5, 129.1, 128.7, 128.1, 127.9, 125.7, 53.3, 51.7, 40.8, 37.0, 31.8, 29.5, 27.1, 26.3, 24.3, 22.7, 17.4, 14.3; IR (neat) (cm^{-1}) 2924s, 2185m, 1690s, 1476w, 1330m, 847m, 623s; HRMS (ESI): m/z calcd for $C_{27}H_{33}ClNO_3S$ $[M + H]^+$ 486.1864, found 486.1864.



3n

To an oven-dried tube was added ynamide **1n**[1] (102.7 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3n** (104.6 mg, 0.27 mmol) in 91% yield.

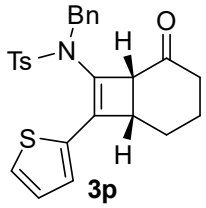
3n: R_f = 0.23 [5:1 petroleum ether/EtOAc]; white solid; mp = 91–92 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.77 (d, 2H, J = 8.3 Hz), 7.43-7.40 (m, 2H), 7.37-7.30 (m, 5H), 3.54 (d, 1H, J = 4.3 Hz), 3.48 (br, 1H), 2.97 (s, 3H), 2.71-2.64 (m, 1H), 2.43 (s, 3H), 2.25-2.16 (m, 2H), 2.07-1.95 (m, 1H), 1.77-1.67 (m, 2H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.9, 144.1, 141.8, 135.5, 131.7, 129.9, 128.8, 128.6, 127.9, 127.3, 55.0, 40.2, 37.4, 35.7, 24.8, 21.7, 17.8, one carbon missing due to overlap, overlapped signal at 128.8 ppm; IR (neat) (cm^{-1}) 2937m, 2875w, 1692s, 1494m, 1229w, 1157m, 676s; HRMS (ESI): m/z calcd for $C_{22}H_{24}NO_3S$ $[M + H]^+$ 382.1471, found 382.1470.



3o

To an oven-dried tube was added ynamide **1o**[10] (125.08 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3o** (109.3 mg, 0.25 mmol) in 82% yield.

3o: R_f = 0.39 [5:1 petroleum ether/EtOAc]; white solid; mp = 140–141 °C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.62-7.58 (m, 2H), 7.55 (d, 2H, J = 8.3 Hz), 7.37-7.27 (m, 5H), 7.24-7.19 (m, 5H), 3.64 (d, 1H, J = 4.1 Hz), 3.49-3.44 (m, 1H), 2.72-2.66 (m, 1H), 2.39 (s, 3H), 2.25-2.07 (m, 3H), 1.80-1.71 (m, 2H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 211.2, 145.0, 144.2, 138.5, 136.1, 131.2, 129.5, 129.4, 129.1, 128.7, 128.5, 128.2, 127.7, 127.3, 56.1, 40.5, 37.2, 24.9, 21.8, 17.8, one carbon missing due to overlap, overlapped signal at 128.7 ppm; IR (neat) (cm^{-1}) 2924m, 2858w, 1688s, 1447m, 1236w, 1054m, 583s; HRMS (ESI): m/z calcd for $C_{27}H_{26}NO_3S$ $[M + H]^+$ 444.1628, found 444.1628.

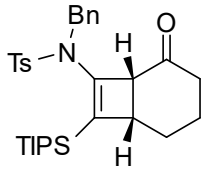


3p

To an oven-dried tube was added ynamide **1p**[11] (132.5 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3p** (59.5 mg, 0.13 mmol) in 43% yield.

3p: R_f = 0.22 [5:1 petroleum ether/EtOAc]; white solid; mp = 153–154 °C; ^{1}H NMR

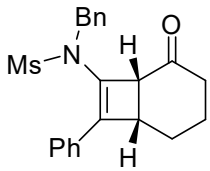
(400 MHz, $CDCl_3$), δ 7.84 (d, 2H, J = 8.3 Hz), 7.36-7.34 (m, 3H), 7.21-7.18 (m, 3H), 7.13-7.11 (m, 2H), 7.03-7.01 (m, 2H), 4.57, 4.52 (ABq, 2H, J_{AB} = 14.4 Hz), 3.41 (d, 1H, J = 4.2 Hz), 3.27-3.24 (m, 1H), 2.46 (s, 3H), 2.17-2.13 (m, 1H), 2.01-1.85 (m, 2H), 1.65-1.56 (m, 1H), 1.47-1.36 (m, 2H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 209.9, 144.3, 138.2, 136.3, 135.5, 134.2, 130.1, 128.6, 128.5, 128.04, 128.02, 127.5, 127.3, 127.2, 124.4, 55.4, 50.9, 40.7, 38.3, 24.9, 21.8, 17.2; IR (neat) (cm^{-1}) 2922m, 2850w, 1690s, 1453m, 1353s, 930m, 557s; HRMS (ESI): m/z calcd for $C_{26}H_{26}NO_3S_2$ $[M + H]^+$ 464.1349, found 464.1349.



3q

To an oven-dried tube was added ynamide **1q**[1] (159.0 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3q** (82.1 mg, 0.15 mmol) in 51% yield.

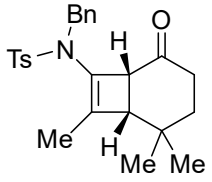
3q: R_f = 0.21 [5:1 petroleum ether/EtOAc]; white solid; mp = 139–140 °C; ^1H NMR (400 MHz, $CDCl_3$), δ 7.73 (d, 2H, J = 8.3 Hz), 7.32-7.21 (m, 4H), 7.25-7.23 (m, 3H), 4.78, 4.59 (ABq, 2H, J_{AB} = 14.6 Hz), 3.67 (d, 1H, J = 4.3 Hz), 2.97-2.94 (m, 1H), 2.45 (s, 3H), 2.02-1.82 (m, 4H), 1.71-1.60 (m, 2H), 1.33-1.25 (m, 3H), 1.07 (d, 9H, J = 7.5 Hz), 1.00 (d, 9H, J = 7.5 Hz); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 210.5, 150.9, 144.8, 144.0, 137.0, 136.0, 129.7, 129.3, 128.5, 128.1, 128.0, 56.3, 52.4, 41.1, 39.1, 27.4, 21.8, 19.5, 19.4, 18.1, 12.2; IR (neat) (cm^{-1}) 3032w, 2926m, 1697s, 1495m, 1347s, 1029w, 552m; HRMS (ESI): m/z calcd for $C_{31}H_{44}NO_3SSi$ $[M + H]^+$ 538.2806, found 538.2806.



3r

To an oven-dried tube was added ynamide **1r**[12] (102.6 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3r** (67.4 mg, 0.22 mmol) in 74% yield.

3r: R_f = 0.16 [5:1 petroleum ether/EtOAc]; yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.47-7.45 (m, 2H), 7.39-7.31 (m, 4H), 7.24-7.20 (m, 4H), 4.66, 4.61 (ABq, 2H, J_{AB} = 14.6 Hz), 3.52 (d, 1H, J = 4.2 Hz), 3.38 (br, 1H), 3.02 (s, 3H), 2.54-2.49 (m, 1H), 2.20-2.11 (m, 2H), 1.81-1.60 (m, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 211.6, 144.2, 135.5, 131.7, 129.1, 128.8, 128.7, 128.3, 127.3, 127.0, 54.9, 52.3, 41.8, 41.1, 37.1, 25.0, 17.5, one carbon missing due to overlap, overlapped signal at 128.8 ppm; IR (neat) (cm^{-1}) 3430w, 2928m, 1696s, 1350s, 1120w, 1085w, 696m; HRMS (ESI): m/z calcd for $C_{22}H_{24}NO_3S$ $[M + H]^+$ 382.1471, found 382.1471.

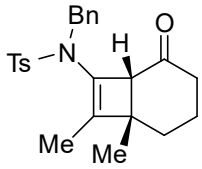


3s

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), 4,4-dimethyl-cyclohexenone **2b** (38.4 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3s** (104.4 mg, 0.25 mmol) in 82% yield.

3s: R_f = 0.31 [5:1 petroleum ether/EtOAc]; white solid; mp = 114–115 ^{o}C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.73 (d, 2H, J = 8.3 Hz), 7.34-7.27 (m, 7H), 4.63, 4.51 (ABq, 2H, J_{AB} = 15.0 Hz), 3.17 (br, 1H), 2.45 (s, 3H), 2.34 (br, 1H), 2.02-1.92 (m, 1H), 1.79-1.78 (m, 3H), 1.56-1.48 (m, 2H), 1.19-1.13 (m, 1H), 1.00 (s, 3H), 0.77 (s, 3H); ^{13}C{^{1}H} NMR (100 $CDCl_3$) δ 211.7, 145.4, 144.1, 136.8, 136.4, 129.9, 128.7, 128.3, 127.9, 127.8, 127.6, 54.1, 51.5, 51.1, 35.8, 32.6, 30.9, 28.1, 25.2, 21.8, 15.5; IR (neat)

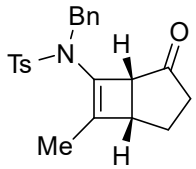
(cm^{-1}) 3450w, 2954m, 1693s, 1496m, 1165s, 1044w, 544m; HRMS (ESI): m/z calcd for $C_{25}H_{30}NO_3S$ $[M + H]^+$ 424.1941, found 424.1941.



3t

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), 3-methyl-cyclohexenone **2c** (33.0 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3t** (51.0 mg, 0.12 mmol) in 42% yield.

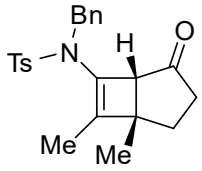
3t: R_f = 0.38 [5:1 petroleum ether/EtOAc]; white solid; mp = 112–113 °C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.74 (d, 2H, J = 8.3 Hz), 7.34-7.27 (m, 7H), 4.66, 4.51 (ABq, 2H, J_{AB} = 14.8 Hz), 2.74 (q, 1H, J = 2.2 Hz), 2.45 (s, 3H), 1.78-1.65 (m, 3H), 1.55 (d, 3H, J = 2.3 Hz), 1.46-1.42 (m, 1H), 1.30-1.23 (m, 2H), 0.94 (s, 3H); $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 211.8, 148.1, 144.2, 136.8, 136.5, 130.0, 128.7, 128.2, 128.0, 127.8, 126.0, 62.1, 51.6, 43.3, 39.9, 31.1, 23.8, 22.0, 18.5, 10.2; IR (neat) (cm^{-1}) 3442w, 2923s, 1696m, 1352s, 1164m, 1018w, 545m; HRMS (ESI): m/z calcd for $C_{24}H_{28}NO_3S$ $[M + H]^+$ 410.1784, found 410.1783.



3u

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), cyclopentenone **2d** (24.6 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3u** (110.4 mg, 0.29 mmol) in 96% yield.

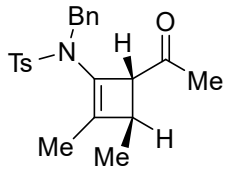
3u: R_f = 0.17 [5:1 petroleum ether/EtOAc]; white solid; mp = 100–101 °C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.72 (d, 2H, J = 8.3 Hz), 7.35-7.24 (m, 7H), 4.51, 4.44 (ABq, 2H, J_{AB} = 15.0 Hz), 2.94 (br, 1H), 2.90 (br, 1H), 2.45 (s, 3H), 1.94-1.78 (m, 2H), 1.74-1.73 (m, 3H), 1.70-1.64 (m, 2H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 216.0, 144.3, 144.2, 136.5, 136.2, 130.0, 129.2, 128.6, 127.9, 127.8, 127.5, 54.3, 51.3, 40.2, 34.1, 21.8, 19.9, 13.1. Spectral data are in agreement with literature values[15].



3v

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), 3-methyl-2-cyclopentenone **2e** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3v** (52.5 mg, 0.13 mmol) in 44% yield.

3v: R_f = 0.43 [5:1 petroleum ether/EtOAc]; yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.73 (d, 2H, J = 8.3 Hz), 7.35-7.24 (m, 7H), 4.48 (s, 2H), 2.53 (br, 1H), 2.46 (s, 3H), 1.94-1.78 (m, 2H), 1.63 (d, 3H, J = 1.9 Hz), 1.44-1.35 (m, 2H), 1.14 (s, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 216.3, 147.7, 144.1, 136.4, 136.1, 129.9, 128.6, 128.4, 128.0, 127.8, 127.6, 61.1, 51.4, 46.2, 36.0, 26.9, 21.8, 21.3, 10.4; IR (neat) (cm^{-1}) 3031w, 2924s, 1729s, 1351m, 1121w, 1027m, 658m; HRMS (ESI): m/z calcd for $C_{23}H_{26}NO_3S$ $[M + H]^+$ 396.1628, found 396.1628.

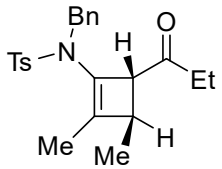


3w

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), (*E*)-3-penten-2-one **2f** (26.6 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the

reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3w** (83.2 mg, 0.22 mmol) in 72% yield.

3w: R_f = 0.52 [5:1 petroleum ether/EtOAc]; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.72 (d, 2H, J = 8.3 Hz), 7.33-7.27 (m, 7H), 4.66, 4.42 (ABq, 2H, J_{AB} = 15.0 Hz), 3.25 (br, 1H), 2.44 (s, 3H), 2.38-2.32 (m, 1H), 1.95 (s, 3H), 1.33-1.32 (m, 3H), 1.02 (d, 3H, J = 6.8 Hz); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 208.1, 143.9, 140.4, 136.5, 129.8, 128.8, 128.6, 128.1, 127.9, 127.4, 63.0, 52.1, 38.1, 28.6, 21.8, 16.9, 12.1, one carbon missing due to overlap; overlapped signal at 127.9 ppm; IR (neat) (cm^{-1}) 3450w, 2960m, 1694s, 1455m, 1166s, 1025w, 609m; HRMS (ESI): m/z calcd for $C_{22}H_{26}NO_3S$ $[M + H]^+$ 384.1628, found 384.1628.



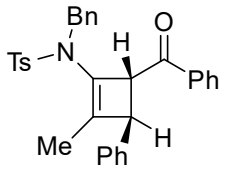
3x

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), (*E*)-4-hexen-3-one **2g** (29.4 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3x** (98.8 mg, 0.25 mmol) in 83% yield.

3x: R_f = 0.54 [5:1 petroleum ether/EtOAc]; white solid; mp = 69–70 ^{o}C; 7.72 (d, 2H, J = 8.3 Hz), 7.32-7.28 (m, 7H), 4.63, 4.44 (ABq, 2H, J_{AB} = 14.9 Hz), 3.31-3.29 (m, 1H), 2.44 (s, 3H), 2.37-2.32 (m, 1H), 2.32-2.26 (m, 2H), 1.26-1.25 (m, 3H), 1.02 (d, 3H, J = 6.9 Hz), 0.92 (t, 3H, J = 7.2 Hz); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.1, 143.8, 140.4, 136.6, 136.5, 129.8, 128.7, 128.6, 128.2, 127.8, 127.4, 61.9, 52.2, 38.2, 35.1, 21.7, 16.9, 12.0, 7.6; IR (neat) (cm^{-1}) 3450w, 2922m, 1708s, 1598m, 1354s, 1117w, 598m; HRMS (ESI): m/z calcd for $C_{23}H_{28}NO_3S$ $[M + H]^+$ 398.1784, found 398.1784.

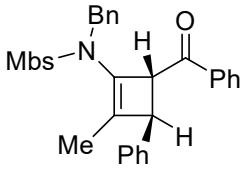
To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), (*E*)-chalcone **2h** (62.5 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at

rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3y** (126.2 mg, 0.25 mmol) in 81% yield.



3y

3y: R_f = 0.38 [5:1 petroleum ether/EtOAc]; white solid; mp = 69–70 °C; ^{1}H NMR (400 MHz, $CDCl_3$), 7.77 (d, 2H, J = 8.4 Hz), 7.67-7.65 (m, 2H), 7.53-7.49 (m, 1H), 7.45-7.43 (m, 2H), 7.37-7.27 (m, 8H), 7.22 (d, 2H, J = 8.1 Hz), 7.06-7.03 (m, 2H), 4.67 (s, 2H), 4.38-4.36 (m, 1H), 3.46 (br, 1H), 2.37 (s, 3H), 1.20-1.19 (m, 3H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 197.7, 143.8, 140.0, 139.7, 137.0, 136.8, 136.4, 133.3, 130.9, 129.8, 128.9, 128.7, 128.6, 128.5, 127.8, 127.7, 127.5, 127.4, 60.1, 52.7, 49.5, 21.7, 12.4, one carbon missing due to overlap, overlapped signal at 128.9 ppm; IR (neat) (cm^{-1}) 3029w, 2921s, 1728m, 1350m, 1120w, 812m, 546s; HRMS (ESI): m/z calcd for $C_{32}H_{30}NO_3S$ $[M + H]^+$ 508.1941, found 508.1942.

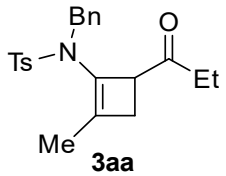


3z

To an oven-dried tube was added ynamide **1b**[2] (113.5 mg, 0.36 mmol), (*E*)-chalcone **2h** (62.5 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3z** (118.7 mg, 0.23 mmol) in 76% yield.

3z: R_f = 0.14 [5:1 petroleum ether/EtOAc]; white solid; mp = 120–121 °C; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.82 (d, 2H, J = 8.9 Hz), 7.68 (d, 2H, J = 6.9 Hz), 7.53-7.49 (m, 1H), 7.45-7.43 (m, 2H), 7.37-7.27 (m, 8H), 7.05-7.03 (m, 2H), 6.89-6.87 (m, 2H), 4.69, 4.65 (ABq, 2H, J_{AB} = 14.9 Hz), 4.39-4.37 (m, 1H), 3.81 (s, 3H), 3.46 (br, 1H),

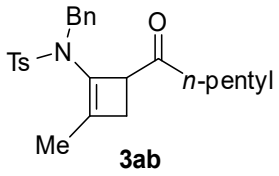
1.22 (t, 3H, J = 1.6 Hz); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 197.8, 163.1, 139.8, 139.4, 136.9, 136.5, 133.2, 131.6, 131.1, 129.8, 128.9, 128.67, 128.64, 128.57, 128.53, 127.8, 127.5, 127.4, 114.3, 60.0, 55.7, 52.5, 49.5, 12.4; IR (neat) (cm^{-1}) 3431s, 2922m, 1701m, 1455s, 1126m, 833m, 555m; HRMS (ESI): m/z calcd for $C_{32}H_{30}NO_4S$ $[M + H]^+$ 524.1890, found 524.1893. Spectral data are in agreement with literature values[2].



3aa

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), 1-penten-3-one **2i** (25.2 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3aa** (79.0 mg, 0.21 mmol) in 69% yield.

3aa: R_f = 0.50 [5:1 petroleum ether/EtOAc]; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.71 (d, 2H, J = 8.2 Hz), 7.32-7.27 (m, 7H), 4.61-4.43 (m, 2H), 3.78-3.75 (m, 1H), 2.44 (s, 3H), 2.33-2.14 (m, 4H), 1.34-1.32 (m, 3H), 0.90 (t, 3H, J = 7.3 Hz); $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 210.3, 143.9, 137.5, 136.63, 136.58, 129.9, 129.9, 128.6, 128.3, 127.9, 127.4, 53.6, 52.3, 34.7, 30.9, 21.8, 14.5, 7.6; IR (neat) (cm^{-1}) 3451m, 2923m, 1708s, 1597w, 1350s, 1164s, 814m; HRMS (ESI): m/z calcd for $C_{22}H_{26}NO_3S$ $[M + H]^+$ 384.1628, found 384.1627.



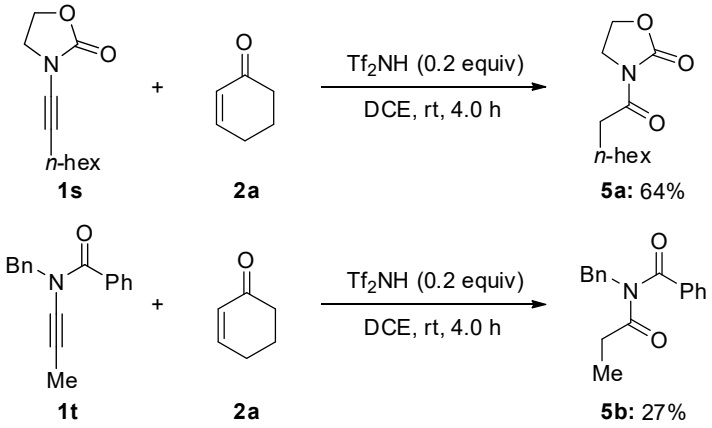
3ab

To an oven-dried tube was added ynamide **1a**[1] (107.8 mg, 0.36 mmol), 1-octen-3-one **2j** (37.9 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 10.0 min. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [isocratic eluent: 10:1 petroleum ether /EtOAc] to afford cyclobutenamide **3ab** (104.4 mg, 0.25 mmol)

in 82% yield.

3ab: R_f = 0.61 [5:1 petroleum ether/EtOAc]; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$), δ 7.71 (d, 2H, J = 8.2 Hz), 7.32-7.28 (m, 7H), 4.60-4.43 (m, 2H), 3.77-3.74 (m, 1H), 2.44 (s, 3H), 2.31-2.09 (m, 4H), 1.44-1.13 (m, 9H), 0.88 (t, 3H, J = 7.3 Hz); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 210.1, 143.8, 137.2, 136.75, 136.66, 129.9, 128.6, 128.3, 127.9, 127.4, 53.6, 52.2, 41.5, 31.5, 30.9, 23.2, 22.7, 21.8, 14.5, 14.2, one carbon missing due to overlap, overlapped signal at 127.9 ppm; IR (neat) (cm^{-1}) 3446s, 2955m, 1706m, 1352s, 1164s, 1048w, 665m; HRMS (ESI): m/z calcd for $C_{25}H_{32}NO_3S$ $[M + H]^+$ 426.2097, found 426.2097.

1.3 [2 + 2] Cycloaddition of *N*-acyl ynamides.

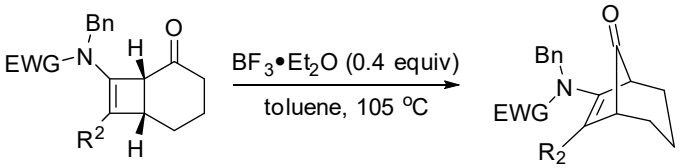


To an oven-dried tube was added ynamide **1s**[1] (70.3 mg, 0.36 mmol), cyclohexenone **2a** (28.8 mg, 0.30 mmol), DCE (1.5 mL, ynamide *concn* = 0.24 *M*), and Tf_2NH (16.9 mg, 0.06 mmol) at rt. Then the reaction vessel was capped and stirred at rt for 4.0 h. After the reaction was judged to be complete by TLC, the reaction mixture was purified by flash silica gel column chromatography [gradient eluent: 10:1~6:1 petroleum ether/EtOAc] to afford amide **5a** (44.8 mg, 0.23 mmol) in 64% yield. **5a**: R_f = 0.30 [6:1 petroleum ether/EtOAc]; white solid; mp = 39–40 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.41 (t, 2H, J = 8.1 Hz), 4.02 (t, 2H, J = 8.0 Hz), 2.92 (t, 2H, J = 7.5 Hz), 1.70-1.64 (m, 2H), 1.36-1.35 (m, 8H), 0.88 (t, 3H, J = 6.5 Hz); Spectral data are in agreement with literature values.[13]

Amide **5b** (40.9 mg, 0.19 mmol) was prepared from ynamide **1t**[15] (89.8 mg, 0.36 mmol), and cyclohexenone **2a** (28.8 mg, 0.30 mmol) in 27% yield after stirring at rt

for 4.0 h. **5b**: R_f = 0.45 [10:1 petroleum ether/EtOAc]; colourless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56-7.51 (m, 3H), 7.44-7.38 (m, 2H), 7.30-7.21 (m, 5H), 5.00 (s, 2H), 2.41 (q, 2H, J = 7.3 Hz), 1.05 (t, 3H, J = 7.3 Hz); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 177.7, 174.4, 137.6, 136.1, 132.5, 128.9, 128.7, 128.5, 127.9, 127.6, 49.6, 32.1, 9.8; IR (neat) (cm^{-1}) 3334w, 2929w, 1656s, 1346m, 1191m, 1022s, 692s; HRMS (ESI): m/z calcd for $C_{17}H_{18}NO_2$ $[M + H]^+$ 268.1332, found 268.1335.

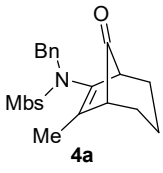
1.4 Chemical Transformations of Cyclobutenamides 3.



3b: EWG = Mbs, R^2 = Me
3k: EWG = Ts, R^2 = *n*-hex
3l: EWG = Ts, R^2 = Ph

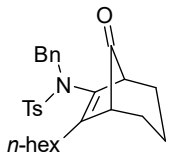
4a: EWG = Mbs, R^2 = Me, 91%
4b: EWG = Ts, R^2 = *n*-hex, 86%
4c: EWG = Ts, R^2 = Ph, 95%

To an oven-dried tube were added cyclobutenamide **3b** (41.2 mg, 0.10 mmol), toluene (1.5 mL, cyclobutenamide concn = 0.067 *M*) and BF_3•Et_2O (4.9 μL, 0.04 mmol) at rt. The reaction vessel was then capped it and directly heated to 105 °C. After stirring at 105 °C for 1.0 h, the reaction mixture was cooled to rt slowly. The crude mixture was purified by flash silica gel column chromatography [gradient eluent: 7:1~5:1 petroleum ether/EtOAc] to afford bicyclic ketone **4a** (37.4 mg, 0.091 mmol) in 91% yield.



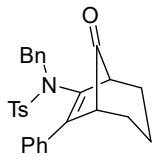
4a

4a: R_f = 0.28 [5:1 petroleum ether/EtOAc]; white solid; mp = 114–115 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, 2H, J = 8.9 Hz), 7.33-7.23 (m, 5H), 7.01 (d, 2H, J = 8.9 Hz), 4.68 (d, 1H, J = 14.4 Hz), 4.26 (d, 1H, J = 14.5 Hz), 3.89 (s, 3H), 2.57 (br, 1H), 2.29 (br, 1H), 1.71-1.68 (m, 1H), 1.68 (s, 3H), 1.58-1.50 (m, 2H), 1.46-1.37 (m, 1H), 1.22-1.08 (m, 2H); ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 213.4, 163.3, 139.9, 136.2, 131.5, 129.5, 128.7, 128.3, 128.1, 114.6, 55.8, 55.3, 52.9, 50.8, 29.2, 27.6, 17.2, 13.6, one carbon missing due to overlap, overlapped signal at 128.7 ppm; Spectral data are in agreement with literature values[14].



4b

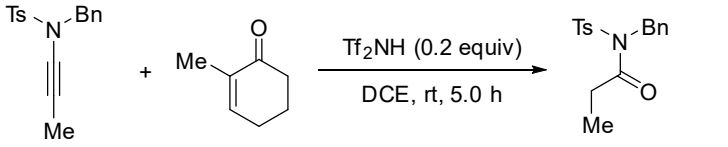
Bicyclic ketone **4b** (39.9 mg, 0.086 mmol) was prepared from cyclobutenamide **3k** (46.5 mg, 0.10 mmol) in 86% yield after stirring at 105 °C for 30.0 min. **4b**: R_f = 0.35 [10:1 petroleum ether/EtOAc]; white solid; mp = 109–110 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, 2H, J = 8.0 Hz), 7.35-7.26 (m, 7H), 4.66 (d, 1H, J = 14.3 Hz), 4.29 (d, 1H, J = 14.3 Hz), 2.68 (br, 1H), 2.46 (s, 3H), 2.29 (br, 1H), 2.23-2.18 (m, 1H), 2.04-1.97 (m, 1H), 1.71-1.52 (m, 6H), 1.46-1.38 (m, 2H), 1.20-1.04 (m, 6H), 0.88 (d, 3H, J = 7.2 Hz); ^{13}C NMR (100 MHz, $CDCl_3$) δ 213.2, 144.6, 144.0, 137.2, 136.1, 130.1, 128.7, 128.6, 128.2, 127.8, 127.5, 53.2, 53.1, 50.8, 31.8, 30.0, 29.2, 28.8, 28.6, 27.2, 22.8, 21.8, 17.5, 14.3; IR (neat) (cm^{-1}) 2929br, 2858w, 1761m, 1495m, 1344s, 1156s; HRMS (ESI): m/z calcd for $C_{28}H_{36}NO_3S$ $[M + H]^+$ 466.2410, found 466.2408.



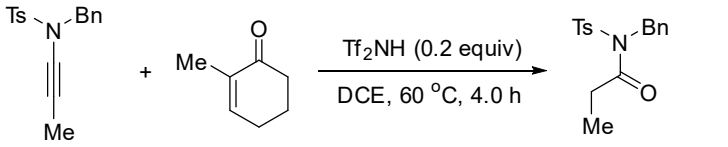
4c

Bicyclic ketone **4c** (43.5 mg, 0.095 mmol) was prepared from cyclobutenamide **3l** (45.8 mg, 0.10 mmol) in 95% yield after stirring at 105 °C for 30.0 min. **4c**: R_f = 0.27 [6:1 petroleum ether/EtOAc]; white solid; mp = 135–136 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, 2H, J = 8.1 Hz), 7.36 (d, 2H, J = 8.1 Hz), 7.28-7.15 (m, 6H), 6.97-6.89 (m, 4H) 4.45 (d, 1H, J = 14.4 Hz), 4.18 (d, 1H, J = 14.4 Hz), 3.06-3.04 (m, 1H), 2.87-2.85 (m, 1H), 2.49 (s, 3H), 2.17-2.12 (m, 1H), 1.89-1.82 (m, 1H), 1.74-1.63 (m, 2H), 1.44-1.39 (m, 1H), 1.29-1.23 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 213.1, 144.3, 136.7, 136.3, 135.7, 133.8, 130.4, 130.2, 128.574, 128.566, 128.55, 128.52, 128.2, 127.7, 127.5, 55.4, 54.6, 52.6, 30.0, 29.1, 21.8, 17.5; IR (neat) (cm^{-1}) 2921m, 2859w, 1764s, 1455m, 1348s, 1269w, 1165s; HRMS (ESI): m/z calcd for $C_{28}H_{28}NO_3S$ $[M + H]^+$ 458.1784, found 458.1793.

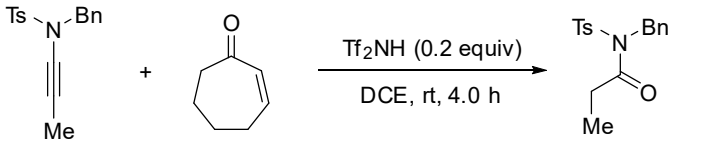
1.5 Failed [2 + 2] Cycloadditions.



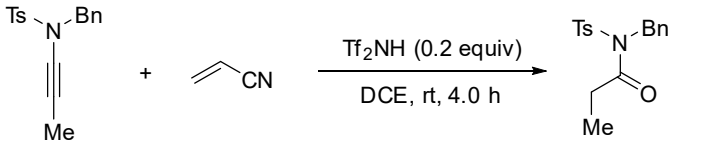
S2: 45%
recovery of **1a:** 38%



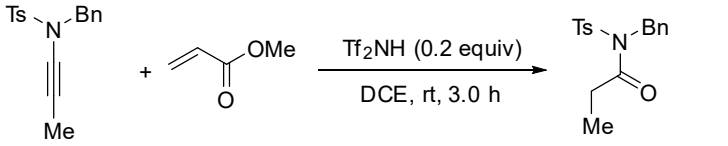
S2: 65%



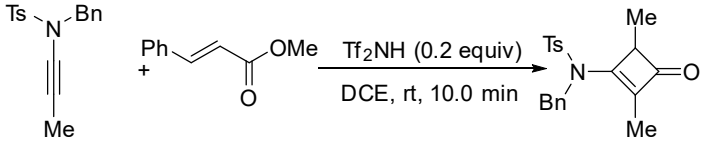
S2: 14%
recovery of **1a:** 34%



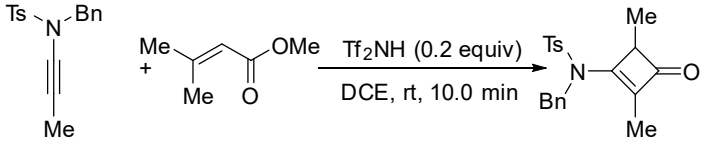
S2: 14%



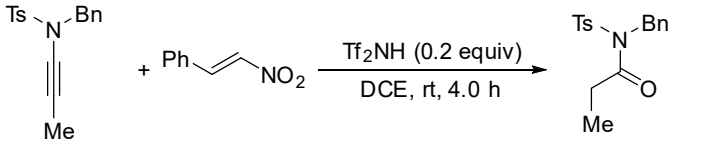
S2: 20%
recovery of **S5:** 99%



S7: 33%
recovery of **S6:** 99%



S7: 29%
recovery of **S8:** 99%



S2: 18%
recovery of **S9:** 87%

References

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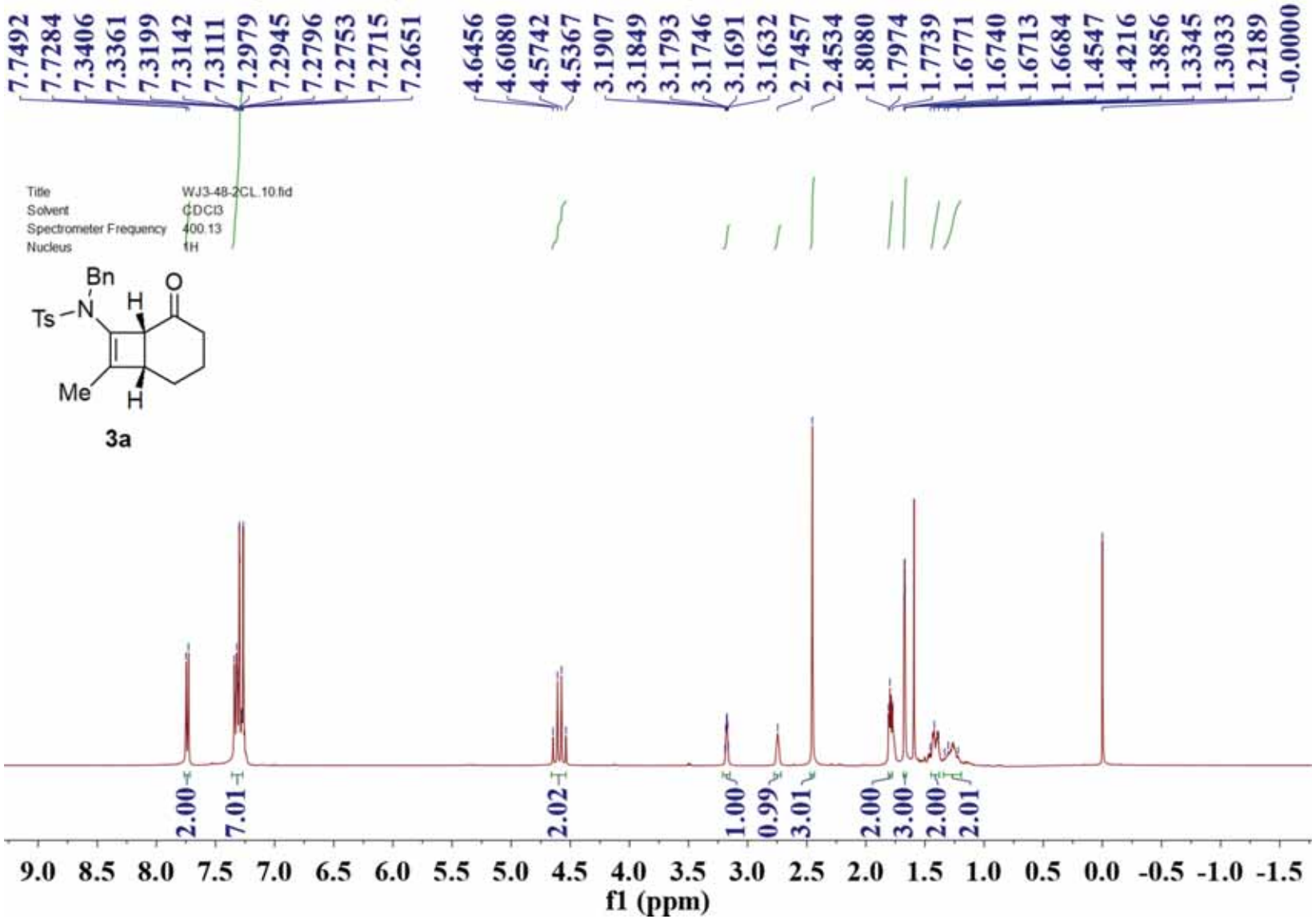
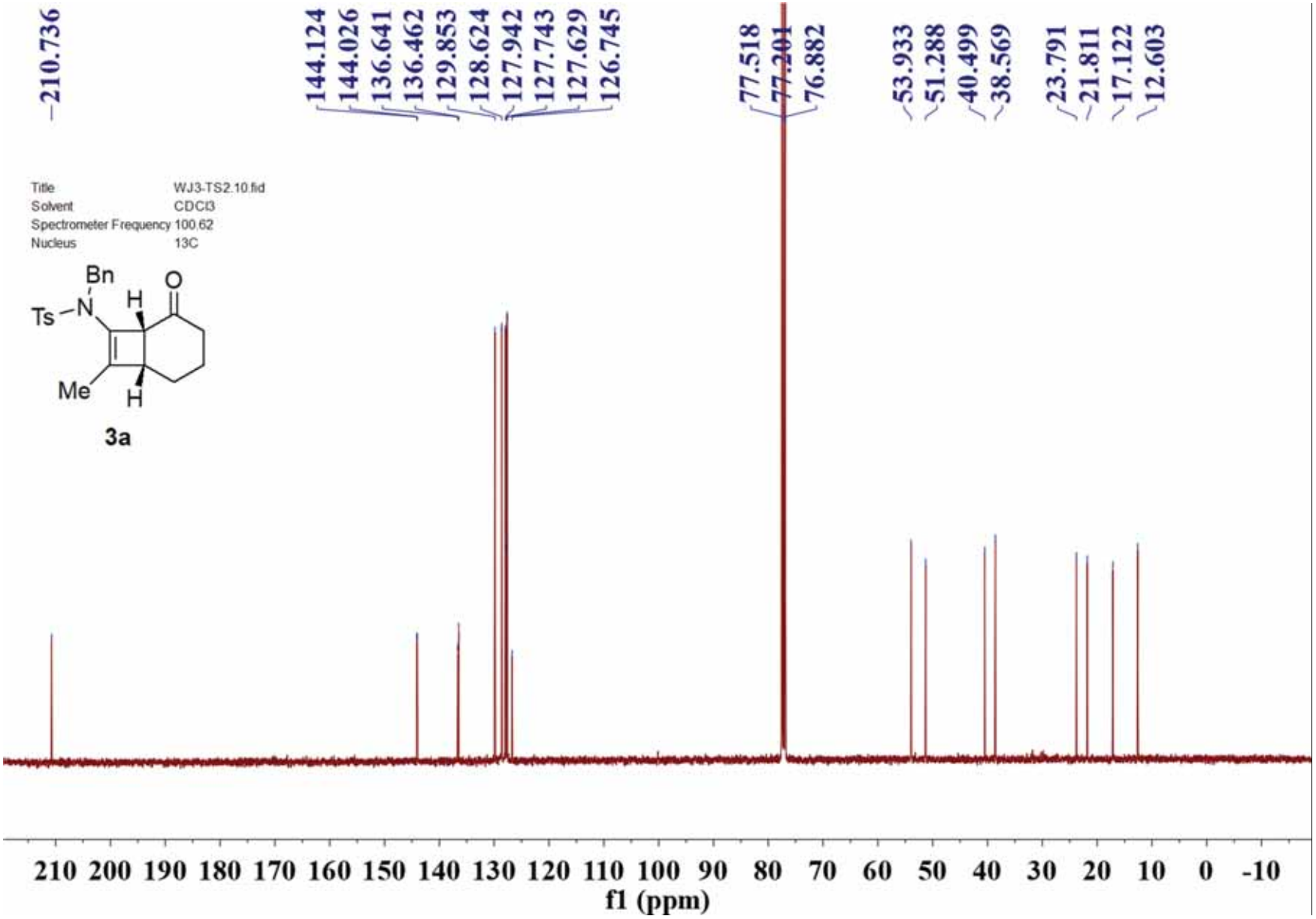
Part II Copies of ^{1}H NMR, $^{13}C\{^{1}H\}$ NMR, and NOESY Spectra.

^{1}H NMR and $^{13}C\{^{1}H\}$ NMR Spectra of Cyclobutenamides 3, Bicyclic Ketones 4, and Amide 5b.

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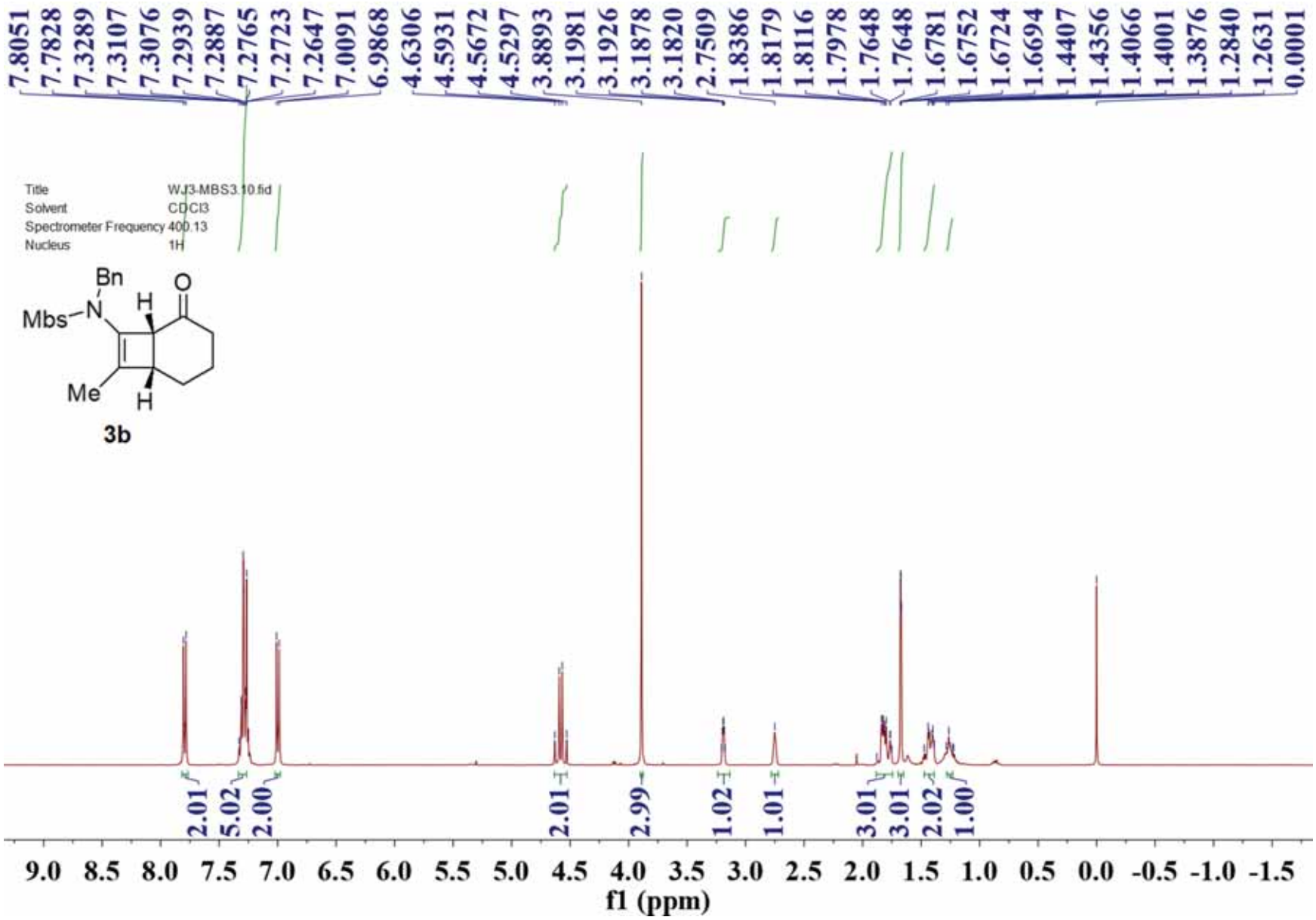
144.124
144.026
136.641
136.462
129.853
128.624
127.942
127.743
127.629
126.745
77.518
77.201
76.882
53.933
51.288
40.499
38.569
23.791
21.811
17.122
12.603
Title WJ3-TS2.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
O
Ts
N
H
Me
H
3a
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.7828
7.3289
7.3107
7.3076
7.2939
7.2887
7.2765
7.2723
7.2647
7.0091
6.9868
4.6306
4.5931
4.5672
4.5297
3.8893
3.1981
3.1926
3.1878
3.1820
2.7509
1.8386
1.8179
1.8116
1.7978
1.7648
1.7648
1.6781
1.6752
1.6724
1.6694
1.4407
1.4356
1.4066
1.4001
1.3876
1.2840
1.2631
0.0001
Title WJ3-MBS3.10.fid
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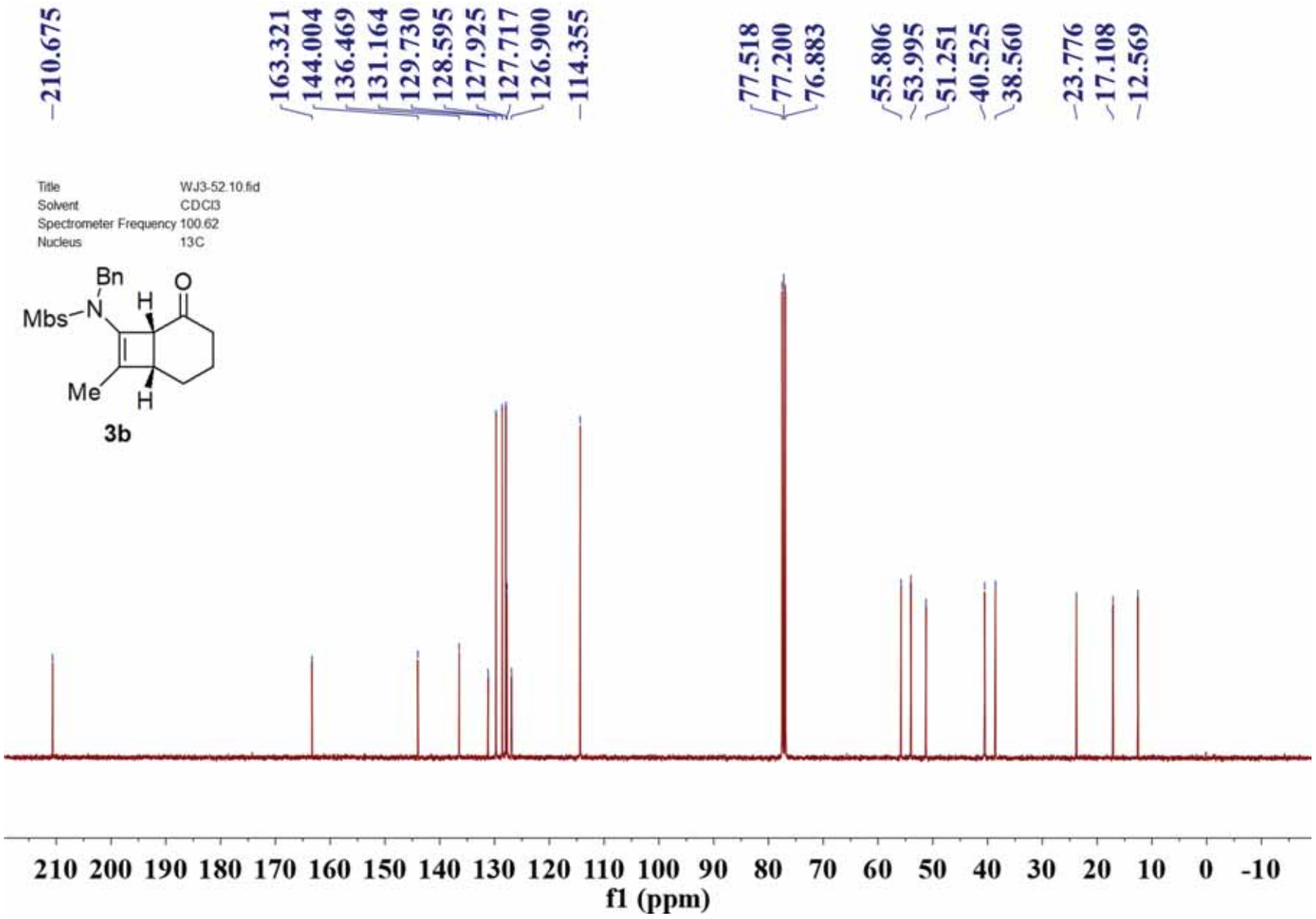
Nucleus 1H
Bn
O
Mbs
N
H
Me
H
3b
2.01
5.02
2.00
2.01
2.99
1.02
1.01
3.01
3.01
2.02
1.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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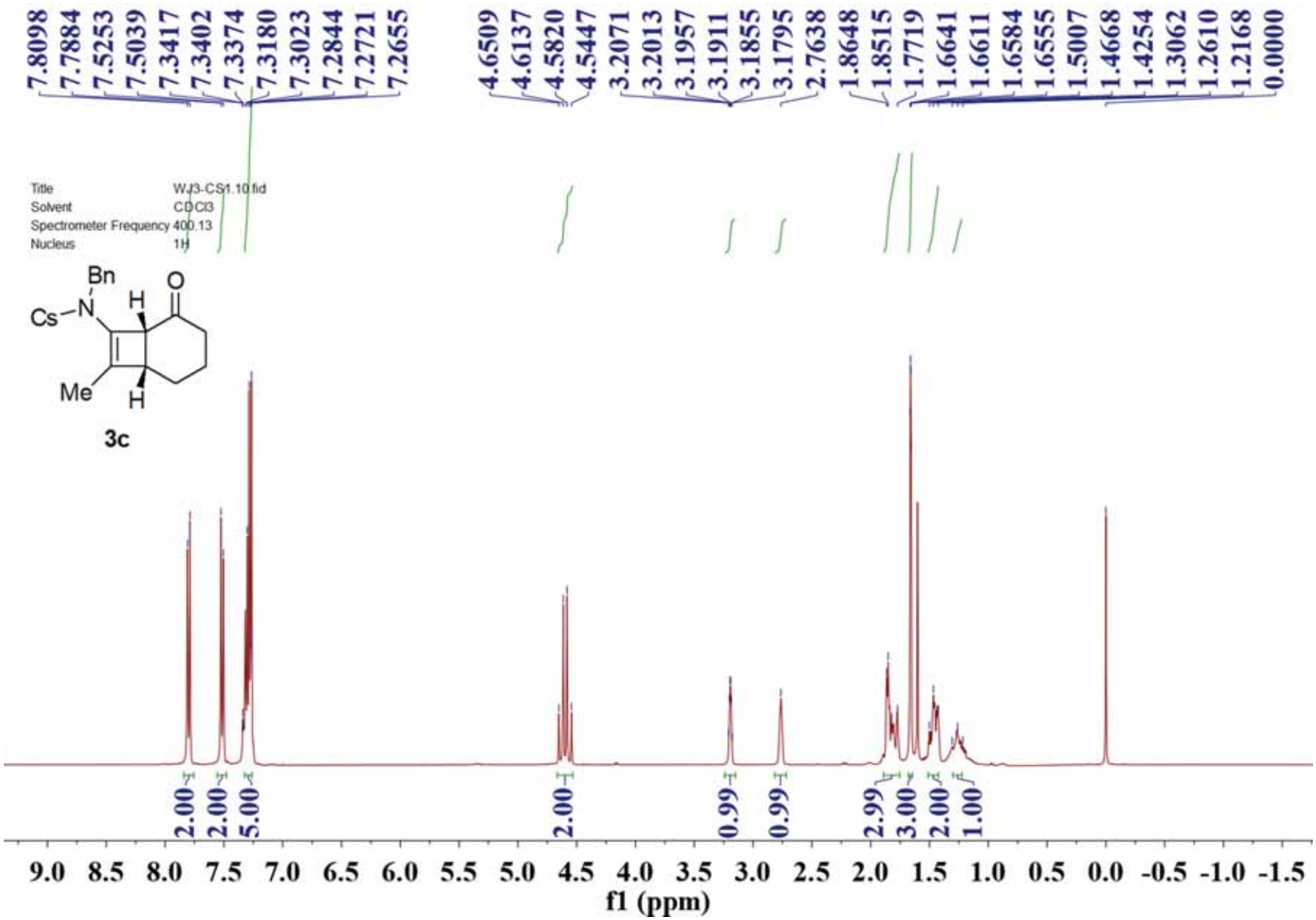
136.469
131.164
129.730
128.595
127.925
127.717
126.900
114.355
77.518
77.200
76.883
55.806
53.995
51.251
40.525
38.560
23.776
17.108
12.569
Title WJ3-52.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
Mbs
N
H
O
Me
H
3b
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.5253
7.5039
7.3417
7.3402
7.3374
7.3180
7.3023
7.2844
7.2721
7.2655
4.6509
4.6137
4.5820
4.5447
3.2071
3.2013
3.1957
3.1911
3.1855
3.1795
2.7638
1.8648
1.8515
1.7719
1.6641
1.6611
1.6584
1.6555
1.5007
1.4668
1.4254
1.3062
1.2610
1.2168
0.0000
Title WJ3-CS1.10.fid
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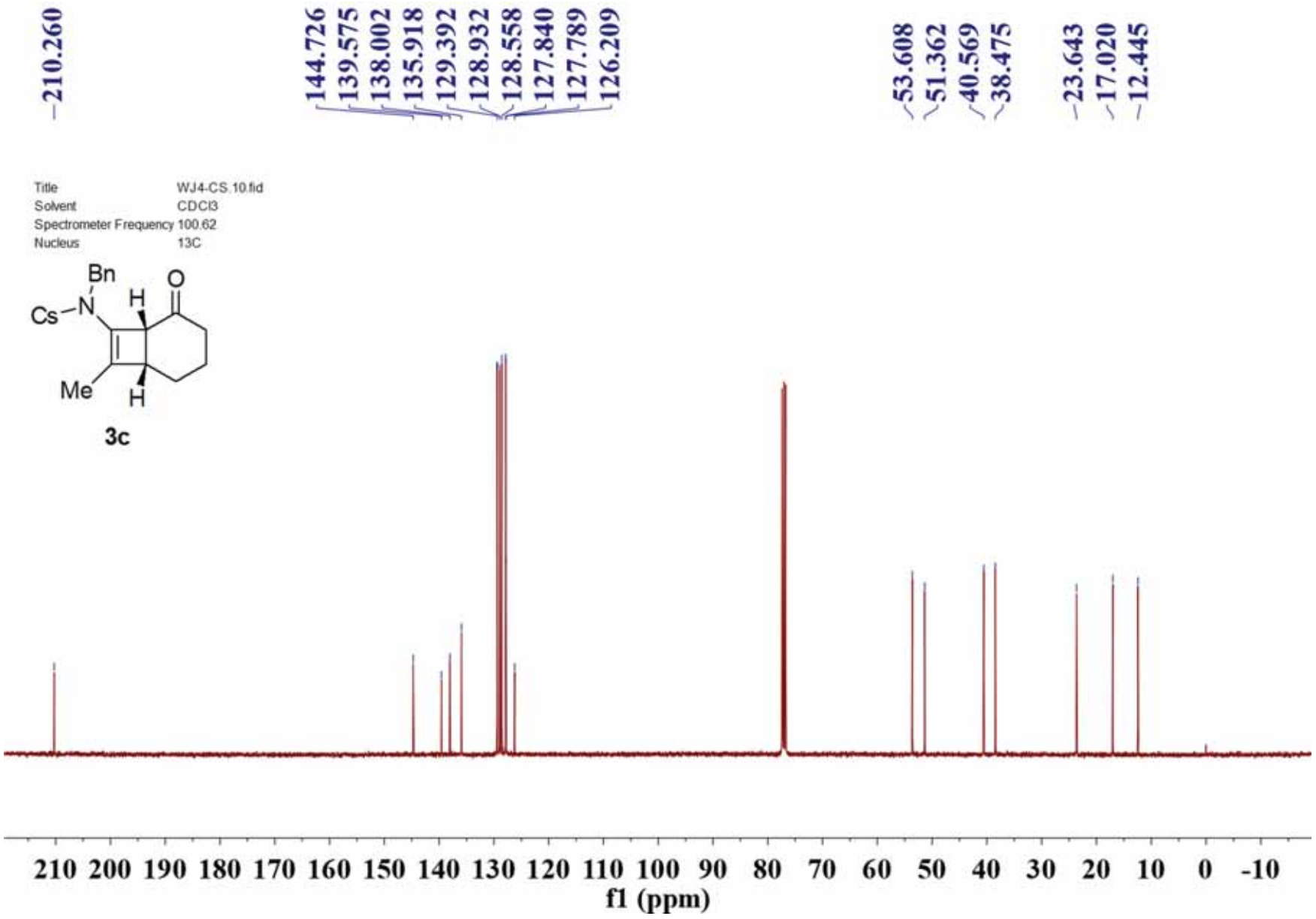
Bn
O
Cs
N
H
Me
H
3c
2.00
2.00
5.00
2.00
0.99
0.99
2.99
3.00
2.00
1.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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38.475
23.643
17.020
12.445
Title WJ4-CS.10.fid
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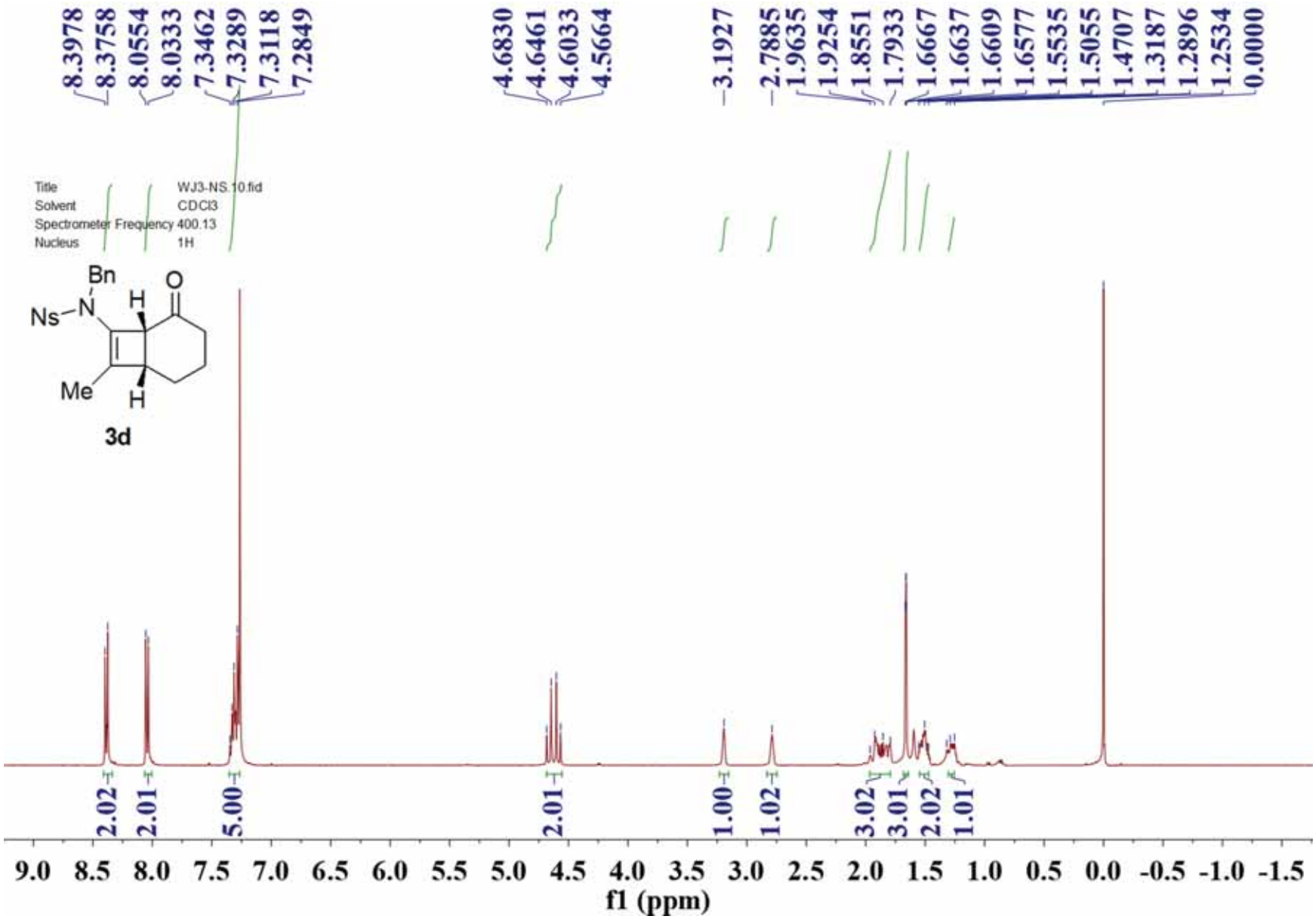
Nucleus 13C
Bn
Cs
N
H
O
Me
H
3c
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.3289
7.3118
7.2849
4.6830
4.6461
4.6033
4.5664
3.1927
2.7885
1.9635
1.9254
1.8551
1.7933
1.6667
1.6637
1.6609
1.6577
1.5535
1.5055
1.4707
1.3187
1.2896
1.2534
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Spectrometer Frequency 400.13
Nucleus 1H
Bn
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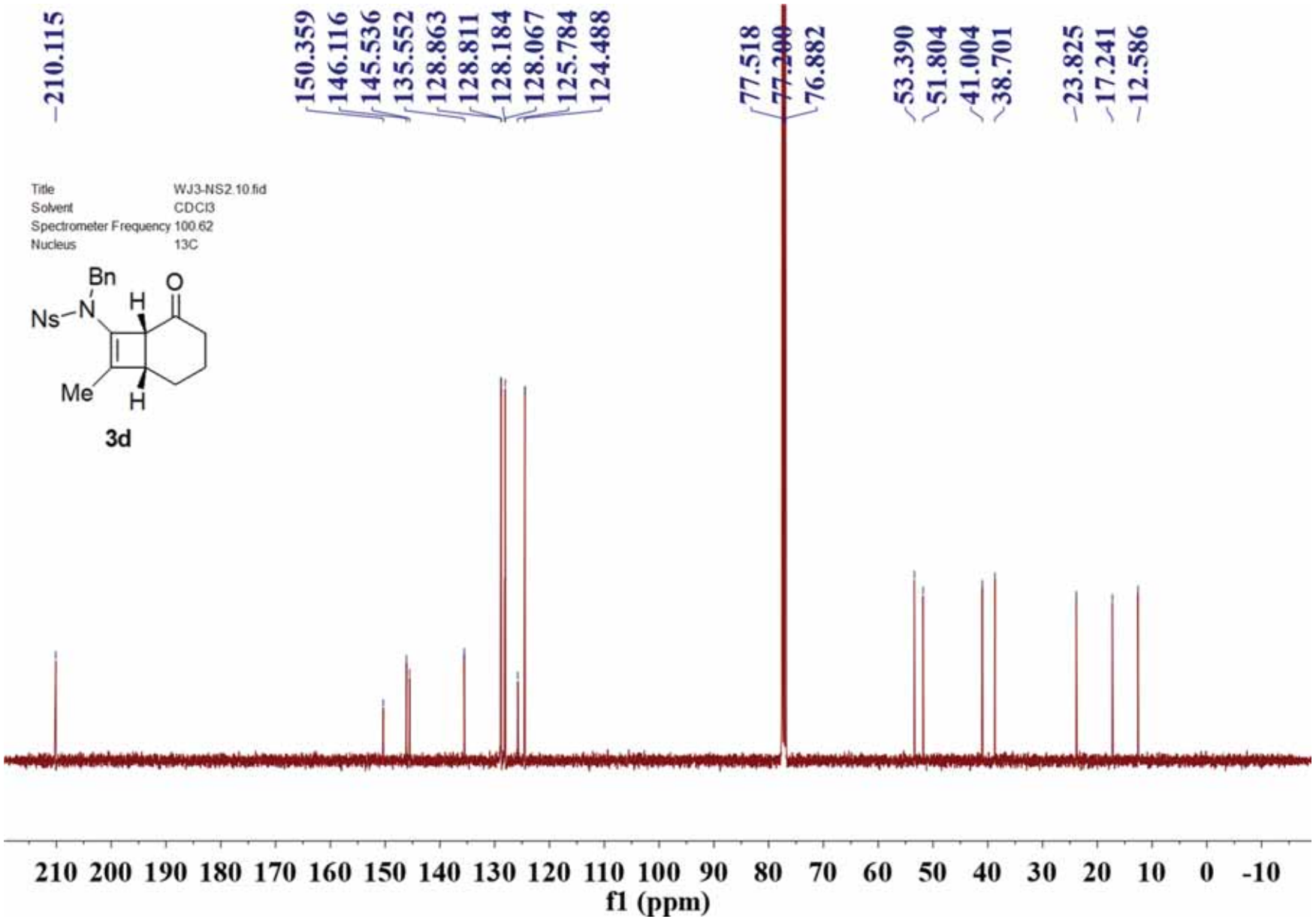
N
H
O
Me
H
3d
2.02
2.01
5.00
2.01
1.00
1.02
3.02
3.01
2.02
1.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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53.390
51.804
41.004
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Nucleus 13C
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N
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H
O
Me
H
3d
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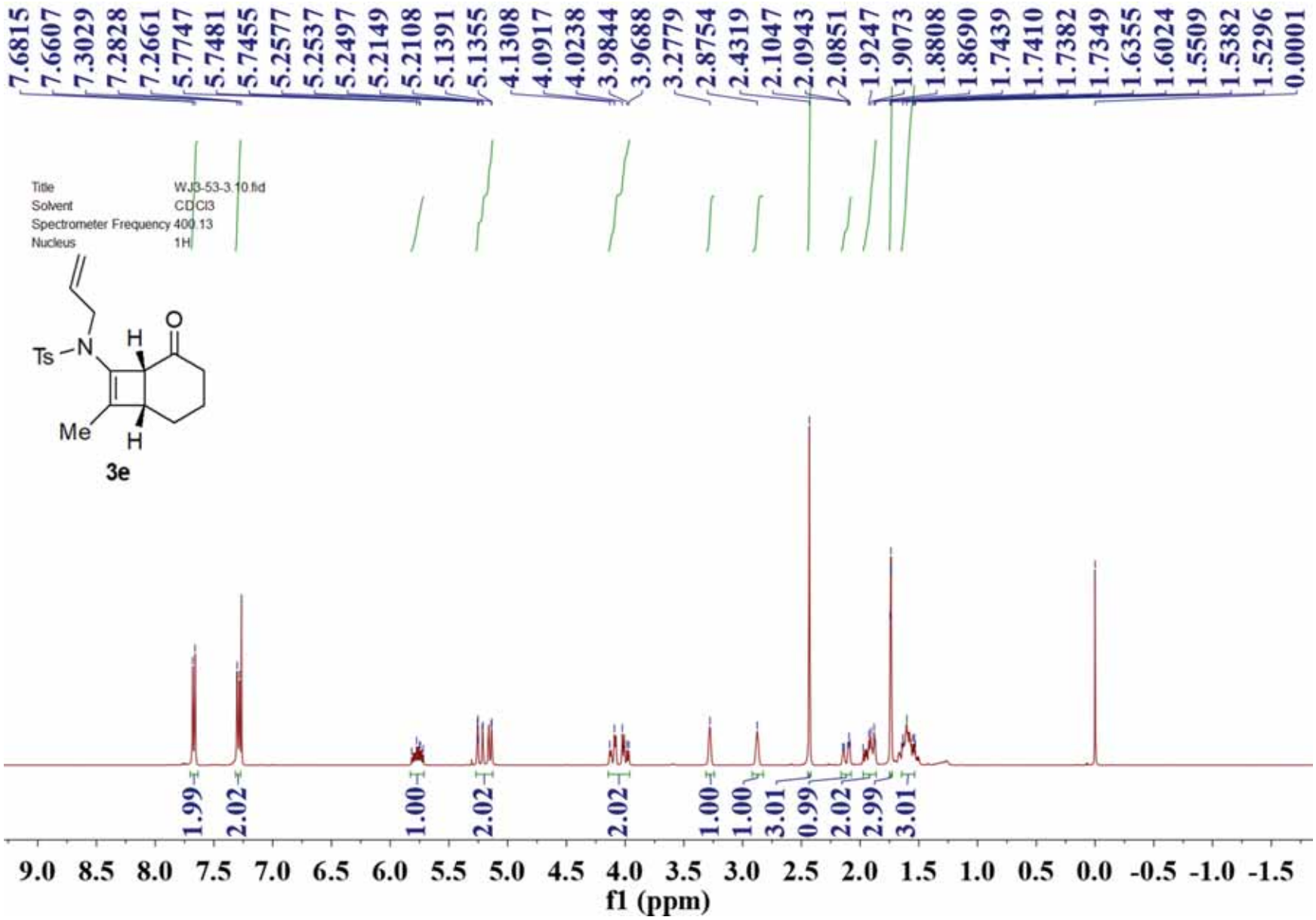
f1 (ppm)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4.0917
4.0238
3.9844
3.9688
3.2779
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2.1047
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2.0851
1.9247
1.9073
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1.8690
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1.7349
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1.6024
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H
O
Me
H
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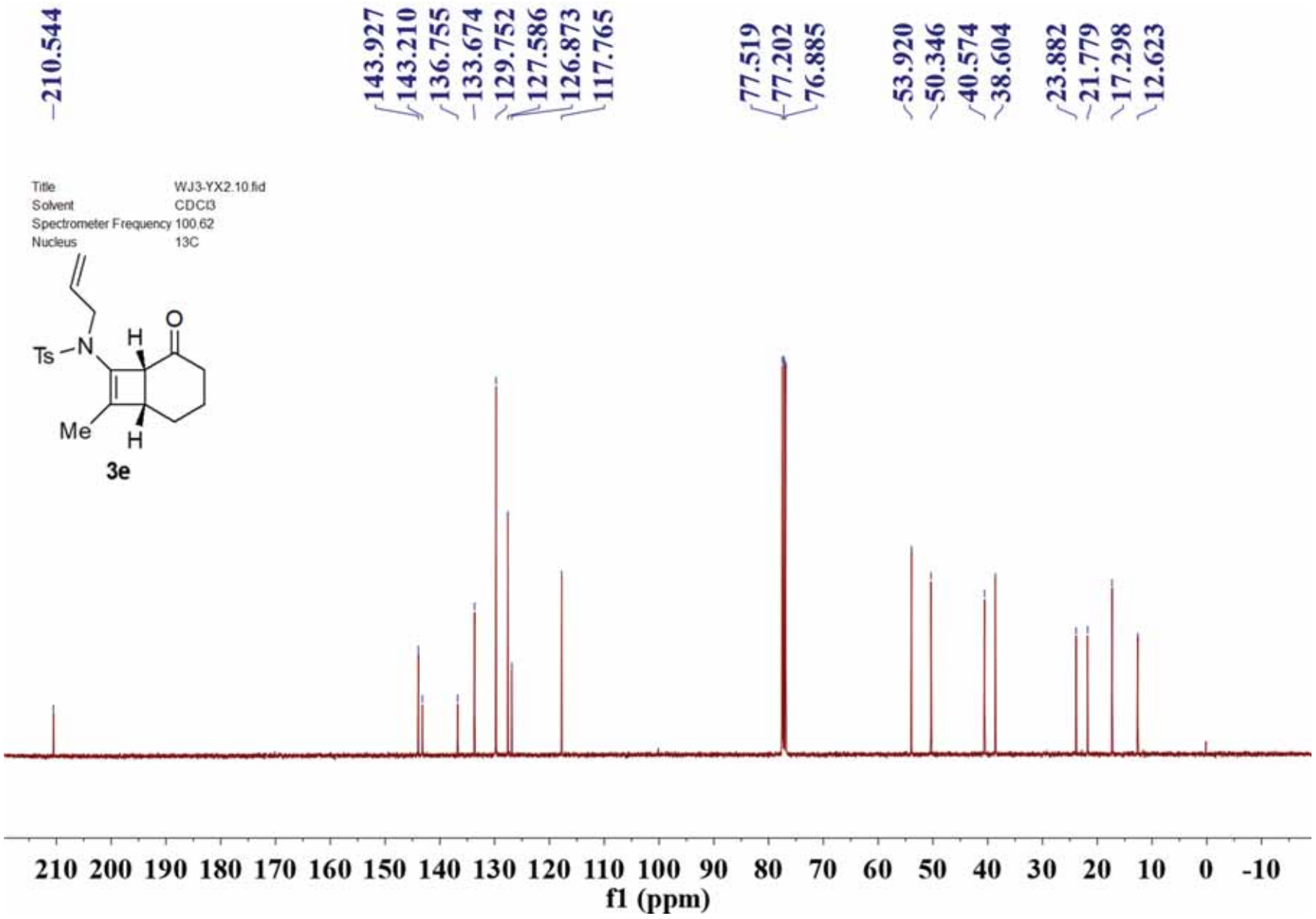
1.00
2.02
2.02
1.00
1.00
3.01
0.99
2.02
2.99
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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40.574
38.604
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Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
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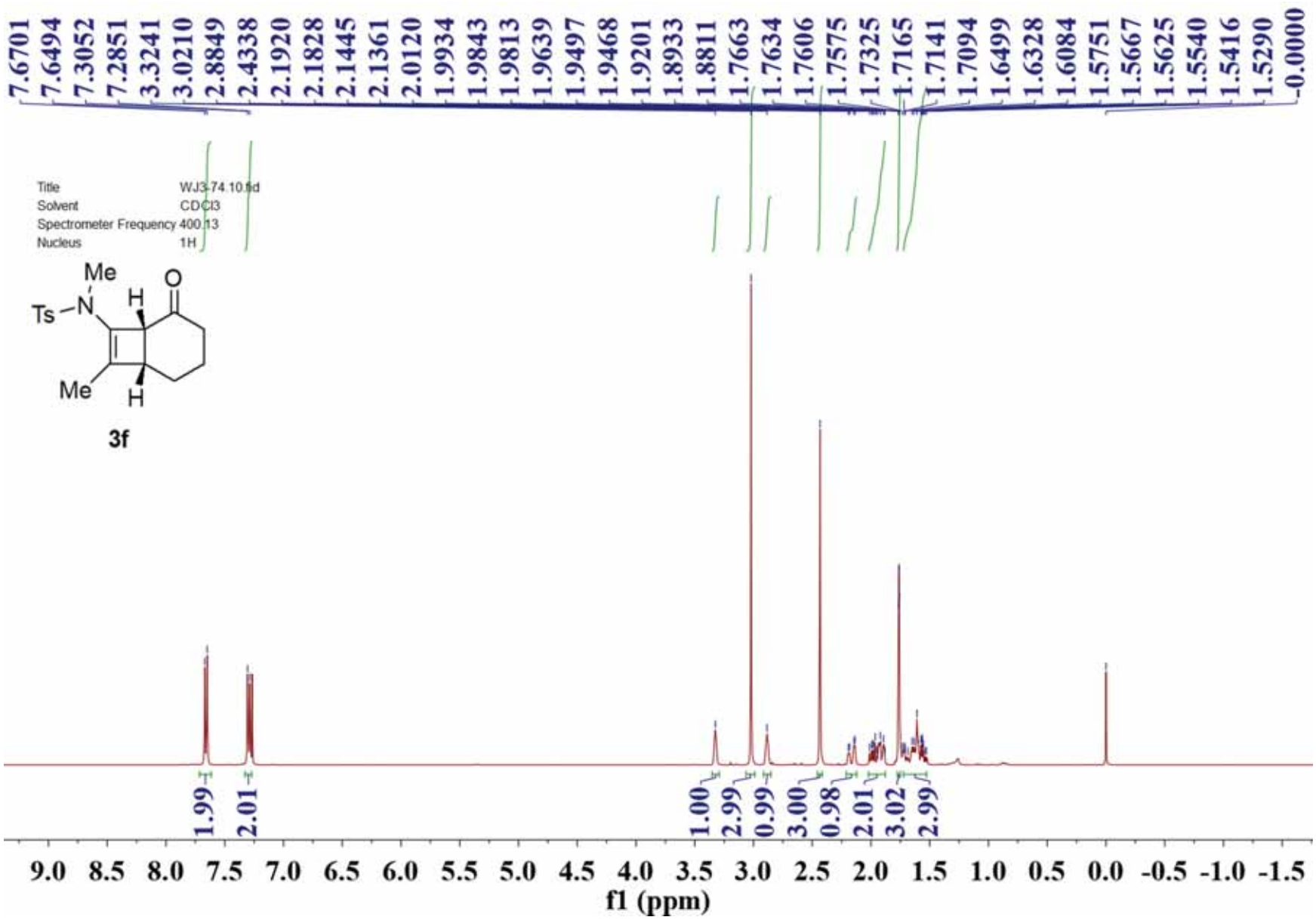
H
O
Me
H
3e
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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Solvent CDCl3
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N
Ts
H
O
Me
H
3f
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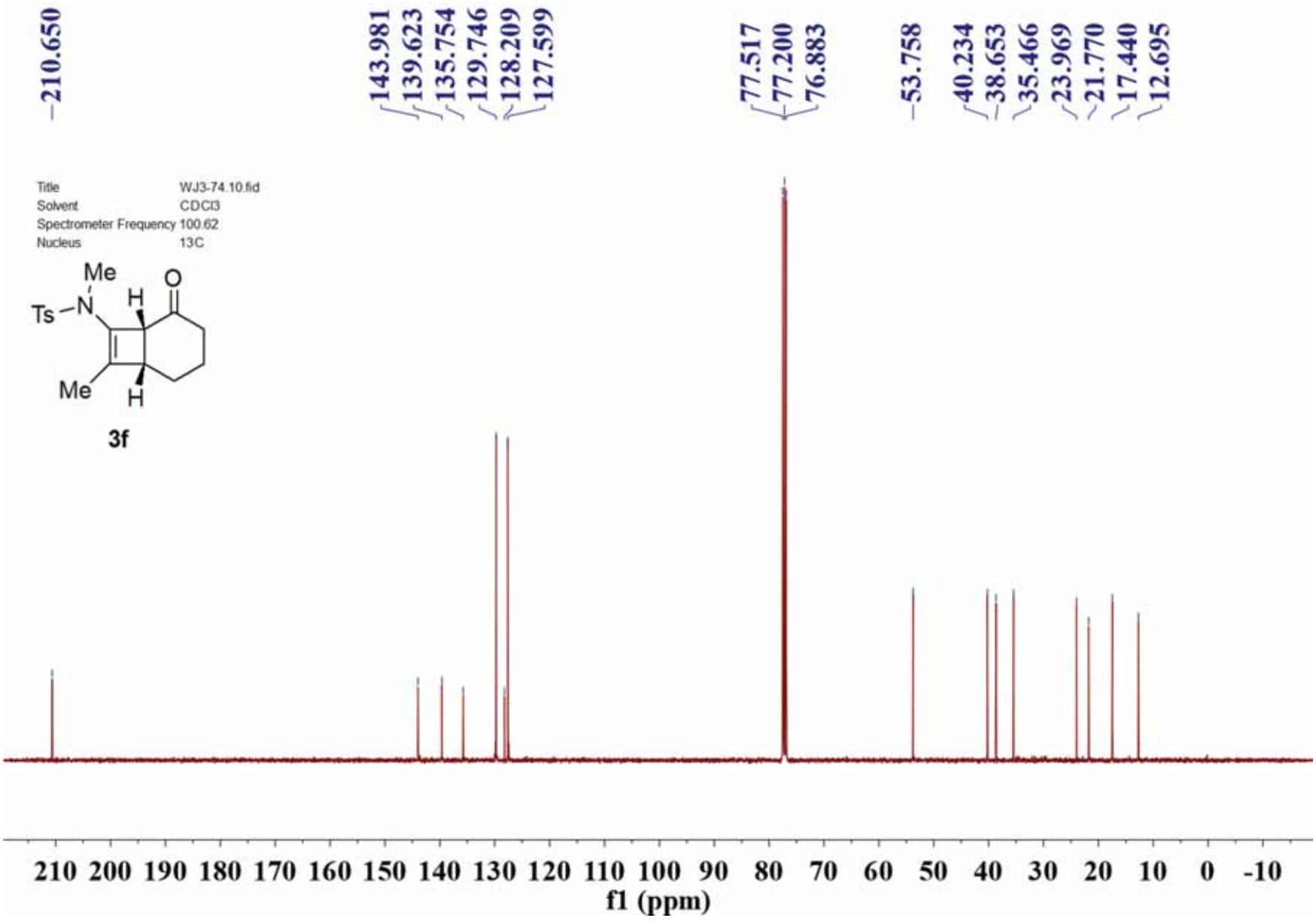
1.00
2.99
0.99
3.00
0.98
2.01
3.02
2.99
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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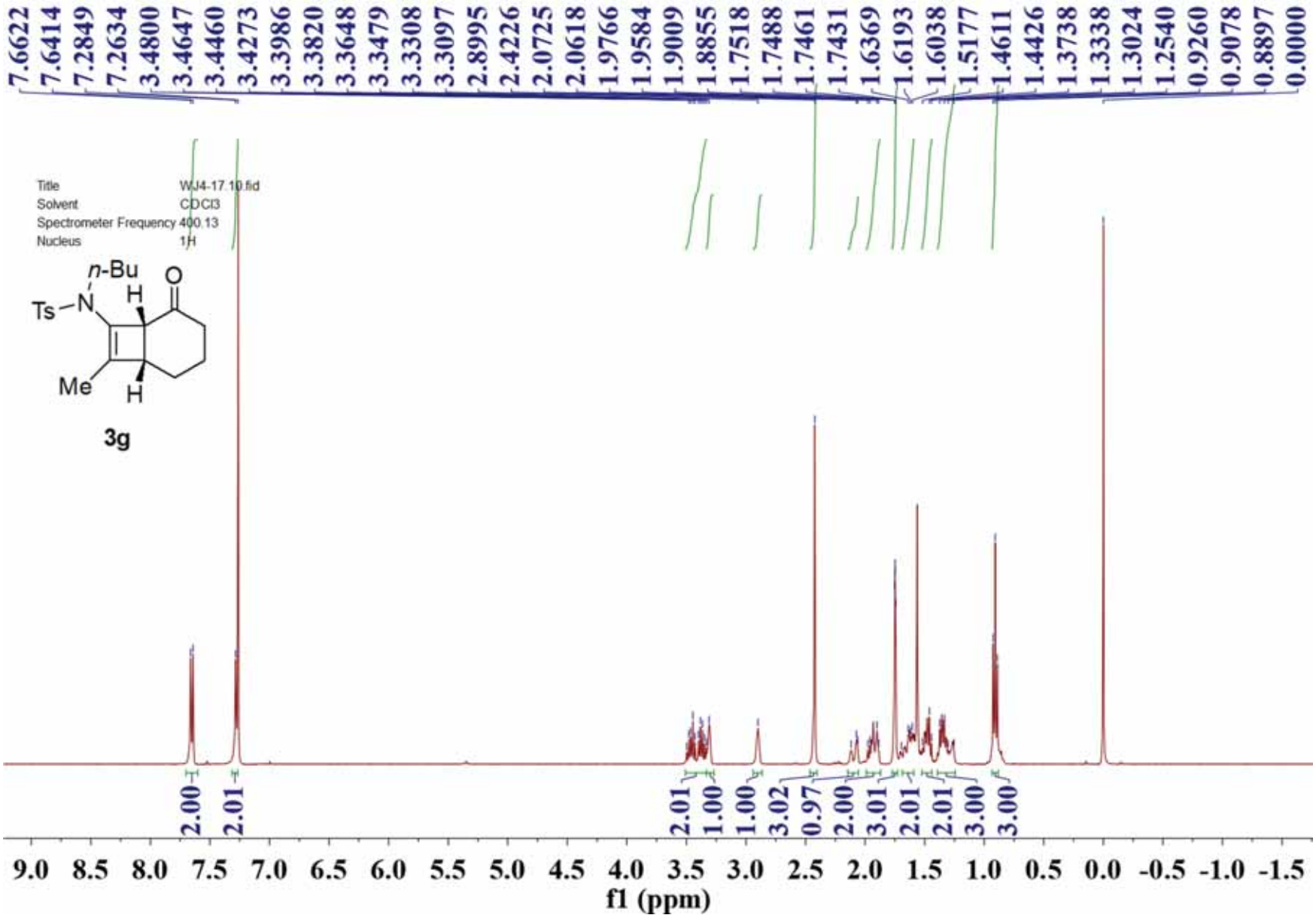
40.234
38.653
35.466
23.969
21.770
17.440
12.695
Title WJ3-74.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Me
Ts
N
H
O
Me
H
3f
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.2634
3.4800
3.4647
3.4460
3.4273
3.3986
3.3820
3.3648
3.3479
3.3308
3.3097
2.8995
2.4226
2.0725
2.0618
1.9766
1.9584
1.9009
1.8855
1.7518
1.7488
1.7461
1.7431
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1.5177
1.4611
1.4426
1.3738
1.3338
1.3024
1.2540
0.9260
0.9078
0.8897
0.0000
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n-Bu
Ts
N
H
O
Me
H
3g
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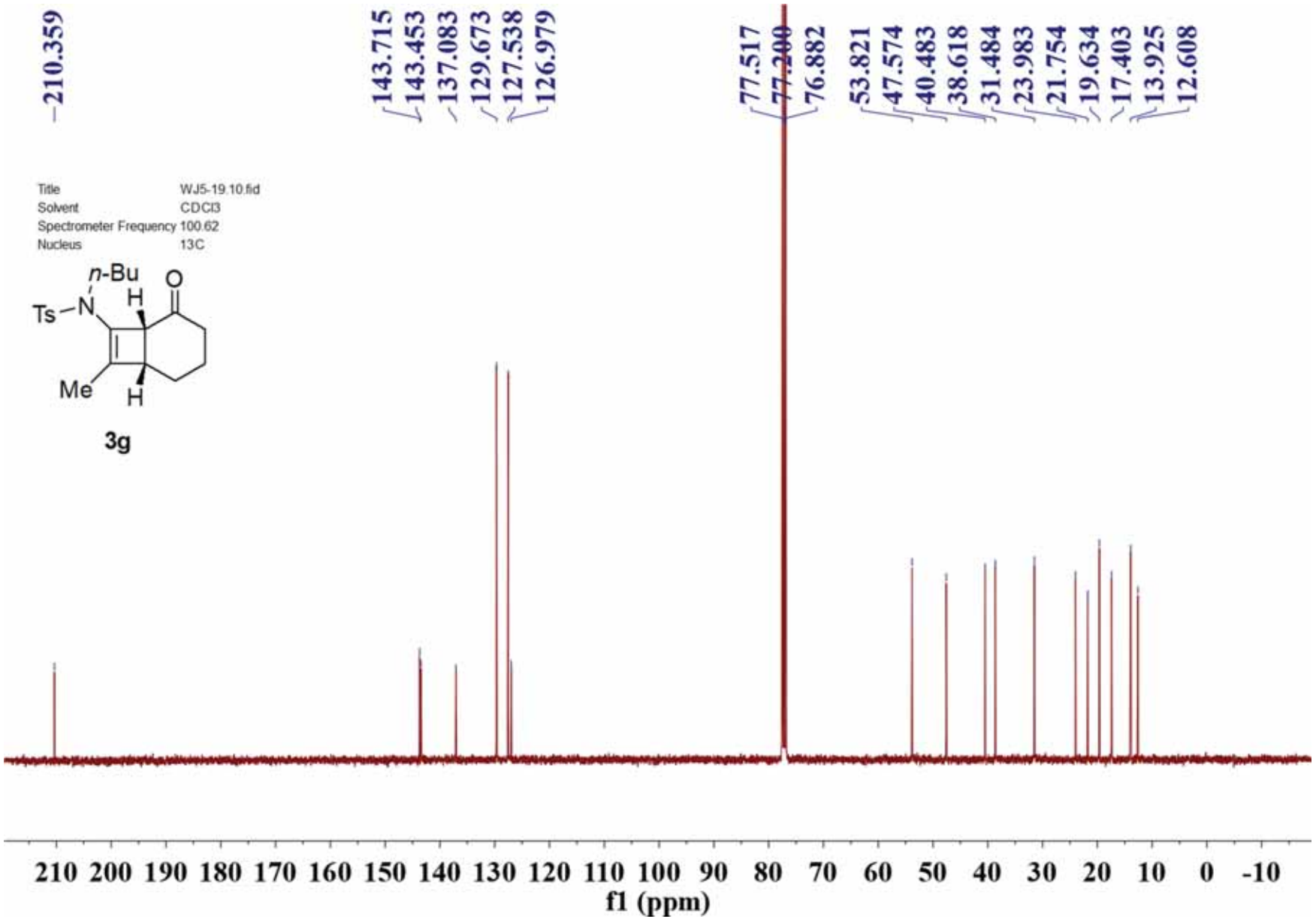
2.01
2.01
1.00
1.00
3.02
0.97
2.00
3.01
2.01
2.01
3.00
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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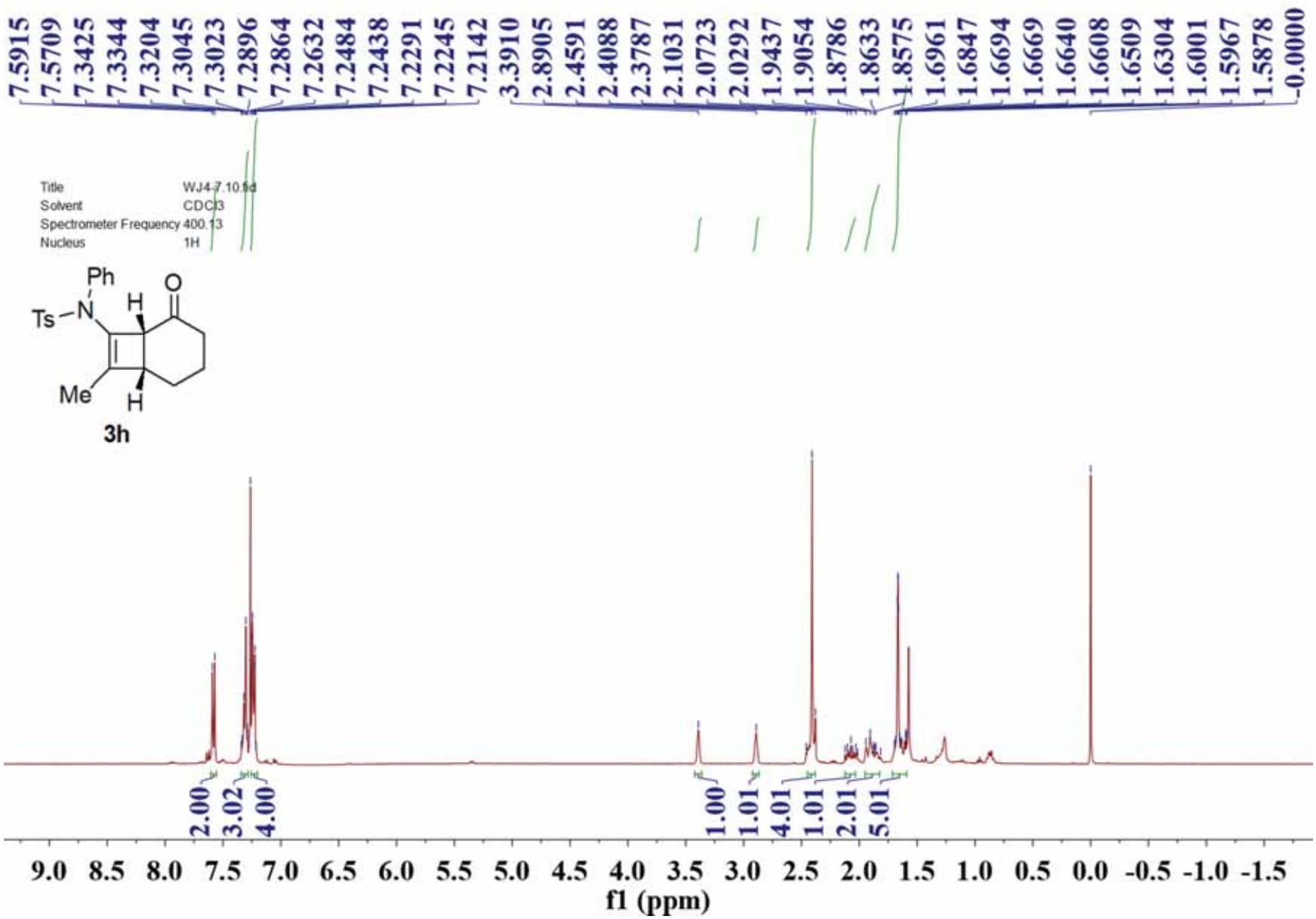
77.517
77.200
76.882
53.821
47.574
40.483
38.618
31.484
23.983
21.754
19.634
17.403
13.925
12.608
Title WJ5-19.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
n-Bu
Ts
N
H
O
Me
H
3g
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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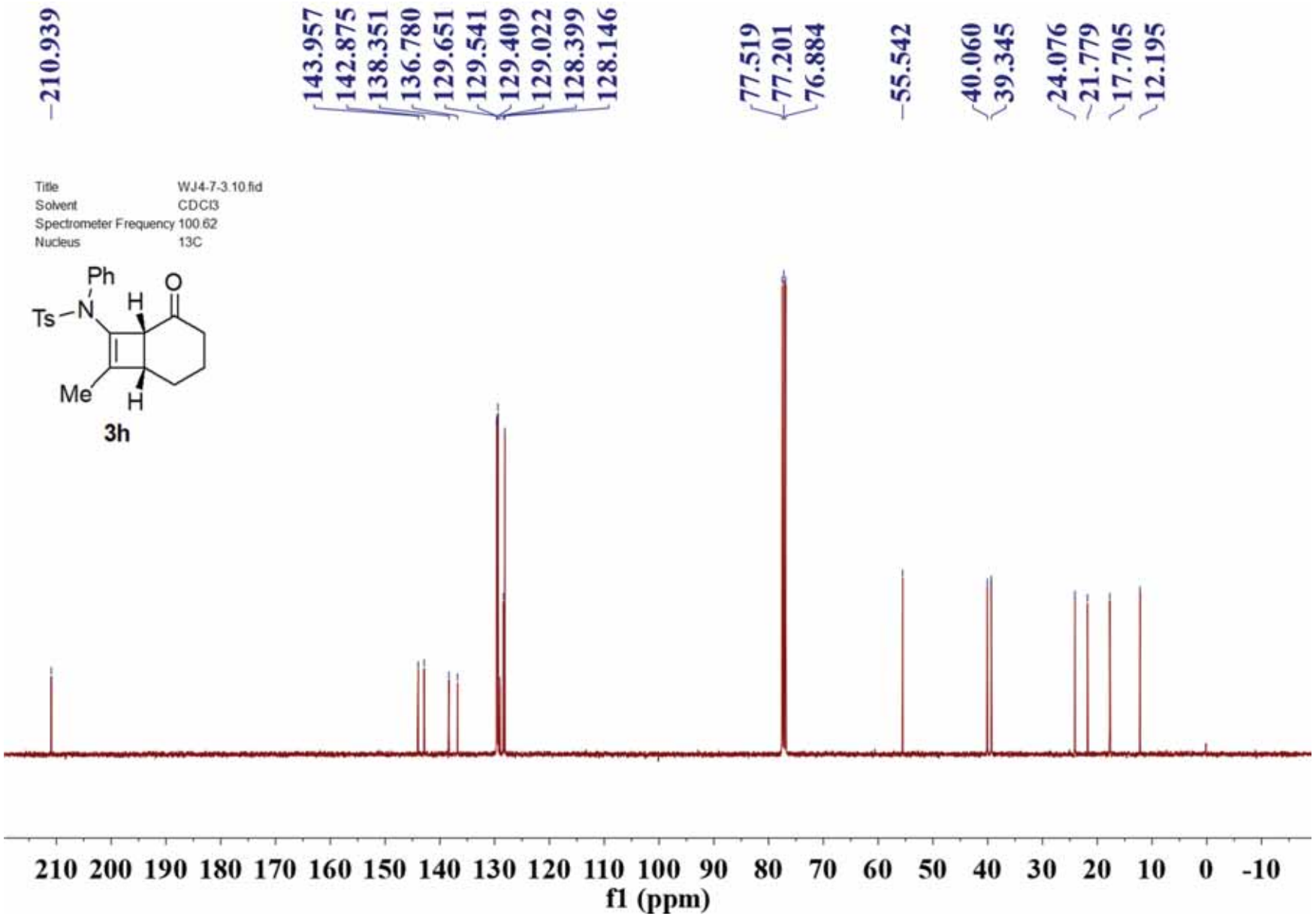
7.3425
7.3344
7.3204
7.3045
7.3023
7.2896
7.2864
7.2632
7.2484
7.2438
7.2291
7.2245
7.2142
3.3910
2.8905
2.4591
2.4088
2.3787
2.1031
2.0723
2.0292
1.9437
1.9054
1.8786
1.8633
1.8575
1.6961
1.6847
1.6694
1.6669
1.6640
1.6608
1.6509
1.6304
1.6001
1.5967
1.5878
-0.0000
Title
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Ph
O
Ts
N
H
Me
H
3h
2.00
3.02
4.00
1.00
1.01
4.01
1.01
2.01
5.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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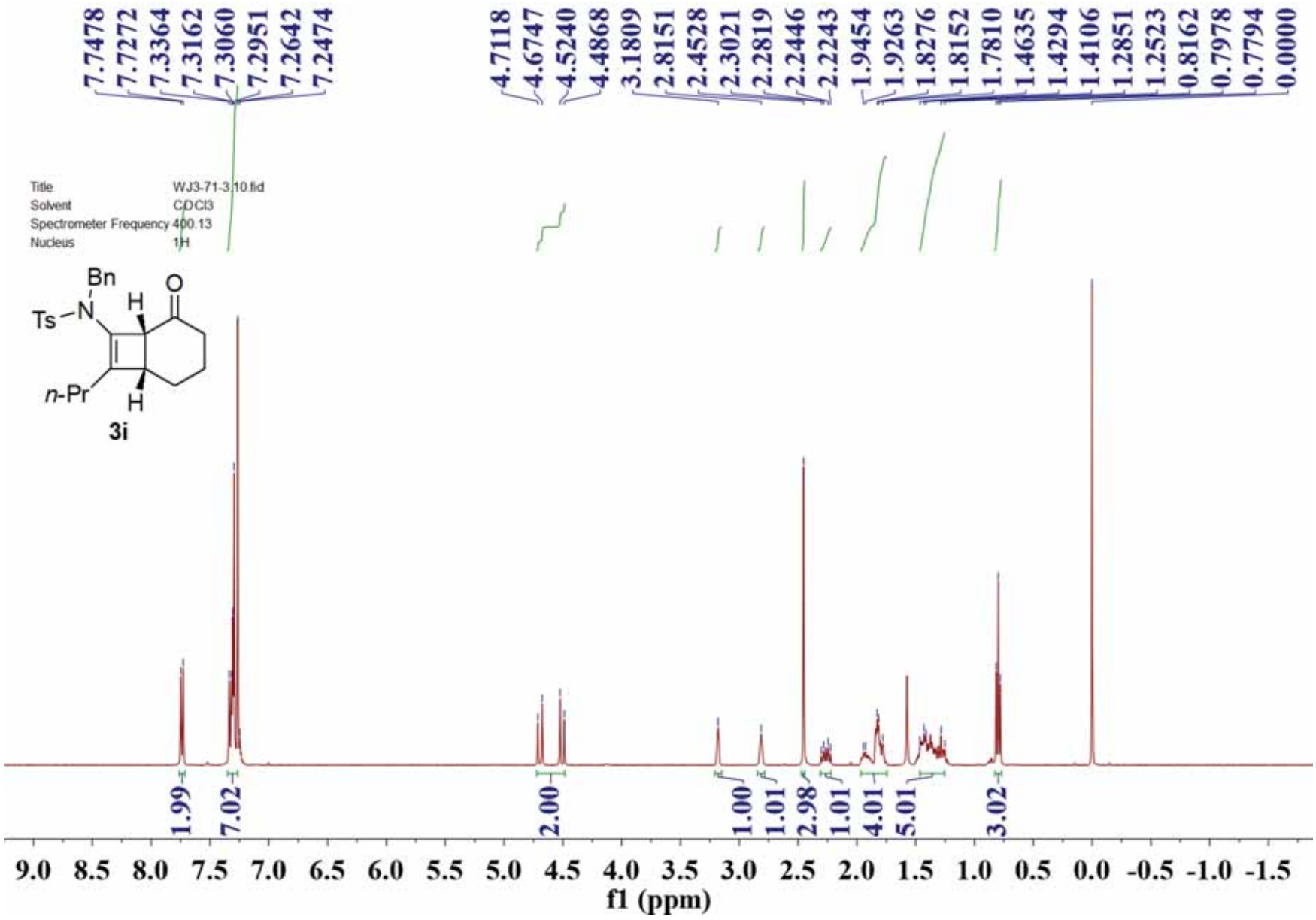
142.875
138.351
136.780
129.651
129.541
129.409
129.022
128.399
128.146
77.519
77.201
76.884
55.542
40.060
39.345
24.076
21.779
17.705
12.195
Title WJ4-7-3.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Ph
N
Ts
H
O
Me
H
3h
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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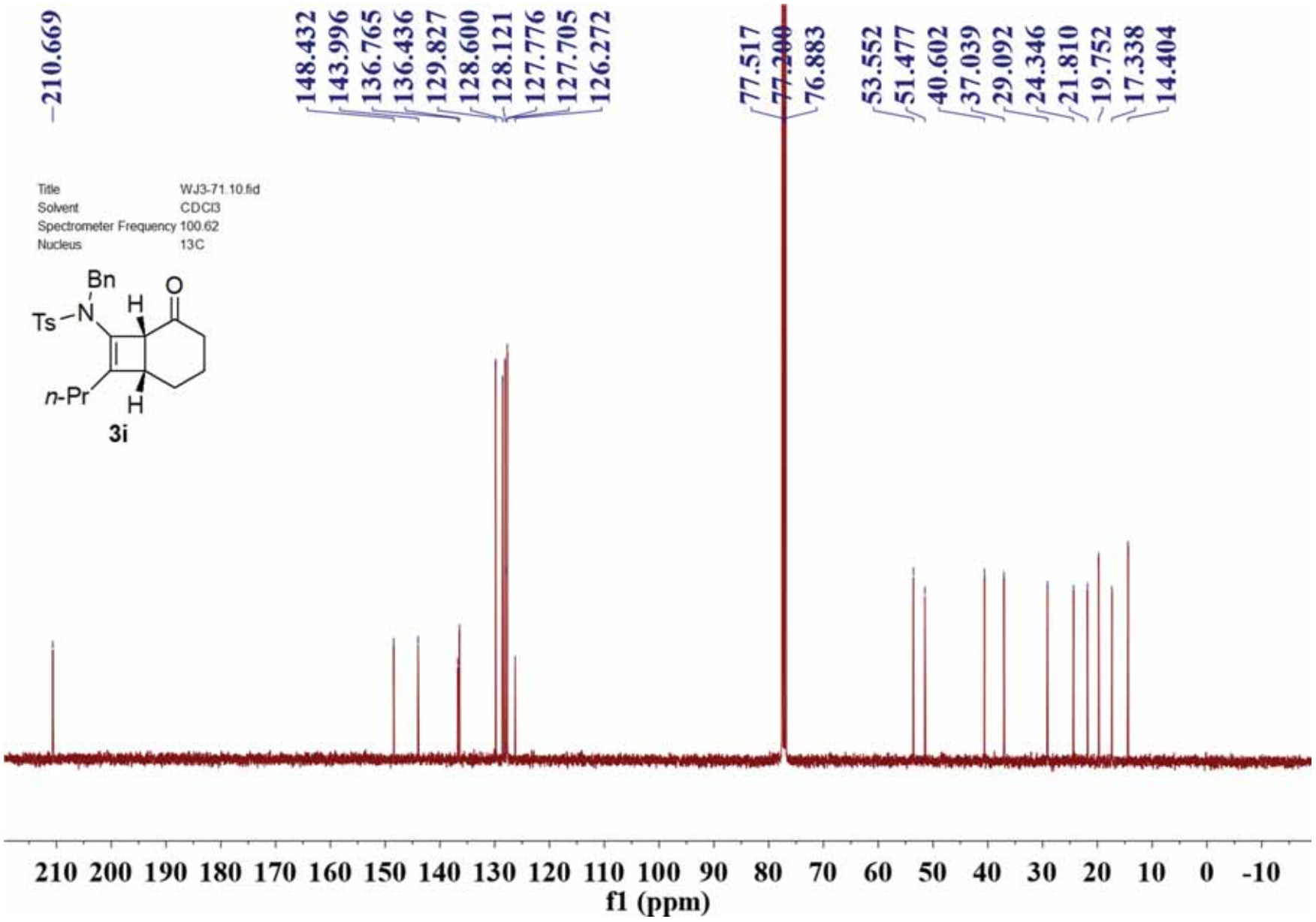
7.7272
7.3364
7.3162
7.3060
7.2951
7.2642
7.2474
4.7118
4.6747
4.5240
4.4868
3.1809
2.8151
2.4528
2.3021
2.2819
2.2446
2.2243
1.9454
1.9263
1.8276
1.8152
1.7810
1.4635
1.4294
1.4106
1.2851
1.2523
0.8162
0.7978
0.7794
0.0000
Title WJ3-71-3.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
Ts
N
H
O
n-Pr
H
3i
1.99
7.02
2.00
1.00
1.01
2.98
1.01
4.01
5.01
3.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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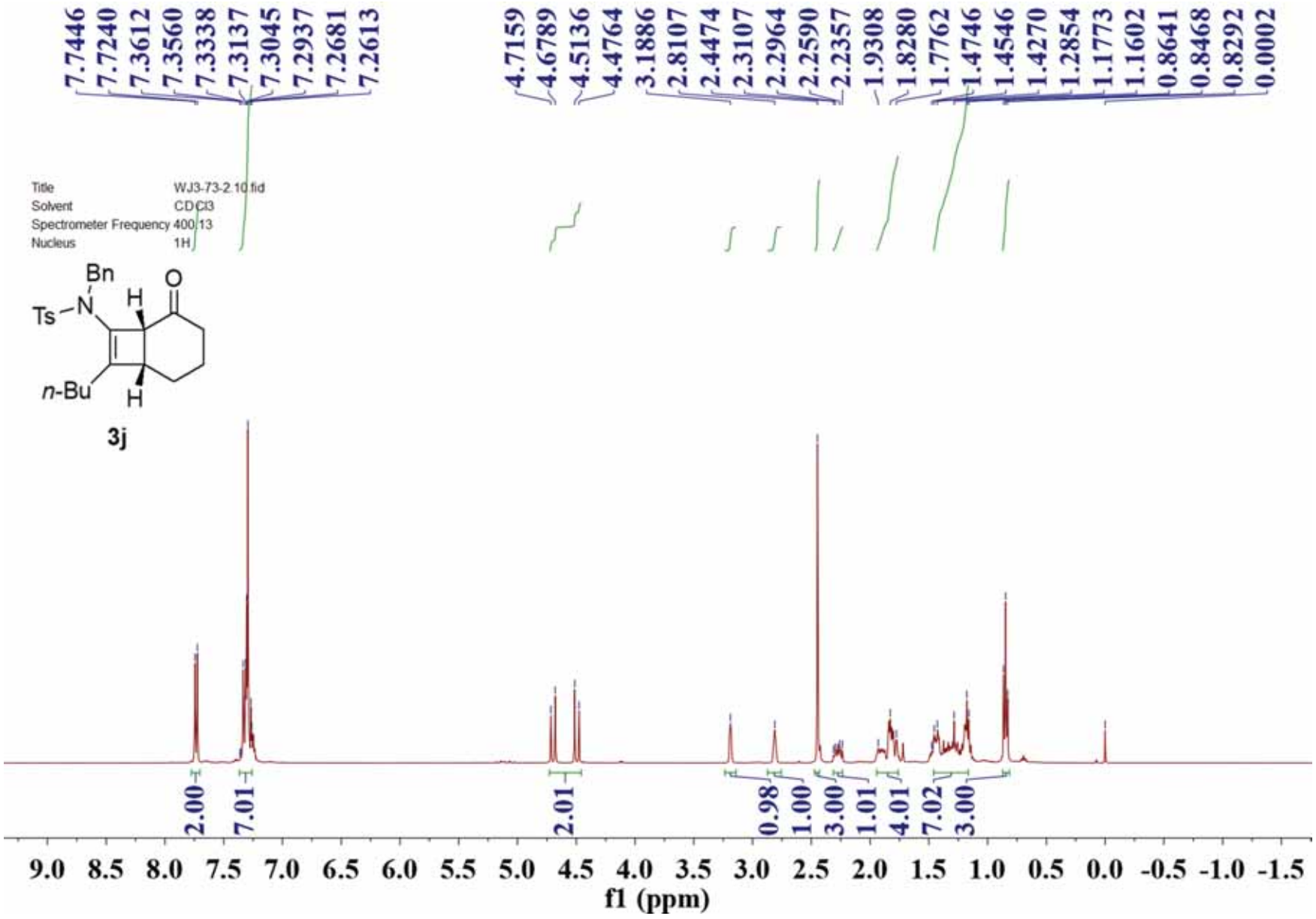
136.436
129.827
128.600
128.121
127.776
127.705
126.272
77.517
77.200
76.883
53.552
51.477
40.602
37.039
29.092
24.346
21.810
19.752
17.338
14.404
Title WJ3-71.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
Ts
N
H
O
n-Pr
H
3i
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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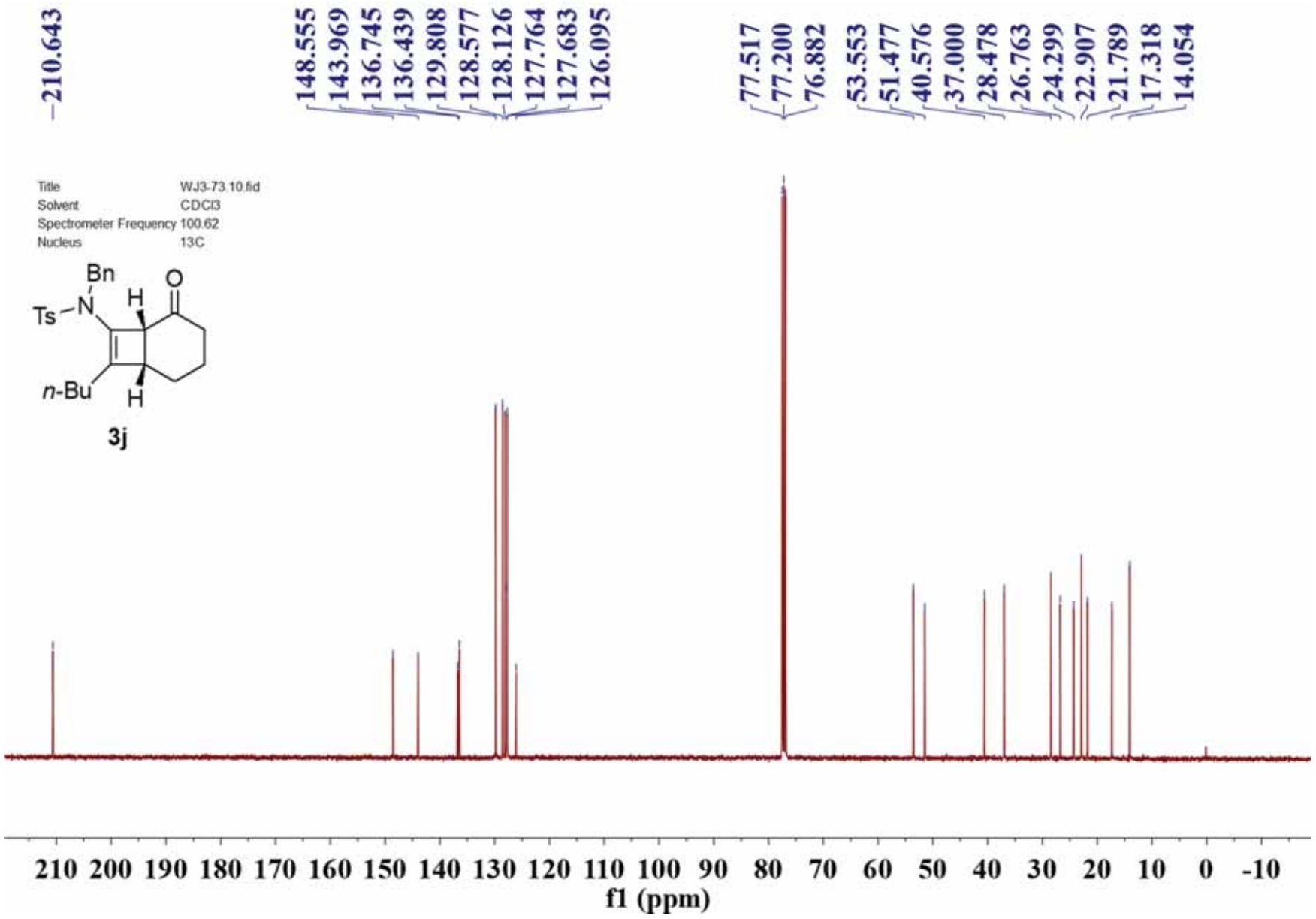
7.7240
7.3612
7.3560
7.3338
7.3137
7.3045
7.2937
7.2681
7.2613
4.7159
4.6789
4.5136
4.4764
3.1886
2.8107
2.4474
2.3107
2.2964
2.2590
2.2357
1.9308
1.8280
1.7762
1.4746
1.4546
1.4270
1.2854
1.1773
1.1602
0.8641
0.8468
0.8292
0.0002
Title WJ3-73-2.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
Ts
N
H
O
n-Bu
H
3j
2.00
7.01
2.01
0.98
1.00
3.00
1.01
4.01
7.02
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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143.969
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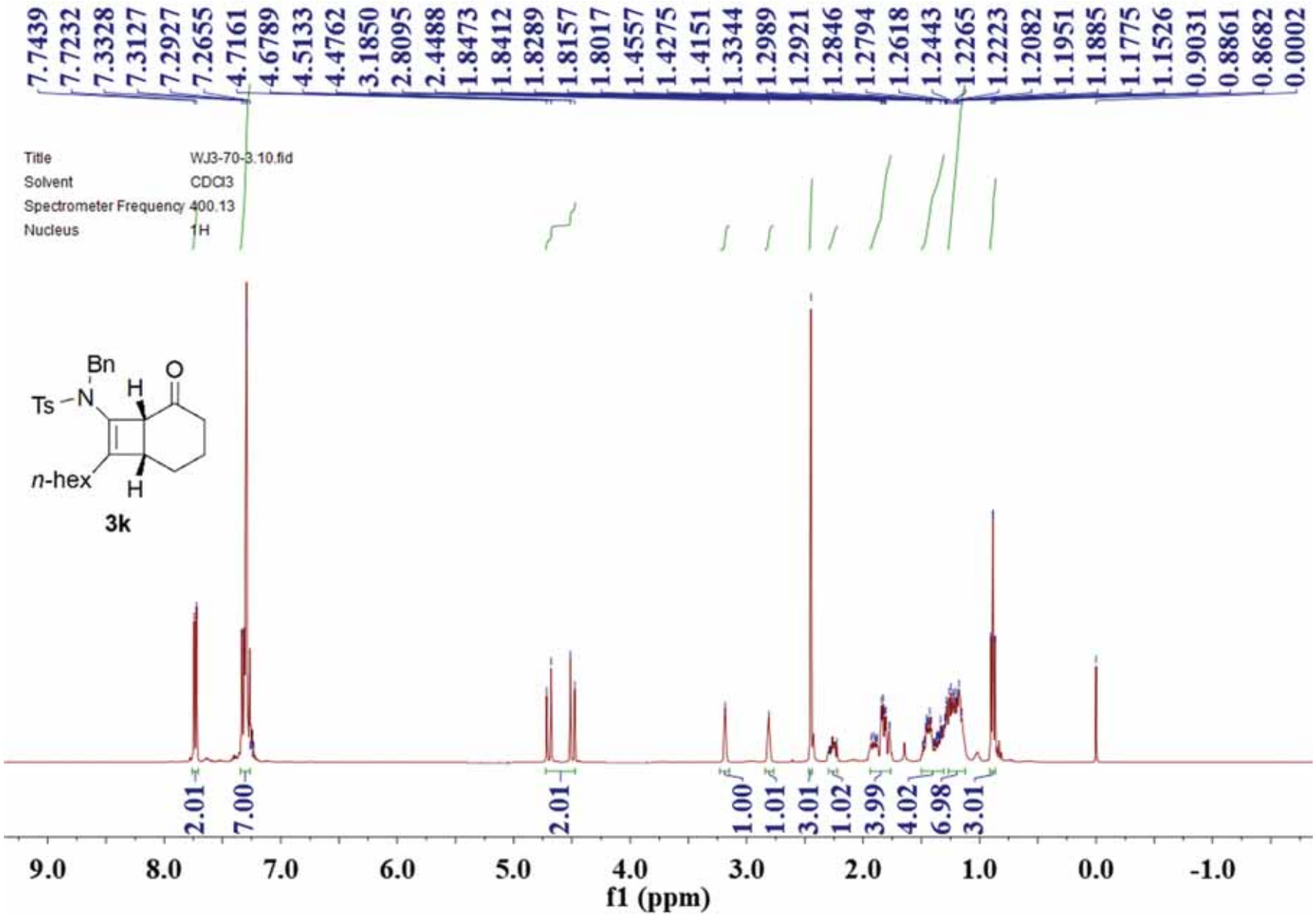
129.808
128.577
128.126
127.764
127.683
126.095
77.517
77.200
76.882
53.553
51.477
40.576
37.000
28.478
26.763
24.299
22.907
21.789
17.318
14.054
Title WJ3-73.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
Ts
N
H
O
n-Bu
H
3j
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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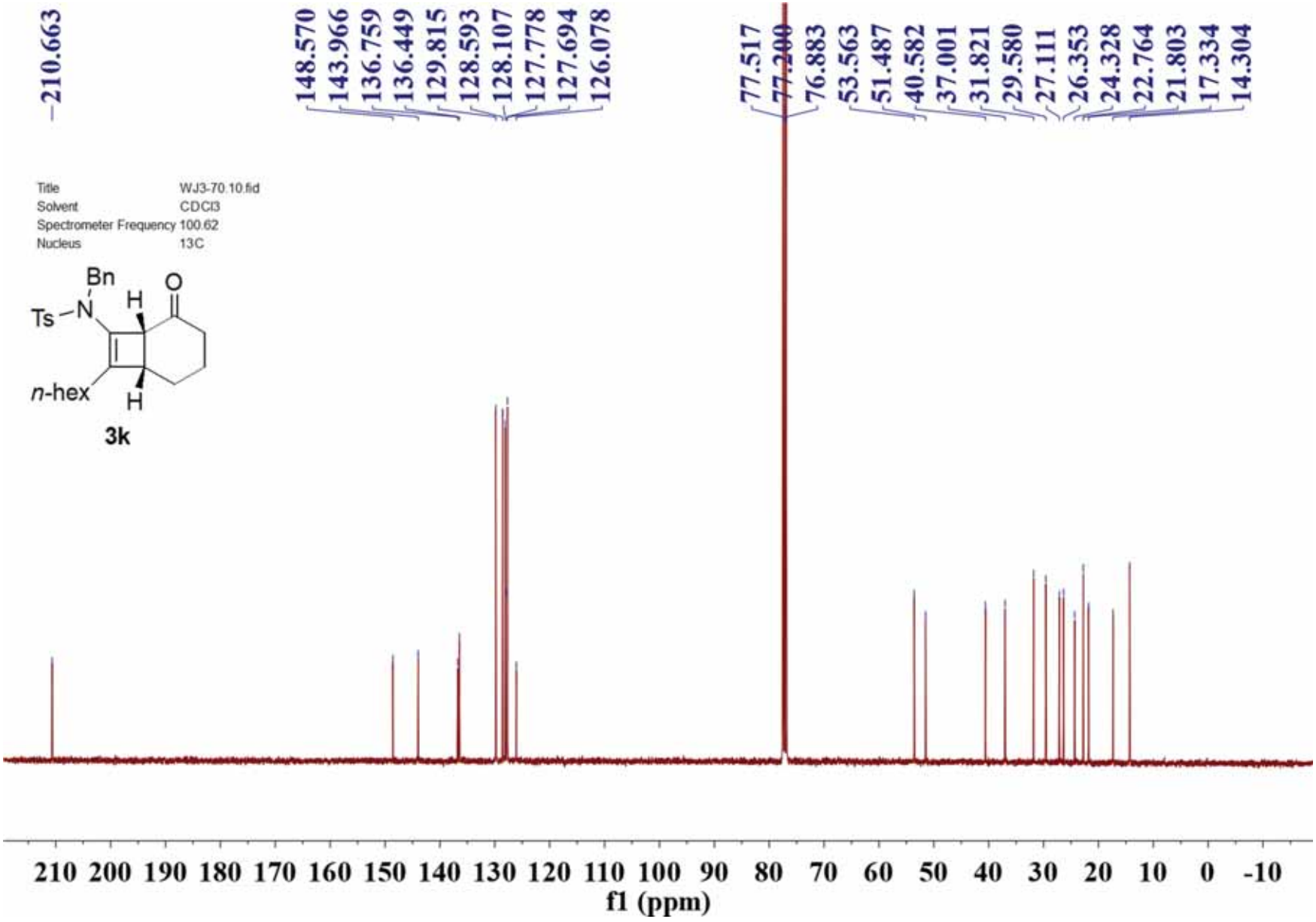
7.7232
7.3328
7.3127
7.2927
7.2655
4.7161
4.6789
4.5133
4.4762
3.1850
2.8095
2.4488
1.8473
1.8412
1.8289
1.8157
1.8017
1.4557
1.4275
1.4151
1.3344
1.2989
1.2921
1.2846
1.2794
1.2618
1.2443
1.2265
1.2223
1.2082
1.1951
1.1885
1.1775
1.1526
0.9031
0.8861
0.8682
0.0002
Title WJ3-70-3.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
O
Ts
N
H
n-hex
H
3k
2.01
7.00
2.01
1.00
1.01
3.01
1.02
3.99
4.02
6.98
3.01
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
f1 (ppm)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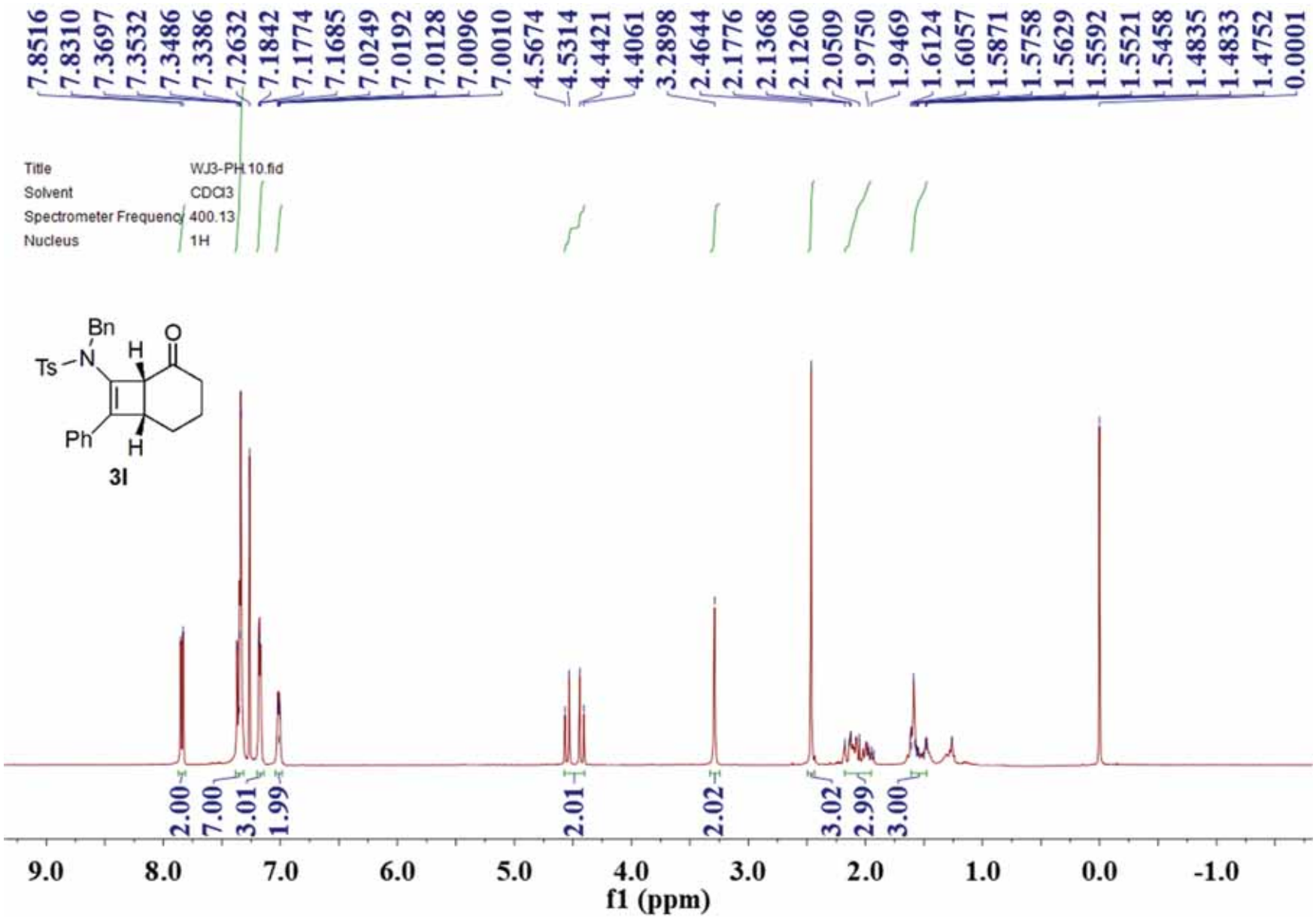
143.966
136.759
136.449
129.815
128.593
128.107
127.778
127.694
126.078
77.517
77.200
76.883
53.563
51.487
40.582
37.001
31.821
29.580
27.111
26.353
24.328
22.764
21.803
17.334
14.304
Title WJ3-70.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
Ts
N
H
O
n-hex
H
3k
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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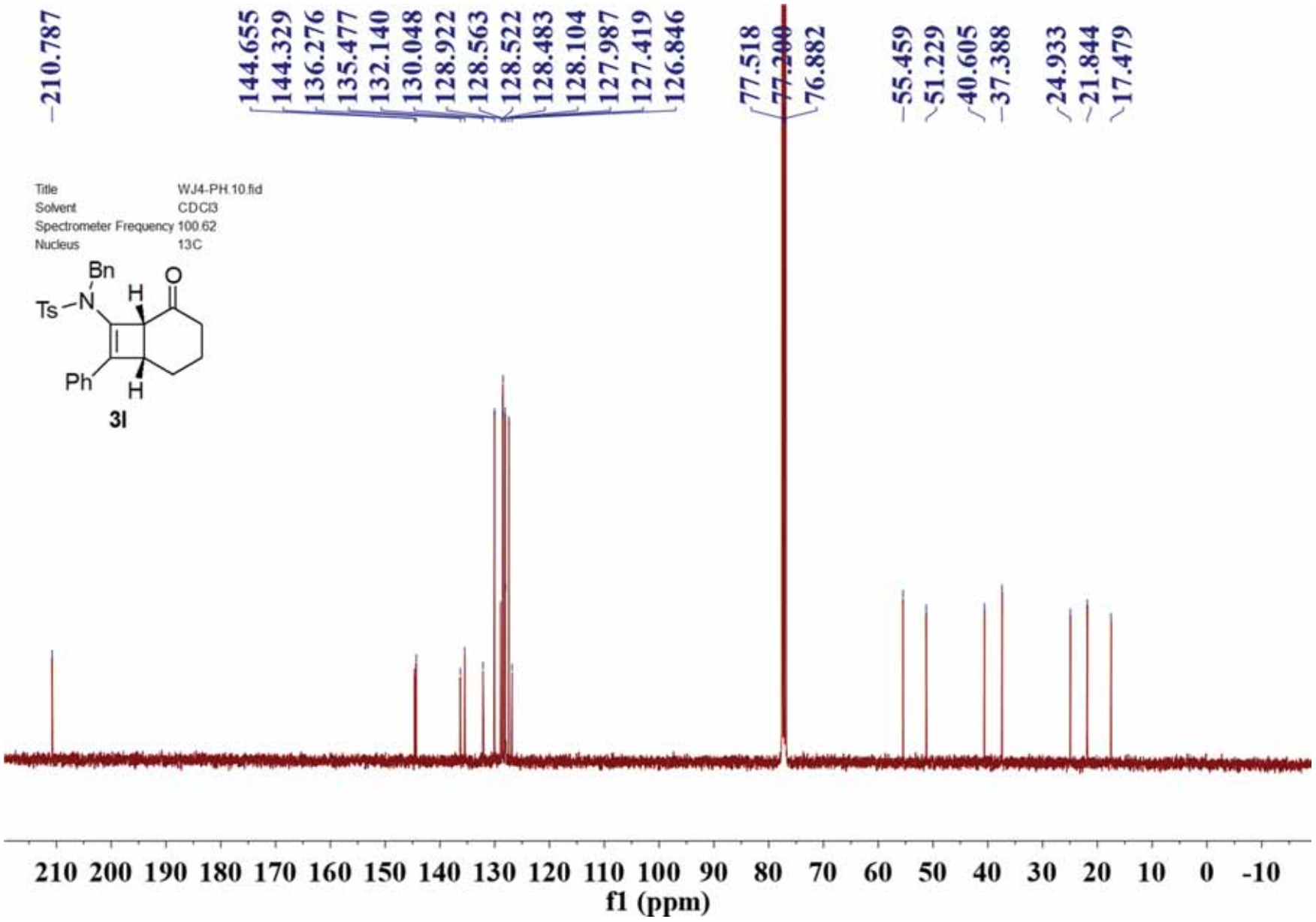
7.3486
7.3386
7.2632
7.1842
7.1774
7.1685
7.0249
7.0192
7.0128
7.0096
7.0010
4.5674
4.5314
4.4421
4.4061
3.2898
2.4644
2.1776
2.1368
2.1260
2.0509
1.9750
1.9469
1.6124
1.6057
1.5871
1.5758
1.5629
1.5592
1.5521
1.5458
1.4835
1.4833
1.4752
0.0001
Title WJ3-PH 10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
N
Ts
H
O
Ph
H
3l
2.00
7.00
3.01
1.99
2.01
2.02
3.02
2.99
3.00
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
f1 (ppm)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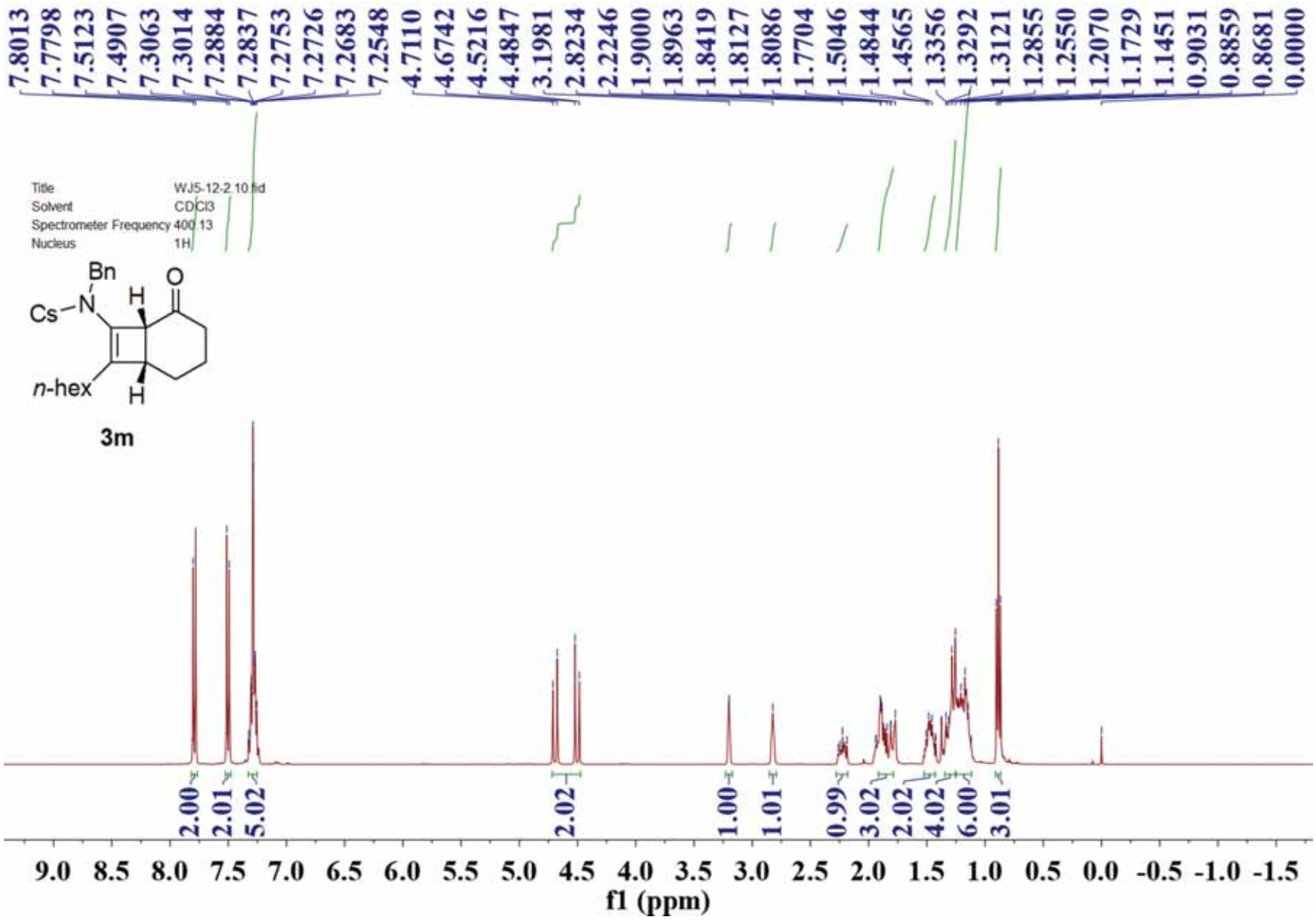
144.329
136.276
135.477
132.140
130.048
128.922
128.563
128.522
128.483
128.104
127.987
127.419
126.846
77.518
77.200
76.882
55.459
51.229
40.605
37.388
24.933
21.844
17.479
Title WJ4-PH.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
N
H
O
Ts
Ph
H
3l
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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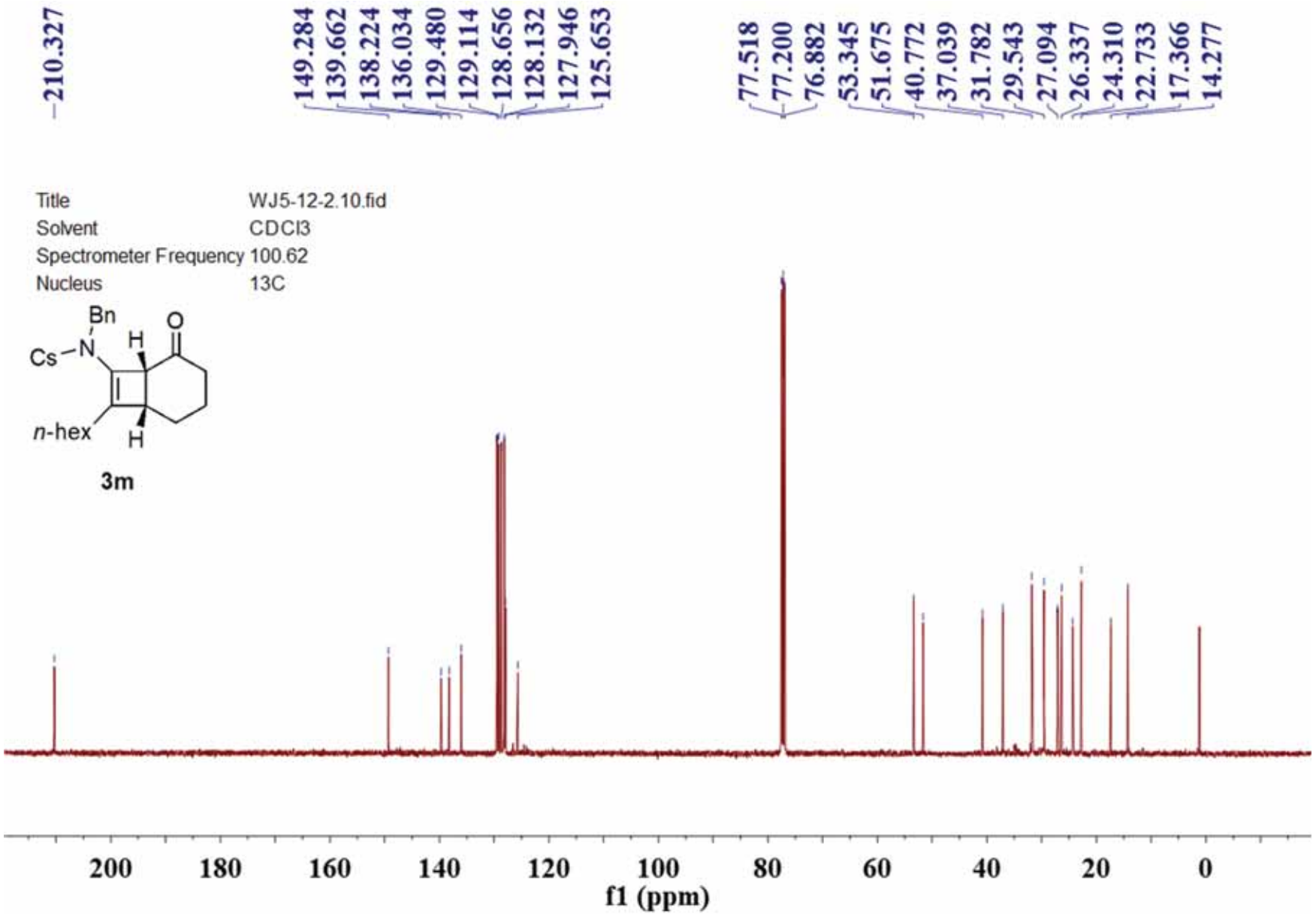
7.7798
7.5123
7.4907
7.3063
7.3014
7.2884
7.2837
7.2753
7.2726
7.2683
7.2548
4.7110
4.6742
4.5216
4.4847
3.1981
2.8234
2.2246
1.9000
1.8963
1.8419
1.8127
1.8086
1.7704
1.5046
1.4844
1.4565
1.3356
1.3292
1.3121
1.2855
1.2550
1.2070
1.1729
1.1451
0.9031
0.8859
0.8681
0.0000
Title WJ5-12-2.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
N
H
O
Cs
n-hex
H
3m
2.00
2.01
5.02
2.02
1.00
1.01
0.99
3.02
2.02
4.02
6.00
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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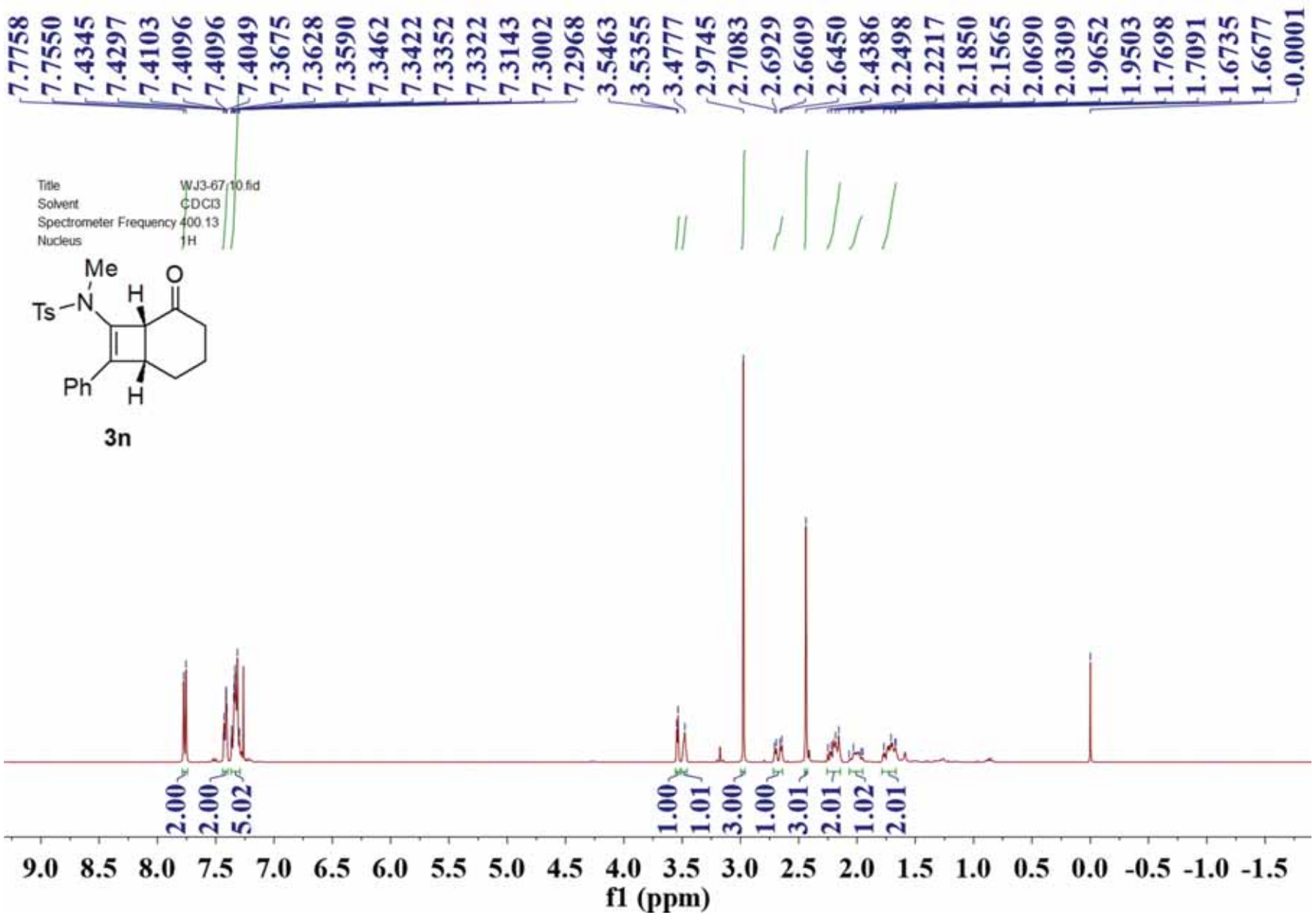
138.224
136.034
129.480
129.114
128.656
128.132
127.946
125.653
77.518
77.200
76.882
53.345
51.675
40.772
37.039
31.782
29.543
27.094
26.337
24.310
22.733
17.366
14.277
Title WJ5-12-2.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
Cs
N
H
O
n-hex
H
3m
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)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7.4297
7.4103
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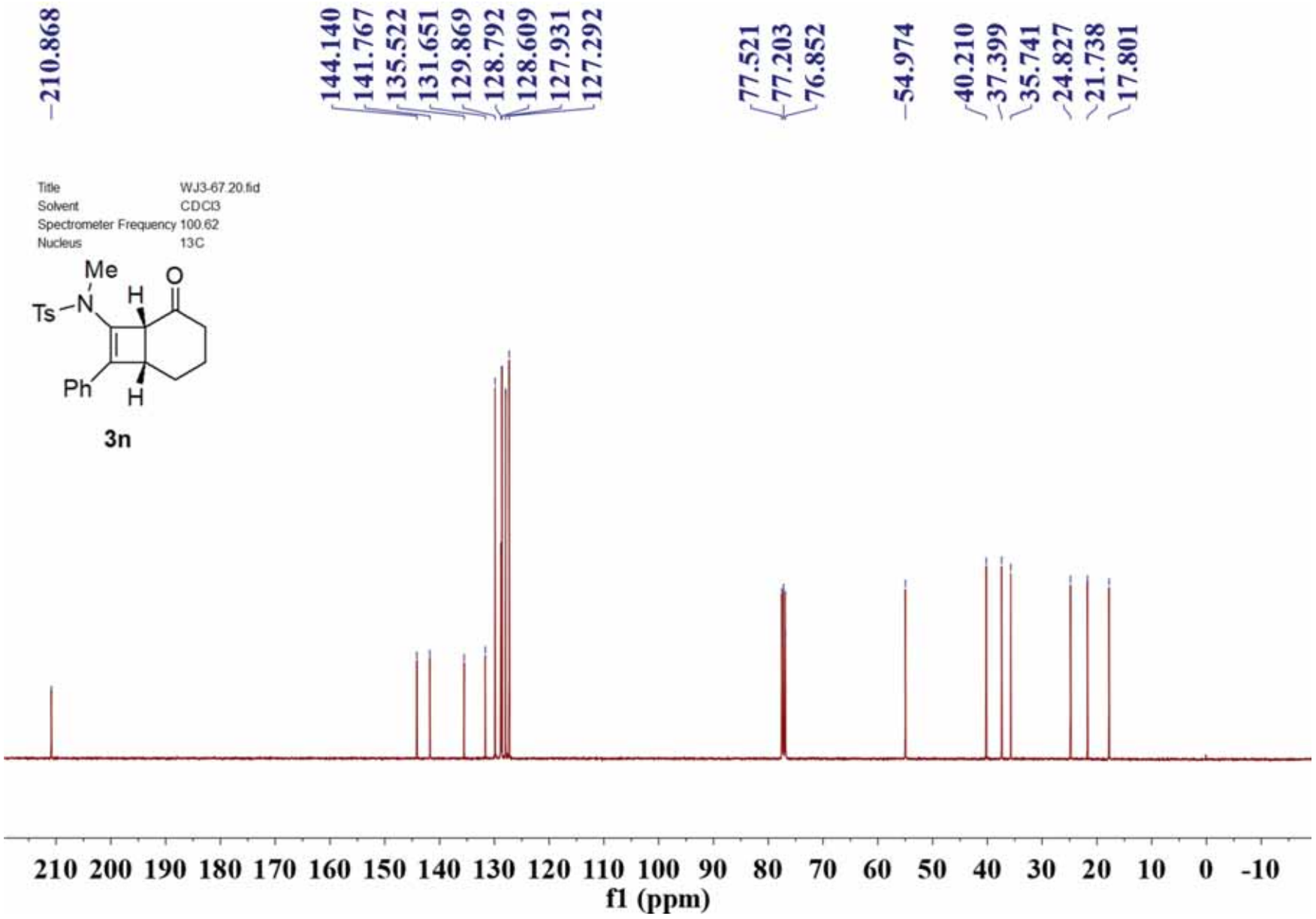
7.4096
7.4049
7.3675
7.3628
7.3590
7.3462
7.3422
7.3352
7.3322
7.3143
7.3002
7.2968
3.5463
3.5355
3.4777
2.9745
2.7083
2.6929
2.6609
2.6450
2.4386
2.2498
2.2217
2.1850
2.1565
2.0690
2.0309
1.9652
1.9503
1.7698
1.7091
1.6735
1.6677
-0.0001
Title WJ3-67-10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Me
N
Ts
H
O
Ph
H
3n
2.00
2.00
5.02
1.00
1.01
3.00
1.00
3.01
2.01
1.02
2.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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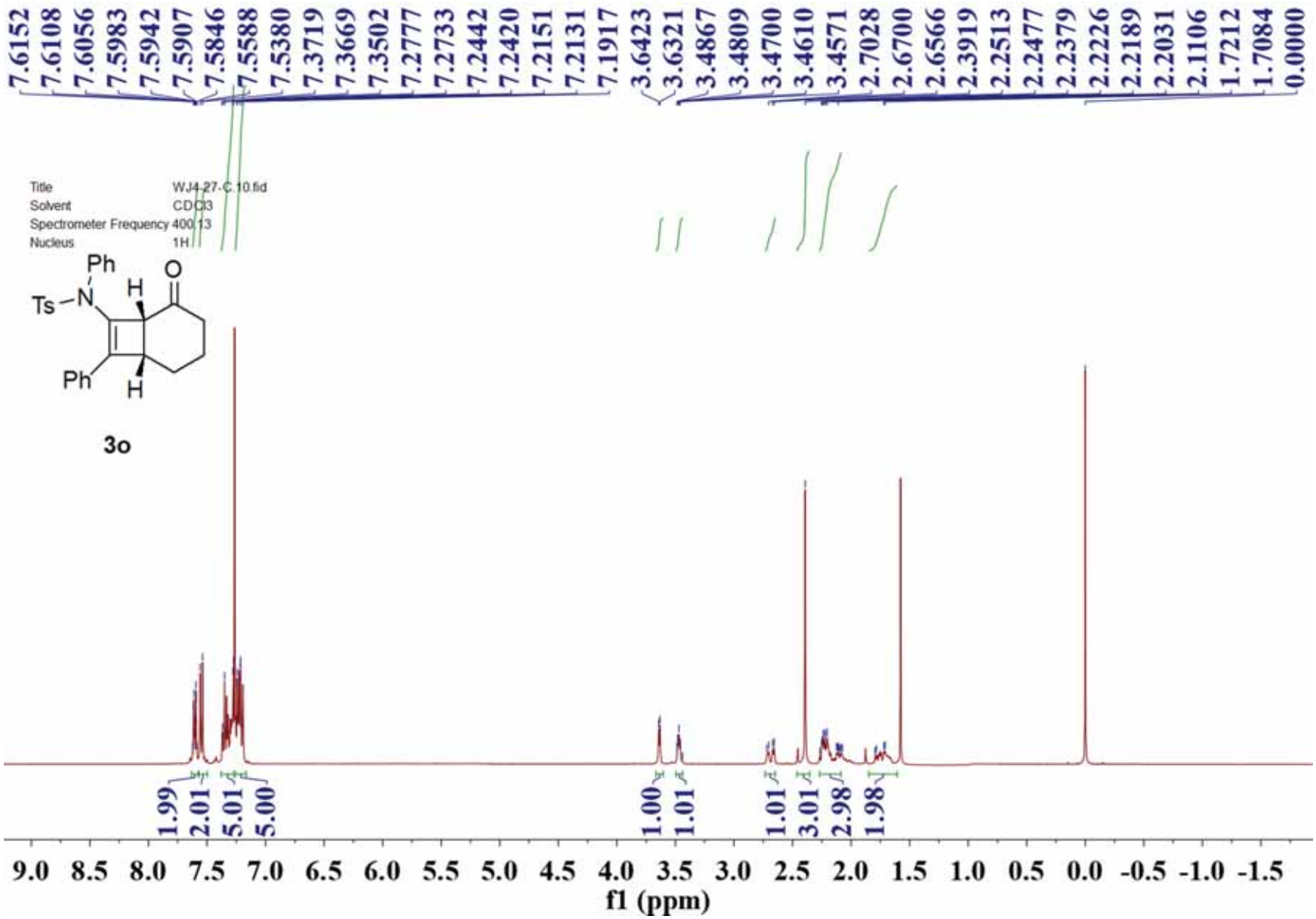
128.792
128.609
127.931
127.292
77.521
77.203
76.852
54.974
40.210
37.399
35.741
24.827
21.738
17.801
Title WJ3-67.20.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Me
O
H
Ts
N
Ph
H
3n
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.5942
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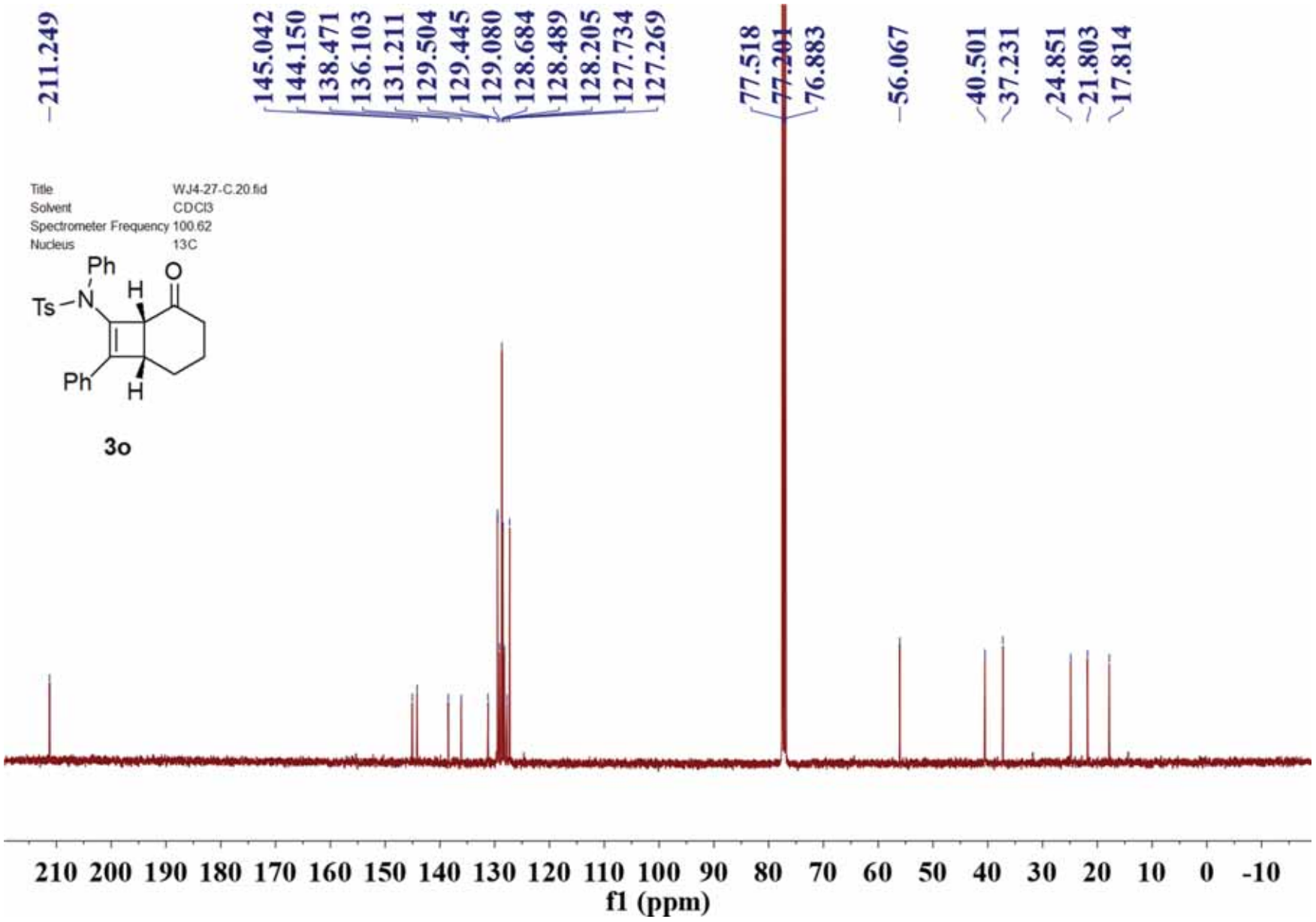
7.5846
7.5588
7.5380
7.3719
7.3669
7.3502
7.2777
7.2733
7.2442
7.2420
7.2151
7.2131
7.1917
3.6423
3.6321
3.4867
3.4809
3.4700
3.4610
3.4571
2.7028
2.6700
2.6566
2.3919
2.2513
2.2477
2.2379
2.2226
2.2189
2.2031
2.1106
1.7212
1.7084
0.0000
Title WJ4-27-C.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Ph
O
Ts
N
H
Ph
H
3o
1.99
2.01
5.01
5.00
1.00
1.01
1.01
3.01
2.98
1.98
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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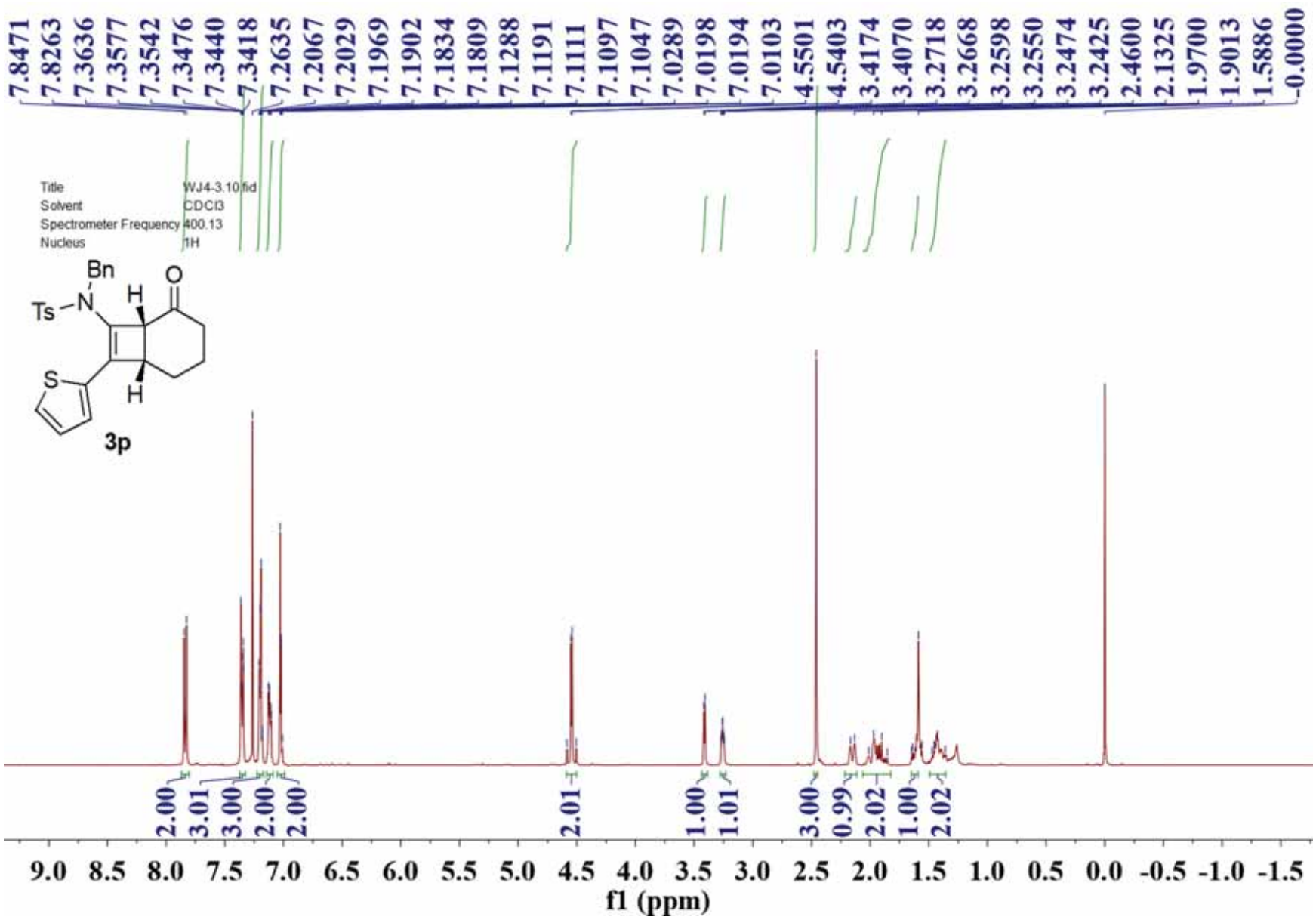
144.150
138.471
136.103
131.211
129.504
129.445
129.080
128.684
128.489
128.205
127.734
127.269
77.518
77.201
76.883
56.067
40.501
37.231
24.851
21.803
17.814
Title WJ4-27-C.20.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Ph
N
Ts
H
O
Ph
H
3o
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.3542
7.3476
7.3440
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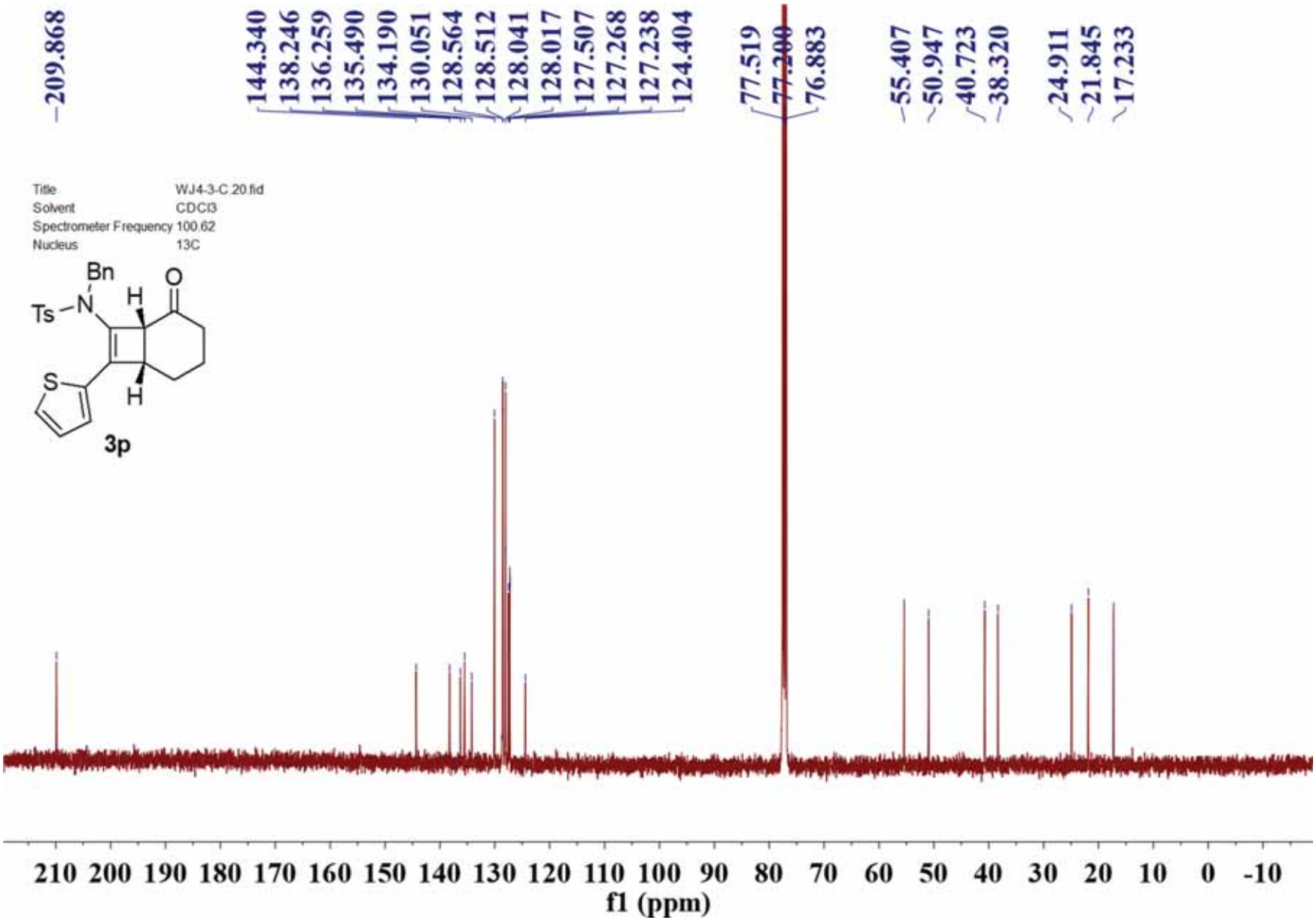
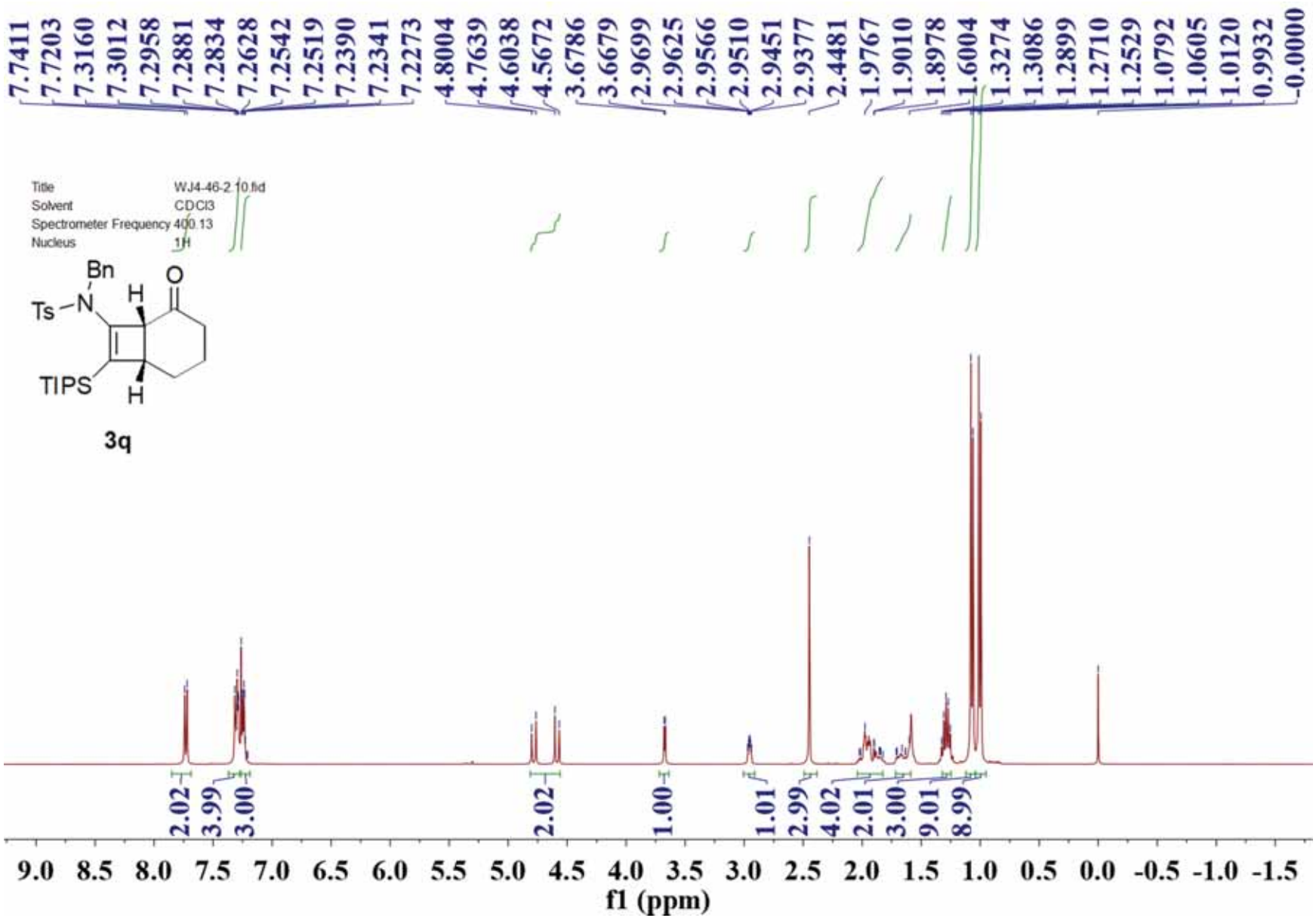
7.2635
7.2067
7.2029
7.1969
7.1902
7.1834
7.1809
7.1288
7.1191
7.1111
7.1097
7.1047
7.0289
7.0198
7.0194
7.0103
4.5501
4.5403
3.4174
3.4070
3.2718
3.2668
3.2598
3.2550
3.2474
3.2425
2.4600
2.1325
1.9700
1.9013
1.5886
-0.0000
Title WJ4-3.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
N
Ts
H
O
S
H
3p
2.00
3.01
3.00
2.00
2.00
2.01
1.00
1.01
3.00
0.99
2.02
1.00
2.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)


209.868
144.340
138.246
136.259
135.490
134.190
130.051
128.564
128.512
128.041
128.017
127.507
127.268
127.238
124.404
77.519
77.200
76.883
55.407
50.947
40.723
38.320
24.911
21.845
17.233
Title WJ4-3-C 20.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
N
H
O
Ts
S
H
3p
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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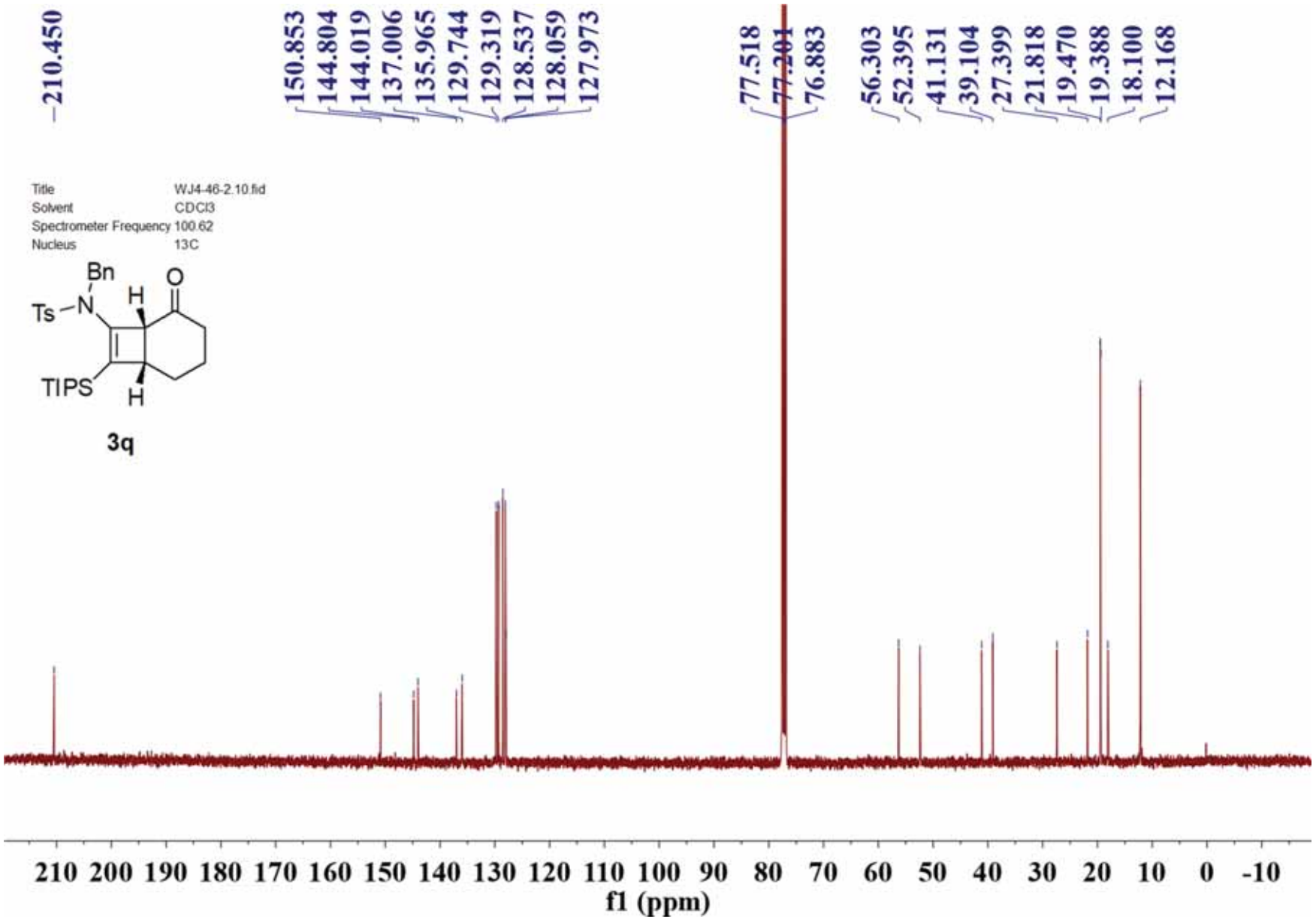
7.2881
7.2834
7.2628
7.2542
7.2519
7.2390
7.2341
7.2273
4.8004
4.7639
4.6038
4.5672
3.6786
3.6679
2.9699
2.9625
2.9566
2.9510
2.9451
2.9377
2.4481
1.9767
1.9010
1.8978
1.6004
1.3274
1.3086
1.2899
1.2710
1.2529
1.0792
1.0605
1.0120
0.9932
-0.0000
Title WJ4-46-2.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
O
Ts
N
H
TIPS
H
3q
2.02
3.99
3.00
2.02
1.00
1.01
2.99
4.02
2.01
3.00
9.01
8.99
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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144.804
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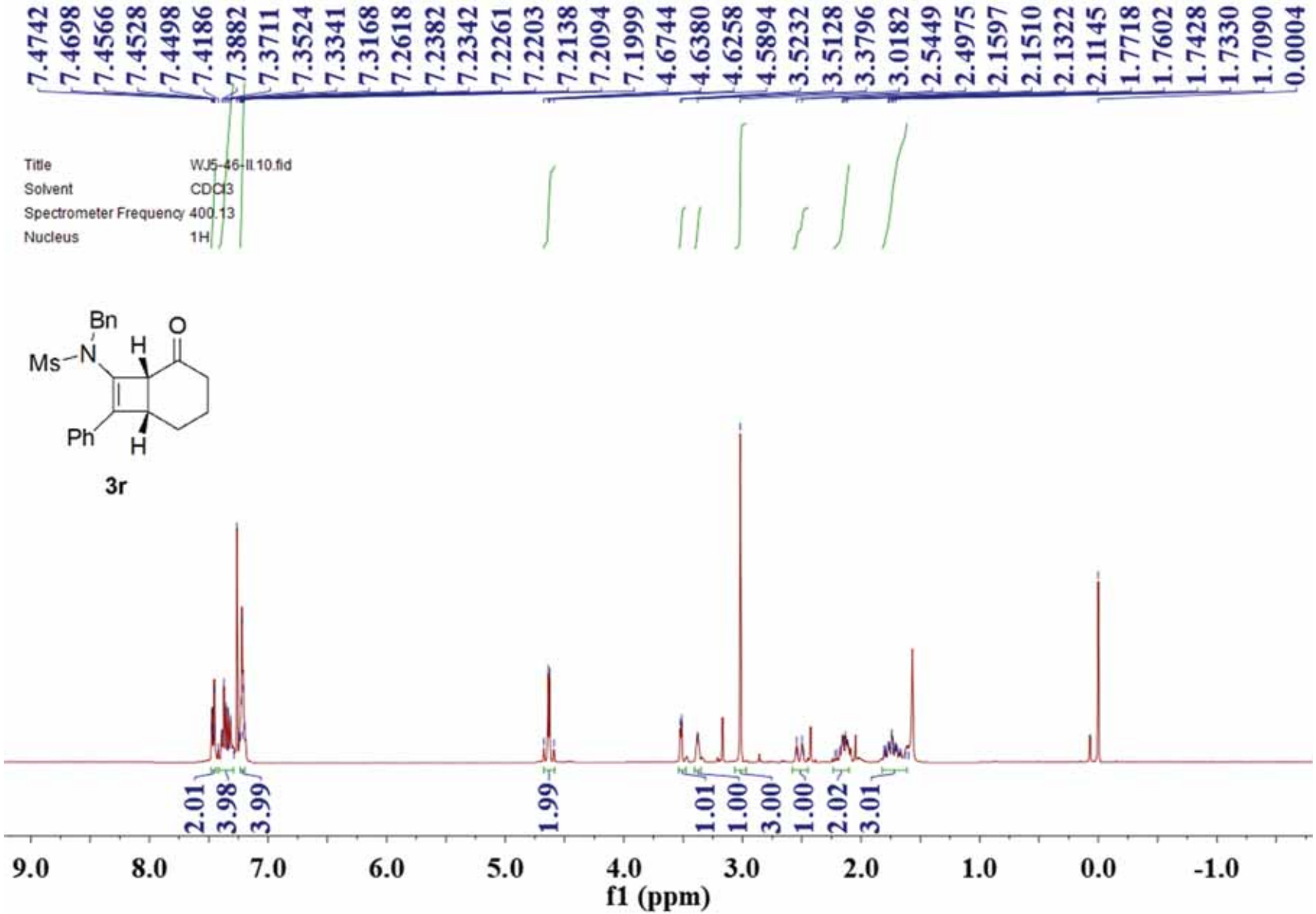
137.006
135.965
129.744
129.319
128.537
128.059
127.973
77.518
77.201
76.883
56.303
52.395
41.131
39.104
27.399
21.818
19.470
19.388
18.100
12.168
Title WJ4-46-2.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
N
H
O
Ts
TIPS
H
3q
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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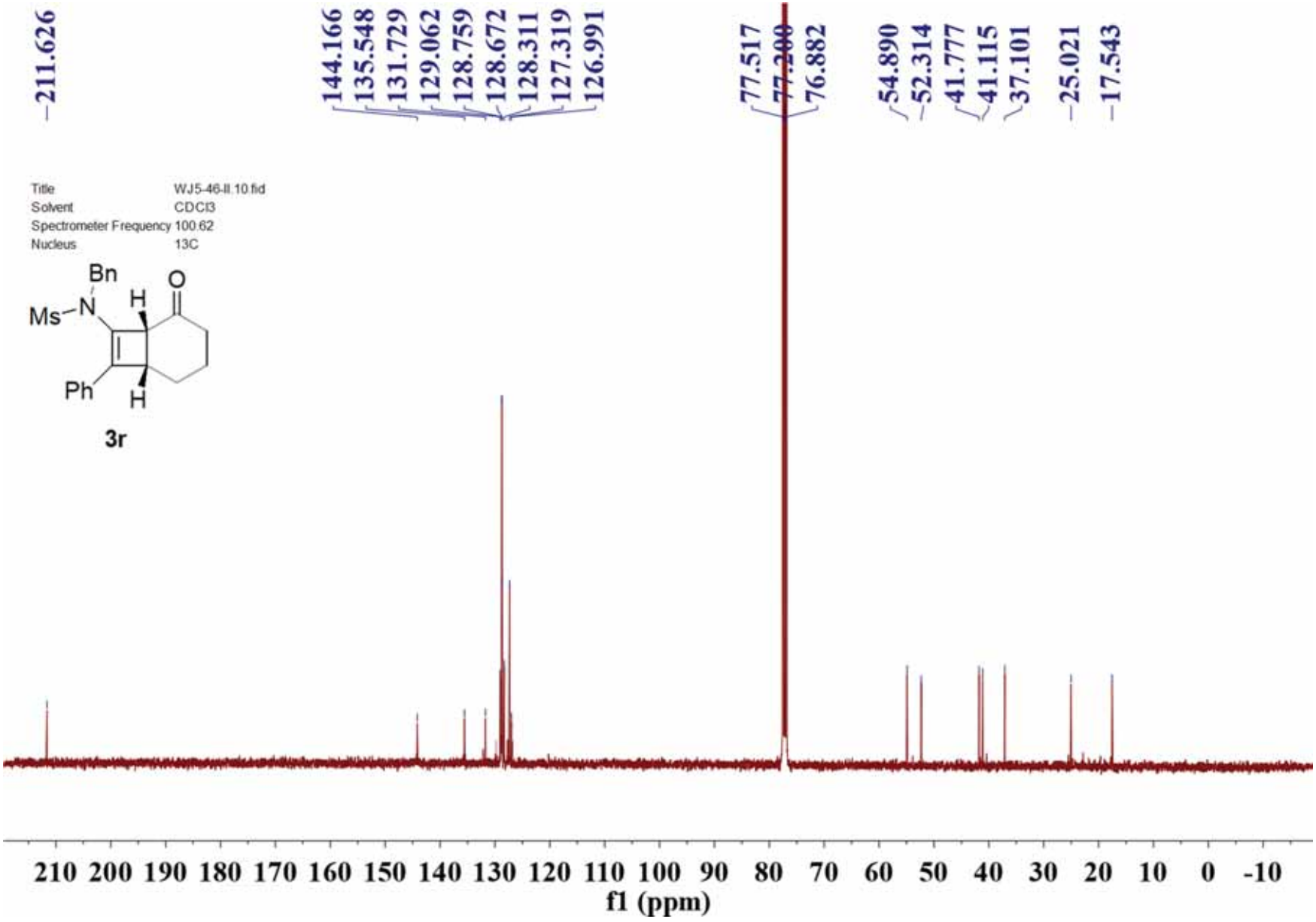
7.4498
7.4186
7.3882
7.3711
7.3524
7.3341
7.3168
7.2618
7.2382
7.2342
7.2261
7.2203
7.2138
7.2094
7.1999
4.6744
4.6380
4.6258
4.5894
3.5232
3.5128
3.3796
3.0182
2.5449
2.4975
2.1597
2.1510
2.1322
2.1145
1.7718
1.7602
1.7428
1.7330
1.7090
0.0004
Title WJ5-46-II.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
O
H
Ms
N
Ph
H
3r
2.01
3.98
3.99
1.99
1.01
1.00
3.00
1.00
2.02
3.01
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
f1 (ppm)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135.548
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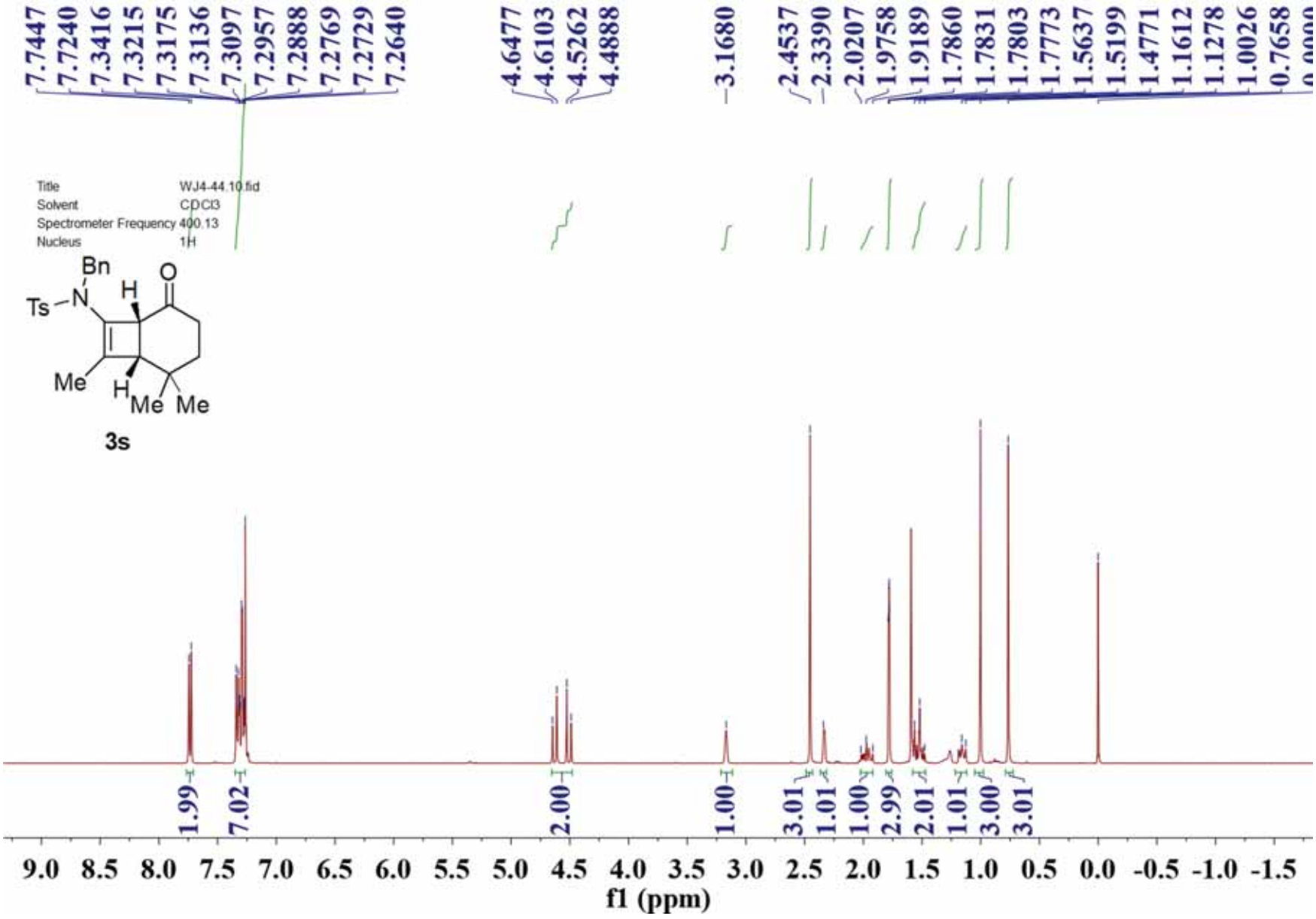
127.319
126.991
77.517
77.200
76.882
54.890
52.314
41.777
41.115
37.101
25.021
17.543
Title WJ5-46-II.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
Ms
N
H
O
Ph
H
3r
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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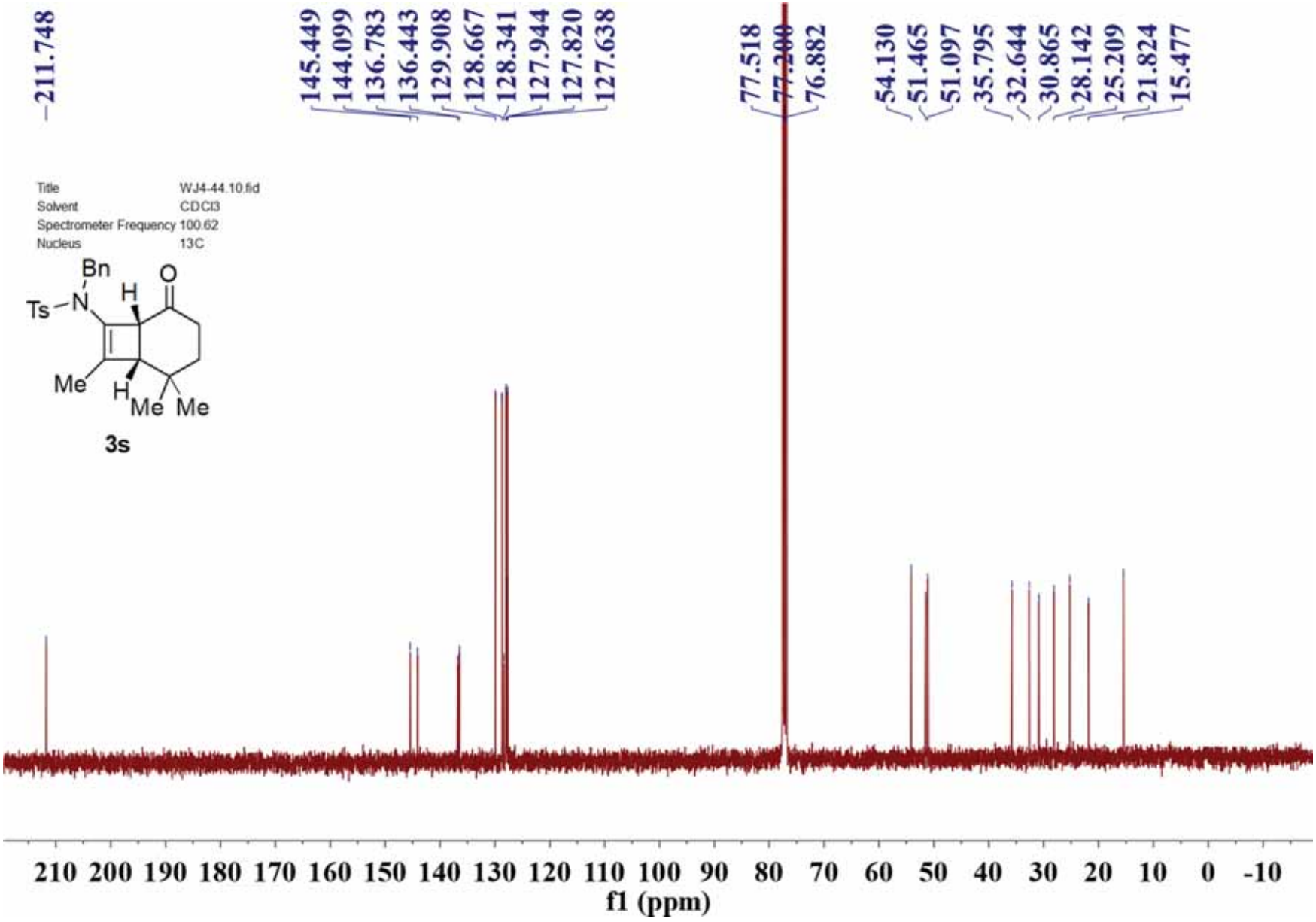
7.3175
7.3136
7.3097
7.2957
7.2888
7.2769
7.2729
7.2640
4.6477
4.6103
4.5262
4.4888
3.1680
2.4537
2.3390
2.0207
1.9758
1.9189
1.7860
1.7831
1.7803
1.7773
1.5637
1.5199
1.4771
1.1612
1.1278
1.0026
0.7658
Title WJ4-44.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
O
H
Ts
N
Me
H
Me
Me
3s
1.99
7.02
2.00
1.00
3.01
1.01
1.00
2.99
2.01
1.01
3.00
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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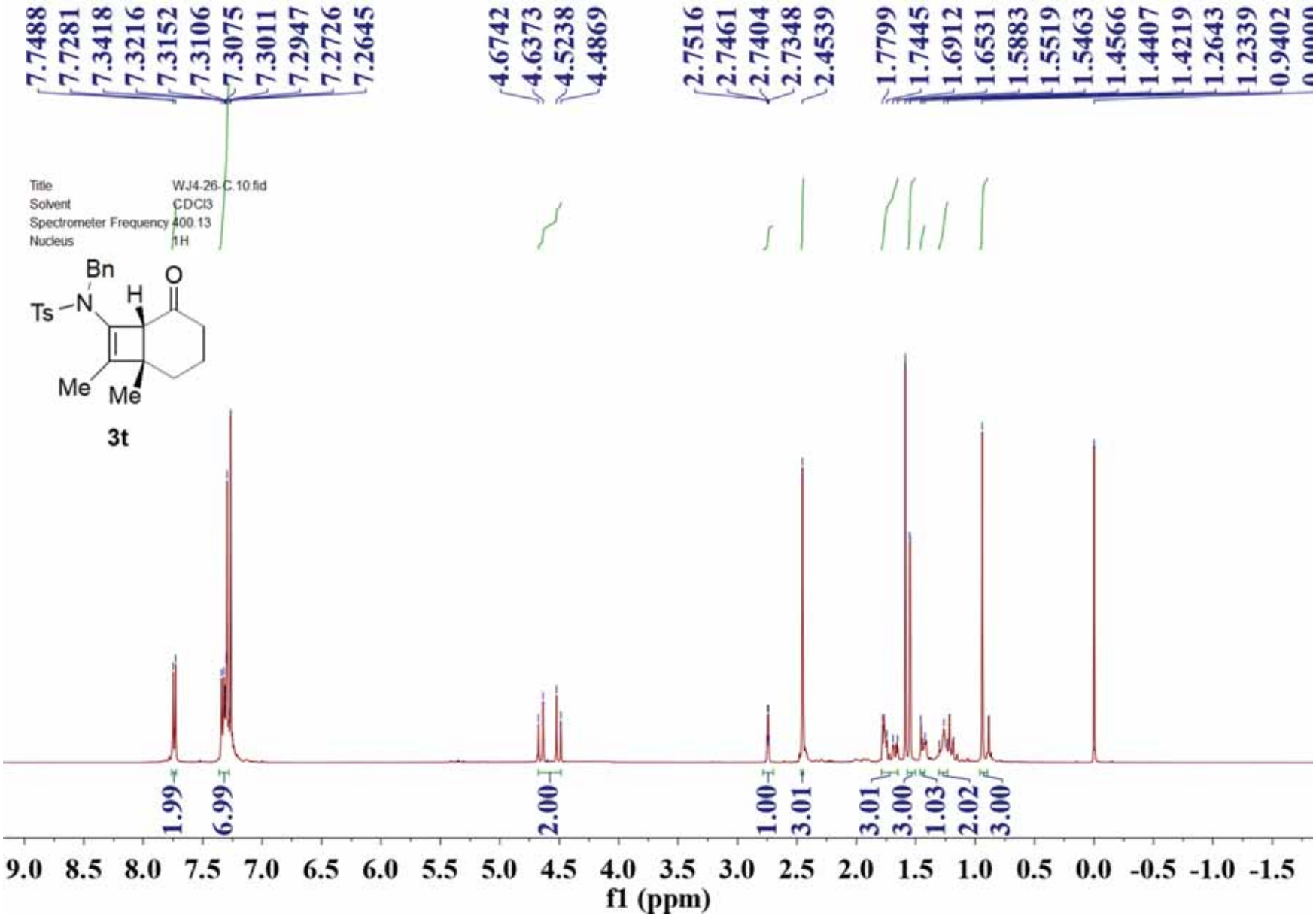
128.341
127.944
127.820
127.638
77.518
77.200
76.882
54.130
51.465
51.097
35.795
32.644
30.865
28.142
25.209
21.824
15.477
Title WJ4-44.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
O
H
Ts
N
Me
H
Me
Me
3s
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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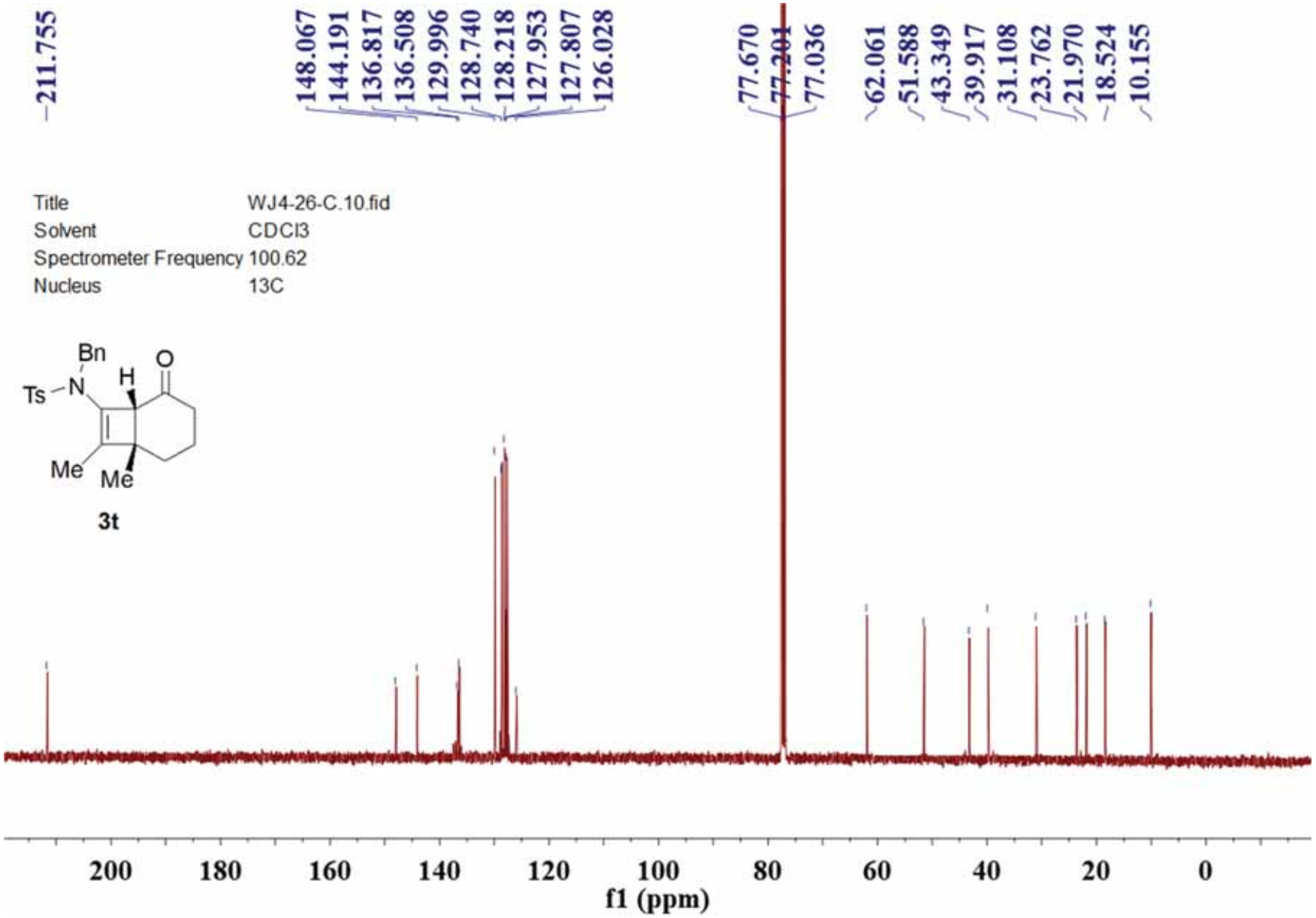
7.3216
7.3152
7.3106
7.3075
7.3011
7.2947
7.2726
7.2645
4.6742
4.6373
4.5238
4.4869
2.7516
2.7461
2.7404
2.7348
2.4539
1.7799
1.7445
1.6912
1.6531
1.5883
1.5519
1.5463
1.4566
1.4407
1.4219
1.2643
1.2339
0.9402
Title WJ4-26-C.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
Ts
N
H
O
Me
Me
3t
1.99
6.99
2.00
1.00
3.01
3.01
3.00
1.03
2.02
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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128.218
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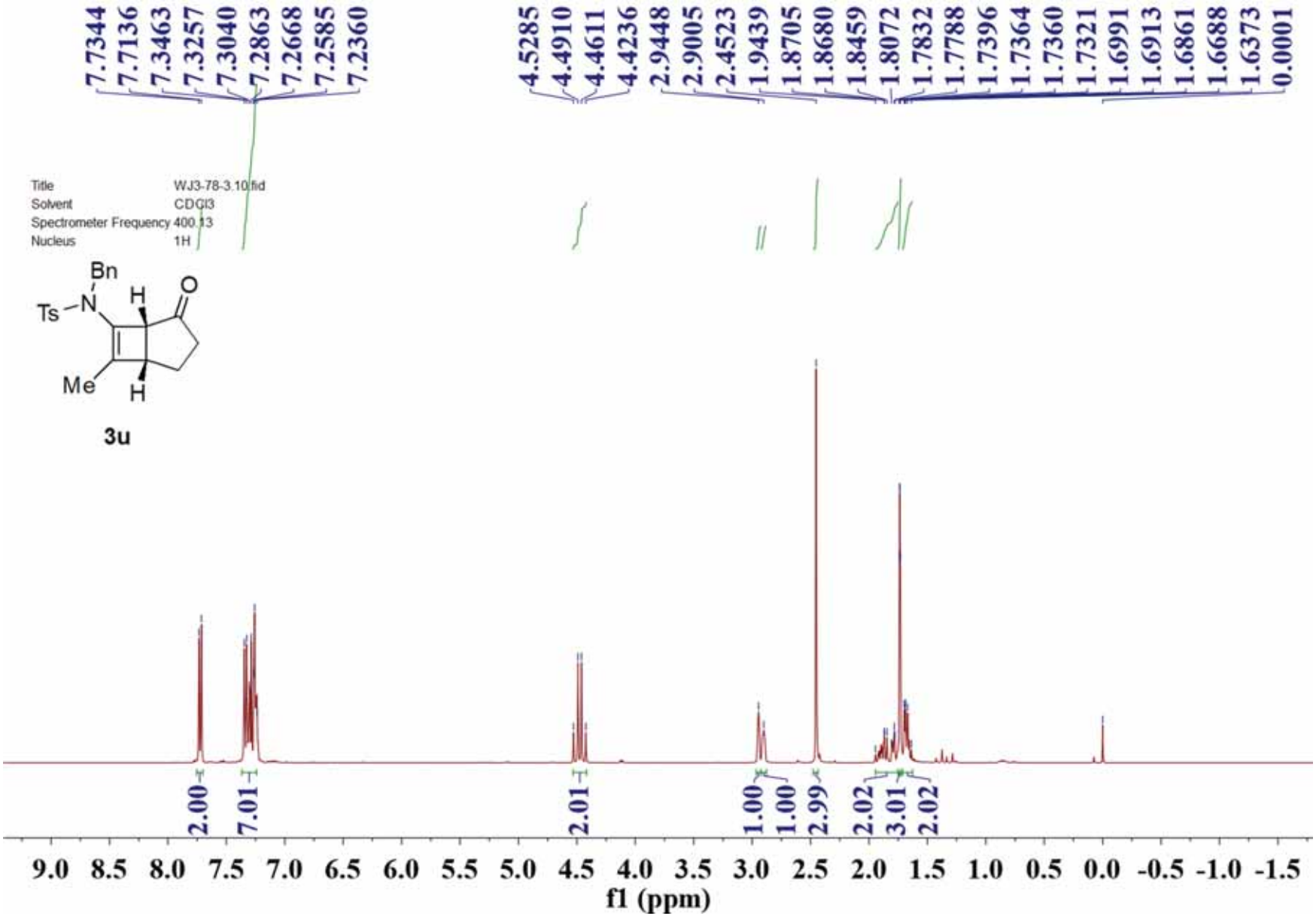
127.807
126.028
77.670
77.201
77.036
62.061
51.588
43.349
39.917
31.108
23.762
21.970
18.524
10.155
Title WJ4-26-C.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
N
H
O
Ts
Me
Me
3t
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)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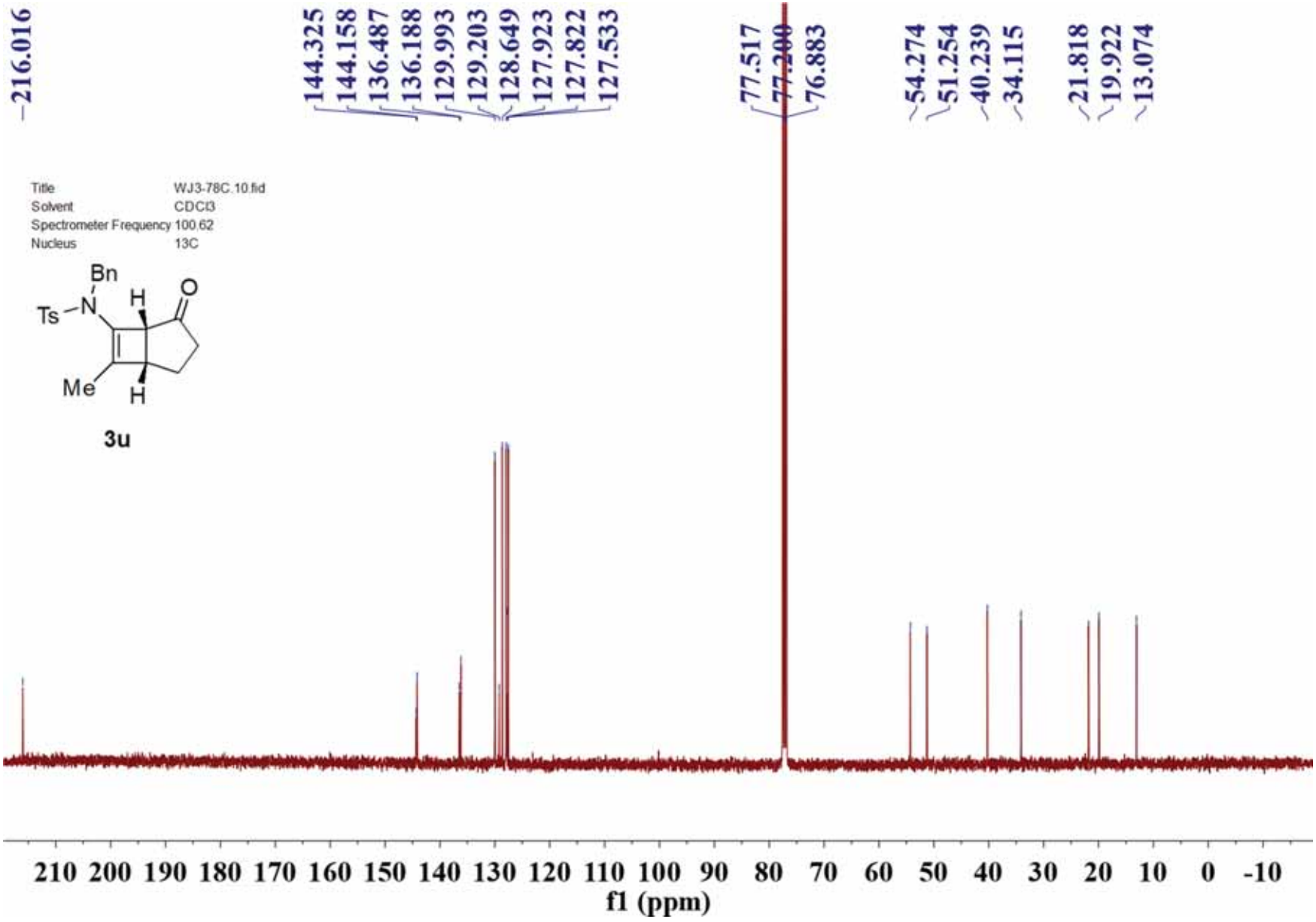
7.3040
7.2863
7.2668
7.2585
7.2360
4.5285
4.4910
4.4611
4.4236
2.9448
2.9005
2.4523
1.9439
1.8705
1.8680
1.8459
1.8072
1.7832
1.7788
1.7396
1.7364
1.7360
1.7321
1.6991
1.6913
1.6861
1.6688
1.6373
0.0001
Title WJ3-78-3.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
Ts
N
H
O
Me
H
3u
2.00
7.01
2.01
1.00
1.00
2.99
2.02
3.01
2.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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128.649
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127.822
127.533
77.517
77.200
76.883
54.274
51.254
40.239
34.115
21.818
19.922
13.074
Title WJ3-78C.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
Ts
N
H
O
Me
H
3u
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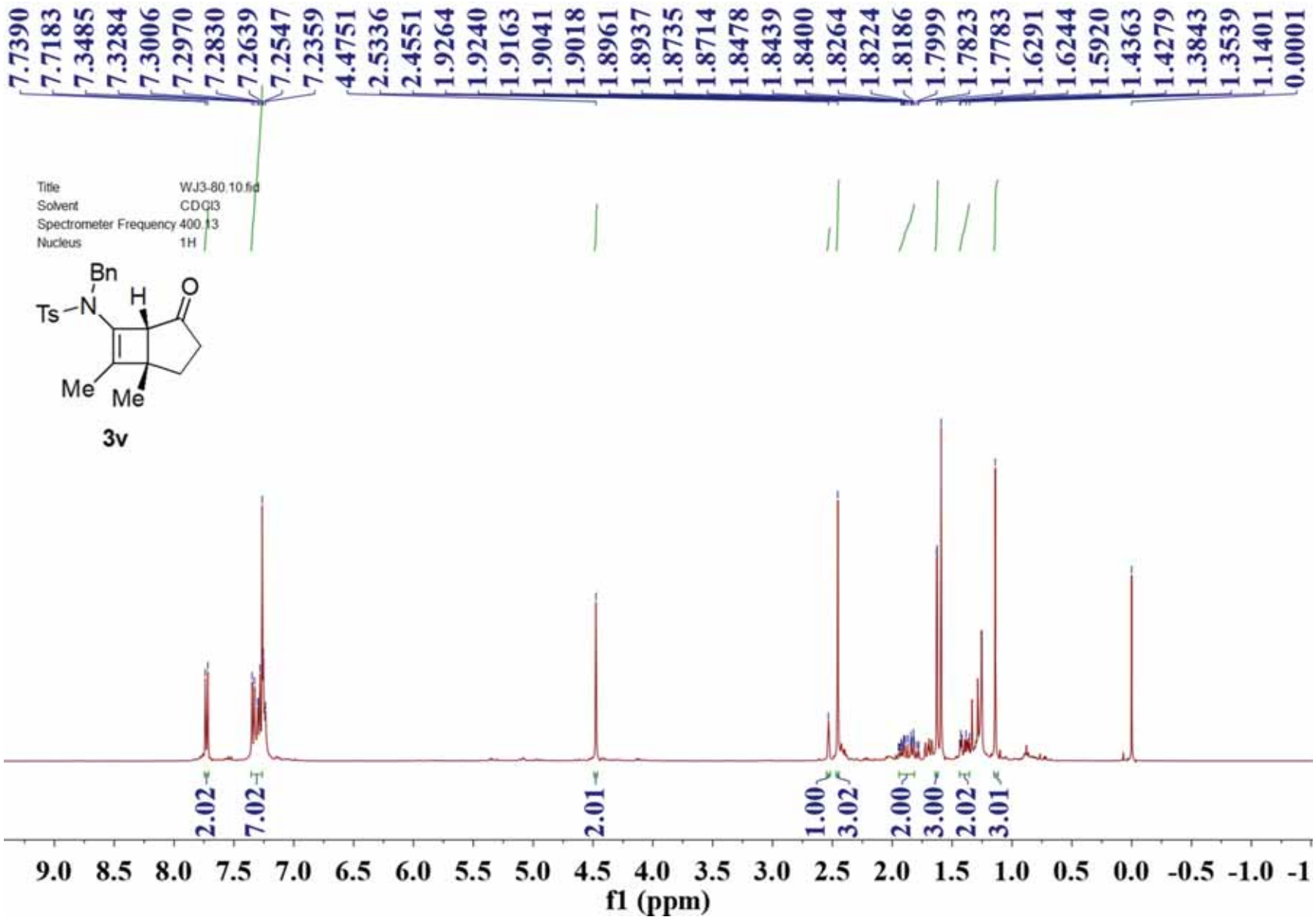
f1 (ppm)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7.2639
7.2547
7.2359
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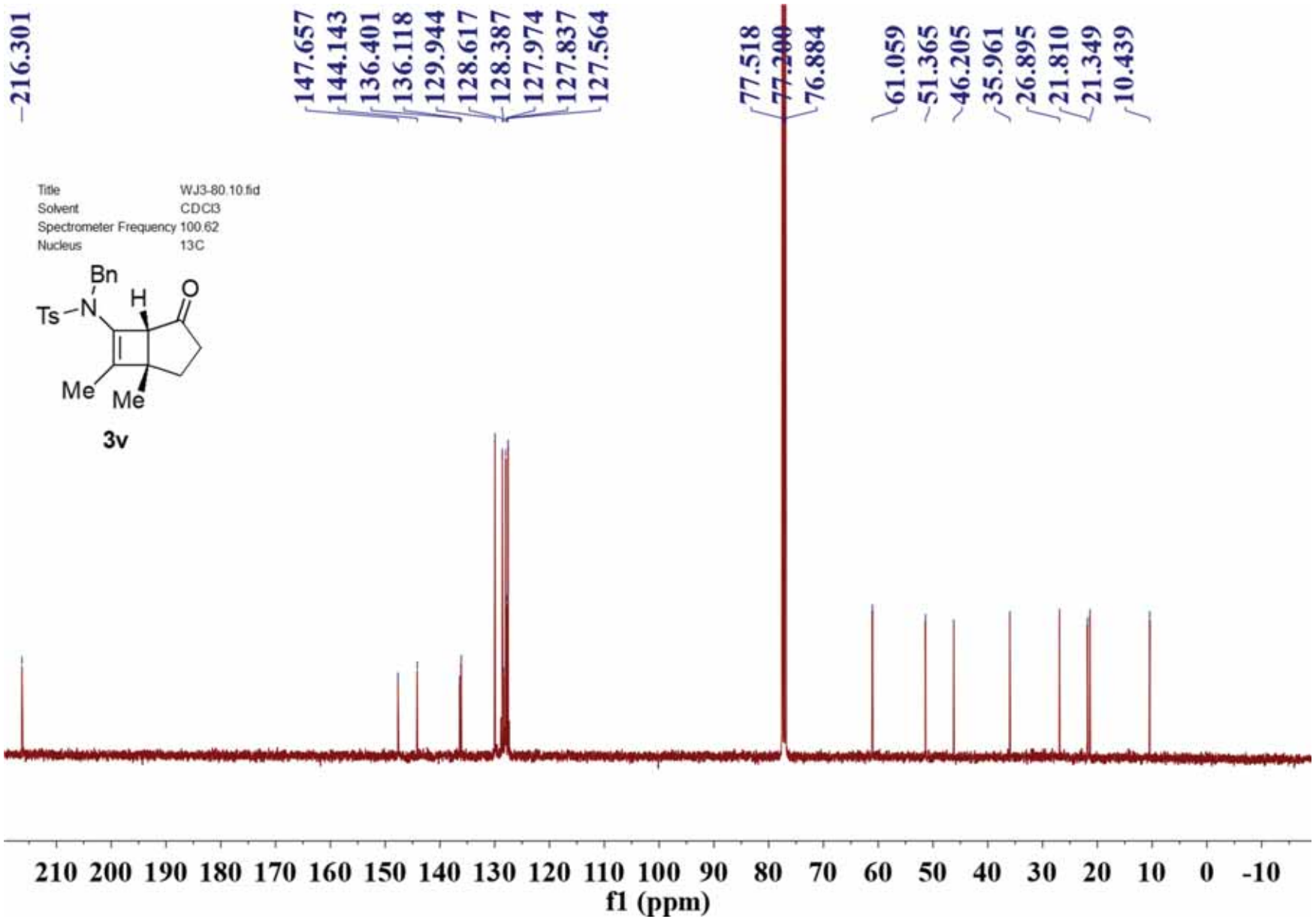
2.5336
2.4551
1.9264
1.9240
1.9163
1.9041
1.9018
1.8961
1.8937
1.8735
1.8714
1.8478
1.8439
1.8400
1.8264
1.8224
1.8186
1.7999
1.7823
1.7783
1.6291
1.6244
1.5920
1.4363
1.4279
1.3843
1.3539
1.1401
0.0001
Title WJ3-80.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
Ts
N
H
O
Me
Me
3v
2.02
7.02
2.01
1.00
3.02
2.00
3.00
2.02
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1
f1 (ppm)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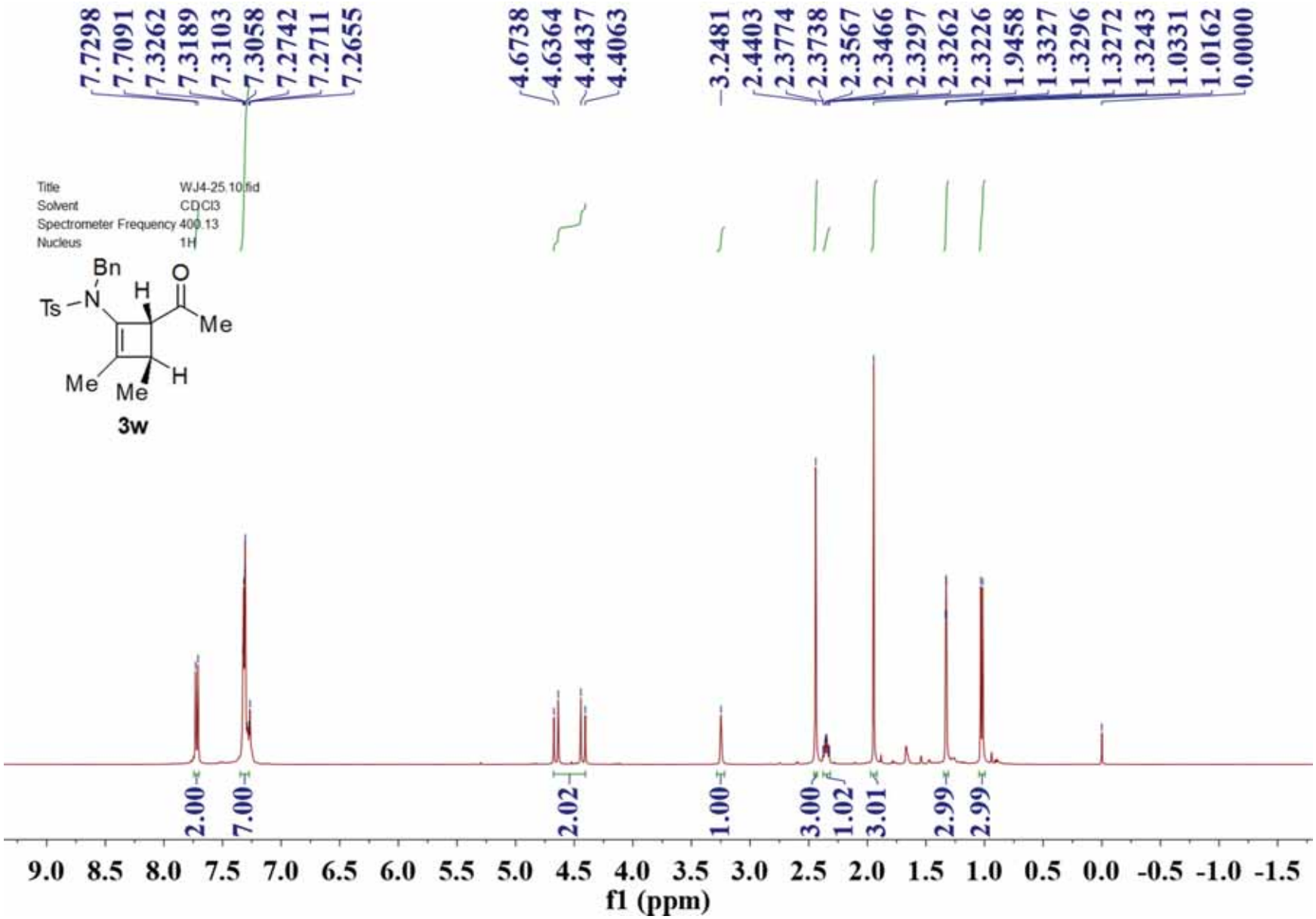
127.564
77.518
77.200
76.884
61.059
51.365
46.205
35.961
26.895
21.810
21.349
10.439
Title WJ3-80.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
H
O
Ts
N
Me
Me
3v
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.2742
7.2711
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4.6364
4.4437
4.4063
3.2481
2.4403
2.3774
2.3738
2.3567
2.3466
2.3297
2.3262
2.3226
1.9458
1.3327
1.3296
1.3272
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1.0162
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Title WJ4-25.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
N
H
O
Ts
Me
Me
Me
H
3w
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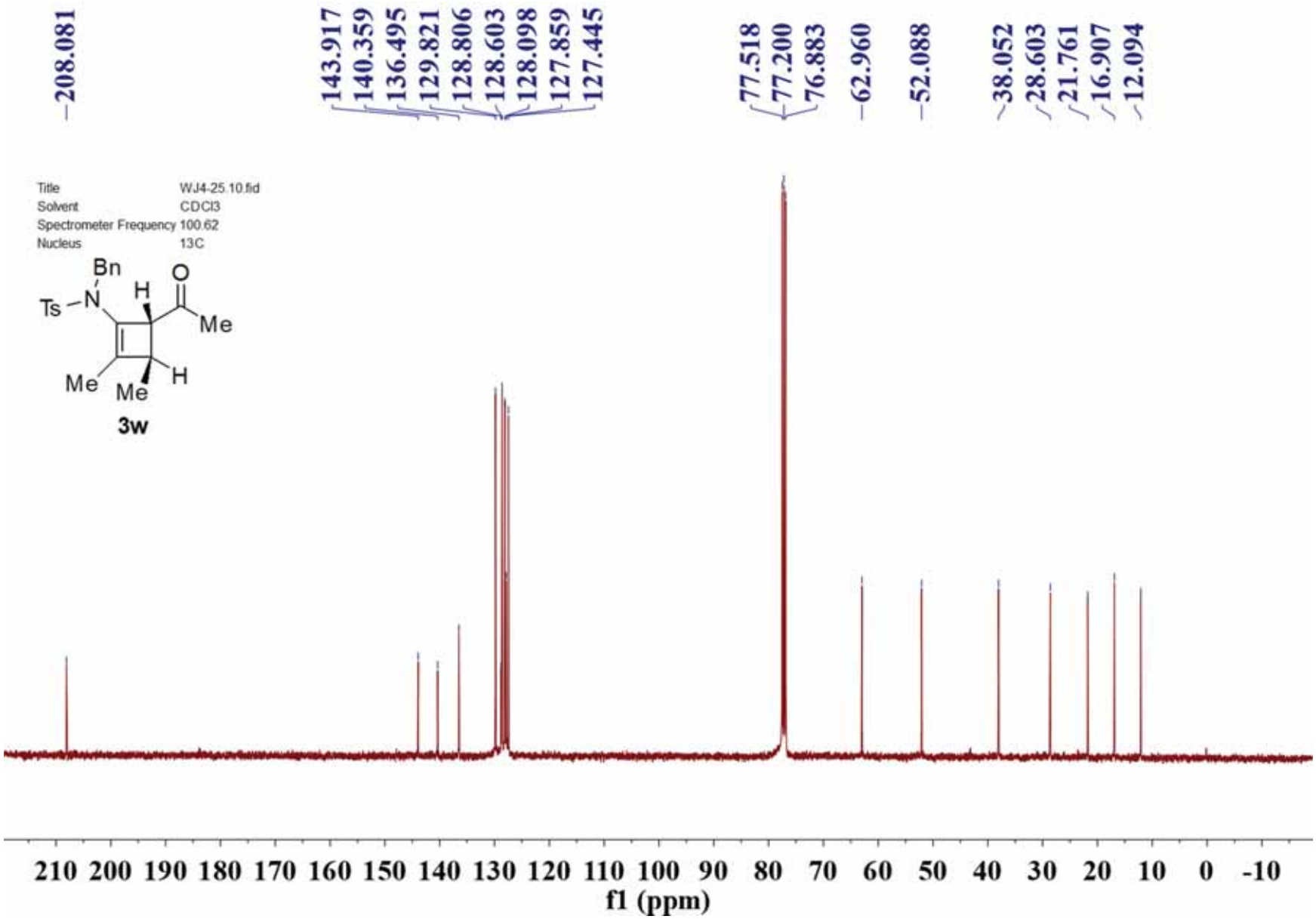
7.00
2.02
1.00
3.00
1.02
3.01
2.99
2.99
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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136.495
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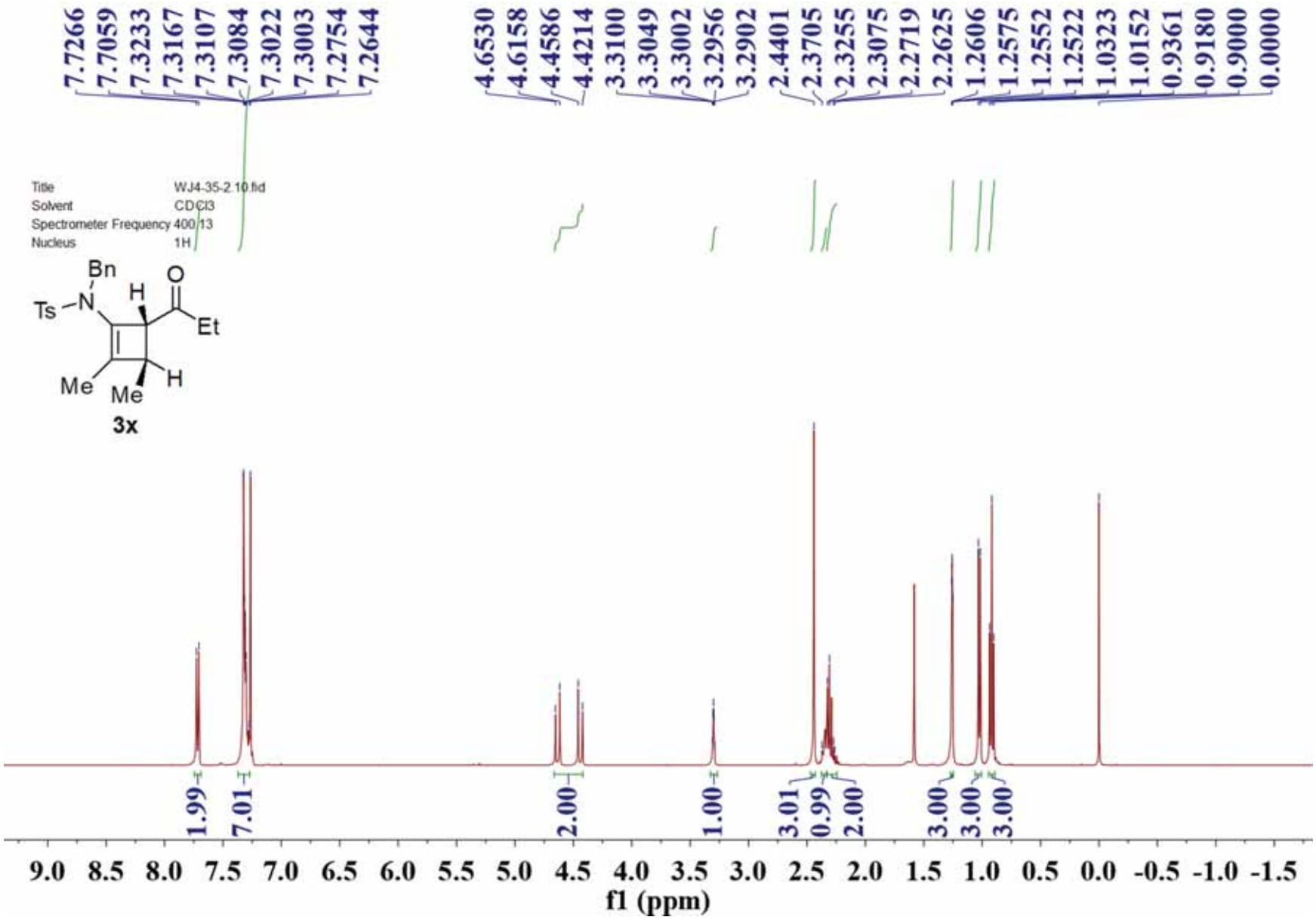
128.603
128.098
127.859
127.445
77.518
77.200
76.883
62.960
52.088
38.052
28.603
21.761
16.907
12.094
Title WJ4-25.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
N
H
O
Ts
Me
Me
Me
H
3w
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.3107
7.3084
7.3022
7.3003
7.2754
7.2644
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4.6158
4.4586
4.4214
3.3100
3.3049
3.3002
3.2956
3.2902
2.4401
2.3705
2.3255
2.3075
2.2719
2.2625
1.2606
1.2575
1.2552
1.2522
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0.9000
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Title WJ4-35-2.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
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Bn
O
H
Ts
N
Et
Me
Me
H
3x
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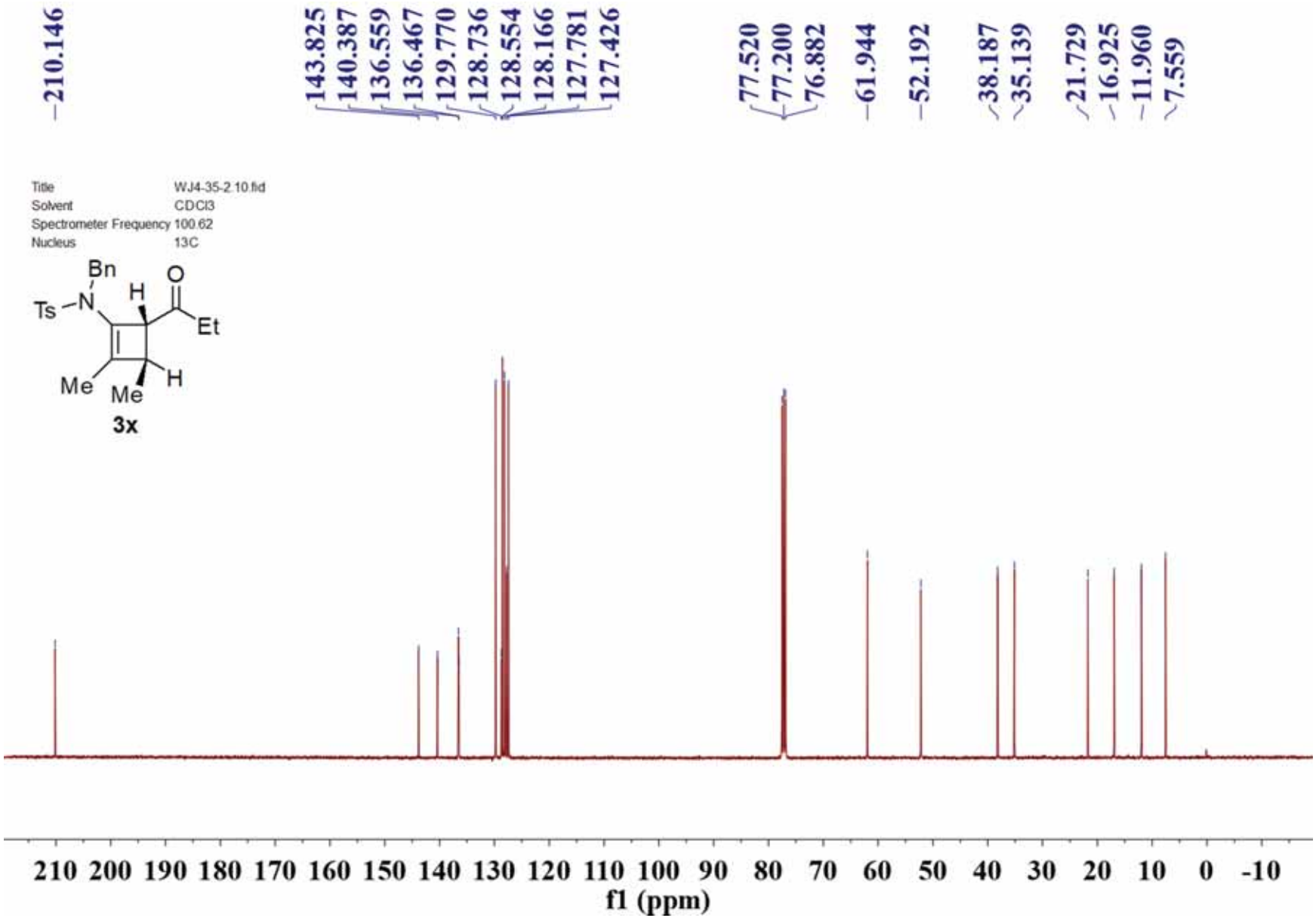
7.01
2.00
1.00
3.01
0.99
2.00
3.00
3.00
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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128.554
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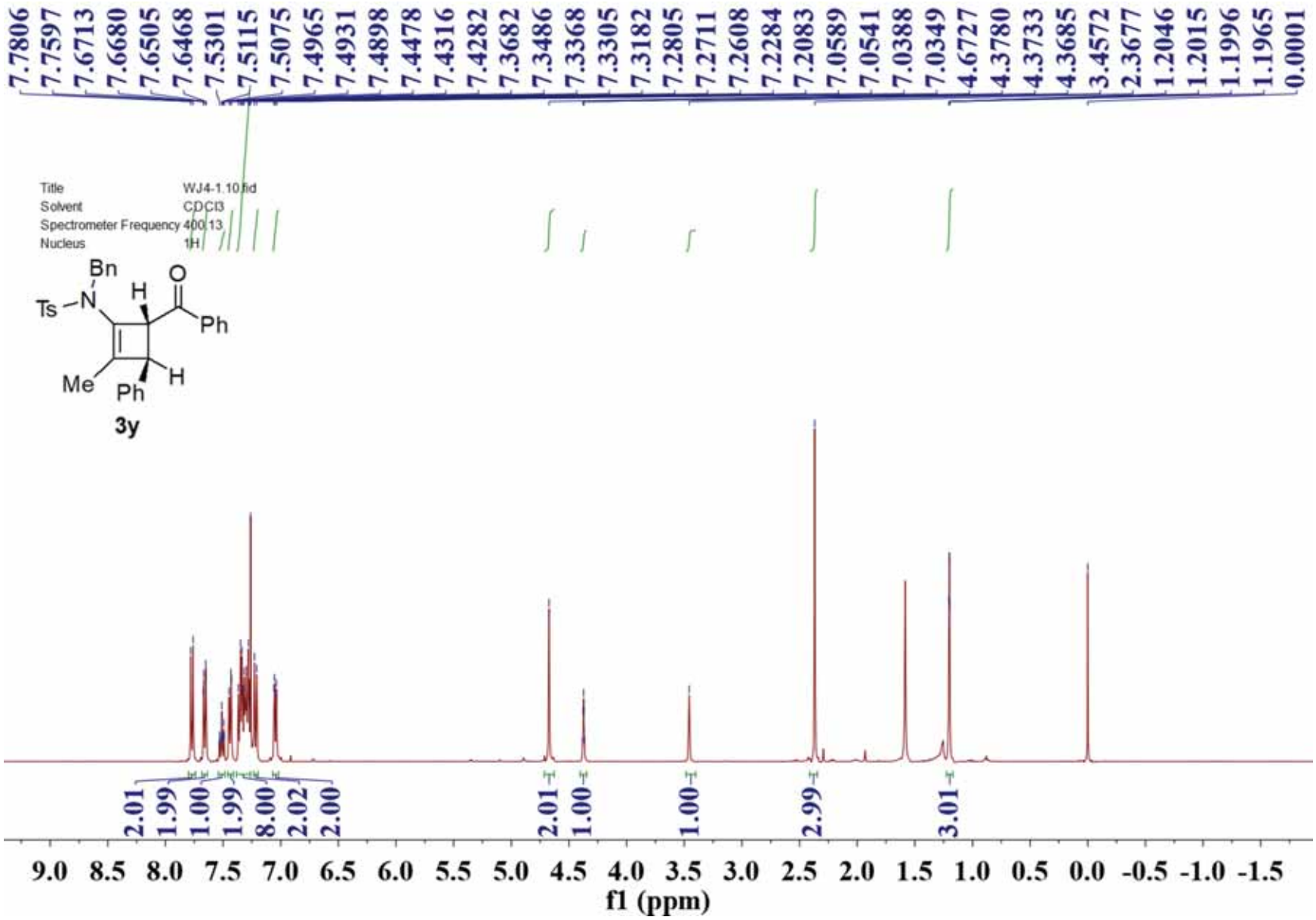
127.426
77.520
77.200
76.882
61.944
52.192
38.187
35.139
21.729
16.925
11.960
7.559
Title WJ4-35-2.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
O
H
Ts
N
Et
Me
Me
H
3x
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.5075
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7.4931
7.4898
7.4478
7.4316
7.4282
7.3682
7.3486
7.3368
7.3305
7.3182
7.2805
7.2711
7.2608
7.2284
7.2083
7.0589
7.0541
7.0388
7.0349
4.6727
4.3780
4.3733
4.3685
3.4572
2.3677
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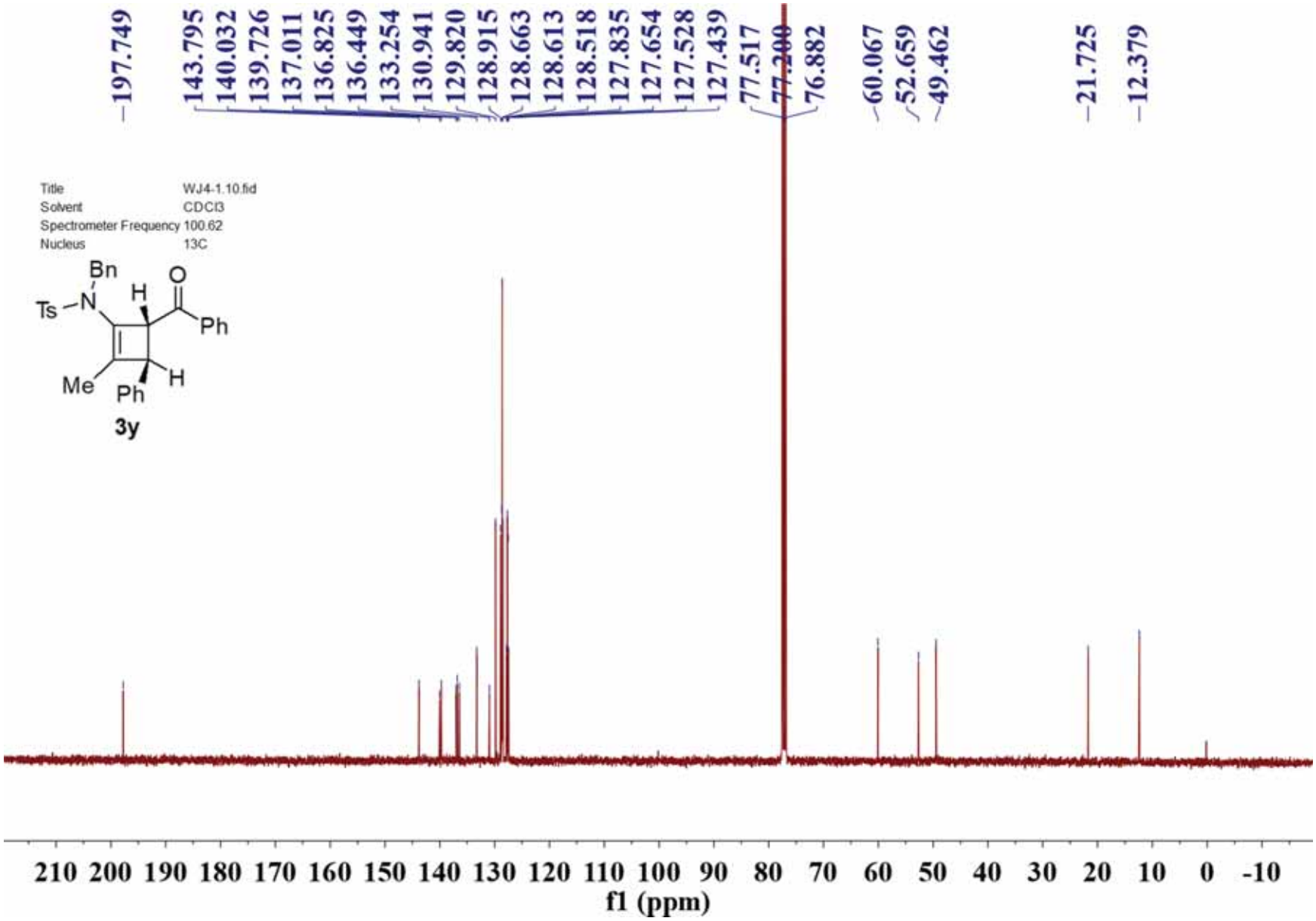
1.2015
1.1996
1.1965
0.0001
Title WJ4-1.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
N
Ts
H
O
Ph
Me
Ph
H
3y
2.01
1.99
1.00
1.99
8.00
2.02
2.00
2.01
1.00
1.00
2.99
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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133.254
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129.820
128.915
128.663
128.613
128.518
127.835
127.654
127.528
127.439
77.517
77.200
76.882
60.067
52.659
49.462
21.725
12.379
Title WJ4-1.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
N
Ts
H
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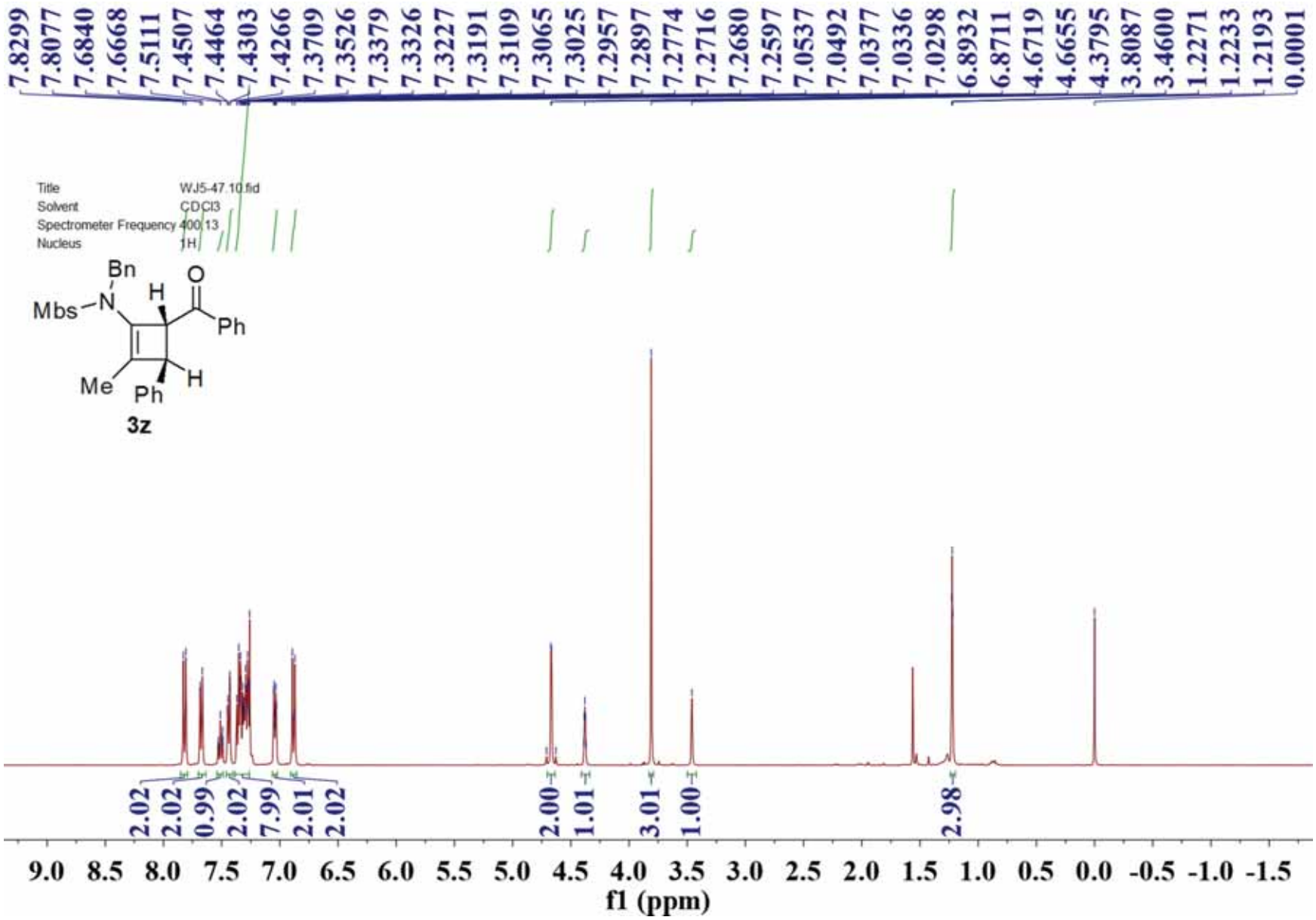
Ph
Me
Ph
H
3y
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.4266
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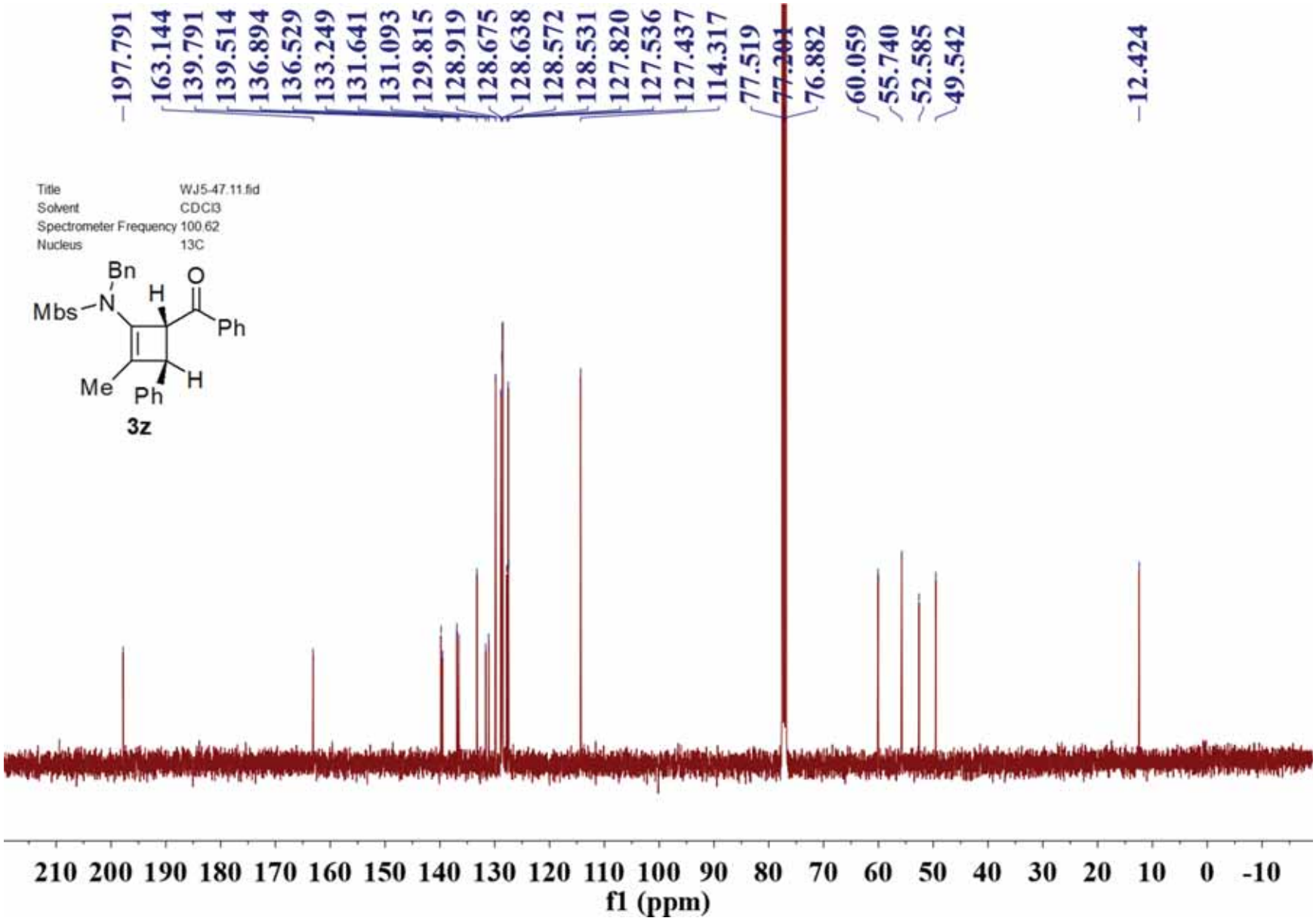
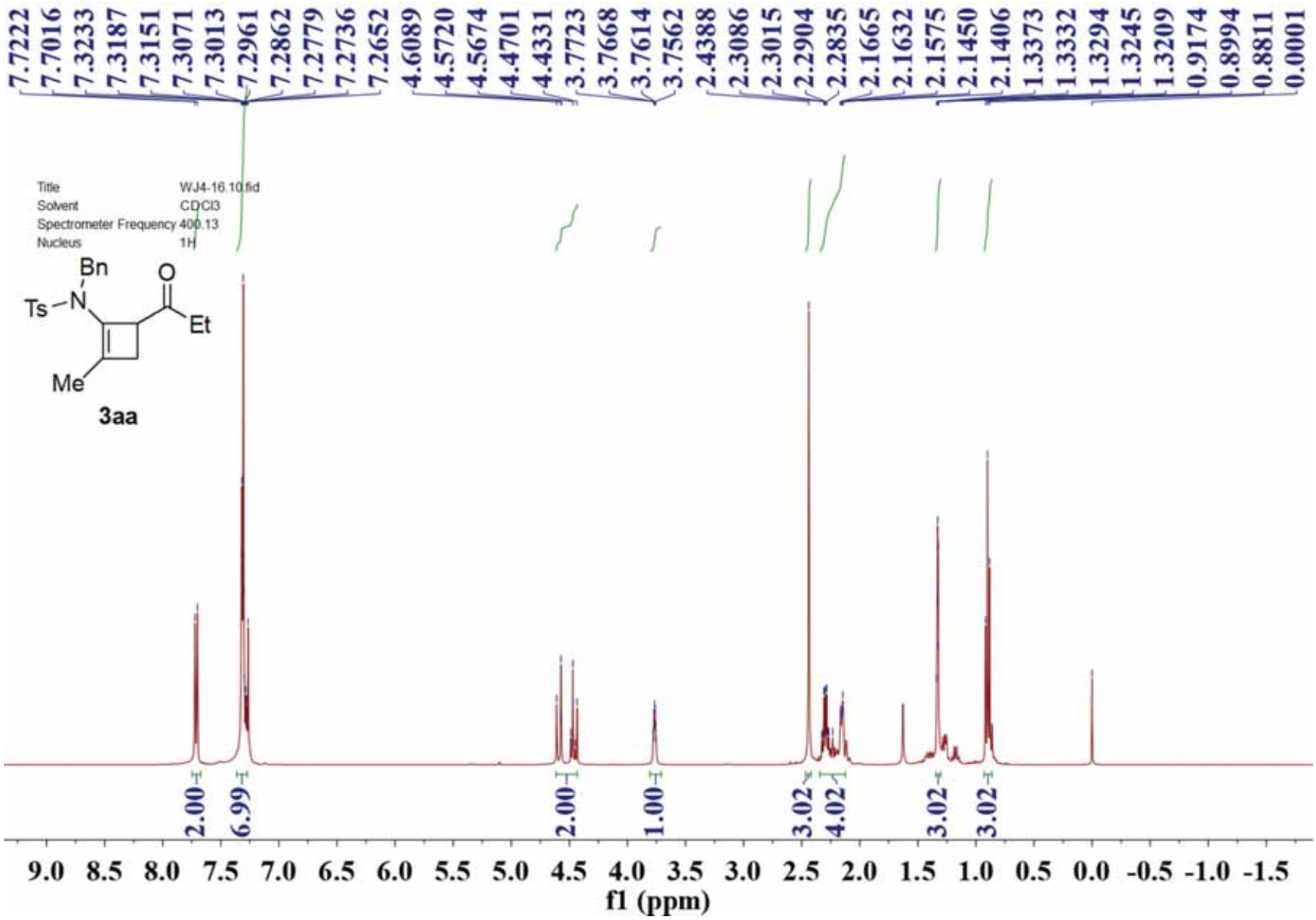
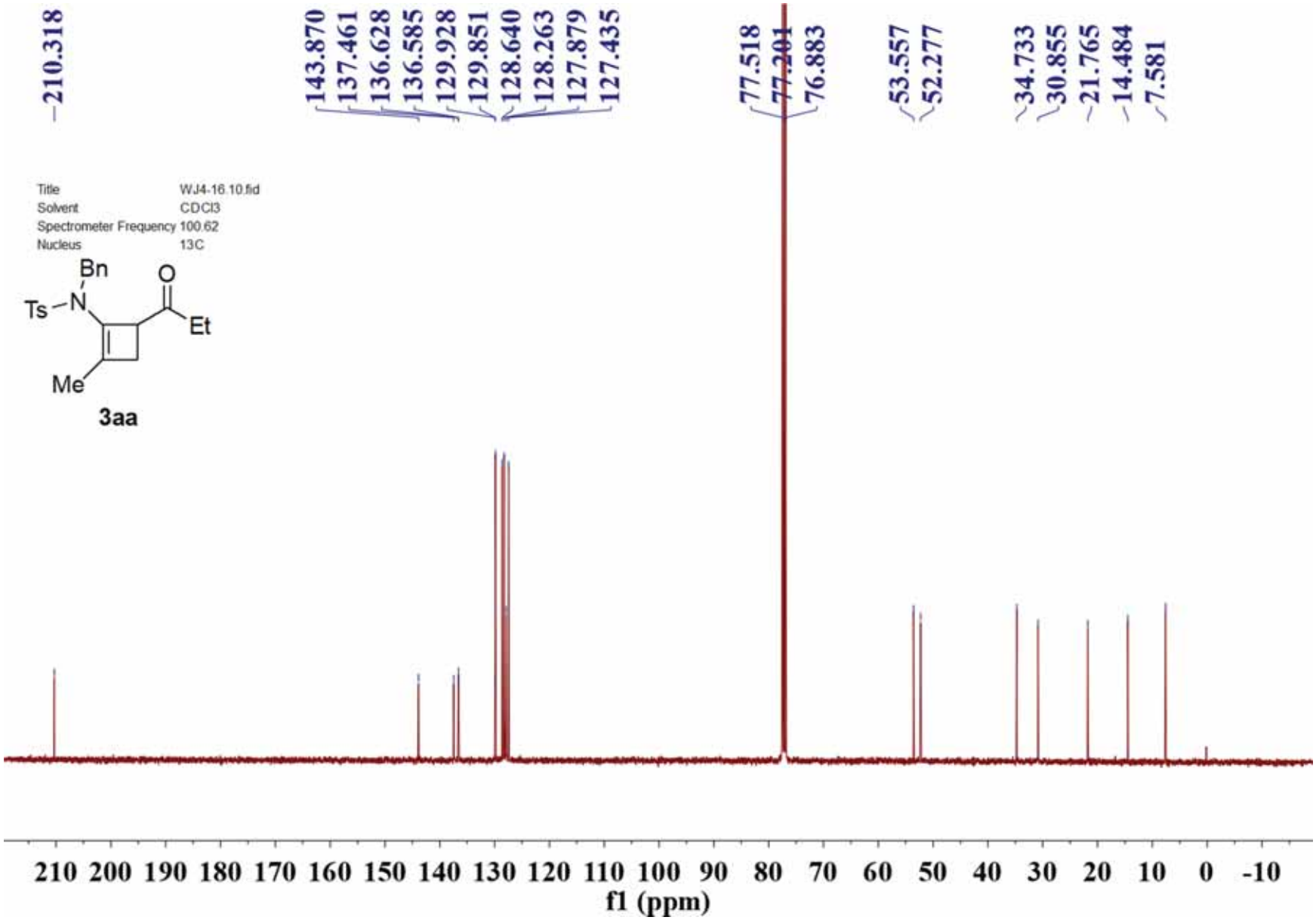
7.3526
7.3379
7.3326
7.3227
7.3191
7.3109
7.3065
7.3025
7.2957
7.2897
7.2774
7.2716
7.2680
7.2597
7.0537
7.0492
7.0377
7.0336
7.0298
6.8932
6.8711
4.6719
4.6655
4.3795
3.8087
3.4600
1.2271
1.2233
1.2193
0.0001
Title WJ5-47.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
O
H
Mbs
N
Ph
Me
Ph
H
3z
2.02
2.02
0.99
2.02
7.99
2.01
2.02
2.00
1.01
3.01
1.00
2.98
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)


197.791
163.144
139.791
139.514
136.894
136.529
133.249
131.641
131.093
129.815
128.919
128.675
128.638
128.572
128.531
127.820
127.536
127.437
114.317
77.519
77.201
76.882
60.059
55.740
52.585
49.542
12.424
Title WJ5-47.11.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
O
H
Mbs
N
Ph
Me
Ph
H
3z
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.7222
7.7016
7.3233
7.3187
7.3151
7.3071
7.3013
7.2961
7.2862
7.2779
7.2736
7.2652
4.6089
4.5720
4.5674
4.4701
4.4331
3.7723
3.7668
3.7614
3.7562
2.4388
2.3086
2.3015
2.2904
2.2835
2.1665
2.1632
2.1575
2.1450
2.1406
1.3373
1.3332
1.3294
1.3245
1.3209
0.9174
0.8994
0.8811
0.0001
Title WJ4-16.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
O
Ts
N
Et
Me
3aa
2.00
6.99
2.00
1.00
3.02
4.02
3.02
3.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)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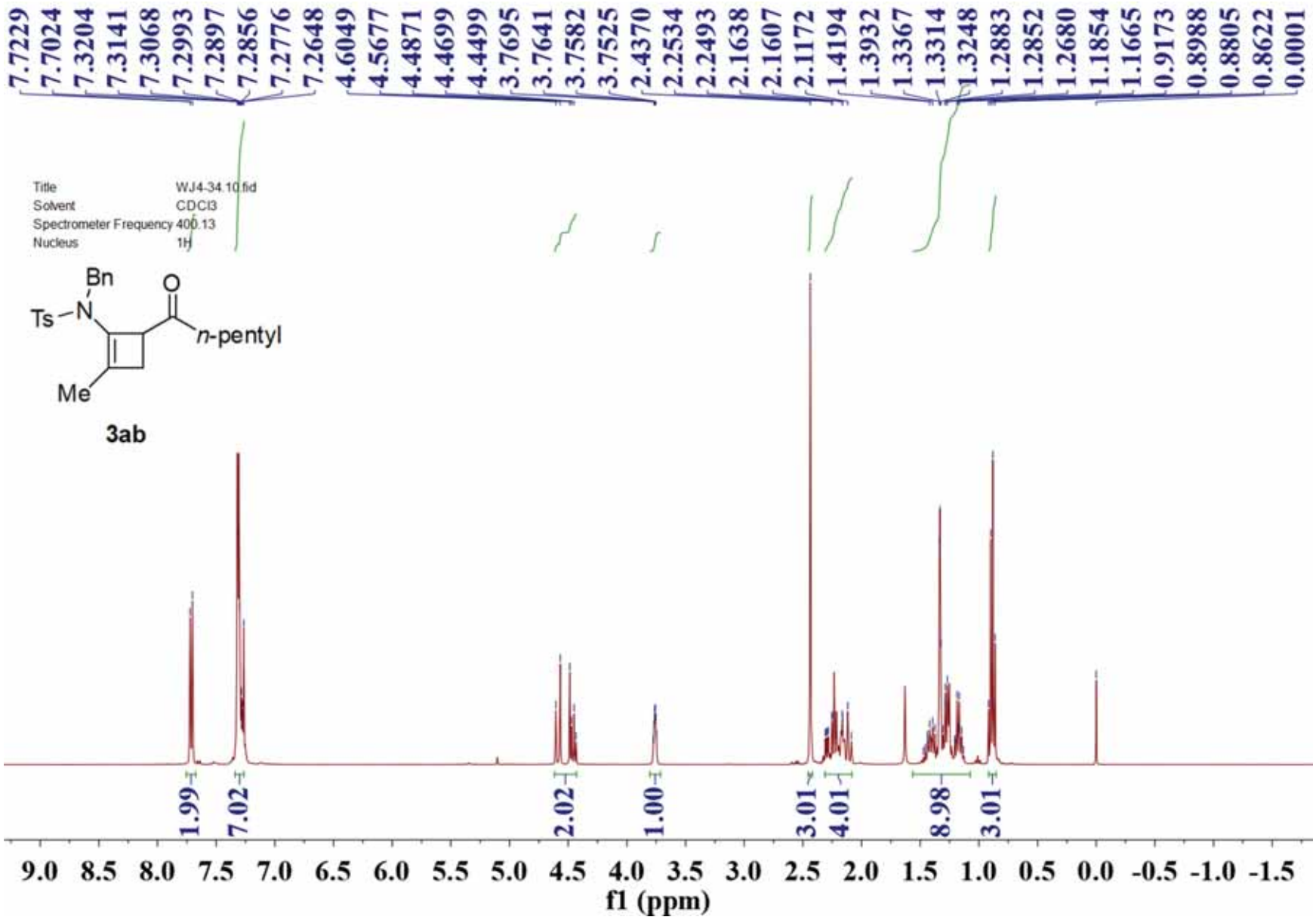
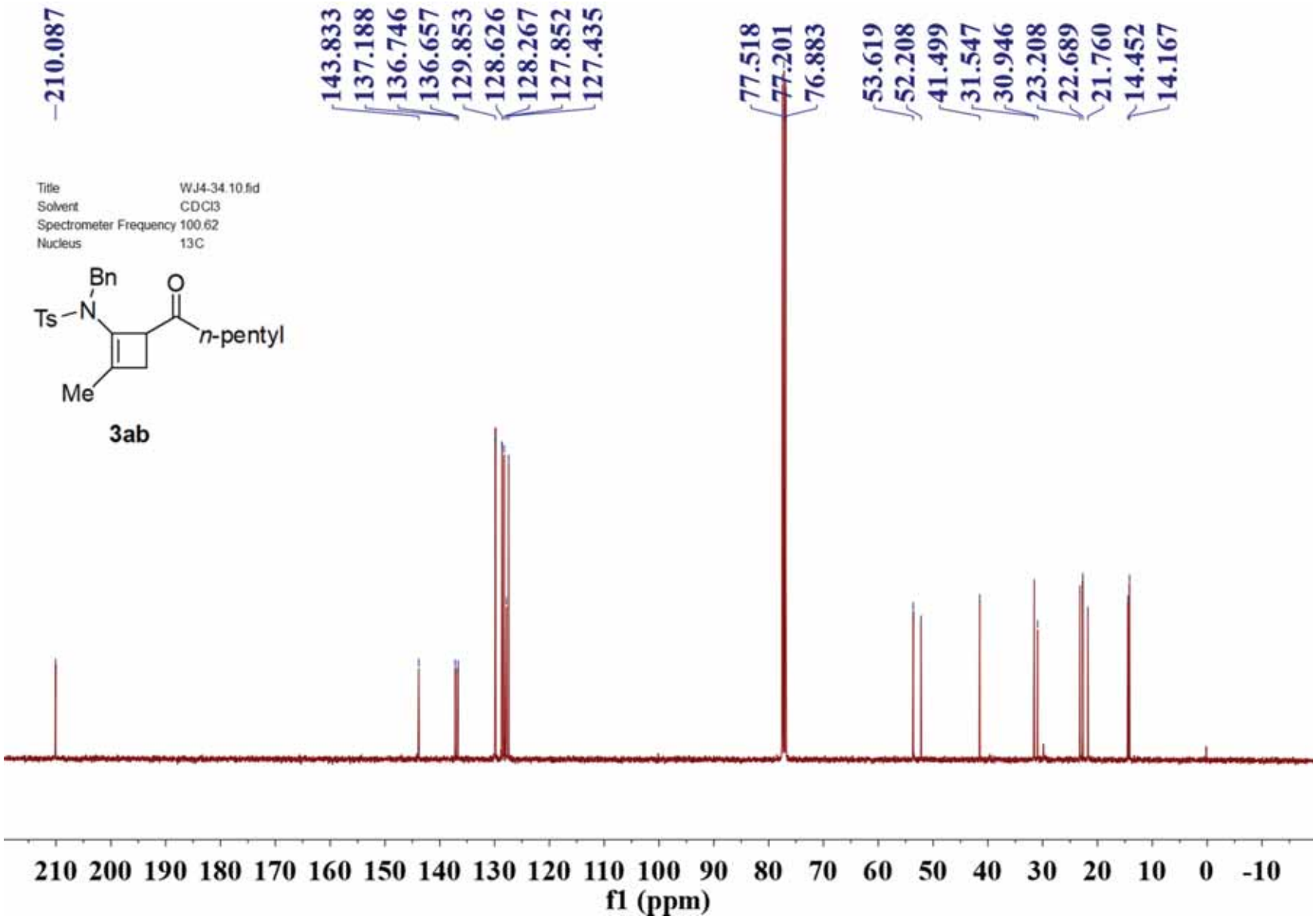
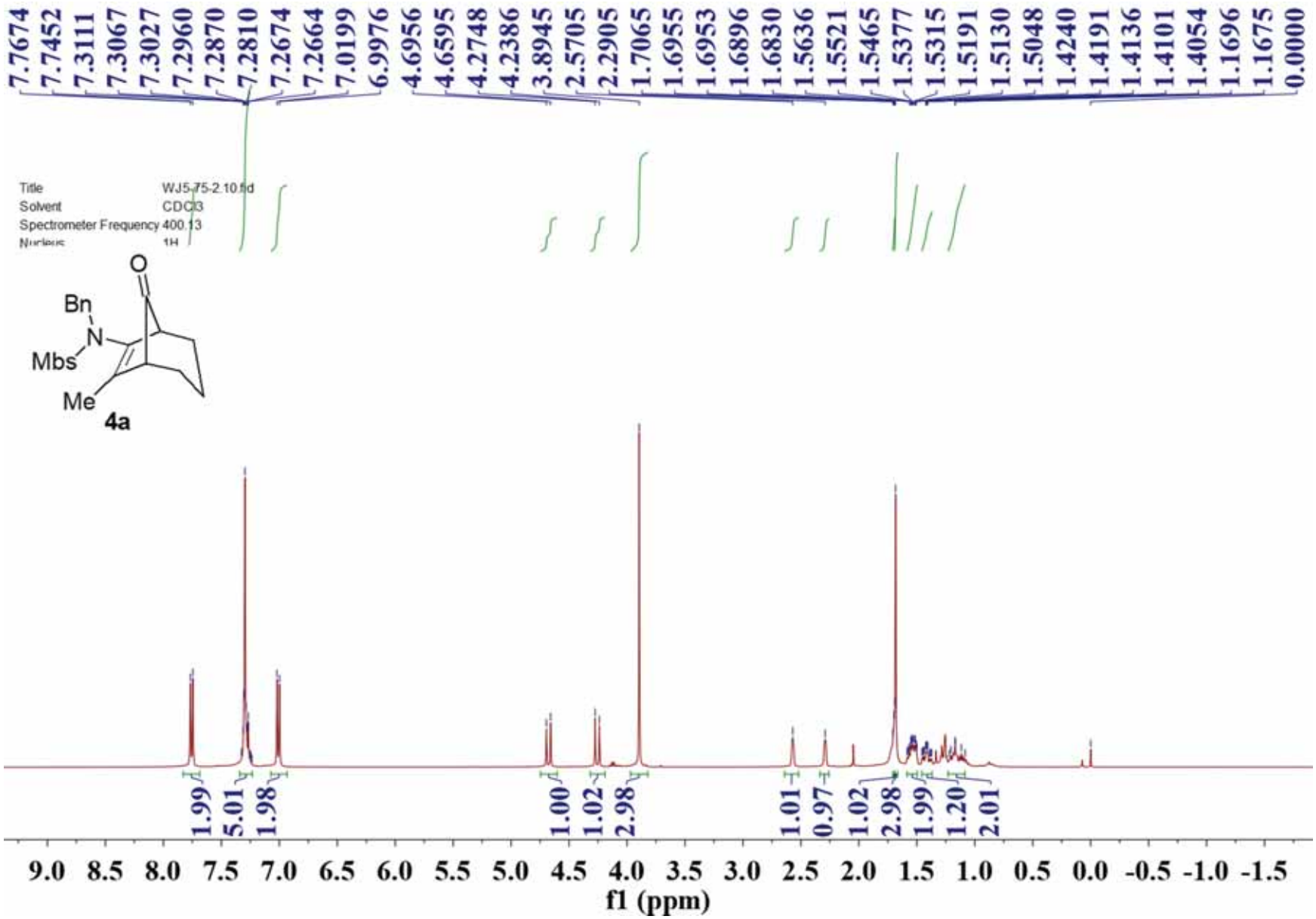
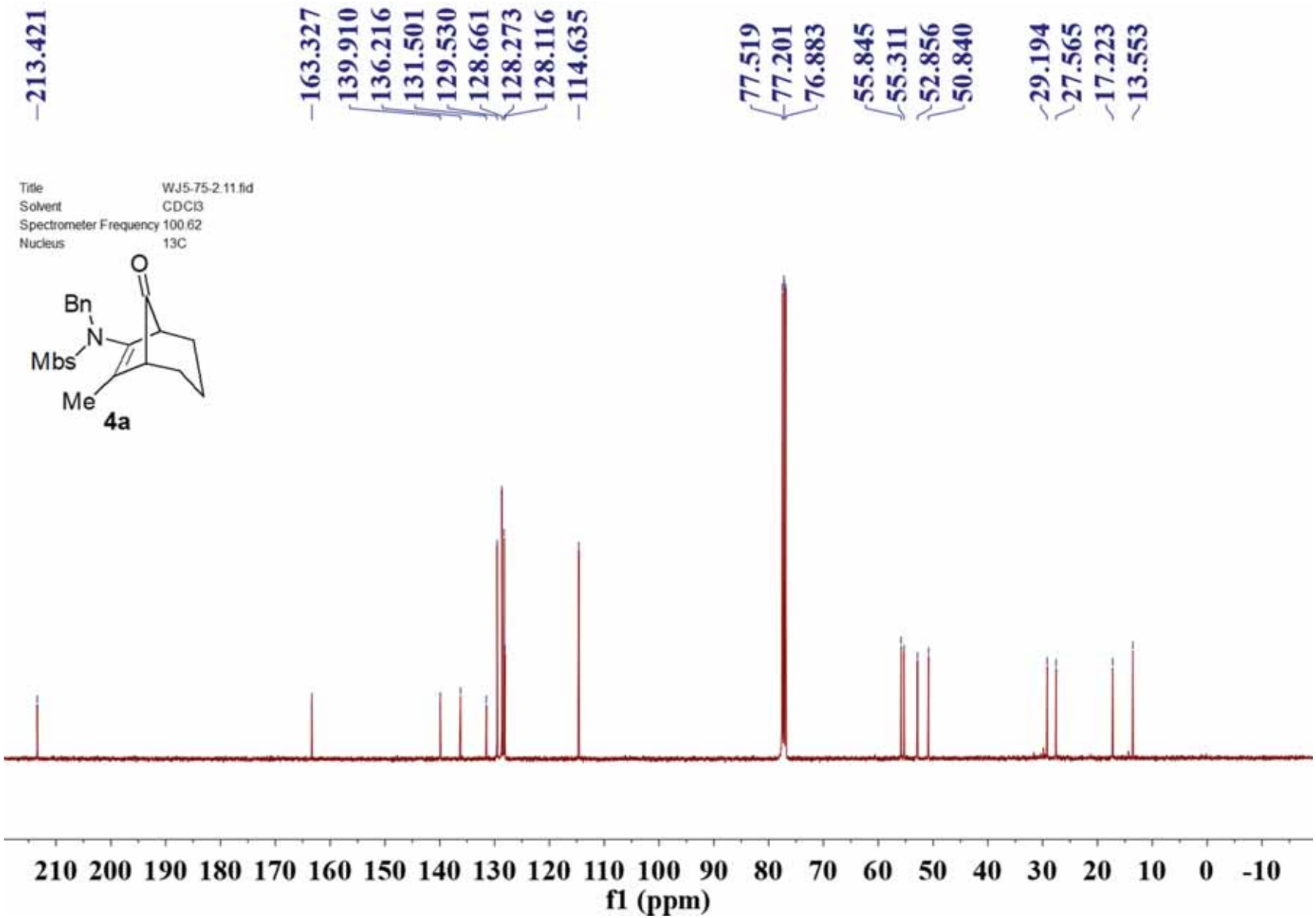
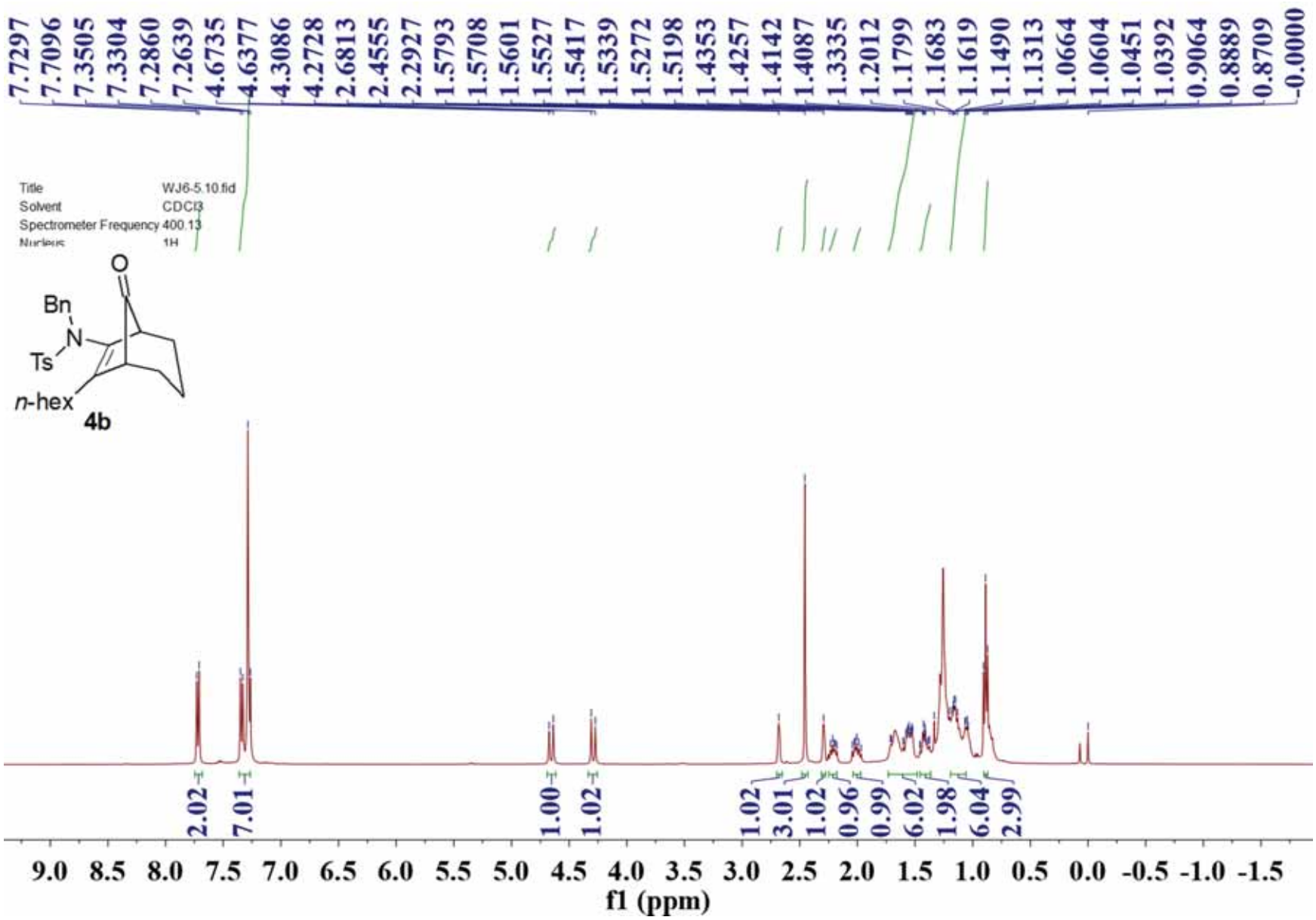
143.870
137.461
136.628
136.585
129.928
129.851
128.640
128.263
127.879
127.435
77.518
77.201
76.883
53.557
52.277
34.733
30.855
21.765
14.484
7.581
Title WJ4-16.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
O
Ts
N
Et
Me
3aa
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

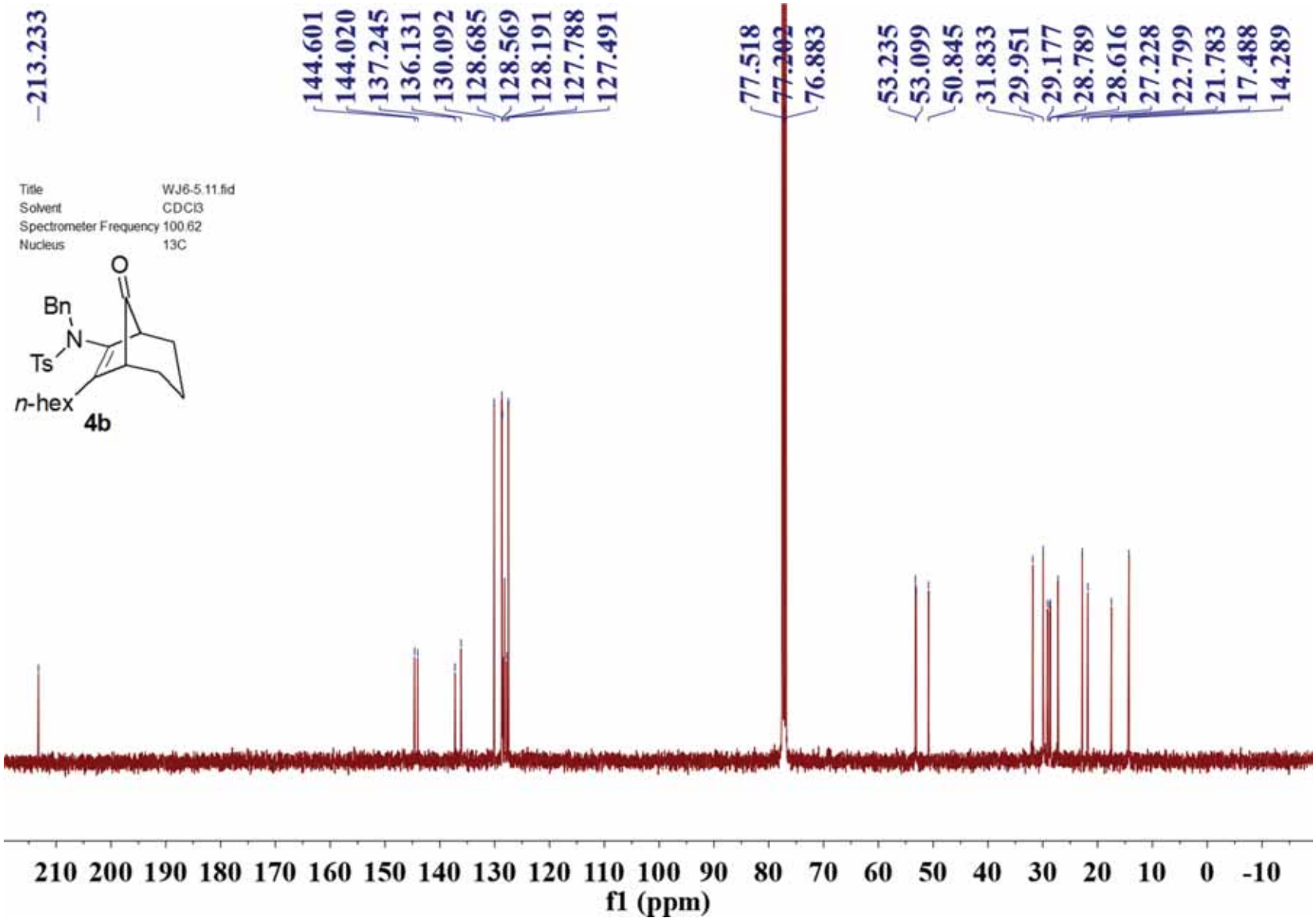

7.7229
7.7024
7.3204
7.3141
7.3068
7.2993
7.2897
7.2856
7.2776
7.2648
4.6049
4.5677
4.4871
4.4699
4.4499
3.7695
3.7641
3.7582
3.7525
2.4370
2.2534
2.2493
2.1638
2.1607
2.1172
1.4194
1.3932
1.3367
1.3314
1.3248
1.2883
1.2852
1.2680
1.1854
1.1665
0.9173
0.8988
0.8805
0.8622
0.0001
Title WJ4-34.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
Ts
N
O
n-pentyl
Me
3ab
1.99
7.02
2.02
1.00
3.01
4.01
8.98
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)

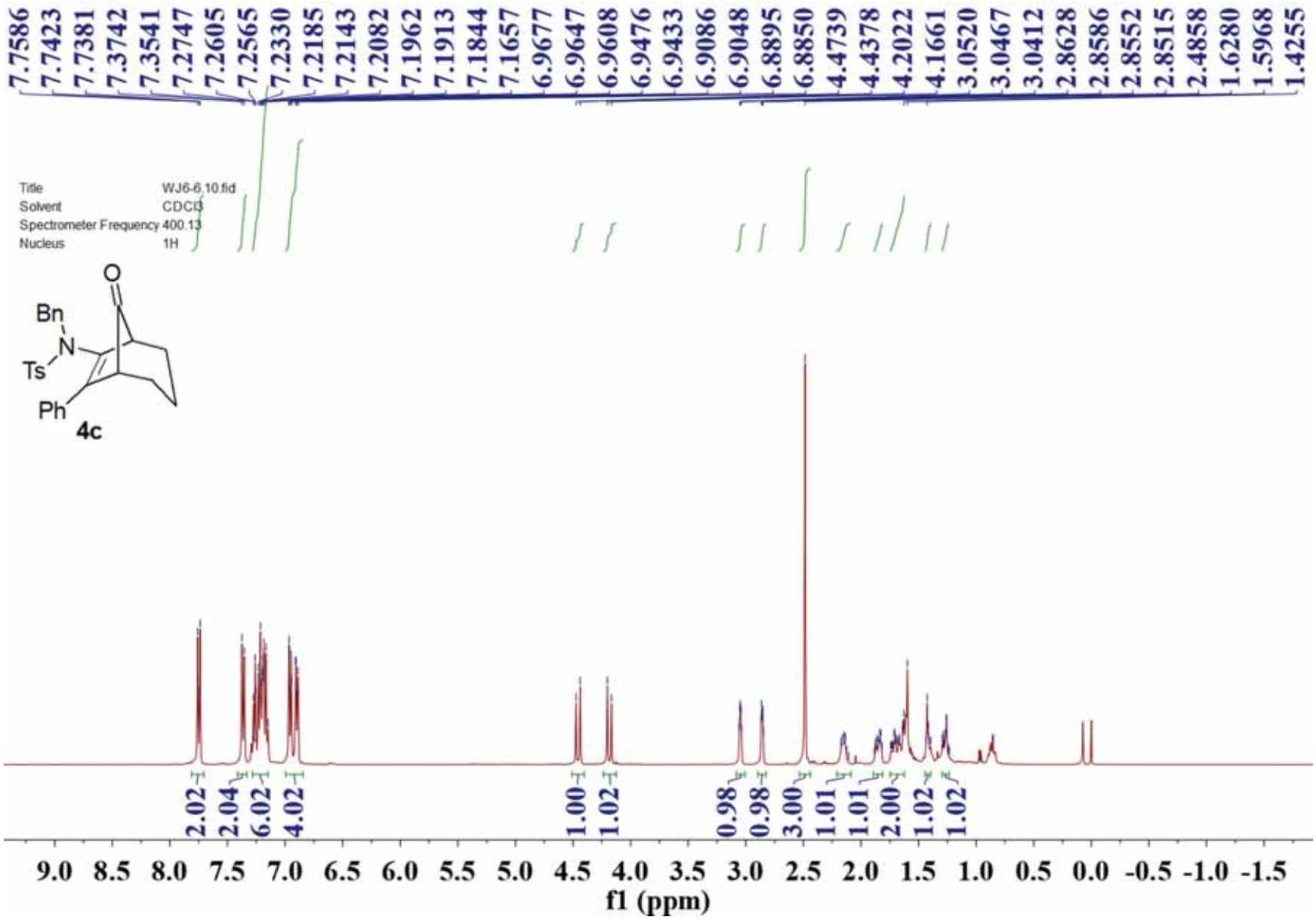

210.087
143.833
137.188
136.746
136.657
129.853
128.626
128.267
127.852
127.435
77.518
77.201
76.883
53.619
52.208
41.499
31.547
30.946
23.208
22.689
21.760
14.452
14.167
Title WJ4-34.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
O
Ts
N
n-pentyl
Me
3ab
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

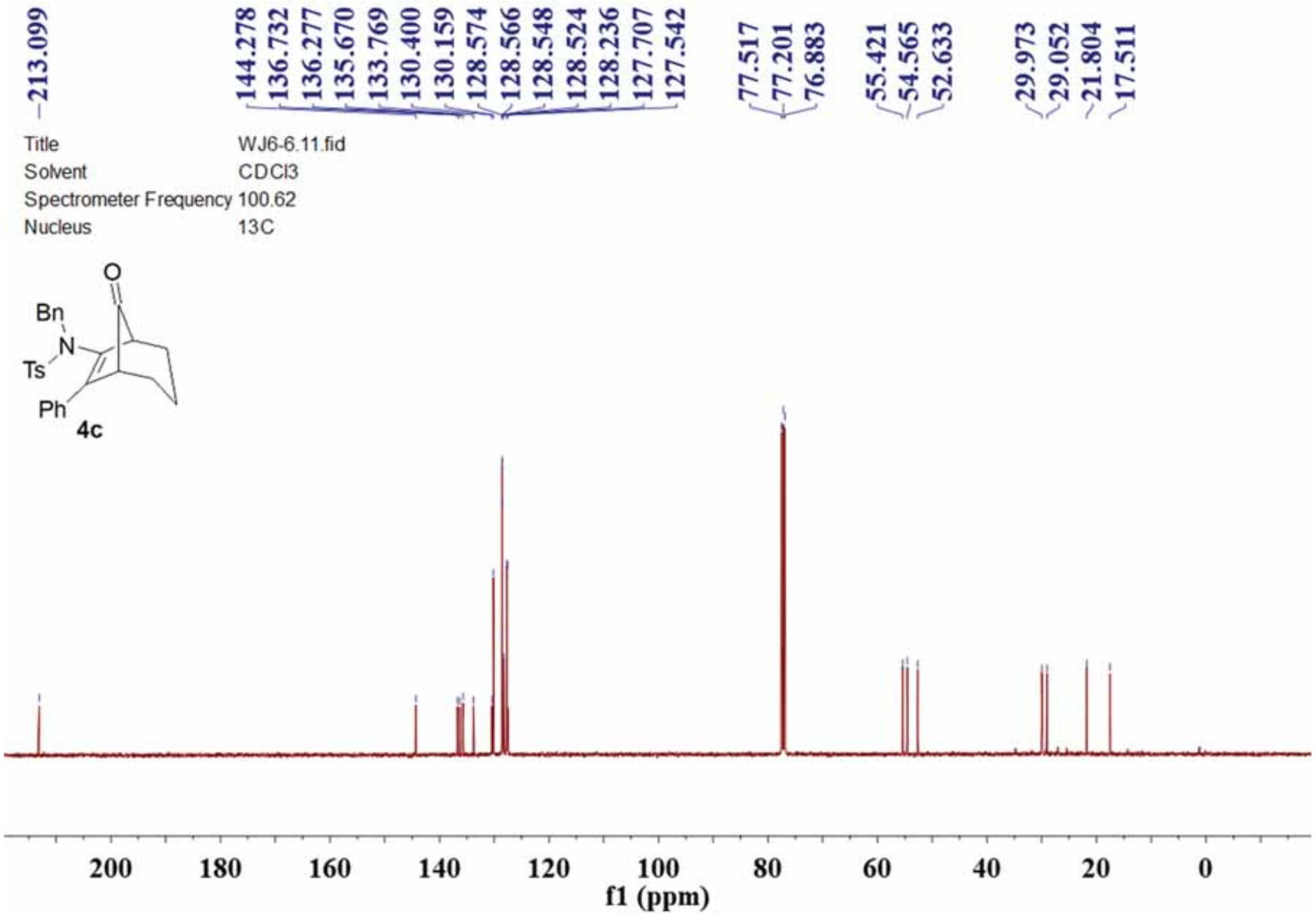

7.7674
7.7452
7.3111
7.3067
7.3027
7.2960
7.2870
7.2810
7.2674
7.2664
7.0199
6.9976
4.6956
4.6595
4.2748
4.2386
3.8945
2.5705
2.2905
1.7065
1.6955
1.6953
1.6896
1.6830
1.5636
1.5521
1.5465
1.5377
1.5315
1.5191
1.5130
1.5048
1.4240
1.4191
1.4136
1.4101
1.4054
1.1696
1.1675
0.0000
Title
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
O
Bn
N
Mbs
Me
4a
1.99
5.01
1.98
1.00
1.02
2.98
1.01
0.97
1.02
2.98
1.99
1.20
2.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)

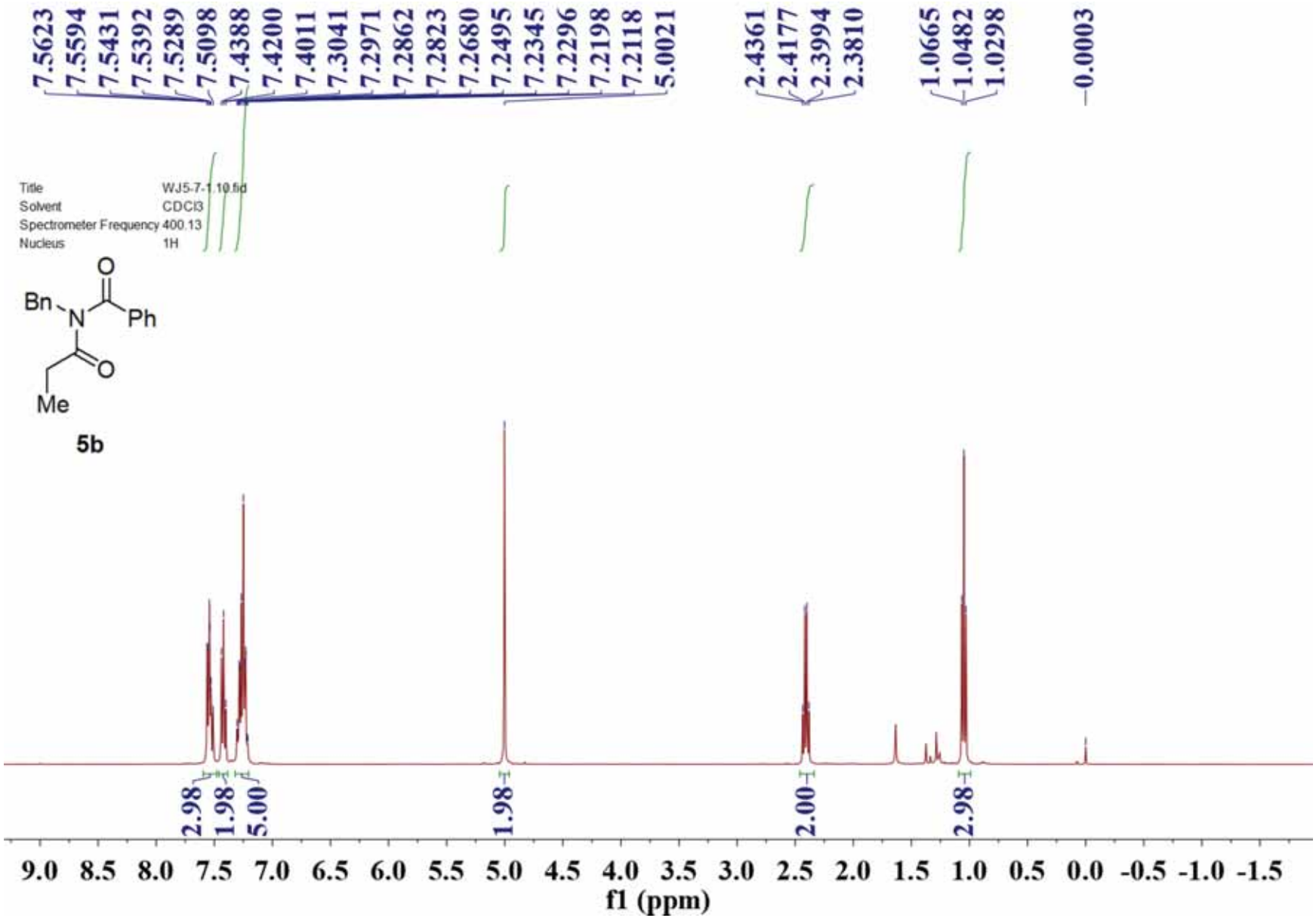

213.421
163.327
139.910
136.216
131.501
129.530
128.661
128.273
128.116
114.635
77.519
77.201
76.883
55.845
55.311
52.856
50.840
29.194
27.565
17.223
13.553
Title WJ5-75-2.11.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
O
Bn
N
Mbs
Me
4a
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

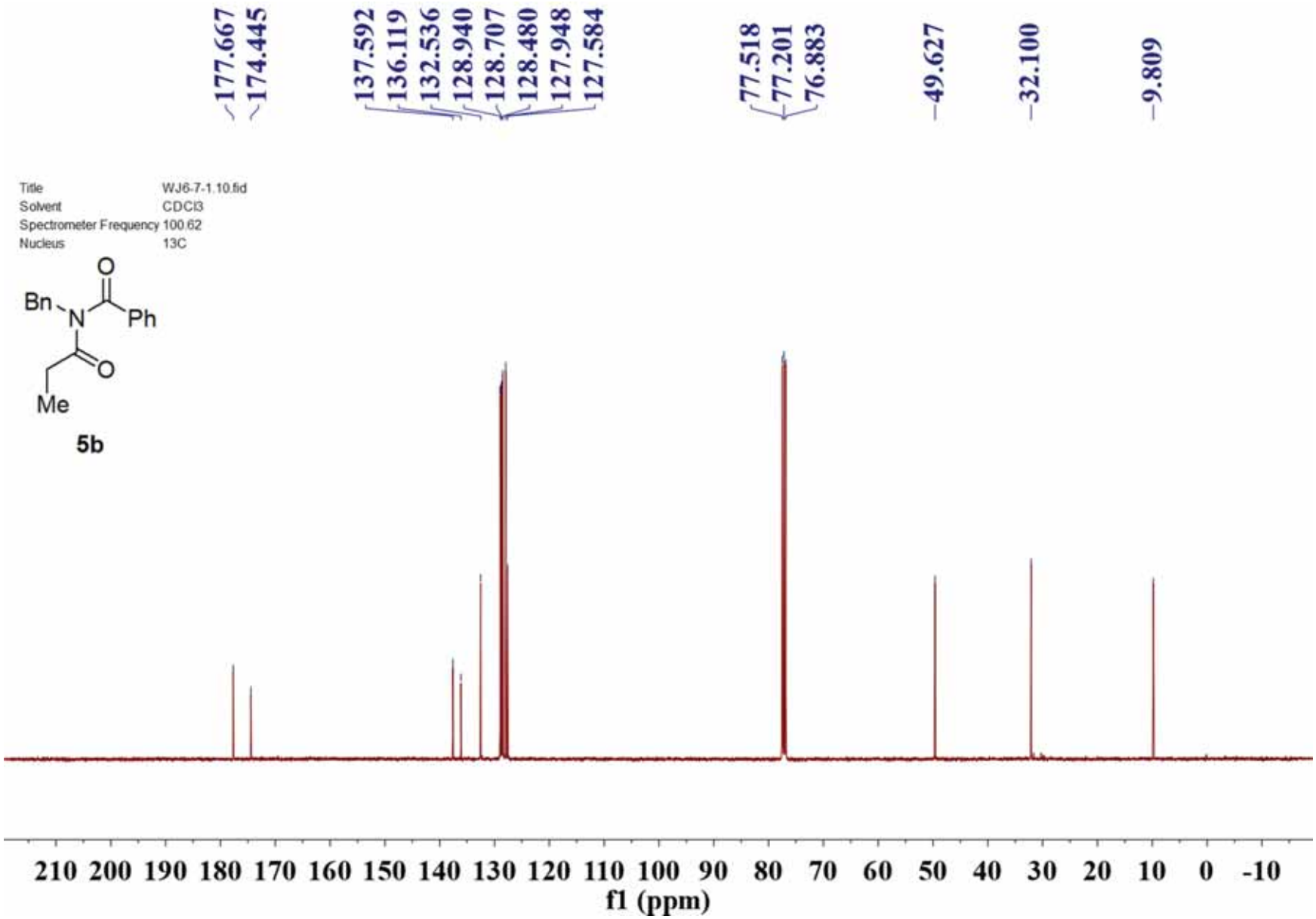

7.7297
7.7096
7.3505
7.3304
7.2860
7.2639
4.6735
4.6377
4.3086
4.2728
2.6813
2.4555
2.2927
1.5793
1.5708
1.5601
1.5527
1.5417
1.5339
1.5272
1.5198
1.4353
1.4257
1.4142
1.4087
1.3335
1.2012
1.1799
1.1683
1.1619
1.1490
1.1313
1.0664
1.0604
1.0451
1.0392
0.9064
0.8889
0.8709
-0.0000
Title WJ6-5.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
N
Ts
n-hex
O
4b
2.02
7.01
1.00
1.02
1.02
3.01
1.02
0.96
0.99
6.02
1.98
6.04
2.99
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)


213.233
144.601
144.020
137.245
136.131
130.092
128.685
128.569
128.191
127.788
127.491
77.518
77.202
76.883
53.235
53.099
50.845
31.833
29.951
29.177
28.789
28.616
27.228
22.799
21.783
17.488
14.289
Title WJ6-5.11.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
O
Bn
N
Ts
n-hex
4b
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

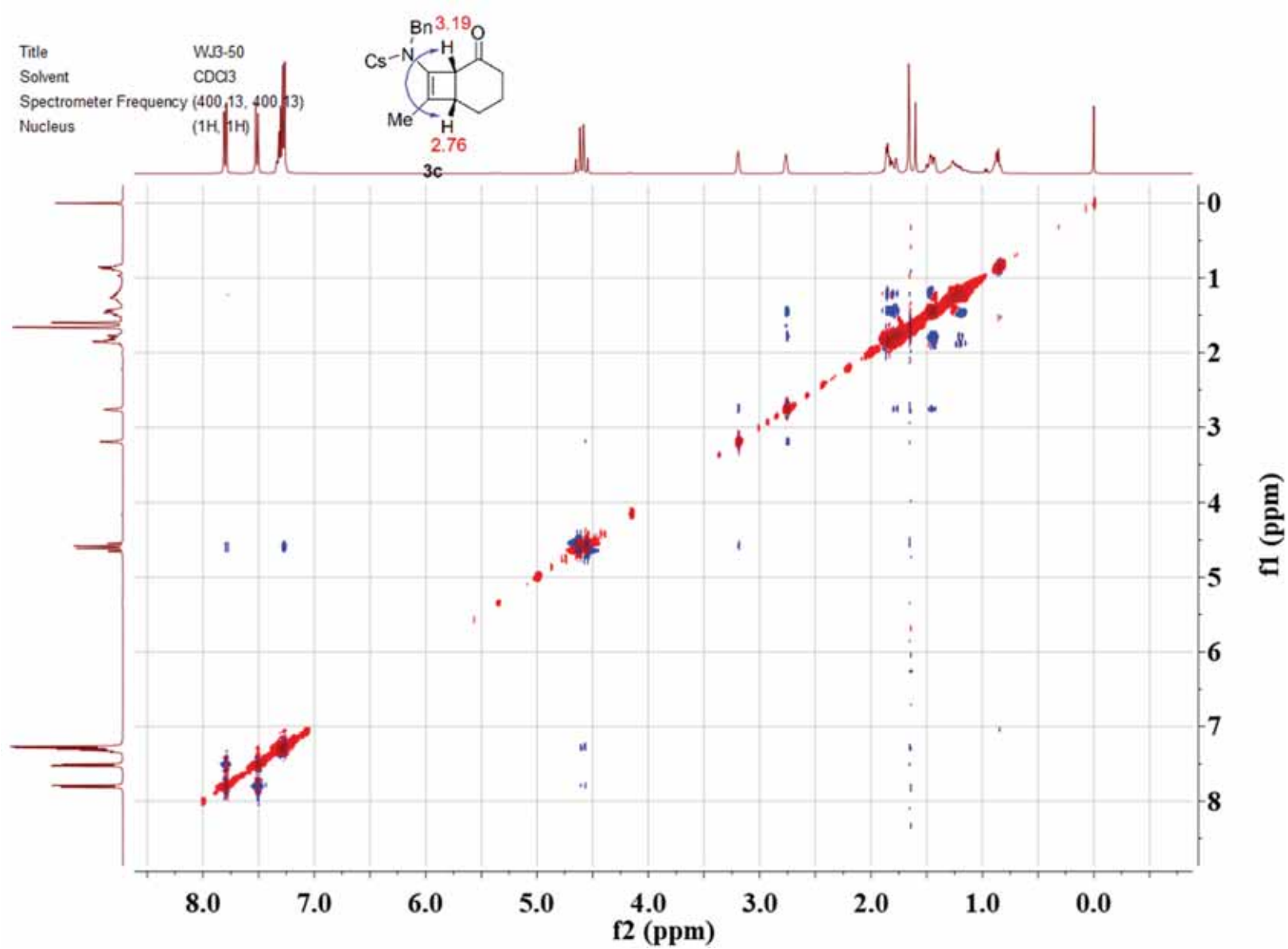

7.7586
7.7423
7.7381
7.3742
7.3541
7.2747
7.2605
7.2565
7.2330
7.2185
7.2143
7.2082
7.1962
7.1913
7.1844
7.1657
6.9677
6.9647
6.9608
6.9476
6.9433
6.9086
6.9048
6.8895
6.8850
4.4739
4.4378
4.2022
4.1661
3.0520
3.0467
3.0412
2.8628
2.8586
2.8552
2.8515
2.4858
1.6280
1.5968
1.4255
Title WJ6-6.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
N
Ts
Ph
O
4c
2.02
2.04
6.02
4.02
1.00
1.02
0.98
0.98
3.00
1.01
1.01
2.00
1.02
1.02
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)

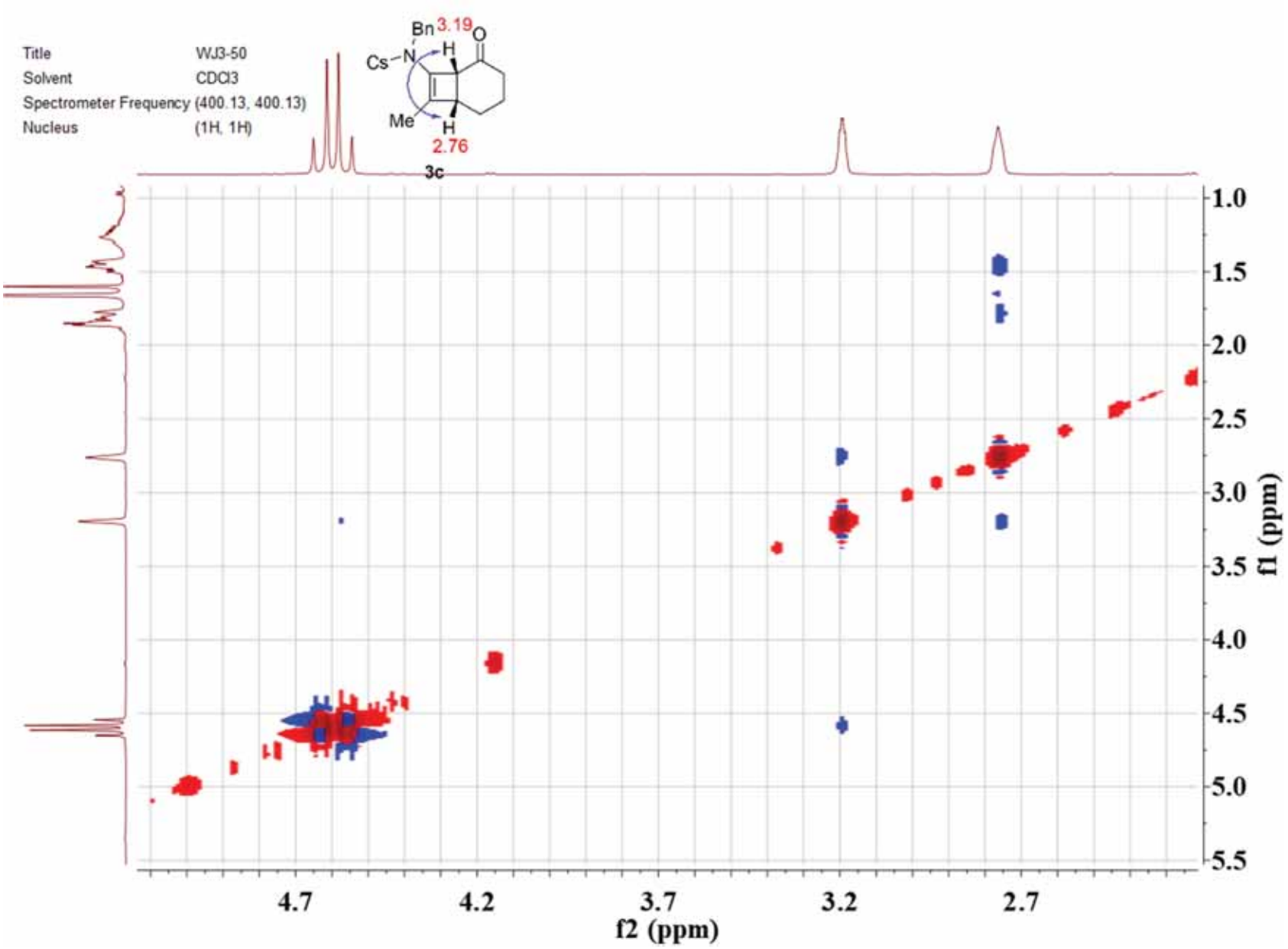

213.099
144.278
136.732
136.277
135.670
133.769
130.400
130.159
128.574
128.566
128.548
128.524
128.236
127.707
127.542
77.517
77.201
76.883
55.421
54.565
52.633
29.973
29.052
21.804
17.511
Title WJ6-6.11.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
O
Bn
N
Ts
Ph
4c
200
180
160
140
120
100
80
60
40
20
0
f1 (ppm)

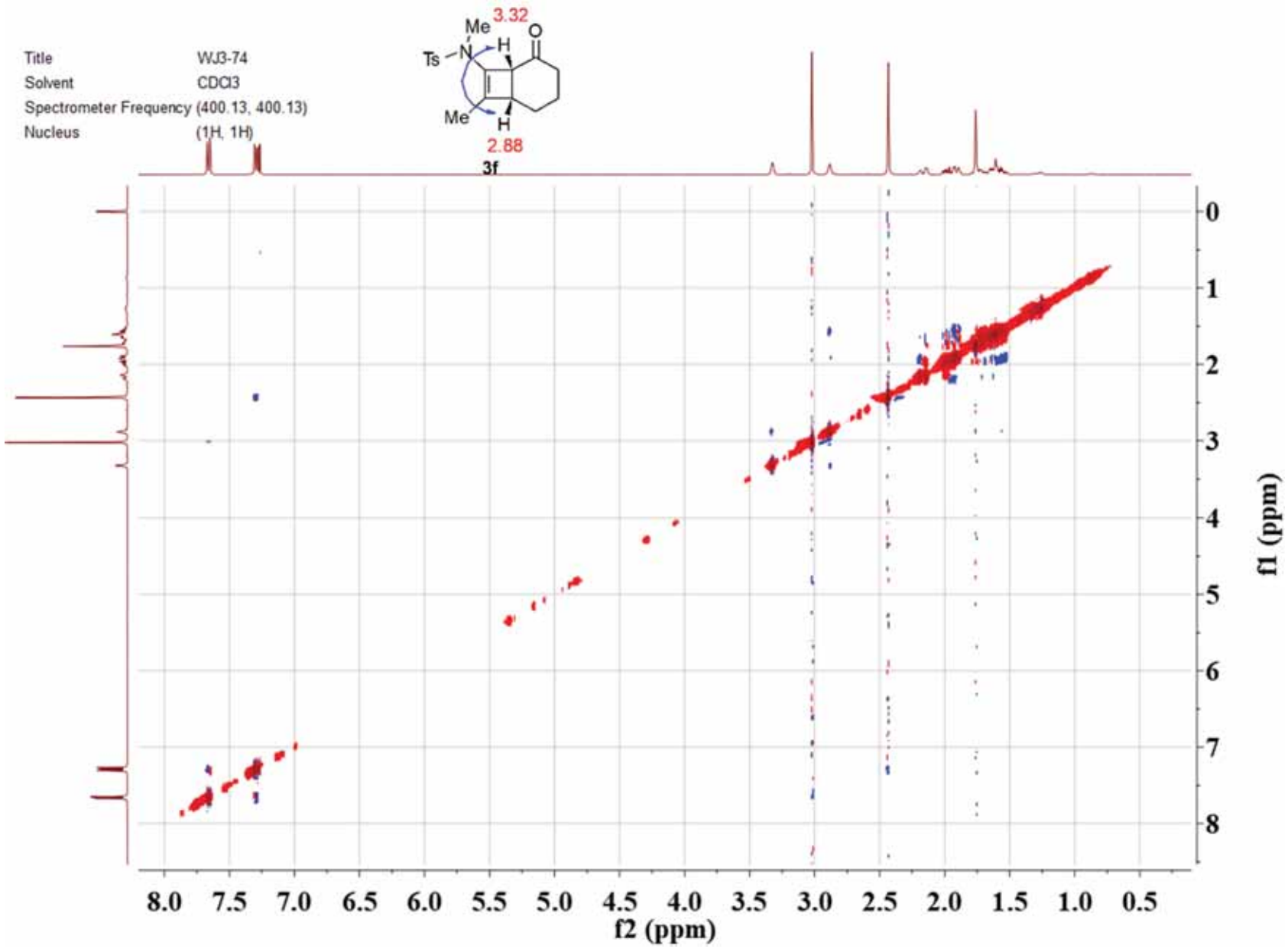

7.5623
7.5594
7.5431
7.5392
7.5289
7.5098
7.4388
7.4200
7.4011
7.3041
7.2971
7.2862
7.2823
7.2680
7.2495
7.2345
7.2296
7.2198
7.2118
5.0021
2.4361
2.4177
2.3994
2.3810
1.0665
1.0482
1.0298
-0.0003
Title WJ5-7-1.10.fid
Solvent CDCl3
Spectrometer Frequency 400.13
Nucleus 1H
Bn
N
O
Ph
O
Me
5b
2.98
1.98
5.00
1.98
2.00
2.98
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)

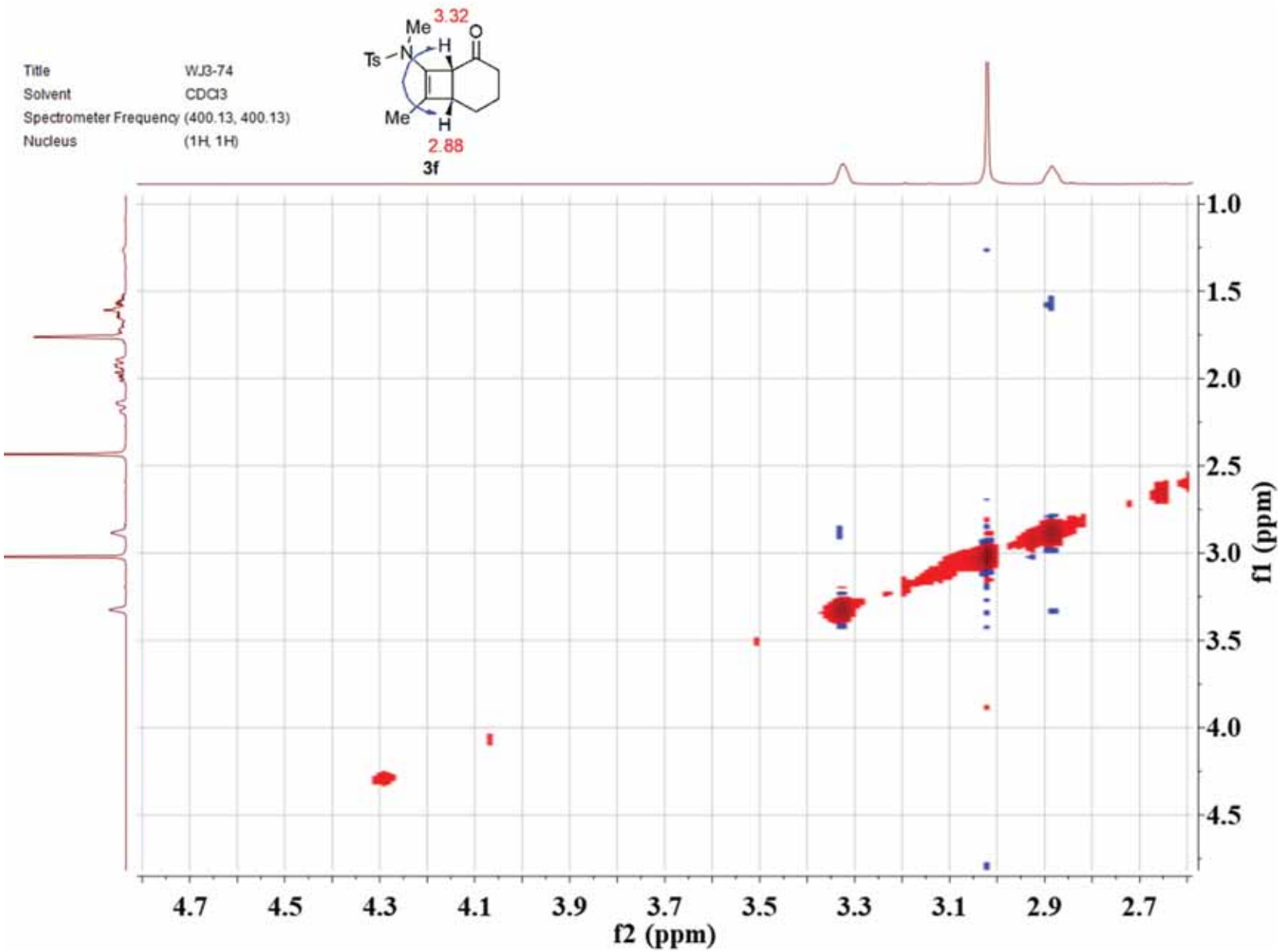

177.667
174.445
137.592
136.119
132.536
128.940
128.707
128.480
127.948
127.584
77.518
77.201
76.883
49.627
32.100
9.809
Title WJ6-7-1.10.fid
Solvent CDCl3
Spectrometer Frequency 100.62
Nucleus 13C
Bn
N
O
Ph
O
Me
5b
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

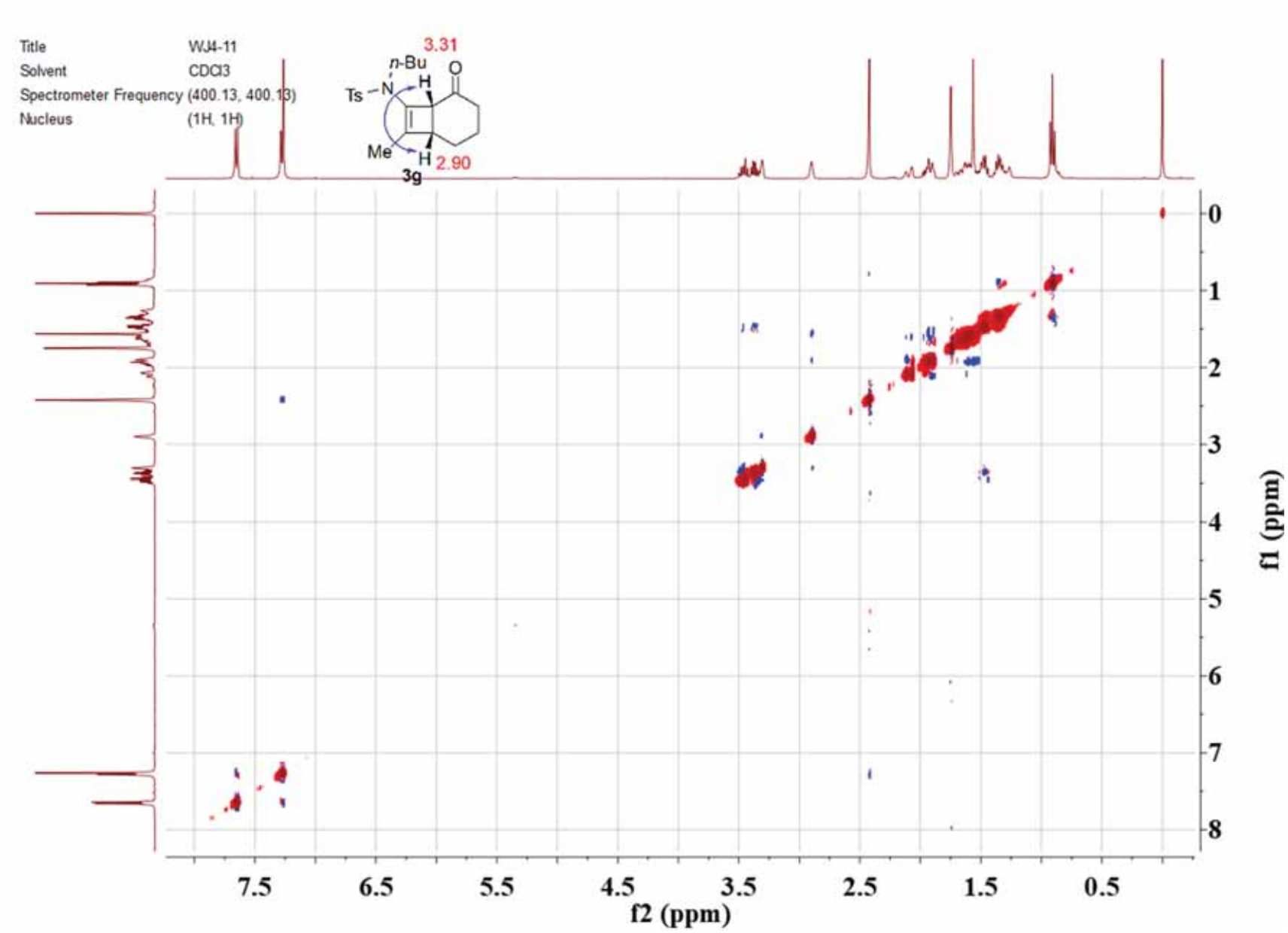
NOESY Spectra of Cyclobutenamides 3.

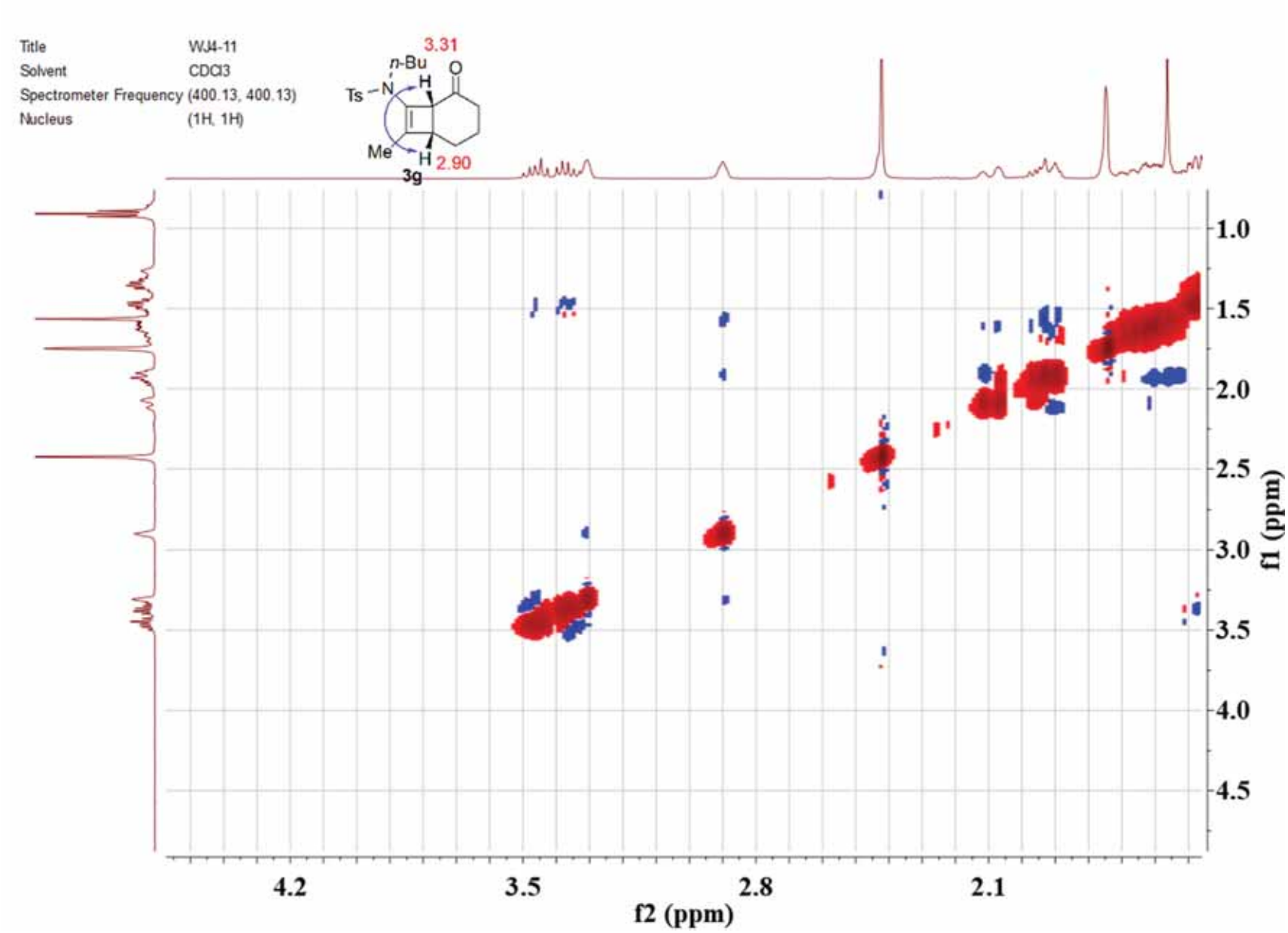


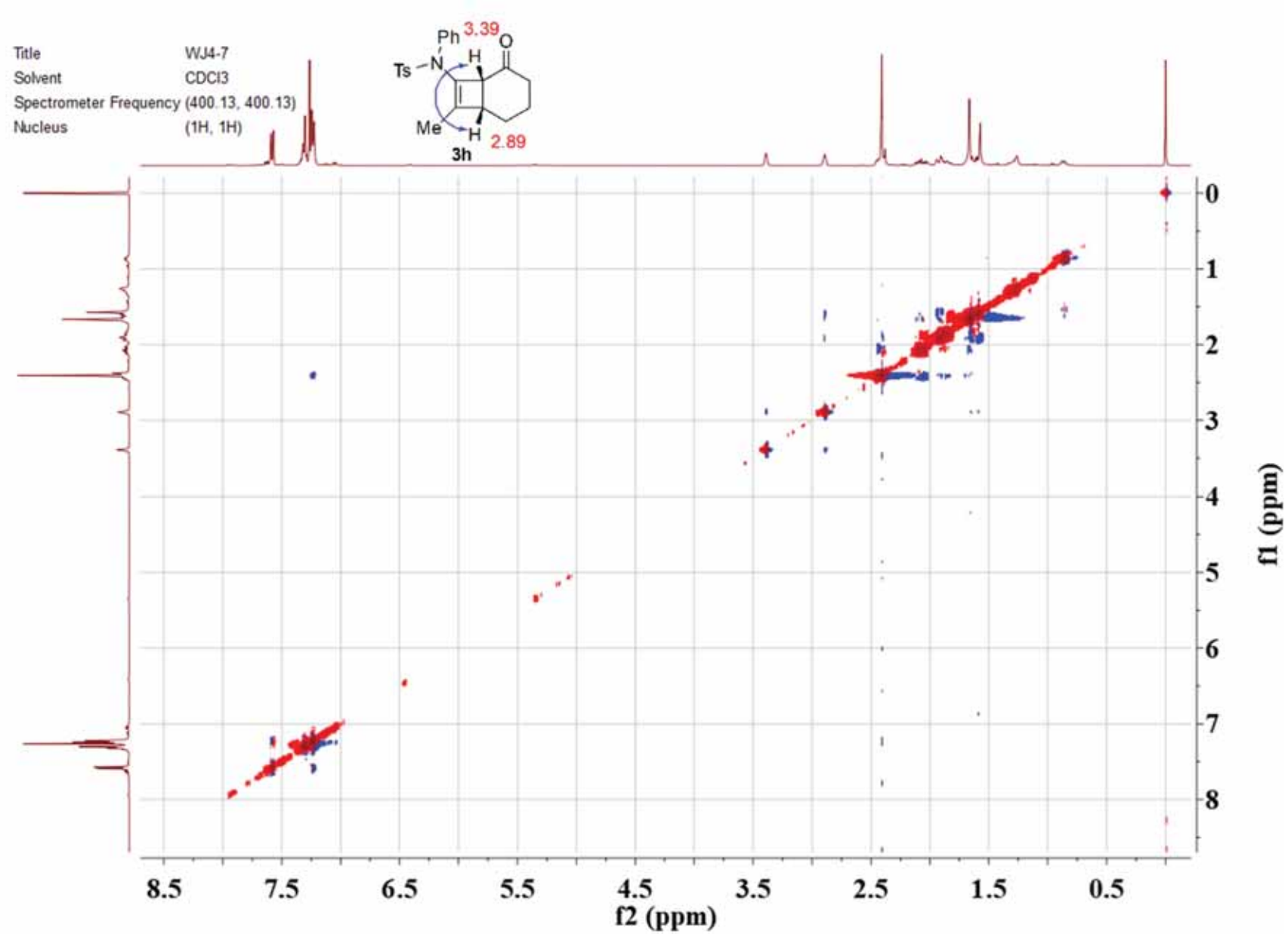

Title WJ3-50
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Cs
N
H
O
Me
H
3.19
2.76
3c
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
f1 (ppm)
4.7
4.2
3.7
3.2
2.7
f2 (ppm)

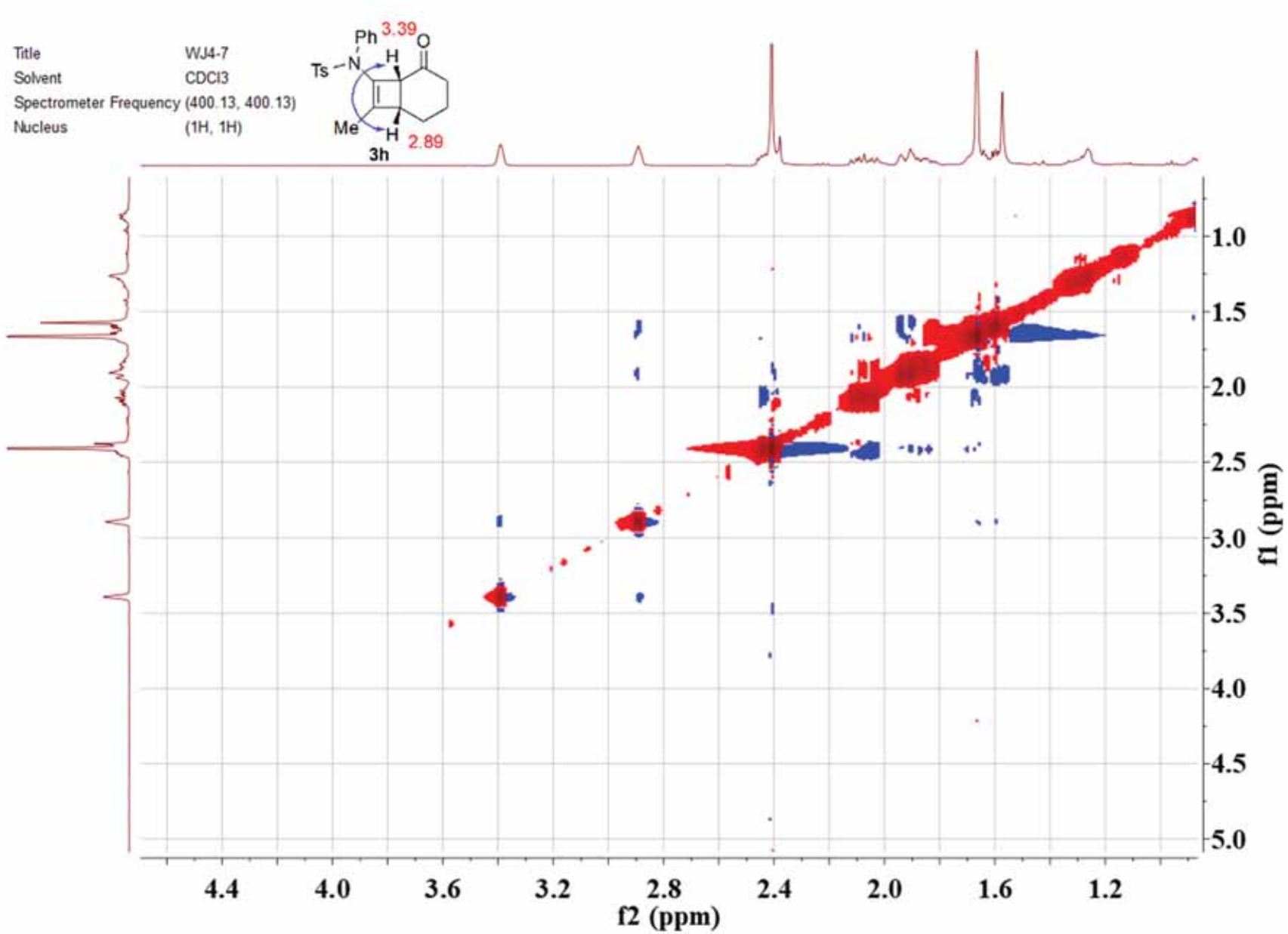

Title WJ3-74
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Me
N
Ts
H
O
3.32
2.88
Me
H
3f
f2 (ppm)
f1 (ppm)

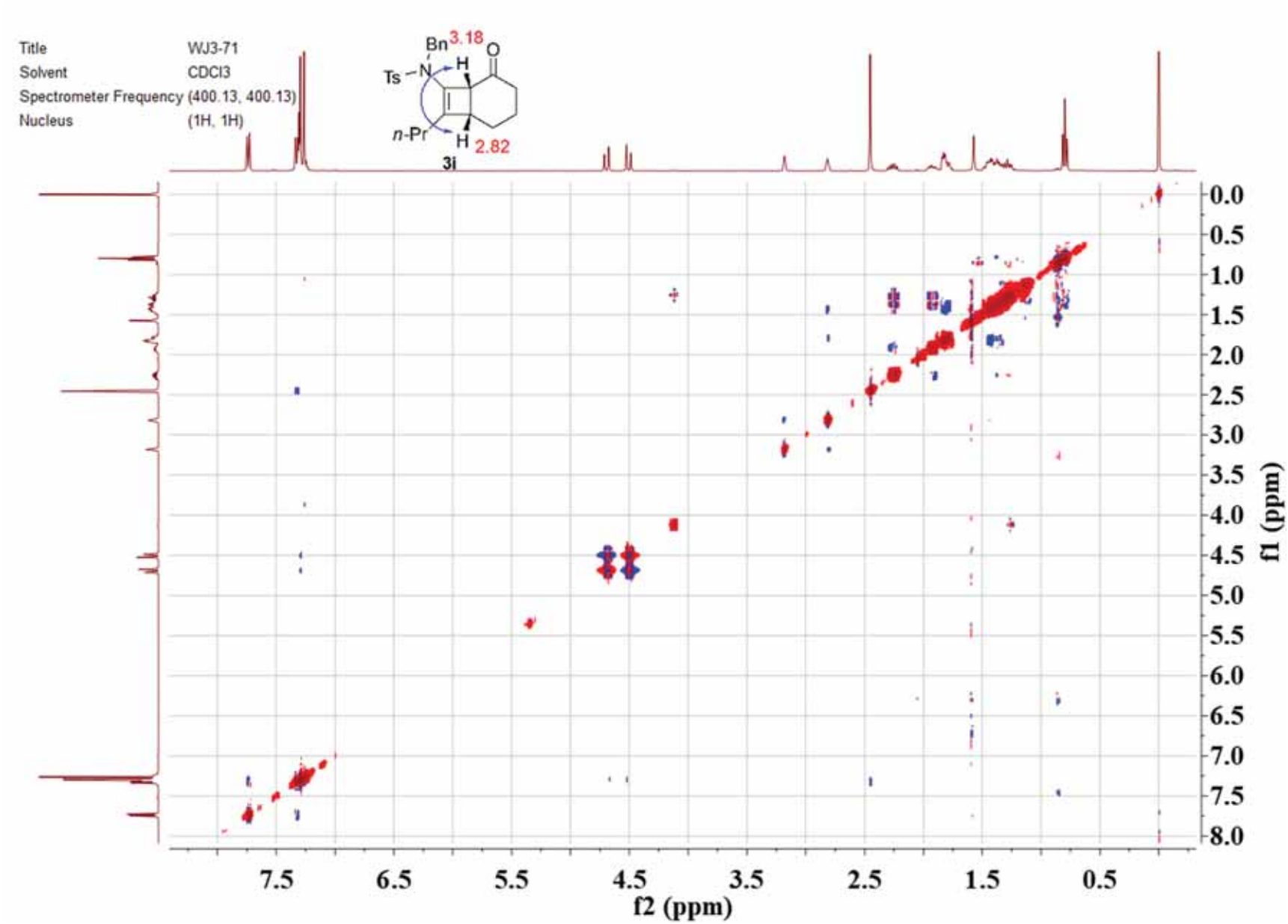

Title WJ3-74
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Me
3.32
Ts
N
H
O
Me
H
2.88
3f
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
f1 (ppm)
4.7
4.5
4.3
4.1
3.9
3.7
3.5
3.3
3.1
2.9
2.7
f2 (ppm)

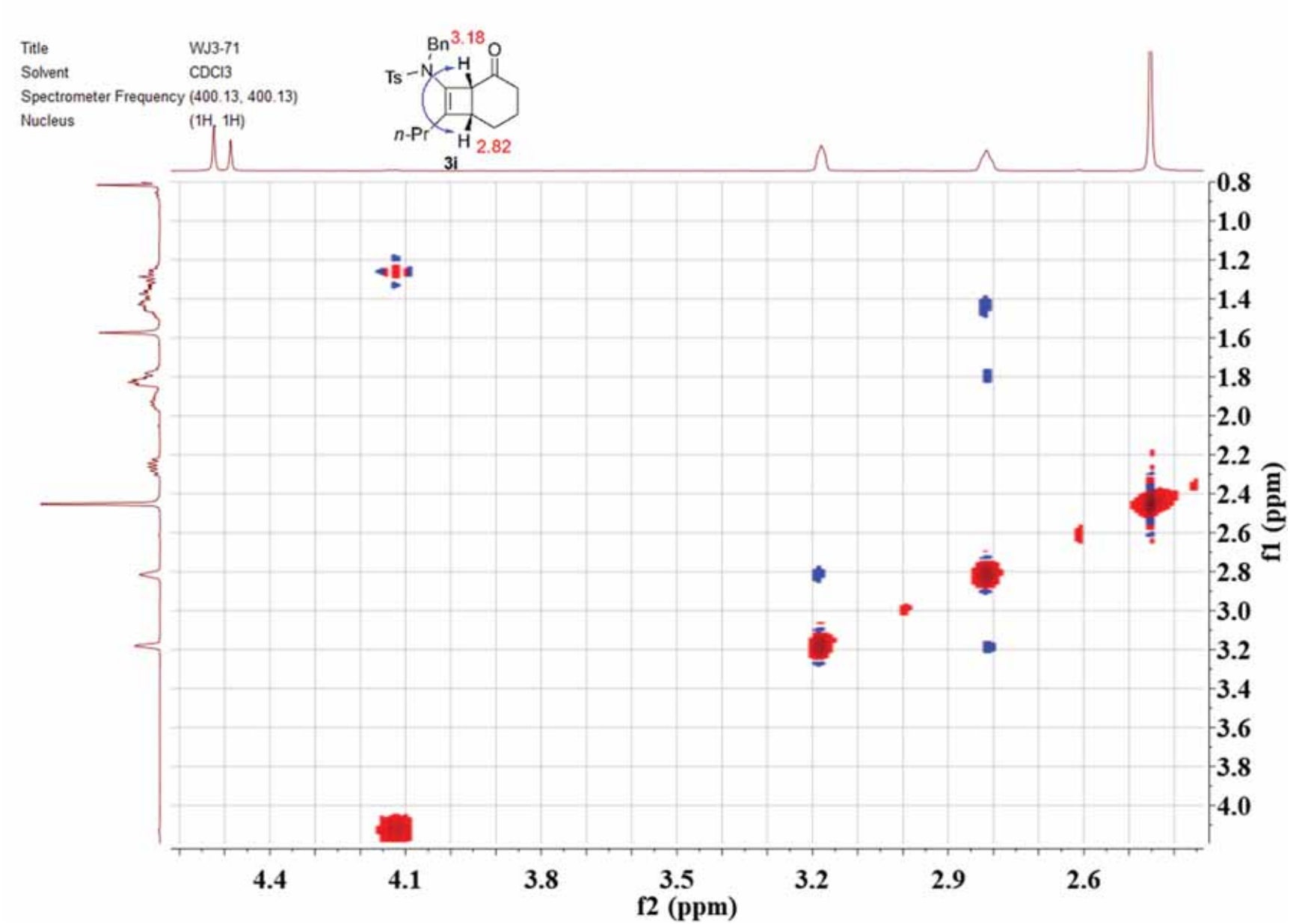

Title WJ4-11
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
3.31
n-Bu
Ts
N
H
O
Me
H
2.90
3g
0
1
2
3
4
5
6
7
8
f1 (ppm)
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
f2 (ppm)

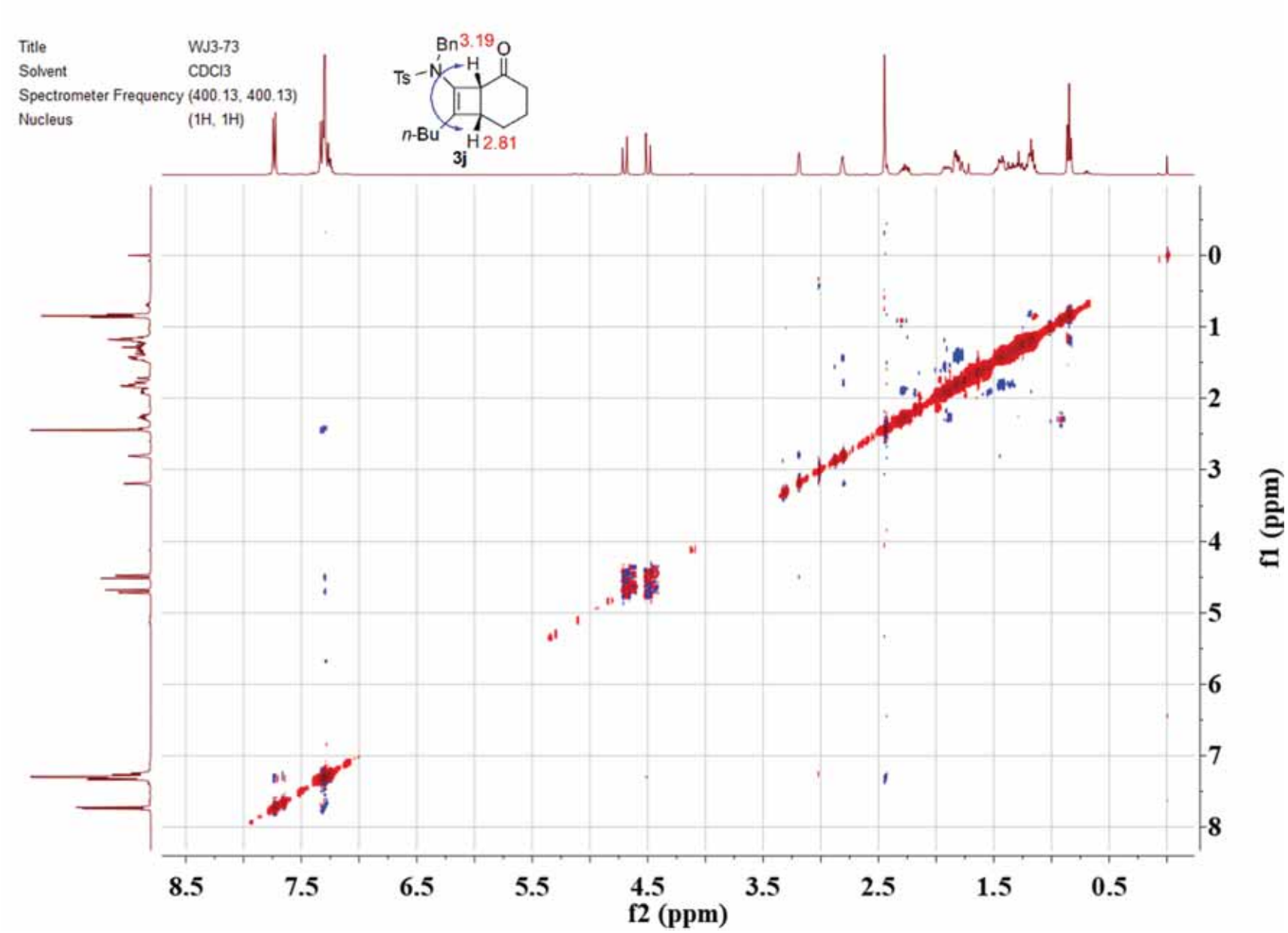

Title WJ4-11
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
3.31
n-Bu
Ts
N
H
O
Me
H
2.90
3g
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
f1 (ppm)
4.2
3.5
2.8
2.1
f2 (ppm)

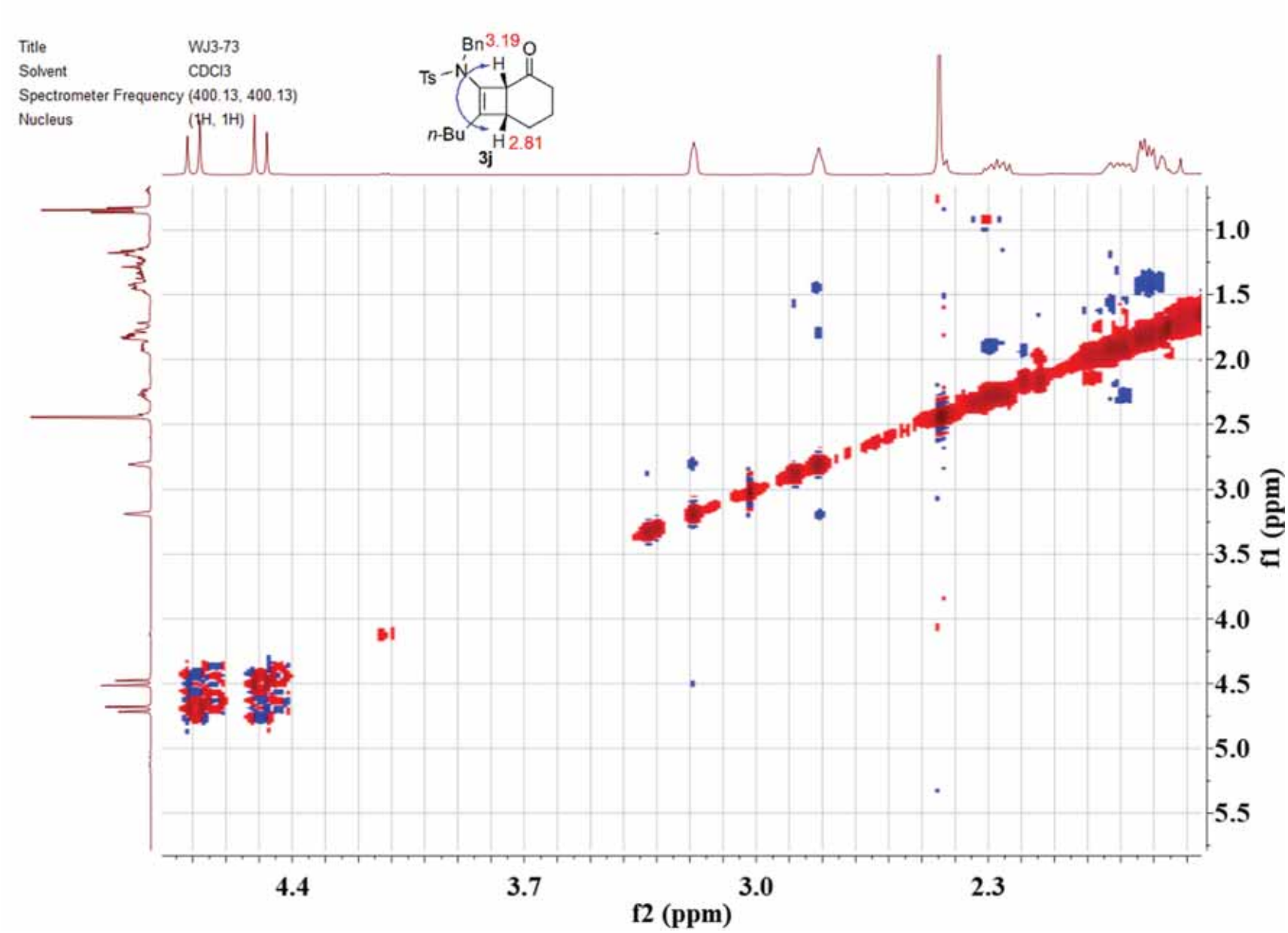

Title WJ4-7
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Ph
Ts
N
H
O
Me
H
3.39
2.89
3h
f1 (ppm)
f2 (ppm)
0
1
2
3
4
5
6
7
8
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5

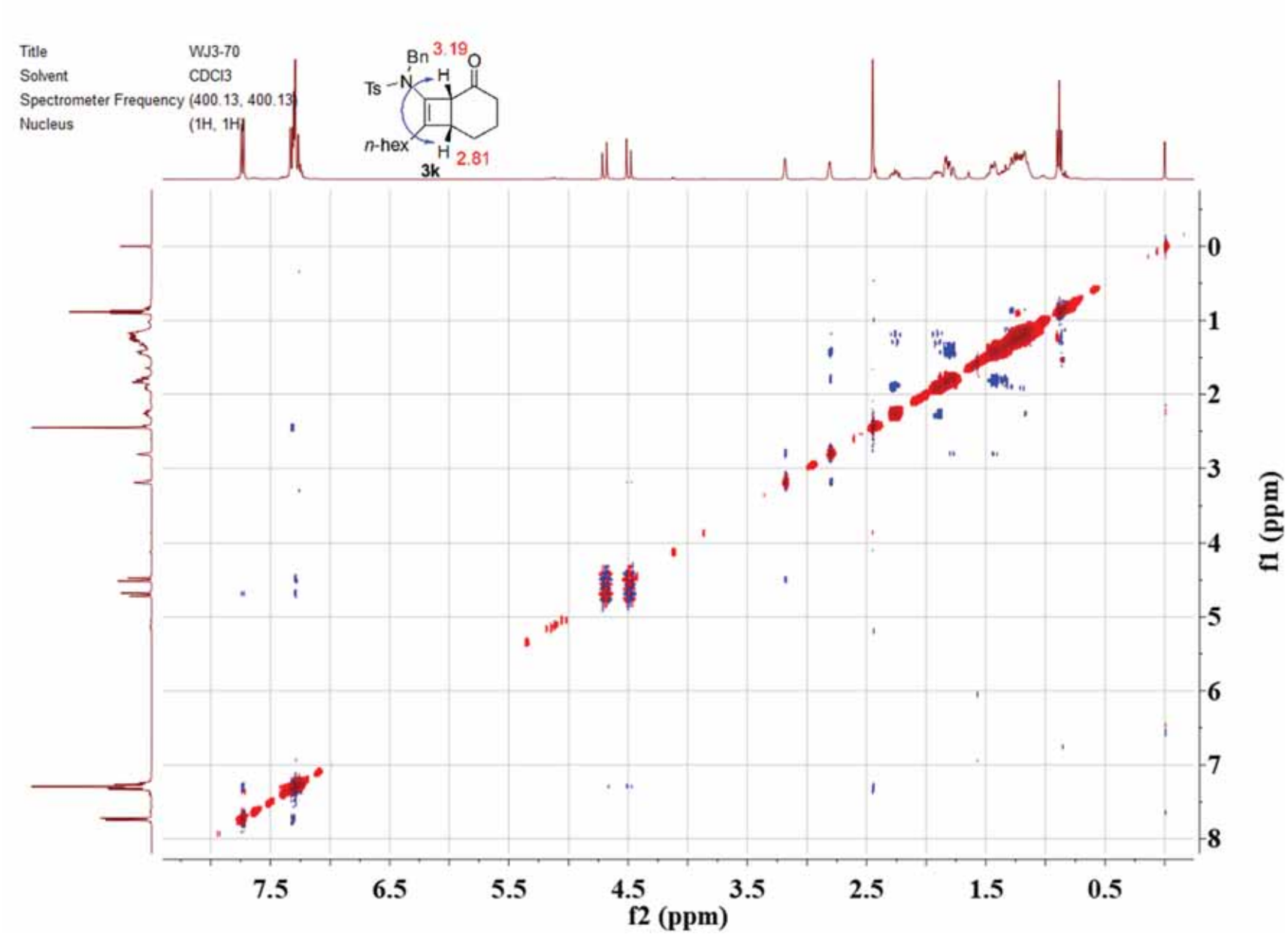

Title WJ4-7
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Ph
3.39
O
Ts
N
H
Me
H
2.89
3h
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
f2 (ppm)
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
f1 (ppm)

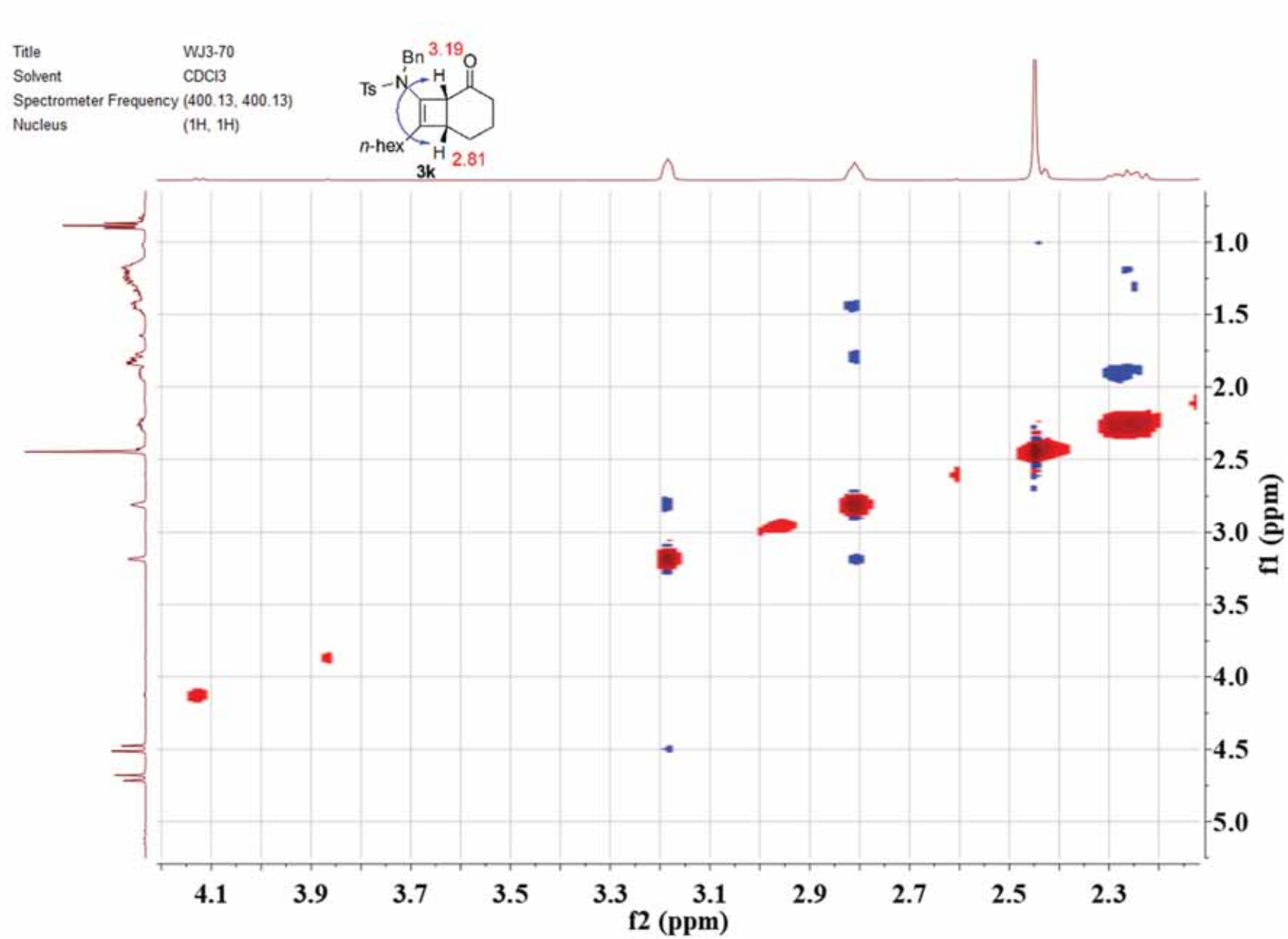

Title WJ3-71
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Ts
N
H
O
n-Pr
H
3.18
2.82
3i
f2 (ppm)
f1 (ppm)

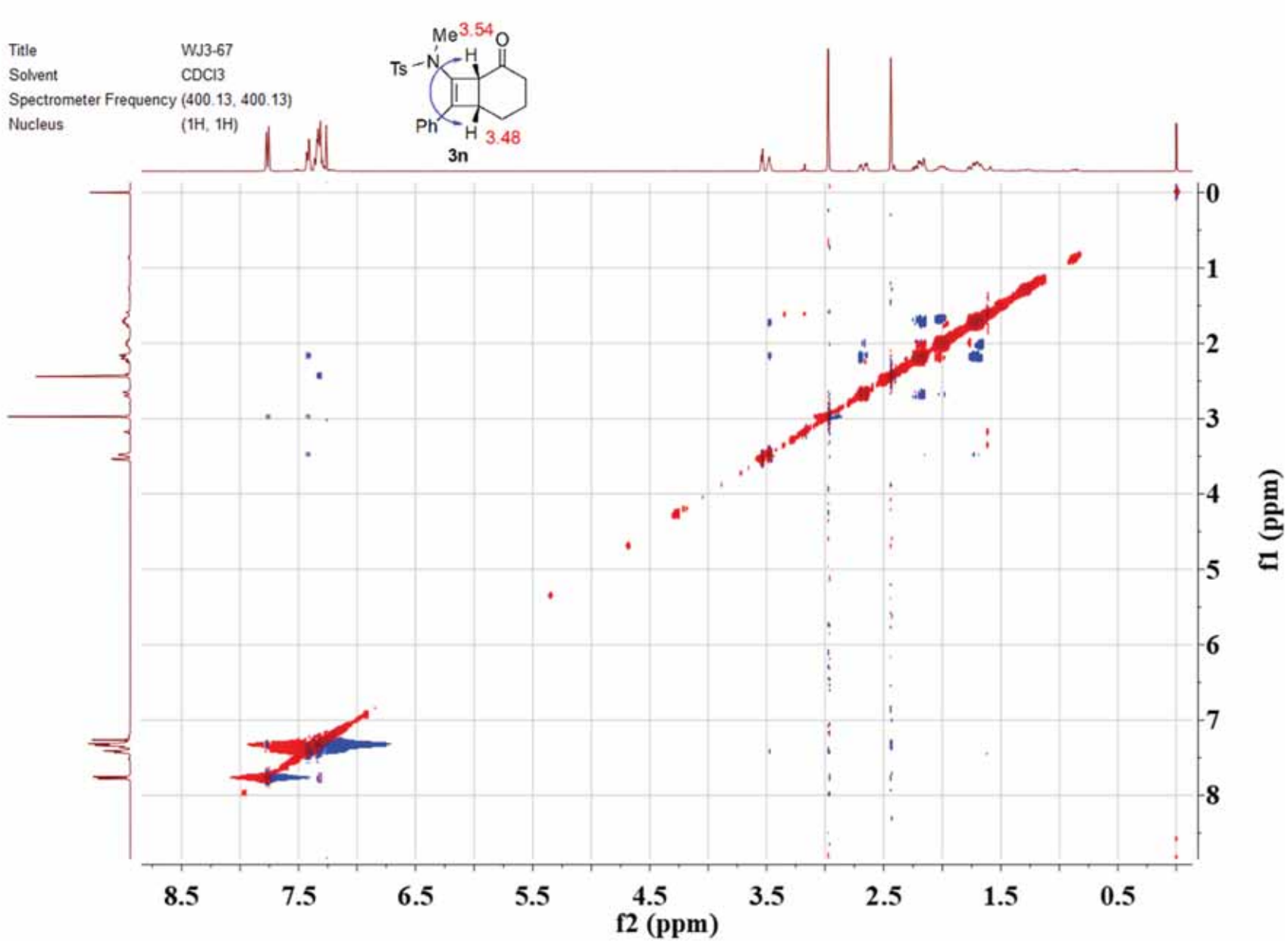

Title WJ3-71
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Ts
N
H
O
n-Pr
H
3.18
2.82
3i
f1 (ppm)
f2 (ppm)
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.4
4.1
3.8
3.5
3.2
2.9
2.6

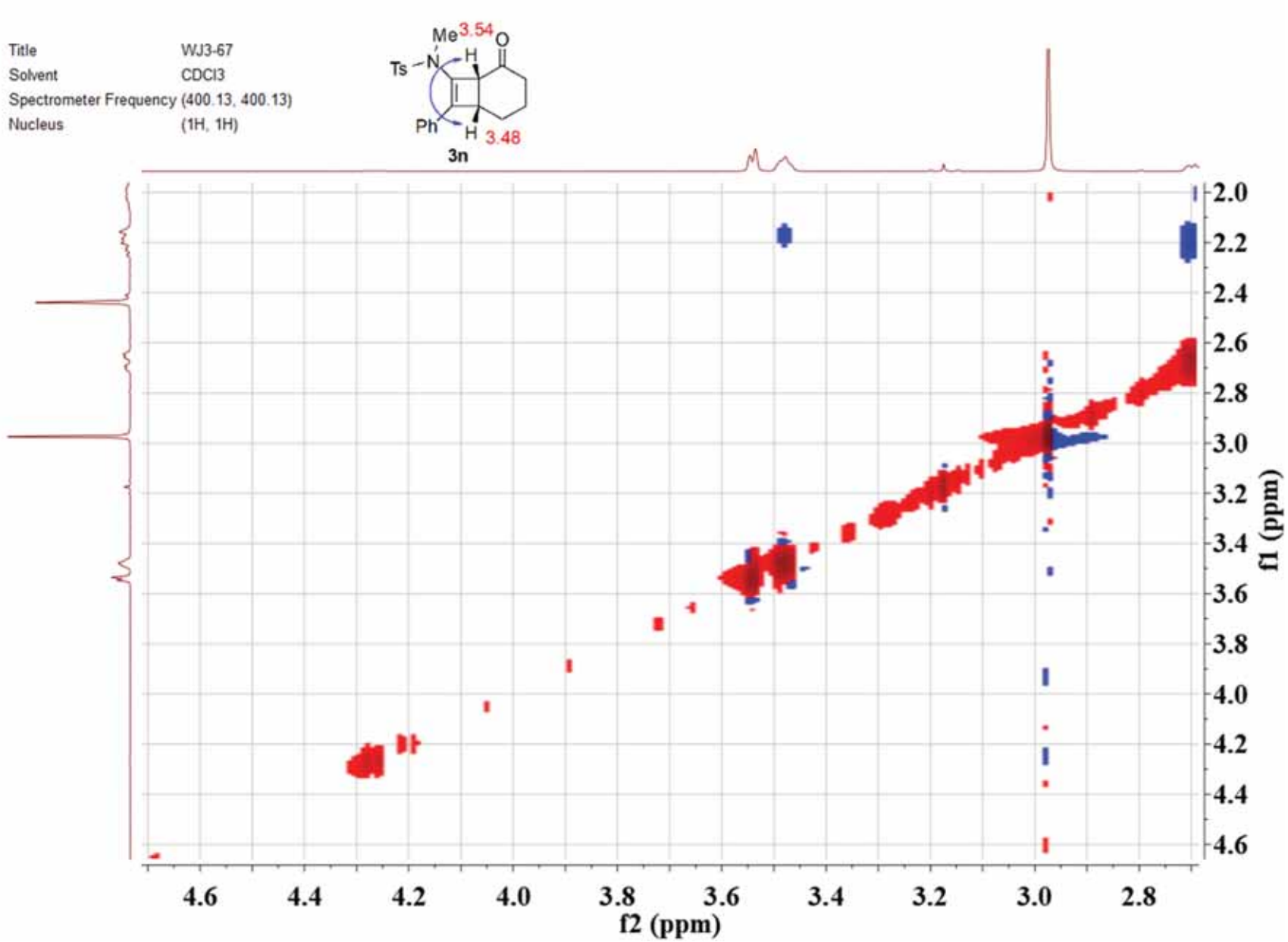

Title WJ3-73
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
3.19
O
Ts
N
H
n-Bu
H
2.81
3j
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
f2 (ppm)
0
1
2
3
4
5
6
7
8
f1 (ppm)

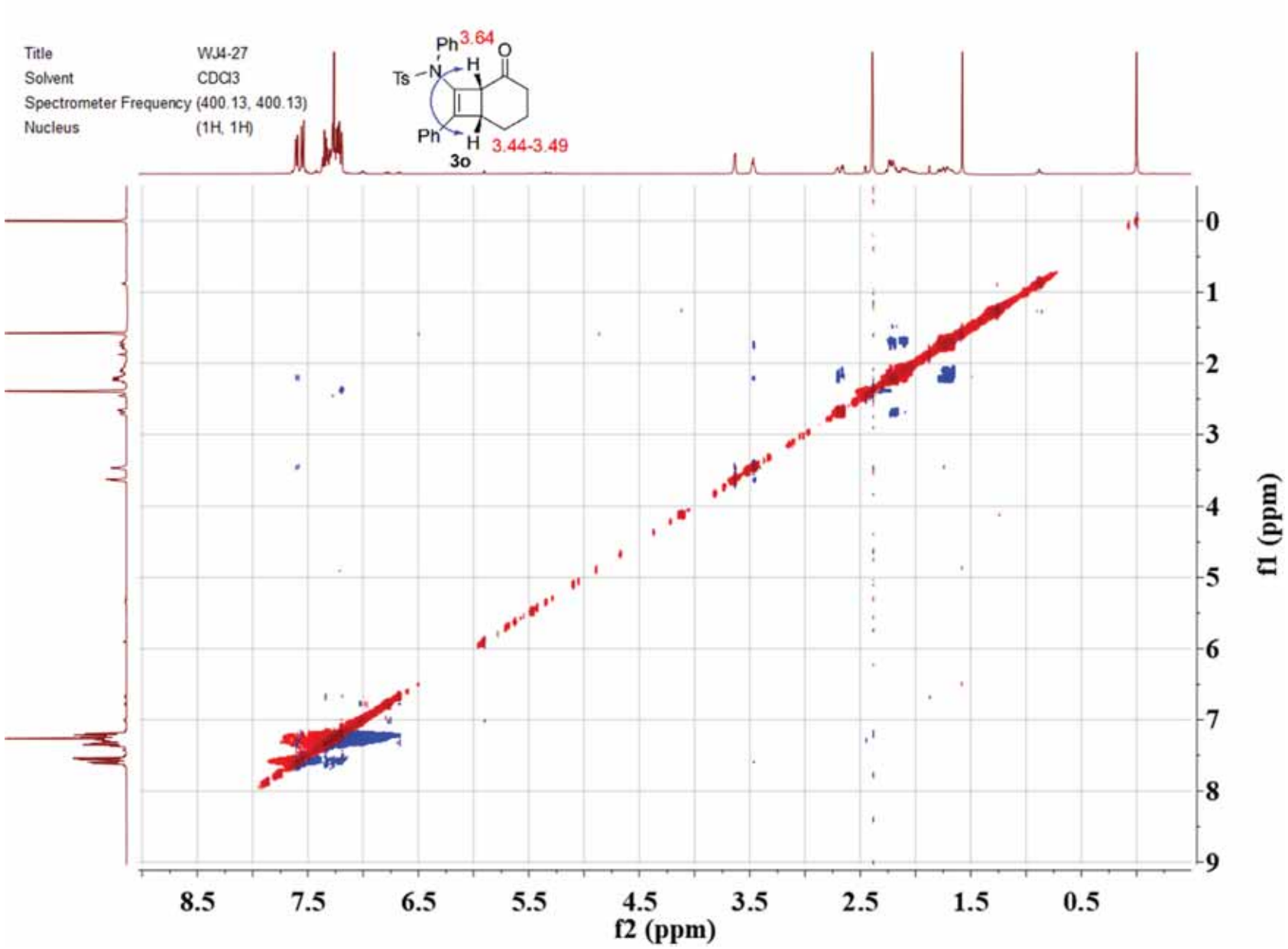

Title WJ3-73
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
3.19
O
Ts
N
H
n-Bu
H 2.81
3j
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
f1 (ppm)
4.4
3.7
3.0
2.3
f2 (ppm)

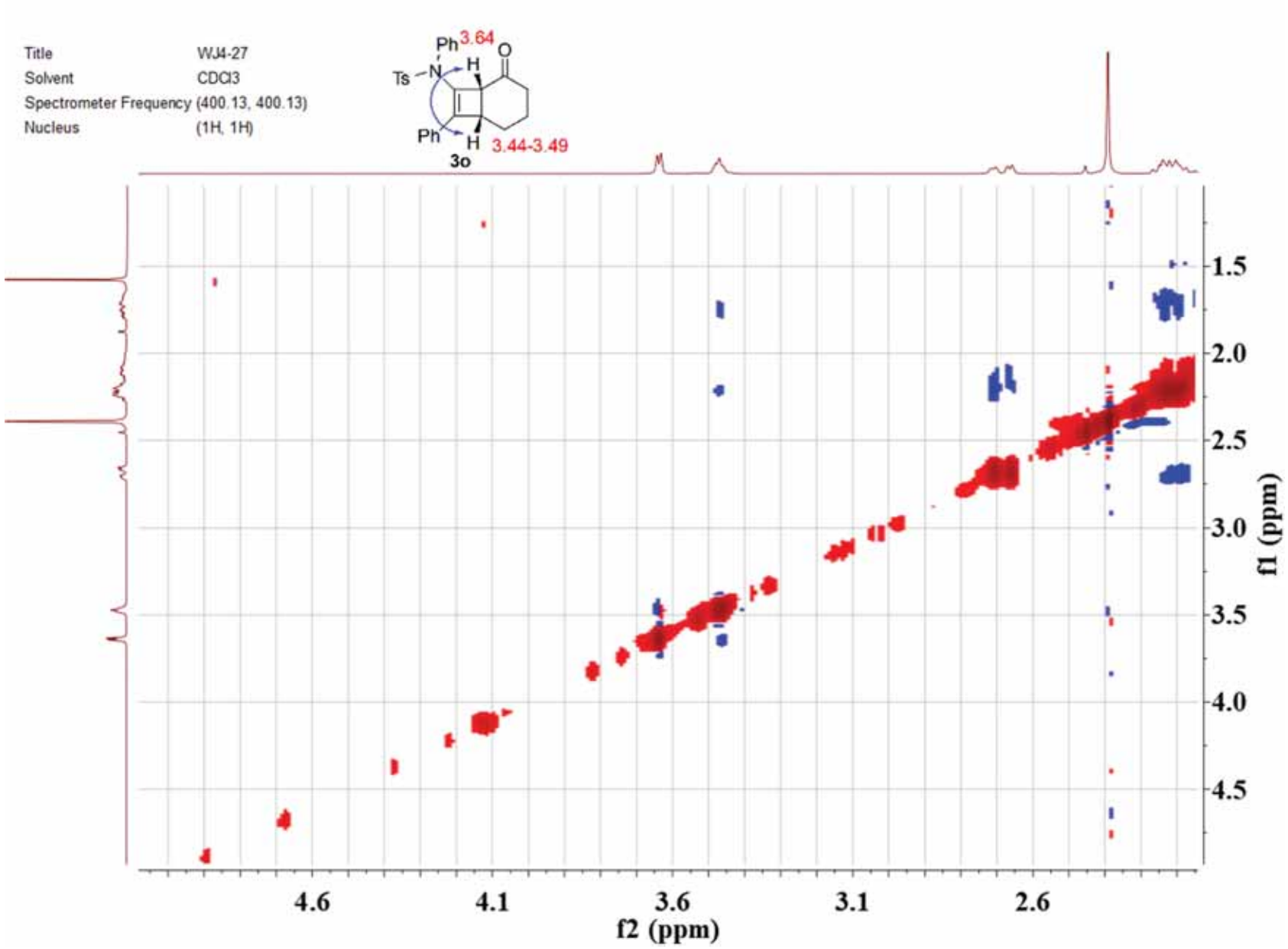

Title WJ3-70
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
3.19
O
Ts
N
H
n-hex
H
2.81
3k
f2 (ppm)
f1 (ppm)
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
0
1
2
3
4
5
6
7
8

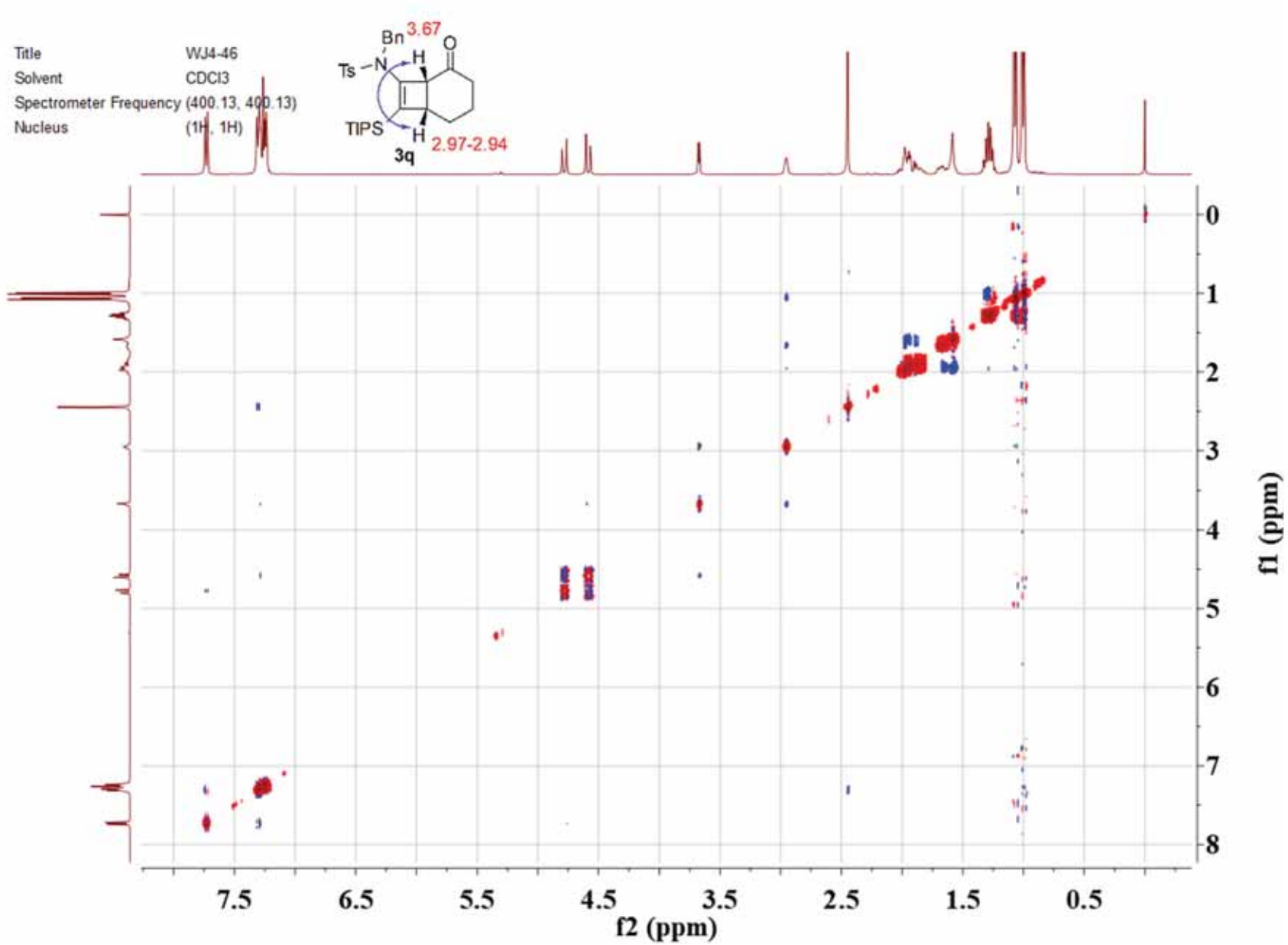

Title WJ3-70
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Ts
N
H
3.19
O
n-hex
H
2.81
3k
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
f1 (ppm)
4.1
3.9
3.7
3.5
3.3
3.1
2.9
2.7
2.5
2.3
f2 (ppm)

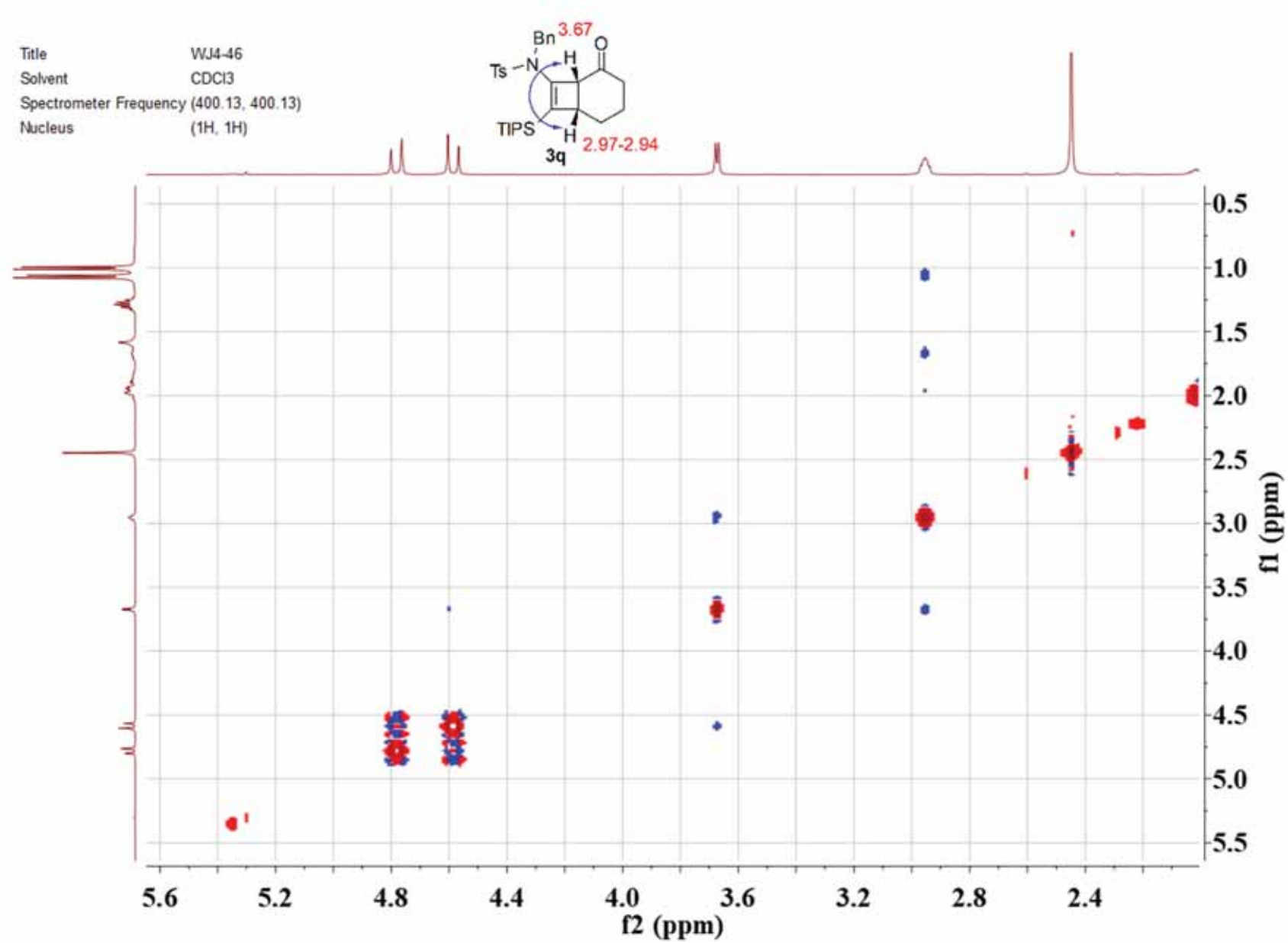

Title WJ3-67
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Me
3.54
O
Ts
N
H
Ph
H
3.48
3n
f2 (ppm)
f1 (ppm)

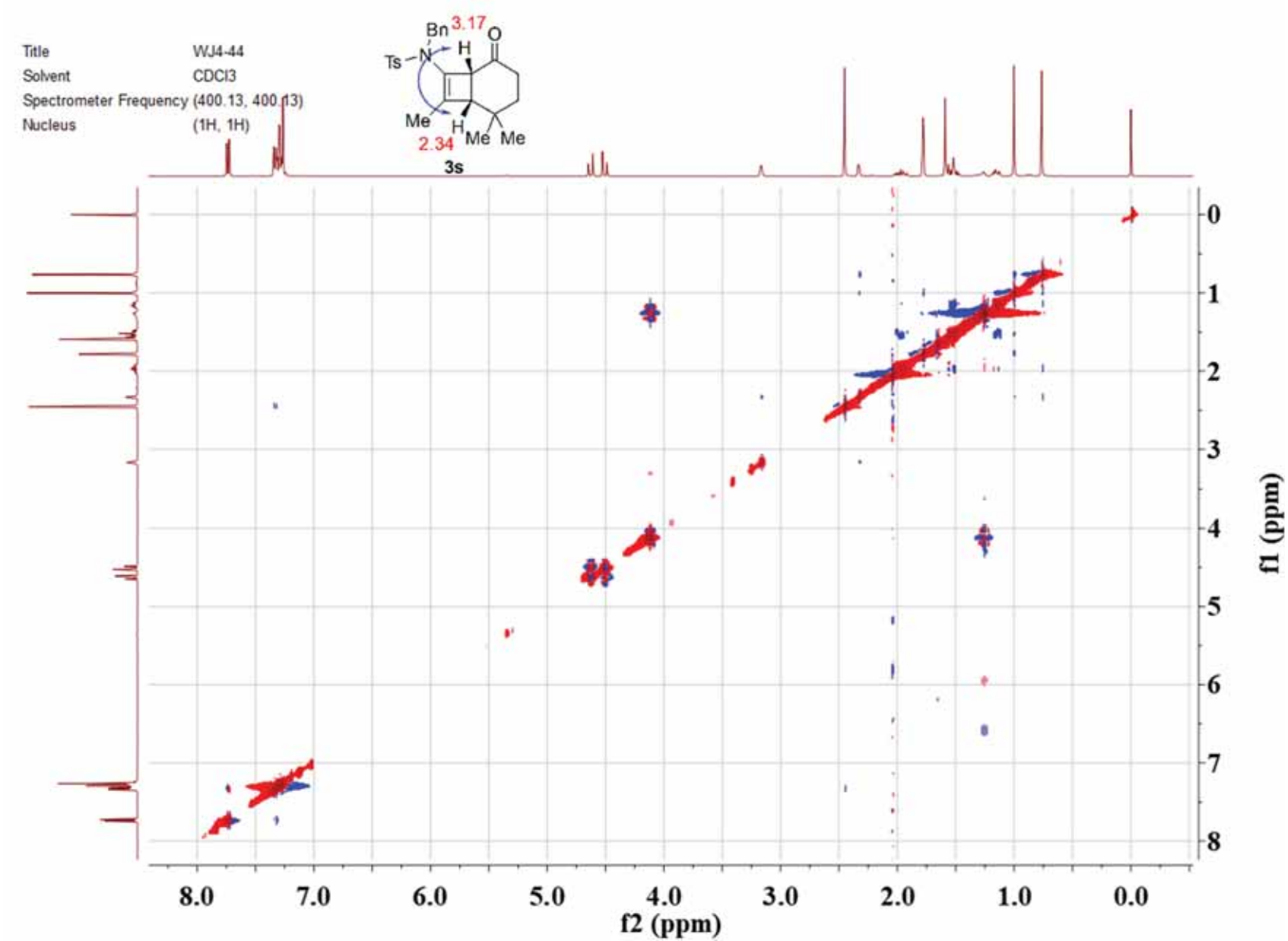

Title WJ3-67
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Me 3.54
Ts N H
O
Ph H 3.48
3n
f2 (ppm)
f1 (ppm)

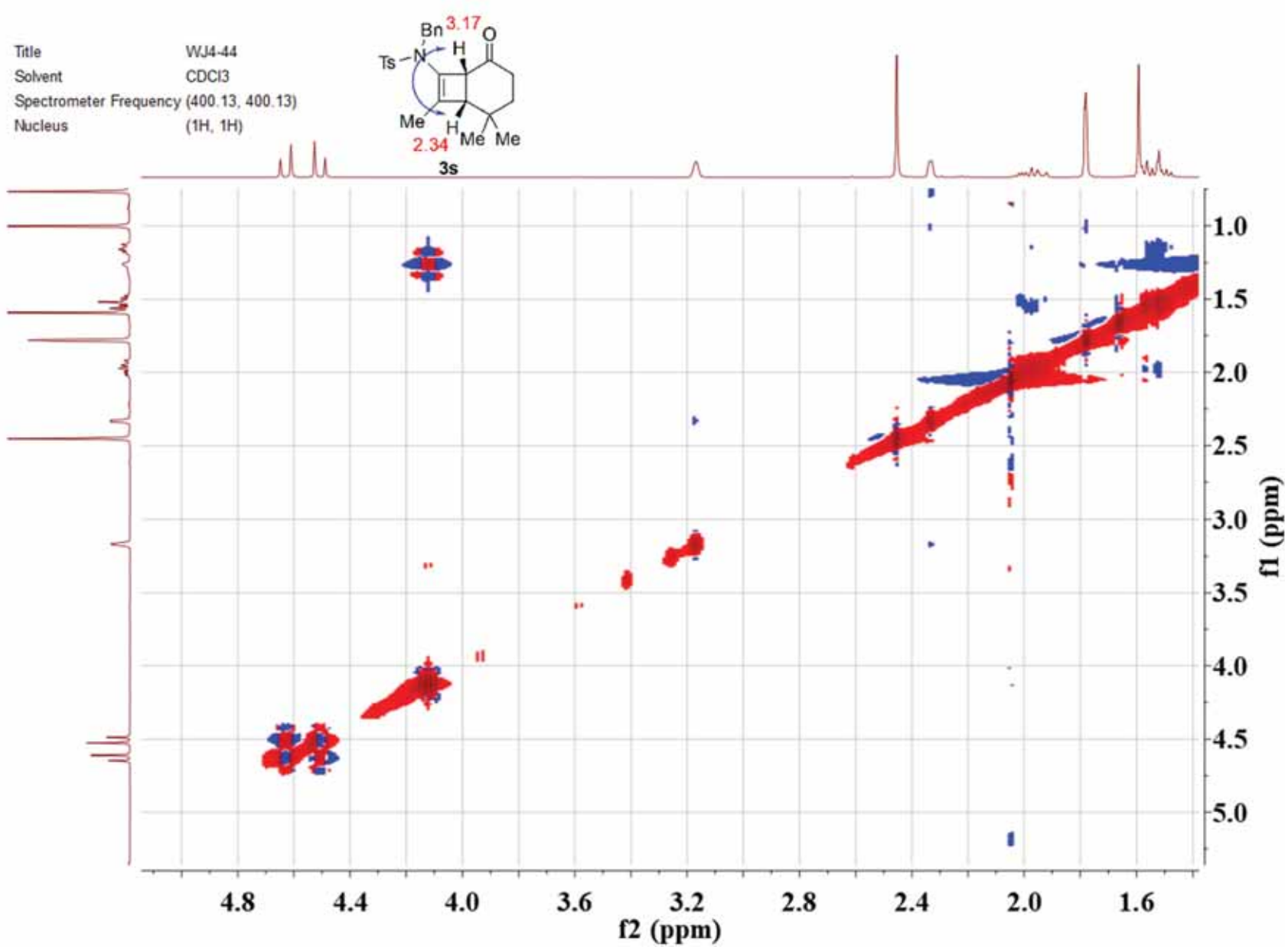

Title WJ4-27
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Ph
3.64
O
Ts
N
H
Ph
H
3.44-3.49
3o
0
1
2
3
4
5
6
7
8
9
f1 (ppm)
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
f2 (ppm)

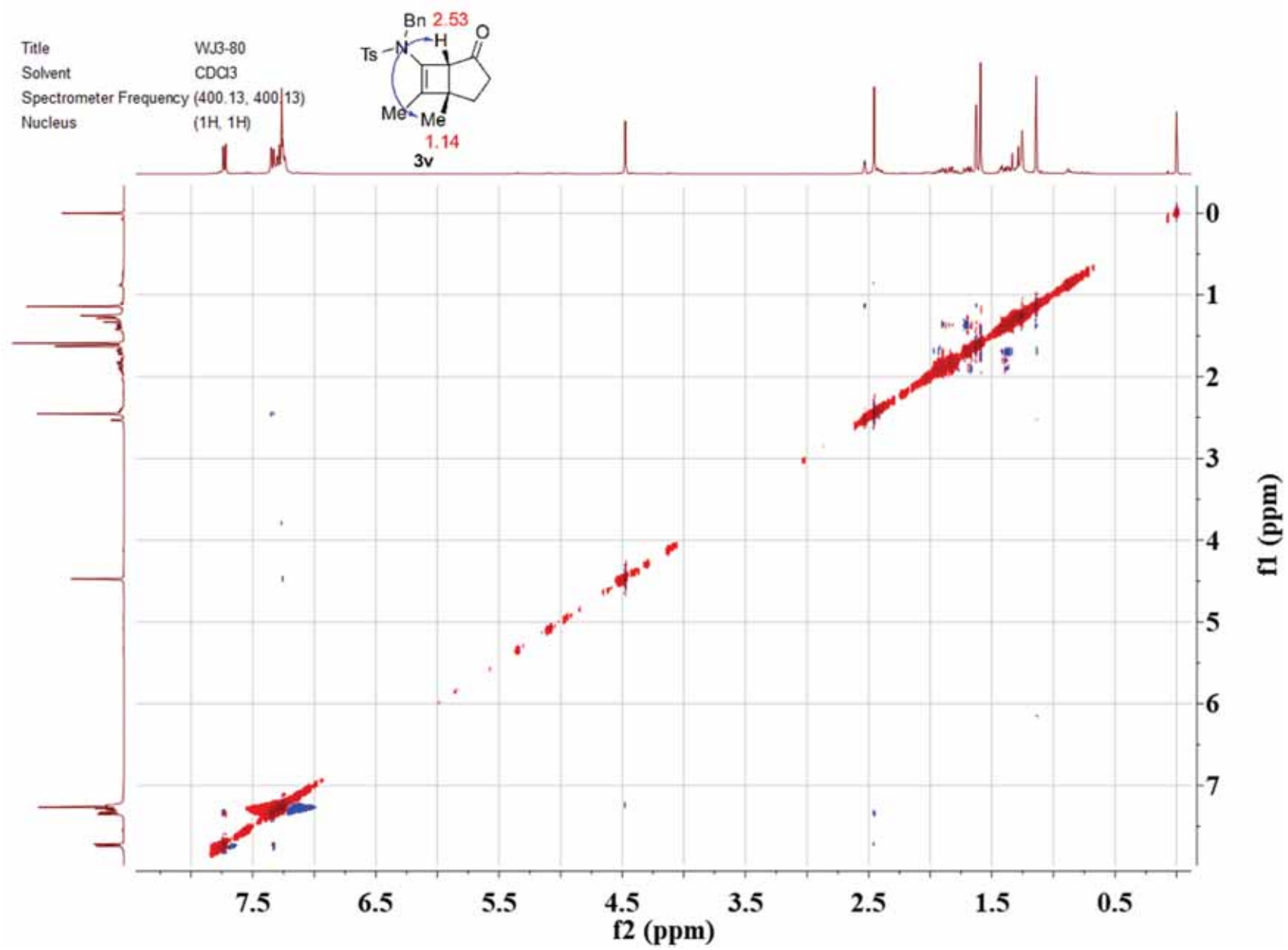

Title WJ4-27
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Ph
3.64
O
Ts
N
H
Ph
H
3.44-3.49
3o
1.5
2.0
2.5
3.0
3.5
4.0
4.5
f1 (ppm)
4.6
4.1
3.6
3.1
2.6
f2 (ppm)

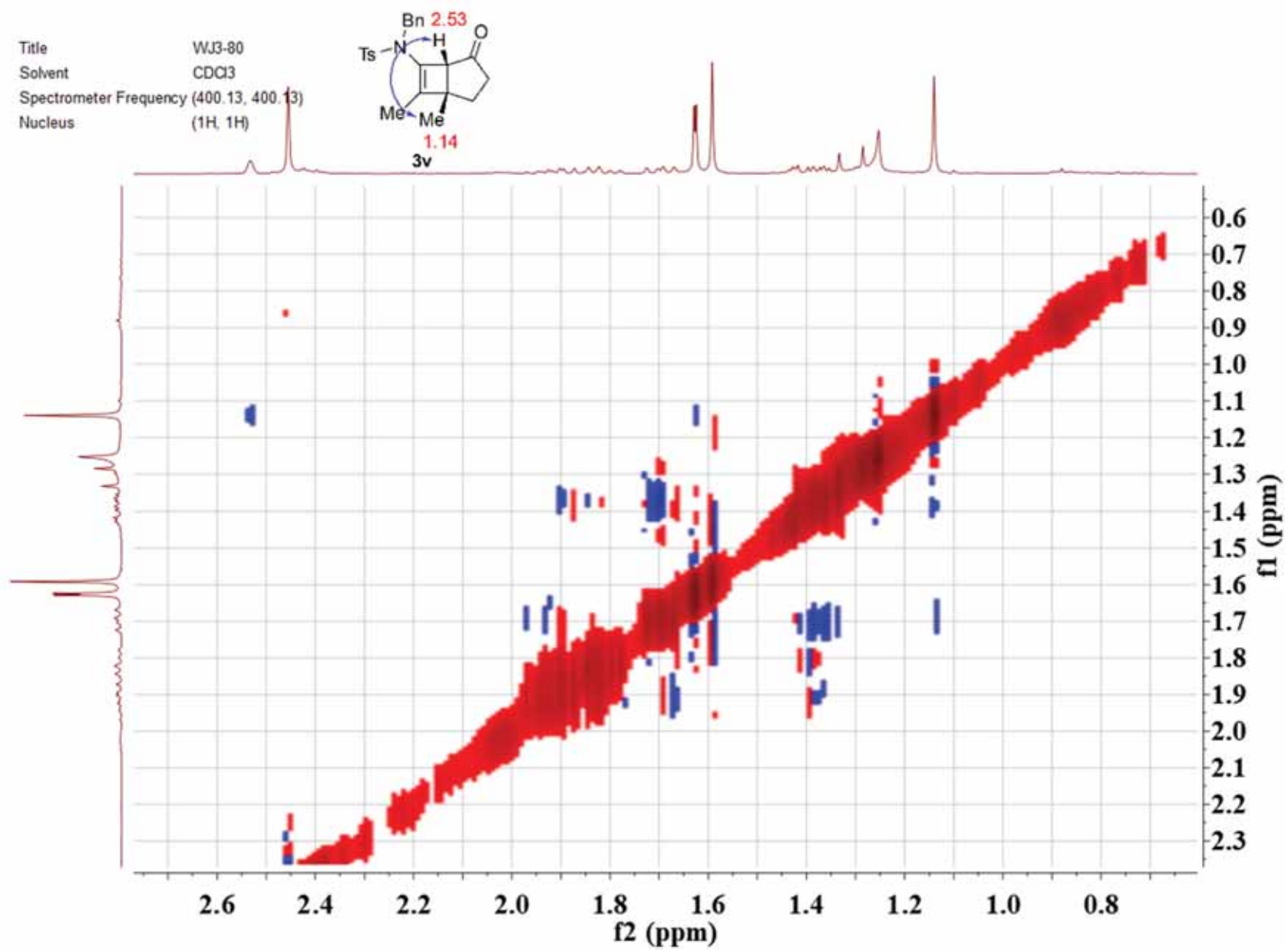

Title WJ4-46
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
3.67
Ts
N
H
O
TIPS
H
2.97-2.94
3q
f2 (ppm)
f1 (ppm)

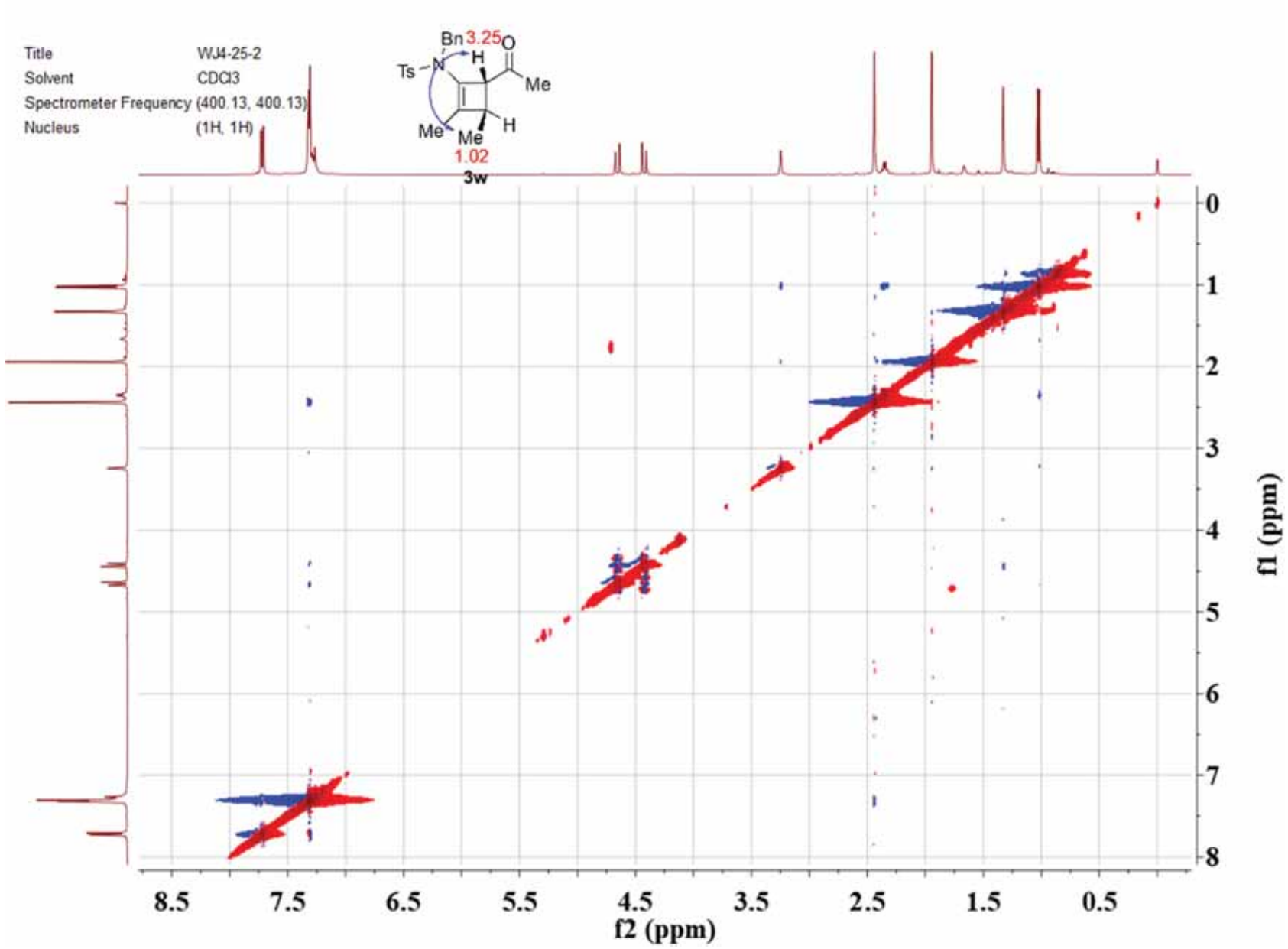

Title WJ4-46
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Ts
N
H
O
TIPS
H
3.67
2.97-2.94
3q
f2 (ppm)
f1 (ppm)

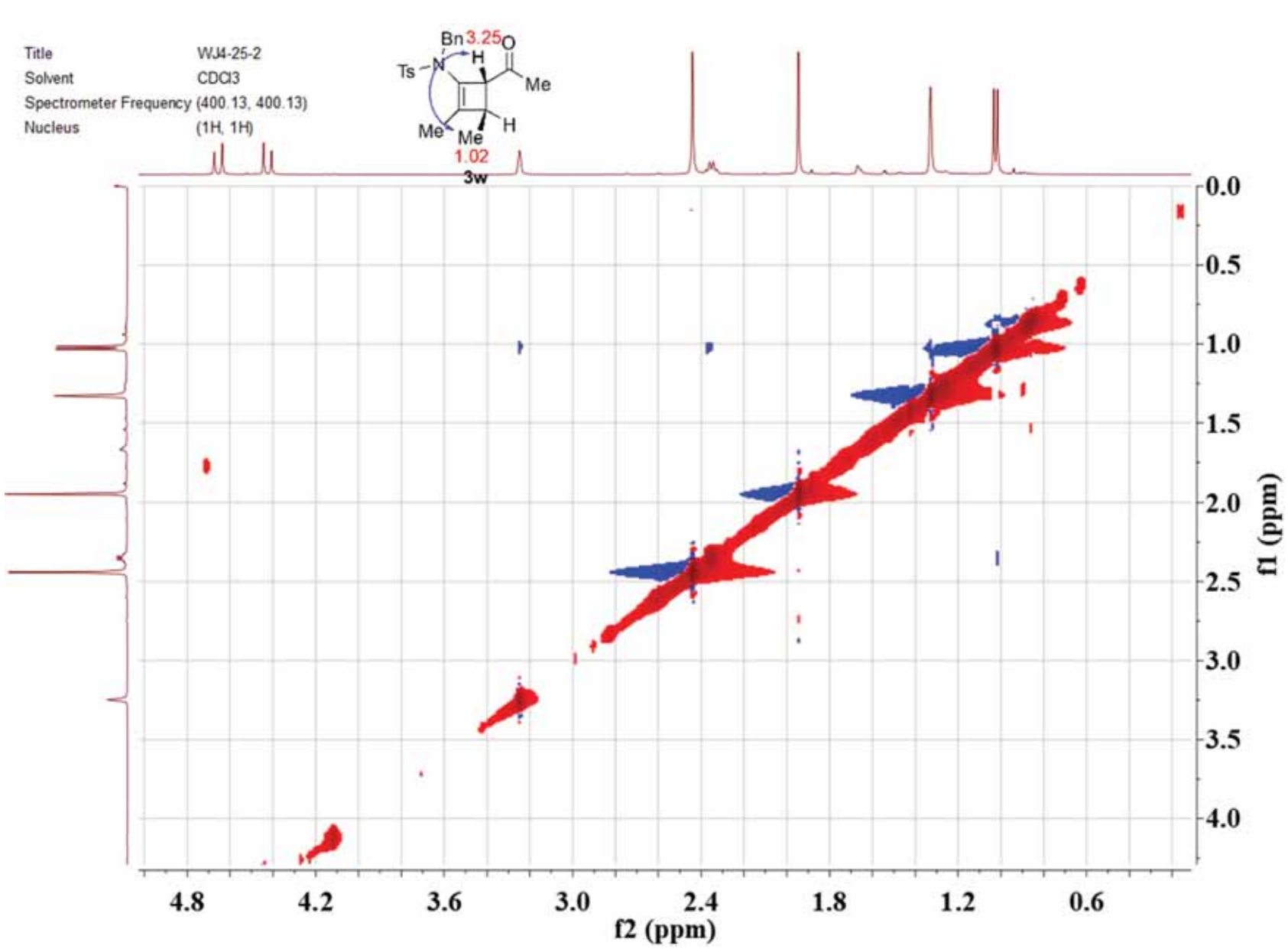

Title WJ4-44
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
3.17
O
Ts
N
H
Me
H
Me Me
2.34
3s
f2 (ppm)
f1 (ppm)

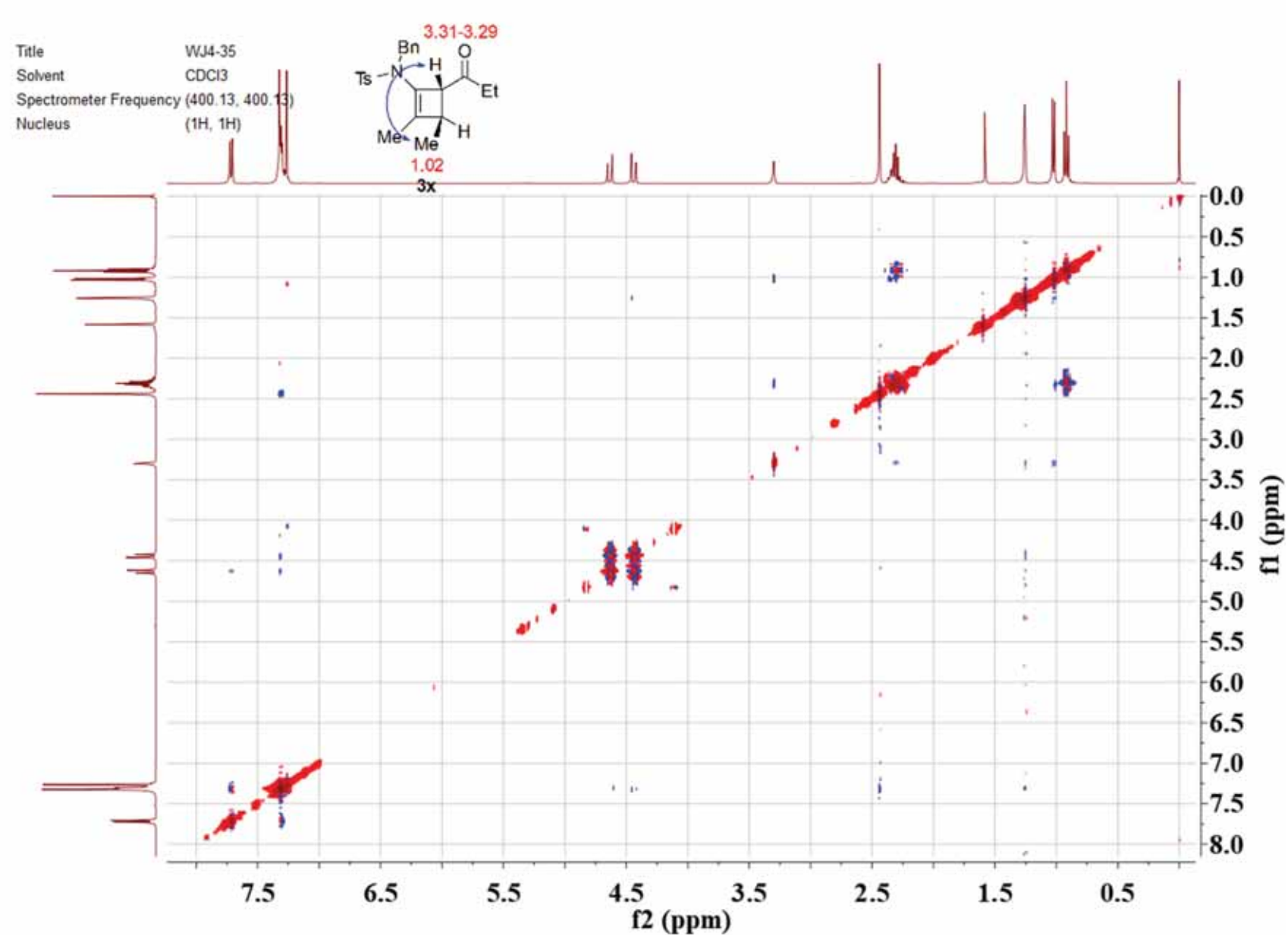

Title WJ4-44
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Ts
N
H
O
3.17
Me
H
Me
Me
2.34
3s
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
f1 (ppm)
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
f2 (ppm)

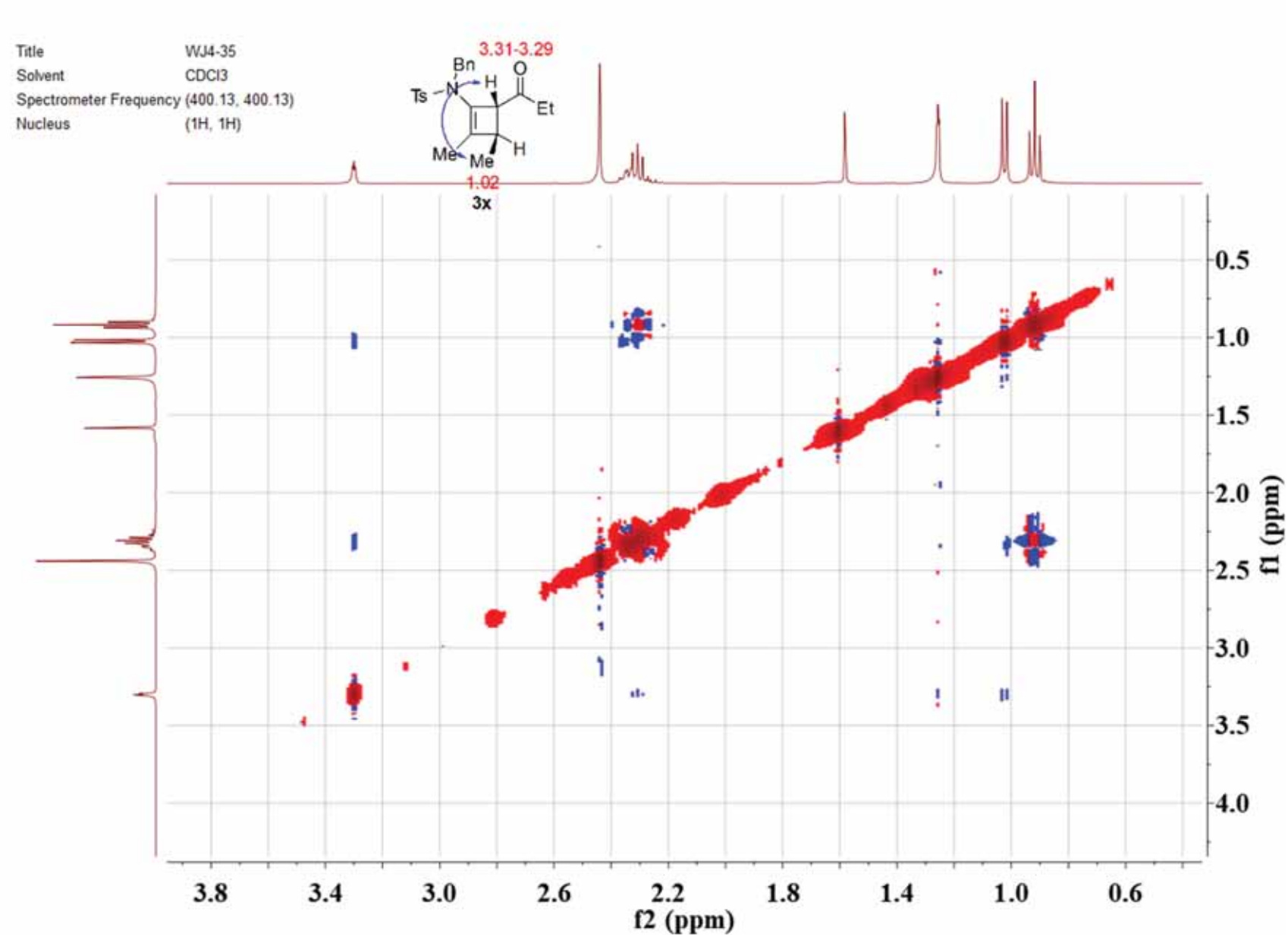

Title WJ3-80
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn 2.53
Ts
N
H
O
Me
Me
1.14
3v
f2 (ppm)
f1 (ppm)


Title WJ3-80
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn 2.53
Ts
N
H
O
Me
Me
1.14
3v
f2 (ppm)
f1 (ppm)

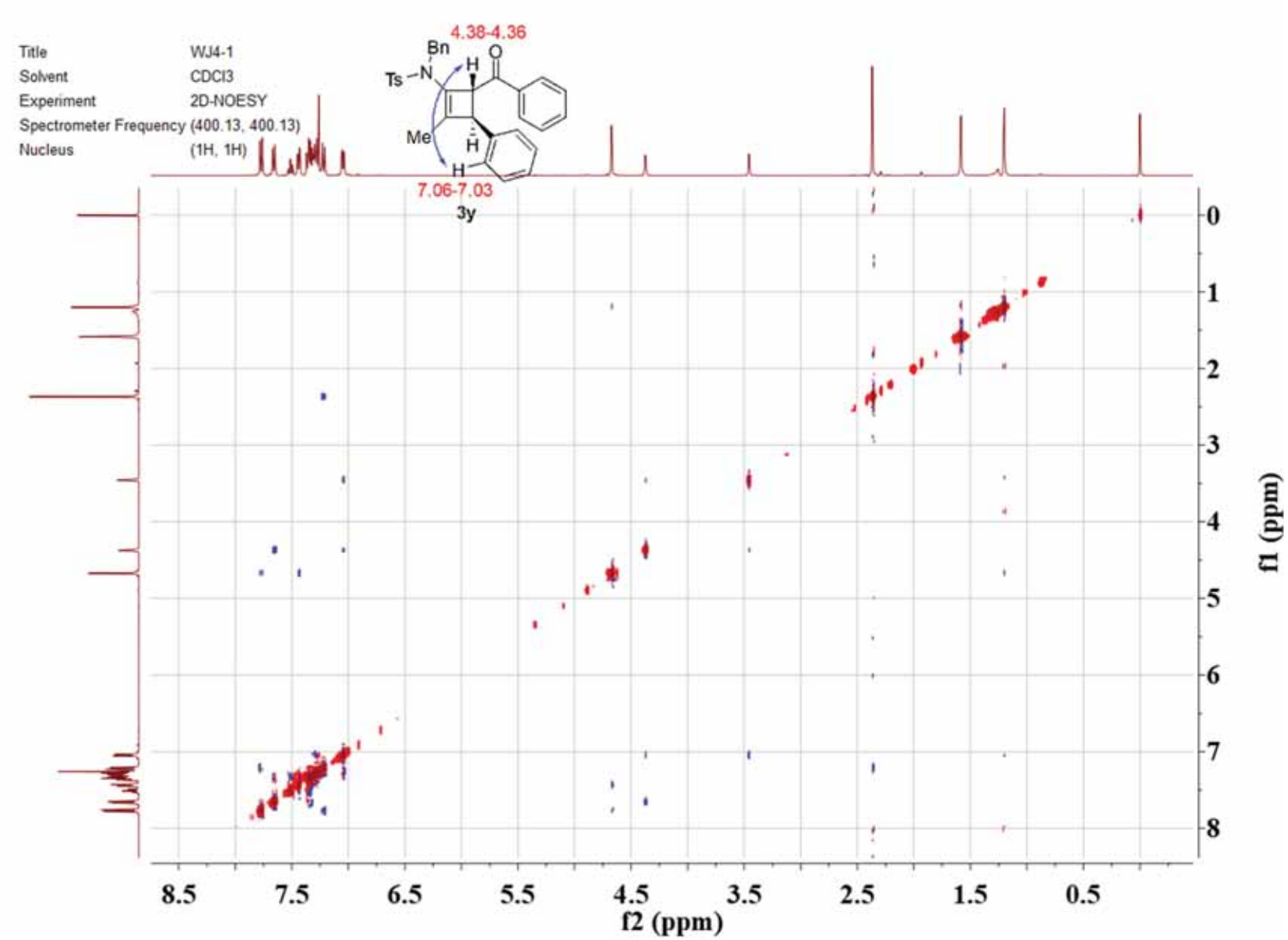

Title WJ4-25-2
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
3.25
O
Ts
N
H
Me
Me
Me
H
1.02
3w
0
1
2
3
4
5
6
7
8
f1 (ppm)
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
f2 (ppm)

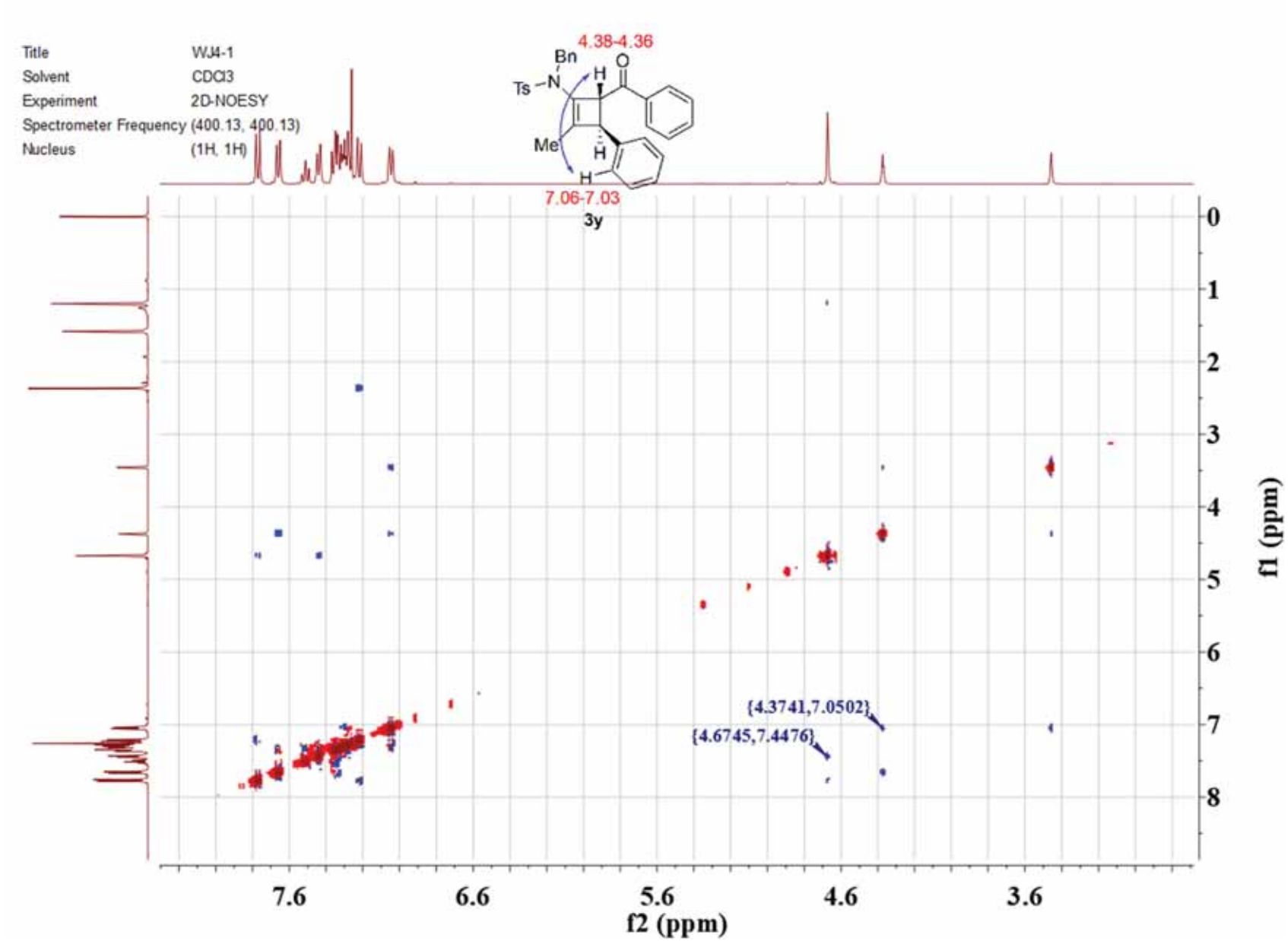

Title WJ4-25-2
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
3.25
O
Ts
N
H
Me
Me
Me
H
1.02
3w
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
f1 (ppm)
4.8
4.2
3.6
3.0
2.4
1.8
1.2
0.6
f2 (ppm)

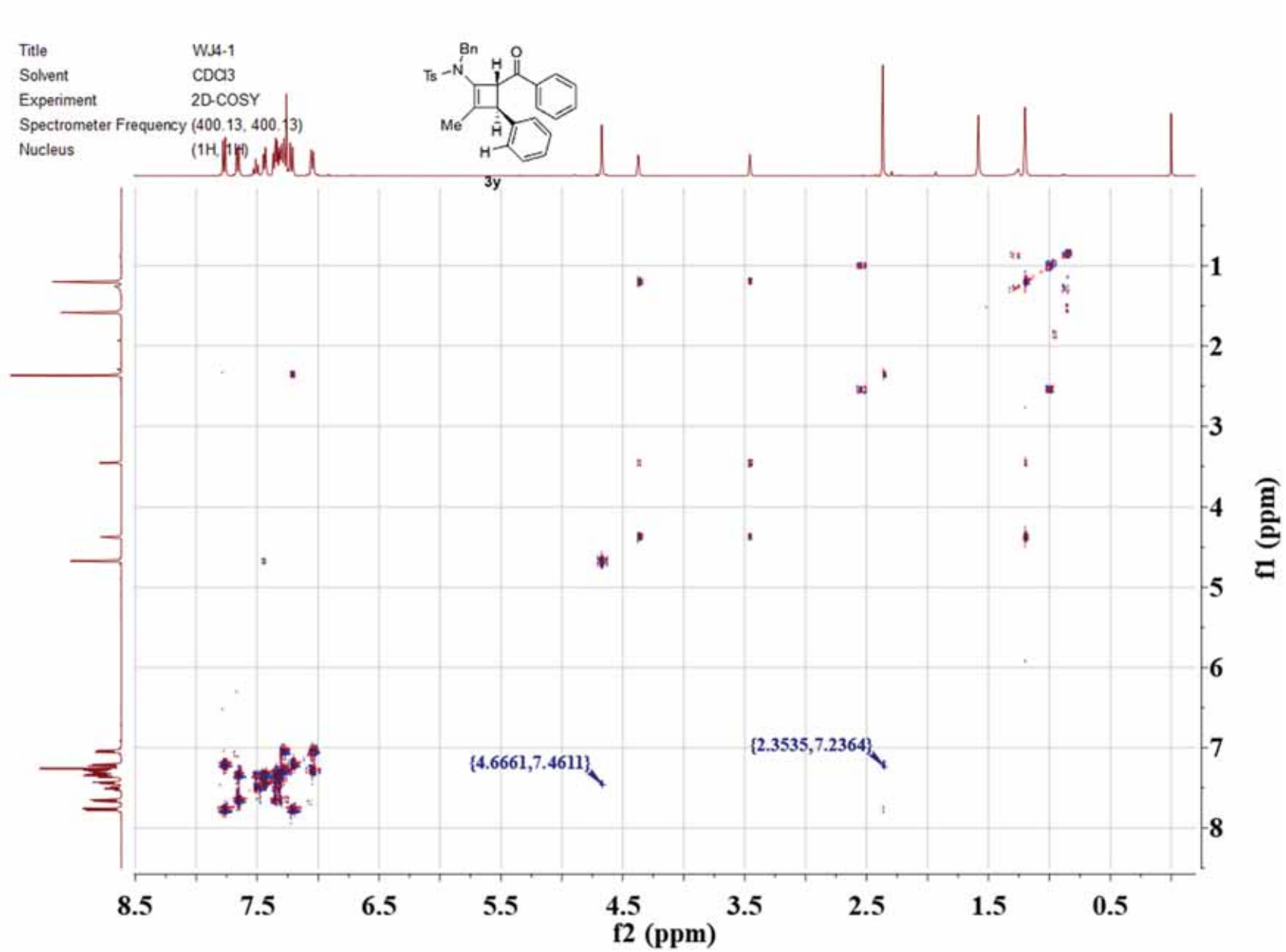

Title WJ4-35
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
3.31-3.29
Bn
Ts
N
H
O
Et
Me
Me
H
1.02
3x
f2 (ppm)
f1 (ppm)

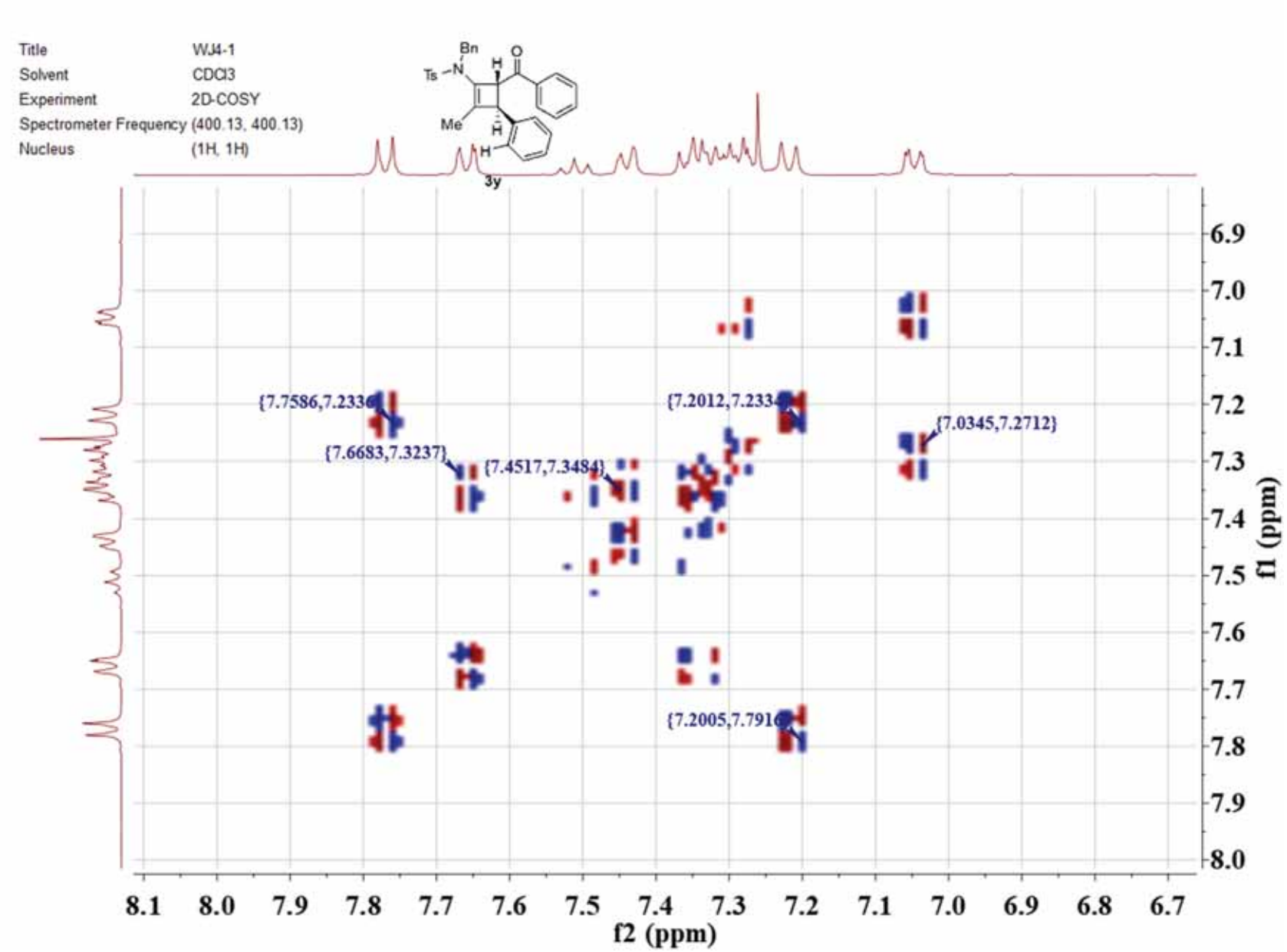

Title WJ4-35
Solvent CDCl3
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
3.31-3.29
Bn
O
Ts
N
H
Et
Me
Me
H
1.02
3x
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
f1 (ppm)
3.8
3.4
3.0
2.6
2.2
1.8
1.4
1.0
0.6
f2 (ppm)

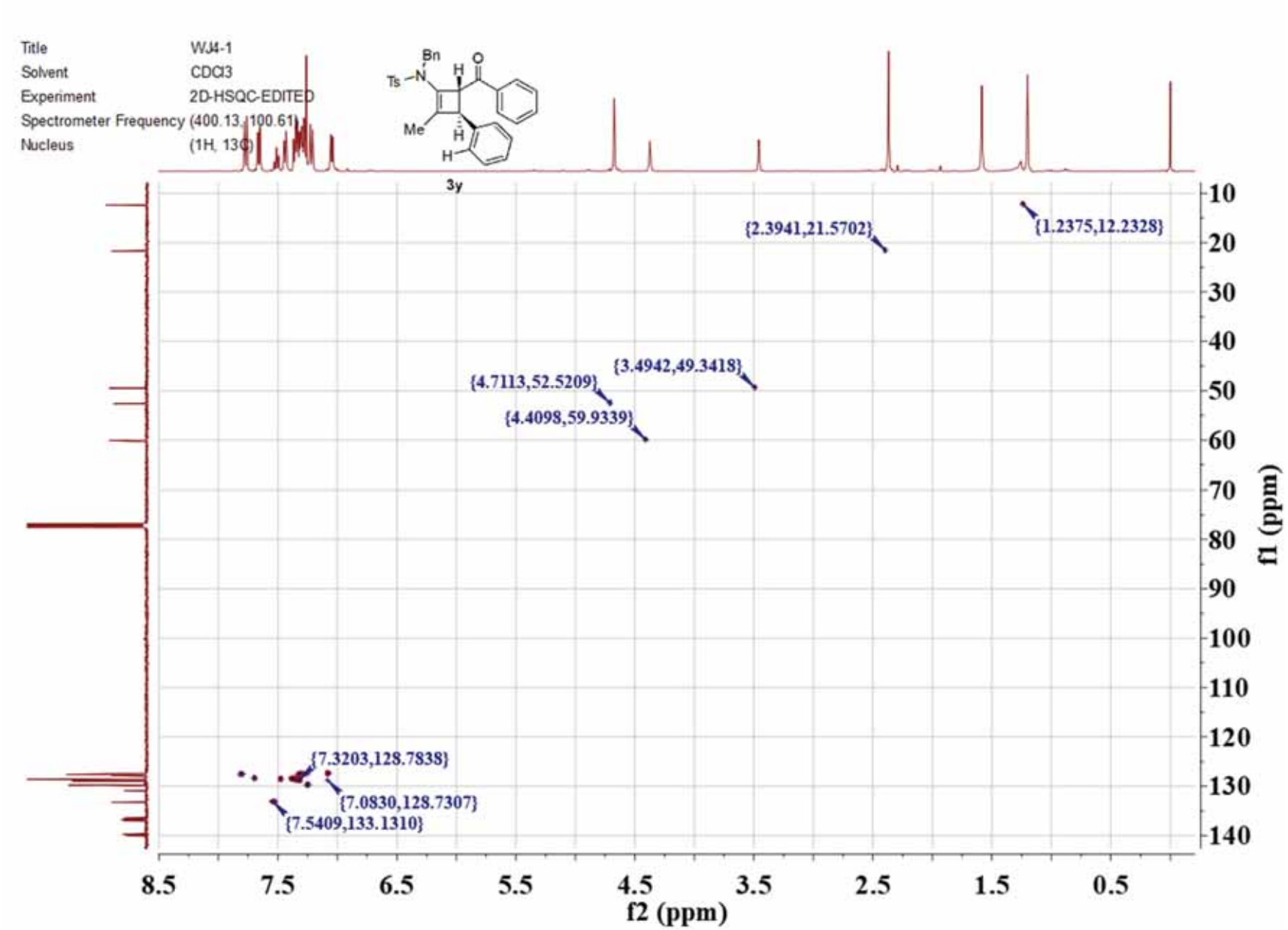
NOESY, COSY, HSQC, and HMBC Spectra of Cyclobutenamides 3y and 3z.

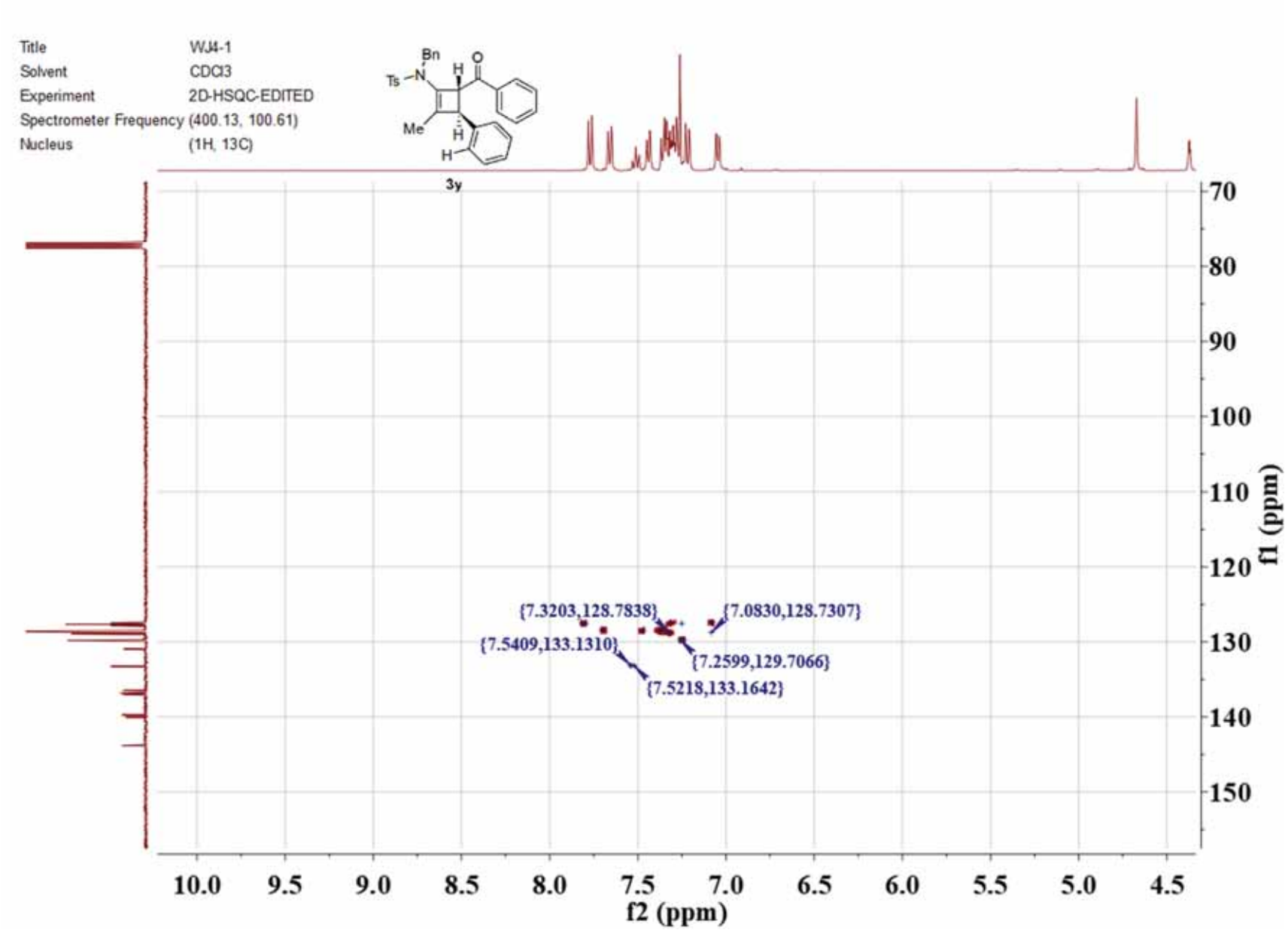


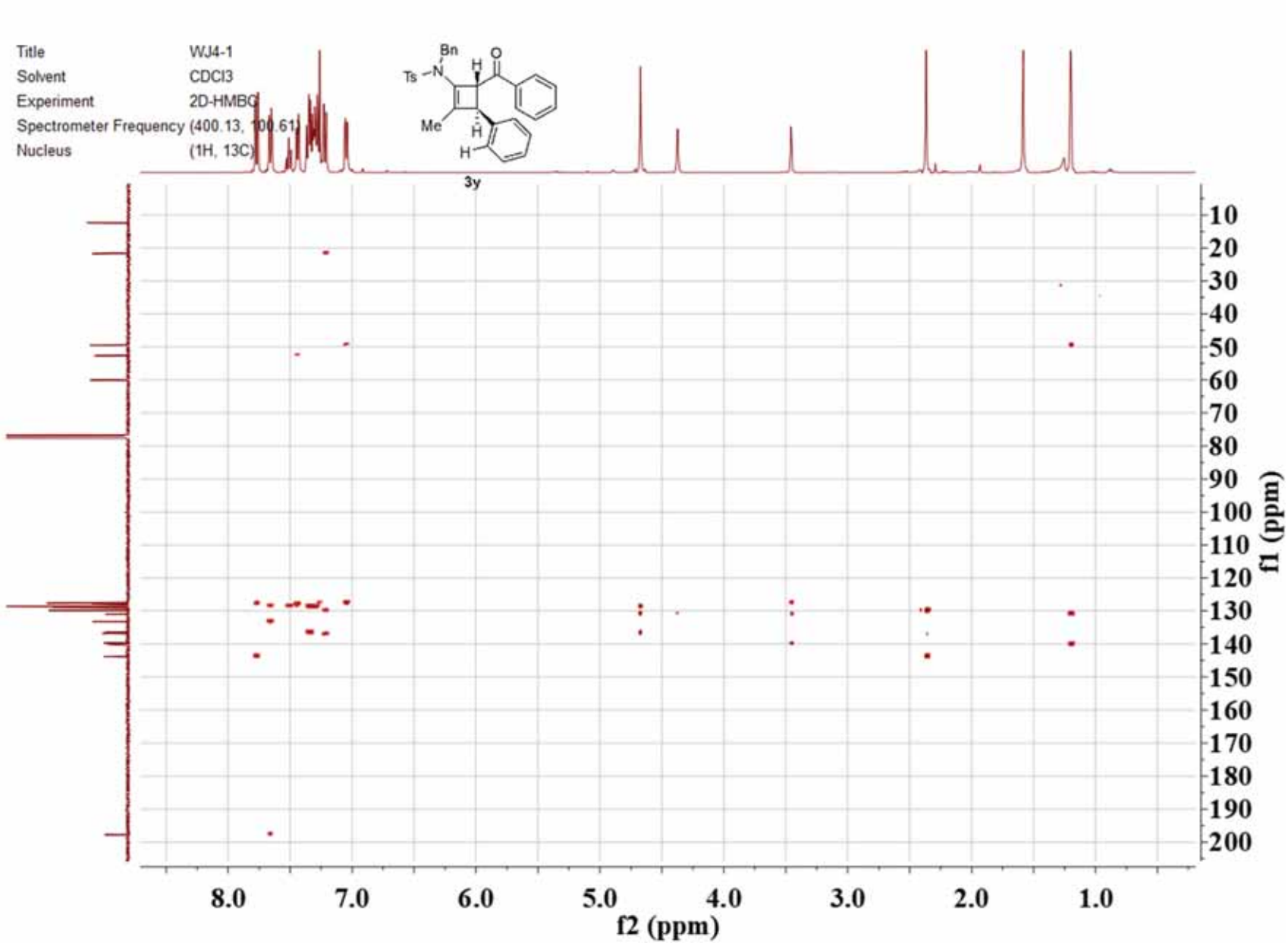

Title WJ4-1
Solvent CDCl3
Experiment 2D-NOESY
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
4.38-4.36
7.06-7.03
3y
{4.3741,7.0502}
{4.6745,7.4476}
f2 (ppm)
f1 (ppm)

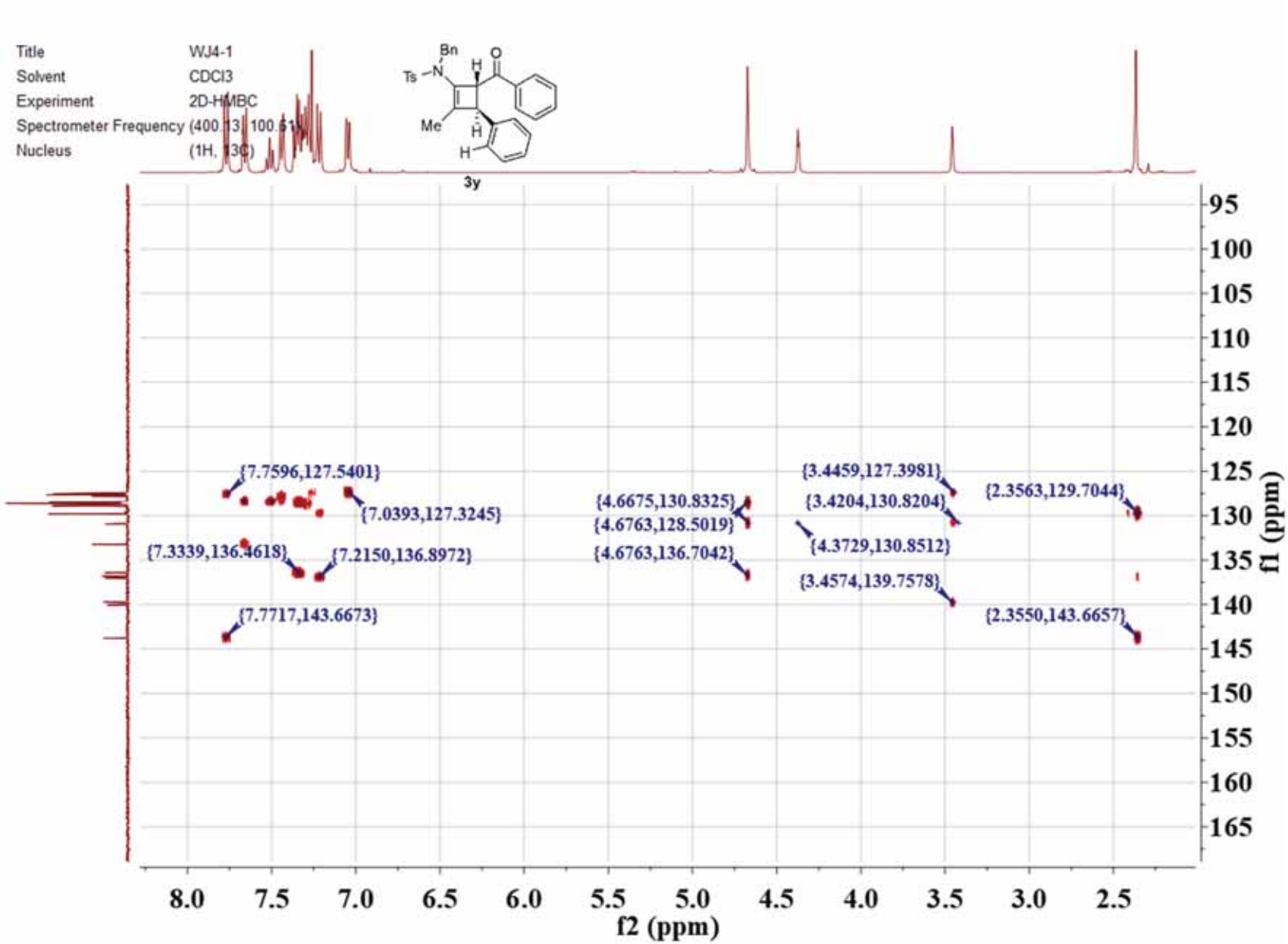

Title WJ4-1
Solvent CDCl3
Experiment 2D-COSY
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Ts
N
O
H
Me
H
H
3y
{4.6661,7.4611}
{2.3535,7.2364}
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
f2 (ppm)
1
2
3
4
5
6
7
8
f1 (ppm)

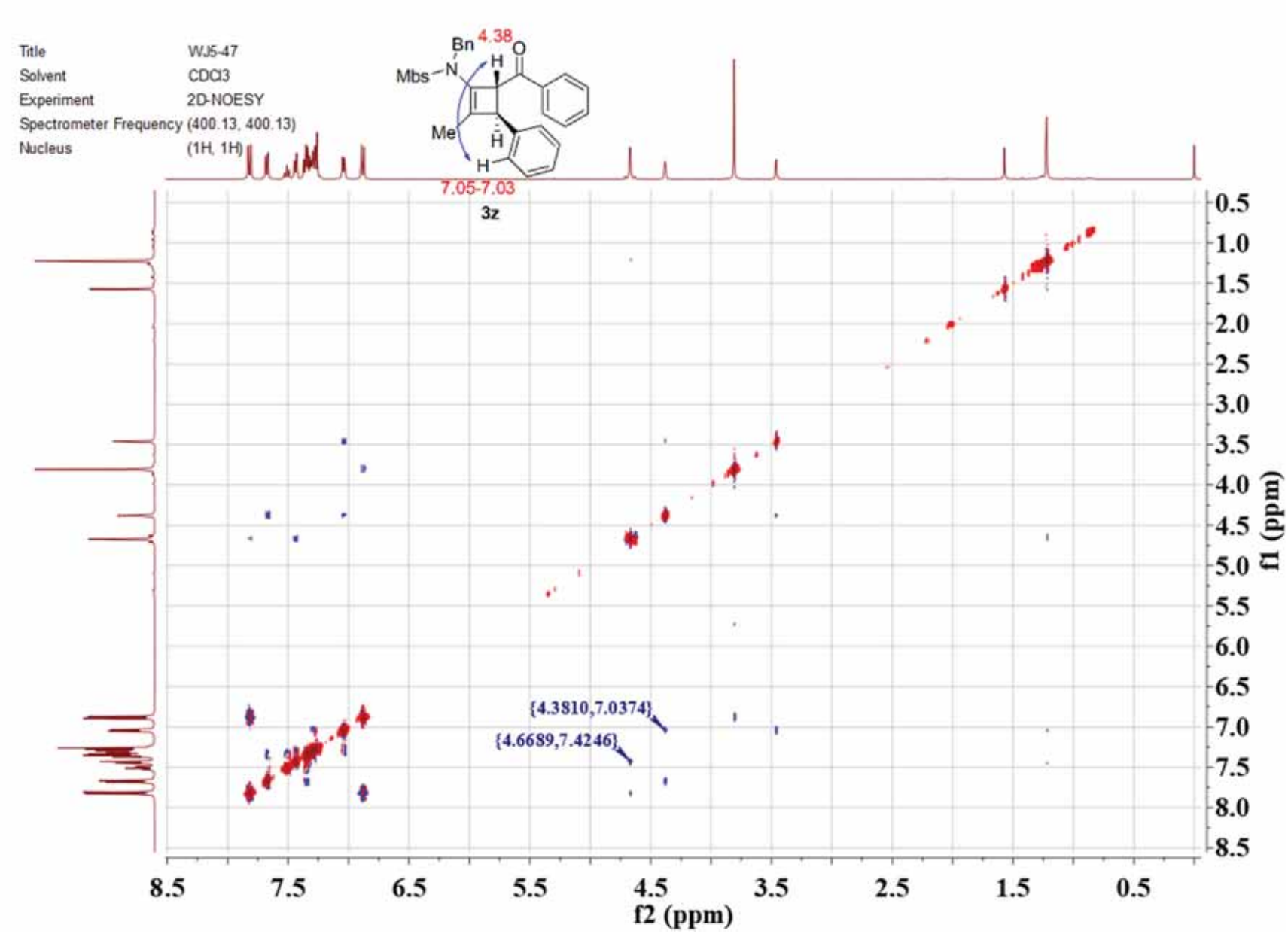

Title WJ4-1
Solvent CDCl3
Experiment 2D-COSY
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
3y
{7.7586,7.2336}
{7.6683,7.3237}
{7.4517,7.3484}
{7.2012,7.2334}
{7.0345,7.2712}
{7.2005,7.7916}
f1 (ppm)
f2 (ppm)

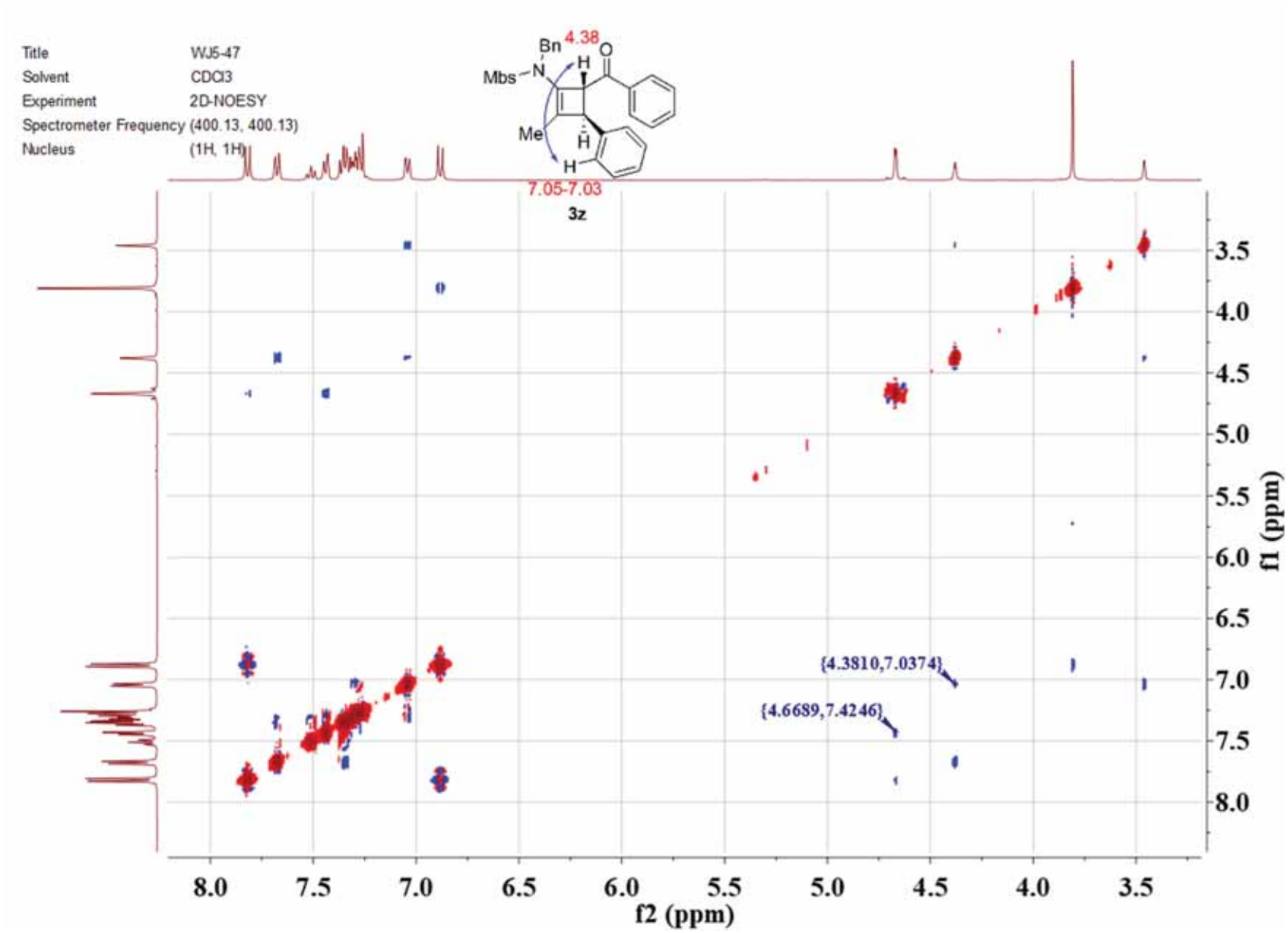

Title WJ4-1
Solvent CDCl3
Experiment 2D-HSQC-EDITED
Spectrometer Frequency (400.13, 100.61)
Nucleus (1H, 13C)
Bn
Ts
N
H
O
Me
H
H
3y
{2.3941,21.5702}
{1.2375,12.2328}
{3.4942,49.3418}
{4.7113,52.5209}
{4.4098,59.9339}
{7.3203,128.7838}
{7.0830,128.7307}
{7.5409,133.1310}
f1 (ppm)
f2 (ppm)

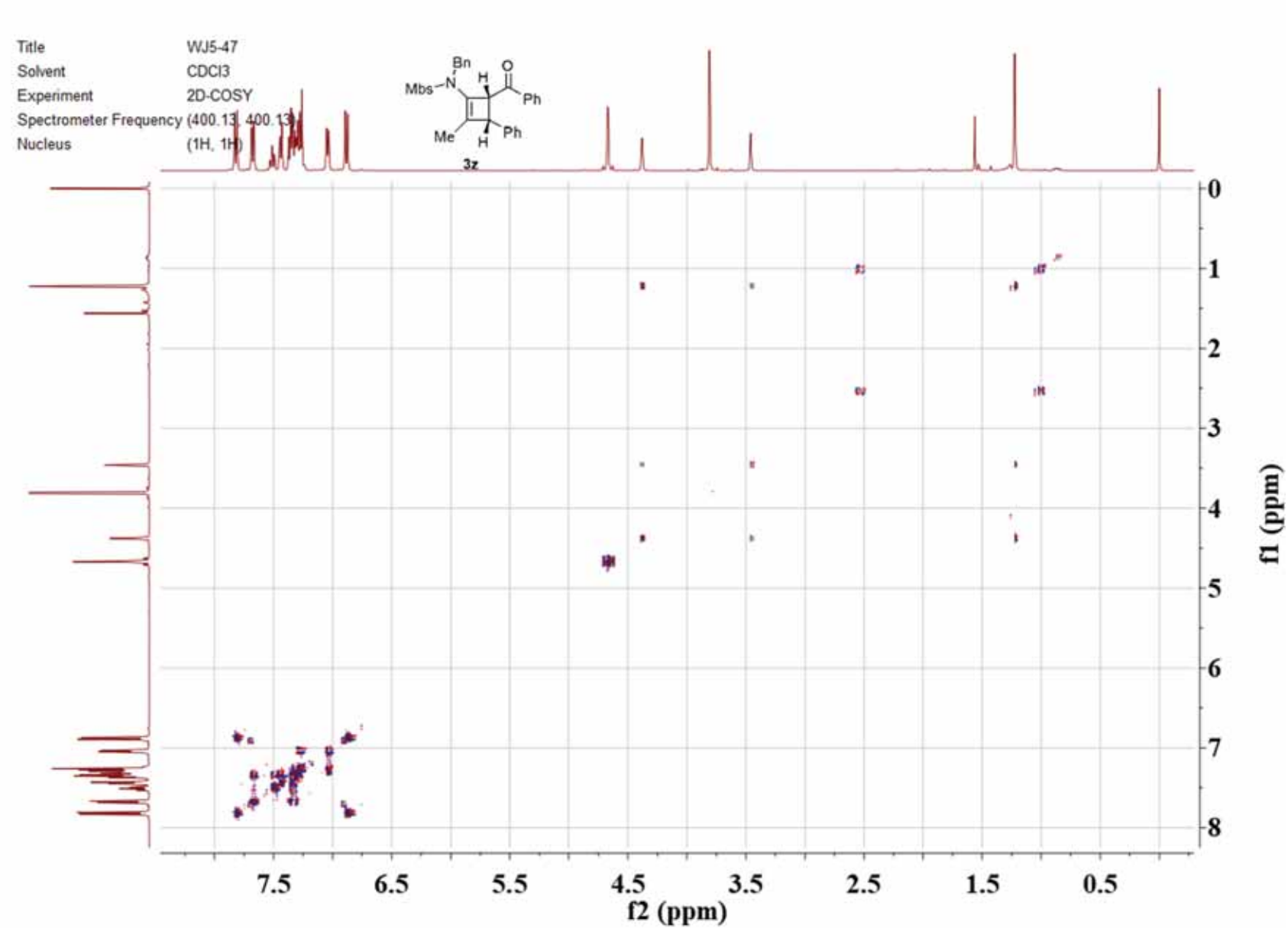

Title WJ4-1
Solvent CDCl3
Experiment 2D-HSQC-EDITED
Spectrometer Frequency (400.13, 100.61)
Nucleus (1H, 13C)
3y
{7.3203,128.7838}
{7.0830,128.7307}
{7.5409,133.1310}
{7.2599,129.7066}
{7.5218,133.1642}
f1 (ppm)
f2 (ppm)

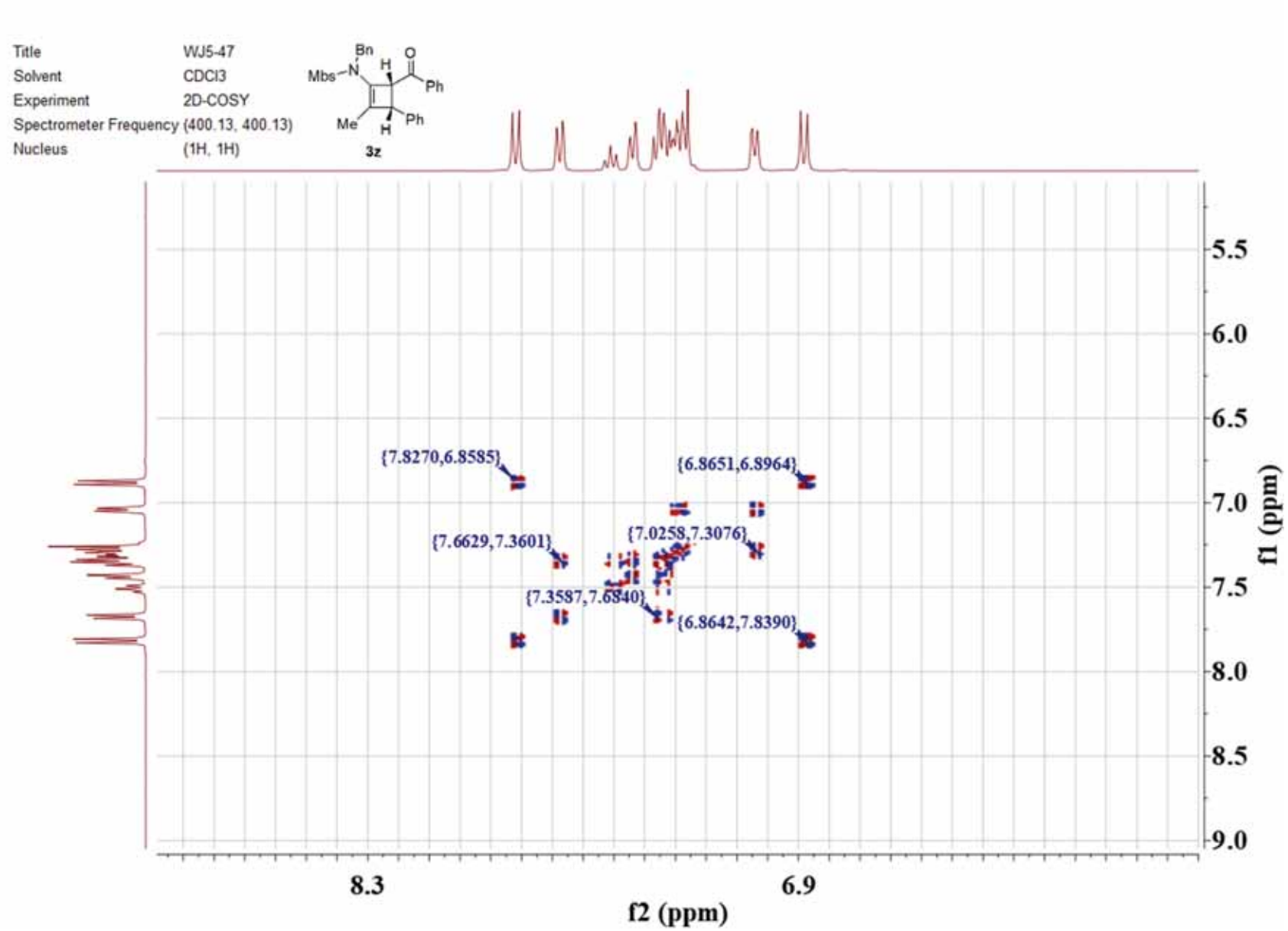

Title WJ4-1
Solvent CDCl3
Experiment 2D-HMBC
Spectrometer Frequency (400.13, 100.61)
Nucleus (1H, 13C)
Bn
Ts
N
H
O
Me
H
H
3y
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
f1 (ppm)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
f2 (ppm)

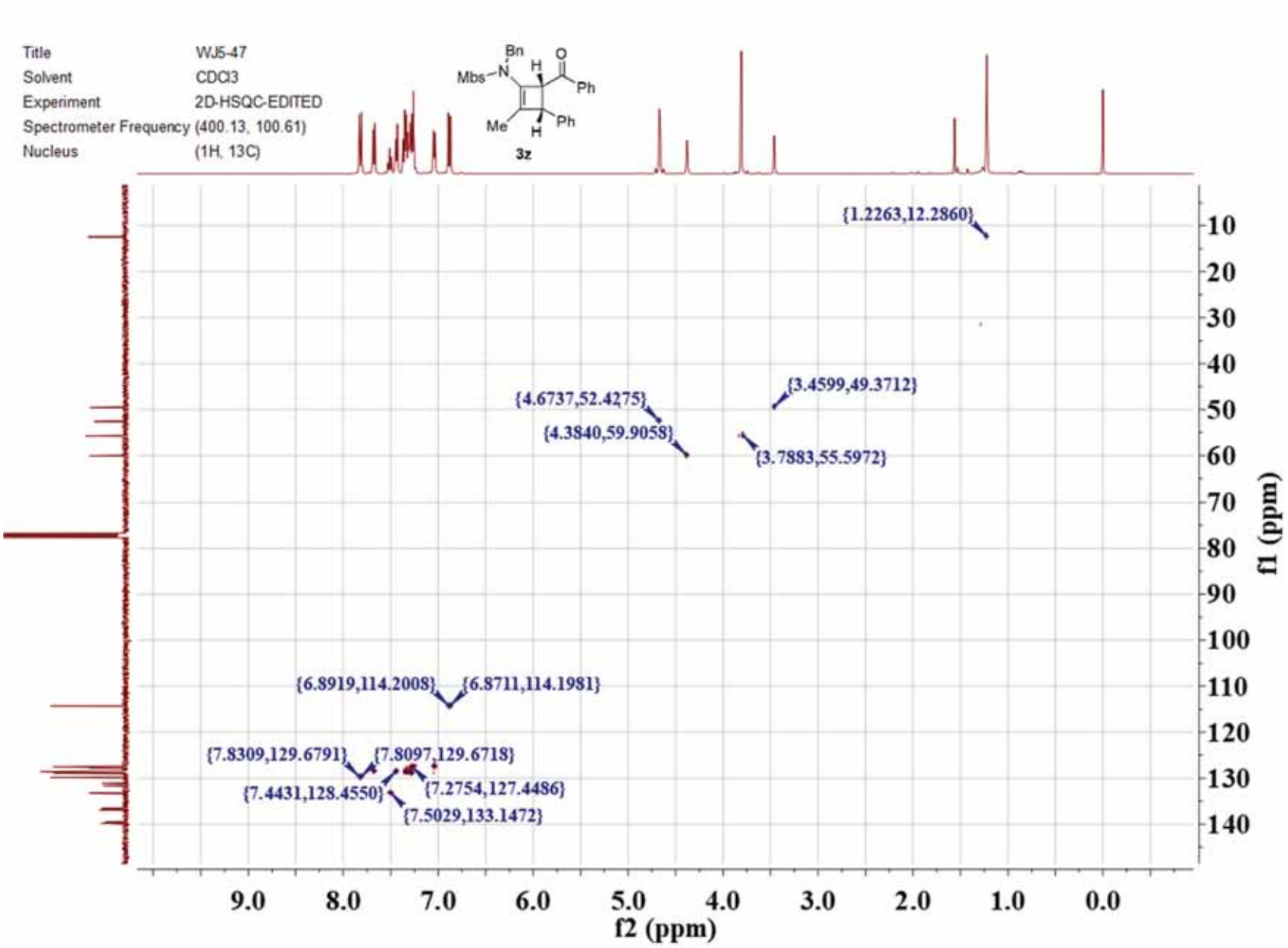

Title WJ4-1
Solvent CDCl3
Experiment 2D-HMBC
Spectrometer Frequency (400.13, 100.61)
Nucleus (1H, 13C)
Bn
Ts
N
H
O
Me
H
H
3y
{7.7596,127.5401}
{7.0393,127.3245}
{7.3339,136.4618}
{7.2150,136.8972}
{7.7717,143.6673}
{4.6675,130.8325}
{4.6763,128.5019}
{4.6763,136.7042}
{3.4459,127.3981}
{3.4204,130.8204}
{4.3729,130.8512}
{3.4574,139.7578}
{2.3563,129.7044}
{2.3550,143.6657}
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
f1 (ppm)
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
f2 (ppm)

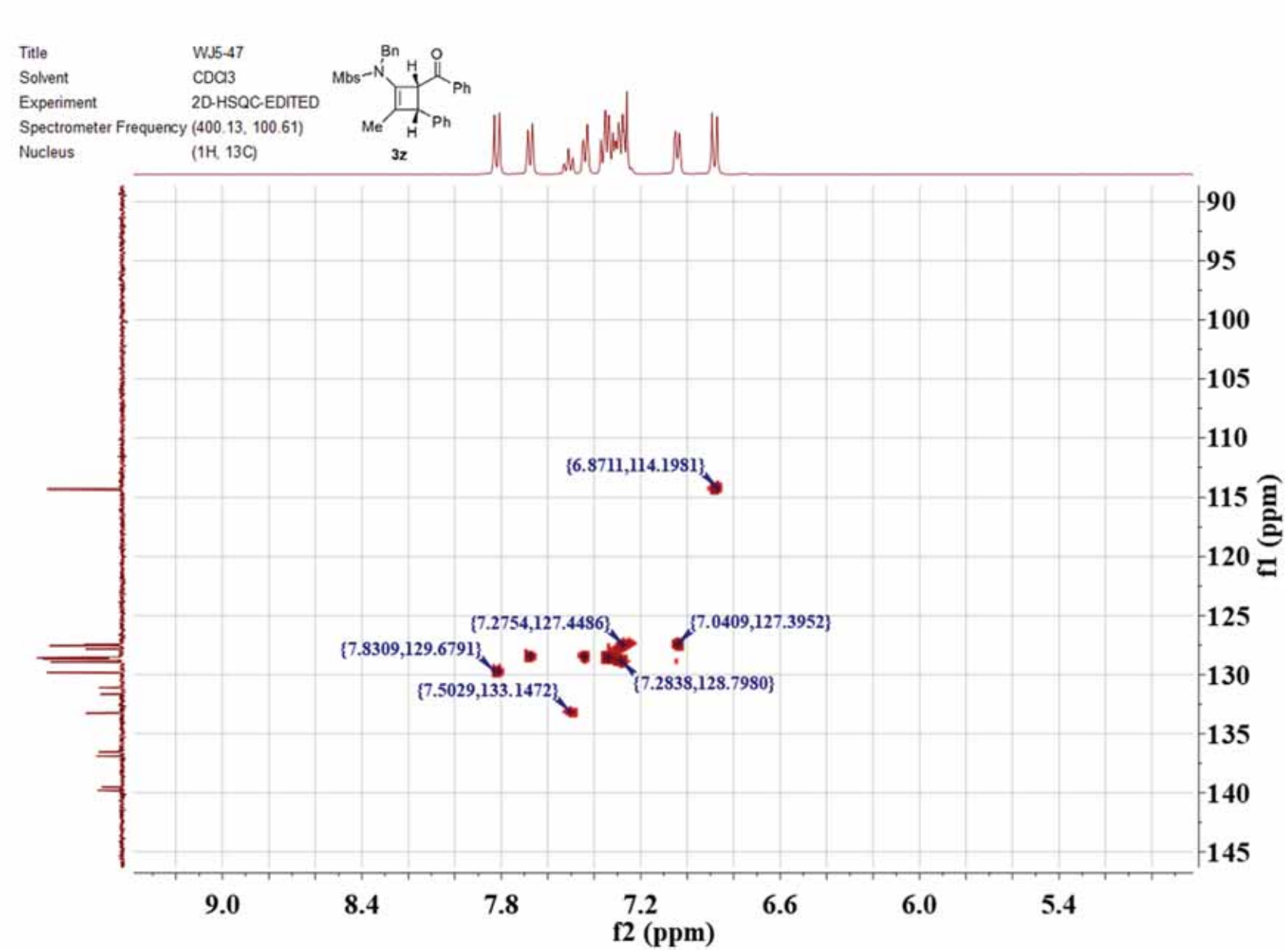

Title WJ5-47
Solvent CDCl3
Experiment 2D-NOESY
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Mbs
N
4.38
H
O
Me
H
H
7.05-7.03
3z
{4.3810,7.0374}
{4.6689,7.4246}
f2 (ppm)
f1 (ppm)

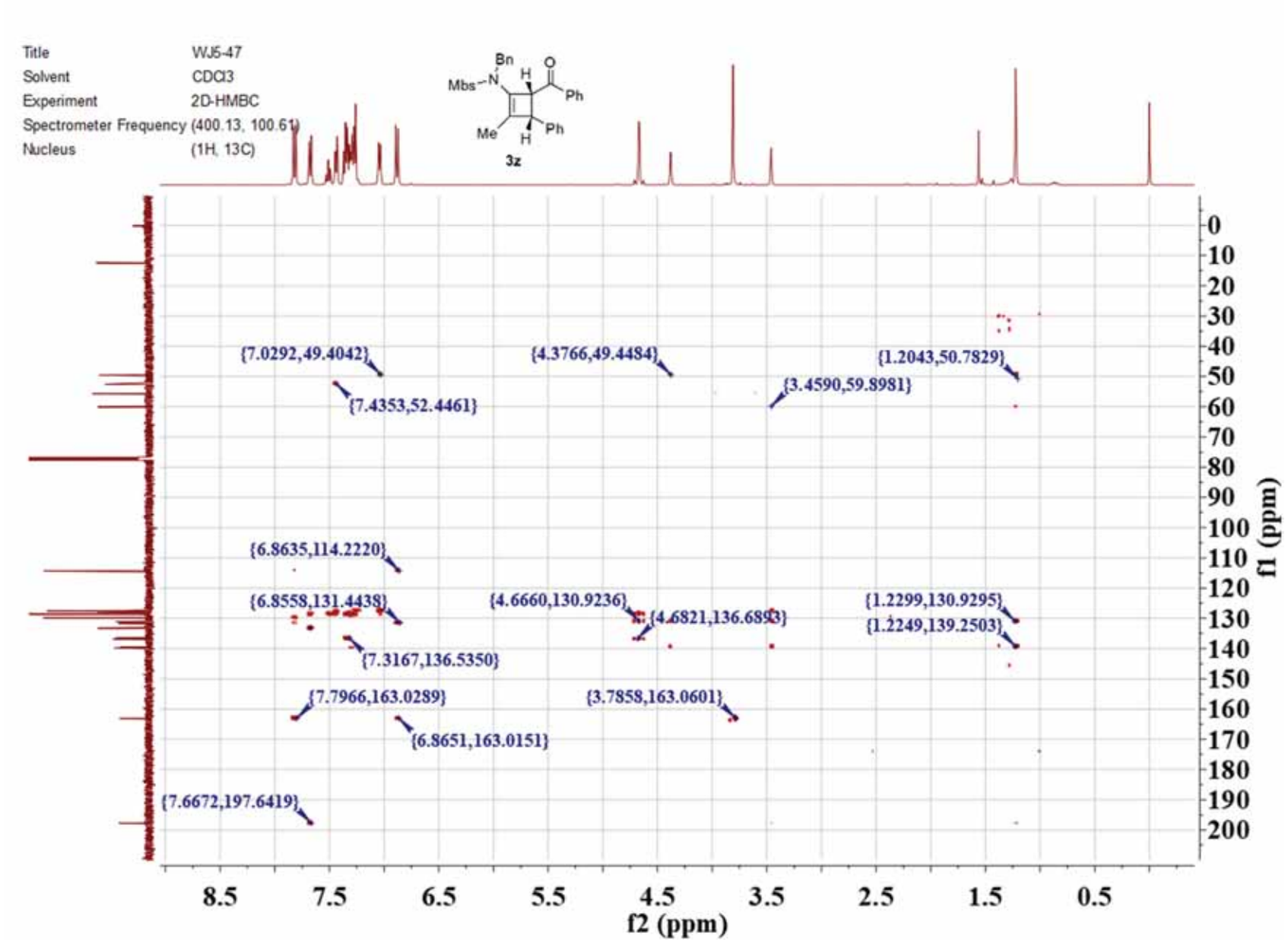

Title WJ5-47
Solvent CDCl3
Experiment 2D-NOESY
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Mbs
N
O
H
Me
4.38
7.05-7.03
3z
{4.3810,7.0374}
{4.6689,7.4246}
f2 (ppm)
f1 (ppm)

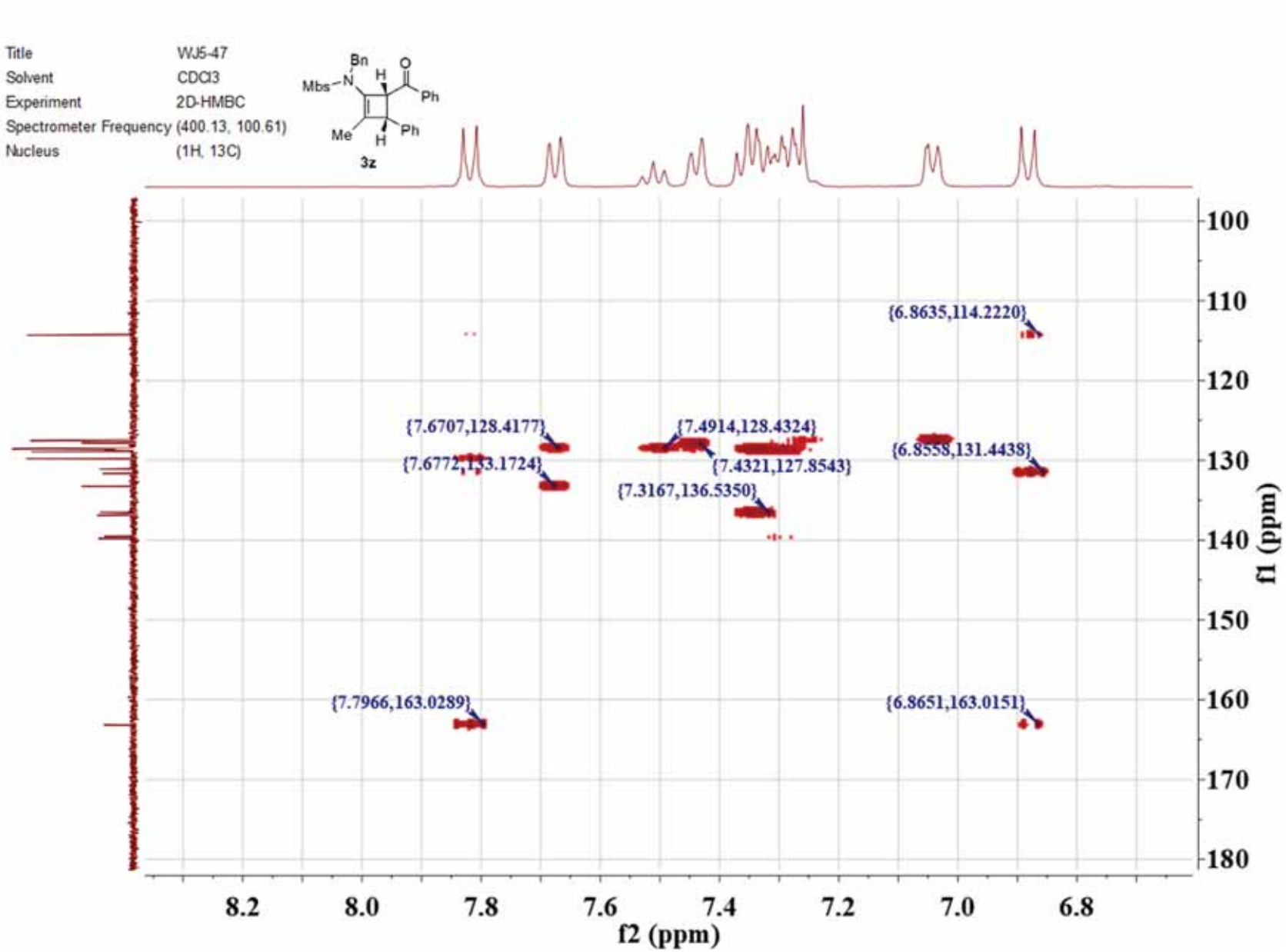

Title WJ5-47
Solvent CDCl3
Experiment 2D-COSY
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Mbs
N
H
O
Ph
Me
Ph
H
3z
0
1
2
3
4
5
6
7
8
f1 (ppm)
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
f2 (ppm)


Title WJ5-47
Solvent CDCl3
Experiment 2D-COSY
Spectrometer Frequency (400.13, 400.13)
Nucleus (1H, 1H)
Bn
Mbs
N
H
O
Ph
Me
Ph
H
3z
{7.8270,6.8585}
{6.8651,6.8964}
{7.6629,7.3601}
{7.0258,7.3076}
{7.3587,7.6840}
{6.8642,7.8390}
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
f1 (ppm)
8.3
6.9
f2 (ppm)


Title WJ5-47
Solvent CDCl3
Experiment 2D-HSQC-EDITED
Spectrometer Frequency (400.13, 100.61)
Nucleus (1H, 13C)
Bn
Mbs
N
H
O
Ph
Me
Ph
H
3z
{1.2263,12.2860}
{4.6737,52.4275}
{3.4599,49.3712}
{4.3840,59.9058}
{3.7883,55.5972}
{6.8919,114.2008}
{6.8711,114.1981}
{7.8309,129.6791}
{7.8097,129.6718}
{7.4431,128.4550}
{7.2754,127.4486}
{7.5029,133.1472}
f1 (ppm)
f2 (ppm)


Title WJ5-47
Solvent CDCl3
Experiment 2D-HSQC-EDITED
Spectrometer Frequency (400.13, 100.61)
Nucleus (1H, 13C)
Bn
Mbs
N
H
O
Ph
Me
Ph
H
3z
{6.8711,114.1981}
{7.2754,127.4486}
{7.0409,127.3952}
{7.8309,129.6791}
{7.2838,128.7980}
{7.5029,133.1472}
90
95
100
105
110
115
120
125
130
135
140
145
f1 (ppm)
9.0
8.4
7.8
7.2
6.6
6.0
5.4
f2 (ppm)


Title WJ5-47
Solvent CDCl3
Experiment 2D-HMBC
Spectrometer Frequency (400.13, 100.61)
Nucleus (1H, 13C)
Bn
Mbs
N
H
O
Ph
Me
Ph
H
3z
{7.0292,49.4042}
{7.4353,52.4461}
{4.3766,49.4484}
{3.4590,59.8981}
{1.2043,50.7829}
{6.8635,114.2220}
{6.8558,131.4438}
{7.3167,136.5350}
{4.6660,130.9236}
{4.6821,136.6893}
{1.2299,130.9295}
{1.2249,139.2503}
{7.7966,163.0289}
{6.8651,163.0151}
{3.7858,163.0601}
{7.6672,197.6419}
f1 (ppm)
f2 (ppm)


Title WJ5-47
Solvent CDCl3
Experiment 2D-HMBC
Spectrometer Frequency (400.13, 100.61)
Nucleus (1H, 13C)
Bn
Mbs
N
H
O
Ph
Me
H
Ph
3z
{6.8635,114.2220}
{7.6707,128.4177}
{7.4914,128.4324}
{6.8558,131.4438}
{7.6772,133.1724}
{7.4321,127.8543}
{7.3167,136.5350}
{7.7966,163.0289}
{6.8651,163.0151}
f1 (ppm)
f2 (ppm)