H-bond network facilitated, diversity-oriented green synthesis of valuable organic compounds *via* atom-economic, regio- and stereoselective reactions involving ynamides and anilines

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Electronic supplementary information

Contents

1. General consideration

1.1 General reagent information

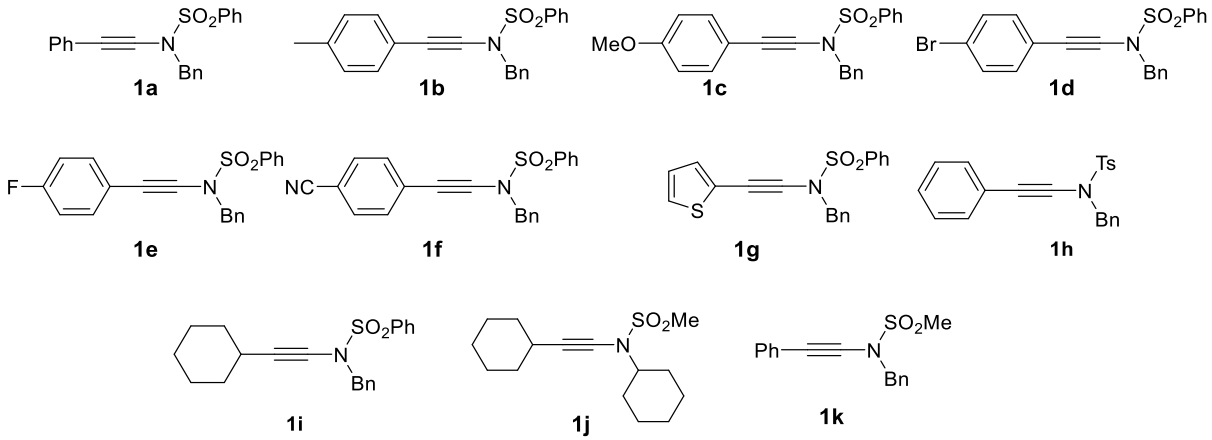
All reagents were purchased from BLD pharma, TCI chemicals, Sigma-Aldrich, AVRA, chemscene and SRL chemicals and used as such. Flash chromatography was performed using silica gel (100-200 mash).

1.2 General analytical information

The products were characterized by ^{1}H, and ^{13}C NMR spectra, which were recorded on a Bruker 400 MHz instrument (400 MHz for ^{1}H NMR, 100 MHz for ^{13}C NMR). Copies of ^{1}H, ^{13}C NMR spectra can be found at the end of the Supporting Information. ^{1}H NMR experiments are reported in units, parts per million (ppm), and were measured relative to residual chloroform (7.26 ppm) or DMSO (2.5 ppm) in the deuterated solvent. ^{13}C NMR spectra were reported in ppm relative to deuterochloroform (77.00 ppm) or DMSO-d_6 (40 ppm), and all were obtained with ^{1}H decoupling. Coupling constants were reported in Hz. Reactions were monitored by thin layer chromatography (TLC) and ^{1}H NMR of the crude reaction mixture using 1,3,5-trimethoxybenzene as the internal standard. Mass spectral data of unknown compounds were obtained on a high-resolution mass spectrometer, HRMS (6546 Q-TOF LC/MS, Agilent). Melting points of unknown compounds were recorded on a KRUSS Optronic M3000 apparatus. The solvent system used for crystallization was a mixture of dichloromethane and hexane (2:1). The crystals were grown by the slow evaporation of the solvent from the solution. The single-crystal XRD data collection and data reduction were performed using CrysAlis PRO on a single-crystal Rigaku Oxford XtaLab Pro diffractometer.

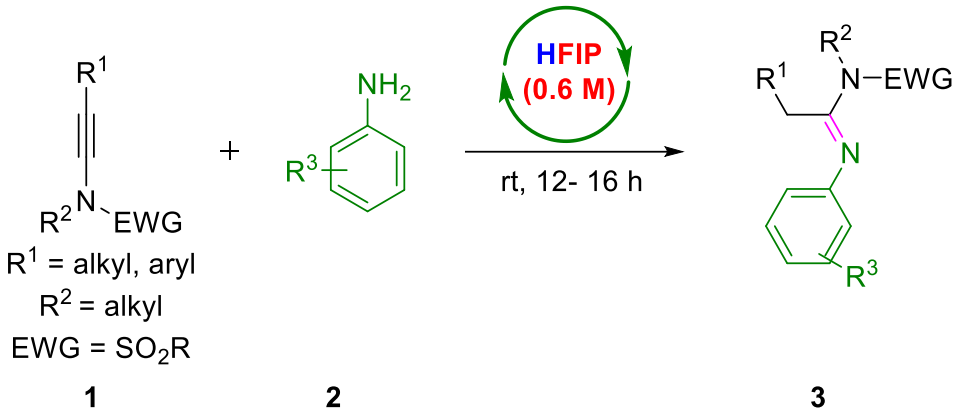
2. Synthesis of starting materials, ynamides (1a–1k)

The structures of the ynamides, which were synthesized and used in the reactions are given below:



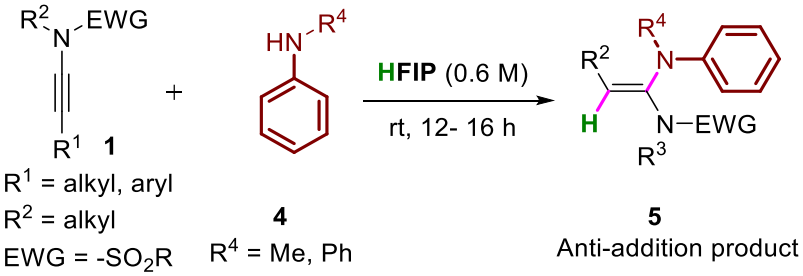
All ynesulfonamides (**1a–1k**)[1,2] were synthesized by following a literature procedure.

3. General experiment procedure for the synthesis of acetimidamides (3aa-3ap).



Representative experimental procedure for the synthesis of (*E*)-*N*-benzyl-*N′*,2-diphenyl-*N*-(phenylsulfonyl)acetimidamide (3aa): *N*-Benzyl-*N*-(phenylethynyl)benzenesulfonamide **1a** (0.104 g, 0.3 mmol, 1 equiv) and aniline **2a** (0.028g, 0.30 mmol, 1.0 equiv) were taken in a round-bottom flask, and then dry HFIP (0.5 mL, 0.6 M) was added to it. The reaction mixture was stirred at room temperature (25 °C). The progress of the reaction was monitored by TLC, and the reaction was found to be completed in 12 h. After the completion of the reaction, the solvent was evaporated under reduced pressure, and the crude product was purified by washing with cold ethanol (2 mL) to afford (*E*)-*N*-benzyl-*N′*,2-diphenyl-*N*-(phenylsulfonyl)acetimidamide **(3aa)** (0.130 g, 0.28 mmol) as a white solid in 95% yield. Several products such as **3ba, 3ca, 3da, 3ea, 3fa, 3ga, 3ha, 3ab, 3ad, 3ae, 3ah, 3aj,** and **3ap** were obtained pure by a simple cold ethanol wash; however, the other products, were obtained pure by column chromatography.

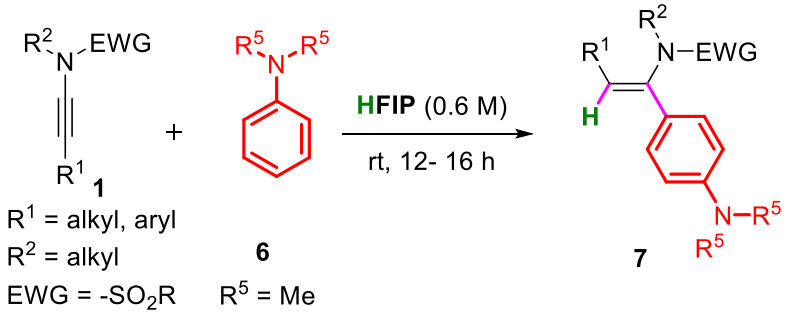
4. General experiment procedure for the synthesis of ketene *N*,*N*-acetals (5aa-5ab).



Representative experimental procedure for the synthesis of (*E*)-*N*-benzyl-*N*-(1-(methyl(phenyl)amino)-2-phenylvinyl)benzenesulfonamide (5aa): *N*-Benzyl-*N*-(phenylethynyl)benzenesulfonamide **1a** (0.104 g, 0.3 mmol, 1 equiv) and *N*-methylaniline **4a** (0.033g, 0.30 mmol, 1.0 equiv) were taken in a round-bottom flask, and then dry HFIP (0.5 mL, 0.6 M) was added to it. The reaction mixture was stirred at 25 °C. The progress of the reaction was monitored by TLC. The reaction was found to be completed in 12 h. After the completion of the reaction, the solvent was evaporated under reduced pressure. The crude product was purified by washing with cold ethanol (2 mL) to afford pure (*E*)-*N*-benzyl-*N*-(1-(methyl(phenyl)amino)-2-phenylvinyl)benzenesulfonamide **(5aa)** (0.114 g, 0.25 mmol) as a white solid in 84% yield. Two additional products, 5ba and 5ha, were obtained as pure products

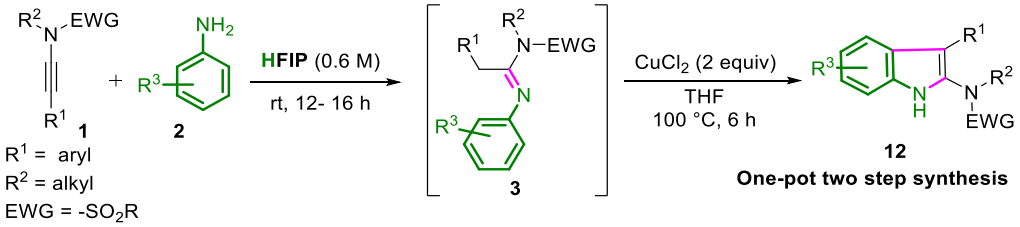
by simple cold ethanol wash; however, the remaining two products were obtained pure by column chromatography.

5. General experiment procedure for the synthesis of *α*-aryl enamides (7aa-7ja)



Representative experimental procedure for the synthesis of (*Z*)-*N*-benzyl-*N*-(1-(4-(dimethylamino)phenyl)-2-phenylvinyl)benzenesulfonamide (7aa): *N*-Benzyl-*N*-(phenylethynyl)benzenesulfonamide **1a** (0.104 g, 0.3 mmol, 1 equiv) and *N*,*N*-dimethylaniline **6a** (0.037g, 0.30 mmol, 1.0 equiv) were taken in a round bottom flask and then dry HFIP (0.5 mL, 0.6 M) was added to it. The reaction mixture was stirred at room temperature (25 °C). The progress of the reaction was monitored by TLC, and the reaction was found to be completed in 12 h. After the completion of the reaction, the solvent was evaporated under reduced pressure. The crude product was purified by flash chromatography using 100-200 mesh silica and 0-5% ethyl acetate in hexane as an eluent to afford pure (*Z*)-*N*-benzyl-*N*-(1-(4-(dimethylamino)phenyl)-2-phenylvinyl)benzenesulfonamide **(7aa)** (0.112 g, 0.24 mmol) as a white solid in 79% yield.

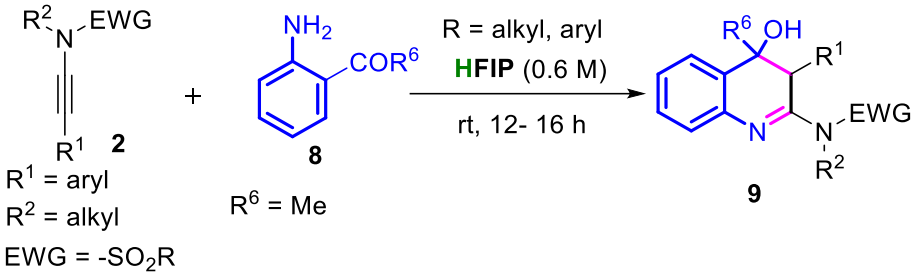
6. General experiment procedure for the synthesis of 2-amino indole (12aa-12aj).



Representative experimental procedure for the synthesis of *N*-benzyl-*N*-(3-phenyl-1*H*-indol-2-yl)benzenesulfonamide (13): An oven-dried sealed tube was charged with aniline **2a** (28 mg, 0.30 mmol) and *N*-benzyl-*N*-(phenylethynyl)benzenesulfonamide **1a** (0.104 g, 0.3 mmol, 1 equivalent). Dry HFIP (0.5 mL, 0.6 M) was then added to the mixture. The reaction vessel was sealed and stirred at room temperature (25 °C) for 12 hours. The progress of the reaction was monitored by TLC. After the completion of the reaction, HFIP was removed by purging nitrogen gas into the reaction mixture. Then the crude product was dissolved in dry THF (2 mL), and anhydrous $CuCl_2$ (0.081 g, 0.6 mmol) was added to it. The reaction mixture was then heated to 100 °C. The reaction progress was monitored by TLC and found to be completed in 6 h. The reaction was then allowed to cool down to room temperature. Then the solvent was evaporated under reduced pressure to yield a crude product, which was extracted in a separating funnel using ethyl acetate (2 × 40 mL) and water (2 × 20 mL). The combined organic

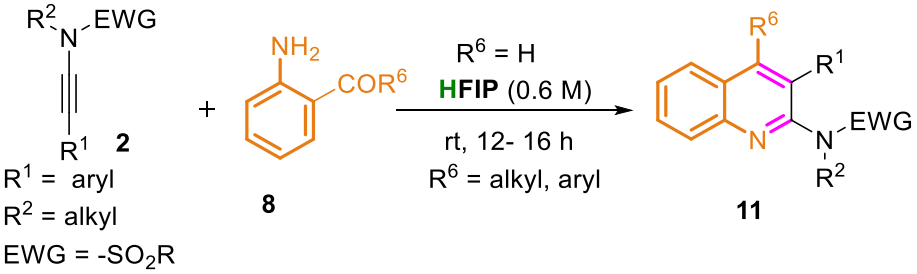
layers were dried over sodium sulfate and evaporated. The crude product was purified by column chromatography using 100-200 mesh silica gel and 20% ethyl acetate in hexane as eluent, to afford pure *N*-benzyl-*N*-(3-phenyl-1*H*-indol-2-yl)benzenesulfonamide (0.100 g, 0.228 mmol) in 76% yield.

7. General experiment procedure for the synthesis of 3,4-dihydroquinolines (9aa-9ka).



Representative experimental procedure for the synthesis of *N*-benzyl-*N*-(4-hydroxy-4-methyl-3-phenyl-3,4-dihydroquinolin-2-yl)benzenesulfonamide (9aa): *N*-Benzyl-*N*-(phenylethynyl)benzenesulfonamide **1a** (0.104 g, 0.3 mmol, 1 equiv) and 1-(2-aminophenyl)ethan-1-one **8a** (0.041g, 0.30 mmol, 1.0 equiv) were taken in a round-bottom flask and then dry HFIP (0.5 mL, 0.6 M) was added to it. The reaction mixture was stirred at room temperature (25 °C). The progress of the reaction was monitored by TLC. After the completion of the reaction, the solvent was evaporated under reduced pressure. The crude reaction mixture was purified by column chromatography using 100-200 mesh silica gel and 15% ethyl acetate in hexane used as an eluent to furnish pure *N*-benzyl-*N*-(4-hydroxy-4-methyl-3-phenyl-3,4-dihydroquinolin-2-yl)benzenesulfonamide (**9aa**) (0.133 g, 0.275 mmol) as a colourless gummy oil in 92% yield.

8. General experiment procedure for the synthesis of 2-aminoquinoline (11ab-11ac).



Representative experimental procedure for the synthesis of *N*-benzyl-*N*-(3-phenylquinolin-2-yl)benzenesulfonamide (11aa): *N*-Benzyl-*N*-(phenylethynyl)benzenesulfonamide **1a** (0.104 g, 0.3 mmol, 1 equiv) and 2-aminobenzaldehyde **8a** (0.037g, 0.30 mmol, 1.0 equiv) were taken in a round-bottom flask, and then dry HFIP (0.5 mL, 0.6 M) was added to it. The reaction mixture was stirred at room temperature (25 °C). The progress of the reaction was monitored by TLC, and the reaction was found to be completed in 12 h. The solvent was evaporated under reduced pressure. The crude product was purified by column chromatography using 100-200 mesh silica gel and 10% ethyl acetate in hexane as an eluent to afford pure *N*-benzyl-*N*-(3-phenylquinolin-2-

yl)benzenesulfonamide **(11ab)** (0.126 g, 0.278 mmol) as a white solid in 93% yield. For the synthesis of **11a1**, **11da**, **11ha**, **11ka**, and **11ac,** the reaction mixture was heated at 80 °C for 5 h after the completion of the first step of acetimidamide formation.

9. Crystal structures of 3ea, 5aa, 7ja, 11aa and 12aj.

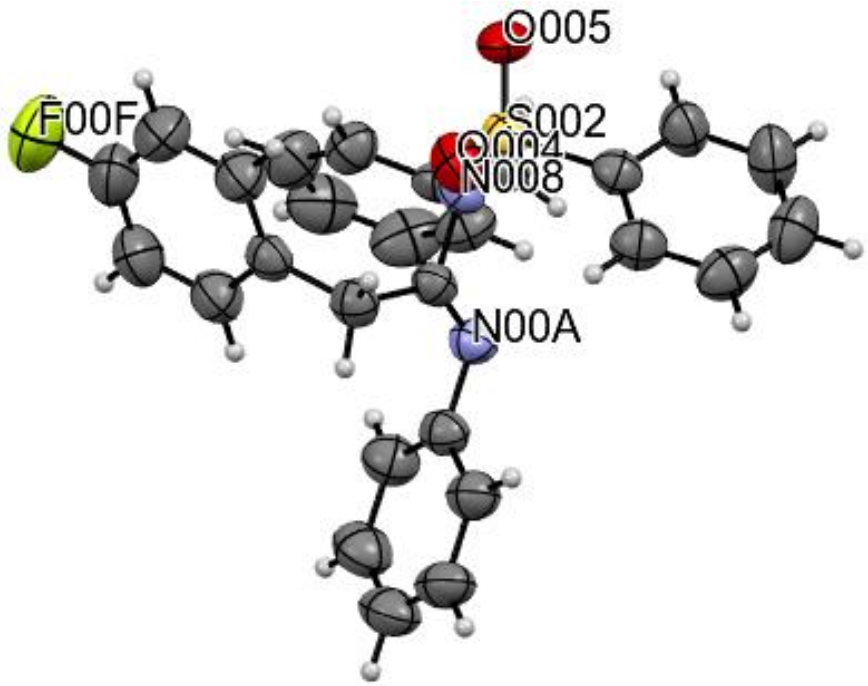


Figure *S1*. X-ray crystal structure of **3ea** (thermal ellipsoid shown at 50% probability) including hetero-atom numbering.

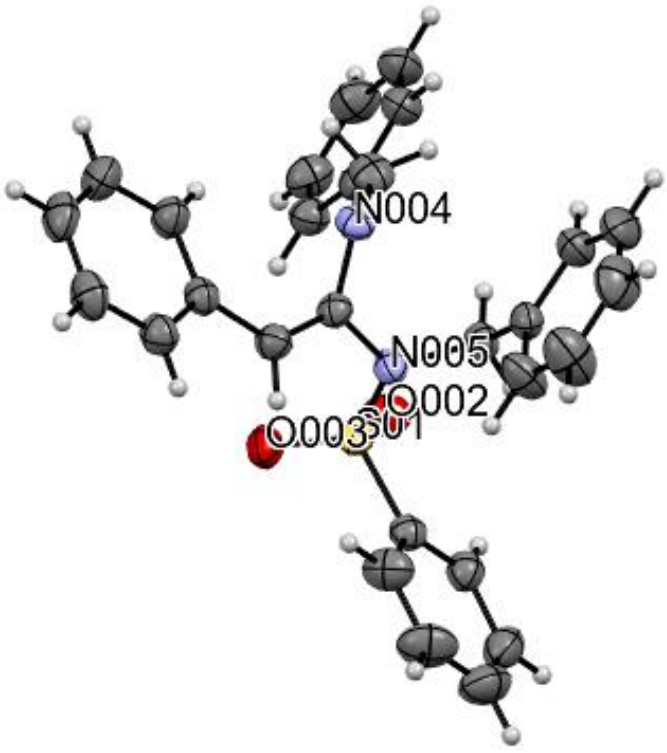


Figure *S2*. X-ray crystal structure of **5aa** (thermal ellipsoid shown at 50% probability) including hetero-atom numbering.

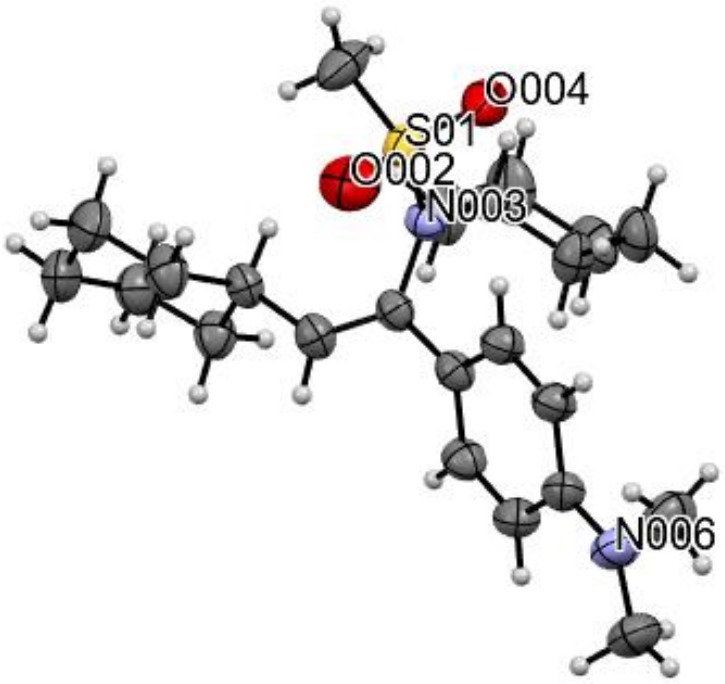


Figure *S3*. X-ray crystal structure of **7ja** (thermal ellipsoid shown at 50% probability) including hetero-atom numbering.

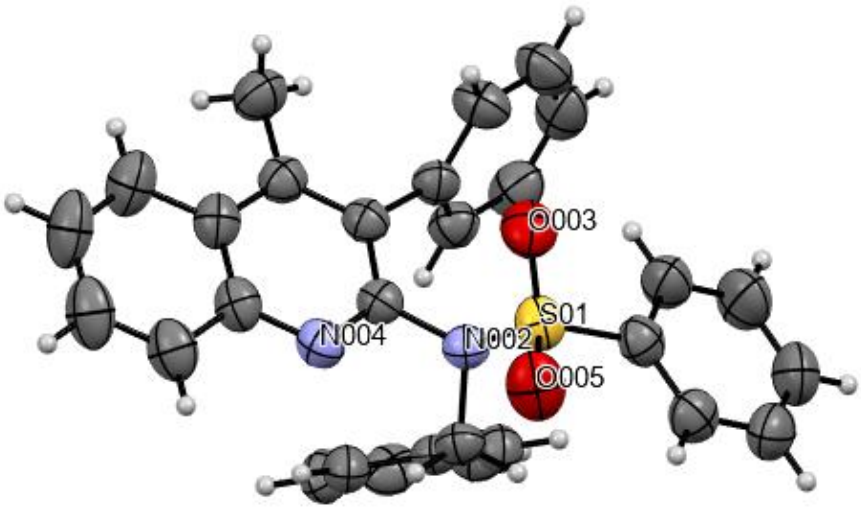


Figure *S4*. X-ray crystal structure of **11aa** (thermal ellipsoid shown at 50% probability) including hetero-atom numbering.

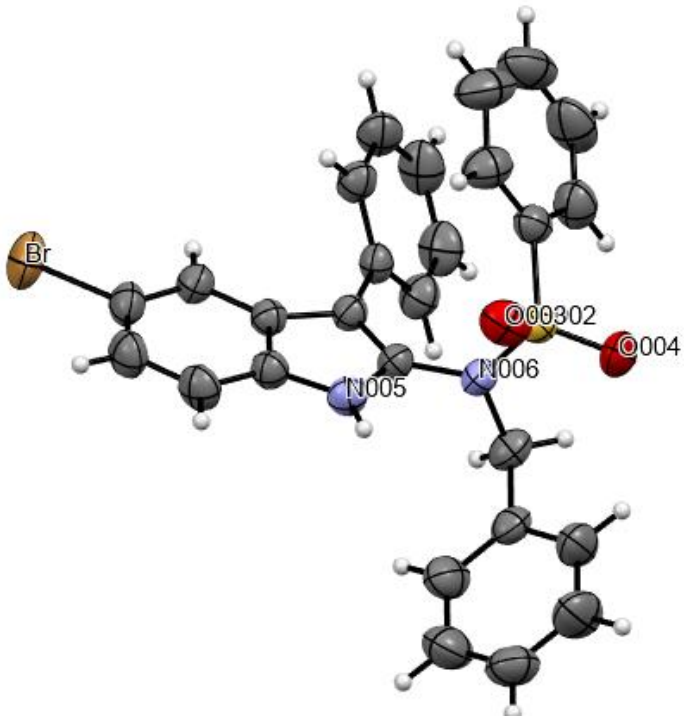


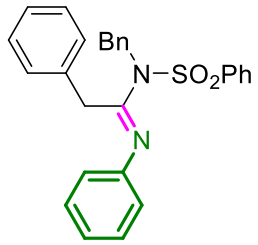
Figure *S5*. X-ray crystal structure of **12aj** (thermal ellipsoid shown at 50% probability) including hetero-atom numbering

10. Table-*S1* Selected crystal data of 3ea, 5aa, 7ja, 11aa and 12aj.

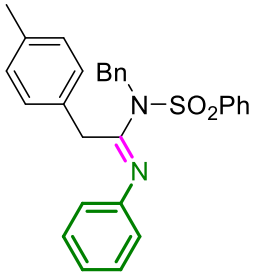
Empirical formula	$C_{27}H_{23}FN_2O_2S$	$C_{28}H_{26}N_2O_2S$	$C_{23}H_{36}N_2O_2S$	$C_{29}H_{24}N_2O_2S$	$C_{27}H_{21}BrN_2O_2S$
Formula weight	458.5514	454.57	404.60	464.56	517.43
Temperature/ K	293	293	293	293	293
Crystal system	orthorhombic	monoclinic	tetragonal	monoclinic	monoclinic
Space group	P 21 21 21	-P 2ac 2ab	P 41	P 21/n	P 21/c
a/Å	8.2276(3)	15.8520(1)	10.66109(16)	9.4440(2)	10.6973(2)
b/Å	17.6666(7)	16.7047(2)	10.66109(16)	14.0026(3)	27.1866(4)
c/Å	32.3110(13)	17.3783(2)	20.1451(5)	17.9836(3)	8.6779(2)
α (°)	90	90	90	90	90
β (°)	90	90	90	91.366(2)	109.432(2)

γ(°)	90	90	90	90	90
Volume/Å3	4696.5(3)	4601.83(8)	2289.67(9)	2377.49(8)	2379.98(8)
Z	8	8	4	4	4
μ/mm-1	1.510	1.470	1.400	1.438	3.389
Dx [g cm-3]	1.297	1.312	1.174	1.298	1.444
F(000)	1920.0	1920.0	880.0	976.0	1056.0
2Θ range for data collection (°)	4.8300-78.9290	5.8160-79.7260	4.147- 79.830	4.002- 79.814	4.383- 79.984
Index ranges	-10≤ h ≤ 7 -21≤ k ≤ 21, -39 ≤ l ≤ 40	-19≤ h ≤ 19 -19≤ k ≤ 20, -21 ≤ l ≤ 31	-11≤ h ≤ 13 -11≤ k ≤ 13, -24 ≤ l ≤ 19	-10≤ h ≤ 11 -17≤ k ≤ 17, -22 ≤ l ≤ 22	-13≤ h ≤ 13 -33≤ k ≤ 24, -7 ≤ l ≤ 10
Reflections measured	6323	8489	4485	6932	7234
Unique reflections	9174	4903	4087	5025	5044
Parameters /restraints	595/0	299/0	256/1	308/0	298/0
Goodness-of-fit on F2	1.047	1.062	1.079	1.090	1.060
R1 [I ≥ 2σ (I)]	0.0449	0.0384	0.0470	0.0474	0.0443
wR2 (all data)	0.1008	0.0990	0.1137	0.1241	0.1061
Largest diff. peak/hole/e Å-3	0.118/-0.265	0.191/ -0.358	0.150/ -0.461	0.145/-0.405	0.751/-0.745
CCDC	**2420474**	**2420911**	**2420913**	**2448538**	**2448537**

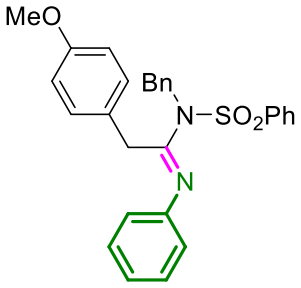
11. Analytical data of synthesized compounds.



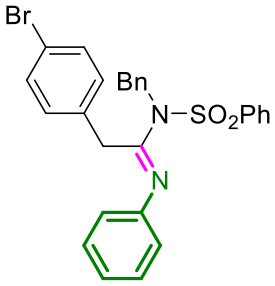
(*E*)-*N*-Benzyl-*N′*,2-diphenyl-*N*-(phenylsulfonyl)acetimidamide (3aa): white sloid (0.126 g, 95%);**^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.90 (d, *J* = 7.5 Hz, 2H), 7.77 (t, *J* = 7.4 Hz, 1H), 7.66 (t, *J* = 7.6 Hz, 2H), 7.30 – 7.19 (m, 5H), 7.20 – 7.05 (m, 5H), 7.01 (t, *J* = 7.4 Hz, 1H), 6.74 (d, *J* = 7.1 Hz, 2H), 6.41 (d, *J* = 7.6 Hz, 2H), 4.73 (s, 2H), 3.82 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 155.30, 147.98, 138.33, 136.62, 134.86, 134.20, 129.70, 129.56, 128.92, 128.81, 128.55, 128.50, 128.31, 127.74, 127.02, 123.96, 119.71, 50.83, 36.76; HRMS (ESI) m/z calcd for $C_{27}H_{25}N_2O_2S$ $[M+H]^+$: 441.1637; found: 441.1638.



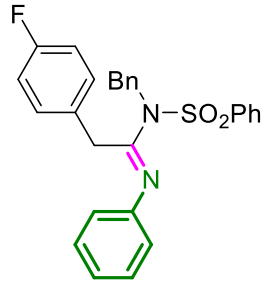
(*E*)-*N*-Benzyl-*N′*-phenyl-*N*-(phenylsulfonyl)-2-(*p*-tolyl)acetimid amide (3ba): white solid (0.122 g, 89%): **^{1}H NMR (400 MHz, DMSO)** δ 7.89 (d, *J* = 7.5 Hz, 2H), 7.77 (t, *J* = 7.4 Hz, 1H), 7.66 (t, *J* = 7.6 Hz, 2H), 7.24 (t, *J* = 6.9 Hz, 5H), 7.08 (d, *J* = 6.4 Hz, 2H), 7.00 (t, *J* = 7.4 Hz, 1H), 6.94 (d, *J* = 7.7 Hz, 2H), 6.63 (d, *J* = 7.7 Hz, 2H), 6.40 (d, *J* = 7.6 Hz, 2H), 4.73 (s, 2H), 3.74 (s, 2H), 2.25 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 155.42, 148.02, 138.43, 136.71, 136.17, 134.16, 131.73, 129.65, 129.55, 129.41, 128.75, 128.56, 128.39, 128.35, 127.71, 123.93, 119.74, 50.74, 36.26, 21.07; HRMS (ESI) m/z calcd for $C_{28}H_{27}N_2O_2S$ $[M+H]^+$: 455.1793; found: 455.1784.



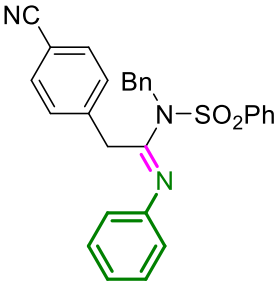
(*E*)-*N*-Benzyl-2-(4-methoxyphenyl)-*N*'-phenyl-*N*-(phenyl sulfonyl)acetimidamide (3ca): off-white solid (0.120 g, 85%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.89 (d, *J* = 7.5 Hz, 2H), 7.77 (t, *J* = 7.2 Hz, 1H), 7.67 (t, *J* = 7.5 Hz, 2H), 7.25 (dd, *J* = 11.5, 7.4 Hz, 5H), 7.13 – 6.95 (m, 3H), 6.69- 6.64 (m, 4H), 6.40 (d, *J* = 7.5 Hz, 2H), 4.71 (s, 2H), 3.72 (s, 5H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 158.47, 155.63, 148.03, 138.36, 136.66, 134.18, 129.99, 129.69, 129.57, 128.54, 128.42, 128.32, 127.72, 126.53, 123.95, 119.74, 114.28, 55.50, 50.79, 35.89; HRMS (ESI) m/z calcd for $C_{28}H_{27}N_2O_3S$ $[M+H]^+$: 471.1742; found: 471.1732.



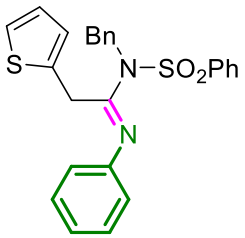
(*E*)-*N*-Benzyl-2-(4-bromophenyl)-*N′*-phenyl-*N*-(phenylsulfonyl) acetimidamide (3da): white solid (0.143 g, 91%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.97 – 7.87 (m, 2H), 7.77 (t, *J* = 7.4 Hz, 1H), 7.68 (t, *J* = 7.6 Hz, 2H), 7.24 (m, 7H), 7.04 (dd, *J* = 14.7, 7.2 Hz, 3H), 6.65 (d, *J* = 8.3 Hz, 2H), 6.43 (d, *J* = 7.5 Hz, 2H), 4.69 (s, 2H), 3.80 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 155.18, 147.83, 138.04, 136.30, 134.27, 131.60, 131.16, 129.82, 129.64, 128.79, 128.49, 128.21, 127.78, 124.15, 120.27, 119.62, 51.04, 36.64; HRMS (ESI) m/z calcd for $C_{27}H_{24}BrN_2O_2S$ $[M+H]^+$: 519.0742; found: 519.0736.



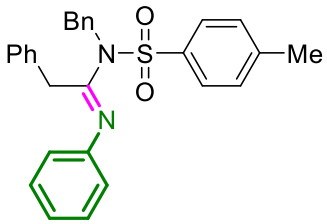
(*E*)-*N*-Benzyl-2-(4-fluorophenyl)-*N′*-phenyl-*N*-(phenylsulfonyl) acetimidamide (3ea): white solid (0.122 g, 89%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.93 (d, *J* = 7.6 Hz, 2H), 7.77 (t, *J* = 7.4 Hz, 1H), 7.68 (t, *J* = 7.6 Hz, 2H), 7.30 – 7.18 (m, 5H), 7.04 (dd, *J* = 19.7, 7.1 Hz, 3H), 6.92 (t, *J* = 8.7 Hz, 2H), 6.80 – 6.67 (m, 2H), 6.42 (d, *J* = 7.6 Hz, 2H), 4.70 (s, 2H), 3.82 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 161.44 (d, *J* = 242.7 Hz), 155.46, 147.89, 138.10, 136.38, 134.26, 130.88, 130.80, 129.80, 129.61, 128.73, 128.48, 128.23, 127.79, 124.09, 119.64, 115.60, 115.39, 51.01, 36.31; HRMS (ESI) m/z calcd for $C_{27}H_{24}FN_2O_2S$ $[M+H]^+$: 459.1543; found: 459.1543.



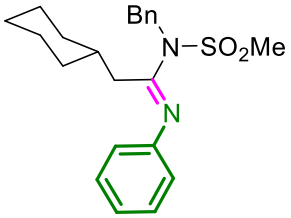
(*E*)-*N*-Benzyl-2-(4-cyanophenyl)-*N′*-phenyl-*N*-(phenylsulfonyl) acetimidamide (3fa): white solid (0.131 g, 93%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.95 (d, *J* = 7.5 Hz, 2H), 7.77 (t, *J* = 7.4 Hz, 1H), 7.68 (t, *J* = 7.6 Hz, 2H), 7.53 (d, *J* = 8.1 Hz, 2H), 7.28- 7.21 (m, 5H), 7.04 (dd, *J* = 14.9, 7.3 Hz, 3H), 6.84 (d, *J* = 8.1 Hz, 2H), 6.44 (d, *J* = 7.6 Hz, 2H), 4.70 (s, 2H), 3.93 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 154.75, 147.71, 140.70, 137.91, 136.16, 134.37, 132.56, 130.02, 129.91, 129.69, 128.98, 128.52, 128.19, 127.89, 124.29, 119.59, 119.18, 109.87, 51.18, 37.54; HRMS (ESI) m/z calcd for $C_{28}H_{24}N_3O_2S$ $[M+H]^+$: 466.1589; found: 466.1600.



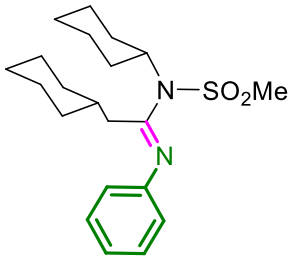
(*E*)-*N*-Benzyl-*N′*-phenyl-*N*-(phenylsulfonyl)-2-(thiophen-2-yl) acetimidamide (3ga): light yellow solid (0.116 g, 86%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.93 (d, *J* = 7.5 Hz, 2H), 7.78 (t, *J* = 7.4 Hz, 1H), 7.68 (t, *J* = 7.6 Hz, 2H), 7.34 – 7.17 (m, 6H), 7.03 (dd, *J* = 12.6, 5.4 Hz, 3H), 6.84 (dd, *J* = 5.0, 3.5 Hz, 1H), 6.47 (d, *J* = 2.6 Hz, 1H), 6.38 (d, *J* = 7.6 Hz, 2H), 4.73 (s, 2H), 4.01 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 154.52, 147.73, 138.06, 136.54, 135.85, 134.27, 129.83, 129.57, 128.51, 128.32, 128.20, 127.68, 127.32, 127.22, 125.78, 124.09, 119.61, 51.07, 31.57, 26.50; HRMS (ESI) m/z calcd for $C_{25}H_{23}N_2O_2S_2$ $[M+H]^+$: 447.1201; found: 447.1233.



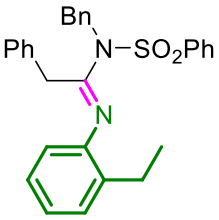
(*E*)-*N*-Benzyl-*N′*,2-diphenyl-*N*-tosylacetimidamide (3ha): white solid (0.131 g, 96%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.78 (d, *J* = 8.2 Hz, 2H), 7.46 (d, *J* = 8.1 Hz, 2H), 7.28 – 7.19 (m, 5H), 7.18-7.12 (m, 3H), 7.08 – 6.98 (m, 3H), 6.73 (d, *J* = 7.1 Hz, 2H), 6.43 (d, *J* = 7.6 Hz, 2H), 4.69 (s, 2H), 3.83 (s, 2H), 2.43 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 155.41, 148.06, 144.77, 136.59, 135.36, 134.96, 130.15, 129.55, 128.97, 128.76, 128.60, 128.49, 128.31, 127.69, 126.95, 123.94, 119.72, 50.88, 36.93, 21.55; HRMS (ESI) m/z calcd for $C_{28}H_{27}N_2O_2S$ $[M+H]^+$: 455.1793; found: 455.1790.



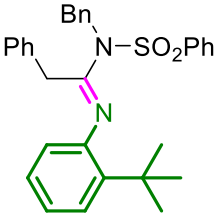
(*E*)-*N*-Benzyl-2-cyclohexyl-*N*-(methylsulfonyl)-*N′*-phenyl acetimidamide (3ia): brown solid (0.106 g, 79%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.44 – 7.37 (m, 4H), 7.35 – 7.27 (m, 3H), 7.03 (t, *J* = 7.4 Hz, 1H), 6.63 – 6.57 (m, 2H), 4.88 (s, 2H), 3.23 (s, 3H), 2.28 (d, *J* = 6.9 Hz, 2H), 1.41 (dd, *J* = 21.4, 11.4 Hz, 4H), 1.19 (d, *J* = 10.6 Hz, 2H), 1.03 – 0.80 (m, 3H), 0.47 – 0.32 (m, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 158.32, 148.53, 137.51, 129.34, 129.20, 128.73, 127.99, 123.69, 120.12, 50.56, 40.80, 38.01, 35.76, 32.51, 26.07, 25.90; HRMS (ESI) m/z calcd for $C_{27}H_{31}N_2O_2S$ $[M+H]^+$: 447.2106; found: 447.2145.



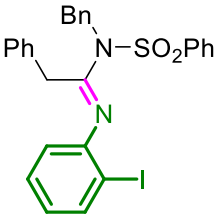
(*E*)-*N*,2-Dicyclohexyl-*N*-(methylsulfonyl)-*N′*-phenyl acetimidamide (3ja): yellow gummy oil (0.095 g, 84%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.32 (dd, *J* = 8.1, 7.6 Hz, 2H), 7.10 – 7.02 (m, 1H), 6.68 (d, *J* = 7.4 Hz, 2H), 3.75 (ddd, *J* = 12.1, 8.8, 3.5 Hz, 1H), 3.24 (s, 3H), 2.20 (d, *J* = 6.2 Hz, 2H), 1.98 (d, *J* = 10.0 Hz, 2H), 1.79 (d, *J* = 12.9 Hz, 2H), 1.70 (dd, *J* = 18.4, 10.3 Hz, 5H), 1.61 – 1.46 (m, 4H), 1.35 (q, *J* = 12.7 Hz, 2H), 1.16 – 1.05 (m, 3H), 1.01 – 0.91 (m, 1H), 0.62 (q, *J* = 11.8 Hz, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 160.23, 148.42, 129.34, 123.86, 119.75, 59.86, 42.24, 40.30, 35.77, 32.76, 32.57, 26.51, 26.08, 26.02, 25.22; HRMS (ESI) m/z calcd for $C_{21}H_{33}N_2O_2S$ $[M+H]^+$: 377.2263; found: 377.2346.



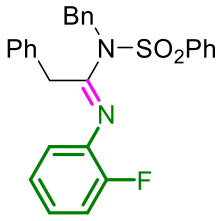
(*E*)-*N*-benzyl-*N′*-(2-ethylphenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3ab): white solid (0.126 g, 90%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.97 – 7.85 (m, 2H), 7.75 (dd, *J* = 10.6, 4.3 Hz, 1H), 7.64 (dd, *J* = 10.7, 4.8 Hz, 2H), 7.26 – 7.16 (m, 6H), 7.13 – 7.07 (m, 3H), 7.02 (td, *J* = 7.5, 1.5 Hz, 1H), 6.95 (td, *J* = 7.4, 1.3 Hz, 1H), 6.86 (dd, *J* = 7.3, 2.0 Hz, 2H), 6.24 – 6.13 (m, 1H), 4.86 (s, 2H), 3.70 (s, 2H), 1.97 (q, *J* = 7.5 Hz, 2H), 0.85 (t, *J* = 7.5 Hz, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 154.91, 146.07, 139.15, 136.97, 135.05, 134.17, 133.67, 129.73, 129.03, 128.84, 128.65, 128.23, 127.98, 127.78, 127.16, 126.77, 124.35, 118.89, 50.68, 36.84, 24.03, 14.35; HRMS (ESI) m/z calcd for $C_{29}H_{29}N_2O_2S$ $[M+H]^+$: 469.1950; found: 469.2093.



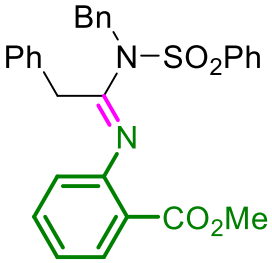
(*E*)-*N*-Benzyl-*N′*-(2-(tert-butyl)phenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3ac): colorless gummy oil (0.121 g, 81%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.88 (d, *J* = 7.5 Hz, 2H), 7.73 (t, *J* = 7.4 Hz, 1H), 7.60 (t, *J* = 7.7 Hz, 2H), 7.29 – 7.22 (m, 7H), 7.17 (d, *J* = 3.6 Hz, 2H), 6.99 – 6.89 (m, 4H), 5.95 – 5.79 (m, 1H), 4.87 (s, 2H), 3.60 (s, 2H), 1.10 (s, 9H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 153.37, 146.35, 139.66, 139.59, 137.08, 135.66, 134.15, 129.59, 128.94, 128.84, 128.77, 128.61, 128.30, 127.98, 127.19, 126.79, 126.74, 124.14, 119.71, 50.35, 37.38, 35.06, 29.85; HRMS (ESI) m/z calcd for $C_{31}H_{33}N_2O_2S$ $[M+H]^+$: 497.2263; found: 497.2275.



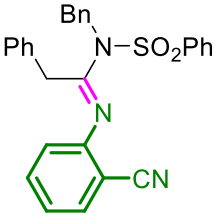
(*E*)-*N*-Benzyl-*N'*-(2-iodophenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3ad): brown solid (0.155 g, 91%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.92 (d, *J* = 7.4 Hz, 2H), 7.81 – 7.71 (m, 2H), 7.63 (t, *J* = 7.7 Hz, 2H), 7.30 – 7.16 (m, 9H), 6.91 – 6.82 (m, 2H), 6.77 (td, *J* = 7.7, 1.4 Hz, 1H), 6.29 – 6.20 (m, 1H), 4.90 (s, 2H), 3.74 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 156.49, 149.42, 139.31, 139.11, 137.01, 134.70, 134.25, 129.77, 129.45, 128.87, 128.67, 128.50, 128.17, 127.75, 127.22, 125.71, 120.13, 91.07, 50.86, 37.32; HRMS (ESI) m/z calcd for $C_{27}H_{24}IN_2O_2S$ $[M+H]^+$: 567.0603; found: 567.0625.



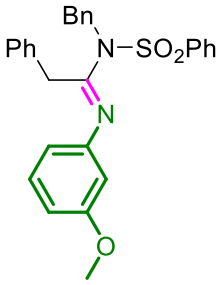
(*E*)-*N*-Benzyl-*N*'-(2-fluorophenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3ae): colorless gummy oil (0.124 g, 90%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.87 (d, *J* = 7.4 Hz, 2H), 7.75 (t, *J* = 7.4 Hz, 1H), 7.63 (t, *J* = 7.7 Hz, 2H), 7.30 – 7.21 (m, 3H), 7.13 (p, *J* = 7.1 Hz, 6H), 7.07 – 6.98 (m, 2H), 6.73 (d, *J* = 7.1 Hz, 2H), 6.50 – 6.39 (m, 1H), 4.82 (s, 2H), 3.79 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** merged peaks were present δ 157.86, 152.00 (d, *J* = 242.9 Hz), 138.60, 136.77, 135.62 (d, *J* = 12.6 Hz), 134.52, 134.34, 129.75, 128.90, 128.81, 128.69, 128.31, 128.28, 127.85, 127.22, 125.53 (d, *J* = 6.8 Hz), 125.27 (d, *J* = 2.5 Hz), 116.51 (d, *J* = 19.5 Hz), 50.85, 37.42; HRMS (ESI) m/z calcd for $C_{27}H_{24}FN_2O_2S$ $[M+H]^+$: 459.1543; found: 459.1585.



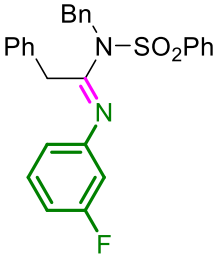
Methyl (*E*)-2-((1-(N-benzylphenylsulfonamido)-2-phenylethylidene)amino)benzoate (3hq): brown gummy (0.144 g, 94%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.89 (d, *J* = 7.4 Hz, 2H), 7.76 – 7.70 (m, 3H), 7.60 (t, *J* = 7.8 Hz, 2H), 7.43 (dd, *J* = 8.6, 2.4 Hz, 1H), 7.28 (dd, *J* = 6.8, 3.1 Hz, 3H), 7.22 – 7.15 (m, 5H), 6.85 – 6.81 (m, 2H), 6.18 (d, *J* = 8.6 Hz, 1H), 4.86 (s, 2H), 3.81 (s, 2H), 3.64 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 165.10, 155.55, 146.88, 139.25, 137.17, 134.89, 134.16, 133.25, 130.34, 129.60, 128.84, 128.60, 128.36, 128.07, 127.74, 127.50, 127.18, 123.13, 121.94, 52.64, 50.95, 37.91.



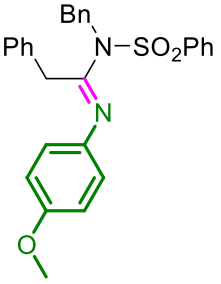
(*E*)-*N*-Benzyl-*N*'-(2-cyanophenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3af): white solid (0.122 g, 87%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.91 (dd, *J* = 8.4, 1.1 Hz, 2H), 7.75 (dd, *J* = 10.6, 4.3 Hz, 1H), 7.68 (dd, *J* = 7.8, 1.2 Hz, 1H), 7.62 (t, *J* = 7.8 Hz, 2H), 7.49 (td, *J* = 8.1, 1.4 Hz, 1H), 7.32 – 7.21 (m, 5H), 7.21 – 7.10 (m, 4H), 6.85 – 6.75 (m, 2H), 6.40 (d, *J* = 7.8 Hz, 1H), 4.92 (s, 2H), 3.86 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 157.51, 150.62, 138.91, 136.91, 134.54, 134.42, 134.39, 133.60, 129.78, 128.97, 128.78, 128.66, 128.35, 127.93, 127.84, 127.33, 124.48, 120.70, 117.37, 103.45, 50.94, 37.10; HRMS (ESI) m/z calcd for $C_{28}H_{24}N_3O_2S$ $[M+H]^+$: 466.1589; found: 466.1575.



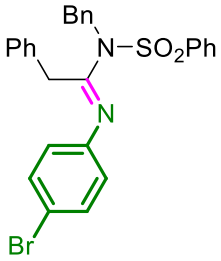
(*E*)-*N*-Benzyl-*N′*-(3-methoxyphenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3ag): colourless gummy oil (0.125 g, 88%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.90 (d, *J* = 7.9 Hz, 2H), 7.77 (t, *J* = 7.4 Hz, 1H), 7.67 (t, *J* = 7.6 Hz, 2H), 7.26 – 7.05 (m, 9H), 6.75 (d, *J* = 7.2 Hz, 2H), 6.58 (d, *J* = 8.2 Hz, 1H), 6.00 (d, *J* = 7.7 Hz, 1H), 5.85 (s, 1H), 4.73 (s, 2H), 3.82 (s, 2H), 3.63 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 160.23, 155.28, 149.26, 138.31, 136.65, 134.92, 134.22, 130.48, 129.70, 128.96, 128.81, 128.54, 128.36, 127.75, 127.04, 111.92, 109.43, 105.48, 55.39, 50.89, 36.87; HRMS (ESI) m/z calcd for $C_{28}H_{27}N_2O_3S$ $[M+H]^+$: 471.1742; found: 471.1878.



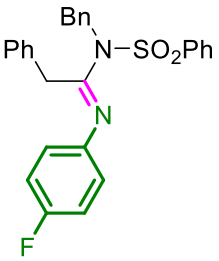
(*E*)-*N*-Benzyl-*N′*-(3-fluorophenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3ah): white solid (0.128 g, 93%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.90 (dd, *J* = 5.2, 3.3 Hz, 2H), 7.81 – 7.74 (m, 1H), 7.72 – 7.63 (m, 2H), 7.29 – 7.22 (m, 4H), 7.20 – 7.07 (m, 5H), 6.87 – 6.79 (m, 1H), 6.73 (d, *J* = 6.8 Hz, 2H), 6.26 – 6.16 (m, 2H), 4.75 (s, 2H), 3.84 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 164.07, 162.85 (d, *J* = 244.4 Hz), 155.98, 149.80, 149.70, 138.39, 136.68, 134.73, 134.31, 131.29 (d, *J* = 9.6 Hz), 129.75, 128.86, 128.63, 128.41, 128.36, 127.81, 127.12, 116.02, 110.53 (d, *J* = 20.9 Hz), 107.00 (d, *J* = 22.9 Hz), 50.89, 36.88; HRMS (ESI) m/z calcd for $C_{27}H_{24}FN_2O_2S$ $[M+H]^+$: 459.1543; found: 459.1691.



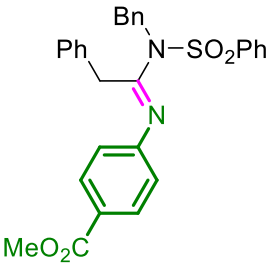
(*E*)-*N*-Benzyl-*N′*-(4-methoxyphenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3ai): brown gummy oil (0.126 g, 88%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.92 – 7.87 (m, 2H), 7.79 – 7.73 (m, 1H), 7.65 (t, *J* = 7.7 Hz, 2H), 7.23- 7.12 (m, 6H), 7.05 (d, *J* = 6.4 Hz, 2H), 6.83 (d, *J* = 8.8 Hz, 2H), 6.73 (d, *J* = 7.0 Hz, 2H), 6.38 (d, *J* = 8.8 Hz, 2H), 4.71 (s, 2H), 3.85 (s, 2H), 3.67 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 156.16, 155.65, 141.11, 138.38, 136.67, 135.03, 134.14, 129.67, 128.92, 128.81, 128.53, 128.31, 127.70, 126.98, 120.88, 114.86, 55.62, 50.80, 36.62; HRMS (ESI) m/z calcd for $C_{28}H_{27}N_2O_3S$ $[M+H]^+$: 471.1742; found: 471.1863.



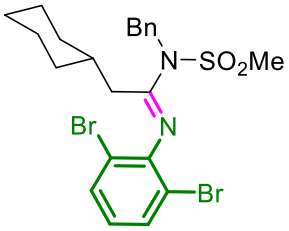
(*E*)-*N*-Benzyl-*N′*-(4-bromophenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (3aj): white solid (0.15 g, 96%); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.90 – 7.81 (m, 2H), 7.68 – 7.63 (m, 1H), 7.54 (dd, *J* = 10.6, 4.8 Hz, 2H), 7.33 – 7.29 (m, 2H), 7.24 – 7.16 (m, 4H), 7.12 (t, *J* = 7.2 Hz, 2H), 7.05 (d, *J* = 7.0 Hz, 2H), 6.76 (d, *J* = 7.2 Hz, 2H), 6.27 (d, *J* = 8.6 Hz, 2H), 4.73 (s, 2H), 3.82 (s, 2H); **^{13}C NMR (101 MHz, CDCl$_3$)** δ 155.72, 146.90, 138.51, 135.84, 134.31, 133.32, 131.99, 131.38, 129.30, 129.13, 128.84, 128.54, 128.45, 128.20, 128.18, 127.93, 127.42, 126.72, 122.20, 121.30, 116.46, 50.86, 37.29; HRMS (ESI) m/z calcd for $C_{27}H_{24}BrN_2O_2S$ $[M+H]^+$: 471.1742; found: 471.1711.



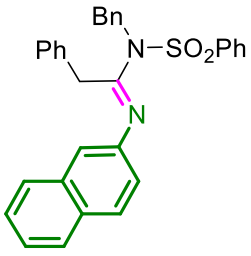
(*E*)-*N*-Benzyl-*N'*-(4-fluorophenyl)-2-phenyl-*N*-(phenylsulfonyl) acetimidamide (**3ak**): white solid (0.126 mg, 91%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.90 (dd, *J* = 8.3, 1.1 Hz, 2H), 7.78- 7.74 (m, 1H), 7.68- 7.64 (m, 2H), 7.28 – 7.04 (m, 10H), 6.72 (d, *J* = 6.9 Hz, 2H), 6.41 (dd, *J* = 8.8, 4.9 Hz, 2H), 4.74 (s, 2H), 3.84 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 159.13 (d, *J* = 239.5 Hz), 156.14, 144.32, 138.38, 136.66, 134.83, 134.23, 129.71, 128.85, 128.83, 128.58, 128.46, 128.31, 127.76, 127.05, 121.34 (d, *J* = 8.0 Hz), 116.23 (d, *J* = 22.5 Hz), 50.85, 36.71; HRMS (ESI) m/z calcd for $C_{27}H_{24}FN_2O_2S$ $[M+H]^+$: 459.1543; found: 459.1667.



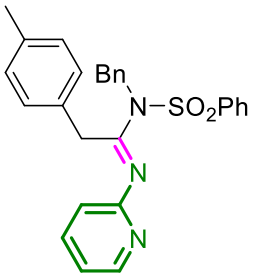
Methyl (*E*)-4-((1-(*N*-benzylphenylsulfonamido)-2-phenylethylidene)amino)benzoate (**3al**): yellow gummy oil (0.128 g, 86%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.92 – 7.88 (m, 2H), 7.82 – 7.75 (m, 3H), 7.66 (t, *J* = 7.7 Hz, 2H), 7.28 – 7.25 (m, 3H), 7.17 – 7.11 (m, 5H), 6.74 (d, *J* = 6.8 Hz, 2H), 6.51 – 6.48 (m, 2H), 4.80 (s, 2H), 3.81 (s, 2H), 3.78 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 166.26, 155.40, 152.25, 138.49, 136.71, 134.60, 134.34, 130.91, 129.74, 128.88, 128.80, 128.68, 128.35, 128.28, 127.84, 127.16, 125.10, 120.02, 52.37, 50.85, 36.99; HRMS (ESI) m/z calcd for $C_{29}H_{27}N_2O_4S$ $[M+H]^+$: 499.1692; found: 499.1708.



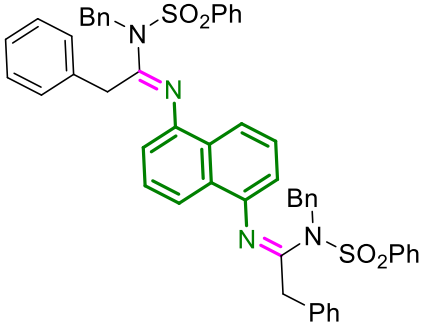
(*E*)-*N*-Benzyl-2-cyclohexyl-*N'*-(2,6-dibromophenyl)-*N*-(methylsulfonyl)acetimidamide (**3im**): yellow gummy oil (0.143 g, 88%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.65 (d, *J* = 8.0 Hz, 2H), 7.46 (d, *J* = 7.4 Hz, 2H), 7.37 (t, *J* = 7.5 Hz, 2H), 7.28 (t, *J* = 7.2 Hz, 1H), 6.93 (t, *J* = 8.0 Hz, 1H), 5.09 (s, 2H), 3.38 (s, 3H), 2.29 (d, *J* = 6.8 Hz, 2H), 1.66 – 1.41 (m, 6H), 1.09 – 0.90 (m, 3H), 0.73 – 0.56 (m, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 162.14, 145.06, 138.00, 132.85, 128.75, 128.00, 127.78, 126.40, 115.55, 50.88, 41.94, 36.16, 32.85, 26.02, 25.80; HRMS (ESI) m/z calcd for $C_{22}H_{27}Br_2N_2O_2S$ $[M+2]^+$: 543.0160; found: 543.0152.



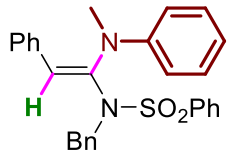
(*E*)-*N*-Benzyl-*N'*-(naphthalen-2-yl)-2-phenyl-N-(phenylsulfonyl) acetimidamide (**3an**): off- white solid (0.135 g, 92%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 8.01 – 7.93 (m, 2H), 7.85 – 7.77 (m, 2H), 7.67 (t, *J* = 7.8 Hz, 2H), 7.57 (d, *J* = 8.3 Hz, 1H), 7.49 – 7.43 (m, 1H), 7.35 – 7.23 (m, 5H), 7.19 – 7.11 (m, 5H), 6.98 (d, *J* = 8.4 Hz, 1H), 6.86 – 6.79 (m, 2H), 6.44 (d, *J* = 7.2 Hz, 1H), 4.96 (s, 2H), 3.74 (s, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 156.01, 144.23, 139.16, 137.05, 134.93, 134.26, 134.07, 129.85, 128.98, 128.84, 128.81, 128.34, 128.20, 128.00, 127.89, 127.14, 126.79, 126.30, 126.23, 125.98, 124.02, 123.56, 114.20, 50.91, 36.79; HRMS (ESI) m/z calcd for $C_{31}H_{27}N_2O_2S$ $[M+H]^+$: 491.1793; found: 491.2006.



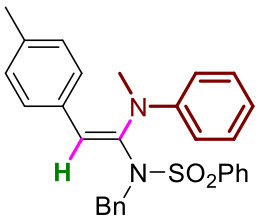
(*E*)-*N*-Benzyl-*N*-(phenylsulfonyl)-*N′*-(pyridin-2-yl)-2-(*p*-tolyl)acetimidamide (3bo): brown gummy oil (0.103 g, 75%); **1H NMR (400 MHz, CDCl3)** δ 8.24 (ddd, *J* = 5.0, 1.9, 0.8 Hz, 1H), 7.81 – 7.77 (m, 2H), 7.55 – 7.50 (m, 1H), 7.45 – 7.37 (m, 3H), 7.17 – 7.14 (m, 3H), 7.12 (dd, *J* = 4.5, 2.5 Hz, 2H), 6.86 – 6.81 (m, 3H), 6.65 (d, *J* = 8.0 Hz, 2H), 6.24 (d, *J* = 8.0 Hz, 1H), 4.77 (s, 2H), 3.83 (s, 2H), 2.21 (s, 3H); **^{13}C NMR (101 MHz, CDCl$_3$)** δ 159.88, 157.15, 148.63, 139.17, 137.51, 136.40, 136.18, 133.14, 131.45, 129.11, 128.76, 128.58, 128.27, 128.19, 128.07, 127.31, 119.00, 116.00, 50.63, 36.94, 20.98; HRMS (ESI) m/z calcd for $C_{27}H_{26}N_3O_2S$ $[M+H]^+$: 456.1746; found: 456.2163.



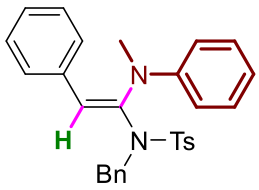
(1*E*,1′*Z*)-*N′*,*N‴*-(Naphthalene-1,5-diyl)bis(*N*-benzyl-2-phenyl-*N*-(phenylsulfonyl)acetimidamide) (3ap): off-white solid (0.24 g, 94%); **^{1}H NMR (400 MHz, DMSO-d$_6$** and **CDCl$_3$)** δ 7.91 (d, *J* = 7.3 Hz, 4H), 7.72 (d, *J* = 7.2 Hz, 2H), 7.61 (t, *J* = 7.3 Hz, 3H), 7.31 – 6.96 (m, 19H), 6.79 (dd, *J* = 26.0, 6.0 Hz, 4H), 6.63 (d, *J* = 8.3 Hz, 2H), 6.30 (d, *J* = 6.9 Hz, 2H), 4.89 (s, 4H), 3.67 (s, 4H); **^{13}C NMR (101 MHz, DMSO-d$_6$** and **CDCl$_3$)** δ 160.64, 148.88, 143.81, 141.55, 139.51, 138.71, 134.32, 133.70, 133.40, 133.33, 132.97, 132.69, 132.45, 131.64, 131.41, 130.26, 124.06, 119.20, 55.63, 41.83; HRMS (ESI) m/z calcd for $C_{52}H_{45}N_4O_4S_2$ $[M+H_2O]^+$: 870.2910; found: 870.2885.



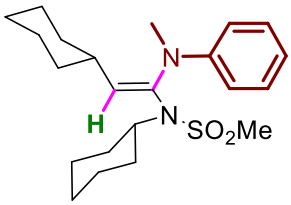
(*E*)-*N*-Benzyl-*N*-(1-(methyl(phenyl)amino)-2-phenylvinyl) benzenesulfonamide (5aa): white crystalline solid (0.114 g, 84%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.85 (d, *J* = 7.5 Hz, 2H), 7.72 (t, *J* = 7.4 Hz, 1H), 7.61 (t, *J* = 7.7 Hz, 2H), 7.34 – 7.23 (m, 3H), 7.23 – 7.16 (m, 2H), 7.10 (t, *J* = 7.3 Hz, 2H), 7.07 – 6.92 (m, 5H), 6.67 (t, *J* = 7.2 Hz, 1H), 6.61 (d, *J* = 8.0 Hz, 2H), 6.01 (s, 1H), 4.60 (s, 2H), 2.57 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 145.10, 139.71, 137.67, 136.92, 134.92, 133.88, 129.83, 128.94, 128.72, 128.61, 128.54, 127.97, 127.82, 127.60, 127.20, 119.85, 116.74, 115.92, 51.75, 36.87; HRMS (ESI) m/z calcd for $C_{28}H_{27}N_2O_2S$ $[M+H]^+$: 455.1793; found: 455.1957.



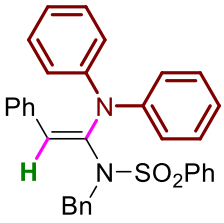
(*E*)-*N*-Benzyl-*N*-(1-(methyl(phenyl)amino)-2-(*p*-tolyl)vinyl) benzenesulfonamide (5ba): white solid (0.127 g, 90%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.91 – 7.78 (m, 2H), 7.74- 7.70 (m, 1H), 7.59 (t, *J* = 7.7 Hz, 2H), 7.30- 7.25 (m, 3H), 7.18 (dd, *J* = 7.4, 1.8 Hz, 2H), 6.98 (dd, *J* = 8.5, 7.4 Hz, 2H), 6.92 (d, *J* = 8.1 Hz, 2H), 6.86 (d, *J* = 8.2 Hz, 2H), 6.67 (t, *J* = 7.3 Hz, 1H), 6.60 (d, *J* = 7.9 Hz, 2H), 5.99 (s, 1H), 4.58 (s, 2H), 2.57 (s, 3H), 2.19 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 145.14, 139.77, 136.98, 136.74, 136.61, 133.84, 131.97, 129.80, 129.27, 128.97, 128.70, 128.52, 127.94, 127.81, 127.63, 119.68, 117.24, 115.65, 51.75, 36.73, 21.18; HRMS (ESI) m/z calcd for $C_{29}H_{29}N_2O_2S$ $[M+H]^+$: 469.1950; found: 469.1973.



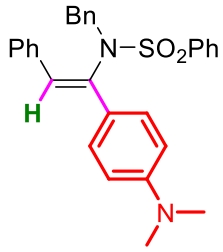
(*E*)-*N*-Benzyl-4-methyl-*N*-(1-(methyl(phenyl)amino)-2-phenylvinyl)benzenesulfonamide (5ha): off-white solid (0.131 g, 93%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.74 (d, *J* = 8.3 Hz, 2H), 7.41 (d, *J* = 8.1 Hz, 2H), 7.32 – 7.25 (m, 3H), 7.23 – 7.19 (m, 2H), 7.11 (t, *J* = 7.3 Hz, 2H), 7.06 – 6.95 (m, 5H), 6.68 (t, *J* = 7.3 Hz, 1H), 6.61 (d, *J* = 7.9 Hz, 2H), 6.03 (s, 1H), 4.57 (s, 2H), 2.59 (s, 3H), 2.42 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 145.13, 144.31, 137.74, 137.00, 136.91, 134.98, 130.22, 128.92, 128.70, 128.61, 128.52, 127.93, 127.88, 127.58, 127.14, 119.80, 116.55, 115.90, 51.64, 36.90, 21.53; HRMS (ESI) m/z calcd for $C_{29}H_{29}N_2O_2S$ $[M+H]^+$: 469.1950; found: 469.1962.



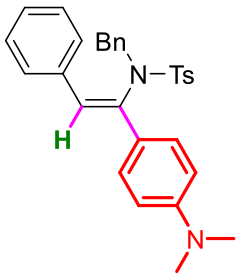
(*E*)-*N*-Cyclohexyl-*N*-(2-cyclohexyl-1-(methyl(phenyl) amino)vinyl)methanesulfonamide (5ja): colourless gummy oil (0.097 g, 83%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.22 (dd, *J* = 8.7, 7.3 Hz, 2H), 6.90 (d, *J* = 7.9 Hz, 2H), 6.74 (t, *J* = 7.3 Hz, 1H), 5.01 (d, *J* = 9.2 Hz, 1H), 3.61 – 3.47 (m, 1H), 3.05 (s, 3H), 2.98 (s, 3H), 1.85 – 1.41 (m, 14H), 1.26 – 0.98 (m, 7H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 146.44, 134.47, 129.22, 128.13, 118.51, 114.74, 59.34, 41.47, 36.74, 36.45, 32.71, 31.98, 30.94, 26.54, 26.29, 26.18, 25.98, 25.72, 25.52, 25.49; HRMS (ESI) m/z calcd for $C_{22}H_{35}N_2O_2S$ $[M+H]^+$: 391.2419; found: 391.2498.



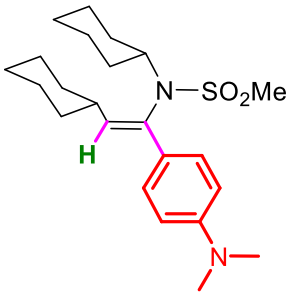
(*E*)-*N*-Benzyl-*N*-(1-(diphenylamino)-2-phenylvinyl) benzenesulfonamide (5ab): off-white solid (0.137 g, 88%); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.59 – 7.51 (m, 2H), 7.46 – 7.42 (m, 1H), 7.32 – 7.26 (m, 2H), 7.20 – 7.16 (m, 3H), 7.15 – 7.13 (m, 2H), 6.96 (dd, *J* = 7.7, 1.6 Hz, 2H), 6.94 – 6.82 (m, 7H), 6.80 – 6.74 (m, 2H), 6.73 – 6.67 (m, 4H), 6.12 (s, 1H), 4.48 (s, 2H); **^{13}C NMR (101 MHz, CDCl$_3$)** merged peaks were present δ 143.95, 139.80, 136.71, 136.00, 134.11, 132.71, 129.09, 128.69, 128.60, 128.47, 128.26, 128.05, 127.54, 127.48, 127.35, 126.53, 123.14, 122.99, 117.15, 51.49; HRMS (ESI) m/z calcd for $C_{33}H_{29}N_2O_2S$ $[M+H]^+$: 517.1950; found: 517.2140.



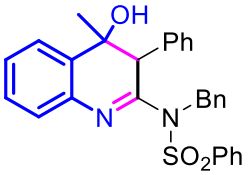
(*Z*)-*N*-Benzyl-*N*-(1-(4-(dimethylamino)phenyl)-2-phenylvinyl) benzenesulfonamide (7aa): yellow gummy oil (0.122 g, 79%); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.53 – 7.47 (m, 3H), 7.33 (dd, *J* = 8.8, 6.8 Hz, 2H), 7.24 – 7.15 (m, 8H), 7.02 – 6.95 (m, 4H), 6.58 (s, 1H), 6.50 (d, *J* = 8.9 Hz, 2H), 4.51 (s, 2H), 2.94 (s, 6H); **^{13}C NMR (101 MHz, CDCl$_3$)** merged peaks were present δ 150.42, 140.84, 137.17, 136.02, 135.91, 132.30, 130.04, 128.91, 128.56, 128.51, 128.28, 128.04, 127.87, 127.25, 126.48, 126.39, 111.71, 52.04, 40.36; HRMS (ESI) m/z calcd for $C_{29}H_{29}N_2O_2S$ $[M+H]^+$: 469.1950; found: 469.2069.



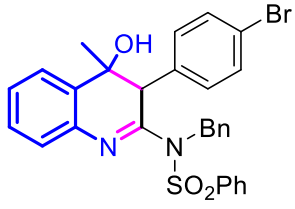
(*Z*)-*N*-Benzyl-*N*-(1-(4-(dimethylamino)phenyl)-2-phenylvinyl)-4-methylbenzenesulfonamide (**7ha**): colourless gummy (0.117 g, 80%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.49 (d, *J* = 8.3 Hz, 2H), 7.31 – 7.29 (m, 2H), 7.25 – 7.16 (m, 8H), 7.00 – 6.92 (m, 2H), 6.87 (d, *J* = 8.9 Hz, 2H), 6.60 (s, 1H), 6.47 (d, *J* = 9.0 Hz, 2H), 4.50- 4.38 (m, 2H), 2.88 (s, 6H), 2.40 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** merged peaks were present δ 150.61, 143.83, 137.89, 136.87, 136.18, 136.01, 130.12, 129.90, 128.81, 128.74, 128.69, 128.55, 127.95, 127.70, 126.08, 125.79, 111.84, 51.48, 40.35, 21.50; HRMS (ESI) m/z calcd for $C_{30}H_{31}N_2O_2S$ $[M+H]^+$: 483.2106; found: 483.2129.



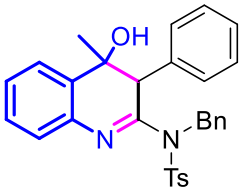
(*Z*)-*N*-Cyclohexyl-*N*-(2-cyclohexyl-1-(4-(dimethylamino) phenyl)vinyl)methanesulfonamide (**7ja**): white crystalline solid (0.088g, 72%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.24 (d, *J* = 8.9 Hz, 2H), 6.64 (d, *J* = 8.9 Hz, 2H), 5.73 (d, *J* = 10.5 Hz, 1H), 3.15 (s, 3H), 2.89 (s, 6H), 2.37 (dd, *J* = 20.9, 10.6 Hz, 1H), 1.89 (d, *J* = 11.2 Hz, 1H), 1.78 – 1.60 (m, 7H), 1.47 (t, *J* = 14.3 Hz, 2H), 1.36 – 1.07 (m, 9H), 0.85 – 0.74 (m, 2H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 150.09, 136.90, 132.88, 129.09, 127.78, 112.03, 58.71, 41.04, 38.04, 33.41, 32.56, 31.79, 26.06, 26.02, 25.91, 25.80, 25.65, 25.28; HRMS (ESI) m/z calcd for $C_{23}H_{37}N_2O_2S$ $[M+H]^+$: 405.2576; found: 405.2678.



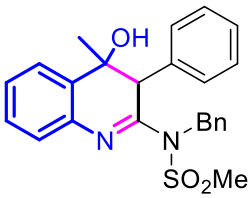
***N*-Benzyl-*N*-(4-hydroxy-4-methyl-3-phenyl-3,4-dihydroquinolin-2-yl)benzenesulfonamide** (**9aa**): yellow gummy oil (0.133 g, 92%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.95 – 7.88 (m, 2H), 7.72 – 7.65 (m, 1H), 7.60 – 7.52 (m, 2H), 7.30 (td, *J* = 7.6, 1.5 Hz, 1H), 7.24- 7.21 (m, 2H), 7.19 – 7.07 (m, 7H), 6.96 (t, *J* = 7.8 Hz, 2H), 6.51 (d, *J* = 7.3 Hz, 2H), 5.36 (s, 1H), 4.99- 4.62 (m, 2H), 4.62 (s, 1H), 1.28 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 159.30, 142.75, 139.28, 137.33, 134.44, 133.89, 131.40, 129.47, 129.22, 129.02, 128.63, 128.36, 128.31, 128.07, 127.69, 127.38, 126.93, 126.18, 125.13, 70.50, 55.25, 50.15, 24.44; HRMS (ESI) m/z calcd for $C_{29}H_{27}N_2O_3S$ $[M+H]^+$: 483.1742; found: 483.1753.



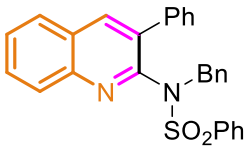
***N*-Benzyl-*N*-(3-(4-bromophenyl)-4-hydroxy-4-methyl-3,4-dihydroquinolin-2-yl)benzenesulfonamide** (**9da**): yellow gummy oil (0.147 g, 87%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 8.00 – 7.91 (m, 2H), 7.73 – 7.65 (m, 1H), 7.57 (t, *J* = 7.8 Hz, 2H), 7.31- 7.25 (m, 3H), 7.22 – 7.07 (m, 8H), 6.42 (d, *J* = 8.1 Hz, 2H), 5.44 (s, 1H), 4.99-4.68 (m, 2H), 4.68 (s, 1H), 1.30 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** merged peaks were present δ 158.92, 142.49, 139.06, 137.06, 133.92, 131.52, 131.23, 131.00, 129.56, 129.38, 128.31, 128.22, 127.41, 127.27, 126.41, 125.21, 121.11, 70.33, 54.90, 50.35, 24.36; HRMS (ESI) m/z calcd for $C_{29}H_{26}BrN_2O_3S$ $[M+2]^+$: 563.0848; found: 563.0846.



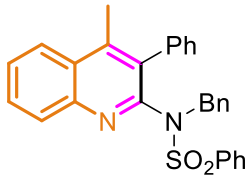
***N*-Benzyl-*N*-(4-hydroxy-4-methyl-3-phenyl-3,4-dihydroquinolin-2-yl)-4-methylbenzenesulfonamide (9ha)**: yellow gummy oil (0.14 g, 94%); **^{1}H NMR (400 MHz, DMSO-d$_6$)** δ 7.79 (d, *J* = 8.3 Hz, 2H), 7.35 (d, *J* = 8.1 Hz, 2H), 7.31 (td, *J* = 7.6, 1.3 Hz, 1H), 7.23 (ddd, *J* = 8.8, 7.6, 1.0 Hz, 2H), 7.20 – 7.07 (m, 7H), 6.96 (t, *J* = 7.7 Hz, 2H), 6.51 (d, *J* = 7.4 Hz, 2H), 5.36 (s, 1H), 4.92 (dd, *J* = 36.4, 15.4 Hz, 2H), 4.67 (s, 1H), 2.39 (s, 3H), 1.30 (s, 3H); **^{13}C NMR (101 MHz, DMSO-d$_6$)** δ 159.37, 144.40, 142.80, 137.37, 136.34, 134.55, 131.44, 129.92, 129.21, 129.04, 128.59, 128.35, 128.31, 128.12, 127.62, 127.32, 126.91, 126.22, 125.13, 70.50, 55.29, 50.14, 24.47, 21.52; HRMS (ESI) m/z calcd for $C_{30}H_{29}N_2O_3S$ $[M+H]^+$: 497.1899; found: 497.1920.



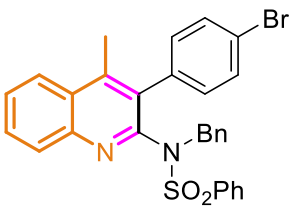
***N*-Benzyl-*N*-(4-hydroxy-4-methyl-3-phenyl-3,4-dihydroquinolin-2-yl)methanesulfonamide (9ka)**: yellow gummy oil (0.102 g, 81%); ^{1}H NMR (400 MHz, DMSO) δ 7.34 – 7.23 (m, 8H), 7.16 – 7.05 (m, 4H), 6.78 (d, *J* = 7.0 Hz, 2H), 5.25 (s, 1H), 5.05 (d, *J* = 16.7 Hz, 1H), 4.74 (d, *J* = 16.7 Hz, 1H), 4.04 (s, 1H), 3.35 (s, 3H), 1.28 (s, 3H); ^{13}C NMR (101 MHz, DMSO) δ 160.73, 141.65, 138.07, 134.35, 133.77, 129.67, 128.84, 128.39, 128.27, 127.68, 127.53, 127.43, 127.09, 125.43, 124.38, 72.43, 53.71, 49.70, 42.86, 31.19; HRMS (ESI) m/z calcd for $C_{24}H_{25}N_2O_3S$ $[M+H]^+$: 421.1586; found: 421.1603.



***N*-Benzyl-*N*-(3-phenylquinolin-2-yl)benzenesulfonamide (11ab)**: yellow gummy liquid (0.126 g, 93%); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.04 (s, 1H), 7.94 (d, *J* = 8.5 Hz, 1H), 7.80 (dd, *J* = 8.4, 1.2 Hz, 3H), 7.73 (ddd, *J* = 8.4, 6.9, 1.4 Hz, 1H), 7.64 – 7.56 (m, 2H), 7.49 (dd, *J* = 11.0, 4.5 Hz, 2H), 7.37 (qd, *J* = 5.3, 3.1 Hz, 3H), 7.25 – 7.21 (m, 2H), 7.13 – 7.07 (m, 1H), 7.00 (t, *J* = 7.5 Hz, 2H), 6.87 – 6.79 (m, 2H), 4.63 (s, 2H); HRMS (ESI) m/z calcd for $C_{28}H_{23}N_2O_2S$ $[M+H]^+$: 451.1480; found: 451.1486.

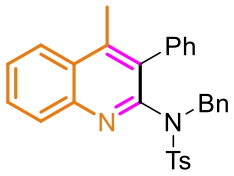


***N*-Benzyl-*N*-(4-methyl-3-phenylquinolin-2-yl)benzenesulfonamide (11aa)**: yellow gummy oil (0.124 g, 89%); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.94 (dd, *J* = 8.5, 1.3 Hz, 2H), 7.75 – 7.59 (m, 3H), 7.58 – 7.46 (m, 2H), 7.42 – 7.34 (m, 2H), 7.34 – 7.27 (m, 1H), 7.23 (t, *J* = 7.5 Hz, 2H), 7.10 – 7.05 (m, 1H), 7.01 – 6.94 (m, 2H), 6.71 (dd, *J* = 5.1, 3.2 Hz, 4H), 4.48 (s, 2H), 2.28 (s, 3H); **^{13}C NMR (101 MHz, CDCl$_3$)** δ 150.63, 145.75, 145.44, 139.09, 136.48, 135.71, 134.86, 132.72, 130.77, 129.88, 129.41, 129.16, 128.82, 128.38, 128.12, 127.80, 127.71, 127.63, 127.27, 127.20, 124.34, 54.21, 16.58; HRMS (ESI) m/z calcd for $C_{29}H_{25}N_2O_2S$ $[M+H]^+$: 465.1637; found: 465.1633.

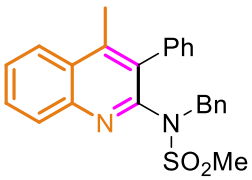


***N*-Benzyl-*N*-(3-(4-bromophenyl)-4-methylquinolin-2-yl)benzenesulfonamide (11da)**: colourless gummy oil (0.144 g, 88%); **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.05 – 7.99 (m, 1H), 7.99 – 7.92 (m, 1H), 7.75 (ddd, *J* = 8.3, 6.9, 1.4 Hz, 1H), 7.70 (dt, *J* = 8.5, 1.6 Hz, 2H), 7.67 – 7.60 (m, 2H), 7.55 – 7.46 (m, 2H), 7.41 (d, *J* = 8.3 Hz, 2H), 7.23 – 7.14 (m, 1H), 7.13 – 7.02 (m, 2H), 6.80 (dd, *J* =

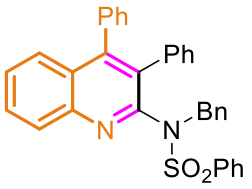
5.1, 3.2 Hz, 2H), 6.61 (br s, 2H), 4.59 (s, 2H), 2.34 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 150.38, 145.89, 145.17, 138.60, 135.41, 134.69, 132.83, 132.45, 130.72, 129.89, 129.53, 129.44, 129.08, 128.40, 128.17, 127.71, 127.64, 127.39, 124.27, 121.41, 54.33, 16.51; HRMS (ESI) m/z calcd for $C_{29}H_{25}N_2BrO_2S$ $[M+2]^+$: 544.0742; found: 544.0711.



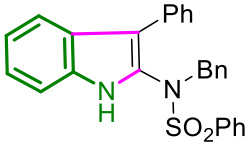
***N*-Benzyl-4-methyl-*N*-(4-methyl-3-phenylquinolin-2-yl)benzene sulfonamide (11ha)**: yellow gummy oil (0.124 g, 86%); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.94 (ddd, *J* = 9.2, 8.6, 0.8 Hz, 2H), 7.66 (ddd, *J* = 8.4, 6.9, 1.4 Hz, 1H), 7.58 – 7.44 (m, 3H), 7.31 – 7.25 (m, 1H), 7.19 (dt, *J* = 8.0, 6.7 Hz, 5H), 7.10 – 7.02 (m, 1H), 7.02 – 6.93 (m, 2H), 6.87 – 6.57 (m, 4H), 4.47 (s, 2H), 2.38 (s, 3H), 2.27 (s, 3H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 150.66, 145.73, 145.24, 143.45, 136.52, 136.01, 135.79, 134.92, 130.74, 129.87, 129.37, 129.28, 129.16, 128.98, 128.04, 127.73, 127.58, 127.52, 127.15, 127.06, 124.27, 54.05, 21.58, 16.50; HRMS (ESI) m/z calcd for $C_{30}H_{27}N_2O_2S$ $[M+H]^+$: 479.1793; found: 479.1767.



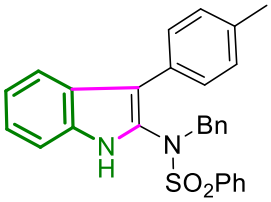
***N*-Benzyl-*N*-(4-methyl-3-phenylquinolin-2-yl)methanesulfonamide (11ka)**: yellow gummy oil (0.102 g, 85%); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.97 (ddd, *J* = 19.0, 8.4, 0.6 Hz, 2H), 7.66 (ddd, *J* = 8.3, 6.9, 1.3 Hz, 1H), 7.53 (ddd, *J* = 8.3, 6.9, 1.3 Hz, 1H), 7.31 – 7.25 (m, 3H), 7.19 – 7.05 (m, 4H), 7.05 – 6.81 (m, 4H), 4.44 (s, 2H), 2.95 (s, 3H), 2.34 (s, 3H); **^{13}C NMR (101 MHz, DMSO)** merged peaks were present δ 151.53, 145.67, 136.13, 135.17, 133.93, 130.58, 129.56, 129.46, 128.32, 127.98, 127.77, 127.64, 127.41, 127.15, 124.27, 54.22, 40.85, 16.52; HRMS (ESI) m/z calcd for $C_{24}H_{23}N_2O_2S$ $[M+H]^+$: 403.1480; found: 403.1442.



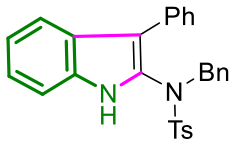
***N*-Benzyl-*N*-(3,4-diphenylquinolin-2-yl)benzenesulfonamide (11 ac)**: yellow gummy oil (0.118 g, 75%); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.07 (dd, *J* = 8.4, 0.4 Hz, 1H), 7.84 – 7.70 (m, 4H), 7.61 (ddd, *J* = 7.4, 4.7, 1.3 Hz, 1H), 7.55 – 7.53 (m, 1H), 7.49 (ddd, *J* = 4.9, 4.2, 1.7 Hz, 3H), 7.21 (d, *J* = 2.7 Hz, 2H), 7.17 – 7.12 (m, 2H), 7.09 – 7.00 (m, 6H), 6.80 (dd, *J* = 17.8, 16.5 Hz, 4H), 4.60 (s, 2H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 150.94, 150.03, 146.33, 139.32, 136.35, 135.78, 134.85, 134.63, 132.65, 131.32, 130.05, 129.63, 129.47, 128.95, 128.57,128.30, 128.04, 127.90, 127.63, 127.57, 127.33, 127.20, 127.02, 126.68, 126.57, 54.12; HRMS (ESI) m/z calcd for $C_{34}H_{27}N_2O_2S$ $[M+H]^+$: 527.1793; found: 527.1788.



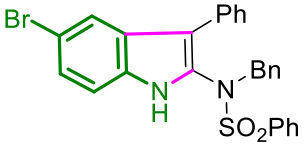
***N*-Benzyl-*N*-(3-phenyl-1*H*-indol-2-yl)benzenesulfonamide (12aa)**: light yellow gummy oil (0.100 g, 78%); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.52 (s, 1H), 7.79 – 7.75 (m, 2H), 7.69 – 7.63 (m, 1H), 7.54- 7.48 (m, 3H), 7.32- 7.28 (m, 1H), 7.26 – 7.21 (m, 2H), 7.19- 7.15 (m, Hz, 5H), 7.10 – 7.04 (m, 3H), 6.60 (dd, *J* = 8.2, 1.4 Hz, 2H), 4.52 (s, 2H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 138.48, 136.02, 133.25, 133.00, 129.37, 129.07, 128.39, 128.28, 127.86, 127.64, 127.43, 126.90, 126.48, 123.02, 120.07, 119.46, 112.57, 110.98, 53.52; HRMS (ESI) m/z calcd for $C_{27}H_{23}N_2O_2S$ $[M+H]^+$: 439.1480; found: 439.1485.



***N*-Benzyl-*N*-(3-(*p*-tolyl)-1*H*-indol-2-yl)benzenesulfonamide (12ba)**: off-white solid (0.115 g, 85%); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.57 (s, 1H), 7.79 (dd, *J* = 8.4, 1.2 Hz, 2H), 7.68 (t, *J* = 7.5 Hz, 1H), 7.58 – 7.47 (m, 3H), 7.31 (d, *J* = 8.1 Hz, 1H), 7.25 – 7.17 (m, 4H), 7.13 – 7.06 (m, 3H), 7.01 (d, *J* = 7.8 Hz, 2H), 6.50 (d, *J* = 8.0 Hz, 2H), 4.55 (s, 2H), 2.37 (s, 3H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 138.51, 136.54, 136.11, 133.23, 133.16, 129.94, 129.34, 129.10, 128.88, 128.35, 128.25, 127.79, 127.46, 127.40, 126.57, 122.89, 119.92, 119.45, 112.36, 110.93, 53.33, 21.12; HRMS (ESI) m/z calcd for $C_{28}H_{25}N_2O_2S$ $[M+H]^+$: 453.1637; found: 453.1648.



***N*-Benzyl-4-methyl-*N*-(3-phenyl-1*H*-indol-2-yl)benzenesulfonamide (12ha)**: colourless gummy oil (0.11 g, 81%); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.55 (s, 1H), 7.69 – 7.61 (m, 2H), 7.50 (d, *J* = 8.0 Hz, 1H), 7.33 – 7.28 (m, 3H), 7.26 – 7.16 (m, 7H), 7.12 – 7.04 (m, 3H), 6.65 (dd, *J* = 8.2, 1.3 Hz, 2H), 4.54 (s, 2H), 2.47 (s, 3H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 144.22, 136.11, 135.55, 133.25, 133.06, 129.86, 129.10, 128.36, 128.28, 127.80, 127.47, 126.78, 126.43, 122.94, 120.02, 119.43, 112.53, 110.97, 53.50, 21.58; HRMS (ESI) m/z calcd for $C_{28}H_{25}N_2O_2S$ $[M+H]^+$: 453.1637; found: 453.1637.



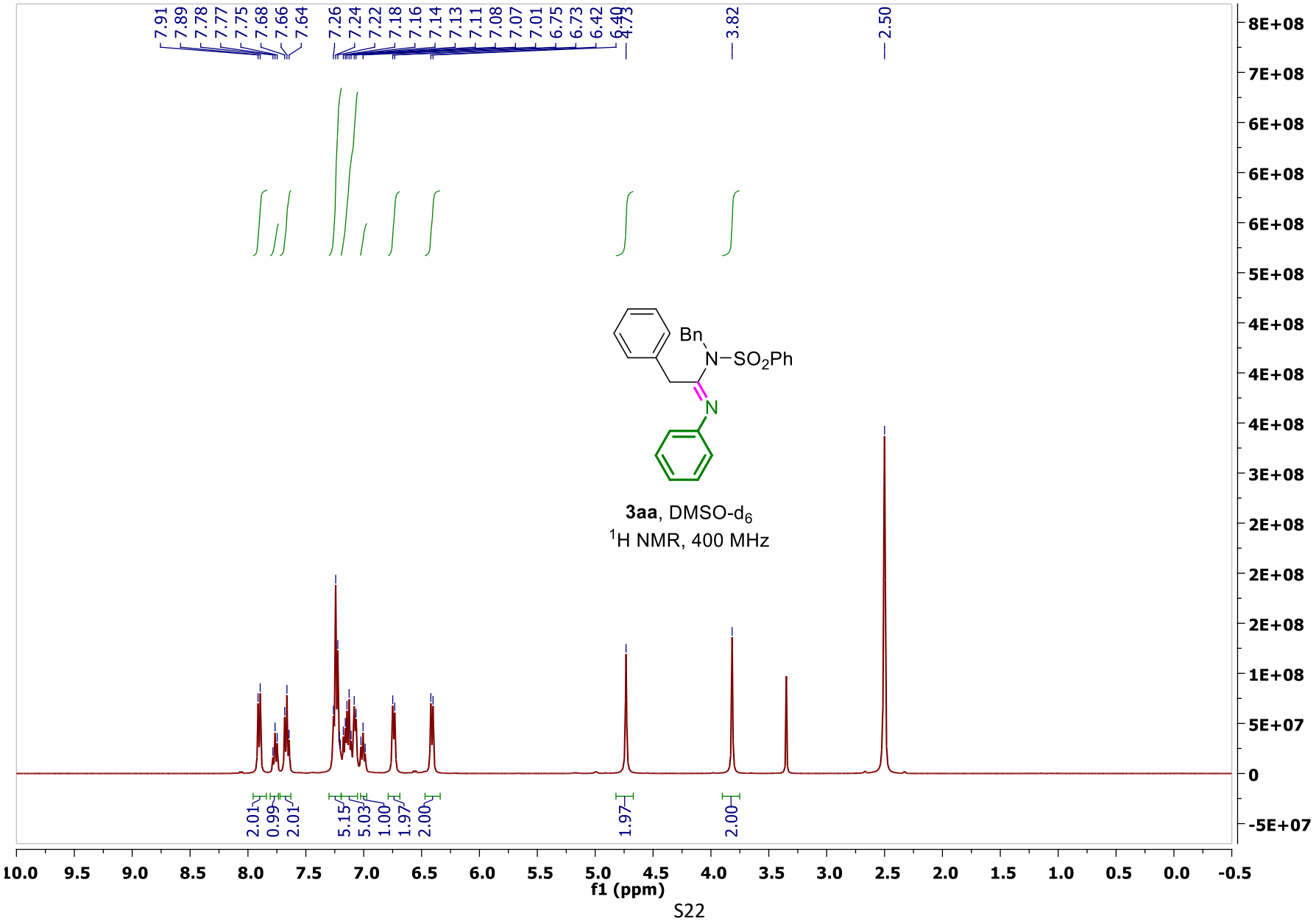
***N*-Benzyl-*N*-(5-bromo-3-phenyl-1*H*-indol-2-yl)benzene sulfonamide (12aj)**: off-white solid (0.133 g, 86%); **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.66 (s, 1H), 7.76 (dd, *J* = 8.4, 1.2 Hz, 2H), 7.72 – 7.64 (m, 1H), 7.61 – 7.51 (m, 3H), 7.29 (dd, *J* = 8.6, 1.9 Hz, 1H), 7.25 (dd, *J* = 3.9, 2.6 Hz, 1H), 7.23 – 7.13 (m, 6H), 7.08 – 7.01 (m, 2H), 6.54 (dd, *J* = 8.2, 1.3 Hz, 2H), 4.51 (s, 2H); **^{13}C NMR (101 MHz, $CDCl_3$)** δ 138.28, 135.74, 133.39, 132.26, 131.73, 129.44, 128.98, 128.53, 128.41, 128.22, 128.10, 127.94, 127.37, 127.22, 125.92, 121.88, 113.43, 112.52, 112.15, 53.34; HRMS (ESI) m/z calcd for $C_{27}H_{22}N_2O_2SBr$ $[M+H]^+$: 517.0585; found: 517.0576.

12. References.

1. A. Coste, G. Karthikeyan, F. Couty and G. Evano, *Angew. Chemie - Int. Ed.*, **2009**, *48*, 4381–4385.

2. K. Jouvin, J. Heimburger and G. Evano, *Chem. Sci.*, **2012**, *3*, 756–76

13. ^{1}H, ^{13}C, NOE NMR spectra of synthesized compounds.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2.01
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5.03
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2.00
1.97
2.00
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4E+08
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3E+08
2E+08
2E+08
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1E+08
5E+07
0
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9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
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5.0
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0.5
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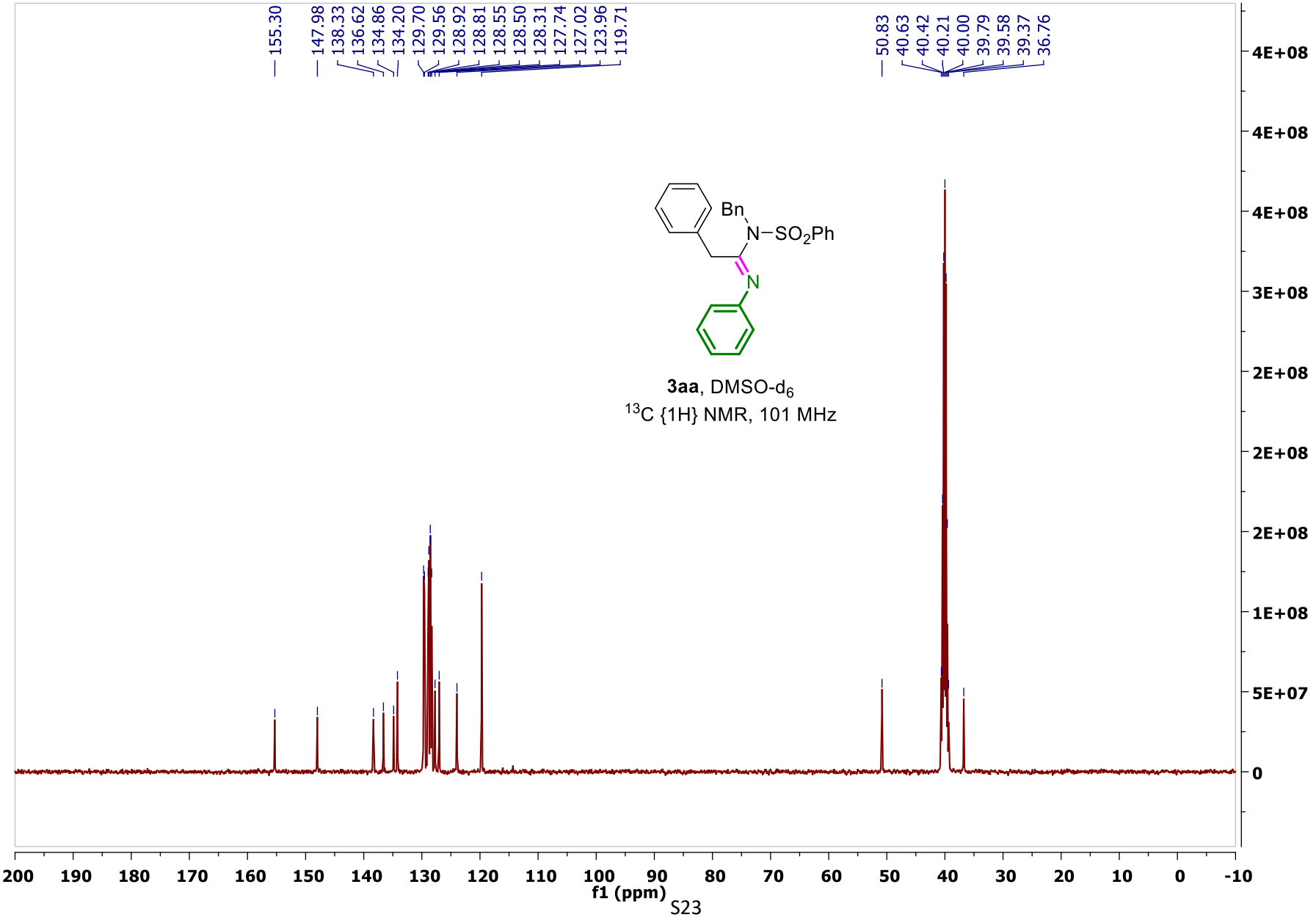
-0.5
f1 (ppm)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Bn
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13C {1H} NMR, 101 MHz
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4E+08
4E+08
3E+08
2E+08
2E+08
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1E+08
5E+07
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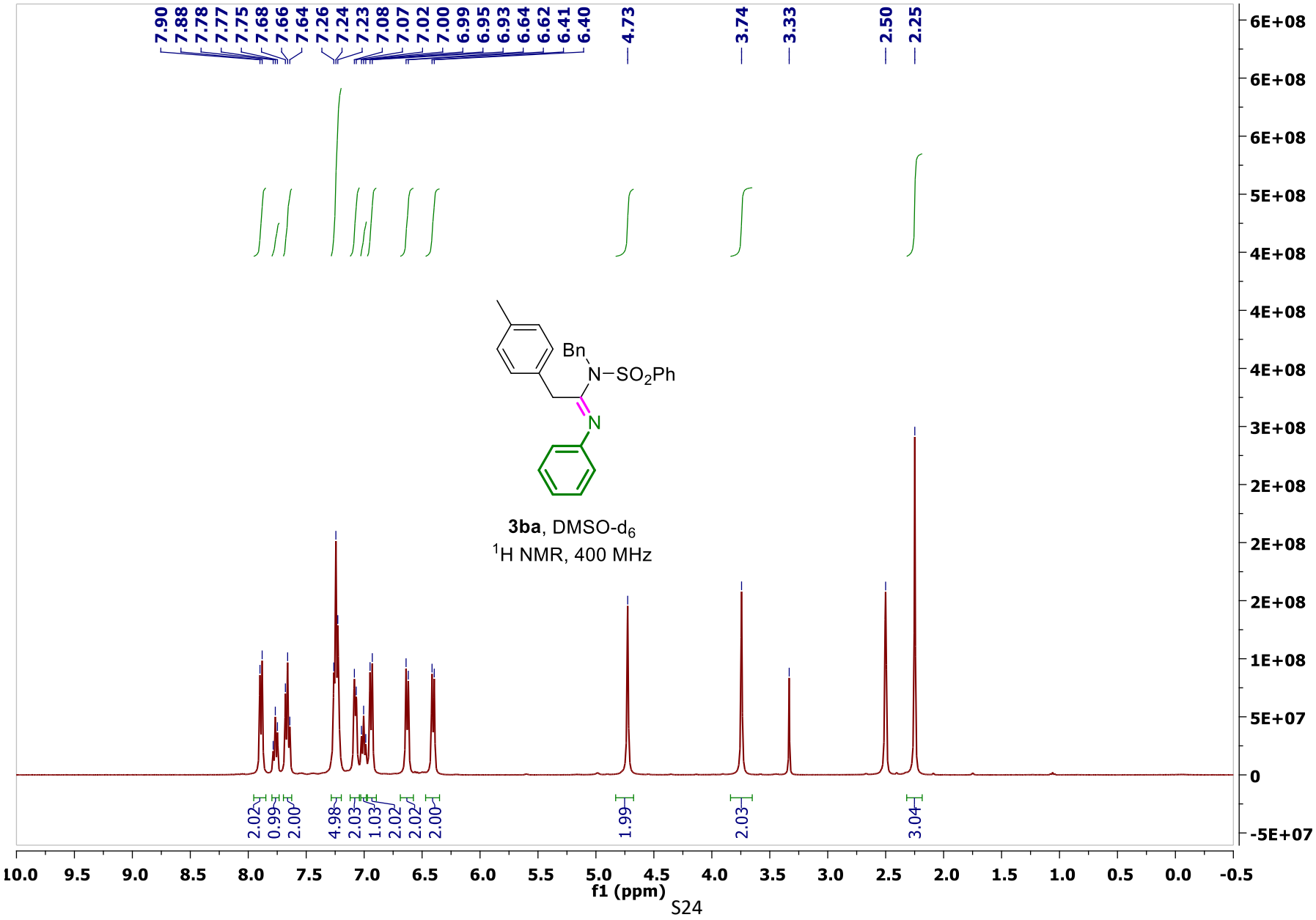
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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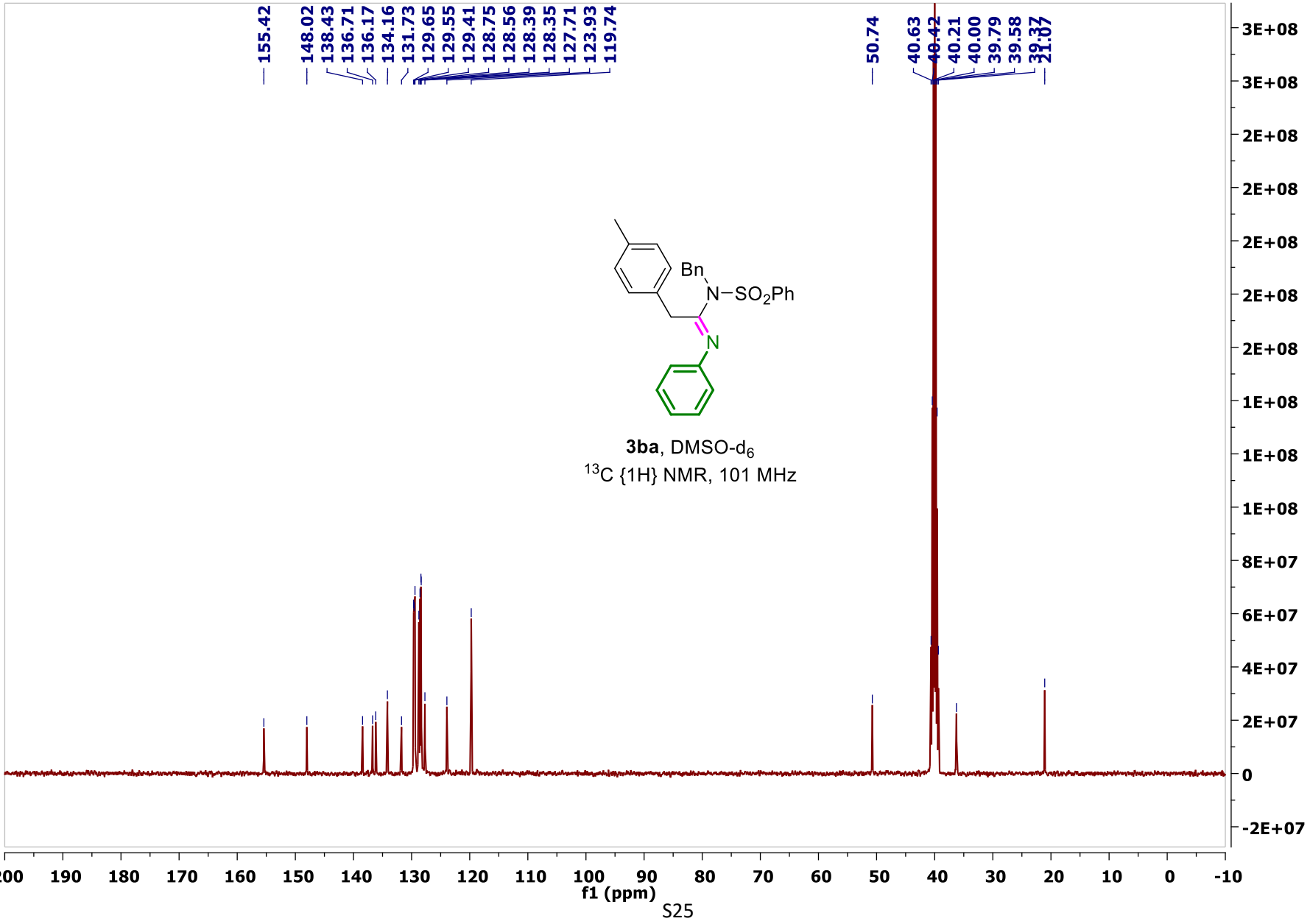
7.88
7.78
7.77
7.75
7.68
7.66
7.64
7.26
7.24
7.23
7.08
7.07
7.02
7.00
6.99
6.95
6.93
6.64
6.62
6.41
6.40
4.73
3.74
3.33
2.50
2.25
Bn
N–SO2Ph
N
3ba, DMSO-d6
1H NMR, 400 MHz
2.02
0.99
2.00
4.98
2.03
1.03
2.02
2.02
2.00
1.99
2.03
3.04
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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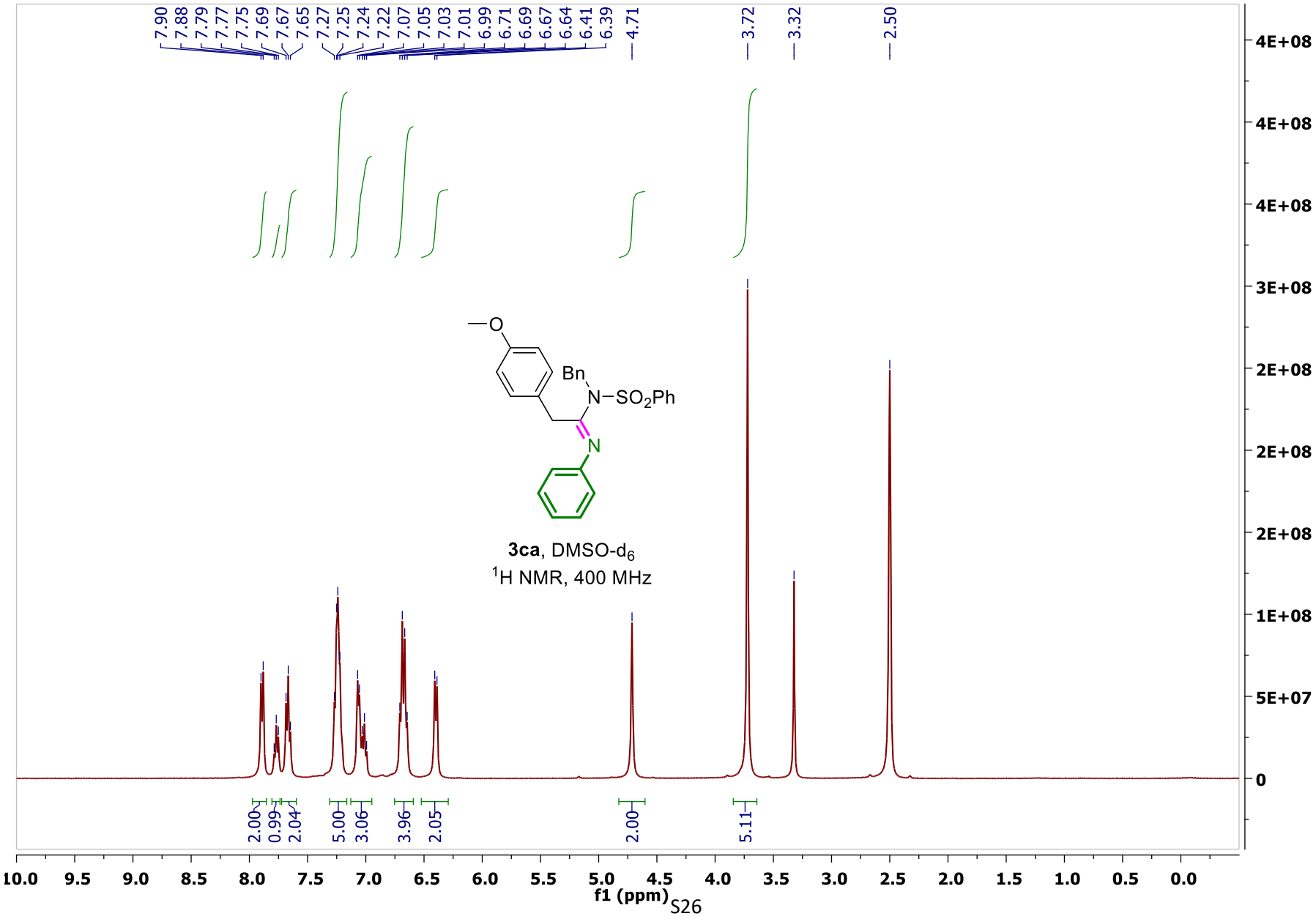
148.02
138.43
136.71
136.17
134.16
131.73
129.65
129.55
129.41
128.75
128.56
128.39
128.35
127.71
123.93
119.74
50.74
40.63
40.42
40.21
40.00
39.79
39.58
39.37
21.07
Bn
N–SO2Ph
N
3ba, DMSO-d6
13C {1H} NMR, 101 MHz
3E+08
2E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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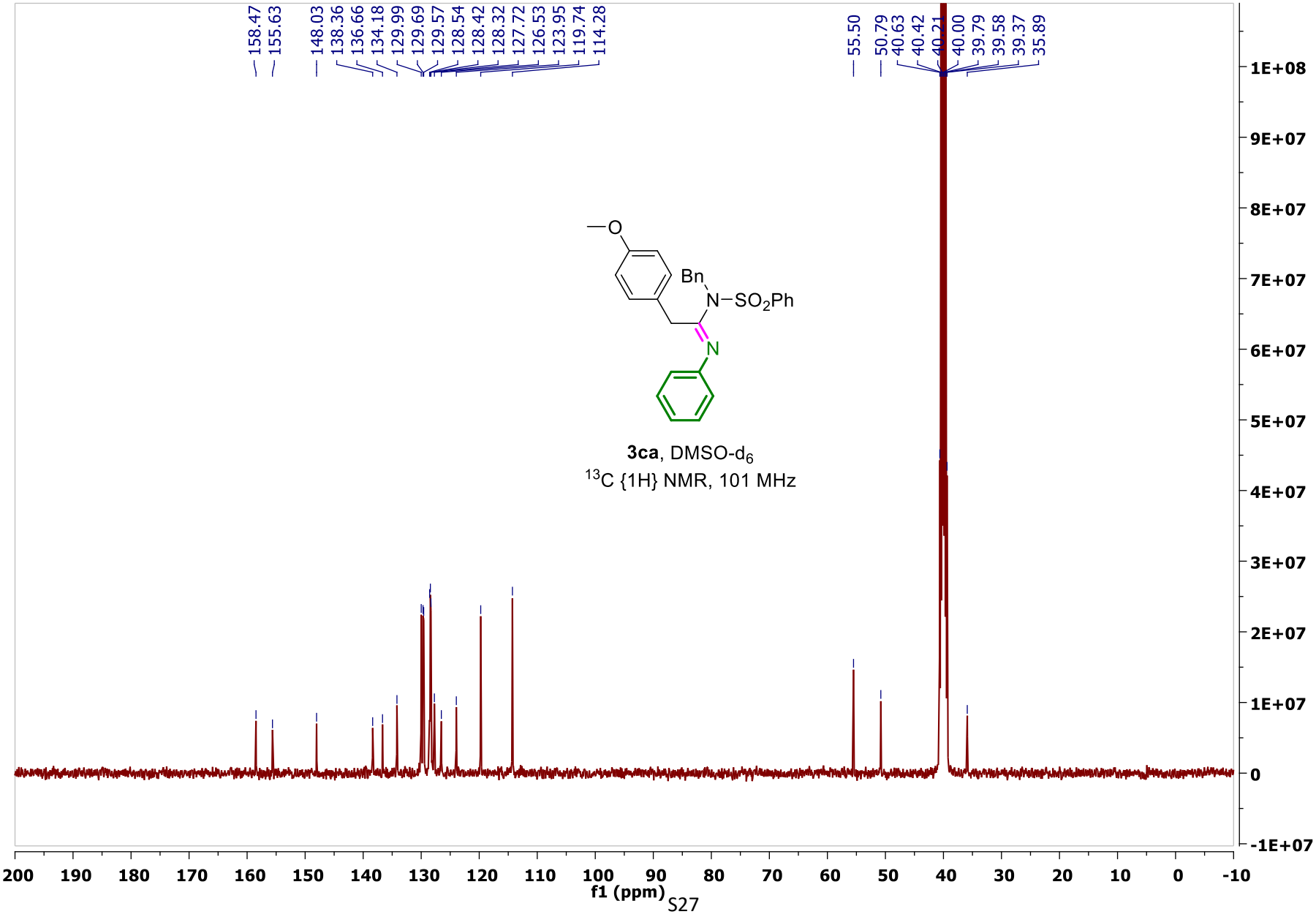
7.88
7.79
7.77
7.75
7.69
7.67
7.65
7.27
7.25
7.24
7.22
7.07
7.05
7.03
7.01
6.99
6.71
6.69
6.67
6.64
6.41
6.39
4.71
3.72
3.32
2.50
Bn
N−SO2Ph
N
3ca, DMSO-d6
1H NMR, 400 MHz
2.00
0.99
2.04
5.00
3.06
3.96
2.05
2.00
5.11
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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155.63
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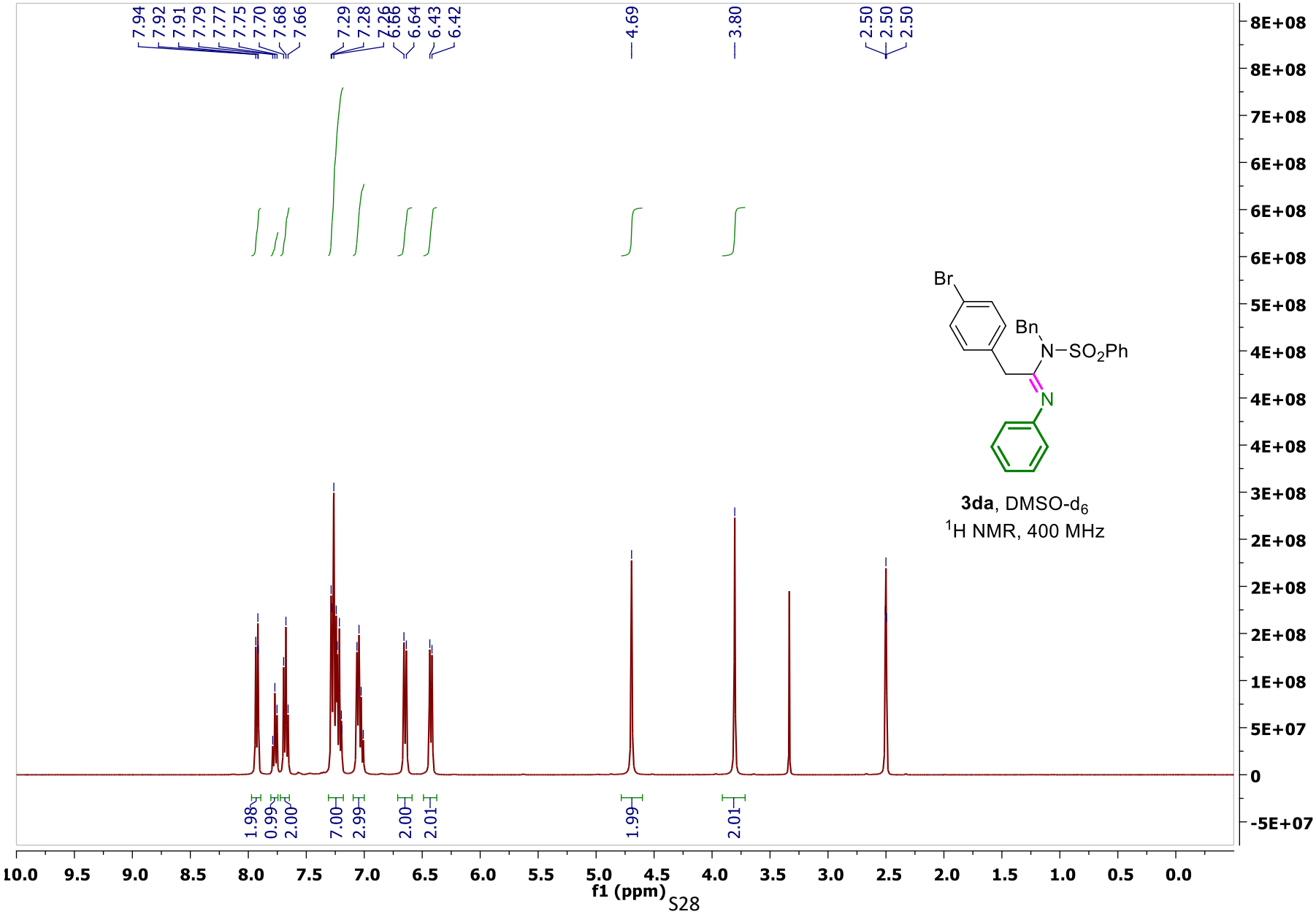
138.36
136.66
134.18
129.99
129.69
129.57
128.54
128.42
128.32
127.72
126.53
123.95
119.74
114.28
55.50
50.79
40.63
40.42
40.21
40.00
39.79
39.58
39.37
35.89
O
Bn
N–SO2Ph
N
3ca, DMSO-d6
13C {1H} NMR, 101 MHz
1E+08
9E+07
8E+07
7E+07
6E+07
5E+07
4E+07
3E+07
2E+07
1E+07
0
-1E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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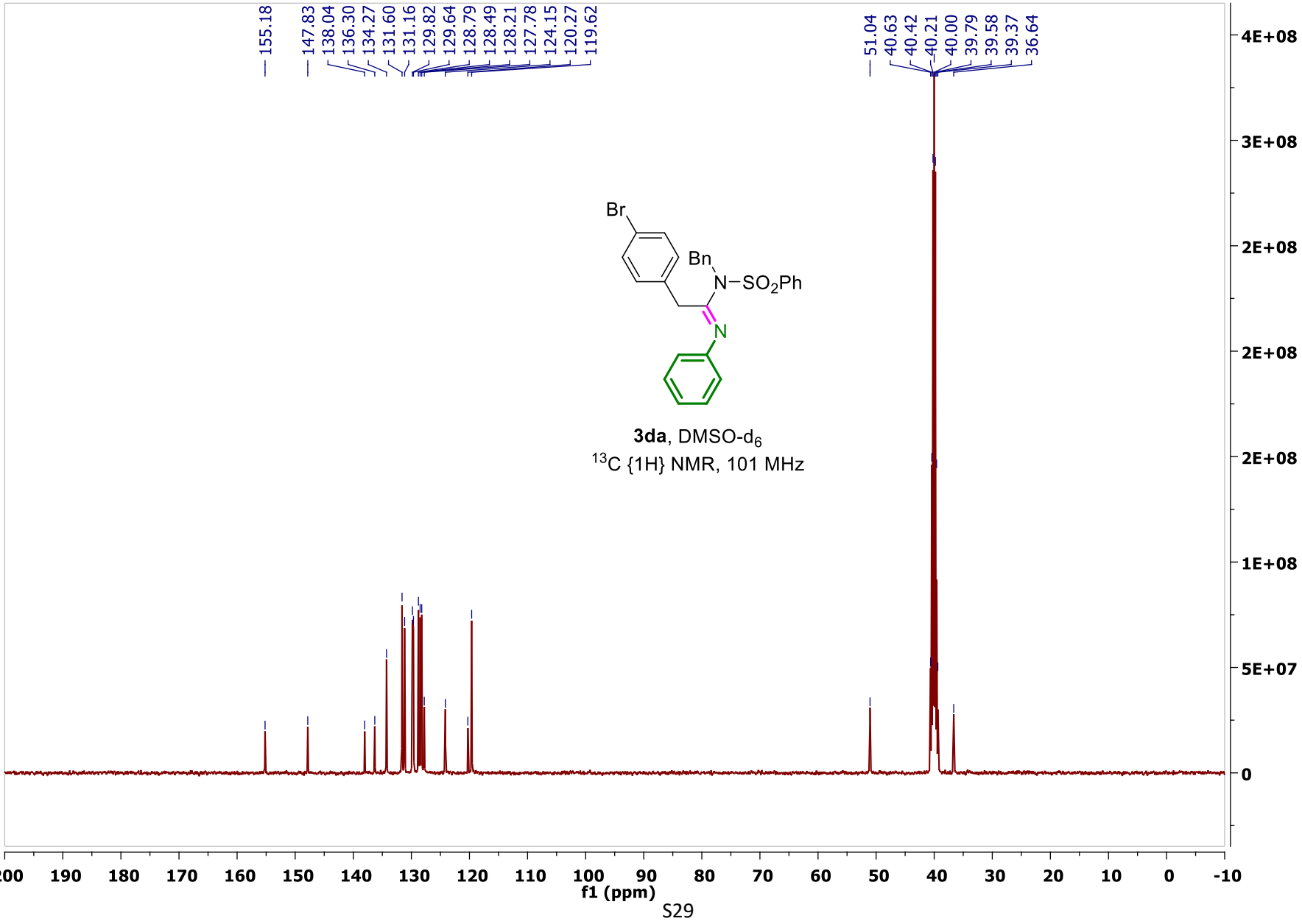
7.92
7.91
7.79
7.77
7.75
7.70
7.68
7.66
7.29
7.28
7.26
6.66
6.64
6.43
6.42
4.69
3.80
2.50
2.50
2.50
Br
Bn
N−SO2Ph
N
3da, DMSO-d6
1H NMR, 400 MHz
1.98
0.99
2.00
7.00
2.99
2.00
2.01
1.99
2.01
f1 (ppm)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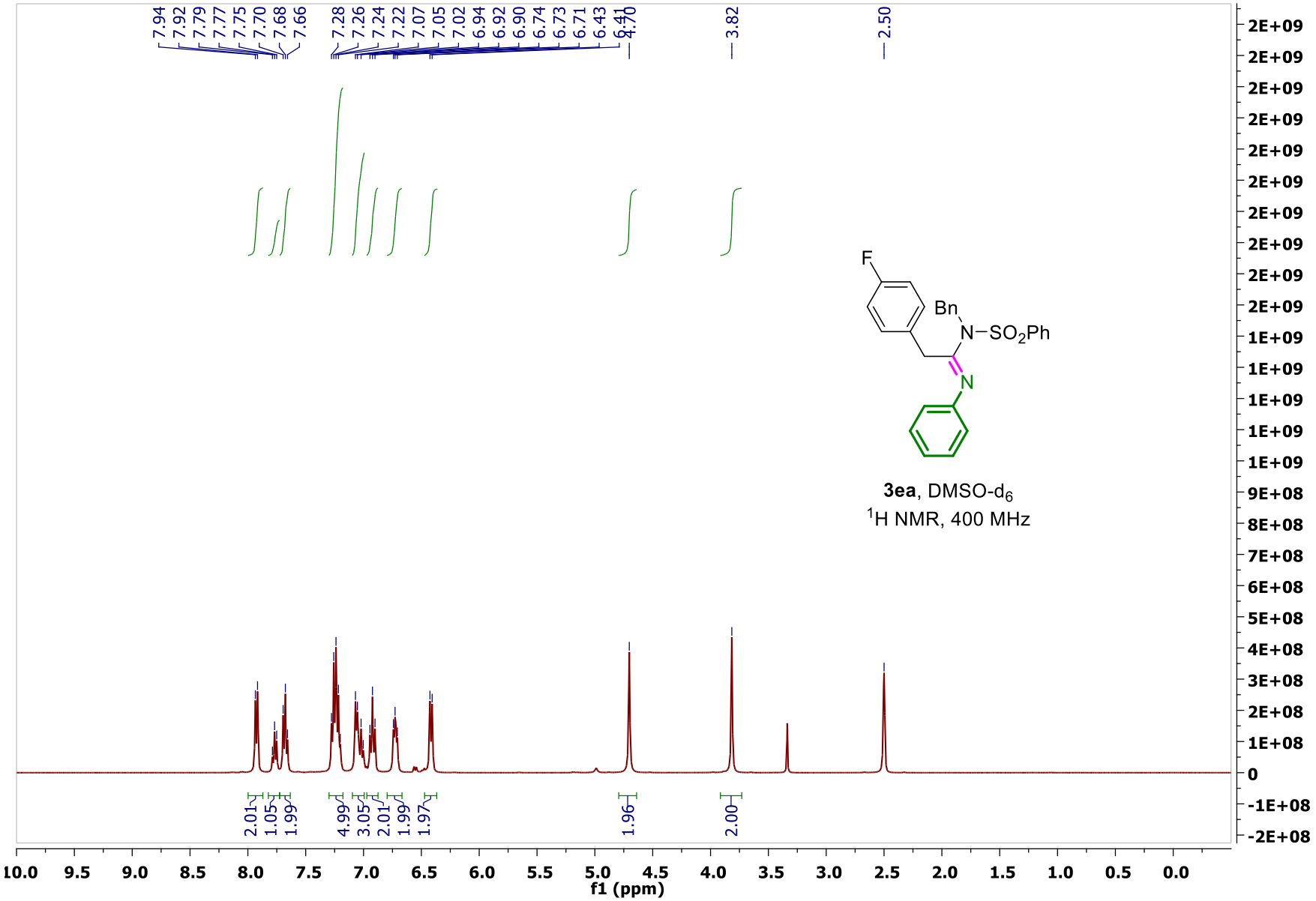
136.30
134.27
131.60
131.16
129.82
129.64
128.79
128.49
128.21
127.78
124.15
120.27
119.62
51.04
40.63
40.42
40.21
40.00
39.79
39.58
39.37
36.64
Br
Bn
N−SO2Ph
N
3da, DMSO-d6
13C {1H} NMR, 101 MHz
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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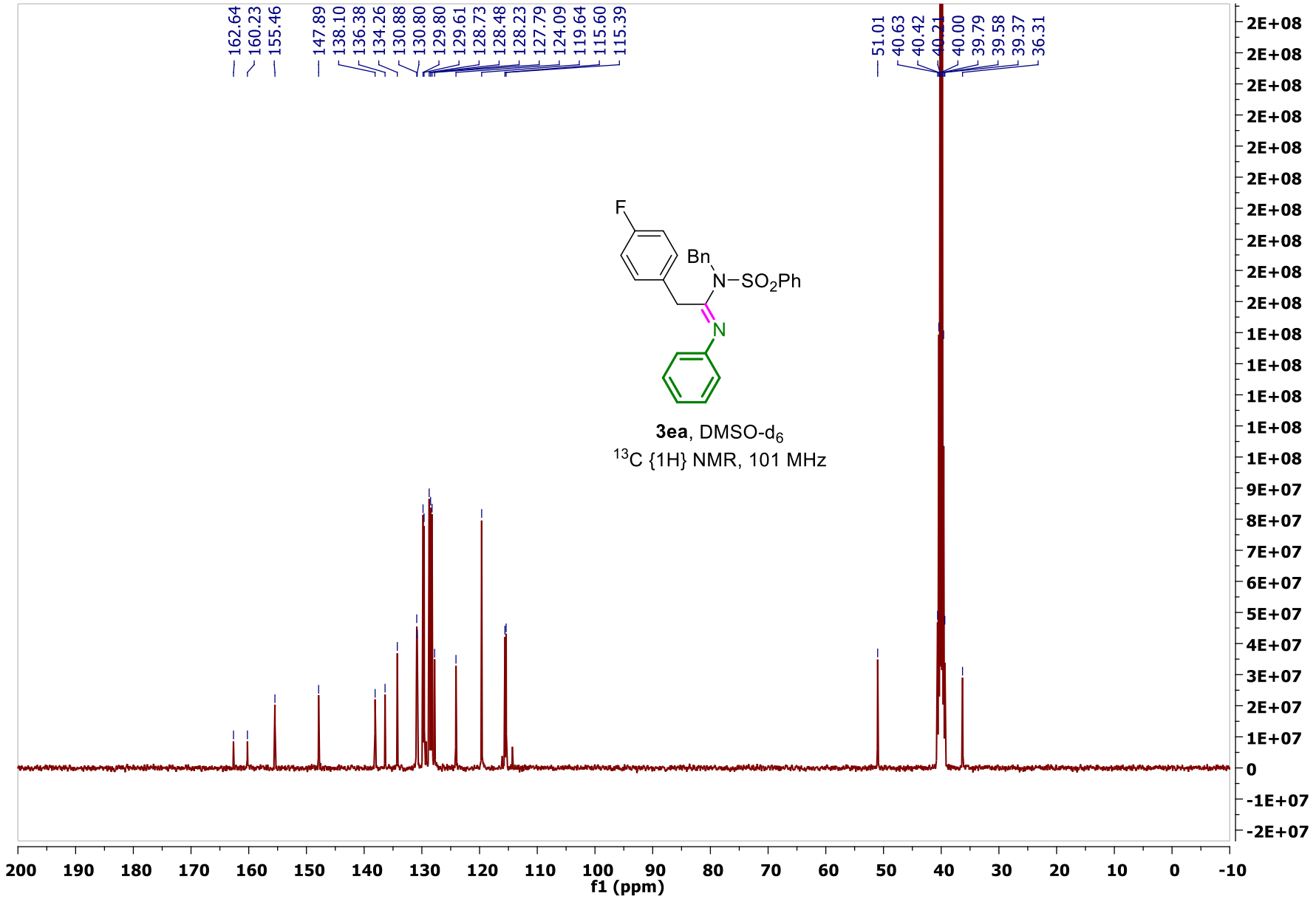
7.92
7.79
7.77
7.75
7.70
7.68
7.66
7.28
7.26
7.24
7.22
7.07
7.05
7.02
6.94
6.92
6.90
6.74
6.73
6.71
6.43
6.41
4.70
3.82
2.50
F
Bn
N−SO2Ph
N
3ea, DMSO-d6
1H NMR, 400 MHz
2.01
1.05
1.99
4.99
3.05
2.01
1.99
1.97
1.96
2.00
f1 (ppm)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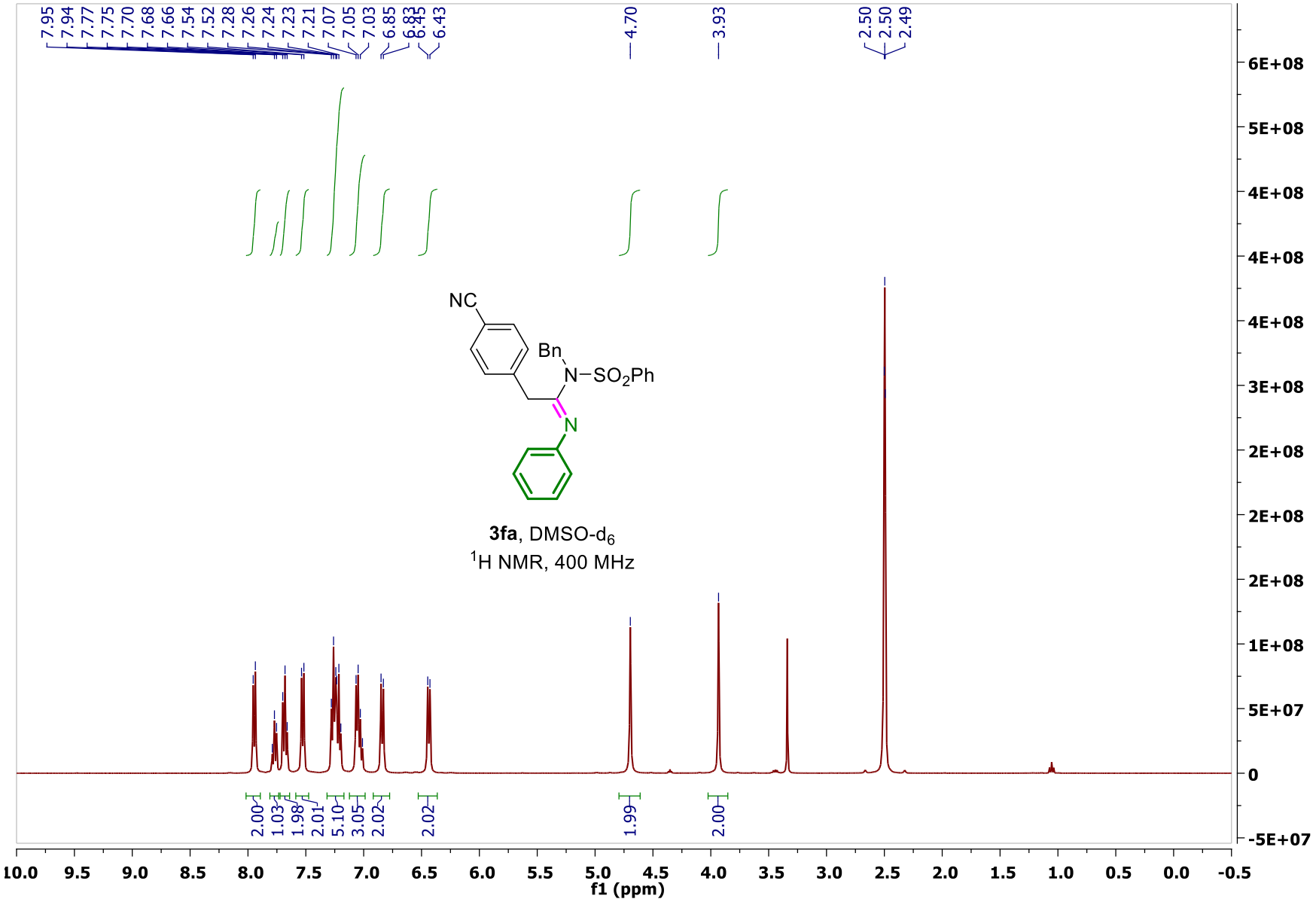
160.23
155.46
147.89
138.10
136.38
134.26
130.88
130.80
129.80
129.61
128.73
128.48
128.23
127.79
124.09
119.64
115.60
115.39
51.01
40.63
40.42
40.21
40.00
39.79
39.58
39.37
36.31
F
Bn
N−SO2Ph
N
3ea, DMSO-d6
13C {1H} NMR, 101 MHz
f1 (ppm)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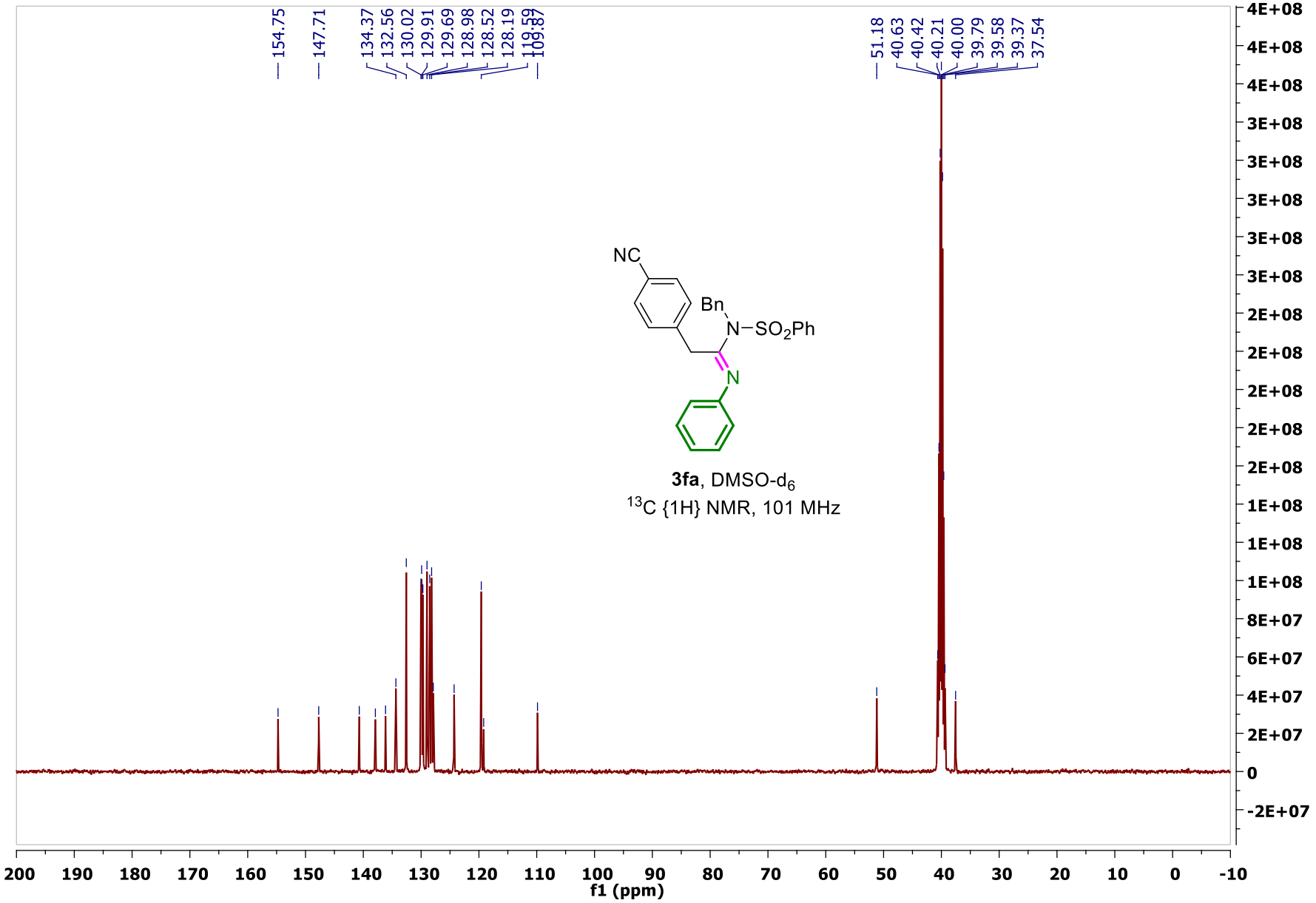
7.94
7.77
7.75
7.70
7.68
7.66
7.54
7.52
7.28
7.26
7.24
7.23
7.21
7.07
7.05
7.03
6.85
6.83
6.45
6.43
4.70
3.93
2.50
2.50
2.49
NC
Bn
N−SO2Ph
N
3fa, DMSO-d6
1H NMR, 400 MHz
2.00
1.03
1.98
2.01
5.10
3.05
2.02
2.02
1.99
2.00
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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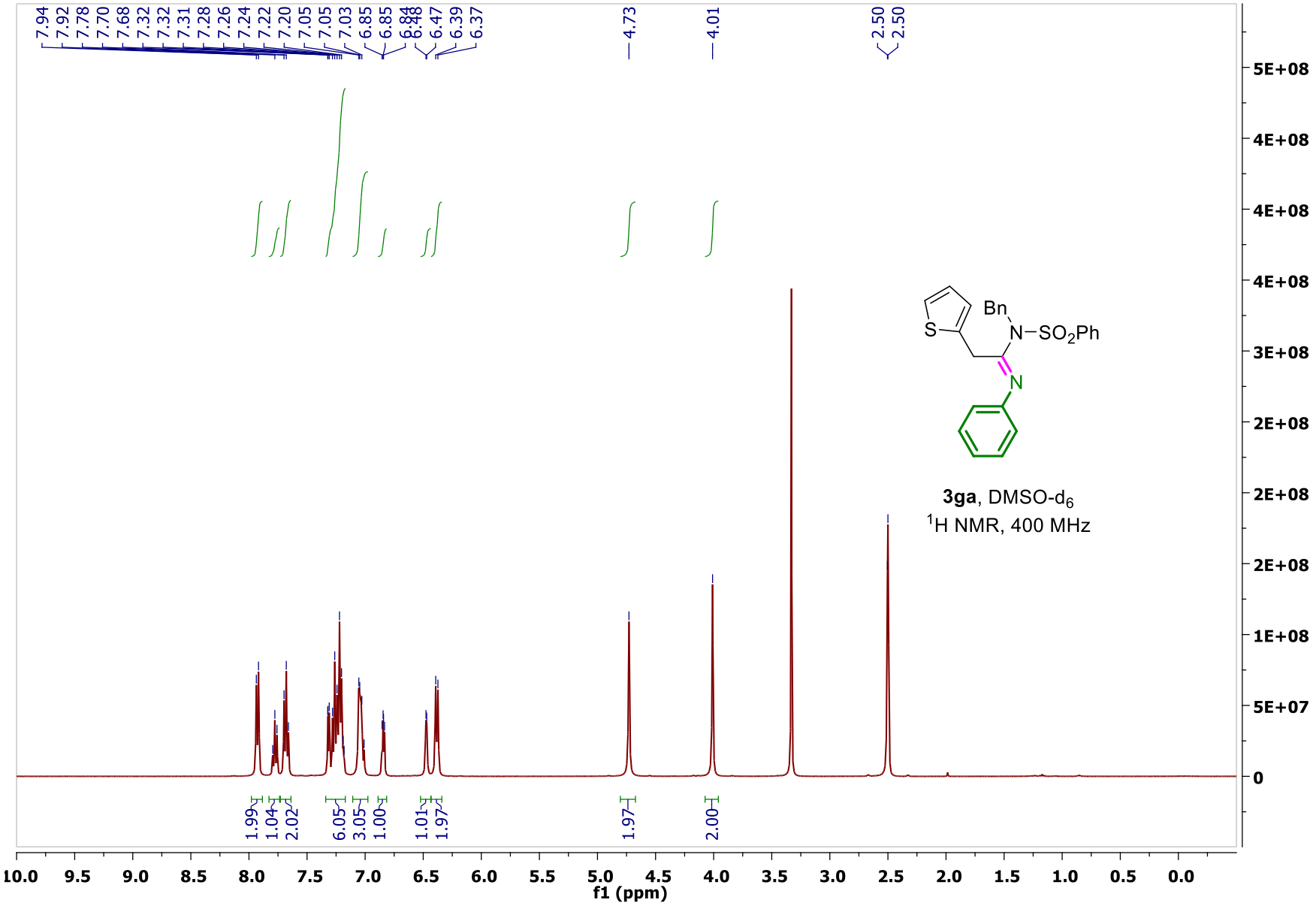
147.71
134.37
132.56
130.02
129.91
129.69
128.98
128.52
128.19
119.59
109.87
51.18
40.63
40.42
40.21
40.00
39.79
39.58
39.37
37.54
NC
Bn
N–SO2Ph
N
3fa, DMSO-d6
13C {1H} NMR, 101 MHz
4E+08
3E+08
2E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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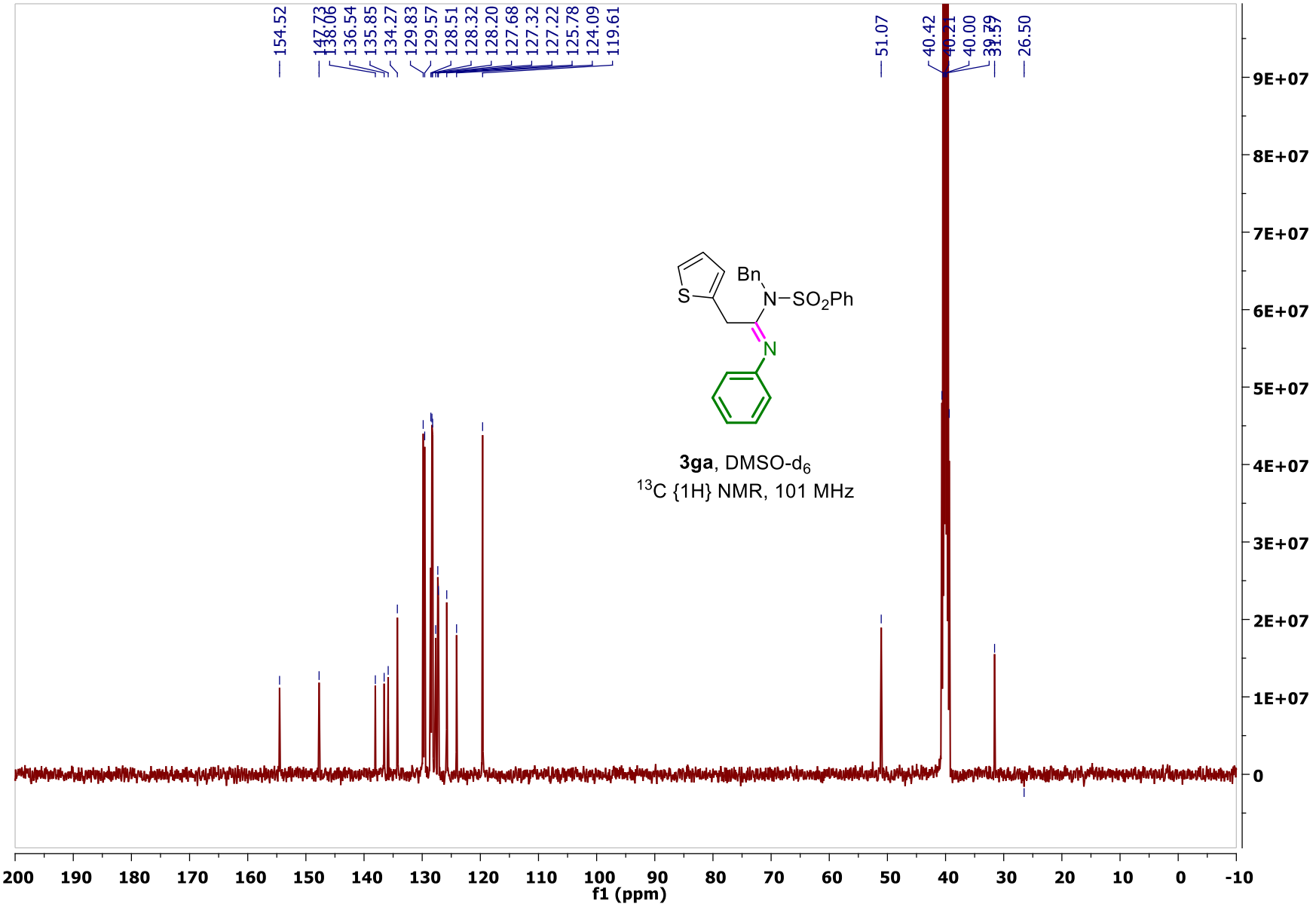
7.92
7.78
7.70
7.68
7.32
7.32
7.31
7.28
7.26
7.24
7.22
7.20
7.05
7.05
7.03
6.85
6.85
6.47
6.39
6.37
4.73
4.01
2.50
2.50
Bn
N−SO2Ph
S
N
3ga, DMSO-d6
1H NMR, 400 MHz
1.99
1.04
2.02
6.05
3.05
1.00
1.01
1.97
1.97
2.00
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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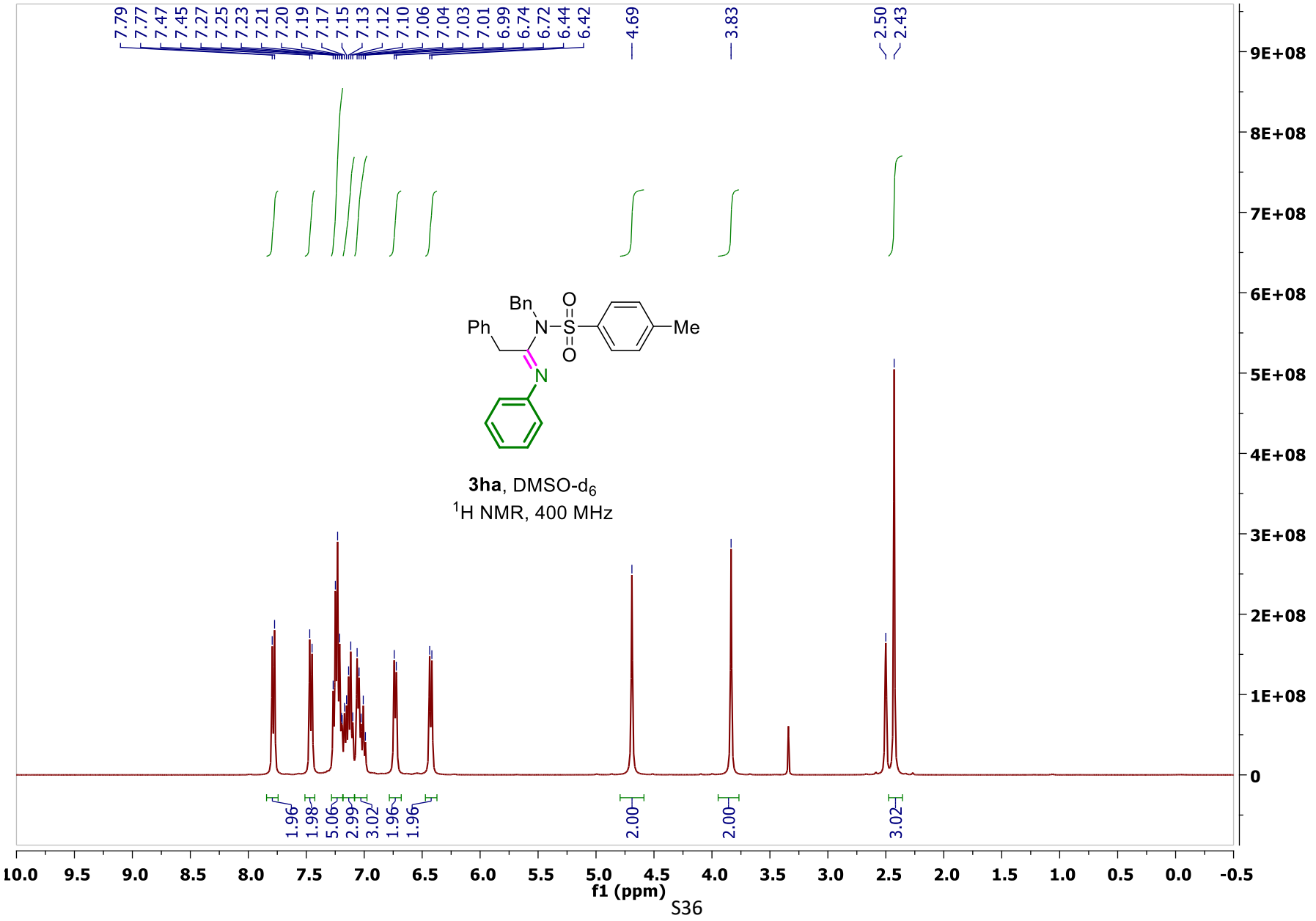
138.06
136.54
135.85
134.27
129.83
129.57
128.51
128.32
128.20
127.68
127.32
127.22
125.78
124.09
119.61
51.07
40.42
40.21
40.00
39.79
39.57
26.50
Bn
N–SO2Ph
S
N
3ga, DMSO-d6
13C {1H} NMR, 101 MHz
9E+07
8E+07
7E+07
6E+07
5E+07
4E+07
3E+07
2E+07
1E+07
0
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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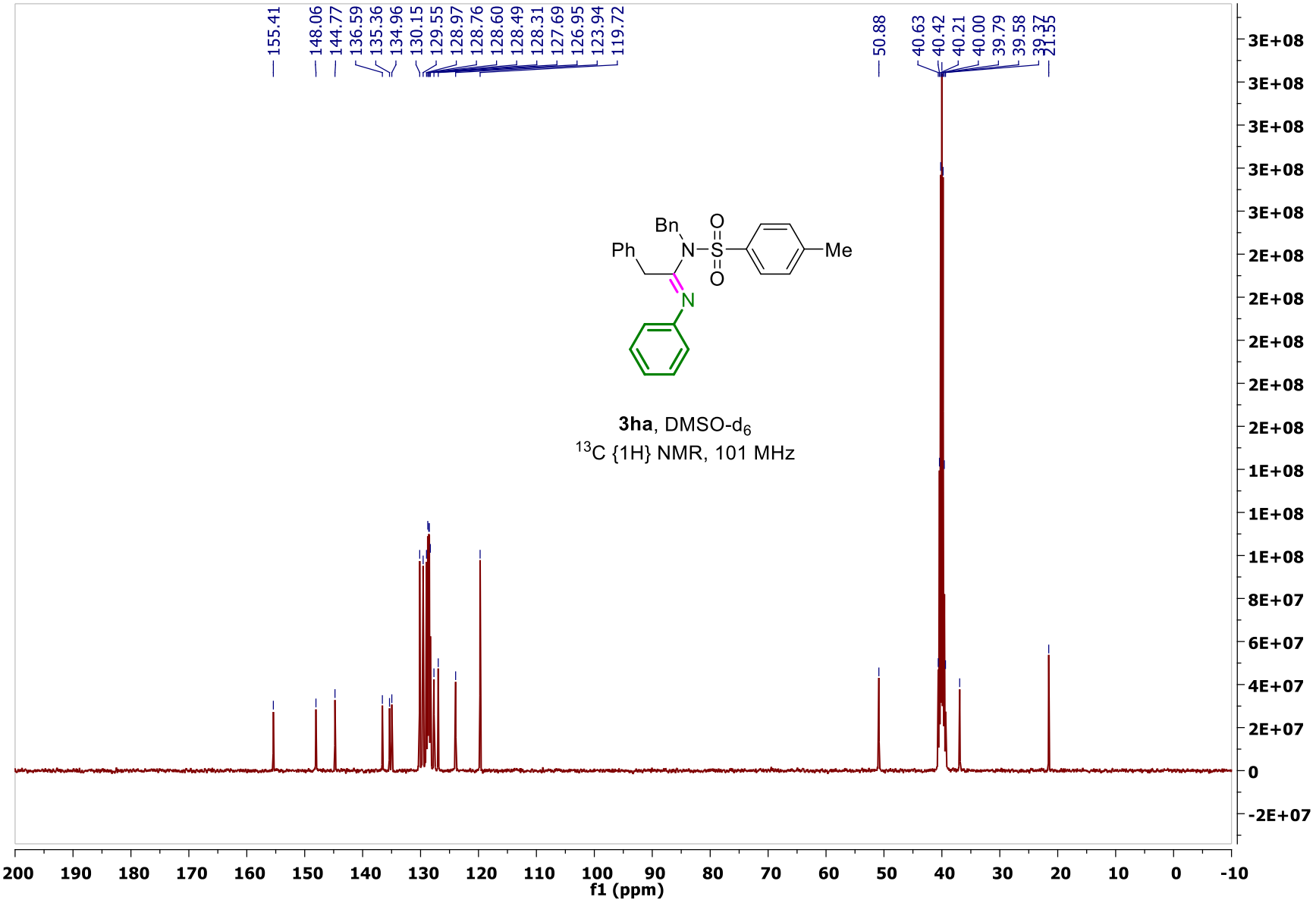
7.77
7.47
7.45
7.27
7.25
7.23
7.21
7.20
7.19
7.17
7.15
7.13
7.12
7.10
7.06
7.04
7.03
7.01
6.99
6.74
6.72
6.44
6.42
4.69
3.83
2.50
2.43
Bn
Ph
N
S
O
O
Me
N
3ha, DMSO-d6
1H NMR, 400 MHz
1.96
1.98
5.06
2.99
3.02
1.96
1.96
2.00
2.00
3.02
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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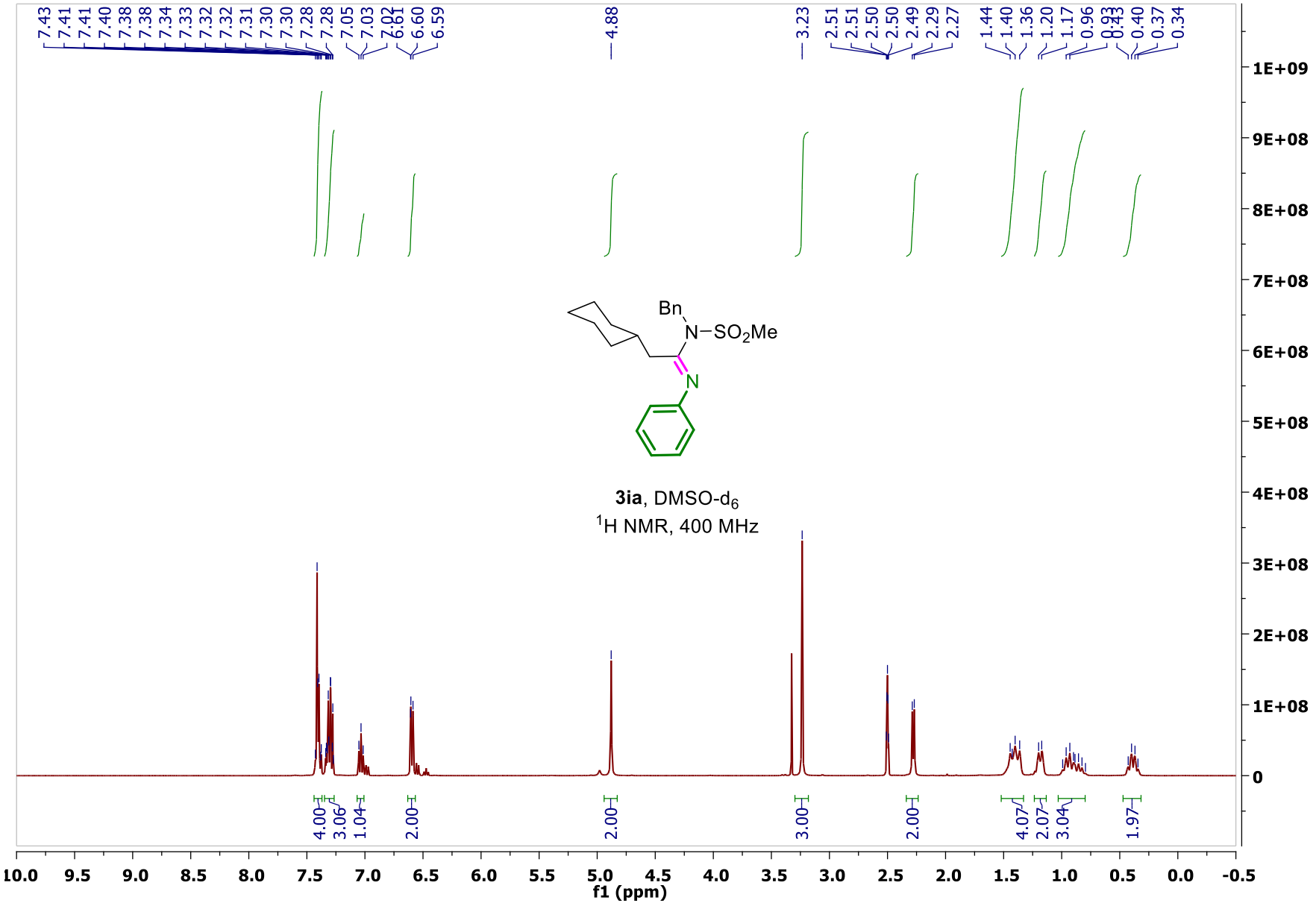
136.59
135.36
134.96
130.15
129.55
128.97
128.76
128.60
128.49
128.31
127.69
126.95
123.94
119.72
50.88
40.63
40.42
40.21
40.00
39.79
39.58
39.37
21.55
Bn
Ph
N
S
O
O
Me
N
3ha, DMSO-d6
13C {1H} NMR, 101 MHz
3E+08
2E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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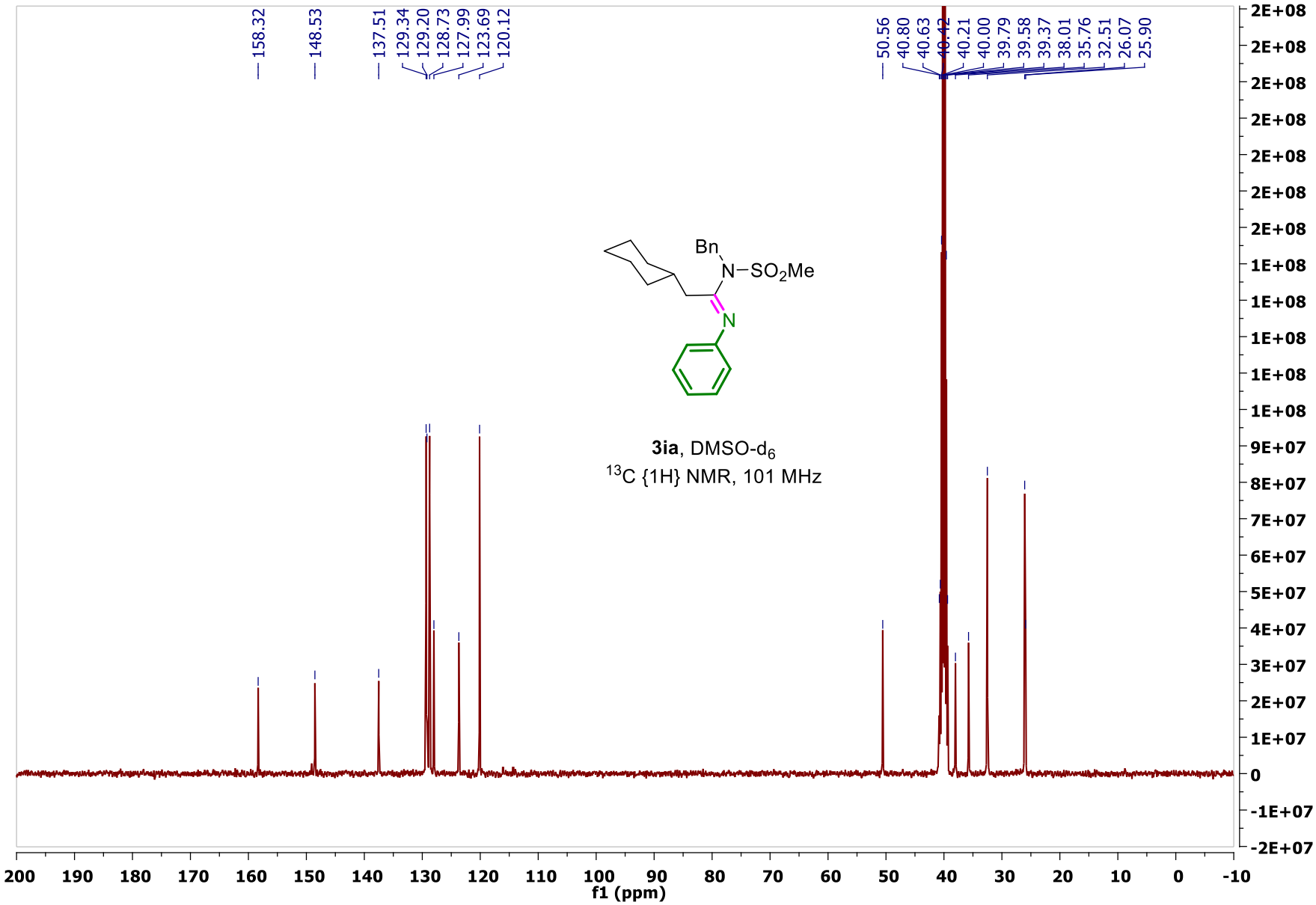
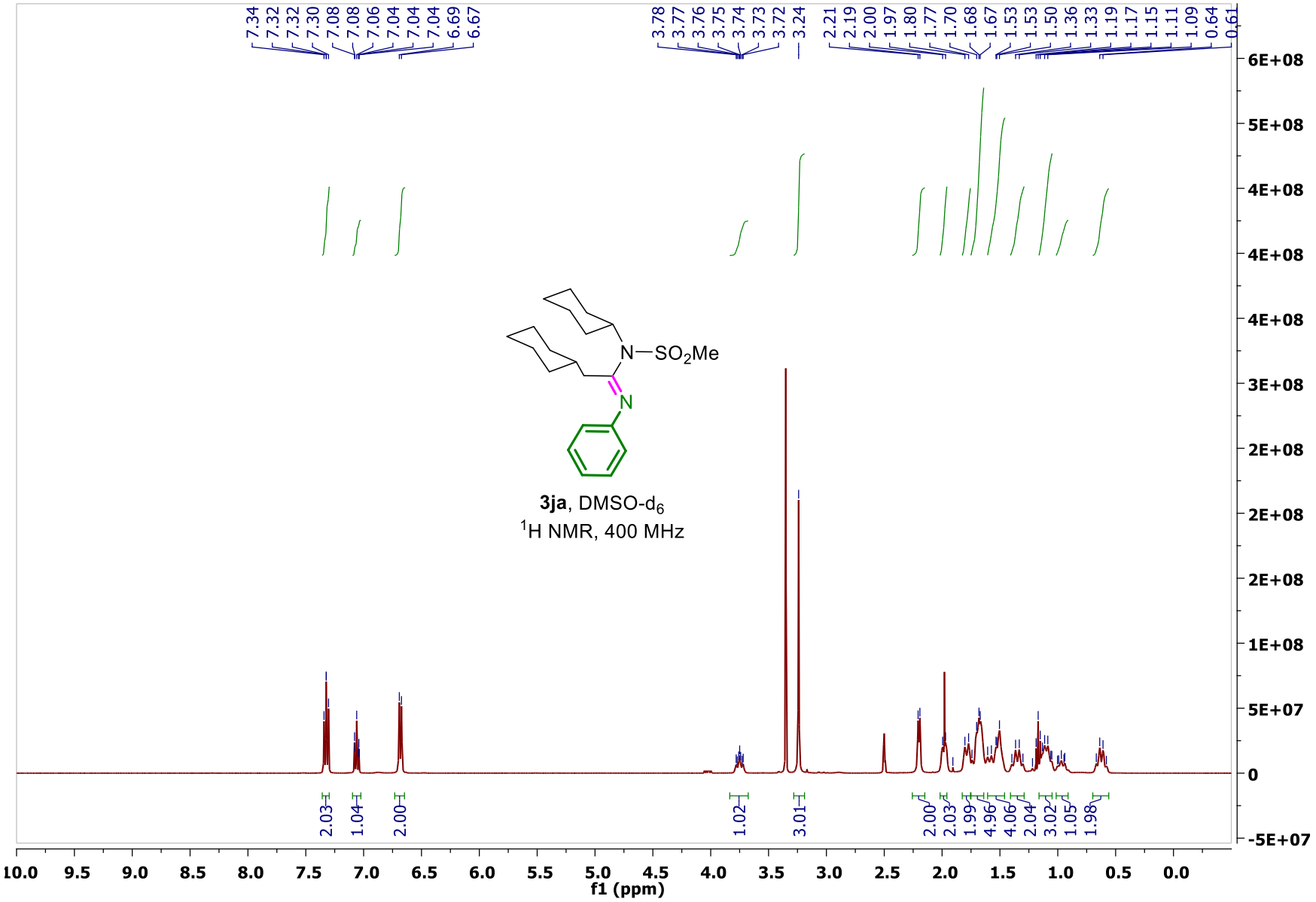
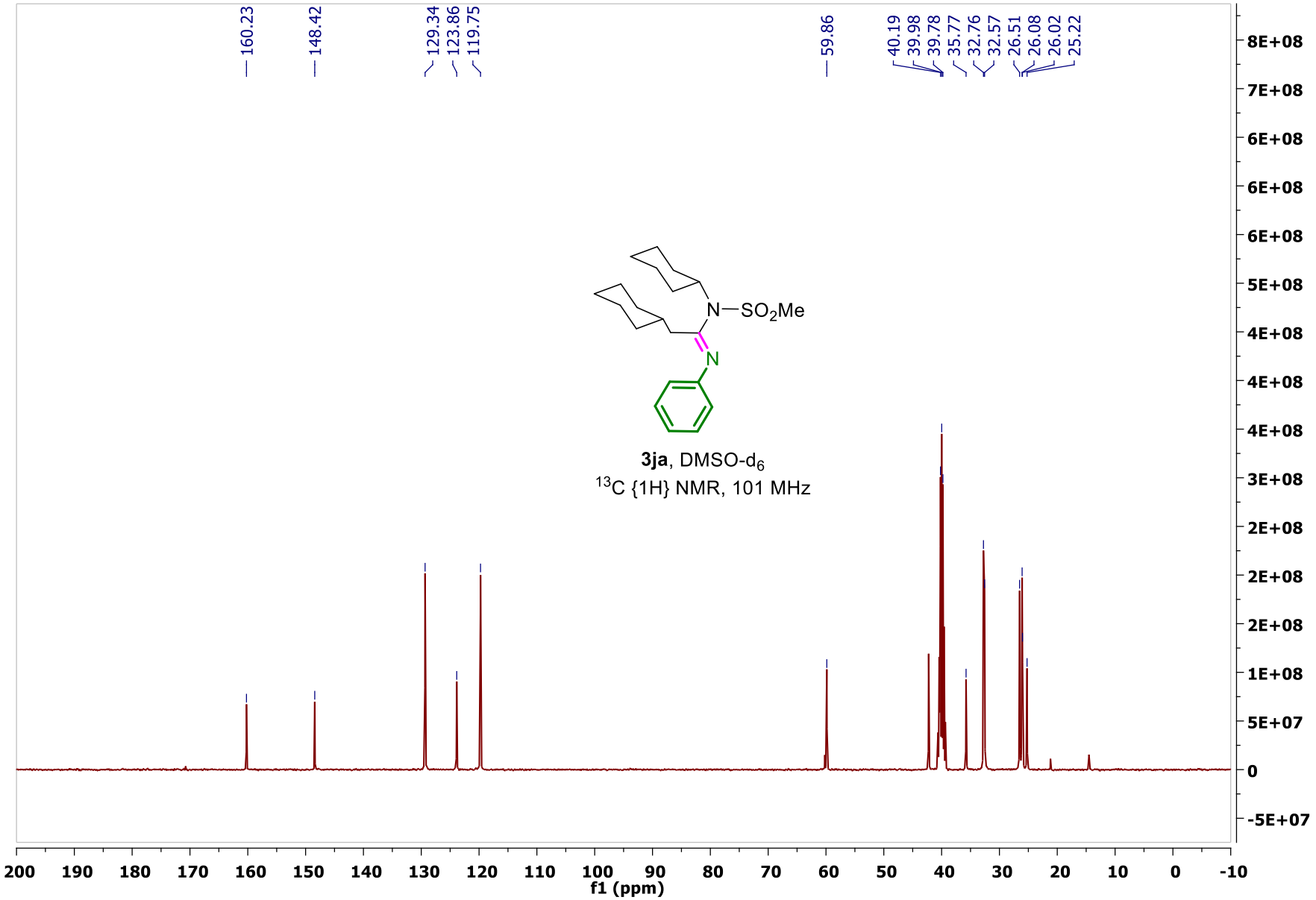
7.41
7.41
7.40
7.38
7.38
7.34
7.33
7.32
7.32
7.31
7.30
7.30
7.28
7.28
7.05
7.03
7.02
6.61
6.60
6.59
4.88
3.23
2.51
2.51
2.50
2.50
2.49
2.29
2.27
1.44
1.40
1.36
1.20
1.17
0.96
0.93
0.43
0.40
0.37
0.34
Bn
N−SO2Me
N
3ia, DMSO-d6
1H NMR, 400 MHz
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
4.00
3.06
1.04
2.00
2.00
3.00
2.00
4.07
2.07
3.04
1.97
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


158.32
148.53
137.51
129.34
129.20
128.73
127.99
123.69
120.12
50.56
40.80
40.63
40.42
40.21
40.00
39.79
39.58
39.37
38.01
35.76
32.51
26.07
25.90
Bn
N−SO2Me
N
3ia, DMSO-d6
13C {1H} NMR, 101 MHz
f1 (ppm)


7.34
7.32
7.32
7.30
7.08
7.08
7.06
7.04
7.04
7.04
6.69
6.67
3.78
3.77
3.76
3.75
3.74
3.73
3.72
3.24
2.21
2.19
2.00
1.97
1.80
1.77
1.70
1.68
1.67
1.53
1.53
1.50
1.36
1.33
1.19
1.17
1.15
1.11
1.09
0.64
0.61
N—SO2Me
N
3ja, DMSO-d6
1H NMR, 400 MHz
2.03
1.04
2.00
1.02
3.01
2.00
2.03
1.99
4.96
4.06
2.04
3.02
1.05
1.98
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


160.23
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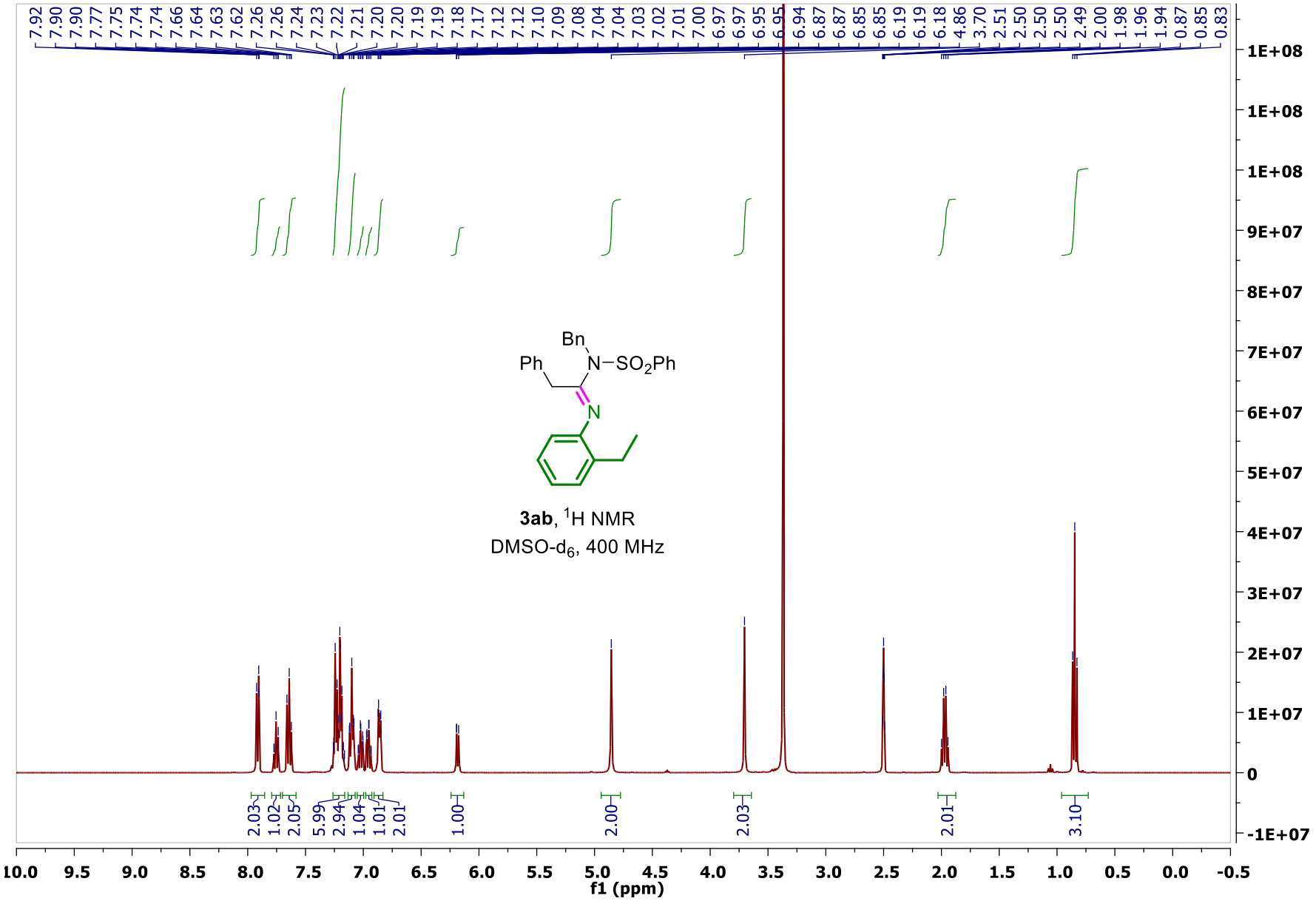
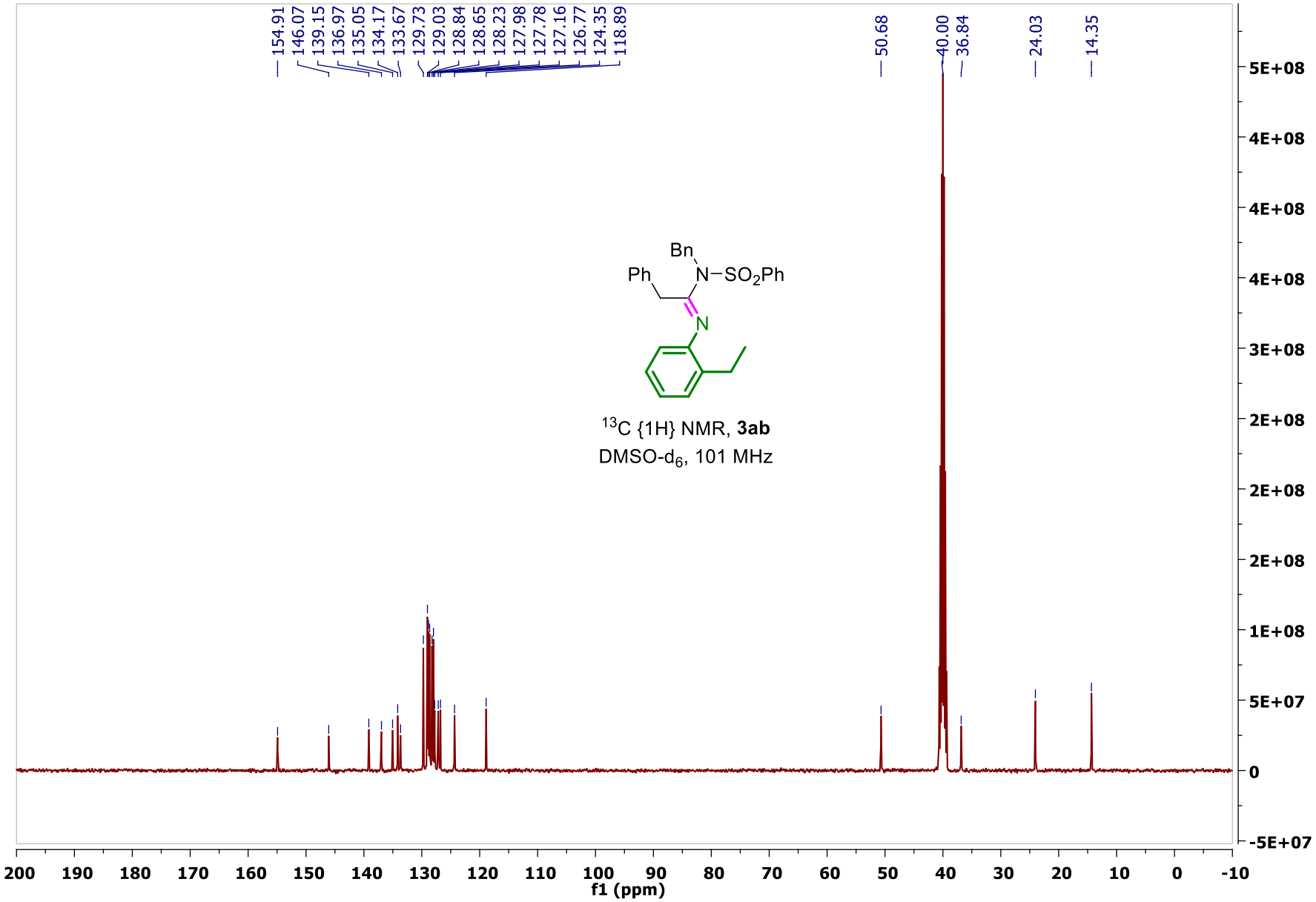
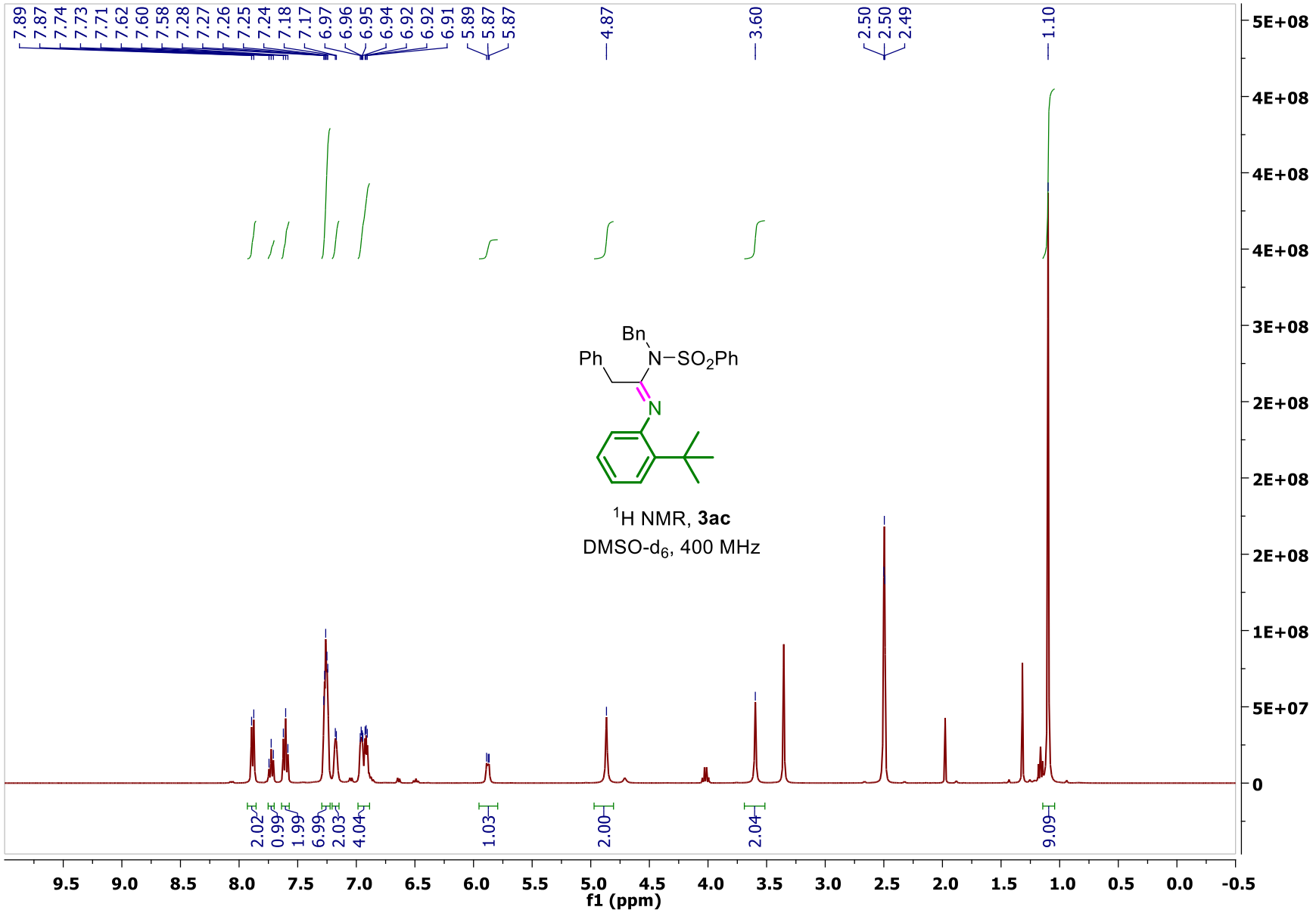
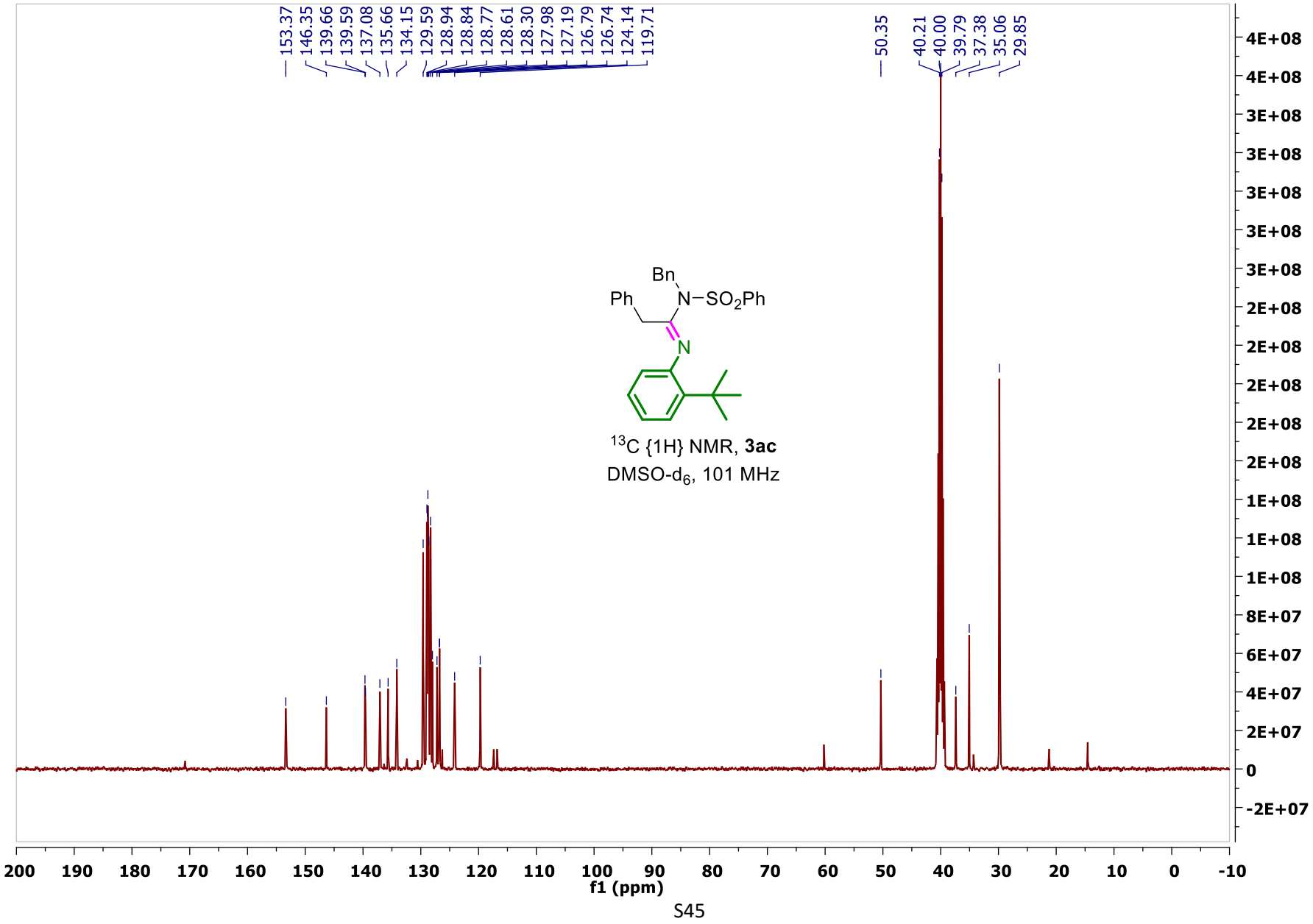
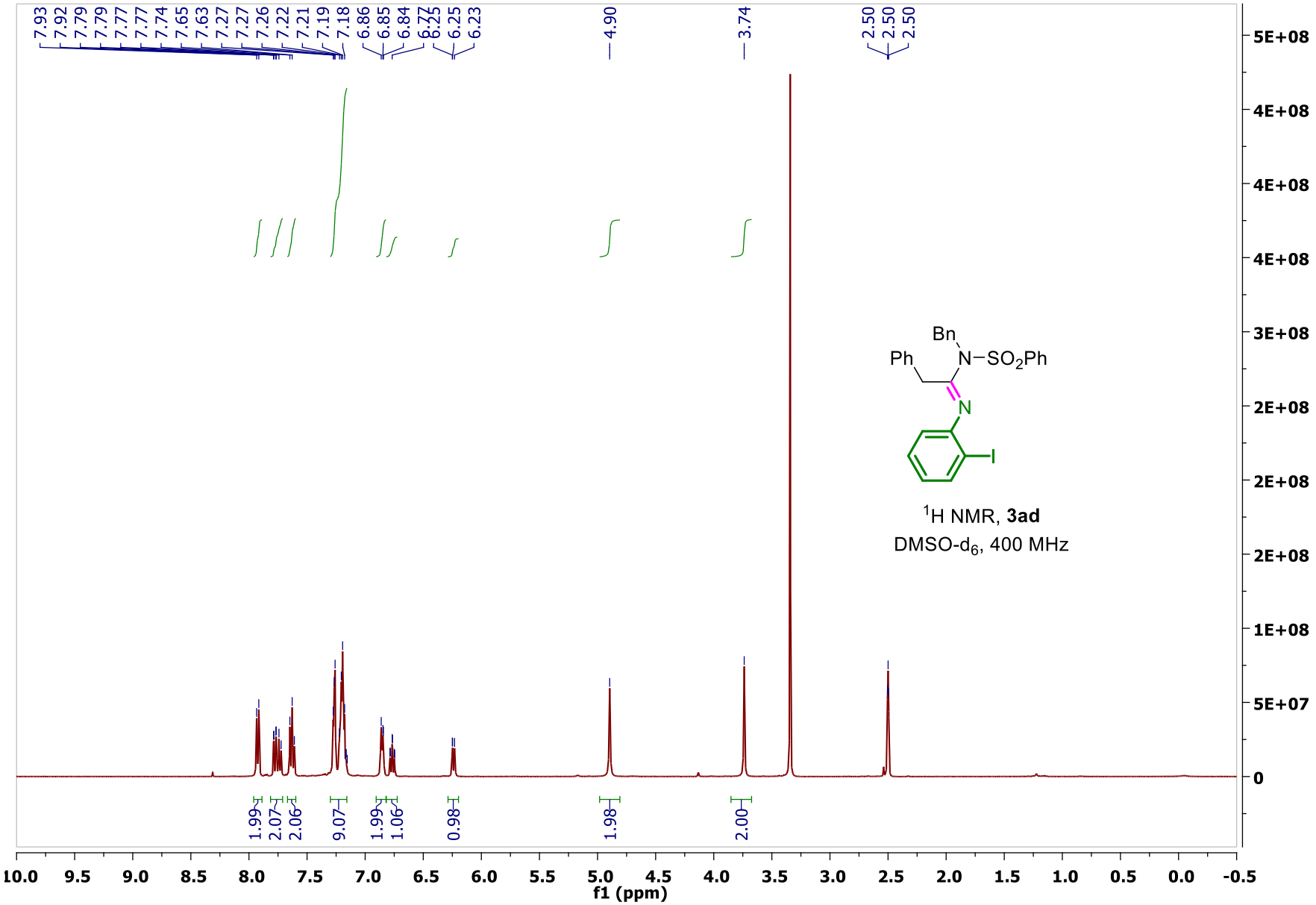
129.34
123.86
119.75
59.86
40.19
39.98
39.78
35.77
32.76
32.57
26.51
26.08
26.02
25.22
N—SO2Me
N
3ja, DMSO-d6
13C {1H} NMR, 101 MHz
8E+08
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

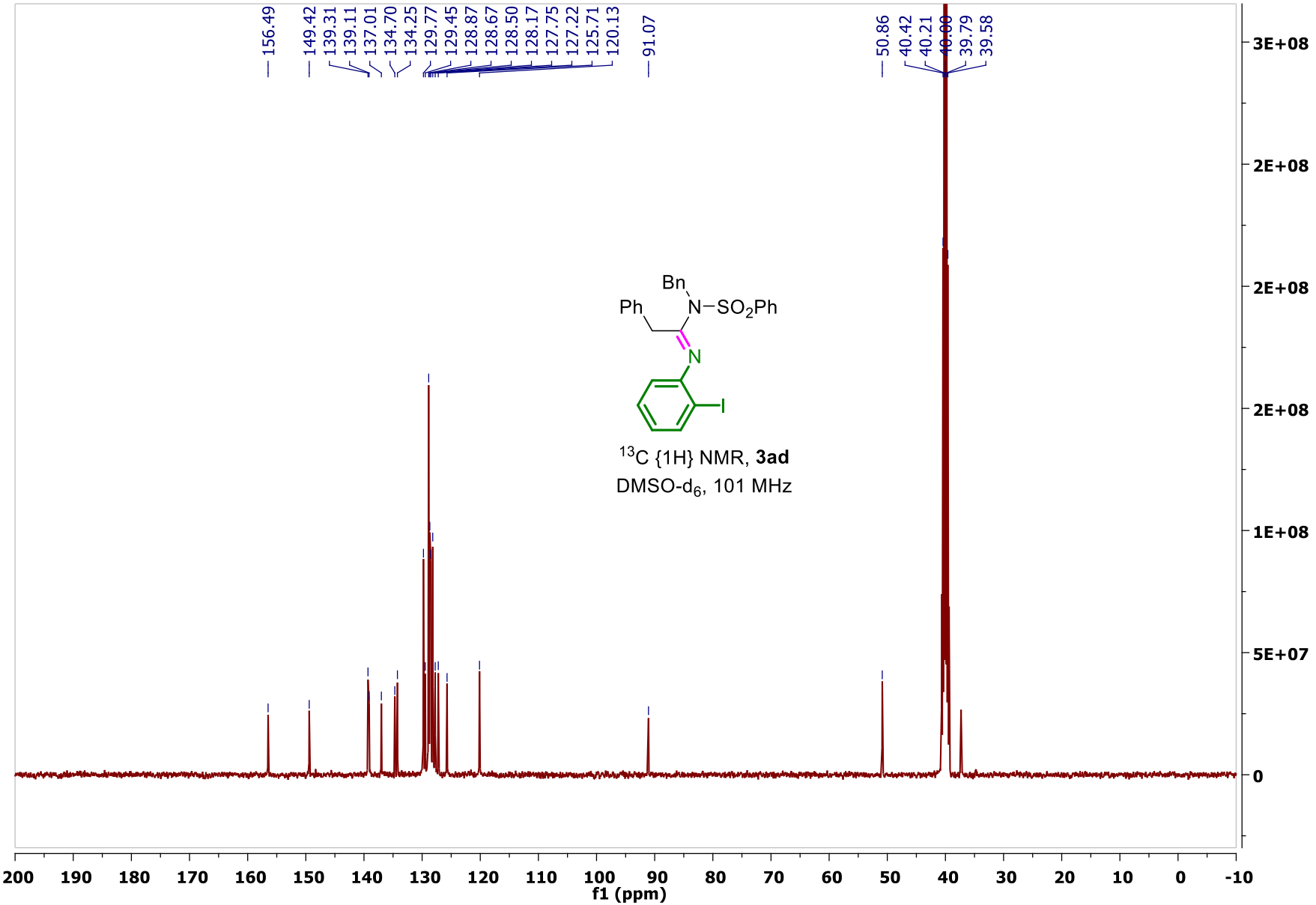

Bn
Ph
N−SO2Ph
N
3ab, 1H NMR
DMSO-d6, 400 MHz
f1 (ppm)

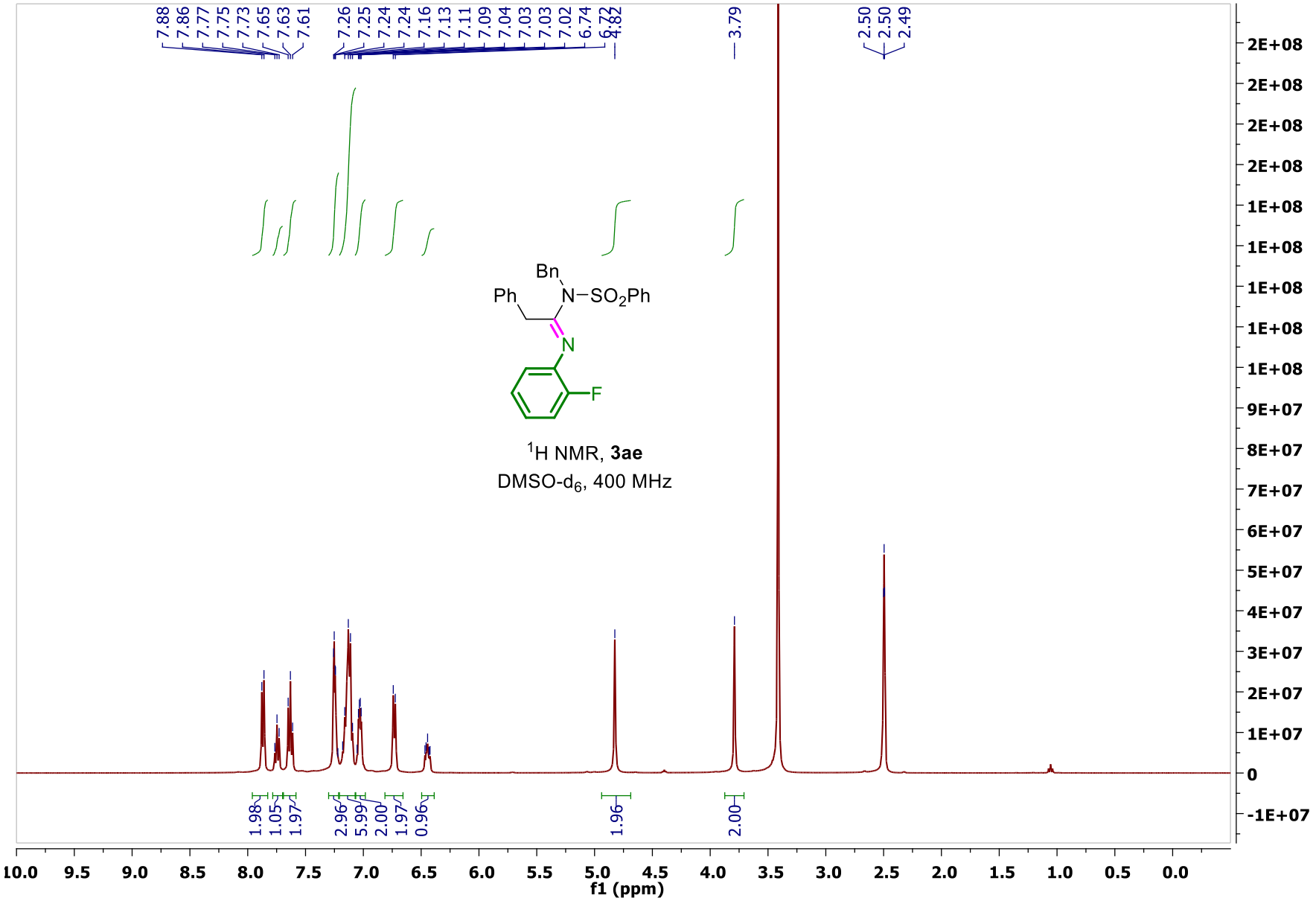

154.91
146.07
139.15
136.97
135.05
134.17
133.67
129.73
129.03
128.84
128.65
128.23
127.98
127.78
127.16
126.77
124.35
118.89
50.68
40.00
36.84
24.03
14.35
Bn
Ph
N−SO2Ph
N
13C {1H} NMR, 3ab
DMSO-d6, 101 MHz
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

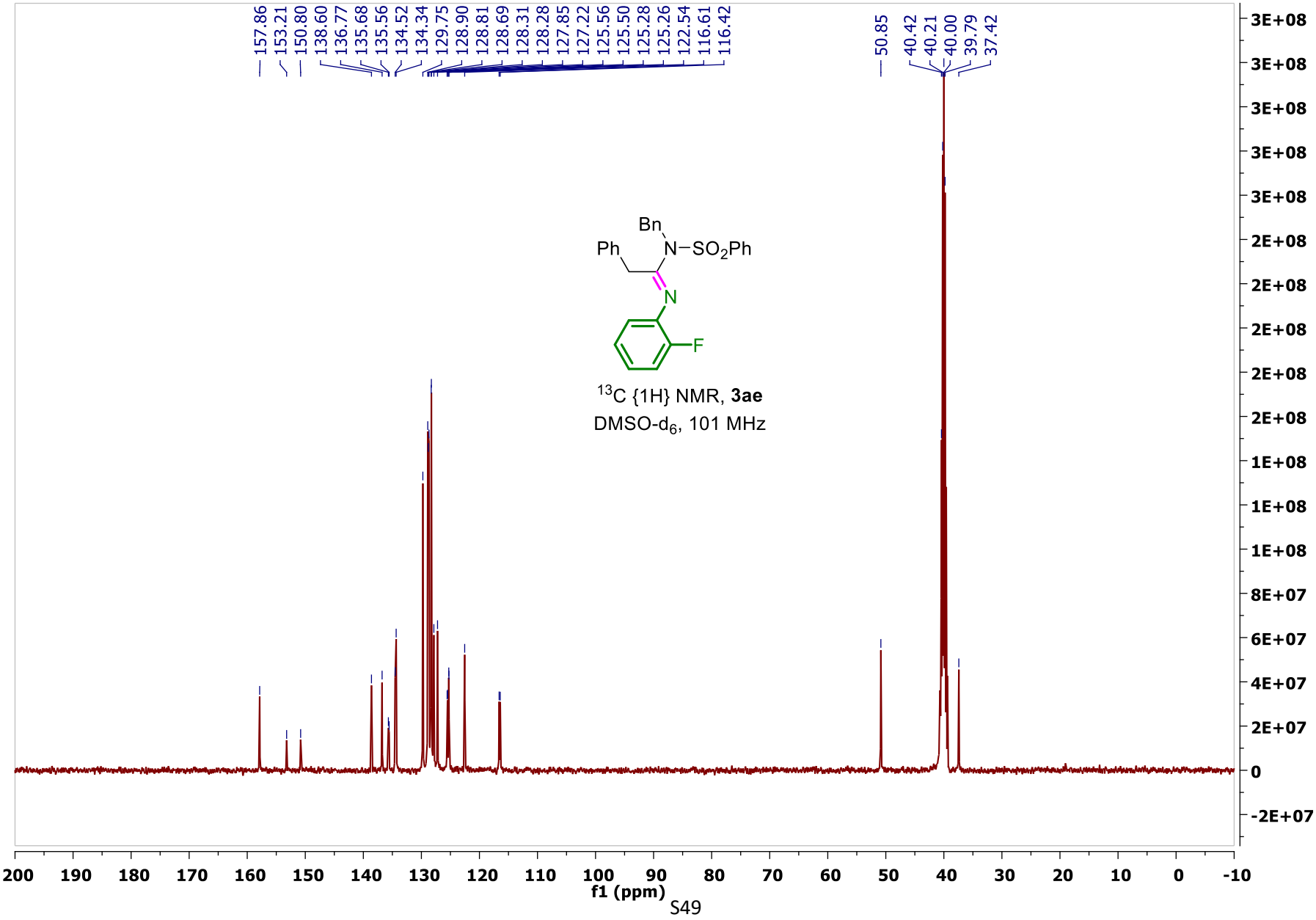

7.89
7.87
7.74
7.73
7.71
7.62
7.60
7.58
7.28
7.27
7.26
7.25
7.24
7.18
7.17
6.97
6.96
6.95
6.94
6.92
6.92
6.91
5.89
5.87
5.87
4.87
3.60
2.50
2.50
2.49
1.10
Bn
Ph
N−SO2Ph
N
1H NMR, 3ac
DMSO-d6, 400 MHz
2.02
0.99
1.99
6.99
2.03
4.04
1.03
2.00
2.04
9.09
f1 (ppm)

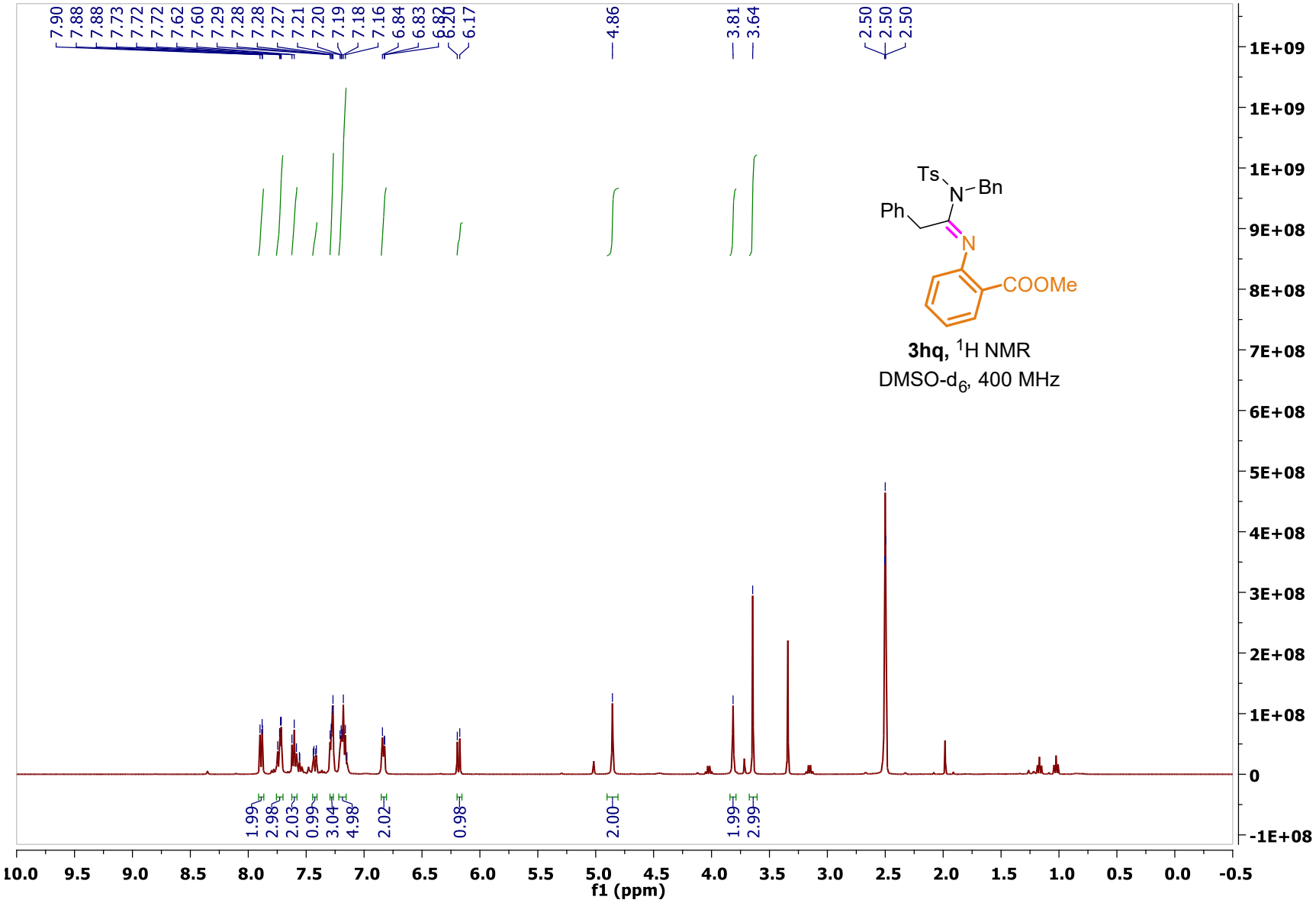

153.37
146.35
139.66
139.59
137.08
135.66
134.15
129.59
128.94
128.84
128.77
128.61
128.30
127.98
127.19
126.79
126.74
124.14
119.71
50.35
40.21
40.00
39.79
37.38
35.06
29.85
Bn
Ph
N−SO2Ph
N
13C {1H} NMR, 3ac
DMSO-d6, 101 MHz
4E+08
4E+08
3E+08
3E+08
3E+08
3E+08
3E+08
2E+08
2E+08
2E+08
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

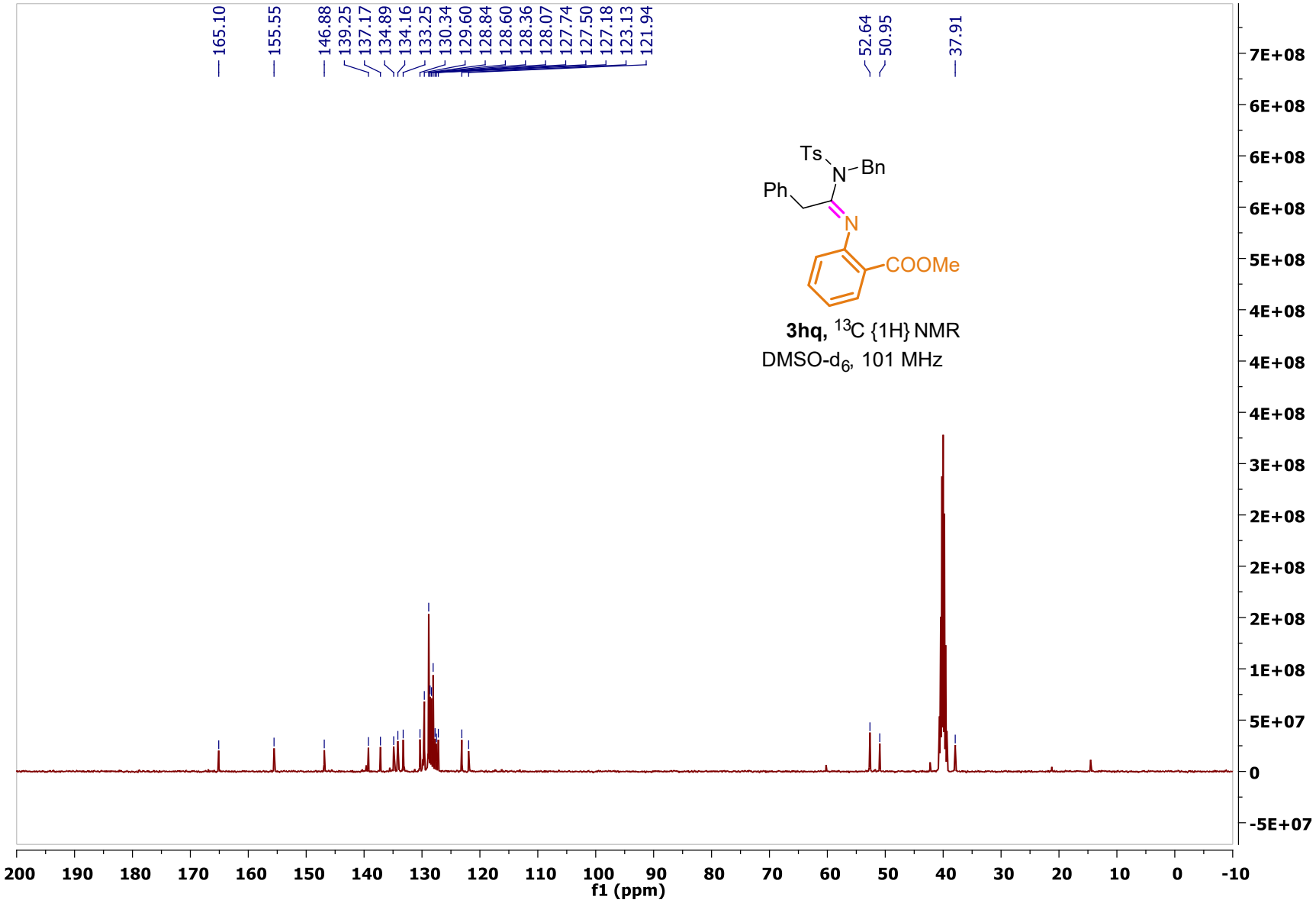

7.93
7.92
7.79
7.79
7.77
7.77
7.74
7.65
7.63
7.27
7.27
7.26
7.22
7.21
7.19
7.18
6.86
6.85
6.84
6.77
6.25
6.25
6.23
4.90
3.74
2.50
2.50
2.50
1.99
2.07
2.06
9.07
1.99
1.06
0.98
1.98
2.00
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)
Bn
Ph
N−SO2Ph
N
I
1H NMR, 3ad
DMSO-d6, 400 MHz

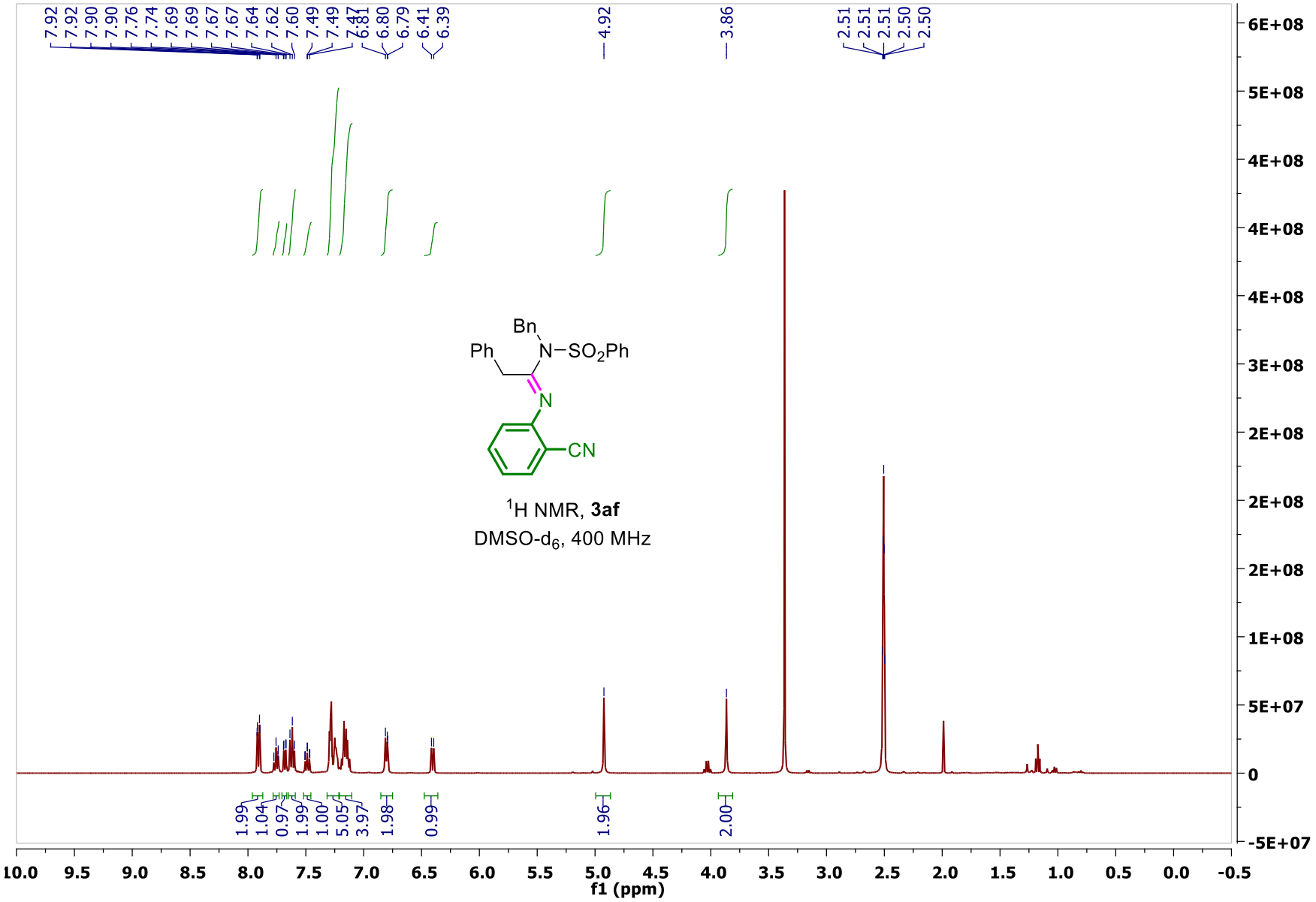

156.49
149.42
139.31
139.11
137.01
134.70
134.25
129.77
129.45
128.87
128.67
128.50
128.17
127.75
127.22
125.71
120.13
91.07
50.86
40.42
40.21
40.00
39.79
39.58
Bn
Ph
N−SO2Ph
N
I
13C {1H} NMR, 3ad
DMSO-d6, 101 MHz
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

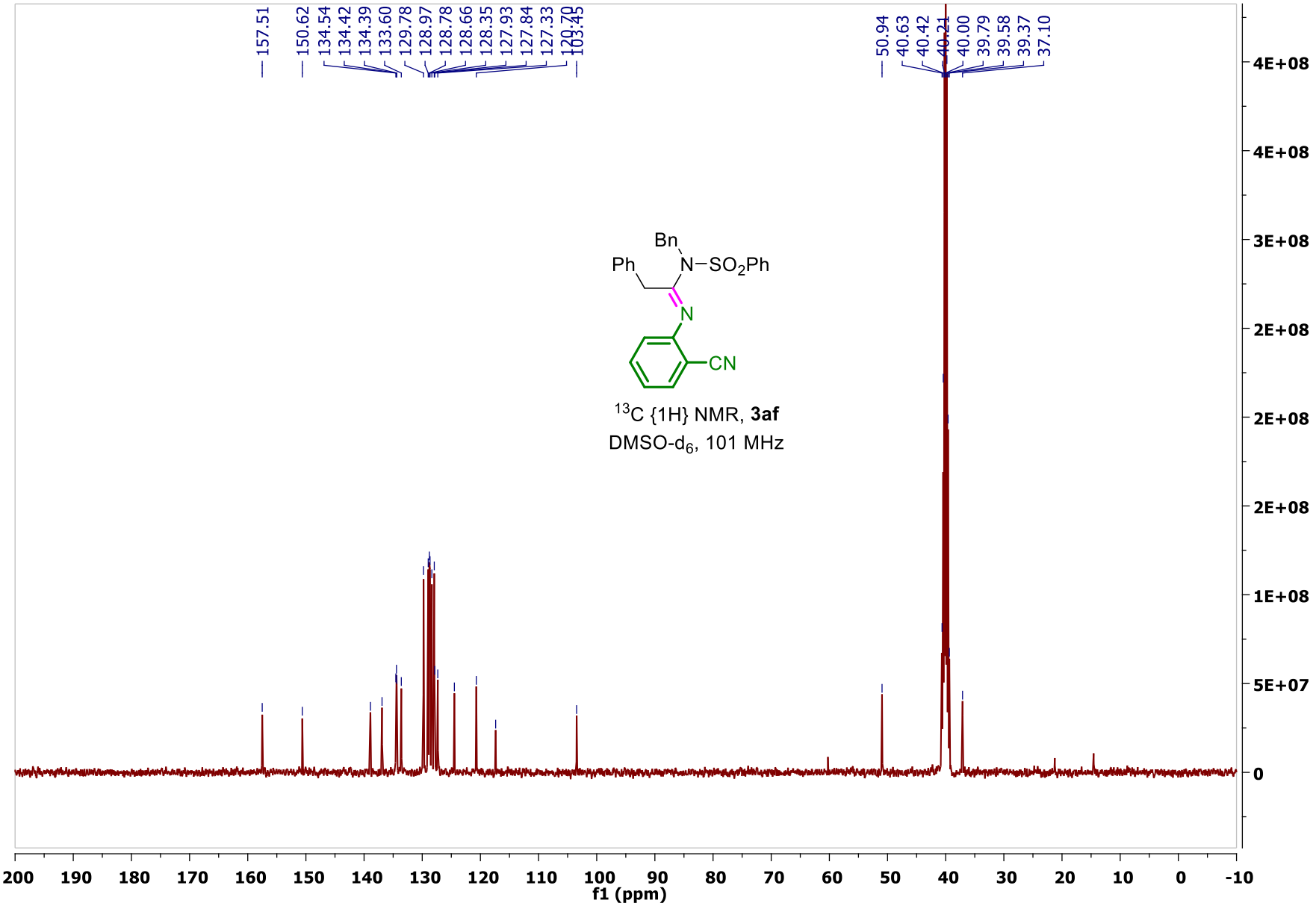

7.88
7.86
7.77
7.75
7.73
7.65
7.63
7.61
7.26
7.25
7.24
7.24
7.16
7.13
7.11
7.09
7.04
7.03
7.03
7.02
6.74
6.72
4.82
3.79
2.50
2.50
2.49
Bn
Ph
N−SO2Ph
N
F
1H NMR, 3ae
DMSO-d6, 400 MHz
1.98
1.05
1.97
2.96
5.99
2.00
1.97
0.96
1.96
2.00
f1 (ppm)


157.86
153.21
150.80
138.60
136.77
135.68
135.56
134.52
134.34
129.75
128.90
128.81
128.69
128.31
128.28
127.85
127.22
125.56
125.50
125.28
125.26
122.54
116.61
116.42
50.85
40.42
40.21
40.00
39.79
37.42
Bn
Ph
N–SO2Ph
N
F
13C {1H} NMR, 3ae
DMSO-d6, 101 MHz
3E+08
2E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


7.90
7.88
7.88
7.73
7.72
7.72
7.62
7.60
7.29
7.28
7.28
7.27
7.21
7.20
7.19
7.18
7.16
6.84
6.83
6.82
6.20
6.17
4.86
3.81
3.64
2.50
2.50
2.50
Ts
N
Bn
Ph
N
COOMe
3hq, 1H NMR
DMSO-d6, 400 MHz
1.99
2.98
2.03
0.99
3.04
4.98
2.02
0.98
2.00
1.99
2.99
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


165.10
155.55
146.88
139.25
137.17
134.89
134.16
133.25
130.34
129.60
128.84
128.60
128.36
128.07
127.74
127.50
127.18
123.13
121.94
52.64
50.95
37.91
Ts
N
Bn
Ph
N
COOMe
3hq, 13C {1H} NMR
DMSO-d6, 101 MHz
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.92
7.92
7.90
7.90
7.76
7.74
7.69
7.69
7.67
7.67
7.64
7.62
7.60
7.49
7.49
7.47
6.81
6.80
6.79
6.41
6.39
4.92
3.86
2.51
2.51
2.51
2.50
2.50
Bn
Ph
N−SO2Ph
N
CN
1H NMR, 3af
DMSO-d6, 400 MHz
1.99
1.04
0.97
1.99
1.00
5.05
3.97
1.98
0.99
1.96
2.00
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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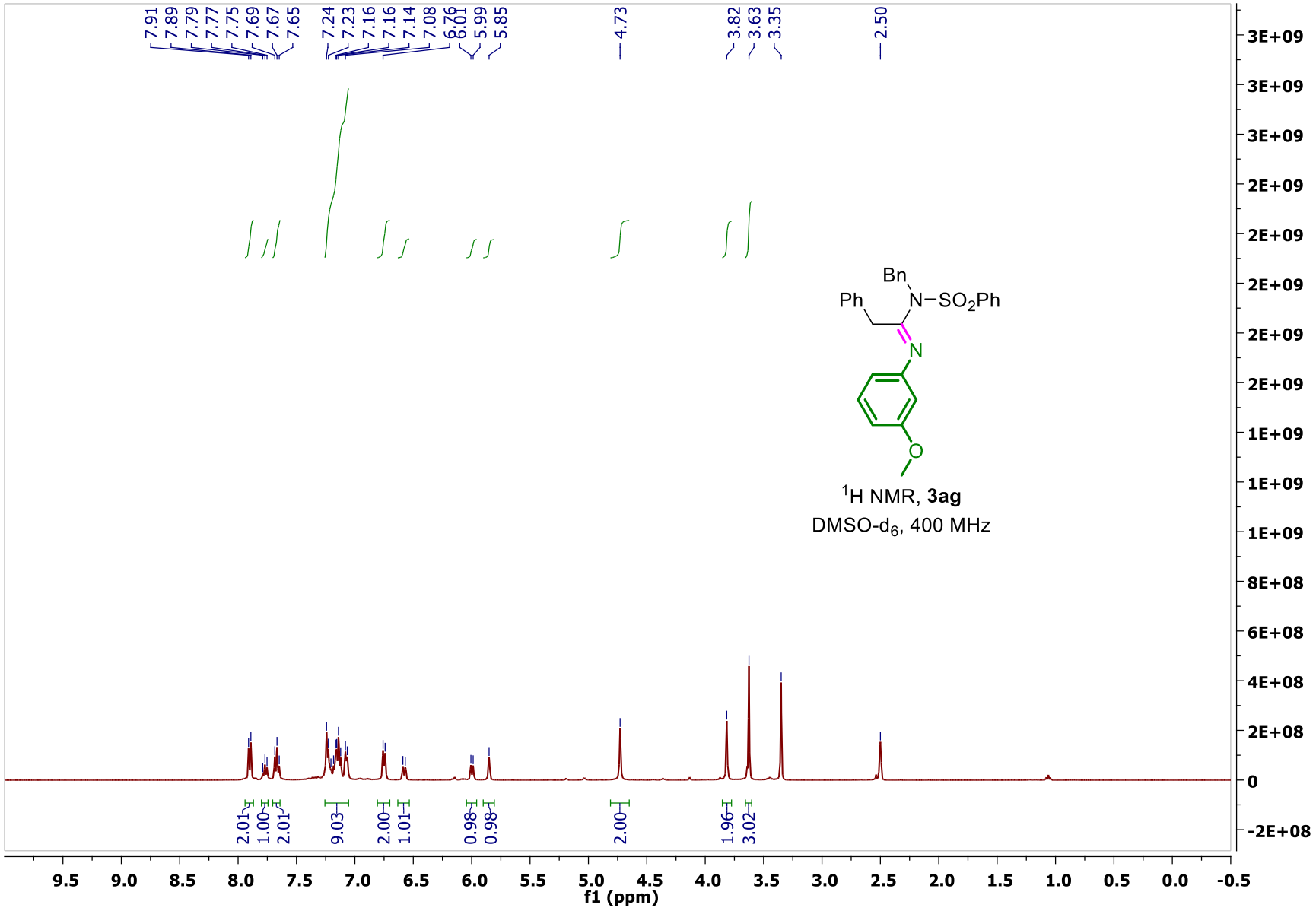
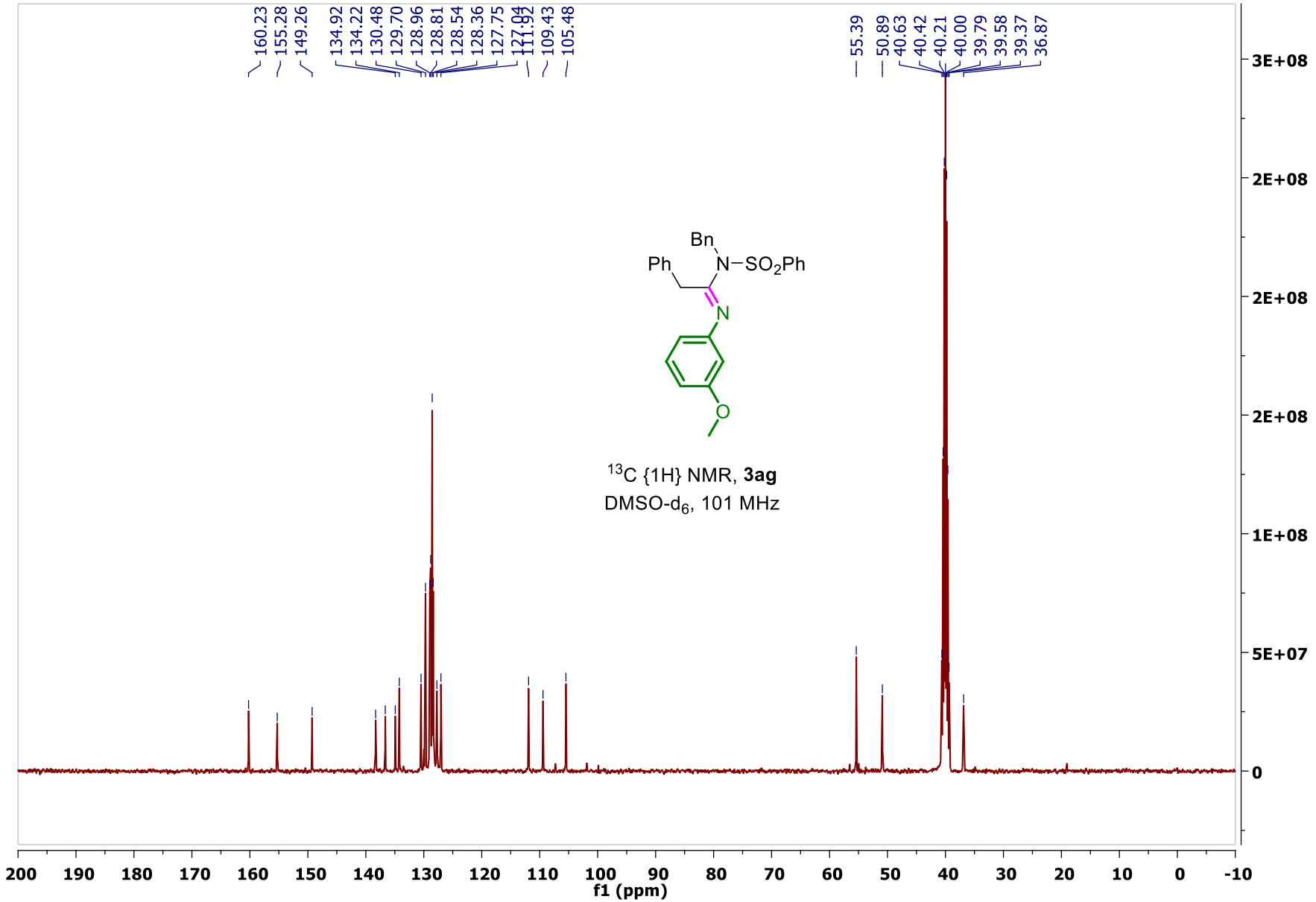
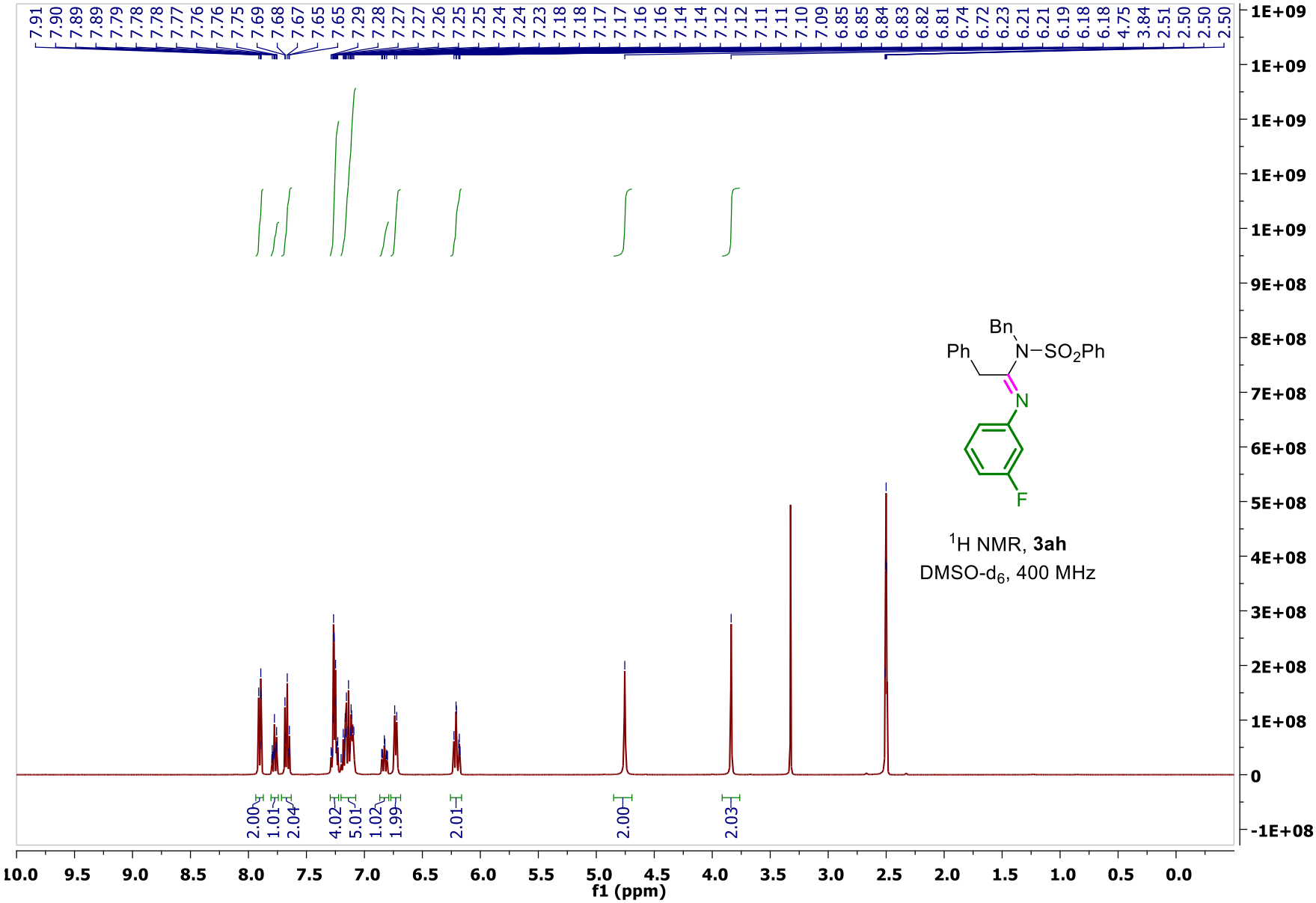
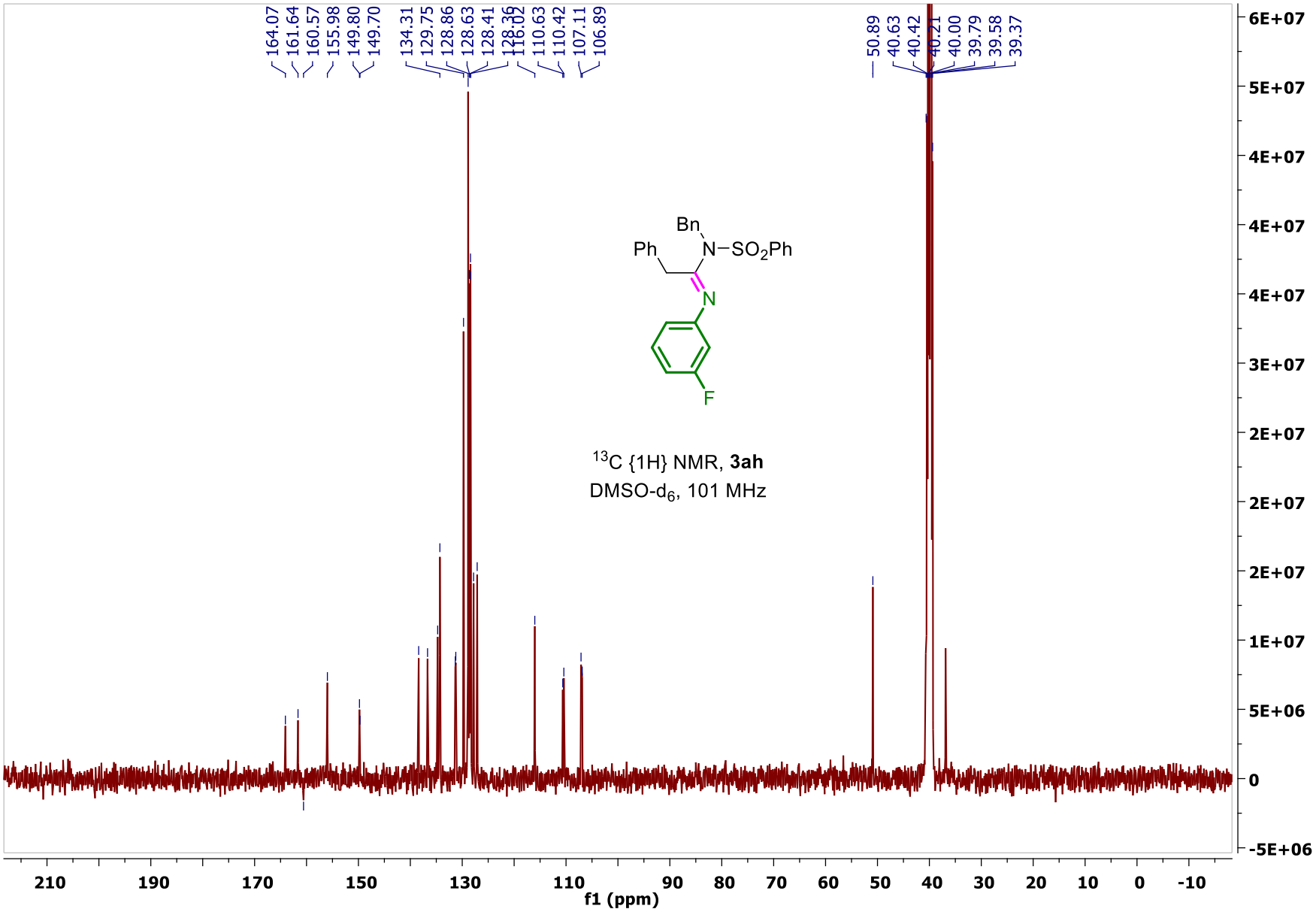
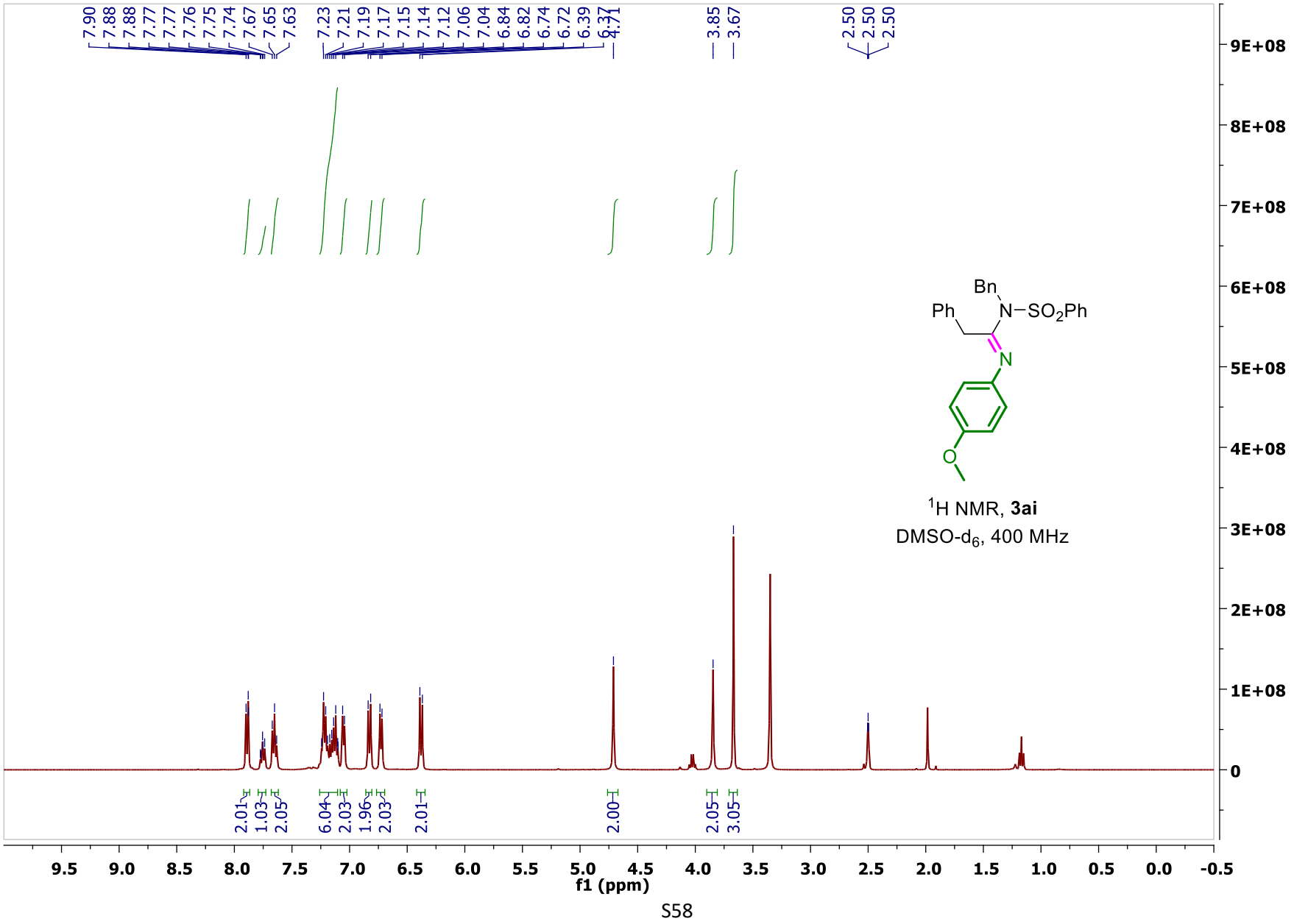
150.62
134.54
134.42
134.39
133.60
129.78
128.97
128.78
128.66
128.35
127.93
127.84
127.33
120.70
103.45
50.94
40.63
40.42
40.21
40.00
39.79
39.58
39.37
37.10
Bn
Ph
N−SO2Ph
N
CN
13C {1H} NMR, 3af
DMSO-d6, 101 MHz
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

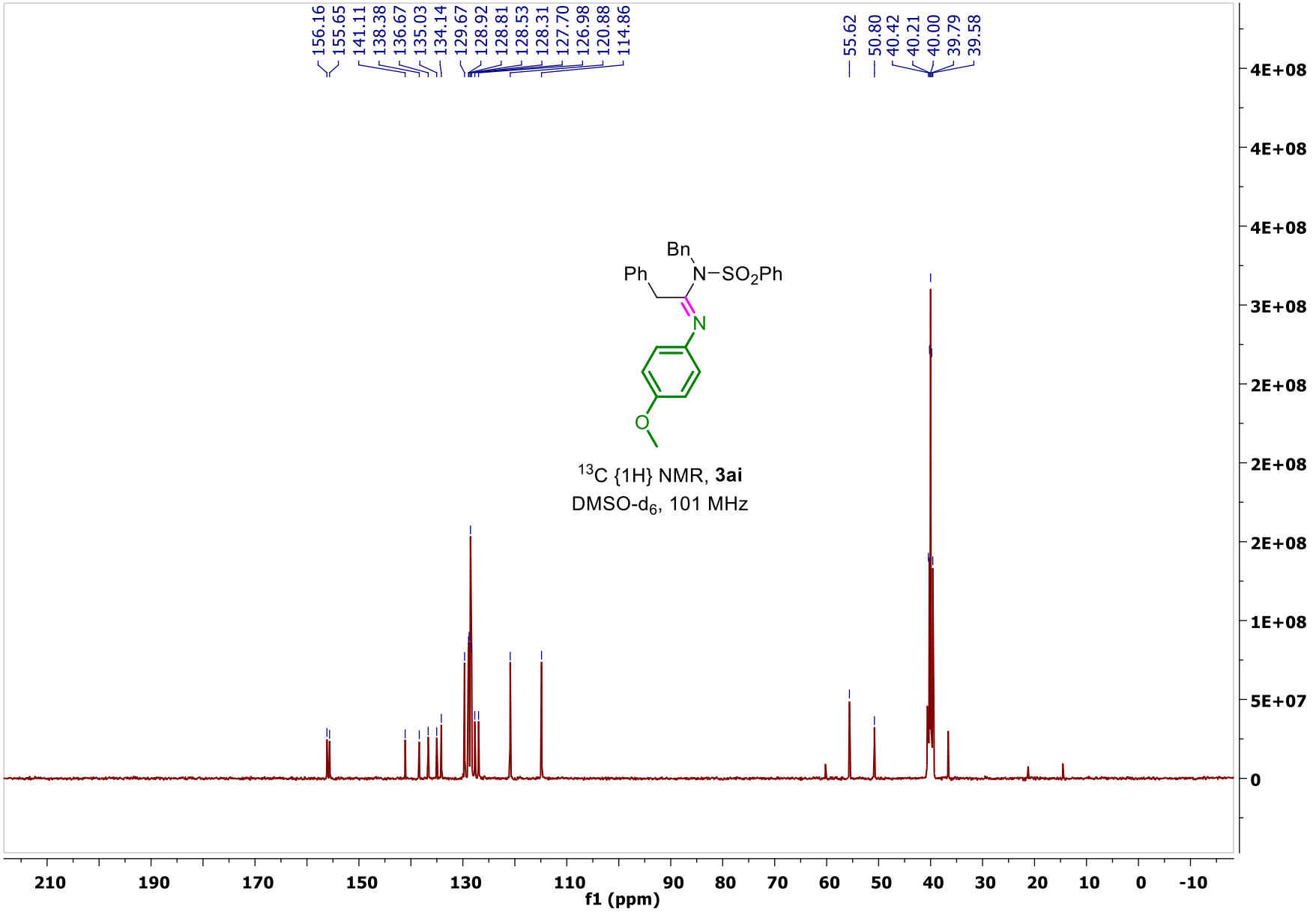

7.91
7.89
7.79
7.77
7.75
7.69
7.67
7.65
7.24
7.23
7.16
7.16
7.14
7.08
6.76
6.01
5.99
5.85
4.73
3.82
3.63
3.35
2.50
Bn
Ph
N−SO2Ph
N
O
1H NMR, 3ag
DMSO-d6, 400 MHz
2.01
1.00
2.01
9.03
2.00
1.01
0.98
0.98
2.00
1.96
3.02
f1 (ppm)

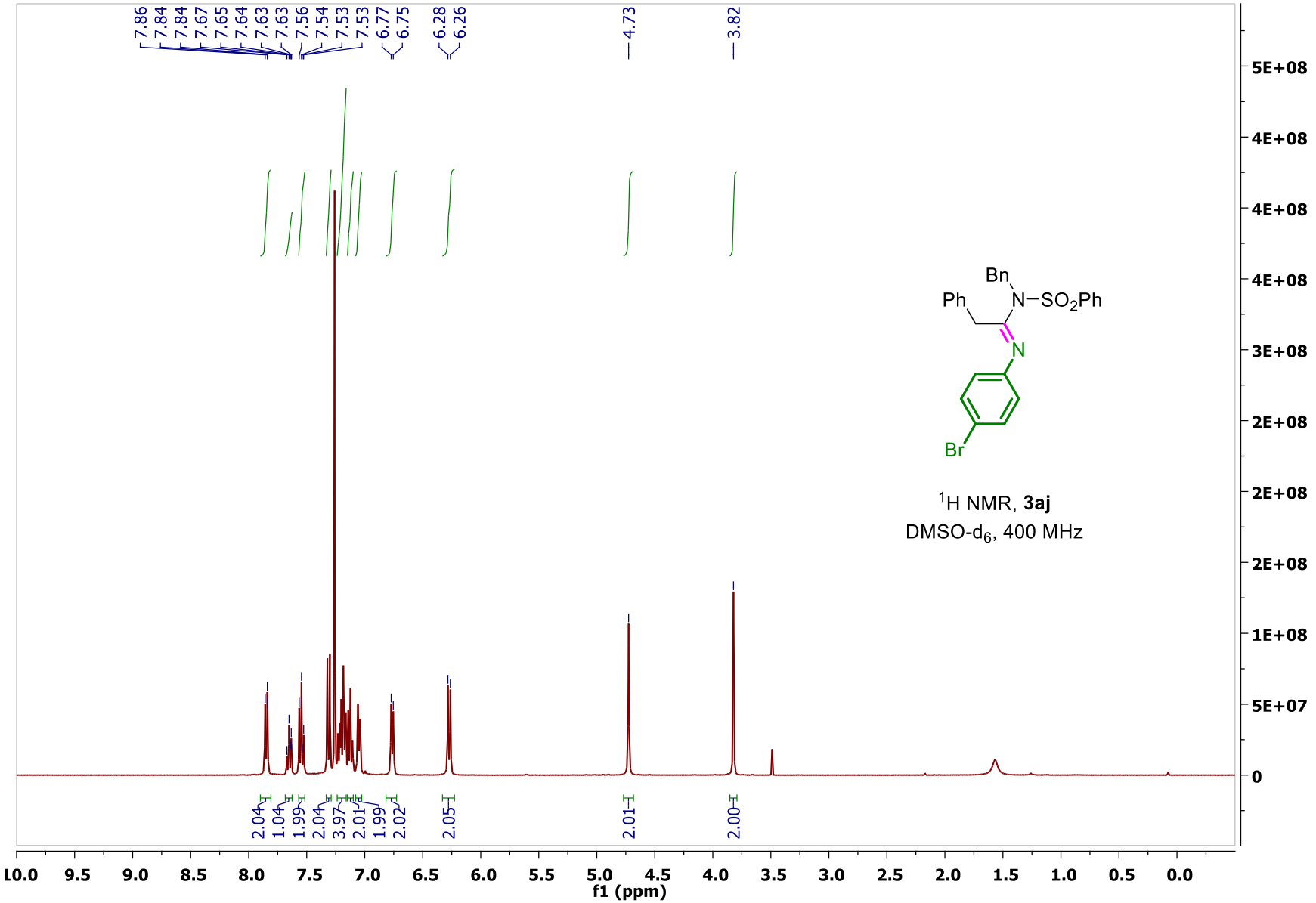

160.23
155.28
149.26
134.92
134.22
130.48
129.70
128.96
128.81
128.54
128.36
127.75
127.04
111.92
109.43
105.48
55.39
50.89
40.63
40.42
40.21
40.00
39.79
39.58
39.37
36.87
Bn
Ph
N−SO2Ph
N
O
13C {1H} NMR, 3ag
DMSO-d6, 101 MHz
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

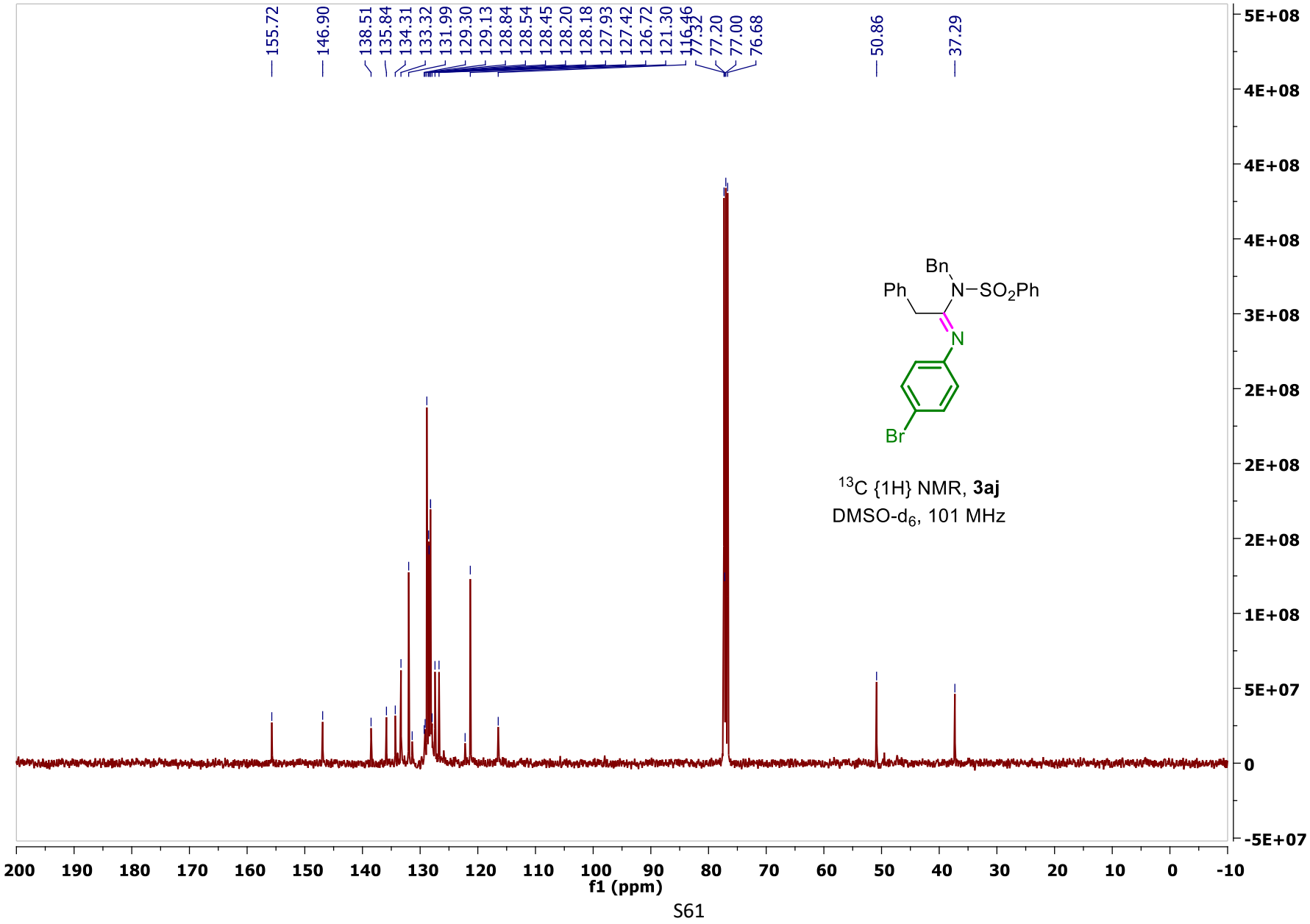

Bn
Ph
N−SO2Ph
N
F
1H NMR, 3ah
DMSO-d6, 400 MHz
f1 (ppm)

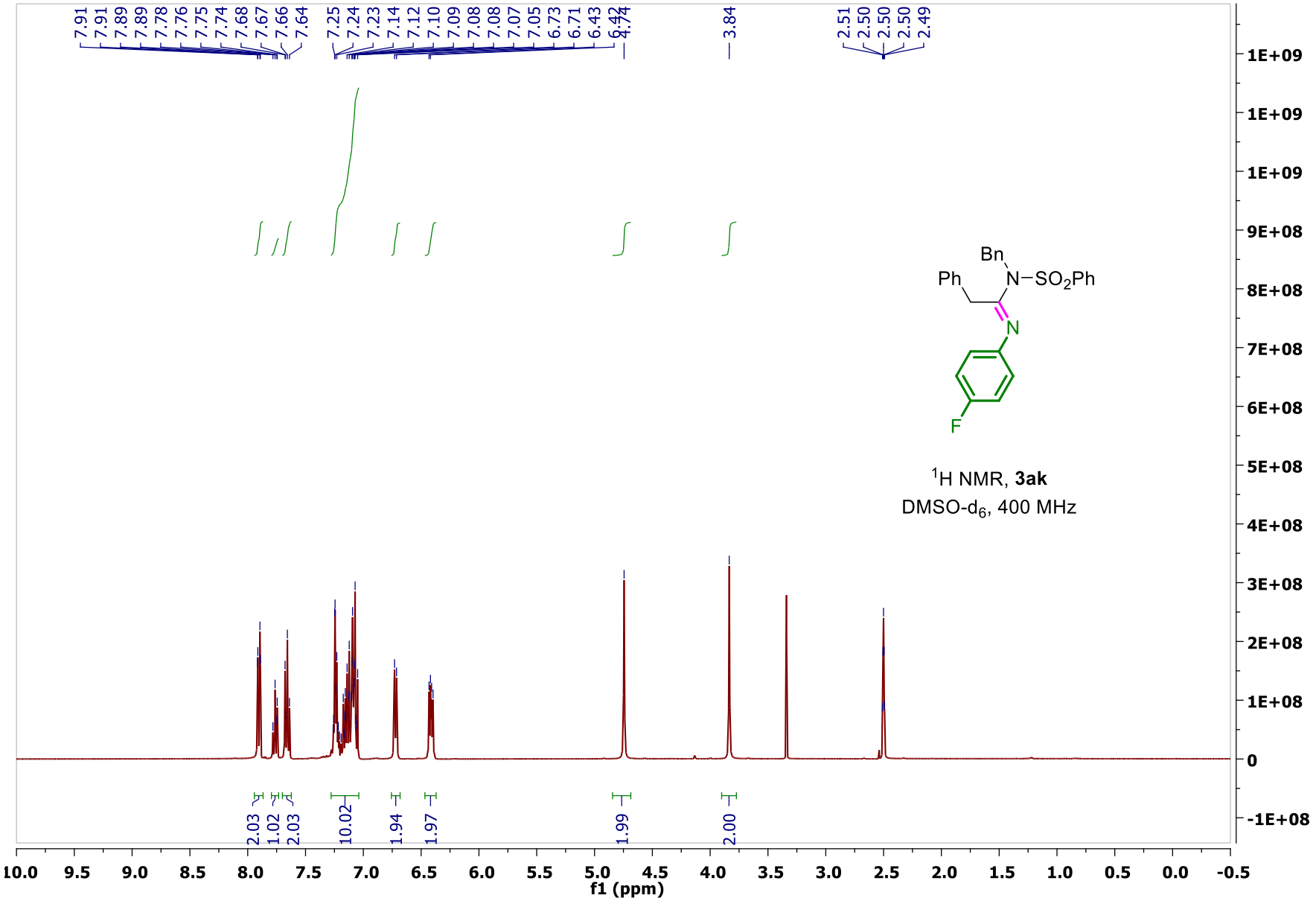

164.07
161.64
160.57
155.98
149.80
149.70
134.31
129.75
128.86
128.63
128.41
128.36
128.02
110.63
110.42
107.11
106.89
50.89
40.63
40.42
40.21
40.00
39.79
39.58
39.37
Bn
Ph
N−SO2Ph
N
F
13C {1H} NMR, 3ah
DMSO-d6, 101 MHz
6E+07
5E+07
4E+07
4E+07
4E+07
3E+07
2E+07
2E+07
2E+07
1E+07
5E+06
0
-5E+06
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

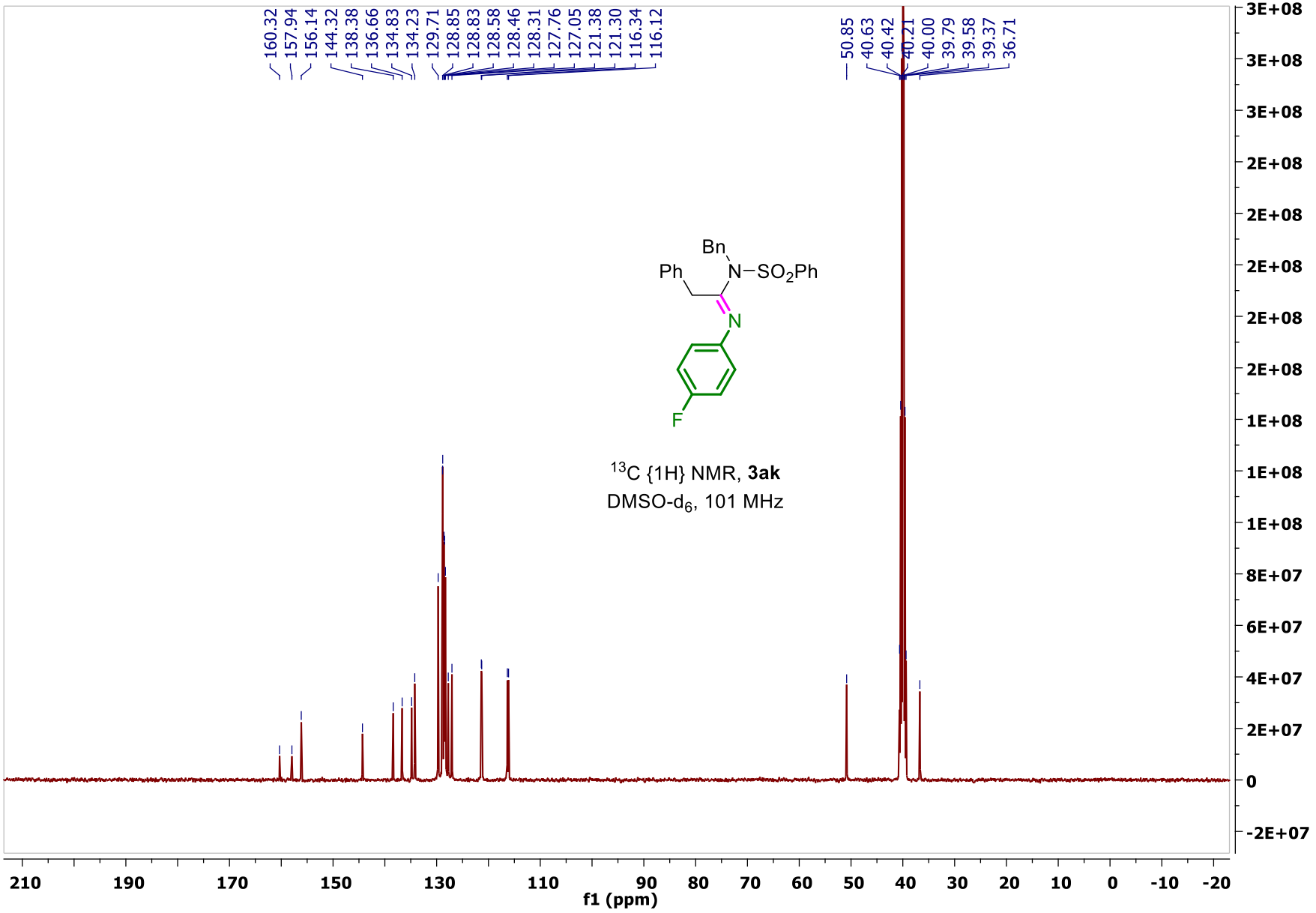

7.90
7.88
7.88
7.77
7.77
7.76
7.75
7.74
7.67
7.65
7.63
7.23
7.21
7.19
7.17
7.15
7.14
7.12
7.06
7.04
6.84
6.82
6.74
6.72
6.39
6.37
4.71
3.85
3.67
2.50
2.50
2.50
Bn
Ph
N−SO2Ph
N
O
1H NMR, 3ai
DMSO-d6, 400 MHz
2.01
1.03
2.05
6.04
2.03
1.96
2.03
2.01
2.00
2.05
3.05
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

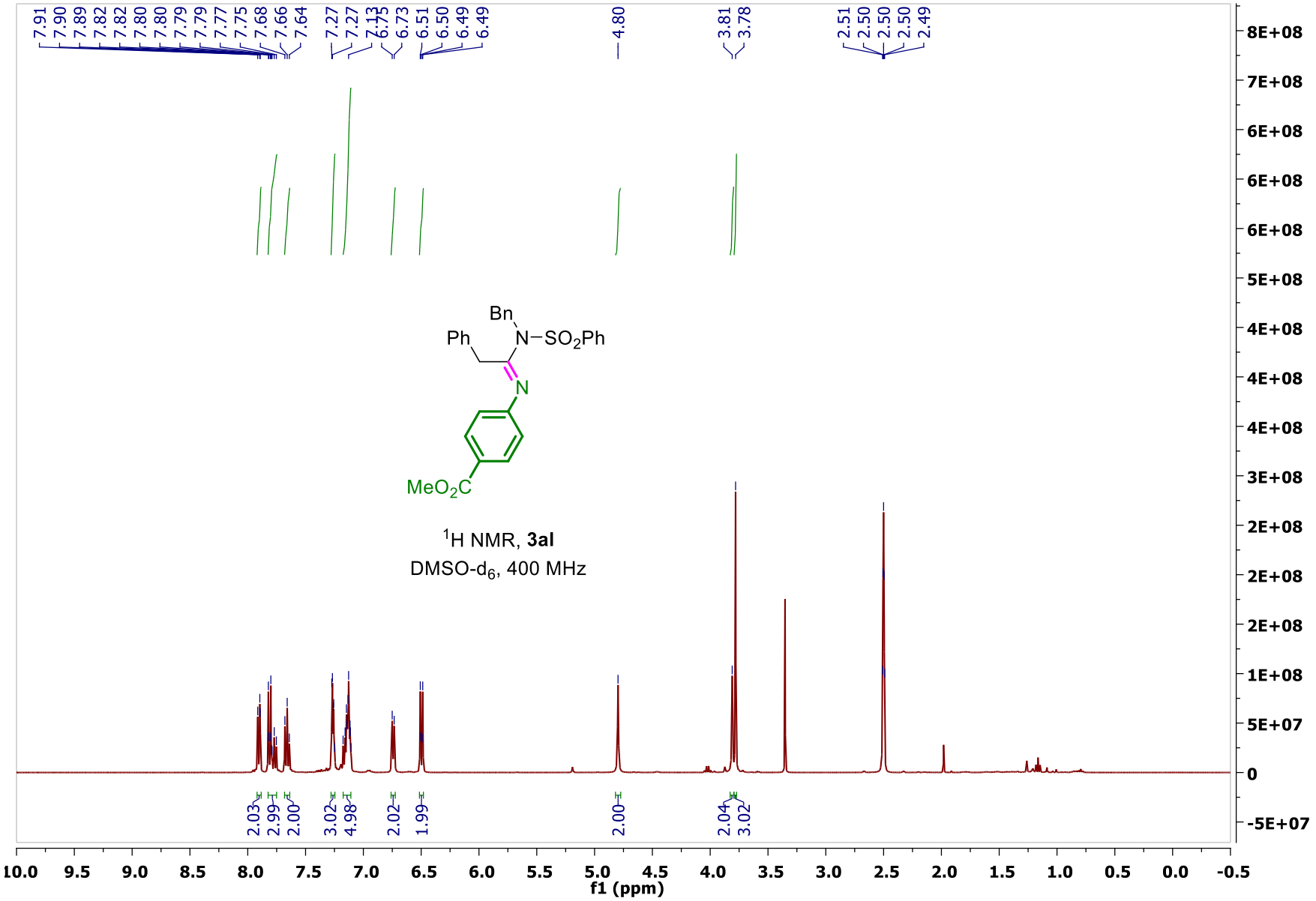

156.16
155.65
141.11
138.38
136.67
135.03
134.14
129.67
128.92
128.81
128.53
128.31
127.70
126.98
120.88
114.86
55.62
50.80
40.42
40.21
40.00
39.79
39.58
Bn
Ph
N−SO2Ph
N
O
13C {1H} NMR, 3ai
DMSO-d6, 101 MHz
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

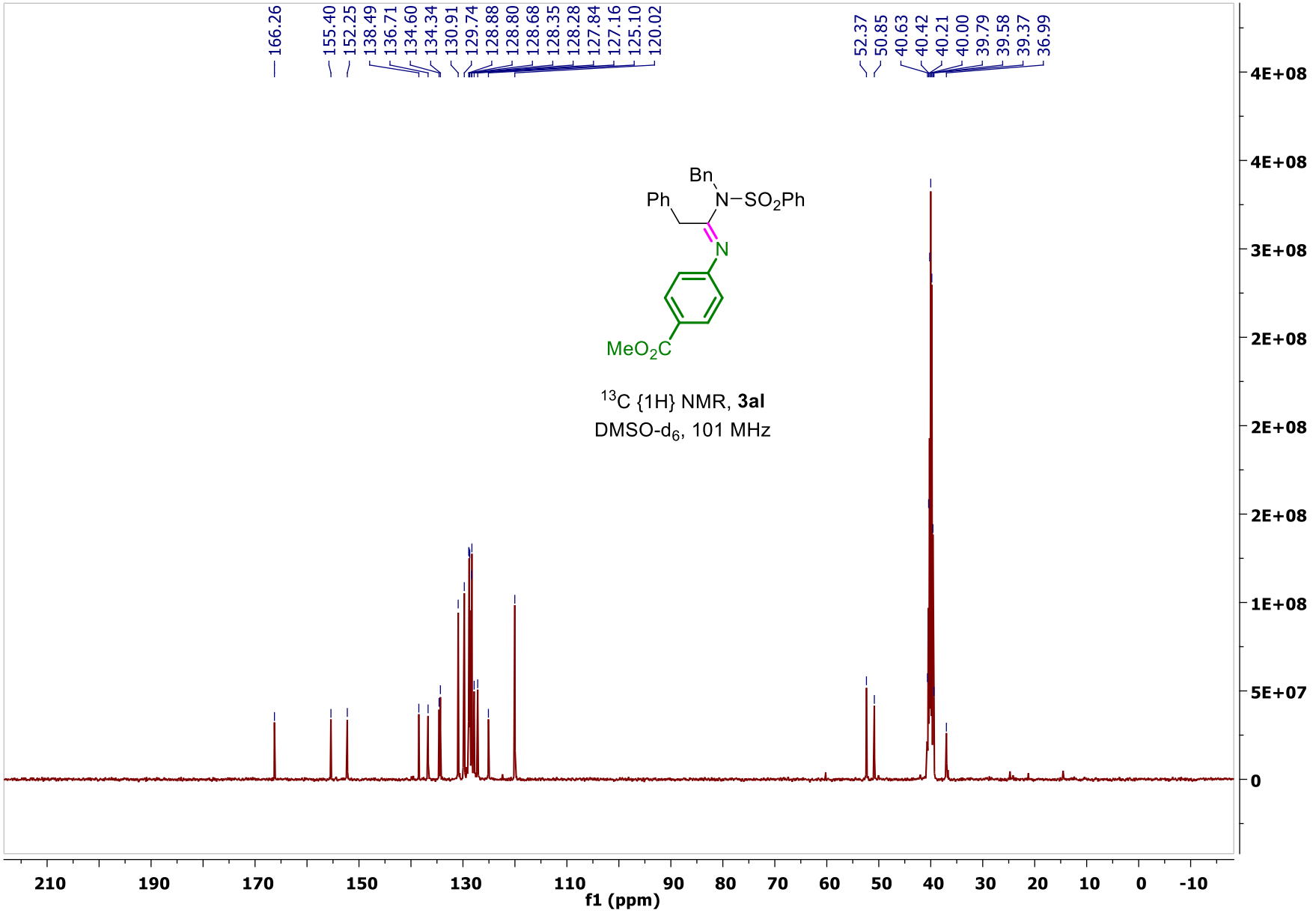

7.86
7.84
7.84
7.67
7.65
7.64
7.63
7.63
7.56
7.54
7.53
7.53
6.77
6.75
6.28
6.26
4.73
3.82
Bn
Ph
N−SO2Ph
N
Br
1H NMR, 3aj
DMSO-d6, 400 MHz
2.04
1.04
1.99
2.04
3.97
2.01
1.99
2.02
2.05
2.01
2.00
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

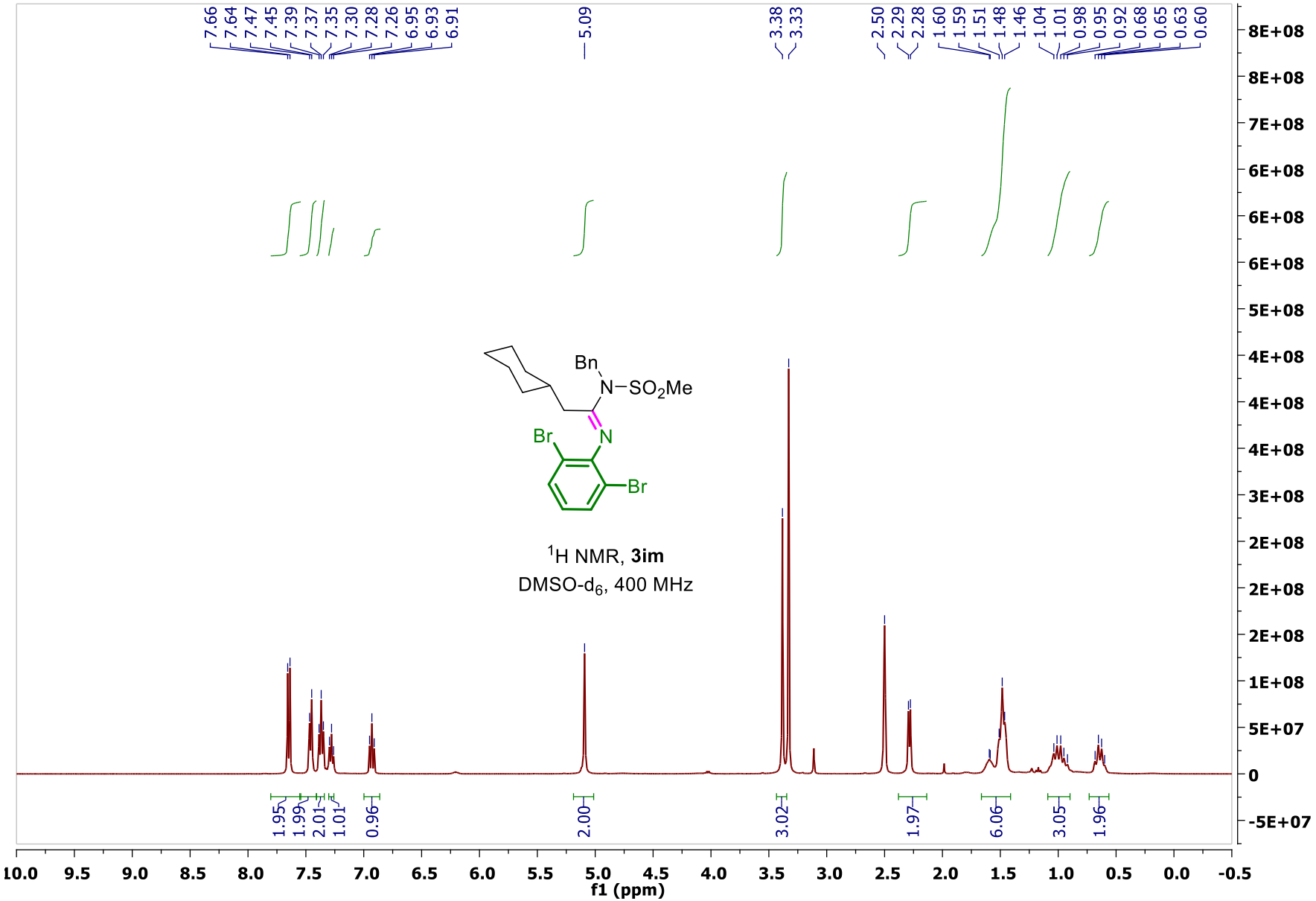

155.72
146.90
138.51
135.84
134.31
133.32
131.99
129.30
129.13
128.84
128.54
128.45
128.20
128.18
127.93
127.42
126.72
121.30
116.46
77.32
77.20
77.00
76.68
50.86
37.29
Bn
Ph
N−SO2Ph
N
Br
13C {1H} NMR, 3aj
DMSO-d6, 101 MHz
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

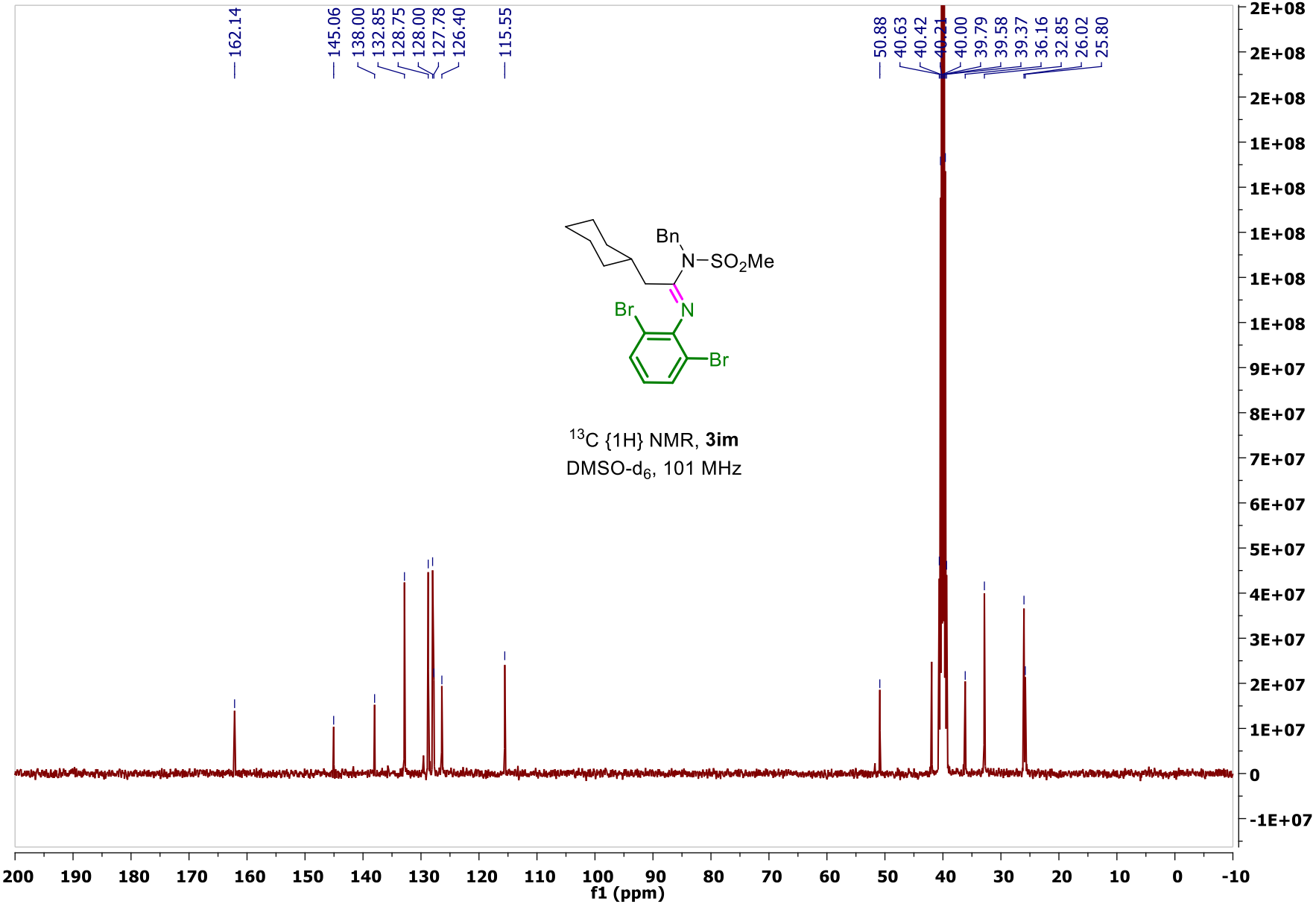

7.91
7.91
7.89
7.89
7.78
7.76
7.75
7.74
7.68
7.67
7.66
7.64
7.25
7.24
7.23
7.14
7.12
7.10
7.09
7.08
7.08
7.07
7.05
6.73
6.71
6.43
6.42
4.74
3.84
2.51
2.50
2.50
2.50
2.49
Bn
Ph
N−SO2Ph
N
F
1H NMR, 3ak
DMSO-d6, 400 MHz
2.03
1.02
2.03
10.02
1.94
1.97
1.99
2.00
f1 (ppm)

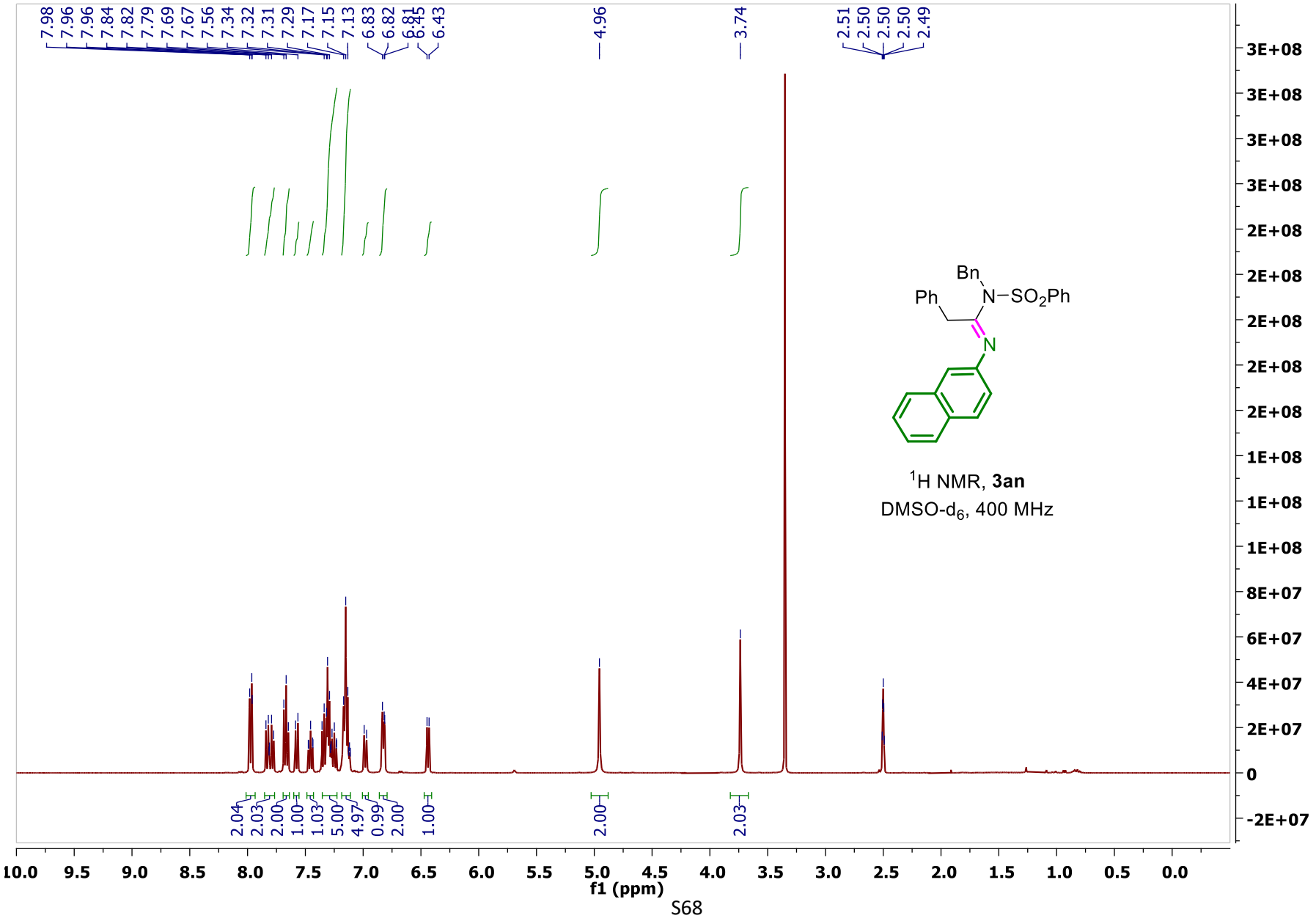

160.32
157.94
156.14
144.32
138.38
136.66
134.83
134.23
129.71
128.85
128.83
128.58
128.46
128.31
127.76
127.05
121.38
121.30
116.34
116.12
50.85
40.63
40.42
40.21
40.00
39.79
39.58
39.37
36.71
Bn
Ph
N−SO2Ph
N
F
13C {1H} NMR, 3ak
DMSO-d6, 101 MHz
3E+08
3E+08
3E+08
2E+08
2E+08
2E+08
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
-10
-20
f1 (ppm)

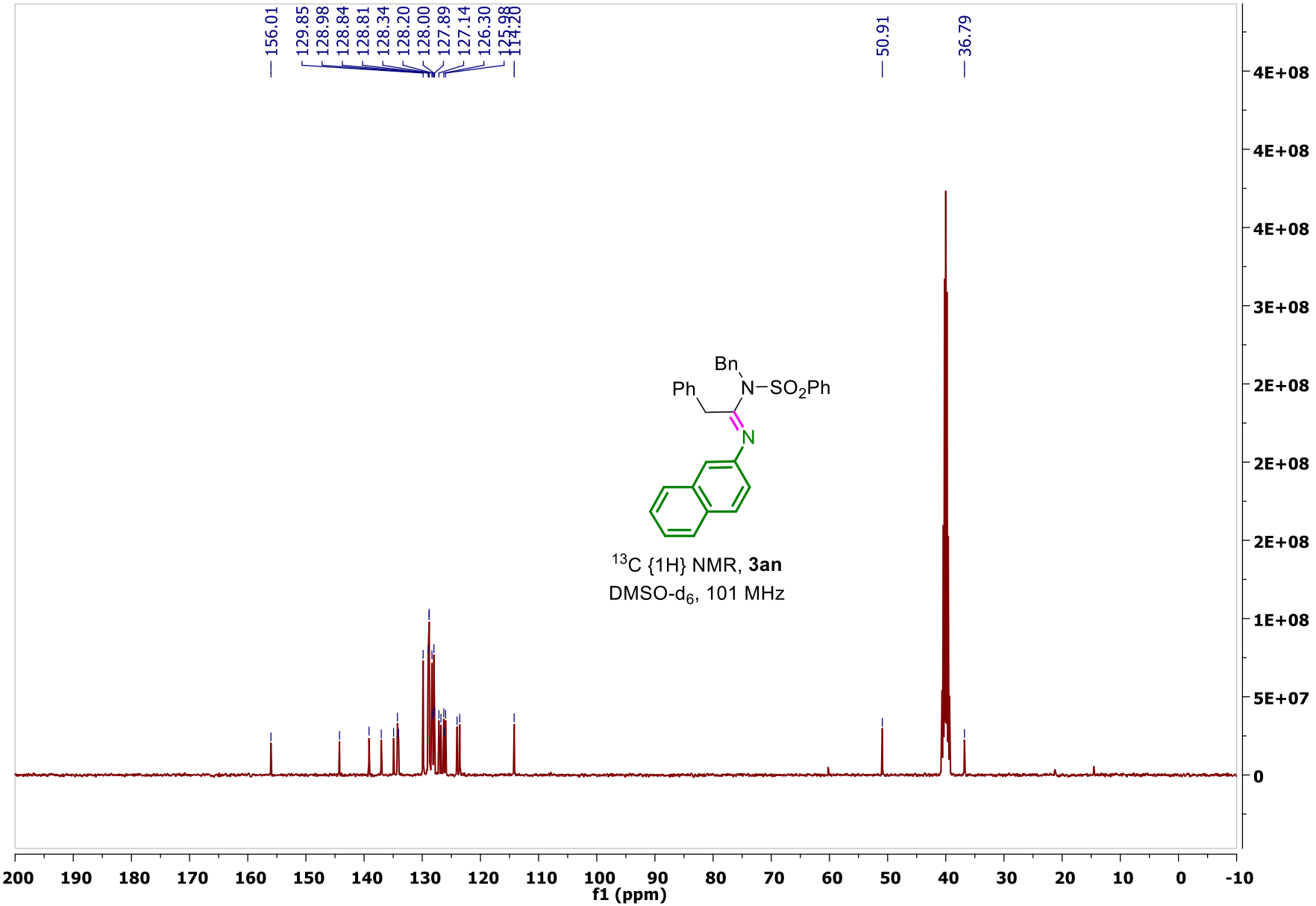

7.91
7.90
7.89
7.82
7.82
7.80
7.80
7.79
7.79
7.77
7.75
7.68
7.66
7.64
7.27
7.27
7.13
6.75
6.73
6.51
6.50
6.49
6.49
4.80
3.81
3.78
2.51
2.50
2.50
2.50
2.49
Bn
Ph
N−SO2Ph
N
MeO2C
1H NMR, 3al
DMSO-d6, 400 MHz
2.03
2.99
2.00
3.02
4.98
2.02
1.99
2.00
2.04
3.02
8E+08
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

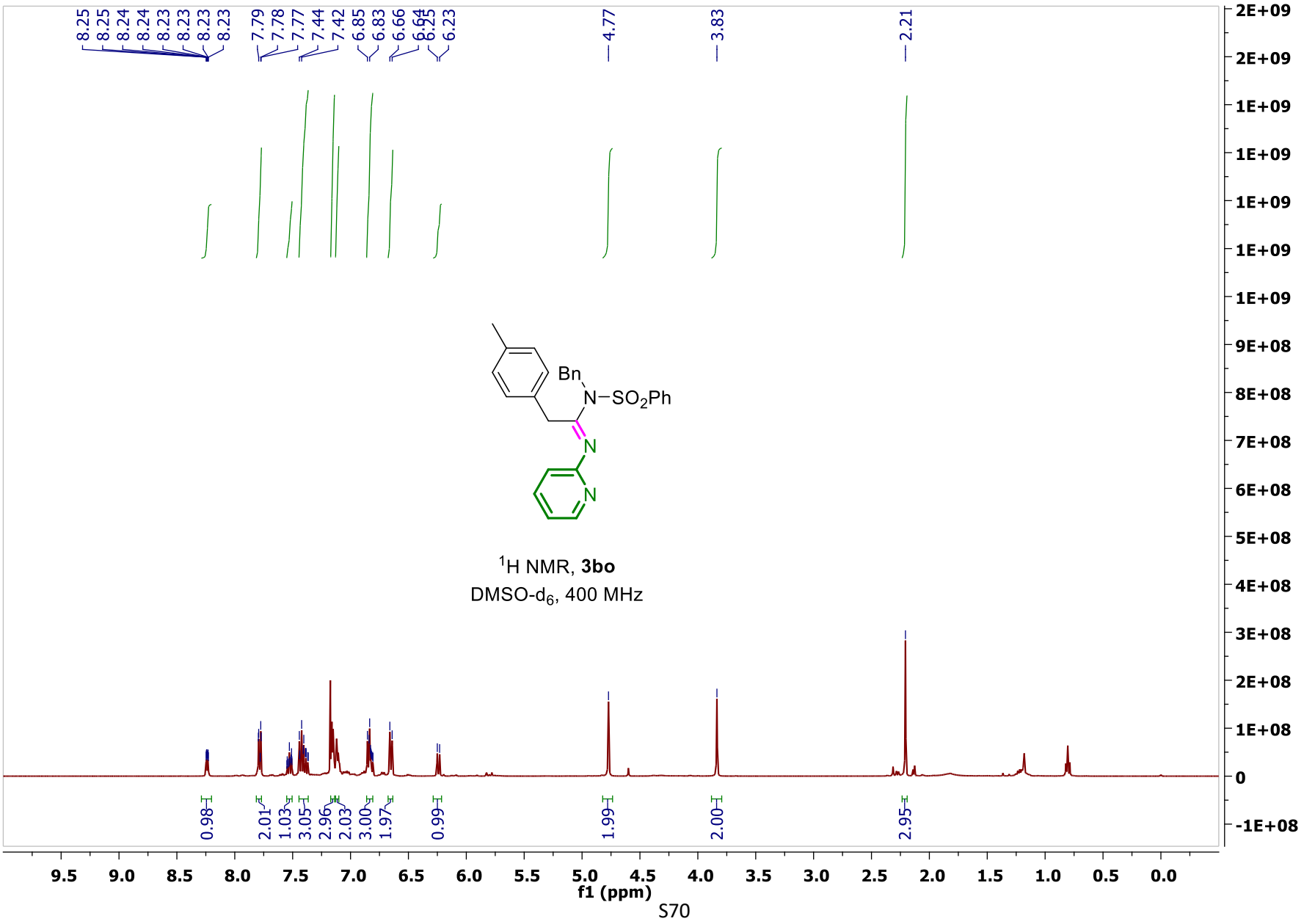

166.26
155.40
152.25
138.49
136.71
134.60
134.34
130.91
129.74
128.88
128.80
128.68
128.35
128.28
127.84
127.16
125.10
120.02
52.37
50.85
40.63
40.42
40.21
40.00
39.79
39.58
39.37
36.99
Bn
Ph
N−SO2Ph
N
MeO2C
13C {1H} NMR, 3al
DMSO-d6, 101 MHz
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

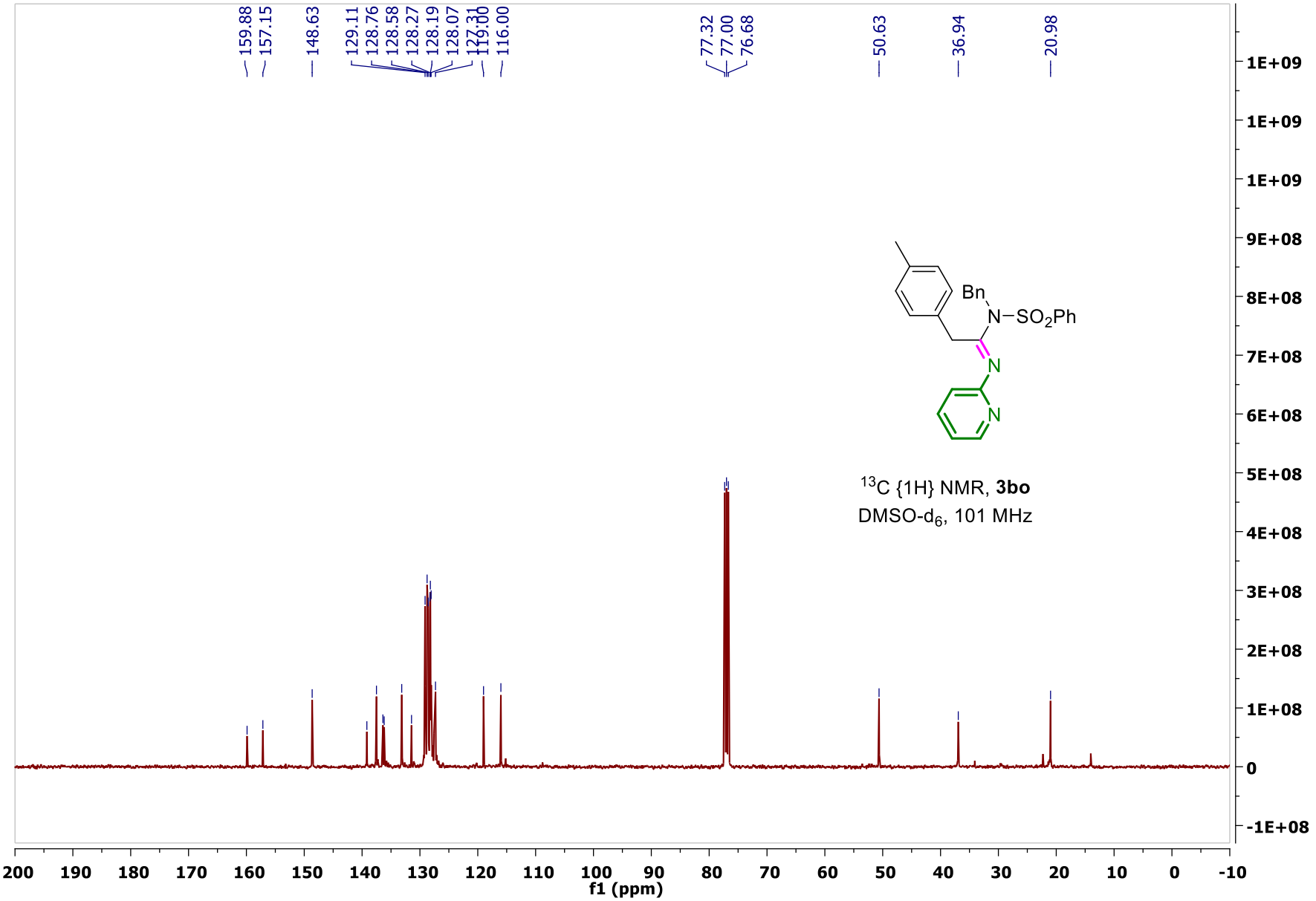

7.66
7.64
7.47
7.45
7.39
7.37
7.35
7.30
7.28
7.26
6.95
6.93
6.91
5.09
3.38
3.33
2.50
2.29
2.28
1.60
1.59
1.51
1.48
1.46
1.04
1.01
0.98
0.95
0.92
0.68
0.65
0.63
0.60
Bn
N−SO2Me
Br
N
Br
1H NMR, 3im
DMSO-d6, 400 MHz
1.95
1.99
2.01
1.01
0.96
2.00
3.02
1.97
6.06
3.05
1.96
f1 (ppm)

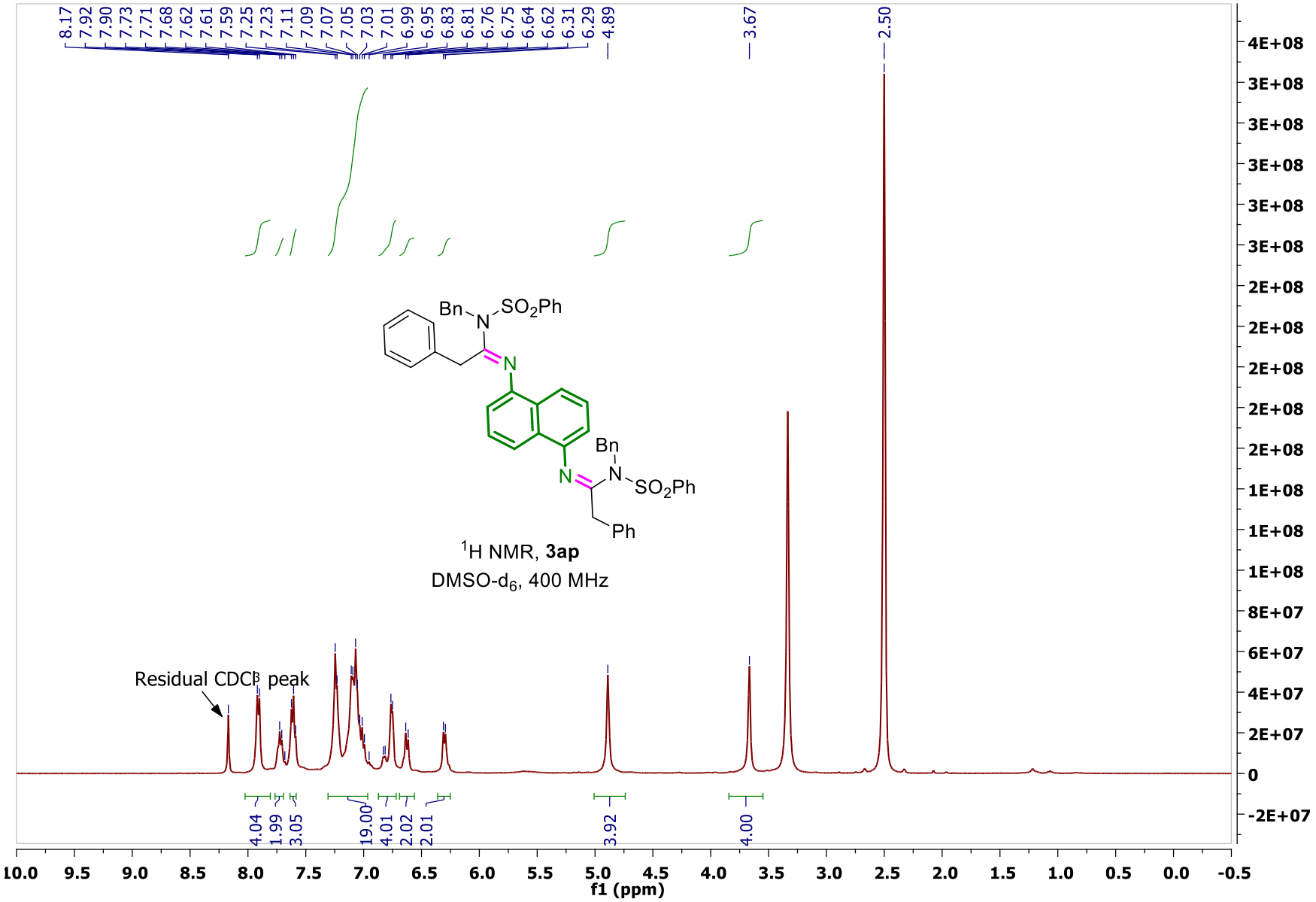

162.14
145.06
138.00
132.85
128.75
128.00
127.78
126.40
115.55
50.88
40.63
40.42
40.21
40.00
39.79
39.58
39.37
36.16
32.85
26.02
25.80
Bn
N−SO2Me
Br
N
Br
13C {1H} NMR, 3im
DMSO-d6, 101 MHz
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
1E+08
1E+08
1E+08
9E+07
8E+07
7E+07
6E+07
5E+07
4E+07
3E+07
2E+07
1E+07
0
-1E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

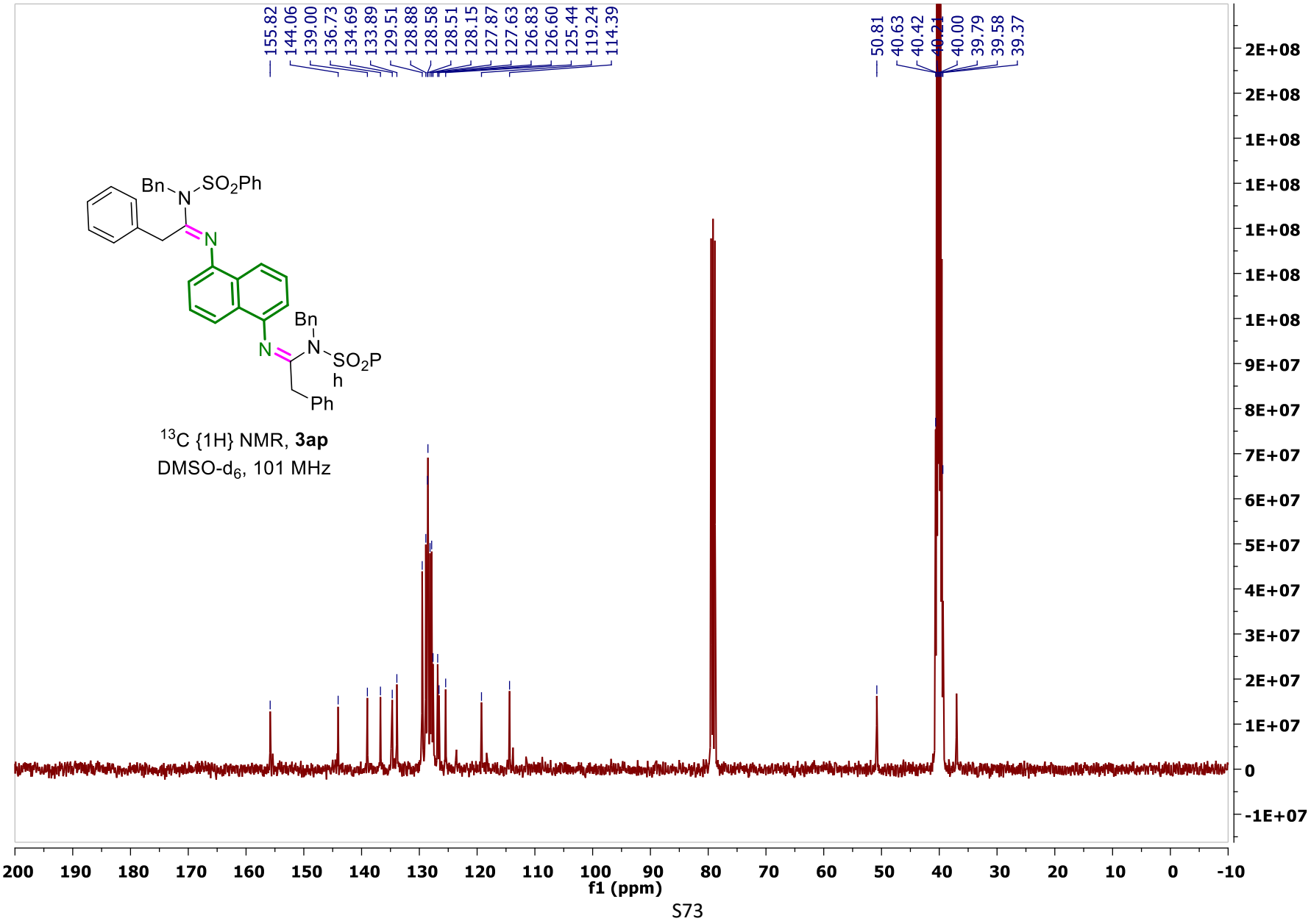

7.98
7.96
7.96
7.84
7.82
7.79
7.69
7.67
7.56
7.34
7.32
7.31
7.29
7.17
7.15
7.13
6.83
6.82
6.81
6.45
6.43
4.96
3.74
2.51
2.50
2.50
2.50
2.49
Bn
Ph
N−SO2Ph
N
1H NMR, 3an
DMSO-d6, 400 MHz
2.04
2.03
2.00
1.00
1.03
5.00
4.97
0.99
2.00
1.00
2.00
2.03
f1 (ppm)

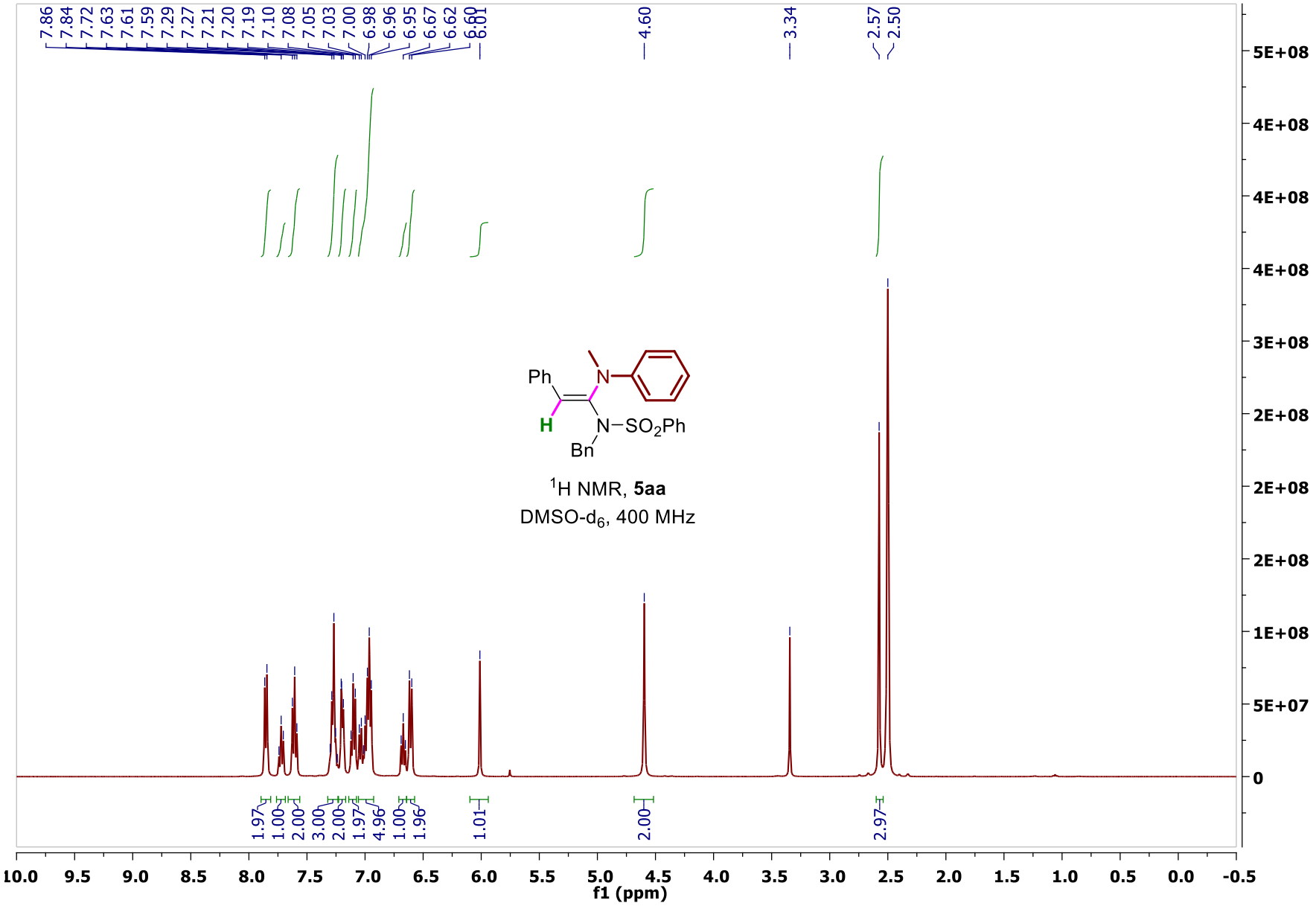

156.01
129.85
128.98
128.84
128.81
128.34
128.20
128.00
127.89
127.14
126.30
125.98
114.20
50.91
36.79
Bn
Ph
N−SO2Ph
N
13C {1H} NMR, 3an
DMSO-d6, 101 MHz
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

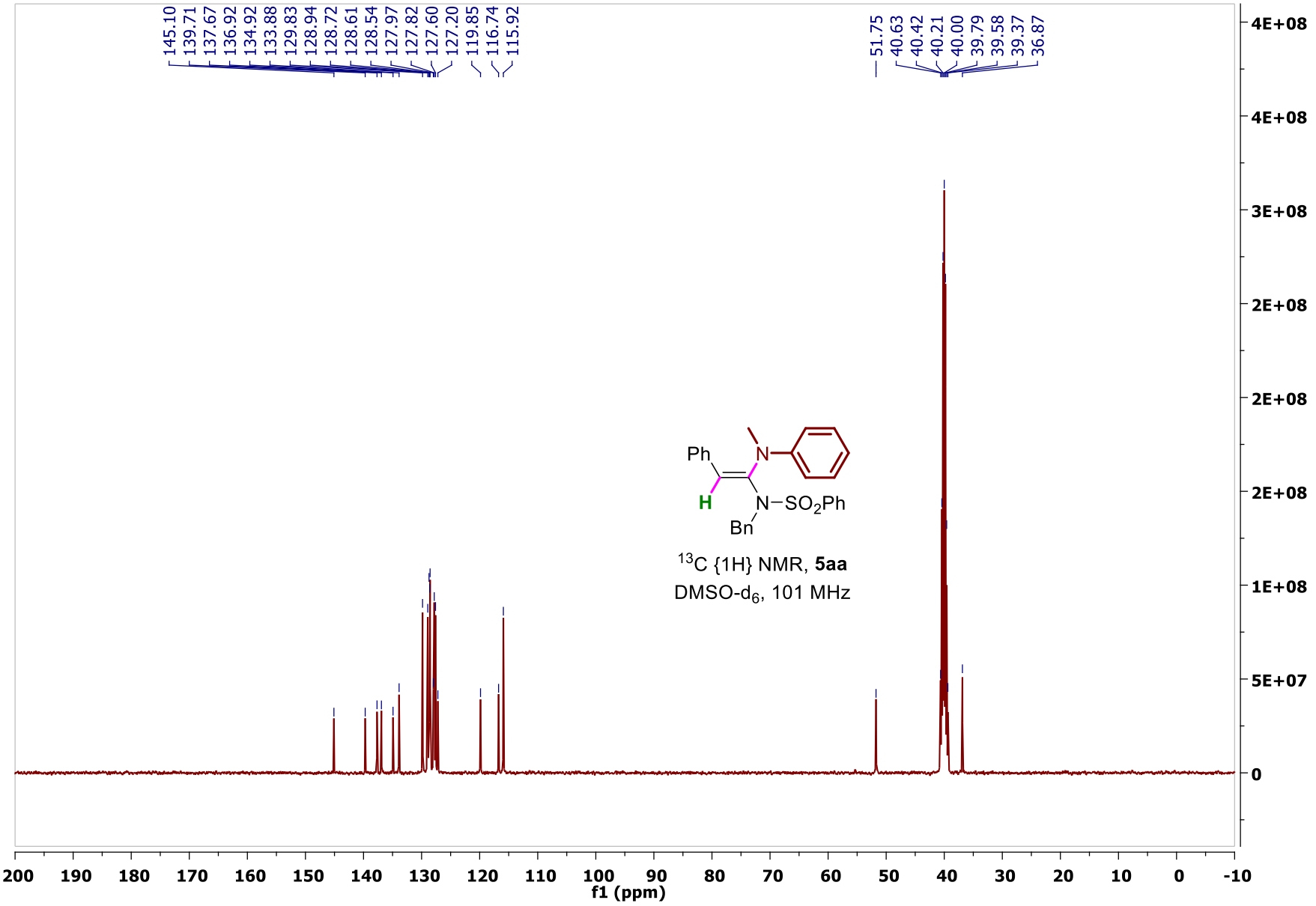

8.25
8.25
8.24
8.24
8.23
8.23
8.23
7.79
7.78
7.77
7.44
7.42
6.85
6.83
6.66
6.64
6.25
6.23
4.77
3.83
2.21
Bn
N–SO2Ph
N
N
1H NMR, 3bo
DMSO-d6, 400 MHz
0.98
2.01
1.03
3.05
2.96
2.03
3.00
1.97
0.99
1.99
2.00
2.95
f1 (ppm)

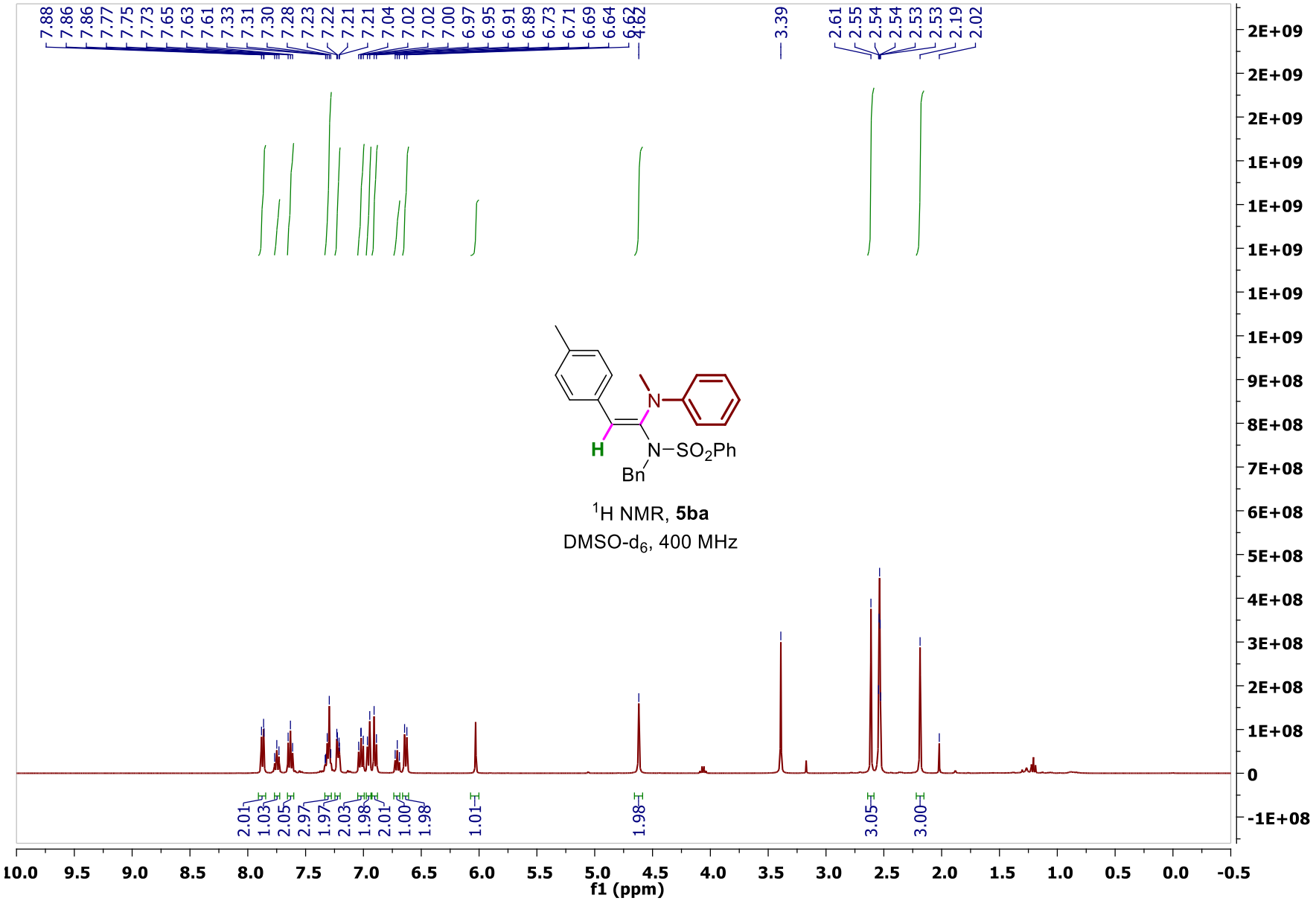

159.88
157.15
148.63
129.11
128.76
128.58
128.27
128.19
128.07
127.31
119.00
116.00
77.32
77.00
76.68
50.63
36.94
20.98
Bn
N–SO2Ph
N
N
13C {1H} NMR, 3bo
DMSO-d6, 101 MHz
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

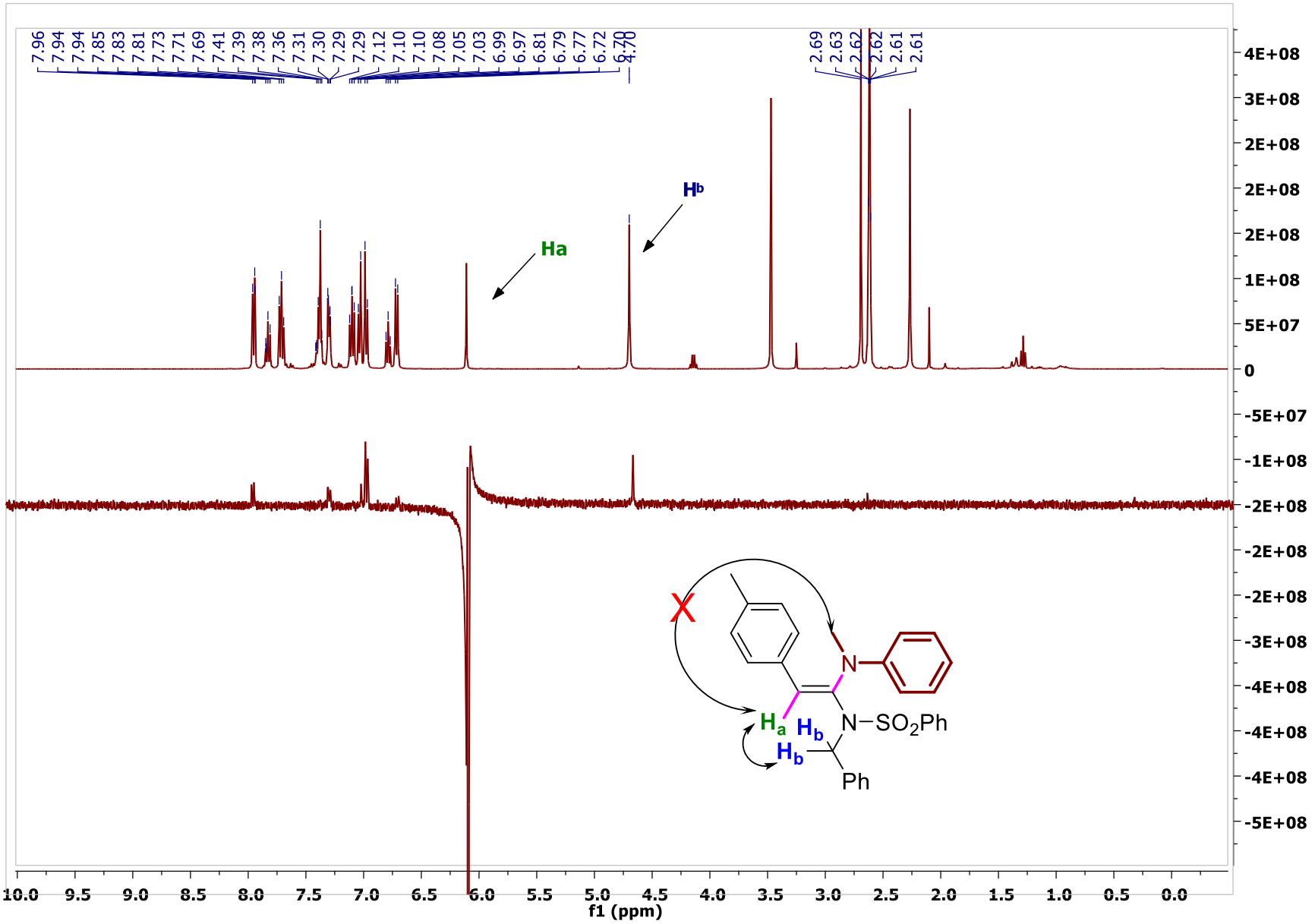

8.17
7.92
7.90
7.73
7.71
7.68
7.62
7.61
7.59
7.25
7.23
7.11
7.09
7.07
7.05
7.03
7.01
6.99
6.95
6.83
6.81
6.76
6.75
6.64
6.62
6.31
6.29
4.89
3.67
2.50
Bn
N
SO2Ph
N
Bn
N
N
SO2Ph
Ph
1H NMR, 3ap
DMSO-d6, 400 MHz
Residual CDCl3 peak
4.04
1.99
3.05
19.00
4.01
2.02
2.01
3.92
4.00
f1 (ppm)

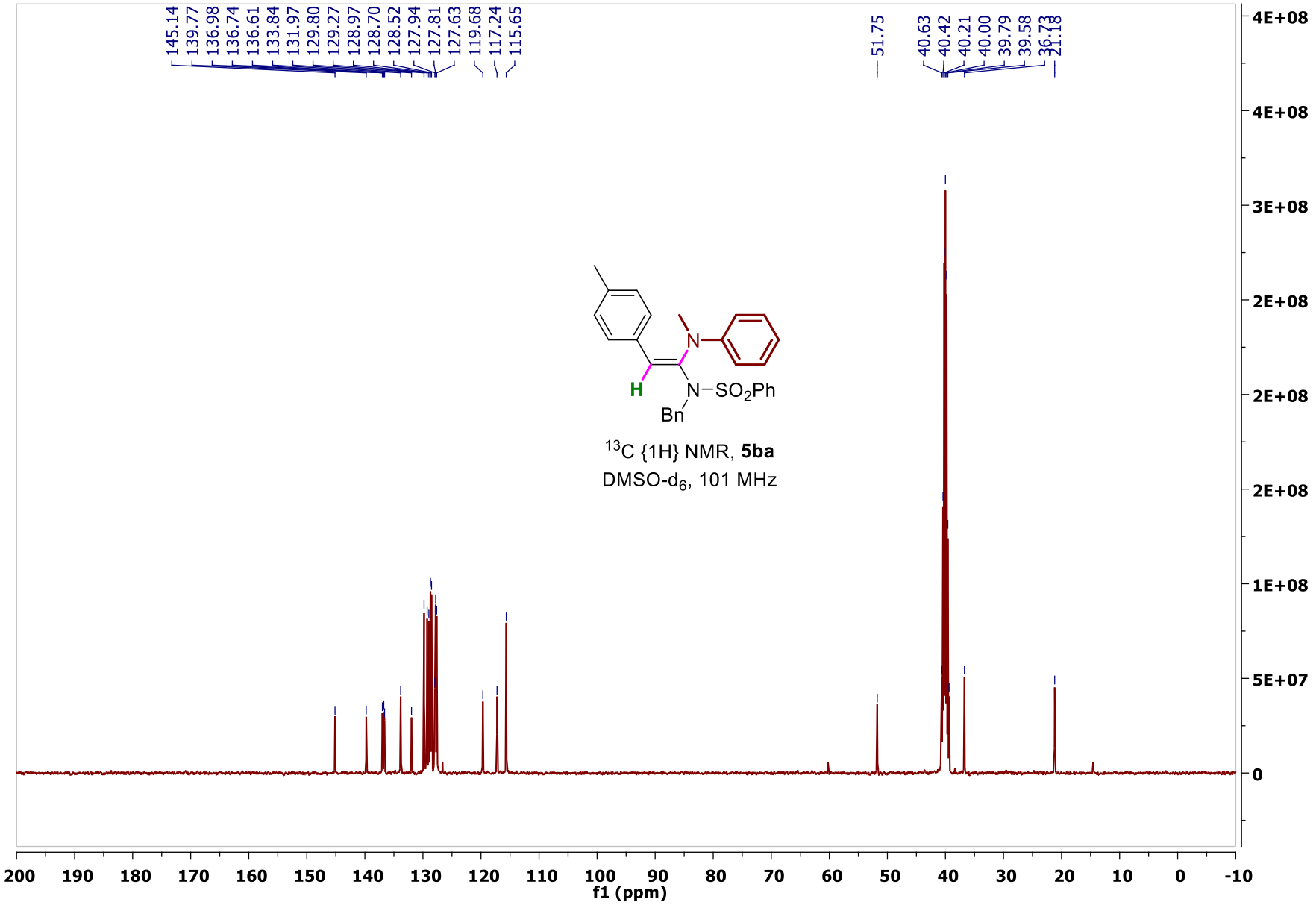

155.82
144.06
139.00
136.73
134.69
133.89
129.51
128.88
128.58
128.51
128.15
127.87
127.63
126.83
126.60
125.44
119.24
114.39
50.81
40.63
40.42
40.21
40.00
39.79
39.58
39.37
Bn
N
SO2Ph
N
Bn
N
SO2P
h
Ph
13C {1H} NMR, 3ap
DMSO-d6, 101 MHz
2E+08
2E+08
1E+08
1E+08
1E+08
1E+08
1E+08
9E+07
8E+07
7E+07
6E+07
5E+07
4E+07
3E+07
2E+07
1E+07
0
-1E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

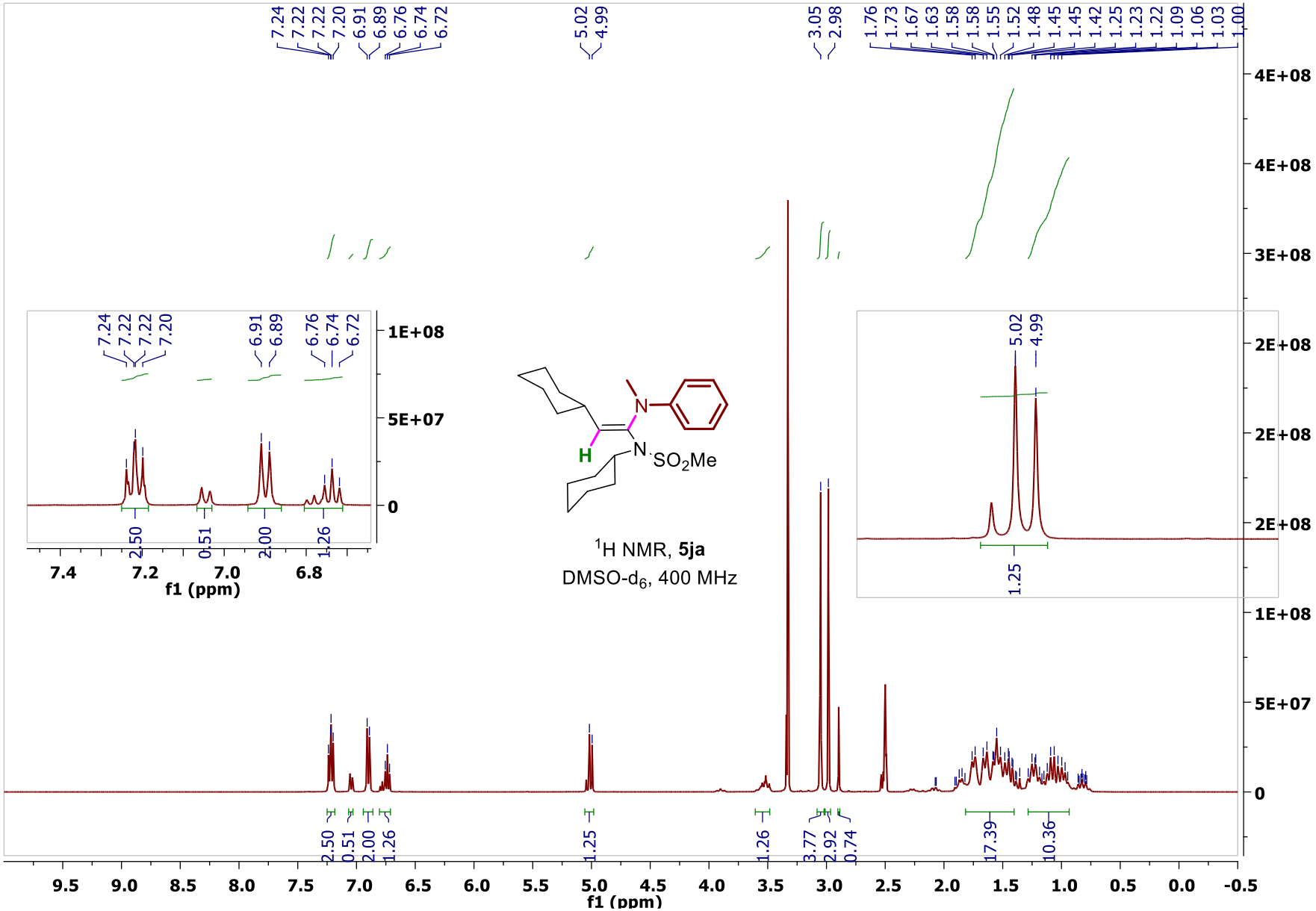

7.86
7.84
7.72
7.63
7.61
7.59
7.29
7.27
7.21
7.20
7.19
7.10
7.08
7.05
7.03
7.00
6.98
6.96
6.95
6.67
6.62
6.60
6.01
4.60
3.34
2.57
2.50
Ph
N
H
N−SO2Ph
Bn
1H NMR, 5aa
DMSO-d6, 400 MHz
1.97
1.00
2.00
3.00
2.00
1.97
4.96
1.00
1.96
1.01
2.00
2.97
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

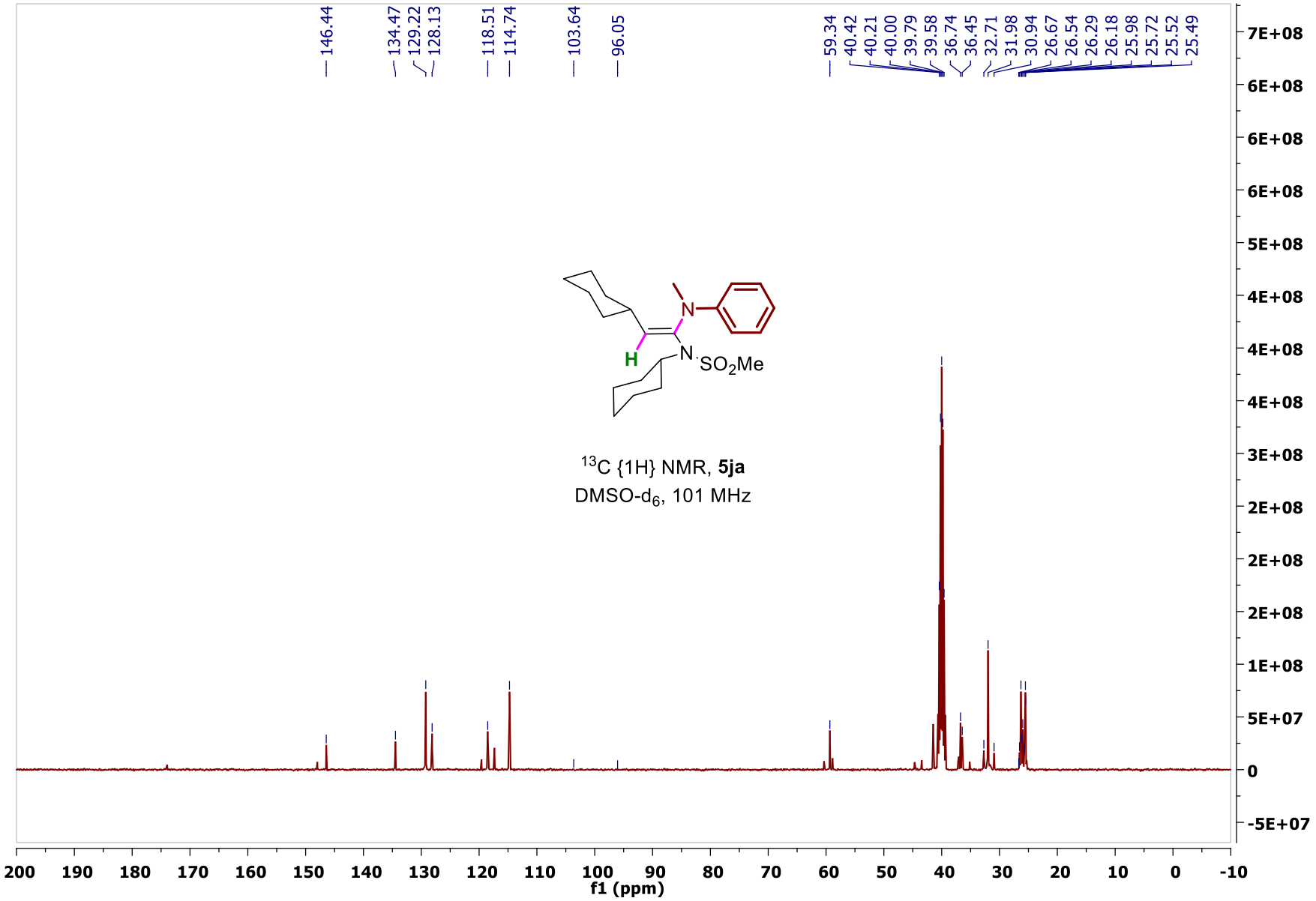

145.10
139.71
137.67
136.92
134.92
133.88
129.83
128.94
128.72
128.61
128.54
127.97
127.82
127.60
127.20
119.85
116.74
115.92
51.75
40.63
40.42
40.21
40.00
39.79
39.58
39.37
36.87
Ph
N
H
N−SO2Ph
Bn
13C {1H} NMR, 5aa
DMSO-d6, 101 MHz
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.88
7.86
7.86
7.77
7.75
7.73
7.65
7.63
7.61
7.33
7.31
7.30
7.28
7.23
7.22
7.21
7.21
7.04
7.02
7.02
7.00
6.97
6.95
6.91
6.89
6.73
6.71
6.69
6.64
6.62
4.82
3.39
2.61
2.55
2.54
2.54
2.53
2.53
2.19
2.02
N
H
N−SO2Ph
Bn
1H NMR, 5ba
DMSO-d6, 400 MHz
2.01
1.03
2.05
2.97
1.97
2.03
1.98
2.01
1.00
1.98
1.01
1.98
3.05
3.00
f1 (ppm)


7.96
7.94
7.94
7.85
7.83
7.81
7.73
7.71
7.69
7.41
7.39
7.38
7.36
7.31
7.30
7.29
7.29
7.12
7.10
7.10
7.08
7.05
7.03
6.99
6.97
6.81
6.79
6.77
6.72
6.70
4.70
2.69
2.63
2.62
2.62
2.61
2.61
Hb
Ha
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
-1E+08
-2E+08
-2E+08
-2E+08
-2E+08
-3E+08
-4E+08
-4E+08
-4E+08
-5E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)
X
N
Ha Hb
N−SO2Ph
Hb
Ph


145.14
139.77
136.98
136.74
136.61
133.84
131.97
129.80
129.27
128.97
128.70
128.52
127.94
127.81
127.63
119.68
117.24
115.65
51.75
40.63
40.42
40.21
40.00
39.79
39.58
36.73
21.18
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
N
H
N−SO2Ph
Bn
13C {1H} NMR, 5ba
DMSO-d6, 101 MHz
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


7.24
7.22
7.22
7.20
6.91
6.89
6.76
6.74
6.72
5.02
4.99
3.05
2.98
1.76
1.73
1.67
1.63
1.58
1.58
1.55
1.52
1.48
1.45
1.45
1.42
1.25
1.23
1.22
1.09
1.06
1.03
1.00
4E+08
3E+08
2E+08
1E+08
5E+07
0
2.50
0.51
2.00
1.26
1.25
1.26
3.77
2.92
0.74
17.39
10.36
f1 (ppm)
N
N
SO2Me
H
1H NMR, 5ja
DMSO-d6, 400 MHz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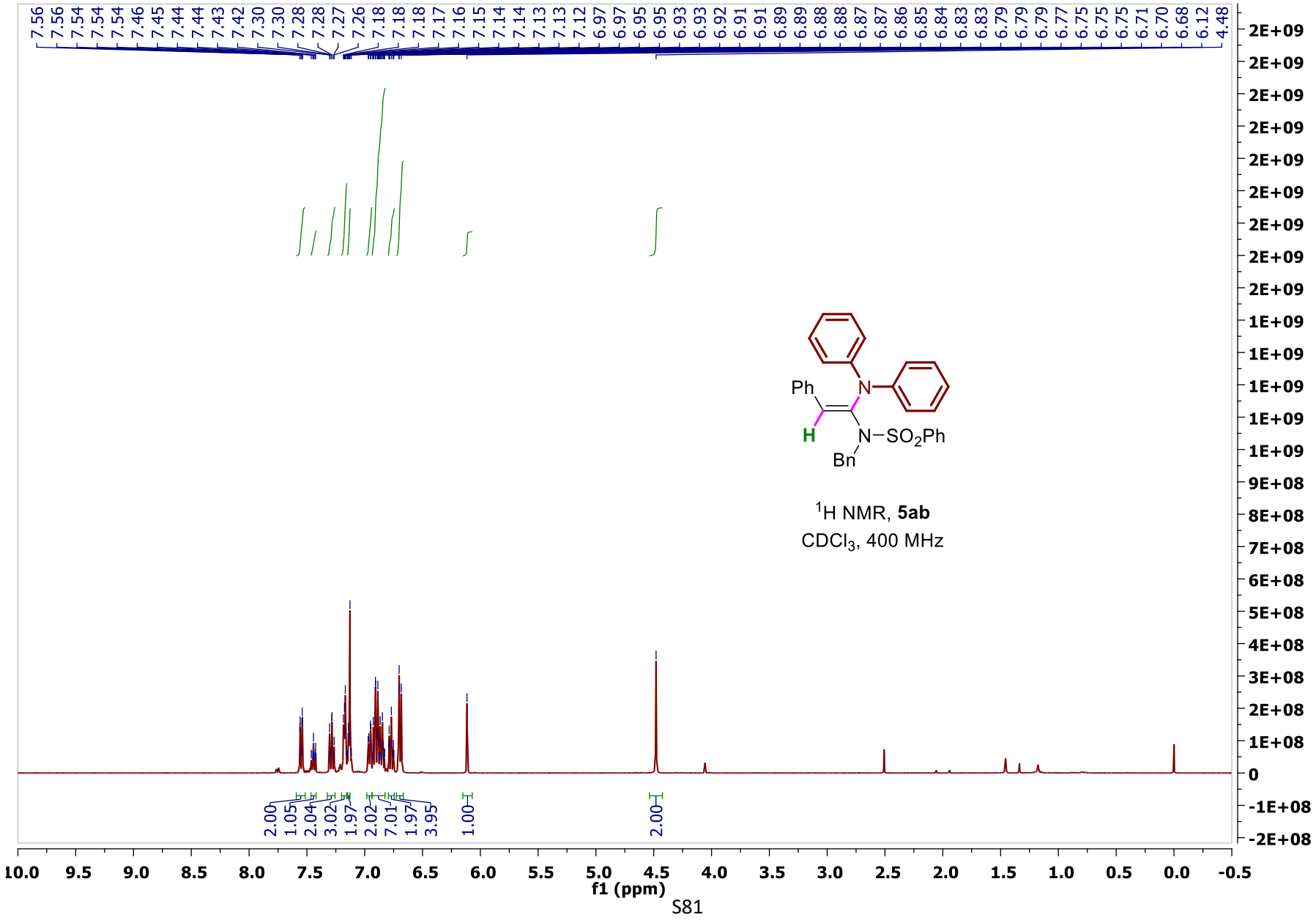
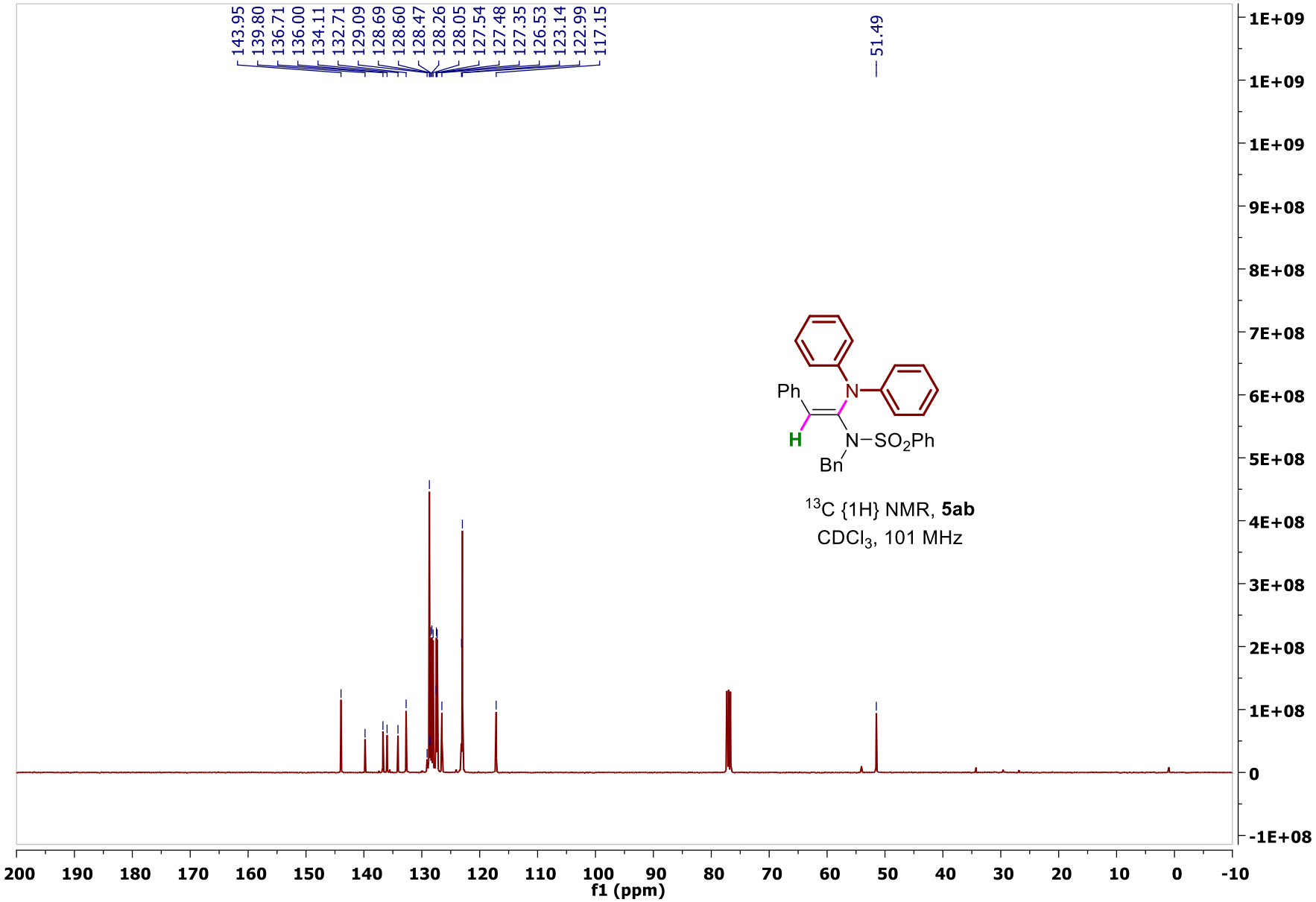
134.47
129.22
128.13
118.51
114.74
103.64
96.05
59.34
40.42
40.21
40.00
39.79
39.58
36.74
36.45
32.71
31.98
30.94
26.67
26.54
26.29
26.18
25.98
25.72
25.52
25.49
N
N
H
SO2Me
13C {1H} NMR, 5ja
DMSO-d6, 101 MHz
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


Ph
N
H
N–SO2Ph
Bn
1H NMR, 5ab
CDCl3, 400 MHz
f1 (ppm)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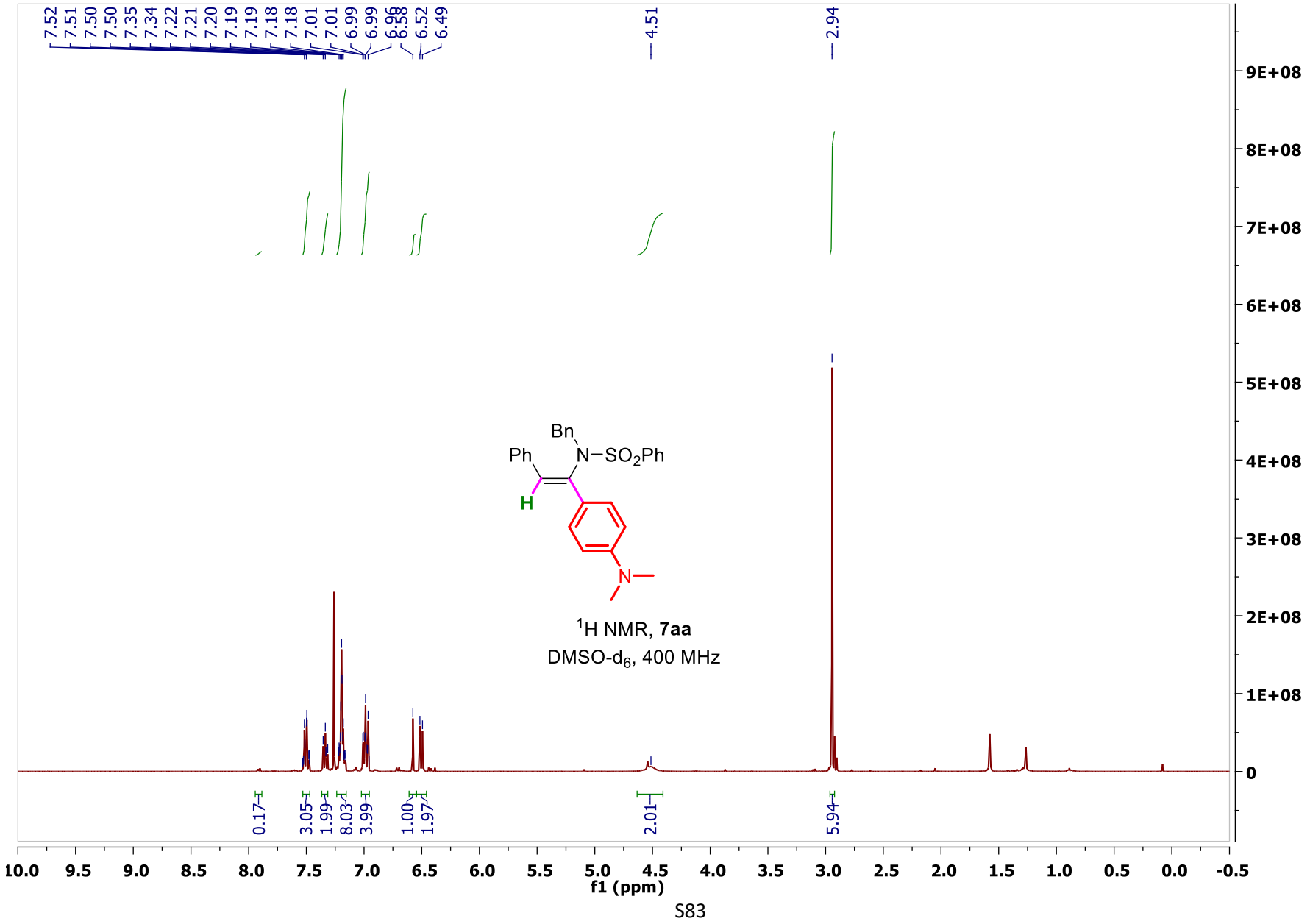
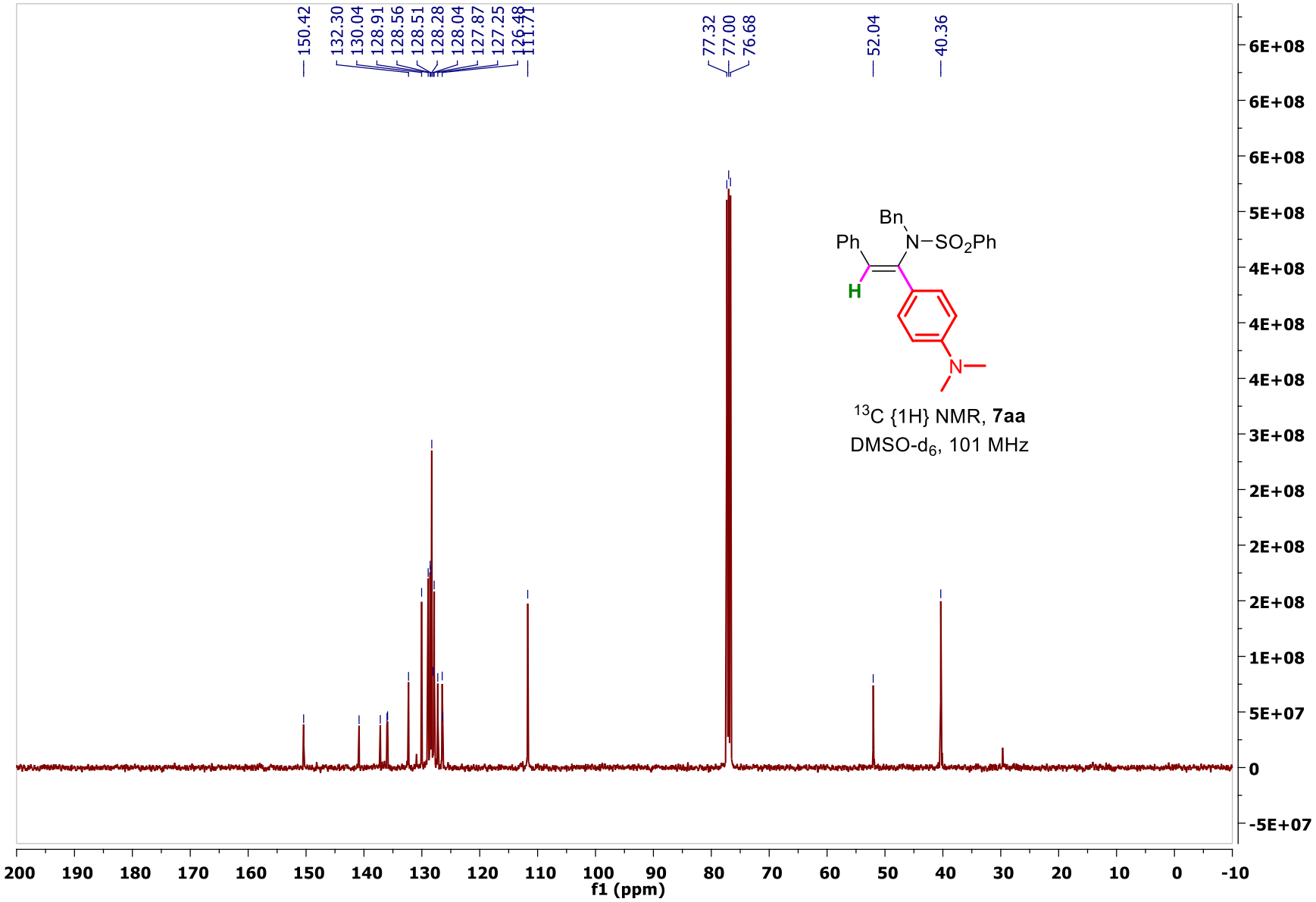
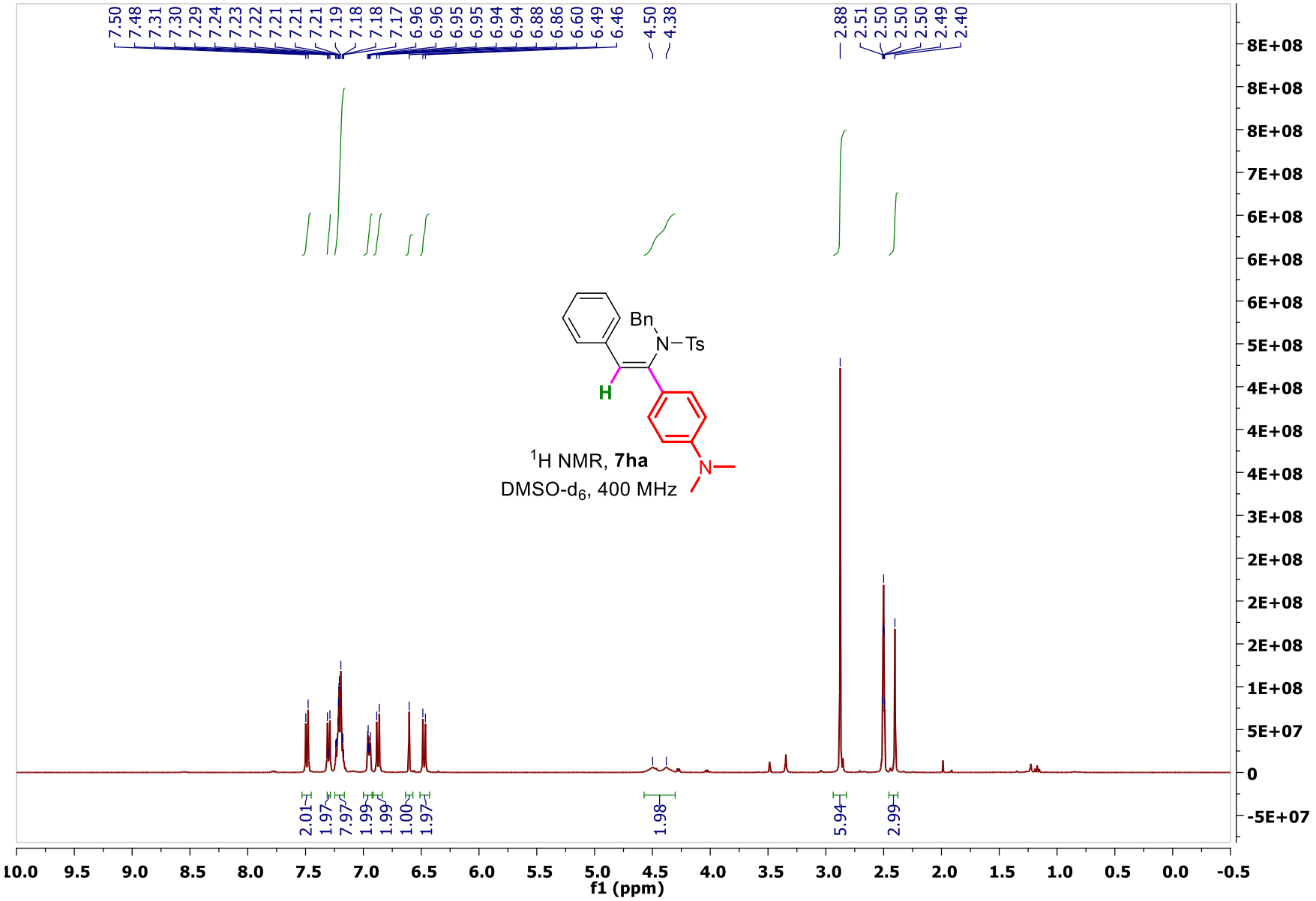
139.80
136.71
136.00
134.11
132.71
129.09
128.69
128.60
128.47
128.26
128.05
127.54
127.48
127.35
126.53
123.14
122.99
117.15
51.49
Ph
N
H
N−SO2Ph
Bn
13C {1H} NMR, 5ab
CDCl3, 101 MHz
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.52
7.51
7.50
7.50
7.35
7.34
7.22
7.21
7.20
7.19
7.19
7.18
7.18
7.01
7.01
6.99
6.99
6.58
6.52
6.49
4.51
2.94
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
Bn
Ph
N−SO2Ph
H
N
1H NMR, 7aa
DMSO-d6, 400 MHz
0.17
3.05
1.99
8.03
3.99
1.00
1.97
2.01
5.94
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)


150.42
132.30
130.04
128.91
128.56
128.51
128.28
128.04
127.87
127.25
126.48
111.71
77.32
77.00
76.68
52.04
40.36
Bn
Ph
N−SO2Ph
H
N
13C {1H} NMR, 7aa
DMSO-d6, 101 MHz
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
5E+07
0
-5E+07
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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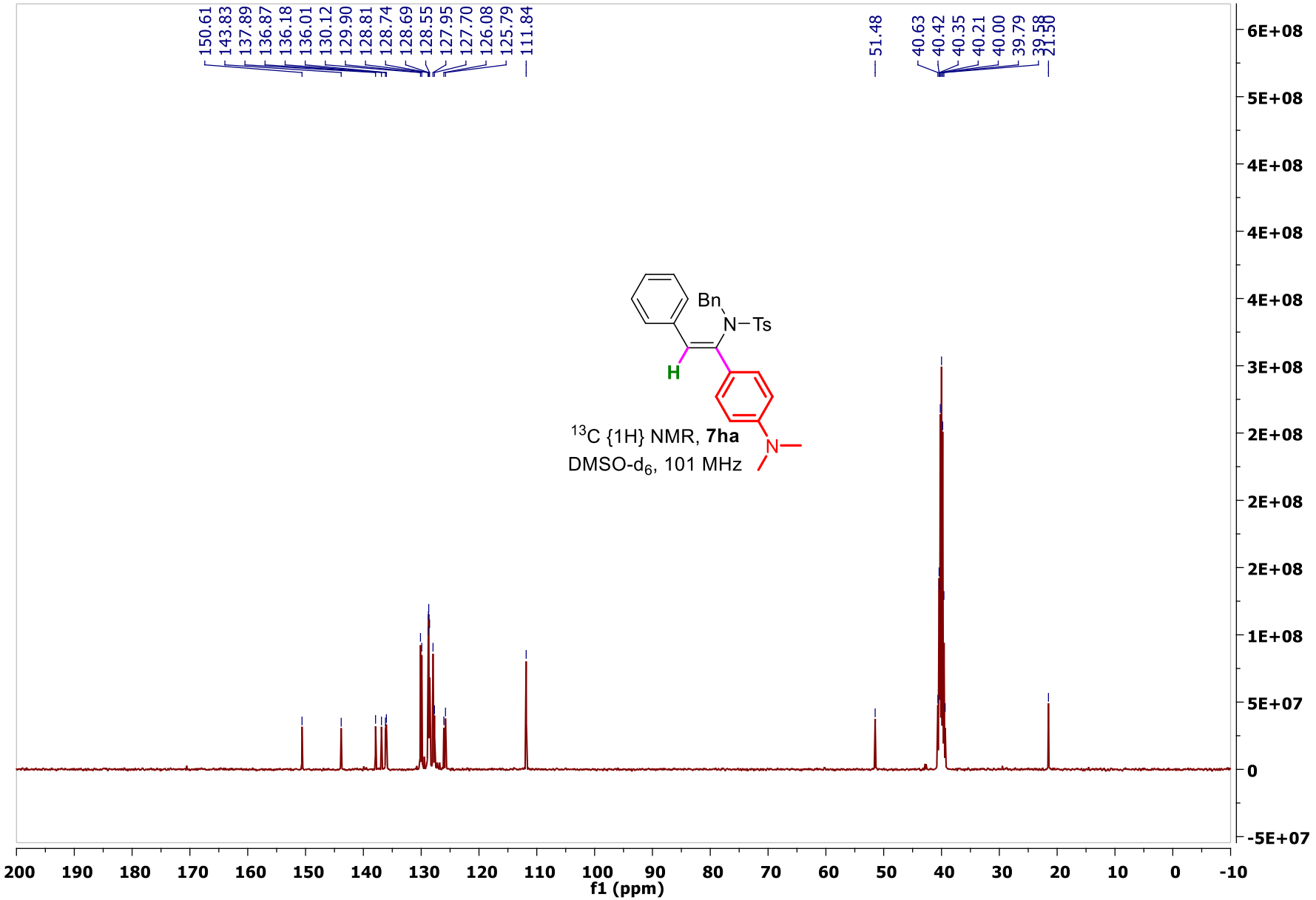
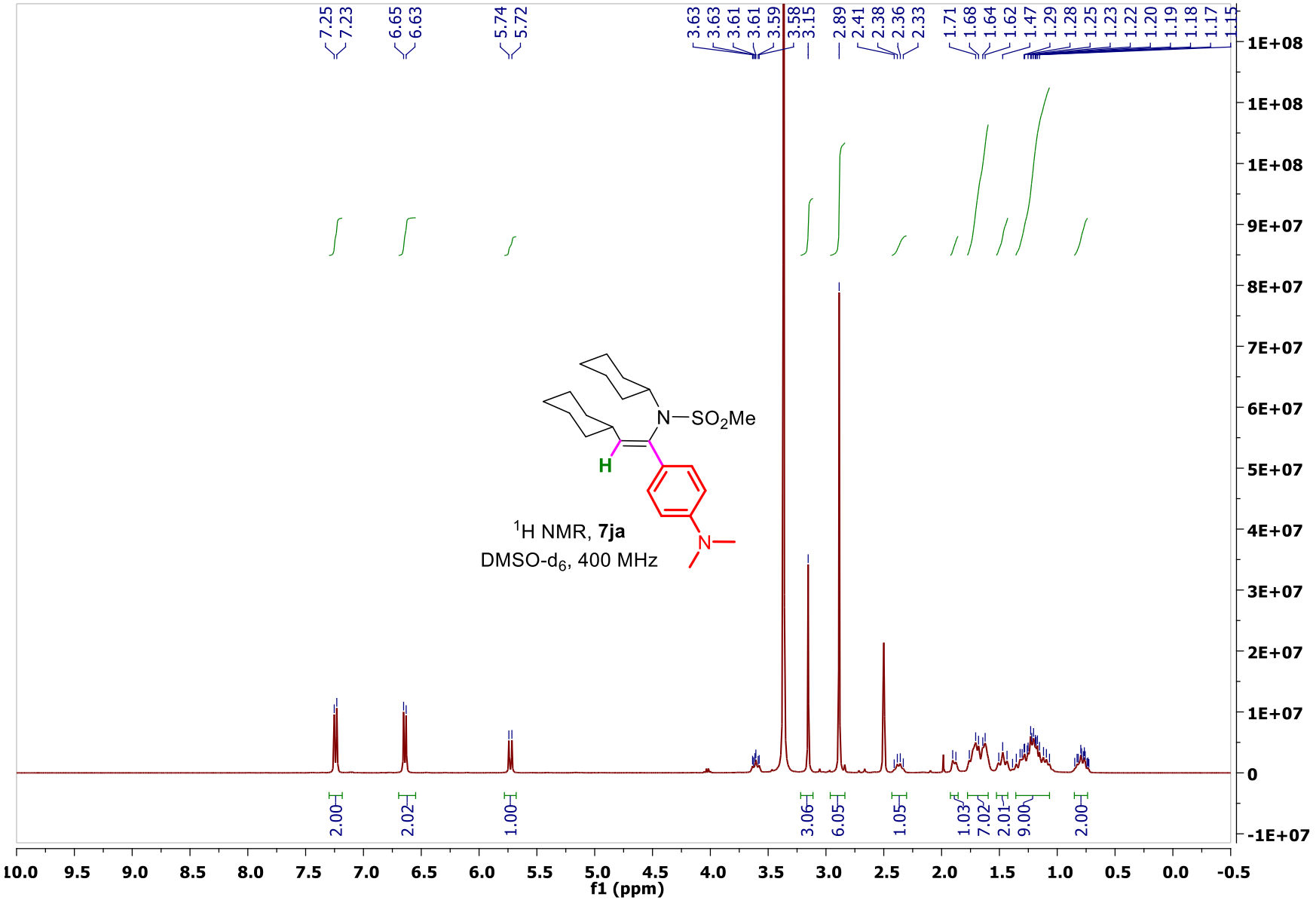
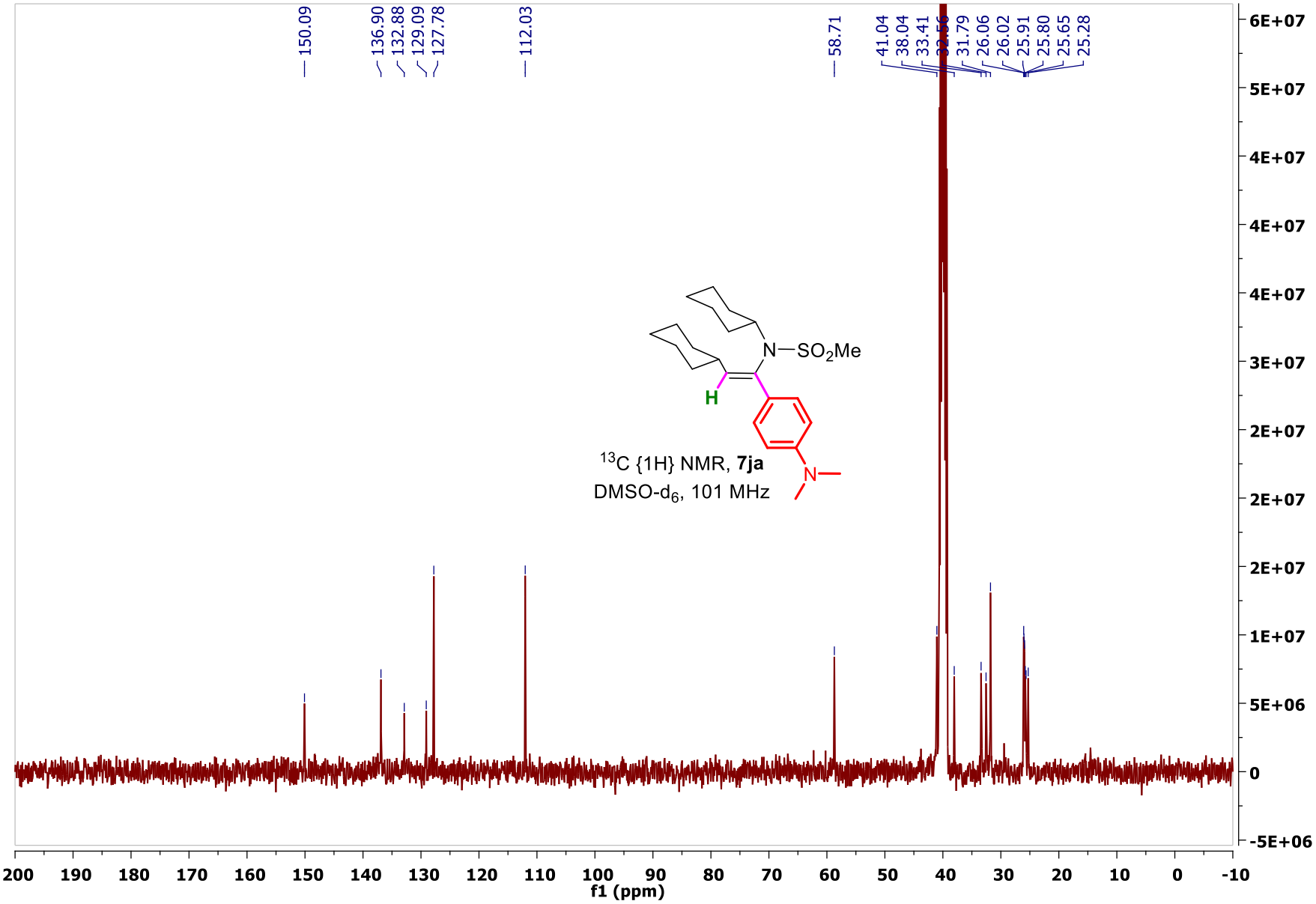
7.48
7.31
7.30
7.29
7.24
7.23
7.22
7.21
7.21
7.21
7.19
7.18
7.18
7.17
6.96
6.96
6.95
6.95
6.94
6.94
6.88
6.86
6.60
6.49
6.46
4.50
4.38
2.88
2.51
2.50
2.50
2.50
2.49
2.40
Bn
N−Ts
H
N
^{1}H NMR, **7ha**
DMSO-d$_6$, 400 MHz
2.01
1.97
7.97
1.99
1.99
1.00
1.97
1.98
5.94
2.99
f1 (ppm)


150.61
143.83
137.89
136.87
136.18
136.01
130.12
129.90
128.81
128.74
128.69
128.55
127.95
127.70
126.08
125.79
111.84
51.48
40.63
40.42
40.35
40.21
40.00
39.79
39.58
21.50
Bn
N–Ts
H
N
13C {1H} NMR, 7ha
DMSO-d6, 101 MHz
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.25
7.23
6.65
6.63
5.74
5.72
3.63
3.63
3.61
3.61
3.59
3.58
3.15
2.89
2.41
2.38
2.36
2.33
1.71
1.68
1.64
1.62
1.47
1.29
1.28
1.25
1.23
1.22
1.20
1.19
1.18
1.17
1.15
N—SO2Me
H
N
1H NMR, 7ja
DMSO-d6, 400 MHz
2.00
2.02
1.00
3.06
6.05
1.05
1.03
7.02
2.01
9.00
2.00
f1 (ppm)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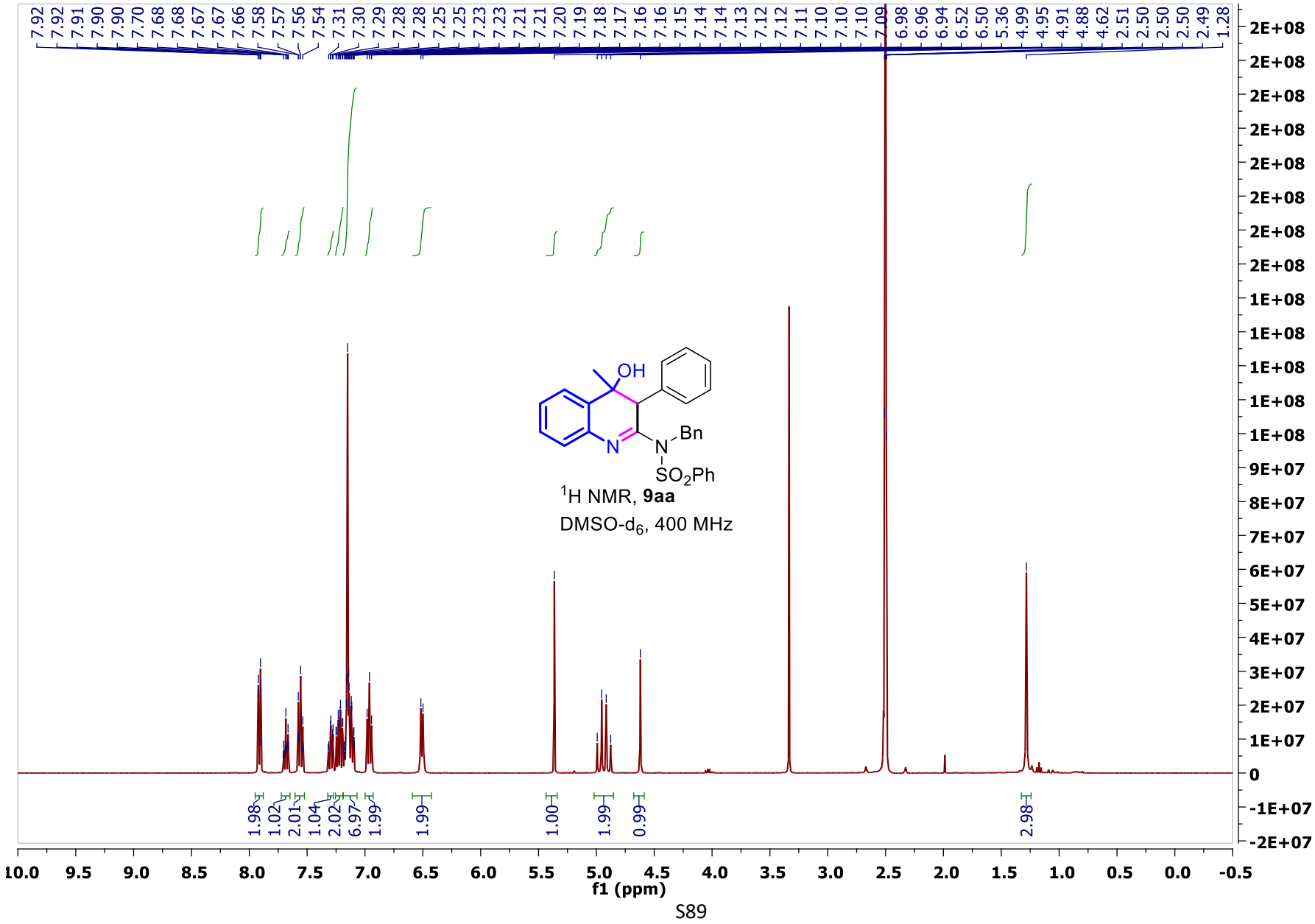
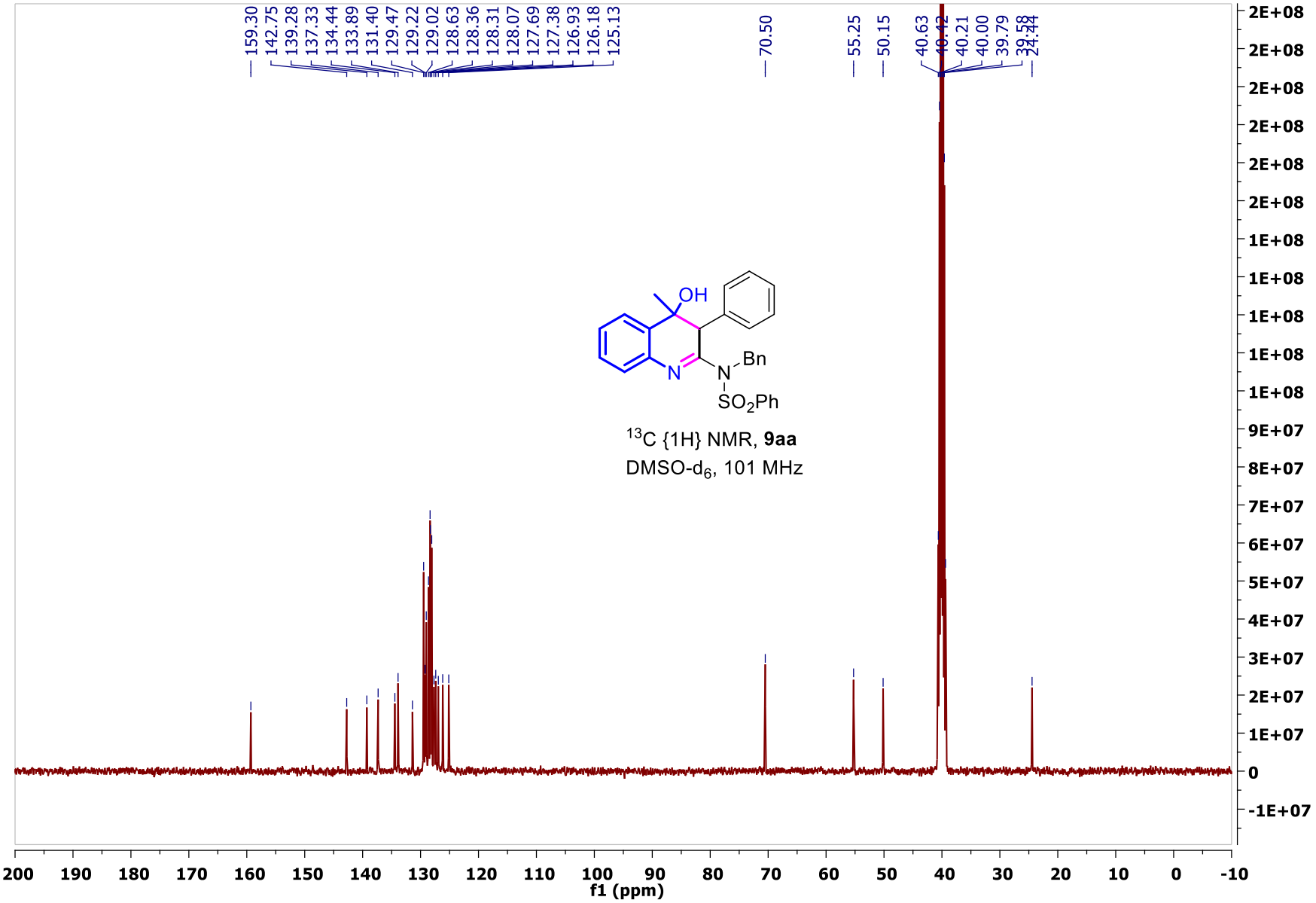
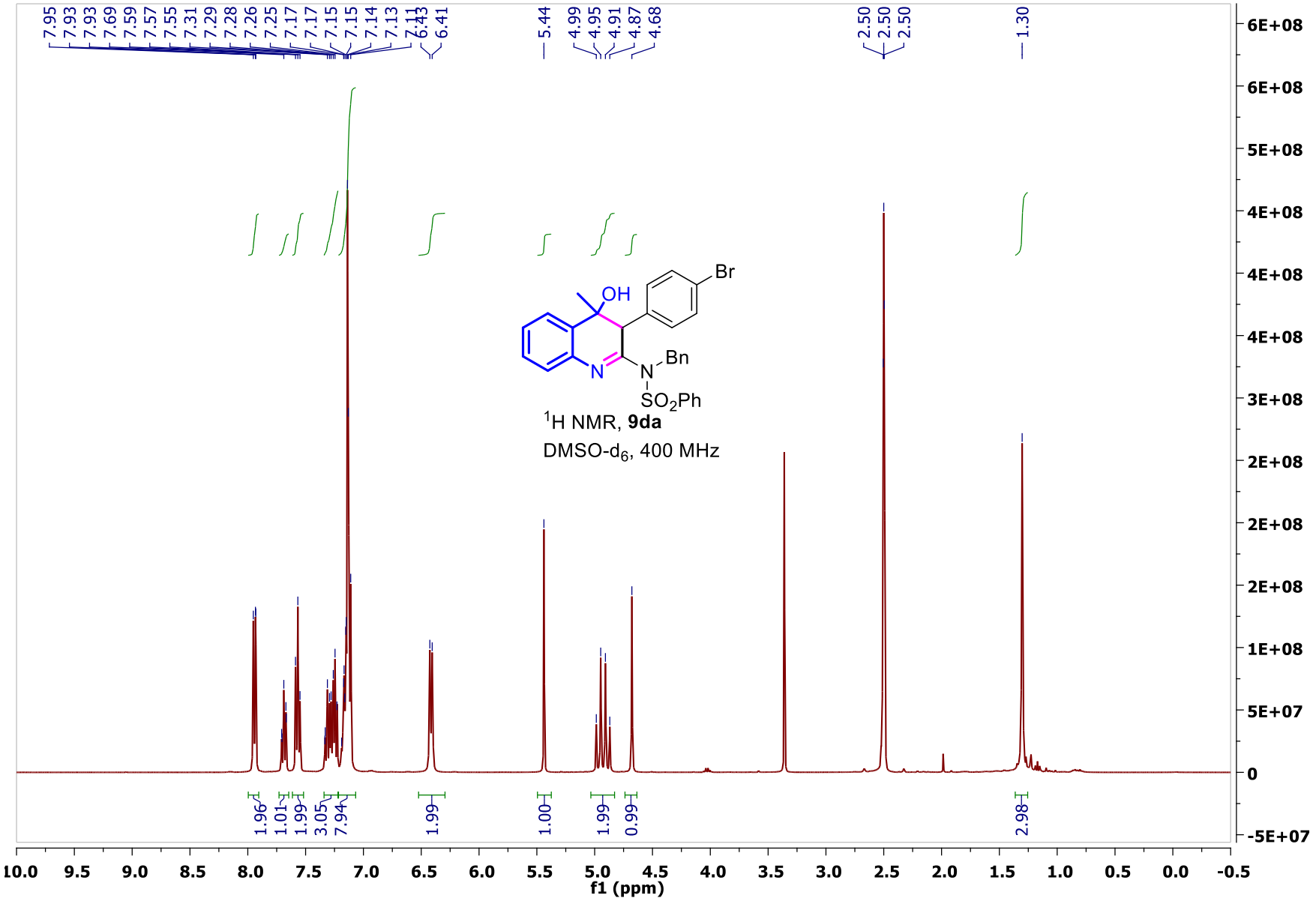
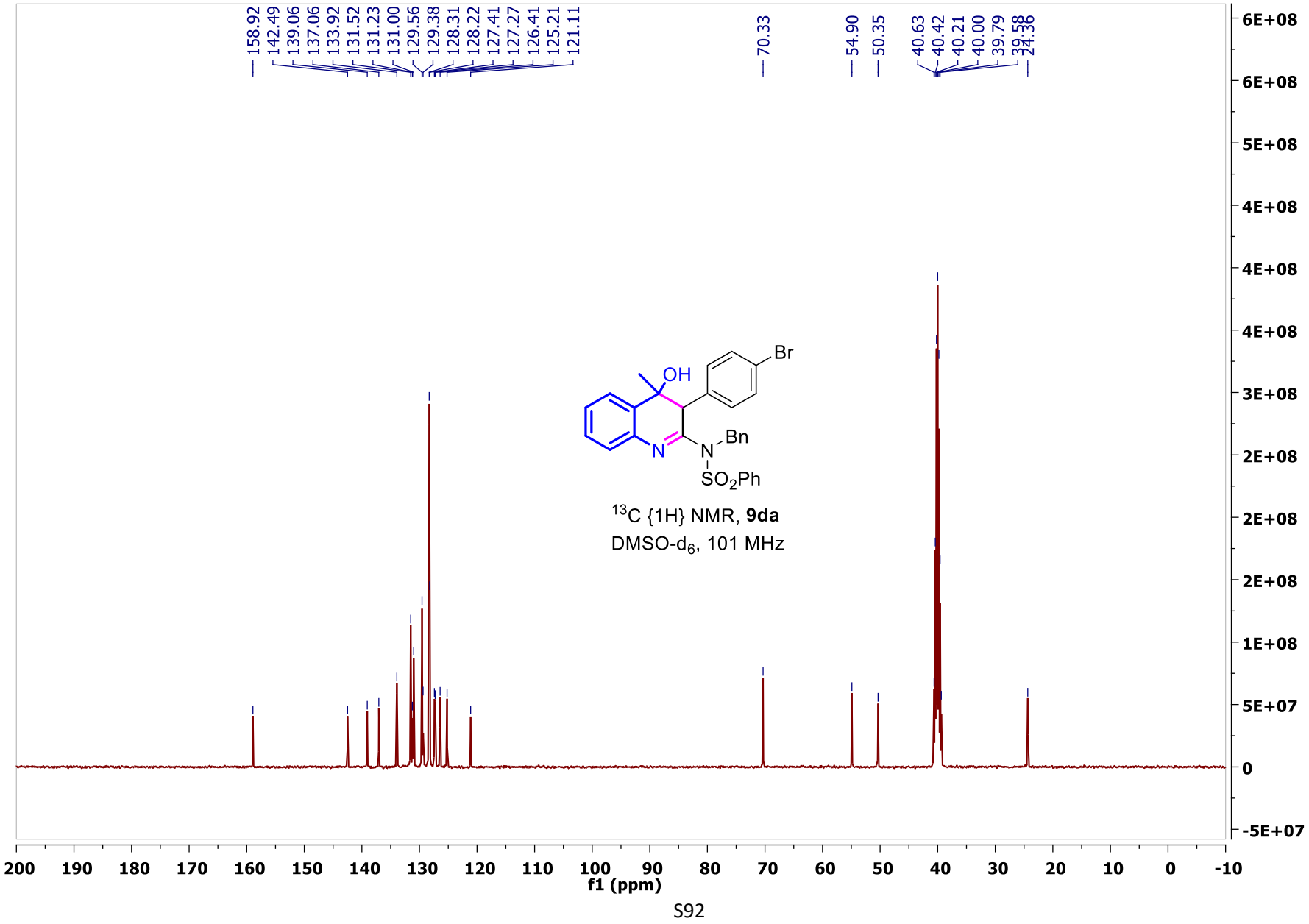
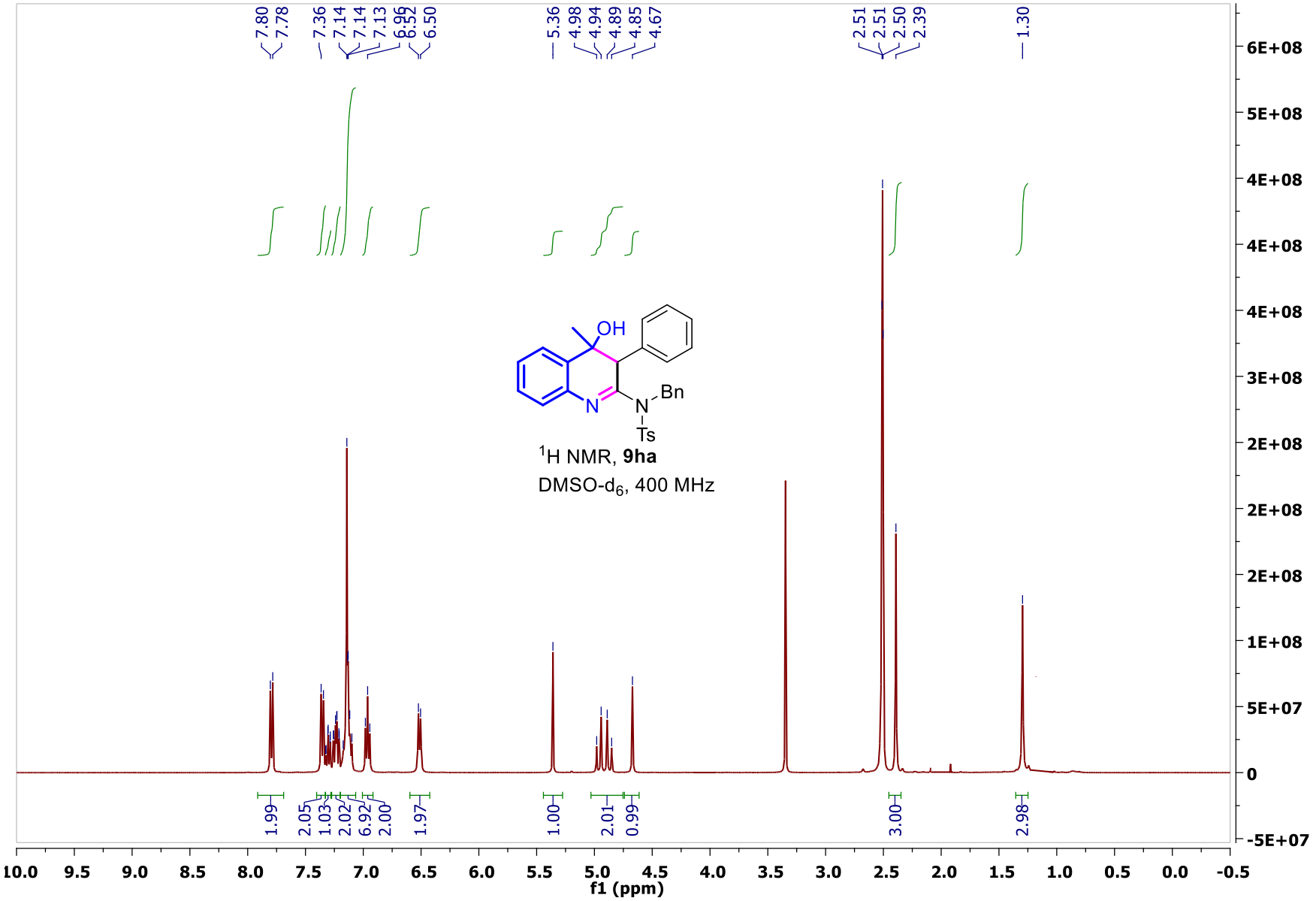
136.90
132.88
129.09
127.78
112.03
58.71
41.04
38.04
33.41
32.56
31.79
26.06
26.02
25.91
25.80
25.65
25.28
N—SO2Me
H
N
13C {1H} NMR, 7ja
DMSO-d6, 101 MHz
6E+07
5E+07
4E+07
4E+07
4E+07
3E+07
2E+07
2E+07
2E+07
1E+07
5E+06
0
-5E+06
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

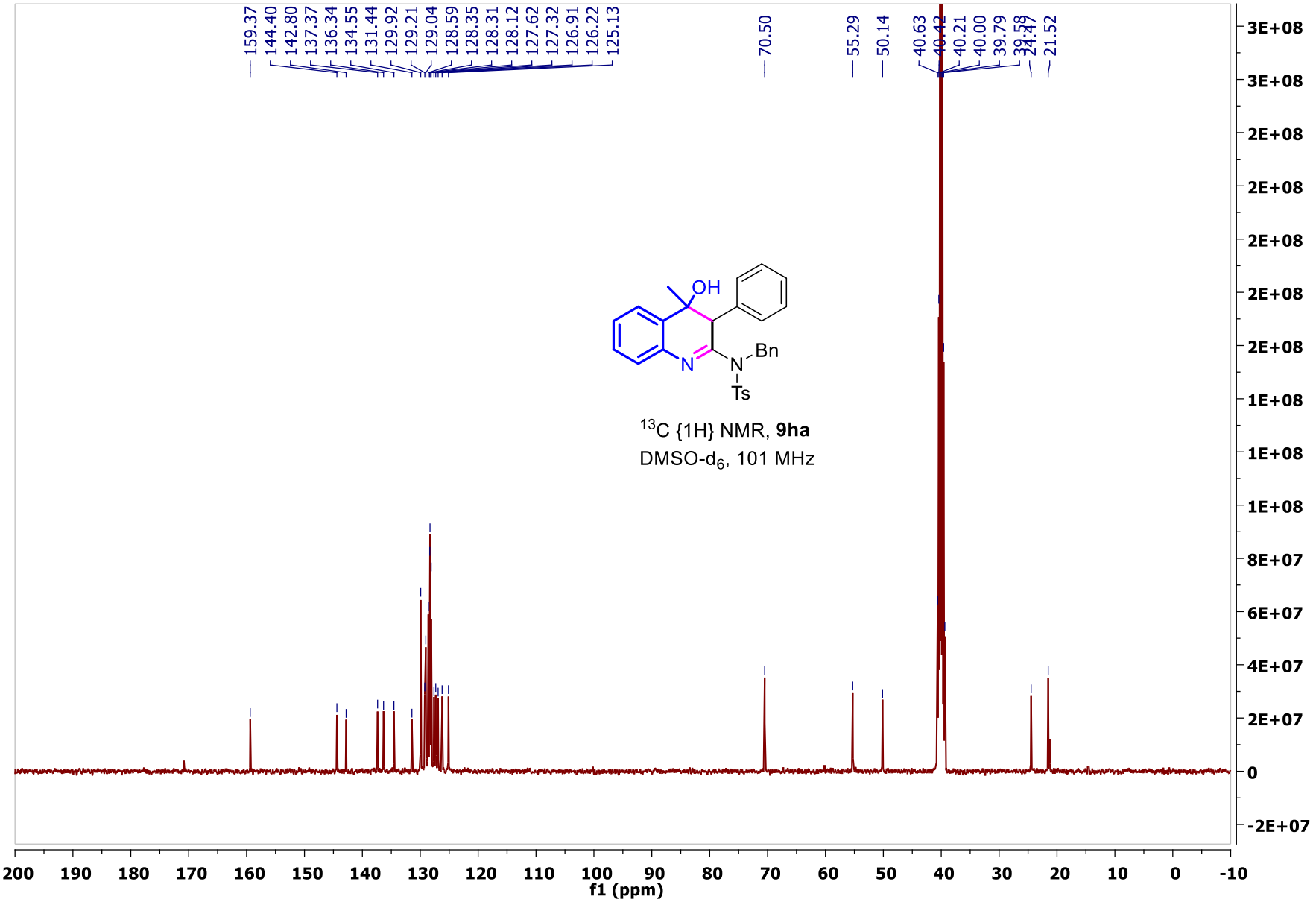

OH
N
N
Bn
SO2Ph
1H NMR, 9aa
DMSO-d6, 400 MHz
f1 (ppm)


159.30
142.75
139.28
137.33
134.44
133.89
131.40
129.47
129.22
129.02
128.63
128.36
128.31
128.07
127.69
127.38
126.93
126.18
125.13
70.50
55.25
50.15
40.63
40.42
40.21
40.00
39.79
39.58
24.44
OH
N
N
Bn
SO2Ph
13C {1H} NMR, 9aa
DMSO-d6, 101 MHz
f1 (ppm)


7.95
7.93
7.93
7.69
7.59
7.57
7.55
7.31
7.29
7.28
7.26
7.25
7.17
7.17
7.15
7.15
7.14
7.13
7.11
6.43
6.41
5.44
4.99
4.95
4.91
4.87
4.68
2.50
2.50
2.50
1.30
Br
OH
N
Bn
N
SO2Ph
1H NMR, 9da
DMSO-d6, 400 MHz
1.96
1.01
1.99
3.05
7.94
1.99
1.00
1.99
0.99
2.98
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


158.92
142.49
139.06
137.06
133.92
131.52
131.23
131.00
129.56
129.38
128.31
128.22
127.41
127.27
126.41
125.21
121.11
70.33
54.90
50.35
40.63
40.42
40.21
40.00
39.79
39.58
24.36
OH
Br
Bn
N
N
SO2Ph
13C {1H} NMR, 9da
DMSO-d6, 101 MHz
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
5E+07
0
-5E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


7.80
7.78
7.36
7.14
7.14
7.13
6.96
6.52
6.50
5.36
4.98
4.94
4.89
4.85
4.67
2.51
2.51
2.50
2.39
1.30
OH
N
N
Bn
Ts
1H NMR, 9ha
DMSO-d6, 400 MHz
1.99
2.05
1.03
2.02
6.92
2.00
1.97
1.00
2.01
0.99
3.00
2.98
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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144.40
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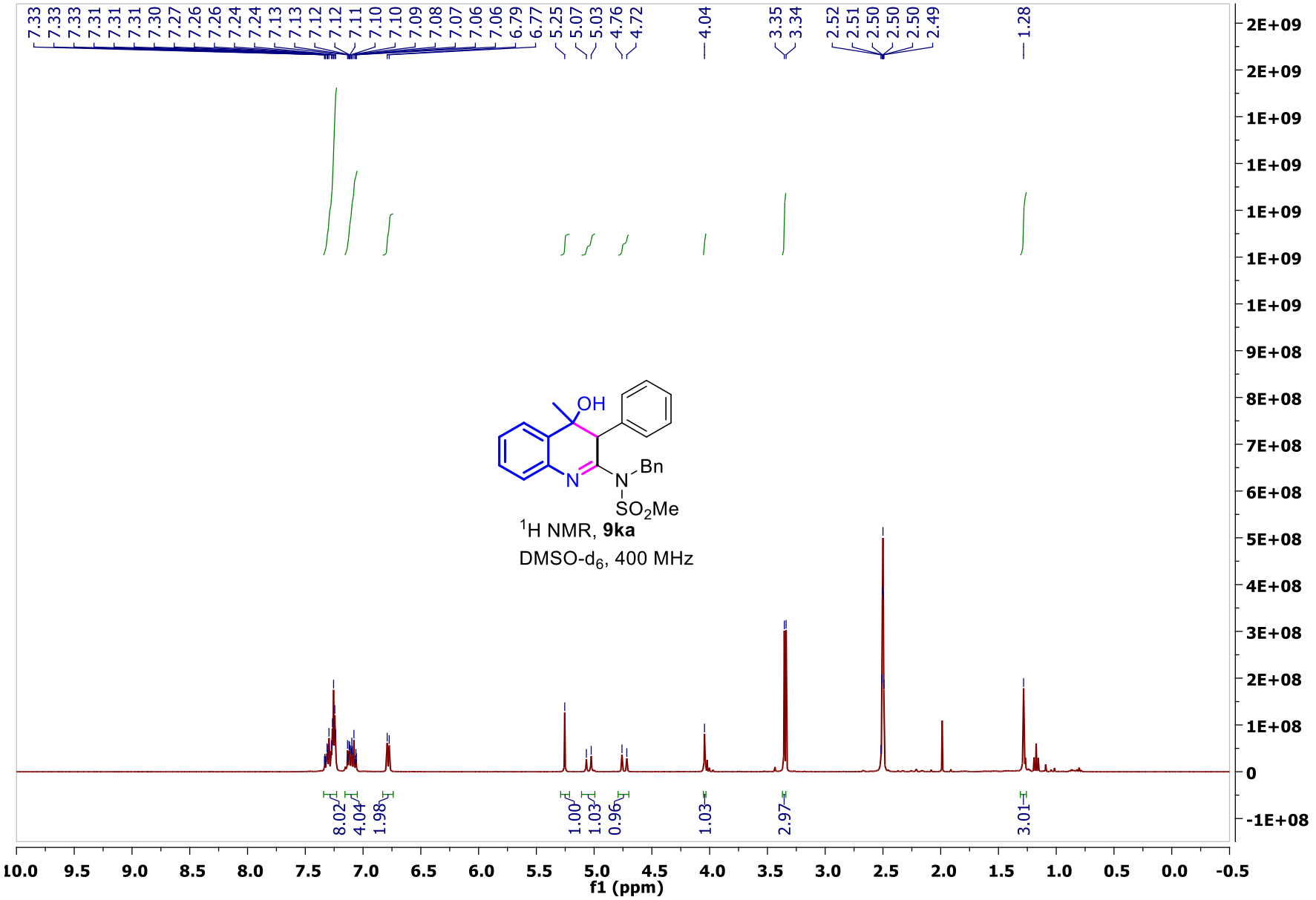
137.37
136.34
134.55
131.44
129.92
129.21
129.04
128.59
128.35
128.31
128.12
127.62
127.32
126.91
126.22
125.13
70.50
55.29
50.14
40.63
40.42
40.21
40.00
39.79
24.47
21.52
OH
N
N
Bn
Ts
13C {1H} NMR, 9ha
DMSO-d6, 101 MHz
3E+08
2E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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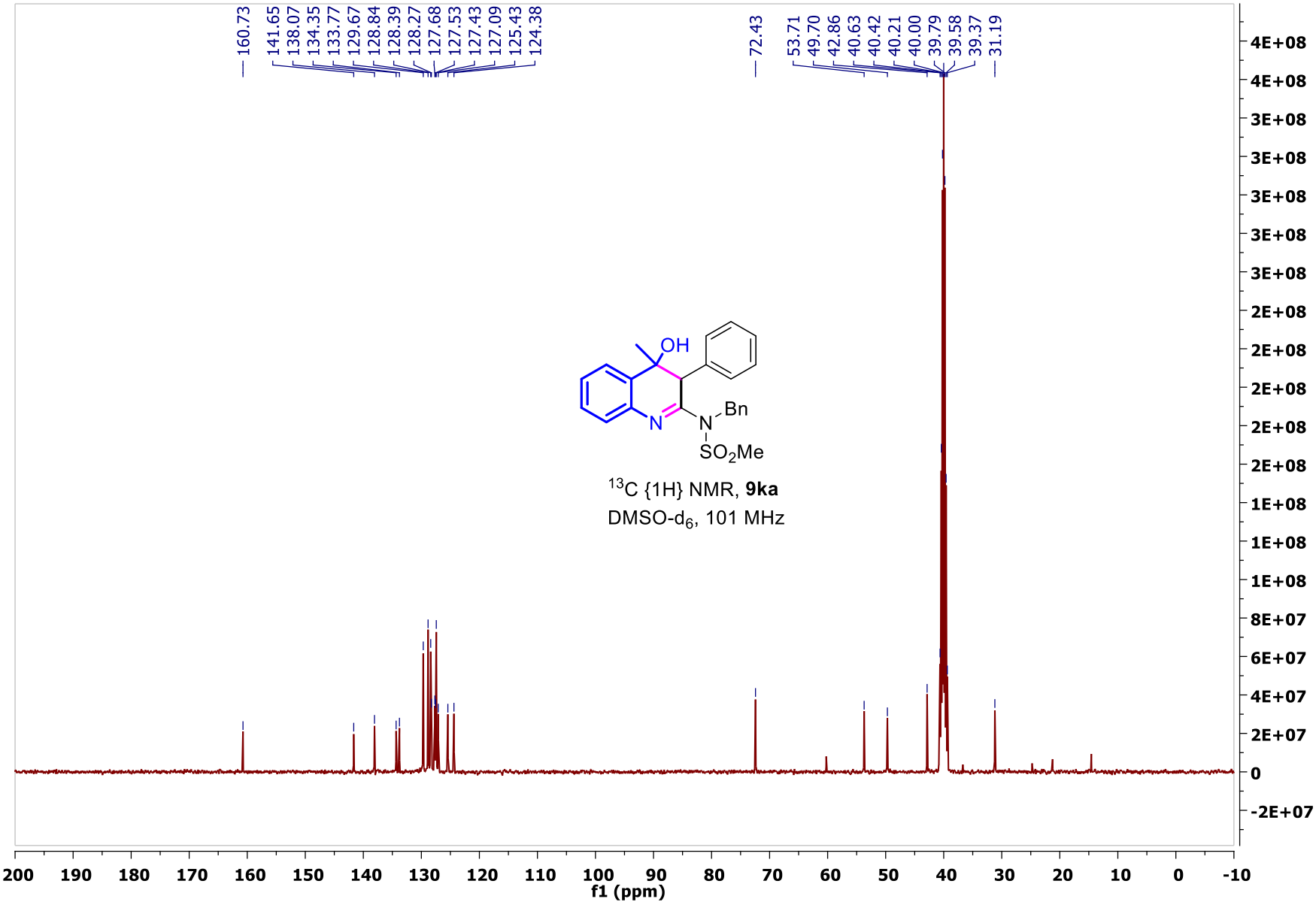
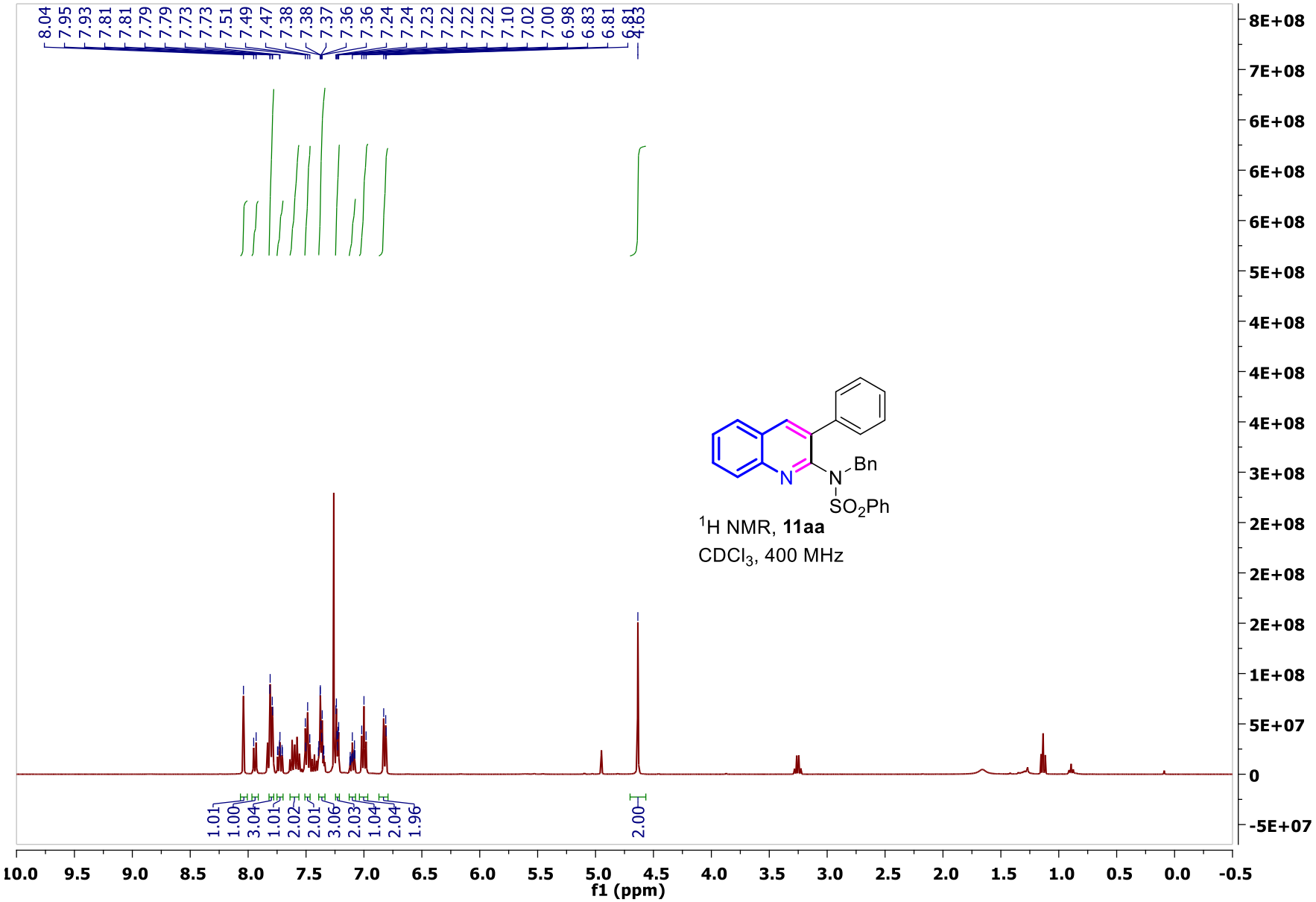
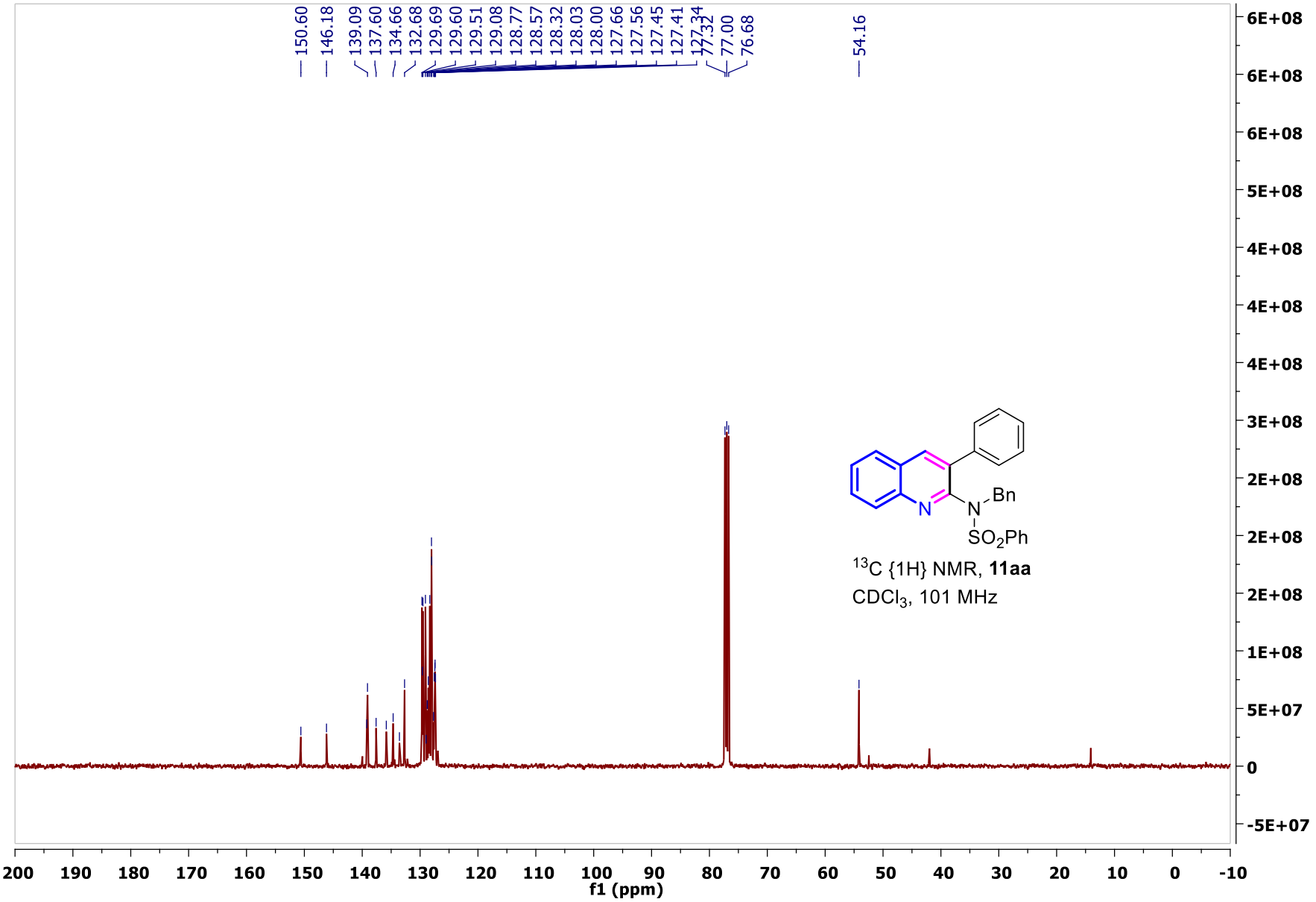
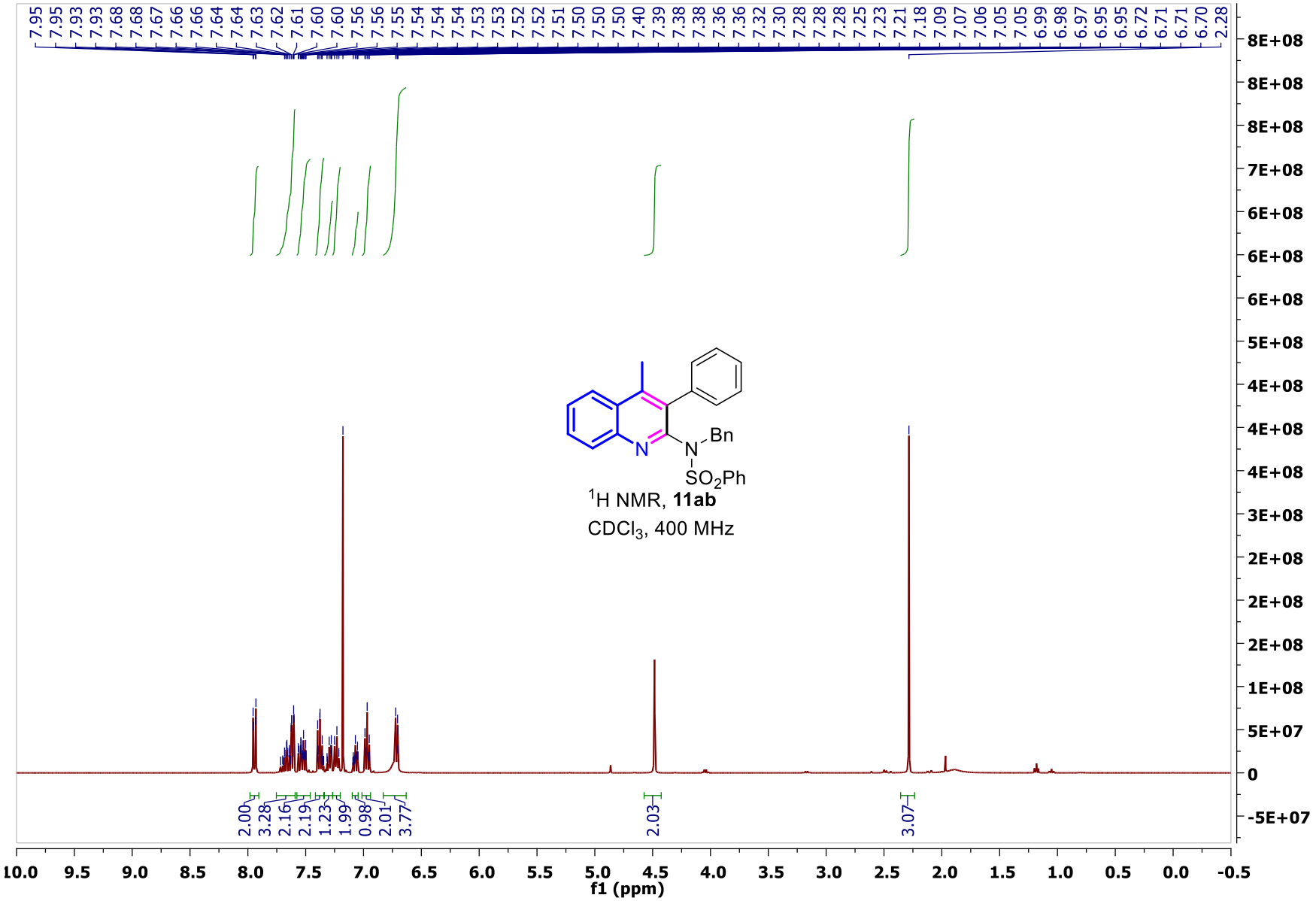
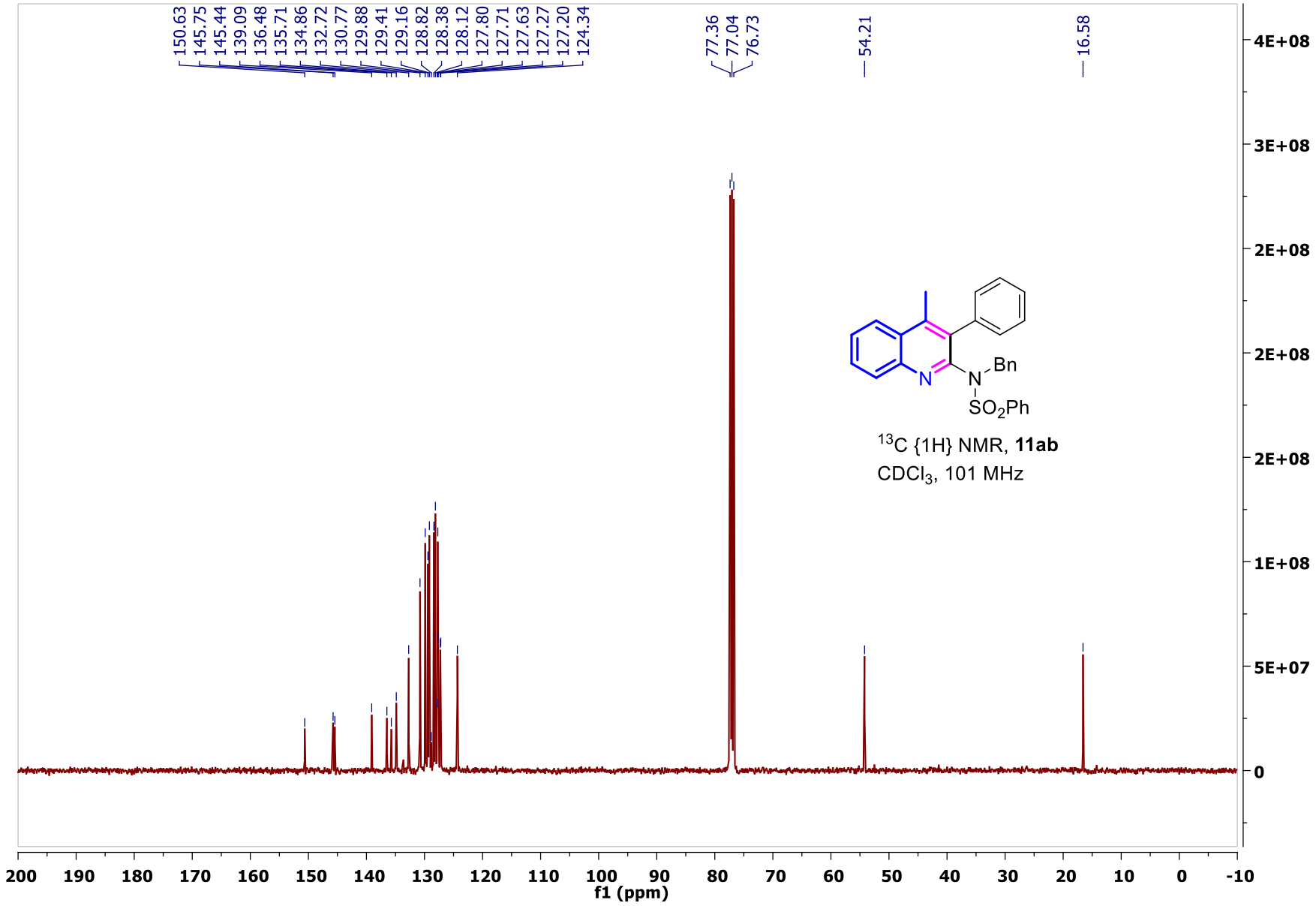
7.33
7.33
7.31
7.31
7.31
7.30
7.27
7.26
7.26
7.24
7.24
7.13
7.13
7.12
7.12
7.11
7.10
7.10
7.09
7.08
7.07
7.06
7.06
6.79
6.77
5.25
5.07
5.03
4.76
4.72
4.04
3.35
3.34
2.52
2.51
2.50
2.50
2.50
2.49
1.28
OH
N
N
Bn
SO2Me
1H NMR, 9ka
DMSO-d6, 400 MHz
8.02
4.04
1.98
1.00
1.03
0.96
1.03
2.97
3.01
f1 (ppm)

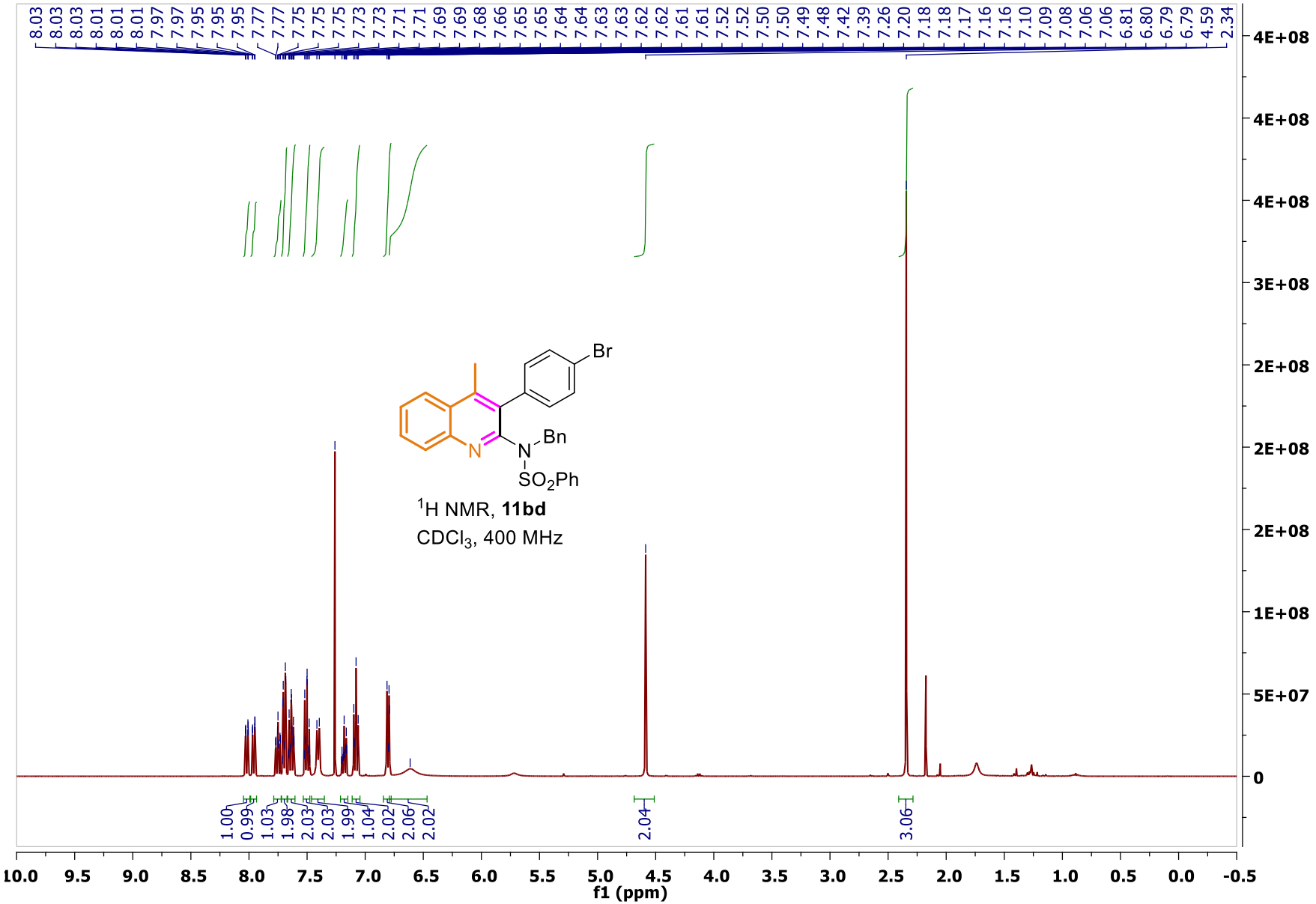

160.73
141.65
138.07
134.35
133.77
129.67
128.84
128.39
128.27
127.68
127.53
127.43
127.09
125.43
124.38
72.43
53.71
49.70
42.86
40.63
40.42
40.21
40.00
39.79
39.58
39.37
31.19
OH
N
N
Bn
SO2Me
13C {1H} NMR, 9ka
DMSO-d6, 101 MHz
4E+08
4E+08
3E+08
3E+08
3E+08
3E+08
3E+08
2E+08
2E+08
2E+08
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

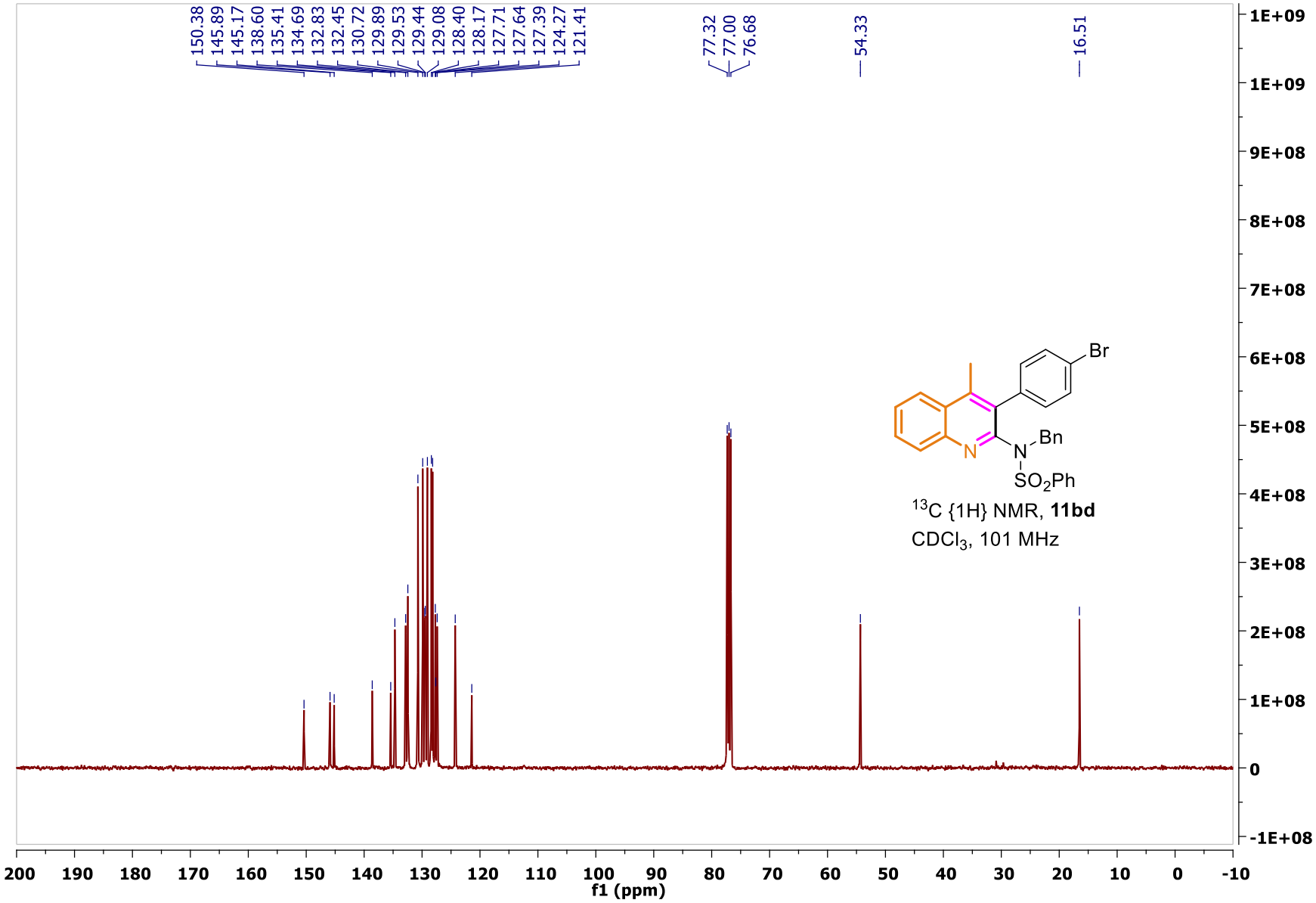

8.04
7.95
7.93
7.81
7.81
7.79
7.79
7.73
7.73
7.51
7.49
7.47
7.38
7.38
7.37
7.36
7.36
7.24
7.24
7.23
7.22
7.22
7.22
7.10
7.02
7.00
6.98
6.83
6.81
6.81
4.63
Bn
N
N
SO2Ph
1H NMR, 11aa
CDCl3, 400 MHz
1.01
1.00
3.04
1.01
2.02
2.01
3.06
2.03
1.04
2.04
1.96
2.00
8E+08
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

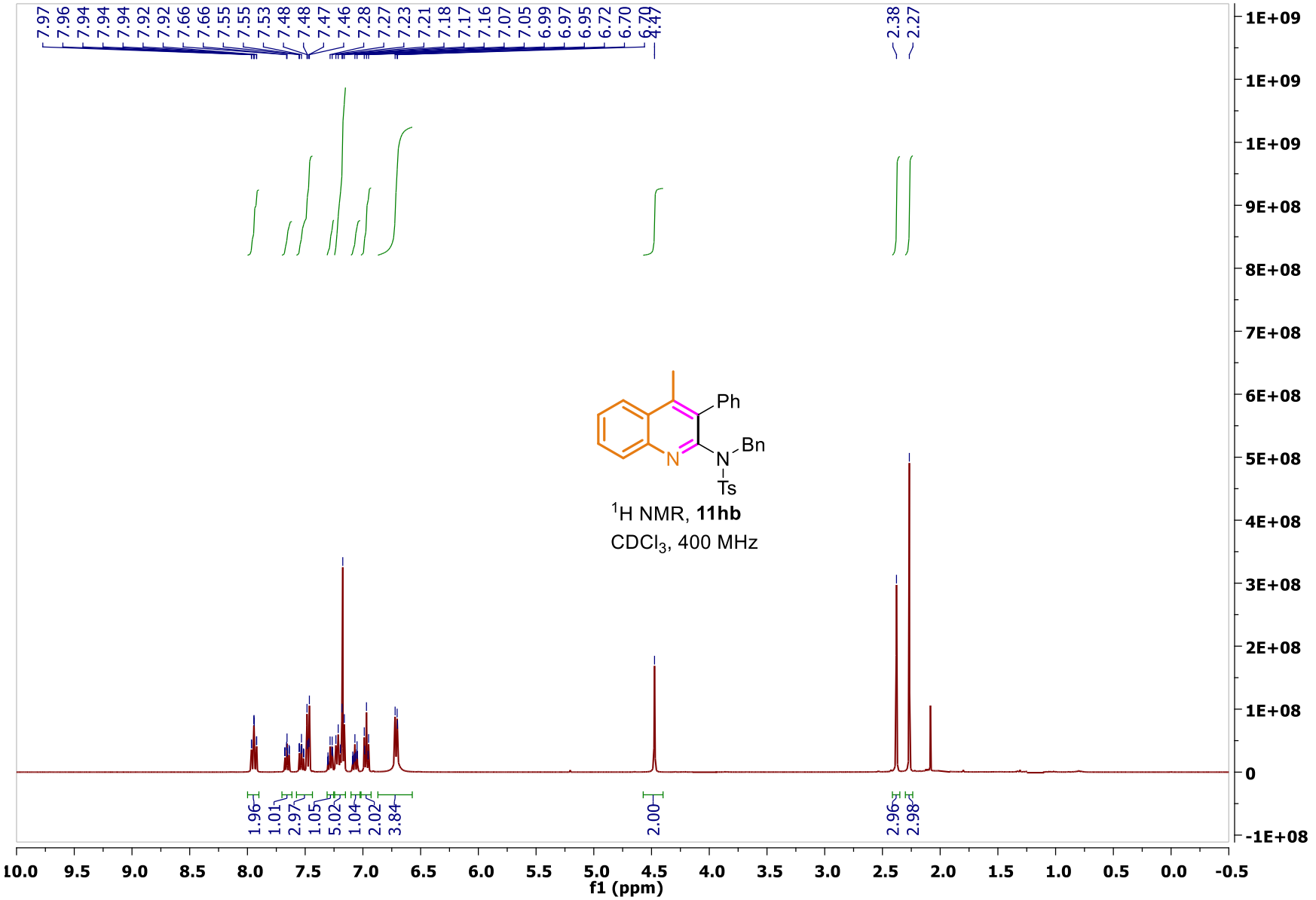

150.60
146.18
139.09
137.60
134.66
132.68
129.69
129.60
129.51
129.08
128.77
128.57
128.32
128.03
128.00
127.66
127.56
127.45
127.41
127.34
77.32
77.00
76.68
54.16
Bn
N
N
SO2Ph
13C {1H} NMR, 11aa
CDCl3, 101 MHz
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

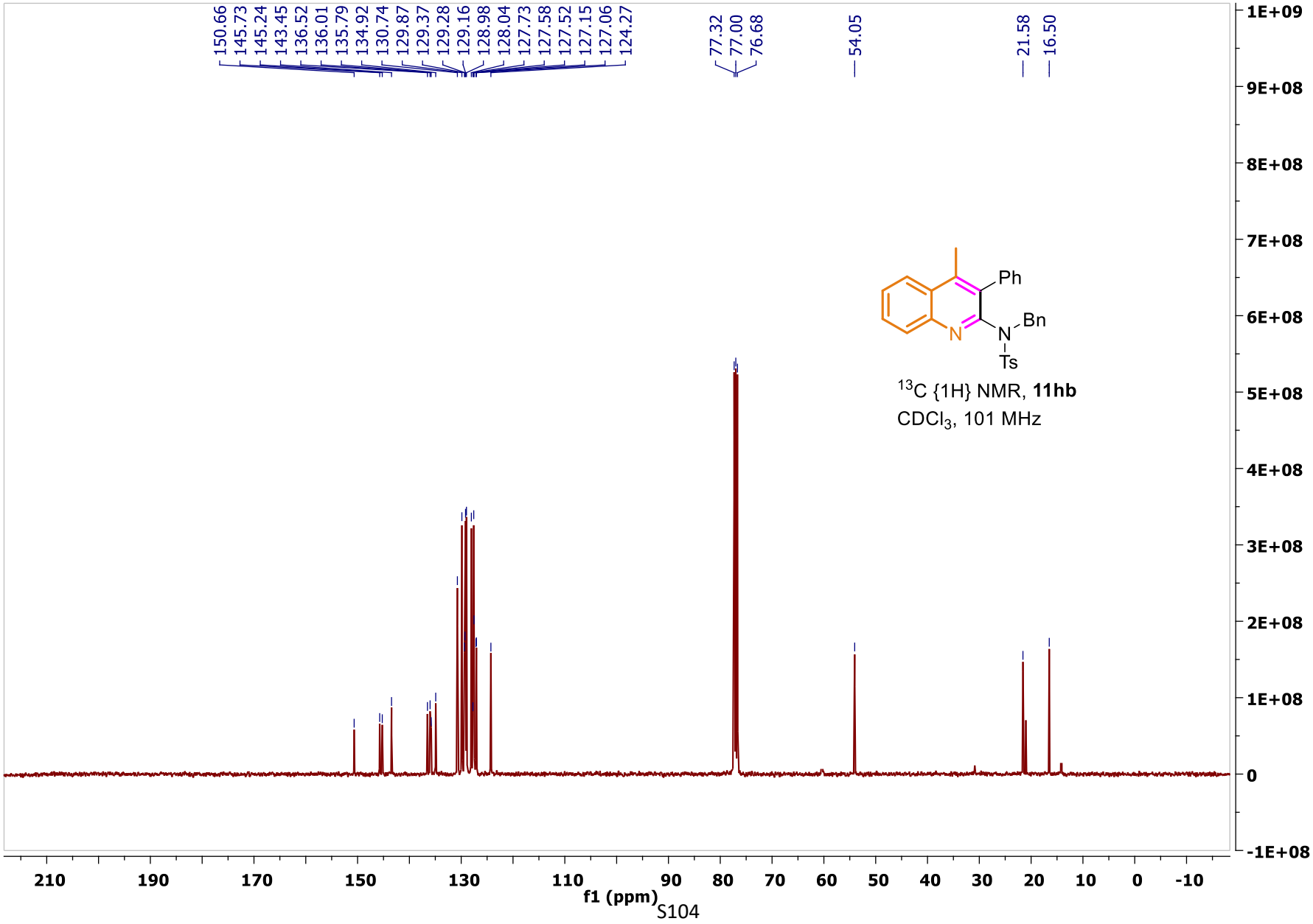

7.95 7.95 7.93 7.93 7.68 7.68 7.67 7.66 7.66 7.64 7.64 7.63 7.62 7.61 7.60 7.60 7.56 7.56 7.55 7.54 7.54 7.54 7.53 7.53 7.52 7.52 7.51 7.50 7.50 7.50 7.40 7.39 7.38 7.38 7.36 7.36 7.32 7.30 7.28 7.28 7.28 7.25 7.23 7.21 7.18 7.09 7.07 7.06 7.05 7.05 6.99 6.98 6.97 6.95 6.95 6.72 6.71 6.71 6.70 2.28
8E+08
8E+08
8E+08
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
N
Bn
N
SO2Ph
1H NMR, 11ab
CDCl3, 400 MHz
2.00 3.28 2.16 2.19 1.23 1.99 0.98 2.01 3.77
2.03
3.07
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

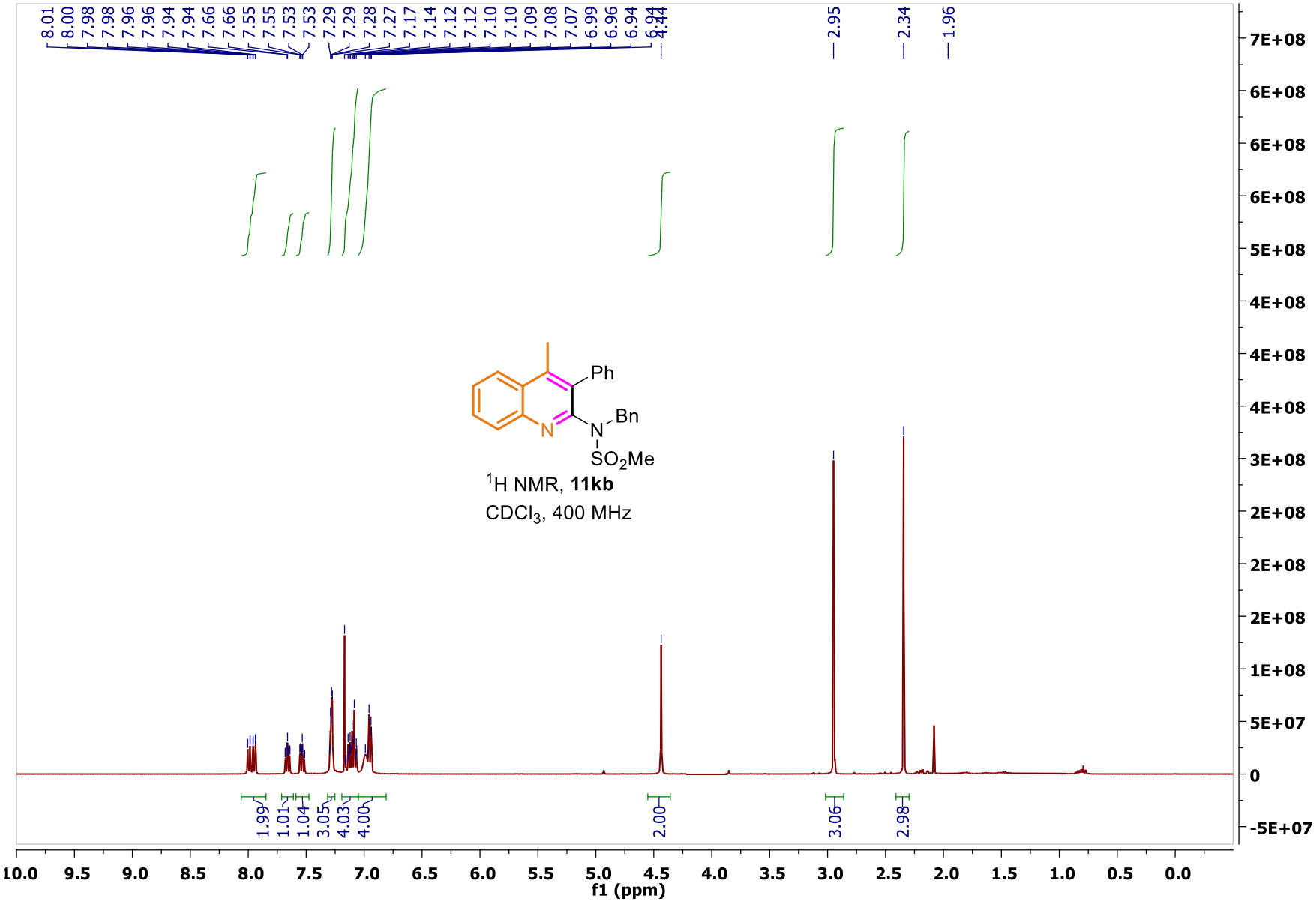

150.63
145.75
145.44
139.09
136.48
135.71
134.86
132.72
130.77
129.88
129.41
129.16
128.82
128.38
128.12
127.80
127.71
127.63
127.27
127.20
124.34
77.36
77.04
76.73
54.21
16.58
Bn
N
N
SO2Ph
13C {1H} NMR, 11ab
CDCl3, 101 MHz
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

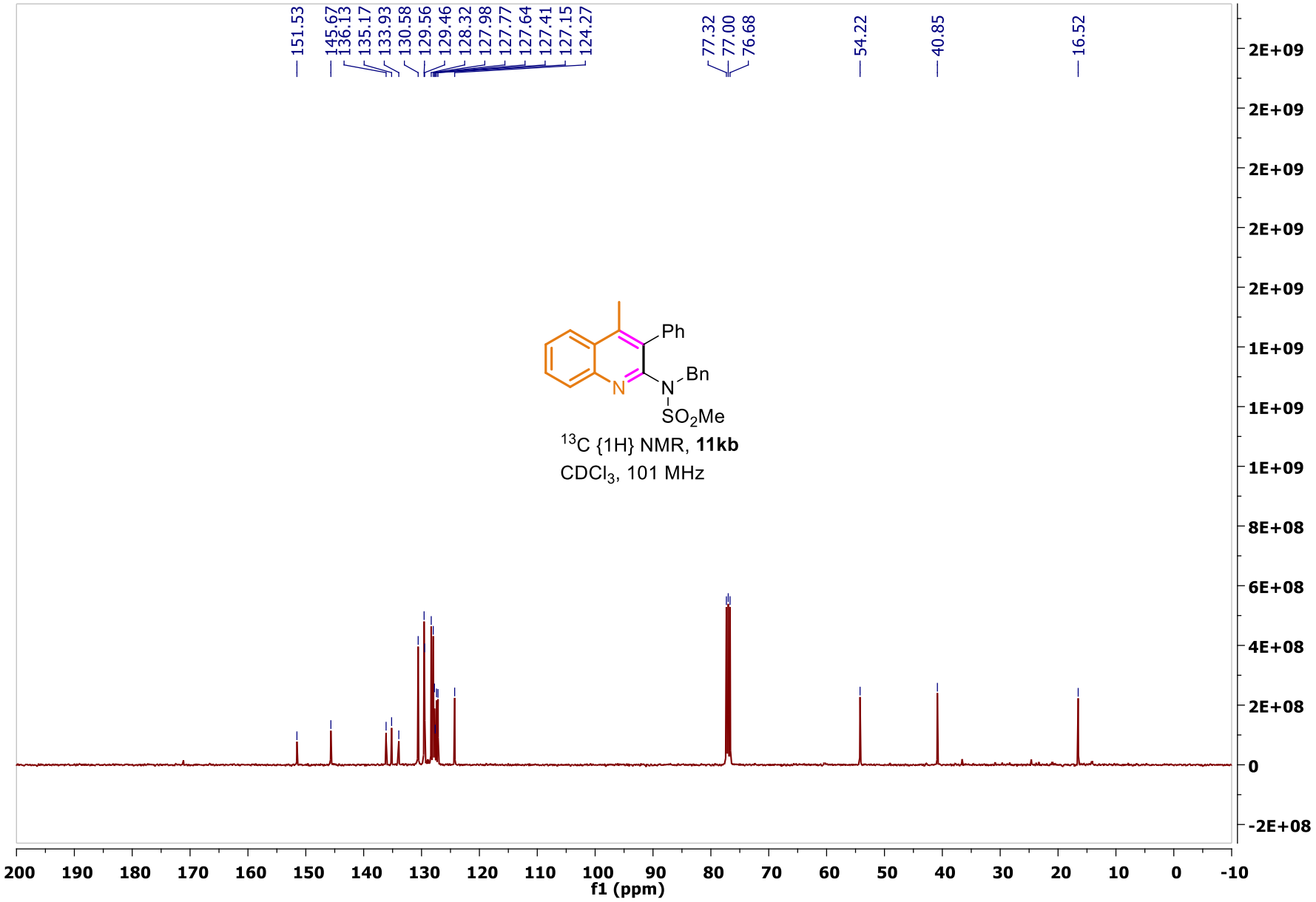

Br
N
Bn
N
SO2Ph
1H NMR, 11bd
CDCl3, 400 MHz
f1 (ppm)

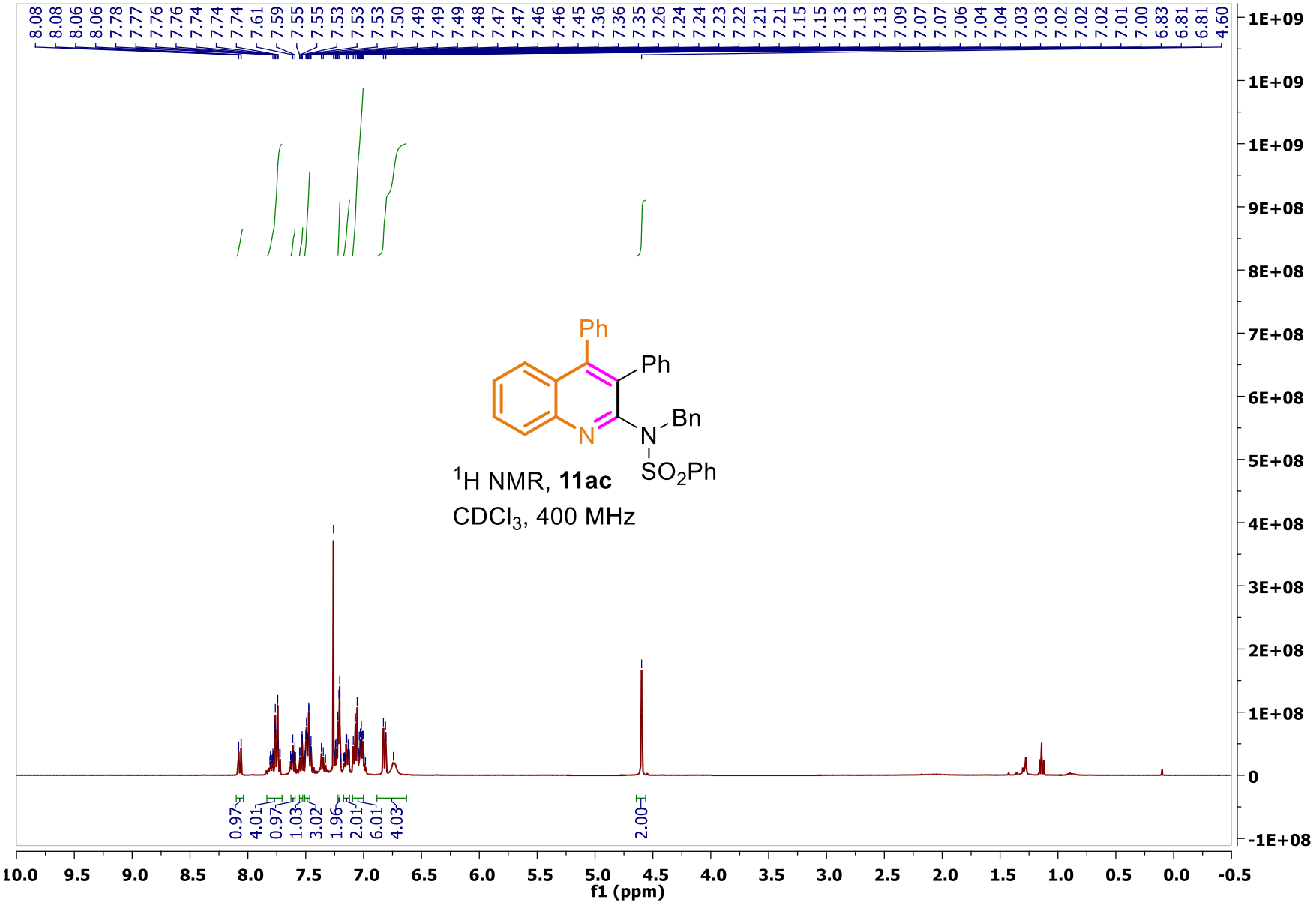

150.38
145.89
145.17
138.60
135.41
134.69
132.83
132.45
130.72
129.89
129.53
129.44
129.08
128.40
128.17
127.71
127.64
127.39
124.27
121.41
77.32
77.00
76.68
54.33
16.51
Br
N
N
Bn
SO2Ph
13C {1H} NMR, 11bd
CDCl3, 101 MHz
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

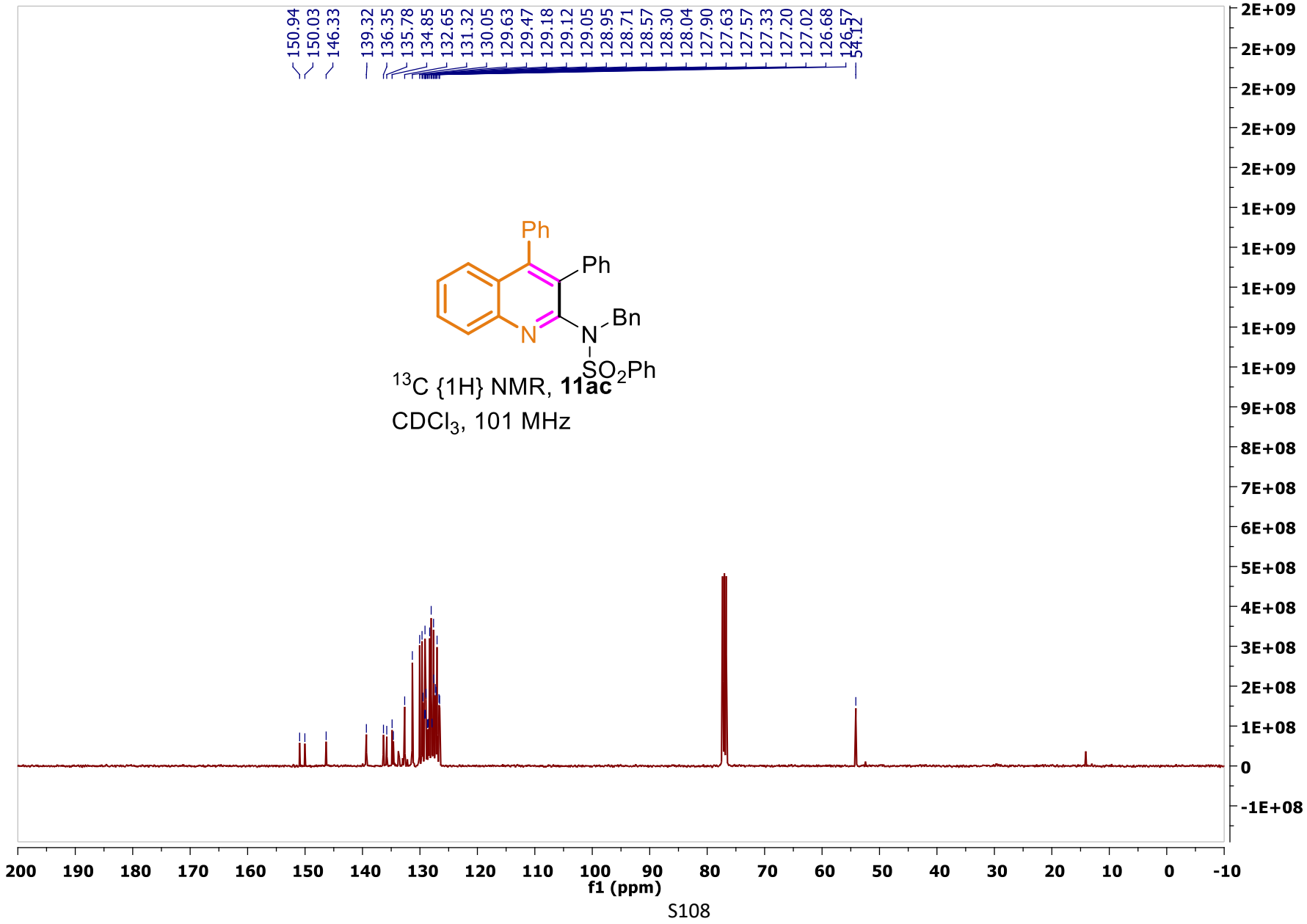

7.97
7.96
7.94
7.94
7.94
7.92
7.92
7.66
7.66
7.55
7.53
7.48
7.48
7.47
7.46
7.28
7.27
7.23
7.21
7.18
7.17
7.16
7.07
7.05
6.99
6.97
6.95
6.72
6.70
4.47
2.38
2.27
Ph
Bn
N
Ts
^{1}H NMR, **11hb**
$CDCl_3$, 400 MHz
1.96
1.01
2.97
1.05
5.02
1.04
2.02
3.84
2.00
2.96
2.98
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

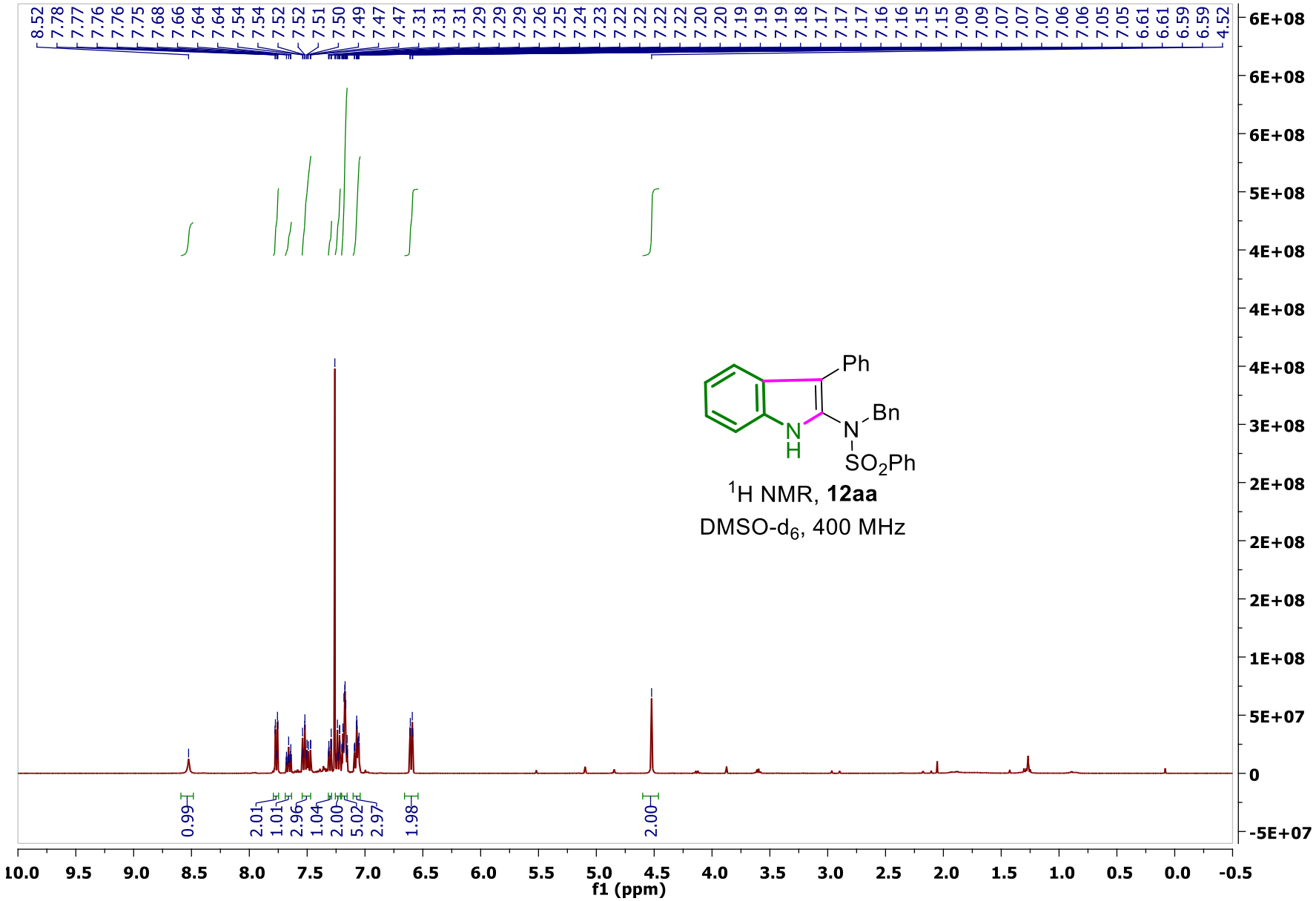

150.66
145.73
145.24
143.45
136.52
136.01
135.79
134.92
130.74
129.87
129.37
129.28
129.16
128.98
128.04
127.73
127.58
127.52
127.15
127.06
124.27
77.32
77.00
76.68
54.05
21.58
16.50
Ph
Bn
N
N
Ts
^{13}C {1H} NMR, **11hb**
$CDCl_3$, 101 MHz
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

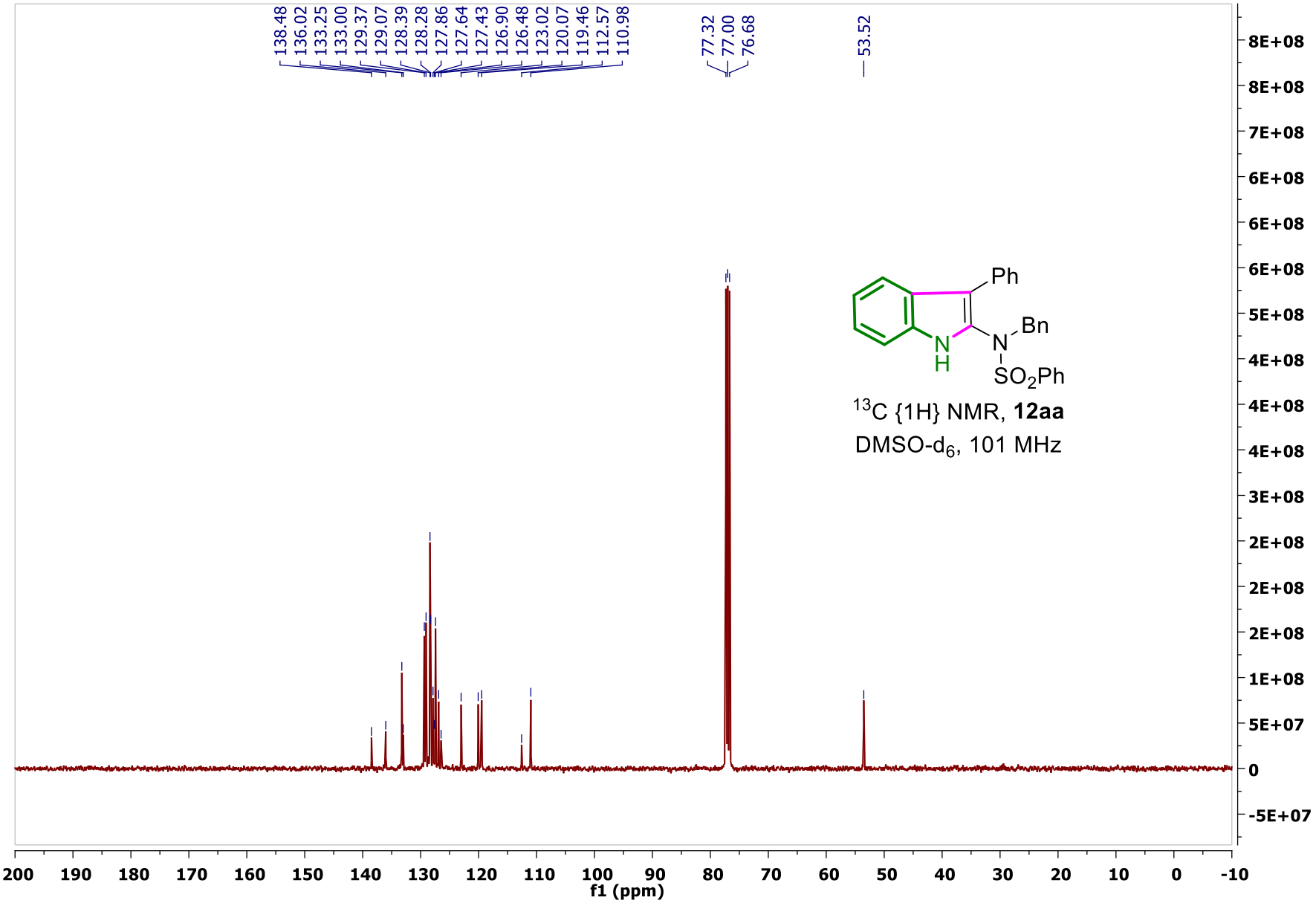

8.01
8.00
7.98
7.98
7.96
7.96
7.94
7.94
7.66
7.66
7.55
7.55
7.53
7.53
7.29
7.29
7.28
7.27
7.17
7.14
7.12
7.12
7.10
7.10
7.09
7.08
7.07
6.99
6.96
6.94
6.94
4.44
2.95
2.34
1.96
Ph
Bn
N
N
SO2Me
1H NMR, 11kb
CDCl3, 400 MHz
1.99
1.01
1.04
3.05
4.03
4.00
2.00
3.06
2.98
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

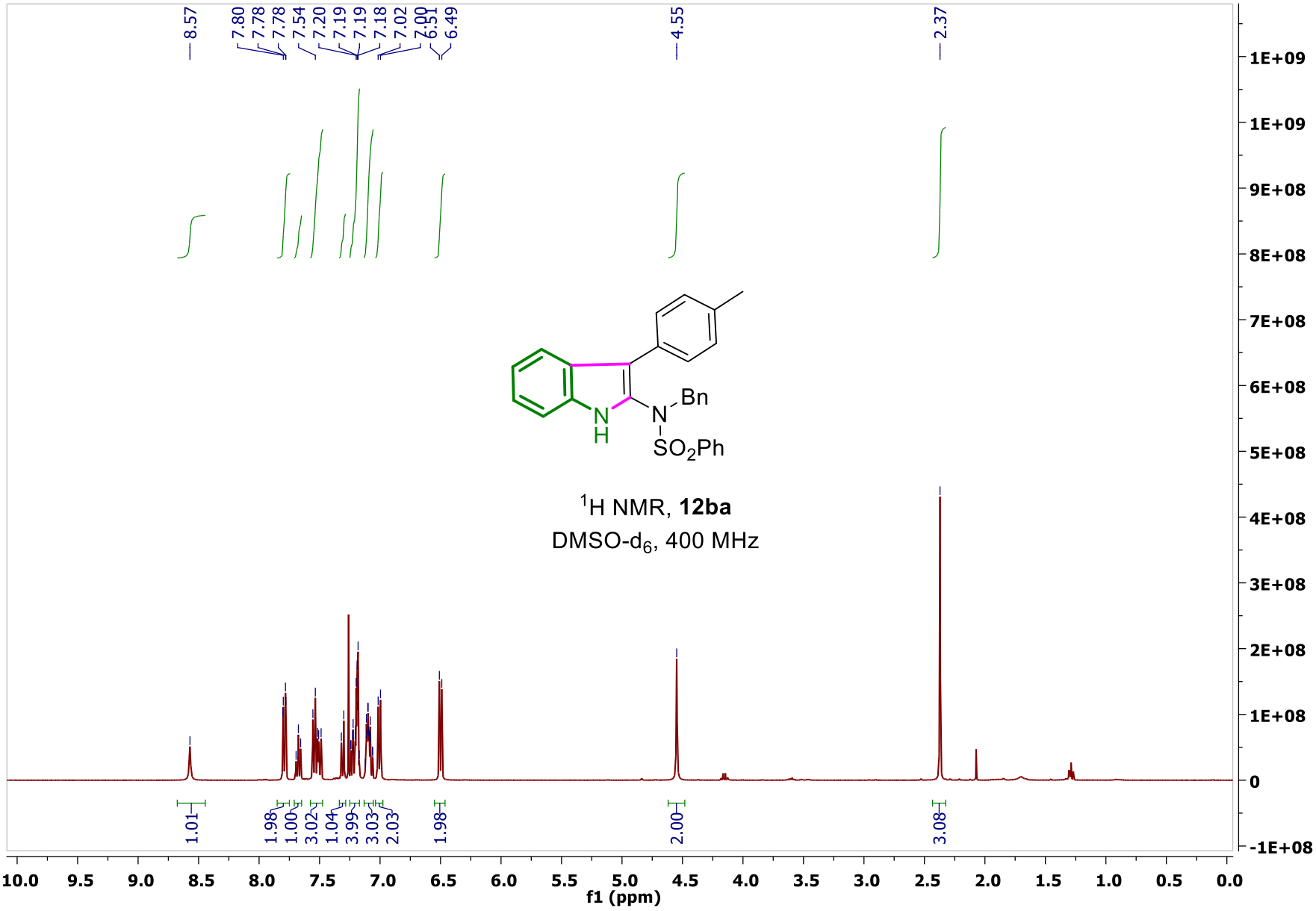

151.53
145.67
136.13
135.17
133.93
130.58
129.56
129.46
128.32
127.98
127.77
127.64
127.41
127.15
124.27
77.32
77.00
76.68
54.22
40.85
16.52
Ph
Bn
N
N
SO2Me
13C {1H} NMR, 11kb
CDCl3, 101 MHz
2E+09
2E+09
2E+09
2E+09
2E+09
1E+09
1E+09
1E+09
8E+08
6E+08
4E+08
2E+08
0
-2E+08
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

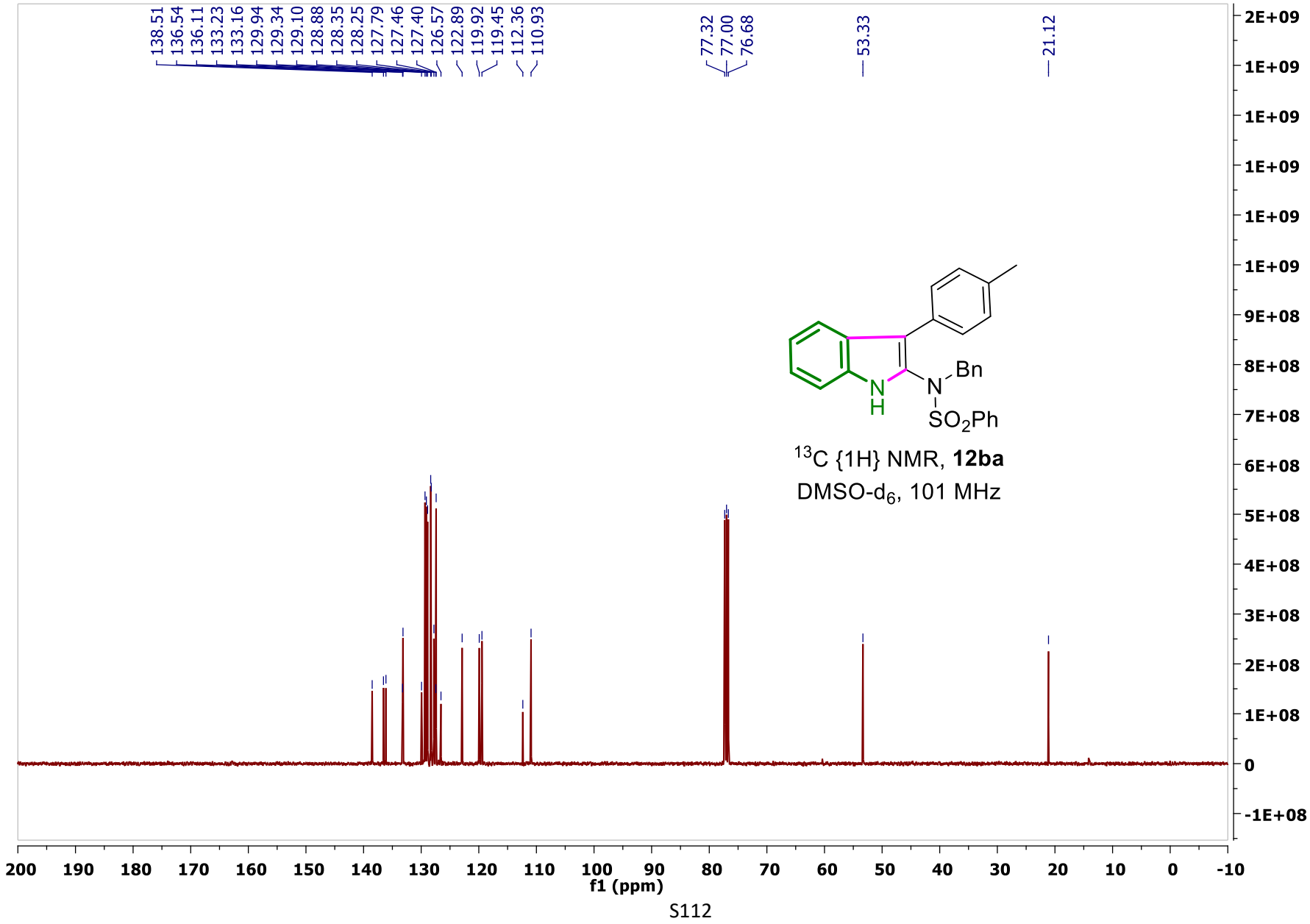

Ph
Ph
N
Bn
N
SO2Ph
1H NMR, 11ac
CDCl3, 400 MHz
f1 (ppm)

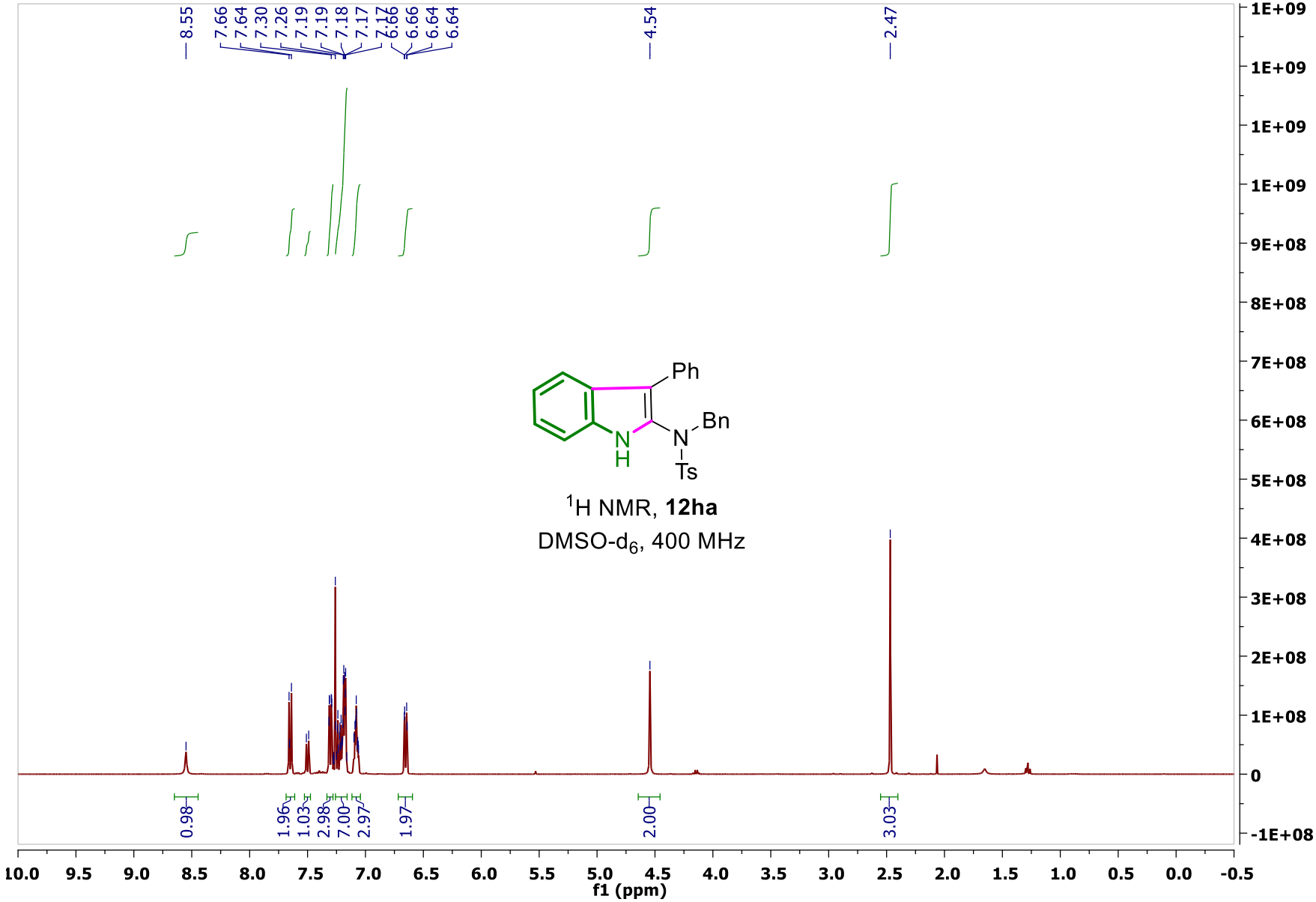

150.94
150.03
146.33
139.32
136.35
135.78
134.85
132.65
131.32
130.05
129.63
129.47
129.18
129.12
129.05
128.95
128.71
128.57
128.30
128.04
127.90
127.63
127.57
127.33
127.20
127.02
126.68
126.57
54.12
Ph
Ph
Bn
N
N
SO2Ph
13C {1H} NMR, 11ac
CDCl3, 101 MHz
2E+09
2E+09
2E+09
2E+09
2E+09
1E+09
1E+09
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

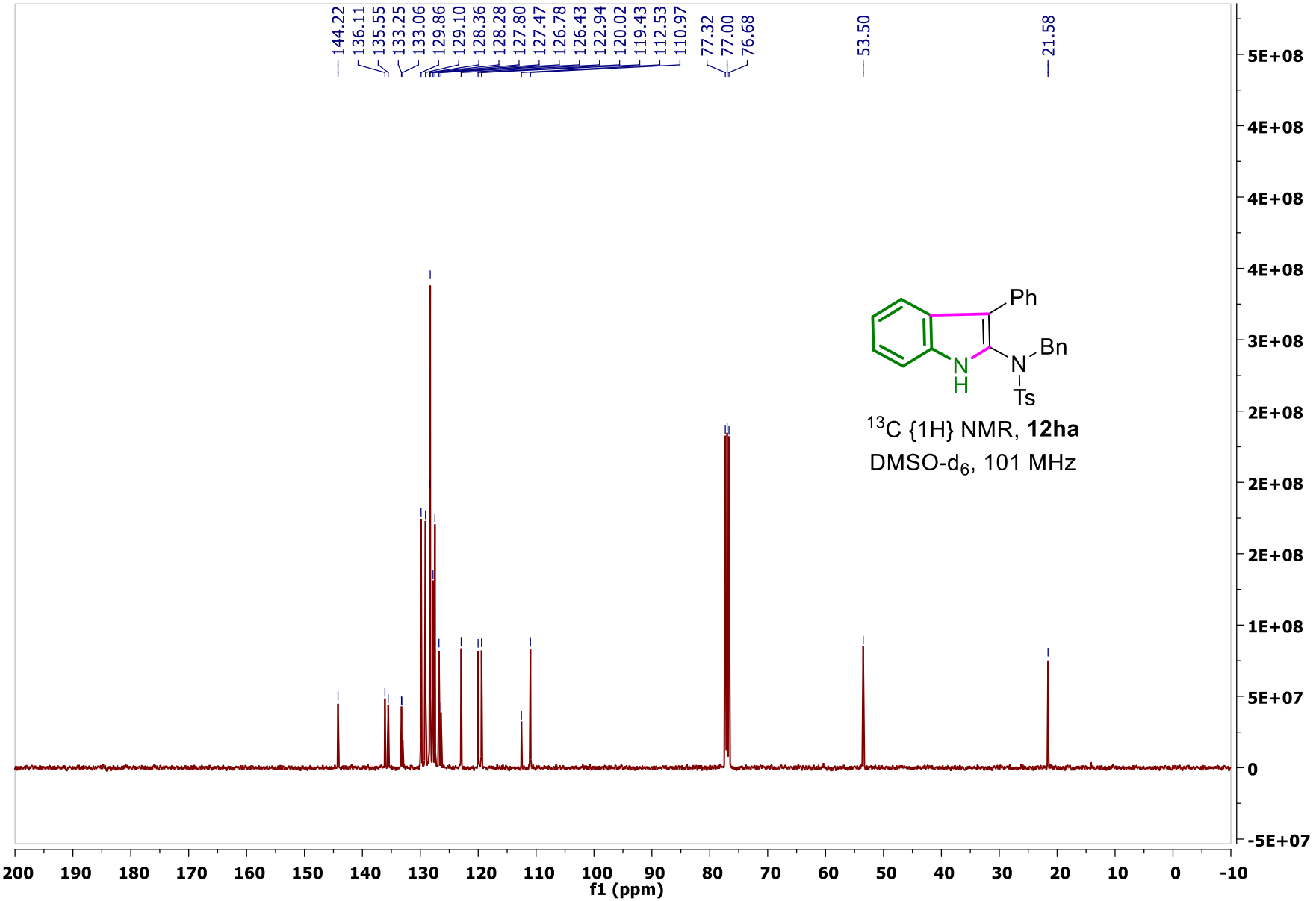

Ph
Bn
N
H
N
SO2Ph
1H NMR, 12aa
DMSO-d6, 400 MHz
f1 (ppm)

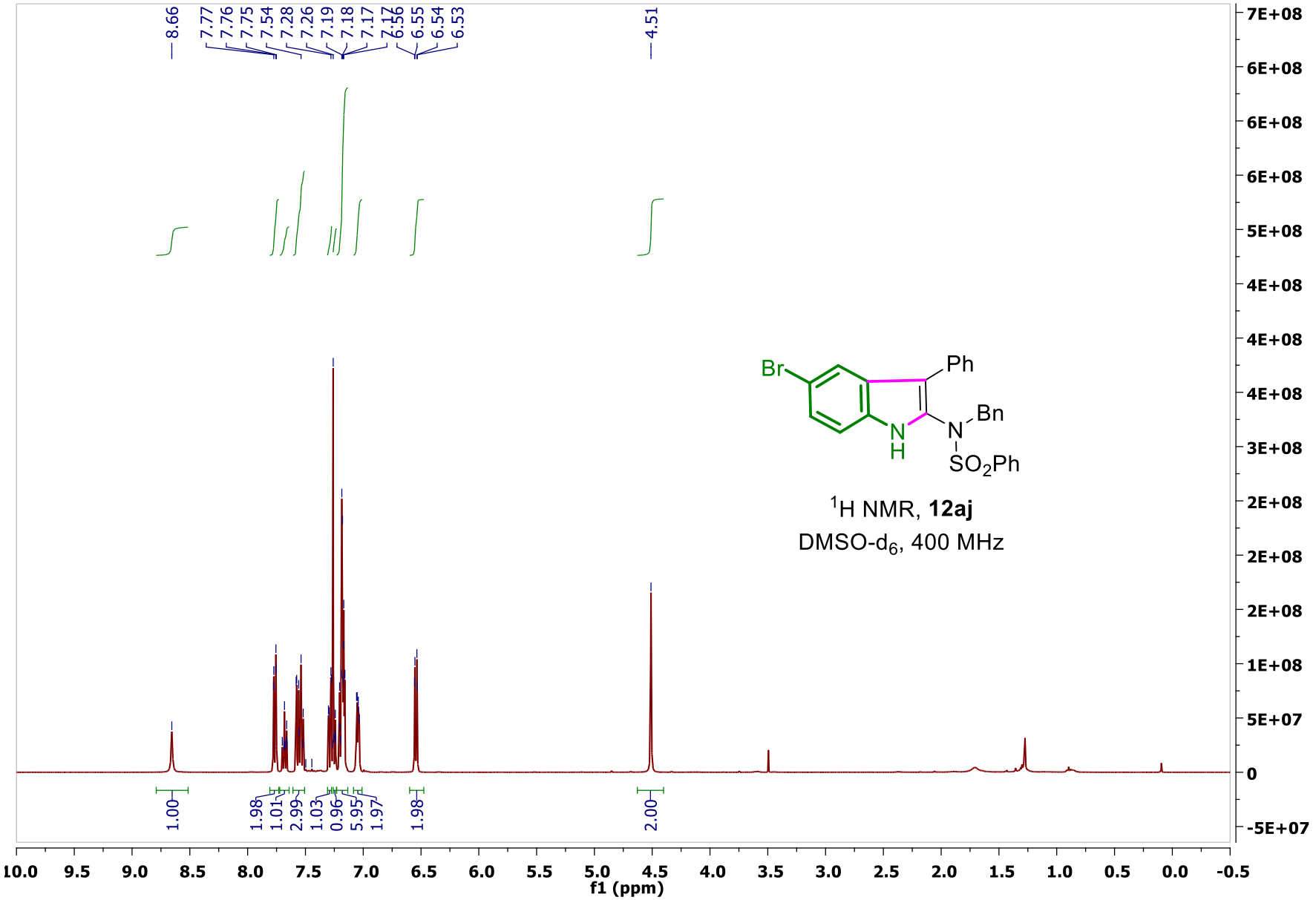

138.48
136.02
133.25
133.00
129.37
129.07
128.39
128.28
127.86
127.64
127.43
126.90
126.48
123.02
120.07
119.46
112.57
110.98
77.32
77.00
76.68
53.52
Ph
Bn
N
N
H
SO2Ph
13C {1H} NMR, 12aa
DMSO-d6, 101 MHz
8E+08
8E+08
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

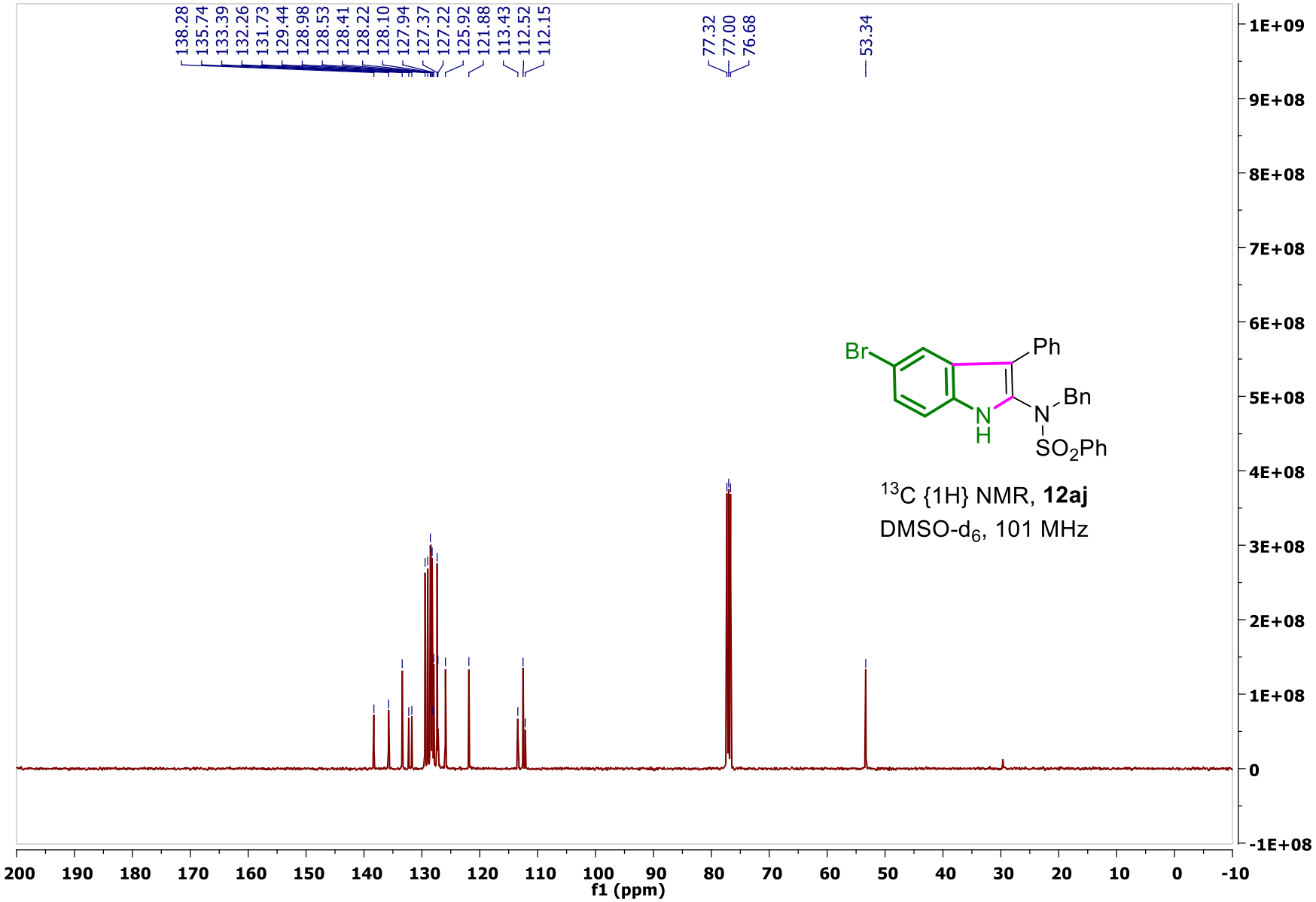

8.57
7.80
7.78
7.78
7.54
7.20
7.19
7.19
7.18
7.02
7.00
6.51
6.49
4.55
2.37
Bn
N
N
H
SO2Ph
1H NMR, 12ba
DMSO-d6, 400 MHz
1.01
1.98
1.00
3.02
1.04
3.99
3.03
2.03
1.98
2.00
3.08
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


138.51
136.54
136.11
133.23
133.16
129.94
129.34
129.10
128.88
128.35
128.25
127.79
127.46
127.40
126.57
122.89
119.92
119.45
112.36
110.93
77.32
77.00
76.68
53.33
21.12
Bn
N
H
N
SO2Ph
13C {1H} NMR, 12ba
DMSO-d6, 101 MHz
2E+09
1E+09
1E+09
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


8.55
7.66
7.64
7.30
7.26
7.19
7.19
7.18
7.17
7.17
6.66
6.66
6.64
6.64
4.54
2.47
Ph
Bn
N
H
N
Ts
1H NMR, 12ha
DMSO-d6, 400 MHz
0.98
1.96
1.03
2.98
7.00
2.97
1.97
2.00
3.03
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


144.22
136.11
135.55
133.25
133.06
129.86
129.10
128.36
128.28
127.80
127.47
126.78
126.43
122.94
120.02
119.43
112.53
110.97
77.32
77.00
76.68
53.50
21.58
Ph
Bn
N
H
N
Ts
13C {1H} NMR, 12ha
DMSO-d6, 101 MHz
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


8.66
7.77
7.76
7.75
7.54
7.28
7.26
7.19
7.18
7.17
7.12
6.56
6.55
6.54
6.53
4.51
Br
Ph
N
H
N
Bn
SO2Ph
1H NMR, 12aj
DMSO-d6, 400 MHz
1.00
1.98
1.01
2.99
1.03
0.96
5.95
1.97
1.98
2.00
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


138.28
135.74
133.39
132.26
131.73
129.44
128.98
128.53
128.41
128.22
128.10
127.94
127.37
127.22
125.92
121.88
113.43
112.52
112.15
77.32
77.00
76.68
53.34
Br
Ph
Bn
N
H
N
SO2Ph
13C {1H} NMR, 12aj
DMSO-d6, 101 MHz
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)