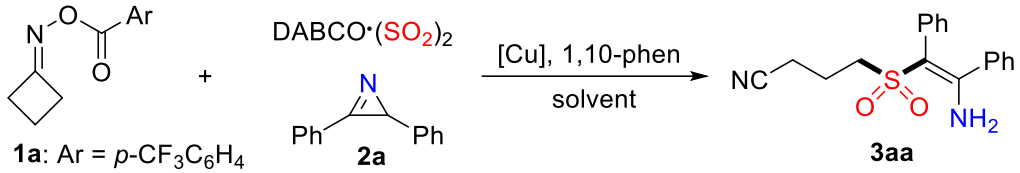
Electronic Supplementary Material (ESI) for ChemComm.

Supporting Information

General experimental methods:

Unless otherwise stated, all commercial reagents were used as received. All solvents were dried and distilled according to standard procedures. Flash column chromatography was performed using silica gel (60-Å pore size, 32–63μm, standard grade). Analytical thin–layer chromatography was performed using glass plates pre-coated with 0.25 mm 230–400 mesh silica gel impregnated with a fluorescent indicator (254 nm). Thin layer chromatography plates were visualized by exposure to ultraviolet light. Organic solutions were concentrated on rotary evaporators at ~20 Torr at 25–35°C. Nuclear magnetic resonance (NMR) spectra are recorded in parts per million from internal tetramethylsilane on the δ scale. ^{1}H and ^{13}C NMR spectra were recorded in DMSO or $CDCl_3$ on a Bruker DRX-400 spectrometer operating at 400 MHz and 100 MHz, respectively. All chemical shift values are quoted in ppm and coupling constants quoted in Hz. High resolution mass spectrometry (HRMS) spectra were obtained on a micrOTOF II Instrument.

Table S1. Initial studies for the reaction of cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a**, DABCO·$(SO_2)_2$, and 2,3-diphenyl-2*H*-azirine **2a** [a]



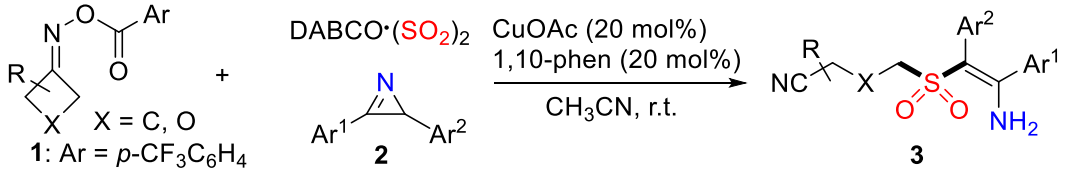
1a: Ar = *p*-$CF_3C_6H_4$ **2a** **3aa**

Entry	[Cu]	DABCO·$(SO_2)_2$	Solvent	Yield (%)[b]
1	$Cu(OAc)_2$	1.0 equiv	CH_3CN	47
2	$Cu(OAc)_2$	1.0 equiv	toluene	n.r.
3	$Cu(OAc)_2$	1.0 equiv	1,4-dioxane	37
4	$Cu(OAc)_2$	1.0 equiv	CH_2Cl_2	32
5	Cu_2O	1.0 equiv	CH_3CN	50
6	$Cu(TFA)_2$	1.0 equiv	CH_3CN	45

7	CuI	1.0 equiv	CH_3CN	31
8	CuOAc	1.0 equiv	CH_3CN	52
9	CuOAc	1.5 equiv	CH_3CN	61
10	CuOAc	2.0 equiv	CH_3CN	60
11[c]	CuOAc	1.5 equiv	CH_3CN	71
12[c,d]	CuOAc	1.5 equiv	CH_3CN	69
13[c]	-	1.5 equiv	CH_3CN	n.r.
14 [c,e]	CuOAc	1.5 equiv	CH_3CN	26
15 [c,f]	CuOAc	-	CH_3CN	22

[a] Reaction conditions: cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (0.2 mmol), DABCO·$(SO_2)_2$ (0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (0.24 mmol), [Cu] (0.04 mmol), and 1,10-phen (0.04 mmol), solvent (2.0 mL), room temperature, 12 h. [b] Isolated yield based on cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a**. [c] 0.3 mmol of 2,3-diphenyl-2*H*-azirine **2a** was used. [d] 50 °C. [e] In the absence of 1,10-phen., 1,10-phen = 1,10-phenanthroline. [f] 0.6 mmol of $K_2S_2O_5$ was used instead of DABCO·$(SO_2)_2$.

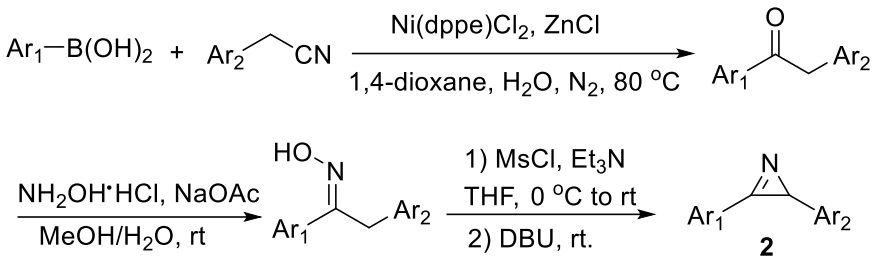
*General experimental procedure (A) for the reaction of O-acyl oximes **1**, DABCO·$(SO_2)_2$ and 2H-azirines **2**.*



Acetonitrile (2.0 mL) was added to a sealed tube containing *O*-acyl oxime **1** (0.2 mmol), DABCO·$(SO_2)_2$ (0.3 mmol), 2*H*-azirines **2** (0.3 mmol), CuOAc (0.04 mmol, 20 mol%) and 1,10-phenanthroline (0.04 mmol, 20 mol%) under N_2 atmosphere *via* a syringe. The resulting mixture was stirred at room temperature for 12 hours. After completion of reaction as monitored by TLC analysis, the mixture was diluted with ethyl acetate and washed with saturated aqueous Na_2CO_3 (10 mL), brine (10 mL), and dried over anhydrous Na_2SO_4. Subsequently, the solvent was concentrated under reduced pressure, and the residue was purified directly by flash column chromatography (*n*-hexane/ethyl acetate = 3:1-1:1) to give the corresponding product **3**.

*General experimental procedure (B) for the synthesis of O-acyl oximes **1** and 2H-azirines **2**.*

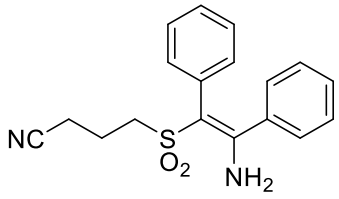
O-Acyl oximes **1a, 1f, 1h,** and **1k** were synthesized from the corresponding commercially available ketones according to the literature.[1] *O*-Acyl oximes **1b**, **1c**, **1d**, **1e** and **1g** were synthesized from the corresponding commercially available alkenes according to the literature.[1] *O*-Acyl oximes **1i** and **1j** were synthesized according to the literature.[2] All of the NMR spectra of the know compounds were consistent with the data in the literatures.[1-2]



Step 1: A sealed round bottom flask containing $Ni(dppe)Cl_2$ (0.1 equiv), zinc chloride (1.5 equiv) and aryl boronic acid (2.0 equiv) was evacuated and purged with nitrogen gas three times. Then, benzyl nitrile (1.0 equiv), H_2O (1.0 equiv) and 1,4-dioxane (0.5 M) were sequentially added to the system and the resulting mixture was stirred at 80 °C for 8 h. The solution passed through a pad of Celite, and washed with DCM for several times. The filtrate was concentrated and the residue was purified on a silica gel column to give the corresponding arylketone.[3]

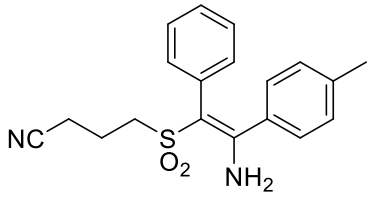
Step 2: A mixture solvent of MeOH/H_2O (v/v = 20:1) was added to a mixture of arylketone (1.0 equiv), $NH_2OH{\cdot}HCl$ (1.5 equiv) and sodium acetate (2.0 equiv) in a round bottom flask. The resulting solution was stirred at room temperature for 5 h. After completion of reaction as monitored by TLC analysis, the solvent was removed in vacuo. The resulting mixture was solved in CH_2Cl_2 and successively washed with saturated aqueous $NaHCO_3$ and brine, and dried over anhydrous Na_2SO_4. Then the solution was filtered, concentrated and used in the next step without further purification.

Step 3: Methanesulfonyl chloride (1.5 equiv) was added to a mixture of the crude oxime (1.0 equiv), triethylamine (1.5 equiv) and dry THF (0.5 M) in a flask at 0 °C. The solution got cloudy after the addition of methanesulfonyl chloride. The resulting mixture was stirred for 30 min, and DBU (1.5 equiv) was subsequently added over 1 min. After stirred for additional 30 min, the mixture was filtered through a pad of Celite and washed with ether. The organic solution was concentrated in vacuo and the residue was purified directly by flash column chromatography to give 2*H*-azirine **2**.



(*Z*)-4-((2-Amino-1,2-diphenylvinyl)sulfonyl)butanenitrile (**3aa**)

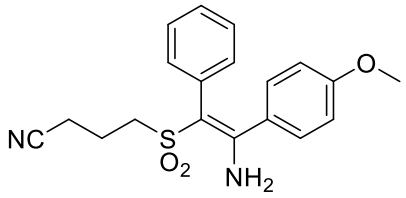
This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3aa** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.28 – 6.98 (m, 12H), 3.06 – 3.00 (m, 2H), 2.66 (t, *J* = 7.1 Hz, 2H), 2.06 (dd, *J* = 14.7, 7.2 Hz, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 158.1, 137.7, 134.8, 134.0, 129.0, 128.9, 128.1, 127.9, 127.1, 120.3, 100.4, 52.3, 19.2, 15.6. HRMS (ESI) calcd for $C_{18}H_{19}N_2O_2S^+$: 327.1162 ($M+H^+$), found: 327.1168.



(*Z*)-4-((2-Amino-1-phenyl-2-(*p*-tolyl)vinyl)sulfonyl)butanenitrile (**3ab**)

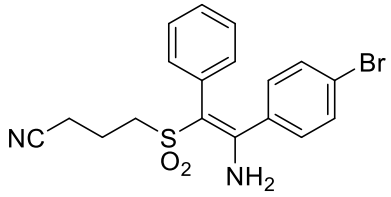
This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2-phenyl-3-(*p*-tolyl)-2*H*-azirine **2b** (62.2 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title

compound **3ab** as a white solid; ^{1}H NMR (400 MHz, DMSO): δ (ppm) 7.21 – 7.03 (m, 9H), 6.97 (d, *J* = 7.8 Hz, 2H), 3.11 – 2.96 (m, 2H), 2.65 (t, *J* = 7.1 Hz, 2H), 2.07 (s, 3H), 2.09 – 1.94 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 158.1, 138.5, 134.9, 134.9, 134.0, 128.9, 128.7, 127.9, 127.0, 120.3, 100.3, 52.3, 21.0, 19.2, 15.6. HRMS (ESI) calcd for $C_{19}H_{21}N_2O_2S^+$: 341.1318 ($M+H^+$), found: 341.1330.



(Z)-4-((2-Amino-2-(4-methoxyphenyl)-1-phenylvinyl)sulfonyl)butanenitrile (**3ac**)

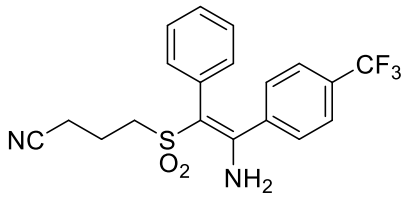
This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 3-(4-methoxyphenyl)-2-phenyl-2*H*-azirine **2c** (67.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3ac** as a white solid; ^{1}H NMR (400 MHz, DMSO): δ (ppm) 7.12-7.08 (m, 9H), 6.72 (d, *J* = 8.2 Hz, 2H), 3.65 (s, 3H), 3.09 – 2.91 (m, 2H), 2.65 (t, *J* = 7.1 Hz, 2H), 2.13 – 1.95 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 159.8, 157.9, 135.2, 134.0, 130.6, 129.9, 128.1, 127.0, 120.4, 113.5, 100.2, 55.5, 52.4, 19.3, 15.6. HRMS (ESI) calcd for $C_{19}H_{21}N_2O_3S^+$: 357.1267 ($M+H^+$), found: 357.1274.



(*Z*)-4-((2-Amino-2-(4-bromophenyl)-1-phenylvinyl)sulfonyl)butanenitrile (**3ad**)

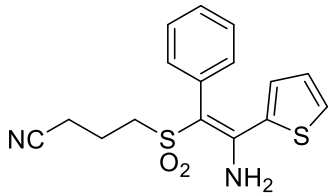
This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 3-(4-bromophenyl)-2-phenyl-2*H*-azirine **2d** (81.6 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3ad** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.37 (d, *J* = 8.2 Hz, 2H), 7.14-7.09 (m, 9H), 3.06 – 2.98 (m, 2H), 2.65 (t, *J* = 7.1 Hz, 2H), 2.13 – 1.96 (m, 2H). ^{13}C NMR

(100 MHz, DMSO) δ (ppm) 156.9, 137.0, 134.5, 134.0, 131.1, 131.1, 128.1, 127.3, 122.3, 120.2, 100.8, 52.3, 19.1, 15.6. HRMS (ESI) calcd for $C_{18}H_{18}BrN_2O_2S^+$: 405.0267 ($M+H^+$), found: 405.0277.



(*Z*)-4-((2-Amino-1-phenyl-2-(4-(trifluoromethyl)phenyl)vinyl)sulfonyl)butanenitrile (**3ae**)

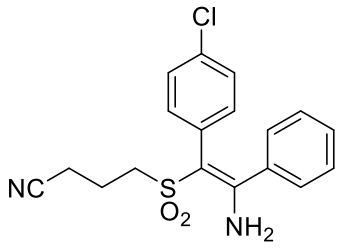
This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2-phenyl-3-(4-(trifluoromethyl)phenyl)-2*H*-azirine **2e** (78.4 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 3/1) to afford the title compound **3ae** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.55 (d, *J* = 7.9 Hz, 2H), 7.41 (d, *J* = 7.9 Hz, 2H), 7.21 (s, 2H), 7.14 – 7.07 (m, 5H), 3.13 – 2.96 (m, 2H), 2.67 (t, *J* = 7.1 Hz, 2H), 2.15 – 1.94 (m, 2H). ^{19}F NMR (376 MHz, DMSO) δ (ppm) -61.25 (s). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 156.6, 141.9, 134.3, 134.1, 130.0, 129.3 (q, $^2J_{CF}$ = 32.0 Hz), 128.1, 127.5, 125.1 (q, $^3J_{CF}$ = 3.8 Hz), 124.2 (q, $^1J_{CF}$ = 270.5 Hz), 120.3, 101.2, 52.4, 19.2, 15.7. HRMS (ESI) calcd for $C_{19}H_{18}F_3N_2O_2S^+$: 395.1036 ($M+H^+$), found: 395.1042.



(*Z*)-4-((2-Amino-1-phenyl-2-(thiophen-2-yl)vinyl)sulfonyl)butanenitrile (**3af**)

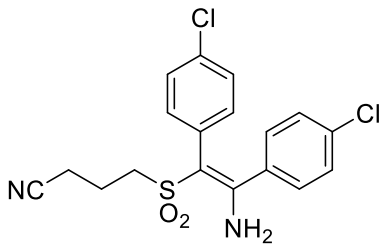
This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2-phenyl-3-(thiophen-2-yl)-2*H*-azirine **2f** (59.8 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title

compound **3af** as a brown solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.52 (d, *J* = 5.0 Hz, 1H), 7.26 – 7.20 (m, 5H), 7.14 – 7.02 (m, 3H), 6.90 (t, *J* = 4.3 Hz, 1H), 3.11 – 3.03 (m, 2H), 2.67 (t, *J* = 7.1 Hz, 2H), 2.10 – 1.97 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 150.2, 138.3, 134.8, 134.1, 130.4, 129.8, 128.5, 128.1, 126.9, 120.3, 101.7, 52.4, 19.2, 15.7. HRMS (ESI) calcd for $C_{16}H_{17}N_2O_2S_2^+$: 333.0726 ($M+H^+$), found: 333.0737.



(*Z*)-4-((2-Amino-1-(4-chlorophenyl)-2-phenylvinyl)sulfonyl)butanenitrile (**3ag**)

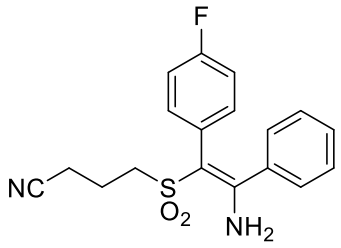
This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2-(4-chlorophenyl)-3-phenyl-2*H*-azirine **2g** (68.3 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 1/1) to afford the title compound **3ag** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.26 – 7.18 (m, 7H), 7.14-7.09 (m, 4H), 3.12 – 2.98 (m, 2H), 2.66 (t, *J* = 7.1 Hz, 2H), 2.12 – 1.99 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 158.6, 137.5, 135.7, 134.0, 131.9, 129.3, 129.1, 128.3, 128.0, 120.4, 99.2, 52.5, 19.2, 15.7. HRMS (ESI) calcd for $C_{18}H_{18}ClN_2O_2S^+$: 361.0772 ($M+H^+$), found: 361.0780.



(*Z*)-4-((2-Amino-1,2-bis(4-chlorophenyl)vinyl)sulfonyl)butanenitrile (**3ah**)

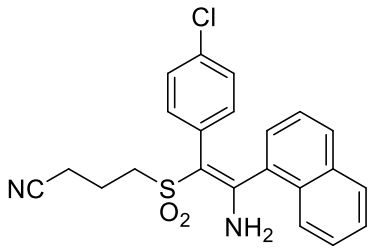
This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2,3-bis(4-chlorophenyl)-2*H*-azirine **2h** (78.6 mg, 0.3 mmol) as starting material and purified by column

chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3ah** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.19 (m, 10H), 3.08 – 3.00 (m, 2H), 2.66 (t, *J* = 7.0 Hz, 2H), 2.10 – 1.98 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 157.3, 136.4, 135.8, 133.9, 133.7, 132.1, 131.0, 128.4, 128.2, 120.3, 99.6, 52.5, 19.2, 15.7. HRMS (ESI) calcd for $C_{18}H_{17}Cl_2N_2O_2S^+$: 395.0382 ($M+H^+$), found: 395.0388.



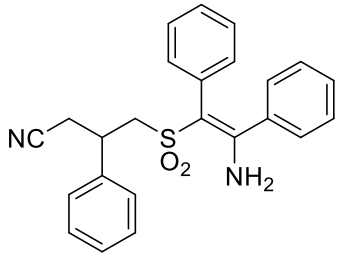
(*Z*)-4-((2-Amino-1-(4-fluorophenyl)-2-phenylvinyl)sulfonyl)butanenitrile (**3ai**)

This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2-(4-fluorophenyl)-3-phenyl-2*H*-azirine **2i** (63.4 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 3/1) to afford the title compound **3ai** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.22-7.09 (m, 9H), 6.90 (t, *J* = 8.5 Hz, 2H), 3.07 – 3.00 (m, 2H), 2.66 (t, *J* = 7.1 Hz, 2H), 2.10 – 1.98 (m, 2H). ^{19}F NMR (376 MHz, DMSO) δ (ppm) -115.33 – 155.41 (m). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 161.4 (d, $^{1}J_{CF}$ = 244.3 Hz), 158.5, 137.7, 136.1 (d, $^{3}J_{CF}$ = 8.3 Hz), 131.3, 129.2, 129.0, 128.3, 120.4, 114.9 (d, $^{2}J_{CF}$ = 21.2 Hz), 99.3, 52.3, 19.2, 15.7. HRMS (ESI) calcd for $C_{18}H_{18}FN_2O_2S^+$: 345.1068 ($M+H^+$), found: 345.1075.



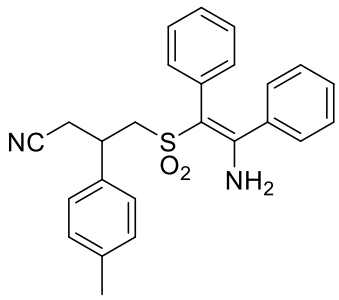
(*Z*)-4-((2-Amino-1-(4-chlorophenyl)-2-(naphthalen-1-yl)vinyl)sulfonyl)butanenitrile (**3aj**)

This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2-(4-chlorophenyl)-3-(naphthalen-1-yl)-2*H*-azirine **2j** (83.3 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3aj** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 8.04 (d, *J* = 8.4 Hz, 1H), 7.84 (d, *J* = 8.2 Hz, 1H), 7.78 (d, *J* = 7.8 Hz, 1H), 7.59 (t, *J* = 7.5 Hz, 1H), 7.49 (t, *J* = 7.5 Hz, 1H), 7.41 – 7.32 (m, 4H), 7.05 (d, *J* = 7.7 Hz, 2H), 6.95 (d, *J* = 7.9 Hz, 2H), 3.14 (t, *J* = 7.5 Hz, 2H), 2.72 (t, *J* = 7.0 Hz, 2H), 2.20 – 2.08 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 156.9, 135.0, 134.9, 133.5, 133.1, 132.1, 130.1, 129.2, 128.6, 127.7, 127.2, 127.2, 126.5, 125.3, 125.3, 120.4, 100.6, 52.5, 19.4, 15.7. HRMS (ESI) calcd for $C_{22}H_{20}ClN_2O_2S^+$: 411.0929 ($M+H^+$), found: 411.0939.



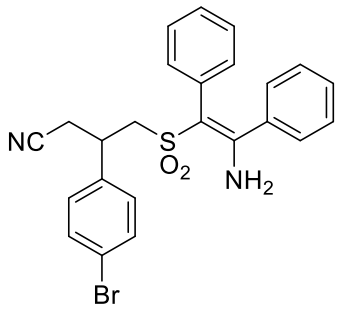
(*Z*)-4-((2-Amino-1,2-diphenylvinyl)sulfonyl)-3-phenylbutanenitrile (**3ba**)

This compound was prepared following general procedure A using 3-phenylcyclobutan-1-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1b** (66.7 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3ba** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.47 – 7.27 (m, 5H), 7.21 – 6.90 (m, 12H), 3.70 – 3.60 (m, 1H), 3.55 – 3.31 (m, 2H), 3.20 -3.02 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 158.1, 141.1, 137.8, 134.7, 134.1, 129.1, 129.1, 129.0, 128.1, 128.1, 128.0, 127.9, 127.1, 119.2, 100.8, 57.7, 37.3, 24.3. HRMS (ESI) calcd for $C_{24}H_{23}N_2O_2S^+$: 403.1475 ($M+H^+$), found: 403.1482.



(*Z*)-4-((2-Amino-1,2-diphenylvinyl)sulfonyl)-3-(*p*-tolyl)butanenitrile (**3ca**)

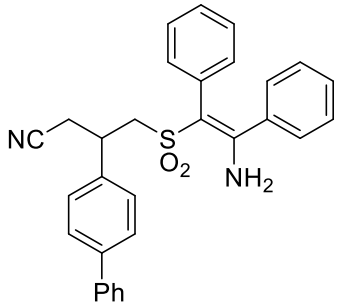
This compound was prepared following general procedure A using 3-(*p*-tolyl)cyclobutan-1-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1c** (69.5 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3ca** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.29 – 6.93 (m, 16H), 3.56-3.5 (m, 1H), 3.47 – 3.33 (m, 1H), 3.28 (dd, *J* = 14.4, 5.7 Hz, 1H), 3.12-2.97 (m, 2H), 2.29 (s, 3H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 158.0, 138.0, 137.7, 137.1, 134.6, 134.0, 129.6, 129.0, 128.9, 128.0, 127.8, 127.0, 119.1, 100.7, 57.6, 36.8, 24.2, 21.0. HRMS (ESI) calcd for $C_{25}H_{25}N_2O_2S^+$: 417.1631 ($M+H^+$), found: 417.1643.



(*Z*)-4-((2-Amino-1,2-diphenylvinyl)sulfonyl)-3-(4-bromophenyl)butanenitrile (**3da**)

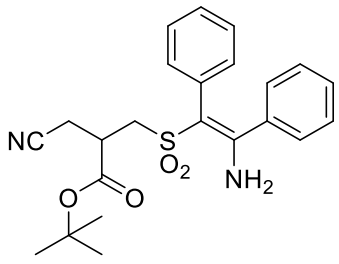
This compound was prepared following general procedure A using 3-(4-bromophenyl)cyclobutan-1-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1d** (82.4 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3da** as a light yellow solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.56 (d, *J* = 7.6 Hz, 2H), 7.38 (d, *J* = 7.7 Hz, 2H), 7.21 – 6.96 (m, 11H), 3.67 – 3.57 (m, 1H), 3.46 – 3.31 (m, 2H), 3.13 – 2.97 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm)

158.1, 140.4, 137.8, 134.6, 134.0, 131.9, 130.5, 129.1, 129.0, 128.1, 127.9, 127.1, 121.3, 119.0, 100.7, 57.4, 36.9, 24.1. HRMS (ESI) calcd for $C_{24}H_{22}BrN_2O_2S^+$: 481.0580 ($M+H^+$), found: 481.0590.



(*Z*)-3-([1,1'-Biphenyl]-4-yl)-4-((2-amino-1,2-diphenylvinyl)sulfonyl)butanenitrile (**3ea**)

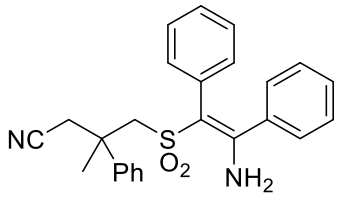
This compound was prepared following general procedure A using 3-([1,1'-biphenyl]-4-yl)cyclobutan-1-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1e** (81.9 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3ea** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.69 (d, *J* = 7.9 Hz, 4H), 7.53-7.47 (m, 4H), 7.38 (t, *J* = 7.3 Hz, 1H), 7.20 – 6.97 (m, 12H), 3.74 – 3.64 (m, 1H), 3.51 – 3.39 (m, 2H), 3.19-3.06 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 158.1, 140.2, 140.2, 139.9, 137.8, 134.7, 134.1, 129.4, 129.1, 129.0, 128.8, 128.1, 127.9, 127.4, 127.1, 119.3, 100.9, 57.8, 37.1, 24.2. HRMS (ESI) calcd for $C_{30}H_{27}N_2O_2S^+$: 479.1788 ($M+H^+$), found: 479.1794.



tert-Butyl (*Z*)-3-((2-amino-1,2-diphenylvinyl)sulfonyl)-2-(cyanomethyl)propanoate (**3fa**)

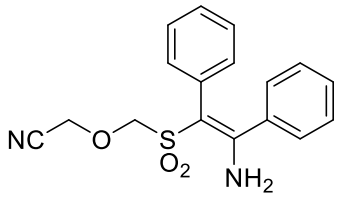
This compound was prepared following general procedure A using 3-(((4-(trifluoromethyl)benzoyl)oxy)imino)cyclobutane-1-carboxylate **1f** (71.5 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by

column chromatography on silica gel (*n*-hexane/ethyl acetate = 1/1) to afford the title compound **3fa** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.25-7.15 (m, 7H), 7.14 – 7.05 (m, 5H), 3.47 - 3.42 (m, 1H), 3.23 - 3.16 (m, 2H), 3.06 – 2.88 (m, 2H), 1.43 (s, 9H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 170.0, 158.6, 137.7, 134.6, 134.2, 129.2, 129.1, 128.2, 128.0, 127.3, 118.5, 100.7, 82.3, 53.7, 37.6, 27.9, 19.5. HRMS (ESI) calcd for $C_{23}H_{26}N_2NaO_4S^+$: 449.1505 ($M+H^+$), found: 449.1512.



(*Z*)-4-((2-Amino-1,2-diphenylvinyl)sulfonyl)-3-methyl-3-phenylbutanenitrile (**3ga**)

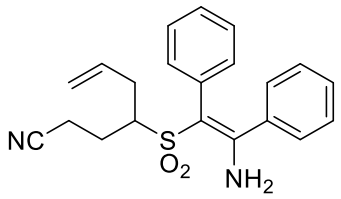
This compound was prepared following general procedure A using 3-methyl-3-phenylcyclobutan-1-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1g** (69.5 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 3/1) to afford the title compound **3ga** as a light yellow solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.50 (d, *J* = 7.9 Hz, 2H), 7.38 (t, *J* = 7.5 Hz, 2H), 7.29 (t, *J* = 7.2 Hz, 1H), 7.19-7.11 (m, 5H), 7.07-6.96 (m, 7H), 3.59 – 3.48 (m, 2H), 3.38 – 3.21 (m, 2H), 1.73 (s, 3H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 157.1, 143.8, 137.8, 134.9, 134.1, 129.1, 129.1, 128.8, 128.2, 127.9, 127.4, 127.0, 126.5, 118.9, 103.6, 62.4, 40.4, 29.8, 25.0. HRMS (ESI) calcd for $C_{25}H_{25}N_2O_2S^+$: 417.1631 ($M+H^+$), found: 417.1642.



(*Z*)-2-(((2-Amino-1,2-diphenylvinyl)sulfonyl)methoxy)acetonitrile (**3ha**)

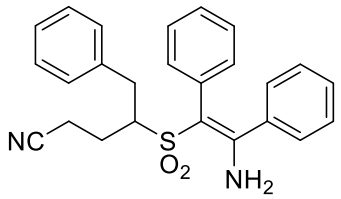
This compound was prepared following general procedure A using oxetan-3-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1h** (51.8 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 3/1) to afford the title compound **3ha** as a white

solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.27 (broad, 2H), 7.23 – 7.15 (m, 5H), 7.10 - 7.04 (m, 5H), 4.82 (s, 2H), 4.59 (s, 2H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 160.1, 137.6, 134.6, 134.3, 129.3, 129.1, 128.3, 128.0, 127.1, 117.1, 98.5, 82.9, 58.0. HRMS (ESI) calcd for $C_{17}H_{16}N_2NaO_3S^+$: 351.0774 ($M+Na^+$), found: 351.0785.



(*Z*)-4-((2-Amino-1,2-diphenylvinyl)sulfonyl)hept-6-enenitrile (**3ia**)

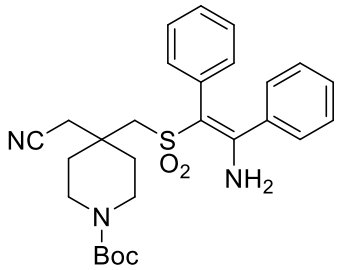
This compound was prepared following general procedure A using 2-allylcyclobutan-1-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1i** (59.5 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 3/1) to afford the title compound **3ia** as a colorless oil; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.37 – 6.88 (m, 12H), 5.87-5.77 (m, 1H), 5.22-5.10 (m, 2H), 2.95-2.82 (m, 1H), 2.74 – 2.54 (m, 3H), 2.50 - 2.41 (m, 1H), 2.18 – 2.09 (m, 1H), 1.97 – 1.86 (m, 1H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 159.3, 137.9, 134.7, 134.4, 134.1, 129.1, 128.9, 128.2, 128.0, 127.2, 120.3, 118.8, 98.6, 59.6, 31.8, 23.1, 14.6. HRMS (ESI) calcd for $C_{21}H_{23}N_2O_2S^+$: 367.1475 ($M+H^+$), found: 367.1478.



(*Z*)-4-((2-Amino-1,2-diphenylvinyl)sulfonyl)-5-phenylpentanenitrile (**3ja**)

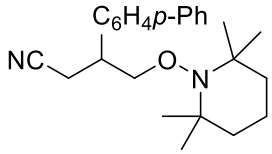
This compound was prepared following general procedure A using *O*-(4-(trifluoromethyl)benzoyl) oxime **1j** (69.5 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 3/1) to afford the title compound **3ia** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.35 – 7.06 (m, 17H), 3.42 – 3.35 (m, 1H), 3.15 -3.07 (m, 1H), 2.87 – 2.79 (m, 1H), 2.57 – 2.37 (m, 2H), 2.12 – 2.01 (m, 1H), 1.87

– 1.69 (m, 1H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 159.4, 137.9, 137.7, 134.7, 134.0, 129.4, 129.2, 129.1, 129.1, 128.2, 128.1, 127.2, 127.2, 120.1, 98.7, 61.7, 33.9, 23.3, 14.8. HRMS (ESI) calcd for $C_{25}H_{25}N_2O_2S^+$: 417.1631 ($M+H^+$), found: 417.1644.



tert-Butyl (*Z*)-4-(((2-amino-1,2-diphenylvinyl)sulfonyl)methyl)-4-(cyanomethyl)piperidine-1-carboxylate (**3ka**)

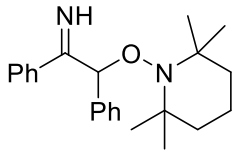
This compound was prepared following general procedure A using *tert*-butyl 2-(((4-(trifluoromethyl)benzoyl)oxy)imino)-7-azaspiro[3.5]nonane-7-carboxylate **1k** (85.3 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 2/1) to afford the title compound **3ka** as a white solid; ^{1}H NMR (400 MHz, DMSO) δ (ppm) 7.22 – 7.01 (m, 12H), 3.50 – 3.20 (m, 6H), 2.99 (s, 2H), 1.88 – 1.76 (m, 2H), 1.56 – 1.48 (2, 2H), 1.39 (s, 9H). ^{13}C NMR (100 MHz, DMSO) δ (ppm) 157.3, 154.3, 137.7, 134.9, 134.0, 129.2, 129.1, 128.2, 127.9, 127.0, 118.6, 104.0, 79.2, 57.0, 35.5, 34.0, 28.5, 25.9. HRMS (ESI) calcd for $C_{27}H_{33}N_3NaO_4S^+$: 518.2084 ($M+Na^+$), found: 518.2097.



3-([1,1'-Biphenyl]-4-yl)-4-((2,2,6,6-tetramethylpiperidin-1-yl)oxy)butanenitrile (**4**)

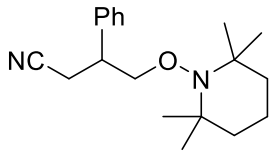
This compound was prepared following general procedure A using 3-([1,1'-biphenyl]-4-yl)cyclobutan-1-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1e** (81.9 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) and TEMPO (62.5 mg, 0.4 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 10/1) to afford the title compound **4** as a Colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm) 7.62-7.59 (m, 4H), 7.47 (t, *J* = 7.5 Hz, 2H), 7.37 (t, *J* = 8.2 Hz, 3H), 4.05

(d, *J* = 6.4 Hz, 2H), 3.38-3.23 (m, 1H), 2.98 (dd, *J* = 16.7, 5.7 Hz, 1H), 2.81 (dd, *J* = 16.7, 8.0 Hz, 1H), 1.60 – 1.26 (m, 6H), 1.18-1.10 (m, 12H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm) 140.5, 140.4, 138.1, 128.7, 127.9, 127.3, 127.3, 126.9, 118.6, 78.0, 59.9, 41.6, 39.6, 39.5, 32.9, 32.9, 21.0, 20.2, 20.0, 16.9. HRMS (ESI) calcd for $C_{25}H_{33}N_2O^+$: 377.2587 ($M+H^+$), found: 377.2588.



1,2-Diphenyl-2-((2,2,6,6-tetramethylpiperidin-1-yl)oxy)ethan-1-imine (**5**)[7]

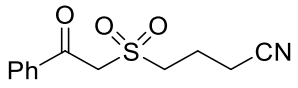
This compound was prepared following general procedure A using 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) and TEMPO (62.5 mg, 0.4 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 8/1) to afford the title compound **5** as a light yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm) 7.76-7.74 (m, 2H), 7.40 – 7.12 (m, 8H), 5.79 (s, 1H), 1.59 – 1.31 (m, 9H), 1.20 (s, 3H), 1.12 (s, 3H), 0.53 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm) 177.8, 138.9, 137.0, 130.2, 128.1, 128.1, 127.9, 127.6, 127.2, 88.7, 60.6, 59.4, 40.3, 34.0, 33.0, 20.2, 16.9.



3-Phenyl-4-((2,2,6,6-tetramethylpiperidin-1-yl)oxy)butanenitrile (**6**)[8]

This compound was prepared following general procedure A using 3-phenylcyclobutan-1-one *O*-(4-(trifluoromethyl)benzoyl) oxime **1b** (81.9 mg, 0.2 mmol) and TEMPO (62.5 mg, 0.4 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 8/1) to afford the title compound **6** as a a colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm) 7.36-7.24 (m, 5H), 3.99 (d, *J* = 6.4 Hz, 2H), 3.29 – 3.14 (m, 1H), 2.92 (dd, *J* = 16.7, 5.9 Hz, 1H), 2.74 (dd, *J* = 16.7, 8.0 Hz, 1H), 1.59 – 1.18 (m, 6H), 1.11-1.07 (m, 12H). ^{13}C NMR (100 MHz, $CDCl_3$) δ

(ppm) 139.2, 128.7, 127.6, 127.5, 118.7, 78.1, 59.9, 41.9, 39.6, 39.6, 33.0, 21.0, 20.2, 20.1, 17.0.



4-((2-Oxo-2-phenylethyl)sulfonyl)butanenitrile (**7**)[9]

This compound was prepared following general procedure A using cyclobutanone *O*-(4-(trifluoromethyl)benzoyl) oxime **1a** (51.4 mg, 0.2 mmol), 2,3-diphenyl-2*H*-azirine **2a** (58.0 mg, 0.3 mmol) and trimethyl((1-phenylvinyl)oxy)silane (385 mg, 2 mmol) as starting material and purified by column chromatography on silica gel (*n*-hexane/ethyl acetate = 5/1) to afford the title compound **7** as a light yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 7.6 Hz, 2H), 7.68 (t, *J* = 7.4 Hz, 1H), 7.54 (t, *J* = 7.7 Hz, 2H), 4.63 (s, 2H), 3.45 (t, *J* = 7.3 Hz, 2H), 2.64 (t, *J* = 7.1 Hz, 1H), 2.33-2.26 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm) 189.0, 135.5, 134.9, 129.3, 129.1, 118.0, 60.1, 51.8, 18.4, 16.3.

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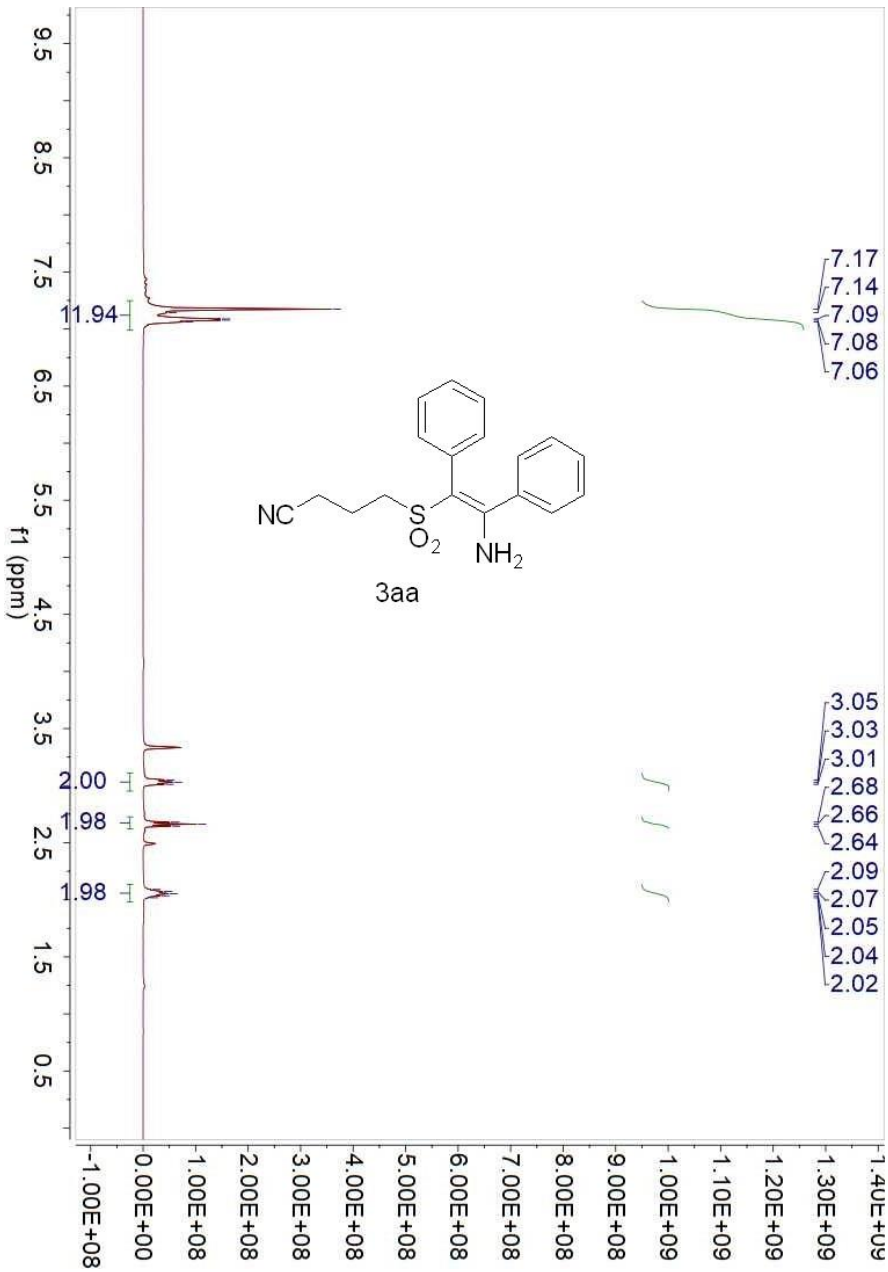
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NH2
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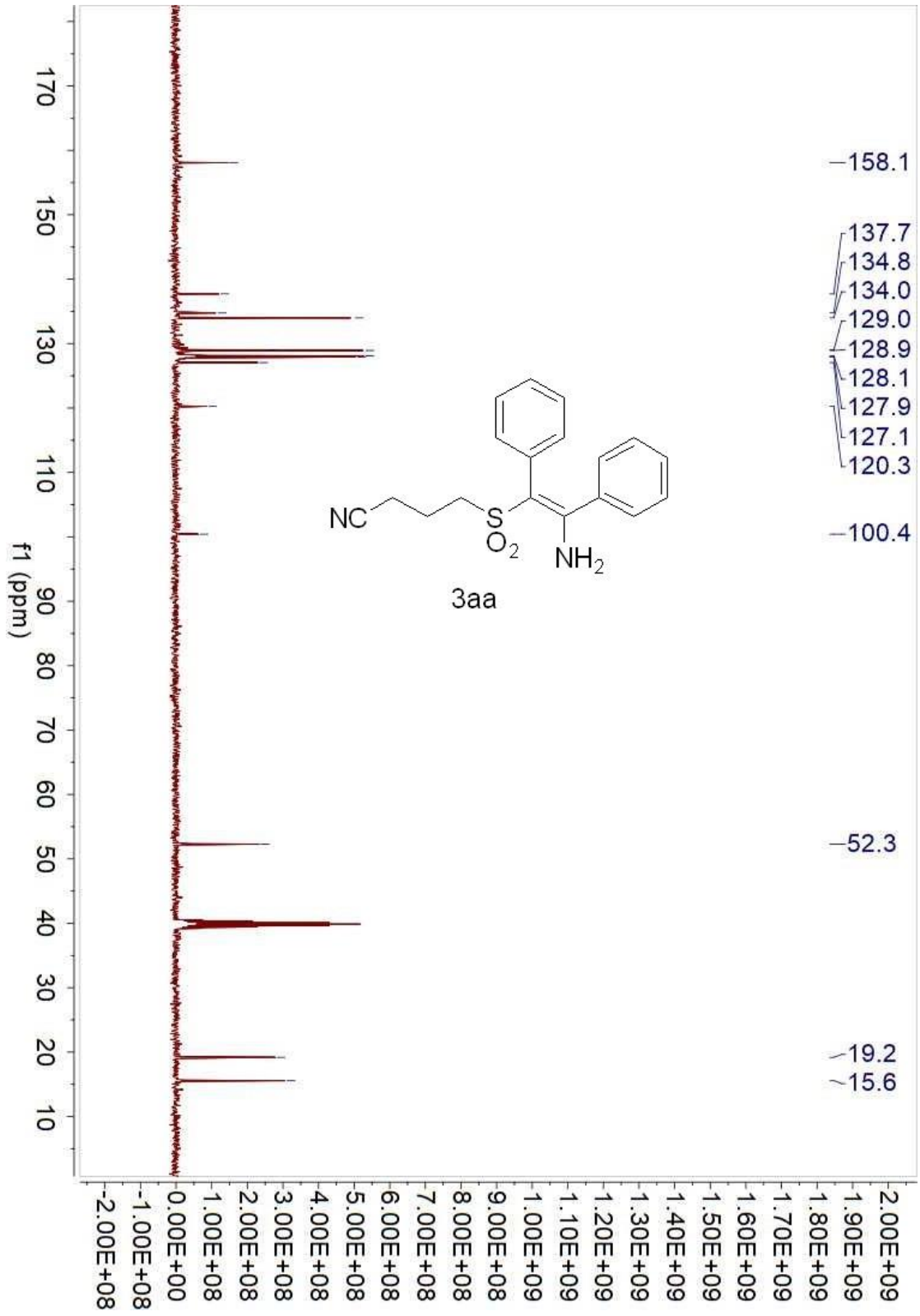
f1 (ppm)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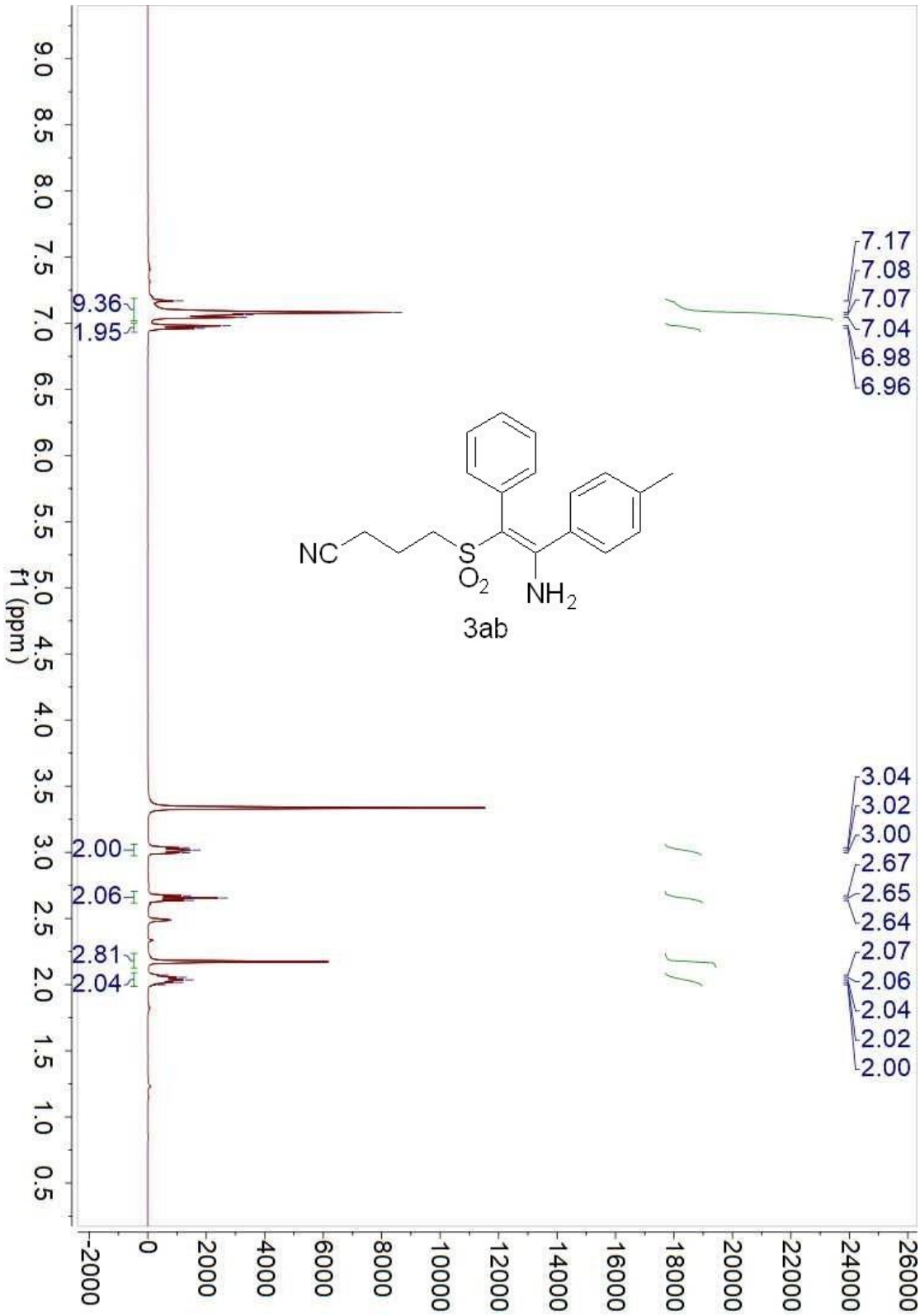
f1 (ppm)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S
O2
NH2
3ab
3.04
3.02
3.00
2.67
2.65
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2.06
2.04
2.02
2.00
2.00
2.06
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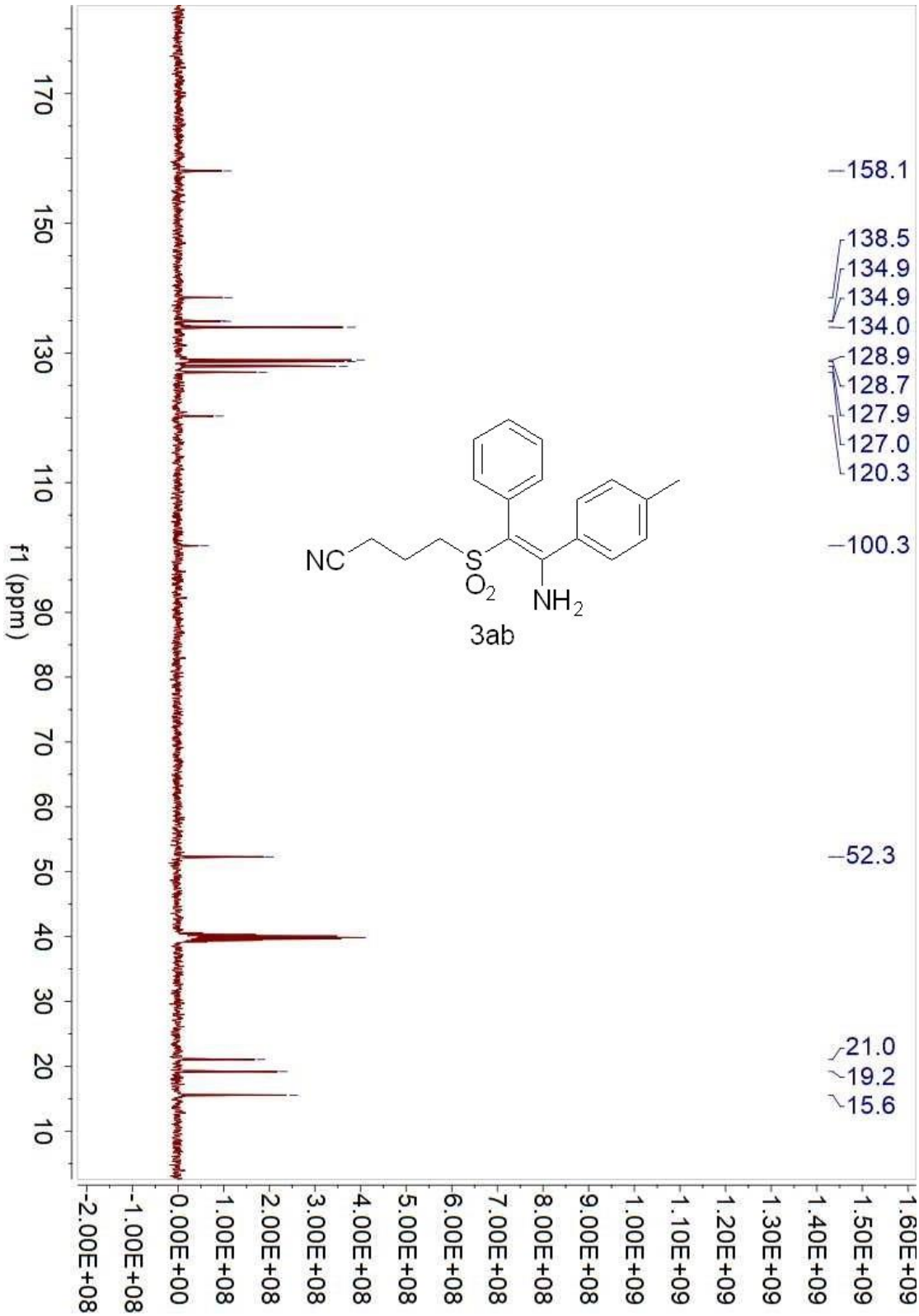
2.04
f1 (ppm)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127.9
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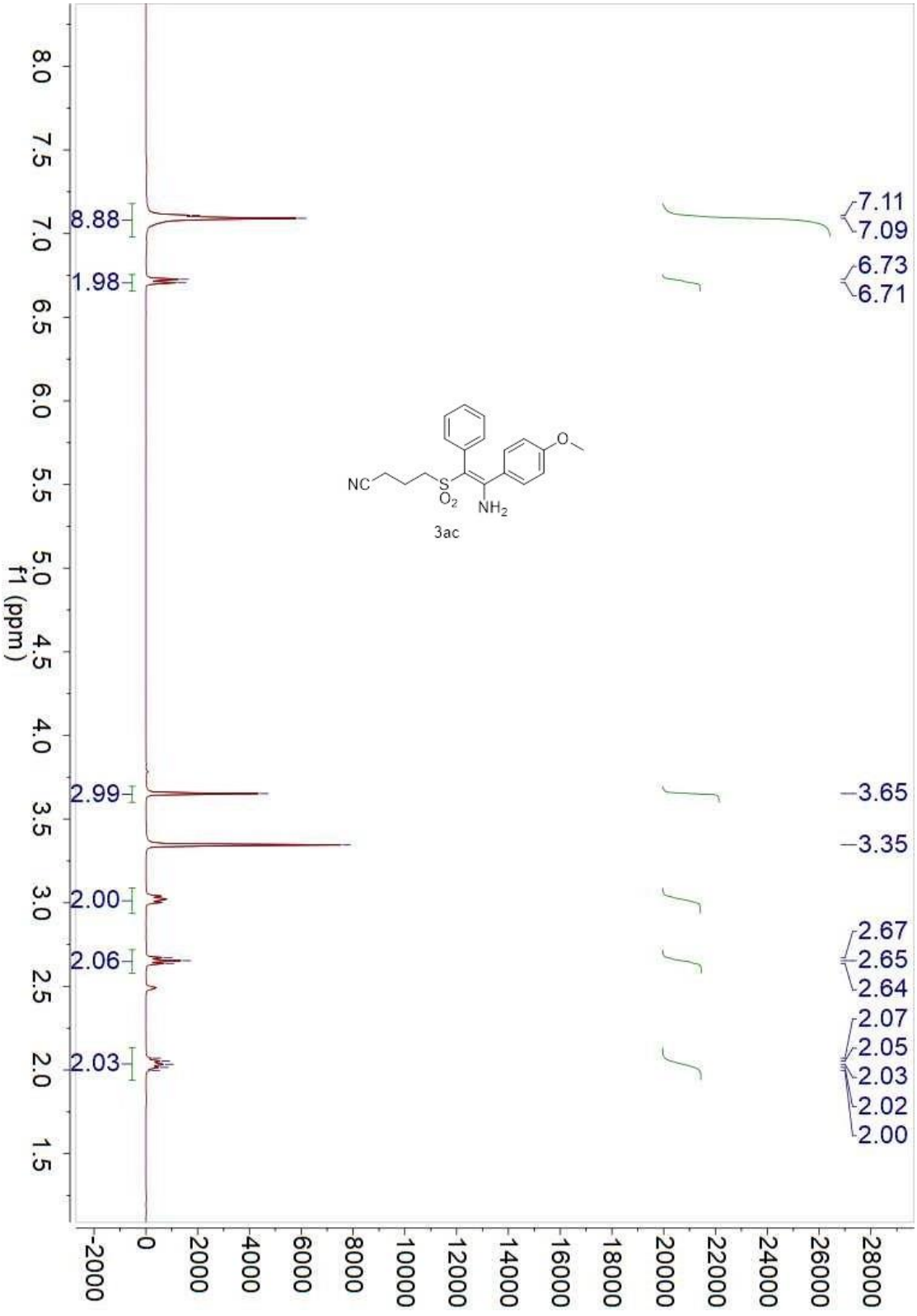
19.2
15.6
NC
S
O2
NH2
3ab
f1 (ppm)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7.09
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6.71
3.65
3.35
2.67
2.65
2.64
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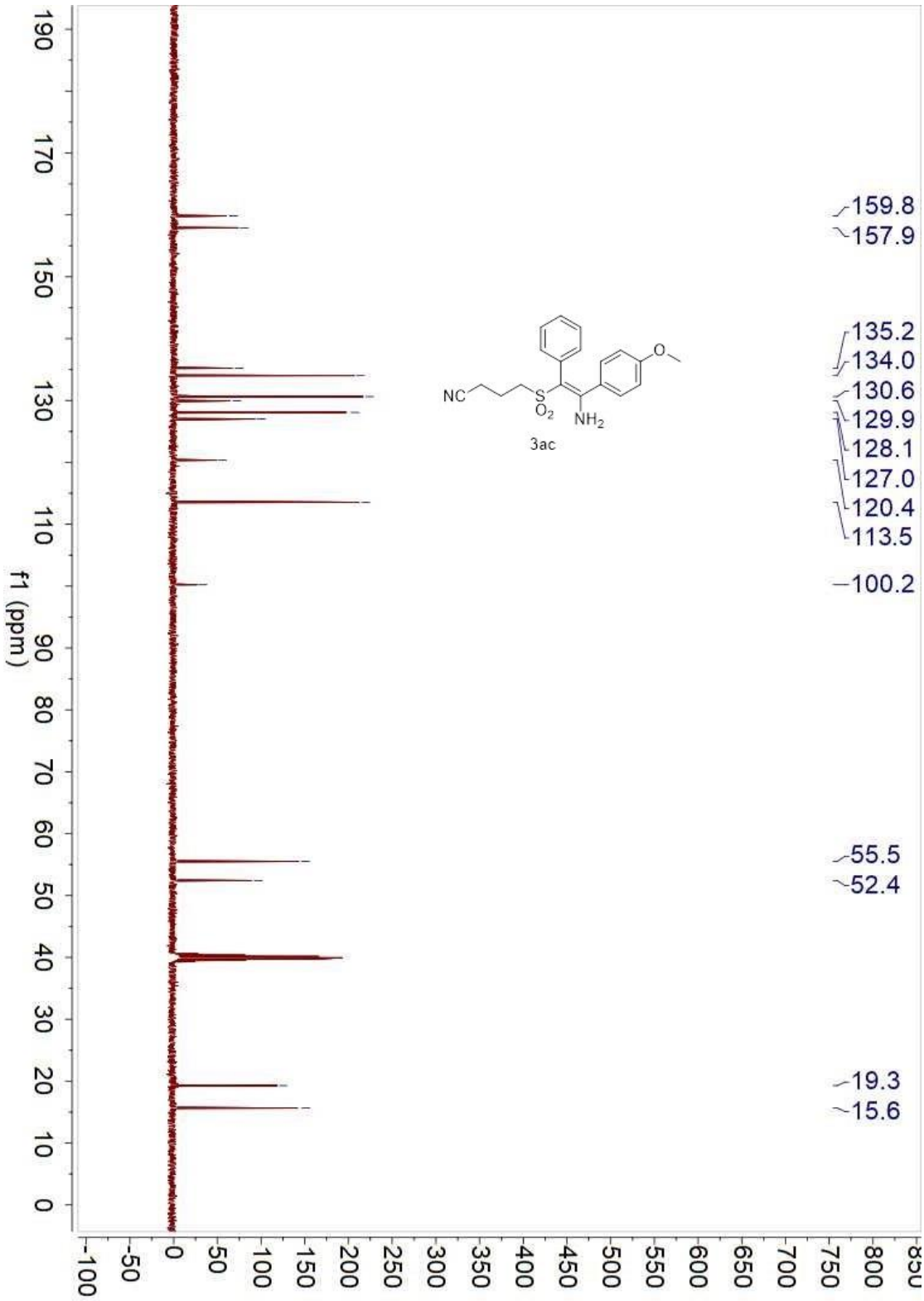
2.05
2.03
2.02
2.00
NC
S
O2
NH2
O
3ac
f1 (ppm)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128.1
127.0
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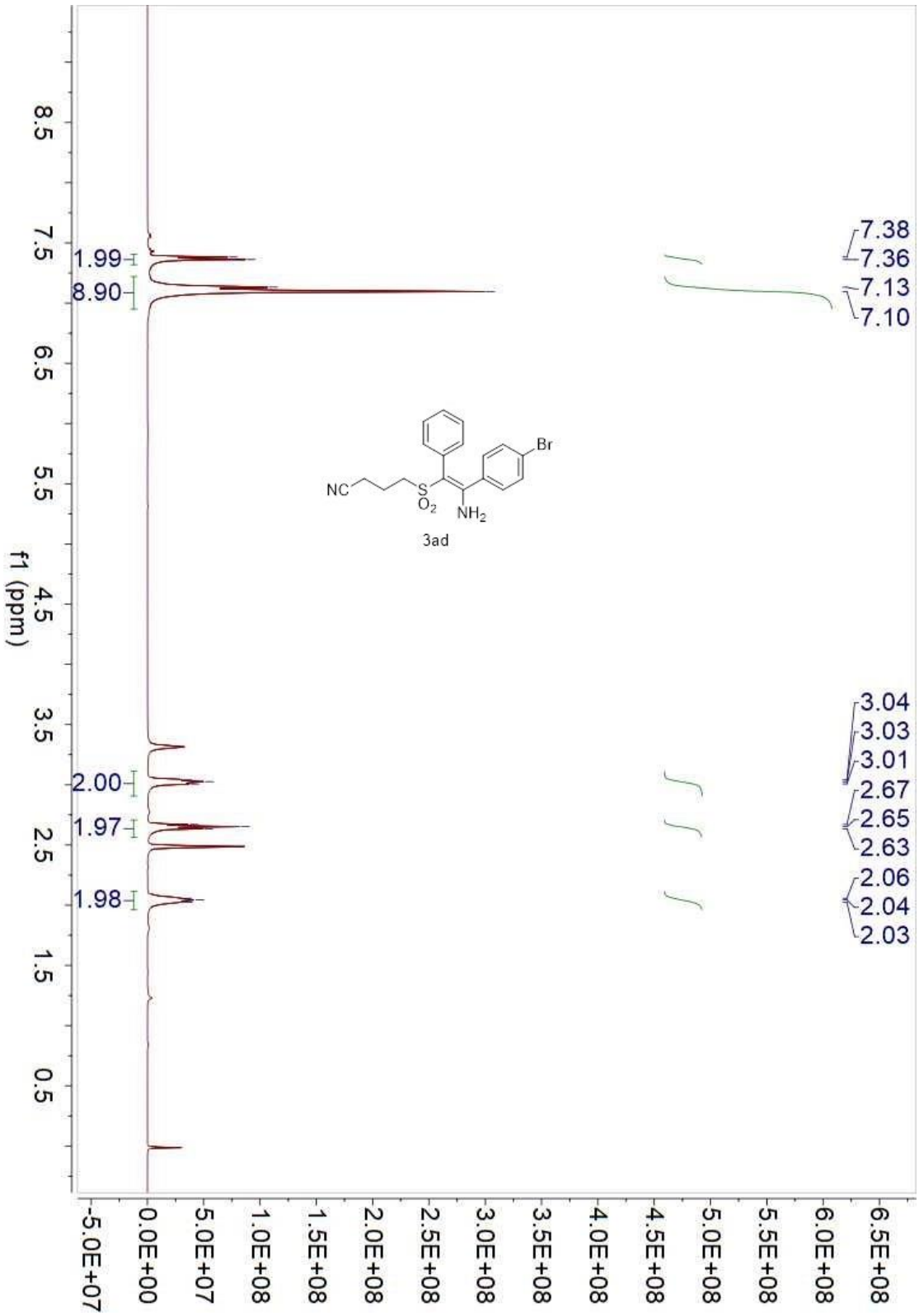
52.4
19.3
15.6
NC
S
O2
NH2
O
3ac
f1 (ppm)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7.13
7.10
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8.90
3.04
3.03
3.01
2.67
2.65
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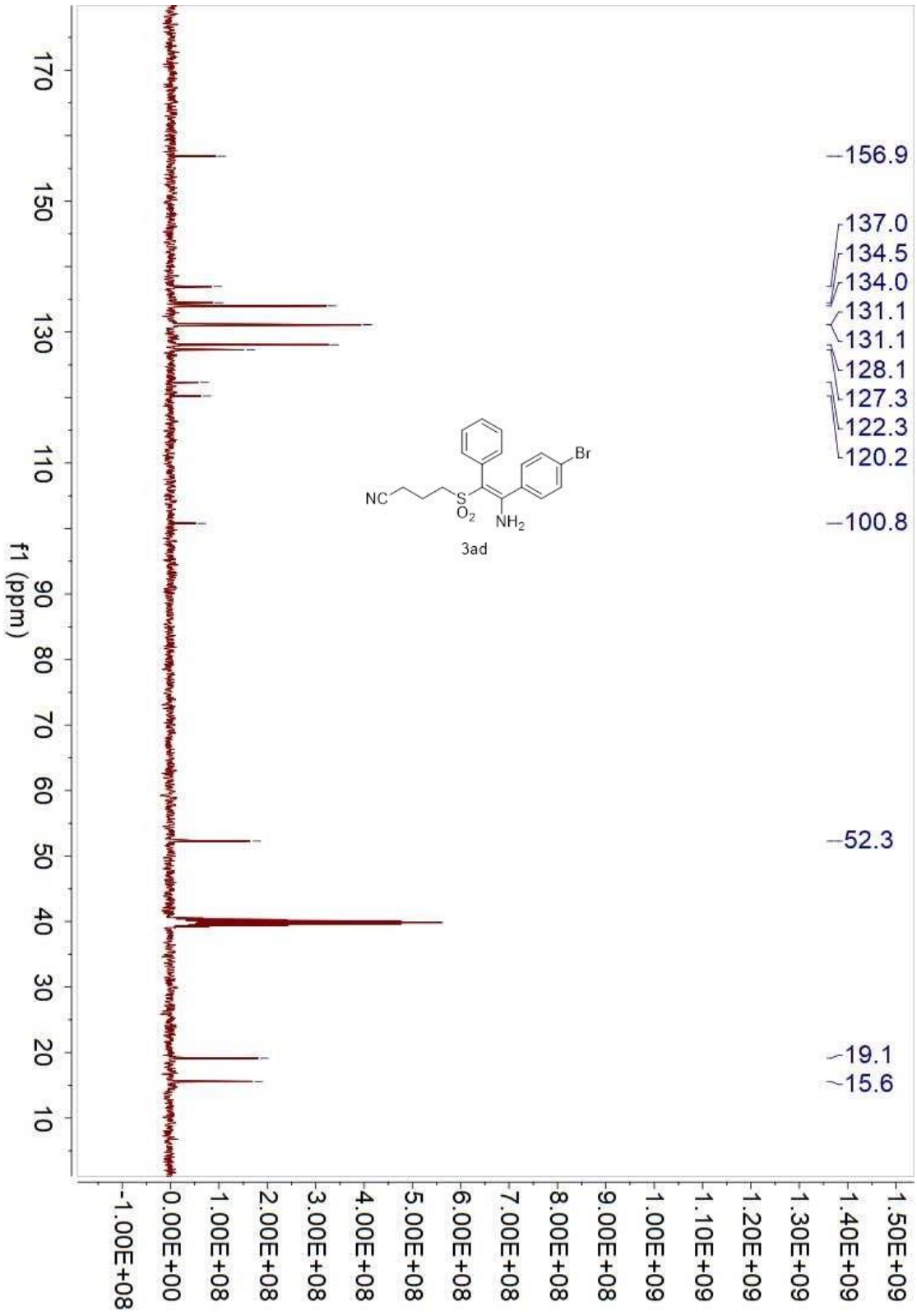
2.06
2.04
2.03
2.00
1.97
1.98
NC
S
O2
NH2
Br
3ad
f1 (ppm)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52.3
19.1
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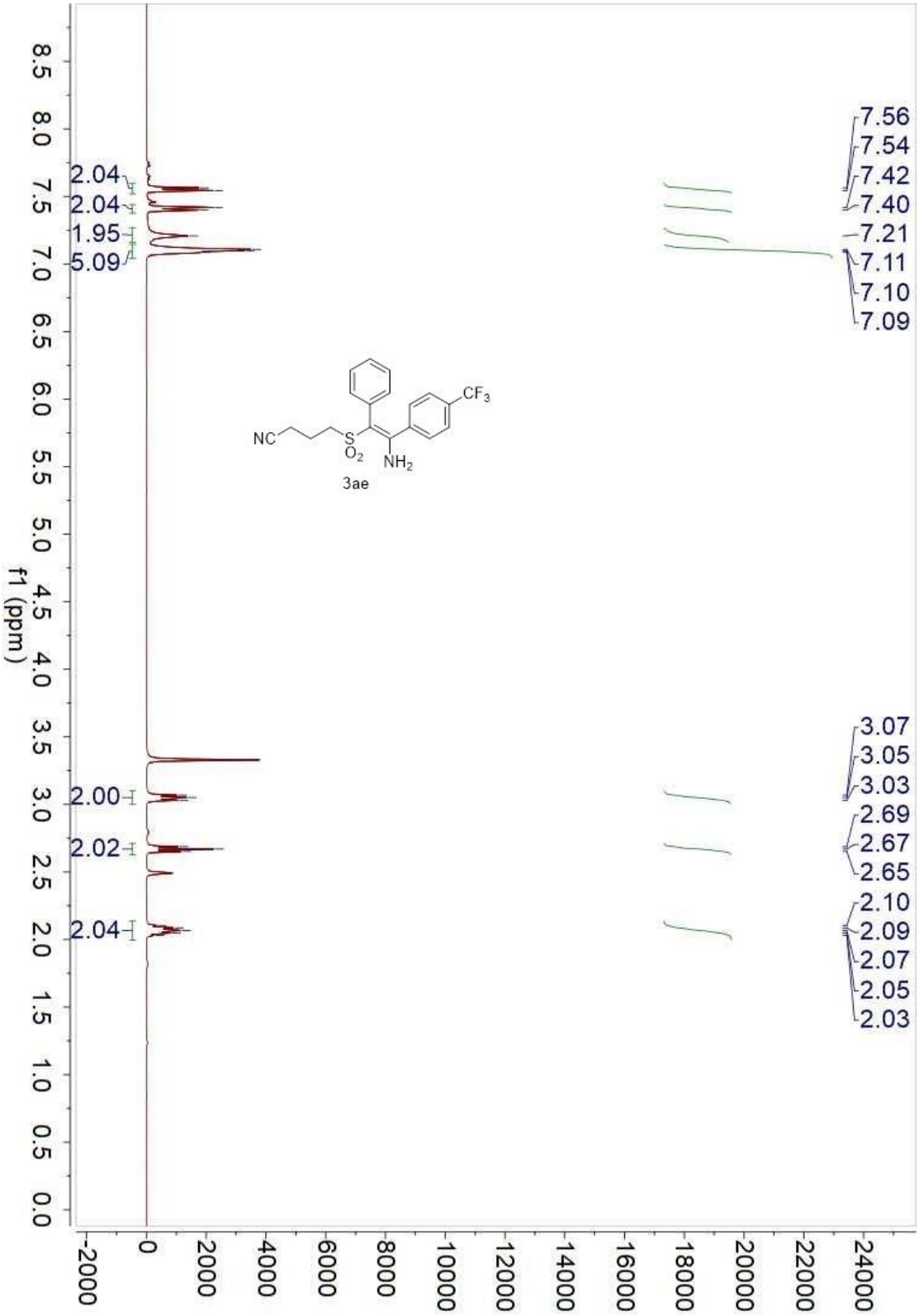
Br
NC
S
O2
NH2
3ad
f1 (ppm)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7.09
3.07
3.05
3.03
2.69
2.67
2.65
2.10
2.09
2.07
2.05
2.03
2.04
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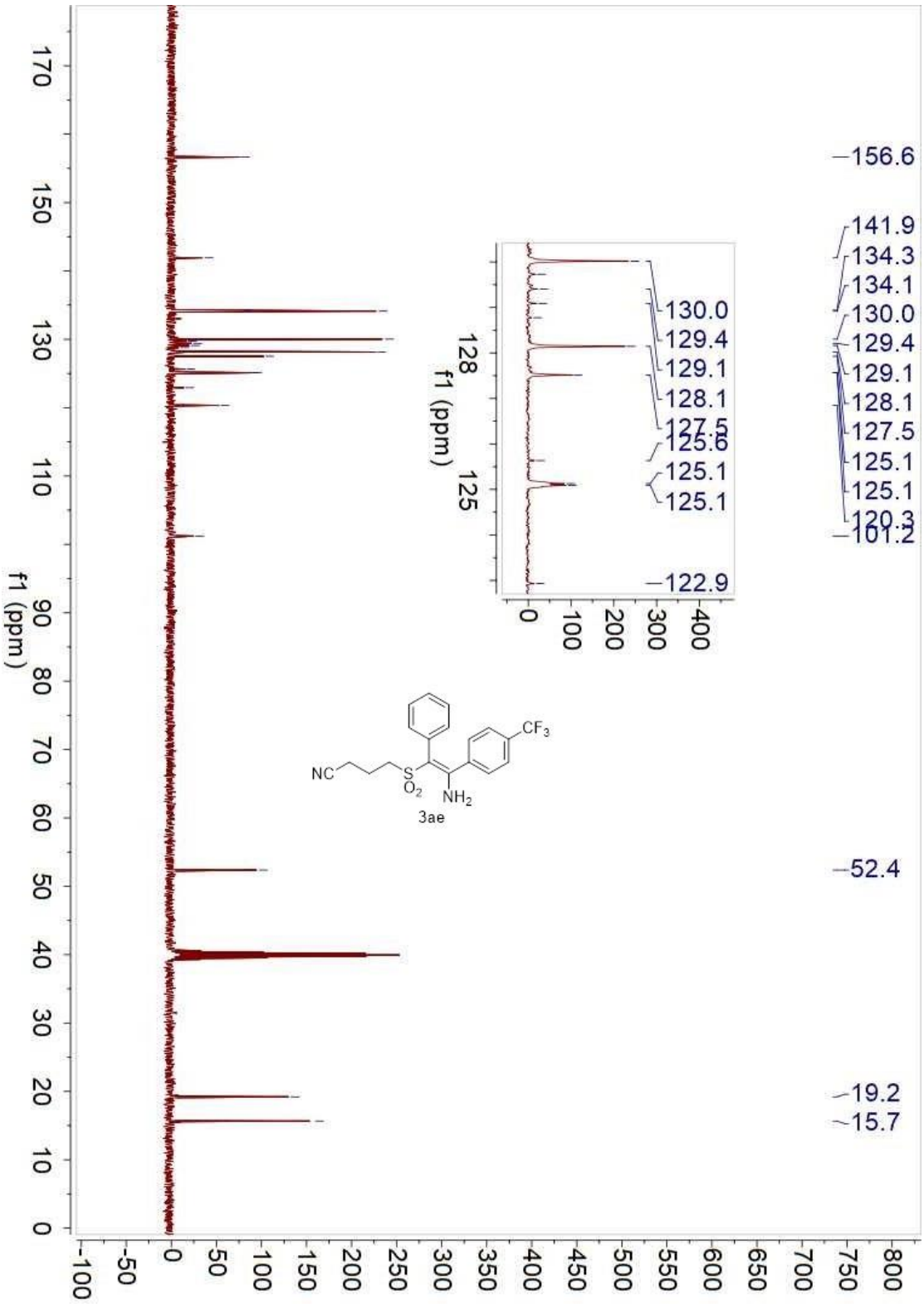
5.09
2.00
2.02
2.04
NC
S
O2
NH2
CF3
3ae
f1 (ppm)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129.1
128.1
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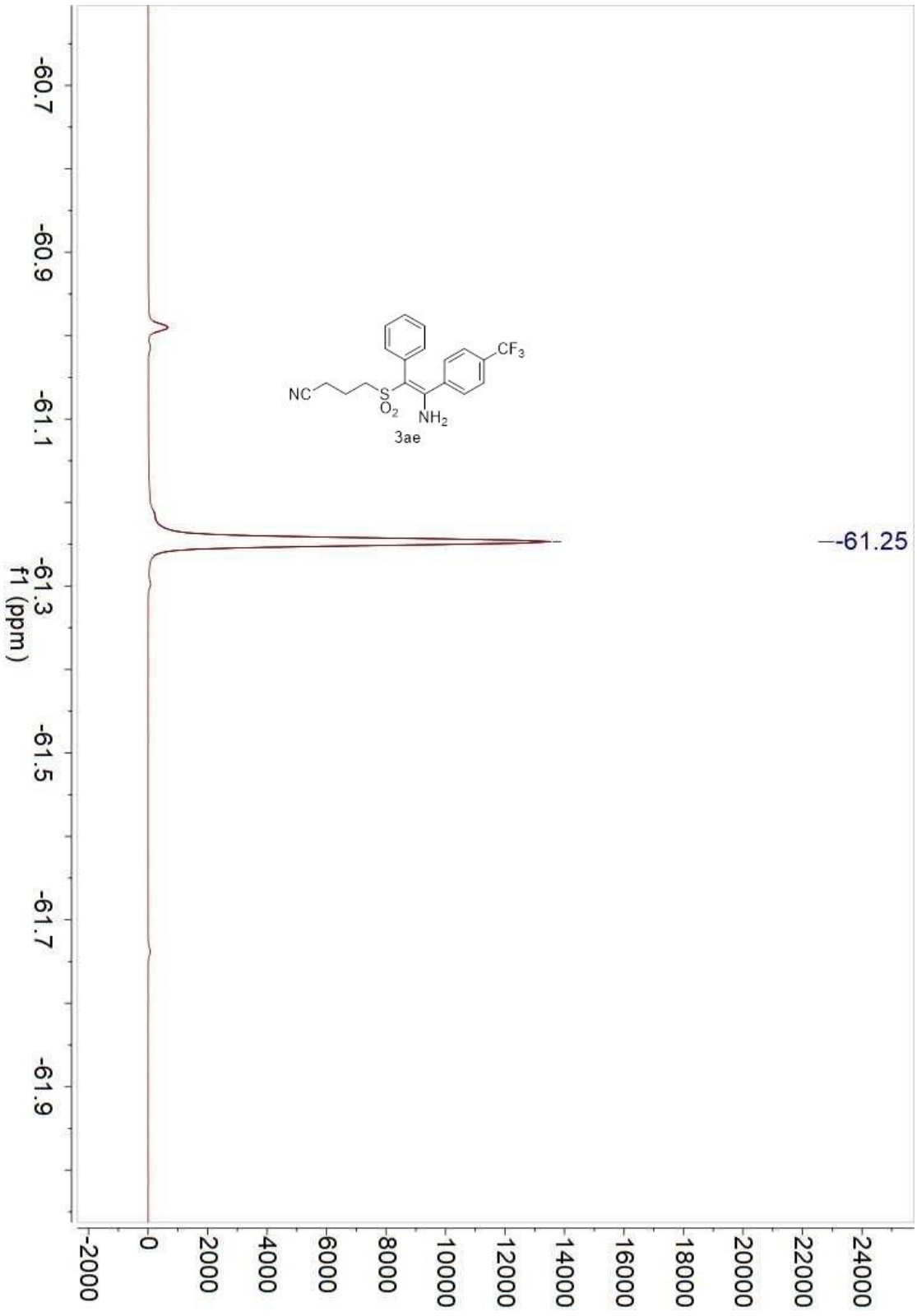
125.6
125.1
125.1
120.3
101.2
52.4
19.2
15.7
130.0
129.4
129.1
128.1
127.5
125.6
125.1
125.1
122.9
f1 (ppm)
NC
S
O2
NH2
CF3
3ae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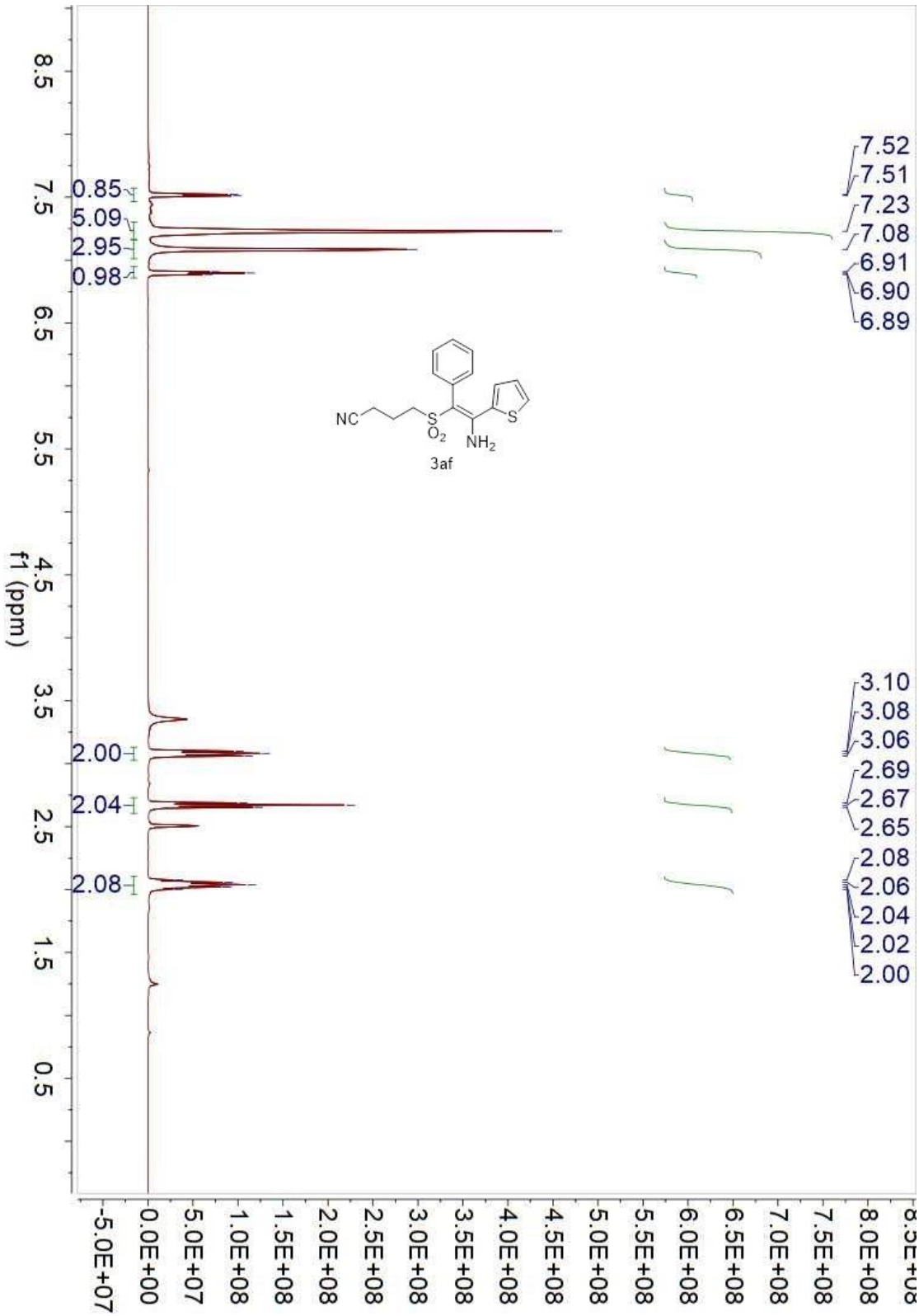
-61.1
-61.3
-61.5
-61.7
-61.9
f1 (ppm)
-61.25
NC
S
O2
NH2
CF3
3ae
-2000
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
22000
24000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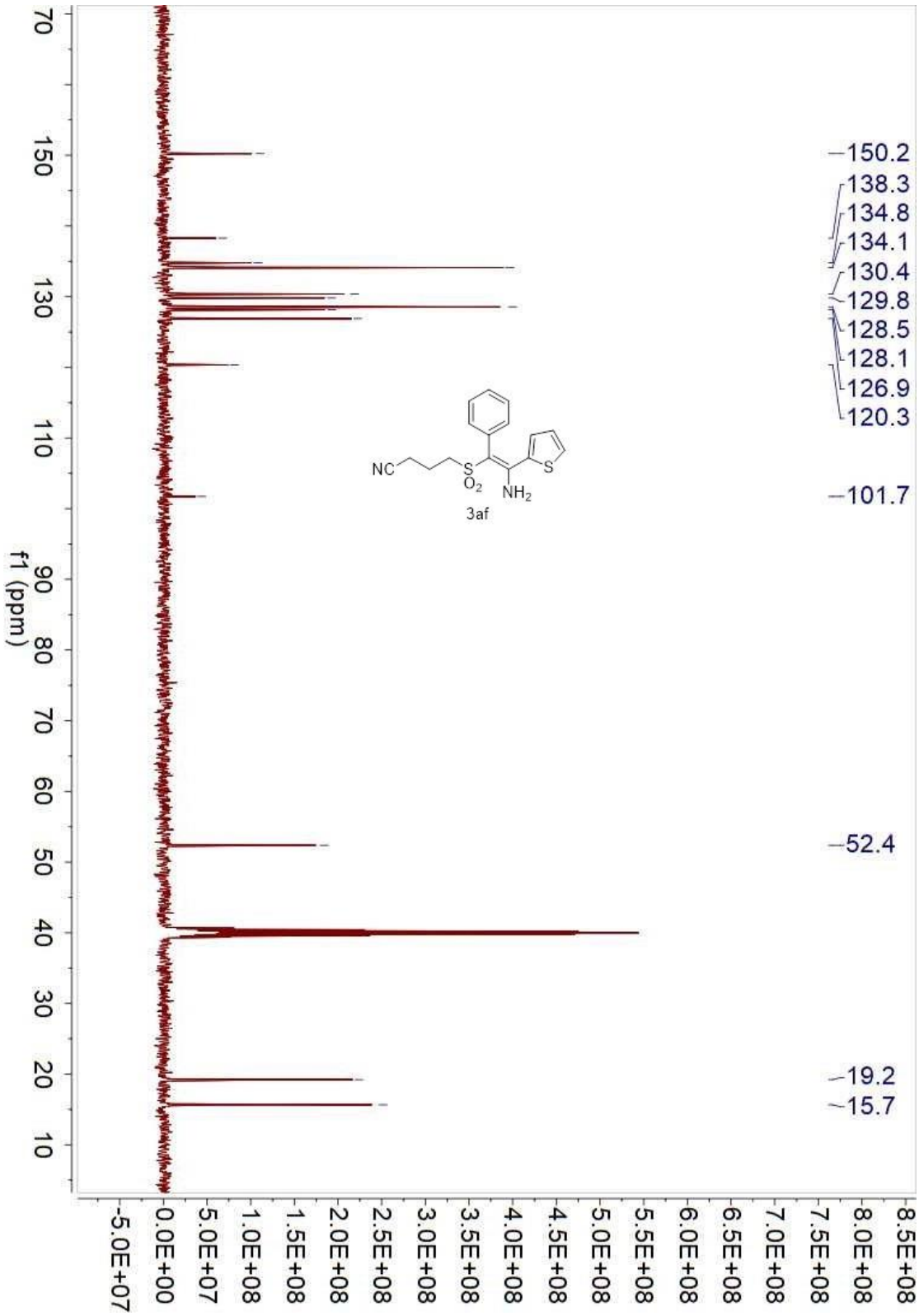
7.51
7.23
7.08
6.91
6.90
6.89
0.85
5.09
2.95
0.98
3.10
3.08
3.06
2.69
2.67
2.65
2.08
2.06
2.04
2.02
2.00
2.00
2.04
2.08
NC
S
O2
NH2
S
3af
f1 (ppm)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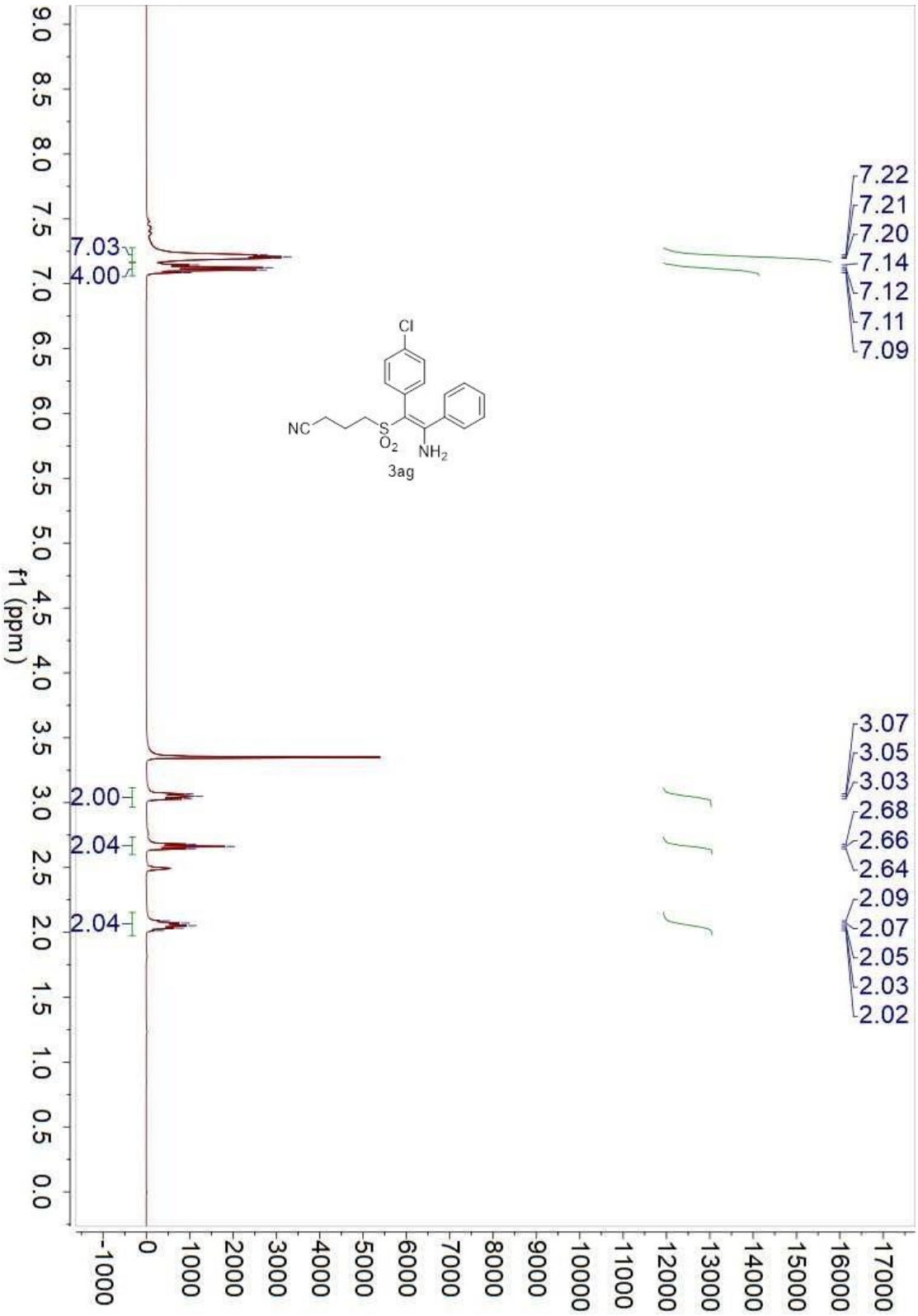
134.8
134.1
130.4
129.8
128.5
128.1
126.9
120.3
101.7
52.4
19.2
15.7
NC
S
O2
NH2
S
3af
f1 (ppm)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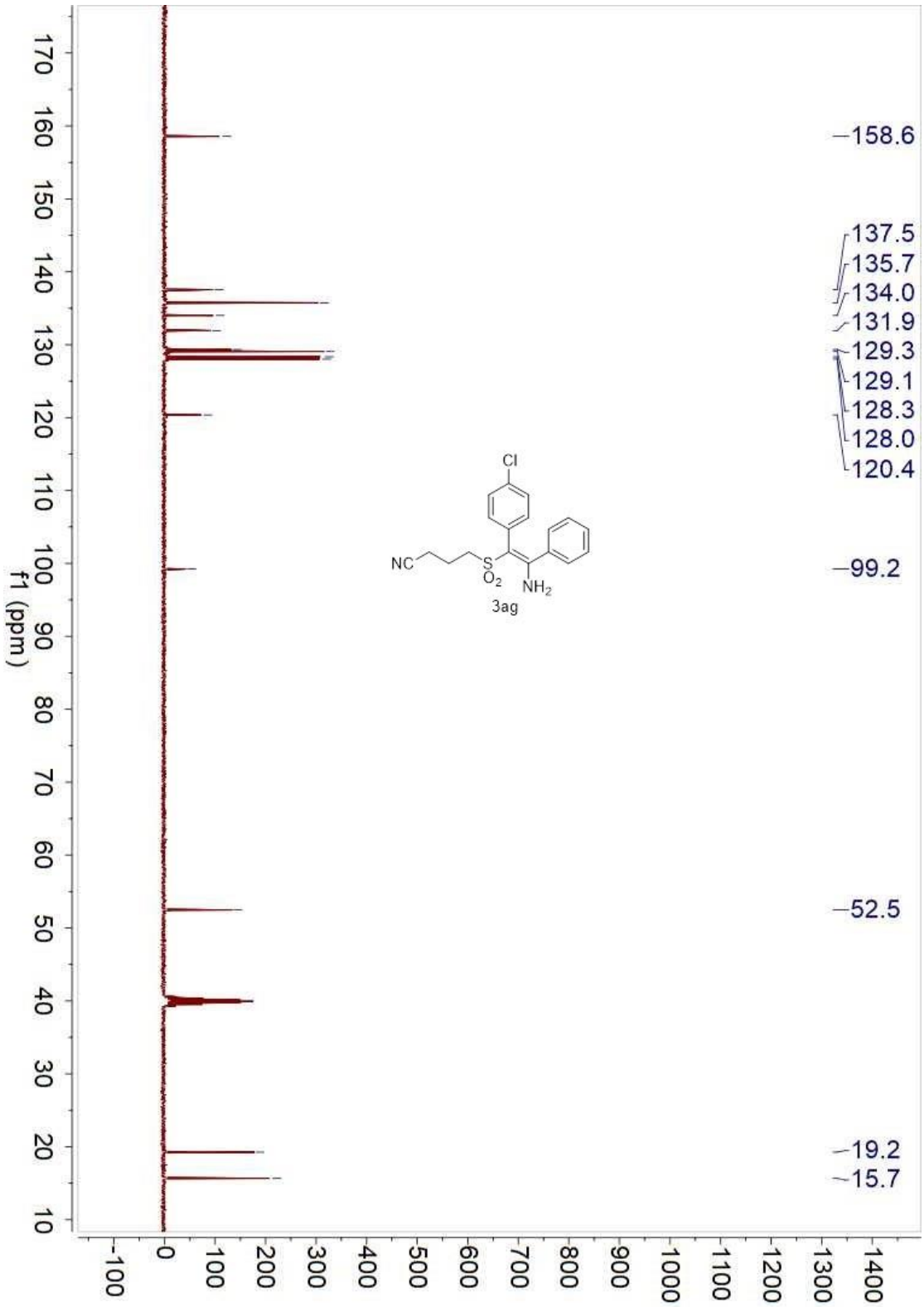
7.12
7.11
7.09
7.03
4.00
3.07
3.05
3.03
2.68
2.66
2.64
2.09
2.07
2.05
2.03
2.02
2.00
2.04
2.04
Cl
NC
S
O2
NH2
3ag
f1 (ppm)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137.5
135.7
134.0
131.9
129.3
129.1
128.3
128.0
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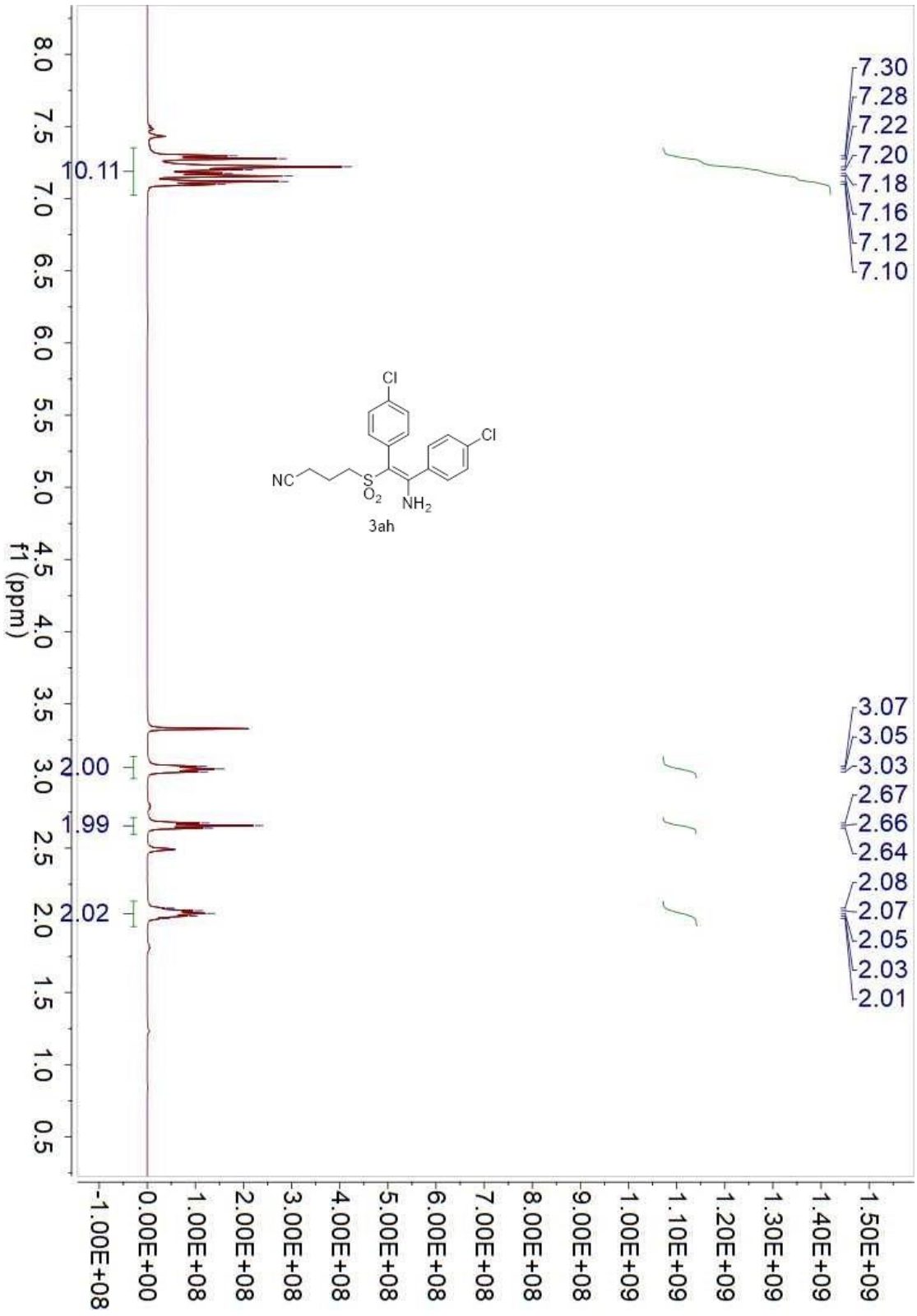
99.2
52.5
19.2
15.7
Cl
NC
S
O2
NH2
3ag
f1 (ppm)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7.28
7.22
7.20
7.18
7.16
7.12
7.10
10.11
Cl
Cl
NC
S
O2
NH2
3ah
3.07
3.05
3.03
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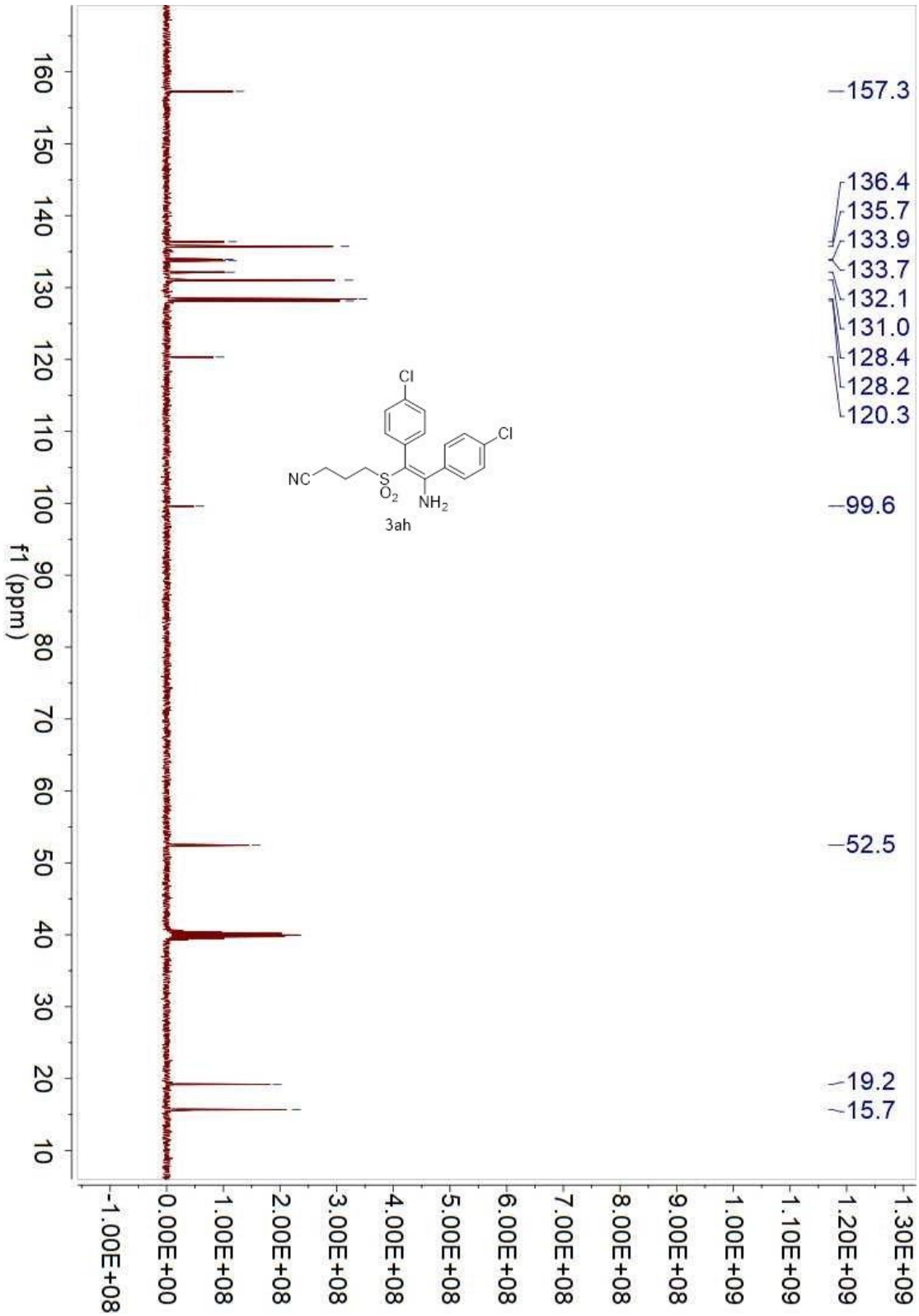
2.01
2.00
1.99
2.02
f1 (ppm)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136.4
135.7
133.9
133.7
132.1
131.0
128.4
128.2
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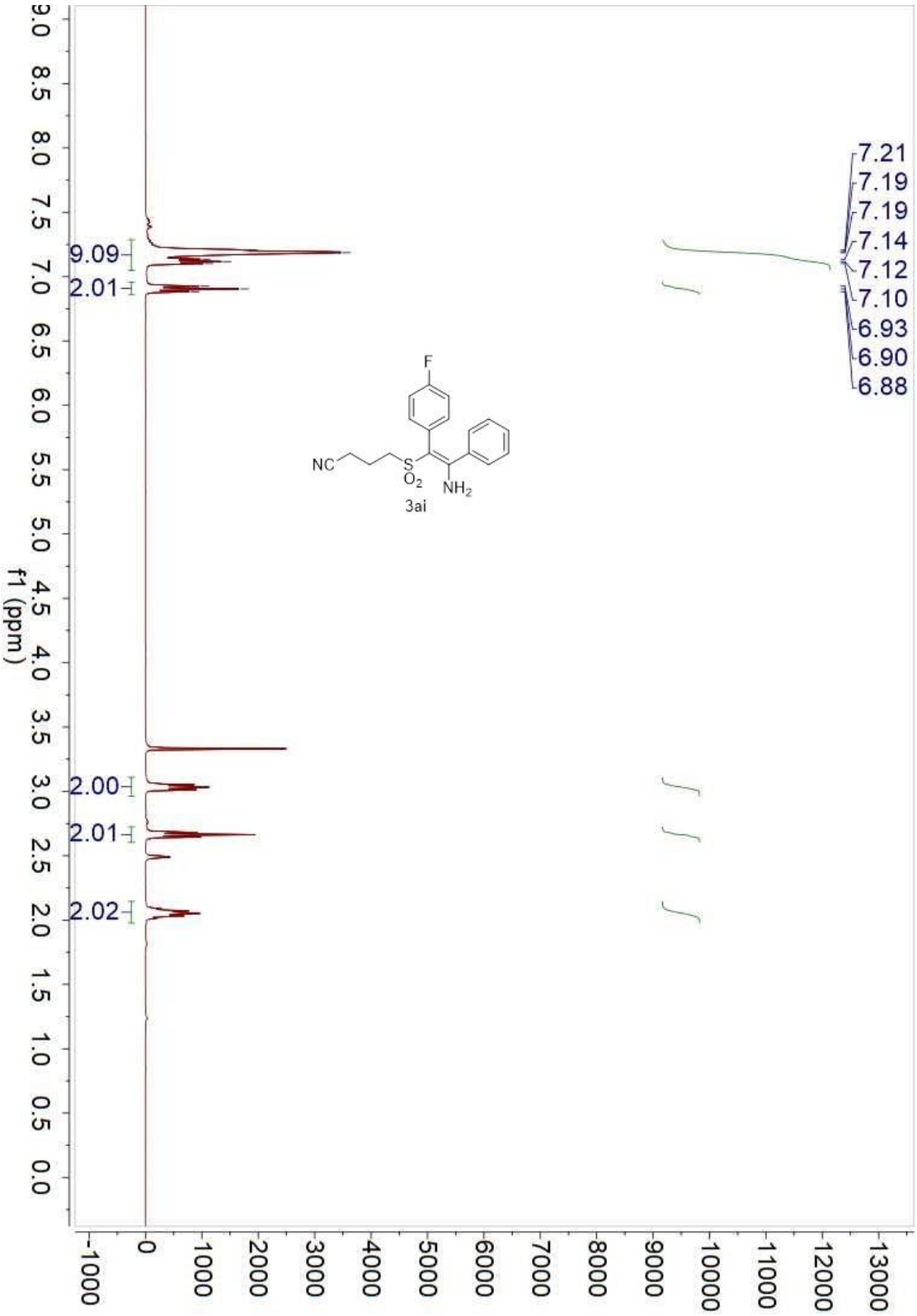
52.5
19.2
15.7
Cl
Cl
NC
S
O2
NH2
3ah
f1 (ppm)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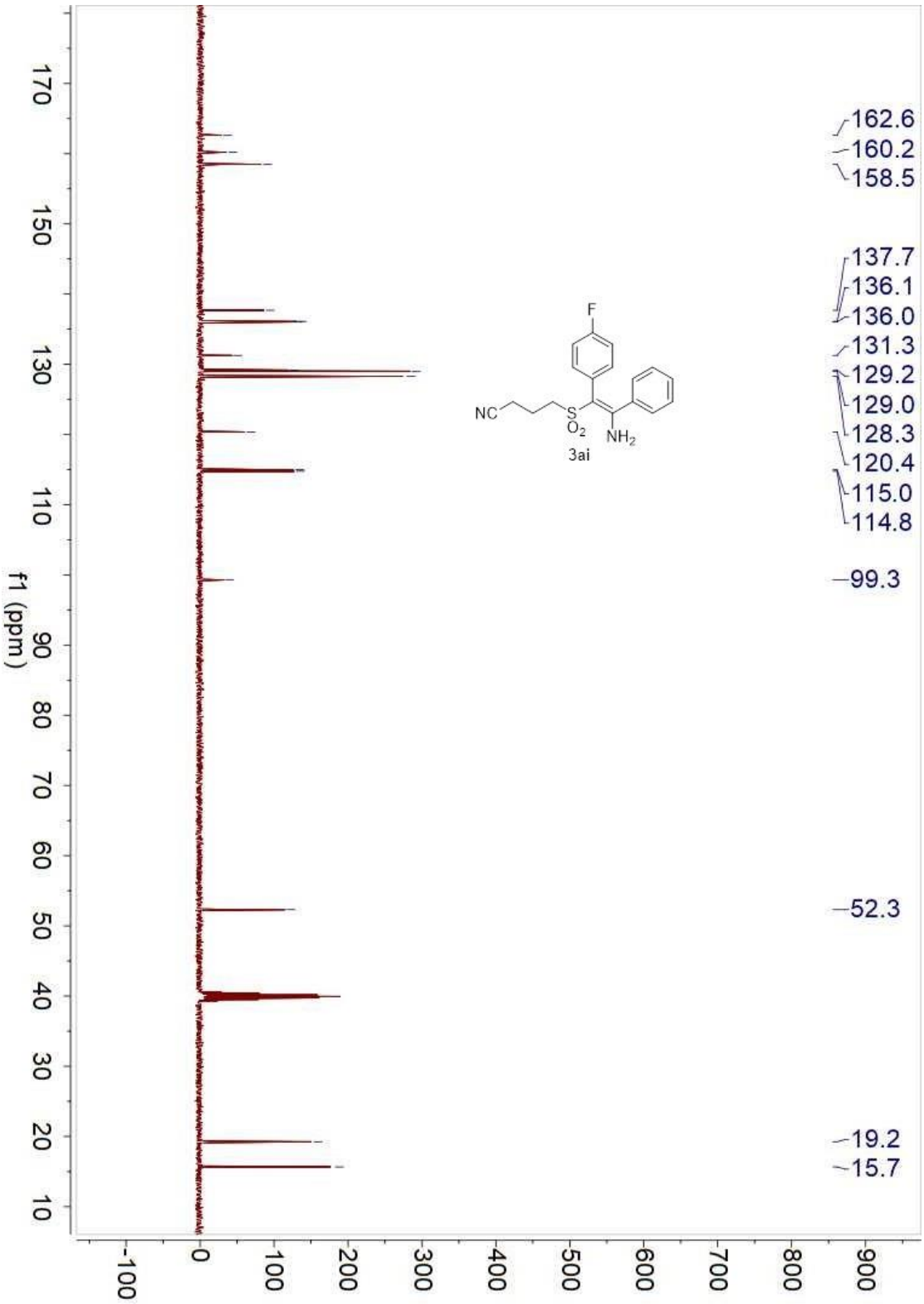
7.19
7.19
7.14
7.12
7.10
6.93
6.90
6.88
9.09
2.01
2.00
2.01
2.02
F
NC
S
O2
NH2
3ai
f1 (ppm)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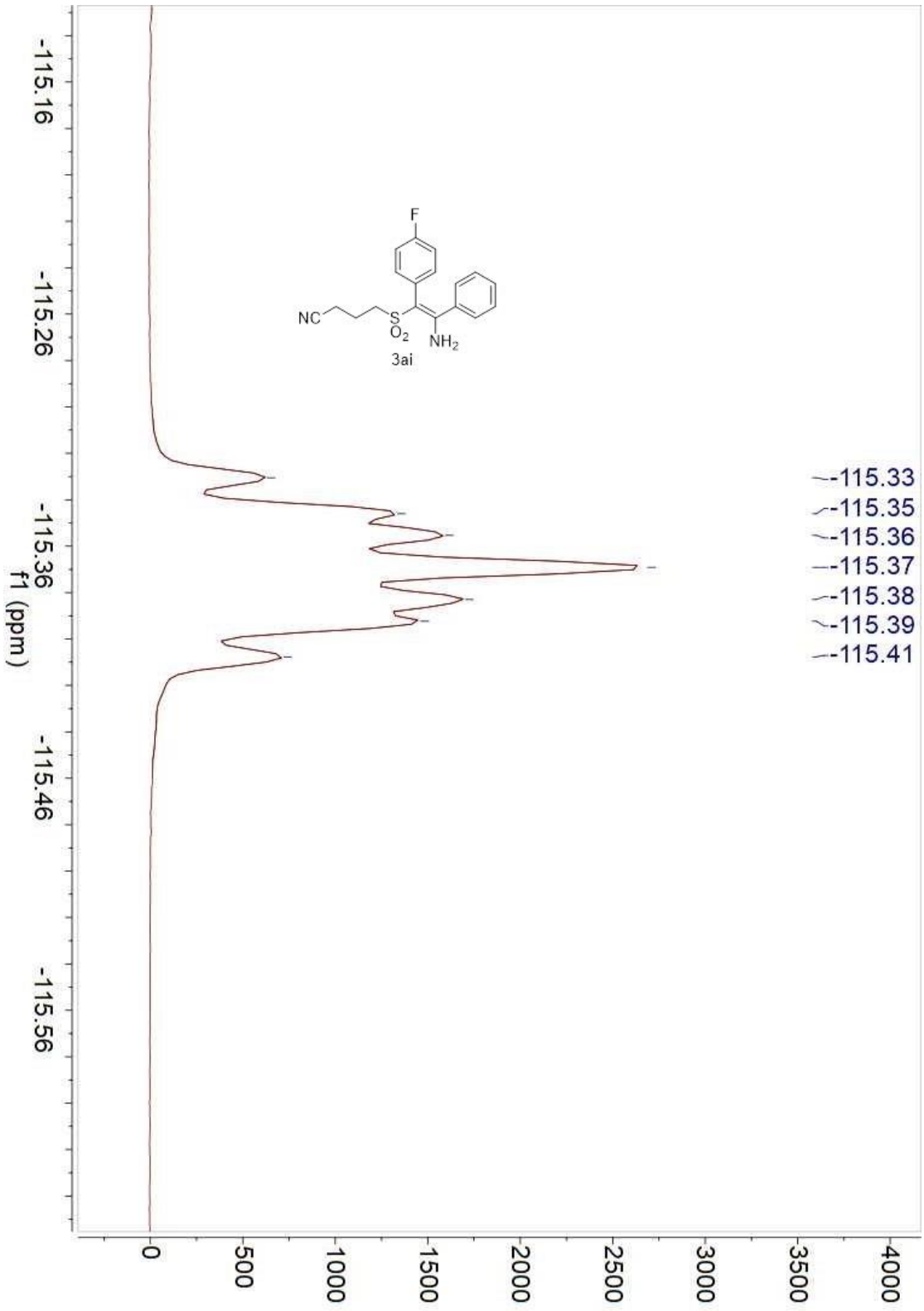
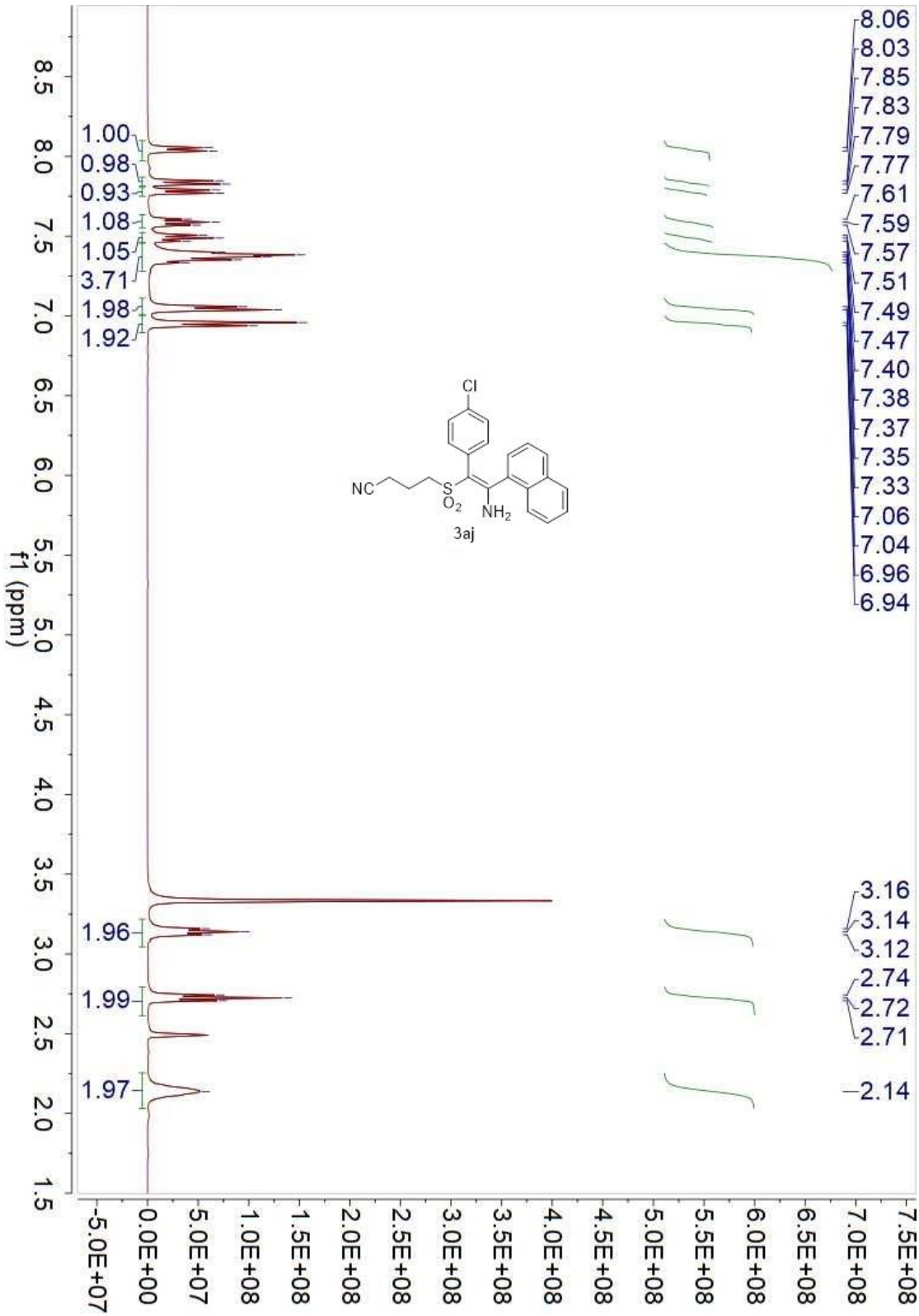
160.2
158.5
137.7
136.1
136.0
131.3
129.2
129.0
128.3
120.4
115.0
114.8
99.3
52.3
19.2
15.7
F
NC
S
O2
NH2
3ai
f1 (ppm)


F
NC
S
O2
NH2
3ai
-115.33
-115.35
-115.36
-115.37
-115.38
-115.39
-115.41
-115.16
-115.26
-115.36
-115.46
-115.56
f1 (ppm)
0
500
1000
1500
2000
2500
3000
3500
4000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7.79
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7.59
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7.51
7.49
7.47
7.40
7.38
7.37
7.35
7.33
7.06
7.04
6.96
6.94
1.00
0.98
0.93
1.08
1.05
3.71
1.98
1.92
3.16
3.14
3.12
2.74
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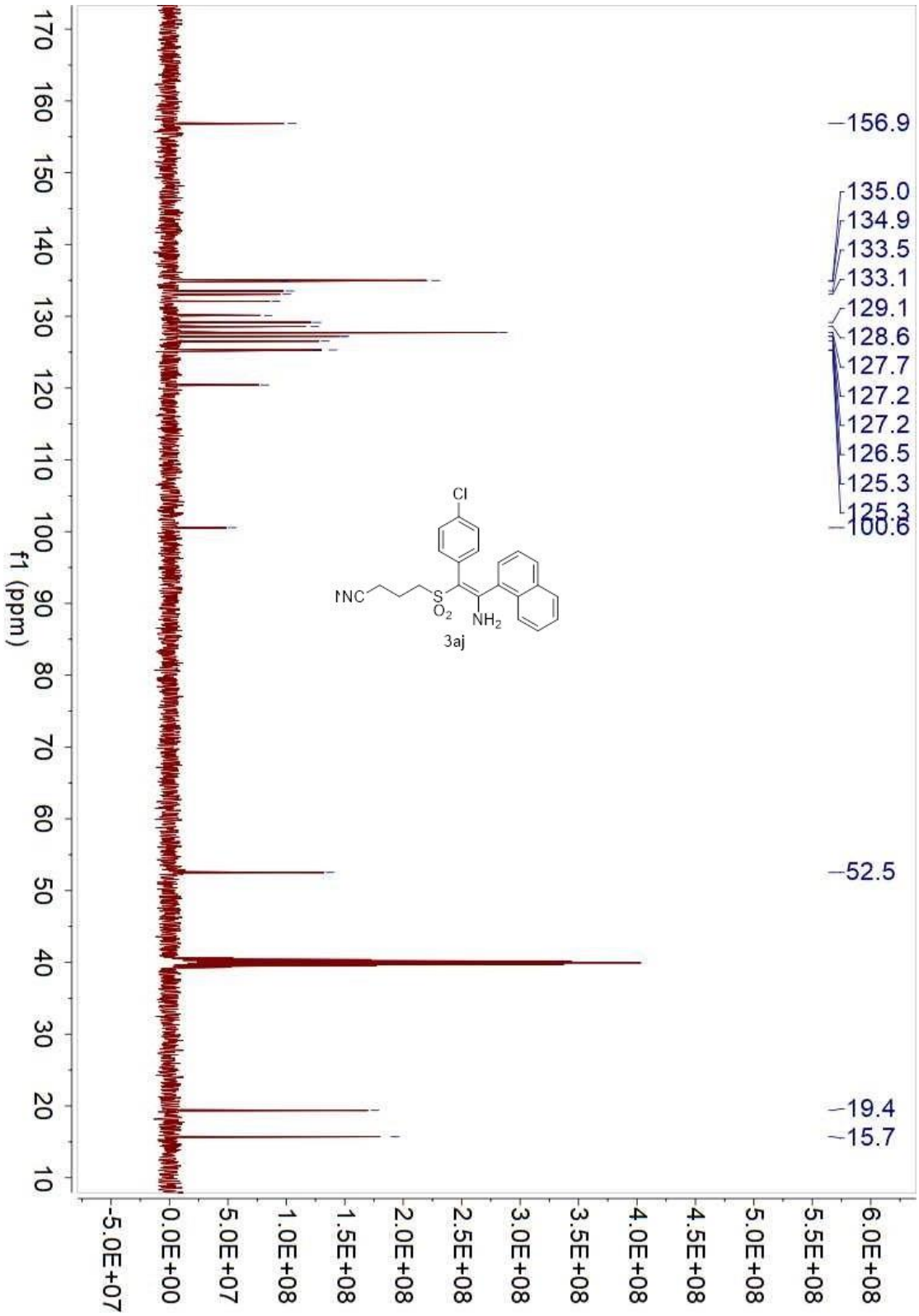
2.71
2.14
1.96
1.99
1.97
Cl
NC
S
O2
NH2
3aj
f1 (ppm)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127.2
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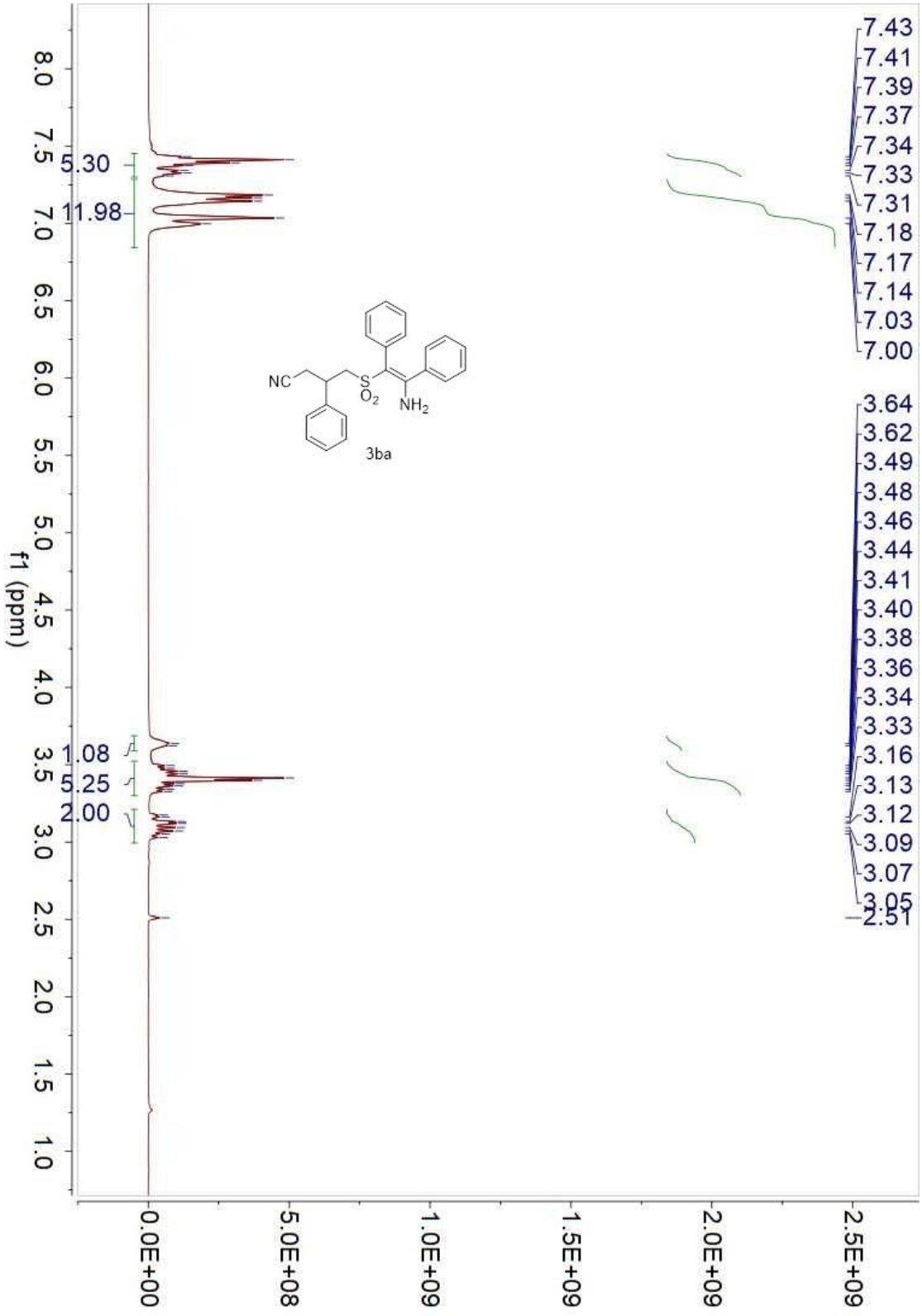
100.6
52.5
19.4
15.7
Cl
NC
S
O2
NH2
3aj
f1 (ppm)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7.14
7.03
7.00
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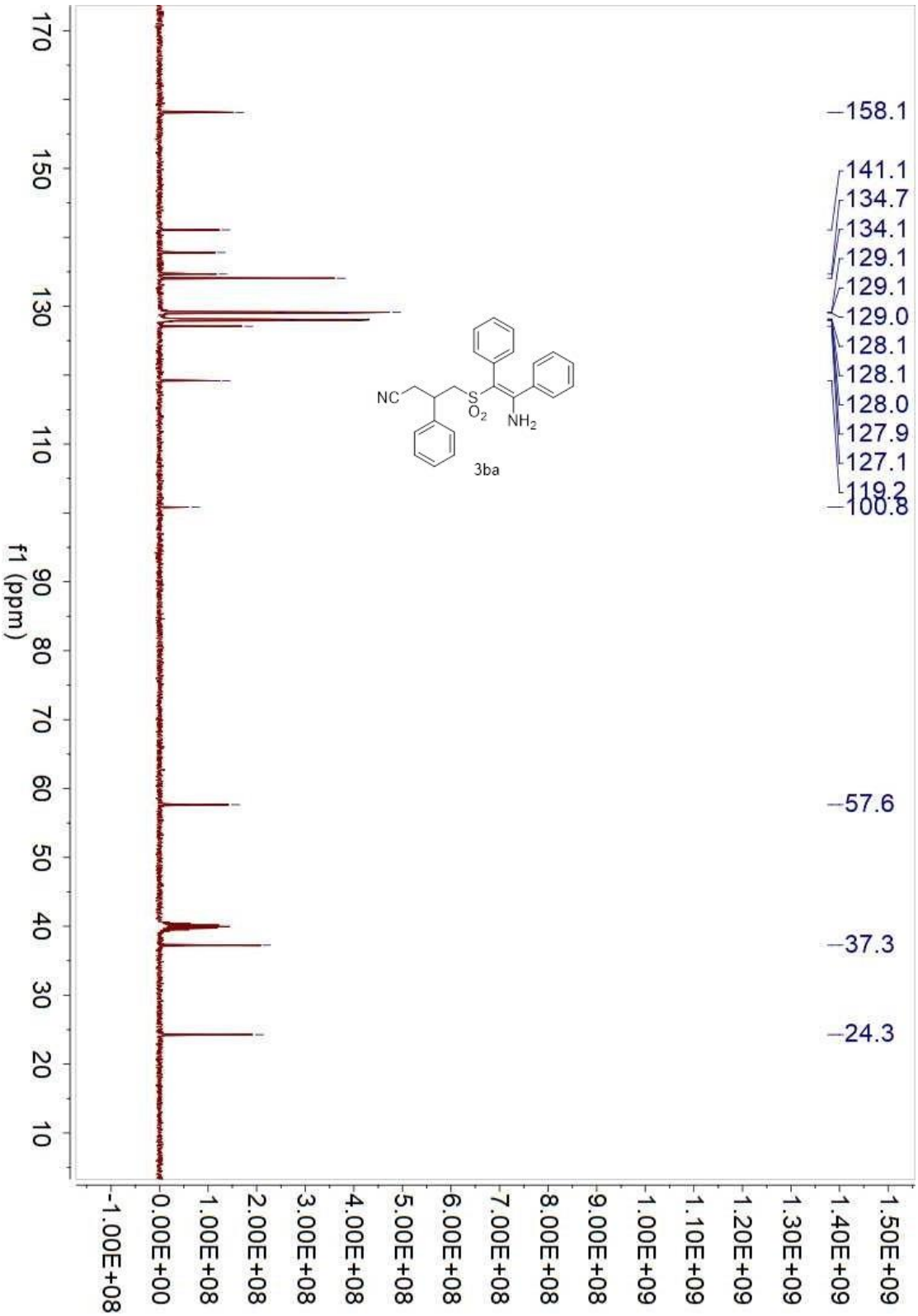
3.62
3.49
3.48
3.46
3.44
3.41
3.40
3.38
3.36
3.34
3.33
3.16
3.13
3.12
3.09
3.07
3.05
2.51
5.30
11.98
1.08
5.25
2.00
NC
S
O2
NH2
3ba
f1 (ppm)
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.0E+00
5.0E+08
1.0E+09
1.5E+09
2.0E+09
2.5E+09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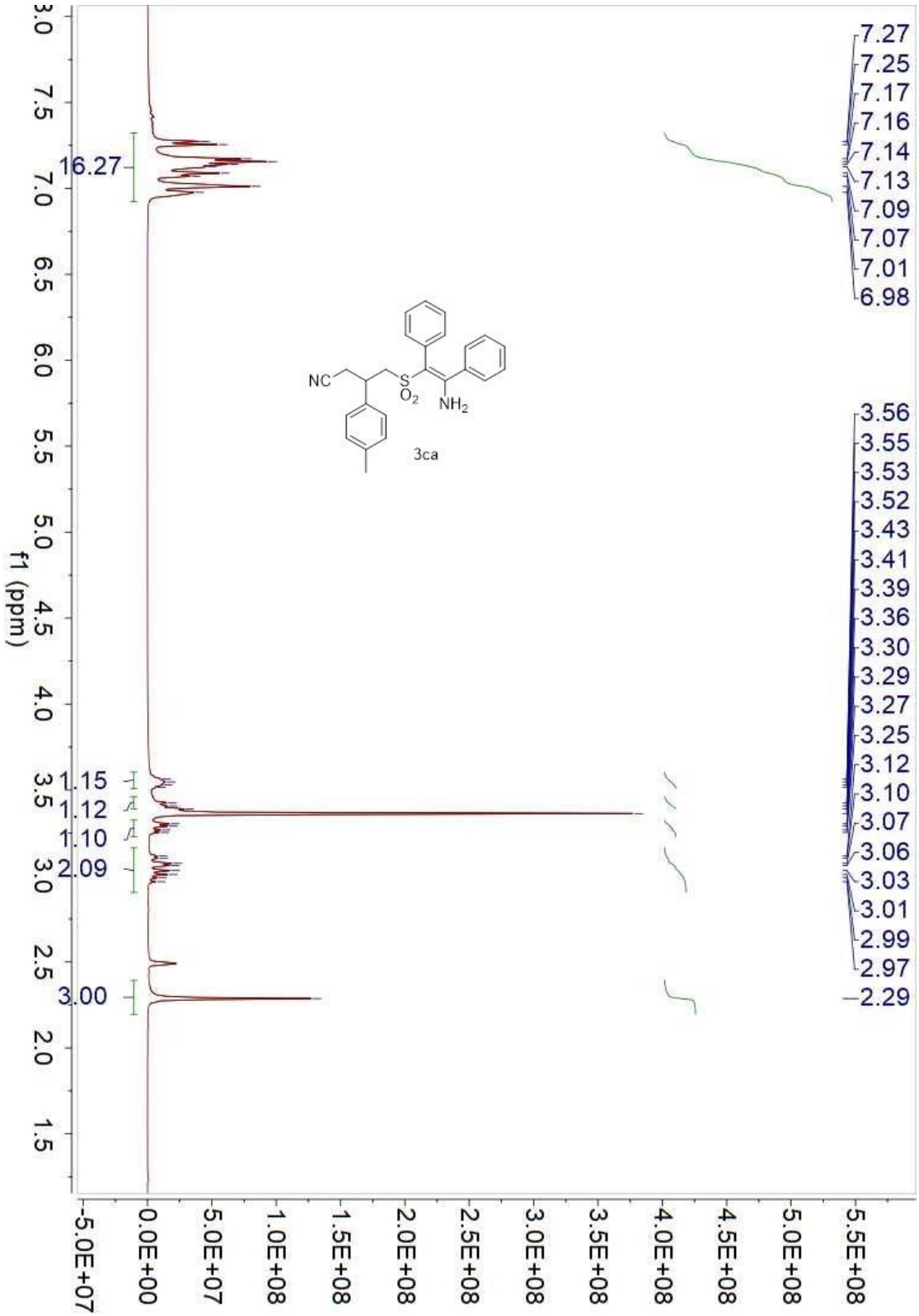
100.8
57.6
37.3
24.3
NC
S
O2
NH2
3ba
f1 (ppm)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7.13
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7.07
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6.98
3.56
3.55
3.53
3.52
3.43
3.41
3.39
3.36
3.30
3.29
3.27
3.25
3.12
3.10
3.07
3.06
3.03
3.01
2.99
2.97
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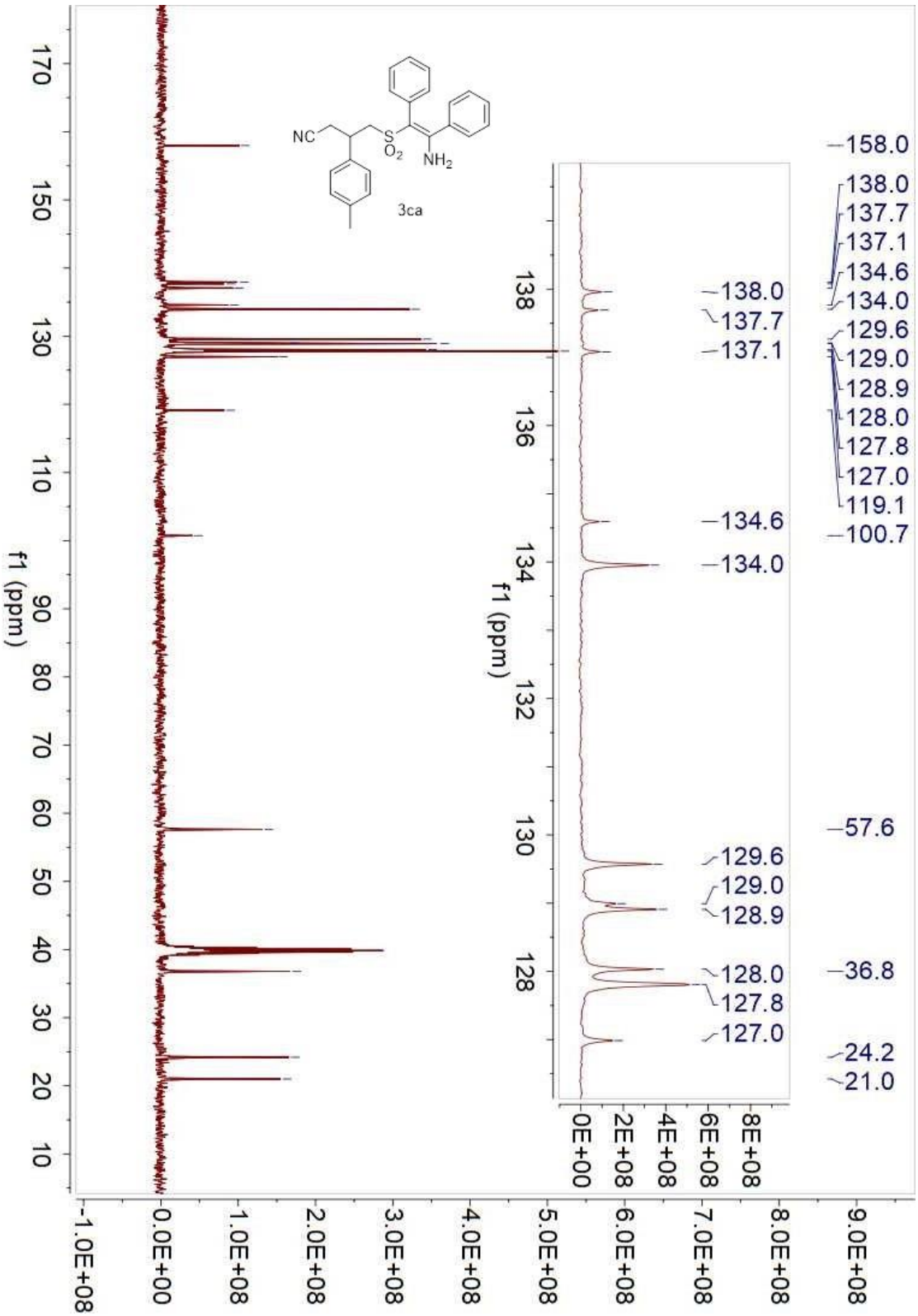
1.15
1.12
1.10
2.09
3.00
NC
S
O2
NH2
3ca
f1 (ppm)


NC
S
O2
NH2
3ca
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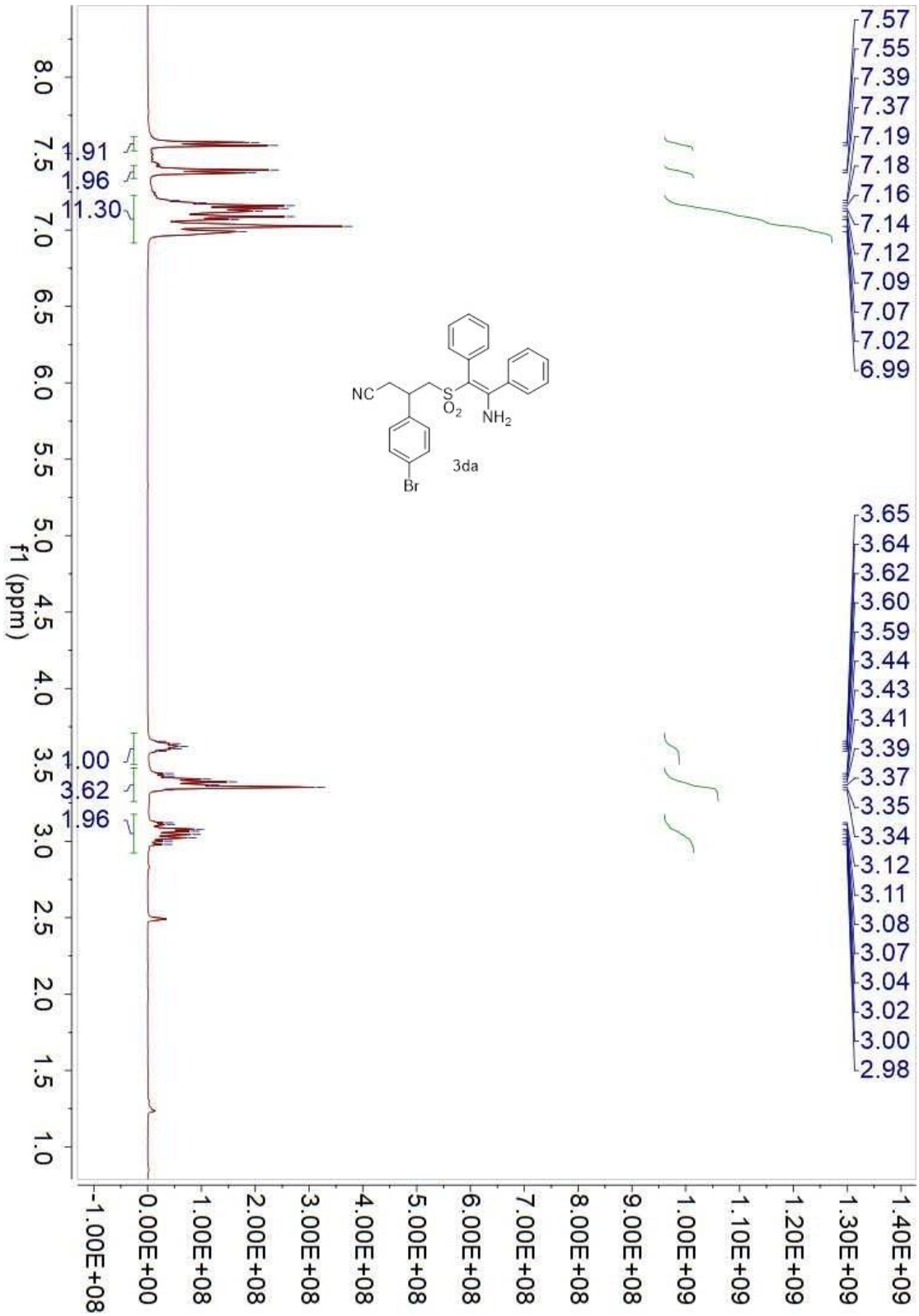
138.0
137.7
137.1
134.6
134.0
129.6
129.0
128.9
128.0
127.8
127.0
119.1
100.7
57.6
36.8
24.2
21.0
f1 (ppm)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7.37
7.19
7.18
7.16
7.14
7.12
7.09
7.07
7.02
6.99
3.65
3.64
3.62
3.60
3.59
3.44
3.43
3.41
3.39
3.37
3.35
3.34
3.12
3.11
3.08
3.07
3.04
3.02
3.00
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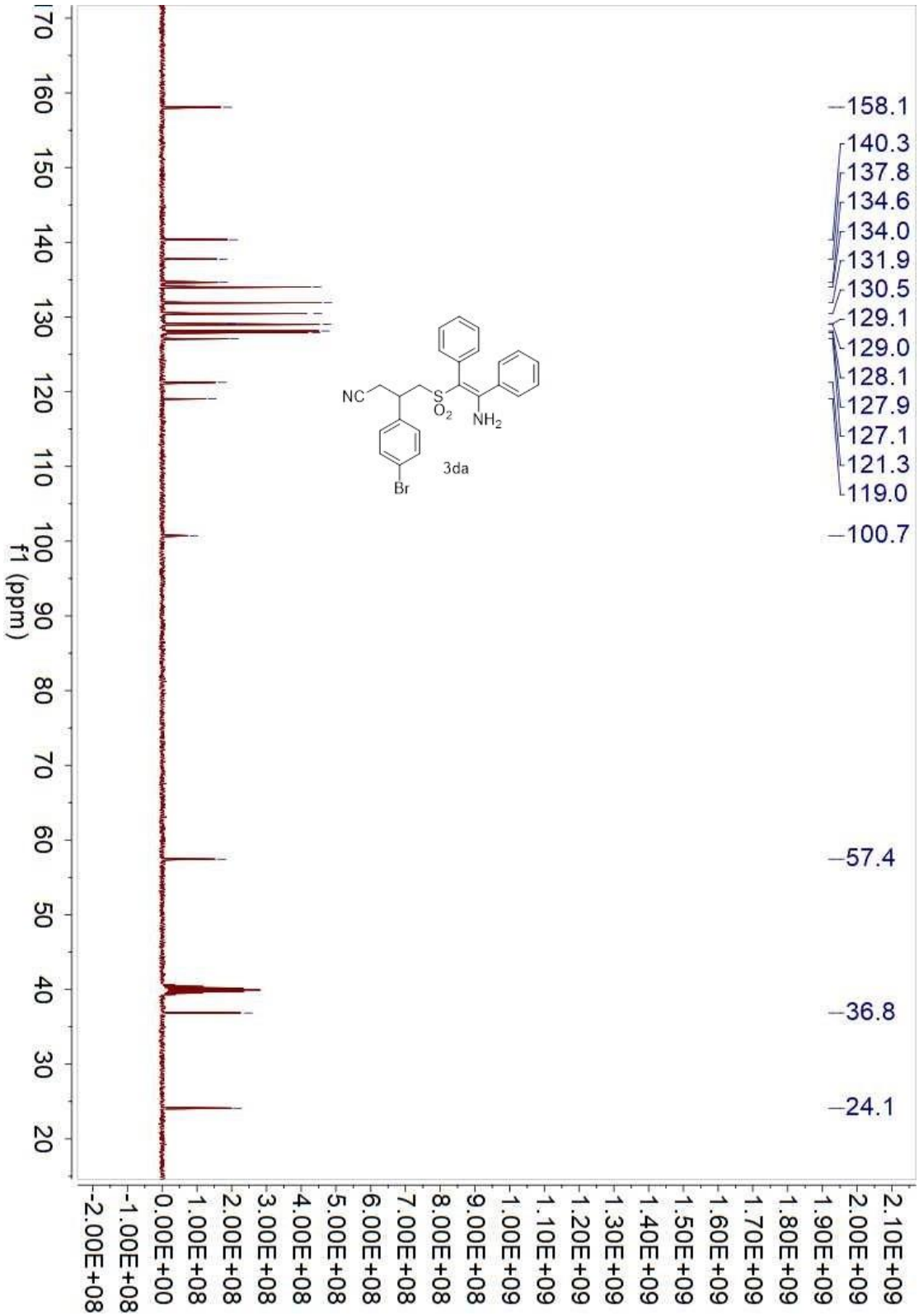
11.30
1.00
3.62
1.96
NC
S
O2
NH2
Br
3da
f1 (ppm)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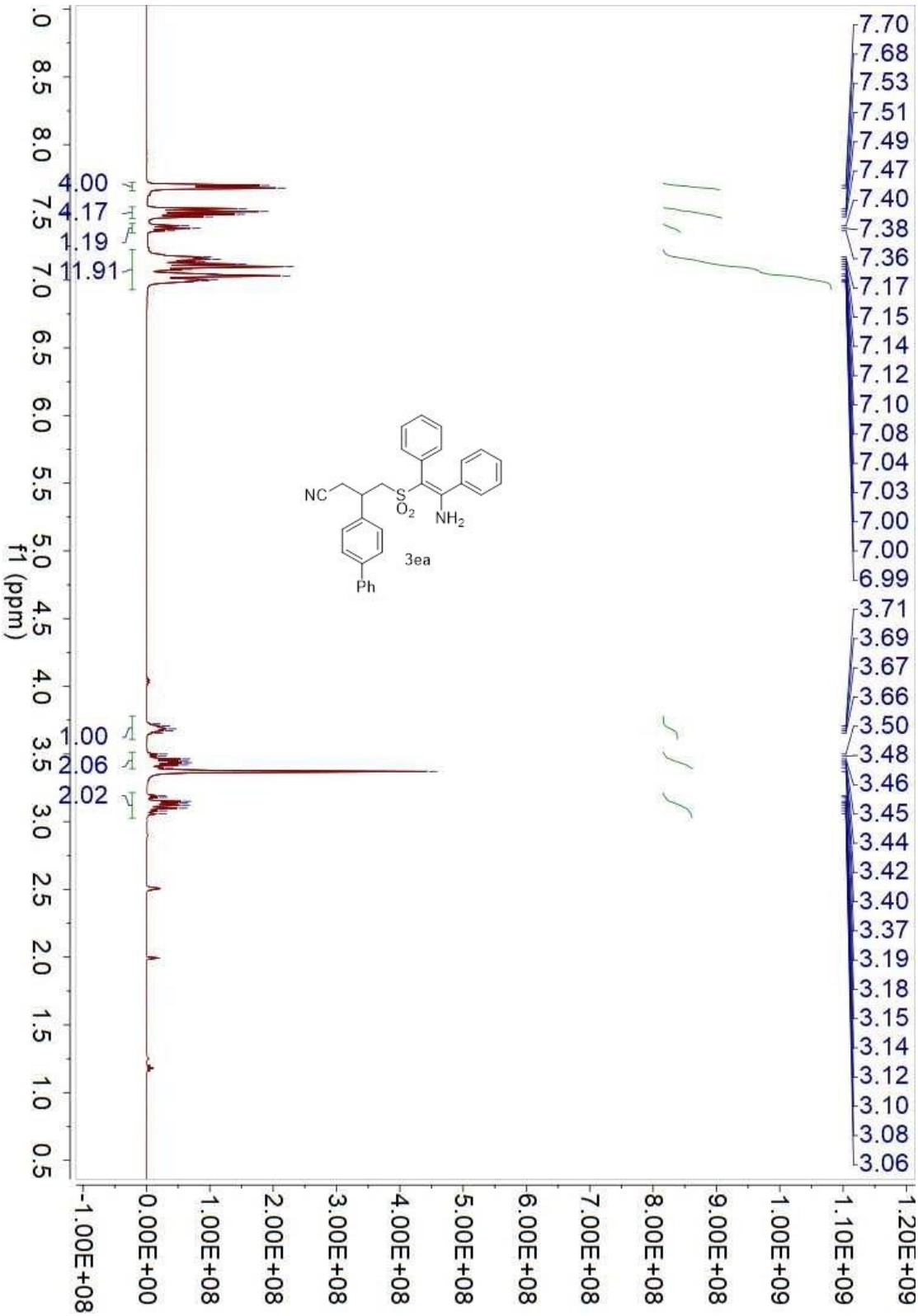
131.9
130.5
129.1
129.0
128.1
127.9
127.1
121.3
119.0
100.7
57.4
36.8
24.1
NC
S
O2
NH2
Br
3da
f1 (ppm)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7.47
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7.36
7.17
7.15
7.14
7.12
7.10
7.08
7.04
7.03
7.00
7.00
6.99
3.71
3.69
3.67
3.66
3.50
3.48
3.46
3.45
3.44
3.42
3.40
3.37
3.19
3.18
3.15
3.14
3.12
3.10
3.08
3.06
4.00
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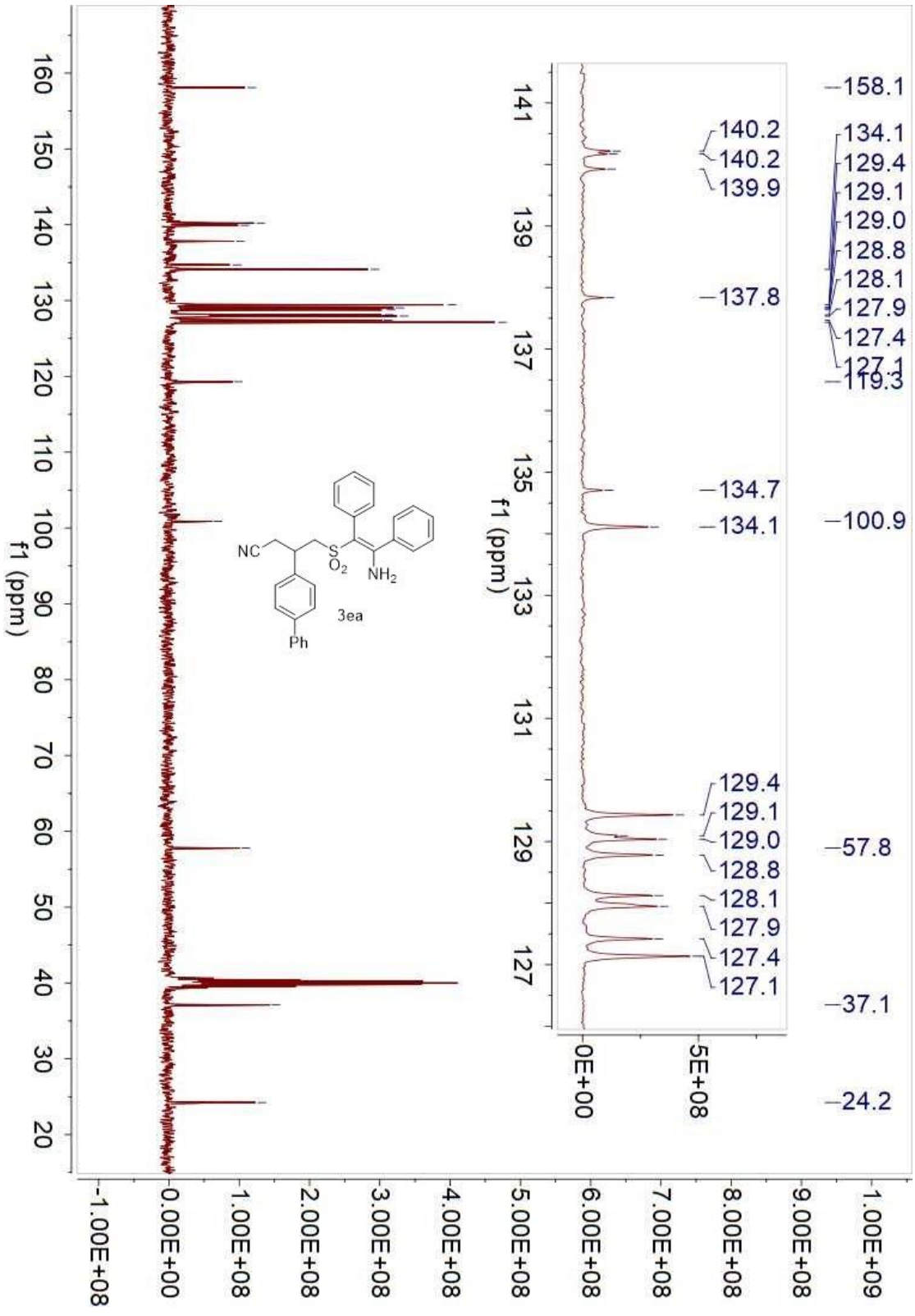
11.91
1.00
2.06
2.02
NC
S
O2
NH2
Ph
3ea
f1 (ppm)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134.1
129.4
129.1
129.0
128.8
128.1
127.9
127.4
127.1
119.3
100.9
57.8
37.1
24.2
140.2
140.2
139.9
137.8
134.7
134.1
129.4
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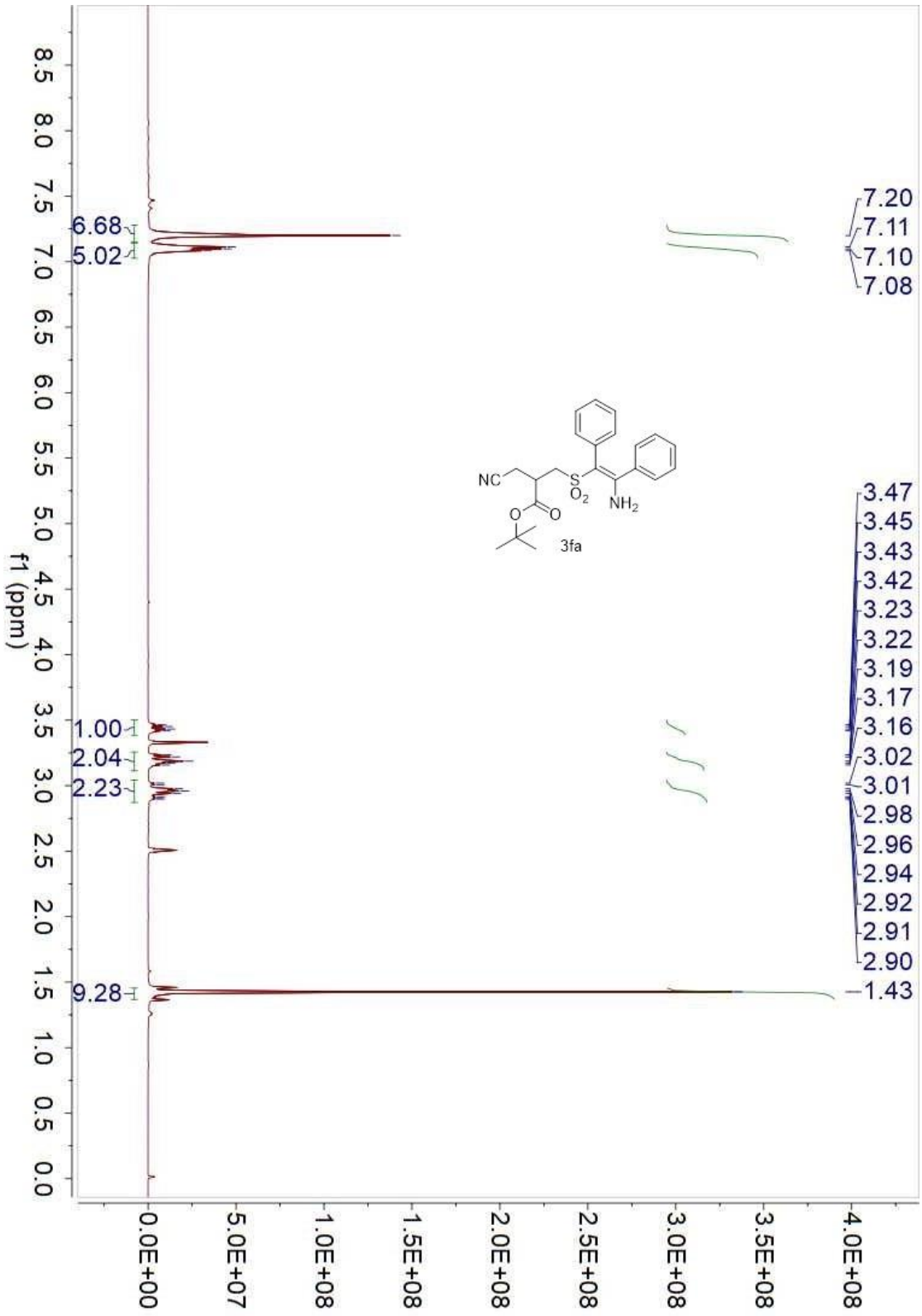
128.1
127.9
127.4
127.1
NC
S
O2
NH2
Ph
3ea
f1 (ppm)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9.28
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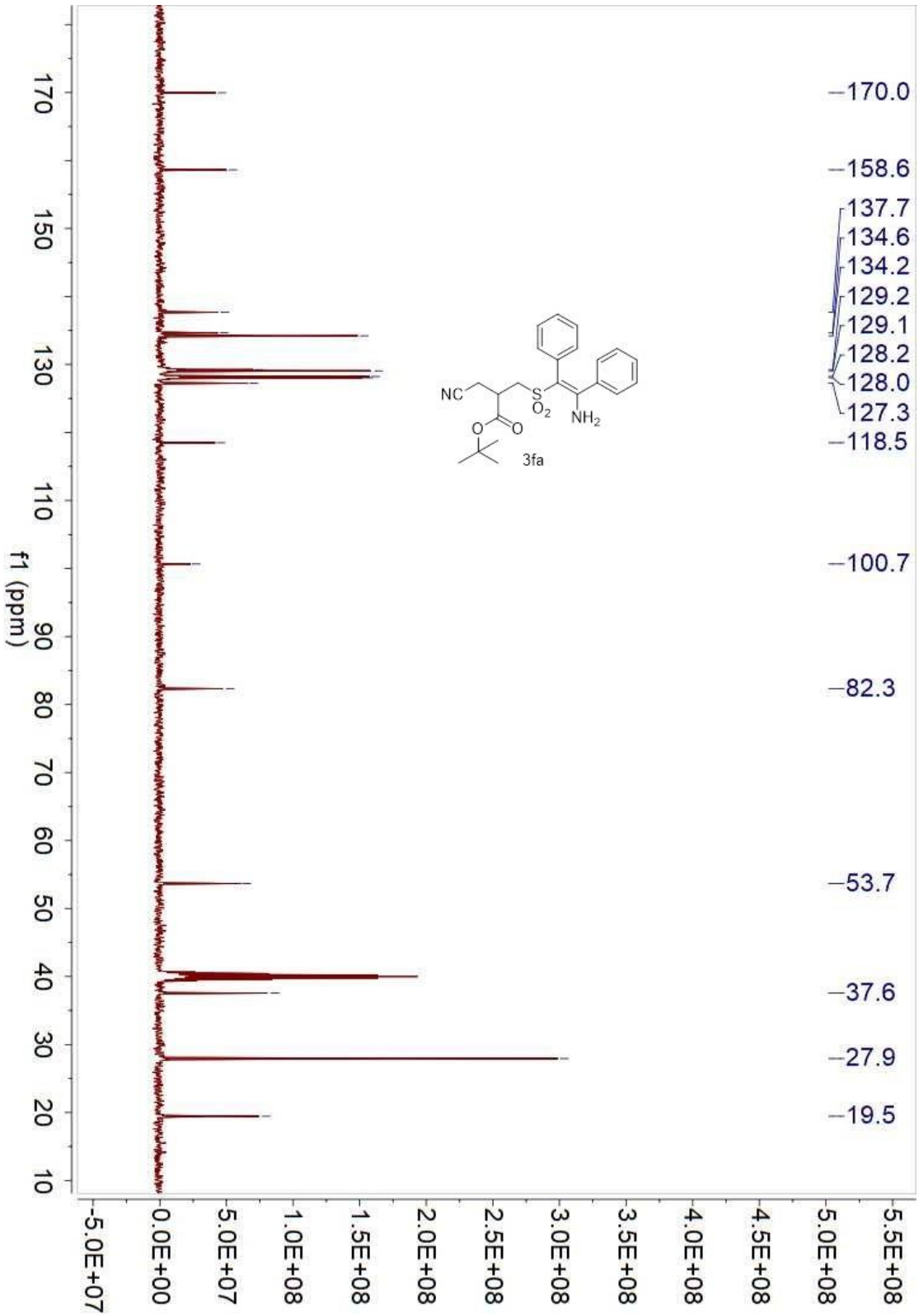
7.11
7.10
7.08
3.47
3.45
3.43
3.42
3.23
3.22
3.19
3.17
3.16
3.02
3.01
2.98
2.96
2.94
2.92
2.91
2.90
1.43
NC
O2
NH2
O
O
3fa
f1 (ppm)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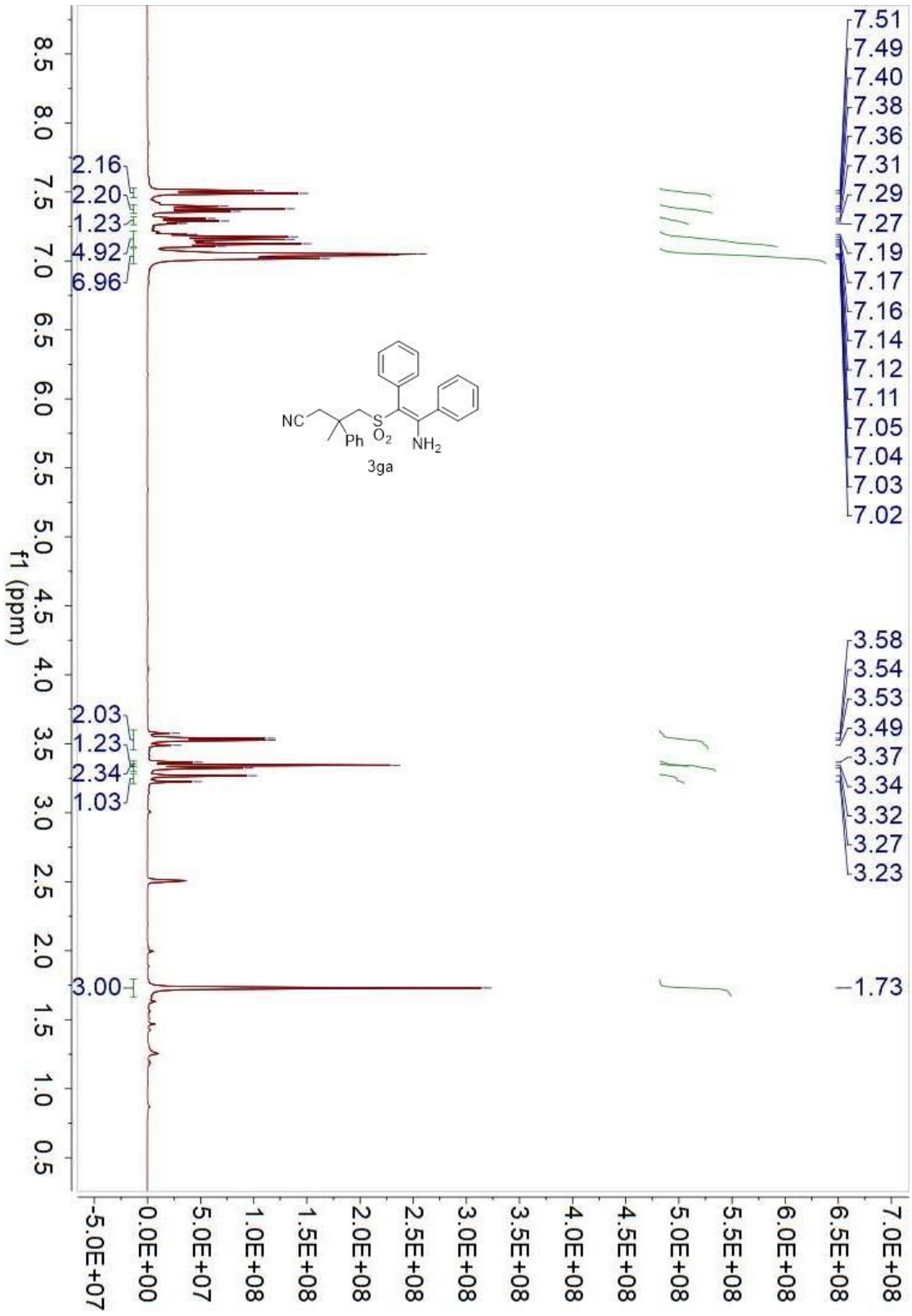
158.6
137.7
134.6
134.2
129.2
129.1
128.2
128.0
127.3
118.5
100.7
82.3
53.7
37.6
27.9
19.5
NC
S
O2
NH2
O
O
3fa
f1 (ppm)
170
150
130
110
90
80
70
60
50
40
30
20
10
-5.0E+07
0.0E+00
5.0E+07
1.0E+08
1.5E+08
2.0E+08
2.5E+08
3.0E+08
3.5E+08
4.0E+08
4.5E+08
5.0E+08
5.5E+08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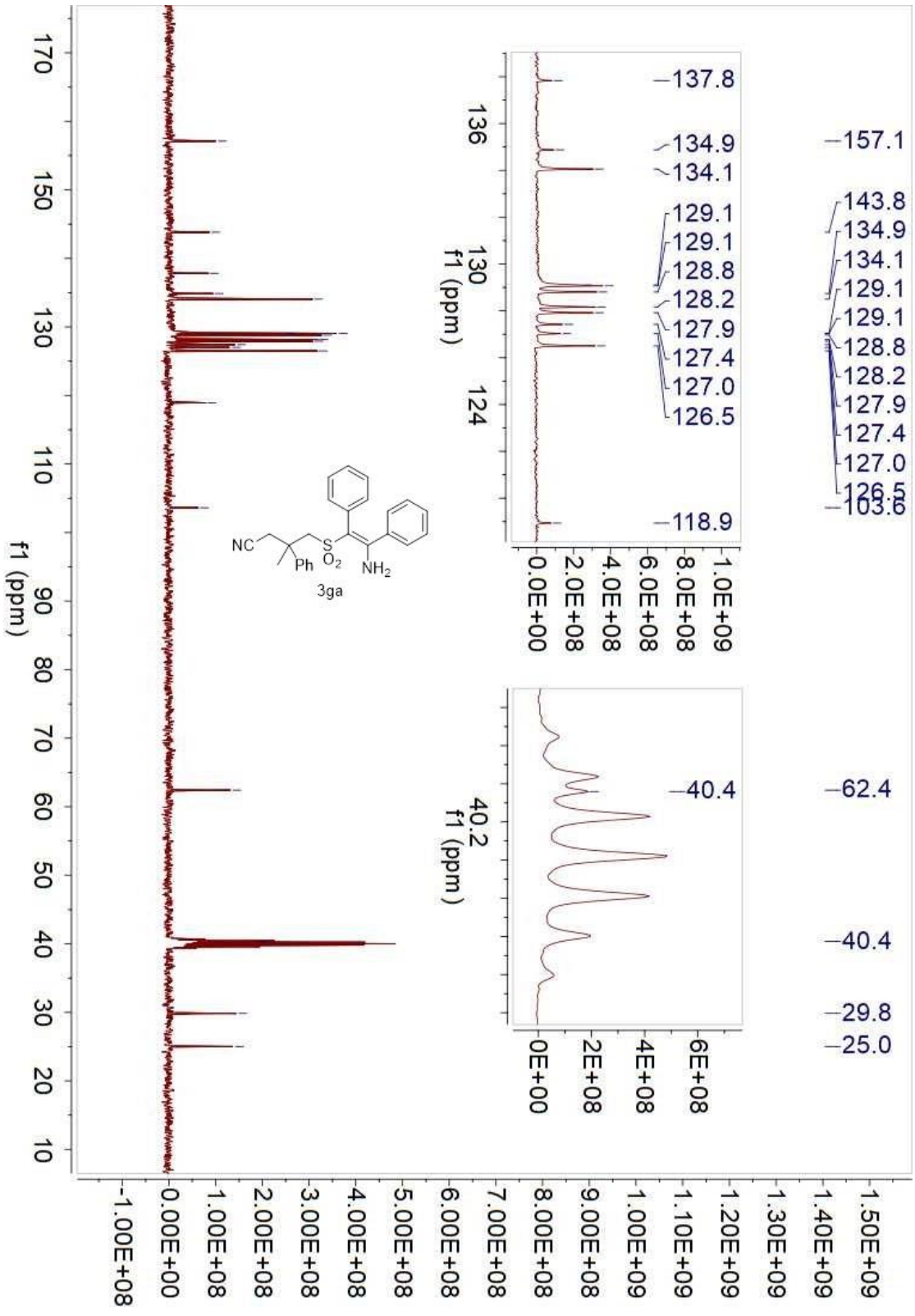
7.27
7.19
7.17
7.16
7.14
7.12
7.11
7.05
7.04
7.03
7.02
3.58
3.54
3.53
3.49
3.37
3.34
3.32
3.27
3.23
1.73
2.16
2.20
1.23
4.92
6.96
2.03
1.23
2.34
1.03
3.00
NC
Ph
S
O2
NH2
3ga
f1 (ppm)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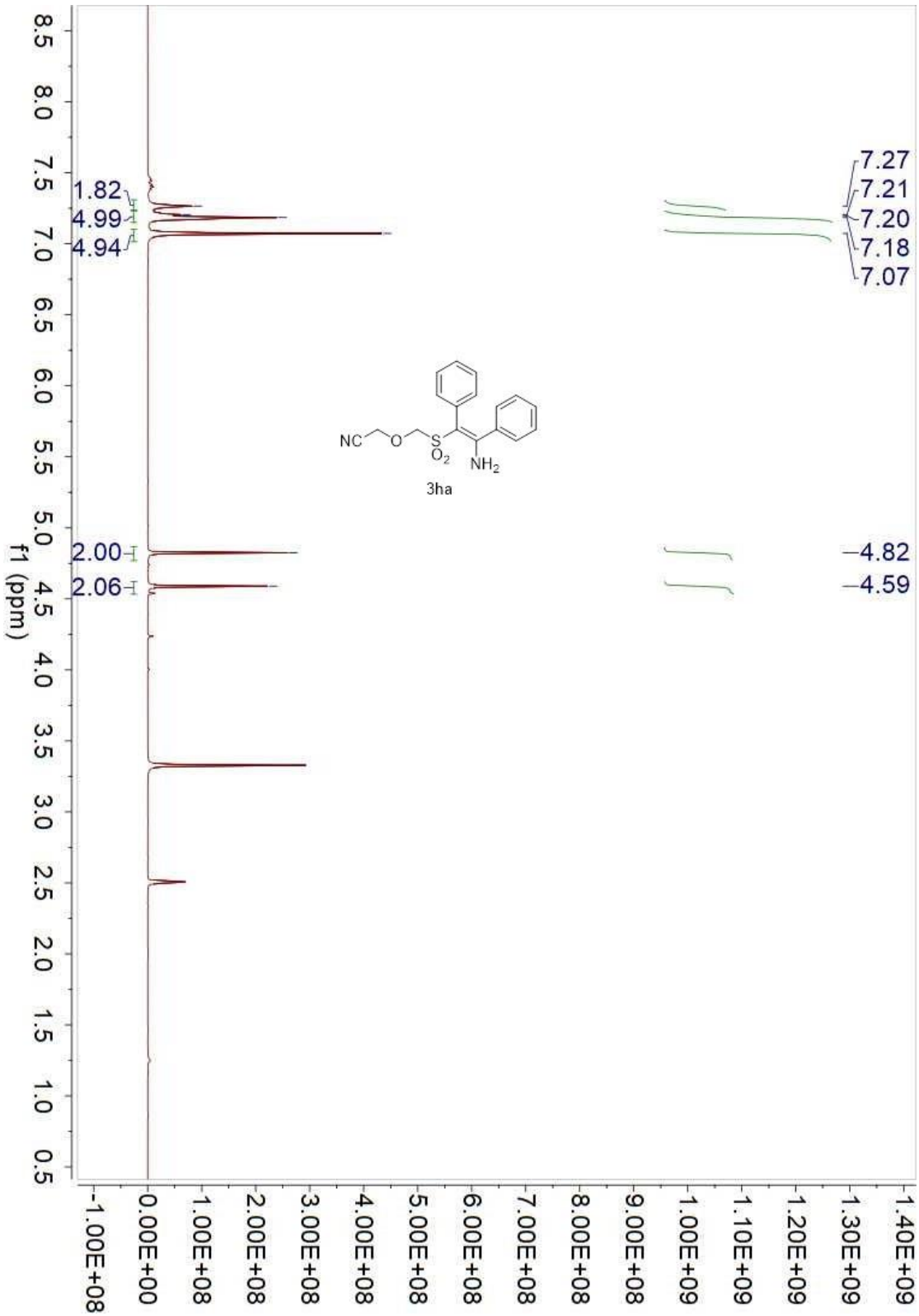
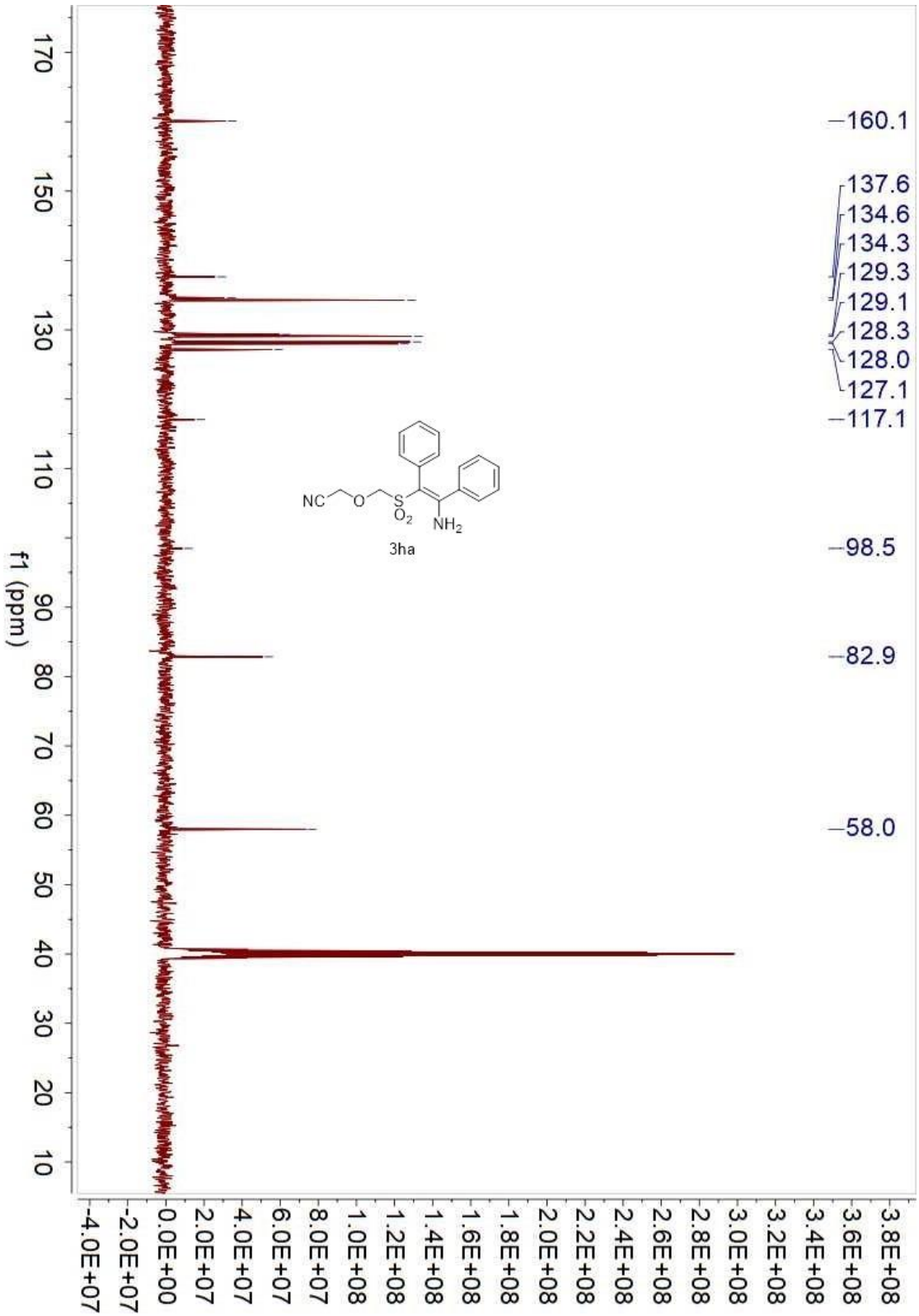
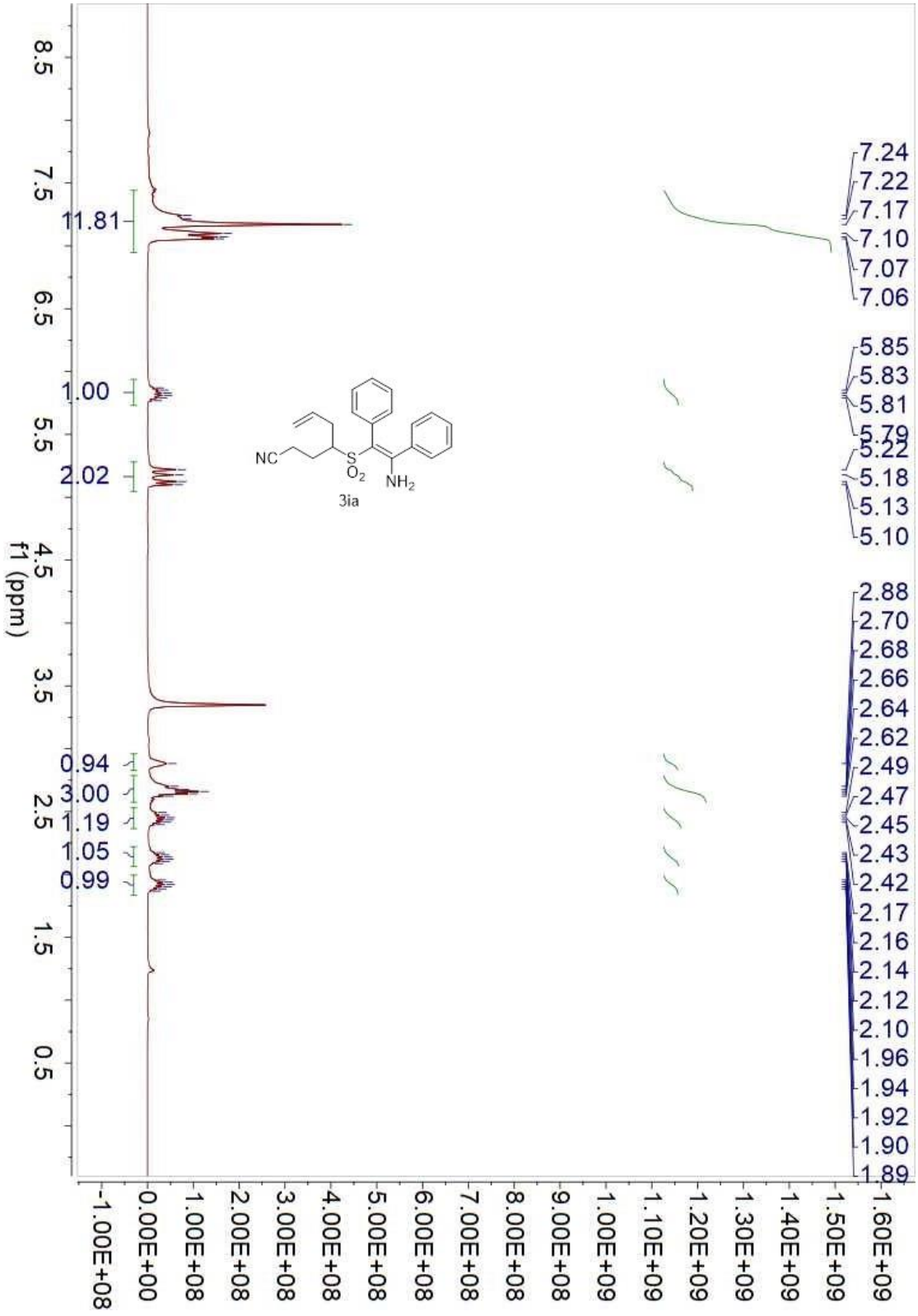
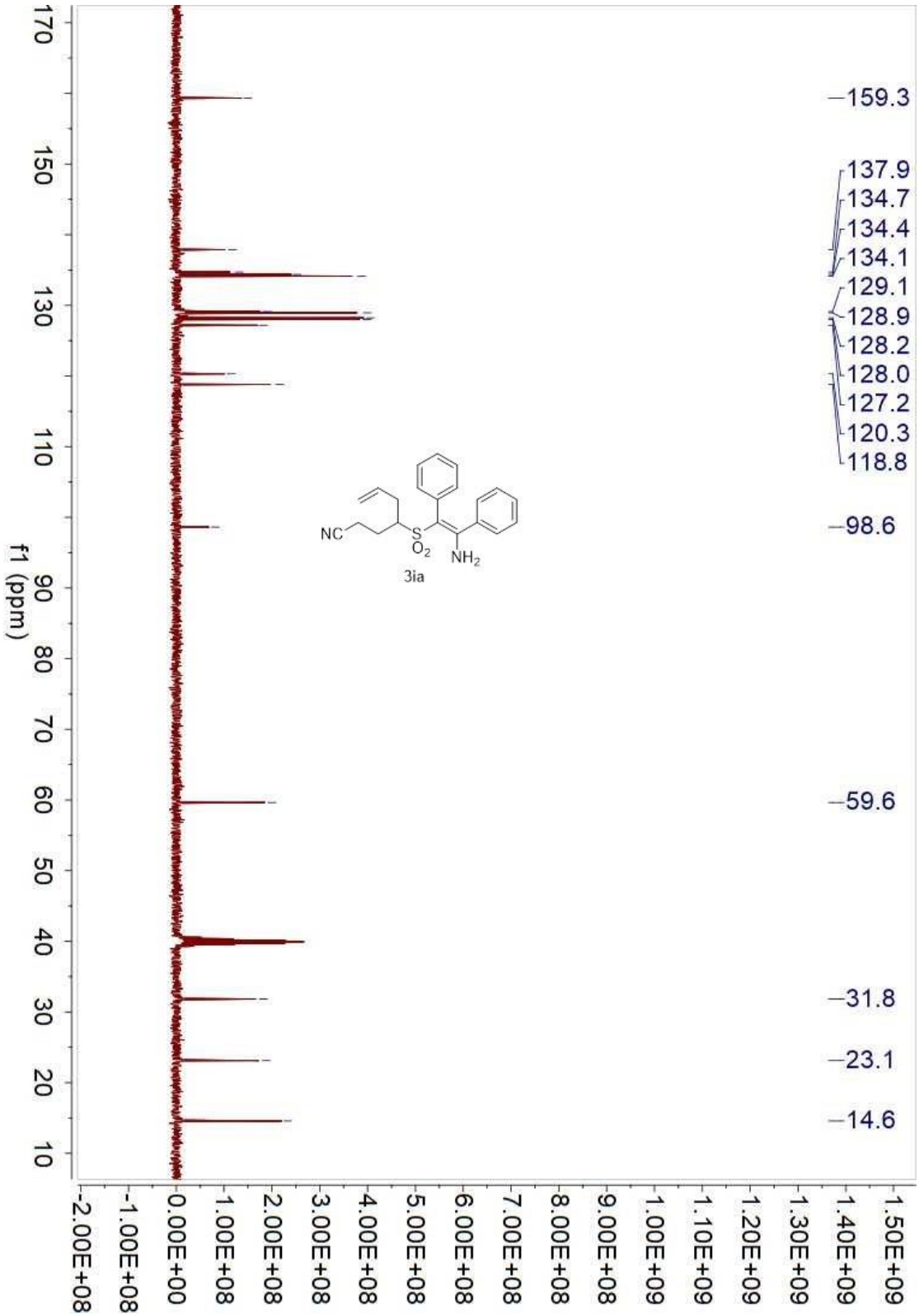
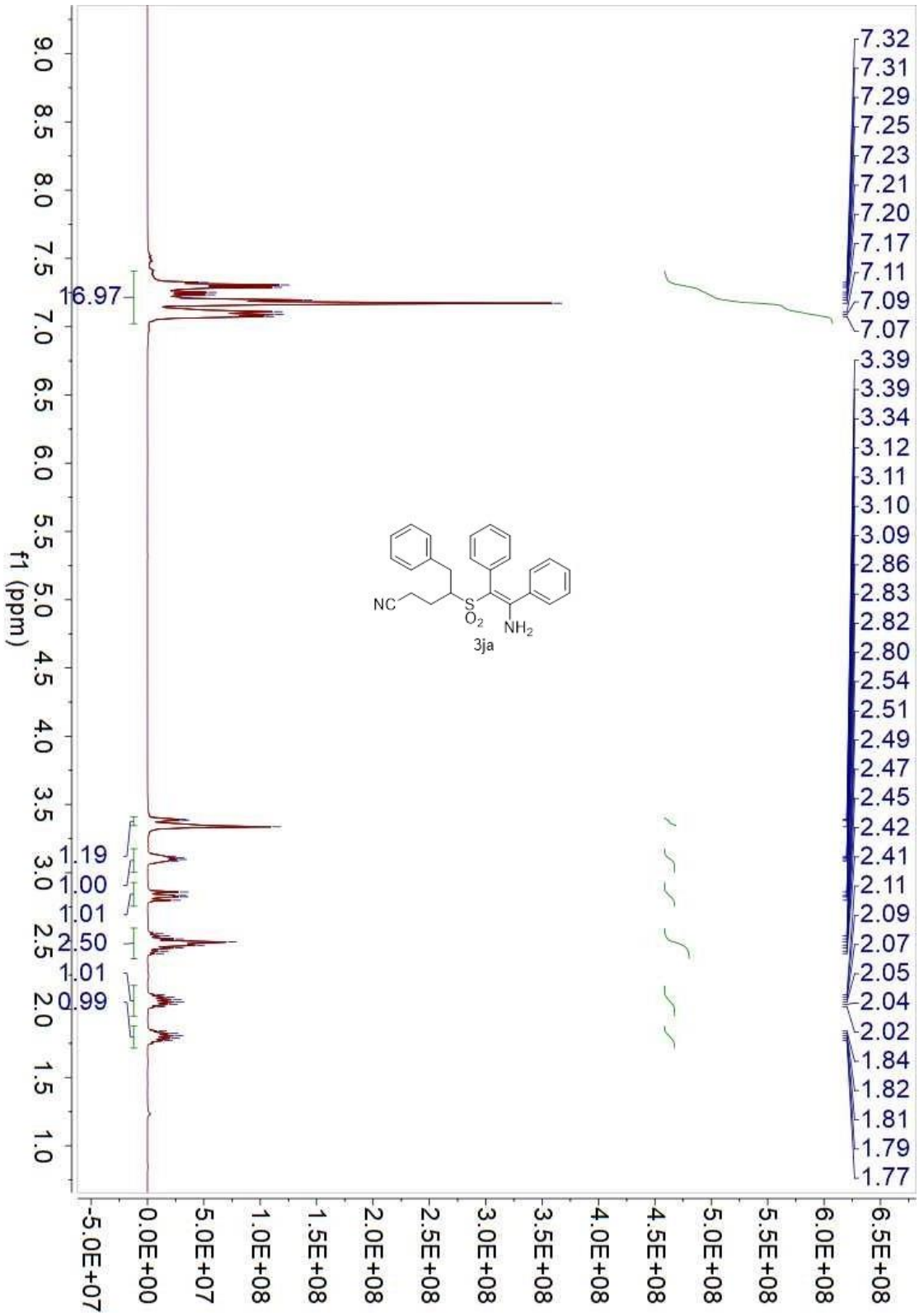
134.9
134.1
129.1
129.1
128.8
128.2
127.9
127.4
127.0
126.5
118.9
157.1
143.8
134.9
134.1
129.1
129.1
128.8
128.2
127.9
127.4
127.0
126.5
103.6
40.4
62.4
40.4
29.8
25.0
NC
Ph
S
O2
NH2
3ga
f1 (ppm)

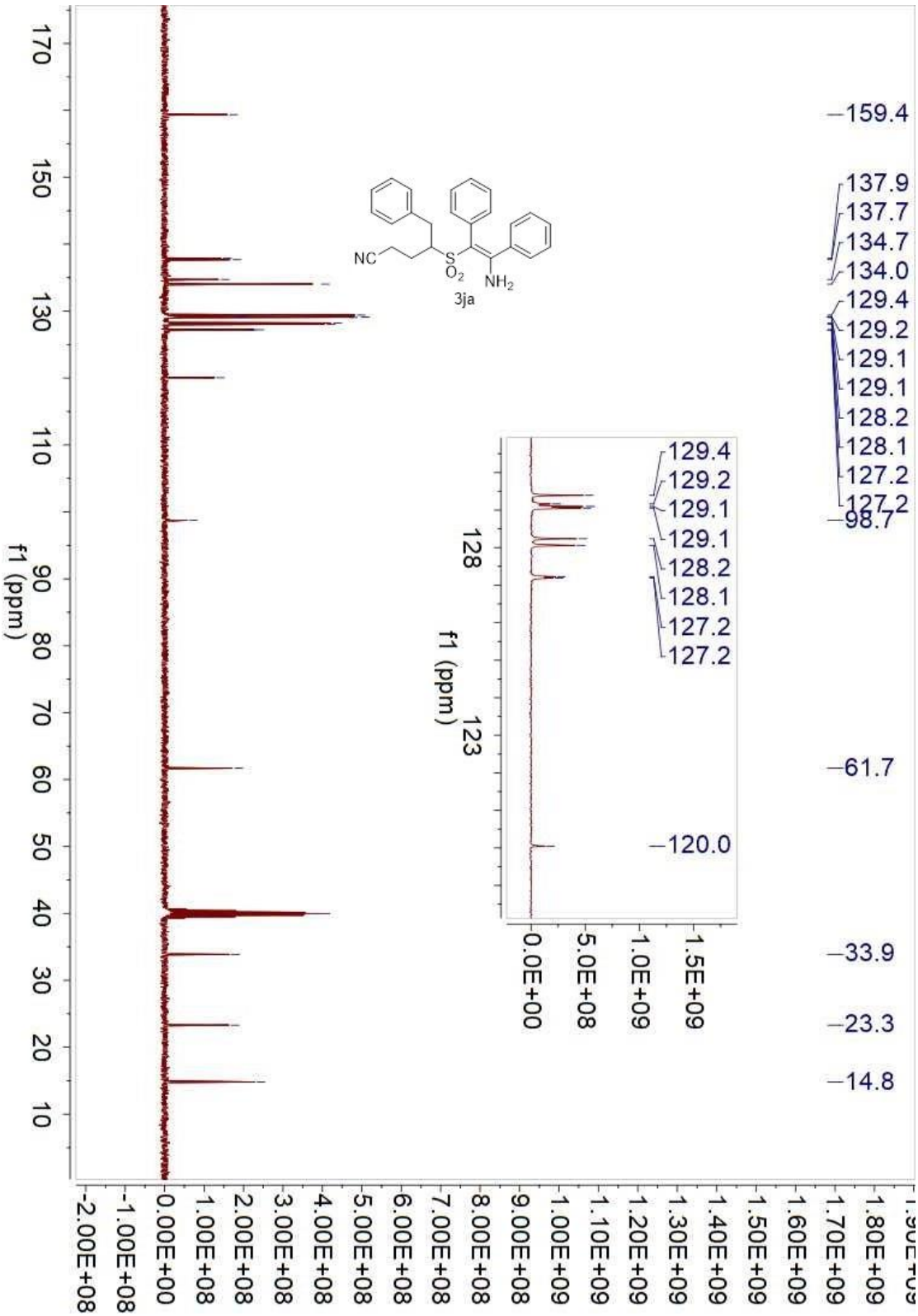

1.82
4.99
4.94
2.00
2.06
7.27
7.21
7.20
7.18
7.07
4.82
4.59
NC
O
S
O2
NH2
3ha
f1 (ppm)

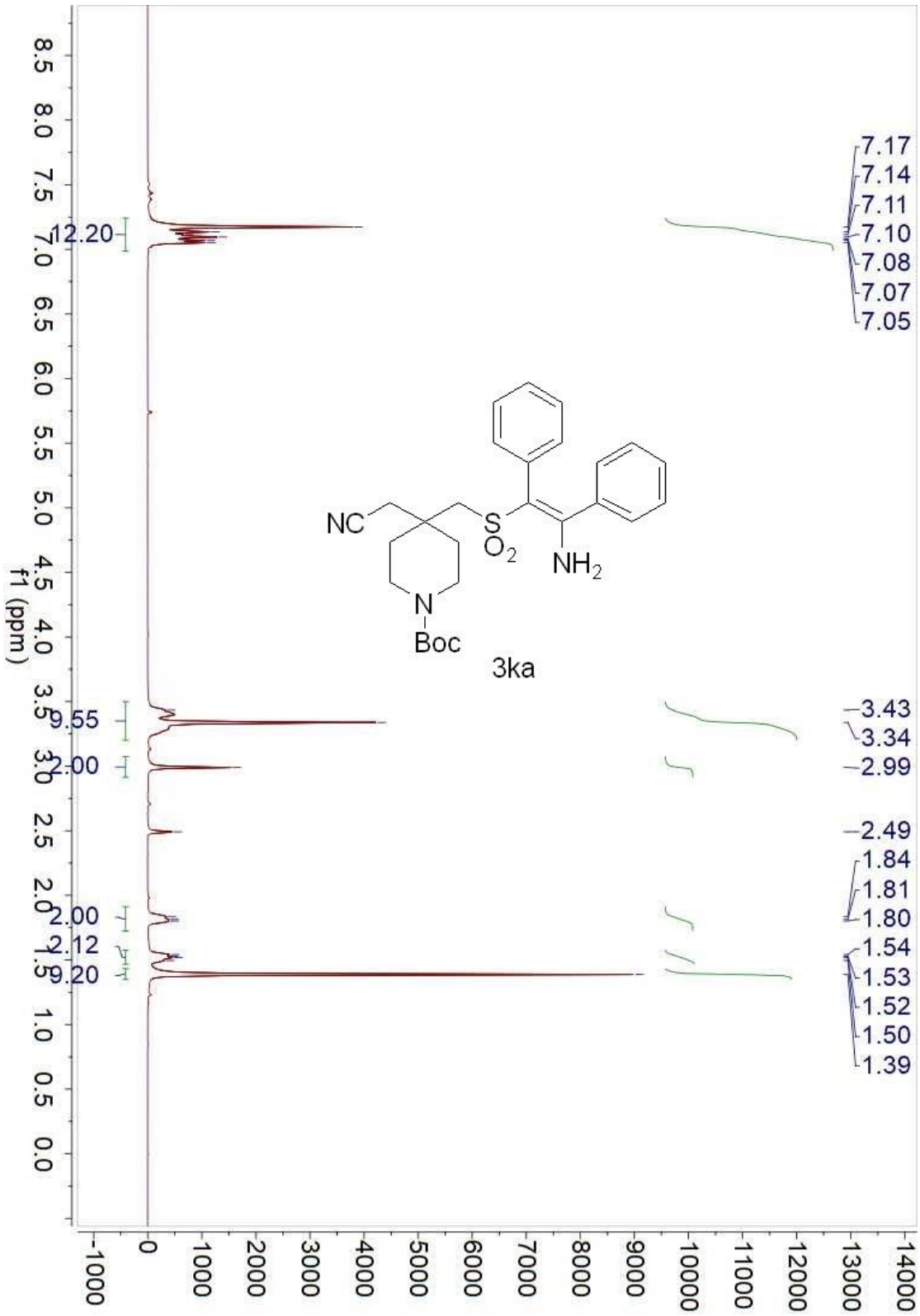

160.1
137.6
134.6
134.3
129.3
129.1
128.3
128.0
127.1
117.1
98.5
82.9
58.0
NC
O
S
O2
NH2
3ha
f1 (ppm)

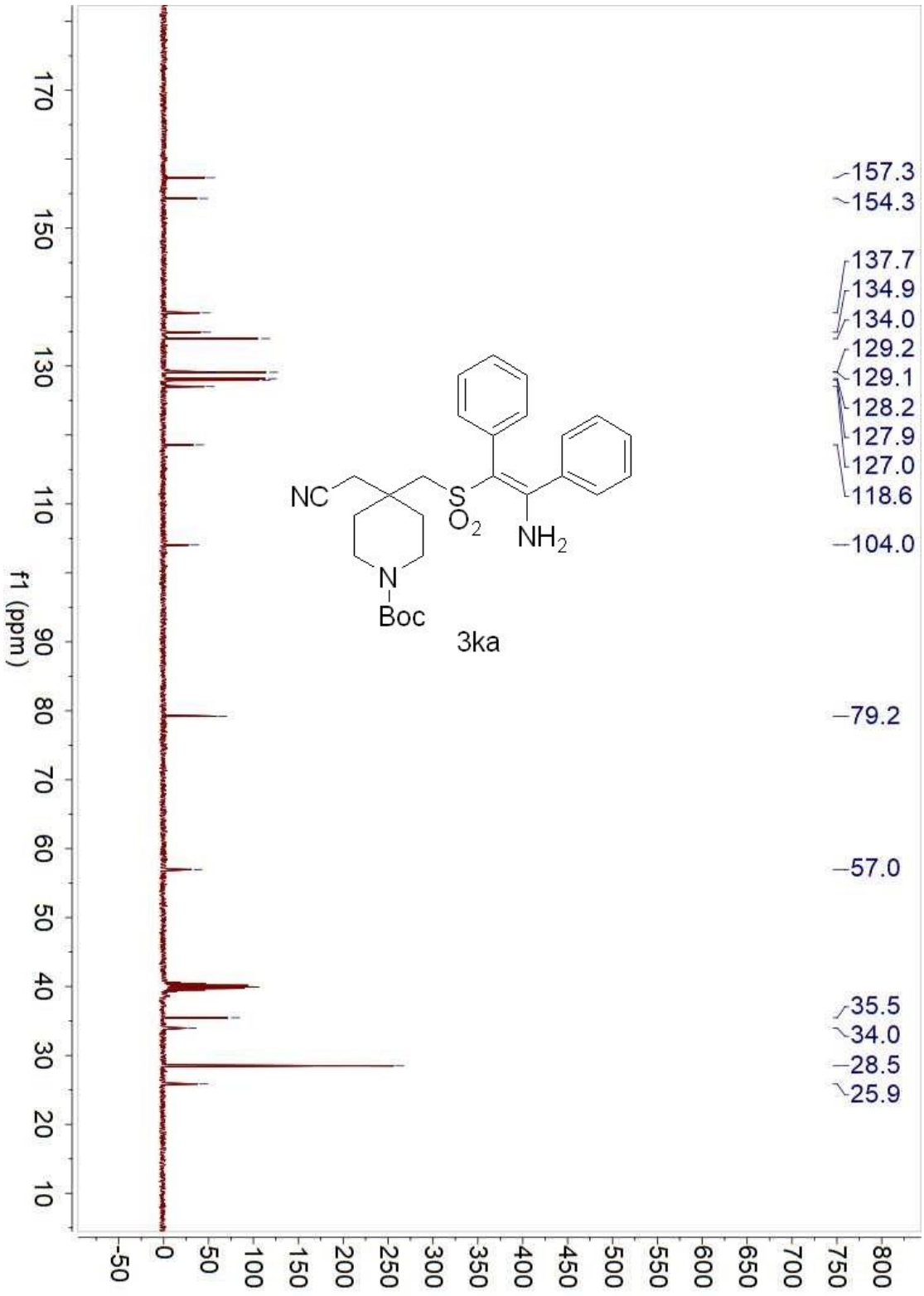

7.24
7.22
7.17
7.10
7.07
7.06
5.85
5.83
5.81
5.79
5.22
5.18
5.13
5.10
2.88
2.70
2.68
2.66
2.64
2.62
2.49
2.47
2.45
2.43
2.42
2.17
2.16
2.14
2.12
2.10
1.96
1.94
1.92
1.90
1.89
11.81
1.00
2.02
0.94
3.00
1.19
1.05
0.99
NC
S
O2
NH2
3ia
f1 (ppm)


159.3
137.9
134.7
134.4
134.1
129.1
128.9
128.2
128.0
127.2
120.3
118.8
98.6
59.6
31.8
23.1
14.6
NC
S
O2
NH2
3ia
f1 (ppm)


7.32
7.31
7.29
7.25
7.23
7.21
7.20
7.17
7.11
7.09
7.07
3.39
3.39
3.34
3.12
3.11
3.10
3.09
2.86
2.83
2.82
2.80
2.54
2.51
2.49
2.47
2.45
2.42
2.41
2.11
2.09
2.07
2.05
2.04
2.02
1.84
1.82
1.81
1.79
1.77
16.97
1.19
1.00
1.01
2.50
1.01
0.99
NC
S
O2
NH2
3ja
f1 (ppm)


NC
SO2
NH2
3ja
159.4
137.9
137.7
134.7
134.0
129.4
129.2
129.1
129.1
128.2
128.1
127.2
127.2
98.7
61.7
33.9
23.3
14.8
120.0
f1 (ppm)


7.17
7.14
7.11
7.10
7.08
7.07
7.05
12.20
9.55
2.00
2.00
2.12
9.20
3.43
3.34
2.99
2.49
1.84
1.81
1.80
1.54
1.53
1.52
1.50
1.39
NC
S
O2
NH2
N
Boc
3ka
f1 (ppm)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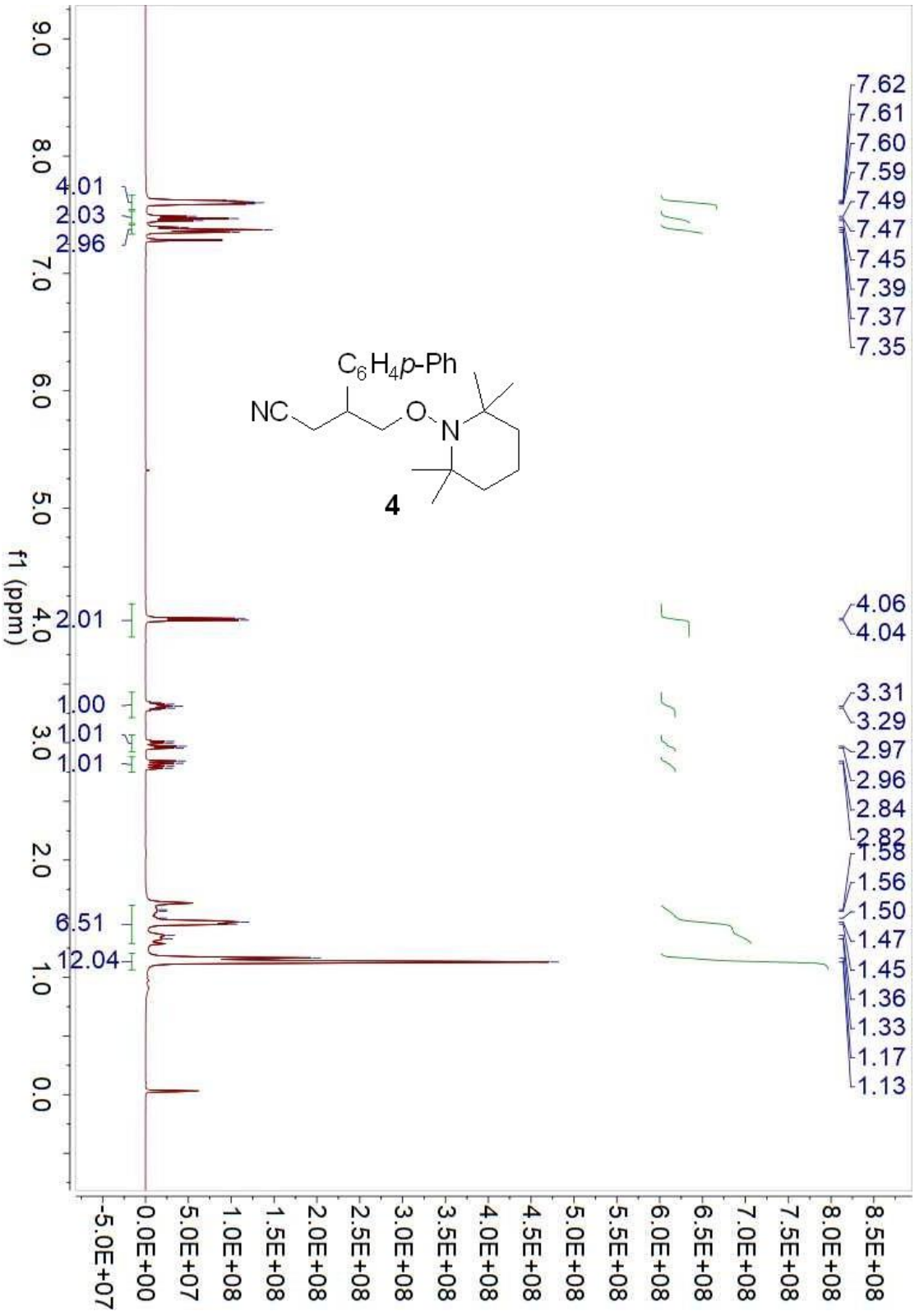
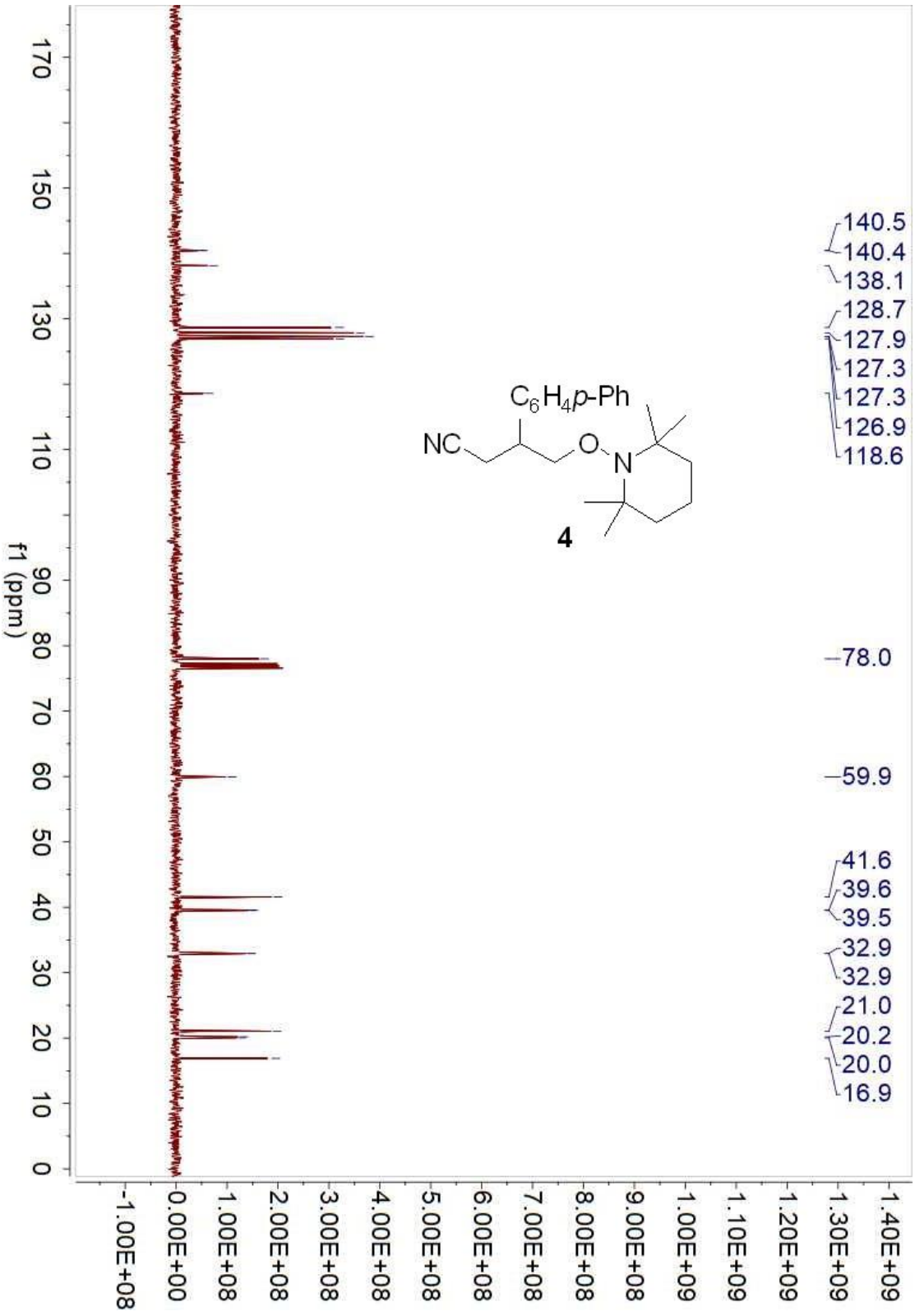
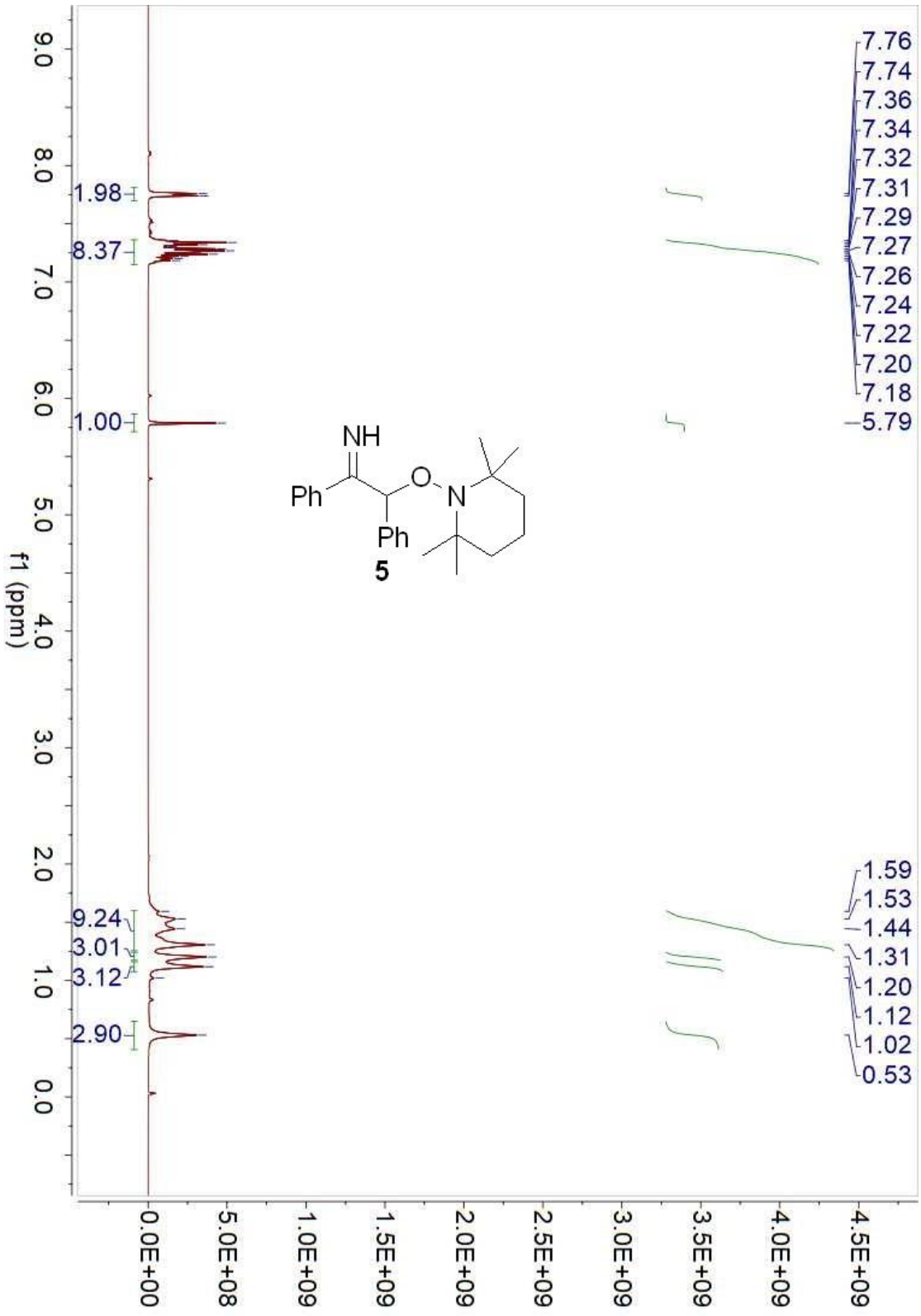
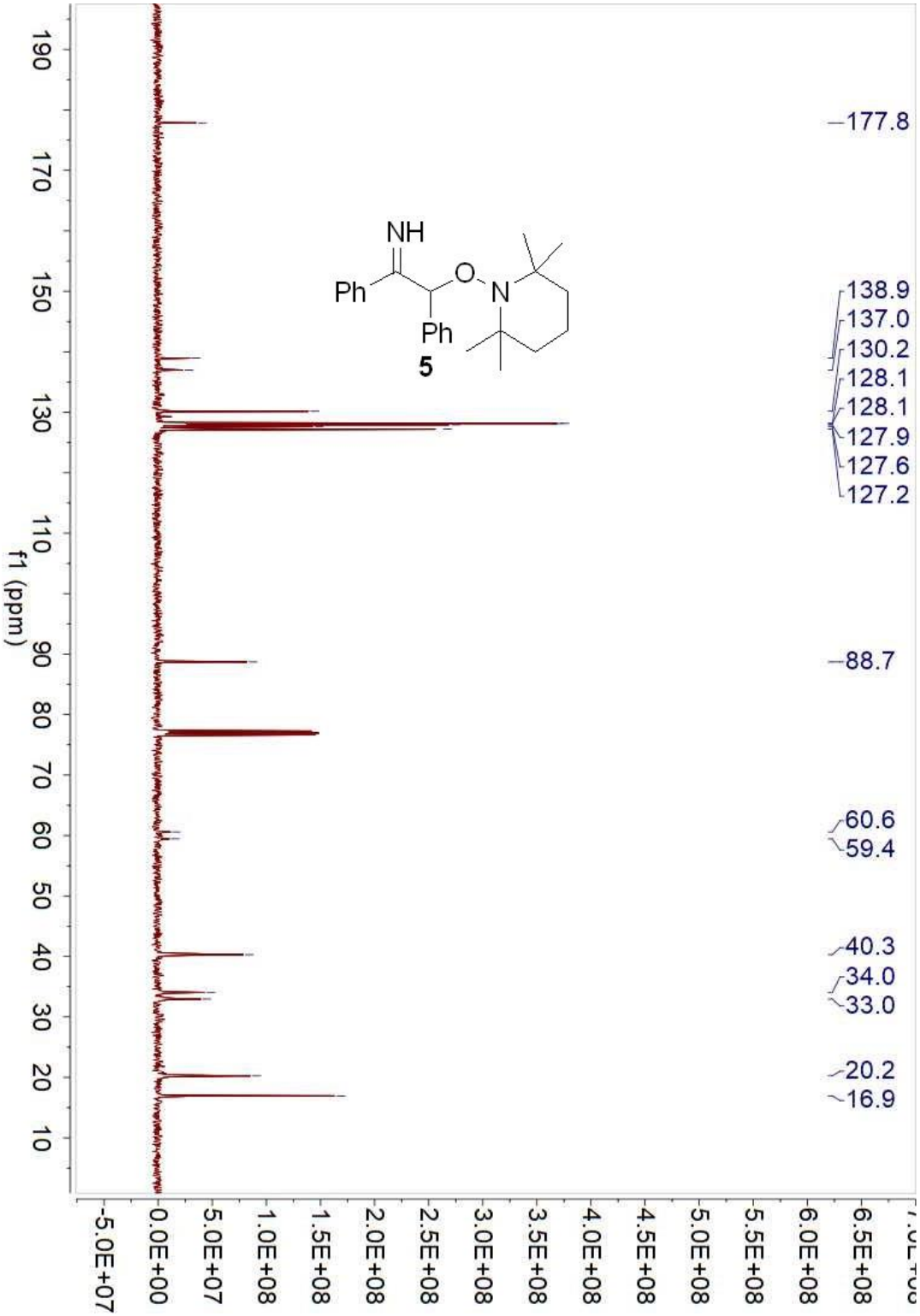
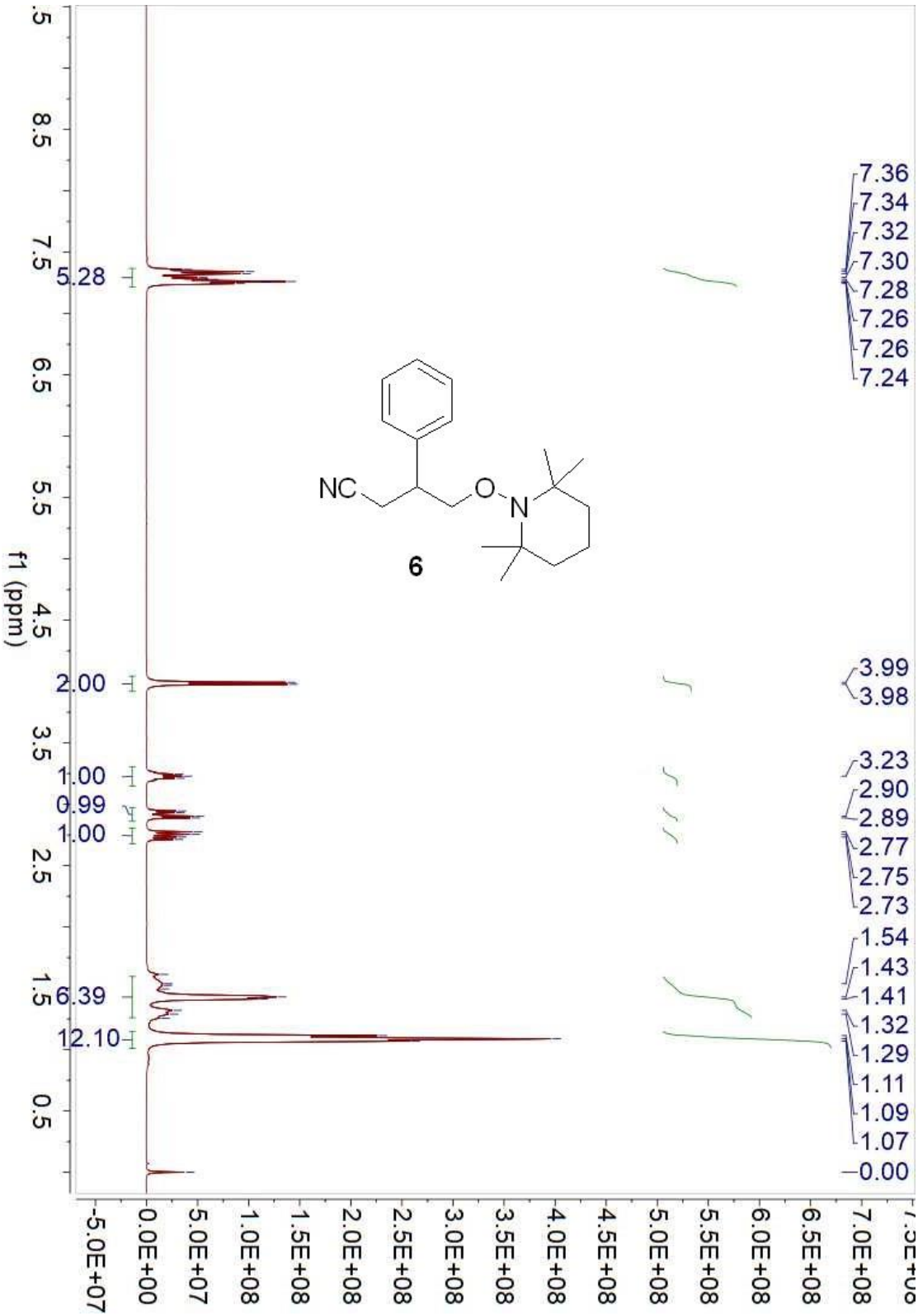
154.3
137.7
134.9
134.0
129.2
129.1
128.2
127.9
127.0
118.6
104.0
79.2
57.0
35.5
34.0
28.5
25.9
NC
S
O2
NH2
N
Boc
3ka
f1 (ppm)

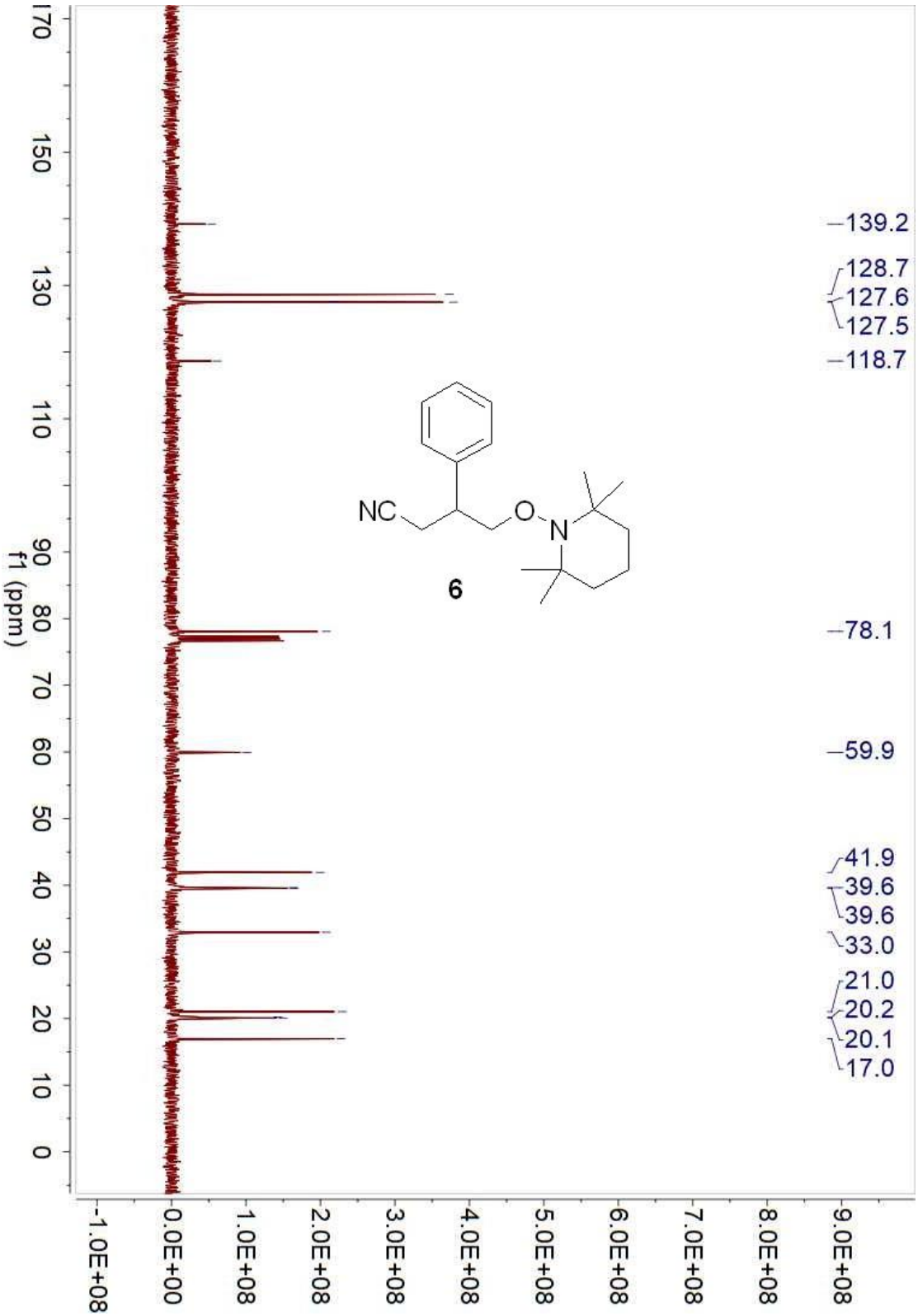

7.62
7.61
7.60
7.59
7.49
7.47
7.45
7.39
7.37
7.35
4.01
2.03
2.96
C6H4p-Ph
NC
O
N
4
4.06
4.04
3.31
3.29
2.97
2.96
2.84
2.82
1.58
1.56
1.50
1.47
1.45
1.36
1.33
1.17
1.13
2.01
1.00
1.01
1.01
6.51
12.04
f1 (ppm)

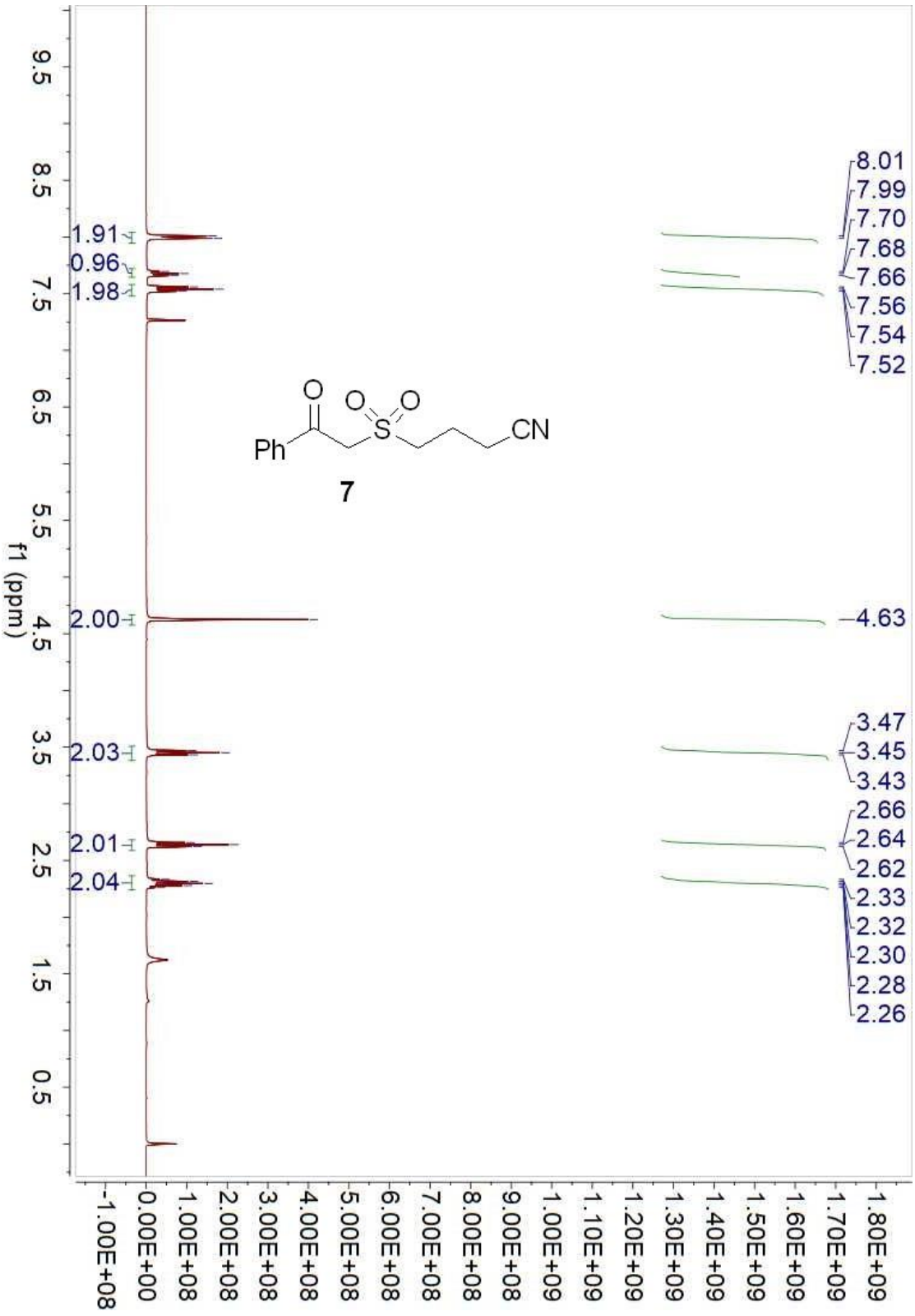

140.5
140.4
138.1
128.7
127.9
127.3
127.3
126.9
118.6
78.0
59.9
41.6
39.6
39.5
32.9
32.9
21.0
20.2
20.0
16.9
C6H4p-Ph
NC
O
N
4
f1 (ppm)


7.76
7.74
7.36
7.34
7.32
7.31
7.29
7.27
7.26
7.24
7.22
7.20
7.18
5.79
1.59
1.53
1.44
1.31
1.20
1.12
1.02
0.53
1.98
8.37
1.00
9.24
3.01
3.12
2.90
NH
Ph
O
N
Ph
5
f1 (ppm)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
0.0E+00
5.0E+08
1.0E+09
1.5E+09
2.0E+09
2.5E+09
3.0E+09
3.5E+09
4.0E+09
4.5E+09


NH
Ph
O
N
Ph
5
177.8
138.9
137.0
130.2
128.1
128.1
127.9
127.6
127.2
88.7
60.6
59.4
40.3
34.0
33.0
20.2
16.9
f1 (ppm)


NC
O
N
6
f1 (ppm)
5.28
2.00
1.00
0.99
1.00
6.39
12.10
7.36
7.34
7.32
7.30
7.28
7.26
7.26
7.24
3.99
3.98
3.23
2.90
2.89
2.77
2.75
2.73
1.54
1.43
1.41
1.32
1.29
1.11
1.09
1.07
0.00


139.2
128.7
127.6
127.5
118.7
78.1
59.9
41.9
39.6
39.6
33.0
21.0
20.2
20.1
17.0
NC
O
N
6
f1 (ppm)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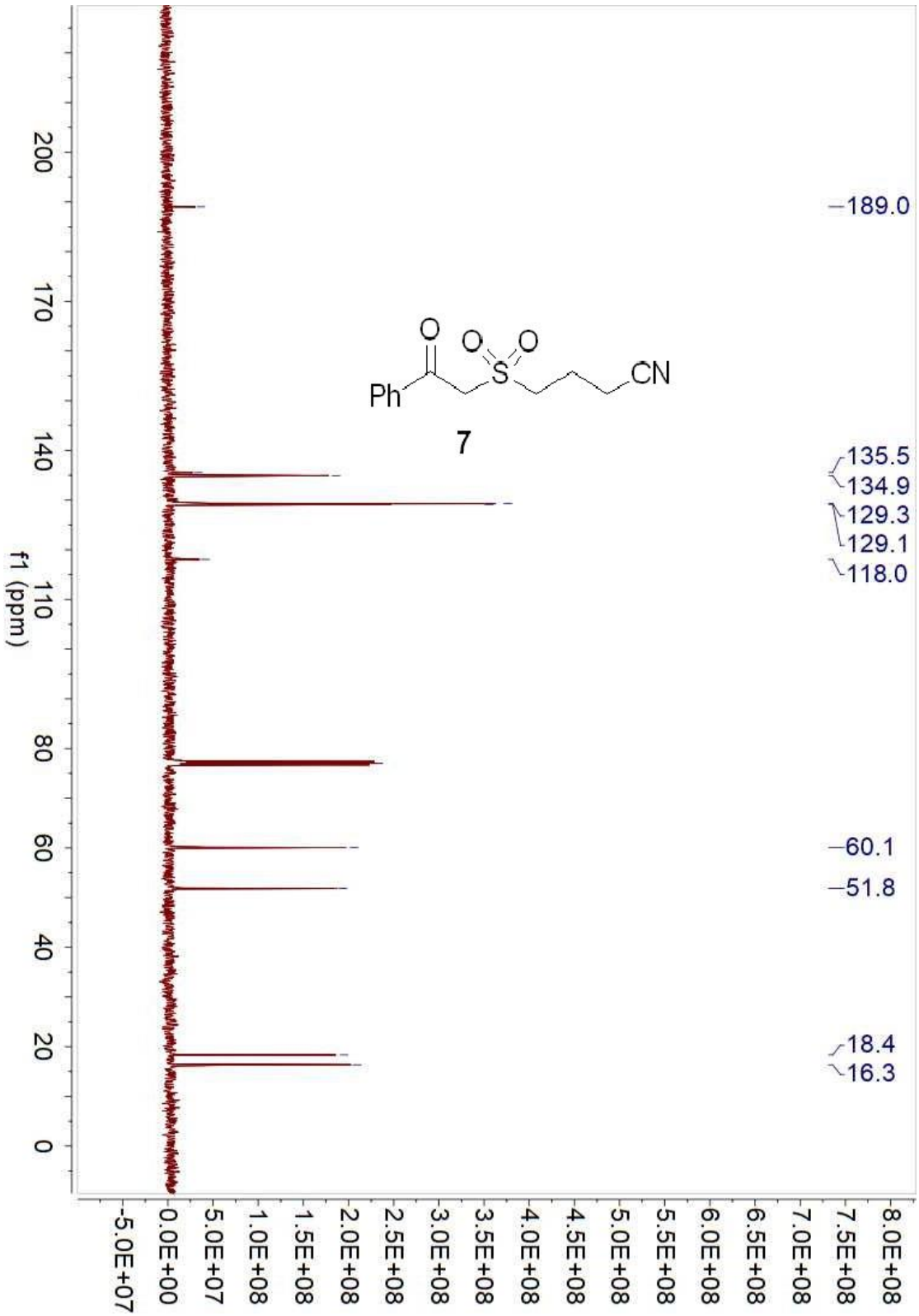
7.99
7.70
7.68
7.66
7.56
7.54
7.52
4.63
3.47
3.45
3.43
2.66
2.64
2.62
2.33
2.32
2.30
2.28
2.26
1.91
0.96
1.98
2.00
2.03
2.01
2.04
O
O
S
O
Ph
CN
7
f1 (ppm)


189.0
135.5
134.9
129.3
129.1
118.0
60.1
51.8
18.4
16.3
f1 (ppm)
Ph
CN
7