Electronic Supplementary Material (ESI) for ChemComm.

Electricity-driven, oxidative C-H selenylative and tellurylative annulation of N-(2-alkynyl)anilines: Sustainable synthesis of 3-selanyl/tellanylquinolines

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#Equal contribution

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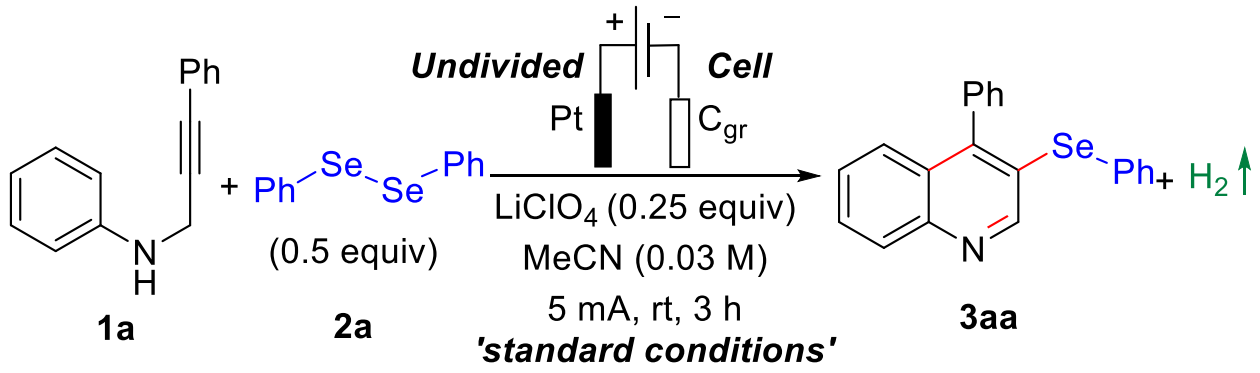
1. General Reagent Information

All reagents and solvents were purchased from Sigma-Aldrich, TCI, Finar and other local chemicalcompanies. Flash column chromatography was performed using silica gel (100-200 mesh)

2. General Analytical Information

The starting materials such as N-(3-phenylprop-2-yn-1-yl) aniline and products such as 4-phenyl-3-(phenylselanyl)quinoline and 4-phenyl-3-(phenyltellanyl)quinoline were characterized by ^{1}H NMR, ^{13}C NMR, ^{77}Se NMR (for unknown compounds only) and ^{19}F NMR (for unknown compounds only) spectra whichwere recorded on a Bruker 400 MHz instrument (400 MHz for ^{1}H NMR, 101 MHz for ^{13}C NMR,76 MHz for ^{77}Se NMR and 377 MHz for ^{19}F NMR). Copies of ^{1}H, ^{13}C, ^{77}Se and ^{19}F 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) in the deuterated solvent. ^{13}C NMR spectra are reported in ppm relative to deuterochloroform (77.00 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-trimethylbenzene(mesitylene) as the internal standard. Mass spectral data were obtained on LC-MS-8040 (Shimadzu). 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. Cyclic Voltammetry and all the chronopotentiometry (CCE) experiments were conducted on a AUTOLAB potentiostat/galvanostat.

3. Table *S1*. Optimization of the Reaction Conditions[a]

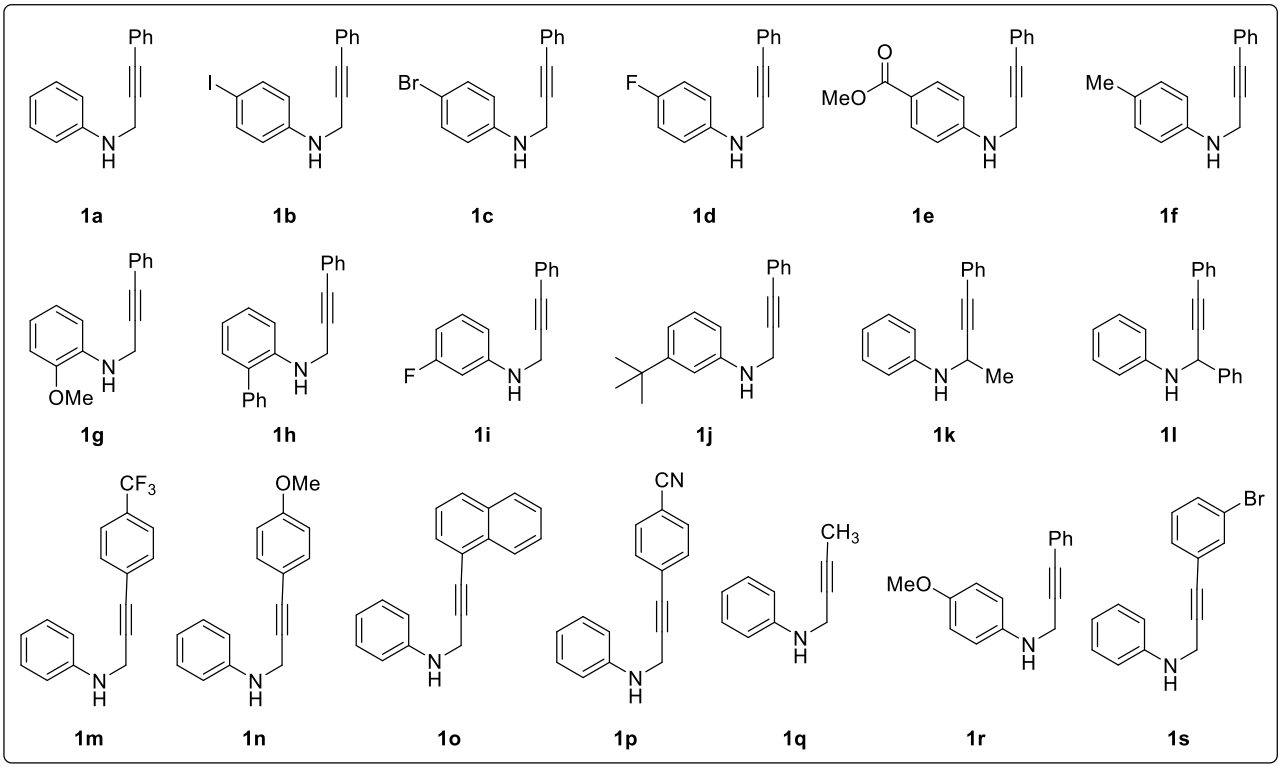


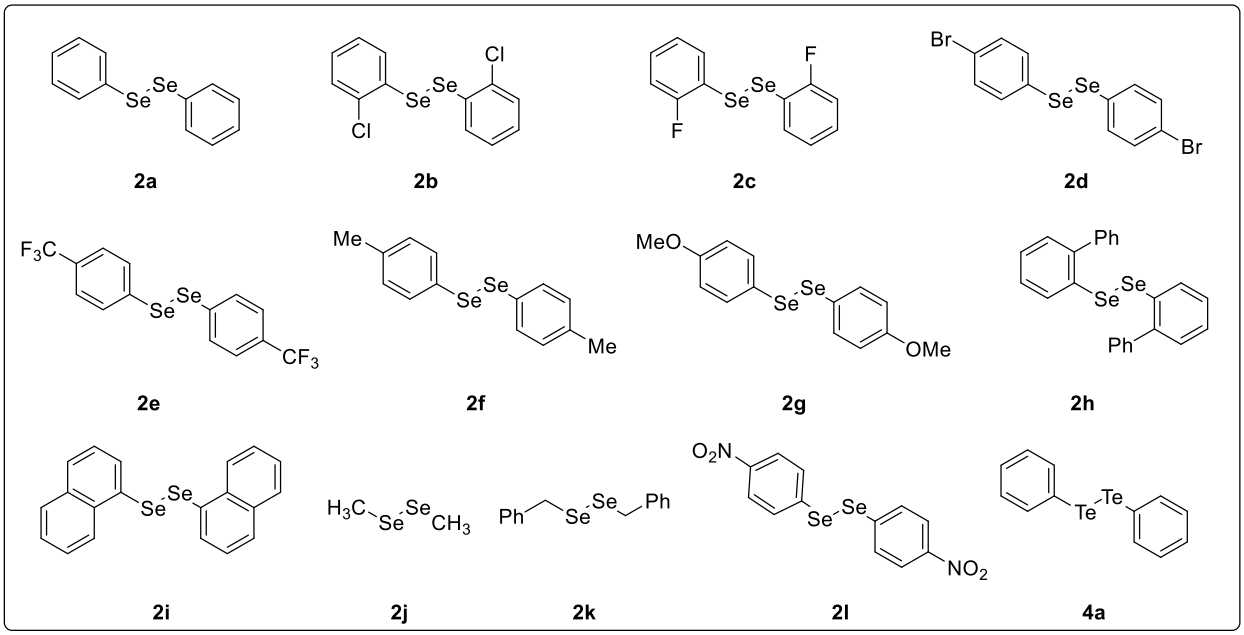
entry	variation from the standard conditions	yield (%)[b]
1	**none**	**92**
2	Pt as cathode instead of C_{gr}	90
3	C_{gr} as anode instead of Pt	trace
4	C_{gr} as anode and Pt as cathode	60
5	Ni-foam as anode instead of Pt	43
6	$^{n}Bu_4NBr$ instead of $LiClO_4$	12
7	Et_4NBr instead of $LiClO_4$	19
8	$^{n}Bu_4NClO_4$ instead of $LiClO_4$	30
9	$^{n}Bu_4NPF_6$ instead of $LiClO_4$	10
10	KI instead of $LiClO_4$	83
11	EtOH instead of MeCN	36
12	^{i}PrOH instead of MeCN	65
13	DMF instead of MeCN	trace
14	H_2O instead of MeCN	0
15	0.6 equiv of **2a** was used instead of 0.5 equiv	91
16	1.0 equiv of **2a** was used instead of 0.5 equiv	90
17	0.5 equiv $LiClO_4$ was used instead of 0.25 equiv	91
18	0.125 equiv $LiClO_4$ was used instead of 0.25 equiv	71
19	reaction conducted for 2 h	70
20	10 mA instead of 5 mA	88
21	2 mA instead of 5 mA	63
22	no electrolyte	0
23	no electricity	0

[a]Reactions were conducted in a 0.1 mmol scale in an undivided cell equipped with an anode (1 x 1 cm^2), cathode (1 x 1.5 cm^2), and an Ag/AgCl reference electrode under constant current electrolysis, Q = 54C, 0.0005596F (Faradaic efficiency = 49.32%); [b]Yield was determined by the ^{1}H NMR of the crude reaction mixture using 1,3,5-trimethylbenzene as the internal standard.

4. Synthesis of *N*-(2-Alkynyl)anilines (1a-1s), and Diaryl diselenides (2a-2l).

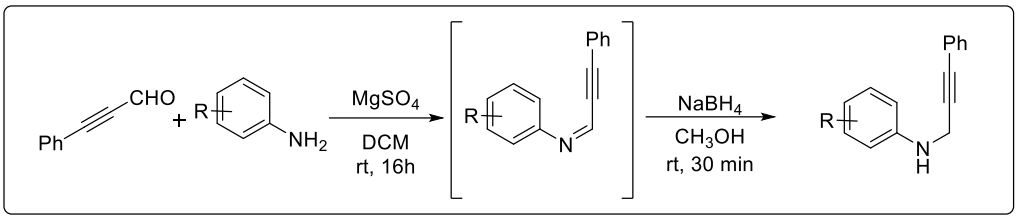
The starting materials (**1** and **2**), as shown below, were synthesized by following the literature protocols.[1-5]





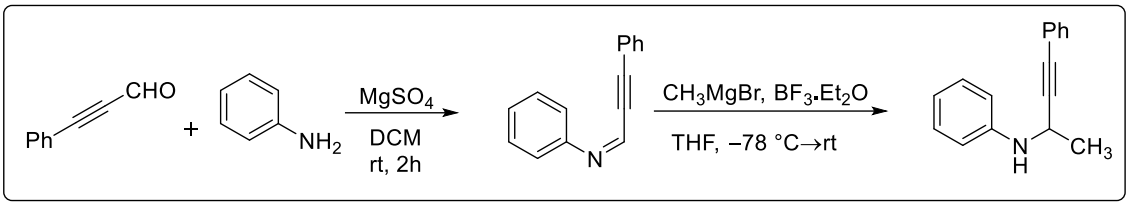
A. General Method for the Preparation of 1a to 1j and 1r:

The starting materials **1a** to **1j** and **1r** were synthesized using the reported protocol.[1]



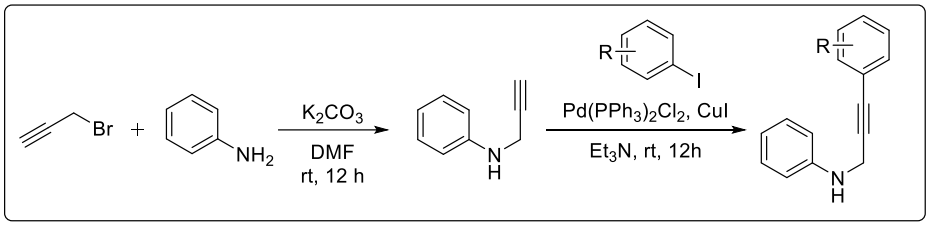
B. General Method for the Preparation of 1k and 1l:

The starting materials **1k** and **1l** were synthesized using the reported protocol.[3,4]



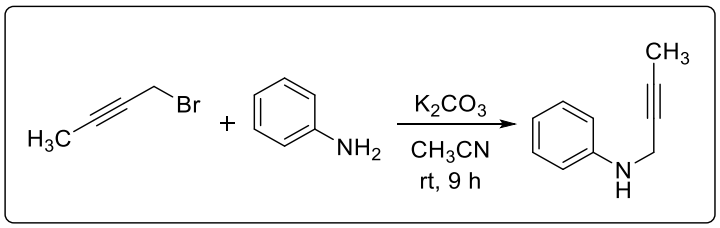
C. General Method for the Preparation of 1m to 1p and 1s:

The starting materials **1m** to **1o**, **1q** and **1s** were synthesized using the reported protocol.[1]



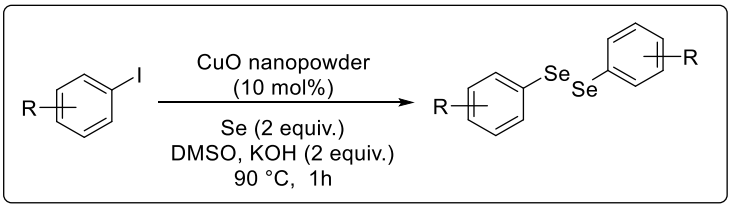
D. Method for the Preparation of 1q:

The starting material **1q** was synthesized using the reported protocol.[1]

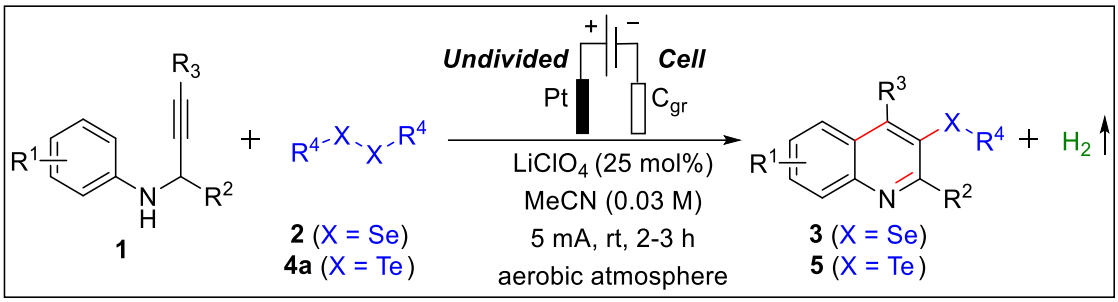


E. General Method for the Preparation of Diaryl diselenides 2b to 2i and 2l:

The starting materials **2b** to **2i** and **2l** were synthesized using the reported protocol.[5] However, **2a**, **2j**, **2k** and **4a** were commercially available.

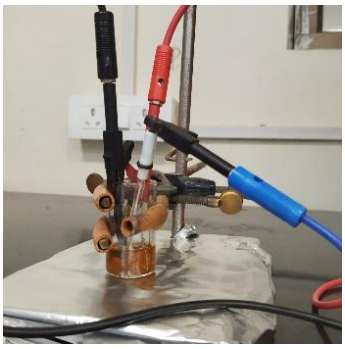


5. General Experimental Procedure for the Synthesis of 3-Selanylquinolines (3aa-3qa and 3ab−3ak) and 3-Telanylquinolines (5aa – 5ja)



Representative experimental procedure for the synthesis of 4-phenyl-3-(phenylselanyl)quinoline (3aa):

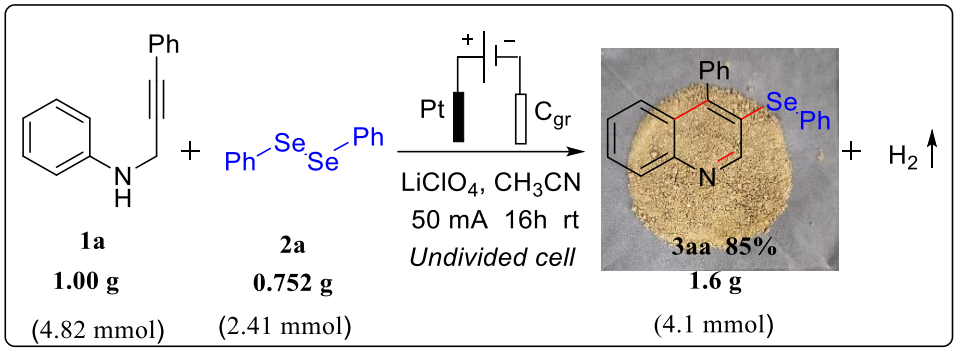
In an undivided electrochemical cell, *N*-(3-phenylprop-2-yn-1-yl)aniline (0.103 g, 0.5 mmol), 1,2-diphenyldiselenide (0.084 g, 0.275 mmol), lithium perchlorate (0.013 g, 0.0125 mmol) and acetonitrile (10 mL) were taken. The cell was equipped with Pt as working electrode (anode), graphite sheet as counter electrode (cathode) and $Ag/AgNO_3$ as reference electrode. The reaction mixture was subjected to a constant current of 0.005 A at room temperature in open air condition for 3 hours. The progress of the reaction was monitored using TLC. After the completion of the reaction, the reaction mixture was quenched using $NaHCO_3$ solution and extracted using ethyl acetate (2x15 mL). The organic layer was dried using anhydrous Na_2SO_4 and was concentrated under reduced pressure. The crude product was purified using silica gel column chromatography (hexane:ethyl acetate = 95:5) to obtain the pure product, 4-phenyl-3-(phenylselanyl)quinoline (**3aa**) as yellow solid in 88% yield (0.171g).



Reaction Setup

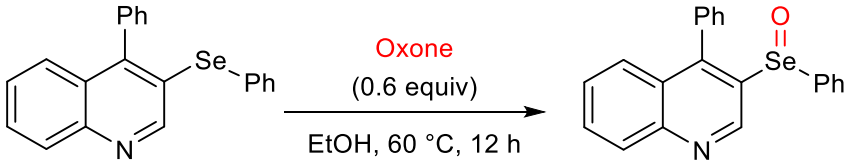
Electrodes Used

A. Gram Scale Synthesis of 4-Phenyl-3-(phenylselanyl)quinoline (3aa):

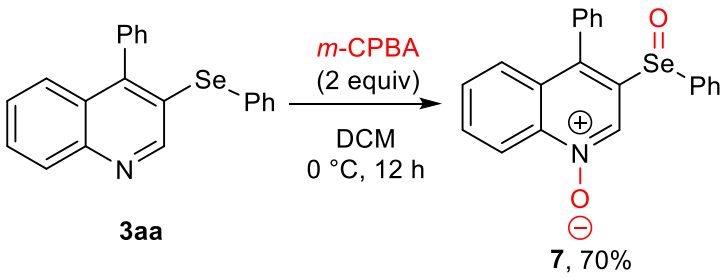


In an undivided cell, the starting material (1g, 4.82 mmol), 2a (0.752g, 2.41 mmol), $LiClO_4$ (0.128 g, 1.205 mmol) and acetonitrile (25 mL) were taken. The cell was equipped with Pt as working electrode, graphite sheet as counter electrode and Ag/Ag^+ as reference electrode. The reaction mixture was subjected to constant current of 0.06 A at room temperature in open air condition for 16 hours. The progress of the reaction was monitored using TLC. After the completion of the reaction, the reaction mixture was quenched using $NaHCO_3$ solution and was extracted using ethyl acetate (2x15 mL). The organic layer was dried using anhydrous Na_2SO_4 and was concentrated under reduced pressure. The crude product was purified using column chromatography (hexane:ethyl acetate = 95:5) to obtain the pure product.

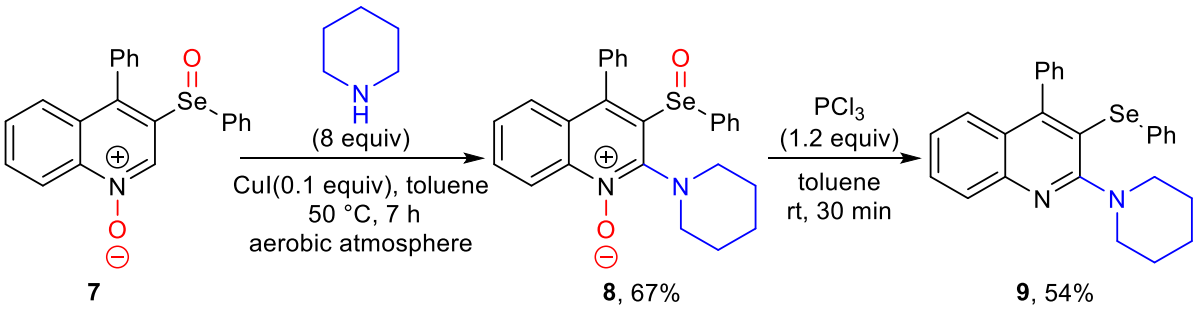
B. Experimental Procedures for the Synthetic Diversification of 3aa



To the starting material **3aa** (0.100 g, 0.28 mmol) dissolved in ethanol (2 mL), oxone (0.103 g, 0.168 mmol) was added and the reaction mixture was heated at 60 °C for 12 hours and the reaction was monitored using TLC. After the completion of the reaction, the reaction mixture was filtered and concentrated under reduced pressure. The crude product was the purified using column chromatography (DCM:Methanol = 95:5) and the pure product was characterized using spectroscopic techniques.



To the starting material, **3aa** (0.200 g, 0.55 mmol) dissolved in DCM (4 mL), *m*-CPBA (0.190 g, 1.1 mmol) was added at 0 °C, and the reaction mixture was allowed to stir at room temperature overnight and the progress of the reaction was monitored using TLC. After the completion of the reaction, it was quenched using sodium bicarbonate solution and was extracted using DCM (2 x 15 mL). The organic layer was concentrated under reduced pressure, and the crude was purified using silica gel column chromatography (DCM:Methanol = 90:10).



The compound **7** (0.150 g, 0.38 mmol) was dissolved in toluene (5 mL), and to it, piperidine (0.259 g, 3.04 mmol) and CuI (7.24 mg, 0.038 mmol) were added. The mixture was stirred at 50 °C for 7 hours, then cooled down to room temperature, diluted with 10 mL DCM and washed with 10 mL H_2O. The aqueous layer was extracted twice with DCM (5 mL) and the combined organic phase was dried over anhydrous Na_2SO_4. After evaporation of the solvents, the residue was purified by silica gel chromatography (DCM:Methanol = 90:10). Then to a stirred mixture of **8** (0.06 g, 0.25 mmol) in toluene (1.0 mL), PCl_3 (26.25 µL, 0.3 mmol) was added dropwise. The reaction mixture was stirred for 30 min at room temperature. Saturated solution of $NaHCO_3$ (5 mL) was added and then stirred for additional 5 min. The aqueous layer was then washed with DCM (20 mL x 3). The combined organic layer were dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure to give crude product, which was purified by column chromatography (hexane:ethyl acetate = 40:60).

6. *In-Situ* Detection of (2,2-Diphenylvinyl)(phenyl)selane by LC-MS

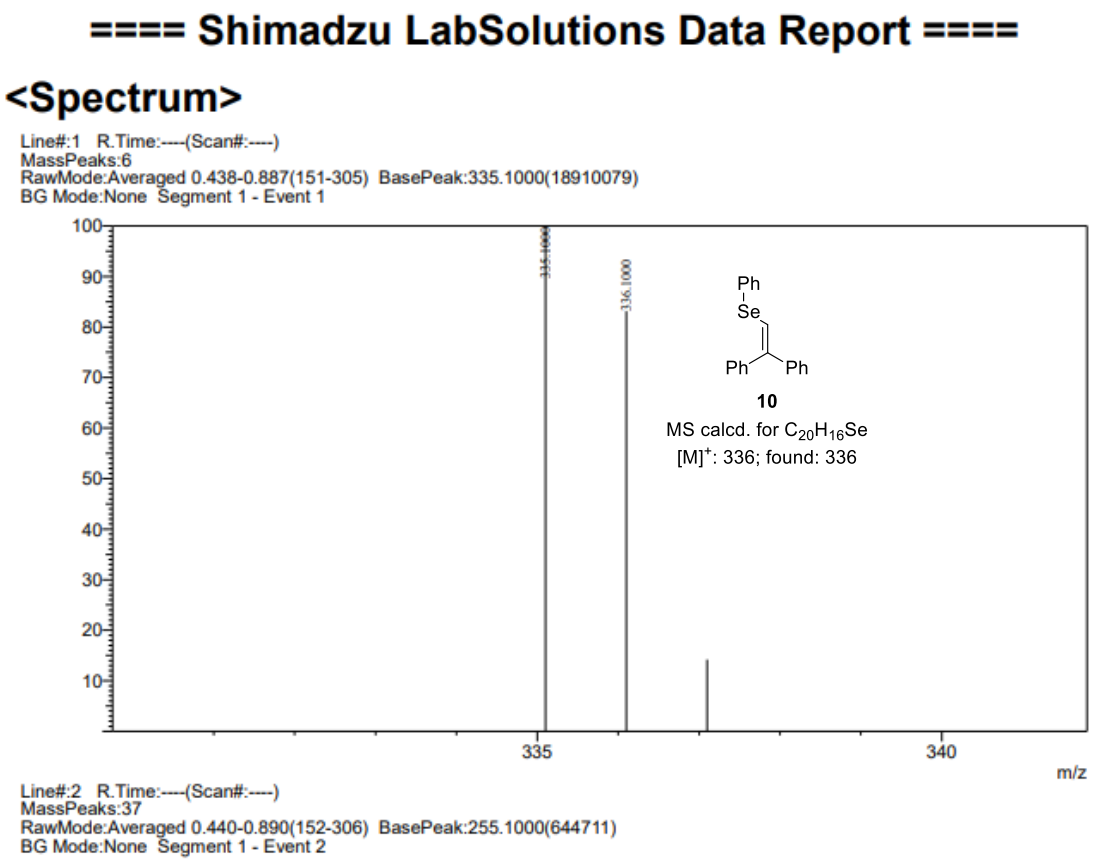
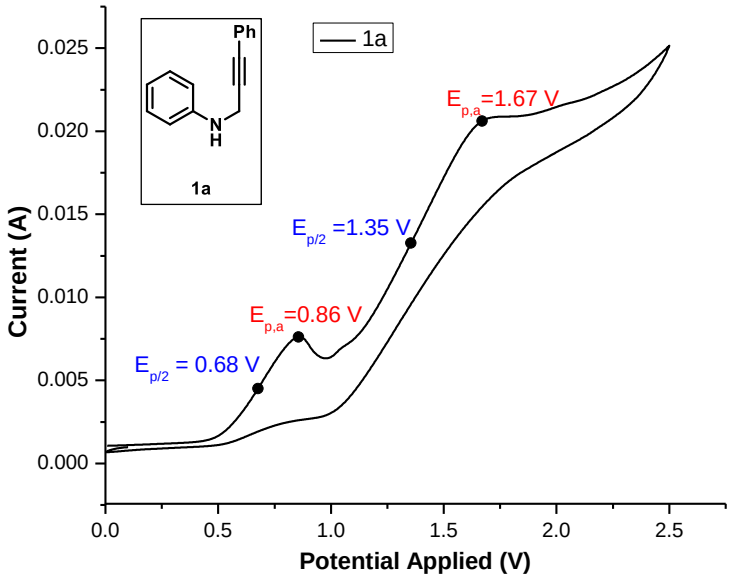
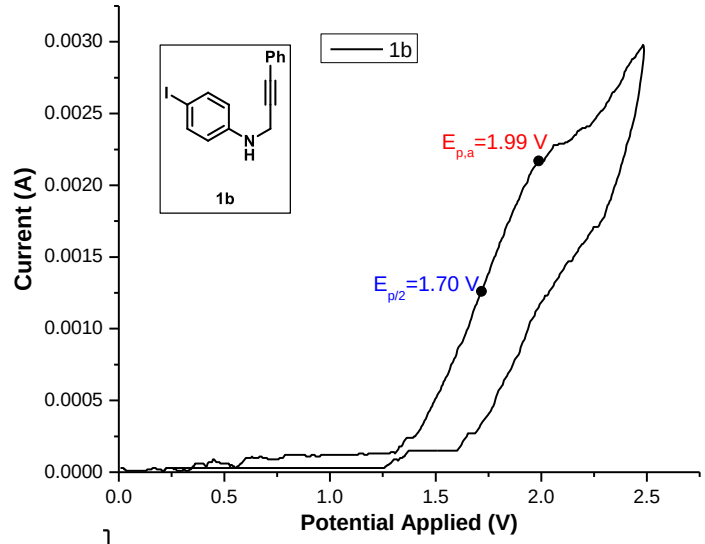
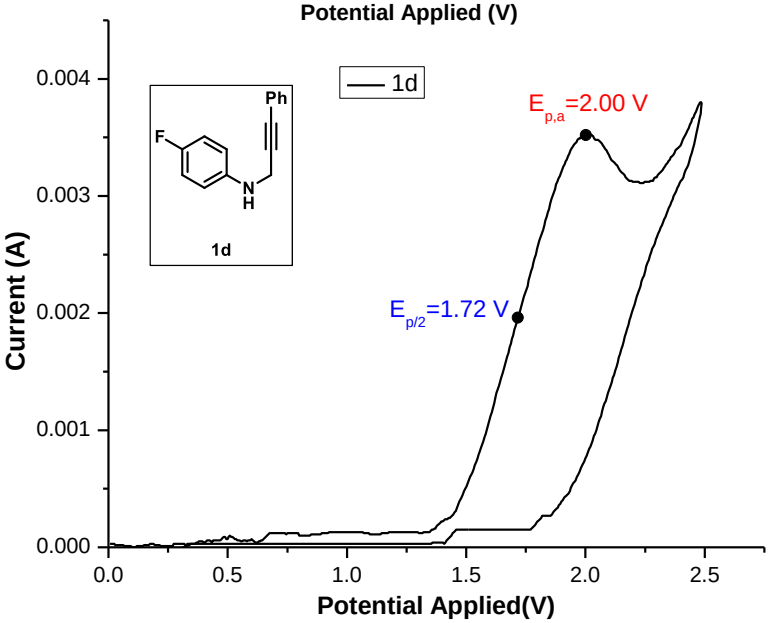


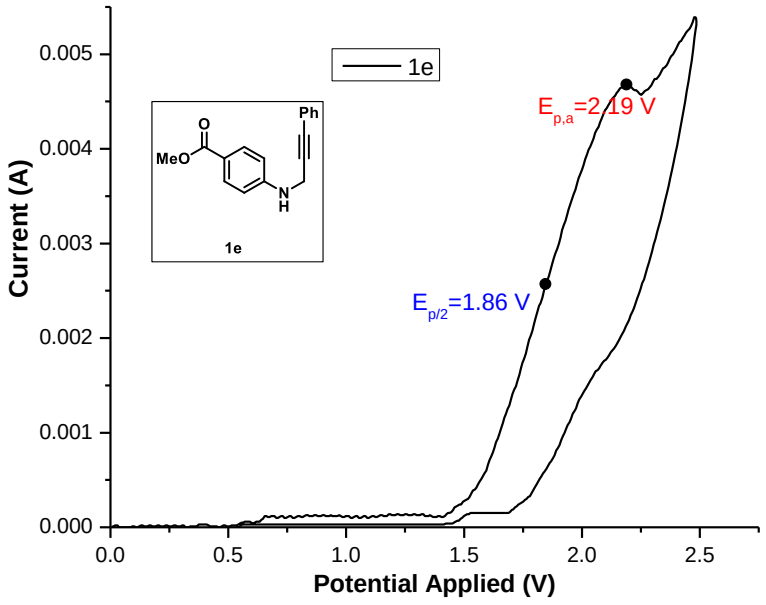
Figure S1: *In-Situ* Detection of (2,2-Diphenylvinyl)(phenyl)selane by LC-MS Mass Spectrum of the Reaction Mixture of 1a and 2a in presence of DPE

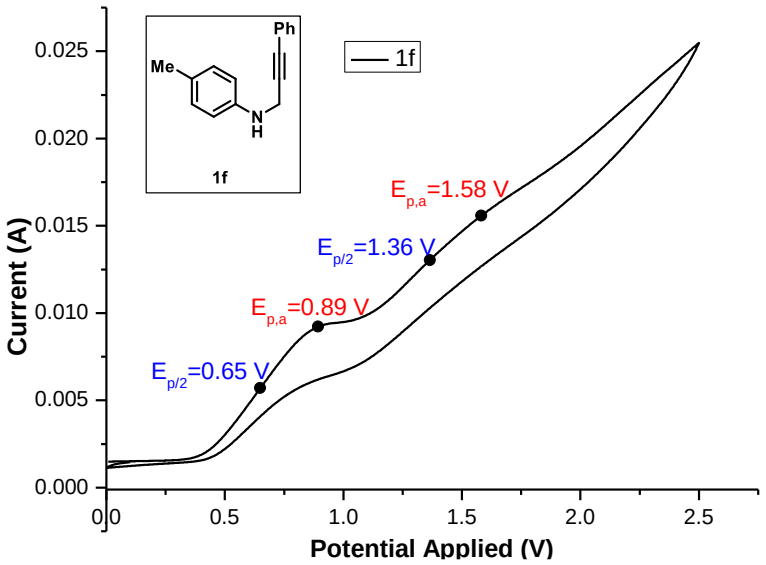
7. Cyclic Voltammetry

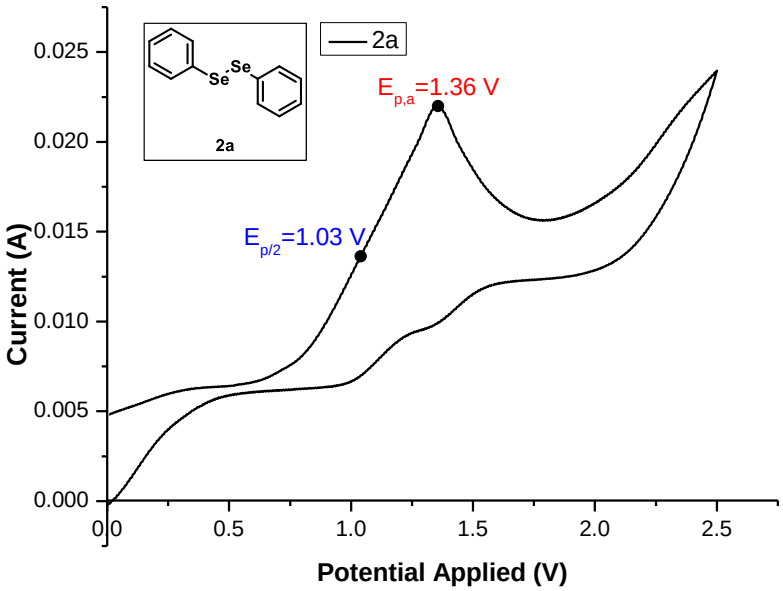


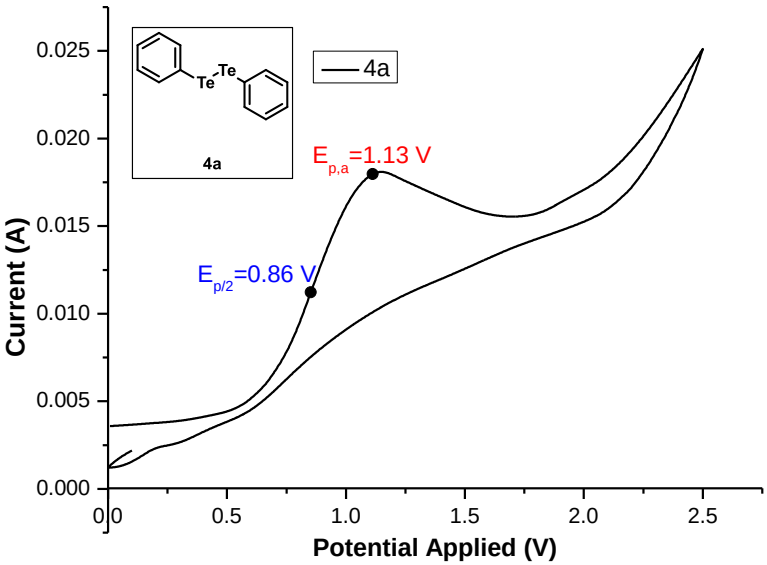

1b
Ph
I
N
H
1b
$E_{p,a}$=1.99 V
$E_{p/2}$=1.70 V
Current (A)
Potential Applied (V)
0.0030
0.0025
0.0020
0.0015
0.0010
0.0005
0.0000
0.0
0.5
1.0
1.5
2.0
2.5


1d
Ph
F
N
H
1d
$E_{p,a}$=2.00 V
$E_{p/2}$=1.72 V
Current (A)
Potential Applied(V)
0.004
0.003
0.002
0.001
0.000
0.0
0.5
1.0
1.5
2.0
2.5


1e
Ph
O
MeO
N
H
1e
$E_{p,a}$=2.19 V
$E_{p/2}$=1.86 V
Current (A)
Potential Applied (V)
0.005
0.004
0.003
0.002
0.001
0.000
0.0
0.5
1.0
1.5
2.0
2.5


1f
Ph
Me
N
H
1f
$E_{p,a}$=1.58 V
$E_{p/2}$=1.36 V
$E_{p,a}$=0.89 V
$E_{p/2}$=0.65 V
Current (A)
Potential Applied (V)
0.000
0.005
0.010
0.015
0.020
0.025
0.0
0.5
1.0
1.5
2.0
2.5


2a
Se
Se
2a
$E_{p,a}$=1.36 V
$E_{p/2}$=1.03 V
Current (A)
Potential Applied (V)
0.000
0.005
0.010
0.015
0.020
0.025
0.0
0.5
1.0
1.5
2.0
2.5


4a
Te
Te
4a
$E_{p,a}$=1.13 V
$E_{p/2}$=0.86 V
Current (A)
Potential Applied (V)
0.000
0.005
0.010
0.015
0.020
0.025
0.0
0.5
1.0
1.5
2.0
2.5

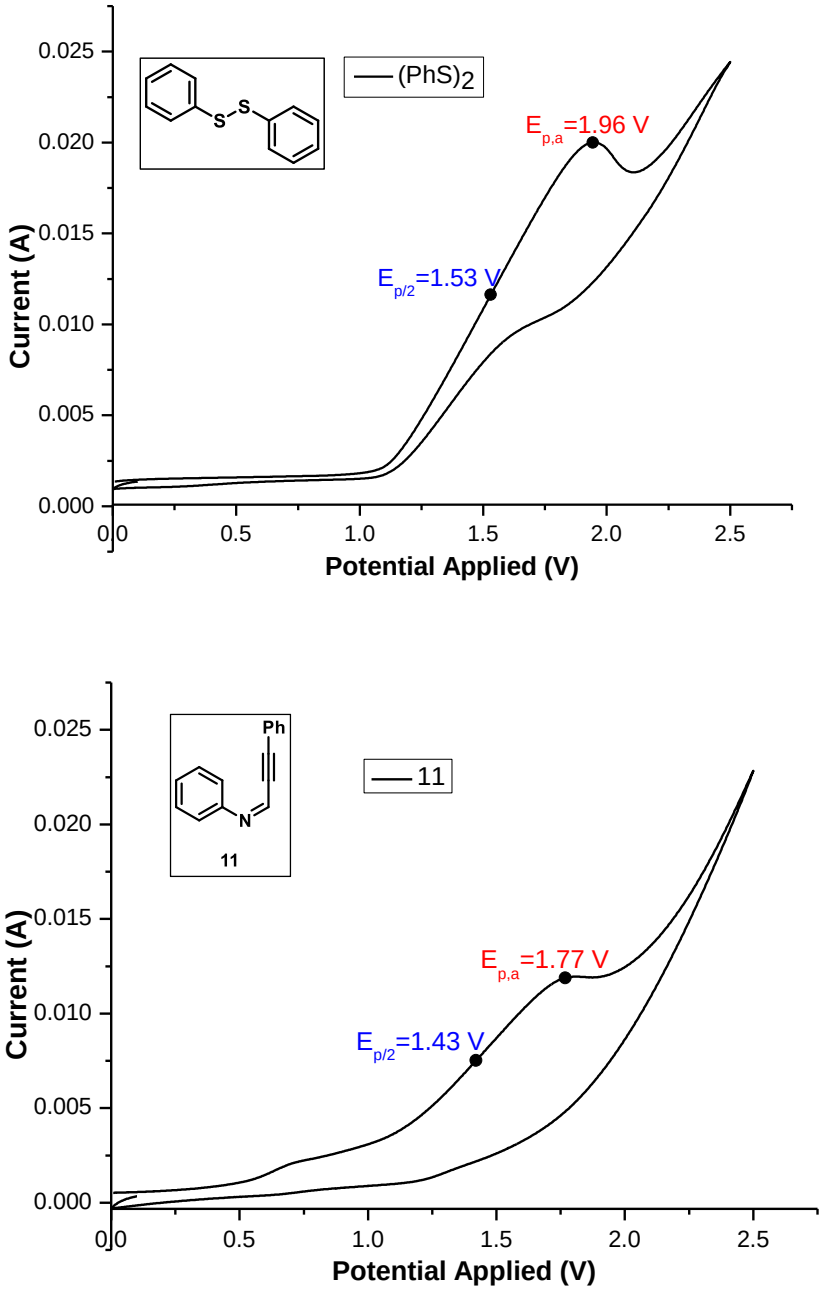


Figure S2: Cyclic Voltammograms of **1a, 1b, 1d, 1e, 1f, 2a, 4a, (PhS)$_2$** and **11**

8. Calculation of Faradaic Efficiency

Faradaic Efficiency = Charge required for the formation of **3aa** / Total charge applied

Charge required for the generation of **3aa** (0.1 mmol scale) = nFM

$$= 3\ e^- \times 96491\ C\ mol^{-1} \times 0.1 \times 10^{-3}\ mol \times 0.92 = 26.634\ C$$

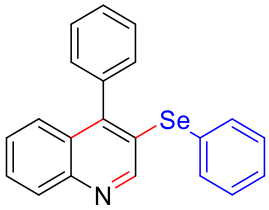
(Considering the 3-electron oxidation for the conversion of starting material **1a** to product **3aa** in 92% yield)

Total charge applied = It = 0.005 A x 10800 s = 54 C

Faradaic Efficiency = (26.634 / 54) x 100% = 49.32%

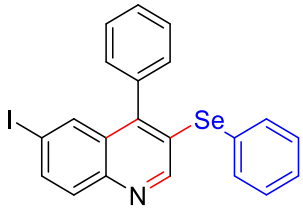
9. Characterization of all Synthesized Products

4-Phenyl-3-(phenylselanyl)quinoline (3aa):



Yellow solid (0.153 g, 85% yield). Eluent: hexane: ethyl acetate (95:5). mp: 139-141 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.71 (s, 1H), 8.07 (d, *J* = 8.3 Hz, 1H), 7.67 (ddd, *J* = 8.4, 6.7, 1.6 Hz, 1H), 7.56 – 7.48 (m, 5H), 7.47 (dd, *J* = 3.0, 0.9 Hz, 1H), 7.45 – 7.41 (m, 1H), 7.35 – 7.27 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 151.8, 147.6, 146.6, 138.6, 137.3, 135.0, 130.5, 129.5, 129.4, 128.9, 128.7, 128.6, 127.9, 127.1, 125.8.

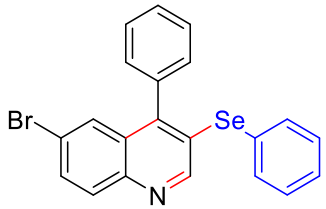
6-Iodo-4-phenyl-3-(phenylselanyl)quinoline (3ba):



Yellow solid (0.202 g, 83%). Eluent: hexane: ethyl acetate (95:5). mp: 130-132 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.63 (s, 1H), 7.88 (d, *J* = 8.8 Hz, 1H), 7.84 (s, 1H), 7.77 (d, *J* = 8.8 Hz, 1H), 7.55 (d, *J* = 6.2 Hz, 3H), 7.50 (d, *J* = 6.8 Hz, 2H), 7.35 – 7.27 (m, 5H). **^{13}C NMR (101**

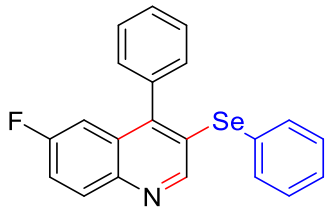
MHz, $CDCl_3$) δ 152.2, 146.5, 145.6, 137.8, 136.4, 135.1, 134.5, 131.2, 129.8, 129.5, 129.6, 129.0, 128.9, 128.70, 128.6, 128.2, 93.3.

6-Bromo-4-phenyl-3-(phenylselanyl)quinoline (3ca):



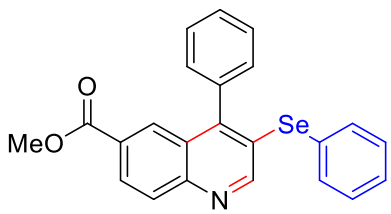
Yellow solid (0.181 g, 80%). Eluent: hexane: ethyl acetate (95:5). mp: 121-123 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.62 (s, 1H), 7.92 (d, *J* = 8.9 Hz, 1H), 7.71 (dd, *J* = 8.9, 2.2 Hz, 1H), 7.61 (d, *J* = 2.1 Hz, 1H), 7.58 – 7.55 (m, 3H), 7.52 – 7.49 (m, 2H), 7.36 – 7.28 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 152.1, 146.7, 145.3, 136.5, 135.1, 132.4, 131.3, 129.8, 129.2, 129.0, 128.95, 128.91, 128.6, 128.4, 127.9, 121.3.

6-Fluoro-4-phenyl-3-(phenylselanyl)quinoline (3da):



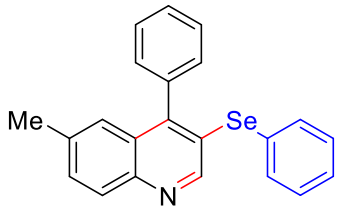
Yellow solid (0.147 g, 78%). Eluent: hexane: ethyl acetate (95:5). mp: 77-80 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.60 (s, 1H), 8.05 (dd, *J* = 9.2, 5.5 Hz, 1H), 7.62 – 7.47 (m, 5H), 7.41 (ddd, *J* = 9.1, 8.0, 2.8 Hz, 1H), 7.36 – 7.27 (m, 5H), 7.08 (dd, *J* = 10.1, 2.8 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 160.9 (d, *J* = 248.3 Hz), 151.1, 147.2 (d, *J* = 5.5 Hz), 143.8, 136.7, 135.0, 132.0 (d, *J* = 9.3 Hz), 129.8, 129.2, 128.9, 128.8, 128.6, 128.2, 119.1 (d, *J* = 25.9 Hz), 109.3 (d, *J* = 23.3 Hz).

Methyl 4-phenyl-3-(phenylselanyl)quinoline-6-carboxylate (3ea):



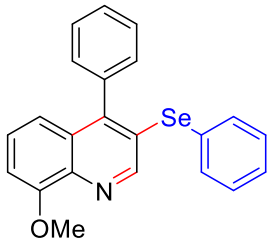
Off white solid (0.173 g, 80%). Eluent: hexane: ethyl acetate (95:5). mp:136-138 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.71 (s, 1H), 8.24 (s, 1H), 8.22 (d, *J* = 1.9 Hz, 1H), 8.09 (dd, *J* = 8.4, 1.0 Hz, 1H), 7.59 – 7.54 (m, 3H), 7.51 (dd, *J* = 8.0, 1.6 Hz, 2H), 7.37 – 7.27 (m, 5H), 3.88 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 165.5, 152.7, 147.9, 147.4, 135.4, 134.0, 128.8, 128.7, 128.2, 128.0, 127.8, 127.7, 127.6, 127.4, 127.3, 126.1, 51.3. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 376.7 (s). **HRMS (ESI)** m/z calcd. for $[M+H]^+$:420.0503; Found: 420.0506.

6-Methyl-4-phenyl-3-(phenylselanyl)quinoline (3fa):



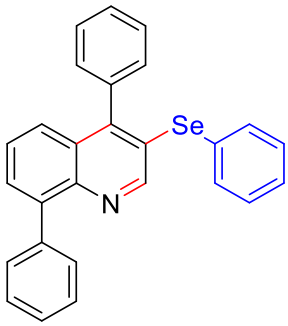
Yellow solid (0.112 g, 60%). Eluent: hexane: ethyl acetate (95:5). mp: 115-119 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.58 (s, 1H), 8.01 (d, *J* = 8.4 Hz, 1H), 7.82 (d, *J* = 6.9 Hz, 2H), 7.63 – 7.56 (m, 1H), 7.47 (dd, *J* = 8.3, 0.7 Hz, 1H), 7.39 – 7.32 (m, 2H), 7.24 (s, 2H), 7.22 (d, *J* = 1.9 Hz, 2H), 7.08 – 7.01 (m, 2H), 3.87 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 151.5, 147.9, 145.5, 137.5, 137.2, 134.4, 131.4, 129.7, 129.6, 129.4, 129.3, 128.6, 128.5, 128.1, 127.9, 126.6, 124.8, 21.8.

8-Methoxy-4-phenyl-3-(phenylselanyl)quinoline (3ga):



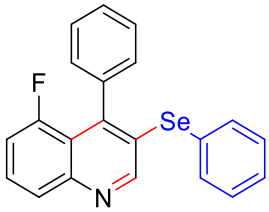
Yellow solid (0.103 g, 53%). Eluent: hexane: ethyl acetate (95:5). mp: 151-154 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.59 (s, 1H), 7.42 (d, *J* = 6.2 Hz, 3H), 7.38 (d, *J* = 6.5 Hz, 2H), 7.20 (ddd, *J* = 16.1, 9.0, 4.5 Hz, 6H), 6.93 (dd, *J* = 12.3, 8.2 Hz, 2H), 3.98 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 155.5, 150.9, 148.1, 138.7, 137.5, 134.6, 129.6, 129.3, 129.0, 128.6, 128.5, 128.2, 127.7, 127.2, 117.7, 107.2, 56.1. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 371.2. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NOSe^+$ $[M+H]^+$:392.0554; Found: 392.0557.

4,8-Diphenyl-3-(phenylselanyl)quinoline (3ha):



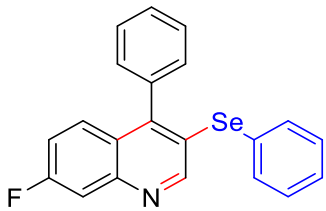
Yellow solid (0.139 g, 64%). Eluent: hexane: ethyl acetate (95:5). mp: 140-142 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.66 (s, 1H), 7.65 (ddd, *J* = 8.0, 4.3, 1.9 Hz, 3H), 7.60 – 7.54 (m, 3H), 7.52 (td, *J* = 4.2, 1.9 Hz, 1H), 7.50 (d, *J* = 1.7 Hz, 1H), 7.49 – 7.47 (m, 2H), 7.47 – 7.44 (m, 2H), 7.39 (ddd, *J* = 7.4, 4.1, 1.4 Hz, 3H), 7.32 – 7.27 (m, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 151.4, 147.6, 144.4, 141.1, 139.6, 137.6, 135.3, 130.6, 129.8, 129.7, 129.4, 128.7, 128.6, 128.4, 128.3, 128.0, 127.4, 127.1, 126.7, 125.6. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 374.5. **HRMS (ESI)** m/z calcd. for $[M+H]^+$:438.0761; Found: 438.0768.

5-Fluoro-4-phenyl-3-(phenylselanyl)quinoline (3ia):



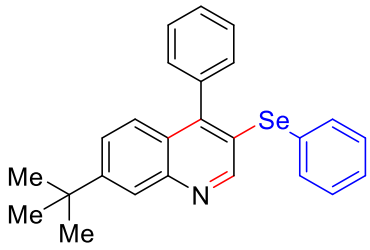
Yellow solid (0.093 g, 50%). Eluent: hexane: ethyl acetate (95:5). mp: 75-77 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.71 (s, 1H), 7.70 (dd, J = 9.8, 2.5 Hz, 1H), 7.53 (dd, J = 5.1, 1.8 Hz, 3H), 7.51 – 7.44 (m, 3H), 7.35 – 7.27 (m, 5H), 7.23 – 7.18 (m, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 164.0, 161.5, 153.6, 148.6, 147.9 (d, J = 12.5 Hz), 137.0, 134.5, 129.7, 129.4, 129.2, 128.8, 128.7, 128.4, 128.3, 126.0, 125.1, 115.2 (dd, J = 432.3, 22.7 Hz). **^{19}F NMR (377 MHz, $CDCl_3$)** δ -110.4. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 370.0. **HRMS (ESI)** m/z calcd. for $C_{21}H_{15}FNSe^+$: $[M+H]^+$:380.0354; Found: 380.0357

7-Fluoro-4-phenyl-3-(phenylselanyl)quinoline (3ia'):



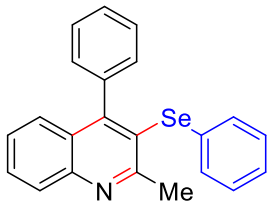
Yellow solid (0.054 g, 29%). Eluent: hexane: ethyl acetate (95:5). mp: 78-80 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (s, 1H), 7.88 (d, J = 8.4 Hz, 1H), 7.58 (dd, J = 8.2, 5.5 Hz, 1H), 7.55 (d, J = 6.7 Hz, 2H), 7.52 – 7.48 (m, 3H), 7.38 – 7.30 (m, 6H), 7.09 (dd, J = 11.8, 7.8 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 159.1, 156.5, 151.8, 148.1, 143.9, 139.7, 135.5, 129.9, 128.8, 128.5, 128.4, 128.3, 128.05, 128.02, 125.9 (d, J = 3.7 Hz), 118.2 (d, J = 9.2 Hz), 112.4 (d, J = 21.7 Hz). **^{19}F NMR (377 MHz, $CDCl_3$)** δ -107.8. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 379.2. **HRMS (ESI)** m/z calcd. for $C_{21}H_{15}FNSe^+$: $[M+H]^+$:380.0354; Found: 380.0357

7-(*tert*-Butyl)-4-phenyl-3-(phenylselanyl)quinoline (3ja):



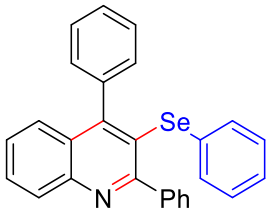
Yellow solid (0.135 g, 65%). Eluent: hexane: ethyl acetate (95:5). mp: 87-89 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.75 (s, 1H), 8.04 (d, *J* = 1.5 Hz, 1H), 7.55 – 7.48 (m, 4H), 7.45 (s, 1H), 7.41 (dd, *J* = 9.3, 3.1 Hz, 2H), 7.31 – 7.22 (m, 5H), 1.41 (s, 9H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.0, 152.6, 148.9, 147.1, 137.4, 133.8, 130.2, 129.5, 129.3, 128.5, 127.9, 126.0, 125.7, 125.4, 124.8, 35.0, 31.1. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 365.2. **HRMS (ESI)** m/z calcd. for $C_{25}H_{24}NSe^+$: $[M+H]^+$:418.1074; Found: 418.1078.

2-Methyl-4-phenyl-3-(phenylselanyl)quinoline (3ka):



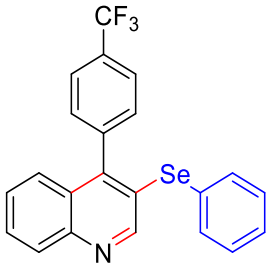
Yellow solid (0.135 g, 72%). Eluent: hexane: ethyl acetate (95:5). mp: 130-133 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.08 (d, *J* = 8.4 Hz, 1H), 7.71 (ddd, *J* = 8.4, 5.2, 3.1 Hz, 1H), 7.46 – 7.38 (m, 5H), 7.21 – 7.17 (m, 2H), 7.14 – 7.11 (m, 3H), 7.07 – 7.03 (m, 2H), 2.87 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 162.1, 154.9, 147.5, 139.0, 133.0, 130.1, 129.7, 129.3, 129.1, 128.7, 128.1, 128.0, 127.2, 127.0, 126.3, 126.2, 124.5, 27.3. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 348.6. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NSe^+$: $[M+H]^+$:376.0599; Found: 376.0607.

2,4-Diphenyl-3-(phenylselanyl)quinoline (3la):



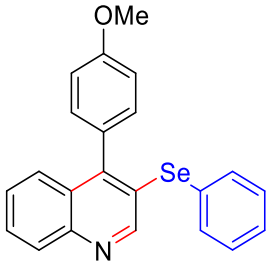
Golden yellow solid (0.132 g, 61%). Eluent: hexane: ethyl acetate (95:5). mp: 132-134 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.01 (d, J = 8.2 Hz, 1H), 7.57 – 7.50 (m, 1H), 7.35 – 7.20 (m, 7H), 7.17 – 7.02 (m, 5H), 6.90 – 6.51 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 162.9, 154.6, 147.3, 142.1, 138.8, 133.1, 131.8, 130.0, 129.6, 129.5, 129.1, 128.6, 128.1, 128.0, 127.6, 127.4, 126.9, 126.8, 126.4, 125.2.

3-(Phenylselanyl)-4-(4-(trifluoromethyl)phenyl)quinoline (3ma):



Orange liquid (0.182 g, 85%). Eluent: hexane: ethyl acetate (95:5). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.69 (s, 1H), 7.93 (d, J = 8.8 Hz, 1H), 7.66 (d, J = 8.0 Hz, 2H), 7.62 (dd, J = 8.8, 1.9 Hz, 1H), 7.47 (dd, J = 8.2, 1.3 Hz, 2H), 7.40 (dd, J = 8.2, 1.4 Hz, 2H), 7.32 (dt, J = 5.2, 1.8 Hz, 1H), 7.30 – 7.28 (m, 1H), 7.23 (ddd, J = 4.2, 3.7, 2.1 Hz, 2H), 7.10 (d, J = 1.9 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.5, 150.7, 147.4, 137.1, 135.9, 133.1, 132.8, 129.8, 129.6, 129.2, 128.7, 128.5, 128.0, 127.4, 126.4, 126.1 (d, *J* = 3.5 Hz), 124.7. **^{19}F NMR (377 MHz, $CDCl_3$)** δ -62.57. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 397.1.

4-(4-Methoxyphenyl)-3-(phenylselanyl)quinoline (3na):

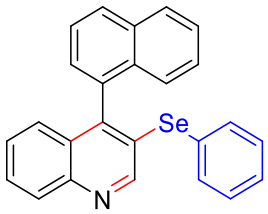


Orange solid (0.132 g, 68%). (Eluent: hexane: ethyl acetate (95:5). mp: 92-94°C **^{1}H NMR (400 MHz, $CDCl_3$):** δ 8.58 (s, 1H), 8.01 (d, *J* = 8.4 Hz, 1H), 7.82 (d, *J* = 6.9 Hz, 2H), 7.65 – 7.56 (m,

1H), 7.47 (dd, *J* = 8.3, 0.7 Hz, 1H), 7.39 – 7.31 (m, 2H), 7.24 (s, 2H), 7.22 (d, *J* = 1.9 Hz, 2H), 7.04 (d, *J* = 8.6 Hz, 2H), 3.87 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 152.2, 146.0, 145.7, 140.3, 135.1, 134.5, 133.3, 131.8, 130.1, 129.7, 129.6, 129.0, 128.6, 128.5, 128.4, 128.1, 127.0, 126.0, 125.6 (d, J = 3.4 Hz) , 124.0 (q, J = 270 Hz).

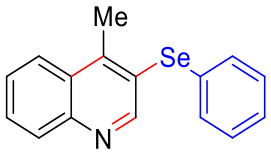
13C NMR (101 MHz, CDCl3) δ 152.2, 146.0, 145.7, 140.3, 135.1, 134.5, 133.3, 131.8, 130.1, 129.7, 129.6, 129.0, 128.6, 128.5, 128.4, 128.1, 127.0, 126.0, 125.6 (d, J = 3.4 Hz) , 124.0 (q, J = 270 Hz).

4-(Naphthalen-1-yl)-3-(phenylselanyl)quinoline (3oa):



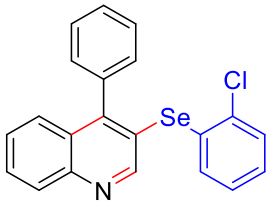
Yellow solid (0.157 g, 77%). Eluent: hexane: ethyl acetate (95:5). mp: 80-82°C. **^{1}H NMR (400 MHz, $CDCl_3$)** (400 MHz, CDCl3) δ 8.79 (s, 1H), 8.13 (d, J = 8.4 Hz, 1H), 8.01 (dd, J = 19.4, 8.3 Hz, 2H), 7.70 – 7.59 (m, 2H), 7.56 – 7.49 (m, 1H), 7.45 (dd, J = 8.0, 1.4 Hz, 2H), 7.40 (dd, J = 7.0, 1.0 Hz, 1H), 7.36 – 7.26 (m, 4H), 7.25 – 7.20 (m, 3H).**^{13}C NMR (101 MHz, $CDCl_3$)** δ 152.4, 146.8, 146.6, 134.9, 134.8, 133.6, 131.3, 129.6, 129.5, 129.3, 129.2, 129.1, 128.6, 128.3, 127.5, 127.3, 126.7, 126.3, 126.2, 125.4.

4-Methyl-3-(phenylselanyl)quinoline (3pa):



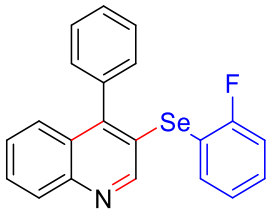
Yellow liquid (0.083 g, 56%)**.** Eluent: hexane: ethyl acetate (98:2). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.88 (s, 1H), 8.06 (t, J = 8.1 Hz, 2H), 7.71 (t, J = 7.5 Hz, 1H), 7.59 (t, J = 7.6 Hz, 1H), 7.38 (m, J = 2.4 Hz, 2H), 7.25 (m, J = 5.1 Hz, 3H), 2.86 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 154.8, 147.2, 146.9, 132.0, 130.8, 130.1, 129.6, 129.4, 128.4, 127.3, 127.0, 125.7, 124.2, 18.5.

3-((2-Chlorophenyl)selanyl)-4-phenylquinoline (3ab):



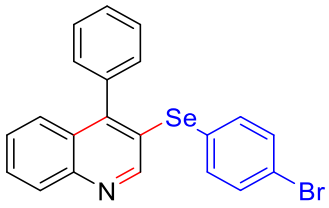
Yellow solid (0.108 g, 55%). Eluent: hexane: ethyl acetate (95:5). mp: 78-82ºC **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.85 (s, 1H), 8.13 (d, J = 8.3 Hz, 1H), 7.72 (ddd, J = 8.4, 6.7, 1.5 Hz, 1H), 7.53 (dd, J = 8.5, 1.0 Hz, 1H), 7.50 (ddd, J = 4.5, 3.5, 1.7 Hz, 3H), 7.48 – 7.44 (m, 1H), 7.36 (dd, J = 7.9, 1.4 Hz, 1H), 7.30 (ddd, J = 5.5, 2.9, 1.5 Hz, 2H), 7.21 – 7.15 (m, 2H), 7.08 (ddd, J = 8.0, 7.2, 1.4 Hz, 1H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 154.0, 151.1, 147.4, 137.1, 135.7, 133.5, 131.7, 129.8, 129.7, 129.6, 129.1, 128.6, 128.5, 128.1, 127.5, 127.2, 126.4, 124.4. **^{77}Se NMR (76 MHz, CDCl3)** δ 358.5. **HRMS (ESI)** m/z calcd. for $C_{21}H_{15}ClNSe^+$ $[M+H]^+$:396.0058; Found: 396.0062.

3-((2-Fluorophenyl)selanyl)-4-phenylquinoline (3ac):



Yellow solid (0.128 g, 68%). Eluent: hexane: ethyl acetate (95:5). mp: 71-73 ºC. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.73 (s, 1H), 8.09 (d, *J* = 8.4 Hz, 1H), 7.72 – 7.65 (m, 1H), 7.56 – 7.50 (m, 3H), 7.49 (s, 1H), 7.47 – 7.40 (m, 1H), 7.40 – 7.28 (m, 4H), 7.06 (dt, *J* = 10.5, 8.0 Hz, 2H). **^{13}C NMR (101 MHz, CDCl$_3$)** δ 163.2, 160.7, 152.5, 149.2, 147.0, 137.1, 136.0, 130.6 (d, *J* = 7.7 Hz), 129.5, 129.3, 128.7, 128.6, 128.0, 127.2, 126.1, 125.1 (d, *J* = 3.2 Hz), 124.9, 116.6 (d, *J* = 22.0 Hz), 116.0 (d, *J* = 23.3 Hz). **^{19}F NMR (377 MHz, CDCl$_3$)** δ -102.0. **^{77}Se NMR (76 MHz, CDCl3)** δ 292.1. **HRMS (ESI)** m/z calcd. for $C_{21}H_{15}FNSe^+$ $[M+H]^+$:380.0354; Found: 380.0355.

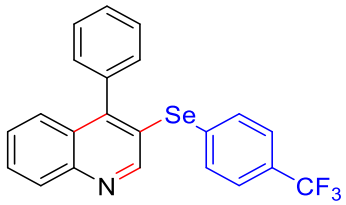
3-((4-Bromophenyl)selanyl)-4-phenylquinoline (3ad):



Yellow solid (0.153 g, 70%)**.** Eluent: hexane: ethyl acetate (95:5). mp: 74-77 ºC. **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.62 (s, 1H), 7.92 (d, *J* = 8.9 Hz, 1H), 7.71 (dd, *J* = 8.9, 2.2 Hz, 1H), 7.61 (d, *J* =

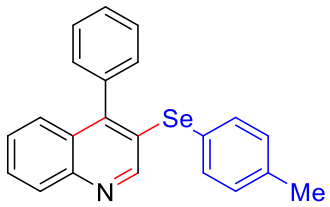
2.1 Hz, 1H), 7.58 – 7.55 (m, 3H), 7.52 – 7.49 (m, 2H), 7.36 – 7.28 (m, 5H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 152.1, 146.7, 145.3, 136.5, 135.1, 132.4, 131.3, 129.8, 129.2, 129.0, 128.95, 128.91, 128.6, 128.4, 127.9, 121.3.

4-Phenyl-3-((4-(trifluoromethyl)phenyl)selanyl)quinoline (3ae):



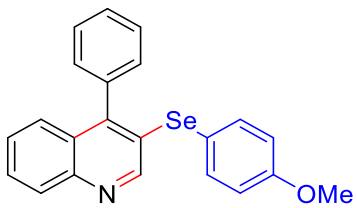
Yellow solid (0.128 g, 60%). Eluent: hexane: ethyl acetate (95:5). mp:75-77 °C **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.86 (s, 1H), 8.13 (d, J = 8.4 Hz, 1H), 7.72 (ddd, J = 8.4, 6.7, 1.6 Hz, 1H), 7.54 – 7.48 (m, 5H), 7.47 – 7.42 (m, 5H), 7.28 – 7.27 (m, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.6, 150.7, 147.4, 137.1, 136.0, 132.8, 129.8, 129.8, 129.6, 129.2, 128.7, 128.5, 128.0, 127.4, 126.4, 126.1 (d, J = 3.5 Hz), 125.3, 124.0 (q, J = 270 Hz). **^{19}F NMR (377 MHz, $CDCl_3$)** δ -62.73.

4-Phenyl-3-(p-tolylselanyl)quinoline (3af):



Yellow solid (0.159 g, 85%). Eluent: hexane: ethyl acetate (95:5). mp: 101-103 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.64 (s, 1H), 8.06 (d, *J* = 8.3 Hz, 1H), 7.65 (ddd, *J* = 8.3, 6.7, 1.5 Hz, 1H), 7.56 – 7.51 (m, 1H), 7.48 (dt, *J* = 7.9, 1.9 Hz, 1H), 7.41 (d, *J* = 8.2 Hz, 1H), 7.35 (dd, *J* = 7.6, 1.8 Hz, 1H), 7.11 (d, *J* = 7.8 Hz, 1H), 2.35 (s, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 151.8, 147.6, 146.6, 138.6, 137.3, 135.2, 130.5, 129.5, 129.4, 128.9, 128.6, 127.9, 127.3, 127.1, 125.8, 125.2.

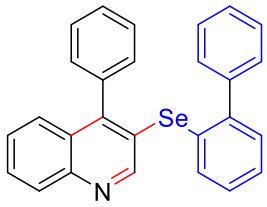
3-((4-Methoxyphenyl)selanyl)-4-phenylquinoline (3ag):



Yellow solid (0.177 g, 91%). Eluent: hexane: ethyl acetate (95:5). mp: 74-78 °C **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.58 (s, 1H), 8.06 (d, *J* = 8.2 Hz, 1H), 7.63 (ddd, *J* = 8.3, 6.7, 1.5 Hz, 1H), 7.58 –

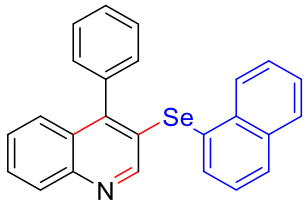
7.52 (m, 3H), 7.51 – 7.46 (m, 3H), 7.42 – 7.38 (m, 1H), 7.37 – 7.34 (m, 2H), 6.88 – 6.83 (m, 2H), 3.80 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 160.3, 151.1, 146.81, 146.5, 137.5, 137.2, 129.5, 129.4, 128.7, 128.6, 127.9, 127.8, 127.1, 125.7, 118.5, 115.5, 55.4.

3-([1,1'-Biphenyl]-2-ylselanyl)-4-phenylquinoline (3ah):



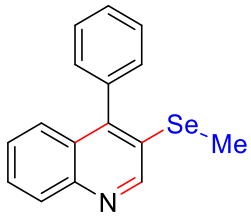
Yellow solid (0.177 g, 81%)**.** Eluent: hexane: ethyl acetate (95:5). mp: 120-122 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.72 (s, 1H), 8.10 (d, *J* = 8.4 Hz, 1H), 7.67 (t, *J* = 7.5 Hz, 1H), 7.46 (d, *J* = 5.7 Hz, 4H), 7.42 (d, *J* = 6.6 Hz, 1H), 7.37 (dd, *J* = 13.8, 6.0 Hz, 1H), 7.32 (d, *J* = 6.4 Hz, 5H), 7.25 – 7.22 (m, 2H), 7.20 (dd, *J* = 8.1, 1.4 Hz, 1H), 7.16 (dd, *J* = 4.6, 3.0 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.7, 148.6, 146.0, 145.1, 144.4, 141.6, 136.7, 134.6, 134.0, 133.1, 131.0, 130.8, 130.6, 130.5, 130.4, 130.3, 130.1, 129.21, 129.18, 129.0, 128.4, 128.2, 127.9, 127.9, 127.6, 127.51, 127.45. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 373.1. **HRMS (ESI)** m/z calcd. for $C_{27}H_{20}NSe^+$ $[M+H]^+$:438.0761; Found: 438.0760.

3-(Naphthalen-1-ylselanyl)-4-phenylquinoline (3ai):



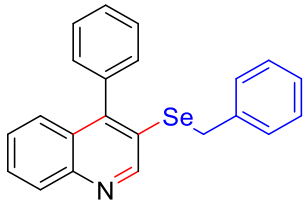
Brown liquid (0.156 g, 76%). Eluent: hexane: ethyl acetate (95:5). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.37 (s, 1H), 8.20 (d, *J* = 7.9 Hz, 1H), 8.00 (d, *J* = 8.3 Hz, 1H), 7.90 (d, *J* = 8.2 Hz, 1H), 7.85 (d, *J* = 7.3 Hz, 2H), 7.66 – 7.61 (m, 1H), 7.58 (ddd, *J* = 5.6, 5.1, 1.6 Hz, 2H), 7.50 (d, *J* = 7.3 Hz, 2H), 7.47 (d, *J* = 1.7 Hz, 1H), 7.45 (d, *J* = 1.8 Hz, 1H), 7.44 – 7.41 (m, 2H), 7.39 (dd, *J* = 5.6, 4.8 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 151.3, 147.4, 146.6, 137.2, 135.6, 134.5, 134.3, 130.2, 129.5, 129.4, 128.8, 128.7, 127.9, 127.8, 127.3, 127.1, 126.9, 126.5, 126.1, 125.7.

3-(Methylselanyl)-4-phenylquinoline (3aj):



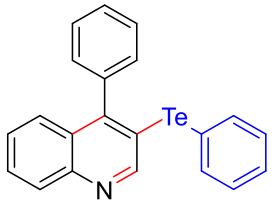
Yellow solid (0.137 g, 92%). Eluent: hexane: ethyl acetate (95:5). mp: 125-128 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.96 (s, 1H), 8.11 (d, *J* = 8.4 Hz, 1H), 7.65 (ddd, *J* = 8.4, 6.5, 1.8 Hz, 1H), 7.58 – 7.49 (m, 3H), 7.45 (ddd, *J* = 8.5, 1.8, 0.6 Hz, 1H), 7.43 – 7.38 (m, 1H), 7.34 – 7.30 (m, 2H), 2.33 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 149.3, 146.9, 145.5, 136.2, 128.4, 128.3, 127.7, 127.6, 127.5, 126.6, 126.0, 124.7, 124.6, 6.3.

3-(Benzylselanyl)-4-phenylquinoline (3ak):



Yellow solid (0.159 g, 85%). Eluent: hexane: ethyl acetate (95:5). mp: 102-105 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 9.04 (s, 1H), 8.13 (d, J = 8.5 Hz, 1H), 7.68 (ddd, J = 8.4, 6.4, 1.8 Hz, 1H), 7.50 – 7.46 (m, 3H), 7.45 – 7.39 (m, 2H), 7.22 – 7.10 (m, 7H), 4.06 (s, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.0, 150.3, 147.0, 137.6, 137.4, 129.5, 129.4, 129.2, 128.9, 128.5, 128.4, 127.4, 127.1, 127.0, 126.2, 124.9, 31.9. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 318.1. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NSe^{+}$ $[M+H]^{+}$:376.0604; Found: 376.0609.

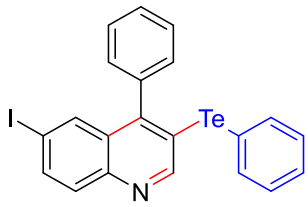
4-Phenyl-3-(phenyltellanyl)quinoline (5aa):



Orange solid (0.184 g, 90%). Eluent: hexane: ethyl acetate (95:5). mp: 142-146 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.56 (s, 1H), 7.96 (d, *J* = 8.4 Hz, 1H), 7.74 (d, *J* = 7.1 Hz, 2H), 7.54 (dd, *J* = 11.0, 3.9 Hz, 1H), 7.47 – 7.40 (m, 3H), 7.36 (d, *J* = 7.8 Hz, 1H), 7.29 (dd, *J* = 11.9, 7.2 Hz, 2H), 7.25 – 7.21 (m, 2H), 7.21 – 7.15 (m, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 154.0, 151.1, 147.0, 140.5,

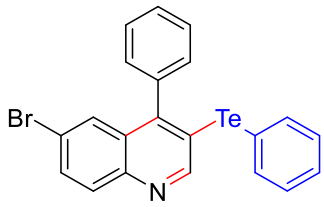
139.8, 129.9, 129.4, 129.1, 129.0, 128.9, 128.8, 128.1, 126.9, 125.8, 114.6, 113.3. **HRMS (ESI)** m/z calcd. for $C_{21}H_{16}NTe^+$ $[M+H]^+$:412.0345; Found: 412.0350.

6-Iodo-4-phenyl-3-(phenyltellanyl)quinoline (5ba):



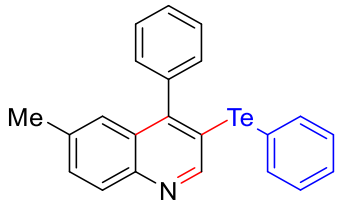
Yellow solid (0.246 g, 92%). Eluent: hexane: ethyl acetate (95:5). mp: 142-145 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.57 (s, 1H), 7.89 – 7.84 (m, 3H), 7.79 (d, *J* = 1.7 Hz, 1H), 7.75 (d, *J* = 8.8 Hz, 1H), 7.60 – 7.55 (m, 3H), 7.41 (t, *J* = 7.5 Hz, 1H), 7.30 (dt, *J* = 9.6, 5.9 Hz, 4H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 154.1, 149.5, 145.9, 140.8, 139.0, 137.8, 134.4, 131.1, 130.1, 129.6, 129.3, 129.2, 128.7, 116.2, 113.0, 92.9. **HRMS (ESI)** m/z calcd. for $C_{21}H_{15}INTe^+$ $[M+H]^+$:537.9311; Found: 537.9314.

6-Bromo-4-phenyl-3-(phenyltellanyl)quinoline (5ca):



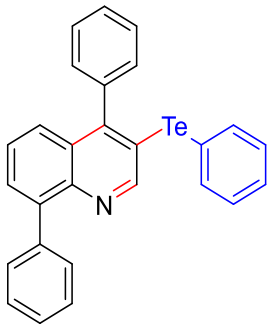
Yellow solid (0.207 g, 85%). Eluent: hexane: ethyl acetate (95:5). mp: 106-113 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.58 (s, 1H), 7.90 (d, *J* = 8.9 Hz, 1H), 7.86 (d, *J* = 7.0 Hz, 2H), 7.69 (dd, *J* = 8.9, 2.1 Hz, 1H), 7.58 (dd, *J* = 6.7, 4.0 Hz, 4H), 7.45 – 7.38 (m, 1H), 7.31 (dt, *J* = 14.6, 6.0 Hz, 4H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 152.87, 148.65, 144.53, 139.74, 137.99, 131.41, 130.14, 129.00, 128.22, 128.18, 128.09, 127.63, 126.72, 119.95, 115.35, 111.95. **HRMS (ESI)** m/z calcd. for $C_{21}H_{15}BrNTe^+$ $[M+H]^+$:489.9450; Found: 489.9444.

6-Methyl-4-phenyl-3-(phenyltellanyl)quinoline (5fa):



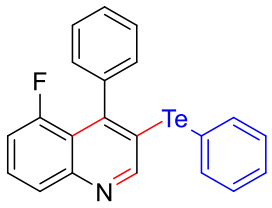
Yellow solid (0.150 g, 71%). Eluent: hexane: ethyl acetate (95:5). mp: 106-110 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.58 (s, 1H), 7.95 (d, *J* = 8.5 Hz, 1H), 7.83 (dd, *J* = 8.0, 1.2 Hz, 2H), 7.56 (dd, *J* = 5.1, 1.9 Hz, 3H), 7.48 (dd, *J* = 8.5, 1.8 Hz, 1H), 7.41 – 7.36 (m, 1H), 7.35 – 7.31 (m, 2H), 7.28 (d, *J* = 7.6 Hz, 1H), 7.19 (s, 1H), 2.40 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.1, 150.5, 145.7, 140.5, 140.0, 136.9, 131.3, 129.9, 129.2, 129.0, 128.9, 128.85, 128.78, 128.1, 124.6, 114.6, 113.4, 21.8. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NTe^+$ $[M+H]^+$:426.0501; Found: 426.0507.

4,8-Diphenyl-3-(phenyltellanyl)quinoline (5ha):



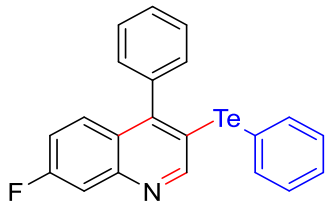
Yellow solid (0.175 g, 72%). Eluent: hexane: ethyl acetate (95:5). mp: 152-155 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.67 (s, 1H), 7.87 (d, *J* = 7.2 Hz, 2H), 7.65 (d, *J* = 6.8 Hz, 3H), 7.58 (d, *J* = 6.1 Hz, 3H), 7.48 (d, *J* = 11.2 Hz, 4H), 7.39 (d, *J* = 5.5 Hz, 4H), 7.28 (s, 1H), 7.23 (s, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 153.4, 150.7, 144.8, 141.1, 140.2, 139.7, 130.6, 130.0, 129.9, 129.1, 128.91, 128.87, 128.6, 128.0, 127.4, 126.6, 125.5, 115.0, 113.0. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NOTe^+$ $[M+H]^+$: 488.0658; Found:488.0667.

5-Fluoro-4-phenyl-3-(phenyltellanyl)quinoline (5ia):



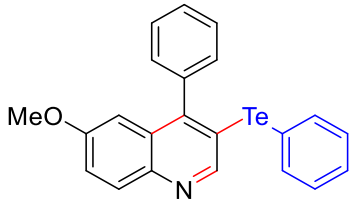
Yellow solid (0.124 g, 58%). Eluent: hexane: ethyl acetate (95:5). mp:64-66 °C **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.64 (s, 1H), 7.83 (d, *J* = 7.7 Hz, 2H), 7.67 (d, *J* = 9.8 Hz, 1H), 7.55 (s, 3H), 7.50 – 7.36 (m, 2H), 7.35 – 7.27 (m, 4H), 7.18 (t, *J* = 8.6 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 164.0, 161.5, 155.2, 151.2, 148.1 (d, *J* = 12.5 Hz), 140.5, 139.6, 125.3, 117.2 (d, *J* = 25.0 Hz), 113.2, 113.0 (d, *J* = 20.3 Hz). **^{19}F NMR (377 MHz, CDCl3)** δ -110.3. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NOTe^+$ $[M+H]^+$:430.0251; Found: 430.0254.

7-Fluoro-4-phenyl-3-(phenyltellanyl)quinoline (5ia'):



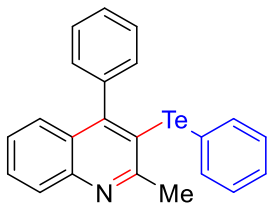
Yellow solid (0.070 g, 33%). Eluent: hexane: ethyl acetate (95:5). mp: 68-74 °C **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.50 (s, 1H), 7.92 – 7.84 (m, 3H), 7.59 – 7.54 (m, 1H), 7.54 – 7.50 (m, 3H), 7.43 (ddd, *J* = 8.6, 2.3, 1.2 Hz, 1H), 7.32 (dd, *J* = 12.2, 4.6 Hz, 4H), 7.08 (ddd, *J* = 11.8, 7.8, 0.9 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 157.5 (d, *J* = 258.6 Hz), 153.6, 148.5, 146.8, 142.5, 141.1, 130.1, 129.3, 128.7, 128.6, 128.5 (d, *J* = 9.4 Hz), 125.8 (d, *J* = 4.0 Hz), 118.5 (d, *J* = 9.5 Hz), 118.1, 113.1, 112.1 (d, *J* = 21.7 Hz). **^{19}F NMR (377 MHz, CDCl3)** δ -108.1. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NOTe^+$ $[M+H]^+$:430.0251; Found: 430.0247.

6-Methoxy-4-phenyl-3-(phenyltellanyl)quinoline (5ra):



Yellow solid (0.138 g, 63%). Eluent: hexane: ethyl acetate (70:30). mp: 81-85 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.48 (s, 1H), 7.94 (d, *J* = 9.2 Hz, 1H), 7.83 (dd, *J* = 8.0, 1.2 Hz, 2H), 7.59 – 7.51 (m, 3H), 7.41 – 7.36 (m, 1H), 7.35 – 7.32 (m, 2H), 7.31 – 7.25 (m, 3H), 6.69 (d, *J* = 2.8 Hz, 1H), 3.69 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 158.0, 151.5, 149.7, 143.2, 140.5, 140.1, 130.9, 129.9, 129.1, 128.9, 128.9, 128.7, 121.3, 115.1, 113.4, 103.8, 55.4. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NOTe^+$ $[M+H]^+$:442.0451; Found: 442.0456.

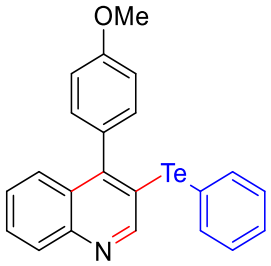
2-Methyl-4-phenyl-3-(phenyltellanyl)quinoline (5ka):



Yellow solid (0.120 g, 57%). Eluent: hexane: ethyl acetate (95:5). mp: 144-148 °C. **^{1}H NMR (400 MHz, CDCl3)** δ 8.06 (d, J = 8.4 Hz, 1H), 7.72 – 7.65 (m, 1H), 7.46 (d, J = 6.2 Hz, 3H), 7.41 – 7.31 (m, 4H), 7.23 – 7.14 (m, 3H), 7.10 (t, J = 7.4 Hz, 2H), 2.97 (s, 3H). **^{13}C NMR (101 MHz, CDCl3)**

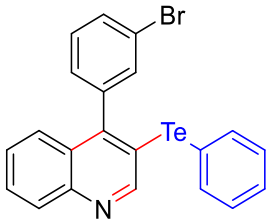
δ 163.0, 157.4, 147.7, 142.2, 136.1, 130.0, 129.5, 129.1, 128.5, 128.3, 128.1, 127.4, 126.2, 126.1, 116.8, 115.5, 29.7. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NOTe^+$ $[M+H]^+$: 426.0501; Found: 426.0506.

4-(4-Methoxyphenyl)-3-(phenyltellanyl)quinoline (5na):



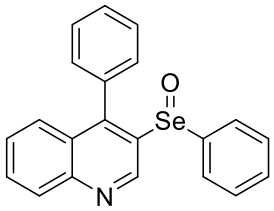
Yellow solid. (0.172 g, 78%). Eluent: hexane: ethyl acetate (95:5). mp: 74-77 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.62 (s, 1H), 8.05 (d, J = 8.3 Hz, 1H), 7.89 – 7.83 (m, 2H), 7.63 (ddd, J = 8.3, 6.8, 1.4 Hz, 1H), 7.51 (dd, J = 8.5, 0.9 Hz, 1H), 7.42 – 7.37 (m, 2H), 7.31 – 7.26 (m, 4H), 7.10 – 7.06 (m, 2H), 3.91 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 160.0, 153.8, 150.8, 147.1, 140.6, 132.0, 130.1, 130.0, 129.4, 129.0, 128.5, 126.9, 125.8, 115.3, 114.4, 113.5, 55.4. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NOTe^+$ $[M+H]^+$:442.0451; Found: 442.0455.

4-(3-Bromophenyl)-3-(phenyltellanyl)quinoline (5sa):



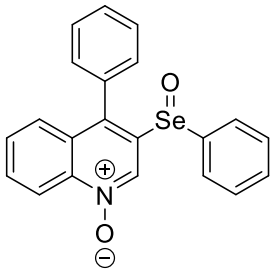
Brown liquid (0.205 g, 84%). Eluent: hexane: ethyl acetate (95:5). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.71 (s, 1H), 8.05 (d, *J* = 8.4 Hz, 1H), 7.81 (dd, *J* = 8.0, 1.2 Hz, 2H), 7.70 – 7.62 (m, 2H), 7.46 – 7.43 (m, 2H), 7.42 (d, *J* = 2.3 Hz, 2H), 7.40 (d, *J* = 3.3 Hz, 1H), 7.29 (d, *J* = 7.6 Hz, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 154.4, 149.7, 147.1, 141.7, 140.5, 140.4, 131.93, 131.87, 130.5, 130.0, 129.6, 129.3, 129.1, 127.6, 127.2, 125.5, 123.0, 114.4, 113.2. **HRMS (ESI)** m/z calcd. for $C_{22}H_{18}NOTe^+$ $[M+H]^+$:489.9450 ; Found: 489.9443.

4-Phenyl-3-(phenylseleninyl)quinoline (6):



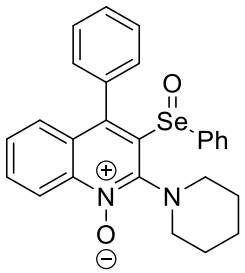
Yellow solid. (0.073 g, 70%). Eluent: DCM: methanol (95:5). mp: 71-73 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 9.50 (s, 1H), 8.20 (d, J = 6.8 Hz, 1H), 7.77 (t, J = 6.5 Hz, 1H), 7.68 – 7.43 (m, 7H), 7.33 (s, 4H), 6.97 (d, J = 7.4 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 149.2, 148.9, 146.3, 133.7, 131.5, 131.2, 130.3, 130.0, 129.8, 129.6, 129.5, 128.8, 127.8, 126.8, 126.3. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 649.68. **HRMS (ESI)** m/z calcd. for $C_{21}H_{16}NOSe^+$ $[M+H]^+$: 394.0346; Found: 394.0352.

4-Phenyl-3-(phenylseleninyl)quinoline 1-oxide (7):



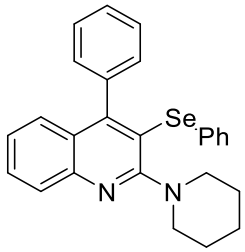
Yellow solid. (0.152 g, 70%). Eluent: DCM: methanol (90:10). mp: 124-127 ºC. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 9.14 (s, 1H), 8.82 (d, *J* = 8.8 Hz, 1H), 7.84 – 7.79 (m, 1H), 7.69 (td, *J* = 7.5, 1.0 Hz, 1H), 7.64 (dt, *J* = 7.4, 1.3 Hz, 1H), 7.61 – 7.56 (m, 3H), 7.50 (td, *J* = 7.7, 1.3 Hz, 1H), 7.42 – 7.38 (m, 1H), 7.36 – 7.31 (m, 2H), 7.25 (s, 1H), 7.23 (d, *J* = 1.4 Hz, 1H), 6.97 (d, *J* = 7.7 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 142.7, 141.3, 137.5, 135.4, 133.0, 131.8, 131.6, 131.2, 130.9, 130.0, 129.9, 129.73, 129.69, 129.0, 128.9, 127.1, 126.4, 120.2. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 845.5. **HRMS (ESI)** m/z calcd. for $C_{21}H_{16}NO_2Se^+$ $[M+H]^+$:378.0397; Found: 378.0401.

4-Phenyl-3-(phenylseleninyl)-2-(piperidin-1-yl)quinoline 1-oxide (8):



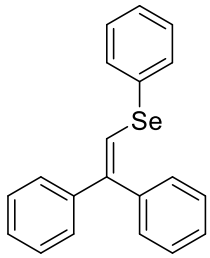
Brown solid (0.120 g, 67%). Eluent: DCM: methanol (90:10). mp: 84-87 °C, **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.75 (d, *J* = 8.3 Hz, 1H), 7.82 – 7.74 (m, 1H), 7.51 – 7.44 (m, 3H), 7.42 – 7.33 (m, 7H), 7.15 (t, *J* = 7.5 Hz, 1H), 6.68 (d, *J* = 7.6 Hz, 1H), 3.48 (dd, *J* = 40.5, 5.6 Hz, 4H), 1.65 (s, 6H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 150.1, 143.4, 142.8, 131.7, 131.5, 131.4, 130.5, 129.9, 129.3, 129.1, 128.6, 128.4, 127.6, 127.6, 127.4, 126.4, 119.3, 5., 25.2, 23.6.

4-Phenyl-3-(phenylselanyl)-2-(piperidin-1-yl)quinoline (9):



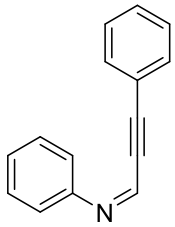
Golden yellow solid (0.060 g, 54%). Eluent: hexane: ethyl acetate (40:60). mp: 106-108 °C. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.90 (dd, *J* = 8.4, 0.6 Hz, 1H), 7.59 (ddd, *J* = 8.4, 6.8, 1.6 Hz, 1H), 7.42 – 7.34 (m, 3H), 7.29 (dd, *J* = 8.3, 1.0 Hz, 1H), 7.21 (ddd, *J* = 8.3, 6.8, 1.2 Hz, 1H), 7.15 – 7.11 (m, 2H), 7.10 – 7.01 (m, 3H), 7.01 – 6.96 (m, 2H), 3.39 (s, 4H), 1.54 (s, 6H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 162.5, 156.1, 147.1, 139.3, 133.7, 130.4, 129.7, 129.6, 128.6, 127.9, 127.7, 127.6, 126.7, 126.0, 125.7, 124.0, 120.5, 51.8, 25.6, 24.5. **^{77}Se NMR (76 MHz, $CDCl_3$)** δ 363.1.

(2,2-diphenylvinyl)(phenyl)selane (10):



White solid. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.61 – 7.56 (m, 2H), 7.43 (dd, J = 7.0, 1.2 Hz, 2H), 7.38 (dt, J = 5.4, 2.2 Hz, 1H), 7.36 – 7.30 (m, 6H), 7.29 – 7.26 (m, 2H), 7.24 – 7.19 (m, 4H), 7.13 (s, 1H).

(*Z*)-*N*,3-diphenylprop-2-yn-1-imine (11):



Yellow liquid. **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.89 (s, 1H), 7.57 – 7.55 (m, 2H), 7.38 – 7.30 (m, 6H), 7.25 – 7.21 (m, 1H), 7.19 – 7.15 (m, 2H). **^{13}C NMR (101 MHz, $CDCl_3$)** δ 151.0, 143.7, 132.5, 129.9, 129.3, 128.6, 128.5, 127.3, 120.9, 94.9, 87.6.

10. References

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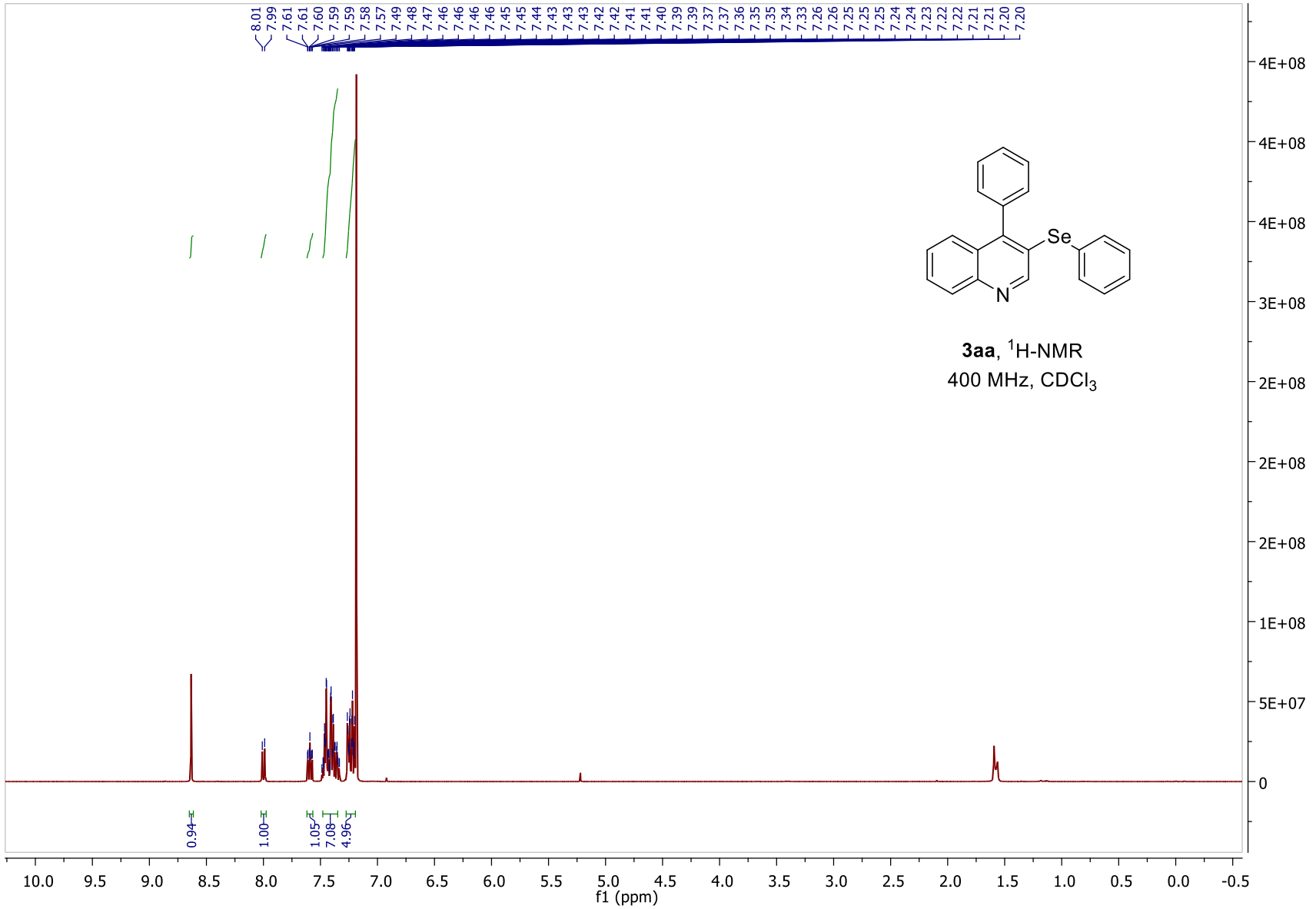
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7.46
7.46
7.46
7.46
7.45
7.45
7.44
7.43
7.43
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7.42
7.42
7.41
7.41
7.40
7.39
7.39
7.37
7.37
7.36
7.35
7.35
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7.26
7.25
7.25
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7.24
7.24
7.23
7.22
7.22
7.21
7.21
7.20
7.20
Se
N
3aa, 1H-NMR
400 MHz, CDCl3
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4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
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1.00
1.05
7.08
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10.0
9.5
9.0
8.5
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7.0
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6.0
5.5
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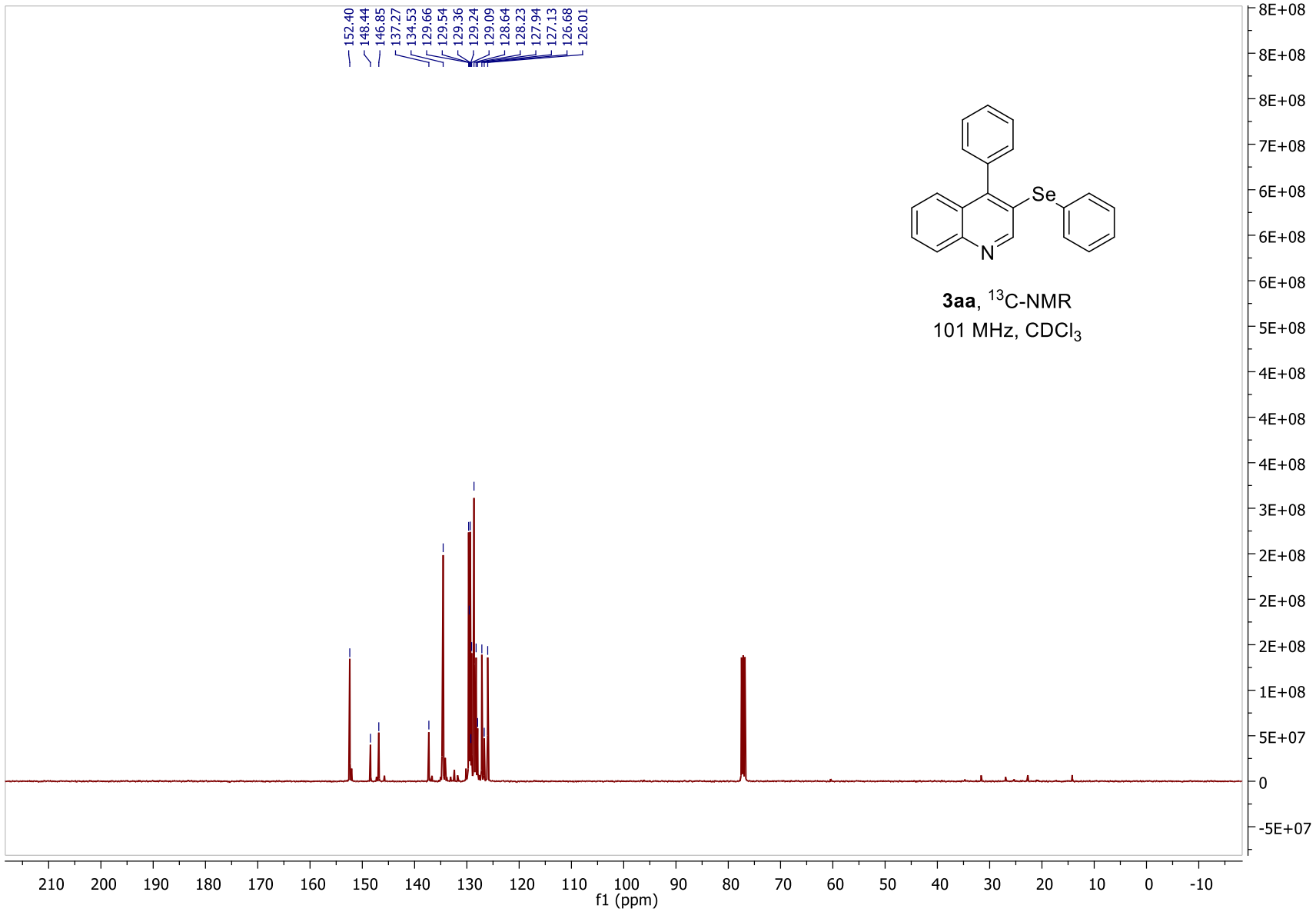
f1 (ppm)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6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
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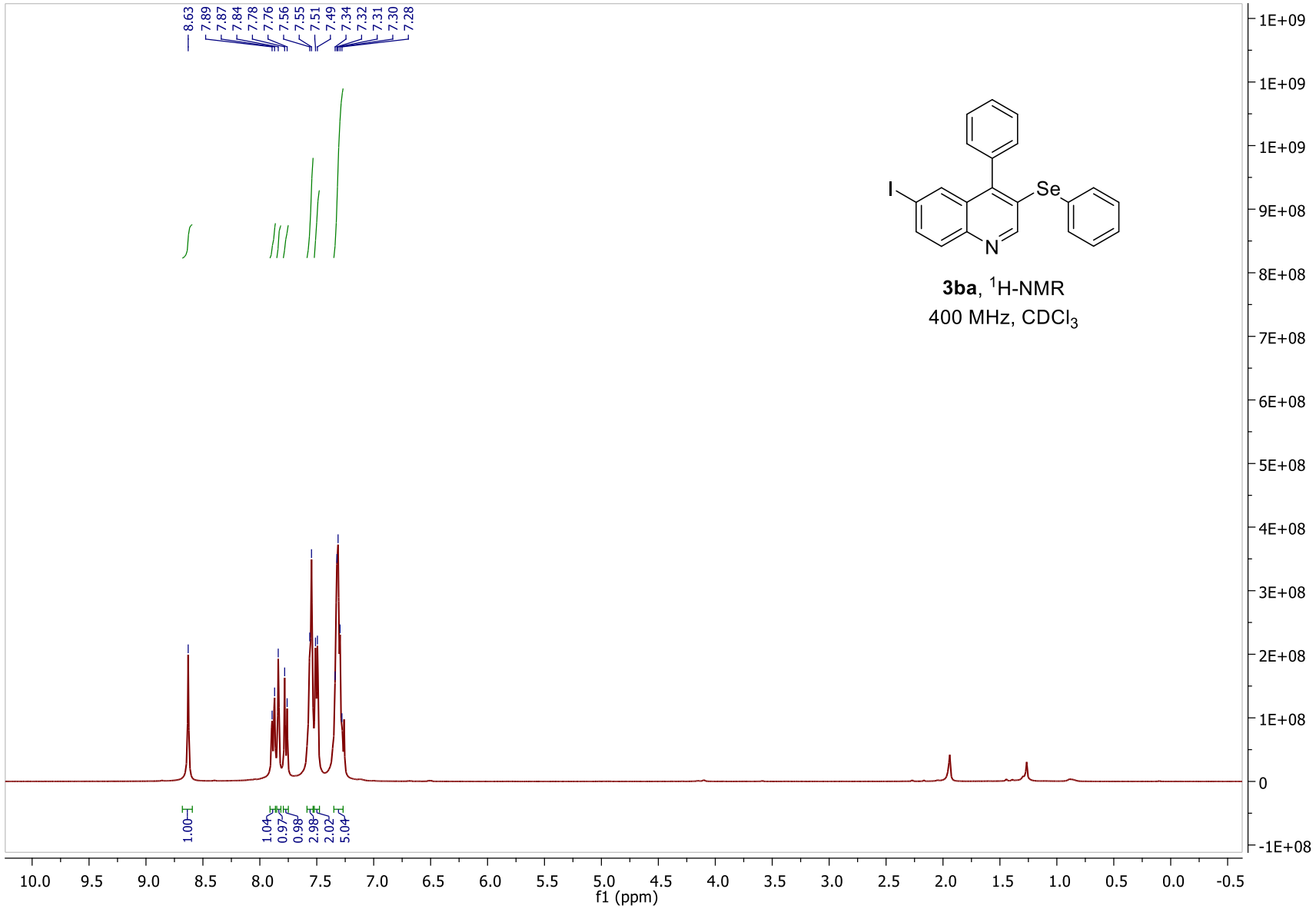
f1 (ppm)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7.30
7.28
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Se
N
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400 MHz, CDCl3
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5.04
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8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
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9.0
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8.0
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6.0
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5.0
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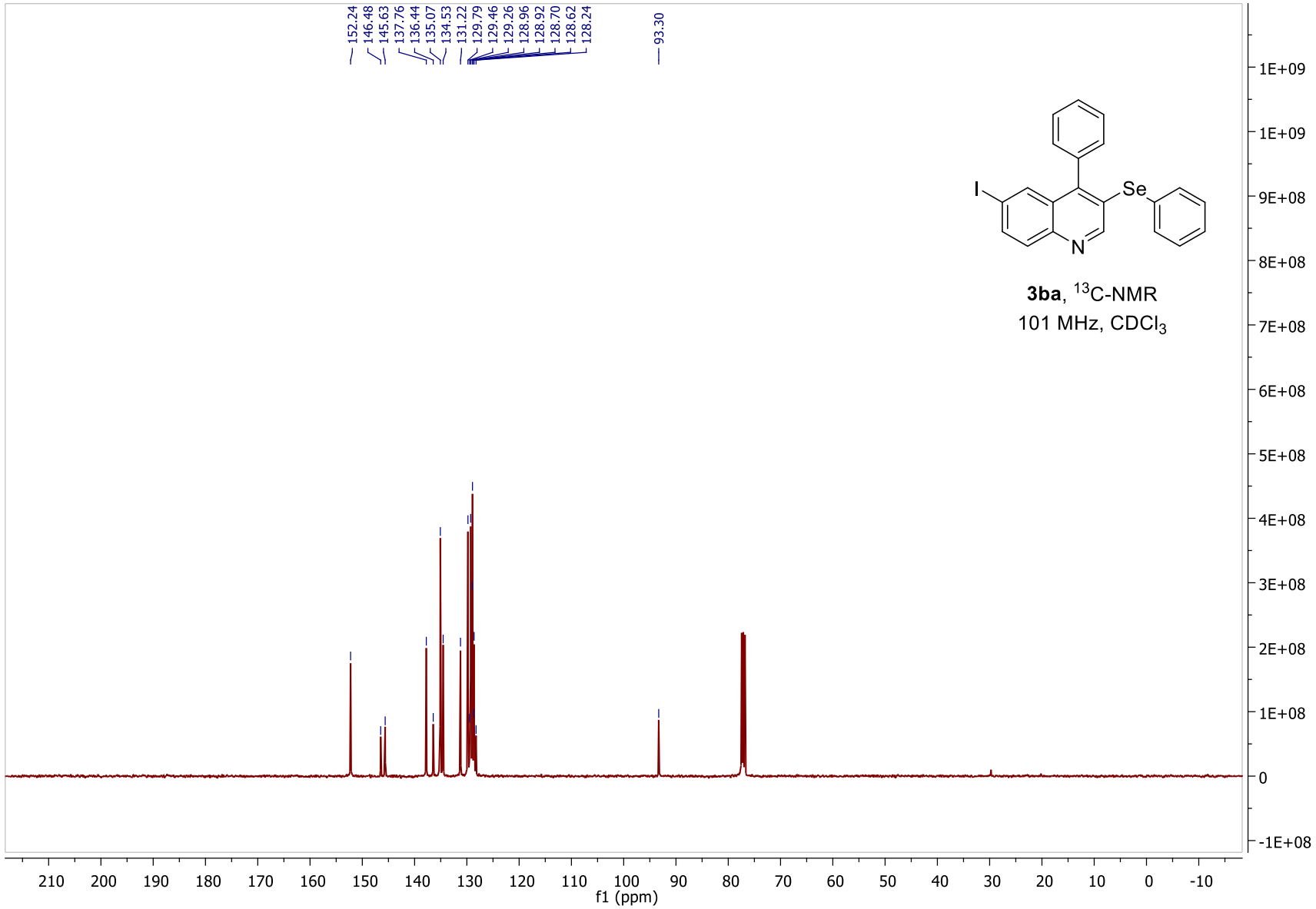
-0.5
f1 (ppm)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Se
N
3ba, 13C-NMR
101 MHz, CDCl3
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1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
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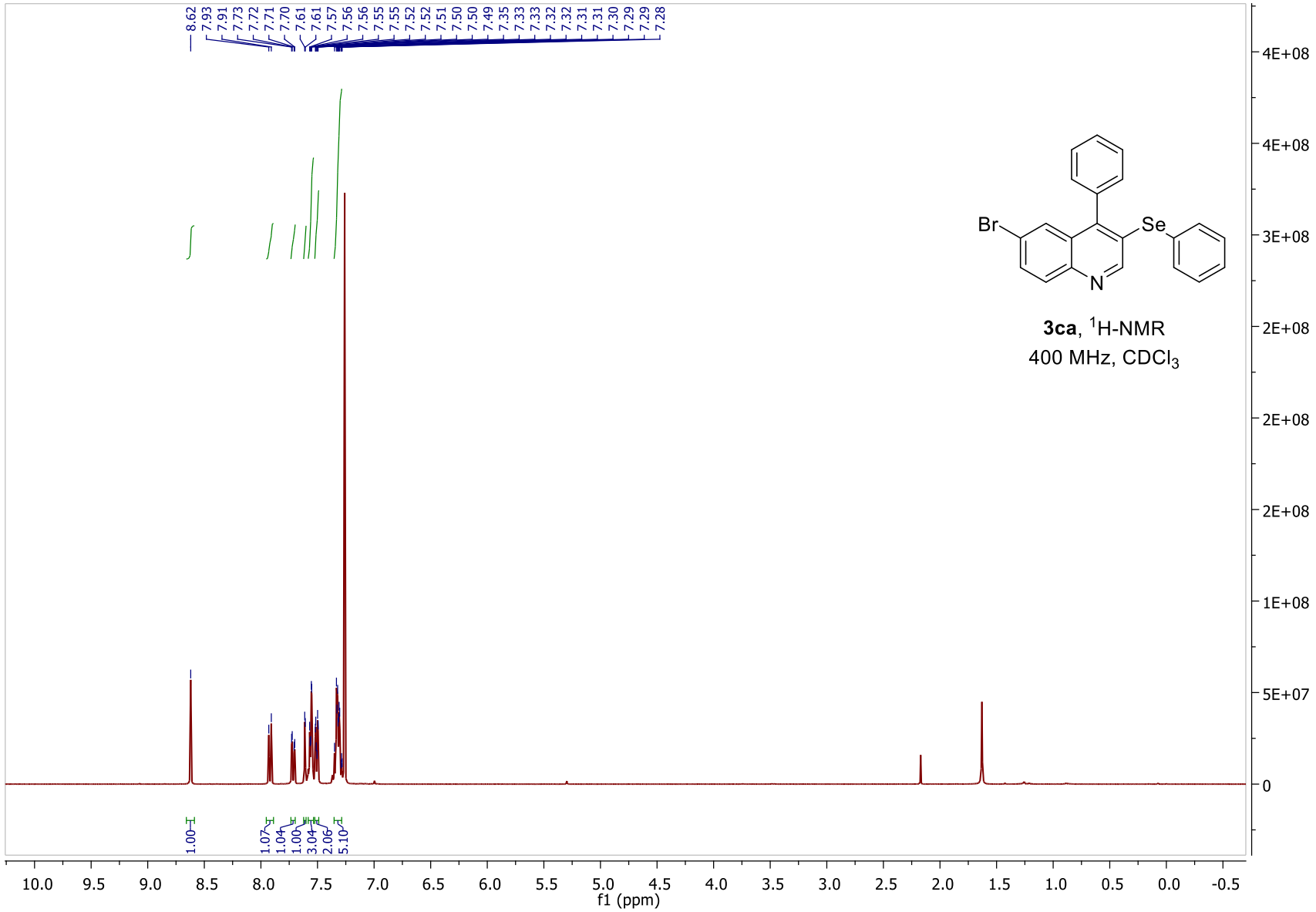
f1 (ppm)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4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
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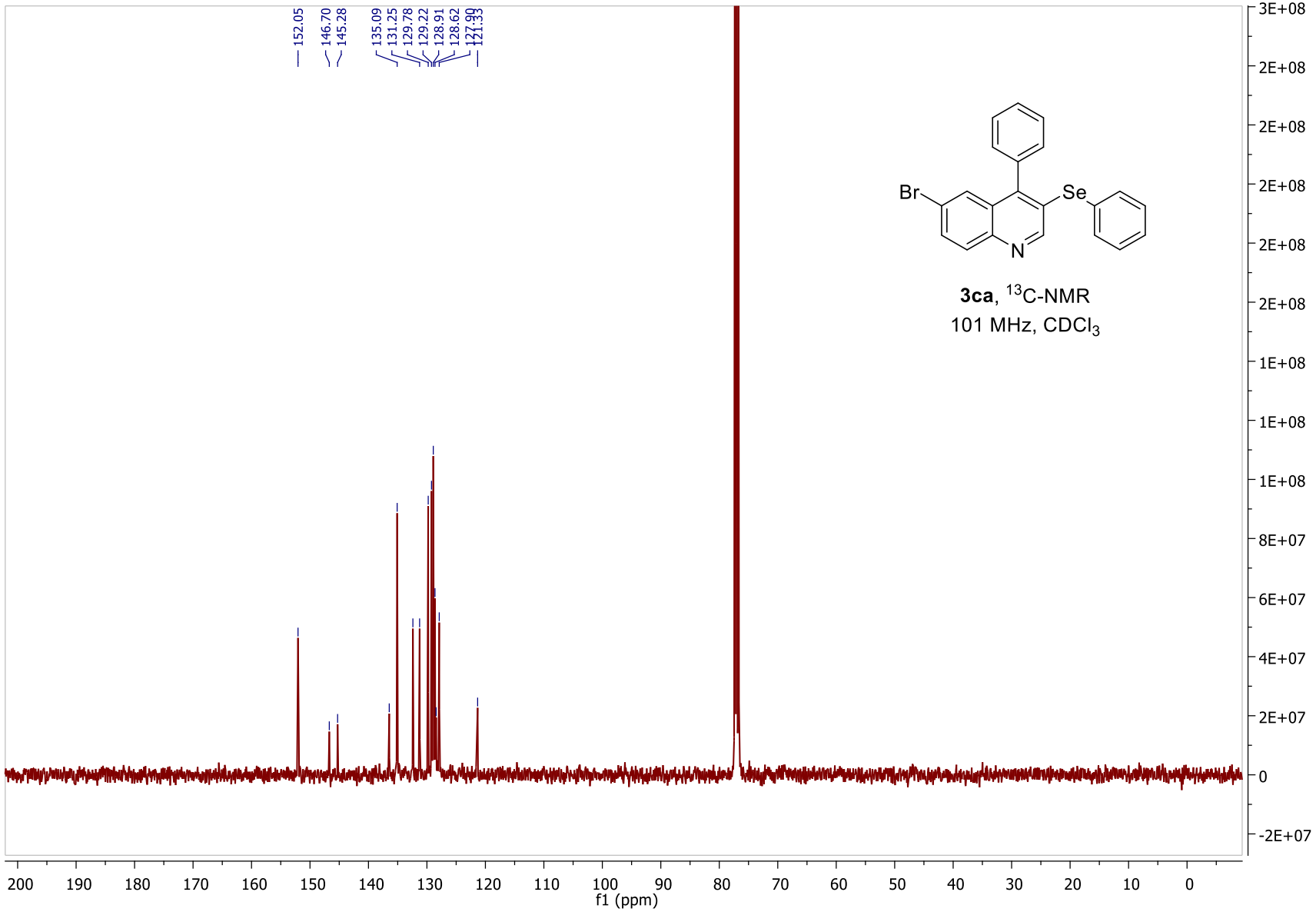
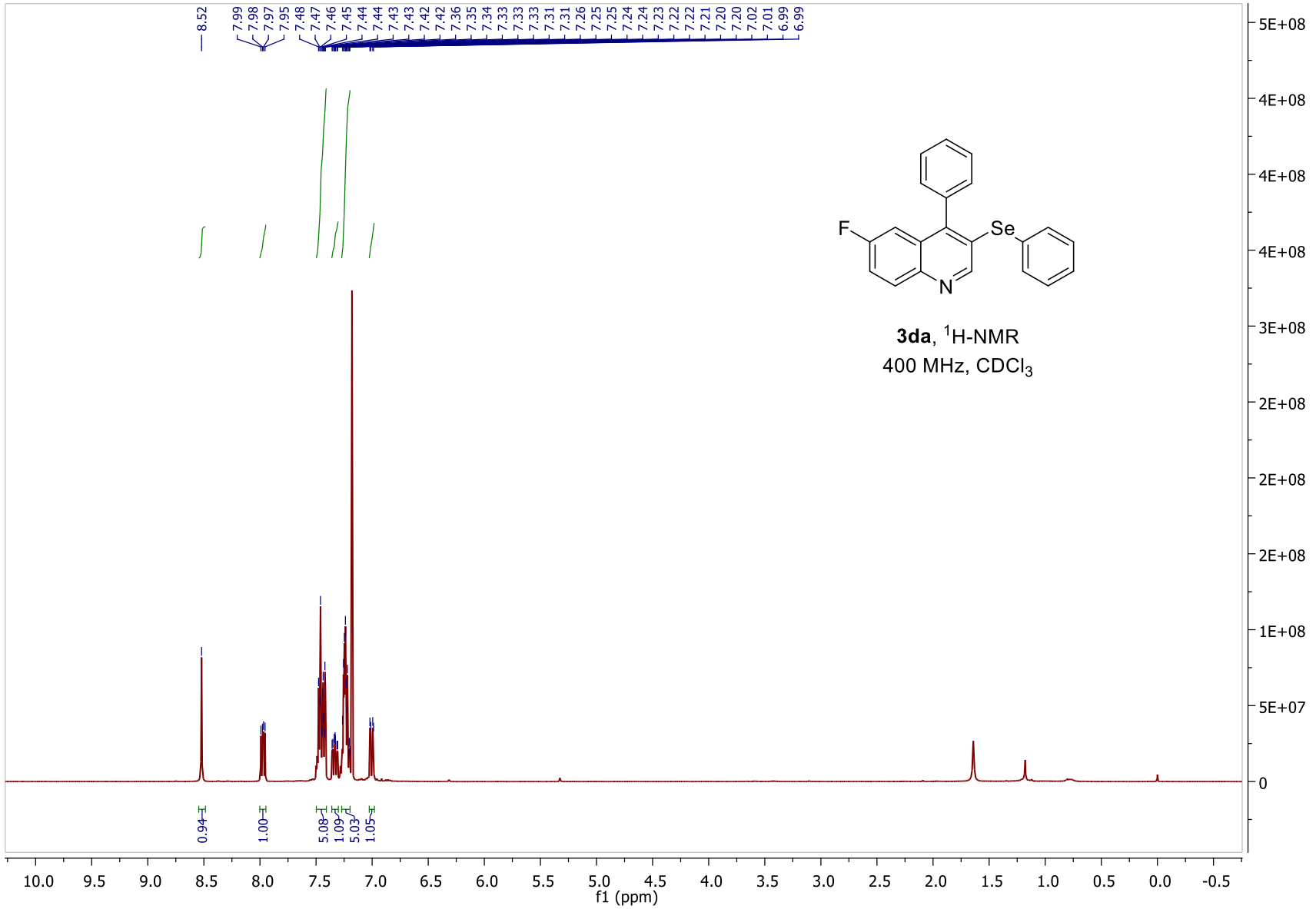


3ca, ^{13}C-NMR
101 MHz, $CDCl_3$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7.21
7.20
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7.02
7.01
6.99
6.99
F
Se
N
3da, 1H-NMR
400 MHz, CDCl3
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1.09
5.03
1.05
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
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1E+08
5E+07
0
10.0
9.5
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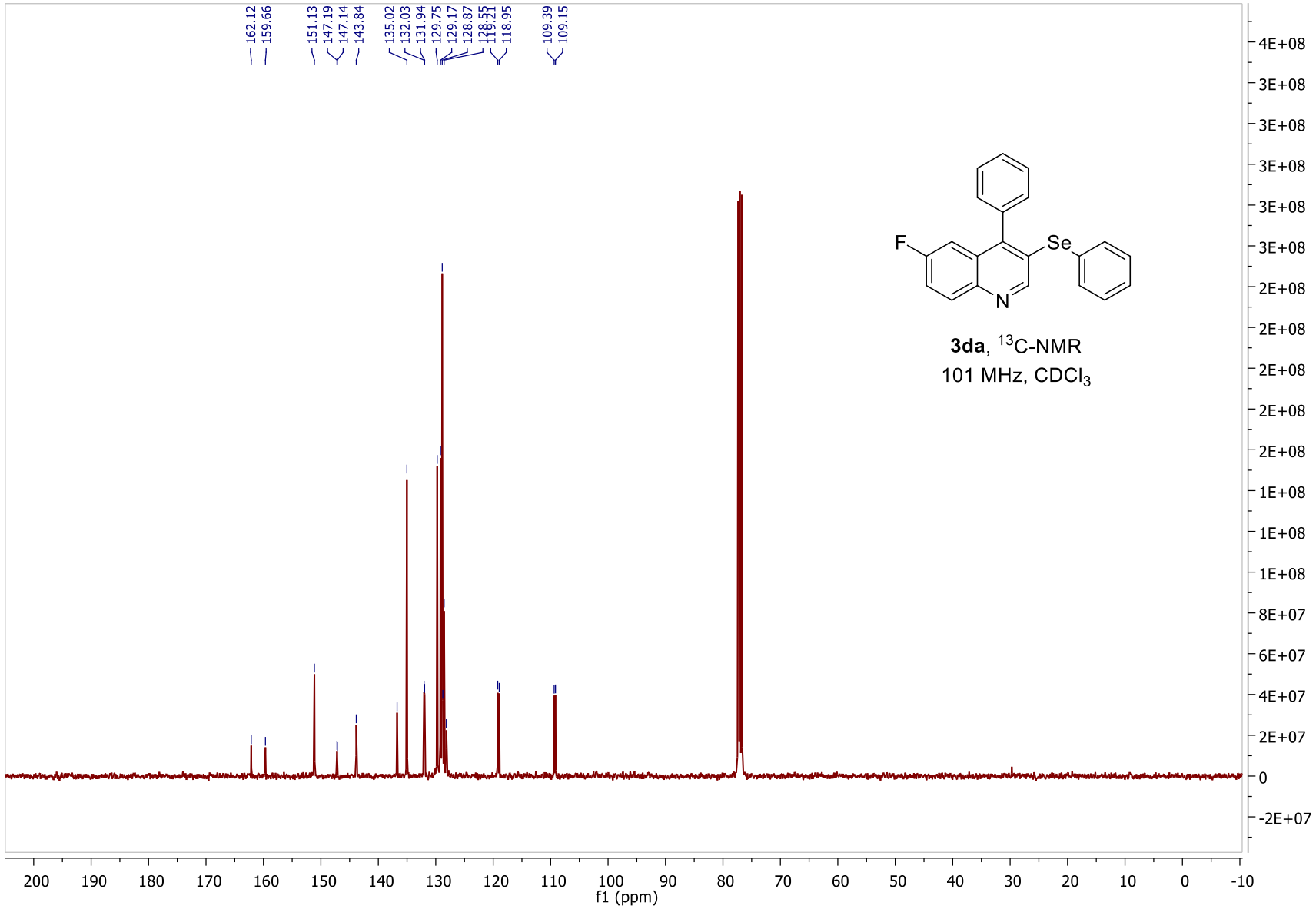
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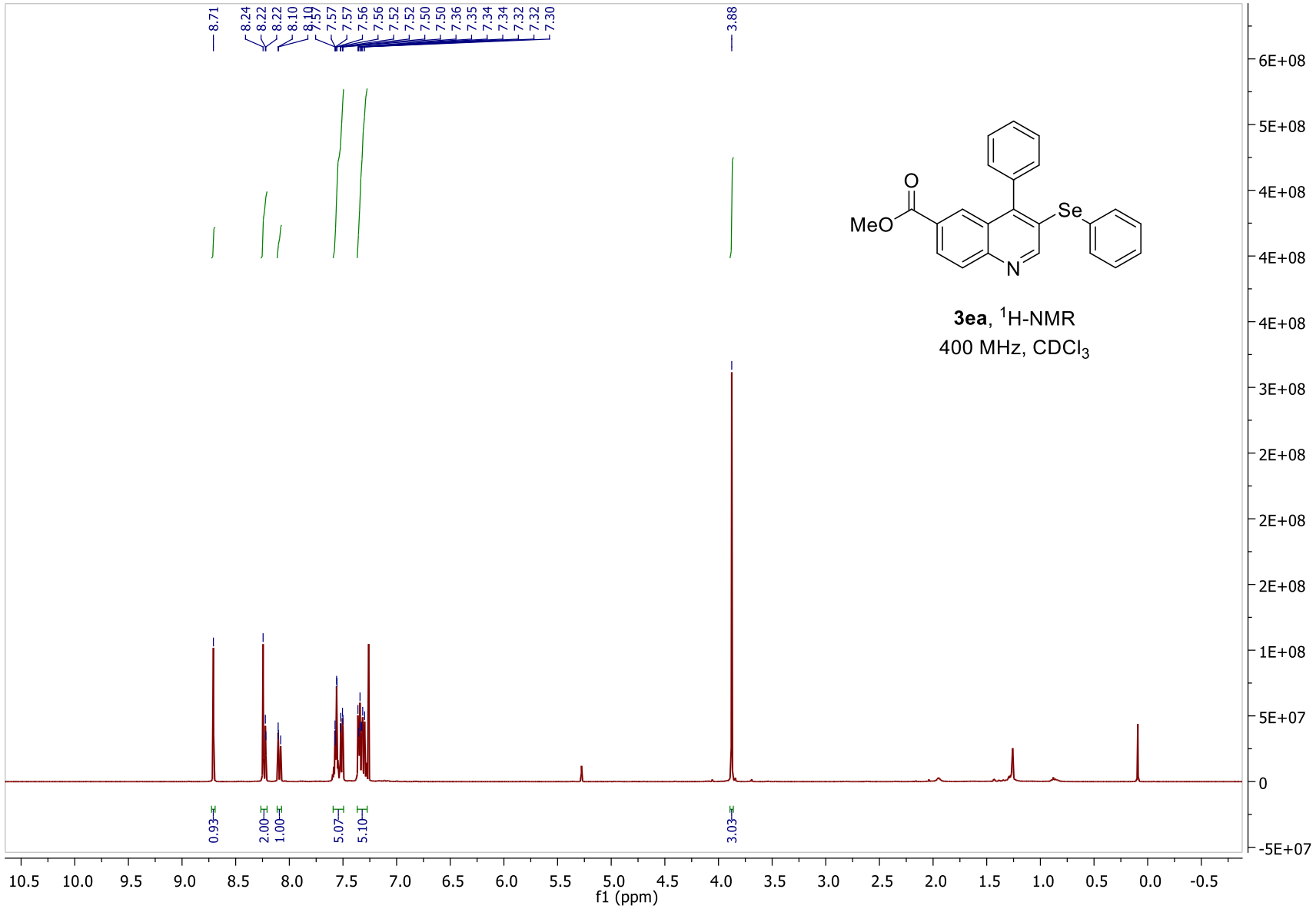
3da, 13C-NMR
101 MHz, CDCl3
f1 (ppm)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7.30
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3ea, 1H-NMR
400 MHz, CDCl3
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1.00
5.07
5.10
3.03
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5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
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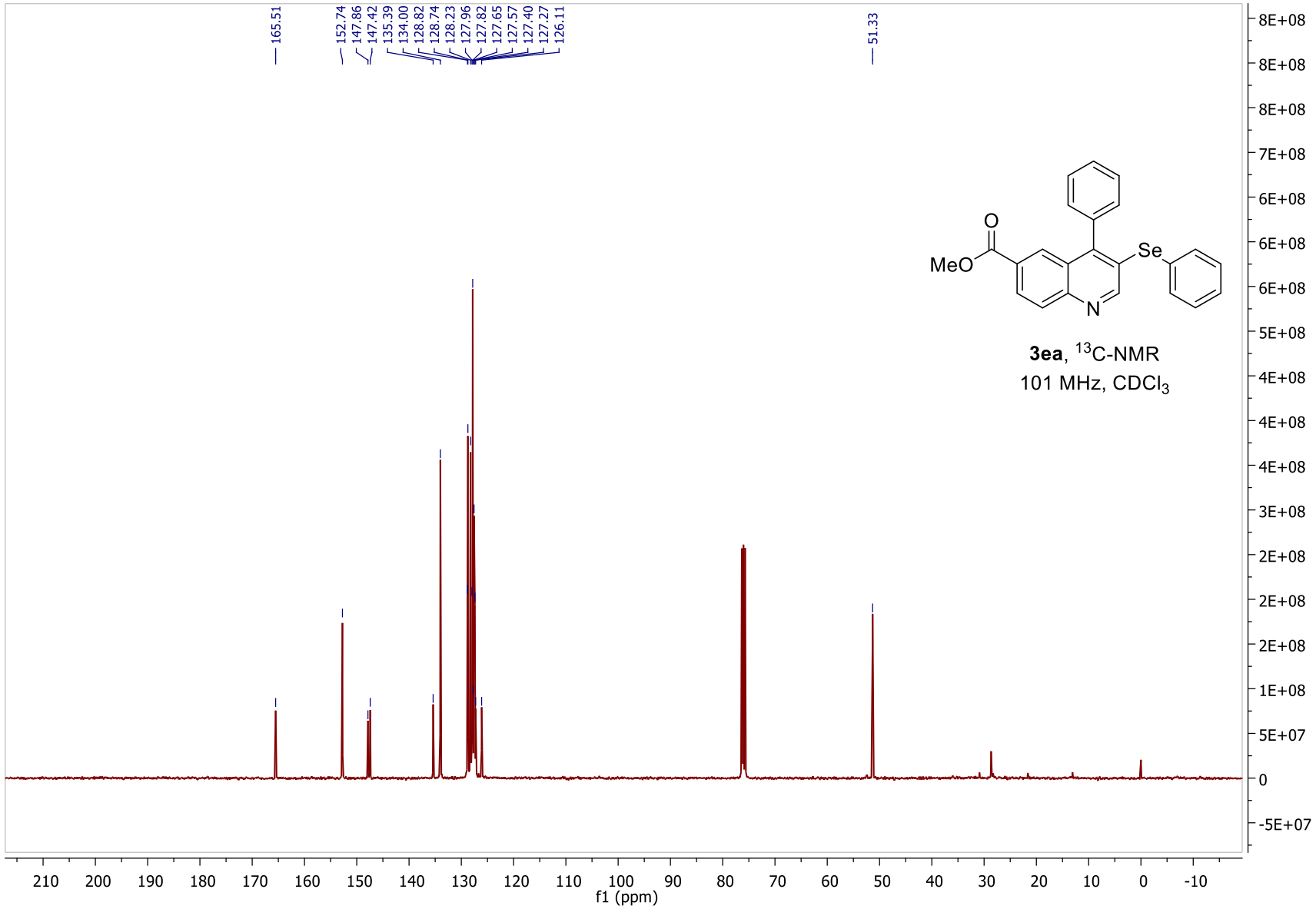
f1 (ppm)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127.40
127.27
126.11
51.33
O
MeO
Se
N
3ea, 13C-NMR
101 MHz, CDCl3
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
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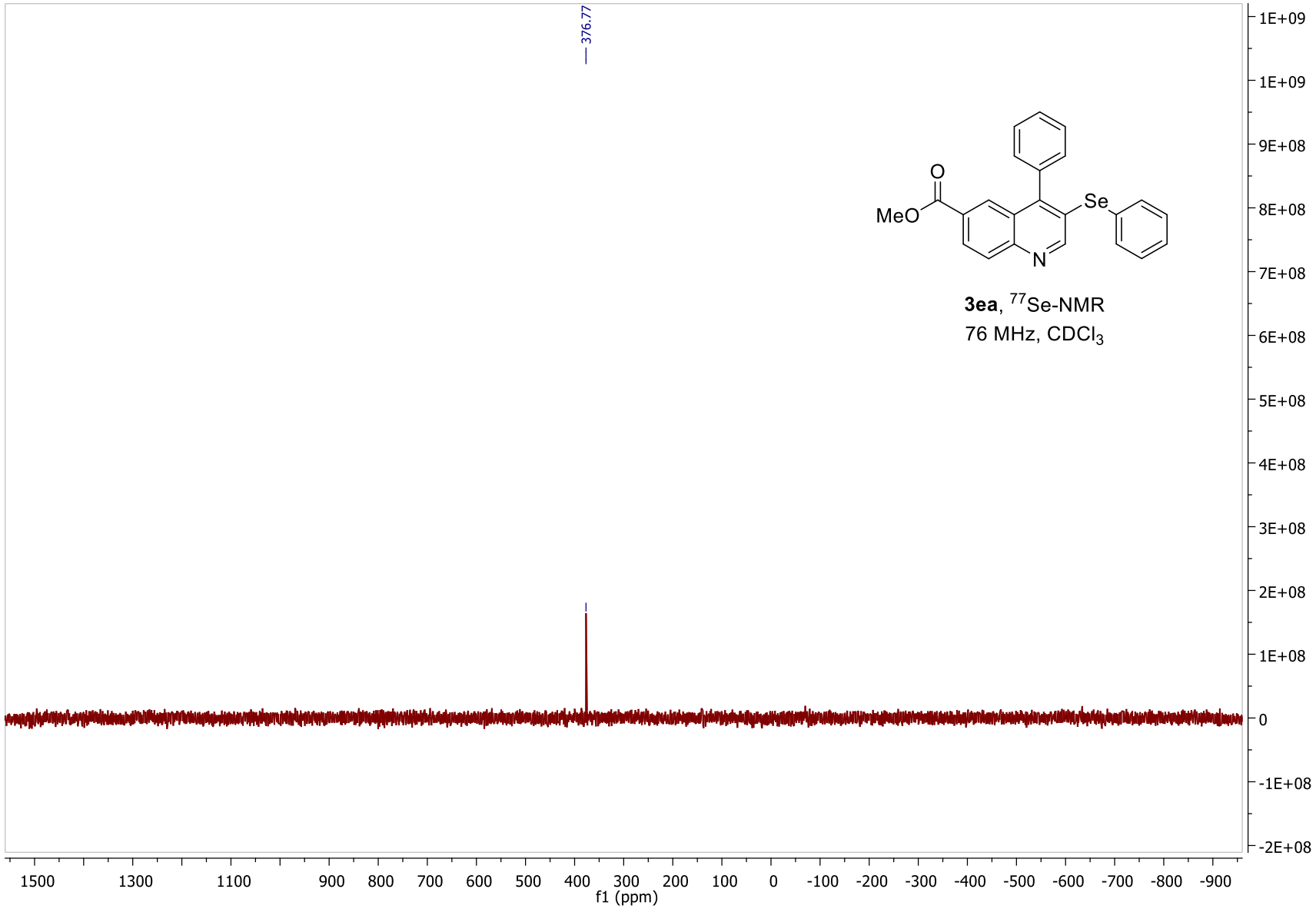
f1 (ppm)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1100
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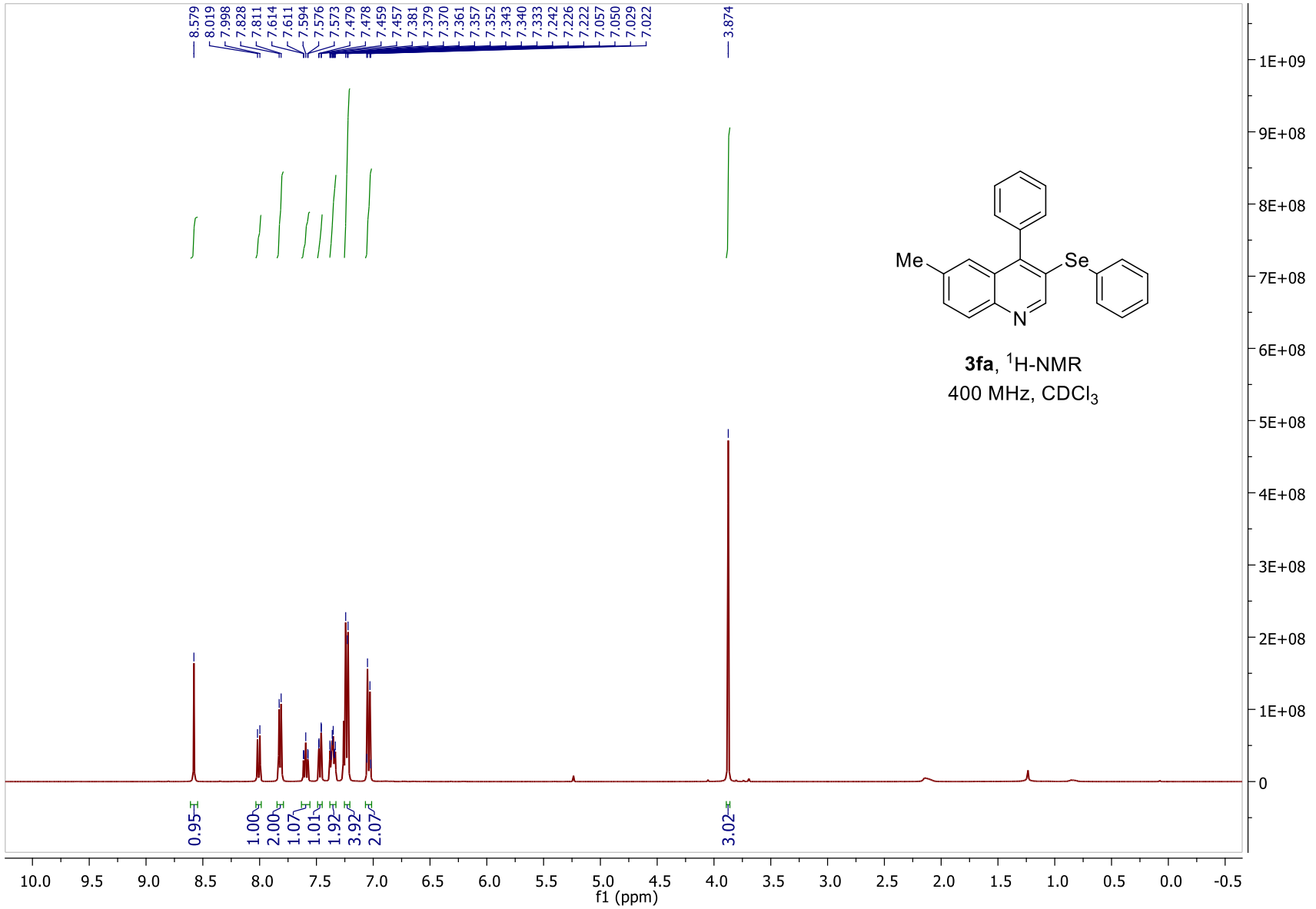
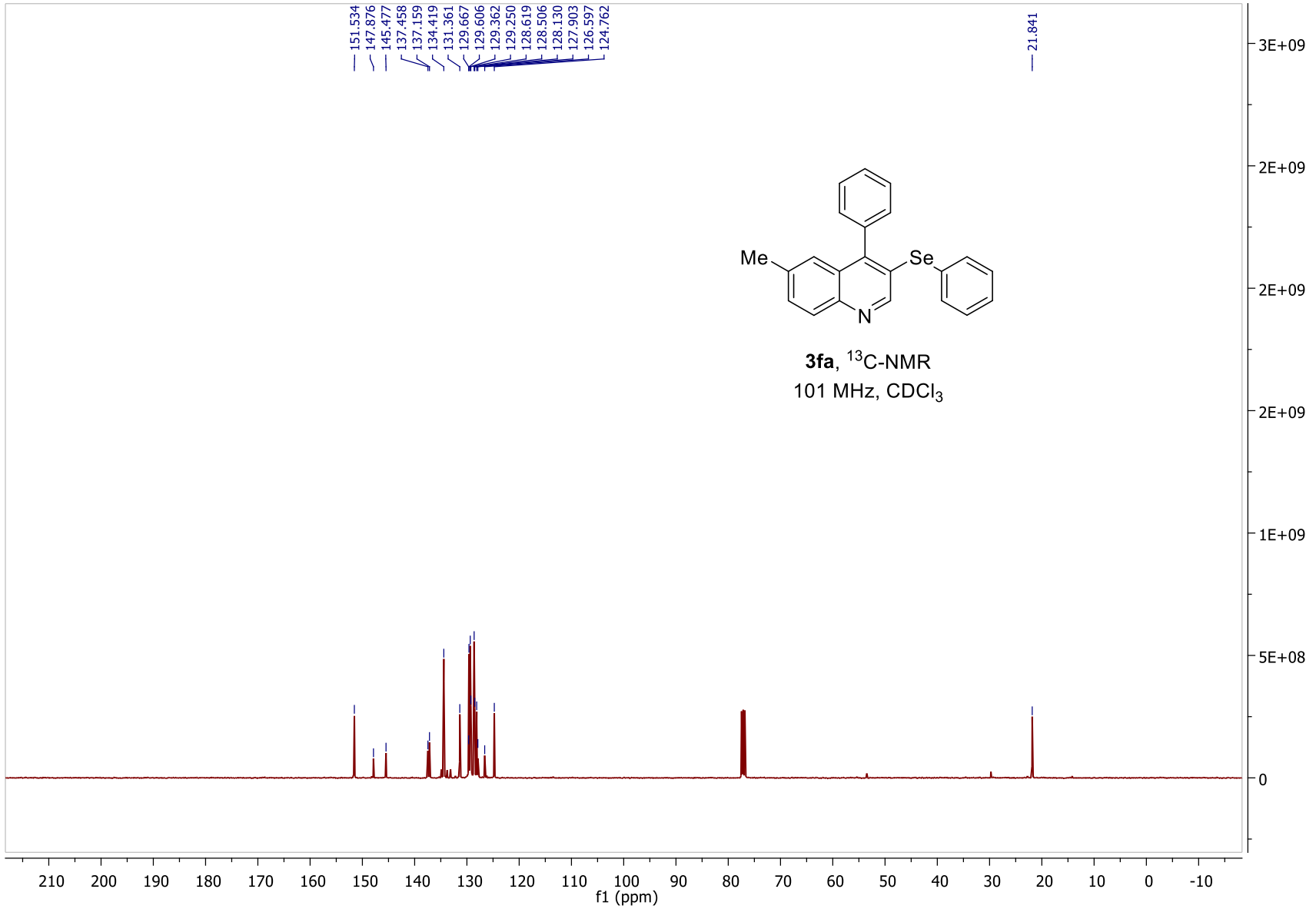
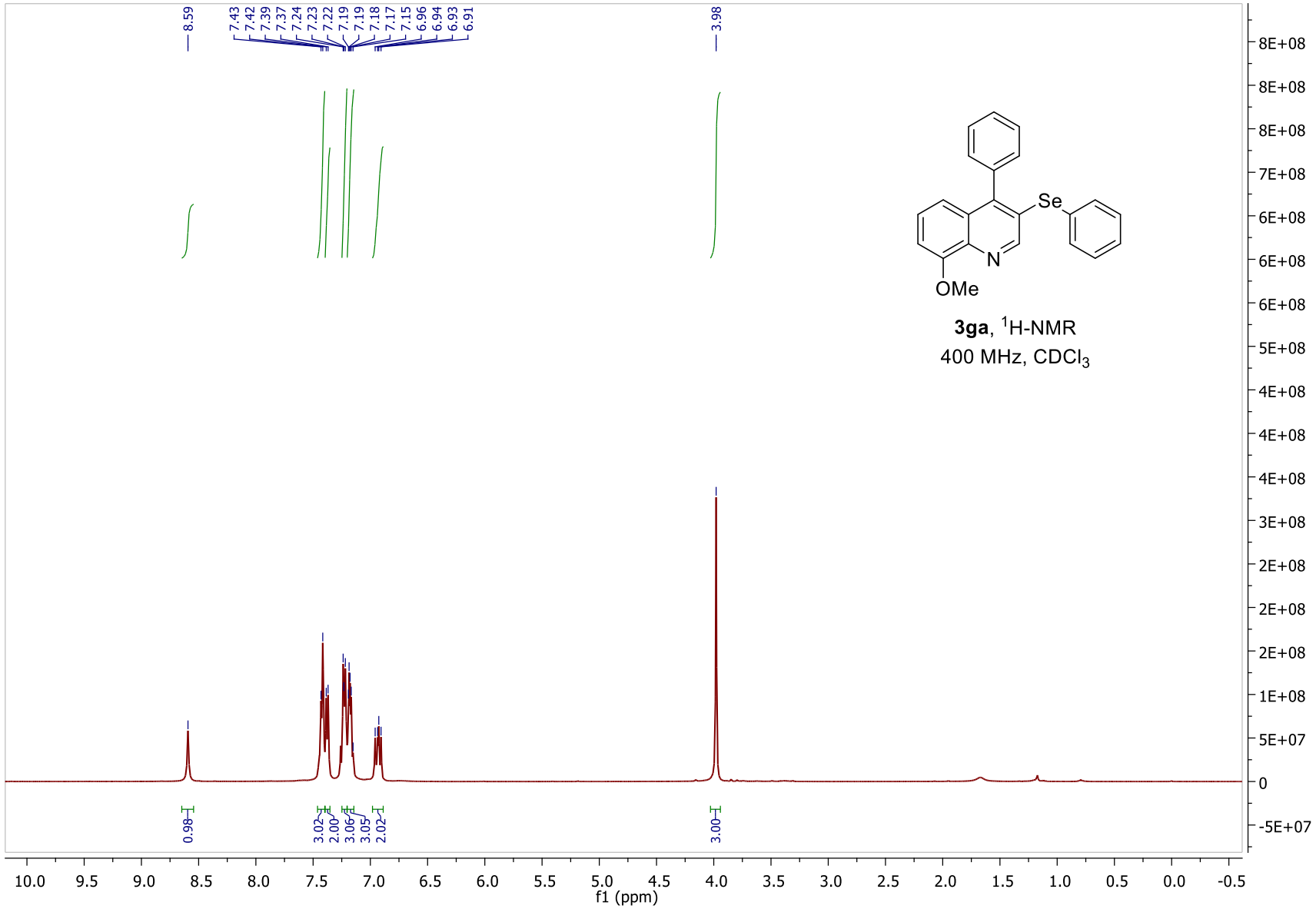
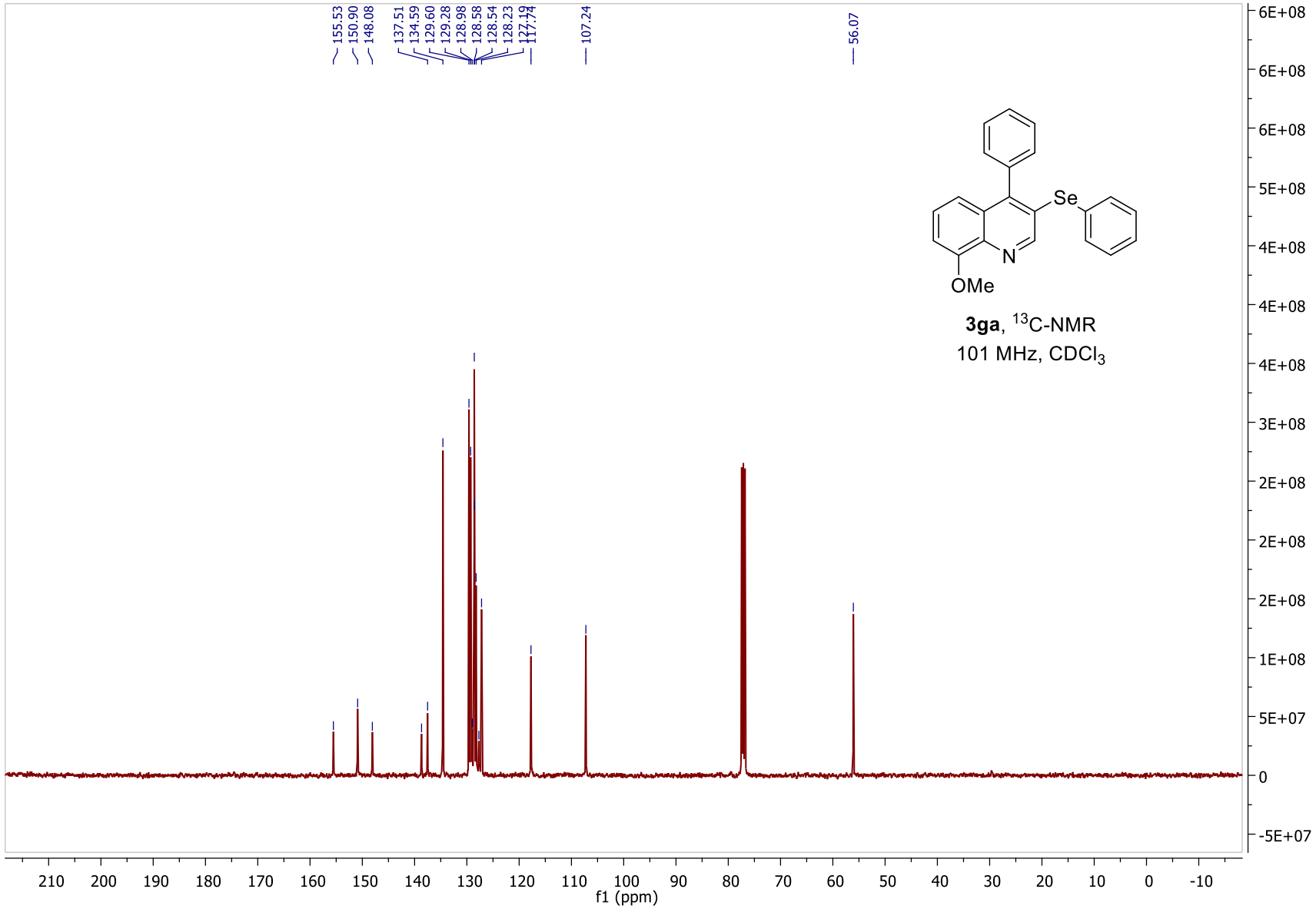
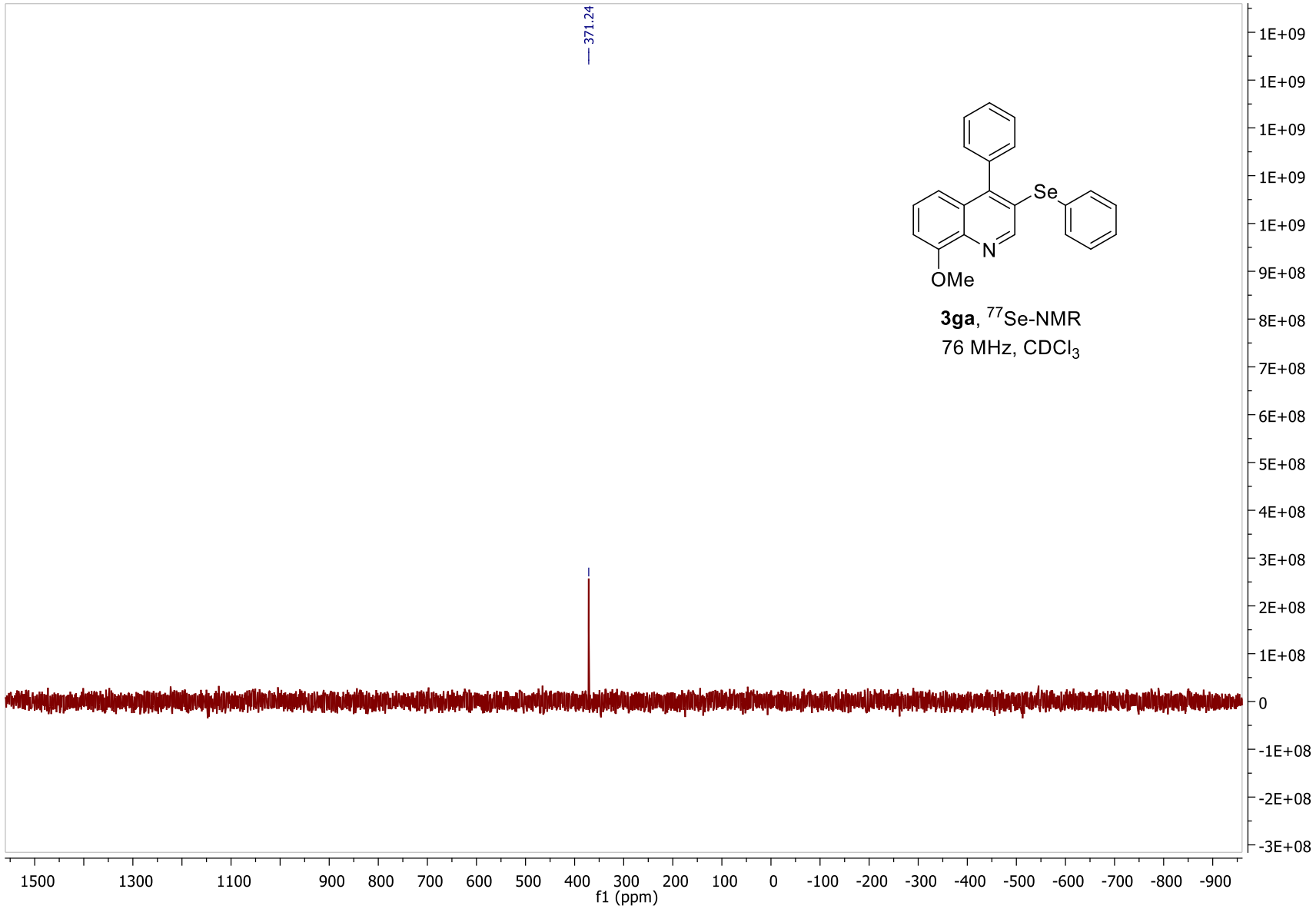
-900
f1 (ppm)

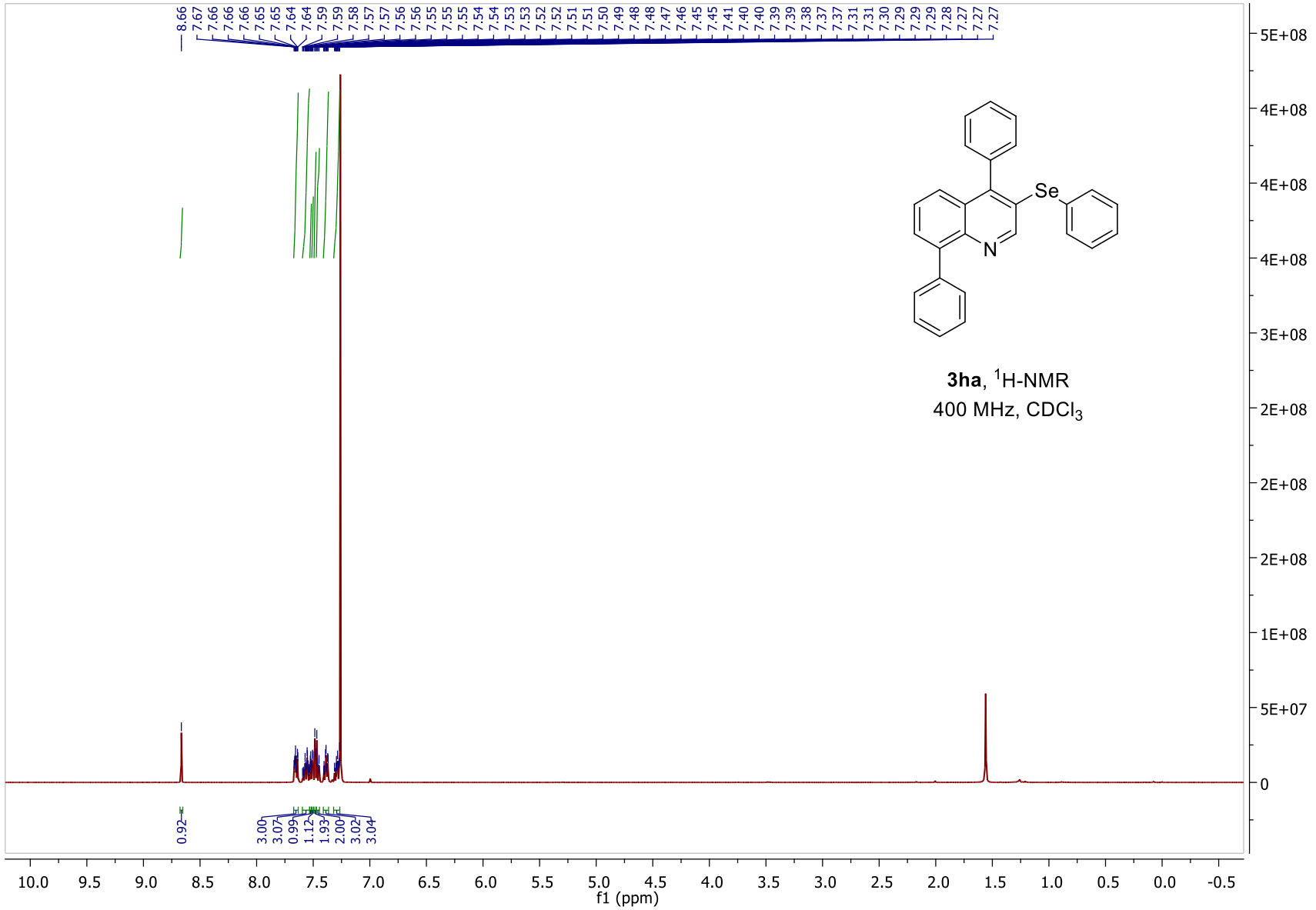

8.579
8.019
7.998
7.828
7.811
7.614
7.611
7.594
7.576
7.573
7.479
7.478
7.459
7.457
7.381
7.379
7.370
7.361
7.357
7.352
7.343
7.340
7.333
7.242
7.226
7.222
7.057
7.050
7.029
7.022
3.874
Me
Se
N
3fa, 1H-NMR
400 MHz, CDCl3
0.95
1.00
2.00
1.07
1.01
1.92
3.92
2.07
3.02
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
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)

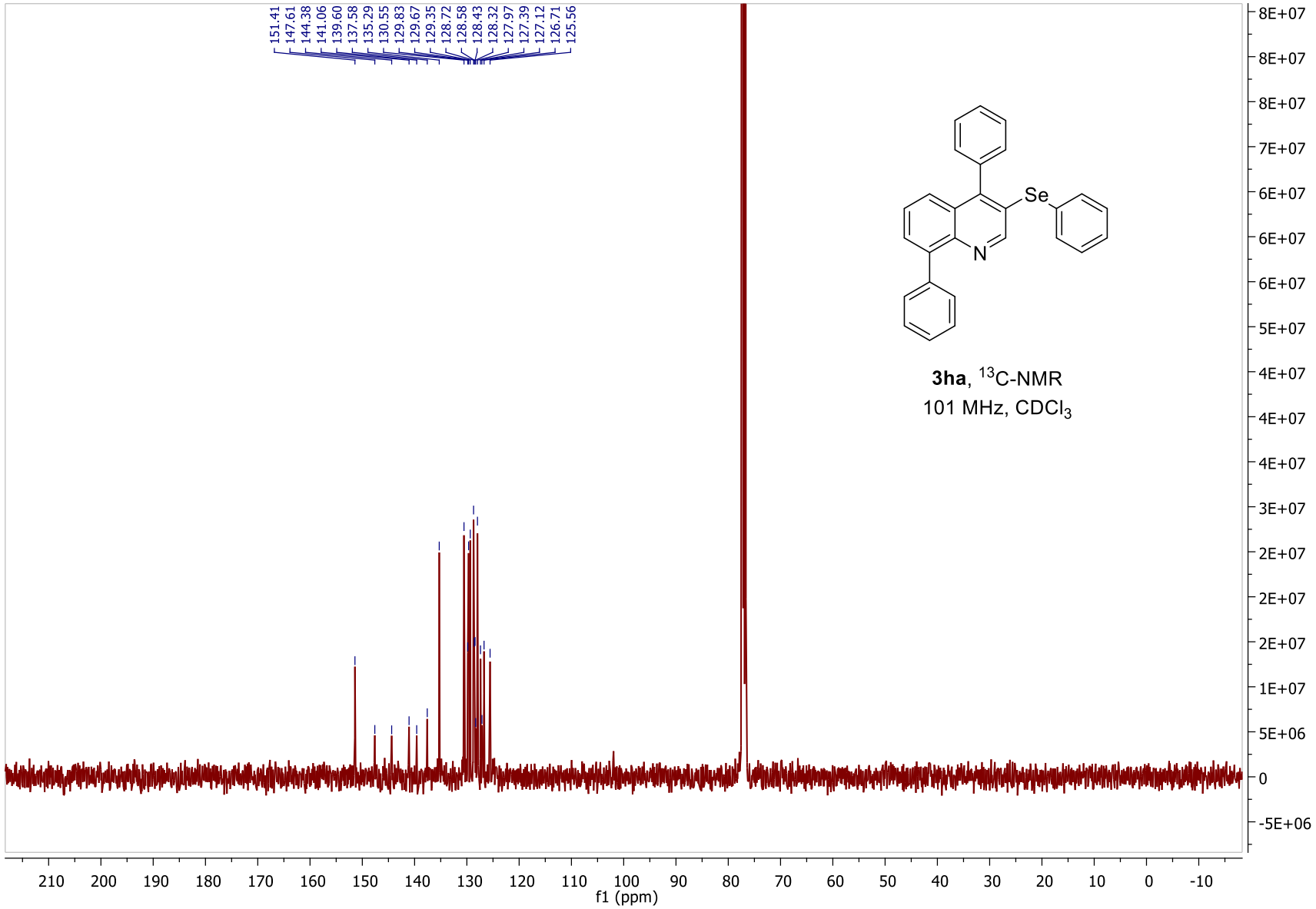

151.534
147.876
145.477
137.458
137.159
134.419
131.361
129.667
129.606
129.362
129.250
128.619
128.506
128.130
127.903
126.597
124.762
21.841
Me
Se
N
3fa, 13C-NMR
101 MHz, CDCl3
3E+09
2E+09
2E+09
2E+09
1E+09
5E+08
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

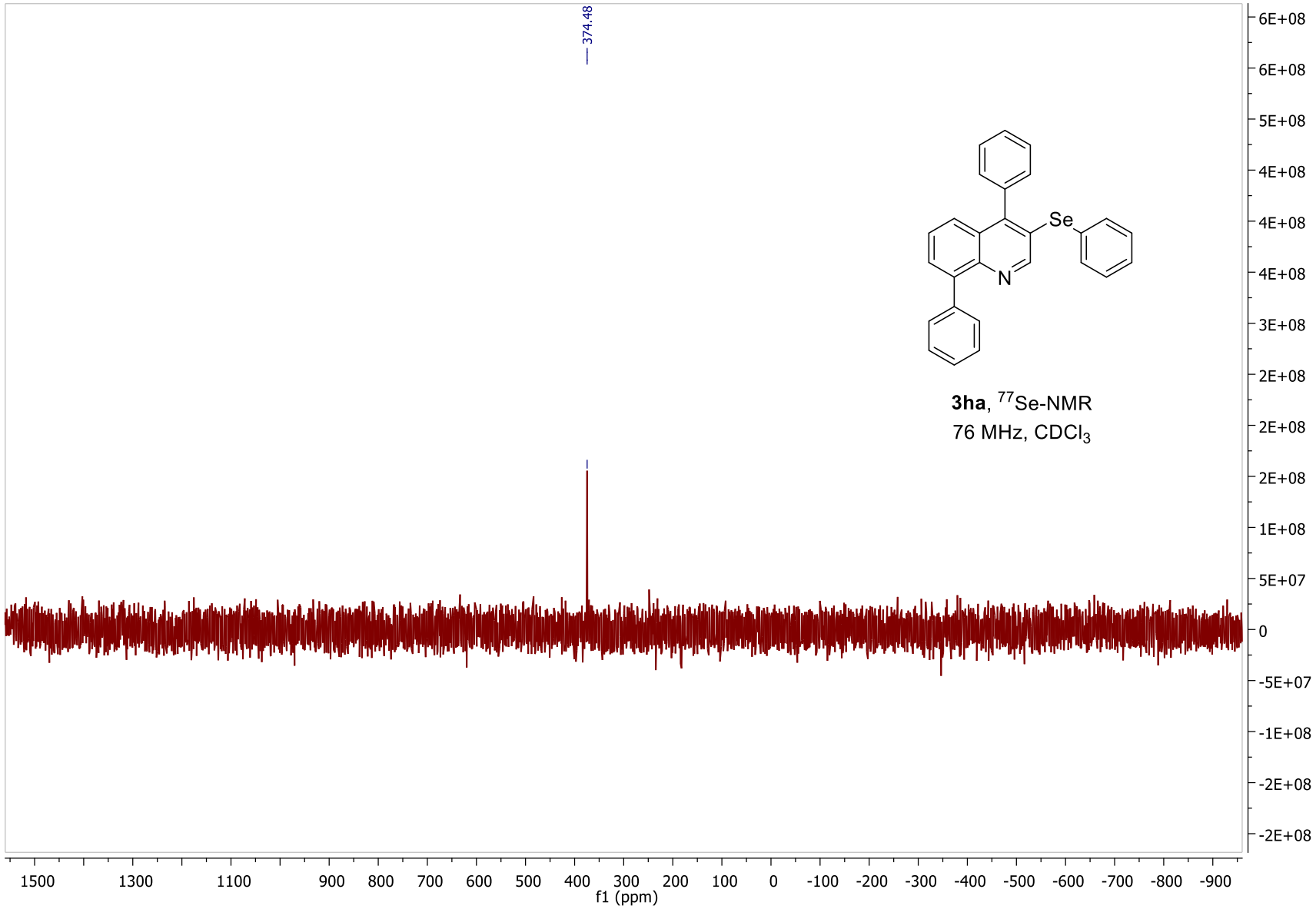

8.59
7.43
7.42
7.39
7.37
7.24
7.23
7.22
7.19
7.19
7.18
7.17
7.15
6.96
6.94
6.93
6.91
3.98
Se
N
OMe
3ga, 1H-NMR
400 MHz, CDCl3
0.98
3.02
2.00
3.06
3.05
2.02
3.00
f1 (ppm)

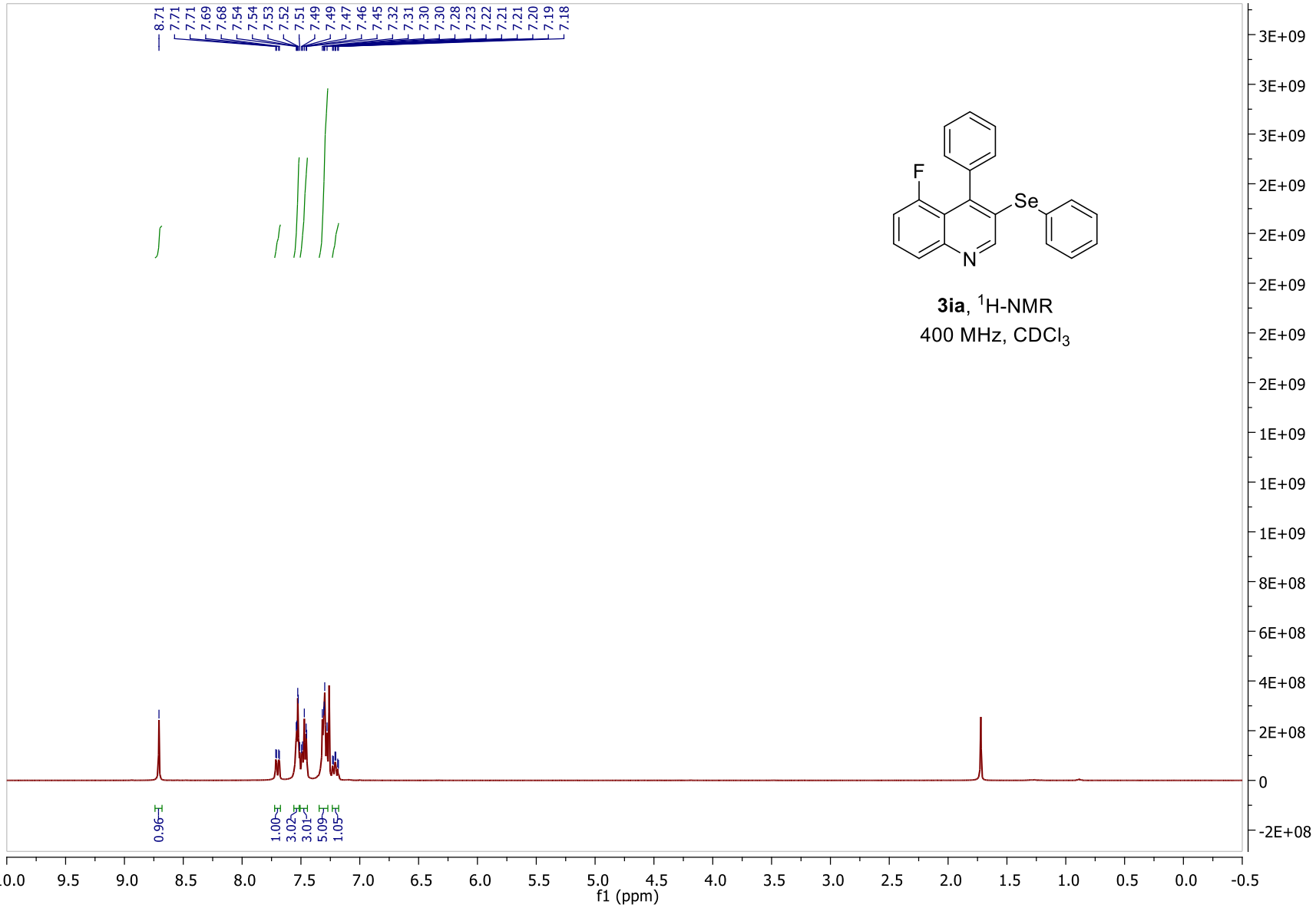

155.53
150.90
148.08
137.51
134.59
129.60
129.28
128.98
128.58
128.54
128.23
127.19
117.74
107.24
56.07
Se
N
OMe
3ga, 13C-NMR
101 MHz, CDCl3
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
5E+07
0
-5E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

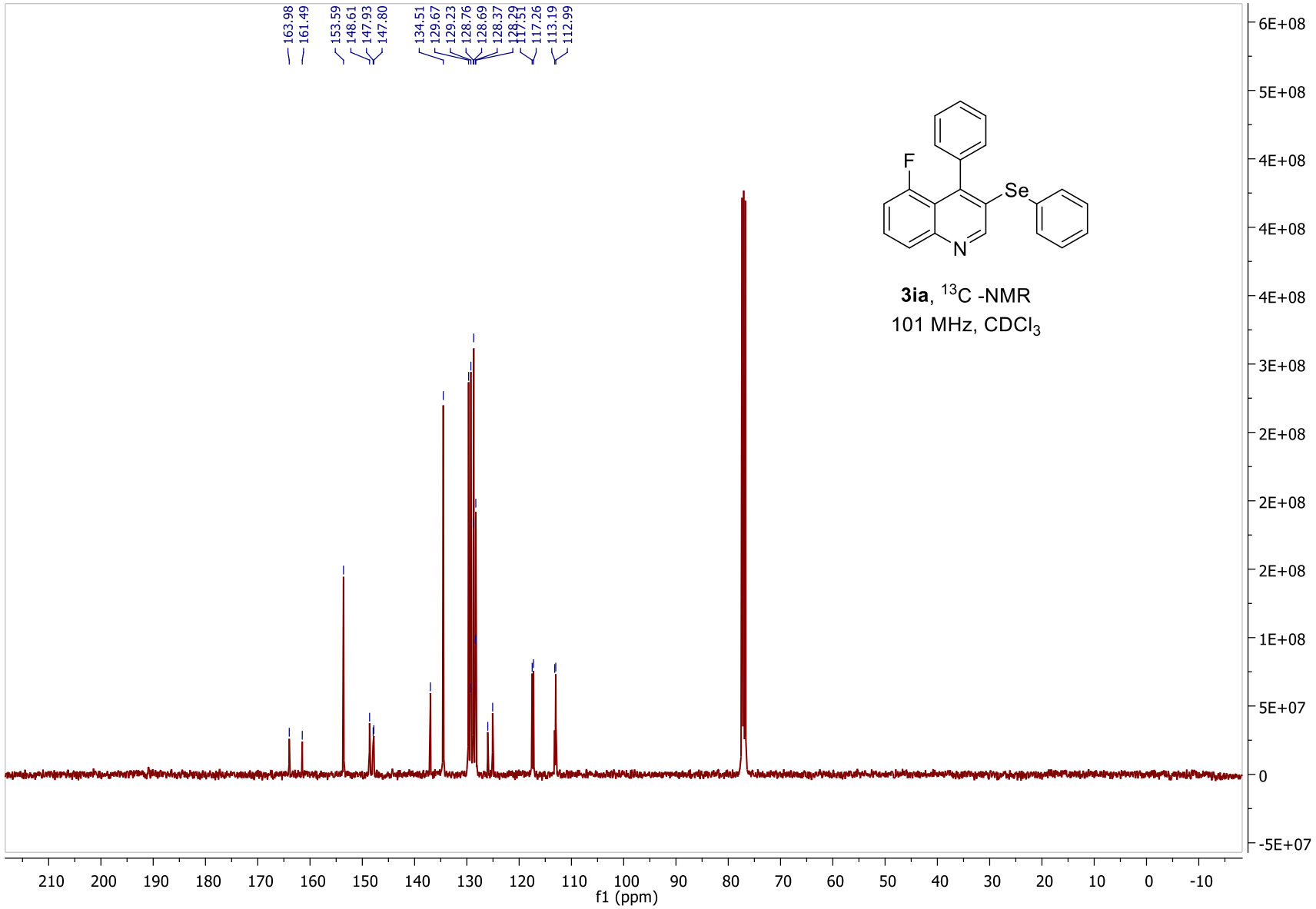

371.24
Se
N
OMe
3ga, ^{77}Se-NMR
76 MHz, $CDCl_3$
1E+09
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
-2E+08
-3E+08
1500 1300 1100 900 800 700 600 500 400 300 200 100 0 -100 -200 -300 -400 -500 -600 -700 -800 -900
f1 (ppm)

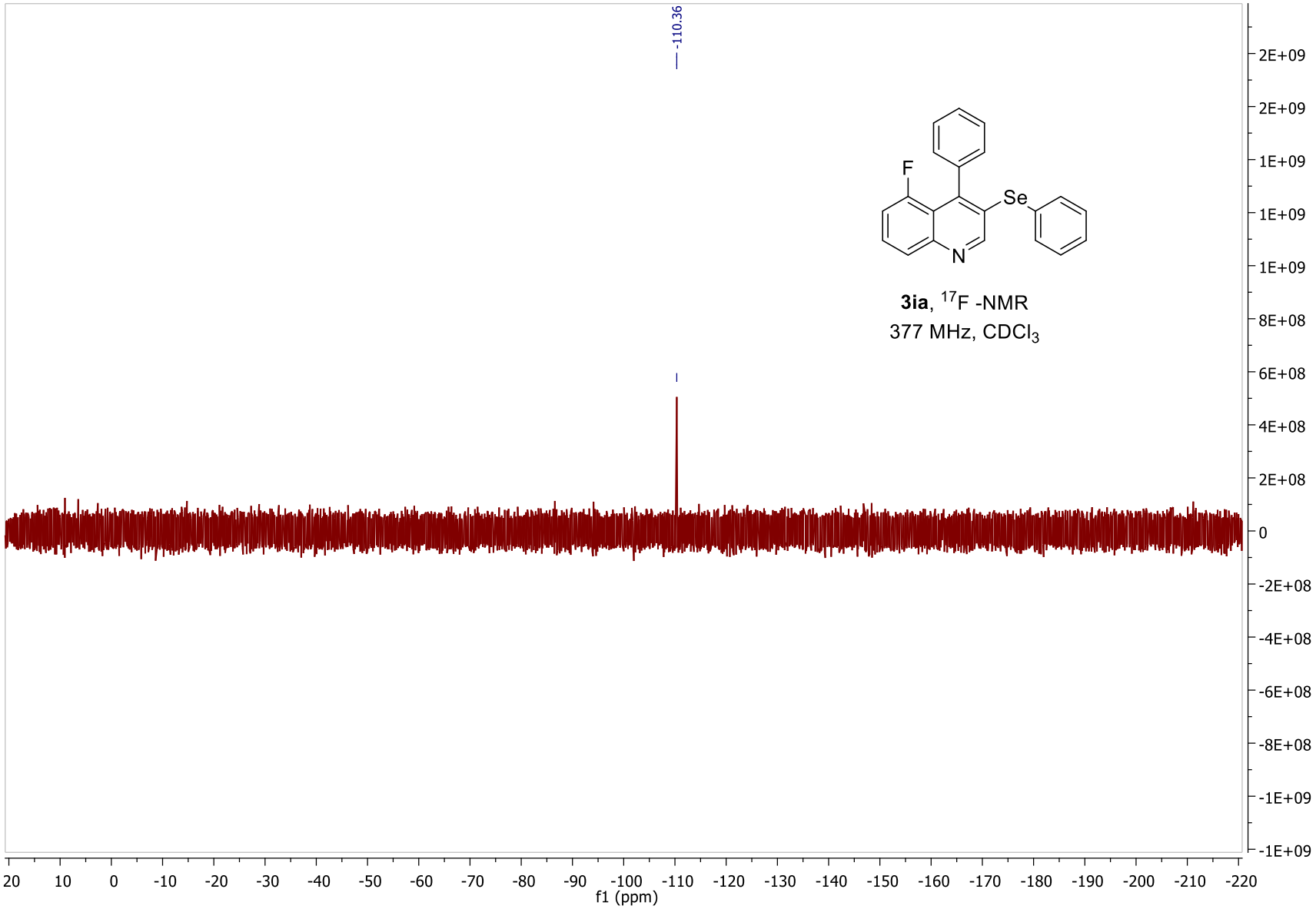

8.66
7.67
7.66
7.66
7.66
7.65
7.65
7.64
7.64
7.59
7.59
7.58
7.57
7.57
7.56
7.56
7.55
7.55
7.55
7.54
7.54
7.53
7.53
7.52
7.52
7.51
7.51
7.50
7.49
7.48
7.48
7.47
7.46
7.45
7.45
7.41
7.40
7.40
7.39
7.39
7.38
7.37
7.37
7.31
7.31
7.30
7.29
7.29
7.28
7.27
7.27
7.27
Se
N
3ha, 1H-NMR
400 MHz, CDCl3
0.92
3.00
3.07
0.99
1.12
1.93
2.00
3.02
3.04
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)

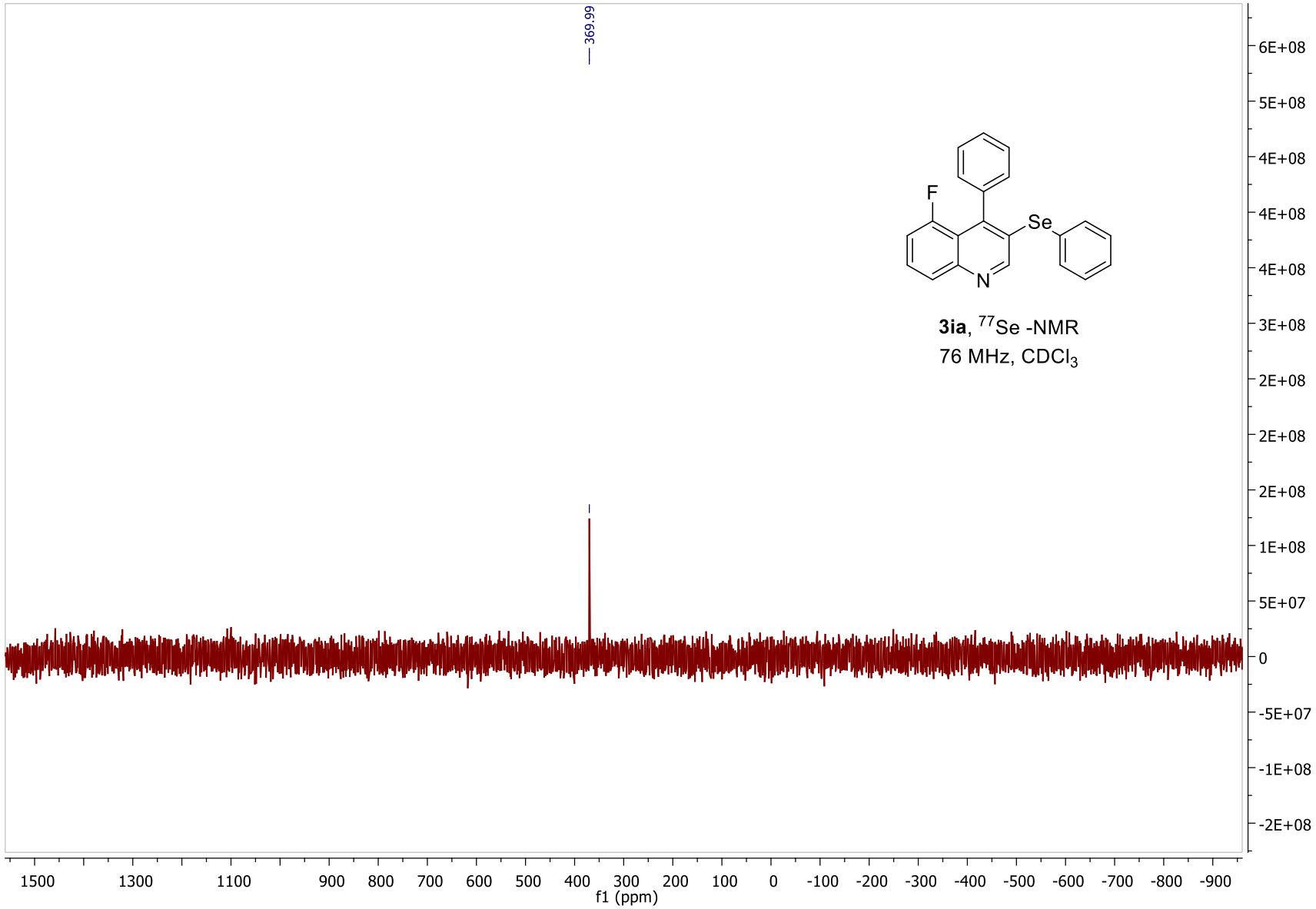

151.41
147.61
144.38
141.06
139.60
137.58
135.29
130.55
129.83
129.67
129.35
128.72
128.58
128.43
128.32
127.97
127.39
127.12
126.71
125.56
Se
N
3ha, 13C-NMR
101 MHz, CDCl3
8E+07
8E+07
8E+07
7E+07
6E+07
6E+07
6E+07
5E+07
4E+07
4E+07
4E+07
3E+07
2E+07
2E+07
2E+07
1E+07
5E+06
0
-5E+06
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

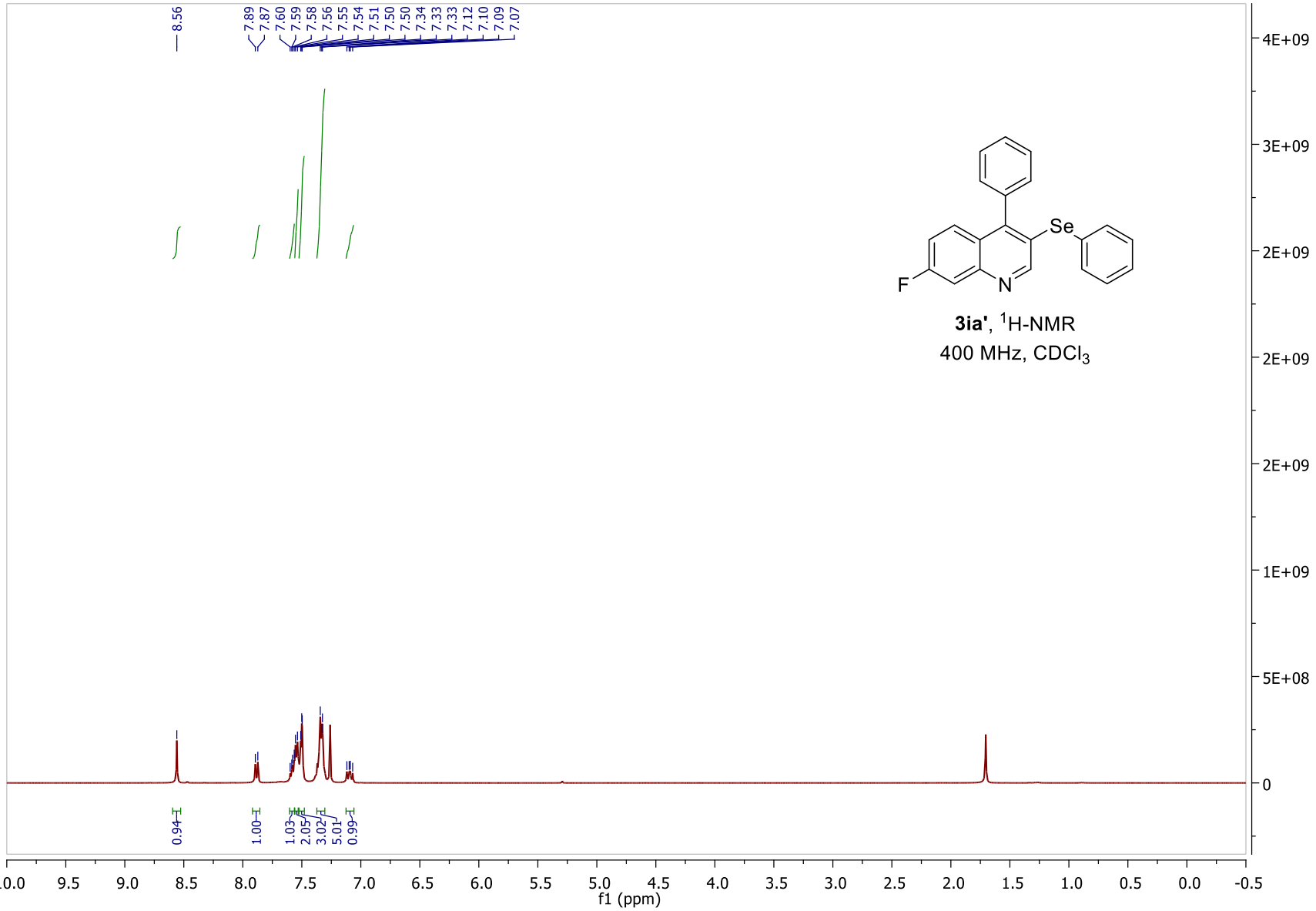

374.48
Se
N
3ha, ^{77}Se-NMR
76 MHz, $CDCl_3$
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
-1E+08
-2E+08
-2E+08
1500 1300 1100 900 800 700 600 500 400 300 200 100 0 -100 -200 -300 -400 -500 -600 -700 -800 -900
f1 (ppm)

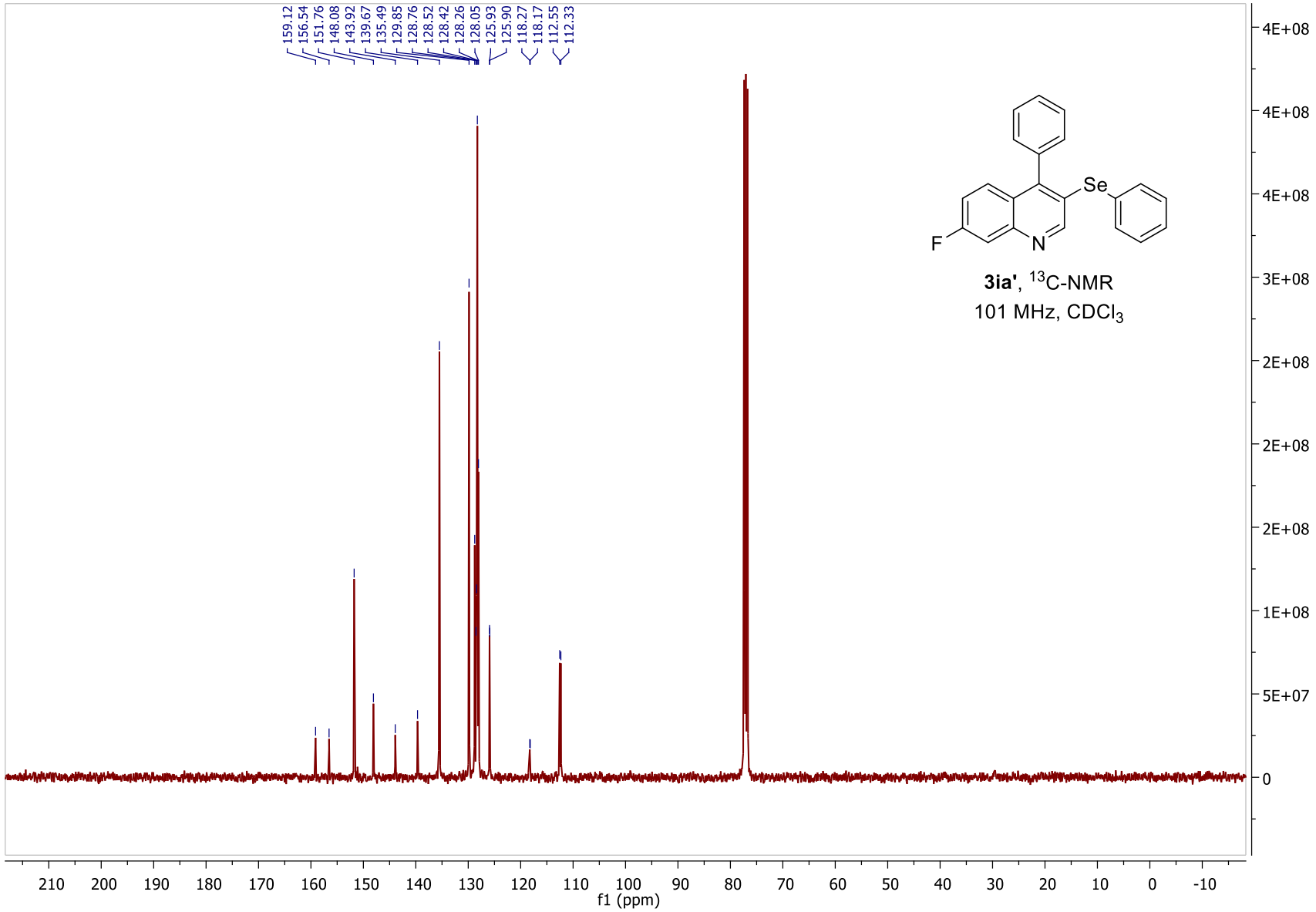

8.71
7.71
7.71
7.69
7.68
7.54
7.54
7.53
7.52
7.51
7.49
7.49
7.47
7.46
7.45
7.32
7.31
7.30
7.30
7.28
7.23
7.22
7.21
7.21
7.20
7.19
7.18
F
Se
N
3ia, 1H-NMR
400 MHz, CDCl3
0.96
1.00
3.02
3.01
5.09
1.05
f1 (ppm)

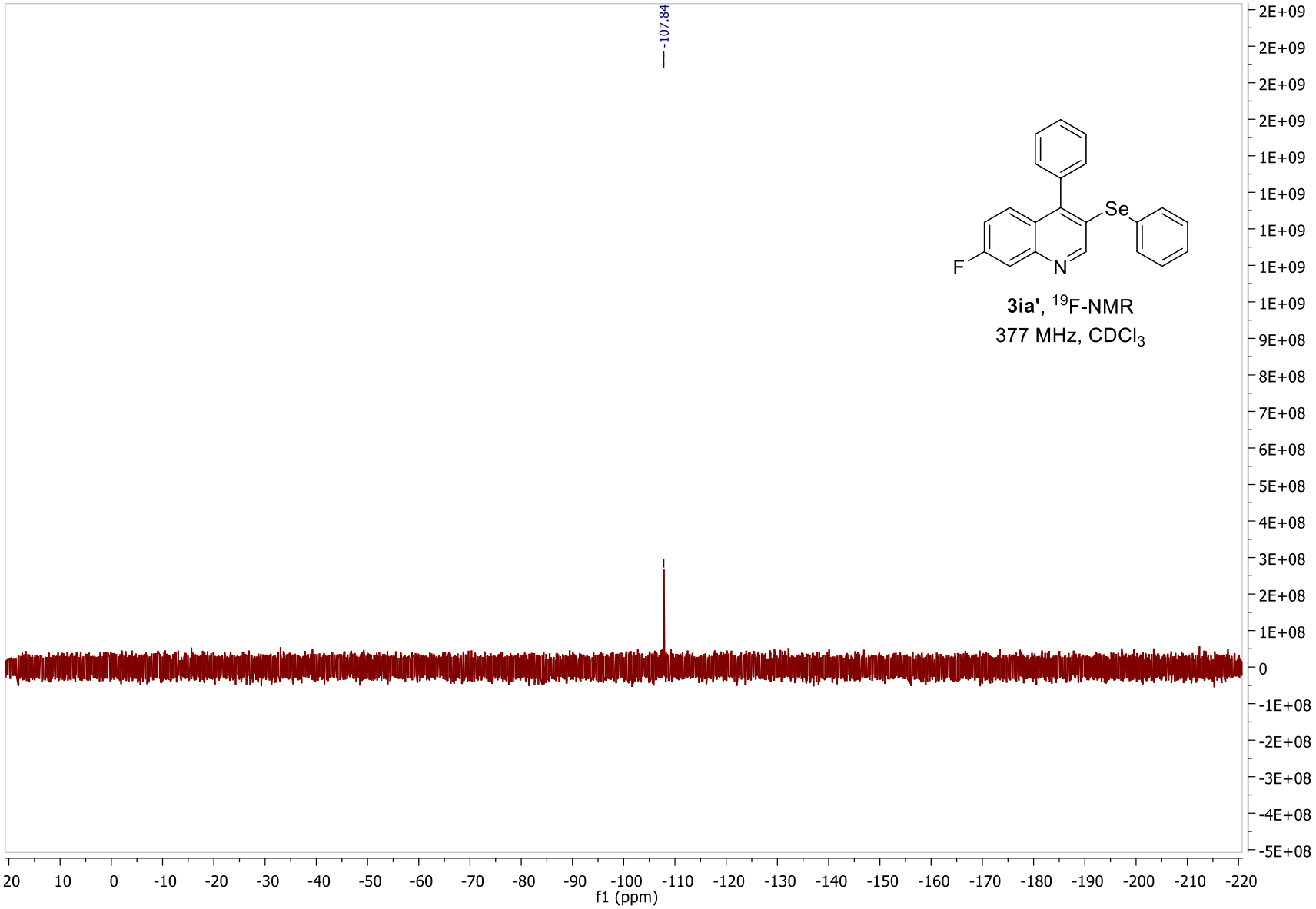

163.98
161.49
153.59
148.61
147.93
147.80
134.51
129.67
129.23
128.76
128.69
128.37
128.29
117.51
117.26
113.19
112.99
F
Se
N
3ia, 13C -NMR
101 MHz, CDCl3
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

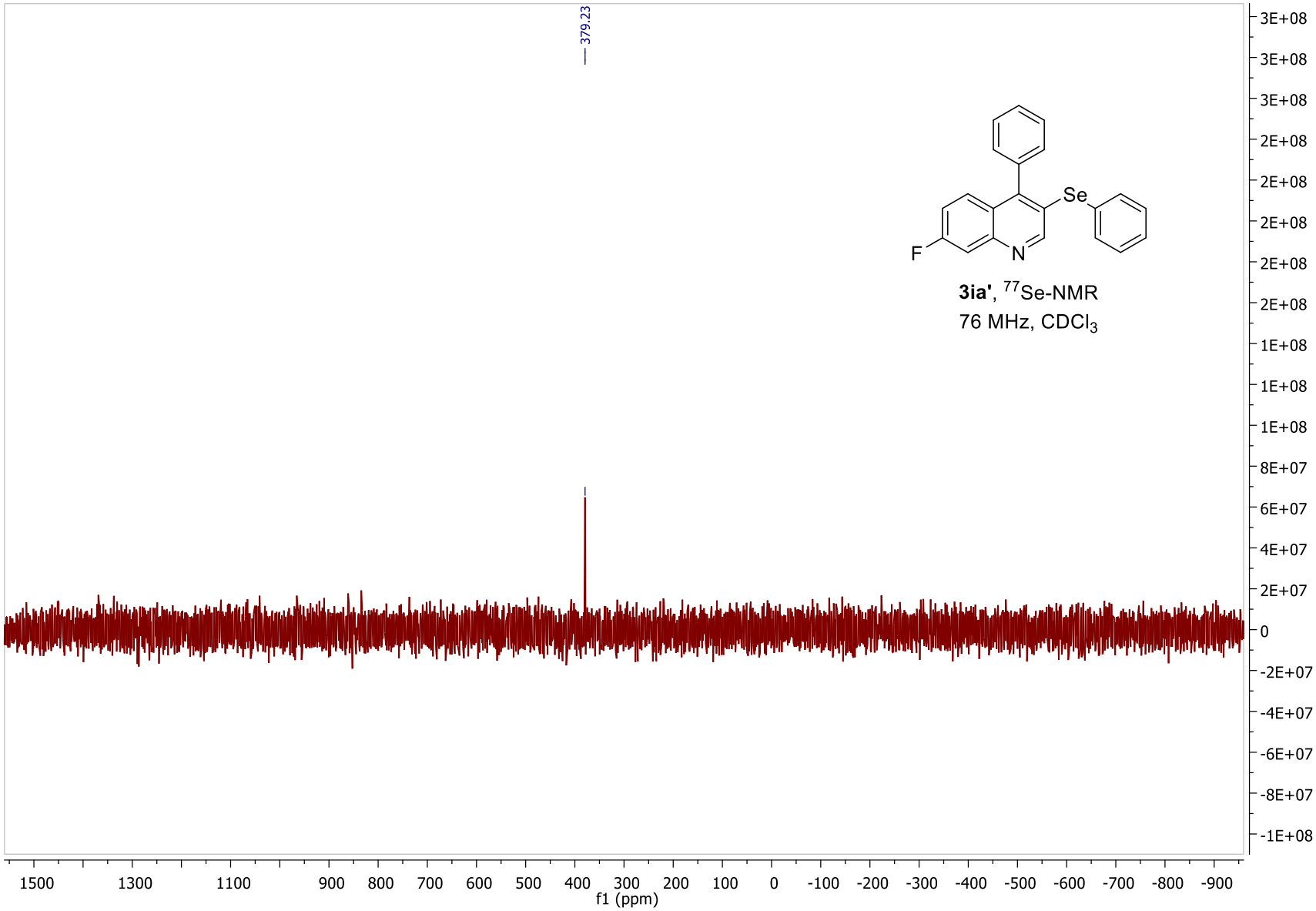

-110.36
F
Se
N
3ia, 17F -NMR
377 MHz, CDCl3
2E+09
2E+09
1E+09
1E+09
1E+09
8E+08
6E+08
4E+08
2E+08
0
-2E+08
-4E+08
-6E+08
-8E+08
-1E+09
-1E+09
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

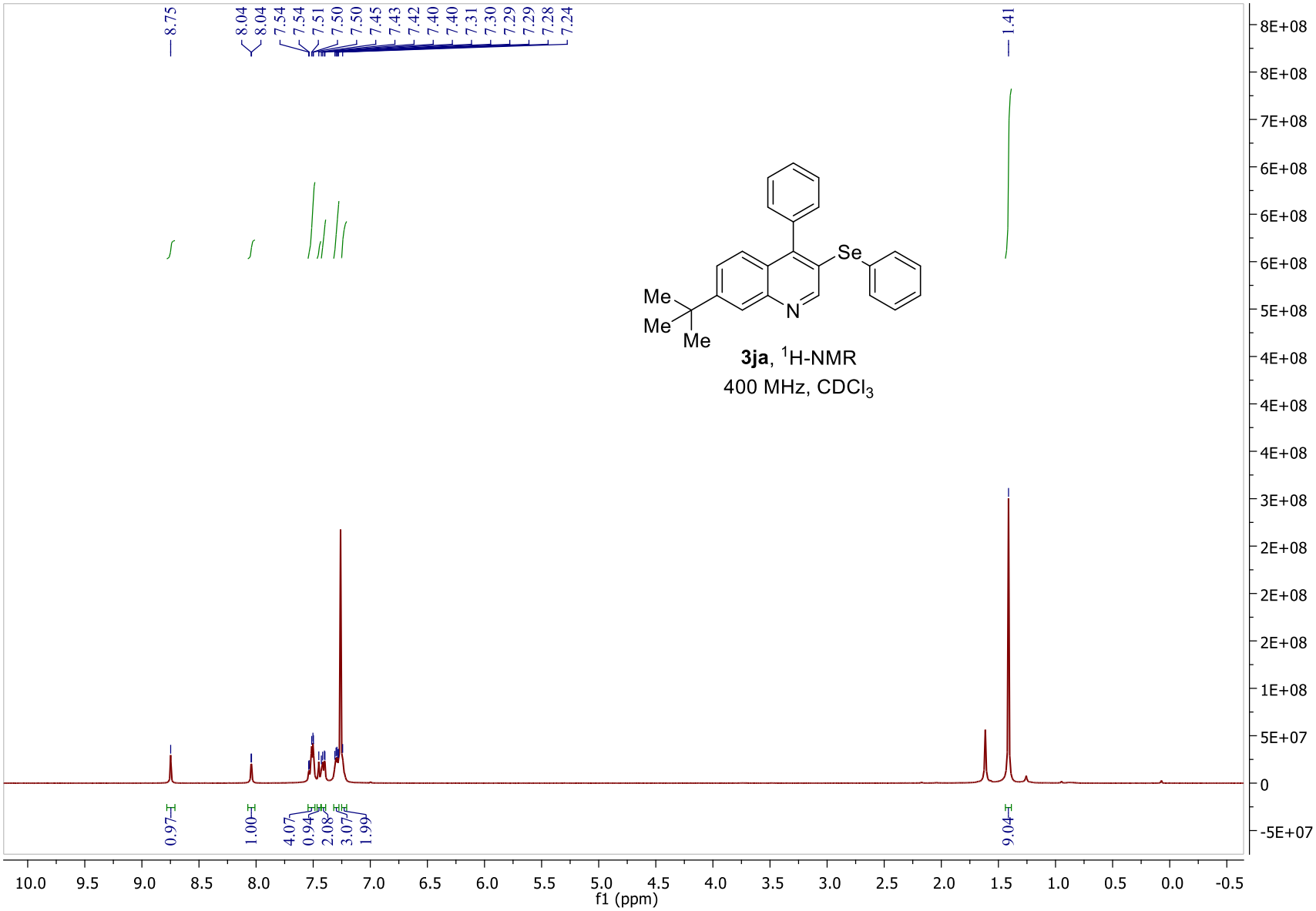

369.99
F
Se
N
3ia, 77Se -NMR
76 MHz, CDCl3
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
-1E+08
-2E+08
1500
1300
1100
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
f1 (ppm)

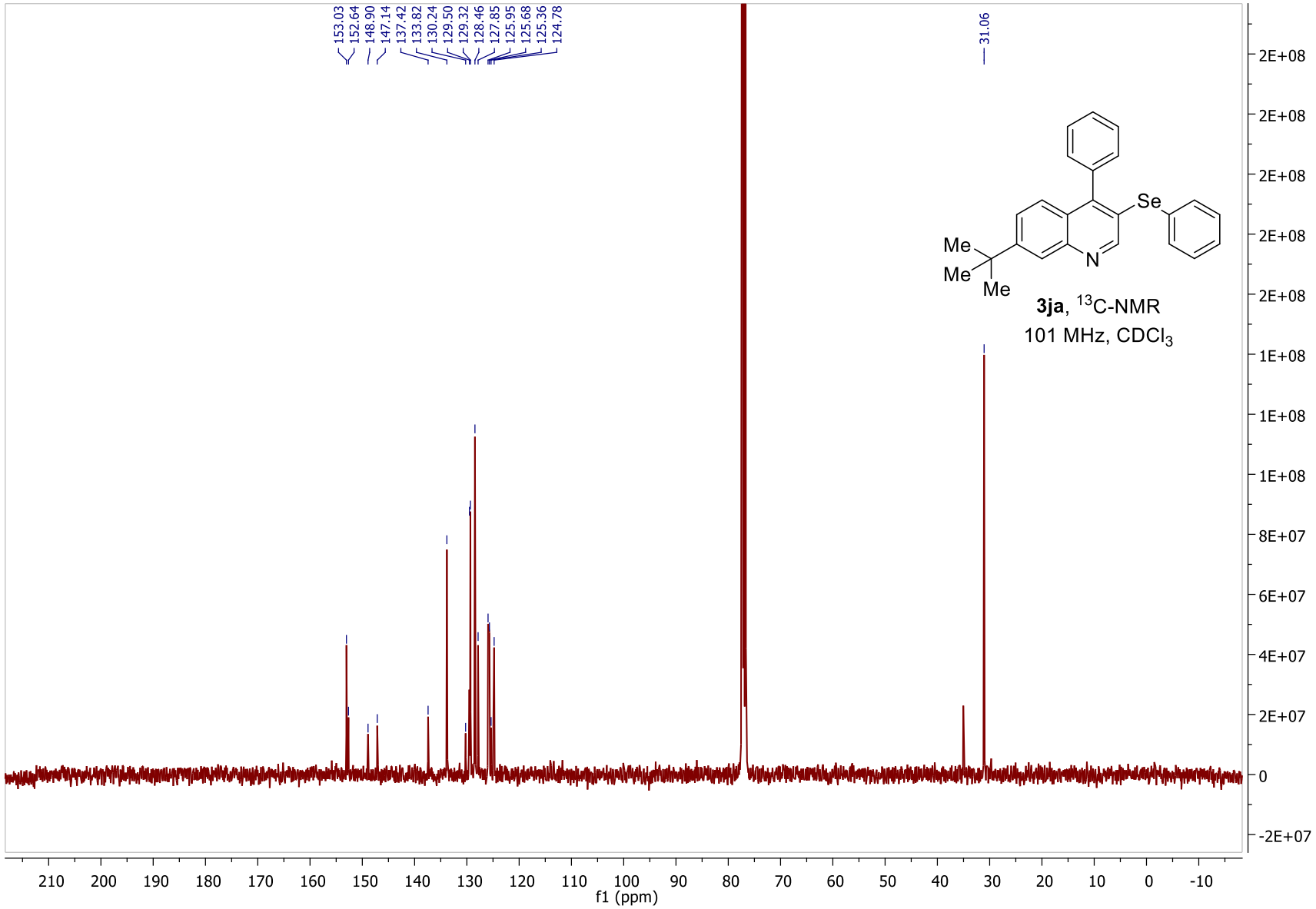

8.56
7.89
7.87
7.60
7.59
7.58
7.56
7.55
7.54
7.51
7.50
7.50
7.34
7.33
7.33
7.12
7.10
7.09
7.07
Se
F
N
3ia', 1H-NMR
400 MHz, CDCl3
4E+09
3E+09
2E+09
2E+09
2E+09
1E+09
5E+08
0
0.94
1.00
1.03
2.05
3.02
5.01
0.99
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

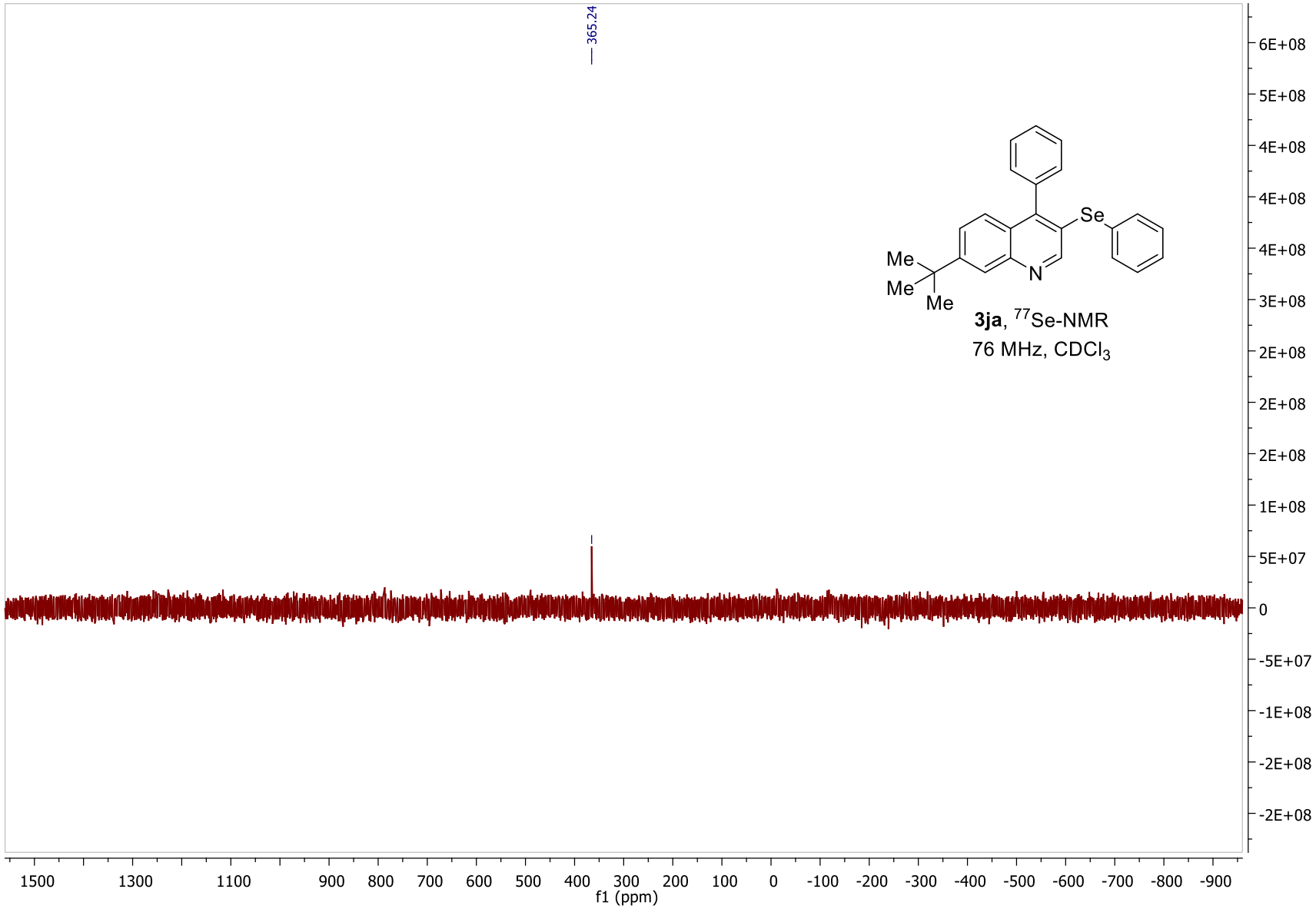

159.12
156.54
151.76
148.08
143.92
139.67
135.49
129.85
128.76
128.52
128.42
128.26
128.05
125.93
125.90
118.27
118.17
112.55
112.33
Se
F
N
3ia', 13C-NMR
101 MHz, CDCl3
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

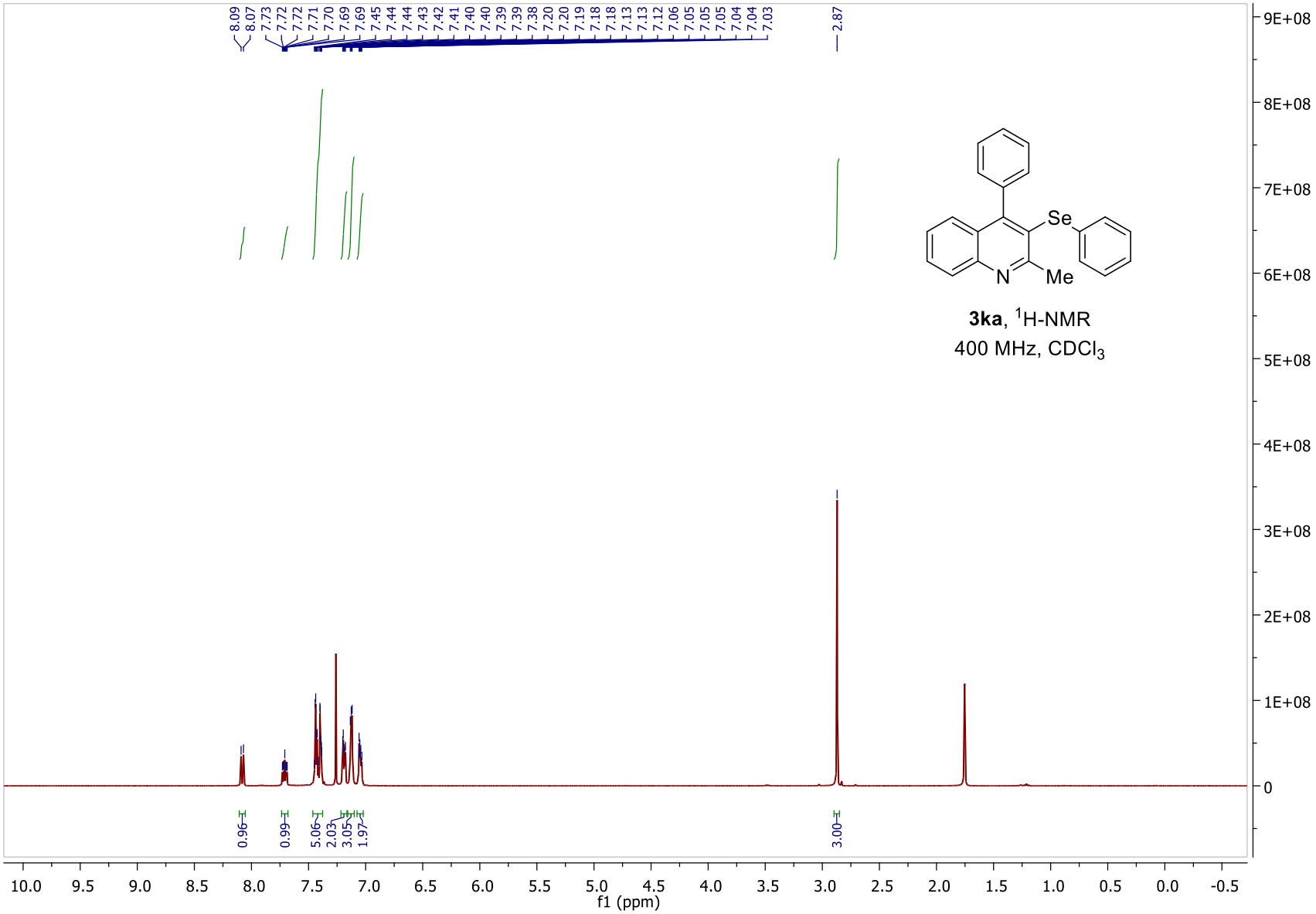

-107.84
Se
F
N
3ia', 19F-NMR
377 MHz, CDCl3
2E+09
2E+09
2E+09
2E+09
1E+09
1E+09
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
-2E+08
-3E+08
-4E+08
-5E+08
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

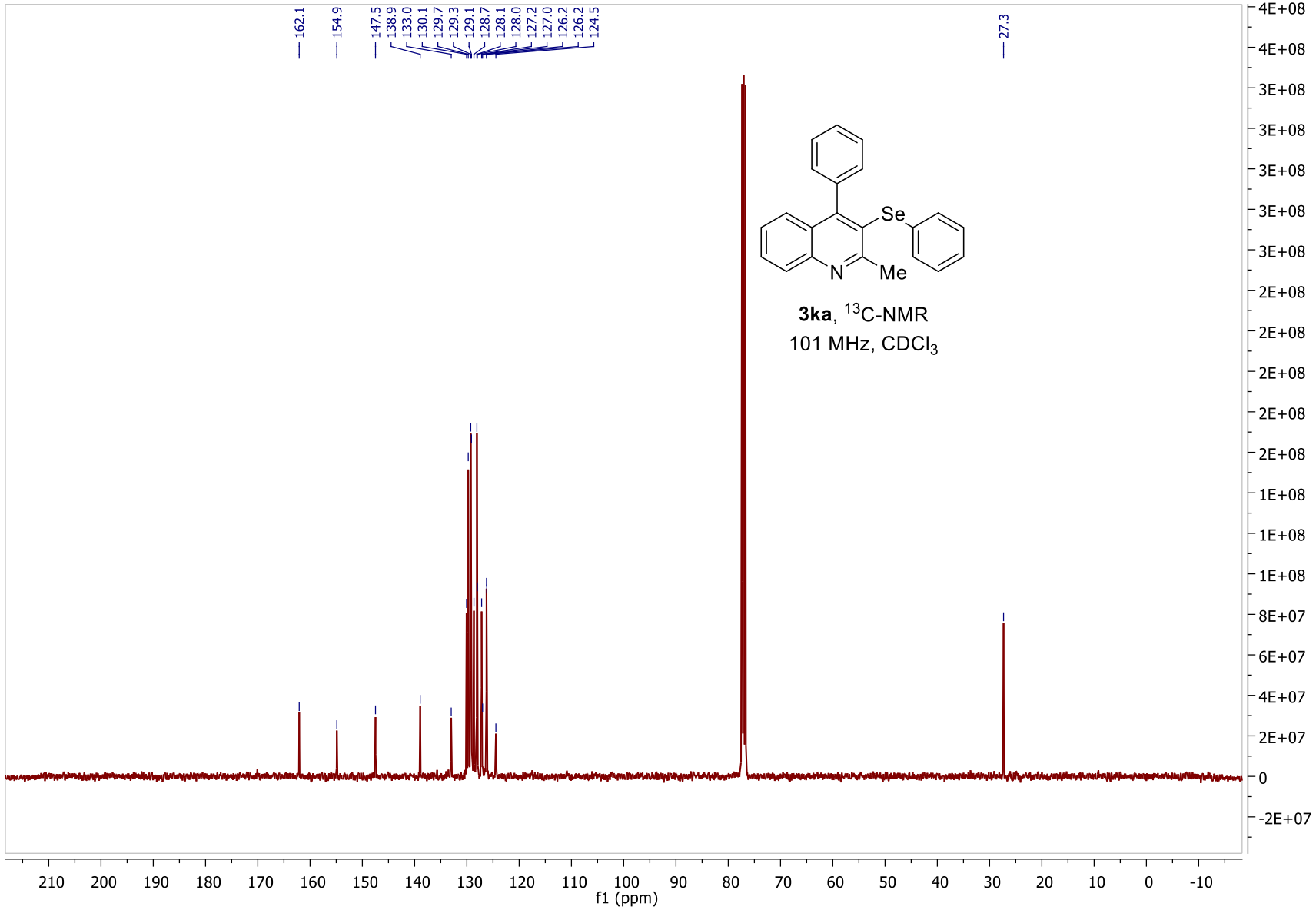

379.23
Se
F
N
3ia', 77Se-NMR
76 MHz, CDCl3
3E+08
3E+08
3E+08
2E+08
2E+08
2E+08
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
-4E+07
-6E+07
-8E+07
-1E+08
1500
1300
1100
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
f1 (ppm)

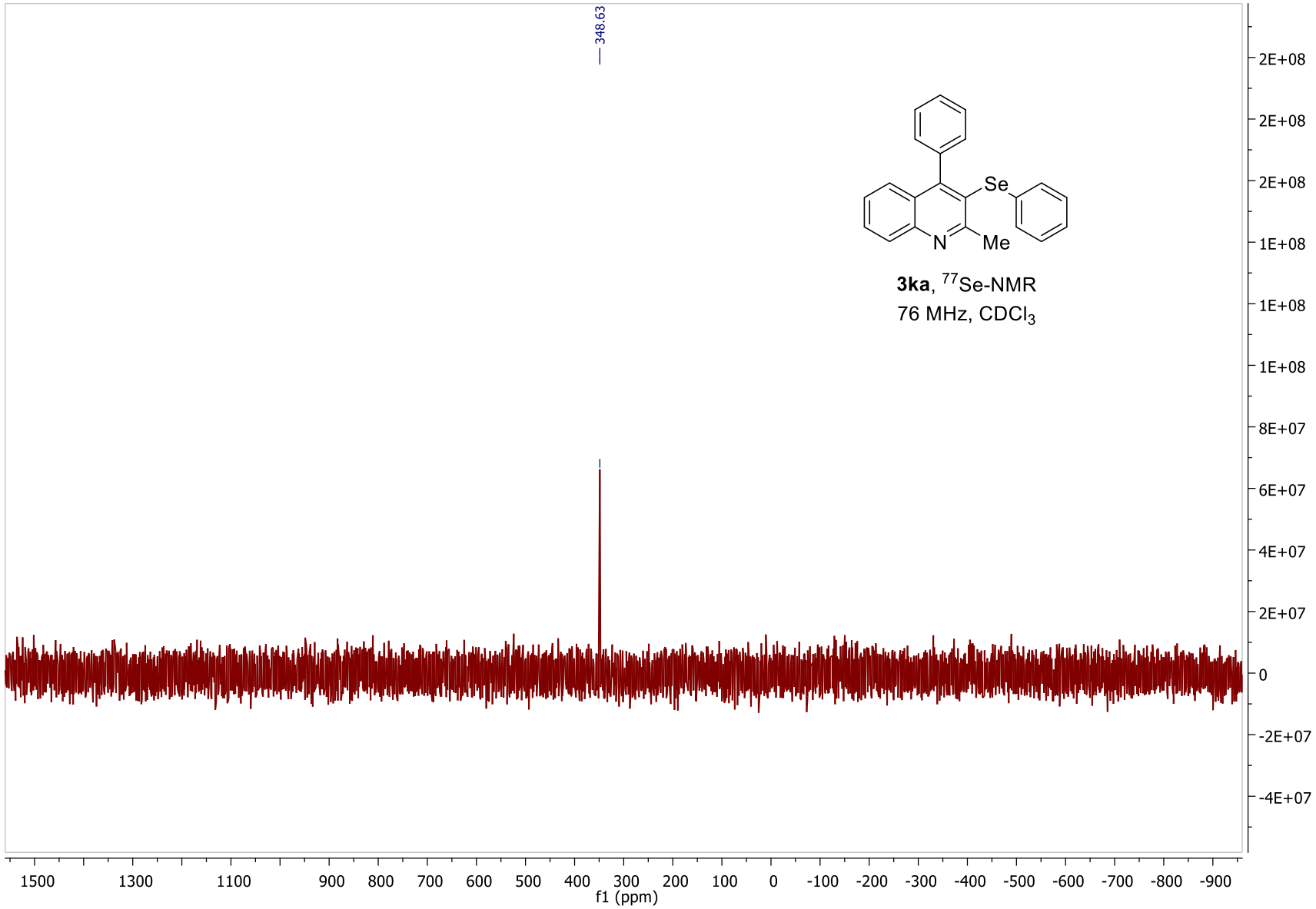

8.75
8.04
8.04
7.54
7.54
7.51
7.50
7.50
7.45
7.43
7.42
7.40
7.40
7.31
7.30
7.29
7.29
7.28
7.24
1.41
Se
N
Me
Me
Me
3ja, 1H-NMR
400 MHz, CDCl3
0.97
1.00
4.07
0.94
2.08
3.07
1.99
9.04
f1 (ppm)

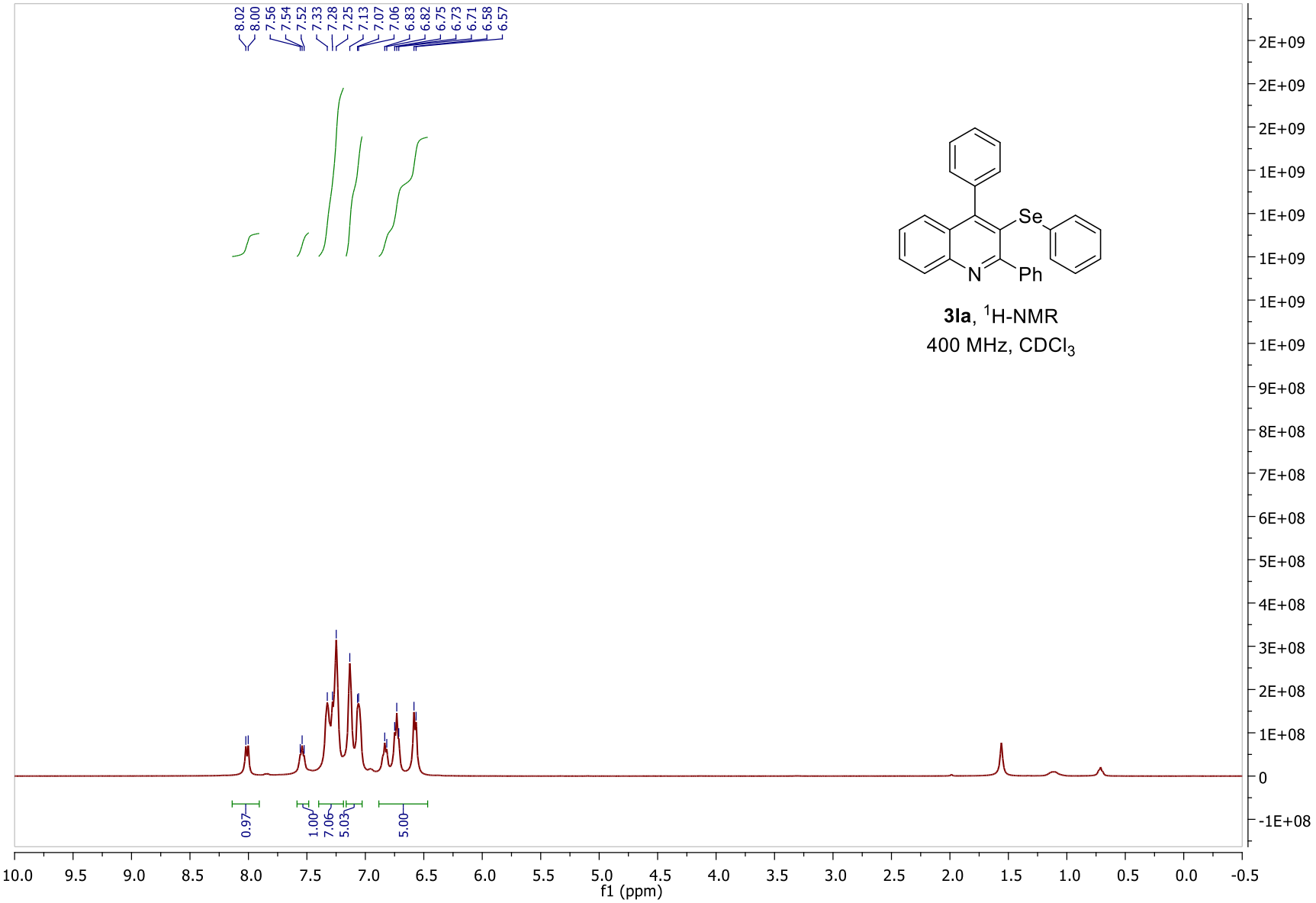

153.03
152.64
148.90
147.14
137.42
133.82
130.24
129.50
129.32
128.46
127.85
125.95
125.68
125.36
124.78
31.06
Se
N
Me
Me
Me
3ja, 13C-NMR
101 MHz, CDCl3
2E+08
2E+08
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


365.24
Me
Me
Me
Se
N
3ja, 77Se-NMR
76 MHz, CDCl3
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
-1E+08
-2E+08
-2E+08
1500 1300 1100 900 800 700 600 500 400 300 200 100 0 -100 -200 -300 -400 -500 -600 -700 -800 -900
f1 (ppm)


8.09
8.07
7.73
7.72
7.72
7.71
7.70
7.69
7.69
7.45
7.44
7.44
7.43
7.42
7.41
7.40
7.40
7.39
7.39
7.38
7.20
7.20
7.19
7.18
7.18
7.13
7.13
7.12
7.06
7.05
7.05
7.05
7.04
7.04
7.03
2.87
Se
N
Me
3ka, 1H-NMR
400 MHz, CDCl3
0.96
0.99
5.06
2.03
3.05
1.97
3.00
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)


162.1
154.9
147.5
138.9
133.0
130.1
129.7
129.3
129.1
128.7
128.1
128.0
127.2
127.0
126.2
126.2
124.5
27.3
Se
N
Me
3ka, 13C-NMR
101 MHz, CDCl3
4E+08
4E+08
3E+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
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


348.63
Se
N
Me
3ka, ^{77}Se-NMR
76 MHz, $CDCl_3$
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
-4E+07
1500 1300 1100 900 800 700 600 500 400 300 200 100 0 -100 -200 -300 -400 -500 -600 -700 -800 -900
f1 (ppm)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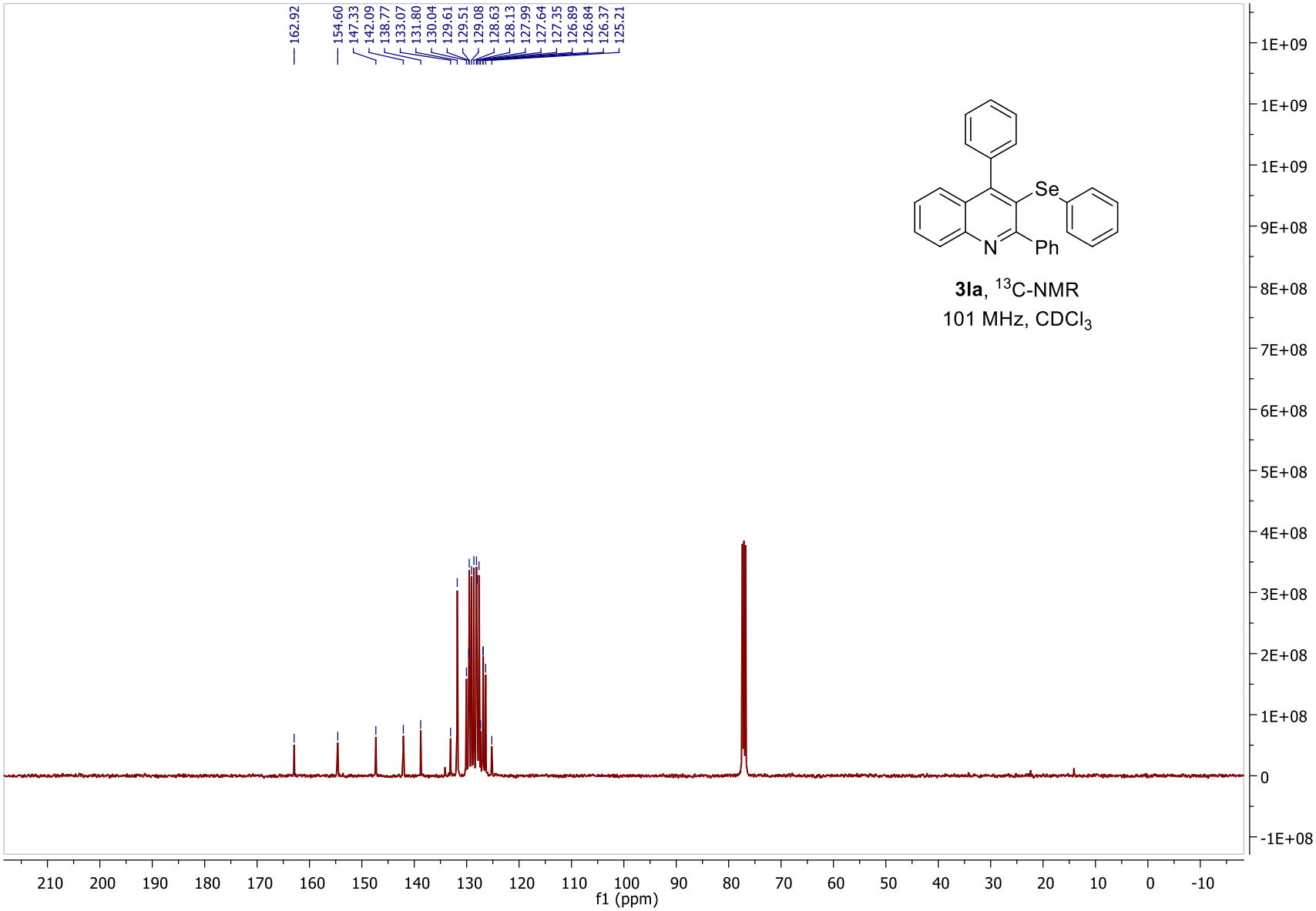
7.52
7.33
7.28
7.25
7.13
7.07
7.06
6.83
6.82
6.75
6.73
6.71
6.58
6.57
Se
N
Ph
3Ia, 1H-NMR
400 MHz, CDCl3
0.97
1.00
7.06
5.03
5.00
f1 (ppm)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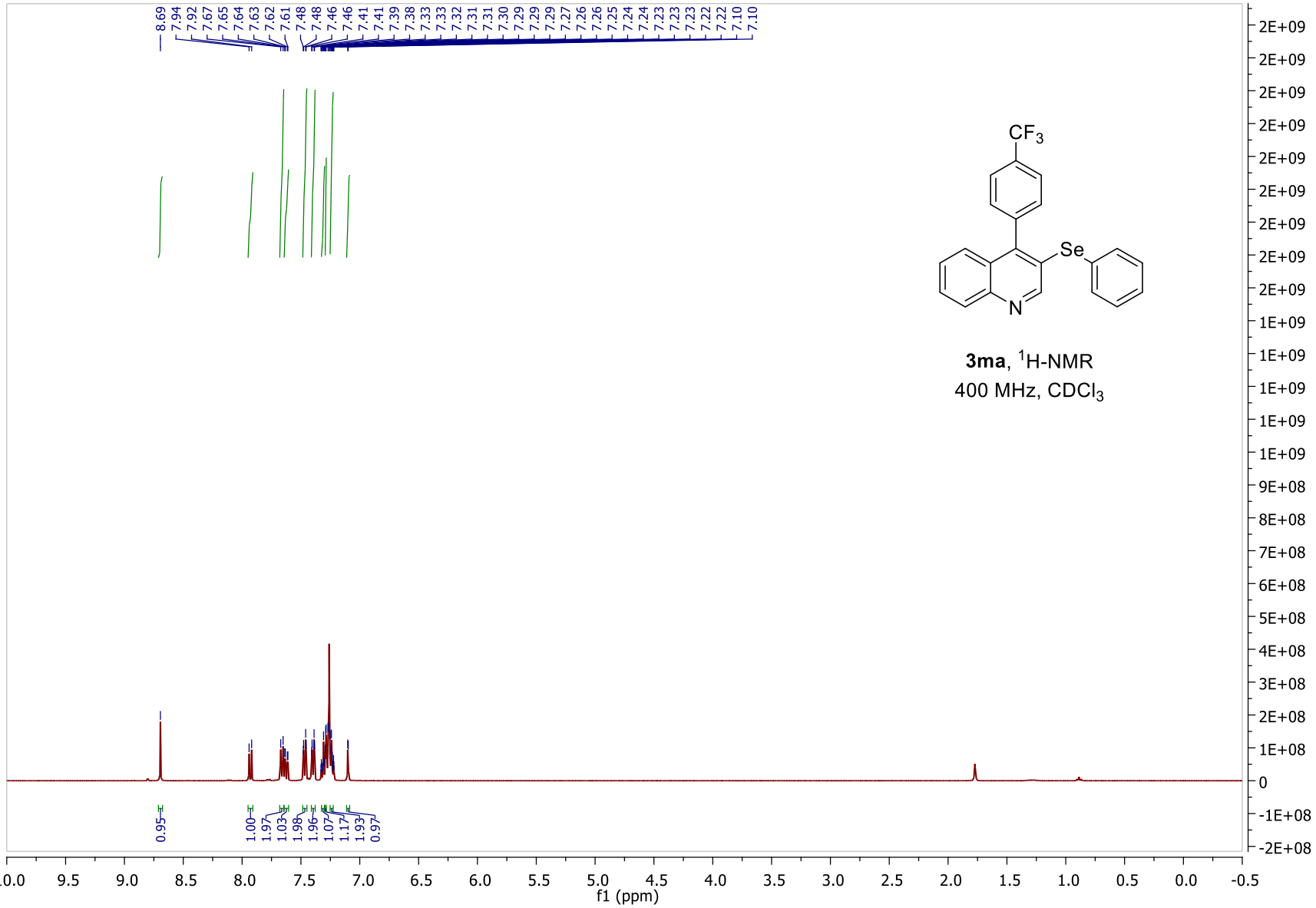
131.80
130.04
129.61
129.51
129.08
128.63
128.13
127.99
127.64
127.35
126.89
126.84
126.37
125.21
Se
N
Ph
3la, 13C-NMR
101 MHz, CDCl3
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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7.62
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7.46
7.41
7.41
7.39
7.38
7.33
7.32
7.31
7.31
7.30
7.29
7.29
7.29
7.27
7.26
7.26
7.25
7.24
7.24
7.23
7.23
7.23
7.22
7.22
7.10
7.10
CF3
Se
N
3ma, 1H-NMR
400 MHz, CDCl3
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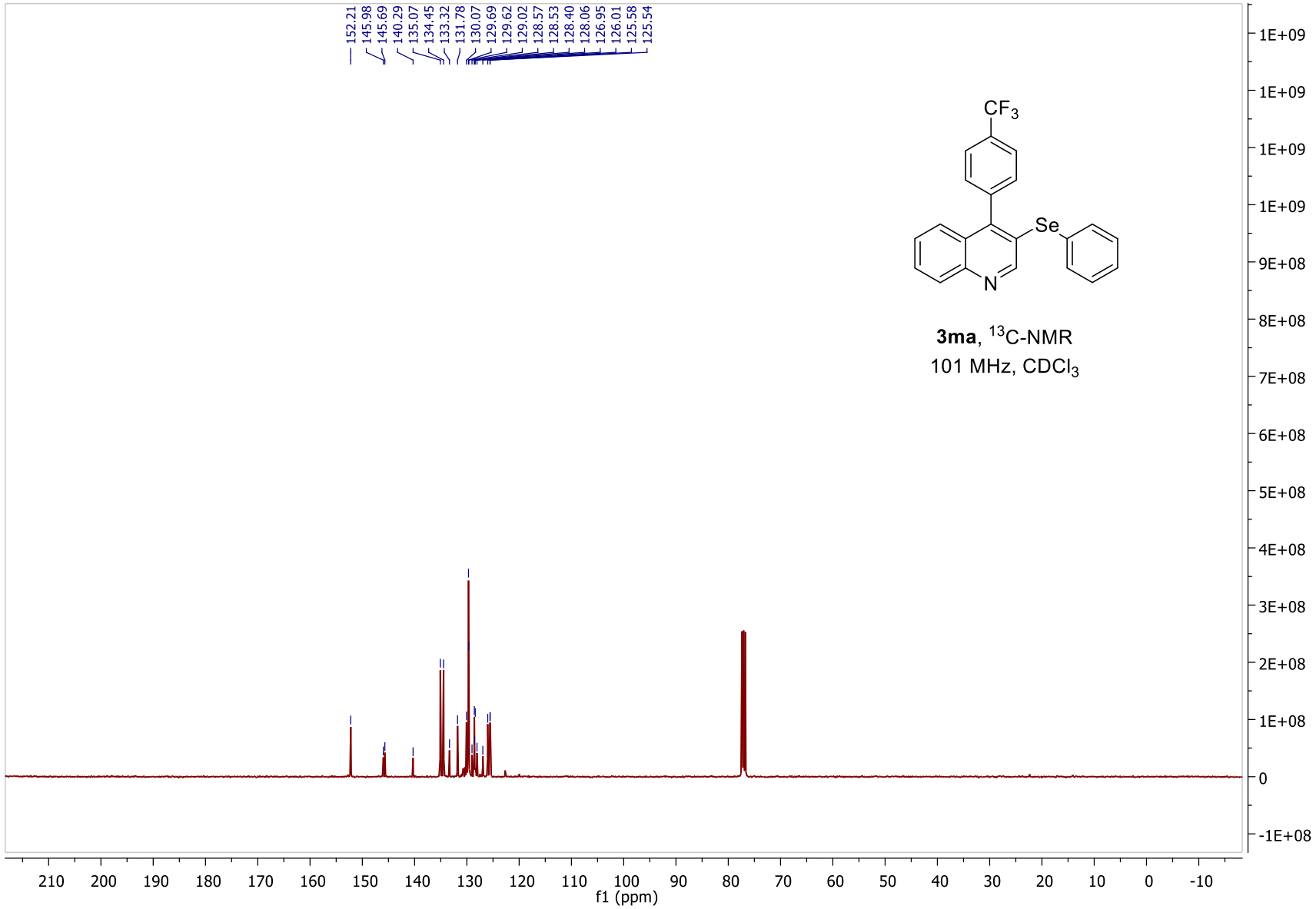
1.97
1.03
1.98
1.96
1.07
1.17
1.93
0.97
f1 (ppm)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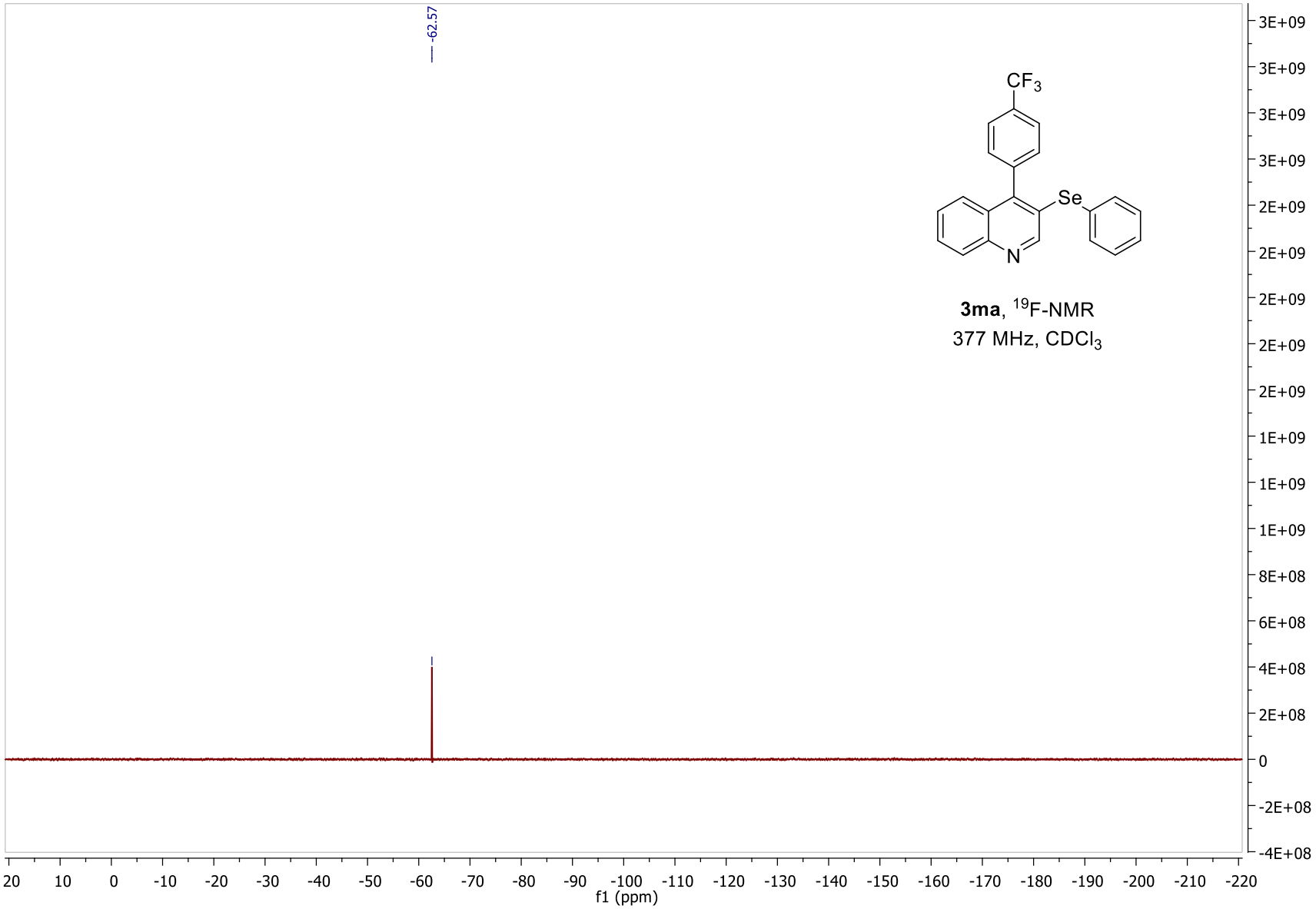
134.45
133.32
131.78
130.07
129.69
129.62
129.02
128.57
128.53
128.40
128.06
126.95
126.01
125.58
125.54
CF3
Se
N
3ma, 13C-NMR
101 MHz, CDCl3
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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N
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377 MHz, CDCl3
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3E+09
3E+09
3E+09
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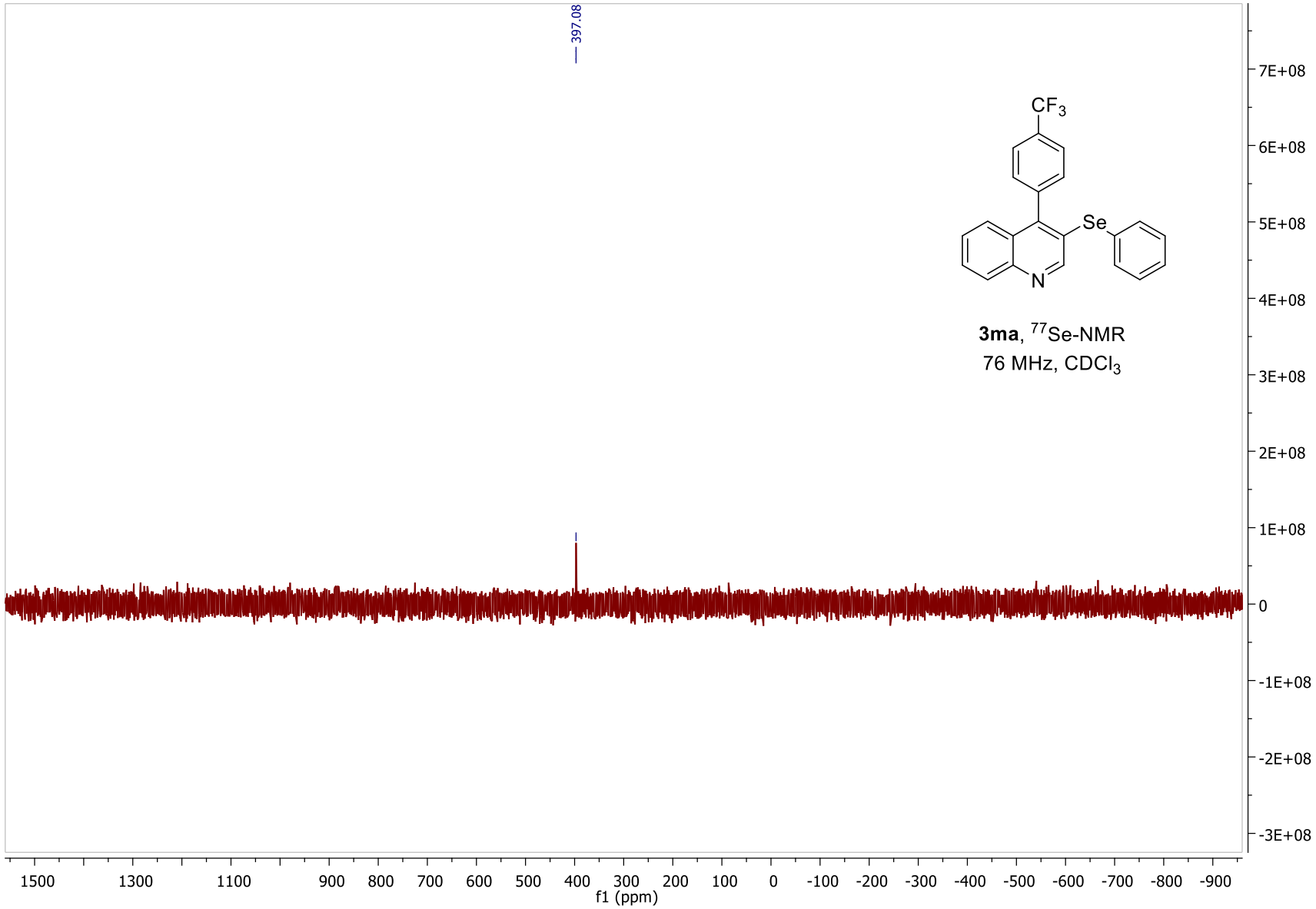
2E+09
2E+09
2E+09
2E+09
2E+09
1E+09
1E+09
1E+09
8E+08
6E+08
4E+08
2E+08
0
-2E+08
-4E+08
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)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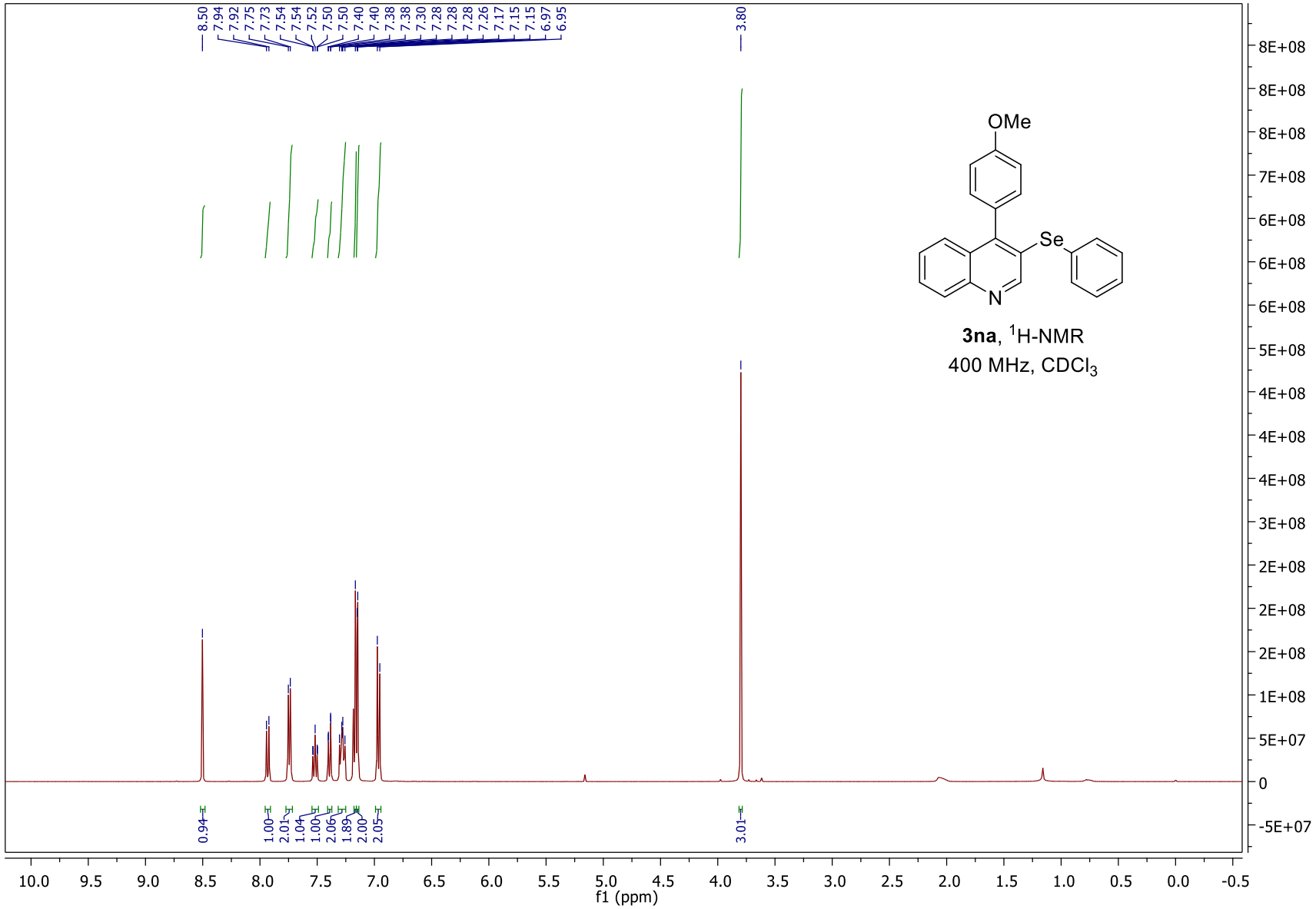
Se
N
3ma, 77Se-NMR
76 MHz, CDCl3
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
-2E+08
-3E+08
1500 1300 1100 900 800 700 600 500 400 300 200 100 0 -100 -200 -300 -400 -500 -600 -700 -800 -900
f1 (ppm)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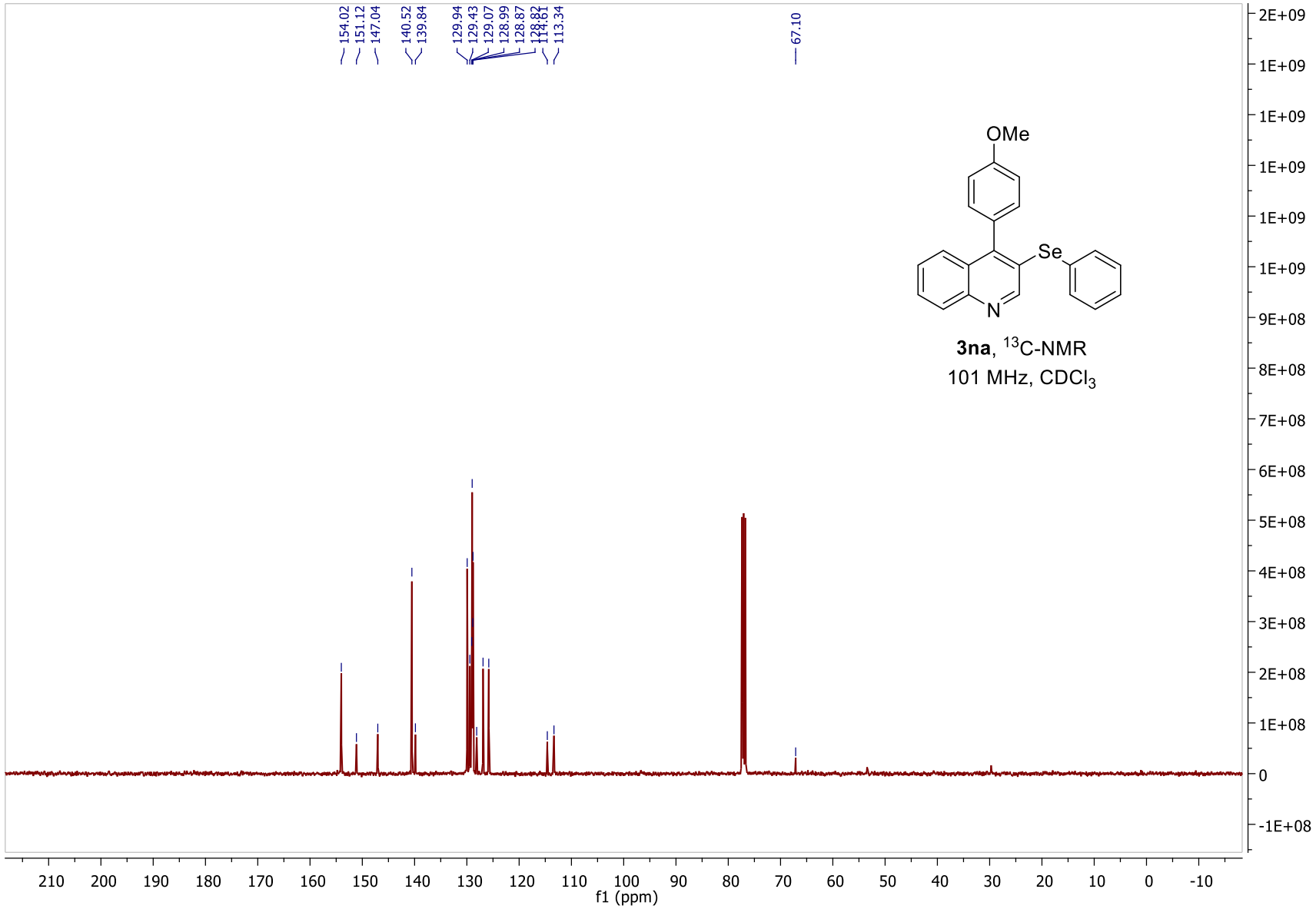
7.92
7.75
7.73
7.54
7.54
7.52
7.50
7.50
7.40
7.40
7.38
7.38
7.30
7.28
7.28
7.28
7.26
7.17
7.15
6.97
6.95
3.80
OMe
Se
N
3na, 1H-NMR
400 MHz, CDCl3
0.94
1.00
2.01
1.04
1.00
2.06
1.89
2.00
2.05
3.01
f1 (ppm)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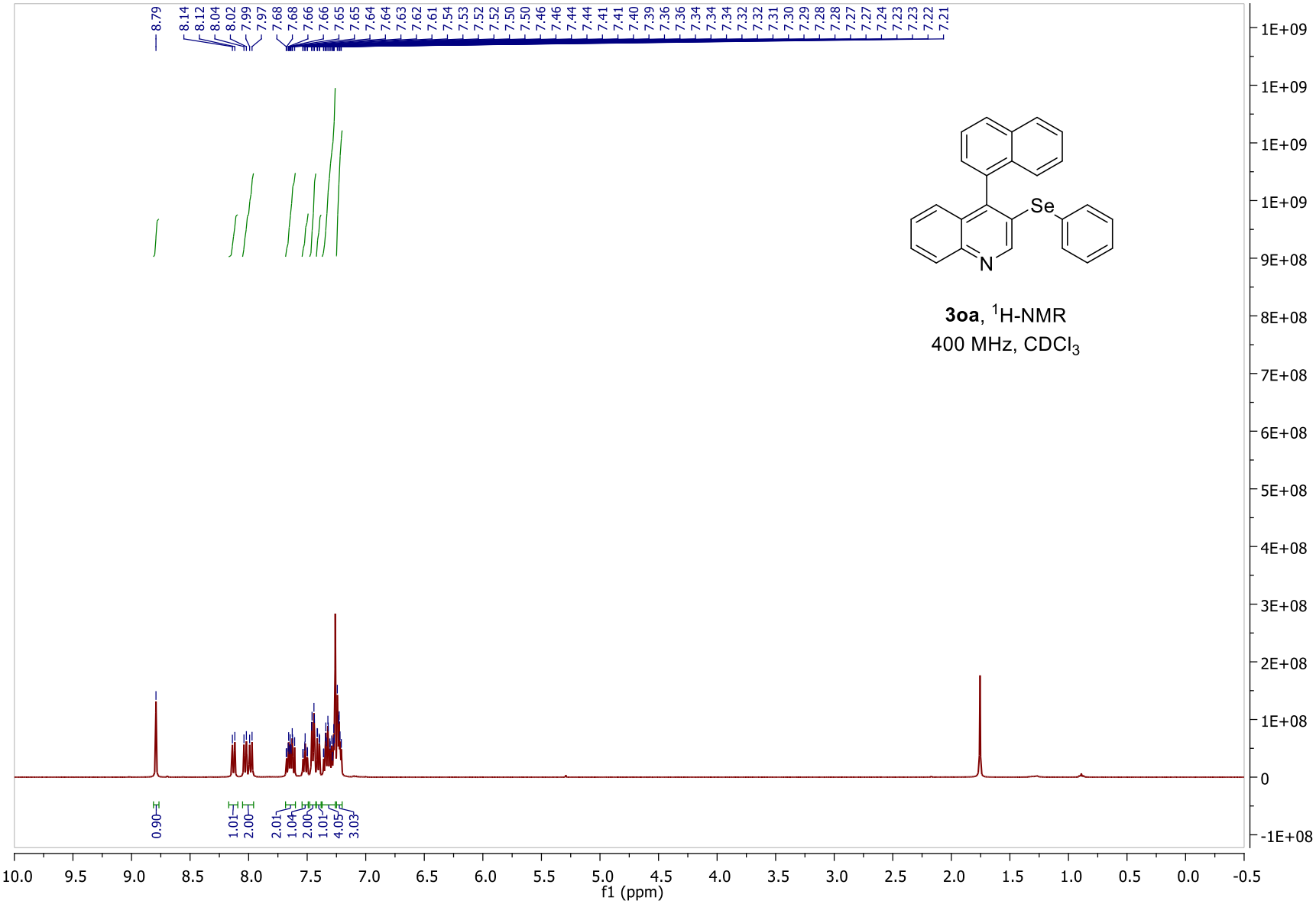
151.12
147.04
140.52
139.84
129.94
129.43
129.07
128.99
128.87
128.82
114.61
113.34
67.10
OMe
Se
N
3na, 13C-NMR
101 MHz, CDCl3
2E+09
1E+09
1E+09
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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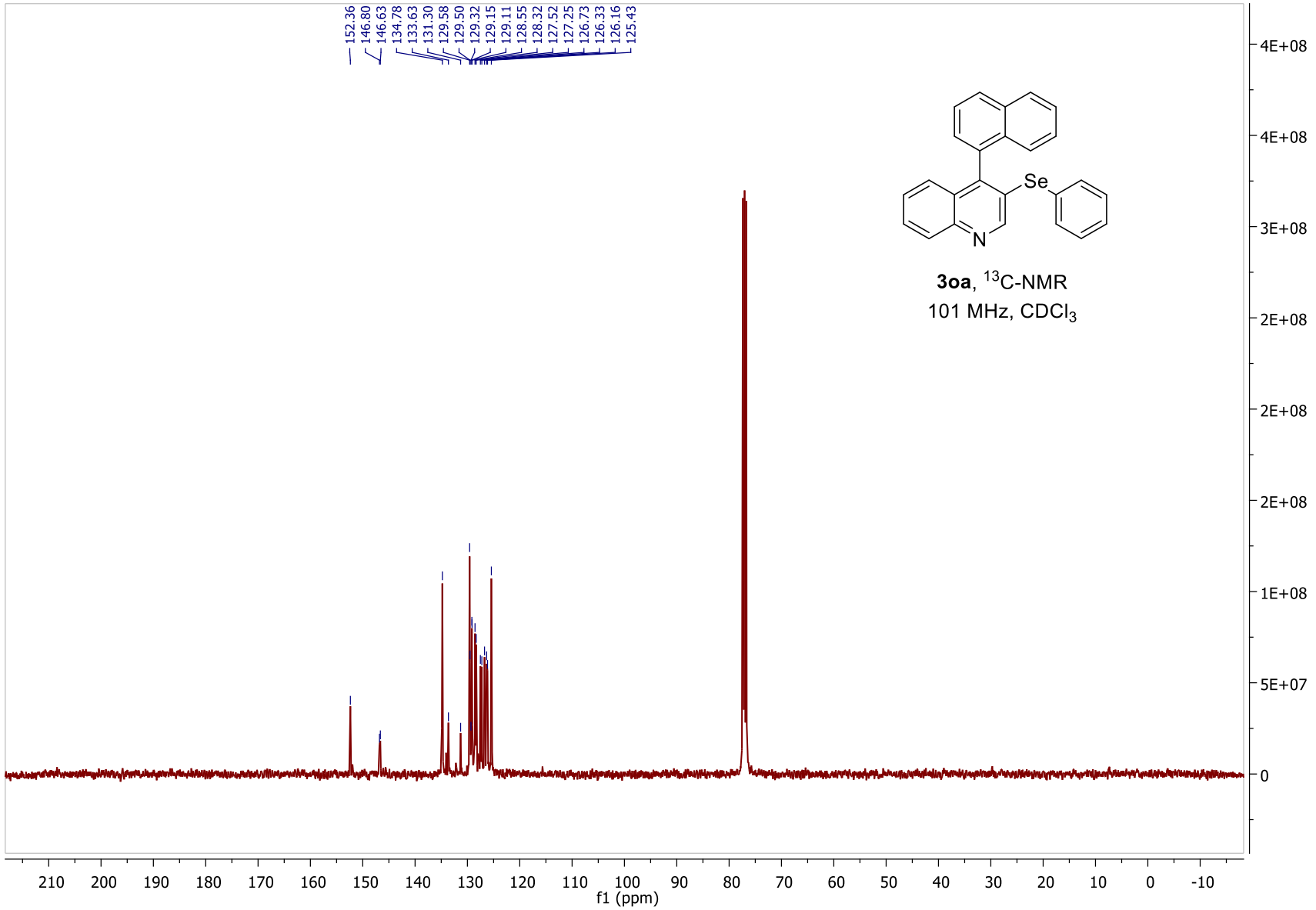
8.14
8.12
8.04
8.02
7.99
7.97
7.68
7.66
7.65
7.64
7.63
7.62
7.61
7.54
7.53
7.52
7.50
7.46
7.44
7.41
7.40
7.39
7.36
7.34
7.32
7.31
7.30
7.29
7.28
7.27
7.24
7.23
7.22
7.21
Se
N
3oa, 1H-NMR
400 MHz, CDCl3
0.90
1.01
2.00
2.01
1.04
2.00
1.01
4.05
3.03
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
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)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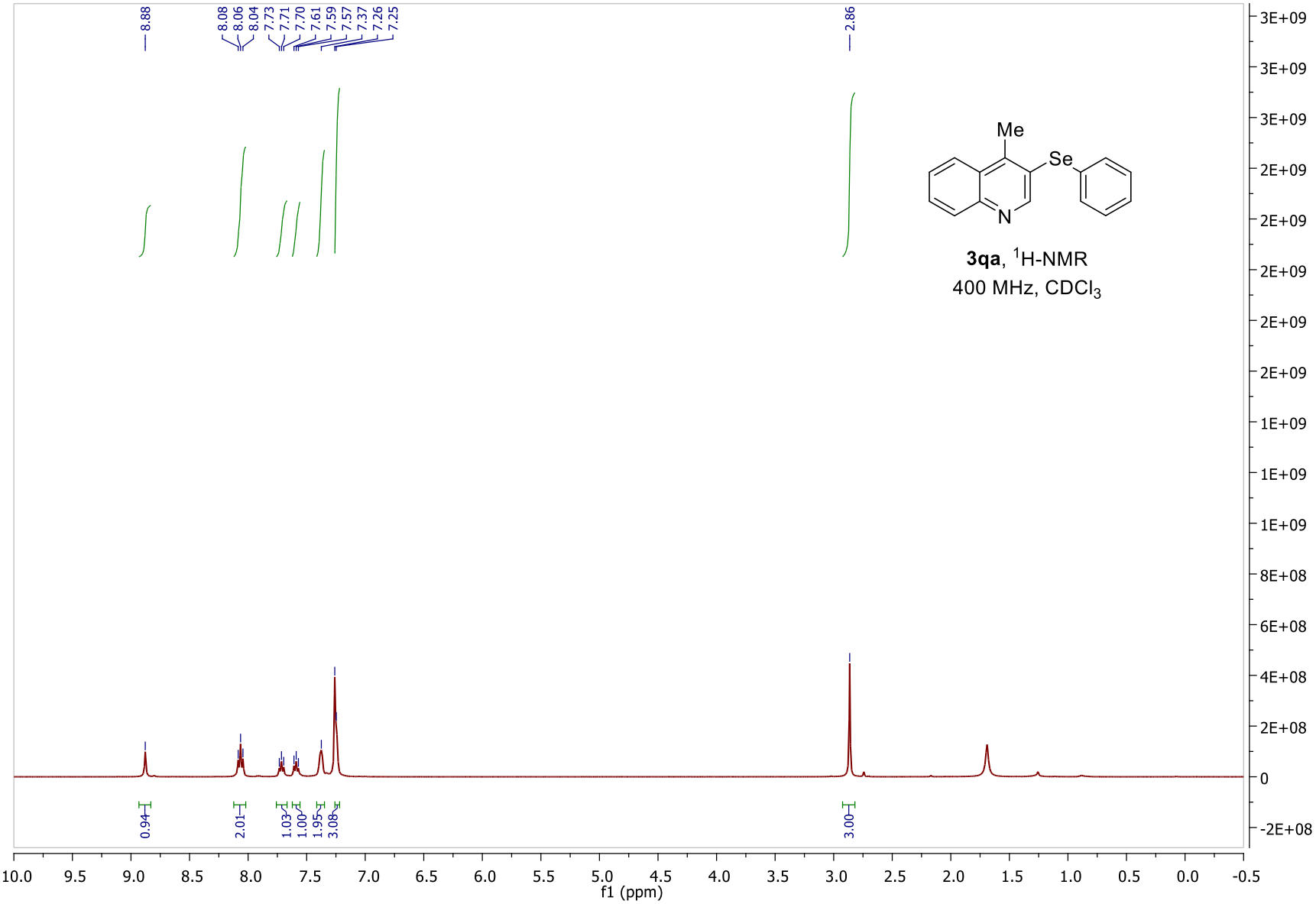
146.80
146.63
134.78
133.63
131.30
129.58
129.50
129.32
129.15
129.11
128.55
128.32
127.52
127.25
126.73
126.33
126.16
125.43
Se
N
3oa, 13C-NMR
101 MHz, CDCl3
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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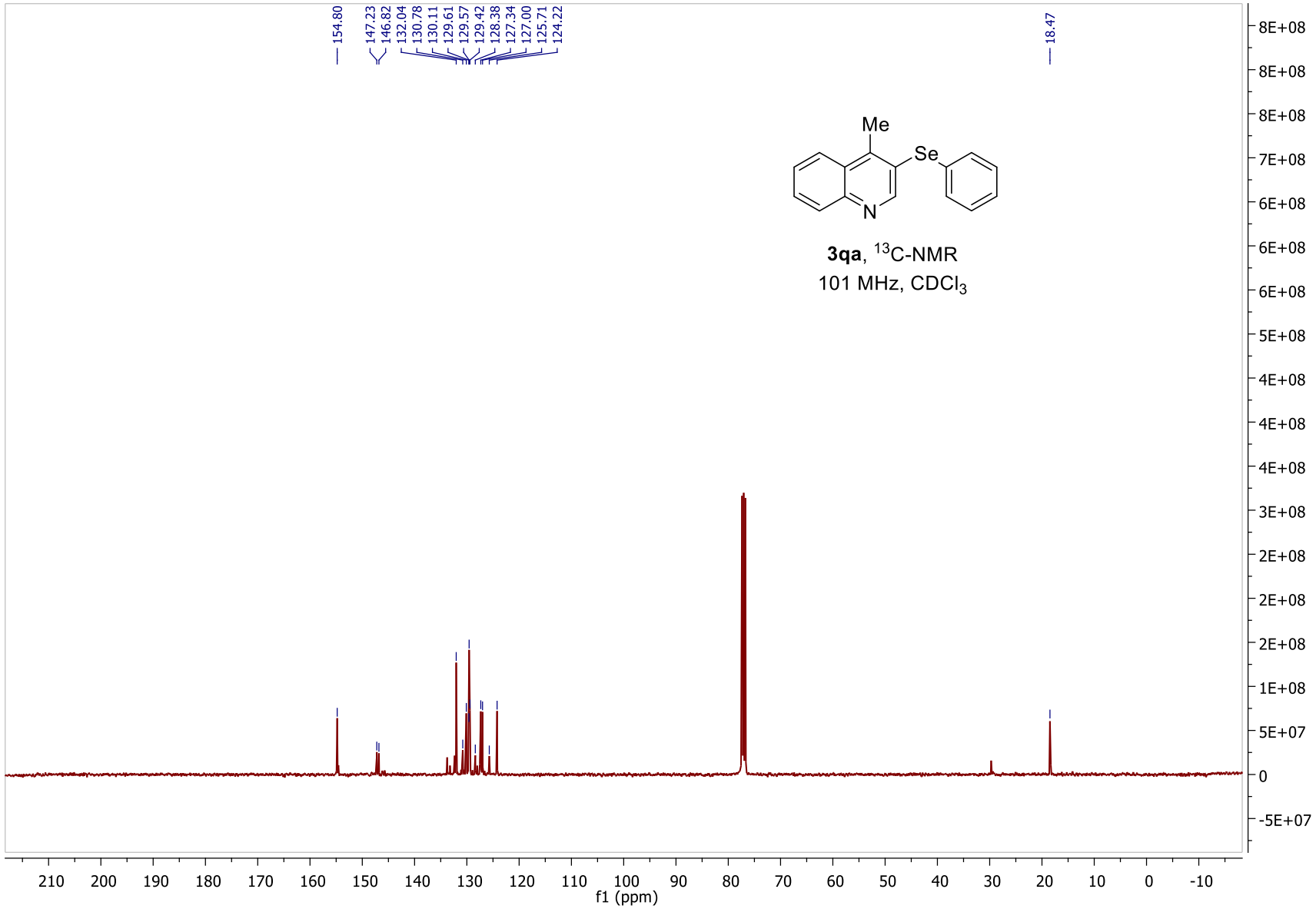
8.08
8.06
8.04
7.73
7.71
7.70
7.61
7.59
7.57
7.37
7.26
7.25
2.86
Me
Se
N
3qa, 1H-NMR
400 MHz, CDCl3
0.94
2.01
1.03
1.00
1.95
3.08
3.00
f1 (ppm)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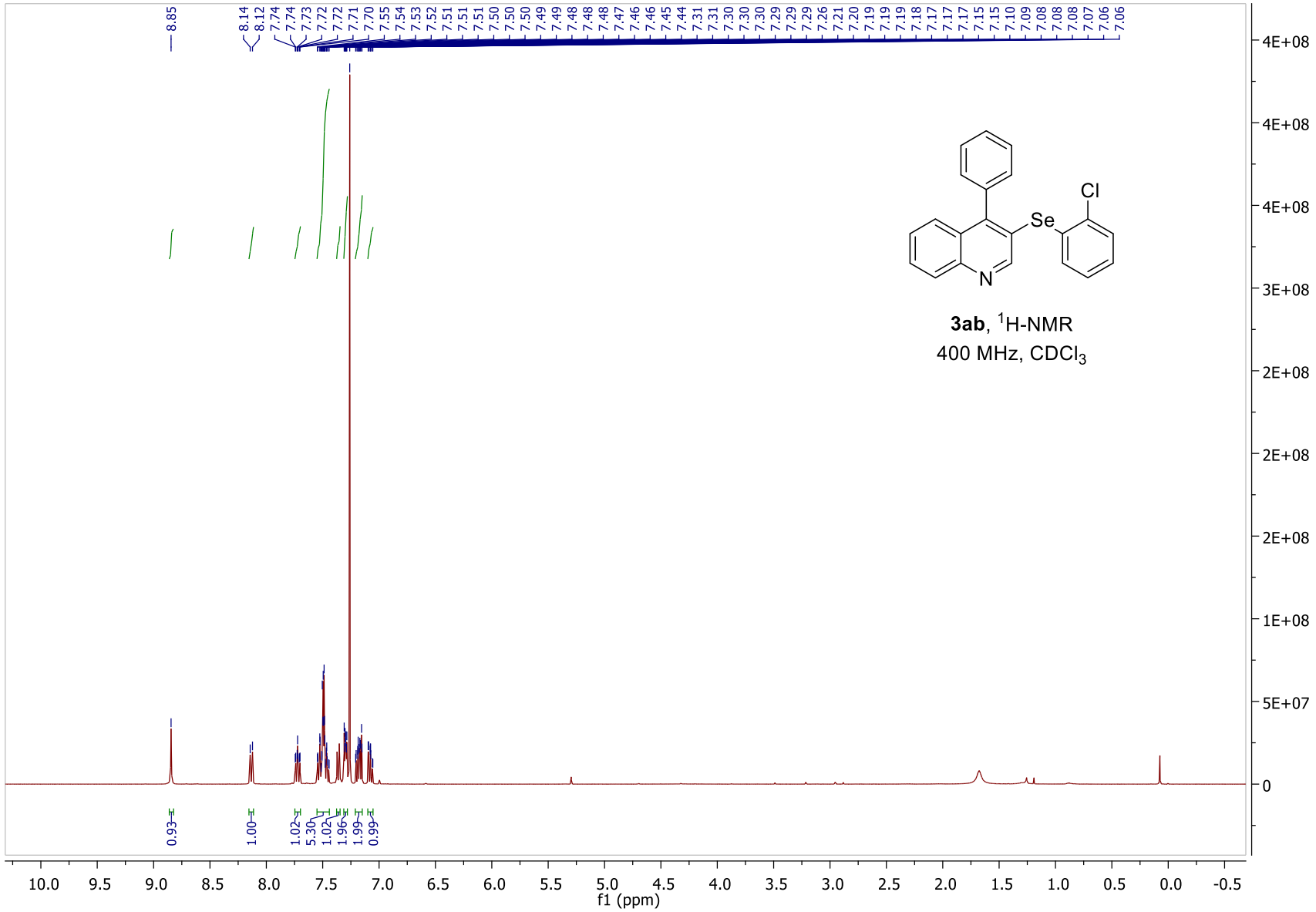
147.23
146.82
132.04
130.78
130.11
129.61
129.57
129.42
128.38
127.34
127.00
125.71
124.22
18.47
Me
Se
N
3qa, 13C-NMR
101 MHz, CDCl3
8E+08
8E+08
8E+08
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.53
7.52
7.51
7.51
7.51
7.50
7.50
7.50
7.49
7.49
7.48
7.48
7.48
7.47
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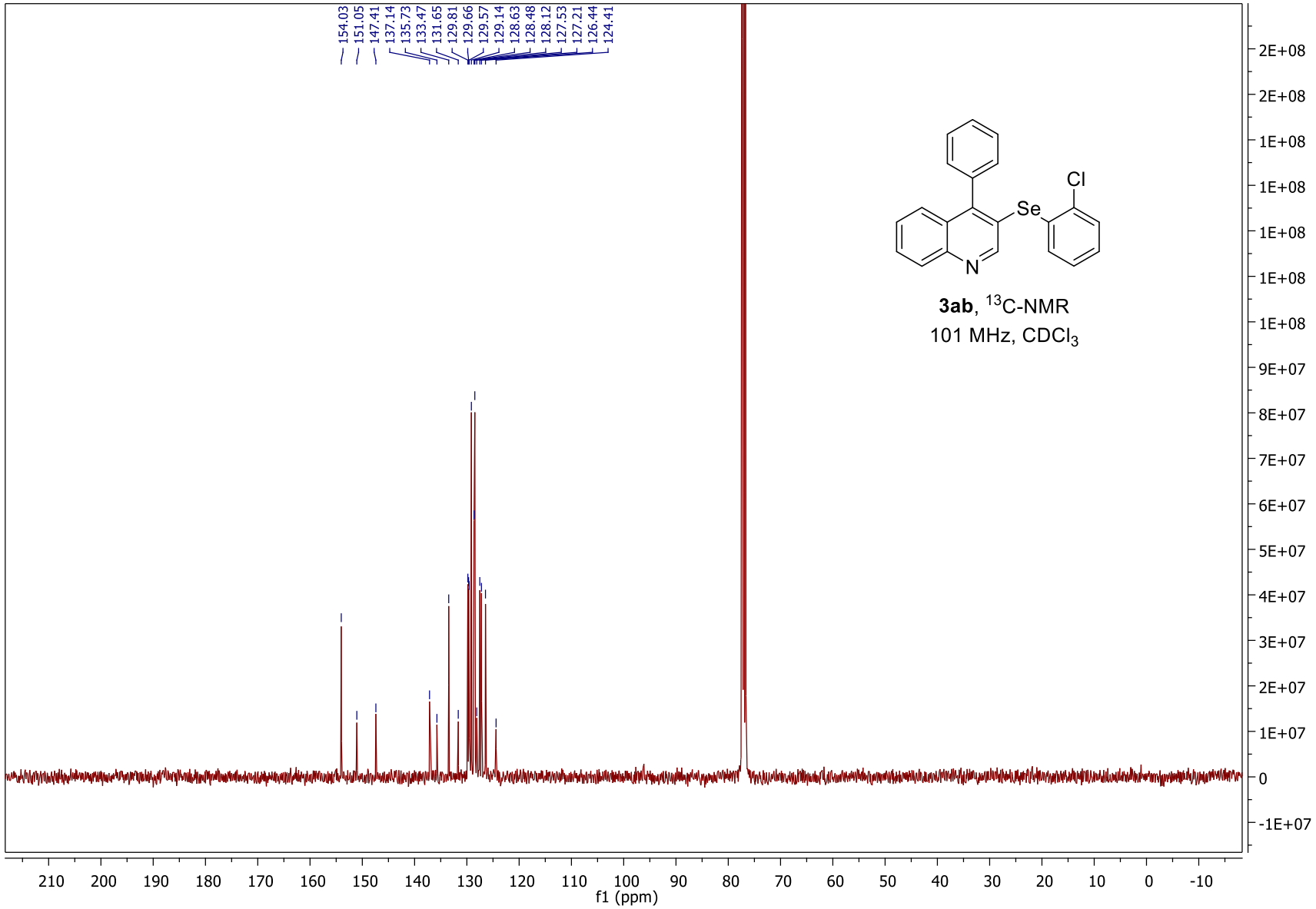
7.45
7.44
7.31
7.31
7.30
7.30
7.30
7.29
7.29
7.29
7.26
7.21
7.20
7.19
7.19
7.19
7.18
7.17
7.17
7.17
7.15
7.15
7.10
7.09
7.08
7.08
7.08
7.07
7.06
7.06
Cl
Se
N
3ab, 1H-NMR
400 MHz, CDCl3
0.93
1.00
1.02
5.30
1.02
1.96
1.99
0.99
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
10.0
9.5
9.0
8.5
8.0
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)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151.05
147.41
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135.73
133.47
131.65
129.81
129.66
129.57
129.14
128.63
128.48
128.12
127.53
127.21
126.44
124.41
Cl
Se
N
3ab, 13C-NMR
101 MHz, CDCl3
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
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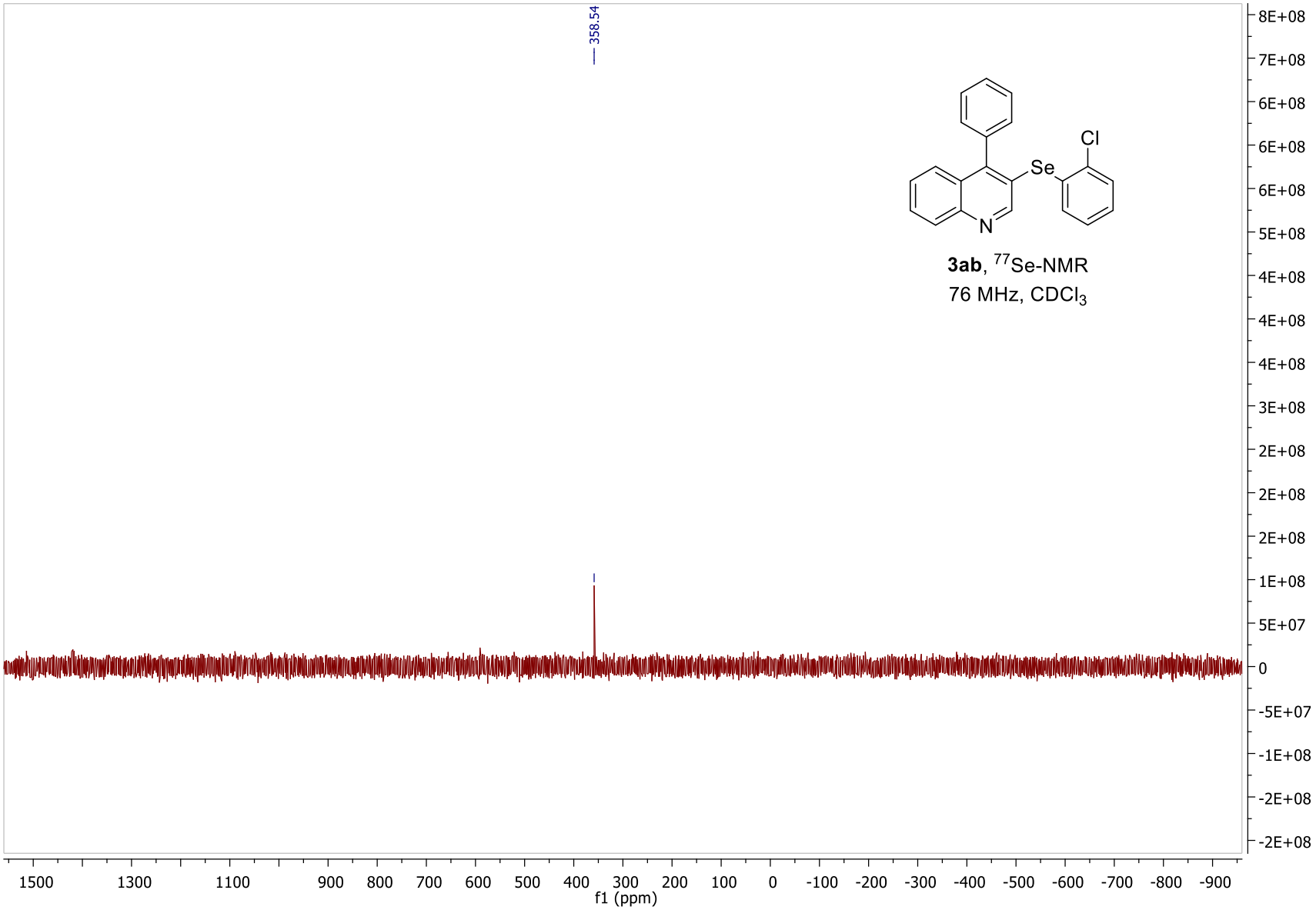
f1 (ppm)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Se
N
3ab, 77Se-NMR
76 MHz, CDCl3
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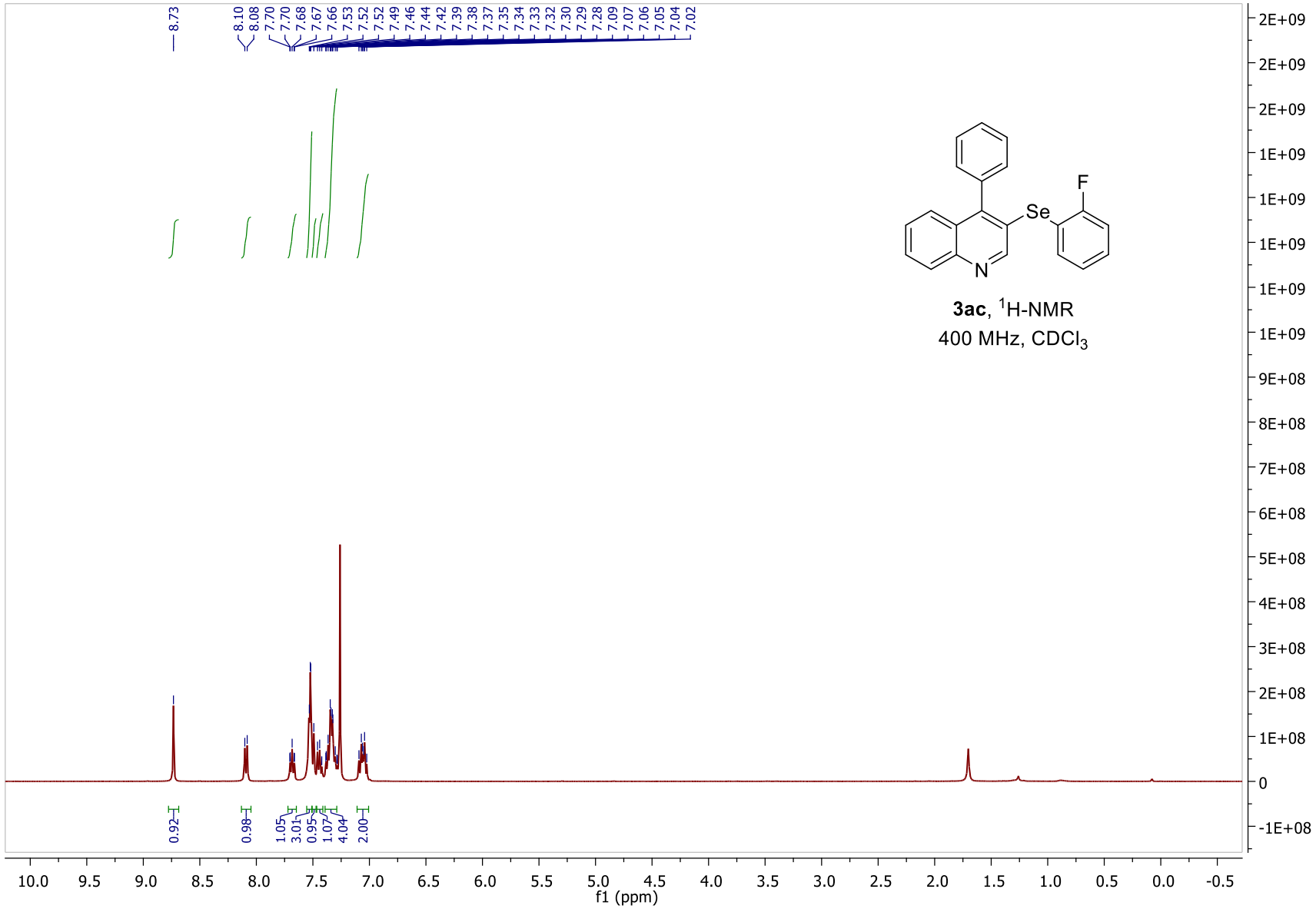
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
-1E+08
-2E+08
-2E+08
1500
1300
1100
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
f1 (ppm)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7.70
7.70
7.68
7.67
7.66
7.53
7.52
7.52
7.49
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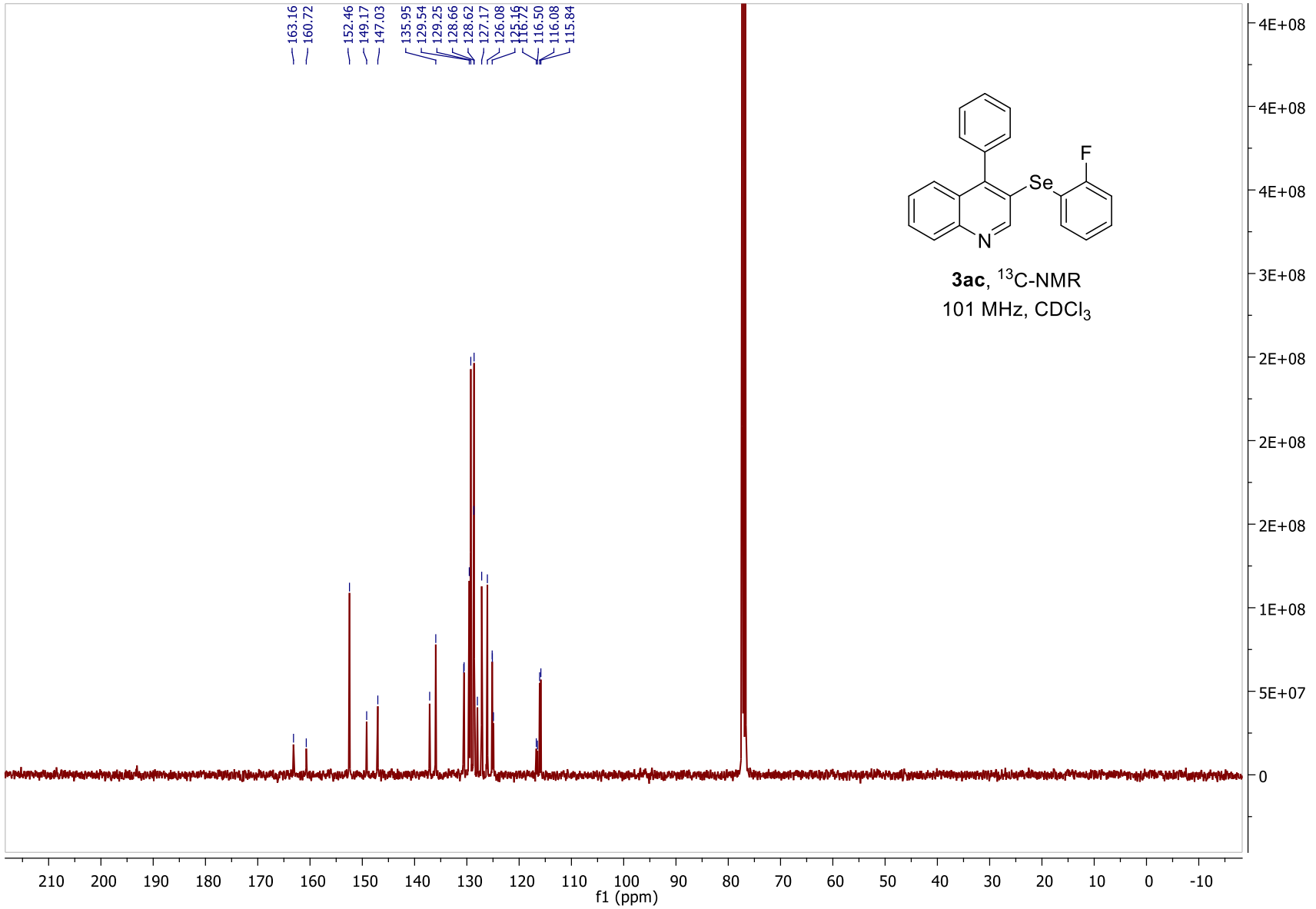
7.44
7.42
7.39
7.38
7.37
7.35
7.34
7.33
7.32
7.30
7.29
7.28
7.09
7.07
7.06
7.05
7.04
7.02
F
Se
N
3ac, 1H-NMR
400 MHz, CDCl3
0.92
0.98
1.05
3.01
0.95
1.07
4.04
2.00
f1 (ppm)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147.03
135.95
129.54
129.25
128.66
128.62
127.17
126.08
125.16
116.72
116.50
116.08
115.84
F
Se
N
3ac, 13C-NMR
101 MHz, CDCl3
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
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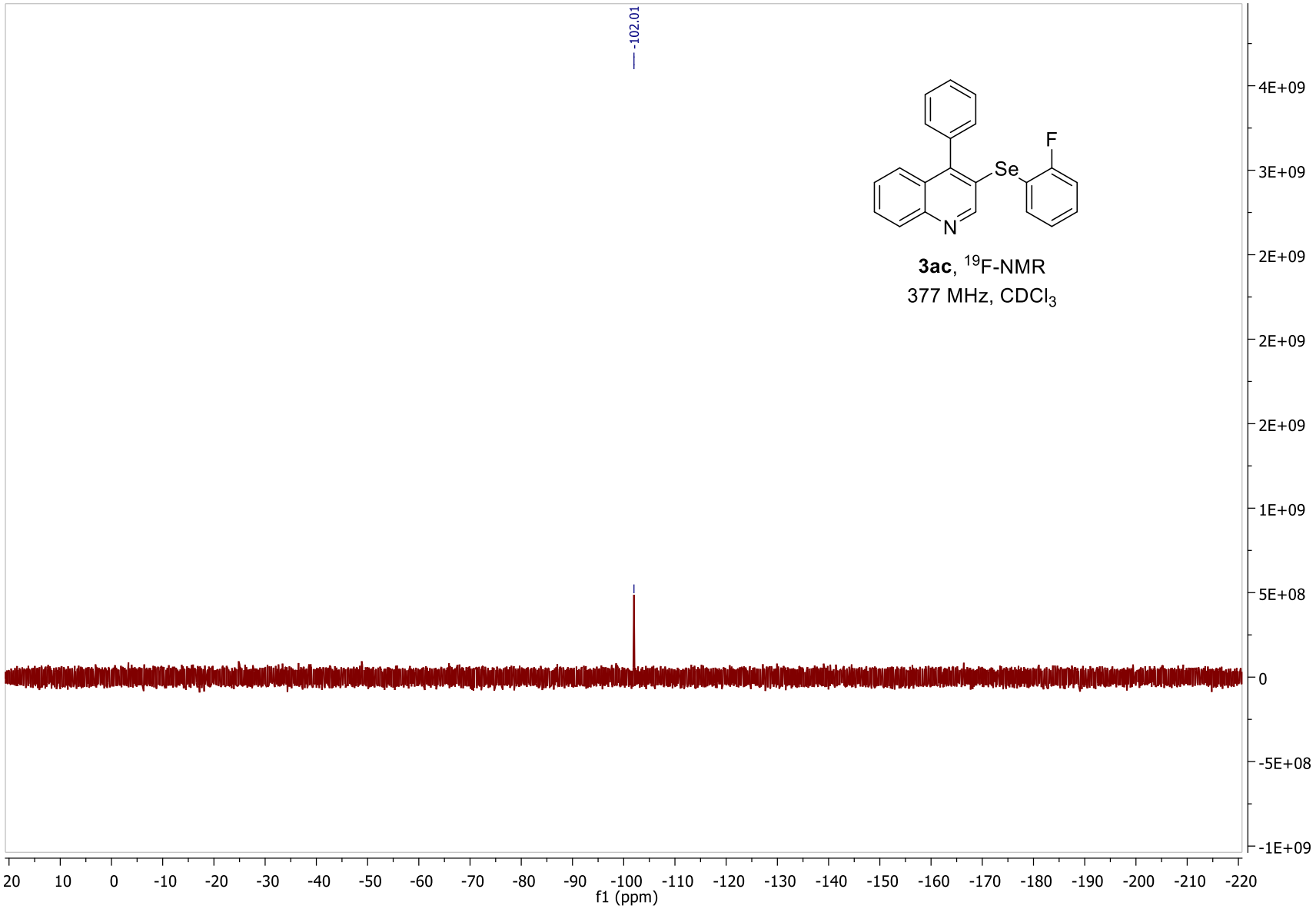
f1 (ppm)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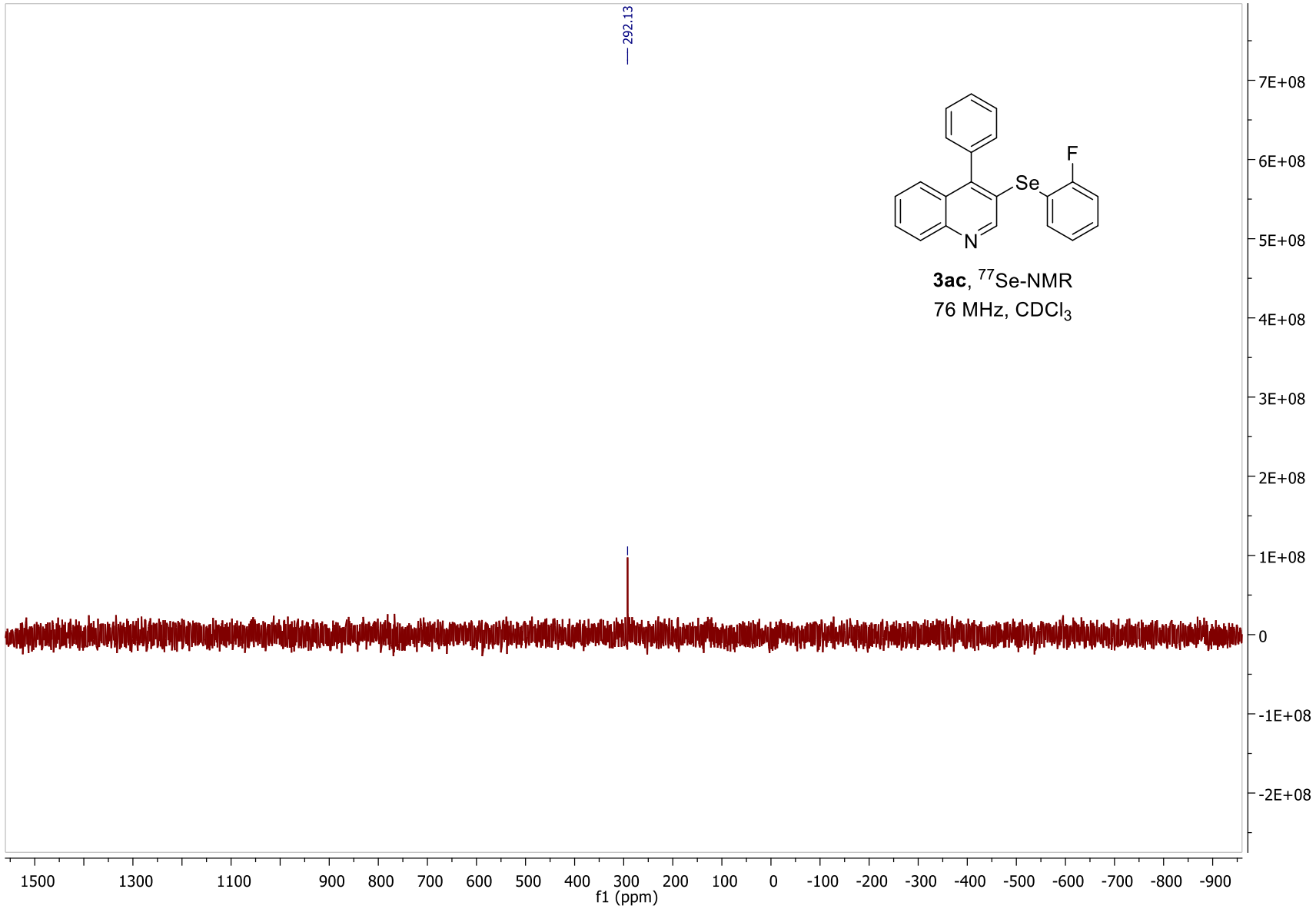
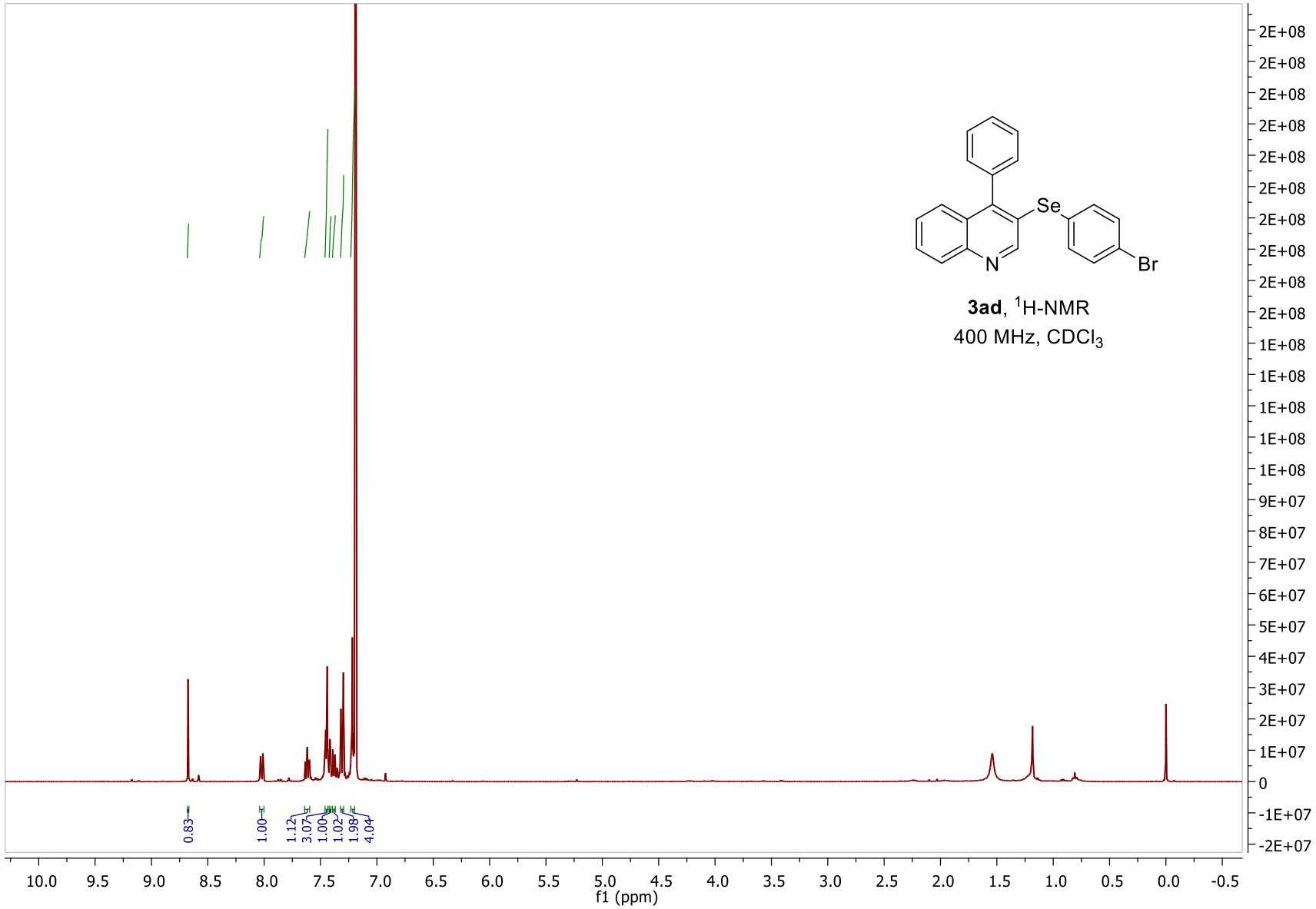
Se
N
3ac, 19F-NMR
377 MHz, CDCl3
4E+09
3E+09
2E+09
2E+09
2E+09
1E+09
5E+08
0
-5E+08
-1E+09
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)


292.13
F
Se
N
3ac, ^{77}Se-NMR
76 MHz, $CDCl_3$
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
-2E+08
1500 1300 1100 900 800 700 600 500 400 300 200 100 0 -100 -200 -300 -400 -500 -600 -700 -800 -900
f1 (ppm)


Se
N
Br
3ad, 1H-NMR
400 MHz, CDCl3
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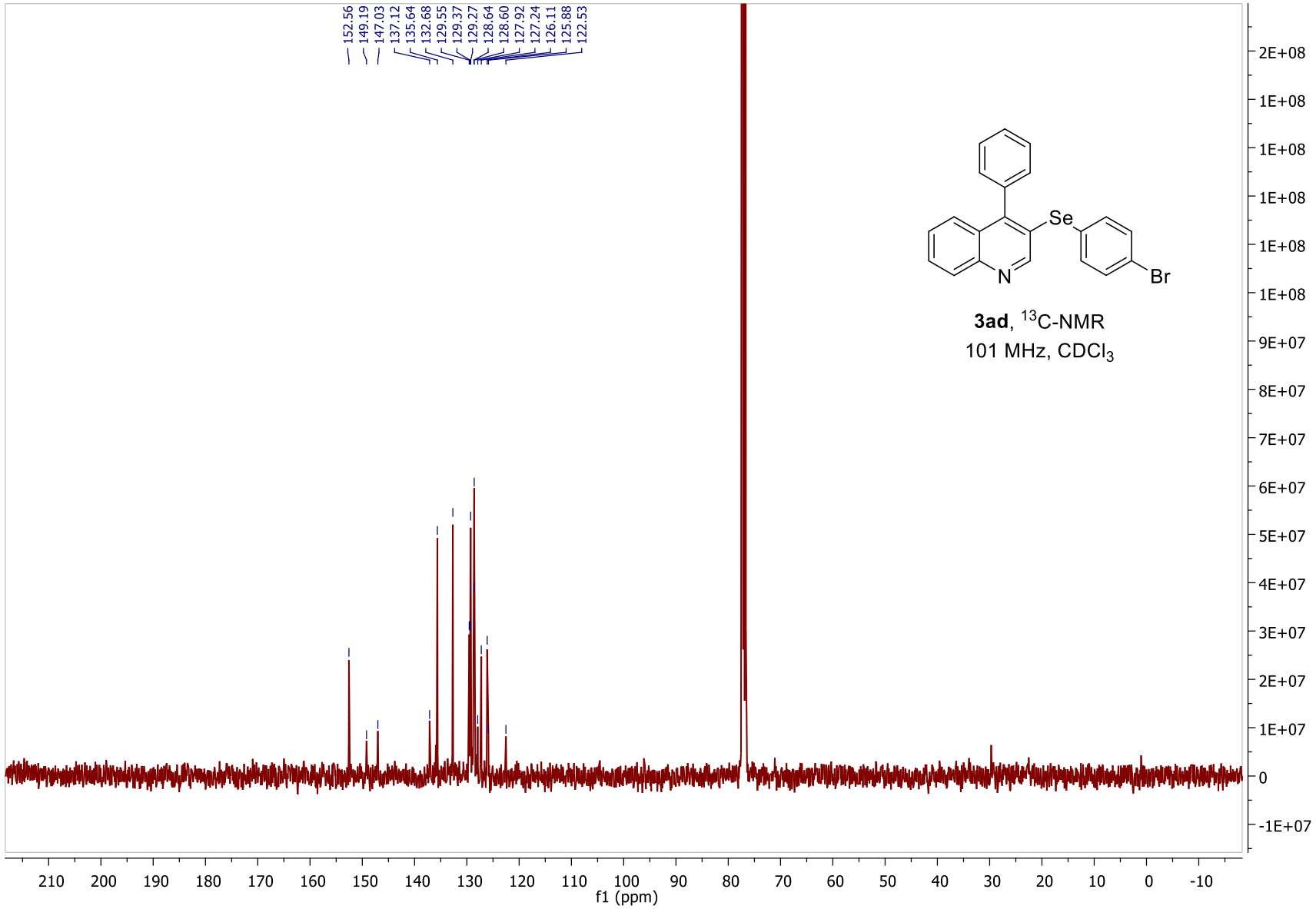
1.00
1.12
3.07
1.00
1.02
1.98
4.04
f1 (ppm)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149.19
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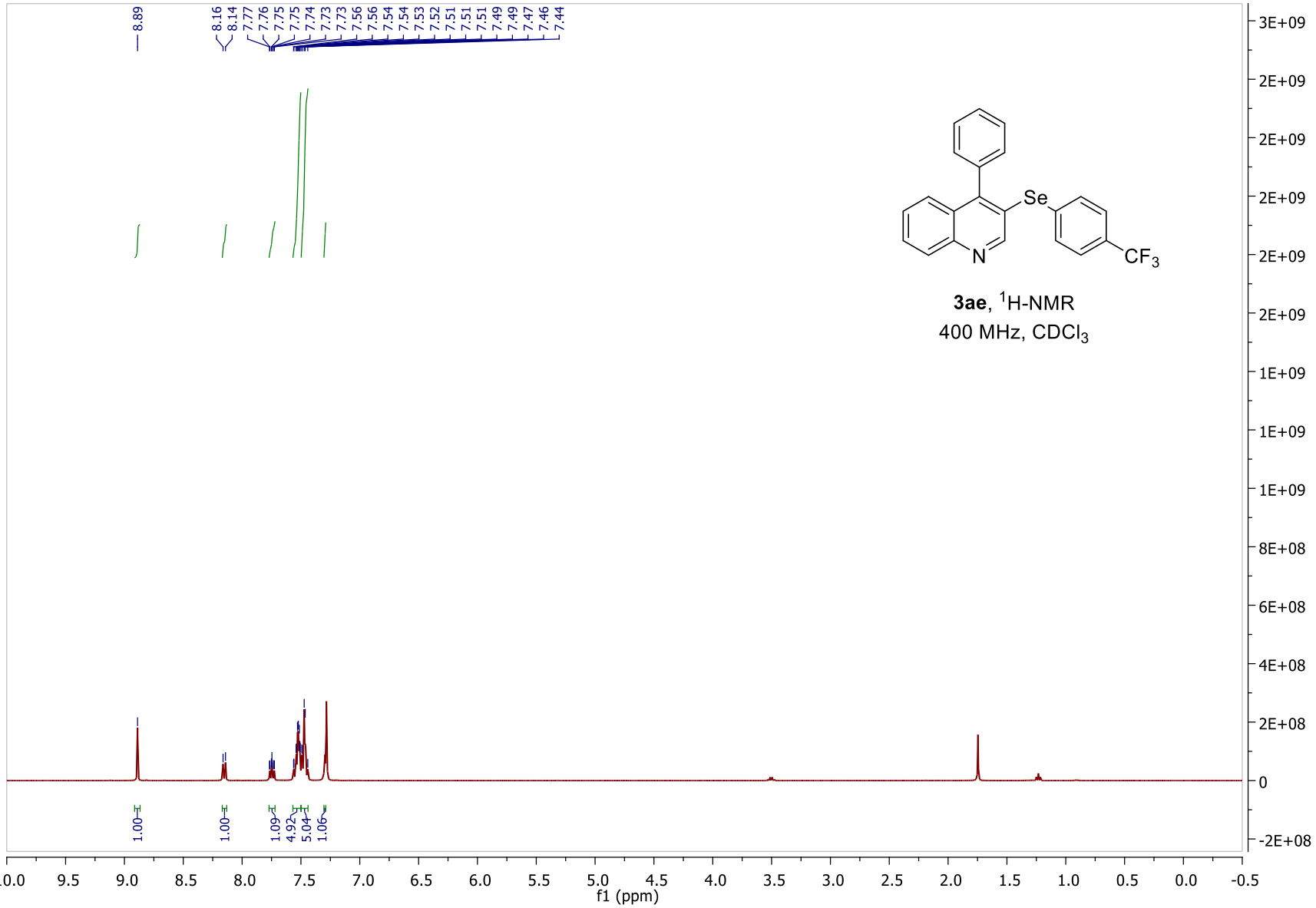
137.12
135.64
132.68
129.55
129.37
129.27
128.64
128.60
127.92
127.24
126.11
125.88
122.53
Se
N
Br
3ad, 13C-NMR
101 MHz, CDCl3
2E+08
1E+08
1E+08
1E+08
1E+08
1E+08
9E+07
8E+07
7E+07
6E+07
5E+07
4E+07
3E+07
2E+07
1E+07
0
-1E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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8.16
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7.76
7.75
7.75
7.74
7.73
7.73
7.56
7.56
7.54
7.54
7.53
7.52
7.51
7.51
7.51
7.49
7.49
7.47
7.46
7.44
Se
N
CF3
3ae, 1H-NMR
400 MHz, CDCl3
1.00
1.00
1.09
4.92
5.04
1.06
3E+09
2E+09
2E+09
2E+09
2E+09
2E+09
1E+09
1E+09
1E+09
8E+08
6E+08
4E+08
2E+08
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-2E+08
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9.0
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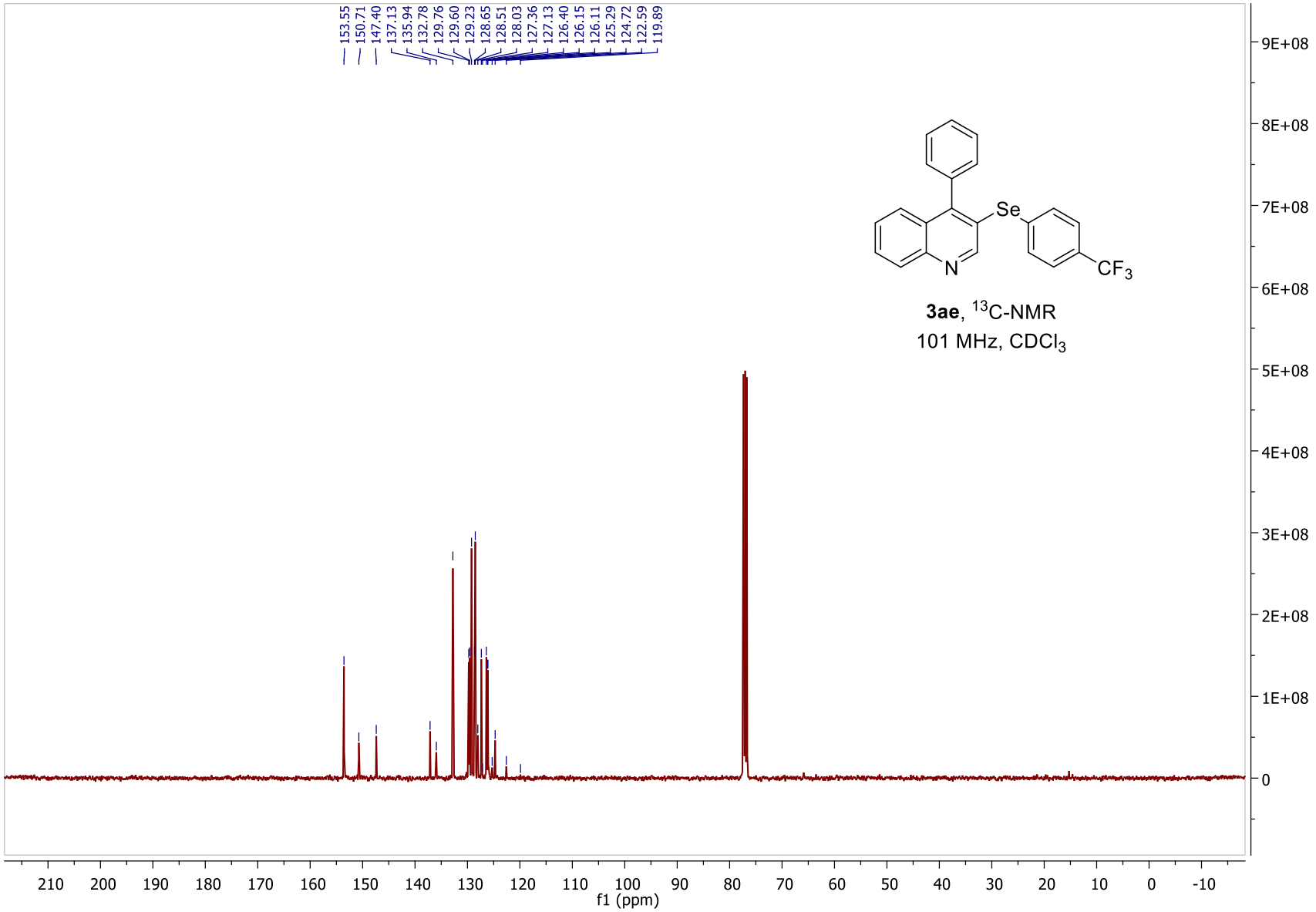
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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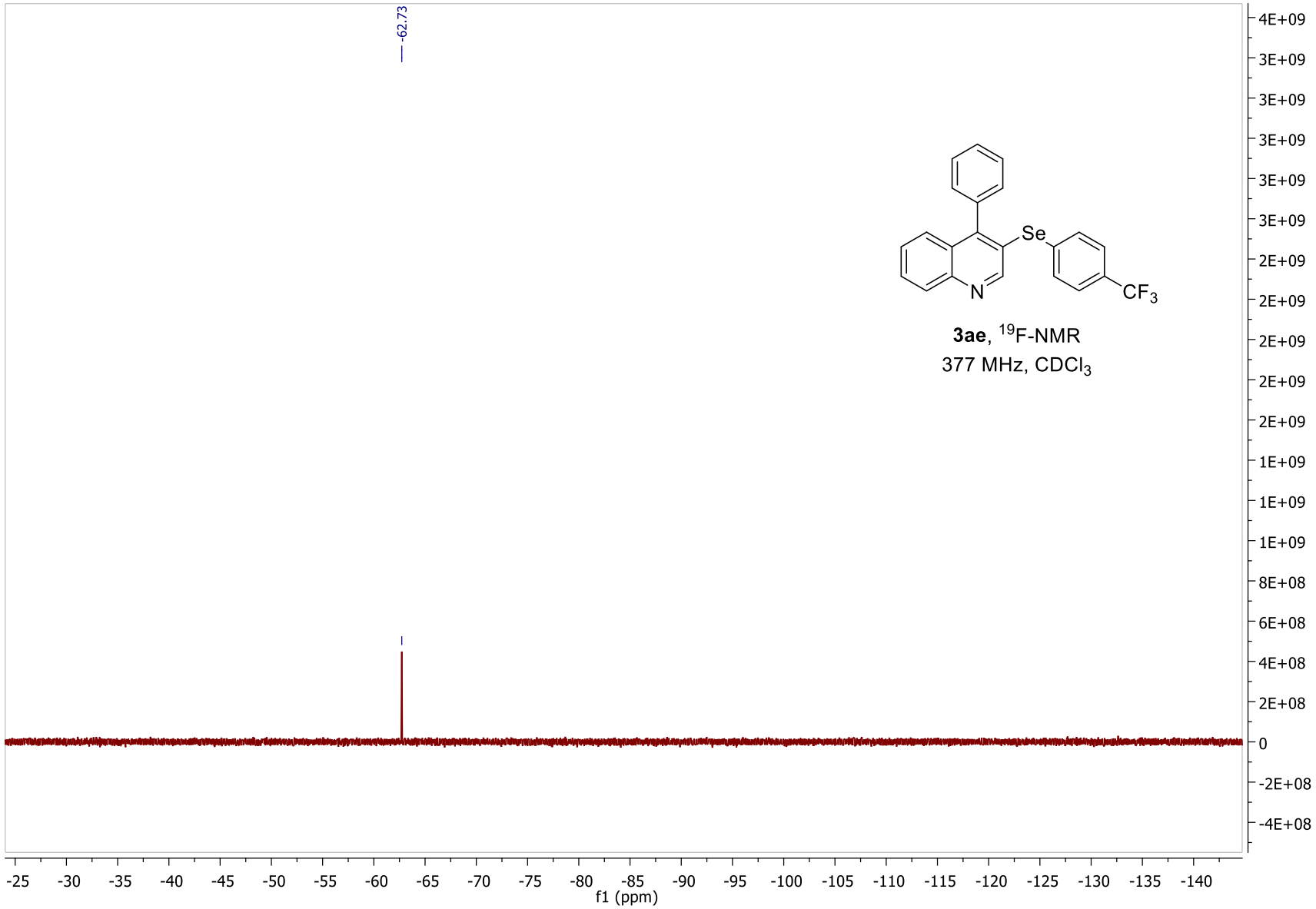
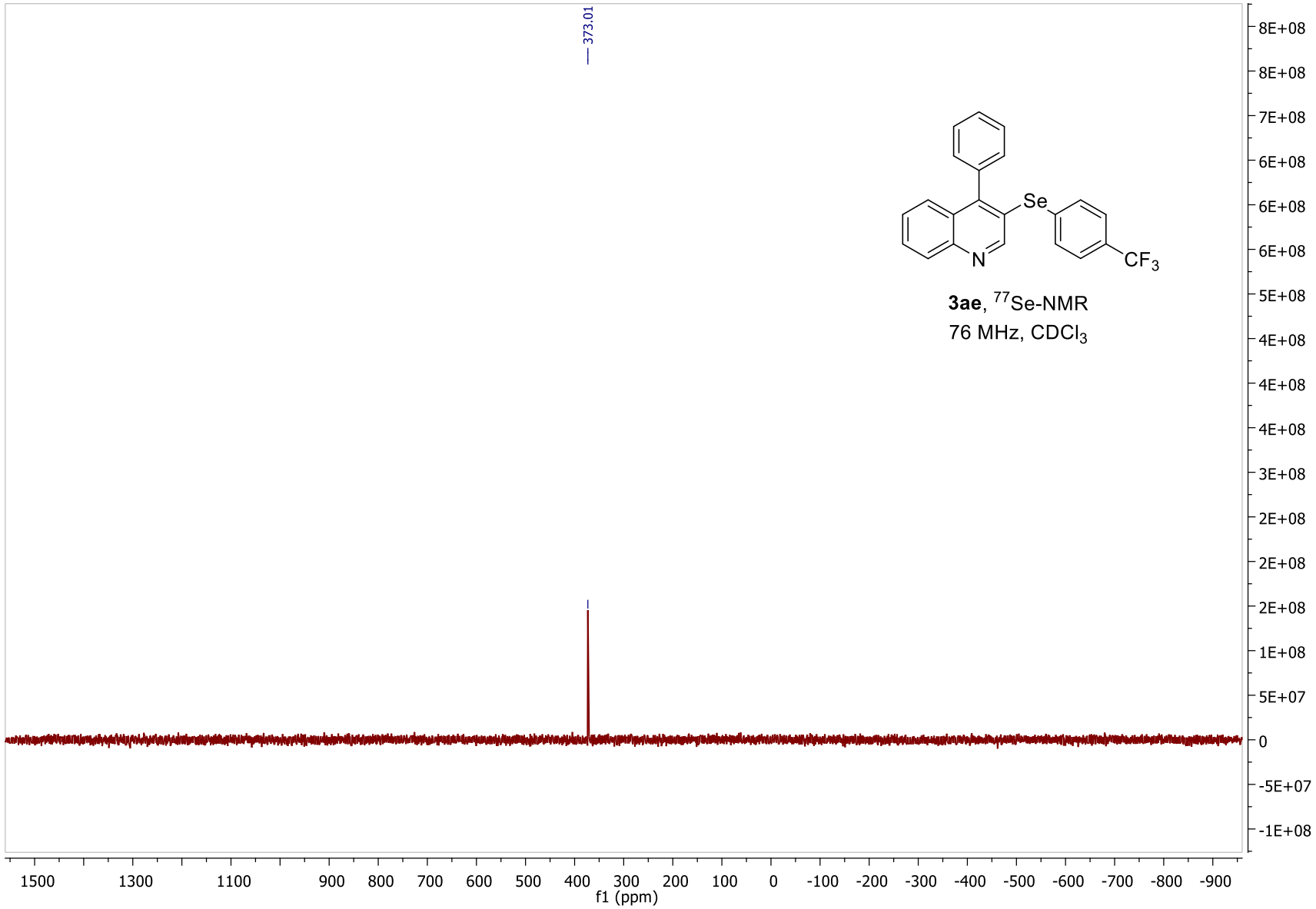
150.71
147.40
137.13
135.94
132.78
129.76
129.60
129.23
128.65
128.51
128.03
127.36
127.13
126.40
126.15
126.11
125.29
124.72
122.59
119.89
Se
N
CF3
3ae, 13C-NMR
101 MHz, CDCl3
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


-62.73
Se
N
CF3
3ae, 19F-NMR
377 MHz, CDCl3
4E+09
3E+09
3E+09
3E+09
3E+09
3E+09
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
-4E+08
-25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90 -95 -100 -105 -110 -115 -120 -125 -130 -135 -140
f1 (ppm)


373.01
Se
N
CF3
3ae, 77Se-NMR
76 MHz, CDCl3
8E+08
8E+08
7E+08
6E+08
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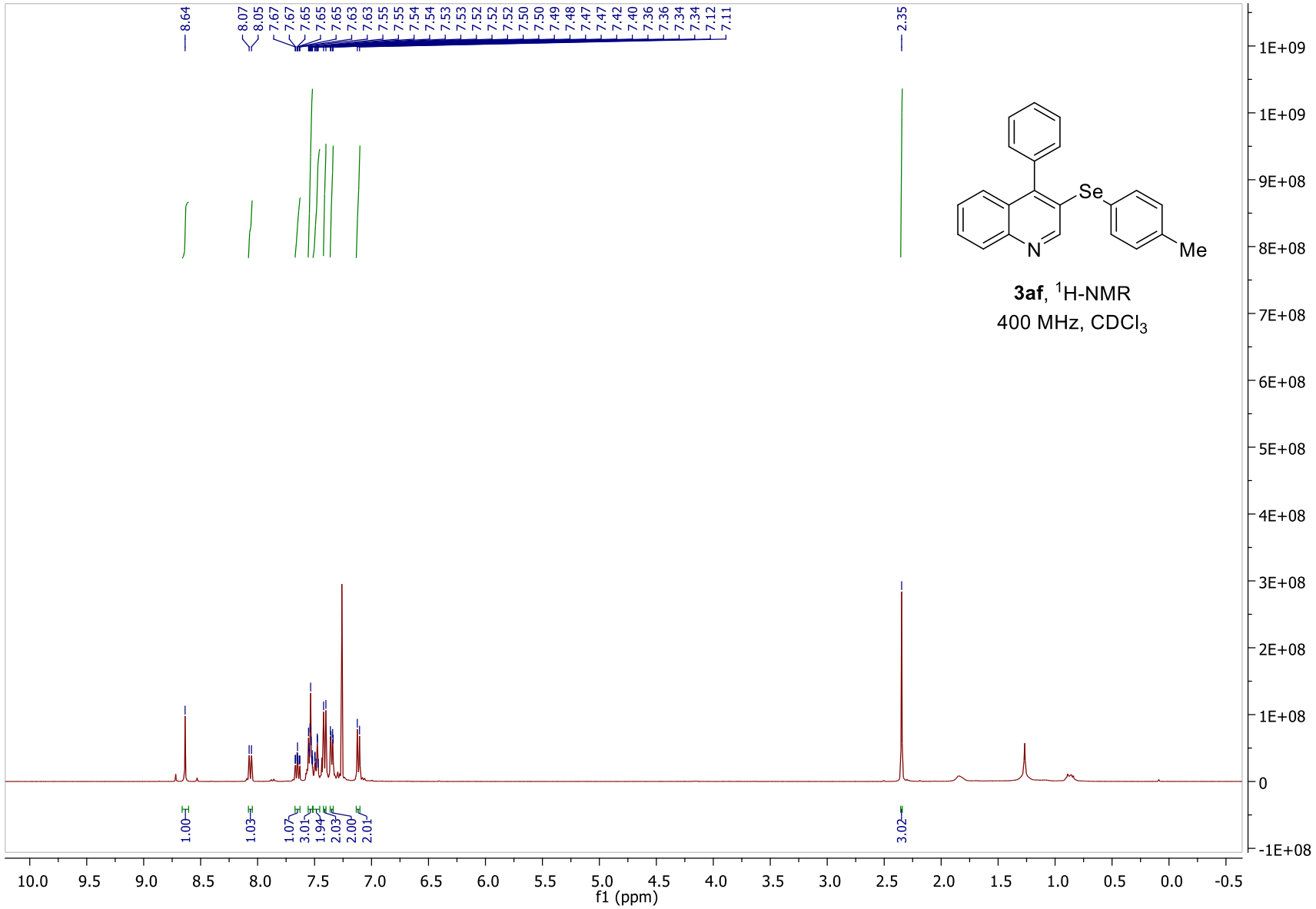
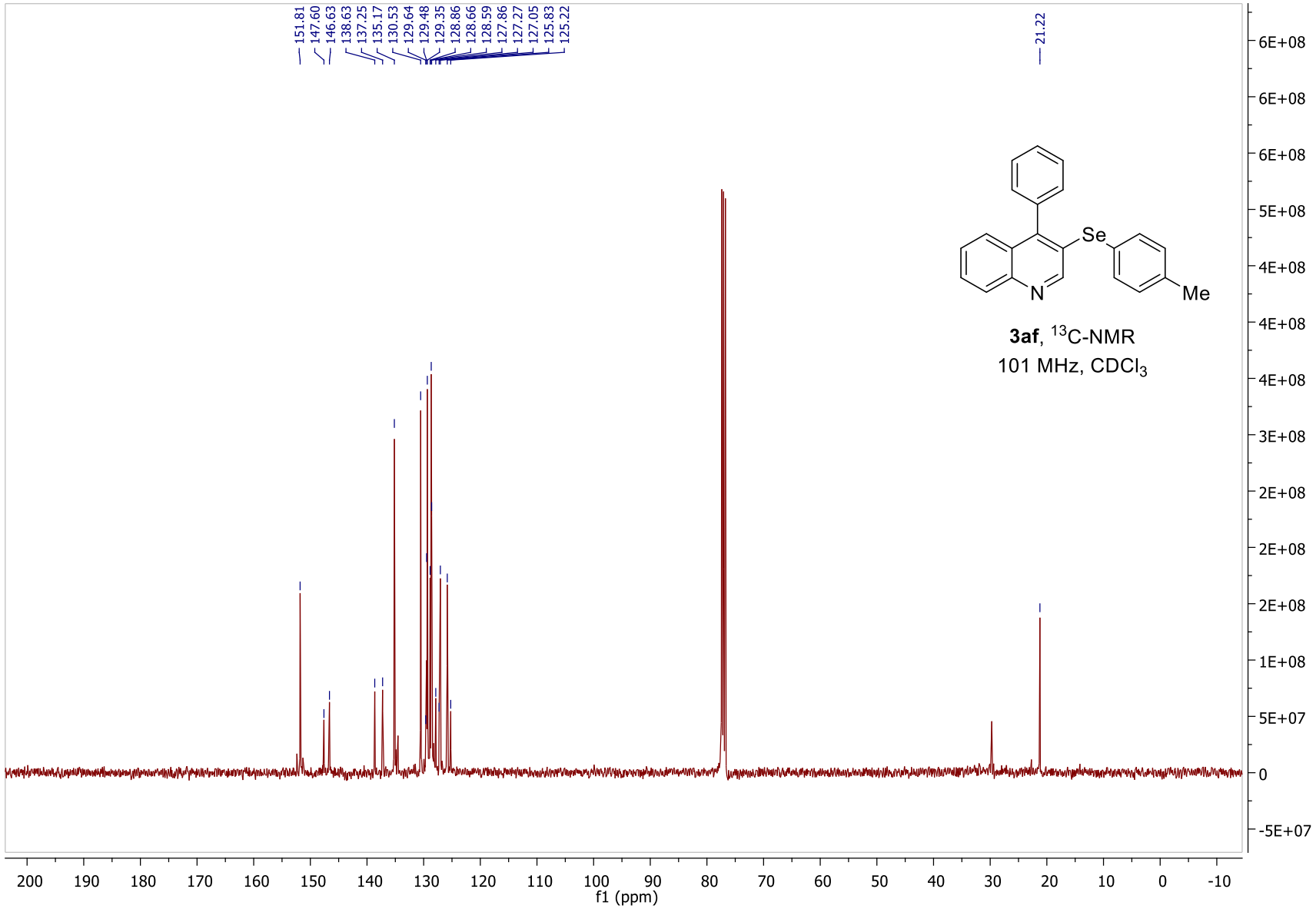
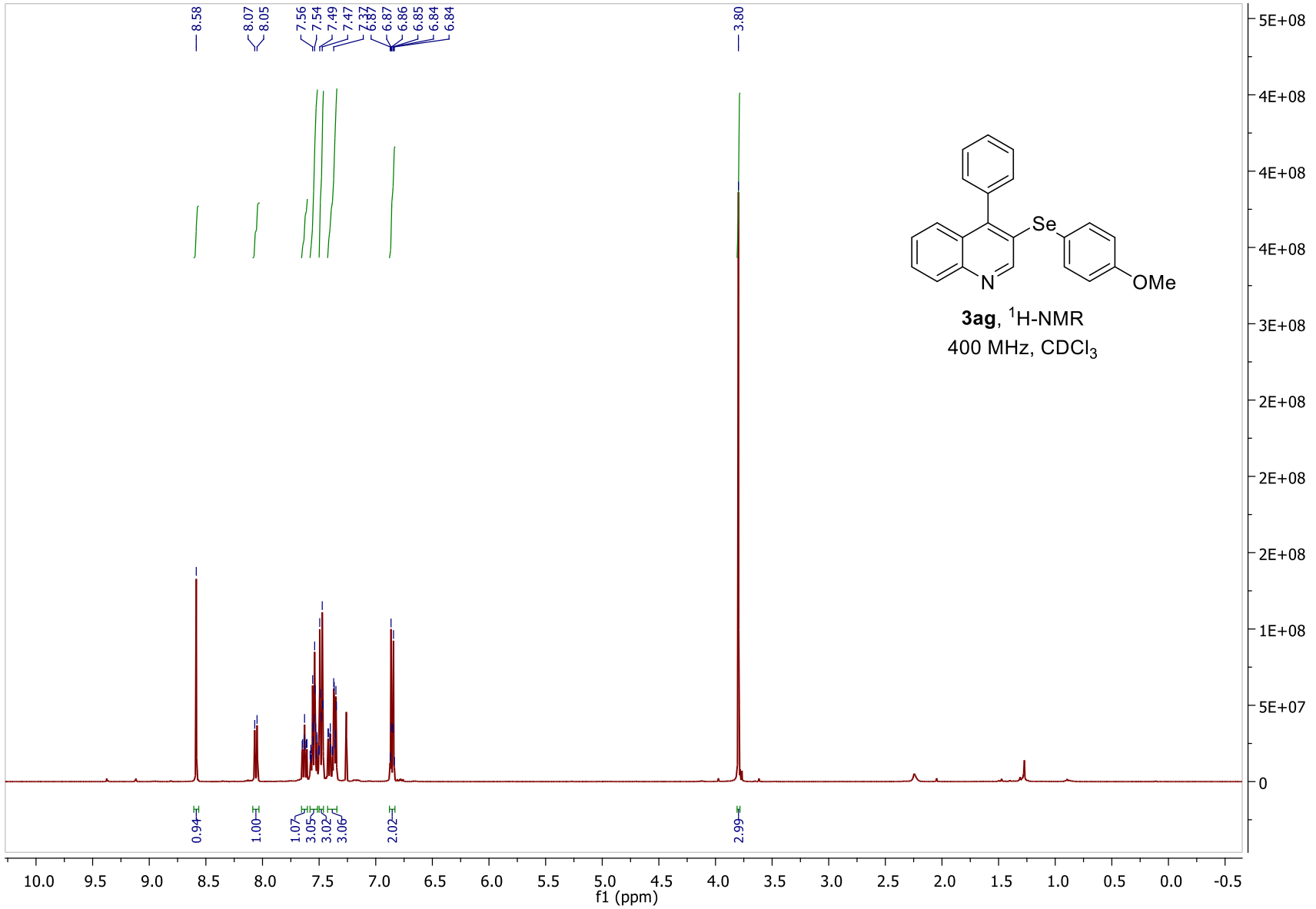
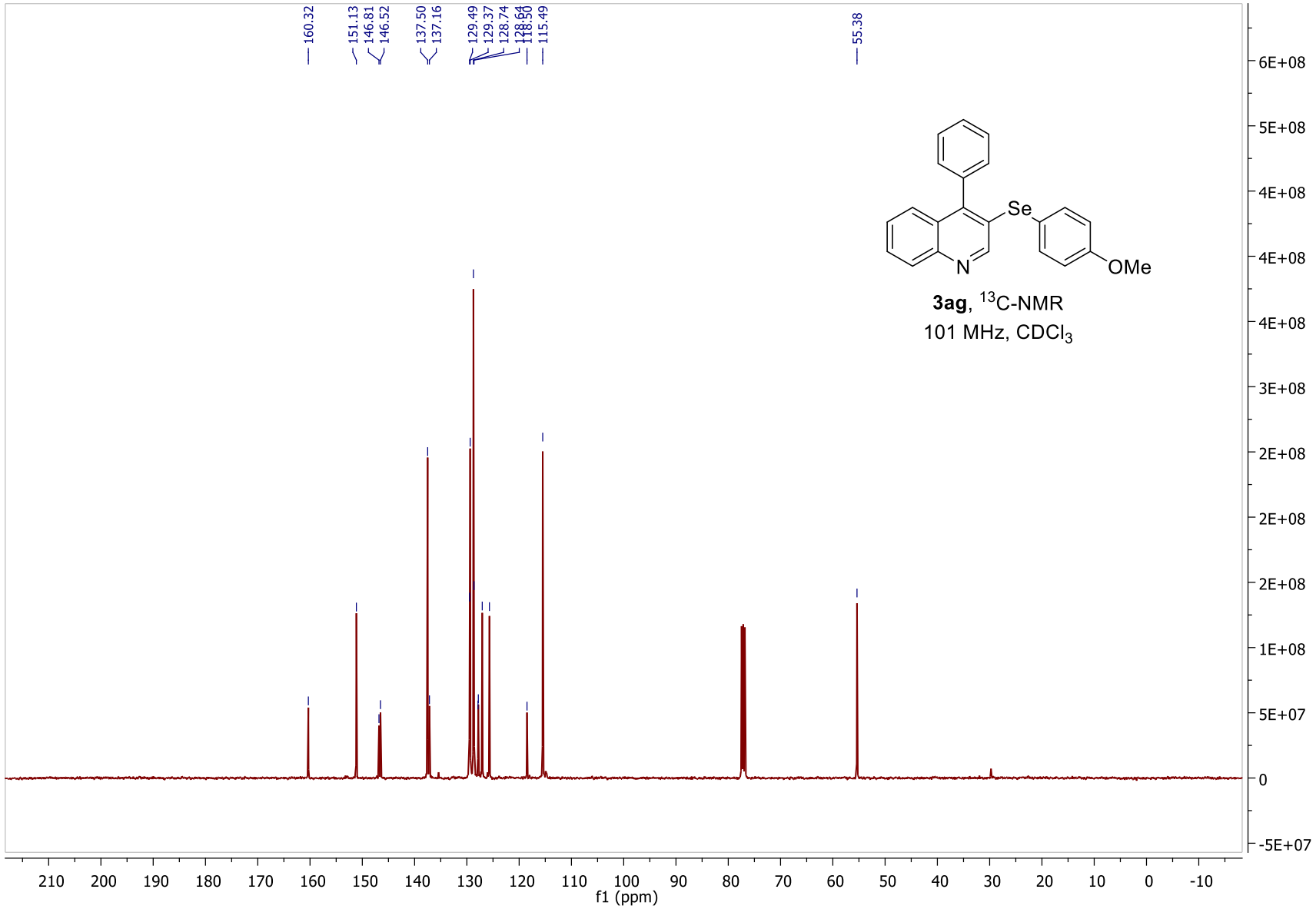
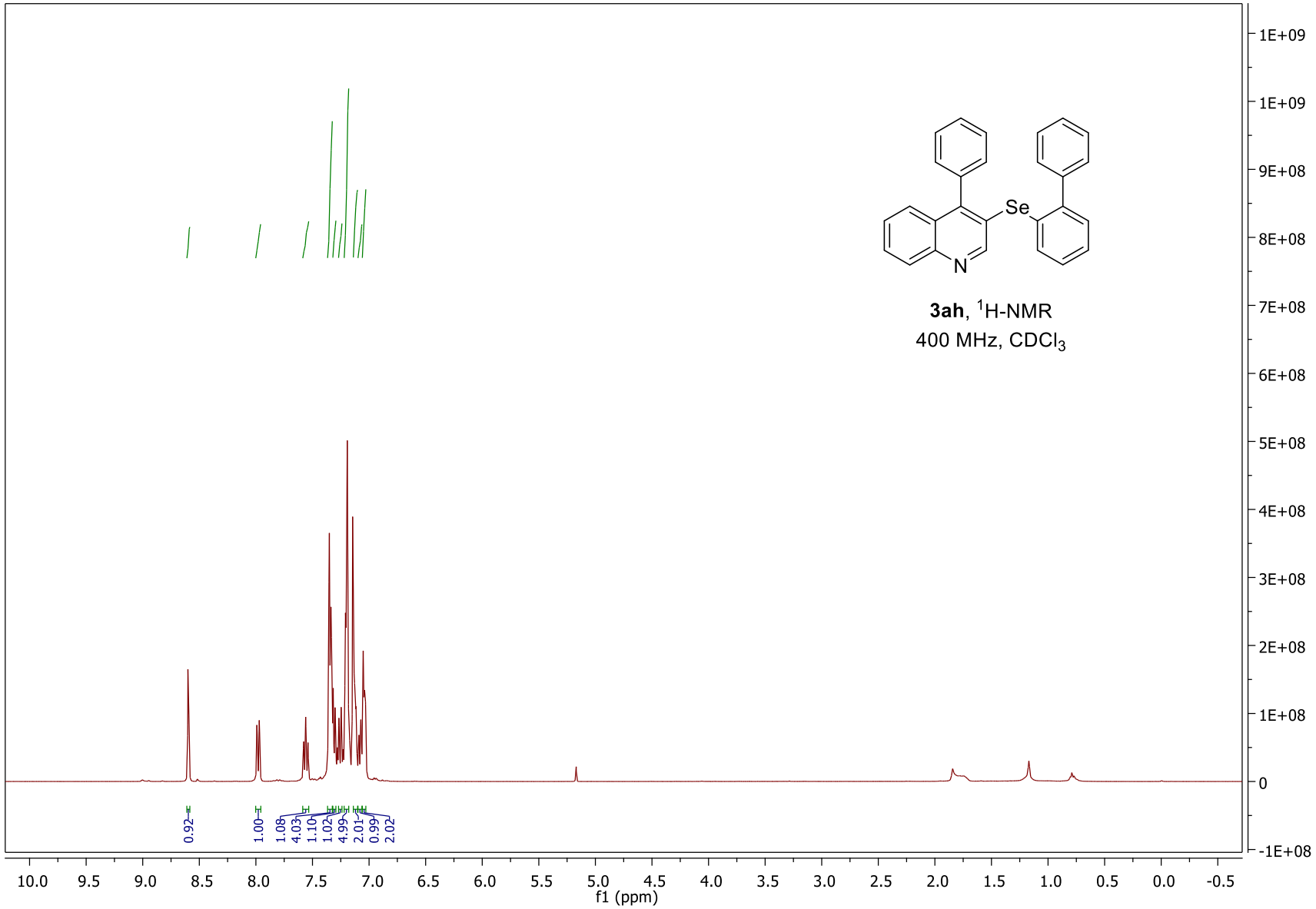
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
-1E+08
1500 1300 1100 900 800 700 600 500 400 300 200 100 0 -100 -200 -300 -400 -500 -600 -700 -800 -900
f1 (ppm)

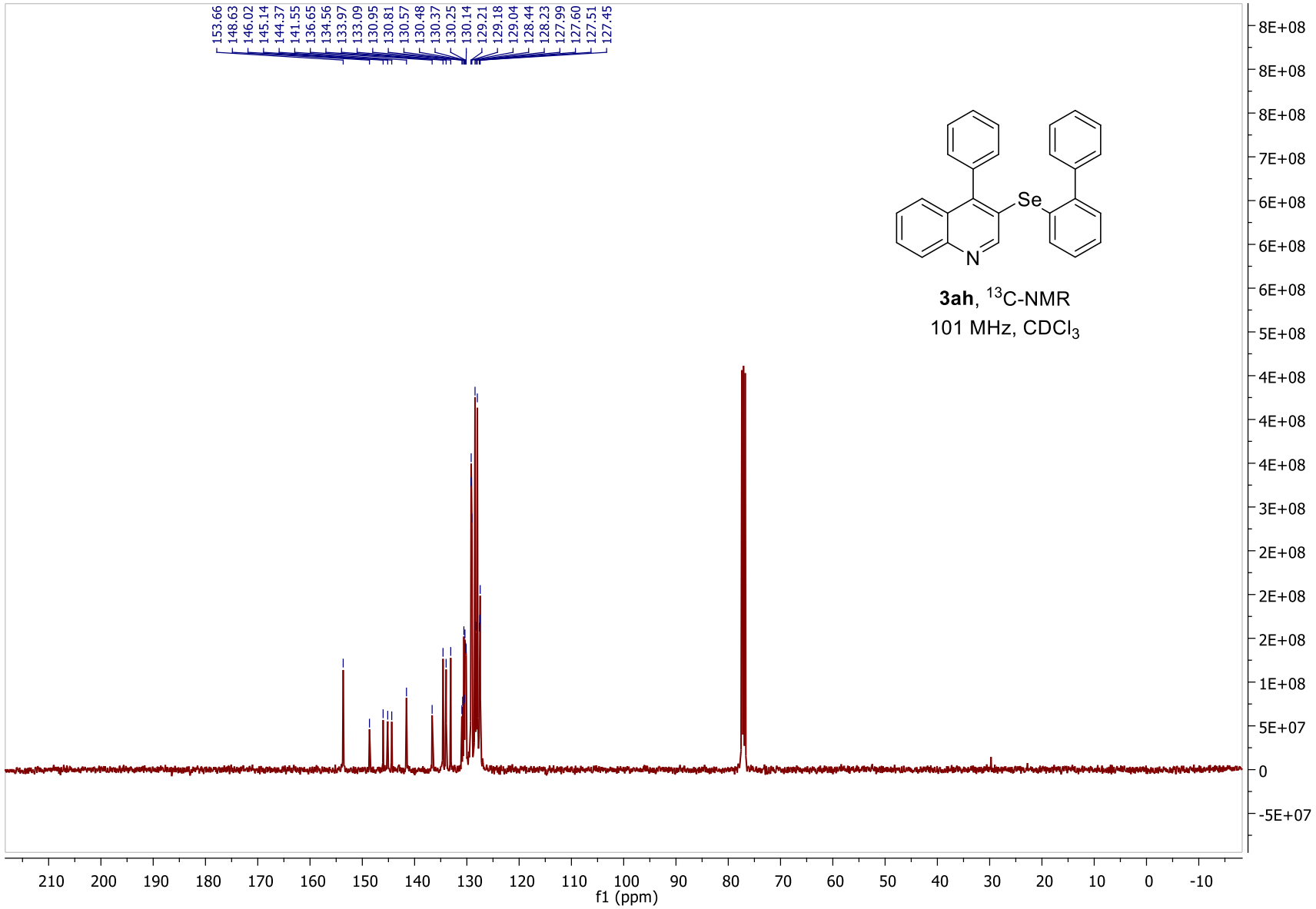

8.64
8.07
8.05
7.67
7.67
7.65
7.65
7.65
7.63
7.63
7.55
7.55
7.54
7.54
7.53
7.53
7.52
7.52
7.52
7.50
7.50
7.49
7.48
7.47
7.47
7.42
7.40
7.36
7.36
7.34
7.34
7.12
7.11
2.35
Se
N
Me
3af, 1H-NMR
400 MHz, CDCl3
1.00
1.03
1.07
3.01
1.94
2.03
2.00
2.01
3.02
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
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)

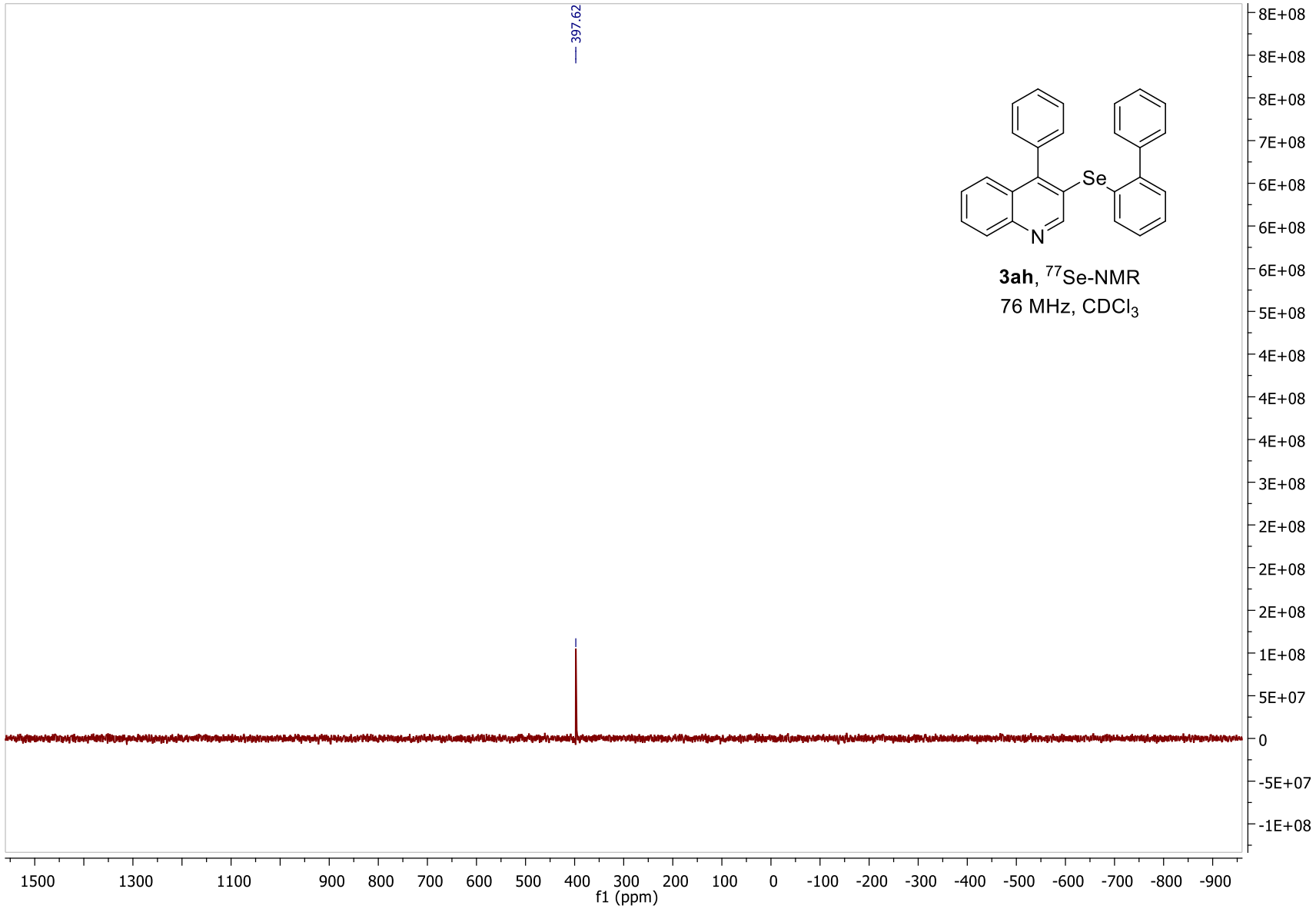

151.81
147.60
146.63
138.63
137.25
135.17
130.53
129.64
129.48
129.35
128.86
128.66
128.59
127.86
127.27
127.05
125.83
125.22
21.22
Se
N
Me
3af, 13C-NMR
101 MHz, CDCl3
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

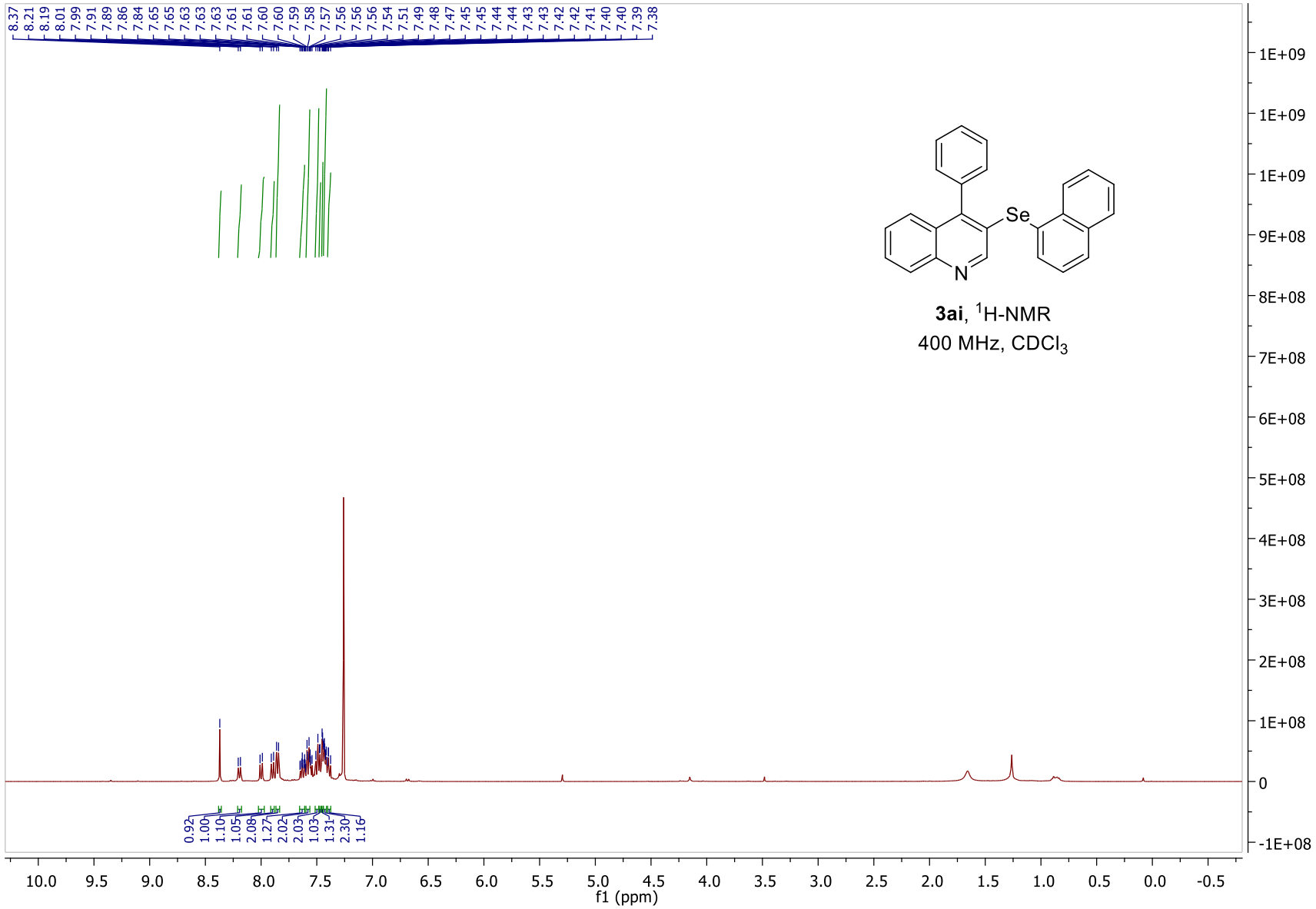

8.58
8.07
8.05
7.56
7.54
7.49
7.47
7.37
6.87
6.86
6.85
6.84
6.84
3.80
Se
N
OMe
3ag, 1H-NMR
400 MHz, CDCl3
0.94
1.00
1.07
3.05
3.02
3.06
2.02
2.99
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

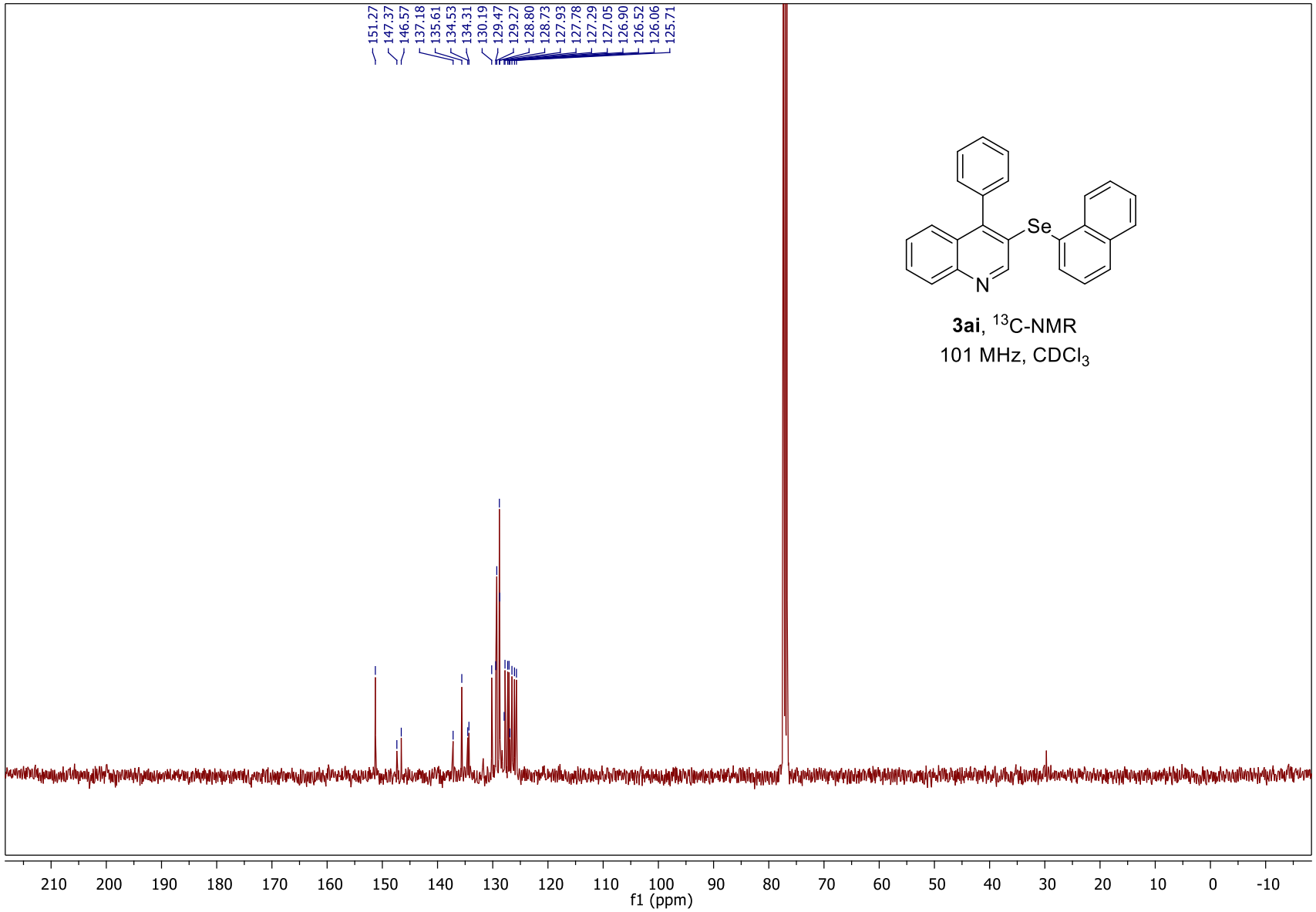

160.32
151.13
146.81
146.52
137.50
137.16
129.49
129.37
128.74
115.49
55.38
Se
N
OMe
3ag, 13C-NMR
101 MHz, CDCl3
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


Se
N
3ah, 1H-NMR
400 MHz, CDCl3
0.92
1.00
1.08
4.03
1.10
1.02
4.99
2.01
0.99
2.02
f1 (ppm)


153.66
148.63
146.02
145.14
144.37
141.55
136.65
134.56
133.97
133.09
130.95
130.81
130.57
130.48
130.37
130.25
130.14
129.21
129.18
129.04
128.44
128.23
127.99
127.60
127.51
127.45
Se
N
3ah, 13C-NMR
101 MHz, CDCl3
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
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


397.62
Se
N
3ah, 77Se-NMR
76 MHz, CDCl3
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
-1E+08
1500 1300 1100 900 800 700 600 500 400 300 200 100 0 -100 -200 -300 -400 -500 -600 -700 -800 -900
f1 (ppm)


8.37
8.21
8.19
8.01
7.99
7.91
7.89
7.86
7.84
7.65
7.65
7.63
7.63
7.63
7.61
7.61
7.60
7.60
7.59
7.58
7.57
7.56
7.56
7.56
7.54
7.51
7.49
7.48
7.47
7.45
7.45
7.44
7.44
7.43
7.43
7.42
7.42
7.41
7.40
7.40
7.39
7.38
Se
N
3ai, 1H-NMR
400 MHz, CDCl3
0.92
1.00
1.10
1.05
2.08
1.27
2.02
2.03
1.03
1.31
2.30
1.16
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)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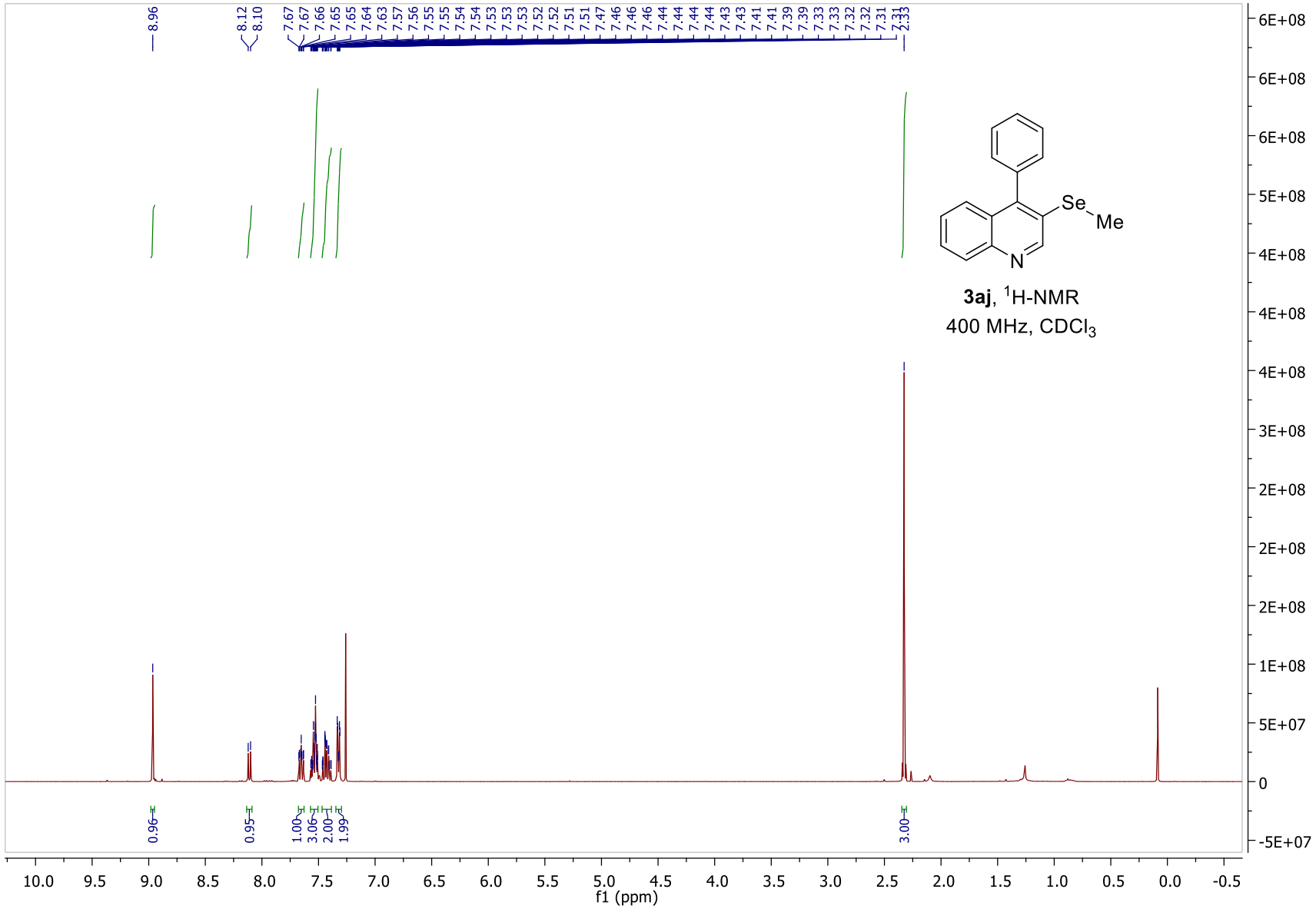
147.37
146.57
137.18
135.61
134.53
134.31
130.19
129.47
129.27
128.80
128.73
127.93
127.78
127.29
127.05
126.90
126.52
126.06
125.71
Se
N
3ai, 13C-NMR
101 MHz, CDCl3
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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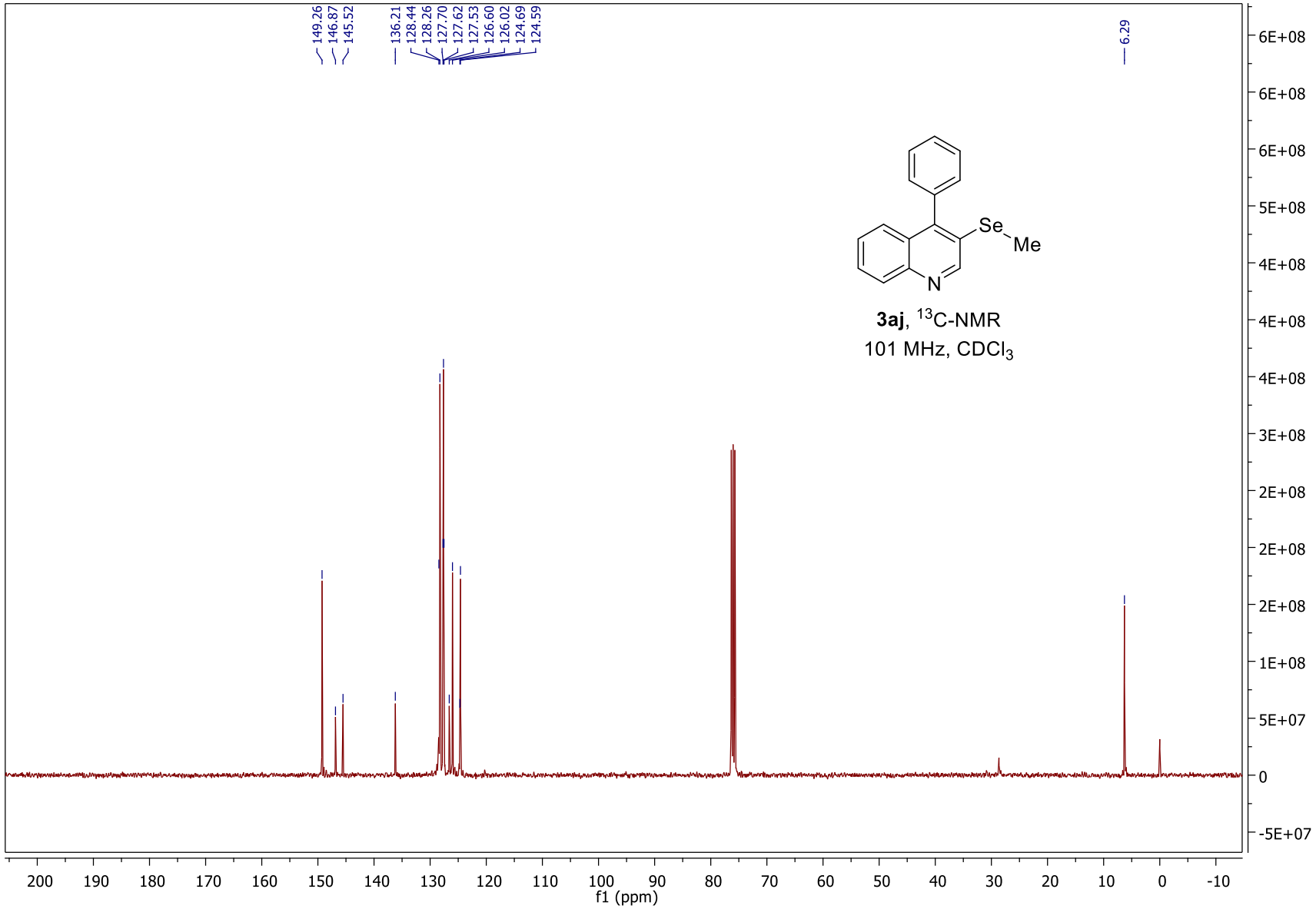
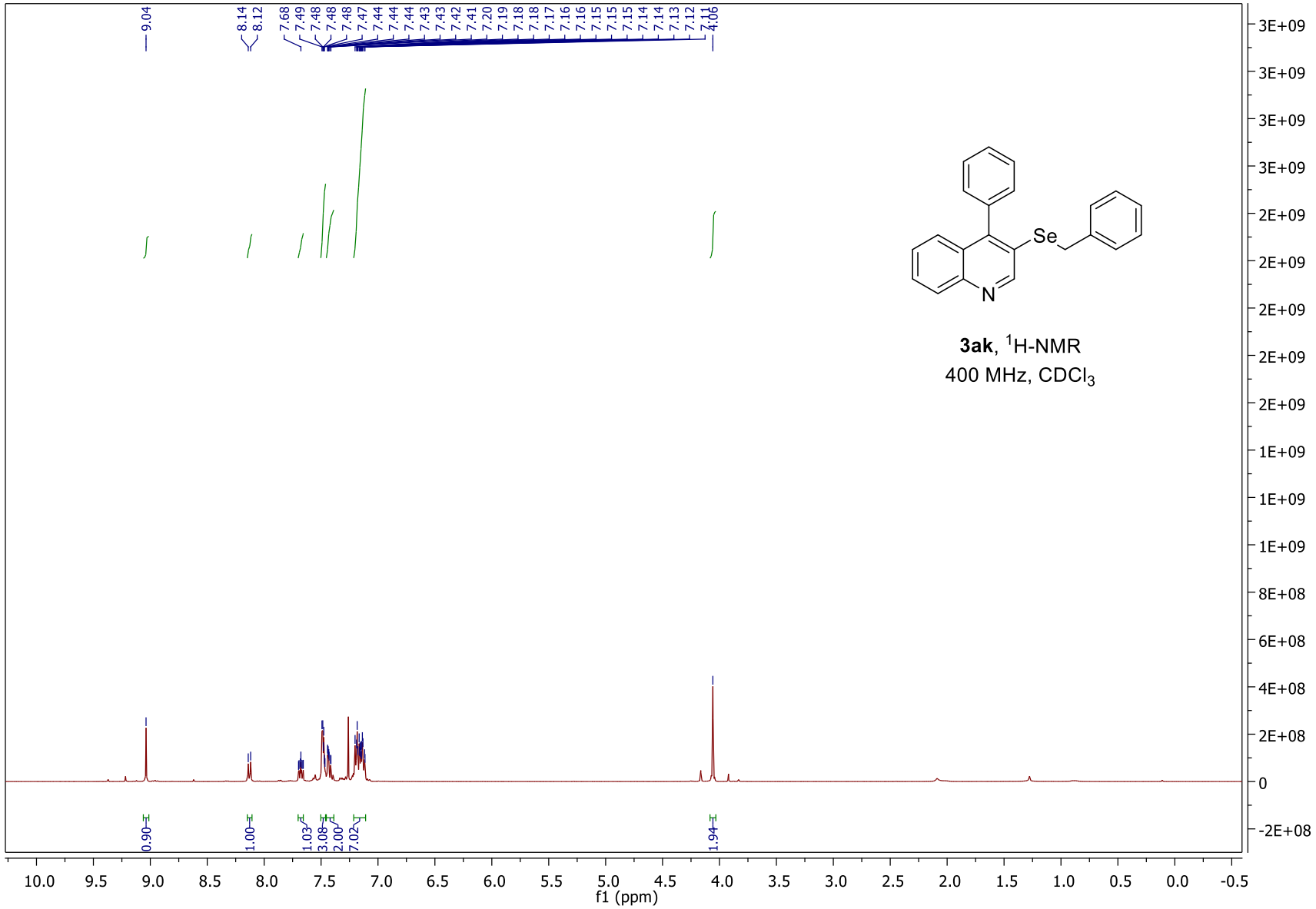
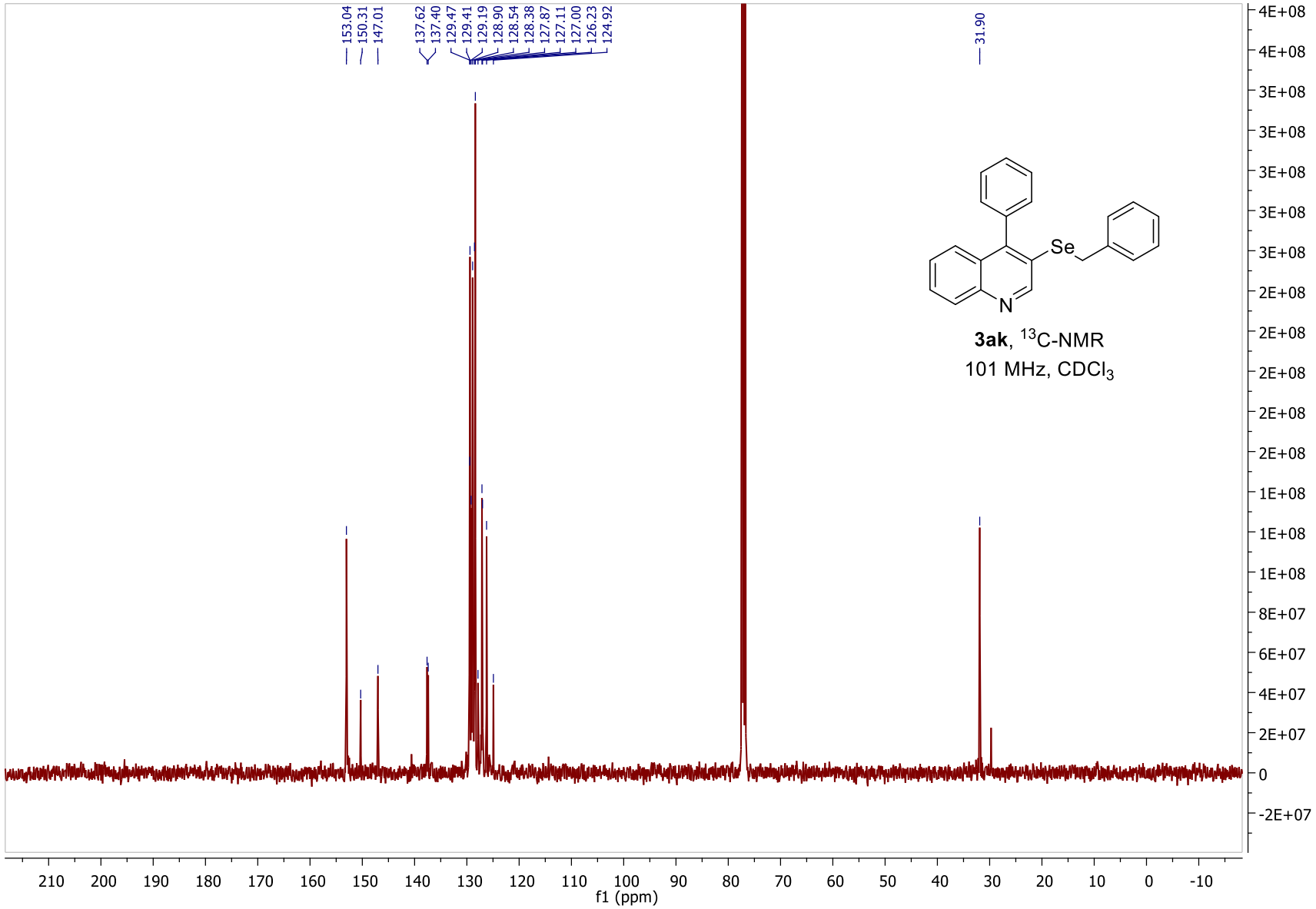
8.12
8.10
7.67
7.67
7.66
7.65
7.65
7.64
7.63
7.57
7.56
7.55
7.55
7.54
7.54
7.53
7.53
7.53
7.52
7.52
7.51
7.51
7.47
7.46
7.46
7.46
7.44
7.44
7.44
7.44
7.43
7.43
7.41
7.41
7.39
7.39
7.33
7.33
7.32
7.32
7.31
7.31
2.33
Se
Me
N
3aj, 1H-NMR
400 MHz, CDCl3
0.96
0.95
1.00
3.06
2.00
1.99
3.00
6E+08
6E+08
6E+08
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)


149.26
146.87
145.52
136.21
128.44
128.26
127.70
127.62
127.53
126.60
126.02
124.69
124.59
6.29
Se
Me
N
3aj, 13C-NMR
101 MHz, CDCl3
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)



3ak, ^{1}H-NMR
400 MHz, $CDCl_3$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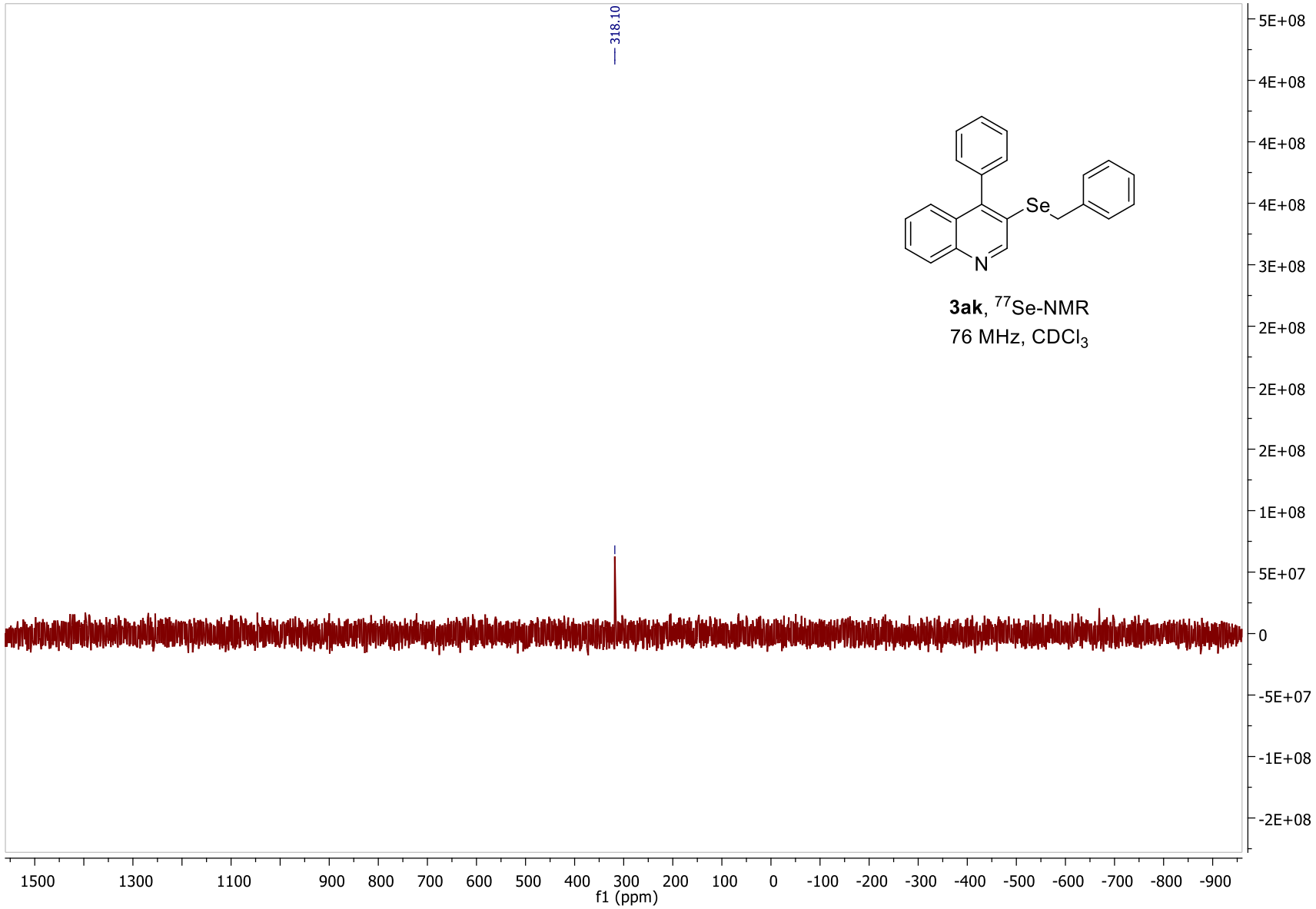
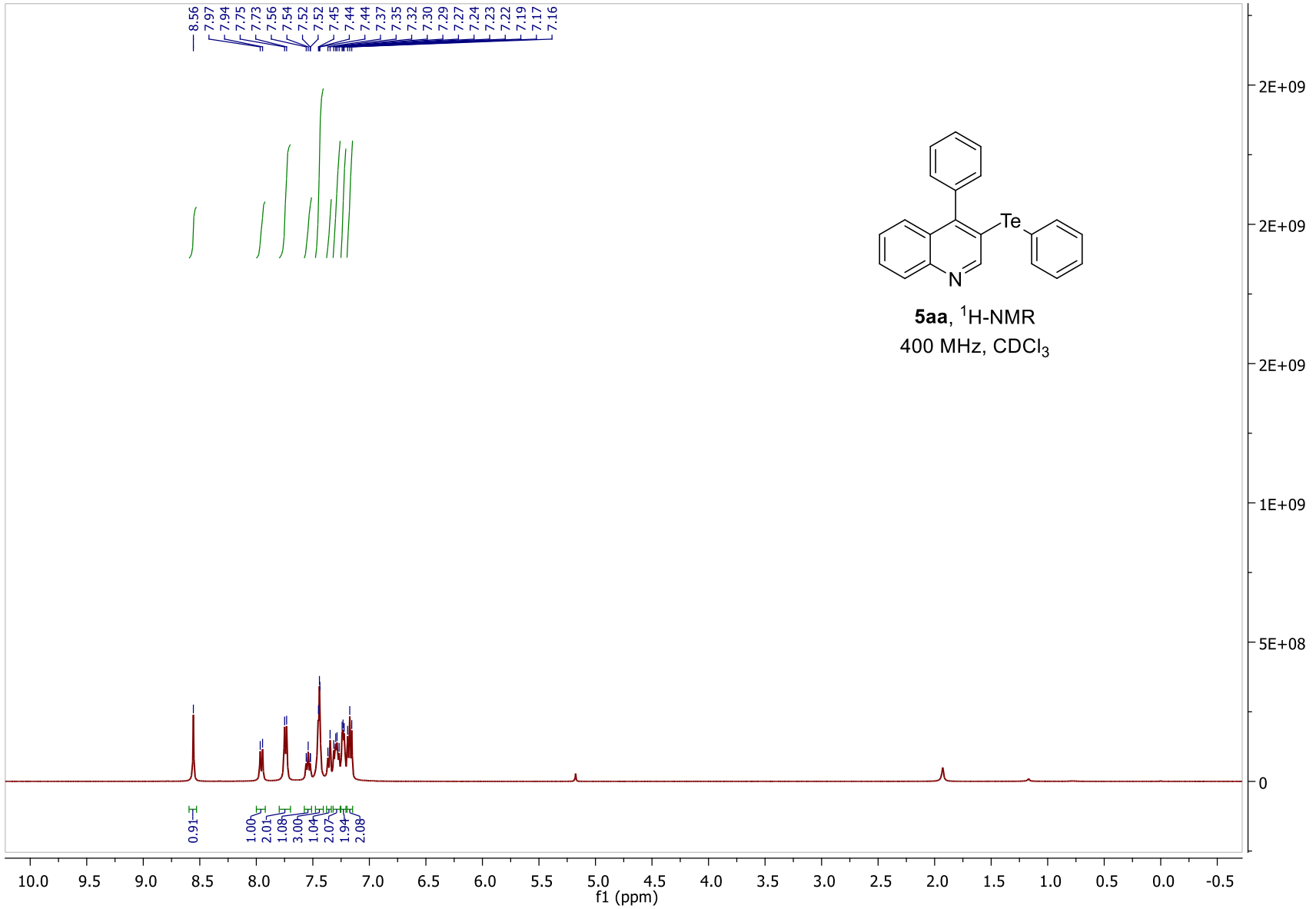
150.31
147.01
137.62
137.40
129.47
129.41
129.19
128.90
128.54
128.38
127.87
127.11
127.00
126.23
124.92
31.90
Se
N
3ak, 13C-NMR
101 MHz, CDCl3
4E+08
4E+08
3E+08
3E+08
3E+08
3E+08
3E+08
2E+08
2E+08
2E+08
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


318.10
Se
N
3ak, 77Se-NMR
76 MHz, CDCl3
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
-1E+08
-2E+08
1500
1300
1100
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
f1 (ppm)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7.73
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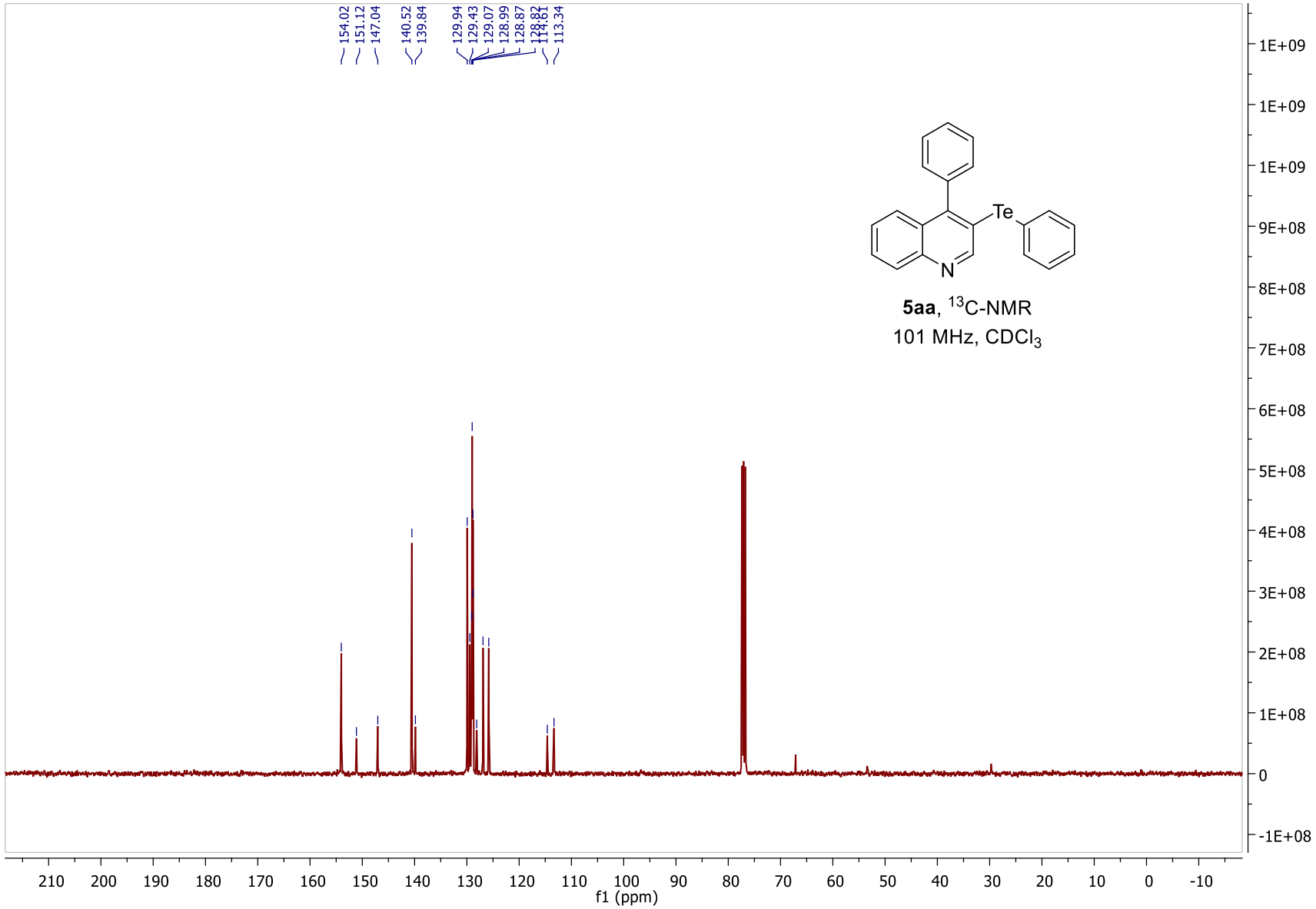
7.54
7.52
7.52
7.45
7.44
7.44
7.37
7.35
7.32
7.30
7.29
7.27
7.24
7.23
7.22
7.19
7.17
7.16
Te
N
5aa, 1H-NMR
400 MHz, CDCl3
2E+09
2E+09
2E+09
1E+09
5E+08
0
0.91
1.00
2.01
1.08
3.00
1.04
2.07
1.94
2.08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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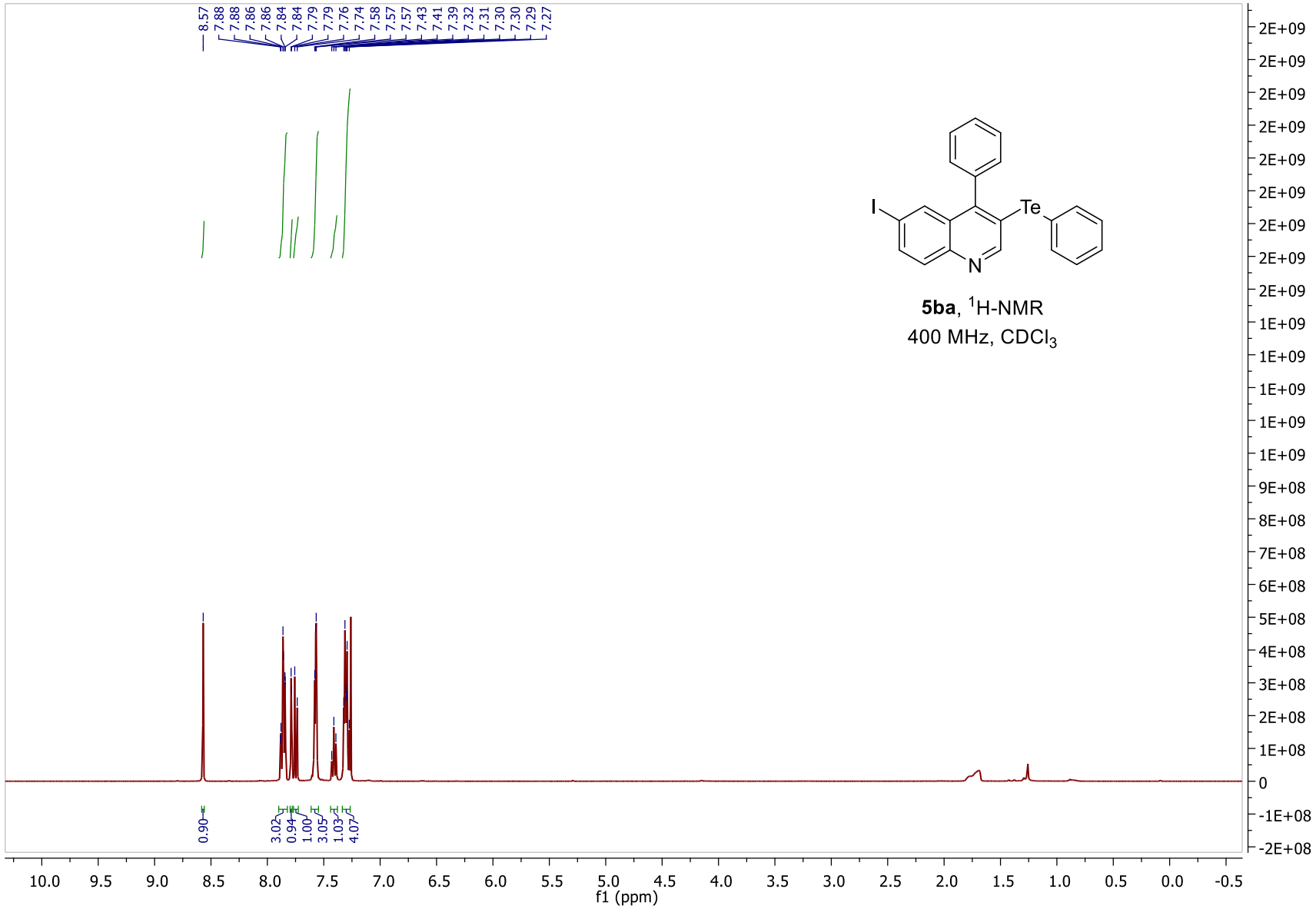
151.12
147.04
140.52
139.84
129.94
129.43
129.07
128.99
128.87
128.82
114.61
113.34
Te
N
5aa, 13C-NMR
101 MHz, CDCl3
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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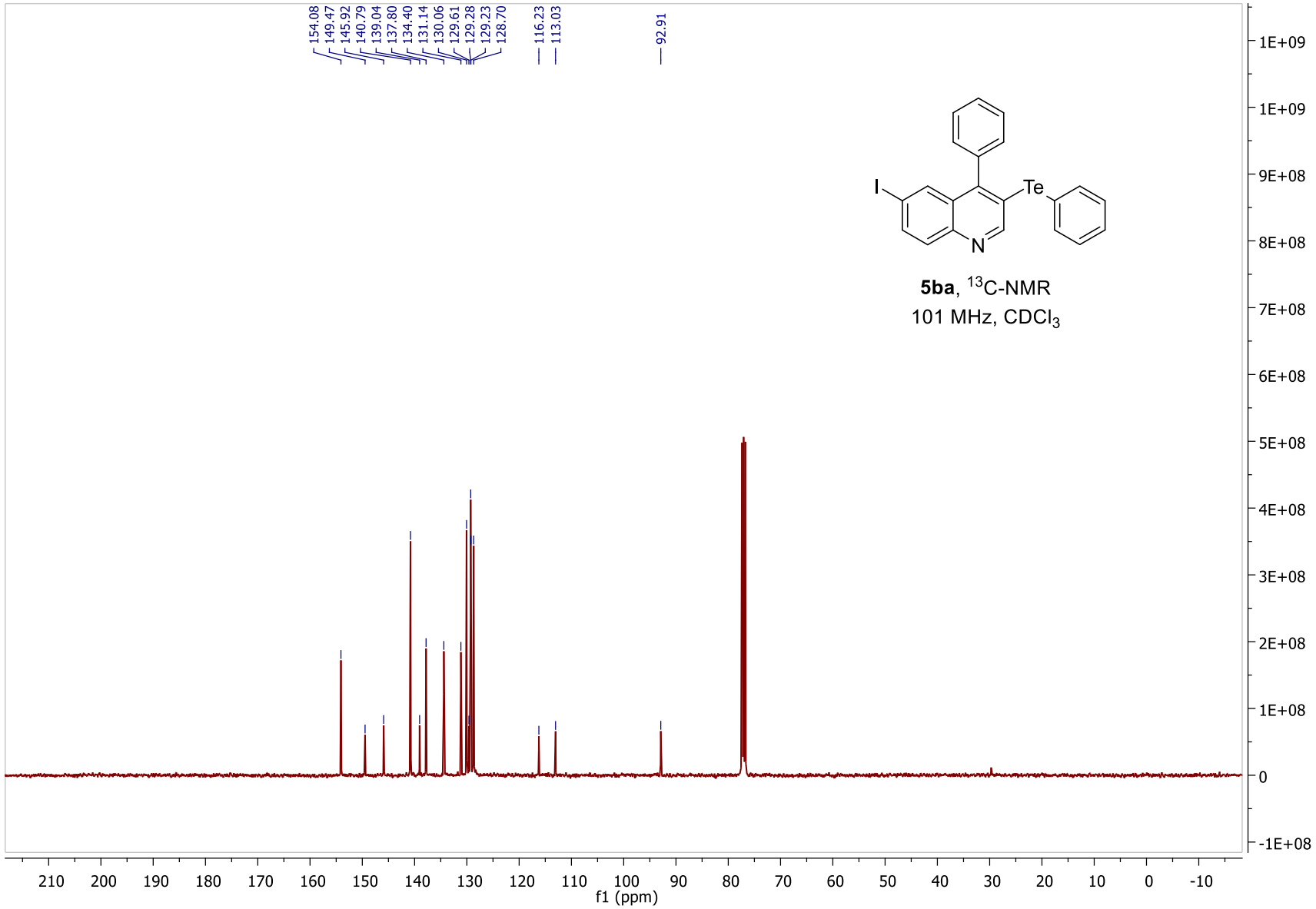
7.84
7.79
7.79
7.76
7.74
7.58
7.57
7.57
7.43
7.41
7.39
7.32
7.31
7.30
7.30
7.29
7.27
I
Te
N
5ba, 1H-NMR
400 MHz, CDCl3
0.90
3.02
0.94
1.00
3.05
1.03
4.07
f1 (ppm)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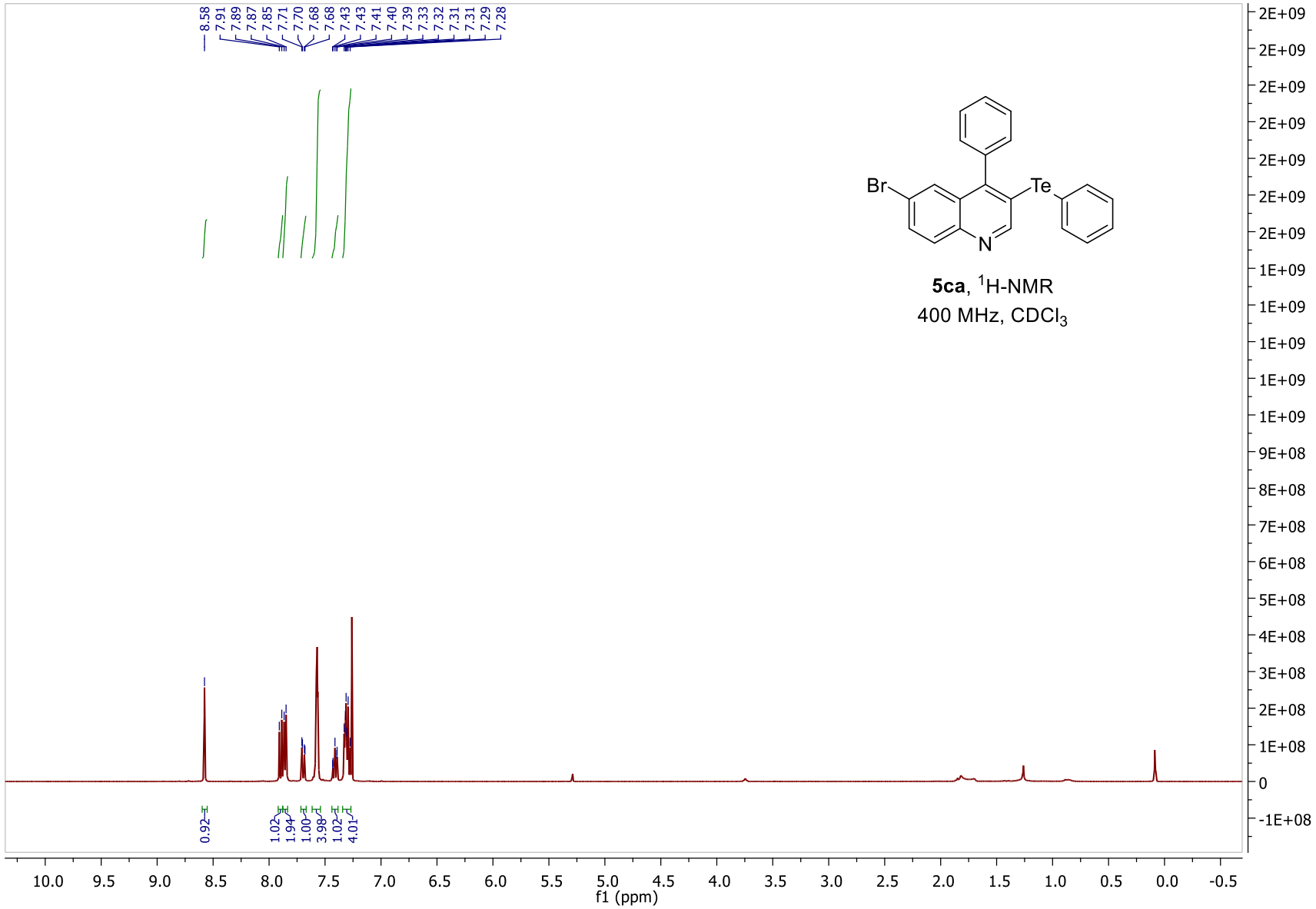
140.79
139.04
137.80
134.40
131.14
130.06
129.61
129.28
129.23
128.70
116.23
113.03
92.91
I
Te
N
5ba, 13C-NMR
101 MHz, CDCl3
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


8.58
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7.71
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7.68
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7.43
7.43
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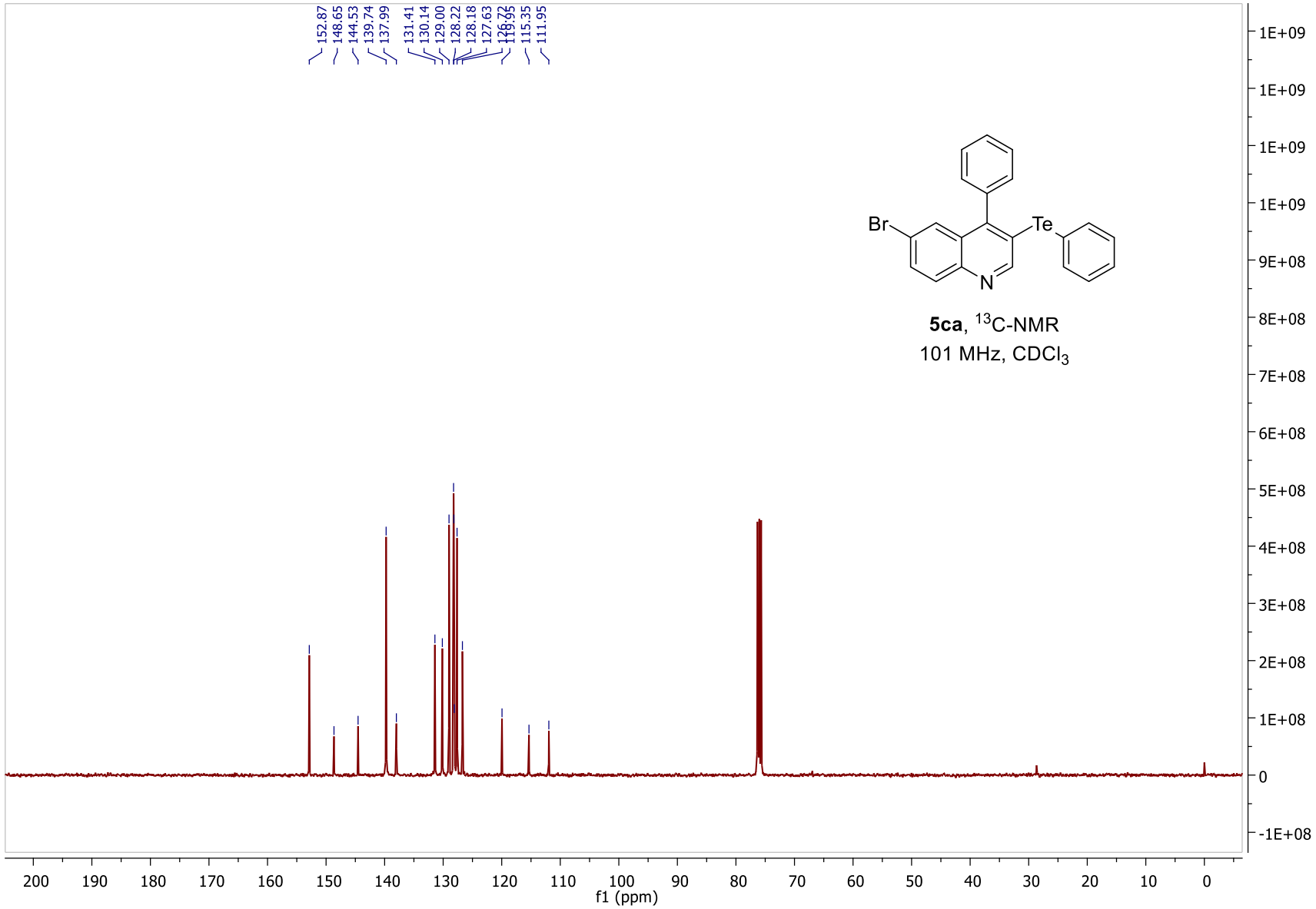
7.40
7.39
7.33
7.32
7.31
7.31
7.29
7.28
Br
Te
N
5ca, 1H-NMR
400 MHz, CDCl3
0.92
1.02
1.94
1.00
3.98
1.02
4.01
f1 (ppm)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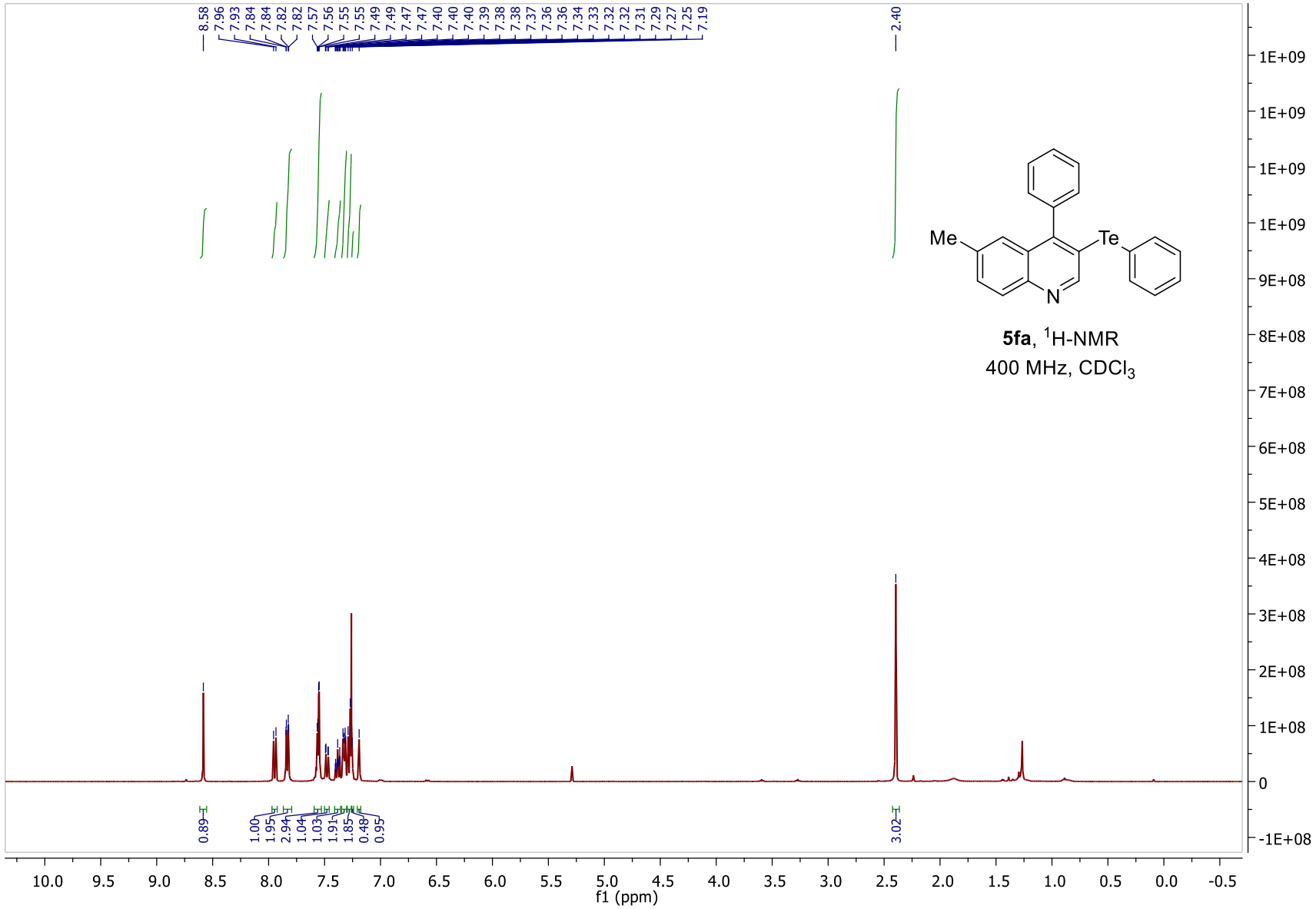
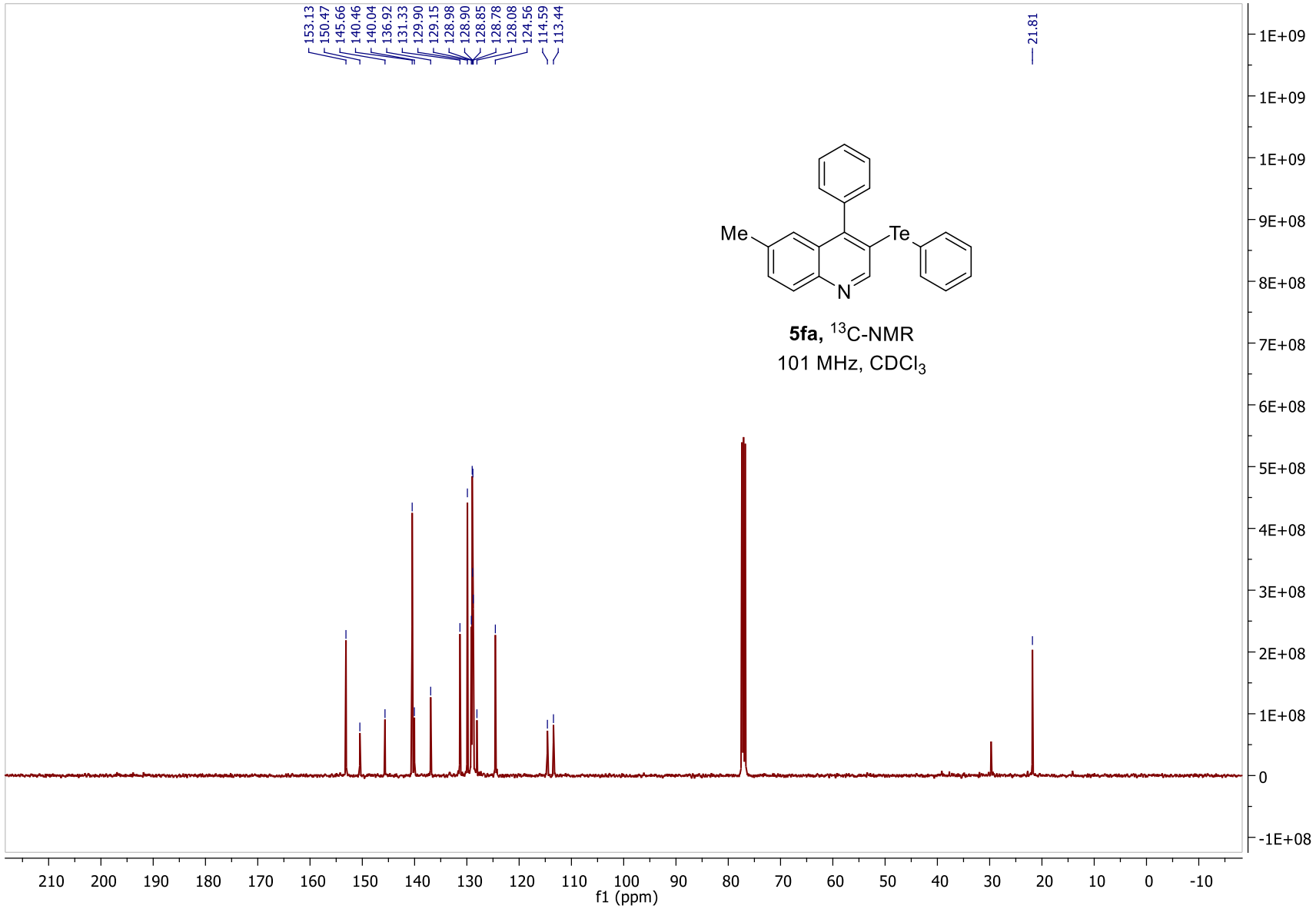
148.65
144.53
139.74
137.99
131.41
130.14
129.00
128.22
128.18
127.63
126.72
115.35
111.95
Br
Te
N
5ca, 13C-NMR
101 MHz, CDCl3
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


8.58
7.96
7.93
7.84
7.84
7.82
7.82
7.57
7.56
7.55
7.55
7.49
7.49
7.47
7.47
7.40
7.40
7.40
7.39
7.38
7.38
7.37
7.36
7.36
7.34
7.33
7.32
7.32
7.31
7.29
7.27
7.25
7.19
2.40
Me
Te
N
5fa, 1H-NMR
400 MHz, CDCl3
0.89
1.00
1.95
2.94
1.04
1.03
1.91
1.85
0.48
0.95
3.02
f1 (ppm)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145.66
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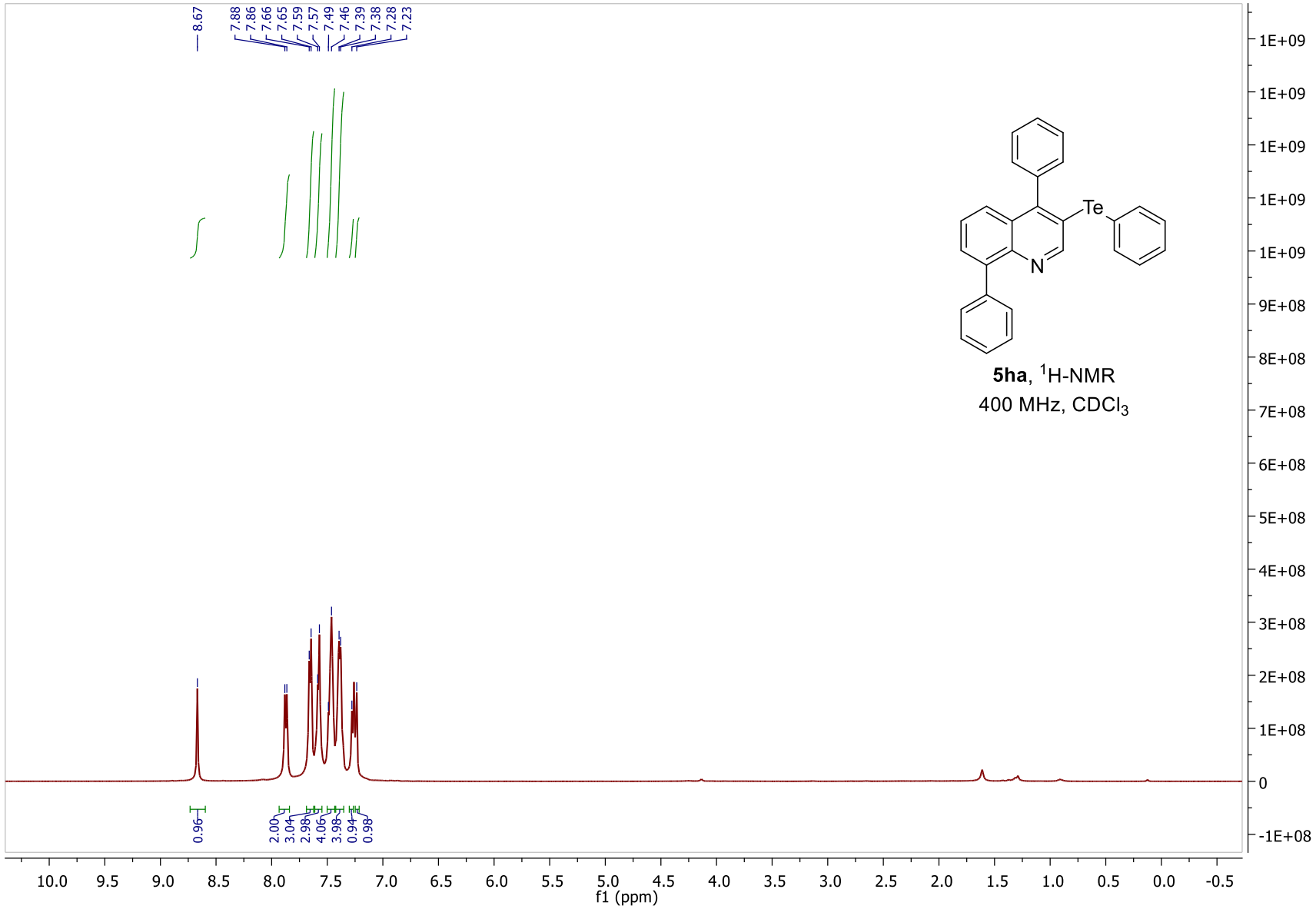
140.04
136.92
131.33
129.90
129.15
128.98
128.90
128.85
128.78
128.08
124.56
114.59
113.44
21.81
Me
Te
N
5fa, 13C-NMR
101 MHz, CDCl3
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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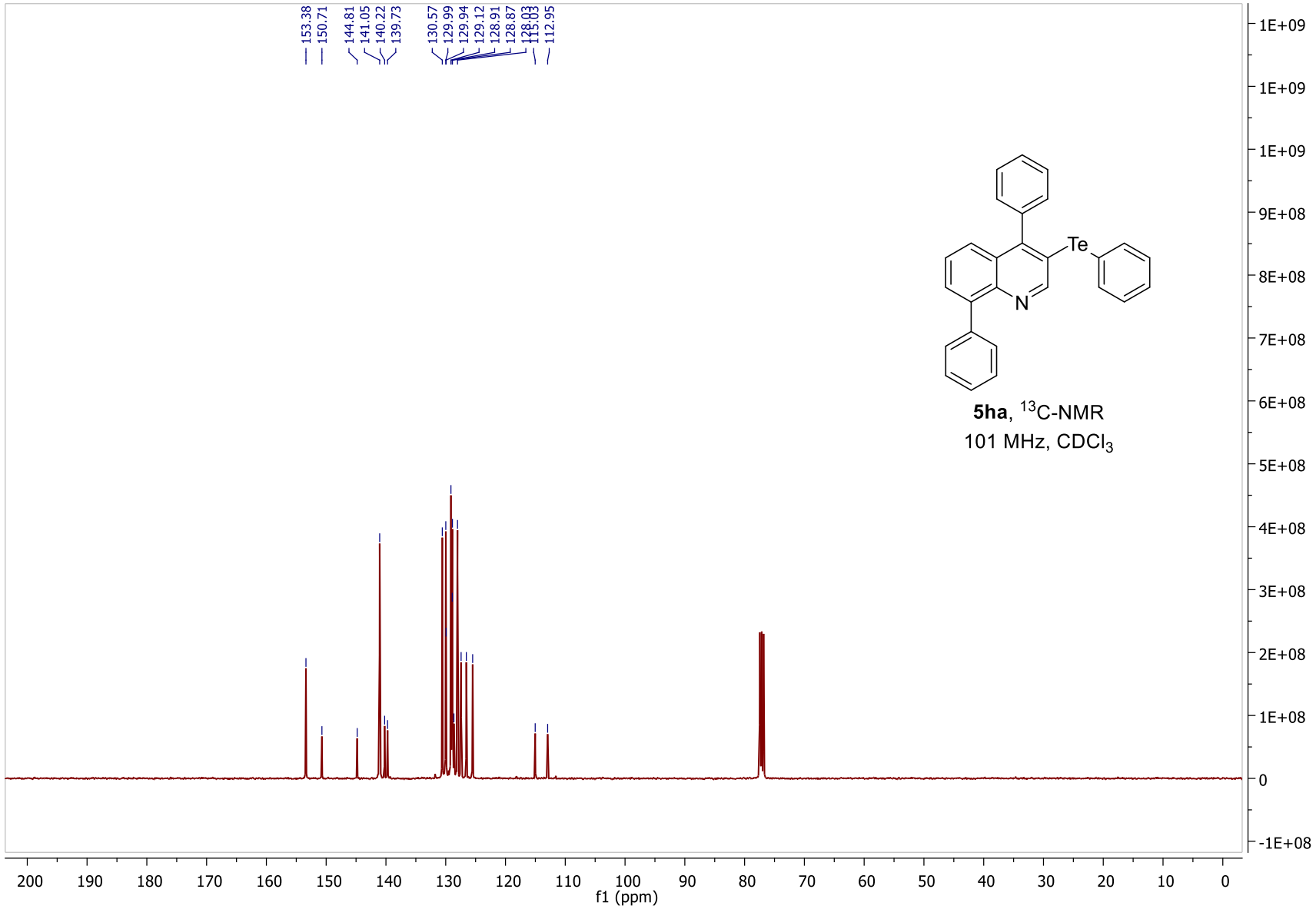
7.88
7.86
7.66
7.65
7.59
7.57
7.49
7.46
7.39
7.38
7.28
7.23
Te
N
5ha, 1H-NMR
400 MHz, CDCl3
0.96
2.00
3.04
2.98
4.06
3.98
0.94
0.98
1E+09
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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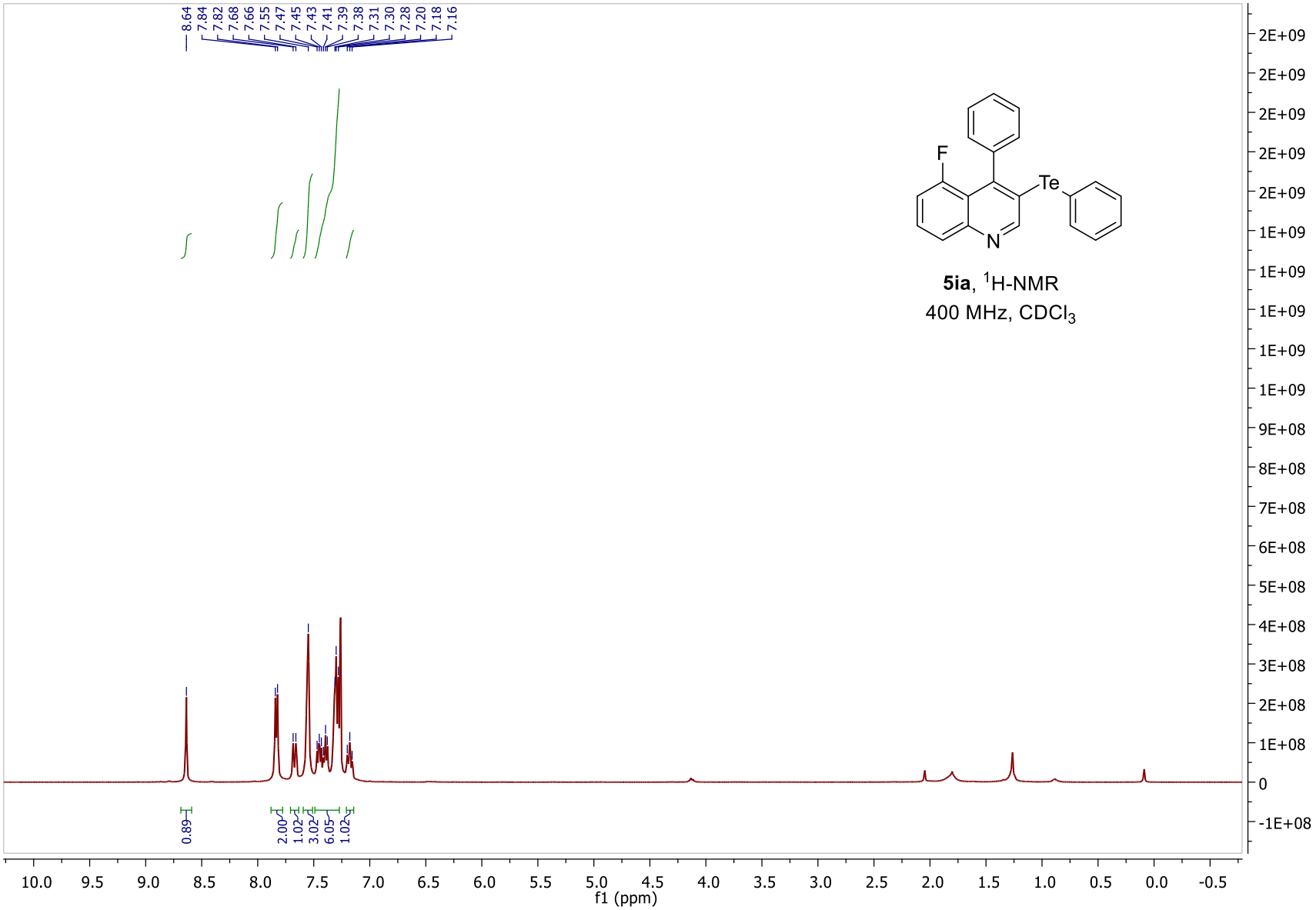
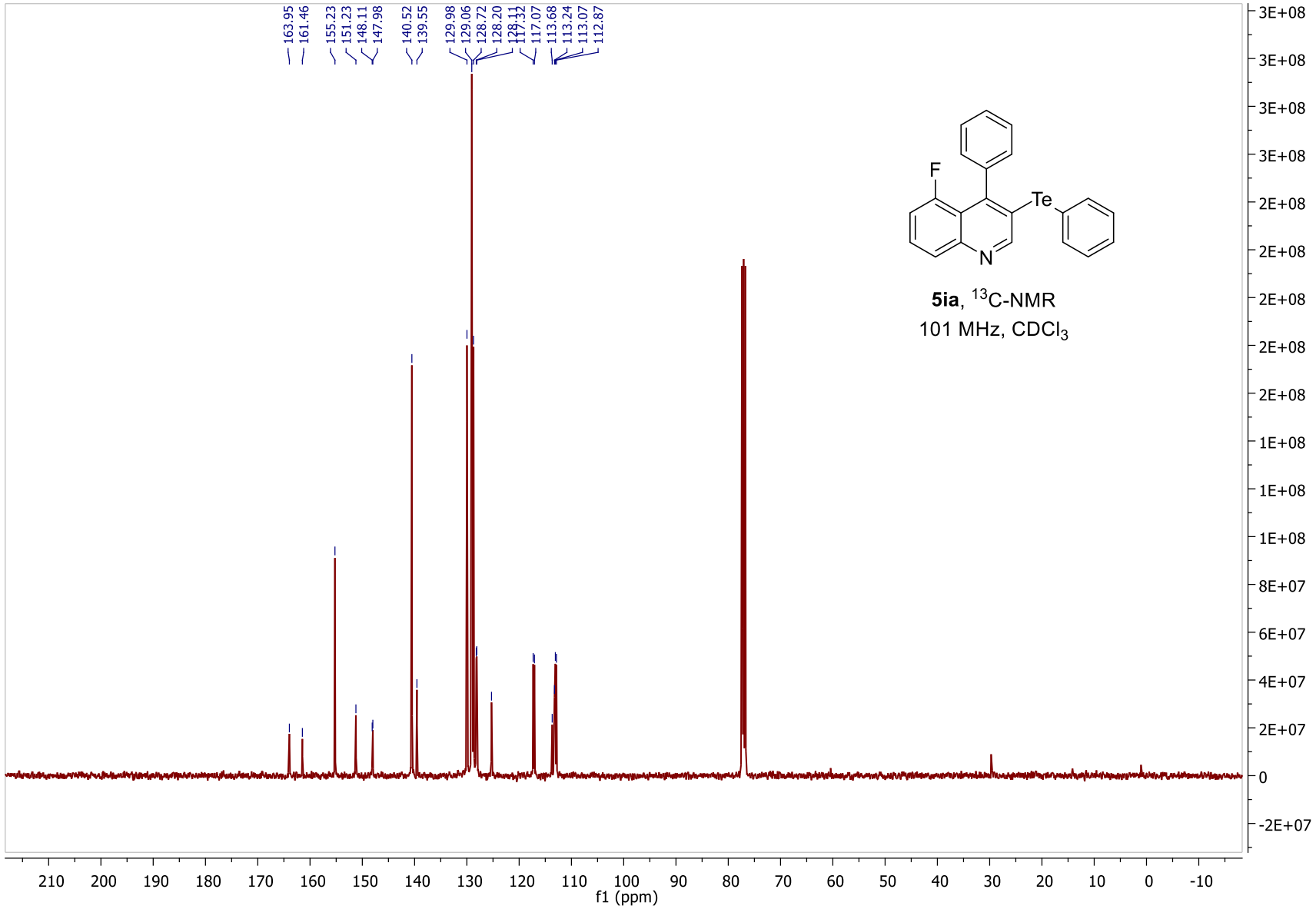
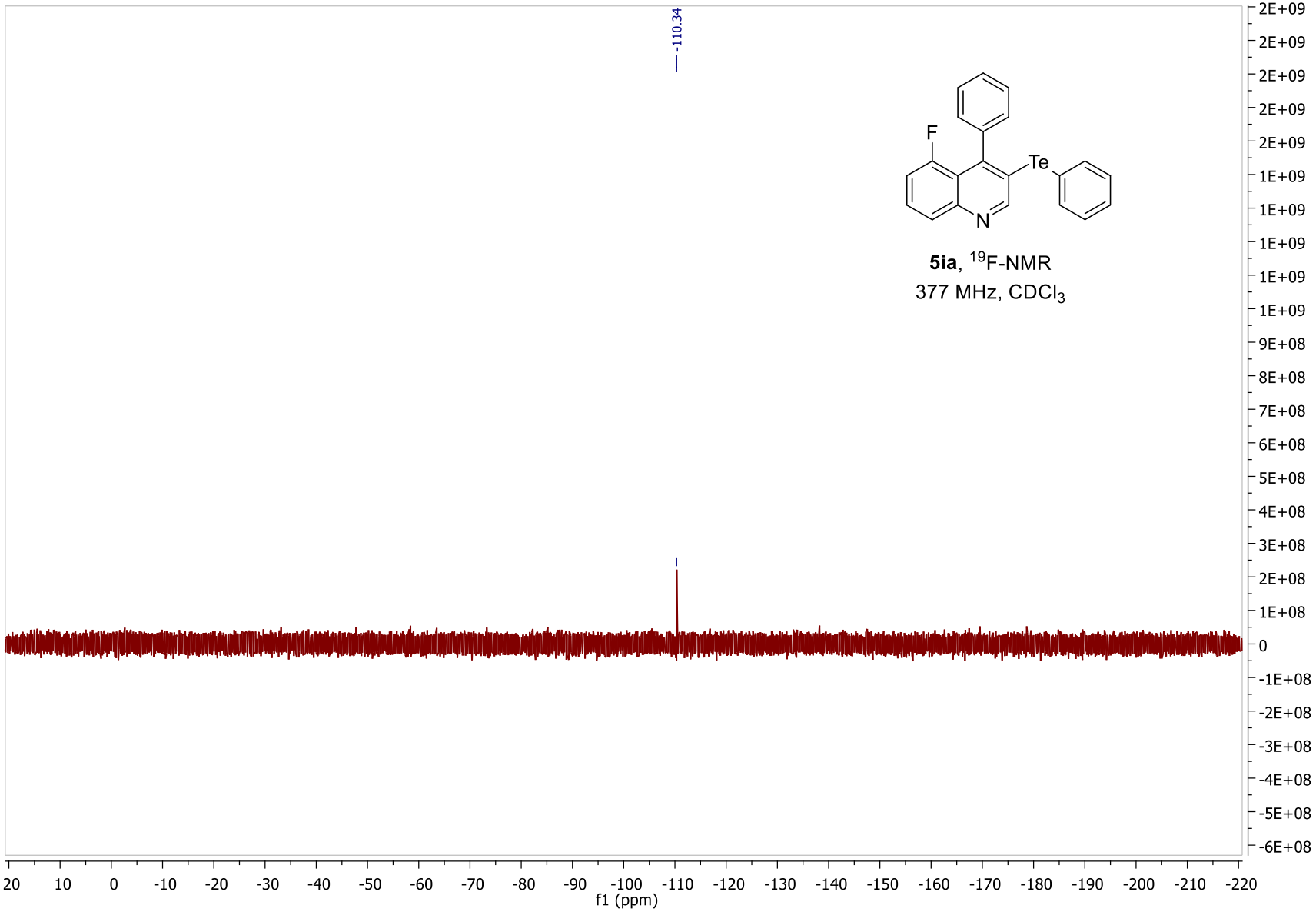
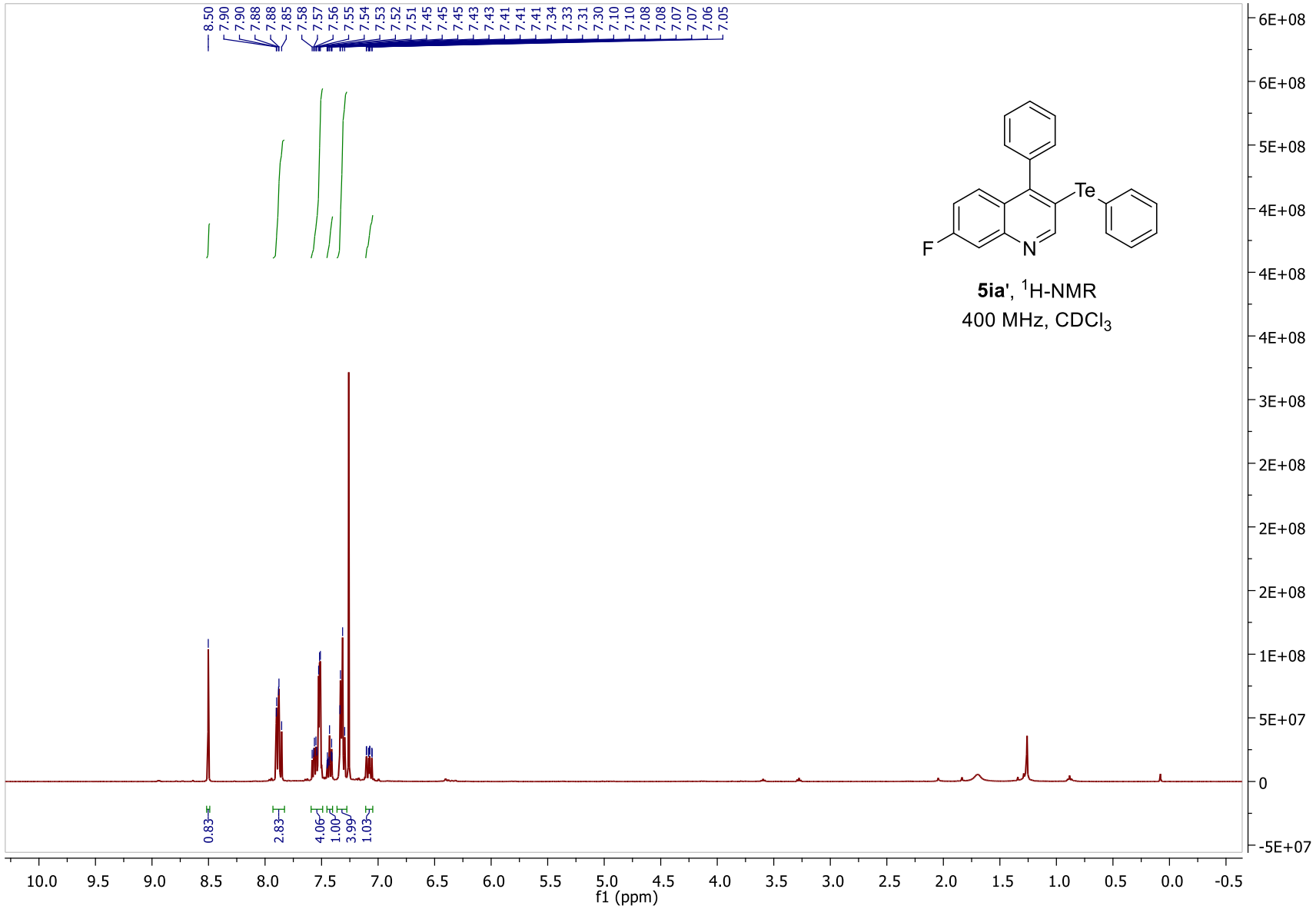
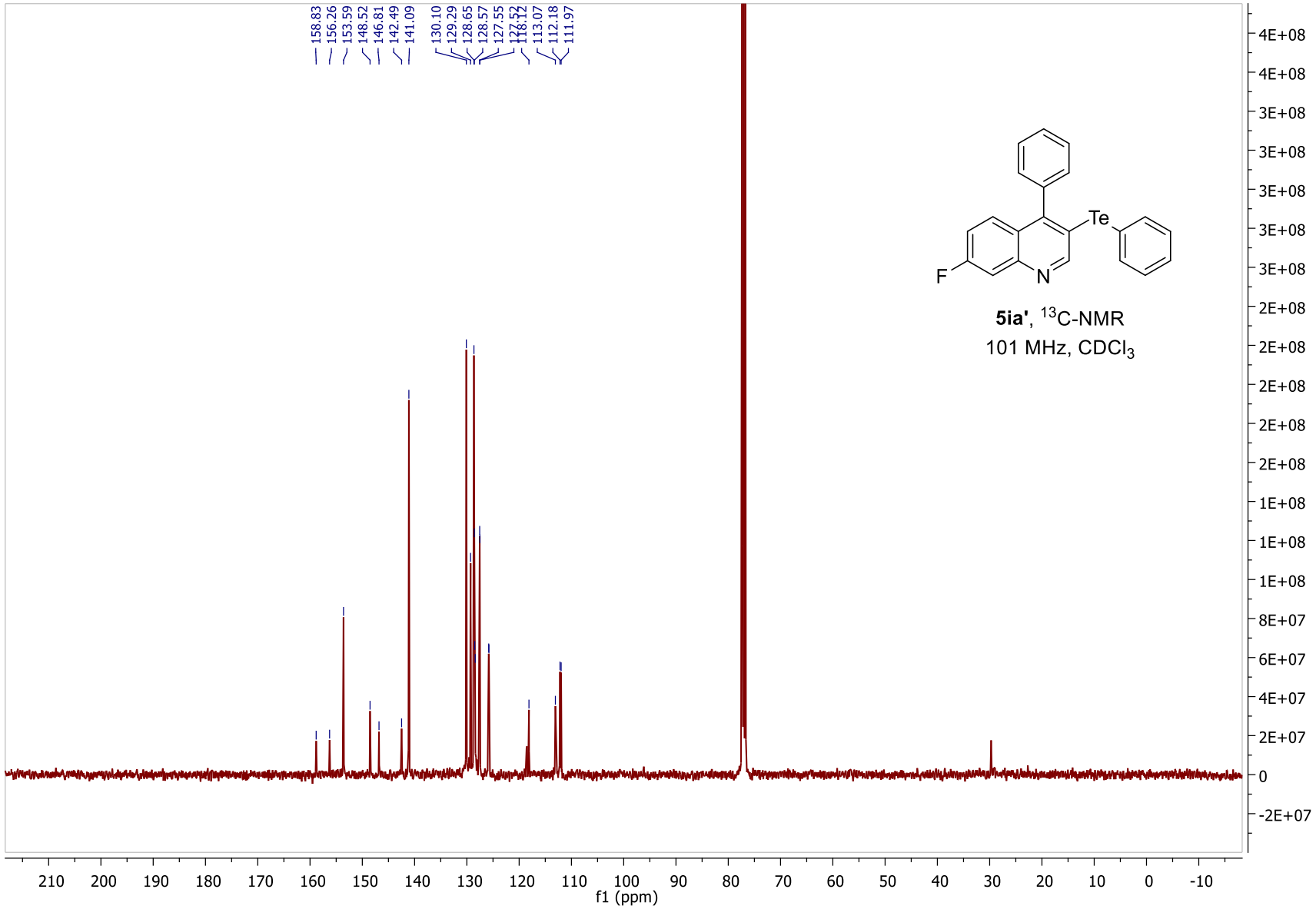
150.71
144.81
141.05
140.22
139.73
130.57
129.99
129.94
129.12
128.91
128.87
128.03
115.03
112.95
Te
N
5ha, 13C-NMR
101 MHz, CDCl3
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

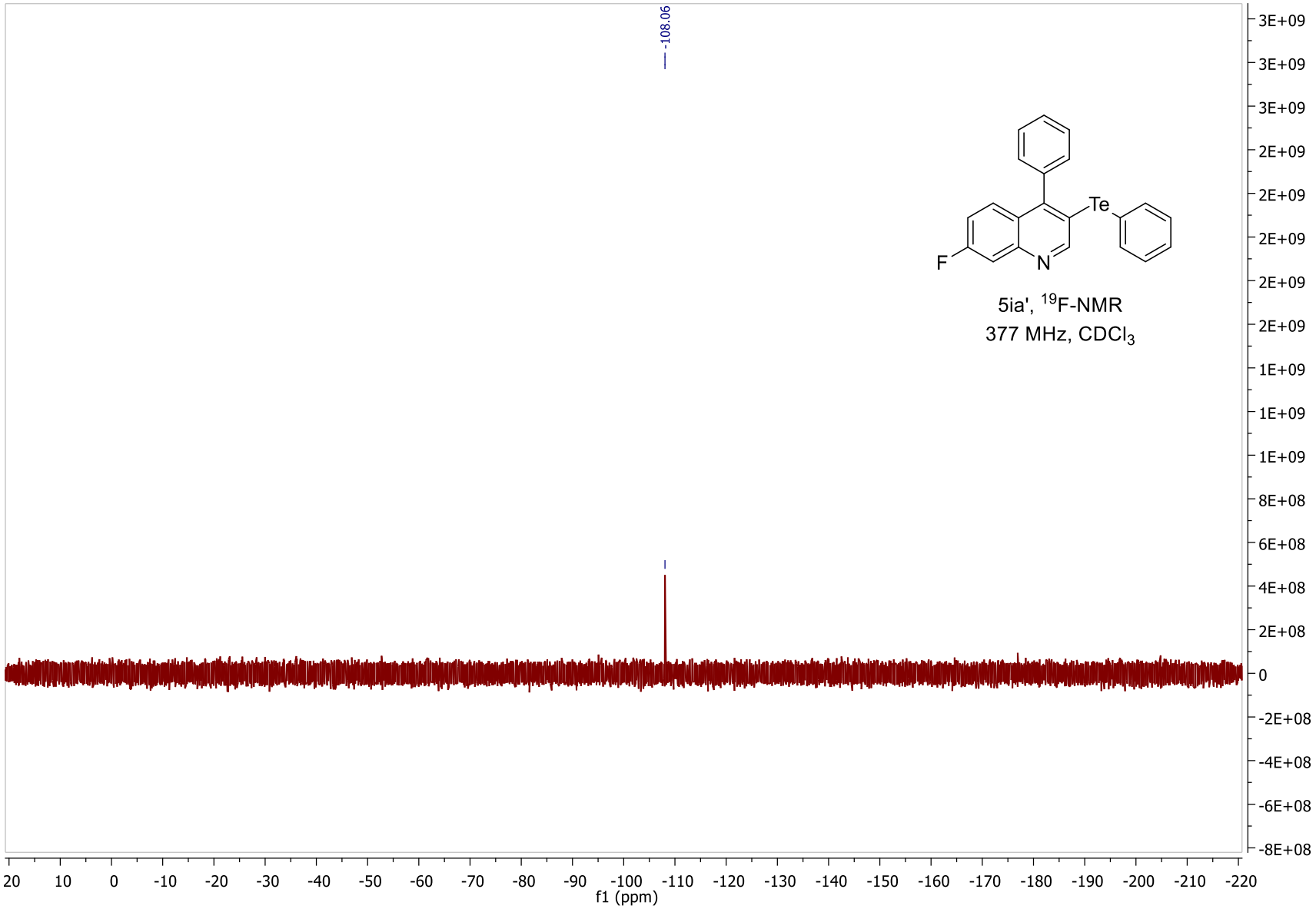

8.64
7.84
7.82
7.68
7.66
7.55
7.47
7.45
7.43
7.41
7.39
7.38
7.31
7.30
7.28
7.20
7.18
7.16
F
Te
N
5ia, 1H-NMR
400 MHz, CDCl3
0.89
2.00
1.02
3.02
6.05
1.02
f1 (ppm)

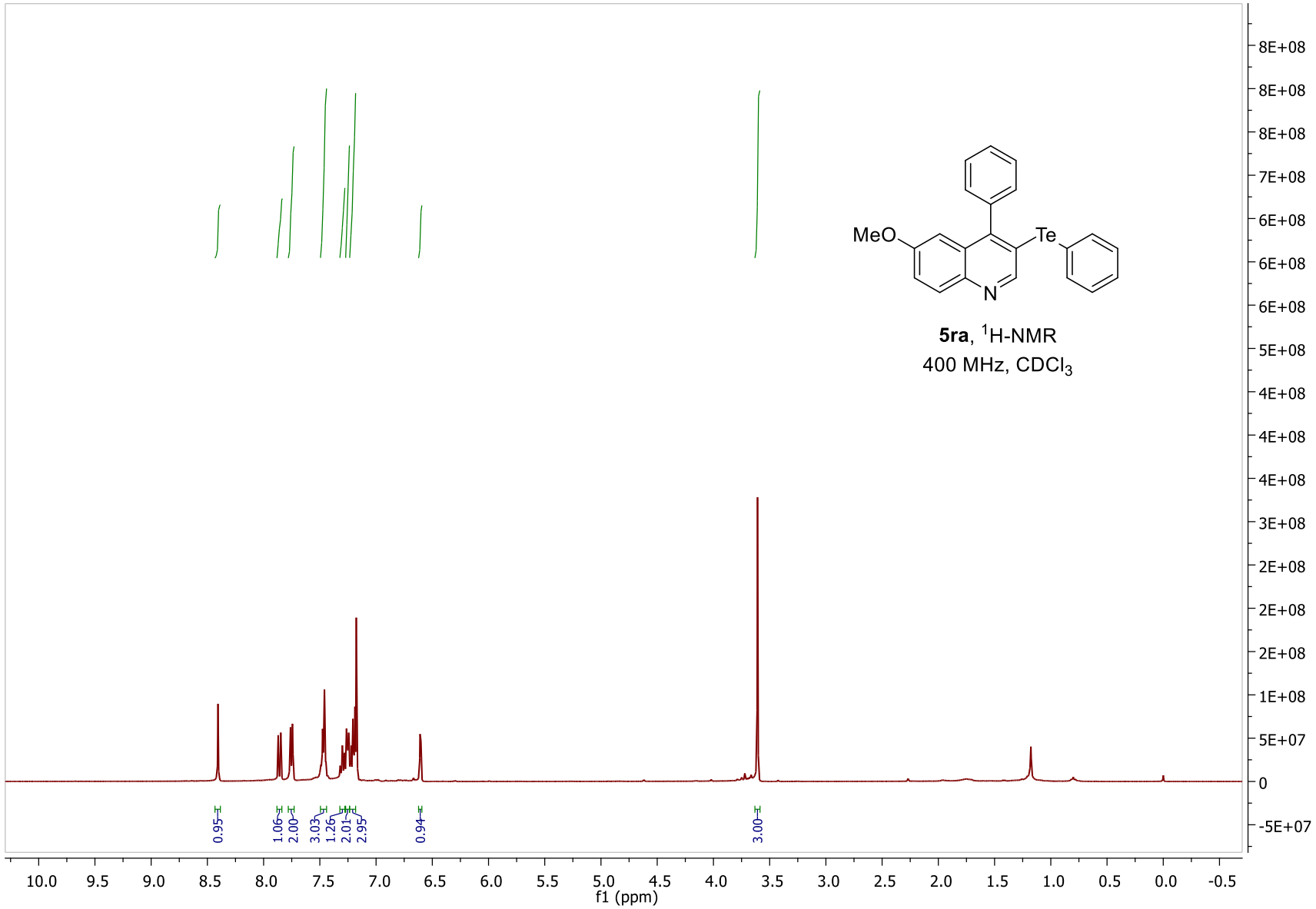

163.95
161.46
155.23
151.23
148.11
147.98
140.52
139.55
129.98
129.06
128.72
128.20
128.11
117.32
117.07
113.68
113.24
113.07
112.87
F
Te
N
5ia, 13C-NMR
101 MHz, CDCl3
3E+08
2E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

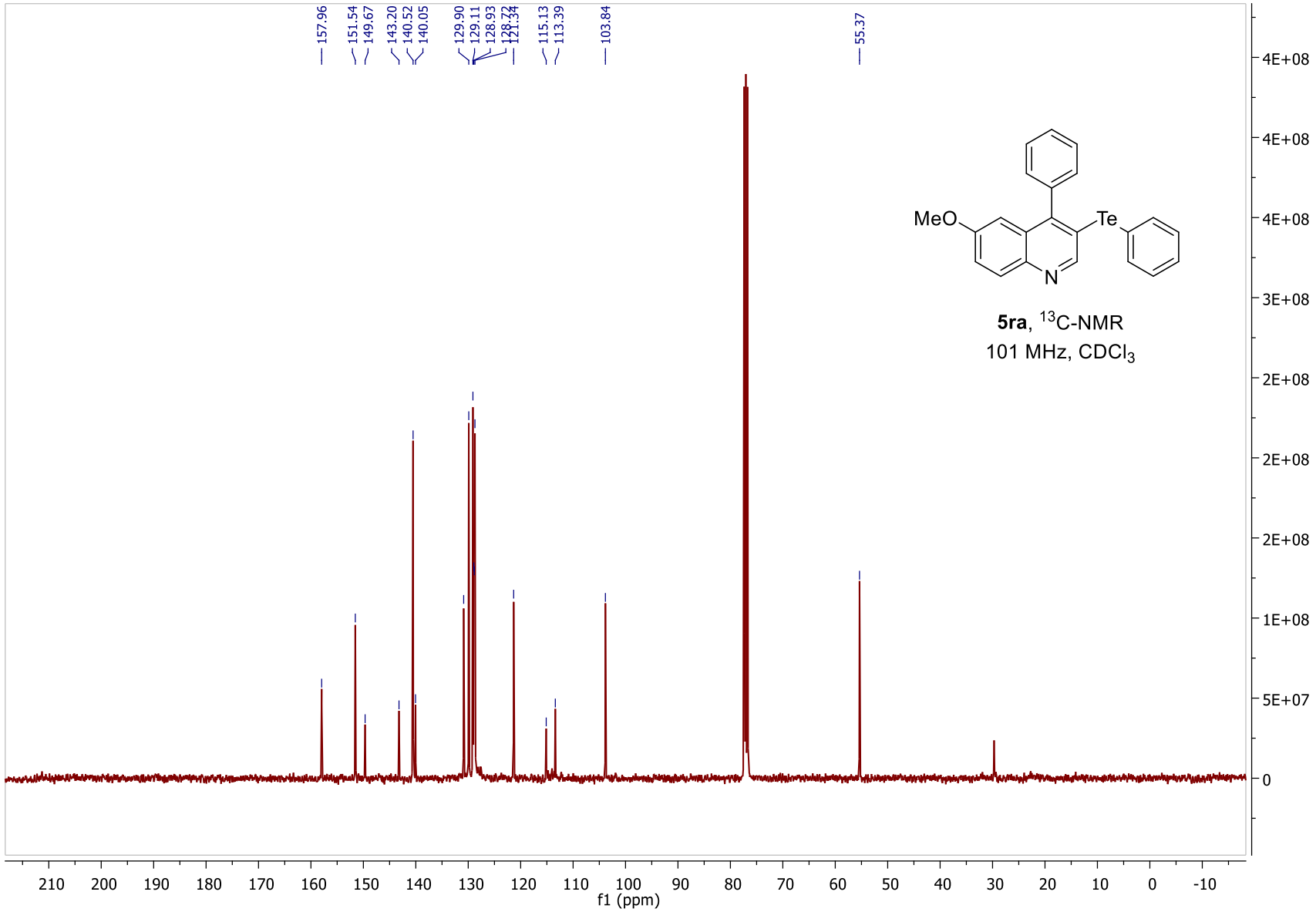

-110.34
F
Te
N
5ia, 19F-NMR
377 MHz, CDCl3
2E+09
2E+09
2E+09
2E+09
2E+09
1E+09
1E+09
1E+09
1E+09
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
-2E+08
-3E+08
-4E+08
-5E+08
-6E+08
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

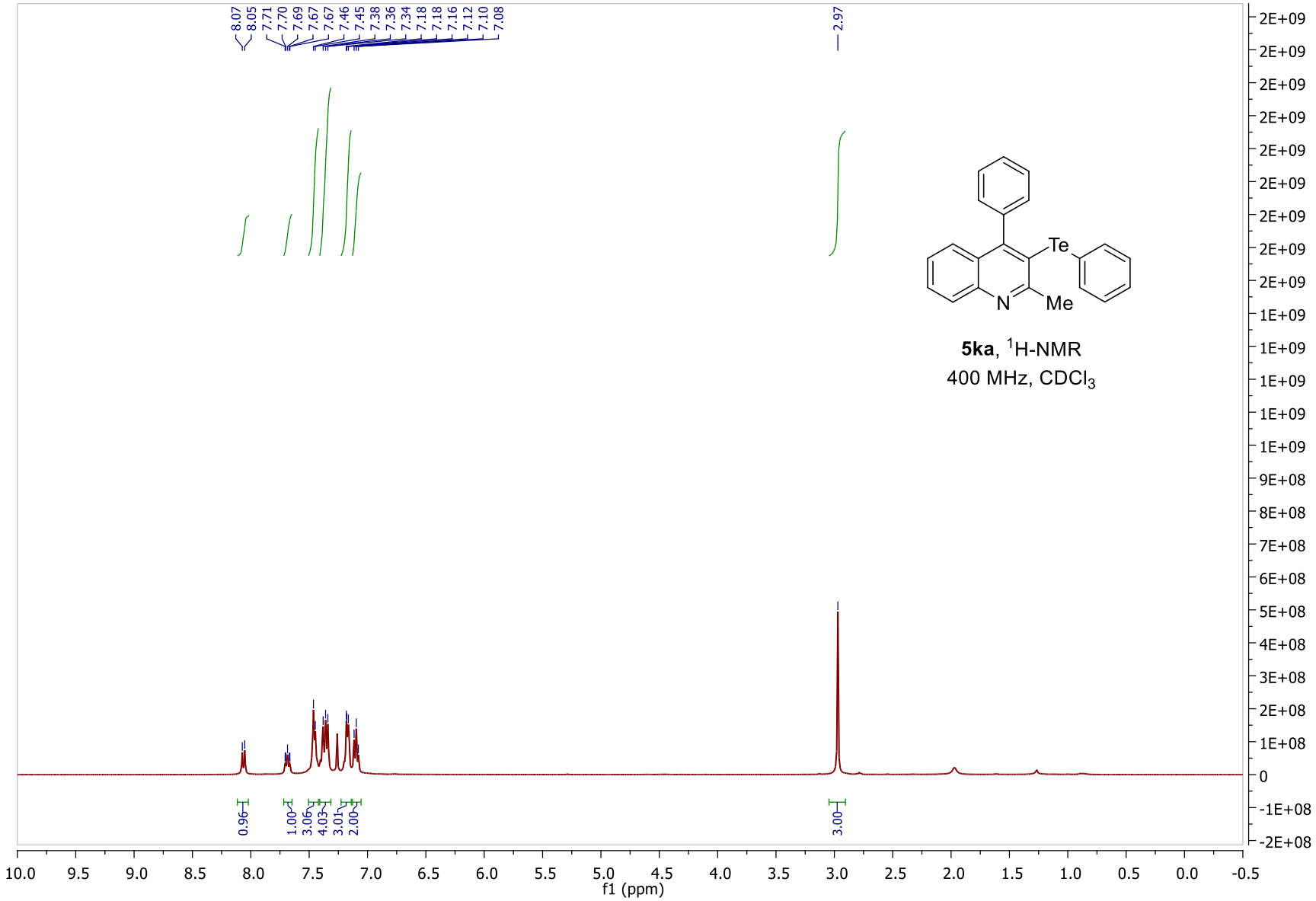

8.50
7.90
7.90
7.88
7.88
7.85
7.58
7.57
7.56
7.55
7.54
7.53
7.52
7.51
7.45
7.45
7.45
7.43
7.43
7.41
7.41
7.41
7.34
7.33
7.31
7.30
7.10
7.10
7.08
7.08
7.07
7.07
7.06
7.05
Te
F
N
5ia', 1H-NMR
400 MHz, CDCl3
0.83
2.83
4.06
1.00
3.99
1.03
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
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)

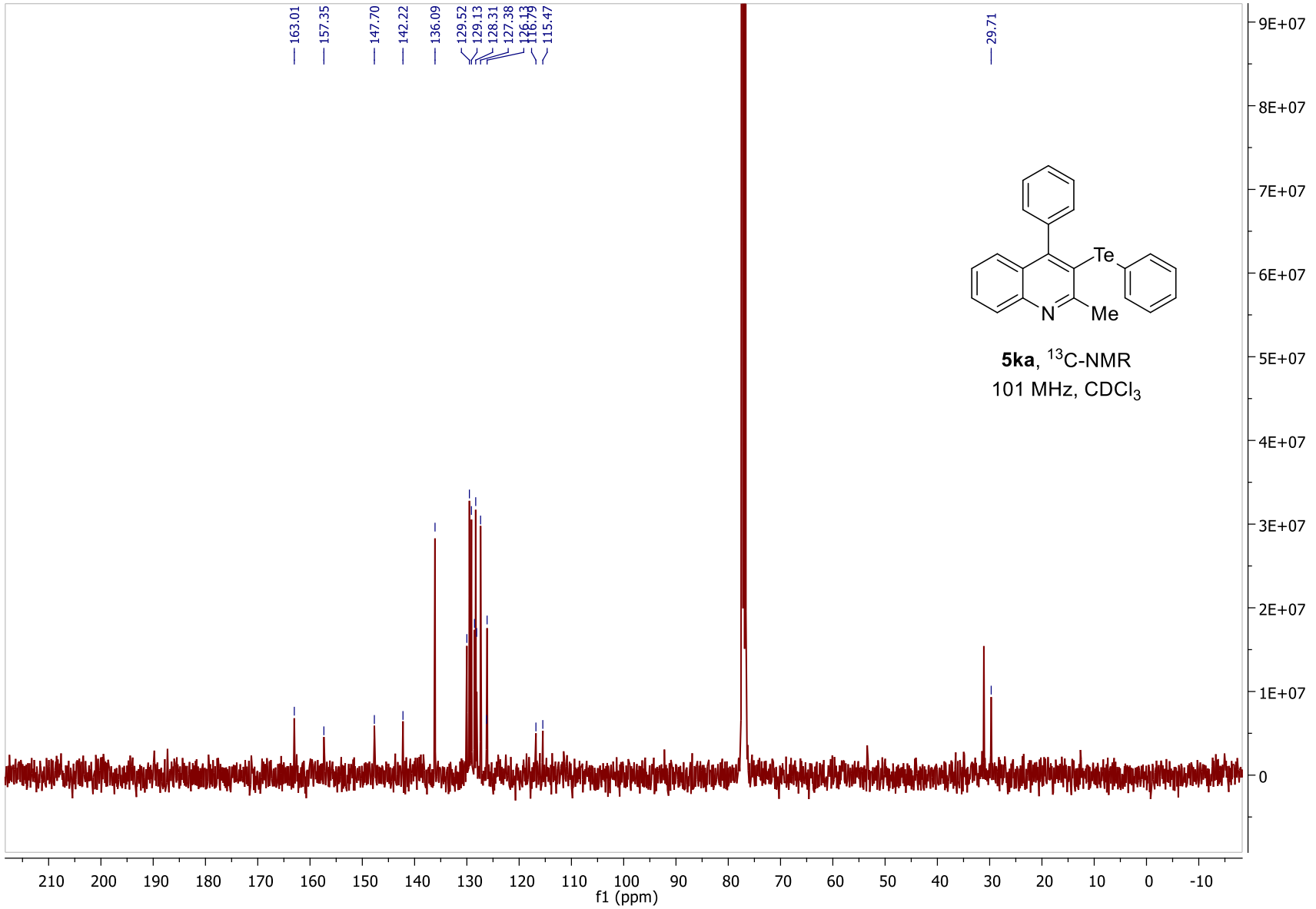

158.83
156.26
153.59
148.52
146.81
142.49
141.09
130.10
129.29
128.65
128.57
127.55
127.52
118.12
113.07
112.18
111.97
Te
F
N
5ia', 13C-NMR
101 MHz, CDCl3
4E+08
4E+08
3E+08
3E+08
3E+08
3E+08
3E+08
2E+08
2E+08
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
8E+07
6E+07
4E+07
2E+07
0
-2E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


-108.06
Te
F
N
5ia', ^{19}F-NMR
377 MHz, $CDCl_3$
3E+09
2E+09
1E+09
8E+08
6E+08
4E+08
2E+08
0
-2E+08
-4E+08
-6E+08
-8E+08
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)


MeO
Te
N
5ra, ^{1}H-NMR
400 MHz, $CDCl_3$
0.95
1.06
2.00
3.03
1.26
2.01
2.95
0.94
3.00
f1 (ppm)


157.96
151.54
149.67
143.20
140.52
140.05
129.90
129.11
128.93
128.72
121.34
115.13
113.39
103.84
55.37
MeO
Te
N
5ra, 13C-NMR
101 MHz, CDCl3
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


8.07
8.05
7.71
7.70
7.69
7.67
7.67
7.46
7.45
7.38
7.36
7.34
7.18
7.18
7.16
7.12
7.10
7.08
2.97
Te
N
Me
5ka, 1H-NMR
400 MHz, CDCl3
0.96
1.00
3.06
4.03
3.01
2.00
3.00
f1 (ppm)


163.01
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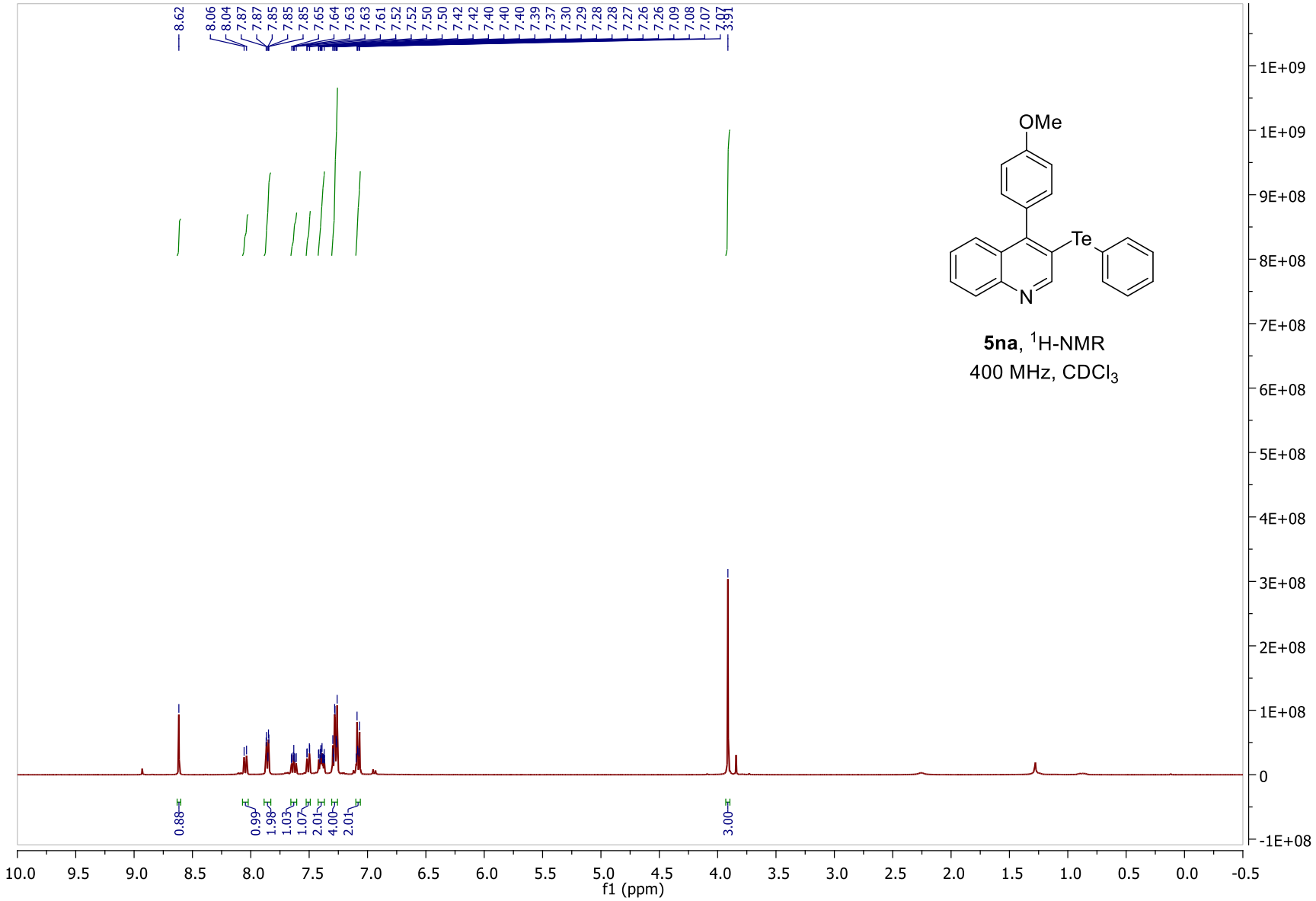
142.22
136.09
129.52
129.13
128.31
127.38
126.13
116.79
115.47
29.71
Te
N
Me
5ka, ^{13}C-NMR
101 MHz, $CDCl_3$
9E+07
8E+07
7E+07
6E+07
5E+07
4E+07
3E+07
2E+07
1E+07
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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8.04
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7.85
7.85
7.85
7.65
7.64
7.63
7.63
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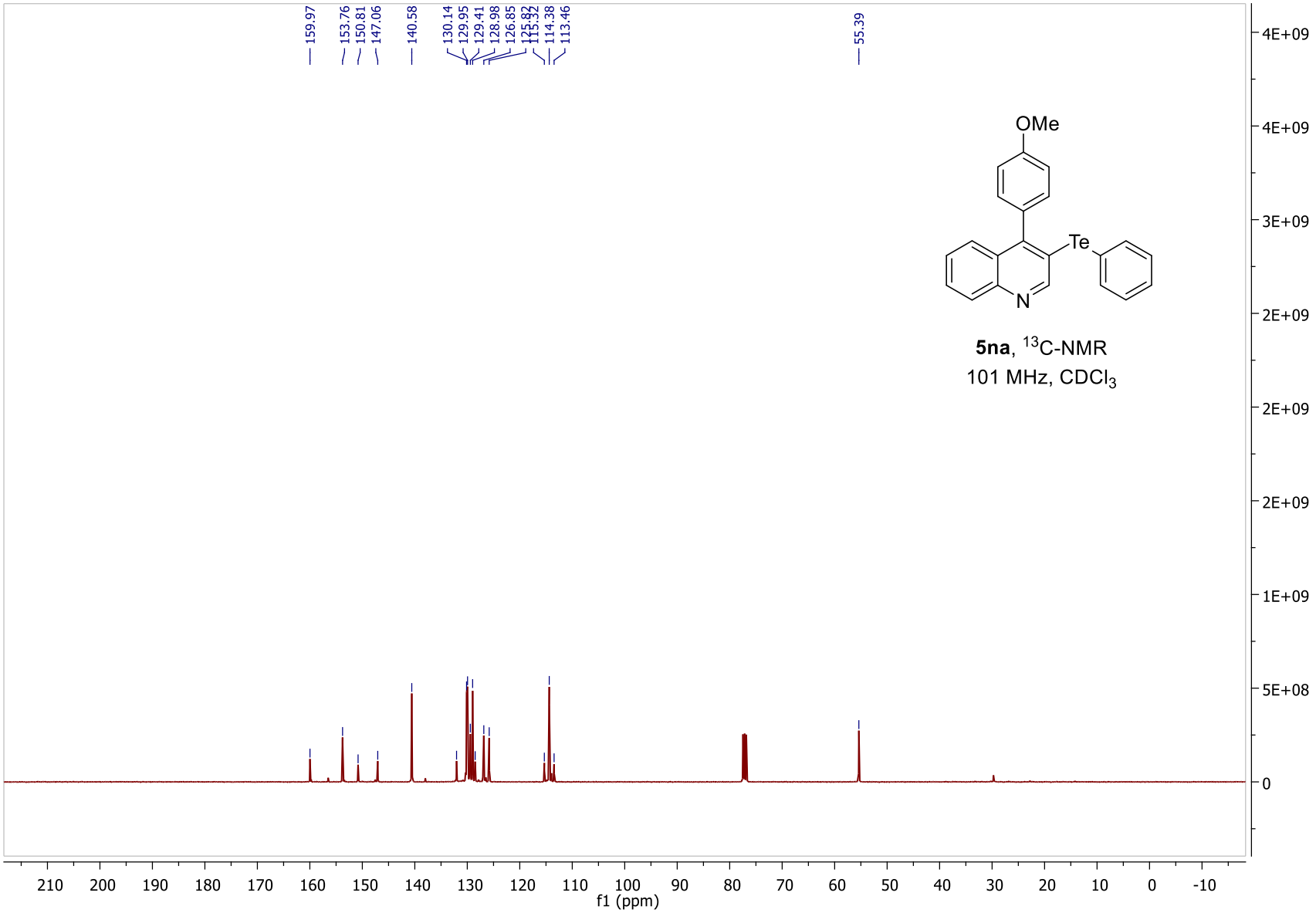
7.52
7.52
7.50
7.50
7.42
7.42
7.40
7.40
7.40
7.39
7.37
7.30
7.29
7.28
7.28
7.27
7.26
7.26
7.09
7.08
7.07
7.07
3.91
OMe
Te
N
5na, 1H-NMR
400 MHz, CDCl3
0.88
0.99
1.98
1.03
1.07
2.01
4.00
2.01
3.00
1E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
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)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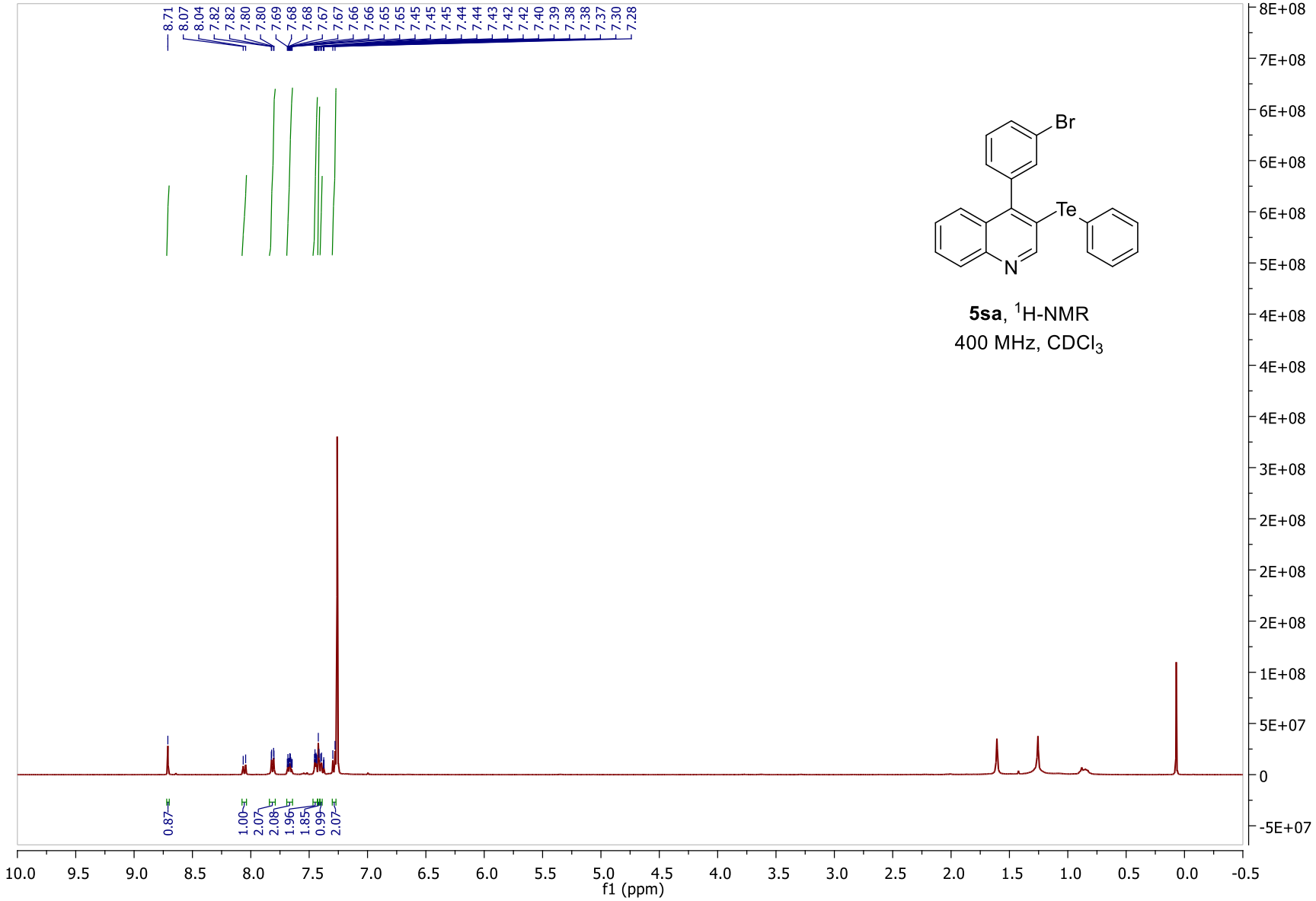
130.14
129.95
129.41
128.98
126.85
125.82
115.32
114.38
113.46
55.39
OMe
Te
N
5na, 13C-NMR
101 MHz, CDCl3
4E+09
4E+09
3E+09
2E+09
2E+09
2E+09
1E+09
5E+08
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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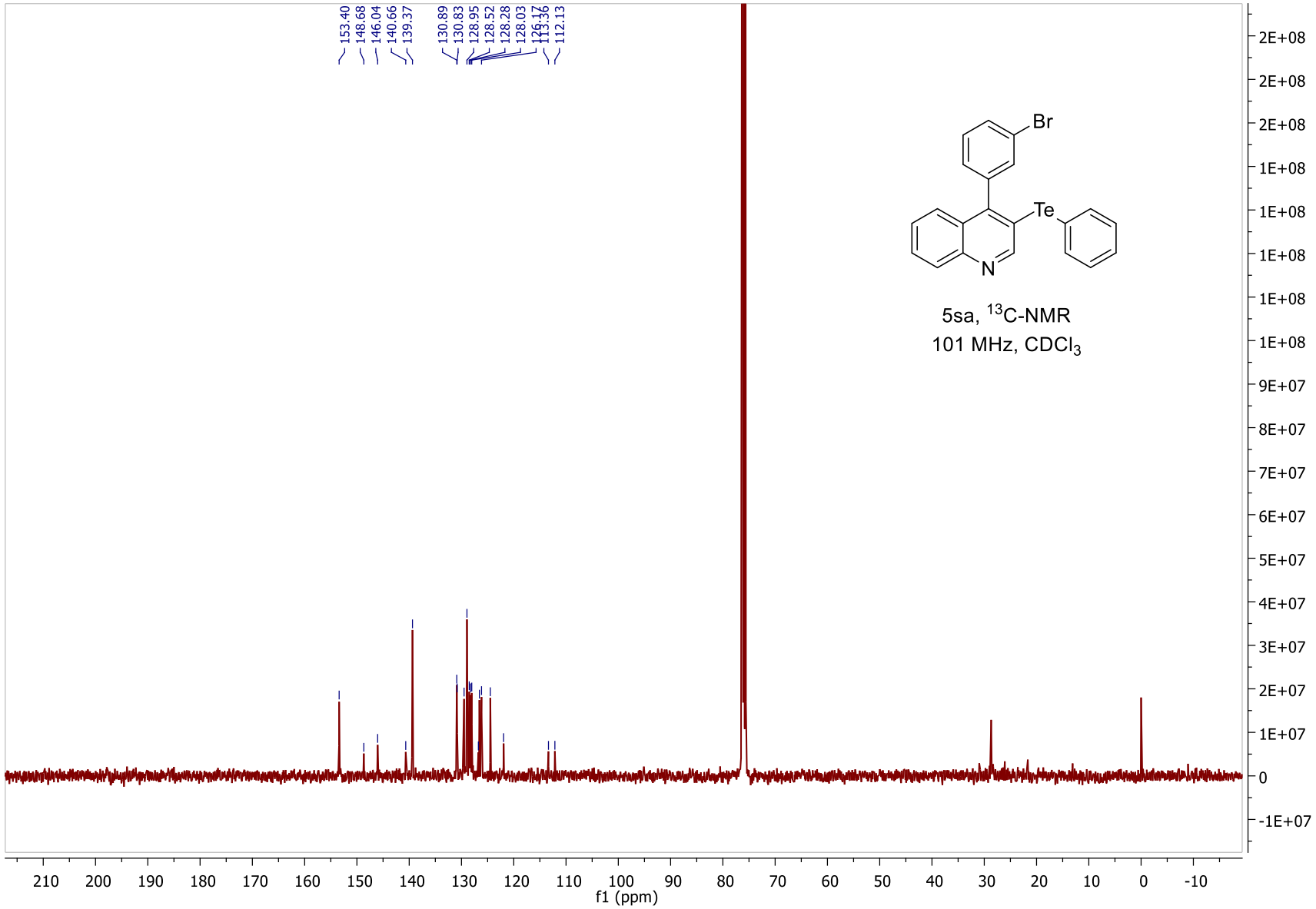
8.07
8.04
7.82
7.82
7.80
7.80
7.69
7.68
7.68
7.67
7.67
7.66
7.66
7.65
7.65
7.45
7.45
7.45
7.44
7.44
7.43
7.42
7.42
7.40
7.39
7.38
7.38
7.37
7.30
7.28
Br
Te
N
5sa, 1H-NMR
400 MHz, CDCl3
0.87
1.00
2.07
2.08
1.96
1.85
0.99
2.07
8E+08
7E+08
6E+08
6E+08
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
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)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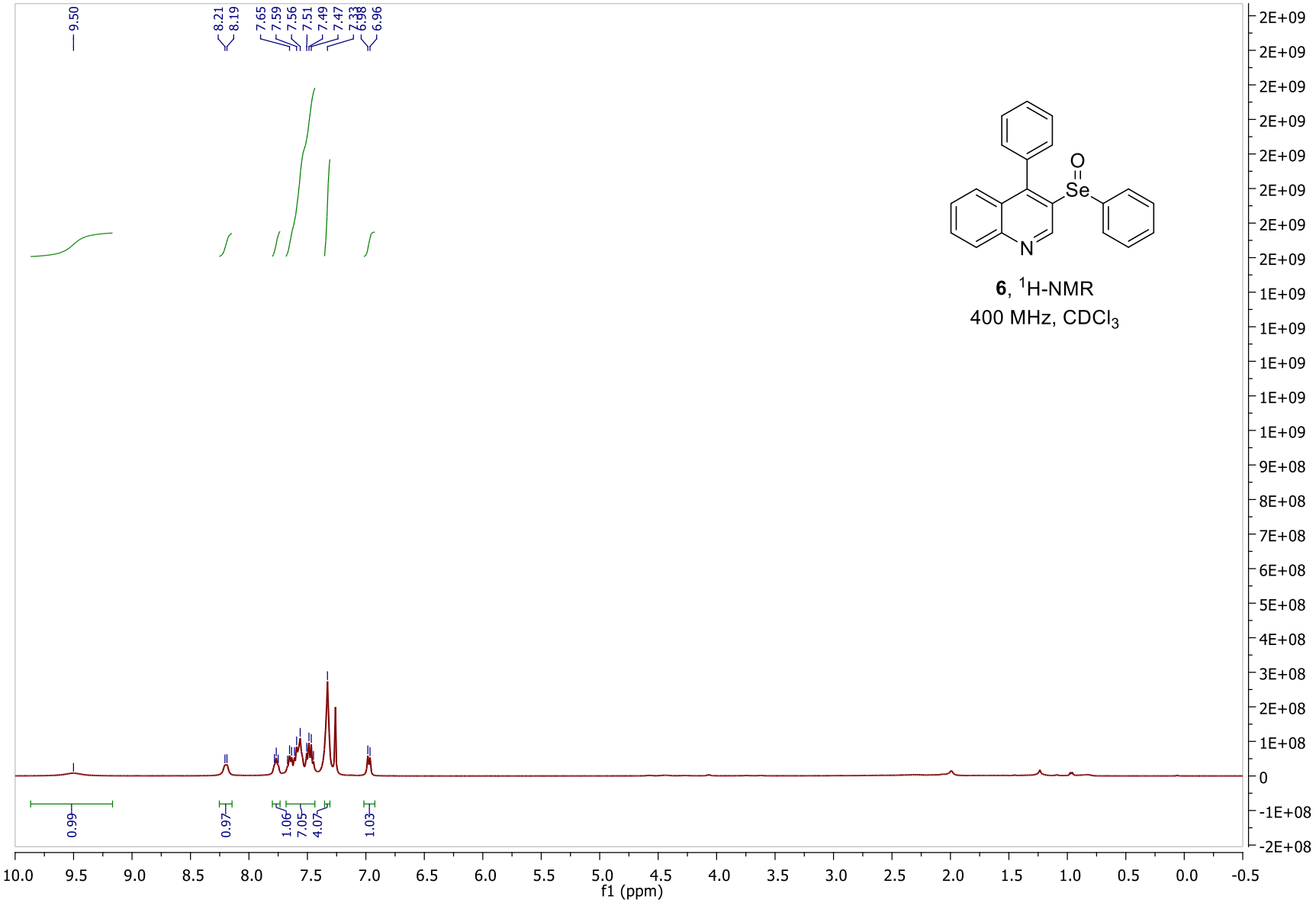
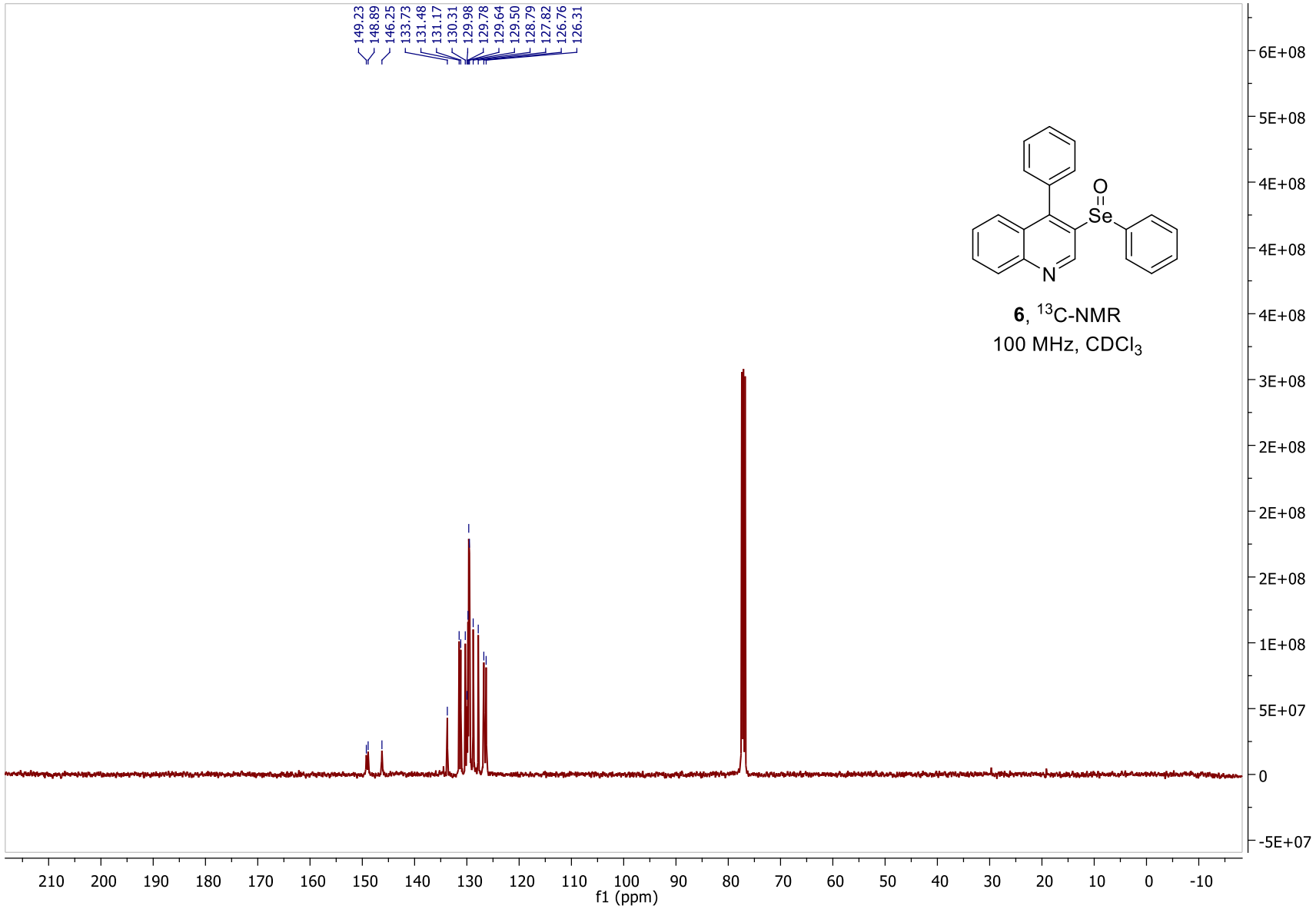
148.68
146.04
140.66
139.37
130.89
130.83
128.95
128.52
128.28
128.03
126.17
119.36
112.13
Br
Te
N
5sa, ^{13}C-NMR
101 MHz, $CDCl_3$
2E+08
2E+08
2E+08
1E+08
1E+08
1E+08
1E+08
1E+08
1E+08
9E+07
8E+07
7E+07
6E+07
5E+07
4E+07
3E+07
2E+07
1E+07
0
-1E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


9.50
8.21
8.19
7.65
7.59
7.56
7.51
7.49
7.47
7.33
6.98
6.96
O
Se
N
6, 1H-NMR
400 MHz, CDCl3
0.99
0.97
1.06
7.05
4.07
1.03
2E+09
1E+09
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
-1E+08
-2E+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)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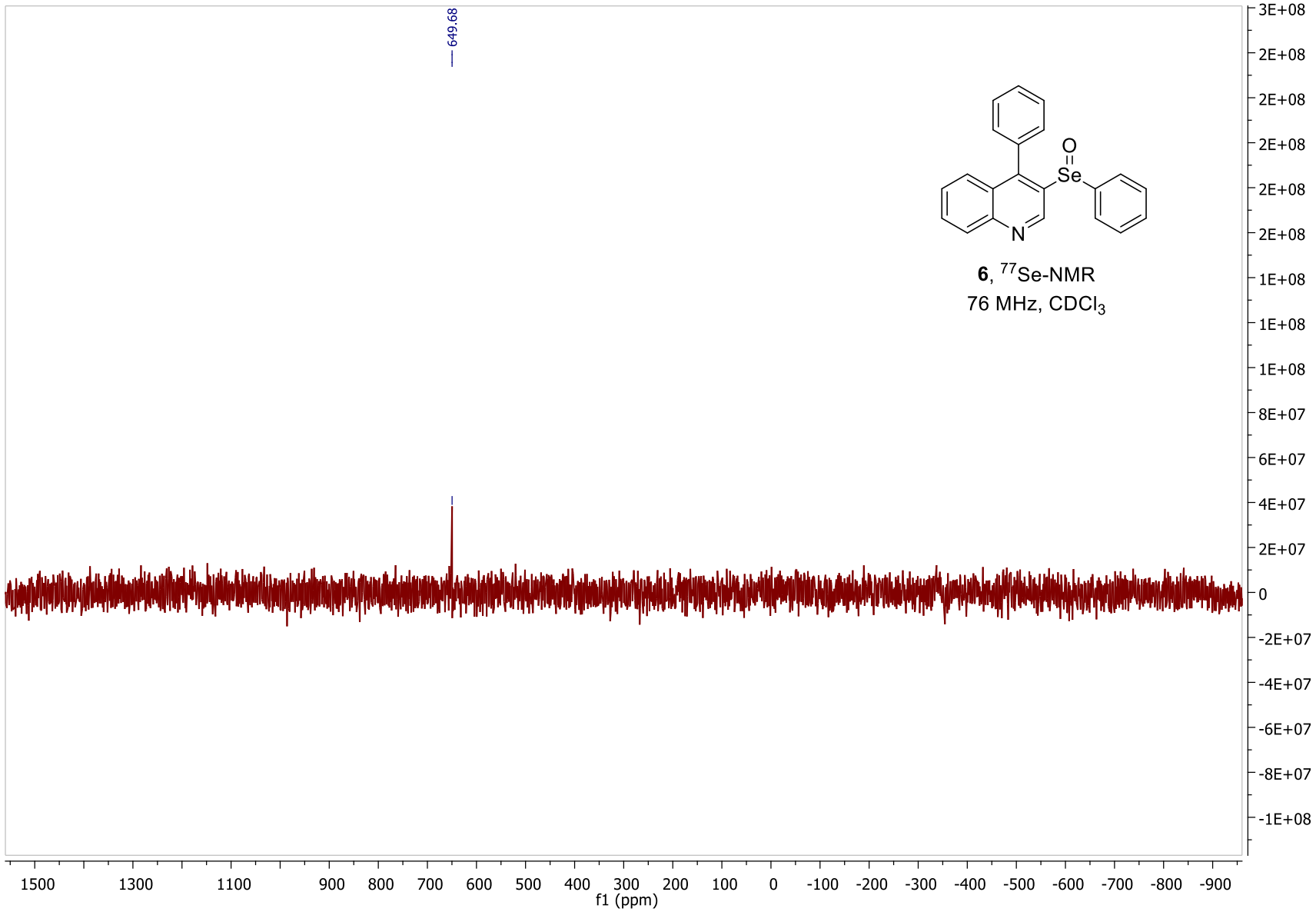
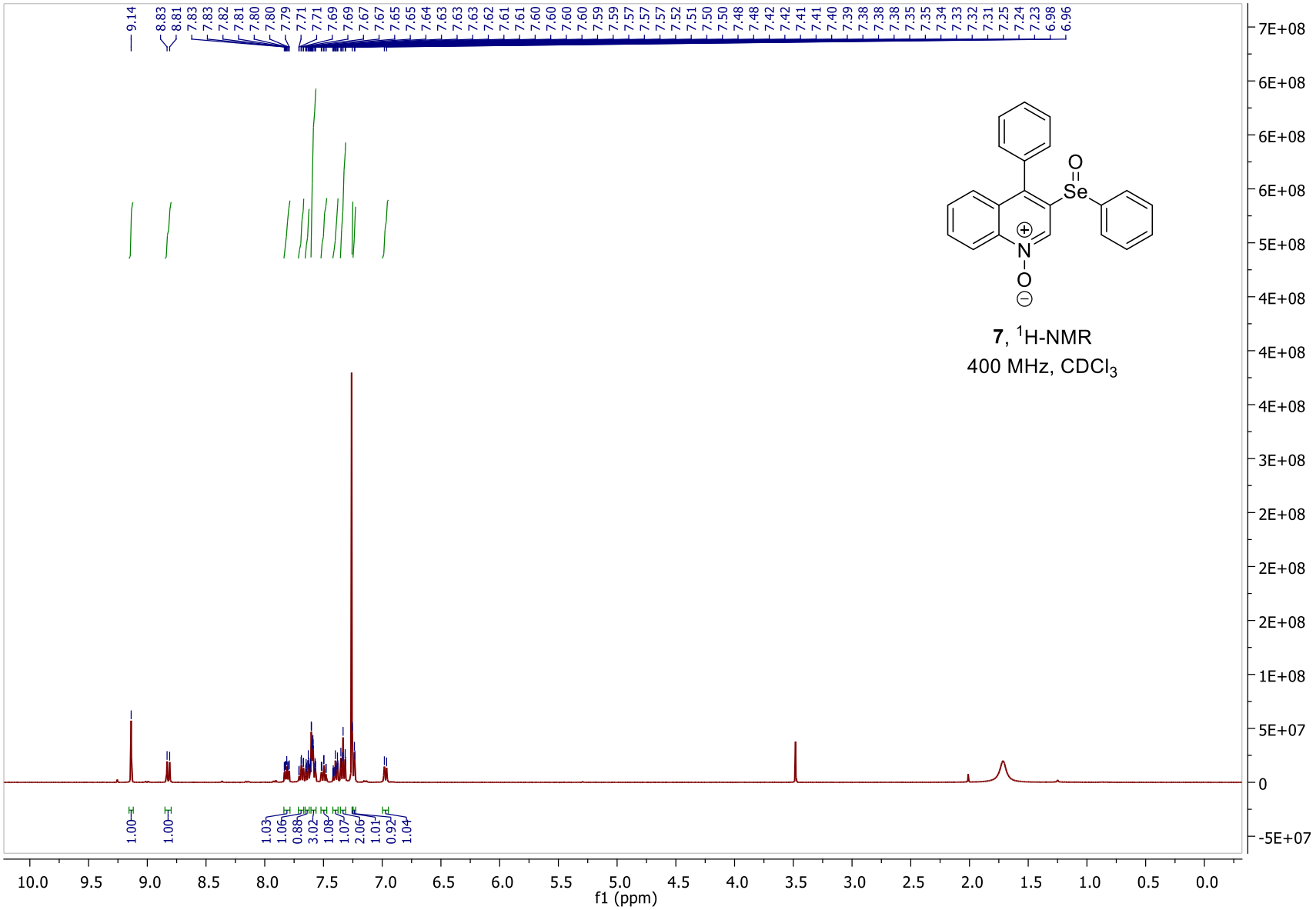
148.89
146.25
133.73
131.48
131.17
130.31
129.98
129.78
129.64
129.50
128.79
127.82
126.76
126.31
O
Se
N
6, 13C-NMR
100 MHz, CDCl3
6E+08
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


649.68
O
Se
N
6, 77Se-NMR
76 MHz, CDCl3
3E+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
-4E+07
-6E+07
-8E+07
-1E+08
1500
1300
1100
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
f1 (ppm)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8.81
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7.80
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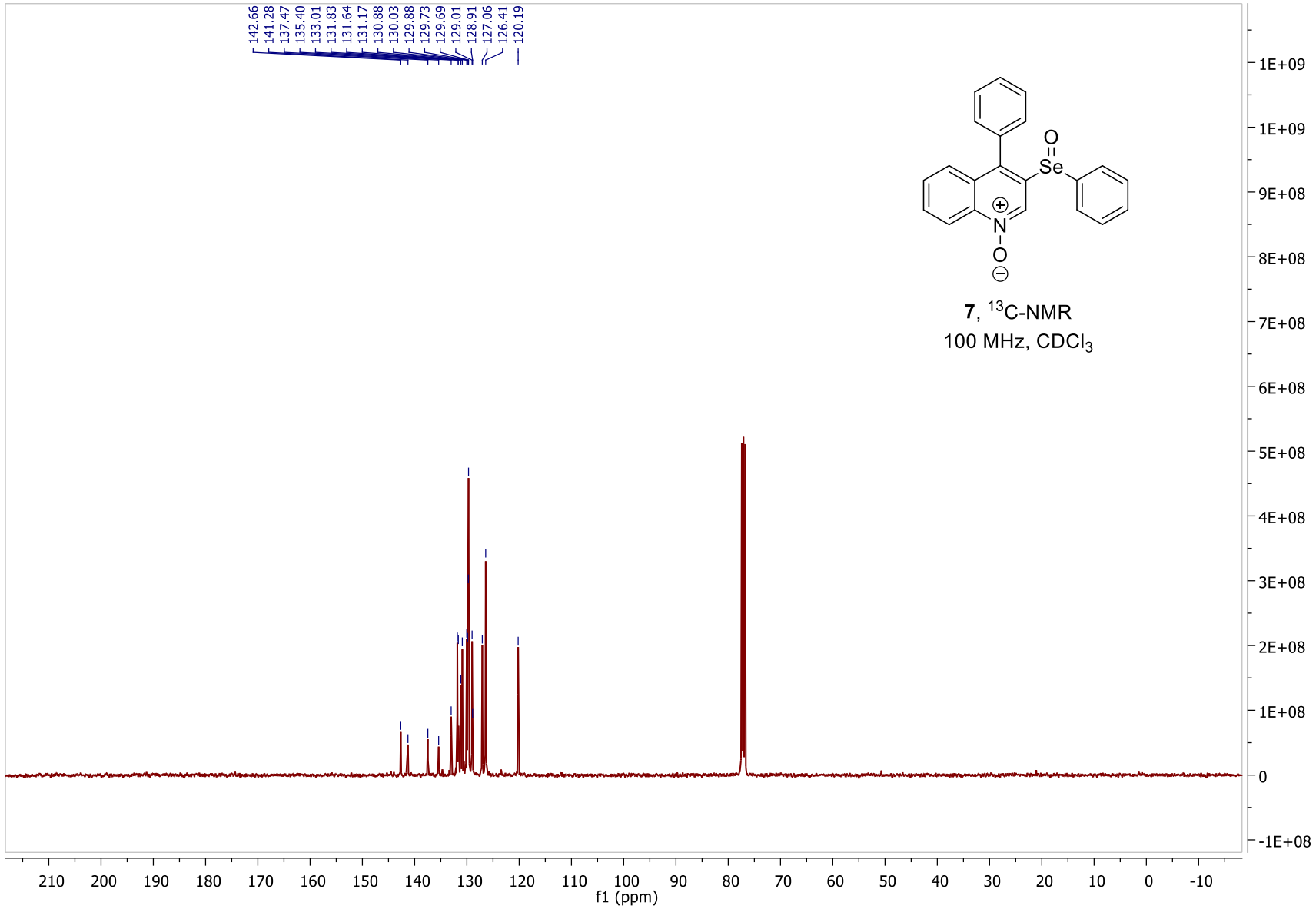
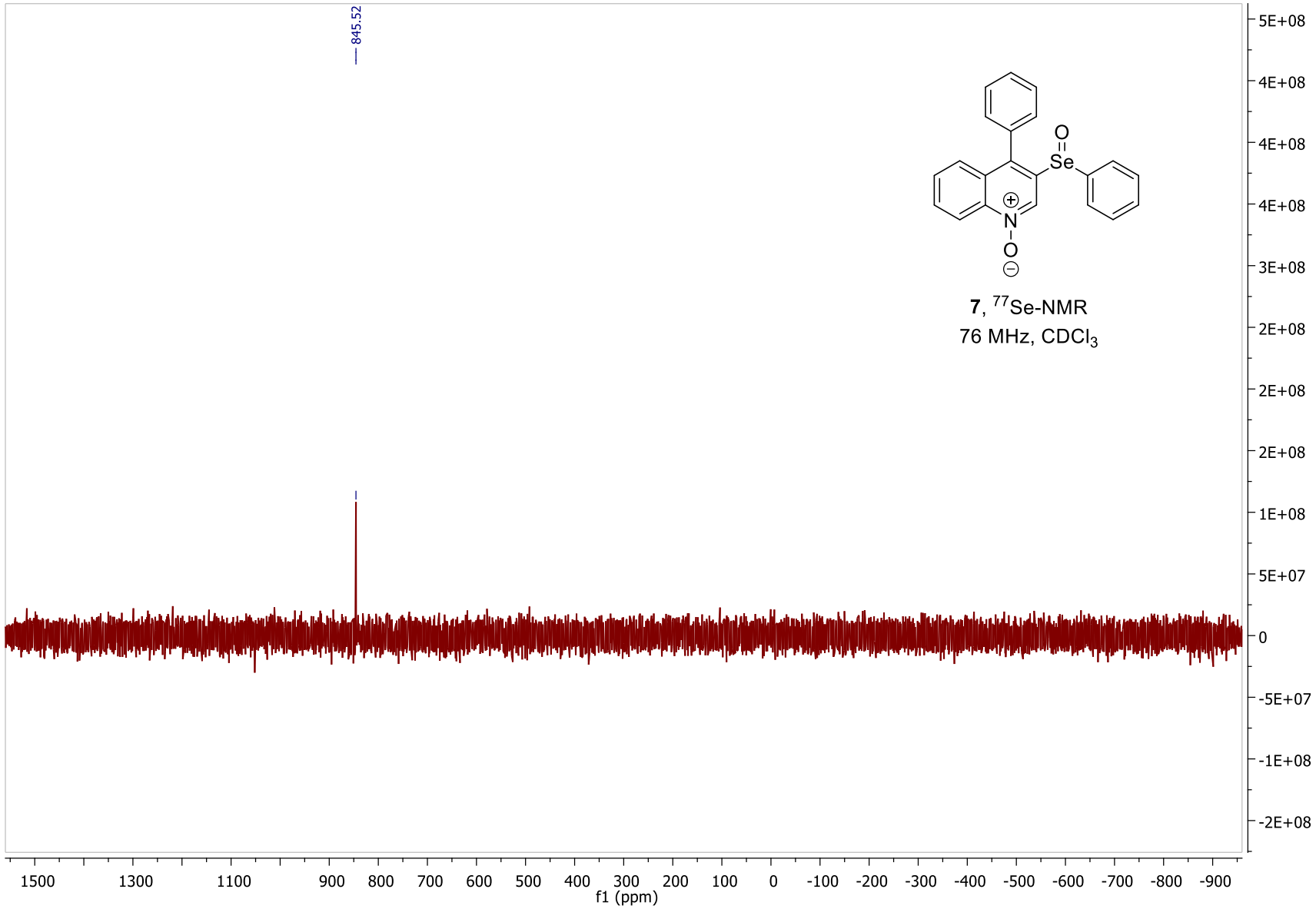
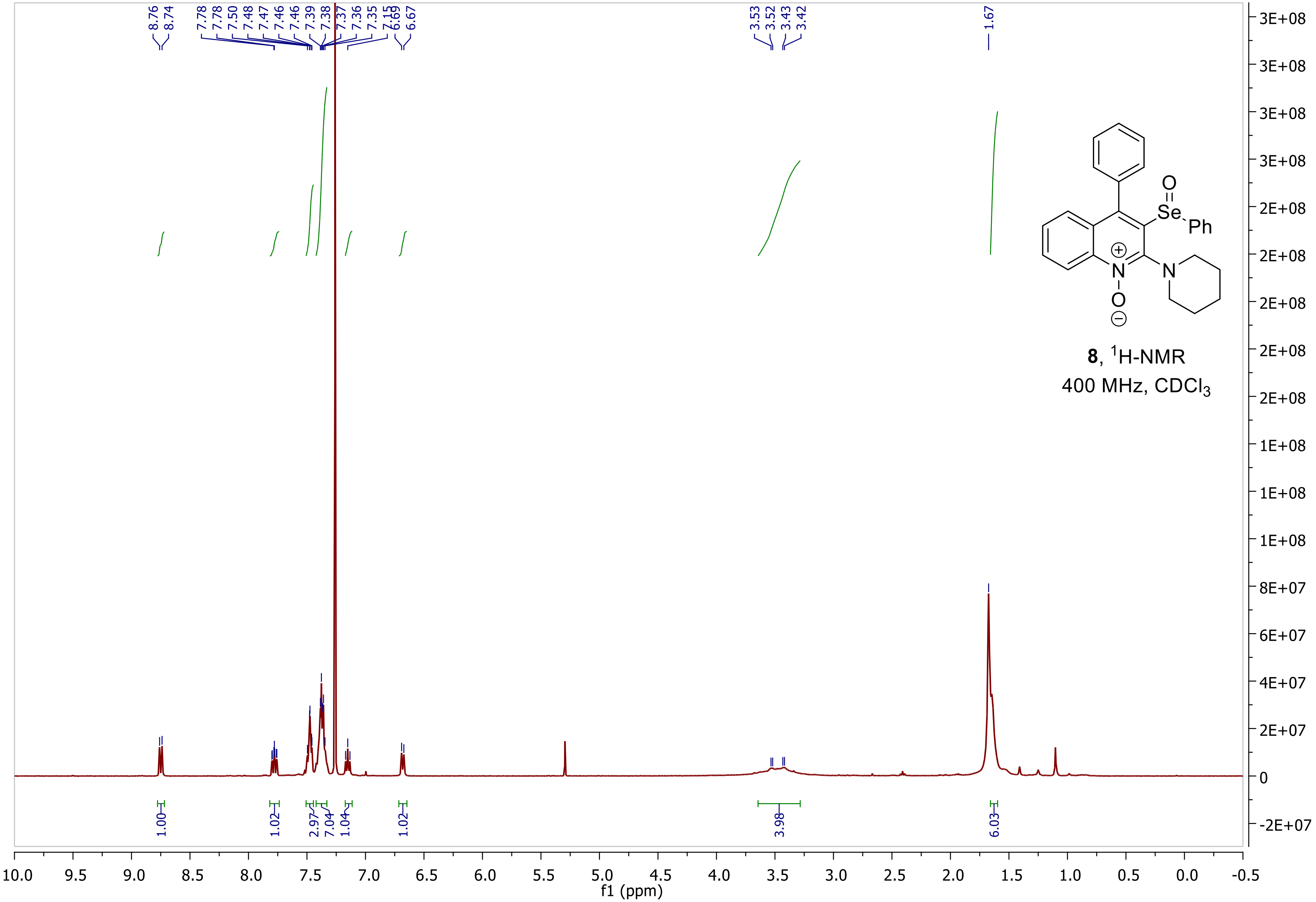
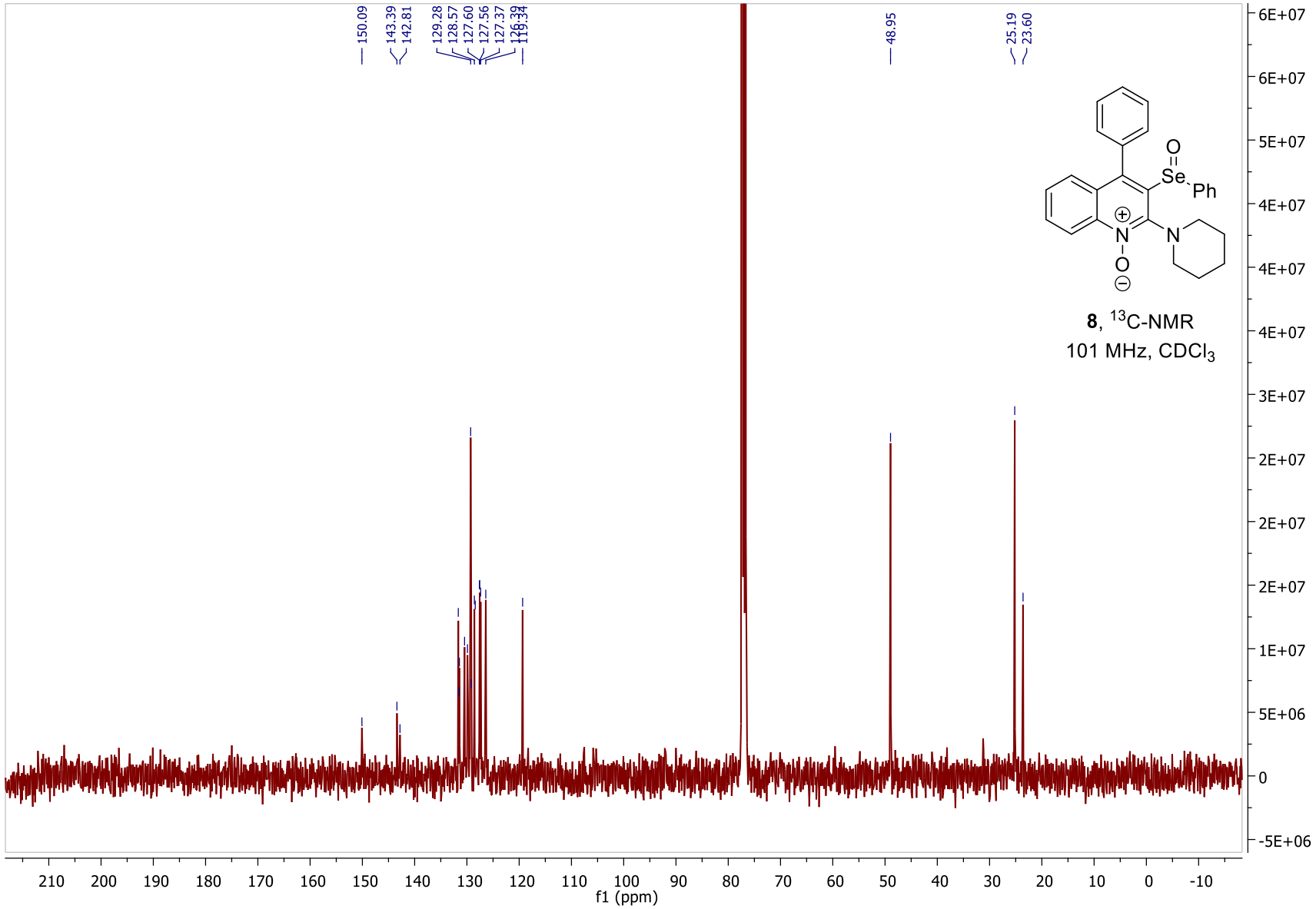
7.69
7.69
7.67
7.67
7.65
7.65
7.64
7.63
7.63
7.63
7.62
7.61
7.61
7.60
7.60
7.60
7.60
7.60
7.59
7.59
7.57
7.57
7.57
7.52
7.51
7.50
7.50
7.48
7.48
7.42
7.42
7.41
7.41
7.40
7.39
7.38
7.38
7.38
7.35
7.35
7.34
7.33
7.32
7.31
7.25
7.24
7.23
6.98
6.96
O
Se
N
O
7, 1H-NMR
400 MHz, CDCl3
1.00
1.00
1.03
1.06
0.88
3.02
1.08
1.07
2.06
1.01
0.92
1.04
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)


142.66
141.28
137.47
135.40
133.01
131.83
131.64
131.17
130.88
130.03
129.88
129.73
129.69
129.01
128.91
127.06
126.41
120.19
O
Se
N
O
7, 13C-NMR
100 MHz, CDCl3
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
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


845.52
O
Se
N
O
7, 77Se-NMR
76 MHz, CDCl3
5E+08
4E+08
4E+08
4E+08
3E+08
2E+08
2E+08
2E+08
1E+08
5E+07
0
-5E+07
-1E+08
-2E+08
1500
1300
1100
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
f1 (ppm)



8.76
8.74
7.78
7.78
7.50
7.48
7.47
7.46
7.46
7.39
7.38
7.37
7.36
7.35
7.15
6.69
6.67
3.53
3.52
3.43
3.42
1.67
1.00
1.02
2.97
7.04
1.04
1.02
3.98
6.03
8, 1H-NMR
400 MHz, CDCl3
f1 (ppm)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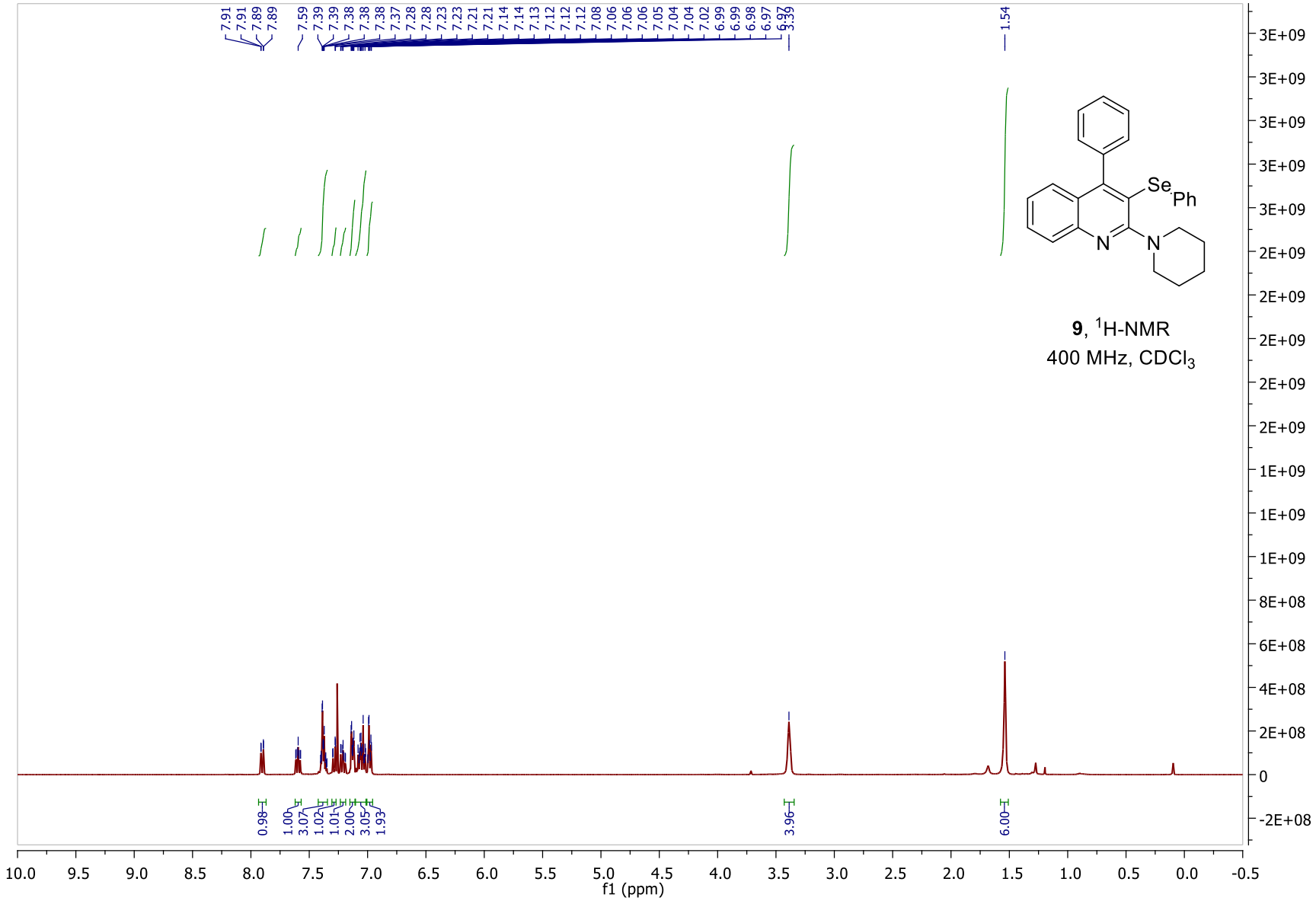
143.39
142.81
129.28
128.57
127.60
127.56
127.37
48.95
25.19
23.60
O
Se
Ph
N
N
O
8, 13C-NMR
101 MHz, CDCl3
6E+07
5E+07
4E+07
3E+07
2E+07
1E+07
5E+06
0
-5E+06
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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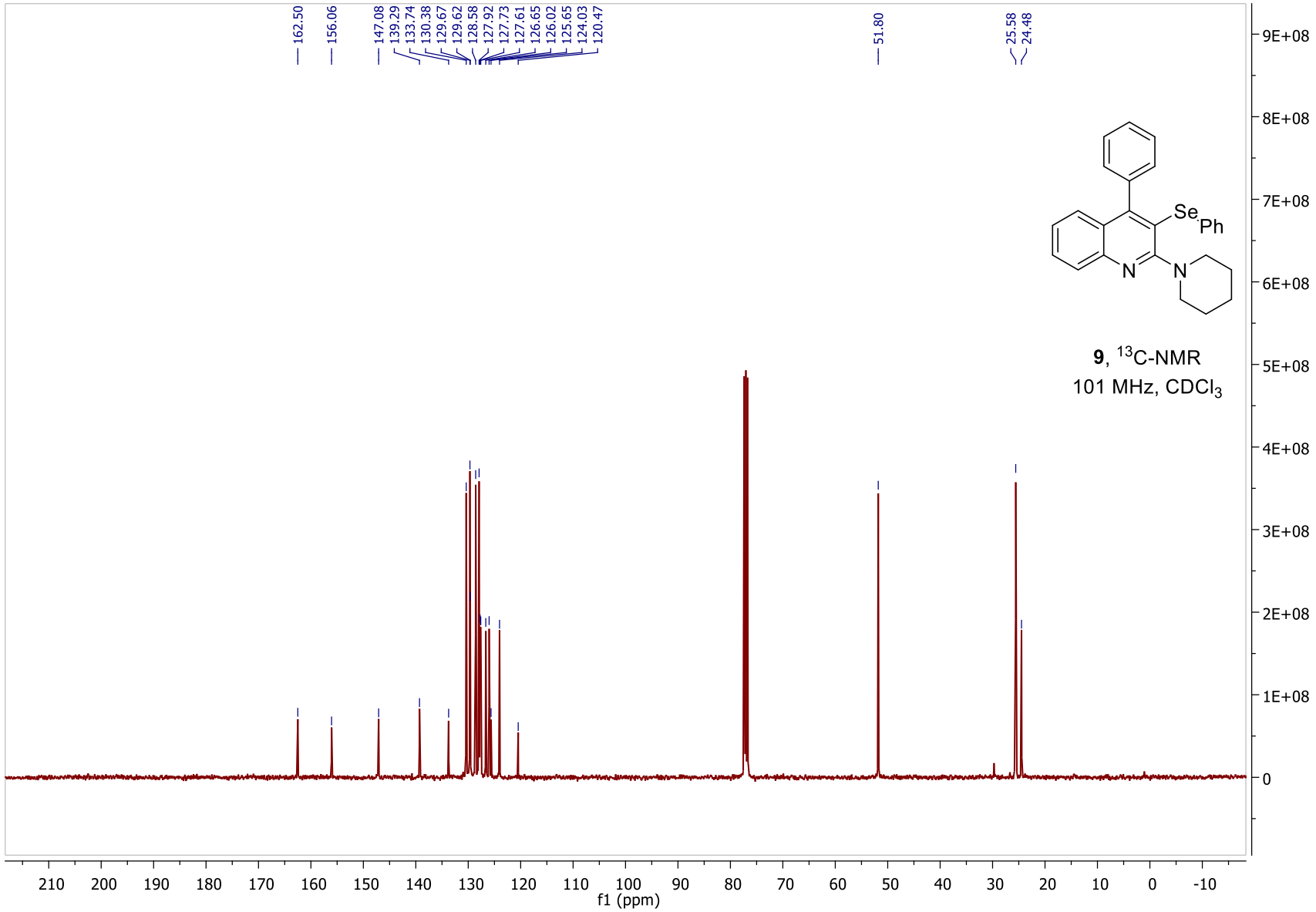
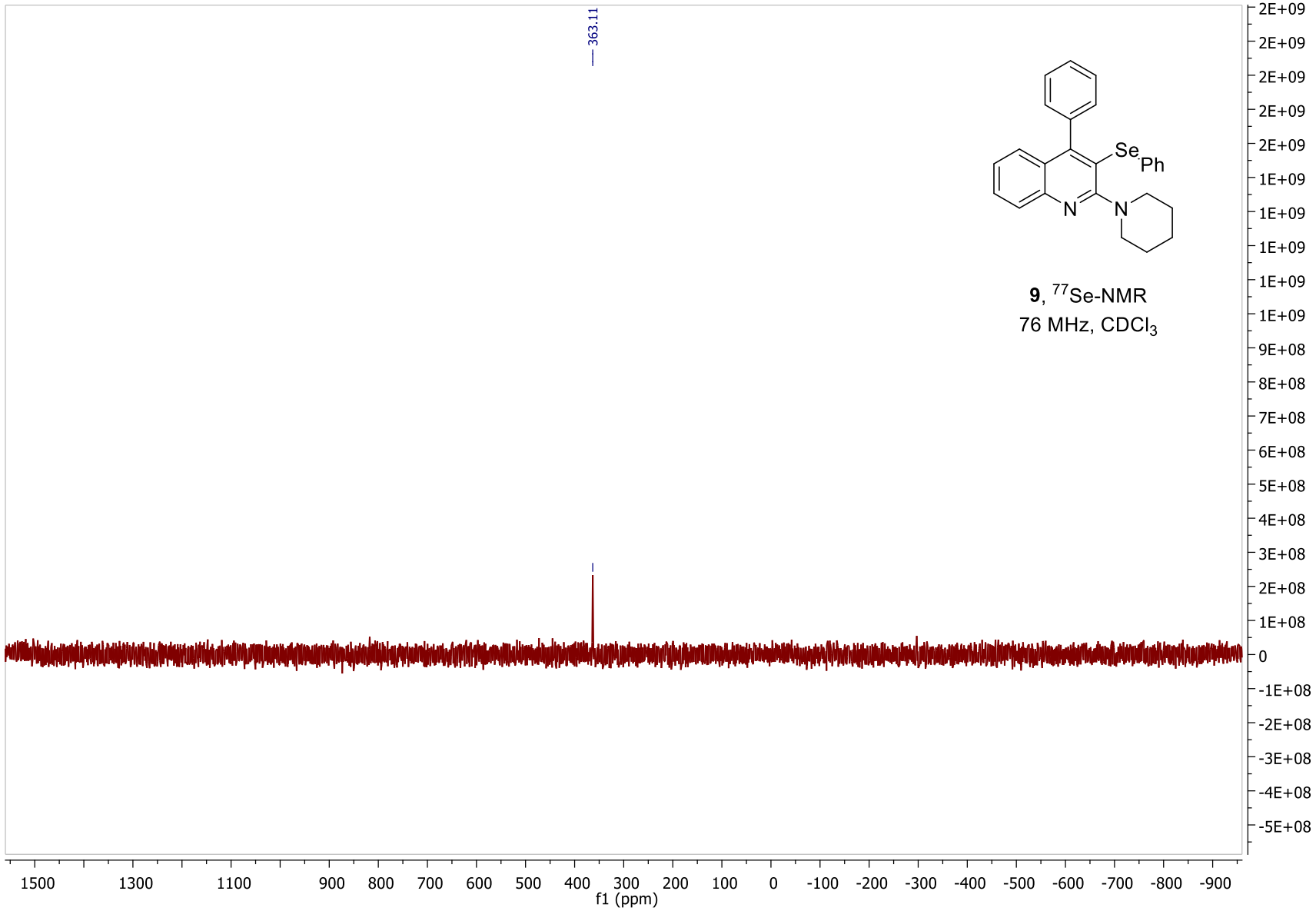
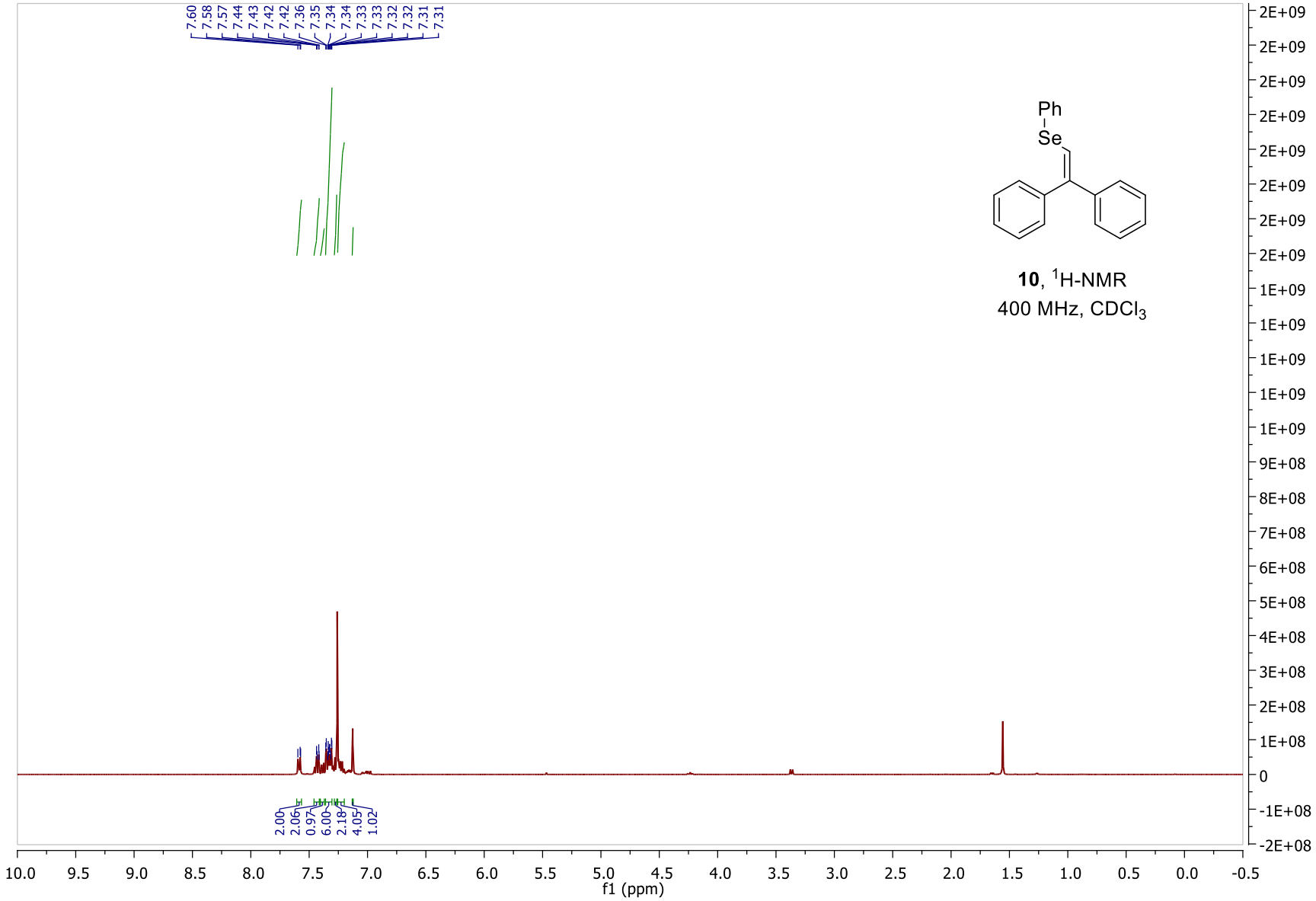
7.91
7.89
7.89
7.59
7.39
7.39
7.38
7.38
7.38
7.37
7.28
7.23
7.23
7.21
7.21
7.14
7.14
7.13
7.12
7.12
7.12
7.08
7.06
7.06
7.06
7.05
7.04
7.04
7.02
6.99
6.99
6.98
6.97
6.97
3.39
1.54
Se
Ph
N
N
9, 1H-NMR
400 MHz, CDCl3
0.98
1.00
3.07
1.02
1.01
2.00
3.05
1.93
3.96
6.00
3E+09
3E+09
3E+09
3E+09
3E+09
2E+09
2E+09
2E+09
2E+09
2E+09
2E+09
1E+09
1E+09
1E+09
1E+09
8E+08
6E+08
4E+08
2E+08
0
-2E+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)


162.50
156.06
147.08
139.29
133.74
130.38
129.67
129.62
128.58
127.92
127.73
127.61
126.65
126.02
125.65
124.03
120.47
51.80
25.58
24.48
Se
Ph
N
N
9, 13C-NMR
101 MHz, CDCl3
9E+08
8E+08
7E+08
6E+08
5E+08
4E+08
3E+08
2E+08
1E+08
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


363.11
Se
Ph
N
N
9, 77Se-NMR
76 MHz, CDCl3
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
-2E+08
-3E+08
-4E+08
-5E+08
1500
1300
1100
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
f1 (ppm)


7.60
7.58
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7.42
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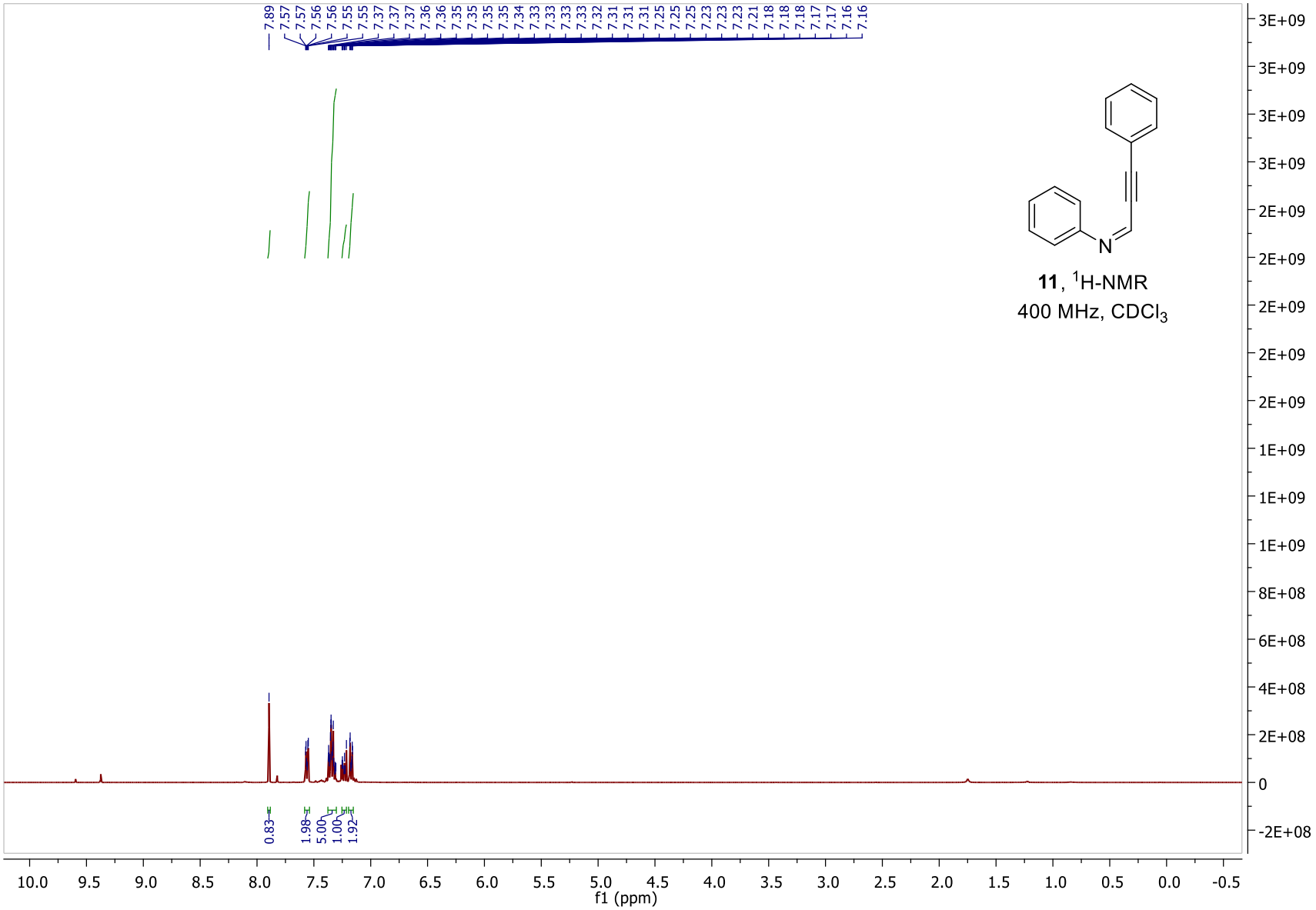
7.36
7.35
7.34
7.34
7.33
7.33
7.32
7.32
7.31
7.31
Ph
Se
10, 1H-NMR
400 MHz, CDCl3
2.00
2.06
0.97
6.00
2.18
4.05
1.02
f1 (ppm)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7.56
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7.55
7.37
7.37
7.37
7.36
7.36
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7.35
7.35
7.34
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7.33
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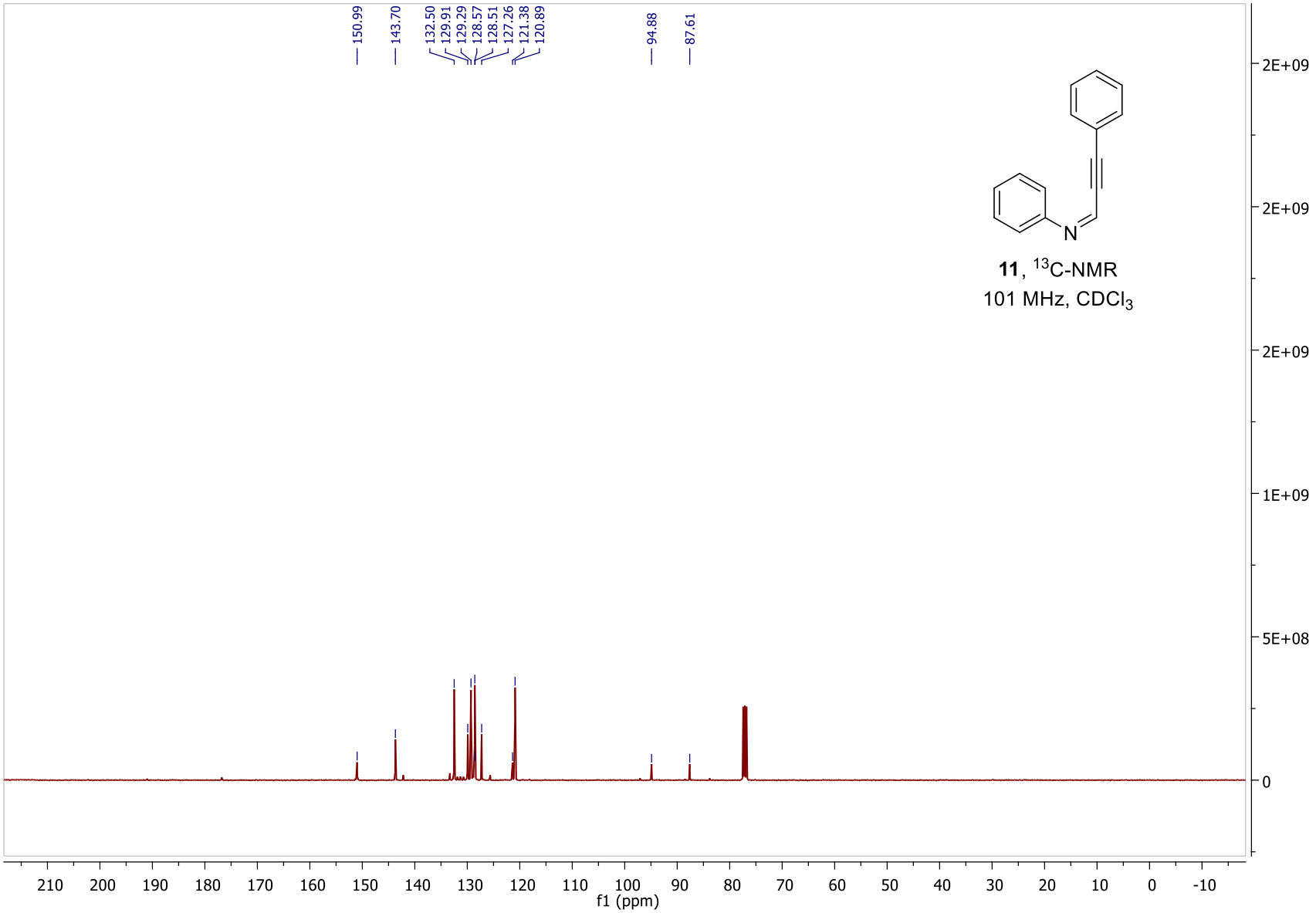
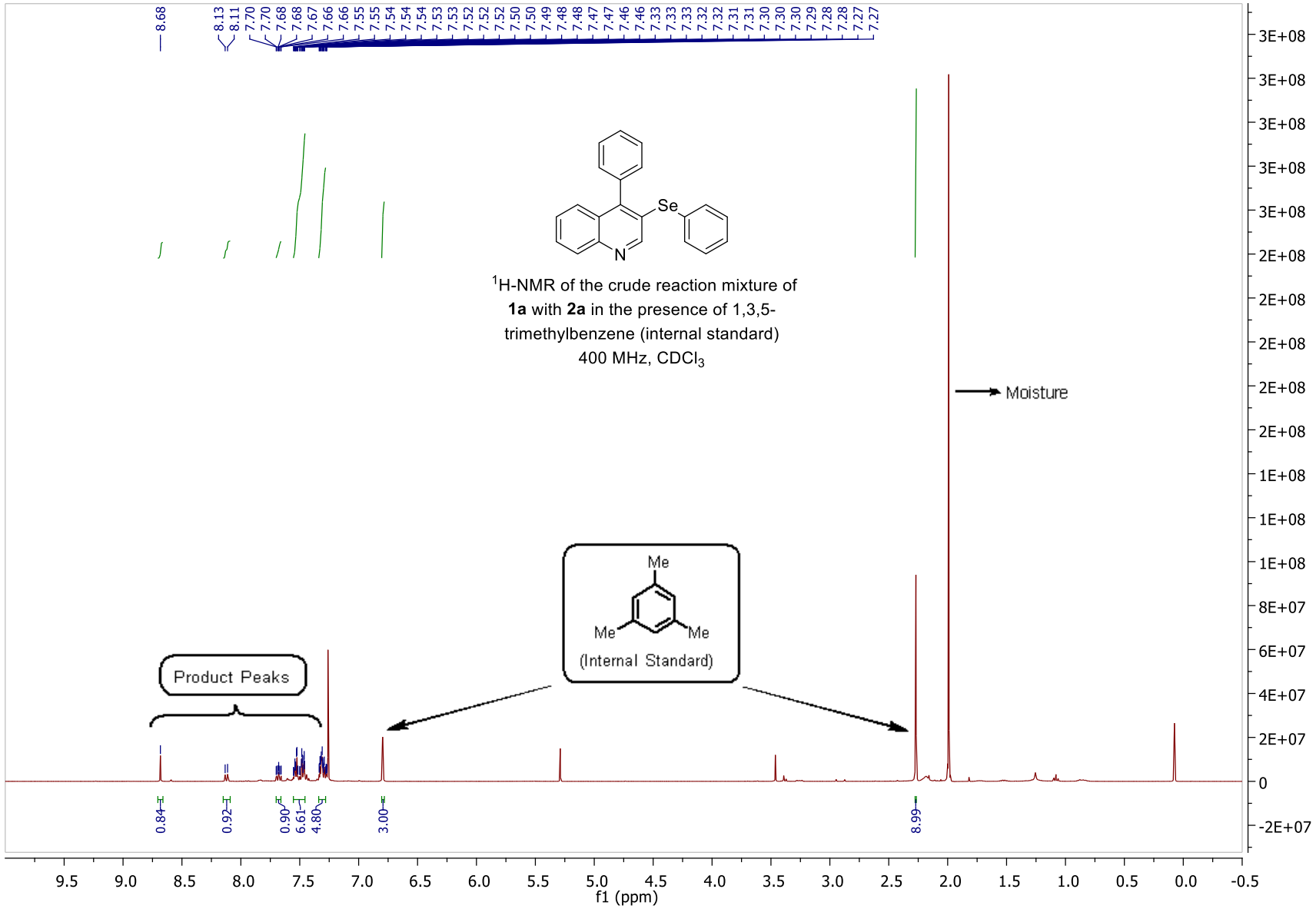
7.32
7.31
7.31
7.31
7.25
7.25
7.25
7.23
7.23
7.23
7.21
7.18
7.18
7.18
7.17
7.17
7.16
7.16
N
11, 1H-NMR
400 MHz, CDCl3
0.83
1.98
5.00
1.00
1.92
3E+09
3E+09
3E+09
3E+09
2E+09
2E+09
2E+09
2E+09
2E+09
2E+09
1E+09
1E+09
1E+09
1E+09
8E+08
6E+08
4E+08
2E+08
0
-2E+08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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)


150.99
143.70
132.50
129.91
129.29
128.57
128.51
127.26
121.38
120.89
94.88
87.61
N
11, 13C-NMR
101 MHz, CDCl3
2E+09
2E+09
2E+09
1E+09
5E+08
0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)



^{1}H-NMR of the crude reaction mixture of **1a** with **2a** in the presence of 1,3,5-trimethylbenzene (internal standard)
400 MHz, $CDCl_3$