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Supporting Information

for

Synthesis of 1,2-diselenides *via* potassium persulfate mediated diselenation of allenamides with diselenides.

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1. General considerations

All reactions were performed using Schlenk tubes, septa, and syringes with protection of nitrogen. THF、CH_3CN、toluene and DCM were freshly distilled over sodium/benzophenone and calcium hydride, respectively. Commercial reagents were used as supplied or were purified by standard techniques where necessary. Column chromatography was performed using Qingdao Haiyang Chemical Co., Ltd silica gel (200–300 mesh) with the appropriate solvent system, as determined by TLC analysis (Qingdao Haiyang Chemical Co., Ltd, silica gel F254) using UV light and $KMnO_4$ stain to visualize the reaction components. Melting points were determined using a WRS-1B digital melting point instrument. IR spectra were recorded on a Nicoletisso FTIR spectrometer using KBr disks. Unless otherwise noted, nuclear magnetic resonance spectra were recorded at room temperature on an Agilent 400 MHz spectrometer using $CDCl_3$ as the solvent and TMS as the internal reference. Chemical shifts for ^{13}C NMR spectra were recorded in parts per million relative to tetramethylsilane using the central peak of deuterochloroform (77.0 ppm) as the internal standard. HRMS was performed using a Bruker Daltonics Bio TOF mass spectrometer.

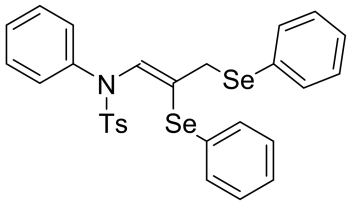
Allenamides **1a-1q** were prepared according to the published methods.[1-4] Diselenides **2b, 2c, 2d, 2e** were prepared according to the published methods.[5] Diselenides **2a, 2f, 2g** and $K_2S_2O_8$ were obtained commercially and used without further purification.

General procedure for Potassium persulfate mediated diselenation of allenamide 1a with diselenide 2a.

Under Ar, allenamide **1a** (0.1mmol) and diselenides **2a** (0.5 mmol) were suspended in dry CH_3CN (2 mL) in a flame-dried schlenk tube. After the mixture was stirred at room temperature for 3 min, the $K_2S_2O_8$ (0.1 mmol) was added. The mixture was stirred at room temperature for 4 h until complete consumption of starting material as monitored by TLC. Then the mixture was diluted with EtOAc (15

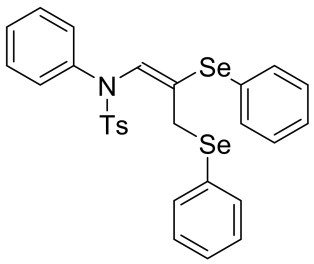
mL) after addition of saturated NaCl solution (10 mL). The layers were then separated and the aqueous layer was extracted with EtOAc (2 x 15 mL) and the collected organic layers were dried over anhydrous sodium sulfate, filtered, and concentrated in vacuo followed by purification through flash chromatography on silica gel column (hexane/EtOAc = 30/1 as the eluent) afforded (*Z*)-**4aa** (40.8 mg, 68% yield) as a white solid and (*E*)-**4aa** (13.2 mg, 22% yield) as a white solid.

2. Analytical Data



(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-4-methyl-*N*-phenylbenzenesulfonamide (**4aa**)

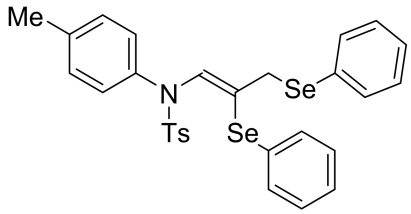
White solid. Yield, 68%. M P, 105.5 – 107.0 ℃. IR (neat) 3459, 2934, 1662, 1365, 1269, 1172, 749 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 (t, *J* = 6.5 Hz, 4H), 7.30 (d, *J* = 8.1 Hz, 2H), 7.27 – 7.13 (m, 11H), 6.79 – 6.74 (m, 2H), 6.66 (s, 1H), 3.51 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.91, 140.02, 135.22, 134.33, 133.88, 133.38, 133.23, 129.51, 129.42, 129.13, 128.98, 128.80, 128.33, 128.17, 127.98, 127.78, 127.30, 126.77, 33.53, 21.62. ^{77}Se NMR (400 MHz, $CDCl_3$) δ 379.1, 354.4. HRMS (ESI) m/z calcd for $C_{28}H_{25}NO_2SSe_2^+$ $[M+Na]^+$ 621.9828, found 621.9824.



(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-4-methyl-*N*-phenylbenzenesulfonamide (**4aa**)

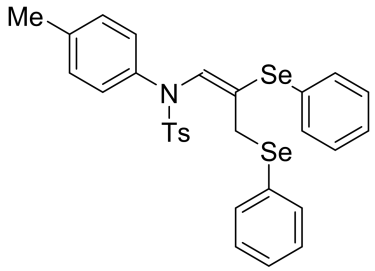
White solid. Yield, 22%. M P, 140.5 – 142.0 ℃. IR (neat) 3453, 2934, 1643, 1367, 1250, 1172, 742 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 – 7.43 (m, 2H), 7.36 – 7.23 (m, 10H), 7.20 – 7.09 (m, 5H), 6.97 – 6.95 (m, 2H), 6.71 (s, 1H), 3.61 (s, 2H), 2.40 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 144.20, 139.46, 133.89, 133.39, 133.24, 131.46, 130.40, 129.73, 129.55, 129.31, 129.27, 128.85, 127.98, 127.81, 127.78, 127.65, 127.44, 127.19, 30.55, 21.65. ^{77}Se NMR (400 MHz, $CDCl_3$) δ 424.6, 341.4. HRMS (ESI) m/z calcd for $C_{28}H_{25}NO_2SSe_2^+$ $[M+Na]^+$ 621.9828, found 621.9827.



(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-4-methyl-*N*-(p-tolyl)benzenesulfonamide (**4ba**)

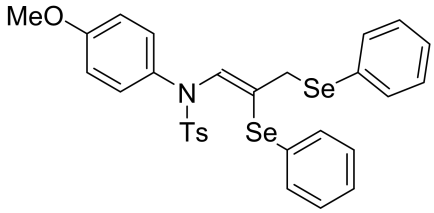
White solid. Yield, 48%. M P, 149.8 – 150.4 ℃. IR (neat) 3469, 2934, 1640, 1362, 1170, 1087, 747 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.28 (m, 6H), 7.24 – 7.13 (m, 8H), 6.97 (d, *J* = 8.1 Hz, 2H), 6.65 (d, *J* = 4.2 Hz, 2H), 6.64 (s, 1H), 3.50 (s, 2H), 2.40 (s, 3H), 2.29 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.81, 137.33, 135.24, 134.38, 133.87, 129.56, 129.45, 129.40, 129.10, 128.96, 128.27, 128.18, 128.16, 128.14, 127.81, 127.76, 127.26, 125.97, 33.65, 21.62, 21.17. HRMS (ESI) m/z calcd for $C_{29}H_{27}NO_2SSe_2^+$ $[M+Na]^+$ 635.9985, found 635.9992.



(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-4-methyl-*N*-(p-tolyl)benzenesulfonamide (**4ba**)

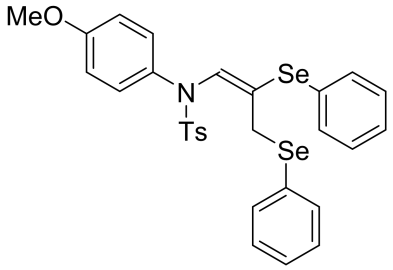
Yellow oil liquid. Yield, 16%. IR (neat) 3443, 2934, 1609, 1362, 1170, 1091, 739 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 – 7.40 (m, 2H), 7.35 (d, *J* = 8.3 Hz, 2H), 7.29 – 7.23 (m, 5H), 7.20 – 7.10 (m, 5H), 7.02 (d, *J* = 8.1 Hz, 2H), 6.82 (d, *J* = 8.3 Hz, 2H), 6.75 (s, 1H), 3.54 (s, 2H), 2.40 (s, 3H), 2.29 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.07, 138.12, 136.54, 134.10, 133.26, 133.00, 131.98, 130.57, 129.86, 129.49, 129.39, 129.24, 128.78, 127.81, 127.50, 127.05, 125.32, 109.99, 30.51, 21.61, 21.14. HRMS

(ESI) m/z calcd for $C_{29}H_{27}NO_2SSe_2^+$ $[M+Na]^+$ 635.9985, found 635.9989.



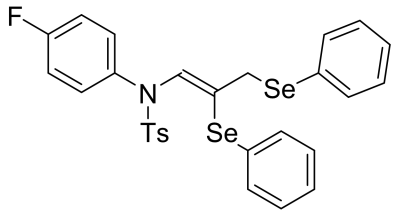
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-methoxyphenyl)-4-methylbenzenes ulfonamide (**4ca**)

White solid. Yield, 63%. M P, 130.5 – 131.8 ℃. IR (neat) 3470, 2933, 1641, 1358, 1169, 1089, 740 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.36 (m, 2H), 7.36 – 7.32 (m, 2H), 7.29 (d, *J* = 8.3 Hz, 2H), 7.27 – 7.06 (m, 10H), 6.67 (s, 1H), 6.66 (d, *J* = 1.9 Hz, 2H), 3.76 (s, 3H), 3.50 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.72, 143.85, 135.09, 134.22, 133.93, 132.41, 130.04, 129.54, 129.41, 129.11, 128.94, 128.34, 128.08, 127.87, 127.84, 127.25, 124.72, 113.92, 55.40, 33.87, 21.63. HRMS (ESI) m/z calcd for $C_{29}H_{27}NO_3SSe_2^+$ $[M+Na]^+$ 651.9934, found 651.9947.



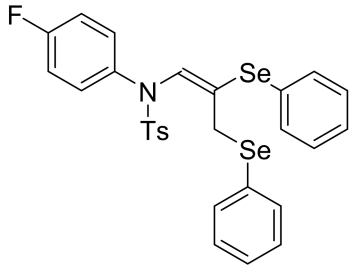
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-methoxyphenyl)-4-methylbenzenes ulfonamide (**4ca**)

Yellow oil liquid. Yield, 21%. IR (neat) 3471, 2934, 1627, 1364, 1172, 1094, 751 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.43 – 7.36 (m, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.27 –7.23 (m, 5H), 7.20 – 7.09 (m, 5H), 6.83 (d, *J* = 8.8 Hz, 2H), 6.78 (s, 1H), 6.71 (d, *J* = 8.9 Hz, 2H), 3.75 (s, 3H), 3.52 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.22, 144.09, 133.24, 132.89, 132.26, 131.55, 130.62, 129.99, 129.50, 129.46, 129.39, 129.22, 128.77, 127.84, 127.45, 127.04, 124.23, 114.38, 55.39, 29.69, 21.60. HRMS (ESI) m/z calcd for $C_{29}H_{27}NO_3SSe_2^+$ $[M+Na]^+$ 651.9934, found 651.9944.



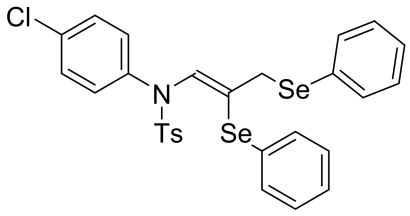
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-fluorophenyl)-4-methylbenzenesulfonamide (**4da**)

White solid. Yield, 71%. M P, 142.1 – 143.2 ℃. IR (neat) 3467, 2934, 1609, 1364, 1171, 1090, 751 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.37 – 7.32 (m, 4H), 7.28 (d, *J* = 8.3 Hz, 2H), 7.23 – 7.13 (m, 8H), 6.86 – 6.80 (m, 2H), 6.68 – 6.64 (m, 2H), 6.63 (s, 1H), 3.50 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.47 (d, *J* = 248.1 Hz), 144.12, 135.78 (d, *J* = 3.1 Hz), 135.02, 133.99, 133.89, 130.28 (d, *J* = 8.7 Hz), 129.51, 129.39, 129.18, 128.98, 128.21, 127.88, 127.79, 127.54, 127.31, 126.32, 115.66 (d, *J* = 22.7 Hz), 33.55, 21.63. HRMS (ESI) m/z calcd for $C_{28}H_{24}FNO_2SSe_2^+$ $[M+Na]^+$ 639.9734, found 639.9746.



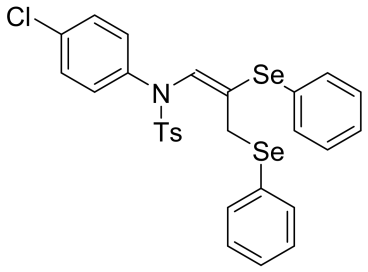
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-fluorophenyl)-4-methylbenzenesulfonamide (**4da**)

White solid. Yield, 18%. M P, 118.4 – 120.1 ℃. IR (neat) 3465, 2937, 1607, 1365, 1171, 1092, 740 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.48 – 7.42 (m, 2H), 7.34 – 7.24 (m, 7H), 7.21 – 7.09 (m, 5H), 6.88 (d, *J* = 6.4 Hz, 4H), 6.61 (s, 1H), 3.61 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.82 (d, *J* = 248.6 Hz), 144.34, 135.34 (d, *J* = 3.4 Hz), 133.57, 133.41, 131.59, 130.91, 130.23, 129.59 (d, *J* = 8.7 Hz), 129.58, 129.54, 129.32, 128.85, 128.16, 127.78, 127.75, 127.27, 116.12 (d, *J* = 22.8 Hz), 30.48, 21.62. HRMS (ESI) m/z calcd for $C_{28}H_{24}FNO_2SSe_2^+$ $[M+Na]^+$ 639.9734, found 639.9747.



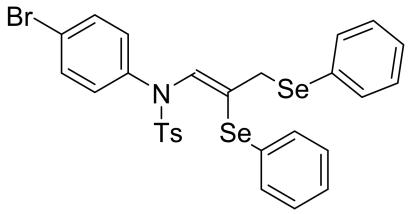
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ea**)

White solid. Yield, 70%. M P, 151.0 – 151.3 ℃. IR (neat) 3465, 2382, 1643, 1274, 1173, 754, 592 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (t, *J* = 8.0 Hz, 4H), 7.29 (d, *J* = 8.1 Hz, 2H), 7.25 – 7.08 (m, 10H), 6.63 (s, 1H), 6.60 (d, *J* = 4.8 Hz, 2H), 3.50 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.19, 138.52, 135.11, 134.00, 133.85, 132.97, 129.56, 129.42, 129.35, 129.20, 129.00, 128.95, 128.28, 127.74, 127.50, 127.40, 127.33, 127.28, 33.35, 21.64. HRMS (ESI) m/z calcd for $C_{28}H_{24}ClNO_2SSe_2^+$ $[M+Na]^+$ 655.9439, found 655.9446.



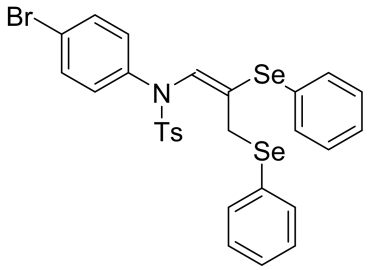
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ea**)

White solid. Yield, 17%. M P, 126.1 – 127.8 ℃. IR (neat) 3473, 2384, 1640, 1272, 1173, 748, 595 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 – 7.43 (m, 2H), 7.31 – 7.25 (m, 7H), 7.19 – 7.09 (m, 7H), 6.87 – 6.82 (m, 2H), 6.53 (s, 1H), 3.63 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.37, 138.13, 133.60, 133.49, 130.32, 130.23, 130.04, 129.87, 129.86, 129.61, 129.35, 129.33, 129.28, 128.87, 128.71, 127.84, 127.74, 127.32, 29.70, 21.62. HRMS (ESI) m/z calcd for $C_{28}H_{24}ClNO_2SSe_2^+$ $[M+Na]^+$ 655.9439, found 655.9440.



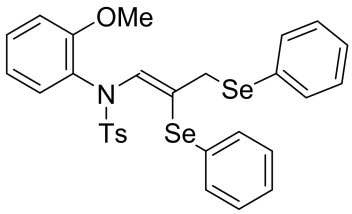
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-bromophenyl)-4-methylbenzenesulfonamide (**4fa**)

White solid. Yield, 76%. M P, 131.2 – 132.2 ℃. IR (neat) 3460, 2936, 1640, 1364, 1171, 1077, 742 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 (t, *J* = 7.7 Hz, 4H), 7.32 – 7.22 (m, 5H), 7.22 – 7.11 (m, 7H), 6.58 (d, *J* = 7.7 Hz, 2H), 6.55 (s, 1H), 3.51 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.21, 139.09, 135.13, 134.00, 133.85, 131.92, 129.69, 129.58, 129.35, 129.21, 129.01, 128.29, 127.74, 127.52, 127.43, 127.39, 127.34, 121.03, 33.32, 21.65. HRMS (ESI) m/z calcd for $C_{28}H_{24}BrNO_2SSe_2^+$ $[M+Na]^+$ 699.8934, found 699.8939.



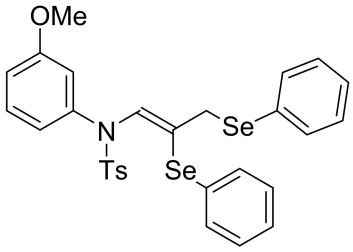
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-bromophenyl)-4-methylbenzenesulfonamide (**4fa**)

Yellow oil liquid. Yield, 13%. IR (neat) 3466, 2935, 1636, 1365, 1171, 1090, 746 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 – 7.45 (m, 2H), 7.34 – 7.27 (m, 9H), 7.21 – 7.09 (m, 5H), 6.79 (d, *J* = 8.6 Hz, 2H), 6.51 (s, 1H), 3.64 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.38, 138.72, 133.66, 133.53, 132.30, 130.08, 130.06, 130.01, 129.96, 129.62, 129.35, 129.32, 128.95, 128.89, 127.87, 127.73, 127.35, 121.58, 30.44, 21.61. HRMS (ESI) m/z calcd for $C_{28}H_{24}BrNO_2SSe_2^+$ $[M+Na]^+$ 699.8934, found 699.8944.



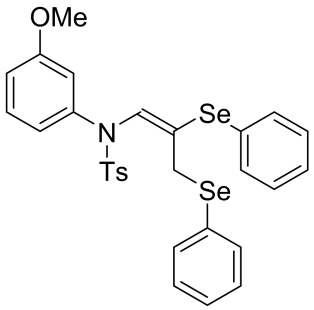
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(2-methoxyphenyl)-4-methylbenzenes ulfonamide (**4ga**)

Obtained as an inseparable mixture (*Z:E*=1:1), Yellow oil liquid. Yield, 34%. IR (neat) 3460, 1662, 1501, 1360, 1281, 1171, 751 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 – 7.33 (m, 11H), 7.33 – 7.11 (m, 21H), 7.08 (s, 1H), 7.00 (s, 1H), 6.95 – 6.88 (m, 2H), 6.73 (t, *J* = 7.4 Hz, 2H), 3.61 (s, 2H), 3.58 (s, 2H), 3.31 (s, 3H), 3.28 (s, 3H), 2.40 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 155.74, 155.32, 143.83, 143.53, 136.02, 135.46, 134.61, 133.50, 133.40, 133.29, 132.96, 132.17, 132.02, 130.78, 130.64, 130.38, 130.35, 130.02, 129.26, 129.19, 129.17, 129.11, 129.10, 128.98, 128.84, 128.35, 127.85, 127.20, 127.16, 127.08, 126.75, 126.06, 123.31, 120.89, 120.73, 120.52, 111.92, 111.52, 54.88, 34.36, 30.55, 21.63. HRMS (ESI) m/z calcd for $C_{29}H_{27}NO_3SSe_2^+$ $[M+H]^+$ 630.0114, found 630.0107.



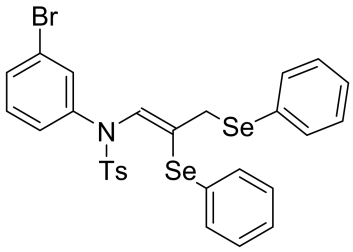
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(3-methoxyphenyl)-4-methylbenzenes ulfonamide (**4ha**)

White solid. Yield, 28%. M P, 113.9 – 115.2 ℃. IR (neat) 3458, 1645, 1271, 751, 693, 664, 582 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.30 (m, 6H), 7.27 – 7.15 (m, 8H), 7.06 (t, *J* = 8.1 Hz, 1H), 6.76 (d, *J* = 8.2 Hz, 1H), 6.65 (s, 1H), 6.61 (s, 1H), 6.27 (d, *J* = 7.8 Hz, 1H), 3.70 (s, 3H), 3.52 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.75, 146.73, 143.92, 140.98, 135.18, 134.41, 133.81, 129.64, 129.42, 129.34, 129.13, 129.01, 128.14, 127.79, 127.75, 127.45, 127.31, 120.05, 114.03, 113.42, 55.38, 33.58, 21.62. HRMS (ESI) m/z calcd for $C_{29}H_{27}NO_3SSe_2^+$ $[M+H]^+$ 630.0115, found 630.0112.



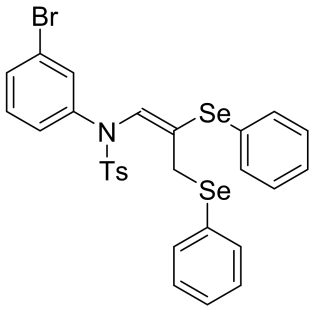
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(3-methoxyphenyl)-4-methylbenzenes ulfonamide (**4ha**)

Yellow oil liquid. Yield, 14%. IR (neat) 3453, 1645, 1271, 1172, 1093, 745, 581 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 - 7.42 (m, 2H), 7.37 (d, *J* = 8.1 Hz, 2H), 7.30 - 7.25 (m, 5H), 7.21 – 7.08 (m, 6H), 6.78 (d, *J* = 8.3 Hz, 1H), 6.69 (s, 1H), 6.55 (s, 1H), 6.52 (d, *J* = 7.9 Hz, 1H), 3.68 (s, 3H), 3.59 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.93, 144.18, 140.40, 133.98, 133.28, 133.19, 131.47, 131.45, 130.47, 129.74, 129.50, 129.27, 128.80, 127.80, 127.60, 127.10, 126.93, 119.79, 114.06, 113.36, 55.34, 30.50, 21.61. HRMS (ESI) m/z calcd for $C_{29}H_{27}NO_3SSe_2^+$ $[M+H]^+$ 630.0115, found 630.0117.



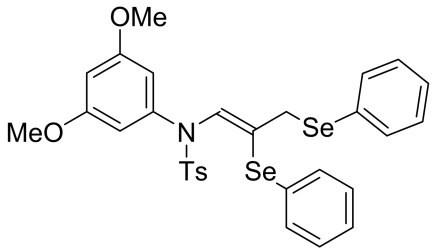
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(3-bromophenyl)-4-methylbenzenesulf onamide (**4ia**)

White solid. Yield, 16%. M P, 125.0 – 126.8 ℃. IR (neat) 3440, 2377, 1645, 1550, 1482, 1271, 751 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.13 (m, 15H), 7.03 (t, *J* = 8.0 Hz, 1H), 6.96 (s, 1H), 6.72 (d, *J* = 8.0 Hz, 1H), 6.52 (s, 1H), 3.49 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.23, 141.14, 135.09, 134.04, 130.88, 130.34, 129.95, 129.55, 129.34, 129.21, 129.10, 128.38, 128.27, 127.73, 127.62, 127.45, 127.41, 127.00, 126.85, 121.97, 33.53, 21.64. HRMS (ESI) m/z calcd for $C_{28}H_{24}BrNO_2SSe_2^+$ $[M+H]^+$ 677.9114, found 677.9108.



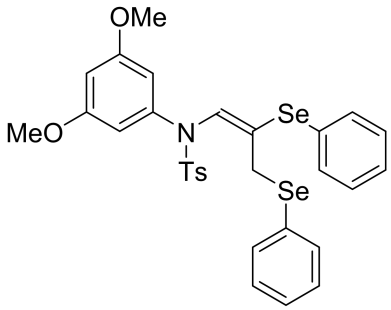
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(3-bromophenyl)-4-methylbenzenesulfonamide (**4ia**)

Yellow oil liquid. Yield, 8%. IR (neat) 3464, 2374, 1645, 1550, 1482, 1281, 753 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 4.1 Hz, 2H), 7.36 – 7.24 (m, 8H), 7.21 – 7.07 (m, 6H), 7.05 (s, 1H), 6.91 (d, *J* = 7.8 Hz, 1H), 6.48 (s, 1H), 3.65 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.48, 140.96, 133.60, 133.47, 130.76, 130.65, 130.63, 130.28, 130.07, 130.04, 129.91, 129.62, 129.41, 129.38, 128.87, 127.85, 127.73, 127.39, 125.90, 122.42, 30.50, 21.63. HRMS (ESI) m/z calcd for $C_{28}H_{24}BrNO_2SSe_2^+$ $[M+Na]^+$ 699.8934, found 699.8919.



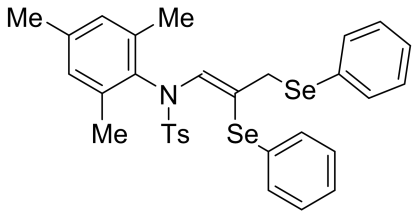
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(3,5-dimethoxyphenyl)-4-methylbenzenesulfonamide (**4ja**)

Yellow oil liquid. Yield, 45%. IR (neat) 3463, 2936, 1607, 1363, 1165, 1067, 750 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.35 (m, 6H), 7.31 – 7.23 (m, 2H), 7.22 – 7.15 (m, 6H), 6.64 (s, 1H), 6.34 (t, *J* = 2.2 Hz, 1H), 6.16 (d, *J* = 2.2 Hz, 2H), 3.67 (s, 6H), 3.54 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.57, 143.95, 141.45, 135.17, 134.56, 133.70, 129.82, 129.43, 129.13, 129.05, 128.24, 128.13, 127.85, 127.82, 127.61, 127.31, 106.31, 99.89, 55.45, 33.59, 21.60, 14.21. HRMS (ESI) m/z calcd for $C_{30}H_{29}NO_4SSe_2^+$ $[M+Na]^+$ 682.0040, found 682.0049.



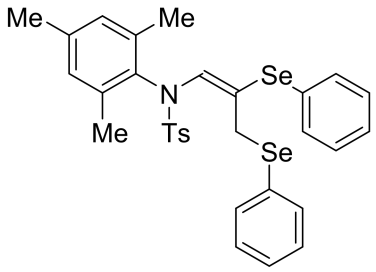
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(3,5-dimethoxyphenyl)-4-methylbenzenesulfonamide (**4ja**)

Yellow oil liquid. Yield, 22%. IR (neat) 3442, 2937, 1607, 1364, 1166, 1067, 751 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.40 (m, 4H), 7.32 – 7.28 (m, 2H), 7.27 – 7.24 (m, 3H), 7.20 (d, *J* = 8.3 Hz, 2H), 7.17 – 7.09 (m, 3H), 6.70 (s, 1H), 6.32 (t, *J* = 2.1 Hz, 1H), 6.15 (d, *J* = 2.2 Hz, 2H), 3.65 (s, 6H), 3.61 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.71, 144.19, 140.87, 135.18, 134.10, 133.18, 133.16, 131.45, 130.58, 129.50, 129.25, 128.78, 127.82, 127.59, 127.04, 126.50, 105.96, 100.45, 55.43, 30.47, 29.70, 21.60. HRMS (ESI) m/z calcd for $C_{30}H_{29}NO_4SSe_2^+$ $[M+Na]^+$ 682.0040, found 682.0043.



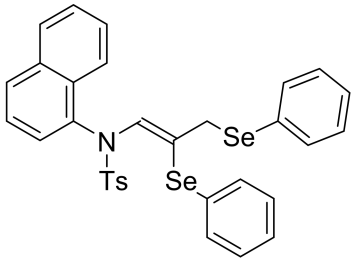
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-mesityl-4-methylbenzenesulfonamide (**4ka**)

Yellow oil liquid. Yield, 27%. IR (neat) 3450, 2939, 1627, 1357, 1168, 1072, 747 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.43 (d, *J* = 8.1 Hz, 2H), 7.33 – 7.29 (m, 3H), 7.22 – 7.10 (m, 9H), 7.12 (s, 1H), 6.76 (s, 2H), 3.54 (s, 2H), 2.40 (s, 3H), 2.23 (s, 3H), 1.82 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.04, 139.52, 139.17, 136.19, 134.74, 133.33, 131.82, 130.43, 129.73, 129.45, 129.00, 128.97, 128.36, 127.75, 127.73, 127.67, 126.97, 108.31, 36.46, 21.64, 21.12, 19.08. HRMS (ESI) m/z calcd for $C_{31}H_{31}NO_2SSe_2^+$ $[M+K]^+$ 680.0038, found 680.0053.



(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-mesityl-4-methylbenzenesulfonamide (**4ka**)

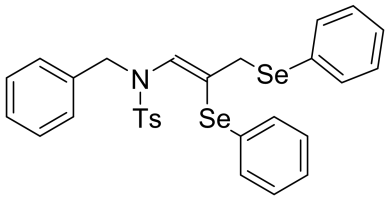
Yellow oil liquid. Yield, 27%. IR (neat) 3457, 2934, 1638, 1361, 1168, 1089, 751 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.56 (d, *J* = 8.3 Hz, 2H), 7.40 – 7.35 (m, 2H), 7.33 (s, 1H), 7.24 (d, *J* = 8.2 Hz, 2H), 7. 21 – 7.17 (m, 4H), 7.07 – 7.02 (m, 4H), 6.72 (s, 2H), 3.04 (s, 2H), 2.40 (s, 3H), 2.15 (s, 3H), 1.90 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.41, 139.18, 138.49, 136.32, 132.82, 132.16, 132.11, 131.79, 131.33, 130.74, 129.92, 129.88, 129.12, 128.60, 127.79, 127.19, 126.69, 109.79, 29.63, 21.66, 21.04, 18.96. HRMS (ESI) m/z calcd for $C_{31}H_{31}NO_2SSe_2^+$ $[M+K]^+$ 680.0038, found 680.0069.



(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-4-methyl-*N*-(naphthalen-1-yl)benzenesulfonamide (**4la**)

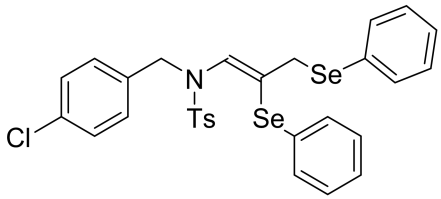
Obtained as an inseparable mixture (*Z:E*=1.5:1), Yellow oil liquid. Yield, 79%. IR (neat) 3455, 2933, 1639, 1363, 1171, 1094, 752 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 8.20 (d, *J* = 7.7 Hz, 1H), 7.92 (d, *J* = 8.2 Hz, 1H), 7.83 – 7.73 (m, 4H), 7.49 – 7.30 (m, 10H), 7.30 – 7.02 (m, 17H), 7.01 – 6.96 (m, 3H), 6.97 (s, 1H), 6.92 (s, 1H), 6.82 (d, *J* = 7.3 Hz, 1H), 6.60 (d, *J* = 7.3 Hz, 1H), 3.50 (d, *J* = 18.8 Hz, 2H), 3.16 (d, *J* = 27.9 Hz, 2H), 2.40 (s, 3H), 2.39 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.43, 144.10, 135.83, 134.87, 134.68, 134.57, 134.44, 133.85, 133.38, 133.30, 132.57, 132.54, 131.54, 131.49, 129.74, 129.67, 129.56, 129.52, 129.49, 129.34, 129.19, 129.01, 128.98, 128.63, 128.36, 128.27, 128.22, 128.11, 127.91, 127.87, 127.32, 127.29, 127.28, 127.00, 126.62,

126.46, 125.21, 124.92, 124.79, 123.91, 123.56, 119.89, 34.55, 30.41, 29.72, 21.66. HRMS (ESI) m/z calcd for $C_{32}H_{27}NO_2SSe_2^+$ $[M+Na]^+$ 671.9985, found 671.9996.



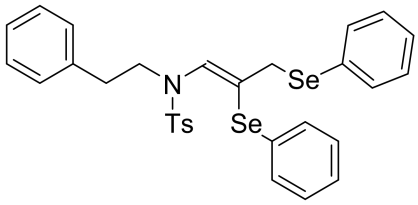
(*Z*)-*N*-benzyl-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-4-methylbenzenesulfonamide (**4ma**)

Obtained as an inseparable mixture (*Z:E*=9:1), White solid. Yield, 82%. M P, 170.7 – 171.6 ℃. IR (neat) 3469, 2932, 1653, 1357, 1169, 1093, 744 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.1 Hz, 2H), 7.35 – 7.05 (m, 19H), 5.78 (s, 1H), 5.46 (s, 1H), 4.24 (s, 2H), 4.11 (s, 2H), 3.86 (s, 2H), 3.40 (s, 2H), 2.40 (s, 4H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.71, 139.27, 135.39, 135.03, 135.01, 133.15, 130.10, 129.71, 129.07, 128.95, 128.86, 128.36, 128.29, 127.97, 127.74, 127.61, 127.18, 126.84, 54.35, 32.34, 29.70, 21.61. HRMS (ESI) m/z calcd for $C_{29}H_{27}NO_2SSe_2^+$ $[M+Na]^+$ 635.9985, found 635.9998.



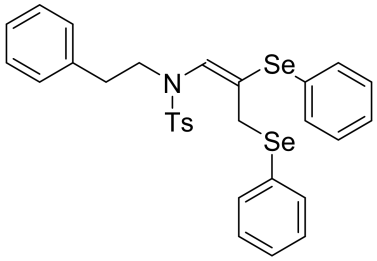
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-(4-chlorobenzyl)-4-methylbenzenesulfonamide (**4na**)

Obtained as an inseparable mixture (*Z:E*=3:1), White solid. Yield, 27%. M P, 135.5 – 136.7 ℃. IR (neat) 3449, 1662, 1405, 1166, 1092, 740, 553 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.54 – 7.48 (m, 3H), 7.40 (d, *J* = 7.7 Hz, 1H), 7.31 – 7.02 (m, 20H), 5.77 (s, 1H), 5.41 (s, 1H), 4.19 (s, 2H), 4.05 (s, 2H), 3.85 (s, 2H), 3.41 (s, 2H), 2.40 (s, 4H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.85, 139.51, 134.90, 133.92, 133.68, 133.60, 133.19, 133.08, 130.30, 130.18, 129.80, 129.75, 129.25, 129.09, 129.07, 128.95, 128.84, 128.50, 128.09, 128.07, 127.77, 127.57, 127.54, 127.23, 127.15, 126.55, 53.63, 32.16, 21.61. HRMS (ESI) m/z calcd for $C_{29}H_{26}ClNO_2SSe_2^+$ $[M+Na]^+$ 669.9595, found 669.9587.



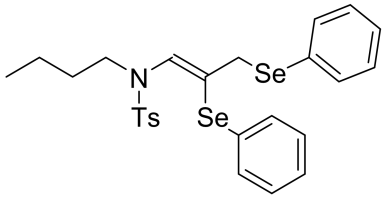
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-4-methyl-*N*-phenethylbenzenesulfonamide (**4oa**)

White solid. Yield, 69%. M P, 81.0 – 81.5 ℃. IR (neat) 3457, 2936, 1643, 1354, 1167, 1096, 746 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.56 – 7.39 (m, 6H), 7.38 – 7.18 (m, 11H), 7.15 (d, *J* = 7.5 Hz, 2H), 5.97 (s, 1H), 3.60 (s, 2H), 3.40 – 3.33 (m, 2H), 2.84 – 2.78 (m, 2H), 2.40 (s, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.61, 138.29, 135.49, 134.34, 134.08, 133.45, 129.85, 129.61, 129.41, 129.24, 129.16, 129.04, 128.86, 128.51, 128.36, 127.53, 127.41, 126.53, 51.68, 34.97, 32.62, 21.57. HRMS (ESI) m/z calcd for $C_{30}H_{29}NO_2SSe_2^+$ $[M+Na]^+$ 650.0141, found 650.0149.



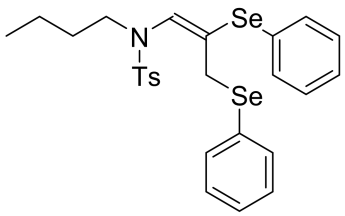
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-4-methyl-*N*-phenethylbenzenesulfonamide (**4oa**)

Yellow oil liquid. Yield, 9%. IR (neat) 3466, 2934, 1662, 1354, 1167, 1095, 737 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ7.59 – 7.56 (m, 4H), 7.41 (d, *J* = 8.0 Hz, 2H), 7.33 – 7.29 (m, 3H), 7.26 – 7.15 (m, 8H), 7.03 (d, *J* = 7.0 Hz, 2H), 5.42 (s, 1H), 4.14 (s, 2H), 3.07 – 3.03 (m, 2H), 2.49 – 2.45 (m, 2H), 2.37 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 143.66, 137.97, 134.31, 134.06, 129.72, 129.61, 129.59, 129.39, 129.02, 128.89, 128.73, 128.47, 127.97, 127.93, 127.92, 127.61, 127.40, 126.50, 51.87, 34.74, 31.85, 21.51. HRMS (ESI) m/z calcd for $C_{30}H_{29}NO_2SSe_2^+$ $[M+Na]^+$ 650.0141, found 650.0149.



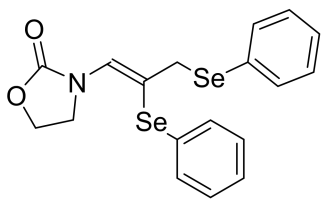
(*Z*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-butyl-4-methylbenzenesulfonamide (**4pa**)

Yellow oil liquid. Yield, 25%. IR (neat) 3446, 2936, 1608, 1356, 1168, 1092, 742 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.49 (t, *J* = 7.0 Hz, 4H), 7.44 – 7.40 (m, 2H), 7.34 – 7.17 (m, 8H), 5.78 (s, 1H), 3.57 (s, 2H), 3.06 (t, *J* = 6.8 Hz, 2H), 2.40 (s, 3H), 1.45 – 1.32 (m, 4H), 0.89 (t, *J* = 7.0 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.44, 137.70, 135.49, 135.14, 133.45, 129.88, 129.52, 129.16, 129.08, 128.25, 128.02, 127.56, 127.33, 126.51, 50.10, 32.42, 30.32, 21.55, 19.97, 13.71. HRMS (ESI) m/z calcd for $C_{26}H_{29}NO_2SSe_2^+$ $[M+Na]^+$ 602.0141, found 602.0145.



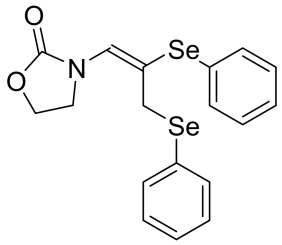
(*E*)-*N*-(2,3-bis(phenylselanyl)prop-1-en-1-yl)-*N*-butyl-4-methylbenzenesulfonamide (**4pa**)

Yellow oil liquid. Yield, 13%. IR (neat) 3446, 2938, 1627, 1354, 1165, 1091, 750 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.57 (d, *J* = 4.1 Hz, 4H), 7.45 (d, *J* = 8.1 Hz, 2H), 7.35 – 7.29 (m, 3H), 7.27 – 7.19 (m, 5H), 5.39 (s, 1H), 4.19 (s, 2H), 2.84 (t, *J* = 6.9 Hz, 2H), 2.40 (s, 3H), 1.25 – 1.19 (m, 4H), 0.84 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.56, 139.97, 134.33, 134.08, 133.83, 130.45, 129.82, 129.57, 129.53, 129.35, 128.99, 127.85, 127.43, 127.41, 50.31, 31.82, 30.16, 21.53, 19.89, 13.63. HRMS (ESI) m/z calcd for $C_{26}H_{29}NO_2SSe_2^+$ $[M+Na]^+$ 602.0141, found 602.0143.



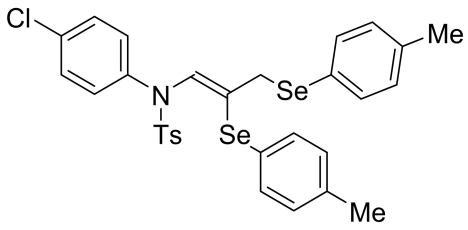
(*Z*)-3-(2,3-bis(phenylselanyl)prop-1-en-1-yl)oxazolidin-2-one (**4qa**)

Yellow oil liquid. Yield, 24%. IR (neat) 3443, 2936, 1635, 1480, 1403, 1070, 743 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.53 – 7.48 (m, 4H), 7.30 – 7.22 (m, 6H), 6.97 (s, 1H), 4.26 – 4.21 (m, 2H), 3.85 (s, 2H), 3.70 – 3.65 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 134.72, 132.22, 130.59, 130.24, 129.62, 129.50, 129.27, 129.08, 128.04, 127.39, 109.99, 62.31, 44.27, 31.46. HRMS (ESI) m/z calcd for $C_{18}H_{17}NO_2Se_2^+$ $[M+Na]^+$ 461.9482, found 461.9481.



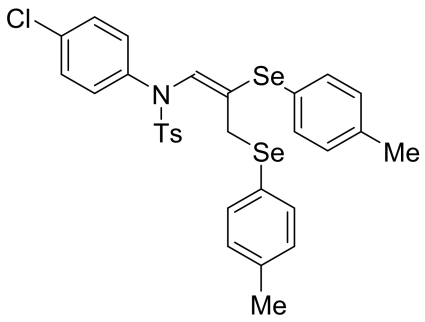
(*E*)-3-(2,3-bis(phenylselanyl)prop-1-en-1-yl)oxazolidin-2-one (**4qa**)

Yellow oil liquid. Yield, 24%. IR (neat) 3442, 2935, 1635, 1401, 1228, 1068, 743 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.53 – 7.43 (m, 2H), 7.40 – 7.30 (m, 2H), 7.26 – 7.22 (m, 6H), 6.91 (s, 1H), 4.25 (t, *J* = 7.9 Hz, 2H), 4.09 (t, *J* = 7.9 Hz, 2H), 3.82 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 134.50, 134.45, 130.50, 130.44, 130.40, 129.85, 129.50, 129.03, 127.73, 126.94, 109.77, 62.85, 44.41, 38.59. HRMS (ESI) m/z calcd for $C_{18}H_{17}NO_2Se_2^+$ $[M+Na]^+$ 461.9482, found 461.9484.



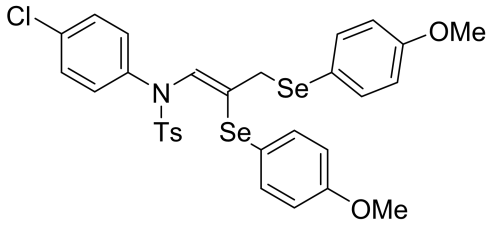
(*Z*)-*N*-(2,3-bis(p-tolylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4eb**)

Yellow oil liquid. Yield, 34%. IR (neat) 3448, 1645, 1406, 1370, 1093, 751, 592 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.32 – 7.25 (m, 4H), 7.22 – 7.16 (m, 4H), 7.08 (d, *J* = 8.5 Hz, 2H), 6.99 (d, *J* = 7.6 Hz, 2H), 6.92 (d, *J* = 7.7 Hz, 2H), 6.57 (d, *J* = 8.5 Hz, 2H), 6.50 (s, 1H), 3.41 (s, 2H), 2.40 (s, 3H), 2.27 (s, 3H), 2.24 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.07, 138.61, 138.55, 137.34, 135.66, 134.14, 132.87, 129.98, 129.68, 129.47, 129.39, 128.89, 128.41, 127.84, 127.81, 126.55, 125.54, 123.35, 32.97, 21.65, 21.22, 21.13. HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNO_2SSe_2^+$ $[M+H]^+$ 661.9932, found 661.9923.



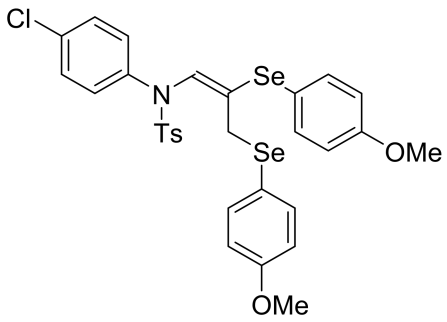
(*E*)-*N*-(2,3-bis(p-tolylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4eb**)

Yellow oil liquid. Yield, 33%. IR (neat) 3462, 1645, 1368, 1271, 1174, 1094, 752 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, J = 7.2 Hz, 2H), 7.27 (d, J = 7.3 Hz, 2H), 7.21 – 7.14 (m, 8H), 6.92 (d, J = 7.0 Hz, 2H), 6.81 (d, J = 7.9 Hz, 2H), 6.37 (s, 1H), 3.63 (s, 2H), 2.40 (s, 3H), 2.36 (s, 3H), 2.28 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 144.22, 138.34, 138.06, 137.48, 134.29, 134.03, 133.32, 131.87, 130.15, 129.63, 129.52, 129.34, 129.18, 128.81, 128.53, 128.47, 127.75, 127.69, 30.61, 21.62, 21.22, 21.13. HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNO_2SSe_2^+$ $[M+H]^+$ 661.9932, found 661.9931.



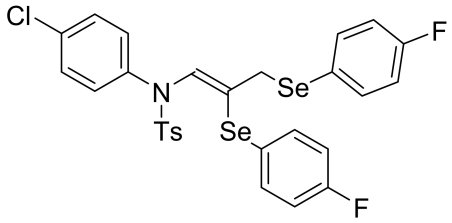
(*Z*)-*N*-(2,3-bis((4-methoxyphenyl)selanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ec**)

Yellow oil liquid. Yield, 35%. IR (neat) 3446, 1634, 1496, 1252, 1174, 1093, 753 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.38 – 7.27 (m, 6H), 7.21 – 7.13 (m, 4H), 6.76 – 6.68 (m, 6H), 6.39 (s, 1H), 3.75 (s, 6H), 3.34 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.17, 159.56, 144.18, 138.65, 137.89, 136.41, 134.08, 132.89, 130.49, 129.49, 129.37, 128.91, 127.74, 125.18, 119.31, 116.81, 114.81, 114.65, 55.27, 33.16, 21.60. HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNO_4SSe_2^+$ $[M+H]^+$ 693.9830, found 693.9816.



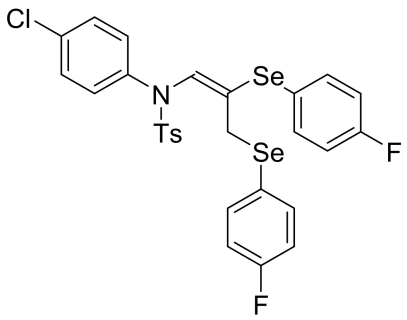
(*E*)-*N*-(2,3-bis((4-methoxyphenyl)selanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methyl benzenesulfonamide (**4ec**)

Yellow oil liquid. Yield, 17%. IR (neat) 3473, 1645, 1496, 1281, 753, 671, 567 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.5 Hz, 2H), 7.29 (d, *J* = 8.5 Hz, 2H), 7.23 (d, *J* = 8.2 Hz, 2H), 7.18 – 7.13 (m, 4H), 6.85 (d, *J* = 8.6 Hz, 2H), 6.76 (d, *J* = 8.6 Hz, 2H), 6.66 (d, *J* = 8.6 Hz, 2H), 6.21 (s, 1H), 3.84 (s, 3H), 3.76 (s, 3H), 3.61 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.94, 159.56, 144.16, 138.50, 136.71, 136.38, 133.86, 133.50, 133.14, 129.48, 129.13, 128.31, 127.71, 127.43, 119.55, 118.98, 115.02, 114.48, 55.33, 55.19, 30.97, 21.60. HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNO_4SSe_2^+$ $[M+H]^+$ 693.9830, found 693.9814.



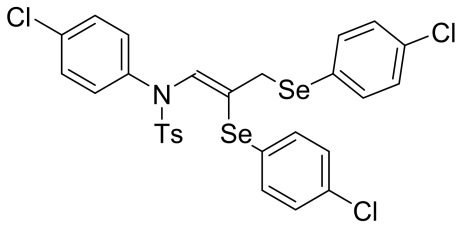
(*Z*)-*N*-(2,3-bis((4-fluorophenyl)selanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbe nzenesulfonamide (**4ed**)

Yellow oil liquid. Yield, 55%. IR (neat) 3451, 1645, 1493, 1368, 1174, 1094, 745 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.38 – 7.30 (m, 3H), 7.28 – 7.10 (m, 7H), 6.92 – 6.80 (m, 4H), 6.65 (d, *J* = 8.5 Hz, 2H), 6.43 (s, 1H), 3.38 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.04 (d, *J* = 249.2 Hz), 162.56 (d, *J* = 248.1 Hz), 144.51, 138.31, 137.64 (d, *J* = 8.1 Hz), 136.60 (d, *J* = 7.9 Hz), 133.69, 133.28, 129.57, 129.56, 129.02, 127.69, 127.10, 126.74, 123.60 (d, *J* = 3.3 Hz), 121.69 (d, *J* = 2.9 Hz), 116.46 (d, *J* = 21.5 Hz), 116.16 (d, *J* = 21.4 Hz), 33.88, 21.59. HRMS (ESI) m/z calcd for $C_{28}H_{22}ClF_2NO_2SSe_2^+$ $[M+Na]^+$ 691.9250, found 691.9267.



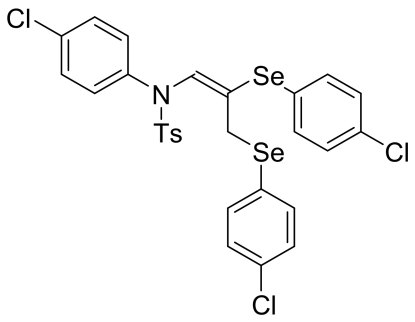
(*E*)-*N*-(2,3-bis((4-fluorophenyl)selanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ed**)

Yellow oil liquid. Yield, 28%. IR (neat) 3451, 1645, 1405, 1369, 1173, 1093, 750 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.51 – 7.37 (m, 2H), 7.27 – 7.15 (m, 8H), 6.98 (t, *J* = 8.5 Hz, 2H), 6.89 – 6.74 (m, 4H), 6.41 (s, 1H), 3.56 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.84 (d, *J* = 248.7 Hz), 162.61 (d, *J* = 247.6 Hz), 144.51, 138.13, 136.23 (d, *J* = 8.0 Hz), 136.20 (d, *J* = 8.1 Hz), 133.64, 133.38, 130.37, 129.61, 129.53, 129.34, 128.53, 127.69, 124.11 (d, *J* = 3.4 Hz), 123.57 (d, *J* = 3.3 Hz), 116.59 (d, *J* = 21.5 Hz), 116.05 (d, *J* = 21.5 Hz), 30.88, 21.60. HRMS (ESI) m/z calcd for $C_{28}H_{22}ClF_2NO_2SSe_2^+$ $[M+Na]^+$ 691.9250, found 691.9232.



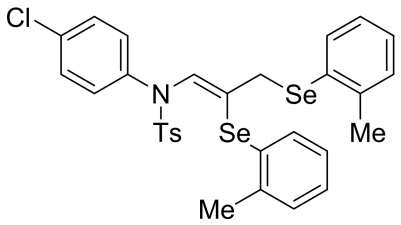
(*Z*)-*N*-(2,3-bis((4-chlorophenyl)selanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ee**)

Yellow oil liquid. Yield, 38%. IR (neat) 3445, 1645, 1369, 1270, 1172, 1093, 752 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.27 – 7.17 (m, 8H), 7.14 (d, *J* = 8.3 Hz, 2H), 7.11 – 7.05 (m, 4H), 6.54 (d, *J* = 6.7 Hz, 2H), 6.51 (s, 1H), 3.45 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.59, 138.18, 136.24, 135.51, 134.71, 133.86, 133.35, 129.65, 129.58, 129.42, 129.11, 129.03, 128.02, 127.70, 127.15, 125.56, 125.40, 109.99, 33.85, 21.70. HRMS (ESI) m/z calcd for $C_{28}H_{22}Cl_3NO_2SSe_2^+$ $[M+H]^+$ 701.8839, found 701.8811.



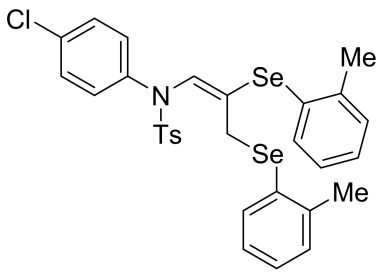
(*E*)-*N*-(2,3-bis((4-chlorophenyl)selanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ee**)

Yellow oil liquid. Yield, 19%. IR (neat) 3493, 1645, 1550, 1481, 1272, 1094, 750 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.37 (d, *J* = 8.2 Hz, 2H), 7.27 – 7.23 (m, 5H), 7.18 (d, *J* = 8.3 Hz, 5H), 7.06 (d, *J* = 8.2 Hz, 2H), 6.81 (d, *J* = 8.5 Hz, 2H), 6.46 (s, 1H), 3.59 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.60, 137.94, 135.03, 134.95, 134.32, 133.88, 133.81, 133.30, 130.53, 129.66, 129.56, 129.40, 129.24, 129.02, 128.55, 127.79, 127.69, 127.43, 30.76, 21.63. HRMS (ESI) m/z calcd for $C_{28}H_{22}Cl_3NO_2SSe_2^+$ $[M+H]^+$ 701.8839, found 701.8810.



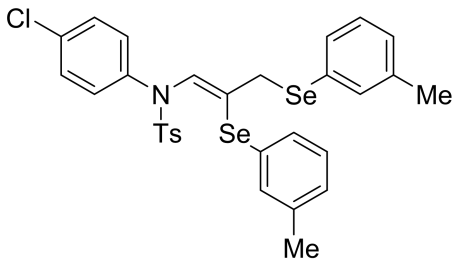
(*Z*)-*N*-(2,3-bis(o-tolylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ef**)

Yellow solid. Yield, 42%. M P, 107.7 – 110.1℃. IR (neat) 3454, 1640, 1490, 1365, 1172, 1092, 7512 cm^{-1}.^1H NMR (400 MHz, $CDCl_3$) δ 7.33 (d, *J* = 7.4 Hz, 2H), 7.25 – 7.11 (m, 10H), 6.99 (dd, *J* = 22.4, 15.5 Hz, 2H), 6.68 (s, 1H), 6.63 (d, *J* = 7.7 Hz, 2H), 3.47 (s, 2H), 2.44 (s, 3H), 2.35 (s, 3H), 2.26 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 144.14, 141.46, 140.81, 138.38, 135.94, 134.10, 133.92, 132.95, 130.22, 130.16, 129.95, 129.54, 129.46, 129.23, 128.83, 128.68, 128.44, 127.82, 127.74, 127.45, 126.53, 126.36, 32.77, 22.77, 22.63, 21.61.HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNNaO_2SSe_2^+$ $[M+Na]^+$683.9752, found 683.9758.



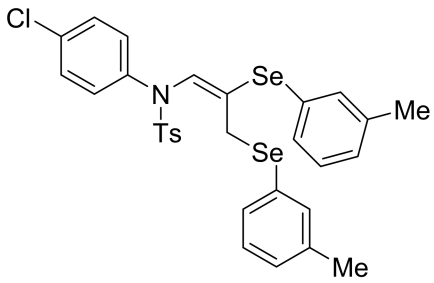
(*E*)-*N*-(2,3-bis(o-tolylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ef**)

Yellow oil liquid. Yield, 21%. IR (neat) 3467, 1642, 1490, 1365, 1172, 1093, 750 cm^{-1}.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 (d, *J* = 7.1 Hz, 2H), 7.25 – 7.09 (m, 12H), 6.86 (d, *J* = 7.2 Hz, 2H), 6.31 (s, 1H), 3.65 (s, 2H), 2.42 (s, 3H), 2.40 (s, 3H), 2.29 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 144.25, 141.08, 139.84, 138.39, 134.74, 133.51, 133.29, 132.66, 130.51, 130.40, 129.94, 129.81, 129.56, 129.23, 128.87, 128.48, 127.98, 127.70, 127.37, 126.83, 126.75, 126.37, 29.69, 29.13, 22.47, 21.58.HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNNaO_2SSe_2^+$ $[M+Na]^+$683.9752, found 683.9751.



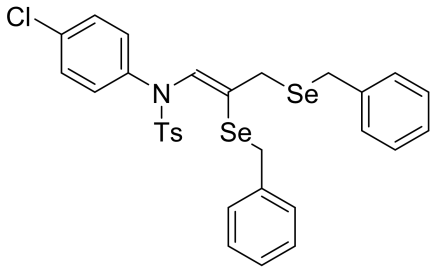
(*Z*)-*N*-(2,3-bis(m-tolylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4eg**)

Yellow solid. Yield, 44%. M P, 123.5 – 124.3℃. IR (neat) 3446, 1638, 1489 1365, 1171, 1092, 776 cm^{-1}.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (d, *J* = 7.3 Hz, 2H), 7.21 – 7.02 (m, 12H), 6.73 (d, *J* = 7.8 Hz, 2H), 6.63 (s, 1H), 3.55 (s, 2H), 2.43 (s, 3H), 2.29 (s, 3H), 2.27 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 144.11, 139.03, 138.78, 138.64, 135.76, 134.37, 134.11, 132.88, 132.15, 130.69, 129.53, 129.33, 129.28, 129.10, 128.95, 128.90, 128.81, 128.15, 127.71, 127.19, 33.16, 29.67, 21.62, 21.20.HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNNaO_2SSe_2^+$ $[M+Na]^+$683.9752, found 683.9760.



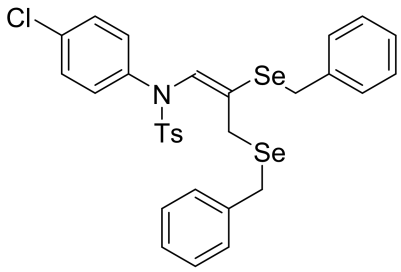
(*E*)-*N*-(2,3-bis(m-tolylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4eg**)

Yellow oil liquid. Yield, 22%. IR (neat) 3471, 1693, 1662, 1494, 1172, 1093, 776 cm^{-1}.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (d, *J* = 7.3 Hz, 2H), 7.22 – 7.15 (m, 7H), 7.11 (d, *J* = 7.8 Hz, 2H), 7.04 – 6.98 (m, 3H), 6.87 (d, *J* = 8.3 Hz, 2H), 6.56 (s, 1H), 3.63 (s, 2H), 2.41 (s, 3H), 2.32 (s, 3H), 2.25 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 144.33, 139.16, 138.63, 138.22, 134.07, 134.03, 133.66, 133.51, 130.49, 130.17, 129.92, 129.70, 129.59, 129.27, 129.19, 129.11, 128.90, 128.68, 128.64, 128.62, 128.17, 127.73, 30.43, 29.69, 21.59, 21.28.HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNNaO_2SSe_2^+$ $[M+Na]^+$683.9752, found 683.9761.



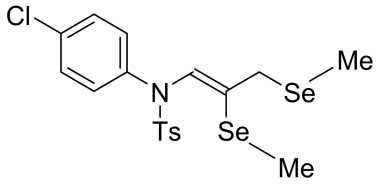
(*Z*)-*N*-(2,3-bis(benzylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4eh**)

White solid. Yield, 41%. M P, 125.3 – 127.1 ℃. IR (neat) 3464, 1625, 1406 1362, 1171, 1093, 700 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.2 Hz, 2H), 7.29 – 7.16 (m, 12H), 7.15 – 7.10 (m, 2H), 7.00 (d, *J* = 8.7 Hz, 2H), 6.67 (s, 1H), 3.81 (s, 2H), 3.76 (s, 2H), 3.33 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.38, 138.66, 138.53, 137.58, 134.05, 133.02, 129.80, 129.66, 129.12, 129.04, 129.01, 128.95, 128.58, 128.50, 127.84, 127.49, 127.00, 126.92, 29.05, 28.95, 27.68, 21.63. HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNO_2SSe_2^+$ $[M+H]^+$ 661.9932, found 661.9929.



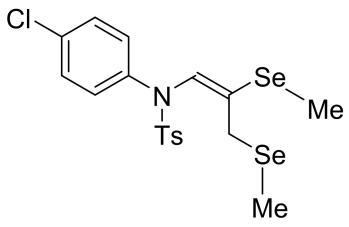
(*E*)-*N*-(2,3-bis(benzylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4eh**)

White solid. Yield, 41%. M P, 124.1 – 124.7 ℃. IR (neat) 3451, 1645, 1363, 1268, 1173, 1093, 753 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.31 (d, *J* = 8.2 Hz, 2H), 7.25 (d, *J* = 6.5 Hz, 2H), 7.22 – 7.17 (m, 10H), 7.11 (d, *J* = 8.6 Hz, 2H), 6.66 (d, *J* = 8.6 Hz, 2H), 6.41 (s, 1H), 3.91 (s, 2H), 3.67 (s, 2H), 3.09 (s, 2H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.37, 138.79, 138.67, 138.17, 133.73, 133.22, 130.25, 129.65, 129.24, 129.11, 129.02, 129.00, 128.75, 128.52, 128.51, 127.79, 126.89, 126.77, 31.20, 28.38, 26.30, 21.63. HRMS (ESI) m/z calcd for $C_{30}H_{28}ClNO_2SSe_2^+$ $[M+H]^+$ 661.9932, found 661.9937.



(*Z*)-*N*-(2,3-bis(methylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulfonamide (**4ei**)

Yellow oil liquid. Yield, 51%. IR (neat) 3450, 1643, 1360, 1169, 1092, 746, 589 cm^{-1}. ^1H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.0 Hz, 2H), 7.25 – 7.21 (m, 4H), 7.06 (d, *J* = 8.5 Hz, 2H), 6.53 (s, 1H), 3.40 (s, 2H), 2.40 (s, 3H), 2.07 (s, 3H), 1.95 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.32, 138.46, 133.99, 133.05, 131.93, 129.61, 128.97, 127.81, 124.64, 28.01, 21.61, 4.74, 4.39. HRMS (ESI) m/z calcd for $C_{18}H_{20}ClNO_2SSe_2^+$ $[M+H]^+$ 509.9306, found 509.9298.



(*E*)-*N*-(2,3-bis(methylselanyl)prop-1-en-1-yl)-*N*-(4-chlorophenyl)-4-methylbenzenesulf

onamide (**4ei**)

Yellow oil liquid. Yield, 26%. IR (neat) 3444, 1645, 1362, 1172, 1094, 752, 568 cm^{-1}. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 (d, *J* = 8.2 Hz, 2H), 7.24 (d, *J* = 8.1 Hz, 4H), 7.01 (d, *J* = 8.6 Hz, 2H), 6.20 (s, 1H), 3.39 (s, 2H), 2.40 (s, 3H), 2.17 (s, 3H), 1.82 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.41, 139.36, 134.21, 133.68, 133.20, 129.66, 129.33, 128.34, 127.83, 125.08, 25.76, 21.63, 6.98, 5.06. HRMS (ESI) m/z calcd for $C_{18}H_{20}ClNO_2SSe_2^+$ $[M+H]^+$ 509.9306, found 509.9299.

3. References

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2. L. L. Wei, J. A. Mulder, H. Xiong, C. A. Zificsak, C. J. Douglas and R. P. Hsung, *Tetrahedron.*2001, **57**, 459-466.
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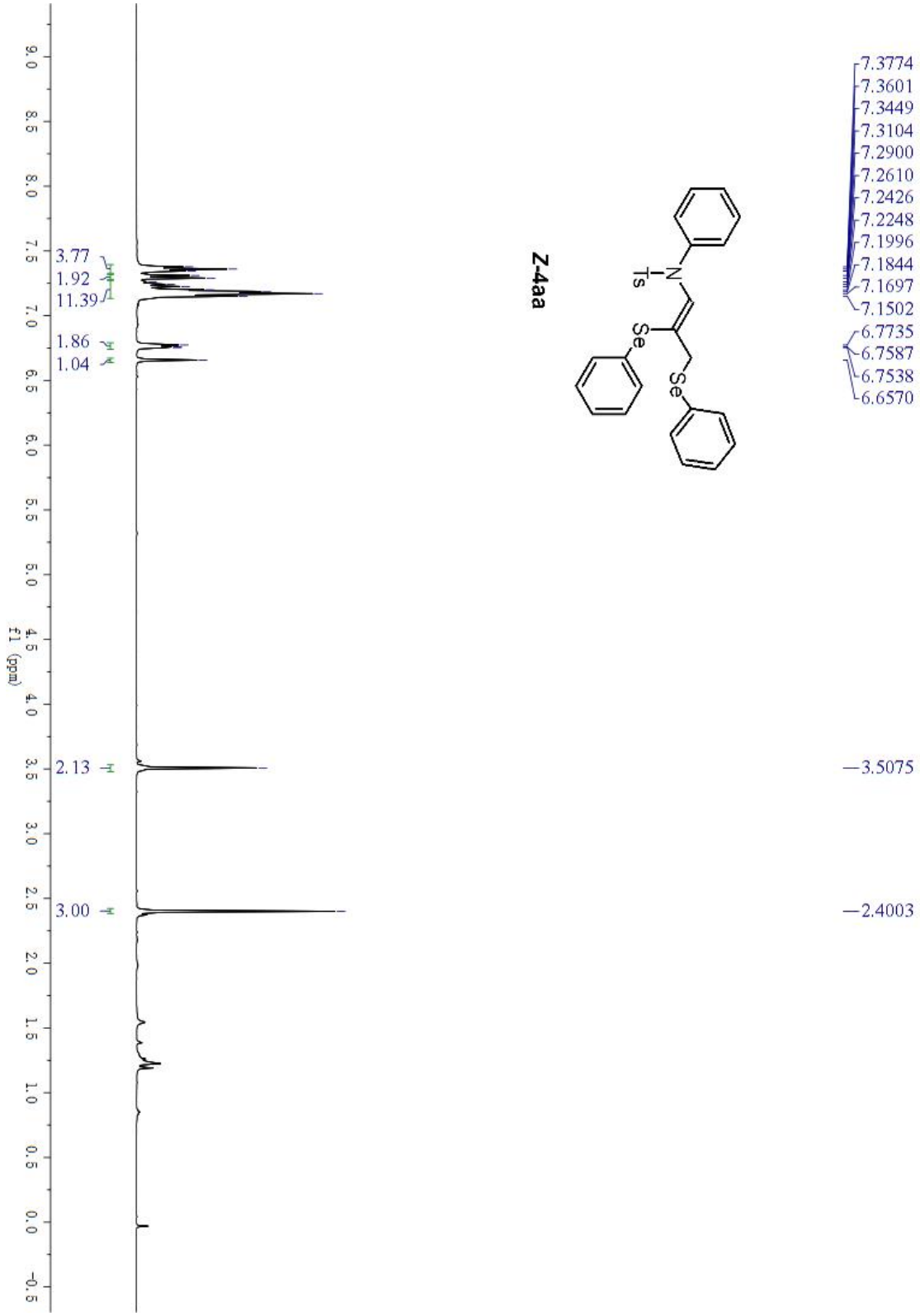
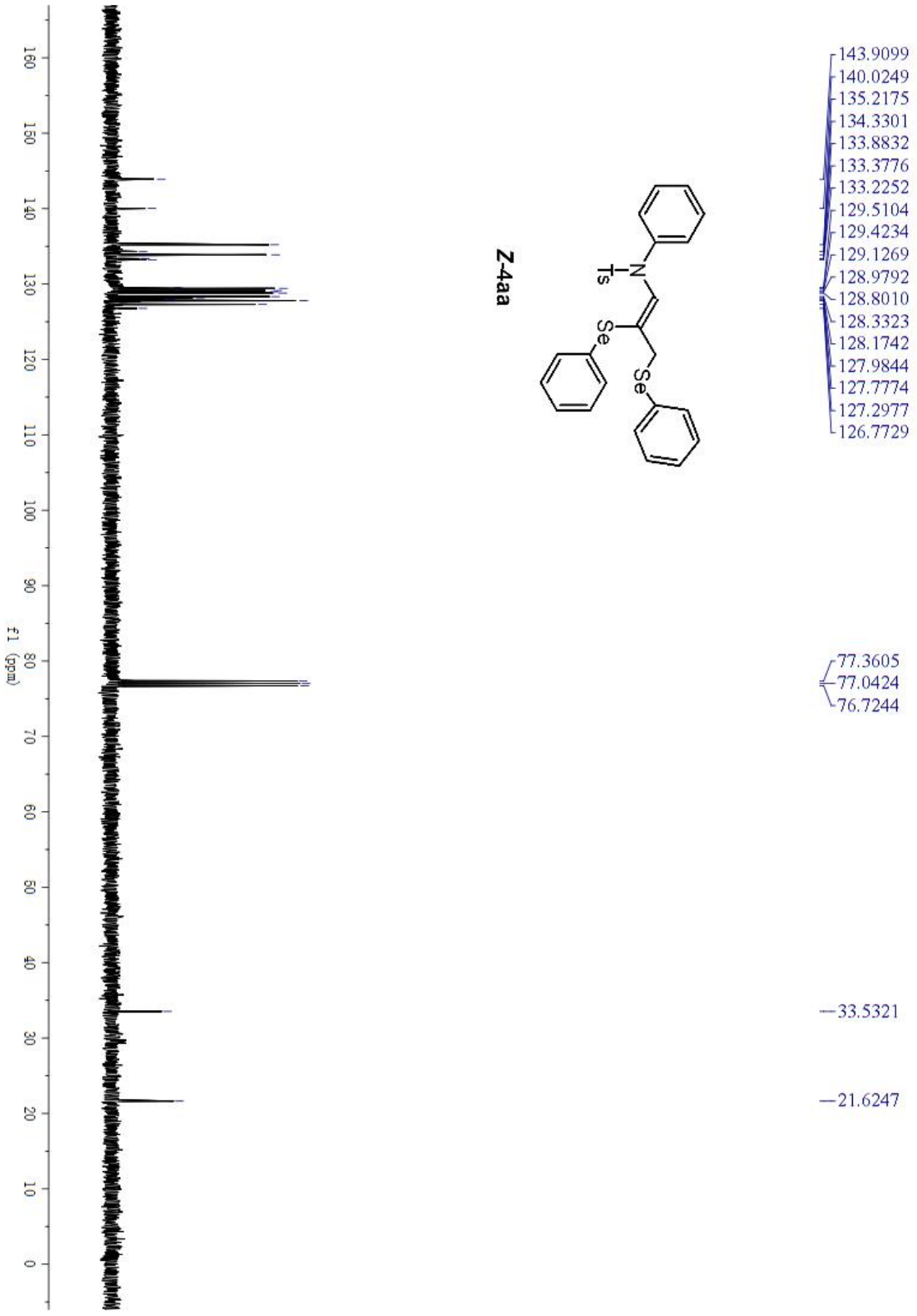
4. NMR Spectra for 4aa – 4qa

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129.4234
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128.1742
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126.7729
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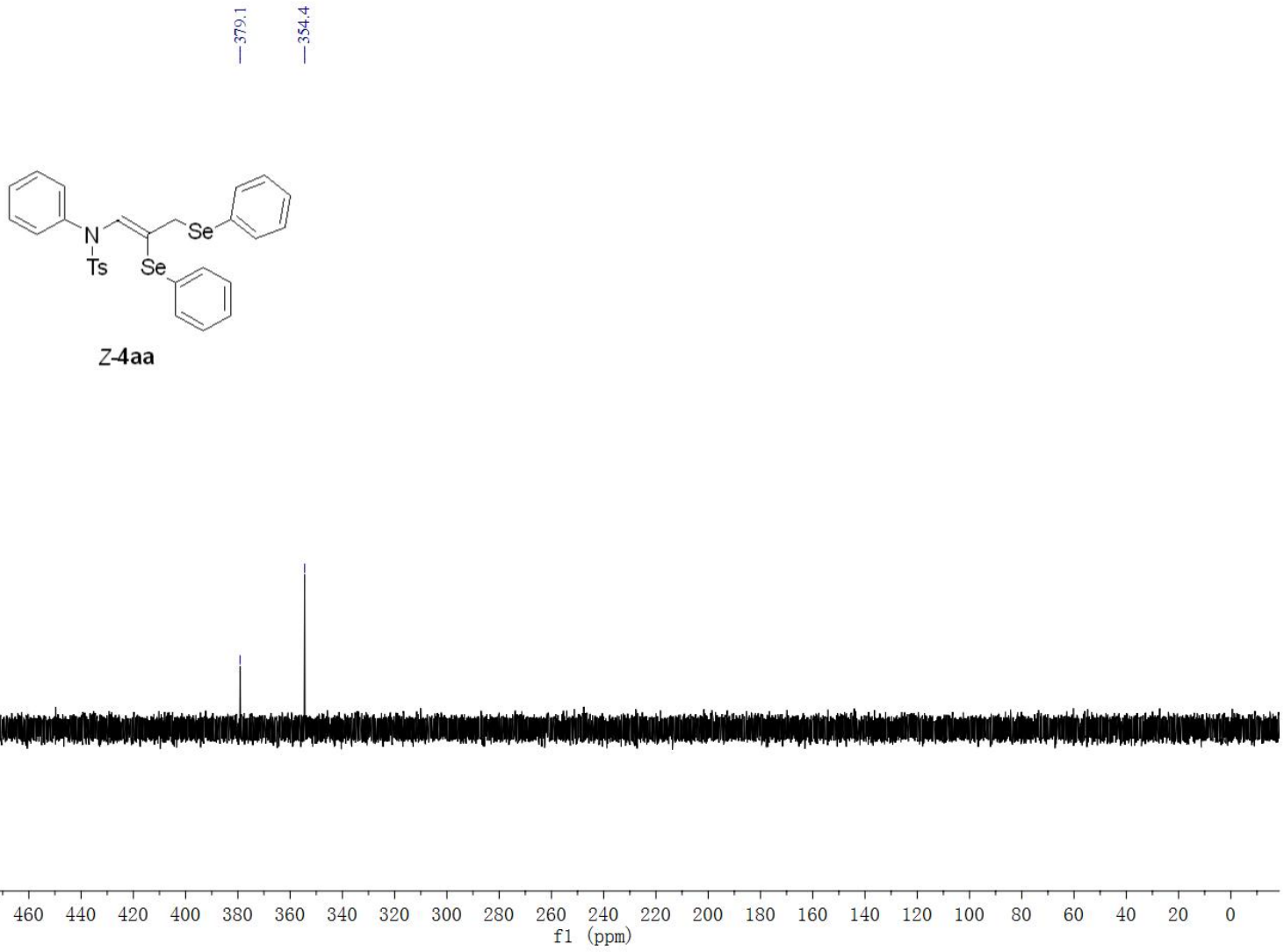
f1 (ppm)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354.4
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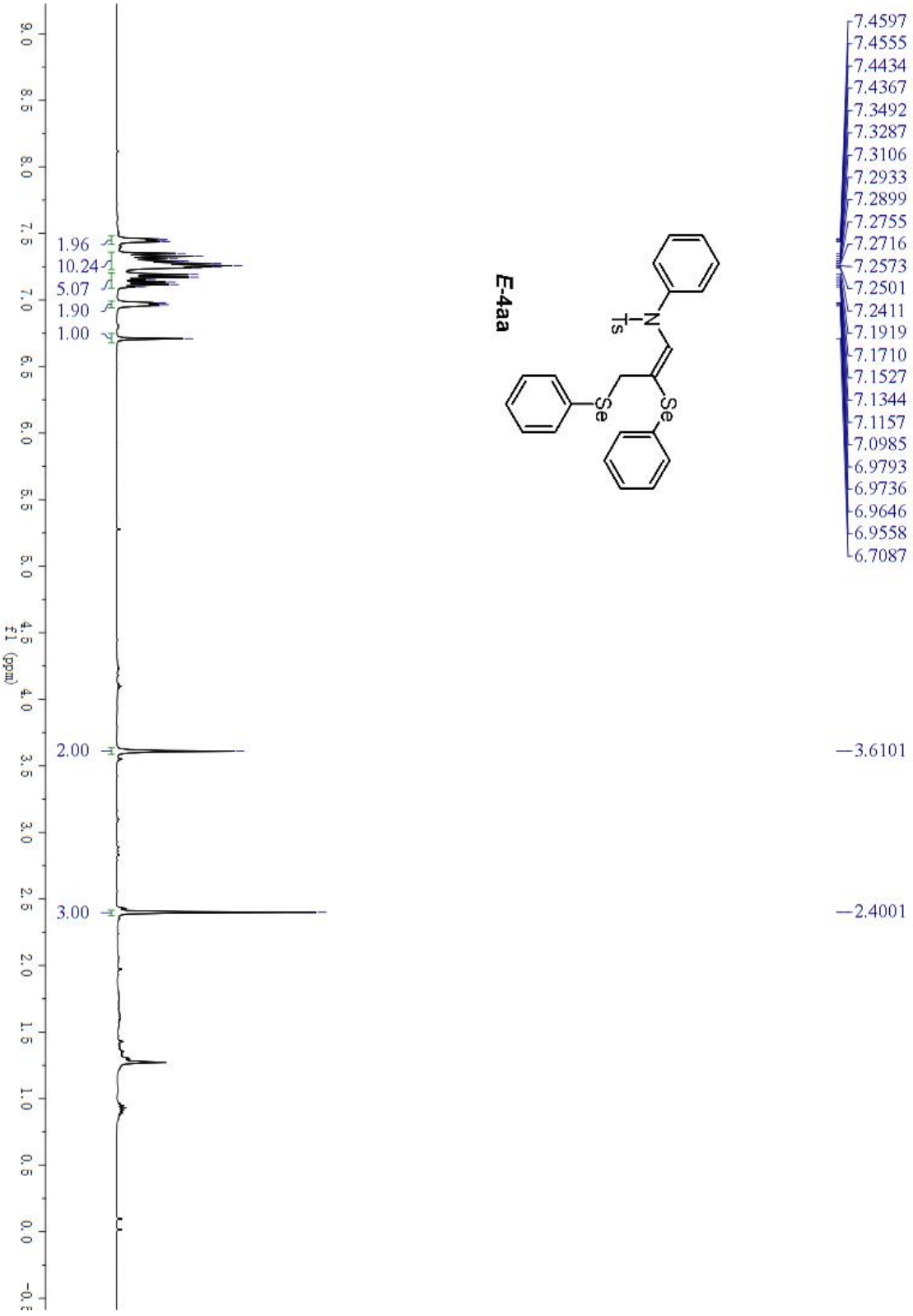
Ts
Se
Se
500 480 460 440 420 400 380 360 340 320 300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0
f1 (ppm)

Z-**4aa**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3.00
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7.2573
7.2501
7.2411
7.1919
7.1710
7.1527
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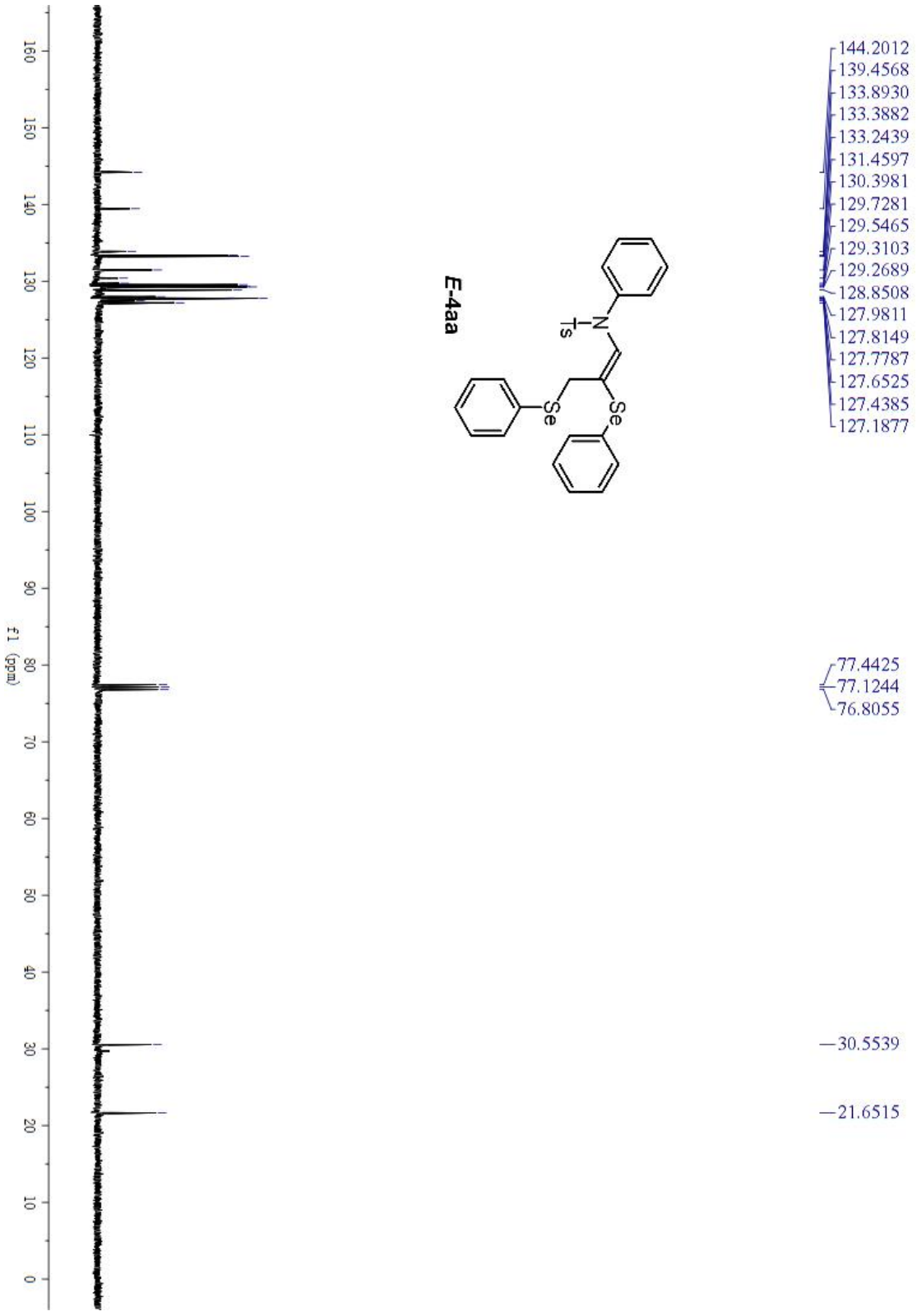
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Se
Se
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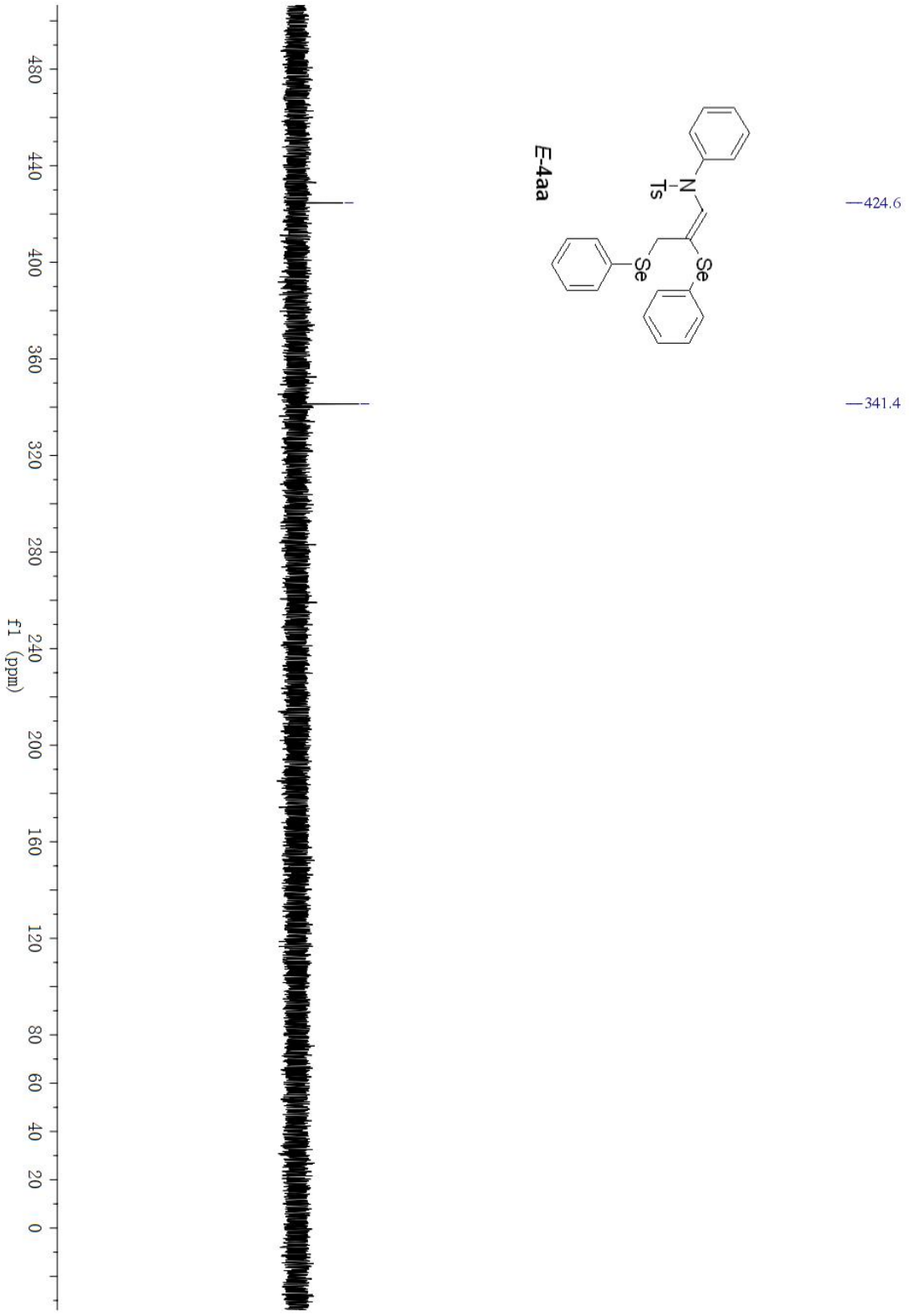
f1 (ppm)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Se
Se
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400
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280
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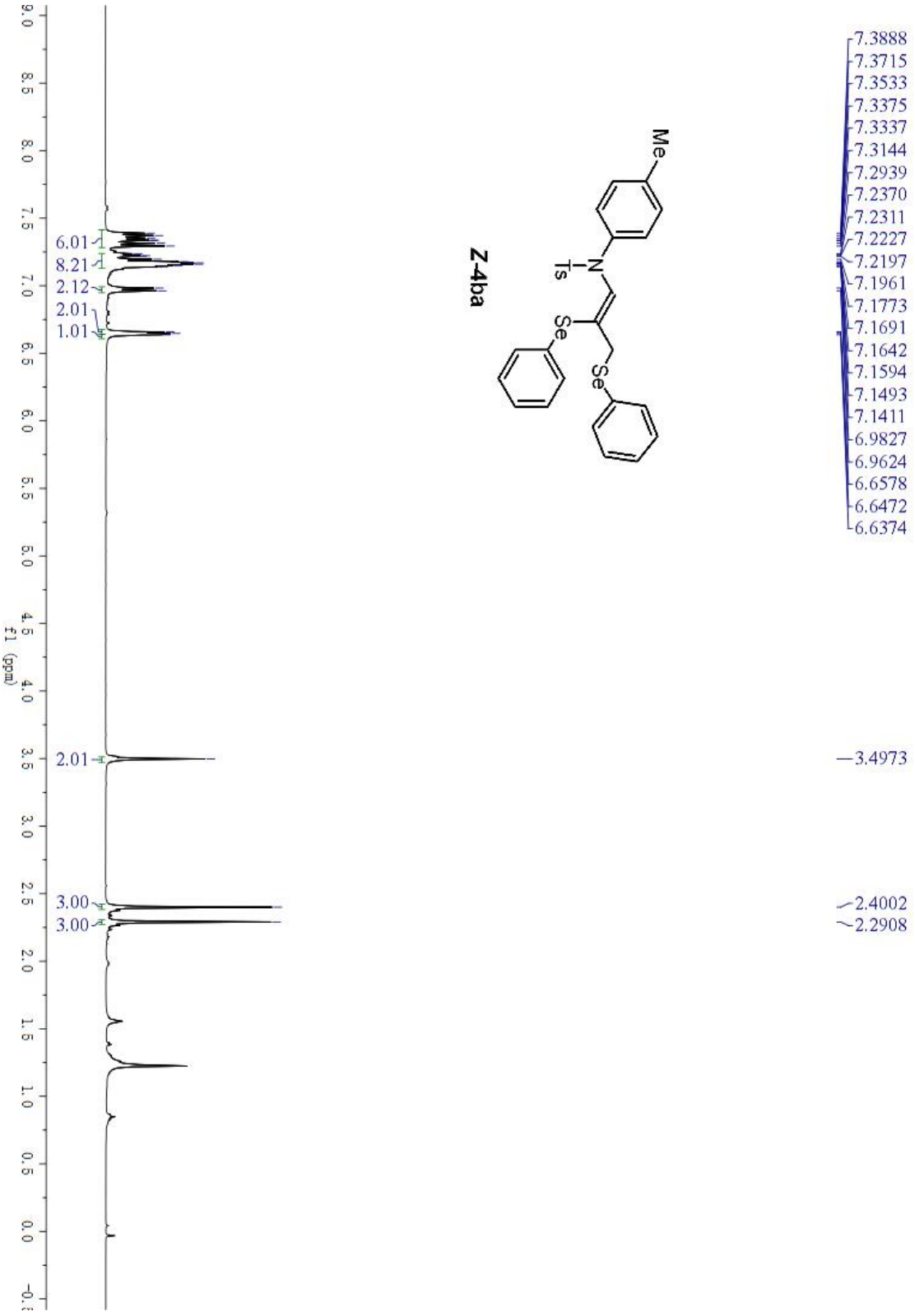
200
160
120
80
60
40
20
0
f1 (ppm)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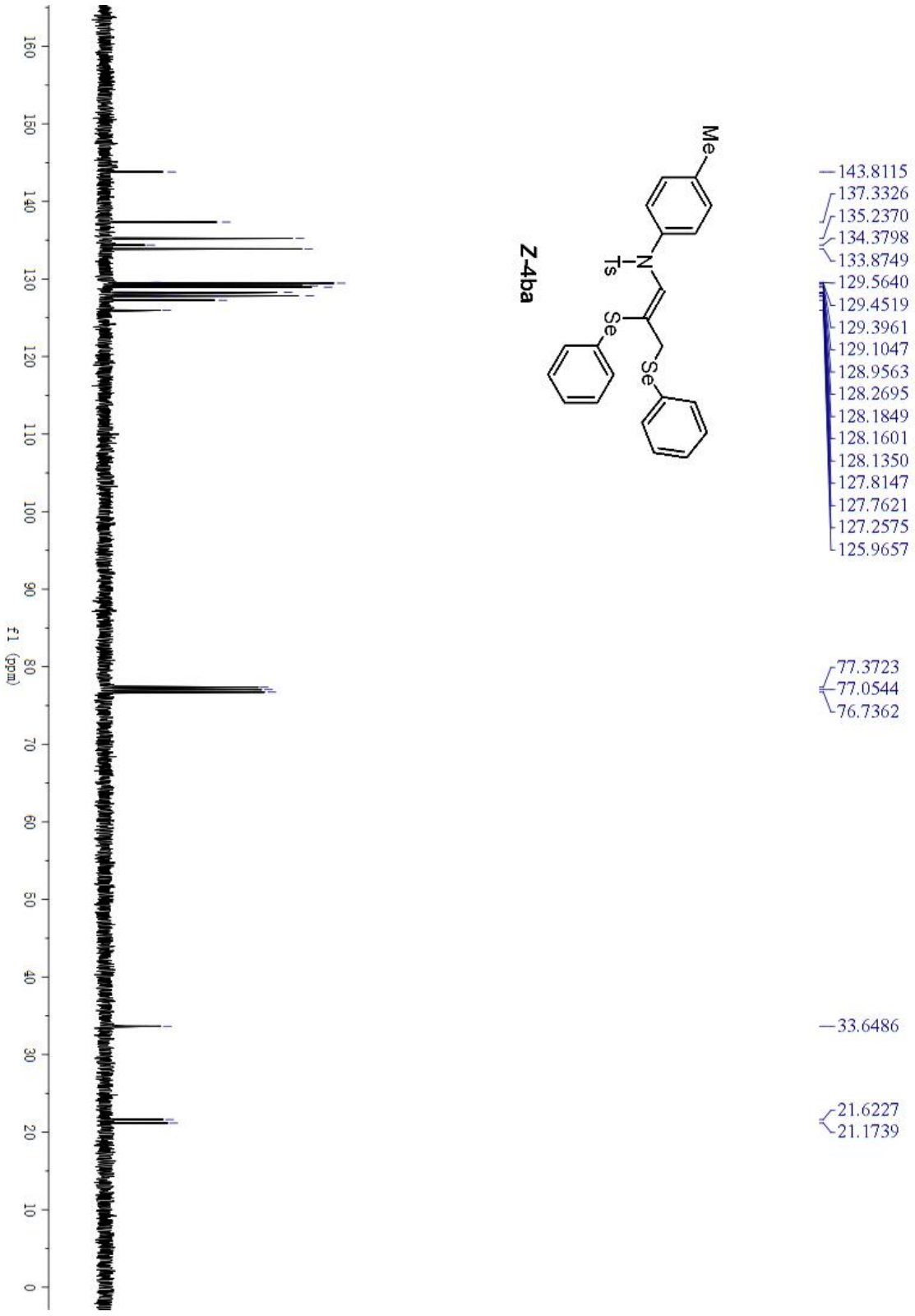
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Ts
Se
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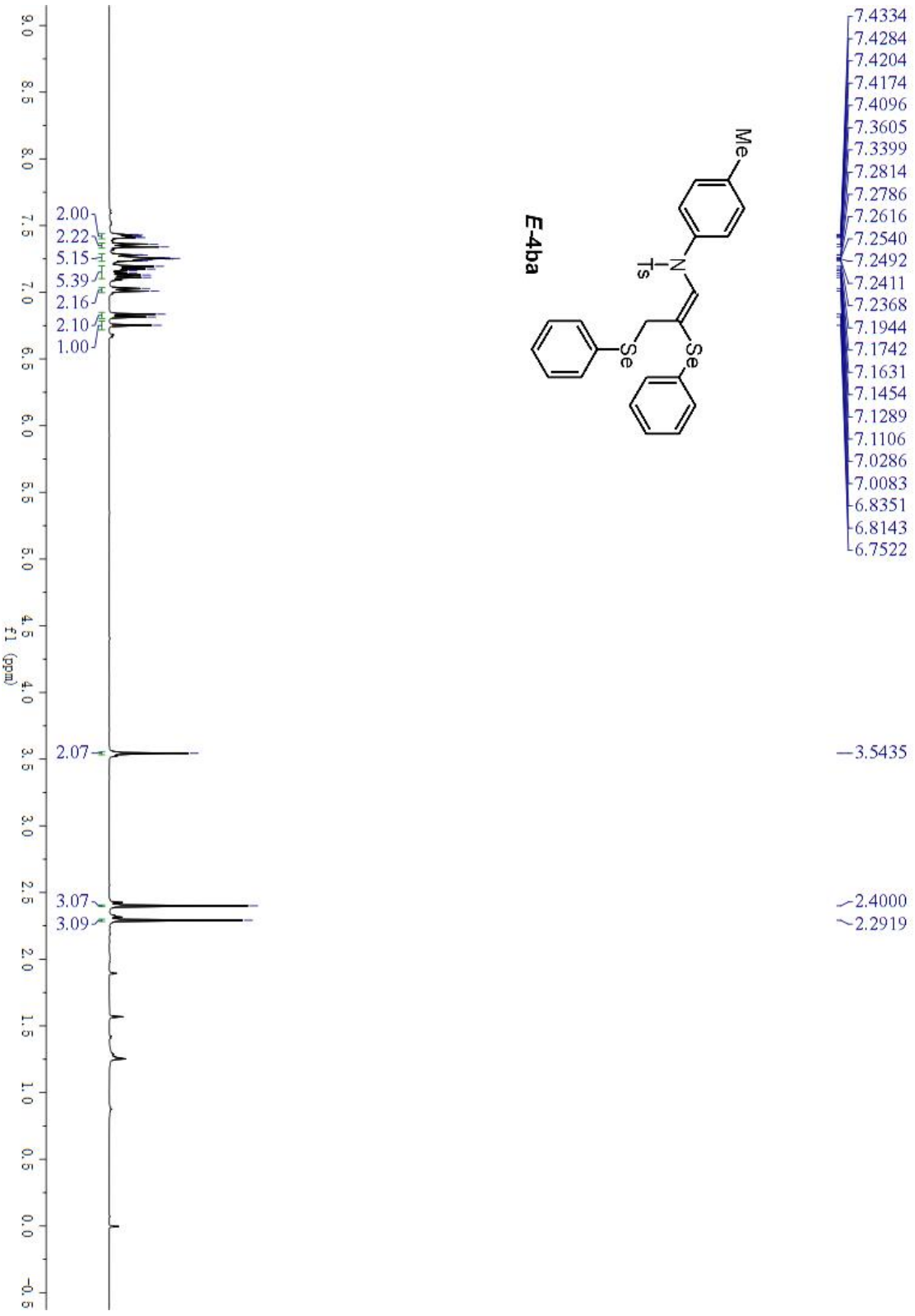
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Se
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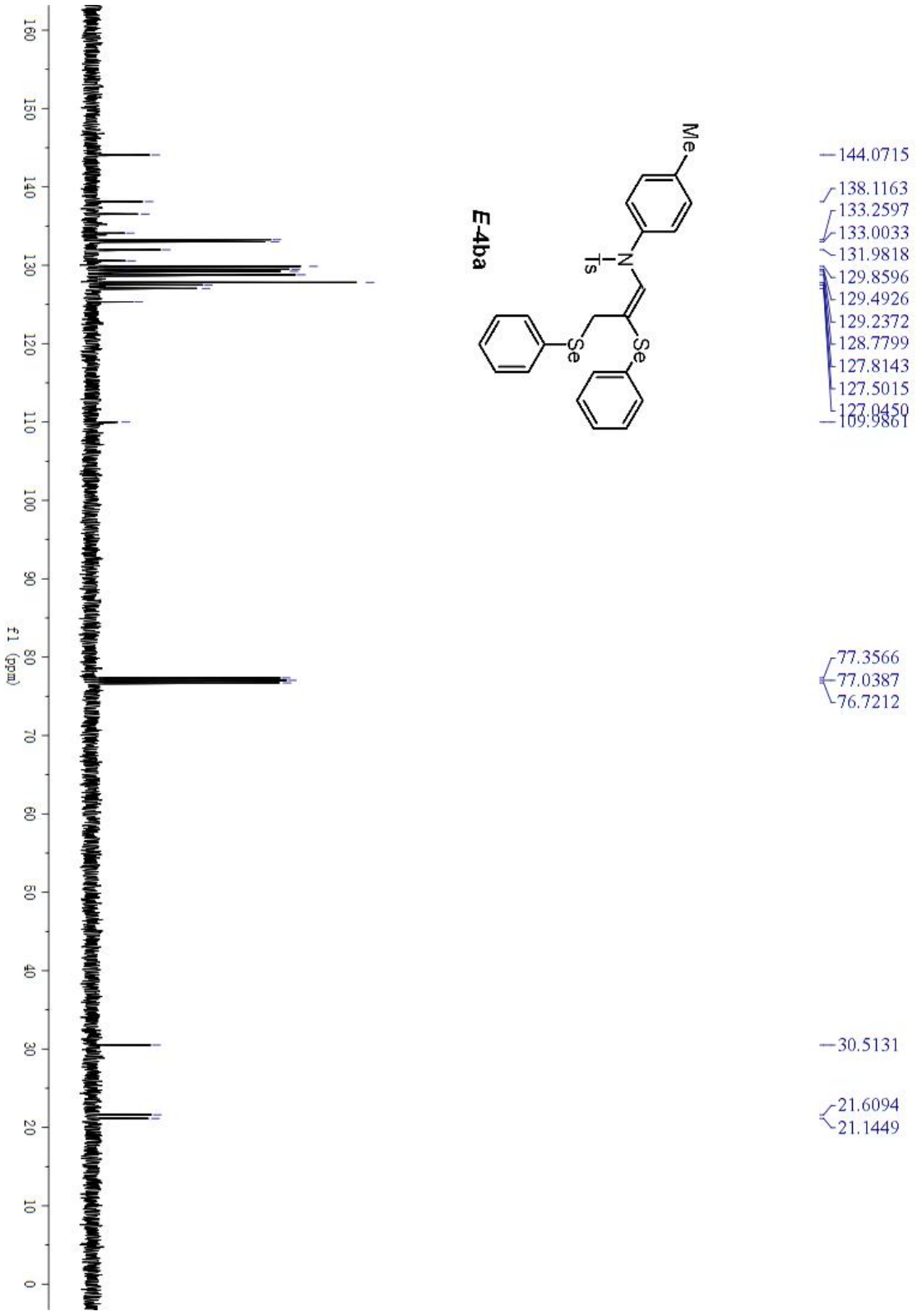
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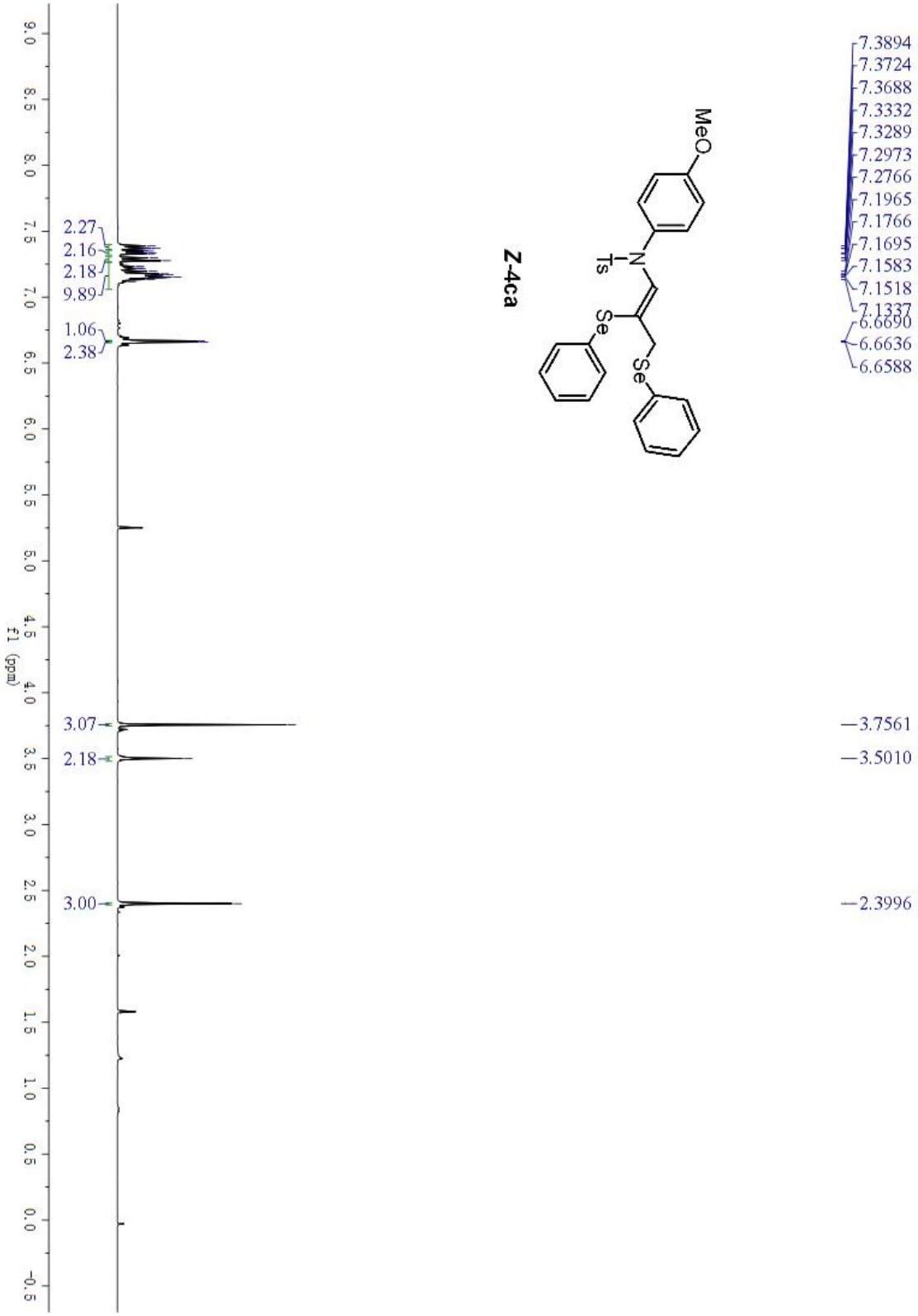
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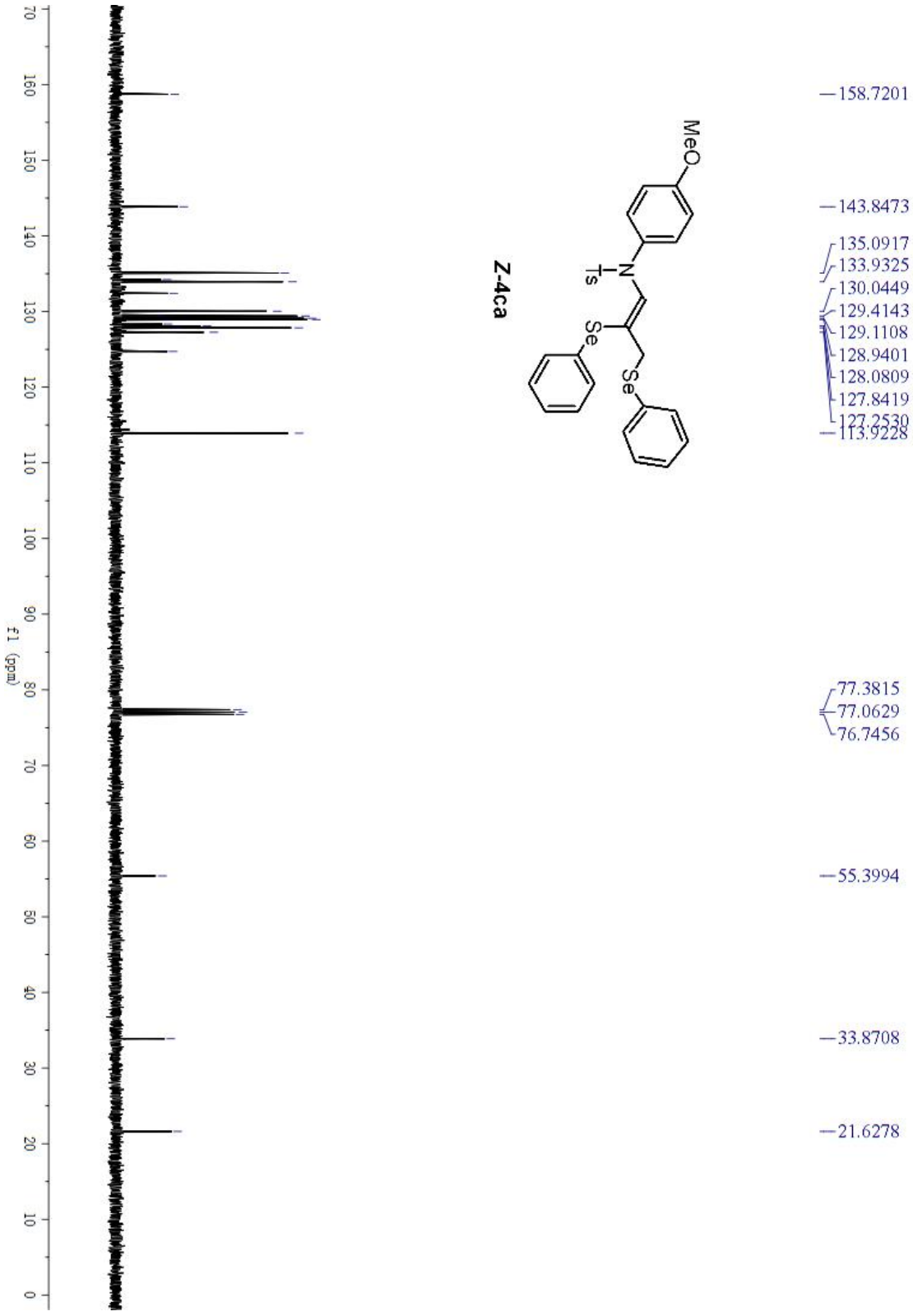
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Ts
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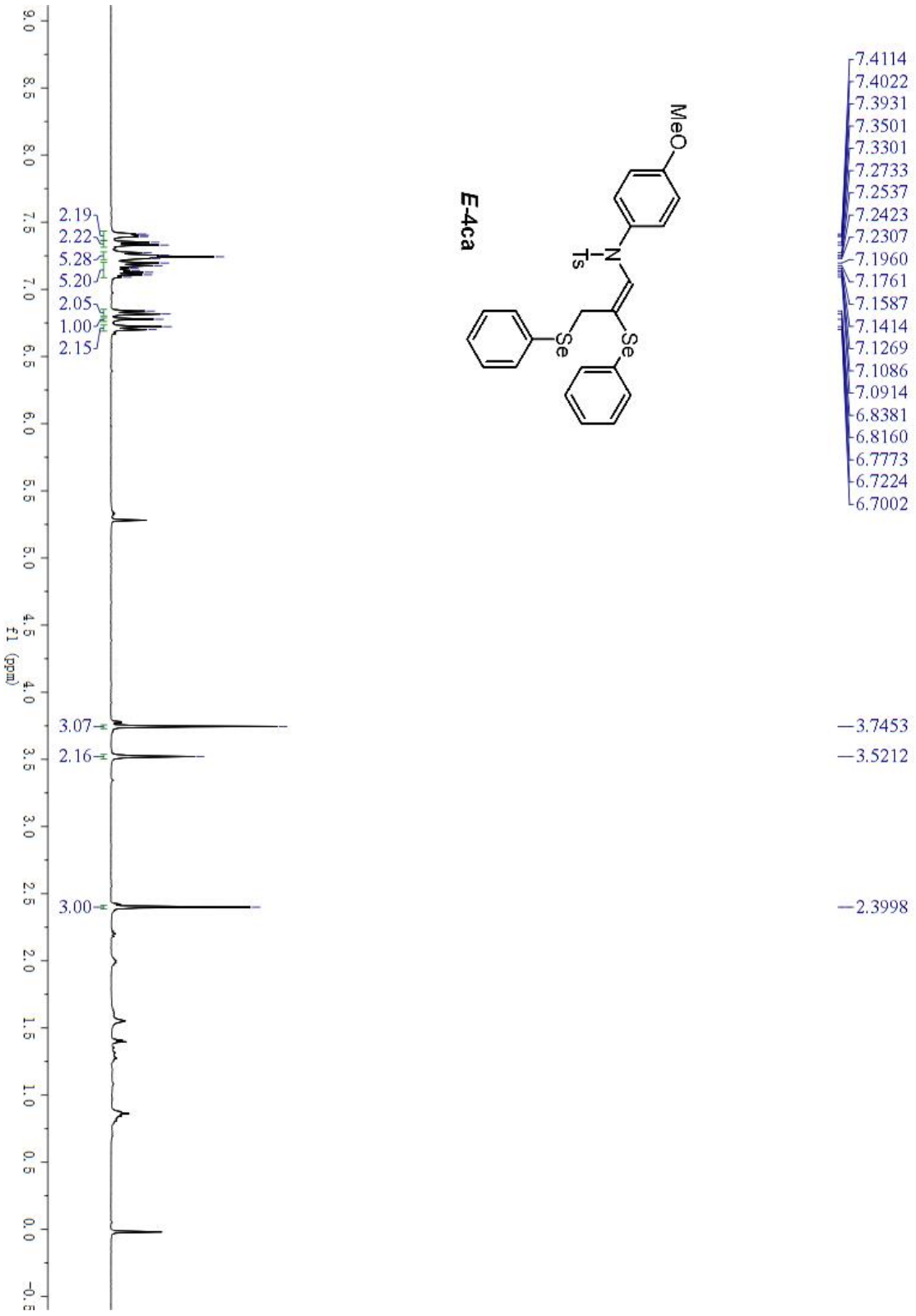
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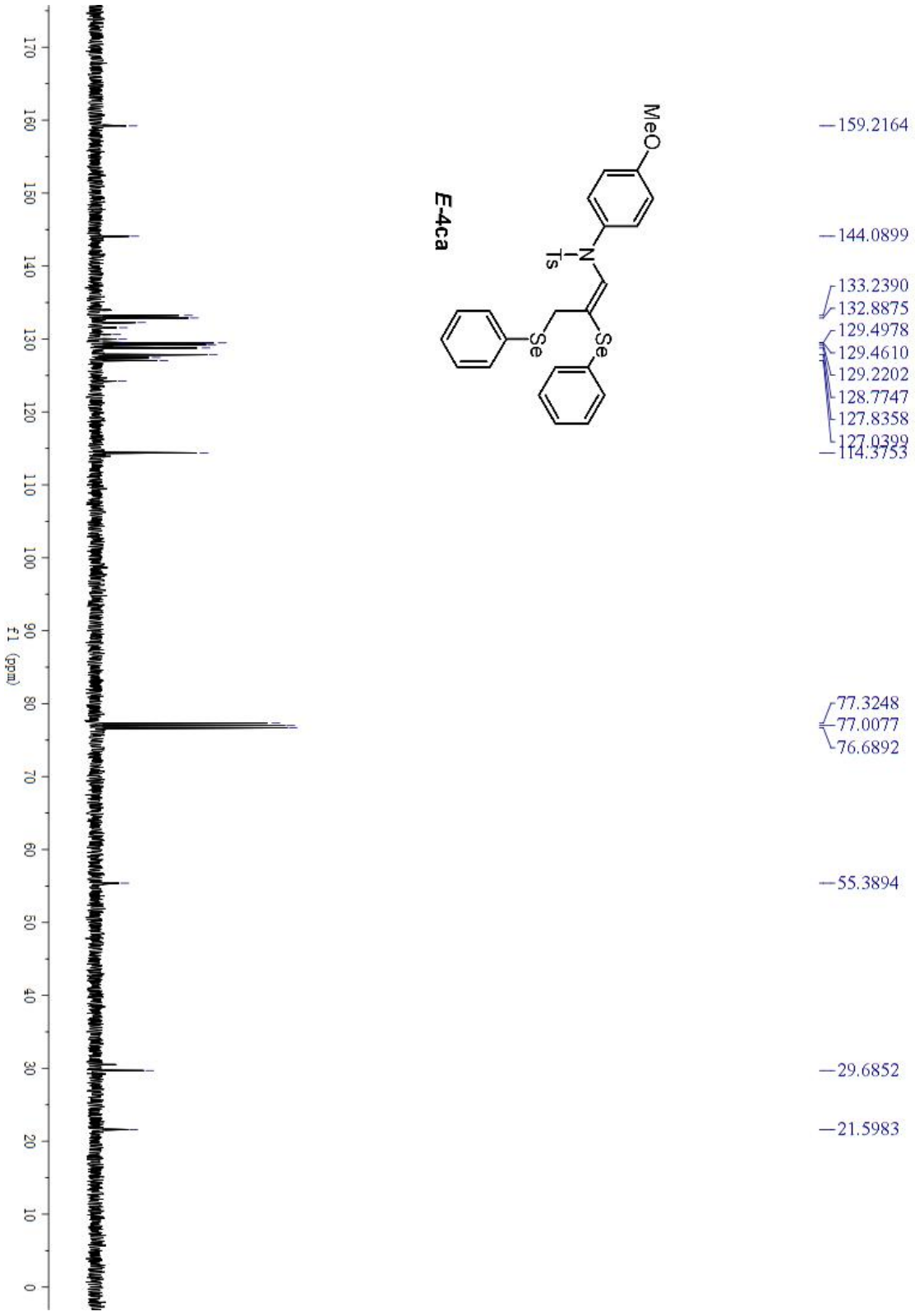
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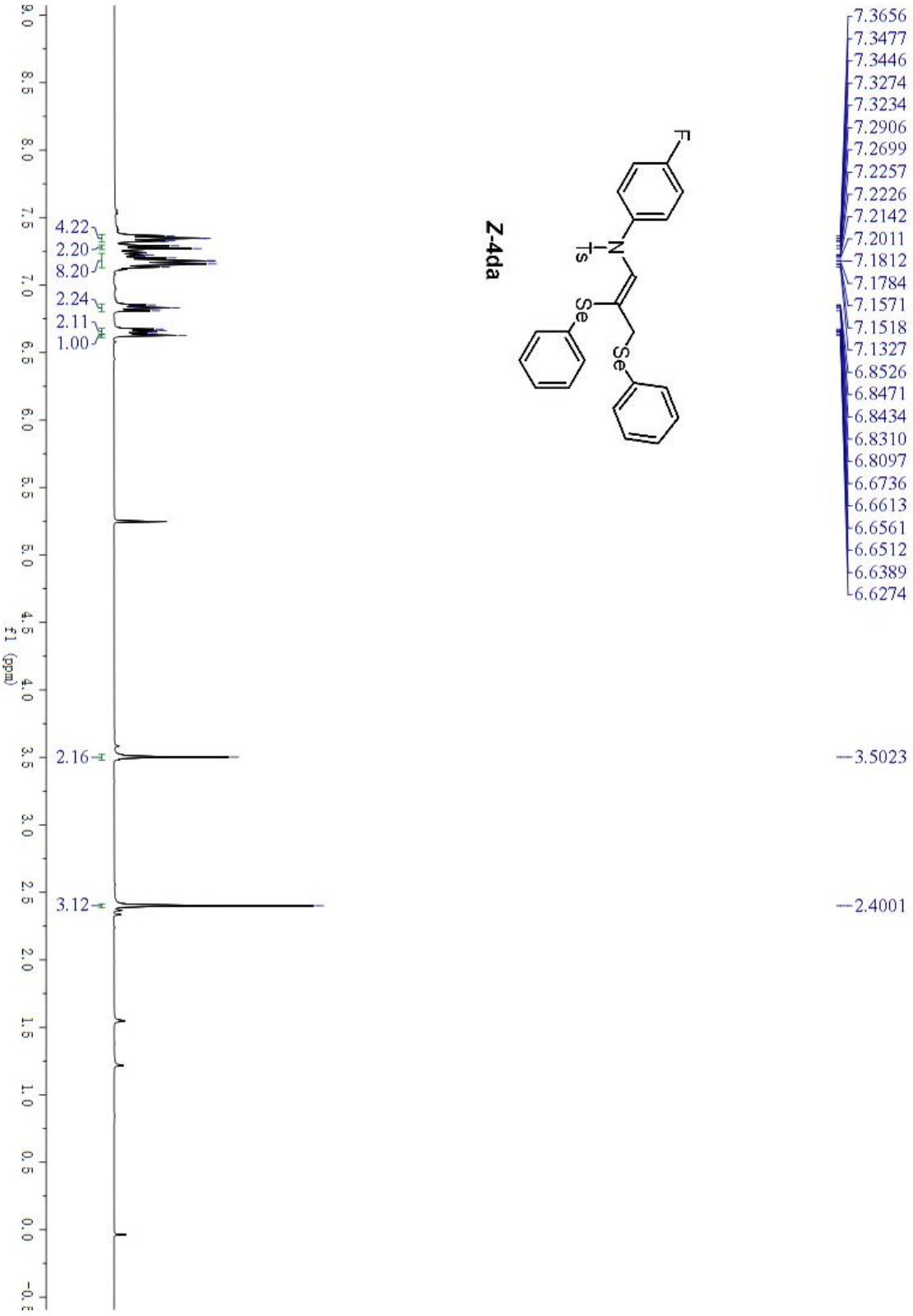
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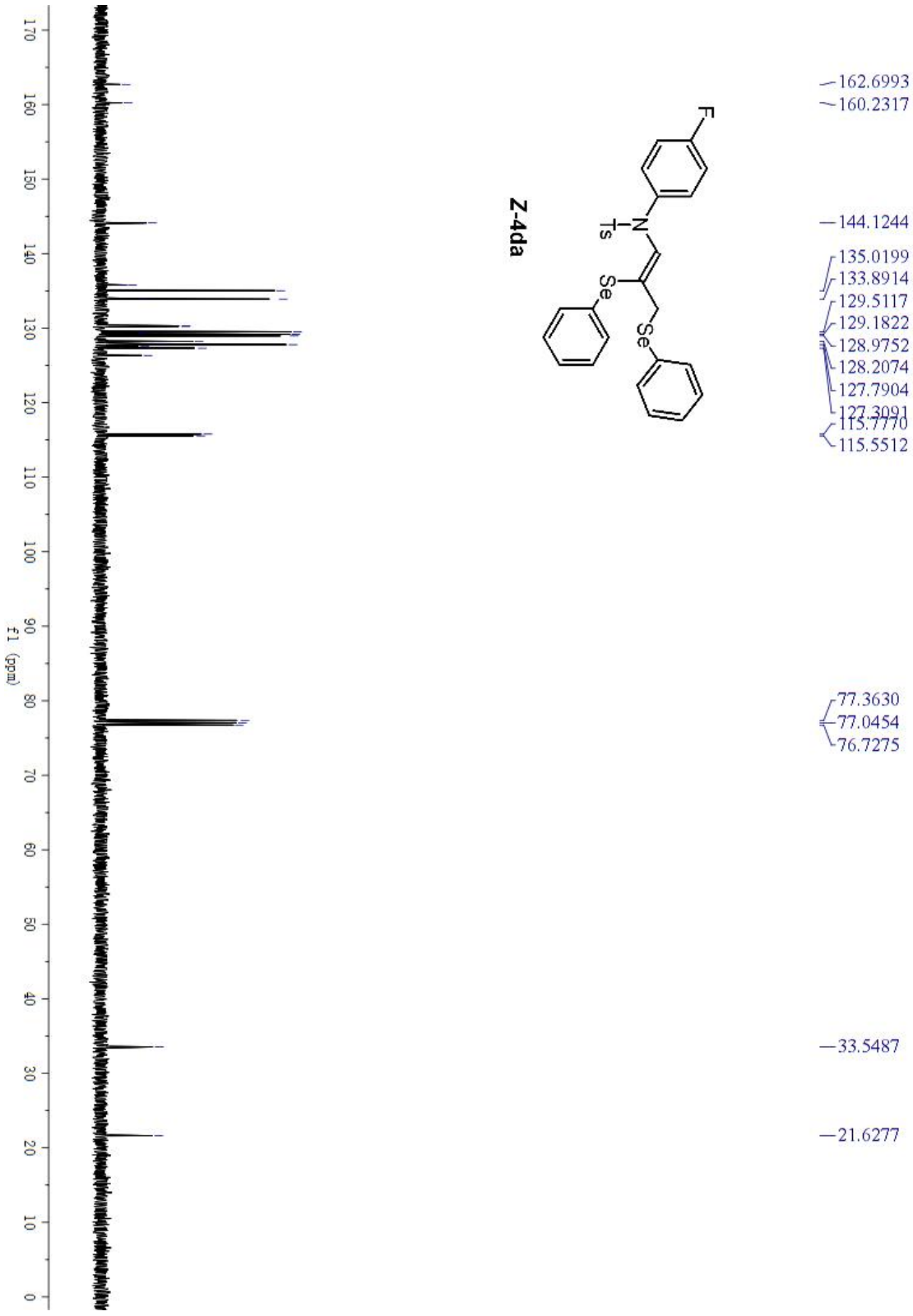
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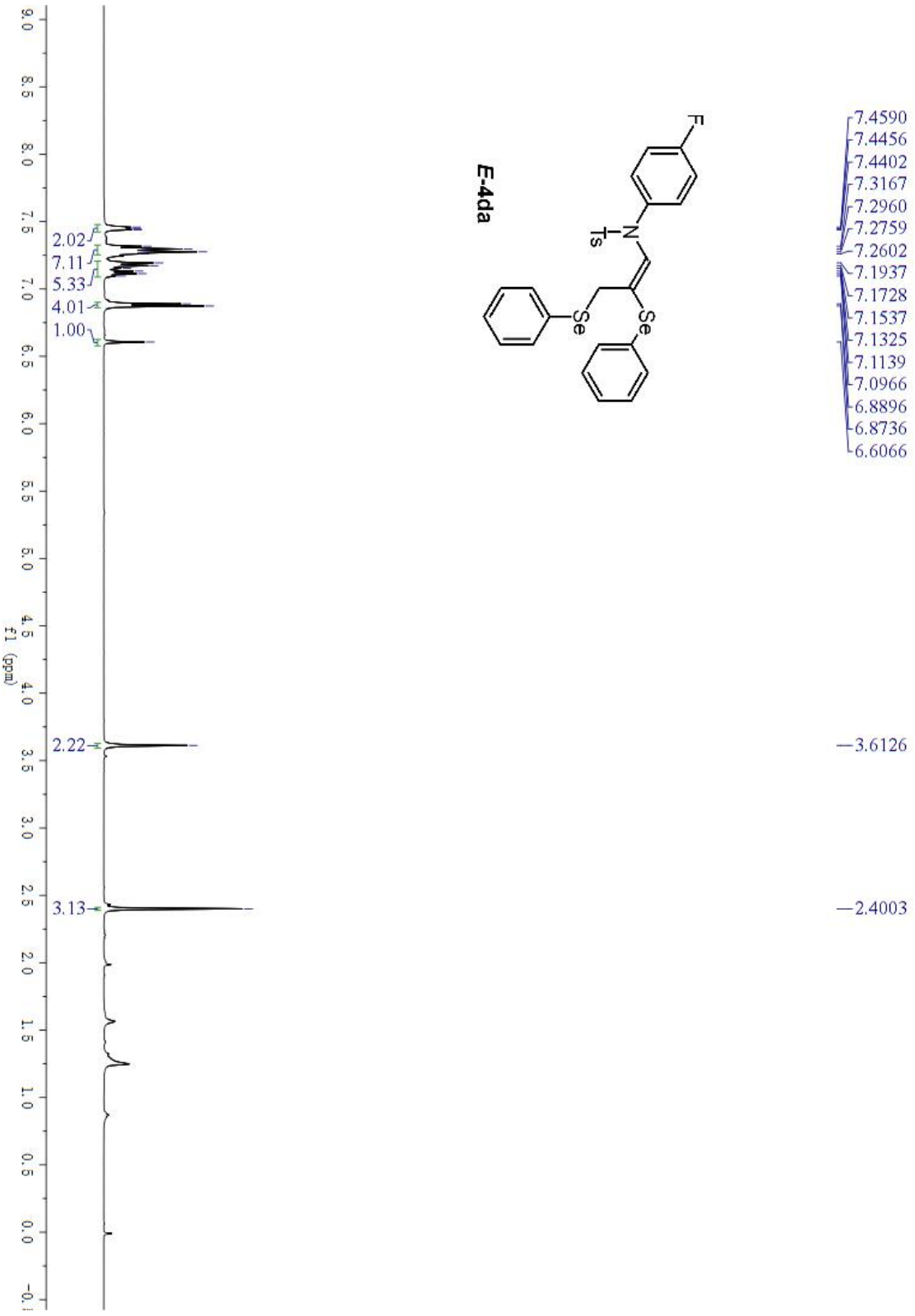
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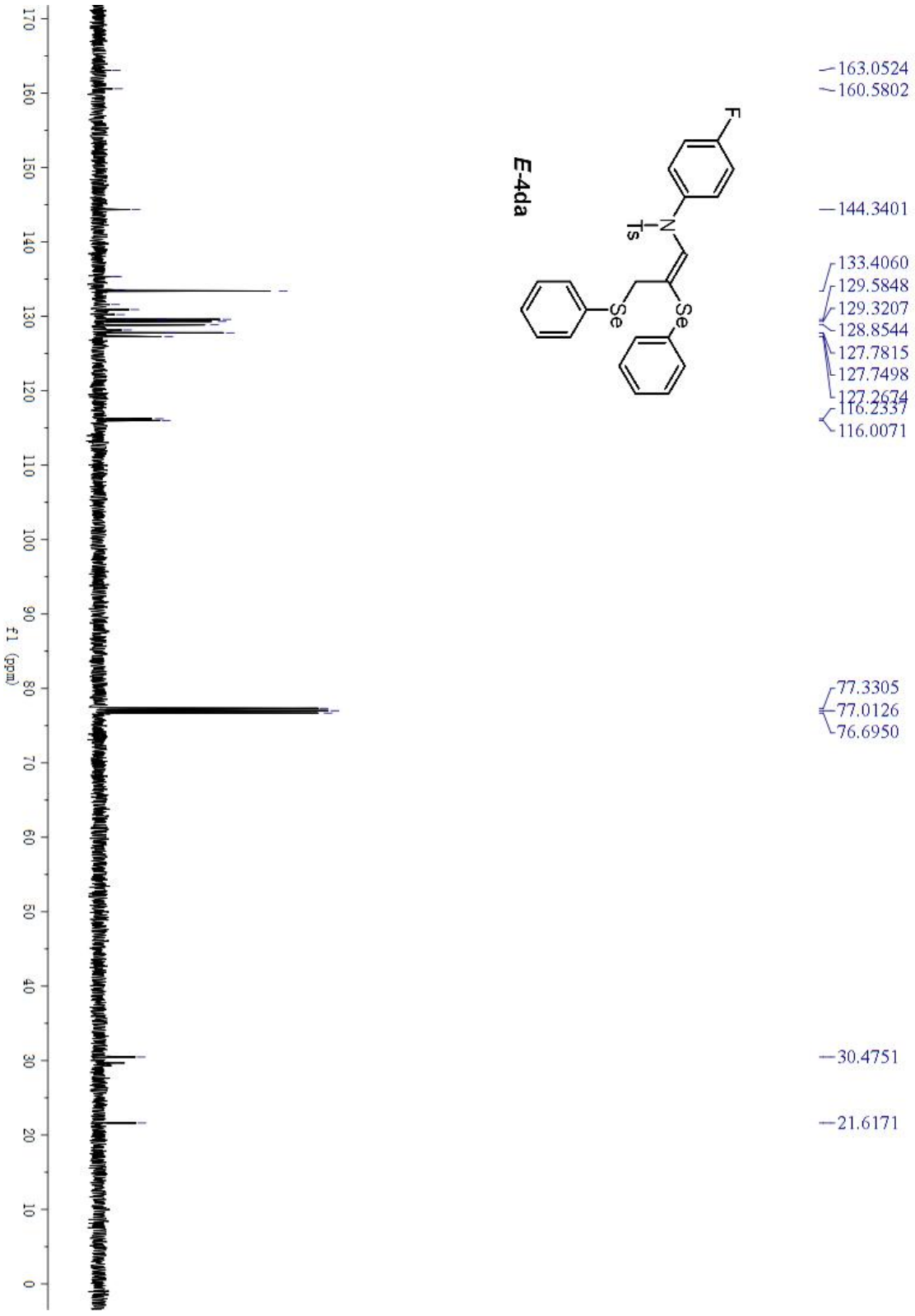
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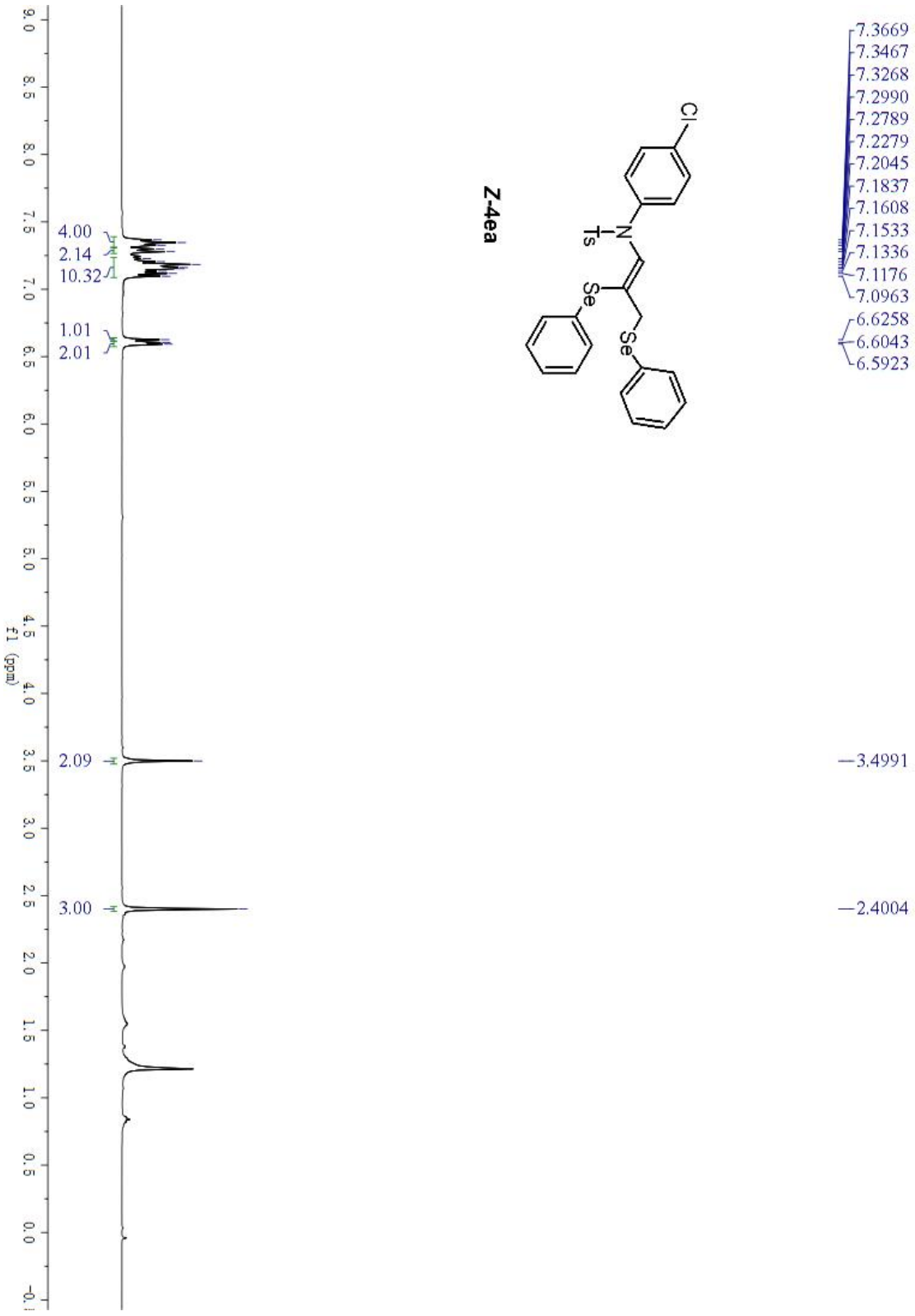
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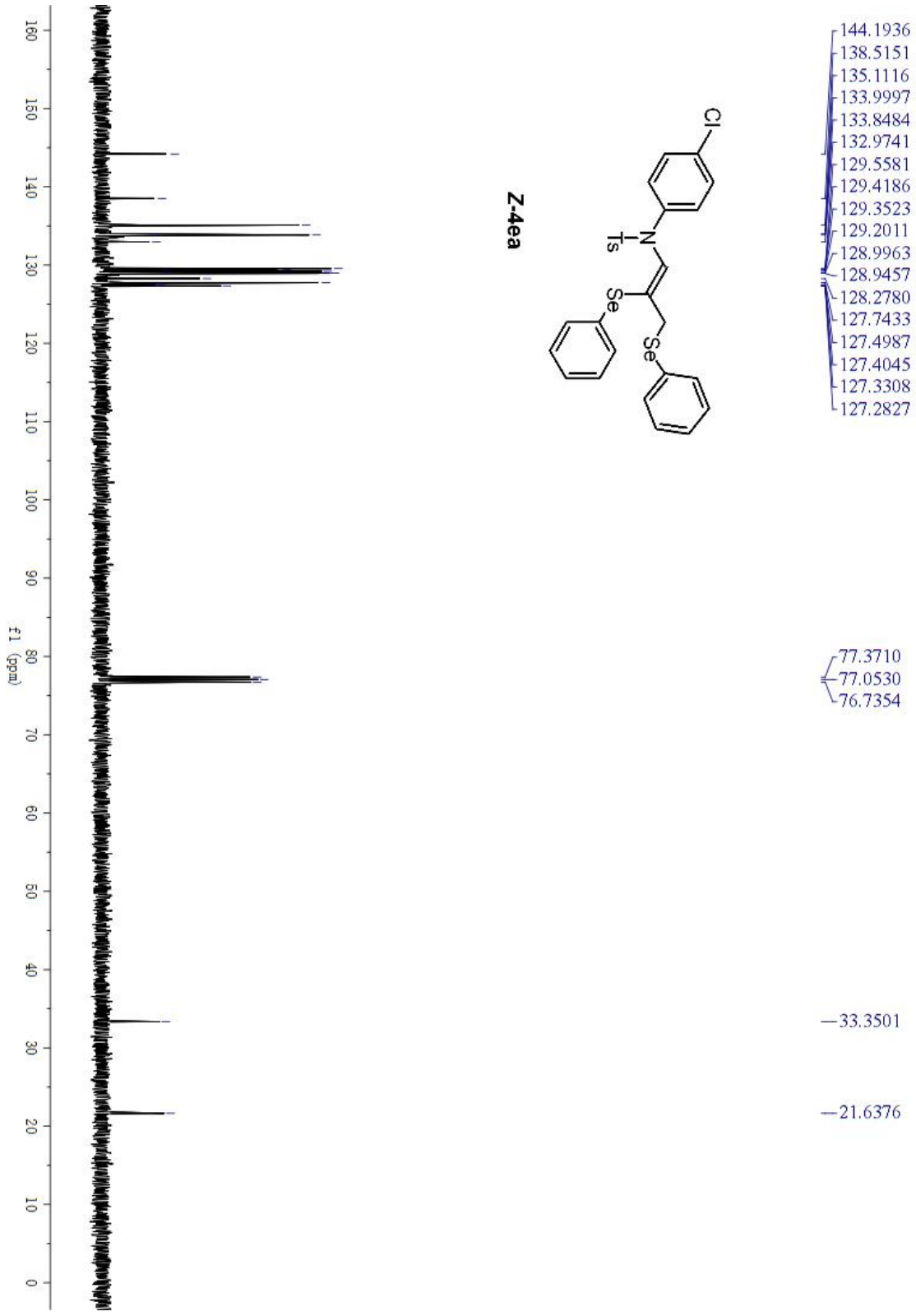
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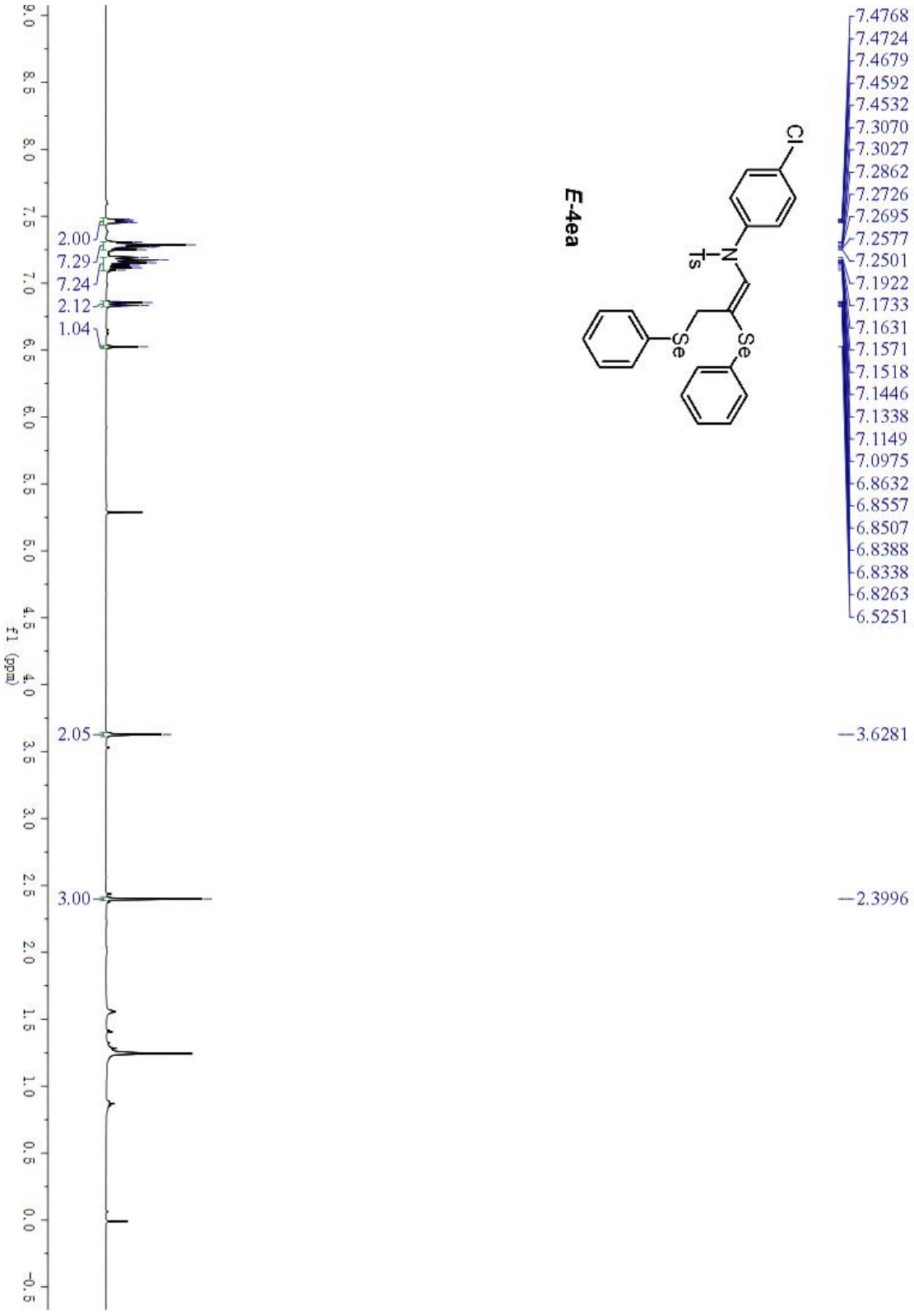
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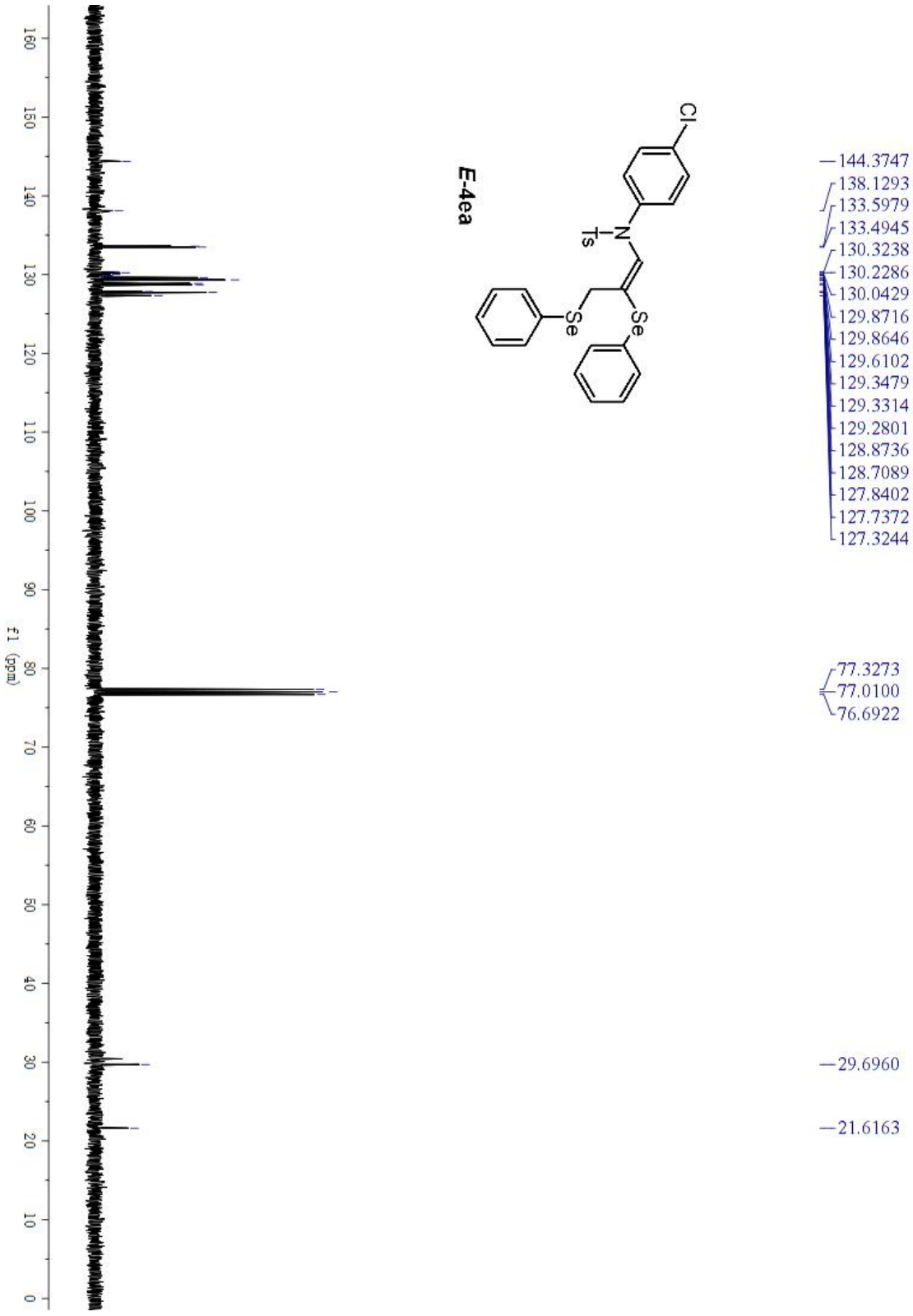
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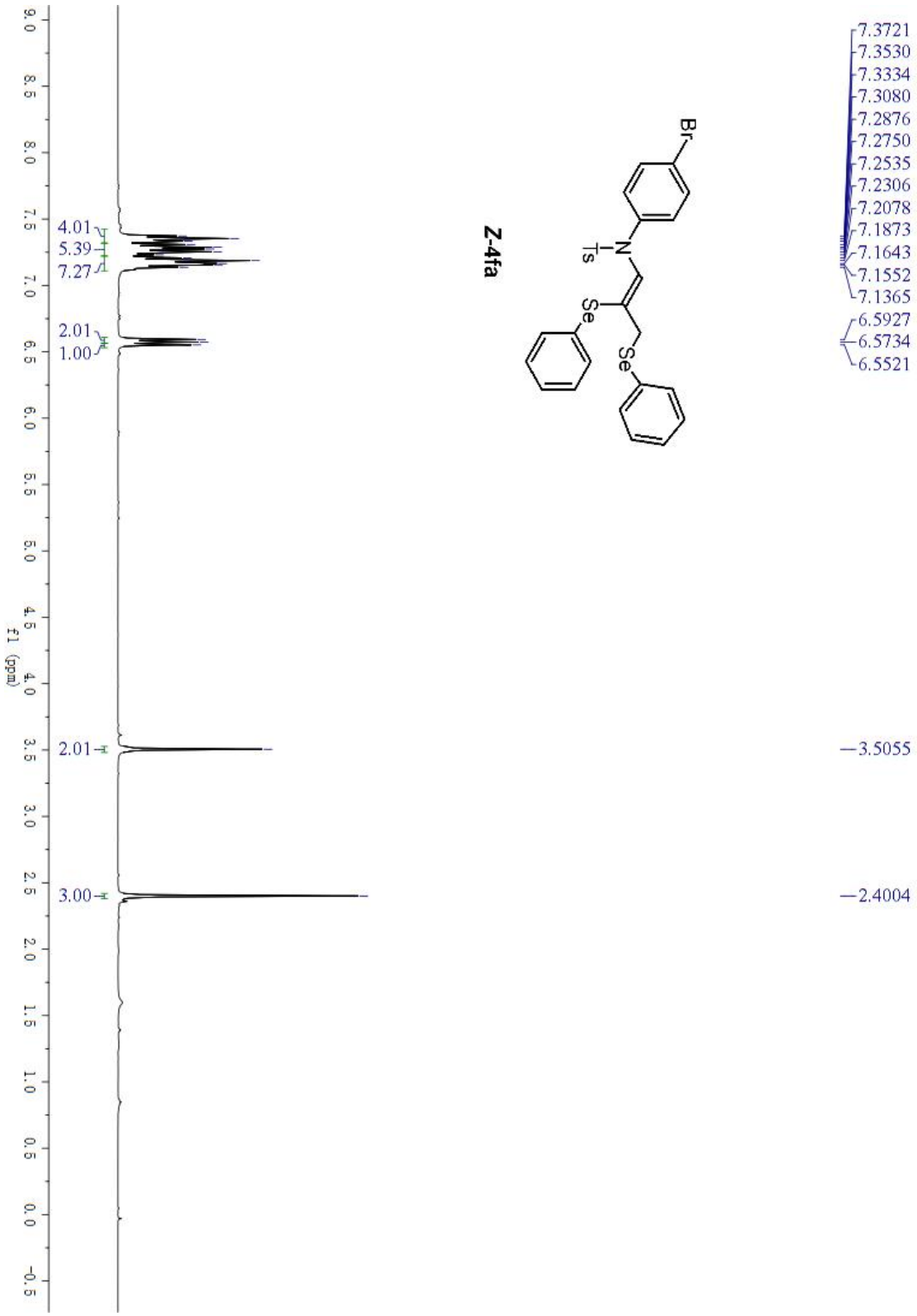
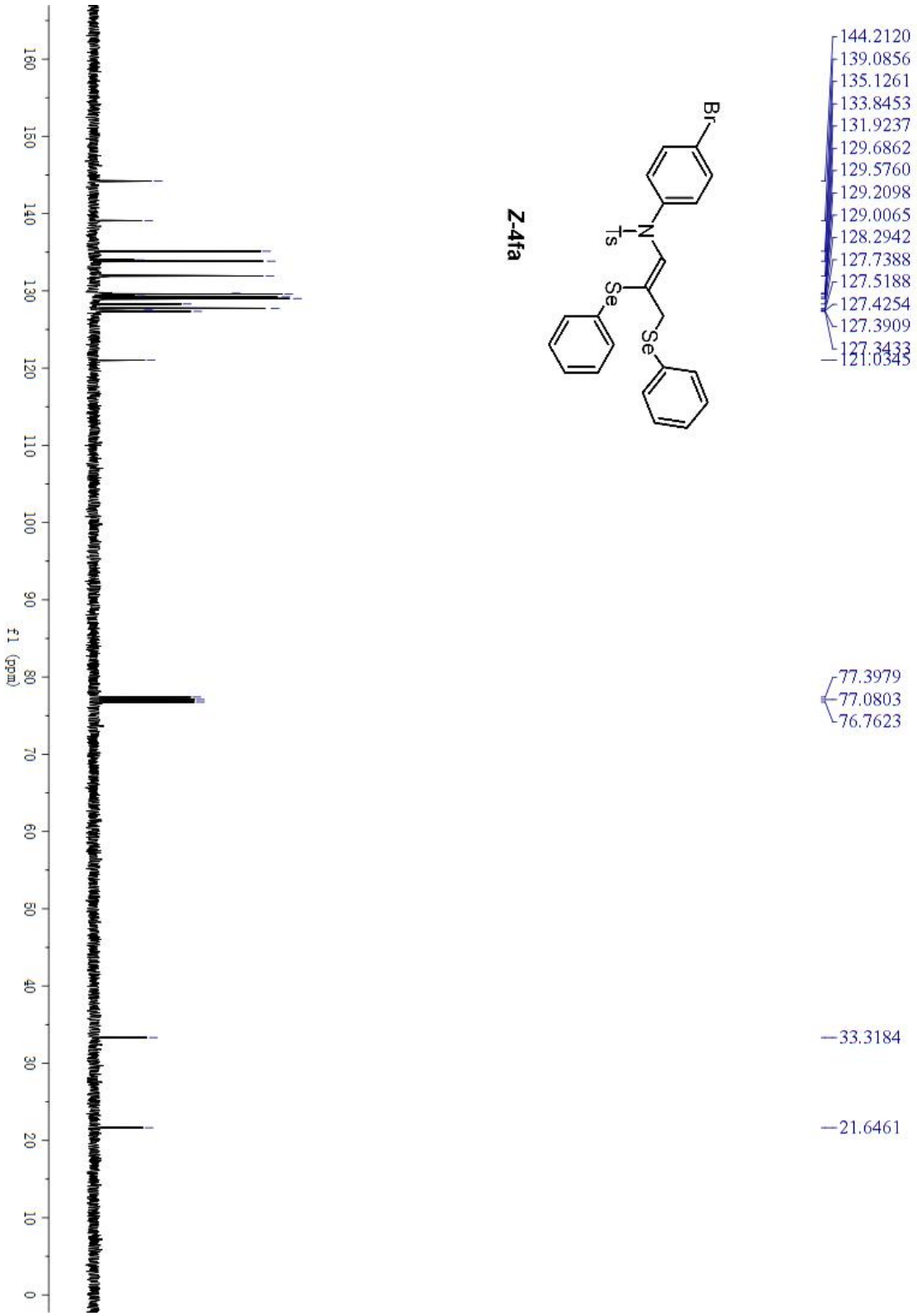
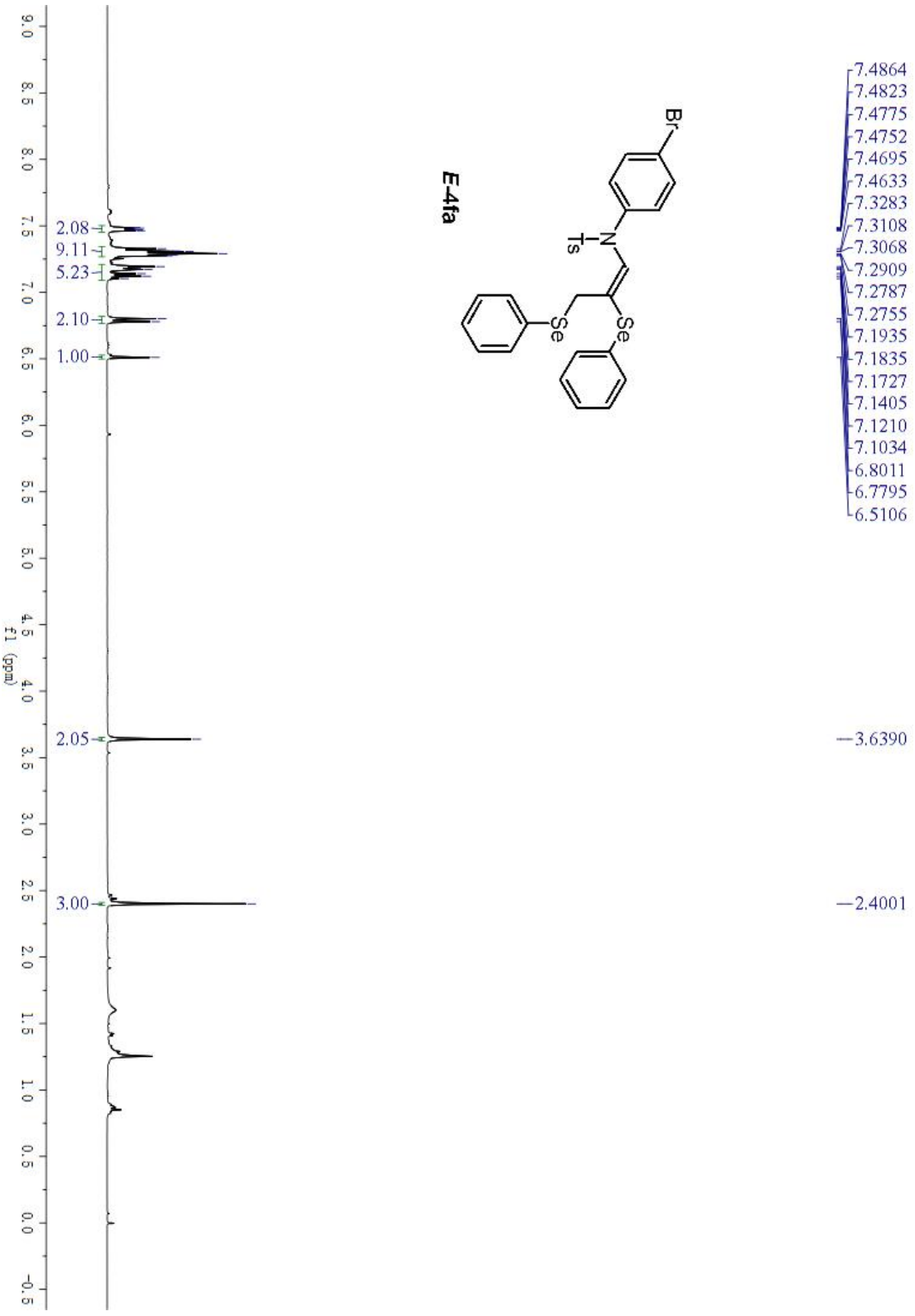
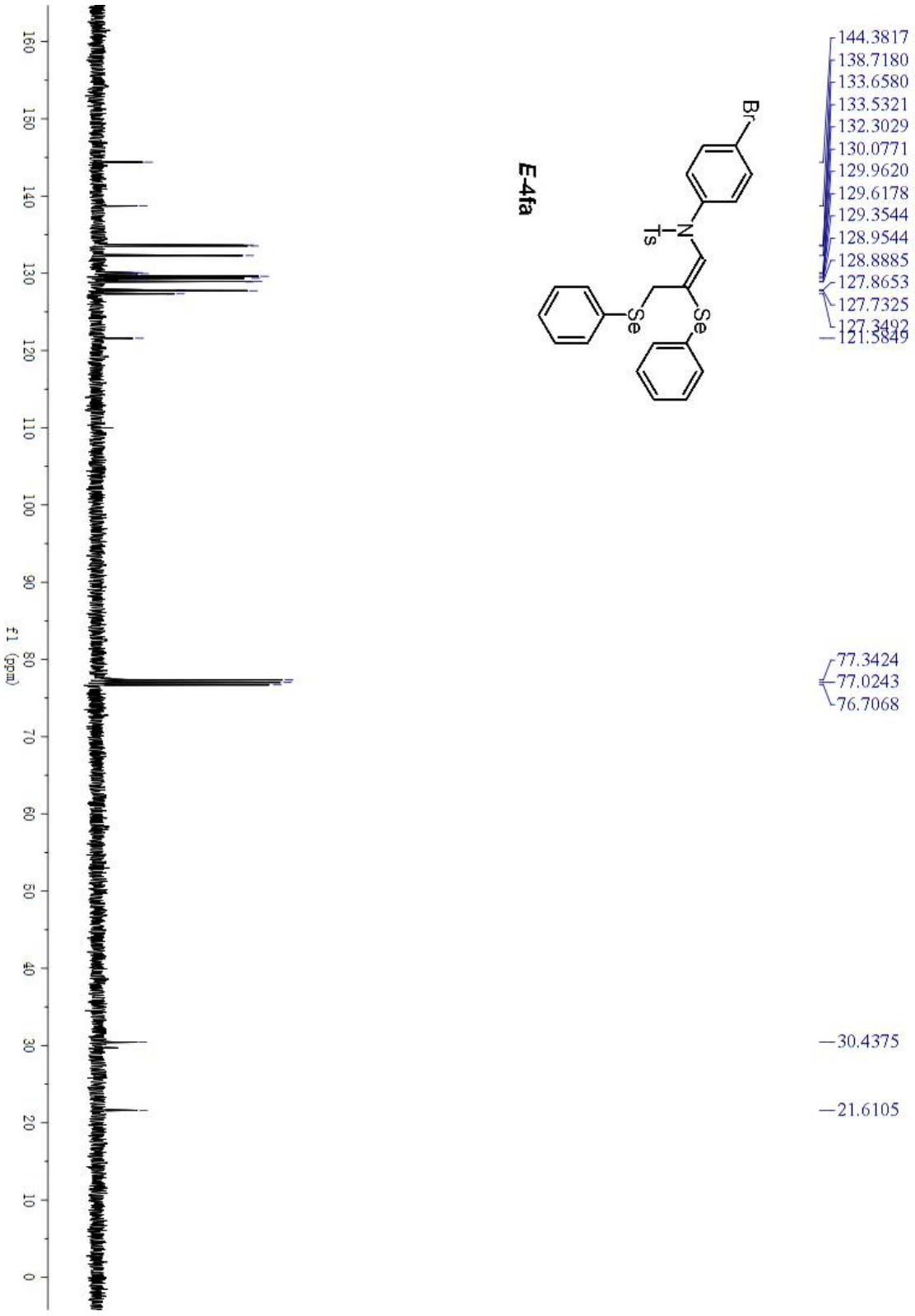
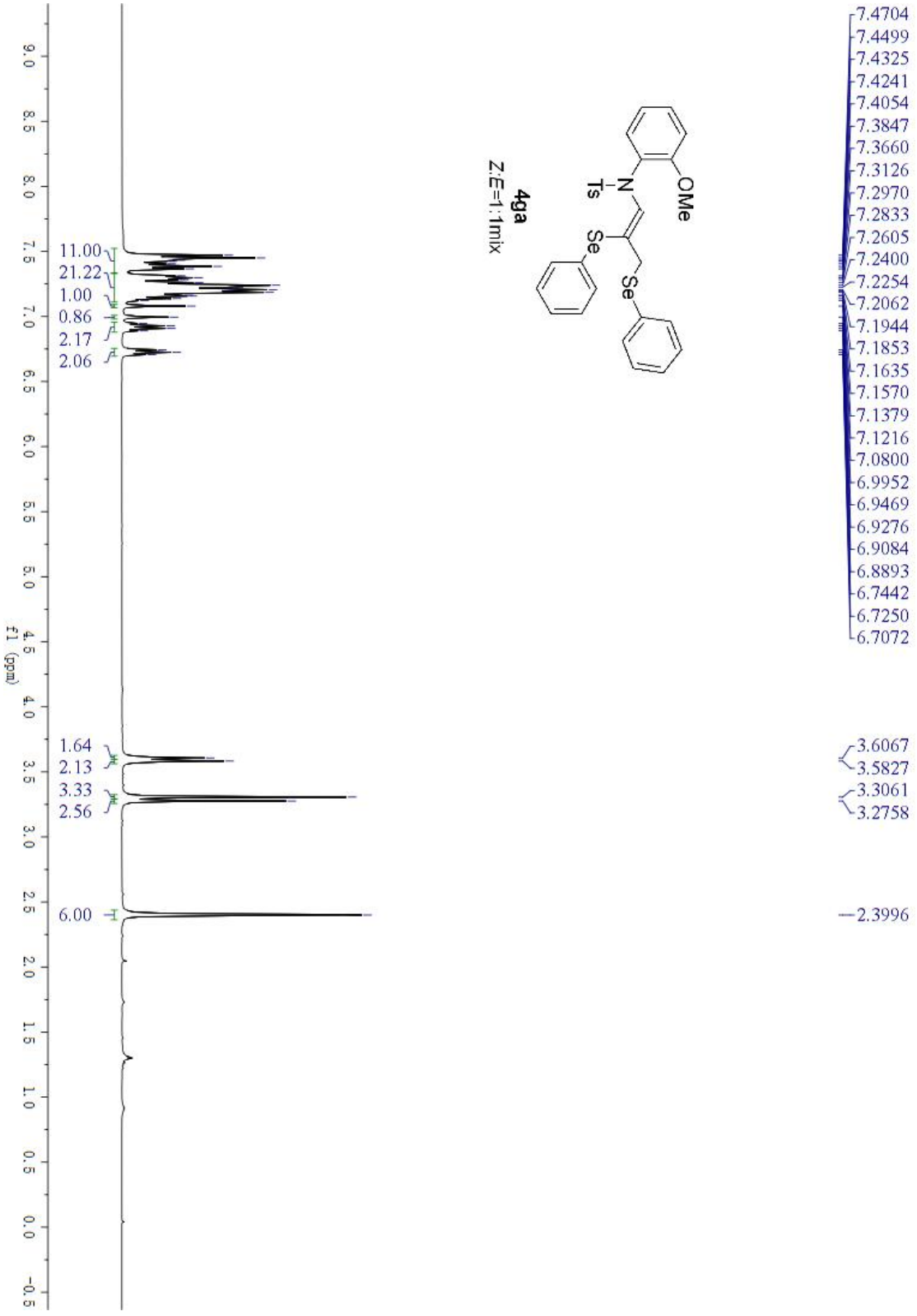
21.6163
f1 (ppm)


Z-4fa
Br
N
Ts
Se
Se
7.3721
7.3530
7.3334
7.3080
7.2876
7.2750
7.2535
7.2306
7.2078
7.1873
7.1643
7.1552
7.1365
6.5927
6.5734
6.5521
4.01
5.39
7.27
2.01
1.00
2.01
3.00
3.5055
2.4004
f1 (ppm)


Z-4fa
Br
N
Ts
Se
Se
144.2120
139.0856
135.1261
133.8453
131.9237
129.6862
129.5760
129.2098
129.0065
128.2942
127.7388
127.5188
127.4254
127.3909
127.3433
121.0345
77.3979
77.0803
76.7623
33.3184
21.6461
f1 (ppm)


E-4fa
Br
N
Ts
Se
Se
7.4864
7.4823
7.4775
7.4752
7.4695
7.4633
7.3283
7.3108
7.3068
7.2909
7.2787
7.2755
7.1935
7.1835
7.1727
7.1405
7.1210
7.1034
6.8011
6.7795
6.5106
2.08
9.11
5.23
2.10
1.00
2.05
3.00
3.6390
2.4001
f1 (ppm)


E-4fa
Br
N
Ts
Se
Se
144.3817
138.7180
133.6580
133.5321
132.3029
130.0771
129.9620
129.6178
129.3544
128.9544
128.8885
127.8653
127.7325
127.3492
121.5849
77.3424
77.0243
76.7068
30.4375
21.6105
f1 (ppm)


4ga
Z:E=1:1mix
OMe
N
Ts
Se
Se
11.00
21.22
1.00
0.86
2.17
2.06
1.64
2.13
3.33
2.56
6.00
f1 (ppm)
7.4704
7.4499
7.4325
7.4241
7.4054
7.3847
7.3660
7.3126
7.2970
7.2833
7.2605
7.2400
7.2254
7.2062
7.1944
7.1853
7.1635
7.1570
7.1379
7.1216
7.0800
6.9952
6.9469
6.9276
6.9084
6.8893
6.7442
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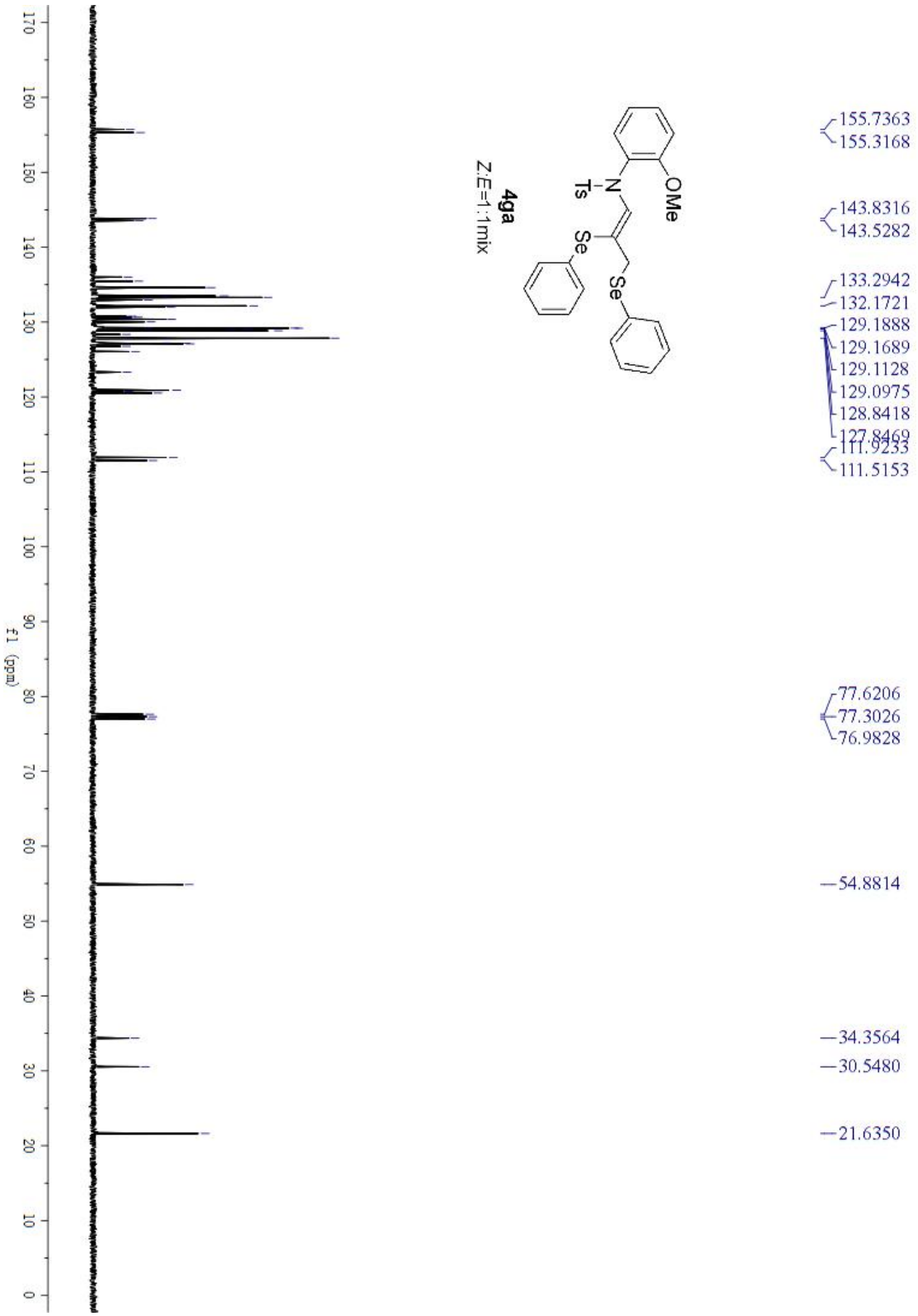
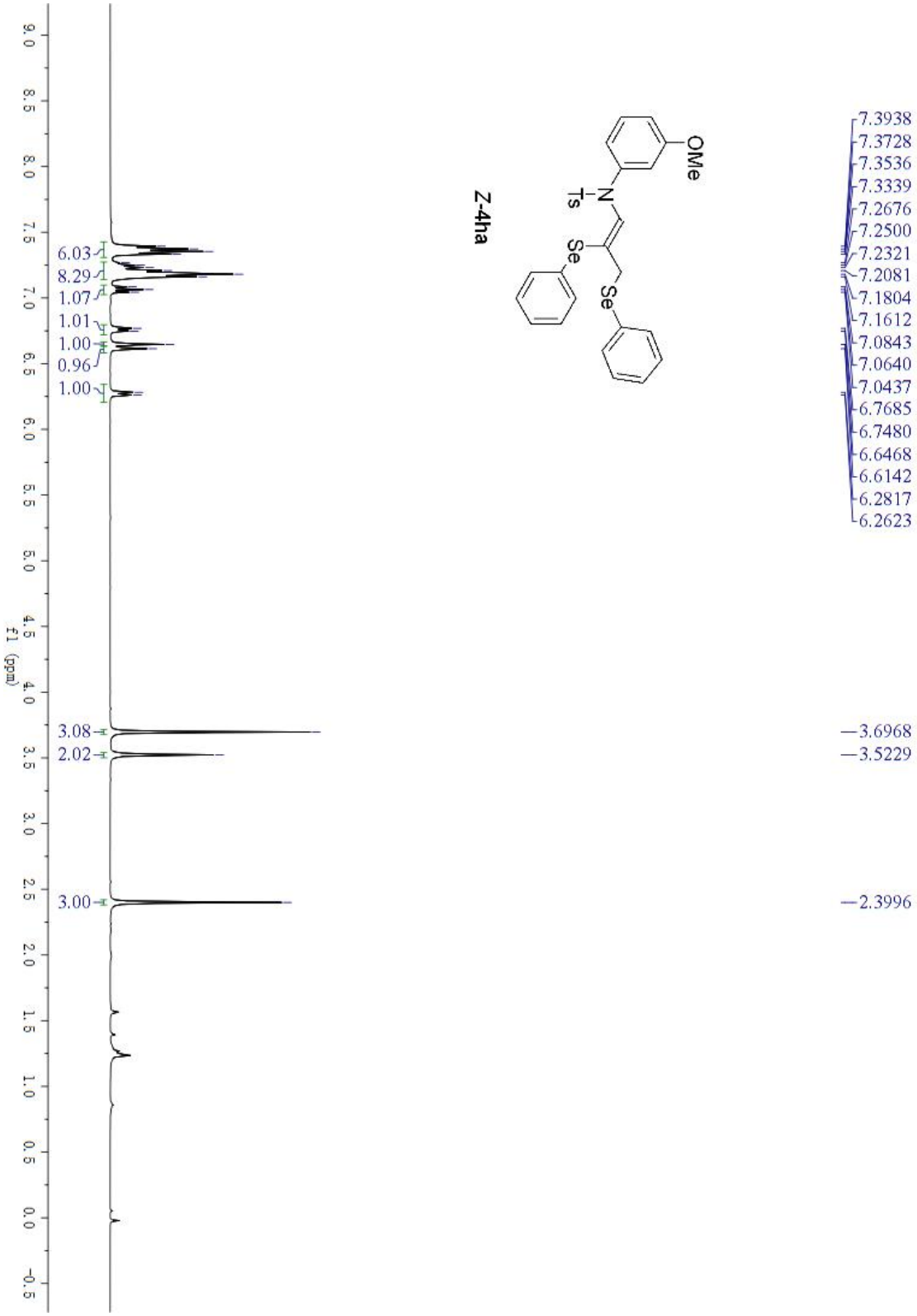
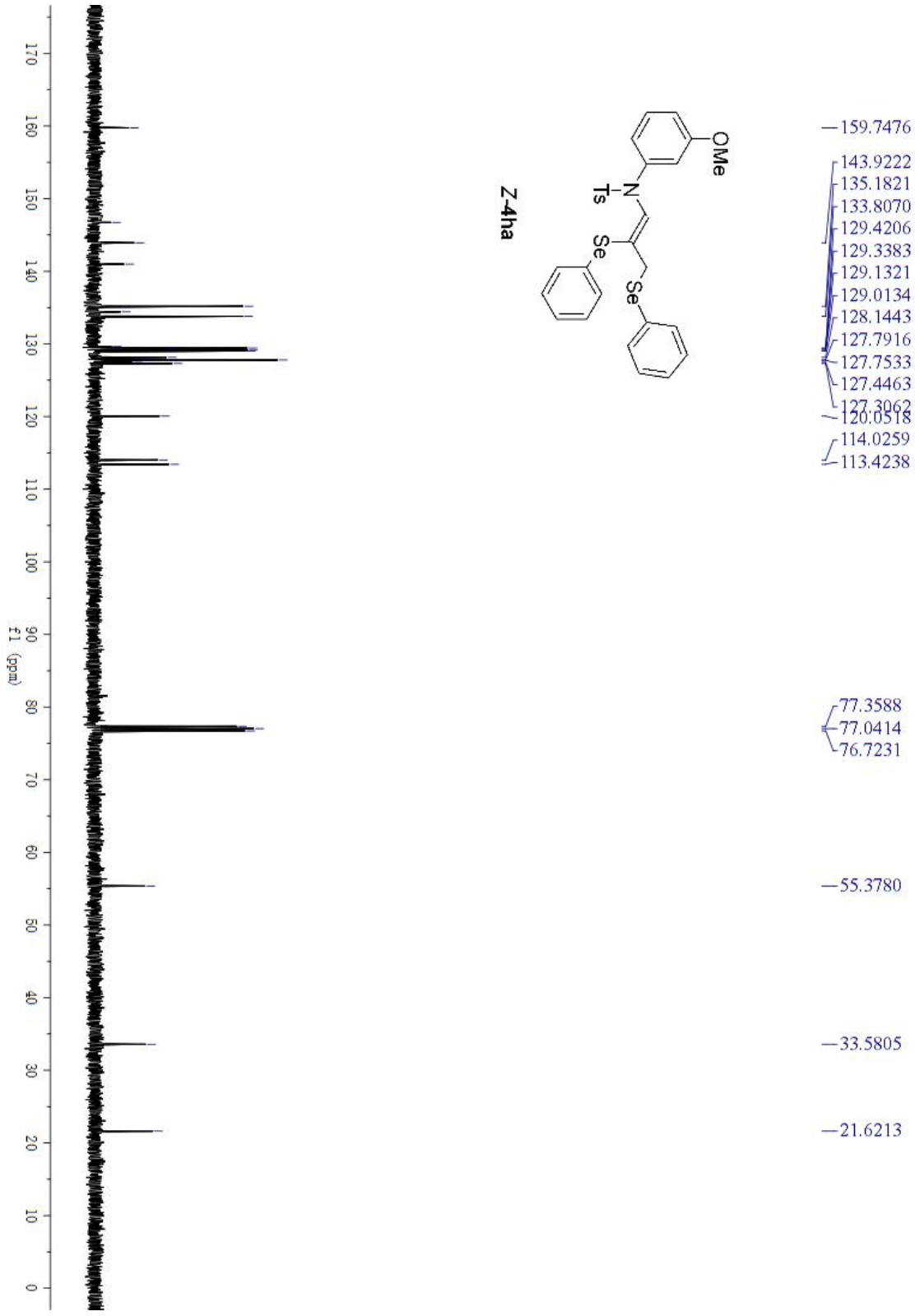
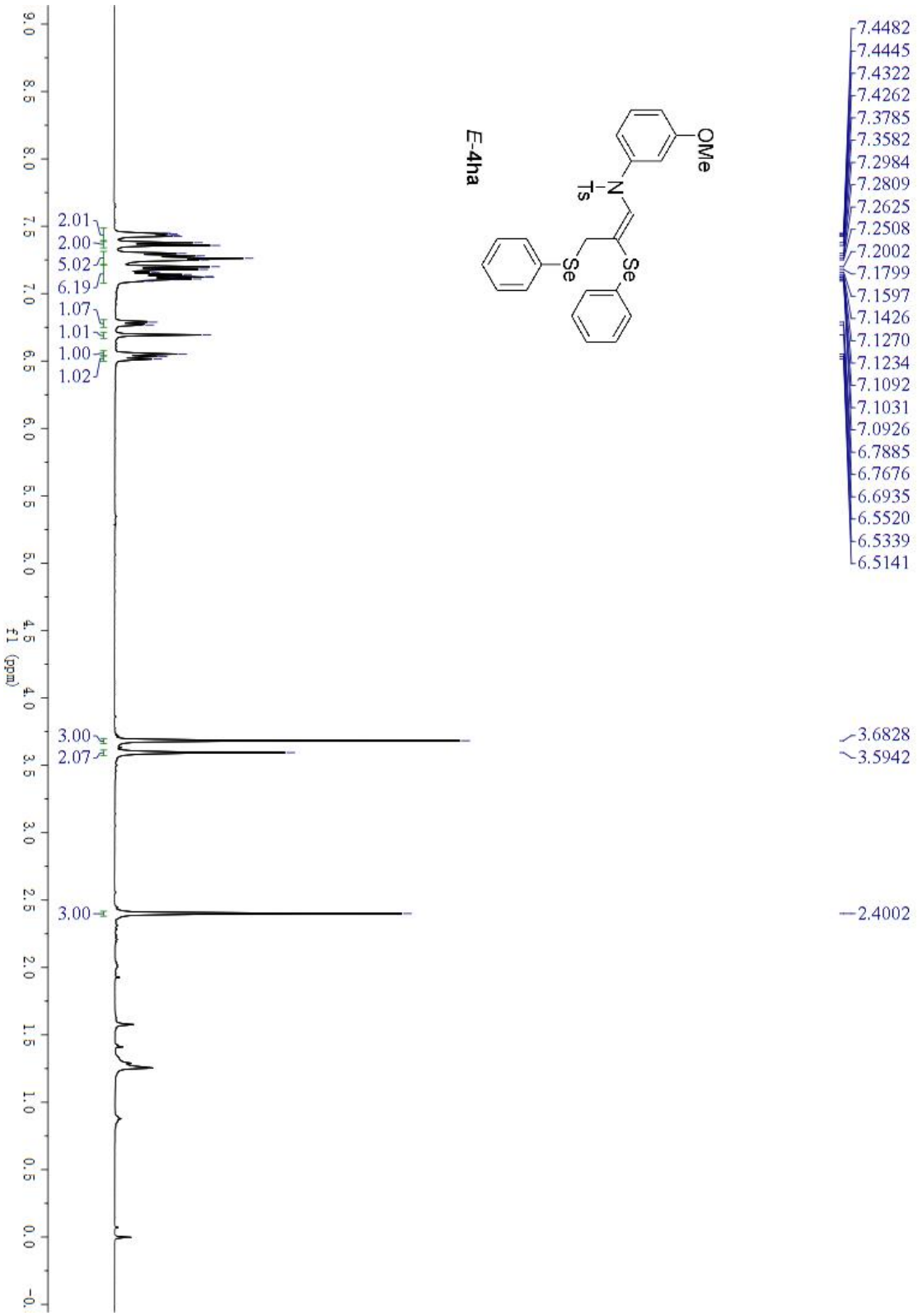
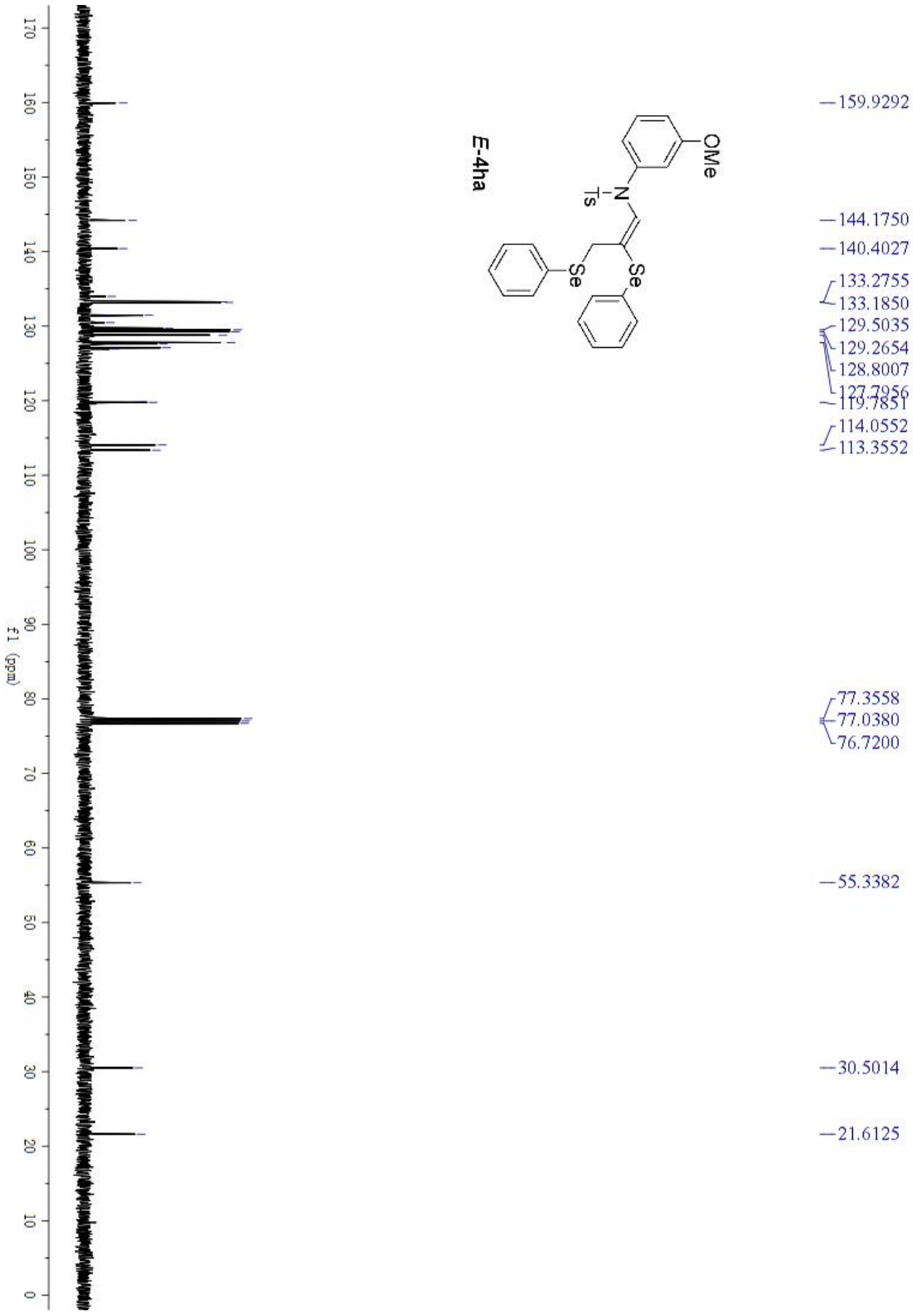
3.6067
3.5827
3.3061
3.2758
2.3996

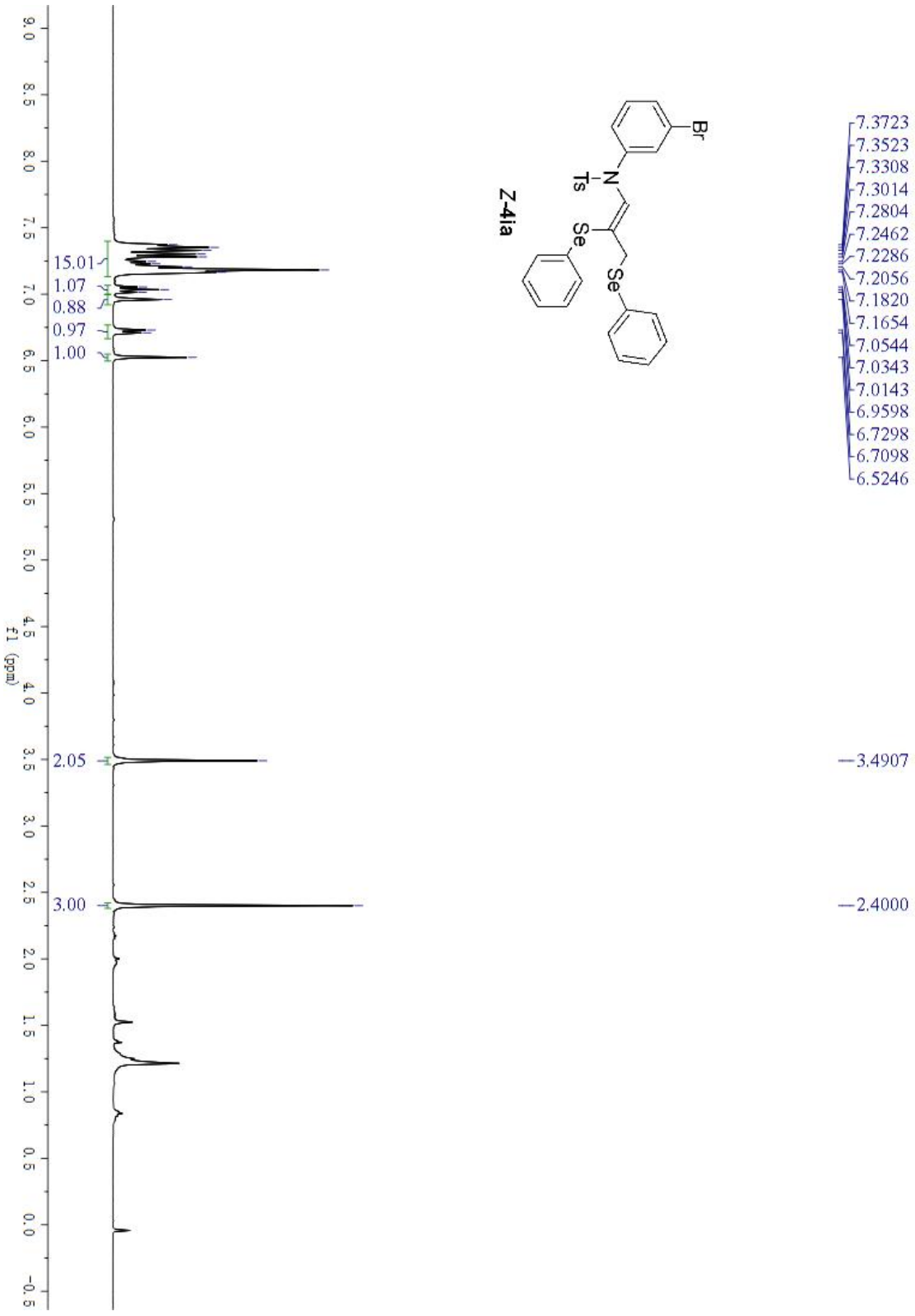

4ga
Z:E=1:1mix
OMe
N
Ts
Se
Se
155.7363
155.3168
143.8316
143.5282
133.2942
132.1721
129.1888
129.1689
129.1128
129.0975
128.8418
127.8469
111.9233
111.5153
77.6206
77.3026
76.9828
54.8814
34.3564
30.5480
21.6350
f1 (ppm)

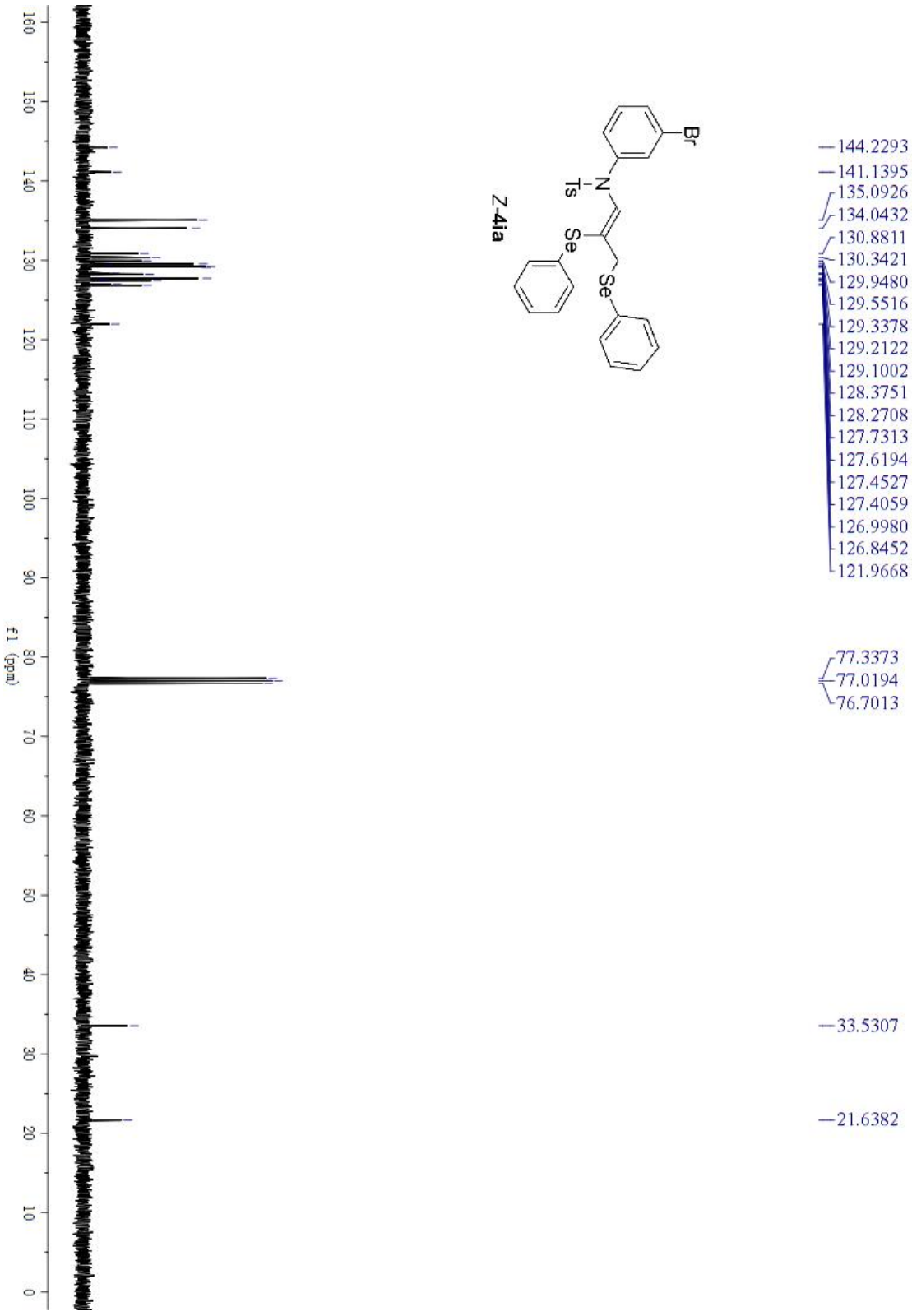

Z-4ha
OMe
N
Ts
Se
Se
f1 (ppm)
6.03
8.29
1.07
1.01
1.00
0.96
1.00
3.08
2.02
3.00
7.3938
7.3728
7.3536
7.3339
7.2676
7.2500
7.2321
7.2081
7.1804
7.1612
7.0843
7.0640
7.0437
6.7685
6.7480
6.6468
6.6142
6.2817
6.2623
3.6968
3.5229
2.3996

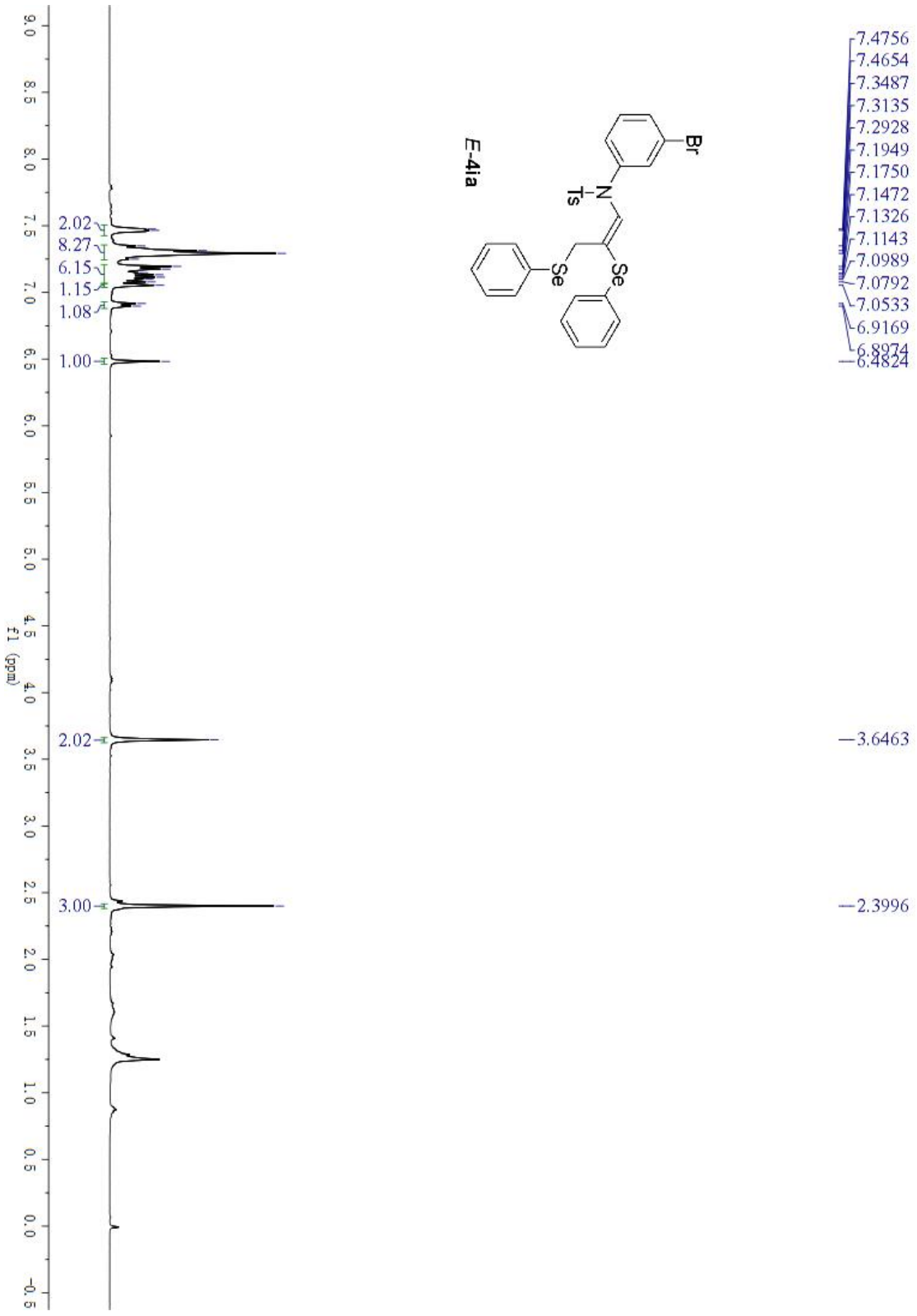

Z-4ha
OMe
N
Ts
Se
Se
159.7476
143.9222
135.1821
133.8070
129.4206
129.3383
129.1321
129.0134
128.1443
127.7916
127.7533
127.4463
127.3062
120.0518
114.0259
113.4238
77.3588
77.0414
76.7231
55.3780
33.5805
21.6213
f1 (ppm)

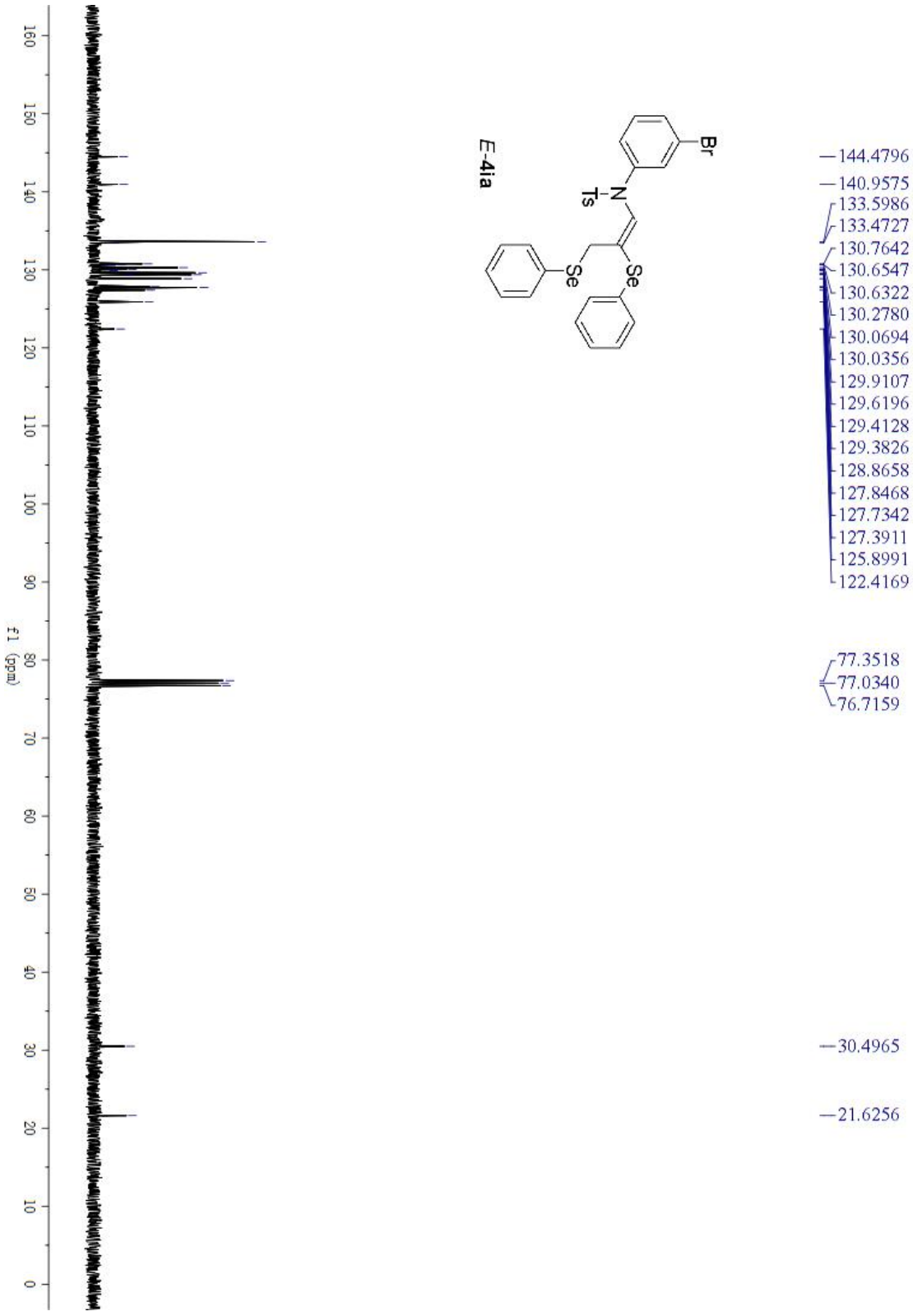

E-4ha
OMe
Ts
N
Se
Se
2.01
2.00
5.02
6.19
1.07
1.01
1.00
1.02
3.00
2.07
3.00
7.4482
7.4445
7.4322
7.4262
7.3785
7.3582
7.2984
7.2809
7.2625
7.2508
7.2002
7.1799
7.1597
7.1426
7.1270
7.1234
7.1092
7.1031
7.0926
6.7885
6.7676
6.6935
6.5520
6.5339
6.5141
3.6828
3.5942
2.4002
f1 (ppm)


E-4ha
OMe
N
Ts
Se
Se
159.9292
144.1750
140.4027
133.2755
133.1850
129.5035
129.2654
128.8007
127.7956
119.7851
114.0552
113.3552
77.3558
77.0380
76.7200
55.3382
30.5014
21.6125
f1 (ppm)


Z-4ia
Br
N
Ts
Se
Se
7.3723
7.3523
7.3308
7.3014
7.2804
7.2462
7.2286
7.2056
7.1820
7.1654
7.0544
7.0343
7.0143
6.9598
6.7298
6.7098
6.5246
15.01
1.07
0.88
0.97
1.00
2.05
3.00
3.4907
2.4000
f1 (ppm)


Z-4ia
Br
N
Ts
Se
Se
144.2293
141.1395
135.0926
134.0432
130.8811
130.3421
129.9480
129.5516
129.3378
129.2122
129.1002
128.3751
128.2708
127.7313
127.6194
127.4527
127.4059
126.9980
126.8452
121.9668
77.3373
77.0194
76.7013
33.5307
21.6382
f1 (ppm)


E-4ia
Br
N
Ts
Se
Se
2.02
8.27
6.15
1.15
1.08
1.00
2.02
3.00
f1 (ppm)
7.4756
7.4654
7.3487
7.3135
7.2928
7.1949
7.1750
7.1472
7.1326
7.1143
7.0989
7.0792
7.0533
6.9169
6.8974
6.4824
3.6463
2.3996


E-4ia
Br
N
Ts
Se
Se
144.4796
140.9575
133.5986
133.4727
130.7642
130.6547
130.6322
130.2780
130.0694
130.0356
129.9107
129.6196
129.4128
129.3826
128.8658
127.8468
127.7342
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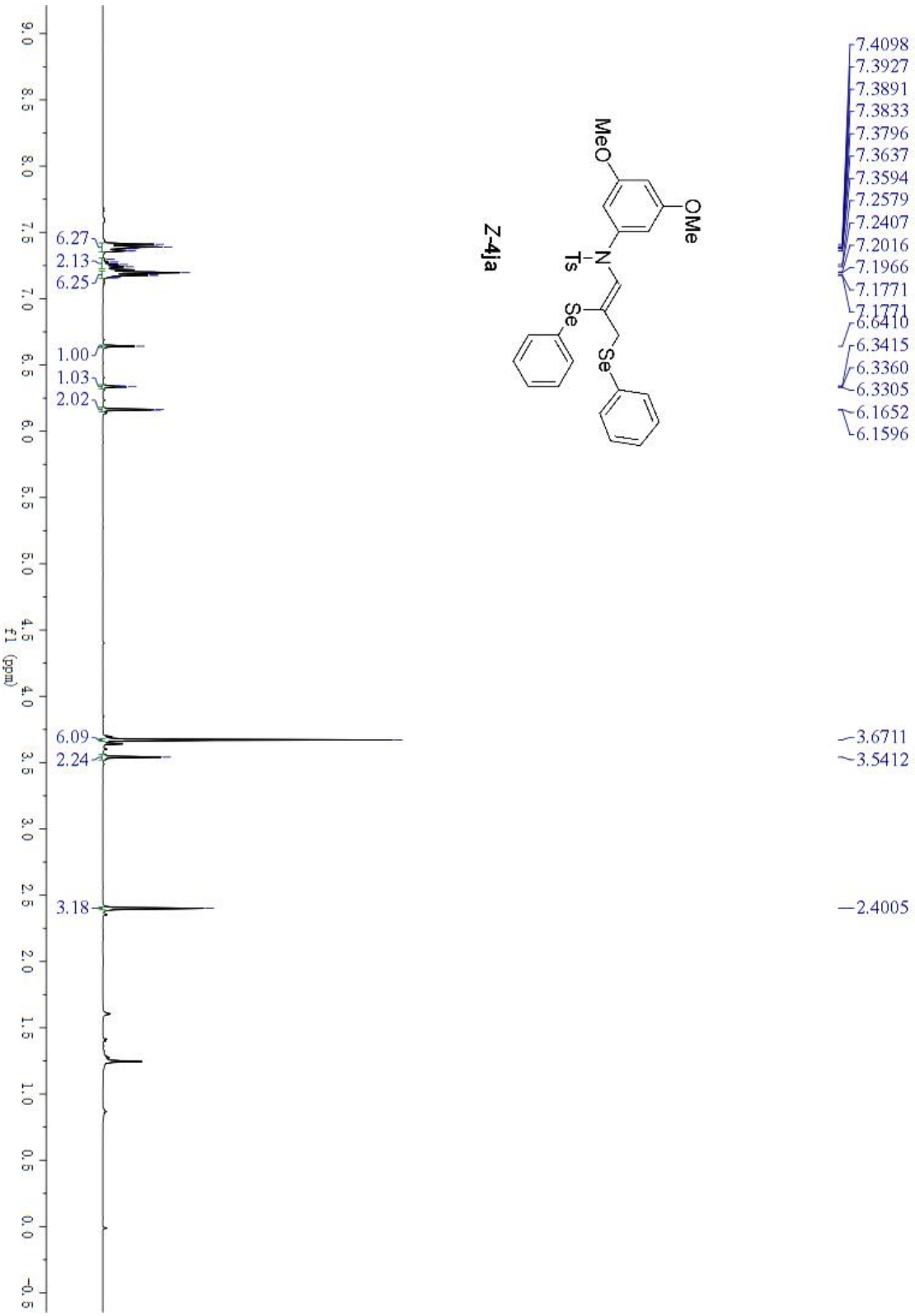
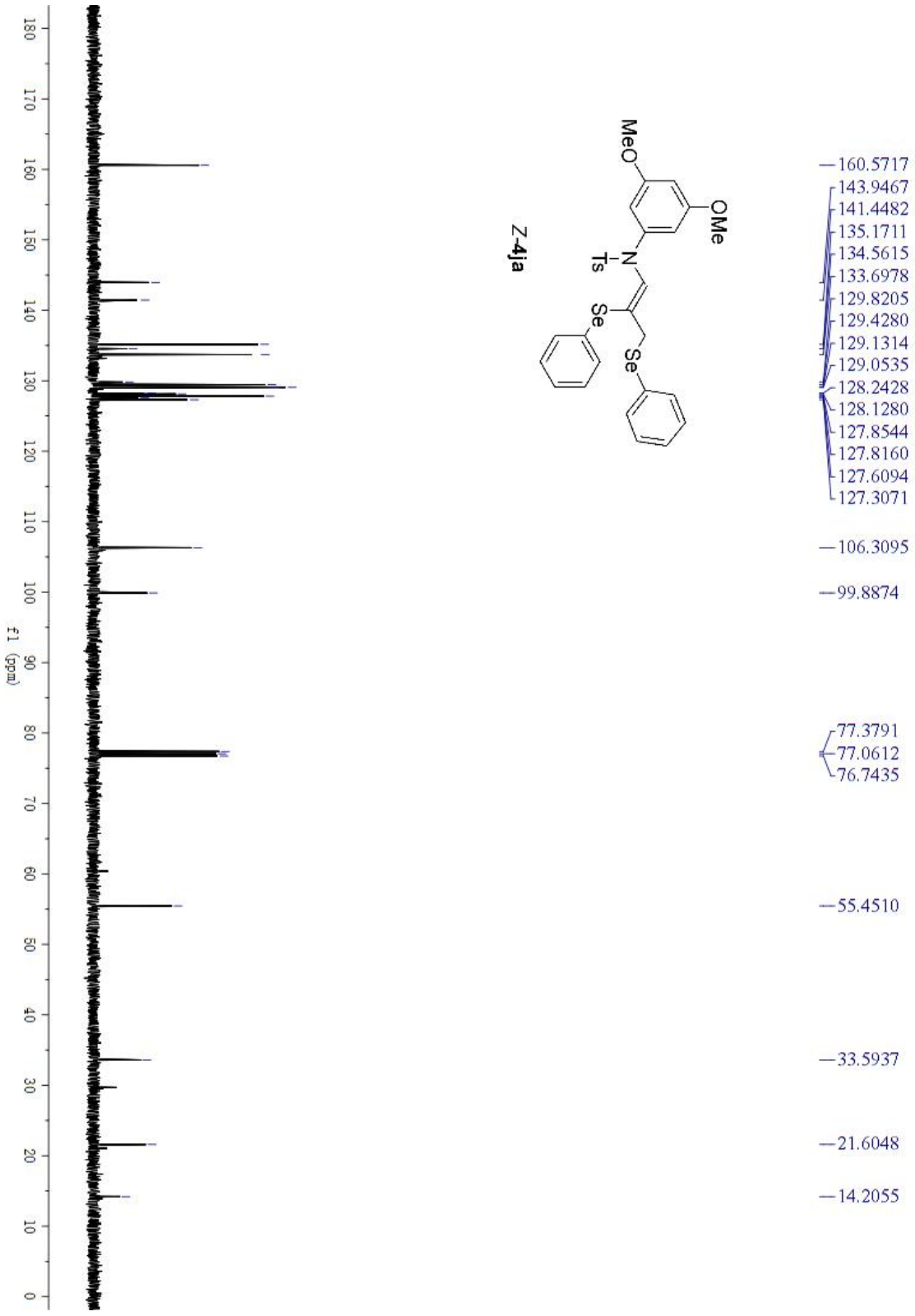
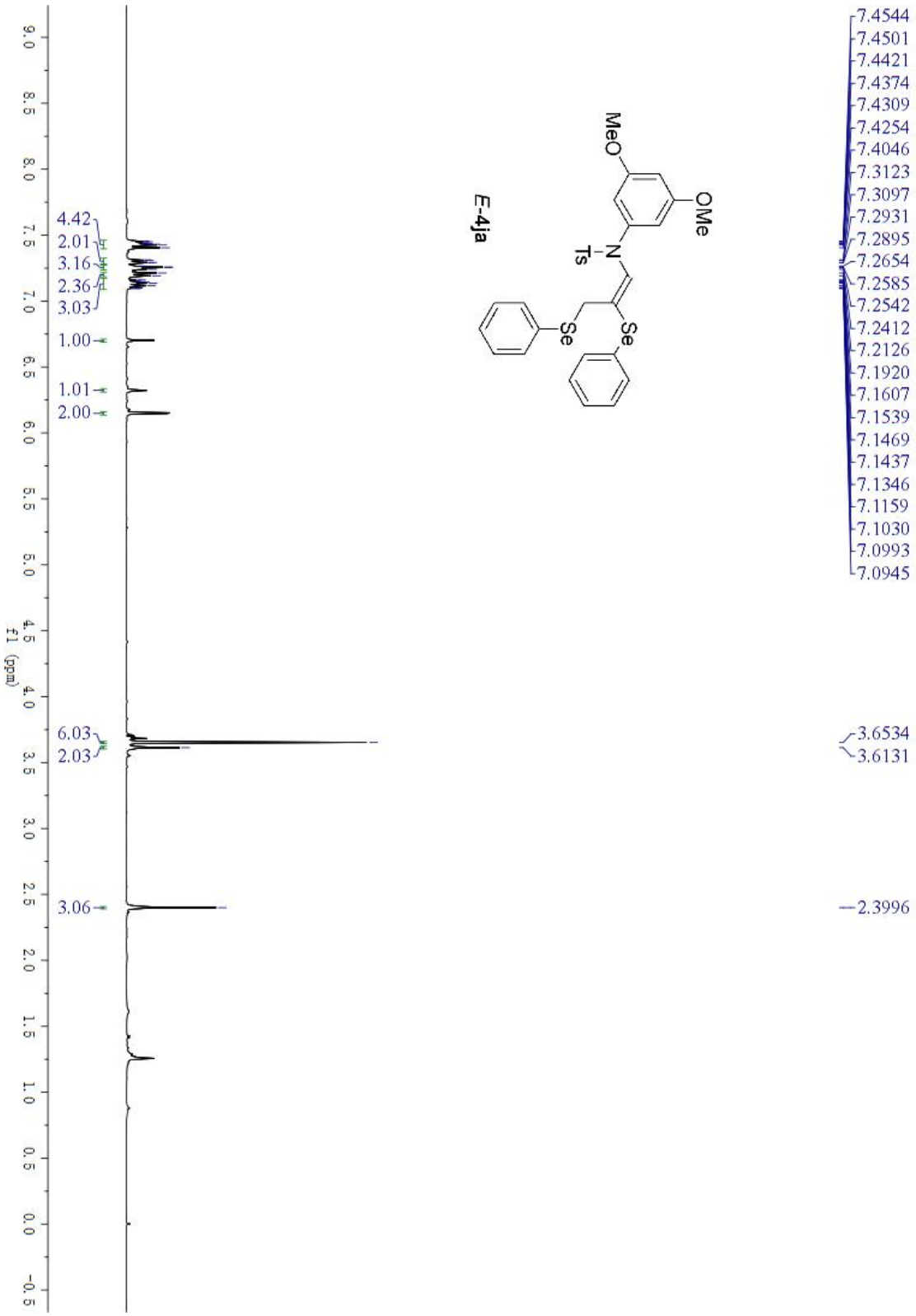
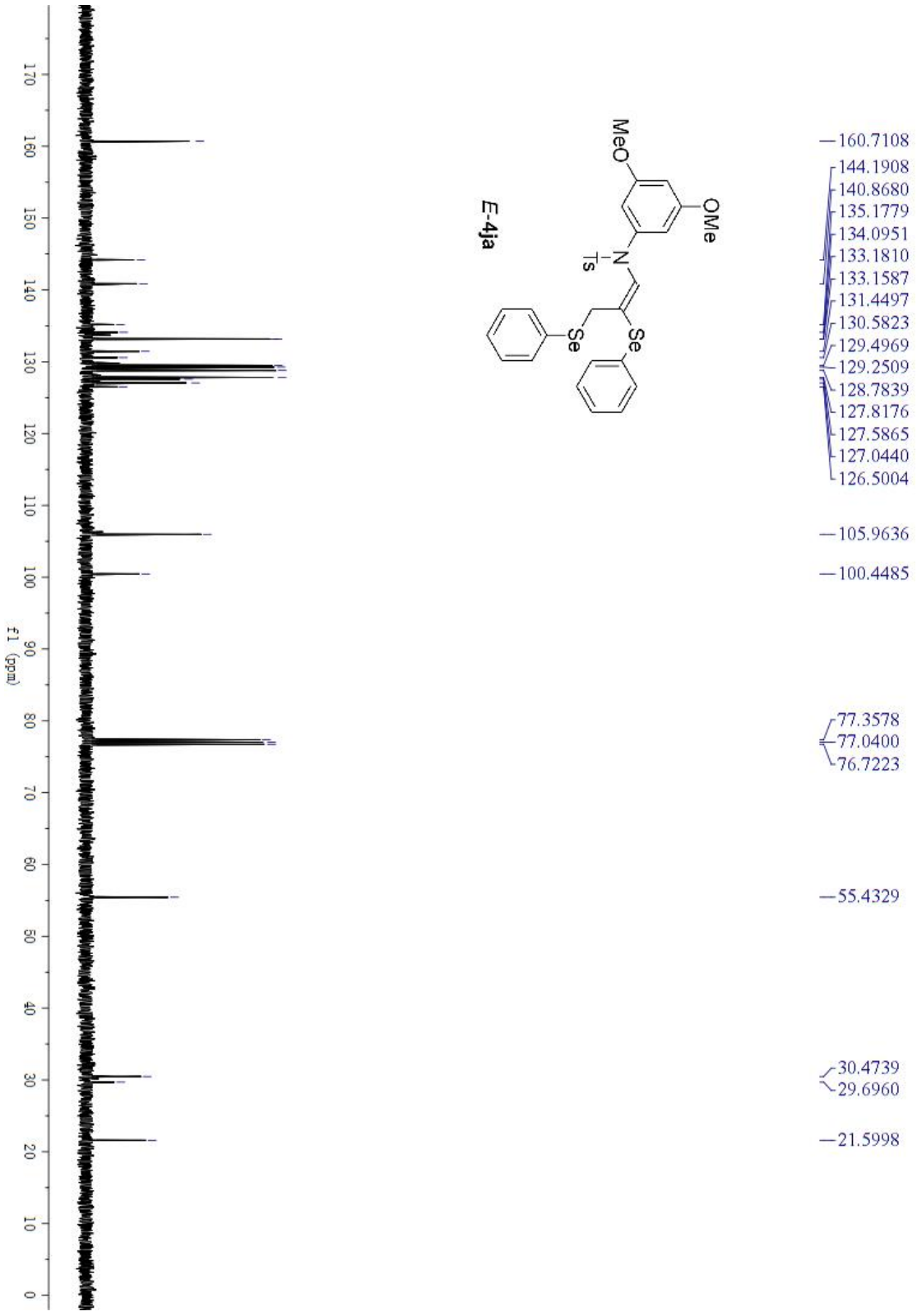
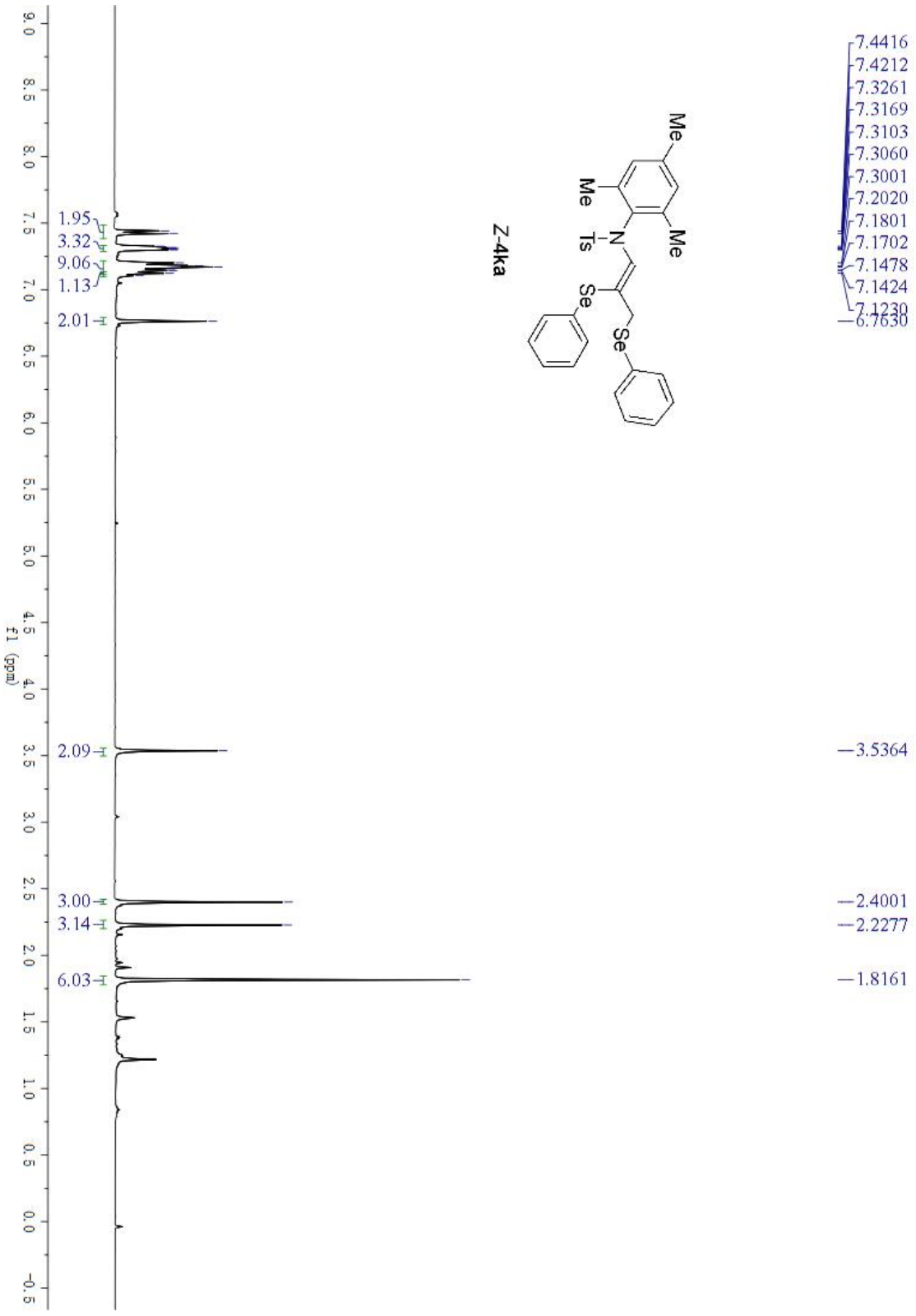
76.7159
30.4965
21.6256
f1 (ppm)

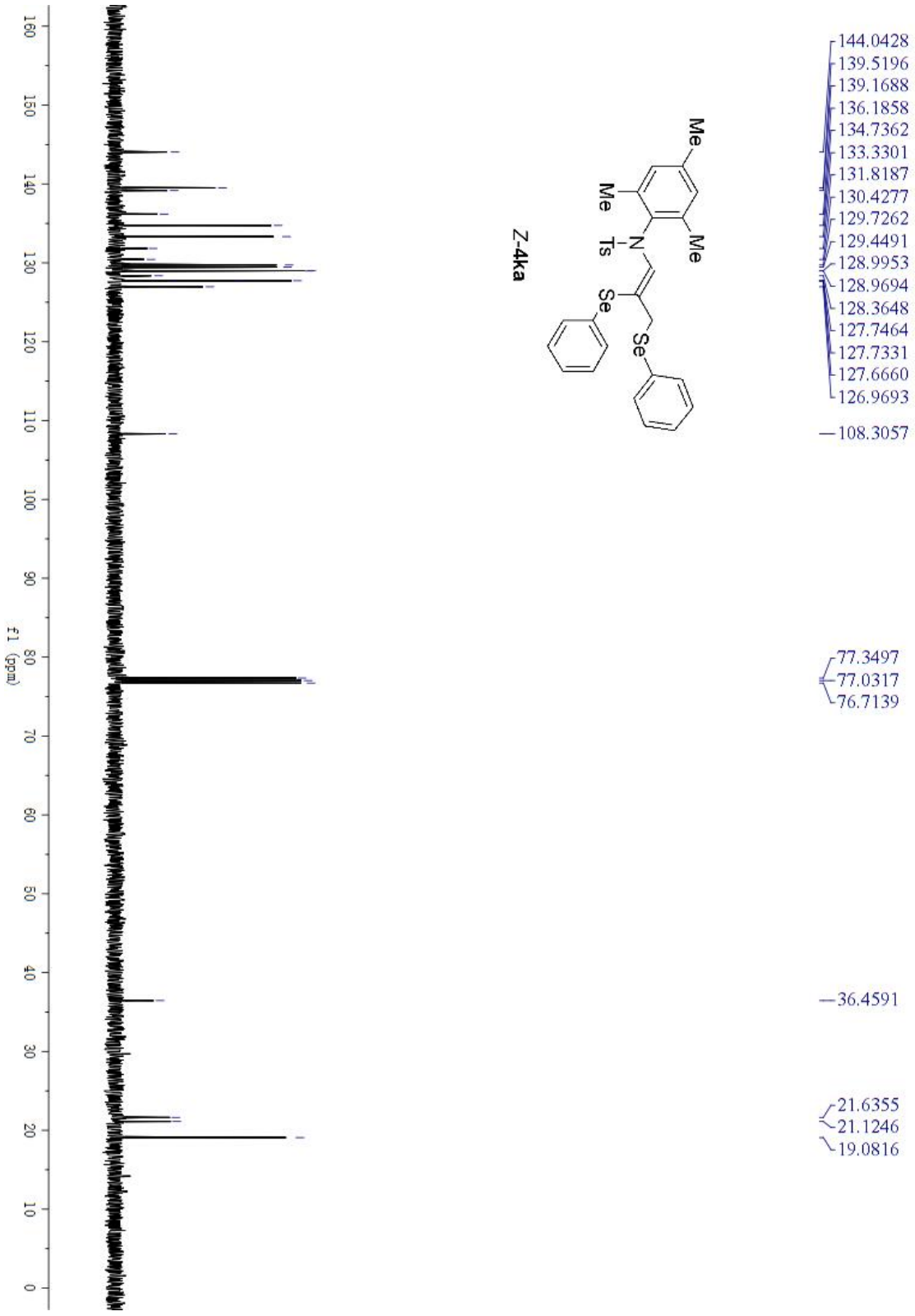

Z-4ja
MeO
OMe
N
Ts
Se
Se
7.4098
7.3927
7.3891
7.3833
7.3796
7.3637
7.3594
7.2579
7.2407
7.2016
7.1966
7.1771
7.1771
6.6410
6.3415
6.3360
6.3305
6.1652
6.1596
6.27
2.13
6.25
1.00
1.03
2.02
6.09
2.24
3.18
3.6711
3.5412
2.4005
f1 (ppm)

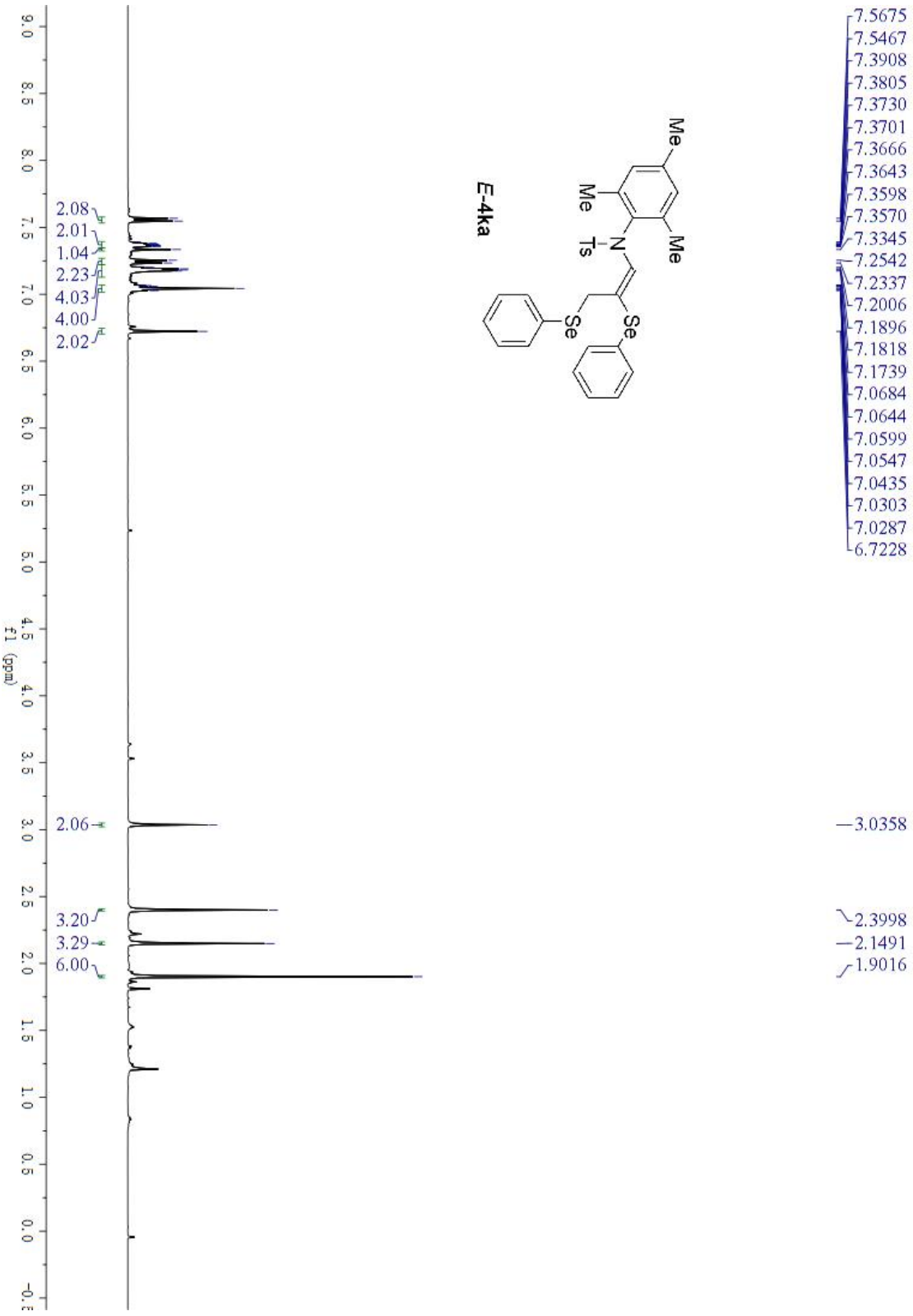

Z-4ja
MeO
OMe
N
Ts
Se
Se
160.5717
143.9467
141.4482
135.1711
134.5615
133.6978
129.8205
129.4280
129.1314
129.0535
128.2428
128.1280
127.8544
127.8160
127.6094
127.3071
106.3095
99.8874
77.3791
77.0612
76.7435
55.4510
33.5937
21.6048
14.2055
f1 (ppm)


E-4ja
MeO
OMe
N
Ts
Se
Se
4.42
2.01
3.16
2.36
3.03
1.00
1.01
2.00
6.03
2.03
3.06
7.4544
7.4501
7.4421
7.4374
7.4309
7.4254
7.4046
7.3123
7.3097
7.2931
7.2895
7.2654
7.2585
7.2542
7.2412
7.2126
7.1920
7.1607
7.1539
7.1469
7.1437
7.1346
7.1159
7.1030
7.0993
7.0945
3.6534
3.6131
2.3996
f1 (ppm)

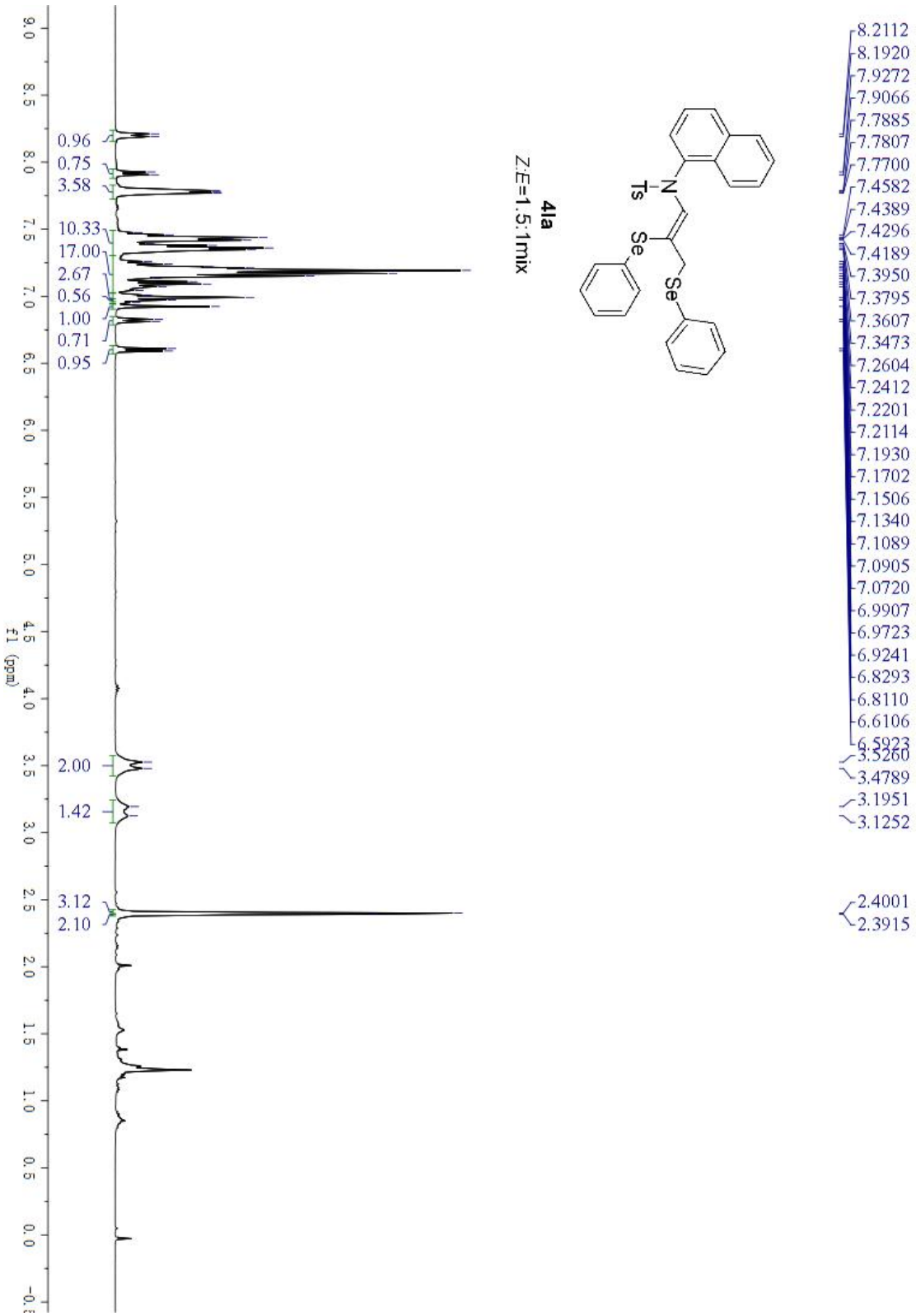

E-4ja
MeO
OMe
N
Ts
Se
Se
160.7108
144.1908
140.8680
135.1779
134.0951
133.1810
133.1587
131.4497
130.5823
129.4969
129.2509
128.7839
127.8176
127.5865
127.0440
126.5004
105.9636
100.4485
77.3578
77.0400
76.7223
55.4329
30.4739
29.6960
21.5998
f1 (ppm)

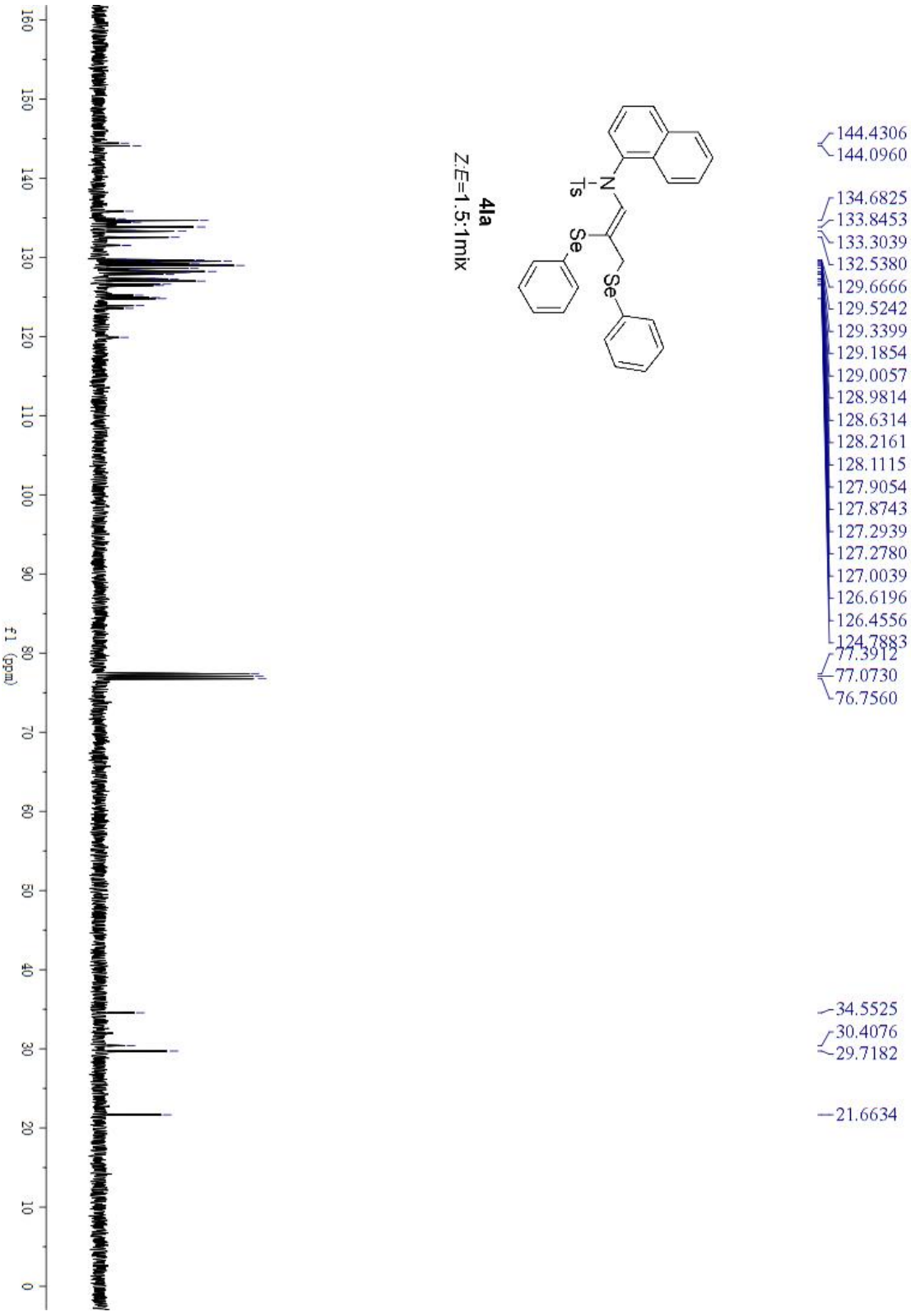

Z-4ka
Me
Me
Me
Ts
N
Se
Se
7.4416
7.4212
7.3261
7.3169
7.3103
7.3060
7.3001
7.2020
7.1801
7.1702
7.1478
7.1424
7.1230
6.7630
1.95
3.32
9.06
1.13
2.01
2.09
3.00
3.14
6.03
3.5364
2.4001
2.2277
1.8161
f1 (ppm)

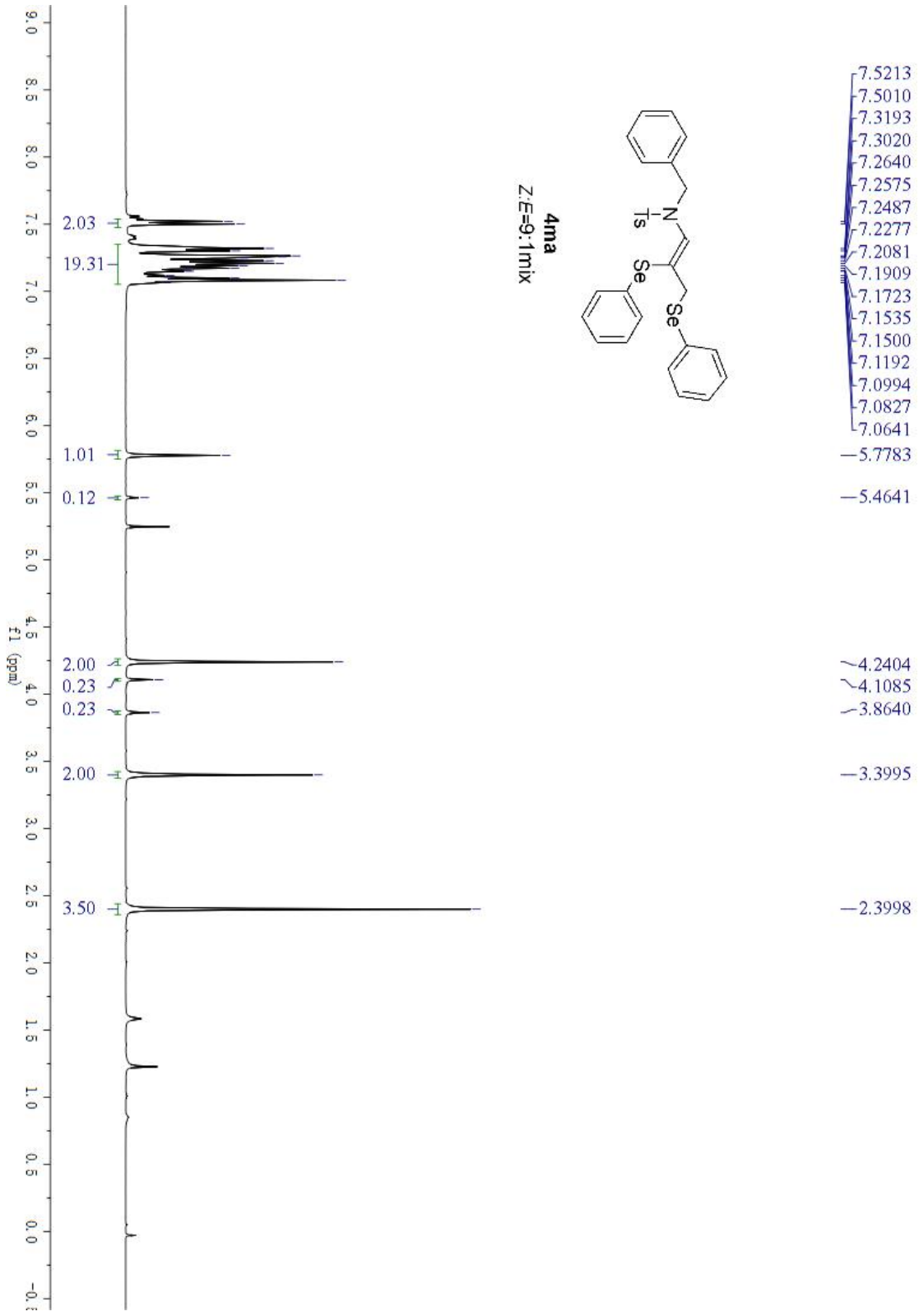

Z-4ka
Me
Me
Me
N
Ts
Se
Se
144.0428
139.5196
139.1688
136.1858
134.7362
133.3301
131.8187
130.4277
129.7262
129.4491
128.9953
128.9694
128.3648
127.7464
127.7331
127.6660
126.9693
108.3057
77.3497
77.0317
76.7139
36.4591
21.6355
21.1246
19.0816
f1 (ppm)

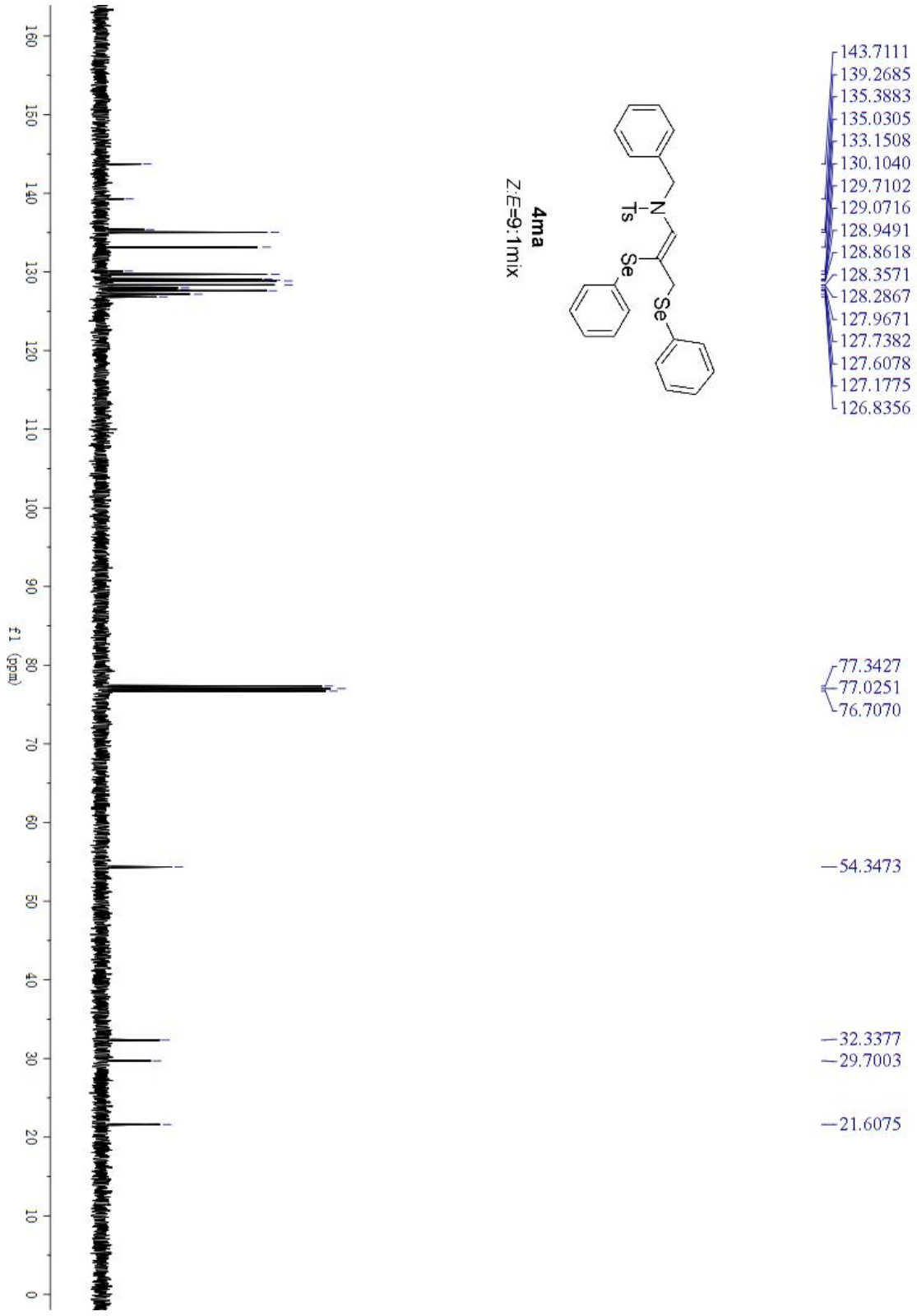

E-4ka
Me
Me
Ts
N
Me
Se
Se
f1 (ppm)
2.08
2.01
1.04
2.23
4.03
4.00
2.02
2.06
3.20
3.29
6.00
7.5675
7.5467
7.3908
7.3805
7.3730
7.3701
7.3666
7.3643
7.3598
7.3570
7.3345
7.2542
7.2337
7.2006
7.1896
7.1818
7.1739
7.0684
7.0644
7.0599
7.0547
7.0435
7.0303
7.0287
6.7228
3.0358
2.3998
2.1491
1.9016

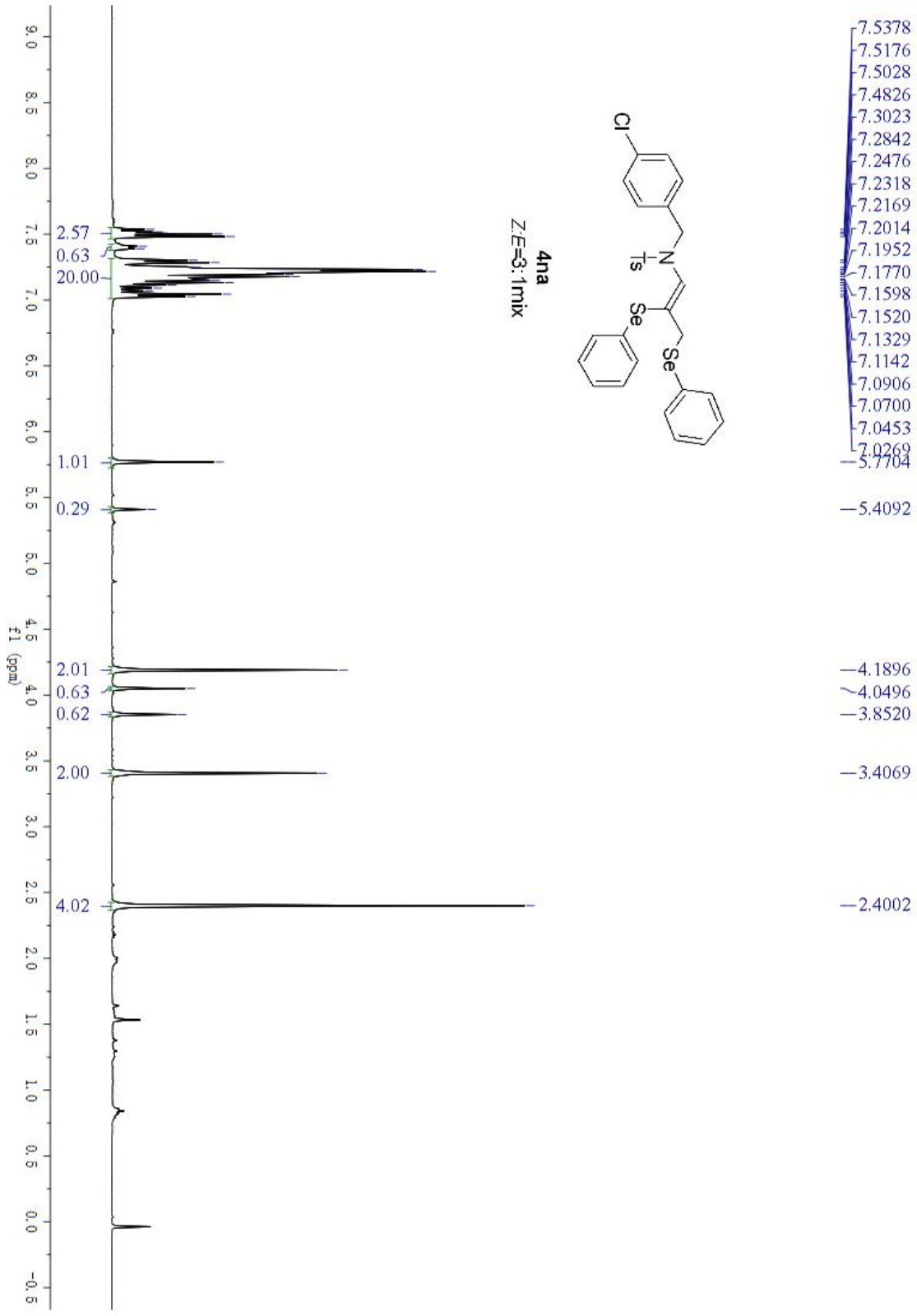
E-4ka
Me
Me
Me
N
Ts
Se
Se
144.4054
139.1817
138.4945
136.3178
132.8170
132.1595
132.1095
131.7917
131.3251
130.7375
129.9167
129.8829
129.1208
128.5980
127.7913
127.1864
126.6878
109.7906
77.3639
77.0460
76.7282
29.6327
21.6571
21.0402
18.9635
f1 (ppm)

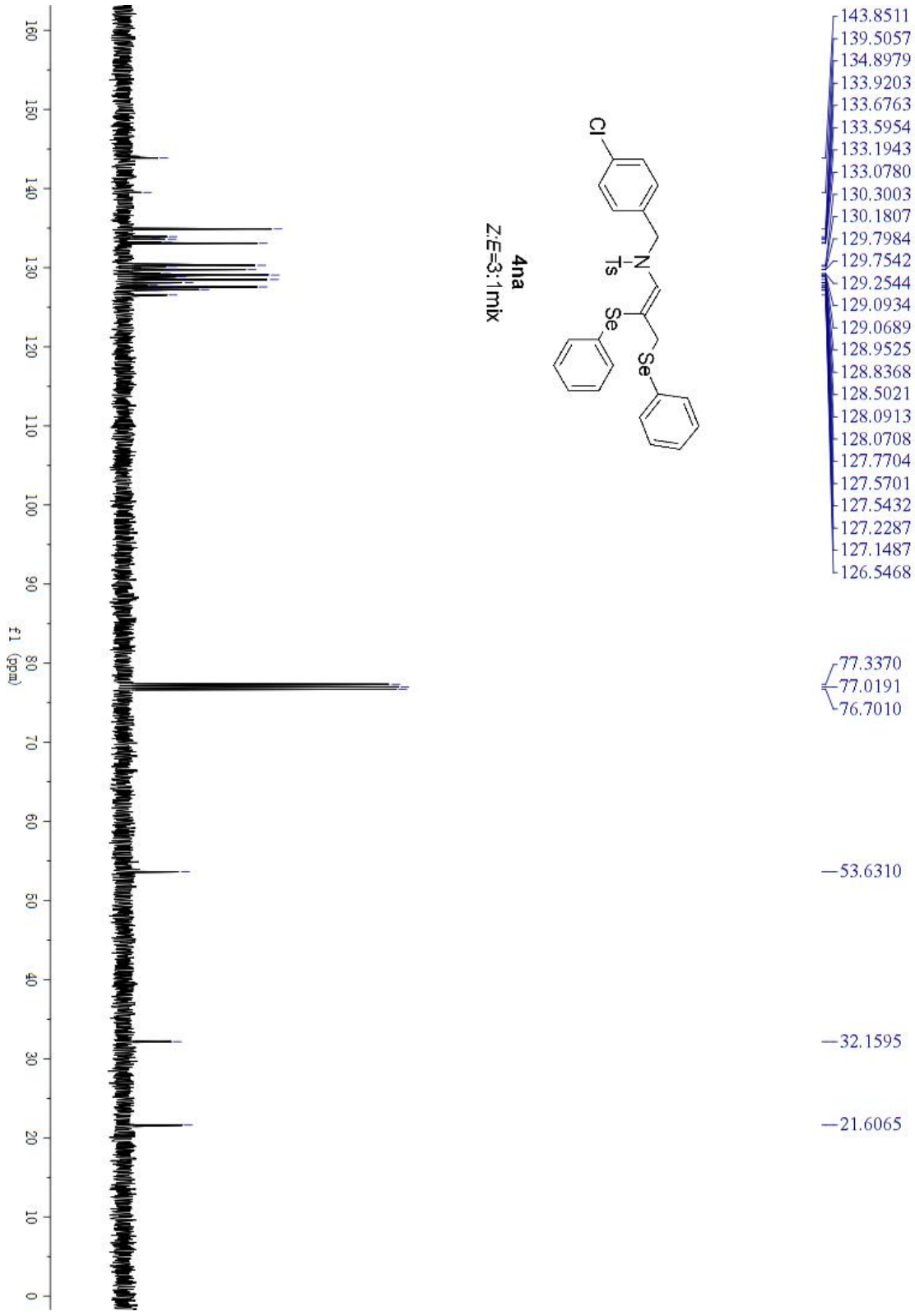

4la
Z:E=1.5:1mix
Ts
N
Se
Se
0.96
0.75
3.58
10.33
17.00
2.67
0.56
1.00
0.71
0.95
2.00
1.42
3.12
2.10
f1 (ppm)
8.2112
8.1920
7.9272
7.9066
7.7885
7.7807
7.7700
7.4582
7.4389
7.4296
7.4189
7.3950
7.3795
7.3607
7.3473
7.2604
7.2412
7.2201
7.2114
7.1930
7.1702
7.1506
7.1340
7.1089
7.0905
7.0720
6.9907
6.9723
6.9241
6.8293
6.8110
6.6106
3.5260
3.4789
3.1951
3.1252
2.4001
2.3915

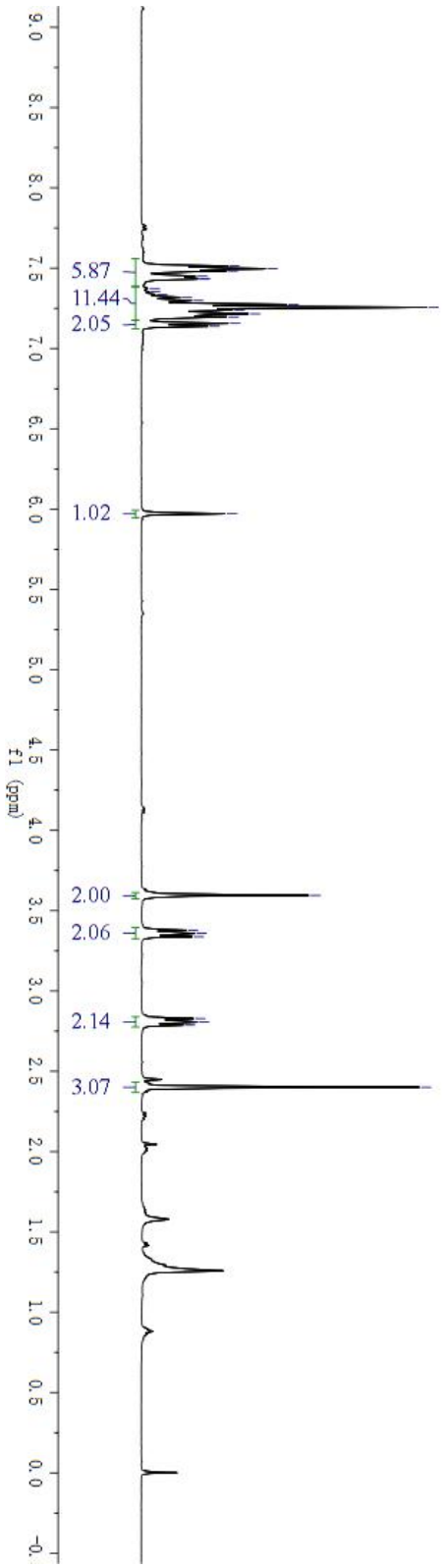

4la
Z:E=1.5:1mix
Ts
N
Se
Se
144.4306
144.0960
134.6825
133.8453
133.3039
132.5380
129.6666
129.5242
129.3399
129.1854
129.0057
128.9814
128.6314
128.2161
128.1115
127.9054
127.8743
127.2939
127.2780
127.0039
126.6196
126.4556
124.7883
77.3912
77.0730
76.7560
34.5525
30.4076
29.7182
21.6634
f1 (ppm)

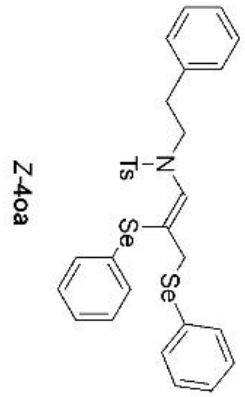

4ma
Z:E=9:1mix
Ts
N
Se
Se
2.03
19.31
1.01
0.12
2.00
0.23
0.23
2.00
3.50
f1 (ppm)
7.5213
7.5010
7.3193
7.3020
7.2640
7.2575
7.2487
7.2277
7.2081
7.1909
7.1723
7.1535
7.1500
7.1192
7.0994
7.0827
7.0641
5.7783
5.4641
4.2404
4.1085
3.8640
3.3995
2.3998


4ma
Z:E=9:1mix
Ts
N
Se
Se
143.7111
139.2685
135.3883
135.0305
133.1508
130.1040
129.7102
129.0716
128.9491
128.8618
128.3571
128.2867
127.9671
127.7382
127.6078
127.1775
126.8356
77.3427
77.0251
76.7070
54.3473
32.3377
29.7003
21.6075
f1 (ppm)


4na
Z:E=3:1mix
Cl
N
Ts
Se
Se
2.57
0.63
20.00
1.01
0.29
2.01
0.63
0.62
2.00
4.02
f1 (ppm)
7.5378
7.5176
7.5028
7.4826
7.3023
7.2842
7.2476
7.2318
7.2169
7.2014
7.1952
7.1770
7.1598
7.1520
7.1329
7.1142
7.0906
7.0700
7.0453
7.0269
5.7704
5.4092
4.1896
4.0496
3.8520
3.4069
2.4002


4na
Z:E=3:1mix
Cl
N
Ts
Se
Se
143.8511
139.5057
134.8979
133.9203
133.6763
133.5954
133.1943
133.0780
130.3003
130.1807
129.7984
129.7542
129.2544
129.0934
129.0689
128.9525
128.8368
128.5021
128.0913
128.0708
127.7704
127.5701
127.5432
127.2287
127.1487
126.5468
77.3370
77.0191
76.7010
53.6310
32.1595
21.6065
f1 (ppm)





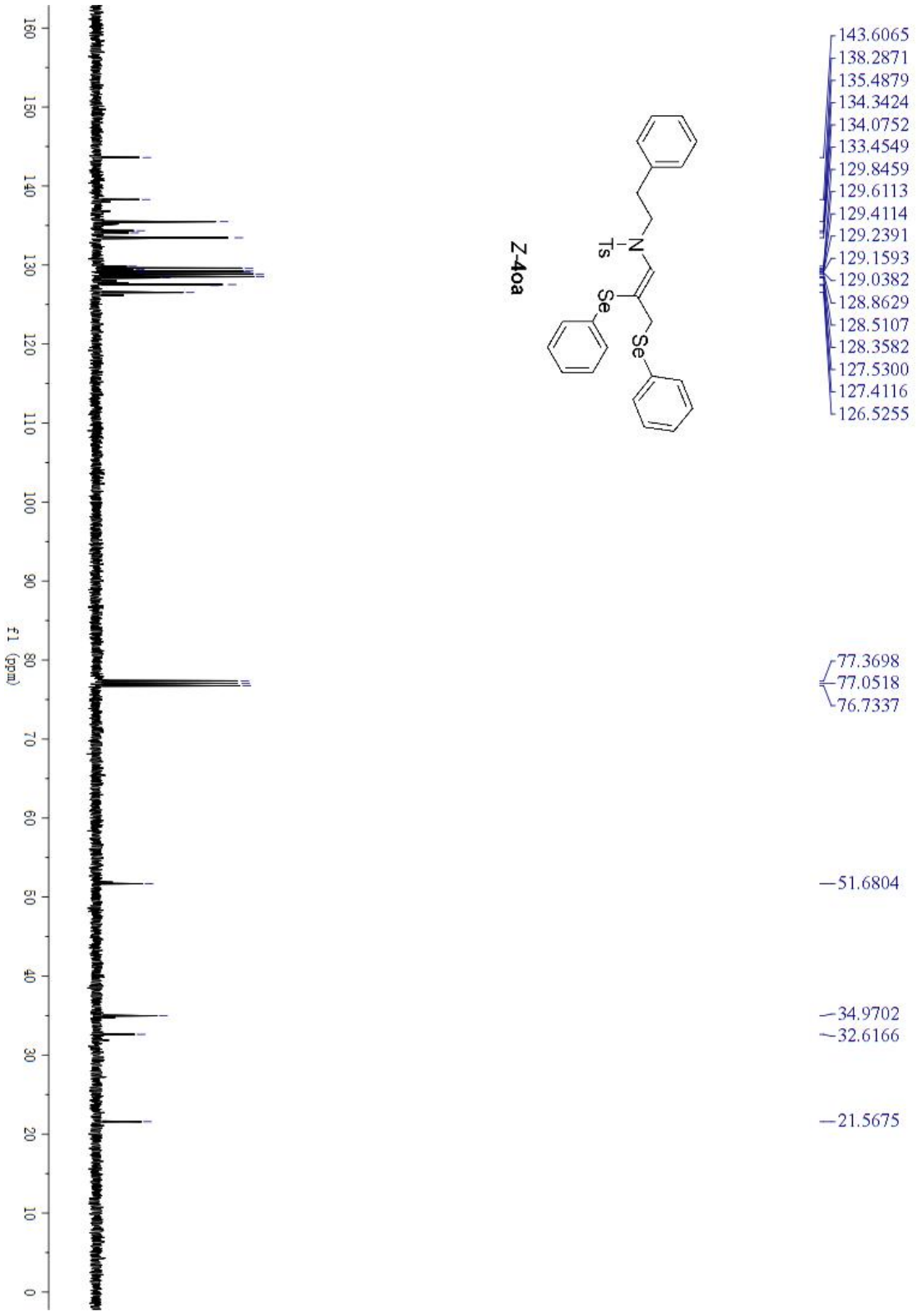
Z-4oa

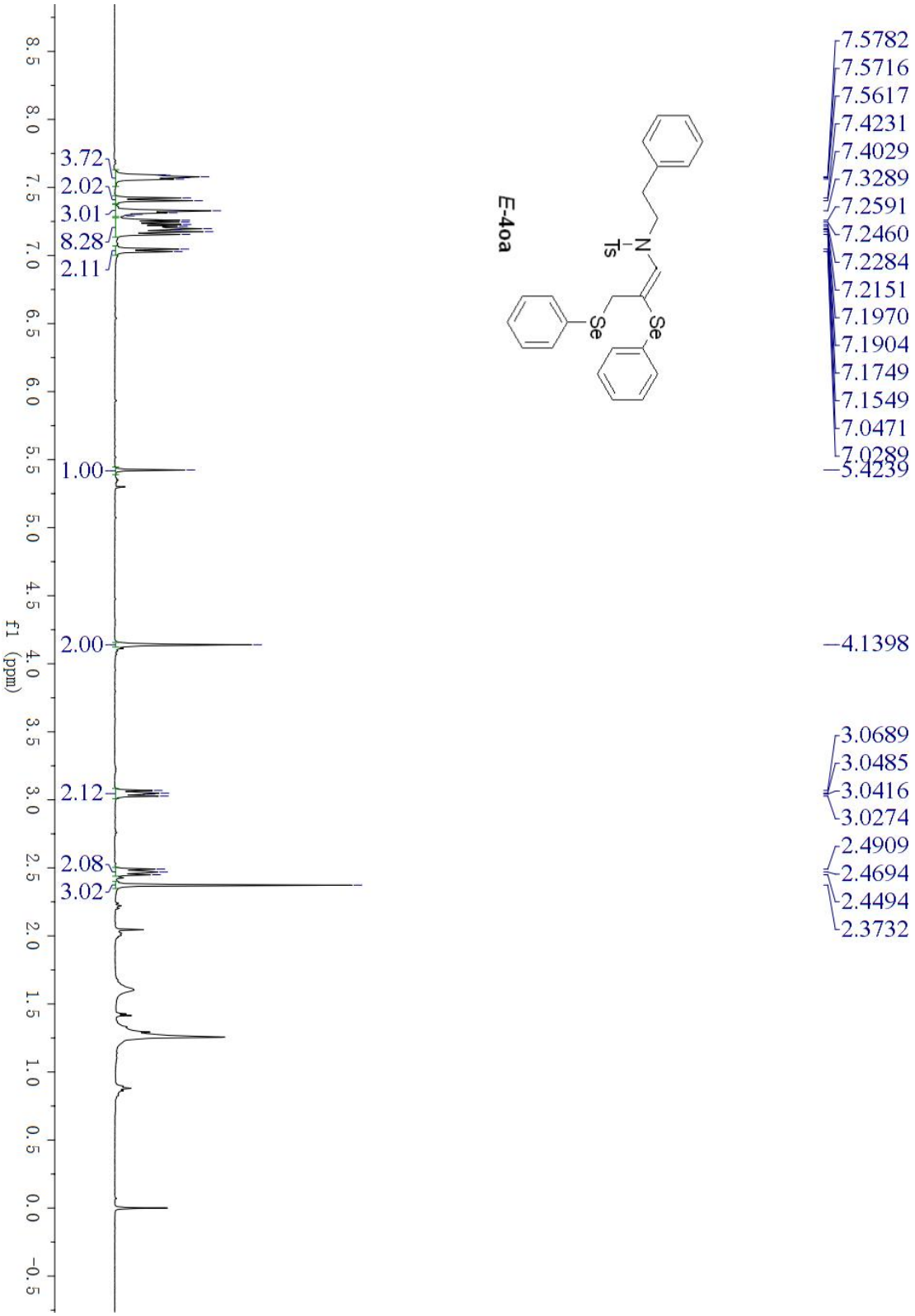
7.5143
7.4972
7.4825
7.4503
7.4358
7.4318
7.3735
7.3549
7.3374
7.3189
7.2988
7.2747
7.2562
7.2396
7.2159
7.1961
7.1567
7.1380
5.9716

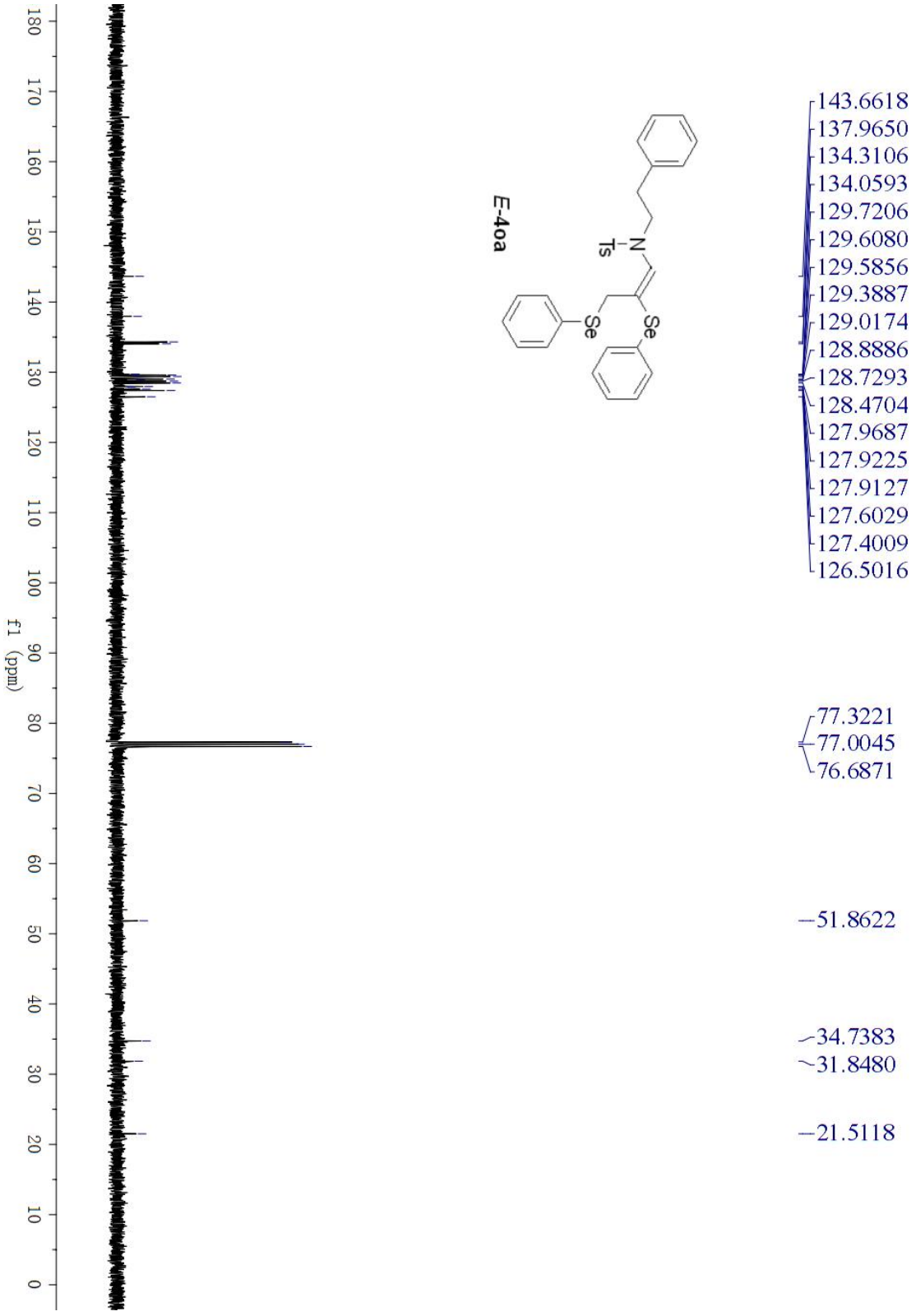
3.5955
3.3790
3.3588
3.3377

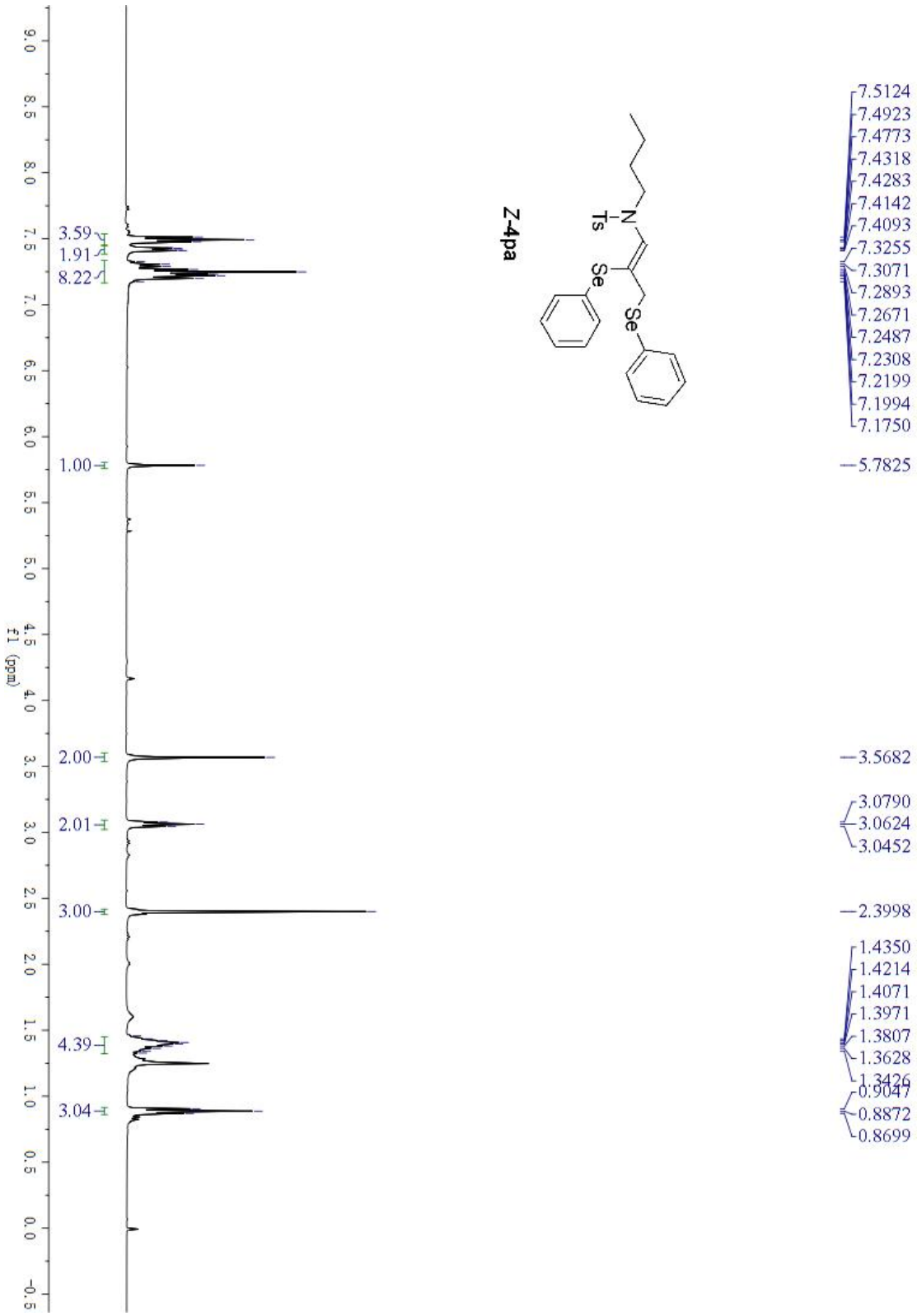
2.8282
2.8066
2.7871

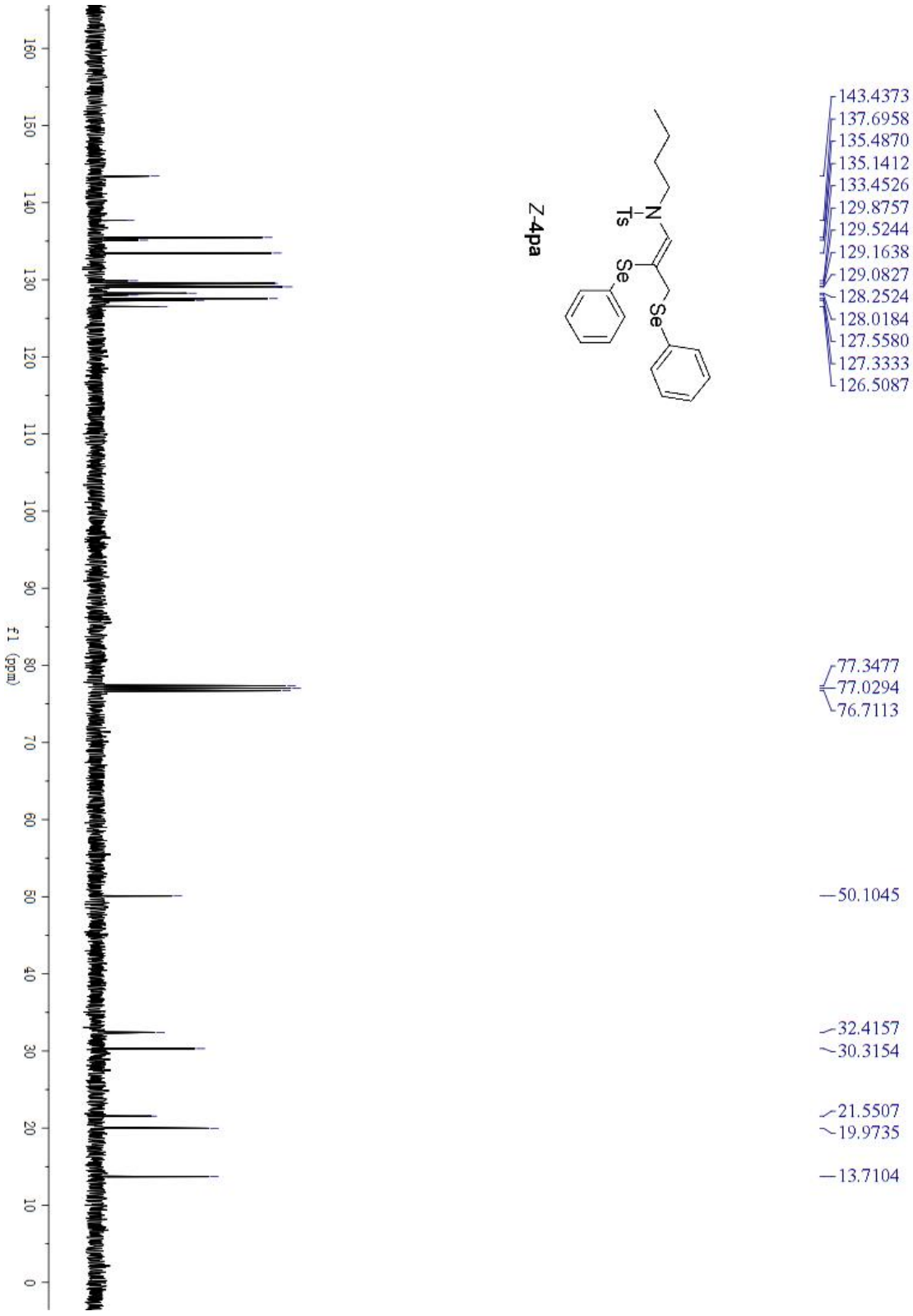
2.4004

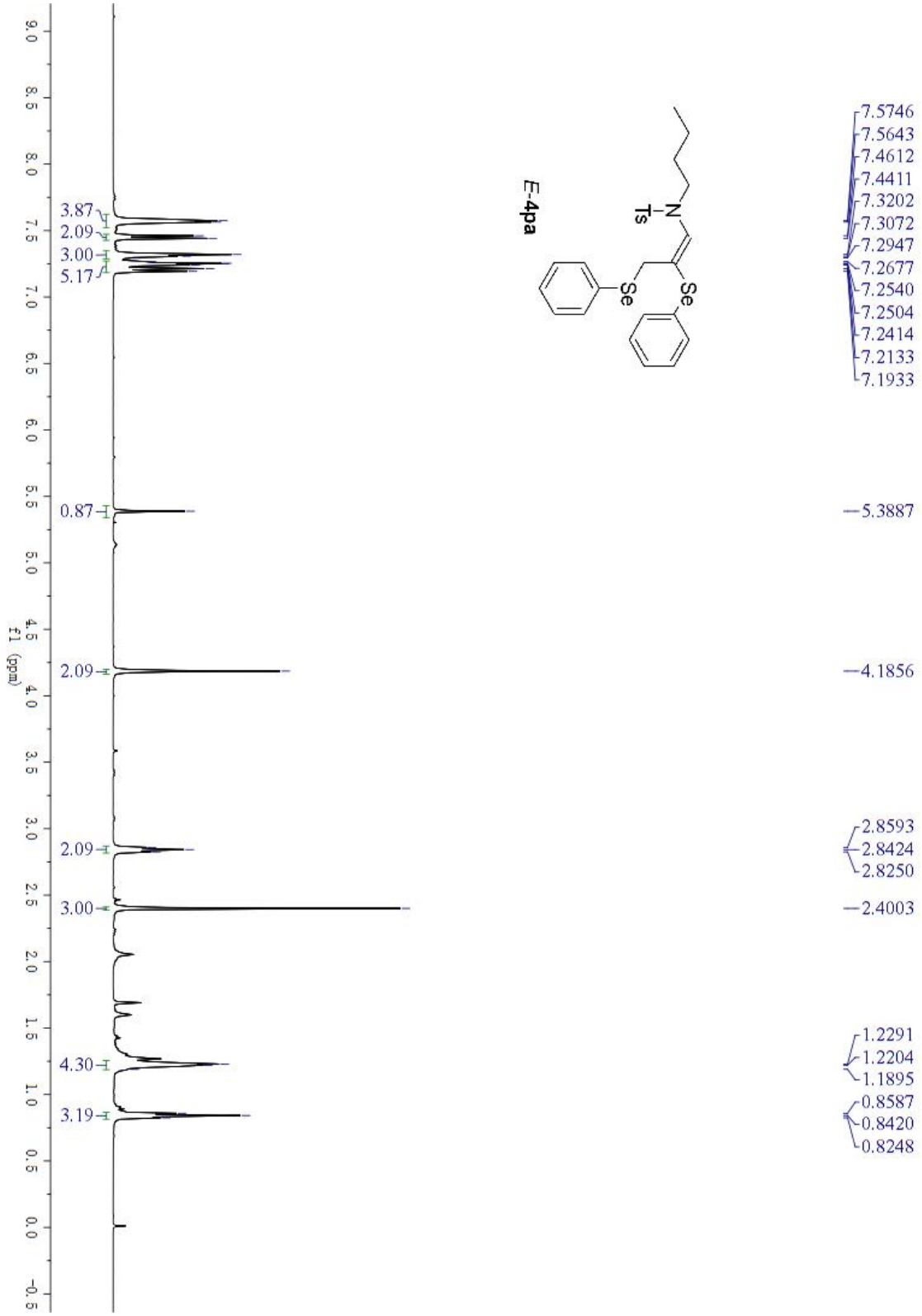

Z-4oa
Ts
N
Se
Se
143.6065
138.2871
135.4879
134.3424
134.0752
133.4549
129.8459
129.6113
129.4114
129.2391
129.1593
129.0382
128.8629
128.5107
128.3582
127.5300
127.4116
126.5255
77.3698
77.0518
76.7337
51.6804
34.9702
32.6166
21.5675
f1 (ppm)

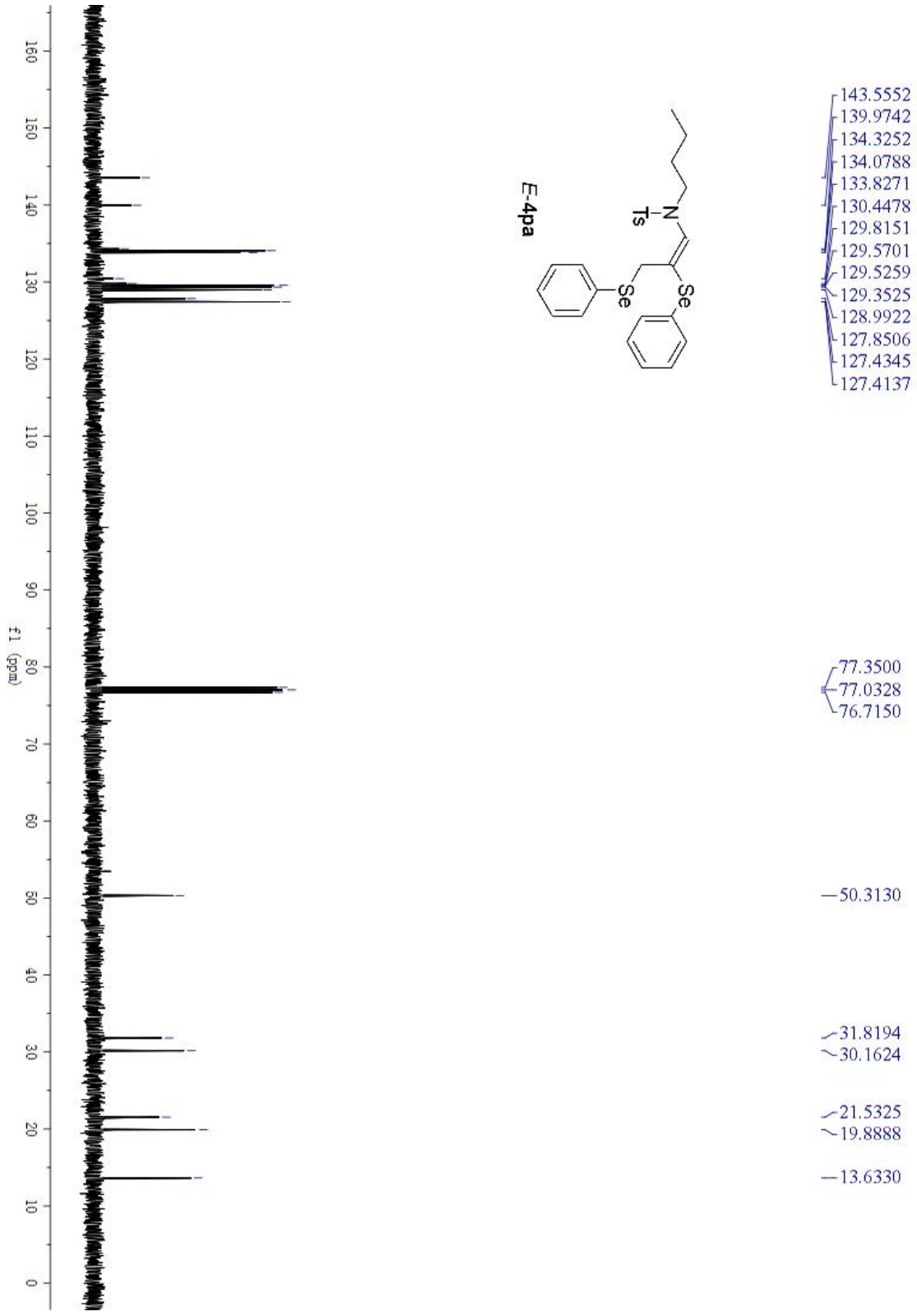

E-4oa
Ts
N
Se
Se
3.72
2.02
3.01
8.28
2.11
1.00
2.00
2.12
2.08
3.02
f1 (ppm)
7.5782
7.5716
7.5617
7.4231
7.4029
7.3289
7.2591
7.2460
7.2284
7.2151
7.1970
7.1904
7.1749
7.1549
7.0471
7.0289
5.4239
4.1398
3.0689
3.0485
3.0416
3.0274
2.4909
2.4694
2.4494
2.3732

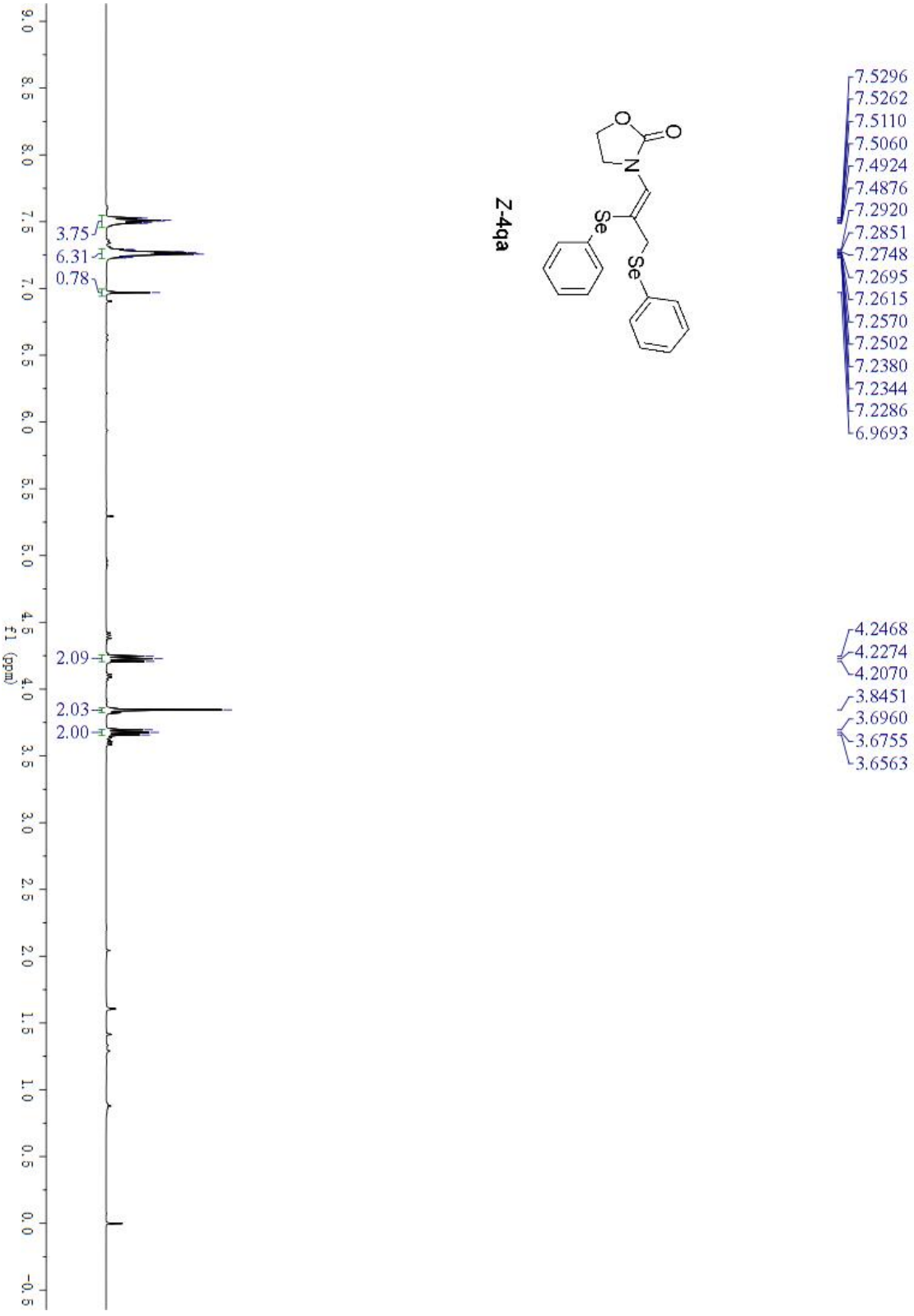

E-4oa
Ts
N
Se
Se
143.6618
137.9650
134.3106
134.0593
129.7206
129.6080
129.5856
129.3887
129.0174
128.8886
128.7293
128.4704
127.9687
127.9225
127.9127
127.6029
127.4009
126.5016
77.3221
77.0045
76.6871
51.8622
34.7383
31.8480
21.5118
f1 (ppm)

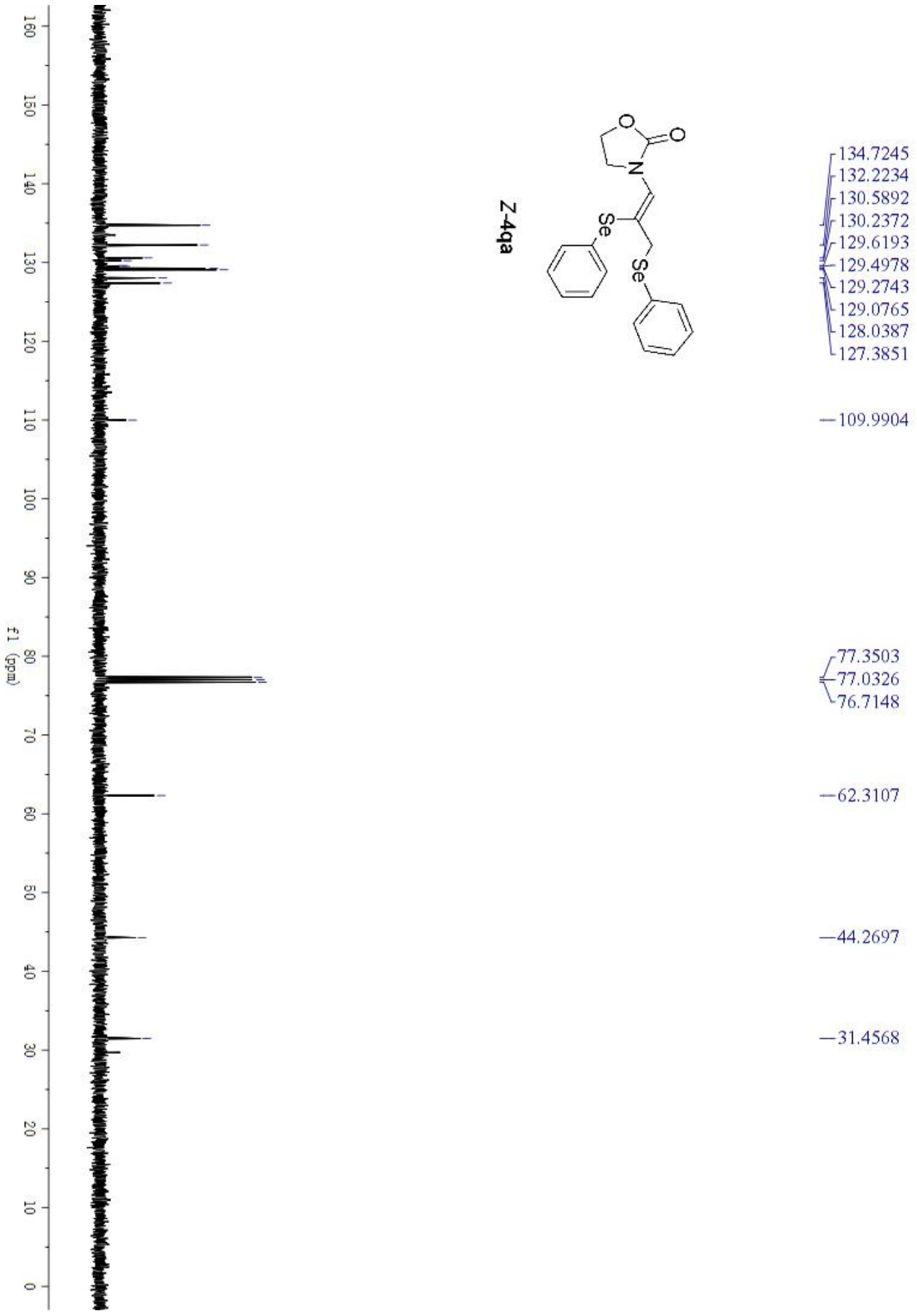

Z-4pa
Ts
N
Se
Se
7.5124
7.4923
7.4773
7.4318
7.4283
7.4142
7.4093
7.3255
7.3071
7.2893
7.2671
7.2487
7.2308
7.2199
7.1994
7.1750
5.7825
3.5682
3.0790
3.0624
3.0452
2.3998
1.4350
1.4214
1.4071
1.3971
1.3807
1.3628
1.3426
0.9047
0.8872
0.8699
3.59
1.91
8.22
1.00
2.00
2.01
3.00
4.39
3.04
f1 (ppm)

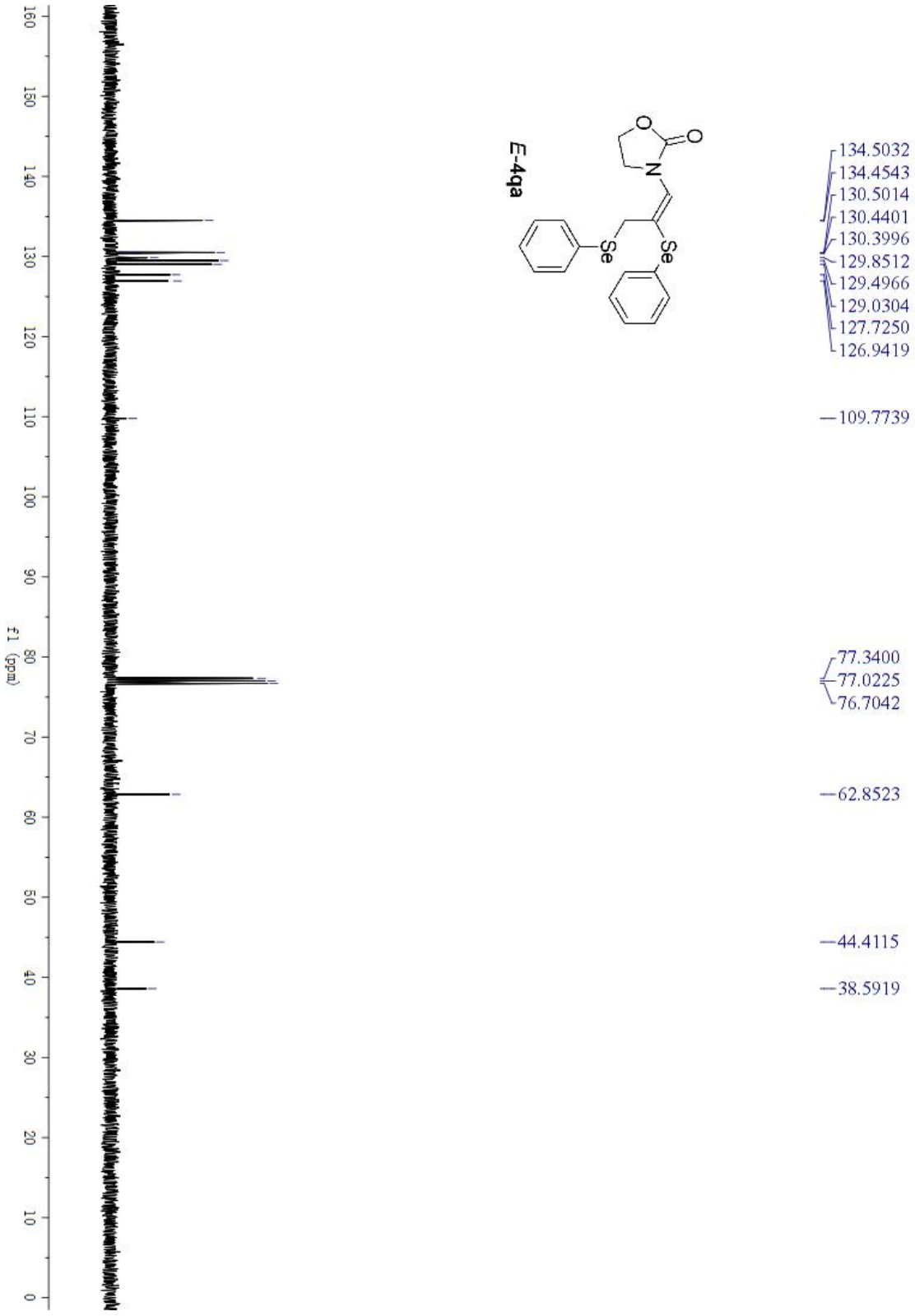

Z-4pa
Ts
N
Se
Se
143.4373
137.6958
135.4870
135.1412
133.4526
129.8757
129.5244
129.1638
129.0827
128.2524
128.0184
127.5580
127.3333
126.5087
77.3477
77.0294
76.7113
50.1045
32.4157
30.3154
21.5507
19.9735
13.7104
f1 (ppm)


E-4pa
Ts
N
Se
Se
7.5746
7.5643
7.4612
7.4411
7.3202
7.3072
7.2947
7.2677
7.2540
7.2504
7.2414
7.2133
7.1933
5.3887
4.1856
2.8593
2.8424
2.8250
2.4003
1.2291
1.2204
1.1895
0.8587
0.8420
0.8248
3.87
2.09
3.00
5.17
0.87
2.09
2.09
3.00
4.30
3.19
f1 (ppm)

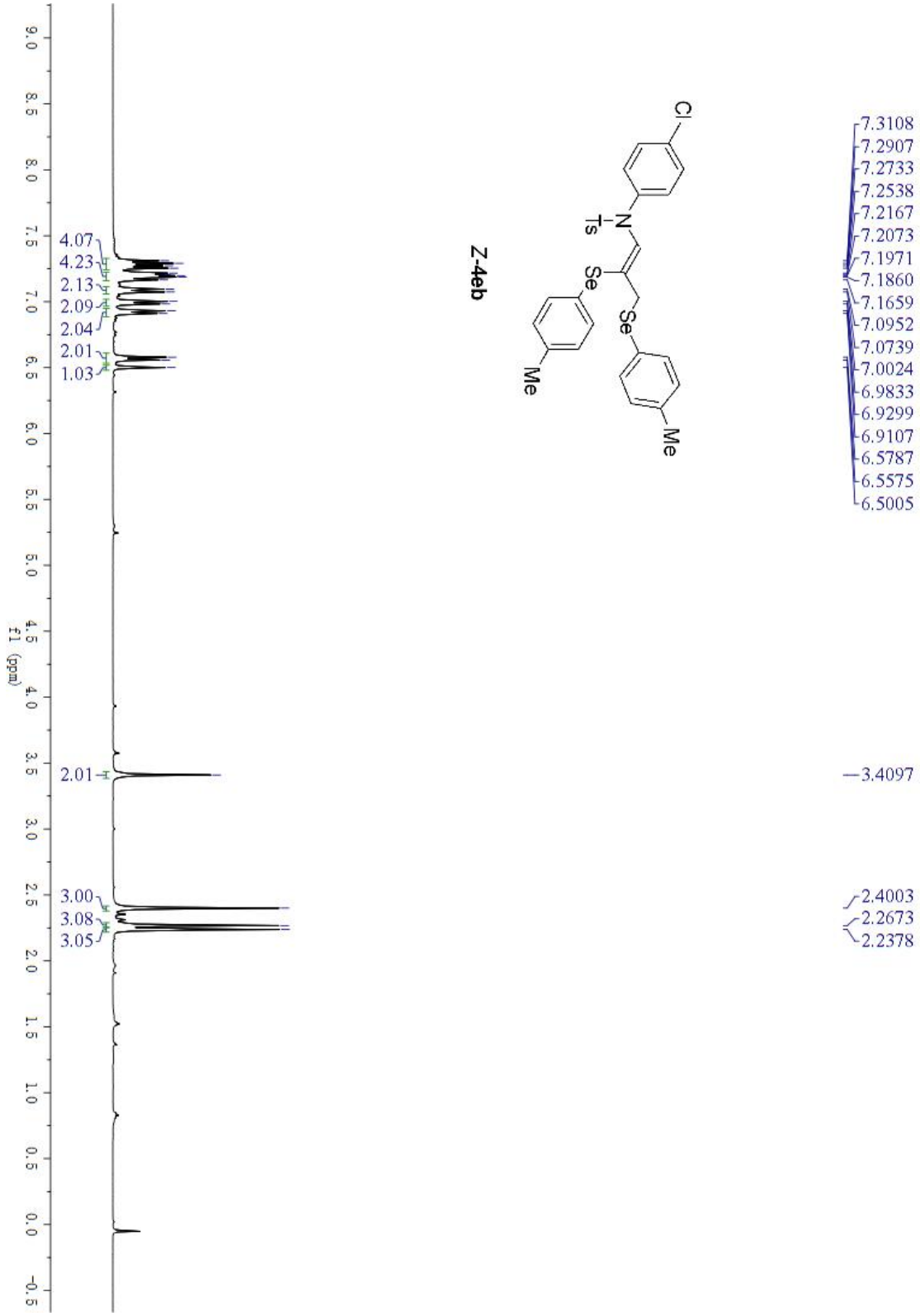

E-4pa
Ts
N
Se
Se
143.5552
139.9742
134.3252
134.0788
133.8271
130.4478
129.8151
129.5701
129.5259
129.3525
128.9922
127.8506
127.4345
127.4137
77.3500
77.0328
76.7150
50.3130
31.8194
30.1624
21.5325
19.8888
13.6330
f1 (ppm)


Z-4qa
O
O
N
Se
Se
7.5296
7.5262
7.5110
7.5060
7.4924
7.4876
7.2920
7.2851
7.2748
7.2695
7.2615
7.2570
7.2502
7.2380
7.2344
7.2286
6.9693
4.2468
4.2274
4.2070
3.8451
3.6960
3.6755
3.6563
3.75
6.31
0.78
2.09
2.03
2.00
f1 (ppm)


Z-4qa
134.7245
132.2234
130.5892
130.2372
129.6193
129.4978
129.2743
129.0765
128.0387
127.3851
109.9904
77.3503
77.0326
76.7148
62.3107
44.2697
31.4568
f1 (ppm)


E-4qa
O
O
N
Se
Se
134.5032
134.4543
130.5014
130.4401
130.3996
129.8512
129.4966
129.0304
127.7250
126.9419
109.7739
77.3400
77.0225
76.7042
62.8523
44.4115
38.5919
f1 (ppm)

5. NMR Spectra for 4eb – 4eg

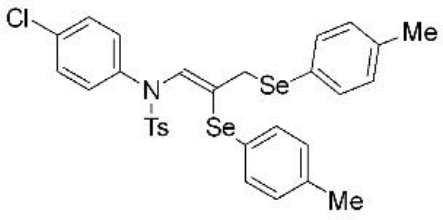


144.0705
138.6068
138.5482
137.3380
135.6571
134.1372
132.8687
129.9831
129.6813
129.5203
129.4665
129.3866
128.8873
128.4112
127.8355
127.8128
126.5450
123.3489

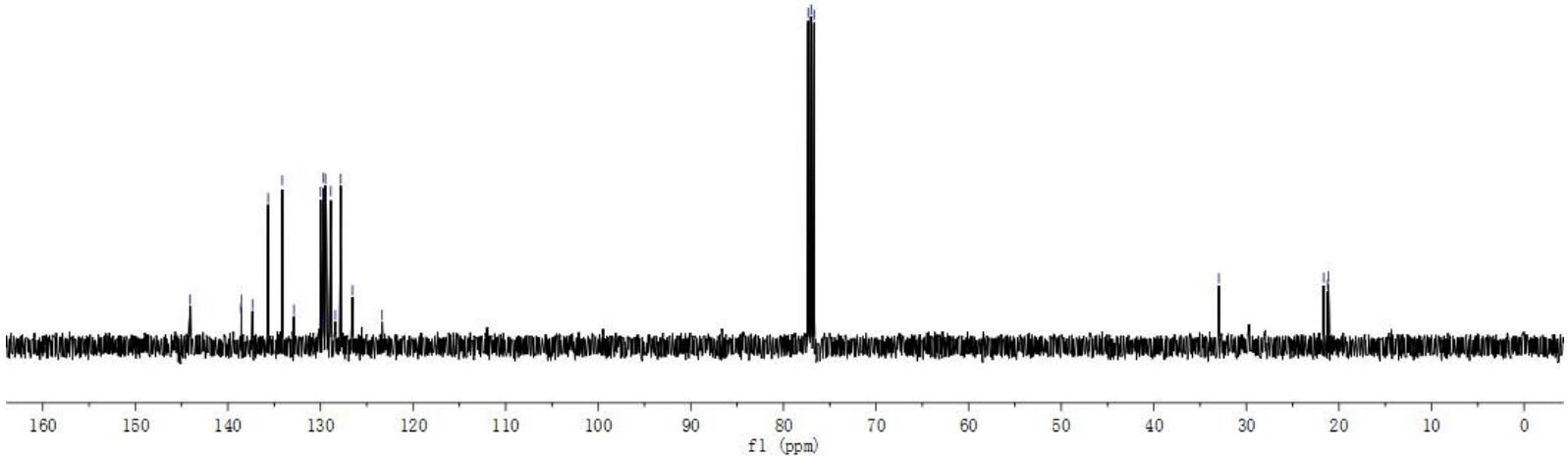
77.3294
77.0115
76.6940

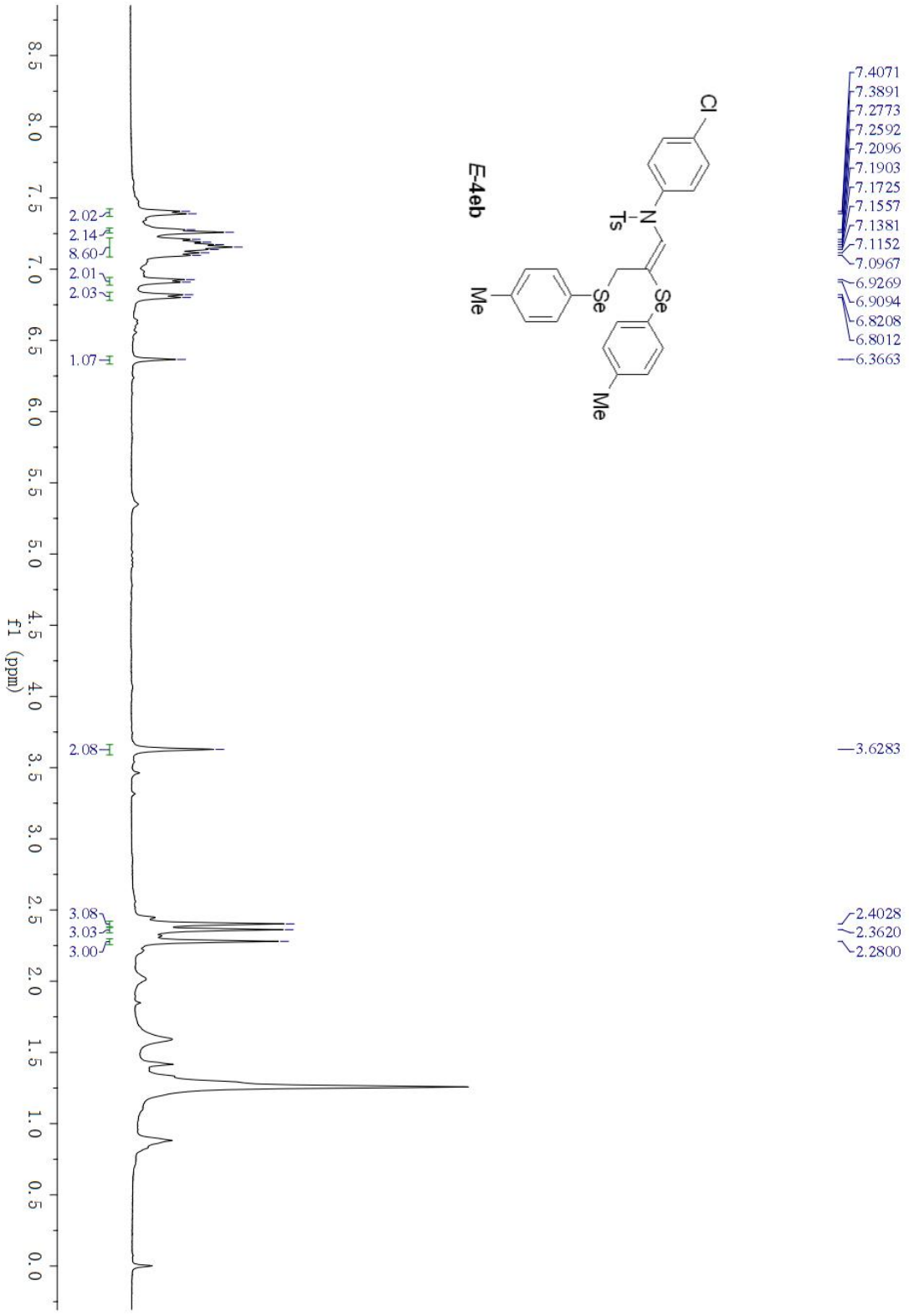
32.9682

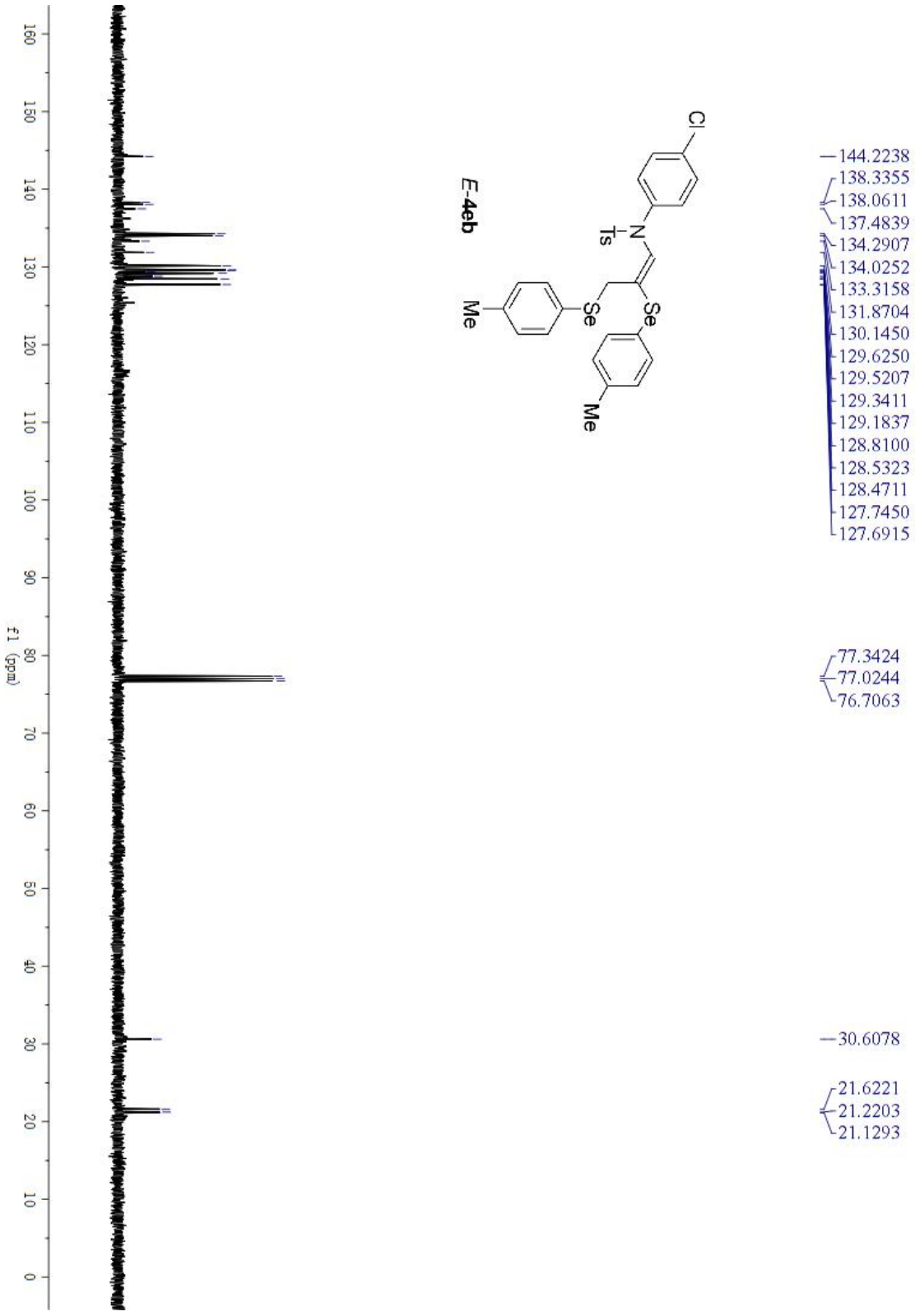
21.6538
21.2151
21.1253

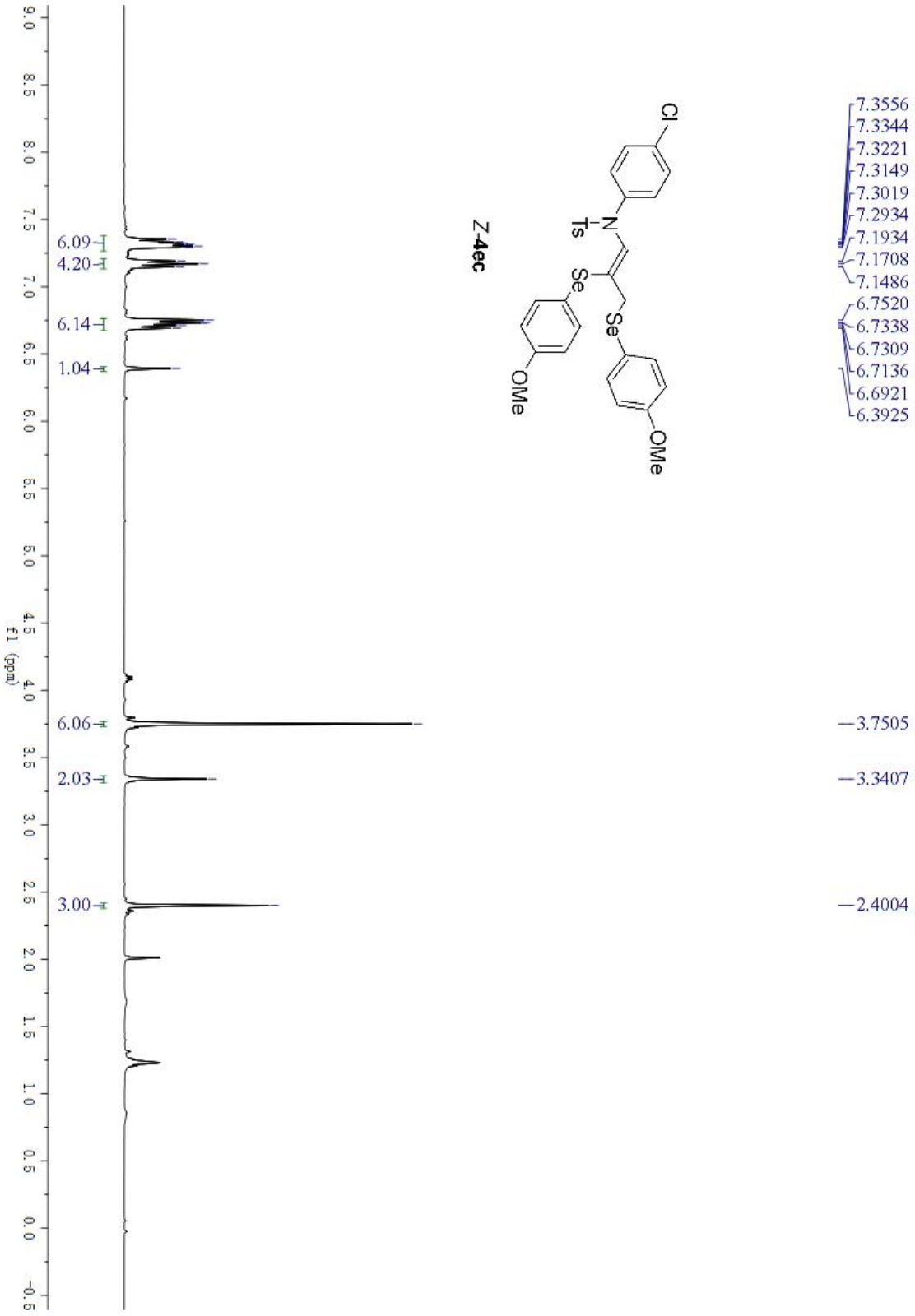


Z-**4eb**

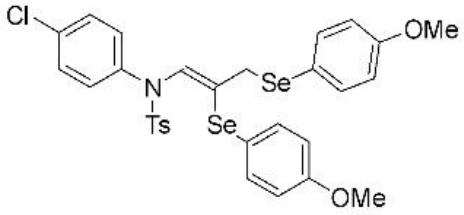



E-4eb
Cl
N
Ts
Se
Se
Me
Me
7.4071
7.3891
7.2773
7.2592
7.2096
7.1903
7.1725
7.1557
7.1381
7.1152
7.0967
6.9269
6.9094
6.8208
6.8012
6.3663
3.6283
2.4028
2.3620
2.2800
2.02
2.14
8.60
2.01
2.03
1.07
2.08
3.08
3.03
3.00
f1 (ppm)

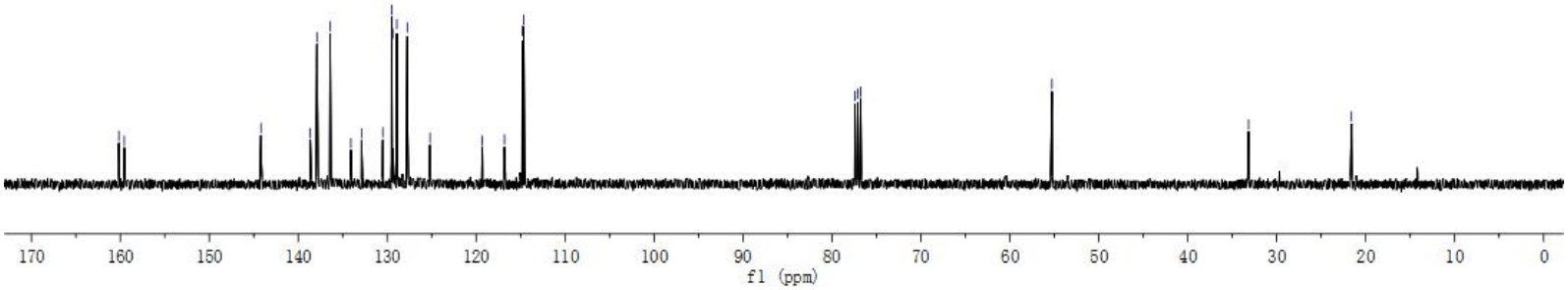

E-4eb
Cl
Ts
N
Se
Se
Me
Me
144.2238
138.3355
138.0611
137.4839
134.2907
134.0252
133.3158
131.8704
130.1450
129.6250
129.5207
129.3411
129.1837
128.8100
128.5323
128.4711
127.7450
127.6915
77.3424
77.0244
76.7063
30.6078
21.6221
21.2203
21.1293
f1 (ppm)

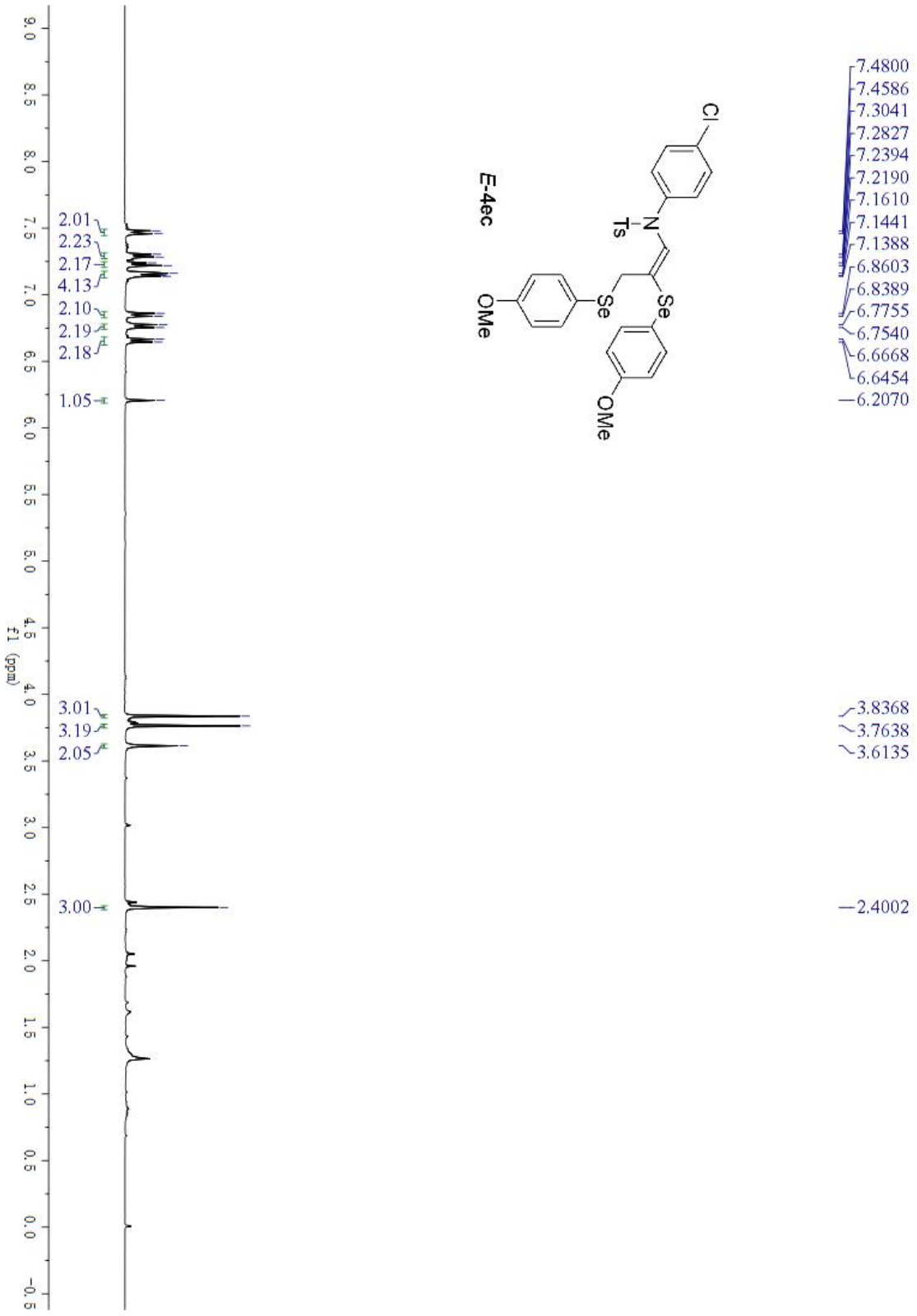

Z-4ec
Cl
N
Ts
Se
Se
OMe
OMe
7.3556
7.3344
7.3221
7.3149
7.3019
7.2934
7.1934
7.1708
7.1486
6.7520
6.7338
6.7309
6.7136
6.6921
6.3925
6.09
4.20
6.14
1.04
6.06
2.03
3.00
3.7505
3.3407
2.4004
f1 (ppm)

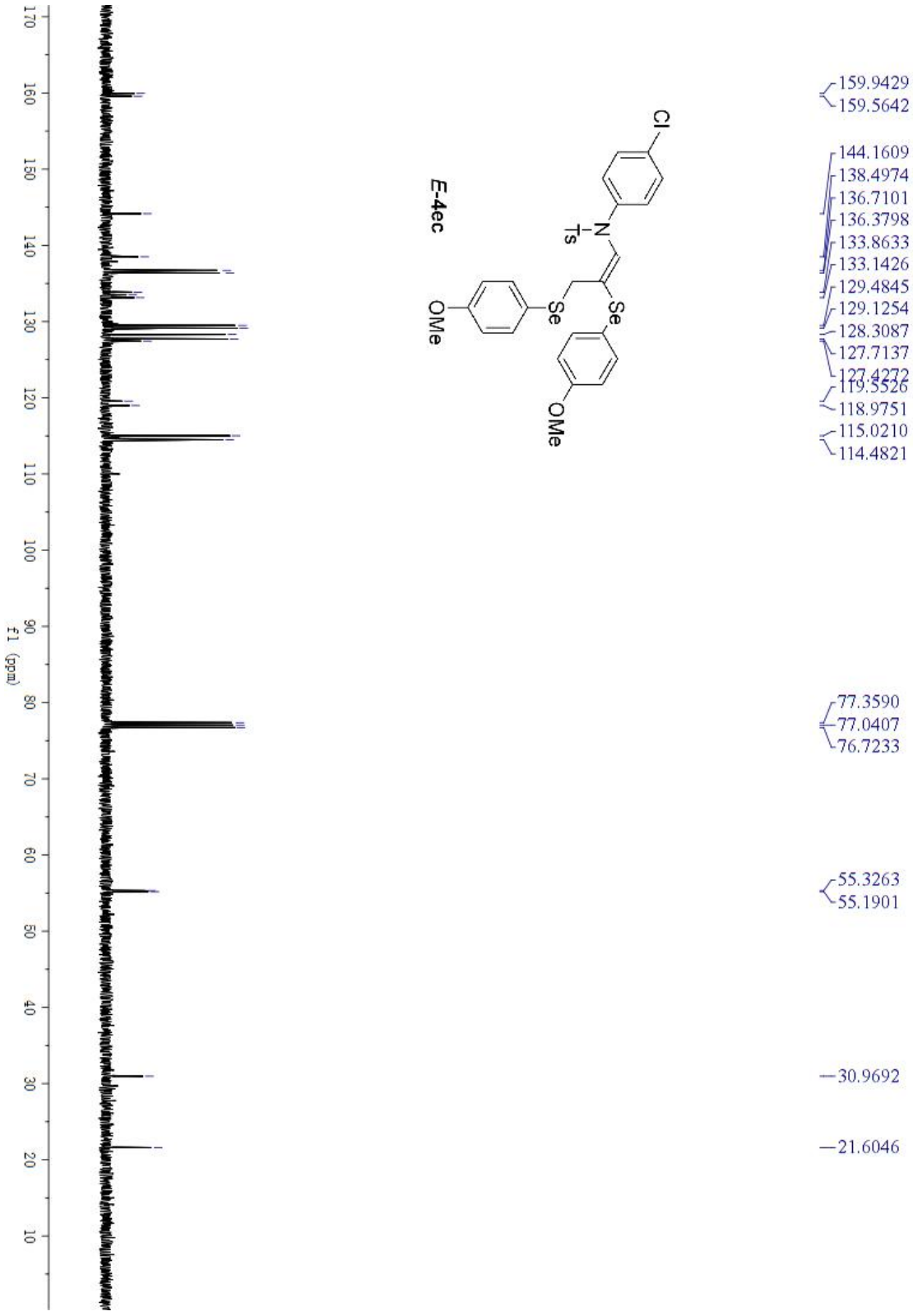
160.1671
159.5556
144.1840
138.6458
137.8913
136.4116
134.0836
132.8874
130.4883
129.4927
129.3656
128.9114
127.7417
125.1812
119.3118
116.8132
114.8147
114.6455
77.4045
77.0858
76.7682
55.2706
33.1593
21.6032



Z-**4ec**




E-4ec
Cl
N
Ts
Se
Se
OMe
OMe
7.4800
7.4586
7.3041
7.2827
7.2394
7.2190
7.1610
7.1441
7.1388
6.8603
6.8389
6.7755
6.7540
6.6668
6.6454
6.2070
3.8368
3.7638
3.6135
2.4002
2.01
2.23
2.17
4.13
2.10
2.19
2.18
1.05
3.01
3.19
2.05
3.00
f1 (ppm)


E-4ec
Cl
N
Ts
Se
Se
OMe
OMe
159.9429
159.5642
144.1609
138.4974
136.7101
136.3798
133.8633
133.1426
129.4845
129.1254
128.3087
127.7137
127.4272
119.5526
118.9751
115.0210
114.4821
77.3590
77.0407
76.7233
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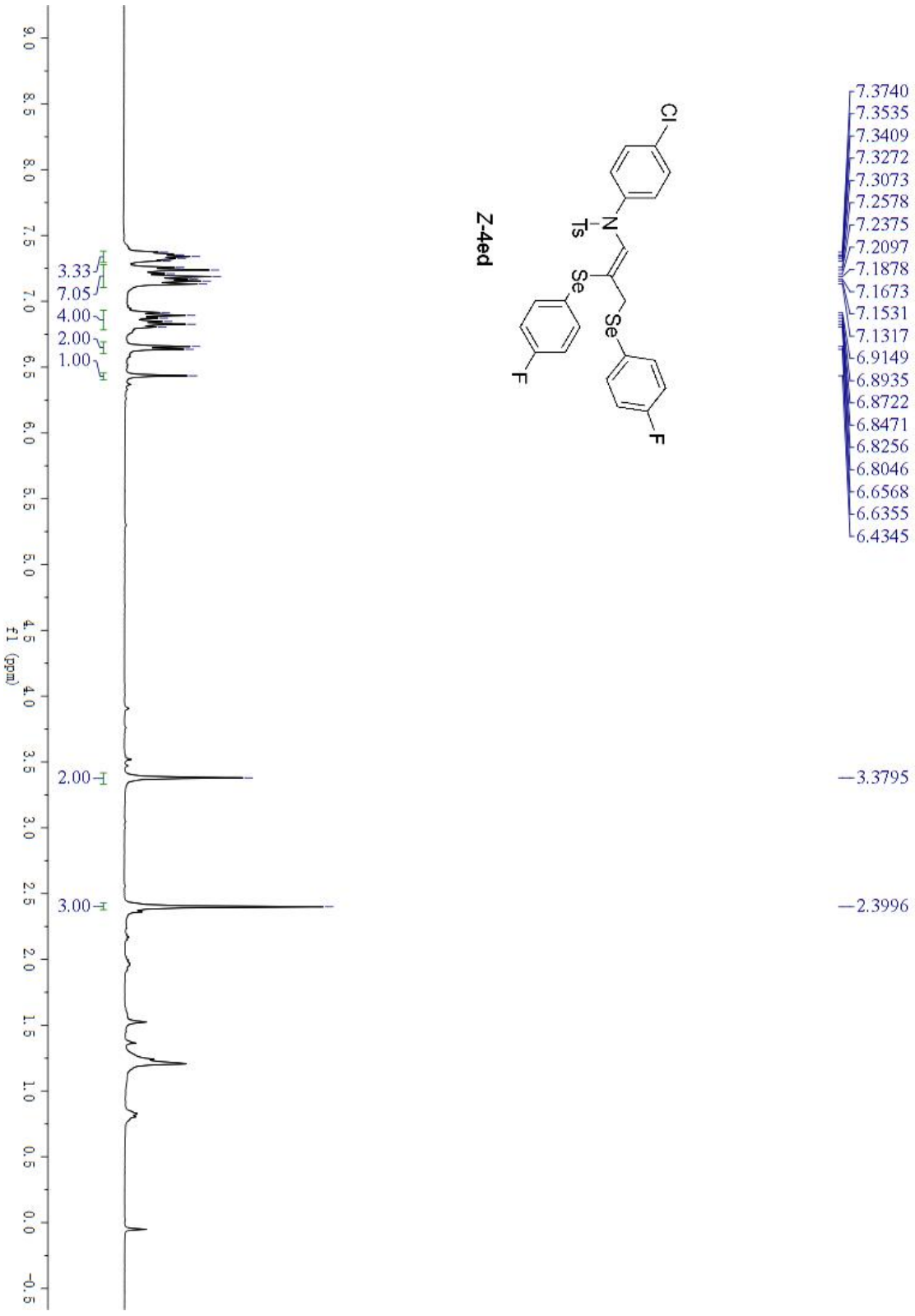
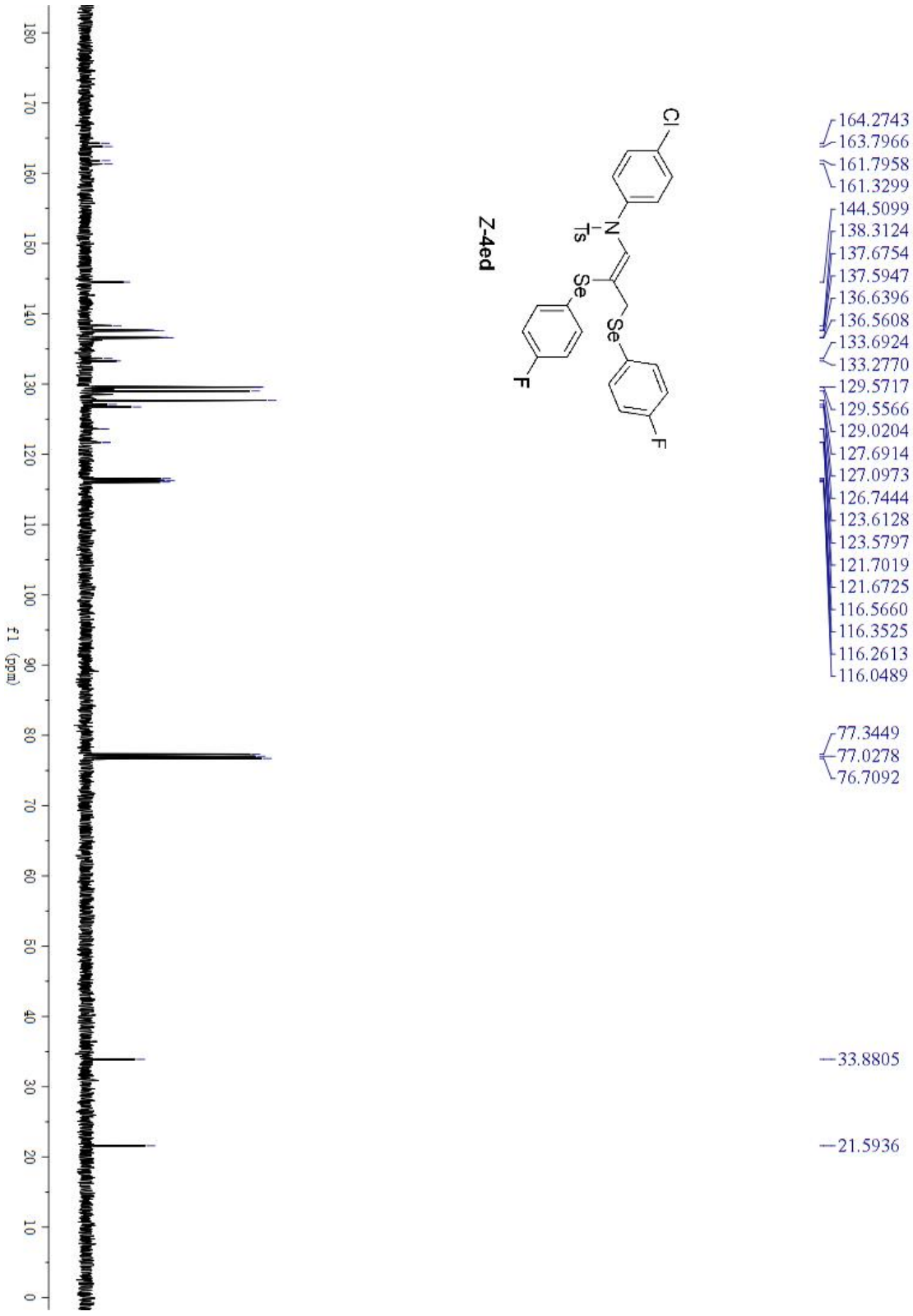
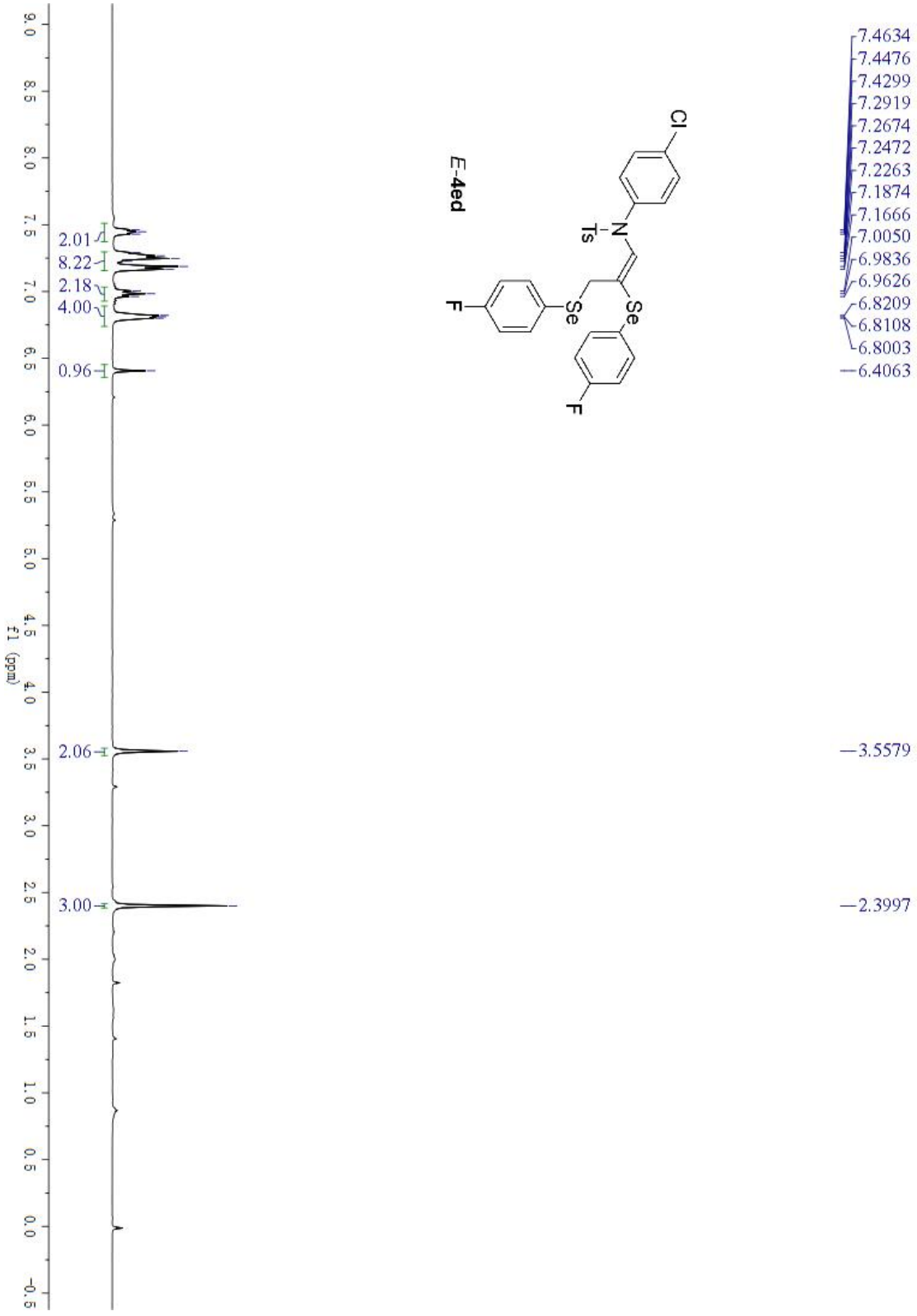
55.1901
30.9692
21.6046
f1 (ppm)


Z-4ed
Cl
N
Ts
Se
Se
F
F
7.3740
7.3535
7.3409
7.3272
7.3073
7.2578
7.2375
7.2097
7.1878
7.1673
7.1531
7.1317
6.9149
6.8935
6.8722
6.8471
6.8256
6.8046
6.6568
6.6355
6.4345
3.33
7.05
4.00
2.00
1.00
2.00
3.00
3.3795
2.3996
f1 (ppm)


Z-4ed
Cl
N
Ts
Se
Se
F
F
164.2743
163.7966
161.7958
161.3299
144.5099
138.3124
137.6754
137.5947
136.6396
136.5608
133.6924
133.2770
129.5717
129.5566
129.0204
127.6914
127.0973
126.7444
123.6128
123.5797
121.7019
121.6725
116.5660
116.3525
116.2613
116.0489
77.3449
77.0278
76.7092
33.8805
21.5936
f1 (ppm)


E-4ed
Cl
Ts
N
Se
Se
F
F
2.01
8.22
2.18
4.00
0.96
2.06
3.00
f1 (ppm)
7.4634
7.4476
7.4299
7.2919
7.2674
7.2472
7.2263
7.1874
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6.8209
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6.8003
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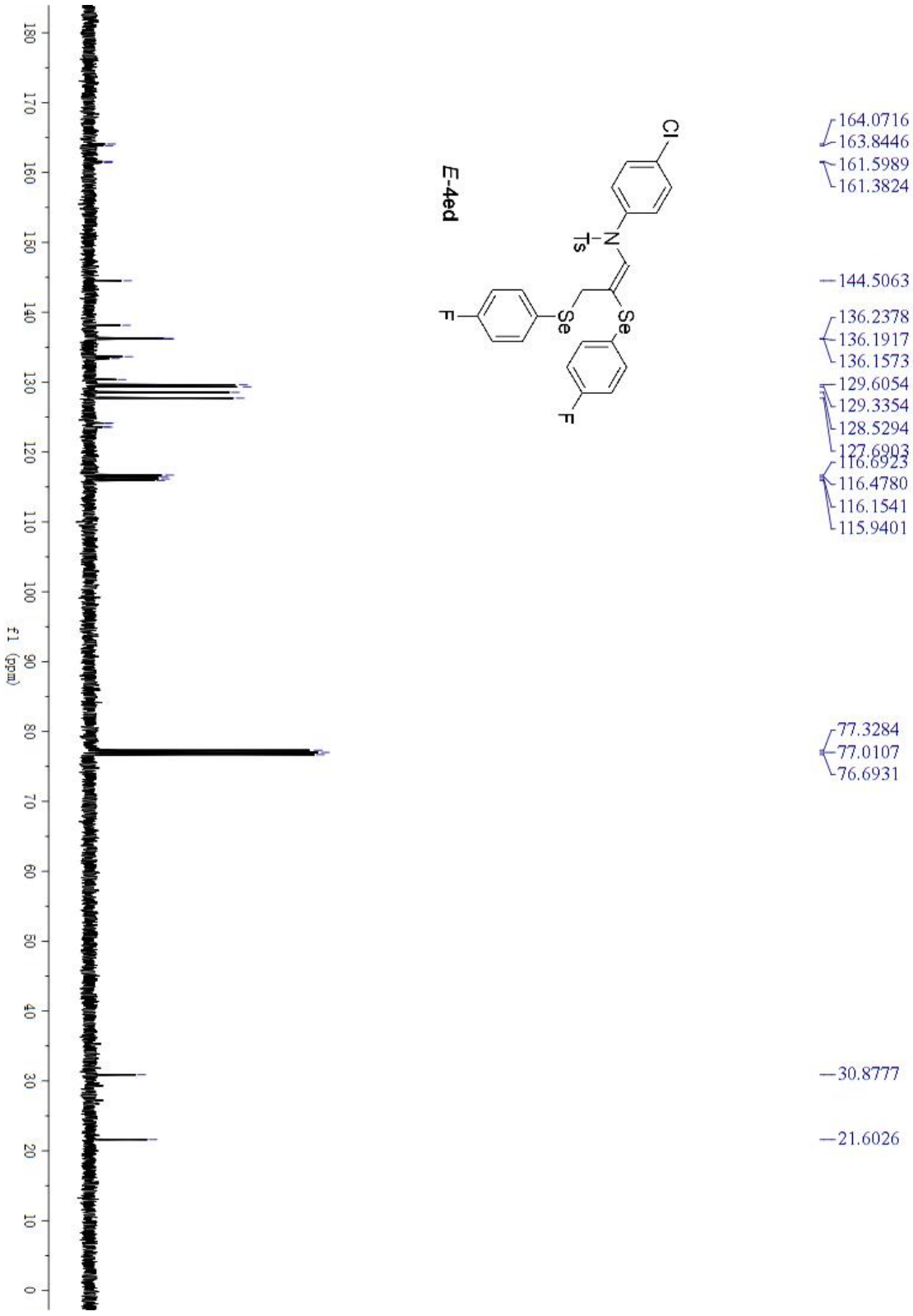
3.5579
2.3997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Cl
Ts
N
Se
Se
F
F
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161.3824
144.5063
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136.1917
136.1573
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129.3354
128.5294
127.6903
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116.1541
115.9401
77.3284
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76.6931
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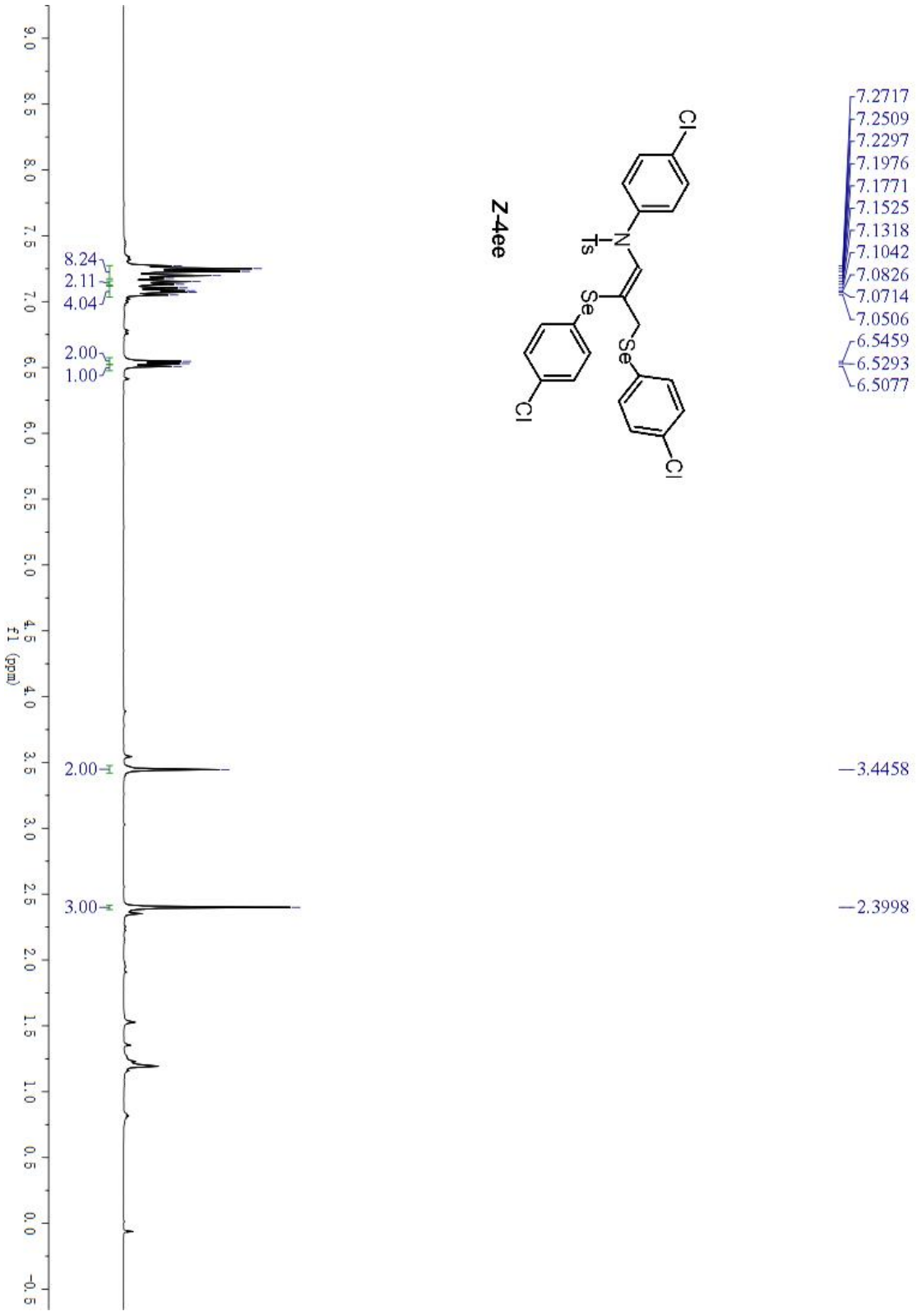
f1 (ppm)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N
Ts
Se
Se
Cl
Cl
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7.2297
7.1976
7.1771
7.1525
7.1318
7.1042
7.0826
7.0714
7.0506
6.5459
6.5293
6.5077
8.24
2.11
4.04
2.00
1.00
2.00
3.00
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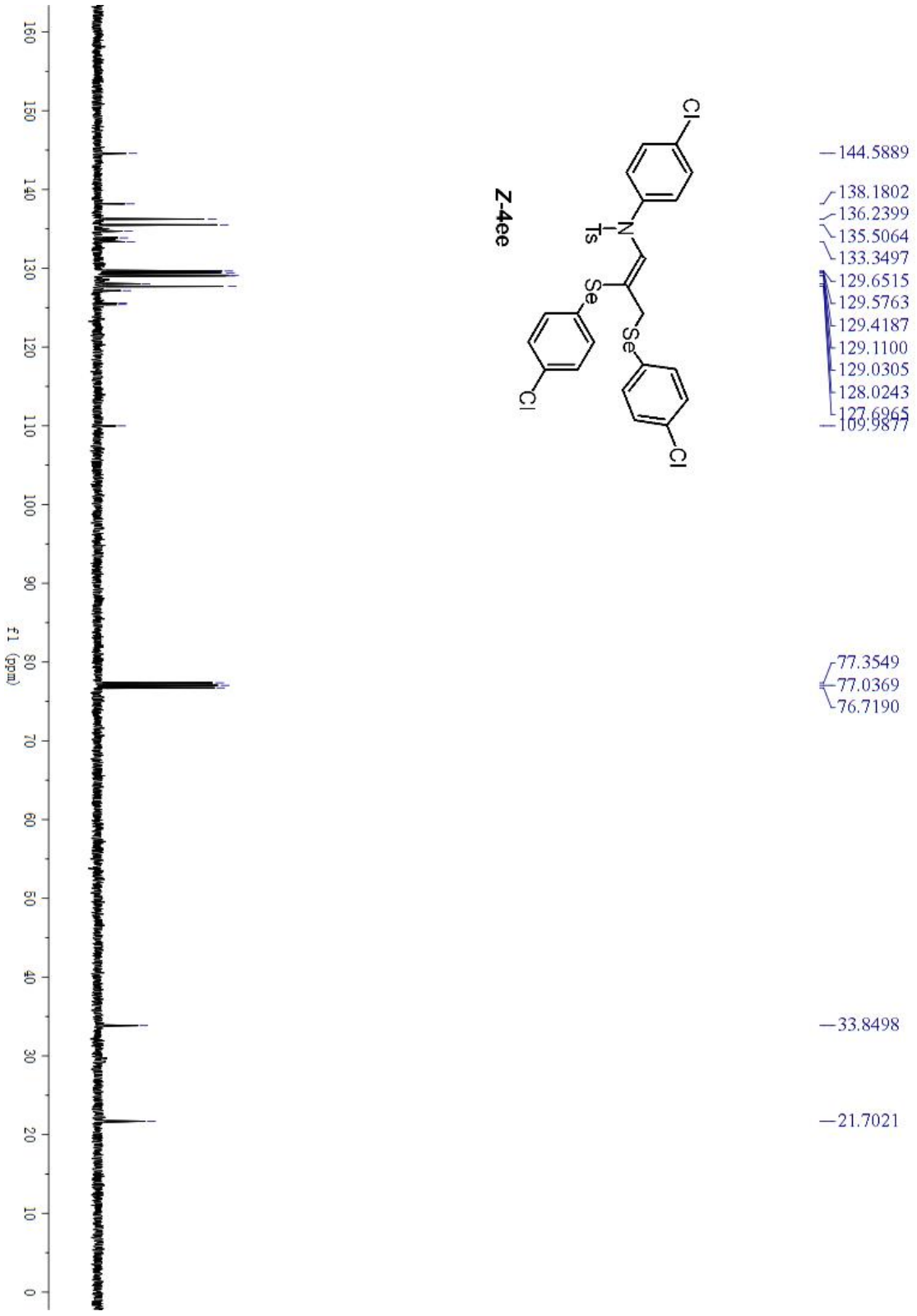
2.3998
f1 (ppm)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Cl
N
Ts
Se
Se
Cl
Cl
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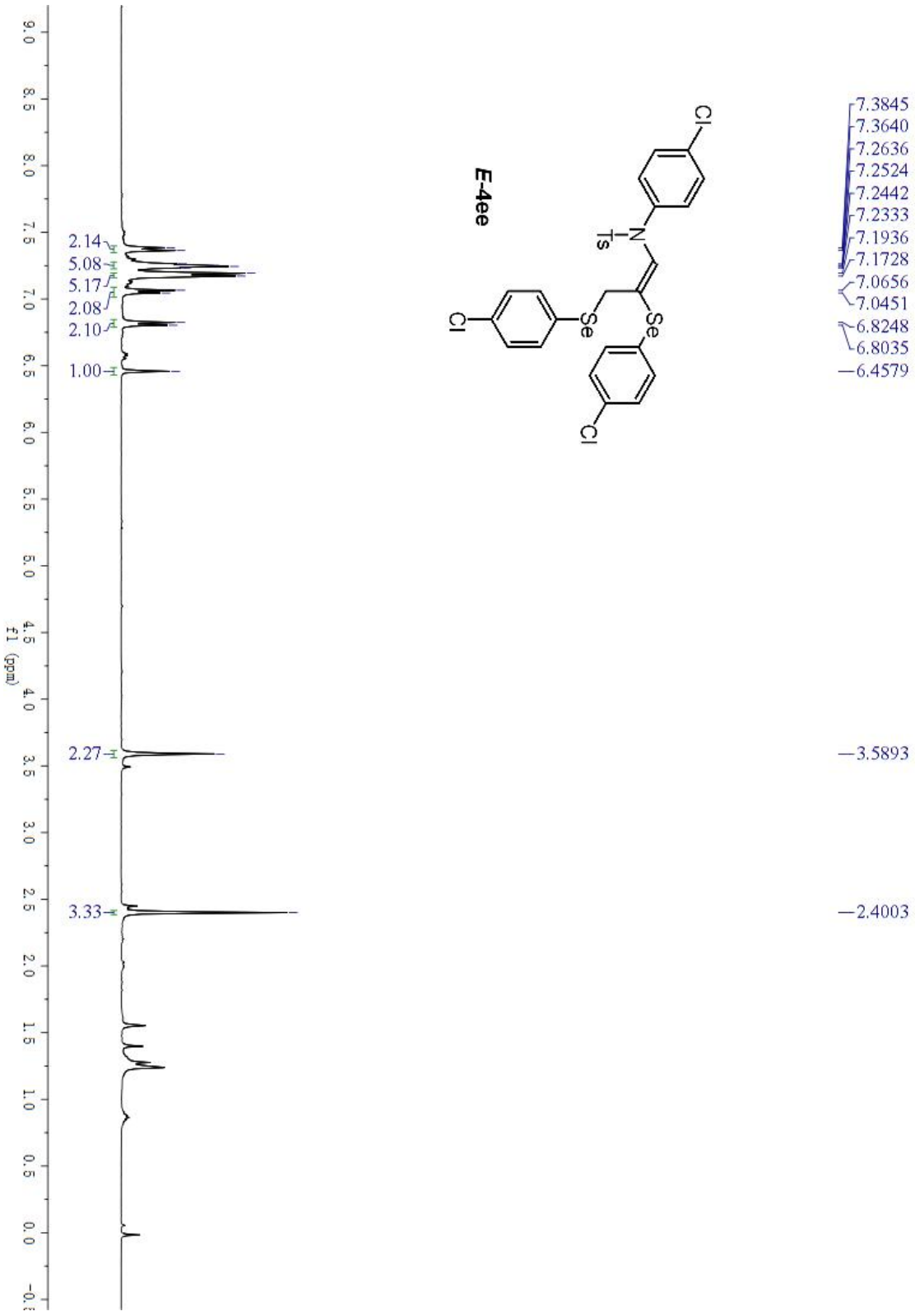
129.5763
129.4187
129.1100
129.0305
128.0243
127.6965
109.9877
77.3549
77.0369
76.7190
33.8498
21.7021
f1 (ppm)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Ts
Se
Se
Cl
Cl
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7.2524
7.2442
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7.1936
7.1728
7.0656
7.0451
6.8248
6.8035
6.4579
3.5893
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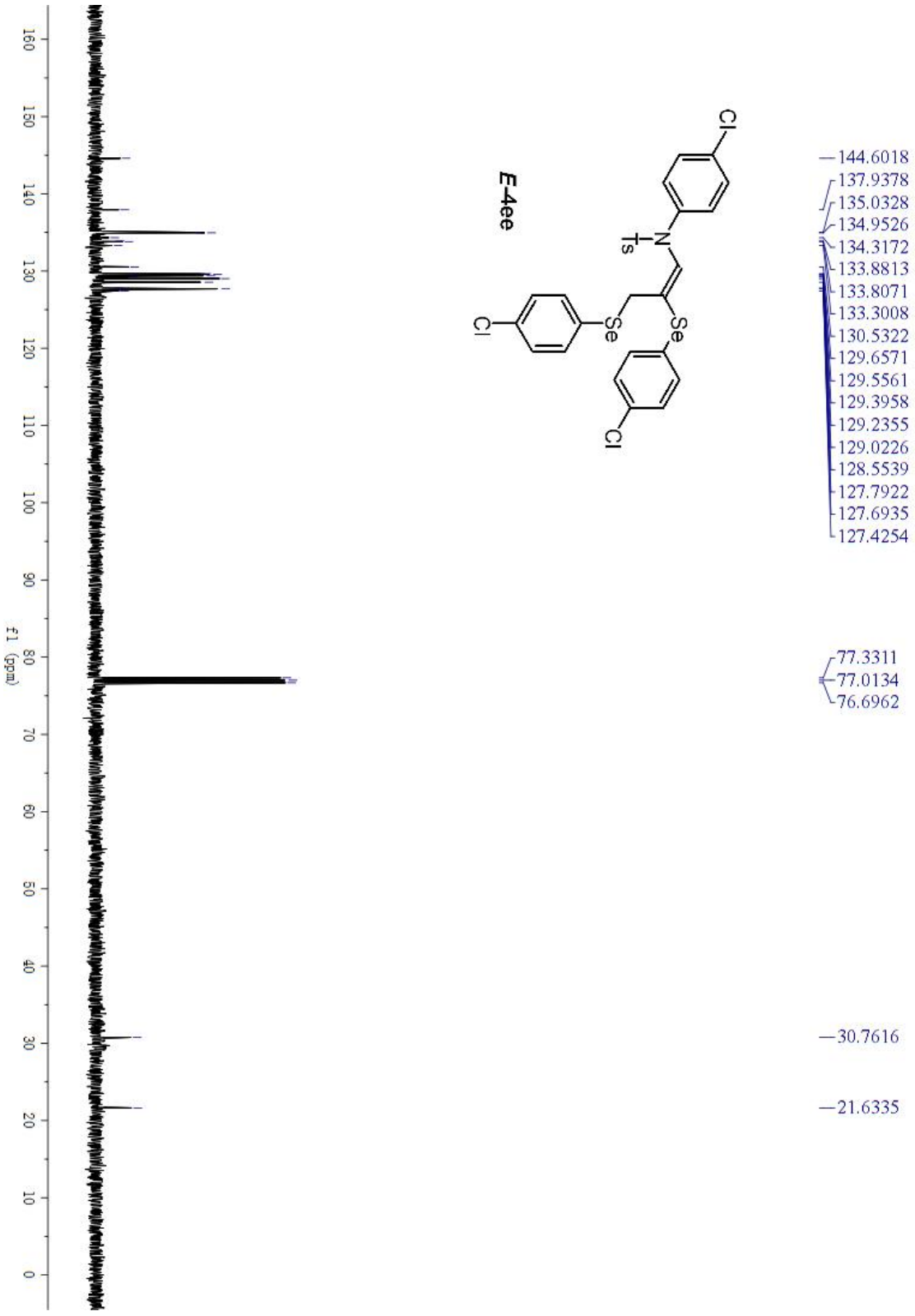
2.14
5.08
5.17
2.08
2.10
1.00
2.27
3.33
f1 (ppm)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Ts
Se
Se
Cl
Cl
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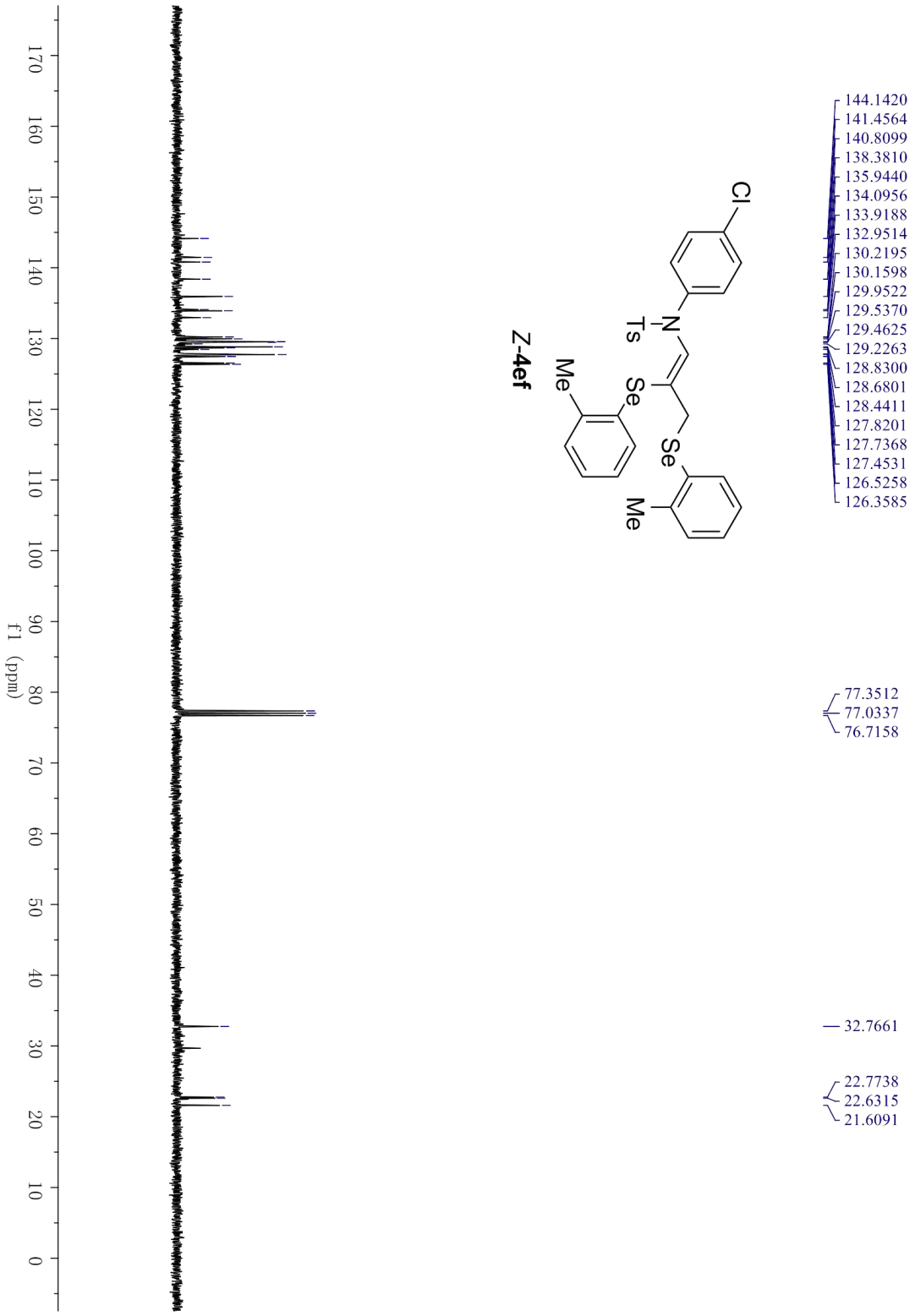
133.8813
133.8071
133.3008
130.5322
129.6571
129.5561
129.3958
129.2355
129.0226
128.5539
127.7922
127.6935
127.4254
77.3311
77.0134
76.6962
30.7616
21.6335
f1 (ppm)


Cl
N
Ts
Se
Me
Se
Me
Z-4ef
7.3420
7.3234
7.2875
7.2209
7.2023
7.1802
7.1511
7.1301
7.0657
7.0482
6.9709
6.6767
6.6389
6.6195
3.4716
2.4431
2.3500
2.2554
2.01
10.56
2.40
1.05
2.07
2.03
3.04
3.11
3.00
f1 (ppm)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129.9522
129.5370
129.4625
129.2263
128.8300
128.6801
128.4411
127.8201
127.7368
127.4531
126.5258
126.3585
77.3512
77.0337
76.7158
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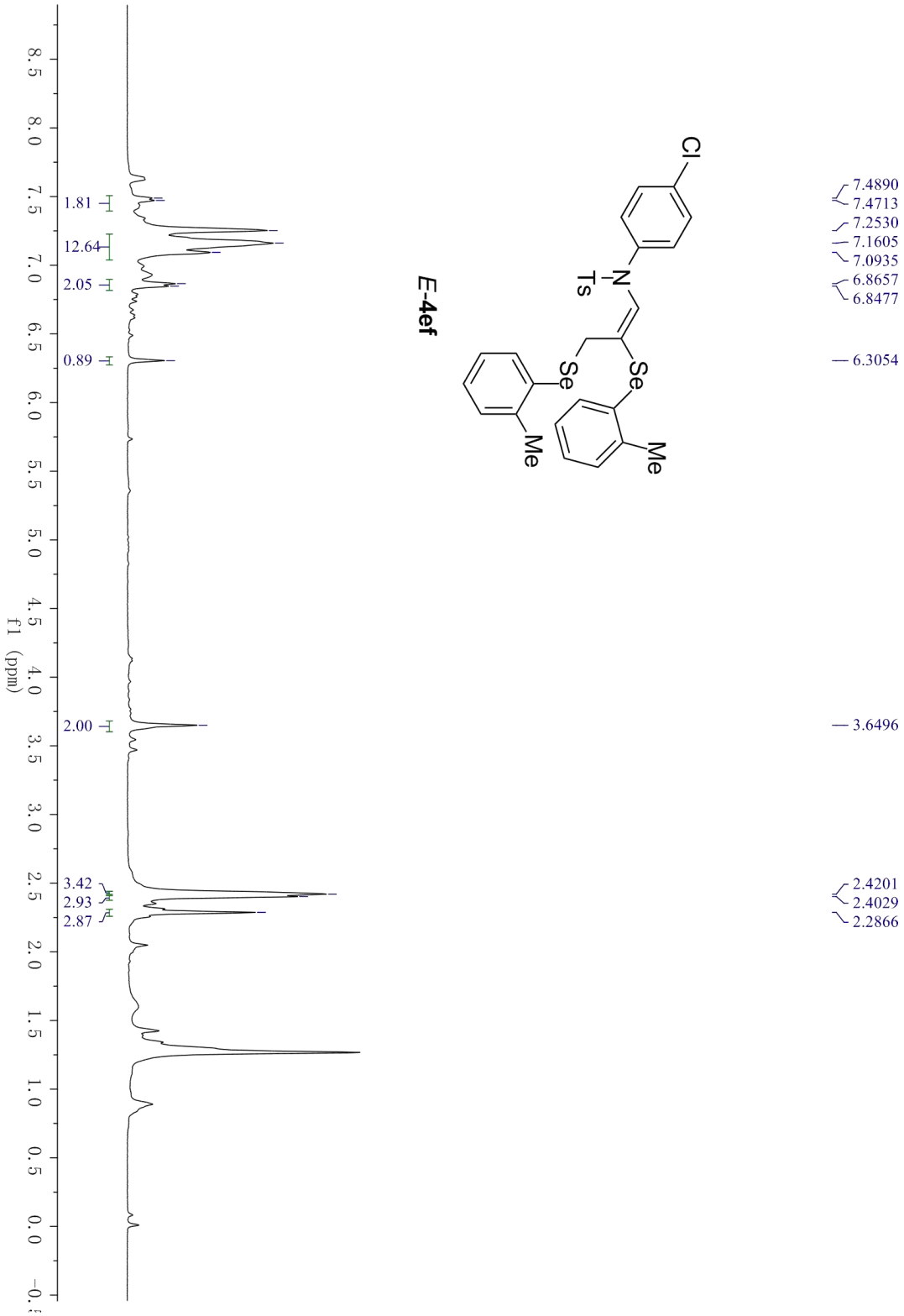
22.7738
22.6315
21.6091
Z-4ef
Cl
N
Ts
Se
Me
Se
Me
f1 (ppm)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Ts
Se
Se
Me
Me
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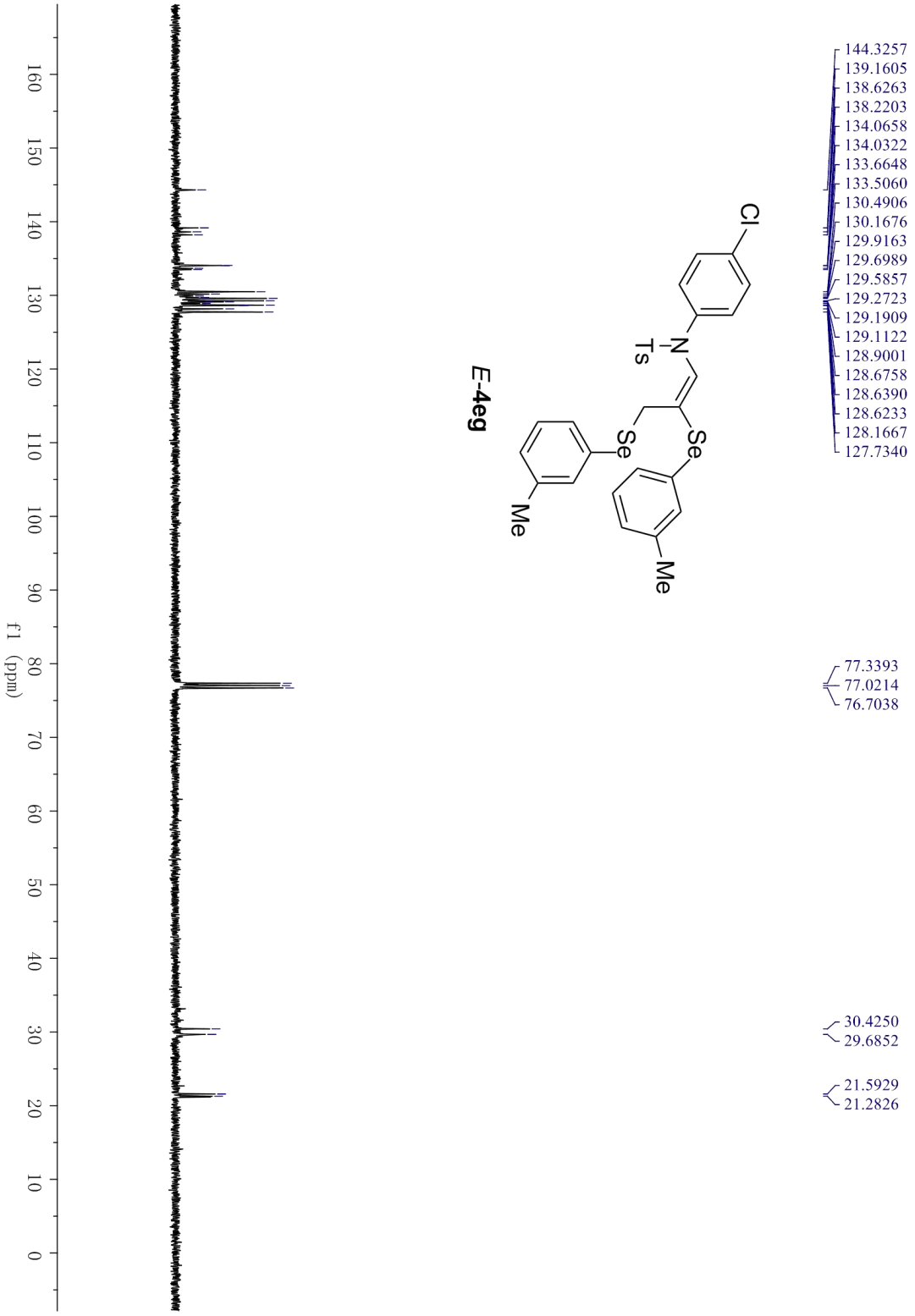
7.2530
7.1605
7.0935
6.8657
6.8477
6.3054
3.6496
2.4201
2.4029
2.2866
1.81
12.64
2.05
0.89
2.00
3.42
2.93
2.87
f1 (ppm)


144.3257
139.1605
138.6263
138.2203
134.0658
134.0322
133.6648
133.5060
130.4906
130.1676
129.9163
129.6989
129.5857
129.2723
129.1909
129.1122
128.9001
128.6758
128.6390
128.6233
128.1667
127.7340
77.3393
77.0214
76.7038
30.4250
29.6852
21.5929
21.2826
E-4eg
Cl
Ts
N
Se
Se
Me
Me
f1 (ppm)
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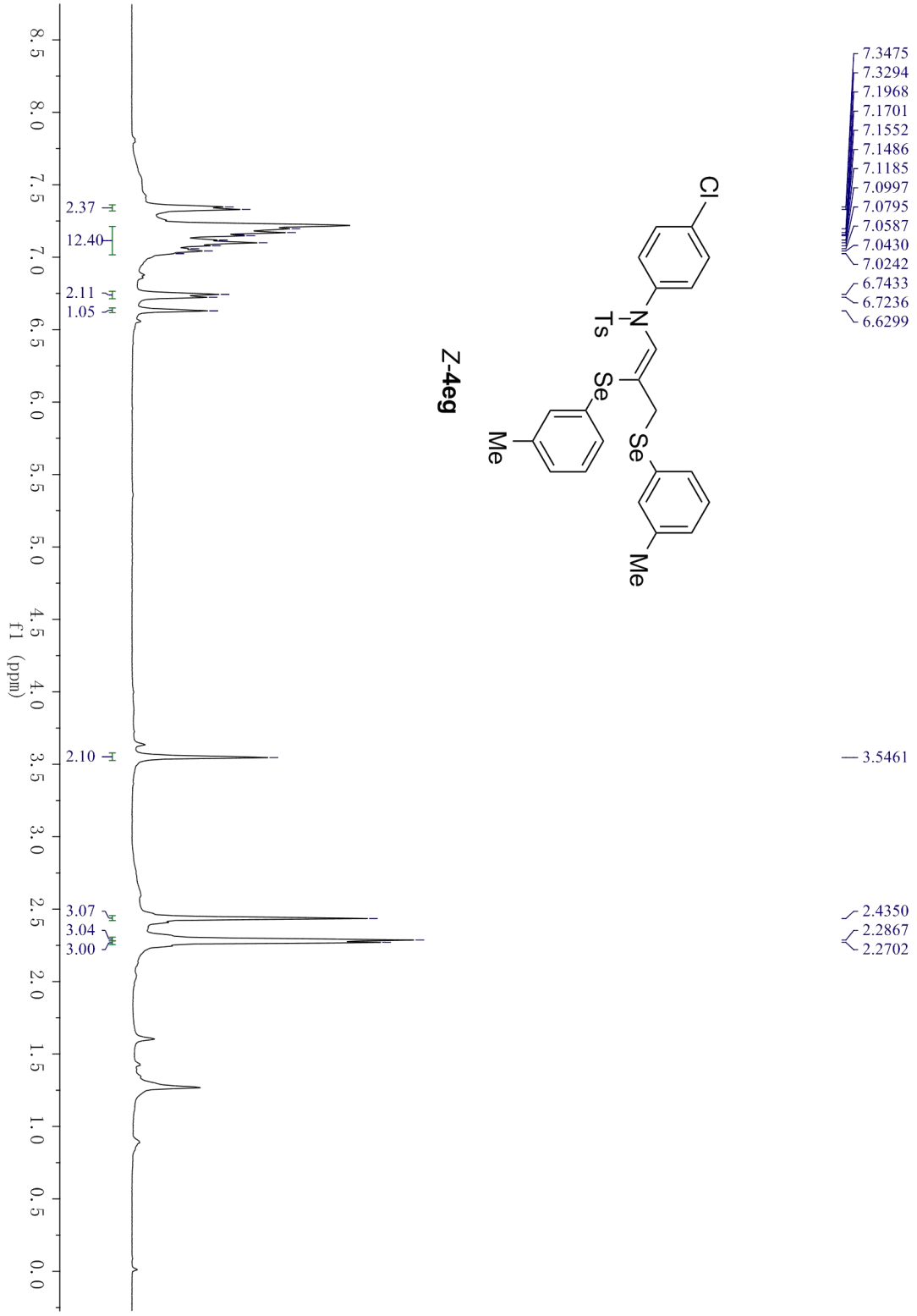
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0


Z-4eg
Cl
N
Ts
Se
Se
Me
Me
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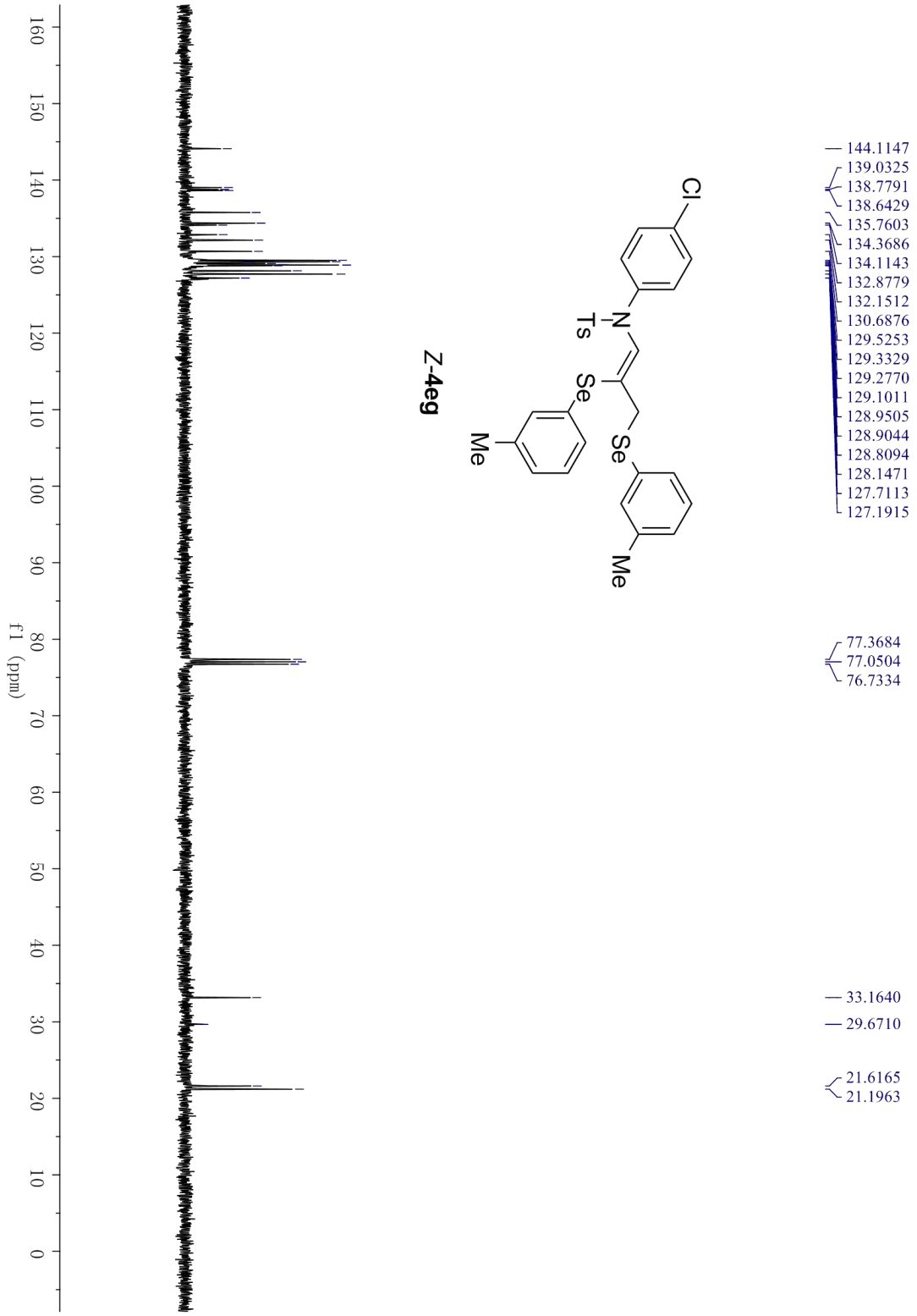
7.1701
7.1552
7.1486
7.1185
7.0997
7.0795
7.0587
7.0430
7.0242
6.7433
6.7236
6.6299
3.5461
2.4350
2.2867
2.2702
2.37
12.40
2.11
1.05
2.10
3.07
3.04
3.00
f1 (ppm)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134.1143
132.8779
132.1512
130.6876
129.5253
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129.2770
129.1011
128.9505
128.9044
128.8094
128.1471
127.7113
127.1915
77.3684
77.0504
76.7334
33.1640
29.6710
21.6165
21.1963
Cl
N
Ts
Se
Me
Se
Me
Z-4eg
f1 (ppm)
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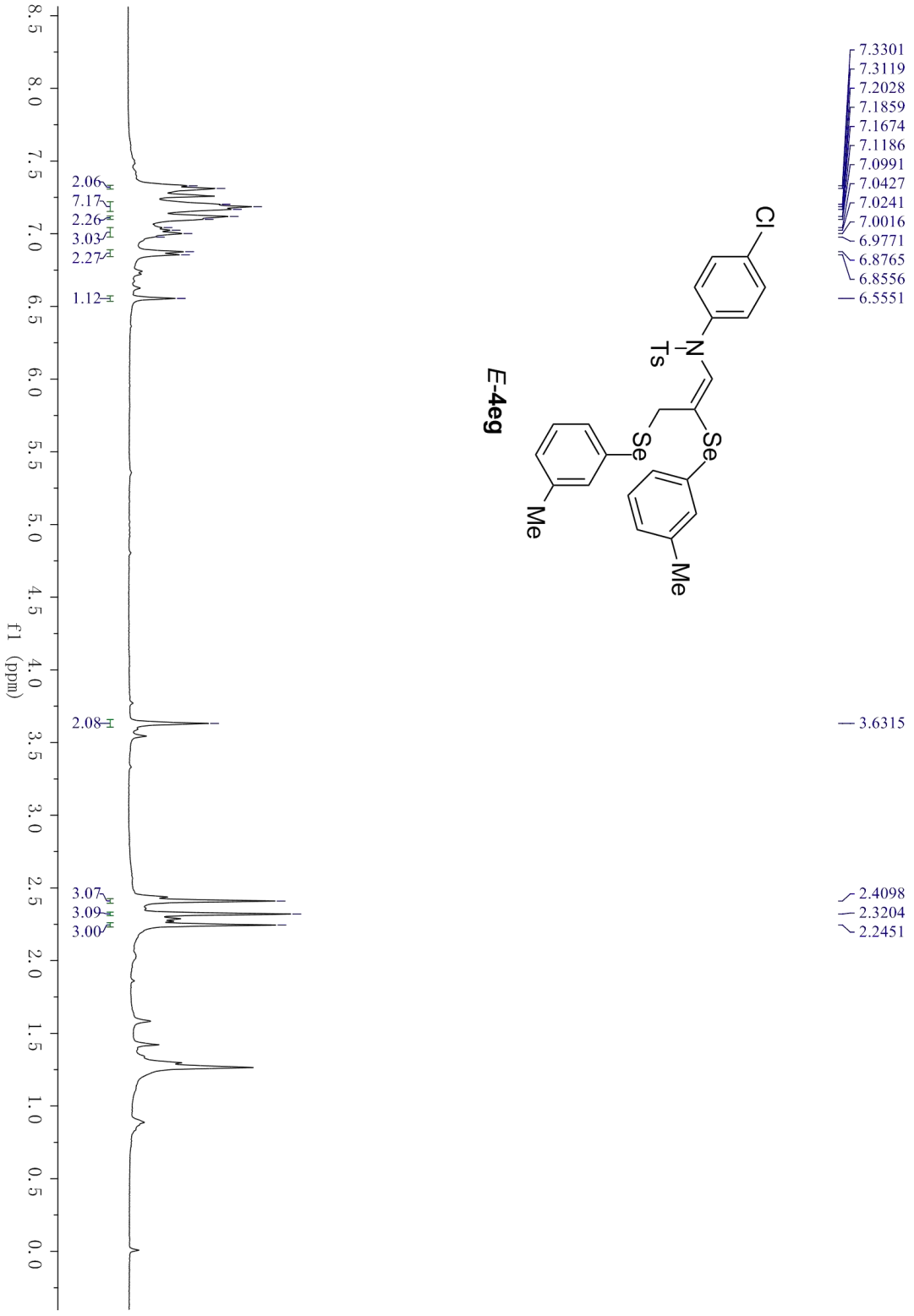
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0


8.5
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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)
2.06
7.17
2.26
3.03
2.27
1.12
2.08
3.07
3.09
3.00
Cl
N
Ts
Se
Se
Me
Me
E-4eg
7.3301
7.3119
7.2028
7.1859
7.1674
7.1186
7.0991
7.0427
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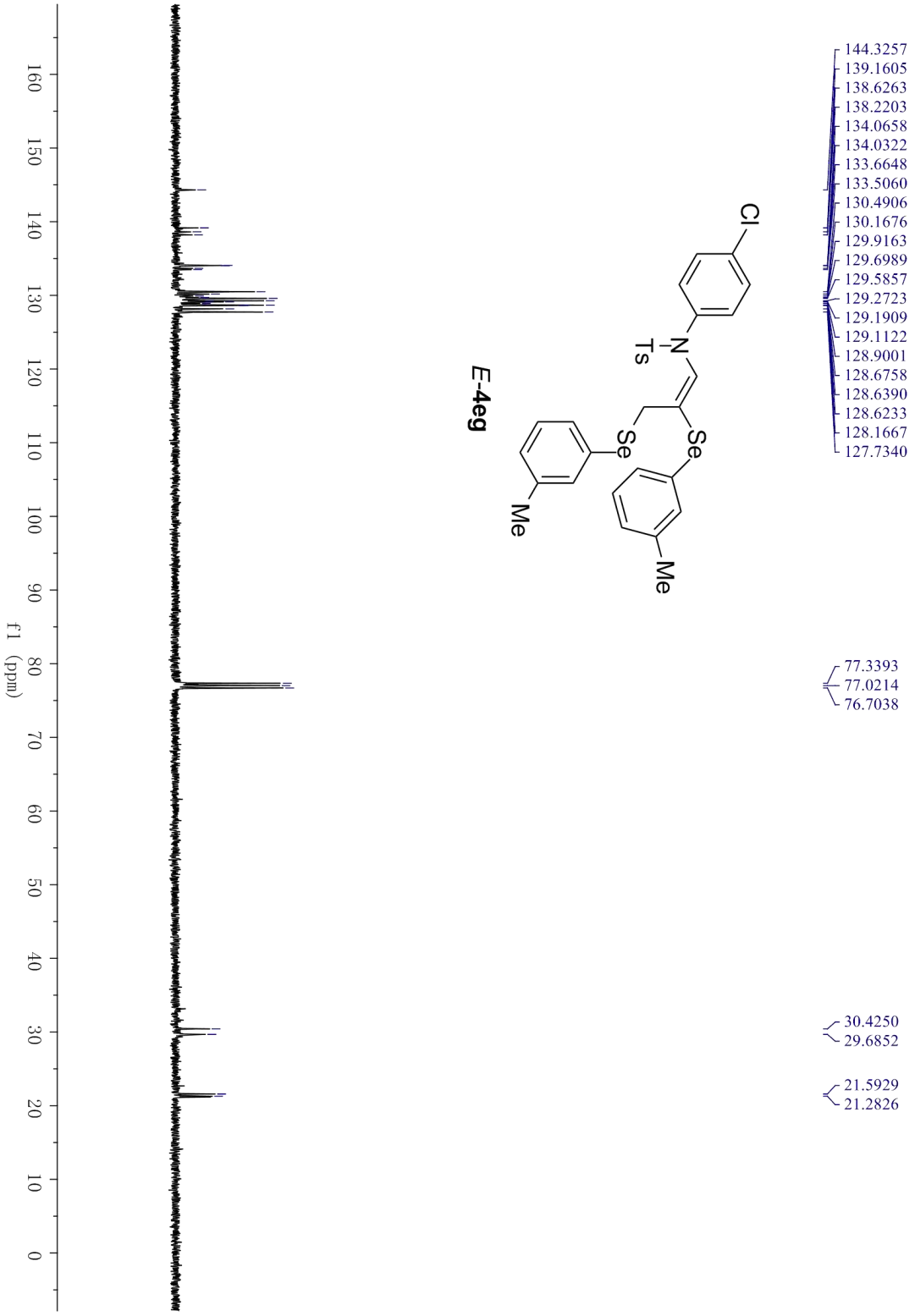
2.2451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139.1605
138.6263
138.2203
134.0658
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133.5060
130.4906
130.1676
129.9163
129.6989
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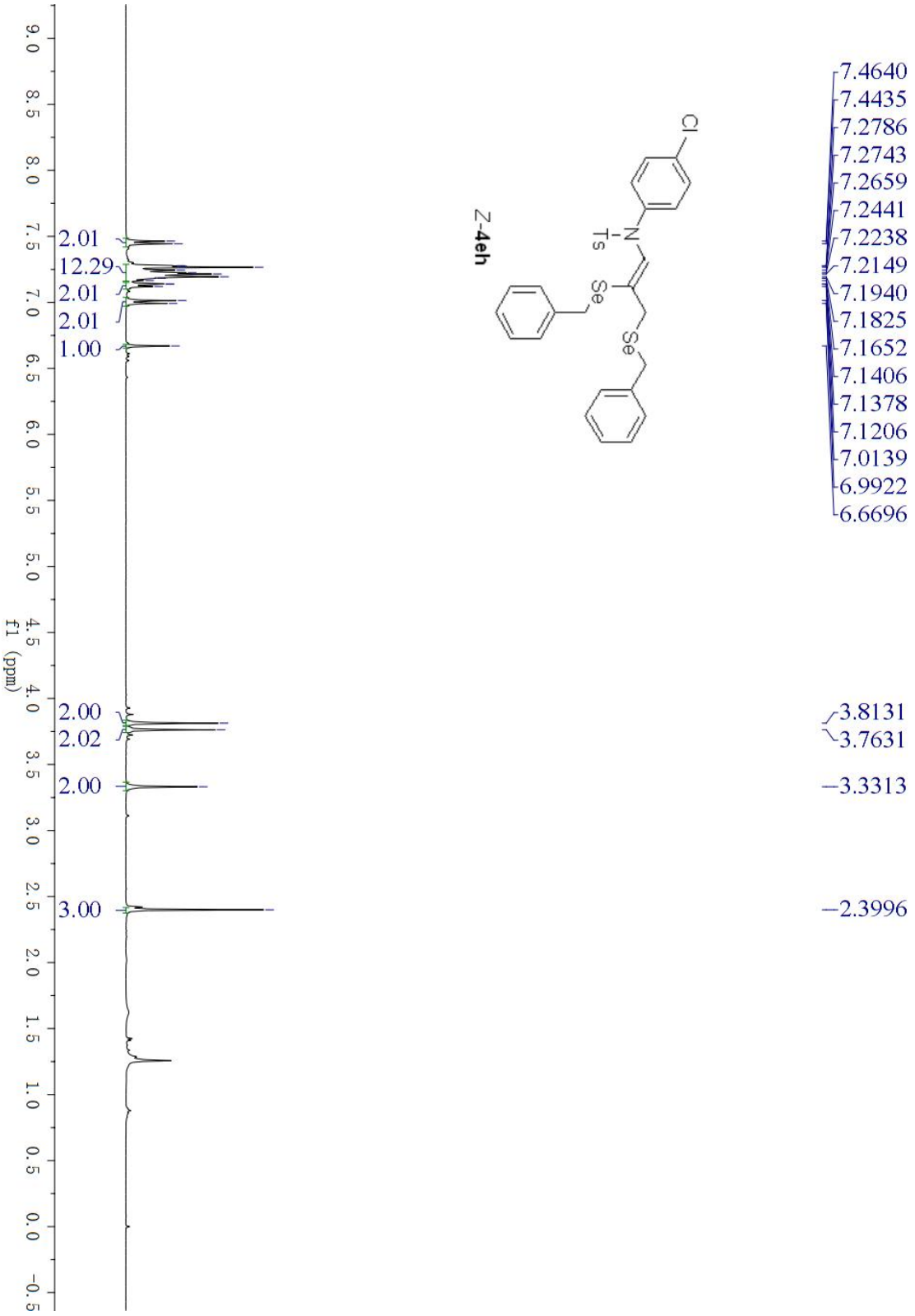
129.1122
128.9001
128.6758
128.6390
128.6233
128.1667
127.7340
77.3393
77.0214
76.7038
30.4250
29.6852
21.5929
21.2826
f1 (ppm)
E-4eg
Cl
N
Ts
Se
Se
Me
Me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Cl
N
Ts
Se
Se
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7.2659
7.2441
7.2238
7.2149
7.1940
7.1825
7.1652
7.1406
7.1378
7.1206
7.0139
6.9922
6.6696
2.01
12.29
2.01
2.01
1.00
2.00
2.02
2.00
3.00
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3.7631
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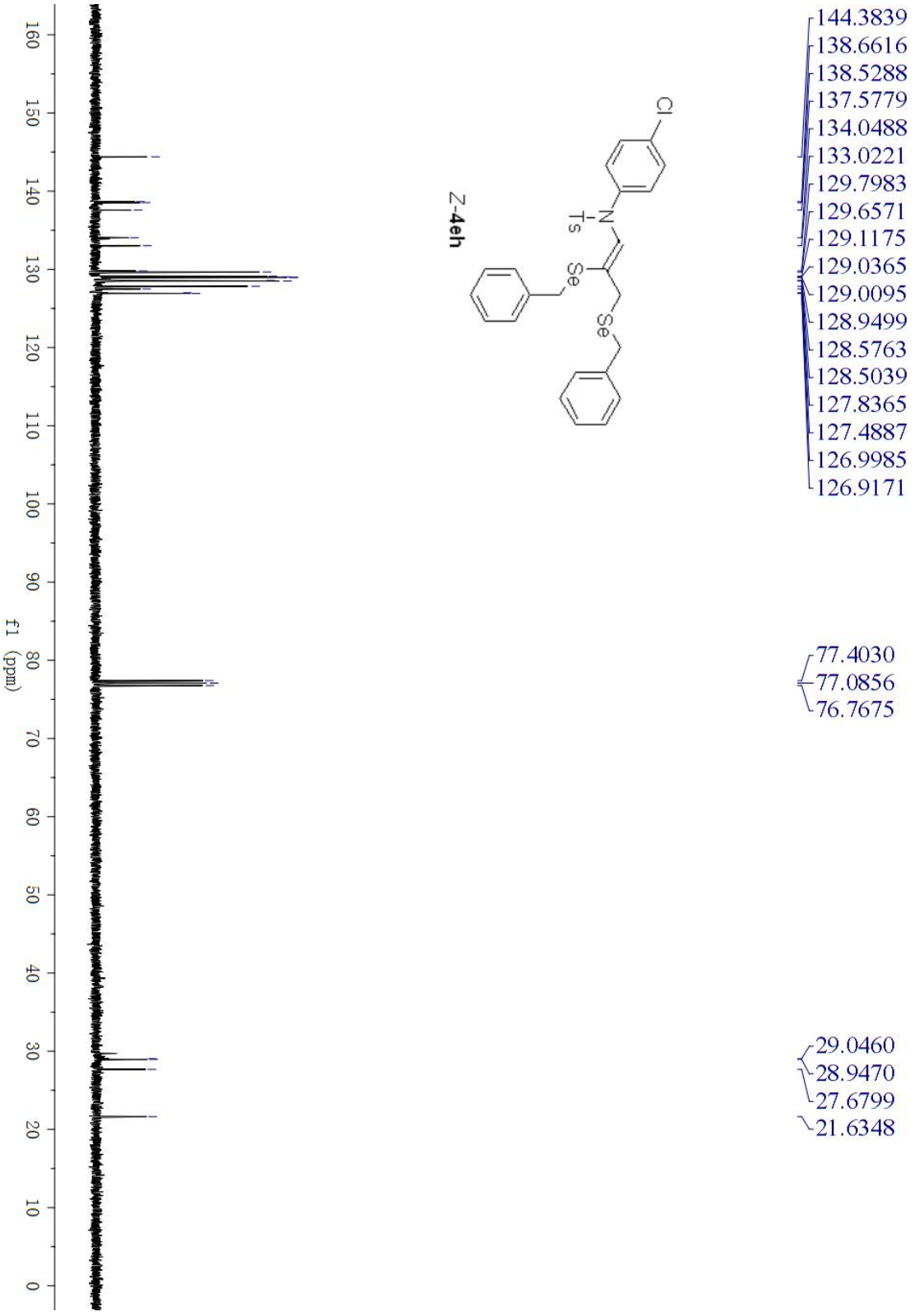
2.3996
f1 (ppm)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Cl
N
Ts
Se
Se
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138.5288
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134.0488
133.0221
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129.6571
129.1175
129.0365
129.0095
128.9499
128.5763
128.5039
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127.4887
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28.9470
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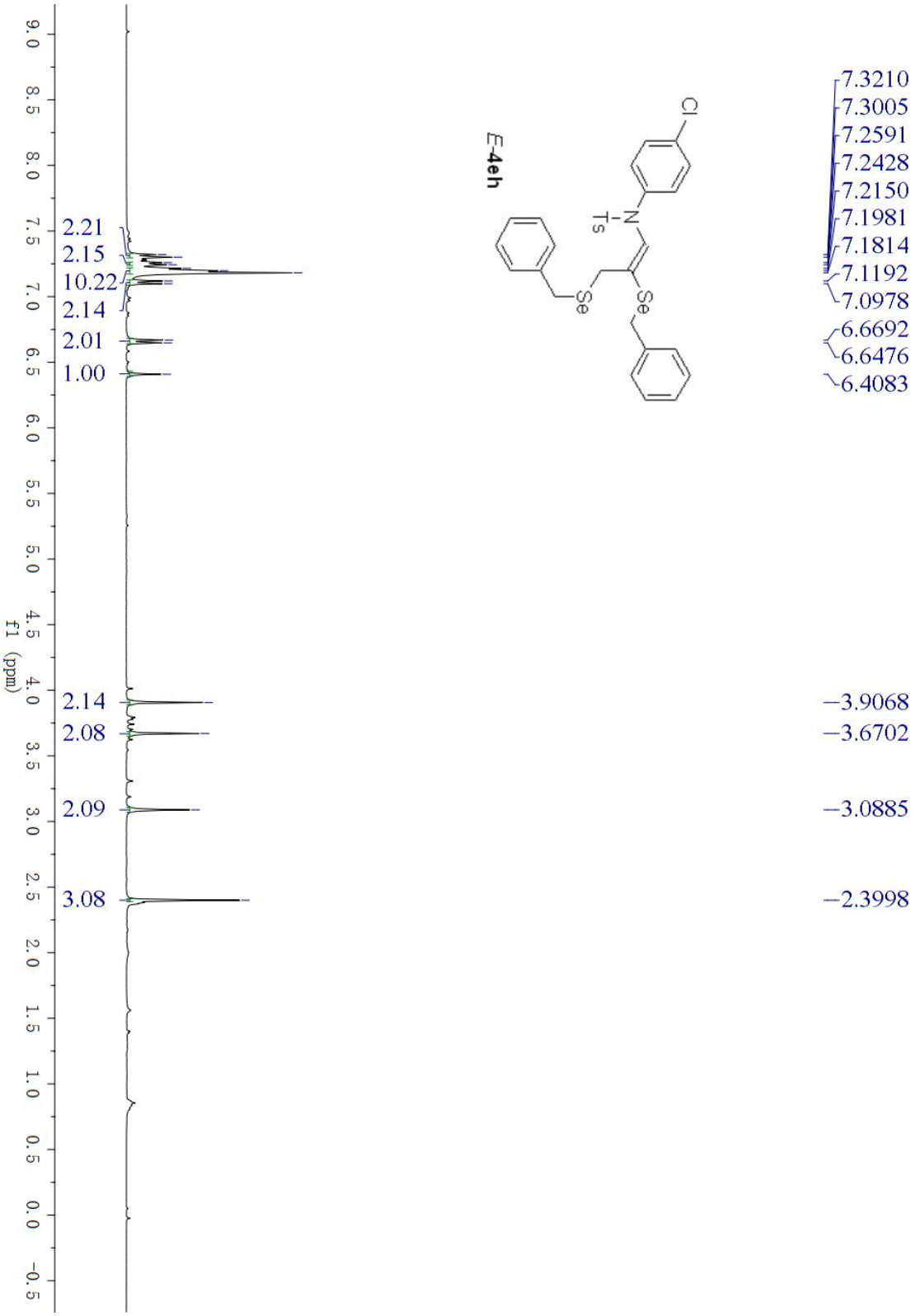
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Ts
Se
Se
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7.1814
7.1192
7.0978
6.6692
6.6476
6.4083
2.21
2.15
10.22
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2.09
3.08
3.9068
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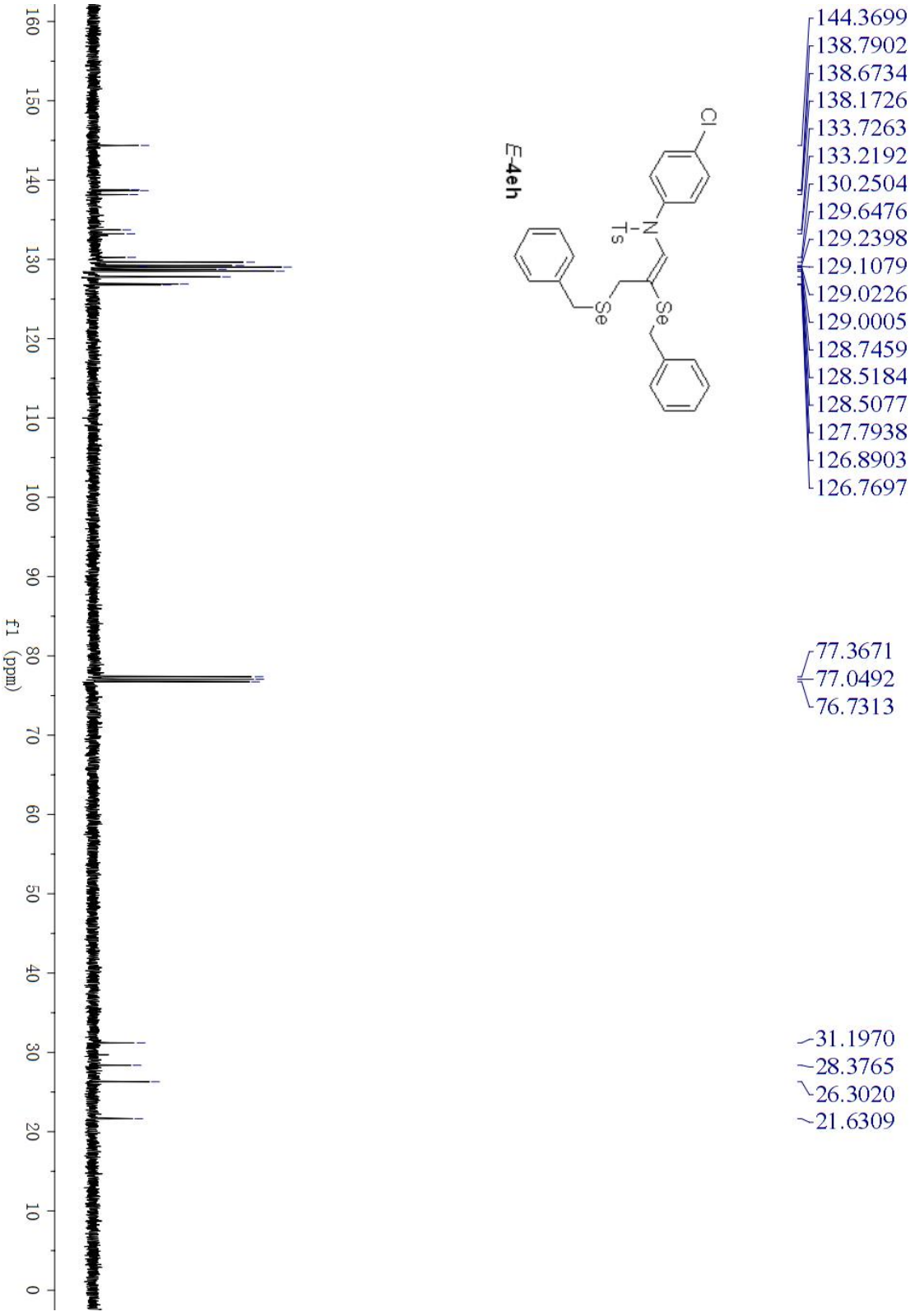
2.3998
f1 (ppm)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Se
Se
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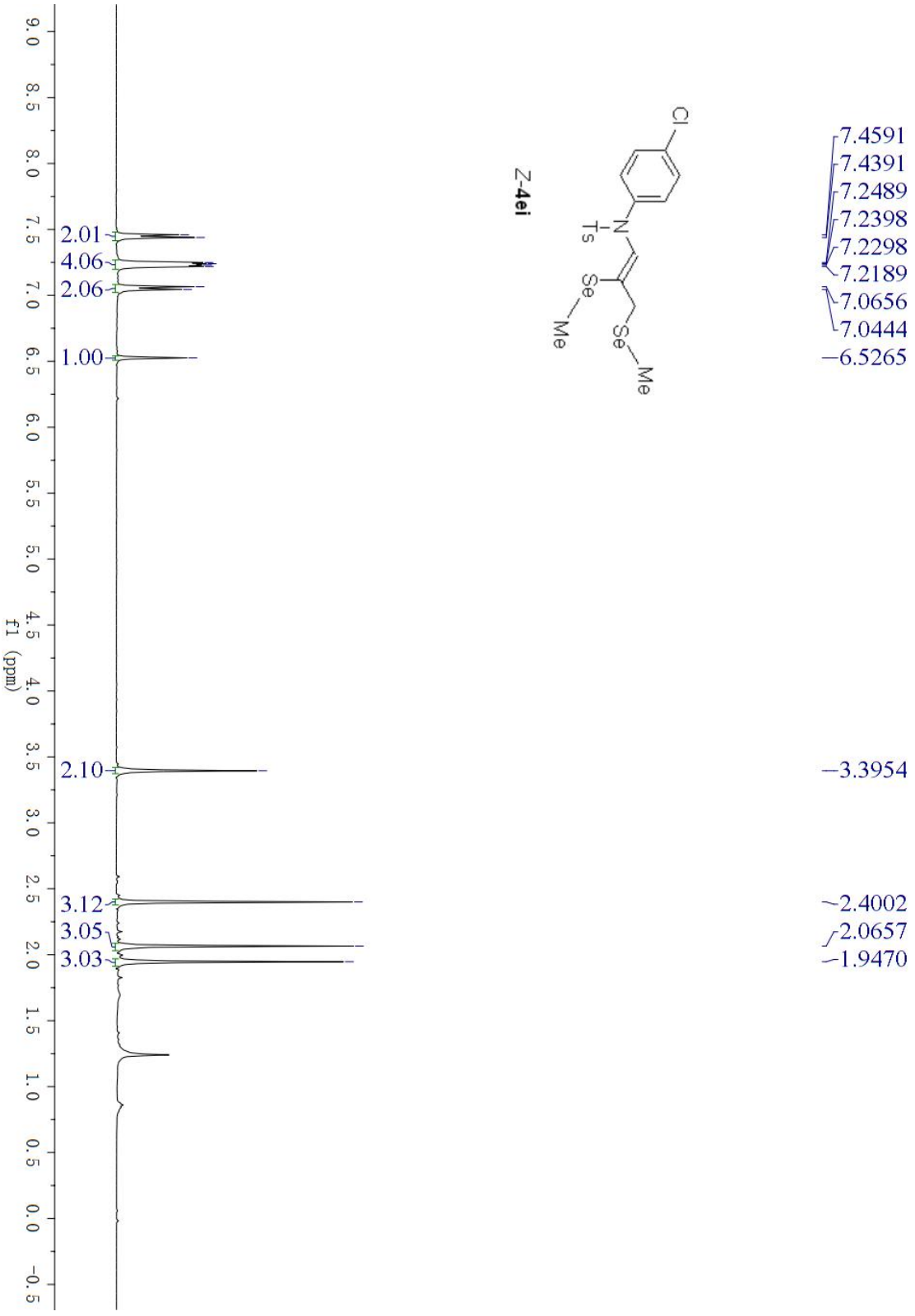
f1 (ppm)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Ts
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Se
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1.00
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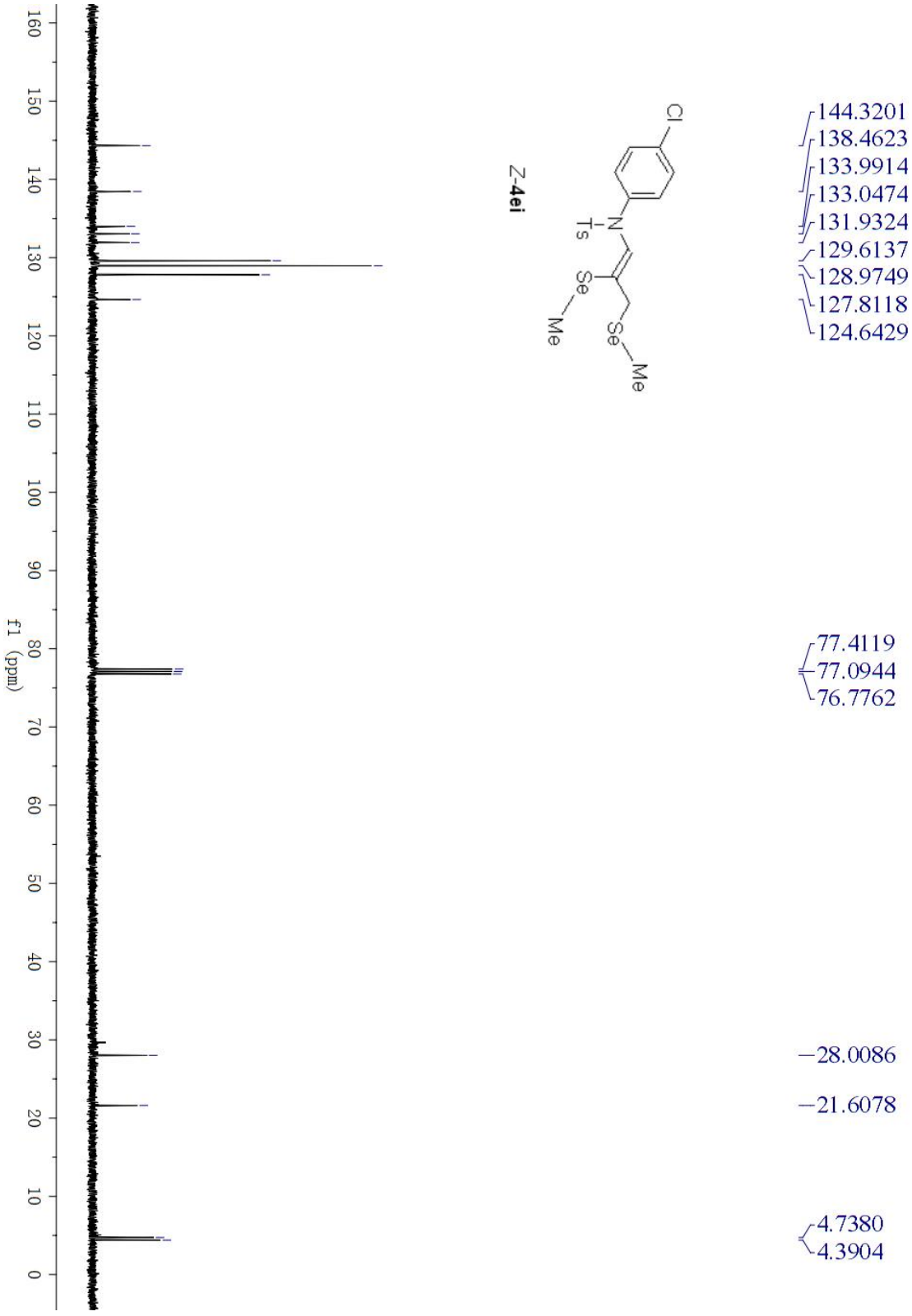
3.03
f1 (ppm)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Ts
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Me
Se
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133.0474
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128.9749
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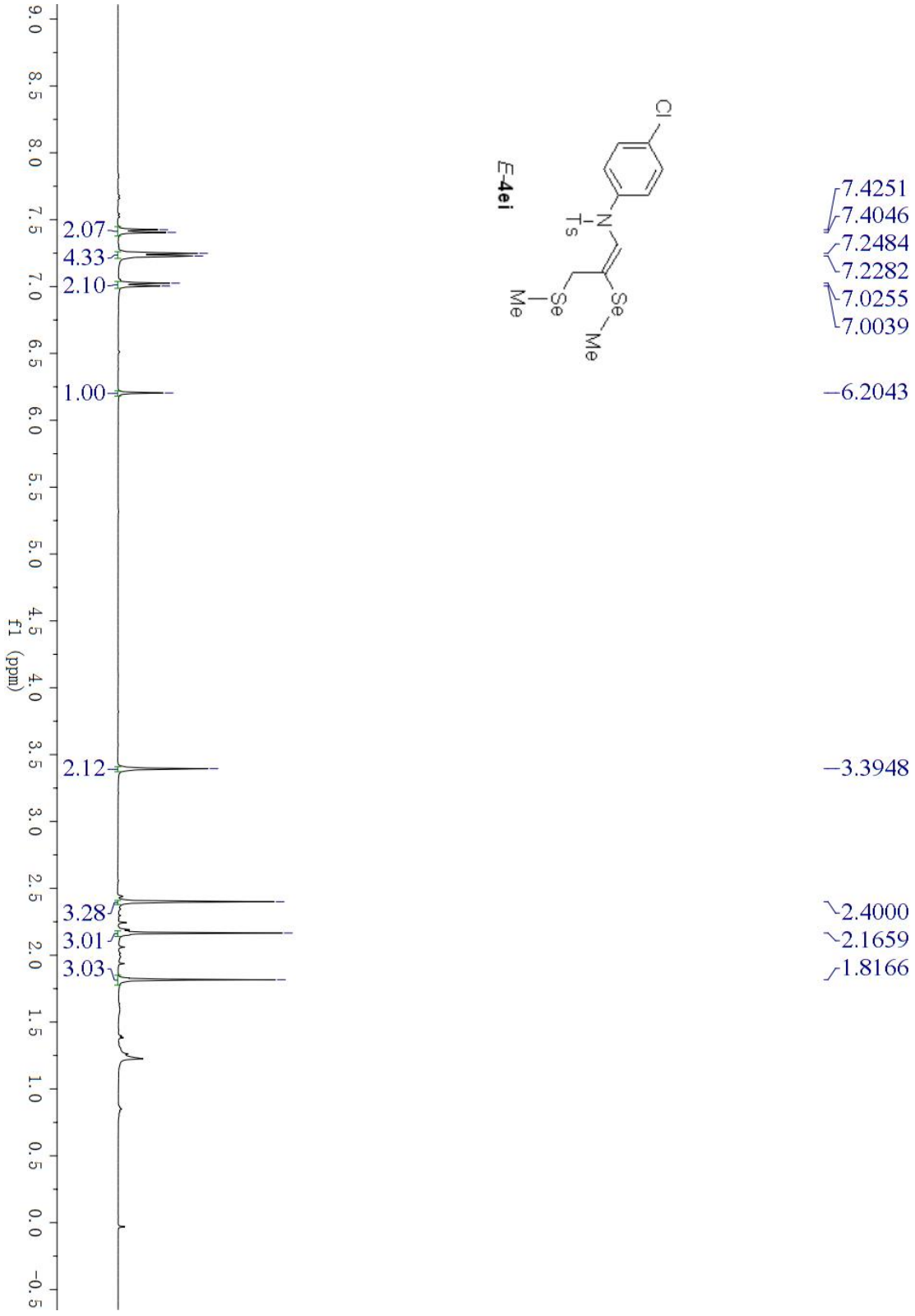
76.7762
28.0086
21.6078
4.7380
4.3904
f1 (ppm)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Ts
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Me
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1.00
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3.28
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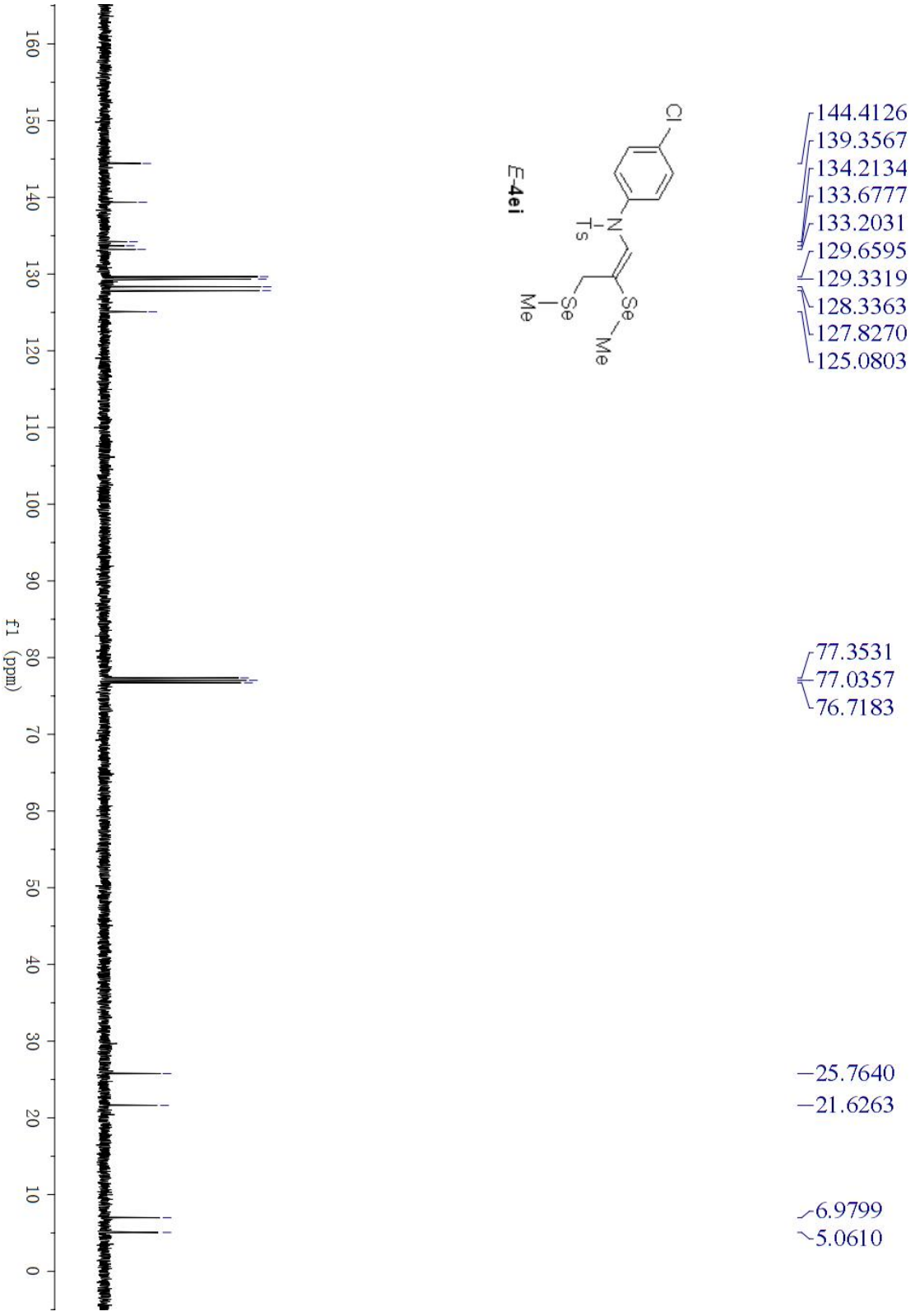
3.03
f1 (ppm)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128.3363
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77.0357
76.7183
25.7640
21.6263
6.9799
5.0610
f1 (ppm)