Supporting Information for

Disulfonation of Terminal Alkynes for 1,2- Bisulfonylethenes

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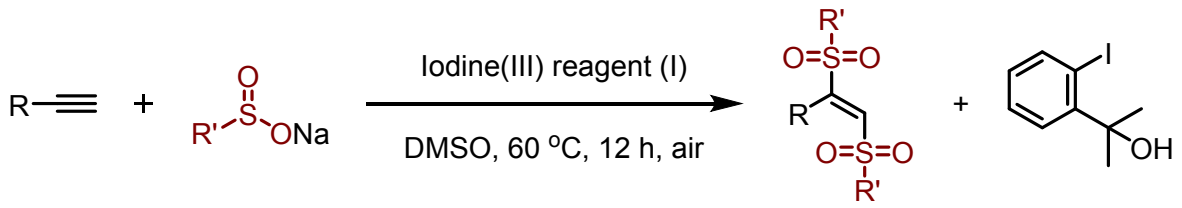
Contents

I. General information.

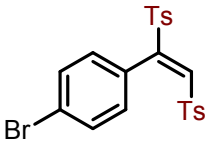
All reagents were purchased from commercial sources and used without treatment, unless otherwise indicated. The products were purified by column chromatography over silica gel. NMR spectra were recorded on a Bruker Avance 600 (^{1}H: 600 MHz, ^{13}C:150 MHz) and Bruker Avance 500 (^{1}H: 500 MHz, ^{13}C: 125 MHz) at ambient temperature. Data were reported as chemical shifts in ppm relative to TMS (0.00 ppm) for ^{1}H and $CDCl_3$ (77.0 ppm) for ^{13}C. The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad. Mass spectra were recorded on BRUKER AutoflexIII Smartbeam MS-spectrometer. High-resolution mass spectra (HRMS) were recorded on Bruck microTof by using ESI method.

II. General procedures for Synthesis of 1,2-Disulfonylethenes.



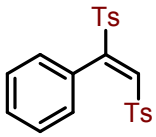
To a solution of substrate (0.3 mmol), Sodium sulfinate (1.2 mmol) in DMSO (4 mL) at 60 °C was added iodine(III) reagent (I) (356 mg, 1.2 mmol). Then the mixture was stirred until (12 h) the complete consumption of substrate as indicated by TLC. The resulting mixture was concentrated and taken up by dichloromethane (3 × 30 mL). The organic layer was washed with brine (3 × 40 mL), dried over Na_2SO_4 and concentrated. The residue was purified by a silica gel column chromatography (petroleum ether/ethyl acetate) and the target product was afforded.

III. Characterization of products.

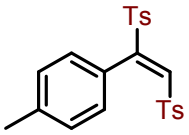


(3aa)[1] Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1aa** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (140.0 mg, 95%).

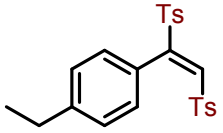
mp: 201-202 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.48 (d, *J* = 8.4 Hz, 2H), 7.39(d, *J* = 8.4 Hz, 2H), 7.35 (d, *J* = 8.4 Hz, 2H), 7.25 - 7.22 (m, 4H), 6.81 (d, *J* = 8.4 Hz, 2H), 2.44 (s, 3H), 2.42 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.4, 146.0, 145.7, 138.0, 136.0, 133.0, 131.7, 131.0, 129.94, 129.91, 129.1, 128.2, 126.0, 125.0, 21.74, 21.71. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}BrNaO_4S_2$ $[M+Na]^+$ 512.9800, found 512.9781.



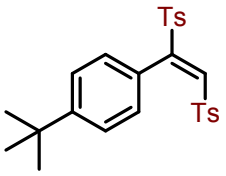
(3ab)[1] Prepared following the genernal procedure showed above using phenylacetylene (**1ab** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (75.5 mg, 61%). mp: 156-157 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.45 (d, *J* = 8.0 Hz, 2H), 7.38 - 7.34 (m, 3H), 7.22 - 7.17 (m, 6H), 6.92 (d, *J* = 7.5 Hz, 2H), 2.41 (s, 3H), 2.39 (s, 3H); **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.7, 145.7, 145.4, 137.5, 136.3, 133.2, 130.2, 130.0, 129.79, 129.70, 129.2, 128.2, 127.7, 127.0, 21.69, 21.65. **HRMS** (ESI) m/z calcd. for $C_{22}H_{22}NaO_4S_2$ $[M+Na]^+$ 435.0695, found 435.0690.



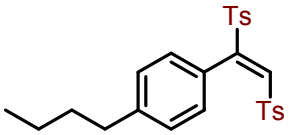
(3ac)[1] Prepared following the genernal procedure showed above using 4-ethynyltoluene (**1ac** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (83.2 mg, 65%). mp: 181-182 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.71 (s, 1H), 7.47 (d, *J* = 8.4 Hz, 2H), 7.38 (d, *J* = 8.4 Hz, 2H), 7.23 - 7.17 (m, 4H), 7.01 (d, *J* = 7.8 Hz, 2H), 6.83 (d, *J* = 7.8 Hz, 2H), 2.41 (s, 3H), 2.39 (s, 3H), 2.34 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.8, 145.5, 145.3, 140.3, 137.3, 136.4, 133.3, 130.0, 129.73, 129.67, 129.1, 128.4, 128.2, 123.9, 21.7, 21.64, 21.4. **HRMS** (ESI) m/z calcd. for $C_{23}H_{22}NaO_4S_2$ $[M+Na]^+$ 449.0852, found 449.0854.



(3ad)[1] Prepared following the genernal procedure showed above using 4-ethylphenylacetylene (**1ad** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (100.4 mg, 76%). mp: 155-156 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.73 (s, 1H), 7.43 (d, *J* = 8.4 Hz, 2H), 7.37 (d, *J* = 8.4 Hz, 2H), 7.20 - 7.15 (m, 4H), 7.01 (d, *J* = 7.8 Hz, 2H), 6.82 (d, *J* = 8.4 Hz, 2H), 2.63 (q, *J* = 7.8 Hz, 2H), 2.40 (s, 3H), 2.39 (s, 3H), 1.23 (t, J = 7.8 Hz, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.9, 146.5, 145.5, 145.2, 137.6, 136.3, 133.3, 130.1, 129.7, 129.1, 128.2, 127.2, 124.1, 28.7, 21.67, 21.62, 15.3. **HRMS** (ESI) m/z calcd. for $C_{24}H_{24}NaO_4S_2$ $[M+Na]^+$ 463.1008, found 463.1013.

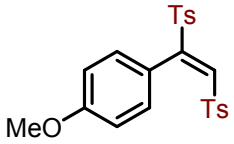


(3ae)[1] Prepared following the genernal procedure showed above using 4-tert-butylphenylacetylene (**1ae** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (111.1 mg, 79%). mp: 105-106 °C. **^{1}H NMR** (600 MHz, CDCl3) δ 7.75 (s, 1H), 7.39 - 7.35 (m, 4H), 7.19 - 7.15 (m, 4H), 7.12 (d, J = 7.8 Hz, 2H), 6.80 (d, J = 8.4 Hz, 2H), 2.39 (s, 3H), 2.37 (s, 3H), 1.29 (s, 9H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 153.3, 153.0, 145.5, 145.0, 137.8, 136.1, 133.3, 129.8, 129.58, 129.51, 129.1, 128.1, 124.6, 123.8, 34.7, 31.1, 21.64, 21.58. **HRMS** (ESI) m/z calcd. for $C_{26}H_{28}NaO_4S_2$ $[M+Na]^+$ 491.1321, found 491.1306.

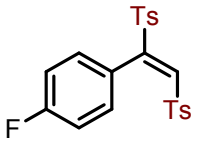


(3af)[1] Prepared following the genernal procedure showed above using 1-butyl-4-eth-1-ynylbenzene (**1af** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (104.0 mg, 74%). mp: 106-107 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.73 (s, 1H), 7.43 (d, *J* = 7.8 Hz, 2H), 7.36 (d, *J* = 8.4 Hz, 2H), 7.18 - 7.16 (m, 4H), 6.99 (d, *J* = 7.8 Hz, 2H), 6.82 (d, *J* = 8.4 Hz, 2H), 2.58 (t, *J* = 7.8 Hz, 2H), 2.40 (s, 3H), 2.39 (s, 3H), 1.61 - 1.55 (m, 2H), 1.38 - 1.31 (m, 2H), 0.95 (t, *J* = 7.2 Hz, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 153.0, 145.5, 145.21, 145.17, 137.5, 136.4,

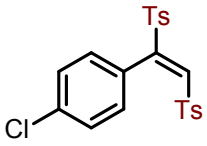
133.3, 130.1, 129.66, 129.62, 129.1, 128.2, 127.8, 124.1, 35.4, 33.3, 22.2, 21.68, 21.65, 13.9. **HRMS** (ESI) m/z calcd. for $C_{26}H_{28}NaO_4S_2$ $[M+Na]^+$ 491.1321, found 491.1330.



(3ag)[1] Prepared following the genernal procedure showed above using 4-methoxyphenylacetylene (**1ag** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (90.2 mg, 68%). mp: 148-149 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.72 (s, 1H), 7.47 (d, *J* = 7.8 Hz, 2H), 7.39 (d, *J* = 8.4 Hz, 2H), 7.23 - 7.18 (m, 4H), 6.92 (d, *J* = 9.0 Hz, 2H), 6.73 (d, *J* = 9.0 Hz, 2H), 3.81 (s, 3H), 2.42 (s, 3H), 2.39 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 161.1, 152.6, 145.5, 145.3, 137.3, 136.4, 133.5, 131.8, 129.74, 129.71, 129.1, 128.1, 118.8, 113.3, 55.2, 21.69, 21.66. **HRMS** (ESI) m/z calcd. for $C_{23}H_{22}NaO_5S_2$ $[M+Na]^+$ 465.0801, found 465.0777.

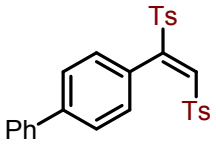


(3ah)[1] Prepared following the genernal procedure showed above using 4-fluorophenylacetylene (**1ah** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (94.3 mg, 73%). mp: 170-171 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.48 (d, *J* = 8.0 Hz, 2H), 7.38 (d, *J* = 8.0 Hz, 2H), 7.25 - 7.20 (m, 4H), 6.97 - 6.89 (m, 4H), 2.42 (s, 3H), 2.40 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 163.7 (d, *J* = 252.0 Hz), 151.7, 145.9, 145.6, 137.9, 136.2, 133.0, 132.3 (d, *J* = 9.0 Hz), 129.87, 129.82, 129.1, 128.1, 122.9 (d, *J* = 3.5 Hz), 115.1 (d, *J* = 21.8 Hz), 21.68, 21.65. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}FNaO_4S_2$ $[M+Na]^+$ 453.0601, found 453.0591.

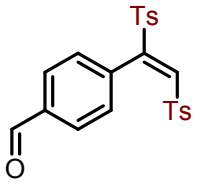


(3ai)[1] Prepared following the genernal procedure showed above using 4-chlorophenylacetylene (**1ai** 0.3 mmol). The desired product was purified by a silica gel

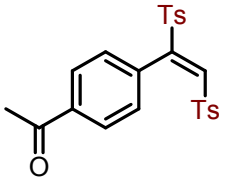
column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (123.4 mg, 92%). mp: 186-187 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.49 (d, *J* = 8.0 Hz, 2H), 7.39 (d, *J* = 8.0 Hz, 2H), 7.26 - 7.19 (m, 6H), 6.88 (d, *J* = 8.5 Hz, 2H), 2.44 (s, 3H), 2.41 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.4, 146.0, 145.7, 138.0, 136.6, 136.1, 133.0, 131.5, 129.93, 129.89, 129.1, 128.18, 128.13, 125.5, 21.73, 21.70. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}ClNaO_4S_2$ $[M+Na]^+$ 469.0305, found 469.0285.



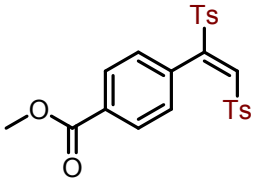
(3aj) Prepared following the genernal procedure showed above using 4-ethynyl-1,1'-biphenyl (**1aj** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (117.3 mg, 80%). mp: 165-166 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.78 (s, 1H), 7.58 (d, *J* = 7.5 Hz, 2H), 7.49 - 7.46 (m, 3H), 7.46 - 7.37 (m, 6H), 7.22 - 7.17 (m, 4H), 6.99 (d, *J* = 8.0 Hz, 2H), 2.39 (s, 6H); **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.5, 145.7, 145.4, 142.7, 139.8, 137.8, 136.3, 133.2, 130.6, 129.76, 129.75, 129.2, 128.9, 128.2, 128.0, 127.0, 126.3, 125.8, 21.69, 21.66. **HRMS** (ESI) m/z calcd. for $C_{28}H_{24}NaO_4S_2$ $[M+Na]^+$ 511.1008, found 511.0998.



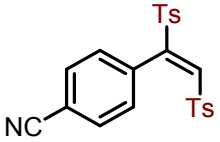
(3ak) Prepared following the genernal procedure showed above using 4-ethynylbenzaldehyde (**1ak** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (97.8 mg, 74%). mp: 168-169 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 10.03 (s, 1H), 7.76 - 7.74 (m, 3H), 7.53 (d, *J* = 8.5 Hz, 2H), 7.38 (d, *J* = 8.0 Hz, 2H), 7.27 (d, *J* = 8.0 Hz, 2H), 7.22 (d, *J* = 8.0 Hz, 2H), 7.14 (d, *J* = 8.0 Hz, 2H), 2.44 (s, 3H), 2.42 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 191.5, 151.4, 146.2, 146.0, 137.8, 136.9, 136.0, 133.3, 132.8, 130.9, 130.1, 130.0, 129.2, 128.7, 128.2, 21.75, 21.72. **HRMS** (ESI) m/z calcd. for $C_{23}H_{20}NaO_5S_2$ $[M+Na]^+$ 463.0644, found 463.0630.



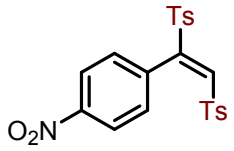
(3al)[1] Prepared following the genernal procedure showed above using 4-ethynyl acetophenone (**1al** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (105.0 mg, 77%). mp: 118-119 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.81 (d, *J* = 8.0 Hz, 2H), 7.74 (s, 1H), 7.52 (d, *J* = 8.0 Hz, 2H), 7.38 (d, *J* = 8.0 Hz, 2H), 7.25 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 7.5 Hz, 2H), 7.06 (d, *J* = 8.0 Hz, 2H), 2.60 (s, 3H), 2.43 (s, 3H), 2.40 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 197.2, 151.5, 146.0, 145.8, 137.8, 137.6, 136.0, 132.8, 131.9, 130.4, 130.0, 129.9, 129.1, 128.1, 127.4, 26.6, 21.68, 21.64. **HRMS** (ESI) m/z calcd. for $C_{24}H_{22}NaO_5S_2$ $[M+Na]^+$ 477.0801, found 477.0798.



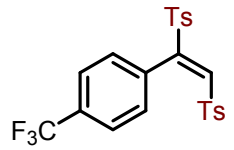
(3am) Prepared following the genernal procedure showed above using methyl 4-ethynylbenzoate (**1am** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (125.6 mg, 89%). mp: 145-146 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.88 (d, *J* = 8.4 Hz, 2H), 7.75 (s, 1H), 7.49 (d, *J* = 8.4 Hz, 2H), 7.37 (d, *J* = 8.4 Hz, 2H), 7.24 (d, *J* = 7.8 Hz, 2H), 7.20 (d, *J* = 7.8 Hz, 2H), 7.01 (d, *J* = 8.4 Hz, 2H), 3.94 (s, 3H), 2.43 (s, 3H), 2.40 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 166.3, 151.7, 146.0, 145.8, 137.8, 136.1, 132.9, 131.7, 131.4, 130.2, 130.0, 129.9, 129.2, 128.8, 128.2, 52.4, 21.7, 21.6. **HRMS** (ESI) m/z calcd. for $C_{24}H_{22}NaO_6S_2$ $[M+Na]^+$ 493.0750, found 493.0748.



(3an) Prepared following the genernal procedure showed above using 4-ethynylbenzonitrile (**1an** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (101.1 mg, 77%). mp: 190-191 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.53 (d, *J* = 8.0 Hz, 4H), 7.38 (d, *J* = 8.5 Hz, 2H), 7.30 (d, *J* = 8.5 Hz, 2H), 7.24 (d, *J* = 8.0 Hz, 2H), 7.10 (d, *J* = 8.0 Hz, 2H), 2.46 (s, 3H), 2.43 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 150.6, 146.4, 146.1, 138.0, 135.9, 132.6, 132.7, 131.4, 130.8, 130.9, 130.2, 129.1, 128.2, 117.9, 113.9, 21.76, 21.74. **HRMS** (ESI) m/z calcd. for $C_{23}H_{19}NNaO_4S_2$ $[M+Na]^+$ 460.0648, found 460.0649.

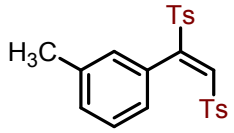


(3ao) Prepared following the genernal procedure showed above using 1-ethynyl-4-nitrobenzene (**1ao** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (116.7 mg, 85%). mp: 243-244 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.10 (d, *J* = 9.0 Hz, 2H), 7.75 (s, 1H), 7.55 (d, *J* = 8.0 Hz, 2H), 7.39 (d, *J* = 8.0 Hz, 2H), 7.30 (d, *J* = 8.0 Hz, 2H), 7.24 (d, *J* = 8.5 Hz, 2H), 7.16 (d, *J* = 9.0 Hz, 2H), 2.45 (s, 3H), 2.43 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 150.4, 148.7, 146.5, 146.2, 138.2, 135.8, 134.0, 132.6, 131.3, 130.2, 130.1, 129.1, 128.2, 122.8, 21.77, 21.73. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}NNaO_6S_2$ $[M+Na]^+$ 480.0546, found 480.0526.

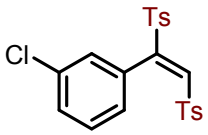


(3ap) Prepared following the genernal procedure showed above using 1-ethynyl-4-(trifluoromethyl)benzene (**1ap** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (125.4 mg, 87%). mp: 179-180 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.78 (s, 1H), 7.46 (d, *J* = 7.8 Hz, 4H), 7.38 (d, *J* = 7.8 Hz, 2H), 7.24 - 7.20 (m, 4H), 7.03 (d, *J* = 7.8 Hz, 2H), 2.41 (s, 6H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.0, 146.2, 145.8, 138.4, 135.8, 132.8, 131.8 (q, *J* = 31.5 Hz), 130.9,

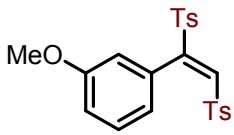
130.6, 130.0, 129.1, 128.2, 124.6 (q, J = 3.6 Hz), 123.5 (d, J = 271.5 Hz), 21.7, 21.6. **HRMS** (ESI) m/z calcd. for $C_{23}H_{19}F_3NaO_4S_2$ $[M+Na]^+$ 503.0569, found 503.0572.



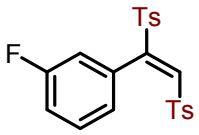
(3aq)[1] Prepared following the genernal procedure showed above using 3-methylphenylacetylene (**1aq** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (94.7 mg, 74%). mp: 117-118 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.42 (d, J = 8.0 Hz, 2H), 7.38 (d, J = 8.0 Hz, 2H), 7.22 - 7.16 (m, 4H), 7.14 (d, J = 7.5 Hz, 1H), 7.07 (t, J = 7.5 Hz, 1H), 6.67 - 6.62 (m, 2H), 2.41 (s, 3H), 2.40 (s, 3H), 2.19 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 153.0, 145.6, 145.2, 137.6, 137.4, 136.3, 133.2, 130.7, 130.4, 129.6, 129.2, 128.2, 127.6, 127.4, 126.8, 21.66, 21.61, 21.1. **HRMS** (ESI) m/z calcd. for $C_{23}H_{22}NaO_4S_2$ $[M+Na]^+$ 449.0852, found 449.0833.



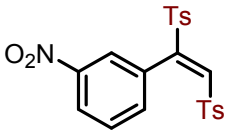
(3ar)[1] Prepared following the genernal procedure showed above using 3-chlorophenylacetylene (**1ar** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (104.6 mg, 78%). mp: 173-174 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.76 (s, 1H), 7.44 (d, J = 8.4 Hz, 2H), 7.39 (d, J = 8.4 Hz, 2H), 7.32 (d, J = 8.4 Hz, 1H), 7.24 - 7.22 (m, 4H), 7.14 (t, J = 7.8 Hz, 1H), 6.79 - 6.76 (m, 2H), 2.43 (s, 3H), 2.42 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.2, 146.1, 145.8, 138.4, 135.9, 133.9, 132.7, 130.1, 129.9, 129.6, 129.2, 129.0, 128.63, 128.60, 128.2, 21.72, 21.69. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}ClNaO_4S_2$ $[M+Na]^+$ 469.0305, found 469.0302.



(3as) Prepared following the genernal procedure showed above using 1-ethynyl-3-methoxybenzene (**1as** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (106.2 mg, 80%). mp: 108-109 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.43 (d, *J* = 8.5 Hz, 2H), 7.40 (d, *J* = 8.5 Hz, 2H), 7.21 - 7.17 (m, 4H), 7.08 (t, *J* = 7.5 Hz, 1H), 6.90 - 6.84 (m, 1H), 6.45 (d, *J* = 7.5 Hz, 1H), 6.38 - 6.29 (m, 1H), 3.63 (s, 3H), 2.40 (s, 3H), 2.39 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 158.7, 152.4, 145.7, 145.2, 137.8, 136.2, 133.1, 129.67, 129.65, 129.2, 128.8, 128.2, 128.0, 122.8, 116.4, 114.6, 55.1, 21.7, 21.6. **HRMS** (ESI) m/z calcd. for $C_{23}H_{22}NaO_5S_2$ $[M+Na]^+$ 465.0801, found 465.0783.

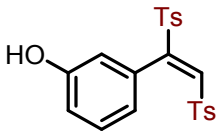


(3at)[1] Prepared following the genernal procedure showed above using 3-fluorophenylacetylene (**1at** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (107.2 mg, 83%). mp: 164-165 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.49 (d, *J* = 8.0 Hz, 2H), 7.39 (d, *J* = 8.0 Hz, 2H), 7.25 - 7.20 (m, 4H), 7.20 - 7.16 (m, 1H), 7.08 - 7.04 (m, 1H), 6.71 (d, *J* = 8.0 Hz, 1H), 6.63 - 6.61 (m, 1H), 2.43 (s, 3H), 2.41 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 161.7 (d, *J* = 248.0 Hz), 151.2, 146.0, 145.7, 138.0, 136.0, 132.9, 129.8 (d, *J* = 7.5 Hz), 129.4 (d, *J* = 7.5 Hz), 129.1, 128.8 (d, *J* = 9.0 Hz), 128.2, 126.3 (d, *J* = 3.0 Hz), 117.1 (d, *J* = 6.0 Hz), 117.0 (d, *J* = 3.6 Hz), 21.71, 21.65. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}FNaO_4S_2$ $[M+Na]^+$ 453.0589, found 453.0601.

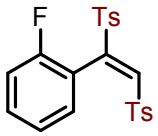


(3au) Prepared following the genernal procedure showed above using 1-ethynyl-3-nitrobenzene (**1au** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (116.7 mg, 85%). mp: 195-196 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.23 (dd, *J* = 8.4, 1.2 Hz, 1H), 7.79 (s, 1H), 7.60 (s, 1H), 7.50 (d, *J* = 8.4 Hz, 2H), 7.47 (t, *J* = 7.8 Hz, 1H), 7.40 (d, *J* = 7.8 Hz, 2H), 7.33 (d, *J*

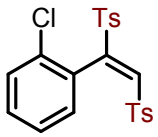
= 7.2 Hz, 1H), 7.28 - 7.24 (m, 4H), 2.42 (s, 6H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 150.1, 147.4, 146.5, 146.2, 138.7, 136.1, 135.8, 132.4, 130.17, 130.12, 129.2, 129.0, 128.1, 124.78, 124.70, 21.7, 21.6. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}NNaO_6S_2$ $[M+Na]^+$ 480.0546, found 480.0538.



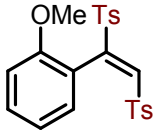
(3av) Prepared following the genernal procedure showed above using 3-ethynylphenol (**1av** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (102.8 mg, 80%). mp: 71-72 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.73 (s, 1H), 7.47 (d, *J* = 8.0 Hz, 2H), 7.40 (d, *J* = 8.0 Hz, 2H), 7.21 - 7.19 (m, 4H), 7.02 (t, *J* = 7.5 Hz, 1H), 6.80 (d, *J* = 7.5 Hz, 1H), 6.42 - 6.38 (m, 2H), 5.76 (s, 1H), 2.40 (s, 3H), 2.38 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 155.3, 152.3, 145.8, 145.6, 137.5, 135.9, 132.9, 129.8, 129.8, 129.2, 129.1, 128.2, 127.9, 122.4, 117.4, 116.9, 21.68, 21.63. **HRMS** (ESI) m/z calcd. for $C_{22}H_{20}NaO_5S_2$ $[M+Na]^+$ 451.0644, found 451.064.



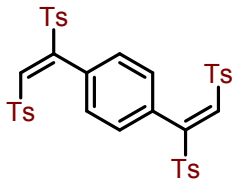
(3aw)[1] Prepared following the genernal procedure showed above using 2-fluorophenylacetylene (**1aw** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (77.5 mg, 60%). mp: 178-179 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.60 (d, *J* = 8.4 Hz, 2H), 7.41 (d, *J* = 8.4 Hz, 2H), 7.39 - 7.36 (m, 1H), 7.29 (d, *J* = 7.8 Hz, 2H), 7.21 (d, *J* = 8.4 Hz, 2H), 7.11 (t, *J* = 7.2 Hz, 1H), 7.07 - 7.05 (m, 1H), 6.88 (t, *J* = 9.0 Hz, 1H), 2.44 (s, 3H), 2.41 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 159.5 (d, *J* = 251.0 Hz), 146.5, 145.9, 145.8, 138.3, 135.9, 132.9, 132.3 (d, *J* = 8.0 Hz), 131.3, 130.1, 129.8, 129.2, 128.3, 123.6 (d, *J* = 3.6Hz), 115.3 (d, *J* = 16.0 Hz), 115.1 (d, *J* = 21.2 Hz), 21.73, 21.71. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}FNaO_4S_2$ $[M+Na]^+$ 453.0601, found 453.0586.



(3ax)[1] Prepared following the genernal procedure showed above using 2-chlorophenylacetylene (**1ax** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (105.9 mg, 79%). mp: 191-192 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.71 (s, 1H), 7.63 (d, *J* = 8.0 Hz, 2H), 7.39 (d, *J* = 8.0 Hz, 2H), 7.35 - 7.28 (m, 3H), 7.25 - 7.20 (m, 4H), 7.08 (d, *J* = 7.5 Hz, 1H), 2.43 (s, 3H), 2.41 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 149.1, 146.0, 145.8, 137.6, 135.7, 134.7, 132.9, 131.5, 131.2, 130.0, 129.7, 129.6, 129.1, 128.4, 126.5, 126.1, 21.71, 21.67. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}ClNaO_4S_2$ $[M+Na]^+$ 469.0305, found 469.0289.

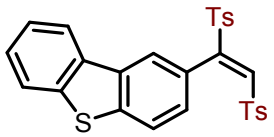


(3ay)[1] Prepared following the genernal procedure showed above using 2-methoxyphenylacetylene (**1ay** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (83.6 mg, 63%). mp: 200-201 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.71 (s, 1H), 7.53 (d, *J* = 8.5 Hz, 2H), 7.40 (d, *J* = 8.5 Hz, 2H), 7.34 - 7.30 (m, 1H), 7.23 (d, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 6.98 (d, *J* = 7.5 Hz, 1H), 6.89 (t, *J* = 7.5 Hz, 1H), 6.57 (d, *J* = 8.0 Hz, 1H), 3.24 (s, 3H), 2.42 (s, 3H), 2.39 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 156.9, 149.5, 145.2, 137.6, 136.3, 133.8, 131.7, 131.0, 129.6, 129.5, 129.2, 128.4, 119.9, 116.0, 109.9, 54.7, 21.65, 21.61. **HRMS** (ESI) m/z calcd. for $C_{23}H_{22}NaO_5S_2$ $[M+Na]^+$ 465.0784, found 465.0801.

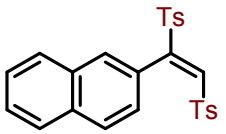


(3az) Prepared following the genernal procedure showed above using 1,4-diethynylbenzene (**1az** 0.15 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (81.8 mg, 73%). mp: 243-244 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.70 (s, 2H), 7.56 (d, *J* = 8.0 Hz, 4H), 7.37 (d, *J* = 8.5 Hz, 4H), 7.34 (d, *J* = 8.0 Hz, 4H), 7.22 (d, *J* = 8.0 Hz, 4H), 6.88 (s, 4H), 2.46 (s, 6H), 2.39 (s, 6H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.2, 146.0, 145.9, 137.3, 136.5, 132.7, 130.2, 129.9, 129.6,

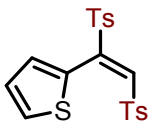
129.4, 129.2, 128.3, 21.75, 21.74. **HRMS** (ESI) m/z calcd. for $C_{38}H_{34}NaO_8S_4$ $[M+Na]^+$ 769.1029, found 769.1037.



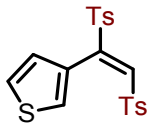
(3ba) Prepared following the genernal procedure showed above using 2-ethynyldibenzo[b,d]thiophene (**1ba** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (135.9 mg, 87%). mp: 218-219 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.90 - 7.86 (m, 3H), 7.64 (d, *J* = 8.0 Hz, 1H), 7.52 - 7.45 (m, 3H), 7.42 (d, *J* = 8.5 Hz, 2H), 7.32 (d, *J* = 8.0 Hz, 2H), 7.17 (d, *J* = 8.0 Hz, 2H), 6.93 - 6.89 (m, 3H), 2.37 (s, 3H), 1.98 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.3, 145.8, 145.4, 141.3, 139.5, 138.9, 135.9, 135.0, 134.7, 133.1, 129.8, 129.31, 129.26, 128.3, 128.1, 127.4, 124.7, 123.1, 123.0, 122.8, 122.1, 121.8, 21.6, 21.1. **HRMS** (ESI) m/z calcd. for $C_{28}H_{22}NaO_4S_3$ $[M+Na]^+$ 541.0572, found 541.0584.



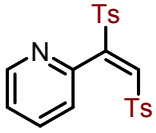
(3bb)[1] Prepared following the genernal procedure showed above using 2-ethynyl naphthalene (**1bb** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (83.2 mg, 84%). mp: 172-173 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.85 (s, 1H), 7.81 (d, *J* = 8.5 Hz, 1H), 7.64 (t, *J* = 9.0 Hz, 2H), 7.55 (t, *J* = 7.0 Hz, 1H), 7.51 - 7.48 (m, 1H), 7.39 - 7.35 (m, 5H), 7.15 (d, *J* = 8.0 Hz, 2H), 7.01 (d, *J* = 8.5 Hz, 2H), 6.95 - 6.93 (m, 1H), 2.37 (s, 3H), 2.29 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.6, 145.7, 145.3, 138.2, 136.1, 133.5, 133.3, 132.1, 130.4, 129.8, 129.6, 129.2, 128.4, 128.2, 127.7, 127.5, 127.4, 126.8, 126.6, 124.3, 21.7, 21.5. **HRMS** (ESI) m/z calcd. for $C_{26}H_{22}NaO_4S_2$ $[M+Na]^+$ 485.0852, found 485.0861.



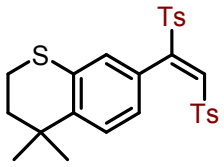
(3ba) Prepared following the genernal procedure showed above using 2-ethynyl thiophene (**1bc** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (85.4 mg, 68%). mp: 147-148 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.79 (s, 1H), 7.55 (d, *J* = 8.4 Hz, 2H), 7.48 - 7.46 (m, 3H), 7.24 (d, *J* = 8.4 Hz, 2H), 7.21 (d, *J* = 7.8 Hz, 2H), 7.08 (d, *J* = 3.6 Hz, 1H), 6.94 (dd, *J* = 4.8, 3.6 Hz, 1H), 2.41 (s, 3H), 2.38 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 146.7, 145.7, 145.4, 138.4, 136.0, 134.1, 133.3, 131.3, 129.8, 129.8, 128.9, 128.1, 126.8, 125.1, 21.66, 21.64. **HRMS** (ESI) m/z calcd. for $C_{20}H_{18}NaO_4S_3$ $[M+Na]^+$ 441.0259, found 441.0253.



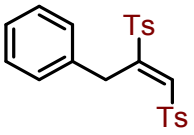
(3bd)[1] Prepared following the genernal procedure showed above using 3-ethynyl thiophene (**1bd** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (90.4 mg, 72%). mp: 135-136 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.48 (d, *J* = 8.0 Hz, 2H), 7.41 (d, *J* = 8.0 Hz, 2H), 7.25 (d, *J* = 2.0 Hz, 1H), 7.27 - 7.24 (m, 1H), 6.85 (dd, *J* = 6.0, 1.0 Hz, 1H), 2.41 (s, 3H), 2.39 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 148.5, 145.6, 145.4, 137.8, 136.2, 133.5, 129.9, 129.78, 129.74, 129.2, 128.8, 128.0, 126.1, 125.3, 21.66, 21.65. **HRMS** (ESI) m/z calcd. for $C_{20}H_{18}NaO_4S_3$ $[M+Na]^+$ 441.0259, found 441.0262.



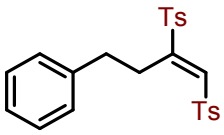
(3be) Prepared following the genernal procedure showed above using 2-ethynylpyridine (**1be** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (52.1 mg, 42%). mp: 158-159 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.50 (d, *J* = 4.2 Hz, 1H), 7.70 - 7.63 (m, 4H), 7.43 (d, *J* = 7.8 Hz, 2H), 7.33 - 7.27 (m, 4H), 7.22 (d, *J* = 8.4 Hz, 2H), 2.44 (s, 3H), 2.40 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 150.9, 149.3, 147.4, 145.8, 145.7, 137.3, 136.1, 135.8, 133.4, 130.1, 129.8, 129.2, 128.4, 126.1, 124.2, 21.7. **HRMS** (ESI) m/z calcd. for $C_{21}H_{19}NNaO_4S_2$ $[M+Na]^+$ 436.0648, found 436.0656.



(3bf) Prepared following the genernal procedure showed above using 7-ethynyl-4,4-dimethylthiochromane (**1bf** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (113.8 mg, 74%). mp: 122-123 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.43 - 7.36 (m, 4H), 7.20 - 7.16 (m, 4H), 6.86 (d, *J* = 8.0 Hz, 1H), 6.77 (d, *J* = 1.5 Hz, 1H), 6.60 (dd, *J* = 8.0, 1.5 Hz, 1H), 3.02 - 2.98 (m, 2H), 2.39 (s, 3H), 2.37 (s, 3H), 1.91 - 1.86 (m, 2H), 1.10 (s, 6H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.8, 145.4, 145.2, 141.1, 137.6, 136.3, 135.2, 133.4, 129.64, 129.59, 129.1, 128.8, 128.2, 127.1, 125.8, 122.1, 37.1, 32.7, 29.7, 23.1, 21.63, 21.58. **HRMS** (ESI) m/z calcd. for $C_{27}H_{28}NaO_4S_3$ $[M+Na]^+$ 535.1050, found 535.1042.

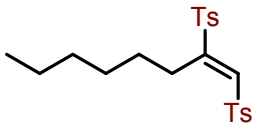


(3bg) Prepared following the genernal procedure showed above using prop-2-yn-1-ylbenzene (**1bg** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (55.0 mg, 44%). mp: 159-160 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.66 (d, *J* = 8.0 Hz, 2H), 7.58 (s, 1H), 7.44 (d, *J* = 8.5 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.12 - 7.06 (m, 5H), 7.03 (d, *J* = 7.0 Hz, 2H), 4.27 (s, 2H), 2.47 (s, 3H), 2.35 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 152.9, 145.9, 145.3, 137.3, 136.4, 134.76, 134.71, 130.3, 129.8, 129.0, 128.6, 128.3, 128.1, 126.5, 31.9, 21.7, 21.6. **HRMS** (ESI) m/z calcd. For $C_{23}H_{22}NaO_4S_2$ $[M+Na]^+$ 449.0852, found 449.0842.

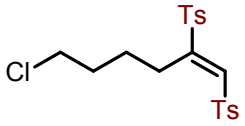


(3bh) Prepared following the genernal procedure showed above using but-3-yn-1-ylbenzene (**1bh** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (55.0 mg, 44%). mp: 133-134 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.0 Hz, 2H), 7.76 (d, *J* = 8.0 Hz, 2H), 7.42 (s, 1H),

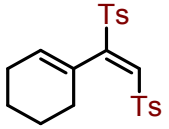
7.40 - 7.37 (m, 4H), 7.28 (t, J = 7.5 Hz, 2H), 7.22 - 7.17 (m, 3H), 2.99 - 2.95 (m, 2H), 2.75 - 2.71 (m, 2H), 2.47 (s, 3H), 2.45 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 153.3, 146.0, 145.8, 140.3, 136.6, 135.5, 134.0, 130.33, 130.30, 128.9, 128.5, 128.4, 127.9, 126.4, 35.9, 29.3, 21.7. **HRMS** (ESI) m/z calcd. For $C_{24}H_{24}NaO_4S_2$ $[M+Na]^+$ 463.1008, found 463.1006.



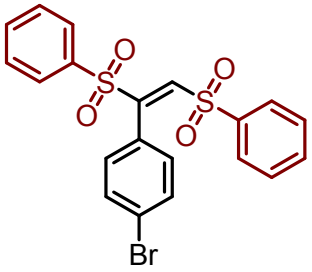
(3bi) Prepared following the genernal procedure showed above using oct-1-yne (**1bi** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (55.0 mg, 44%). mp: 112-113 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80 (d, J = 8.0 Hz, 2H), 7.72 (d, J = 8.0 Hz, 2H), 7.35 - 7.40 (m, 4H), 7.34 (s, 1H), 2.71 - 2.66 (m, 2H), 2.48 (s, 3H), 2.46 (s, 3H), 1.42 - 1.35 (m, 2H), 1.29 - 1.16 (m, 6H), 0.85 (t, J = 7.0 Hz, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 154.8, 145.8, 145.7, 136.9, 135.1, 134.3, 130.25, 130.21, 128.8, 127.9, 31.0, 29.7, 29.5, 26.9, 22.3, 21.69, 21.67, 13.9. **HRMS** (ESI) m/z calcd. For $C_{22}H_{28}NaO_4S_2$ $[M+Na]^+$ 443.1321, found 443.1328.



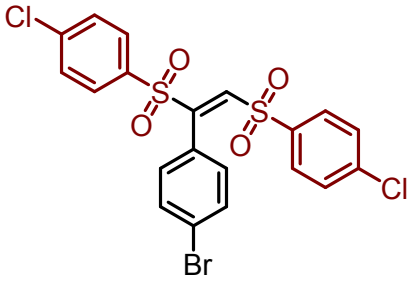
(3bj) Prepared following the genernal procedure showed above using 6-chlorohex-1-yne (**1bj** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (52.5 mg, 41%). mp: 153-154 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80 (d, J = 8.0 Hz, 2H), 7.72 (d, J = 8.0 Hz, 2H), 7.42 - 7.36 (m, 5H), 3.46 (t, J = 6.5 Hz, 2H), 2.78 - 2.70 (m, 2H), 2.48 (s, 3H), 2.46 (s, 3H), 1.80 - 1.72 (m, 2H), 1.60 - 1.51 (m, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 153.8, 146.0, 145.9, 136.6, 135.5, 134.0, 130.33, 130.31, 128.8, 127.9, 44.1, 32.4, 27.1, 26.0, 21.69, 21.68. **HRMS** (ESI) m/z calcd. For $C_{20}H_{23}ClNaO_4S_2$ $[M+Na]^+$ 449.0618, found 449.0604.



(3bk)[1] Prepared following the genernal procedure showed above using 1-ethynylcyclohex-1-ene (**1bk** 0.3 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (55.0 mg, 44%). mp: 145-146 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.75 (d, *J* = 8.0 Hz, 2H), 7.66 (d, *J* = 8.0 Hz, 2H), 7.38 - 7.31 (m, 5H), 5.32 - 5.28 (m, 1H), 2.46 (s, 3H), 2.45 (s, 3H), 1.97 - 1.90 (m, 4H), 1.54 - 1.47 (m, 4H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 155.1, 145.6, 145.5, 137.0, 135.4, 134.8, 133.5, 130.0, 129.7, 129.3, 128.2, 126.8, 28.8, 25.5, 22.1, 21.73, 21.69, 20.9. **HRMS** (ESI) m/z calcd. For $C_{22}H_{24}NaO_4S_2$ $[M+Na]^+$ 439.1008, found 439.0998.

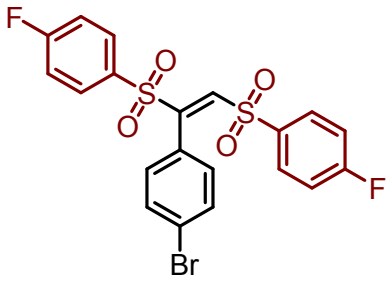


(4a) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), benzenesulfinic acid sodium (**2a** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (125.1 mg, 90%). mp: 192-193 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.79 (s, 1H), 7.65 - 7.60 (m, 4H), 7.52 (d, *J* = 7.5 Hz, 2H), 7.48 - 7.42 (m, 4H), 7.34 (d, *J* = 8.5 Hz, 2H), 6.80 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR** (125 MHz, CDCl3) δ 151.7, 139.0, 138.1, 135.9, 134.7, 134.4, 131.6, 131.2, 129.3, 129.3, 129.1, 128.1, 125.8, 125.1. **HRMS** (ESI) m/z calcd. for $C_{20}H_{15}BrNaO_4S_2$ $[M+Na]^+$ 484.9487, found 484.9477.

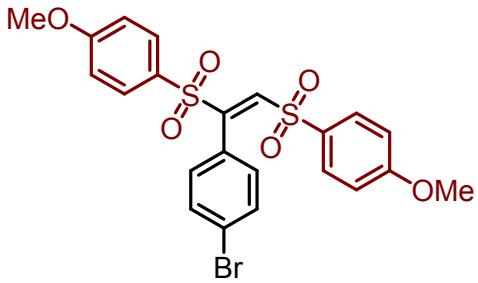


(4b) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium 4-chlorobenzenesulfinate (**2b** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl

acetate=15:1) as white solid (126.1 mg, 79%). mp: 212-213 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.76 (s, 1H), 7.53 (d, *J* = 8.5 Hz, 2H), 7.46 - 7.39 (m, 8H), 6.83 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.7, 141.8, 141.6, 138.2, 137.3, 134.3, 131.6, 131.4, 130.5, 129.71, 129.70, 129.6, 125.6, 125.4. **HRMS** (ESI) m/z calcd. for $C_{20}H_{13}BrCl_2NaO_4S_2$ $[M+Na]^+$ 552.8708, found 552.8679.

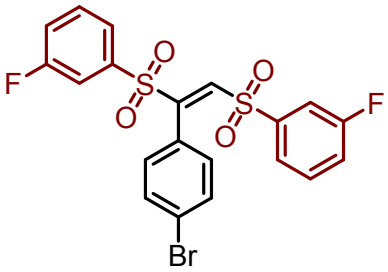


(4c) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium 4-fluorobenzenesulfinate (**2c** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (124.3 mg, 83%). mp: 176-177 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.77 (s, 1H), 7.64 - 7.60 (m, 2H), 7.55 - 7.52 (m, 2H), 7.40 (d, *J* = 8.5 Hz, 2H), 7.16 - 7.10 (m, 4H), 6.83 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 166.3 (d, *J* = 259.0 Hz), 166.2 (d, *J* = 258.6 Hz), 151.7, 138.1, 134.9 (d, *J* = 3.0 Hz), 132.0 (d, *J* = 10.5 Hz), 131.8 (d, *J* = 3.0 Hz), 131.6, 131.4, 131.1 (d, *J* = 10.5 Hz), 125.5, 125.4, 116.78 (d, *J* = 22.8 Hz), 116.73 (d, *J* = 22.8 Hz). **HRMS** (ESI) m/z calcd. for $C_{20}H_{13}BrF_2NaO_4S_2$ $[M+Na]^+$ 520.9299, found 520.9281.

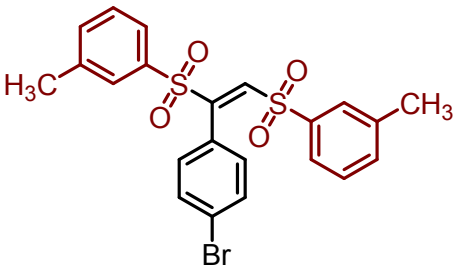


(4d) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium 4-methoxybenzenesulfinate (**2d** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (139.7 mg, 89%). mp: 188-189 °C. **^{1}H NMR** (500

MHz, $CDCl_3$) δ 7.73 (s, 1H), 7.50 (d, *J* = 8.5 Hz, 2H), 7.42 (d, *J* = 8.5 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 6.91 - 6.85 (m, 4H), 6.79 (d, *J* = 8.0 Hz, 2H), 3.87 (s, 3H), 3.85 (s, 3H). **^{13}C NMR** (125 MHz, CDCl3) δ 164.4, 164.3, 151.2, 137.9, 131.6, 131.4, 131.0, 130.4, 130.3, 127.1, 126.2, 124.8, 114.5, 55.78, 55.74. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}BrNaO_6S_2$ $[M+Na]^+$ 544.9699, found 544.9679.

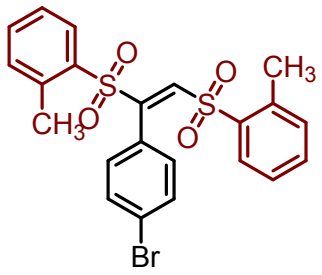


(4e) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium 3-fluorobenzenesulfinate (**2e** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (130.3 mg, 87%). mp: 156-157 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.78 (s, 1H), 7.50 - 7.43 (m, 3H), 7.40 (d, *J* = 8.5 Hz, 2H), 7.36 - 7.31 (m, 3H), 7.29 - 7.25 (m, 2H), 6.85 (d, *J* = 8.0 Hz, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 162.29 (d, *J* = 253.5 Hz), 162.24 (d, *J* = 254.0 Hz), 151.8, 140.7 (d, *J* = 6.0 Hz), 138.2, 137.8 (d, *J* = 6.0 Hz), 131.5, 131.4, 131.2 (d, *J* = 7.5 Hz), 131.1 (d, *J* = 7.5 Hz), 125.6, 125.3, 124.9 (d, *J* = 3.0 Hz), 124.0 (d, *J* = 3.0 Hz), 122.1 (d, *J* = 21.0 Hz), 121.8 (d, *J* = 21.0 Hz), 116.2 (d, *J* = 22.5 Hz), 115.5 (d, *J* = 22.5 Hz). **HRMS** (ESI) m/z calcd. for $C_{20}H_{13}BrF_2NaO_4S_2$ $[M+Na]^+$ 520.9299, found 520.9304.

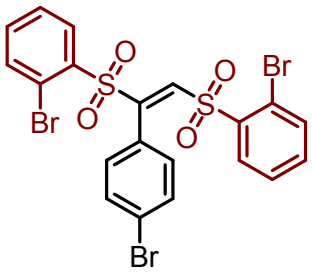


(4f) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium sodium 3-methylbenzenesulfinate (**2f** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (128.3 mg, 87%). mp: 136-137 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.78 (s, 1H),

7.43 (d, J = 7.2 Hz, 1H), 7.42 - 7.39 (m, 2H), 7.35 - 7.32 (m, 4H), 7.32 - 7.27 (m, 3H), 6.77 (d, J = 8.4 Hz, 2H), 2.35 (s, 3H), 2.34 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.7, 139.67, 139.61, 138.8, 138.4, 135.7, 135.4, 135.1, 131.7, 131.0, 129.22, 129.19, 129.0, 128.5, 126.3, 125.8, 125.2, 125.0, 21.18, 21.15. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}BrNaO_4S_2$ $[M+Na]^+$ 512.9800, found 512.9816.

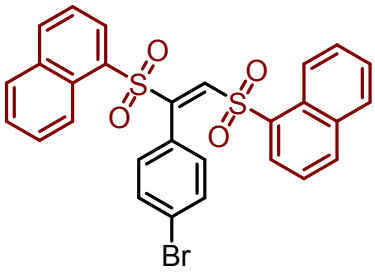


(4g) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium 2-methylbenzenesulfinate (**2g** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (128.3 mg, 87%). mp: 196-197 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.83 (s, 1H), 7.53 (d, J = 8.0 Hz, 1H), 7.48 - 7.42 (m, 3H), 7.27 - 7.25 (d, 2H), 7.20 - 7.16 (m, 3H), 7.12 (t, J = 7.5 Hz, 1H), 6.71 (d, J = 8.5 Hz, 2H), 2.60 (s, 3H), 2.52 (s, 3H). **^{13}C NMR** (125 MHz, CDCl3) δ 151.5, 138.8, 138.5, 137.9, 137.3, 134.7, 134.2, 133.5, 132.7, 132.4, 131.4, 130.97, 130.96, 129.4, 126.7, 126.3, 125.5, 124.9, 20.5, 20.3. **HRMS** (ESI) m/z calcd. for $C_{22}H_{19}BrNaO_4S_2$ $[M+Na]^+$ 512.9800, found 512.9794.

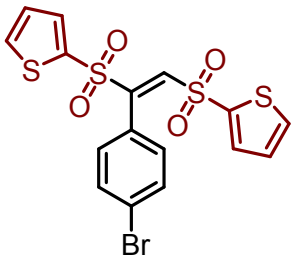


(4h) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium 2-bromobenzenesulfinate (**2h** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (111.8 mg, 60%). mp: 217-218 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.12 (s, 1H), 7.73 (d, J = 7.0 Hz, 1H), 7.71 - 7.68 (m, 2H), 7.57 (d, J = 8.0 Hz, 1H), 7.40 (t,

J = 7.5 Hz, 2H), 7.31 (t, *J* = 7.5 Hz, 1H), 7.26 (t, *J* = 7.5 Hz, 1H), 7.18 (d, *J* = 8.5 Hz, 2H), 6.89 (d, *J* = 8.5 Hz, 2H). **^{13}C NMR** (125 MHz, CDCl3) δ 149.7, 139.9, 138.9, 135.6, 135.5, 135.09, 135.02, 135.00, 133.0, 131.3, 131.1, 130.9, 127.9, 127.6, 125.3, 125.2, 121.3, 121.0. **HRMS** (ESI) m/z calcd. for $C_{20}H_{13}Br_3NaO_4S_2$ $[M+Na]^+$ 640.7698, found 640.7680.

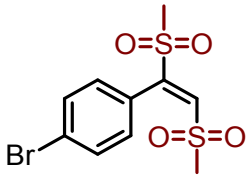


(4i) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium naphthalene-1-sulfinate (**2i** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (126.8 mg, 75%). mp: 136-137 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.42 - 8.39 (m, 2H), 8.14 (s, 1H), 8.04 (d, *J* = 8.4 Hz, 1H), 8.01 (d, *J* = 8.4 Hz, 1H), 7.91 (d, *J* = 8.4 Hz, 2H), 7.81 (d, *J* = 7.2 Hz, 1H), 7.73 (d, *J* = 7.8 Hz, 1H), 7.65 - 7.59 (m, 3H), 7.56 (t, *J* = 7.2 Hz, 1H), 7.34 (t, *J* = 7.8 Hz, 1H), 7.30 (t, *J* = 7.8 Hz, 1H), 6.98 (d, *J* = 8.4 Hz, 2H), 6.24 (d, *J* = 8.4 Hz, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.9, 139.0, 136.3, 135.6, 133.84, 133.79, 133.72, 132.7, 130.7, 130.5, 130.2, 129.3, 129.12, 129.10, 129.0, 128.5, 128.4, 127.24, 127.23, 125.3, 124.8, 124.11, 124.07, 123.8, 123.5. **HRMS** (ESI) m/z calcd. for $C_{28}H_{19}BrNaO_4S_2$ $[M+Na]^+$ 584.9800, found 584.9766.

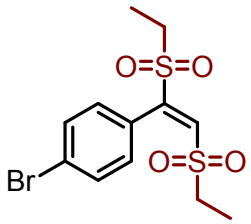


(4j) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium thiophene-2-sulfinate (**2j** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (112.7 mg, 79%). mp: 187-188 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.81 (s, 1H), 7.74 (t,

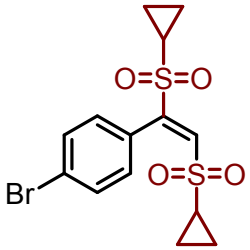
J = 5.0 Hz, 2H), 7.46 - 7.43 (m, 3H), 7.34 (d, *J* = 2.5 Hz, 1H), 7.10 - 7.06 (m, 2H), 6.96 (d, *J* = 8.0 Hz, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.7, 139.9, 137.4, 136.6, 136.3, 135.9, 135.4, 131.5, 131.3, 128.24, 128.21, 125.6, 125.4. **HRMS** (ESI) m/z calcd. for $C_{16}H_{11}BrNaO_4S_4$ $[M+Na]^+$ 496.8616, found 496.8605.



(4k) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium methyl sulfinate (**2k** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (75.3 mg, 74%). mp: 197-198 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.65 (d, *J* = 8.5 Hz, 2H), 7.64 (s, 1H), 7.48 (d, *J* = 8.5 Hz, 2H), 2.92 (s, 3H), 2.81 (s, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 151.1, 137.0, 132.3, 131.5, 126.4, 125.8, 43.4, 39.9. **HRMS** (ESI) m/z calcd. for $C_{10}H_{11}BrNaO_4S_2$ $[M+Na]^+$ 360.9174, found 360.9140.



(4l) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium ethanesulfinate (**2l** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (79.3 mg, 72%). mp: 131-132 °C. **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.63 (d, *J* = 8.5 Hz, 2H), 7.55 (s, 1H), 7.48 (d, *J* = 8.5 Hz, 2H), 2.98 (q, *J* = 7.5 Hz, 2H), 2.86 (q, *J* = 7.5 Hz, 2H), 1.34 (t, *J* = 7.5 Hz, 3H), 1.28 (t, *J* = 7.5 Hz, 3H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 150.5, 136.2, 132.1, 131.4, 126.2, 126.0, 49.7, 46.1. 6.65, 6.61. **HRMS** (ESI) m/z calcd. for $C_{12}H_{15}BrNaO_4S_2$ $[M+Na]^+$ 388.9487, found 388.9479.



(4m) Prepared following the genernal procedure showed above using 4-bromophenylacetylene (**1a** 0.3 mmol), sodium cyclopropanesulfinate (**2m** 1.2 mmol). The desired product was purified by a silica gel column chromatography (petroleum ether/ethyl acetate=15:1) as white solid (104.5 mg, 89%). mp: 135-136 °C. **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.4 Hz, 2H), 7.56 (s, 1H), 7.45 (d, *J* = 8.4 Hz, 2H), 2.38 - 2.27 (m, 1H), 2.24 - 2.13 (m, 1H), 1.24 - 1.18 (m, 2H), 1.15 - 1.10 (m, 2H), 1.07 - 1.02 (m, 2H), 1.02 - 0.97 (m, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 150.3, 136.1, 131.71, 131.65, 126.7, 125.6, 31.7, 29.0, 6.0, 5.7. **HRMS** (ESI) m/z calcd. for $C_{14}H_{115}BrNaO_4S_2$ $[M+Na]^+$ 412.9487, found 412.9466.

IV. Crystallography of 3ac.

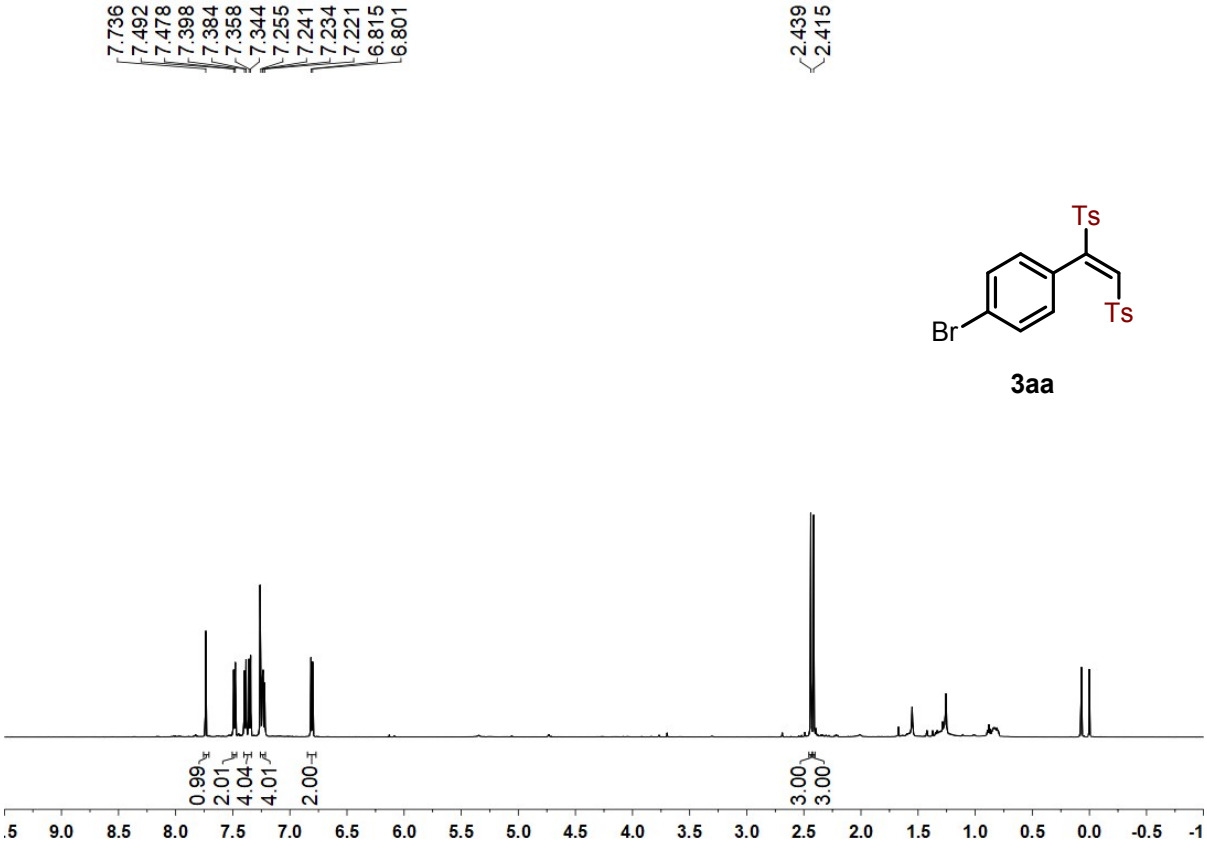
Empirical formula	$C_{23}H_{22}O_4S_2$
Temperature	293(2)K
Wavelength	0.71073 Å
Unit cell dimensions	a = 8.8162(5) Å alpha = 88.965(4) deg. b = 9.9355(5) Å beta = 85.831(4) deg c = 12.7903(7) Å gamma =70.437(5) deg.
Volume	1052.86(10) $Å^3$
Z	2
Calculated density	1.345 g/cm^3
Absorption coefficient	0.280 mm^{-1}
F(000)	448.0
Crystal size	0.1 x 0.1x 0.1 mm
Theta range for data collection	7.58 to 58.722 deg.

Reflections collected / unique	7729
Data / restraints / parameters	4789/0/265
Goodness-of-fit on F^2	1.049
Final R indices [I>2sigma(I)]	$R_1 = 0.0469$, $wR_2 = 0.1138$
R indices (all data)	$R_1 = 0.0679$, $wR_2 = 0.1312$

V. Reference.

1. Liu, Z.; Yang L.; Zhang K.; Chen, W.; Yu, T.; Wang, L.; Gao, W.; Tang, B. *Org. let.* **2020**, *22,* 2081.

VI.NMR spectra copies.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Ts
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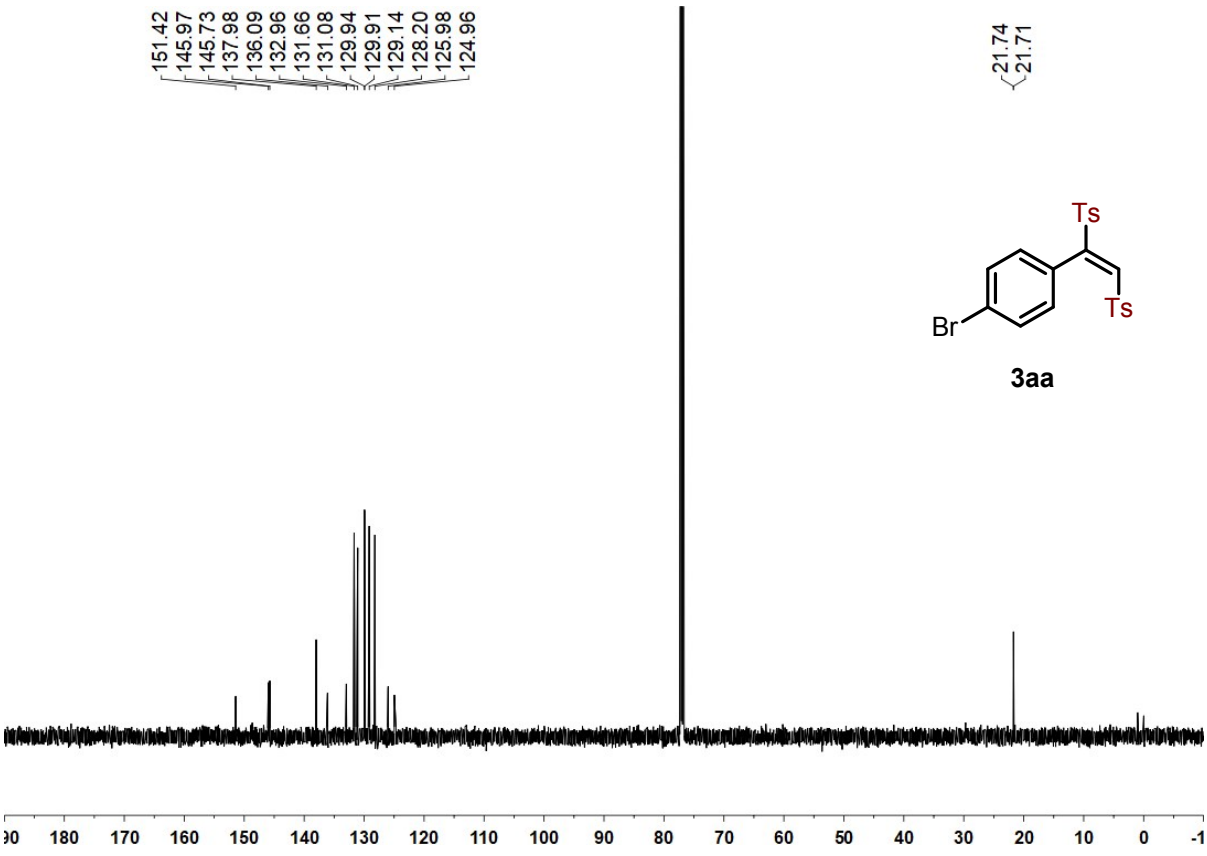
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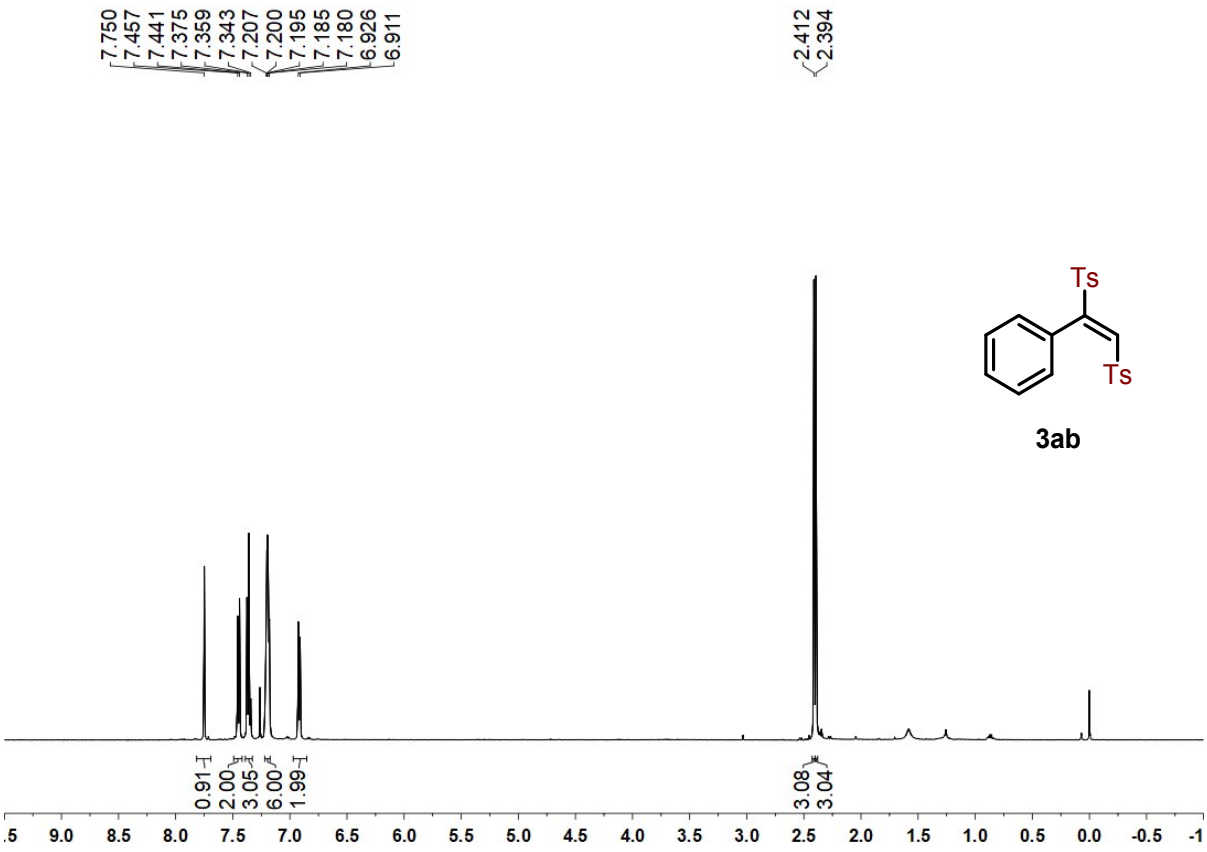
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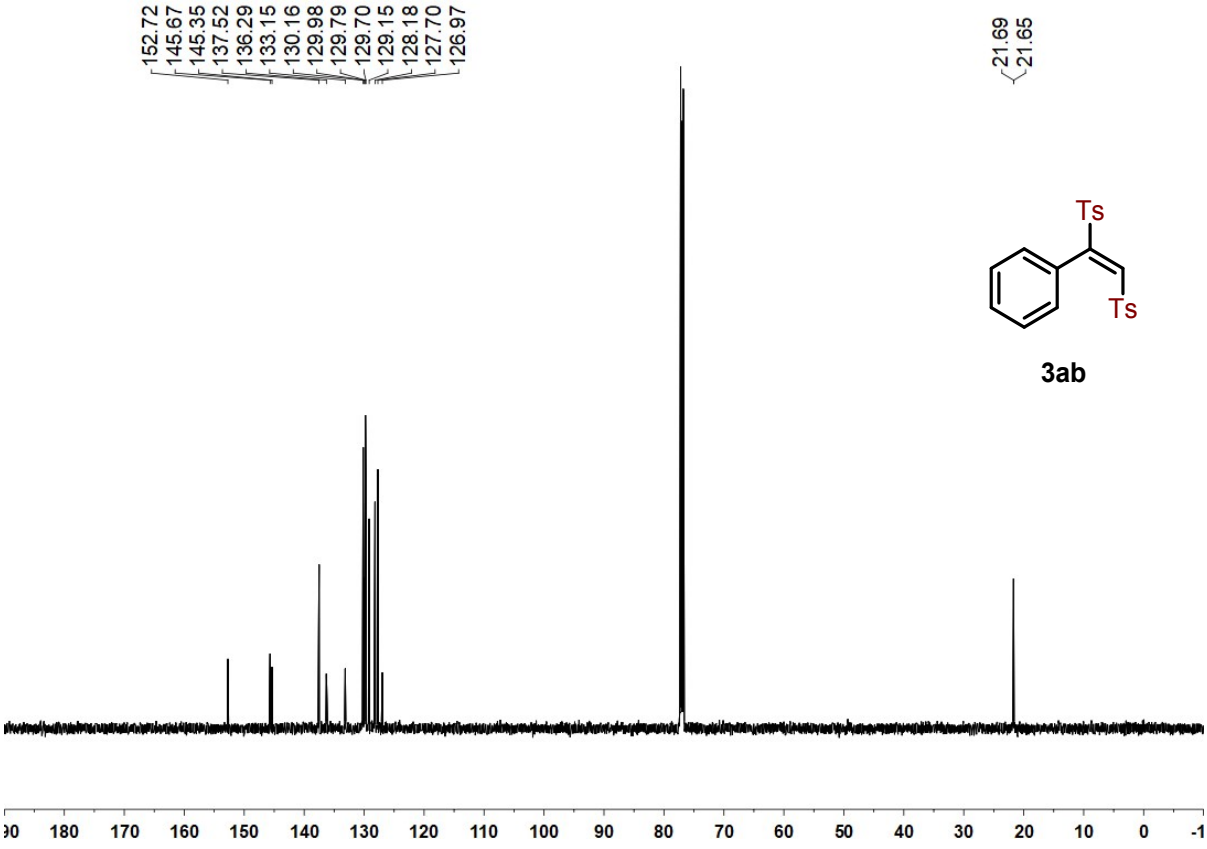
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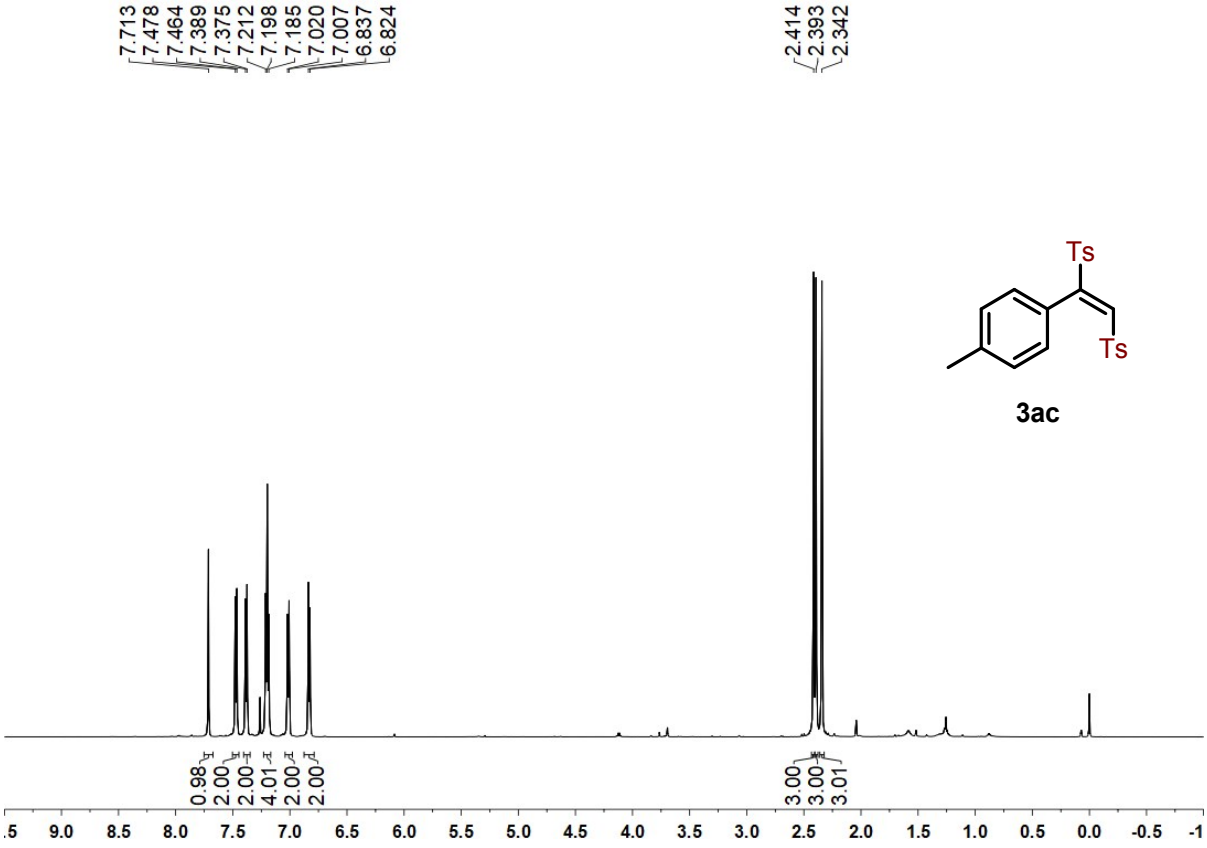
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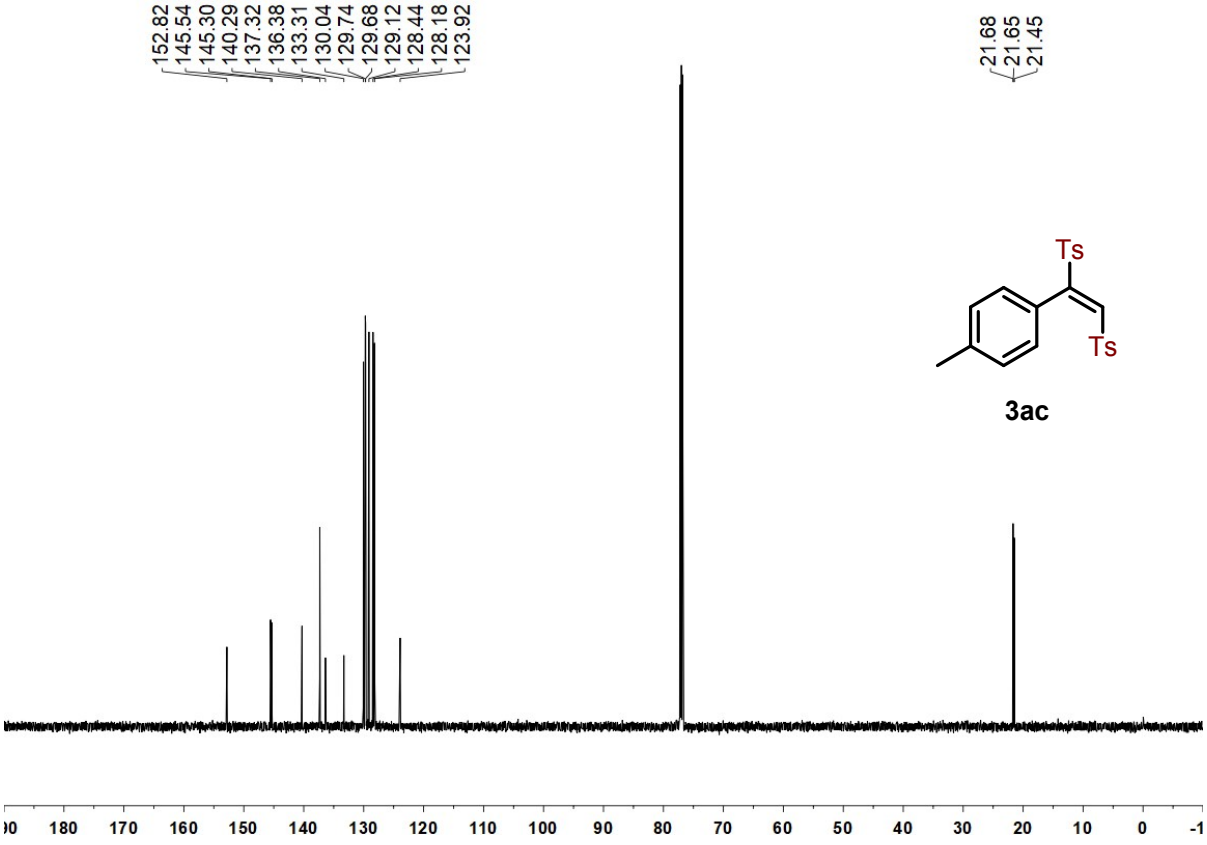
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Ts
Ts
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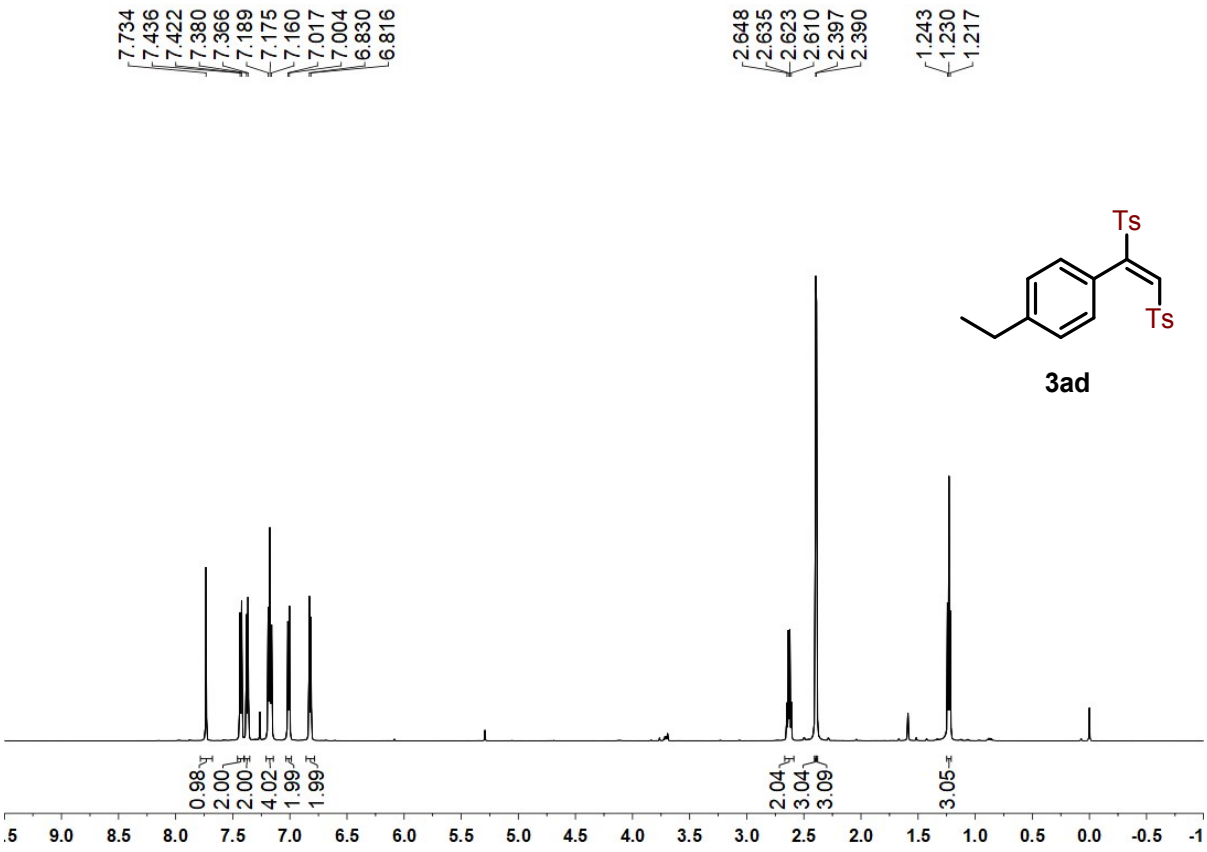
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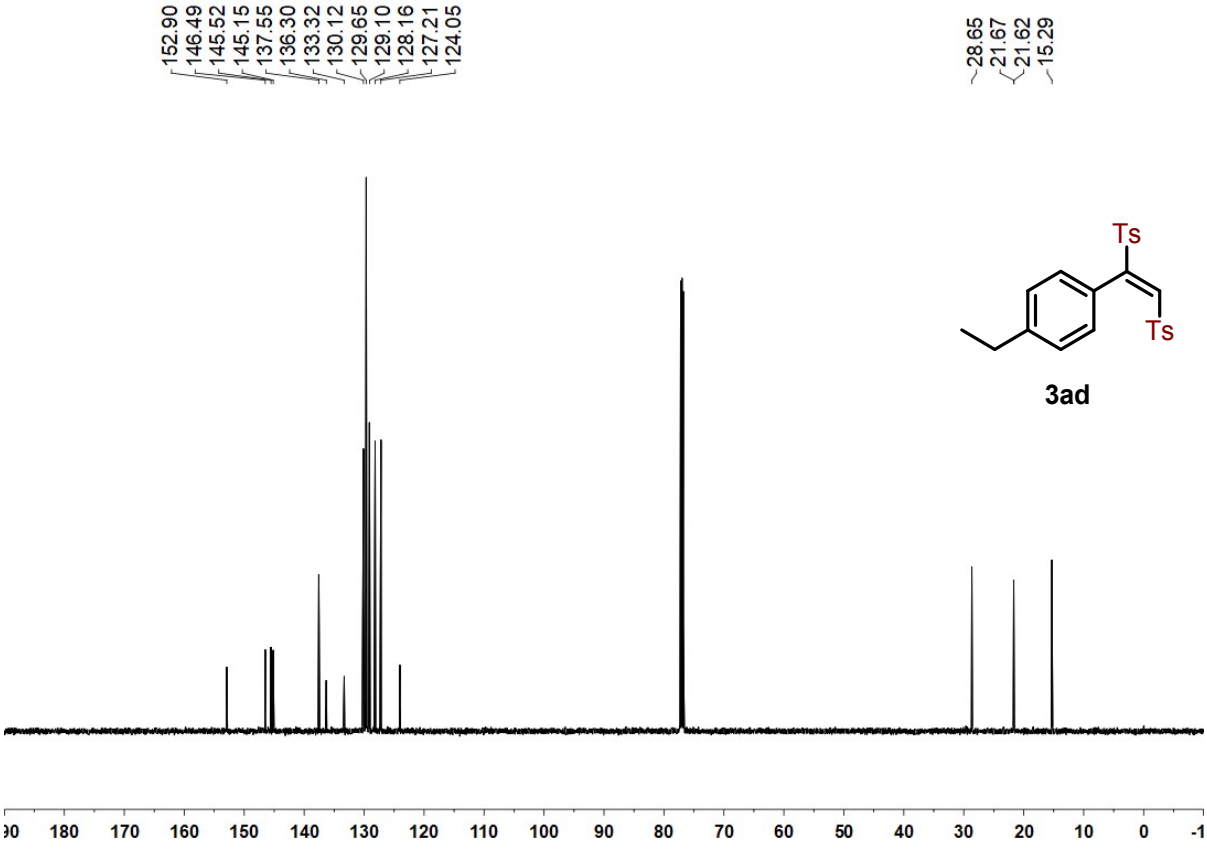
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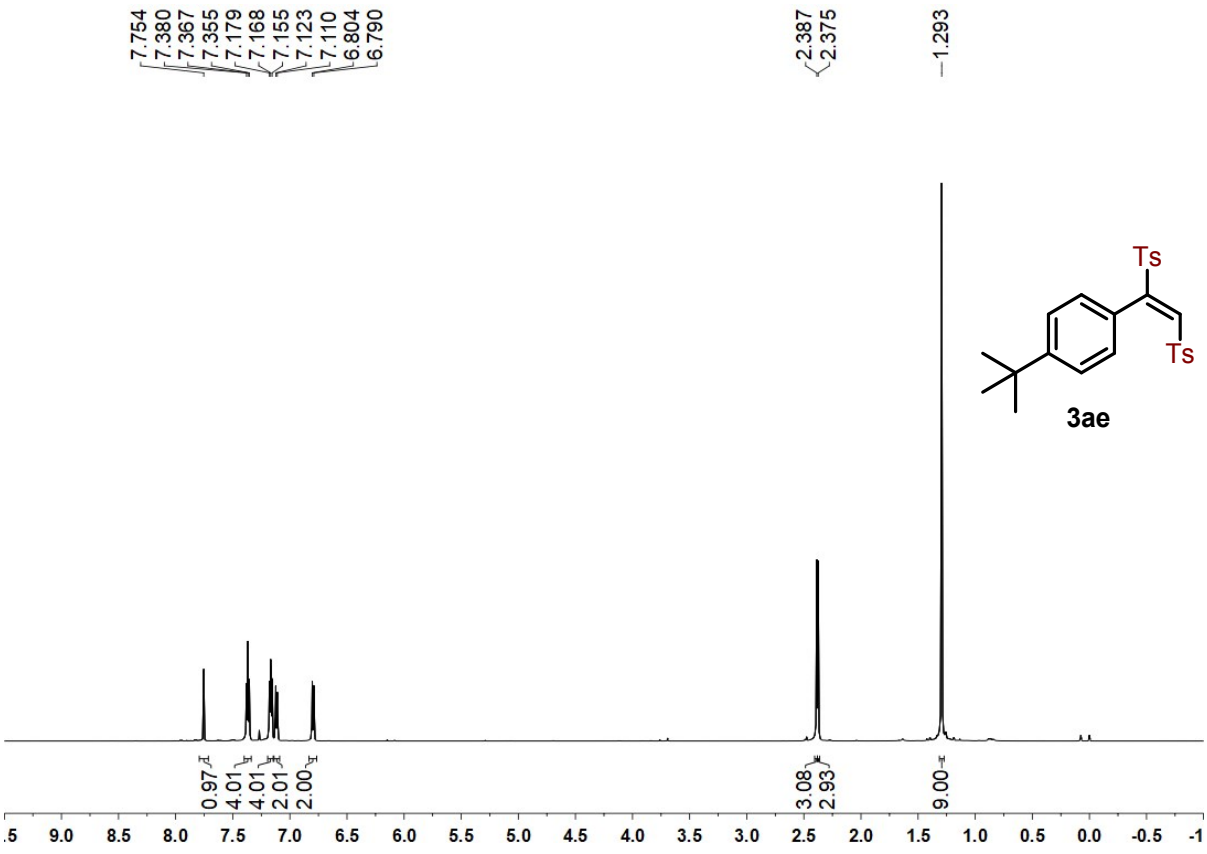
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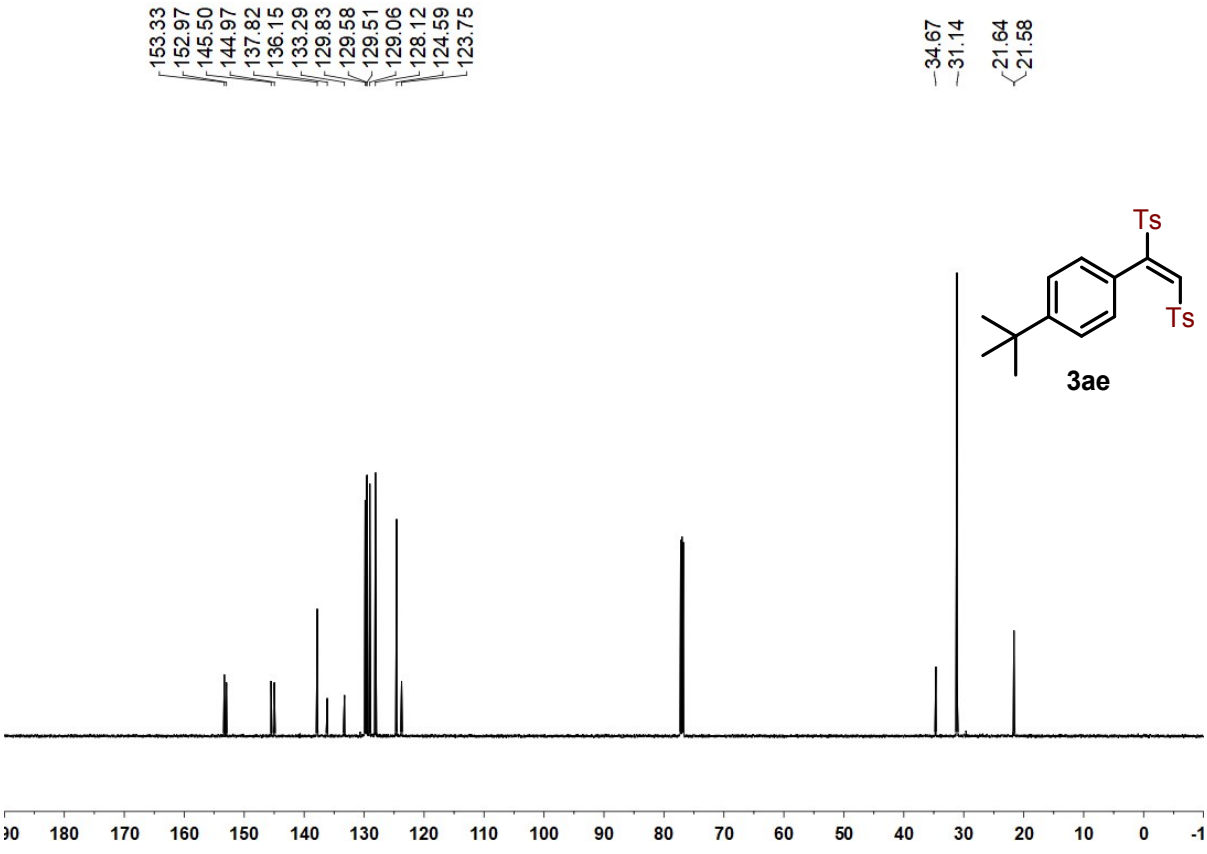
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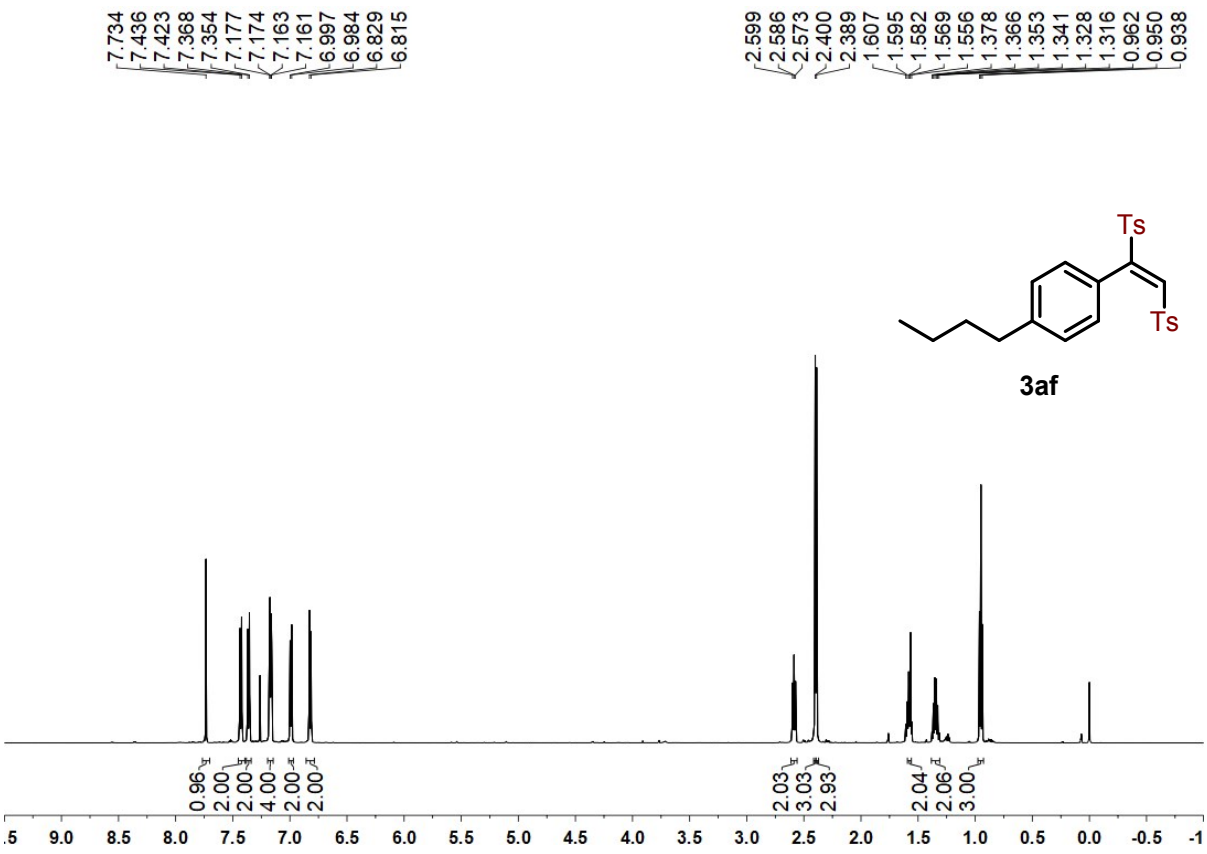
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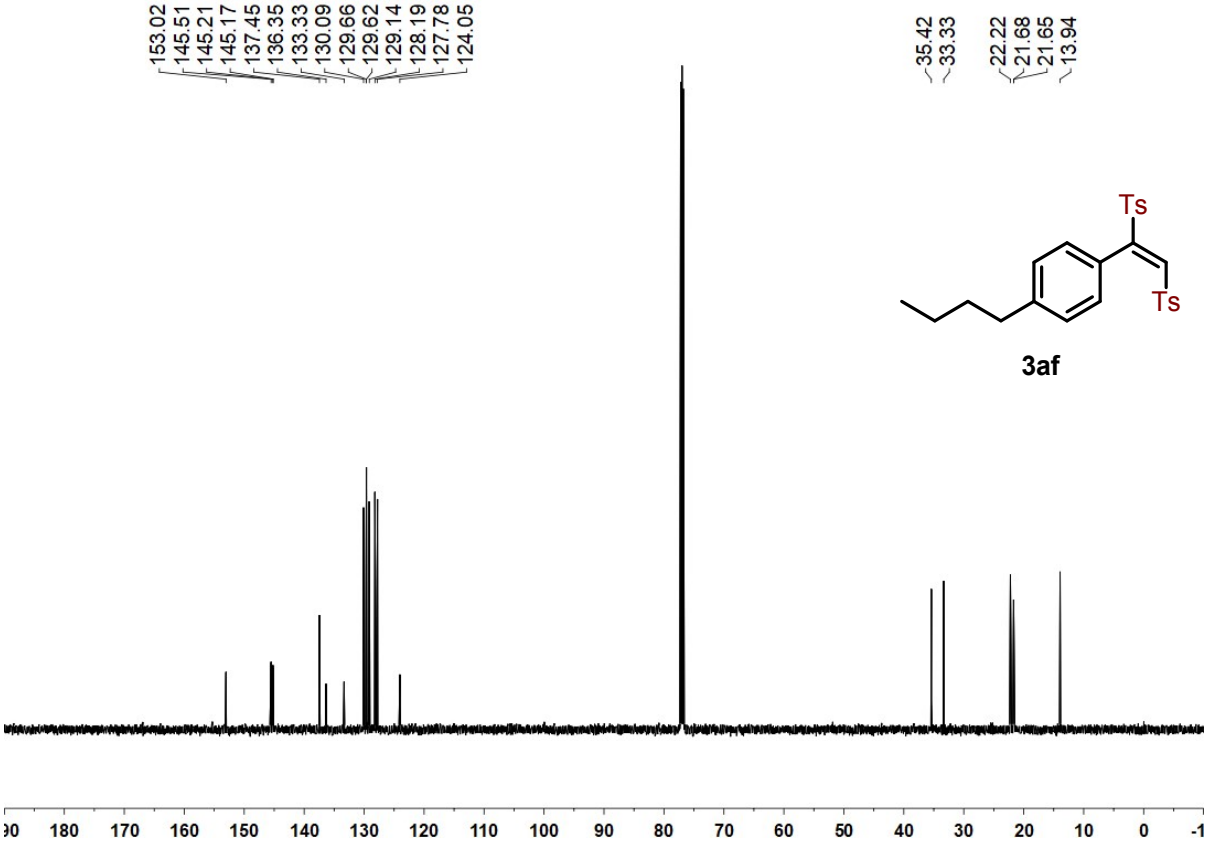
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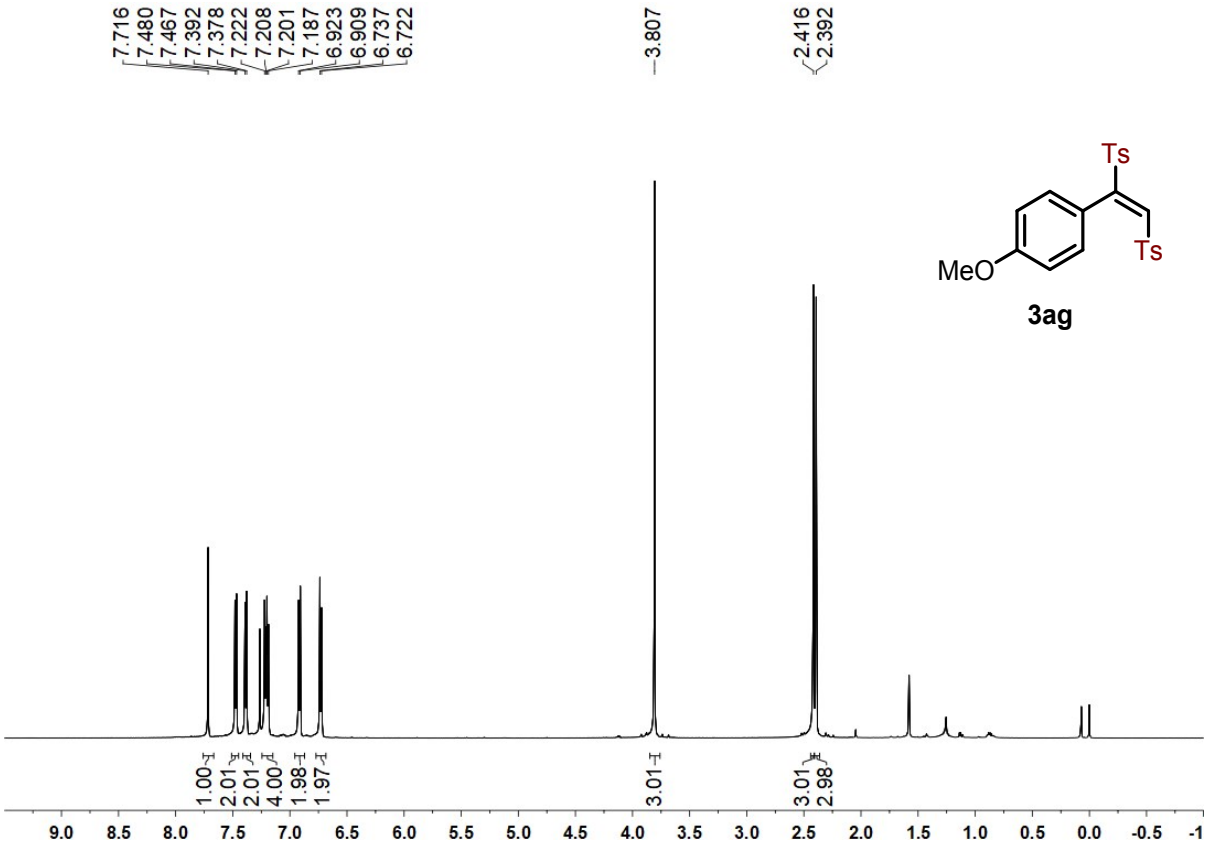
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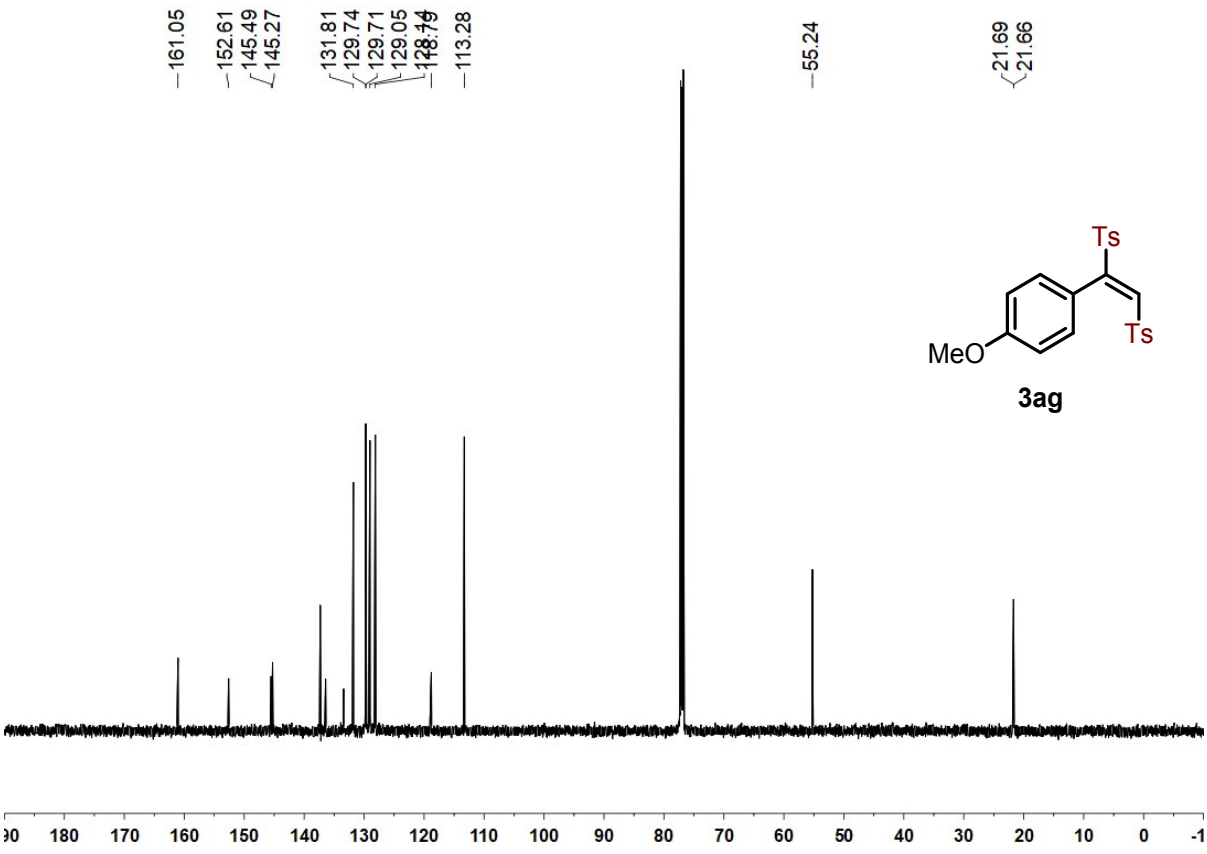
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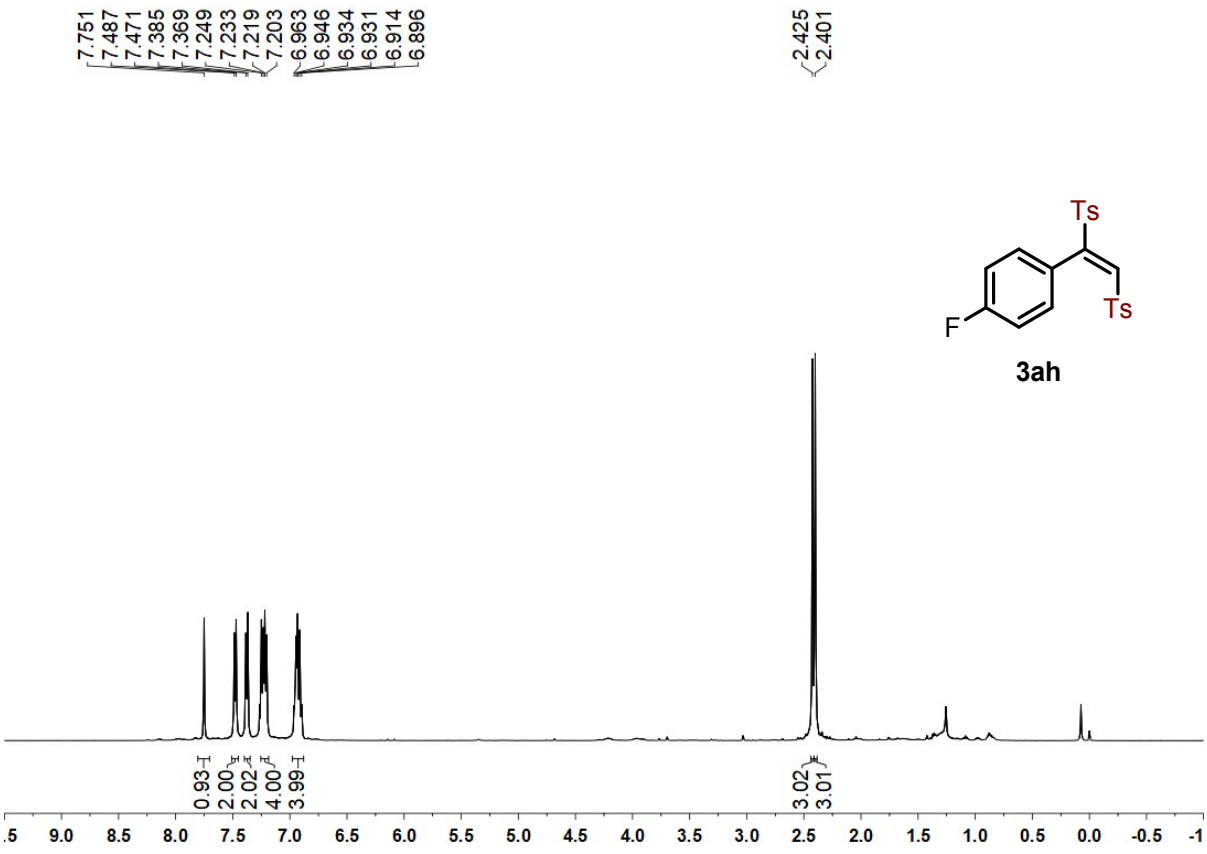
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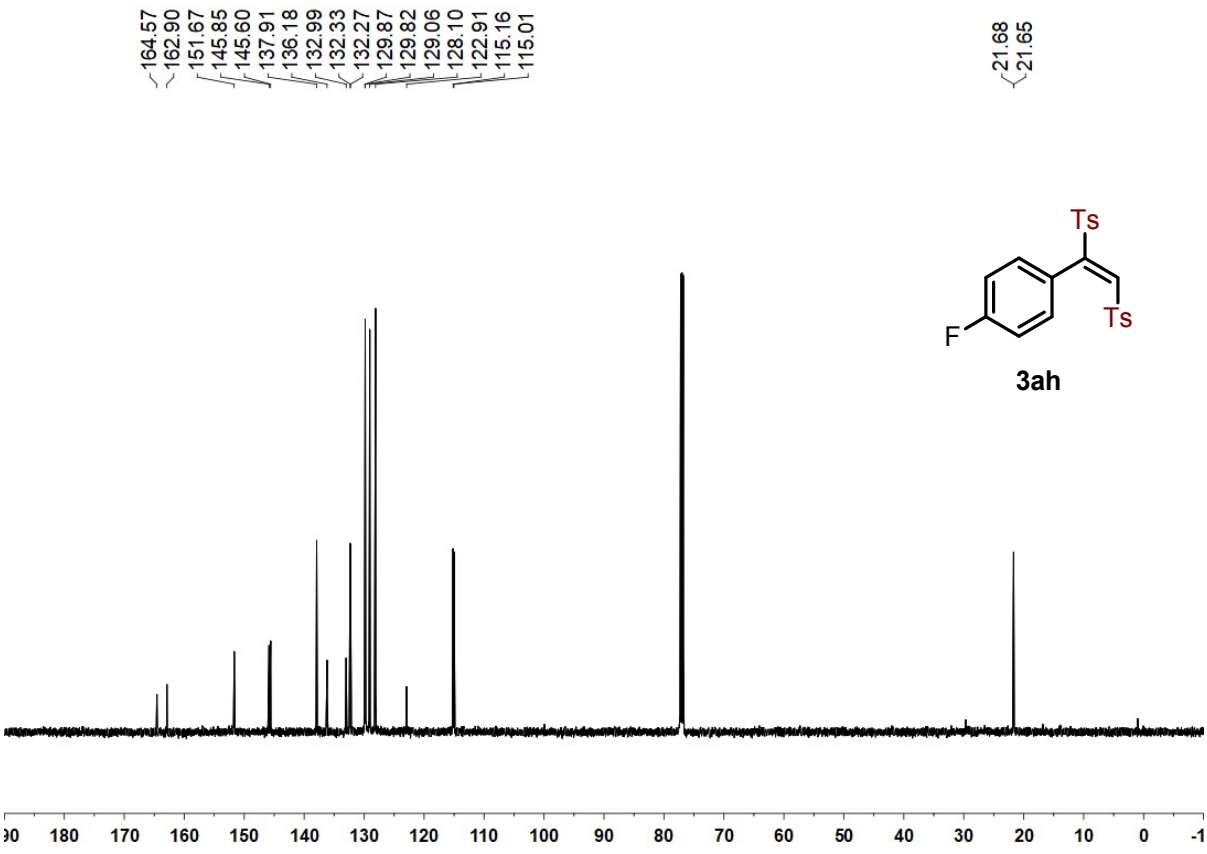
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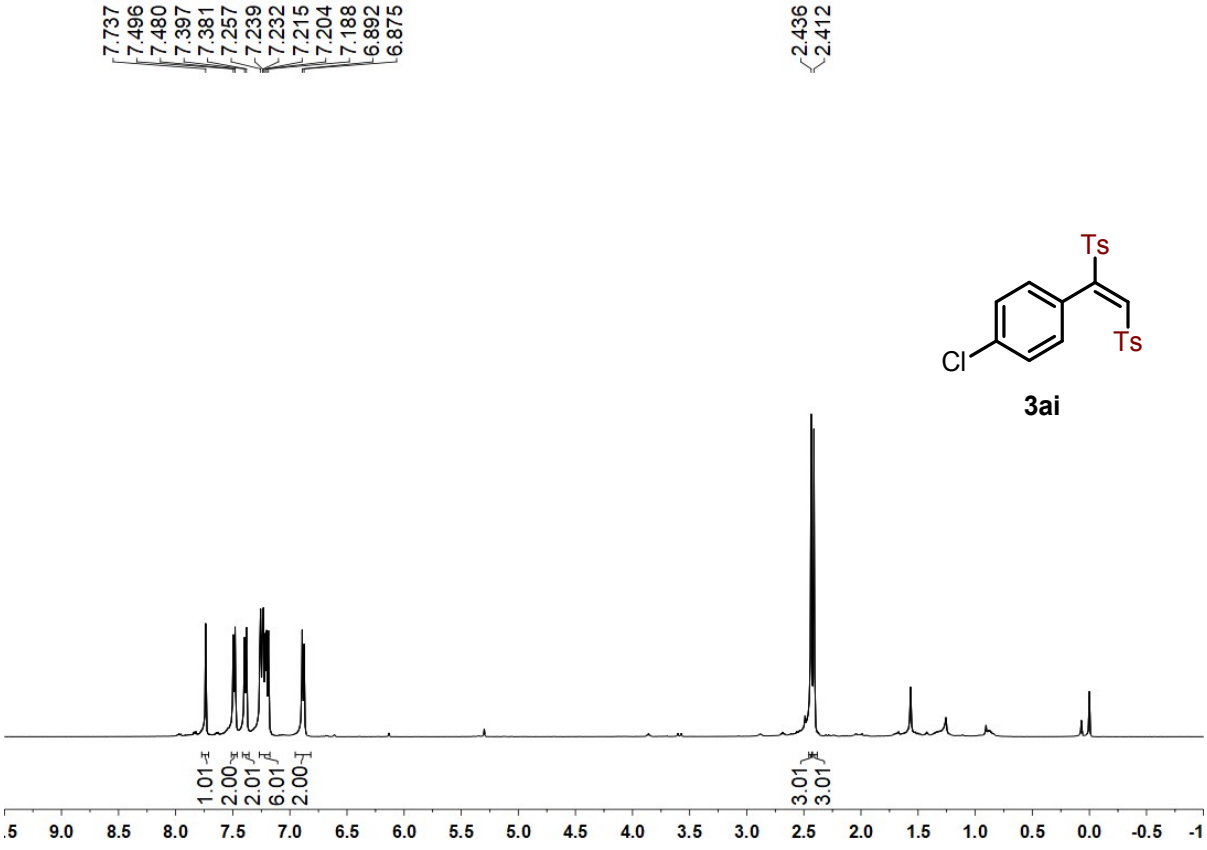
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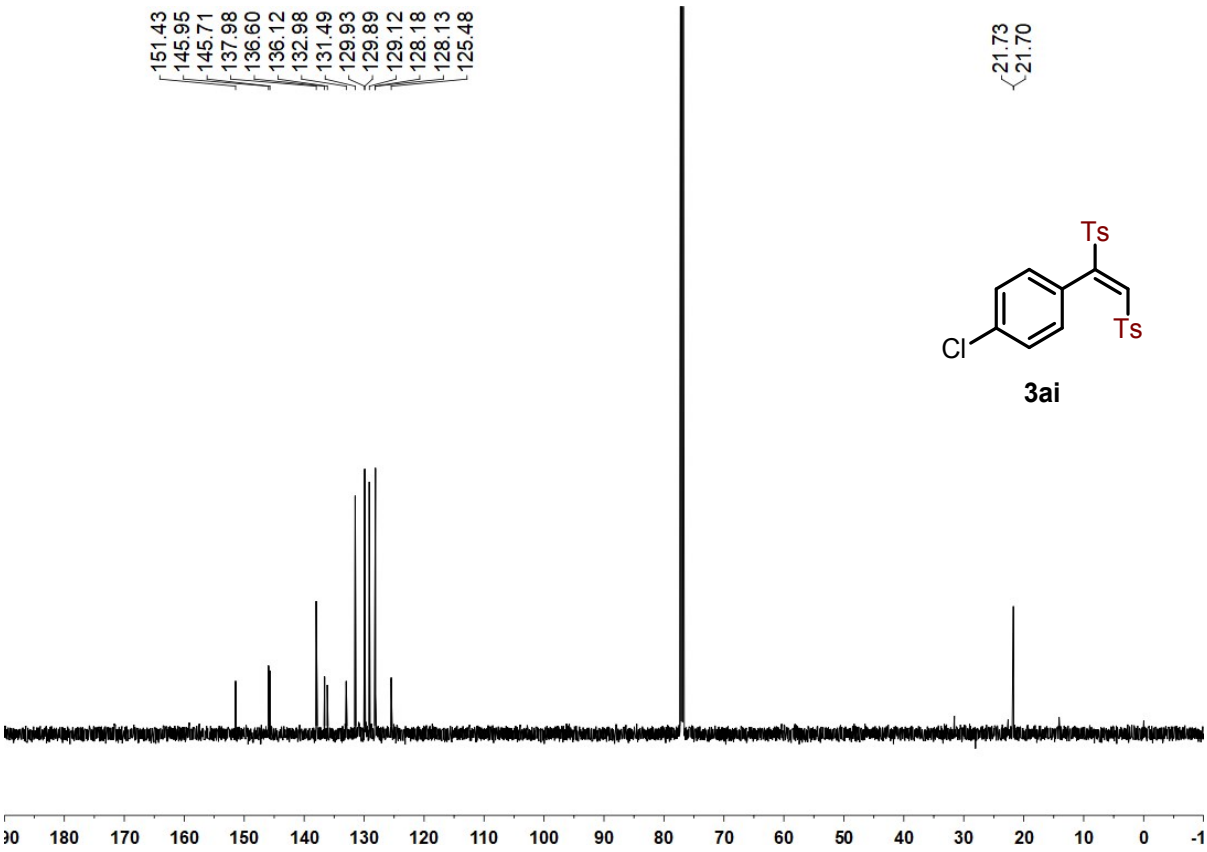
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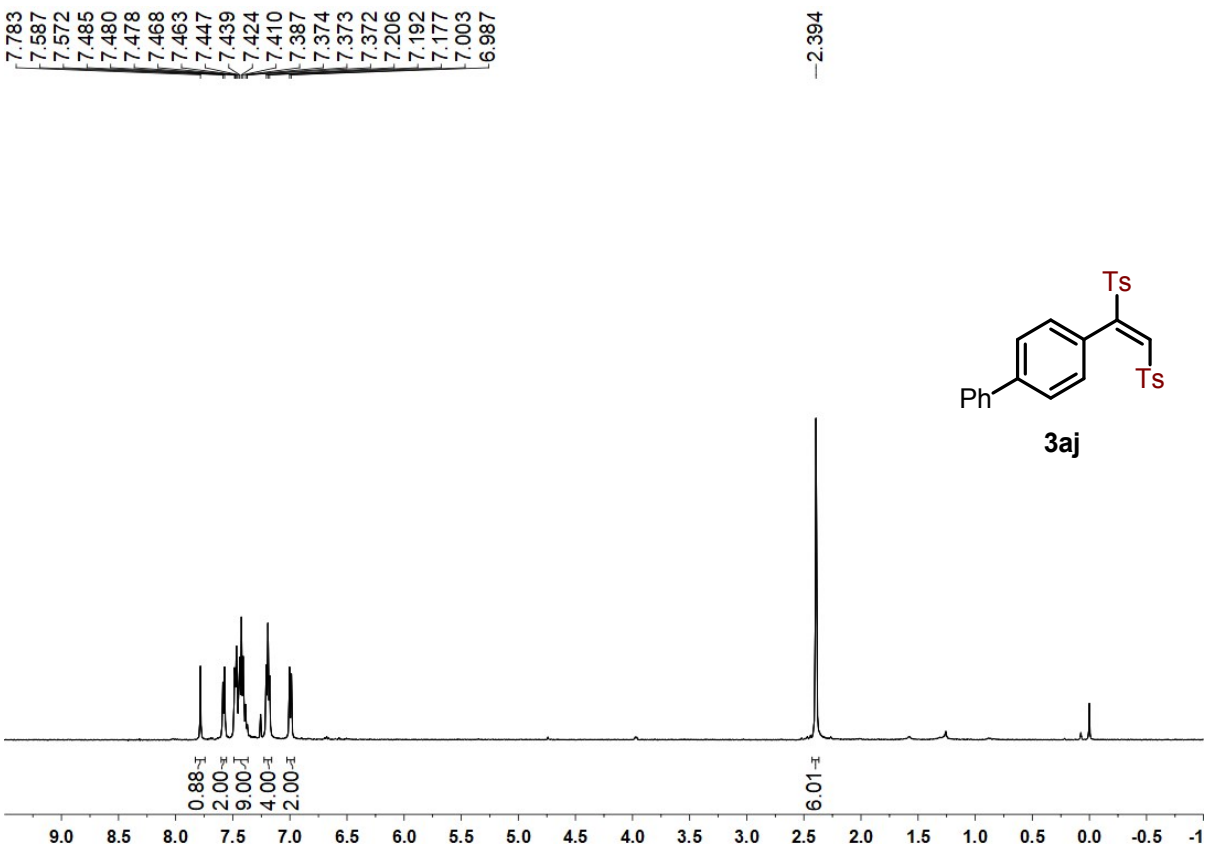
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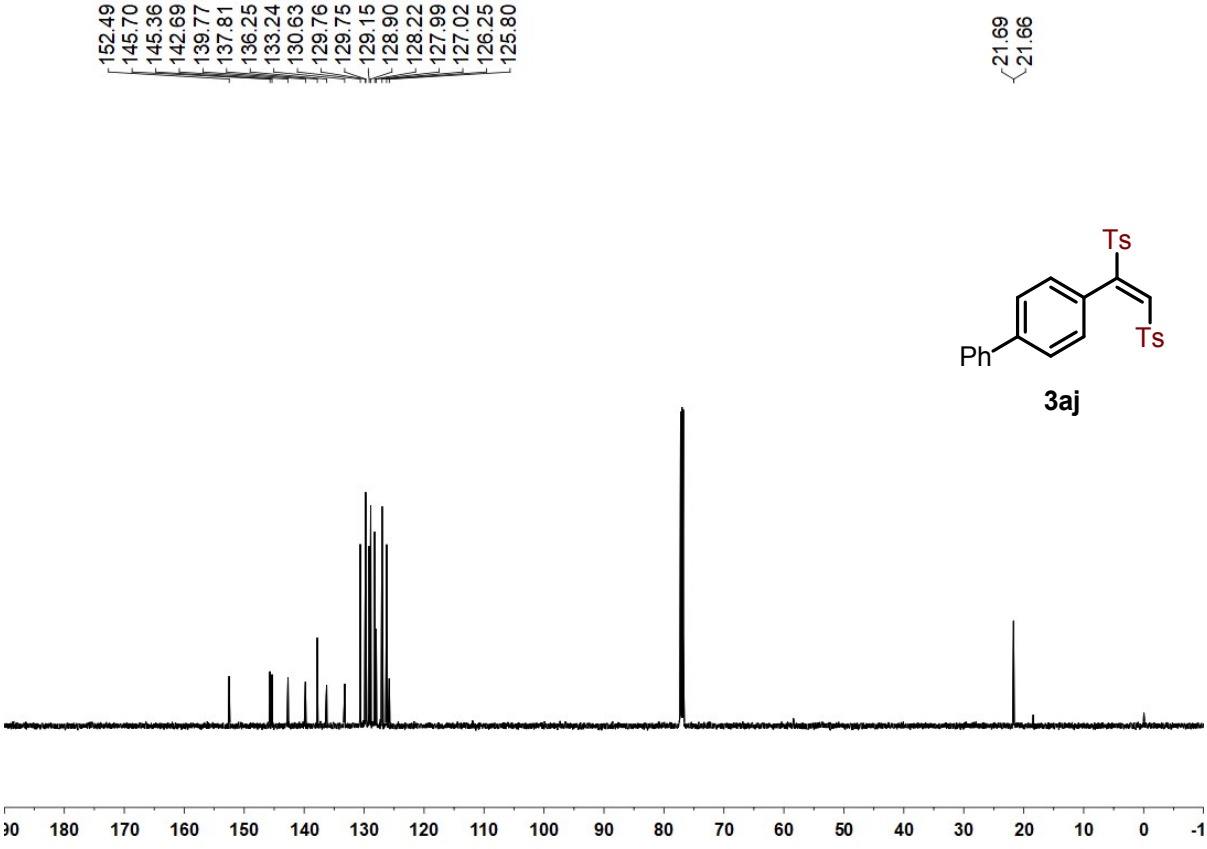
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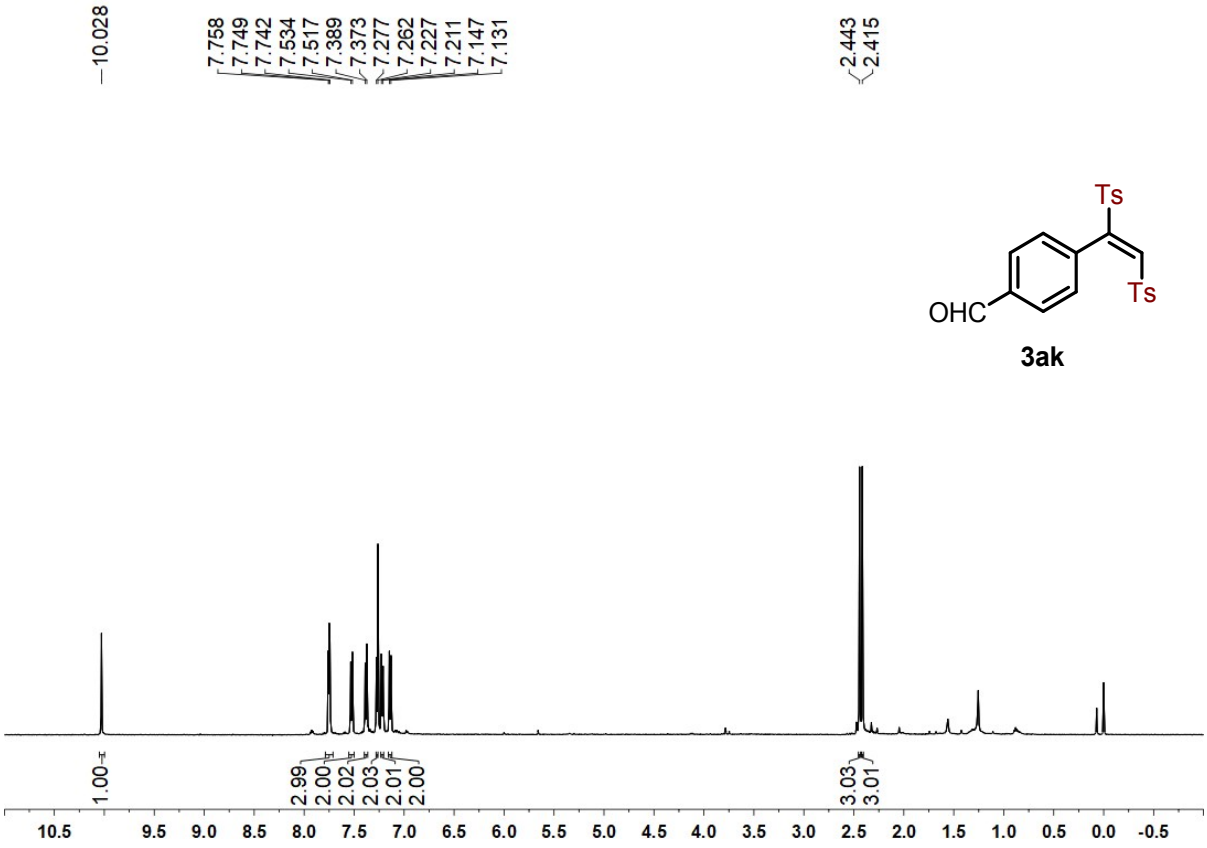
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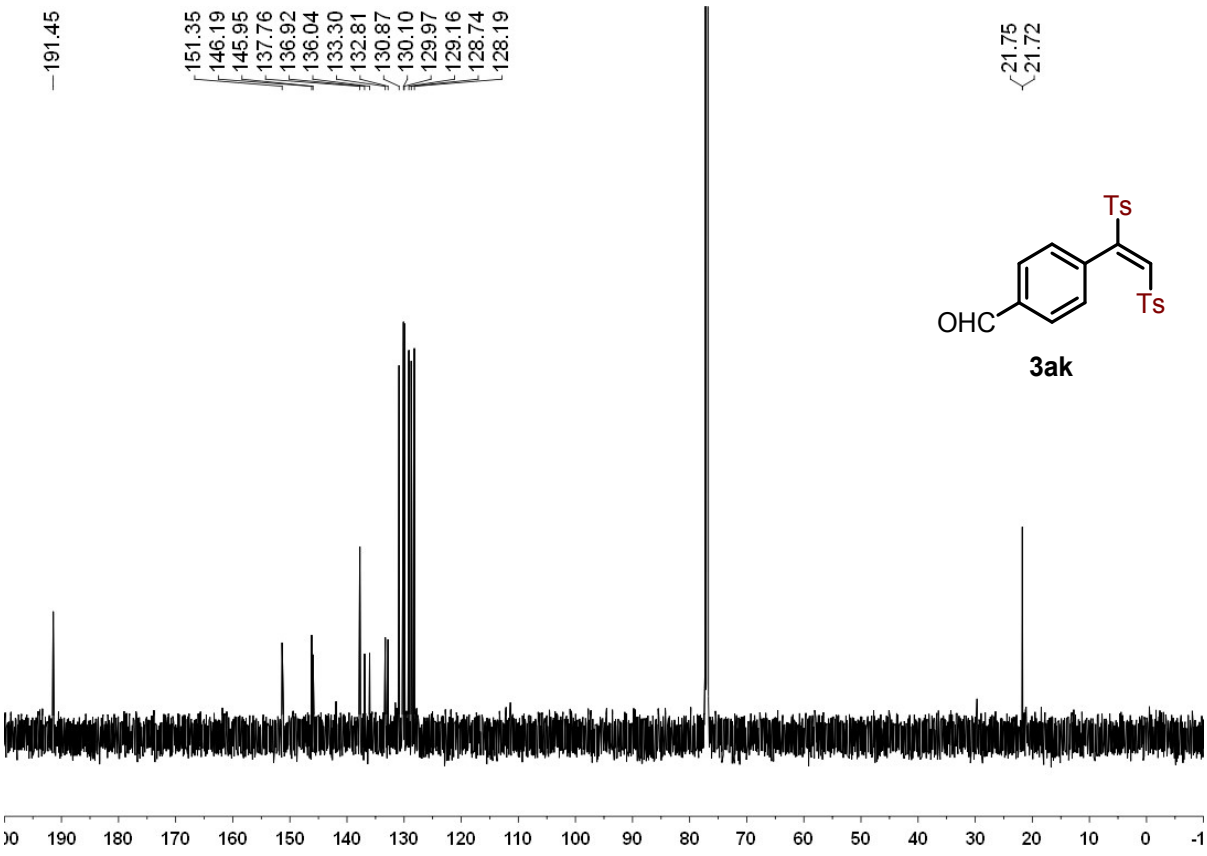
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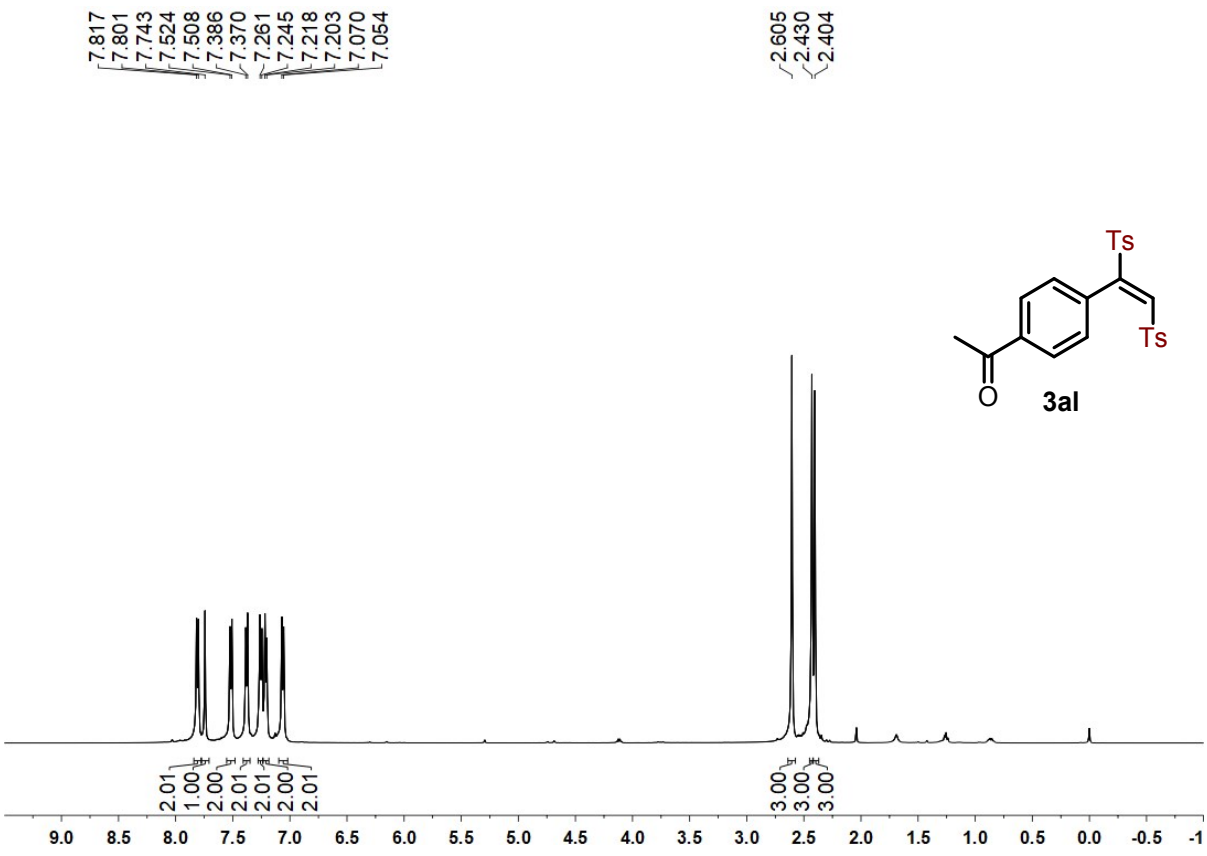
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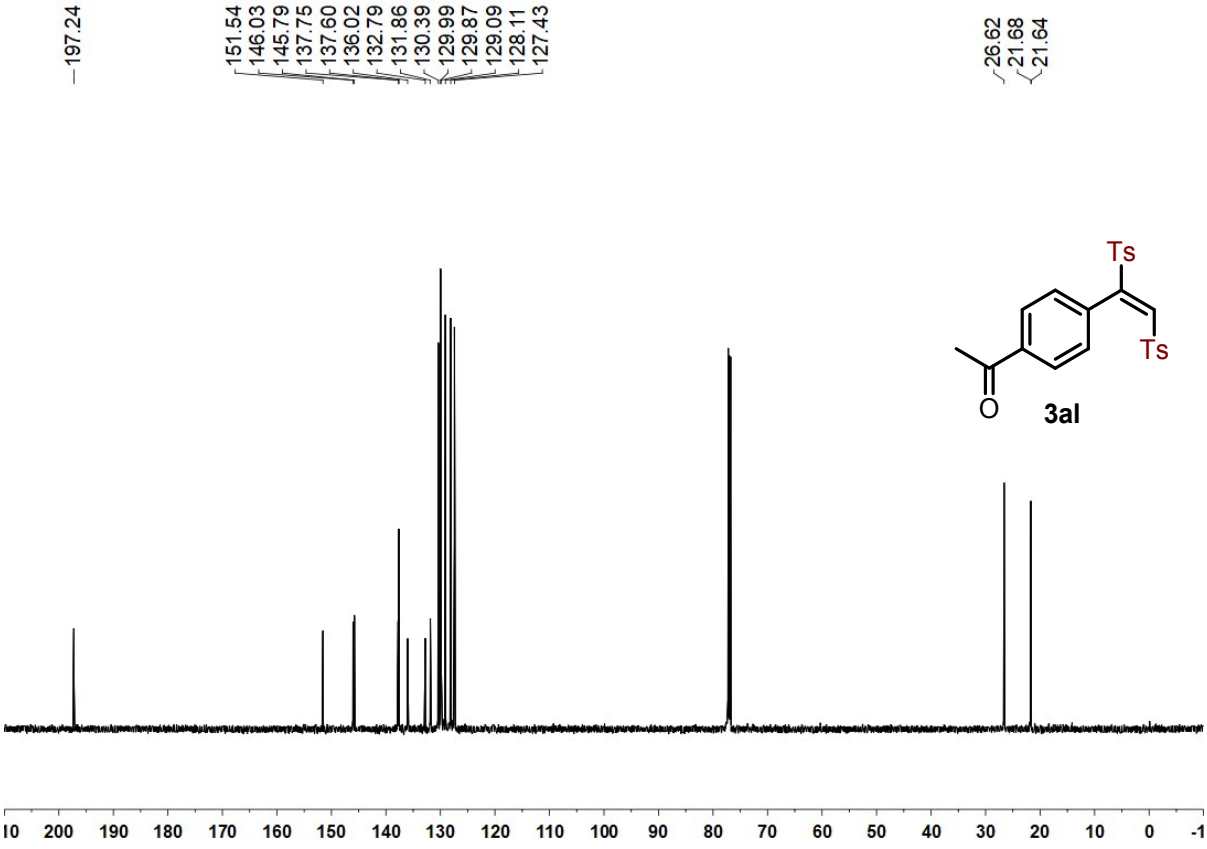
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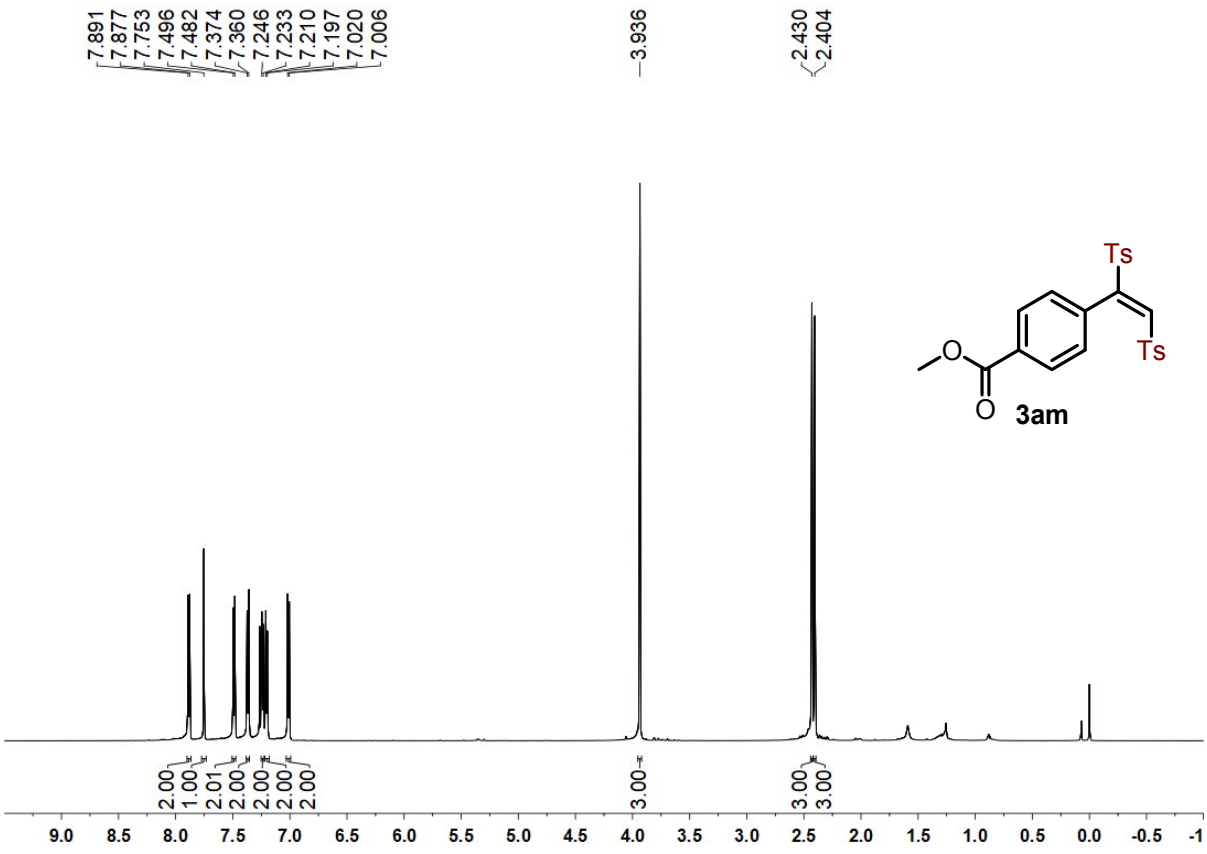
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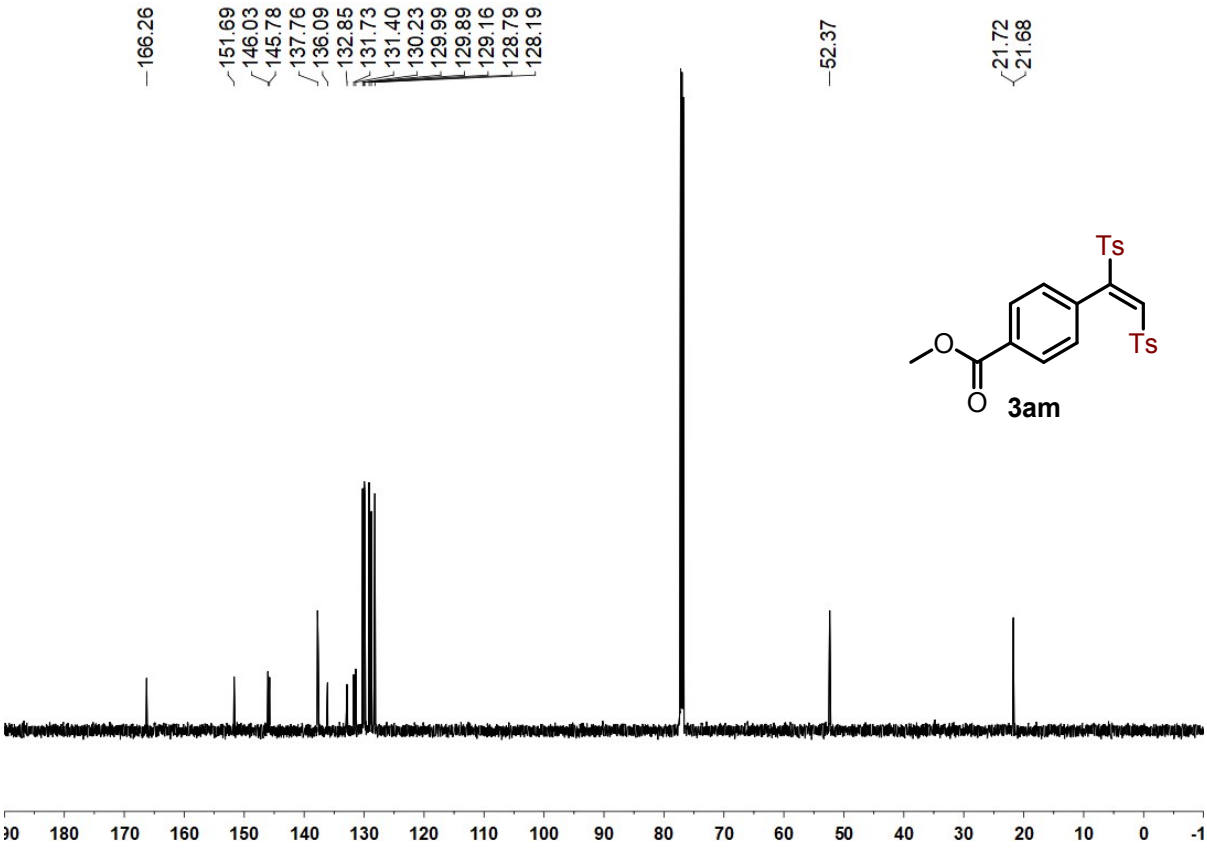
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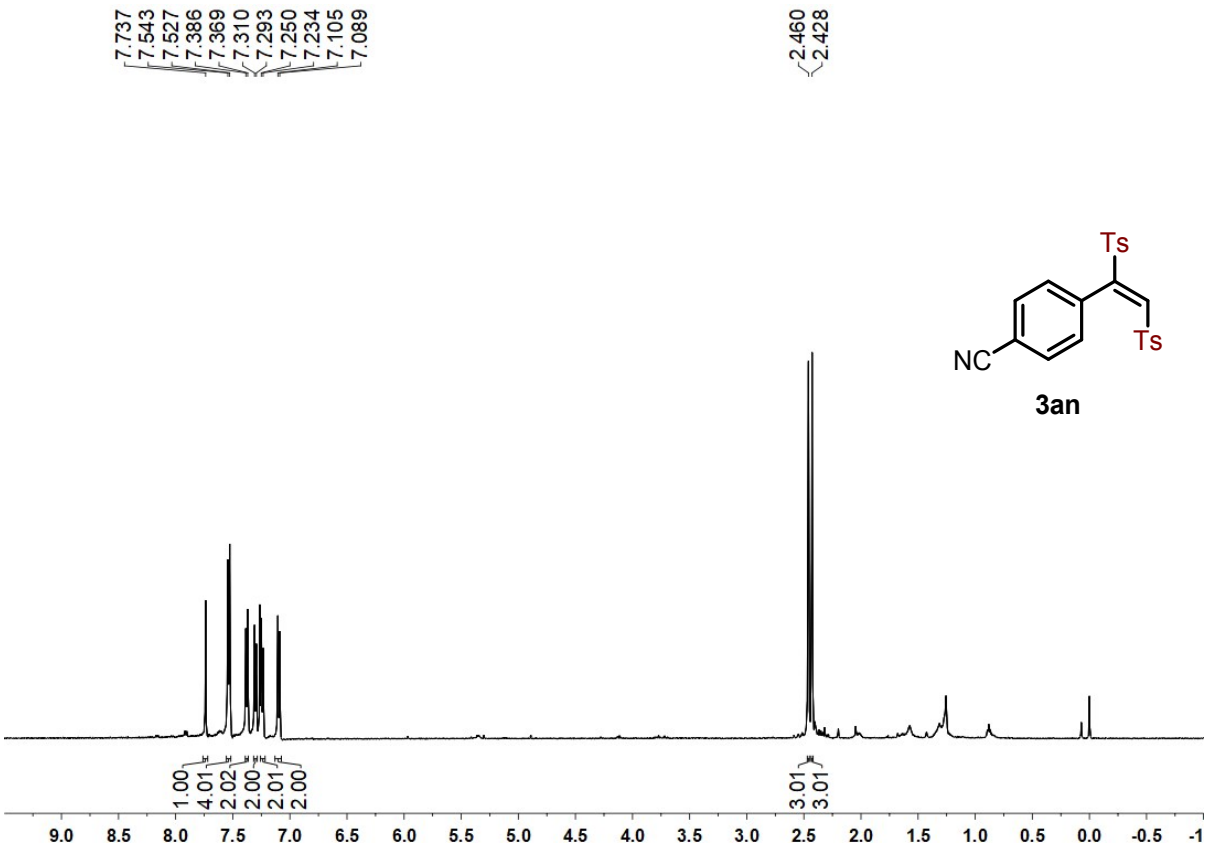
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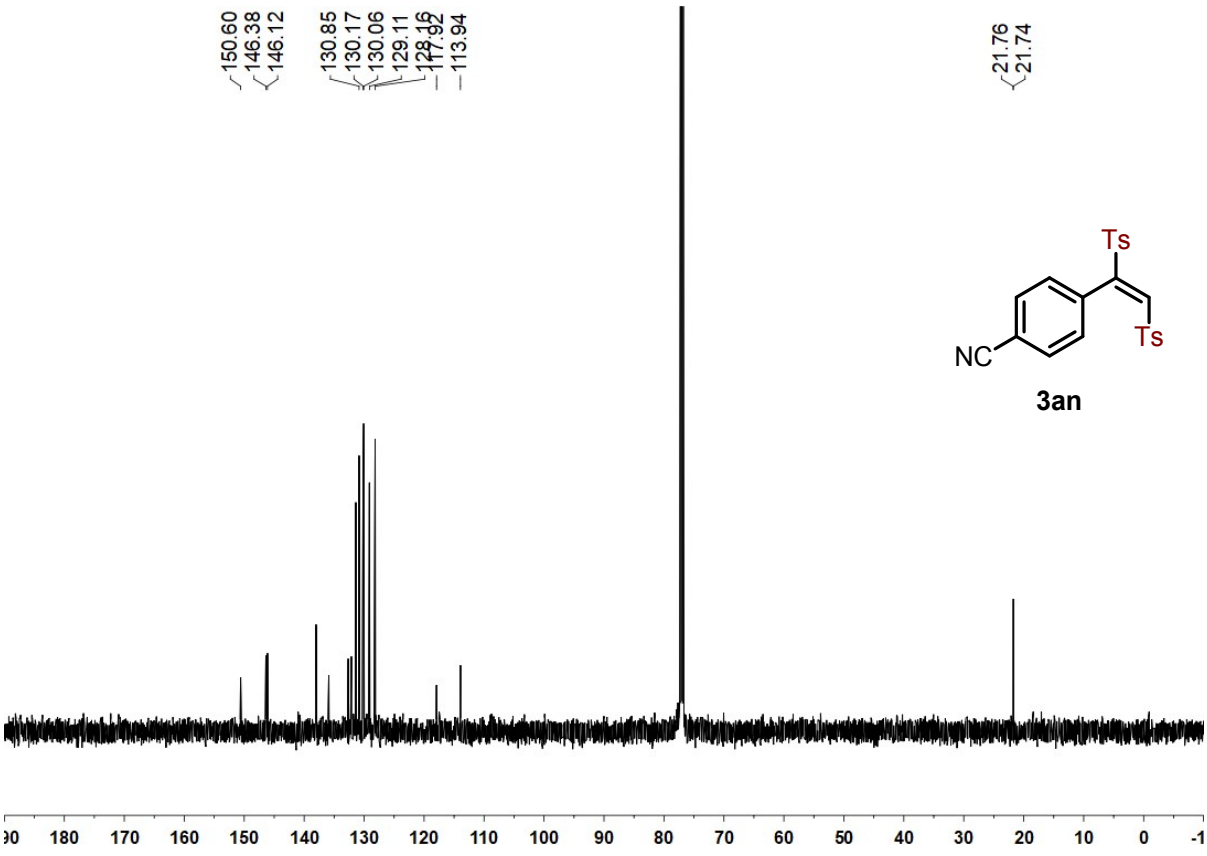
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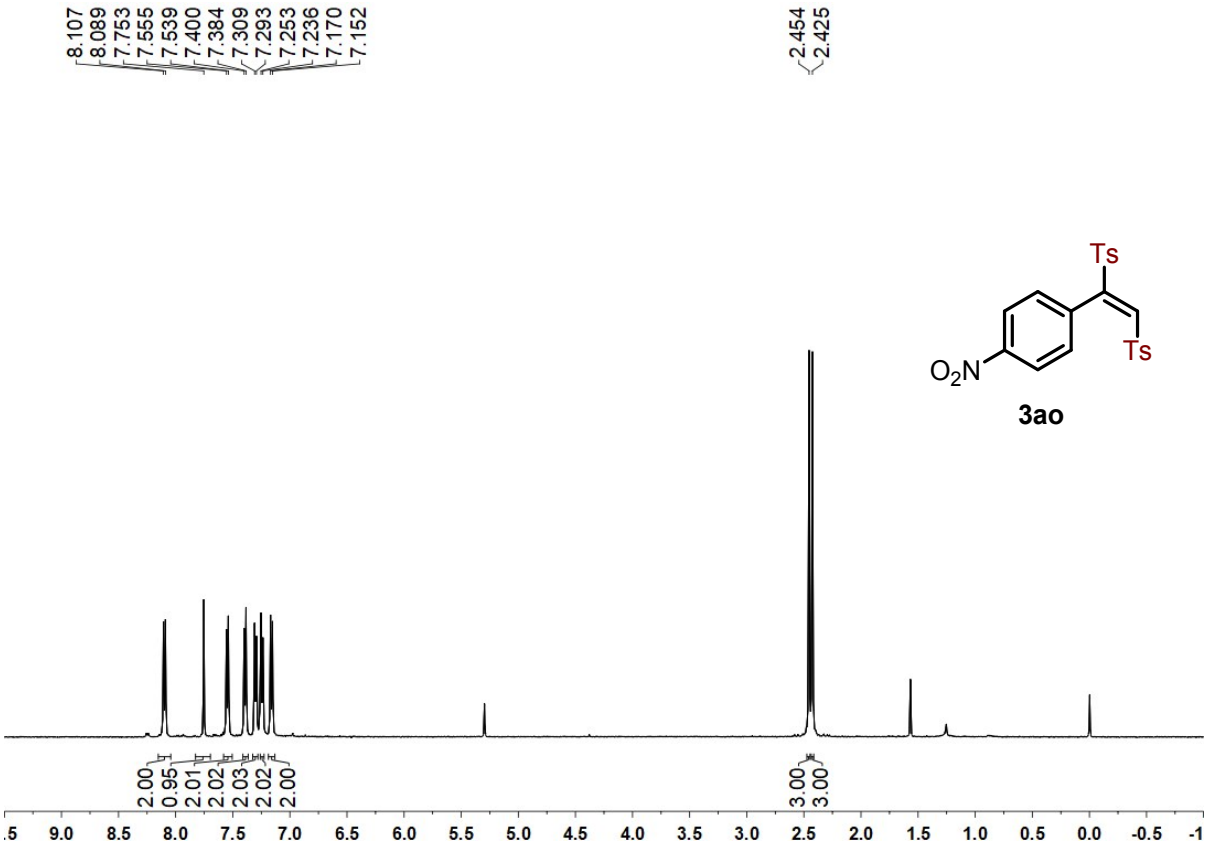
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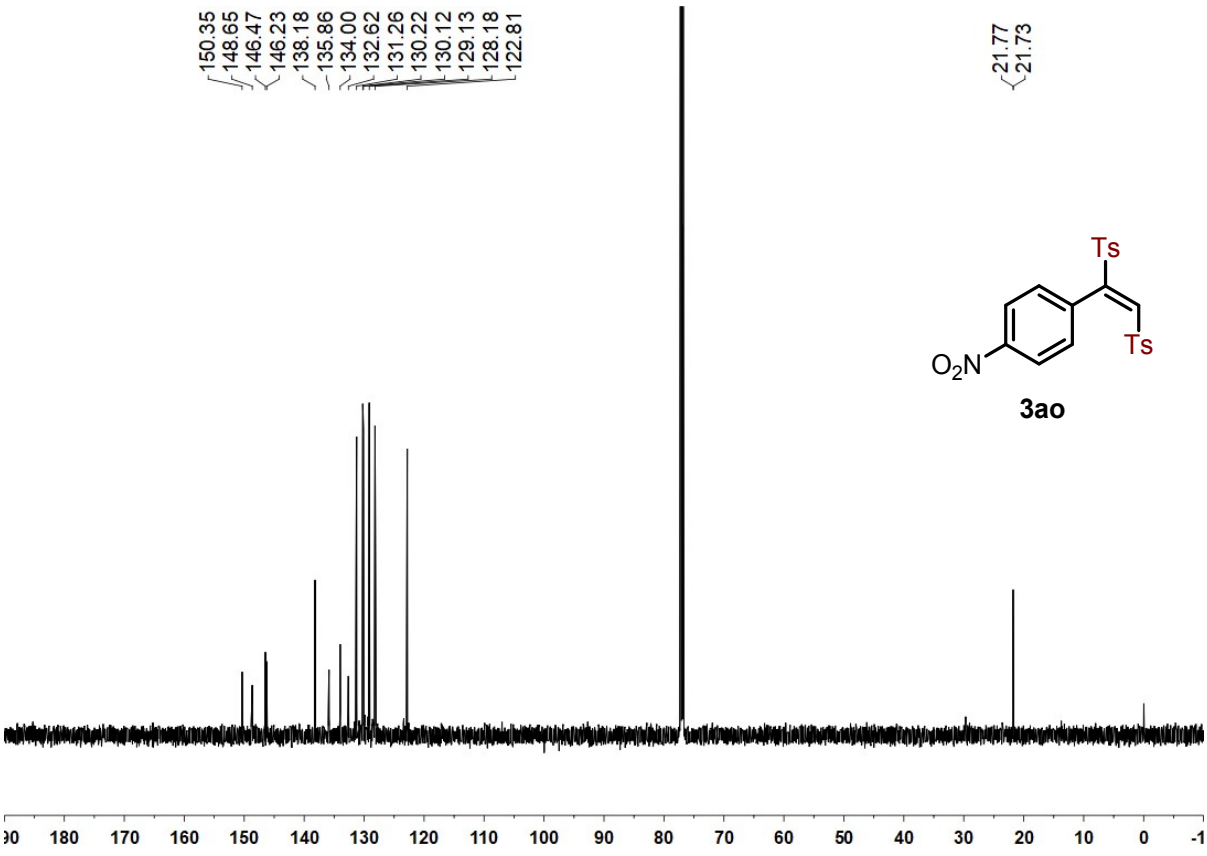
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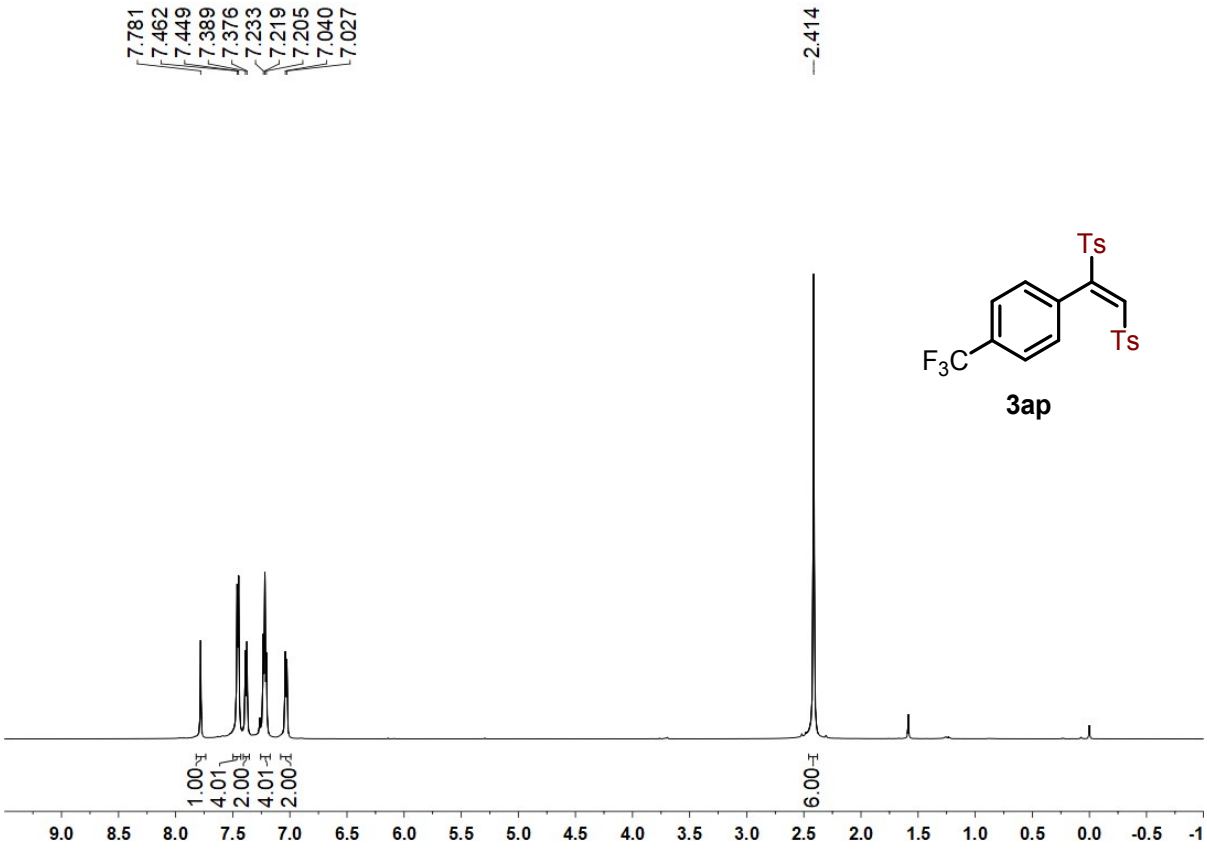
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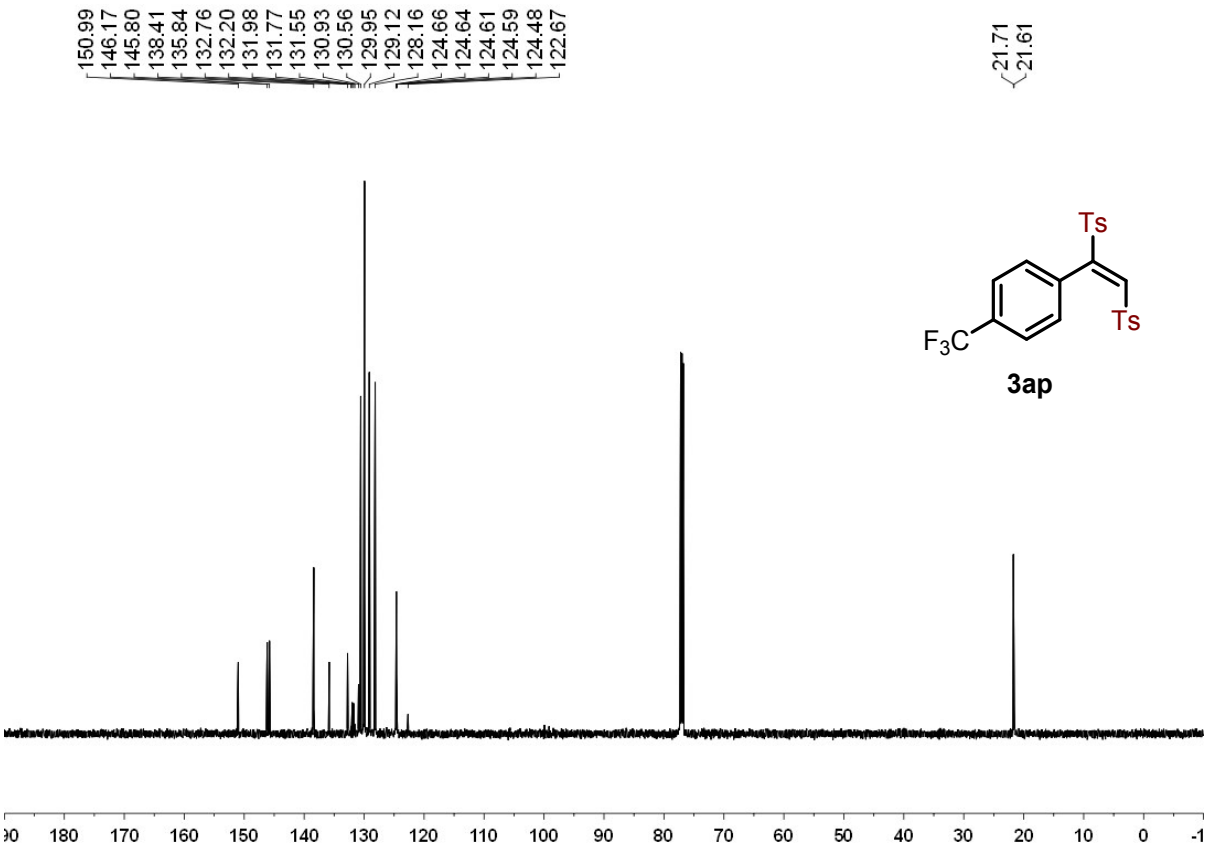
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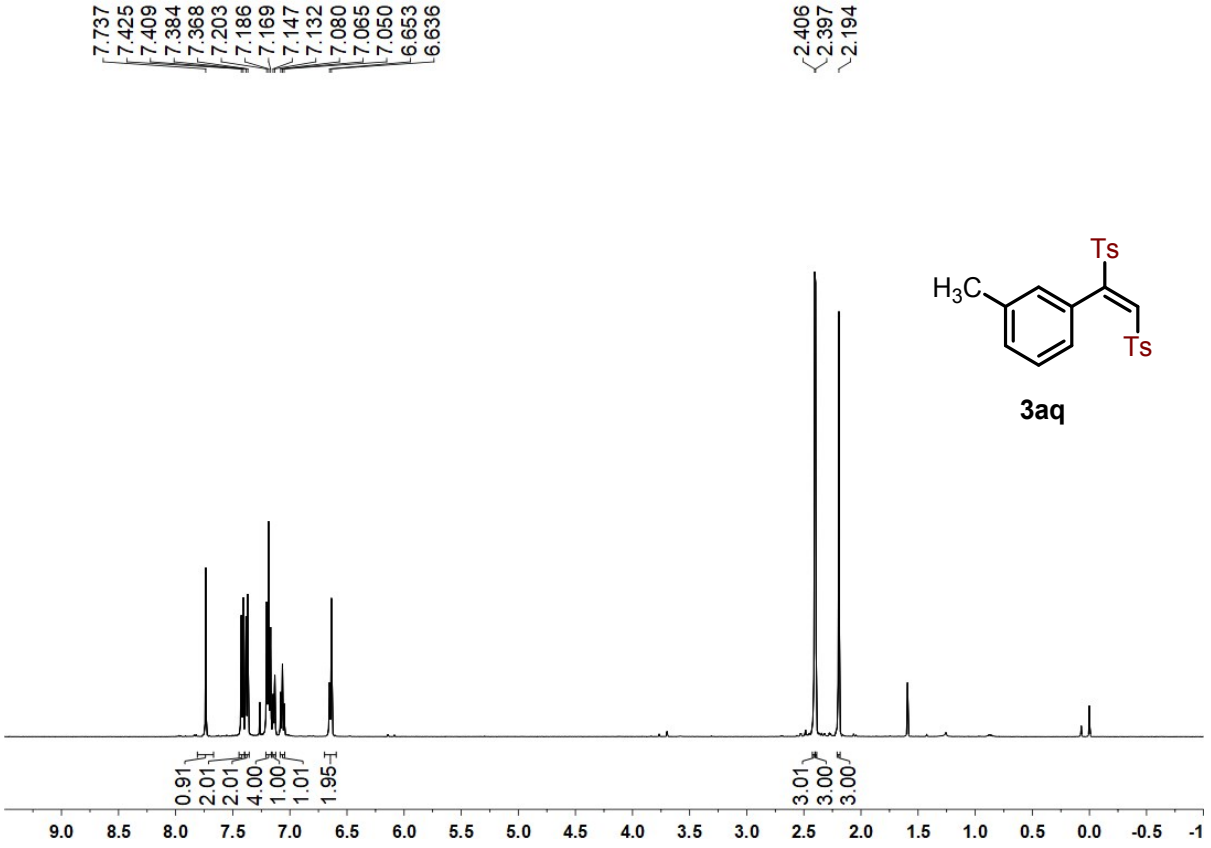
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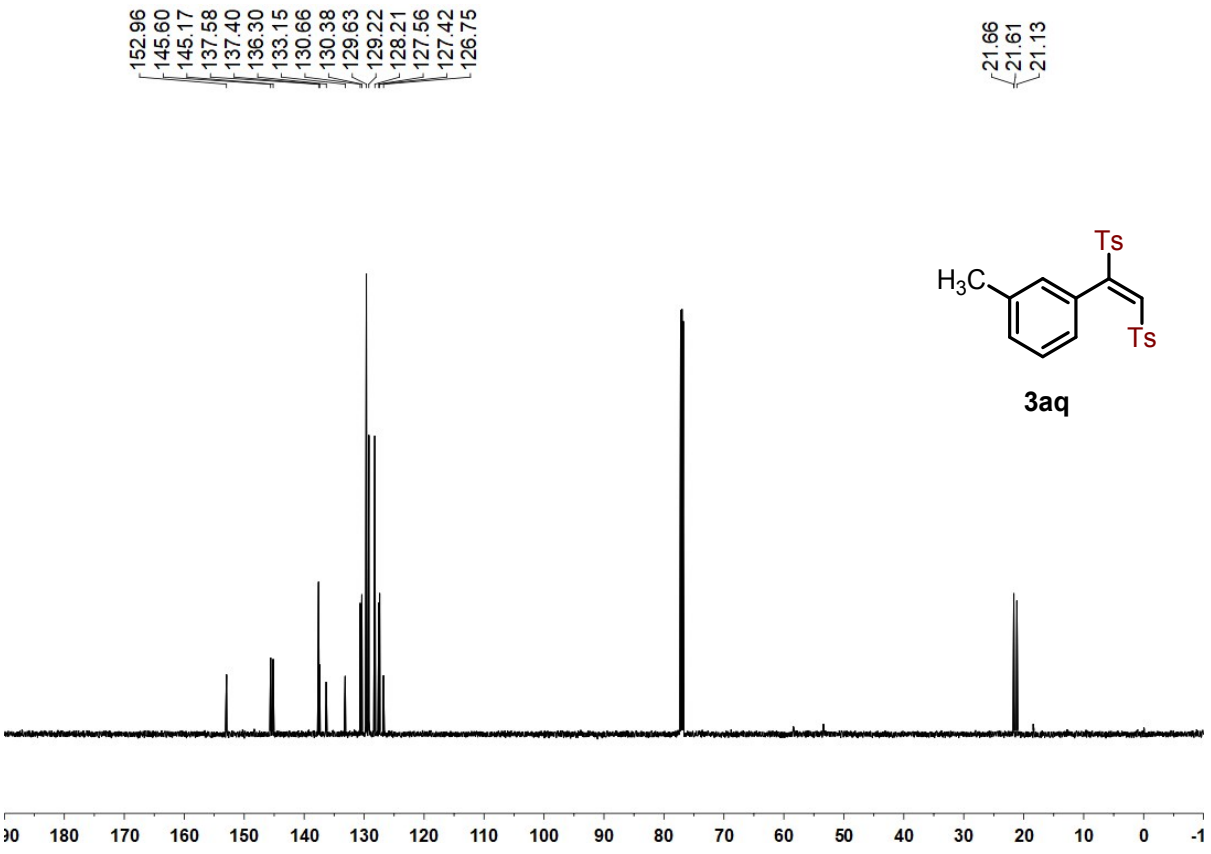
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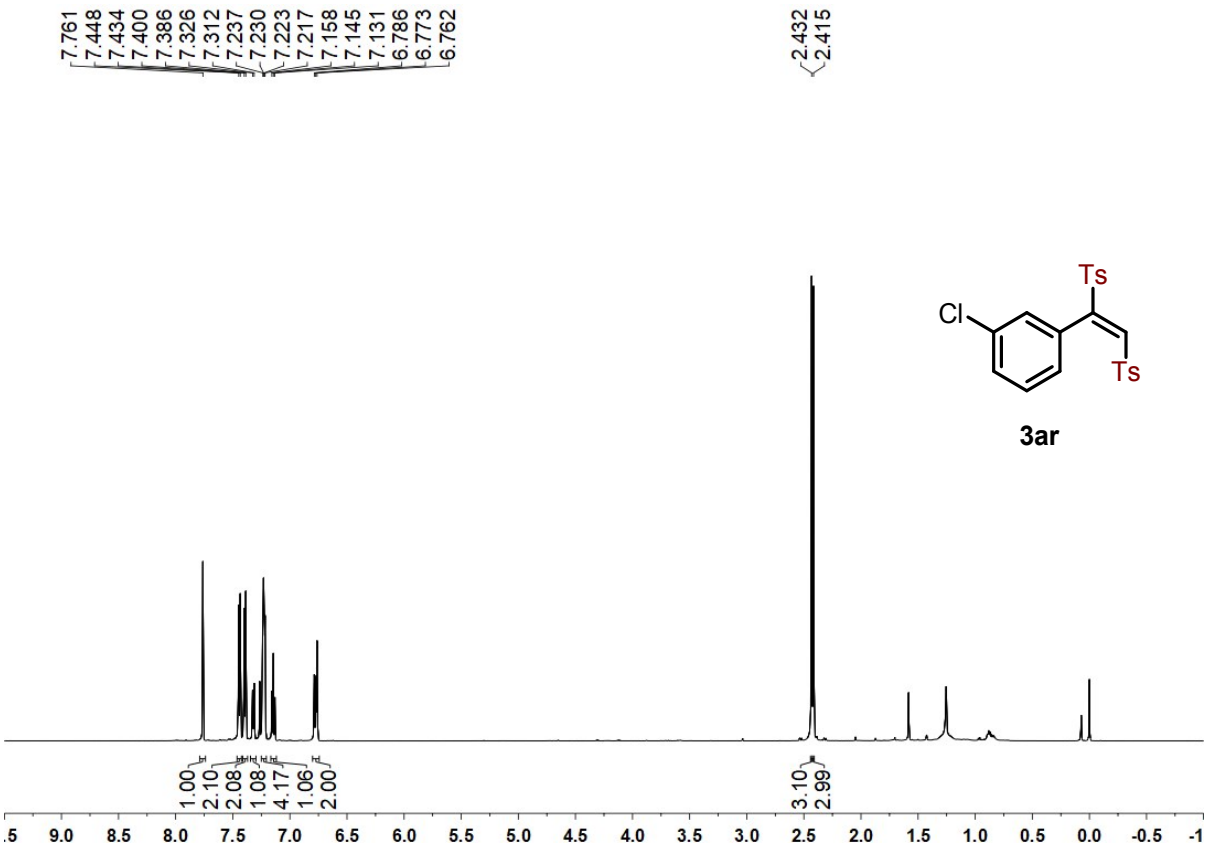
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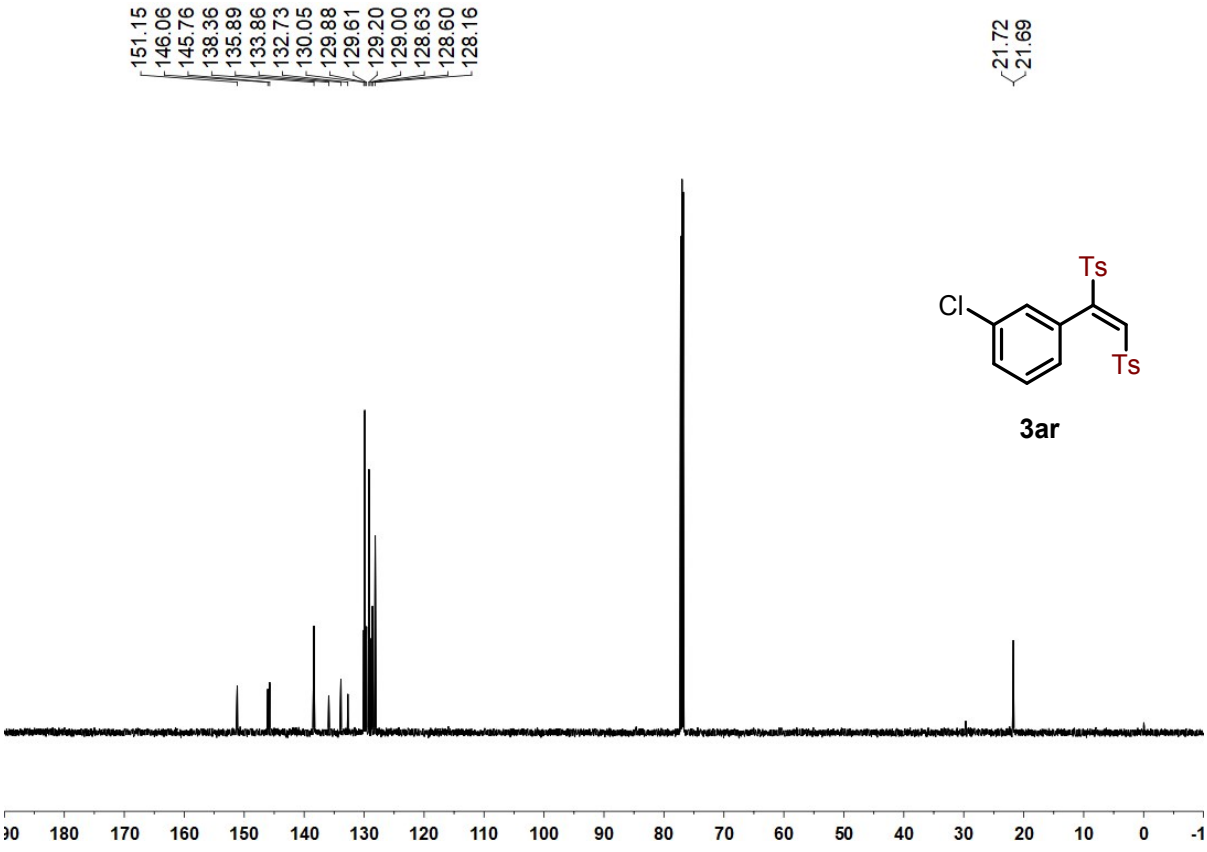
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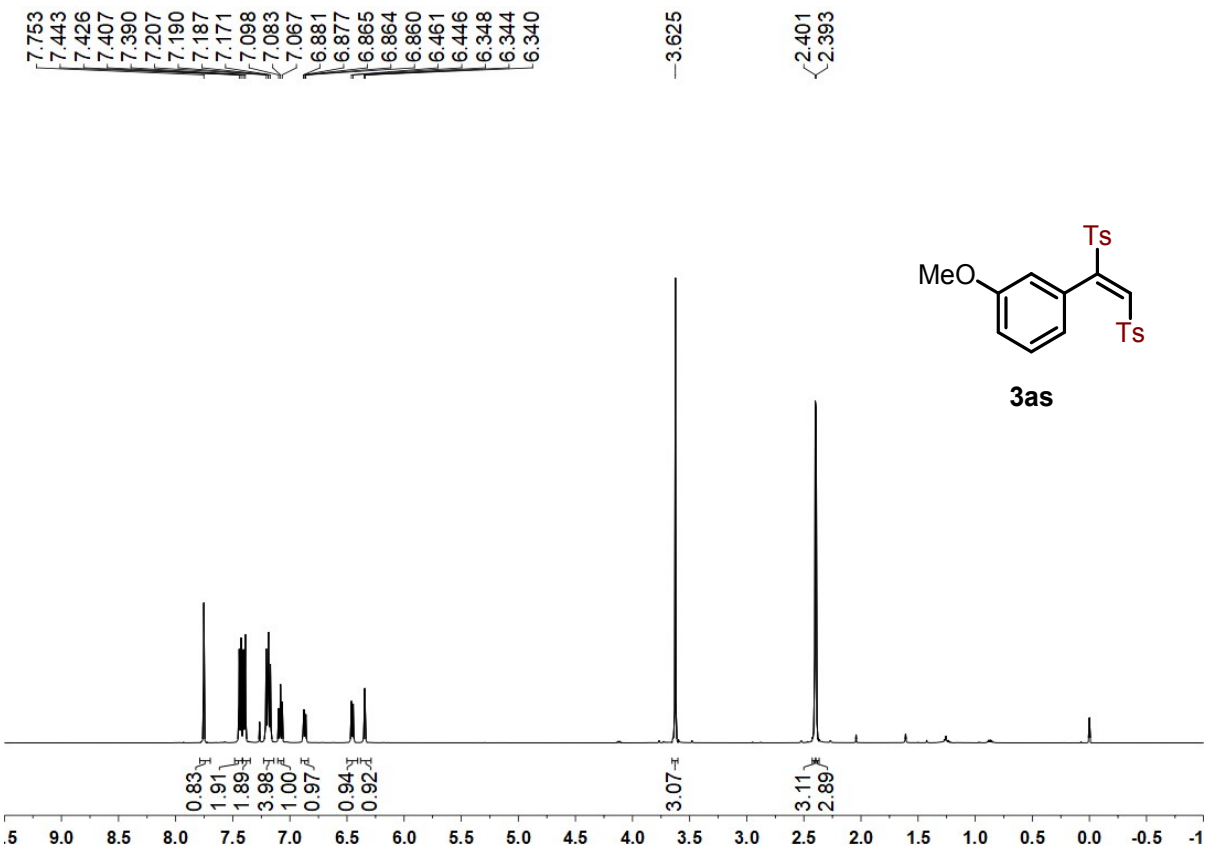
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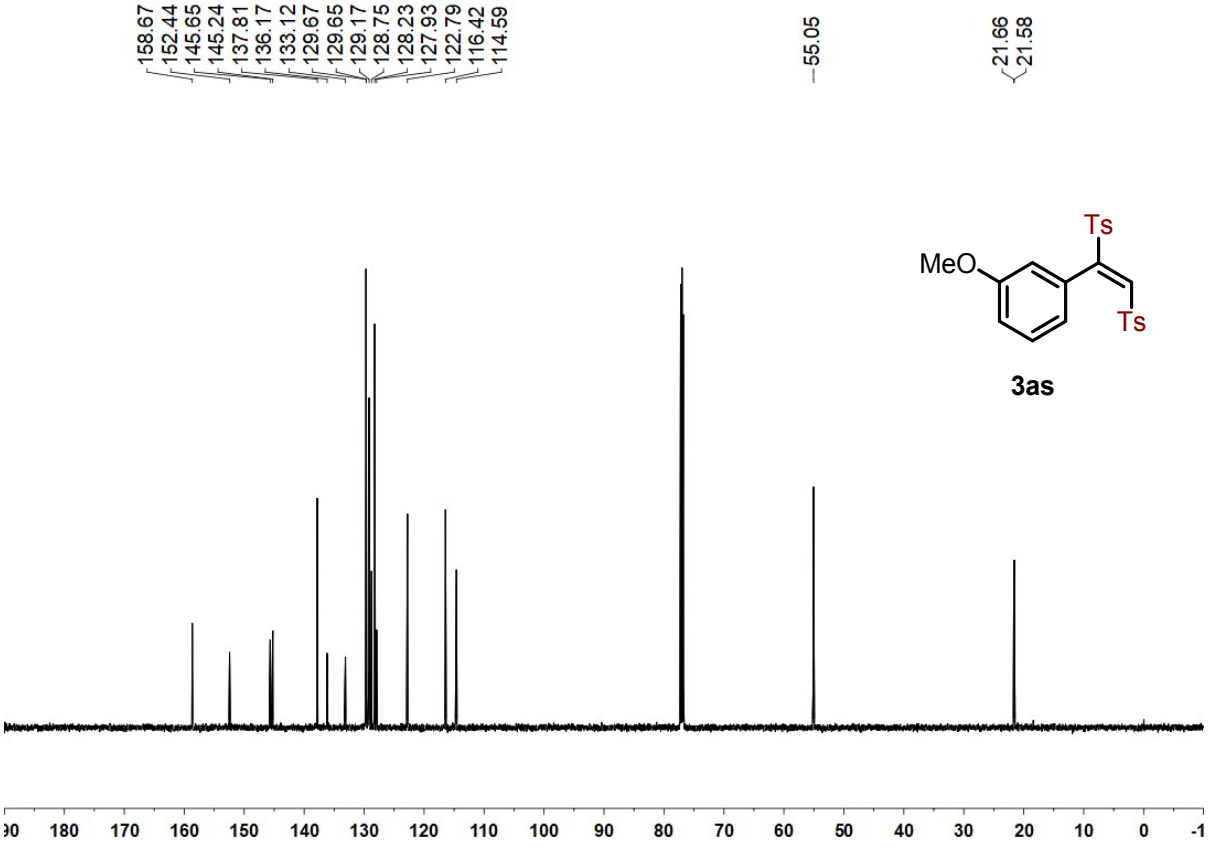
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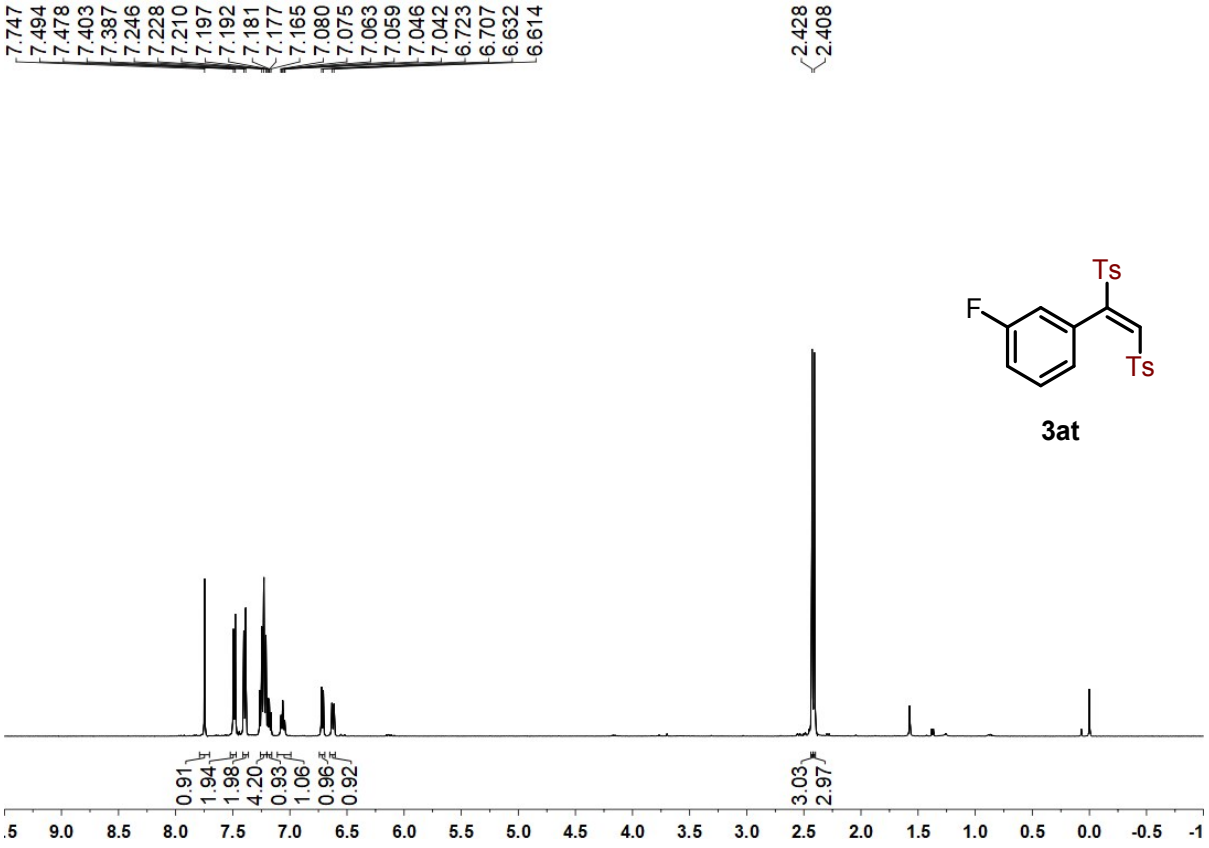
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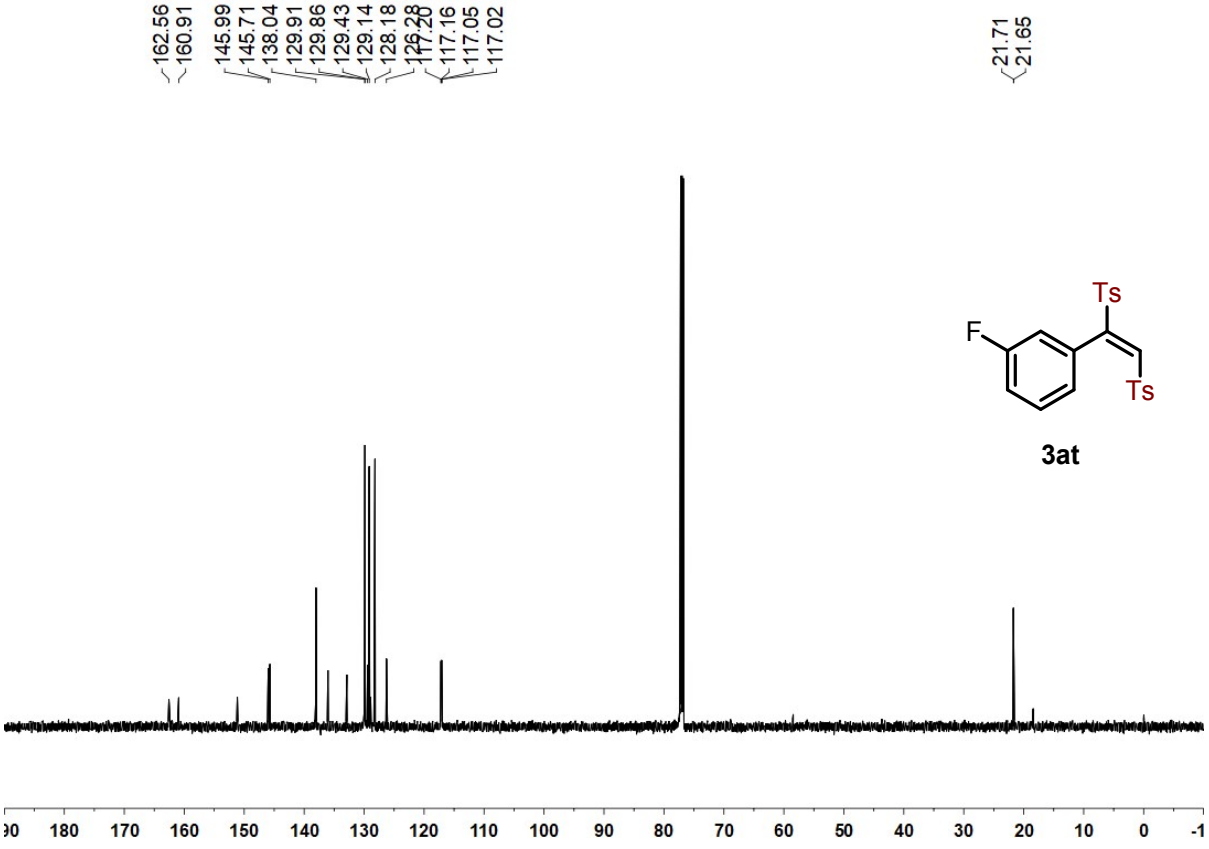
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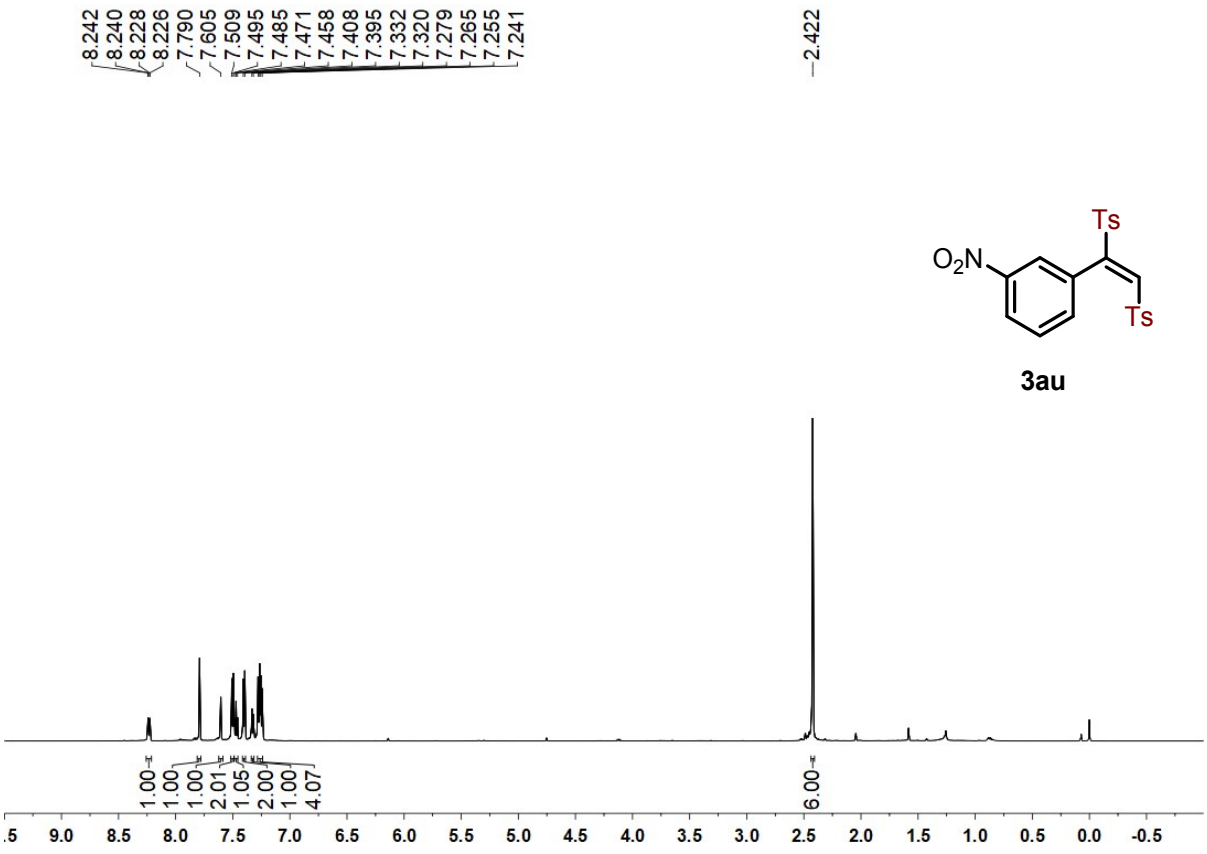
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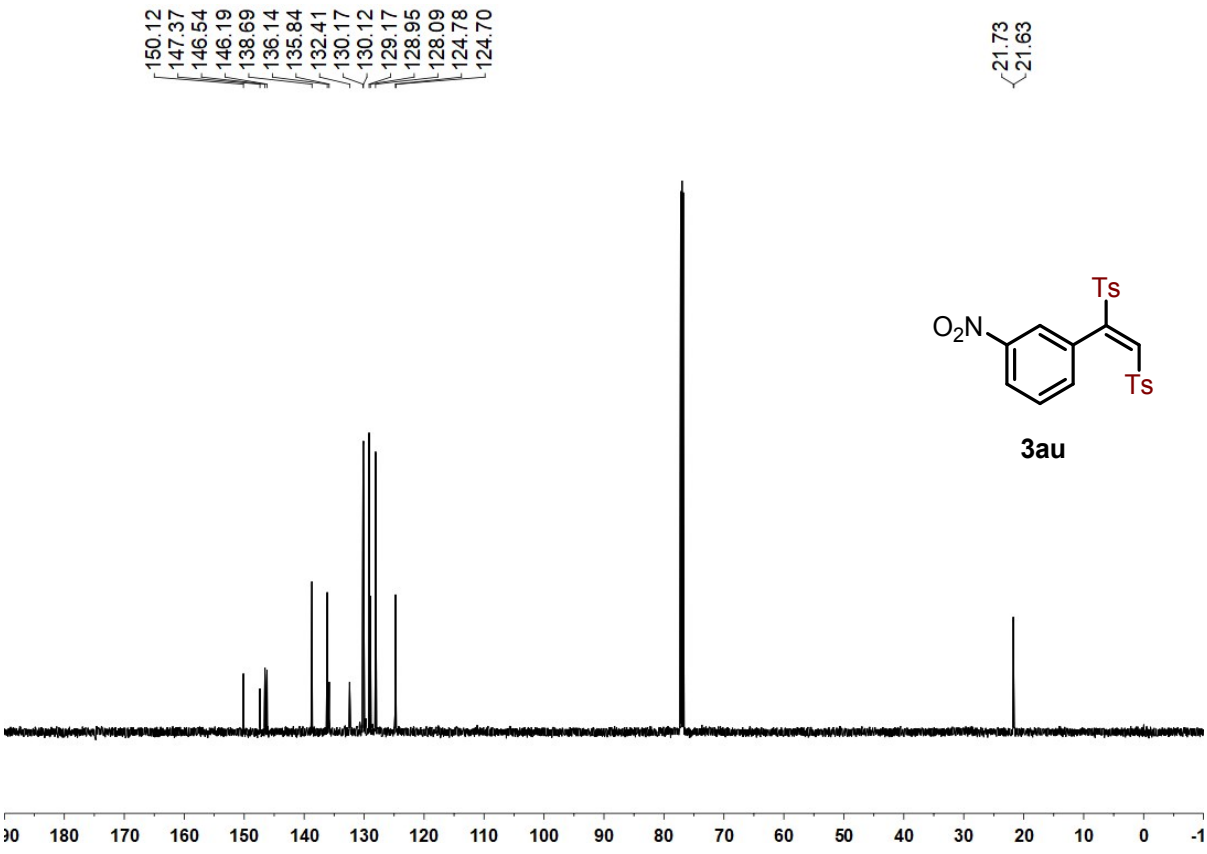
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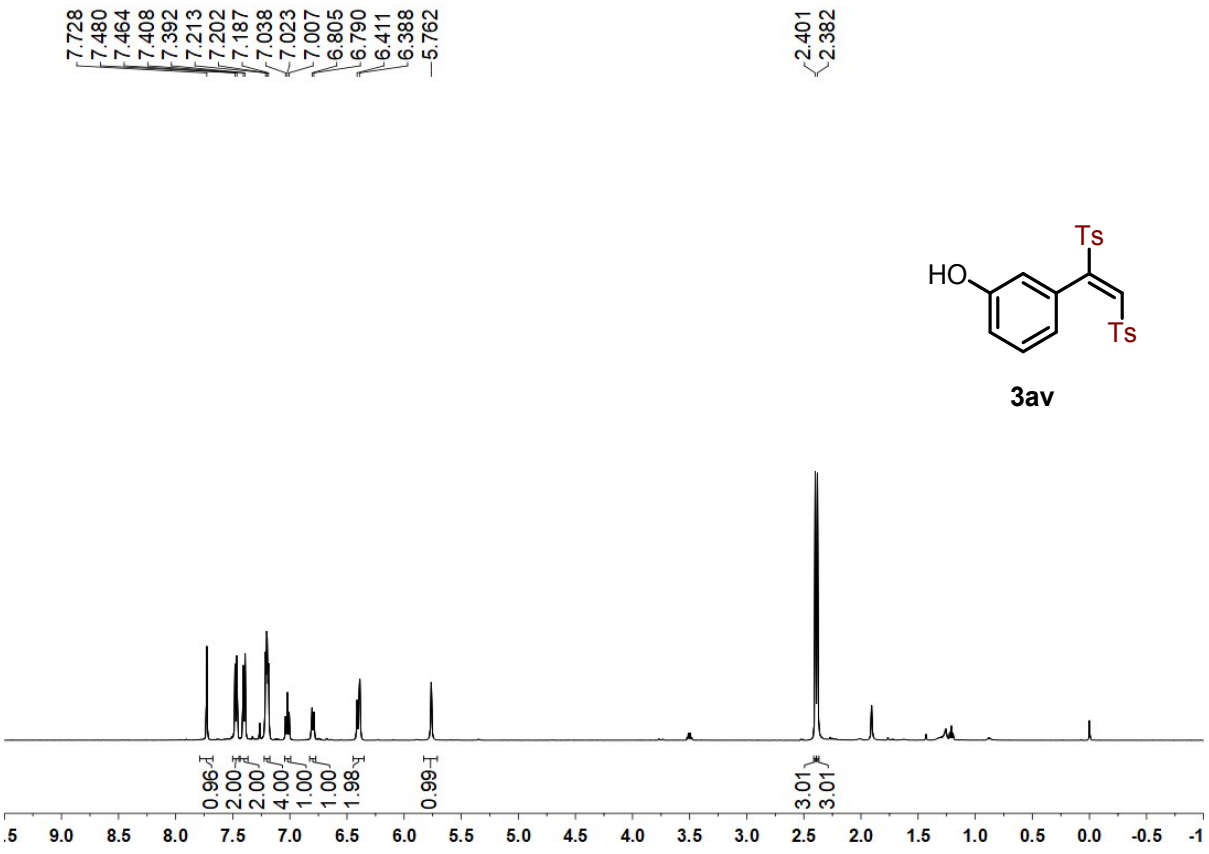
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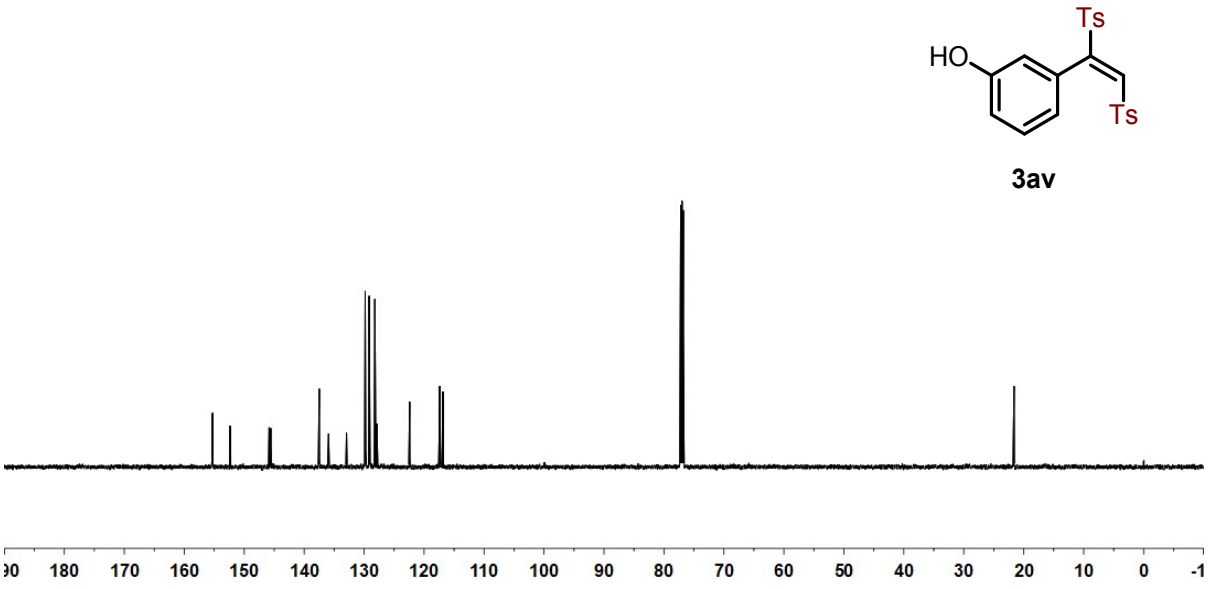
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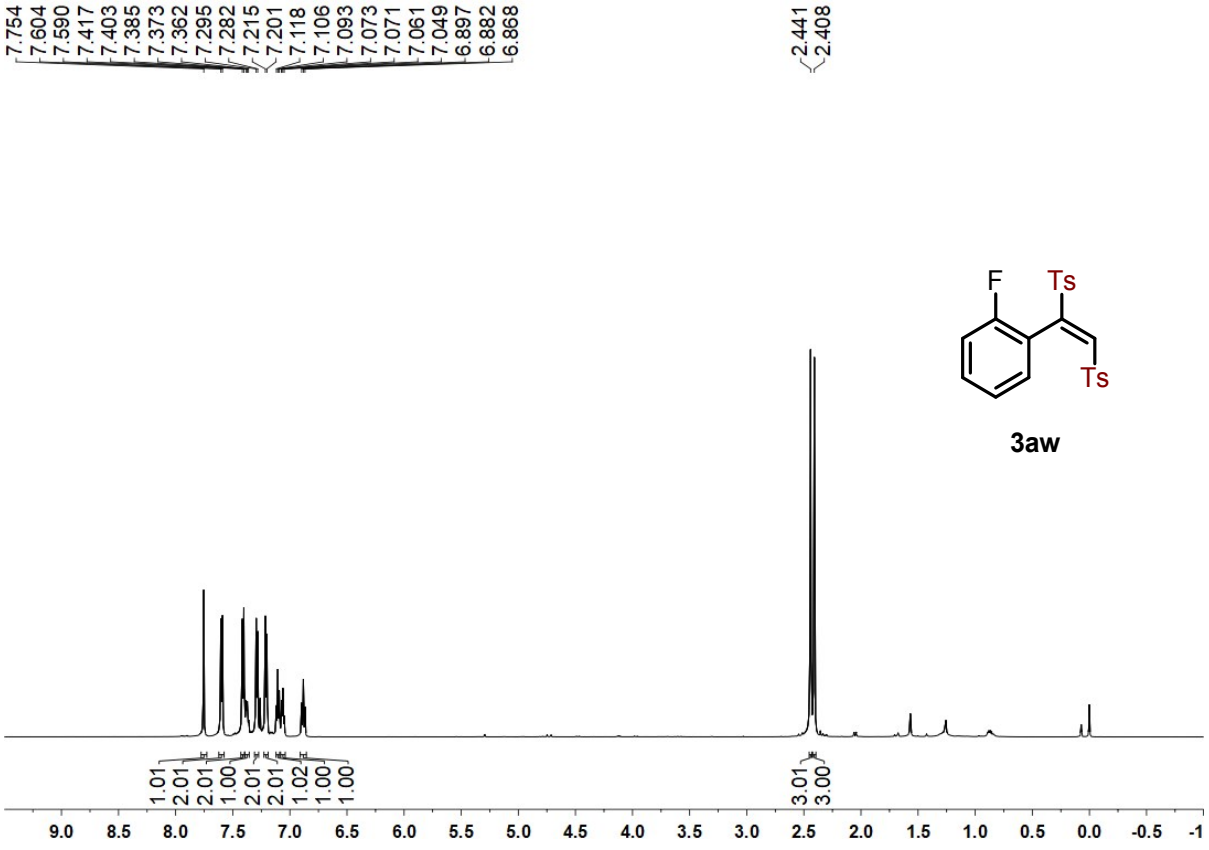
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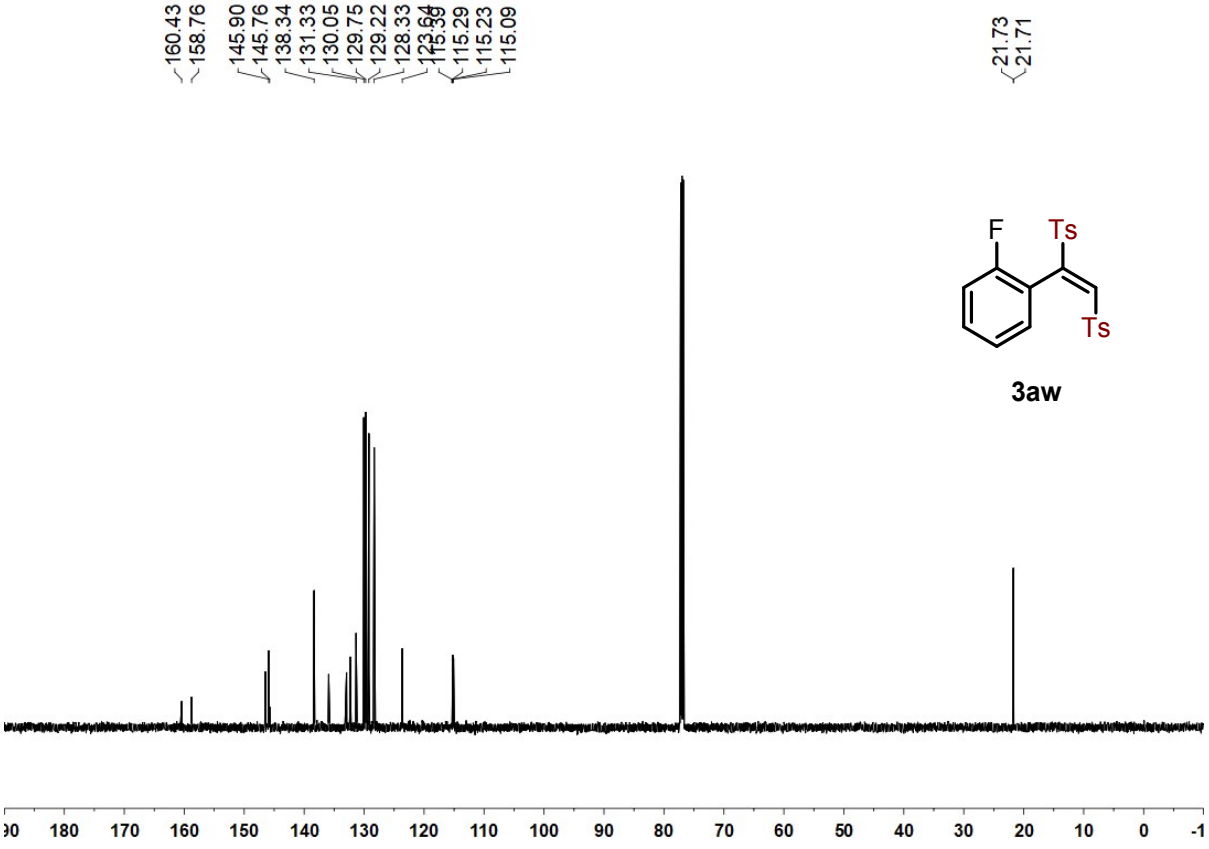
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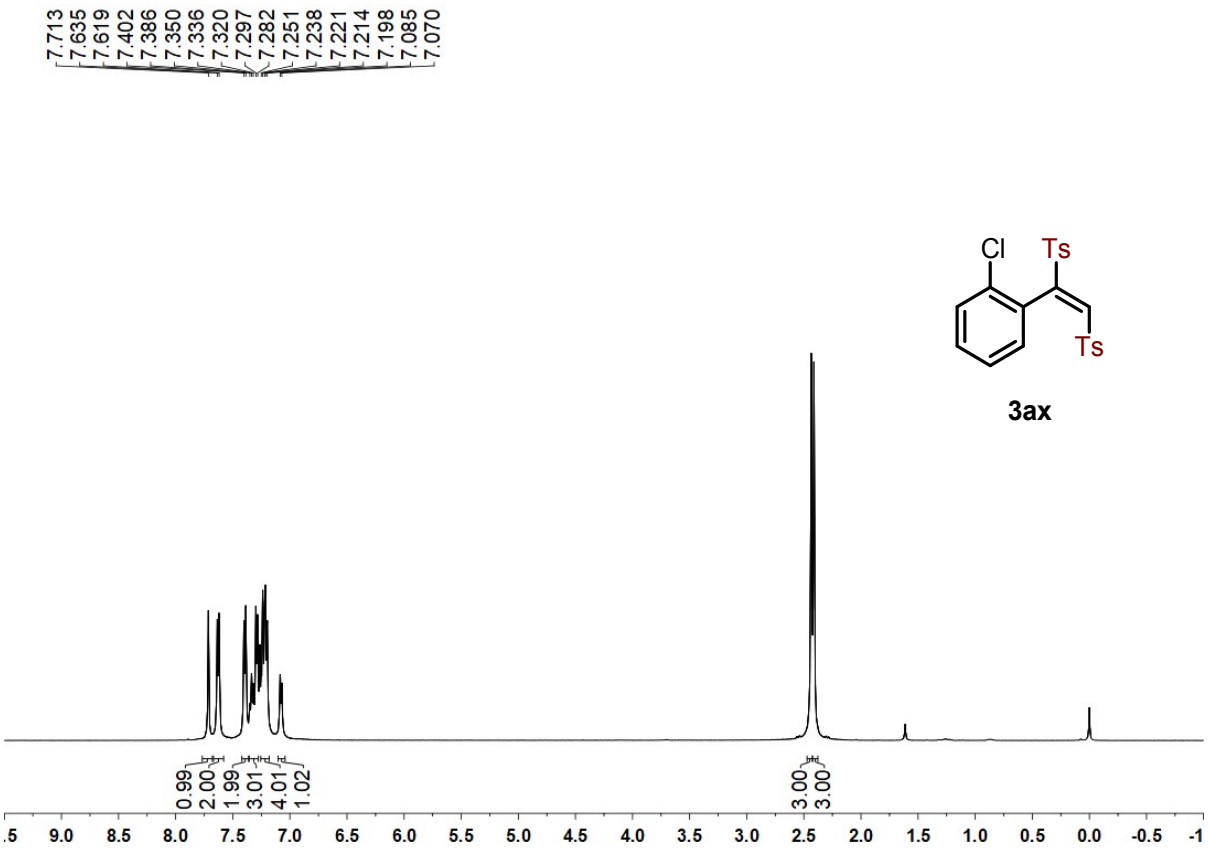
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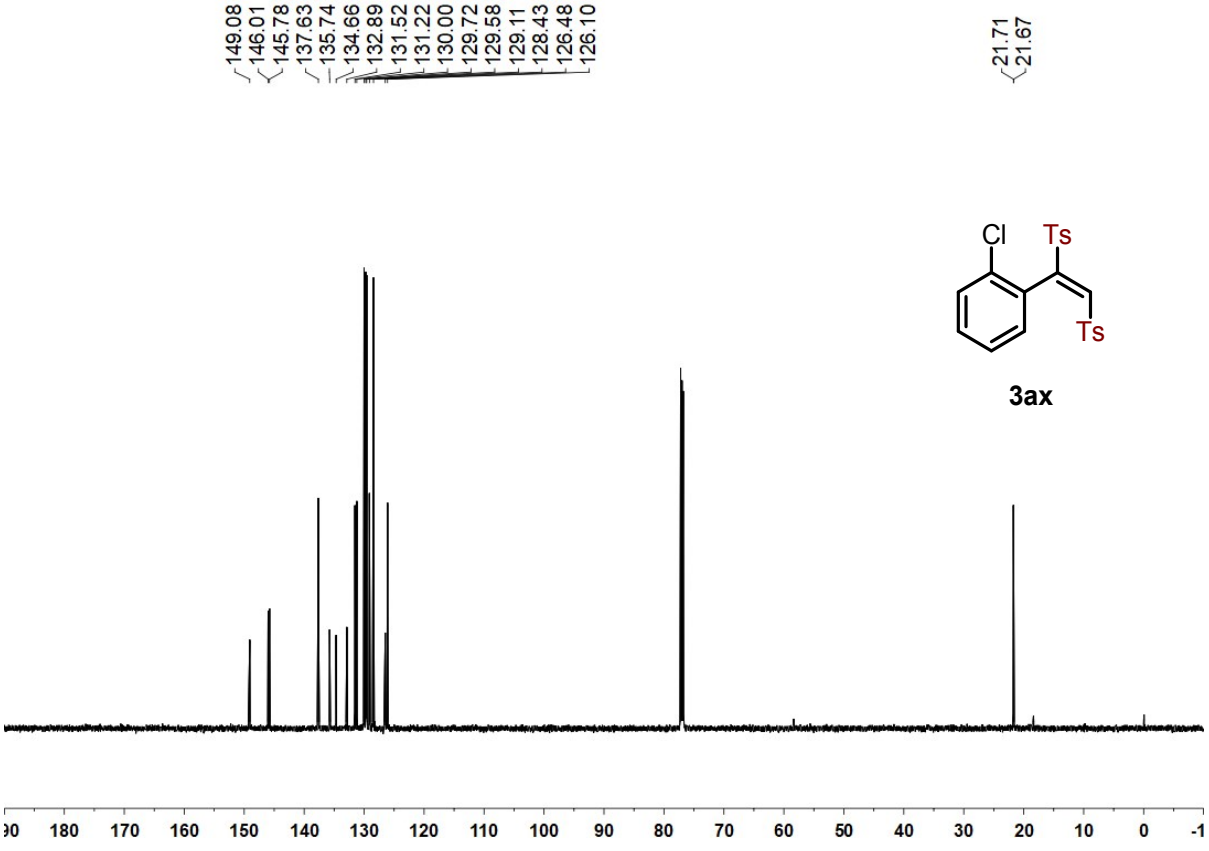
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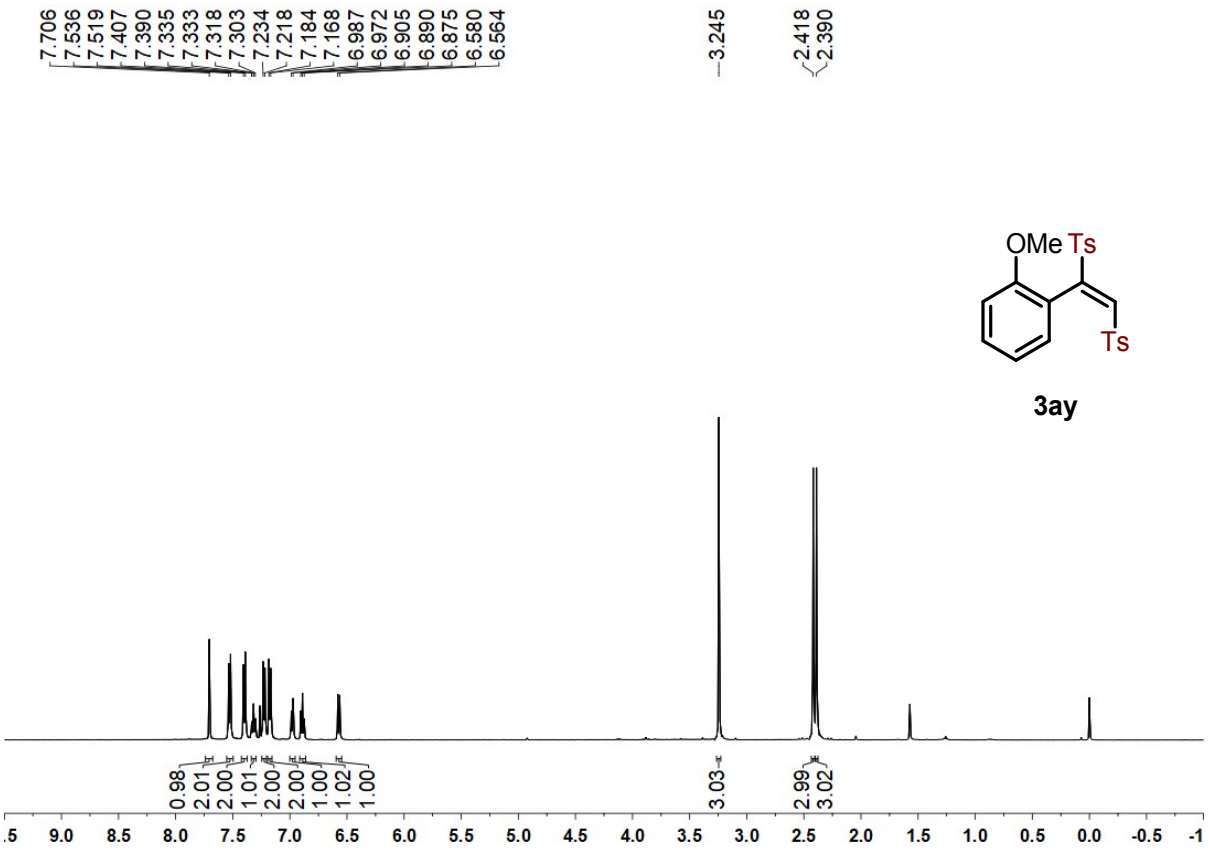
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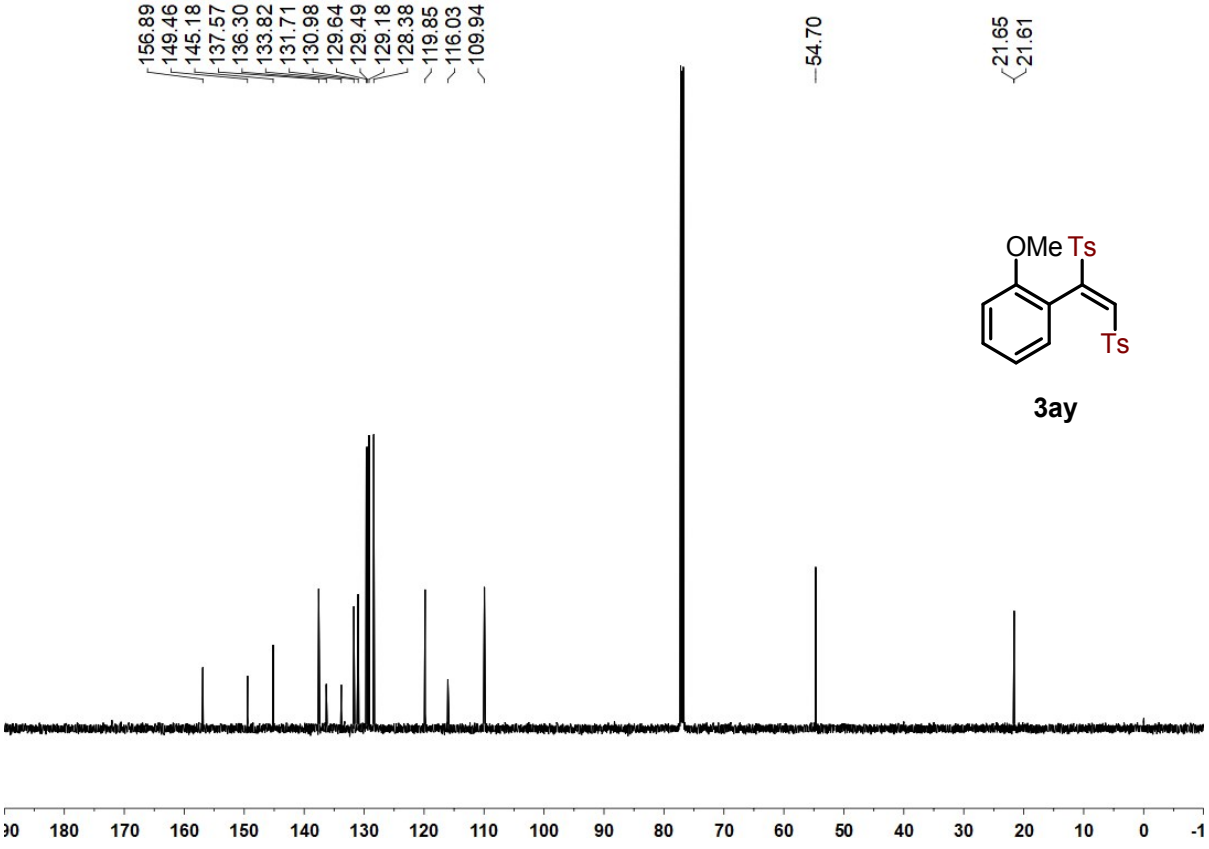
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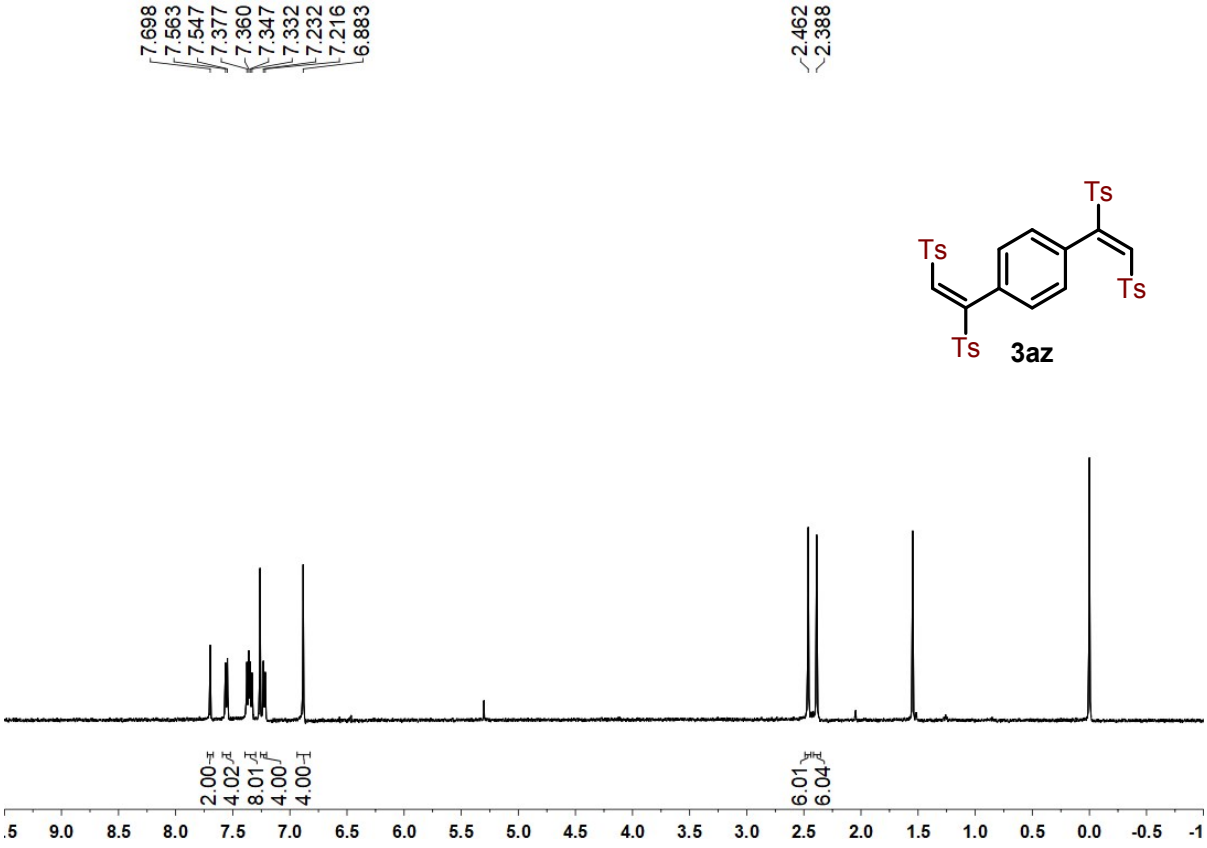
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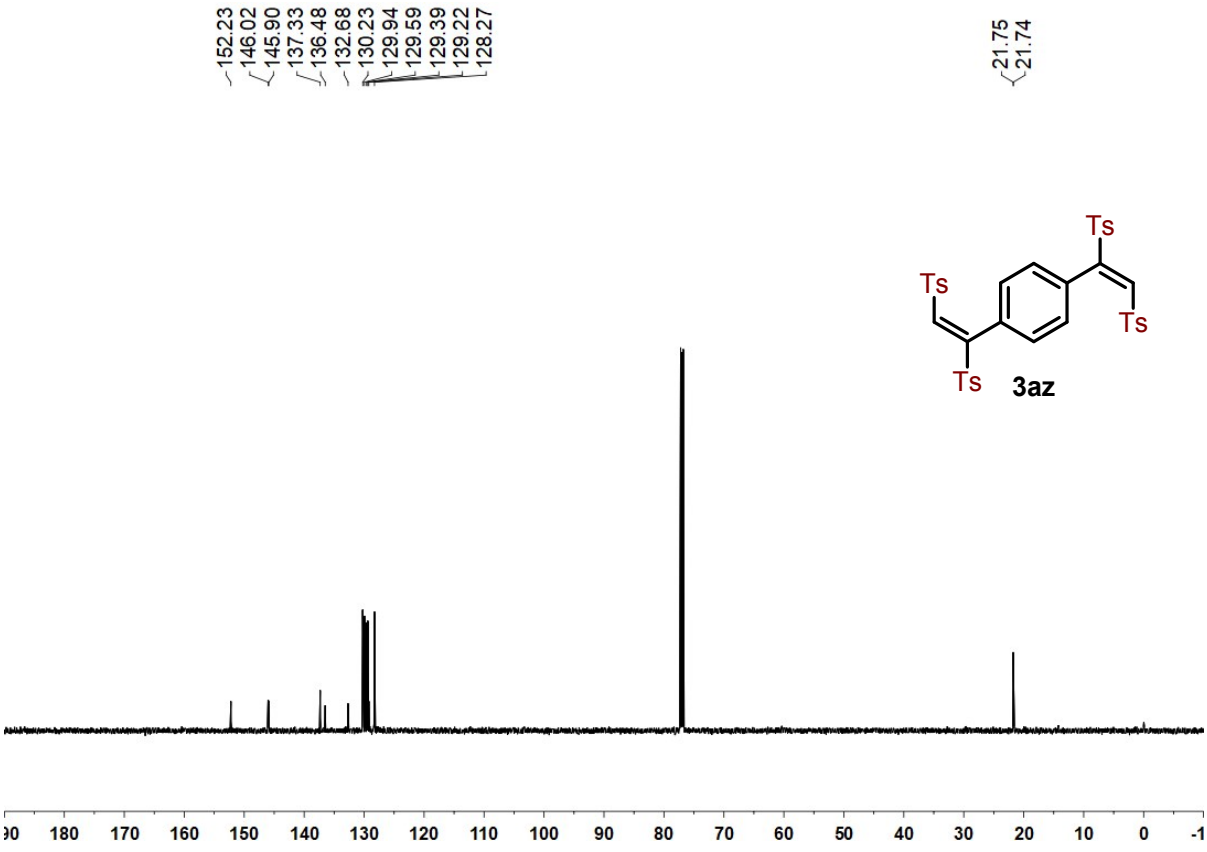
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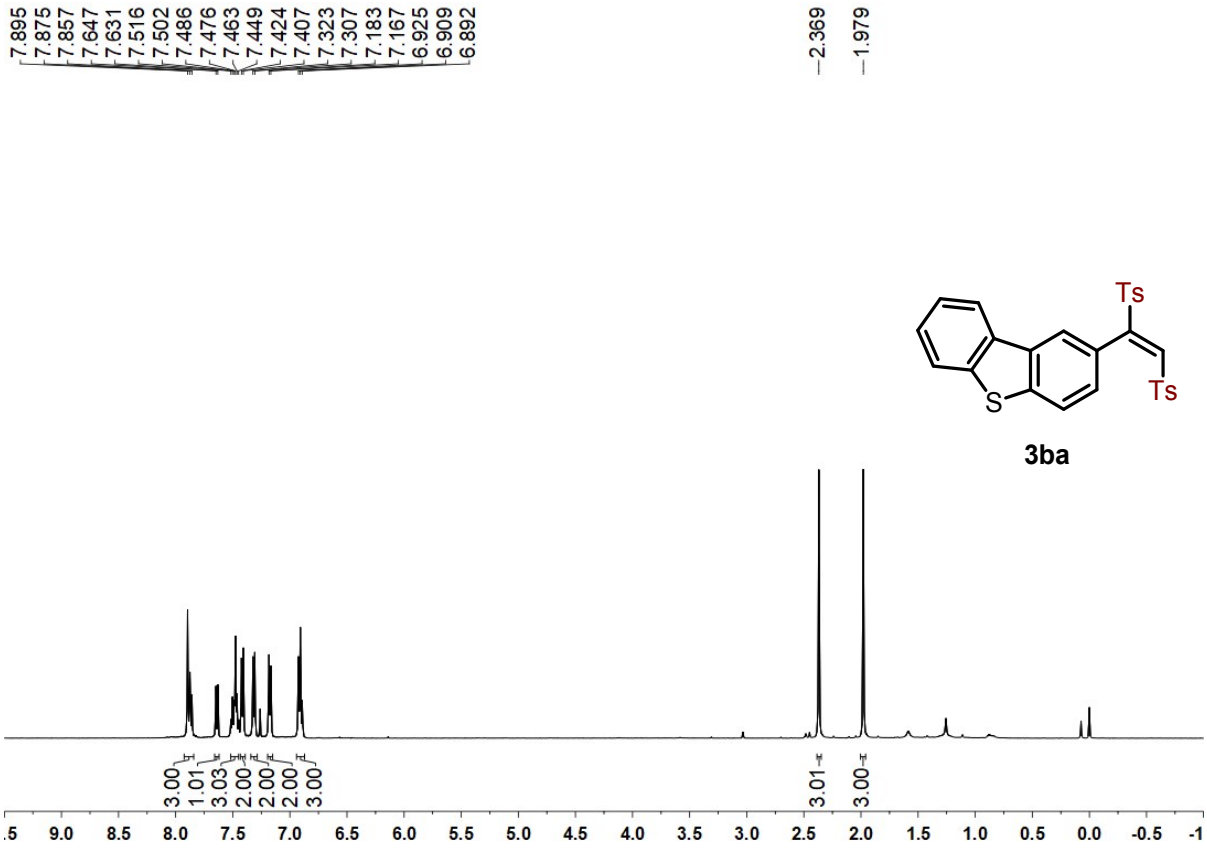
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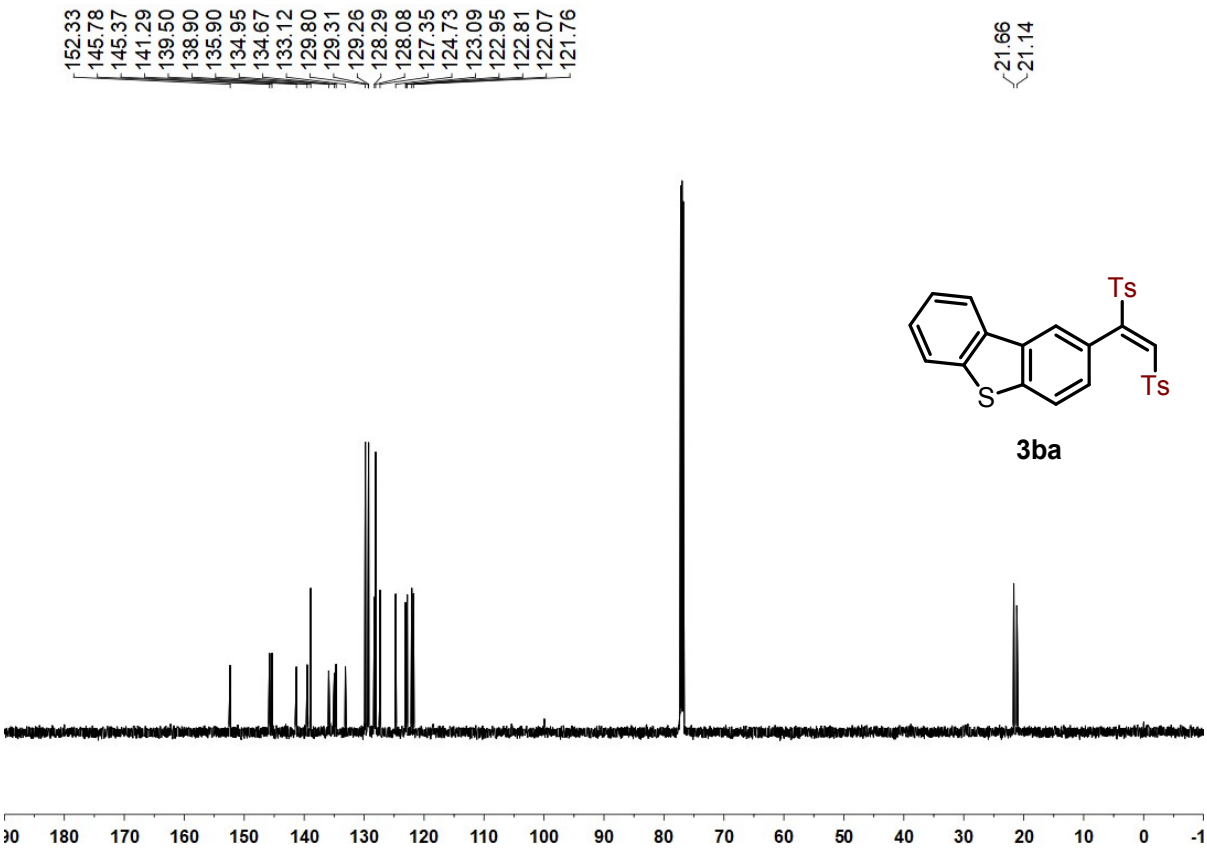
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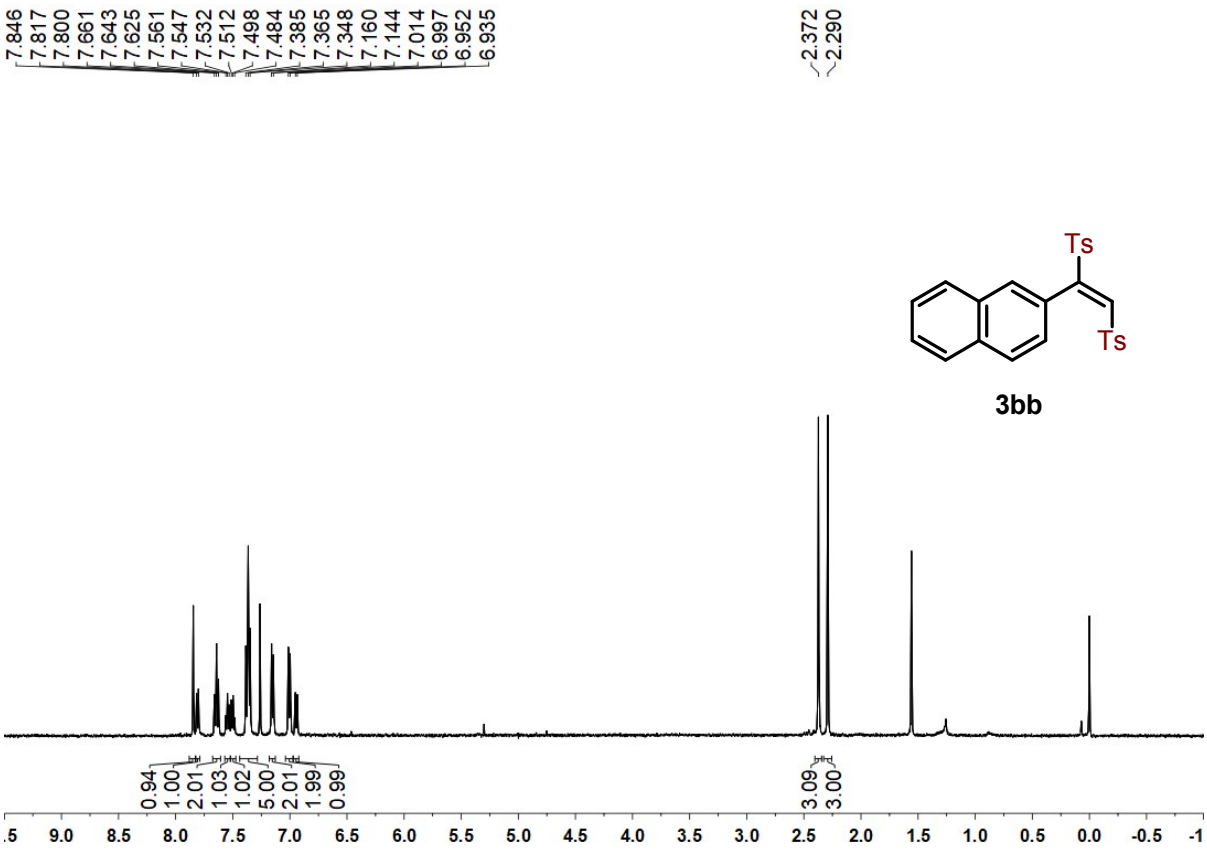
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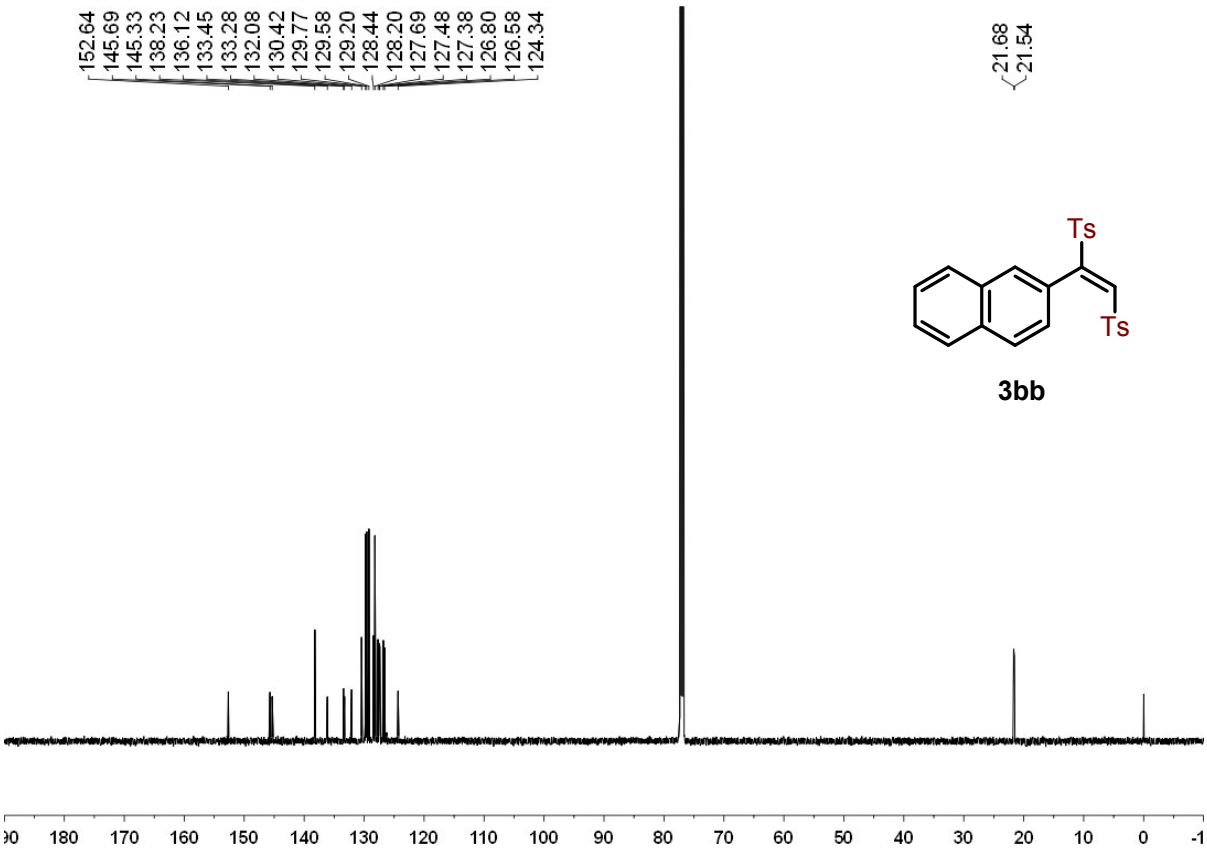
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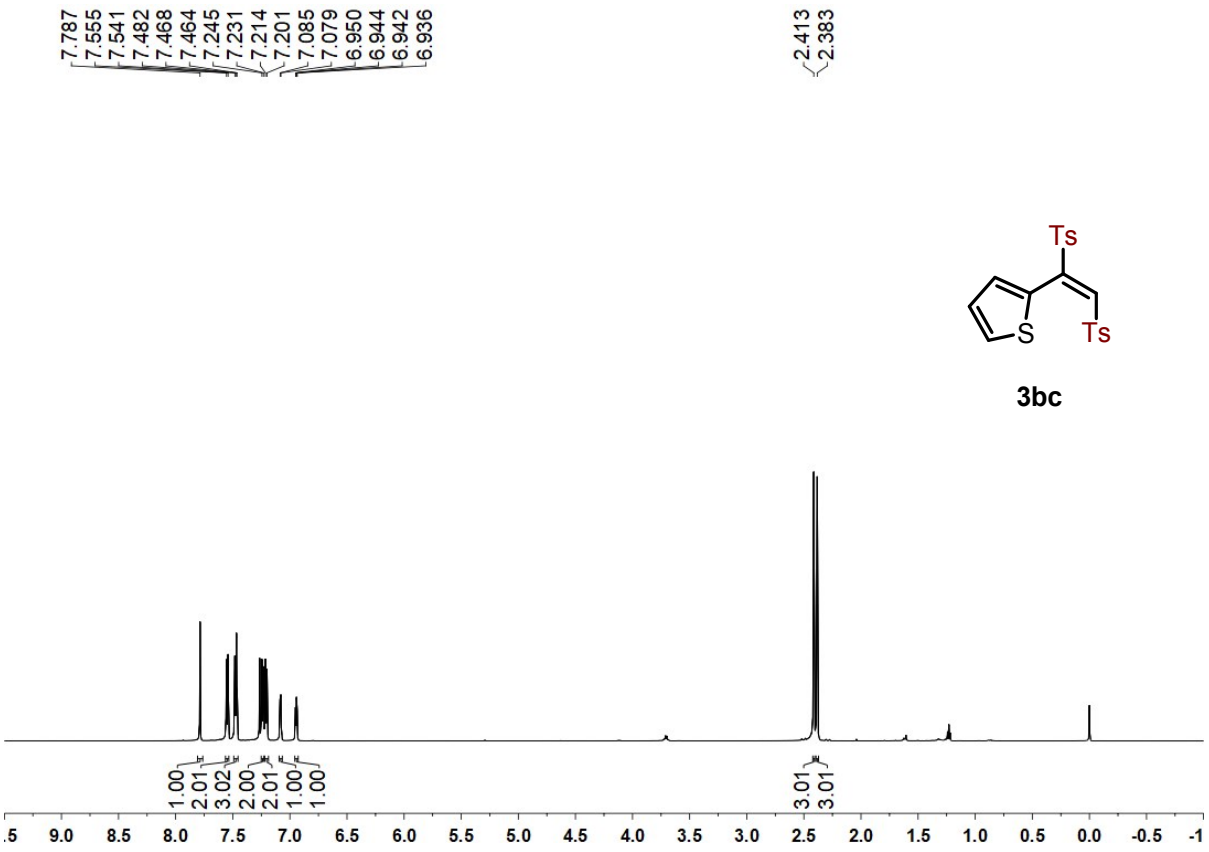
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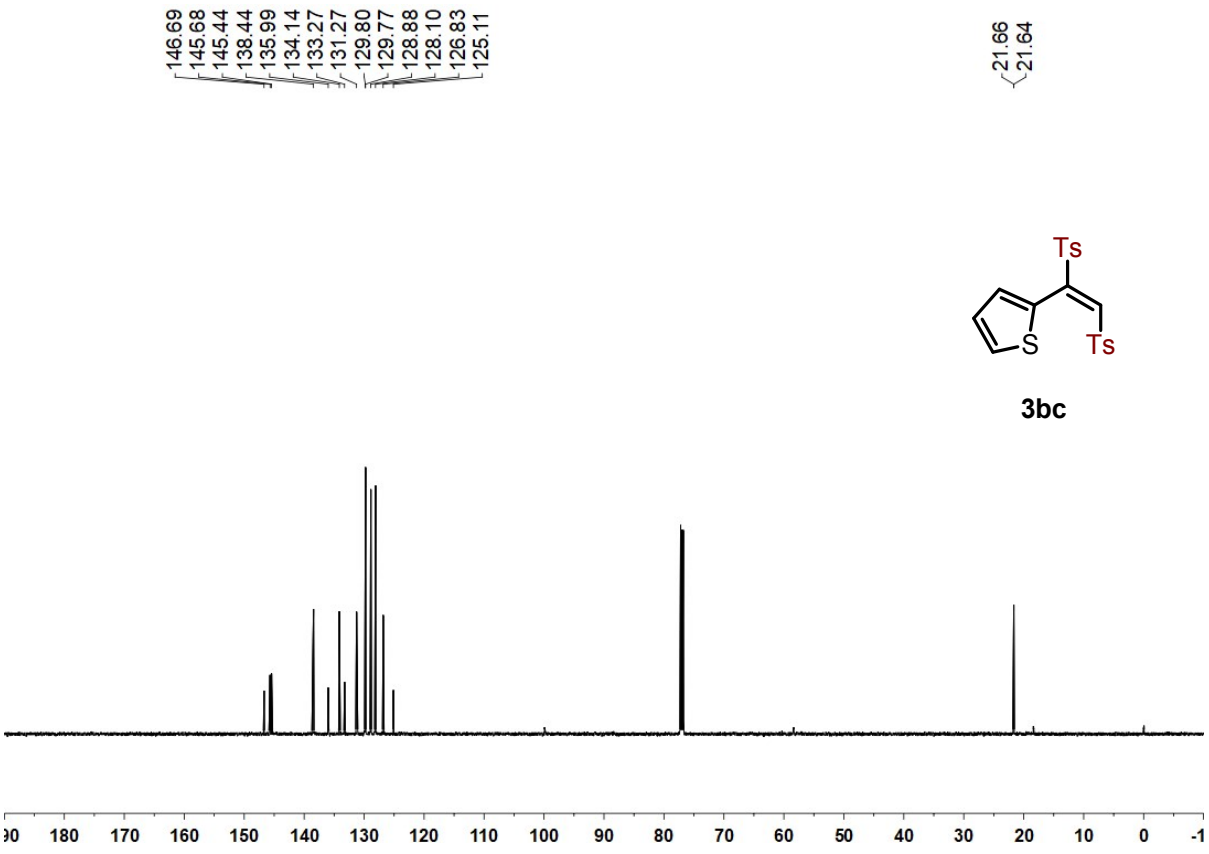
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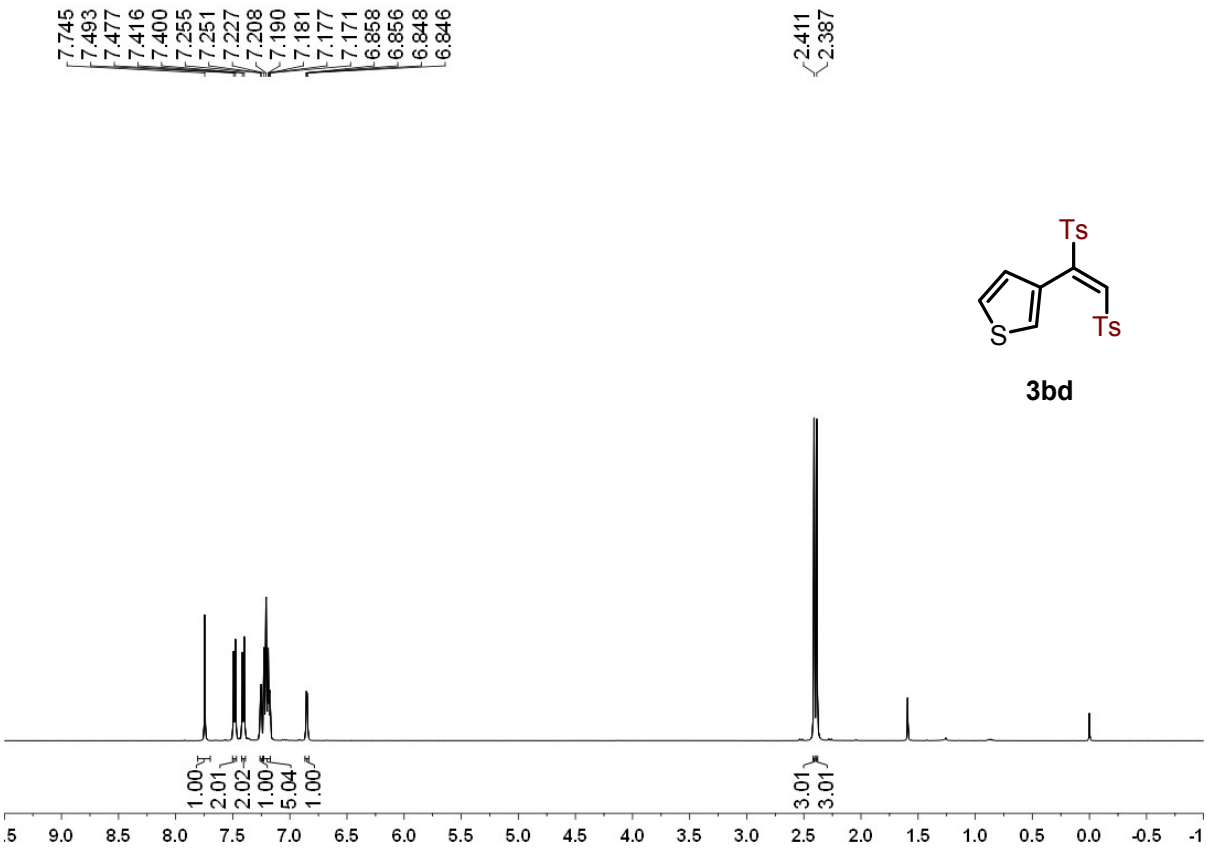
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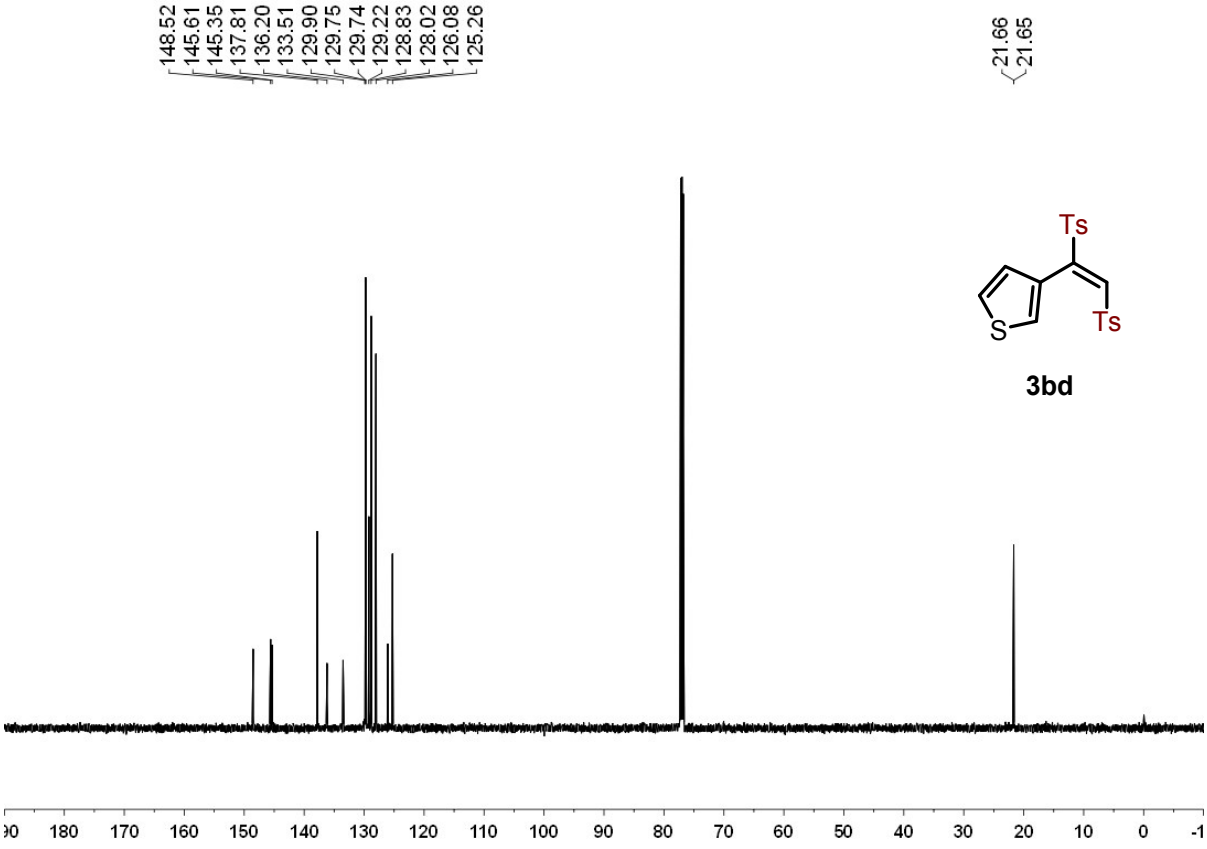
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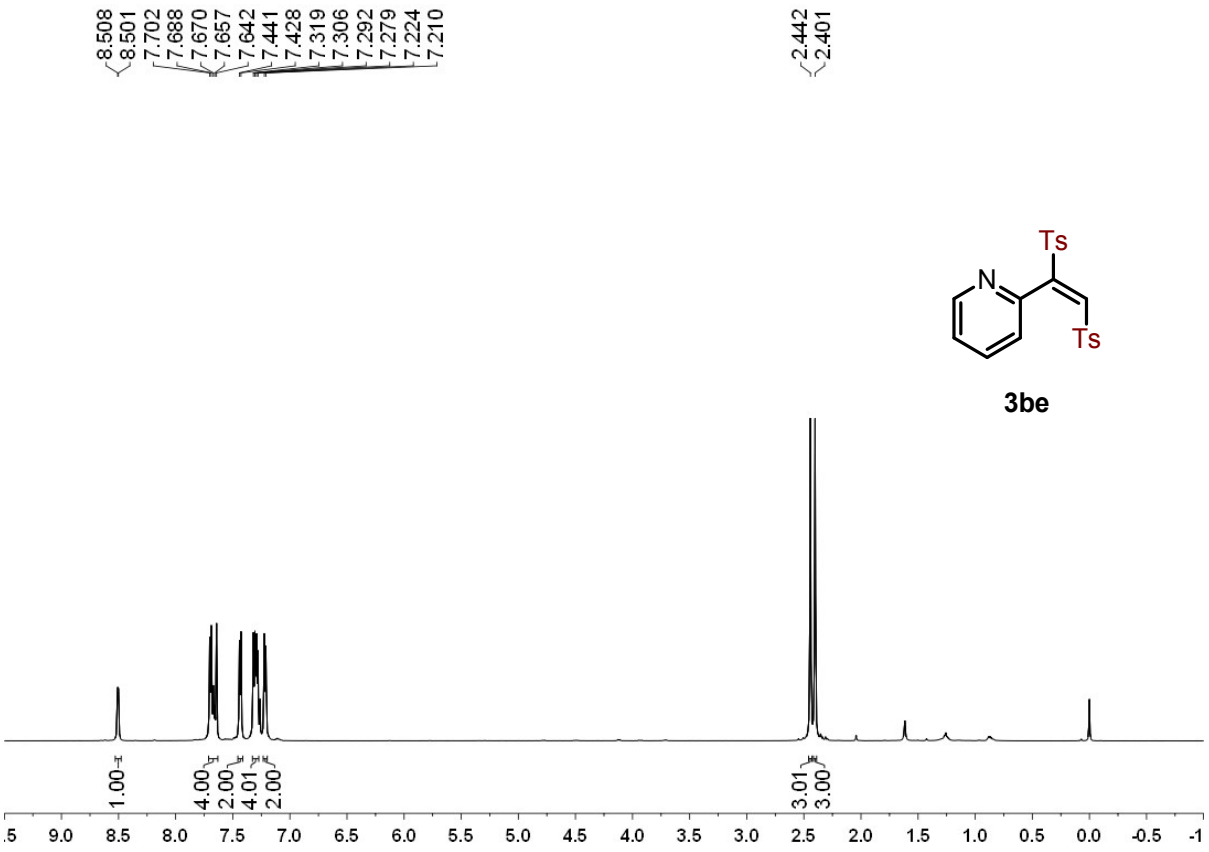
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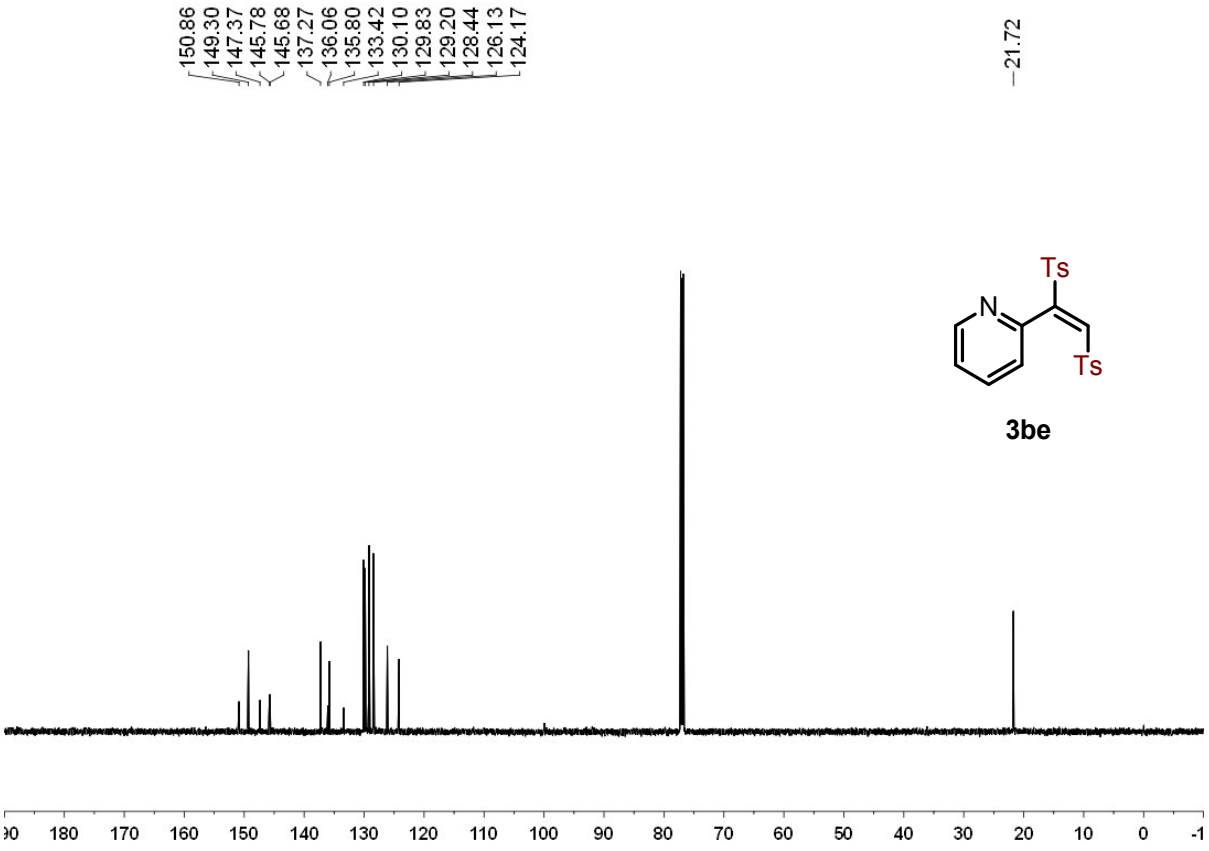
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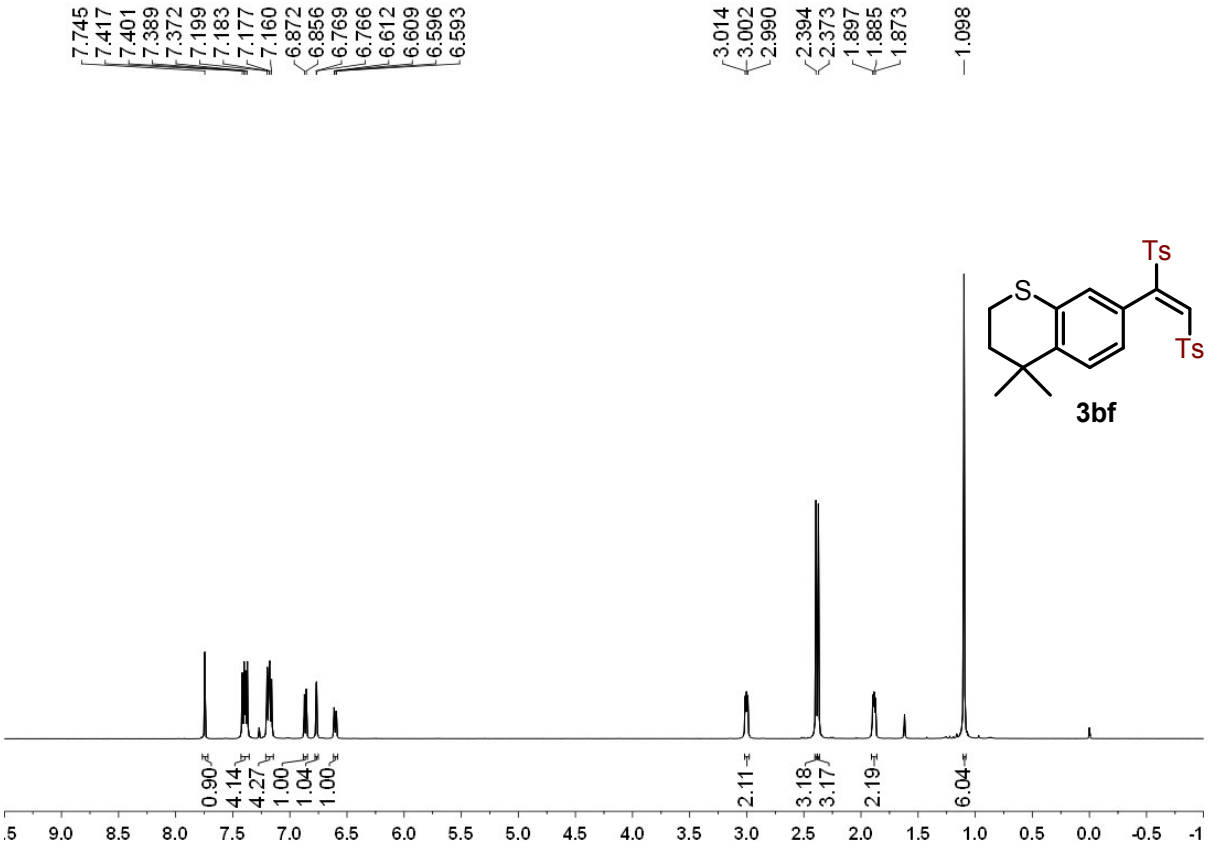
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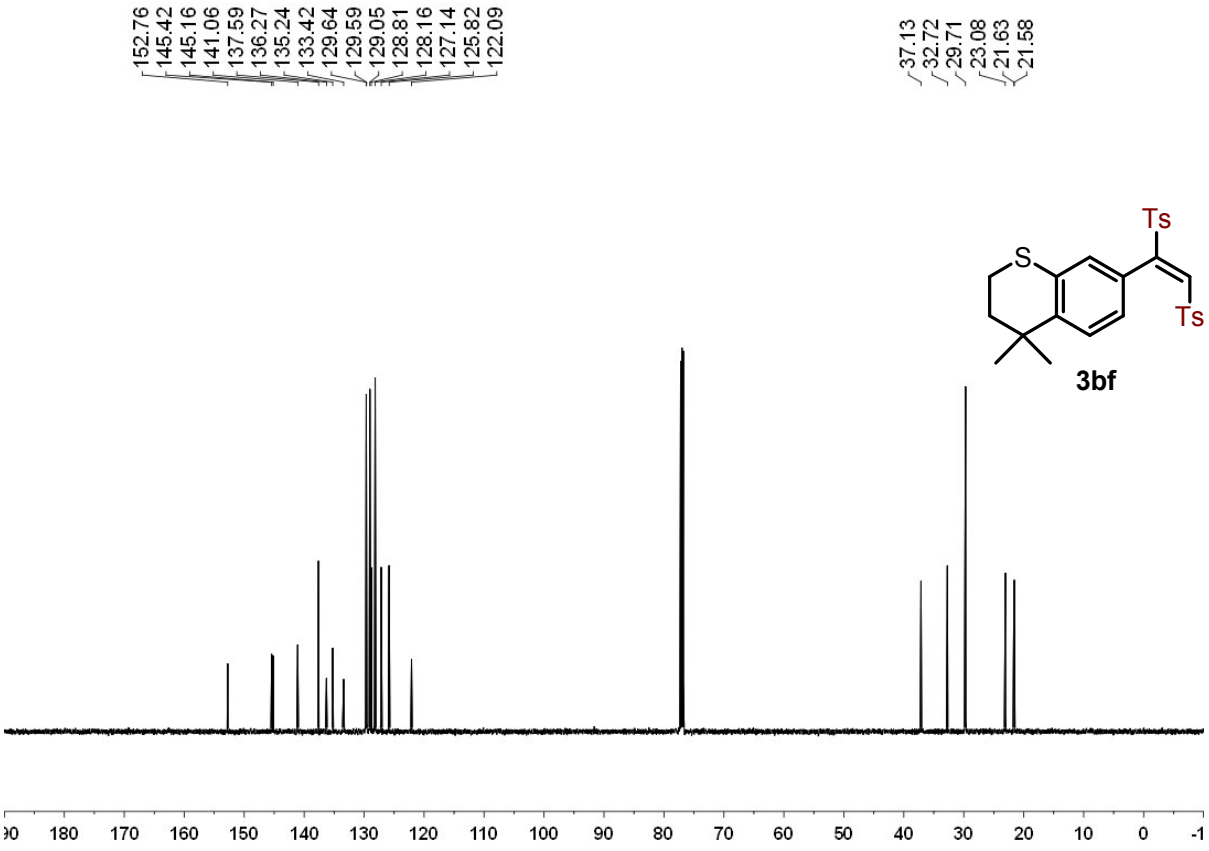
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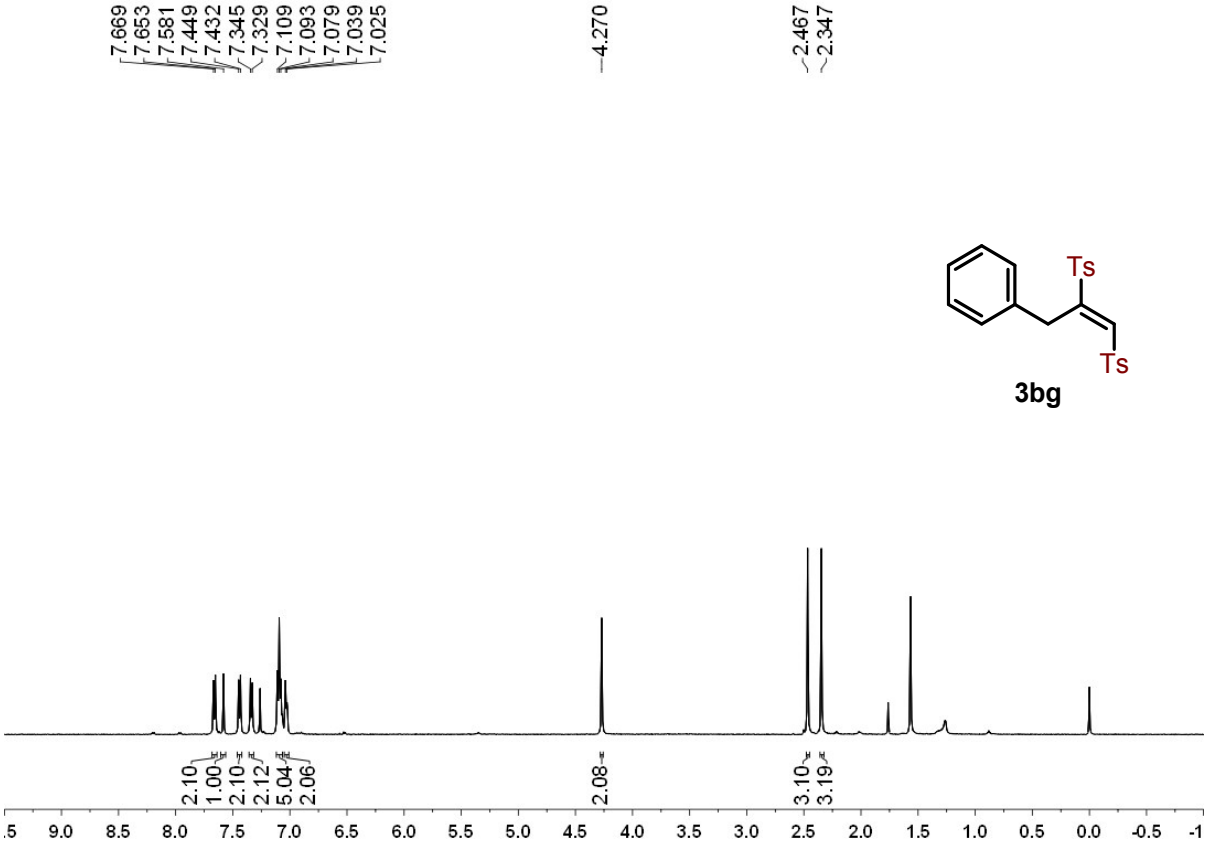
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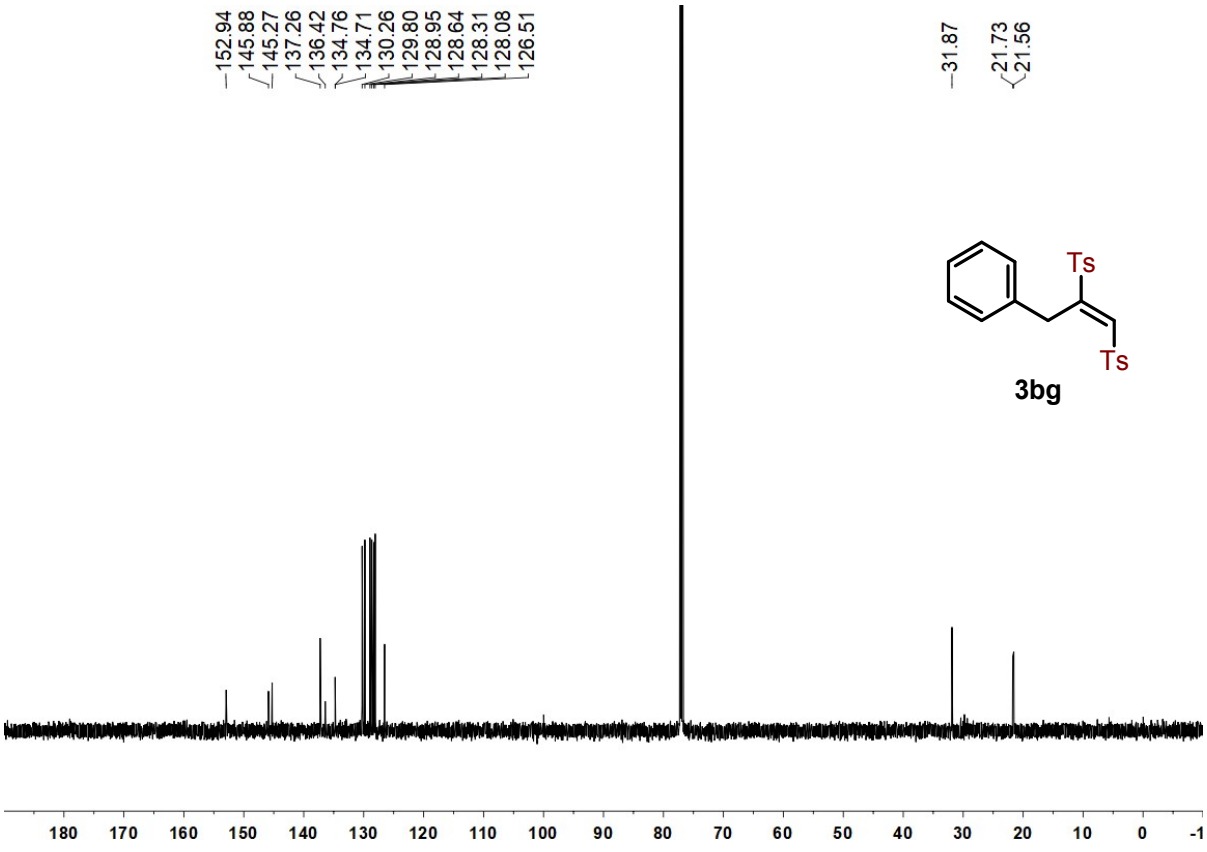
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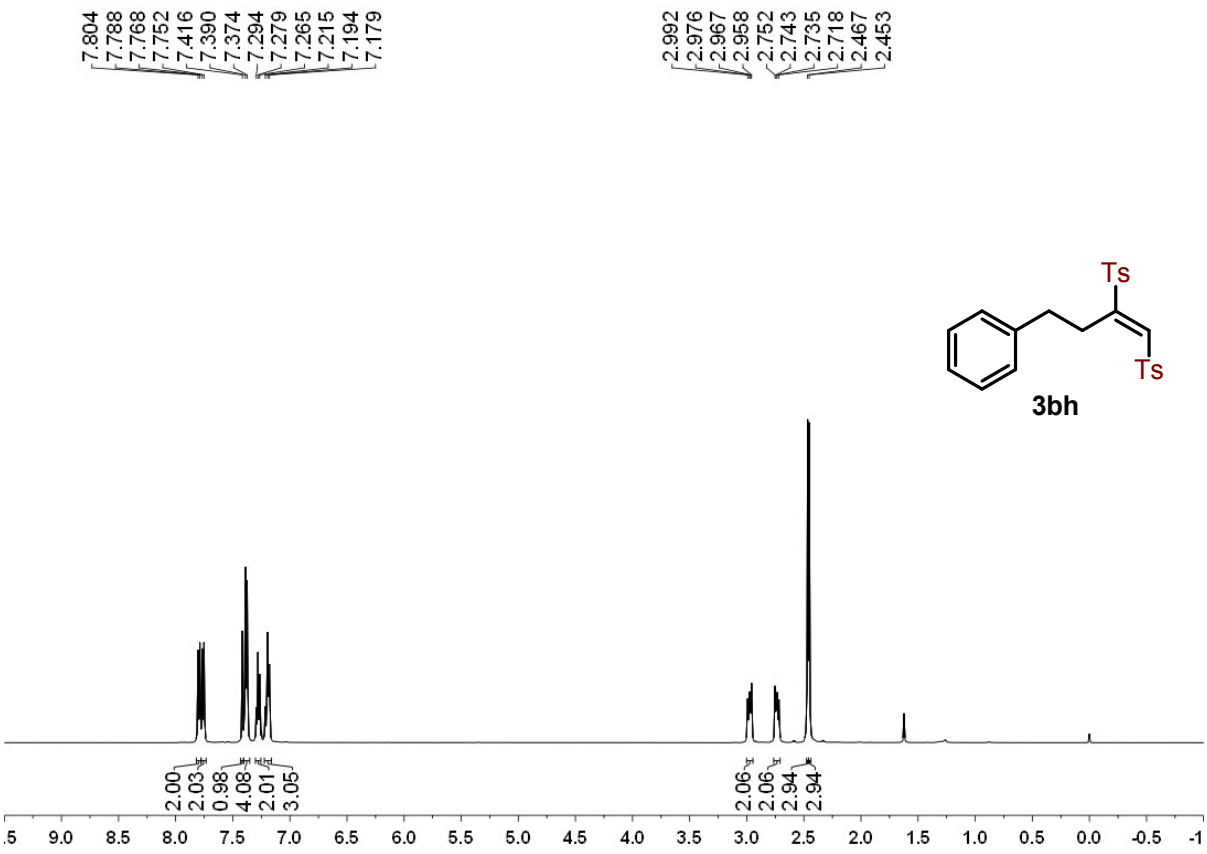
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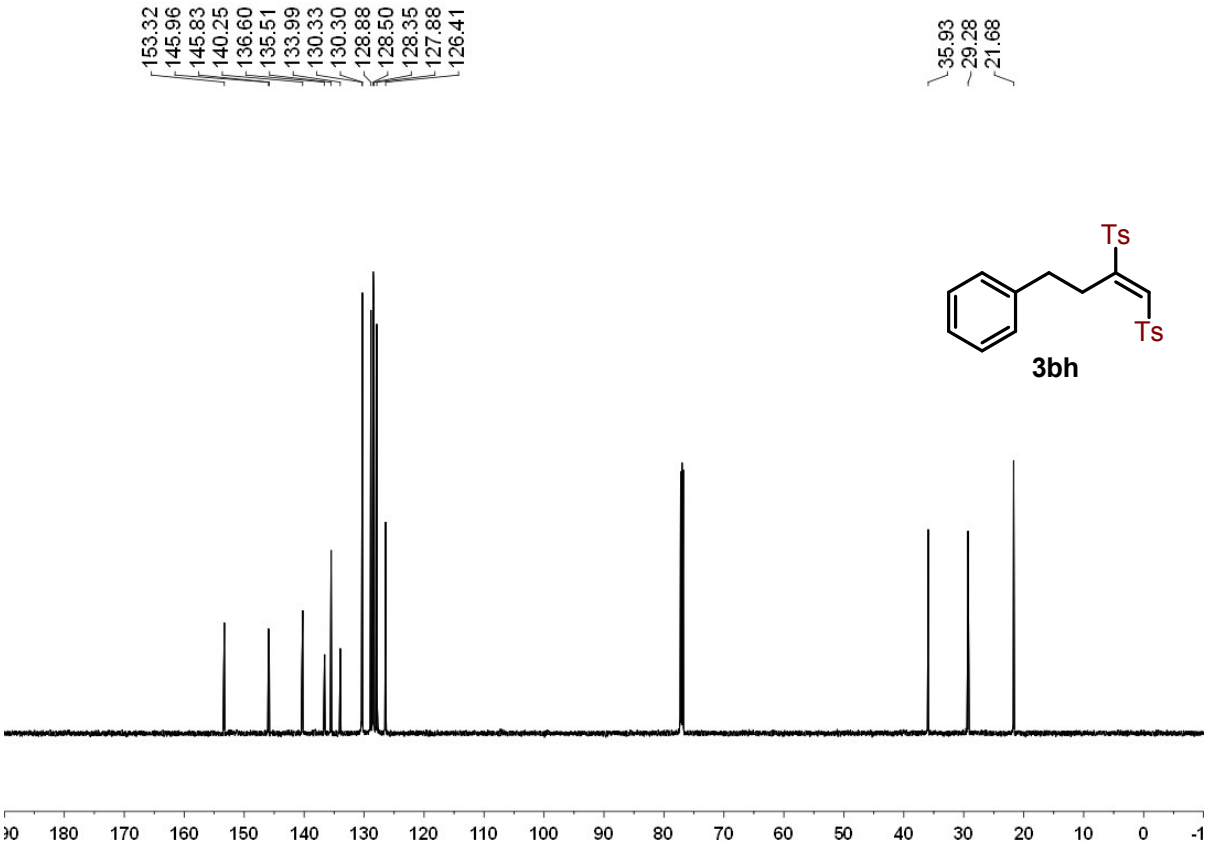
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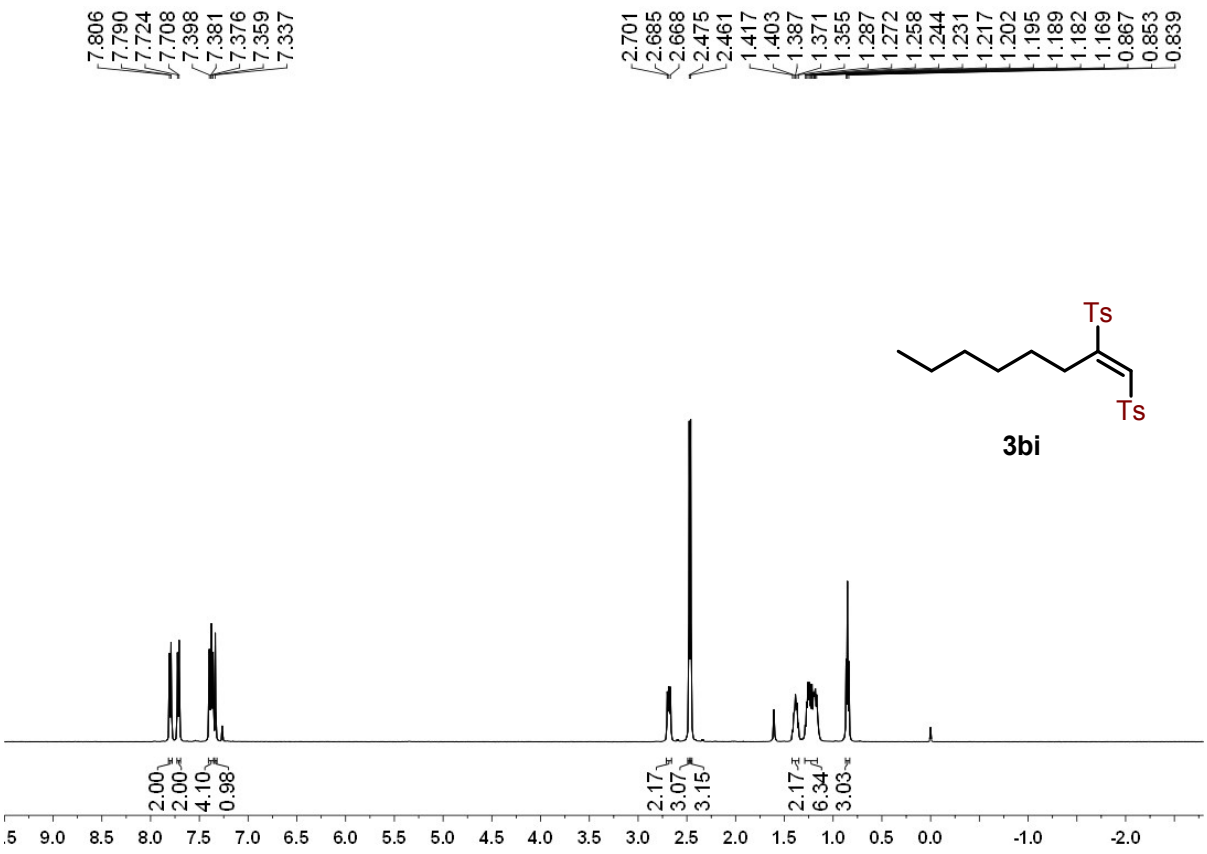
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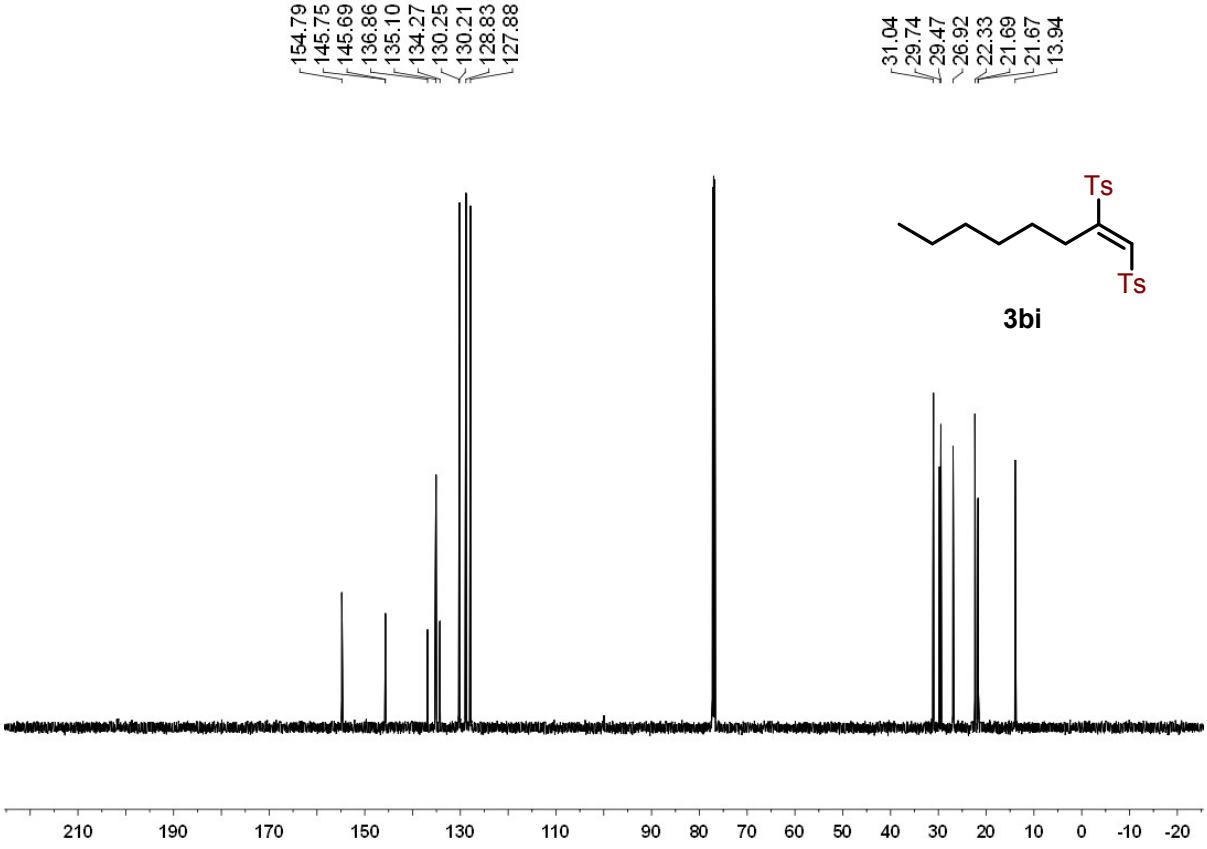
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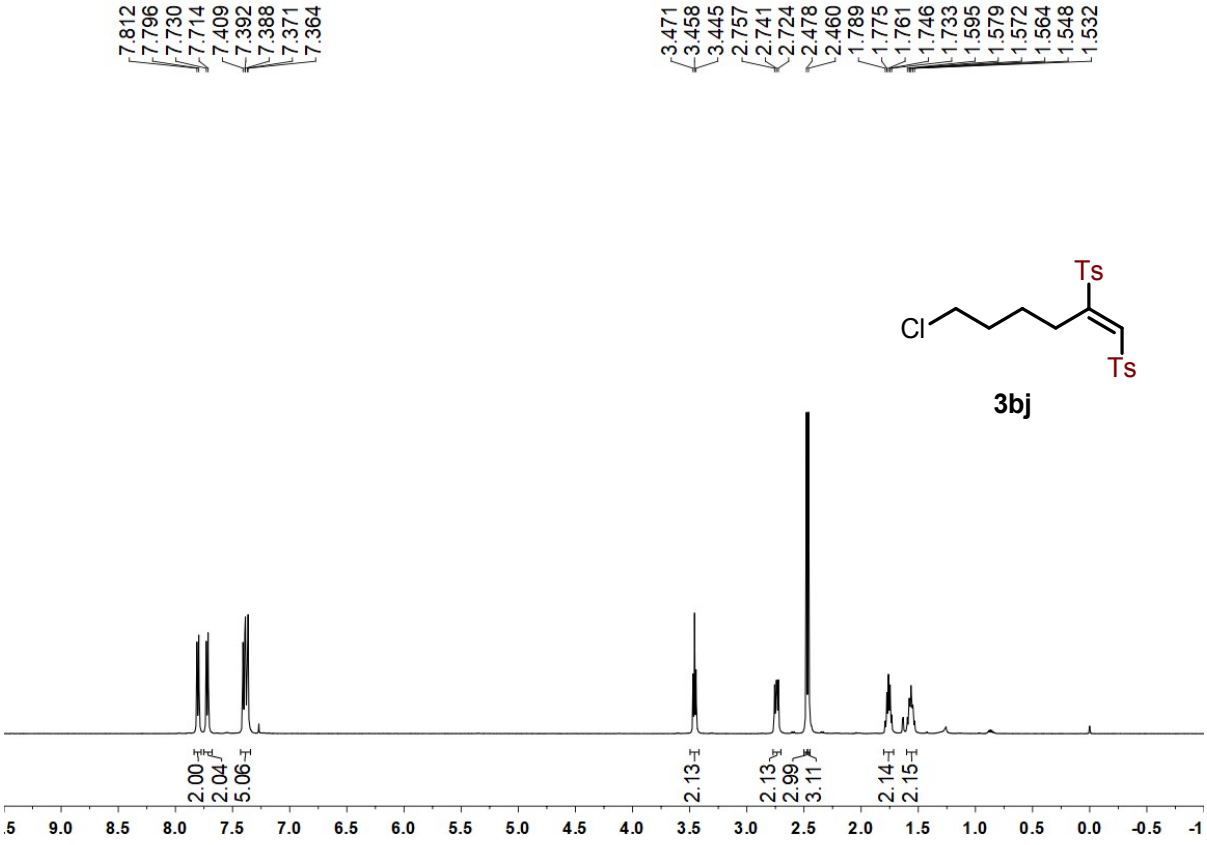
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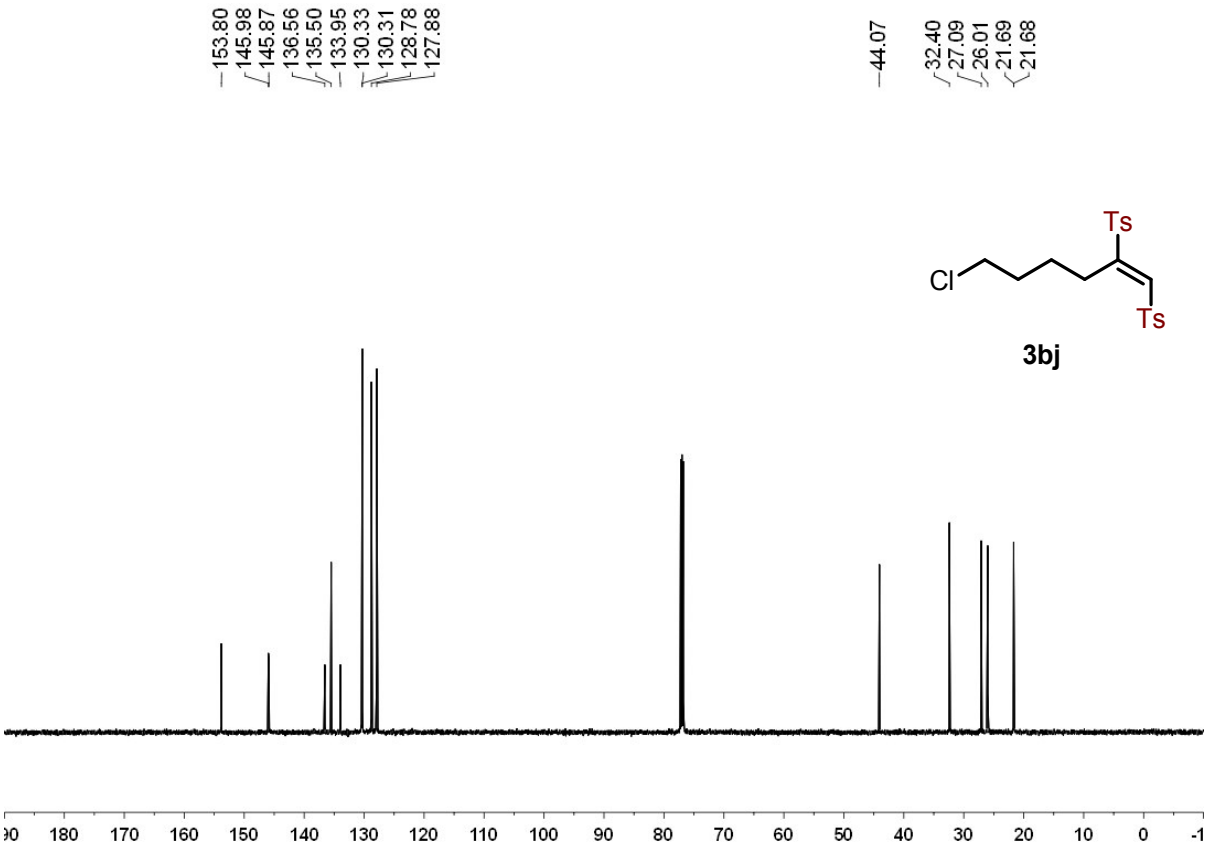
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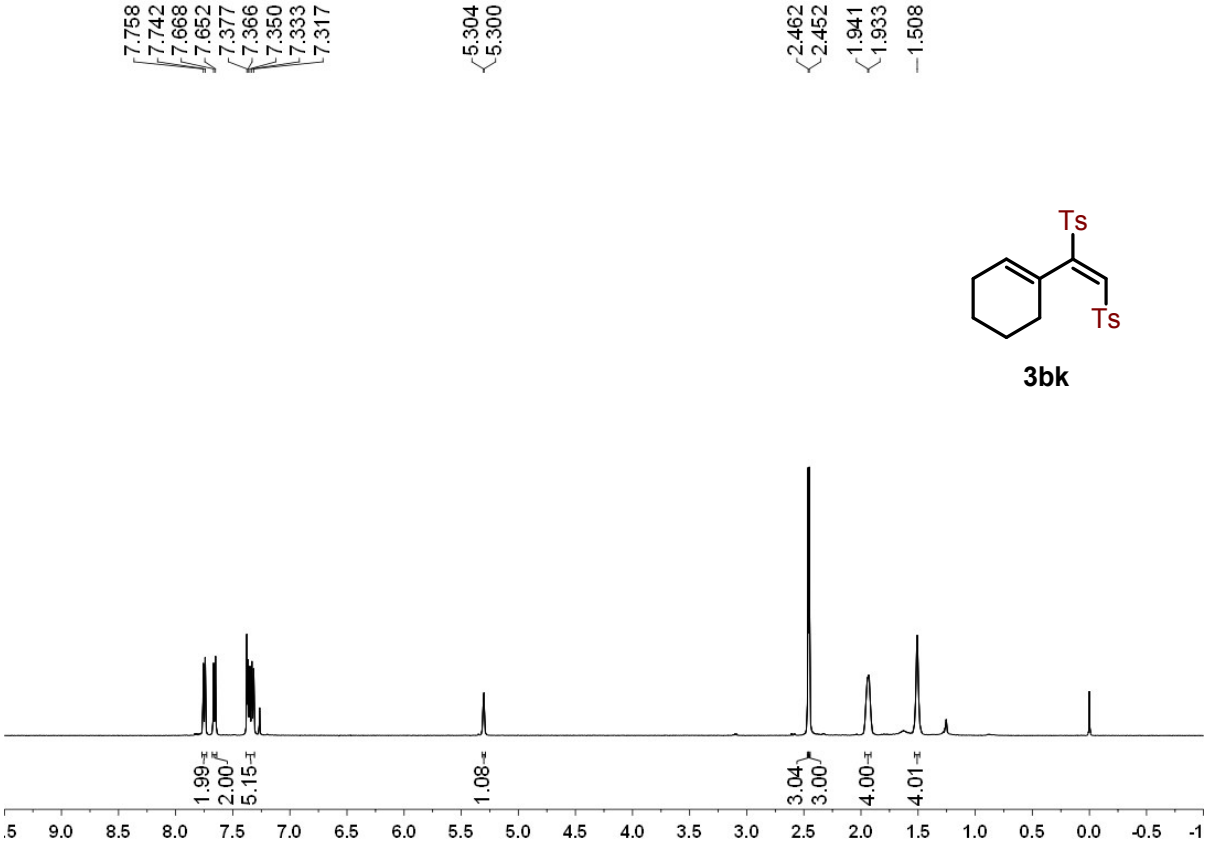
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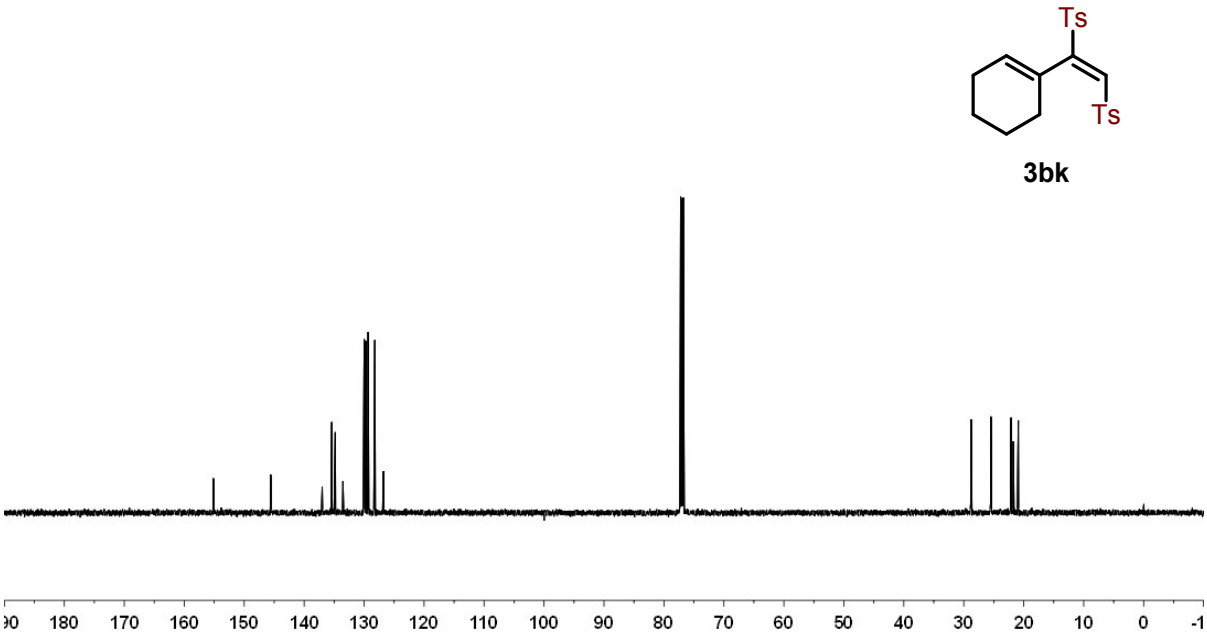
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Ts

3bk


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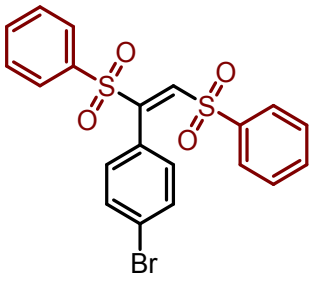
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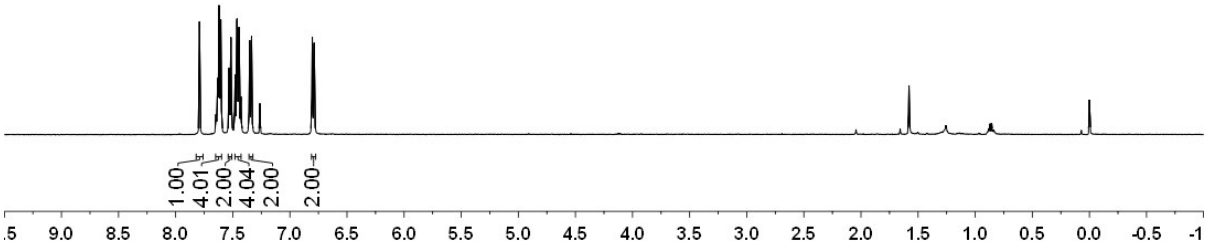
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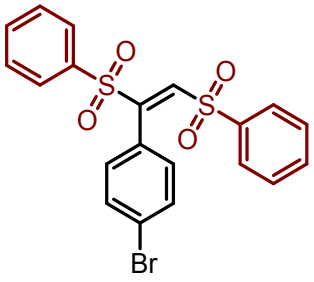
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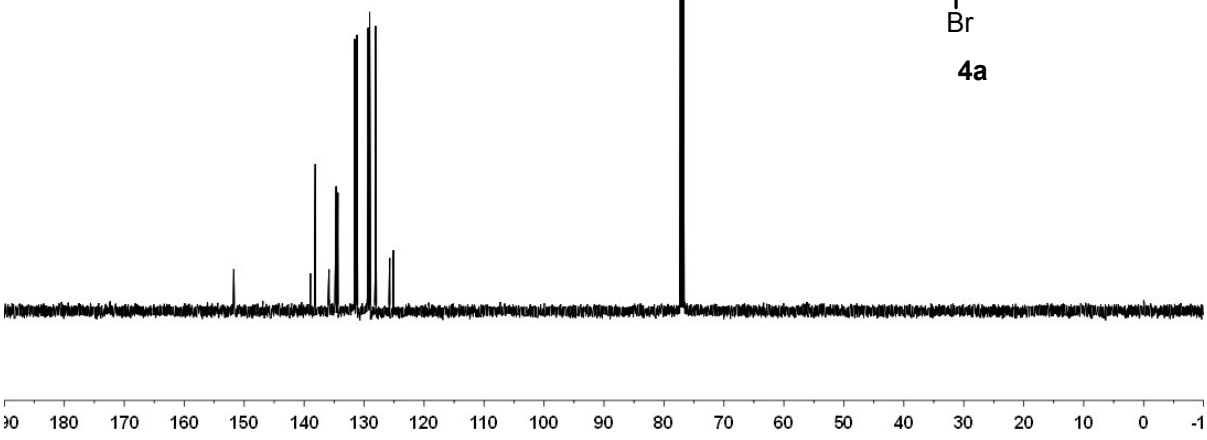
Br

4a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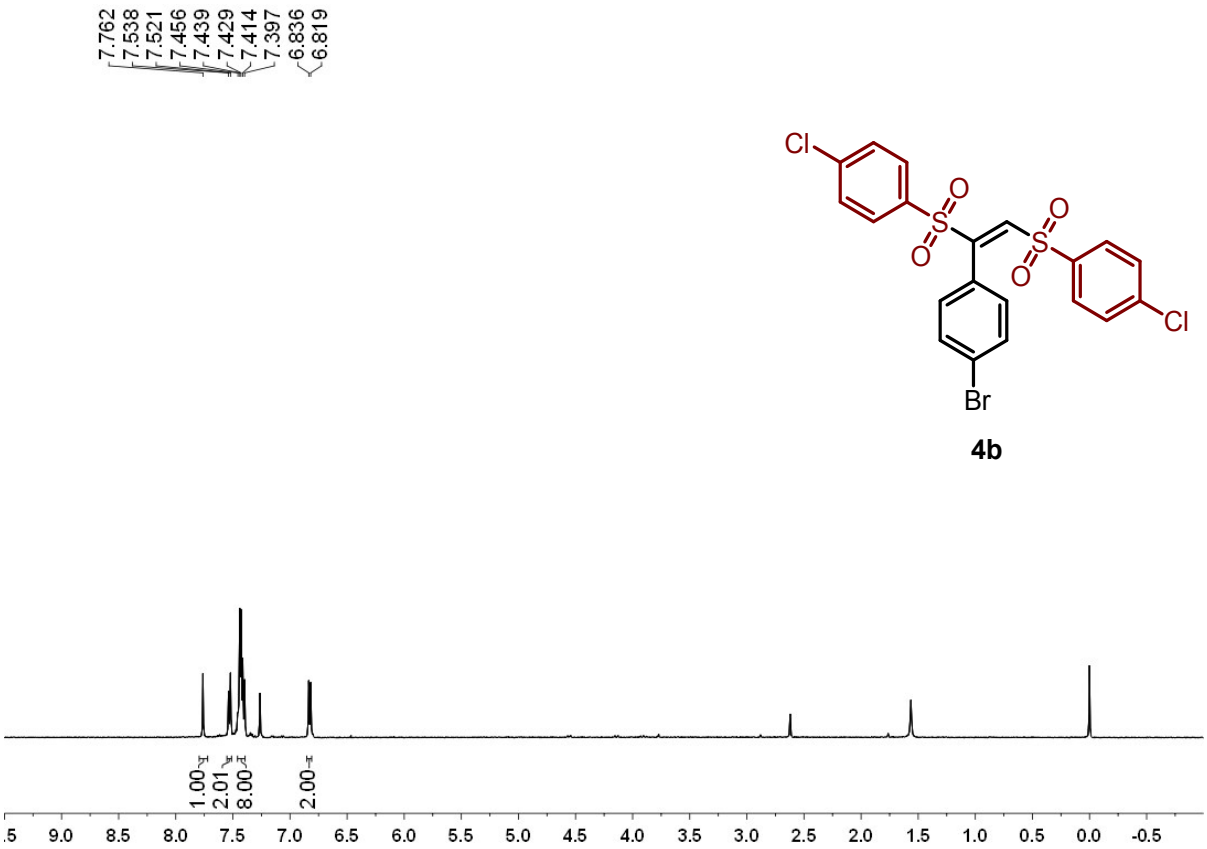
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S
O
Cl
Br
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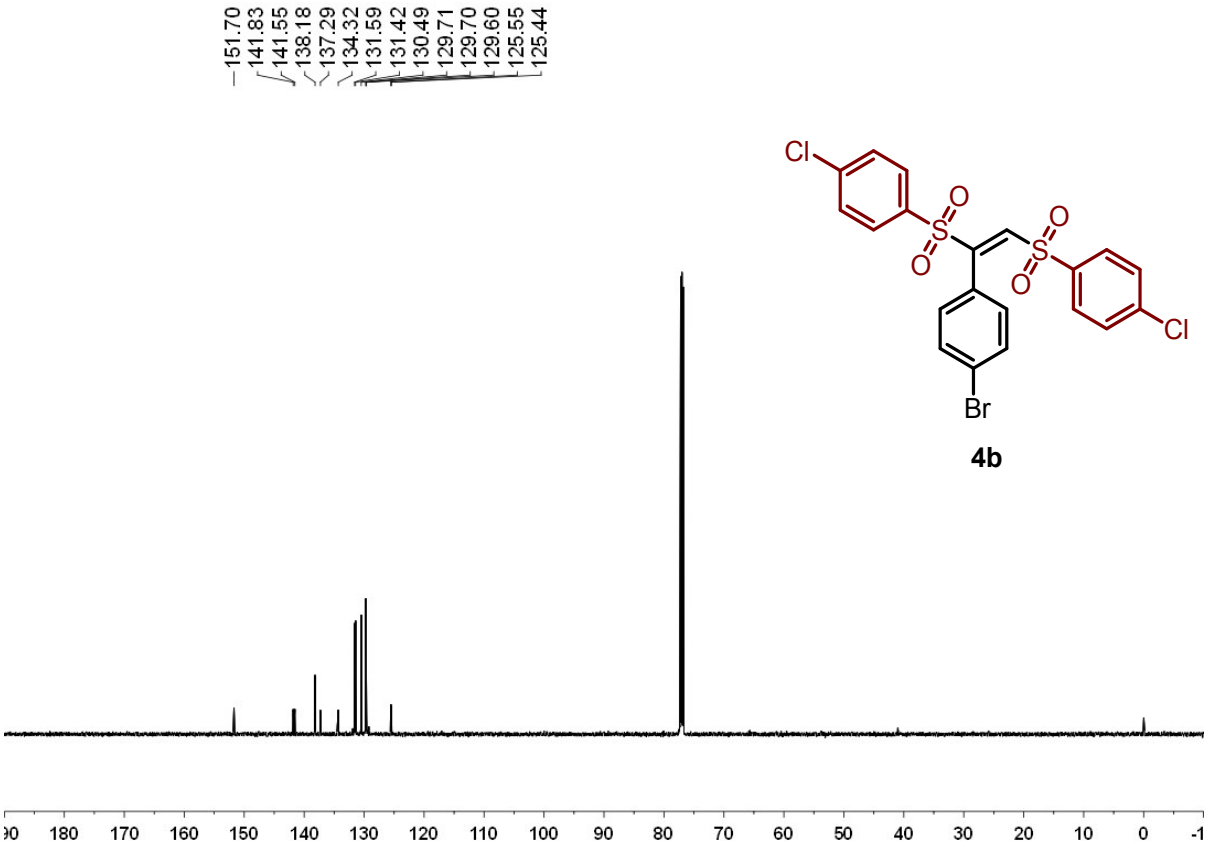
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Br
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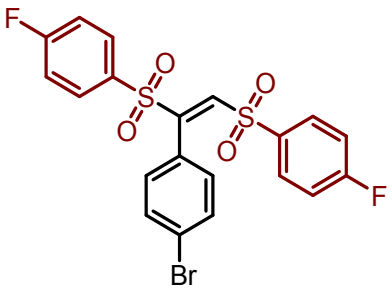
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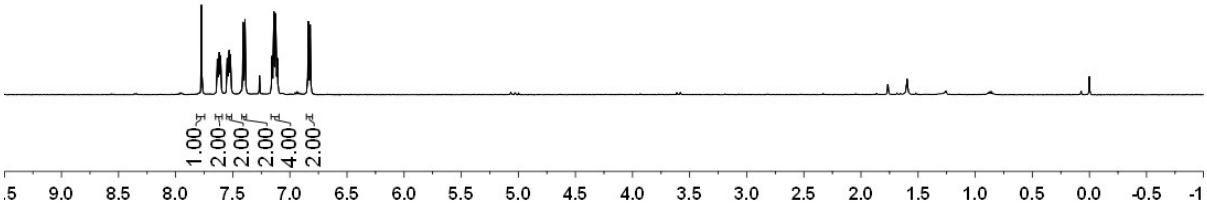
Br

4c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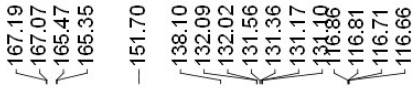
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132.02
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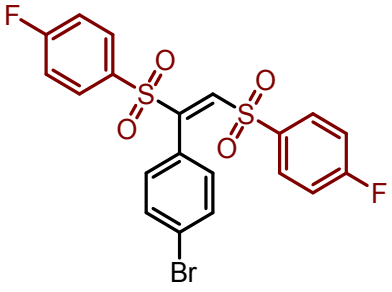
116.66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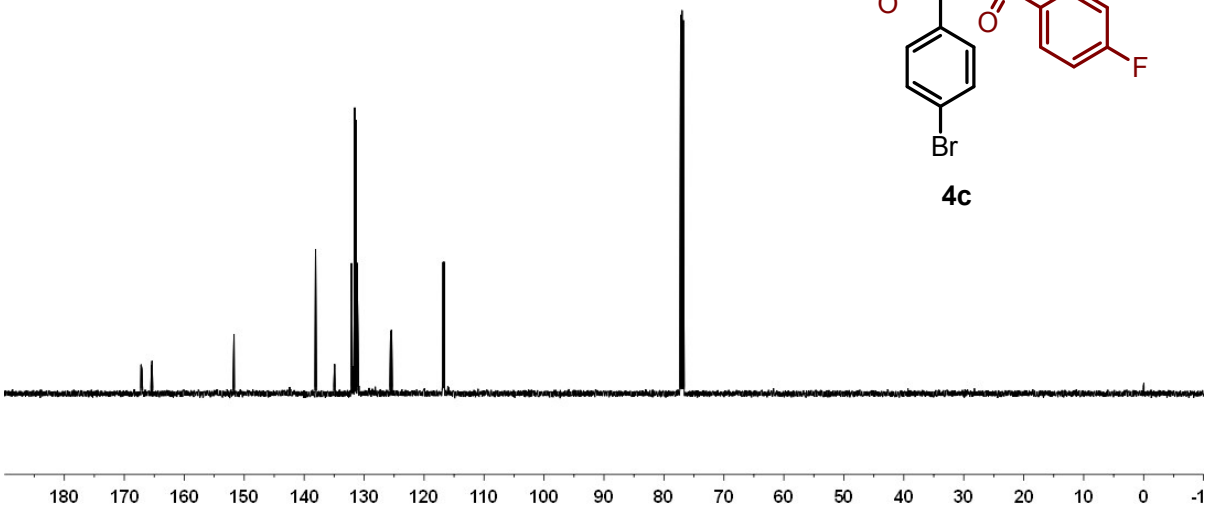
O
S
O
F
Br

4c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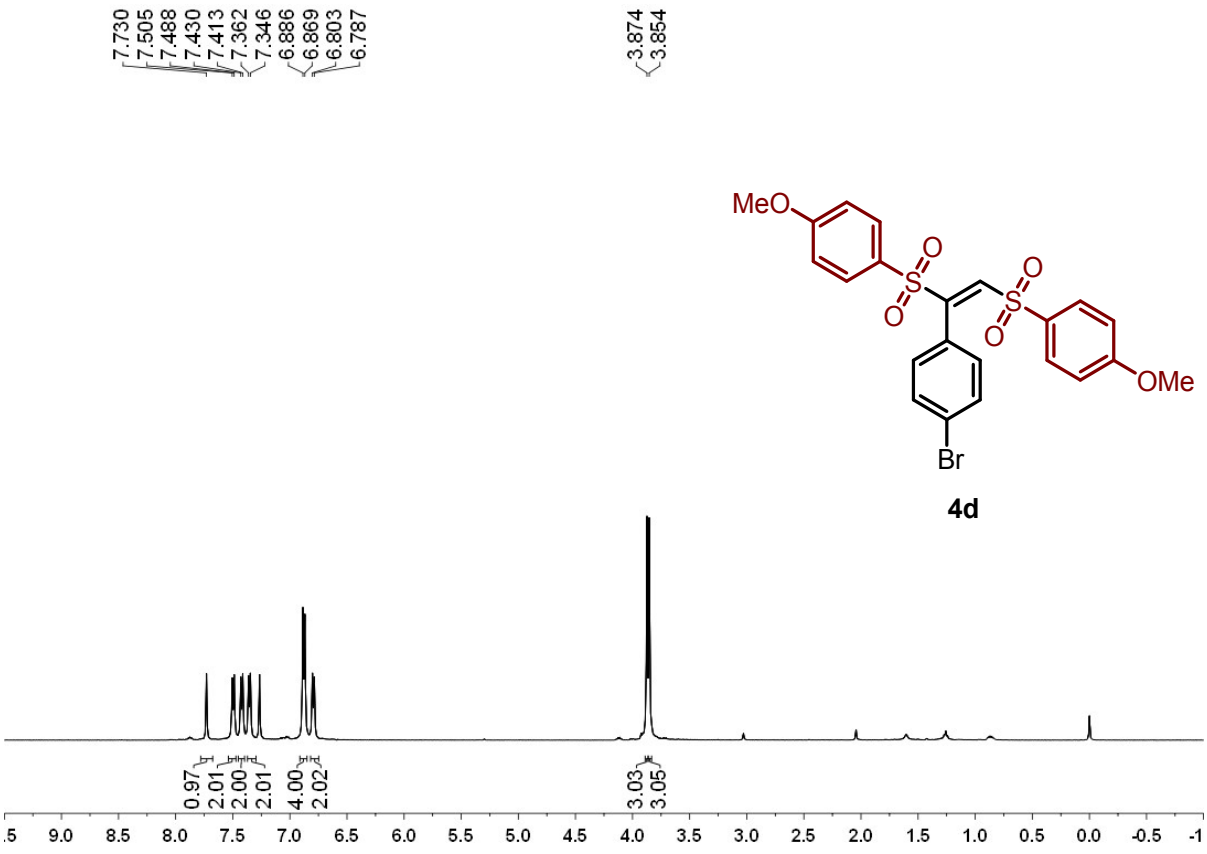
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6.803
6.787
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OMe
Br
4d
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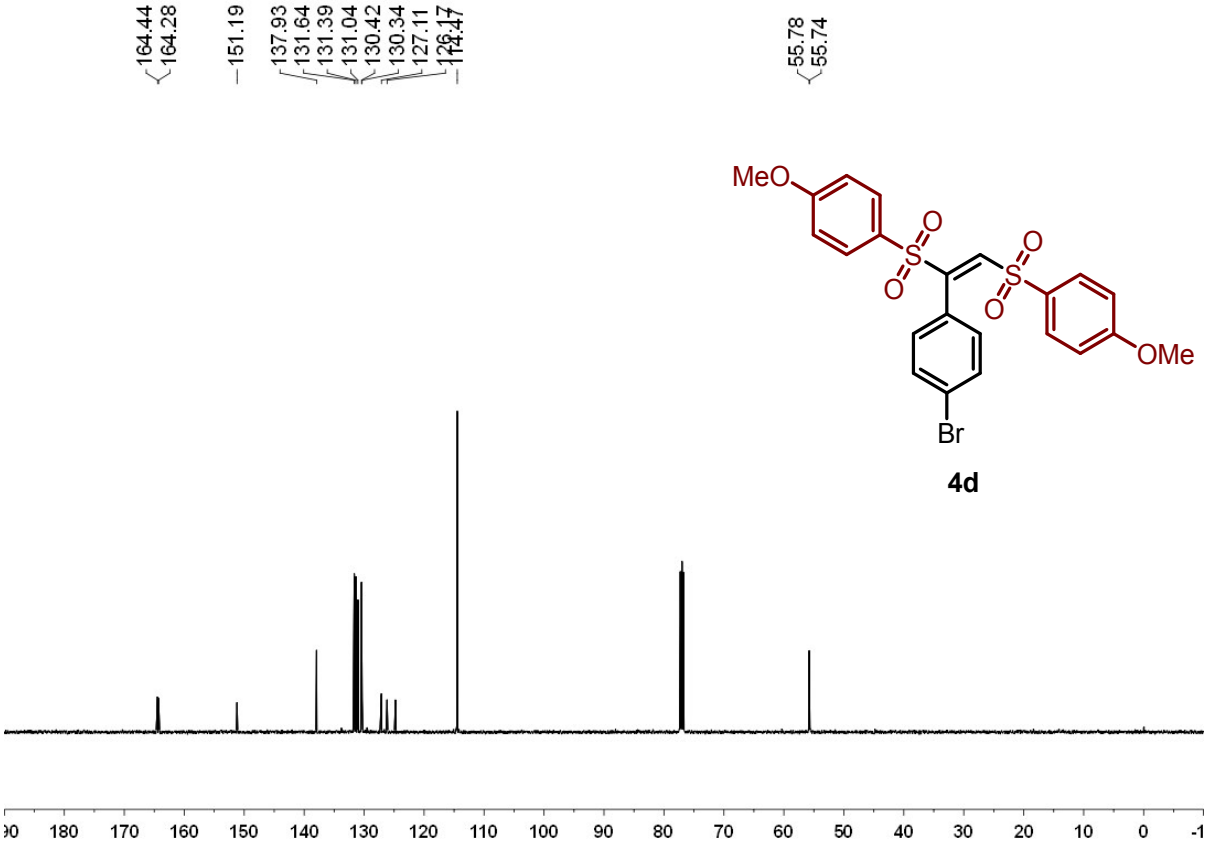
2.00
2.01
4.00
2.02
3.03
3.05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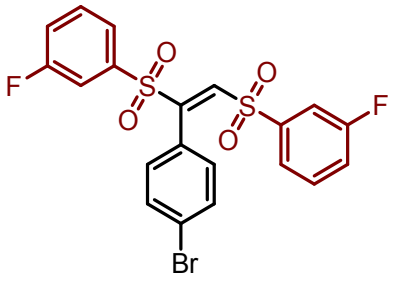
131.39
131.04
130.42
130.34
127.11
55.78
55.74
MeO
OMe
Br
4d


7.784
7.500
7.484
7.475
7.468
7.452
7.440
7.437
7.425
7.410
7.393
7.355
7.343
7.327
7.310
7.290
7.274
7.266
7.248
6.857
6.841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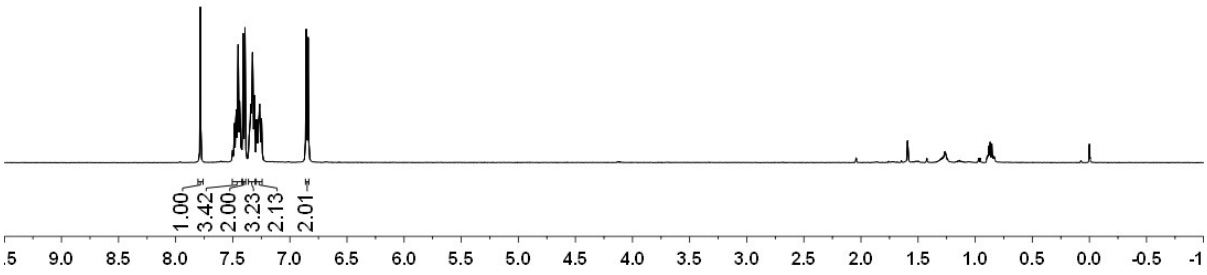
S
O
O
S
F
Br

4e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9.0
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8.0
7.5
7.0
6.5
6.0
5.5
5.0
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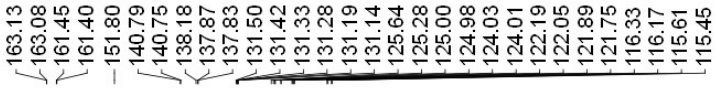
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1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131.42
131.33
131.28
131.19
131.14
125.64
125.28
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124.03
124.01
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121.75
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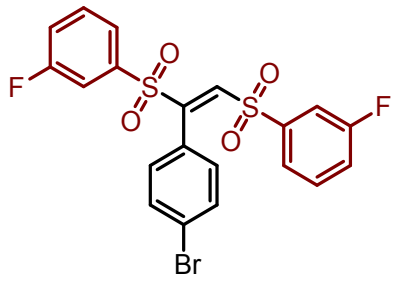
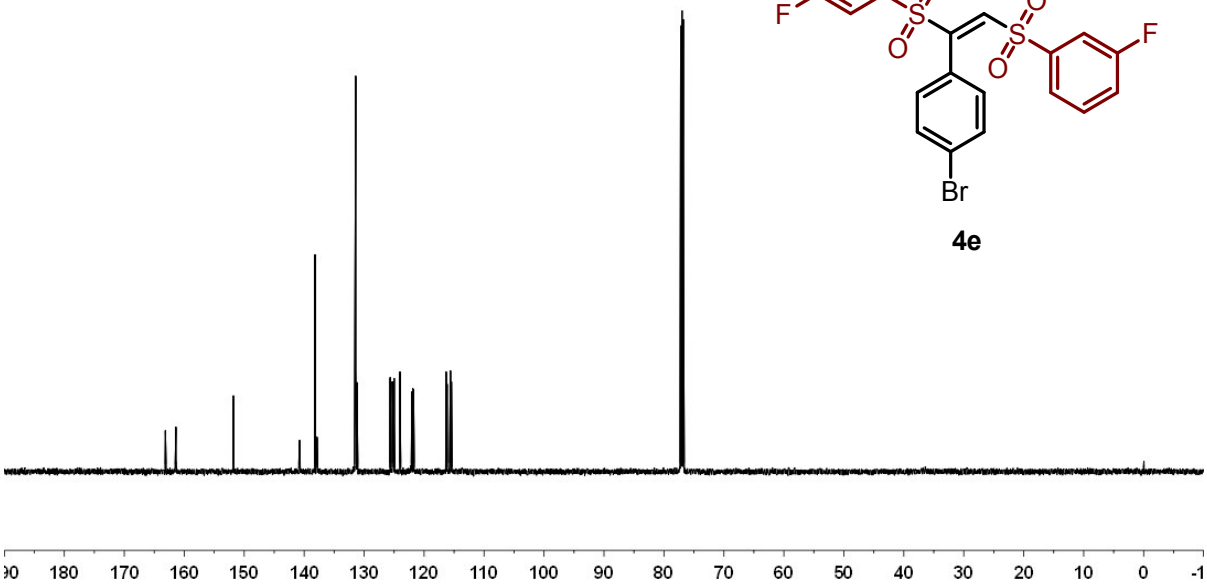
115.61
115.45


F
O
O
S
O
O
S
F
Br

4e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60
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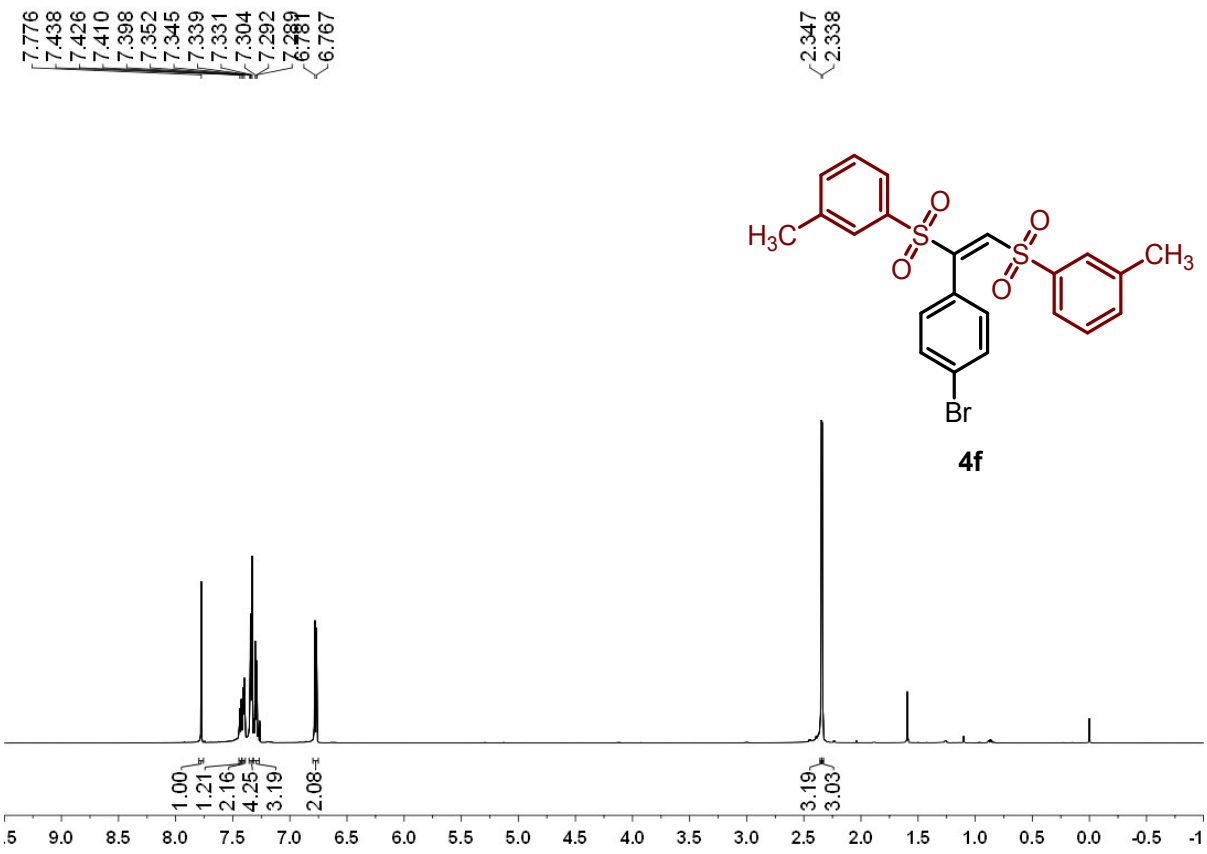
40
30
20
10
0
-1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7.345
7.339
7.331
7.304
7.292
6.781
6.767
2.347
2.338
H3C
CH3
Br
4f
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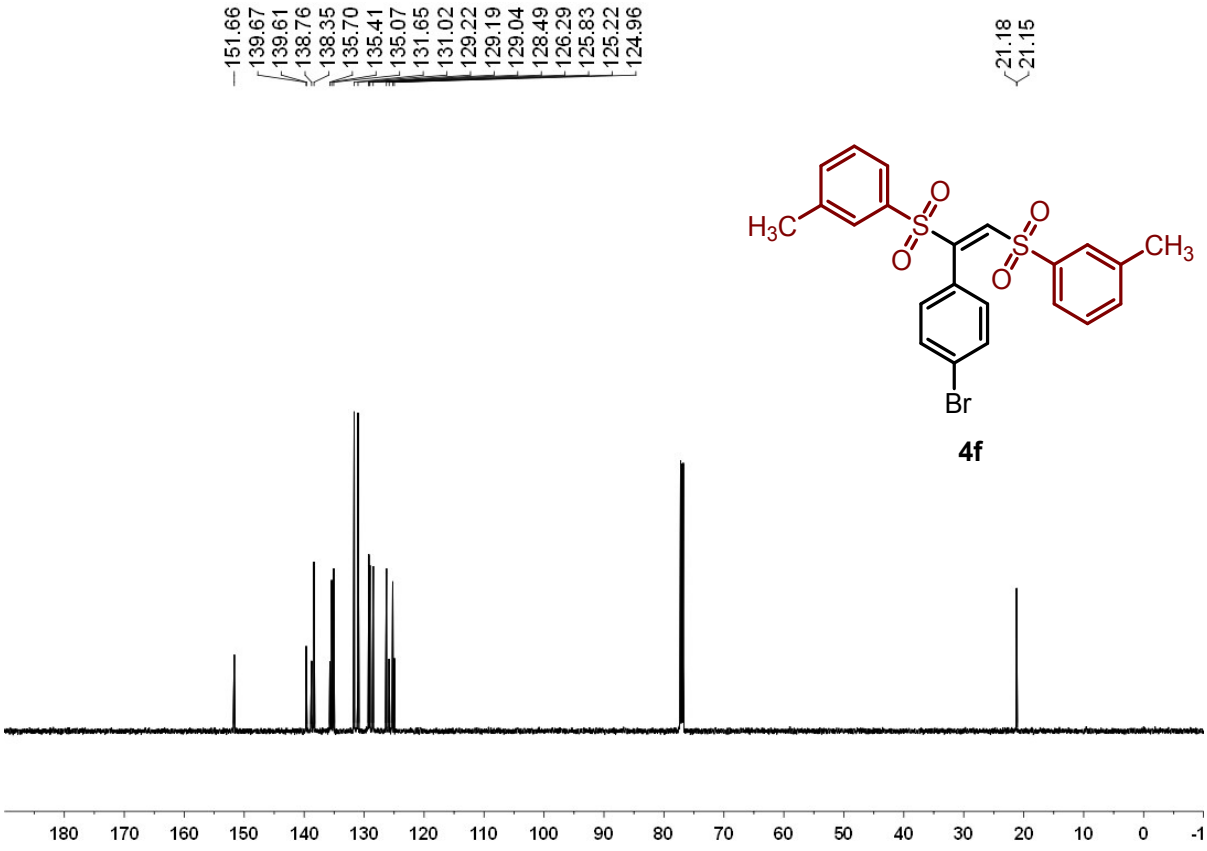
1.21
2.16
4.25
3.19
2.08
3.19
3.03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126.29
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125.22
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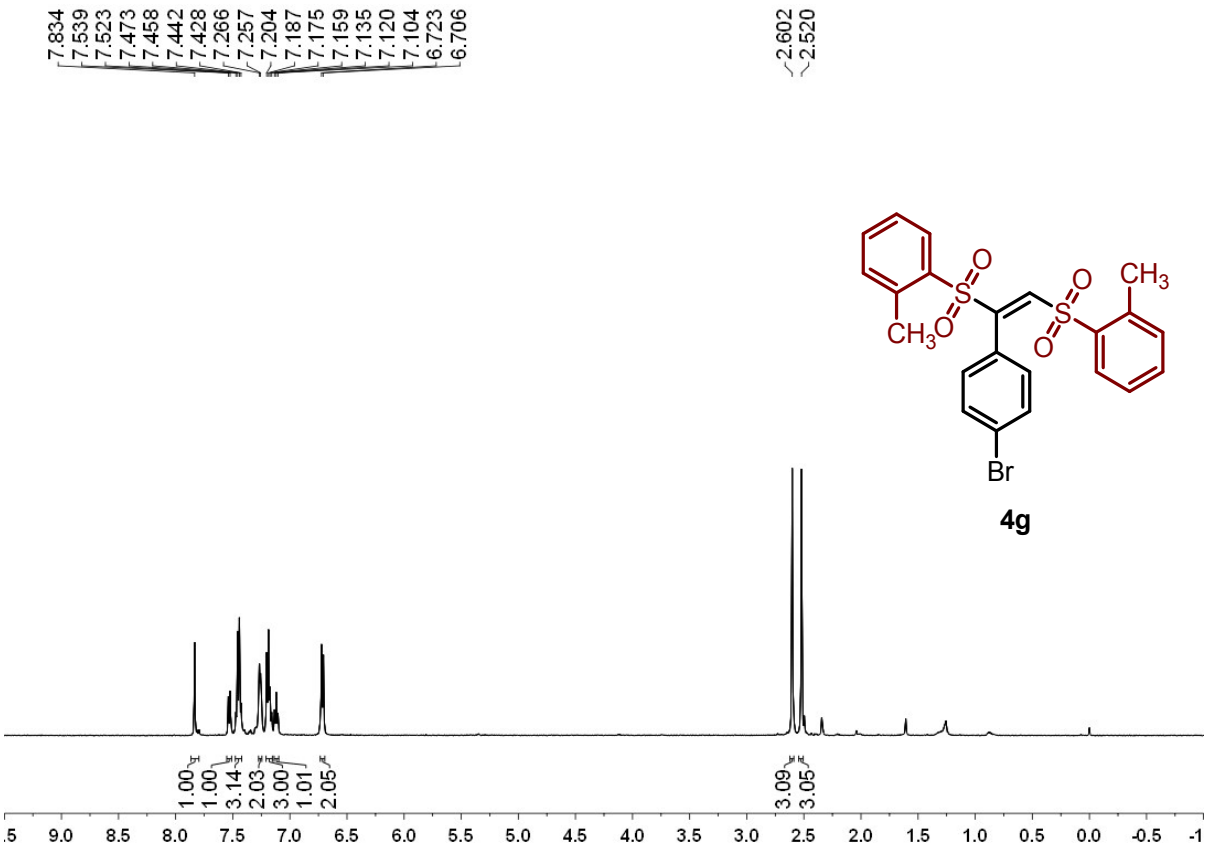
21.18
21.15
H3C
CH3
Br
4f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7.257
7.204
7.187
7.175
7.159
7.135
7.120
7.104
6.723
6.706
2.602
2.520
CH3
CH3
Br
4g
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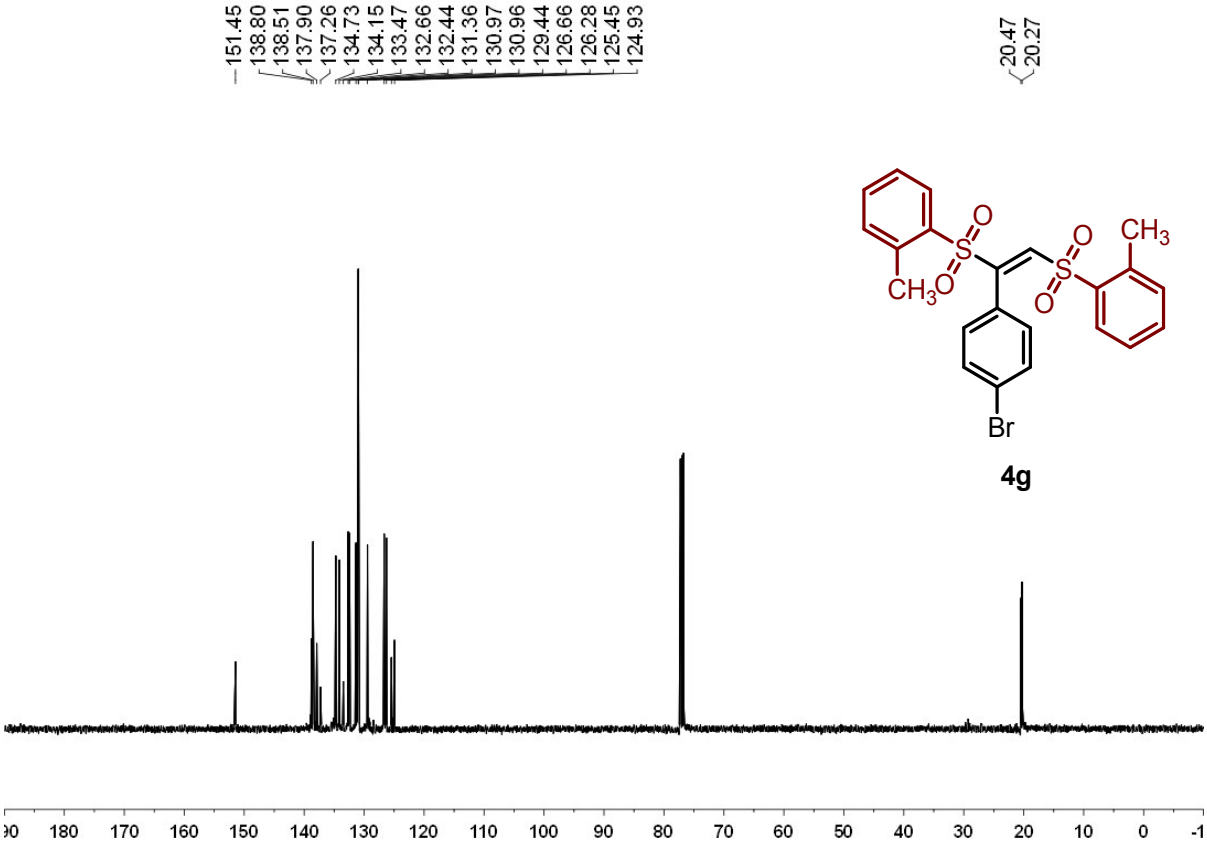
1.00
3.14
2.03
3.00
1.01
2.05
3.09
3.05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133.47
132.66
132.44
131.36
130.97
130.96
129.44
126.66
126.28
125.45
124.93
20.47
20.27
CH3
CH3
Br
4g


8.123
7.738
7.724
7.707
7.693
7.680
7.578
7.562
7.418
7.403
7.388
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7.308
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7.280
7.264
7.250
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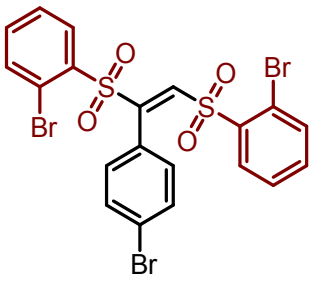
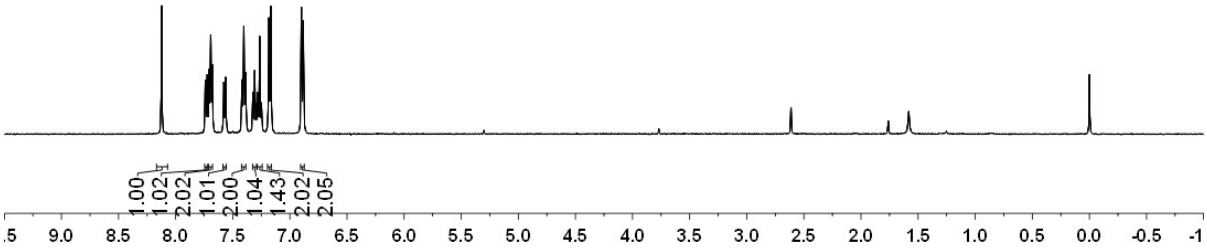
7.167
6.899
6.882


O
S
O
O
S
O
Br
Br
Br

4h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2.02
2.05
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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


149.74
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138.86
135.56
135.45
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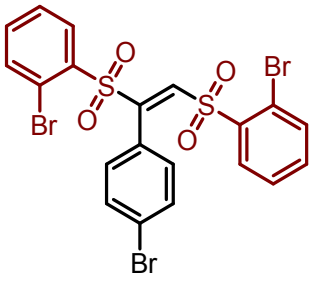
133.00
131.26
131.08
130.94
127.92
127.56
125.31
125.22
121.27
121.01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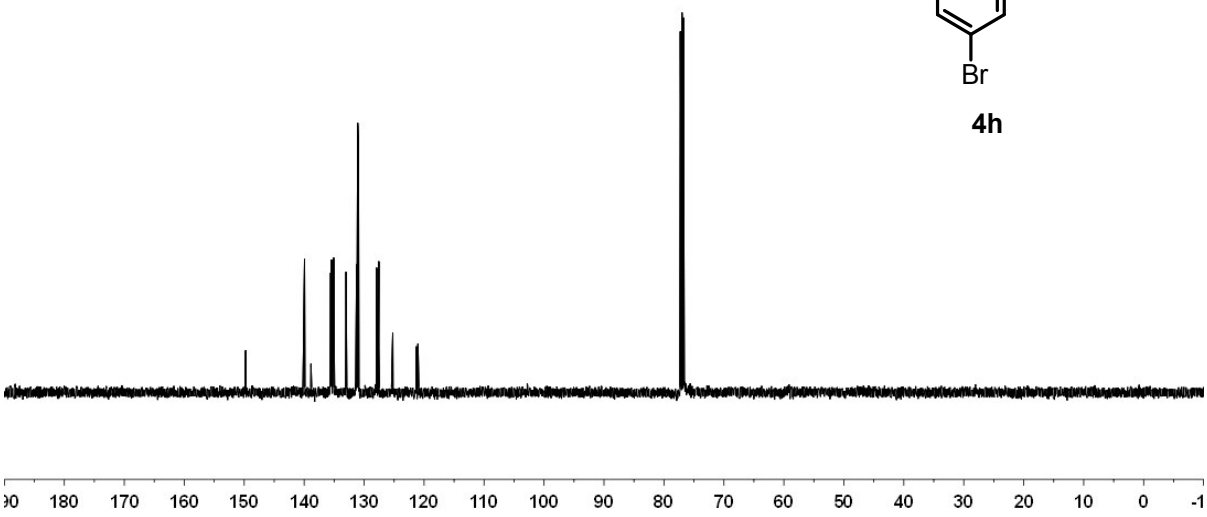
S
O
O
S
O
Br
Br
Br

4h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140
130
120
110
100
90
80
70
60
50
40
30
20
10
0


8.413
8.398
8.135
7.917
7.903
7.802
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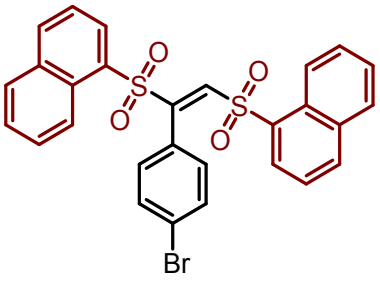
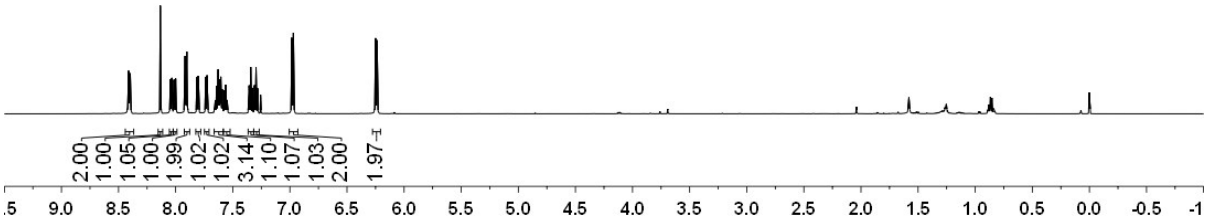
7.628
7.605
7.343
7.296
6.983
6.969
6.251
6.237


O
S
O
O
S
O
Br

4i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1.02
1.02
3.14
1.10
1.07
1.03
2.00
1.97
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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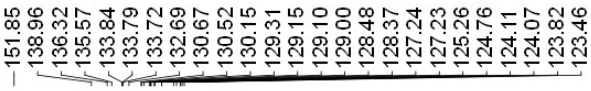
-0.5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129.15
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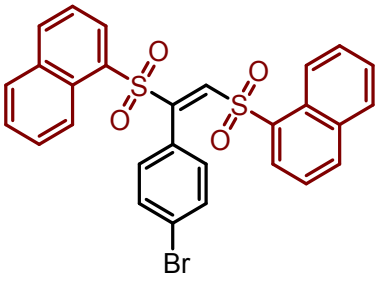
123.46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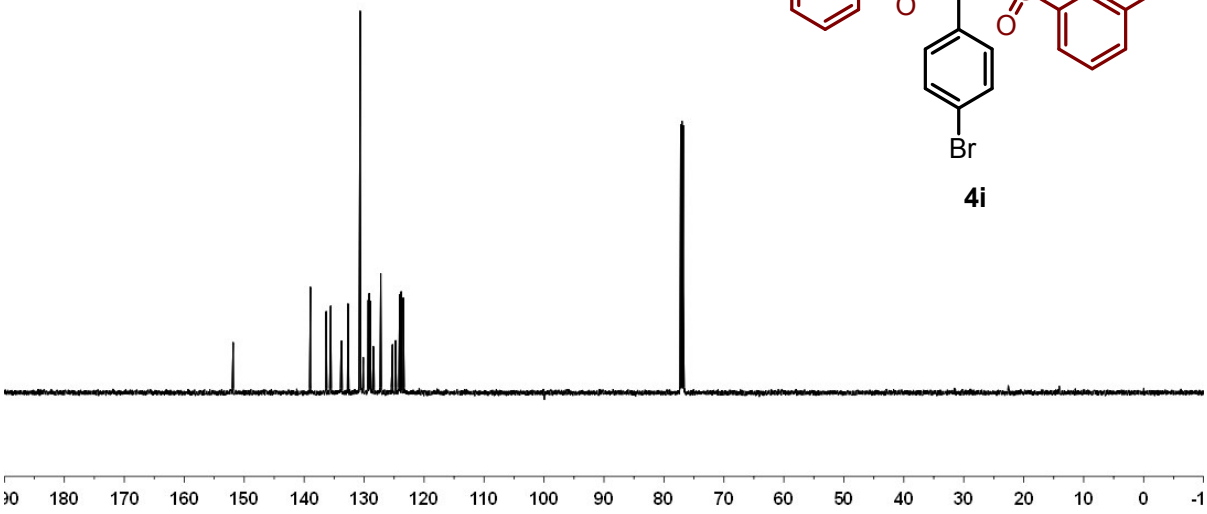
S
O
O
S
O
Br

4i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60
50
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30
20
10
0
-1


7.810
7.753
7.743
7.734
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7.335
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7.091
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7.079
7.070
7.061
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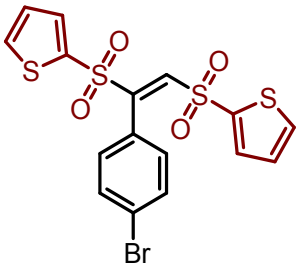
6.951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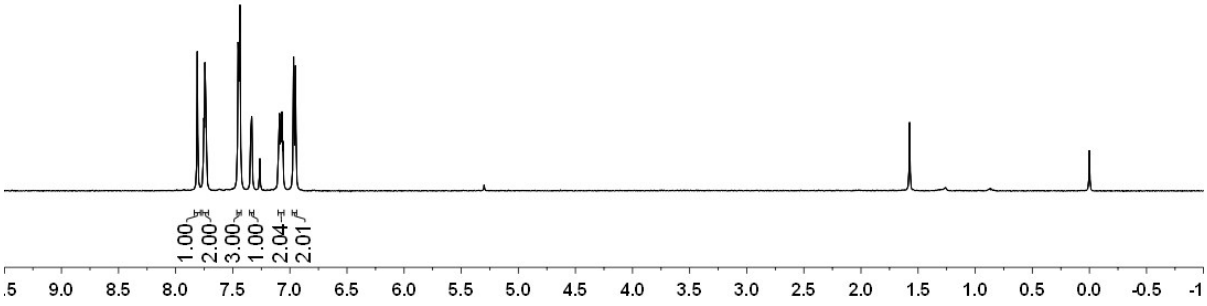
O
O
S
O
O
S
Br

4j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7.5
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6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1


151.70
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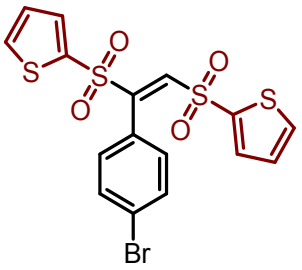
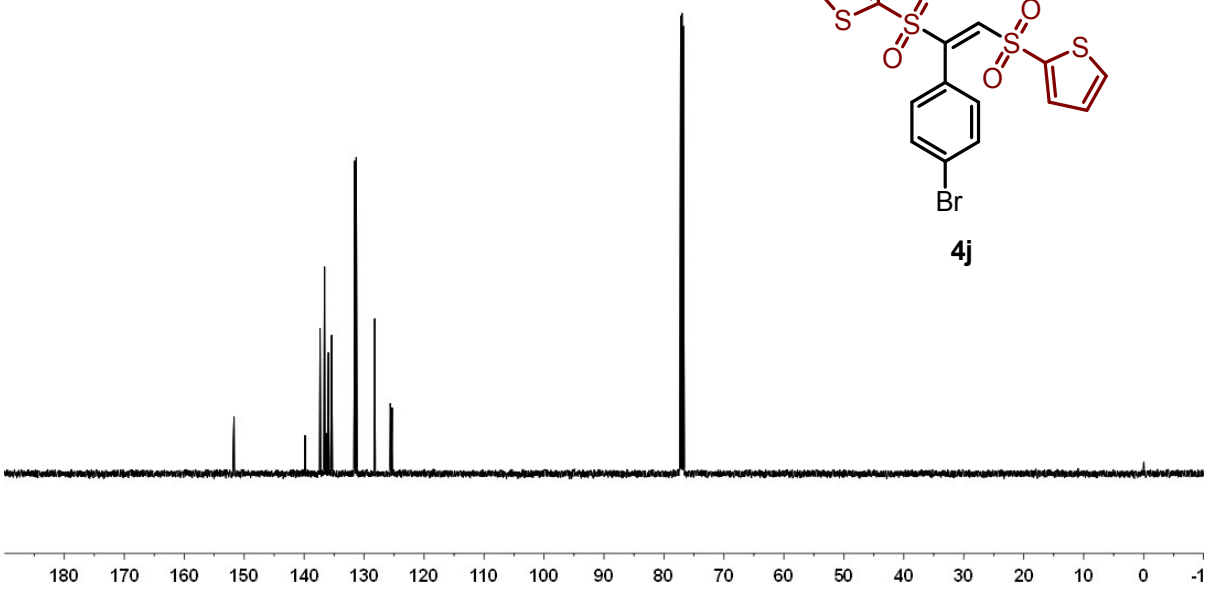
125.35


S
O
O
S
O
O
S
Br

4j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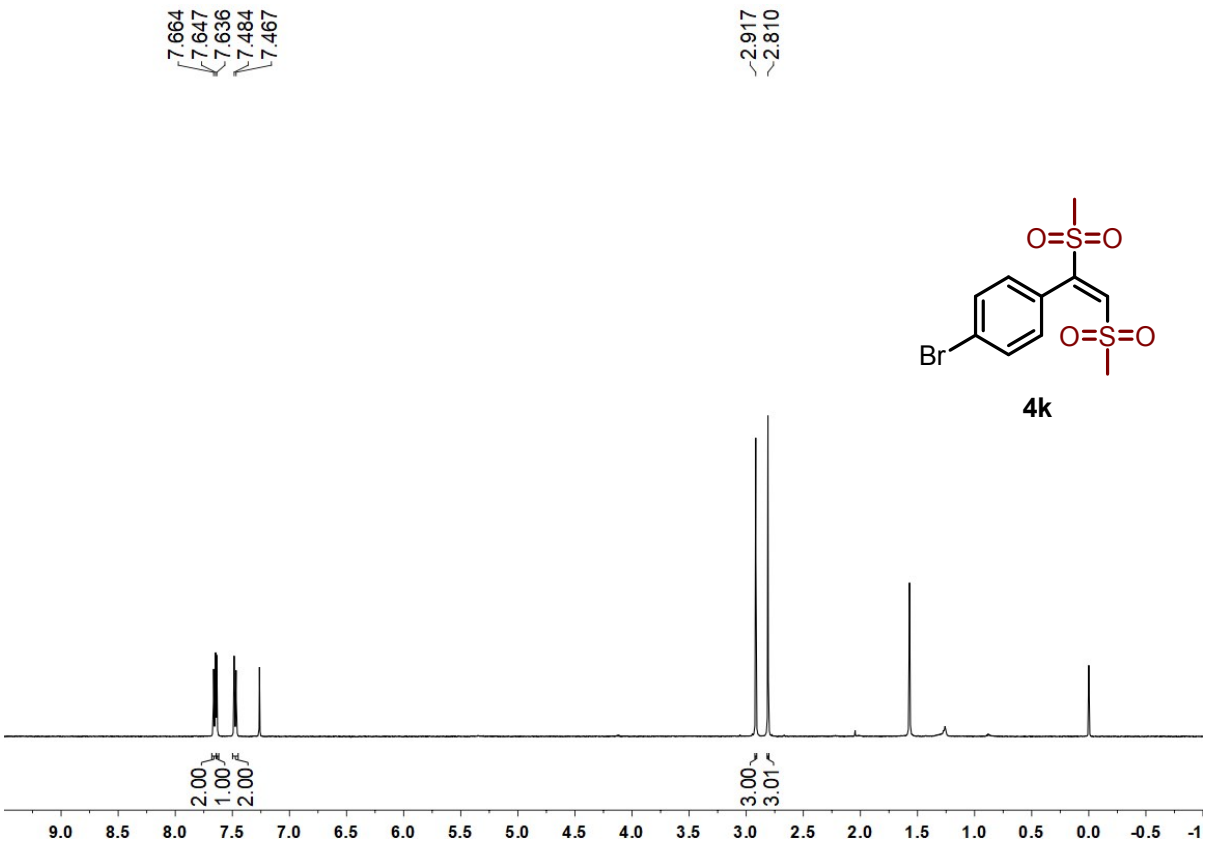
0
-1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7.467
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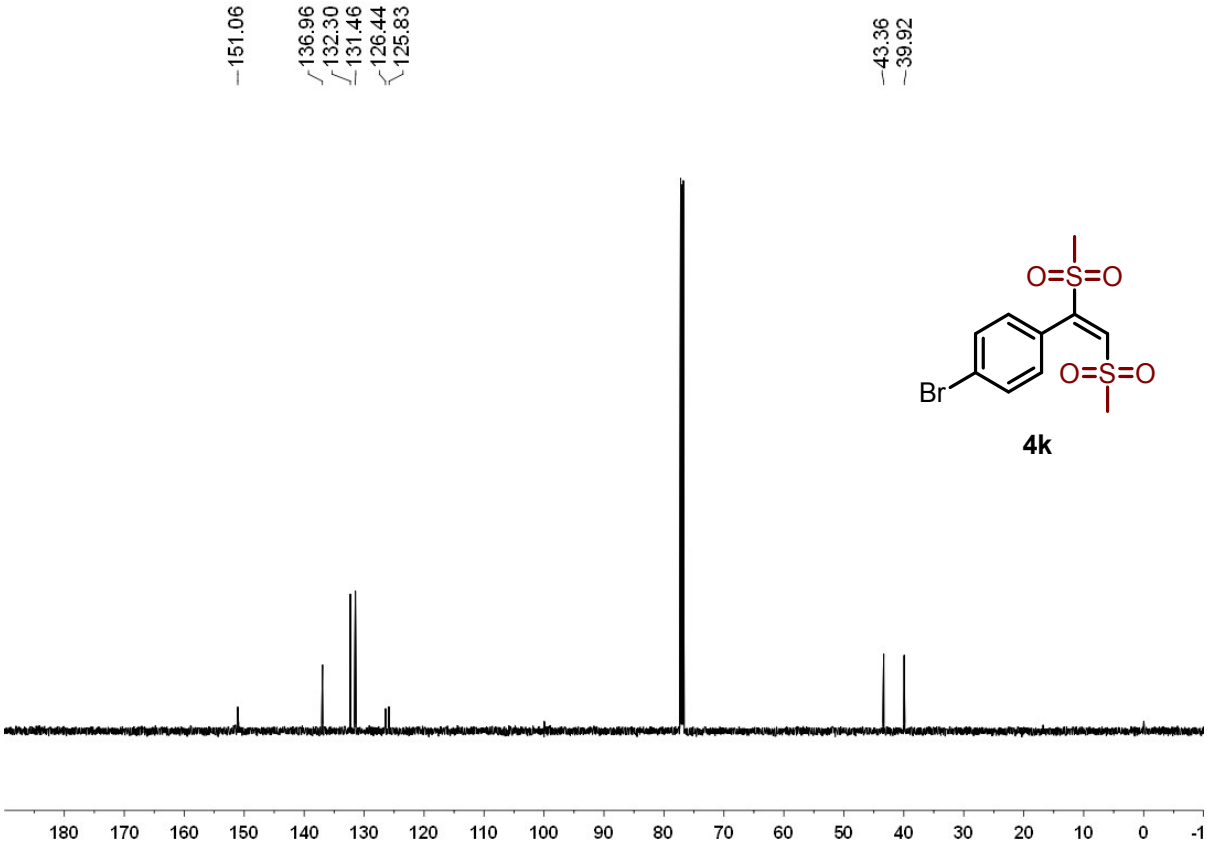
O=S=O
O=S=O
Br
4k
2.00
1.00
2.00
3.00
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1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39.92
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O=S=O
Br
4k
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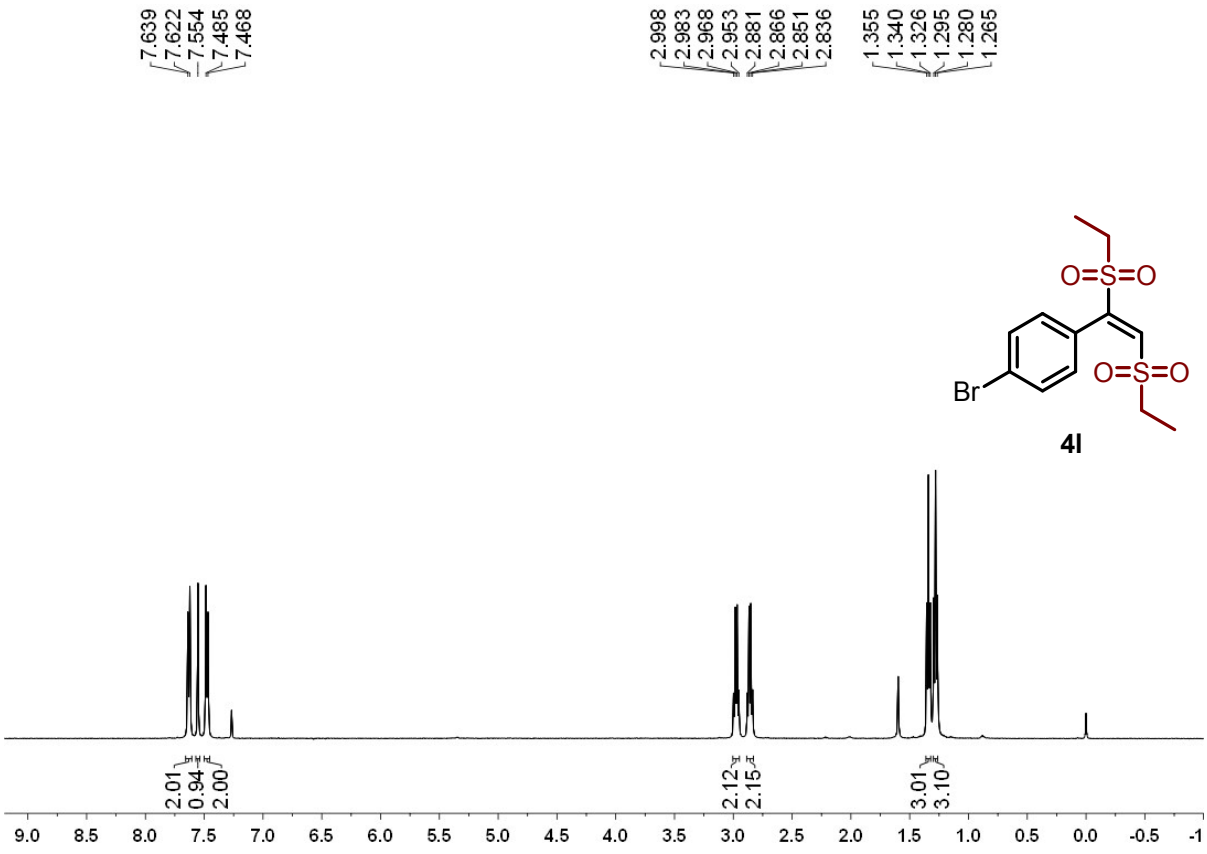
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2.836
1.355
1.340
1.326
1.295
1.280
1.265
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O=S=O
Br
4l
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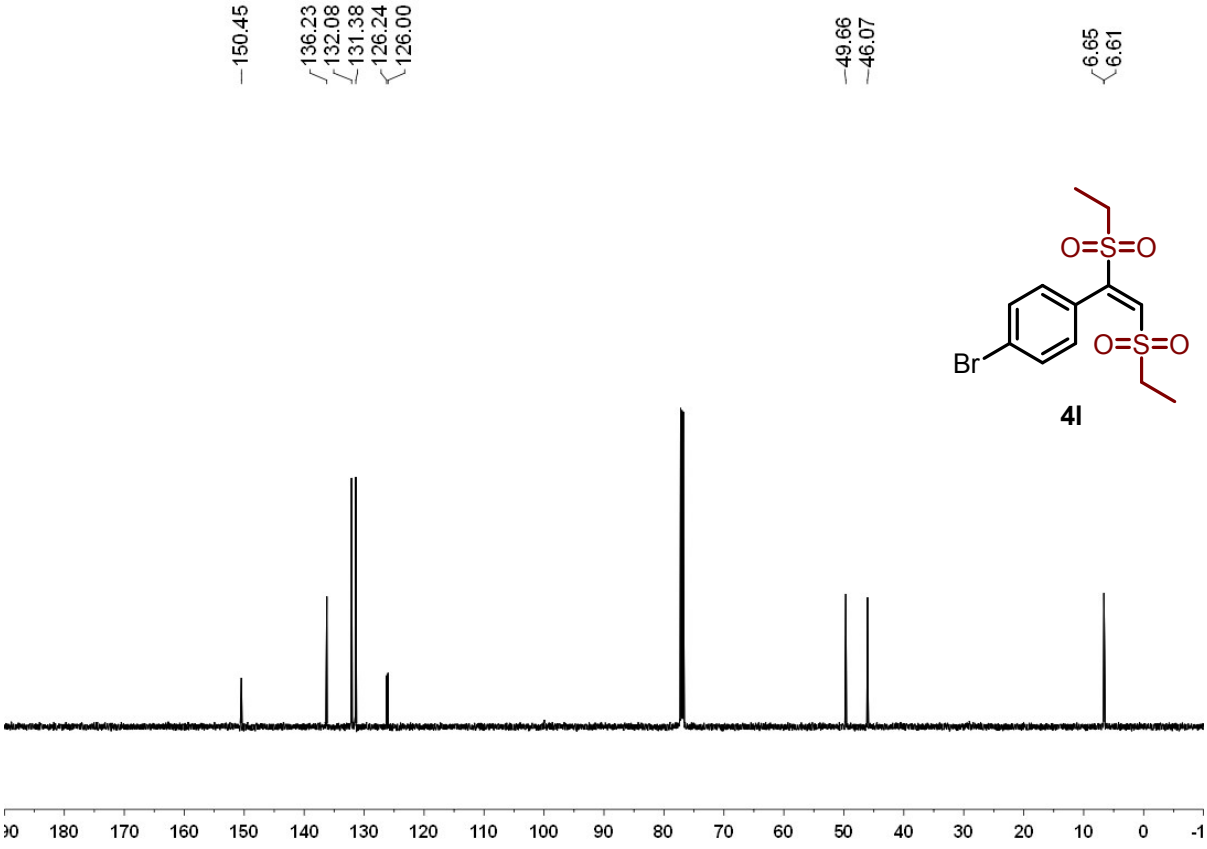
0.94
2.00
2.12
2.15
3.01
3.10
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1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126.24
126.00
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46.07
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6.61
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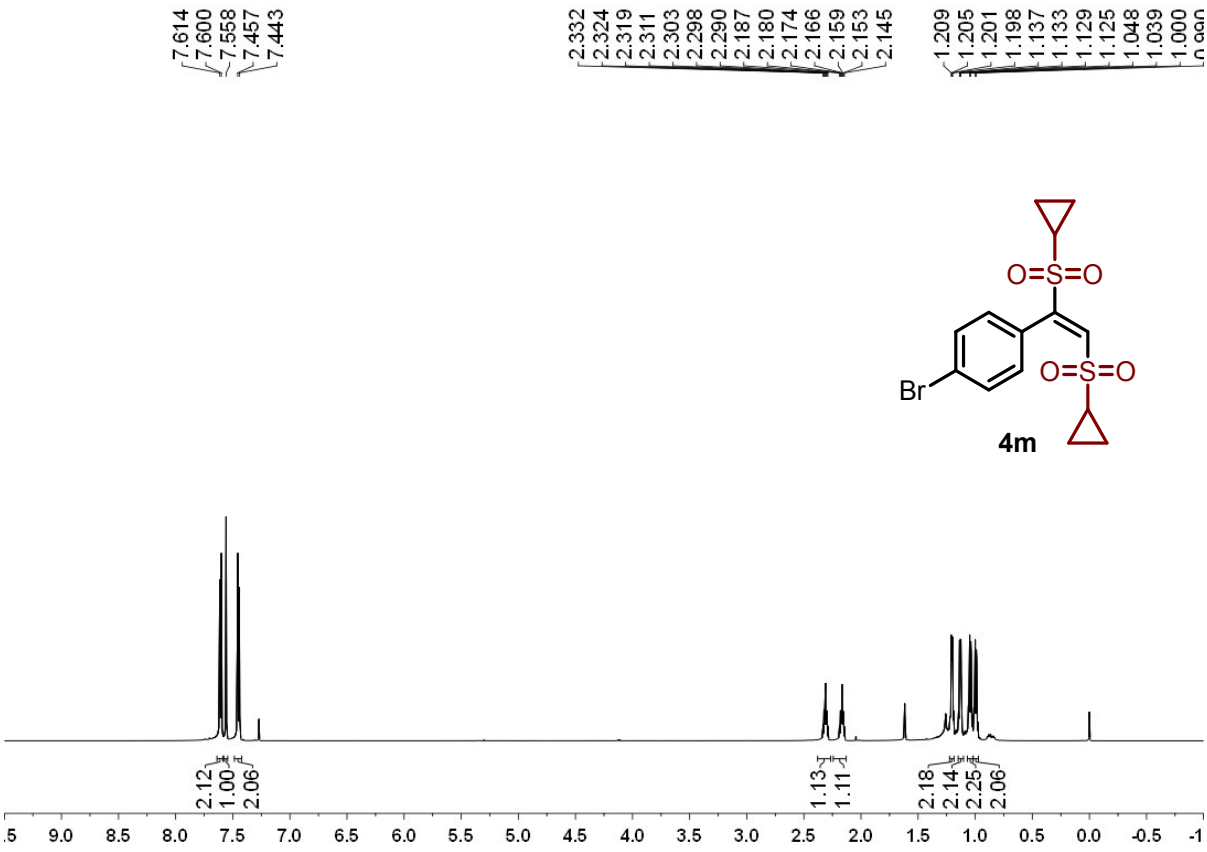
O=S=O
Br
4l
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -1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2.187
2.180
2.174
2.166
2.159
2.153
2.145
1.209
1.205
1.201
1.198
1.137
1.133
1.129
1.125
1.048
1.039
1.000
O=S=O
O=S=O
Br
4m
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2.06
1.13
1.11
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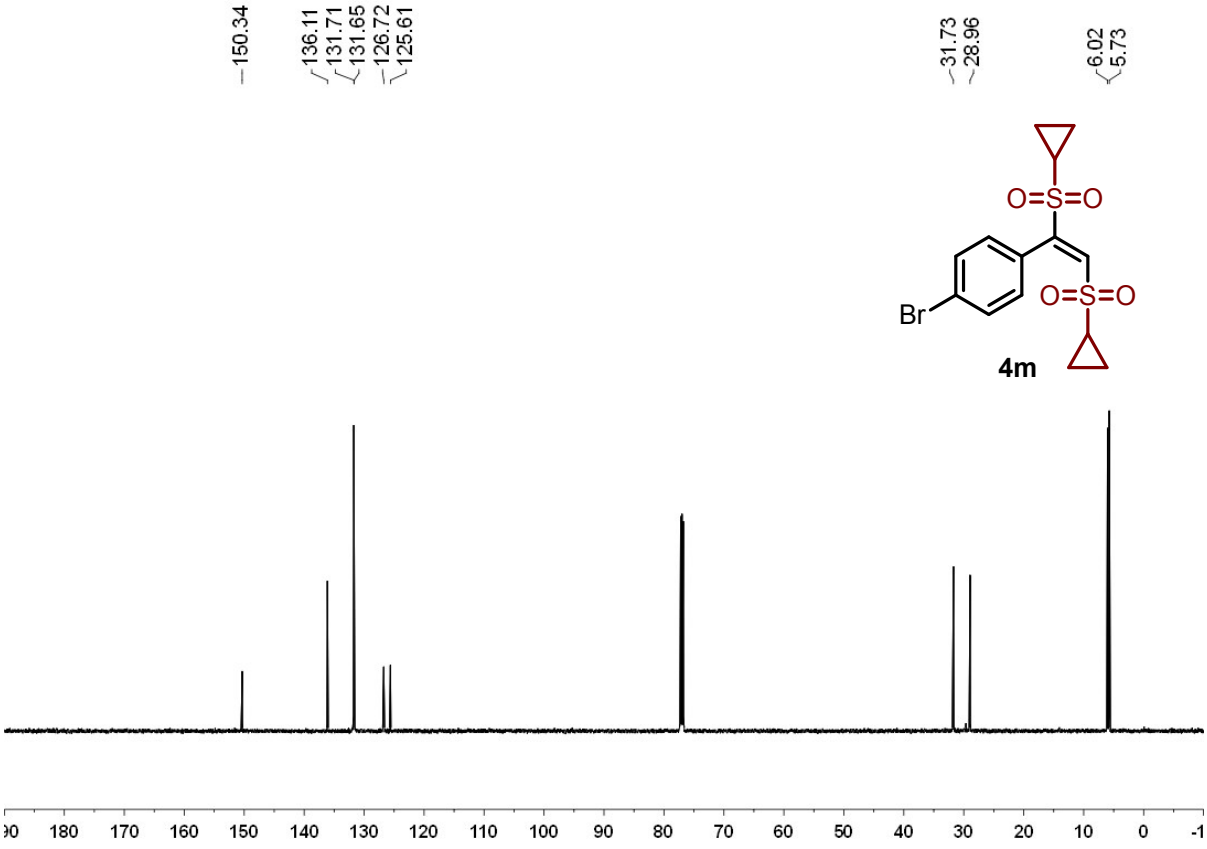
2.25
2.06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126.72
125.61
31.73
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6.02
5.73
O=S=O
O=S=O
Br
4m