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Supporting Information

A One-Pot "Back-to-Front" Approach for the Synthesis of Benzene Ring Substituted Indoles Using Allylboronic Acids

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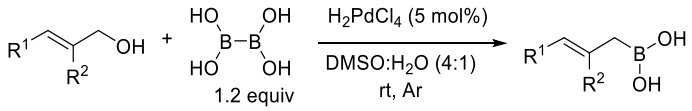
Experimental Section:

General: All reactions involving air or moisture sensitive reagents were carried out in flame dried glassware under nitrogen atmosphere. THF was obtained from Merck India, and was freshly distilled over Na-benzophenone under nitrogen. All other solvents were also obtained from Merck India and were dried according to the standard literature procedure. Reactions were monitored by thin layer chromatography (TLC) using Merck silica gel 60 F254 pre-coated plates (0.25 mm), and visualized under UV light and dipping into $KMnO_4$ solution. Silica gel (particle size 100-200 mesh) was purchased from SRL India for performing column chromatography by using mixture of hexane and ethylacetate eluent. NaH (60% dispersion in mineral oil), indole-2-carboxylic acid and indole-3-carboxaldehyde were received from Spectrochem Pvt. Ltd and used as received. Pyrrole was received from Sigma Aldrich. The ^{1}H NMR spectroscopic data were recorded with a Bruker 400, 500 or 600 MHz instruments. ^{13}C NMR spectra were similarly recorded at 101, 126, 151 MHz NMR Machines, using a broadband decoupled mode. Proton and carbon signals are reported relative to the residual signal present in $CDCl_3$ (δ= 7.26, 77.16) and DMSO-d_6 (δ= 2.50, 39.52). Coupling constant (J) are reported in Hertz (Hz) and refer to apparent multiplicities. The following abbreviations are used for the multiplicities: s: singlet, d: doublet, t: triplet, q: quartet, dd: doublet of doublets, m: multiplate. Infrared (IR) spectra were recorded by Perkin Elmer ATIR spectrometer, and reported in terms of wave number (cm^{-1}). High resolution mass spectra (HRMS) were recorded in ESI (+ Ve) method.

Synthesis of allylic alcohols: All the allylic alcohols were synthesized according to known literature procedure.[1]

General Procedure (GP I): The Synthesis of Allylboronic Acids:[2,3]



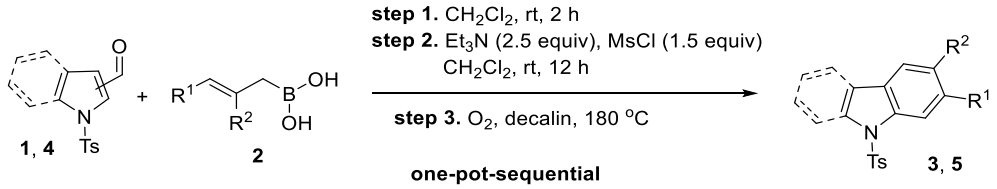
A 10 mL two neck round bottom flask was charged with allyl alcohol (2.0 mmol) and the flask was then backfilled with nitrogen thrice. Then DMSO (1.6 mL) and H_2O (0.4 mL) were added to it and the resulting reaction mixture was stirred for 2 minutes. Next, freshly prepared catalyst H_2PdCl_4 (0.3 M, 0.34 mL, 0.05 mmol) and diboronic acid (216 mg, 2.4 mmol, 1.2 equiv) were added sequentially, and the reaction mixture was stirred at room temperature for another 2 to 24 hours. Upon complete consumption of allyl alcohol as evidenced by TLC (*p*-anisaldehyde stain), reaction mixture was allowed to settle down over 2 to 3 hours for the complete sedimentation of Pd. Then the crude mixture was transferred via syringe to a 25 mL round bottom flask under nitrogen *(Note: For some boronic acids which are unstable under air, the reaction mixture was filtered through HPLC Teflon filter immediately after the completion of reaction).* Then the filtered crude allyl-boronic acid was washed by using 8 mL of degassed chloroform followed by 8 mL of degassed 16% aq. NaCl solution (repeated four times). The mixture was stirred under argon for 1 min. After separation of the two layers, the organic layer was taken into a 25 mL syringe and the aqueous layer was discarded. The organic layer was syringed back into the round bottom flask, and was similarly washed twice more with 16% aq. NaCl. Finally, the organic layer was taken off and transferred into another 25 mL round bottom flask containing Na_2SO_4 under nitrogen with occasional shaking. The resulting crude allylboronic acid solution was used immediately for allylation of desired aldehyde.

(**Note:** [a] all the solvents were degassed for 3 hours with 99.999% Ar under sonication

[b] If in some cases, all allyl alcohols are not consumed even after prolonged reaction time, then additional 1-2 mol% H_2PdCl_4 was added along with 0.2-0.4 equiv of $B_2(OH)_4$. The stirring was continued further until all allyl alcohol get completely consumed.)

Synthesis of pyrrole and indole derivatives: All the protected pyrrole and indole derivatives were synthesized according to known literature procedures.[4]

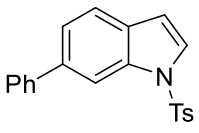
General Procedure II (GP II): One-Pot Synthesis of Indoles and Carbazoles:



A 10 mL screw cap seal reaction tube was charge with pyrrole **1** or indole derivatives **4** (0.2 mmol, 1.0 equiv). Then allyl boronic acid **2** solution in CH_2Cl_2 (2 mL, 0.3 mmol, 1.5 equiv) was added to it and the resulting mixture was stirred at room temperature under inert atmosphere. After completion of first allylation step, Et_3N (70 µL, 0.5 mmol, 2.5 equiv) and methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv) were added and the resulting mixture was stirred at room temperature for 12 h. After completion of elimination step, 2 mL of decalin was added to the reaction mixture, the seal tube is flushed with oxygen gas and stirring was continued at 180 °C under O_2 for 24-36 h. After complete consumption of starting material as indicated by TLC, the reaction was cool down to room temperature. Then, the crude residue was diluted with ethylacetate and carefully transferred to a round bottom flask. After evaporating the ethylacetate in *vacuo*, the crude product was purified by silica gel column chromatography by using ethylacetate/hexane as eluent to obtain the pure desired indoles **3** or carbazoles **5**.

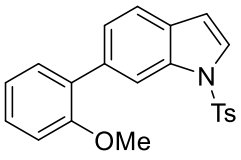
6-Phenyl-1-tosyl-1*H*-indole (3a):[5]

The titled compound **3a** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), cinnamyl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3a** (53 mg, 0.15 mmol, 76%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.25 (s, 1H), 7.82 (d, *J* = 8.4 Hz, 2H), 7.68 (d, *J* = 8.3 Hz, 2H), 7.62 – 7.60 (m, 2H), 7.52 – 7.49 (m, 3H), 7.41 (t, *J* = 7.4 Hz, 1H), 7.29 – 7.24 (m, 2H), 6.70 (d, *J* = 3.6 Hz, 1H), 2.36 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 145.12, 141.57, 138.30, 135.65, 135.54, 130.10, 130.07, 128.98, 127.66, 127.39, 126.98, 123.14, 121.64, 112.19, 108.98, 21.69.



6-(2-Methoxyphenyl)-1-tosyl-1*H*-indole (3b):[6]

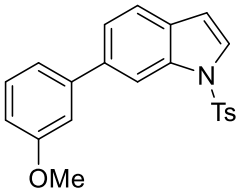
The titled compound **3b** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(2-methoxyphenyl) allyl) boronic acid (0.3



mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3b** (47 mg, 0.12 mmol, 62%) was isolated as white sticky solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.24 (s, 1H), 7.84 (d, *J* = 8.3 Hz, 2H), 7.61 (d, *J* = 3.6 Hz, 1H), 7.57 (d, *J* = 8.1 Hz, 1H), 7.45 (d, *J* = 9.0 Hz, 1H), 7.40 (d, *J* = 7.4 Hz, 2H), 7.25 (d, *J* = 8.1 Hz, 2H), 7.11 (t, *J* = 7.4 Hz, 1H), 7.06 (d, *J* = 8.1 Hz, 1H), 6.67 (d, *J* = 3.5 Hz, 1H), 3.84 (s, 3H), 2.34 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 156.66, 144.96, 135.65, 135.25, 135.04, 131.38, 130.96, 129.96, 129.78, 128.77, 127.06, 126.72, 125.32, 121.09, 120.77, 114.77, 111.52, 109.03, 55.76, 21.66.

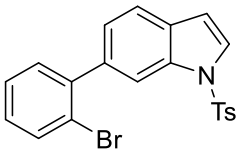
6-(3-Methoxyphenyl)-1-tosyl-1*H*-indole (3c):

The titled compound **3c** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(3-methoxyphenyl) allyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3c** (51.3 mg, 0.14 mmol, 68%) was isolated as white sticky solid after column chromatography on silica gel by using 5% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 8.21 (s, 1H), 7.79 (d, *J* = 8.4 Hz, 2H), 7.60 – 7.58 (m, 1H), 7.56 (s, 1H), 7.47 (dd, *J* = 8.2, 1.5 Hz, 1H), 7.40 (t, *J* = 7.9 Hz, 1H), 7.24 – 7.21 (m, 3H), 7.18 – 7.17 (m, 1H), 6.93 (dd, *J* = 7.8, 2.1 Hz, 1H), 6.67 (d, *J* = 3.6 Hz, 1H), 3.90 (s, 3H), 2.33 (s, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 160.12, 145.12, 143.10, 138.13, 135.54, 135.47, 130.21, 130.06, 129.95, 127.03, 126.97, 123.15, 121.60, 120.19, 113.57, 112.61, 112.22, 108.96, 55.48, 21.68. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2925, 1369, 1169, 674, 577, 540. **HRMS (ESI)**: calculated for $C_{22}H_{20}NO_3S$ ($[M+H]^+$): 378.1156; found 378.1162.



6-(2-Bromophenyl)-1-tosyl-1*H*-indole (3d):

The titled compound **3d** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(2-bromophenyl) allyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70µL, 0.5 mmol, 2.5 equiv). The indole **3d** (57 mg, 0.13 mmol, 67%) was isolated as white sticky solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 8.06 (s, 1H), 7.81 (d, *J* = 8.4 Hz, 2H), 7.69 (d, *J* = 8.0 Hz, 1H),



7.60 (dd, *J* = 3.6, 1.1 Hz, 1H), 7.56 (d, *J* = 8.8 Hz, 1H), 7.41 – 7.35 (m, 2H), 7.26 – 7.25 (m, 1H), 7.25 – 7.21 (m, 3H), 6.68 (d, *J* = 3.6 Hz, 1H), 2.34 (s, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 145.15, 142.84, 137.84, 135.54, 134.68, 133.26, 131.82, 130.27, 130.04, 128.93, 127.56, 127.21, 127.20, 125.01, 123.06, 120.97, 114.84, 109.00, 21.69. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2924, 1371, 1171, 1127, 676, 581. **HRMS (ESI)**: calculated for $C_{21}H_{17}BrNO_2S$ ($[M+H]^+$): 426.0158; found 426.0159.

6-(Naphthalen-1-yl)-1-tosyl-1*H*-indole (3e):

The titled compound **3e** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(naphthalen-1-yl) allyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3e** (52.5 mg, 0.13 mmol, 66%) was isolated as white solid after column chromatography on silica gel by using 5% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 8.12 (s, 1H), 7.94 (d, *J* = 8.1 Hz, 1H), 7.90 (d, *J* = 8.2 Hz, 1H), 7.81 – 7.75 (m, 3H), 7.65 – 7.62 (m, 2H), 7.58 – 7.50 (m, 2H), 7.46 (d, *J* = 6.9 Hz, 1H), 7.42 (d, *J* = 7.5 Hz, 1H), 7.37 (d, *J* = 8.7 Hz, 1H), 7.26 – 7.23 (m, 2H), 6.74 (s, 1H), 2.38 (s, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 145.13, 140.38, 137.45, 135.44, 134.95, 133.99, 131.95, 130.05, 128.50, 127.86, 127.51, 127.17, 126.96, 126.18, 126.11, 125.92, 125.84, 125.55, 121.17, 115.13, 108.94, 21.75. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2923, 1372, 1174, 779, 674, 591. **HRMS (ESI)**: calculated for $C_{25}H_{20}NO_2S$ ($[M+H]^+$): 398.1209; found 398.1210.

6-(Thiophen-2-yl)-1-tosyl-1*H*-indole (3f):

The titled compound **3f** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(thiophen-2-yl) allyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3f** (38.2 mg, 0.10 mmol, 54%) was isolated as yellowish sticky solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 8.23 (s, 1H), 7.78 (d, *J* = 8.3 Hz, 2H), 7.56 (d, *J* = 3.6 Hz, 1H), 7.50 (s, 2H), 7.37 – 7.36 (m, 1H), 7.31 – 7.30 (m, 1H), 7.23 (d, *J* = 8.1 Hz, 2H), 7.12 – 7.10 (m, 1H), 6.64 (d, *J* = 3.5 Hz, 1H), 2.34 (s, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 145.21, 144.91, 135.48, 135.34, 131.37, 130.26, 130.10, 128.26, 127.09, 127.00, 124.97, 123.40, 122.13,

121.79, 110.92, 109.10, 21.72. **FTIR**: ν_{max} (neat)/ cm^{-1} = 1361, 1163, 1119, 811, 668, 579. **HRMS (ESI)**: calculated for $C_{19}H_{16}NO_2S_2$ ($[M+H]^+$): 354.0617; found 354.0620.

6-Methyl-1-tosyl-1H-indole (3g):[7]

The titled compound **3g** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-but-2-en-1-yl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3g** (35.4 mg, 0.12 mmol, 62%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 7.79 (s, 1H), 7.75 (d, *J* = 8.3 Hz, 2H), 7.48 (d, *J* = 3.6 Hz, 1H), 7.39 (d, *J* = 8.0 Hz, 1H), 7.22 (d, *J* = 8.1 Hz, 2H), 7.04 (d, *J* = 7.9 Hz, `1H), 6.59 (d, *J* = 3.7 Hz, 1H), 2.47 (s, 3H), 2.34 (s, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 144.93, 135.64, 135.41, 134.83, 129.99, 128.58, 126.90, 125.85, 124.97, 121.02, 113.77, 109.06, 22.09, 21.69.

6-Propyl-1-tosyl-1*H*-indole (3h):

The titled compound **3h** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-hex-2-en-1-yl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3h** (35.7 mg, 0.11 mmol, 57%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 7.80 (s, 1H), 7.75 (d, *J* = 8.3 Hz, 2H), 7.48 (d, *J* = 3.6 Hz, 1H), 7.40 (d, *J* = 8.0 Hz, 1H), 7.20 (d, *J* = 8.2 Hz, 2H), 7.05 (d, *J* = 8.0 Hz, 1H), 6.59 (d, *J* = 3.6 Hz, 1H), 2.70 (t, *J* = 7.6 Hz, 2H), 2.33 (s, 3H), 1.71 – 1.63 (m, 2H), 0.94 (t, *J* = 7.3 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 144.90, 139.80, 135.46, 129.93, 128.90, 127.00, 126.96, 125.99, 124.46, 121.05, 113.41, 109.15, 38.58, 25.14, 21.66, 13.85. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2930, 1220, 1174, 773, 674. **HRMS (ESI)**: calculated for $C_{18}H_{20}NO_2S$ ($[M+H]^+$): 314.1209; found 314.1214.

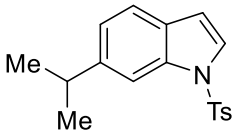
6-Benzyl-1-tosyl-1*H*-indole (3i):

The titled compound **3i** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(4-phenylbut-2-en-1-yl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3i** (40.5 mg, 0.11 mmol, 56%) was isolated as gummy liquid after column chromatography on silica gel

by using 5% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 7.80 (s, 1H), 7.65 (d, *J* = 8.3 Hz, 2H), 7.50 (d, *J* = 3.6 Hz, 1H), 7.41 (d, *J* = 8.0 Hz, 1H), 7.32 – 7.27 (m, 2H), 7.23 (d, *J* = 7.3 Hz, 1H), 7.18 – 7.14 (m, 4H), 7.07 (d, *J* = 8.0 Hz, 1H), 6.59 (d, *J* = 3.6 Hz, 1H), 4.09 (s, 2H), 2.33 (s, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 144.93, 141.53, 138.17, 135.27, 135.22, 129.91, 129.18, 129.04, 128.60, 126.99, 126.24, 124.75, 121.34, 114.00, 109.06, 42.34, 21.70. **FTIR**: ν_{max} (neat)/ cm^{-1} =1369, 1171, 1117, 674, 584, 538. **HRMS (ESI)**: calculated for $C_{22}H_{20}NO_2S$ ($[M+H]^+$): 362.1209; found 362.1212.

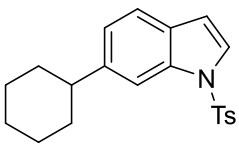
6-Isopropyl-1-tosyl-1*H*-indole (3j):

The titled compound **3j** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(4-methylpent-2-en-1-yl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3j** (38.2 mg, 0.12 mmol, 61%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 7.85 (s, 1H), 7.76 (d, *J* = 8.3 Hz, 2H), 7.50 (d, *J* = 3.6 Hz, 1H), 7.42 (d, *J* = 8.1 Hz, 1H), 7.21 (d, *J* = 8.1 Hz, 2H), 7.11 (d, *J* = 8.1 Hz, 1H), 6.59 (d, *J* = 3.6 Hz, 1H), 3.08 – 2.98 (m, 1H), 2.33 (s, 3H), 1.30 (d, *J* = 6.9 Hz, 6H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 146.12, 144.94, 135.49, 135.37, 129.91, 128.98, 126.95, 126.04, 122.46, 121.12, 111.28, 109.07, 34.64, 24.51, 21.66. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2960, 2869, 1370, 1171, 998, 669, 580. **HRMS (ESI)**: calculated for $C_{18}H_{20}NO_2S$ ($[M+H]^+$): 314.1209; found 314.1212.



6-Cyclohexyl-1-tosyl-1*H*-indole (3k):

The titled compound **3k** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-cyclohexyl allyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3k** (39 mg, 0.11 mmol, 55%) was isolated as gummy liquid after column chromatography on silica gel by using 5% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 7.84 (s, 1H), 7.76 (d, *J* = 8.4 Hz, 2H), 7.49 (d, *J* = 3.6 Hz, 1H), 7.41 (d, *J* = 8.1 Hz, 1H), 7.21 (d, *J* = 8.2 Hz, 2H), 7.09 (dd, *J* = 8.1, 1.4 Hz, 1H), 6.59 (d, *J* = 3.6 Hz, 1H), 2.65 – 2.59 (m, 1H), 2.33 (s, 3H), 1.91 – 1.87 (m, 4H), 1.79 – 1.76 (m, 1H), 1.49 – 1.40 (m, 4H), 1.34 – 1.27 (m, 1H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 145.36, 144.92, 135.50, 135.39, 129.92, 128.98, 126.93, 126.01, 122.90, 121.05, 111.69, 109.12, 45.09, 35.00, 27.10, 26.29, 21.67. **FTIR**: ν_{max}



(neat)/ cm^{-1} = 2924, 2852, 1372, 1177, 1119, 813, 679, 881. **HRMS (ESI)**: calculated for $C_{21}H_{24}NO_2S$ ($[M+H]^+$): 354.1522; found 354.1524.

6-(2,6-Dimethylhept-5-en-1-yl)-1-tosyl-1*H*-indole (3l):

The titled compound **3l** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(5,9-dimethyldeca-2,8-dien-1-yl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3l** (33.6 mg, 0.09 mmol, 44%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 7.78 (s, 1H), 7.74 (d, *J* = 8.4 Hz, 2H), 7.48 (d, *J* = 3.6 Hz, 1H), 7.39 (d, *J* = 8.0 Hz, 1H), 7.19 (d, *J* = 8.1 Hz, 2H), 7.01 (dd, *J* = 8.0, 1.3 Hz, 1H), 6.59 (d, *J* = 4.3 Hz, 1H), 5.10 – 5.07 (m, 1H), 2.78 – 2.75 (m, 1H), 2.51 – 2.47 (m, 1H), 2.40 – 2.38 (m, 1H), 2.33 (s, 3H), 2.12 – 2.04 (m, 1H), 2.01 – 1.94 (m, 1H), 1.79 – 1.73 (m, 1H), 1.70 (s, 3H), 1.62 (s, 3H), 1.42 – 1.37 (m, 1H), 0.84 (d, *J* = 6.6 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 144.88, 138.64, 135.61, 135.39, 131.35, 129.90, 128.93, 126.96, 126.01, 125.13, 124.94, 120.90, 114.19, 109.23, 44.14, 36.89, 35.20, 29.85, 25.85, 21.65, 19.44, 17.84. **FTIR**: ν_{max} (neat)/ cm^{-1} = 3306, 1600, 1372, 1217, 1119, 775, 677, 540. **HRMS (ESI)**: calculated for $C_{24}H_{30}NO_2S$ ($[M+H]^+$): 396.1992; found 396.1996.

5-Methyl-6-phenyl-1-tosyl-1*H*-indole (3m):

The titled compound **3m** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(2-methyl-3-phenylallyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3m** (31.8 mg, 0.09 mmol, 44%) was isolated as gummy liquid after column chromatography on silica gel by using 5% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 7.85 (s, 1H), 7.75 (d, *J* = 8.3 Hz, 2H), 7.54 (d, *J* = 3.6 Hz, 1H), 7.44 (t, *J* = 7.4 Hz, 2H), 7.39 (s, 1H), 7.37 (d, *J* = 7.0 Hz, 1H), 7.33 (d, *J* = 7.1 Hz, 2H), 7.21 (d, *J* = 8.2 Hz, 2H), 6.61 (d, *J* = 3.6 Hz, 1H), 2.34 (s, 3H), 2.28 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 144.95, 142.34, 139.36, 135.56, 133.62, 131.05, 130.22, 129.97, 129.64, 128.23, 127.01, 126.98, 126.84, 122.37, 114.59, 108.76, 21.68, 20.84. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2928, 1217, 1174, 772, 671, 596. **HRMS (ESI)**: calculated for $C_{22}H_{20}NO_2S$ ($[M+H]^+$): 362.1209; found 362.1212.

6-(4-Chlorophenyl)-5-methyl-1-tosyl-1*H*-indole(3n):

The titled compound **3n** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(4-chlorophenyl)-2-methylallyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3n** (35.4 mg, 0.12 mmol, 62%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 7.83 (s, 1H), 7.75 (d, *J* = 7.9 Hz, 2H), 7.56 (d, *J* = 3.5 Hz, 1H), 7.43 (s, 1H), 7.42 – 7.41 (m, 2H), 7.27 (d, *J* = 7.9 Hz, 2H), 7.23 (d, *J* = 8.0 Hz, 2H), 6.62 (d, *J* = 3.6 Hz, 1H), 2.36 (s, 3H), 2.28 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 145.04, 140.74, 138.01, 135.53, 133.59, 133.14, 130.94, 130.87, 130.46, 130.00, 128.46, 127.03, 126.96, 122.55, 114.47, 108.71, 21.68, 20.77. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2930, 1600, 1370, 1123, 809, 766, 674. **HRMS (ESI)**: calculated for $C_{22}H_{19}ClNO_2S$ ($[M+H]^+$): 396.0820; found 396.0819.

6-Ethyl-5-methyl-1-tosyl-1*H*-indole (3o):

The titled compound **3o** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-2-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-but-2-en-1-yl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3o** (28.2 mg, 0.09 mmol, 45%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 7.78 (s, 1H), 7.74 (d, *J* = 8.5 Hz, 2H), 7.45 (d, *J* = 3.7 Hz, 1H), 7.26 (s, 1H), 7.20 (d, *J* = 8.1 Hz, 2H), 6.54 (d, *J* = 3.6 Hz, 1H), 2.72 (q, *J* = 7.5 Hz, 2H), 2.335 (s, 3H), 2.325 (s, 3H), 1.26 (t, *J* = 7.5 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 144.80, 139.86, 135.63, 134.11, 131.55, 129.89, 128.97, 126.91, 125.88, 122.09, 112.66, 108.90, 26.93, 21.65, 19.50, 14.93. **FTIR**: ν_{max} (neat)/ cm^{-1} = 1217, 772, 738, 669, 422. **HRMS (ESI)**: calculated for $C_{18}H_{20}NO_2S$ ($[M+H]^+$): 314.1209; found 314.1213.

5-Phenyl-1-tosyl-1*H*-indole (3p):[8]

The titled compound **3p** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-3-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), cinnamyl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3p** (42.4 mg, 0.12 mmol, 61%)

was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (600 MHz, $CDCl_3$): δ (ppm) 8.04 (d, *J* = 8.6 Hz, 1H), 7.80 (d, *J* = 7.9 Hz, 2H), 7.72 (s, 1H), 7.59 – 7.58 (m, 3H), 7.54 (d, *J* = 8.6 Hz, 1H), 7.43 (t, *J* = 7.4 Hz, 2H), 7.33 (t, *J* = 7.4 Hz, 1H), 7.24 (d, *J* = 8.0 Hz, 2H), 6.70 (d, *J* = 3.4 Hz, 1H), 2.35 (s, 3H). **^{13}C NMR** (151 MHz, $CDCl_3$): δ (ppm) 145.14, 141.40, 136.94, 135.44, 134.36, 131.44, 130.06, 128.91, 127.48, 127.17, 127.06, 126.99, 124.33, 119.94, 113.86, 109.41, 21.72.

5-Isopropyl-1-tosyl-1*H*-indole (3q):

The titled compound **3q** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-3-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(4-methylpent-2-en-1-yl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3q** (39.5 mg, 0.13 mmol, 63%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 7.89 (d, *J* = 8.6 Hz, 1H), 7.76 (d, *J* = 8.0 Hz, 2H), 7.52 (d, *J* = 3.5 Hz, 1H), 7.36 (s, 1H), 7.21 (d, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 8.6 Hz, 1H), 6.59 (d, *J* = 3.4 Hz, 1H), 3.01 – 2.91 (m, 1H), 2.34 (s, 3H), 1.26 (d, *J* = 6.9 Hz, 6H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 144.71, 144.07, 135.63, 133.32, 130.90, 129.81, 126.83, 126.32, 123.67, 118.45, 113.28, 108.95, 33.97, 24.28, 21.49. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2965, 1373, 1220, 772, 674. **HRMS (ESI)**: Calculated for $C_{18}H_{20}NO_2S$ ($[M+H]^+$): 314.1209; found 314.1216.

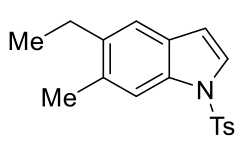
5-(4-Chlorophenyl)-6-methyl-1-tosyl-1*H*-indole(3r):

The titled compound **3r** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-3-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(4-chlorophenyl)-2-methylallyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3r** (50.7 mg, 0.13 mmol, 64%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (600 MHz, $CDCl_3$): δ (ppm) 7.89 (s, 1H), 7.81 (d, *J* = 8.2 Hz, 2H), 7.53 (d, *J* = 3.6 Hz, 1H), 7.38 (d, *J* = 8.3 Hz, 2H), 7.33 (s, 1H), 7.27 (d, *J* = 7.7 Hz, 2H), 7.23 (d, *J* = 8.2 Hz, 2H), 6.62 (d, *J* = 3.6 Hz, 1H), 2.38 (s, 3H), 2.35 (s, 3H). **^{13}C NMR** (151 MHz, $CDCl_3$): δ (ppm) 145.07, 140.56, 136.84, 135.60, 134.65, 132.95, 132.52, 130.86, 130.08, 128.96, 128.39, 126.98, 126.40, 122.20, 114.68, 108.94, 21.74, 21.51. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2925, 1220,

1165, 772, 671. **HRMS (ESI)**: Calculated for $C_{22}H_{19}ClNO_2S$ ($[M+H]^+$): 396.0820; found 396.0826.

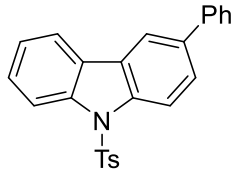
5-Ethyl-6-methyl-1-tosyl-1*H*-indole (3s):

The titled compound **3s** was synthesized according to **GP II** by using 1-tosyl-1*H*-pyrrole-3-carbaldehyde (50 mg, 0.2 mmol, 1.0 equiv), (*E*)-(2-methylpent-2-en-1-yl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The indole **3s** (40 mg, 0.13 mmol, 64%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 7.76 (*J* = 2.7 Hz, 2H), 7.74 (s, 1H), 7.44 (d, *J* = 3.5 Hz, 1H), 7.29 (s, 1H), 7.21 (d, *J* = 8.1 Hz, 2H), 6.56 (d, *J* = 3.5 Hz, 1H), 2.66 (q, *J* = 7.5 Hz, 2H), 2.41 (s, 3H), 2.34 (s, 3H), 1.22 (t, *J* = 7.5 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 144.77, 138.15, 135.88, 133.75, 133.29, 129.96, 129.26, 126.92, 125.73, 119.98, 114.52, 109.00, 26.29, 21.66, 20.23, 14.62. **FTIR**: ν_{max} (neat)/ cm^{-1} = 1217, 1171, 772, 669, 422. **HRMS (ESI)**: Calculated for $C_{18}H_{20}NO_2S$ ($[M+H]^+$): 314.1209; found 314.1213.



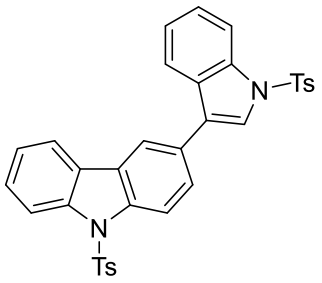
3-Phenyl-9-tosyl-9*H*-carbazole (5a):[9]

The titled compound **5a** was synthesized according to **GP II** by using 1-tosyl-1*H*-indole-3-carbaldehyde (59.9 mg, 0.2 mmol, 1.0 equiv), cinnamyl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5a** (58.8 mg, 0.15 mmol, 74%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (600 MHz, $CDCl_3$): δ (ppm) 8.38 (d, *J* = 8.6 Hz, 1H), 8.34 (d, *J* = 8.4 Hz, 1H), 8.09 (s, 1H), 7.95 (d, *J* = 8.2 Hz, 1H), 7.74 – 7.71 (m, 3H), 7.66 (d, *J* = 8.2 Hz, 2H), 7.52 – 7.46 (m, 3H), 7.39 – 7.34 (m, 2H), 7.12 (d, *J* = 8.1 Hz, 2H), 2.27 (s, 3H). **^{13}C NMR** (151 MHz, $CDCl_3$): δ (ppm) 145.05, 141.05, 138.99, 137.93, 137.46, 135.18, 129.85, 129.02, 127.69, 127.44, 127.41, 127.07, 126.87, 126.68, 126.57, 124.11, 120.18, 118.53, 115.51, 115.38, 21.64.



9-Tosyl-3-(1-tosyl-1*H*-indol-3-yl)-9*H*-carbazole (5b):

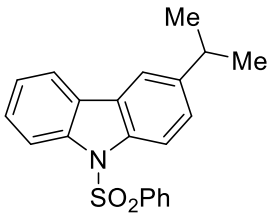
The titled compound **5b** was synthesized according to **GP II** by using 1-tosyl-1*H*-indole-3-carbaldehyde (59.9 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(1-tosyl-1H-indol-3-yl)allyl)boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5b** (76.8 mg, 0.13 mmol, 65%) was isolated as white solid



after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 8.40 (d, *J* = 8.6 Hz, 1H), 8.35 (d, *J* = 8.4 Hz, 1H), 8.11 – 8.06 (m, 2H), 7.94 (d, *J* = 7.8 Hz, 1H), 7.84 –7.81 (m, 3H), 7.75 – 7.70 (m, 4H), 7.52 (t, *J* = 7.8 Hz, 1H), 7.39 (t, *J* = 7.5 Hz, 2H), 7.32 (t, *J* = 7.5 Hz, 1H), 7.25 (s, 1H), 7.23 (s, 1H), 7.13 (d, *J* = 8.2 Hz, 2H), 2.35 (s, 3H), 2.28 (s, 3H). **^{13}C NMR** (151 MHz, $CDCl_3$): δ (ppm) 145.25, 145.15, 138.90, 137.86, 135.66, 135.35, 135.10, 130.12, 129.90, 129.50, 129.08, 127.87, 127.45, 127.12, 127.06, 126.68, 126.27, 125.17, 124.17, 123.80, 123.79, 123.15, 120.46, 120.26, 119.29, 115.66, 115.36, 114.07, 21.74, 21.69. **FTIR**: ν_{max} (neat)/ cm^{-1} =1373, 1175, 755, 584. **HRMS (ESI)**: calculated for $C_{34}H_{27}N_2O_4S_2$ ($[M+H]^+$): 591.1407; found 591.1411.

3-Isopropyl-9-(phenylsulfonyl)-9*H*-carbazole (5c):

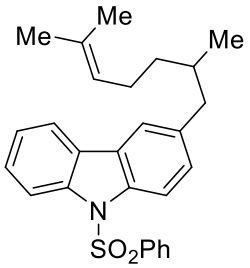
The titled compound **5c** was synthesized according to **GP II** by using 1-(phenylsulfonyl)-1*H*-



indole-3-carbaldehyde (57.0 mg, 0.2 mmol, 1.0 equiv), (*E*)-(4-methylpent-2-en-1-yl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5c** (41.2 mg, 0.12 mmol, 59%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.33 (d, *J* = 8.4 Hz, 1H), 8.25 (d, *J* = 8.6 Hz, 1H), 7.90 (d, *J* = 7.7 Hz, 1H), 7.83 (d, *J* = 7.7 Hz, 2H), 7.75 (s, 1H), 7.48 (t, *J* = 7.7 Hz, 1H), 7.42 (t, *J* = 7.5 Hz, 1H), 7.38 – 7.34 (m, 2H), 7.30 (t, *J* = 7.8 Hz, 2H), 3.09 – 3.04 (m, 1H), 1.33 (d, *J* = 6.9 Hz, 6H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 145.00, 138.71, 138.11, 136.77, 133.78, 129.11, 127.31, 126.70, 126.58, 126.53, 126.43, 123.97, 120.03, 117.46, 115.20, 115.01, 34.11, 24.42. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2960, 1362, 1164, 982, 820, 744, 556. **HRMS (ESI)**: calculated for $C_{21}H_{20}NO_2S$ ($[M+H]^+$): 350.1209; found 350.1208.

3-(2,6-Dimethylhept-5-en-1-yl)-9-(phenylsulfonyl)-9*H*-carbazole (5d):

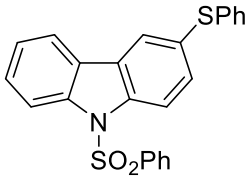
The titled compound **5d** was synthesized according to **GP II** by using 1-(phenylsulfonyl)-1*H*-indole-3-carbaldehyde (57.0 mg, 0.2 mmol, 1.0 equiv), (*E*)-(5,9-dimethyldeca-2,8-dien-1-yl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5d** (42.3 mg, 0.99 mmol, 49%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane



as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.30 (d, *J* = 8.4 Hz, 1H), 8.21 (d, *J* = 8.5 Hz, 1H), 7.86 (d, *J* = 7.6 Hz, 1H), 7.80 (d, *J* = 7.6 Hz, 2H), 7.64 (s, 1H), 7.46 (t, *J* = 7.8 Hz, 1H), 7.42 (t, *J* = 7.5 Hz, 1H), 7.33 (t, *J* = 7.5 Hz, 1H), 7.31 – 7.24 (m, 3H), 5.08 (t, *J* = 7.0 Hz, 1H), 2.77 (dd, *J* = 13.4, 6.0 Hz, 1H), 2.48 (dd, *J* = 13.4, 8.2 Hz, 1H), 2.11 – 2.01 (m, 1H), 2.01 – 1.93 (m, 1H), 1.83 – 1.76 (m, 1H), 1.68 (s, 3H), 1.59 (s, 3H), 1.43 – 1.37 (m, 1H), 1.26 – 1.17 (m, 1H), 0.87 (d, *J* = 6.6 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 138.78, 138.14, 137.71, 136.86, 133.78, 131.37, 129.09, 128.90, 127.35, 126.72, 126.61, 126.57, 124.85, 124.02, 120.35, 120.06, 115.34, 114.89, 43.56, 36.91, 35.03, 25.85, 25.78, 19.51, 17.80. **FTIR**: ν_{max} (neat)/ cm^{-1} = 3070, 2922, 2951, 1601, 1445, 1370, 1172, 977, 724, 685. **HRMS (ESI)**: calculated for $C_{27}H_{30}NO_2S$ ($[M+H]^+$): 432.1992; found 432.1998.

9-(Phenylsulfonyl)-3-(phenylthio)-9*H*-carbazole (5e):

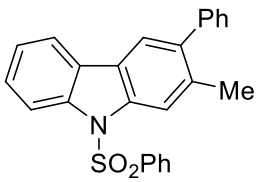
The titled compound **5e** was synthesized according to **GP II** by using 1-(phenylsulfonyl)-1*H*-



indole-3-carbaldehyde (57.0 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(phenylthio) allyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5e** (51.5 mg, 0.12 mmol, 62%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.32 (d, *J* = 8.5 Hz, 1H), 8.29 (d, *J* = 8.7 Hz, 1H), 7.95 (s, 1H), 7.84 – 7.82 (m, 3H), 7.54 – 7.46 (m, 3H), 7.36 – 7.33 (m, 3H), 7.30 – 7.27 (m, 4H), 7.24 – 7.21 (m, 1H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 138.87, 138.02, 137.90, 136.95, 134.08, 131.62, 130.46, 130.14, 129.35, 129.28, 128.06, 127.62, 126.91, 126.66, 125.79, 124.31, 124.02, 120.37, 116.03, 115.31. **FTIR**: ν_{max} (neat)/ cm^{-1} = 1584, 1437, 1370, 1173, 975, 683, 553, 474. **HRMS (ESI)**: calculated for $C_{24}H_{18}NO_2S_2$ ($[M+H]^+$): 416.0774; found 416.0776.

2-Methyl-3-phenyl-9-(phenylsulfonyl)-9*H*-carbazole (5f):

The titled compound **5f** was synthesized according to **GP II** by using 1-(phenylsulfonyl)-1*H*-

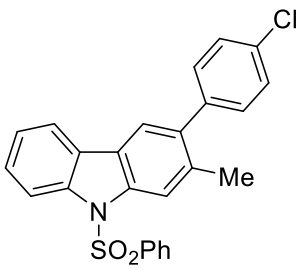


indole-3-carbaldehyde (57.0 mg, 0.2 mmol, 1.0 equiv), (*E*)-(2-methyl-3-phenylallyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5f** (43.7 mg, 0.11 mmol, 55%) was isolated as

white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 8.32 (d, *J* = 8.4 Hz, 1H), 8.24 (s, 1H), 7.88 (d, *J* = 8.0 Hz, 2H), 7.84 (d, *J* = 7.7 Hz, 1H), 7.75 (s, 1H), 7.49 – 7.43 (m, 4H), 7.39 – 7.34 (m, 6H), 2.46 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 141.88, 138.67, 138.62, 138.32, 137.99, 135.68, 133.90, 129.55, 129.24, 128.32, 127.19, 127.11, 126.67, 126.65, 124.48, 124.12, 121.09, 119.92, 116.27, 115.24, 21.80. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2933, 2852, 1446, 1174, 1086, 724, 570, 422. **HRMS (ESI)**: calculated for $C_{25}H_{23}NO_2S$ ($[M+NH_4]^+$): 415.1474; found 415.1499.

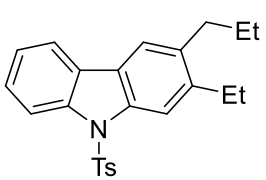
3-(4-Chlorophenyl)-2-methyl-9-(phenylsulfonyl)-9H-carbazole (5g):

The titled compound **5g** was synthesized according to **GP II** by using 1-(phenylsulfonyl)-1*H*-indole-3-carbaldehyde (57.0 mg, 0.2 mmol, 1.0 equiv), (*E*)-(3-(4-chlorophenyl)-2-methylallyl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5g** (56.7 mg, 0.13 mmol, 65%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.32 (d, *J* = 8.4 Hz, 1H), 8.24 (s, 1H), 7.87 (d, *J* = 7.9 Hz, 2H), 7.84 (d, *J* = 7.7 Hz, 1H), 7.71 (s, 1H), 7.50 – 7.46 (m, 2H), 7.42 (d, *J* = 8.2 Hz, 2H), 7.38 – 7.33 (m, 3H), 7.30 (d, *J* = 8.2 Hz, 2H), 2.44 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 140.28, 138.69, 138.29, 138.16, 137.30, 135.50, 133.93, 133.22, 130.88, 129.25, 128.52, 127.33, 126.65, 126.46, 124.57, 124.17, 121.00, 119.93, 116.39, 115.25, 21.73. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2928, 1447, 1368, 1090, 831, 746, 596. **HRMS (ESI)**: calculated for $C_{25}H_{22}ClN_2O_2S$ ($[M+NH_4]^+$): 449.1085; found 449.1080.



2-Ethyl-3-propyl-9-tosyl-9*H*-carbazole (5h):

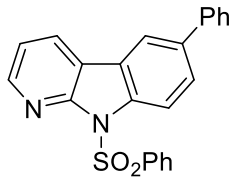
The titled compound **5h** was synthesized according to **GP II** by using 1-tosyl-1*H*-indole-3-carbaldehyde (59.9 mg, 0.2 mmol, 1.0 equiv), (*E*)-(2-ethylhex-2-en-1-yl) boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5h** (40 mg, 0.10 mmol, 51%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (600 MHz, DMSO-d_6): δ (ppm) 8.21 (d, *J* = 8.2 Hz, 1H), 8.02 (d, *J* = 8.0 Hz, 2H), 7.83 (s, 1H), 7.68 (d, *J* = 8.2 Hz, 2H), 7.50 (t, *J* = 7.8 Hz, 1H), 7.36 (t, *J* = 7.5 Hz, 1H), 7.19 (d, *J* = 7.9 Hz,



2H), 2.77 (q, *J* = 7.5 Hz, 2H), 2.63 (t, *J* = 8.0 Hz, 2H), 2.16 (s, 3H), 1.62 – 1.56 (m, 2H), 1.25 (t, *J* = 7.5 Hz, 3H), 0.93 (t, *J* = 7.3 Hz, 3H). **^{13}C NMR** (101 MHz, DMSO-d_6): δ (ppm) 145.48, 142.05, 137.72, 136.51, 136.35, 133.84, 130.05, 127.23, 126.18, 126.10, 124.26, 123.82, 120.51, 120.34, 114.67, 113.88, 34.04, 25.80, 23.95, 20.92, 15.62, 14.05. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2960, 2871, 1454, 1367, 1168, 810, 747, 541. **HRMS (ESI)**: calculated for $C_{24}H_{26}NO_2S$ ($[M+H]^+$): 392.1679; found 392.1681.

6-Phenyl-9-(phenylsulfonyl)-9*H*-pyrido[2,3-b]indole (5i):

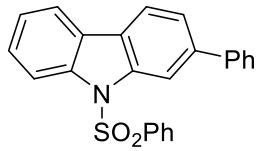
The titled compound **5i** was synthesized according to **GP II** by using 1-(phenylsulfonyl)-1*H*-



pyrrolo[2,3-b]pyridine-3-carbaldehyde (57.0 mg, 0.2 mmol, 1.0 equiv), cinnamyl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5i** (43.8 mg, 0.11 mmol, 57%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.59 (dd, *J* = 4.9, 1.6 Hz, 1H), 8.55 (d, *J* = 8.7 Hz, 1H), 8.24 (dd, *J* = 7.7, 1.6 Hz, 1H), 8.19 – 8.17 (m, 2H), 8.12 (s, 1H), 7.81 (dd, *J* = 8.7, 1.9 Hz, 1H), 7.68 – 7.64 (m, 2H), 7.54 – 7.47 (m, 3H), 7.44 – 7.37 (m, 3H), 7.31 (dd, *J* = 7.7, 4.9 Hz, 1H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 151.37, 147.36, 140.78, 138.88, 137.52, 137.13, 134.08, 129.09, 128.55, 127.89, 127.69, 127.58, 127.44, 123.53, 119.38, 119.16, 118.98, 115.44. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2917, 2852, 1469, 1379, 1182, 974, 752, 591. **HRMS (ESI)**: calculated for $C_{23}H_{16}N_2O_2SNa$ ($[M+Na]^+$): 407.0824; found 407.0833.

2-Phenyl-9-(phenylsulfonyl)-9*H*-carbazole (5j):

The titled compound **5j** was synthesized according to **GP II** by using 1-(phenylsulfonyl)-1*H*-

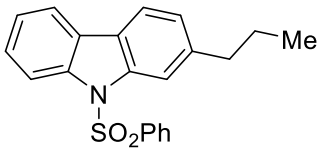


indole-2-carbaldehyde (57.0 mg, 0.2 mmol, 1.0 equiv), cinnamyl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5j** (51.4 mg, 0.13 mmol, 67%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 8.59 (s, 1H), 8.35 (d, *J* = 8.4 Hz, 1H), 7.96 – 7.91 (m, 2H), 7.85 (d, *J* = 8.0 Hz, 2H), 7.74 (d, *J* = 8.1 Hz, 2H), 7.63 – 7.61 (m, 1H), 7.54 – 7.49 (m, 3H), 7.48 – 7.38 (m, 3H), 7.36 – 7.31 (m, 2H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 141.30, 141.03, 139.22, 138.97, 138.17, 133.96, 129.24, 129.08, 127.74, 127.71, 127.57, 126.65, 126.37, 125.72, 124.26, 123.62, 120.36,

120.20, 115.37, 113.80. **FTIR**: ν_{max} (neat)/ cm^{-1} = 1372, 1173, 979, 755, 690, 594. **HRMS (ESI)**: calculated for $C_{24}H_{18}NO_2S$ ($[M+H]^+$): 384.1053; found 384.1053.

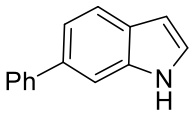
9-(Phenylsulfonyl)-2-propyl-9*H*-carbazole (5k):

The titled compound **5k** was synthesized according to **GP II** by using 1-(phenylsulfonyl)-1*H*-indole-2-carbaldehyde (57.0 mg, 0.2 mmol, 1.0 equiv), (*E*)-hex-2-en-1-ylboronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The carbazole **5k** (35.6 mg, 0.10 mmol, 51%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.31 (d, *J* = 8.4 Hz, 1H), 8.14 (s, 1H), 7.85 (d, *J* = 7.7 Hz, 1H), 7.80 – 7.78 (m, 3H), 7.47 – 7.42 (m, 2H), 7.35 – 7.29 (m, 3H), 7.19 (d, *J* = 7.9 Hz, 1H), 2.79 (t, *J* = 7.6 Hz, 2H), 1.78 – 1.71 (m, 2H), 0.98 (t, *J* = 7.3 Hz, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 142.90, 138.94, 138.67, 138.20, 133.82, 129.12, 127.04, 126.81, 126.63, 124.96, 124.54, 124.11, 119.84, 119.79, 115.41, 115.15, 38.83, 25.14, 13.85. **FTIR**: ν_{max} (neat)/ cm^{-1} = 2959, 2930, 1460, 1370, 1091, 723. **HRMS (ESI)**: calculated for $C_{21}H_{20}NO_2S$ ($[M+H]^+$): 350.1209; found 350.1210.



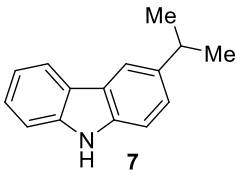
6-Phenyl-1*H*-indole (6):[10]

To a stirred solution of **3a** (34.7 mg, 0.1 mmol, 1 equiv) in MeOH (2 mL) was added 2 mL of KOH (4N) dropwise, and the resulting reaction mixture was refluxed at 80 °C for 48 h. On complete consumption of all the starting material as indicated by TLC, the reaction mixture was quenched by adding saturated aq. NH_4Cl solution. The aqueous layer was extracted with ethylacetate (2×2 mL), the combined organic layers were dried over Na_2SO_4, and evaporated under reduced pressure. The indole **6** (14.6 mg, 0.08 mmol, 76%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 8.21 (s, 1H), 7.71 (d, *J* = 8.2 Hz, 1H), 7.66 (d, *J* = 8.3 Hz, 2H), 7.61 (s, 1H), 7.45 (t, *J* = 7.7 Hz, 2H), 7.40 (dd, *J* = 8.2, 1.4 Hz, 1H), 7.33 (t, *J* = 7.4 Hz, 1H), 7.24 (t, *J* = 2.7 Hz, 1H), 6.59 – 6.58 (m, 1H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 142.49, 136.56, 135.80, 128.83, 127.54, 127.39, 126.74, 124.92, 121.06, 119.98, 109.68, 102.75.



6

3-Isopropyl-9*H*-carbazole (7):[11]

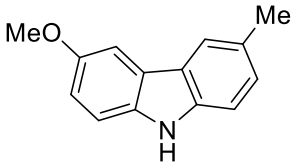


7

To a stirred solution of **5c** (34.9 mg, 0.1 mmol, 1 equiv) in dry THF (2 mL) was added TBAF (0.4 mmol, 1 M in THF, 4 equiv) dropwise, and the resulting reaction mixture was refluxed at 75 ^{o}C for 3 h. On complete consumption of all the starting material as indicated by TLC, the reaction mixture was quenched by adding saturated aq. NH_4Cl solution. The aqueous layer was extracted with ethylacetate (2×2 mL), the combined layers were dried over Na_2SO_4, and evaporated under reduced pressure. The carbazole **7** (20.3 mg, 0.09 mmol, 97%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 8.08 (d, *J* = 7.8 Hz, 1H), 7.94 (s, 2H), 7.41 – 7.39 (m, 2H), 7.34 – 7.31 (m, 2H), 7.25 – 7.21 (m, 1H), 3.17 – 3.06 (m, 1H), 1.38 (d, *J* = 6.9 Hz, 6H).**^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 140.38, 140.01, 138.11, 125.73, 124.97, 123.55, 123.51, 120.34, 119.34, 117.61, 110.68, 110.46, 34.34, 24.85.

3-Methoxy-6-methyl-9*H*-carbazole (Glycozoline) (9):[11]

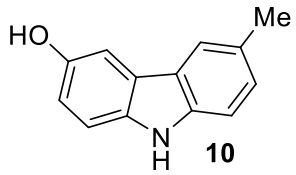
To synthesize compound **9**, at first the corresponding *N*-tosyl-protected carbazole was



9

synthesized according to **GP II** by using 5-methoxy-1-(phenylsulfonyl)-1*H*-indole-3-carbaldehyde **8** (57.0 mg, 0.2 mmol, 1.0 equiv), (*E*)-but-2-en-1-yl boronic acid (0.3 mmol, 1.5 equiv), methanesulfonyl chloride (23.2 µL, 0.3 mmol, 1.5 equiv), Et_3N (70 µL, 0.5 mmol, 2.5 equiv). The corresponding *N*-tosyl-protected carbazole (33 mg, 0.09 mmol, 47%) was isolated as white solid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. Then to a stirred solution of *N*-tosyl-protected carbazole (33 mg, 0.09 mmol, 1 equiv) in dry THF (2 mL) was added TBAF (0.4 mmol, 4 equiv) dropwise, and the resulting reaction mixture was refluxed at 75 ^{o}C for 3 h. On complete consumption of all the starting material as indicated by TLC, the reaction mixture was quenched by adding saturated aq. NH_4Cl solution. The aqueous layer was extracted with ethylacetate (2×2 mL), the combined layers were dried over Na_2SO_4, and evaporated under reduced pressure. The carbazole **9** (20.2 mg, 0.08 mmol, 96%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (400 MHz, $CDCl_3$): δ (ppm) 7.84 (s, 2H), 7.57 – 7.48 (m, 1H), 7.30 (d, *J* = 8.8 Hz, 2H), 7.22 (d, *J* = 8.1 Hz, 1H), 7.06 – 7.01 (m, 1H), 3.93 (s, 3H), 2.53 (s, 3H). **^{13}C NMR** (101 MHz, $CDCl_3$): δ (ppm) 153.87, 138.68, 134.88, 128.47, 127.32, 123.78, 123.66, 120.27, 115.01, 111.40, 110.55, 103.21, 56.20, 21.56.

6-Methyl-9*H*-carbazol-3-ol (Glycozolinol) (10):[11]



10

To a stirred solution of **9** (20.2 mg, 0.08 mmol, 1 equiv) in dry CH_2Cl_2 (2 mL) was added BBr_3 (0.16 mmol, 2 equiv) dropwise, and the resulting reaction mixture was refluxed at 75 ^oC for 3 h. On complete consumption of all the starting material as indicated by TLC, the reaction mixture was quenched by adding saturated aq. NH_4Cl solution. The aqueous layer was extracted with ethylacetate (2×2 mL), the combined layers were dried over Na_2SO_4, and evaporated under reduced pressure. The carbazole **10** (14.5 mg, 0.07 mmol, 92%) was isolated as gummy liquid after column chromatography on silica gel by using 2% ethylacetate in hexane as eluent. **^{1}H NMR** (500 MHz, $CDCl_3$): δ (ppm) 10.70 (s, 1H), 8.86 (s, 1H), 7.75 (s, 1H), 7.35 (d, *J* = 2.3 Hz, 1H), 7.28 (d, *J* = 8.2 Hz, 1H), 7.23 (d, *J* = 8.5 Hz, 1H), 7.13 (d, *J* = 8.2 Hz, 1H), 6.85 (dd, *J* = 8.6, 2.4 Hz, 1H), 2.43 (s, 3H). **^{13}C NMR** (126 MHz, $CDCl_3$): δ (ppm) 150.15, 138.68, 134.07, 126.50, 126.21, 122.82, 122.41, 119.73, 114.78, 111.16, 110.50, 104.69, 21.01.

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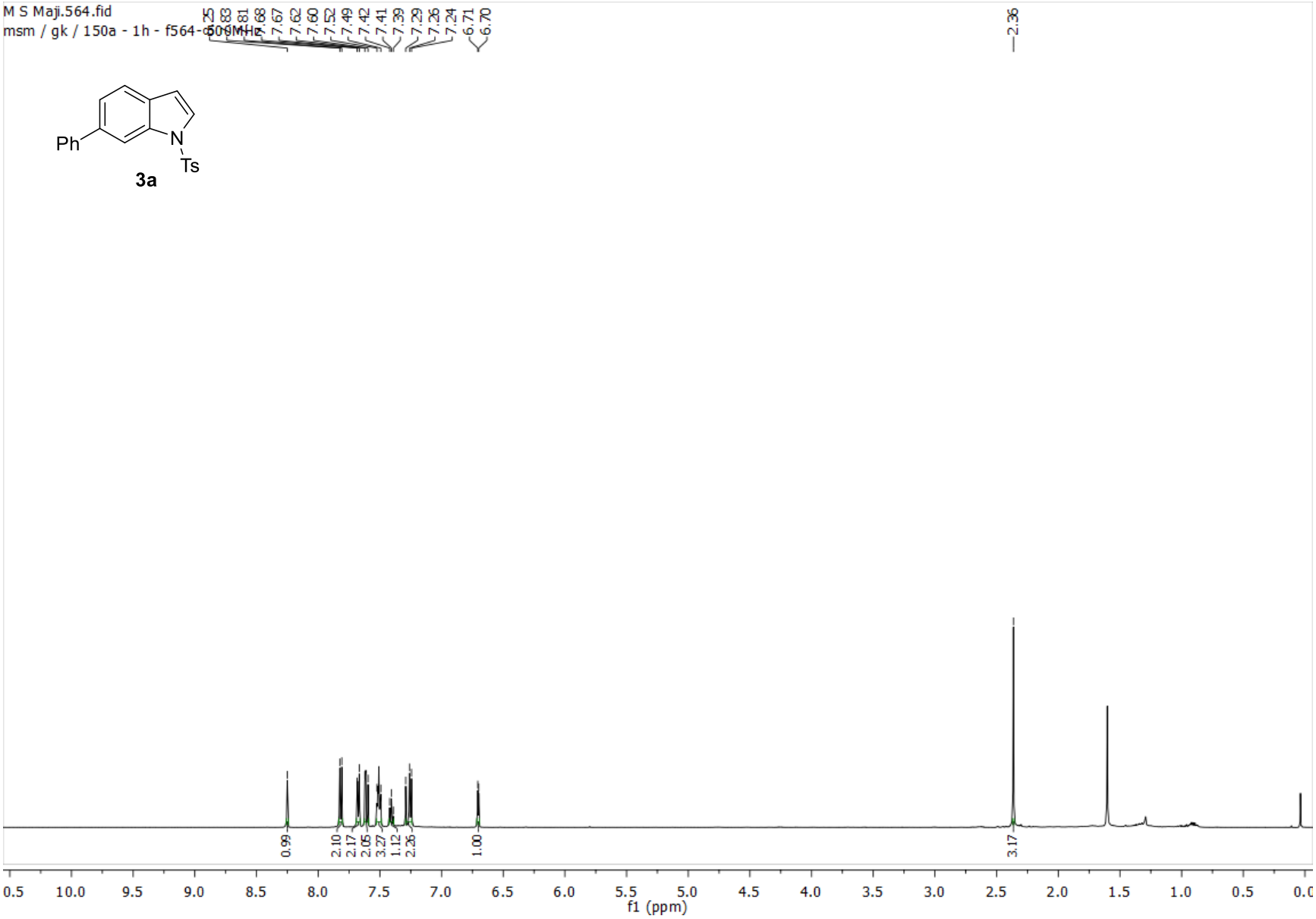
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7.42
7.41
7.39
7.29
7.26
7.24
6.71
6.70
2.36
Ph
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3a
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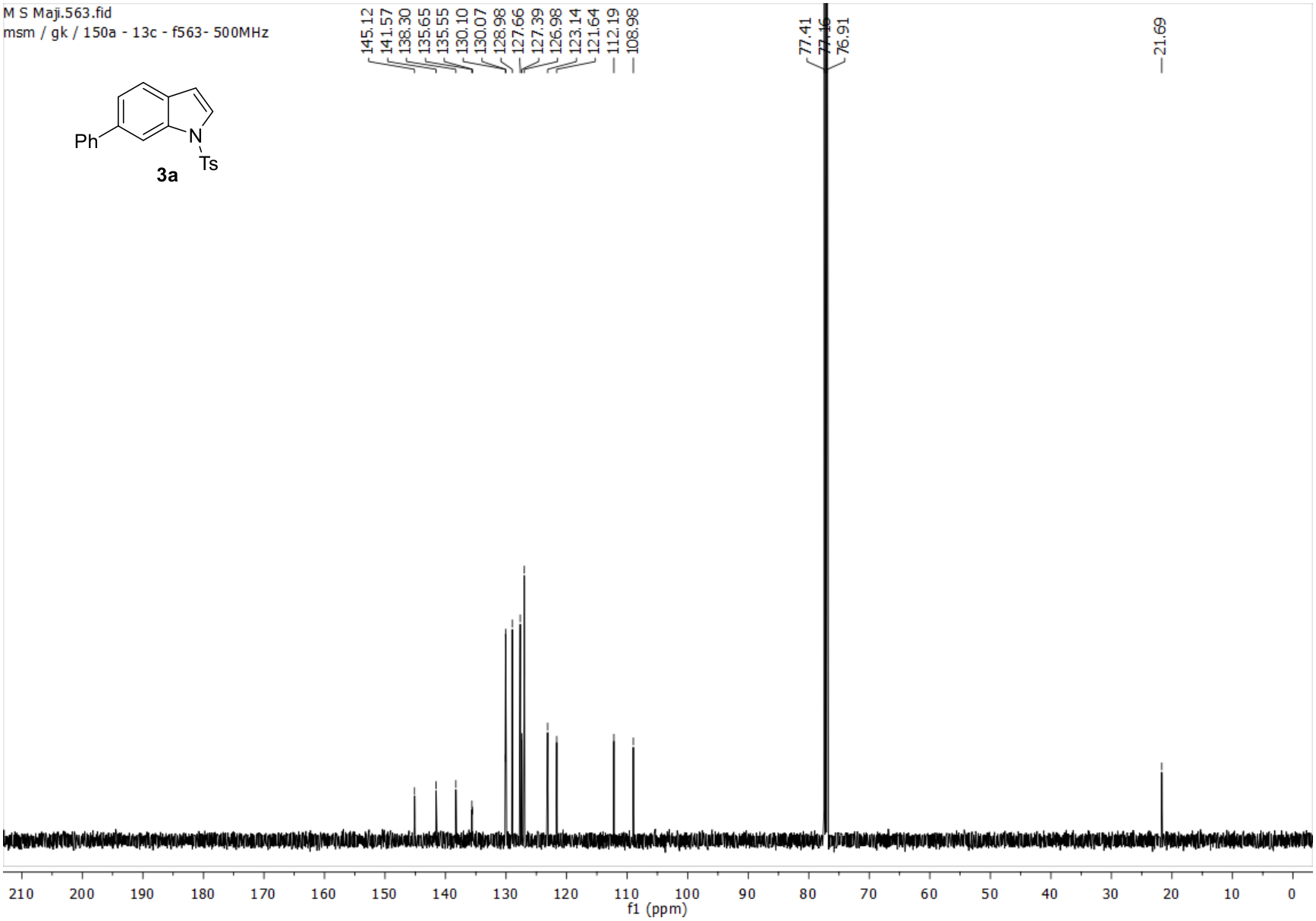
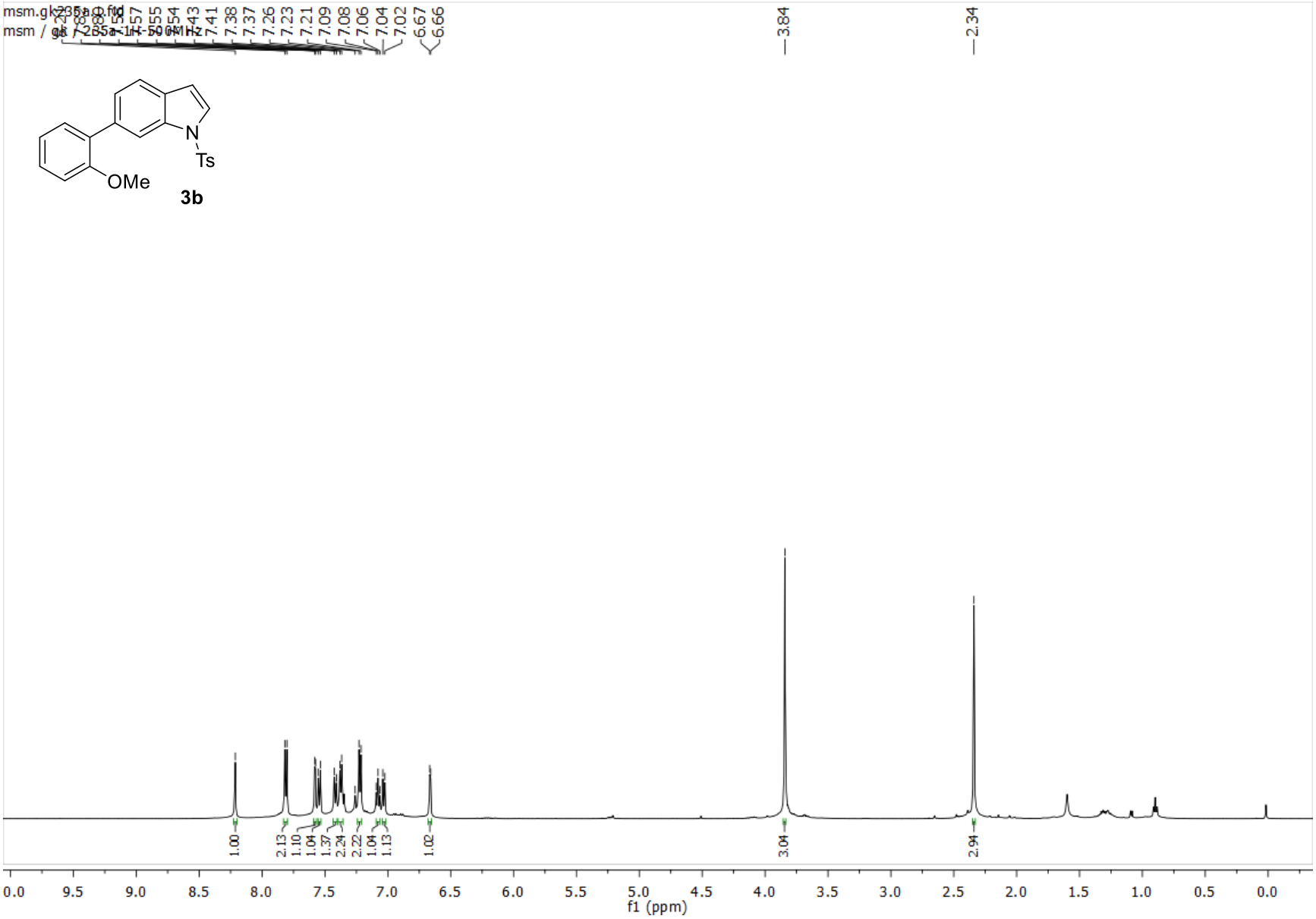
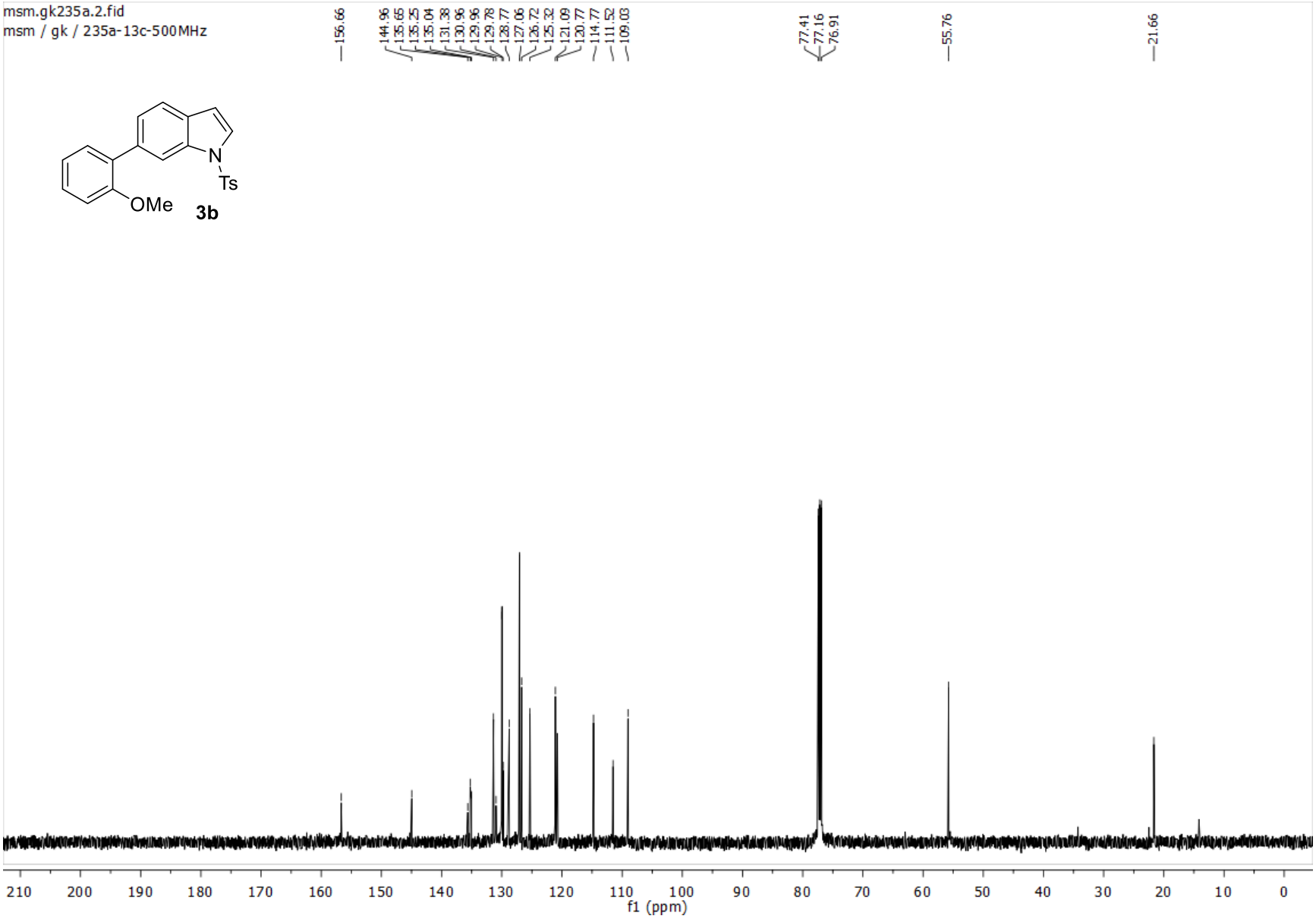
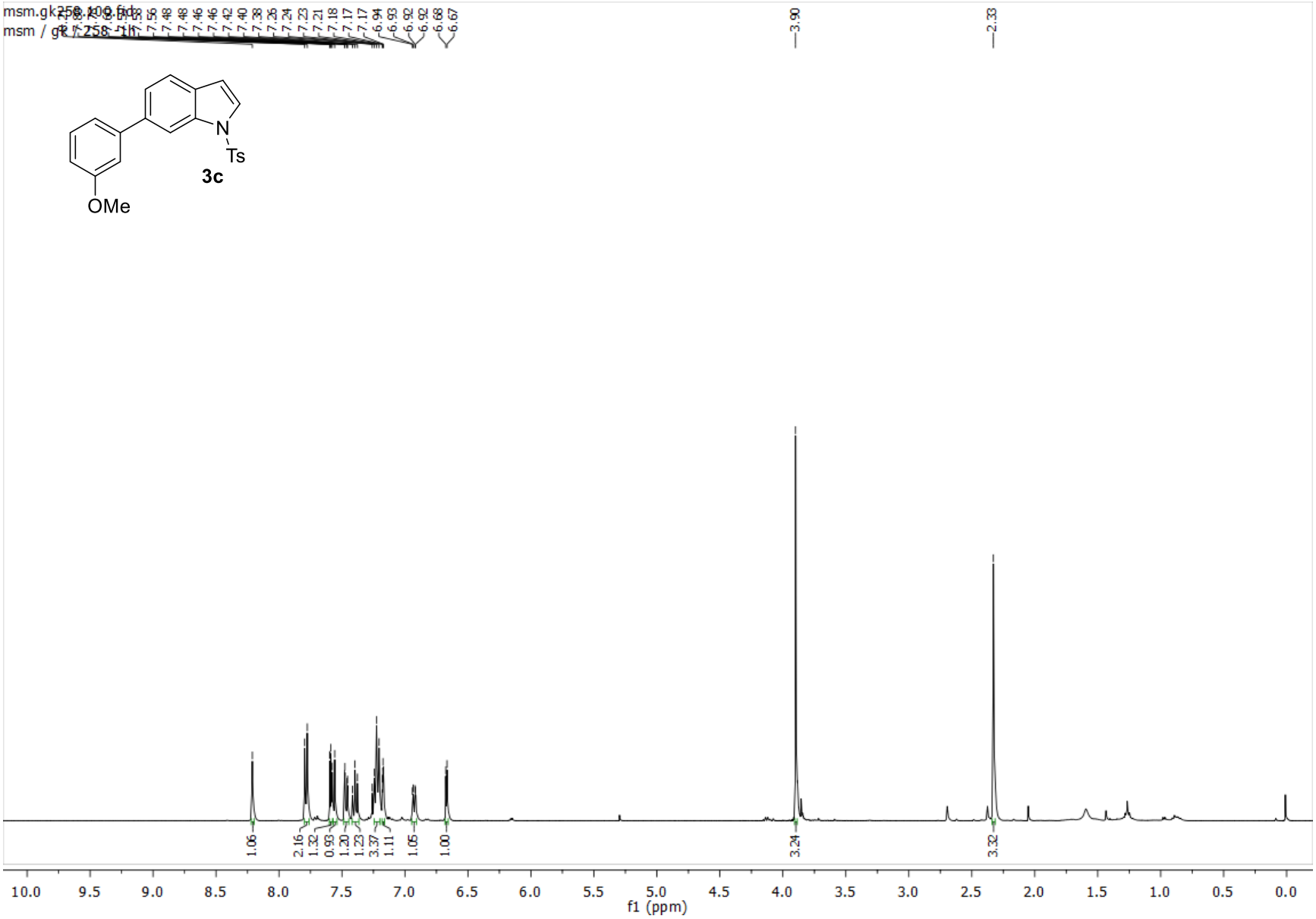
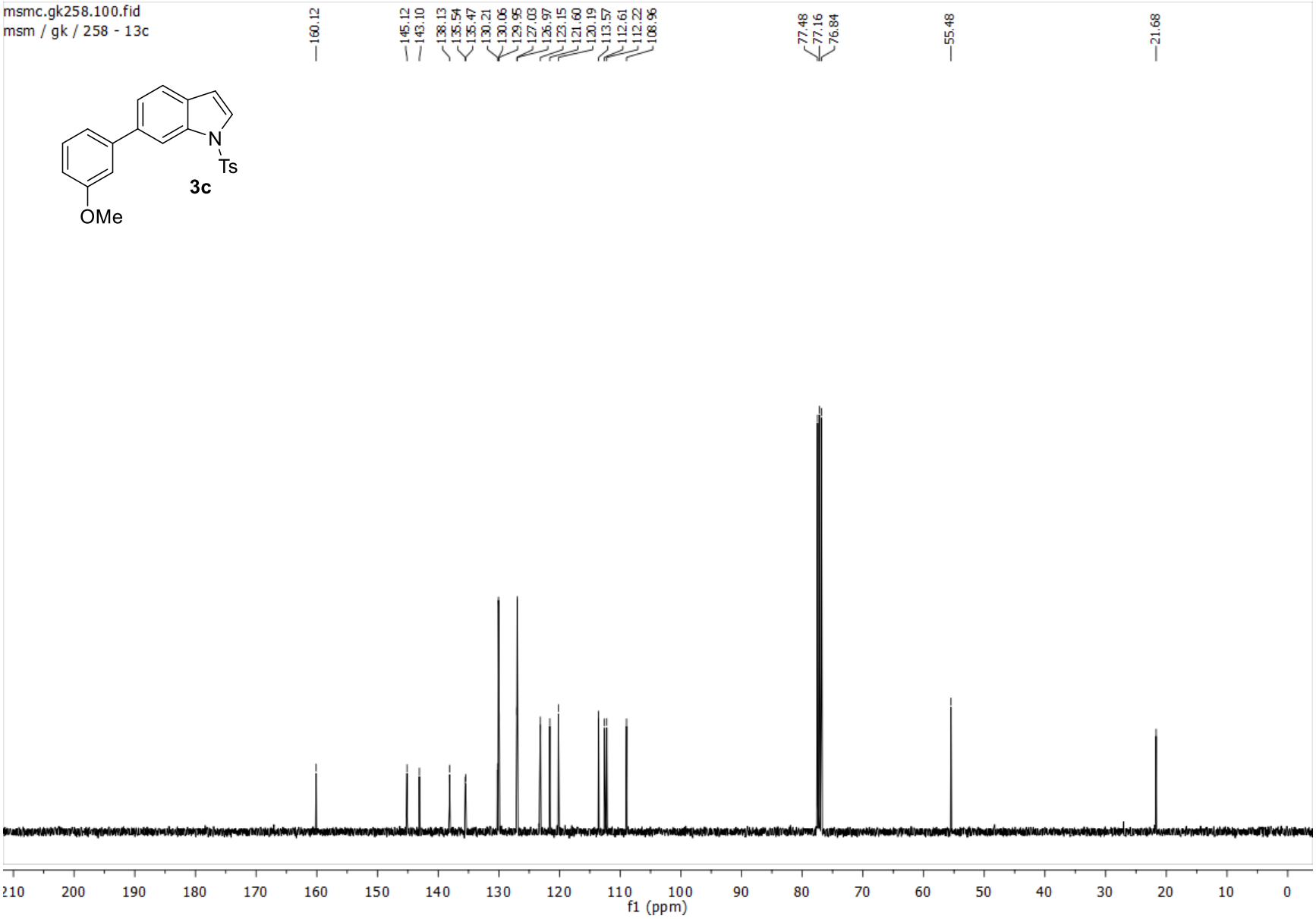
2.10
2.17
2.05
3.27
1.12
2.26
1.00
3.17
f1 (ppm)

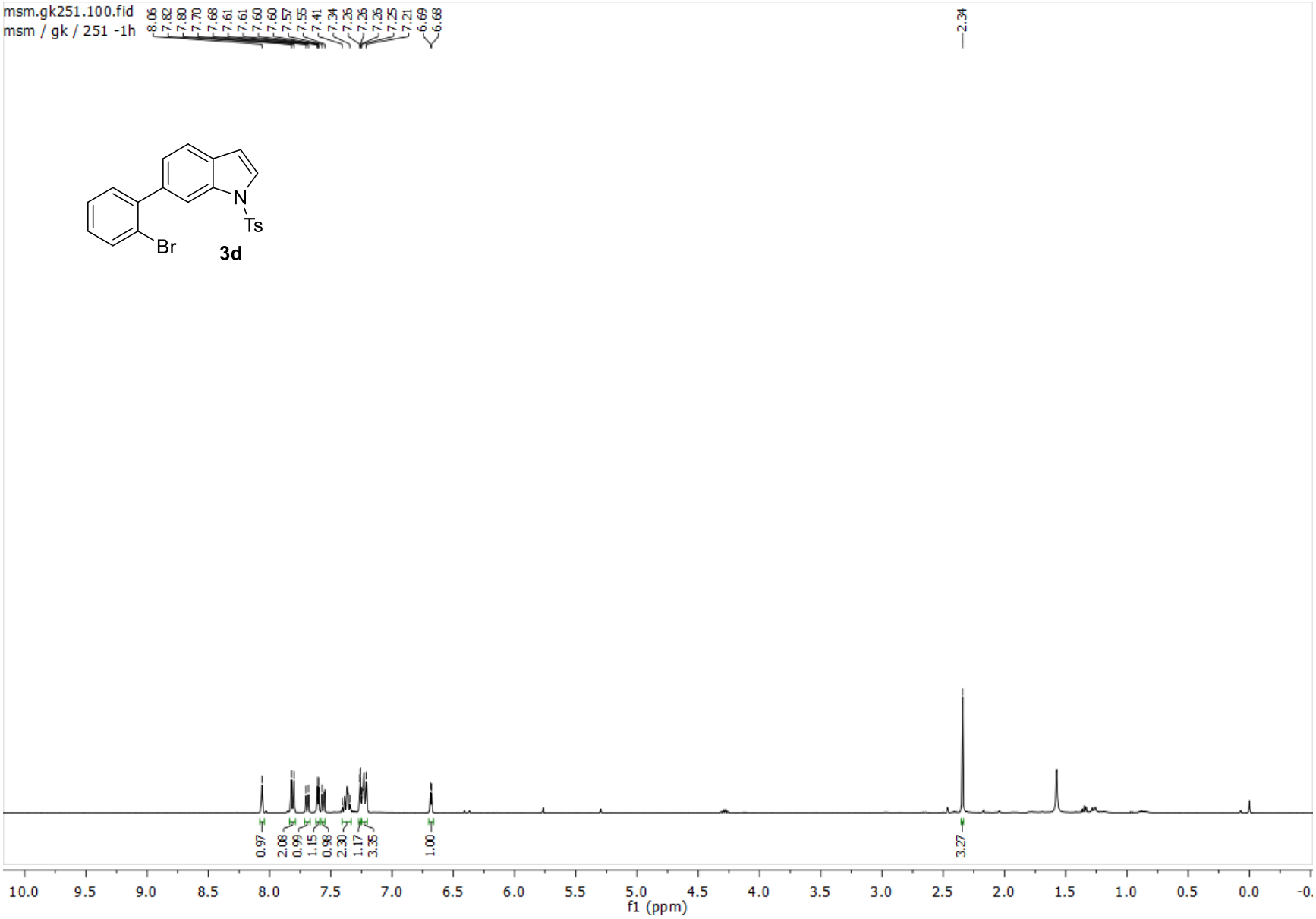

M S Maji.563.fid
msm / gk / 150a - 13c - f563- 500MHz
145.12
141.57
138.30
135.65
135.55
130.10
130.07
128.98
127.66
127.39
126.98
123.14
121.64
112.19
108.98
77.41
77.16
76.91
21.69
Ph
N
Ts
3a
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

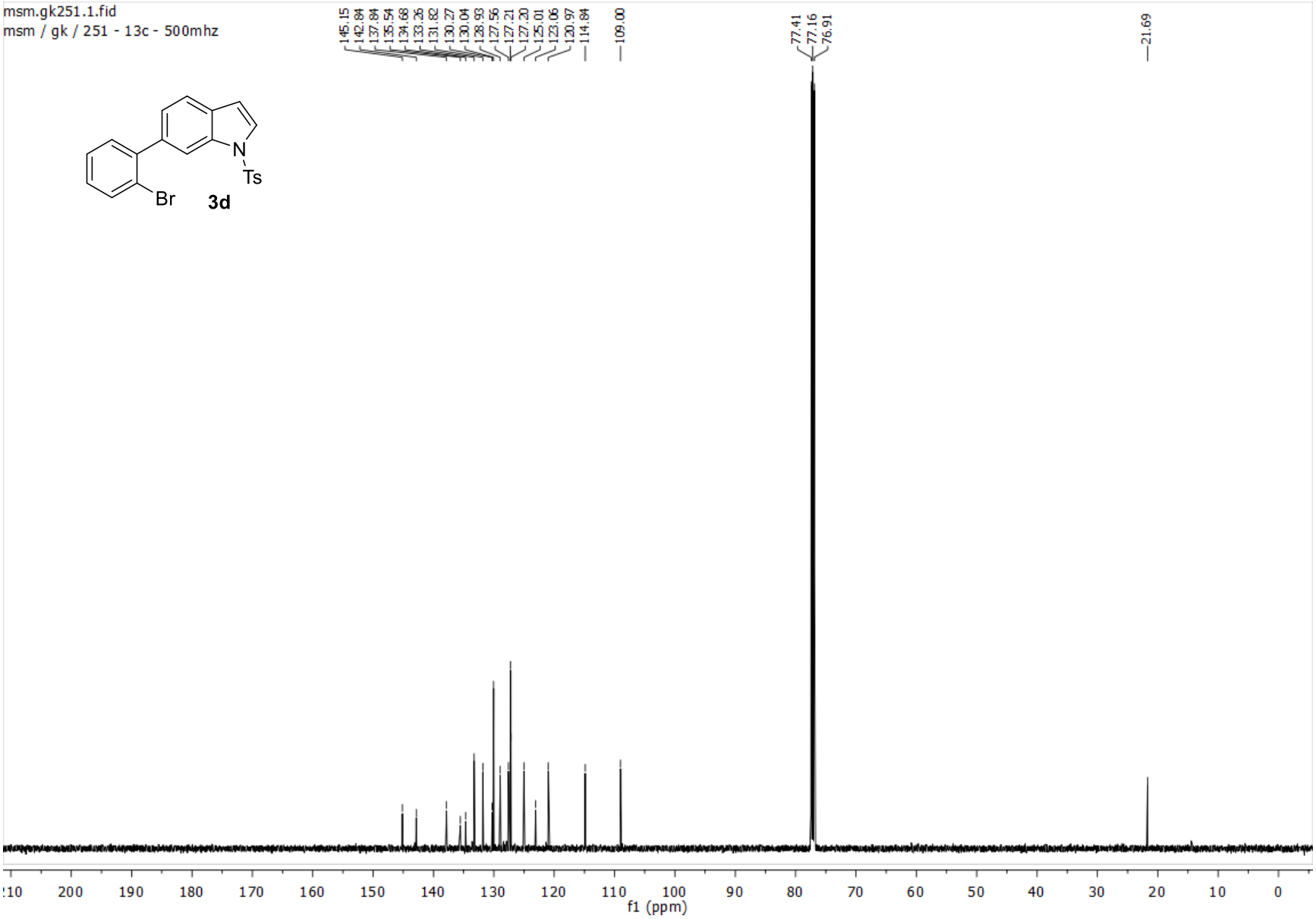

msm.gk295a-1H-500MHz
msm / gk / 295a-1H-500MHz
7.57
7.55
7.54
7.43
7.41
7.38
7.37
7.26
7.23
7.21
7.09
7.08
7.06
7.04
7.02
6.67
6.66
3.84
2.34
N
Ts
OMe
3b
1.00
2.13
1.10
1.04
1.37
2.24
2.22
1.04
1.13
1.02
3.04
2.94
0.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

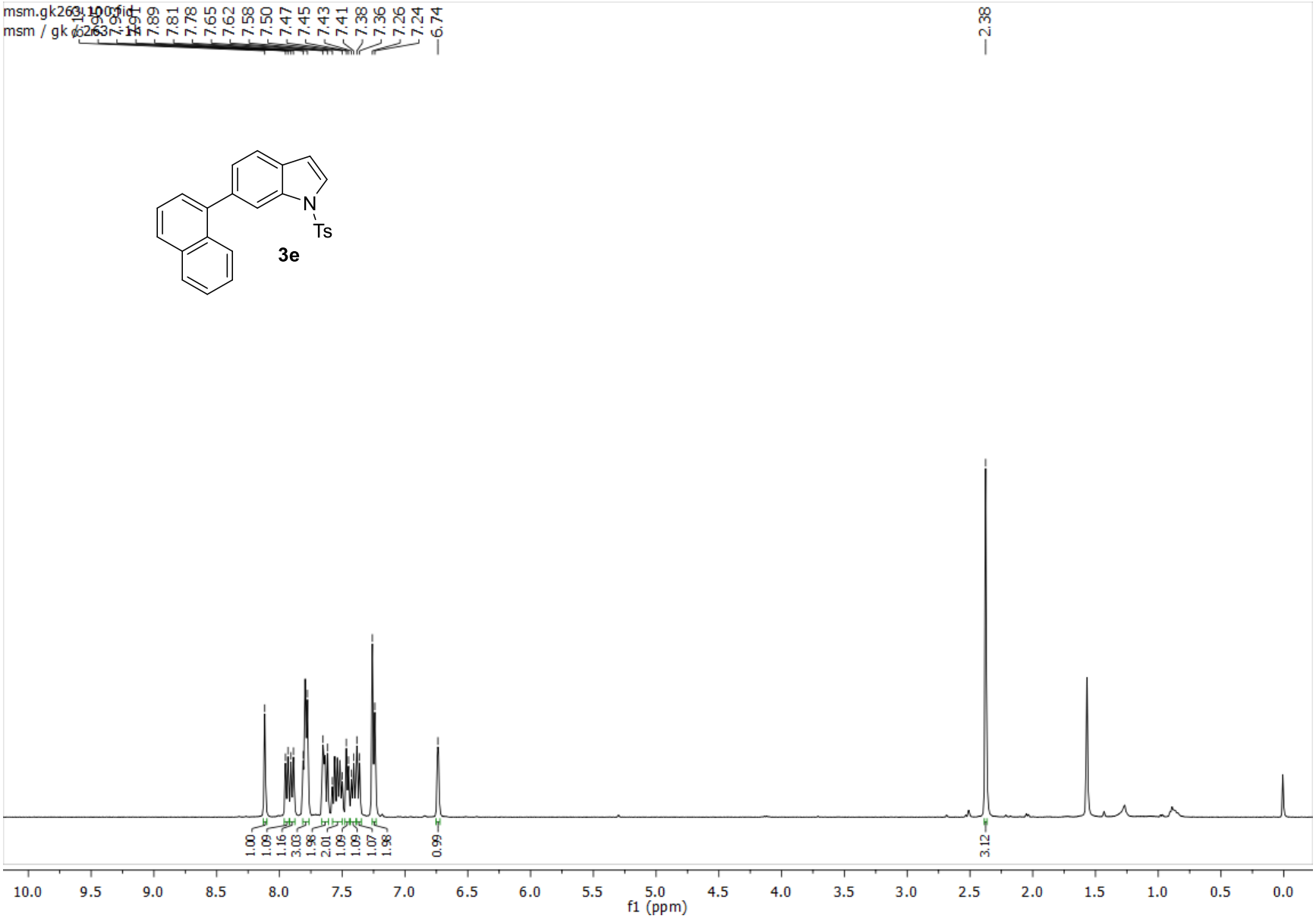

msm.gk235a.2.fid
msm / gk / 235a-13c-500MHz
156.66
144.96
135.65
135.25
135.04
131.38
130.96
129.96
129.78
128.77
127.06
126.72
125.32
121.09
120.77
114.77
111.52
109.03
77.41
77.16
76.91
55.76
21.66
N
Ts
OMe
3b
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

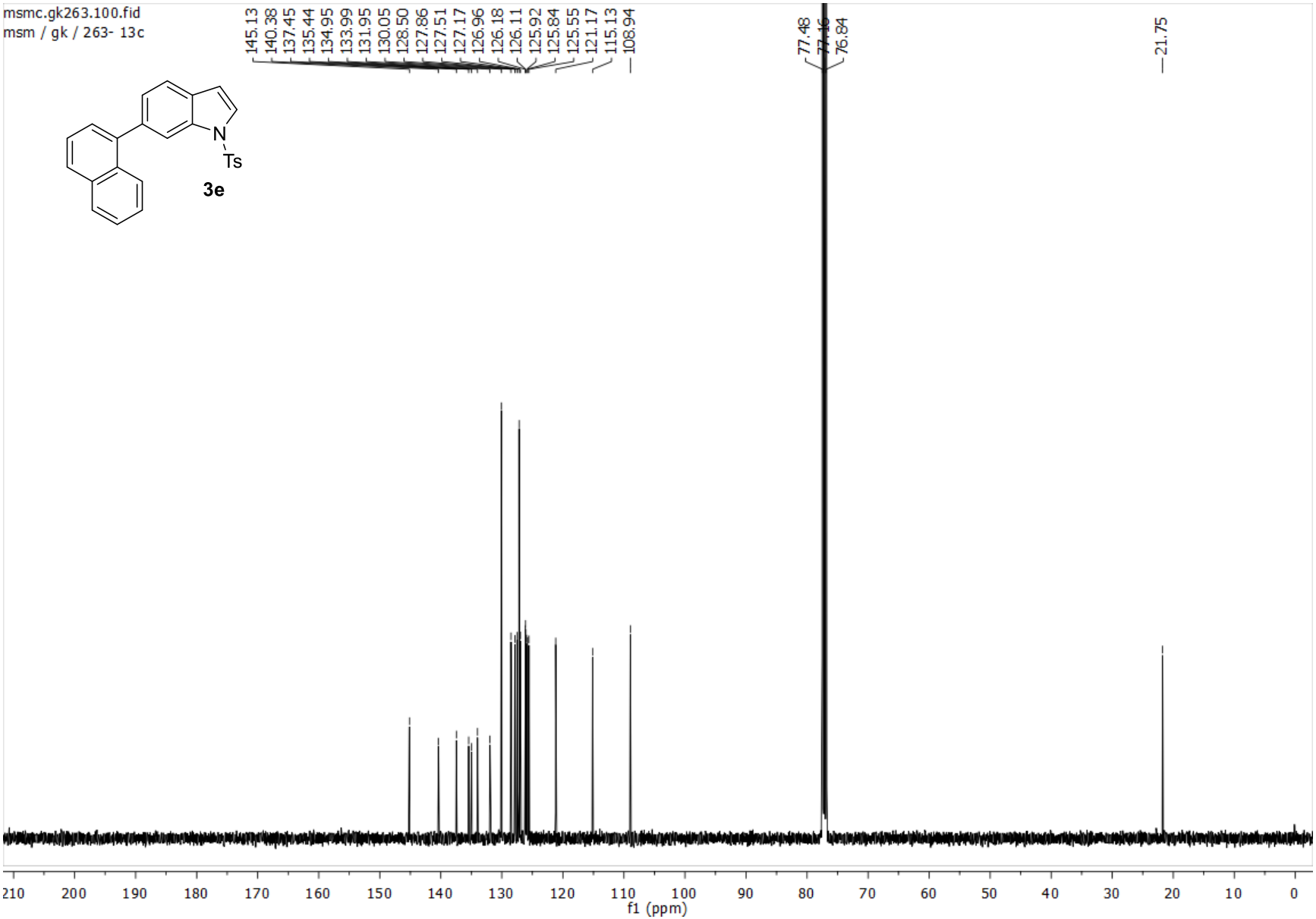

msm.gk258.10.fid
msm / gk / 258 / 1H
7.58
7.56
7.55
7.48
7.48
7.46
7.46
7.42
7.40
7.38
7.26
7.24
7.23
7.21
7.18
7.17
7.17
6.94
6.93
6.92
6.92
6.68
6.67
3.90
2.33
N
Ts
3c
OMe
1.06
2.16
1.32
0.93
1.20
1.23
3.37
1.11
1.05
1.00
3.24
3.32
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

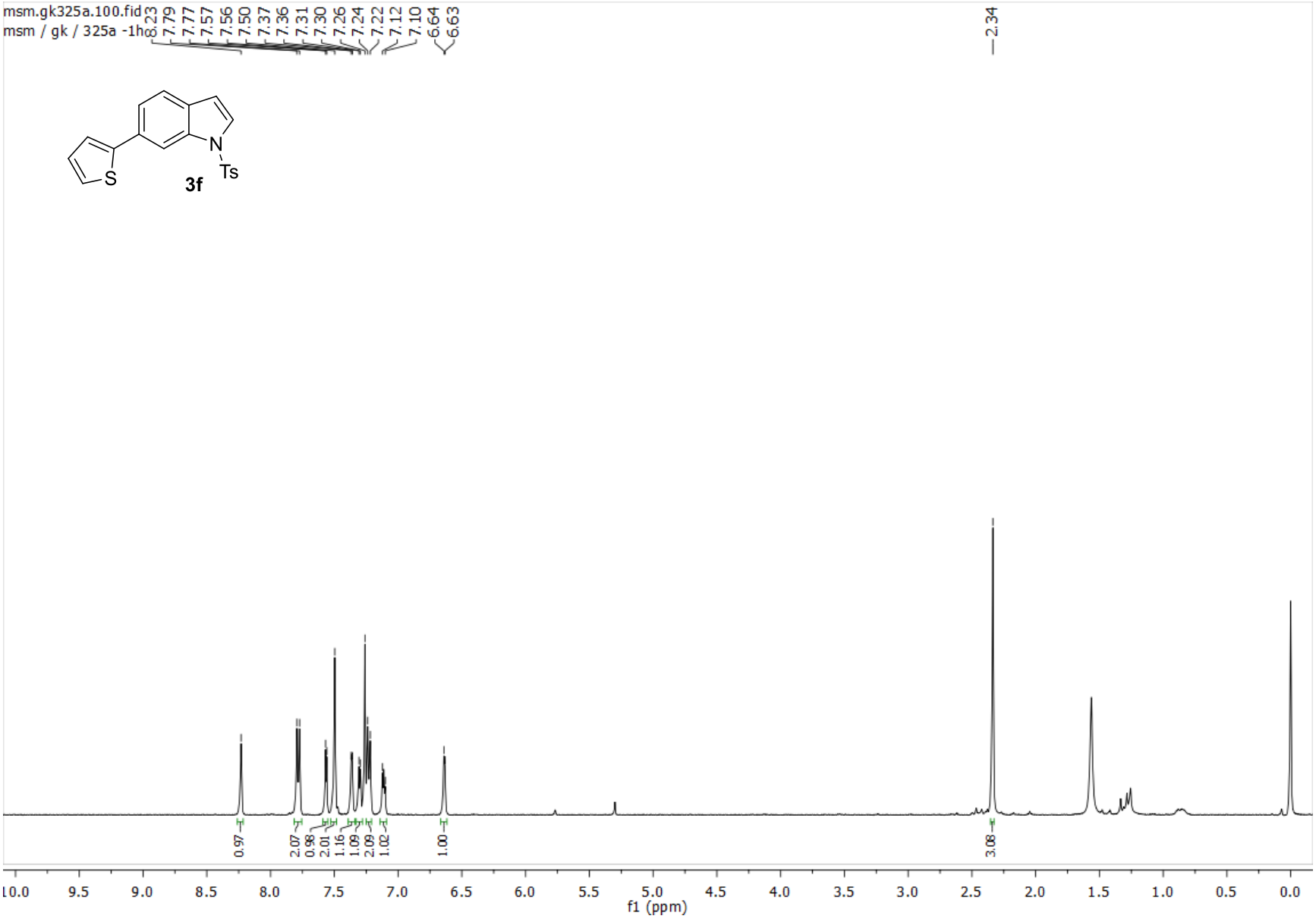

msmc.gk258.100.fid
msm / gk / 258 - 13c
160.12
145.12
143.10
138.13
135.54
135.47
130.21
130.06
129.95
127.03
126.97
123.15
121.60
120.19
113.57
112.61
112.22
108.96
77.48
77.16
76.84
55.48
21.68
N
Ts
OMe
3c
f1 (ppm)

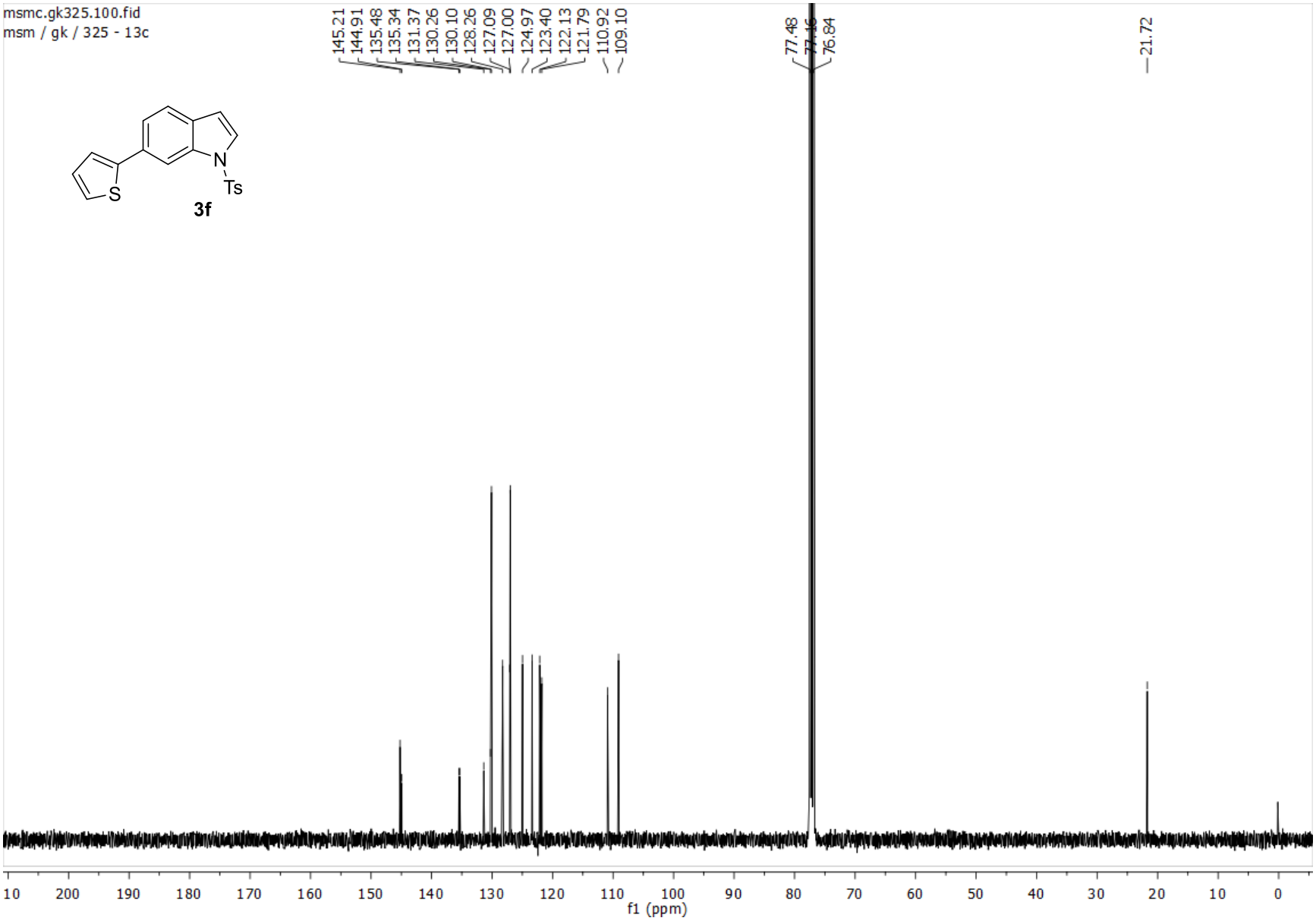

msm.gk251.100.fid
msm / gk / 251 -1h
8.06
7.82
7.80
7.70
7.68
7.61
7.61
7.60
7.60
7.57
7.55
7.41
7.34
7.26
7.26
7.26
7.25
7.21
6.69
6.68
2.34
N
Ts
Br
3d
0.97
2.08
0.99
1.15
0.98
2.30
1.17
3.35
1.00
3.27
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

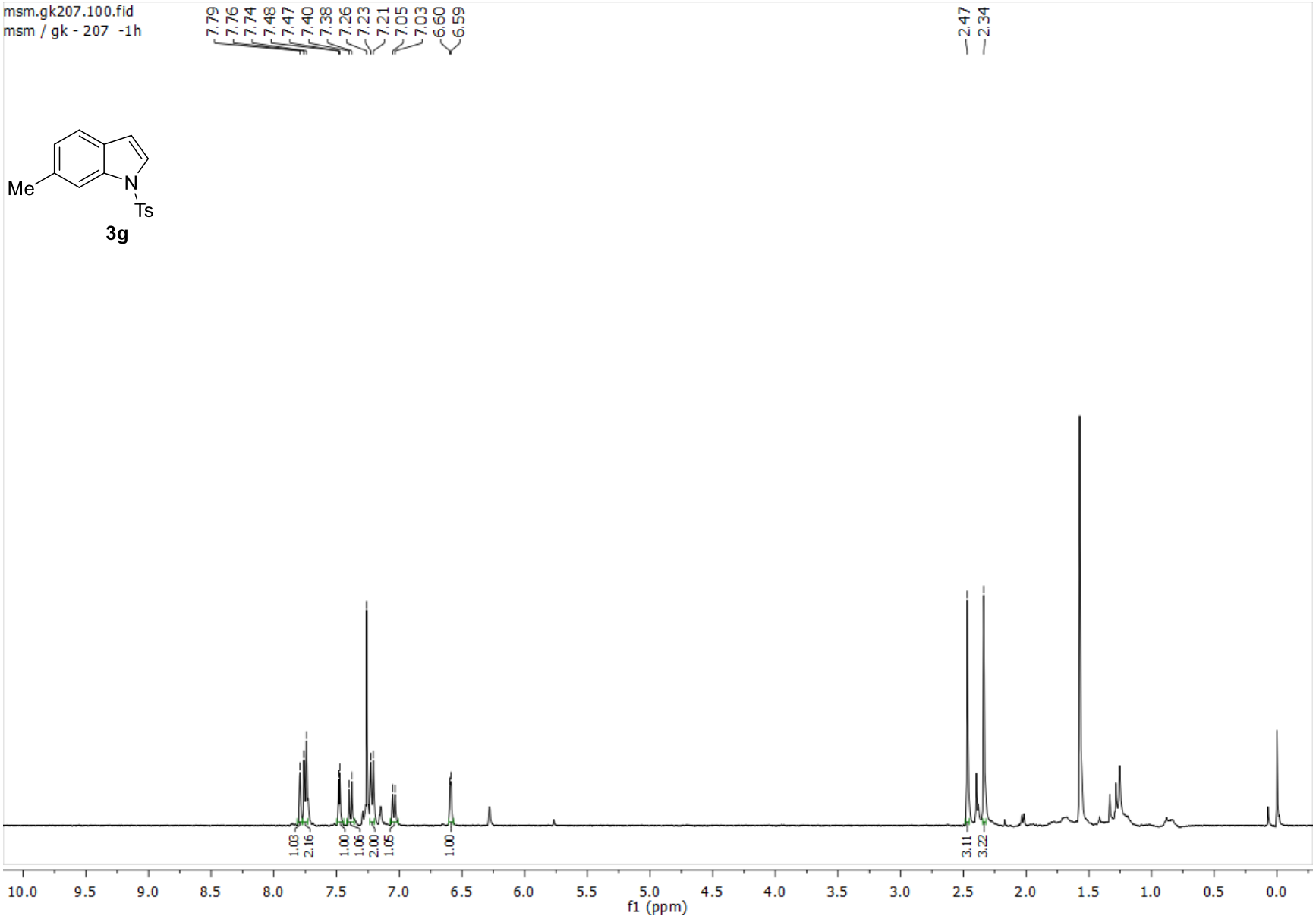

msm.gk251.1.fid
msm / gk / 251 - 13c - 500mhz
145.15
142.84
137.84
135.54
134.68
133.26
131.82
130.27
130.04
128.93
127.56
127.21
127.20
125.01
123.06
120.97
114.84
109.00
77.41
77.16
76.91
21.69
N
Ts
Br
3d
f1 (ppm)

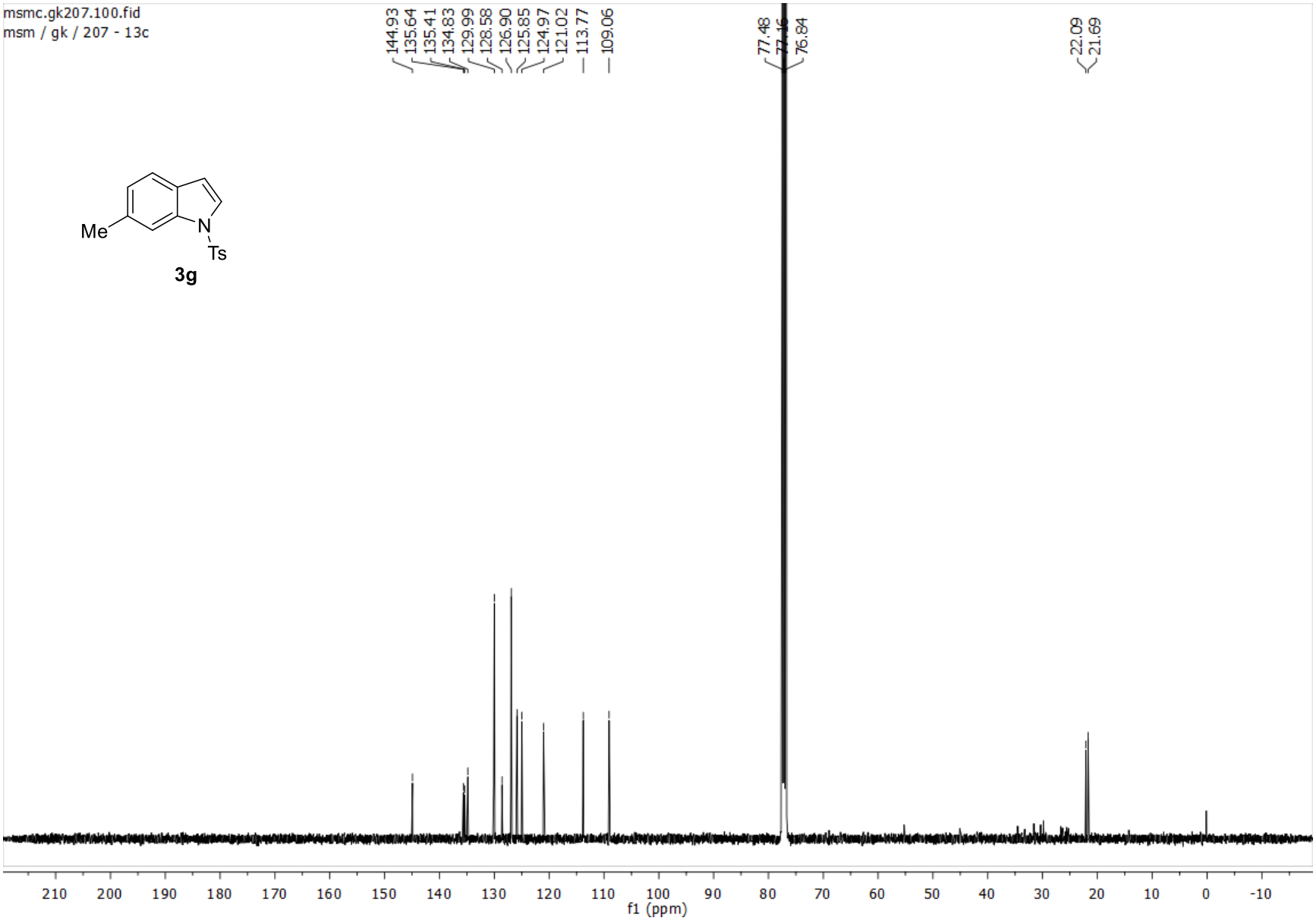

msm.gk263.1.001.fid
msm / gk 263 1 1
7.91
7.89
7.81
7.78
7.65
7.62
7.58
7.50
7.47
7.45
7.43
7.41
7.38
7.36
7.26
7.24
6.74
2.38
N
Ts
3e
1.00
1.09
1.16
3.03
1.98
2.01
1.09
1.09
1.07
1.98
0.99
3.12
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

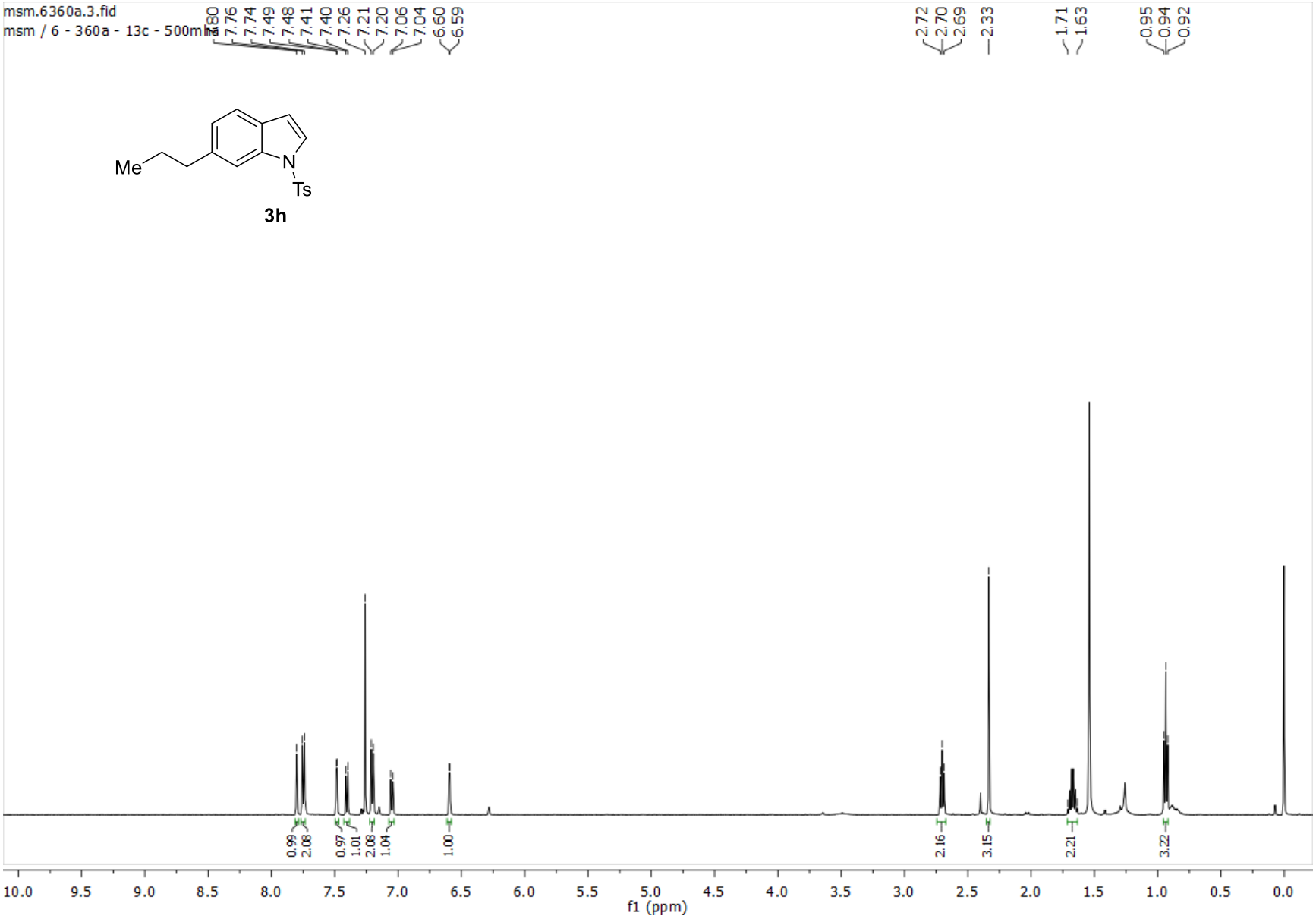

msmc.gk263.100.fid
msm / gk / 263- 13c
145.13
140.38
137.45
135.44
134.95
133.99
131.95
130.05
128.50
127.86
127.51
127.17
126.96
126.18
126.11
125.92
125.84
125.55
121.17
115.13
108.94
77.48
77.16
76.84
21.75
N
Ts
3e
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


msm.gk325a.100.fid
msm / gk / 325a -1h
8.23
7.79
7.77
7.57
7.56
7.50
7.37
7.36
7.31
7.30
7.26
7.24
7.22
7.12
7.10
6.64
6.63
2.34
N
Ts
S
3f
0.97
2.07
0.98
2.01
1.16
1.09
2.09
1.02
1.00
3.08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

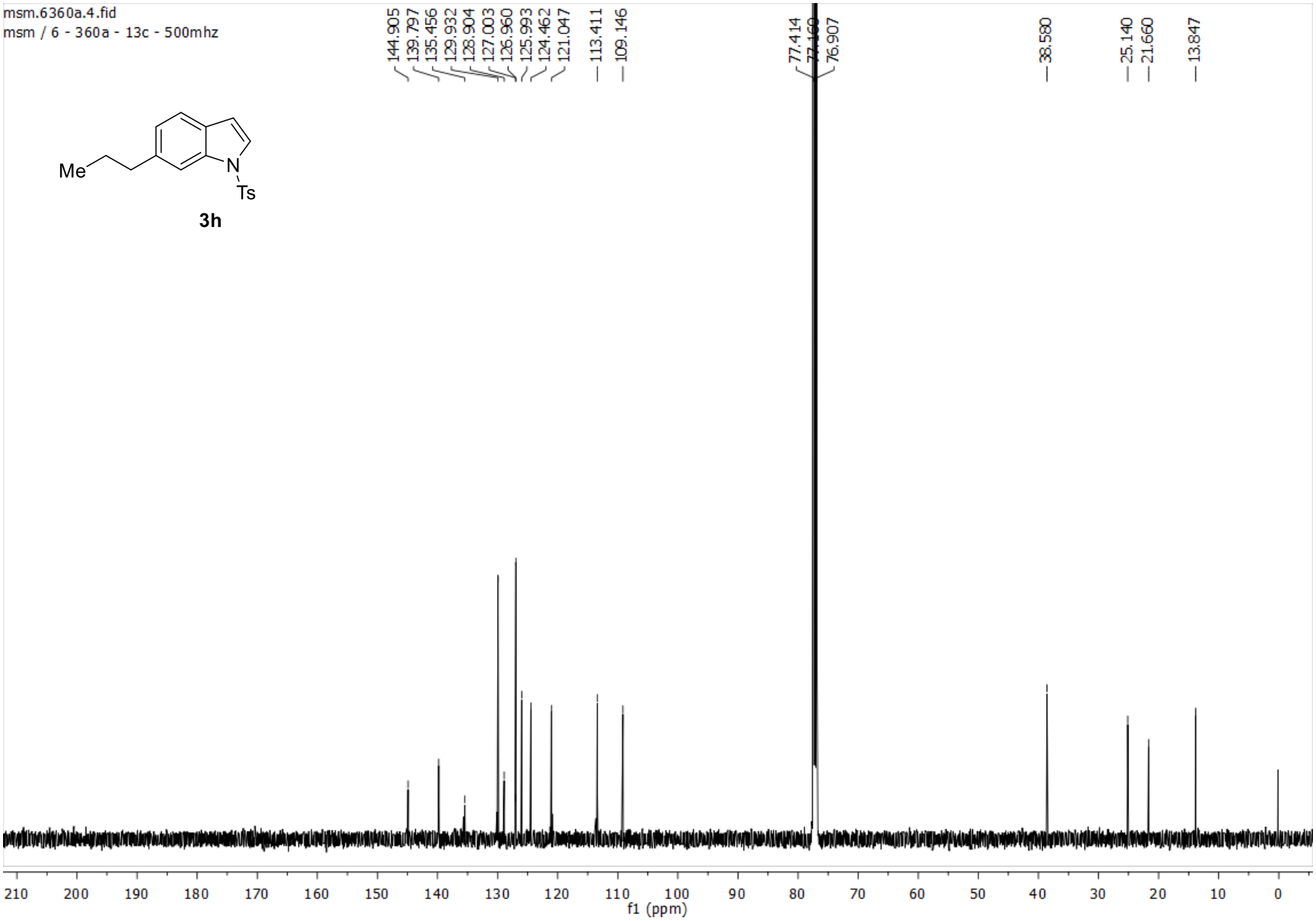

msmc.gk325.100.fid
msm / gk / 325 - 13c
145.21
144.91
135.48
135.34
131.37
130.26
130.10
128.26
127.09
127.00
124.97
123.40
122.13
121.79
110.92
109.10
77.48
77.16
76.84
21.72
N
Ts
S
3f
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

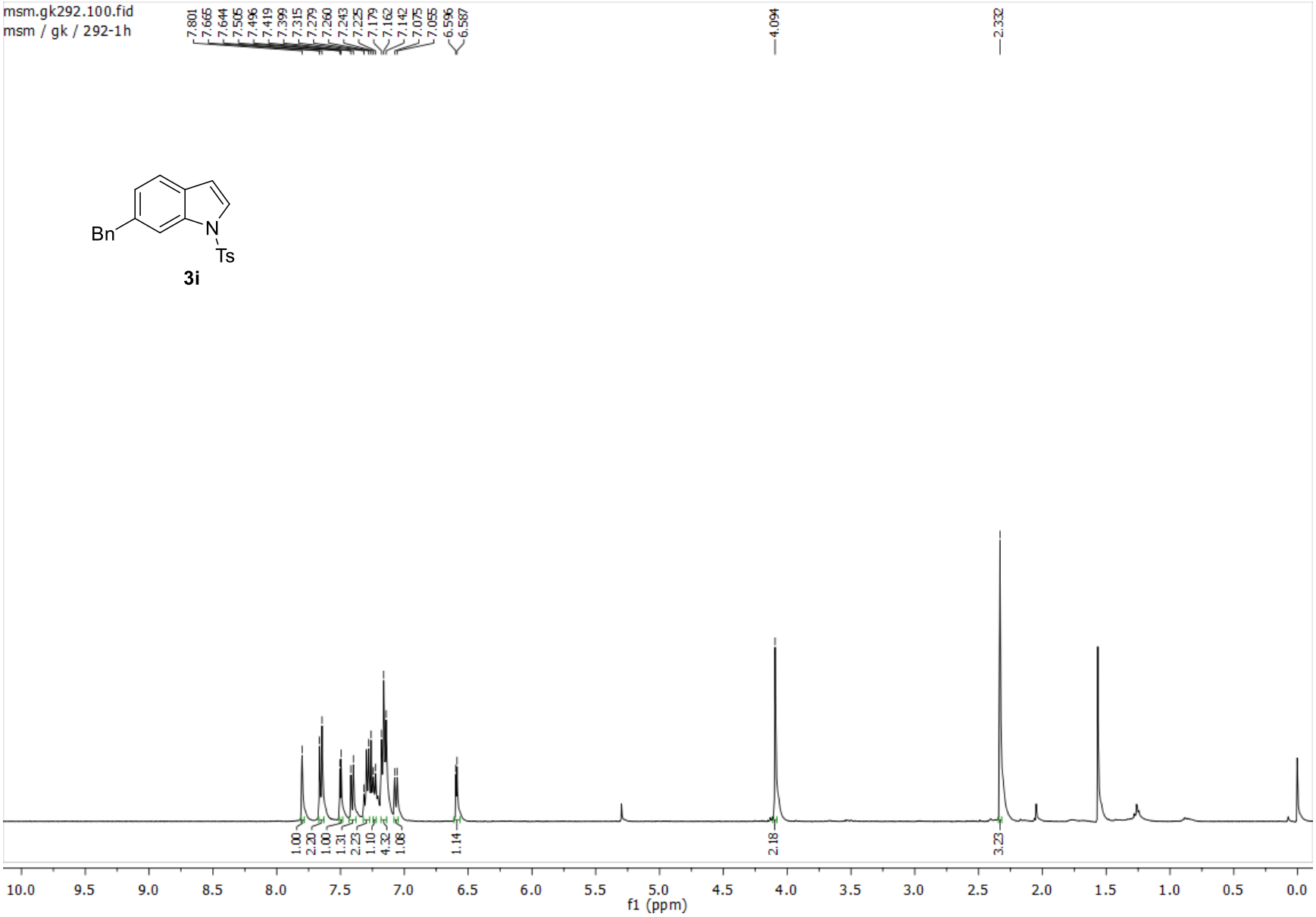

msm.gk207.100.fid
msm / gk - 207 -1h
7.79
7.76
7.74
7.48
7.47
7.40
7.38
7.26
7.23
7.21
7.05
7.03
6.60
6.59
2.47
2.34
Me
N
Ts
3g
1.03
2.16
1.00
1.06
2.00
1.05
1.00
3.11
3.22
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

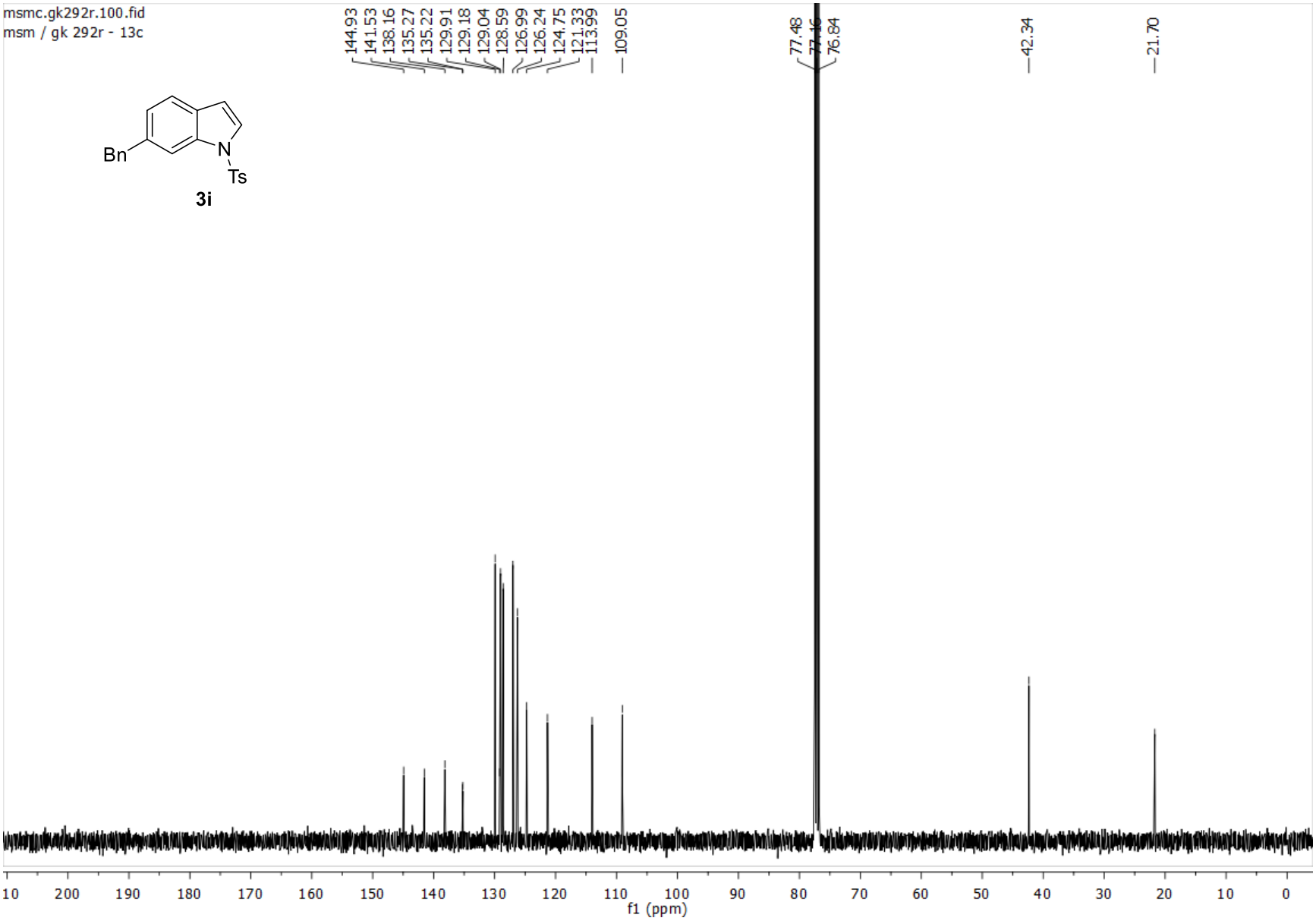

msmc.gk207.100.fid
msm / gk / 207 - 13c
144.93
135.64
135.41
134.83
129.99
128.58
126.90
125.85
124.97
121.02
113.77
109.06
77.48
77.16
76.84
22.09
21.69
Me
N
Ts
3g
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

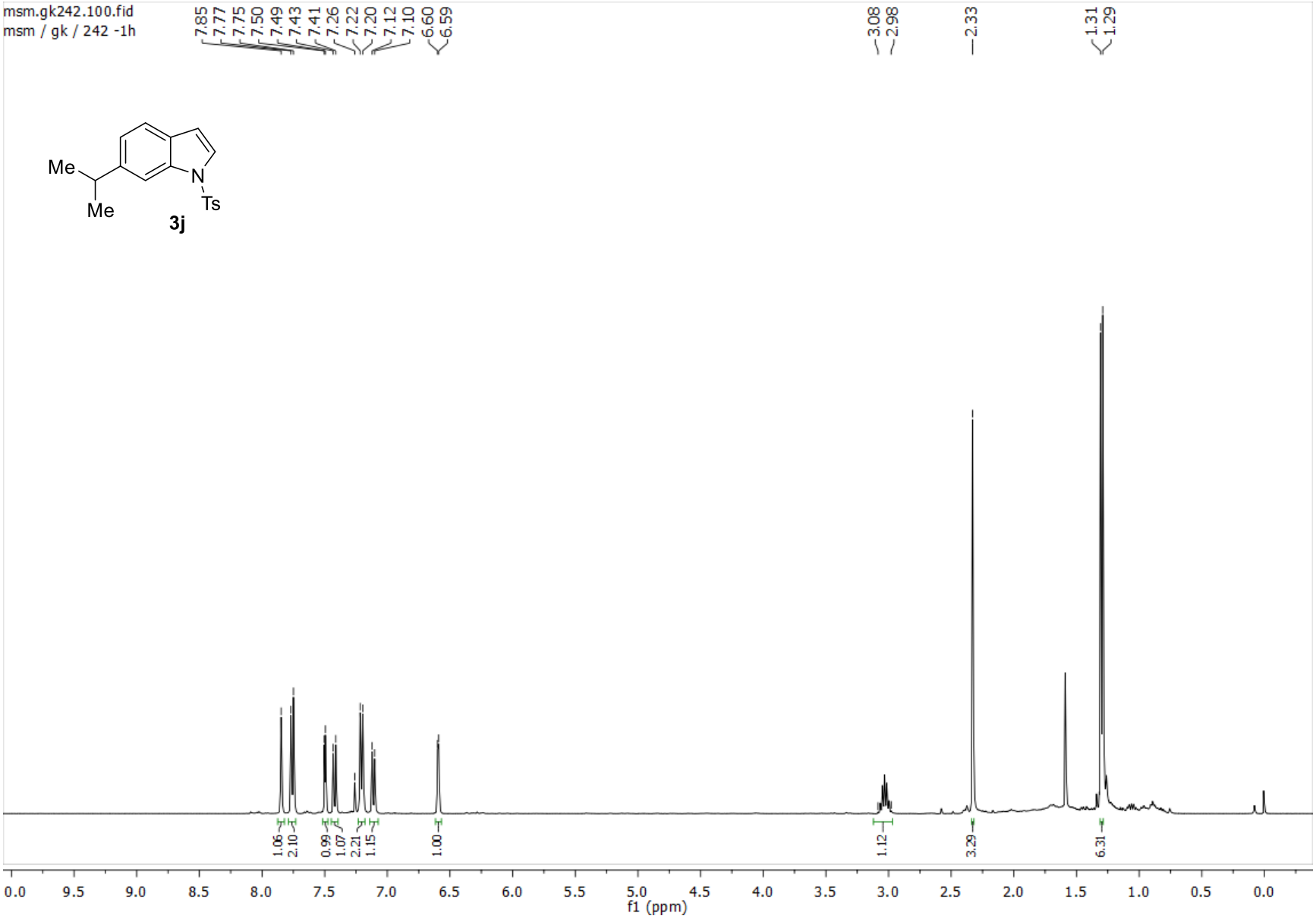

msm.6360a.3.fid
msm / 6 - 360a - 13c - 500mhz
7.80
7.76
7.74
7.49
7.48
7.41
7.40
7.26
7.21
7.20
7.06
7.04
6.60
6.59
2.72
2.70
2.69
2.33
1.71
1.63
0.95
0.94
0.92
Me
N
Ts
0.99
2.08
0.97
1.01
2.08
1.04
1.00
2.16
3.15
2.21
3.22
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

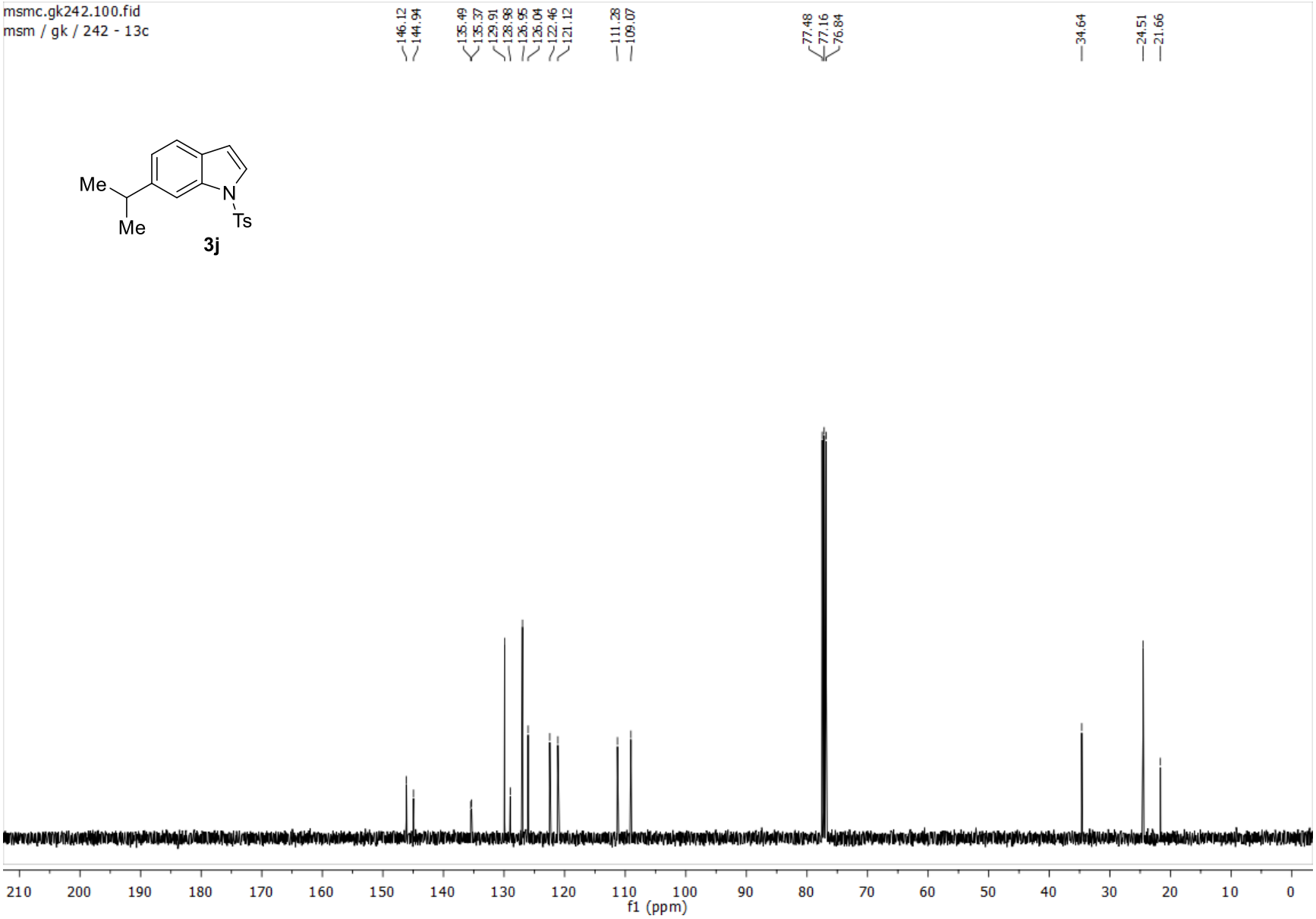
3h

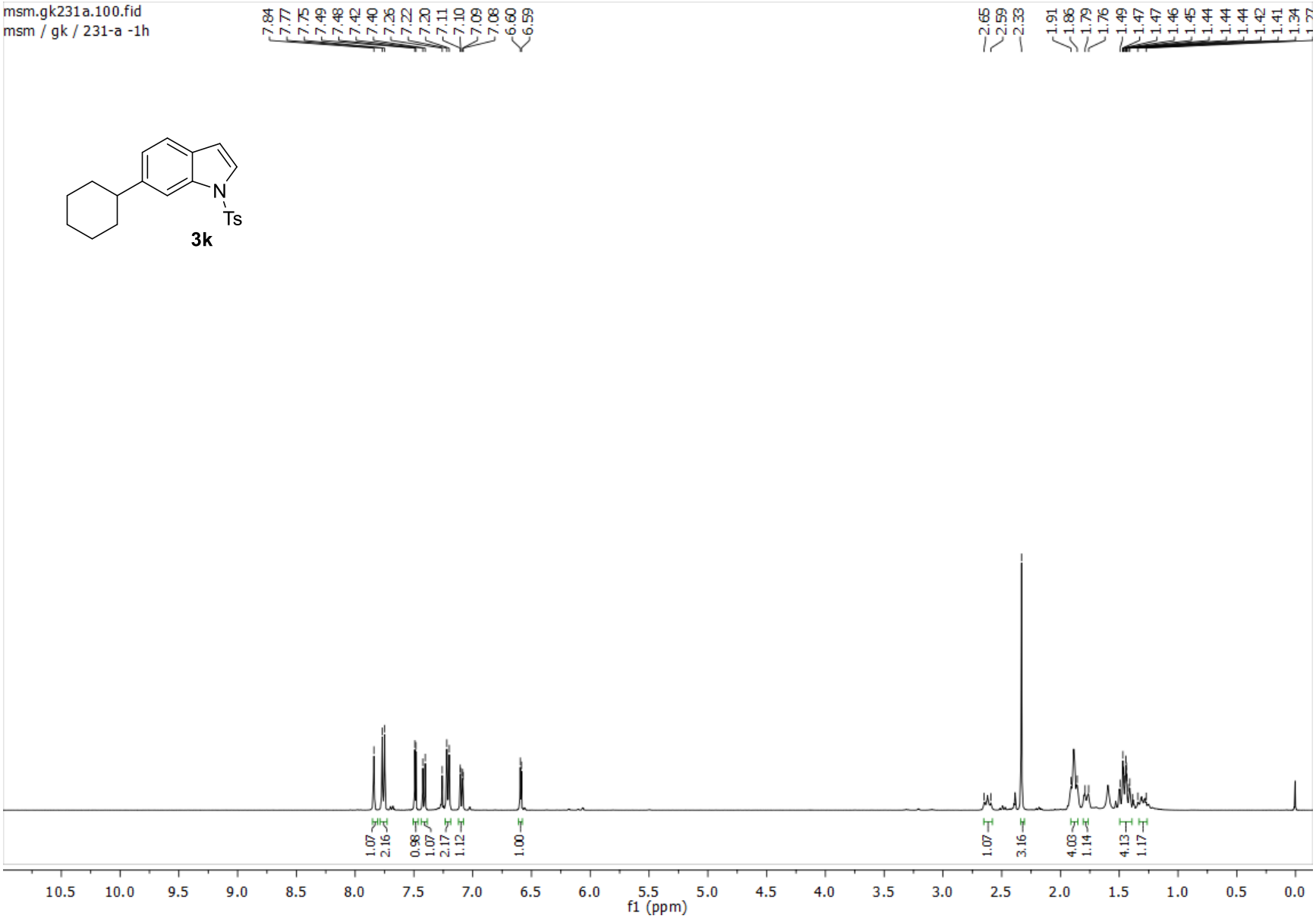

msm.6360a.4.fid
msm / 6 - 360a - 13c - 500mhz
144.905
139.797
135.456
129.932
128.904
127.003
126.960
125.993
124.462
121.047
113.411
109.146
77.414
76.907
38.580
25.140
21.660
13.847
Me
N
Ts
3h
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

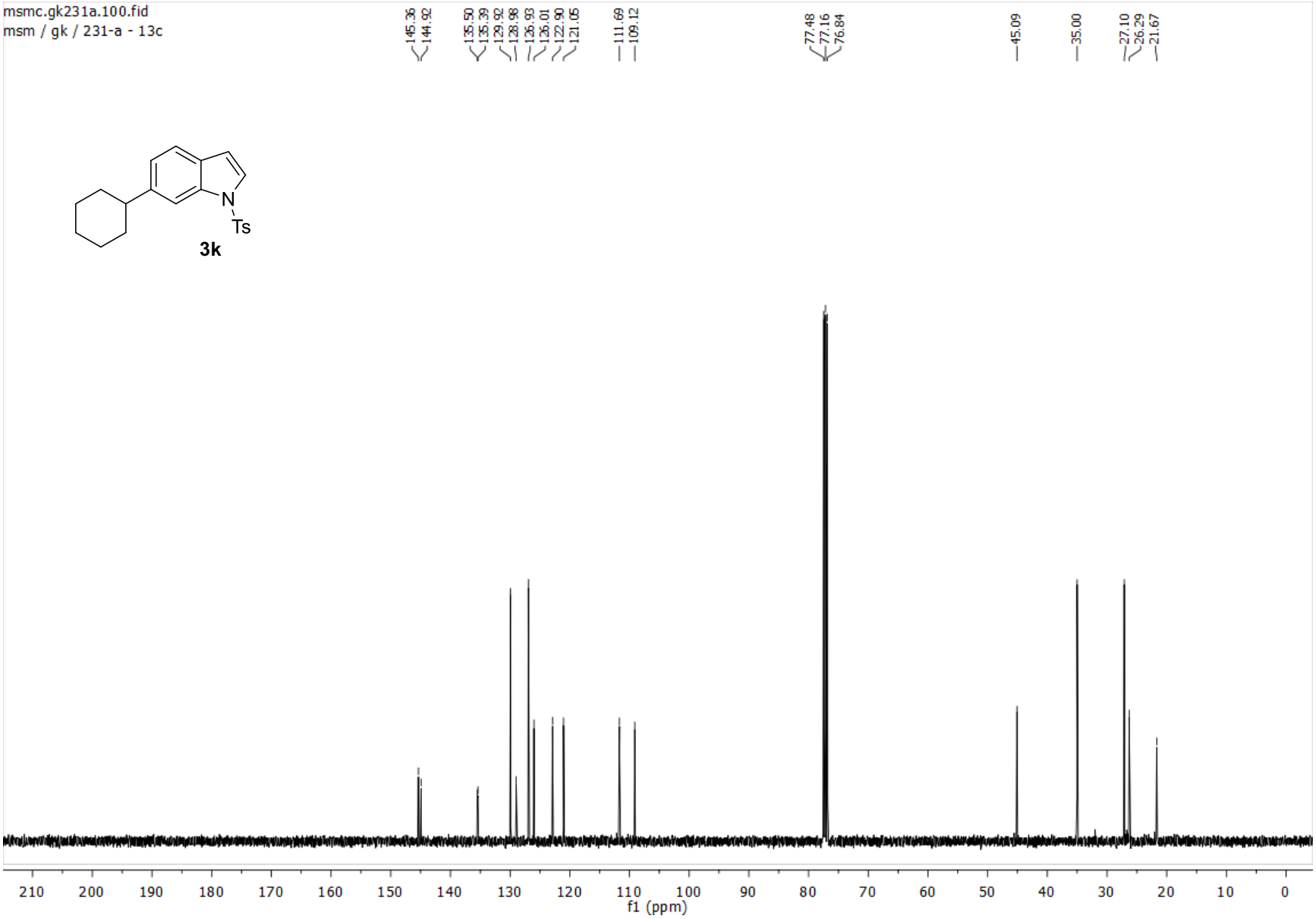

msm.gk292.100.fid
msm / gk / 292-1h
7.801
7.665
7.644
7.505
7.496
7.419
7.399
7.315
7.279
7.260
7.243
7.225
7.179
7.162
7.142
7.075
7.055
6.596
6.587
4.094
2.332
Bn
N
Ts
3i
1.00
2.20
1.00
1.31
2.23
1.10
4.32
1.08
1.14
2.18
3.23
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

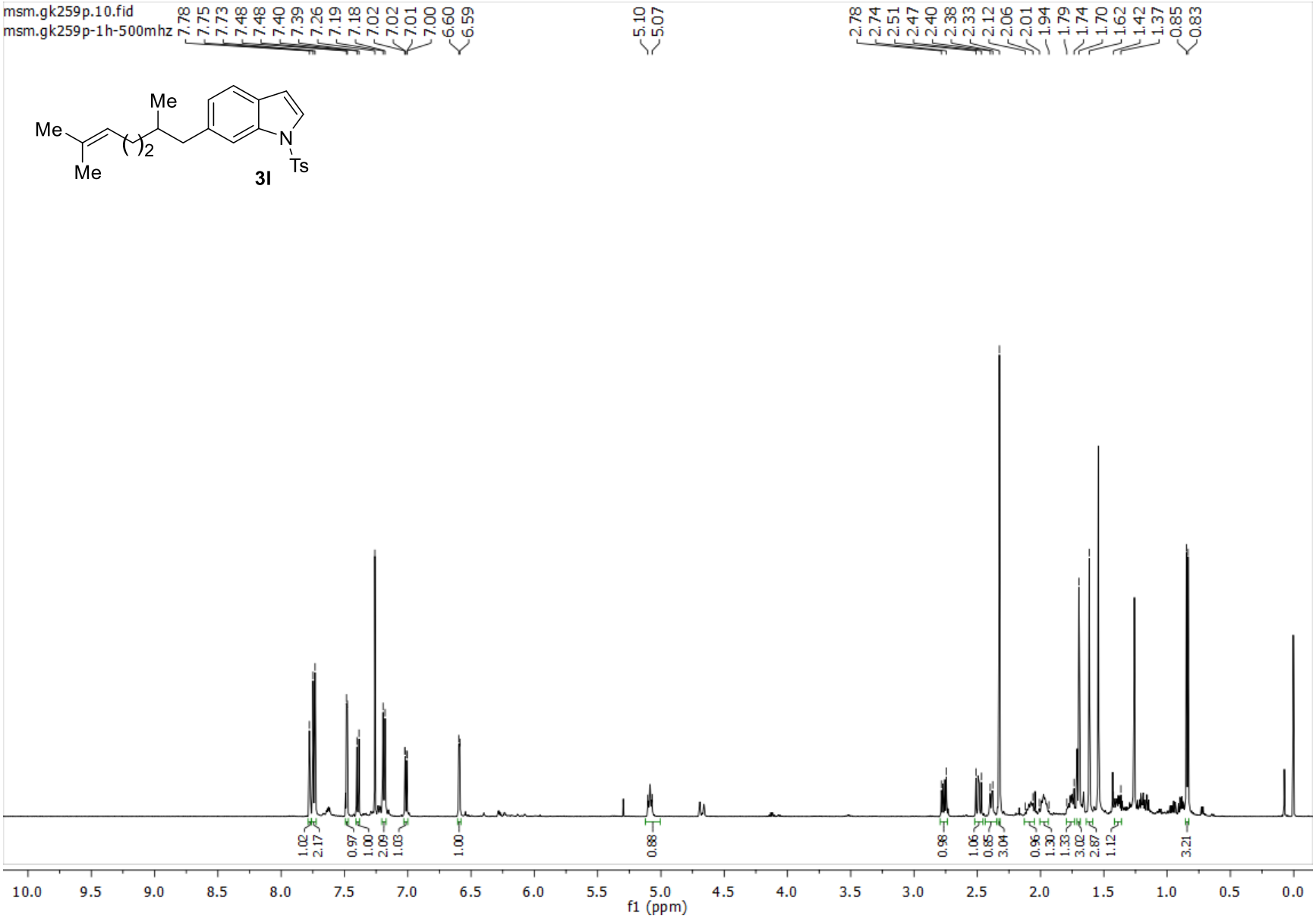

msmc.gk292r.100.fid
msm / gk 292r - 13c
144.93
141.53
138.16
135.27
135.22
129.91
129.18
129.04
128.59
126.99
126.24
124.75
121.33
113.99
109.05
77.48
77.16
76.84
42.34
21.70
Bn
N
Ts
3i
f1 (ppm)

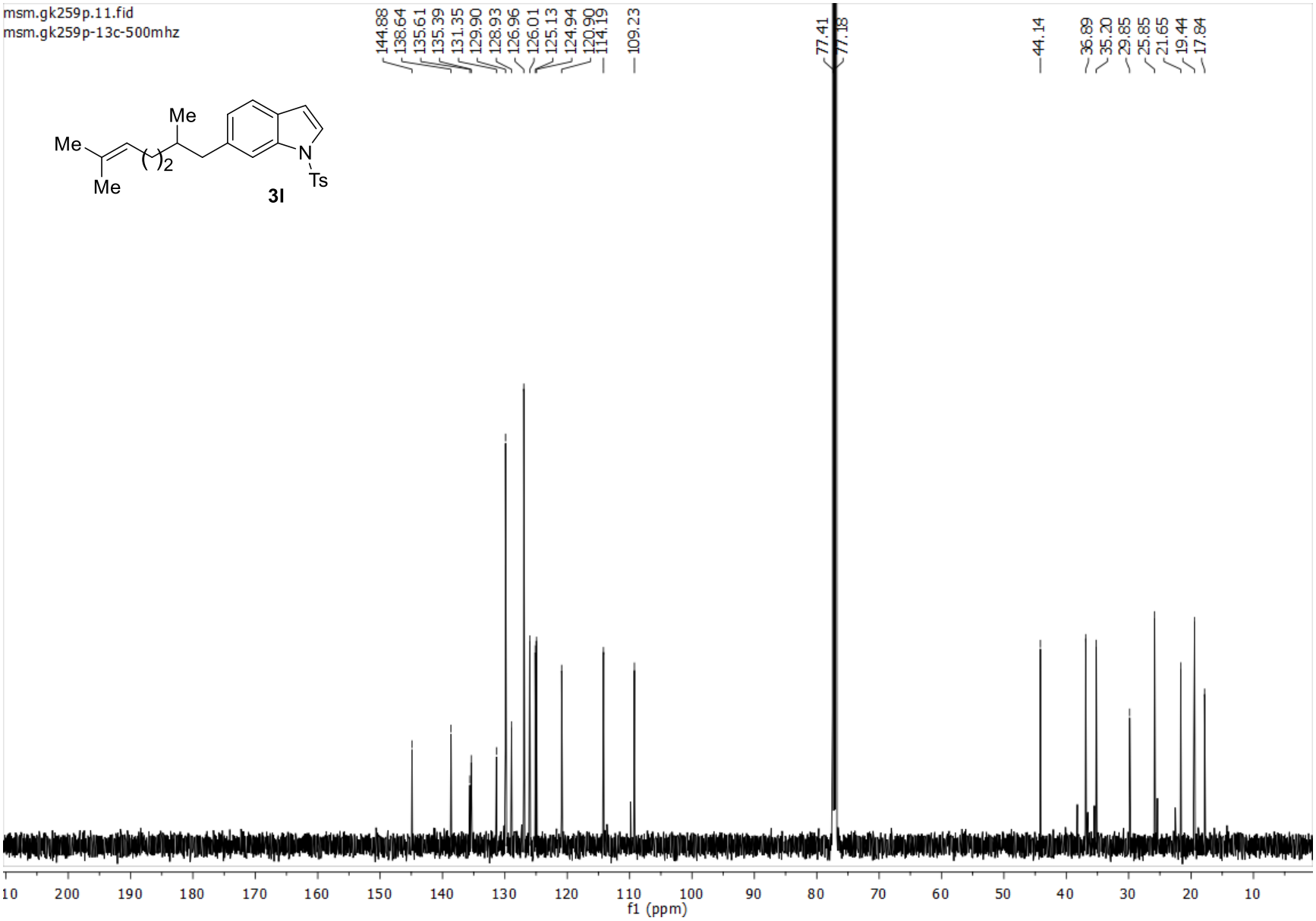

msm.gk242.100.fid
msm / gk / 242 -1h
7.85
7.77
7.75
7.50
7.49
7.43
7.41
7.26
7.22
7.20
7.12
7.10
6.60
6.59
3.08
2.98
2.33
1.31
1.29
Me
Me
N
Ts
3j
1.06
2.10
0.99
1.07
2.21
1.15
1.00
1.12
3.29
6.31
0.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

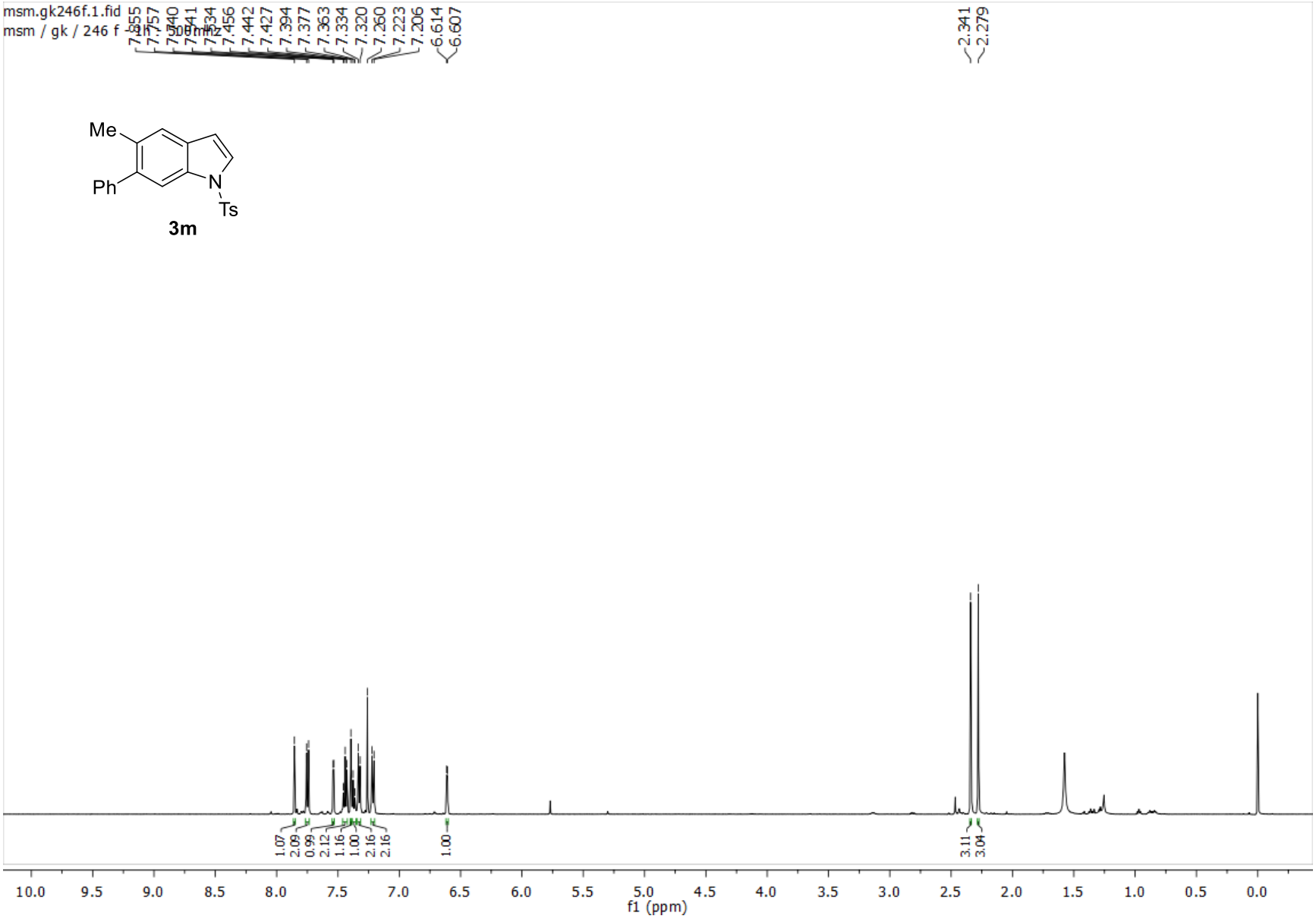

msmc.gk242.100.fid
msm / gk / 242 - 13c
146.12
144.94
135.49
135.37
129.91
128.98
126.95
126.04
122.46
121.12
111.28
109.07
77.48
77.16
76.84
34.64
24.51
21.66
Me
Me
N
Ts
3j
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

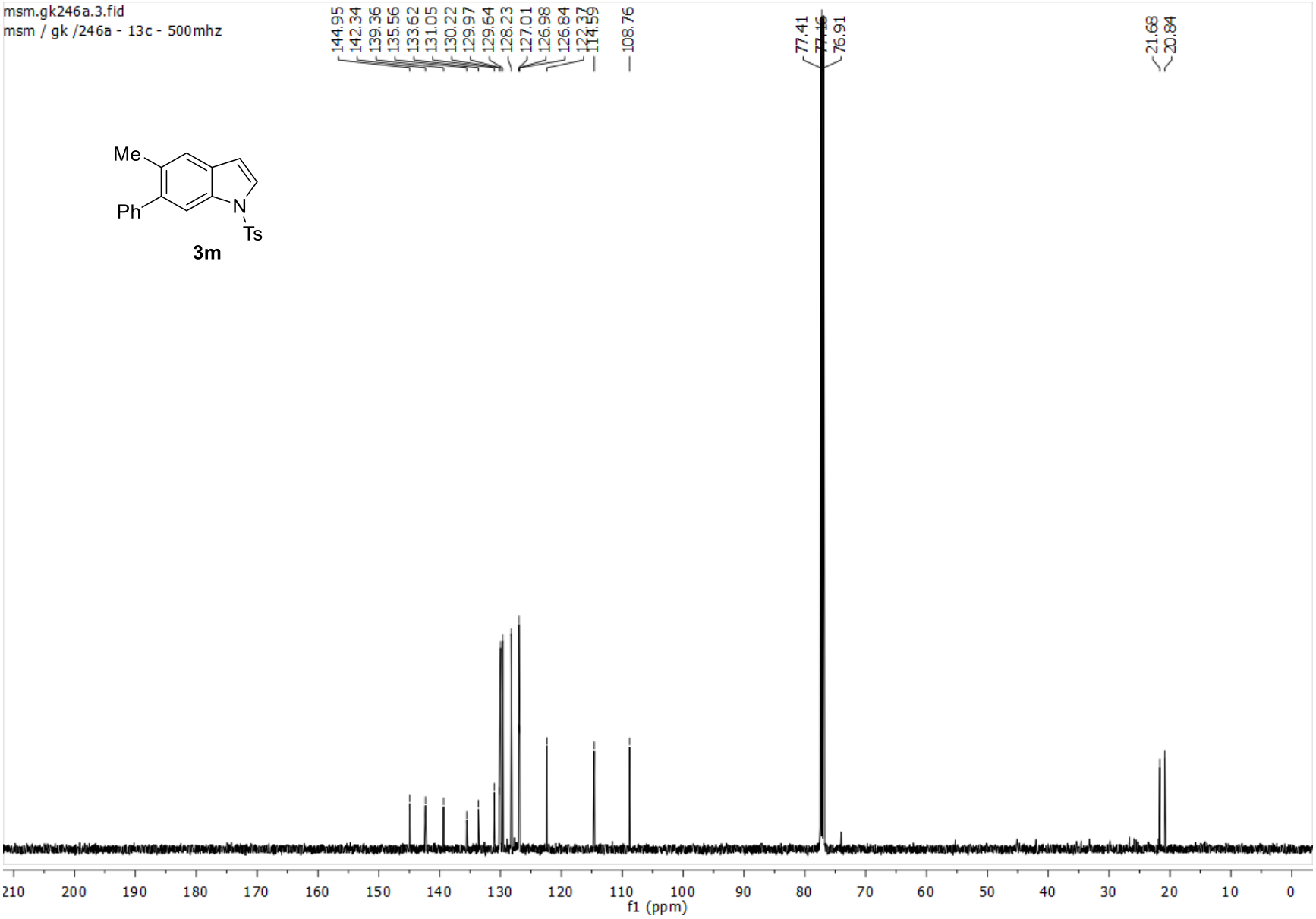

msm.gk231a.100.fid
msm / gk / 231-a -1h
7.84
7.77
7.75
7.49
7.48
7.42
7.40
7.26
7.22
7.20
7.11
7.10
7.09
7.08
6.60
6.59
2.65
2.59
2.33
1.91
1.86
1.79
1.76
1.49
1.47
1.47
1.46
1.45
1.44
1.44
1.44
1.42
1.41
1.34
N
Ts
3k
1.07
2.16
0.98
1.07
2.17
1.12
1.00
1.07
3.16
4.03
1.14
4.13
1.17
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

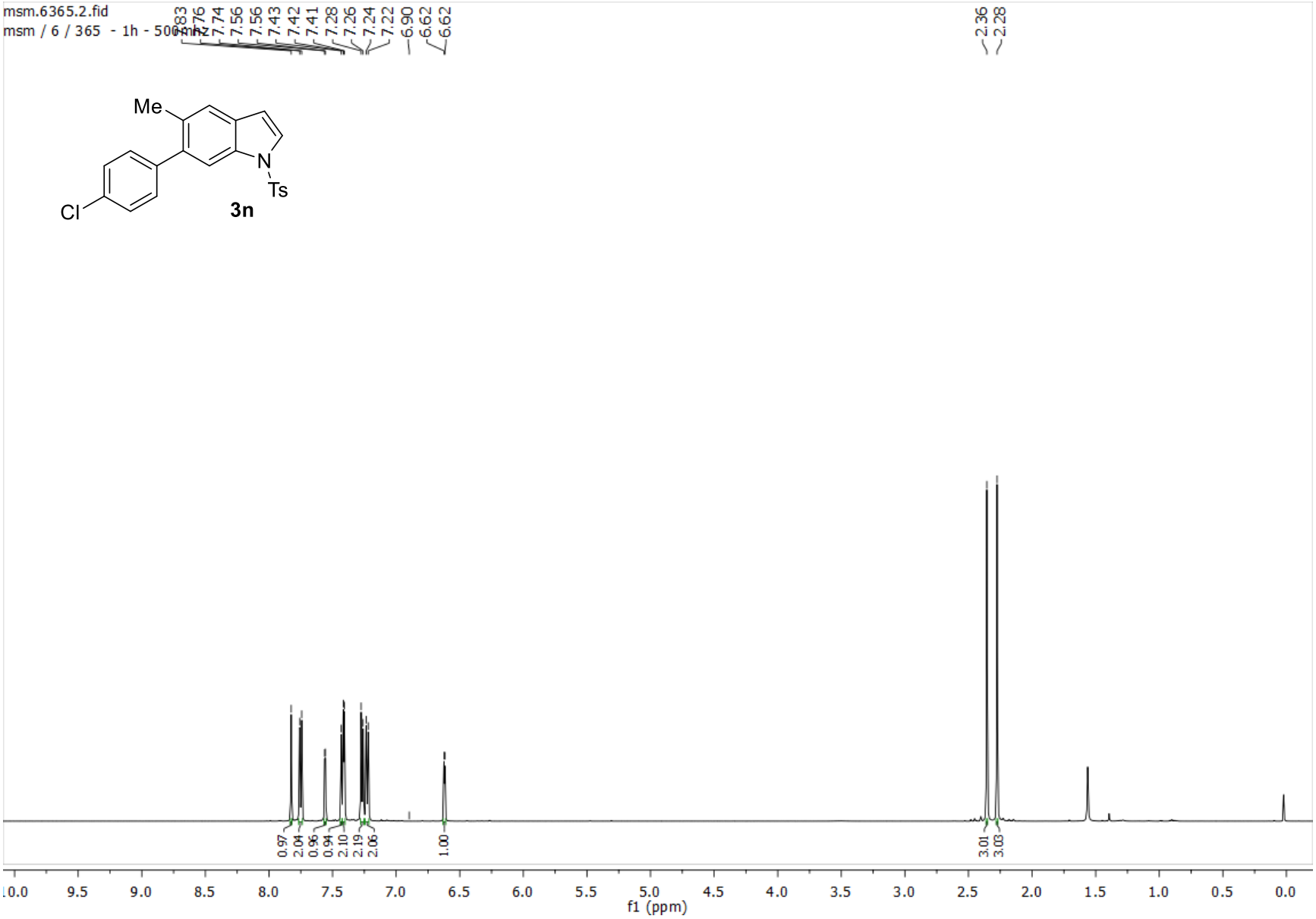

msmc.gk231a.100.fid
msm / gk / 231-a - 13c
145.36
144.92
135.50
135.39
129.92
128.98
126.93
126.01
122.90
121.05
111.69
109.12
77.48
77.16
76.84
45.09
35.00
27.10
26.29
21.67
N
Ts
3k
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

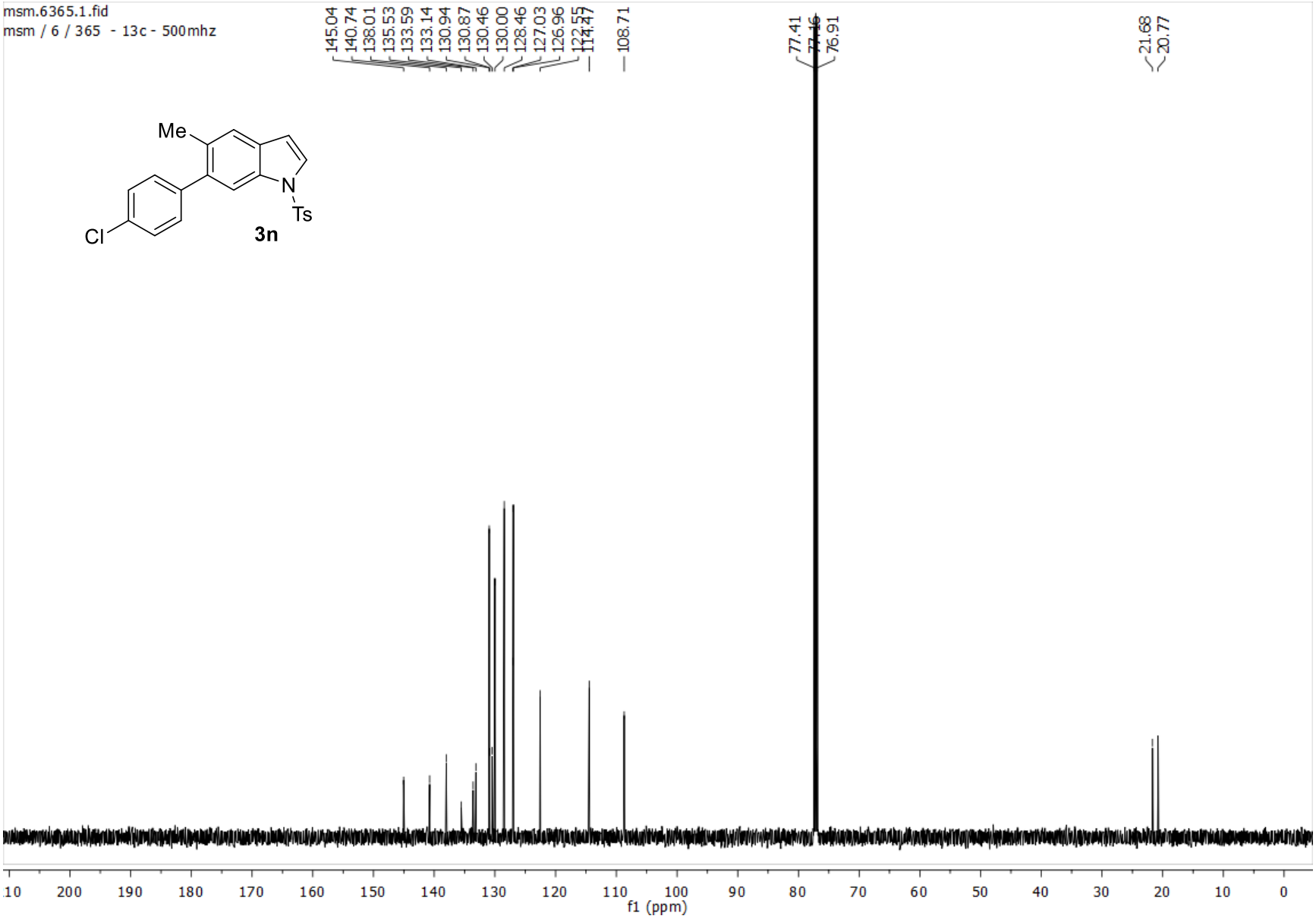

msm.gk259p.10.fid
msm.gk259p-1h-500mhz
7.78 7.75 7.73 7.48 7.48 7.40 7.39 7.26 7.19 7.18 7.02 7.02 7.01 7.00 6.60 6.59
5.10 5.07
2.78 2.74 2.51 2.47 2.40 2.38 2.33 2.12 2.06 2.01 1.94 1.79 1.74 1.70 1.62 1.42 1.37 0.85 0.83
Me
Me
Me
2
N
Ts
3l
1.02 2.17 0.97 1.00 2.09 1.03 1.00 0.88 0.98 1.06 0.85 3.04 0.96 1.30 1.33 3.02 2.87 1.12 3.21
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

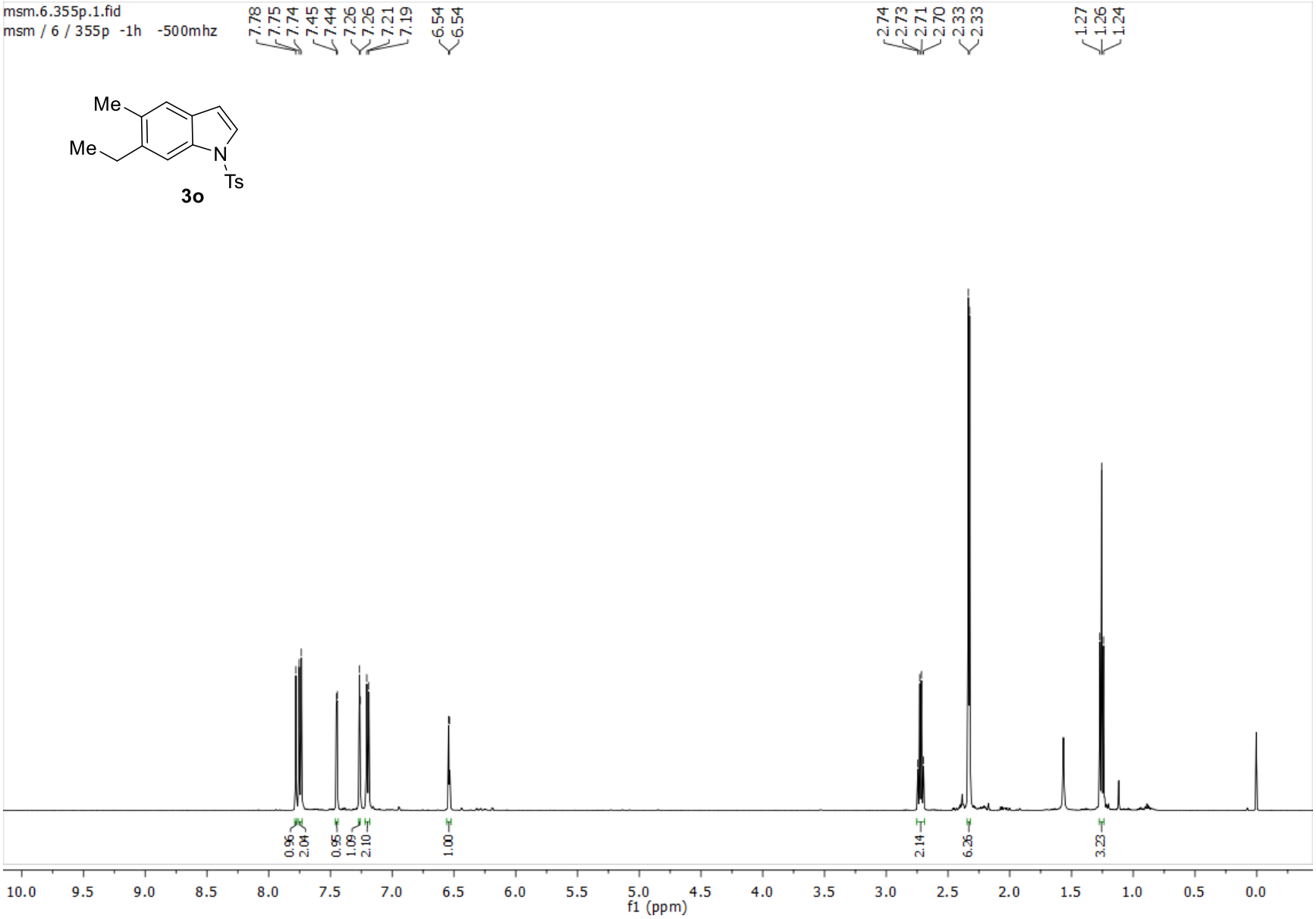

msm.gk259p.11.fid
msm.gk259p-13c-500mhz
144.88
138.64
135.61
135.39
131.35
129.90
128.93
126.96
126.01
125.13
124.94
120.90
114.19
109.23
77.41
77.18
44.14
36.89
35.20
29.85
25.85
21.65
19.44
17.84
Me
Me
Me
2
N
Ts
3l
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

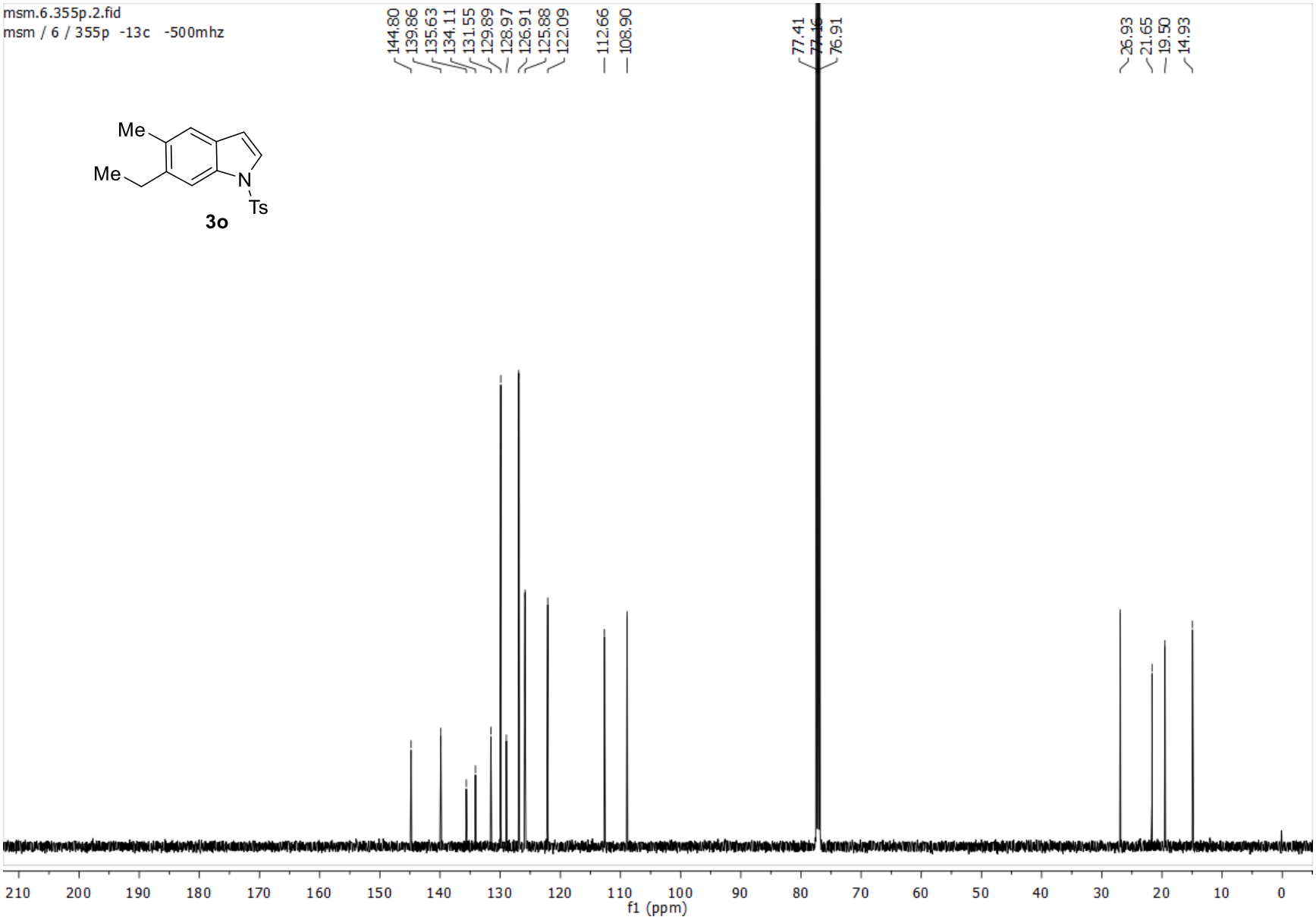

msm.gk246f.1.fid
msm / gk / 246 f
7.755
7.757
7.740
7.741
7.734
7.456
7.442
7.427
7.394
7.377
7.363
7.334
7.320
7.260
7.223
7.206
6.614
6.607
2.341
2.279
Me
Ph
N
Ts
3m
1.07
2.09
0.99
2.12
1.16
1.00
2.16
2.16
1.00
3.11
3.04
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

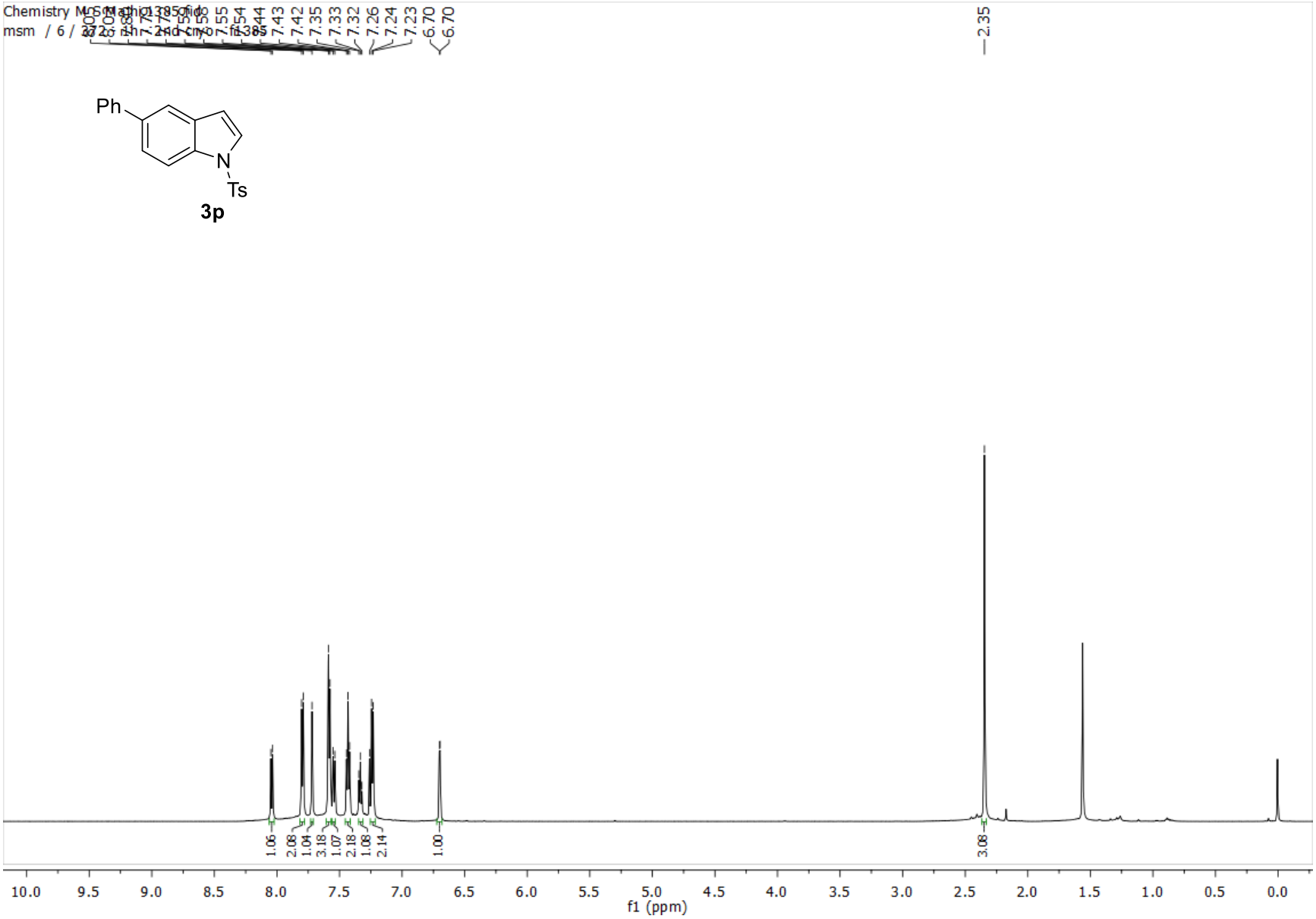

msm.gk246a.3.fid
msm / gk /246a - 13c - 500mhz
144.95
142.34
139.36
135.56
133.62
131.05
130.22
129.97
129.64
128.23
127.01
126.98
126.84
122.37
114.59
108.76
77.41
76.91
21.68
20.84
Me
Ph
N
Ts
3m
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

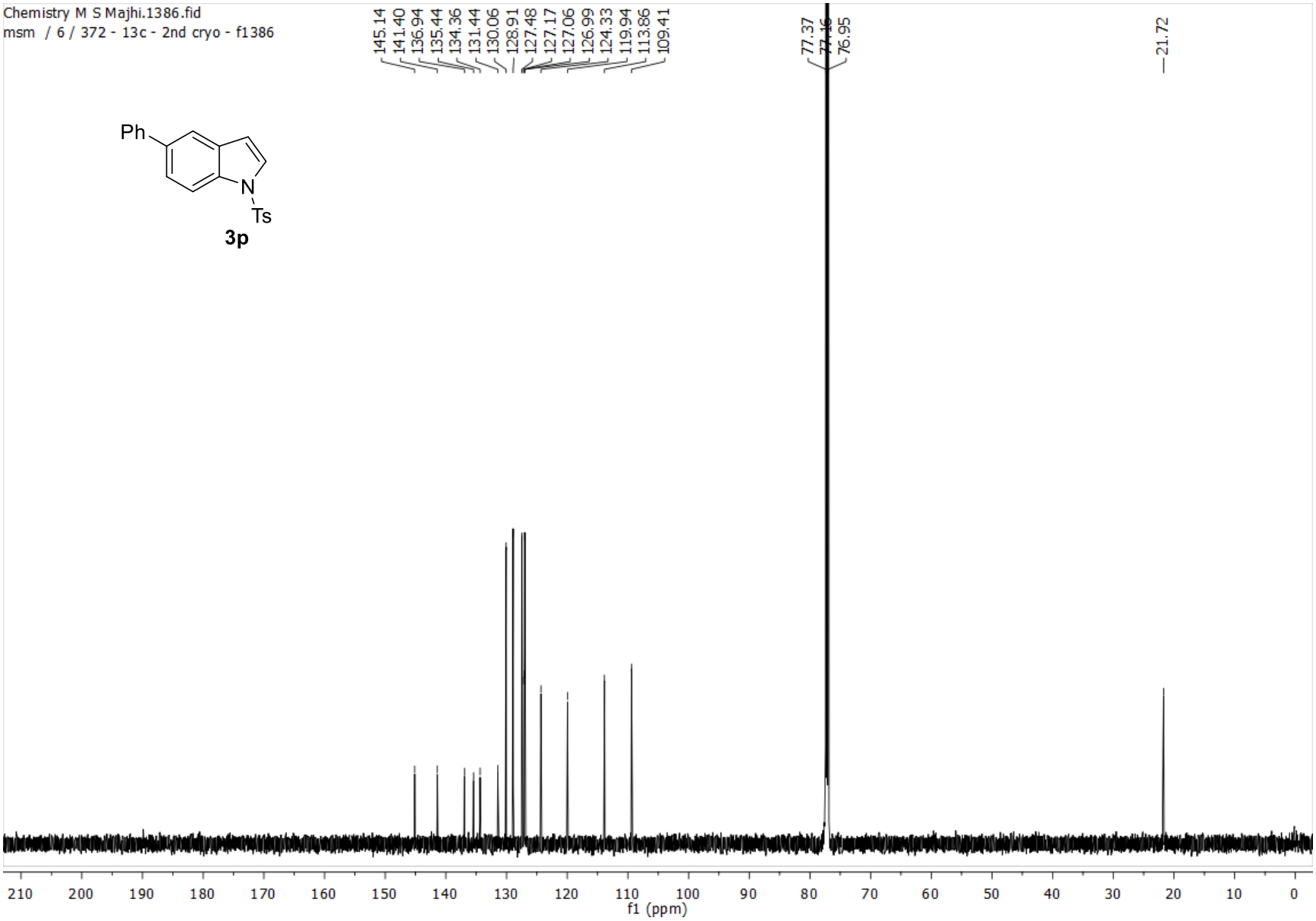

msm.6365.2.fid
msm / 6 / 365 - 1h - 500MHz
7.83
7.76
7.74
7.56
7.56
7.43
7.42
7.41
7.28
7.26
7.24
7.22
6.90
6.62
6.62
2.36
2.28
Me
N
Ts
Cl
3n
0.97
2.04
0.96
0.94
2.10
2.19
2.06
1.00
3.01
3.03
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

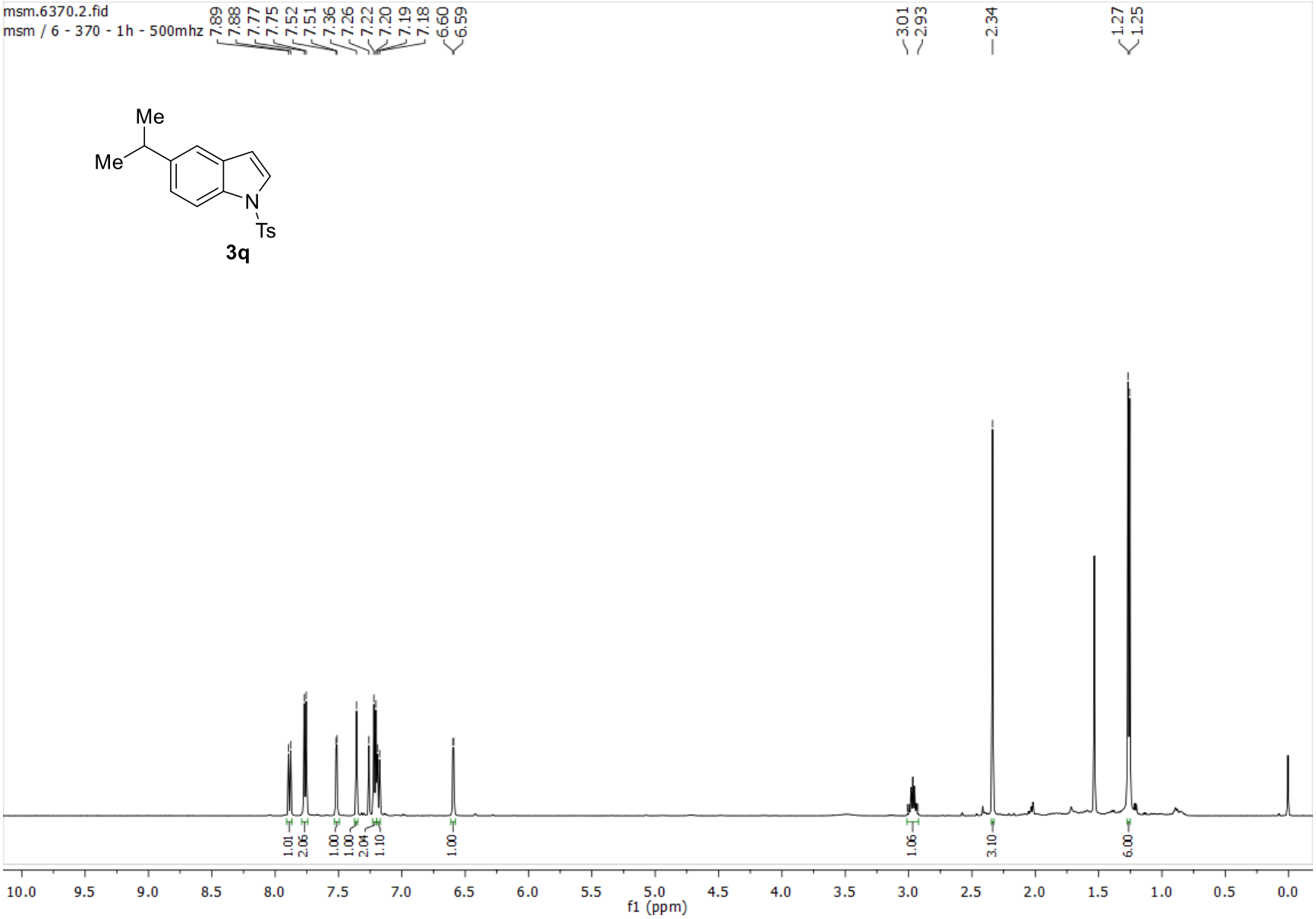

msm.6365.1.fid
msm / 6 / 365 - 13c - 500mhz
145.04
140.74
138.01
135.53
133.59
133.14
130.94
130.87
130.46
130.00
128.46
127.03
126.96
122.55
114.47
108.71
77.41
77.16
76.91
21.68
20.77
Me
N
Ts
Cl
3n
f1 (ppm)

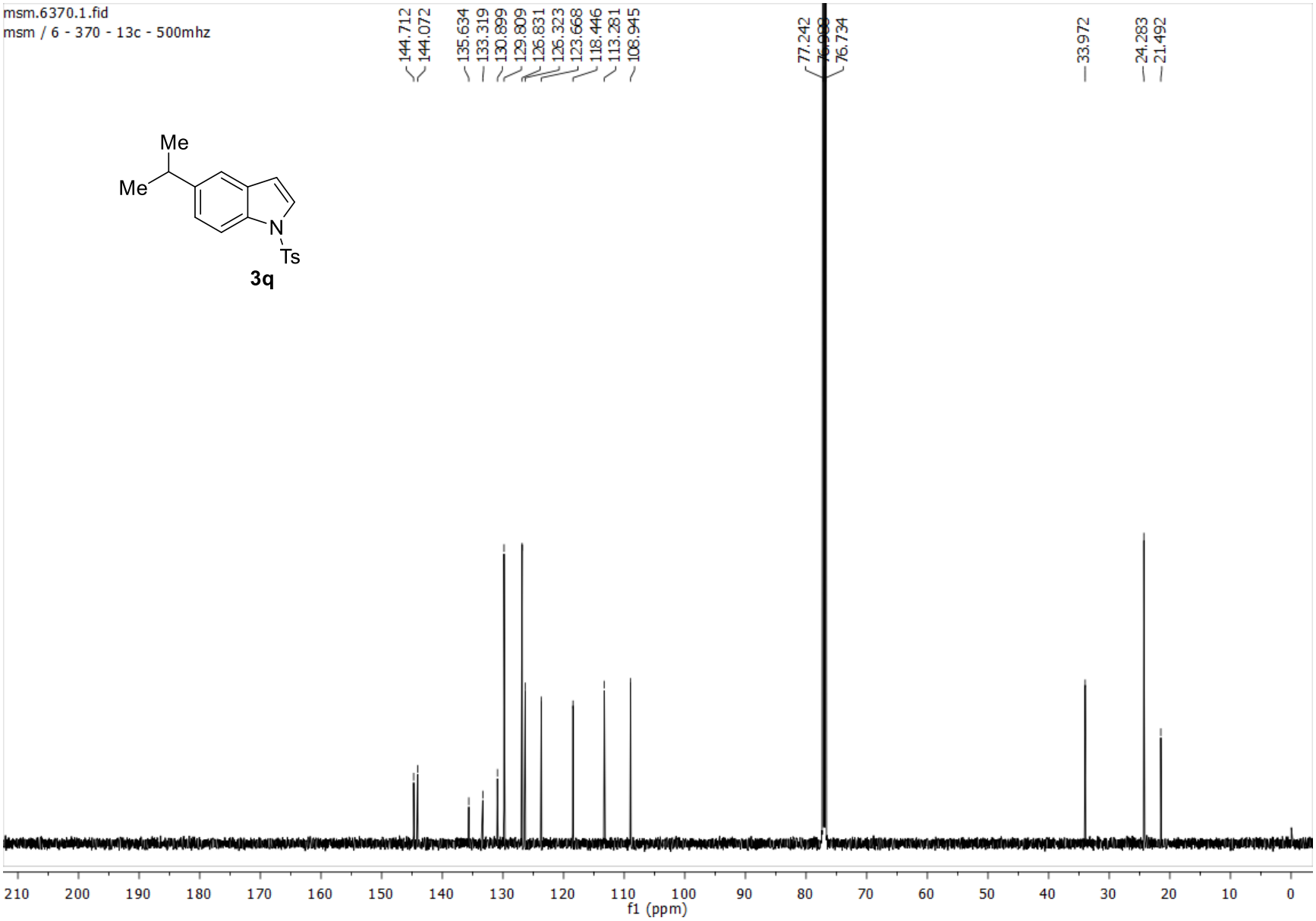

msm.6.355p.1.fid
msm / 6 / 355p -1h -500mhz
7.78
7.75
7.74
7.45
7.44
7.26
7.26
7.21
7.19
6.54
6.54
2.74
2.73
2.71
2.70
2.33
2.33
1.27
1.26
1.24
Me
Me
N
Ts
3o
0.96
2.04
0.95
1.09
2.10
1.00
2.14
6.26
3.23
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

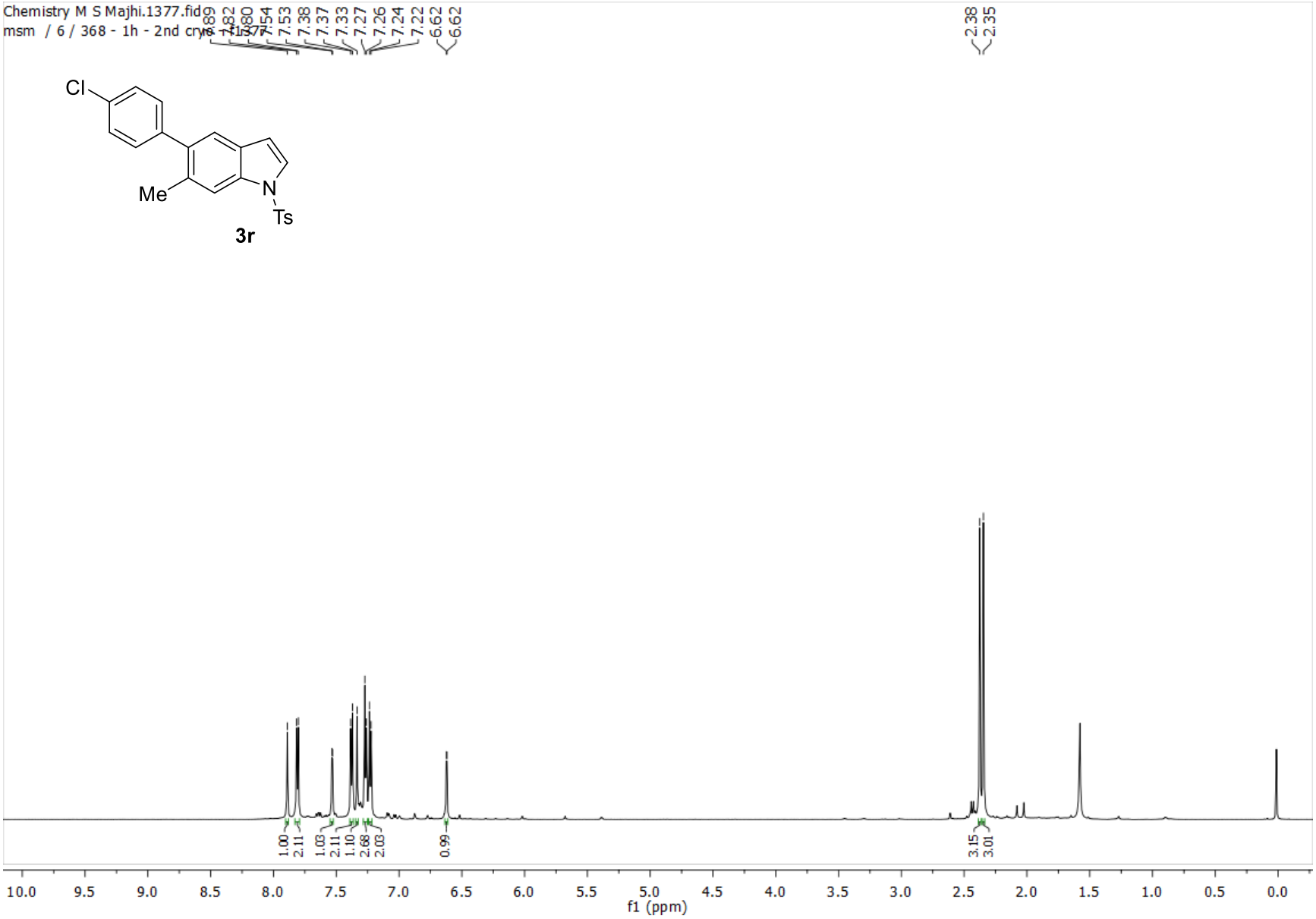

msm.6.355p.2.fid
msm / 6 / 355p -13c -500mhz
144.80
139.86
135.63
134.11
131.55
129.89
128.97
126.91
125.88
122.09
112.66
108.90
77.41
77.16
76.91
26.93
21.65
19.50
14.93
Me
Me
N
Ts
3o
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

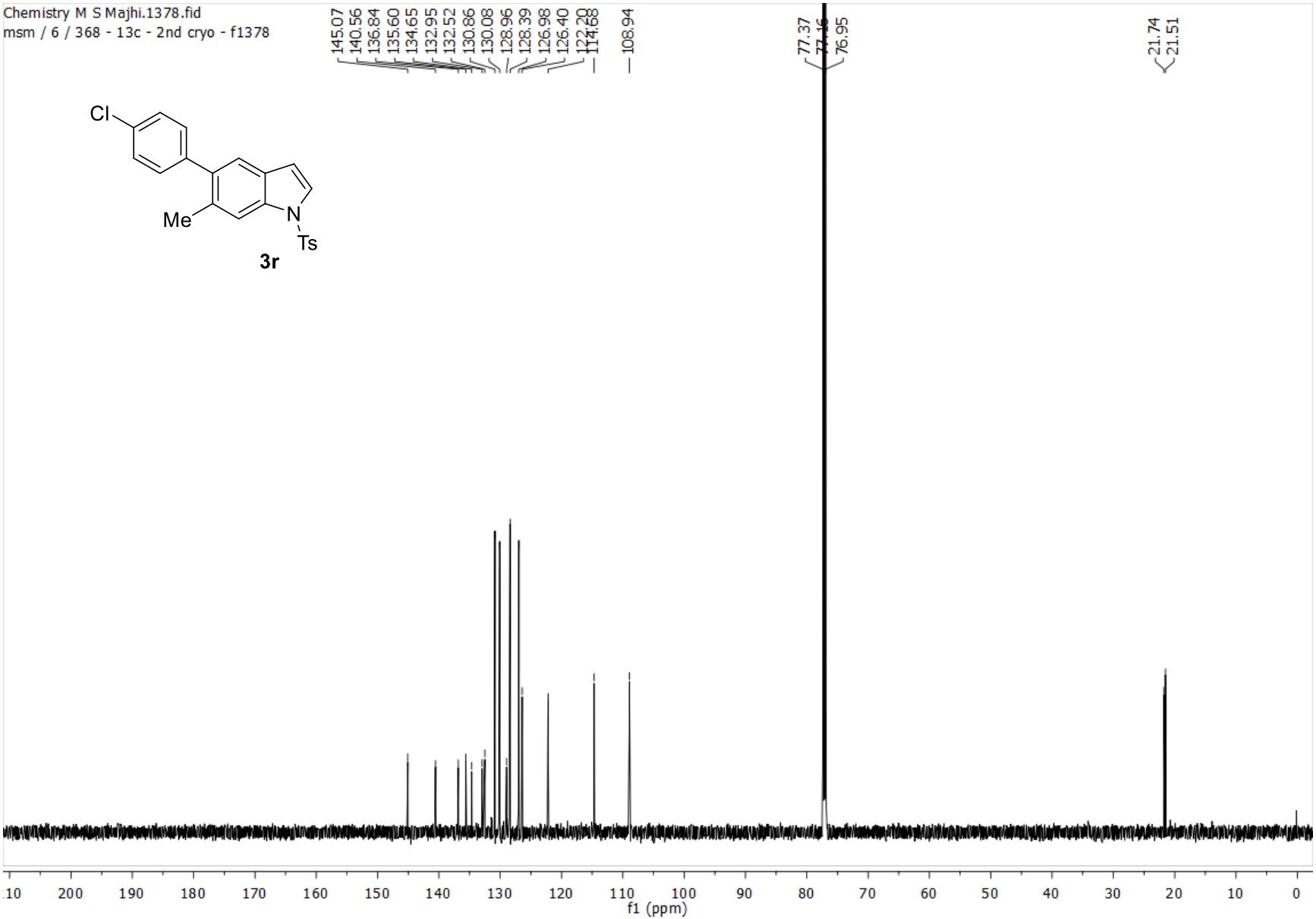

Chemistry MLS Mathi 1385fid
msm / 6 / 272 / 1H / 7.24d cryo / f1385
7.55
7.54
7.44
7.43
7.42
7.35
7.33
7.32
7.26
7.24
7.23
6.70
6.70
2.35
Ph
N
Ts
3p
1.06
2.08
1.04
3.18
1.07
2.18
1.08
2.14
1.00
3.08
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

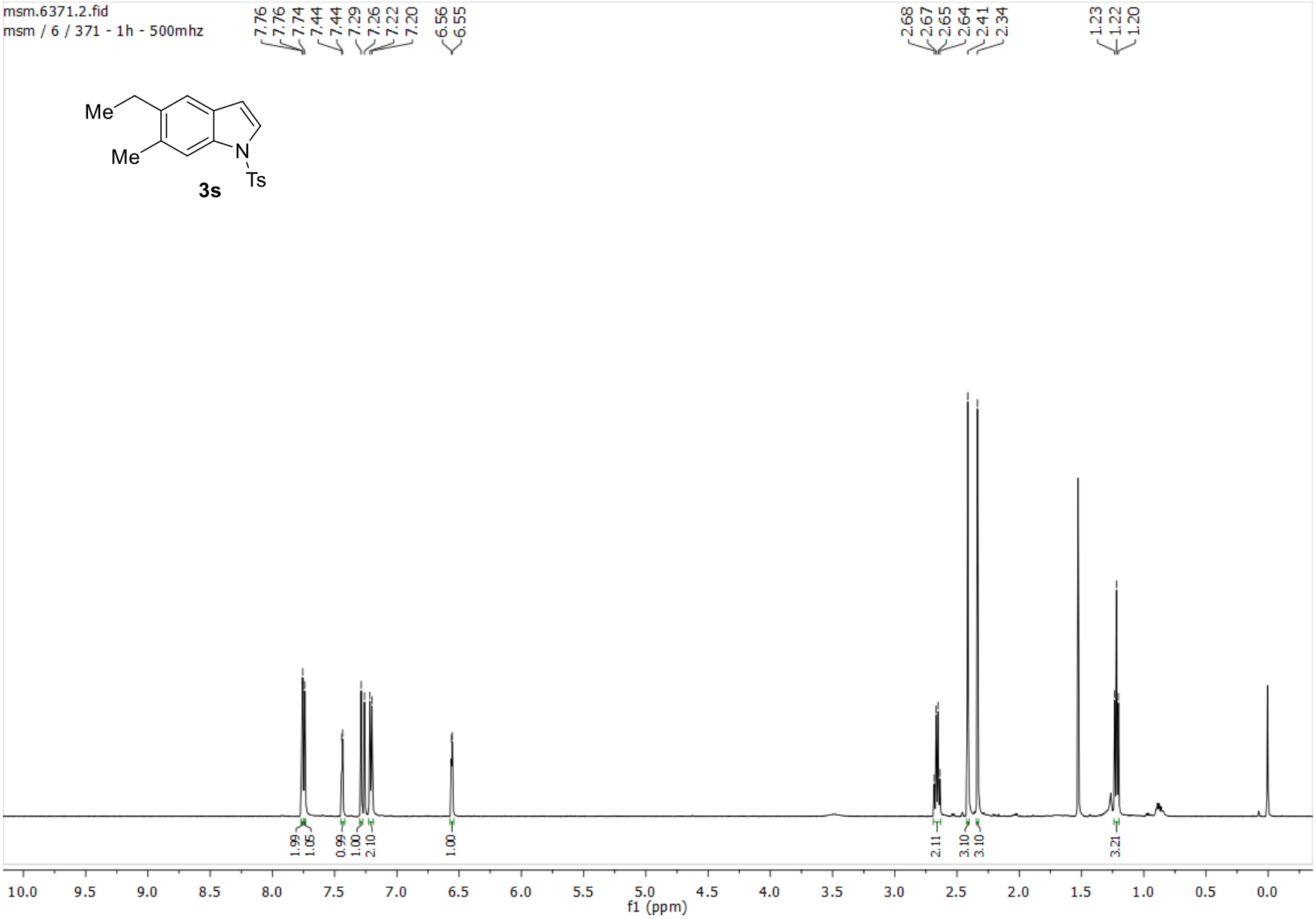

Chemistry M S Majhi.1386.fid
msm / 6 / 372 - 13c - 2nd cryo - f1386
145.14
141.40
136.94
135.44
134.36
131.44
130.06
128.91
127.48
127.17
127.06
126.99
124.33
119.94
113.86
109.41
77.37
77.16
76.95
21.72
Ph
N
Ts
3p
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

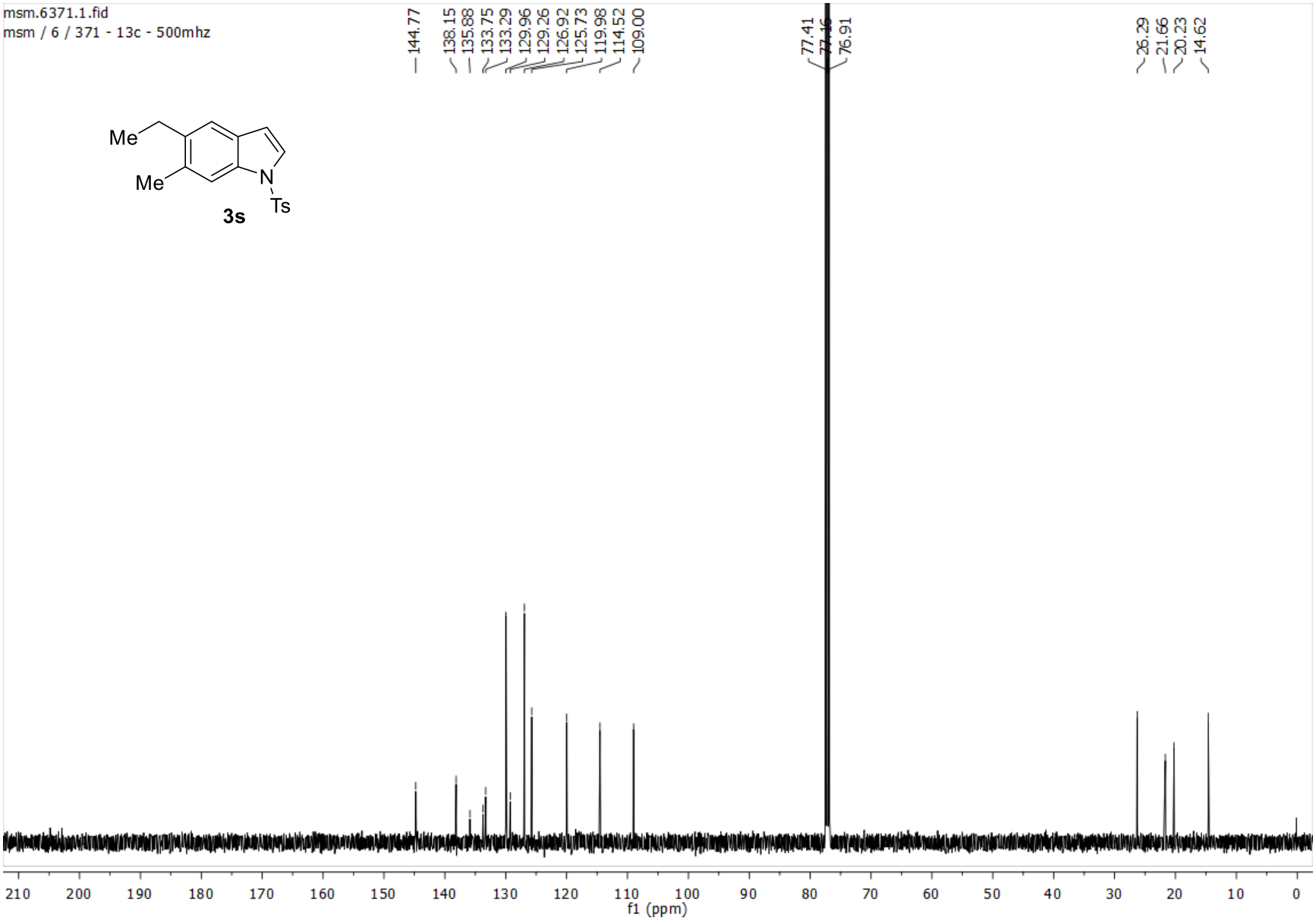

msm.6370.2.fid
msm / 6 - 370 - 1h - 500mhz
7.89
7.88
7.77
7.75
7.52
7.51
7.36
7.26
7.22
7.20
7.19
7.18
6.60
6.59
3.01
2.93
2.34
1.27
1.25
Me
Me
N
Ts
3q
1.01
2.06
1.00
1.00
2.04
1.10
1.00
1.06
3.10
6.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

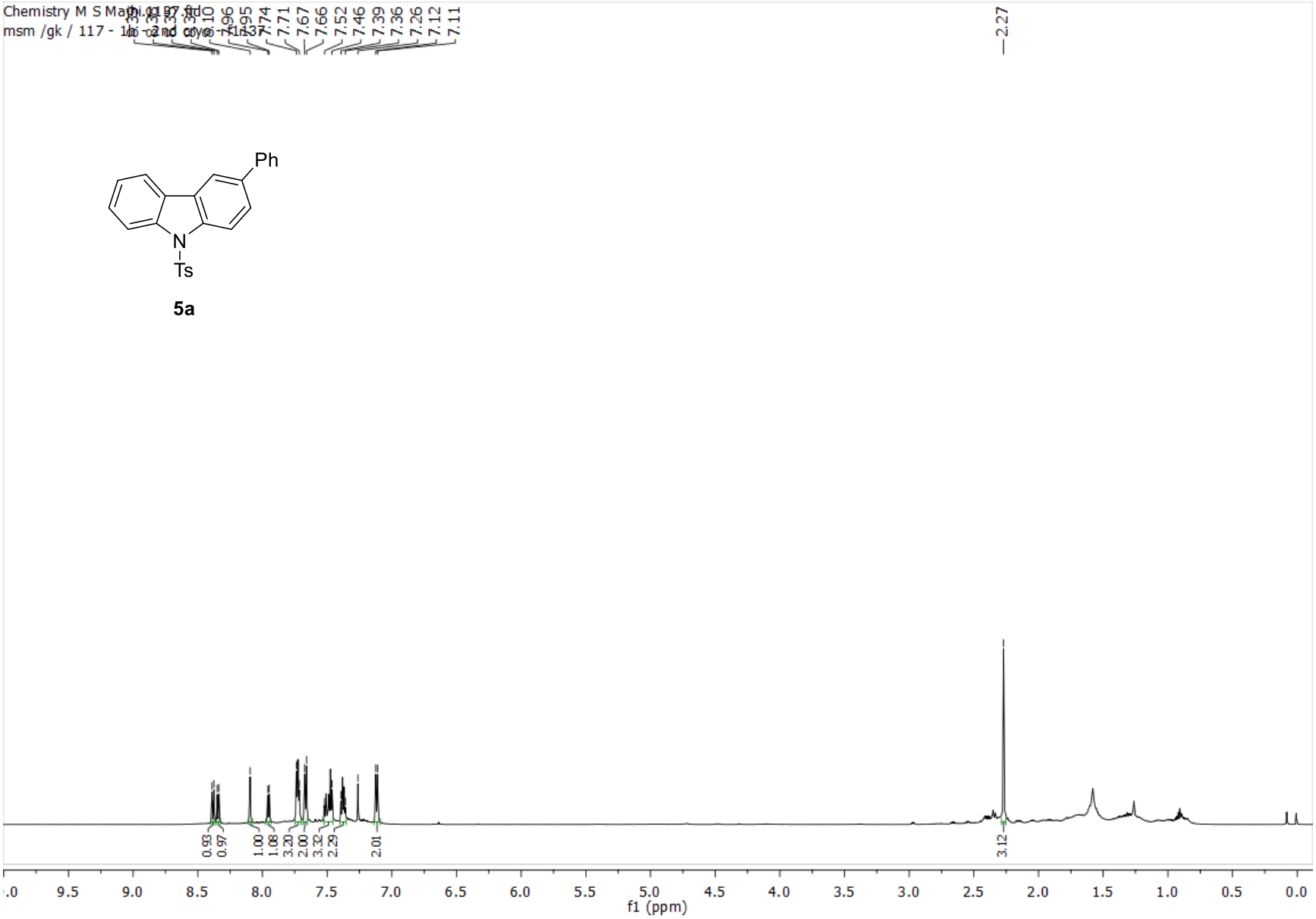

msm.6370.1.fid
msm / 6 - 370 - 13c - 500mhz
144.712
144.072
135.634
133.319
130.899
129.809
126.831
126.323
123.668
118.446
113.281
108.945
77.242
76.988
76.734
33.972
24.283
21.492
Me
Me
N
Ts
3q
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


Chemistry M S Majhi.1377.fid
msm / 6 / 368 - 1h - 2nd cryo 1377
7.89
7.82
7.80
7.54
7.53
7.38
7.37
7.33
7.27
7.26
7.24
7.22
6.62
6.62
2.38
2.35
Cl
Me
N
Ts
3r
1.00
2.11
1.03
2.11
1.10
2.68
2.03
0.99
3.15
3.01
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

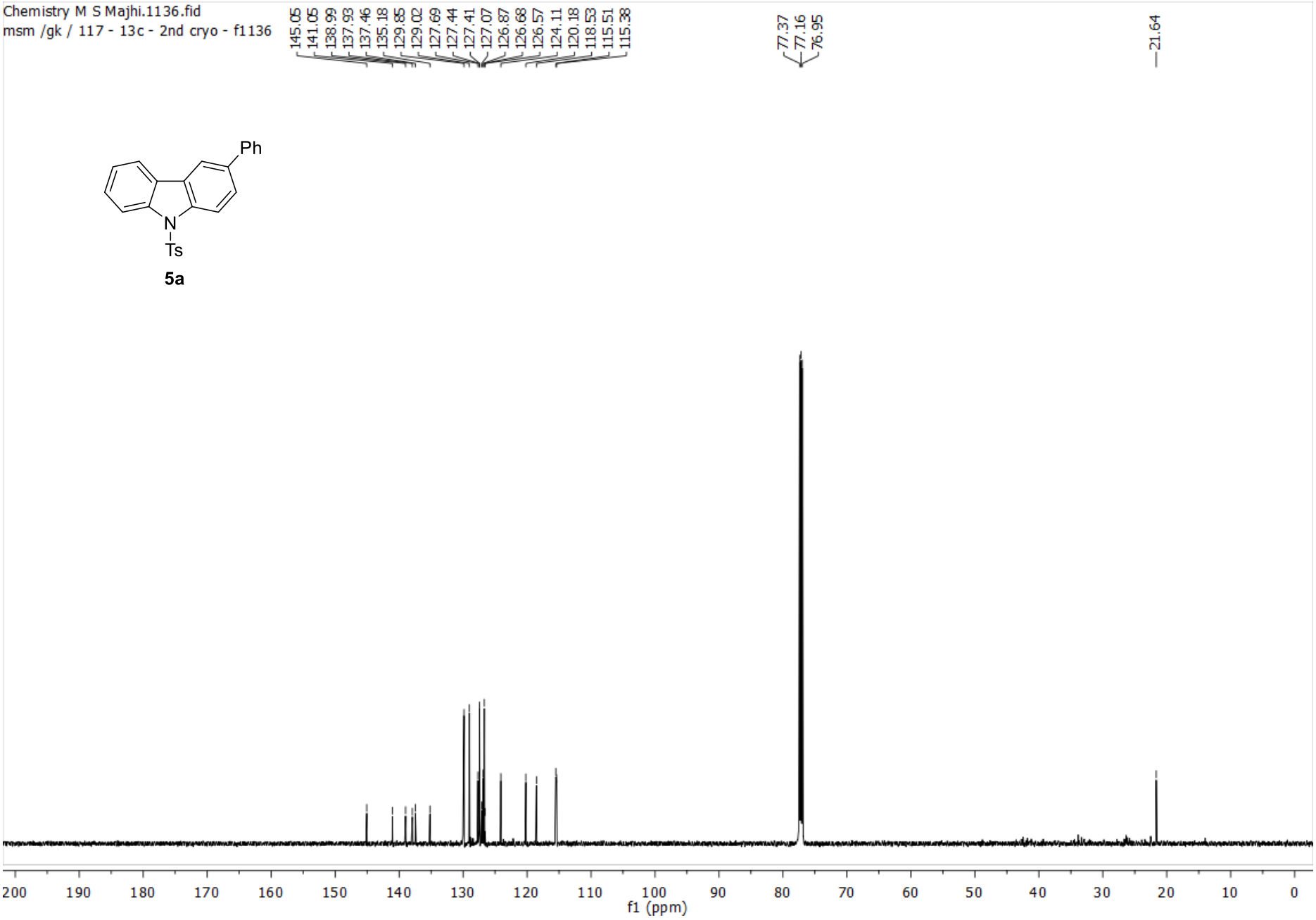

Chemistry M S Majhi.1378.fid
msm / 6 / 368 - 13c - 2nd cryo - f1378
145.07
140.56
136.84
135.60
134.65
132.95
132.52
130.86
130.08
128.96
128.39
126.98
126.40
122.20
114.68
108.94
77.37
77.16
76.95
21.74
21.51
Cl
Me
N
Ts
3r
f1 (ppm)

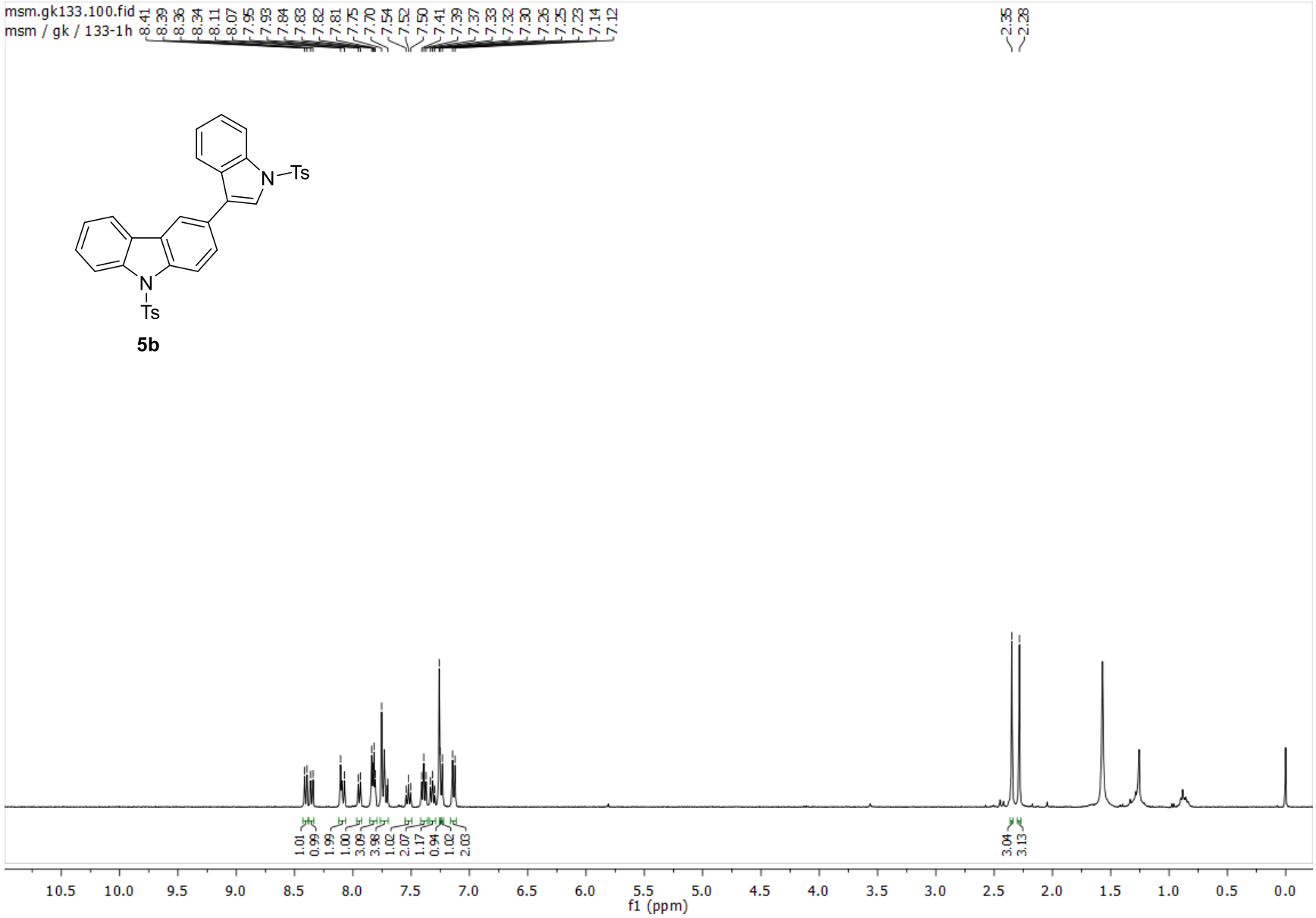

msm.6371.2.fid
msm / 6 / 371 - 1h - 500mhz
7.76
7.76
7.74
7.44
7.44
7.29
7.26
7.22
7.20
6.56
6.55
2.68
2.67
2.65
2.64
2.41
2.34
1.23
1.22
1.20
Me
Me
N
Ts
3s
1.99
1.05
0.99
1.00
2.10
1.00
2.11
3.10
3.10
3.21
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


msm.6371.1.fid
msm / 6 / 371 - 13c - 500mhz
144.77
138.15
135.88
133.75
133.29
129.96
129.26
126.92
125.73
119.98
114.52
109.00
77.41
76.91
26.29
21.66
20.23
14.62
Me
Me
N
Ts
3s
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

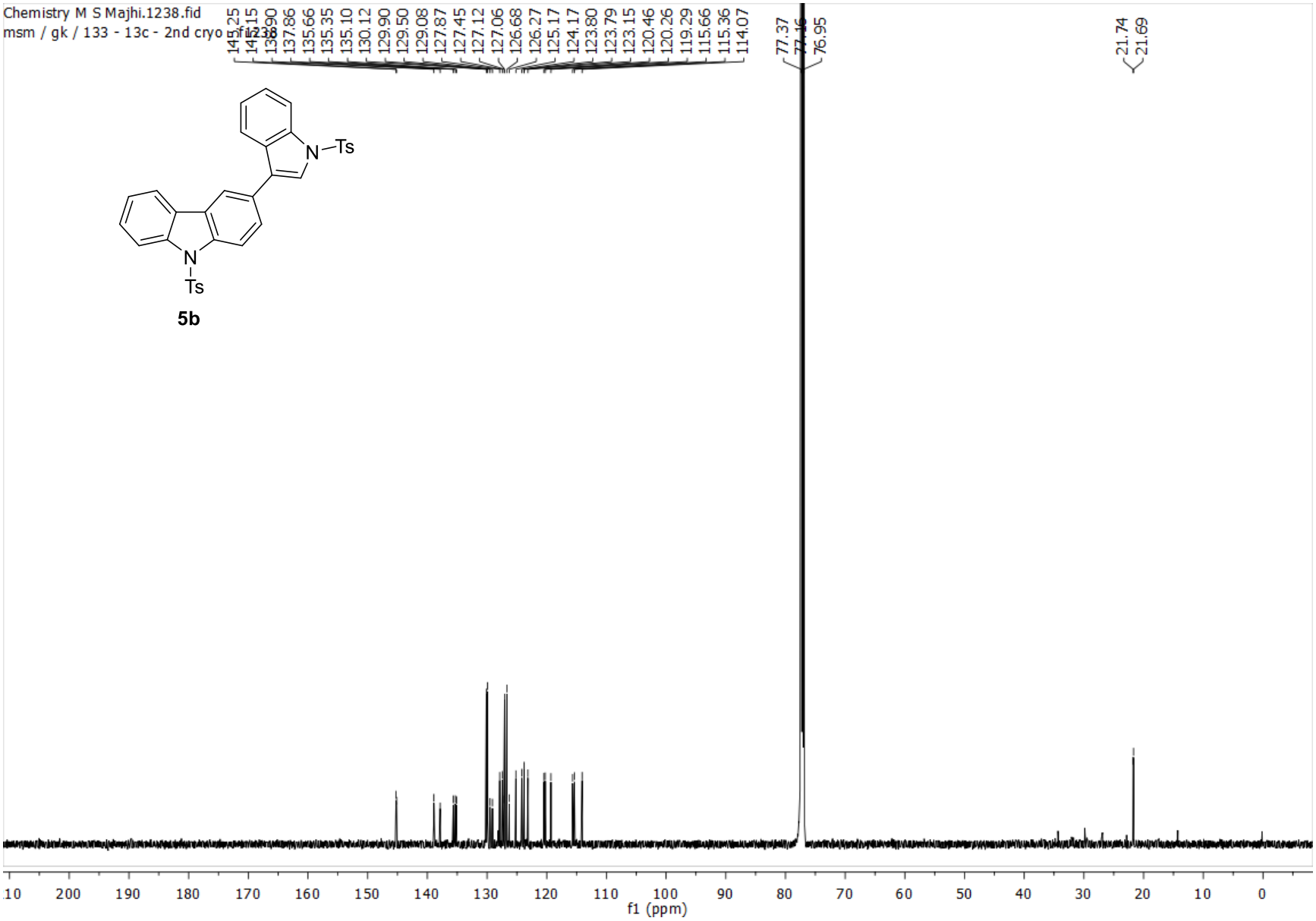

Chemistry M S Madhi 0197.fid
msm /gk / 117 - 1a - 2nd cryo - f1137
8.10
7.96
7.95
7.74
7.71
7.67
7.66
7.52
7.46
7.39
7.36
7.26
7.12
7.11
2.27
Ph
N
Ts
0.93
0.97
1.00
1.08
3.20
2.00
3.32
2.29
2.01
3.12
f1 (ppm)

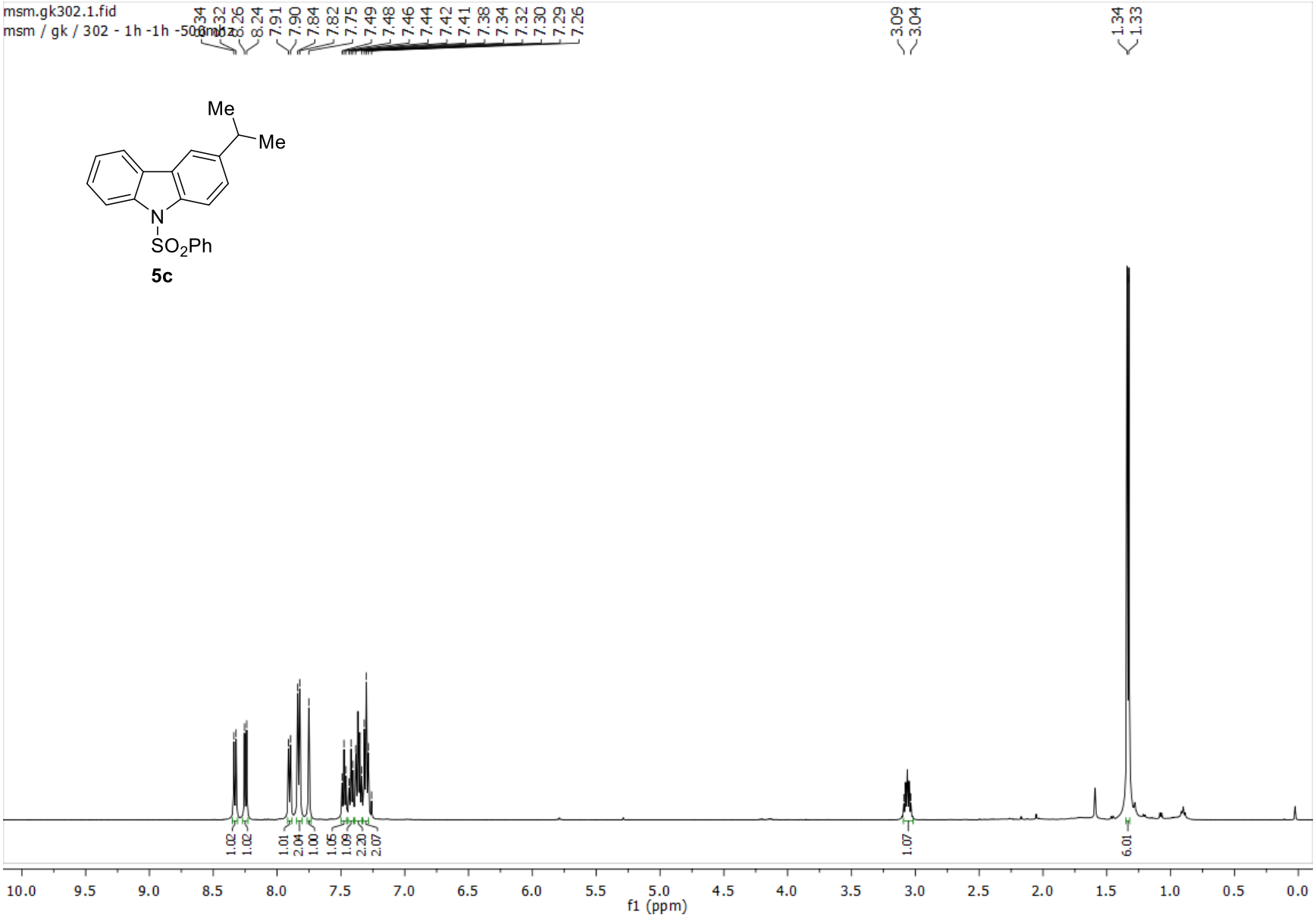
5a

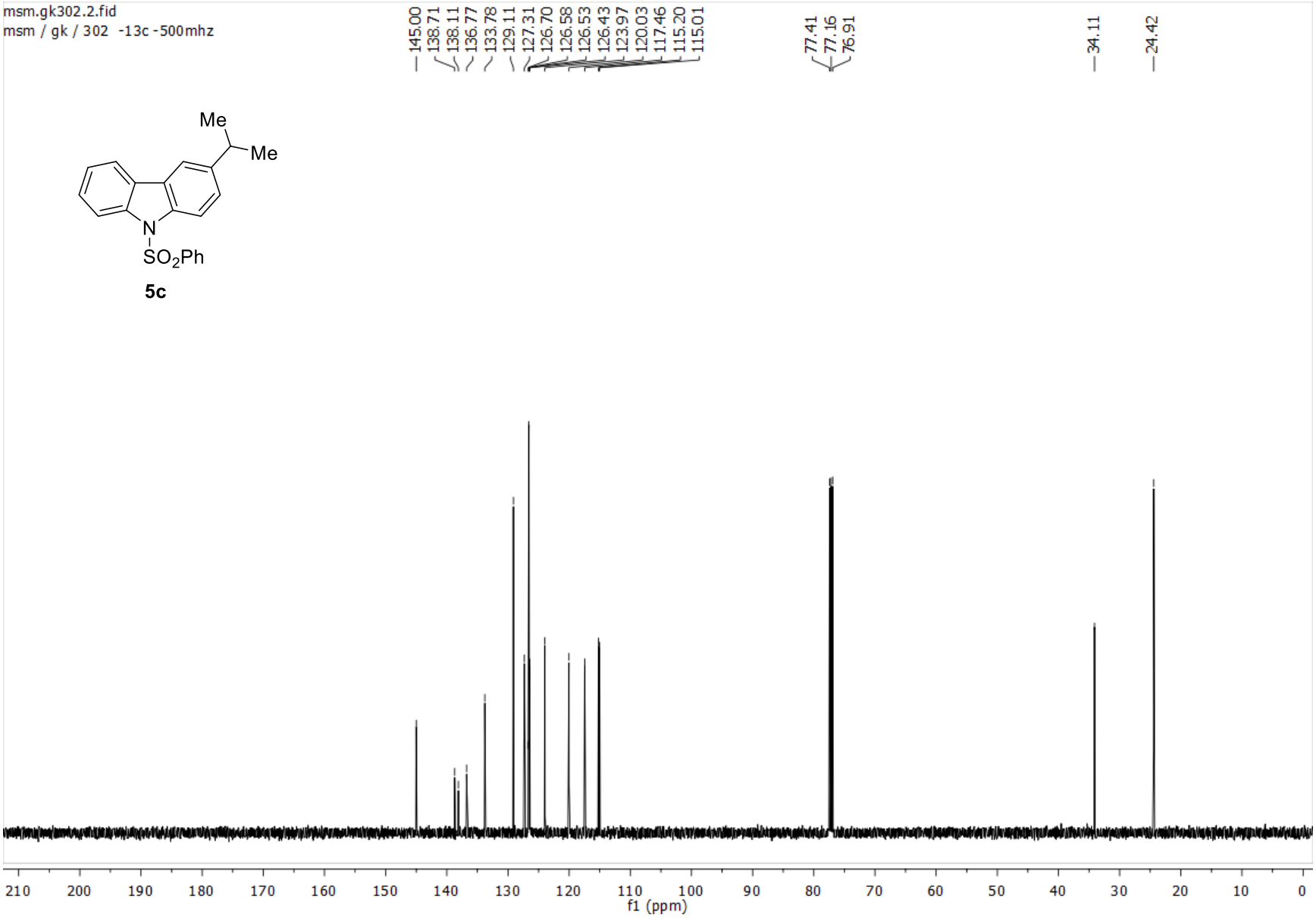

Chemistry M S Majhi.1136.fid
msm /gk / 117 - 13c - 2nd cryo - f1136
145.05
141.05
138.99
137.93
137.46
135.18
129.85
129.02
127.69
127.44
127.41
127.07
126.87
126.68
126.57
124.11
120.18
118.53
115.51
115.38
77.37
77.16
76.95
21.64
Ph
N
Ts
5a
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

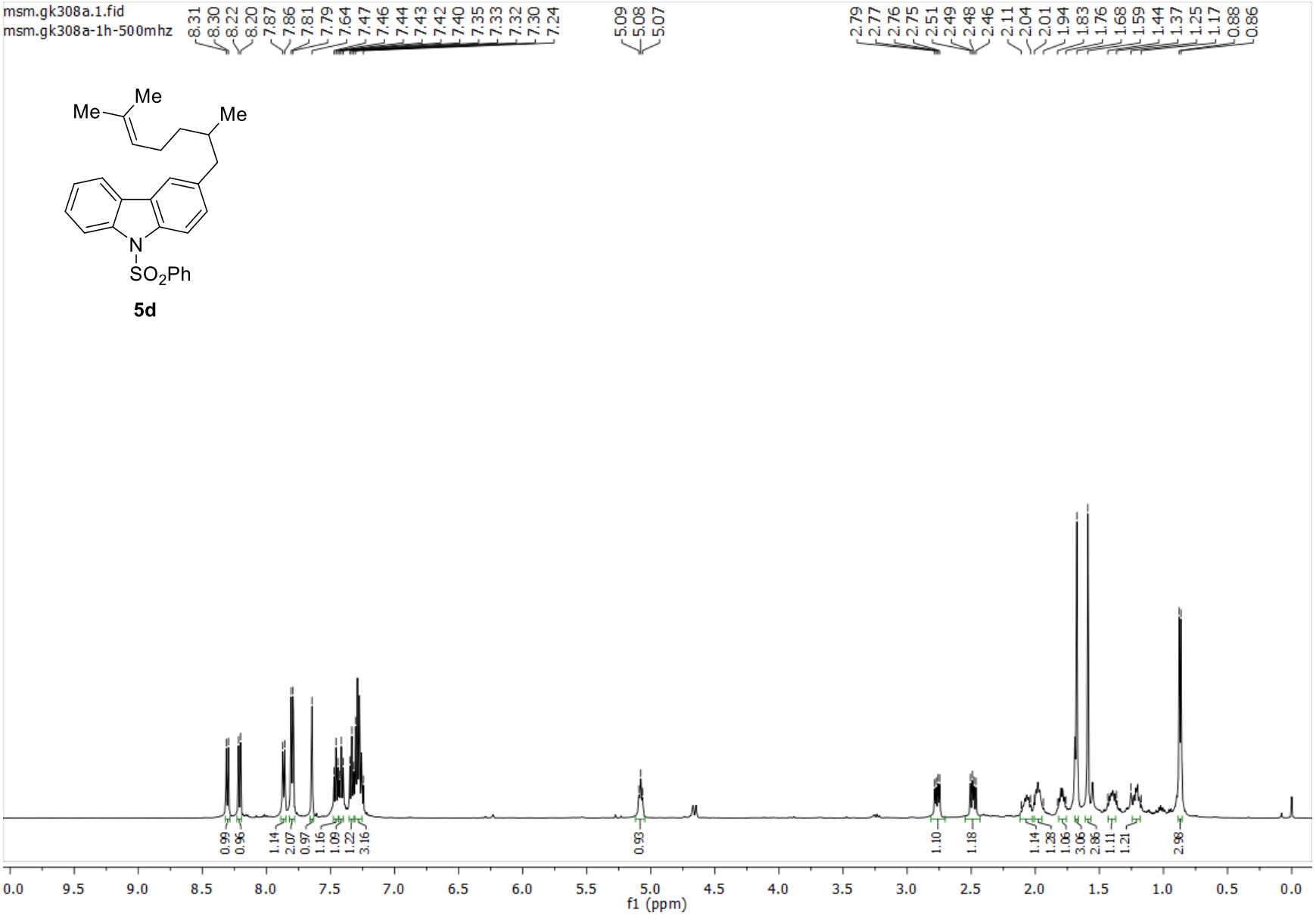

msm.gk133.100.fid
msm / gk / 133-1h
8.41
8.39
8.36
8.34
8.11
8.07
7.95
7.93
7.84
7.83
7.82
7.81
7.75
7.70
7.54
7.52
7.50
7.41
7.39
7.37
7.33
7.32
7.30
7.26
7.25
7.23
7.14
7.12
2.35
2.28
N
Ts
N
Ts
1.01
0.99
1.99
1.00
3.09
3.98
1.02
2.07
1.17
0.94
1.02
2.03
3.04
3.13
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

5b

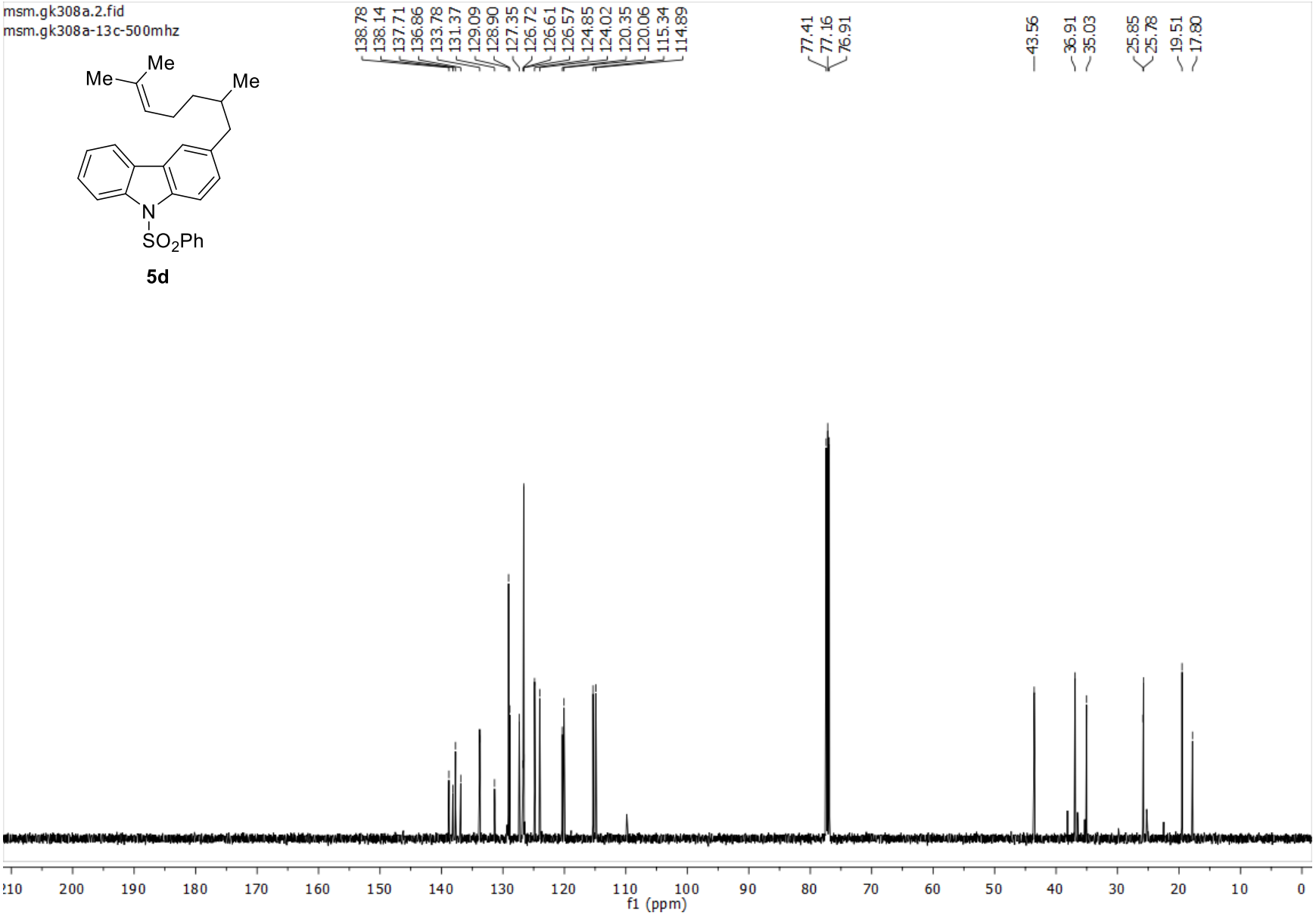

Chemistry M S Majhi.1238.fid
msm / gk / 133 - 13c - 2nd cryo f1 238
145.25
141.15
139.90
137.86
135.66
135.35
135.10
130.12
129.90
129.50
129.08
127.87
127.45
127.12
127.06
126.68
126.27
125.17
124.17
123.80
123.79
123.15
120.46
120.26
119.29
115.66
115.36
114.07
77.37
77.16
76.95
21.74
21.69
N
Ts
N
Ts
5b
f1 (ppm)


msm.gk302.1.fid
msm / gk / 302 - 1h -1h -506mhz
8.34
8.32
8.26
8.24
7.91
7.90
7.84
7.82
7.75
7.49
7.48
7.46
7.44
7.42
7.41
7.38
7.34
7.32
7.30
7.29
7.26
3.09
3.04
1.34
1.33
Me
Me
N
SO2Ph
5c
1.02
1.02
1.01
2.04
1.00
1.05
1.09
2.20
2.07
1.07
6.01
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

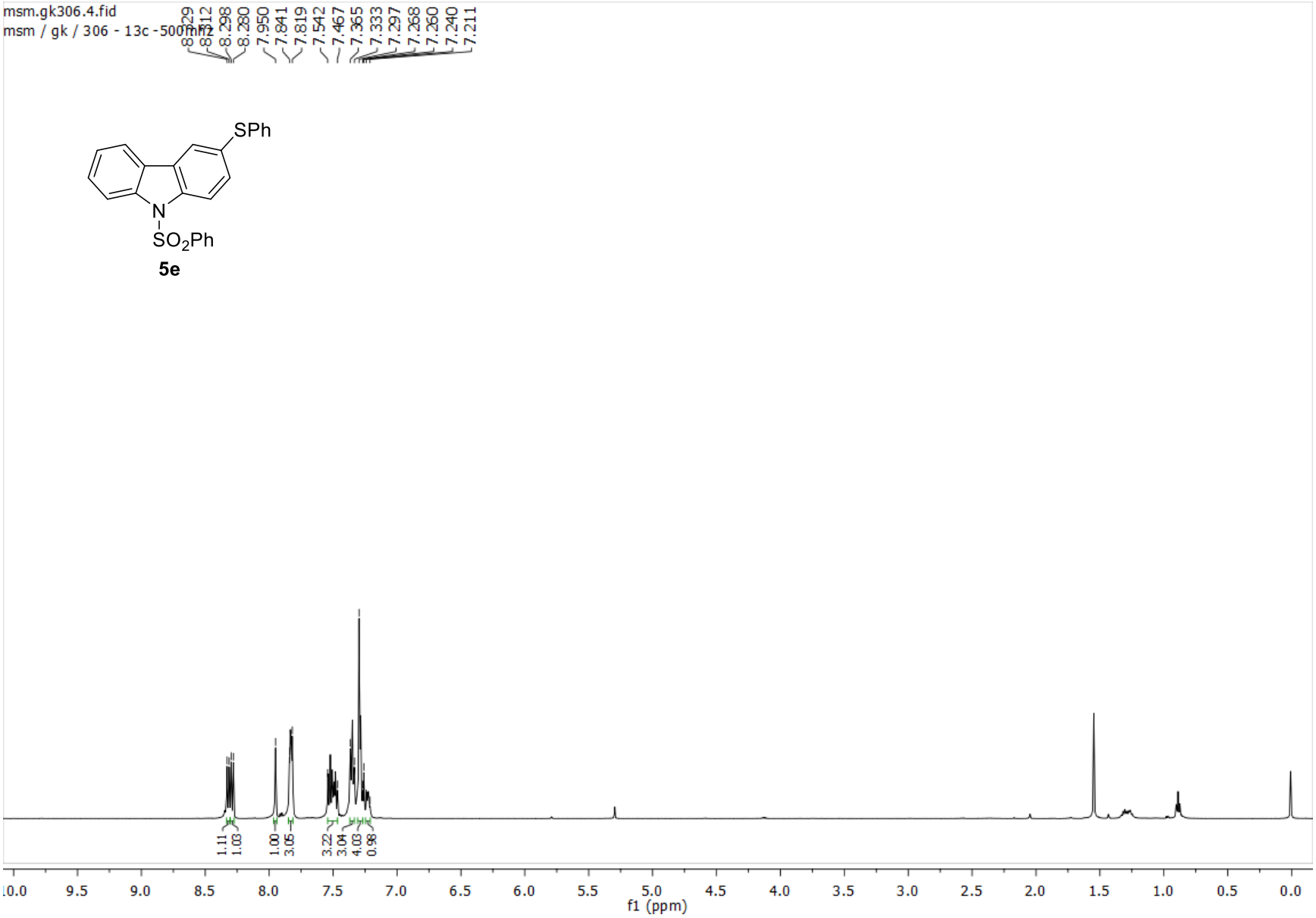

msm.gk302.2.fid
msm / gk / 302 -13c -500mhz
145.00
138.71
138.11
136.77
133.78
129.11
127.31
126.70
126.58
126.53
126.43
123.97
120.03
117.46
115.20
115.01
77.41
77.16
76.91
34.11
24.42
Me
Me
N
SO2Ph
5c
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

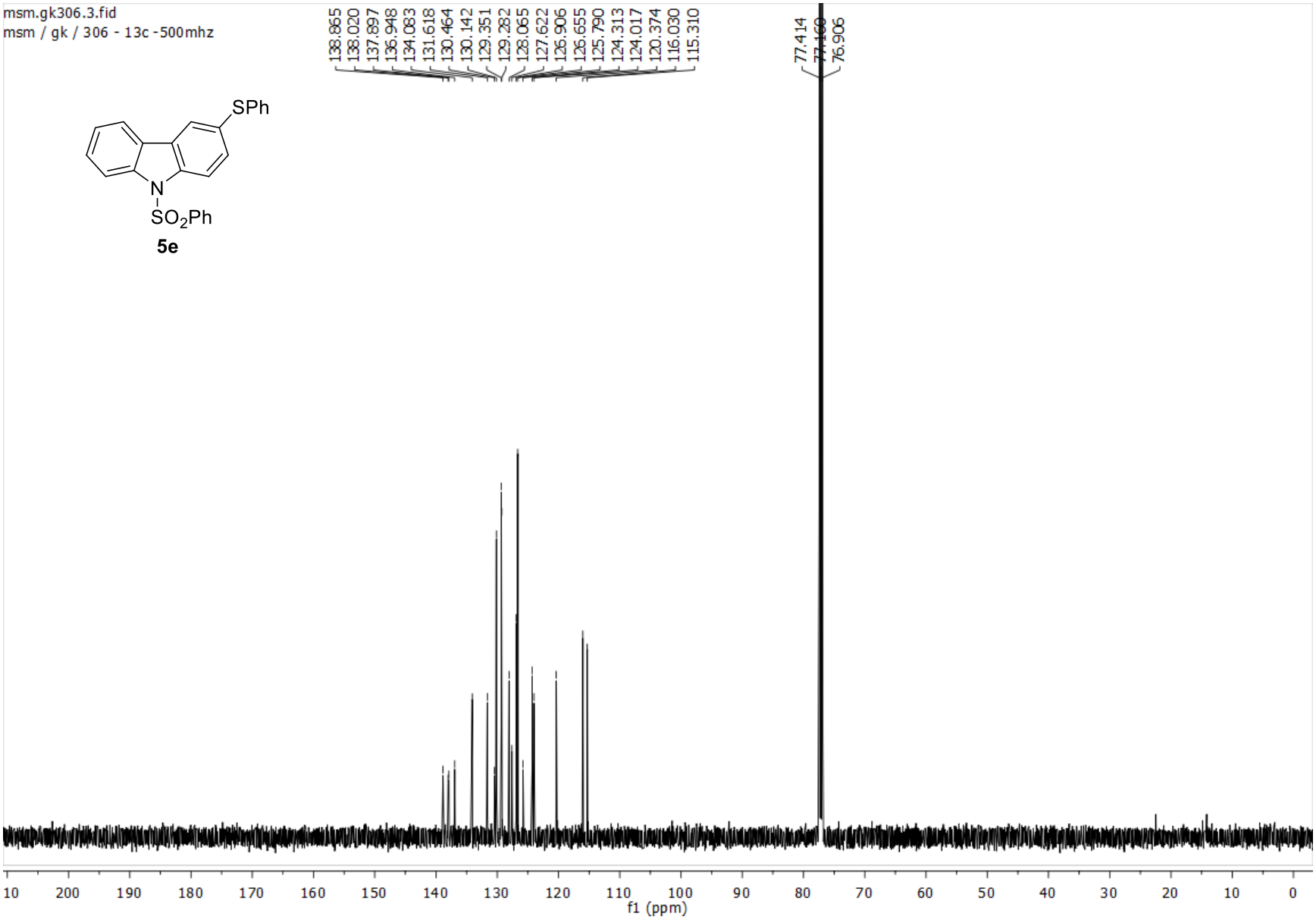

msm.gk308a.1.fid
msm.gk308a-1h-500mhz
8.31 8.30 8.22 8.20 7.87 7.86 7.81 7.79 7.64 7.47 7.46 7.44 7.43 7.42 7.40 7.35 7.33 7.32 7.30 7.24
5.09 5.08 5.07
2.79 2.77 2.76 2.75 2.51 2.49 2.48 2.46 2.11 2.04 2.01 1.94 1.83 1.76 1.68 1.59 1.44 1.37 1.25 1.17 0.88 0.86
Me
Me
Me
N
SO2Ph
0.99 0.96 1.14 2.07 0.97 1.16 1.09 1.22 3.16 0.93 1.10 1.18 1.14 1.28 1.06 3.06 2.86 1.11 1.21 2.98
0.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

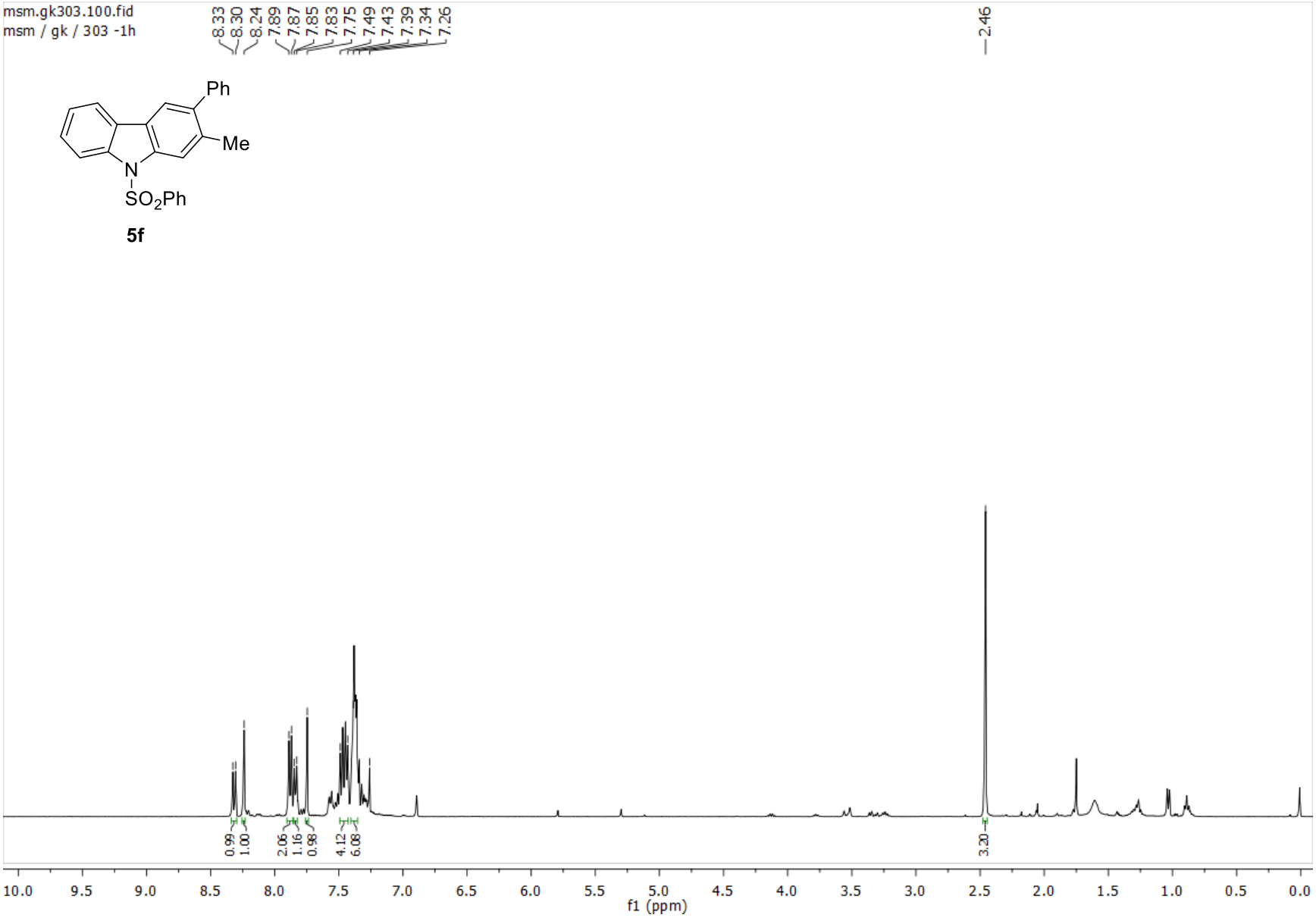
5d

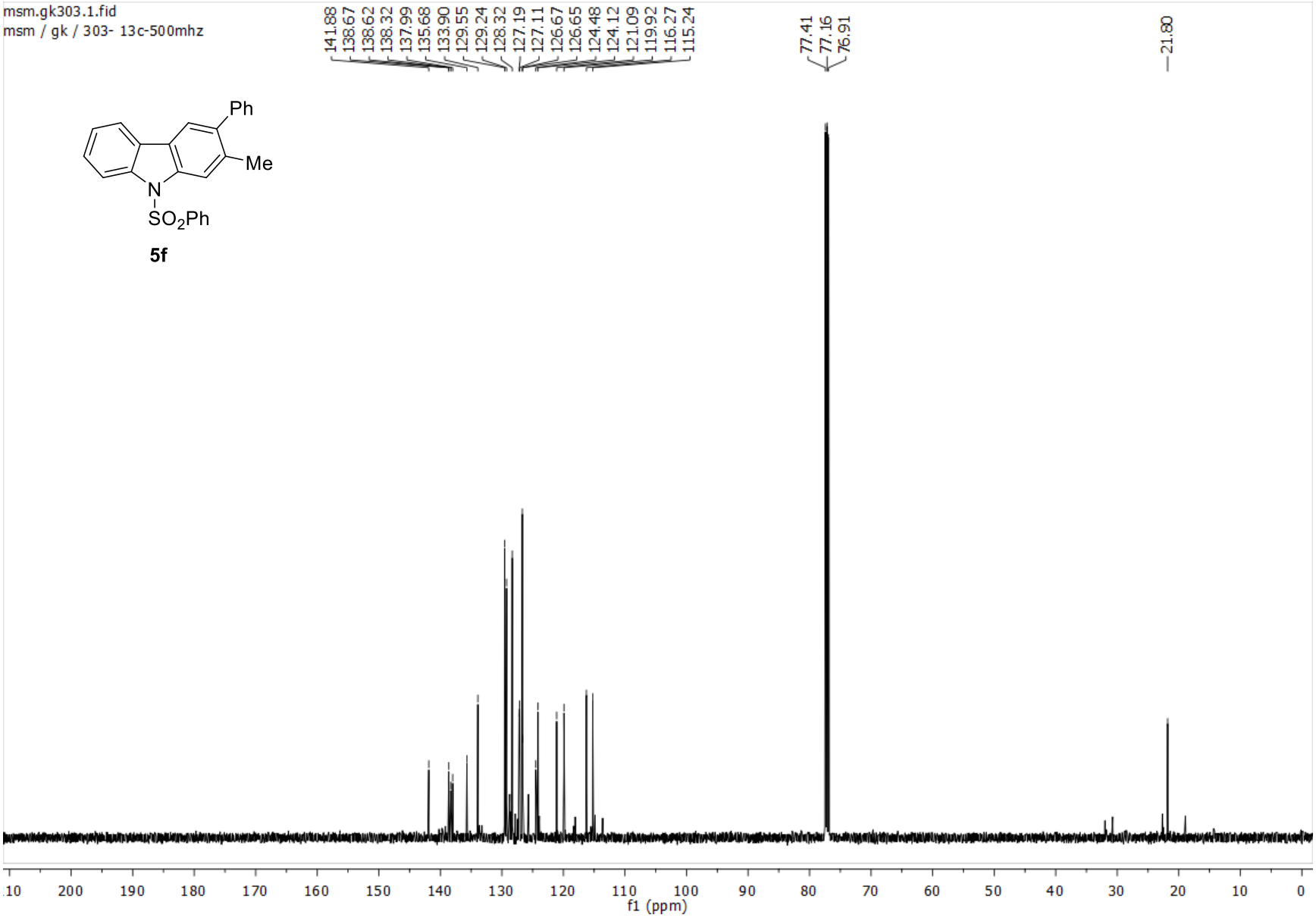

msm.gk308a.2.fid
msm.gk308a-13c-500mhz
Me
Me
Me
N
SO2Ph
138.78
138.14
137.71
136.86
133.78
131.37
129.09
128.90
127.35
126.72
126.61
126.57
124.85
124.02
120.35
120.06
115.34
114.89
77.41
77.16
76.91
43.56
36.91
35.03
25.85
25.78
19.51
17.80
f1 (ppm)

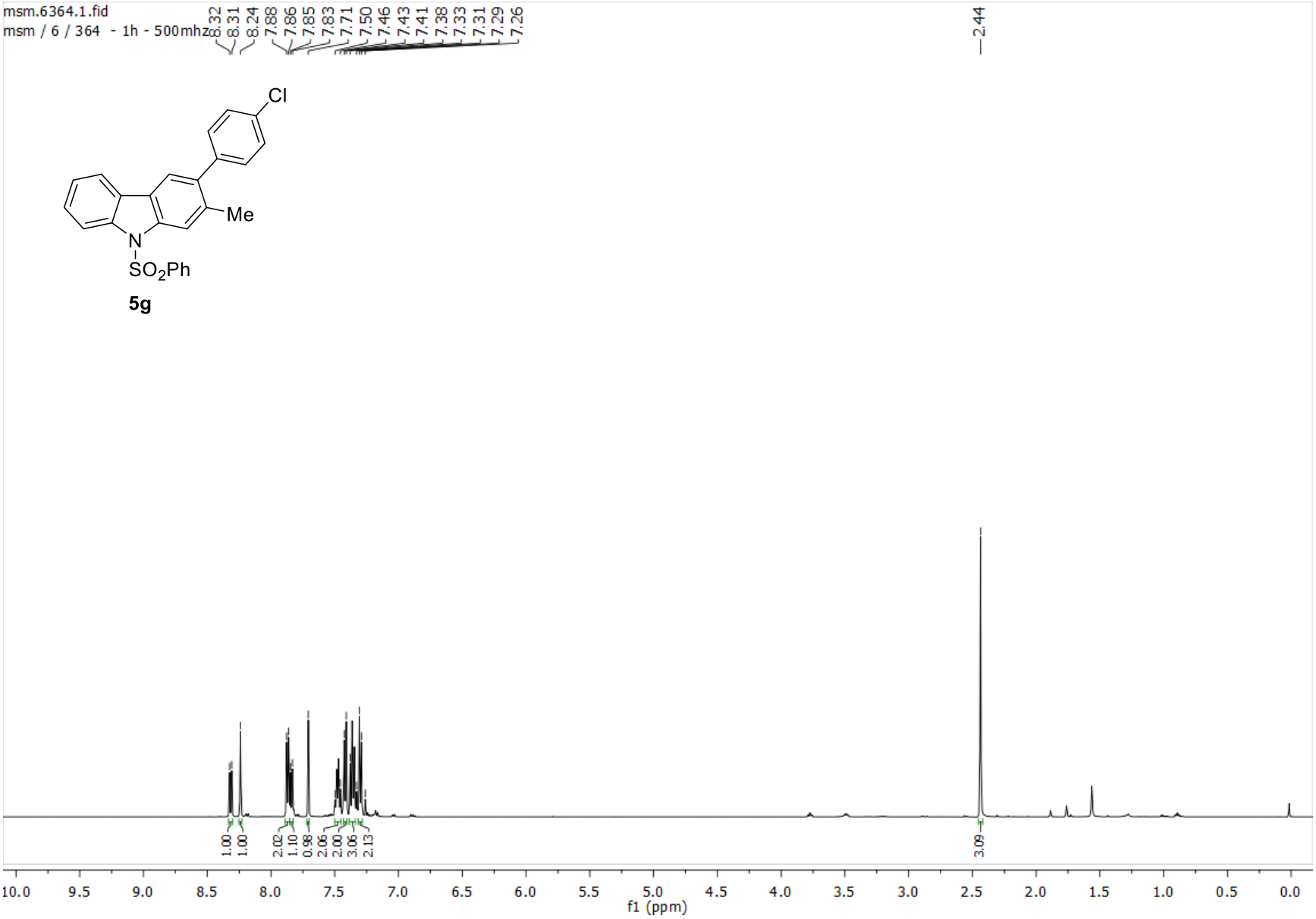
5d

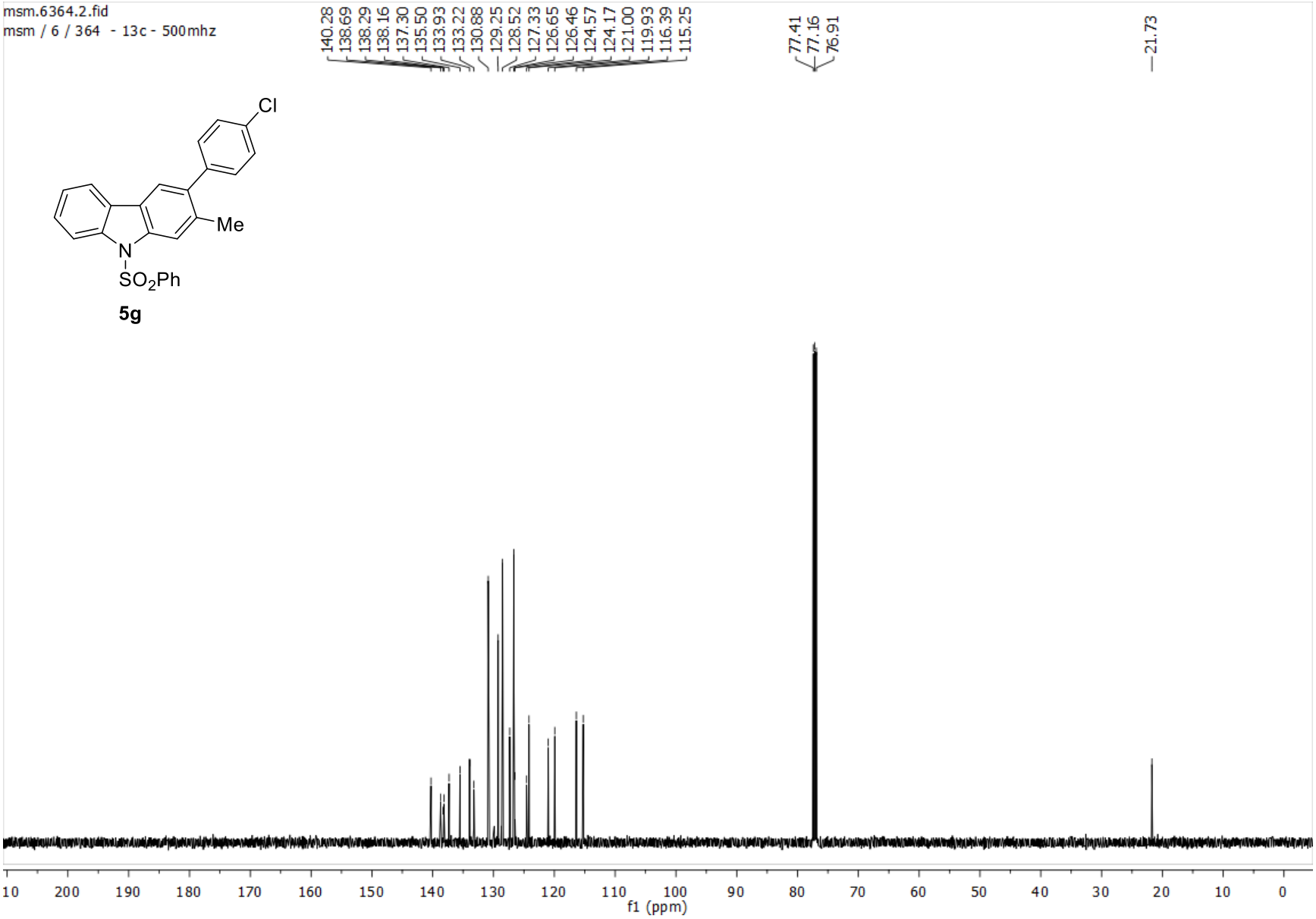

msm.gk306.4.fid
msm / gk / 306 - 13c -500mHz
8.329
8.312
8.298
8.280
7.950
7.841
7.819
7.542
7.467
7.365
7.333
7.297
7.268
7.260
7.240
7.211
SPh
N
SO2Ph
5e
1.11
1.03
1.00
3.05
3.22
3.04
4.03
0.98
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

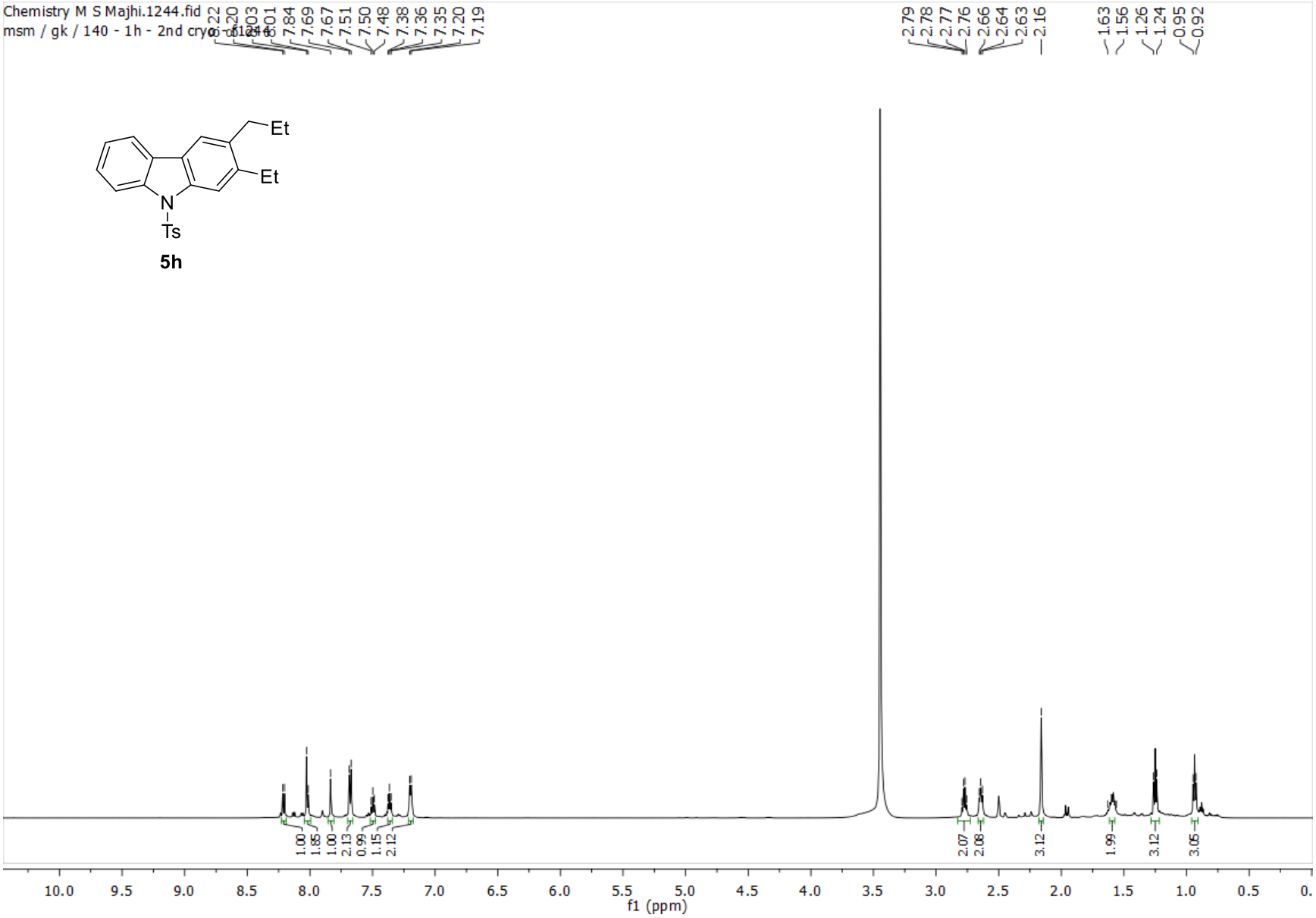

msm.gk306.3.fid
msm / gk / 306 - 13c -500mhz
138.855
138.020
137.897
136.948
134.083
131.618
130.464
130.142
129.351
129.282
128.065
127.622
126.906
126.655
125.790
124.313
124.017
120.374
116.030
115.310
77.414
77.160
76.906
SPh
N
SO2Ph
5e
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

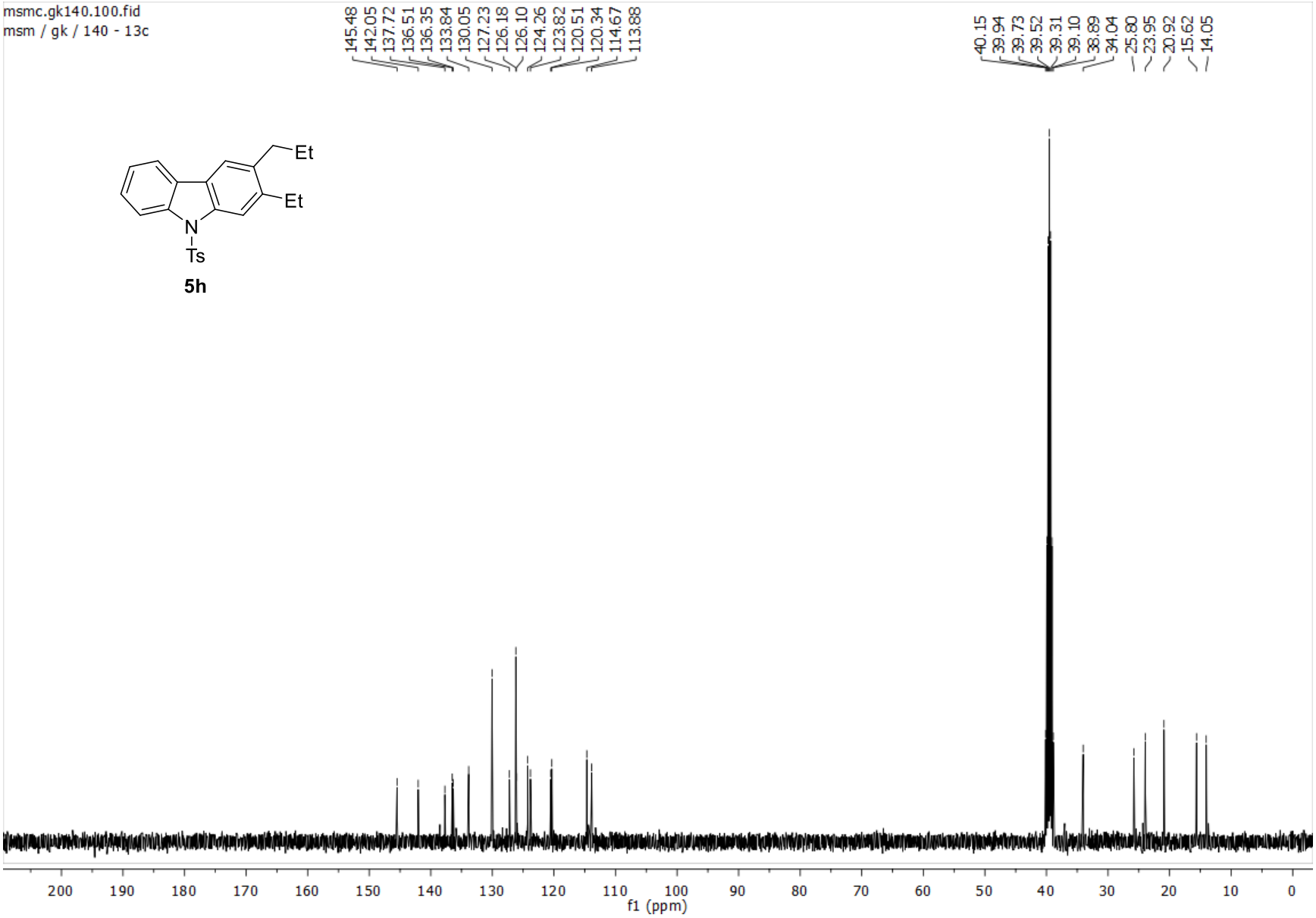

msm.gk303.100.fid
msm / gk / 303 -1h
8.33
8.30
8.24
7.89
7.87
7.85
7.83
7.75
7.49
7.43
7.39
7.34
7.26
2.46
Ph
Me
N
SO2Ph
5f
0.99
1.00
2.06
1.16
0.98
4.12
6.08
3.20
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

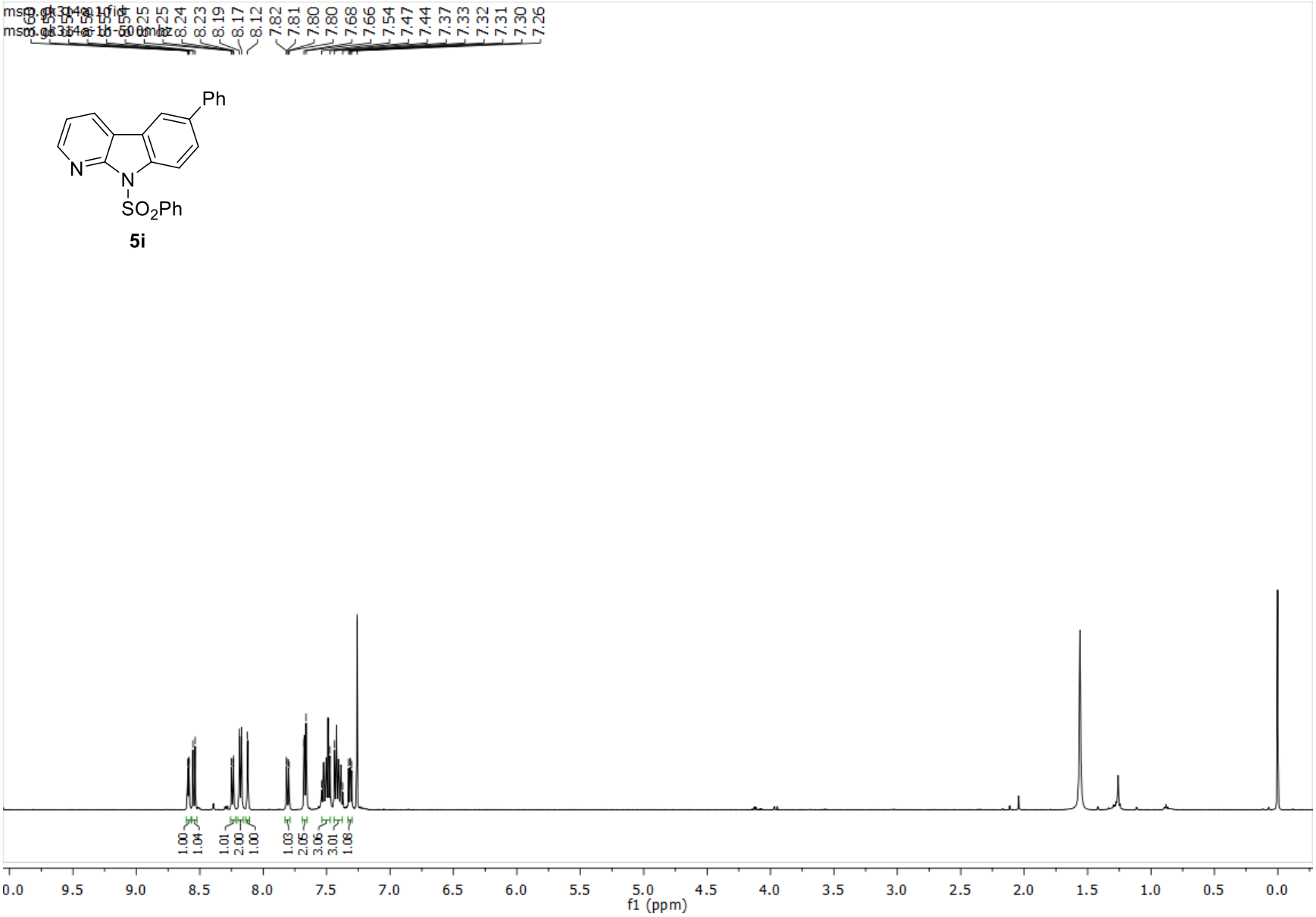

msm.gk303.1.fid
msm / gk / 303- 13c-500mhz
141.88
138.67
138.62
138.32
137.99
135.68
133.90
129.55
129.24
128.32
127.19
127.11
126.67
126.65
124.48
124.12
121.09
119.92
116.27
115.24
77.41
77.16
76.91
21.80
Ph
Me
N
SO2Ph
5f
f1 (ppm)


msm.6364.1.fid
msm / 6 / 364 - 1h - 500mhz
8.32
8.31
8.24
7.88
7.86
7.85
7.83
7.71
7.50
7.46
7.43
7.41
7.38
7.33
7.31
7.29
7.26
2.44
Cl
Me
N
SO2Ph
5g
1.00
1.00
2.02
1.10
0.98
2.06
2.00
3.06
2.13
3.09
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

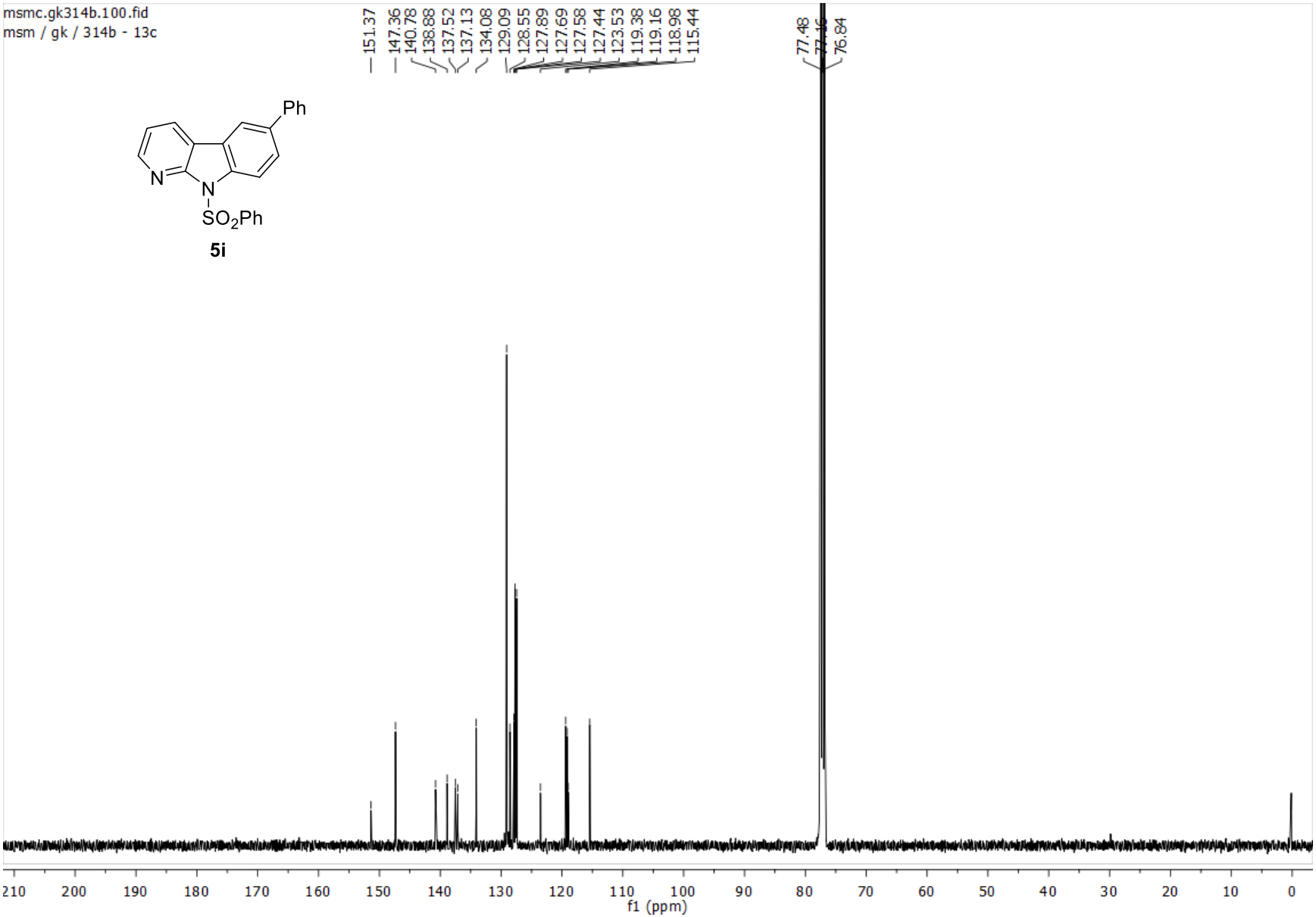

msm.6364.2.fid
msm / 6 / 364 - 13c - 500mhz
140.28
138.69
138.29
138.16
137.30
135.50
133.93
133.22
130.88
129.25
128.52
127.33
126.65
126.46
124.57
124.17
121.00
119.93
116.39
115.25
77.41
77.16
76.91
21.73
Cl
Me
N
SO2Ph
5g
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

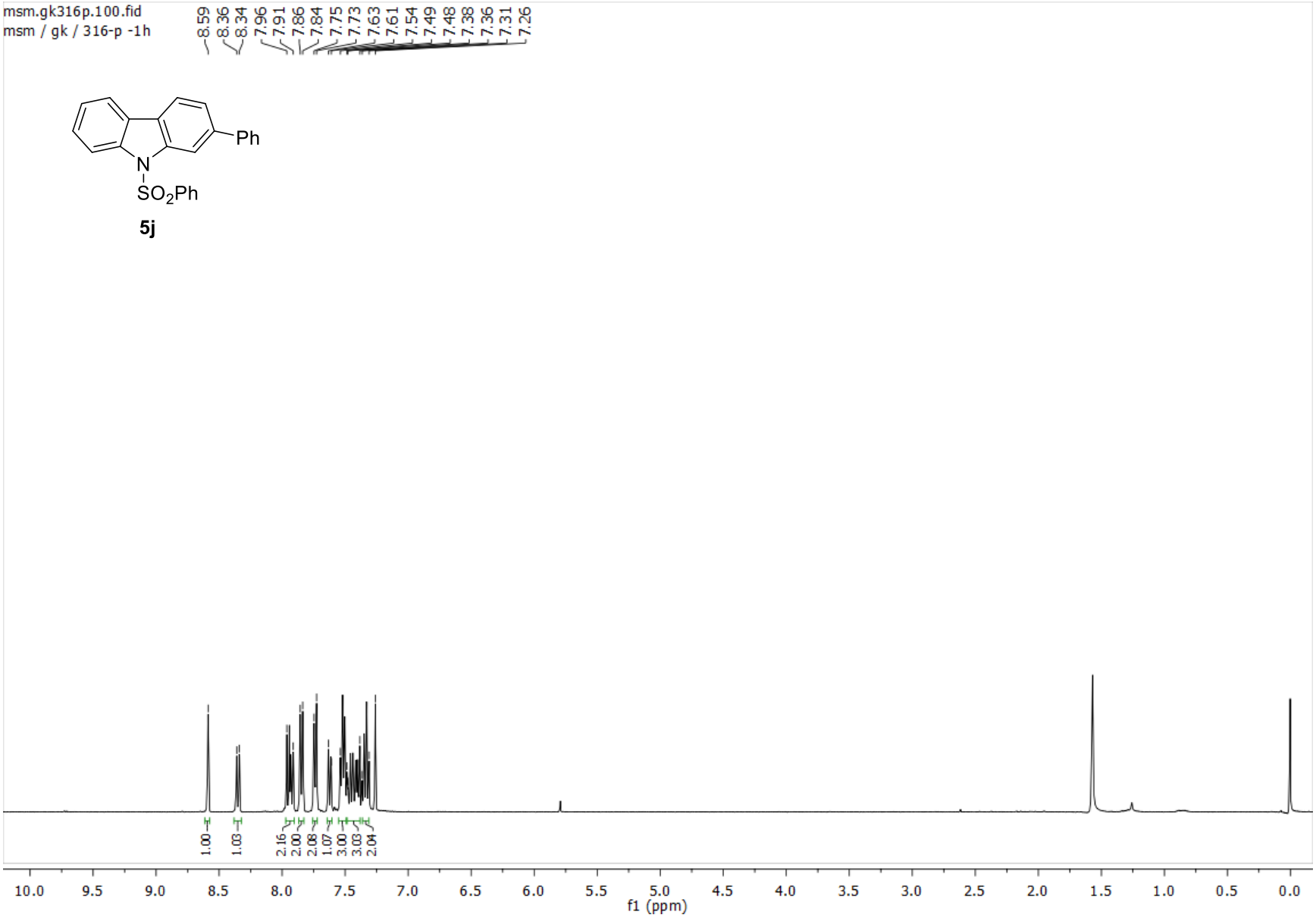

Chemistry M S Majhi.1244.fid
msm / gk / 140 - 1h - 2nd cryo - c1244
8.22
8.20
8.03
8.01
7.84
7.69
7.67
7.51
7.50
7.48
7.38
7.36
7.35
7.20
7.19
2.79
2.78
2.77
2.76
2.66
2.64
2.63
2.16
1.63
1.56
1.26
1.24
0.95
0.92
Et
Et
N
Ts
5h
1.00
1.85
1.00
2.13
0.99
1.15
2.12
2.07
2.08
3.12
1.99
3.12
3.05
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

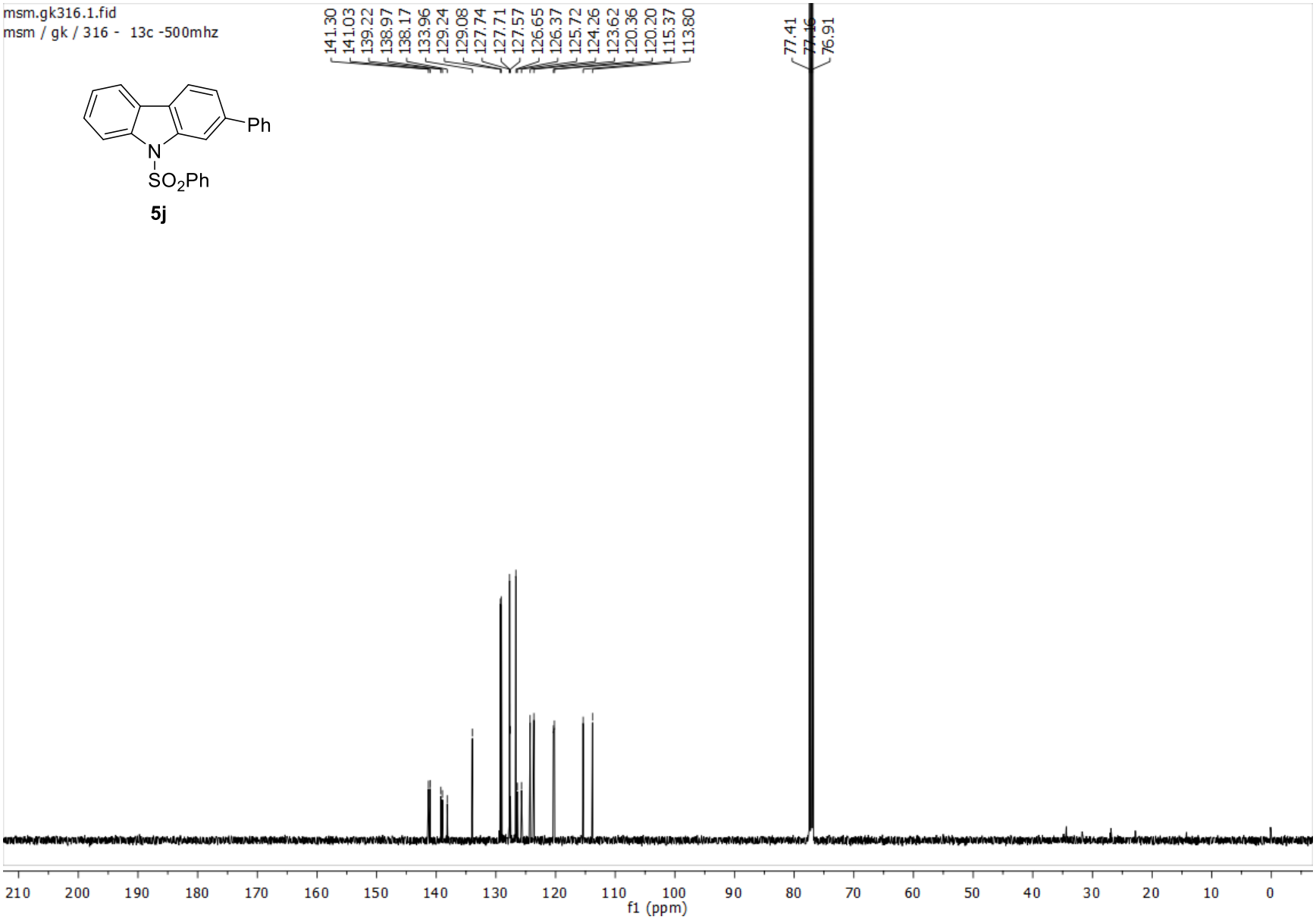

msmc.gk140.100.fid
msm / gk / 140 - 13c
145.48
142.05
137.72
136.51
136.35
133.84
130.05
127.23
126.18
126.10
124.26
123.82
120.51
120.34
114.67
113.88
40.15
39.94
39.73
39.52
39.31
39.10
38.89
34.04
25.80
23.95
20.92
15.62
14.05
Et
Et
N
Ts
5h
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

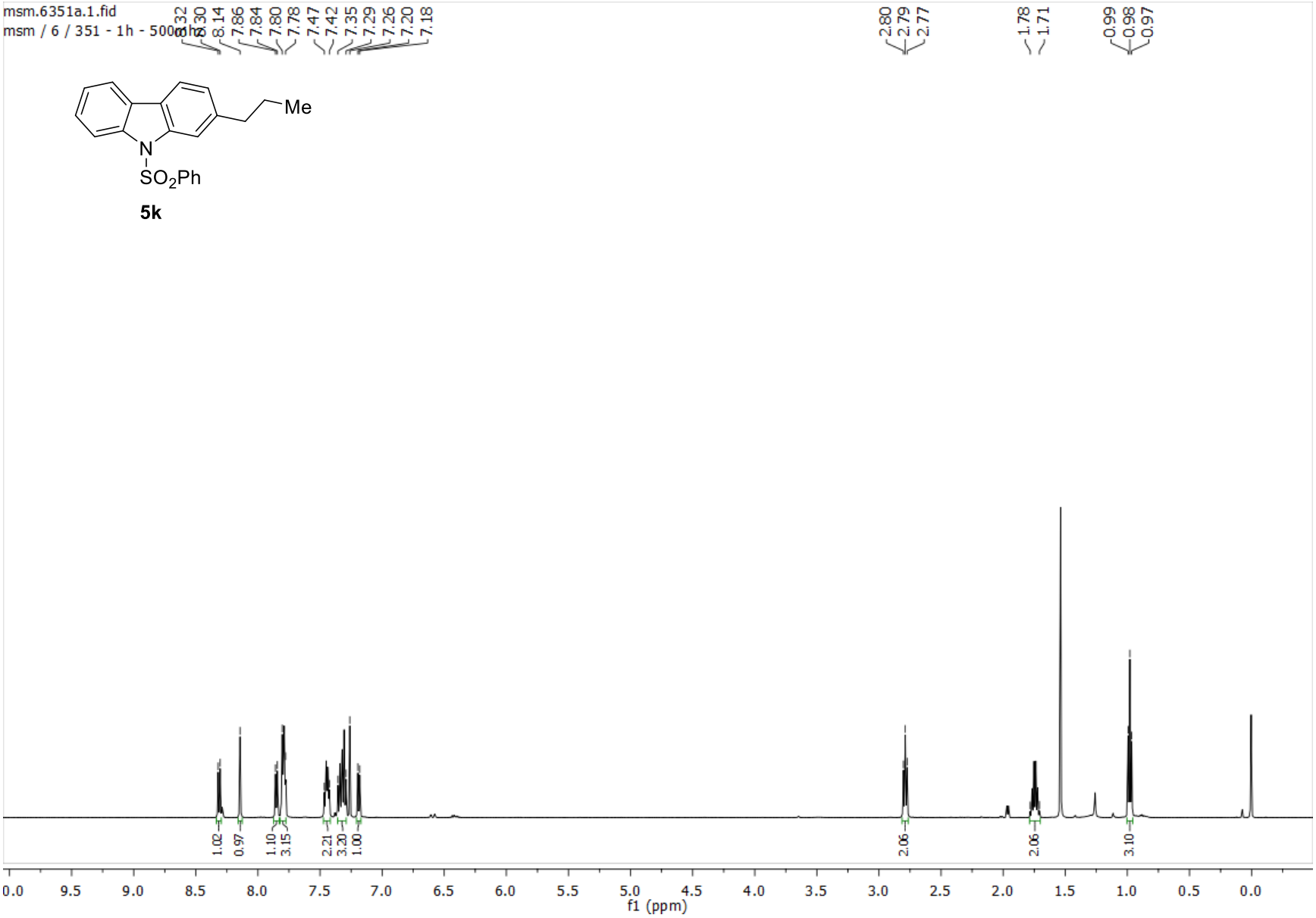

8.25
8.24
8.23
8.19
8.17
8.12
7.82
7.81
7.80
7.80
7.68
7.66
7.54
7.47
7.44
7.37
7.33
7.32
7.31
7.30
7.26
Ph
N
N
SO2Ph
1.00
1.04
1.01
2.00
1.00
1.03
2.05
3.06
3.01
1.08
f1 (ppm)

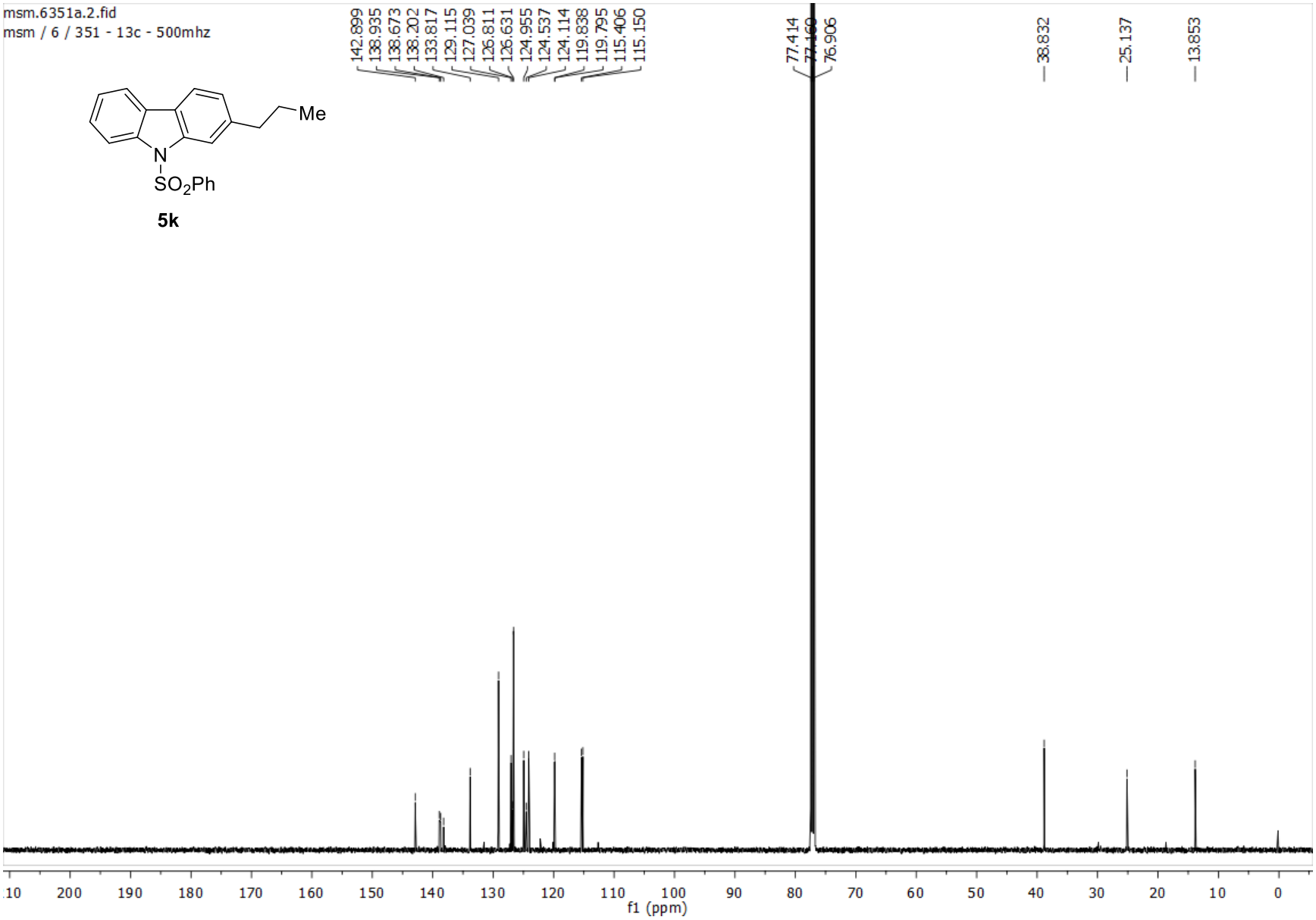
5i

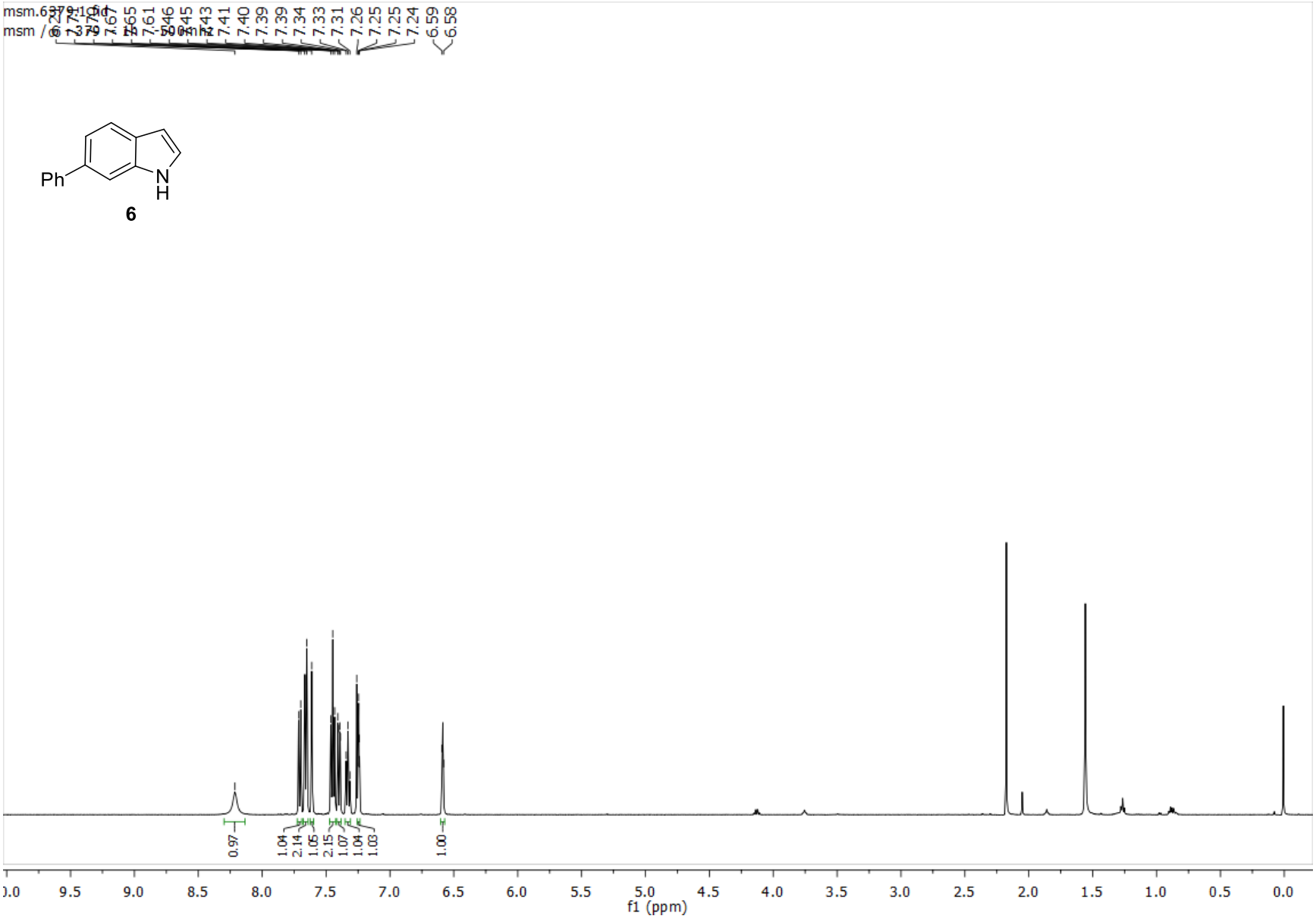

msmc.gk314b.100.fid
msm / gk / 314b - 13c
151.37
147.36
140.78
138.88
137.52
137.13
134.08
129.09
128.55
127.89
127.69
127.58
127.44
123.53
119.38
119.16
118.98
115.44
77.48
76.84
Ph
N
N
SO2Ph
5i
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

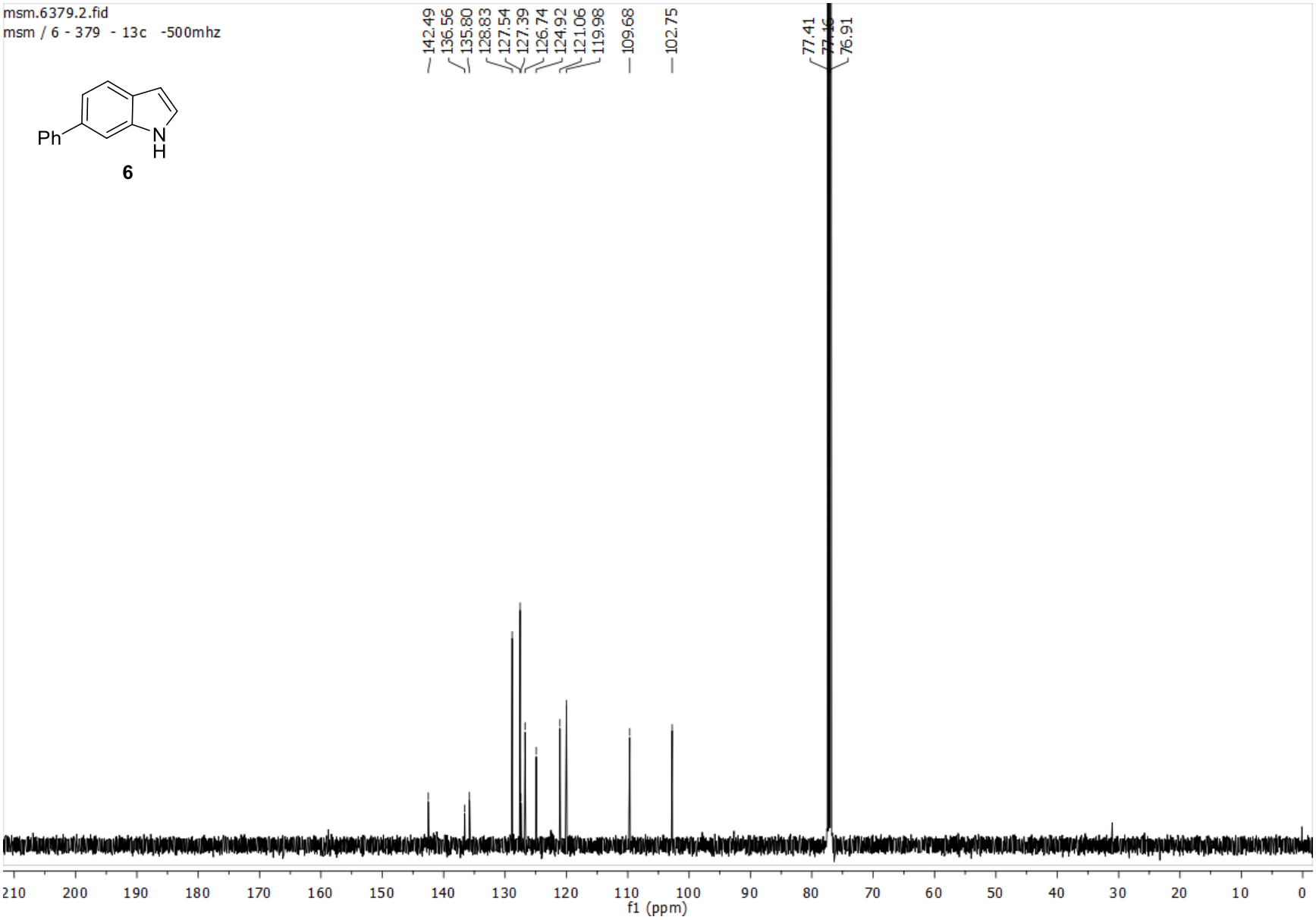

msm.gk316p.100.fid
msm / gk / 316-p -1h
8.59
8.36
8.34
7.96
7.91
7.86
7.84
7.75
7.73
7.63
7.61
7.54
7.49
7.48
7.38
7.36
7.31
7.26
Ph
N
SO2Ph
5j
1.00
1.03
2.16
2.00
2.08
1.07
3.00
3.03
2.04
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

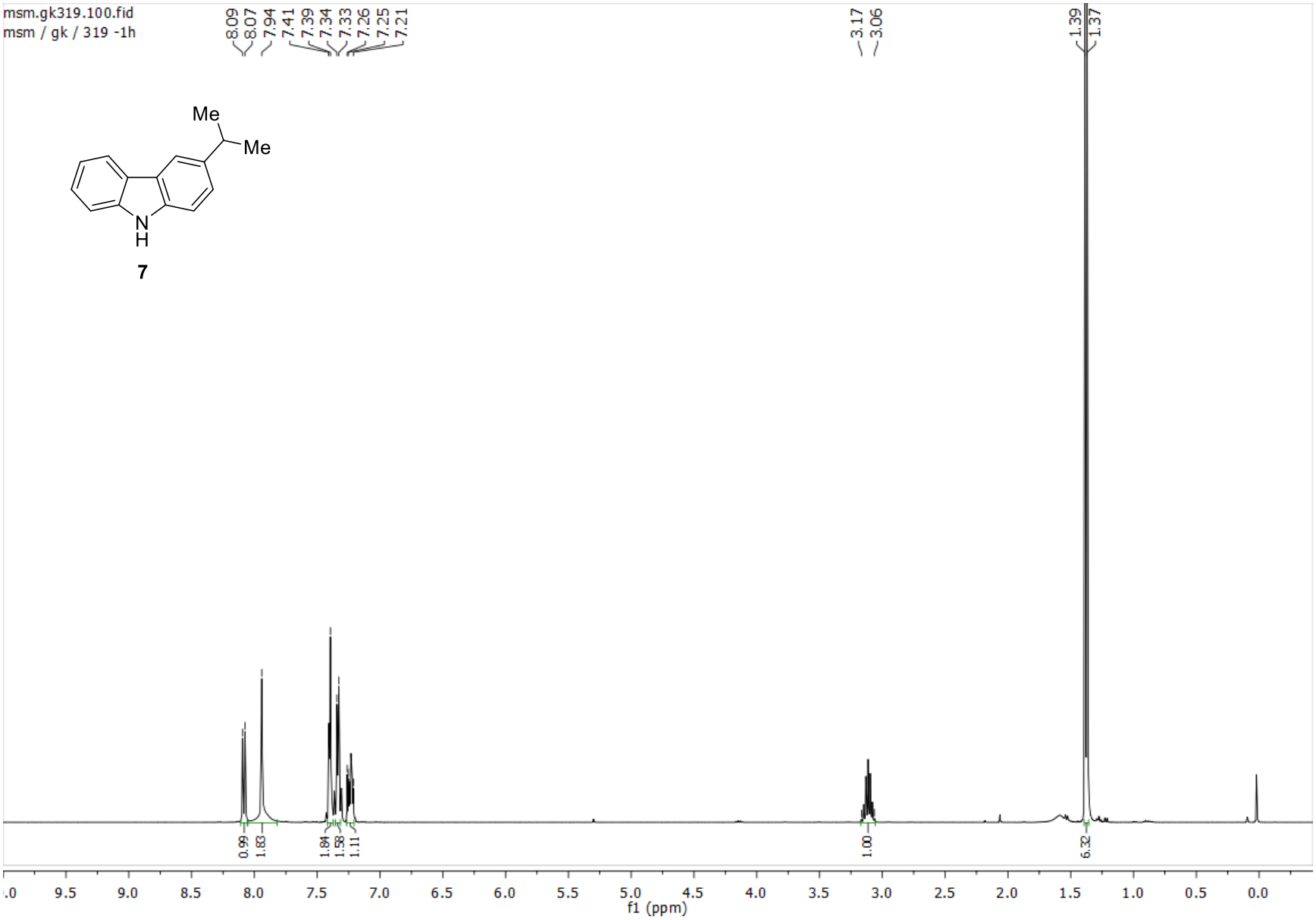

msm.gk316.1.fid
msm / gk / 316 - 13c -500mhz
141.30
141.03
139.22
138.97
138.17
133.96
129.24
129.08
127.74
127.71
127.57
126.65
126.37
125.72
124.26
123.62
120.36
120.20
115.37
113.80
77.41
77.16
76.91
Ph
N
SO2Ph
5j
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

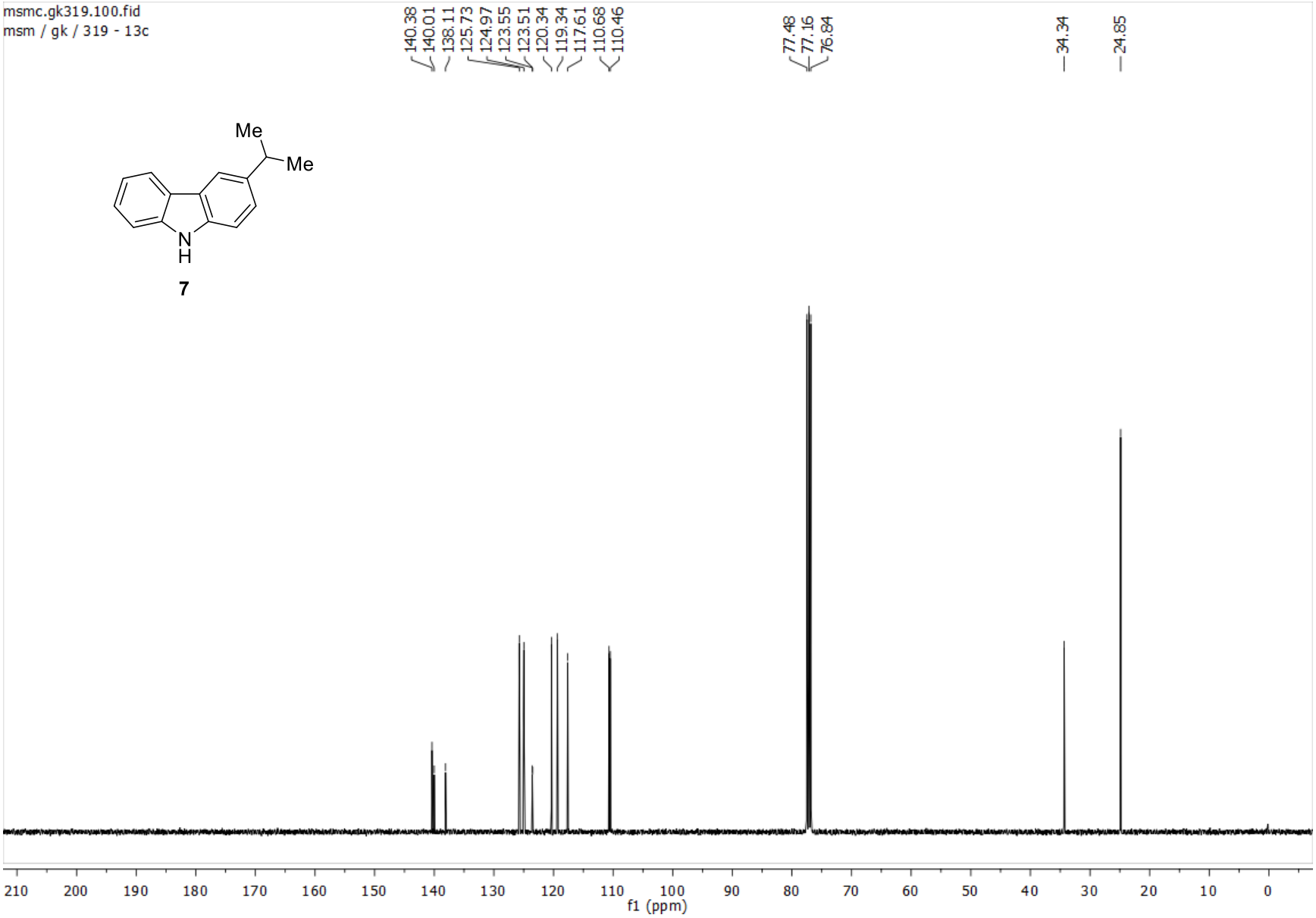

msm.6351a.1.fid
msm / 6 / 351 - 1h - 500mhz
8.32
8.30
8.14
7.86
7.84
7.80
7.78
7.47
7.42
7.35
7.29
7.26
7.20
7.18
2.80
2.79
2.77
1.78
1.71
0.99
0.98
0.97
Me
N
SO2Ph
5k
1.02
0.97
1.10
3.15
2.21
3.20
1.00
2.06
2.06
3.10
f1 (ppm)

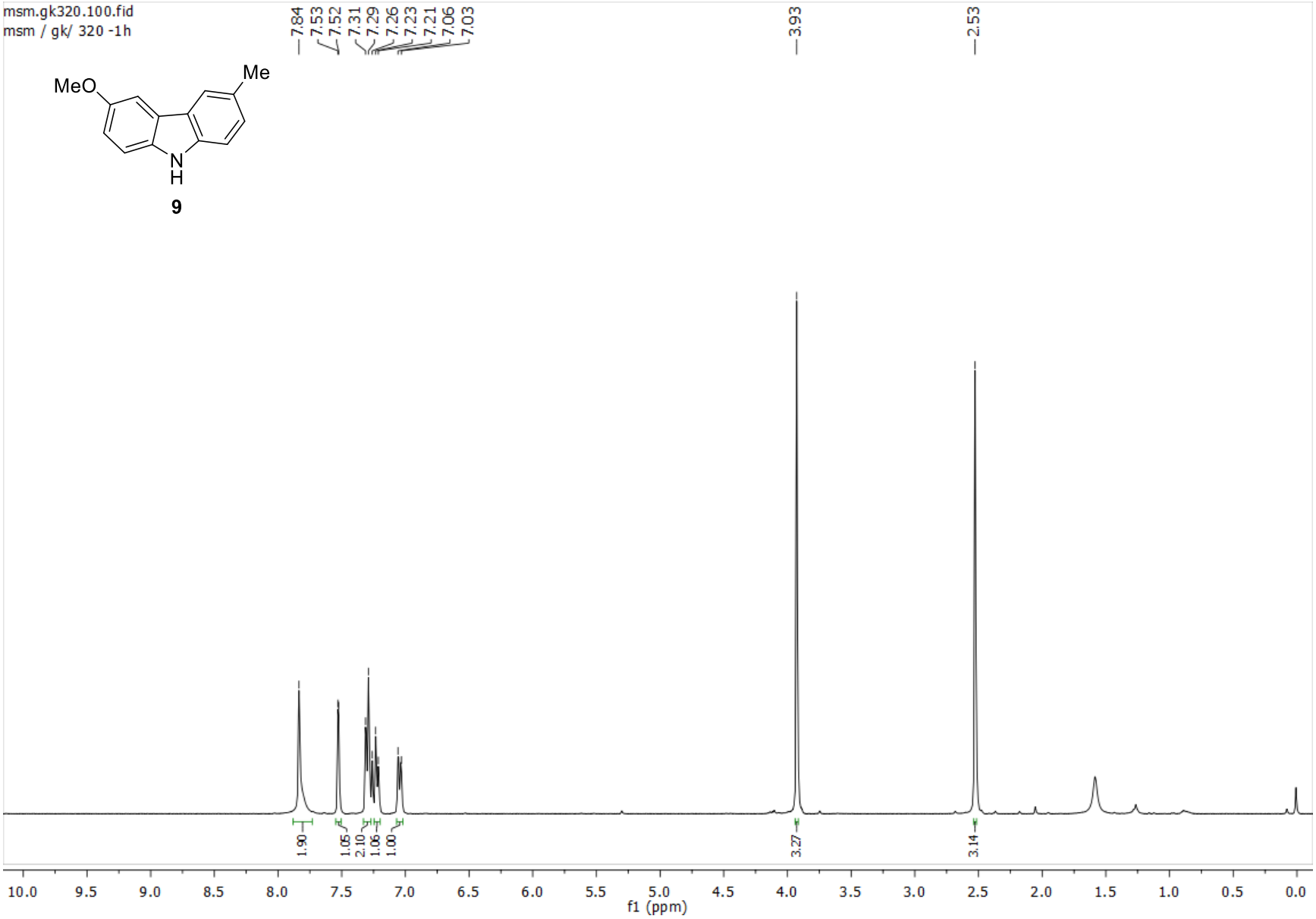

msm.6351a.2.fid
msm / 6 / 351 - 13c - 500mhz
142.899
138.935
138.673
138.202
133.817
129.115
127.039
126.811
126.631
124.955
124.537
124.114
119.838
119.795
115.406
115.150
77.414
76.906
38.832
25.137
13.853
Me
N
SO2Ph
5k
f1 (ppm)

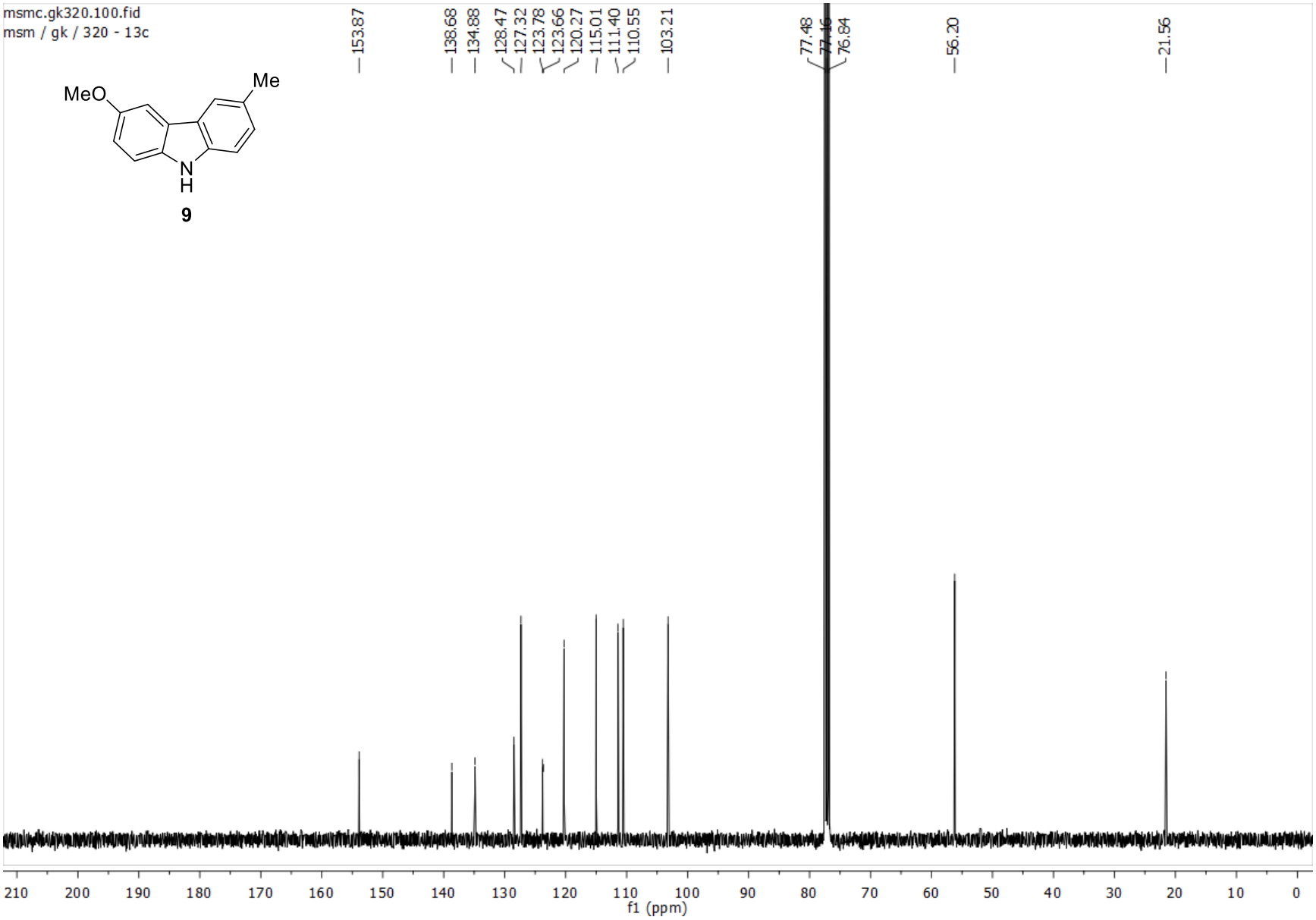

msm.6379.1.fid
msm / 6 - 379 - 1 - 1 - 500mhz
7.67
7.65
7.61
7.46
7.45
7.43
7.41
7.40
7.39
7.39
7.34
7.33
7.31
7.26
7.25
7.25
7.24
6.59
6.58
Ph
N
H
6
0.97
1.04
2.14
1.05
2.15
1.07
1.04
1.03
1.00
f1 (ppm)

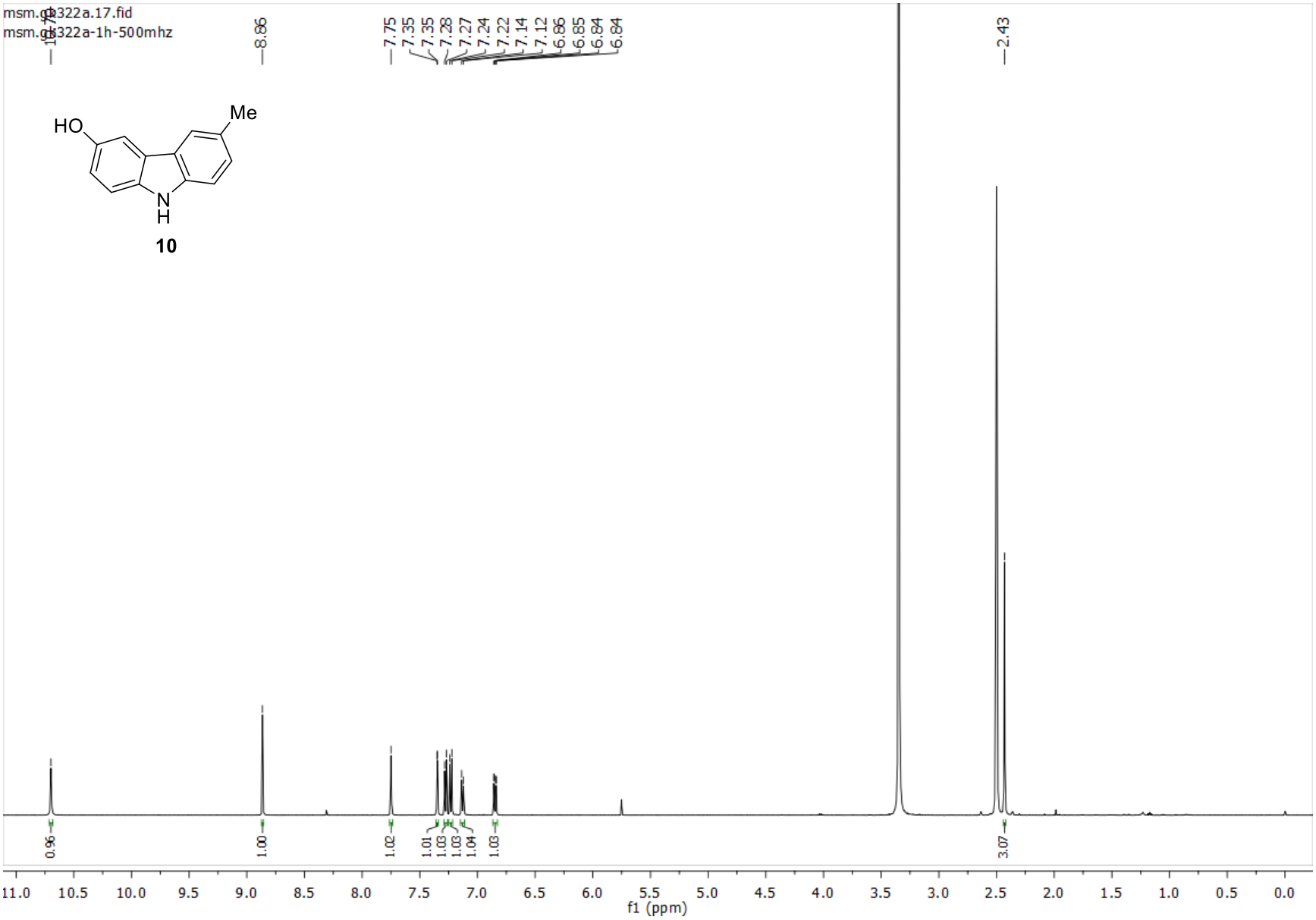

msm.6379.2.fid
msm / 6 - 379 - 13c -500mhz
142.49
136.56
135.80
128.83
127.54
127.39
126.74
124.92
121.06
119.98
109.68
102.75
77.41
77.16
76.91
Ph
N
H
6
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

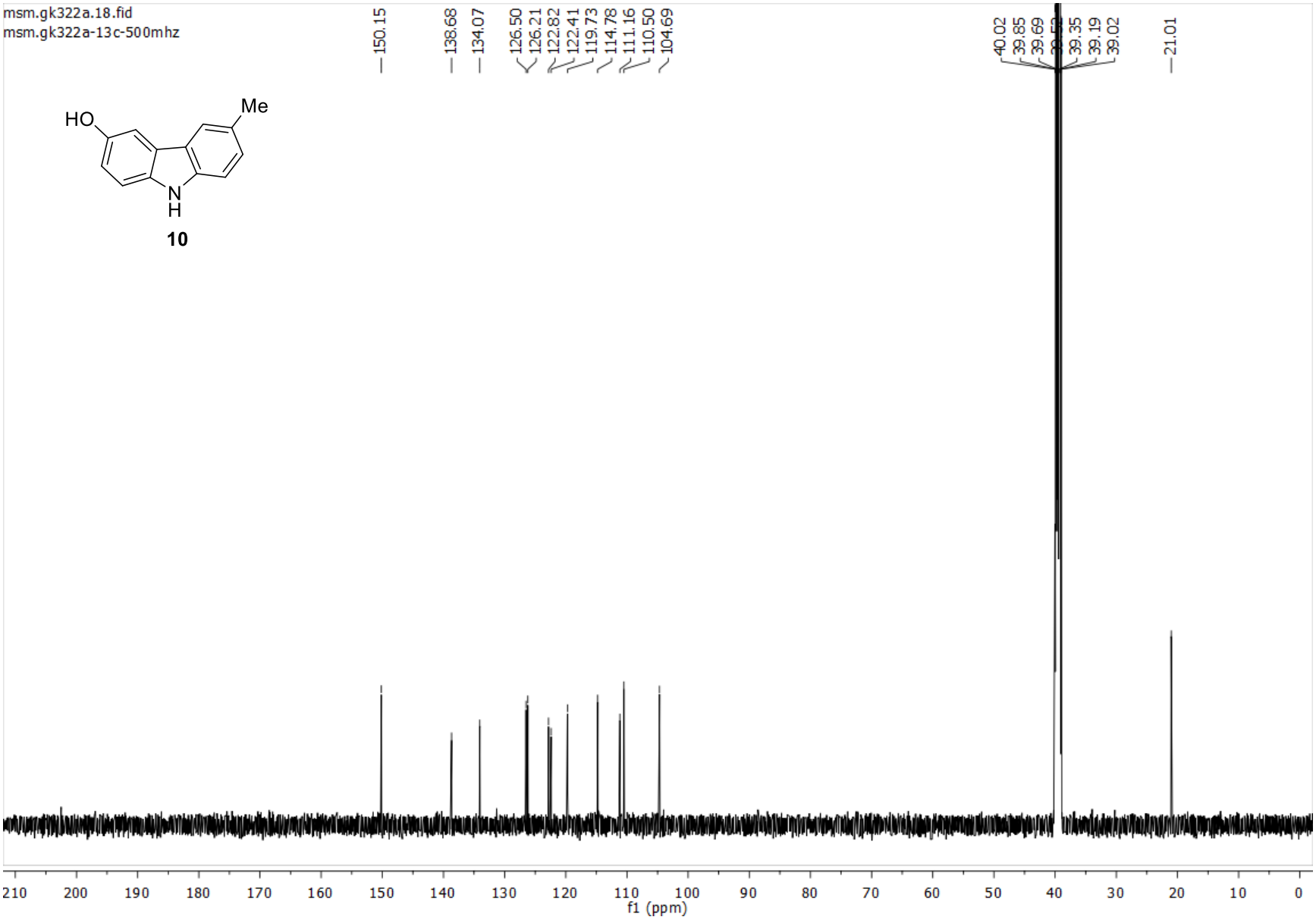

msm.gk319.100.fid
msm / gk / 319 -1h
8.09
8.07
7.94
7.41
7.39
7.34
7.33
7.26
7.25
7.21
3.17
3.06
1.39
1.37
Me
Me
N
H
7
0.99
1.83
1.84
1.58
1.11
1.00
6.32
f1 (ppm)


msmc.gk319.100.fid
msm / gk / 319 - 13c
140.38
140.01
138.11
125.73
124.97
123.55
123.51
120.34
119.34
117.61
110.68
110.46
77.48
77.16
76.84
34.34
24.85
Me
Me
N
H
7
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


msm.gk320.100.fid
msm / gk/ 320 -1h
7.84
7.53
7.52
7.31
7.29
7.26
7.23
7.21
7.06
7.03
3.93
2.53
MeO
Me
N
H
9
1.90
1.05
2.10
1.06
1.00
3.27
3.14
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


msmc.gk320.100.fid
msm / gk / 320 - 13c
MeO
Me
N
H
9
153.87
138.68
134.88
128.47
127.32
123.78
123.66
120.27
115.01
111.40
110.55
103.21
77.48
77.16
76.84
56.20
21.56
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


msm.gk322a.17.fid
msm.gk322a-1h-500mhz
10.78
8.86
7.75
7.35
7.35
7.28
7.27
7.24
7.22
7.14
7.12
6.86
6.85
6.84
6.84
2.43
HO
Me
N
H
10
0.96
1.00
1.02
1.01
1.03
1.03
1.04
1.03
3.07
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


msm.gk322a.18.fid
msm.gk322a-13c-500mhz
150.15
138.68
134.07
126.50
126.21
122.82
122.41
119.73
114.78
111.16
110.50
104.69
40.02
39.85
39.69
39.35
39.19
39.02
21.01
HO
Me
N
H
10
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)