Supporting Information

Efficient Synthesis of Cyclic Amidines-Based Fluorophores via 6π-Electrocyclic Ring Closure

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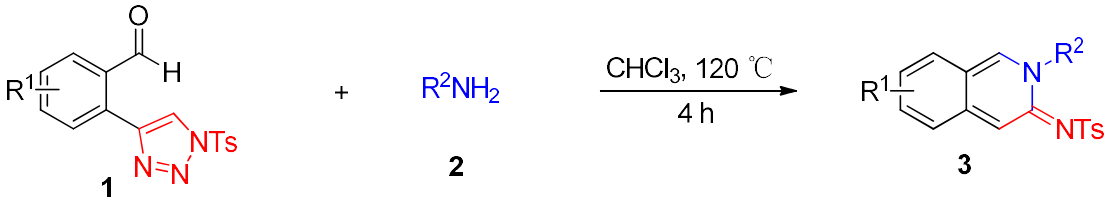
General methods:

Unless stated otherwise, all solvents were purified and dried according to standard methods prior to use. The solvents were distilled from indicated drying reagents: dichlormethane (CaH_2), tetrahydrofuran (Na), diethyl ether (Na), ethyl acetate ($CaCl_2$), 1,4-Dioxane (Na), toluene (Na). N-sulfonly triazoles **1**[1] were prepared according to literature and phenylamine **2** were purchased from Energy chemical and Macklin (China). The reaction products were purified by chromatograph, using 200-300 mesh silica gel (Qingdao, China). ^1H and ^{13}C NMR spectra were recorded on a Varian instrument (400 MHz and 100 MHz, respectively) and internally referenced to tetramethylsilane signal or residual protio solvent signals. Data for ^1H NMR are recorded as follows: chemical shift (δ, ppm), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet, q = quartet or unresolved, coupling constant (s) in Hz, integration). Data for ^{13}C NMR are reported in terms of chemical shift (δ, ppm). High resolution mass spectra (HRMS) were obtained by the ESI ionization sources. IR spectra were recorded on a FT-IR spectrometer and only major peaks were reported in cm^{-1}. Absorption spectra were obtained on a SHIMADZU UV-2600 spectrophotometer. Fluorescence spectra and absolute fluorescence quantum yield were obtained on a HORIBA Fluoromax-4 spectrofluorometer with a calibrated integrating sphere. The photostability was tested on an EDINBURGH FLS920 spectrometer. WT 22RV1 cells or NK-1 receptors-overexpressed 22RV1 cells were supplied by the Mou laboratory of Lanzhou University. Hela cells were supplied by the Li laboratory of Sun Yat-Sen University. The confocol imaging experiments were performed on a ZEISS LSM *T-PMT* confocal fluorescent microscope. NK1R inhibitor aprepitant was purchased from Sigma-Aldrich.

General procedure and spectral data for the synthesis of 3



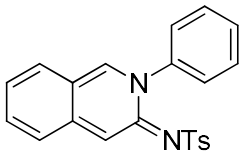
A solution of N-sulfonly triazoles **1** (0.10 mmol, 1.0 equiv) and phenylamine **2** (0.12mmol, 1.2 equiv) in dry $CHCl_3$ (2 mL) was stirred at 120 °C for 4h in a well-sealed tube. After completion of the reaction as indicated by TLC, the reaction was cooled to room temperature, and the mixture was purified by silica gel column flash chromatography (DCM: MeOH = 20:1 to 10:1) to afford product **3** as yellow solid.

1 mmol scale for the synthesis of 3au

A solution of N-sulfonly triazoles **1a** (1.0 mmol, 1.0 equiv) and 3-(4-aminophenyl)propanoic acid (1.2 mmol, 1.2 equiv) in dry $CHCl_3$ (20 mL) was stirred at 120 °C for 4h in a well-sealed tube. After completion of the reaction as indicated by TLC, the reaction was cooled to room temperature, and the mixture was purified by silica gel column flash chromatography (DCM: MeOH = 20:1 to 10:1) to afford product **3au** in 92.4% yield as yellow solid.

Spectral data for the cyclic amidines 3

4-methyl-N-(2-phenylisoquinolin-3(2H)-ylidene)benzenesulfonamide **(3aa)**



Yellow solid (34.0 mg, 91% yield);

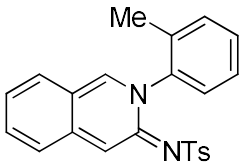
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.44 (s, 1H), 7.93 (s, 1H), 7.67 (d, *J* = 8.2 Hz, 2H), 7.58 (d, *J* = 8.5 Hz, 1H), 7.51 (d, *J* = 5.1 Hz, 2H), 7.49 – 7.42 (m, 3H), 7.35 – 7.28 (m, 2H), 7.22 – 7.15 (m, 1H), 7.12 (d, *J* = 8.0 Hz, 2H), 2.33 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.5, 142.7, 141.8, 141.6, 141.3, 141.1, 134.2, 129.6, 129.4, 128.9, 127.9, 126.6, 126.2, 125.7, 125.4, 120.0, 111.4, 21.4;

IR: 2923, 1640, 1601, 1494, 1471, 1367, 1274, 1262, 1131, 1080, 951, 763 cm^{-1};

HRMS (ESI): $C_{22}H_{18}N_2O_2S$+H, Calc: 375.1162, Found: 375.1148.

4-methyl-N-(2-(o-tolyl)isoquinolin-3(2H)-ylidene)benzenesulfonamide (**3ab**)



Yellow solid (27.9 mg, 72% yield);

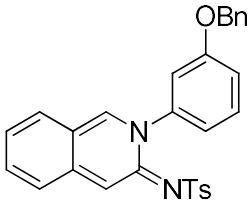
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.34 (s, 1H), 8.02 (s, 1H), 7.67 (d, *J* = 8.2 Hz, 2H), 7.63 – 7.48 (m, 3H), 7.44 (dd, *J* = 10.8, 4.1 Hz, 1H), 7.41 – 7.32 (m, 2H), 7.25 – 7.08 (m, 4H), 2.34 (s, 3H), 2.02 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.6, 142.0, 142.0, 141.5, 141.2, 141.0, 134.3, 134.0, 131.2, 129.9, 128.8, 127.7, 127.2, 126.4, 126.2, 125.9, 125.3, 120.0, 111.5, 21.3, 17.6;

IR: 2922, 1640, 1600, 1468, 1367, 1269, 1131, 1081, 950, 763 cm^{-1};

HRMS (ESI): $C_{23}H_{20}N_2O_2S$+H, Calc: 389.1318, Found: 389.1318.

N-(2-(3-(benzyloxy)phenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3ac**)



Yellow solid (41.3 mg, 86% yield);

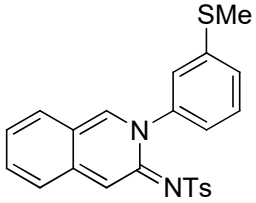
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.45 (s, 1H), 7.95 (s, 1H), 7.74 (d, *J* = 8.2 Hz, 2H), 7.59 (d, *J* = 8.6 Hz, 1H), 7.52 (d, *J* = 3.4 Hz, 2H), 7.38 (dt, *J* = 11.8, 4.1 Hz, 6H), 7.25 – 7.18 (m, 1H), 7.11 (ddd, *J* = 9.8, 8.4, 4.9 Hz, 3H), 7.00 (t, *J* = 2.2 Hz, 1H), 6.92 (dd, *J* = 7.8, 1.2 Hz, 1H), 4.97 (s, 2H), 2.36 – 2.26 (m, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 159.3, 152.4, 142.6, 141.8, 141.5, 141.1, 136.3, 134.1, 130.2, 128.9 128.7, 128.2, 127.9, 127.6, 126.2, 125.8, 125.3, 119.9 119.0, 116.4, 113.4, 111.4, 70.4, 21.3;

IR: 2922, 1640, 1601, 1469, 1367, 1131, 1080, 953 cm^{-1};

HRMS (ESI): $C_{29}H_{24}N_2O_3S$+H, Calc: 481.1580, Found: 481.1580.

4-methyl-N-(2-(3-(methylthio)phenyl)isoquinolin-3(2H)-ylidene)benzenesulfonamide (**3ad**)



Yellow solid (30.2 mg, 72% yield);

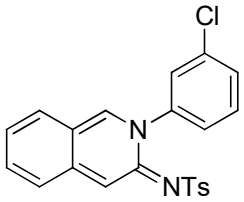
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.42 (d, *J* = 2.2 Hz, 1H), 8.01 (d, *J* = 5.7 Hz, 1H), 7.79 – 7.70 (m, 2H), 7.63 – 7.48 (m, 3H), 7.46 – 7.32 (m, 2H), 7.25 – 7.13 (m, 4H), 7.13 – 7.06 (m, 1H), 2.46 (s, 3H), 2.36 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.5, 142.2, 142.2, 141.9, 141.4, 141.1, 140.8, 134.2, 129.6, 128.9, 127.7, 127.3, 126.2, 125.9, 125.4, 124.0, 122.9, 119.9, 111.6, 21.4, 15.5.

IR: 3056, 1639, 1600, 1467, 1366, 1265, 1130, 1080, 951 cm^{-1};

HRMS (ESI): $C_{23}H_{20}N_2O_2S_2$+H, Calc: 421.1039, Found: 421.1039.

N-(2-(3-chlorophenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3ae**)



Yellow solid (28.6 mg, 70% yield);

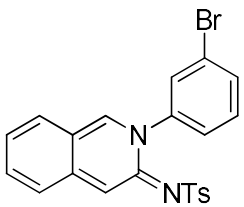
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.40 (s, 1H), 8.01 (s, 1H), 7.73 (d, *J* = 8.2 Hz, 2H), 7.56 (dd, *J* = 14.3, 7.0 Hz, 3H), 7.52 – 7.41 (m, 2H), 7.36 (t, *J* = 1.8 Hz, 1H), 7.32 – 7.25 (m, 2H), 7.25 – 7.11 (m, 3H), 2.37 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.5, 142.4, 142.0, 142.0, 141.3, 141.2, 135.0, 134.3, 130.5, 130.0, 129.0, 127.8, 127.1, 126.1, 125.9, 125.6, 125.0, 120.0, 111.7, 21.4;

IR: 2922, 1641, 1601, 1469, 1368, 1268, 1132, 1081, 952 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2SCl$+H, Calc: 409.0772, Found: 409.0772.

N-(2-(3-bromophenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3af**)



Yellow solid (33.4 mg, 74% yield);

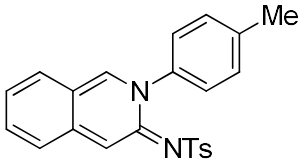
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.39 (s, 1H), 7.98 (s, 1H), 7.71 (d, *J* = 8.2 Hz, 2H), 7.63 (d, *J* = 8.0 Hz, 1H), 7.60 – 7.46 (m, 4H), 7.37 (t, *J* = 8.0 Hz, 1H), 7.31 (d, *J* = 8.6 Hz, 1H), 7.24 – 7.12 (m, 3H), 2.35 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.4, 142.4, 142.0, 141.3, 141.2, 141.1, 134.4, 132.9, 130.8, 129.9, 129.0, 127.8, 126.1, 125.9, 125.6, 125.5, 122.6, 120.0, 111.7, 21.5;

IR: 3026, 1643, 1601, 1474, 1369, 1269, 1130, 1136, 1084, 766, 743 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2SBr$+H, Calc: 453.0267, Found: 453.0264.

4-methyl-N-(2-(p-tolyl)isoquinolin-3(2H)-ylidene)benzenesulfonamide (**3ag**)



Yellow solid (36.1 mg, 93% yield);

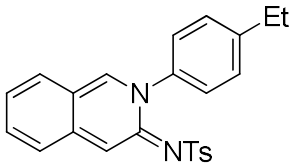
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.35 (s, 1H), 7.84 (s, 1H), 7.63 (d, *J* = 8.2 Hz, 2H), 7.49 (d, *J* = 8.5 Hz, 1H), 7.46 – 7.37 (m, 2H), 7.25 – 7.15 (m, 2H), 7.15 – 7.01 (m, 5H), 2.33 (s, 3H), 2.25 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.7, 142.9, 141.7, 141.3, 141.1, 139.8, 139.2, 134.1, 129.9, 128.9, 127.9, 126.3, 125.7, 125.3, 119.9, 111.2, 21.4, 21.3;

IR: 1640, 1600, 1468, 1366, 1267, 1130, 1080, 950, 750 cm^{-1};

HRMS (ESI): $C_{23}H_{20}N_2O_2S$+H, Calc: 389.1318, Found: 389.1318.

N-(2-(4-ethylphenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3ah**)



Yellow solid (33.8 mg, 84% yield);

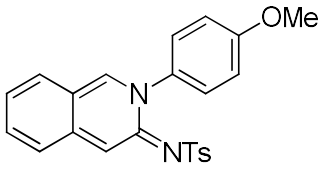
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.44 (s, 1H), 7.91 (s, 1H), 7.70 (d, J = 8.2 Hz, 2H), 7.57 (d, J = 8.5 Hz, 1H), 7.49 (d, J = 4.6 Hz, 2H), 7.25 (dd, J = 23.5, 8.3 Hz, 4H), 7.19 – 7.14 (m, 1H), 7.12 (d, J = 8.0 Hz, 2H), 2.71 (q, J = 7.6 Hz, 2H), 2.33 (s, 3H), 1.27 (t, J = 7.6 Hz, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.7, 146.0 142.7, 141.8, 141.4, 141.0, 139.4, 134.0, 128.8, 127.8, 126.4, 126.3, 125.8, 125.3, 119.9, 111.4, 28.6, 21.4, 15.4;

IR: 2965, 1640, 1600, 1468, 1366, 1130, 1080, 949 cm^{-1};

HRMS (ESI): $C_{24}H_{22}N_2O_2S$+H, Calc: 403.1475, Found: 403.1475.

N-(2-(4-methoxyphenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3ai**)



Yellow solid (34.7 mg, 86% yield);

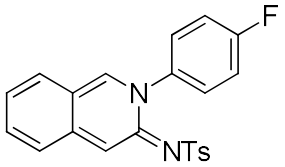
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.44 (s, 1H), 7.95 (s, 1H), 7.74 (d, *J* = 8.2 Hz, 2H), 7.62 – 7.47 (m, 3H), 7.29 (dd, *J* = 6.2, 2.7 Hz, 2H), 7.24 – 7.12 (m, 3H), 7.04 – 6.96 (m, 2H), 3.88 (s, 3H), 2.36 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 160.2, 152.8, 142.9, 141.7, 141.4, 141.1 134.5, 134.0, 128.9, 127.8, 127.7, 126.3, 125.8, 125.3, 119.9, 114.5, 111.4, 55.7, 21.4;

IR: 3057, 2925, 1640, 1600, 1509, 1469, 1367, 1249, 1131, 1081, 951 cm^{-1};

HRMS (ESI): $C_{23}H_{20}N_2O_3S$+H, Calc: 405.1267, Found: 405.1267.

N-(2-(4-fluorophenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3aj**)



Yellow solid (33.8 mg, 86% yield);

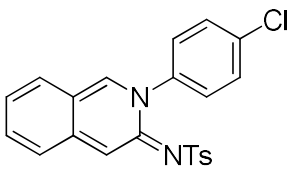
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.45 (s, 1H), 7.88 (s, 1H), 7.68 (d, *J* = 8.2 Hz, 2H), 7.59 (d, *J* = 8.6 Hz, 1H), 7.53 – 7.44 (m, 2H), 7.37 – 7.28 (m, 2H), 7.21 – 7.07 (m, 5H), 2.33 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 164.0, 161.5, 152.6, 142.6, 141.9, 141.3, 141.2, 137.5, 134.3, 129.2, 128.9, 128.6, 128.6, 127.9, 126.1, 125.8, 125.5, 120.0, 116.5, 116.3, 111.4, 21.4;

IR: 1641, 1600, 1505, 1469, 1367, 1131, 1080, 950, 839, 749 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2FS$+H, Calc: 393.1068, Found: 393.1068.

N-(2-(4-chlorophenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3ak**)



Yellow solid (26.9 mg, 66% yield);

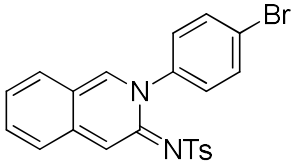
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.42 (s, 1H), 7.92 (s, 1H), 7.69 (d, *J* = 8.2 Hz, 2H), 7.58 (d, *J* = 8.5 Hz, 1H), 7.51 (d, *J* = 3.6 Hz, 2H), 7.44 (d, *J* = 8.6 Hz, 2H), 7.29 (d, *J* = 8.6 Hz, 2H), 7.23 – 7.10 (m, 3H), 2.35 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.4, 142.4, 141.9, 141.4, 141.1, 139.9, 135.7, 134.4, 129.6, 129.0, 128.0, 127.9, 126.2, 125.8, 125.6, 120.1, 111.6, 21.4;

IR: 3066, 1644, 1602, 1490, 1471, 1368, 1233, 1075, 948 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2SCl$+H, Calc: 409.0772, Found: 409.0772.

N-(2-(4-bromophenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3al**)



Yellow solid (31.6 mg, 70% yield);

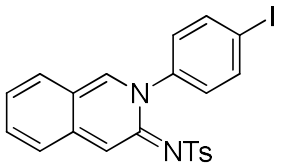
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.38 (s, 1H), 7.93 (s, 1H), 7.69 (d, *J* = 8.2 Hz, 2H), 7.65 – 7.59 (m, 2H), 7.57 (d, *J* = 8.6 Hz, 1H), 7.54 – 7.47 (m, 2H), 7.25 – 7.11 (m, 5H), 2.35 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.5, 142.1, 142.0, 141.3, 141.1, 140.5, 134.3, 132.6, 129.0 128.3, 127.8, 126.2, 125.9, 125.6, 123.8, 120.0, 111.6, 21.4;

IR: 3063, 1641, 1600, 1470, 1366, 1075, 945, 682 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2SBr$+H, Calc: 453.0267, Found: 453.0268.

N-(2-(4-iodophenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3am**)



Yellow solid (37.5 mg, 75% yield);

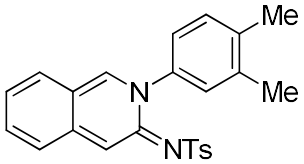
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.41 (s, 1H), 7.90 (s, 1H), 7.78 (d, *J* = 8.5 Hz, 2H), 7.68 (d, *J* = 8.1 Hz, 2H), 7.58 (d, *J* = 8.6 Hz, 1H), 7.49 (d, *J* = 2.9 Hz, 2H), 7.22 – 7.11 (m, 3H), 7.07 (dd, *J* = 9.0, 2.2 Hz, 2H), 2.35 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.4, 142.2, 141.9, 141.3, 141.2, 141.1, 138.5, 134.3, 129.0, 128.4, 127.9, 126.2, 125.8, 125.5, 120.0, 111.4, 95.4, 21.4;

IR: 3056, 2924, 1641, 1602, 1469, 1367, 1264, 1132, 1082, 950, 731 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2SI+H$, Calc: 501.0128, Found: 501.0128.

N-(2-(3,4-dimethylphenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3an**)



Yellow solid (33.4 mg, 83% yield);

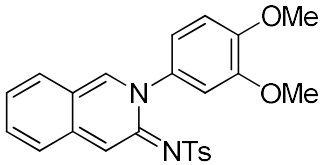
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.44 (s, 1H), 7.91 (s, 1H), 7.71 (d, *J* = 8.2 Hz, 2H), 7.57 (d, *J* = 8.4 Hz, 1H), 7.49 (d, *J* = 3.8 Hz, 2H), 7.23 – 7.08 (m, 4H), 7.07 – 6.97 (m, 2H), 2.33 (s, 3H), 2.28 (s, 3H), 2.24 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.6, 142.9, 141.6, 141.4, 141.0, 139.4, 138.3, 137.9, 134.0, 130.3, 128.8, 127.9, 127.3, 126.3, 125.7, 125.2, 123.6, 119.9, 111.3, 21.4, 19.8, 19.6;

IR: 2918, 1639, 1599, 1493, 1470, 1365, 1269, 1130, 1083, 951, 736, 662 cm^{-1};

HRMS (ESI): $C_{24}H_{22}N_2O_2S+H$, Calc: 403.1475, Found: 403.1475.

N-(2-(3,4-dimethoxyphenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3ao**)



Yellow solid (39.5 mg, 91% yield);

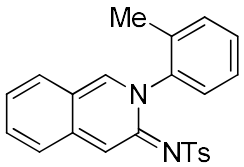
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.46 (s, 1H), 7.96 (s, 1H), 7.74 (d, *J* = 8.2 Hz, 2H), 7.59 (d, *J* = 8.5 Hz, 1H), 7.56 – 7.45 (m, 2H), 7.24 – 7.18 (m, 1H), 7.16 (d, *J* = 8.0 Hz, 2H), 6.89 (ddd, *J* = 12.2, 10.9, 5.5 Hz, 3H), 3.95 (s, 3H), 3.77 (s, 3H), 2.35 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.6, 149.9, 149.0, 143.0, 141.7, 141.5, 141.1, 134.6, 134.0, 128.9, 127.8, 126.2, 125.7, 125.3, 119.9, 118.6, 111.3, 110.9, 110.3, 56.2, 56.1, 21.4;

IR: 2926, 1640, 1599, 1469, 1367, 1266, 1130, 1081, 954, 750 cm^{-1};

HRMS (ESI): $C_{24}H_{22}N_2O_4S+H$, Calc: 435.1373, Found: 435.1373.

4-methyl-N-(2-(o-tolyl)isoquinolin-3(2H)-ylidene)benzenesulfonamide (**3ap**)



Yellow solid (35.8 mg, 89% yield);

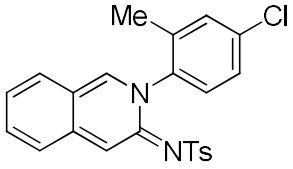
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.30 (s, 1H), 7.97 (s, 1H), 7.68 (d, *J* = 8.2 Hz, 2H), 7.60 – 7.48 (m, 3H), 7.23 – 7.17 (m, 1H), 7.17 – 7.08 (m, 4H), 7.03 (d, *J* = 7.7 Hz, 1H), 2.41 (s, 3H), 2.33 (s, 3H), 1.96 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.8, 142.3, 141.9, 141.5, 141.0, 139.9, 138.8, 133.9, 133.8, 131.8, 128.8, 127.8, 127.6, 126.3, 126.1, 125.9, 125.2, 120.0, 111.4, 21.4, 21.2, 17.5;

IR: 2860, 1640, 1600, 1494, 1468, 1366, 1268, 1131, 1081, 952 cm^{-1};

HRMS (ESI): $C_{24}H_{22}N_2O_2S$+H, Calc: 403.1475, Found: 403.1475.

N-(2-(4-chloro-2-methylphenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3aq**)



Yellow solid (36.3 mg, 86% yield);

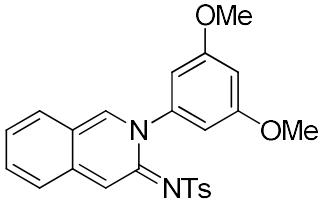
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.32 (s, 1H), 7.98 (s, 1H), 7.67 (d, *J* = 8.2 Hz, 2H), 7.63 – 7.49 (m, 3H), 7.39 – 7.29 (m, 2H), 7.25 – 7.19 (m, 1H), 7.13 (dd, *J* = 17.1, 8.2 Hz, 3H), 2.35 (s, 3H), 1.98 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.6, 142.1, 142.0, 141.3, 141.1, 139.6, 136.3, 135.6, 134.3, 131.1, 128.9, 127.7, 127.7, 127.4, 126.2, 125.9, 125.5, 120.0, 111.5, 21.4, 17.6;

IR: 3056, 1639, 1600, 1490, 1467, 1366, 1267, 1131, 1080, 950 cm^{-1};

HRMS (ESI): $C_{23}H_{19}N_2O_2SCl$+H, Calc: 423.0929, Found: 423.0929.

N-(2-(3,5-dimethoxyphenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3ar**)



Yellow solid (36.9 mg, 85% yield);

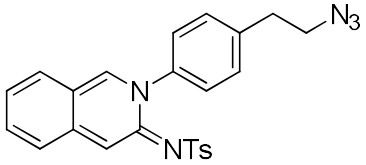
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.46 (s, 1H), 7.92 (s, 1H), 7.75 (d, *J* = 8.2 Hz, 2H), 7.60 (d, *J* = 8.5 Hz, 1H), 7.55 – 7.46 (m, 2H), 7.24 – 7.09 (m, 3H), 6.55 (d, *J* = 2.1 Hz, 1H), 6.48 (d, *J* = 2.2 Hz, 2H), 3.75 (s, 6H), 2.35 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 161.1, 152.4, 143.1, 142.6, 141.8, 141.6, 141.1, 134.1, 128.8, 128.0, 126.2, 125.8, 125.3, 119.8, 111.3, 105.2, 101.7, 55.7, 21.4.

IR: 2981, 1600, 1464, 1366, 1270, 1190, 1155, 1132, 1083, 957 cm^{-1};

HRMS (ESI): $C_{24}H_{22}N_2O_4S$+H, Calc: 435.1373, Found: 435.1373.

N-(2-(4-(2-azidoethyl)phenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3as**)



Yellow solid (24.8 mg, 56% yield);

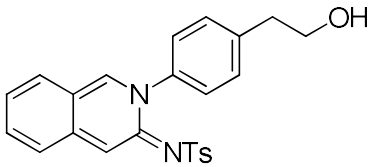
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.41 (s, 1H), 7.95 (s, 1H), 7.71 (d, *J* = 8.2 Hz, 2H), 7.59 – 7.47 (m, 3H), 7.36 (d, *J* = 8.4 Hz, 2H), 7.33 – 7.28 (m, 2H), 7.22 – 7.17 (m, 1H), 7.15 (d, *J* = 8.0 Hz, 2H), 3.59 (t, *J* = 7.0 Hz, 2H), 2.98 (t, *J* = 7.0 Hz, 2H), 2.34 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.7, 142.5, 141.9, 141.2, 140.3, 140.0, 134.2, 129.8, 128.9, 127.8, 126.8, 126.3, 125.8, 125.4, 119.9, 111.5, 52.1, 35.0, 21.4;

IR: 2094, 1640, 1600, 1469, 1367, 1261, 1130, 1080, 949, 749 cm^{-1};

HRMS (ESI): $C_{24}H_{21}N_5O_2S$+H, Calc: 444.1489, Found: 444.1489.

N-(2-(4-(2-hydroxyethyl)phenyl)isoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3at**)



Yellow solid (38.0 mg, 91% yield);

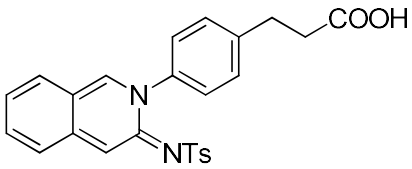
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.48 (s, 1H), 7.88 (s, 1H), 7.74 (d, *J* = 8.2 Hz, 2H), 7.59 (d, *J* = 8.5 Hz, 1H), 7.55 – 7.48 (m, 2H), 7.35 (d, *J* = 8.3 Hz, 2H), 7.24 – 7.14 (m, 5H), 3.87 (t, *J* = 6.2 Hz, 2H), 2.90 (t, *J* = 6.2 Hz, 2H), 2.34 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.7, 143.1, 141.8, 141.4, 141.3, 140.8, 139.7, 134.2, 130.3, 129.0, 128.0, 126.4, 126.4, 125.7, 125.5, 120.0, 111.1, 63.0, 38.9, 21.4;

IR: 3420, 1639, 1600, 1493, 1468, 1366, 1129, 1080, 951, 749 cm^{-1};

HRMS (ESI): $C_{24}H_{22}N_2O_3S$+H, Calc: 419.1424, Found: 419.1424.

3-(4-(3-(tosylimino)isoquinolin-2(3H)-yl)phenyl)propanoic acid (**3au**)



Yellow solid (41.0 mg, 92% yield);

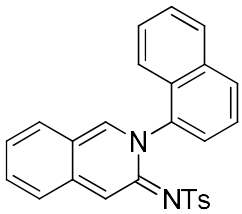
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.48 (s, 1H), 7.85 (s, 1H), 7.69 (d, *J* = 8.1 Hz, 2H), 7.60 (d, *J* = 8.5 Hz, 1H), 7.48 (s, 2H), 7.34 – 7.25 (m, 2H), 7.23 – 7.07 (m, 5H), 2.97 (t, *J* = 7.2 Hz, 2H), 2.67 (t, *J* = 7.2 Hz, 2H), 2.33 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 177.0, 152.2, 143.4, 142.2, 141.7, 141.4, 140.9, 139.7, 134.3, 129.3, 129.0, 128.2, 126.6, 126.3, 125.6, 125.5, 120.1, 111.1, 35.2, 30.2, 21.4;

IR: 3008, 1723, 1640, 1600, 1469, 1367, 1128, 1079, 750 cm^{-1};

HRMS (ESI): $C_{25}H_{22}N_2O_4S$+H, Calc: 447.1373, Found: 447.1373.

4-methyl-N-(2-(naphthalen-1-yl)isoquinolin-3(2H)-ylidene)benzenesulfonamide (**3av**)



Yellow solid (41.0 mg, 60% yield);

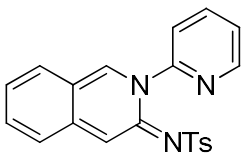
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.43 (s, 1H), 8.11 (s, 1H), 8.05 (d, *J* = 8.3 Hz, 1H), 7.99 (d, *J* = 8.3 Hz, 1H), 7.61 (ddd, *J* = 15.9, 13.3, 8.1 Hz, 5H), 7.49 – 7.35 (m, 4H), 7.27 – 7.20 (m, 1H), 7.03 (dd, *J* = 14.6, 8.3 Hz, 3H), 2.31 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 153.4, 143.1, 142.2, 141.0, 138.5, 134.2, 134.1, 130.3, 128.6, 128.5, 128.5, 127.8, 127.0, 126.3, 126.0, 125.4, 124.5, 122.0, 120.0, 111.5, 21.3;

IR: 1640, 1600, 1472, 1368, 1275, 1132, 1081, 765, 750 cm^{-1};

HRMS (ESI): $C_{26}H_{20}N_2O_2S$+H, Calc: 425.1318, Found: 425.1318.

4-methyl-N-(2-(pyridin-2-yl)isoquinolin-3(2H)-ylidene)benzenesulfonamide (**3aw**)



Yellow solid (22.9 mg, 61% yield);

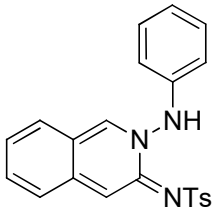
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.69 (s, 1H), 8.59 (d, *J* = 5.3 Hz, 1H), 7.87 (dd, *J* = 18.1, 6.4 Hz, 3H), 7.81 – 7.72 (m, 2H), 7.58 (d, *J* = 8.5 Hz, 1H), 7.49 (d, *J* = 3.8 Hz, 2H), 7.44 (dd, *J* = 4.8, 2.0 Hz, 1H), 7.17 (t, *J* = 6.4 Hz, 3H), 2.33 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.4, 152.0, 149.3, 142.2, 142.0, 141.3, 141.0, 137.9, 134.5, 129.0, 128.3, 126.3, 125.7, 125.4, 124.9, 123.2, 120.1, 111.2, 21.4;

IR: 1641, 1602, 1473, 1368, 1264, 1132, 1081, 952, 748 cm^{-1};

HRMS (ESI): $C_{21}H_{17}N_3O_2S$+H, Calc: 376.1114, Found: 376.1114.

4-methyl-N-(2-(phenylamino)isoquinolin-3(2H)-ylidene)benzenesulfonamide (**3ax**)



Yellow solid (29.2 mg, 75% yield);

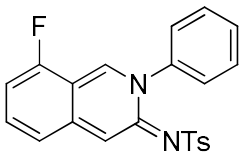
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.91 (s, 1H), 8.66 (s, 1H), 7.95 (s, 1H), 7.66 – 7.58 (m, 3H), 7.57 – 7.50 (m, 2H), 7.29 – 7.26 (m, 1H), 7.26 – 7.21 (m, 2H), 7.12 (t, *J* = 7.4 Hz, 1H), 7.06 (d, *J* = 8.0 Hz, 2H), 6.76 – 6.62 (m, 2H), 2.31 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 150.5, 145.8, 141.5, 141.3, 140.5, 140.2, 134.0, 129.6, 129.0, 127.5, 126.5, 125.9, 125.7, 124.8, 119.8, 117.7, 110.7, 21.4;

IR: 3020, 1639, 1602, 1471, 1367, 1262, 1133, 1080, 958, 750 cm^{-1};

HRMS (ESI): $C_{22}H_{19}N_3O_2S$+H, Calc: 390.1271, Found: 390.1270.

N-(8-fluoro-2-phenylisoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3ba**)



Yellow solid (22.3 mg, 57% yield);

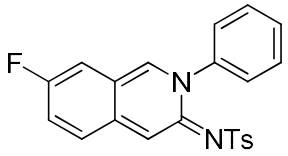
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.60 (s, 1H), 8.03 (s, 1H), 7.68 (d, *J* = 8.2 Hz, 2H), 7.59 – 7.49 (m, 3H), 7.48 – 7.41 (m, 1H), 7.36 (ddd, *J* = 15.0, 9.5, 6.2 Hz, 3H), 7.14 (d, *J* = 8.0 Hz, 2H), 6.79 (dd, *J* = 10.3, 7.4 Hz, 1H), 2.34 (s, 3H).

^{13}C NMR (100 MHz, $CDCl_3$): δ 153.2, 143.4, 142.4, 141.6, 141.3, 141.0, 139.3, 137.9, 134.5, 134.4, 129.9, 129.7, 129.5, 128.9, 126.6, 126.5, 126.2, 121.9, 111.5, 107.5, 107.3, 21.5, 21.4.

IR: 2923, 1654, 1607, 1495, 1473, 1376, 1275, 1134, 1077, 913, 763 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2FS$+H, Calc: 393.1068, Found: 393.1068.

N-(7-fluoro-2-phenylisoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3bb**)



Yellow solid (35.3 mg, 90% yield);

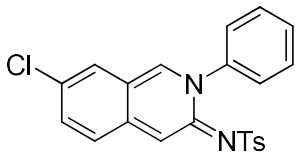
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.36 (s, 1H), 8.02 (s, 1H), 7.66 (d, *J* = 8.2 Hz, 2H), 7.56 (dd, *J* = 9.4, 5.1 Hz, 1H), 7.52 – 7.45 (m, 3H), 7.39 – 7.28 (m, 3H), 7.20 – 7.09 (m, 3H), 2.33 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 160.4, 157.9, 152.5, 141.5, 141.2, 141.1, 139.4, 129.7, 129.4, 129.0, 128.9, 126.5, 126.2, 126.1, 119.6, 119.5, 112.4, 109.2, 109.0, 21.4;

IR: 3066, 2921, 2851, 1649, 1608, 1494, 1432, 1350, 1131, 1080, 758 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2FS$+H, Calc: 393.1068, Found: 393.1068.

N-(7-chloro-2-phenylisoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3bc**)



Yellow solid (37.5 mg, 92% yield);

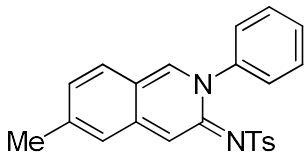
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.35 (s, 1H), 7.97 (s, 1H), 7.72 – 7.60 (m, 2H), 7.59 – 7.45 (m, 5H), 7.39 (dd, *J* = 9.2, 2.0 Hz, 1H), 7.36 – 7.28 (m, 2H), 7.13 (d, *J* = 8.0 Hz, 2H), 2.34 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.9, 141.4, 141.3, 141.1, 140.0, 135.2, 130.8, 129.8, 129.5, 128.9, 127.7, 126.5, 126.1, 125.5, 119.9, 112.1, 21.4;

IR: 1641, 1593, 1470, 1493, 1348, 1275, 1132, 1081, 950, 764, 751 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2SCl$+H, Calc: 409.0772, Found: 409.0772.

4-methyl-N-(6-methyl-2-phenylisoquinolin-3(2H)-ylidene)benzenesulfonamide (**3bd**)



Yellow solid (33.8 mg, 87% yield);

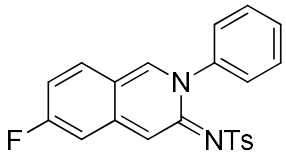
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.35 (s, 1H), 7.82 (s, 1H), 7.68 (d, *J* = 7.3 Hz, 2H), 7.48 (d, *J* = 8.4 Hz, 4H), 7.37 – 7.27 (m, 3H), 7.12 (d, *J* = 7.7 Hz, 2H), 7.02 (d, *J* = 8.7 Hz, 1H), 2.44 (s, 3H), 2.33 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.5, 145.4, 142.2, 142.1, 141.7, 141.5, 141.0, 129.5, 129.3, 128.8, 128.3, 127.6, 126.7, 126.2, 123.9, 118.7, 110.3, 22.6, 21.4;

IR: 1645, 1609, 1503, 1413, 1238, 1207, 1076, 925, 759 cm^{-1};

HRMS (ESI): $C_{23}H_{20}N_2O_2S$+H, Calc: 389.1318, Found: 389.1317.

N-(6-fluoro-2-phenylisoquinolin-3(2H)-ylidene)-4-methylbenzenesulfonamide (**3be**)



Yellow solid (20.0 mg, 51% yield);

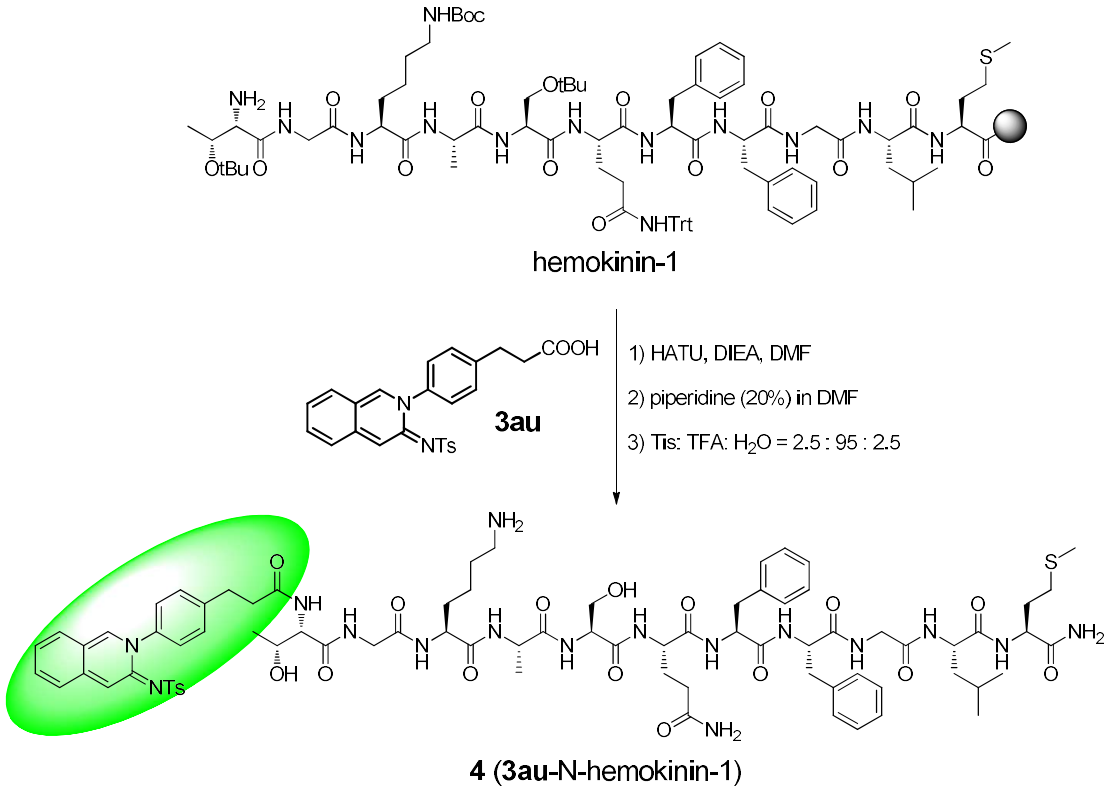
^{1}H NMR (400 MHz, $CDCl_3$): δ 8.41 (s, 1H), 7.88 (s, 1H), 7.67 (d, *J* = 8.2 Hz, 2H), 7.61 (dd, *J* = 9.2, 5.5 Hz, 1H), 7.55 – 7.47 (m, 3H), 7.38 – 7.30 (m, 2H), 7.12 (dd, *J* = 14.2, 5.0 Hz, 3H), 2.34 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$): δ 152.6, 142.6, 141.5, 141.2, 141.2, 131.6, 129.7, 129.5, 128.9, 126.6, 126.2, 117.9, 117.4, 110.5, 110.5, 109.1, 108.1, 108.1, 107.9, 21.4;

IR: 3008, 1643, 1496, 1450, 1275, 1134, 1082, 938, 764 cm^{-1};

HRMS (ESI): $C_{22}H_{17}N_2O_2FS$+H, Calc: 393.1068, Found: 393.1068.

synthesis of 4 (3au-N-hemokinin-1)



The fluorescent probe **4** (**3au**-N-hemokinin-1) was synthesized by conjugating cyclic amidine **3au** with the N-terminal of the hemokinin-1 (HK-1) peptide (TGKASQFFGLM-NH_2) using Fmoc solid-phase method as described before. The method of linking cyclic amidine **3au** was the same as the method of linking the amino acids, and the condensation method used HATU and DIEA in DMF solvent. The characteristics of the peptide were confirmed by ESI-TOF mass spectrometry. The purity of peptide was quantified to be >95% using reversed-phase HPLC by a C18 column as the solid phase and a H_2O : acetonitrile gradient as the liquid phase.

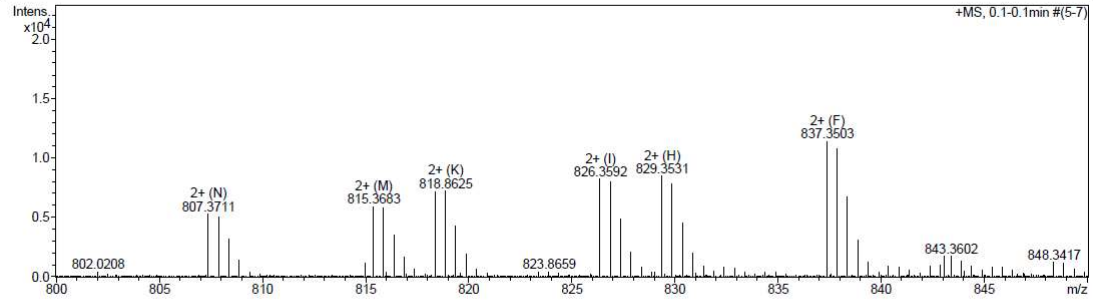
Mass Spectrum SmartFormula Report

Analysis Info

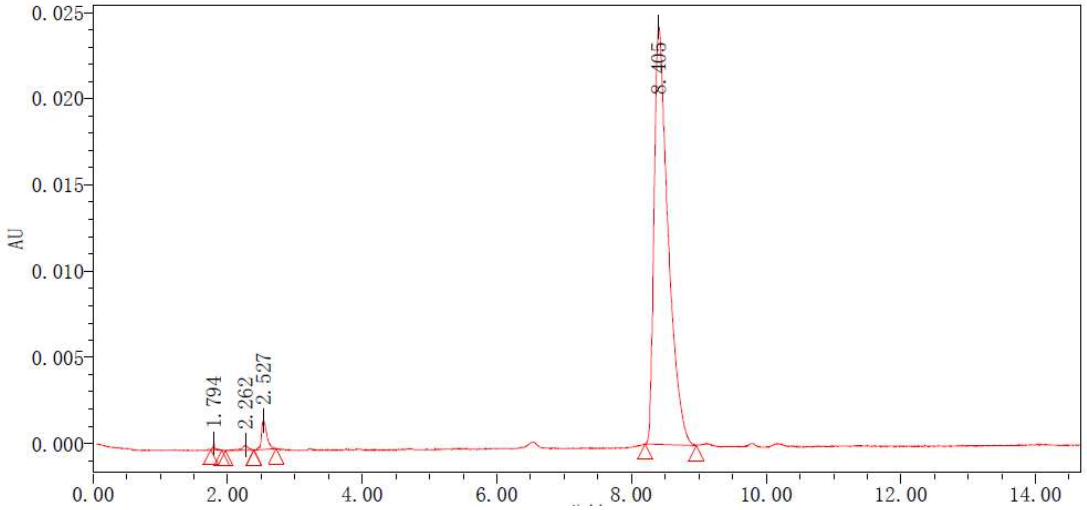
Analysis Name	D:\Data\201805\20180510guoxiaomin01.d	Acquisition Date	5/10/2018 11:32:03 AM
Method	POS_TuneLow_NaTFACal_100-1200.m	Operator	BDAL@DE
Sample Name	< No Sample >	Instrument / Ser#	maXis 4G 20204
Comment			

Acquisition Parameter

Source Type	ESI	Ion Polarity	Positive	Set Nebulizer	0.3 Bar
Focus	Not active	Set Capillary	4500 V	Set Dry Heater	180 °C
Scan Begin	100 m/z	Set End Plate Offset	-500 V	Set Dry Gas	4.0 l/min
Scan End	1200 m/z	Set Collision Cell RF	1500.0 Vpp	Set Divert Valve	Source



Meas. m/z	#	Formula	Score	m/z	err [mDa]	err [ppm]	mSigma	rdb	e⁻ Conf	N-Rule
807.3711	1	C 79 H 106 N 16 O 17 S 2	100.00	807.3676	-3.5	-4.3	16.0	35.0	even	ok



Entry	Retention time min	Area AU*sec	Height AU	% Area
1	1.794	812	369	0.23
2	2.262	1852	283	0.51
3	2.527	9429	1670	2.61
4	8.405	348752	24224	96.65

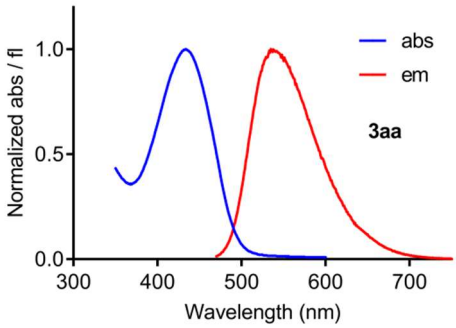
Confocal imaging experiments

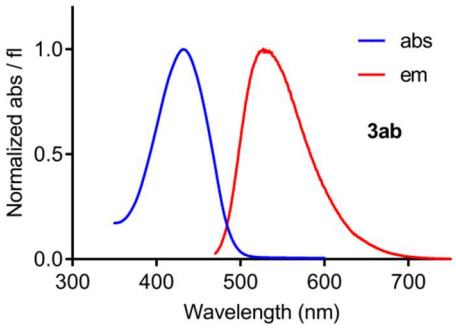
WT 22RV1 cells or NK-1 receptors-overexpressed 22RV1 cells with good growth states were digested with trypsin, centrifuged at 800 r/min, resuspended in medium, counted, and inoculated with 4×10^4 cells per dish. The culture dish was placed in a 5% carbon dioxide incubator at 37 ° C and cultured overnight. The culture dish was then taken out and the medium was discarded. The fluorescent probe **4** (**3au**-N-hemokinin-1) (1 μM) was added, and the culture dish was placed in a 37 ° C incubator and incubated for 30 minutes. It was then washed three times with pre-cooled PBS and then photographed with laser confocal. In the antagonist group, the medium of NK-1 receptors-overexpressed 22RV1 cells was discarded and the NK1R inhibitor aprepitant (1 μM) was added and incubated at 37 ° C for 30 minutes. Subsequently, The cells were washed 3 times with pre-cooled PBS, the fluorescent probe **4** (**3au**-N-hemokinin-1) (1 μM) was added, and the culture dish was placed in a 37 ° C incubator for 30 min. This was followed by washing 3 times with pre-cooled PBS and then taking a photo with laser confocal. Sigma-Aldrich.

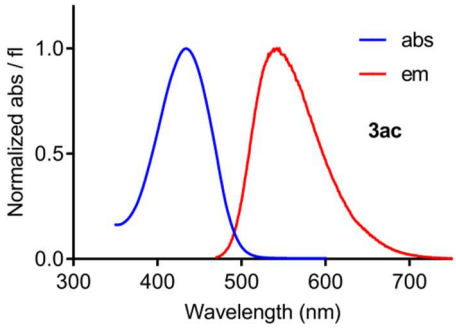
Cytotoxicity assays

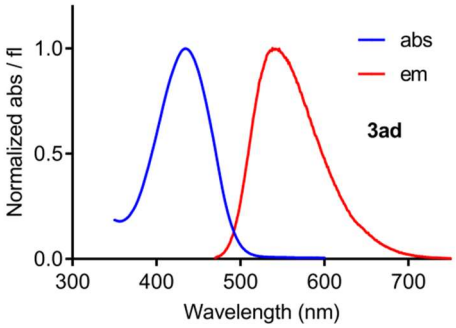
WT Hela cells were seeded at 7×10^3 cells/well in 96-well plates and incubated overnight before being treated in the presence of 6.25-200 μM of **3aa** for 24h. Cell viability (%) was measured by adding 10% CCK-8) for an additional 1 hour. Absorbance was measured at a wavelength of 450 nm. Cell viability was calculated from 3 independent experiments and normalized to the absorbance of wells containing medium only (100%) and that of wells containing untreated cells (0%).

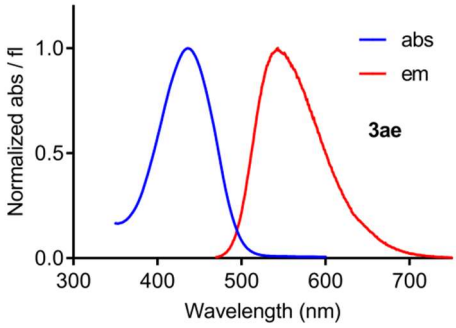
Photophysical properties of 3

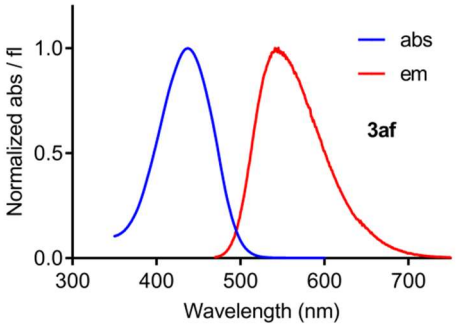


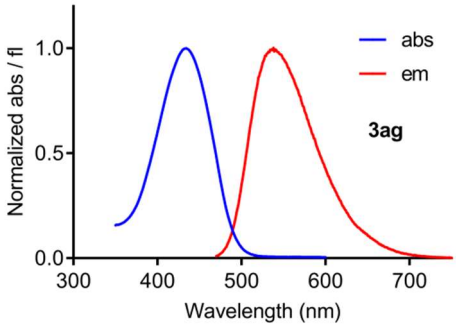


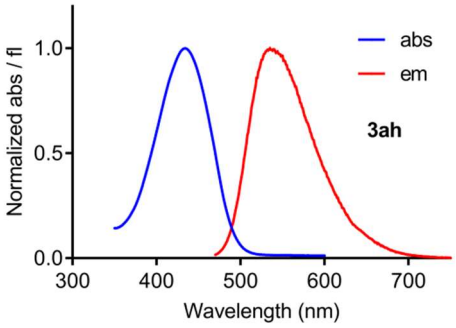


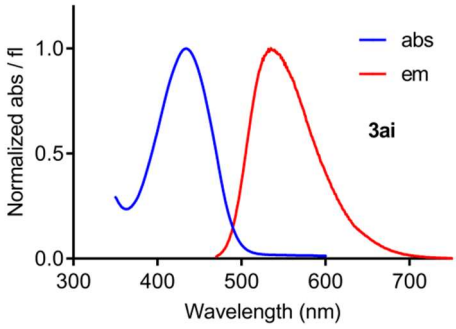








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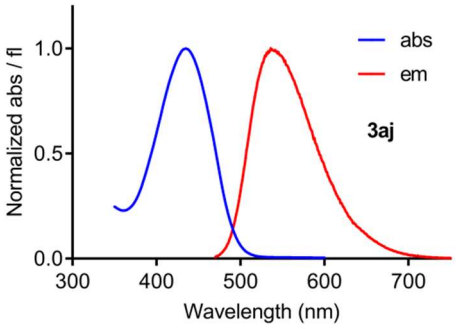
0.5
0.0
300
400
500
600
700
Wavelength (nm)
abs
em
3ai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Wavelength (nm)
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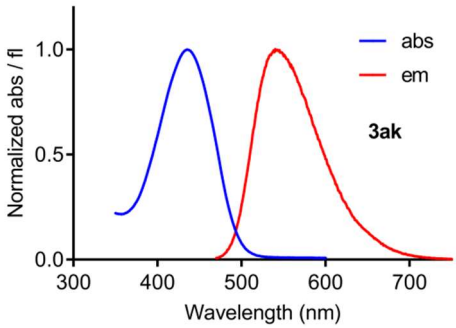
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Wavelength (nm)
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em
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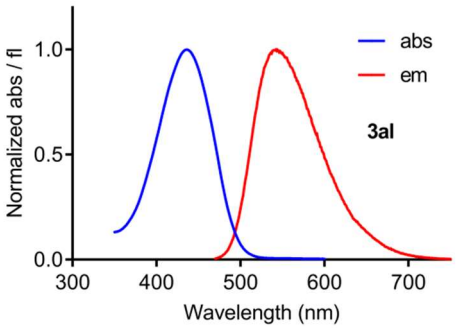
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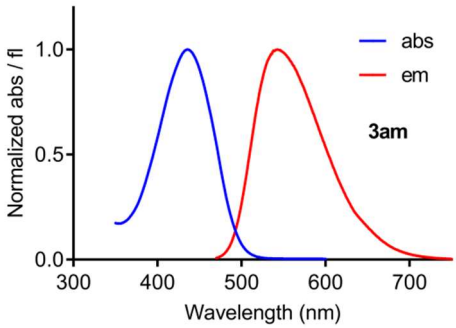
Wavelength (nm)
abs
em
3al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600
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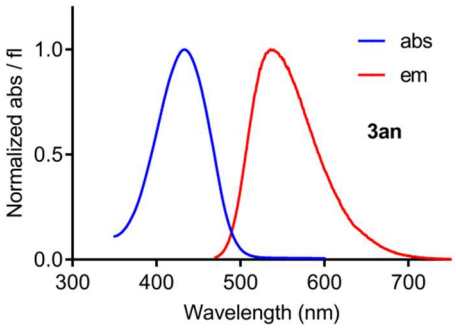
Wavelength (nm)
abs
em
3am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400
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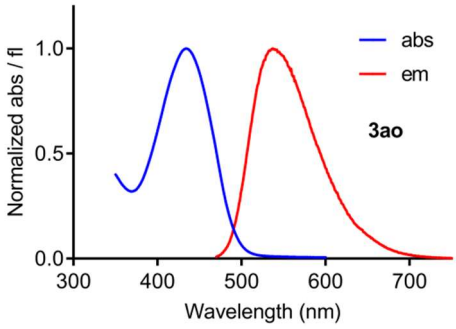
700
Wavelength (nm)
abs
em
3an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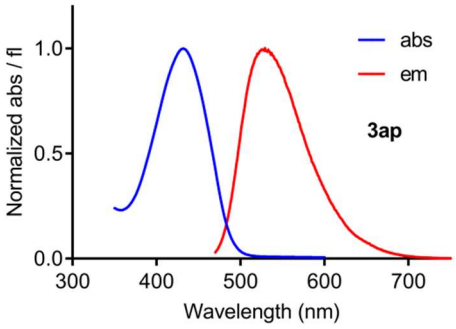
0.0
300
400
500
600
700
Wavelength (nm)
abs
em
3ao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0.0
300
400
500
600
700
Wavelength (nm)
abs
em
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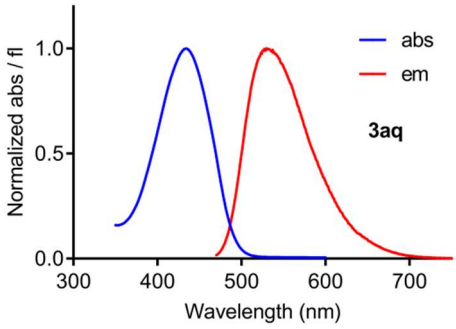
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Wavelength (nm)
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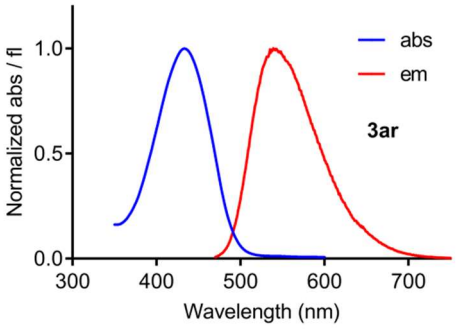
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Wavelength (nm)
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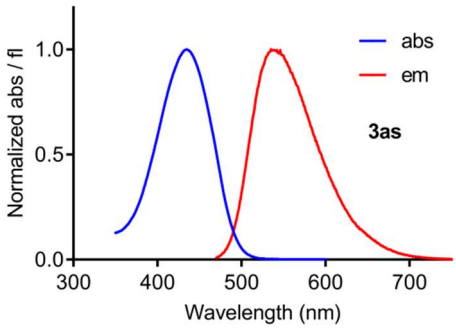
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0.0
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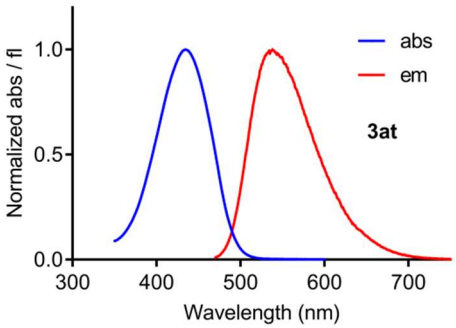
400
500
600
700
Wavelength (nm)
abs
em
3as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400
500
600
700
Wavelength (nm)
abs
em
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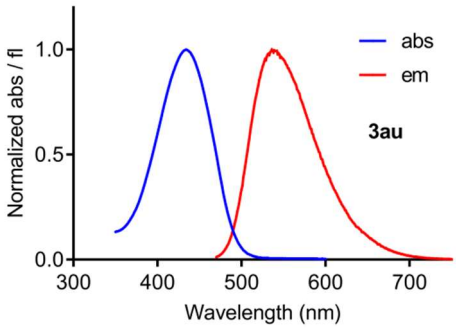
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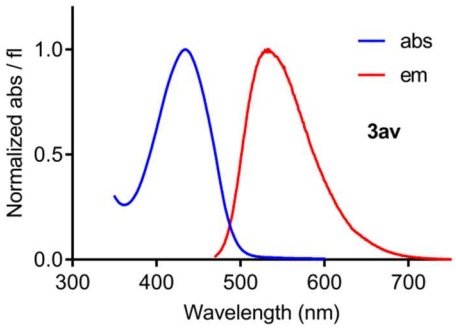
0.0
300
400
500
600
700
Wavelength (nm)
abs
em
3au


Normalized abs / fl
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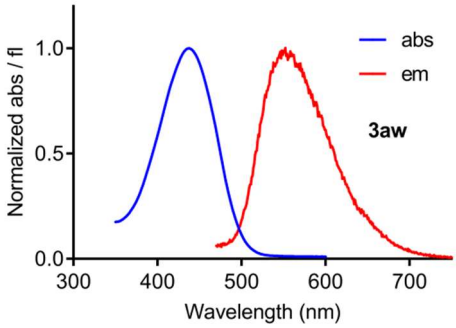
0.0
300
400
500
600
700
Wavelength (nm)
abs
em
3av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400
500
600
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Wavelength (nm)
abs
em
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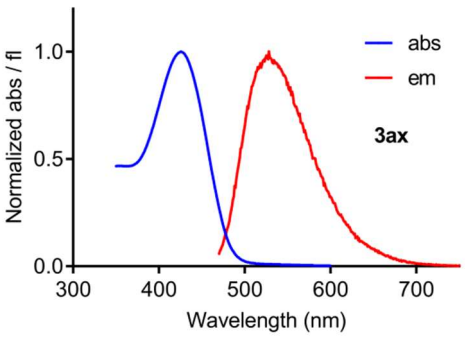
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300
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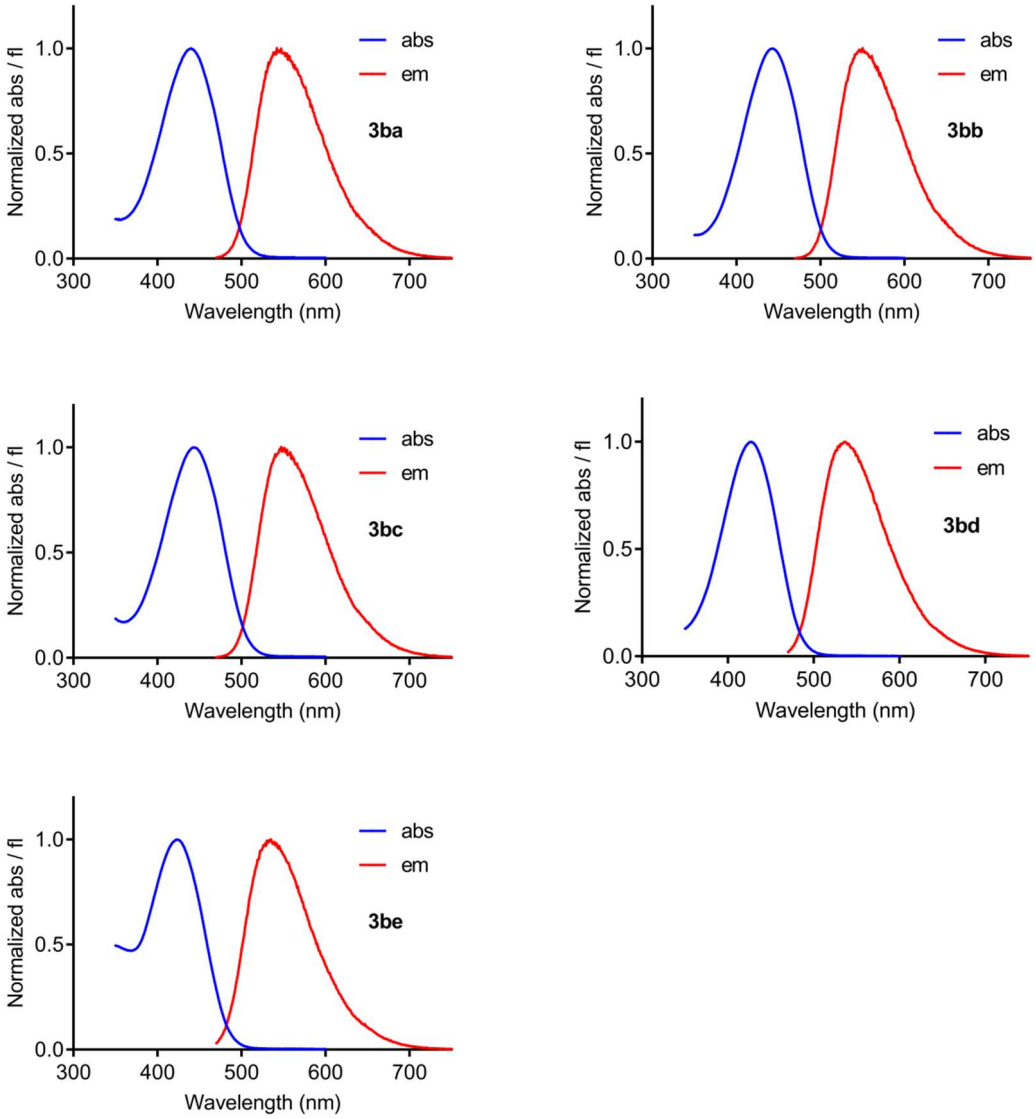
500
600
700
Wavelength (nm)
abs
em
3ax



Hydrolytic stability of 3aa

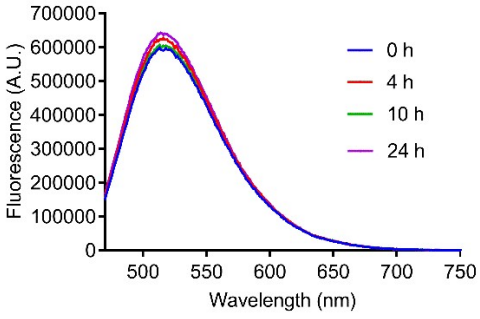
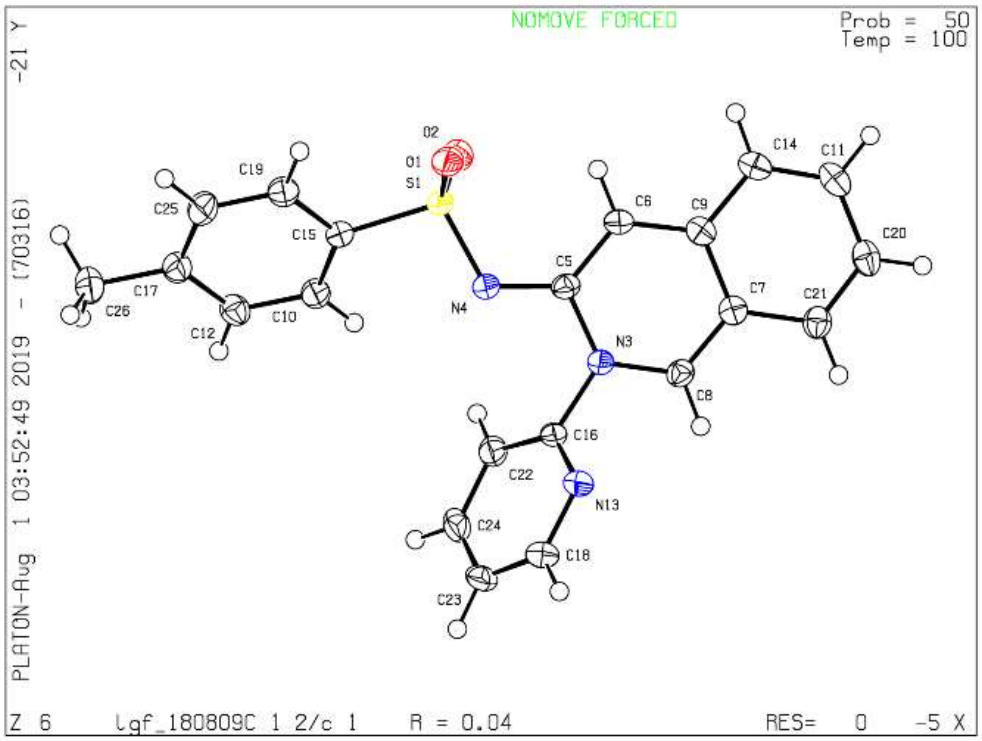


Figure S1. Emission spectra of **3aa** (λex = 433 nm) at different storage time in H_2O at 20 μM.

X-ray Structure of 3aw



Bond precision:	C-C = 0.0025 A		Wavelength=1.54184
Cell:	a=17.4822(3)	b=9.78677(16)	c=20.9912(4)
	alpha=90	beta=103.5756(17)	gamma=90
Temperature:	100 K		

	Calculated	Reported
Volume	3491.13(11)	3491.14(11)
Space group	C 2/c	C 1 2/c 1
Hall group	-C 2yc	-C 2yc
Moiety formula	C21 H17 N3 O2 S	C21 H17 N3 O2 S
Sum formula	C21 H17 N3 O2 S	C21 H18 N2 O2 S
Mr	375.44	362.43
Dx,g cm-3	1.429	1.379
Z	8	8
Mu (mm-1)	1.832	1.793
F000	1568.0	1520.0
F000'	1574.97	
h,k,lmax	20,11,25	20,11,25
Nref	3113	3089
Tmin,Tmax	0.683,0.836	0.357,1.000
Tmin'	0.556	

Correction method= # Reported T Limits: Tmin=0.357 Tmax=1.000 AbsCorr = MULTI-SCAN

Data completeness= 0.992 Theta(max)= 67.079

R(reflections)= 0.0369(2793) wR2(reflections)= 0.0982(3089)

S = 1.035 Npar= 245

The following ALERTS were generated. Each ALERT has the format

test-name_ALERT_alert-type_alert-level.

Click on the hyperlinks for more details of the test.

Alert level B

PLAT043_ALERT_1_B Calculated and Reported Mol. Weight Differ by .. 13.01 Check

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Alert level C

PLAT041_ALERT_1_C Calc. and Reported SumFormula Strings Differ Please Check

PLAT051_ALERT_1_C Mu(calc) and Mu(CIF) Ratio Differs from 1.0 by . 2.19 %

PLAT068_ALERT_1_C Reported F000 Differs from Calcd (or Missing)... Please Check

PLAT911_ALERT_3_C Missing FCF Refl Between Thmin & STh/L= 0.597 25 Report

PLAT913_ALERT_3_C Missing # of Very Strong Reflections in FCF .... 7 Note

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Alert level G

FORMU01_ALERT_1_G There is a discrepancy between the atom counts in the
_chemical_formula_sum and _chemical_formula_moiety. This is
usually due to the moiety formula being in the wrong format.
Atom count from _chemical_formula_sum: C21 H18 N2 O2 S1
Atom count from _chemical_formula_moiety:C21 H17 N3 O2 S1

FORMU01_ALERT_2_G There is a discrepancy between the atom counts in the
_chemical_formula_sum and the formula from the _atom_site* data.
Atom count from _chemical_formula_sum:C21 H18 N2 O2 S1
Atom count from the _atom_site data: C21 H17 N3 O2 S1

CELLZ01_ALERT_1_G Difference between formula and atom_site contents detected.

CELLZ01_ALERT_1_G ALERT: Large difference may be due to a
symmetry error - see SYMMG tests
From the CIF: _cell_formula_units_Z 8
From the CIF: _chemical_formula_sum C21 H18 N2 O2 S
TEST: Compare cell contents of formula and atom_site data

atom	Z*formula	cif sites	diff
C	168.00	168.00	0.00
H	144.00	136.00	8.00
N	16.00	24.00	-8.00
O	16.00	16.00	0.00
S	8.00	8.00	0.00

PLAT432_ALERT_2_G Short Inter X...Y Contact C8 ..C8 3.13 Ang.
1-x,y,1/2-z = 2_655 Check

PLAT909_ALERT_3_G Percentage of I>2sig(I) Data at Theta(Max) Still 83% Note

PLAT955_ALERT_1_G Reported (CIF) and Actual (FCF) Lmax Differ by . 1 Units

PLAT978_ALERT_2_G Number C-C Bonds with Positive Residual Density. 8 Info

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0 **ALERT level A** = Most likely a serious problem - resolve or explain

1 **ALERT level B** = A potentially serious problem, consider carefully

5 **ALERT level C** = Check. Ensure it is not caused by an omission or oversight

8 **ALERT level G** = General information/check it is not something unexpected

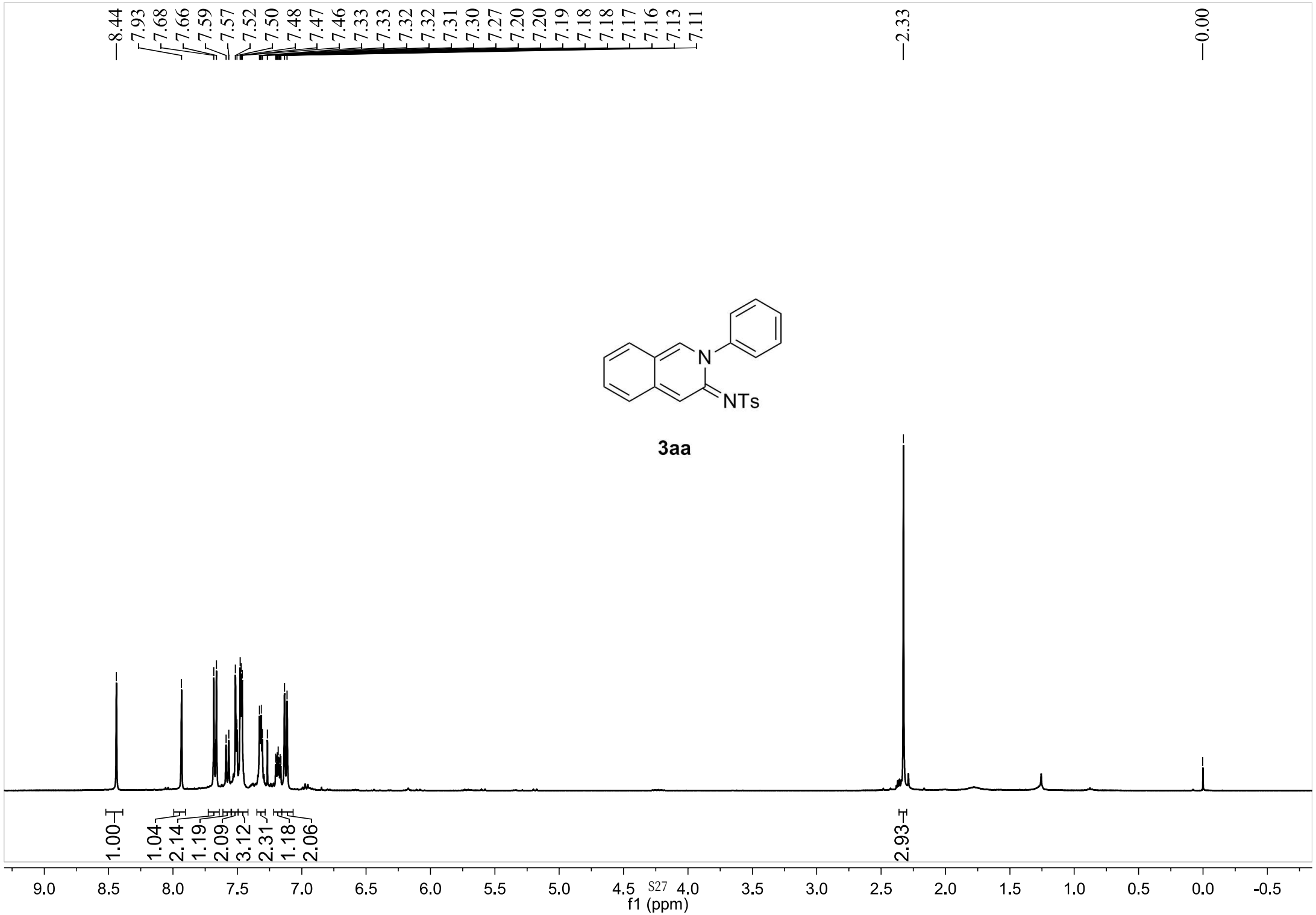
8 ALERT type 1 CIF construction/syntax error, inconsistent or missing data

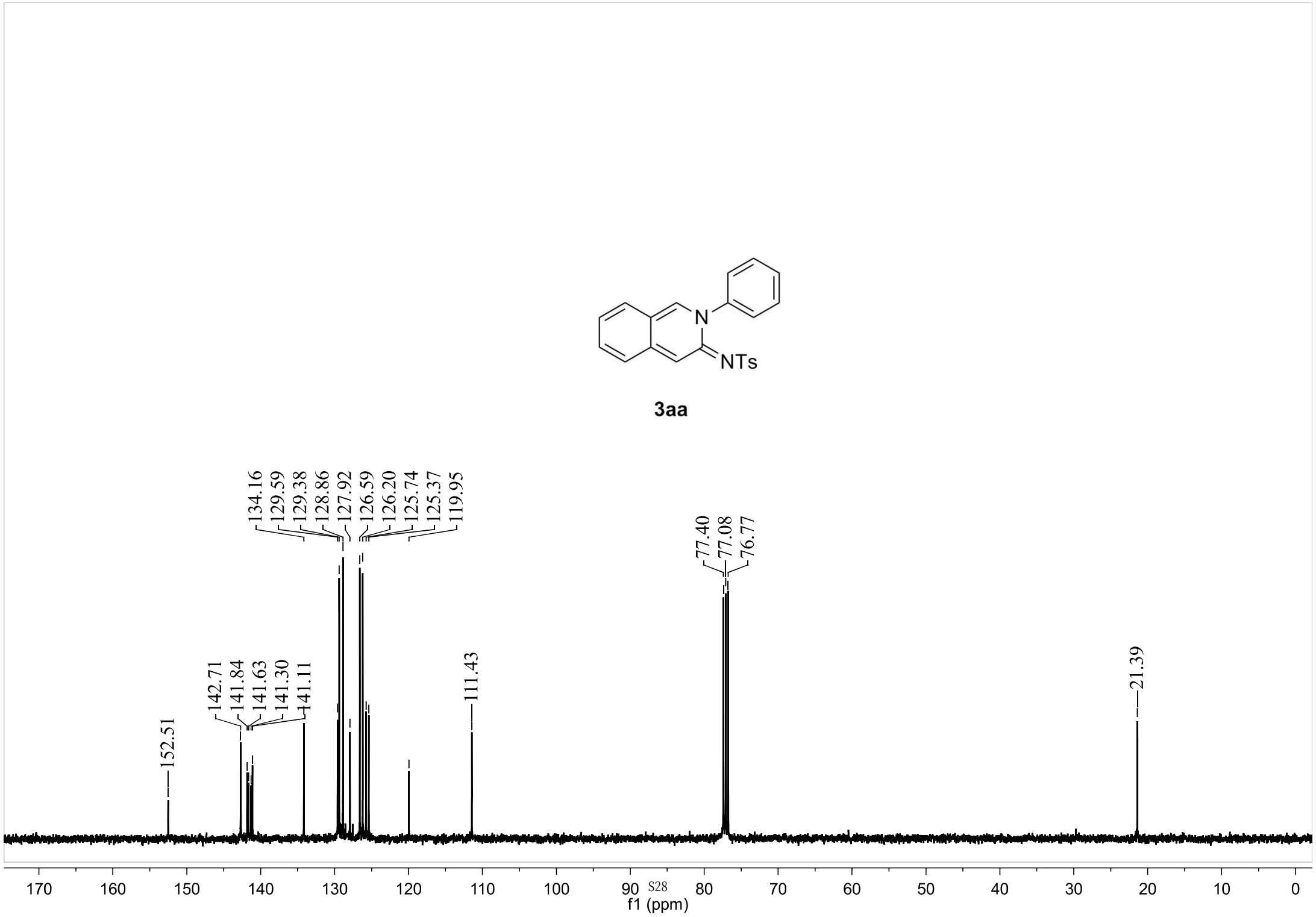
3 ALERT type 2 Indicator that the structure model may be wrong or deficient

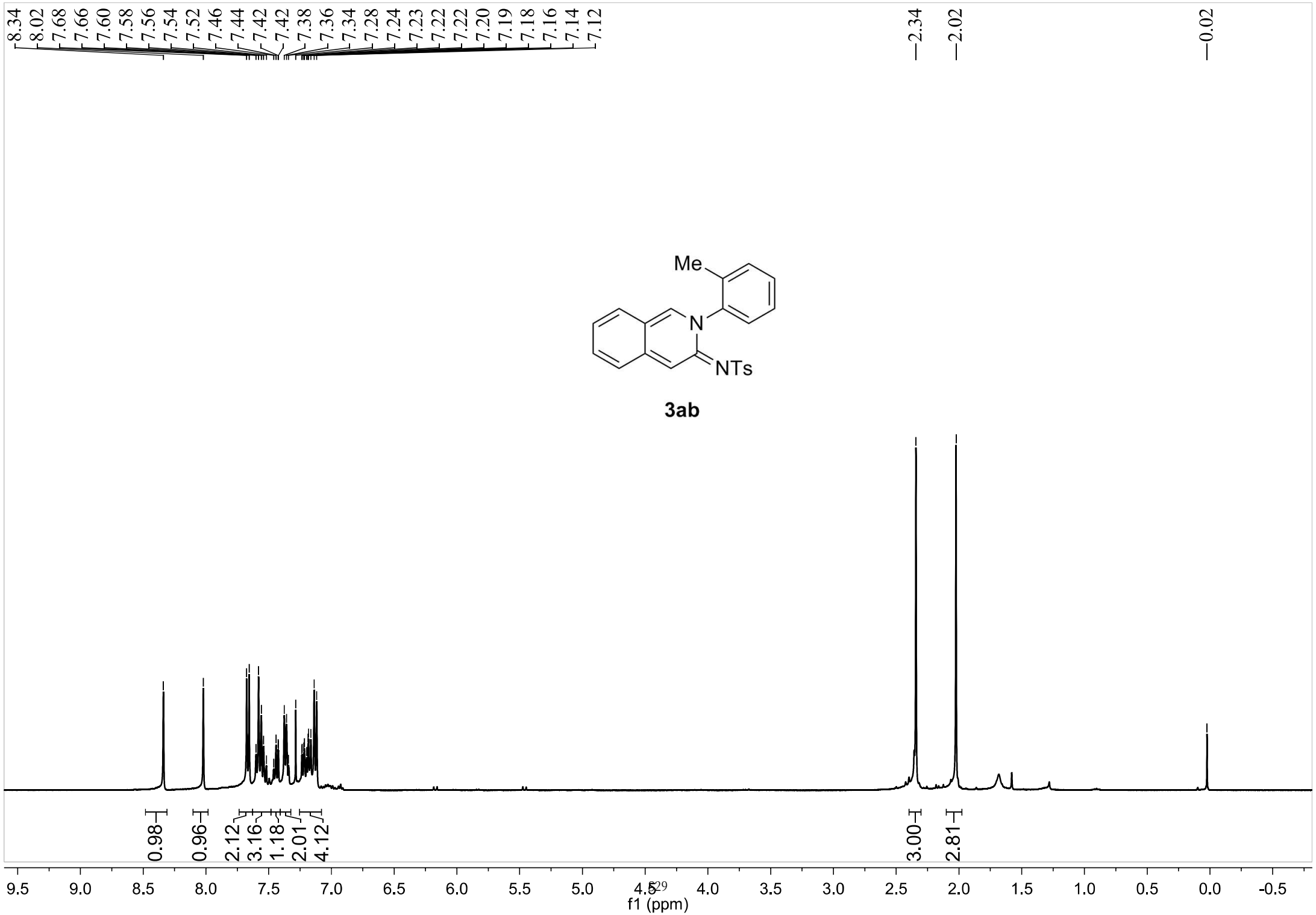
3 ALERT type 3 Indicator that the structure quality may be low

0 ALERT type 4 Improvement, methodology, query or suggestion

0 ALERT type 5 Informative message, check


8.44
7.93
7.68
7.66
7.59
7.57
7.52
7.50
7.48
7.47
7.46
7.33
7.33
7.32
7.32
7.31
7.30
7.27
7.20
7.20
7.19
7.18
7.18
7.17
7.16
7.13
7.11
2.33
0.00
N
NTs
3aa
1.00
1.04
2.14
1.19
2.09
3.12
2.31
1.18
2.06
2.93
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


N
NTs
3aa
134.16
129.59
129.38
128.86
127.92
126.59
126.20
125.74
125.37
119.95
77.40
77.08
76.77
152.51
142.71
141.84
141.63
141.30
141.11
111.43
21.39
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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8.02
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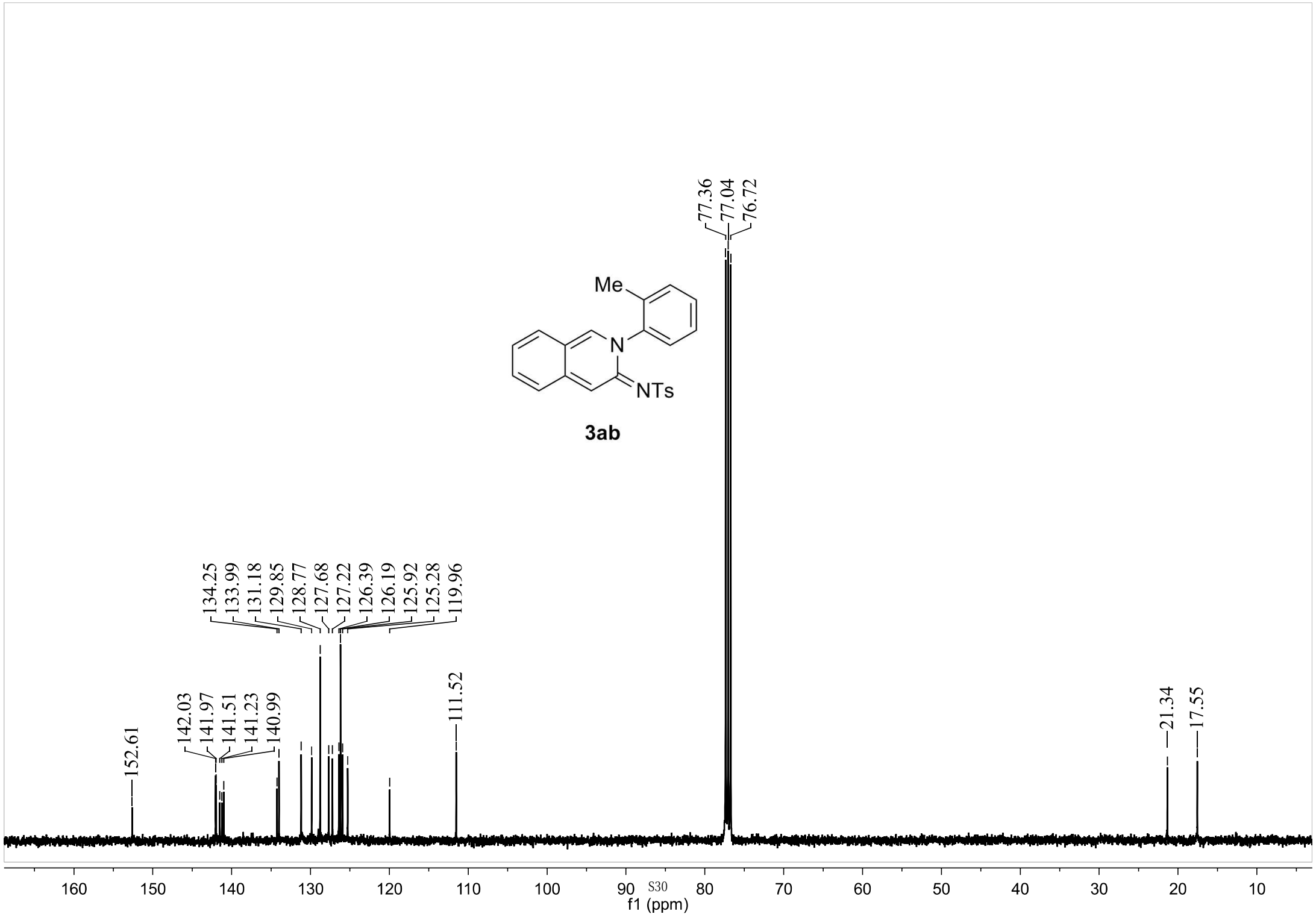
7.66
7.60
7.58
7.56
7.54
7.52
7.46
7.44
7.42
7.42
7.38
7.36
7.34
7.28
7.24
7.23
7.22
7.22
7.20
7.19
7.18
7.16
7.14
7.12
2.34
2.02
0.02
Me
N
NTs
3ab
0.98
0.96
2.12
3.16
1.18
2.01
4.12
3.00
2.81
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


77.36
77.04
76.72
Me
N
NTs
3ab
134.25
133.99
131.18
129.85
128.77
127.68
127.22
126.39
126.19
125.92
125.28
119.96
152.61
142.03
141.97
141.51
141.23
140.99
111.52
21.34
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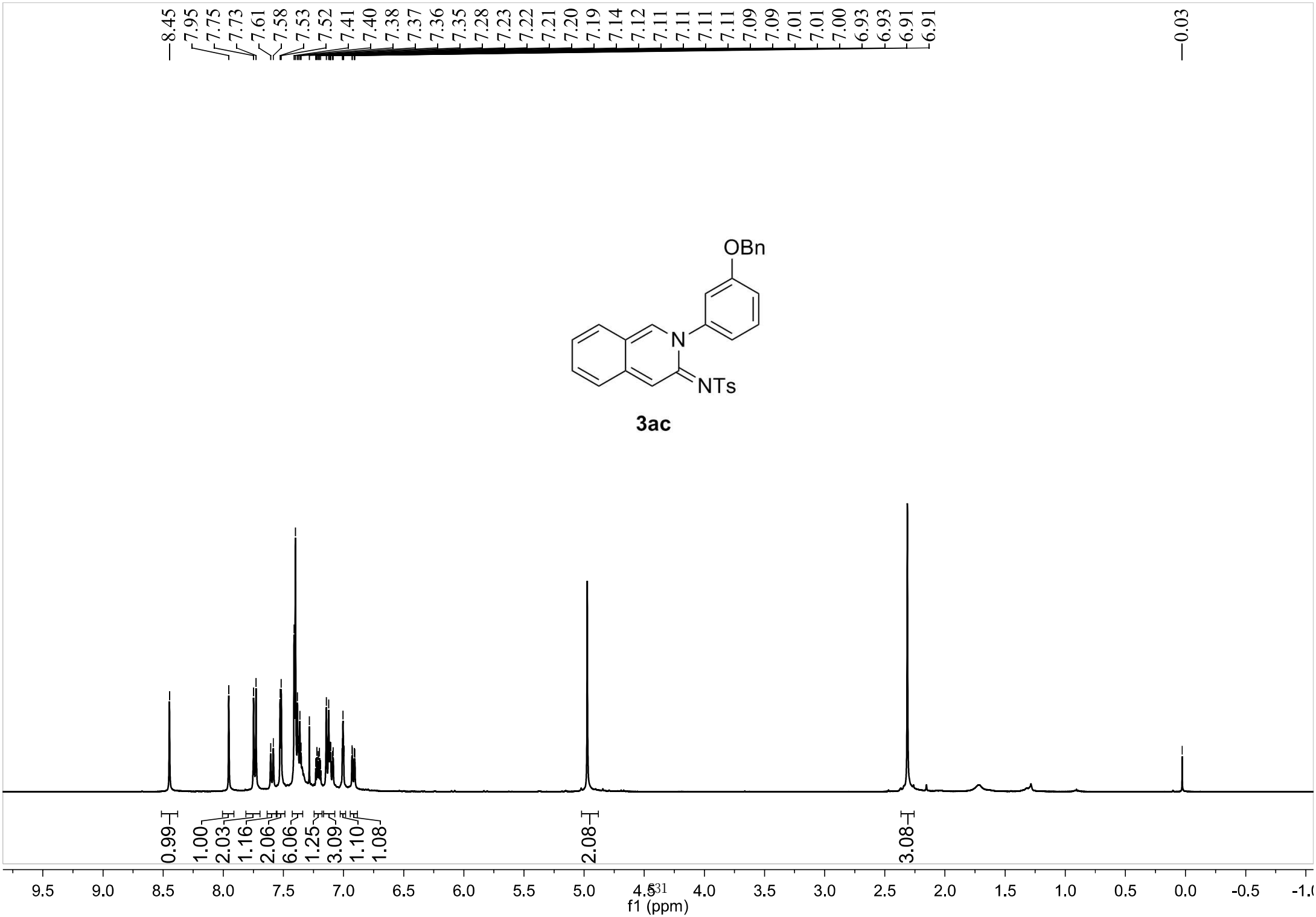
f1 (ppm)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7.36
7.35
7.28
7.23
7.22
7.21
7.20
7.19
7.14
7.12
7.11
7.11
7.11
7.11
7.09
7.09
7.01
7.01
7.00
6.93
6.93
6.91
6.91
0.03
OBn
N
NTs
3ac
0.99
1.00
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2.06
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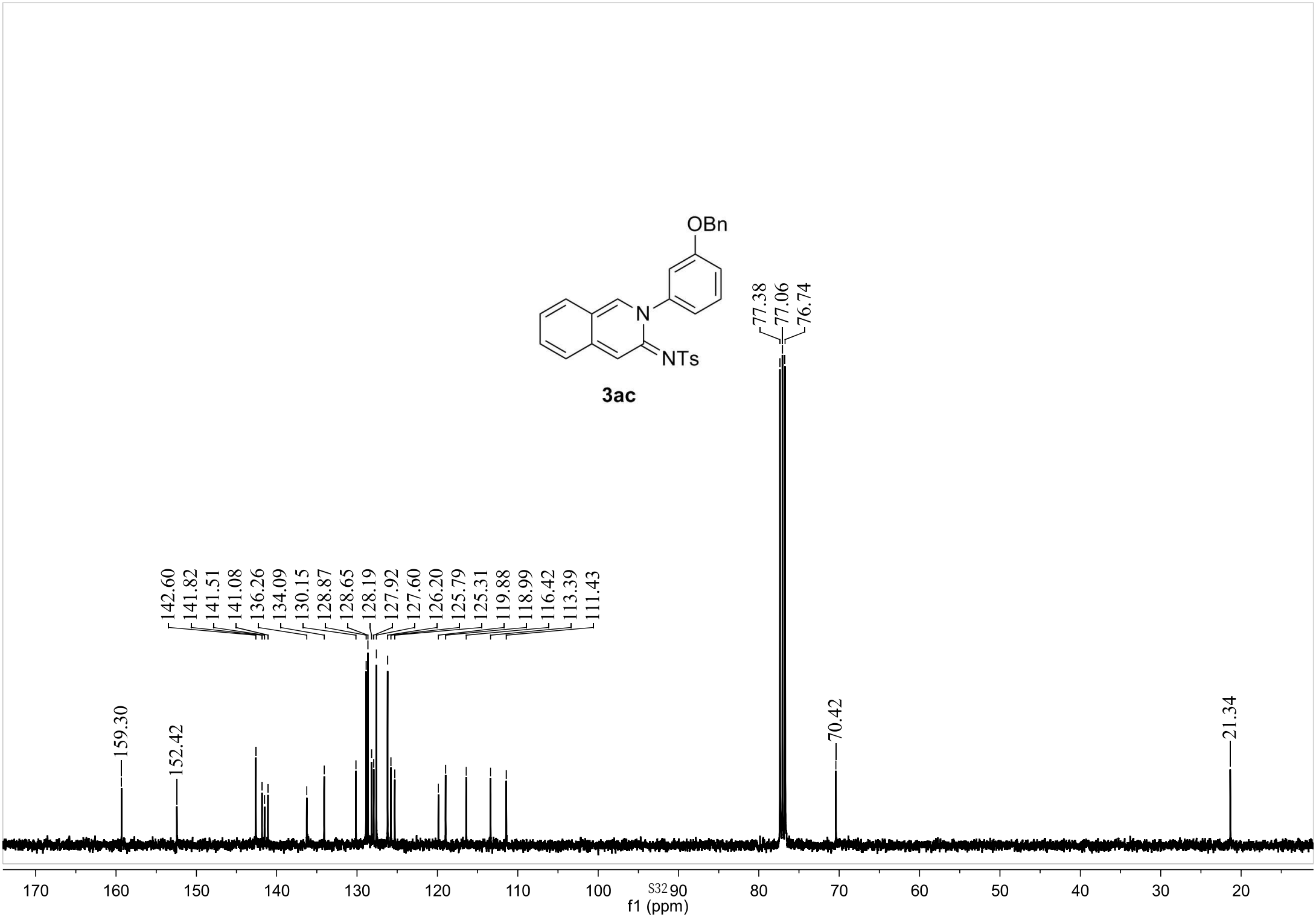
1.25
3.09
1.10
1.08
2.08
3.08
f1 (ppm)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NTs
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141.51
141.08
136.26
134.09
130.15
128.87
128.65
128.19
127.92
127.60
126.20
125.79
125.31
119.88
118.99
116.42
113.39
111.43
159.30
152.42
70.42
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150
140
130
120
110
100
90
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70
60
50
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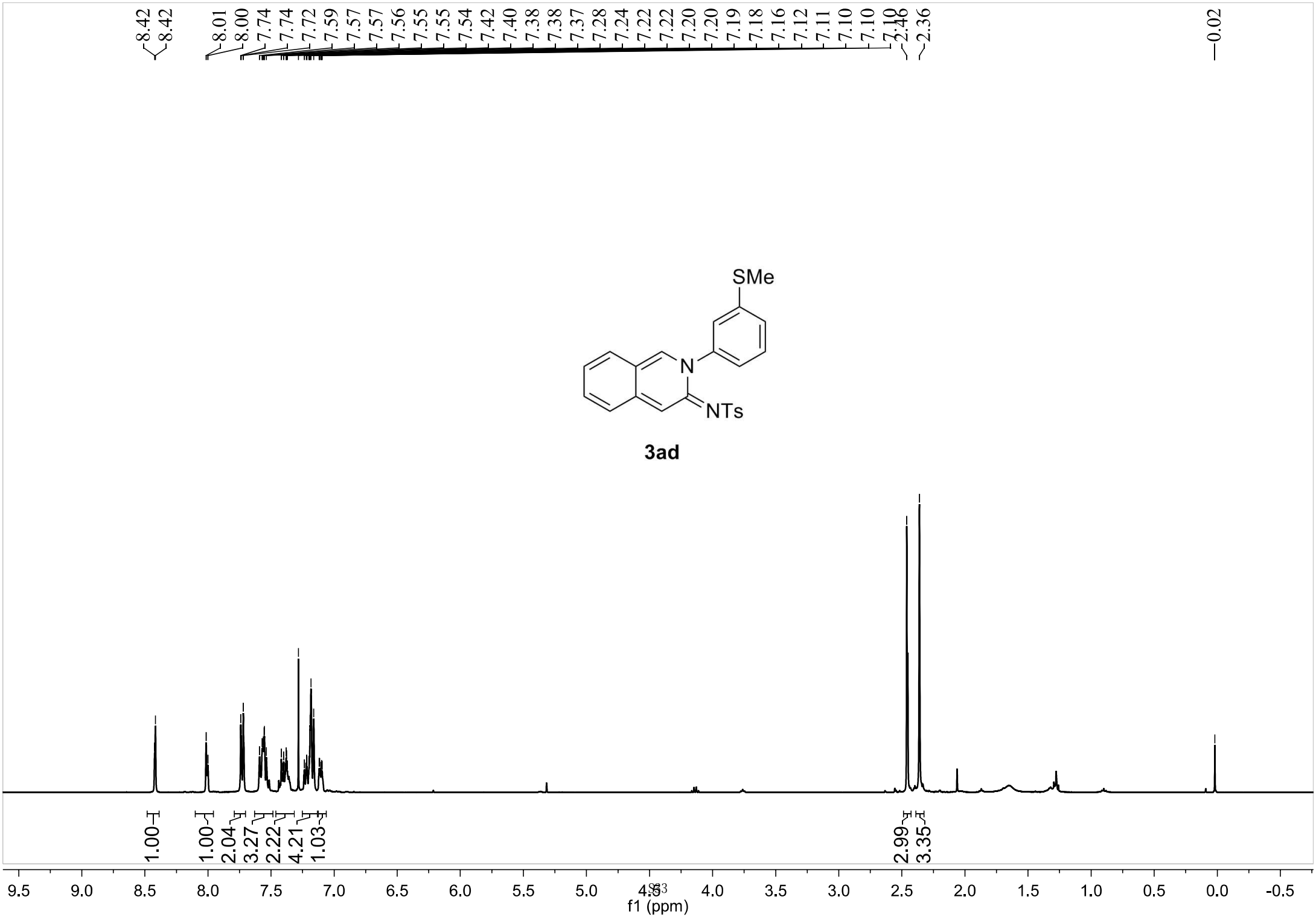
30
20
f1 (ppm)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7.56
7.55
7.55
7.54
7.42
7.40
7.38
7.38
7.37
7.28
7.24
7.22
7.22
7.20
7.20
7.19
7.18
7.16
7.12
7.11
7.10
7.10
2.46
2.36
0.02
SMe
N
NTs
3ad
1.00
1.00
2.04
3.27
2.22
4.21
1.03
2.99
3.35
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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3.0
2.5
2.0
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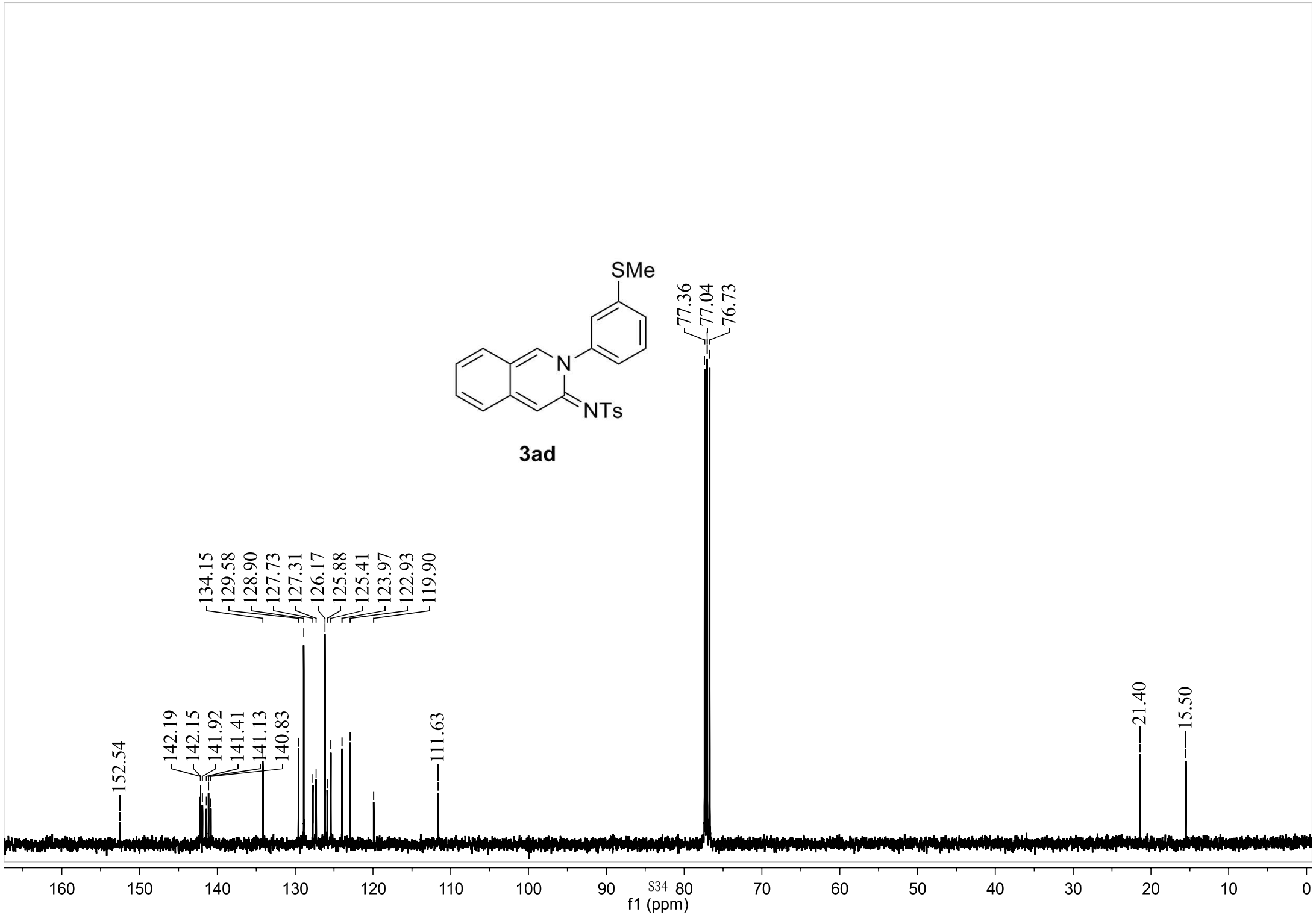
-0.5
f1 (ppm)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NTs
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76.73
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127.31
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125.41
123.97
122.93
119.90
152.54
142.19
142.15
141.92
141.41
141.13
140.83
111.63
21.40
15.50
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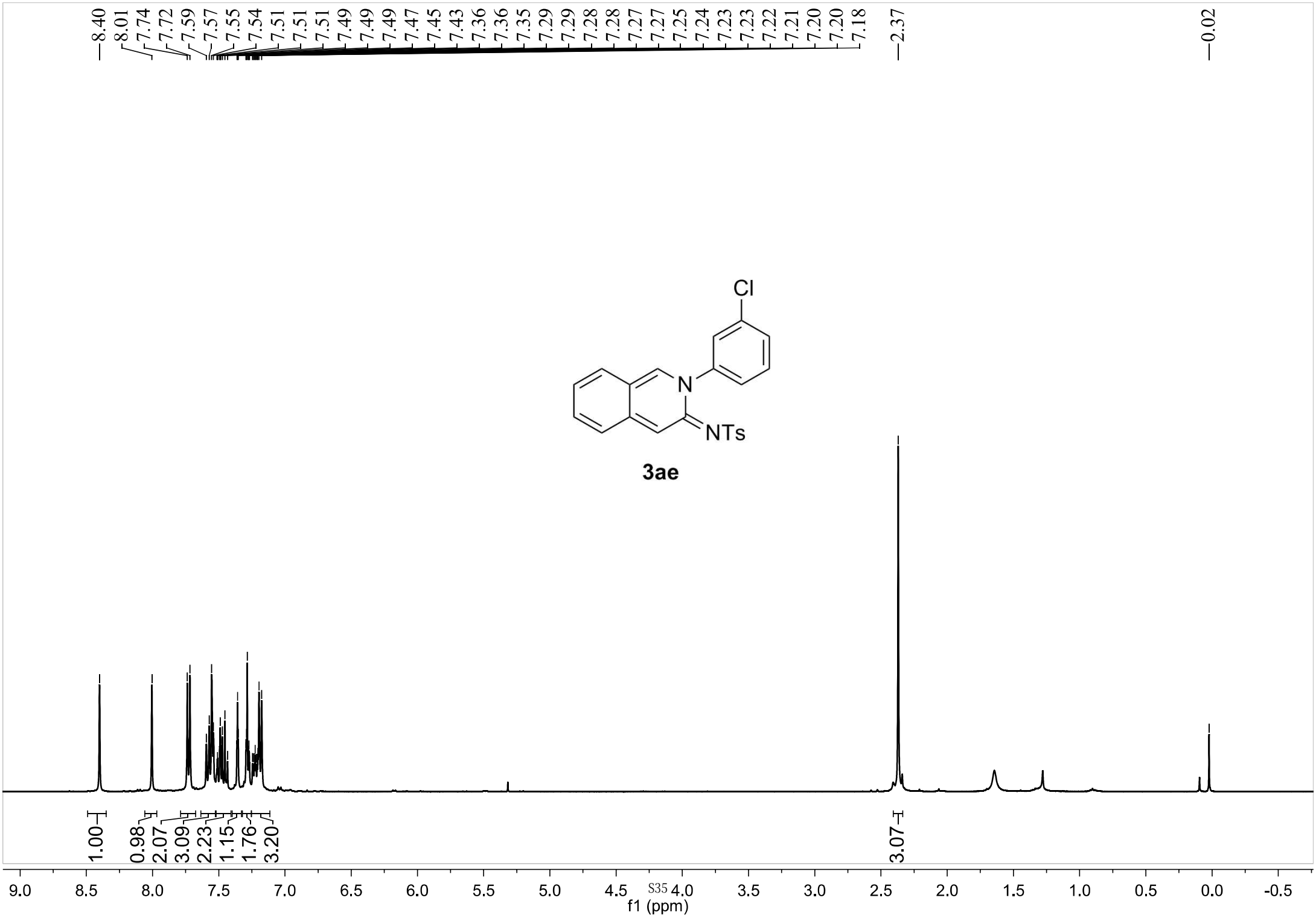
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.57
7.55
7.54
7.51
7.51
7.51
7.49
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7.49
7.47
7.45
7.43
7.36
7.36
7.35
7.29
7.29
7.28
7.28
7.27
7.27
7.25
7.24
7.23
7.23
7.22
7.21
7.20
7.20
7.18
2.37
0.02
Cl
N
NTs
3ae
1.00
0.98
2.07
3.09
2.23
1.15
1.76
3.20
3.07
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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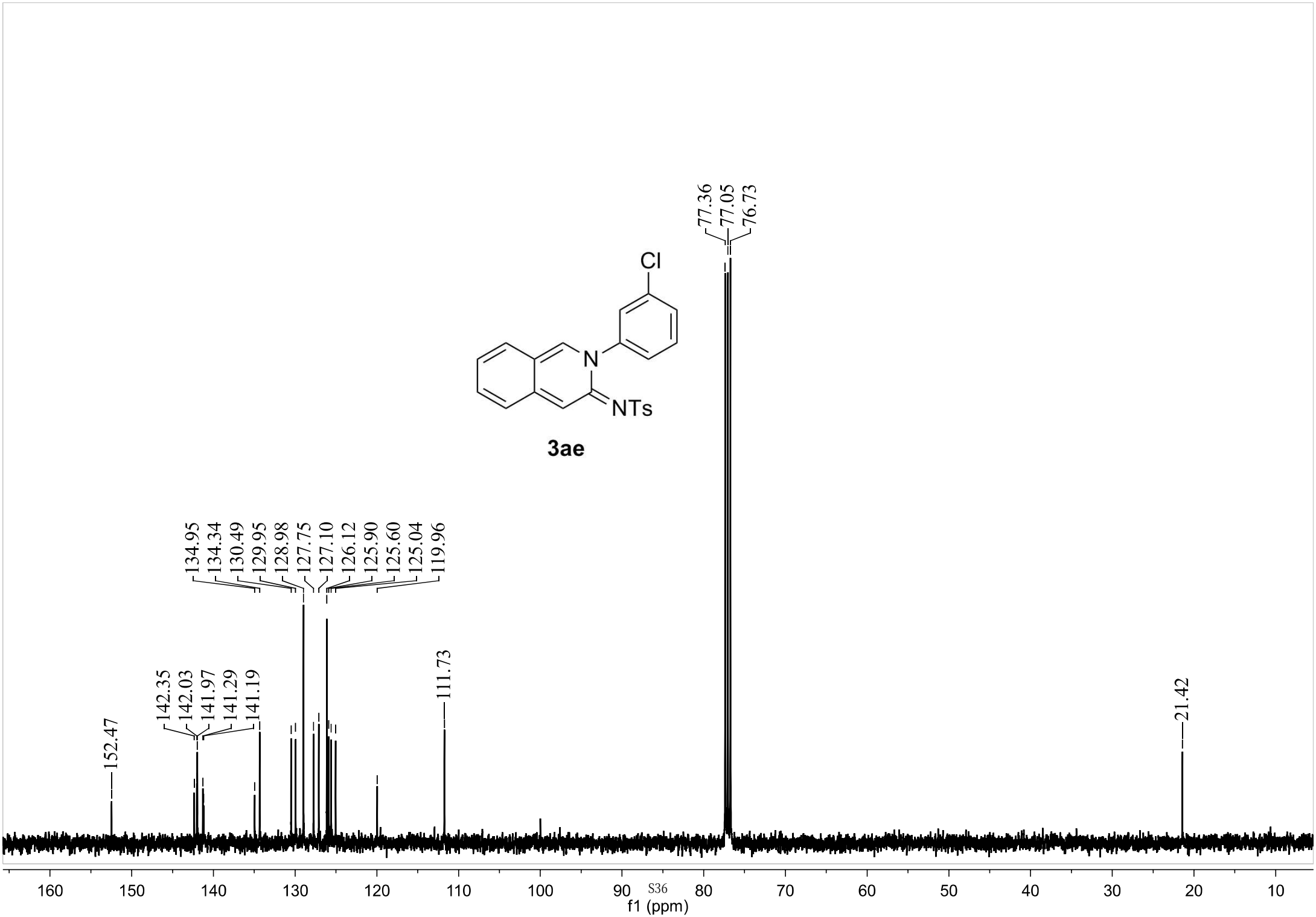
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


Cl
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NTs
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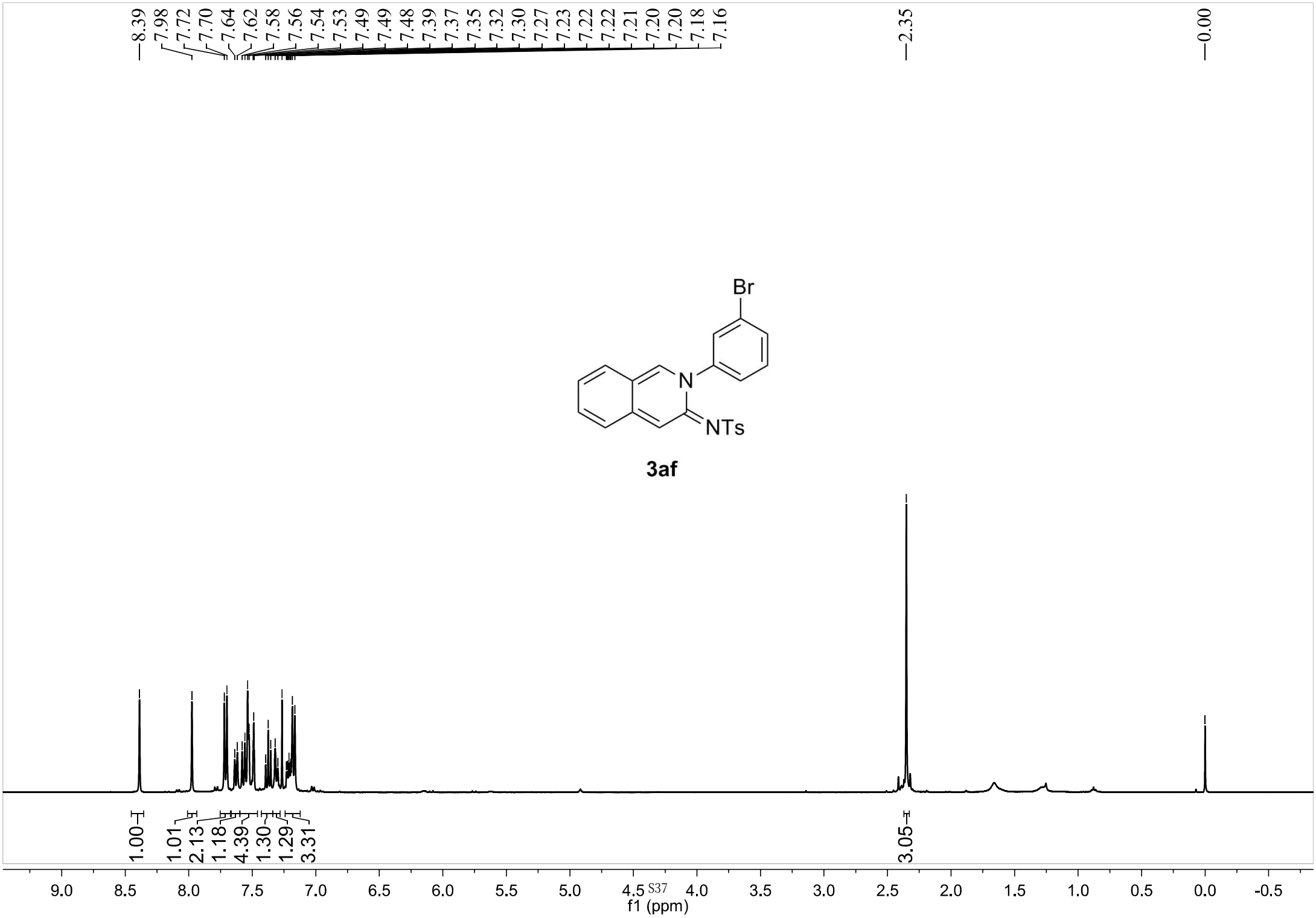
77.05
76.73
134.95
134.34
130.49
129.95
128.98
127.75
127.10
126.12
125.90
125.60
125.04
119.96
142.35
142.03
141.97
141.29
141.19
152.47
111.73
21.42
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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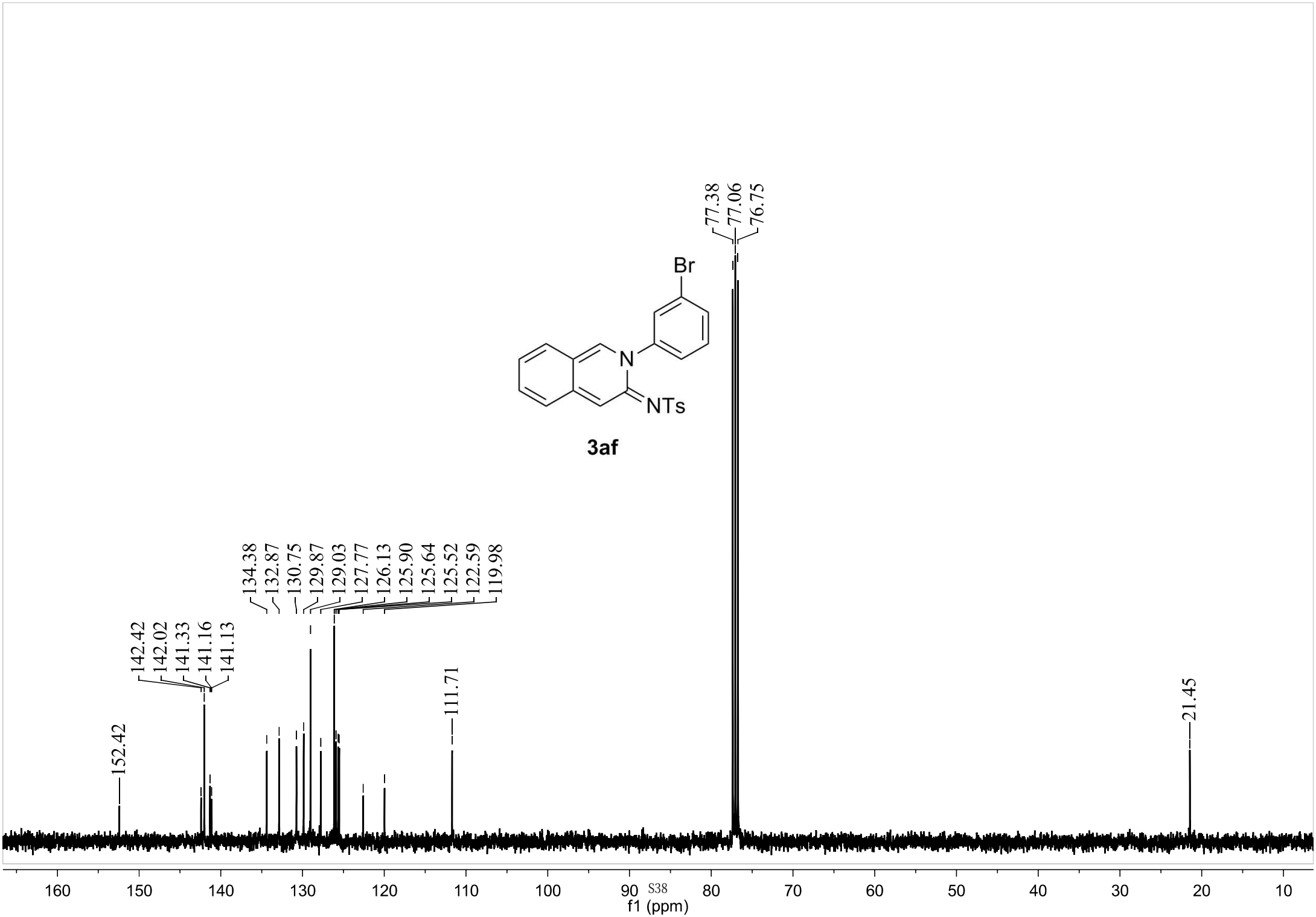
7.53
7.49
7.49
7.48
7.39
7.37
7.35
7.32
7.30
7.27
7.23
7.22
7.22
7.21
7.20
7.20
7.18
7.16
2.35
0.00
Br
N
NTs
3af
1.00
1.01
2.13
1.18
4.39
1.30
1.29
3.31
3.05
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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76.75
Br
N
NTs
3af
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132.87
130.75
129.87
129.03
127.77
126.13
125.90
125.64
125.52
122.59
119.98
142.42
142.02
141.33
141.16
141.13
152.42
111.71
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140
130
120
110
100
90
80
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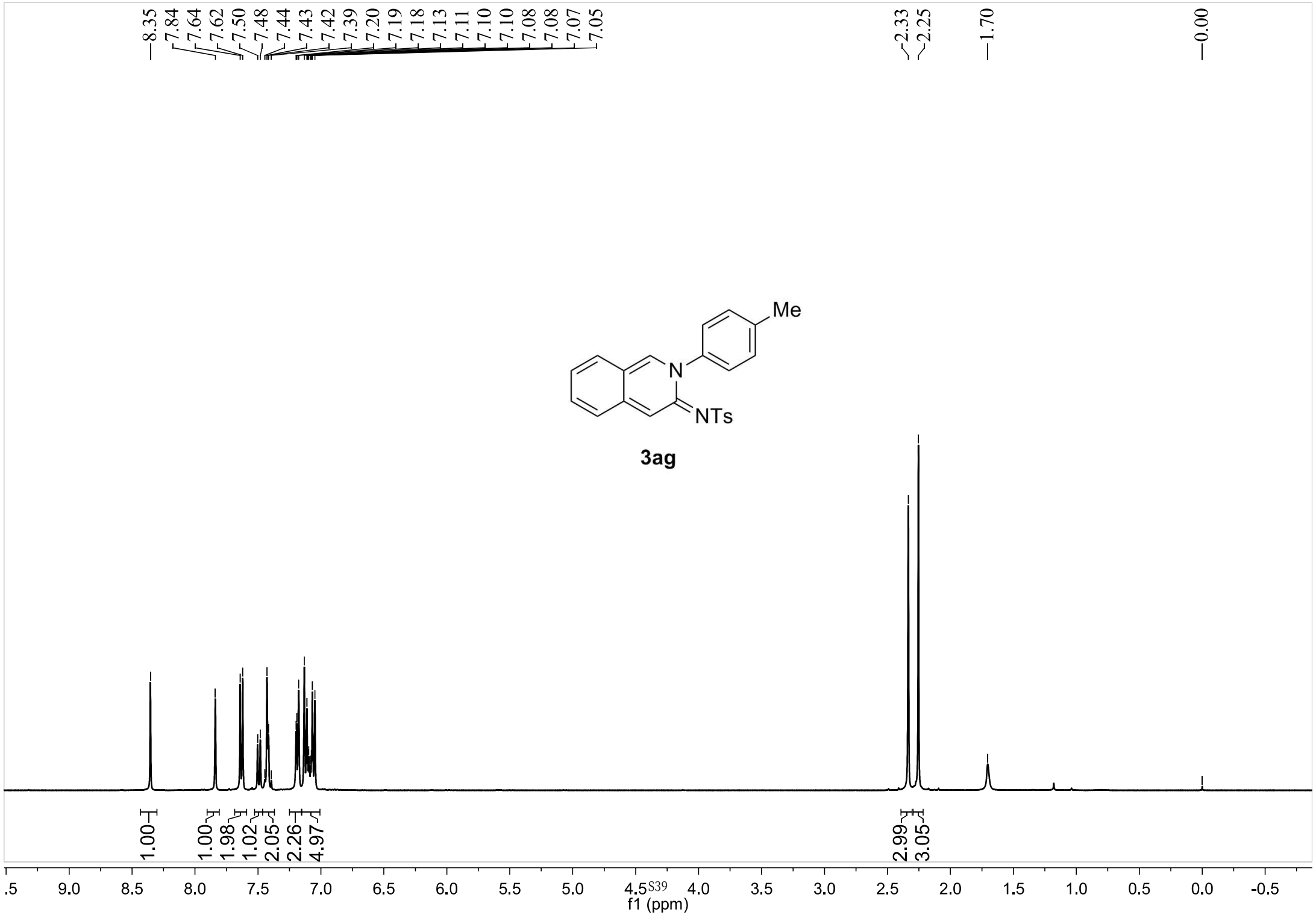
60
50
40
30
20
10
f1 (ppm)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7.18
7.13
7.11
7.10
7.10
7.08
7.08
7.07
7.05
2.33
2.25
1.70
0.00
Me
N
NTs
3ag
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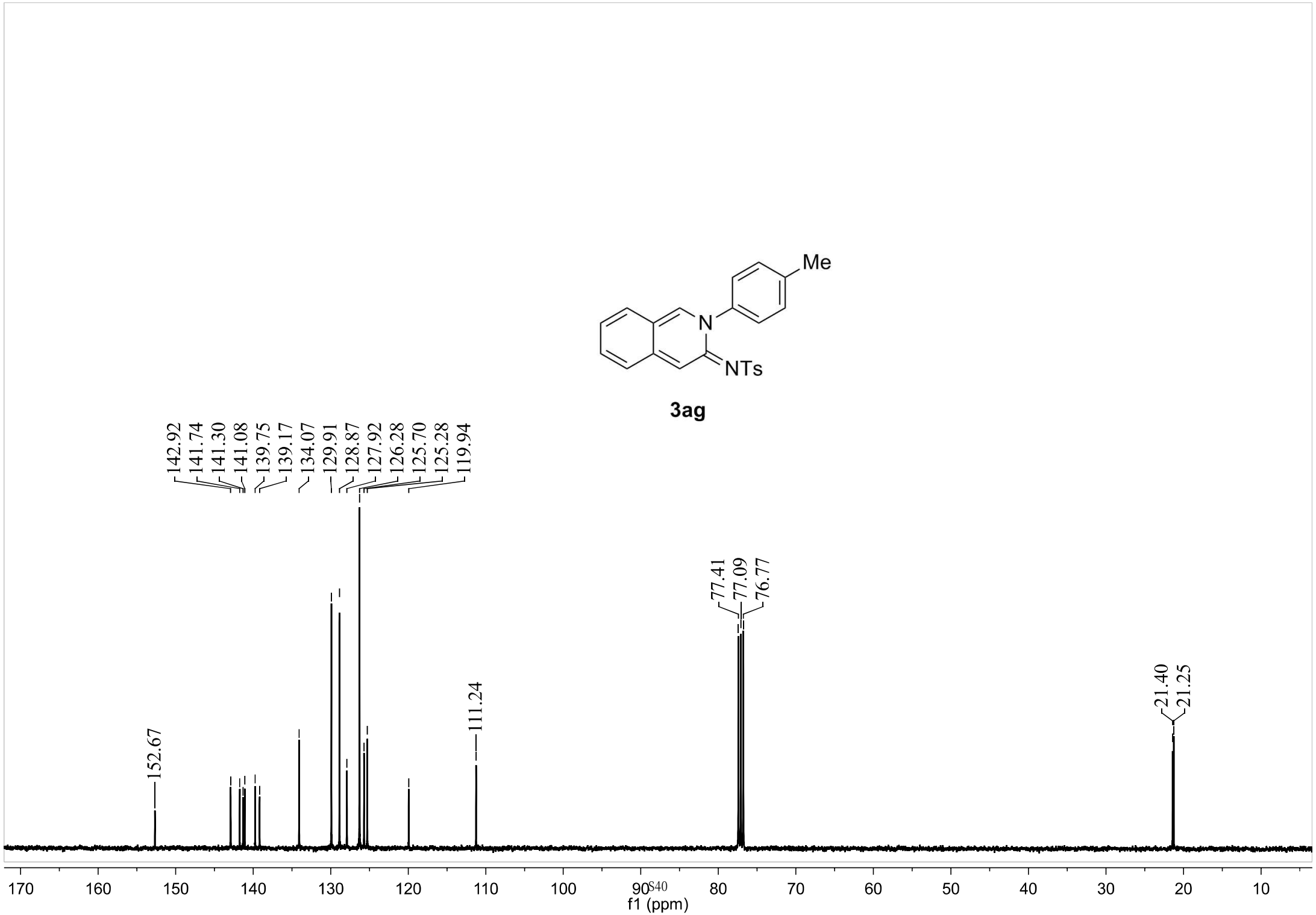
1.00
1.98
1.02
2.05
2.26
4.97
2.99
3.05
f1 (ppm)


Me
N
NTs
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141.30
141.08
139.75
139.17
134.07
129.91
128.87
127.92
126.28
125.70
125.28
119.94
152.67
111.24
77.41
77.09
76.77
21.40
21.25
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160
150
140
130
120
110
100
90
80
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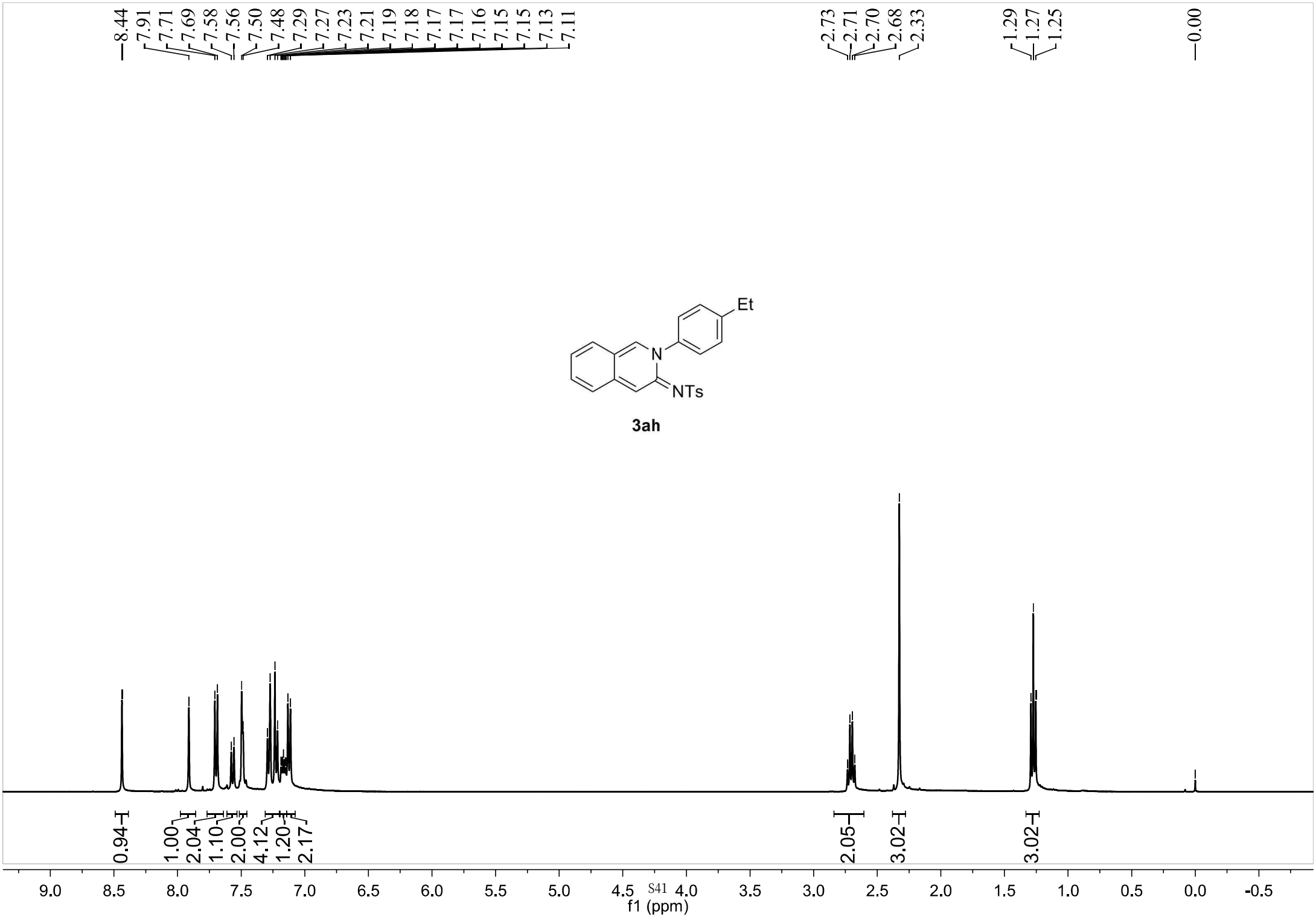
60
50
40
30
20
10
f1 (ppm)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7.27
7.23
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7.18
7.17
7.17
7.16
7.15
7.15
7.13
7.11
2.73
2.71
2.70
2.68
2.33
1.29
1.27
1.25
0.00
Et
N
NTs
3ah
0.94
1.00
2.04
1.10
2.00
4.12
1.20
2.17
2.05
3.02
3.02
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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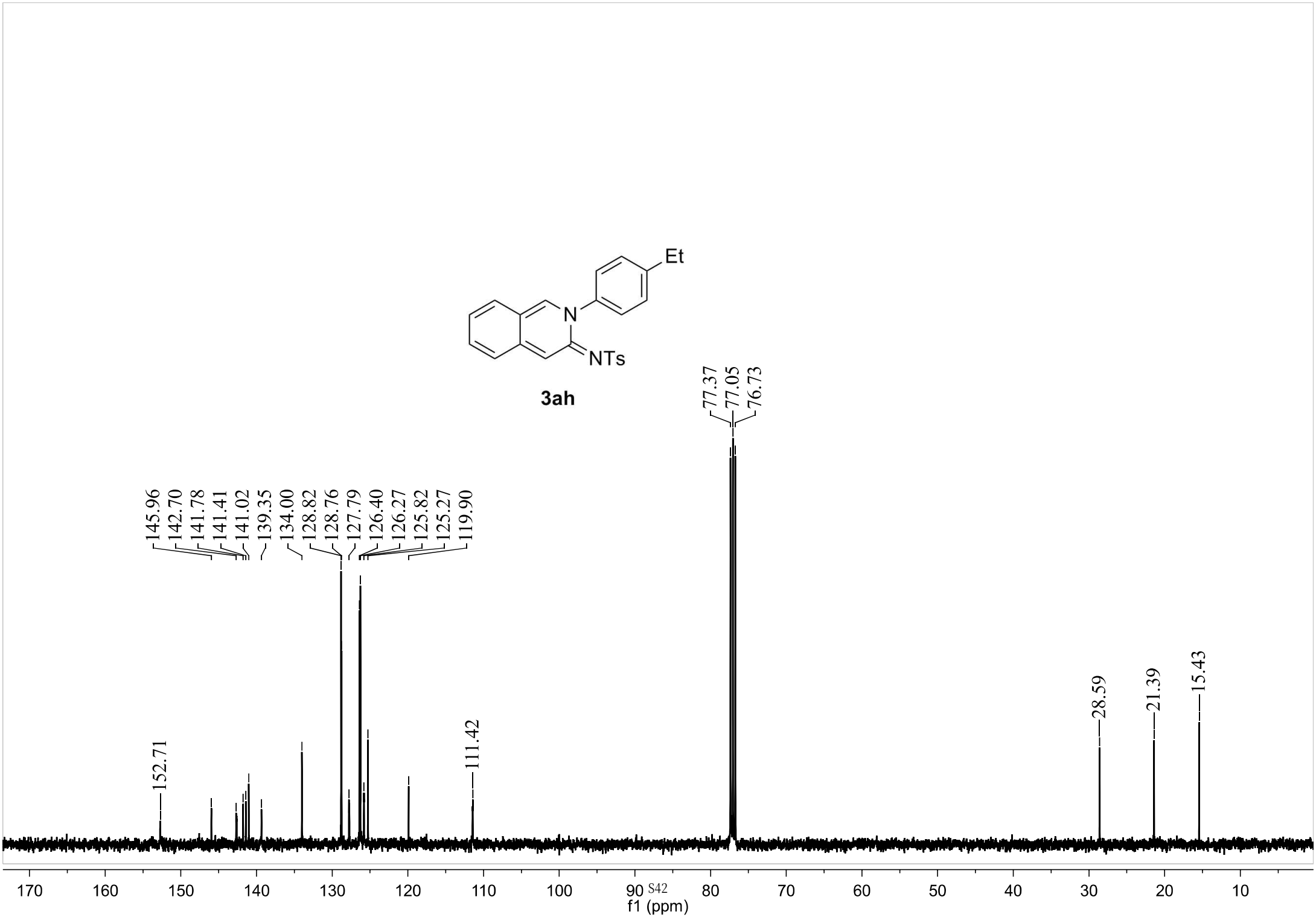
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


Et
N
NTs
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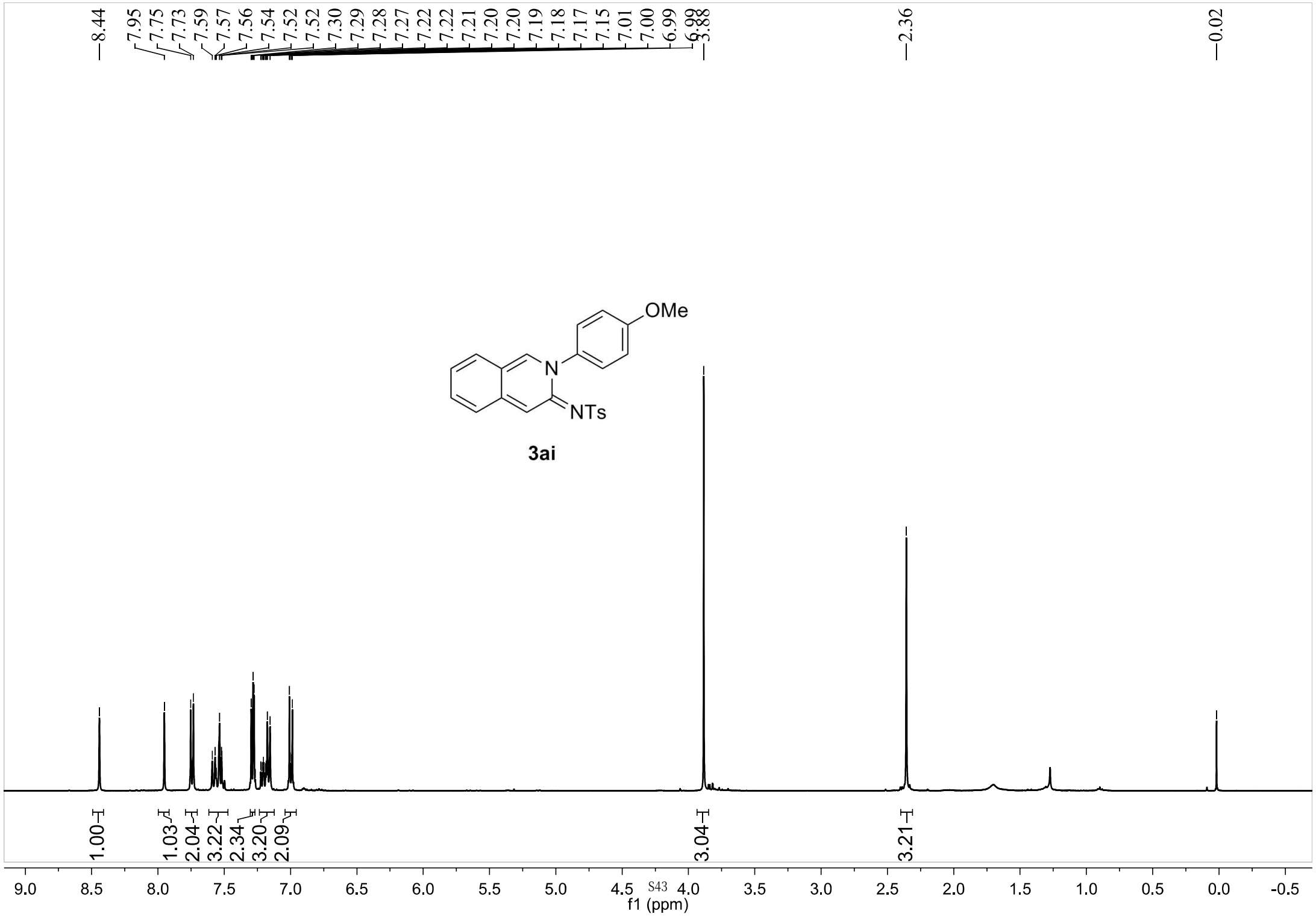
134.00
128.82
128.76
127.79
126.40
126.27
125.82
125.27
119.90
152.71
111.42
77.37
77.05
76.73
28.59
21.39
15.43
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.75
7.73
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7.57
7.56
7.54
7.52
7.52
7.30
7.29
7.28
7.27
7.22
7.22
7.21
7.20
7.20
7.19
7.18
7.17
7.15
7.01
7.00
6.99
6.98
3.88
2.36
0.02
OMe
N
NTs
3ai
1.00
1.03
2.04
3.22
2.34
3.20
2.09
3.04
3.21
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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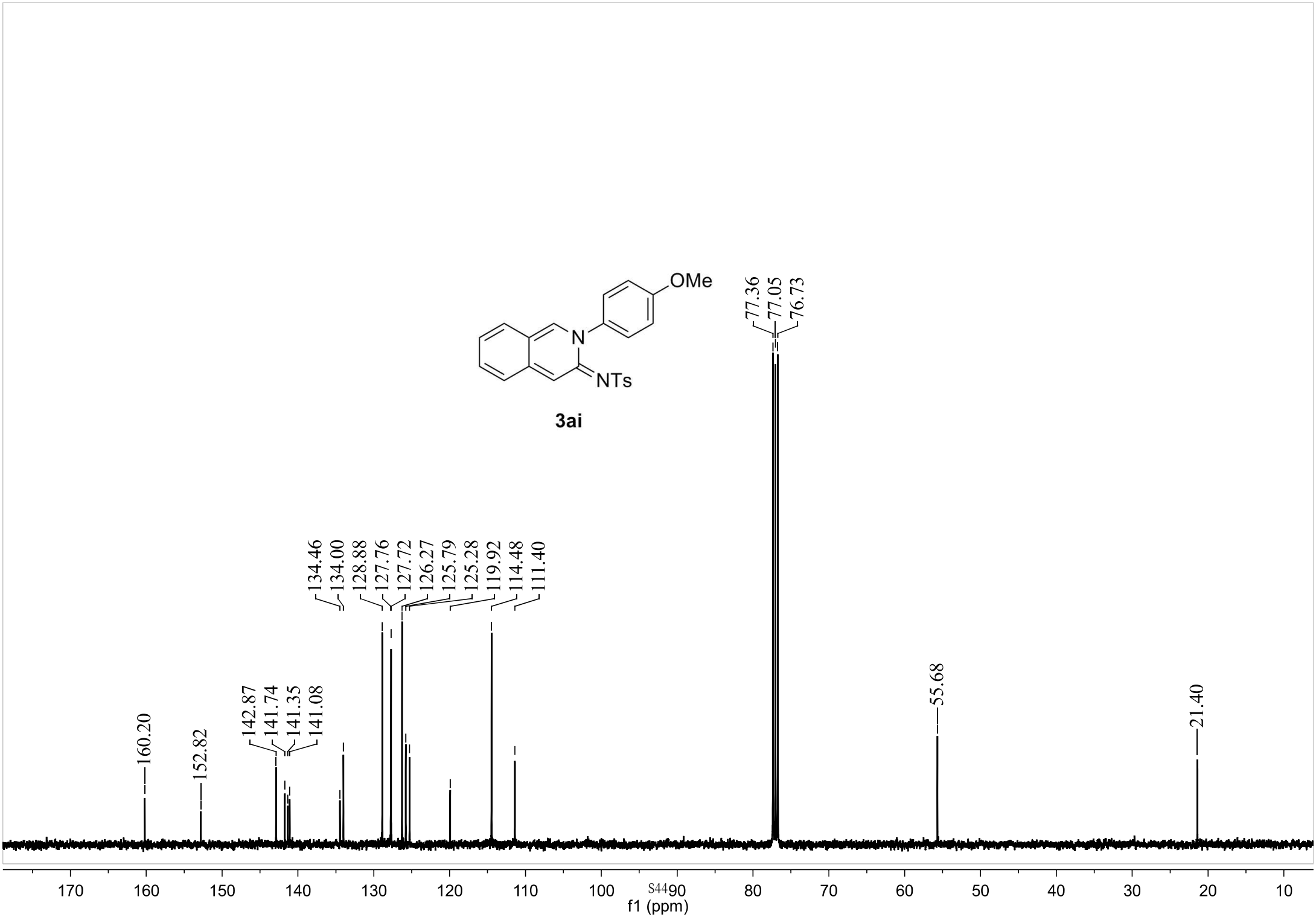
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


OMe
N
NTs
3ai
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77.05
76.73
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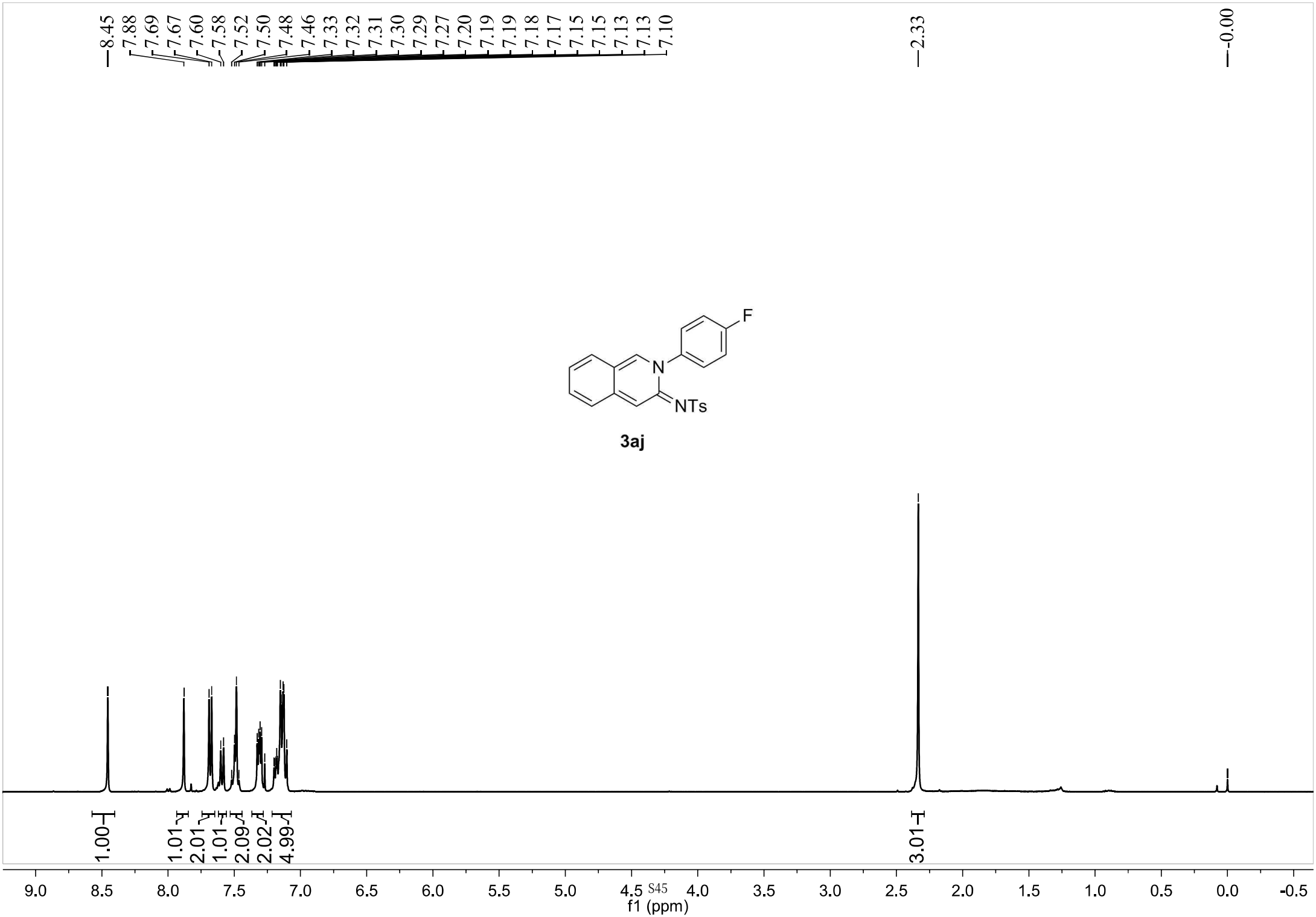
134.00
128.88
127.76
127.72
126.27
125.79
125.28
119.92
114.48
111.40
160.20
152.82
142.87
141.74
141.35
141.08
55.68
21.40
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.46
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7.32
7.31
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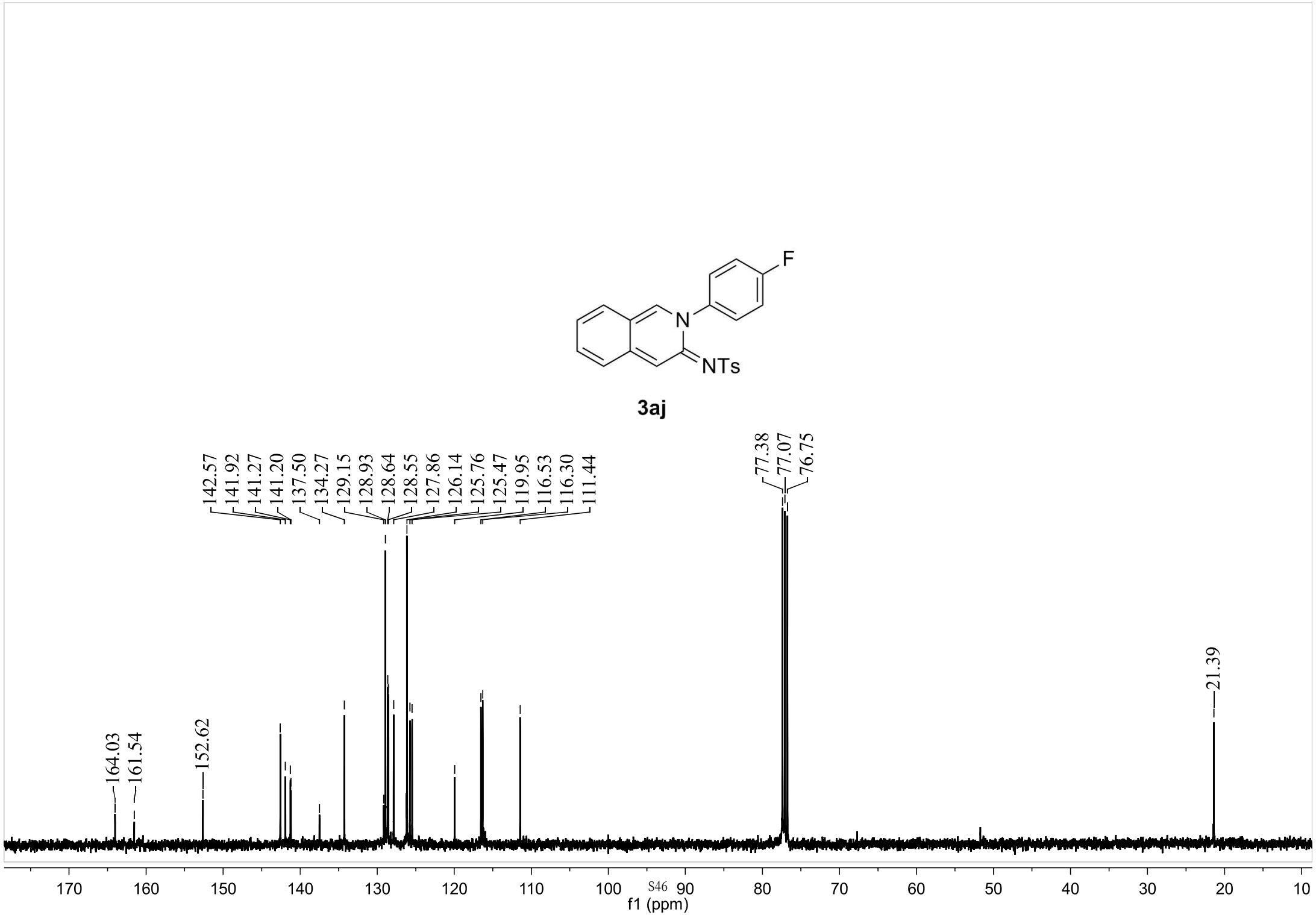
7.29
7.27
7.20
7.19
7.19
7.18
7.17
7.15
7.15
7.13
7.13
7.10
2.33
0.00
F
N
NTs
3aj
1.00
1.01
2.01
1.01
2.09
2.02
4.99
3.01
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


F
N
NTs
3aj
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141.27
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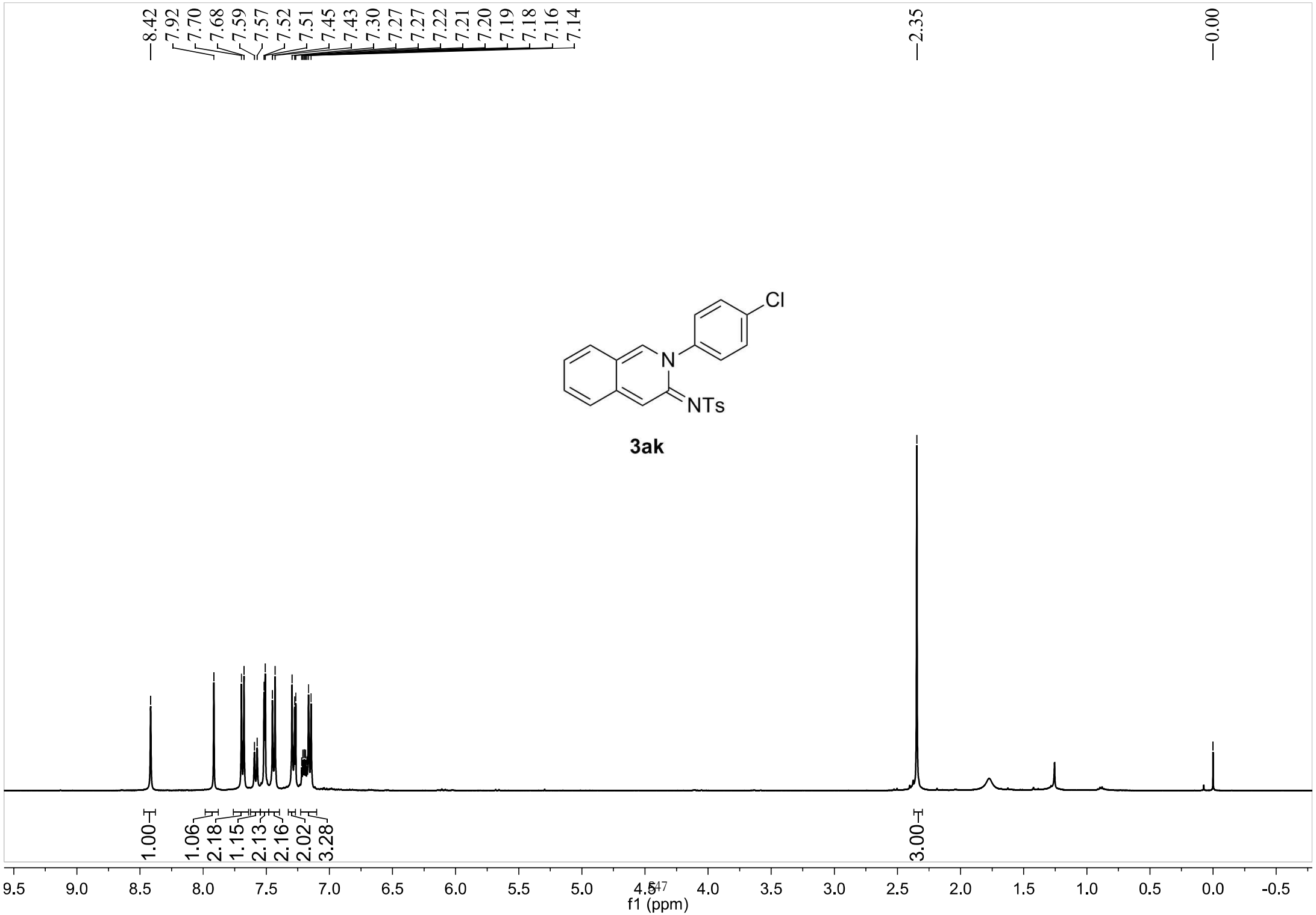
129.15
128.93
128.64
128.55
127.86
126.14
125.76
125.47
119.95
116.53
116.30
111.44
77.38
77.07
76.75
164.03
161.54
152.62
21.39
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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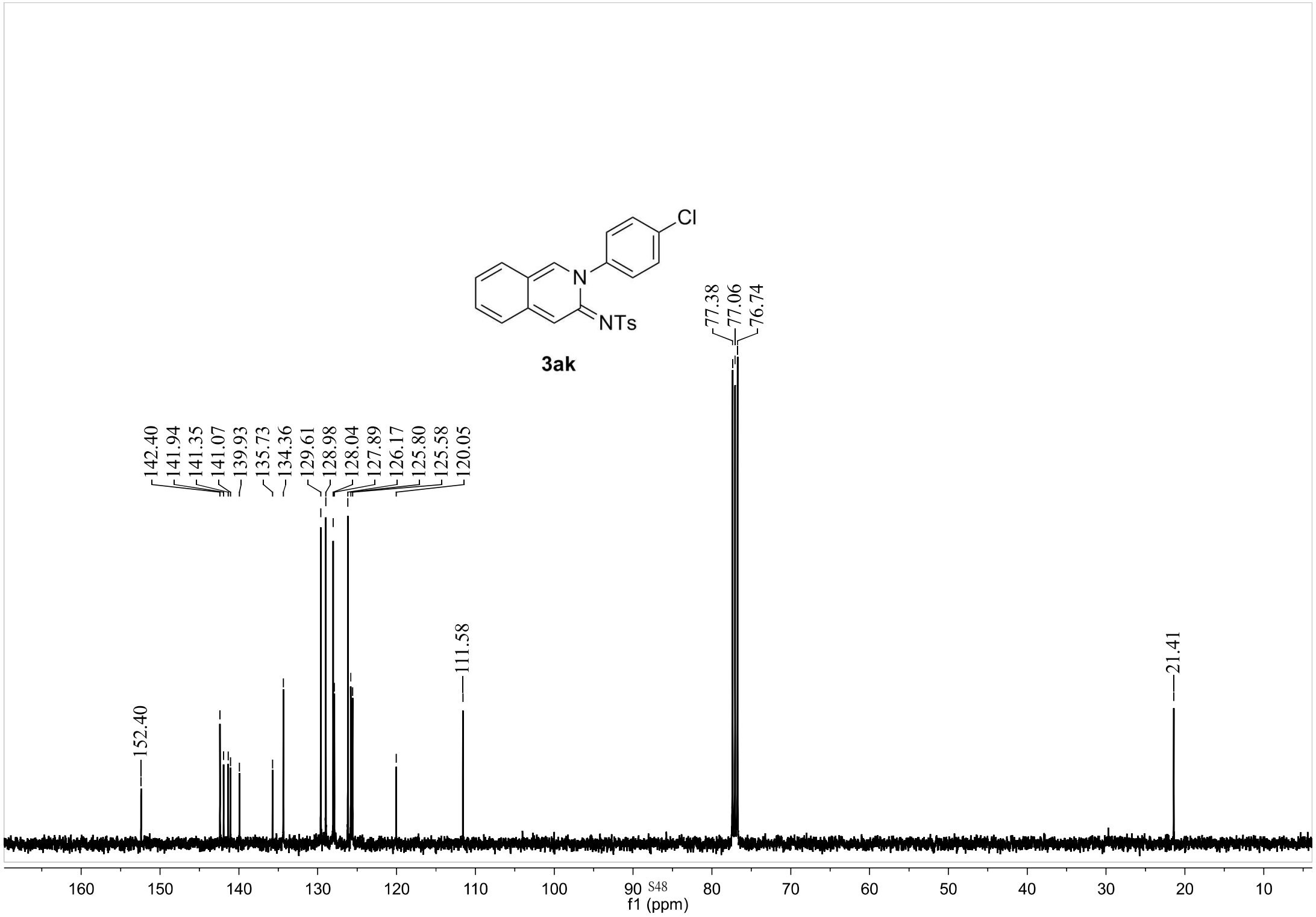
7.43
7.30
7.27
7.27
7.22
7.21
7.20
7.19
7.18
7.16
7.14
2.35
0.00
Cl
N
NTs
3ak
1.00
1.06
2.18
1.15
2.13
2.16
2.02
3.28
3.00
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


Cl
N
NTs
3ak
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141.35
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139.93
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134.36
129.61
128.98
128.04
127.89
126.17
125.80
125.58
120.05
77.38
77.06
76.74
152.40
111.58
21.41
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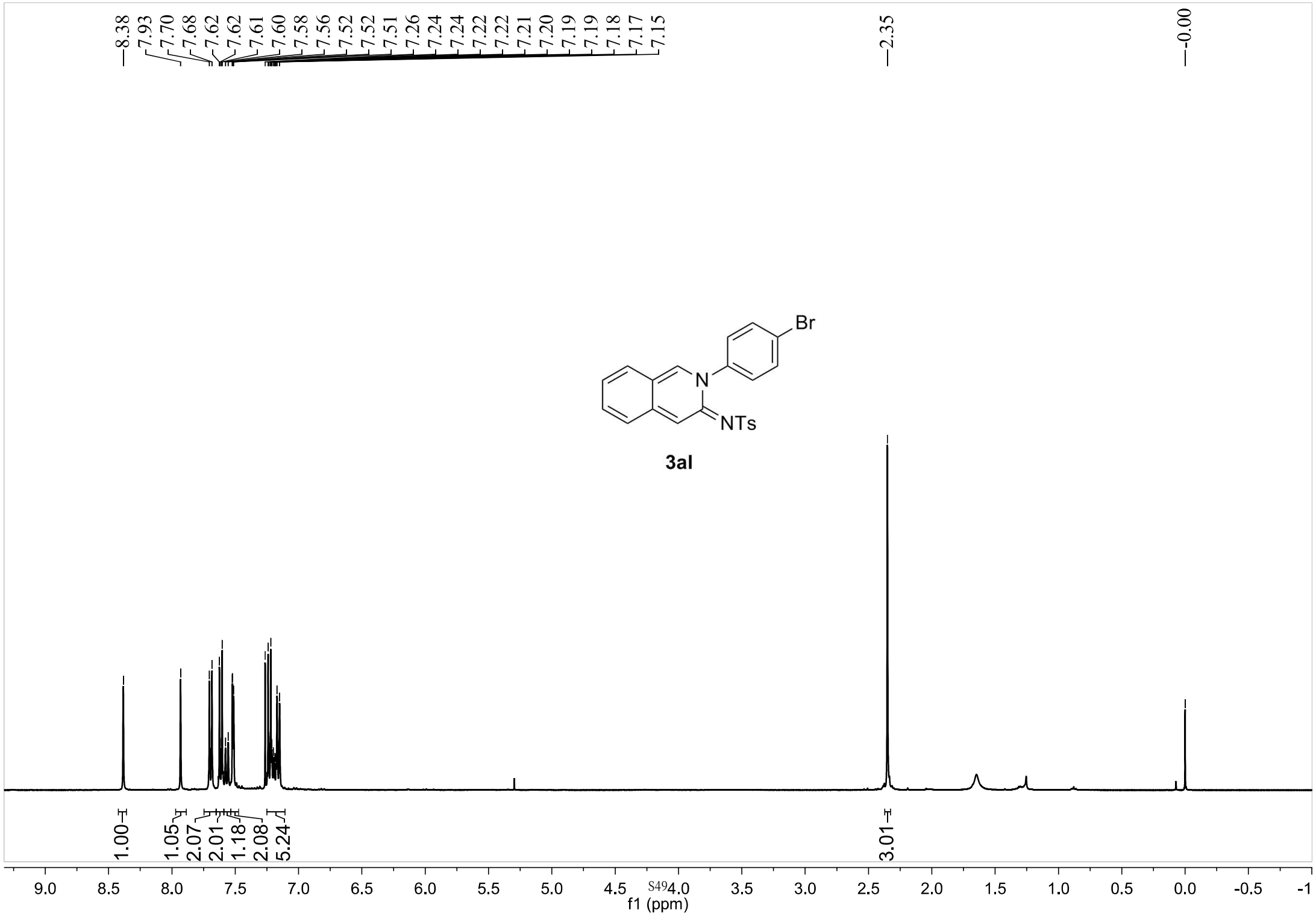
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.56
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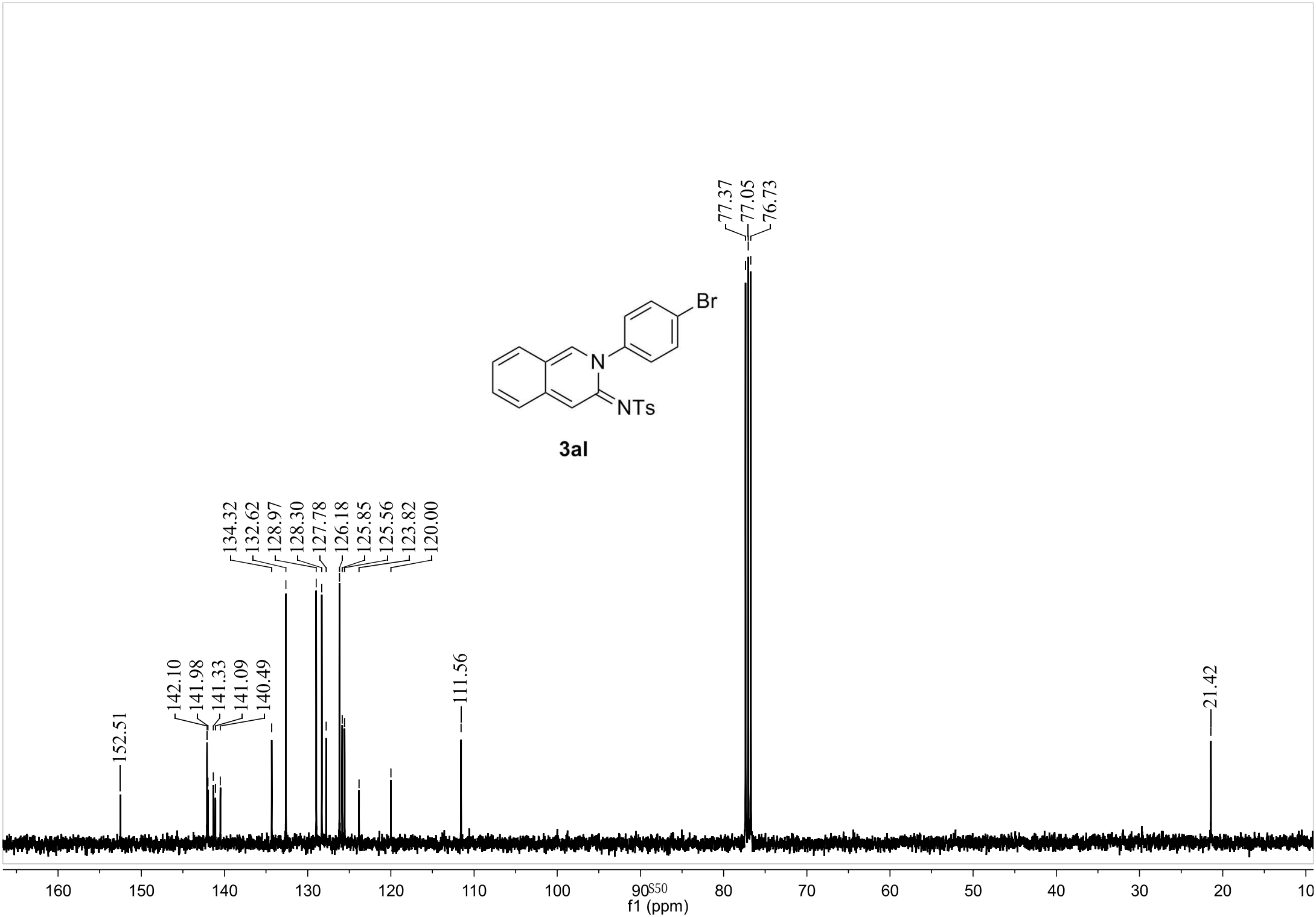
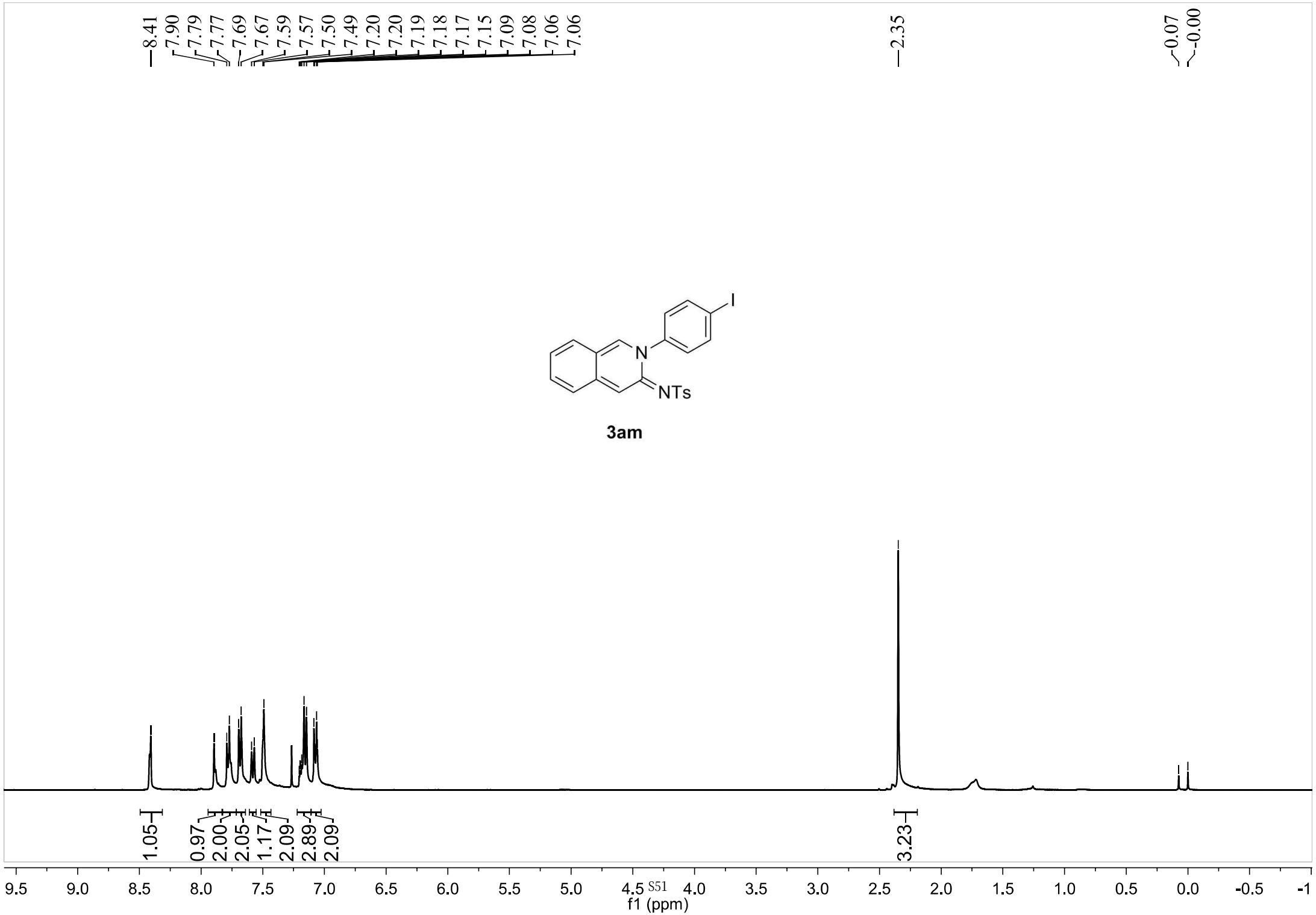
7.51
7.26
7.24
7.24
7.22
7.22
7.21
7.20
7.19
7.19
7.18
7.17
7.15
2.35
-0.00
Br
N
NTs
3aI
1.00
1.05
2.07
2.01
1.18
2.08
5.24
3.01
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1
f1 (ppm)


77.37
77.05
76.73
Br
N
NTs
3aI
134.32
132.62
128.97
128.30
127.78
126.18
125.85
125.56
123.82
120.00
142.10
141.98
141.33
141.09
140.49
152.51
111.56
21.42
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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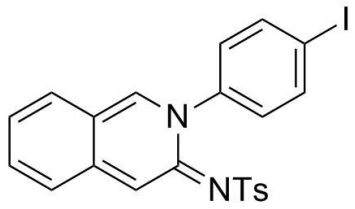
7.57
7.50
7.49
7.20
7.20
7.19
7.18
7.17
7.15
7.09
7.08
7.06
7.06
2.35
0.07
0.00
I
N
NTs
3am
1.05
0.97
2.00
2.05
1.17
2.09
2.89
2.09
3.23
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1
f1 (ppm)


I
N
NTs

3am

142.24
141.92
141.32
141.19
141.06
138.54
134.33
128.98
128.42
127.90
126.17
125.77
125.52
120.01
77.38
77.06
76.74
152.36
111.42
95.43
21.44
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120
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100
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60
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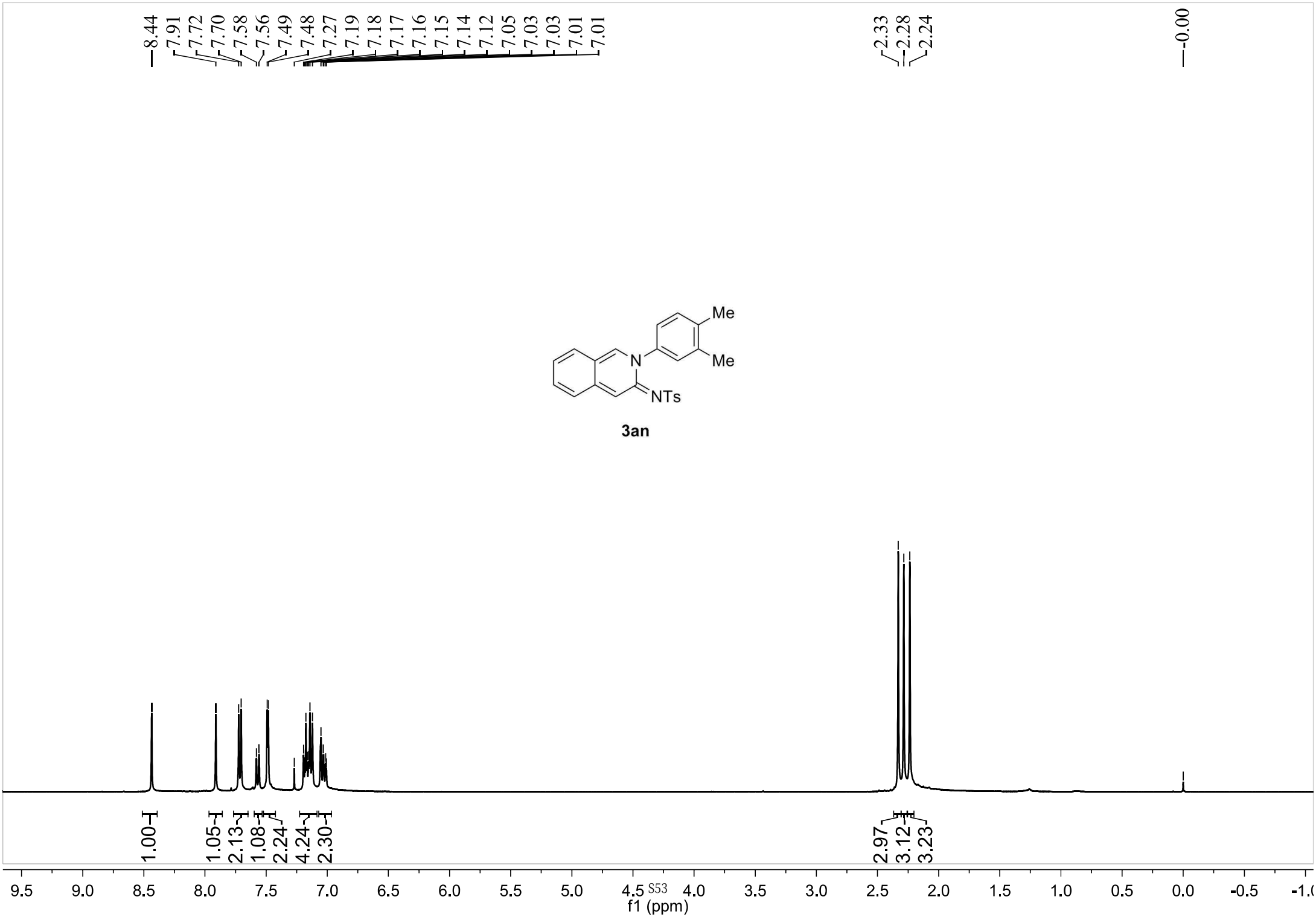
f1 (ppm)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7.15
7.14
7.12
7.05
7.03
7.03
7.01
7.01
2.33
2.28
2.24
0.00
Me
Me
N
NTs
3an
1.00
1.05
2.13
1.08
2.24
4.24
2.30
2.97
3.12
3.23
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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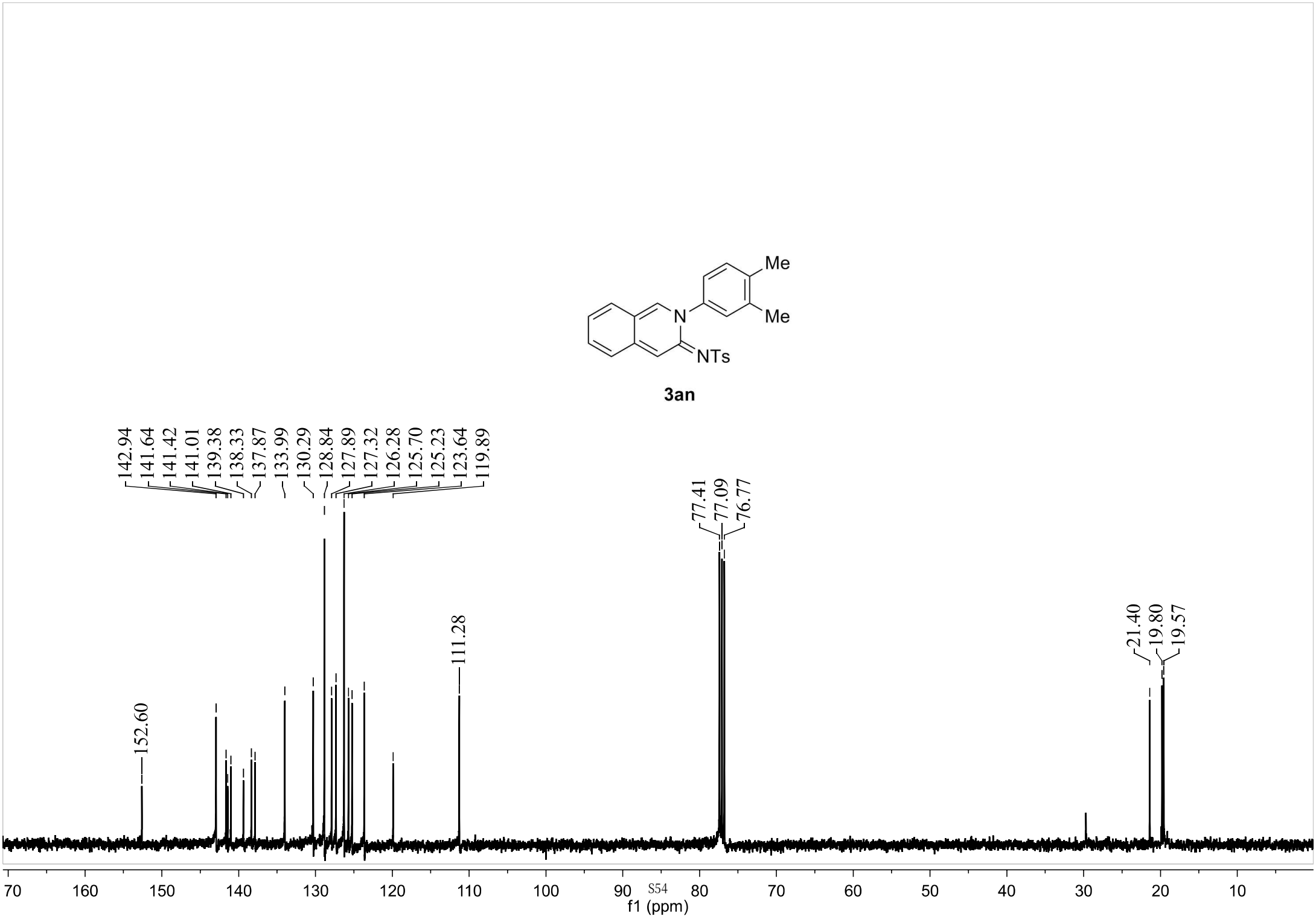
f1 (ppm)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127.89
127.32
126.28
125.70
125.23
123.64
119.89
77.41
77.09
76.77
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111.28
21.40
19.80
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120
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100
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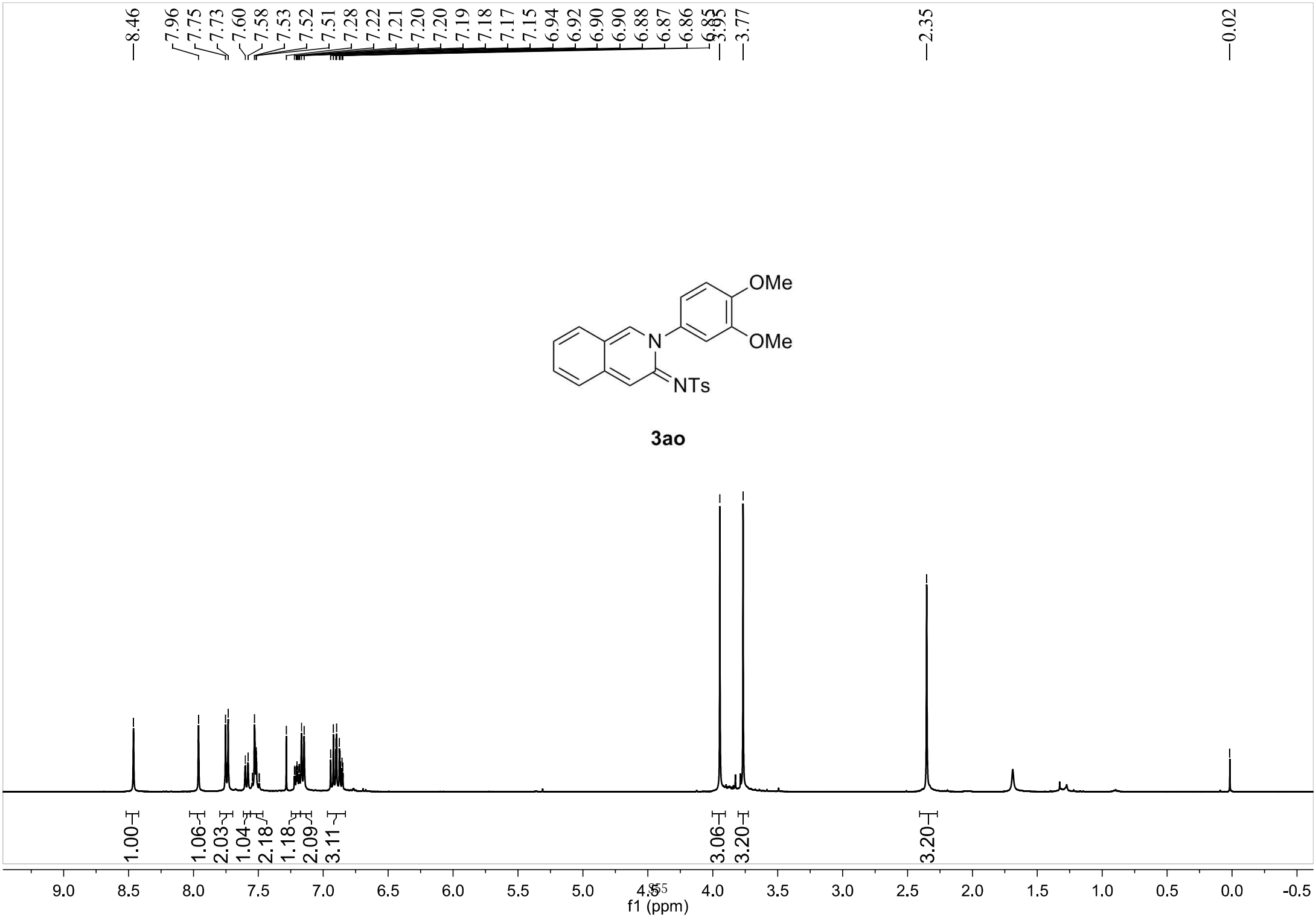
30
20
10
f1 (ppm)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7.20
7.19
7.18
7.17
7.15
6.94
6.92
6.90
6.90
6.88
6.87
6.86
3.95
3.77
2.35
0.02
OMe
OMe
N
NTs
3ao
1.00
1.06
2.03
1.04
2.18
1.18
2.09
3.11
3.06
3.20
3.20
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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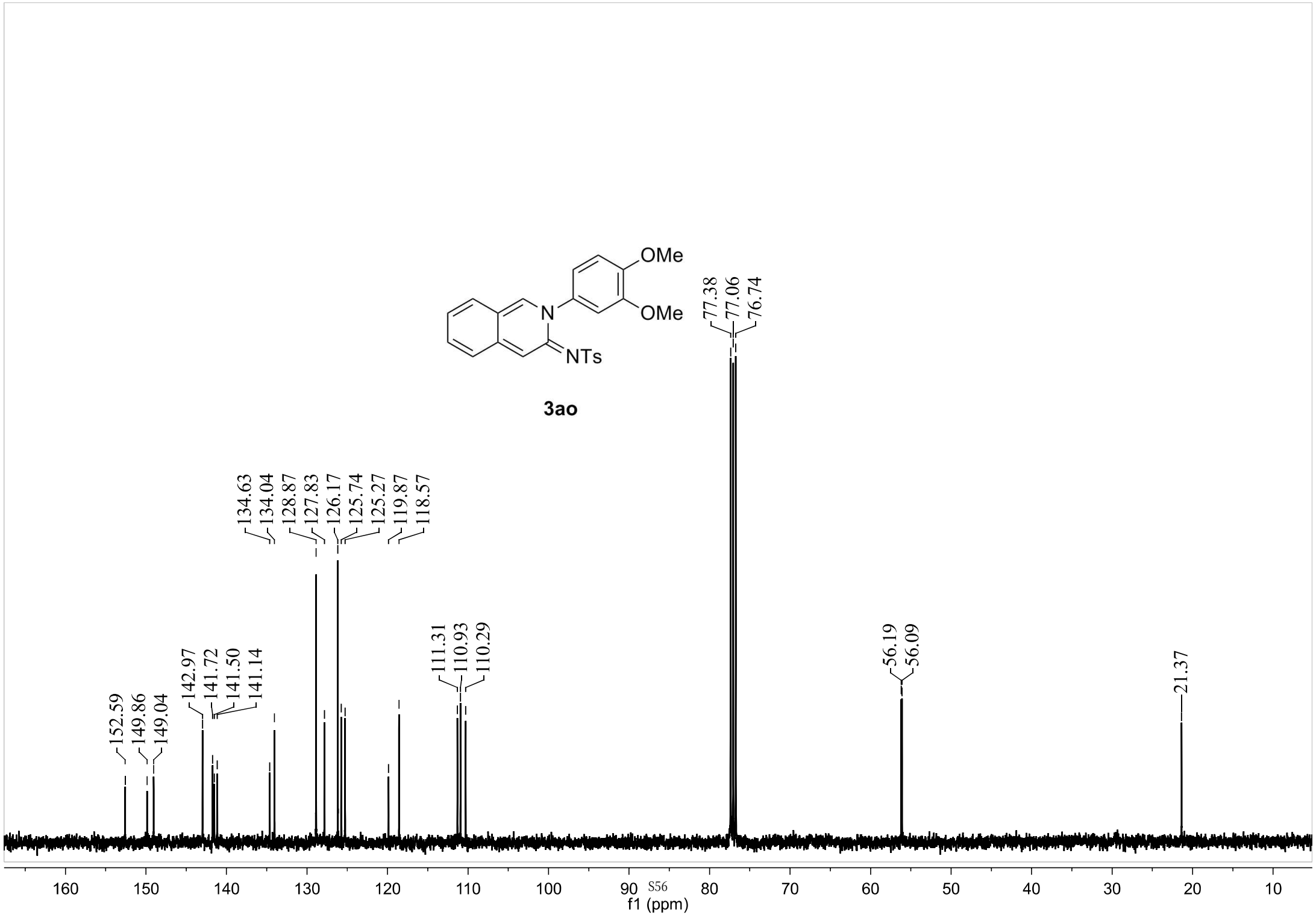
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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OMe
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NTs
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141.14
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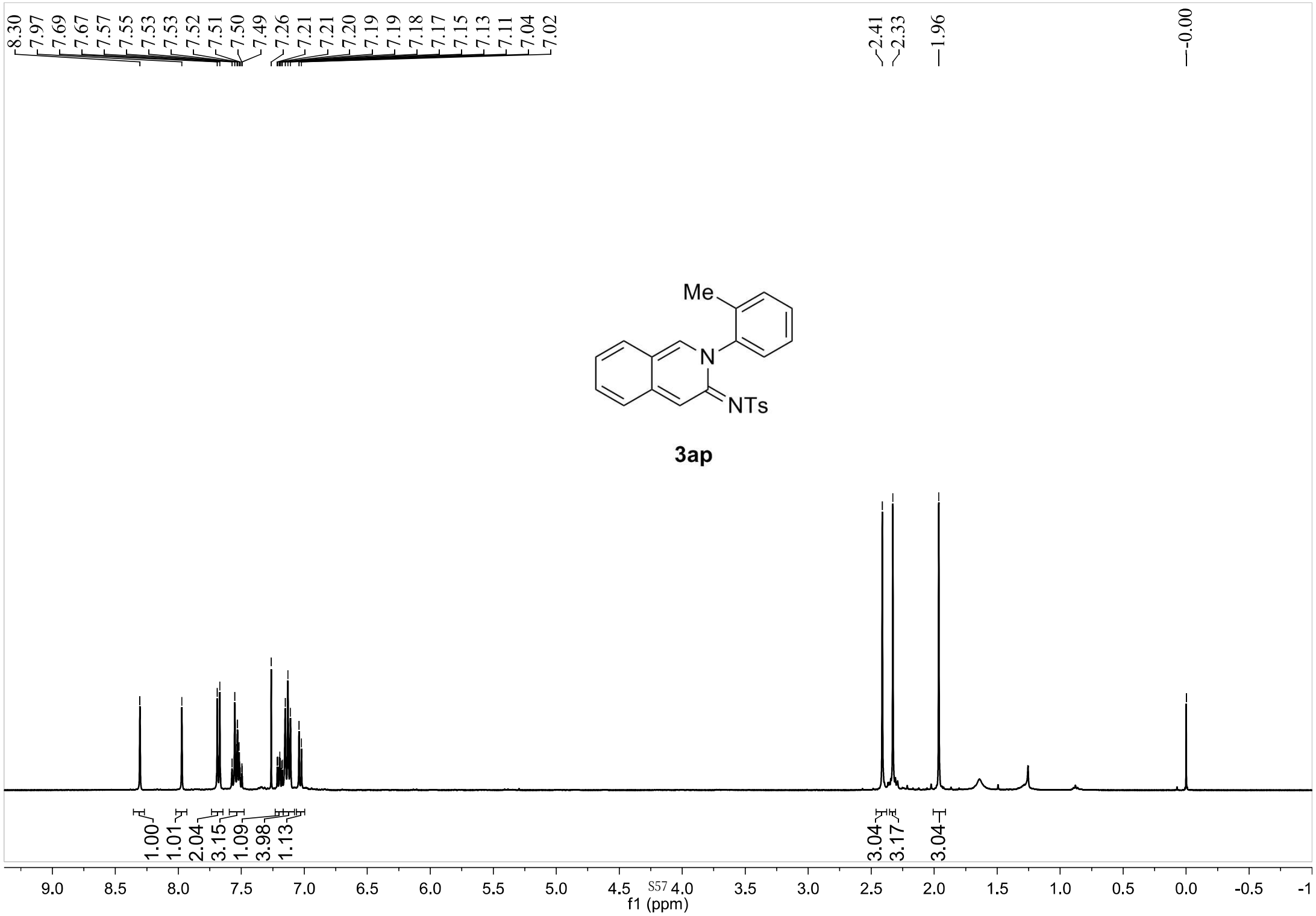
134.04
128.87
127.83
126.17
125.74
125.27
119.87
118.57
111.31
110.93
110.29
77.38
77.06
76.74
56.19
56.09
21.37
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.49
7.26
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7.21
7.20
7.19
7.19
7.18
7.17
7.15
7.13
7.11
7.04
7.02
2.41
2.33
1.96
0.00
Me
N
NTs
3ap
1.00
1.01
2.04
3.15
1.09
3.98
1.13
3.04
3.17
3.04
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8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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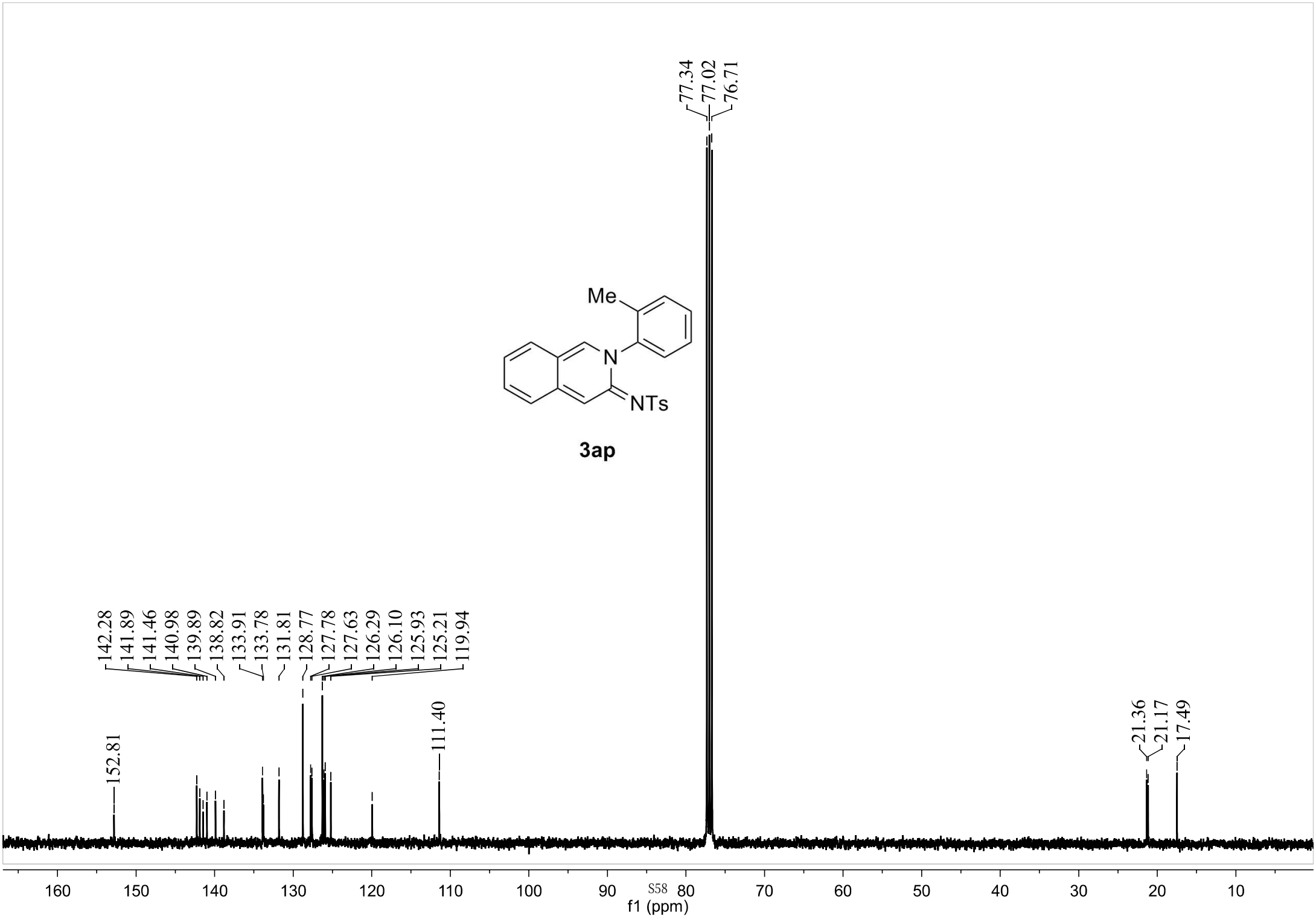
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1
f1 (ppm)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NTs
3ap
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139.89
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133.91
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131.81
128.77
127.78
127.63
126.29
126.10
125.93
125.21
119.94
152.81
111.40
21.36
21.17
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140
130
120
110
100
90
80
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60
50
40
30
20
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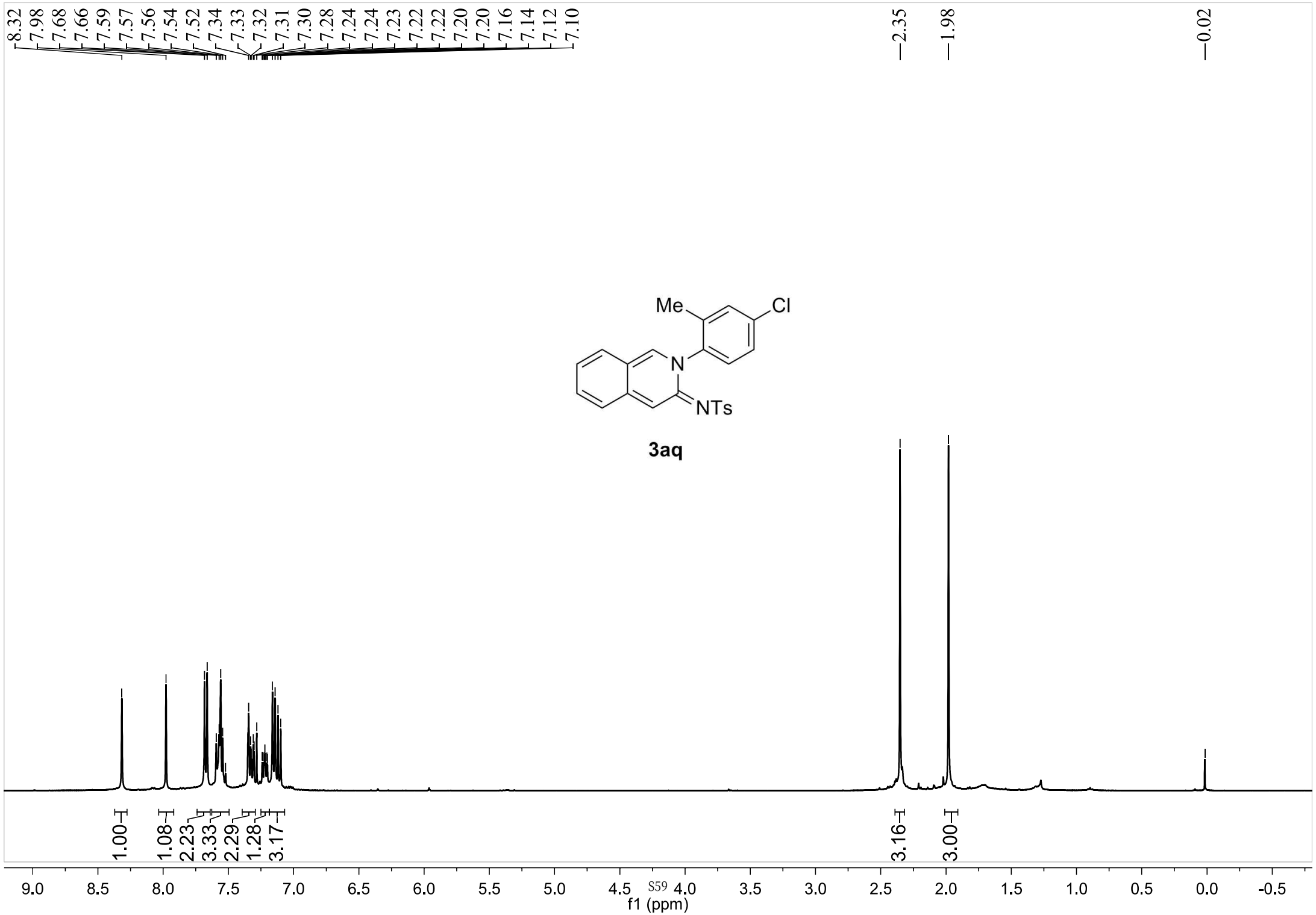
f1 (ppm)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7.33
7.32
7.31
7.30
7.28
7.24
7.24
7.23
7.22
7.22
7.20
7.20
7.16
7.14
7.12
7.10
2.35
1.98
0.02
Me
Cl
N
NTs
3aq
1.00
1.08
2.23
3.33
2.29
1.28
3.17
3.16
3.00
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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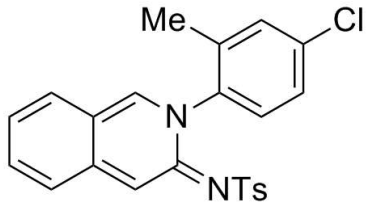
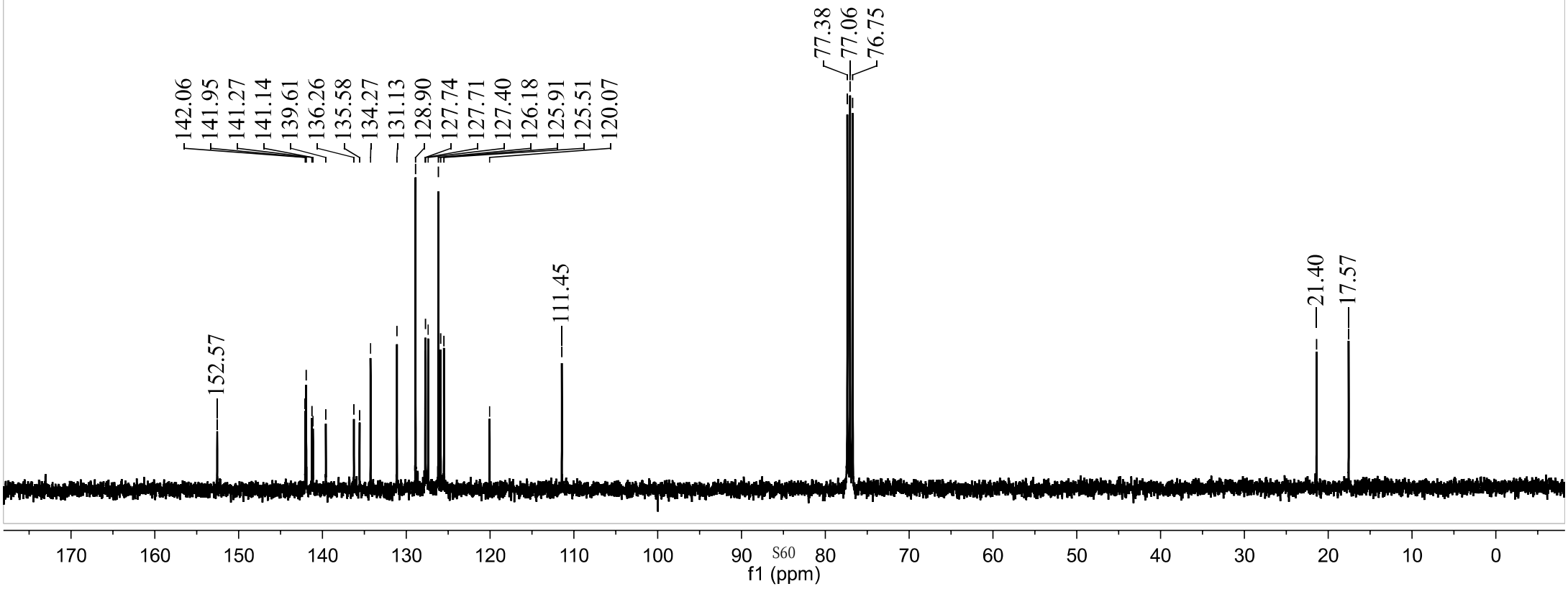
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


Me
Cl
N
NTs

3aq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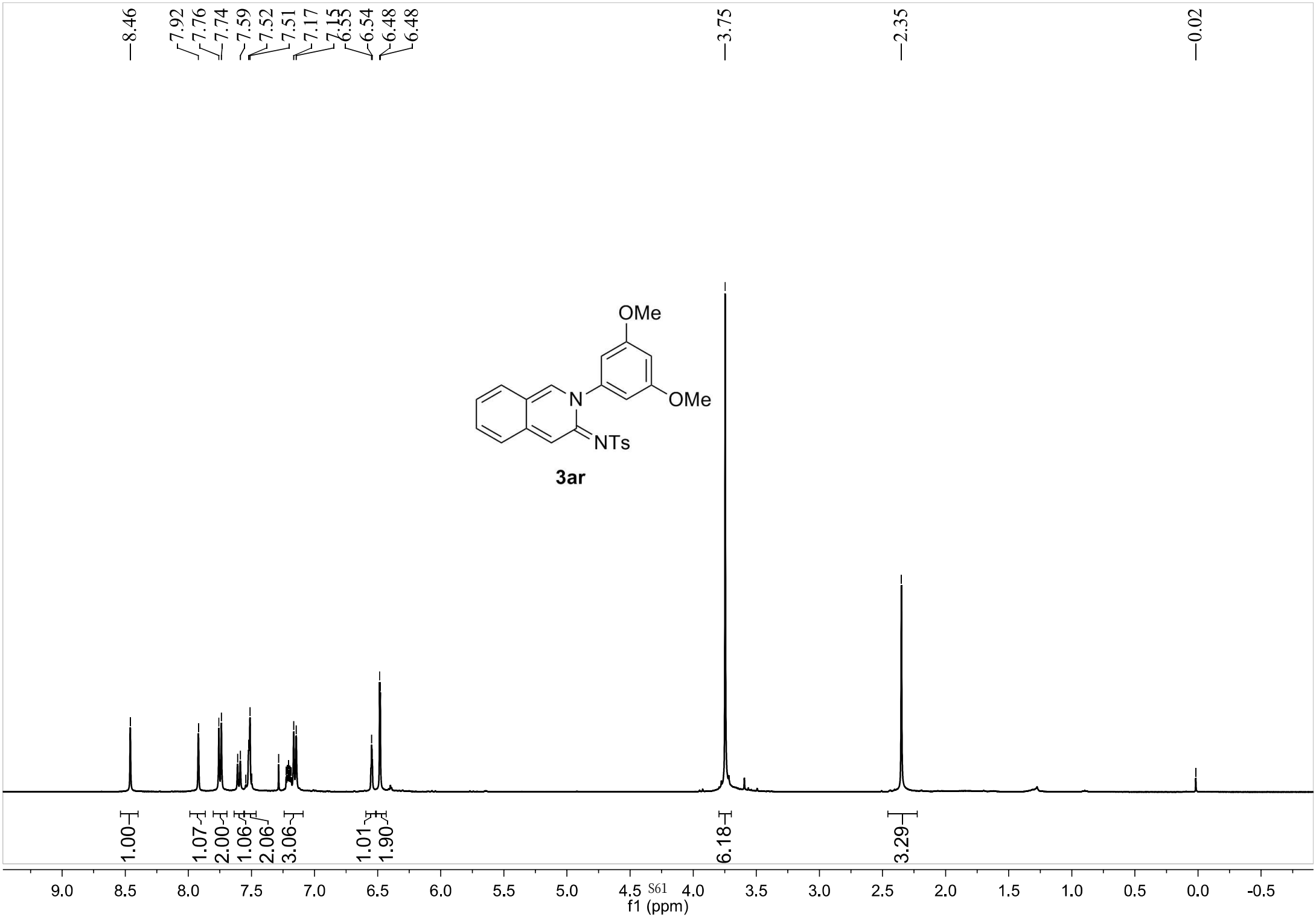
134.27
131.13
128.90
127.74
127.71
127.40
126.18
125.91
125.51
120.07
77.38
77.06
76.75
152.57
111.45
21.40
17.57
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.17
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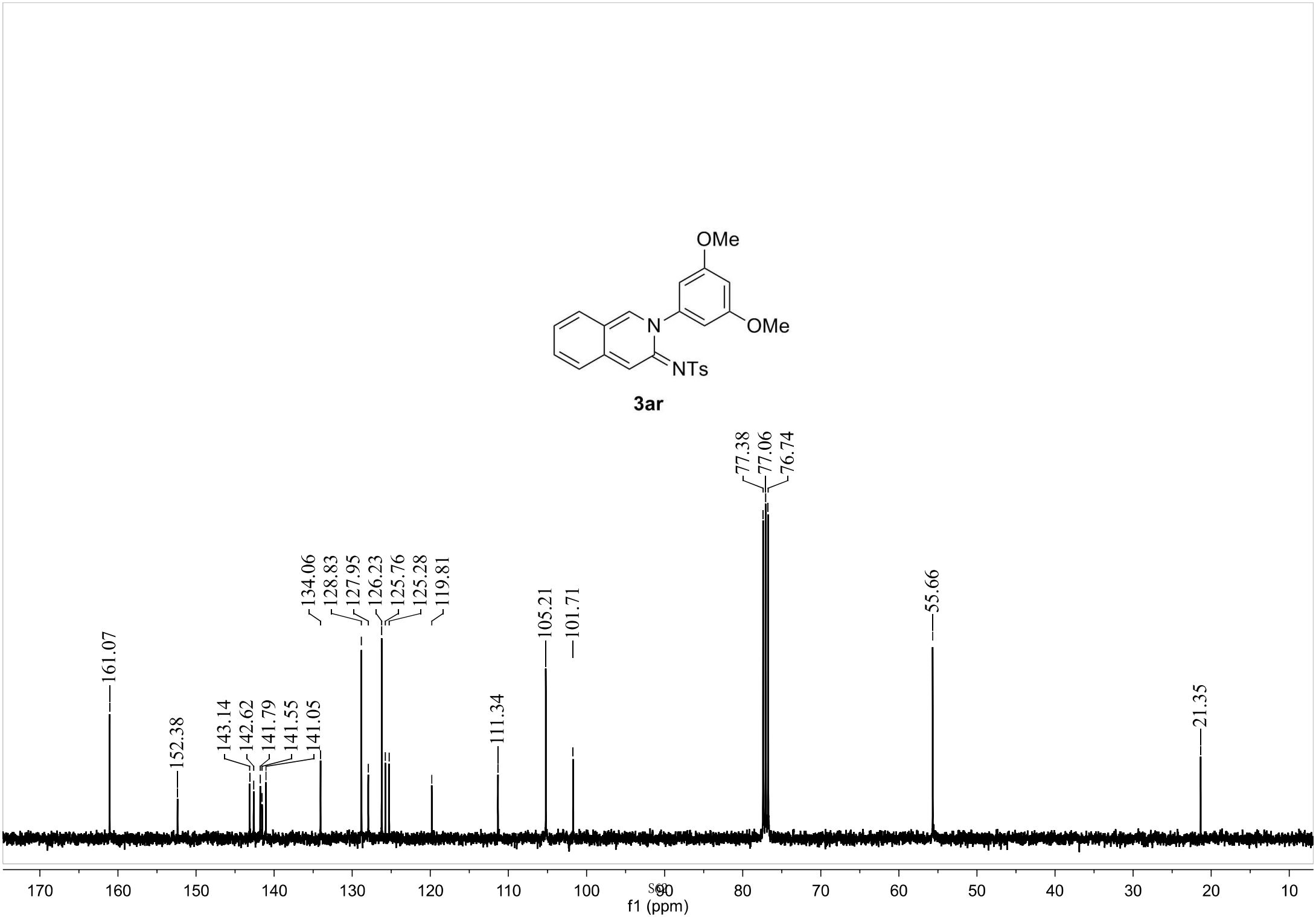
6.55
6.54
6.48
6.48
3.75
2.35
0.02
OMe
OMe
N
NTs
3ar
1.00
1.07
2.00
1.06
2.06
3.06
1.01
1.90
6.18
3.29
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


OMe
N
OMe
NTs
3ar
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152.38
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141.79
141.55
141.05
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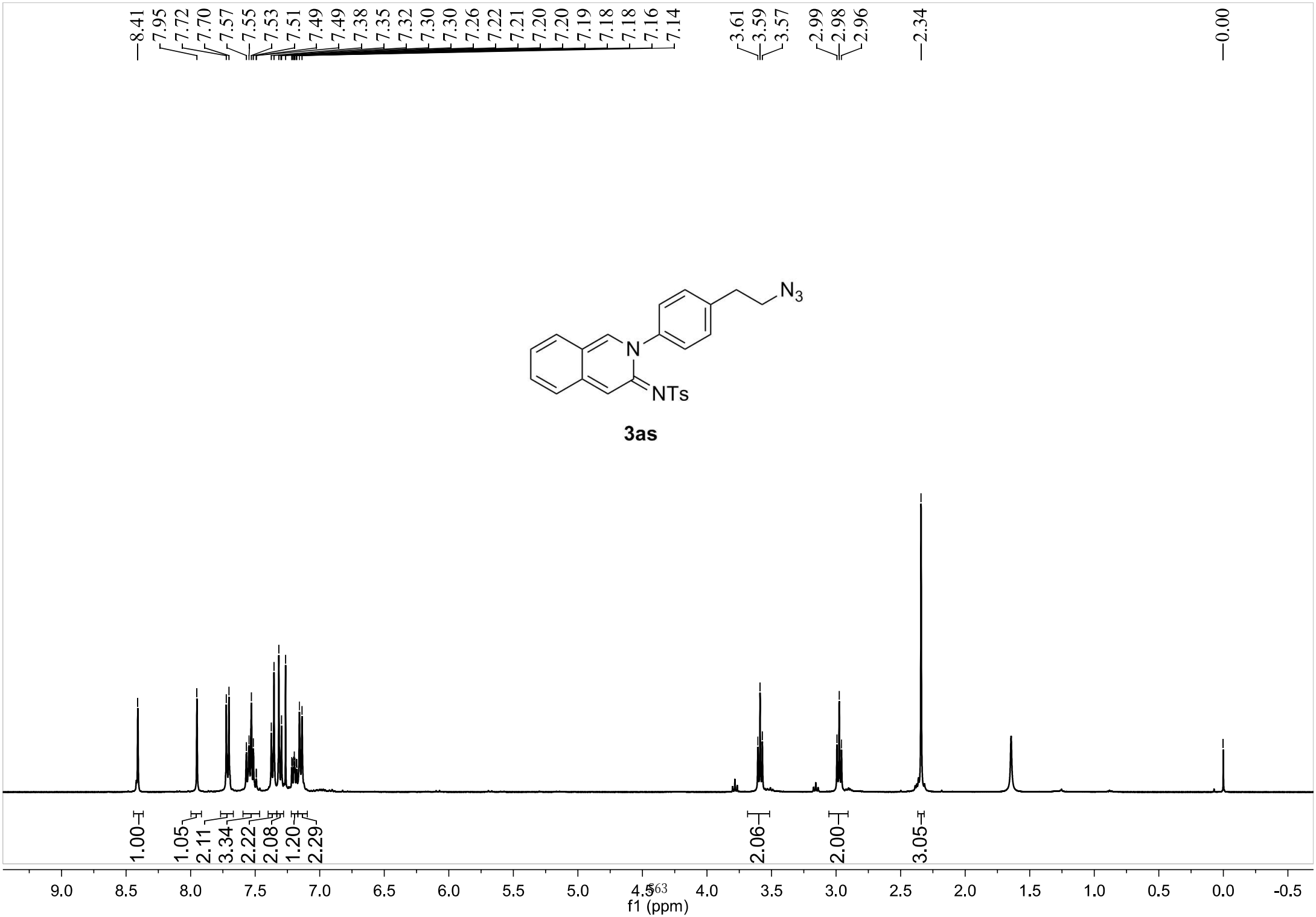
128.83
127.95
126.23
125.76
125.28
119.81
111.34
105.21
101.71
77.38
77.06
76.74
55.66
21.35
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.32
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7.30
7.26
7.22
7.21
7.20
7.20
7.19
7.18
7.18
7.16
7.14
3.61
3.59
3.57
2.99
2.98
2.96
2.34
0.00
N3
N
NTs
3as
1.00
1.05
2.11
3.34
2.22
2.08
1.20
2.29
2.06
2.00
3.05
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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3.0
2.5
2.0
1.5
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0.5
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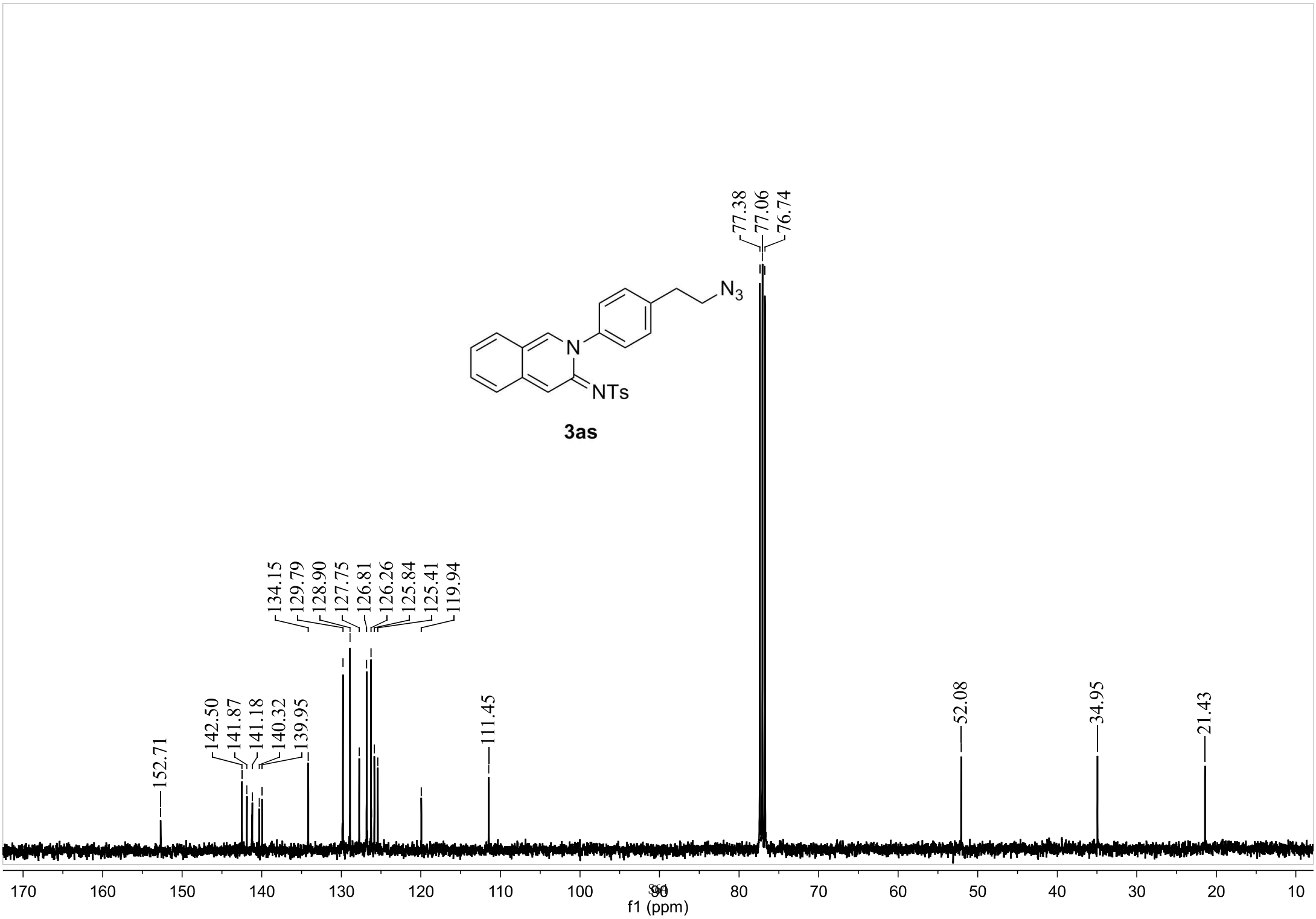
-0.5
f1 (ppm)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77.06
76.74
N3
N
NTs
3as
134.15
129.79
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127.75
126.81
126.26
125.84
125.41
119.94
152.71
142.50
141.87
141.18
140.32
139.95
111.45
52.08
34.95
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140
130
120
110
100
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80
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60
50
40
30
20
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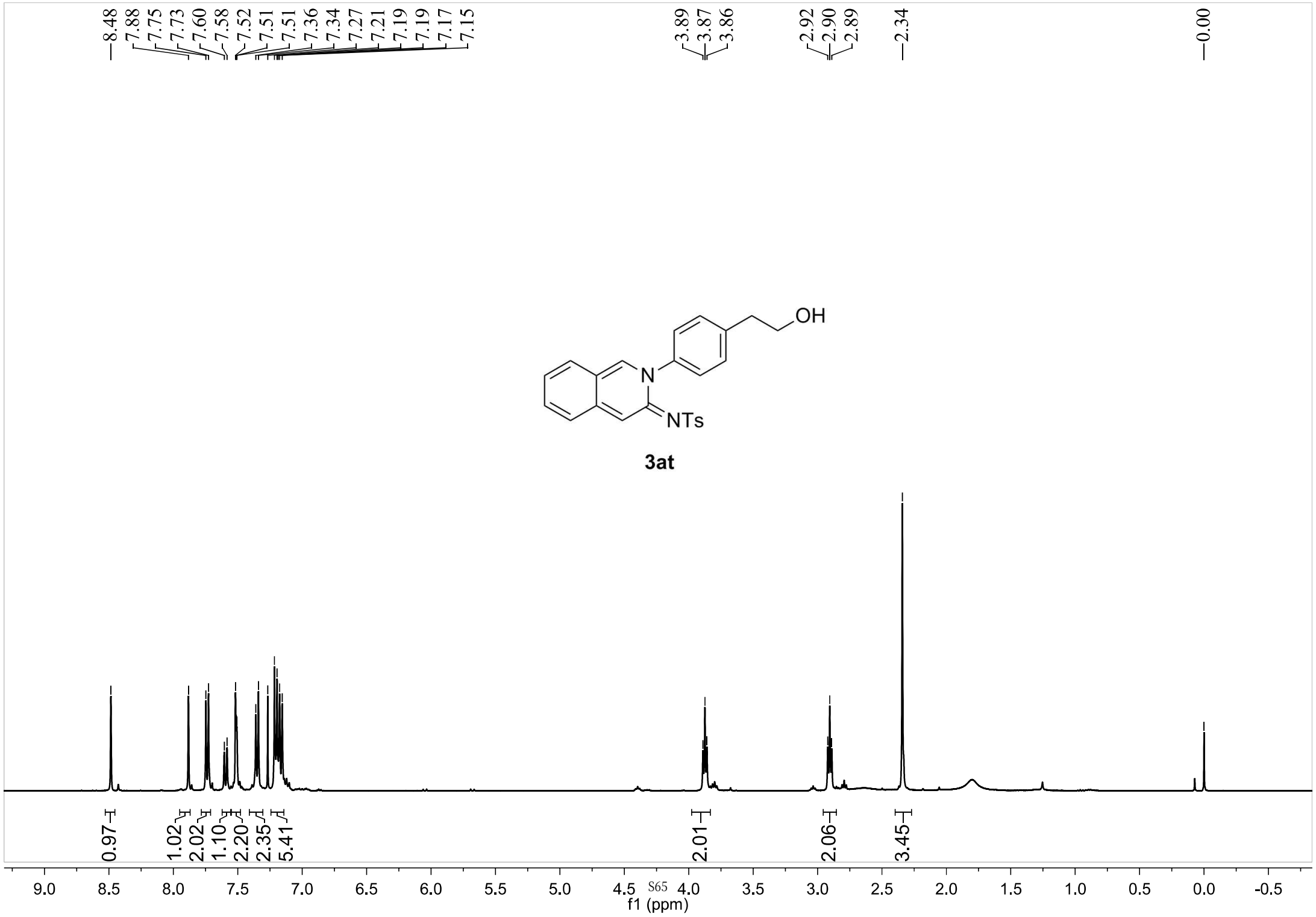
f1 (ppm)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7.34
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7.19
7.19
7.17
7.15
3.89
3.87
3.86
2.92
2.90
2.89
2.34
0.00
OH
N
NTs
0.97
1.02
2.02
1.10
2.20
2.35
5.41
2.01
2.06
3.45
9.0
8.5
8.0
7.5
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6.5
6.0
5.5
5.0
4.5
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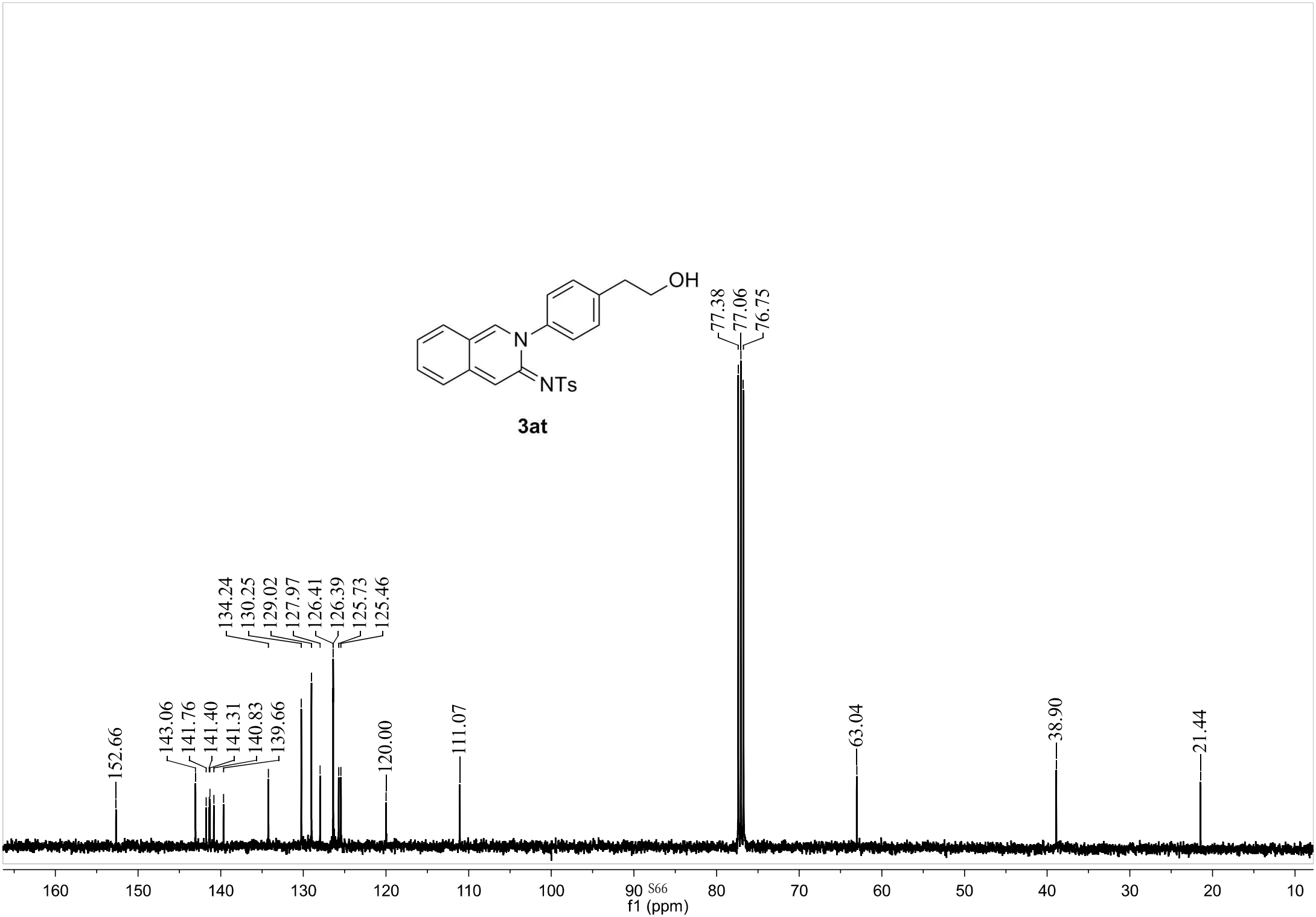
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

3at


OH
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NTs
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125.46
152.66
143.06
141.76
141.40
141.31
140.83
139.66
120.00
111.07
63.04
38.90
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140
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120
110
100
90
80
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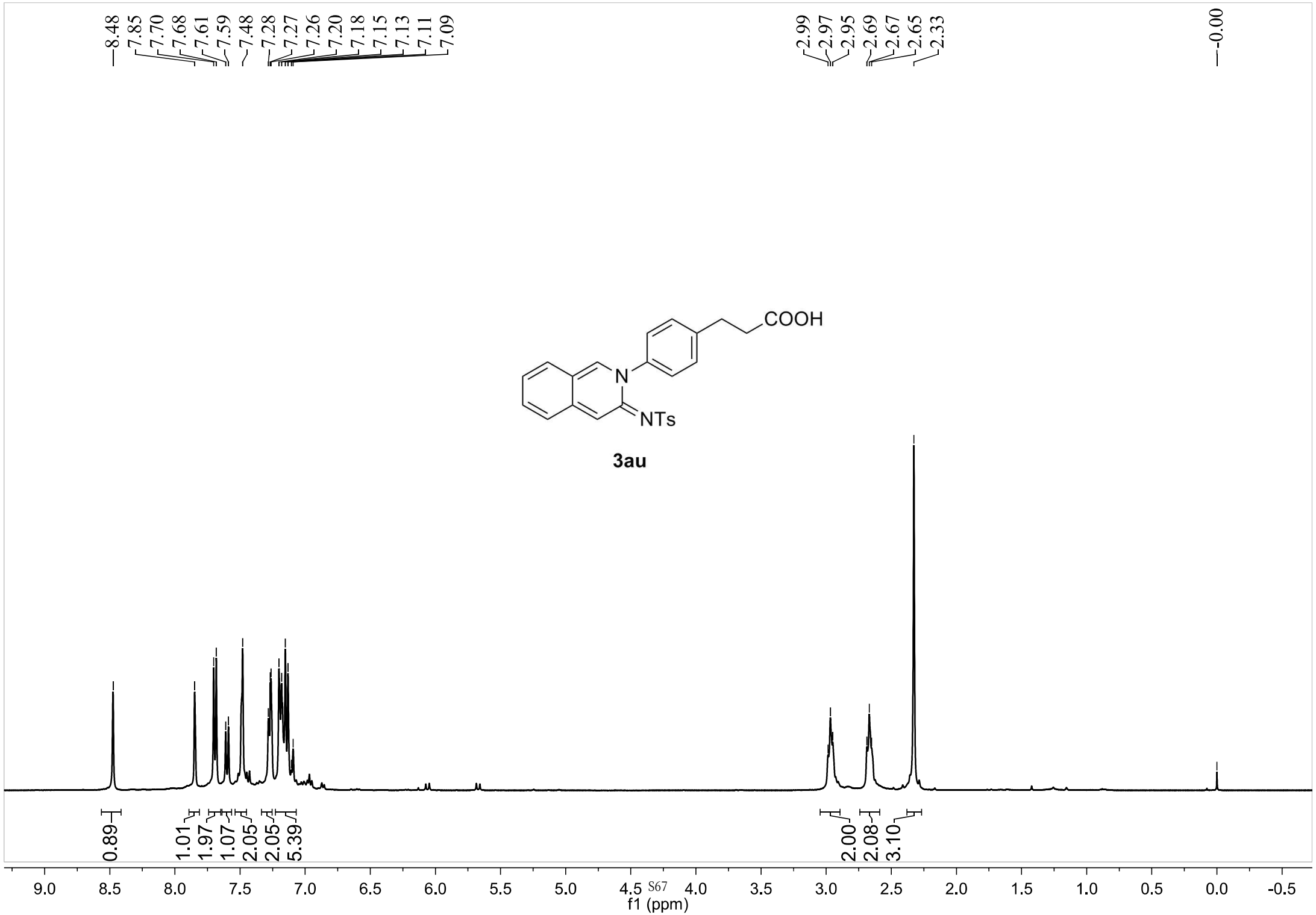
60
50
40
30
20
10
f1 (ppm)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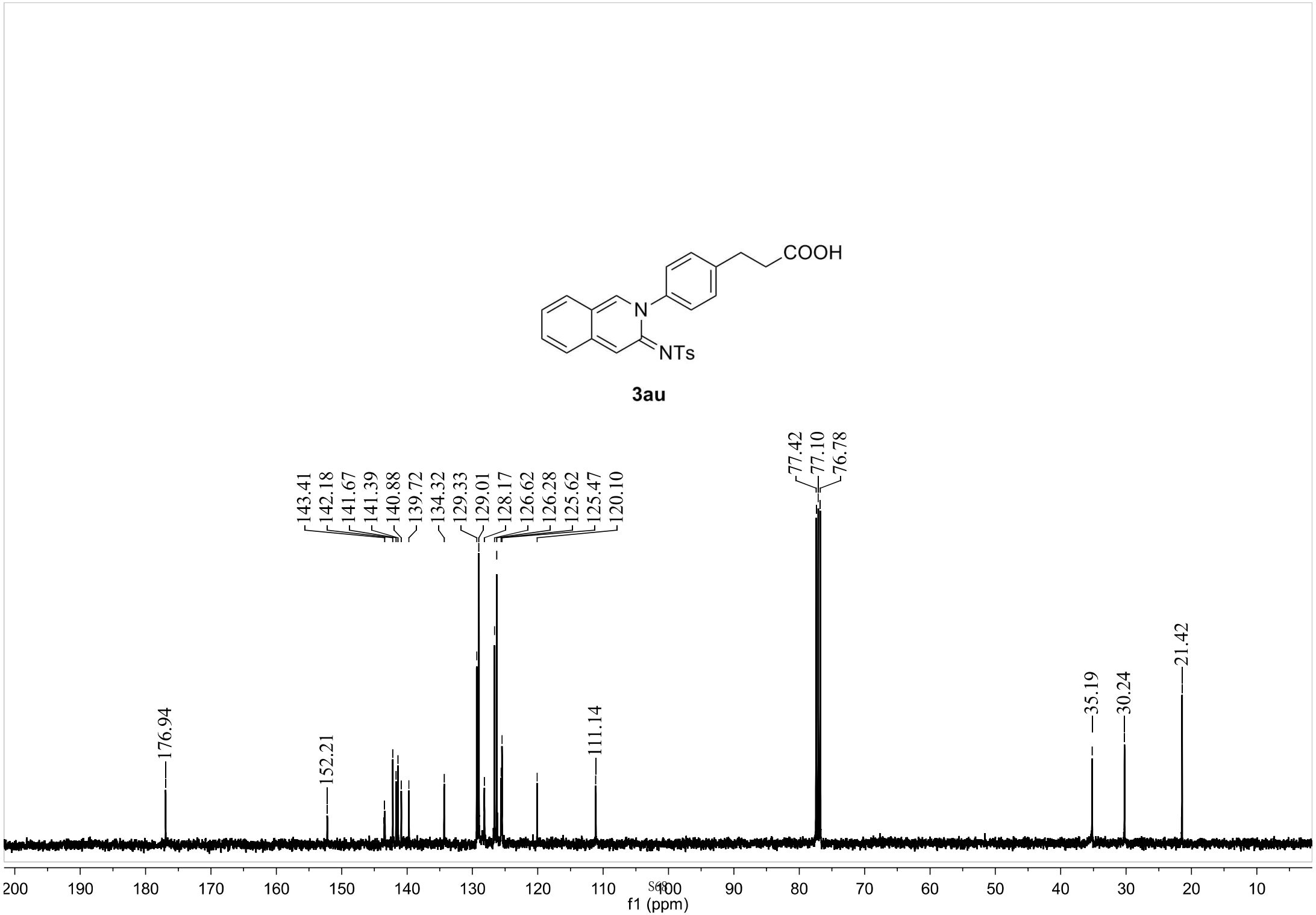
7.18
7.15
7.13
7.11
7.09
2.99
2.97
2.95
2.69
2.67
2.65
2.33
0.00
COOH
N
NTs
3au
0.89
1.01
1.97
1.07
2.05
2.05
5.39
2.00
2.08
3.10
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


COOH
N
NTs
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134.32
129.33
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128.17
126.62
126.28
125.62
125.47
120.10
77.42
77.10
76.78
176.94
152.21
111.14
35.19
30.24
21.42
200
190
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140
130
120
110
100
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80
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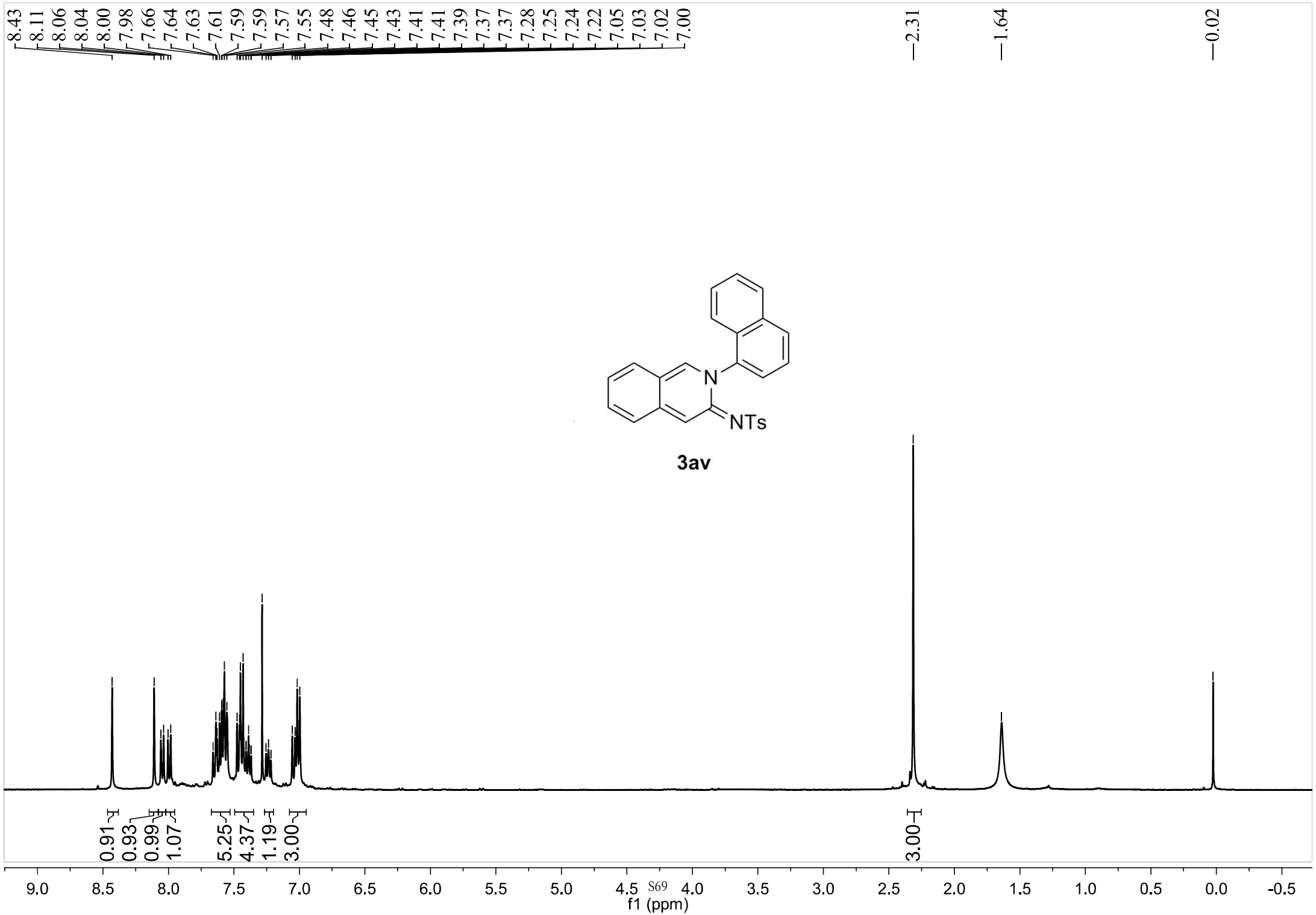
60
50
40
30
20
10
f1 (ppm)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7.61
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7.59
7.57
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7.48
7.46
7.45
7.43
7.41
7.41
7.39
7.37
7.37
7.28
7.25
7.24
7.22
7.05
7.03
7.02
7.00
2.31
1.64
0.02
N
NTs
3av
0.91
0.93
0.99
1.07
5.25
4.37
1.19
3.00
3.00
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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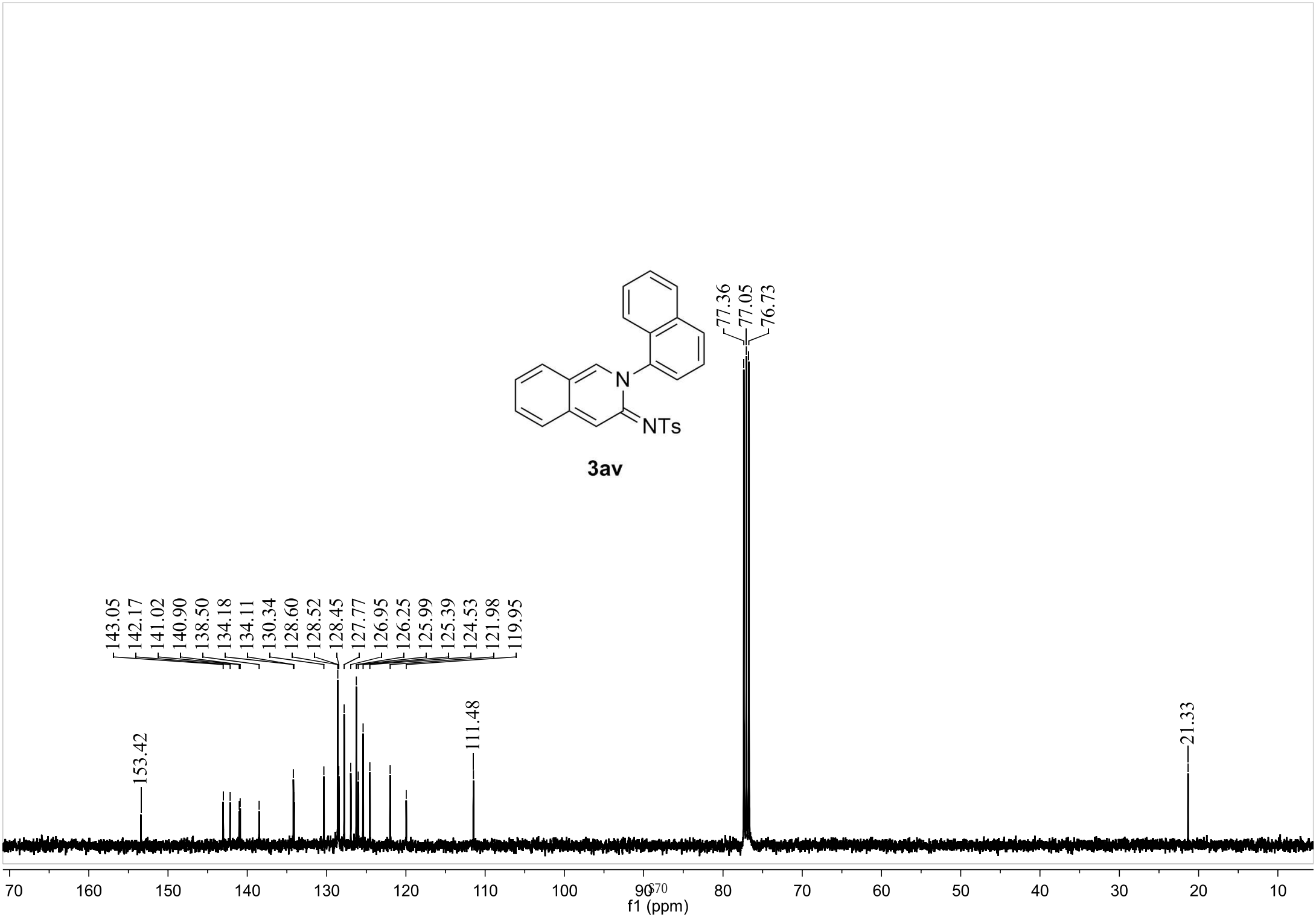
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)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N
NTs
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141.02
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138.50
134.18
134.11
130.34
128.60
128.52
128.45
127.77
126.95
126.25
125.99
125.39
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119.95
153.42
111.48
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60
50
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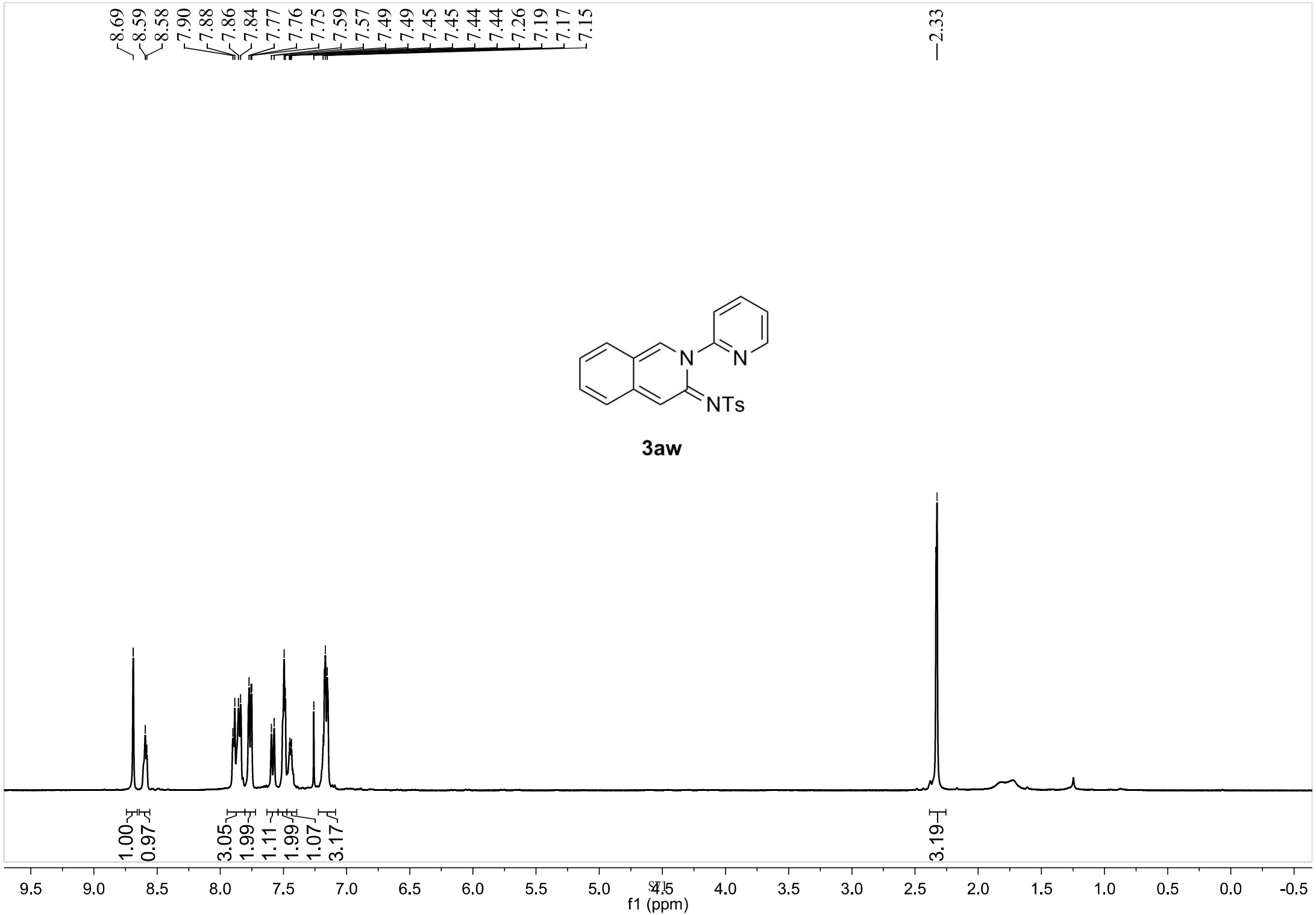
20
10
f1 (ppm)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7.49
7.45
7.45
7.44
7.44
7.26
7.19
7.17
7.15
2.33
N
N
NTs
3aw
1.00
0.97
3.05
1.99
1.11
1.99
1.07
3.17
3.19
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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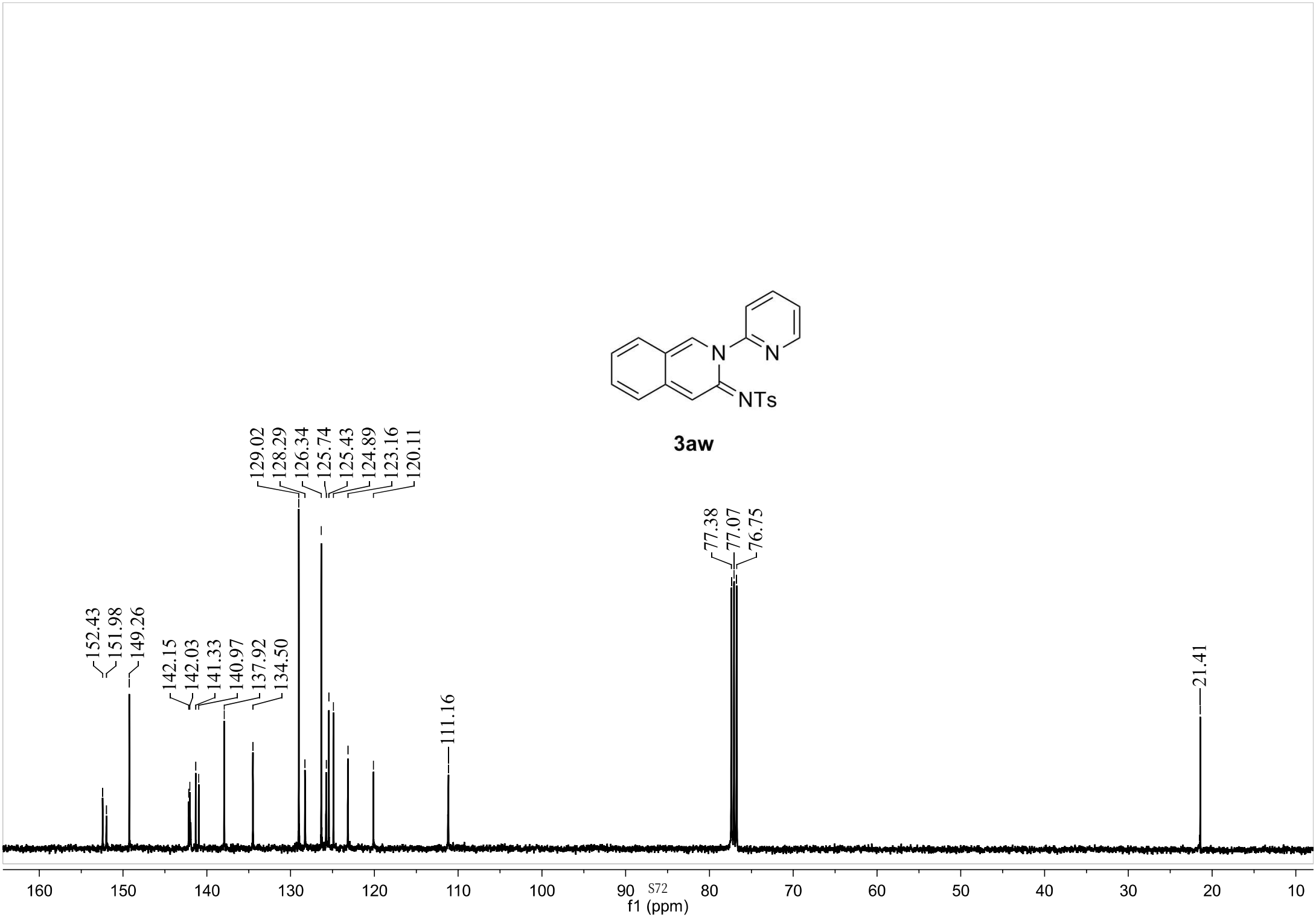
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


N
N
NTs
3aw
152.43
151.98
149.26
142.15
142.03
141.33
140.97
137.92
134.50
129.02
128.29
126.34
125.74
125.43
124.89
123.16
120.11
111.16
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77.07
76.75
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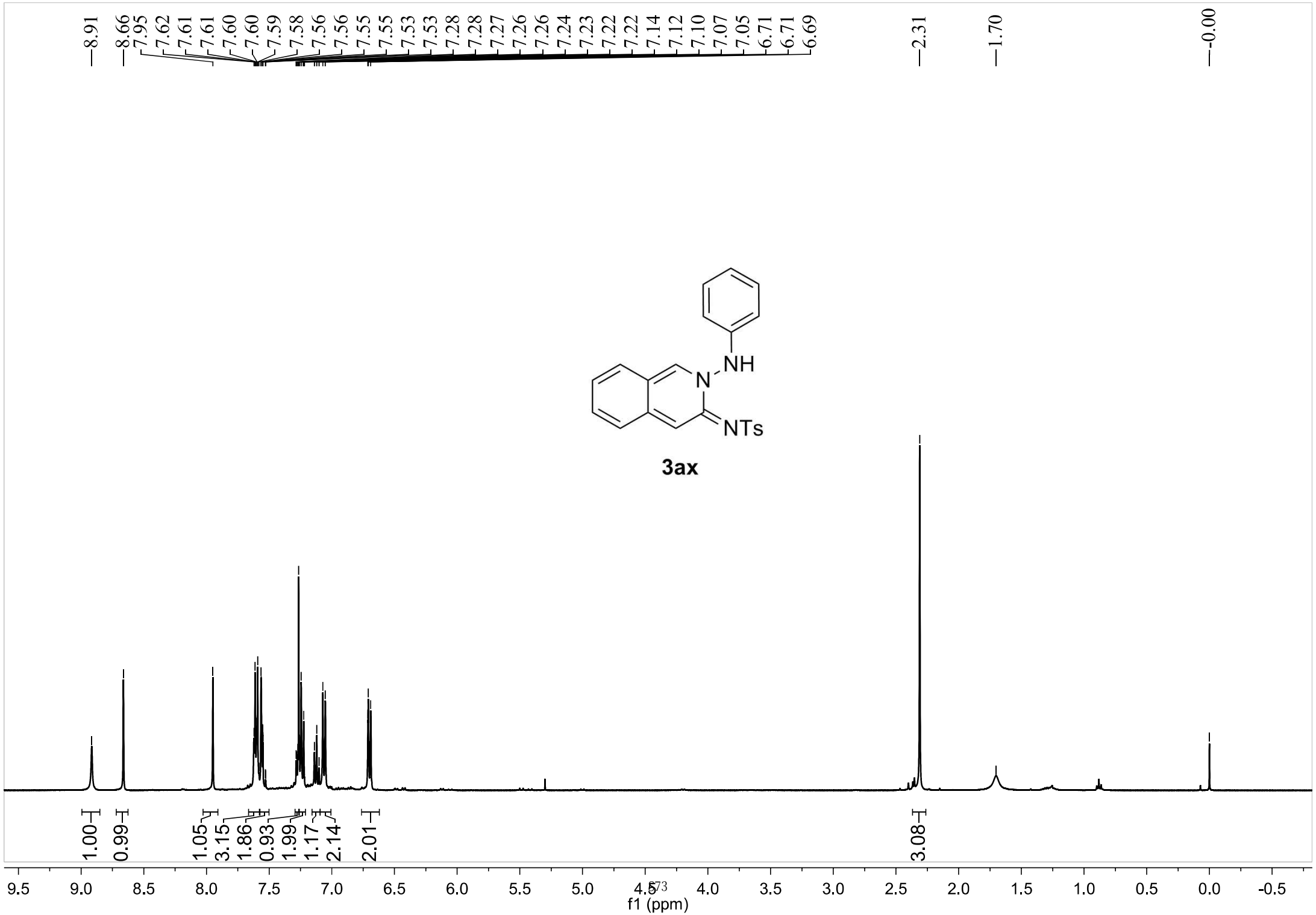
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.07
7.05
6.71
6.71
6.69
2.31
1.70
0.00
NH
N
NTs
3ax
1.00
0.99
1.05
3.15
1.86
0.93
1.99
1.17
2.14
2.01
3.08
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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2.5
2.0
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0.5
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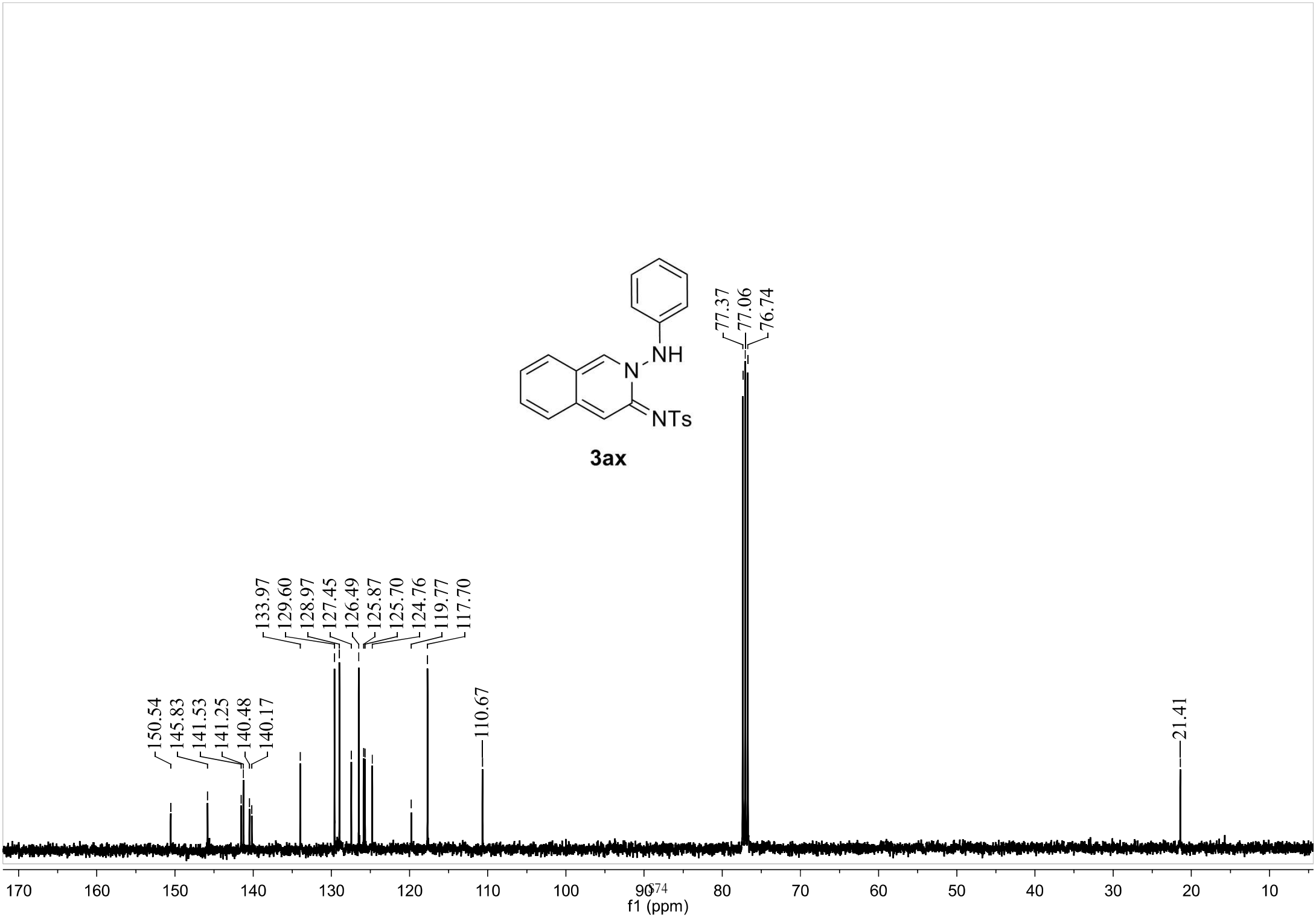
-0.5
f1 (ppm)


NH
N
NTs
3ax
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77.06
76.74
133.97
129.60
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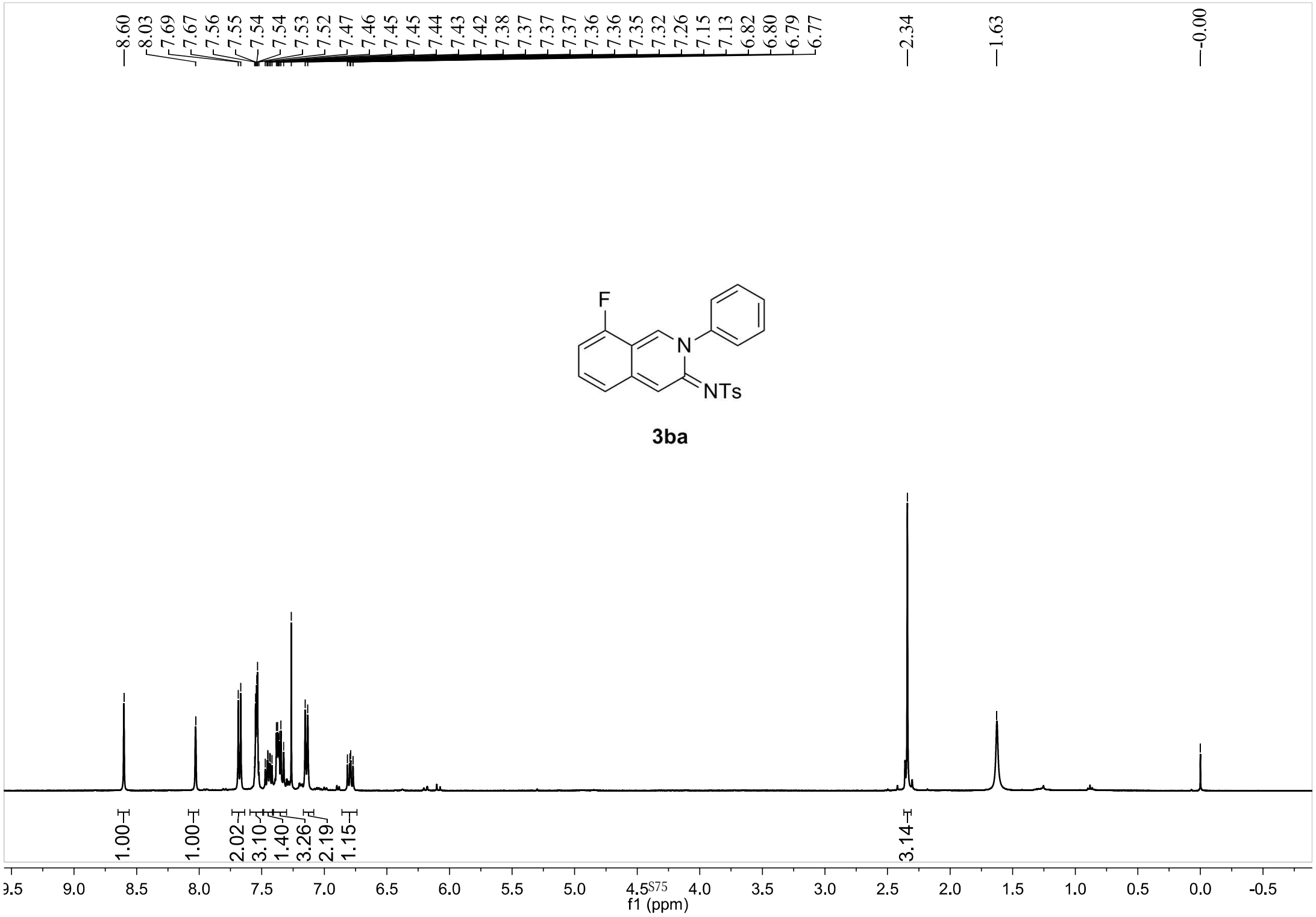
127.45
126.49
125.87
125.70
124.76
119.77
117.70
150.54
145.83
141.53
141.25
140.48
140.17
110.67
21.41
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.54
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7.52
7.47
7.46
7.45
7.45
7.44
7.43
7.42
7.38
7.37
7.37
7.37
7.36
7.36
7.35
7.32
7.26
7.15
7.13
6.82
6.80
6.79
6.77
2.34
1.63
0.00
F
N
NTs
3ba
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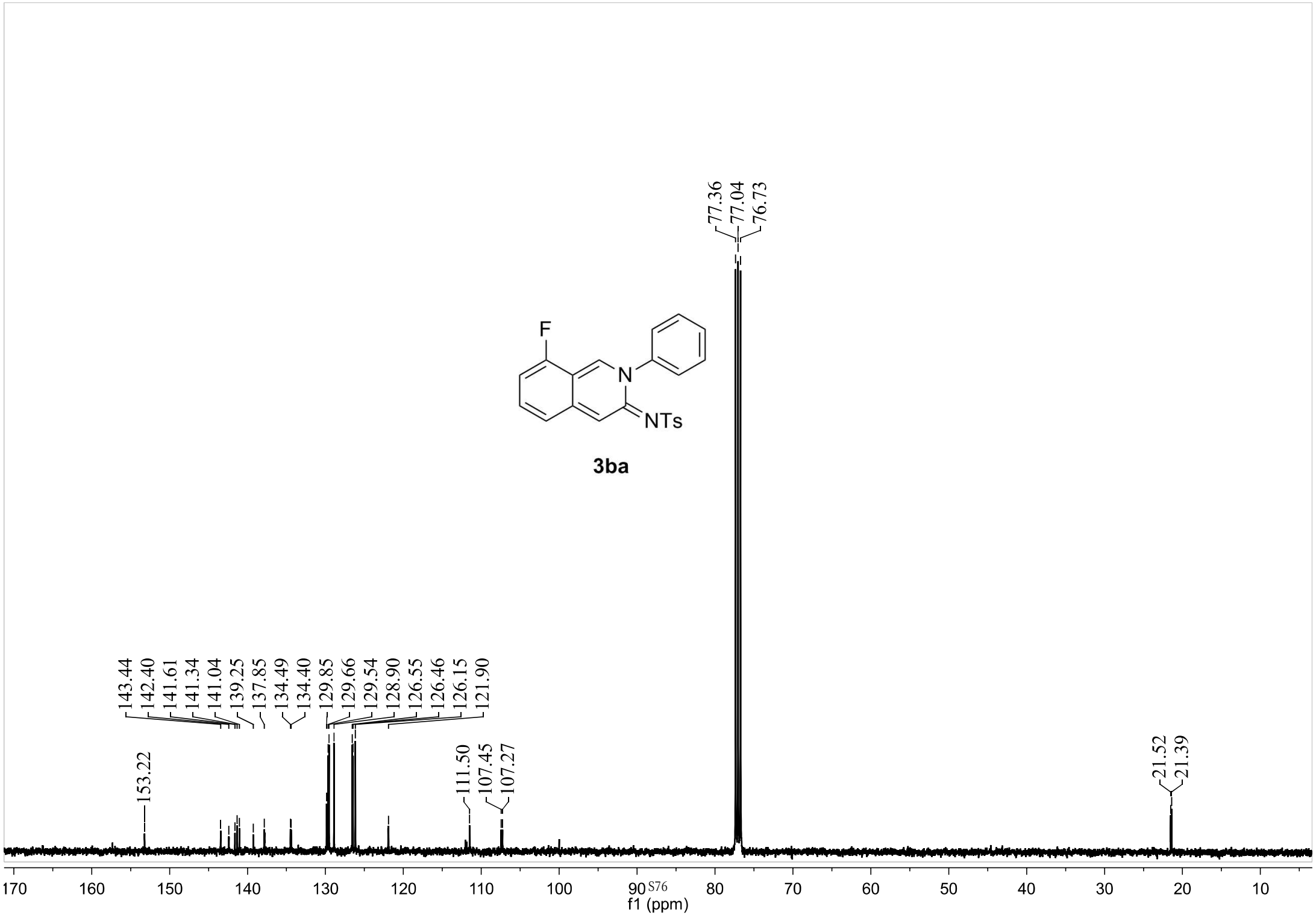
1.00
2.02
3.10
1.40
3.26
2.19
1.15
3.14
f1 (ppm)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76.73
F
N
NTs
3ba
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142.40
141.61
141.34
141.04
139.25
137.85
134.49
134.40
129.85
129.66
129.54
128.90
126.55
126.46
126.15
121.90
153.22
111.50
107.45
107.27
21.52
21.39
170
160
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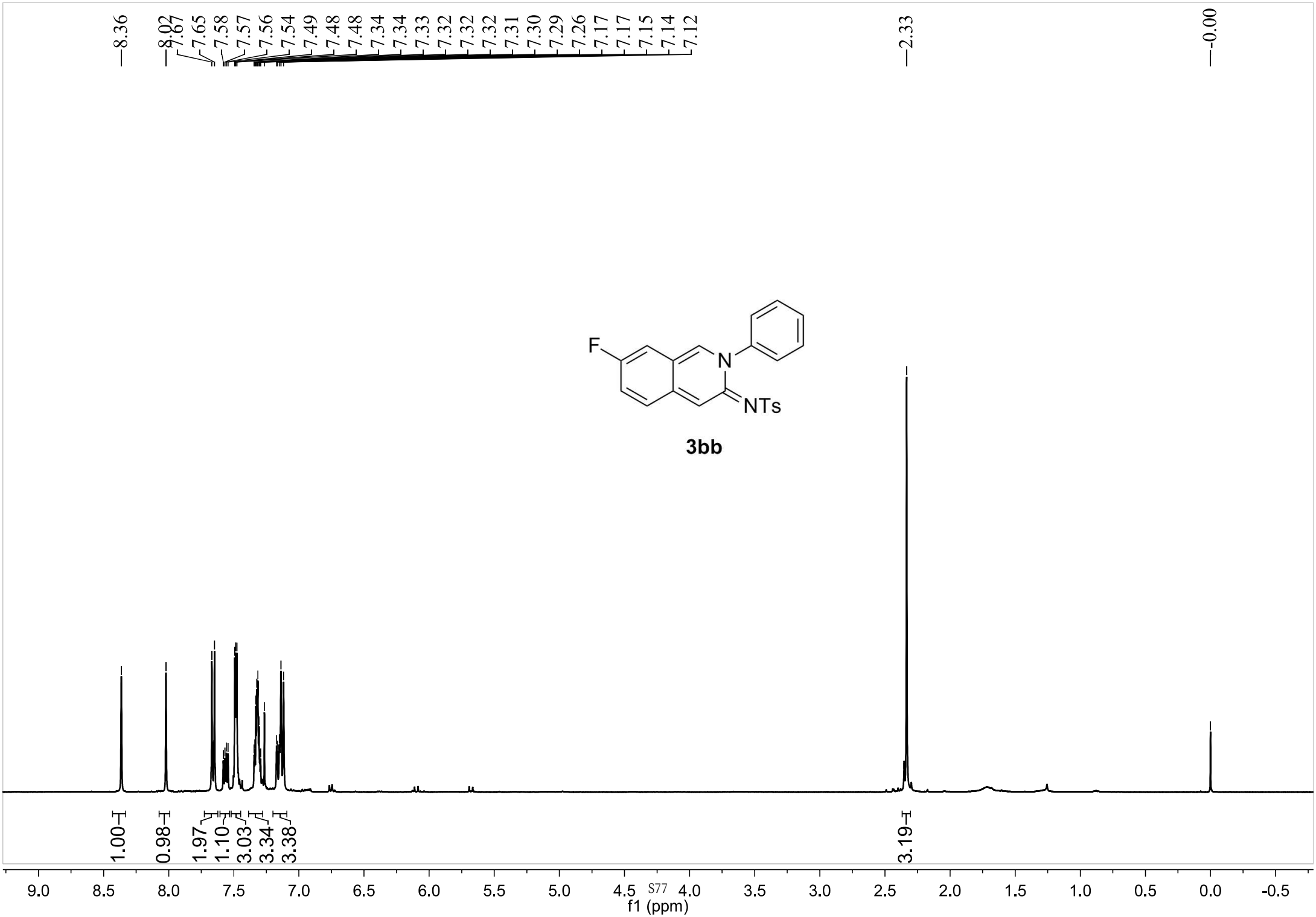
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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8.01
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7.65
7.58
7.57
7.56
7.54
7.49
7.48
7.48
7.34
7.34
7.33
7.32
7.32
7.32
7.31
7.30
7.29
7.26
7.17
7.17
7.15
7.14
7.12
2.33
0.00
F
N
NTs
3bb
1.00
0.98
1.97
1.10
3.03
3.34
3.38
3.19
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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3.0
2.5
2.0
1.5
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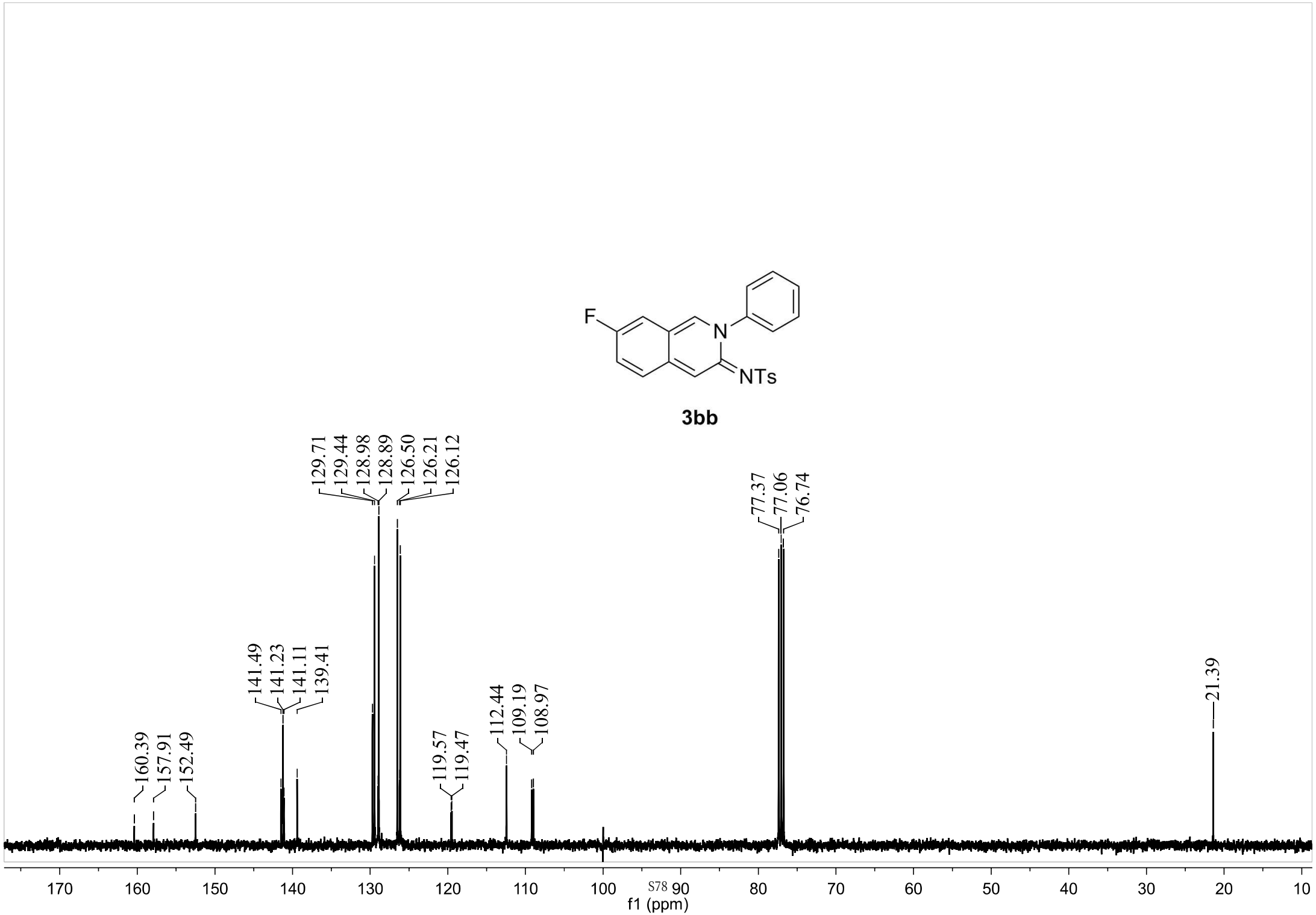
0.5
0.0
-0.5
f1 (ppm)


F
N
NTs
3bb
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152.49
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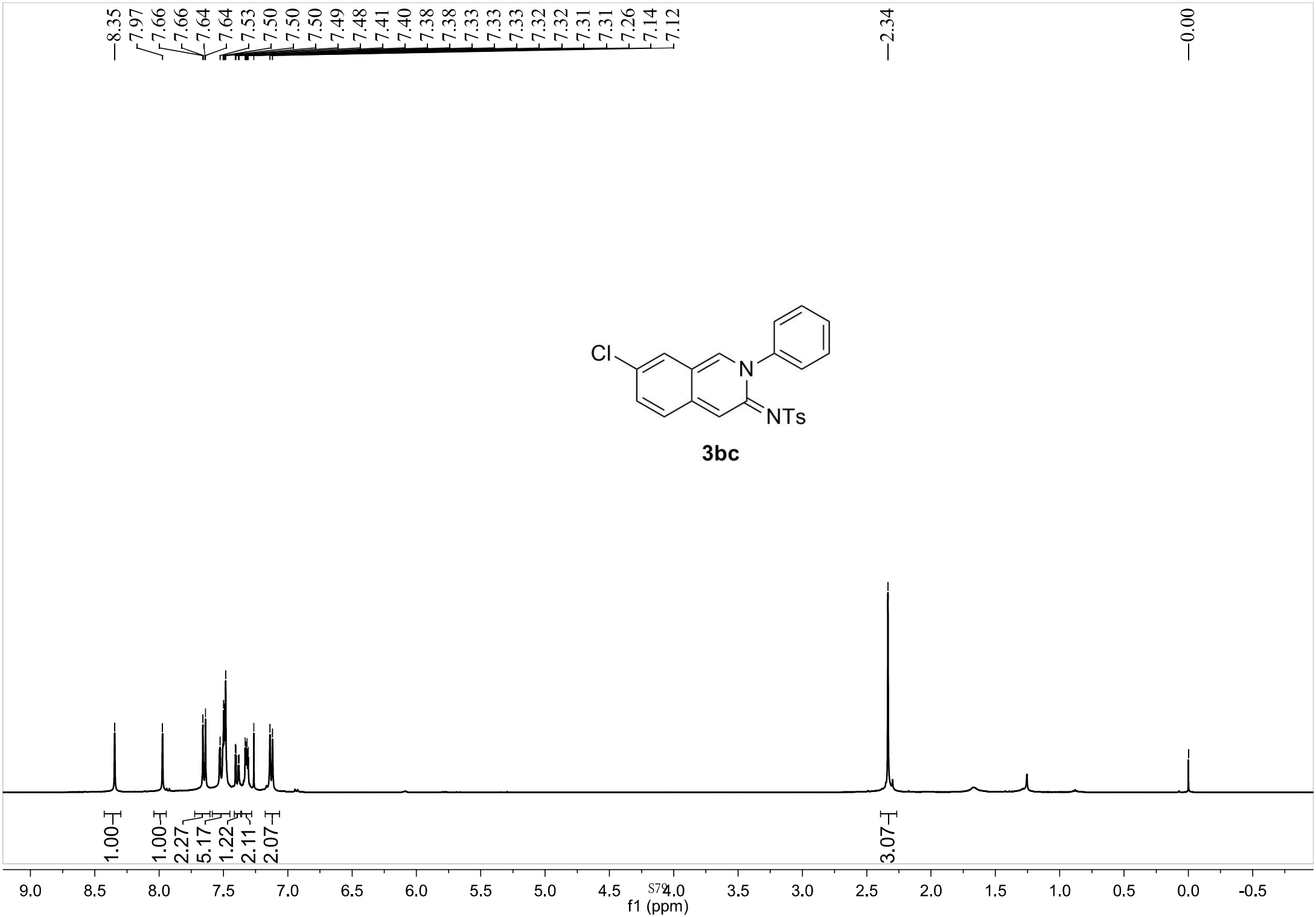
141.11
139.41
129.71
129.44
128.98
128.89
126.50
126.21
126.12
119.57
119.47
112.44
109.19
108.97
77.37
77.06
76.74
21.39
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.50
7.49
7.48
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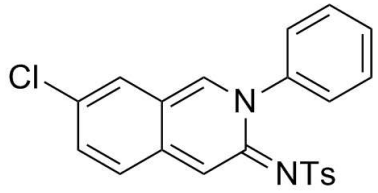
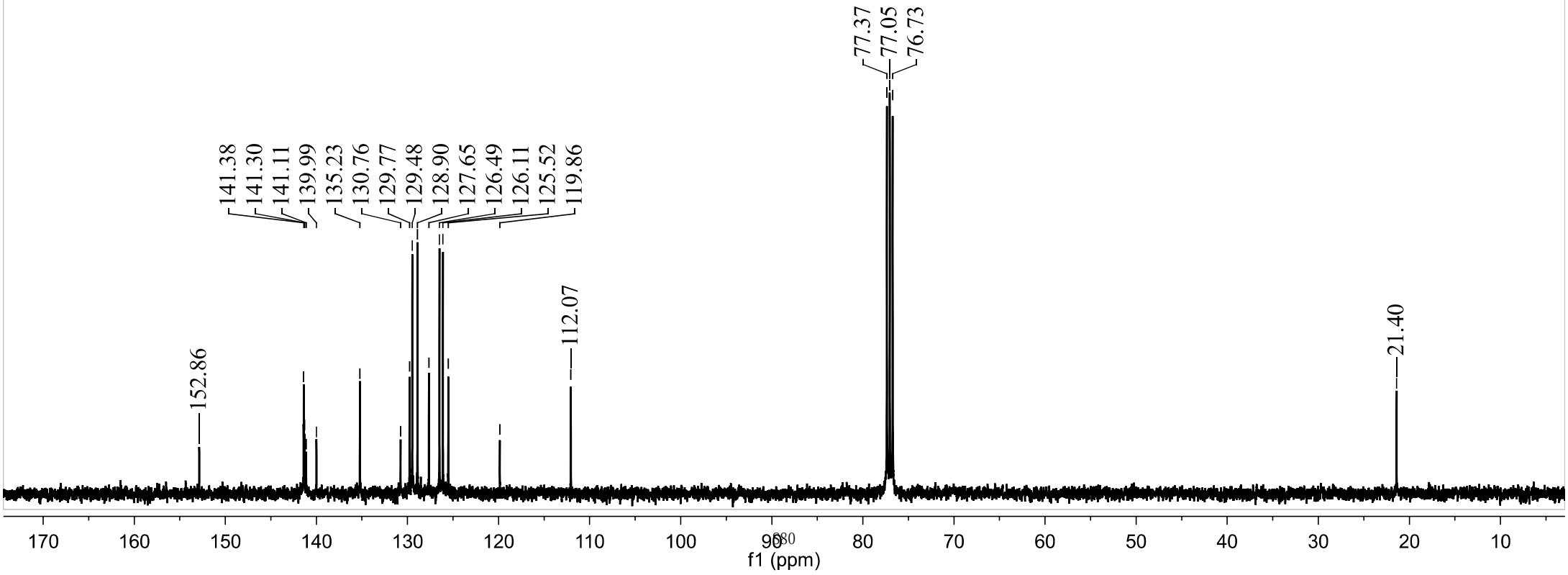
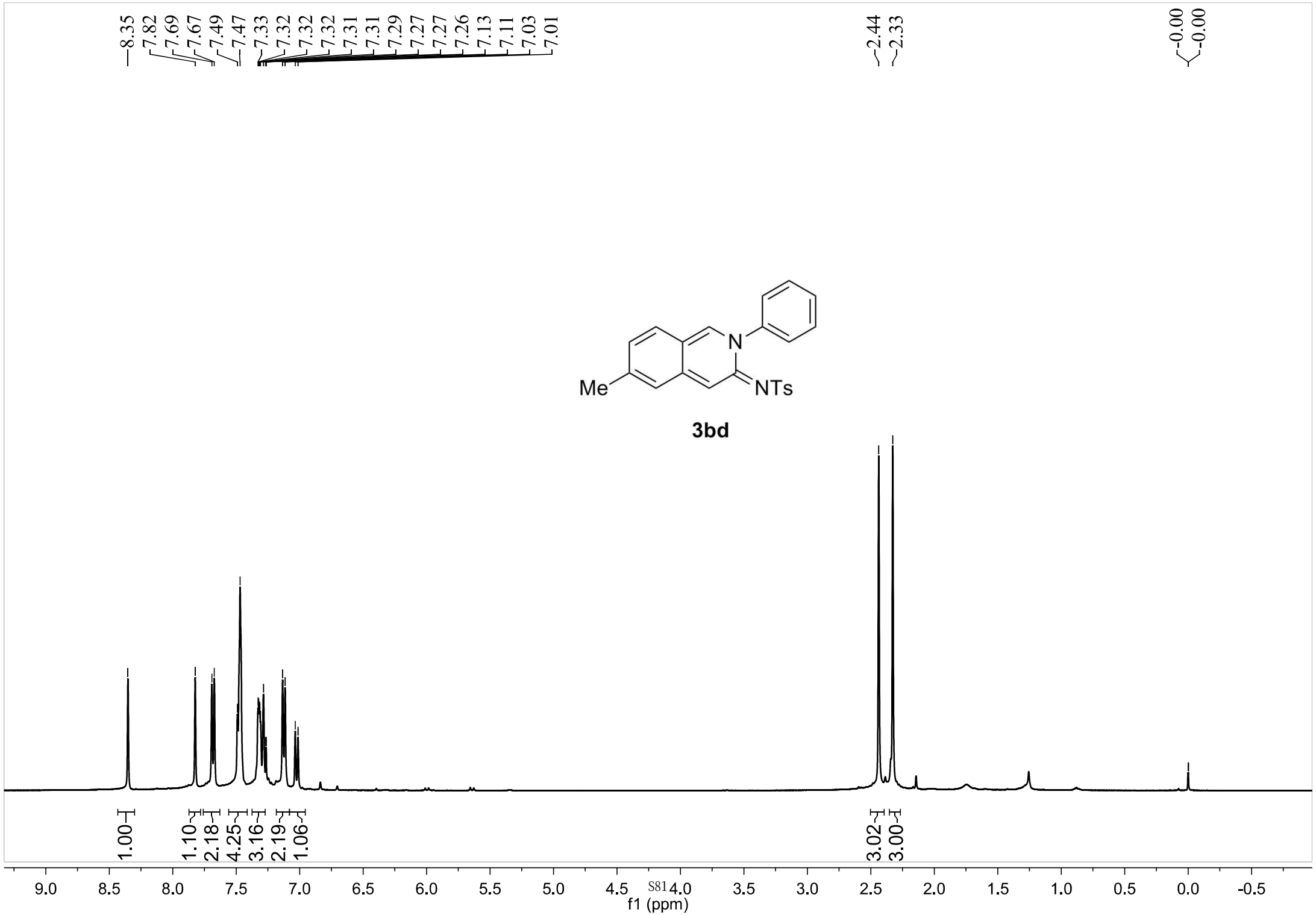
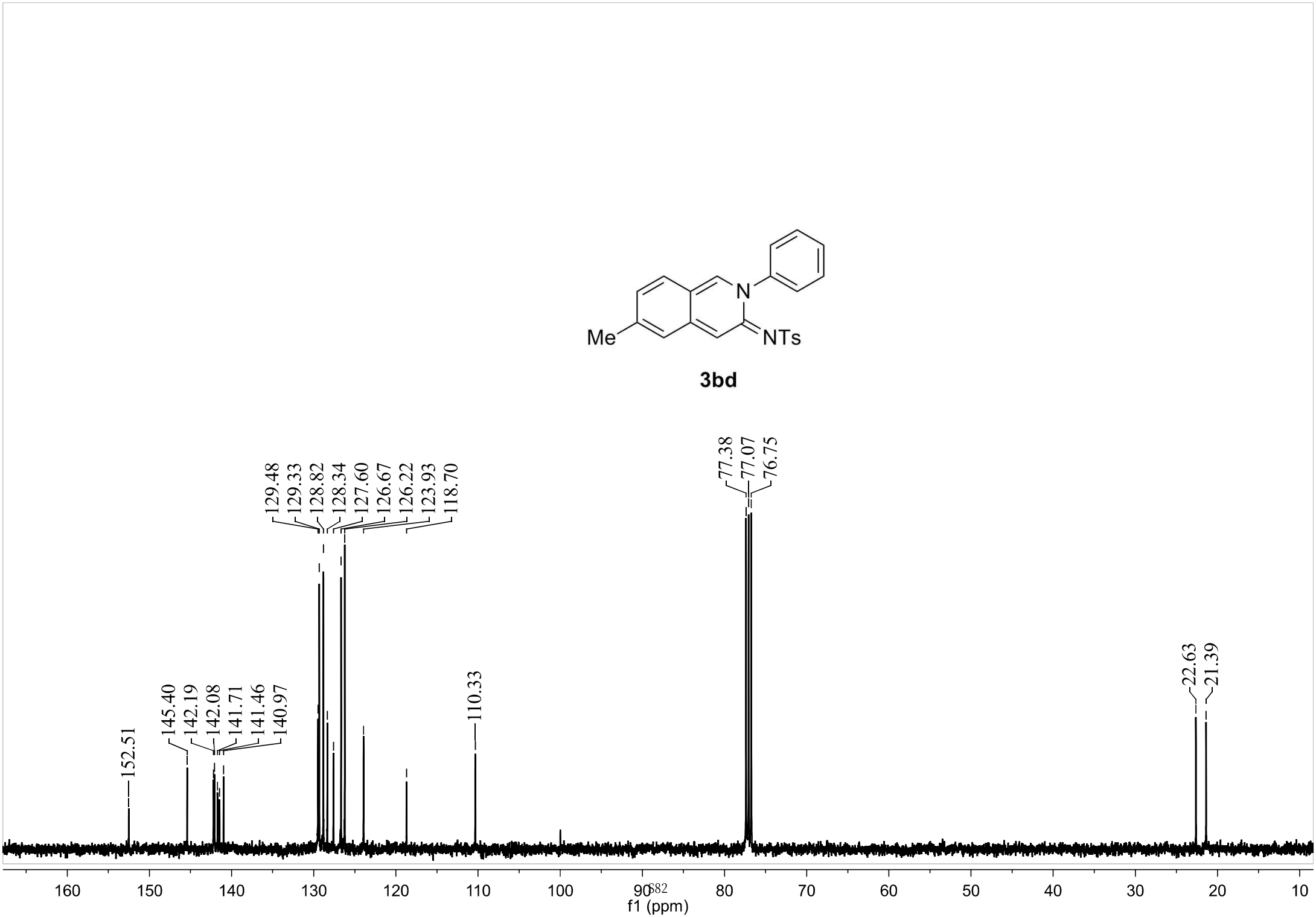
7.40
7.38
7.38
7.33
7.33
7.33
7.32
7.32
7.31
7.31
7.26
7.14
7.12
2.34
0.00
Cl
N
NTs
3bc
1.00
1.00
2.27
5.17
1.22
2.11
2.07
3.07
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

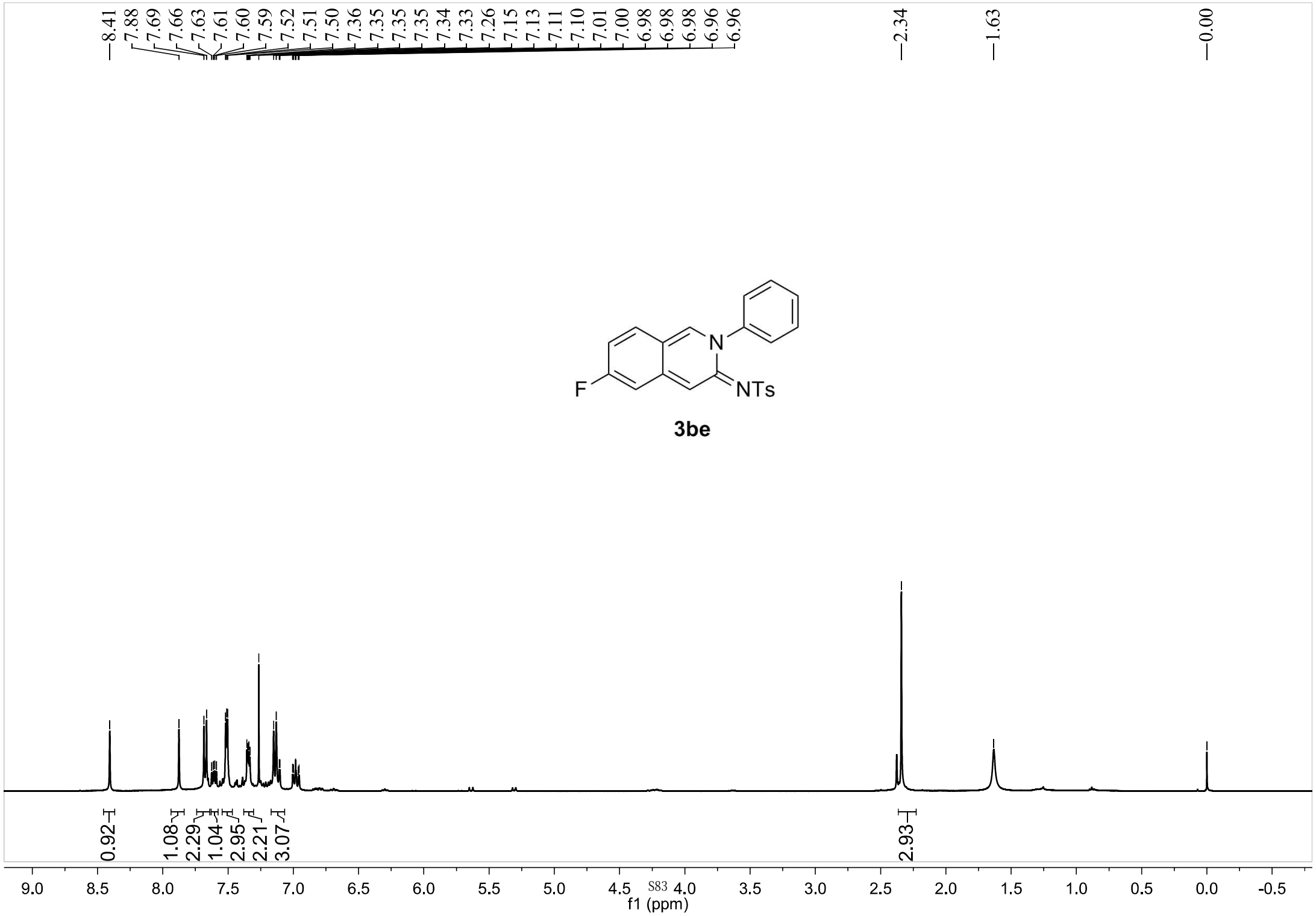

Cl
N
NTs

3bc


77.37
77.05
76.73
141.38
141.30
141.11
139.99
135.23
130.76
129.77
129.48
128.90
127.65
126.49
126.11
125.52
119.86
112.07
152.86
21.40
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


8.35
7.82
7.69
7.67
7.49
7.47
7.33
7.32
7.32
7.32
7.31
7.31
7.29
7.27
7.27
7.26
7.13
7.11
7.03
7.01
2.44
2.33
-0.00
-0.00
N
Me
NTs
3bd
1.00
1.10
2.18
4.25
3.16
2.19
1.06
3.02
3.00
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


Me
N
NTs
3bd
152.51
145.40
142.19
142.08
141.71
141.46
140.97
129.48
129.33
128.82
128.34
127.60
126.67
126.22
123.93
118.70
110.33
77.38
77.07
76.75
22.63
21.39
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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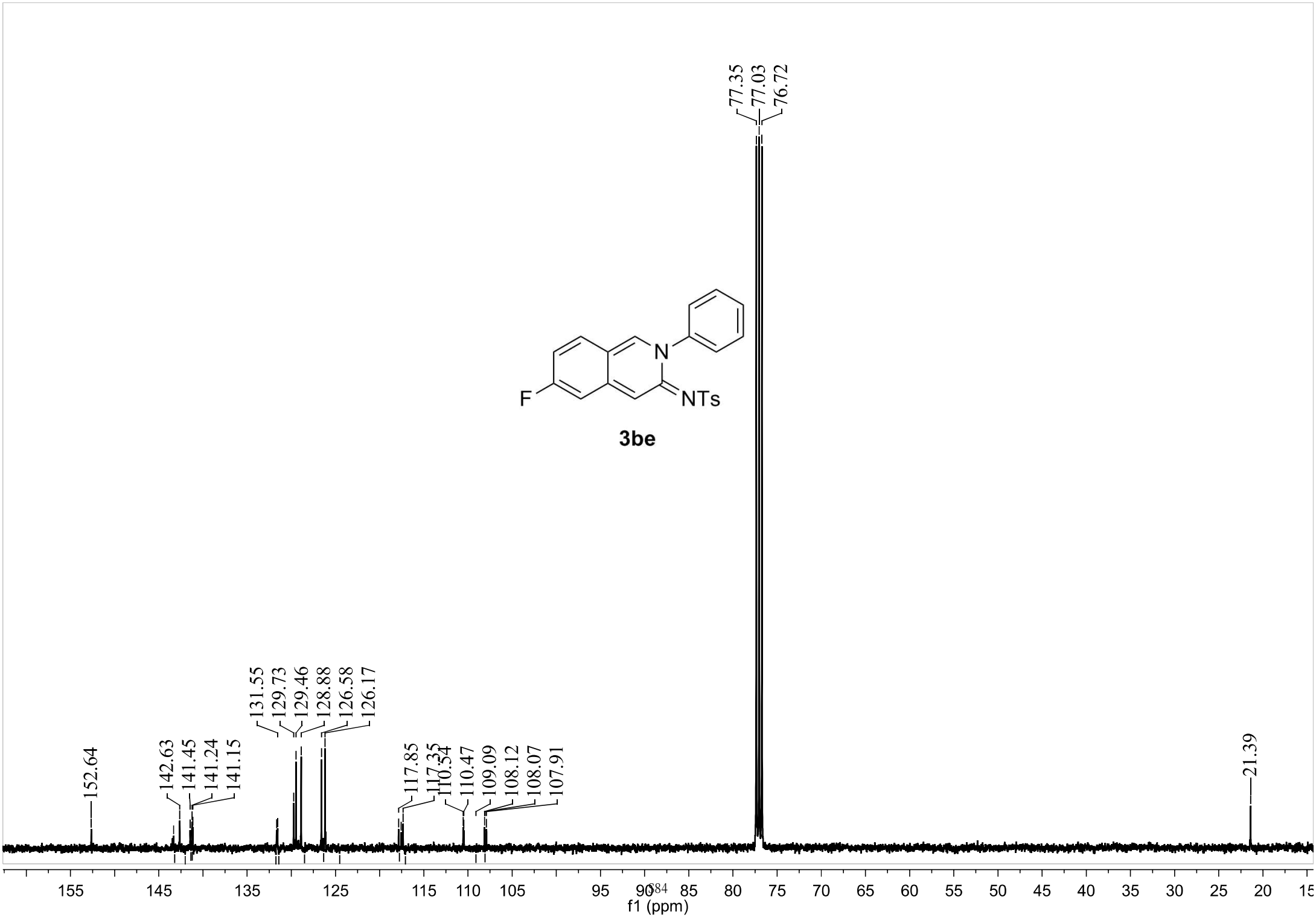
7.63
7.61
7.60
7.59
7.52
7.51
7.50
7.36
7.35
7.35
7.35
7.34
7.33
7.26
7.15
7.13
7.11
7.10
7.01
7.00
6.98
6.98
6.98
6.96
6.96
2.34
1.63
0.00
F
N
NTs
3be
0.92
1.08
2.29
1.04
2.95
2.21
3.07
2.93
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)


77.35
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76.72
F
N
NTs
3be
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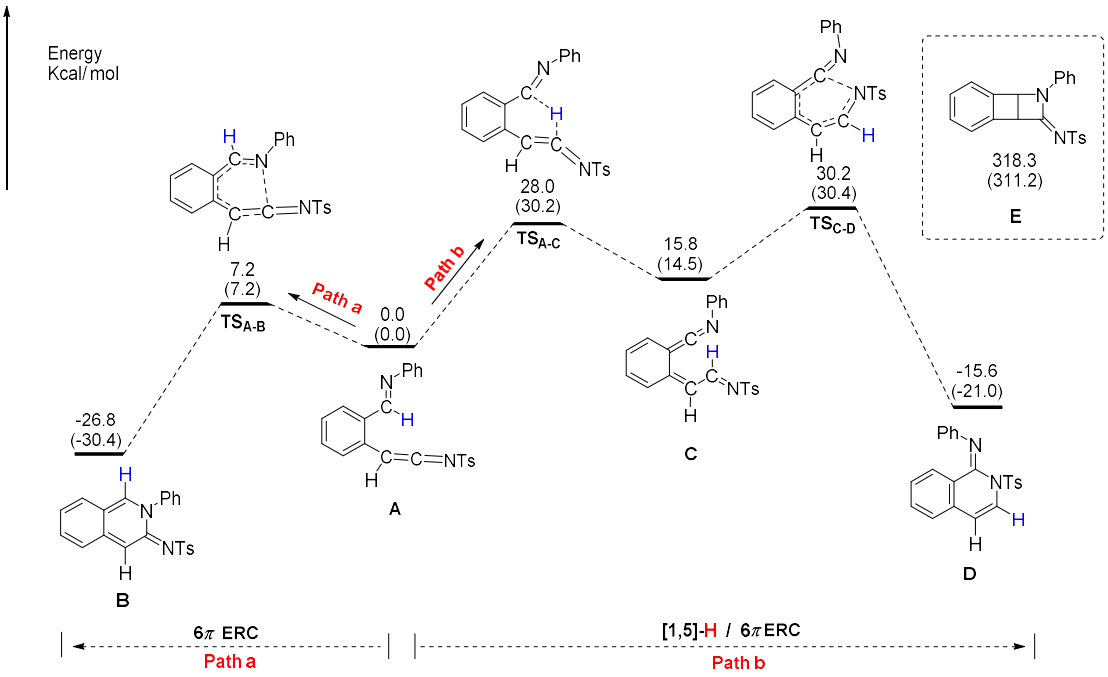
141.45
141.24
141.15
131.55
129.73
129.46
128.88
126.58
126.17
117.85
117.35
110.54
110.47
109.09
108.12
108.07
107.91
21.39
155
145
135
125
115
110
105
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
f1 (ppm)

Computational Details

DFT calculations were carried out at the B3LYP level of theory.[2-5] All structures/species studied in this paper were fully optimized in dichloromethane solvent. Frequency calculations were performed to ensure that a transition state has only one imaginary frequency and a local minimum has no imaginary frequencies. Intrinsic reaction coordinate (IRC) calculations were run to ensure that transition states connect relevant minima.[6, 7] The 6-31G** basis set was used to describe C, H, N and O,[8, 9] while the SDD plus polarization basis set[10-12] was employed to describe S. All DFT calculations were performed using the Gaussian 09 D.01.[13]



Cartesian coordinates for all of the calculated structures

45

A, E = -1507.20640620 , G = -1506.918217

6	3.829104	-4.050669	-0.117305
6	2.532607	-3.747341	-0.515773
6	2.038510	-2.427654	-0.483510
6	2.910457	-1.388790	-0.056711
6	4.215711	-1.720507	0.350381
6	4.676911	-3.030435	0.327361
1	4.176752	-5.078654	-0.152322
1	1.874033	-4.544221	-0.848619
1	4.861537	-0.910466	0.670842
1	5.691077	-3.256557	0.641688
6	2.511057	0.025832	-0.067865
7	3.223985	0.938562	0.486763
6	2.790315	2.277622	0.465451
6	3.772392	3.275137	0.332961

6 1.444551 2.659051 0.624278
6 3.413766 4.620968 0.308184
1 4.810235 2.971586 0.235325
6 1.097080 4.010223 0.617018
1 0.678117 1.908569 0.792027
6 2.073684 4.995359 0.449717
1 4.181870 5.379843 0.188975
1 0.056639 4.292336 0.751685
1 1.796151 6.045249 0.446217
6 0.634872 -2.266616 -0.888080
6 -0.204676 -1.262667 -0.711902
7 -1.021071 -0.343332 -0.641708
6 -2.001484 -0.258320 0.879588
8 -1.732505 1.102000 1.398052
8 -1.739495 -1.453497 1.713989
6 -3.650815 -0.333836 0.204451
6 -4.242634 0.837402 -0.273137
6 -4.311273 -1.562942 0.165611
6 -5.526638 0.763524 -0.806466
1 -3.711906 1.781432 -0.222350
6 -5.595744 -1.611281 -0.370713
1 -3.831756 -2.455186 0.552082
6 -6.222023 -0.455347 -0.863043
1 -5.997882 1.666978 -1.182474
1 -6.120800 -2.561401 -0.405945
6 -7.624223 -0.515159 -1.415504
1 -8.358368 -0.317451 -0.624886
1 -7.777327 0.234099 -2.196952
1 -7.848253 -1.501389 -1.830557
1 0.177113 -3.129911 -1.369981
1 1.593822 0.281474 -0.606906
45
TSA-B, E = -1507.19491798 , G = -1506.906707
6 3.925472 -4.176418 -0.166612
6 2.591267 -3.863971 -0.407785
6 2.149185 -2.528219 -0.472777
6 3.098863 -1.494072 -0.303257
6 4.439504 -1.823496 -0.070347
6 4.857749 -3.152257 0.007237
1 4.235299 -5.215868 -0.117578
1 1.867531 -4.662579 -0.543672
1 5.162565 -1.021960 0.051037
1 5.901829 -3.382552 0.195027
6 2.753293 -0.046007 -0.416187

7 2.324267 0.621282 0.584800
6 2.038128 1.998377 0.433281
6 2.340490 2.839032 1.515971
6 1.445653 2.545340 -0.717478
6 2.100252 4.208965 1.432077
1 2.775451 2.400568 2.408711
6 1.190983 3.915159 -0.787606
1 1.151451 1.894683 -1.534493
6 1.524941 4.752754 0.279517
1 2.351999 4.851615 2.270783
1 0.722482 4.327629 -1.676732
1 1.323936 5.818306 0.220274
6 0.721711 -2.314576 -0.739096
6 -0.016756 -1.224585 -0.632836
7 -0.783569 -0.261047 -0.626176
6 -1.671196 0.034700 0.927937
8 -1.355911 1.433026 1.286668
8 -1.405421 -1.073263 1.875016
6 -3.353583 -0.069523 0.335233
6 -3.941439 1.060769 -0.236112
6 -4.044219 -1.276037 0.456444
6 -5.250846 0.967953 -0.700630
1 -3.387063 1.989723 -0.308462
6 -5.353977 -1.344702 -0.013267
1 -3.567481 -2.135983 0.913338
6 -5.976393 -0.229941 -0.596471
1 -5.718491 1.840110 -1.148456
1 -5.902031 -2.278190 0.076415
6 -7.404746 -0.307487 -1.075493
1 -8.094993 0.006766 -0.283061
1 -7.573912 0.349086 -1.933426
1 -7.675899 -1.327623 -1.359992
1 0.155300 -3.189045 -1.058001
1 2.947401 0.426278 -1.391128
45
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6 2.379807 -4.239248 -0.224767
6 1.390439 -3.527170 0.402681
6 1.382497 -2.097639 0.347097
6 2.441986 -1.448477 -0.380415
6 3.459370 -2.220230 -1.022487
6 3.426758 -3.586341 -0.946398
1 2.373738 -5.324163 -0.175615
1 0.600669 -4.034374 0.948188

1 4.247822 -1.706306 -1.564442
1 4.193293 -4.182328 -1.430506
6 2.431919 -0.061370 -0.417538
7 1.471154 0.669252 0.184157
6 1.559927 2.117063 0.070186
6 2.122010 2.853512 1.112566
6 1.127748 2.731765 -1.103778
6 2.250623 4.235298 0.972176
1 2.449063 2.350479 2.016224
6 1.261668 4.115765 -1.234176
1 0.690763 2.135766 -1.898440
6 1.821305 4.866626 -0.198614
1 2.687851 4.817082 1.777463
1 0.928484 4.603025 -2.145094
1 1.923960 5.942338 -0.302983
6 0.402074 -1.319788 0.967360
6 0.397241 0.088969 0.900652
7 -0.459105 0.985635 1.398908
6 -1.832478 0.522886 2.184603
8 -2.393645 1.769555 2.767890
8 -1.646101 -0.641407 3.107517
6 -2.968053 -0.011859 0.881958
6 -3.356345 0.904447 -0.101559
6 -3.465711 -1.312293 0.881513
6 -4.241711 0.499841 -1.095251
1 -2.968793 1.917826 -0.086052
6 -4.356106 -1.702335 -0.122814
1 -3.166525 -2.002843 1.662205
6 -4.756133 -0.808947 -1.123432
1 -4.544111 1.209468 -1.861160
1 -4.745929 -2.716727 -0.123937
6 -5.721501 -1.227527 -2.206195
1 -6.644492 -0.638292 -2.160439
1 -5.291790 -1.071461 -3.201904
1 -5.991310 -2.282685 -2.115257
1 -0.377169 -1.796863 1.545773
1 3.199514 0.505896 -0.930527
45
TSA-C, E = -1507.15828152 , G = -1506.873618
6 4.201393 -3.859864 -0.589197
6 2.851883 -3.628891 -0.382409
6 2.347793 -2.311947 -0.280143
6 3.286116 -1.238035 -0.357575
6 4.653010 -1.486747 -0.621503

6 5.109754 -2.788669 -0.715677
1 4.564059 -4.880628 -0.664418
1 2.159825 -4.462010 -0.306902
1 5.332549 -0.645061 -0.705353
1 6.166015 -2.984750 -0.867860
6 2.799744 0.097160 -0.260190
7 3.208310 1.218501 0.044432
6 2.710106 2.522751 -0.006509
6 3.651498 3.562785 0.048997
6 1.334231 2.814752 -0.076778
6 3.225857 4.888298 0.004965
1 4.705028 3.313710 0.118868
6 0.924965 4.146089 -0.102865
1 0.597467 2.017229 -0.087449
6 1.862311 5.183596 -0.069443
1 3.958005 5.689090 0.037749
1 -0.135554 4.373964 -0.149913
1 1.529643 6.216710 -0.094570
6 0.942813 -2.046880 -0.162651
6 0.456329 -0.771926 -0.236057
7 -0.596999 -0.048184 -0.035000
6 -1.640389 -0.456371 1.260484
8 -1.617094 0.677018 2.221367
8 -1.389282 -1.833353 1.770467
6 -3.227122 -0.442546 0.418332
6 -3.901730 0.768052 0.251633
6 -3.762754 -1.642234 -0.049707
6 -5.129021 0.769392 -0.407464
1 -3.474744 1.687174 0.637307
6 -4.993402 -1.620692 -0.704494
1 -3.228313 -2.573261 0.103533
6 -5.694331 -0.420275 -0.893792
1 -5.659070 1.708161 -0.543250
1 -5.416958 -2.551433 -1.071704
6 -7.039765 -0.409333 -1.577497
1 -7.186383 0.508368 -2.154327
1 -7.152962 -1.262907 -2.251226
1 -7.850526 -0.462965 -0.840561
1 0.242630 -2.875246 -0.138435
1 1.426589 -0.058902 -0.625553
45
C, E = -1507.18331074 , G = -1506.893060
6 5.030192 -3.238176 0.079491
6 3.679769 -3.151917 0.337958

6	2.925251	-1.989896	0.004991
6	3.703354	-0.861688	-0.455464
6	5.094953	-0.974622	-0.755065
6	5.744735	-2.158119	-0.502640
1	5.558093	-4.159271	0.308738
1	3.147665	-4.003774	0.750751
1	5.628239	-0.112306	-1.140992
1	6.803628	-2.256108	-0.715299
6	3.119814	0.398003	-0.422146
7	2.693484	1.475340	-0.267767
6	2.054251	2.687466	-0.097749
6	2.677408	3.863041	-0.540560
6	0.796346	2.704065	0.527484
6	2.020463	5.076646	-0.354593
1	3.650076	3.814504	-1.017067
6	0.163605	3.932390	0.700929
1	0.334794	1.779401	0.861838
6	0.767628	5.115480	0.264059
1	2.491161	5.993627	-0.693919
1	-0.808344	3.962384	1.182862
1	0.263461	6.065920	0.406475
6	1.512882	-1.951614	0.137618
6	0.703151	-1.152230	-0.674862
7	-0.598160	-0.861255	-0.640799
6	-1.441848	-1.174774	0.763634
8	-1.137784	-0.113419	1.778432
8	-1.358773	-2.594204	1.235247
6	-3.126742	-0.902514	0.186674
6	-3.608064	0.402225	0.054931
6	-3.938323	-1.998419	-0.094643
6	-4.915057	0.601765	-0.380748
1	-2.969345	1.244035	0.299296
6	-5.247946	-1.781043	-0.528100
1	-3.550355	-3.002971	0.032718
6	-5.755125	-0.484254	-0.681011
1	-5.293814	1.615368	-0.484318
1	-5.884863	-2.633895	-0.746578
6	-7.169136	-0.249005	-1.155383
1	-7.725988	0.373893	-0.446854
1	-7.179470	0.274228	-2.118461
1	-7.711399	-1.189836	-1.278611
1	1.043718	-2.642080	0.830159
1	1.189735	-0.717839	-1.555613

45

TSC-D, E = -1507.15794479 , G = -1506.870012

6	5.406347	0.835507	0.778773
6	4.466128	1.453791	0.021393
6	3.273599	0.772522	-0.468112
6	3.225139	-0.681864	-0.180553
6	4.246269	-1.287739	0.666215
6	5.292588	-0.561086	1.128855
1	6.261761	1.400144	1.138787
1	4.562589	2.509300	-0.216868
1	4.151121	-2.343916	0.896977
1	6.052307	-1.024607	1.749471
6	2.309360	-1.508427	-0.718878
7	1.650343	-2.332722	-1.317195
6	0.418107	-2.978362	-1.064104
6	-0.318041	-2.752767	0.109085
6	-0.034399	-3.885787	-2.028154
6	-1.507832	-3.450492	0.307330
1	0.035841	-2.029374	0.836314
6	-1.230152	-4.573242	-1.820636
1	0.557108	-4.042272	-2.924136
6	-1.966384	-4.359149	-0.653338
1	-2.078832	-3.286969	1.216607
1	-1.582906	-5.277250	-2.567783
1	-2.894370	-4.898511	-0.489788
6	2.337299	1.493437	-1.152496
6	1.047282	1.023251	-1.686949
7	-0.100983	0.930635	-1.112968
6	-0.223694	1.425569	0.557062
8	0.367100	2.769903	0.782863
8	0.205267	0.282565	1.407808
6	-2.009648	1.587529	0.664297
6	-2.564564	2.860946	0.765327
6	-2.810101	0.441964	0.676572
6	-3.950586	2.986358	0.874924
1	-1.921694	3.733747	0.761094
6	-4.189528	0.588171	0.782051
1	-2.364106	-0.543449	0.598691
6	-4.781971	1.859037	0.885046
1	-4.389588	3.976804	0.954254
1	-4.819329	-0.297341	0.787219
6	-6.279222	1.994424	1.016872
1	-6.596693	3.036208	0.927687
1	-6.798144	1.410736	0.249465
1	-6.620908	1.621610	1.989574

1 2.570489 2.526621 -1.403621
1 1.012950 0.751412 -2.750959
45
D, E = -1507.23993076 , G = -1506.943096
6 -3.251727 1.727026 2.686334
6 -2.215144 1.969027 1.792068
6 -1.846742 0.994180 0.852163
6 -2.542358 -0.238808 0.807472
6 -3.602060 -0.458175 1.706793
6 -3.950569 0.511635 2.639162
1 -3.525465 2.483982 3.414884
1 -1.677719 2.910590 1.800815
6 -0.787433 1.267443 -0.143340
6 -2.138704 -1.235583 -0.165359
1 -4.142902 -1.399469 1.666312
1 -4.766760 0.327592 3.331434
6 -1.009238 -1.071854 -0.877760
1 -2.738732 -2.128043 -0.305343
1 -0.632389 -1.806462 -1.579835
7 -0.233437 0.099489 -0.773916
6 1.510176 -0.220792 -0.706437
8 2.162284 1.039183 -0.306853
8 1.819876 -0.892582 -1.985526
6 1.694753 -1.409679 0.624461
6 1.760937 -0.944020 1.941120
6 1.799678 -2.766680 0.322026
6 1.921625 -1.868146 2.968120
1 1.701595 0.117596 2.153870
6 1.962112 -3.674916 1.368164
1 1.771795 -3.102202 -0.708376
6 2.020869 -3.244871 2.700910
1 1.978035 -1.516146 3.994301
1 2.049891 -4.733532 1.142095
6 2.185830 -4.230259 3.831052
1 3.027812 -3.954157 4.474391
1 1.291310 -4.250230 4.464076
1 2.357413 -5.242672 3.458131
7 -0.462449 2.476063 -0.414324
6 0.324574 2.937966 -1.477971
6 0.205181 2.447117 -2.792761
6 1.158946 4.044549 -1.242893
6 0.919308 3.043054 -3.831292
1 -0.455792 1.612064 -2.997534
6 1.887845 4.618330 -2.282327

1	1.229274	4.435504	-0.232577
6	1.771601	4.122905	-3.584153
1	0.808433	2.658519	-4.841547
1	2.538443	5.464027	-2.077284
1	2.330038	4.577677	-4.396868

45

E, E=-1506.7104405 G=-1506.410929

C	-1.75065500	4.38152100	-0.65602900
C	-1.04293800	3.76120200	0.38167900
C	-1.60410300	2.59183400	0.86341000
C	-2.78396800	2.05759600	0.35347700
C	-3.49255800	2.66031200	-0.67182800
C	-2.93984800	3.84829700	-1.16737600
H	-1.37031900	5.30633900	-1.07782800
H	-0.12645000	4.18819900	0.77372900
H	-4.42140400	2.26530300	-1.07068200
H	-3.44684800	4.37585300	-1.96876400
C	-2.73988500	0.85858500	1.29410400
H	-3.59954700	0.57155400	1.89781300
N	-1.92230200	-0.27694800	0.81833900
C	-2.38210900	-1.41231300	0.11189500
C	-3.44341900	-1.24667600	-0.77746500
C	-1.85694900	-2.67978500	0.36492700
C	-3.97020100	-2.35596600	-1.43233000
H	-3.84290100	-0.25403500	-0.96045600
C	-2.38272000	-3.77767500	-0.30634200
H	-1.04126200	-2.80068900	1.06938900
C	-3.43931600	-3.62274500	-1.20286200
H	-4.79416400	-2.22571600	-2.12586300
H	-1.97000700	-4.76294300	-0.11681300
H	-3.84886000	-4.48601600	-1.71620200
C	-0.74313200	0.24607100	1.25636500
C	-1.41883600	1.46446700	1.86882800
N	0.52215400	0.00142700	1.20850100
S	1.15538500	-1.21446500	0.26169000
O	0.44833300	-1.29375100	-1.03174600
O	1.30672000	-2.44134400	1.07163800
C	2.78406300	-0.56434200	-0.03715400
C	3.00299200	0.20090100	-1.17514900
C	3.80527400	-0.84681900	0.86513100
C	4.28025800	0.70357000	-1.40618100
H	2.18963800	0.38645500	-1.86840400
C	5.07248700	-0.33530600	0.61766600
H	3.60539900	-1.46526200	1.73350700

C	5.32670000	0.44671200	-0.51646500
H	4.46820200	1.29943600	-2.29419900
H	5.88189500	-0.54963800	1.30968400
H	-1.26213000	1.65784800	2.92763600
C	6.70644700	0.99862300	-0.76074300
H	6.95917300	1.75108400	-0.00765700
H	7.45936500	0.20854200	-0.69745000
H	6.77834300	1.46584800	-1.74446400

References

[1] Shen, H.; Fu, J.; Gong, J.; Yang, Z. *Org. Lett.* **2014**, *16*, 5588-5591.

[2] C. Lee, W. Yang and R. G. Parr, *Development of the Colle-Salvetti correlation-energy formula into a functional of the electron density*, *Phys. Rev. B*, **1988**, *37,* 785-789.

[3] B. Miehlich, A. Savin, H. Stoll and H. Preuss, *Results obtained with the correlation energy density functionals of becke and Lee, Yang and Parr*, *Chem. Phys. Lett.*, **1989**, *157*, 200-206.

[4] A. D. Becke, *Density-functional thermochemistry. III. The role of exact exchange*, *J. Chem. Phys.*, **1993**, *98*, 5648-5652.

[5] P. Stephens, F. Devlin, C. Chabalowski and M. J. Frisch, *Ab initio calculation of vibrational absorption and circular dichroism spectra using density functional force fields*, *J. Phys. Chem.*, **1994**, *98*, 11623-11627.

[6] K. Fukui, *Formulation of the reaction coordinate*, *J. Phys. Chem.*, **1970**, *74*, 4161-4163.

[7] K. Fukui, *The path of chemical reactions - the IRC approach*, *Acc. Chem. Res.*, **1981**, *14*, 363-368.

[8] W. J. Hehre, R. Ditchfield and J. A. Pople, *Self—consistent molecular orbital methods. XII. Further extensions of gaussian—type basis sets for use in molecular orbital studies of organic molecules*, *J. Chem. Phys.*, **1972**, *56*, 2257-2261.

[9] P. C. Hariharan and J. A. Pople, *The influence of polarization functions on molecular orbital hydrogenation energies*, *Theor. Chim. Acta*, **1973**, *28*, 213-222.

[10] P. J. Hay and W. R. Wadt, *Ab initio effective core potentials for molecular calculations. Potentials for K to Au including the outermost core orbitals*, *J. Chem. Phys.*, **1985**, *82*, 299-310.

[11] G. Igel-Mann, H. Stoll and H. Preuss, *Pseudopotentials for main group elements (IIIa through VIIa)*, *Mol. Phys.*, **1988**, *65*, 1321-1328.

[12] D. Andrae, U. Häußermann, M. Dolg, H. Stoll and H. Preuß, *Energy-adjustedab initio pseudopotentials for the second and third row transition elements*, *Theoret. Chim. Acta*, **1990**, *77*, 123-141.

[13] M. J. T. Frisch, G. W.; Schlegel, H. B.; Scuseria, G. E.; Robb, M. A.; Cheeseman, J. R.; Scalmani, G.;Barone, V.; Mennucci, B.; Petersson, G. A.; Nakatsuji, H.; Caricato, M.; Li, X.; Hratchian, H. P.;Izmaylov, A. F.; Bloino, J.; Zheng, G.; Sonnenberg, J. L.; Hada, M.; Ehara, M.; Toyota, K.; Fukuda, R.;Hasegawa, J.; Ishida, M.; Nakajima, T.; Honda, Y.; Kitao, O.; Nakai, H.; Vreven, T.; Montgomery, J. A., Jr.;Peralta, J. E.; Ogliaro, F.; Bearpark, M.; Heyd, J. J.; Brothers, E.; Kudin, K. N.; Staroverov, V. N.;Kobayashi, R.; Normand, J.; Raghavachari, K.; Rendell, A.; Burant, J. C.; Iyengar, S. S.; Tomasi, J.;Cossi, M.; Rega, N.; Millam, M. J.; Klene, M.; Knox, J. E.; Cross, J. B.; Bakken, V.; Adamo, C.; Jaramillo, J.;Gomperts, R.; Stratmann, R. E.; Yazyev, O.; Austin, A. J.; Cammi, R.; Pomelli, C.; Ochterski, J. W.;Martin, R. L.; Morokuma, K.; Zakrzewski, V. G.; Voth, G. A.; Salvador, P.; Dannenberg, J. J.; Dapprich, S.;Daniels, A. D.; Farkas, Ö.; Foresman, J. B.; Ortiz, J. V.; Cioslowski, J.; Fox, D. J., *Gaussian 09, Revision D.01; Gaussian, Inc., Wallingford, CT*, **2009**.