# Supporting Information

## Transition-Metal-Free Regioselective C-H Halogenation of Imidazo[1,2-*a*]pyridines: Sodium Chlorite/Bromite as the Halogen Source

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# 1. General consideration

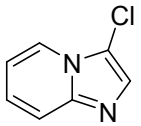
$^{1}H$ and $^{13}C$ NMR spectra were recorded at 400 and 100 Hz, respectively. Mass spectra were recorded were obtained on a ESIMS. Elemental analyses were performed with a elemental analyzer. GC-MS was obtained using electron ionization. TLC was performed using commercially prepared 100-400 mesh silica gel plates.

# 2. General procedure

**Synthesis of 2a according to the following procedure:** A 25 mL sealed tube was charged with a stirring bar, and added imidazo[1,2-*a*]pyridine **1a** (0.5 mmol, 1.0 equiv), $NaClO_2$ (1 mmol, 2.0 equiv), AcOH (2 mmol) and DMF (2 mL). The reaction was allowed to stir at 60℃ until the complete consumption of **2a** was monitored by TLC analysis. The reaction mixture was purified by thin layer chromatography silica gel plate (eluent: petroleum ether : ethyl acetate, V : V = 10 : 1) and then extracted with EtOAc. The solvents were dried in vacuo to afford the pure product.

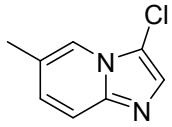
# 3. Characterization data

**2a 3-Chloroimidazo[1,2-*a*]pyridine**



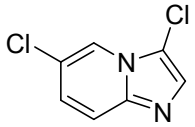

Brown oil (63.1 mg, 83%); IR (KBr): 2992, 1486, 1219, 1037, 954 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 6.4 Hz, 1H), 7.61 (t, *J* = 9.2 Hz, 2H), 7.21 (t, *J* = 7.6 Hz, 1H), 6.91 (t, *J* = 6.8 Hz, 1H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 144.7, 130.2, 124.2, 122.5, 118.0, 112.9, 109.6. ESI-MS m/z (%) 153(100)$[M+H]^+$; Anal. Calcd for $C_7H_5ClN_2$ C, 55.10; H, 3.30; N, 18.36; Found: C, 54.91; H, 3.31; N, 18.45.

**2b 3-Chloro-6-methylimidazo[1,2-*a*]pyridine**



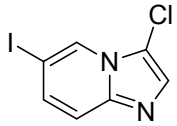

Brown oil (66.4 mg, 80%); IR (KBr): 2986, 1476, 1233, 1025, 960 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.85 (s, 1H), 7.52 (d, *J* = 6.0 Hz, 2H), 7.08 (d, *J* = 9.2 Hz, 1H), 2.38 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 143.6, 129.9, 127.5, 122.8, 120.2, 117.4, 109.2, 18.3. ESI-MS m/z (%) 167(100)$[M+H]^+$; Anal. Calcd for $C_8H_7ClN_2$ C, 57.67; H, 4.24; N, 16.81; Found:. C, 57.43; H, 4.23; N, 16.89.

**2c 3,6-Dichloroimidazo[1,2-*a*]pyridine**



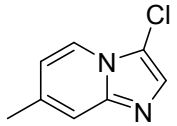

Yellow oil (62.3 mg, 67%); IR (KBr): 2989, 1506, 1249, 899, 690 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.13 (s, 1H), 7.57 (d, *J* = 9.6 Hz, 2H), 7.19 (d, *J* = 8.6 Hz, 1H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 131.0, 126.0, 126.0, 121.8, 120.7, 118.5, 100.0. ESI-MS m/z (%) 187(100)$[M+H]^+$; Anal. Calcd for $C_7H_4Cl_2N_2$ C, 44.95; H, 2.16; N, 14.98; Found: C, 45.09; H, 2.13; N, 14.90.

**2d 3-Chloro-6-iodoimidazo[1,2-*a*]pyridine**



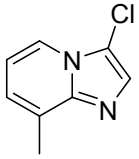

Brown oil (88.6 mg, 64%); IR (KBr): 2977, 1456, 1228, 1027, 954 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.31 (s, 1H), 7.51 (s, 1H), 7.44-7.33 (m, 2H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 143.0, 132.5, 130.4, 127.7, 118.9, 118.9, 109.5. ESI-MS m/z (%) 278(100)$[M+H]^+$; Anal. Calcd for $C_7H_4ClIN_2$ C, 30.19; H, 1.45; N, 10.06; Found:. C, 30.47; H, 1.40; N, 9.95.

**2e 3-Chloro-7-methylimidazo[1,2-*a*]pyridine**



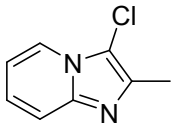

Brown oil (70.1 mg, 85%); IR (KBr): 2973, 1478, 1259, 1011, 931 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.94 (d, $J$ = 6.8 Hz, 1H), 7.47 (s, 1H), 7.36 (s, 1H), 6.76 (d, $J$ = 7.2 Hz, 1H), 2.41 (s, 3H). $^{13}C$ NMR (100MHz, $CDCl_3$) δ 144.8, 135.5, 129.6, 121.7, 116.3, 115.7, 109.0, 21.2. ESI-MS m/z (%) 167(100)$[M+H]^+$; Anal. Calcd for $C_8H_7ClN_2$ C, 57.67; H, 4.24; N, 16.81; Found: C, 57.45; H, 4.26; N, 16.89.

**2f 3-Chloro-8-methylimidazo[1,2-*a*]pyridine**



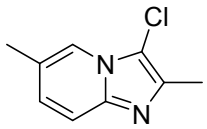

Brown oil (73.8 mg, 89%); IR (KBr): 2956, 1485, 1237, 1017, 921 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.87 (d, $J$ = 6.8 Hz, 1H), 7.46 (s, 1H), 6.94 (d, $J$ = 6.8 Hz, 1H), 6.78 (t, $J$ = 6.8 Hz, 1H), 2.53 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 144.8, 129.4, 127.9, 123.2, 120.5, 113.1, 109.9, 16.4. ESI-MS m/z (%) 167(100)$[M+H]^+$; Anal. Calcd for $C_8H_7ClN_2$ C, 57.67; H, 4.24; N, 16.81; Found: C, 57.41; H, 4.22; N, 16.90.

**2g 3-Chloro-2-methylimidazo[1,2-*a*]pyridine**



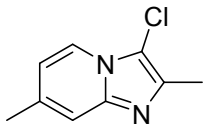
Yellow oil (66.4 mg, 80%); IR (KBr): 2899, 1453, 1172, 1023, 857 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 6.8 Hz, 1H), 7.54 (d, *J* = 8.8 Hz, 1H), 7.20 (t, *J* = 8.0 Hz, 1H), 6.90 (t, *J* = 6.8 Hz, 1H), 2.46 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 143.3, 138.8, 124.1, 122.4, 117.0, 112.5, 110.2, 12.8. ESI-MS m/z (%) 167(100)$[M+H]^+$; Anal. Calcd for $C_8H_7ClN_2$ C, 57.67; H, 4.24; N, 16.81; Found: C, 57.87; H, 4.21; N, 16.72.

**2h 3-Chloro-2,6-dimethylimidazo[1,2-*a*]pyridine**



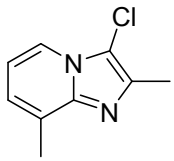

Yellow oil (72.9 mg, 81%); IR (KBr): 2907, 1444, 1208, 1021, 869 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.65 (s, 1H), 7.32 (d, *J* = 9.2 Hz, 1H), 6.93 (d, *J* = 9.2 Hz, 1H), 2.34 (s, 3H), 2.25 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 142.4, 138.5, 127.1, 122.1, 120.1, 116.2, 105.9, 18.2, 12.8. ESI-MS m/z (%) 181(100)$[M+H]^+$; Anal. Calcd for $C_9H_9ClN_2$ C, 59.84; H, 5.02; N, 15.51; Found: C, 60.03; H, 4.99; N, 15.43.

**2i 3-Chloro-2,7-dimethylimidazo[1,2-*a*]pyridine**




Yellow oil (72.9 mg, 81%); IR (KBr): 2906, 1515, 1230, 1008, 906 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.77 (t, *J* = 6.8 Hz, 1H), 7.17 (s, 1H), 6.62-6.58 (m, 1H), 2.34-2.30 (m, 6H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 143.7, 138.2, 135.1, 121.6, 115.4, 115.0, 105.7, 21.2, 12.7. ESI-MS m/z (%) 181(100)$[M+H]^+$; Anal. Calcd for $C_9H_9ClN_2$ C, 59.84; H, 5.02; N, 15.51; Found: C, 59.59; H, 5.04; N, 15.58.

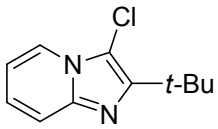
**2j 3-Chloro-2,8-dimethylimidazo[1,2-*a*]pyridine**




Brown oil (70.2 mg, 78%); IR (KBr): 2886, 1446, 1219, 1033, 846 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.81 (d, *J* = 6.8 Hz, 1H), 6.93 (d, *J* = 6.4 Hz, 1H), 6.75 (t, *J* = 6.8 Hz, 1H), 2.52 (s, 3H),

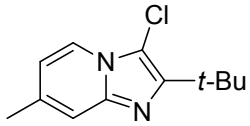
2.41 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$) δ 143.6, 138.0, 126.8, 123.2, 120.4, 112.5, 108.7, 16.6, 12.8. ESI-MS m/z (%) 181(100)$[M+H]^+$; Anal. Calcd for $C_9H_9ClN_2$ C, 59.84; H, 5.02; N, 15.51; Found: C, 59.56; H, 5.05; N, 15.59.

**2k 2-(*tert*-Butyl)-3-chloroimidazo[1,2-*a*]pyridine**



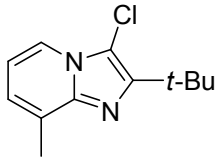

Brown oil (89.4 mg, 86%); IR (KBr): 2957, 1476, 1239, 1037, 767 $cm^{-1}$; $^1$H NMR (400 MHz, $CDCl_3$) δ 7.89 (d, $J$ = 6.8 Hz, 1H), 7.47 (d, $J$ = 8.8 Hz, 1H), 7.04 (t, $J$ = 7.2 Hz, 1H), 6.73 (t, $J$ = 6.8 Hz, 1H), 1.39 (s, 9H). $^{13}$C NMR (100 MHz, $CDCl_3$) δ 149.5, 142.2, 123.6, 122.0, 117.2, 112.3, 104.3, 32.9, 29.6. ESI-MS m/z (%) 209(100)$[M+H]^+$; Anal. Calcd for $C_{11}H_{13}ClN_2$ C, 63.31; H, 6.28; N, 13.42; Found: C, 63.02; H, 6.31; N, 13.49.

**2l 2-(*tert*-Butyl)-3-chloro-7-methylimidazo[1,2-*a*]pyridine**




Brown oil (98.8 mg, 89%); IR (KBr): 2985, 1456, 1189, 10237, 860 $cm^{-1}$; $^1$H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, $J$ = 7.2 Hz, 1H), 7.25 (s, 1H), 6.61 (d, $J$ = 6.8 Hz, 1H), 2.30 (s, 3H), 1.40 (s, 9H). $^{13}$C NMR (100 MHz, $CDCl_3$) δ 149.1, 142.7, 134.8, 121.3, 115.8, 115.0, 103.6, 32.9, 29.6, 21.2. ESI-MS m/z (%) 223(100)$[M+H]^+$; Anal. Calcd for $C_{12}H_{15}ClN_2$ C, 64.72; H, 6.79; N, 12.58; Found: C, 64.47; H, 6.77; N, 12.65.

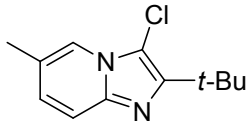
**2m 2-(*tert*-Butyl)-3-chloro-8-methylimidazo[1,2-*a*]pyridine**




Brown oil (102.1 mg, 92%); IR (KBr): 2989, 1470, 1139, 1033, 861 $cm^{-1}$; $^1$H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, $J$ = 6.8 Hz, 1H), 6.93 (d, $J$ = 6.8 Hz, 1H), 6.76 (t, $J$ = 6.8 Hz, 1H), 2.58 (s, 3H), 1.50 (s, 9H). $^{13}$C NMR (100 MHz, $CDCl_3$) δ 148.9, 142.5, 127.3, 122.4, 119.9, 112.3, 104.5, 33.0,

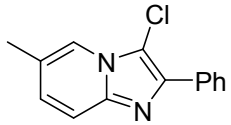
29.7, 16.5. ESI-MS m/z (%) 223(100)$[M+H]^+$; Anal. Calcd for $C_{12}H_{15}ClN_2$ C, 64.72; H, 6.79; N, 12.58; Found: C, 64.52; H, 6.82; N, 12.64.

**2n 2-(*tert*-Butyl)-3-chloro-6-methylimidazo[1,2-*a*]pyridine**



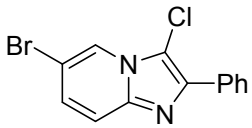

Brown oil (96.6 mg, 87%); IR (KBr): 2899, 1516, 1228, 1066, 790 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.81 (s, 1H), 7.49 (d, $J$ = 9.2 Hz, 1H), 7.02 (d, $J$ = 9.2 Hz, 1H), 2.34 (s, 3H), 1.49 (s, 9H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 149.3, 141.3, 126.9, 122.2, 119.8, 116.6, 103.9, 32.90, 29.6, 18.3. ESI-MS m/z (%) 223(100)$[M+H]^+$; Anal. Calcd for $C_{12}H_{15}ClN_2$ C, 64.72; H, 6.79; N, 12.58; Found: C, 64.44; H, 6.83; N, 12.65.

**2o 3-Chloro-6-methyl-2-phenylimidazo[1,2-*a*]pyridine**



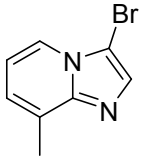

Brown oil (94.4 mg, 78%); IR (KBr): 2913, 1496, 1230, 1041, 832 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 8.12 (d, $J$ = 7.2 Hz, 2H), 7.87 (s, 1H), 7.54-7.45 (m, 3H), 7.36 (t, $J$ = 7.2 Hz, 1H), 7.07 (d, $J$ = 8.8 Hz, 1H), 2.36 (s, 3H).$^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 142.7, 139.4, 132.6, 128.4, 128.4, 128.0, 127.3, 122.7, 120.3, 116.8, 105.2, 18.3. ESI-MS m/z (%) 243(100)$[M+H]^+$; Anal. Calcd for $C_{14}H_{11}ClN_2$ C, 69.28; H, 4.57; N, 11.54; Found: C, 68.99; H, 4.59; N, 11.60.

**2p 6-Bromo-3-chloro-2-phenylimidazo[1,2-*a*]pyridine**



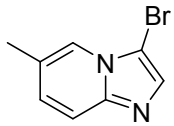

Brown solid (104.0 mg, 68%), mp 142.8-145.4 °C; IR (KBr): 2933, 1436, 1175, 1028, 913 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 8.25-8.21 (m, 2H), 7.62-7.50 (m, 4H), 7.30-7.26 (m, 2H). $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 134.3, 130.1, 128.0, 127.8, 127.8, 123.9, 122.7, 118.6, 118.5, 108.1, 108.0. ESI-MS m/z (%) 307(100)$[M+H]^+$; Anal. Calcd for $C_{13}H_8BrClN_2$ C, 50.76; H, 2.62; N, 9.11; Found: C, 51.02; H, 2.58; N, 9.07.

**3a 3-Bromo-8-methylimidazo[1,2-*a*]pyridine**



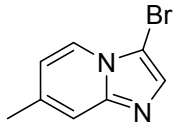

Brown oil (83.0 mg, 79%); IR (KBr): 2929, 1566, 880, 767, 682 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 6.8 Hz, 1H), 7.59 (s, 1H), 7.01 (d, *J* = 6.8 Hz, 1H), 6.83 (t, *J* = 6.8 Hz, 1H), 2.60 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 146.1, 132.8, 127.7, 123.3, 121.6, 113.1, 95.0, 16.4. ESI-MS m/z (%) 211(100)$[M+H]^+$; Anal. Calcd for $C_8H_7BrN_2$ C, 45.53; H, 3.34; N, 13.27; Found: C, 45.60; H, 3.35; N, 13.21.

**3b 3-Bromo-6-methylimidazo[1,2-*a*]pyridine**



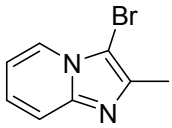

Brown oil (73.5 mg, 70%); IR (KBr): 2929, 1588, 1466, 1251, 1031, 765 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 7.87 (s, 1H), 7.56 (s, 1H), 7.51 (d, *J* = 9.2 Hz, 1H), 7.07 (d, *J* = 9.2 Hz, 1H), 2.36 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 144.9, 133.3, 127.7, 122.9, 121.4, 117.2, 94.2, 18.3. ESI-MS m/z (%) 211(100)$[M+H]^+$; Anal. Calcd for $C_8H_7BrN_2$ C, 45.53; H, 3.34; N, 13.27; Found: C, 45.37; H, 3.35; N, 13.33.

**3c 3-Bromo-7-methylimidazo[1,2-*a*]pyridine**



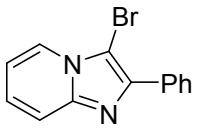

Brown oil (75.6 mg, 72%); IR (KBr): 2913, 1579, 1416, 1040, 766 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 6.8 Hz, 1H), 7.55 (s, 1H), 7.37 (s, 1H), 6.76 (d, *J* = 6.8 Hz, 1H), 2.42 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 144.0, 135.6, 133.2, 122.9, 116.3, 115.8, 93.8, 21.2. ESI-MS m/z (%) 211(100)$[M+H]^+$; Anal. Calcd for $C_8H_7BrN_2$ C, 45.53; H, 3.34; N, 13.27; Found: C, 45.32; H, 3.32; N, 13.34.

**3d 3-Bromo-2-methylimidazo[1,2-*a*]pyridine**



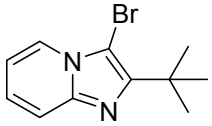

Brown oil (74.6 mg, 71%); IR (KBr): 2988, 1473, 1139, 1009, 778 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 6.8 Hz, 1H), 7.52 (d, *J* = 9.2 Hz, 1H), 7.20 (t, *J* = 7.2 Hz, 1H), 6.88 (t, *J* = 6.8 Hz, 1H), 2.46 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) δ 145.1, 141.8, 124.3, 123.6, 116.9, 112.6, 92.9, 13.6. ESI-MS m/z (%) 211(100)$[M+H]^+$; Anal. Calcd for $C_8H_7BrN_2$ C, 45.53; H, 3.34; N, 13.27; Found: C, 45.61; H, 3.33; N, 13.21.

**3e 3-Bromo-2-phenylimidazo[1,2-*a*]pyridine**



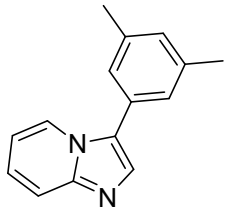

Brown oil (112.9 mg, 83%); IR (KBr): 2976, 1573, 1432, 1072, 897, 782 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) *δ* 8.17-8.11 (m, 3H), 7.64 (d, *J* = 9.2 Hz, 1H), 7.48 (t, *J* = 7.6 Hz, 2H), 7.39 (t, *J* = 7.2 Hz, 1H), 7.26-7.19 (m, 1H), 6.91 (t, *J* = 6.4 Hz, 1H). $^{13}C$ NMR (100 MHz, $CDCl_3$) *δ* 145.5, 142.7, 132.8, 128.5, 128.3, 127.9, 125.2, 124.0, 117.6, 113.1, 91.8. ESI-MS m/z (%) 273 (100)$[M+H]^+$; Anal. Calcd for $C_{17}H_9BrN_2$ C, 57.17; H, 3.32; N, 10.26; Found: C, 56.38; H, 3.30; N, 10.21.

**3f 3-Bromo-2-(*tert*-butyl)imidazo[1,2-*a*]pyridine**



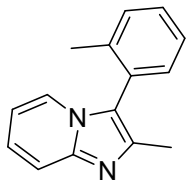

Brown oil (110.9 mg, 88%); IR (KBr): 2956, 1533, 1019, 884, 752 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) *δ* 8.06 (d, *J* = 4.8 Hz, 1H), 7.54 (d, *J* = 10.0 Hz, 1H), 7.13 (t, *J* = 8.0 Hz, 1H), 6.85-6.78 (m, 1H), 1.49 (s, 9H). $^{13}C$ NMR (100 MHz, $CDCl_3$) *δ* 151.9, 143.7, 124.0, 123.2, 117.2, 112.5, 90.0, 33.0, 29.6. ESI-MS m/z (%) 253 (100)$[M+H]^+$; Anal. Calcd for $C_{11}H_{13}BrN_2$ C, 52.19; H, 5.18; N, 11.07; Found: C, 51.96; H, 5.20; N, 11.13.

**5a 3-(3,5-Dimethylphenyl)imidazo[1,2-*a*]pyridine**



Yellow oil (49.3 mg, 74%); IR (KBr): 3006, 1461, 1010, 885, 709 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 8.32 (d, $J$ = 6.9 Hz, 1H), 7.66 (t, $J$ = 9.0 Hz, 2H), 7.18-7.14 (m, 3H), 7.05 (s, 1H), 6.78 (t, $J$ = 6.8 Hz, 1H), 2.38 (s, 6H).. $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 145.9, 138.7, 132.1, 131.9, 129.8, 128.9, 125.6, 123.9, 123.4, 118.0, 112.3, 21.2. ESI-MS m/z (%) 223 (100)$[M+H]^+$; Anal. Calcd for $C_{15}H_{14}N_2$ C, 81.05; H, 6.35; N, 12.60; Found: C, 81.37; H, 6.25; N, 12.38.

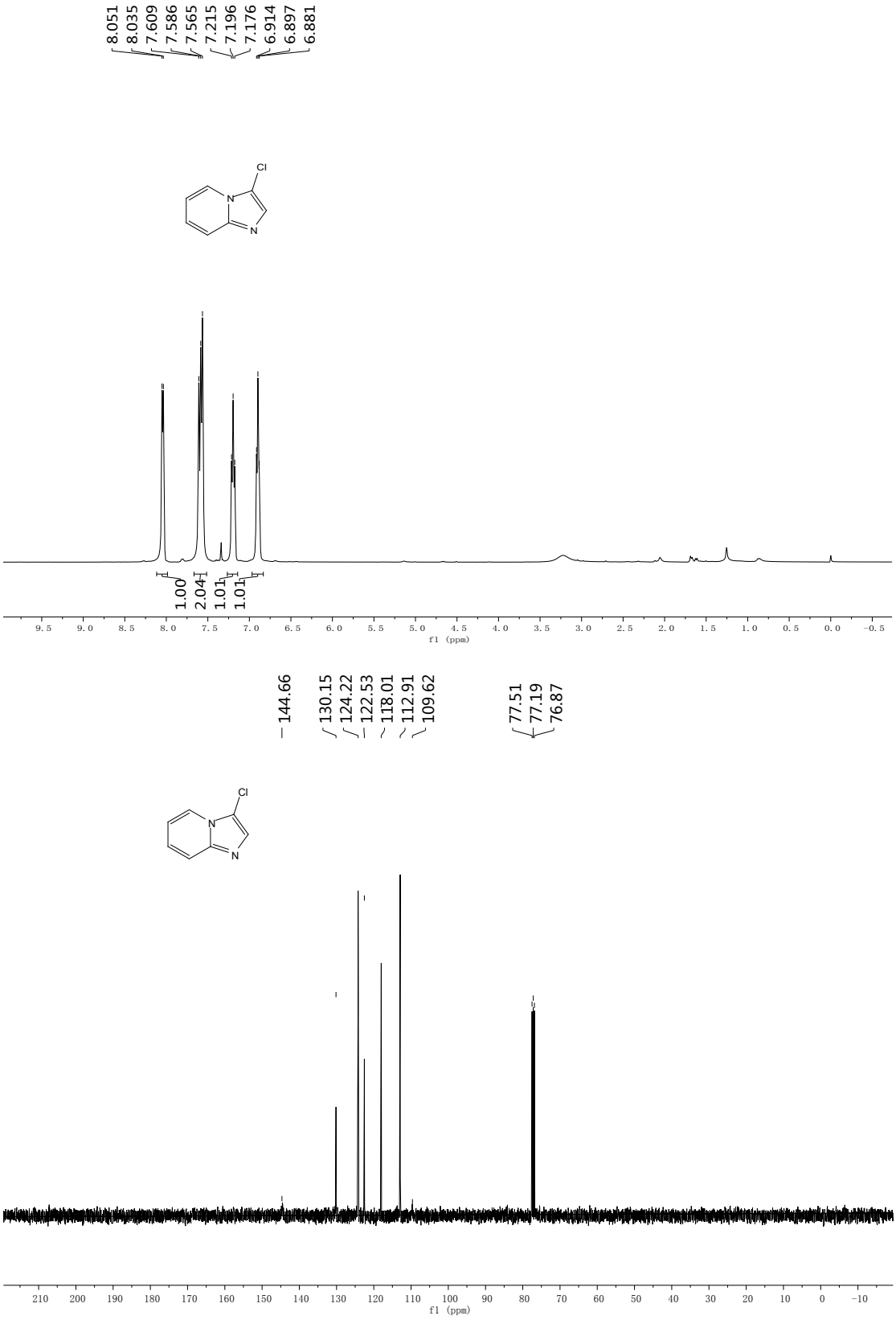
**6a 2-Methyl-3-(*o*-tolyl)imidazo[1,2-*a*]pyridine**



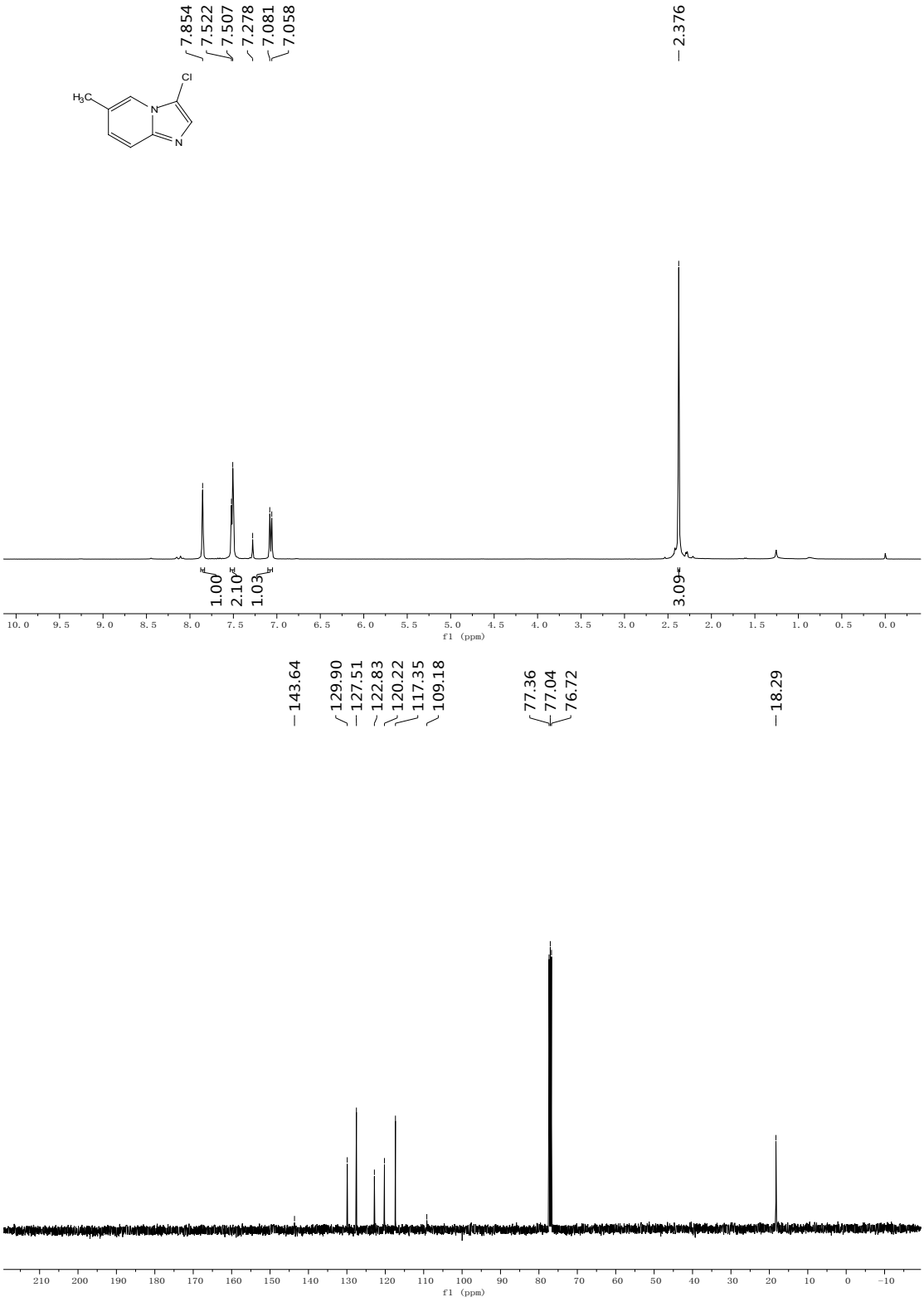
Yellow oil (52.6 mg, 79%); IR (KBr): 3024, 1437, 1109, 894, 766 $cm^{-1}$; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 7.59-7.54 (m, 2H), 7.45-7.21 (m, 4H), 7.19-7.03 (m, 1H), 6.68 (t, $J$ = 6.7 Hz, 1H), 2.34 (s, 3H), 2.06 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 144.3, 140.8, 138.9, 131.6, 130.6, 129.2, 129.1, 128.3, 126.3, 123.8, 123.3, 116.7, 111.7, 19.3, 13.6. ESI-MS m/z (%) 223 (100)$[M+H]^+$; Anal. Calcd for $C_{15}H_{14}N_2$ C, 81.05; H, 6.35; N, 12.60; Found: C, 81.33; H, 6.27; N, 12.40.

# 4. $^{1}H$ and $^{13}C$ NMR spectra

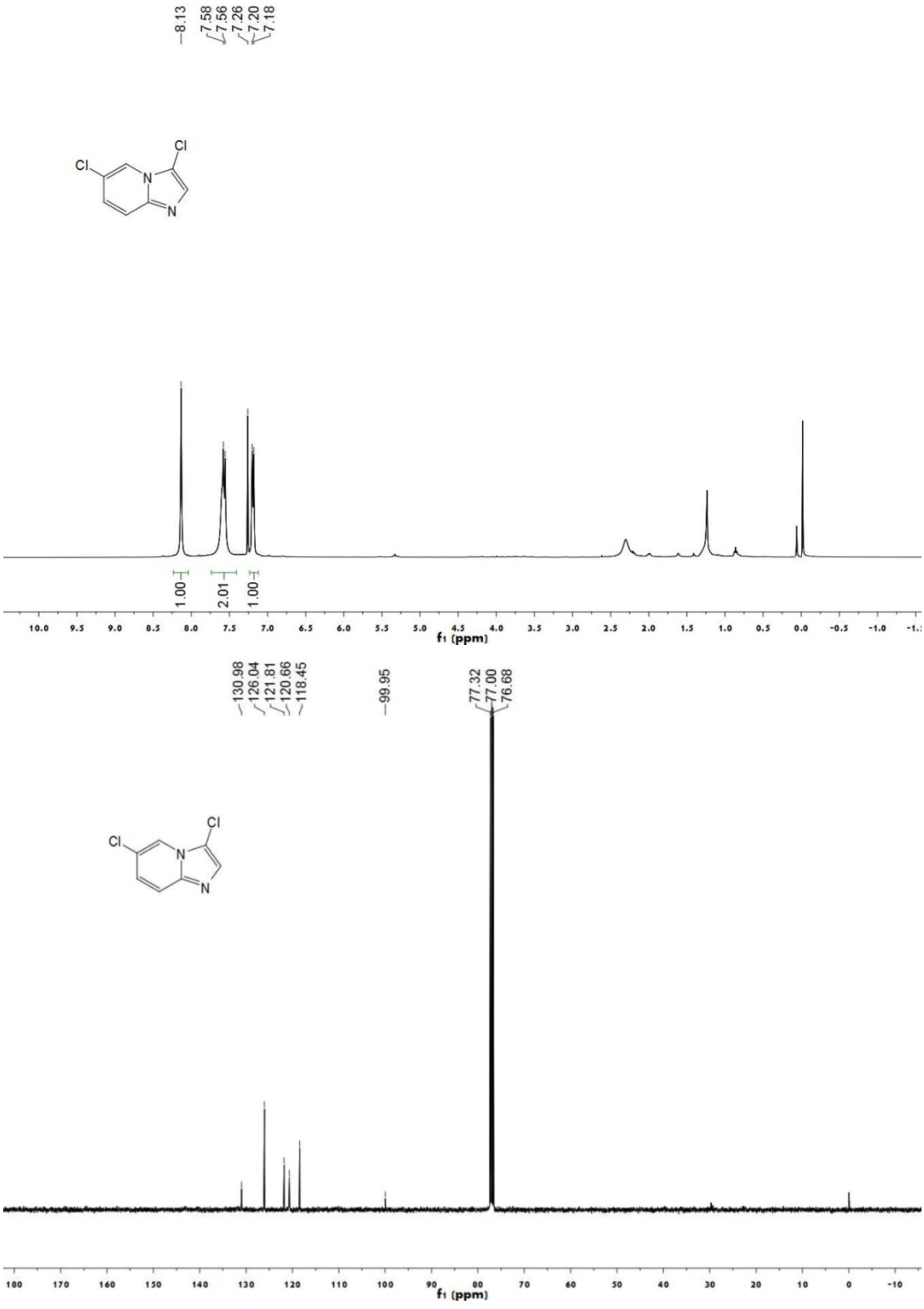
2a



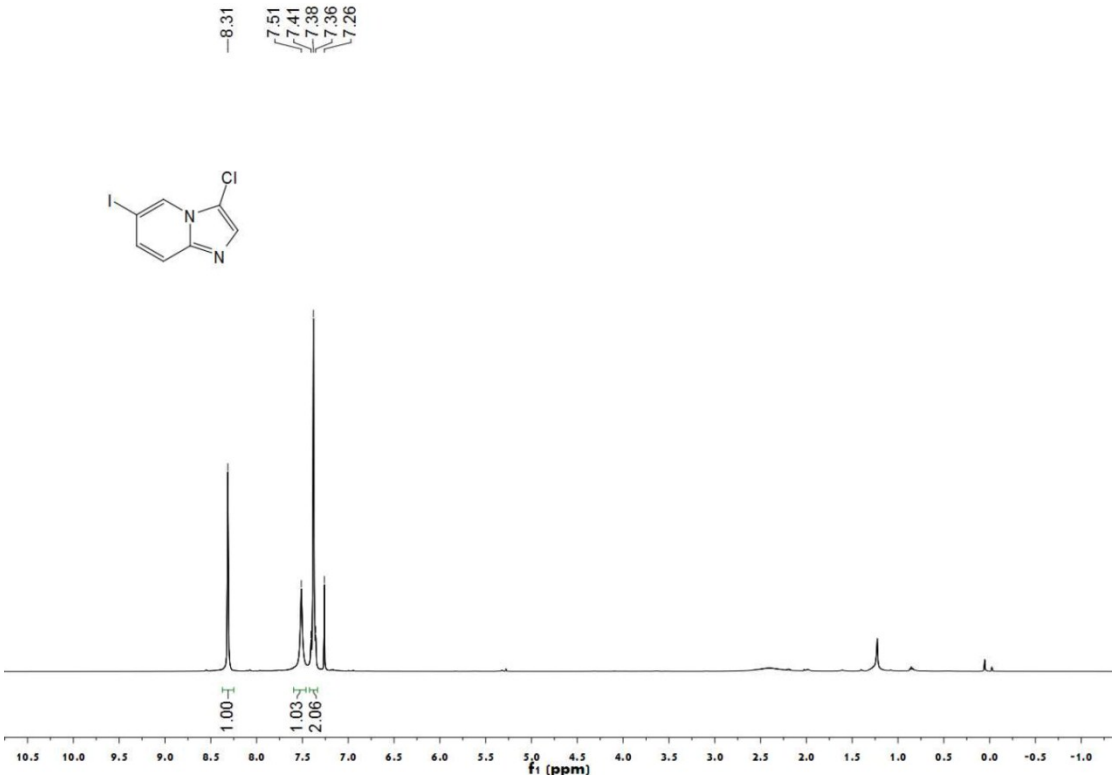
2b

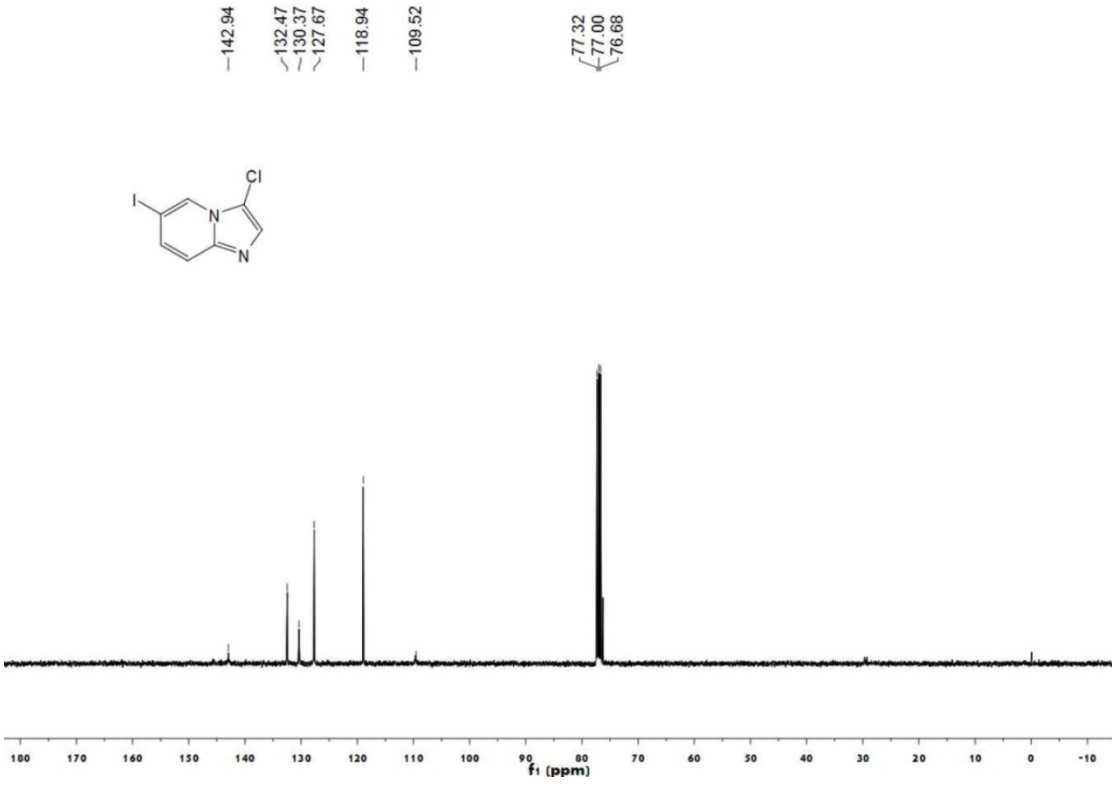

7.854
7.522
7.507
7.278
7.081
7.058
2.376
Cl
$H_3C$
N
N
1.00
2.10
1.03
3.09
f1 (ppm)
143.64
129.90
127.51
122.83
120.22
117.35
109.18
77.36
77.04
76.72
18.29
f1 (ppm)

2c

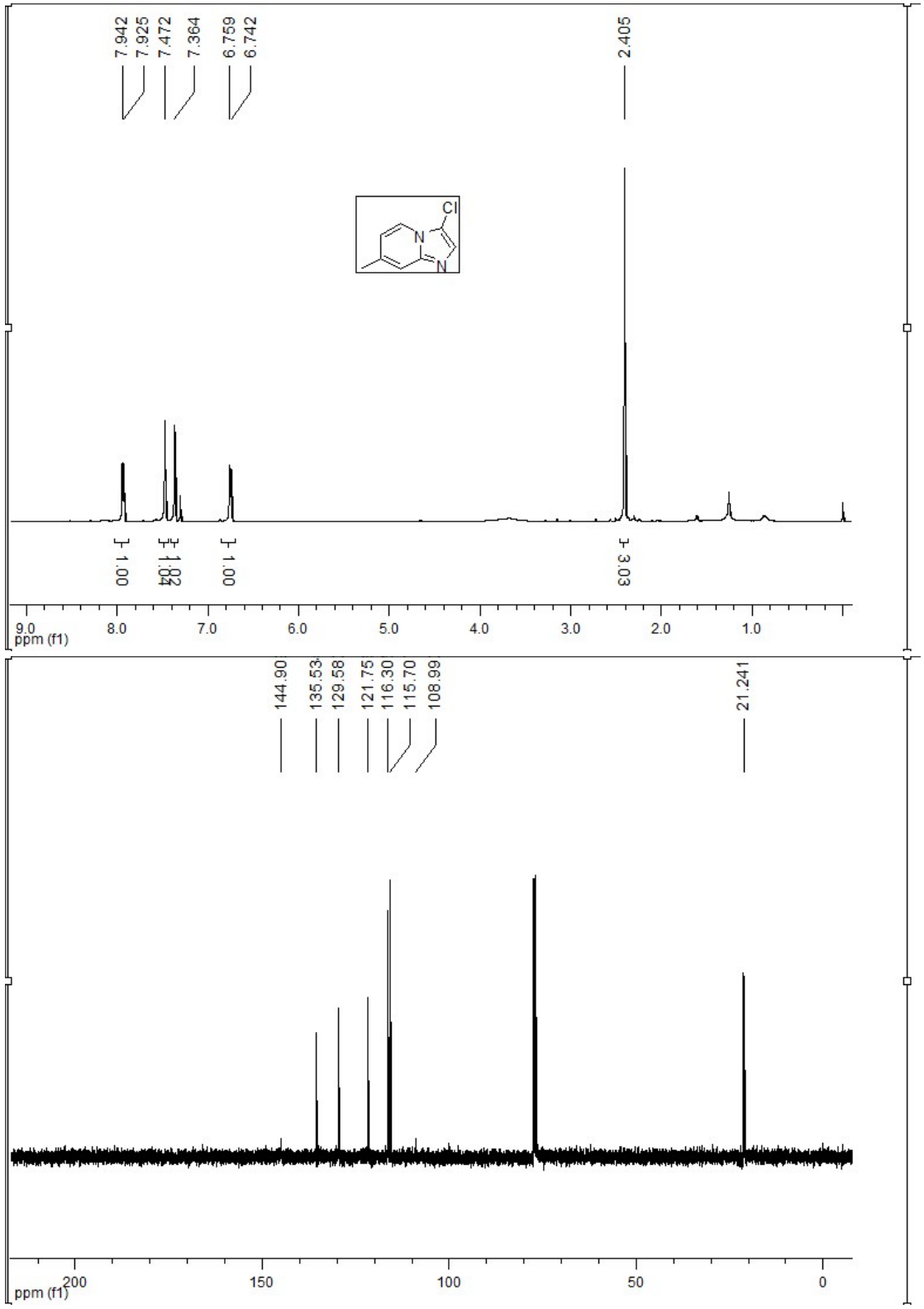

8.13
7.58
7.56
7.26
7.20
7.18
Cl
Cl
N
N
1.00
2.01
1.00
f1 (ppm)
130.98
126.04
121.81
120.66
118.45
99.95
77.32
77.00
76.68
Cl
Cl
N
N
f1 (ppm)

2d

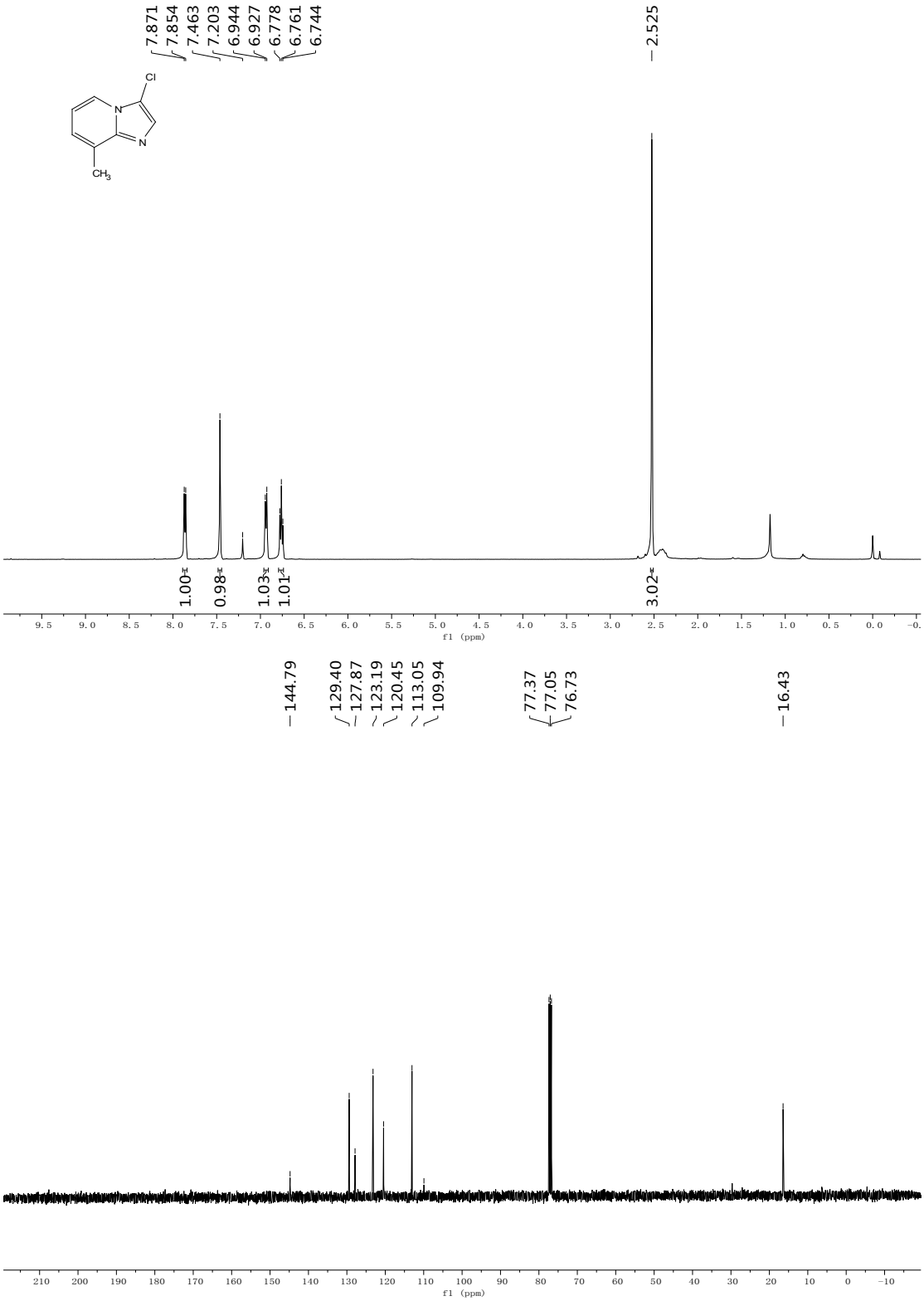

8.31
7.51
7.41
7.38
7.36
7.26
Cl
I
N
N
1.00
1.03
2.06
f1 (ppm)


142.94
132.47
130.37
127.67
118.94
109.52
77.32
77.00
76.68
Cl
I
N
N
f1 (ppm)

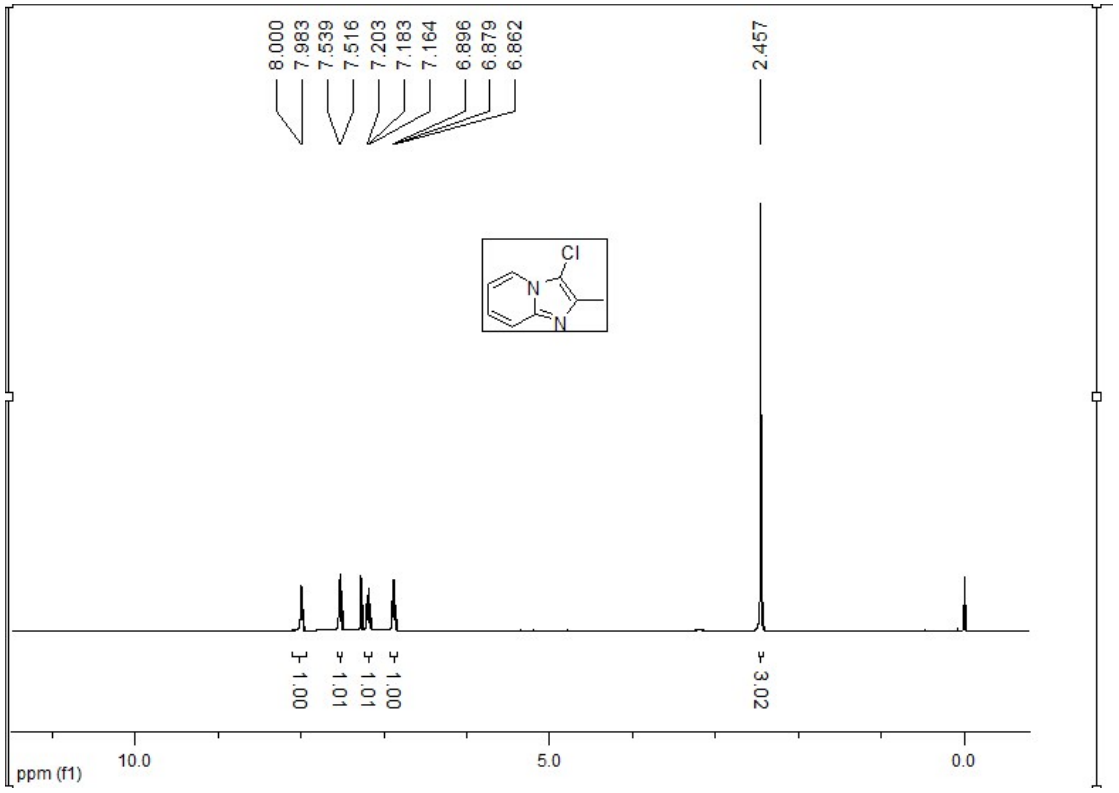
2e

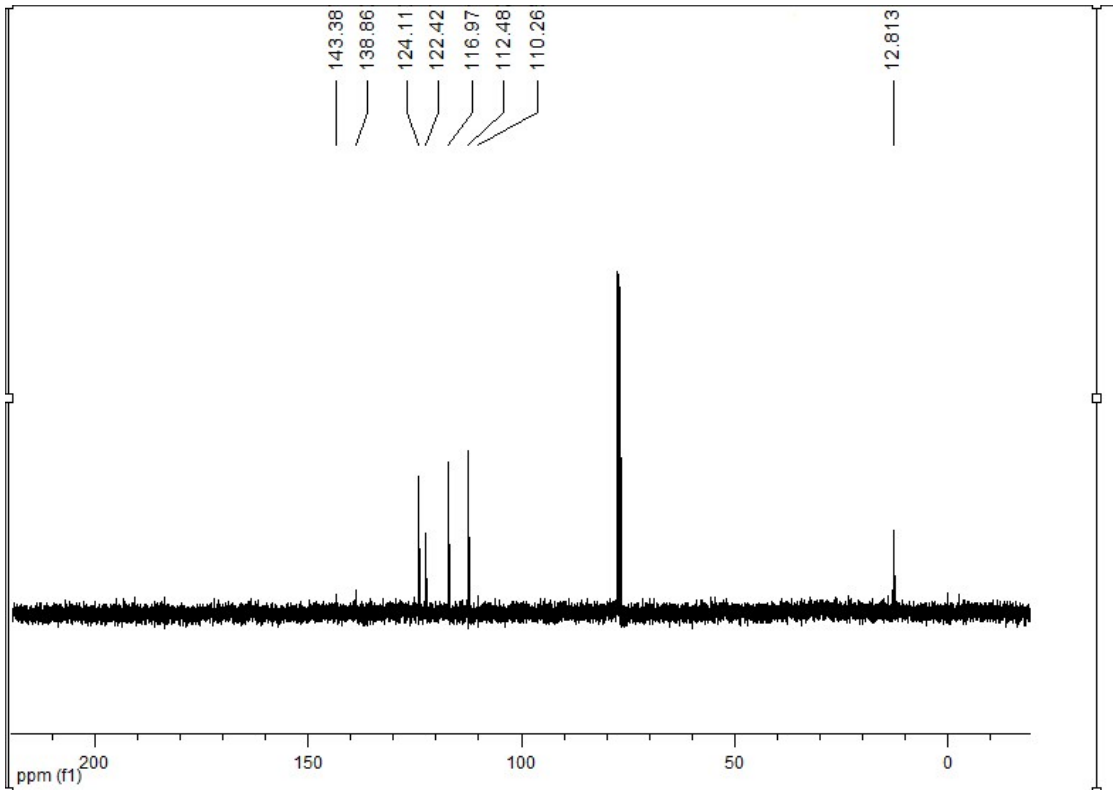

7.942
7.925
7.472
7.364
6.759
6.742
2.405
Cl
N
N
1.00
1.04
1.00
3.03
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ppm (f1)
144.90
135.53
129.58
121.75
116.30
115.70
108.99
21.241
200
150
100
50
0
ppm (f1)

2f

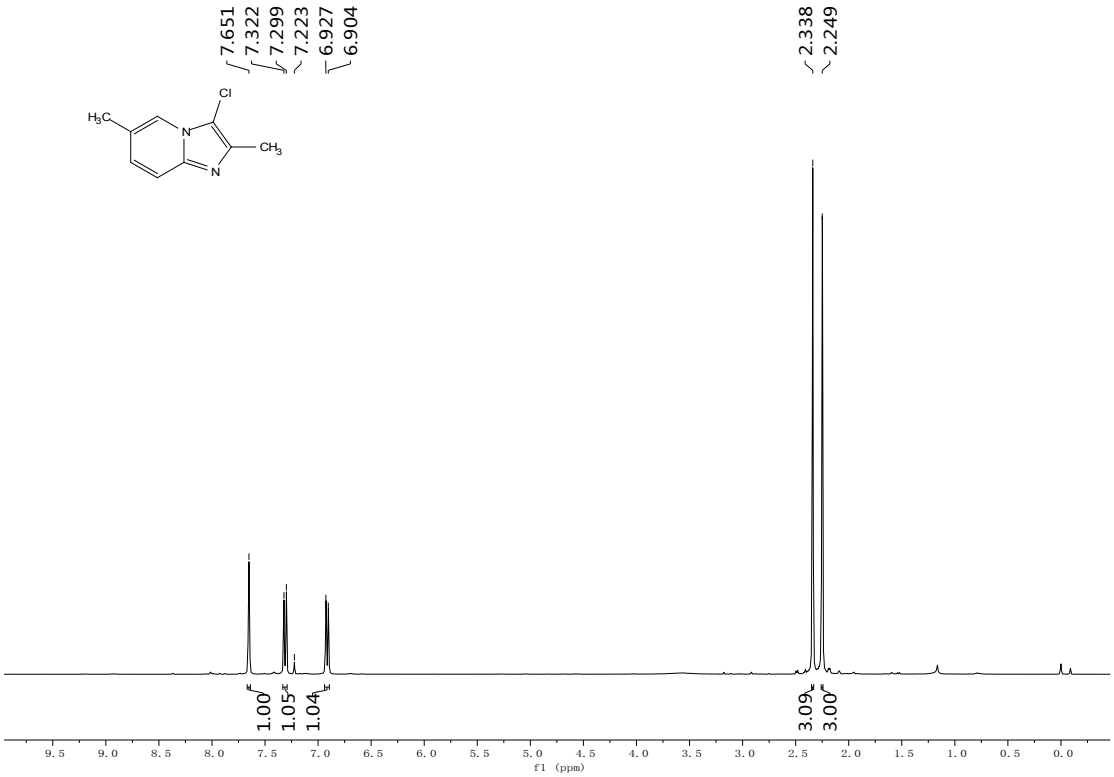

7.871
7.854
7.463
7.203
6.944
6.927
6.778
6.761
6.744
2.525
Cl
N
N
CH3
1.00
0.98
1.03
1.01
3.02
f1 (ppm)
144.79
129.40
127.87
123.19
120.45
113.05
109.94
77.37
77.05
76.73
16.43
f1 (ppm)

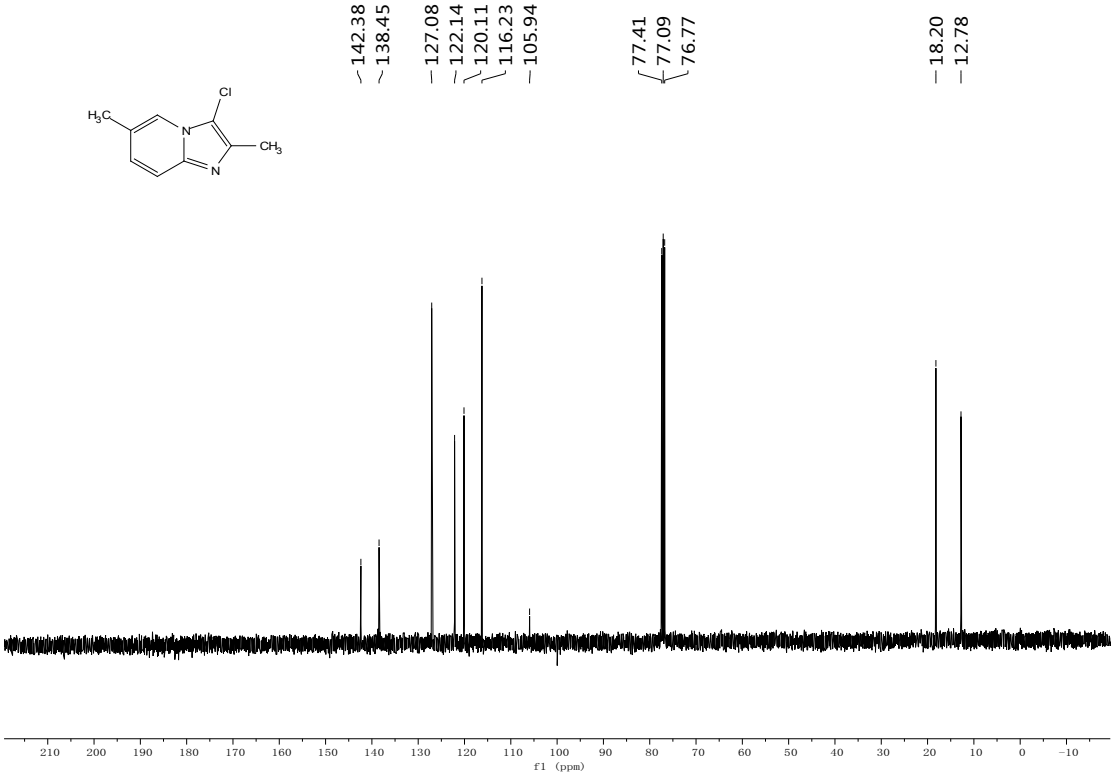
2g


8.000
7.983
7.539
7.516
7.203
7.183
7.164
6.896
6.879
6.862
2.457
Cl
N
N
1.00
1.01
1.01
1.00
3.02
ppm (f1)
10.0
5.0
0.0

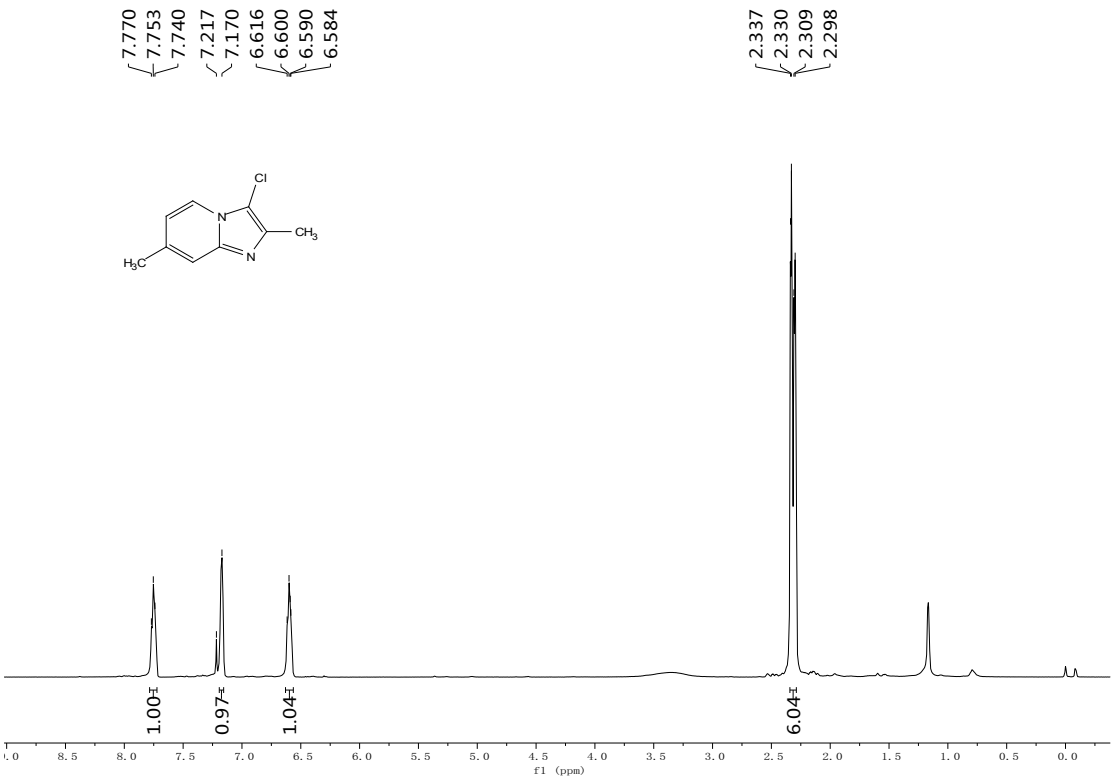

143.38
138.86
124.11
122.42
116.97
112.48
110.26
12.813
ppm (f1)
200
150
100
50
0

2h


7.651
7.322
7.299
7.223
6.927
6.904
2.338
2.249
Cl
H3C
N
CH3
N
1.00
1.05
1.04
3.09
3.00
f1 (ppm)


142.38
138.45
127.08
122.14
120.11
116.23
105.94
77.41
77.09
76.77
18.20
12.78
Cl
H3C
N
CH3
N
f1 (ppm)

2i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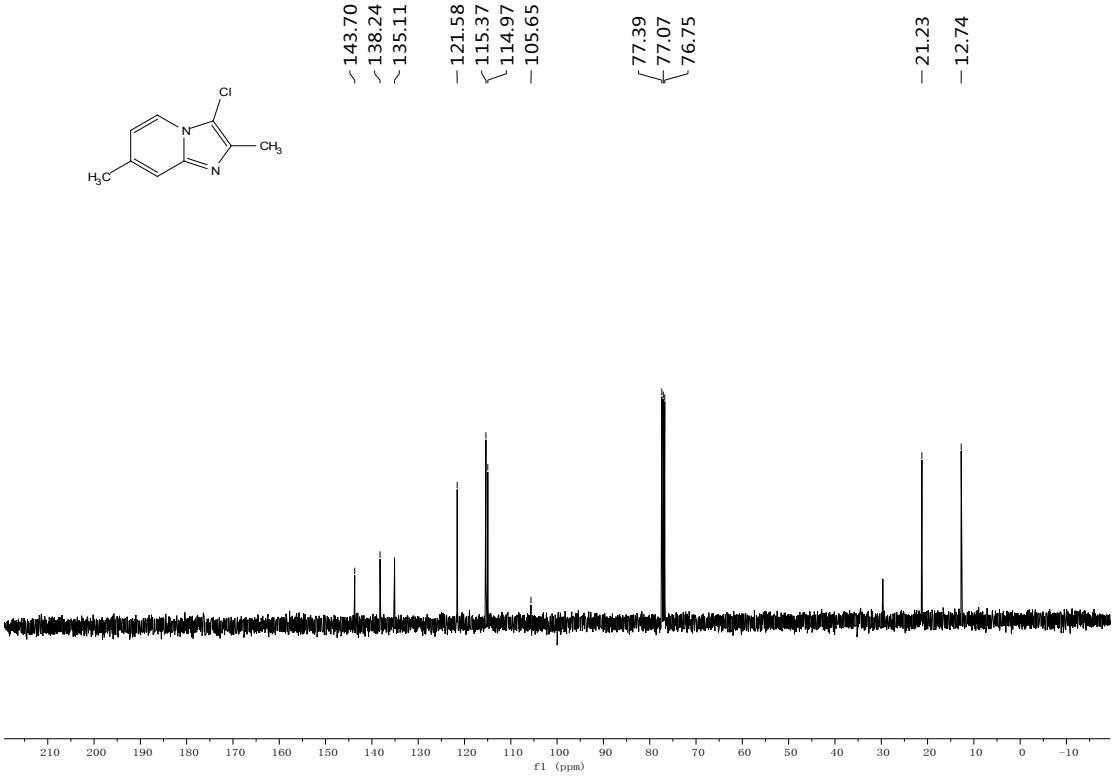
7.753
7.740
7.217
7.170
6.616
6.600
6.590
6.584
2.337
2.330
2.309
2.298
Cl
N
CH3
H3C
N
1.00
0.97
1.04
6.04
f1 (ppm)


143.70
138.24
135.11
121.58
115.37
114.97
105.65
77.39
77.07
76.75
21.23
12.74
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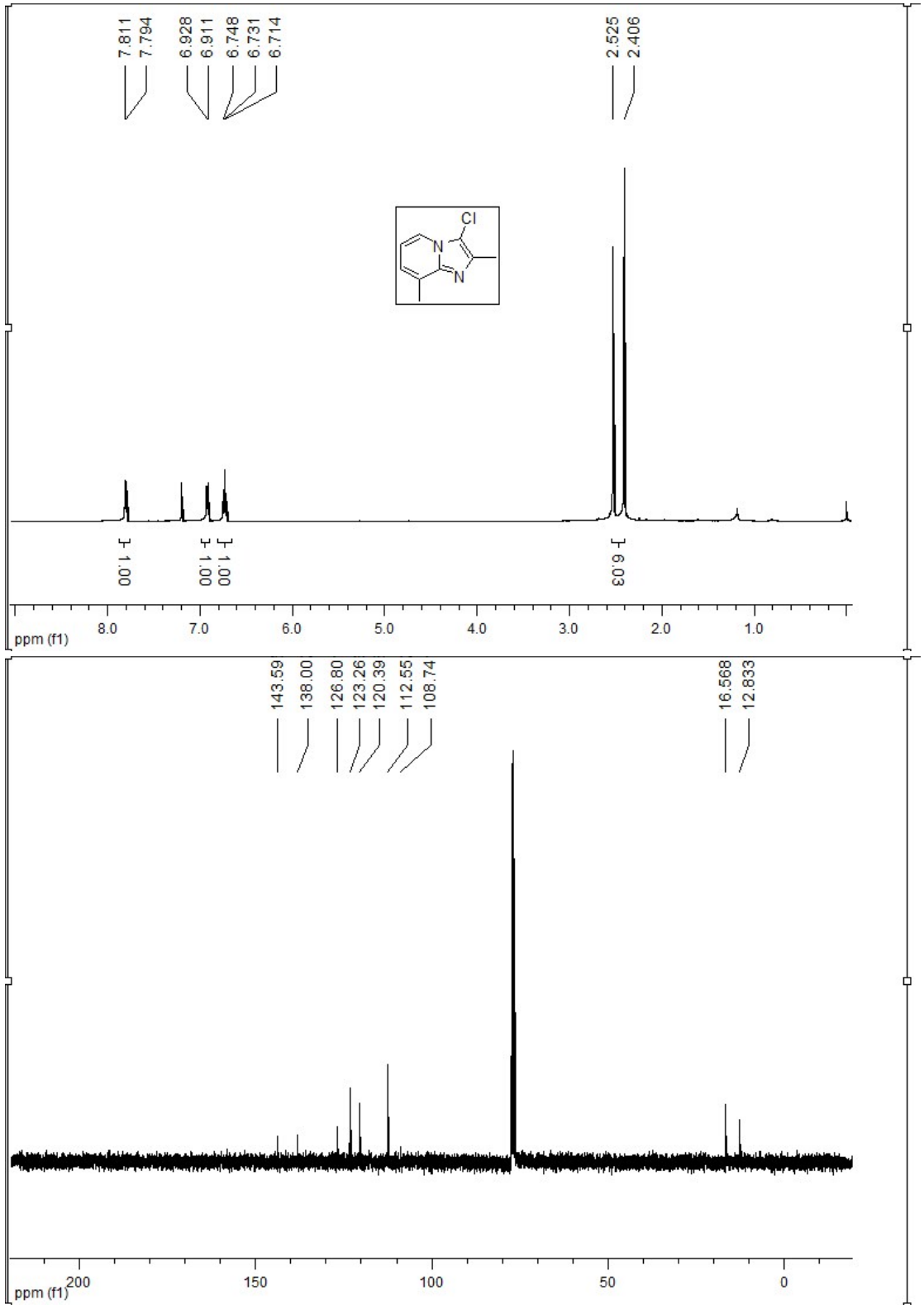
CH3
H3C
N
f1 (ppm)

2j


7.811
7.794
6.928
6.911
6.748
6.731
6.714
2.525
2.406
Cl
N
N
1.00
1.00
1.00
6.03
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
ppm (f1)
143.59
138.00
126.80
123.26
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112.55
108.74
16.568
12.833
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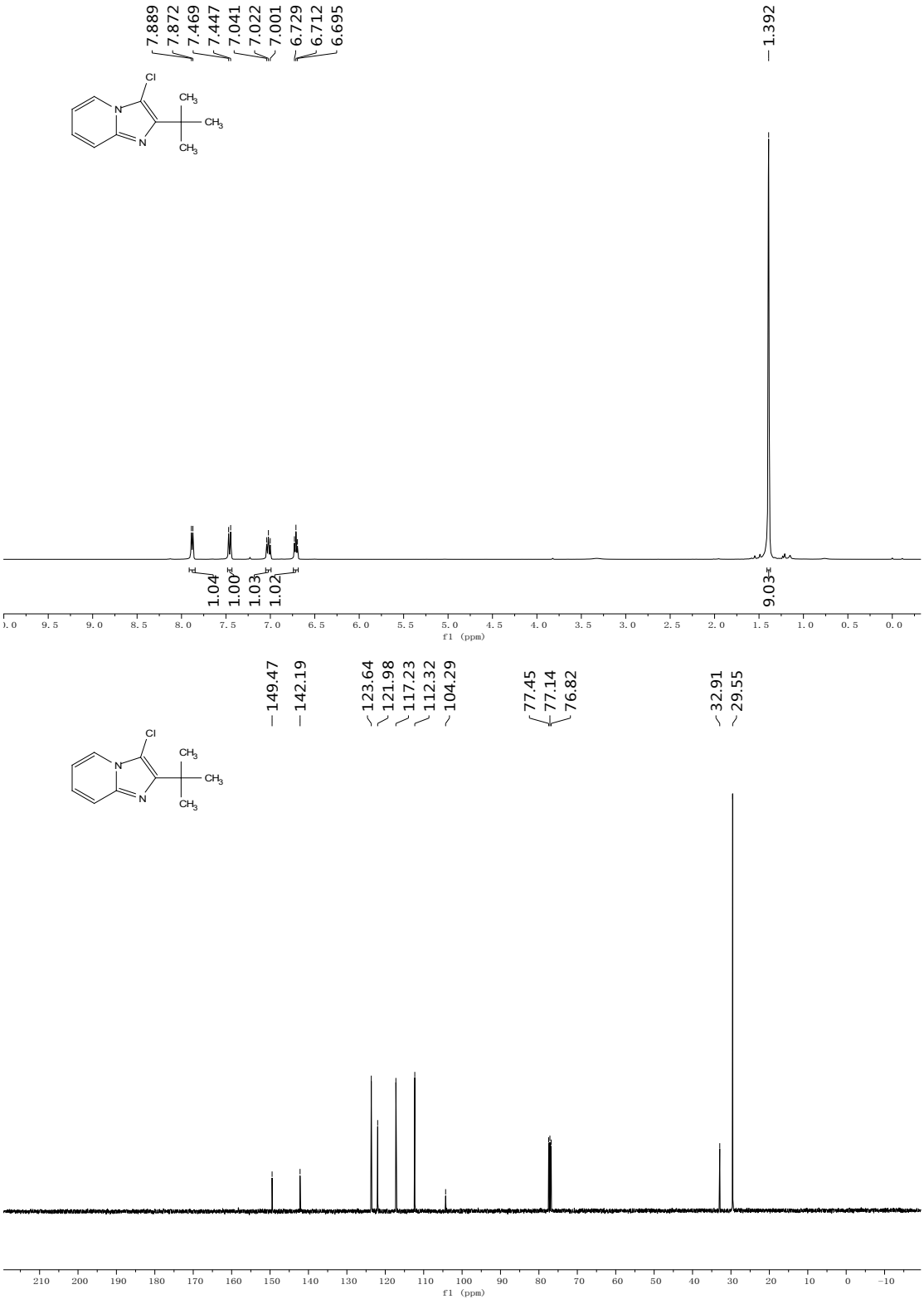
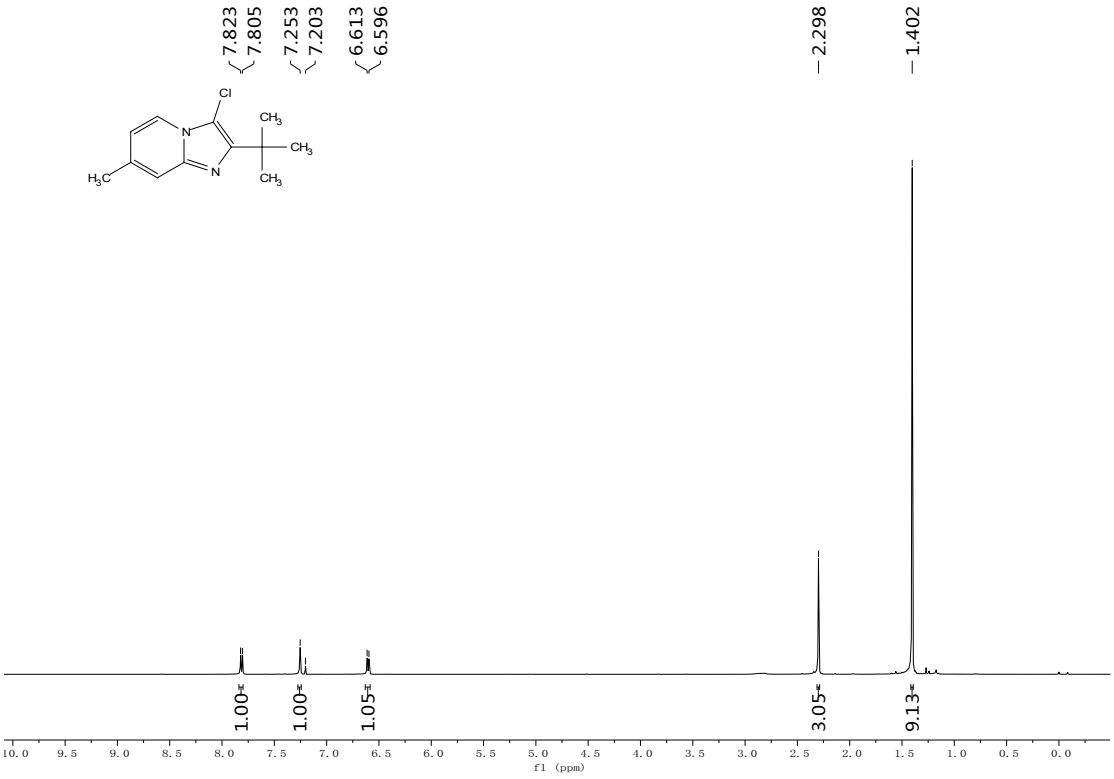
150
100
50
0
ppm (f1)

2k


7.889
7.872
7.469
7.447
7.041
7.022
7.001
6.729
6.712
6.695
1.392
Cl
N
N
CH3
CH3
CH3
1.04
1.00
1.03
1.02
9.03
f1 (ppm)
149.47
142.19
123.64
121.98
117.23
112.32
104.29
77.45
77.14
76.82
32.91
29.55
f1 (ppm)

2l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7.203
6.613
6.596
2.298
1.402
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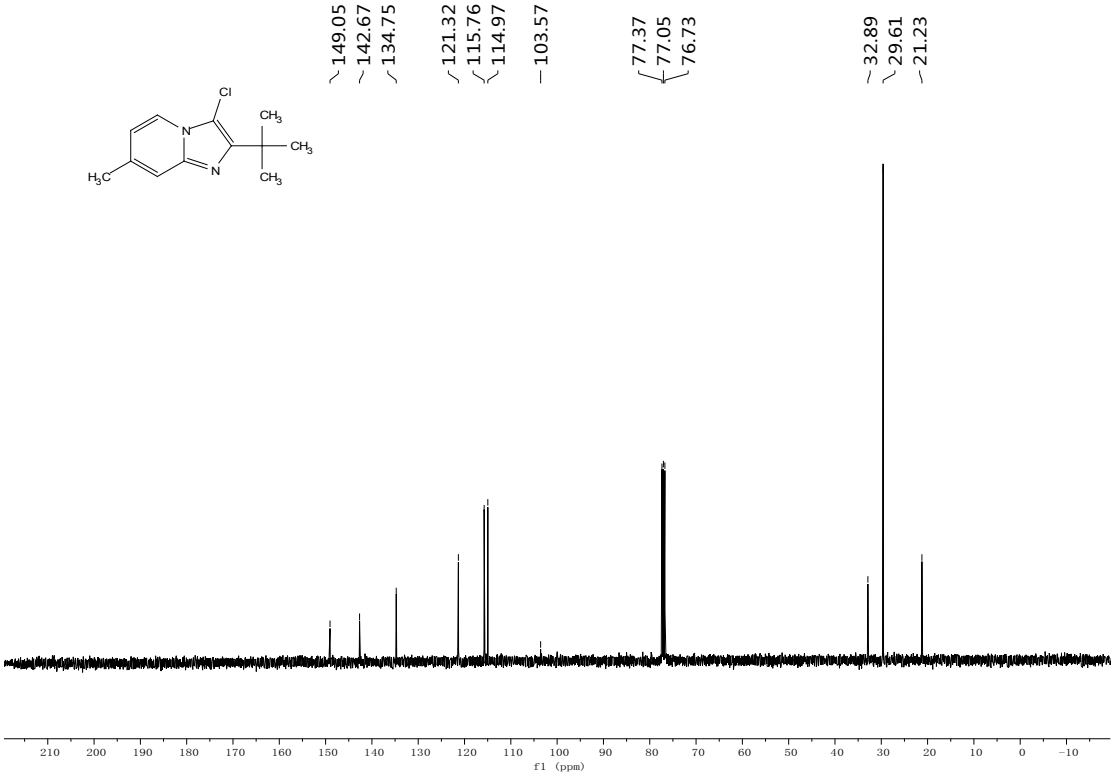
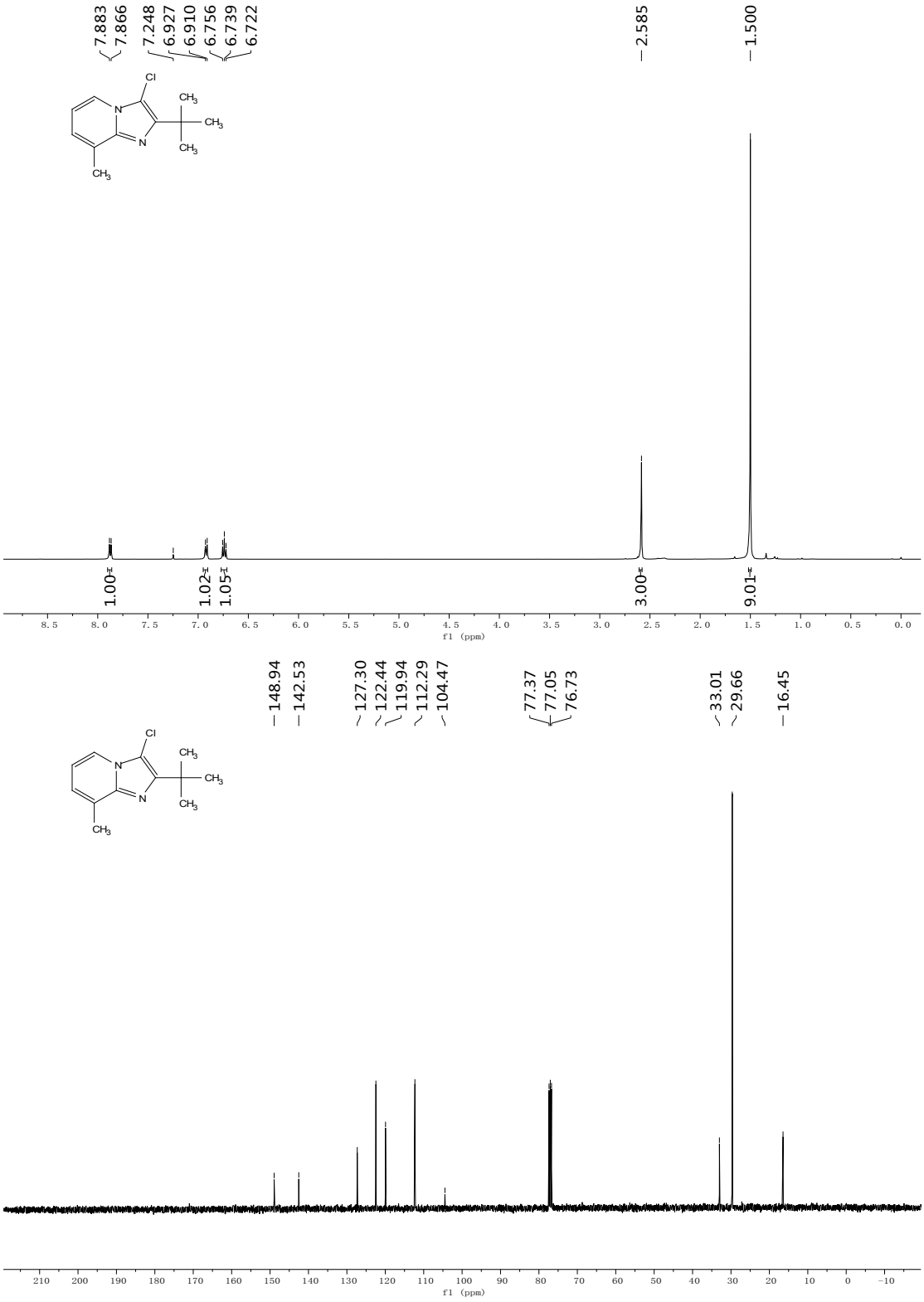
CH3
CH3
CH3
N
N
H3C
1.00
1.00
1.05
3.05
9.13
f1 (ppm)


149.05
142.67
134.75
121.32
115.76
114.97
103.57
77.37
77.05
76.73
32.89
29.61
21.23
Cl
CH3
CH3
CH3
N
N
H3C
f1 (ppm)

2m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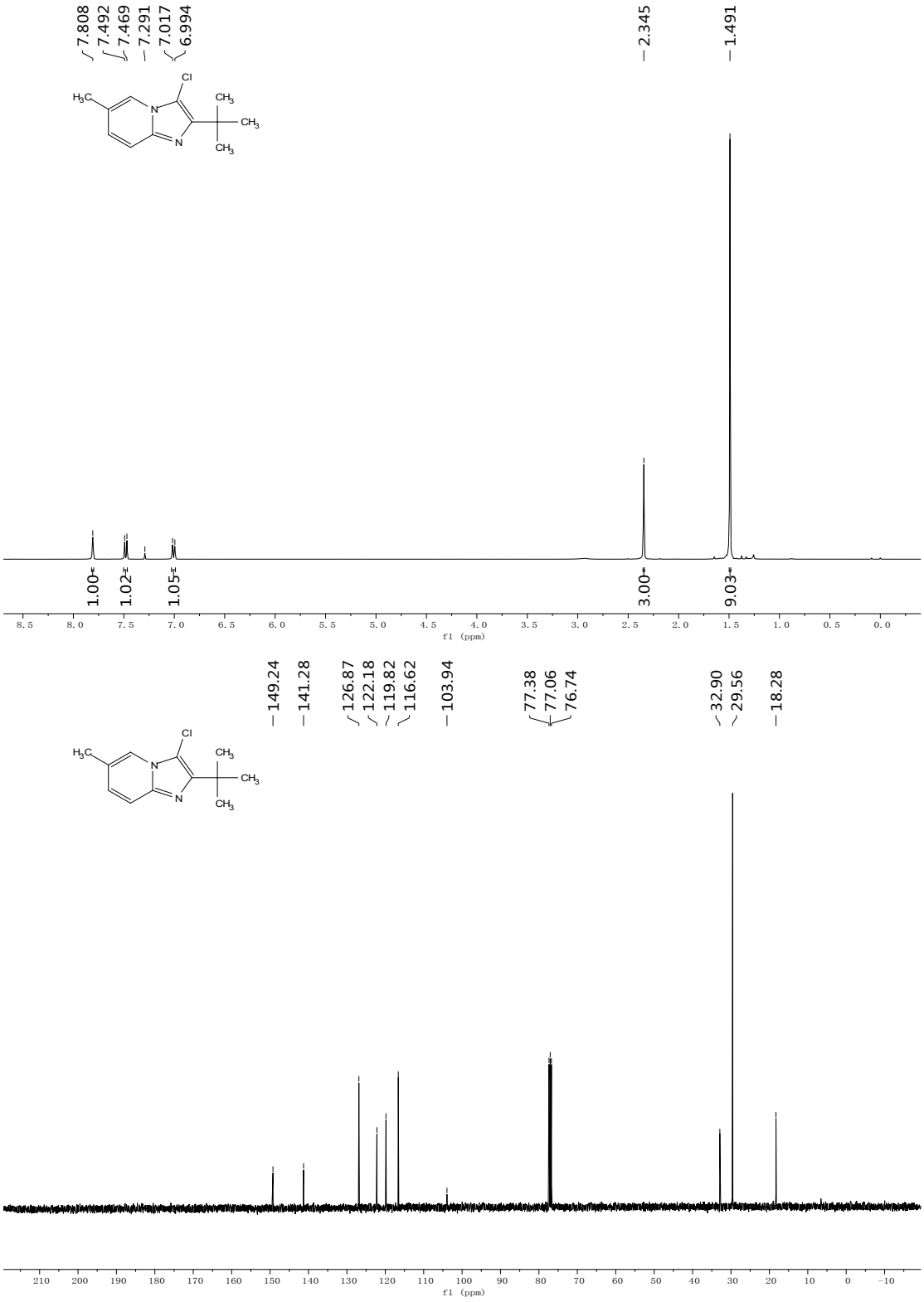
7.866
7.248
6.927
6.910
6.756
6.739
6.722
2.585
1.500
Cl
CH3
CH3
CH3
N
N
CH3
1.00
1.02
1.05
3.00
9.01
f1 (ppm)
148.94
142.53
127.30
122.44
119.94
112.29
104.47
77.37
77.05
76.73
33.01
29.66
16.45
f1 (ppm)

2n


7.808
7.492
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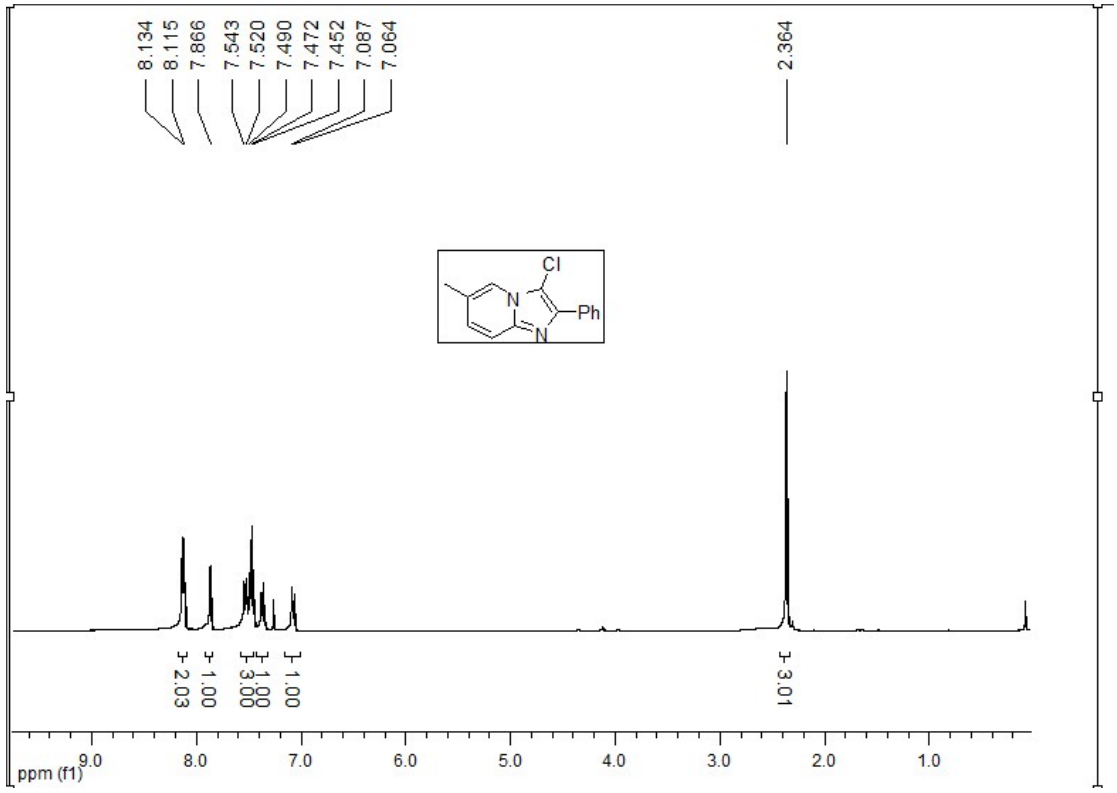
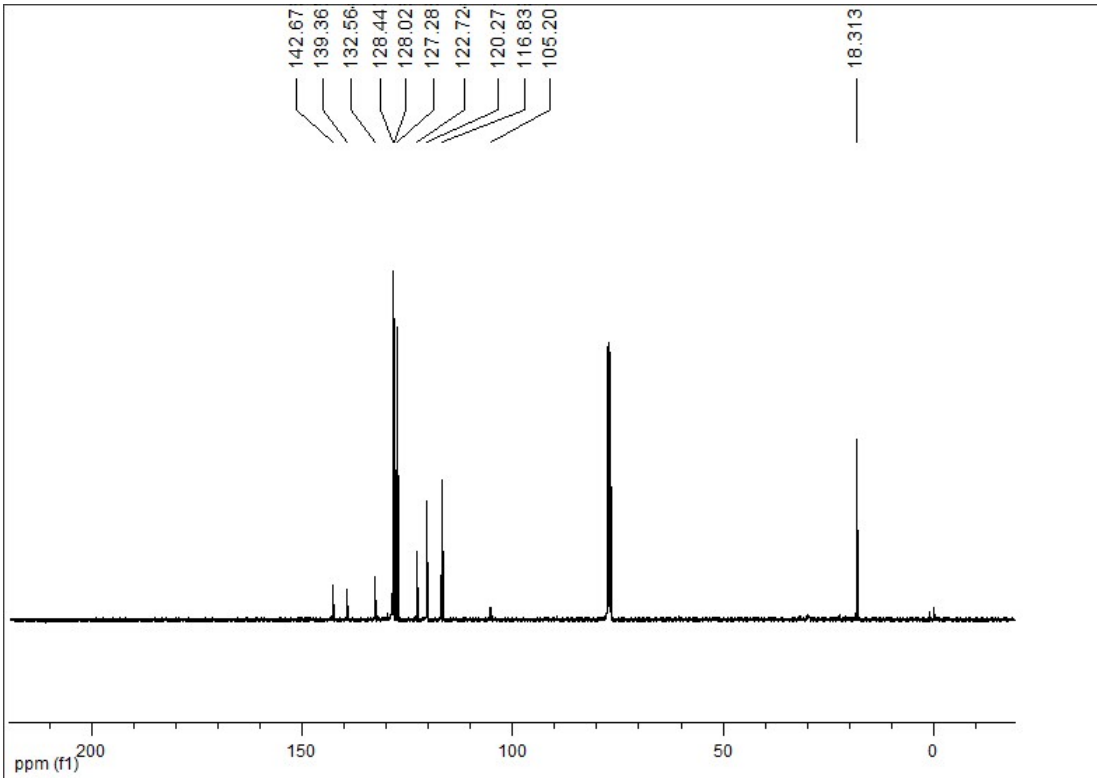
7.291
7.017
6.994
2.345
1.491
Cl
H3C
CH3
CH3
CH3
N
N
1.00
1.02
1.05
3.00
9.03
f1 (ppm)
149.24
141.28
126.87
122.18
119.82
116.62
103.94
77.38
77.06
76.74
32.90
29.56
18.28
f1 (ppm)

2o


8.134
8.115
7.866
7.543
7.520
7.490
7.472
7.452
7.087
7.064
2.364
Cl
N
Ph
N
2.03
1.00
3.00
1.00
3.01
ppm (f1)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0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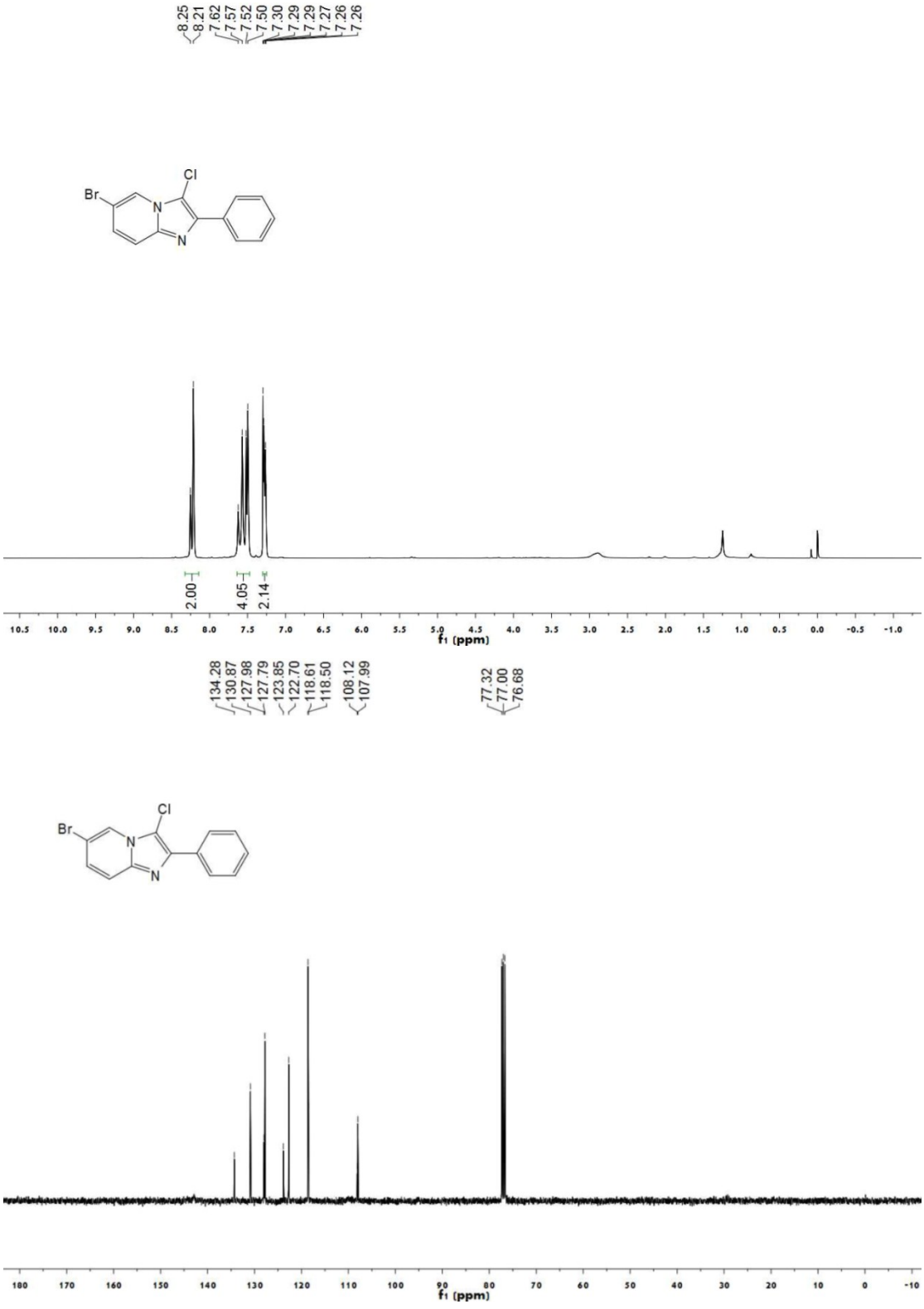
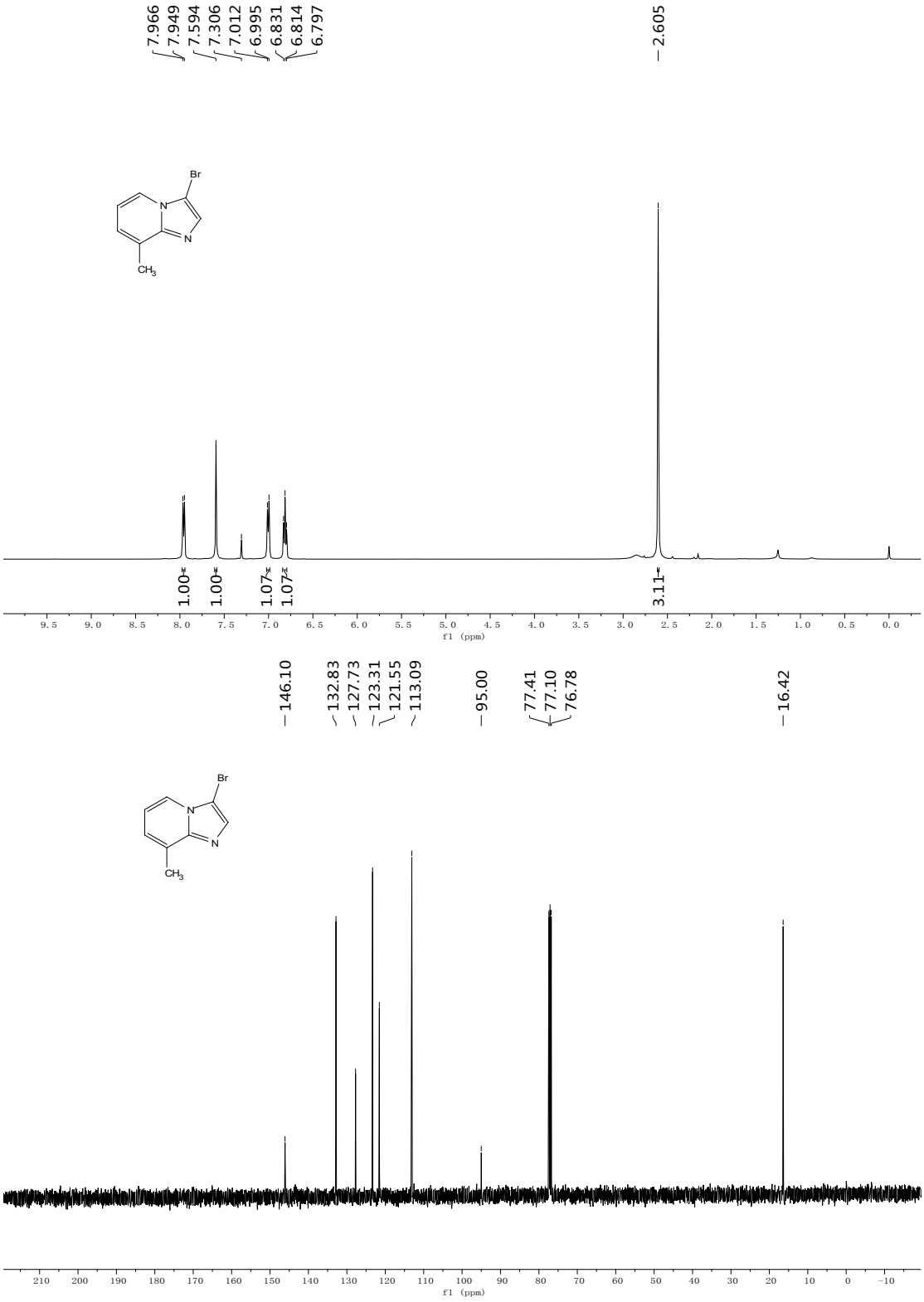
139.36
132.56
128.44
128.02
127.28
122.72
120.27
116.83
105.20
18.313
ppm (f1)
200
150
100
50
0

2p


8.25
8.21
7.62
7.57
7.52
7.50
7.30
7.29
7.29
7.27
7.26
7.26
Br
Cl
N
N
2.00
4.05
2.14
f1 (ppm)
134.28
130.87
127.98
127.79
123.85
122.70
118.61
118.50
108.12
107.99
77.32
77.00
76.68
Br
Cl
N
N
f1 (ppm)

3a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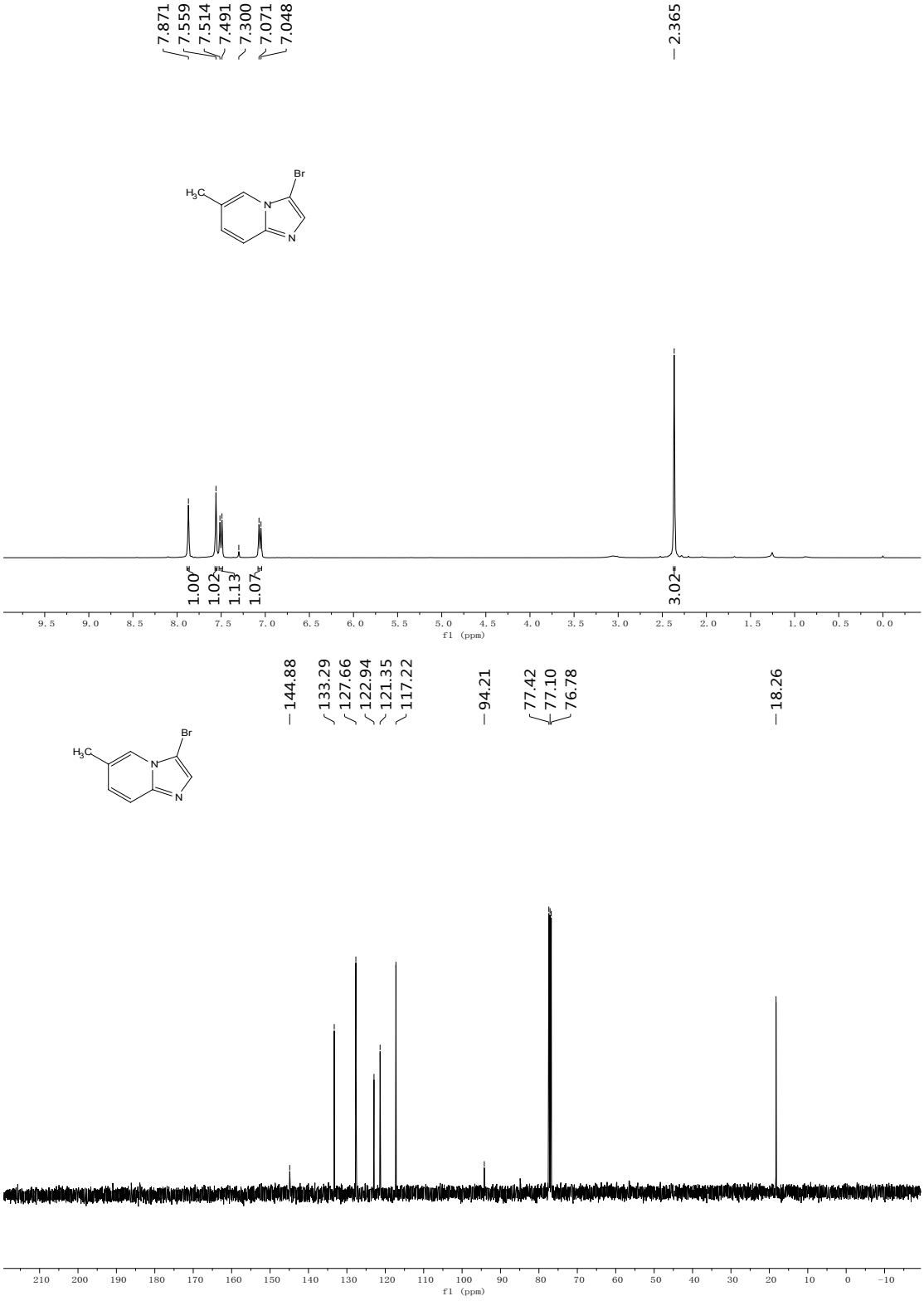
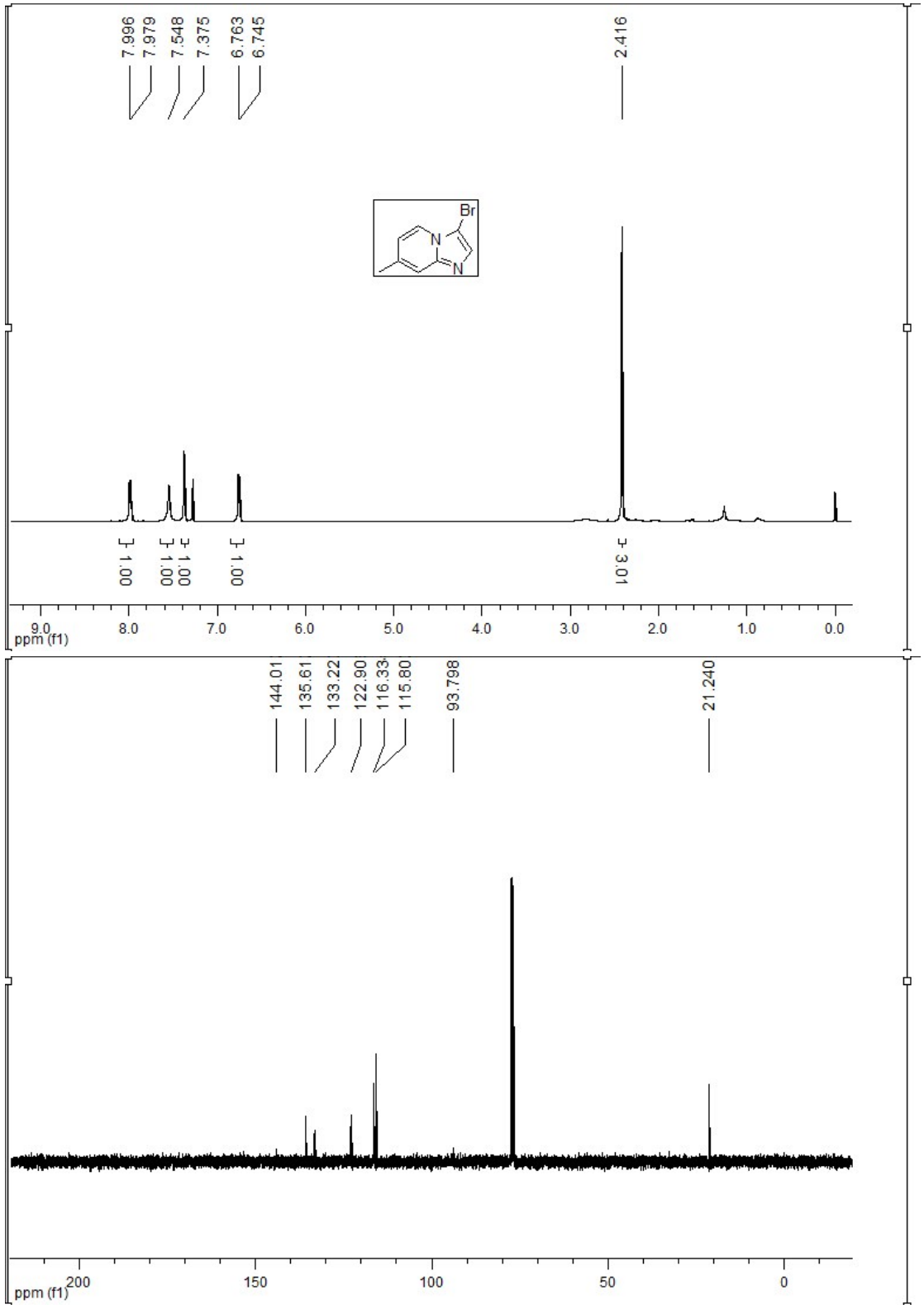
7.594
7.306
7.012
6.995
6.831
6.814
6.797
2.605
Br
N
N
CH3
1.00
1.00
1.07
1.07
3.11
f1 (ppm)
146.10
132.83
127.73
123.31
121.55
113.09
95.00
77.41
77.10
76.78
16.42
Br
N
N
CH3
f1 (ppm)

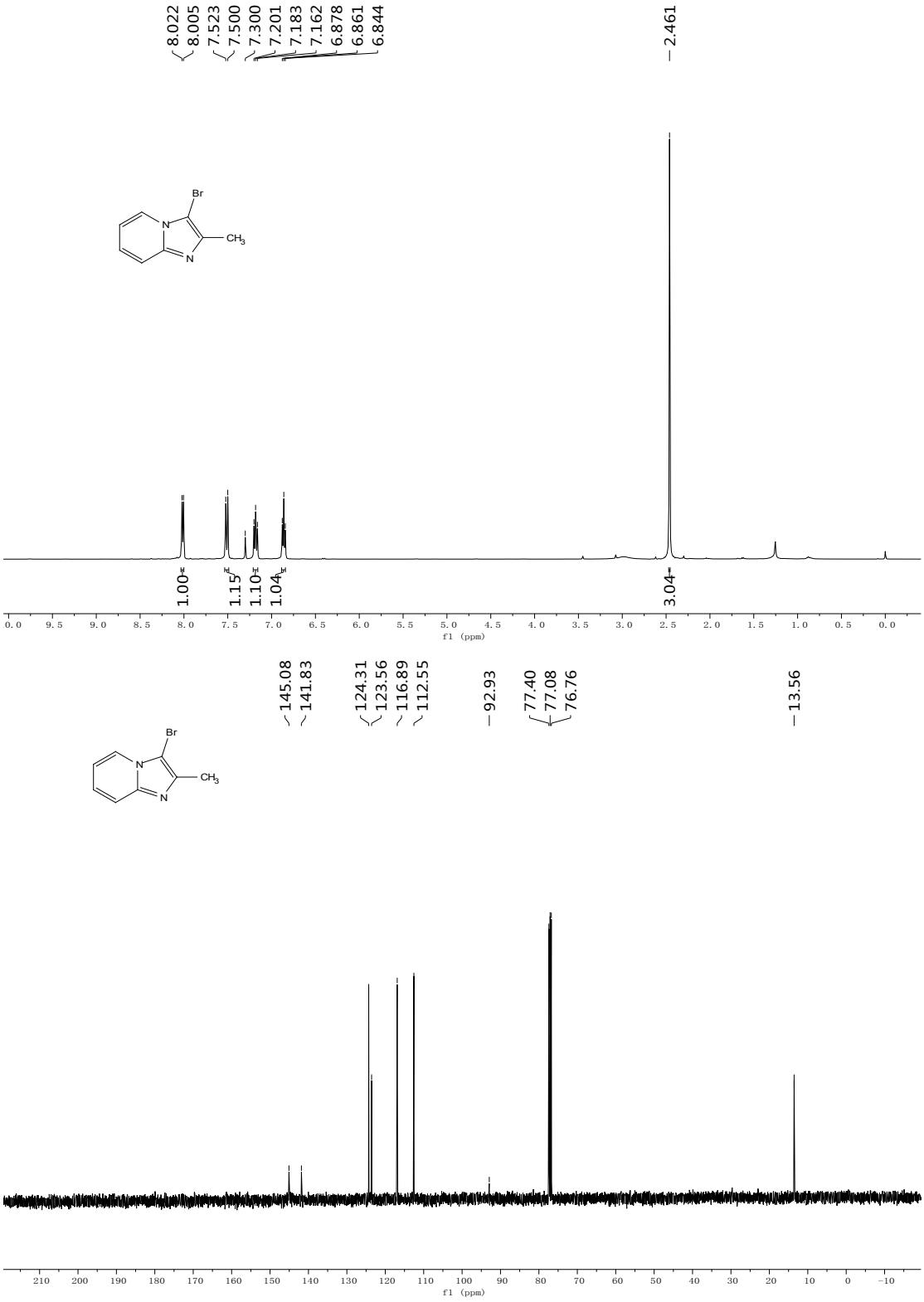
3b


7.871
7.559
7.514
7.491
7.300
7.071
7.048
2.365
Br
H3C
N
N
1.00
1.02
1.13
1.07
3.02
f1 (ppm)
144.88
133.29
127.66
122.94
121.35
117.22
94.21
77.42
77.10
76.78
18.26
Br
H3C
N
N
f1 (ppm)

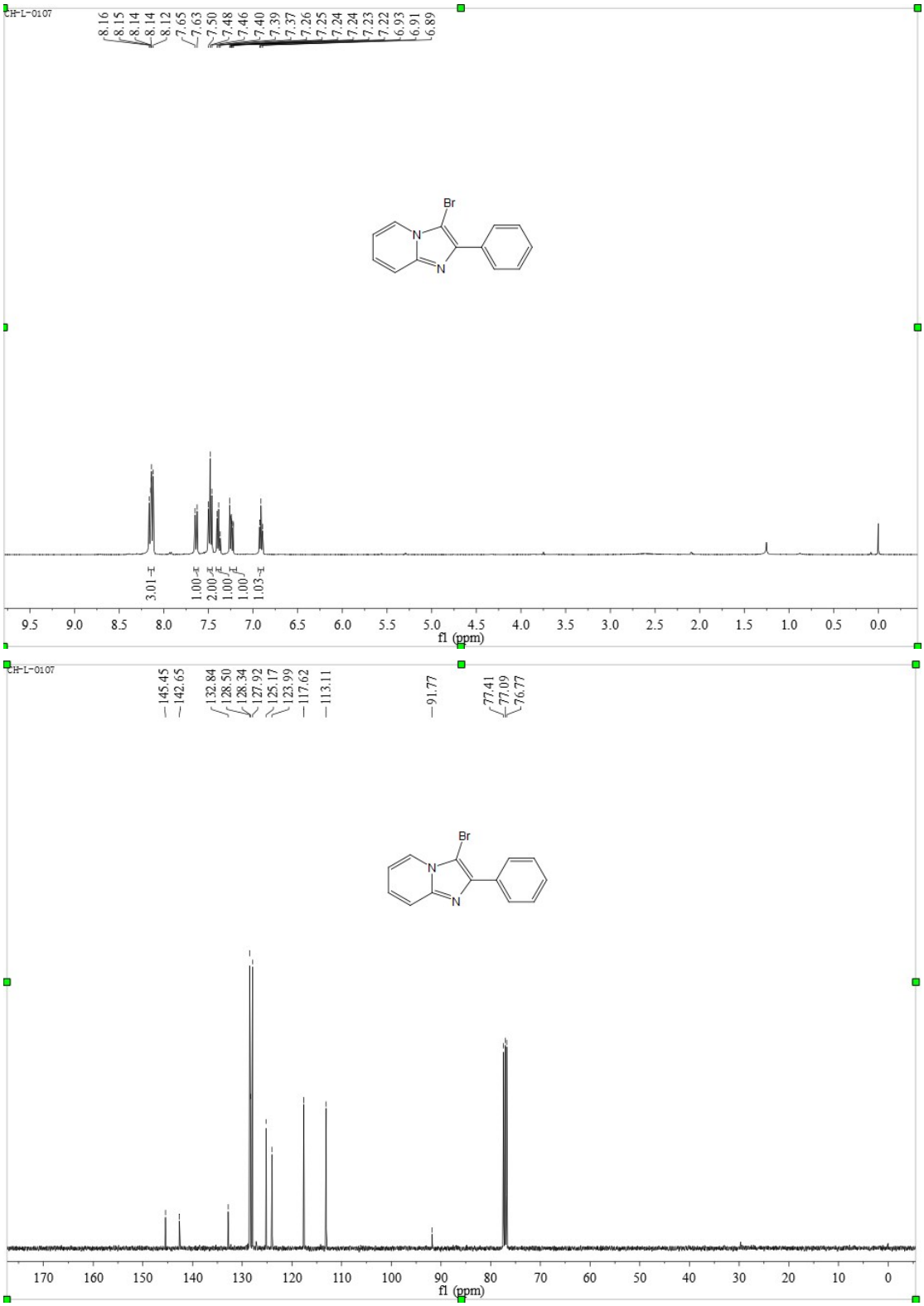
3c


7.996
7.979
7.548
7.375
6.763
6.745
2.416
Br
N
N
1.00
1.00
1.00
1.00
3.01
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
ppm (f1)
144.01
135.61
133.22
122.90
116.33
115.80
93.798
21.240
200
150
100
50
0
ppm (f1)

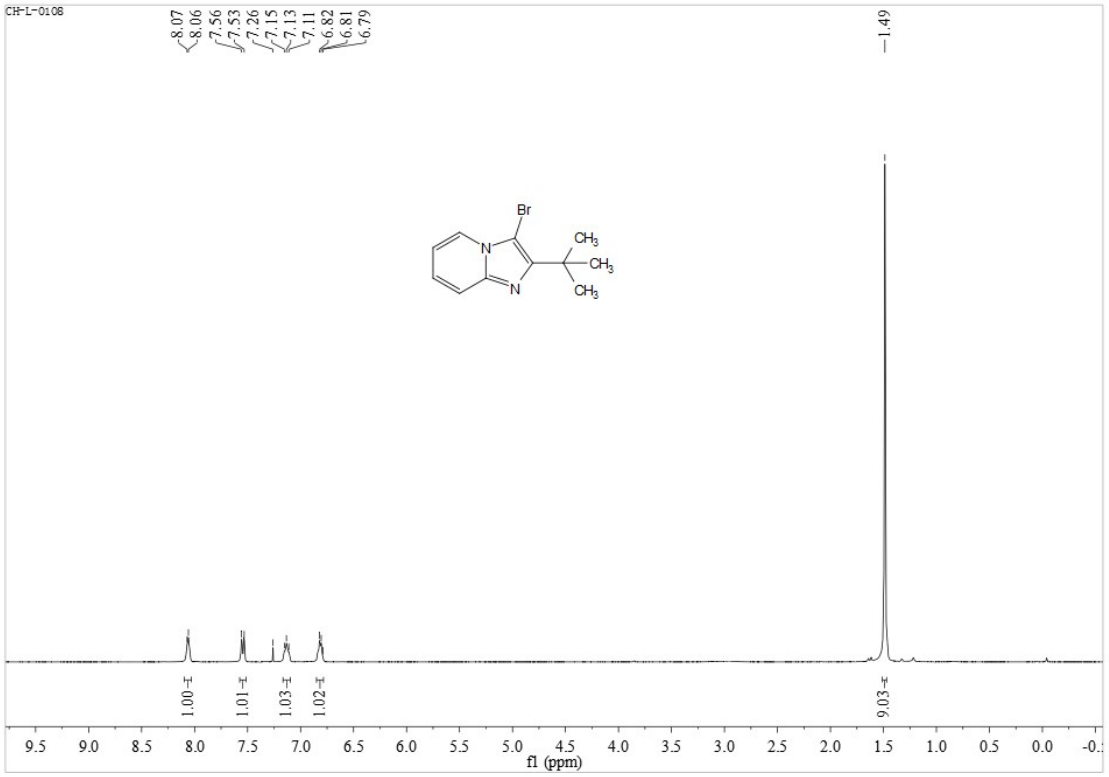
3d

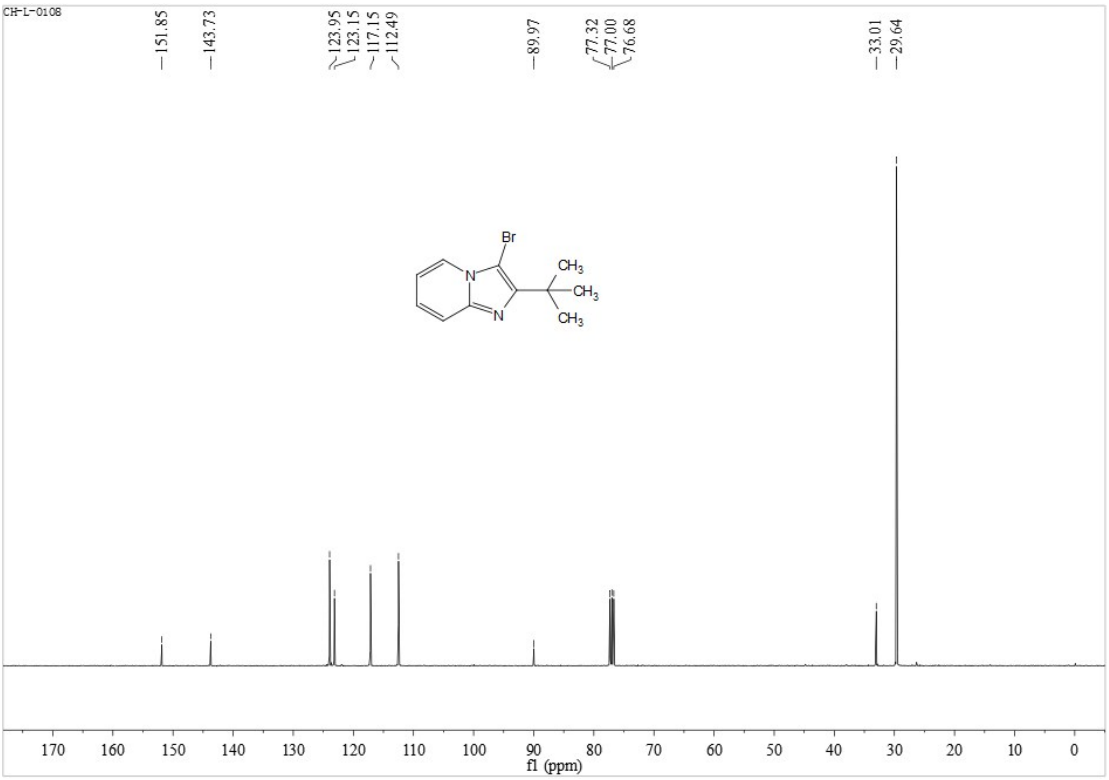

8.022
8.005
7.523
7.500
7.300
7.201
7.183
7.162
6.878
6.861
6.844
2.461
Br
N
CH3
N
1.00
1.15
1.10
1.04
3.04
f1 (ppm)
145.08
141.83
124.31
123.56
116.89
112.55
92.93
77.40
77.08
76.76
13.56
Br
N
CH3
N
f1 (ppm)

3e

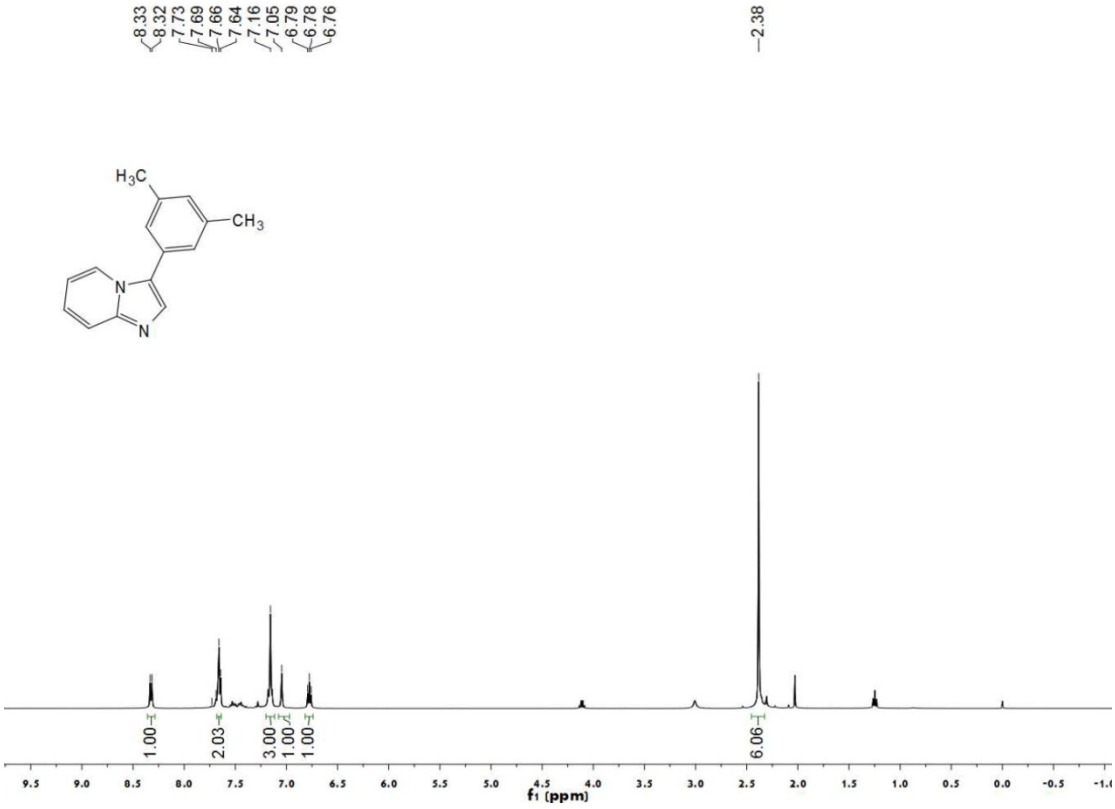

CH-L-0107
8.16
8.15
8.14
8.14
8.12
7.65
7.63
7.50
7.48
7.46
7.40
7.39
7.37
7.26
7.25
7.24
7.24
7.23
7.22
6.93
6.91
6.89
Br
N
N
3.01
1.00
2.00
1.00
1.00
1.03
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)
CH-L-0107
145.45
142.65
132.84
128.50
128.34
127.92
125.17
123.99
117.62
113.11
91.77
77.41
77.09
76.77
Br
N
N
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

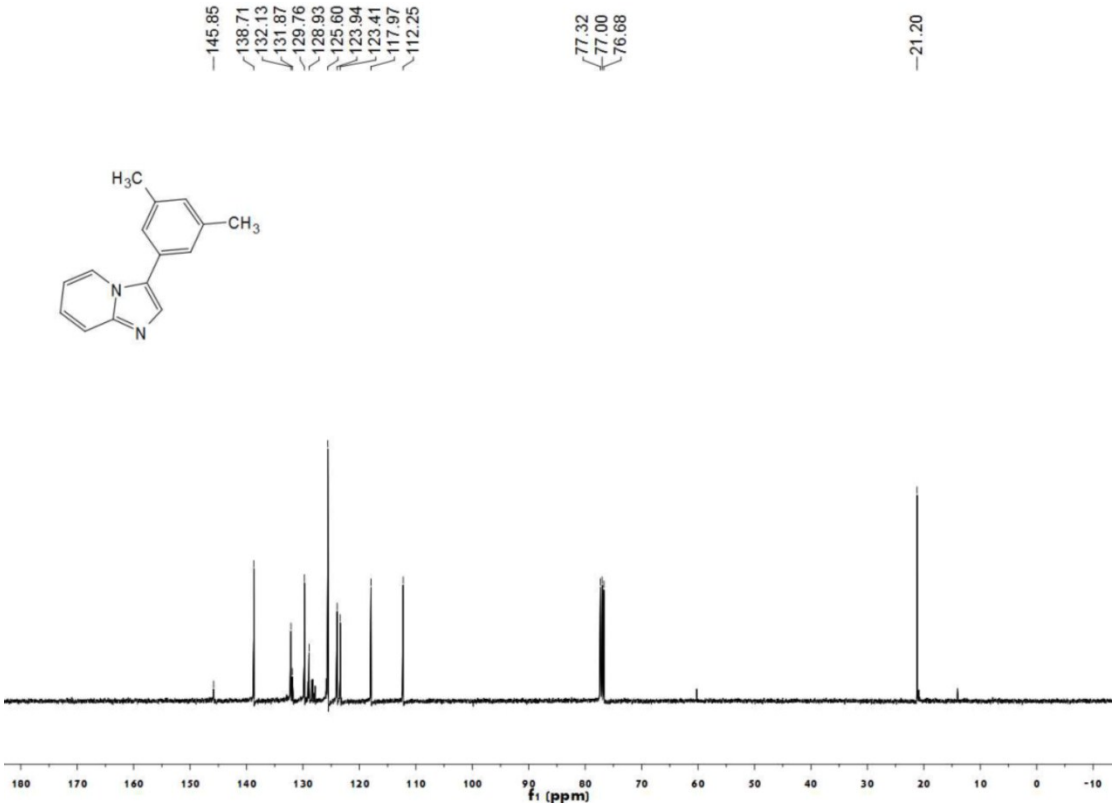
3f


CH-L-0108
8.07
8.06
7.56
7.53
7.26
7.15
7.13
7.11
6.82
6.81
6.79
1.49
Br
N
N
CH3
CH3
CH3
1.00
1.01
1.03
1.02
9.03
f1 (ppm)

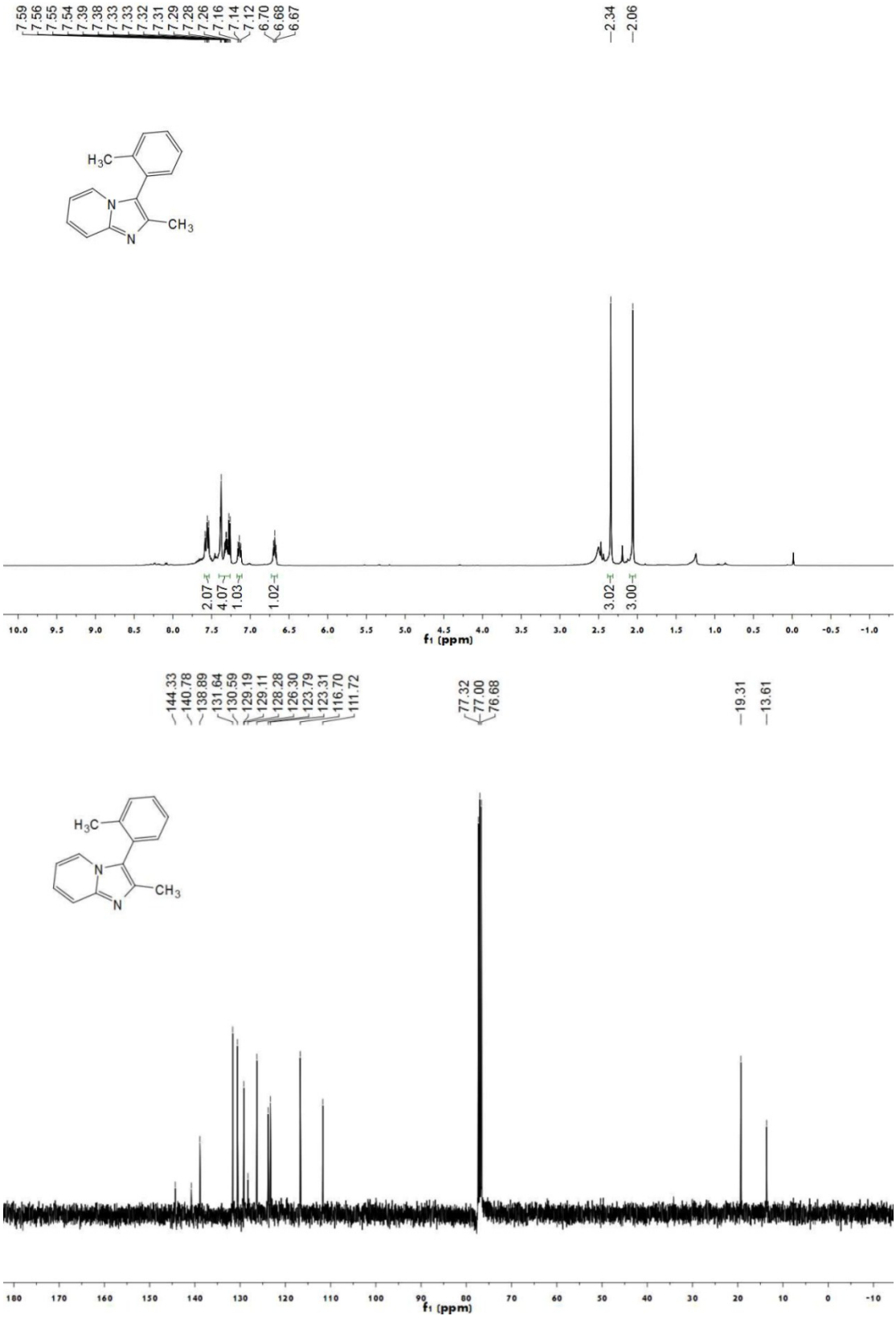

CH-L-0108
151.85
143.73
123.95
123.15
117.15
112.49
89.97
77.32
77.00
76.68
33.01
29.64
Br
N
N
CH3
CH3
CH3
f1 (ppm)

5a


8.33
8.32
7.73
7.69
7.66
7.64
7.16
7.05
6.79
6.78
6.76
2.38
H3C
CH3
N
N
1.00
2.03
3.00
1.00
1.00
6.06
f1 (ppm)


145.85
138.71
132.13
131.87
129.76
128.93
125.60
123.94
123.41
117.97
112.25
77.32
77.00
76.68
21.20
H3C
CH3
N
N
f1 (ppm)

6a


7.59
7.56
7.55
7.54
7.39
7.38
7.33
7.33
7.32
7.31
7.29
7.28
7.26
7.16
7.14
7.12
6.70
6.68
6.67
2.34
2.06
H3C
N
CH3
N
2.07
4.07
1.03
1.02
3.02
3.00
f1 (ppm)
144.33
140.78
138.89
131.64
130.59
129.19
129.11
128.28
126.30
123.79
123.31
116.70
111.72
77.32
77.00
76.68
19.31
13.61
H3C
N
CH3
N
f1 (ppm)