Electronic Supplementary Information (ESI)

Synthesis and cytotoxic activities of novel hybrid compounds of imidazole scaffold-based 2-substituted benzofurans

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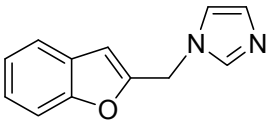
1. General Experimental

Melting points were obtained on a XT-4 melting-point apparatus and were uncorrected. Proton nuclear magnetic resonance (^{1}H-NMR) spectra were recorded on a Bruker Avance 300 spectrometer at 300 MHz. Carbon-13 nuclear magnetic resonance (^{13}C-NMR) was recorded on Bruker Avance 300 spectrometer at 75 MHz. Chemical shifts are reported as δ values in parts per million (ppm) relative to tetramethylsilane (TMS) for all recorded NMR spectra. Low-resolution Mass spectra were recorded on a VG Auto Spec-3000 magnetic sector MS spectrometer. High Resolution Mass spectra were taken on AB QSTAR Pulsar mass spectrometer. Element Analyses were taken on Vario EL III Elementar analyzer.

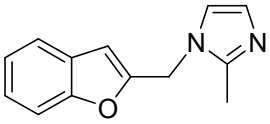
Silica gel (200–300 mesh) for column chromatography and silica GF_{254} for TLC were produced by Qingdao Marine Chemical Company (China). All air- or moisture-sensitive reactions were conducted under an argon atmosphere. Starting materials and reagents used in reactions were obtained commercially from Acros, Aldrich, Fluka and were used without purification, unless otherwise indicated.

2. Analytical Data of Compound 4-24



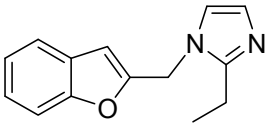
4

White powder, yield 76%, mp 71–73 °C ($CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.62(1H, s), 7.54 (1H, dd, *J* = 7.3, 1.0 Hz), 7.44 (1H, d, *J* = 7.8 Hz), 7.32-7.23(2H, m), 7.23(1H, s), 7.02(1H, s), 6.63(1H, s), 5.21(2H, s). ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.29 (C), 151.72 (C), 137.40 (CH), 129.92 (CH), 127.81 (CH), 125.03 (CH), 123.28 (CH), 121.35 (CH), 119.30 (CH), 111.45 (CH), 105.58 (CH), 44.22 (CH_2). HR-ESI-MS *m*/*z* Calcd for $C_{12}H_{10}N_2O$ 198.0793, Found 198.0757.



5

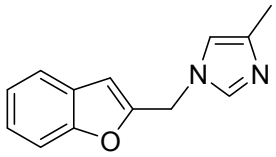
White powder, yield 72%, mp 76–78 °C ($CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.53 (1H, dd, *J* = 7.2, 1.3 Hz), 7.44 (1H, d, *J* = 7.6 Hz), 7.29-7.22 (2H, m), 6.94 (2H, s), 6.52 (1H, s), 5.13 (2H, s), 2.47 (3H, s). ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.26 (C), 152.17 (C), 144.95 (C), 127.69 (CH), 124.88 (CH), 123.26 (CH), 121.27 (CH), 119.75 (CH), 111.43 (CH), 105.01 (CH), 43.58 (CH_2), 13.14 (CH_3). HR-ESI-MS *m*/*z* Calcd for $C_{13}H_{12}N_2O$ 212.0950, Found 212.0919.



6

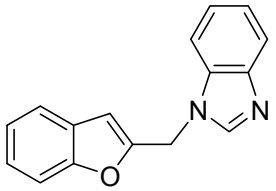
Yellow oil, yield 83%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.52 (1H, dd, *J* = 7.3, 1.1 Hz), 7.43 (1H, d, *J* = 7.6 Hz), 7.29-7.22 (2H, m), 6.98 (1H, s), 6.93 (1H, s), 6.52 (1H, s),

5.14 (2H, s), 2.78 (2H, q, J = 15.0 Hz), 1.36 (3H, t, J = 7.5 Hz). ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.13 (C), 152.21 (C), 149.43 (C), 127.61 (CH), 124.76 (CH), 123.15 (CH), 121.16 (CH), 119.57 (CH), 111.32 (CH), 104.90 (CH), 43.09 (CH_2), 20.12 (CH_2), 11.99 (CH_3). HR-ESI-MS *m/z* Calcd for $C_{14}H_{14}N_2O$ 226.1106, Found 226.1075.



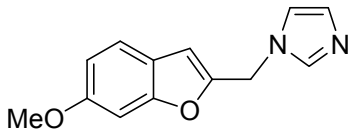
7

Brown oil, yield 54%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.46-7.33 (3H, m), 7.20-7.13 (2H, m), 6.70, 6.63 (1H, s), 6.63, 6.42 (1H, s), 5.03 (2H, s), 2.13 (3H, s). ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.19 (C), 151.96 (C), 138.85 (C), 136.46 (CH), 127.81 (CH), 124.88 (CH), 123.18 (CH), 121.25 (CH), 115.67 (CH), 111.38 (CH), 105.36 (CH), 44.06 (CH_2), 13.71 (CH_3). HR-ESI-MS *m/z* Calcd for $C_{13}H_{12}N_2O$ 212.0950, Found 212.0907.



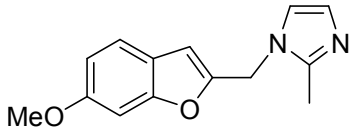
8

White powder, yield 78%, mp 128–130 ^{o}C ($CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.96 (1H, s), 7.84-7.81 (1H, m), 7.47-7.37 (3H, m), 7.28-7.17 (4H, m), 6.56 (1H, s), 5.32 (2H, s). ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.08 (C), 151.07 (C), 143.82 (C), 143.02 (CH), 133.66 (C), 127.69 (C), 124.86 (CH), 123.24 (CH), 122.42 (CH), 121.20 (CH), 120.47 (CH), 111.32 (CH), 109.77 (CH), 105.51 (CH), 42.18 (CH_2). HR-ESI-MS *m/z* Calcd for $C_{16}H_{12}N_2O$ 248.0950, Found 248.0944. Anal. Calcd for $C_{16}H_{12}N_2O$: C, 77.40; H, 4.87; N, 11.28. Found: C, 77.33; H, 4.86; N, 10.95.



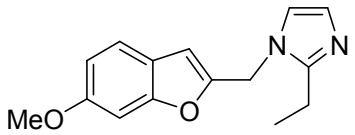
9

Yellow oil, yield 75%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.45(1H, s), 7.27 (1H, d, *J* = 8.6 Hz), 6.95 (1H, s), 6.89 (1H, s), 6.84 (1H, d, *J* = 1.7 Hz), 6.75 (1H, dd, *J* = 8.6, 2.2 Hz), 6.45 (1H, s), 5.02 (2H, s), 3.69 (3H, s). ^{13}C NMR (75 MHz, $CDCl_3$) δ 158.39 (C), 156.21 (C), 150.50 (C), 137.17 (CH), 129.47 (CH), 121.33 (CH), 120.86 (C), 119.18 (CH), 112.27 (CH), 105.47 (CH), 95.88 (CH), 55.65 (CH_3), 44.00 (CH_2). HR-ESI-MS *m*/*z* Calcd for $C_{13}H_{12}N_2O_2$ 228.0899, Found 228.0863.



10

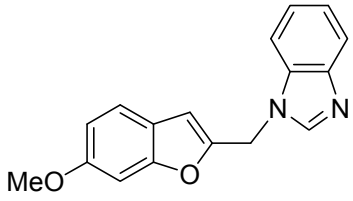
Brown oil, yield 71%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.29 (1H, d, *J* = 8.5 Hz), 6.88 (1H, d, *J* = 2.0 Hz), 6.85-6.83 (2H, m), 6.78 (1H, dd, *J* = 8.5, 2.0 Hz), 6.40 (1H, s), 4.99 (2H, s), 3.74(3H, s), 2.38(3H, s). ^{13}C NMR (75 MHz, $CDCl_3$) δ 158.34 (C), 156.18 (C), 150.88 (C), 144.74 (C), 127.35 (CH), 121.21 (CH), 120.92 (C), 119.54 (CH), 112.21 (CH), 104.85 (CH), 95.95 (CH), 55.70 (CH_3), 43.39 (CH_2), 12.96 (CH_3). HR-ESI-MS *m*/*z* Calcd for $C_{14}H_{14}N_2O_2$ 242.1055, Found 242.1019



11

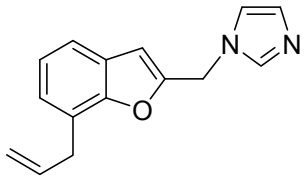
Brown oil, yield 80%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.28 (1H, d, *J* = 8.5 Hz), 6.87 (2H, s), 6.82 (1H, d, *J* = 1.2 Hz), 6.77 (1H, dd, *J* = 8.5, 1.2 Hz), 6.39 (1H, s), 5.00 (2H, s), 3.73 (3H, s), 2.69 (2H, q, *J* = 15.0 Hz), 1.27 (3H, t, *J* = 7.5 Hz). ^{13}C NMR (75 MHz, $CDCl_3$) δ 158.30 (C), 156.15 (C), 151.01 (C), 149.33 (C), 127.35 (CH), 121.20 (CH), 120.93 (C), 119.46 (CH), 112.19 (CH), 104.86 (CH), 95.93 (CH), 55.69 (CH_3),

43.00 (CH_2), 20.06 (CH_2), 11.97 (CH_3). HR-ESI-MS *m/z* Calcd for $C_{15}H_{16}N_2O_2$ 256.1212, Found 256.1178.



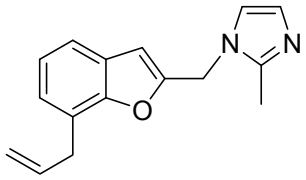
12

Brown oil, yield 70%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.03 (1H, s), 7.76-7.73 (1H, m), 7.43-7.40 (1H, m), 7.30 (1H, d, *J* = 8.6 Hz), 7.26-7.21 (2H, m), 7.19 (1H, s), 6.87 (1H, d, *J* = 1.8 Hz), 6.78 (1H, dd, d, *J* = 8.6, 2.1 Hz), 6.54 (1H, s), 5.42 (2H, s), 3.83 (3H, s). ^{13}C NMR (75 MHz, $CDCl_3$) δ 158.43 (C), 156.22 (C), 149.88 (C), 143.76 (C), 142.94 (CH), 123.25 (CH), 122.44 (CH), 121.29 (CH), 120.87 (C), 120.47 (CH), 112.35 (CH), 109.76 (CH), 105.59 (CH), 95.93 (CH), 55.70 (CH_3), 42.33 (CH_2). HR-ESI-MS *m/z* Calcd for $C_{17}H_{14}N_2O_2$ 278.1055, Found 278.1018.



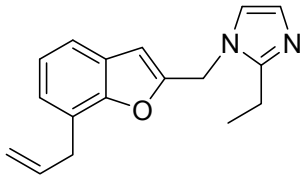
13

Brown oil, yield 80%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.55 (1H, s), 7.31 (1H, d, *J* = 7.5 Hz), 7.13-7.02 (3H, m), 6.96 (1H, s), 6.55 (1H, s), 6.00-5.89 (1H, m), 5.16 (2H, s), 5.09-5.01 (2H, m), 3.55 (2H, d, *J* = 6.6 Hz). ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.73 (C), 151.38 (C), 137.29 (CH), 135.62 (CH), 129.80 (CH), 127.50 (C), 124.95 (CH), 123.85 (CH), 123.39 (C), 119.22 (CH), 116.35 (CH_2), 105.71 (CH), 44.19 (CH_2), 33.77 (CH_2). HR-ESI-MS *m/z* Calcd for $C_{15}H_{14}N_2O$ 238.1106, Found 238.1084.



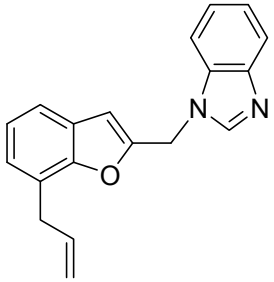
14

Brown oil, yield 73%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.29 (1H, d, *J* = 7.5 Hz), 7.10-7.00 (2H, m), 6.84 (2H, s), 5.99-5.90 (1H, m), 5.08-4.99 (2H, m), 5.03 (2H, s), 3.53 (2H, d, *J* = 6.2 Hz), 2.39 (3H, s). ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.65 (C), 151.77 (C), 144.83 (C), 135.63 (CH), 127.54 (C), 127.34 (CH), 124.79 (CH), 123.77 (C), 123.36 (CH), 119.63 (CH), 119.15 (CH), 116.36 (CH_2), 105.13 (CH), 43.48 (CH_2), 33.81 (CH_2), 12.92 (CH_3). HR-ESI-MS *m*/*z* Calcd for $C_{16}H_{16}N_2O$ 252.1263, Found 252.1221.



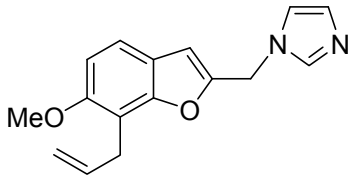
15

Brown oil, yield 78%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.37 (1H, d, *J* = 7.3 Hz), 7.23-7.09 (2H, m), 6.96-6.93 (3H, m), 6.52 (1H, s), 6.09-5.96 (2H, m), 5.16-5.08 (2H, m), 5.14 (2H, s), 3.62 (2H, d, *J* = 6.2 Hz), 2.78 (3H, t, *J* = 7.5 Hz). ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.64 (C), 151.82 (C), 149.42 (C), 135.62 (CH), 127.53 (C), 127.27 (CH), 124.80 (CH), 123.77 (C), 123.37 (CH), 121.16 (CH), 119.62 (CH), 119.15 (CH), 116.34 (CH), 105.19 (CH_2), 43.13 (CH_2), 33.80 (CH_2), 21.74 (CH_2), 12.07 (CH_3). HR-ESI-MS *m*/*z* Calcd for $C_{17}H_{18}N_2O$ 266.1419, 266.1395.



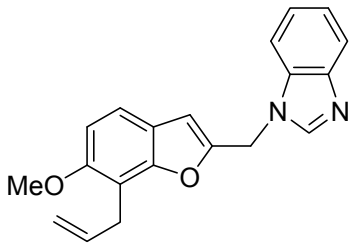
16

Yellow powder, yield 70%, mp 48–50 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.92(1H, s), 7.76-7.73 (1H, m), 7.41-7.39 (1H, m), 7.28-7.20 (3H, m), 7.06-6.99 (2H, m), 6.52 (1H, s), 5.96-5.85 (1H, m), 5.34 (2H, s), 5.05-4.97(2H, dd, *J* = 15.3, 8.4 Hz), 3.51 (2H, d, *J* = 6.3 Hz). ^{13}C NMR (75 MHz, $CDCl_3$) δ 153.69 (C), 150.86 (C), 143.85 (C), 142.96 (CH), 135.60 (CH), 133.74 (C), 127.51 (C), 124.93 (CH), 123.85 (C), 123.41 (CH), 123.25 (CH), 122.44 (CH), 120.52 (CH), 119.21 (CH), 116.38 (CH2), 109.82 (CH), 105.81 (CH), 42.35 (CH_2), 33.81 (CH_2). HR-ESI-MS *m*/*z* Calcd for $C_{19}H_{16}N_2O$ 288.1263, Found 288.1259.



17

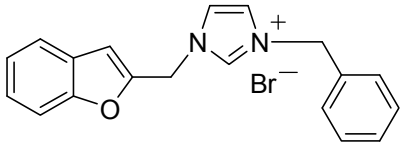
Brown oil, yield 74%. ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.59 (1H, s), 7.30 (1H, d, *J* = 8.6 Hz), 7.05 (1H, s), 6.99 (1H, s), 6.85 (1H, d, *J* = 8.6 Hz), 6.52 (1H, s), 6.05-5.96 (1H, m), 5.13 (2H, s), 5.06 (1H, d, *J* = 1.3 Hz), 4.98 (1H, d, *J* = 10.3 Hz), 3.84 (3H, s), 3.58 (2H, d, *J* = 6.2 Hz). ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.44 (C), 154.80 (C), 150.80 (C), 137.15 (CH), 135.67 (CH), 129.31 (CH), 121.28 (C), 119.26 (CH), 118.71 (CH), 115.07 (CH_2), 112.08 (C), 108.19 (CH), 105.55 (CH), 56.66 (CH_3), 44.12 (CH_2), 27.86 (CH_2). HR-ESI-MS *m*/*z* Calcd for $C_{16}H_{16}N_2O_2$ 268.1212, Found 268.1991.



18

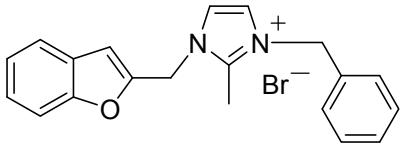
White powder, yield 68%, mp 118–120 °C ($CHCl_3$). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.99 (1H, s), 7.83-7.80 (1H, m), 7.50-7.47 (1H, m), 7.30 (2H, s), 7.29-7.26 (1H, m),

6.85-6.82 (1H, d, J = 8.6 Hz), 6.52 (1H, s), 6.03-5.94 (1H, m), 5.37 (2H, m), 5.05-4.94 (2H, m), 3.83 (3H, s), 3.58 (2H, d, J = 6.2 Hz). ^{13}C NMR (75 MHz, $CDCl_3$) δ 155.44 (C), 154.78 (C), 150.35 (C), 143.80 (C), 142.94 (CH), 135.66 (CH), 133.75 (C), 123.19 (CH), 122.39 (CH), 121.30 (C), 120.43 (CH), 118.65 (CH), 115.10 (CH_2), 112.15 (C), 109.89 (CH), 108.18 (CH), 105.58 (CH), 56.69 (CH_3), 42.35 (CH_2), 27.93 (CH_2). HR-ESI-MS m/z Calcd for $C_{20}H_{18}N_2O_2$ 318.1368, Found 318.1353.



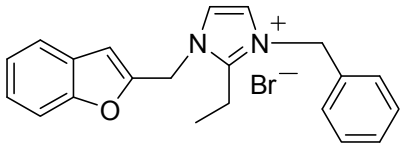
19

White powder, yield 90%, mp 176–178 °C (MeOH). ^{1}H NMR (300 MHz, MeOD) δ 9.42 (1H, s), 7.77 (1H, s), 7.48-7.41 (6H, m), 7.33-7.25 (2H, m), 7.13 (1H, s), 5.72 (2H, s), 5.48 (2H, s). ^{13}C NMR (75 MHz, MeOD) δ 156.88 (C), 150.55 (C), 137.76 (CH), 135.12 (C), 130.49 (CH), 129.89 (CH), 129.03 (C), 126.72 (CH), 124.60 (CH), 124.27 (CH), 122.92 (CH), 112.36 (CH), 109.23 (CH), 54.40 (CH_2), 47.38 (CH_2). HR-ESI-MS m/z Calcd for $C_{19}H_{17}N_2O$ $[M\text{-}Br]^+$ 289.1335, Found 289.1325.



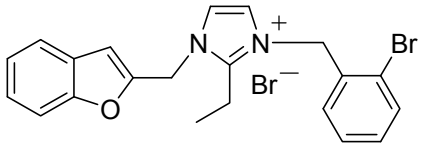
20

White powder, yield 92%, mp 175–177 °C (MeOH). ^{1}H NMR (300 MHz, MeOD) δ 6.38 (1H, s), 6.30-6.24 (2H, m), 6.14-5.91 (8H, m), 5.78 (1H, s), 4.35(2H, s), 4.13(2H, s), 1.49(3H, s). ^{13}C NMR (75 MHz, MeOD) δ 155.41 (C), 149.31 (C), 145.12 (C), 133.53 (C), 129.08 (CH), 128.75 (CH), 127.80 (CH), 127.62 (C), 125.23 (CH), 123.20 (CH), 121.89 (CH), 121.46 (CH), 110.92 (CH), 107.37 (CH), 51.71 (CH_2), 44.97 (CH_2), 9.35 (CH_3). HR-ESI-MS m/z Calcd for $C_{20}H_{19}N_2O$ 303.1492, Found 303.1486.



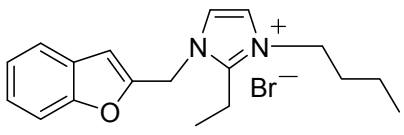
21

White powder, yield 88%, mp 179–181 °C (MeOH). ^{1}H NMR (300 MHz, MeOD) δ 7.59 (1H, d, *J* = 2.2 Hz), 7.53 (1H, d, *J* = 8.6 Hz), 7.46 (1H, d, *J* = 2.2 Hz), 7.35-7.31 (4H, m), 7.25-7.23 (3H, m), 7.14 (1H, s), 6.99 (1H, s), 5.57 (2H, s), 5.37 (2H, s), 3.21 (2H, q, *J* = 15.0 Hz), 1.05 (3H, t, *J* = 7.5 Hz). ^{13}C NMR (75 MHz, MeOD) δ 155.37 (C), 149.32 (C), 148.78 (C), 133.85 (C), 129.08 (CH), 128.77 (CH), 127.75 (CH), 125.29 (CH), 123.24 (CH), 122.23 (CH), 121.92 (CH), 121.48 (CH), 110.90 (CH), 107.59 (CH), 51.58 (CH_2), 44.83 (CH_2), 16.89 (CH_2), 10.33 (CH_3). HR-ESI-MS *m*/*z* Calcd for $C_{21}H_{21}N_2O$ [M-Br]$^+$ 317.1648, Found 310.1641.



22

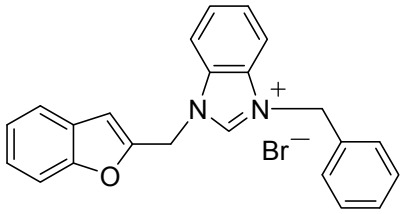
White powder, yield 85%, mp 219–221 °C (MeOH). ^{1}H NMR (300 MHz, MeOD) δ 7.76 (1H, d, *J* = 2.2 Hz), 7.66-7.60 (2H, m), 7.49-7.46 (2H, m), 7.39-7.29 (4H, m), 7.23-7.20 (1H, m), 7.18 (1H, s), 5.77 (2H, s), 5.55 (2H, s), 3.33 (2H, q, *J* = 15.0 Hz), 1.23 (3H, t, *J* = 7.5 Hz). ^{13}C NMR (75 MHz, MeOD) δ 156.77 (C), 150.76 (C), 150.41 (C), 134.85 (CH), 133.95 (C), 132.52 (CH), 132.29 (CH), 130.96 (CH), 129.91 (CH), 129.04 (C), 126.77 (CH), 124.73 (C), 123.53 (CH), 123.27 (CH), 122.98 (CH), 112.37 (CH), 109.07 (CH), 53.23 (CH_2), 46.43(CH_2), 18.61(CH_2), 11.86(CH_3). HR-ESI-MS *m*/*z* Calcd for $C_{21}H_{20}BrN_2O$ [M-Br]$^+$ 395.0754, Found 395.0742.



23

White powder, yield 75%, mp 145–147 °C (MeOH). ^{1}H NMR (300 MHz, MeOD) δ

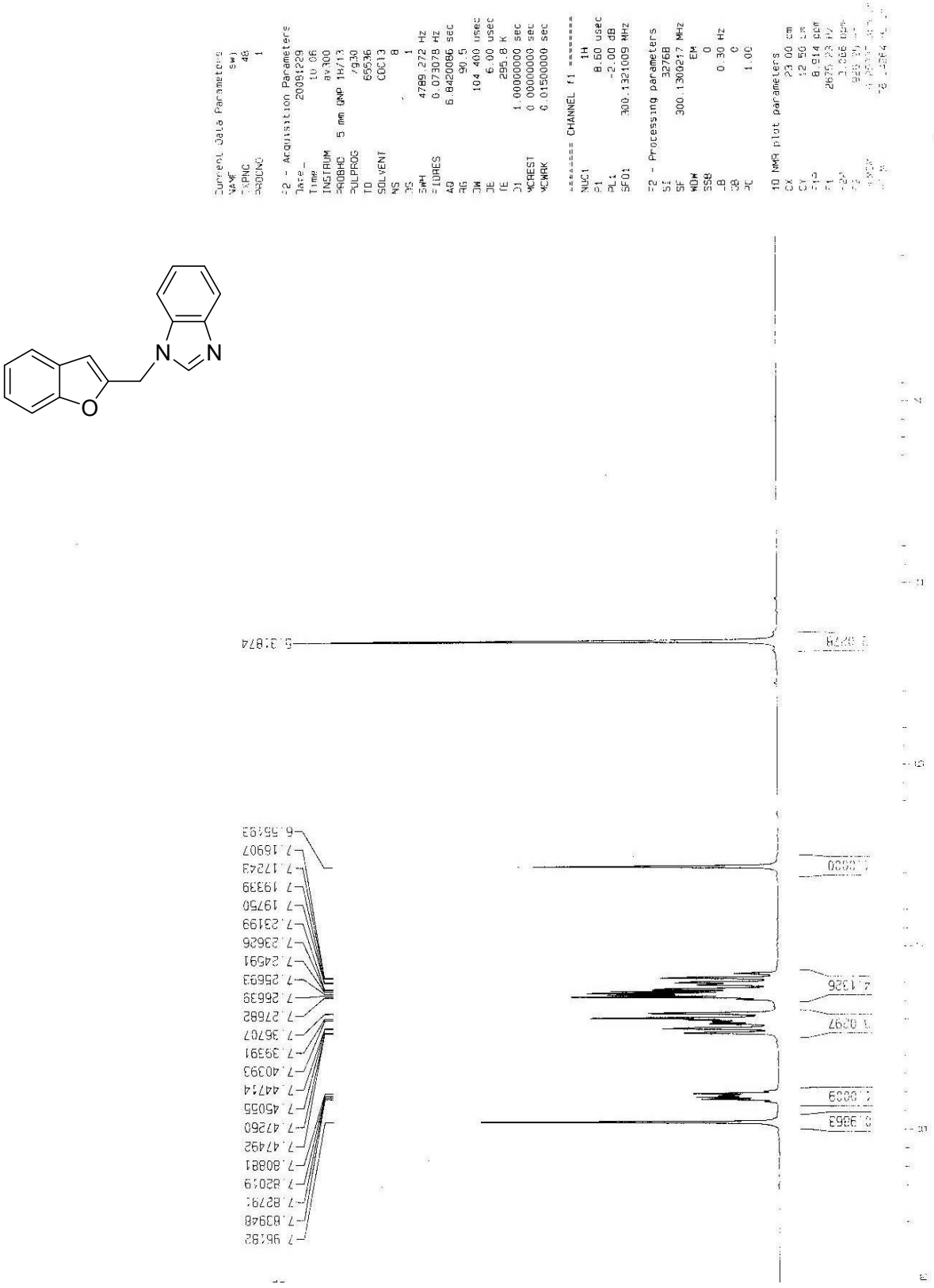
7.69-7.64 (3H, m)，7.48 (1H, d, J = 8.3 Hz), 7.36-7.28 (2H, m), 7.12 (1H, s), 5.68 (2H, s), 4.22 (2H, q, J = 15.0 Hz), 1.93-1.83 (2H, m), 1.51-1.38 (2H, m), 1.33 (3H, t, J = 7.5 Hz), 1.01 (3H, t, J = 7.5 Hz). ^{13}C NMR (75 MHz, MeOD) δ 156.80 (C), 150.76 (C), 149.68 (C), 128.99 (C), 126.64 (CH), 124.61 (CH), 123.24 (CH), 122.91 (CH), 122.80 (CH), 112.22 (CH), 108.77 (CH), 48.75 (CH_2), 33.11 (CH_2), 20.66 (CH_2), 17.95 (CH_2), 13.89 (CH_3), 12.02 (CH_3). HR-ESI-MS m/z Calcd for $C_{18}H_{23}N_2O$ $[M\text{-}Br]^+$ 283.1805, Found 283.1794.

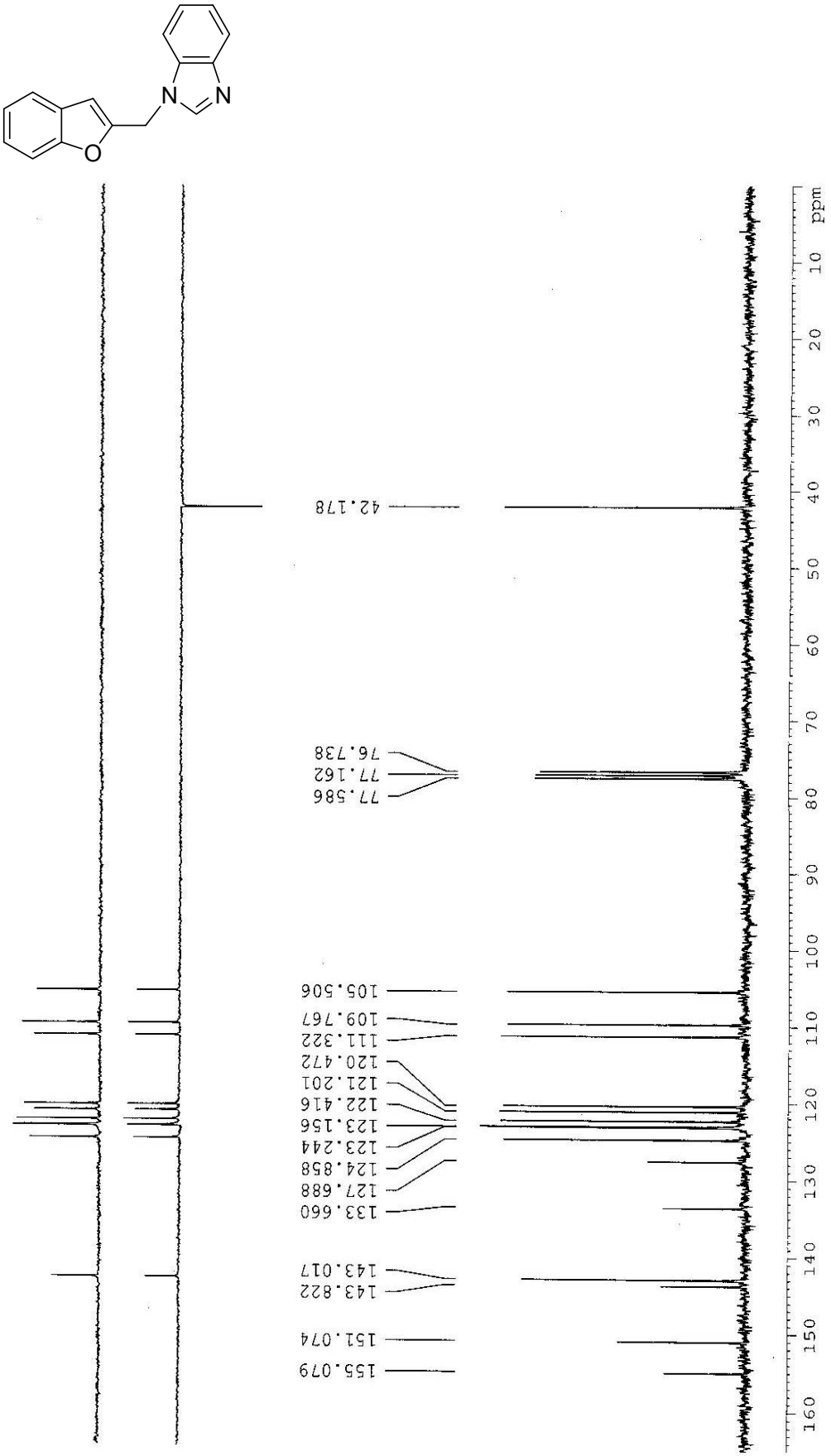


24

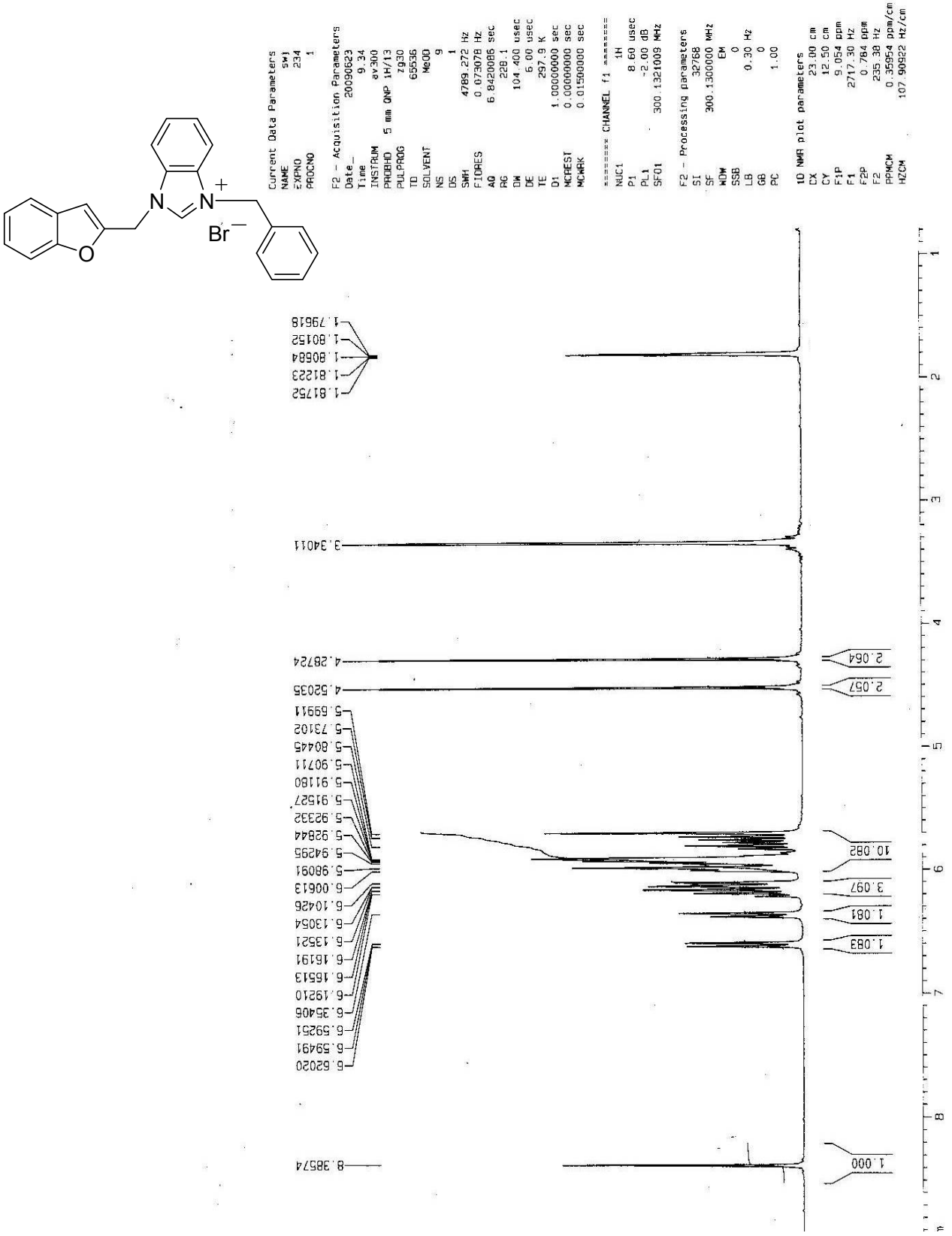
White powder, yield 89%, mp 218–220 °C (MeOH). ^{1}H NMR (300 MHz, MeOD) δ 8.39 (1H, s), 6.60 (1H, d, J = 7.6 Hz), 6.37 (1H, d, J = 7.6 Hz), 6.19-6.10 (3H, m), 6.01-5.91 (6H, m), 5.80-5.73 (2H, m), 5.70 (s, 1H), 4.52 (s, 2H), 4.27 (s, 2H). ^{13}C NMR (75 MHz, MeOD) δ 148.74 (C), 142.01 (C), 133.02 (C), 131.42 (C), 129.04 (CH), 128.91 (CH), 128.04 (CH), 127.57 (C), 127.20 (CH), 127.09 (CH), 125.19 (CH), 123.12 (CH), 121.37 (CH), 113.67 (CH), 113.48 (CH), 110.81 (CH), 107.80 (CH), 50.77 (CH_2), 43.86 (CH_2). HR-ESI-MS m/z Calcd for $C_{23}H_{19}N_2O$ $[M\text{-}Br]^+$ 339.1492, Found 339.1483. Anal. Calcd for $C_{23}H_{19}BrN_2O$: C, 65.88; H, 4.57; N, 6.68. Found: C, 66.29; H, 4.57; N, 6.31.

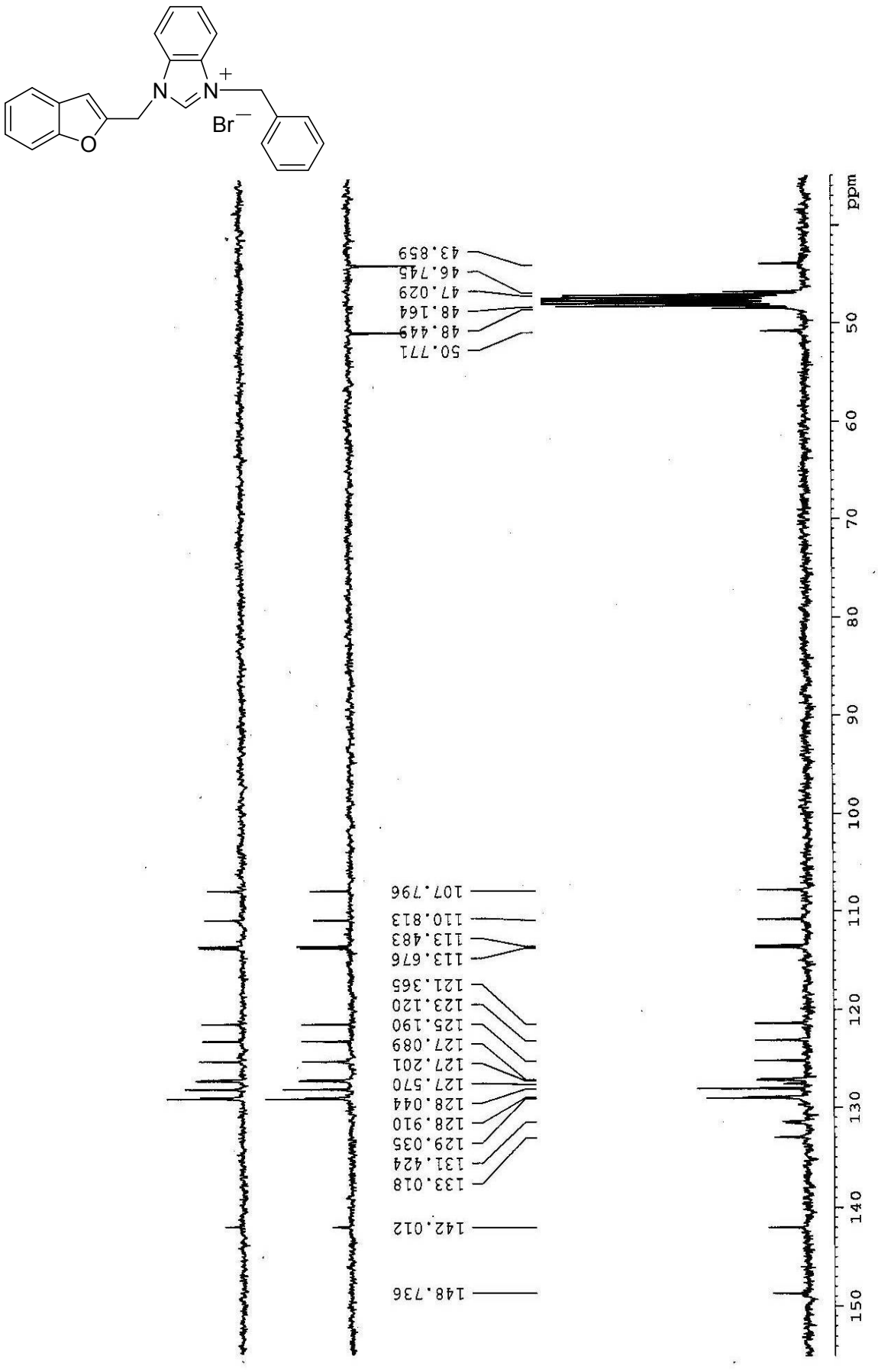
Compound **8** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*



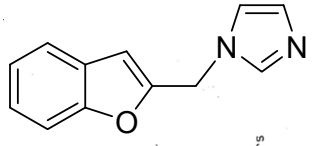


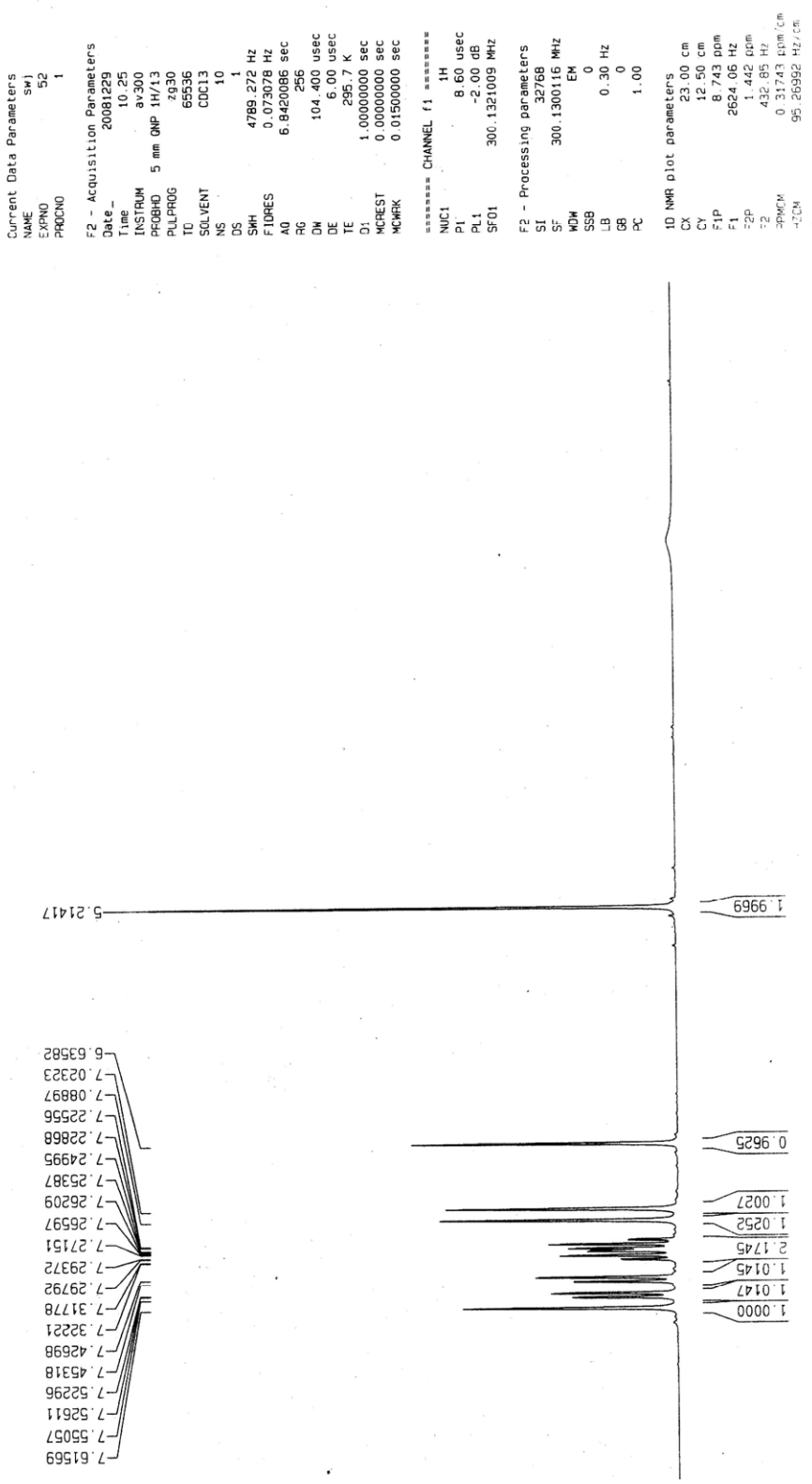
Compound **24** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

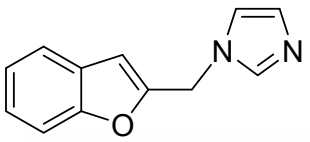


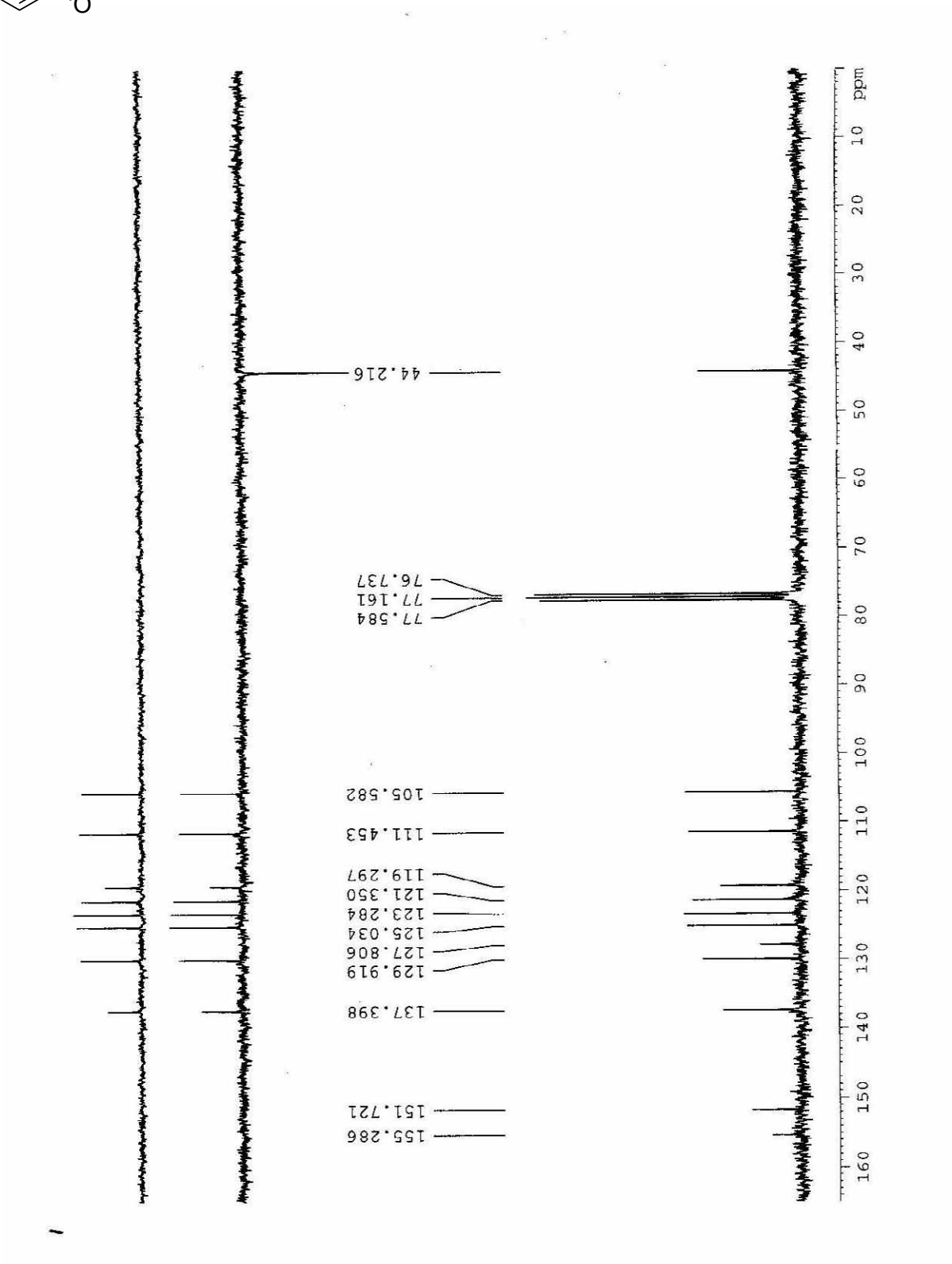


Compound **4** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

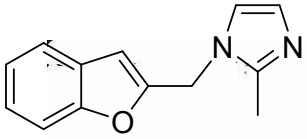


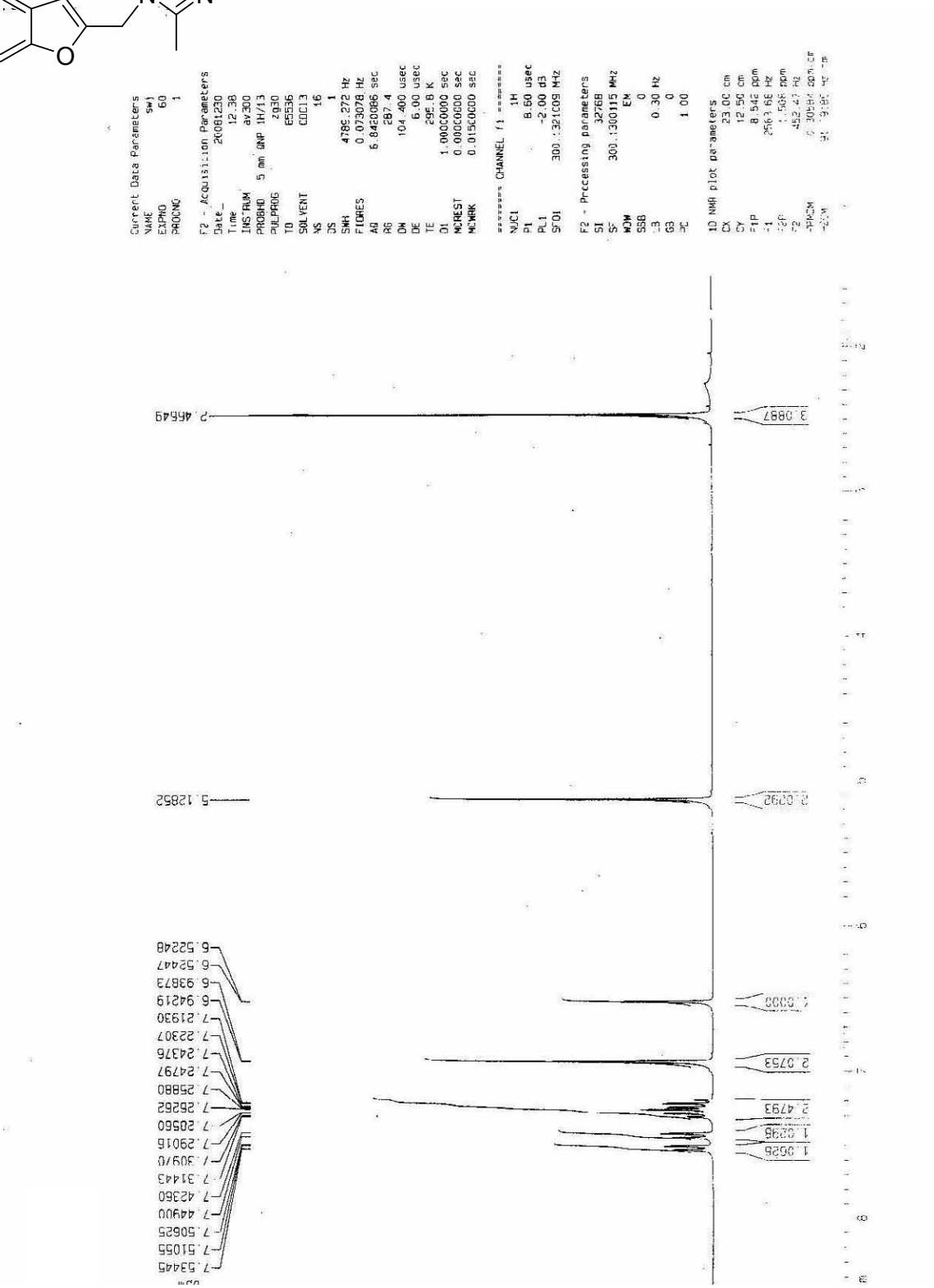


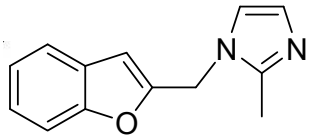


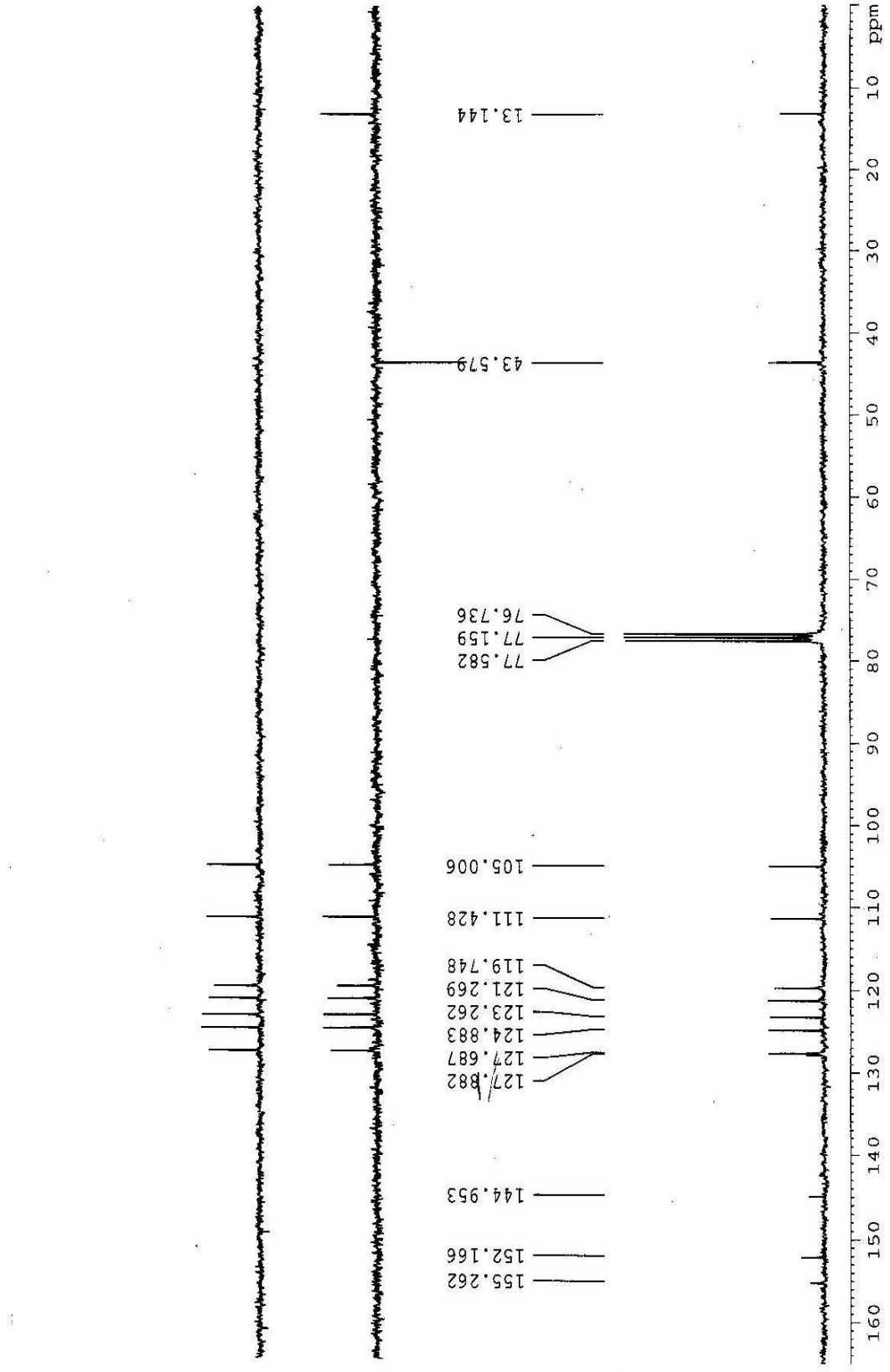


Compound **5** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

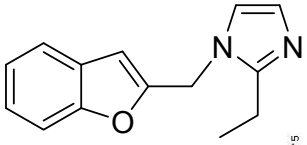


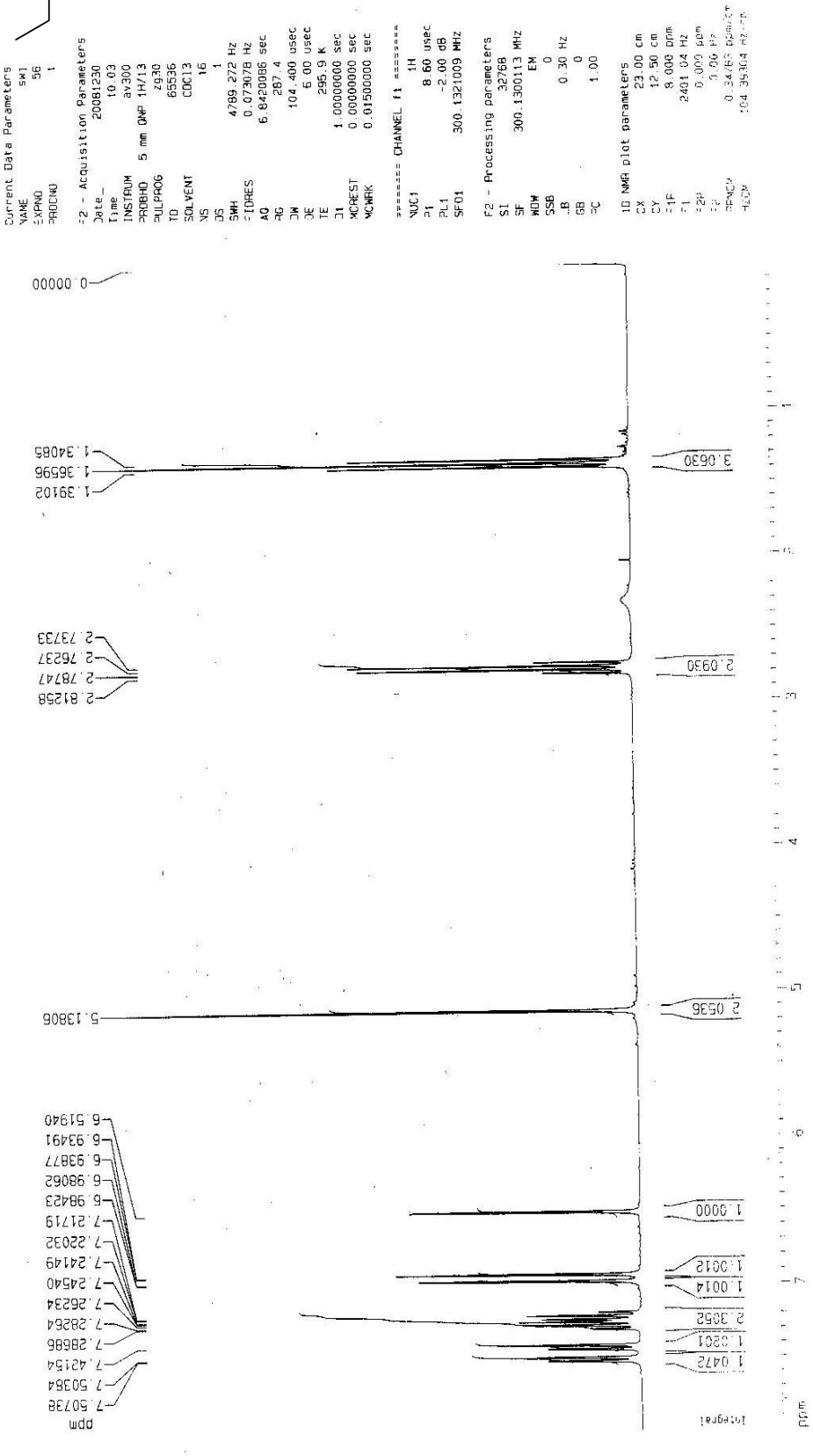


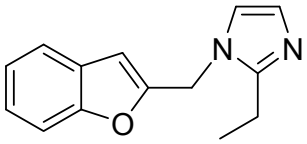


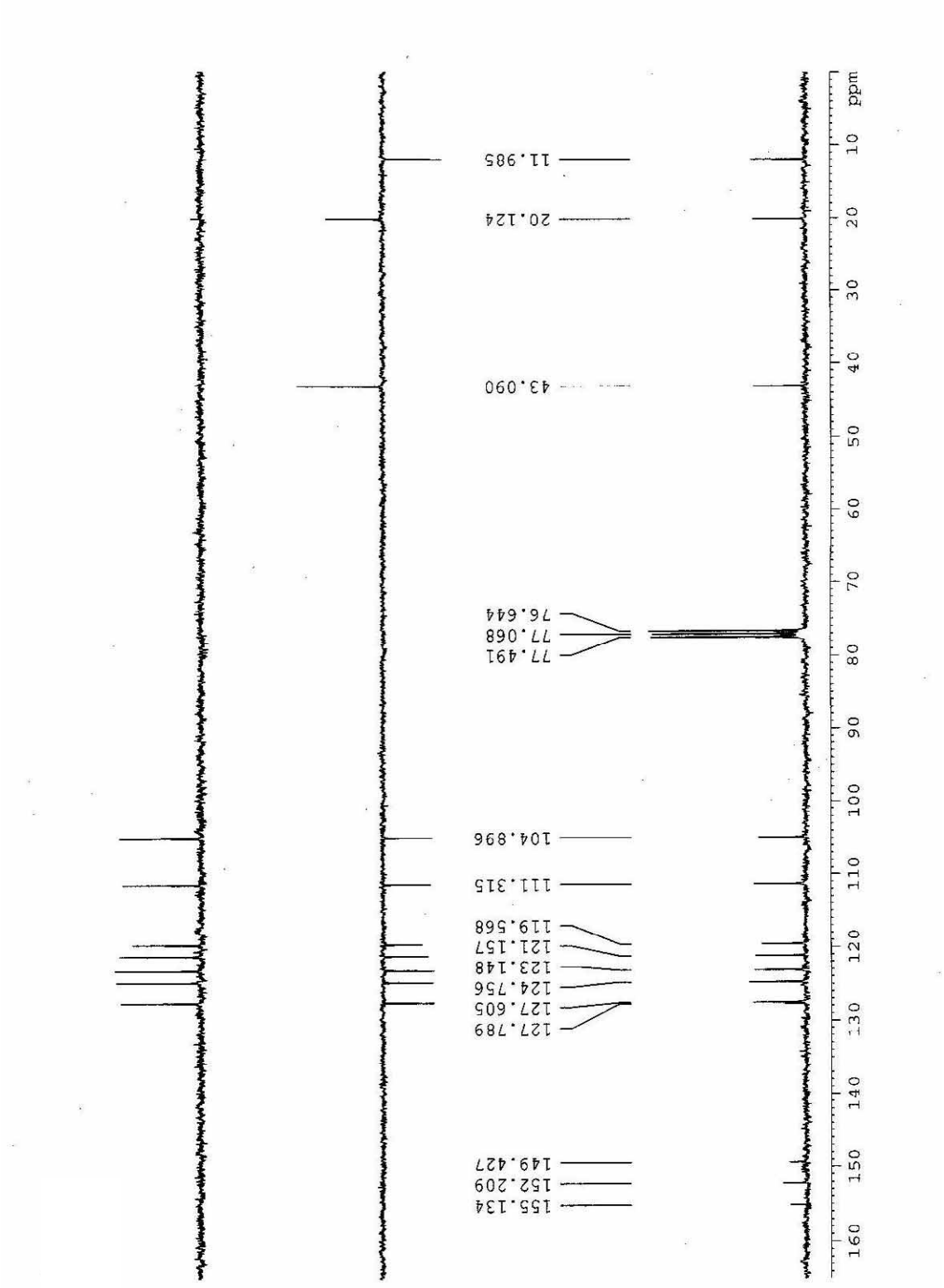


Compound **6** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

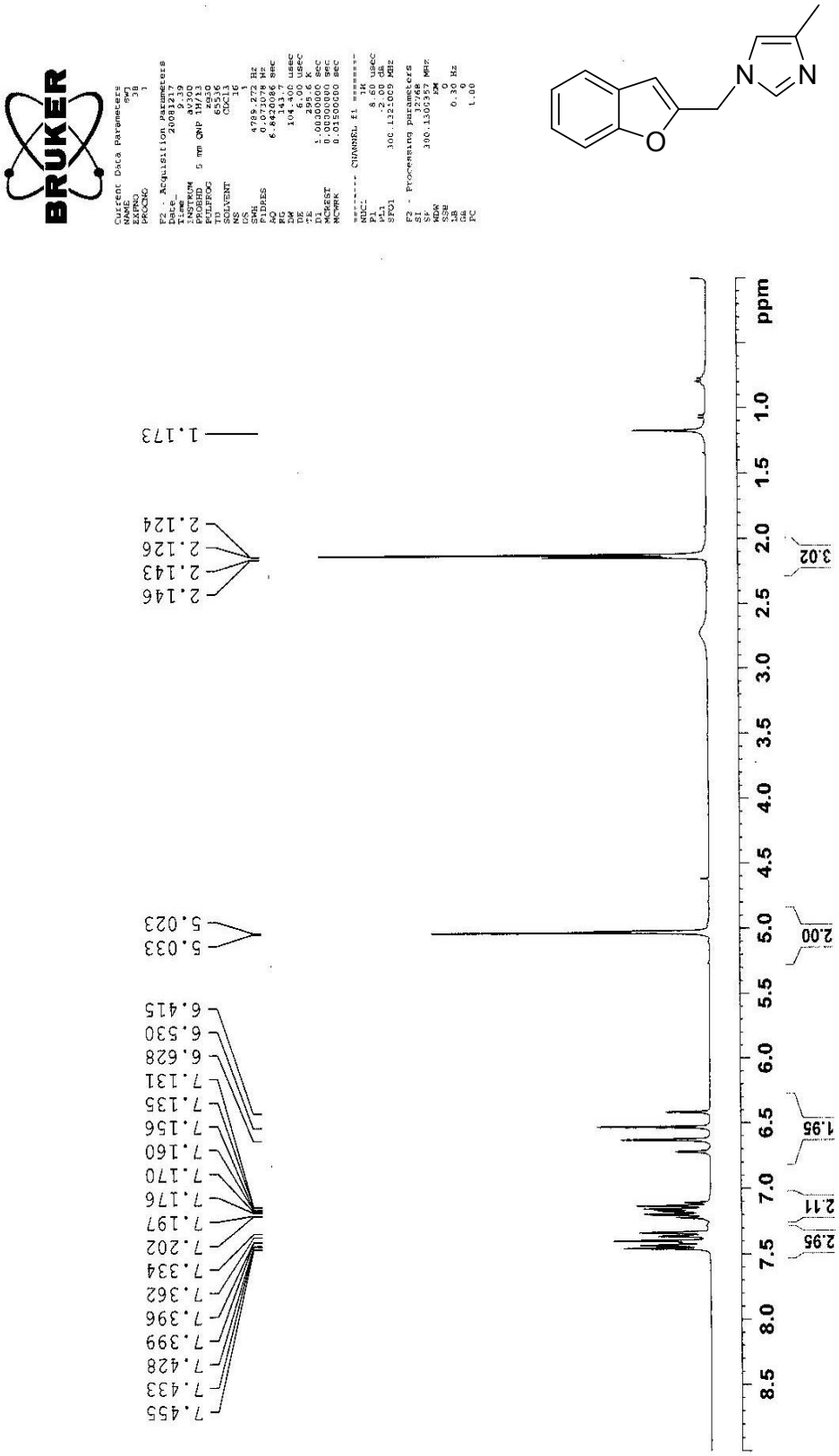


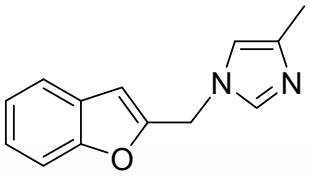


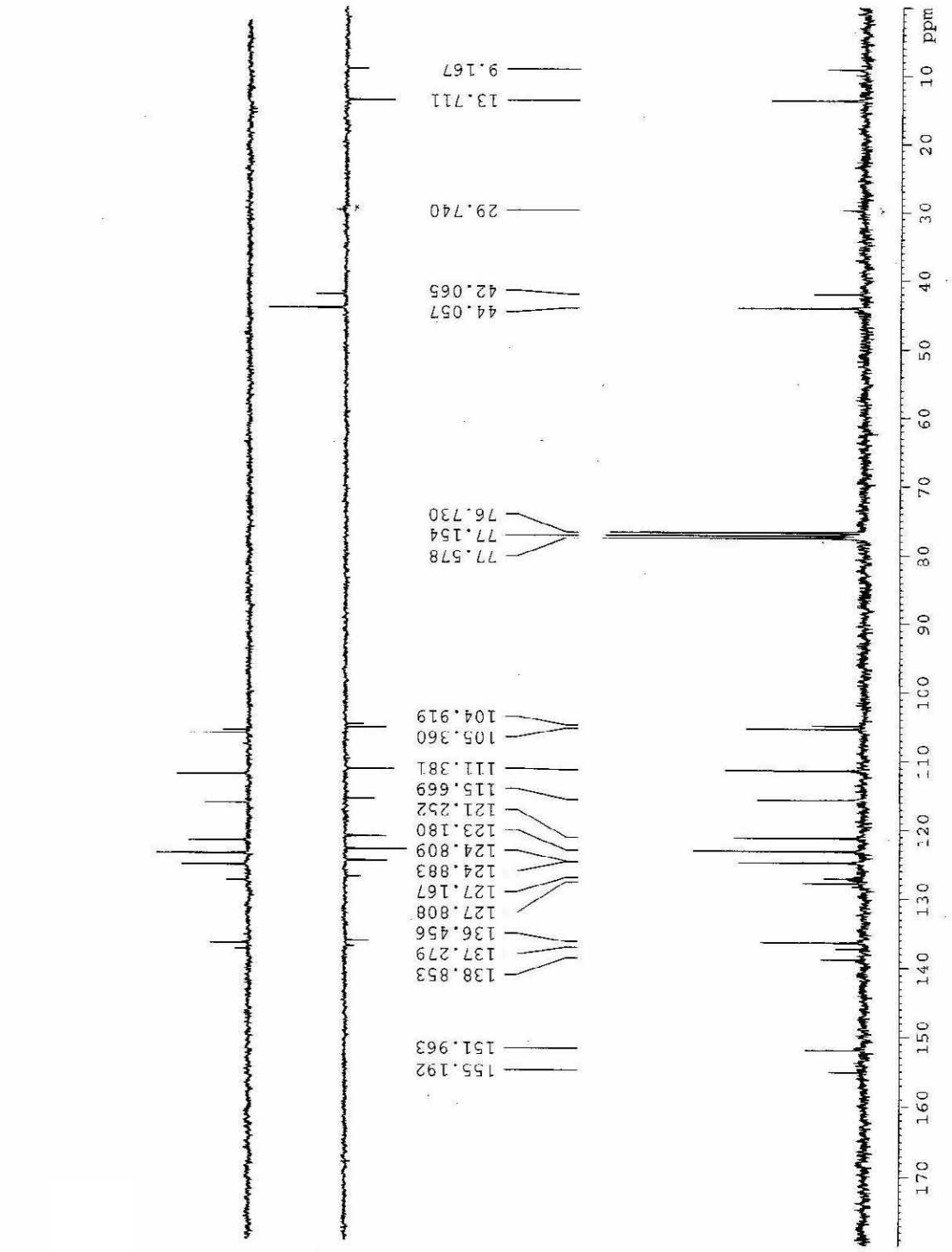




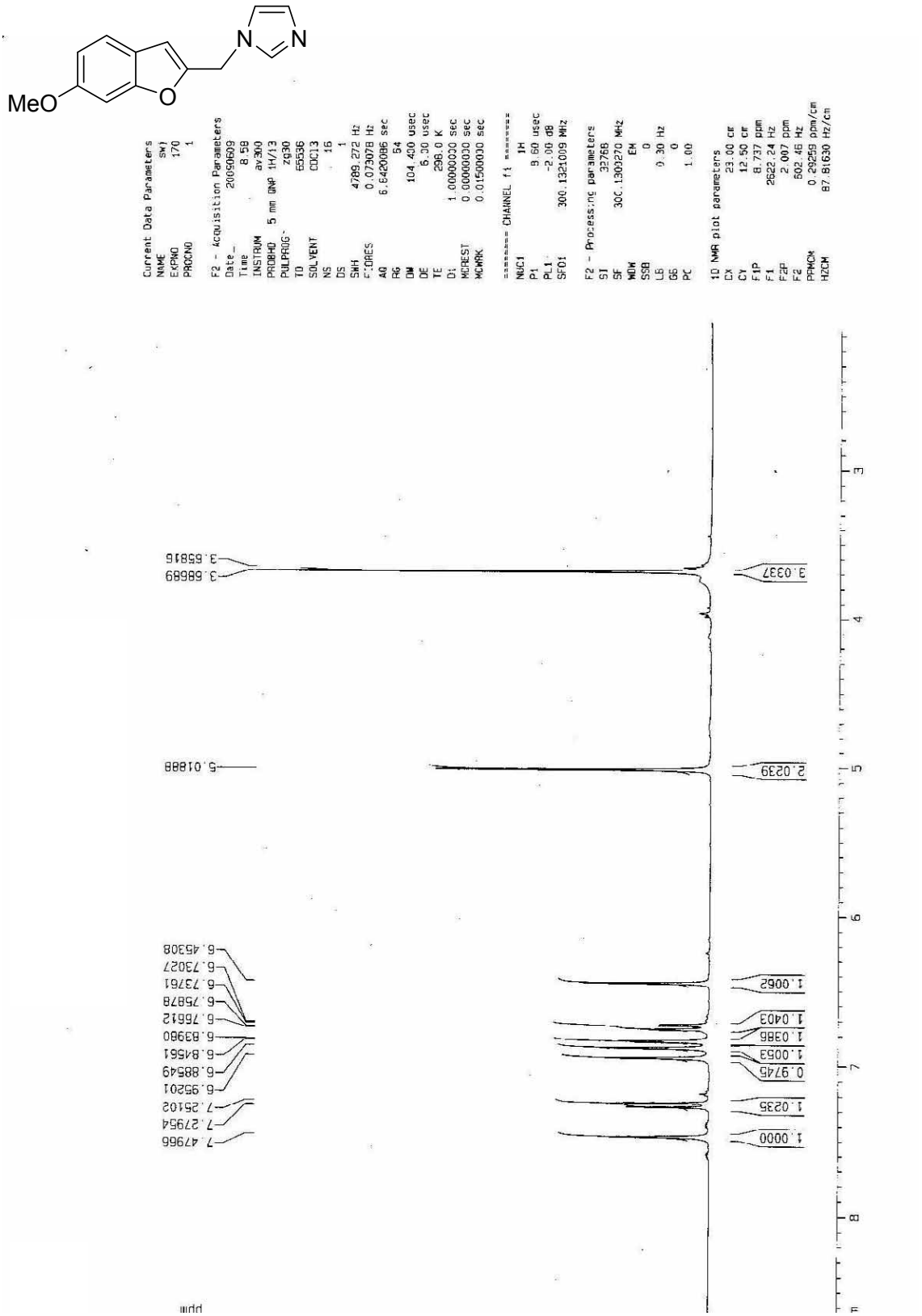
Compound **7** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

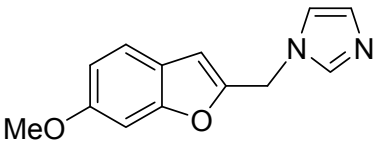


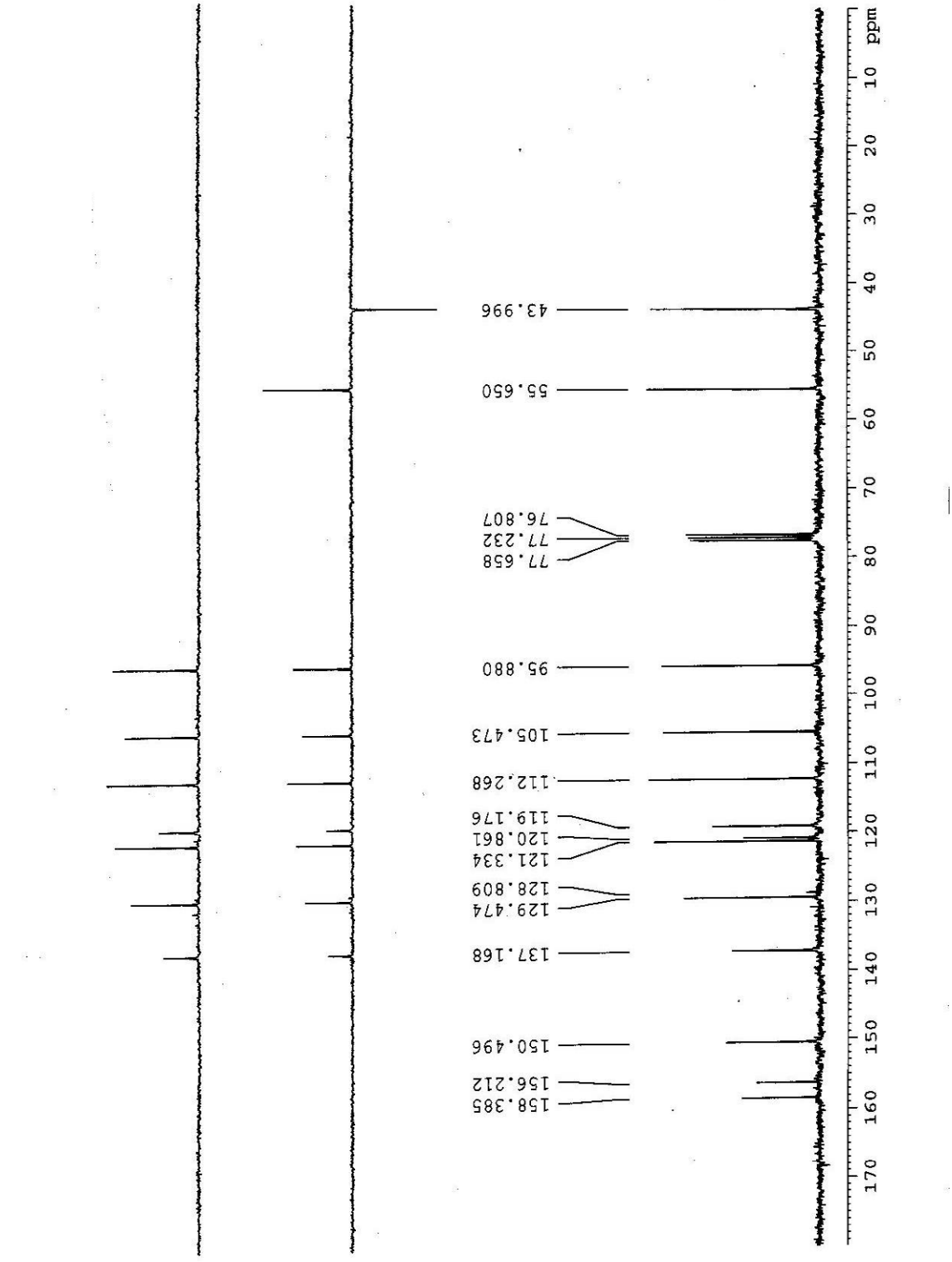




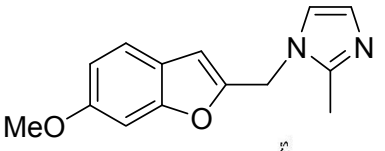
Compound **9** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

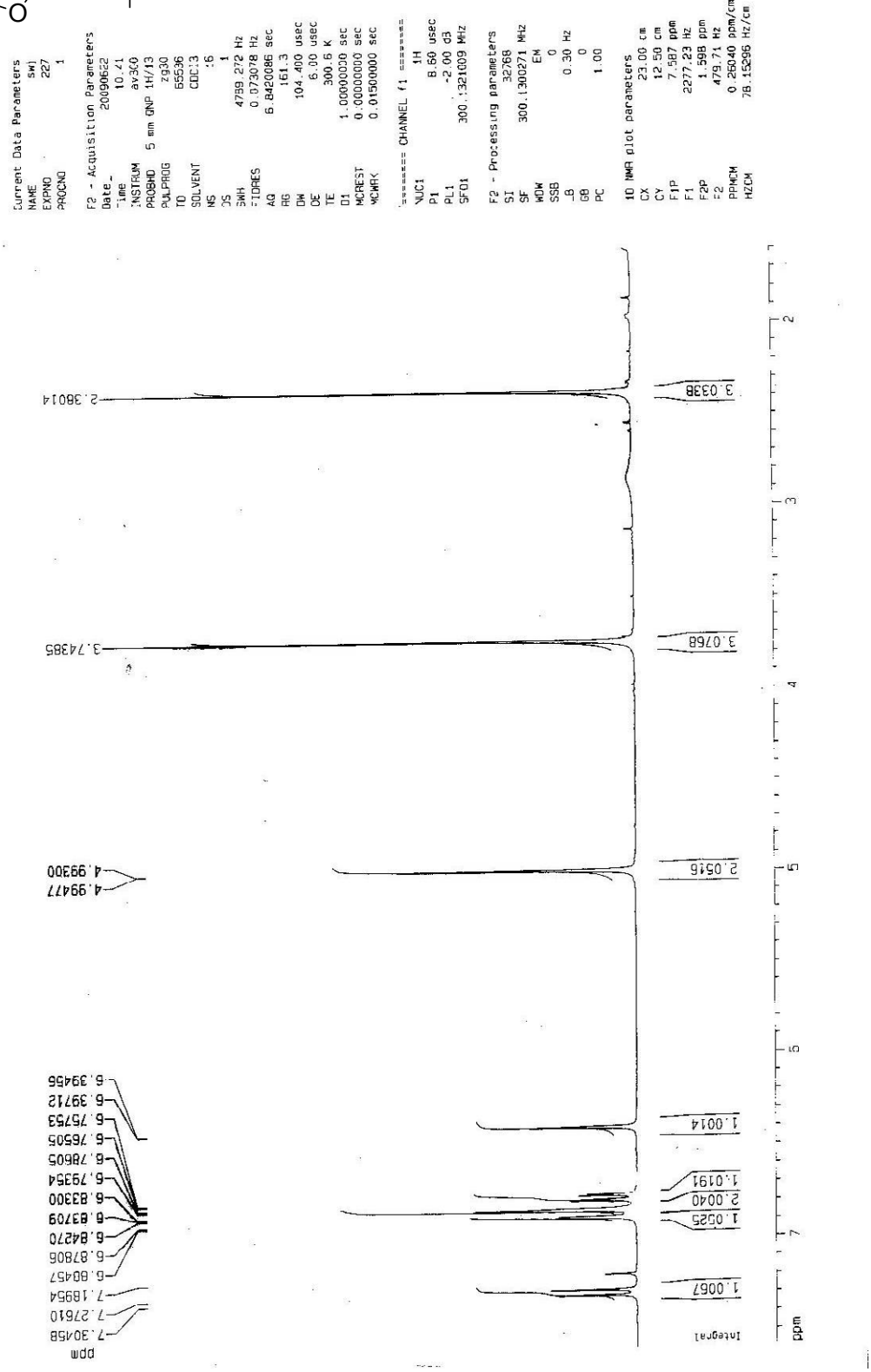


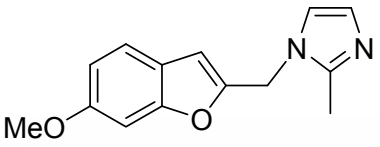


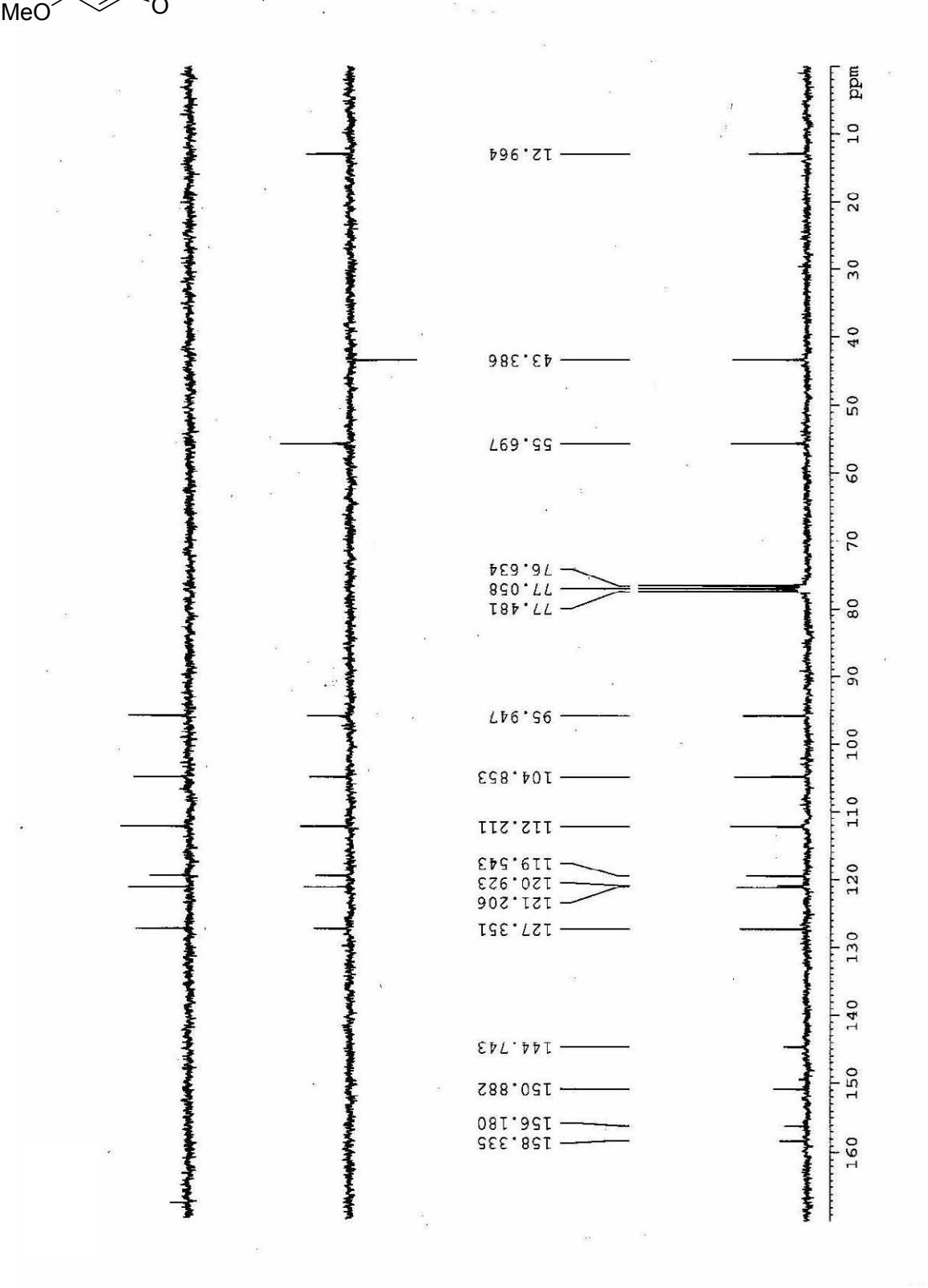


Compound **10** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

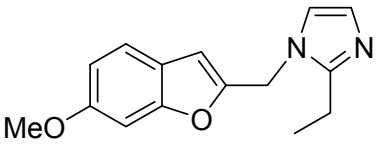


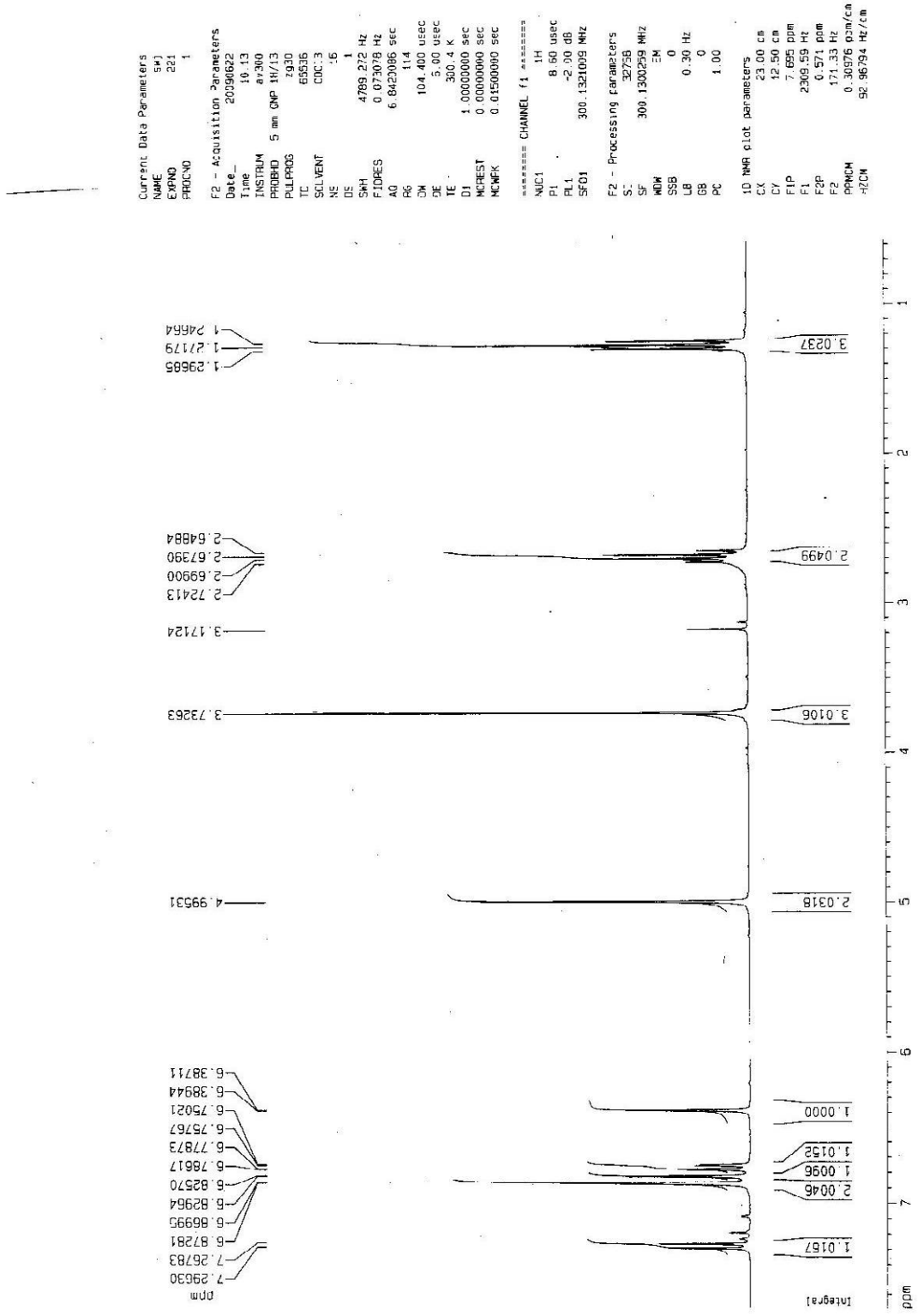


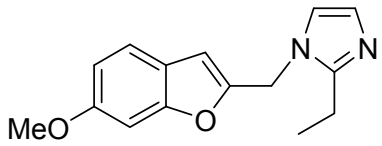


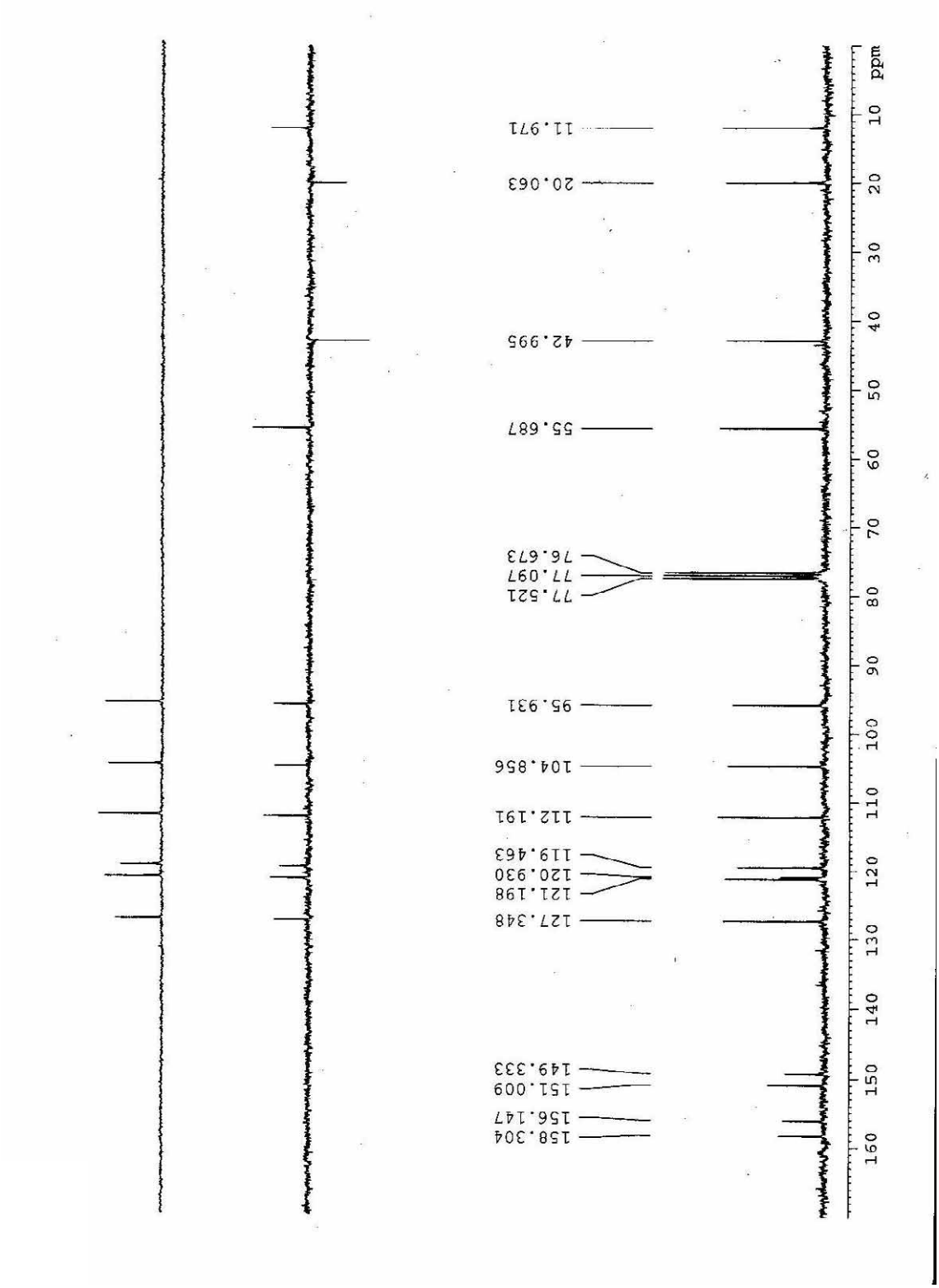


Compound **11** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

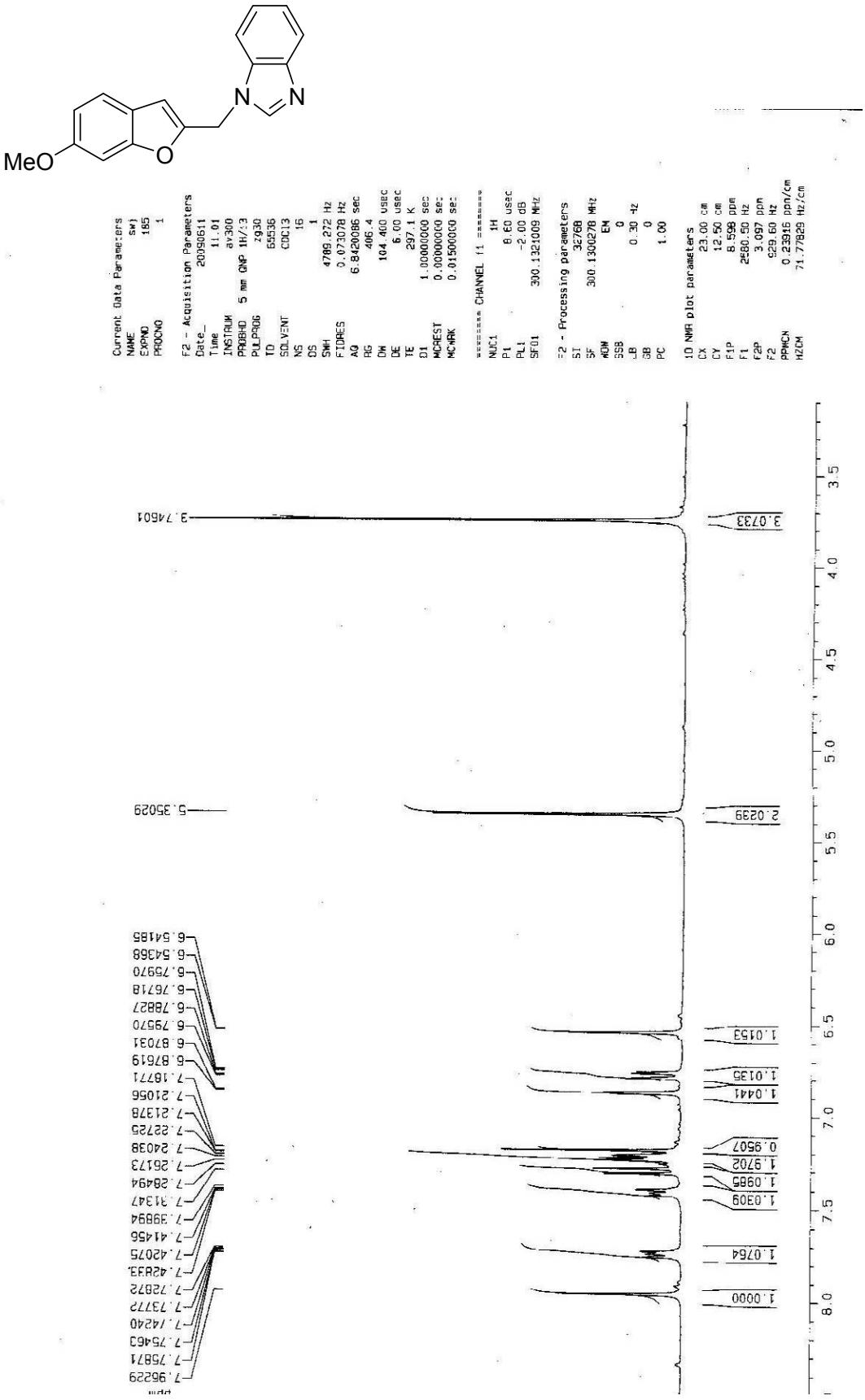


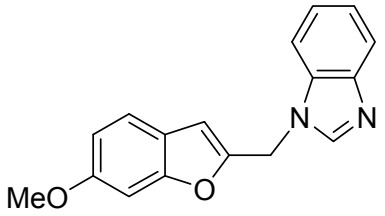


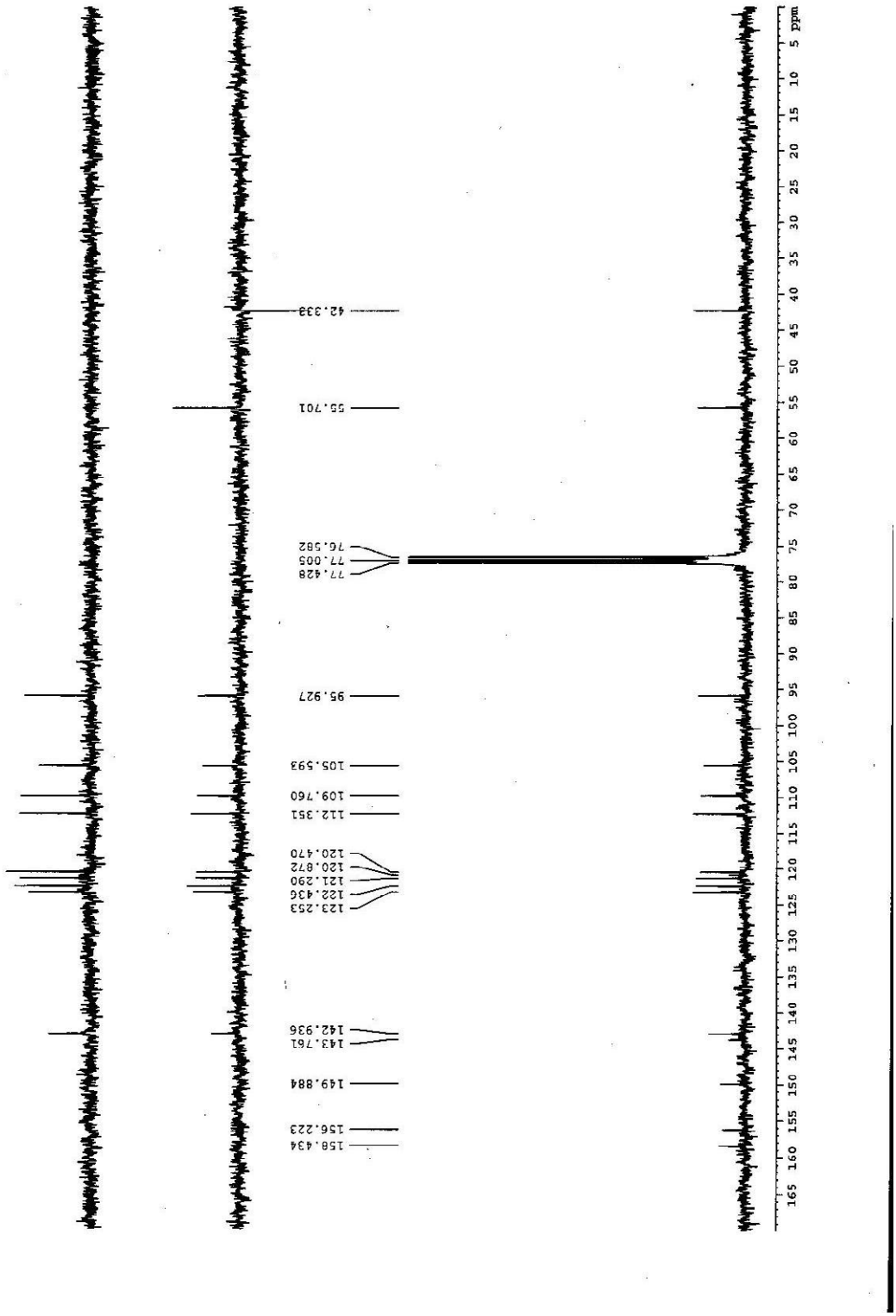




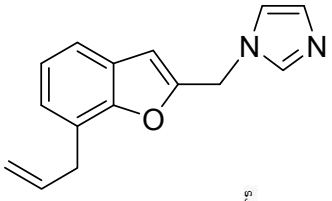
Compound **12** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

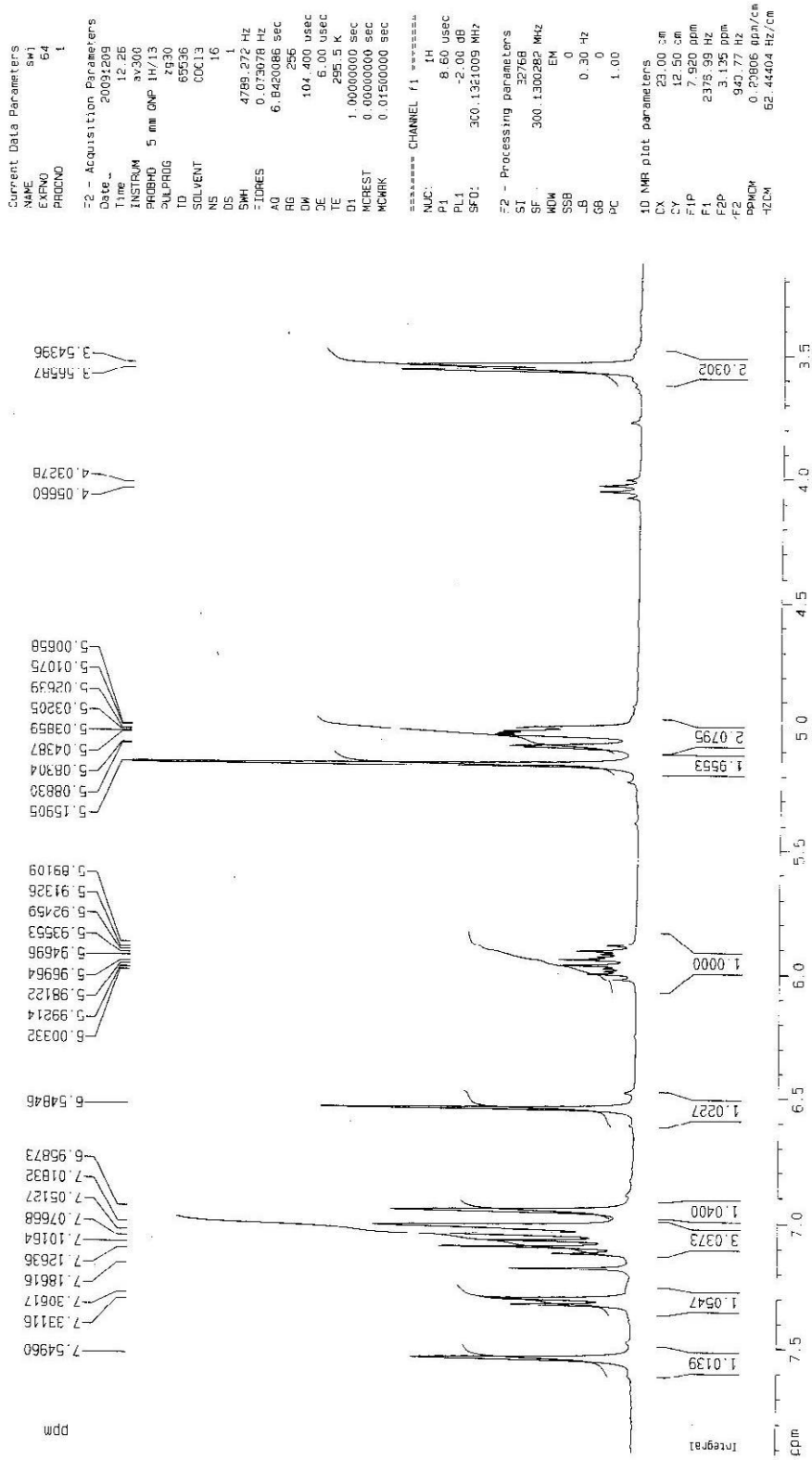


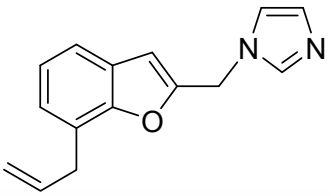


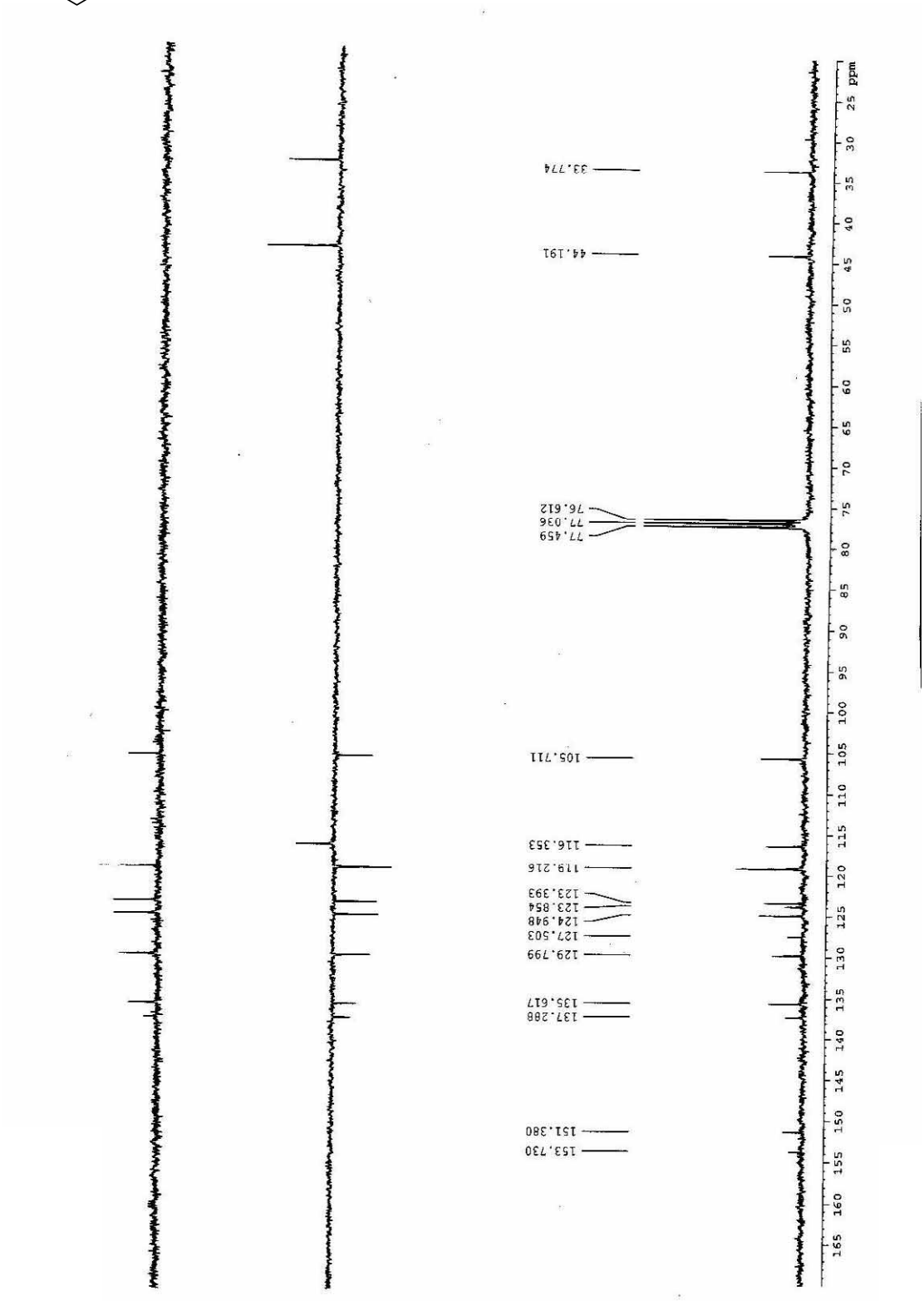


Compound **13** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

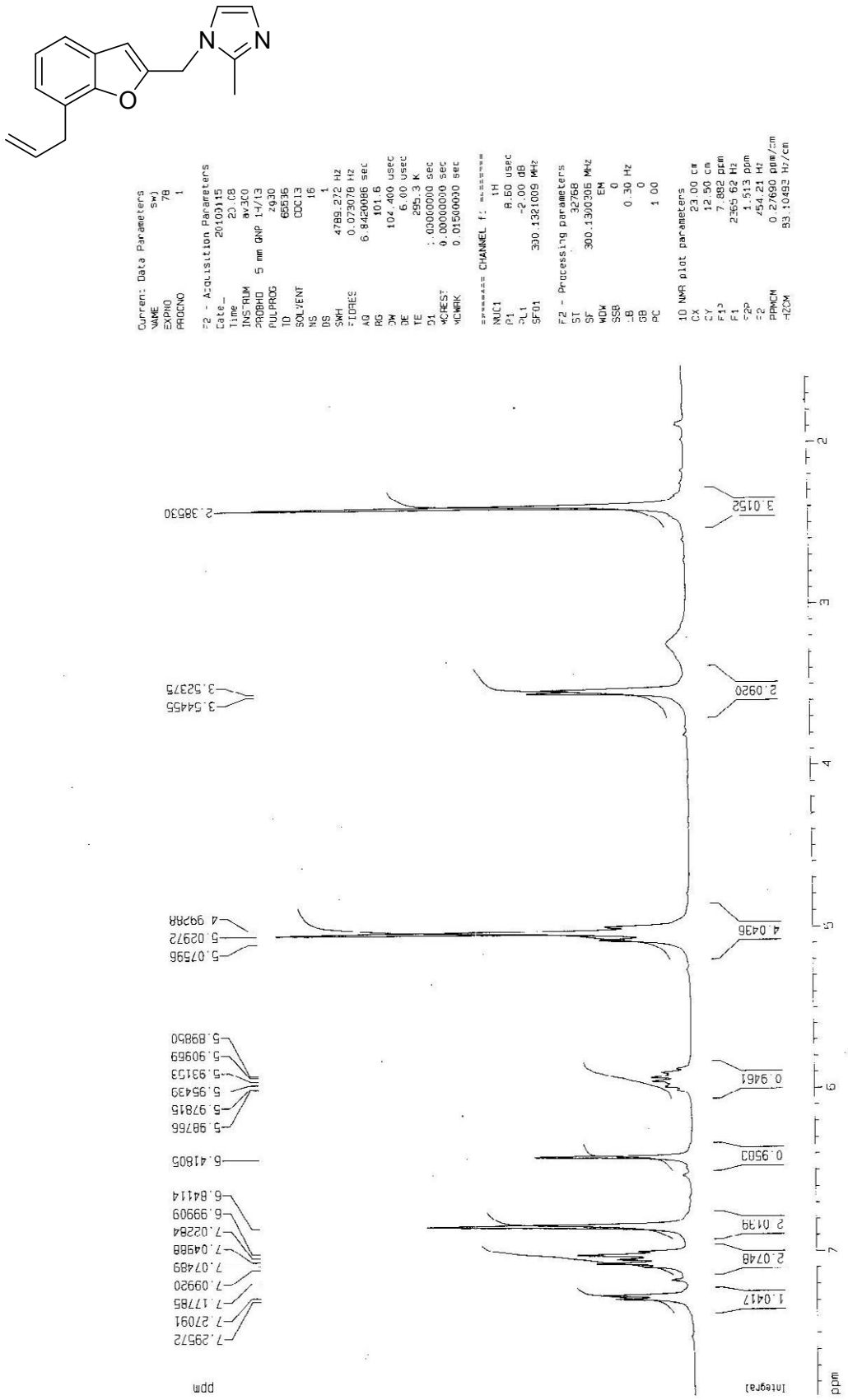


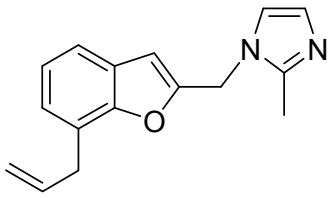


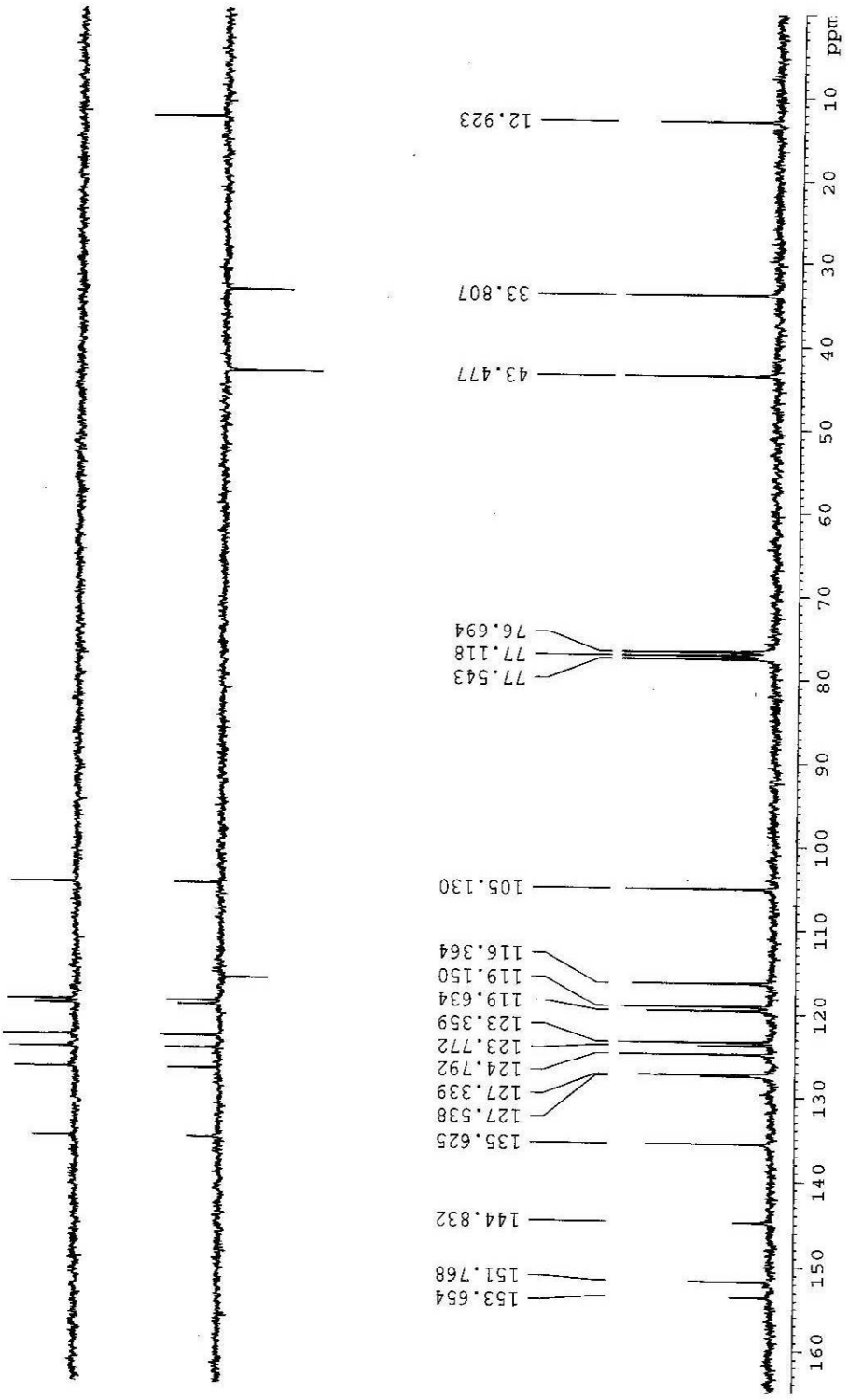




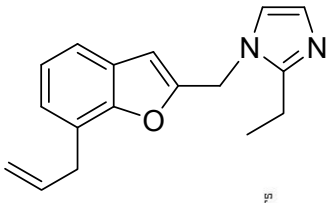
Compound **14** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

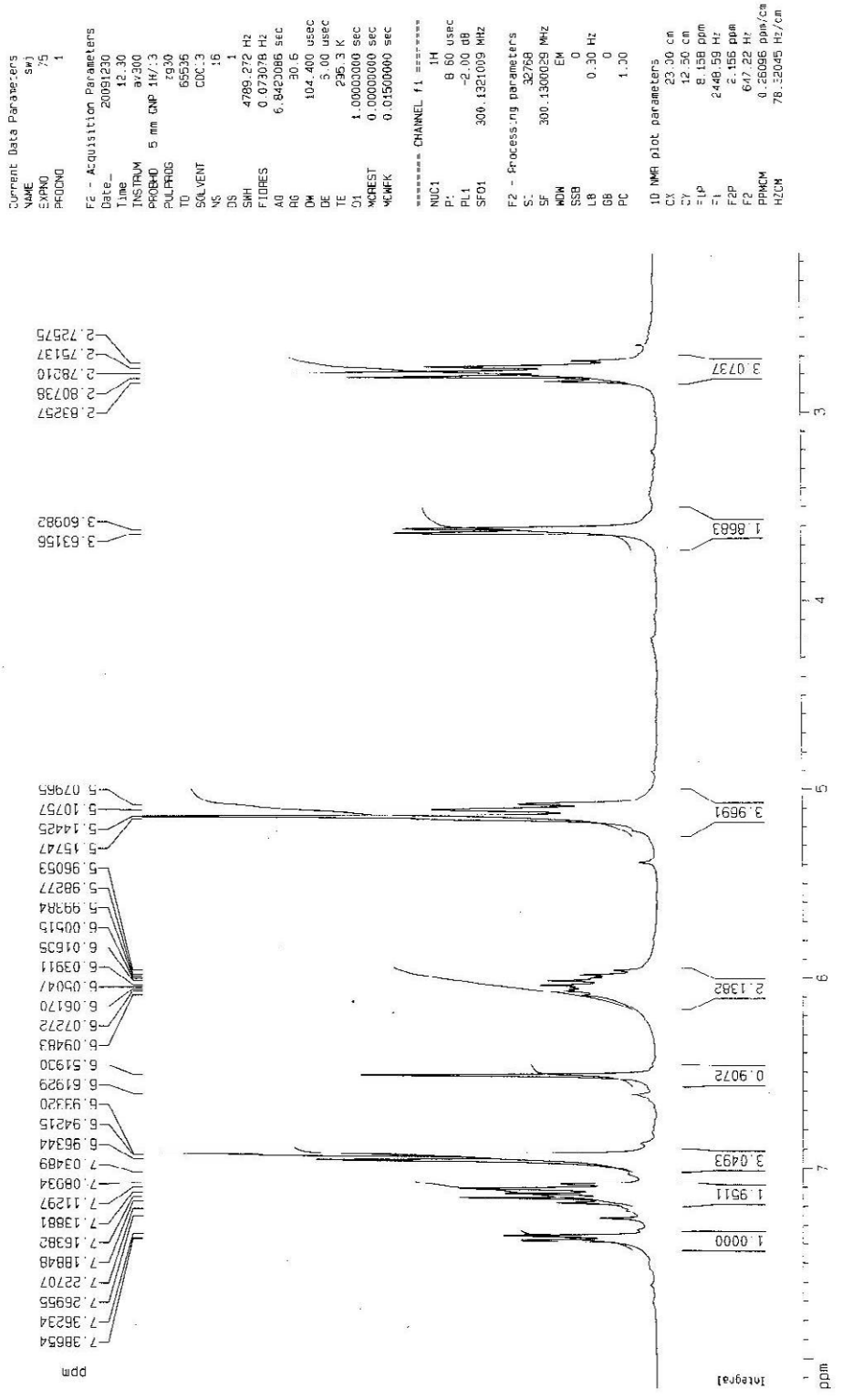


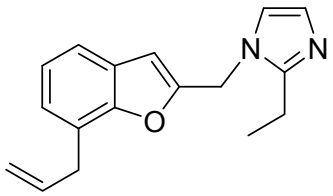


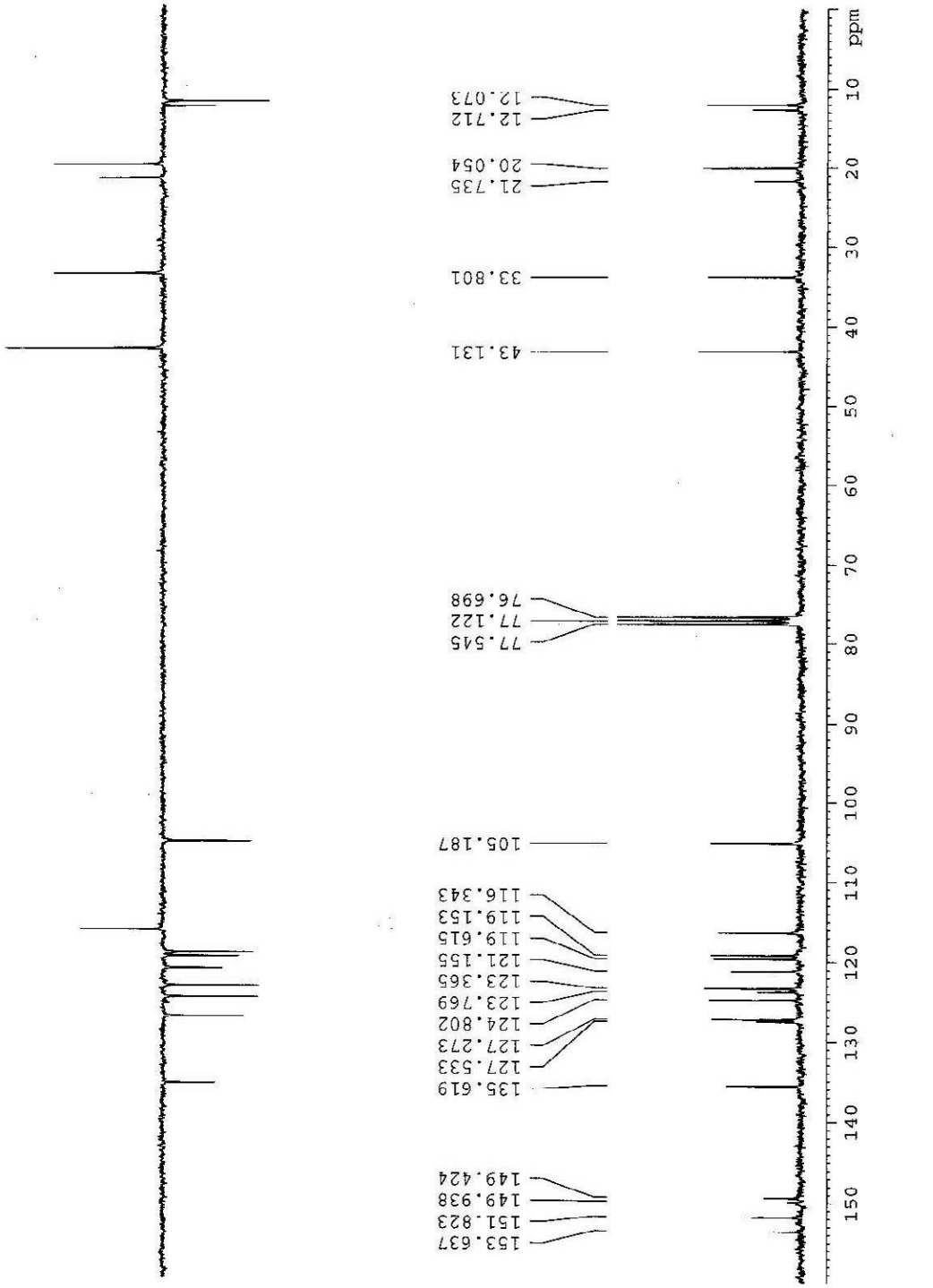


Compound **15** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

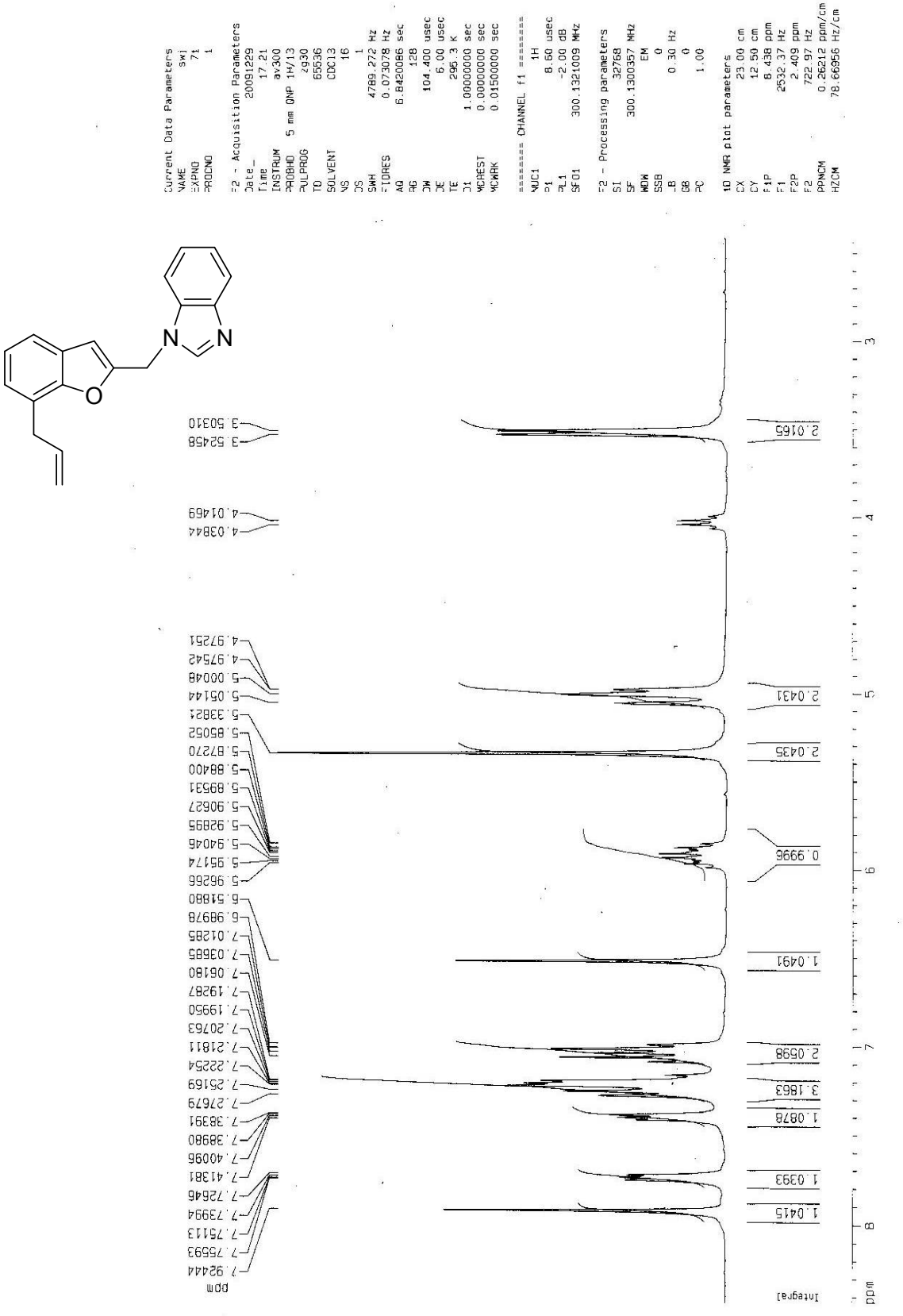


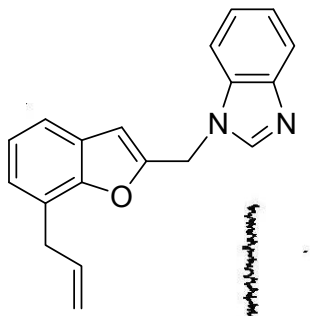


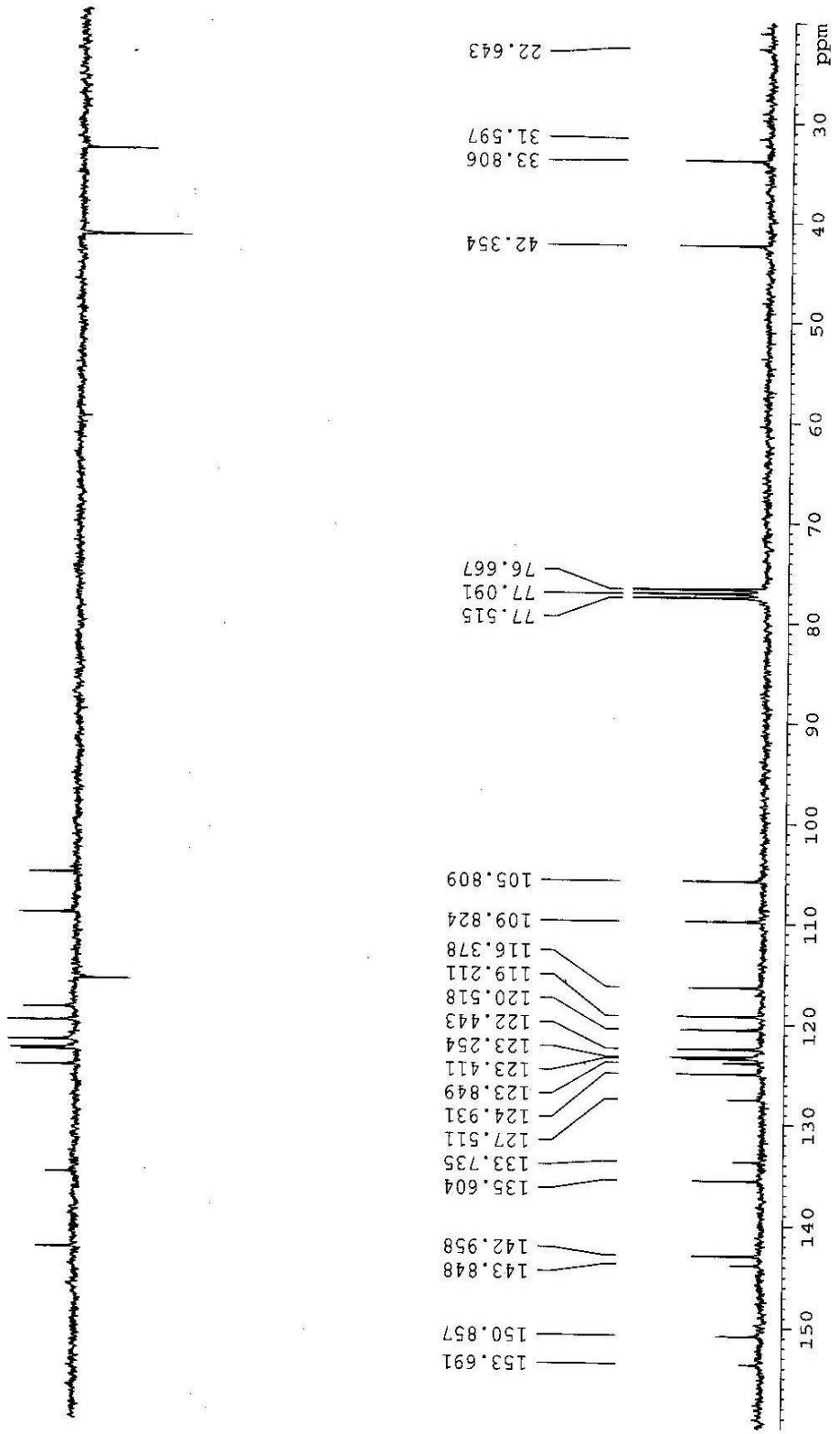




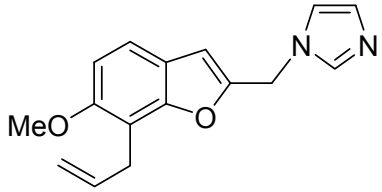
Compound **16** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

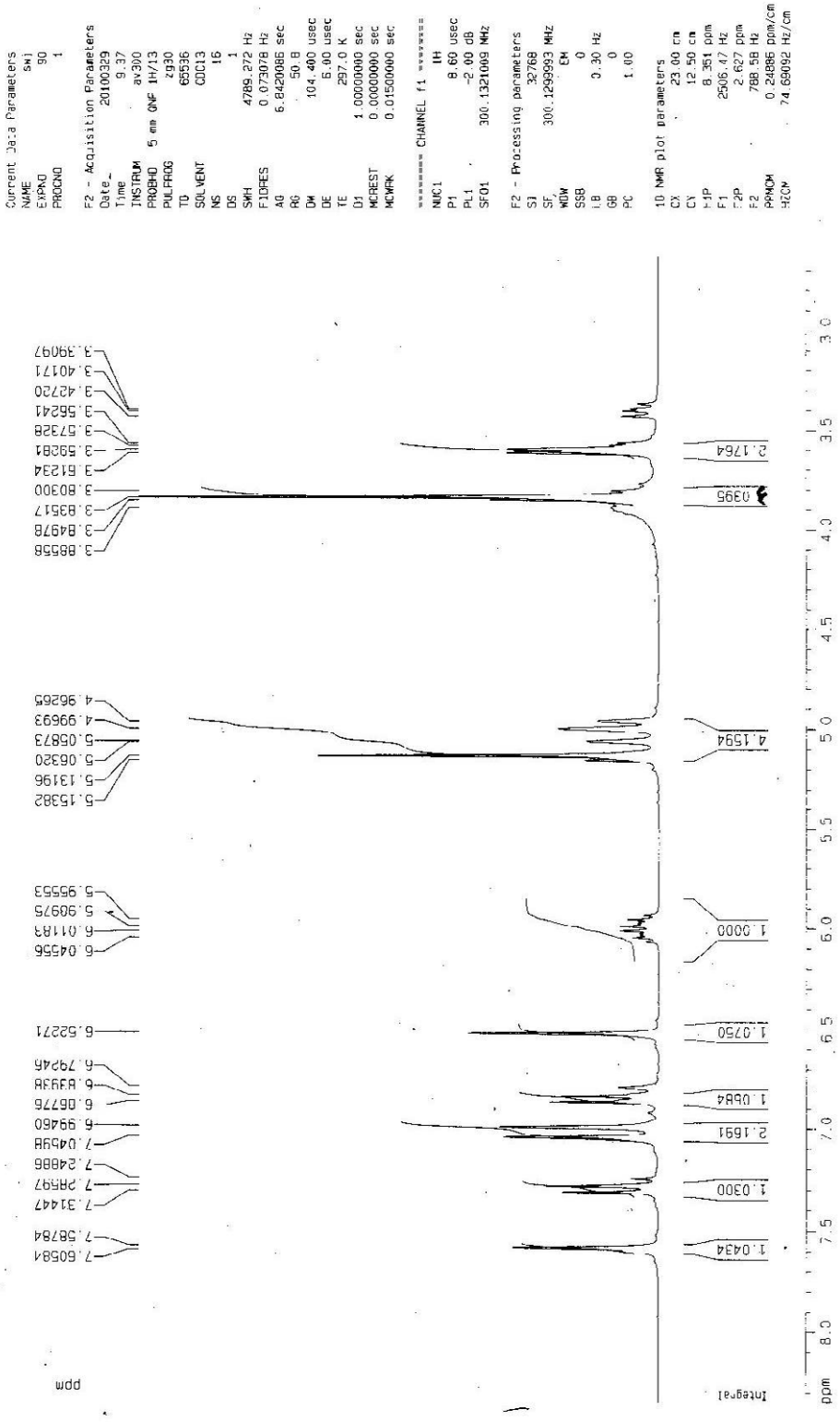


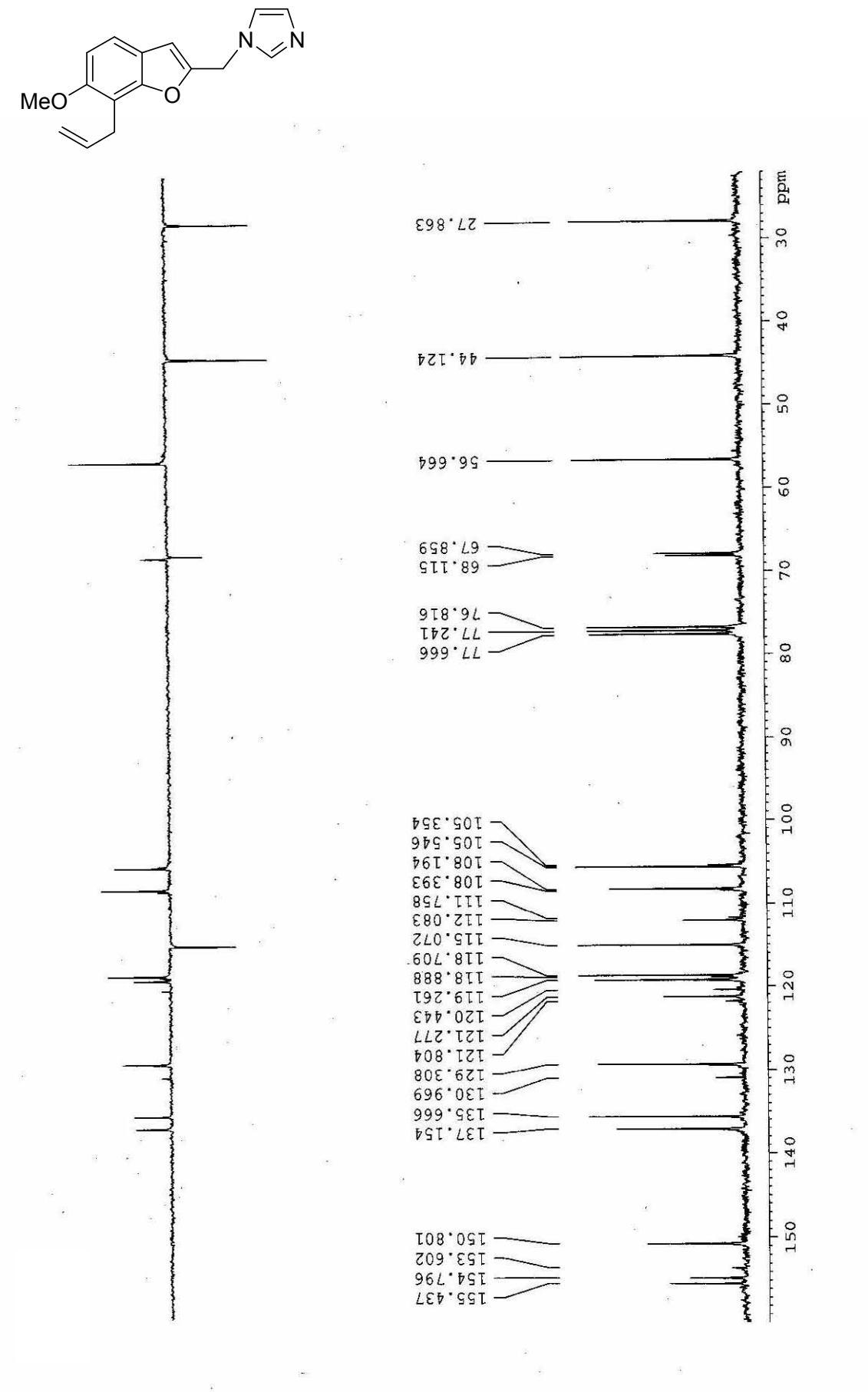




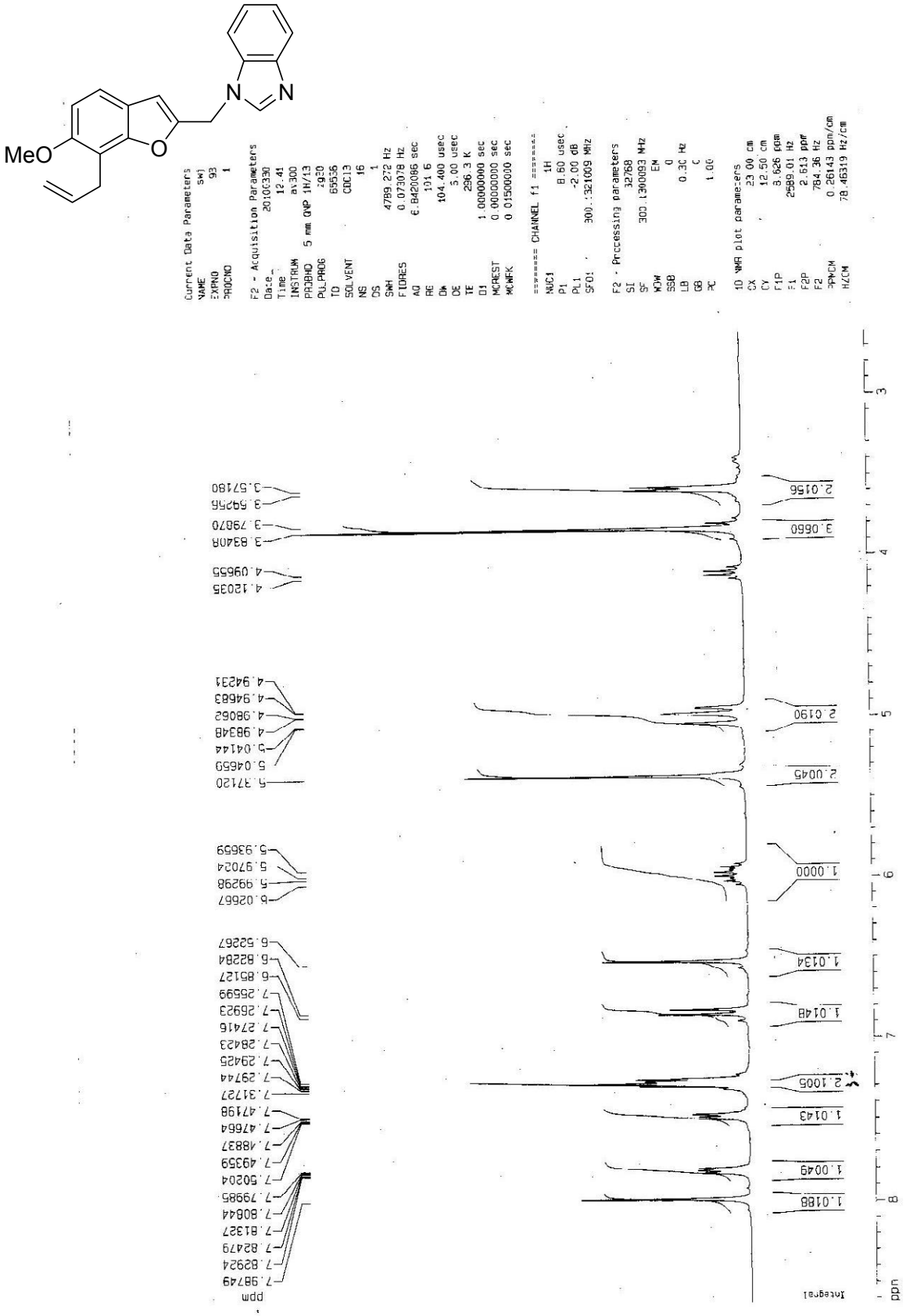
Compound **17** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

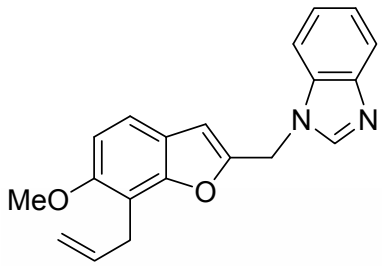


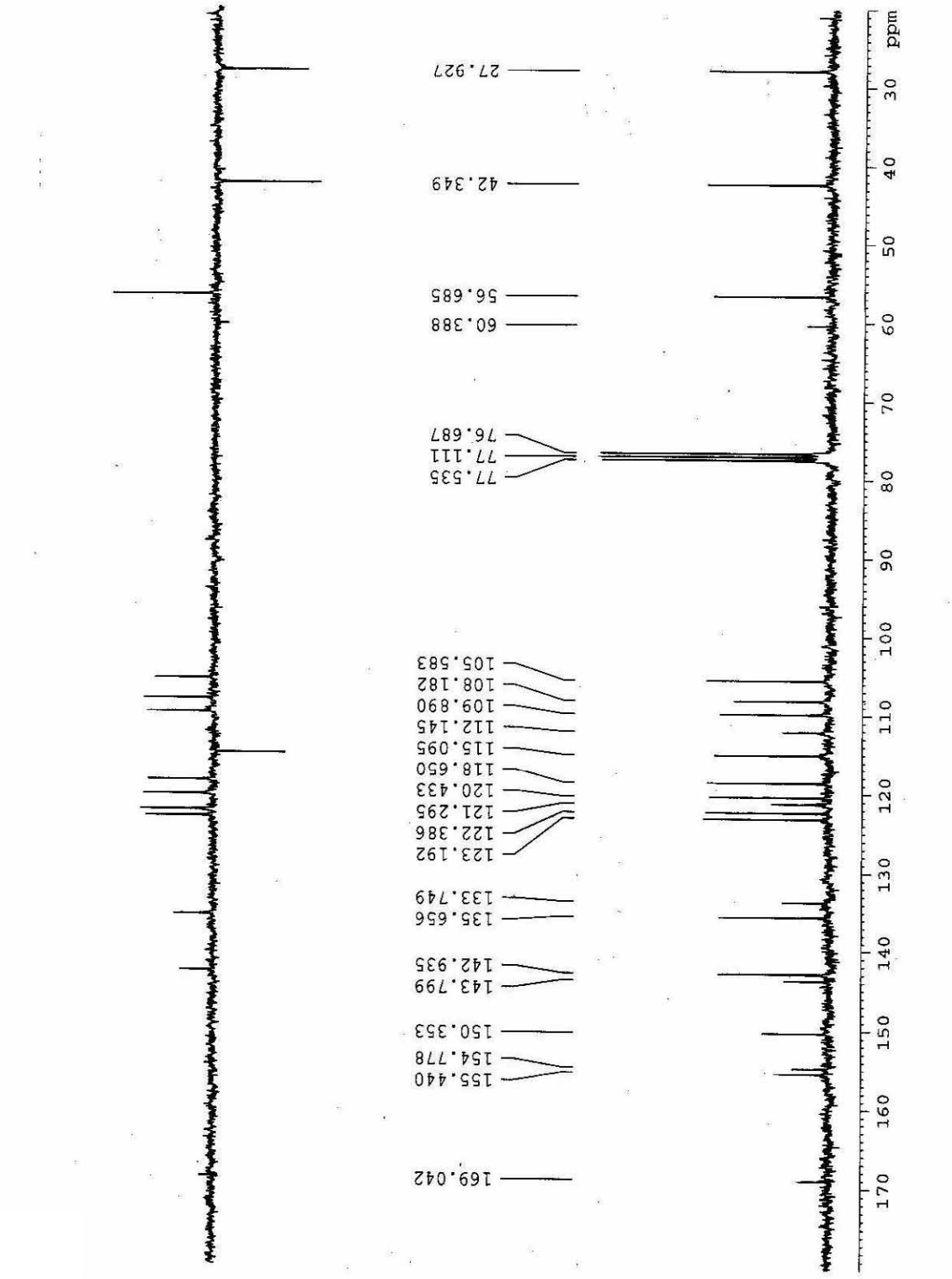




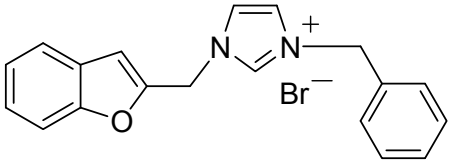
Compound **18** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

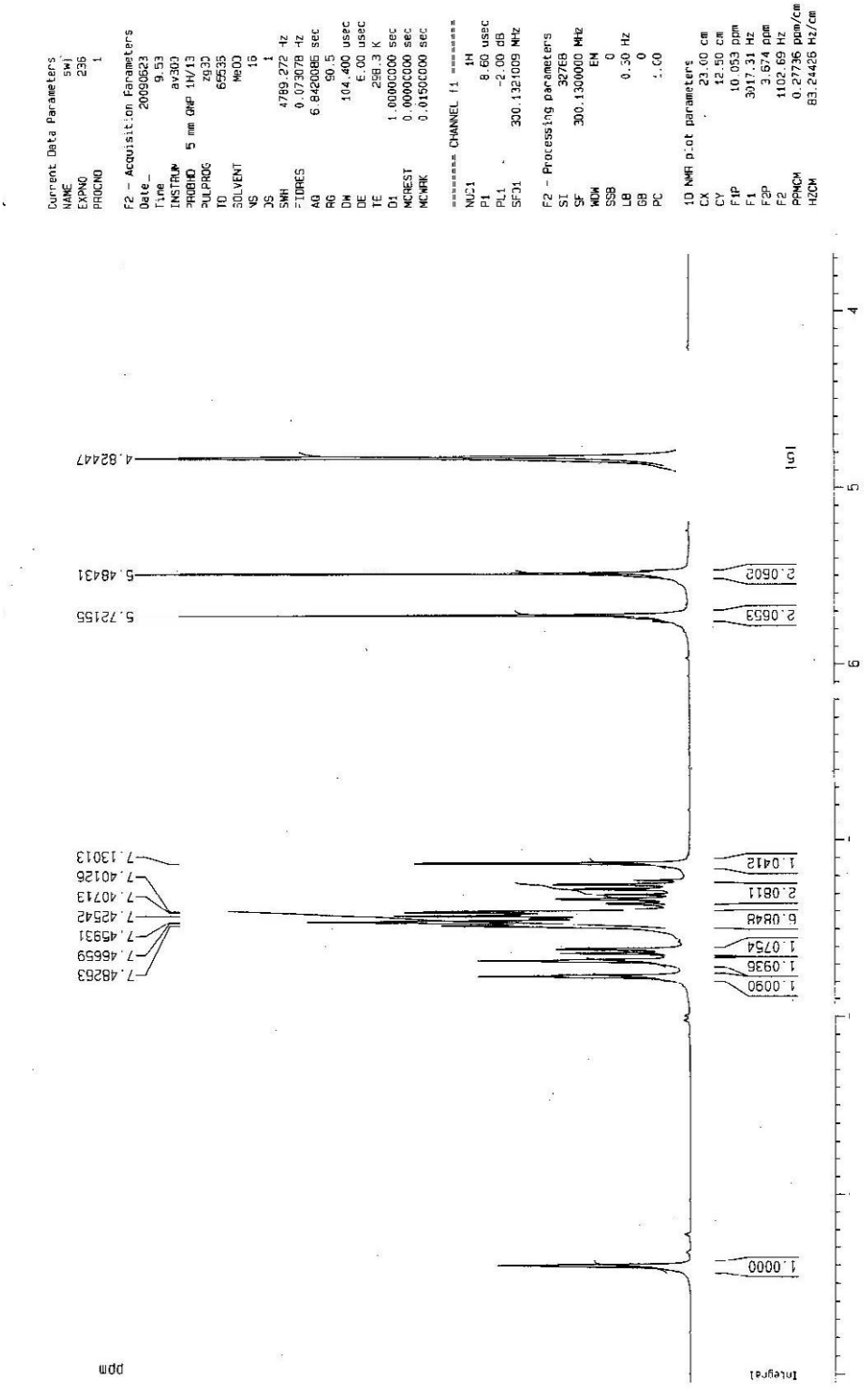


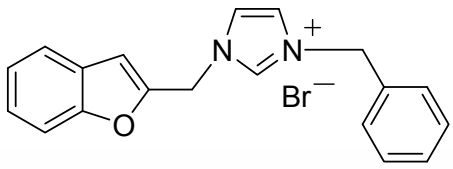


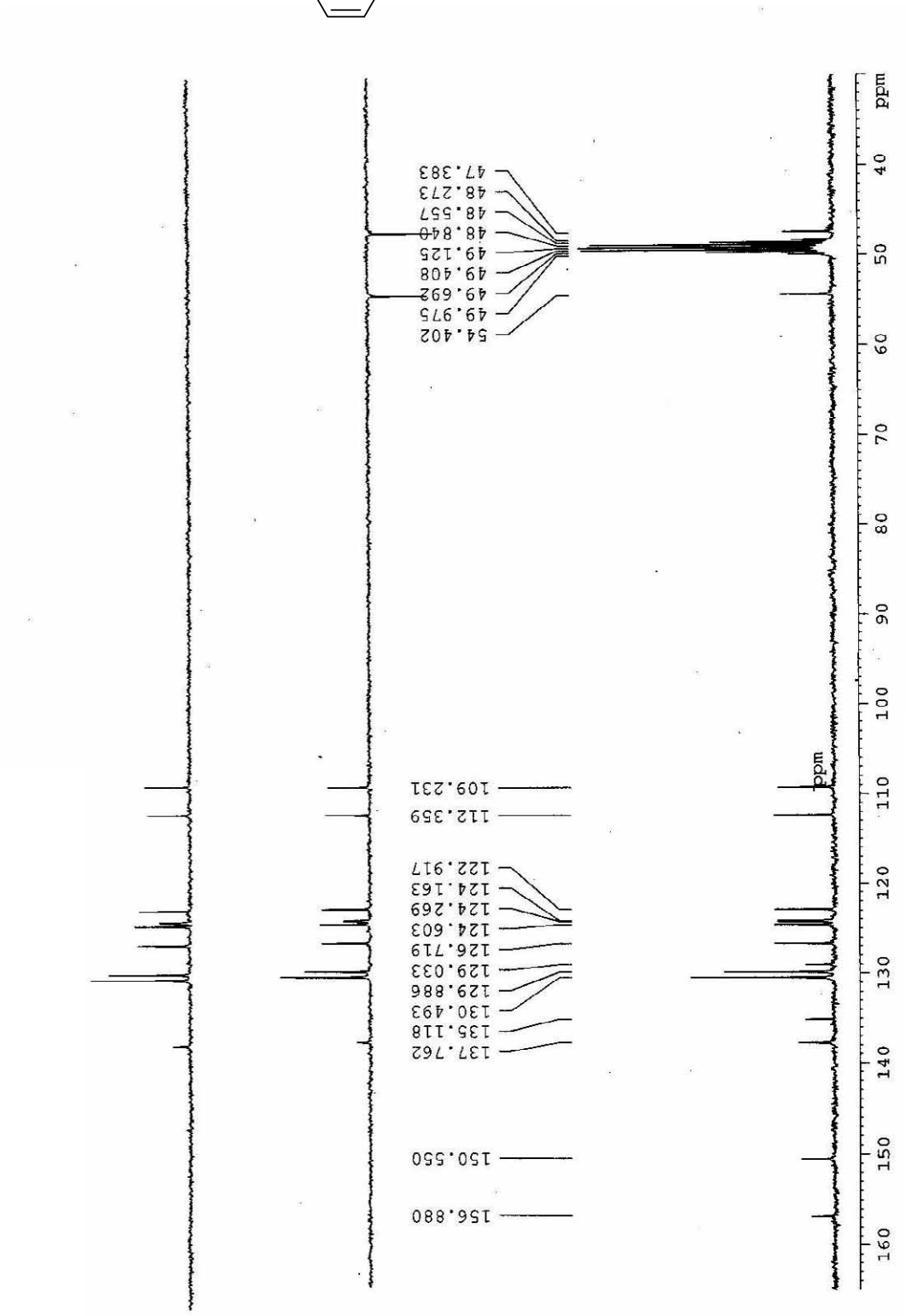


Compound **19** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

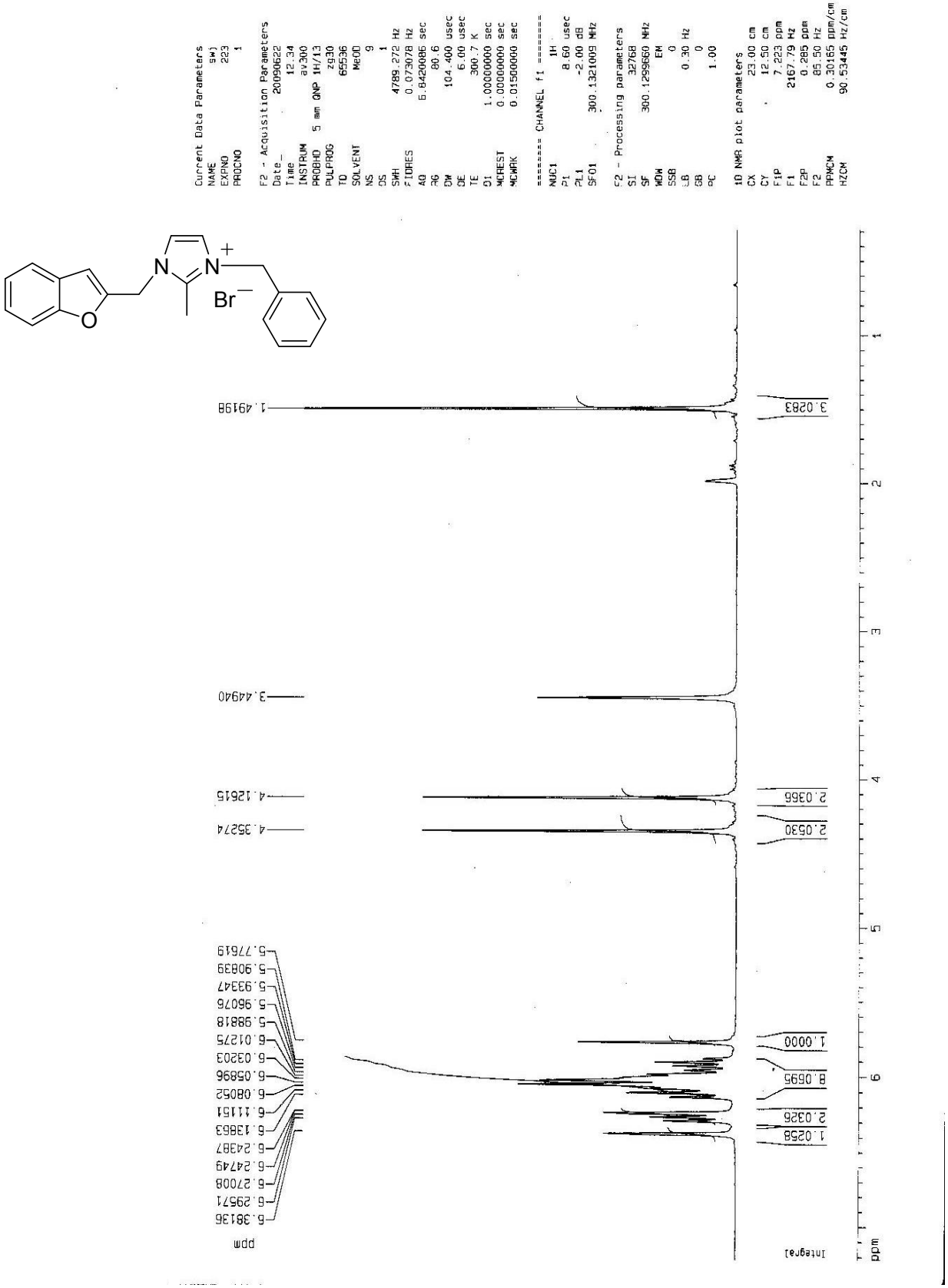


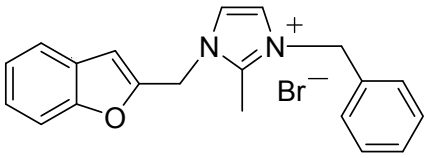


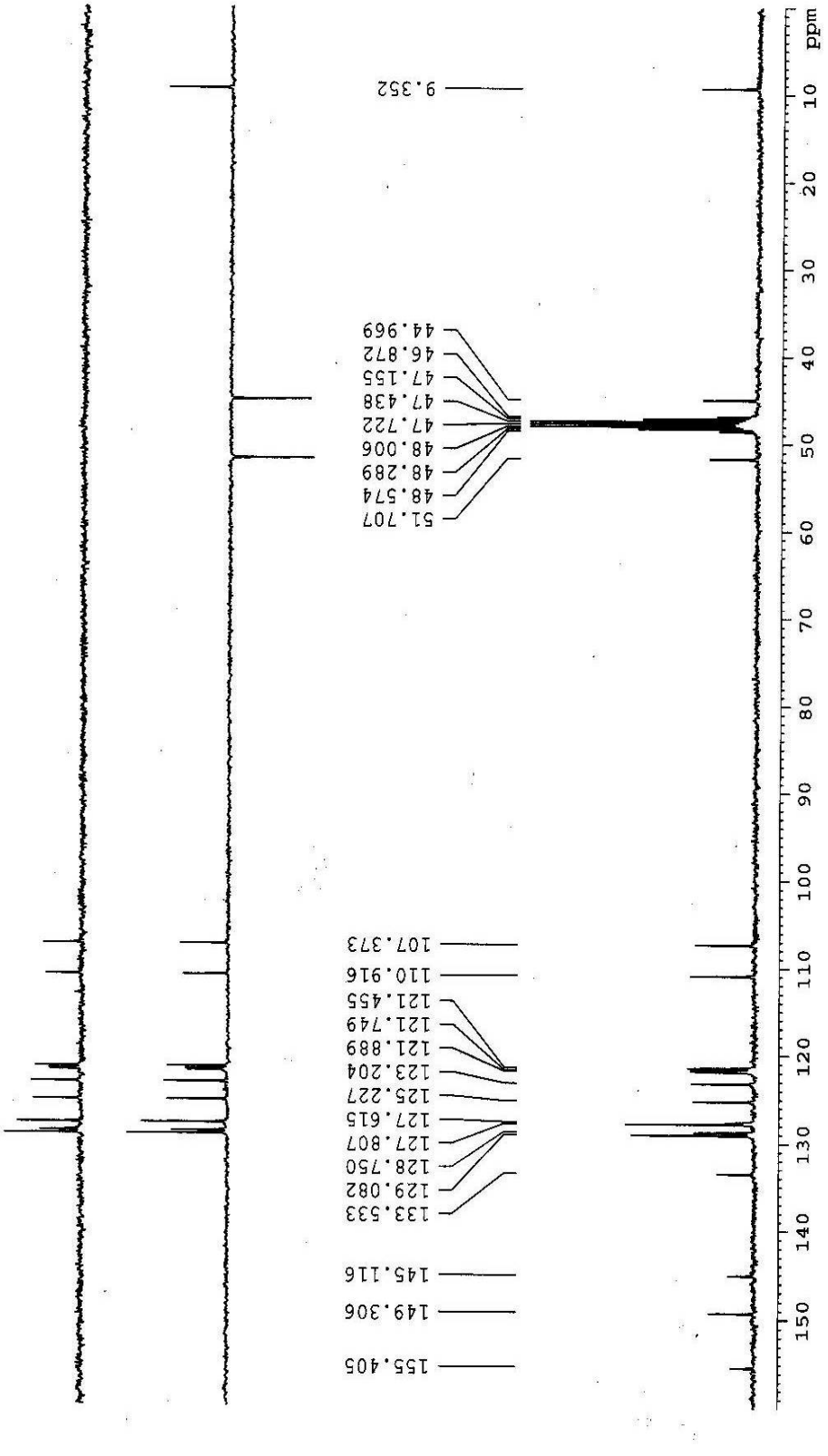




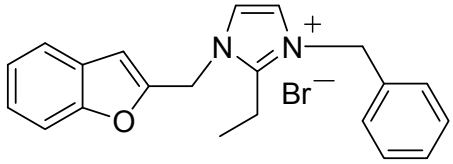
Compound **20** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

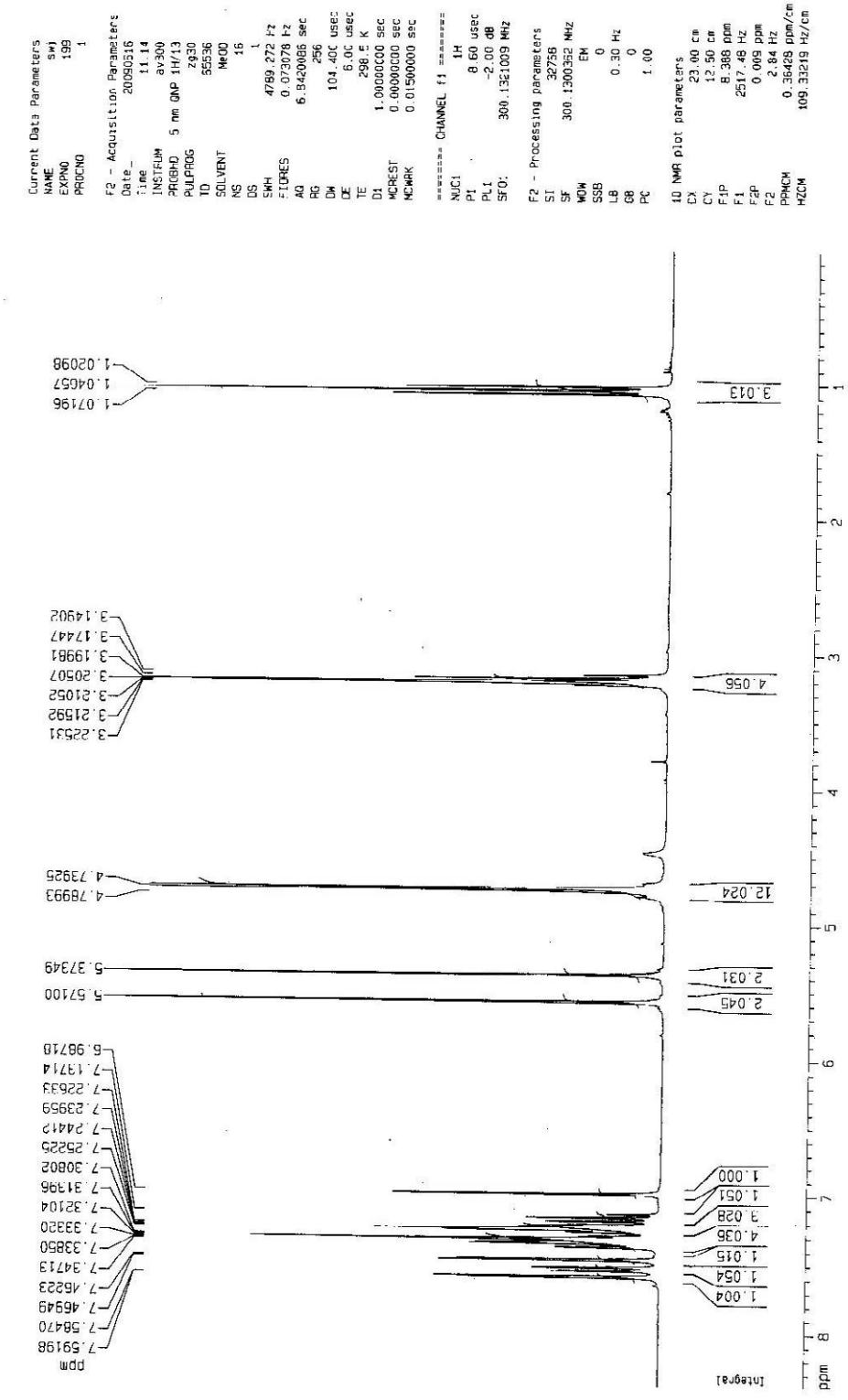


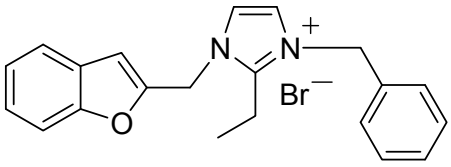


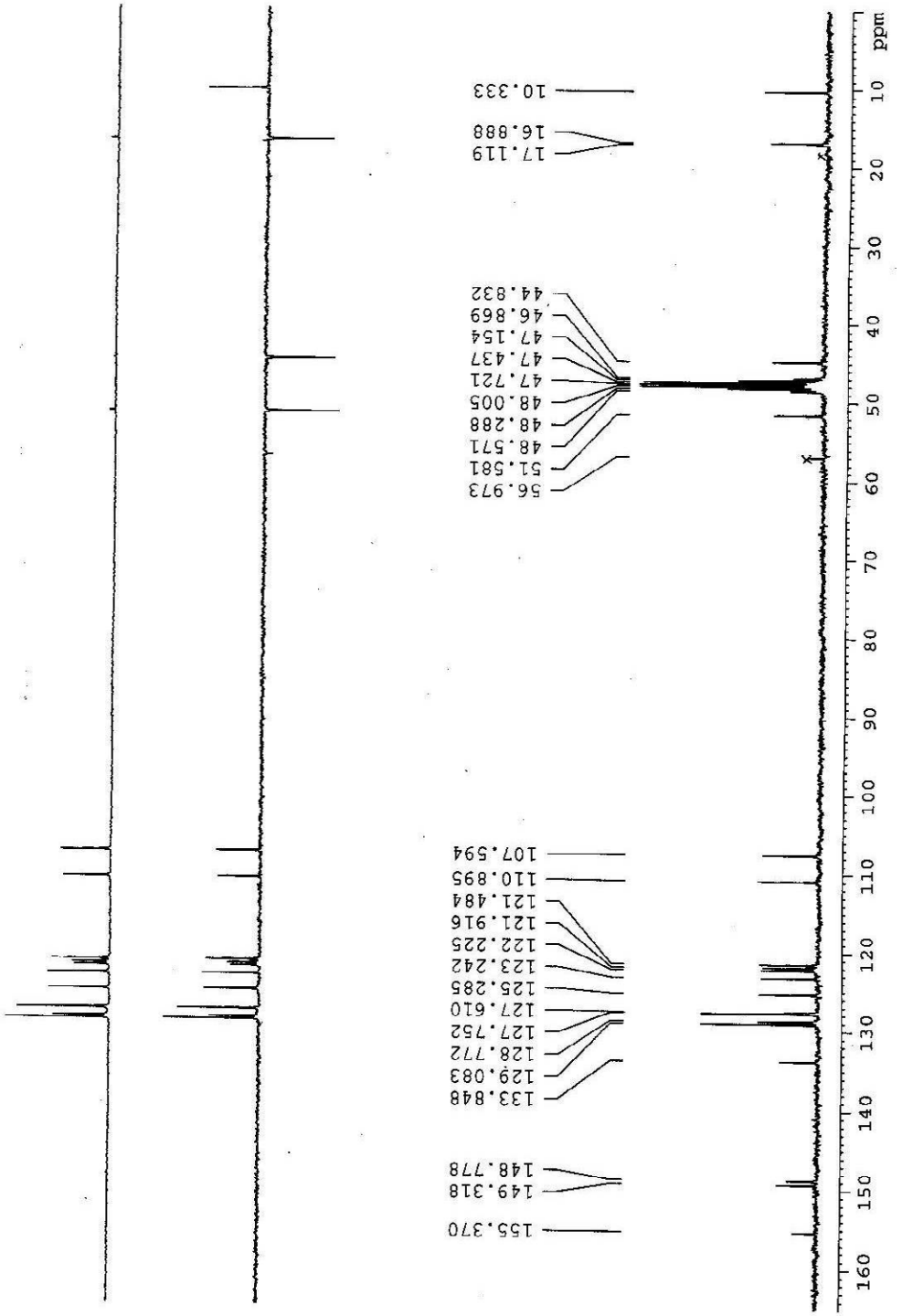


Compound **21** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*

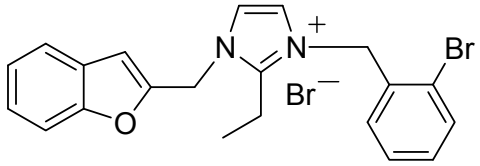


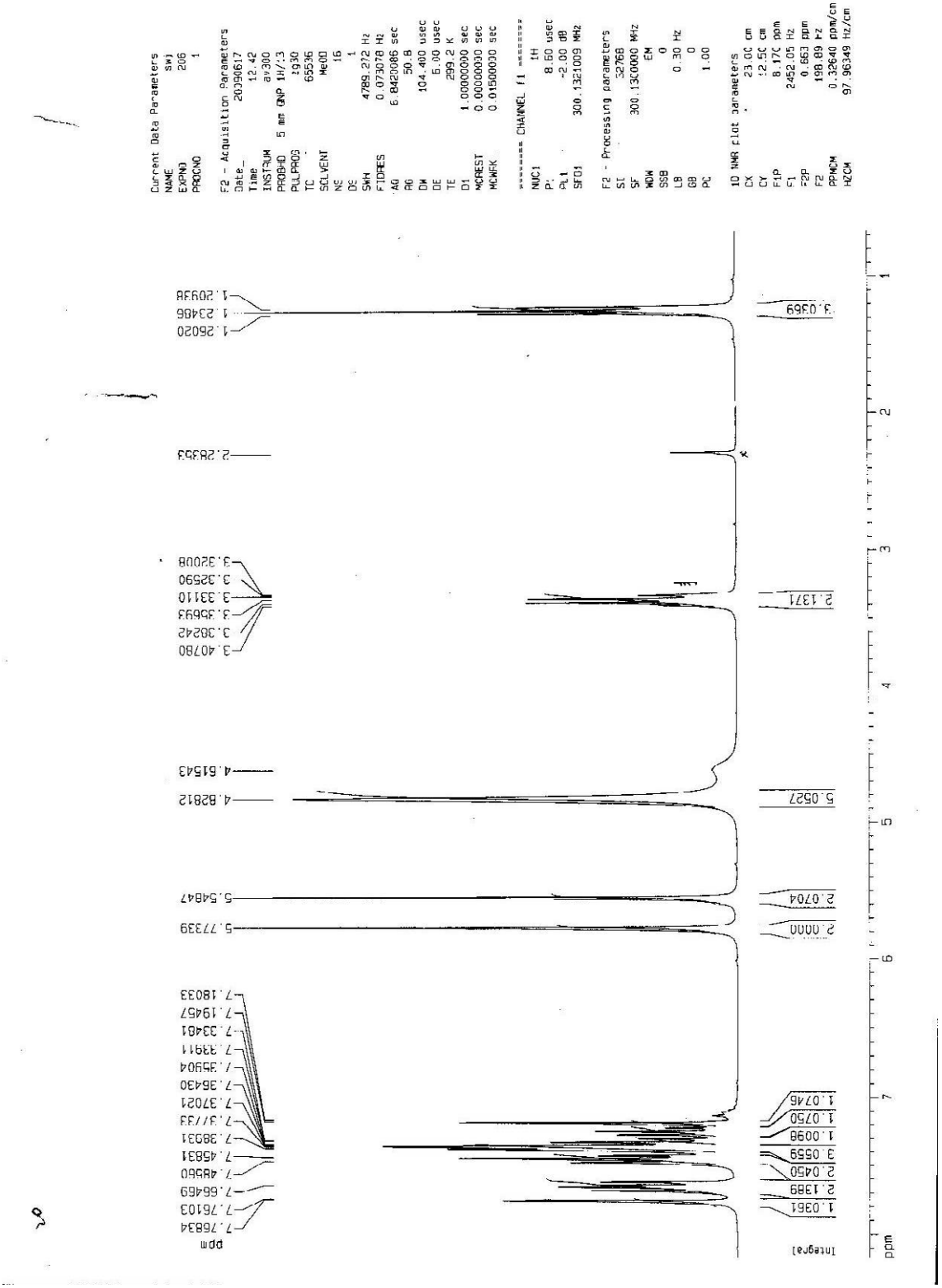


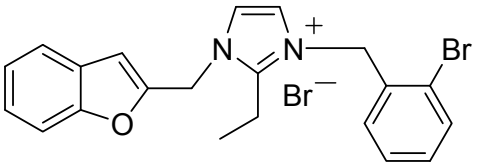


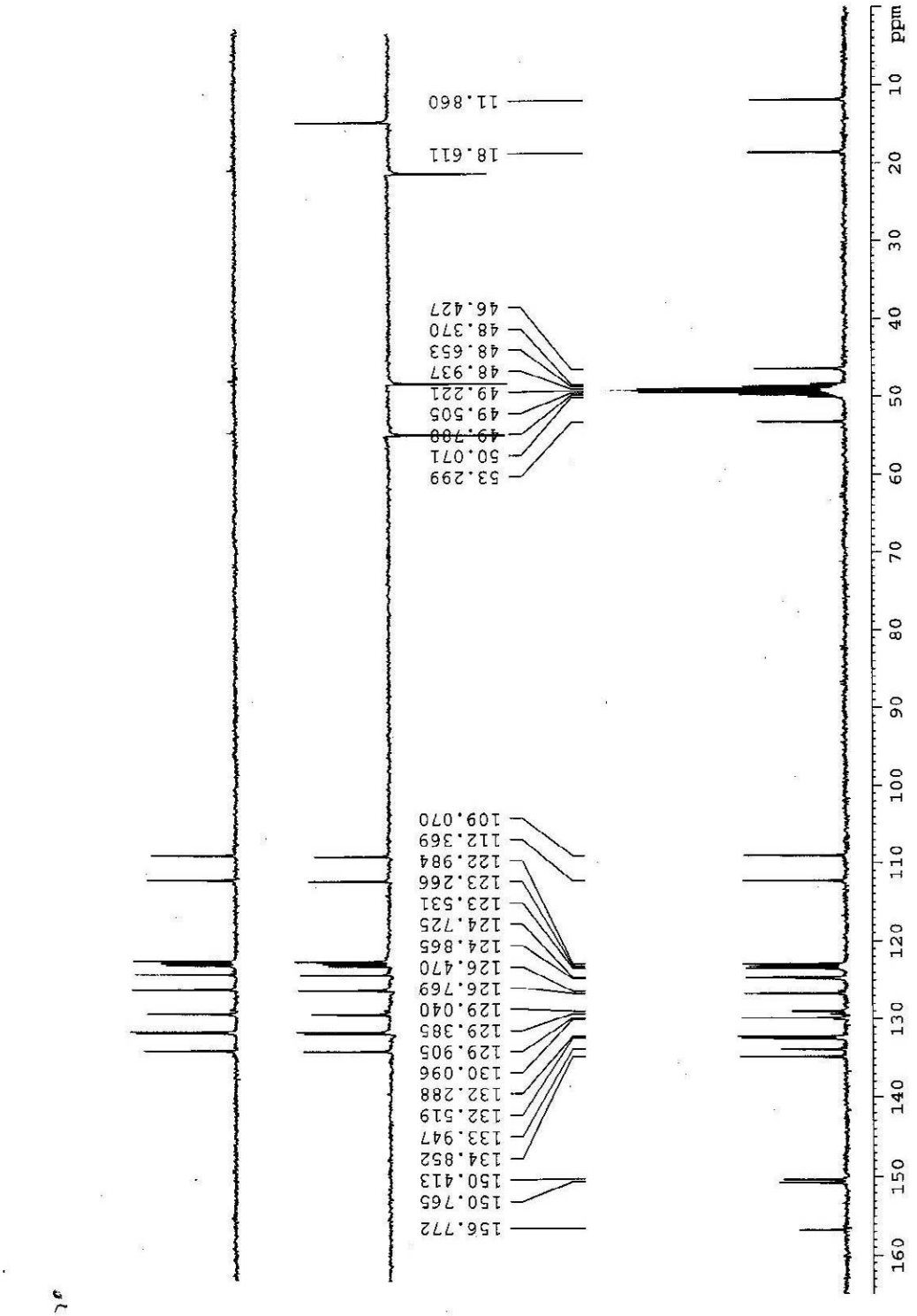


Compound **22** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*






N
N
+
Br
Br⁻
O


11.860
18.611
46.427
48.370
48.653
48.937
49.221
49.505
49.788
50.071
53.299
109.070
112.369
122.984
123.266
123.531
124.725
124.865
126.470
126.769
129.040
129.385
129.905
130.096
132.288
132.519
133.947
134.852
150.413
150.765
156.772
ppm

Compound **23** *^{1}H NMR (300 MHz) and ^{13}C NMR (75 MHz)*