

Supporting Information for

Straightforward Assembly of Phenylimidazoquinoxalines *via* a One-Pot Two Step MCR Process

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General remarks.

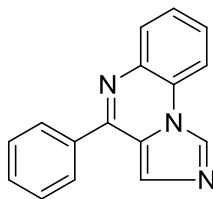
Solvents were purchased from Aldrich or Acros and used without further purification. Other reagents were used as obtained from commercial providers except when otherwise noted. Analytical thin layer chromatography (TLC) was performed on pre-coated silica gel plates available from EMD. Visualization was accomplished with UV light or by staining with basic KMnO_4 solution. Column chromatography was performed using Isco chromatographic systems. Melting points were determined in an open glass capillary and are uncorrected. NMR spectra were recorded in CDCl_3 at 400 MHz (^1H NMR) and 100 MHz (^{13}C NMR). Low and high resolution mass spectra were obtained using ESI methods.

General procedure for the preparation of compounds 9.

Arylglyoxaldehyde (1 eq, 0.48 mmol) and amine (1 eq, 0.48 mmol) were dissolved in DMF (2 ml) and heated at 100°C for 5 min by means of microwave irradiation. Potassium carbonate (2 eq, 0.96 mmol) and TOSMIC (1 eq, 0.48 mmol) were then added and reaction mixture was heated at 180°C for 10 min. After cooling to room temperature, water (20 ml) was added and extraction with EtOAc (3 X 20 ml) was performed. The organic phase was dried over MgSO_4 and concentrated under reduced pressure and crude was purified by flash chromatography (Hexane/EtOAc) to afford title compounds.

Full characterization for compounds 9.

4-phenylimidazo[1,5-a]quinoxaline 9a

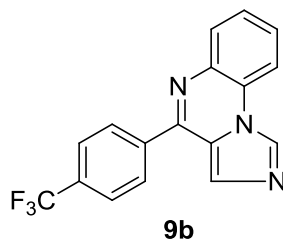


9a

White solid, 67% yield; m.p. $170 - 171^\circ\text{C}$; $R_f = 0.40$ (silica gel, EtOAc); ^1H NMR (400 MHz, CDCl_3) δ ppm 8.75 (s, 1H), 8.14 – 8.00 (m, 3H), 7.99 – 7.92 (m, 2H), 7.63 – 7.52 (m, 5H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 153.9, 137.3, 136.4,

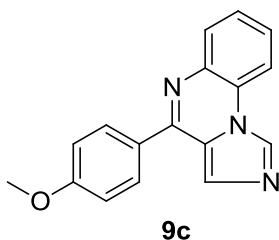
130.6, 130.5, 129.5, 128.9, 128.3, 127.1, 124.3, 123.5, 114.1; $[M+H]^+ = 246.1$; HRMS (ESI): m/z calcd for $C_{16}H_{12}N_3$ $[M+H]^+$: 246.1026, found: 246.1025.

4-(4-(trifluoromethyl)phenyl)imidazo[1,5-*a*]quinoxaline 9b



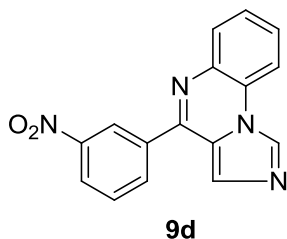
White solid, 61% yield; m.p. 192 – 194 °C; $R_f = 0.42$ (silica gel, EtOAc); 1H NMR (400 MHz, $CDCl_3$) δ ppm 8.78 (s, 1H), 8.19 (d, $J = 8.1$ Hz, 2H), 8.09 (dd, $J = 7.8$, 1.8 Hz, 1H), 7.99 (dd, $J = 7.6$, 1.6 Hz, 1H), 7.93 (s, 1H), 7.85 (d, $J = 8.2$ Hz, 2H), 7.61 (pd, $J = 7.4$, 1.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 152.3, 140.6, 136.2, 132.4 (q, $J_{C-F} = 32.6$ Hz), 130.7, 129.8, 128.9, 128.7, 128.1, 127.3, 125.9 (q, $J_{C-F} = 3.7$ Hz), 125.3, 124.4, 123.3, 122.5, 114.2; $[M+H]^+ = 314.1$; HRMS (ESI): m/z calcd for $C_{17}H_{11}F_3N_3$ $[M+H]^+$: 314.0900, found: 314.0904.

4-(4-methoxyphenyl)imidazo[1,5-*a*]quinoxaline 9c



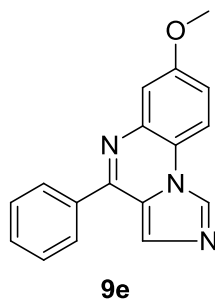
White solid, 52% yield; m.p. 192 – 193 °C; $R_f = 0.39$ (silica gel, EtOAc); 1H NMR (400 MHz, $CDCl_3$) δ ppm 8.73 (s, 1H), 8.10 – 8.02 (m, 3H), 7.99 – 7.89 (m, 2H), 7.60 – 7.49 (m, 2H), 7.09 (d, $J = 8.9$ Hz, 2H), 3.91 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 161.7, 153.2, 136.5, 130.2, 129.89, 129.85, 129.81, 129.4, 128.2, 127.9, 127.02, 124.2, 123.5, 114.2, 114.0, 55.4; $[M+H]^+ = 276.1$; HRMS (ESI): m/z calcd for $C_{17}H_{14}N_3O$ $[M+H]^+$: 276.1131, found: 276.1133.

4-(3-nitrophenyl)imidazo[1,5-a]quinoxaline 9d



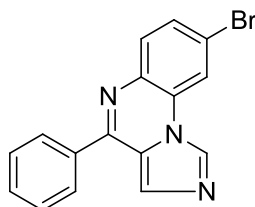
Brown solid, 53% yield; m.p. >250 °C; *R*_f = 0.39 (silica gel, EtOAc); ¹H NMR (400 MHz, CDCl₃) δ ppm 8.98 (t, *J* = 2.0 Hz, 1H), 8.80 (s, 1H), 8.46 – 8.41 (m, 2H), 8.11 (dd, *J* = 7.7, 1.8 Hz, 1H), 8.02 – 7.97 (m, 2H), 7.77 (dt, *J* = 12.4, 6.2 Hz, 1H), 7.68 – 7.58 (m, 2H); ¹³C NMR (100 MHz, CDCl₃) δ ppm 151.00, 148.7, 138.8, 136.0, 133.9, 130.7, 130.0, 129.2, 127.8, 127.7, 127.4, 125.1, 124.4, 123.5, 123.0, 114.2; [M+H]⁺ = 291.0; HRMS (ESI): *m/z* calcd for C₁₆H₁₁N₄O₂ [M+H]⁺: 291.0877, found: 291.0876.

7-methoxy-4-phenylimidazo[1,5-a]quinoxaline 9e



Brown solid, 58% yield; m.p. 164 – 165 °C; *R*_f = 0.34 (silica gel, EtOAc); ¹H NMR (400 MHz, CDCl₃) δ ppm 8.67 (s, 1H), 8.08 – 7.98 (m, 3H), 7.92 (s, 1H), 7.61 – 7.52 (m, 3H), 7.36 (d, *J* = 2.6 Hz, 1H), 7.14 (dd, *J* = 9.0, 2.6 Hz, 1H), 3.99 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm 159.6, 151.2, 137.5, 131.73, 131.69, 130.8, 130.3, 128.9, 128.2, 127.7, 125.1, 114.5, 98.1, 55.9; [M+H]⁺ = 276.1; HRMS (ESI): *m/z* calcd for C₁₇H₁₁N₃O [M+H]⁺: 276.1131, found: 276.1131.

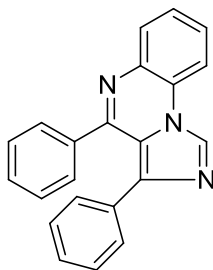
8-bromo-4-phenylimidazo[1,5-a]quinoxaline 9f



9f

White solid, 66% yield; m.p. 205 – 207 °C; R_f = 0.42 (silica gel, Hexane/EtOAc 1:1); ^1H NMR (400 MHz, CDCl_3) δ ppm 8.70 (s, 1H), 8.10 (d, J = 2.0 Hz, 1H), 8.08 – 8.02 (m, 2H), 7.96 (s, 1H), 7.93 (d, J = 8.6 Hz, 1H), 7.65 (dd, J = 8.6, 2.0 Hz, 1H), 7.61 – 7.54 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 154.1, 137.0, 135.4, 131.7, 130.9, 130.4, 129.7, 128.9, 128.74, 128.69, 128.3, 125.2, 123.4, 121.5, 117.31, 117.28; $[\text{M}]^+ = 323.9$; HRMS (ESI): m/z calcd for $\text{C}_{16}\text{H}_{11}\text{BrN}_3$: 324.0131 $[\text{M}+\text{H}]^+$ found: 324.0133 and 326.0111.

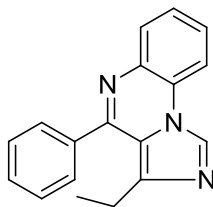
3,4-diphenylimidazo[1,5-a]quinoxaline 9g



9g

Orange solid, 74% yield; m.p. 145 – 147 °C; R_f = 0.36 (silica gel, Hexane/EtOAc 1:1); ^1H NMR (400 MHz, CDCl_3) δ ppm 8.83 (s, 1H), 8.08 (dd, J = 7.6, 1.9 Hz, 1H), 8.00 (dd, J = 7.8, 1.3 Hz, 1H), 7.63 – 7.53 (m, 2H), 7.44 – 7.39 (m, 2H), 7.31 – 7.24 (m, 1H), 7.18 – 7.11 (m, 5H), 7.10 – 7.03 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 155.6, 141.2, 137.2, 136.2, 134.0, 130.2, 129.8, 129.4, 128.9, 128.7, 128.3, 127.9, 127.4, 127.3, 127.0, 124.4, 118.8, 113.9; $[\text{M}+\text{H}]^+ = 322.2$; HRMS (ESI): m/z calcd for $\text{C}_{22}\text{H}_{15}\text{N}_3$ $[\text{M}+\text{H}]^+$: 322.1339, found: 322.1341.

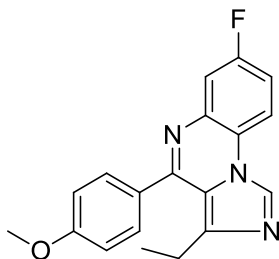
3-ethyl-4-phenylimidazo[1,5-a]quinoxaline 9h



9h

Brown solid, 33% yield; m.p. 127 – 129 °C; R_f = 0.26 (silica gel, Hexane/EtOAc 1:1); ^1H NMR (400 MHz, CDCl_3) δ ppm 8.67 (s, 1H), 8.00 (dd, J = 7.5, 2.0 Hz, 1H), 7.92 (dd, J = 7.7, 1.7 Hz, 1H), 7.66 – 7.61 (m, 2H), 7.57 – 7.48 (m, 5H), 2.47 (q, J = 7.5 Hz, 2H), 1.10 (t, J = 7.5 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 156.0, 143.6, 138.2, 136.0, 130.1, 129.7, 129.1, 128.4, 128.2, 128.1, 126.8, 124.7, 119.4, 113.8, 22.4, 14.0; $[\text{M}+\text{H}]^+ = 274.1$; HRMS (ESI): m/z calcd for $\text{C}_{18}\text{H}_{16}\text{N}_3$ $[\text{M}+\text{H}]^+ : 274.1339$; found: 274.1338.

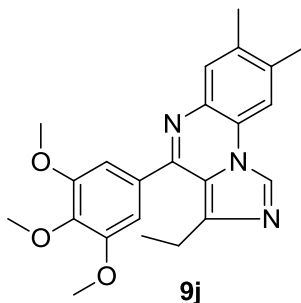
3-ethyl-7-fluoro-4-(4-methoxyphenyl)imidazo[1,5-a]quinoxaline 9i



9i

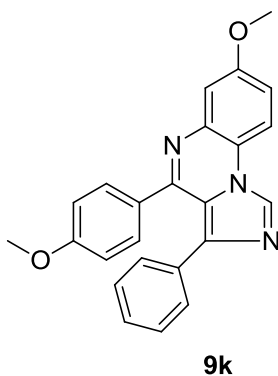
Yellow solid, 40% yield; m.p. 165 – 166 °C; R_f = 0.35 (silica gel, Hexane/EtOAc 1:1); ^1H NMR (400 MHz, CDCl_3) δ ppm 8.57 (s, 1H), 7.97 (dd, J = 9.0, 5.7 Hz, 1H), 7.61 – 7.55 (m, 3H), 7.25 – 7.19 (m, 1H), 7.05 (d, J = 8.8 Hz, 2H), 3.92 (s, 3H), 2.56 (q, J = 7.5 Hz, 2H), 1.13 (t, J = 7.5 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 161.4 (d, $J_{\text{C-F}}$ = 249.7 Hz), 160.1, 154.9, 143.4, 132.8, 131.9, 130.5, 129.8, 128.3, 119.2, 114.7, 114.5, 113.9, 101.1, 100.8, 55.5, 22.6, 13.9; $[\text{M}+\text{H}]^+ = 322.1$; HRMS (ESI): m/z calcd for $\text{C}_{19}\text{H}_{17}\text{FN}_3\text{O}$ $[\text{M}+\text{H}]^+ : 322.1350$; found: 322.1350.

3-ethyl-7,8-dimethyl-4-(3,4,5-trimethoxyphenyl)imidazo[1,5-a]quinoxaline 9j



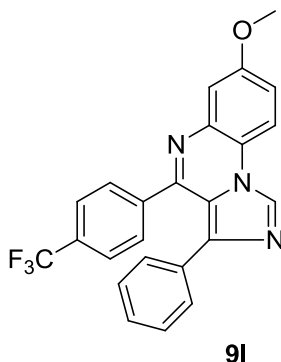
White solid, 39% yield; m.p. 245 – 246 °C; *R*_f = 0.31 (silica gel, EtOAc); ¹H NMR (400 MHz, CDCl₃) δ ppm 8.62 (s, 1H), 7.76 (s, 1H), 7.67 (s, 1H), 6.85 (s, 2H), 3.92 (s, 3H), 3.91 (s, 6H), 2.55 (q, *J* = 7.5 Hz, 2H), 2.47 (s, 3H), 2.40 (s, 3H), 1.16 (t, *J* = 7.5 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm 154.6, 153.3, 143.0, 139.2, 137.8, 135.8, 134.1, 133.9, 130.2, 130.2, 127.7, 122.6, 119.3, 114.3, 114.2, 105.7, 60.9, 56.2, 22.5, 20.2, 19.7, 14.2; [M+H]⁺ = 392.2; HRMS (ESI): *m/z* calcd for C₂₃H₂₆N₃O₃ [M+H]⁺: 392.1969, found: 392.1967.

7-methoxy-4-(4-methoxyphenyl)-3-phenylimidazo[1,5-a]quinoxaline 9k



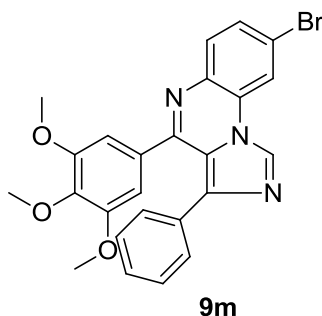
Orange solid, 71% yield; m.p. 224 – 225 °C; *R*_f = 0.24 (silica gel, Hexane/EtOAc 1:1); ¹H NMR (400 MHz, CDCl₃) δ ppm 8.73 (s, 1H), 7.98 (d, *J* = 8.9 Hz, 1H), 7.38 (d, *J* = 2.6 Hz, 1H), 7.34 (d, *J* = 8.8 Hz, 2H), 7.19 – 7.05 (m, 6H), 6.65 (d, *J* = 8.8 Hz, 2H), 4.00 (s, 3H), 3.75 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm 160.6, 159.5, 152.4, 140.5, 134.4, 131.4, 131.3, 130.8, 130.4, 130.0, 129.9, 128.34, 128.32, 127.4, 127.2, 125.1, 118.9, 114.4, 113.31, 113.29, 97.9, 56.0, 55.4; [M+H]⁺ = 382.2; HRMS (ESI): *m/z* calcd for C₂₄H₂₀N₃O₂ [M+H]⁺: 382.1550, found: 382.1549.

7-methoxy-3-phenyl-4-(4-(trifluoromethyl)phenyl)imidazo[1,5-*a*]quinoxaline 9l



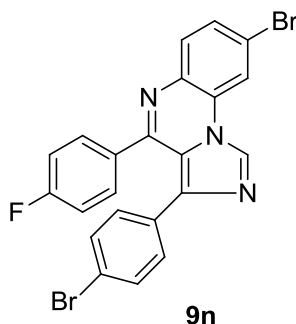
Yellow solid, 66% yield; m.p. 225 – 227 °C; *R*_f = 0.18 (silica gel, Hexane/EtOAc 1:1); ¹H NMR (400 MHz, CDCl₃) δ ppm 8.77 (s, 1H), 8.00 (d, *J* = 9.0 Hz, 1H), 7.48 (d, *J* = 8.1 Hz, 2H), 7.41 (d, *J* = 2.6 Hz, 1H), 7.37 (d, *J* = 8.2 Hz, 2H), 7.17 (dt, *J* = 8.6, 2.4 Hz, 2H), 7.11 – 7.03 (m, 4H), 4.01 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ ppm 160.1, 151.2, 140.6, 140.5, 133.8, 131.70, 131.66, 131.0 (q, *J*_{C-F} = 32.5 Hz), 130.4, 129.7, 129.2, 128.5, 127.6, 127.5, 125.3, 124.8 – 124.5 (m), 122.5, 118.6, 114.6, 110.0, 97.9, 56.0; [M+H]⁺ = 420.1; HRMS (ESI): *m/z* calcd for C₂₄H₁₇F₃N₃O [M+H]⁺ : 420.1325, found: 420.1326.

8-bromo-3-phenyl-4-(3,4,5-trimethoxyphenyl)imidazo[1,5-*a*]quinoxaline 9m



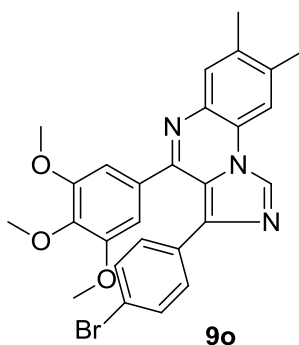
Yellow solid, 59% yield; m.p. 240 – 241 °C; *R*_f = 0.36 (silica gel, Hexane/EtOAc 1:1); ¹H NMR (400 MHz, CDCl₃) δ ppm 8.81 (s, 1H), 8.16 (d, *J* = 2.0 Hz, 1H), 7.94 (d, *J* = 8.6 Hz, 1H), 7.67 (dd, *J* = 8.6, 2.0 Hz, 1H), 7.27 – 7.13 (m, 5H), 6.68 (s, 2H), 3.81 (s, 3H), 3.58 (s, 6H); ¹³C NMR (100 MHz, CDCl₃) δ ppm 155.3, 153.0, 141.3, 139.6, 135.0, 134.1, 132.0, 131.4, 130.4, 129.8, 129.11, 129.09, 127.8, 127.5, 125.2, 121.5, 118.4, 117.1, 117.0, 106.6, 106.5, 60.8, 55.9; [M+H]⁺ = 492.2; HRMS (ESI): *m/z* calcd for C₂₅H₂₁BrN₃O₃ [M+H]⁺ : 490.0761, found: 490.0766 and 492.0746.

8-bromo-3-(4-bromophenyl)-4-(4-fluorophenyl)imidazo[1,5-a]quinoxaline 9n



Yellow solid, 65% yield; m.p. >250 °C; R_f = 0.28 (silica gel, Hexane/EtOAc 8:2); ^1H NMR (400 MHz, CDCl_3) δ ppm 8.79 (s, 1H), 8.15 (d, J = 2.0 Hz, 1H), 7.92 (d, J = 8.7 Hz, 1H), 7.68 (dd, J = 8.6, 2.0 Hz, 1H), 7.45 – 7.37 (m, 2H), 7.30 – 7.23 (m, 2H), 7.07 – 6.99 (m, 2H), 6.95 – 6.86 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 163.8 (d, $J_{\text{C-F}}$ = 250.9 Hz), 154.3, 140.1, 135.1, 132.9, 132.6, 131.6, 131.3, 131.0, 130.9, 130.7, 130.6, 129.1, 125.1, 122.2, 121.9, 118.7, 117.1, 115.3, 115.1; $[\text{M}+\text{H}]^+ = 498.0$; HRMS (ESI): m/z calcd for $\text{C}_{22}\text{H}_{13}\text{Br}_2\text{FN}_3$ $[\text{M}+\text{H}]^+$: 495.9455, found: 495.9448, 497.9449 and 499.9410.

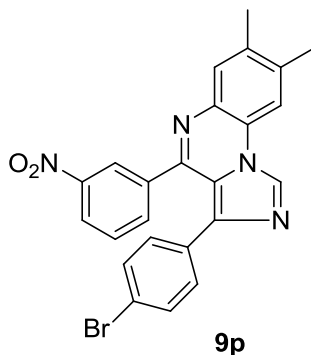
3-(4-bromophenyl)-7,8-dimethyl-4-(3,4,5-trimethoxyphenyl)imidazo[1,5-a]quinoxaline 9o



Orange solid, 70% yield; m.p. 207 – 209 °C; R_f = 0.32 (silica gel, Hexane/EtOAc 1:1); ^1H NMR (400 MHz, CDCl_3) δ ppm 8.78 (s, 1H), 7.85 (s, 1H), 7.76 (s, 1H), 7.29 (d, J = 8.3 Hz, 2H), 7.08 (d, J = 8.3 Hz, 2H), 6.66 (s, 2H), 3.85 (s, 3H), 3.62 (s, 6H), 2.51 (s, 3H), 2.44 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 153.6, 153.1, 139.6, 139.0, 138.4, 136.4, 134.3, 133.6, 132.6, 131.2, 130.5, 130.34, 130.29, 128.5, 122.1, 121.7, 118.9, 114.3, 114.2, 106.6, 106.5, 61.0, 55.8, 20.4,

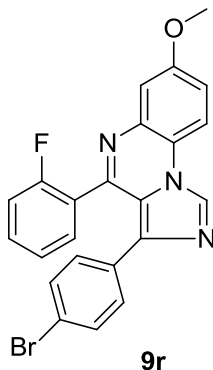
19.7; $[M+H]^+ = 520.0$; HRMS (ESI): m/z calcd for $C_{27}H_{25}BrN_3O_3$ $[M+H]^+$: 518.1074, found: 518.1082 and 520.1066.

3-(4-bromophenyl)-7,8-dimethyl-4-(3-nitrophenyl)imidazo[1,5-*a*]quinoxaline 9p



Brown solid, 55% yield; m.p. 240 – 241 °C; $R_f = 0.34$ (silica gel, Hexane/EtOAc 1:1); 1H NMR (400 MHz, $CDCl_3$) δ ppm 8.81 (s, 1H), 8.27 (t, $J = 1.8$ Hz, 1H), 8.18 (ddd, $J = 8.2, 2.3, 1.1$ Hz, 1H), 7.85 (s, 1H), 7.79 (s, 1H), 7.74 (ddd, $J = 7.7, 1.6, 1.1$ Hz, 1H), 7.38 (t, $J = 7.9$ Hz, 1H), 7.22 (d, $J = 8.6$ Hz, 2H), 7.00 (d, $J = 8.6$ Hz, 2H), 2.53 (s, 3H), 2.45 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ ppm 151.2, 147.7, 139.3, 139.1, 138.6, 136.7, 134.7, 134.6, 134.2, 132.8, 131.3, 130.8, 130.54, 130.48, 128.94, 128.8, 124.4, 124.0, 122.2, 122.1, 118.7, 114.4, 20.5, 19.8; $[M+H]^+ = 475.1$; HRMS (ESI): m/z calcd for $C_{24}H_{18}BrN_4O_2$ $[M+H]^+$: 473.0608, found: 473.0613 and 475.0585.

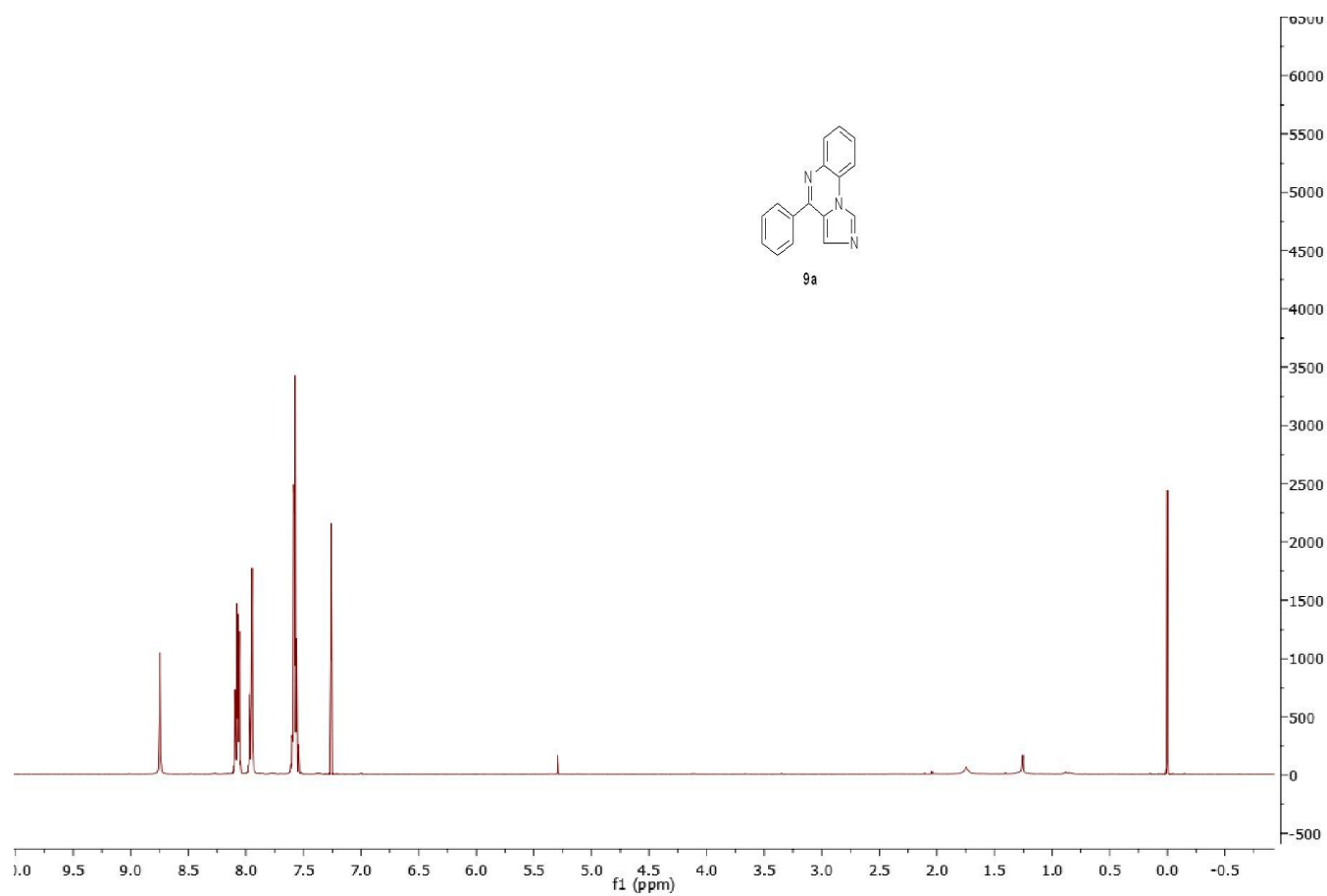
3-(4-bromophenyl)-4-(2-fluorophenyl)-7-methoxyimidazo[1,5-*a*]quinoxaline 9r



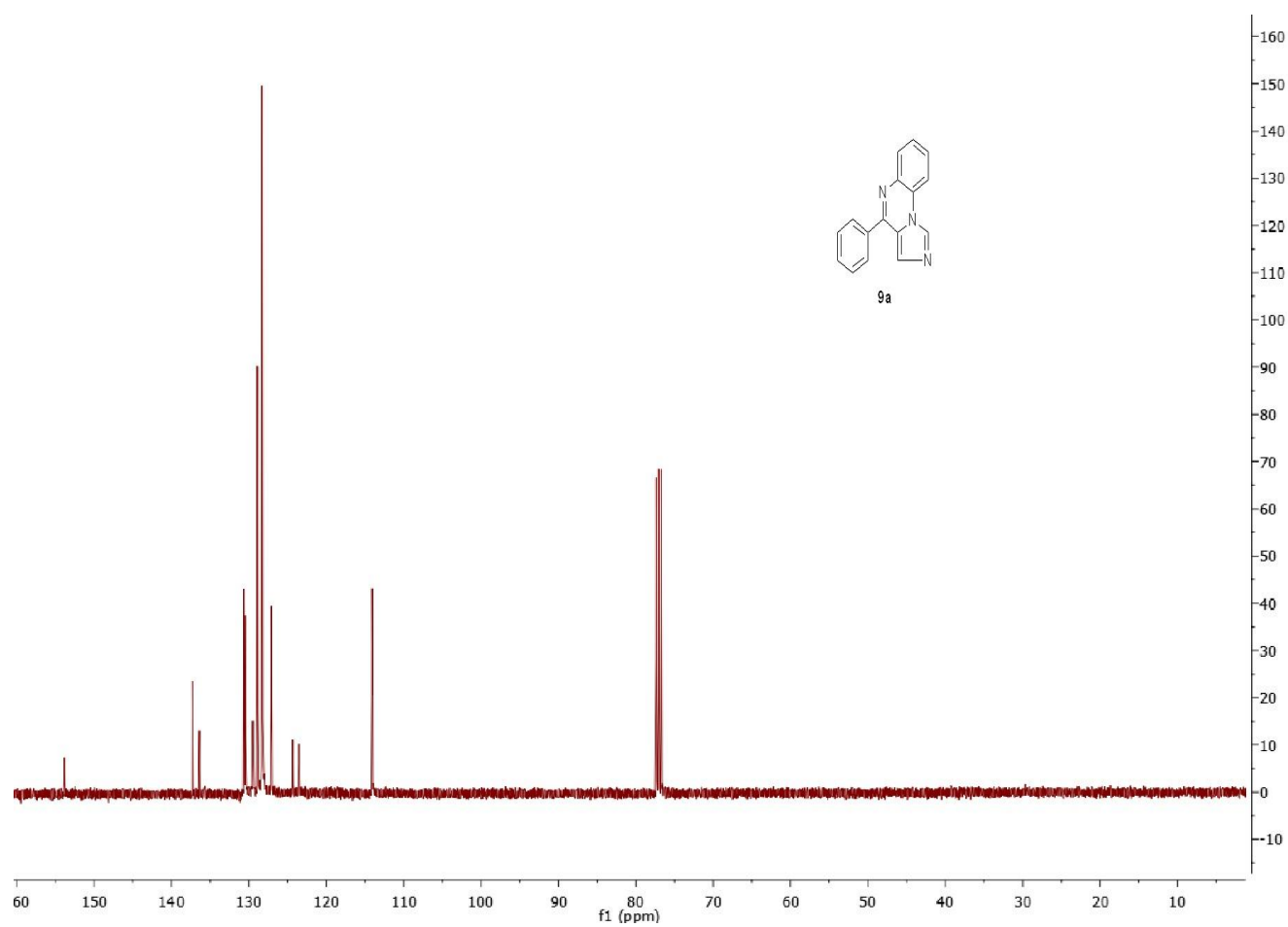
Brown solid, 13% yield; m.p. 233 – 234 °C; $R_f = 0.30$ (silica gel, Hexane/EtOAc 1:1); 1H NMR (400 MHz, $CDCl_3$) δ ppm 8.73 (s, 1H), 8.01 (d, $J = 9.0$ Hz, 1H), 7.48 (td, $J = 7.3, 1.8$ Hz, 1H), 7.40 (d, $J = 2.6$ Hz, 1H), 7.33 (dddd, $J = 8.3, 7.2,$

5.2, 1.8 Hz, 1H), 7.20 – 7.11 (m, 4H), 7.01 (d, $J = 8.5$ Hz, 2H), 6.78 – 6.71 (m, 1H), 4.02 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ ppm 160.1, 159.8 (d, $J_{\text{C-F}} = 249.4$ Hz), 147.5, 139.5, 132.6, 131.8, 131.4, 130.8, 130.4, 130.3, 128.2, 126.0, 125.9, 125.4, 124.3, 121.6, 119.5, 115.7, 115.4, 114.7, 97.9; $[\text{M}+\text{H}]^+ = 450.0$; HRMS (ESI): m/z calcd for $\text{C}_{23}\text{H}_{16}\text{BrFN}_3\text{O}$ $[\text{M}+\text{H}]^+$: 448.0455; found: 448.0461 and 450.0441.

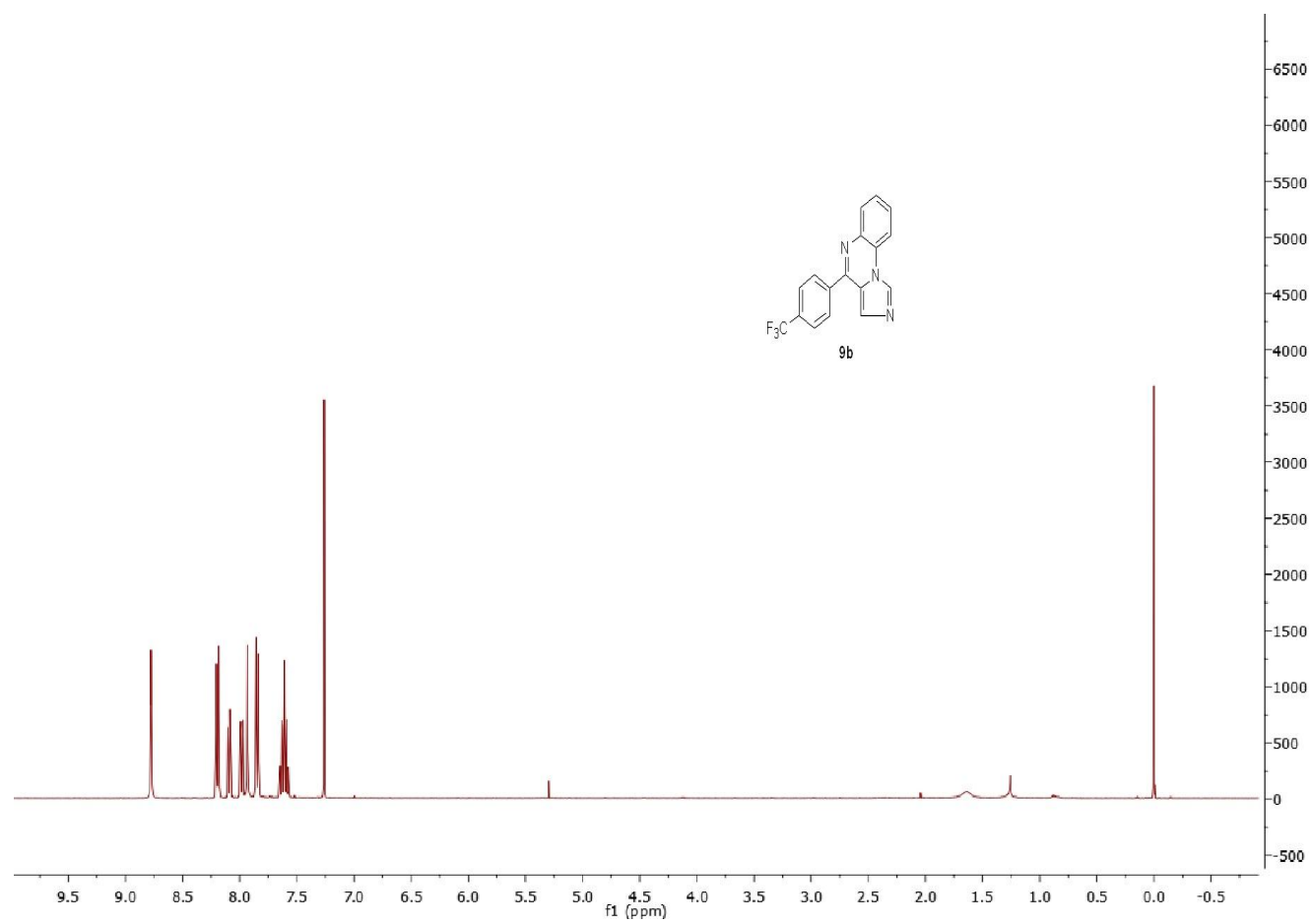
^1H NMR for compound **9a** (CDCl_3 , 400 MHz)



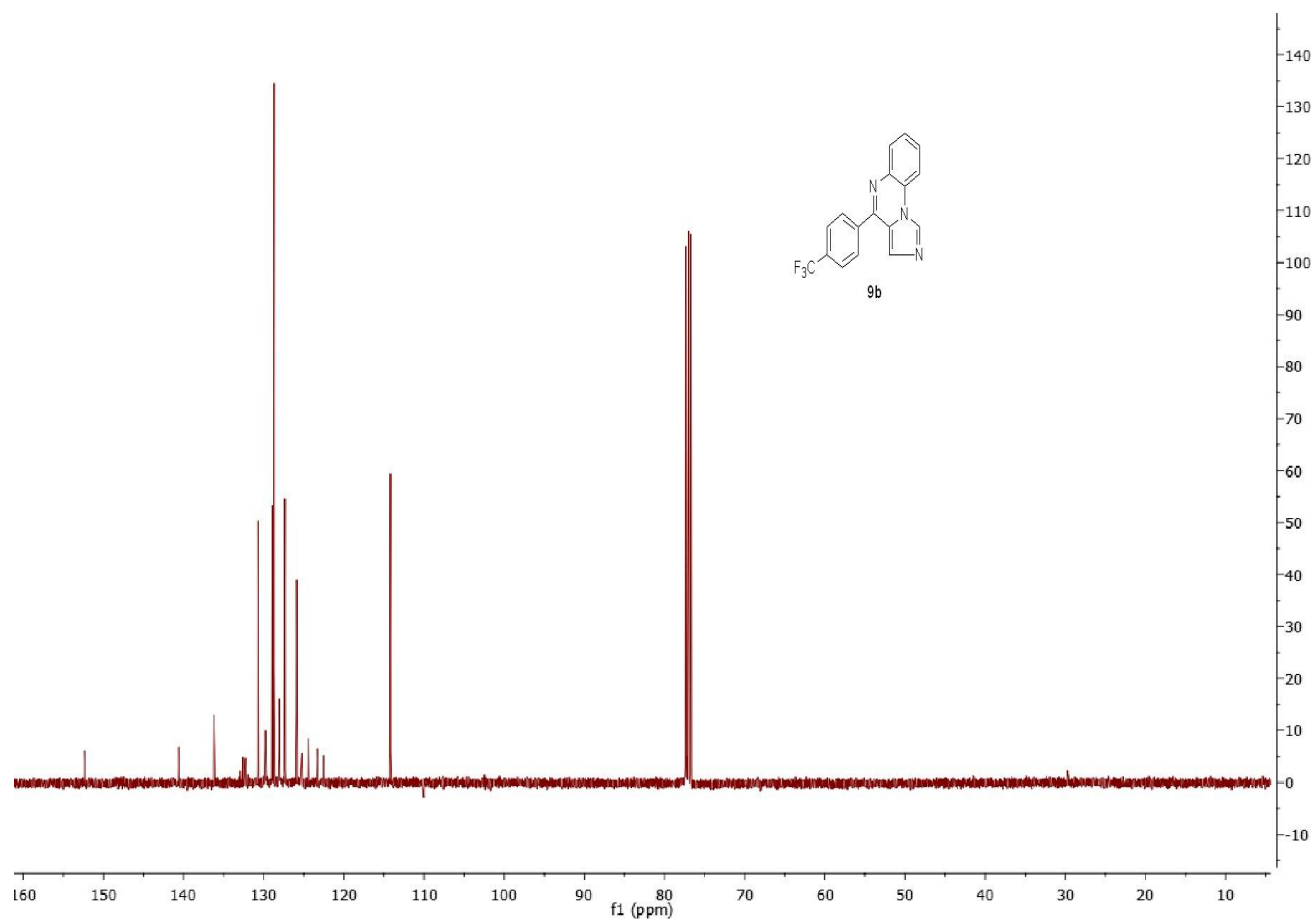
^{13}C NMR for compound **9a** (CDCl_3 , 100 MHz)



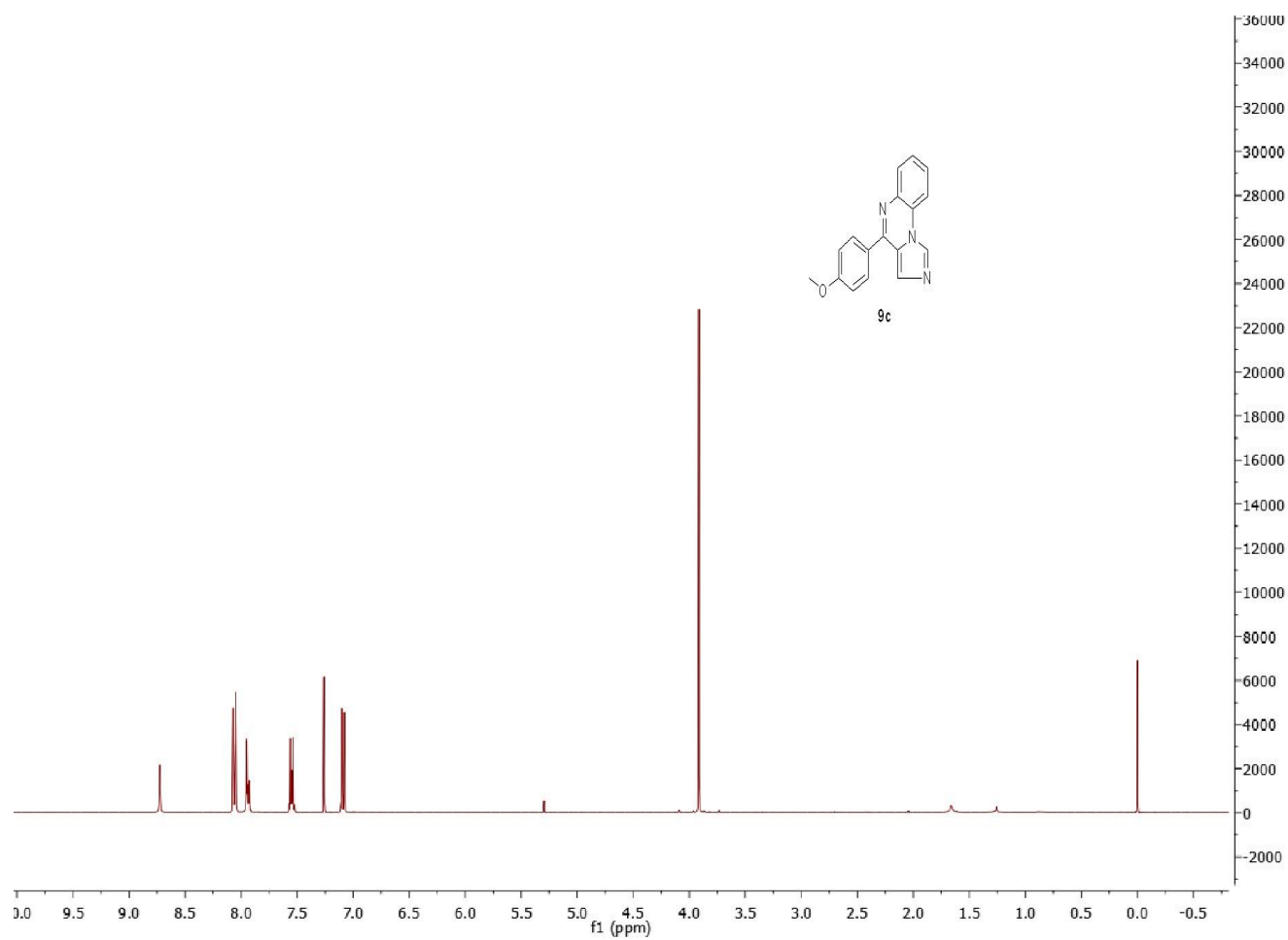
^1H NMR for compound **9b** (CDCl_3 , 400 MHz)



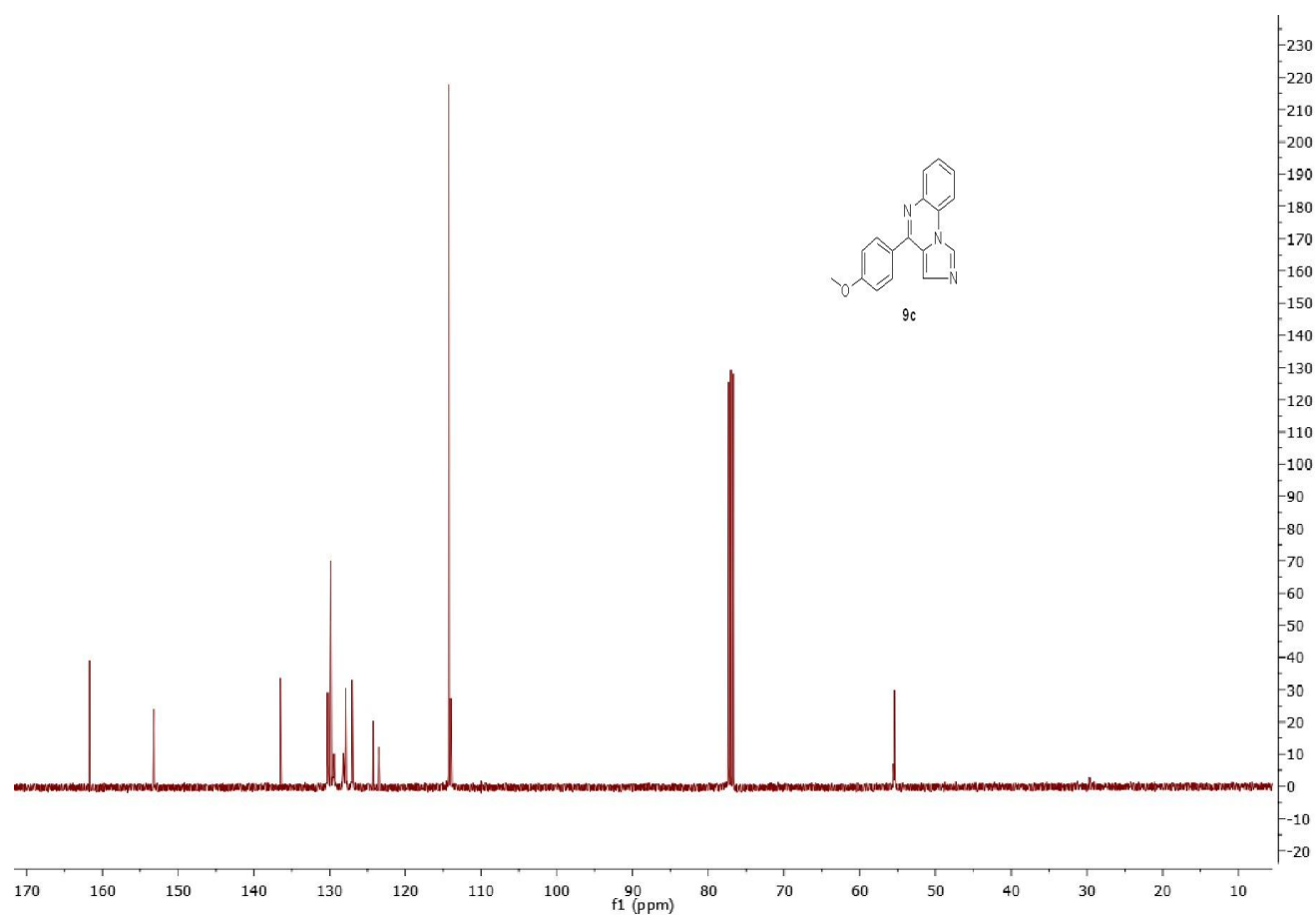
^{13}C NMR for compound **9b** (CDCl_3 , 100 MHz)



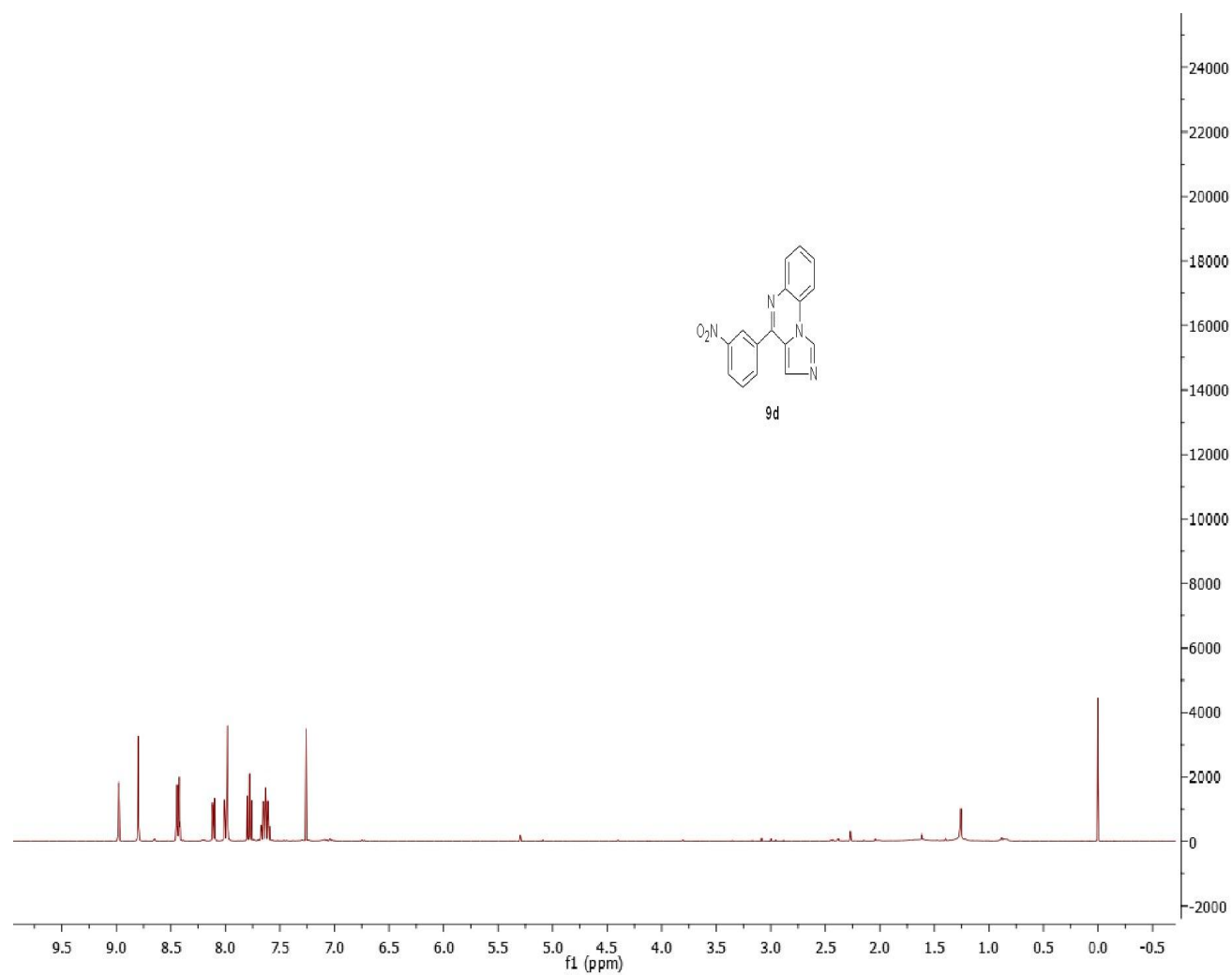
^1H NMR for compound **9c** (CDCl_3 , 400 MHz)



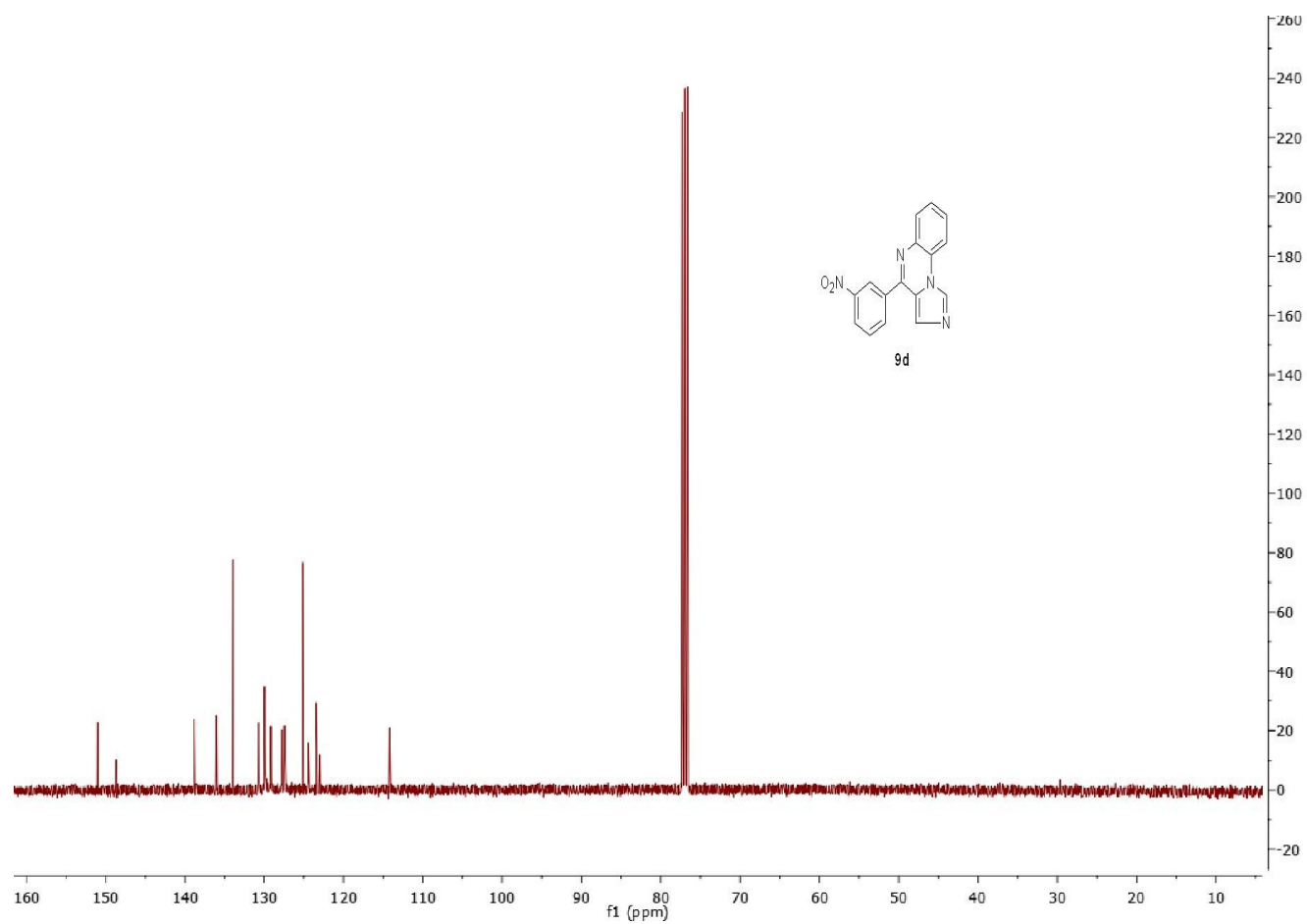
^{13}C NMR for compound **9c** (CDCl_3 , 100 MHz)



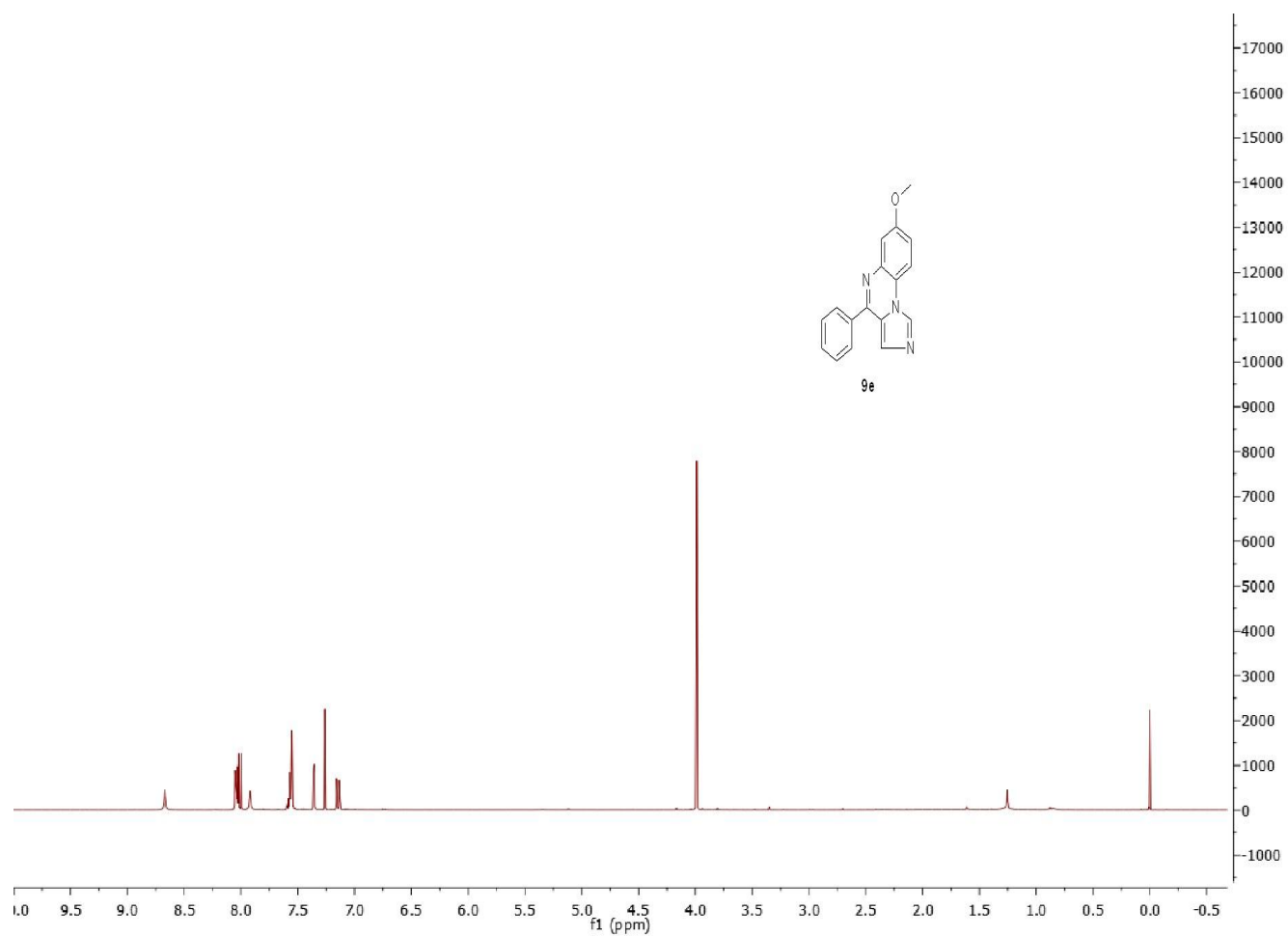
^1H NMR for compound **9d** (CDCl_3 , 400 MHz)



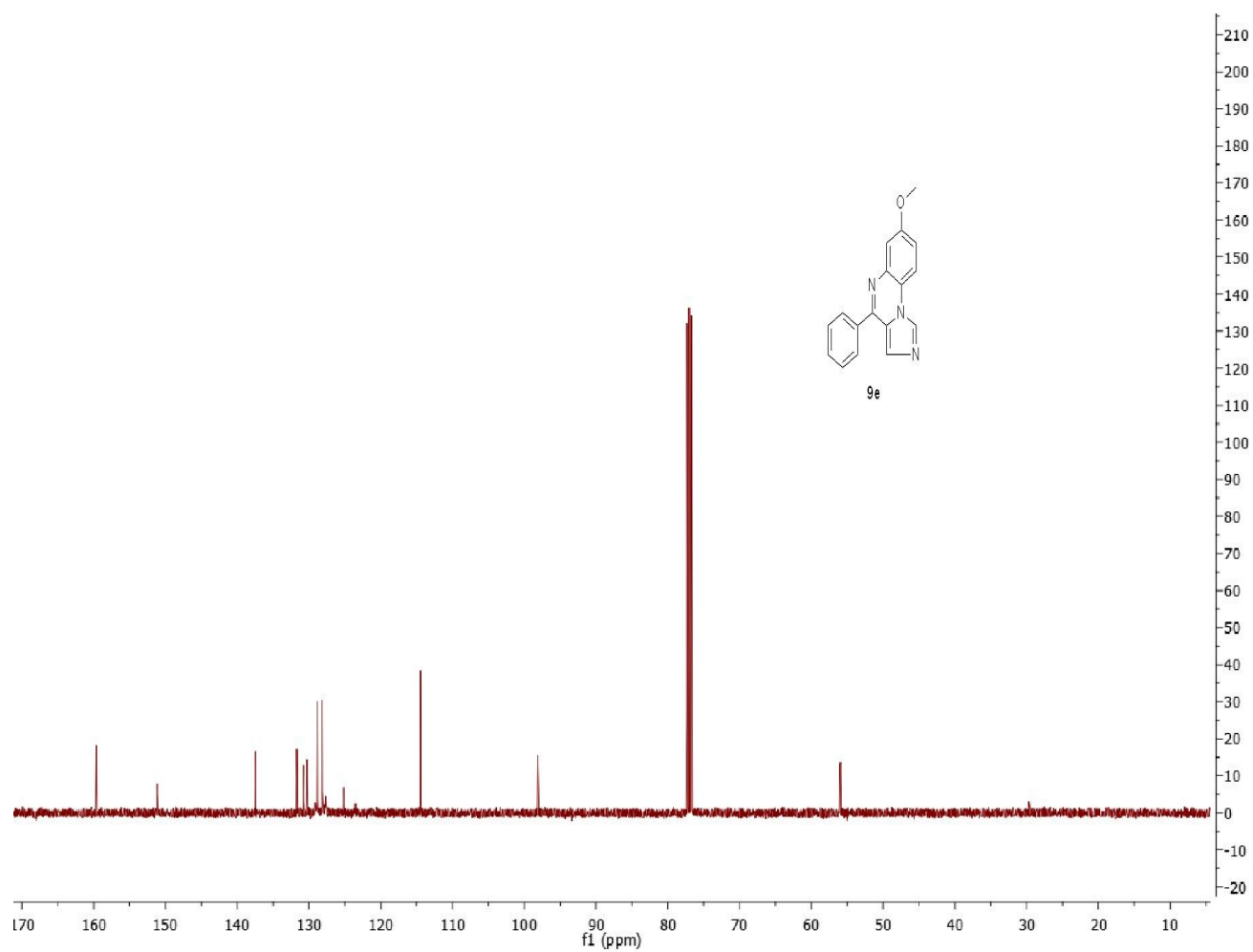
^{13}C NMR for compound **9d** (CDCl_3 , 100 MHz)



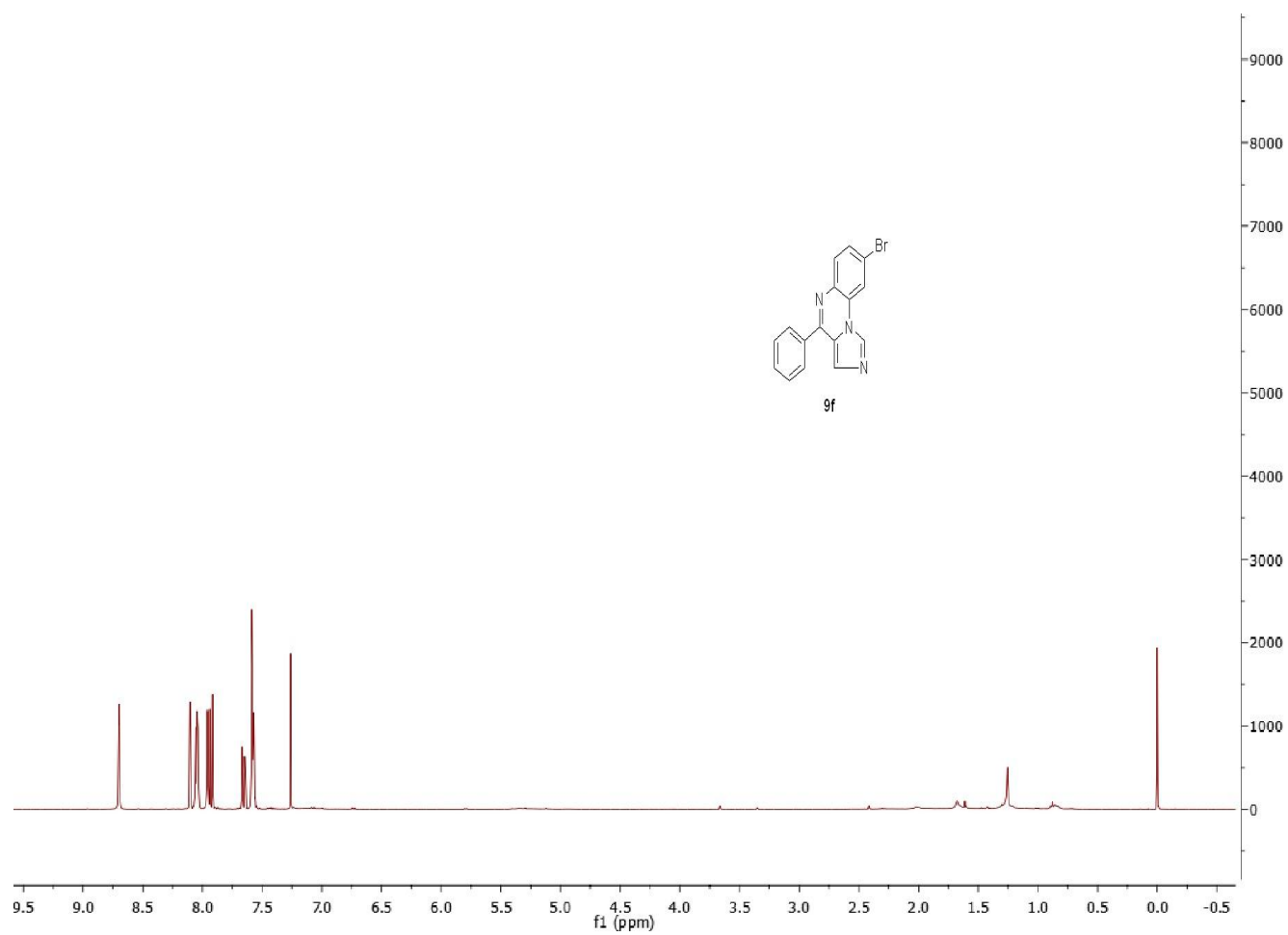
^1H NMR for compound **9e** (CDCl_3 , 400 MHz)



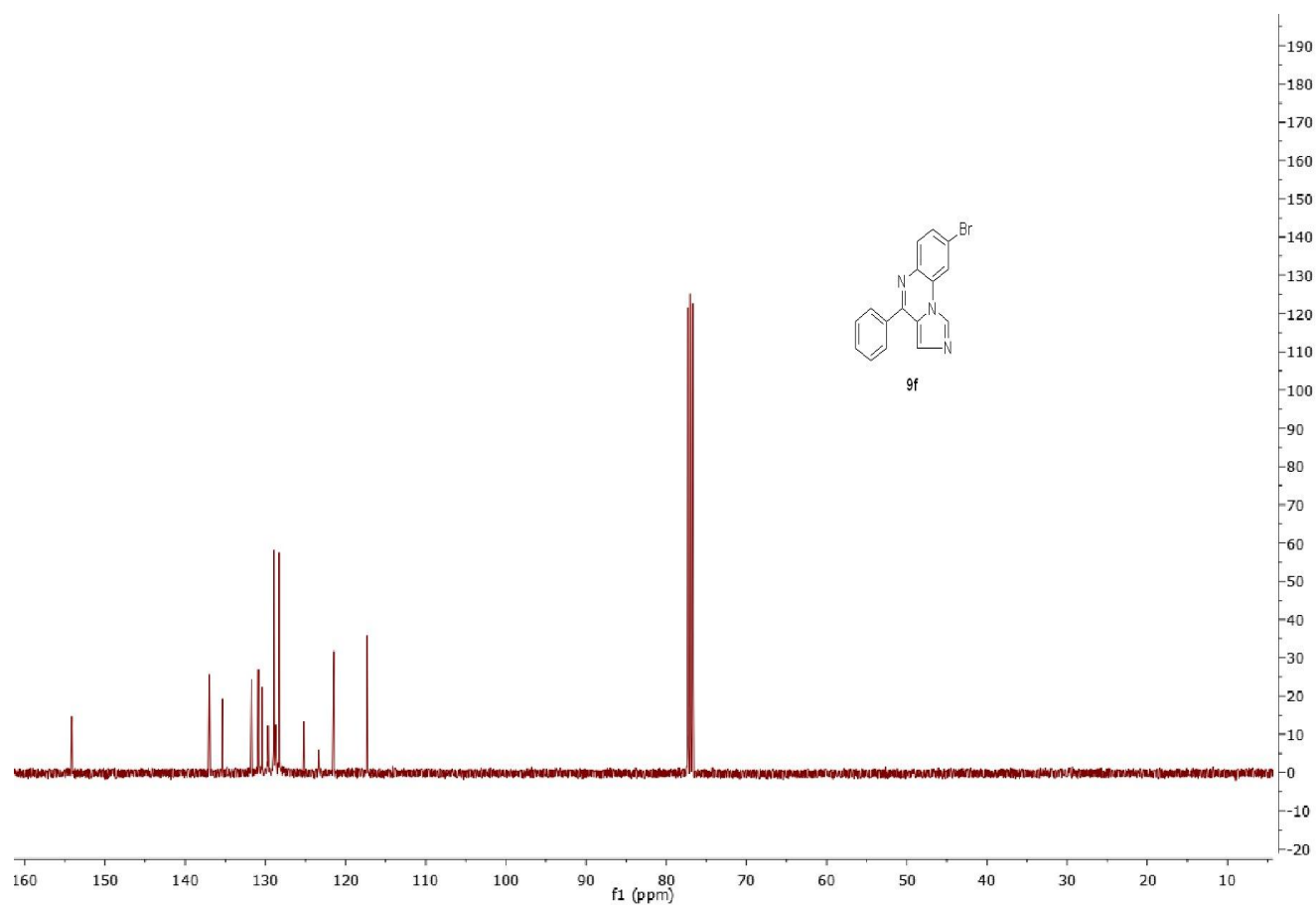
^{13}C NMR for compound **9e** (CDCl_3 , 100 MHz)



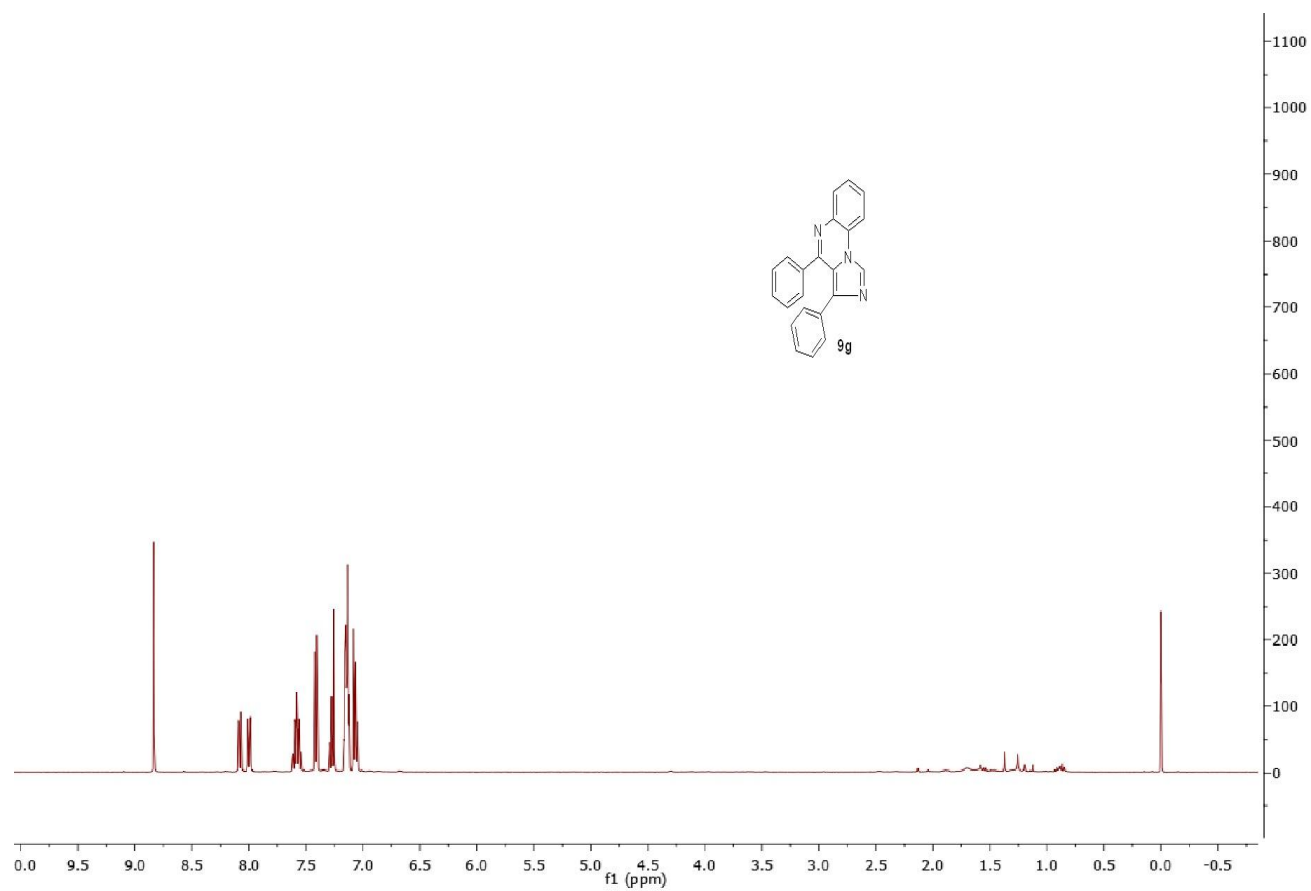
^1H NMR for compound **9f** (CDCl_3 , 400 MHz)



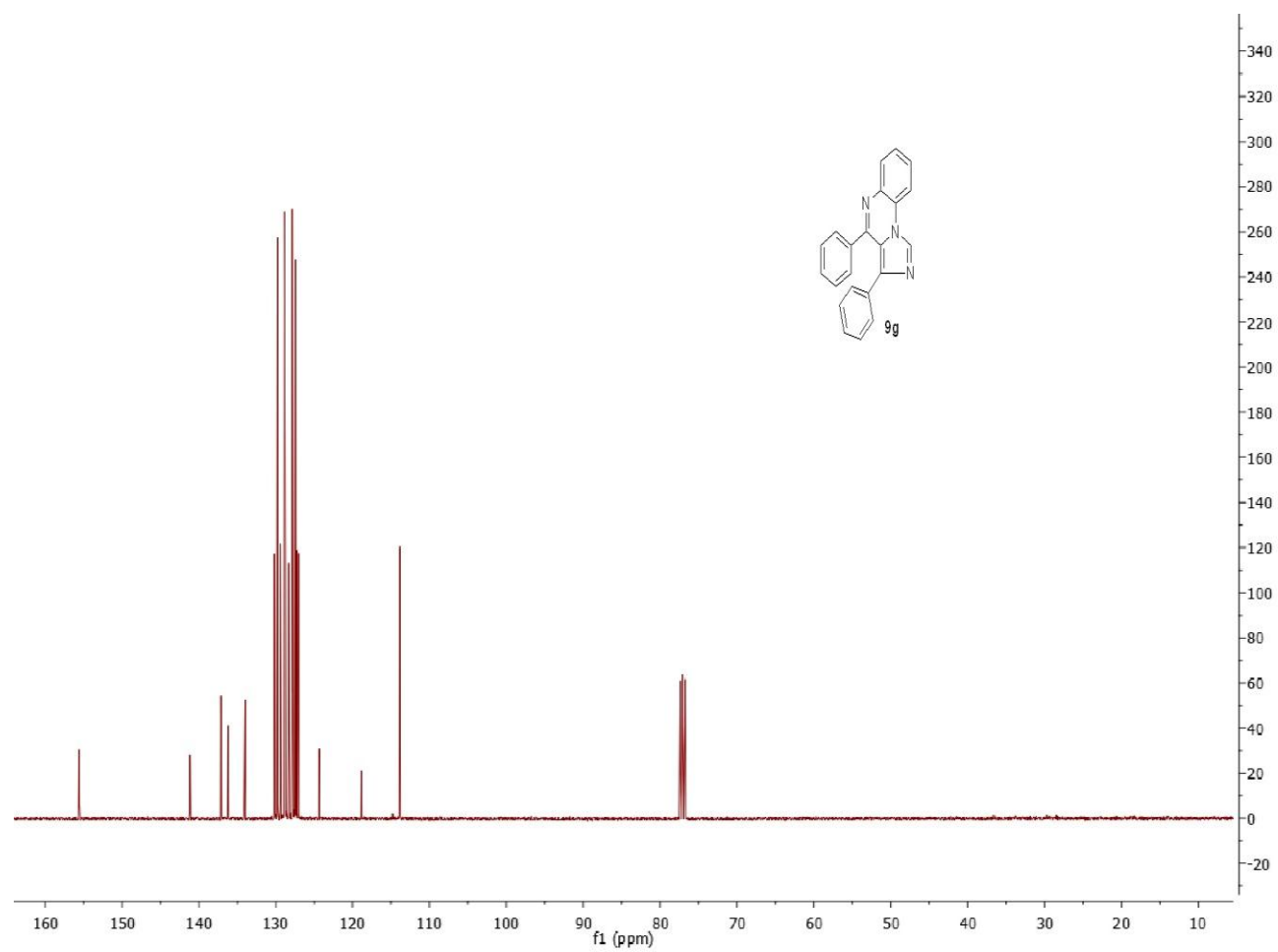
^{13}C NMR for compound **9f** (CDCl_3 , 100 MHz)



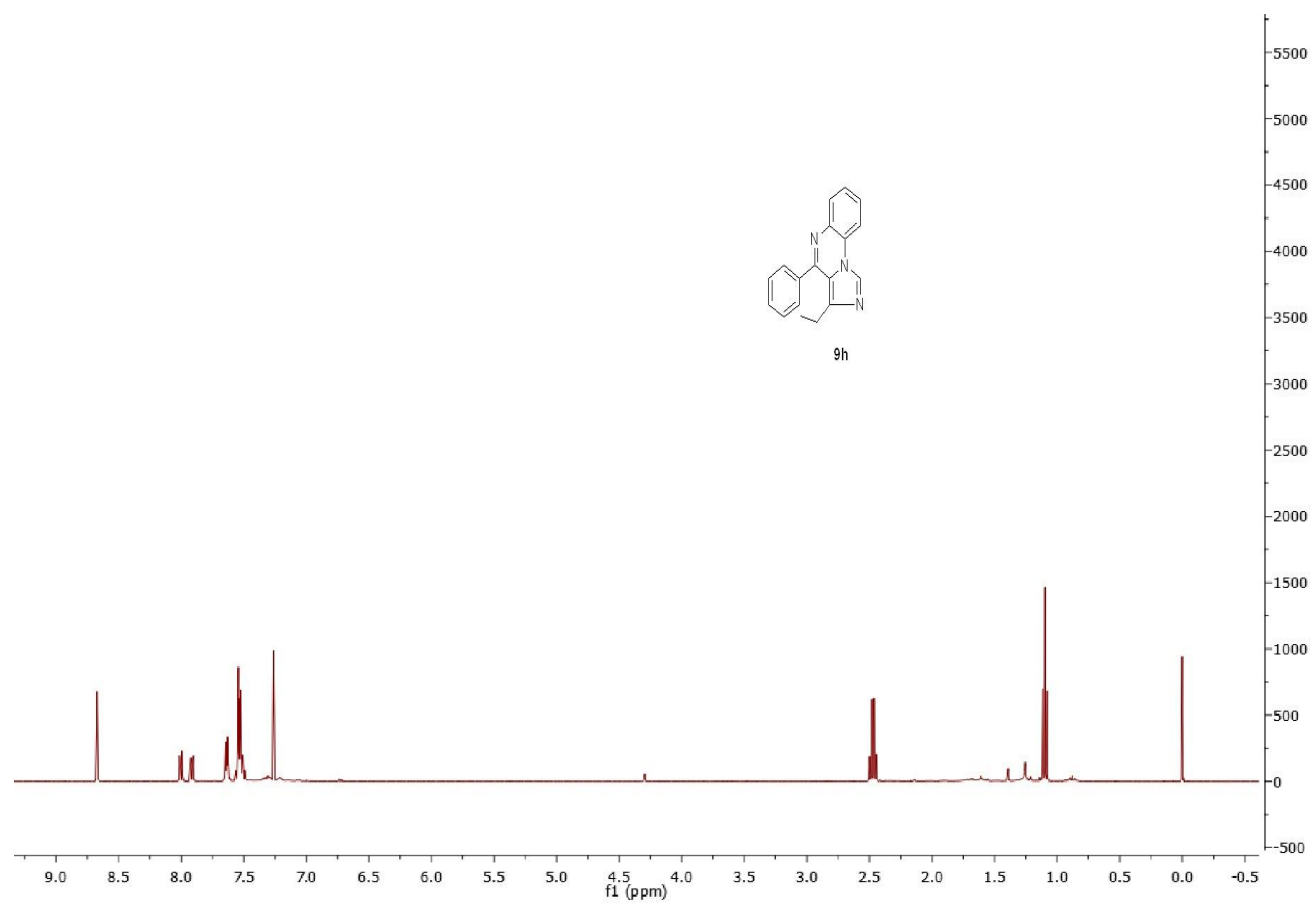
^1H NMR for compound **9g** (CDCl_3 , 400 MHz)



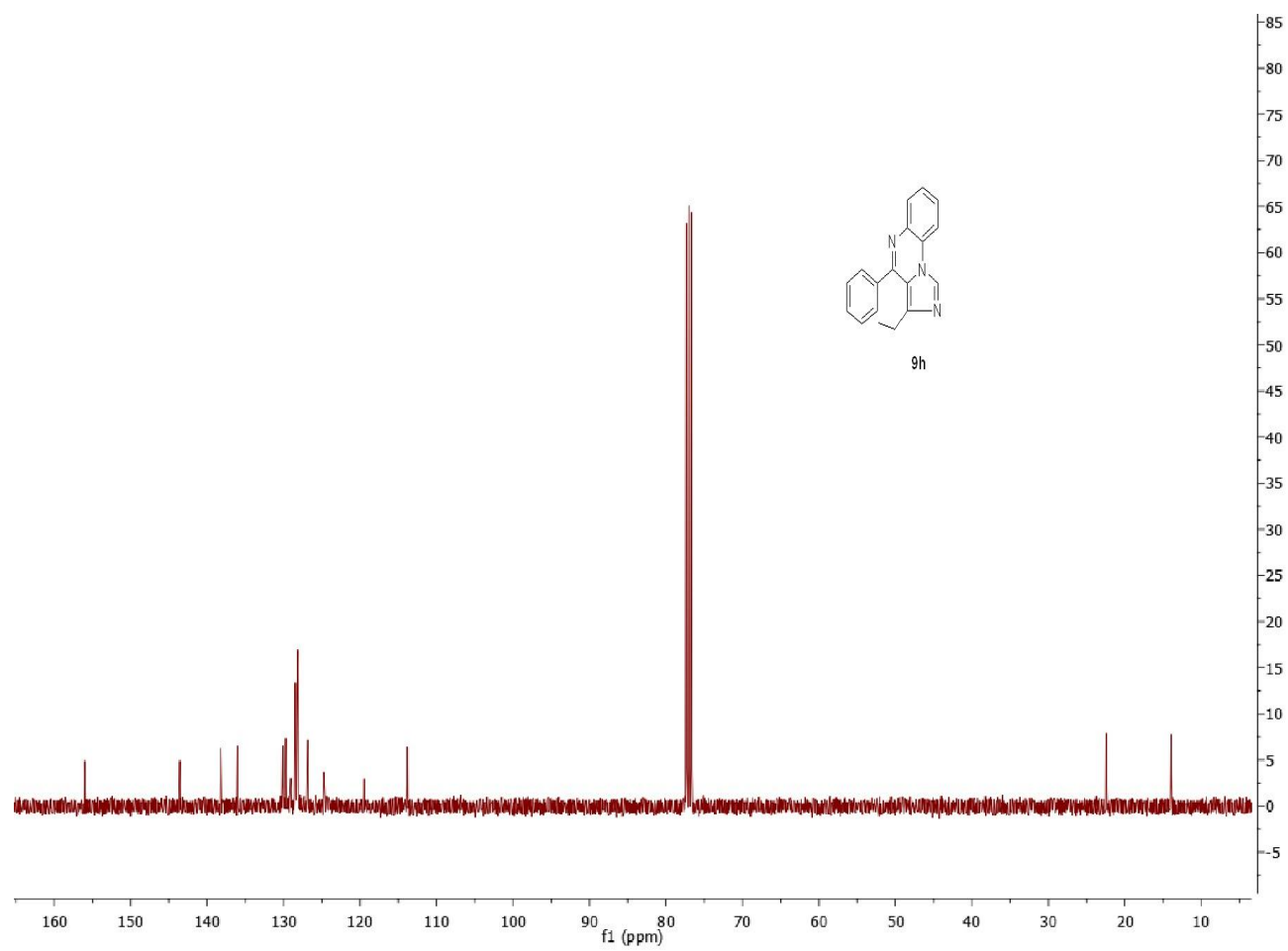
^{13}C NMR for compound **9g** (CDCl_3 , 100 MHz)



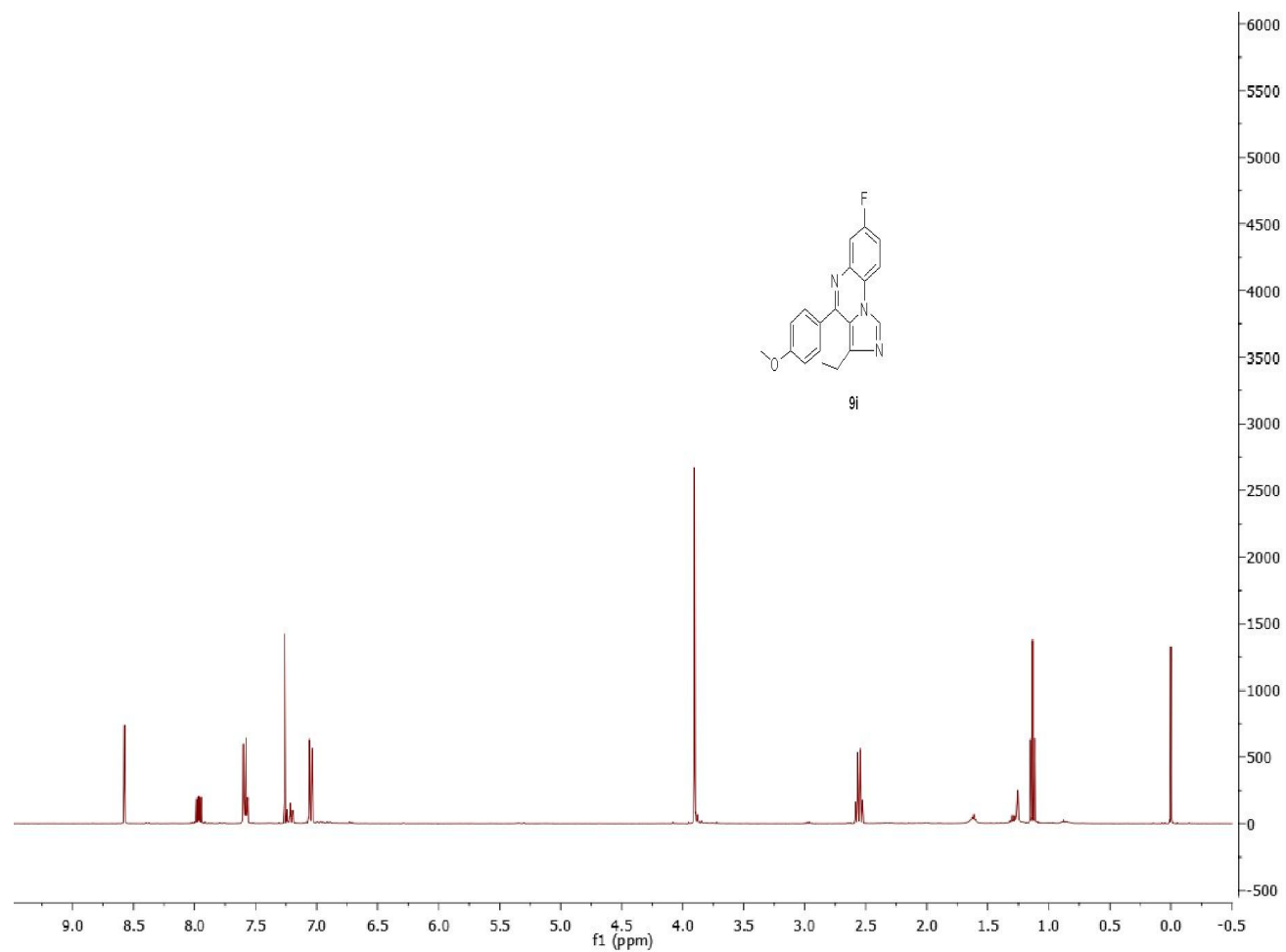
^1H NMR for compound **9h** (CDCl_3 , 400 MHz)



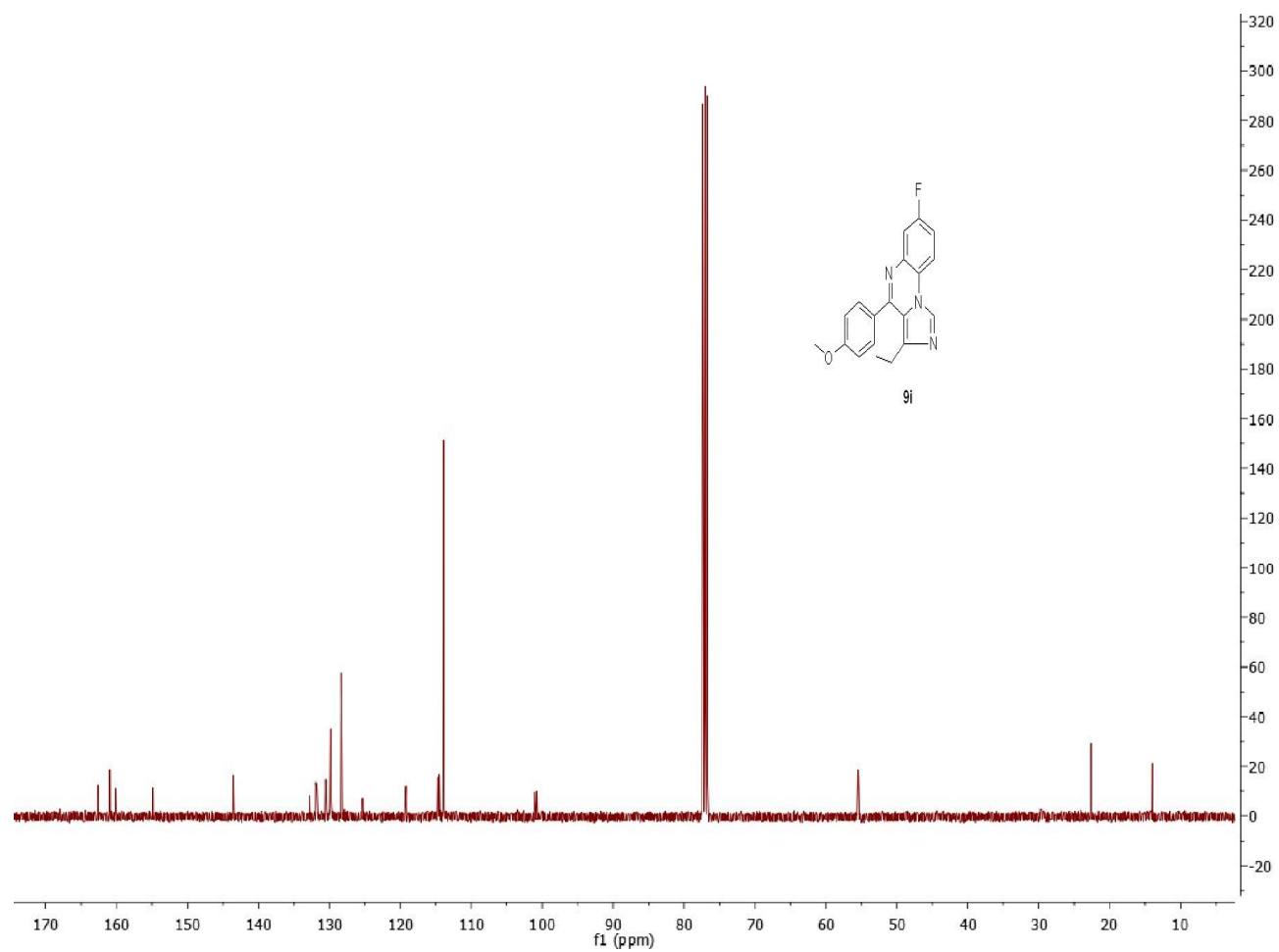
^{13}C NMR for compound **9h** (CDCl_3 , 100 MHz)



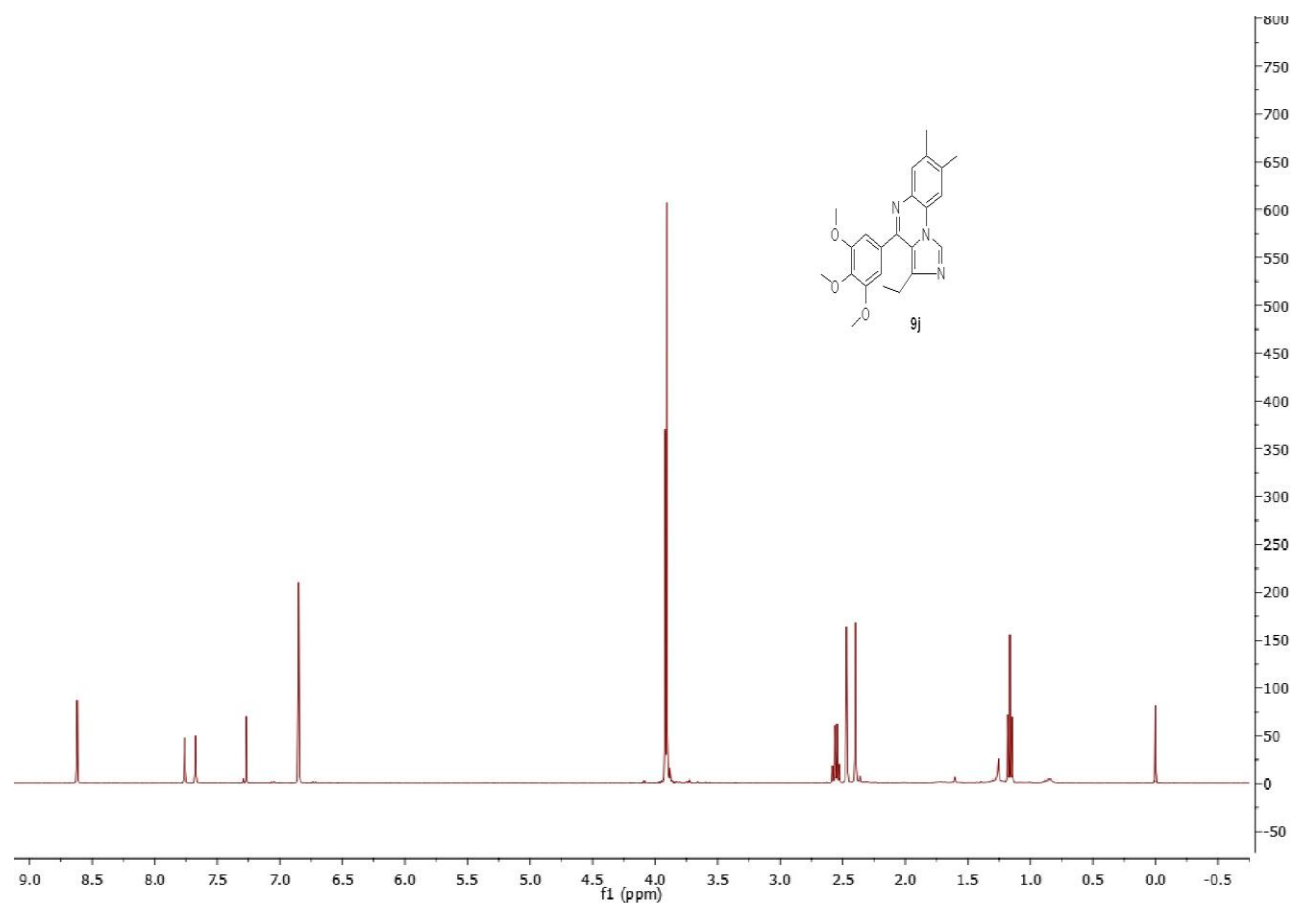
^1H NMR for compound **9i** (CDCl_3 , 400 MHz)



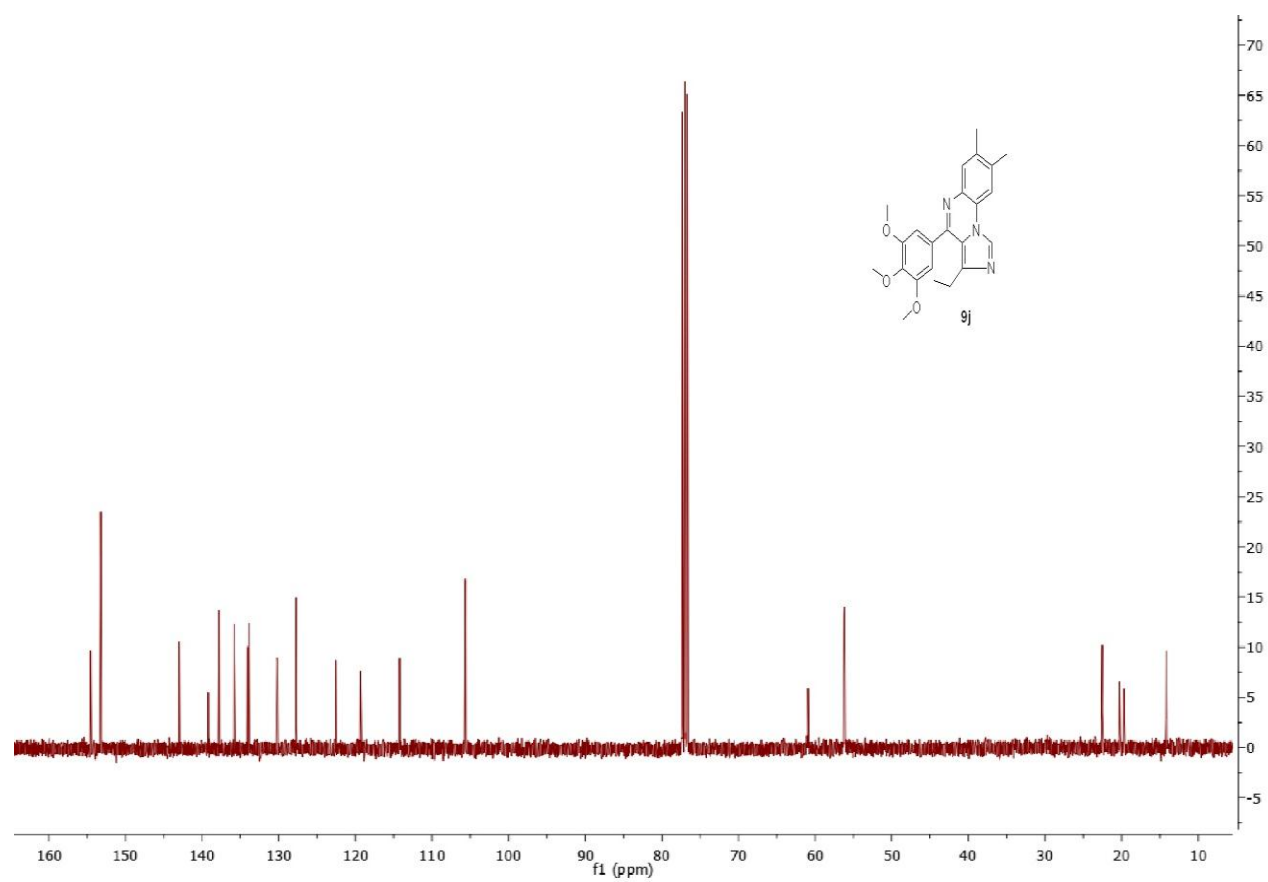
^{13}C NMR for compound **9i** (CDCl_3 , 100 MHz)



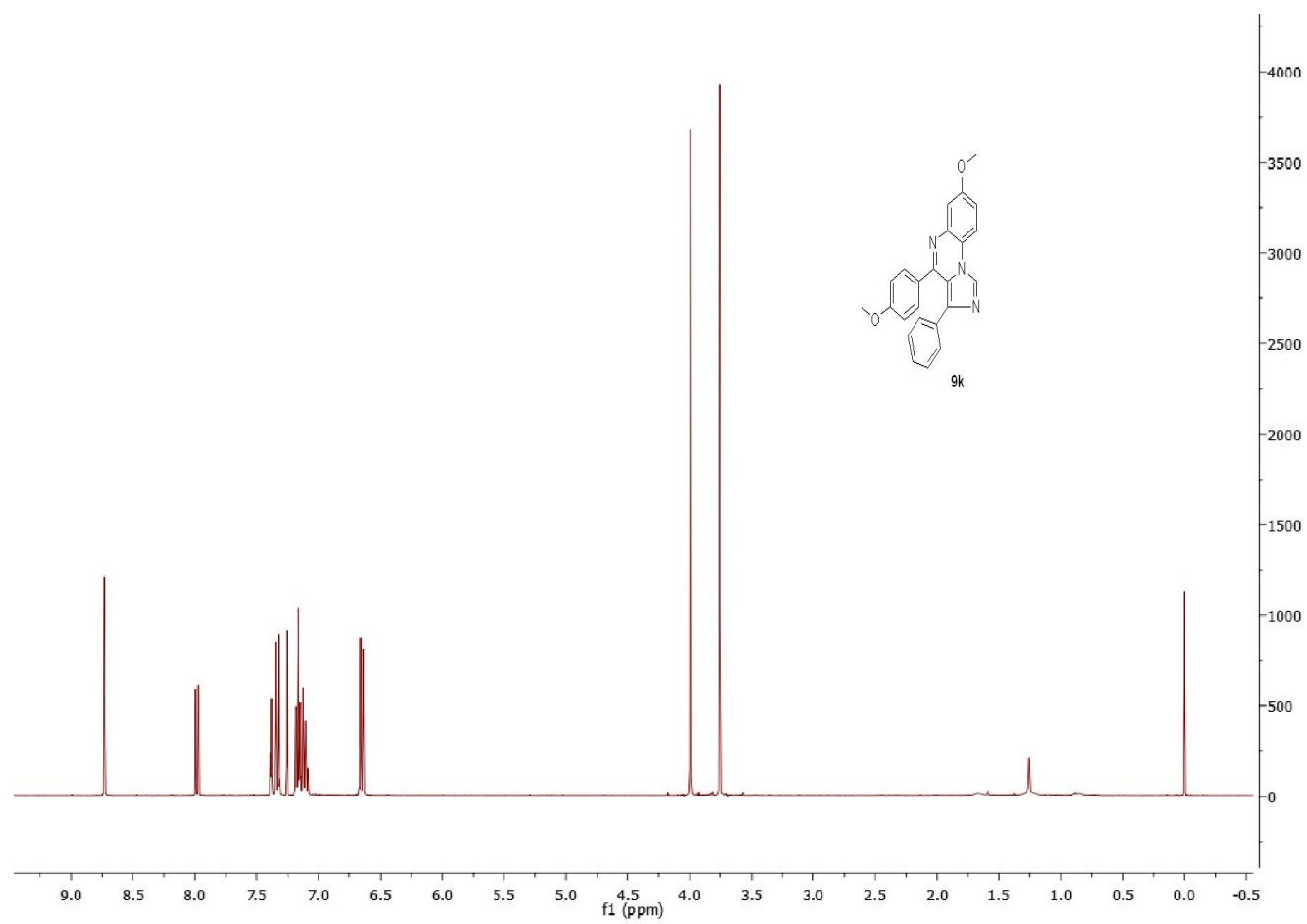
^1H NMR for compound **9j** (CDCl_3 , 400 MHz)



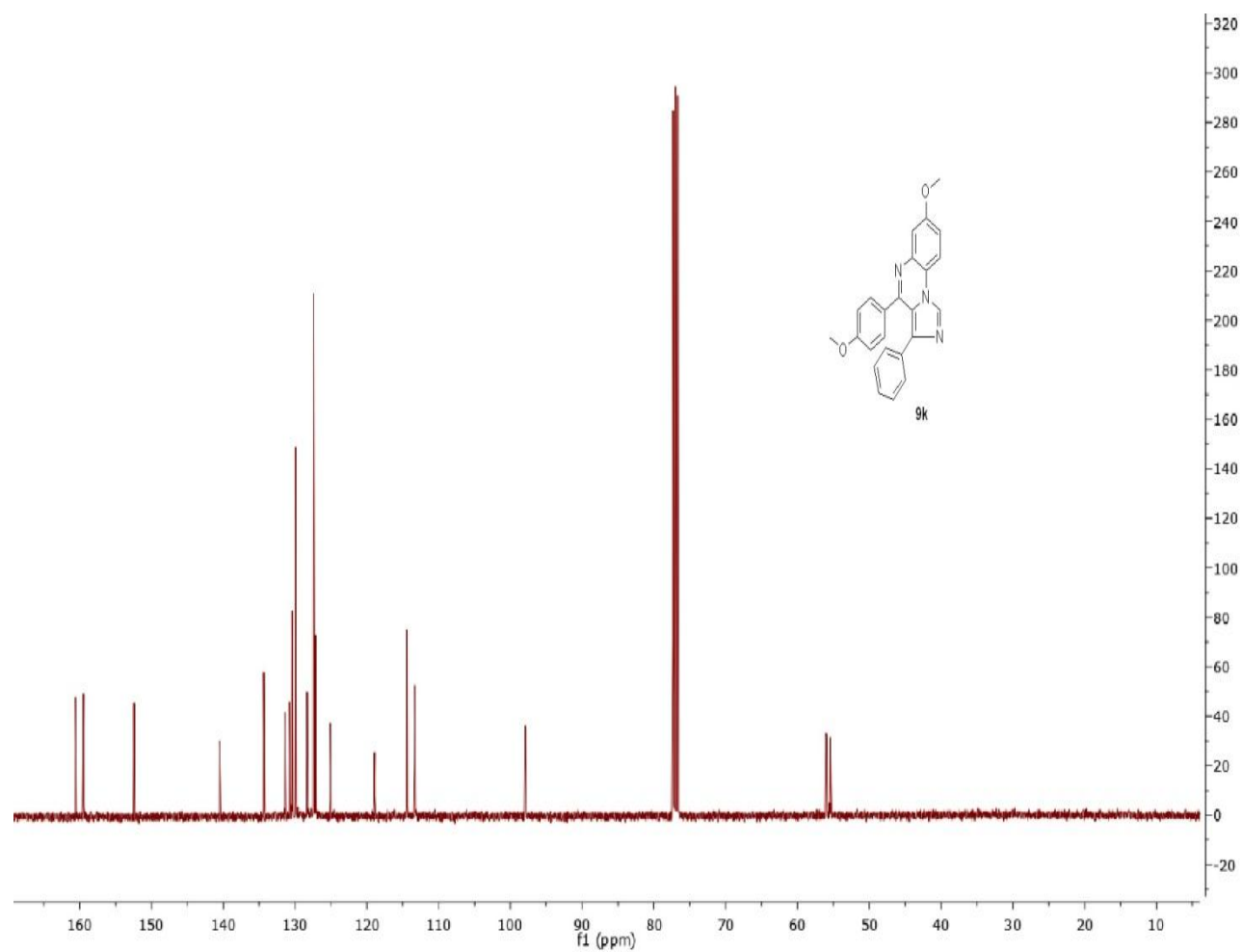
^{13}C NMR for compound **9j** (CDCl_3 , 100 MHz)



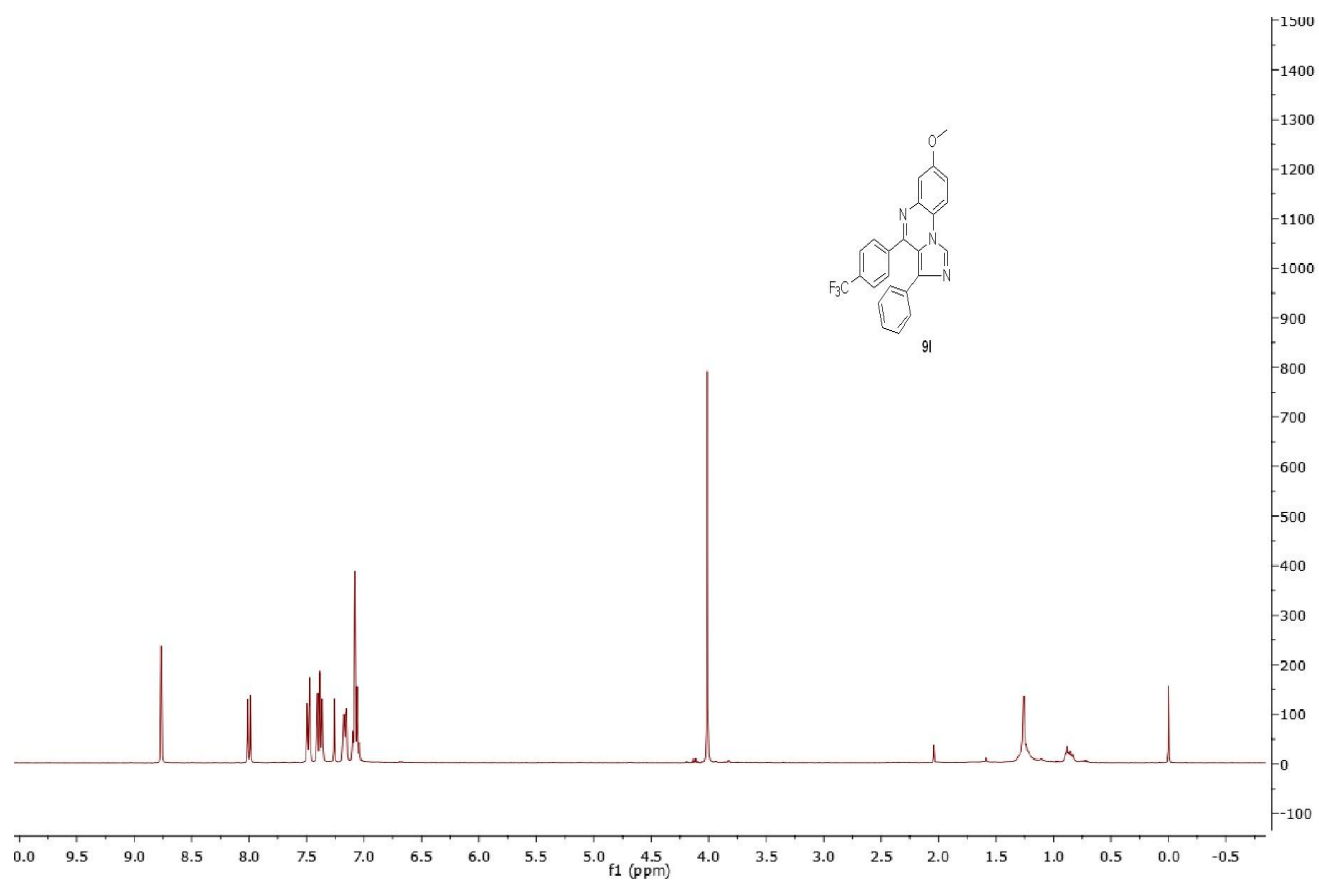
^1H NMR for compound **9k** (CDCl_3 , 400 MHz)



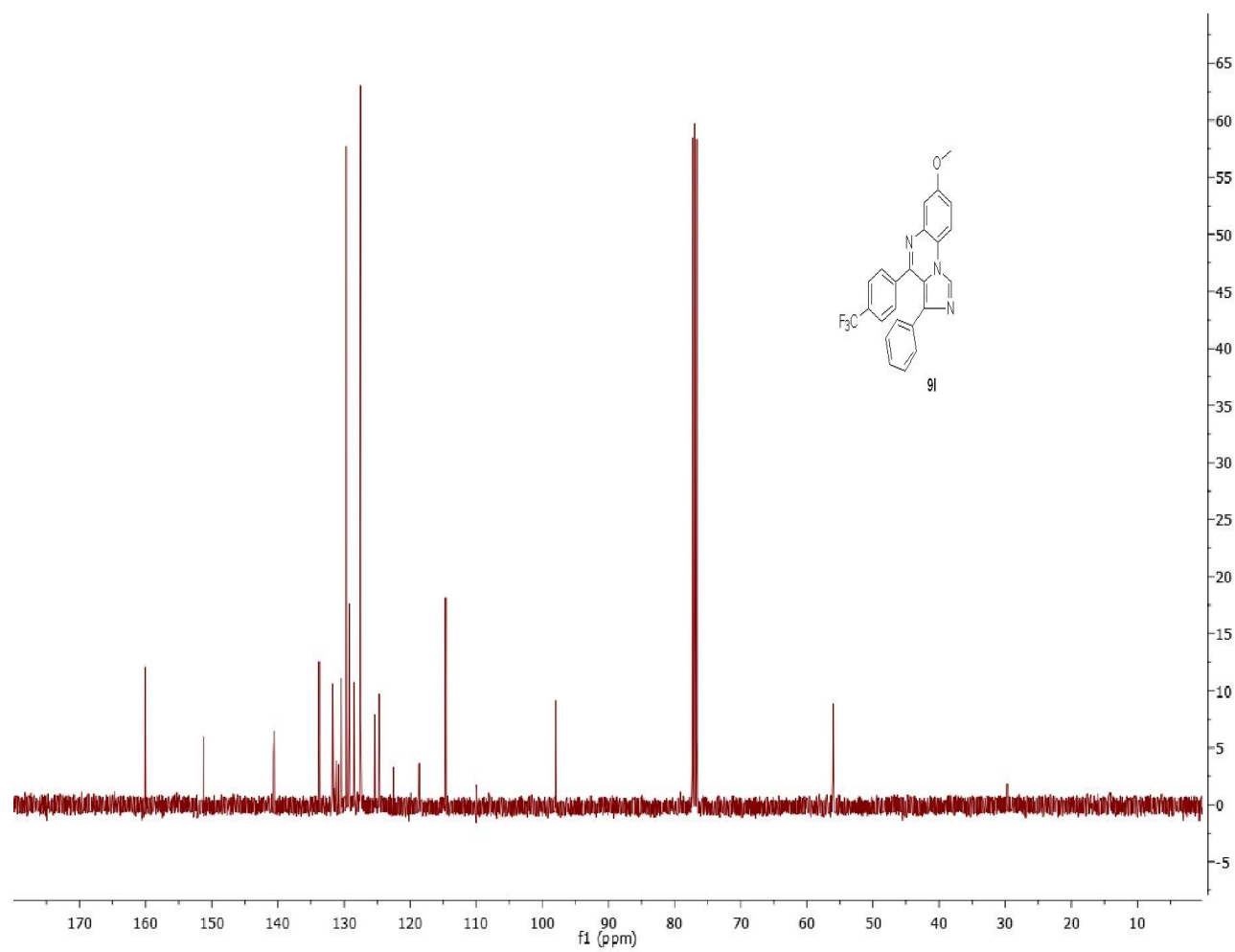
^{13}C NMR for compound **9k** (CDCl_3 , 100 MHz)



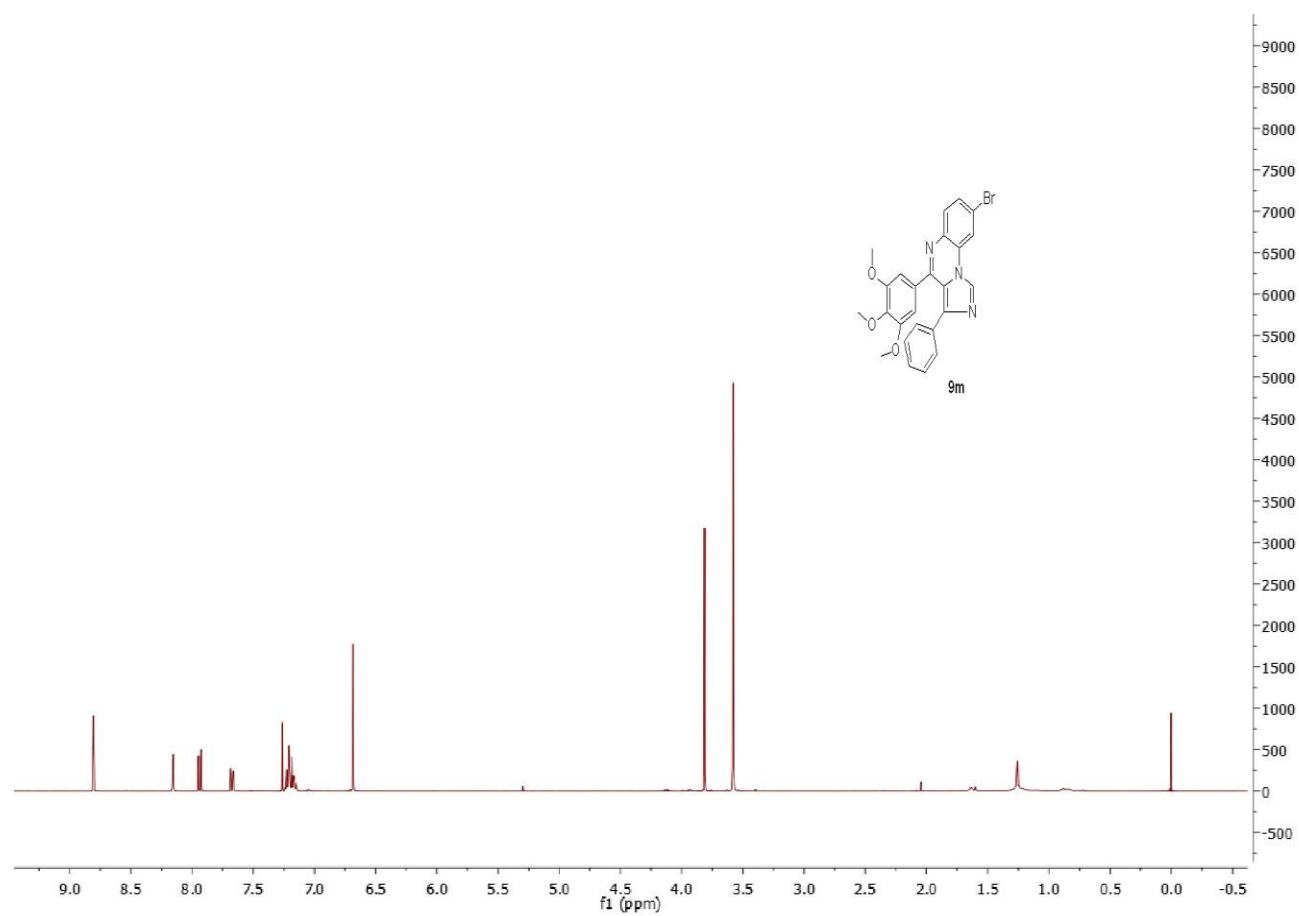
^1H NMR for compound **9l** (CDCl_3 , 400 MHz)



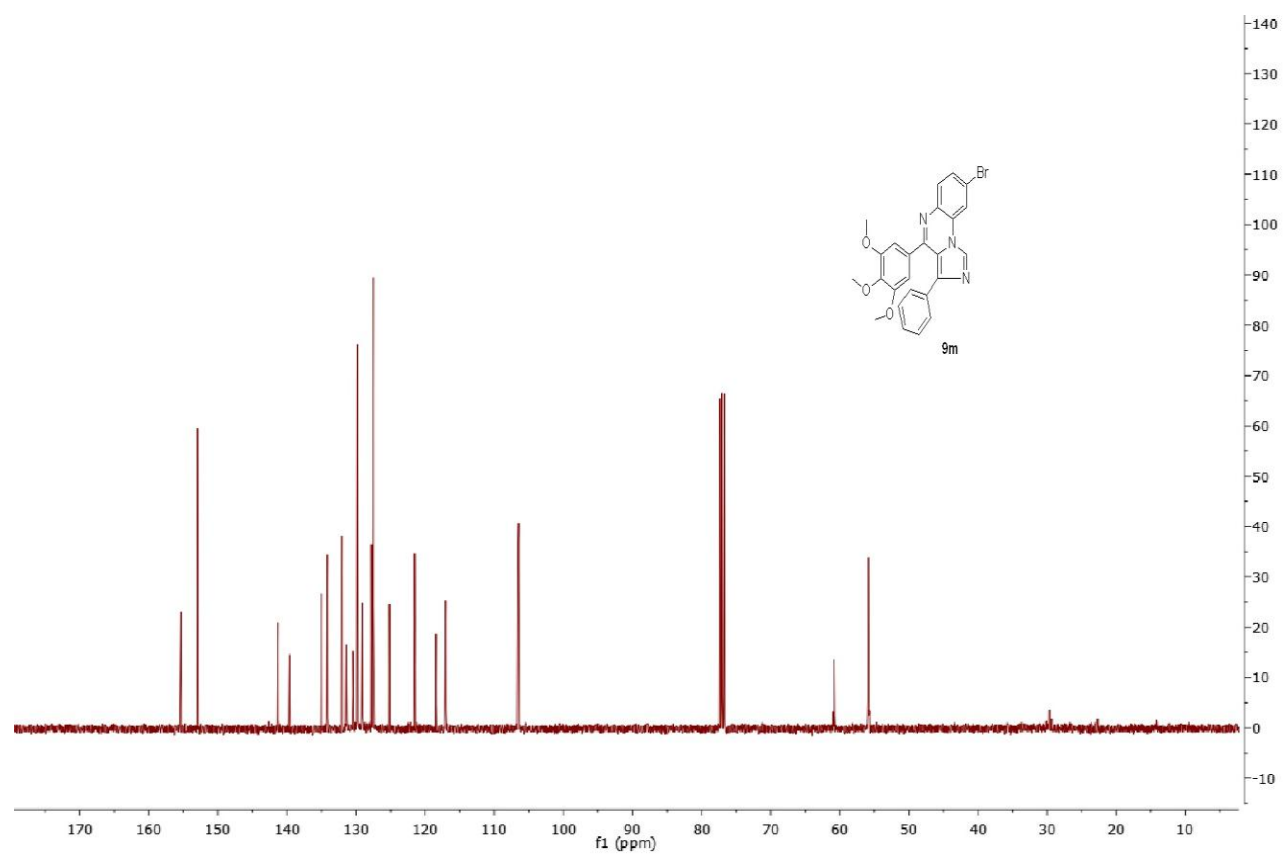
^{13}C NMR for compound **9l** (CDCl_3 , 100 MHz)



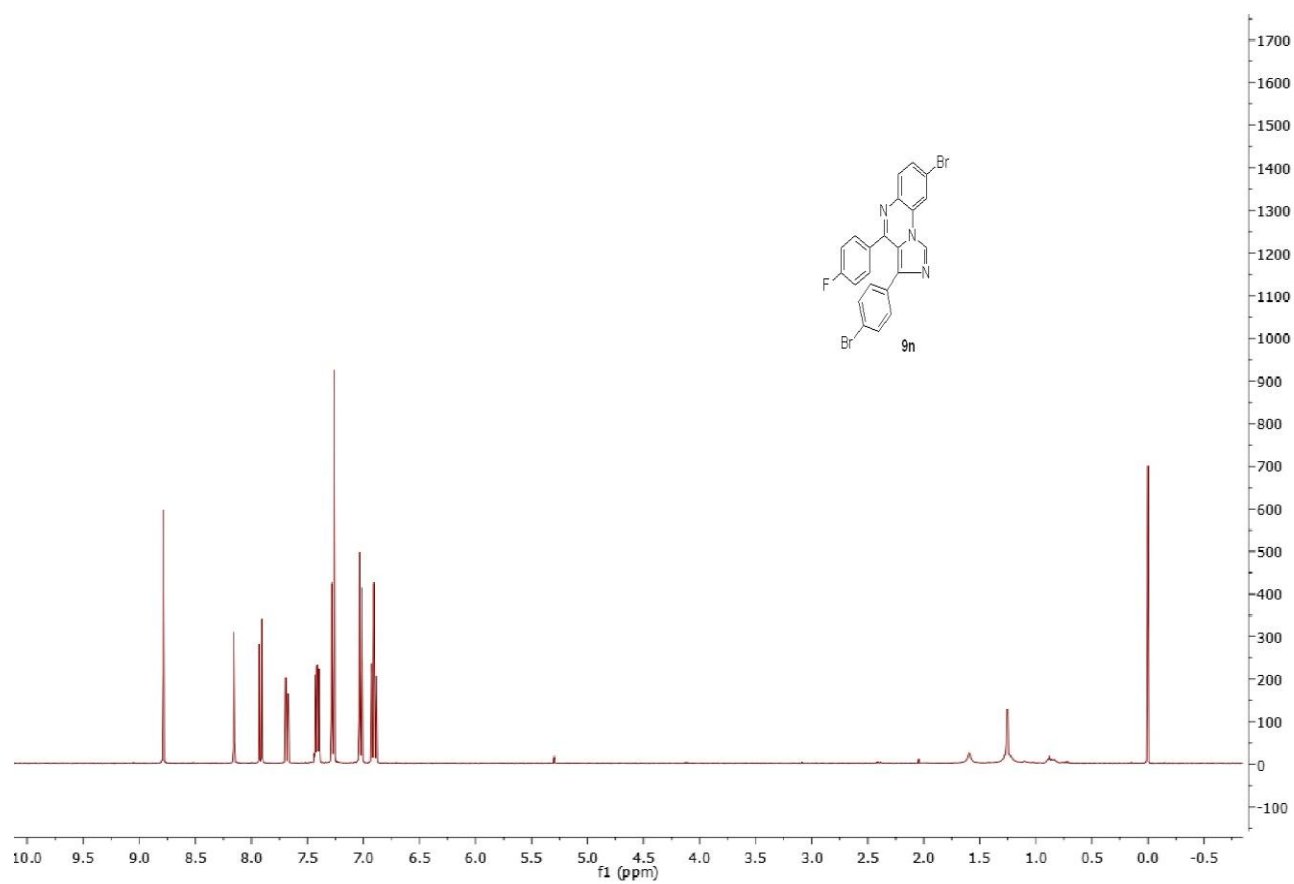
^1H NMR for compound **9m** (CDCl_3 , 400 MHz)



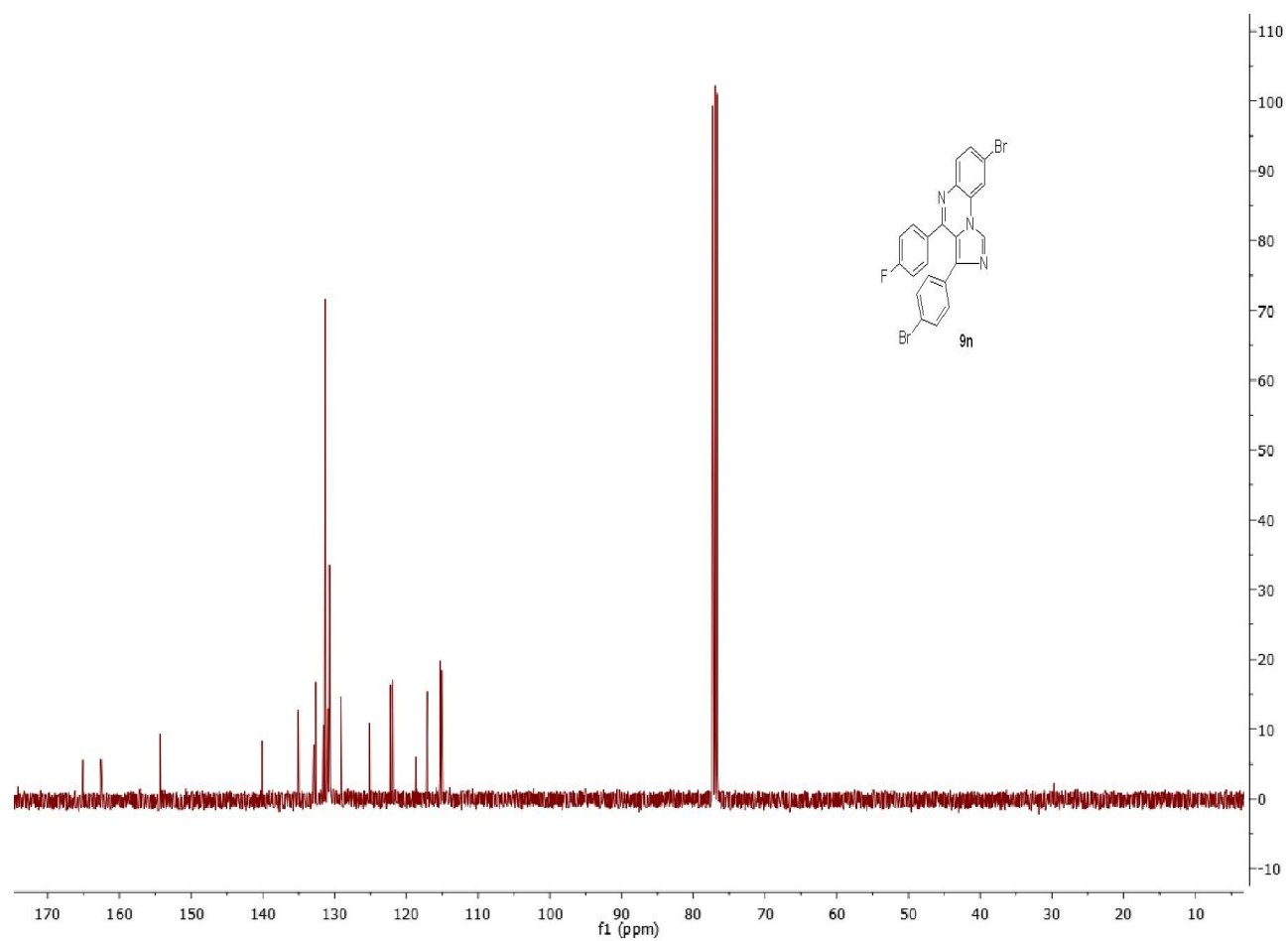
^{13}C NMR for compound **9m** (CDCl_3 , 100 MHz)



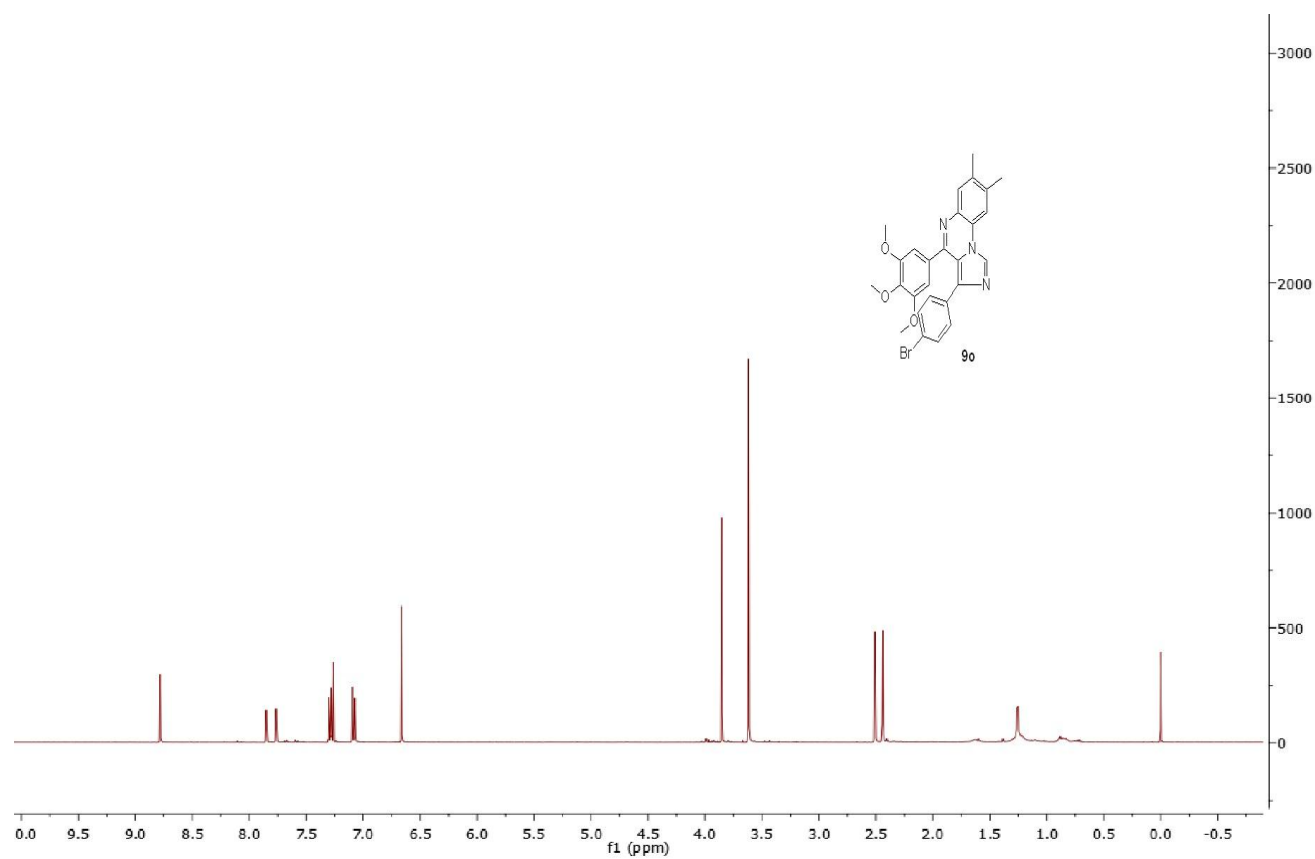
^1H NMR for compound **9n** (CDCl_3 , 400 MHz)



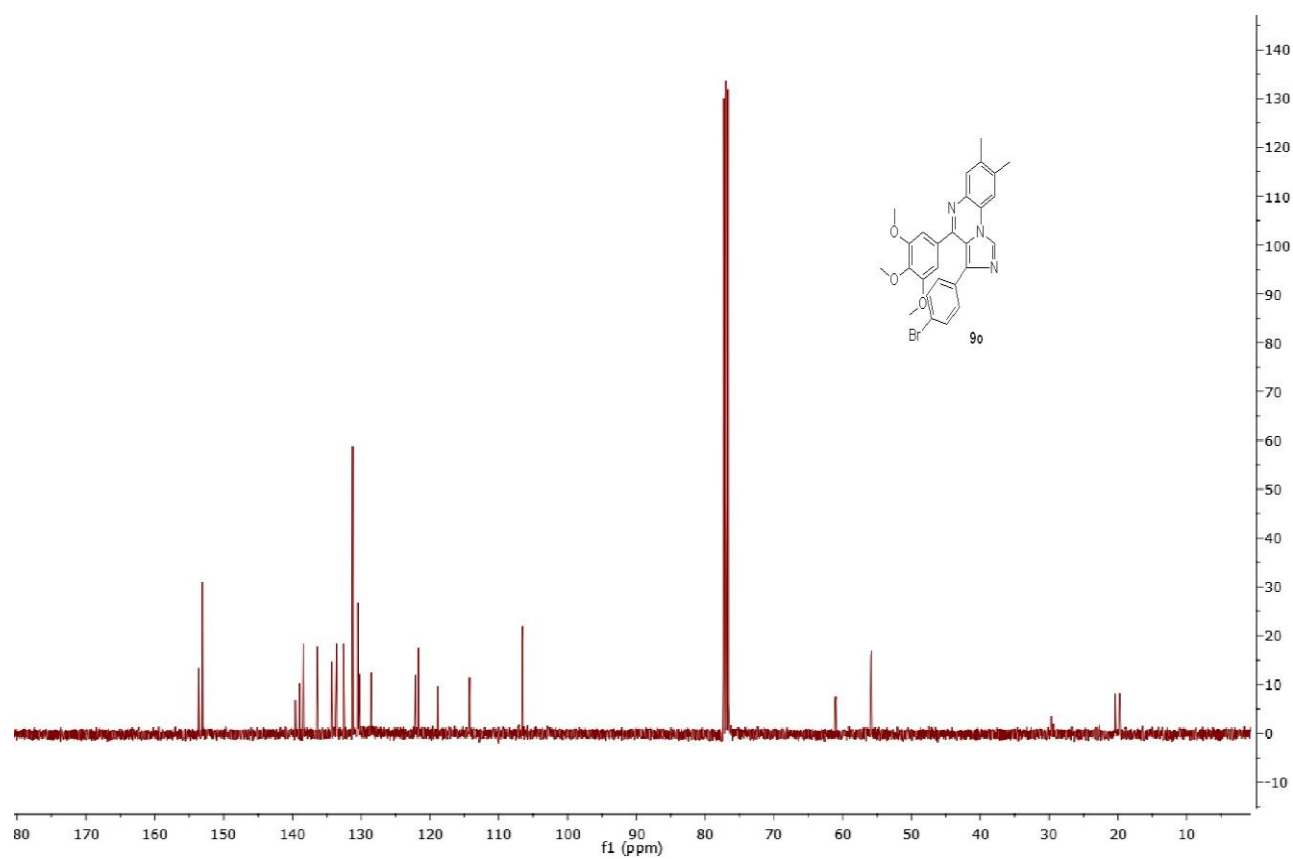
^{13}C NMR for compound **9n** (CDCl_3 , 100 MHz)



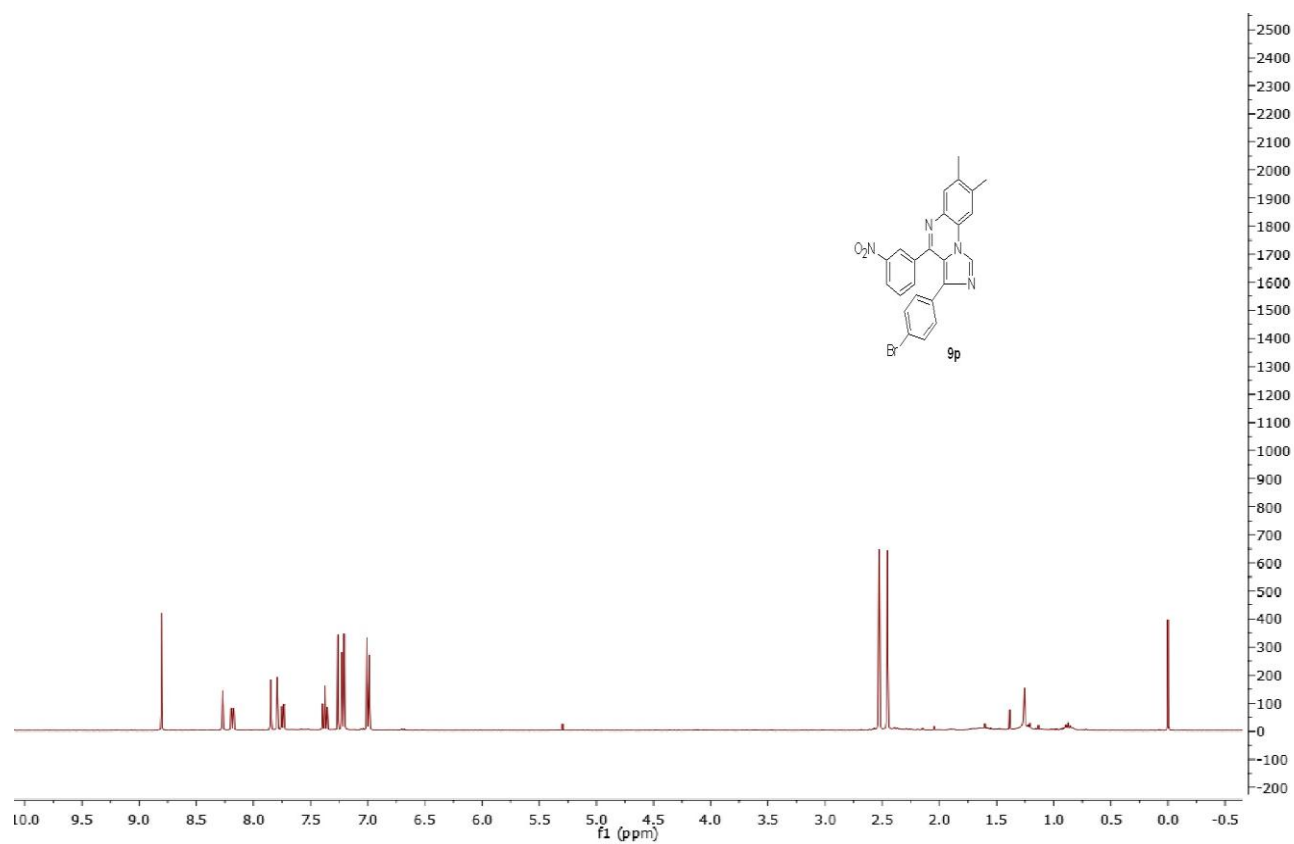
^1H NMR for compound **9o** (CDCl_3 , 400 MHz)



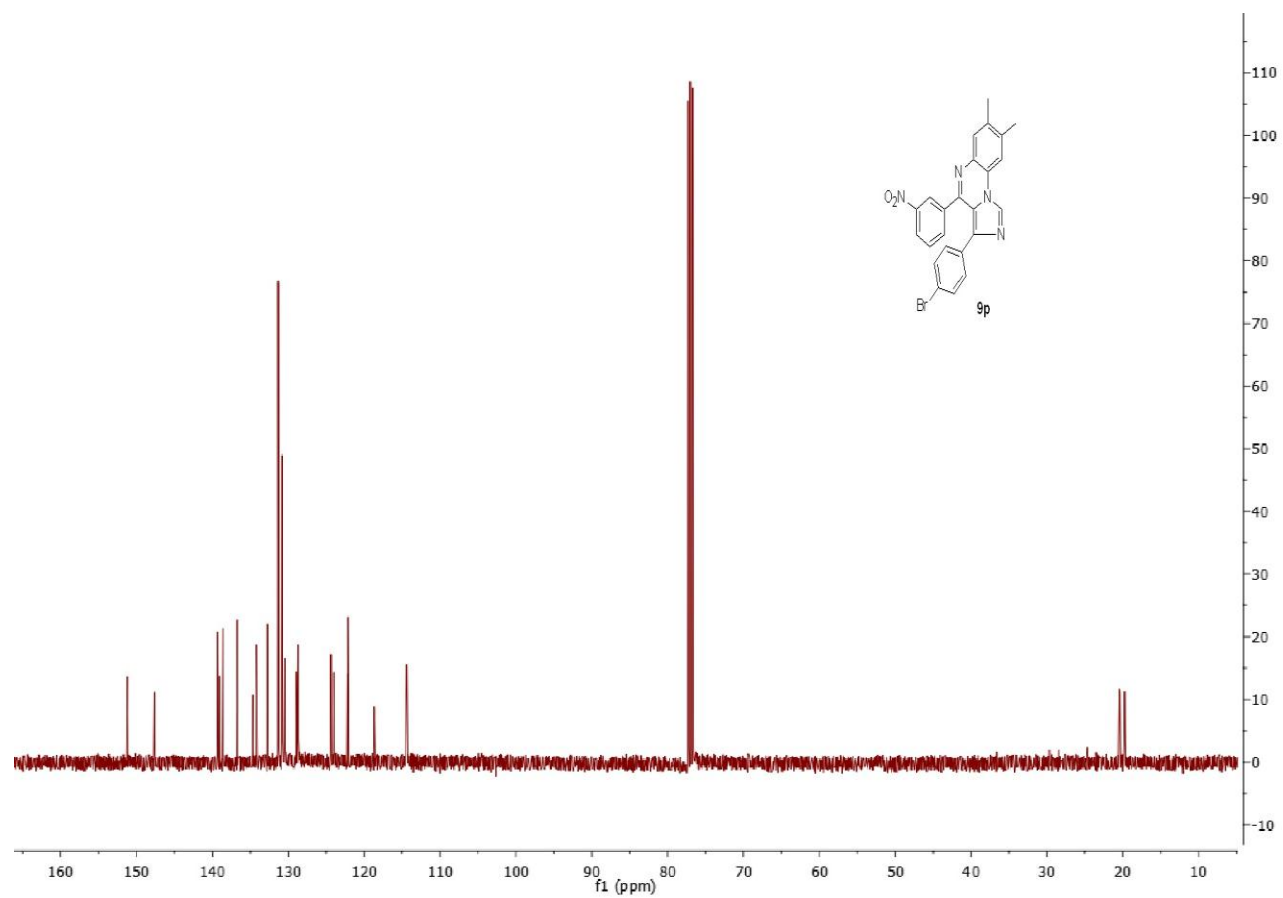
^{13}C NMR for compound **9o** (CDCl_3 , 100 MHz)



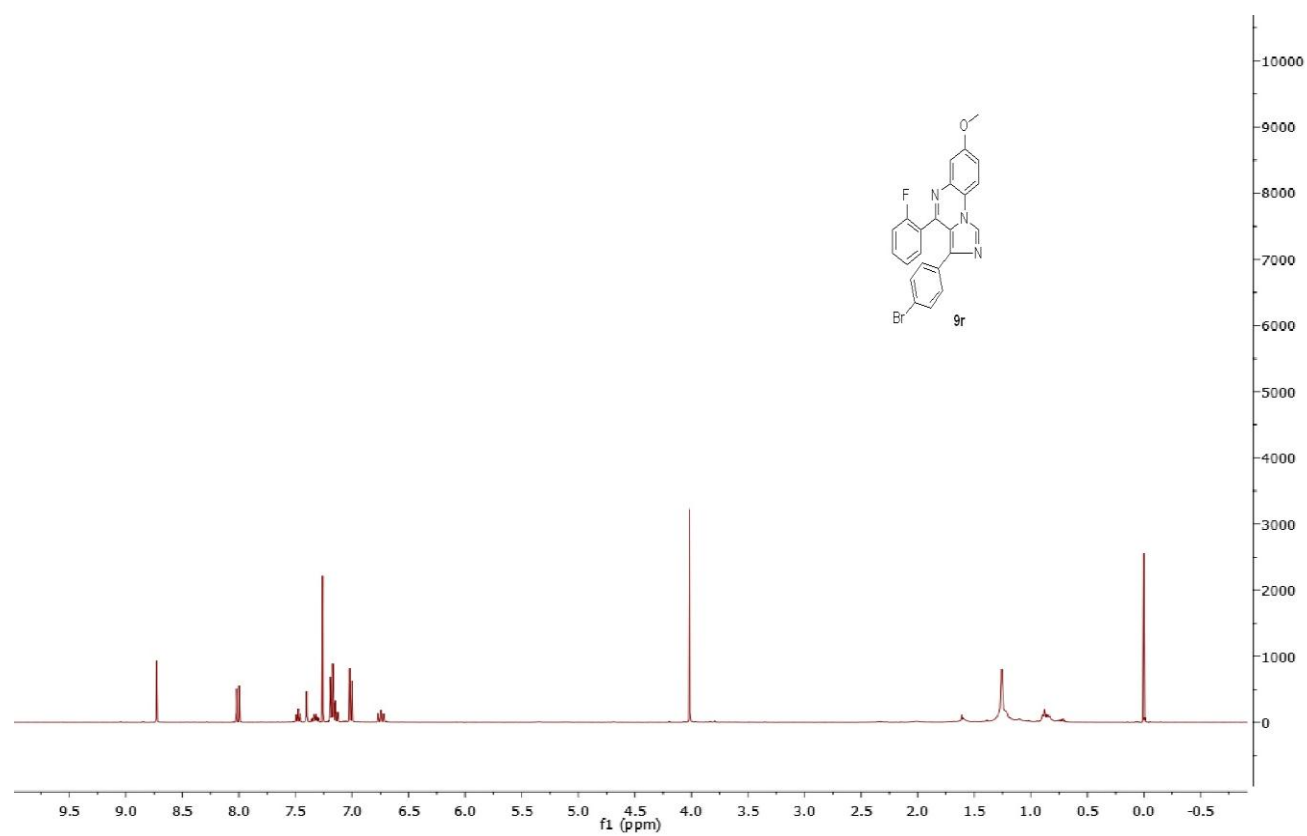
^1H NMR for compound **9p** (CDCl_3 , 400 MHz)



^{13}C NMR for compound **9p** (CDCl_3 , 100 MHz)



^1H NMR for compound **9r** (CDCl_3 , 400 MHz)



^{13}C NMR for compound **9r** (CDCl_3 , 100 MHz)

