Supporting Information

Content

General Consideration

All experiments were performed in a screw capped reaction vial under conventional heating. Reactions were monitored by thin layer chromatography (TLC) on Merck gel 60 F_{254} plates. The ^{1}H and ^{13}C NMR spectra ($CDCl_3$ and DMSO-d_6) were recorded on a JEOL ECX-400P NMR at 400 MHz and 100 MHz, respectively using TMS as internal standard. The high-resolution mass spectral data was obtained using an AGILENT 6520 Q-TOF spectrometer, Bruker ESI instrument-amaZon SL Dual Funnel Iontrap Bench Top and Waters QTOF mass spectrometer. Melting point were recorded on a Büchi M-560 melting point apparatus and are uncorrected. All the chemicals and reagents were purchased from commercial sources and used as received. TBHP 70% aqueous and 5-6 M in decane solution were used. 1-Methyl-3-phenylquinoxalin-2(1*H*)-one[1-3] derivatives were prepared according to the literature procedures.

General procedure for the synthesis of compounds 3(a-z)

An oven dried 10 mL screw capped reaction vial with a small stirring bar was charged with a mixture of 1-methyl-3-phenylquinoxalin-2(1*H*)-one **1** (1 mmol), Benzaldehyde **2** (1.5 mmol), $Pd(OAc)_2$ (10 mol%), TBPB (6 mmol) and H_2O (3mL). The resulting mixture was stirred at 90 ^{o}C for 18 hours. The progress of the reaction was monitored by TLC. After Completion of the reaction, the reaction mixture was cooled up to ambient temperature, washed with 20 mL saturated solution of $NaHCO_3$ and extracted with ethyl acetate (3 X 15 mL). The organic layer was separated, dried over anhydrous Na_2SO_4 and concentrated on a rotary evaporator to obtained the crude product. The crude product thus obtained was further purified on a silica gel column using hexane/ethyl acetate (8:2) as eluent to afford the pure targeted products.

General procedure for the synthesis of compounds 5(a-g)

An oven dried 10 mL screw capped reaction vial with a small stirring bar was charged with a mixture of 1-methyl-3-phenylquinoxalin-2(1*H*)-one **1** (1 mmol), Benzyl Alcohols **4** (1.5 mmol), $Pd(OAc)_2$ (10 mol%), TBPB (6 mmol) and H_2O (3mL). The resulting mixture was stirred at 90 ^{o}C for 18 hours. The progress of the reaction was monitored by TLC. After Completion of the reaction, the reaction mixture was cooled up to ambient temperature, washed with 20 mL saturated solution of $NaHCO_3$ and extracted with ethyl acetate (3 X 15 mL). The organic layer was separated, dried over anhydrous Na_2SO_4 and concentrated on a rotary

evaporator to obtained the crude product. The crude product thus obtained was further purified on a silica gel column using hexane/ethyl acetate (8:2) as eluent to afford the pure targeted products.

General procedure for the synthesis of compounds 7a

An oven dried 10 mL screw capped reaction vial with a small stirring bar was charged with a mixture of 1-methyl-3-phenylquinoxalin-2(1*H*)-one **1** (0.423 mmol), $Pd(OAc)_2$ (10 mol%), Aqueous TBHP (12 mmol) and Toluene **6** (3mL) The resulting mixture was stirred at 90 ^oC for 18 hours. The progress of the reaction was monitored by TLC. After Completion of the reaction, the reaction mixture was cooled up to ambient temperature, washed with 20 mL saturated solution of $NaHCO_3$ and extracted with ethyl acetate (3 X 15 mL). The organic layer was separated, dried over anhydrous Na_2SO_4 and concentrated on a rotary evaporator to obtained the crude product. The crude product thus obtained was further purified on a silica gel column using hexane/ethyl acetate (8:2) as eluent to afford the pure targeted products.

General procedure for the synthesis of compound 18

An oven dried 10 mL screw capped reaction vial with a small stirring bar was charged with a mixture of 3-(2-(4-bromobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (1 mmol), Boronic acids (2.0 mmol), $Pd(PPh_3)_4$ (5 mol%), Cs_2CO_3 (1.5 mmol) and Toluene (2mL). The resulting mixture was heated at 110 ^oC for 16 hours. The progress of the reaction was monitored by TLC. After Completion of the reaction, the reaction mixture was cooled up to ambient temperature and then diluted with water and extracted with EtOAc (3×10 mL). The organic layer was separated, dried over anhydrous Na_2SO_4 and concentrated on a rotary evaporator to obtain the crude product. The crude product thus obtained was further purified on a silica gel column using hexane/ethyl acetate (8:2) as eluent to afford the pure targeted products.

General procedure for the synthesis of compounds 19

An oven dried 10 mL screw capped reaction vial with a small stirring bar was charged with a mixture of 3-(2-benzoyl-4-bromophenyl)-1-methylquinoxalin-2(1H)-one (1 mmol), Boronic acids (2.0 mmol), $Pd(PPh_3)_4$ (5 mol%), Cs_2CO_3 (1.5 mmol) and Toluene (2mL). The resulting mixture was heated at 110 ^oC for 16 hours. The progress of the reaction was monitored by TLC.

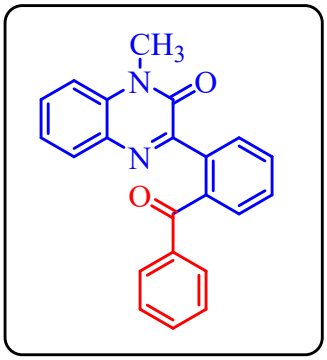
After Completion of the reaction, the reaction mixture was cooled up to ambient temperature and then diluted with water and extracted with EtOAc (3×10 mL). The organic layer was separated, dried over anhydrous Na_2SO_4 and concentrated on a rotary evaporator to obtain the crude product. The crude product thus obtained was further purified on a silica gel column using hexane/ethyl acetate (8:2) as eluent to afford the pure targeted products.

References

1. Xue, Z. Y.; Jiang, Y.; Peng, X. Z.; Yuan, W. C.; Zhang, X. M., *Adv. Synth. Catal.* **2010**, *352*, 2132-2136.
2. Núñez-Rico, J. L.; Vidal-Ferran, A., *Org. Lett.* **2013**, *15*, 2066-2069.
3. Carrër, A.; Brion, J.-D.; Messaoudi, S.; Alami, M., *Org. Lett.* **2013**, *15*, 5606-5609.
4. Zhang, Y.; Huang, T.; Li, X.; Zhang, M.; Song, Y.; Huang, K.; Su, W. *RSC Advances* **2020**, *10*, 22216-22221.

Analytical Data

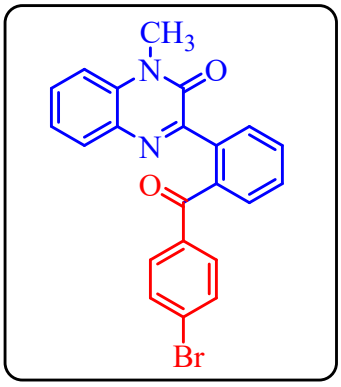
3-(2-benzoylphenyl)-1-methylquinoxalin-2(1H)-one (3a)



It was obtained as yellow solid having melting point 166-168 °C with 81% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 7.7 Hz, 1H), 7.84 (m, *J* = 7.0 Hz, 3H), 7.66 (td, *J* = 7.5, 1.6 Hz, 2H), 7.58 (d, *J* = 6.1 Hz, 1H), 7.55 – 7.50 (m, 2H), 7.48 (d, *J* = 7.4 Hz, 1H), 7.39 (t, *J* = 7.5 Hz, 2H), 7.35 – 7.30 (m, 1H), 7.24 (d, *J* = 7.2 Hz, 1H), 3.58 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.99, 155.31, 154.31, 138.54, 138.46, 137.31, 133.78, 133.61, 133.07, 132.74, 132.12, 130.95, 130.92, 130.50, 130.20, 128.35, 125.74, 123.99, 113.83, 29.46.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{16}N_2O_2$:341.1290; found:341.1290.

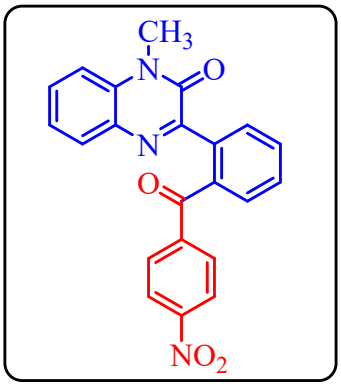
3-(2-(4-bromobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3b)



It was obtained as yellow solid having melting point 180-182 °C with 75% yield.

^{1}H NMR (400 MHz, DMSO-d_6) δ 7.89 (d, *J* = 7.4 Hz, 1H), 7.75 (t, *J* = 8.2 Hz, 2H), 7.68 (d, *J* = 6.4 Hz, 2H), 7.65 (d, *J* = 6.0 Hz 2H), 7.62 (d, *J* = 6.0 Hz, 2H), 7.55 – 7.50 (m, 2H), 7.39 (t, *J* = 7.6 Hz, 1H), 3.51 (s, 3H).
^{13}C NMR (100 MHz, DMSO-d_6) δ 194.93, 155.64, 153.73, 138.80, 136.12, 136.05, 133.16, 132.28, 131.66, 131.40, 131.09, 130.81, 130.77, 129.31, 128.61, 126.71, 123.75, 114.80, 29.21.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{15}BrN_2O_2$:419.0395; found:419.0390

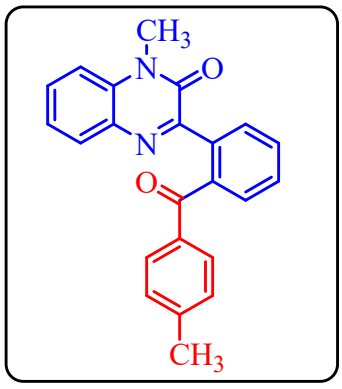
1-methyl-3-(2-(4-nitrobenzoyl)phenyl)quinoxalin-2(1H)-one (3c)



It was obtained as yellow solid having melting point 94-96 °C with 68% yield.

^{1}H NMR (400 MHz, DMSO-d_6) δ 8.30 (d, *J* = 8.8 Hz, 2H), 7.97 – 7.92 (m, 3H), 7.77 (d, *J* = 6.9 Hz, 2H), 7.69 – 7.62 (m, 2H), 7.54 (s, 1H), 7.52 (s, 1H), 7.43 – 7.38 (m, 1H), 3.51 (s, 3H).
^{13}C NMR (100 MHz, DMSO-d_6) δ 194.58, 155.34, 153.79, 149.52, 142.18, 138.41, 135.92, 133.17, 132.27, 131.55, 130.99, 130.94, 130.90, 129.50, 129.36, 128.67, 123.86, 123.52, 114.88, 29.27.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{15}N_3O_4$:386.1141; found:386.1124.

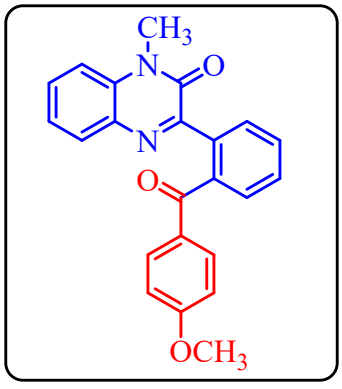
1-methyl-3-(2-(4-methylbenzoyl)phenyl)quinoxalin-2(1H)-one (3d)



It was obtained as yellow solid having melting point 188-190 °C with 79% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 7.8 Hz, 1H), 7.84 (d, *J* = 8.0 Hz, 1H), 7.77 (s, 1H), 7.75 (s, 1H), 7.64 (t, *J* = 7.5 Hz, 1H), 7.57 (d, *J* = 7.7 Hz, 1H), 7.51 (t, *J* = 7.8 Hz, 2H), 7.34 – 7.28 (m, 1H), 7.24 (d, *J* = 9.6 Hz, 1H), 7.21 (s, 1H), 7.19 (s, 1H), 3.57 (s, 1H), 2.37 (s, 1H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.59, 156.89, 154.56, 143.22, 139.94, 136.87, 135.13, 133.63, 133.23, 131.03, 130.76, 130.44, 130.41, 130.38, 129.48, 129.06, 128.95, 123.72, 113.70, 29.38, 21.75.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{18}N_2O_2$:355.1447; found:355.1434.

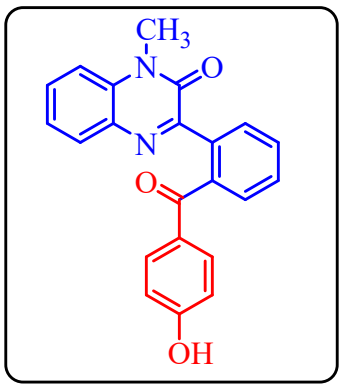
3-(2-(4-methoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3e)



It was obtained as white solid having melting point 200-202 °C with 80% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 6.6 Hz, 1H), 7.84 (dd, *J* = 8.3, 3.1 Hz, 3H), 7.64 (t, *J* = 7.4 Hz, 1H), 7.57 (d, *J* = 7.7 Hz, 1H), 7.52 (dd, *J* = 7.9, 4.1 Hz, 2H), 7.34 – 7.29 (m, 1H), 7.24 (s, 1H), 6.90 (s, 1H), 6.87 (s, 1H), 3.83 (s, 3H), 3.58 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.65, 163.16, 156.87, 154.55, 140.05, 136.80, 133.61, 133.24, 132.58, 130.90, 130.76, 130.53, 130.42, 130.39, 129.35, 129.08, 123.75, 113.73, 113.53, 55.55, 29.40.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{18}N_2O_3$:371.1396; found:371.1393.

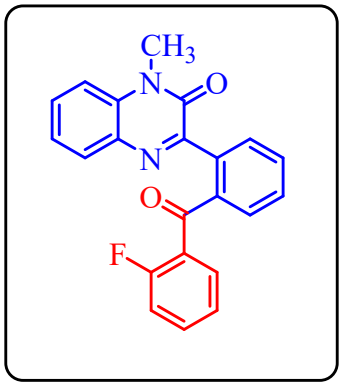
3-(2-(4-hydroxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3f)



It was obtained as yellow solid having melting point 250-252 °C with 66% yield.

^{1}H NMR (400 MHz, DMSO-d_6) δ 10.31 (s, 1H), 7.83 (d, *J* = 6.4 Hz, 1H), 7.72 (d, *J* = 8.2 Hz, 1H), 7.67 (d, *J* = 7.6 Hz, 1H), 7.63 (d, *J* = 8.7 Hz, 1H), 7.61 (s, 2H), 7.59 (s, 1H), 7.54 – 7.49 (m, 2H), 7.38 (t, *J* = 7.5 Hz, 1H), 6.81 (s, 1H), 6.79 (s, 1H), 3.52 (s, 3H).
^{13}C NMR (100 MHz, DMSO-d_6) δ 194.30, 161.70, 156.28, 153.69, 139.72, 136.27, 133.19, 132.35, 132.29, 130.62, 130.58, 130.36, 129.28, 129.04, 128.66, 128.28, 123.61, 114.91, 114.73, 29.14.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{16}N_2O_3$:357.1239; found:357.1235.

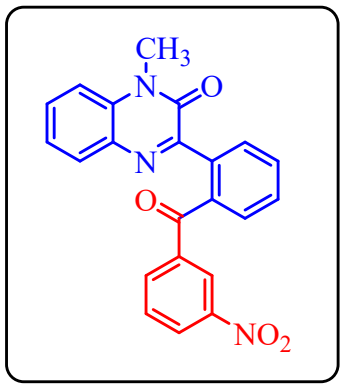
3-(2-(2-fluorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3g)



It was obtained as yellow solid having melting point 160-162 °C with 72% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.84 (dd, *J* = 7.7, 1.3 Hz, 1H), 7.68 (dtd, *J* = 15.0, 7.5, 1.7 Hz, 2H), 7.59 (d, *J* = 7.7 Hz, 1H), 7.56 – 7.53 (m, 1H), 7.51 (d, *J* = 6.5 Hz, 1H), 7.47 – 7.40 (m, 1H), 7.36 – 7.32 (m, 1H), 7.26 (d, *J* = 8.5 Hz, 1H), 7.17 (t, *J* = 7.6 Hz, 1H), 7.09 – 7.03 (m, 1H), 3.61 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 193.35, 161.20 (d, *J* = 257.1 Hz), 157.21, 154.62, 139.85, 136.65, 133.82, 133.72, 133.66, 133.25, 132.00 (d, *J* = 7.5 Hz), 130.75, 130.45 (d, *J* = 7.7 Hz), 129.46, 129.39, 128.60 (d, *J* = 26.0 Hz), 126.59, 126.47, 123.97 (d, *J* = 5.0 Hz), 123.78, 116.57 (d, *J* = 22.3 Hz), 113.73, 29.40.
^{19}F NMR (377 MHz, Chloroform-*d*) δ -110.14 (dt, *J* = 12.3, 6.7 Hz).
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{15}FN_2O_2$:359.1196; found:359.1187.

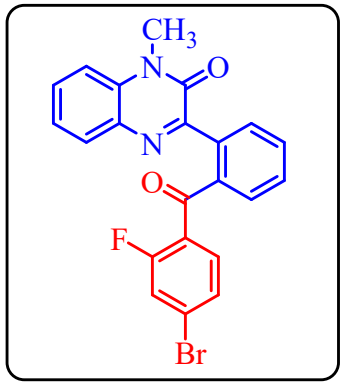
1-methyl-3-(2-(3-nitrobenzoyl)phenyl)quinoxalin-2(1H)-one (3h)



It was obtained as yellow solid having melting point 164-166 °C with 61% yield.

^{1}H NMR (400 MHz, DMSO-d_6) δ 8.41 (d, *J* = 5.2 Hz, 2H), 8.13 (d, *J* = 7.7 Hz, 1H), 7.93 (d, *J* = 6.5 Hz, 1H), 7.80 (d, *J* = 2.9 Hz, 1H), 7.78 (d, *J* = 4.0 Hz, 1H), 7.76 (s, 1H), 7.68 (d, *J* = 9.1 Hz, 1H), 7.63 (d, *J* = 9.8 Hz, 1H), 7.58 (d, *J* = 7.7 Hz, 1H), 7.52 (d, *J* = 8.5 Hz, 1H), 7.40 (d, *J* = 7.2 Hz, 1H), 3.49 (s, 3H).
^{13}C NMR (100 MHz, DMSO-d_6) δ 193.89, 155.33, 153.79, 147.50, 138.44, 138.18, 135.96, 135.64, 133.13, 132.27, 131.56, 130.99, 130.90, 130.28, 129.54, 129.36, 128.66, 126.96, 123.90, 123.84, 114.85, 29.25.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{15}N_3O_4$:386.1141; found:386.1133.

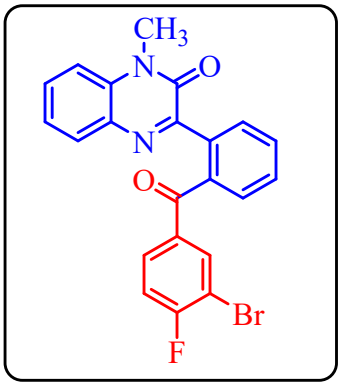
3-(2-(4-bromo-2-fluorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3i)



It was obtained as yellow solid having melting point 188-190 °C with 63% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.88 (td, *J* = 8.0, 1.2 Hz, 2H), 7.69 – 7.65 (m, 1H), 7.60 (t, *J* = 7.9 Hz, 1H), 7.56 (dd, *J* = 7.2, 1.4 Hz, 1H), 7.53 (d, *J* = 5.1 Hz, 1H), 7.37 – 7.32 (m, 2H), 7.30 – 7.28 (m, 1H), 7.27 (s, 1H), 3.61 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 192.35, 160.99 (d, *J* = 262.0 Hz), 156.80, 154.56, 139.71, 136.51, 133.68, 133.26, 133.12 (d, *J* = 2.7 Hz), 132.06, 130.90, 130.54 (d, *J* = 17.7 Hz), 129.45, 129.01, 128.99, 127.55, 127.51, 127.10 (d, *J* = 9.5 Hz), 125.52 (d, *J* = 11.6 Hz), 123.90, 120.29 (d, *J* = 25.2 Hz), 113.80, 29.46.
^{19}F NMR (377 MHz, Chloroform-*d*) δ -107.29 (t, *J* = 8.6 Hz).
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}BrFN_2O_2$:437.0301; found:437.0293.

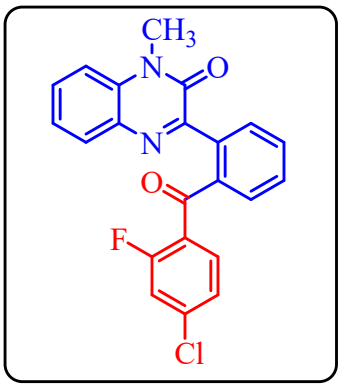
3-(2-(3-bromo-4-fluorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3j)



It was obtained as yellow solid having melting point 194-196 °C with 70% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.11 (d, *J* = 6.7 Hz, 1H), 7.97 (d, *J* = 7.7 Hz, 1H), 7.84 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.82 – 7.77 (m, 1H), 7.68 (td, *J* = 7.4, 1.7 Hz, 1H), 7.56 (d, *J* = 8.8 Hz, 1H), 7.54 – 7.50 (m, 2H), 7.35 (t, *J* = 7.0 Hz, 1H), 7.28 (d, *J* = 7.2 Hz, 1H), 7.13 (t, *J* = 8.3 Hz, 1H), 3.60 (s, 1H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 194.10, 161.61 (d, *J* = 254.9 Hz), 156.10, 154.50, 138.97, 136.64, 135.74, 135.28 (d, *J* = 3.6 Hz), 133.53, 133.16, 131.48 (d, *J* = 7.9 Hz), 131.09, 130.73, 130.38, 130.16, 129.34, 129.01, 123.96, 116.30 (d, *J* = 23.2 Hz), 113.83, 109.39 (d, *J* = 21.4 Hz), 29.47.
^{19}F NMR (376 MHz, Chloroform-*d*) δ -100.49.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}BrFN_2O_2$:437.0301; found:437.0297.

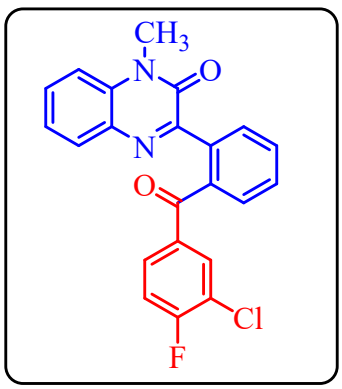
3-(2-(4-chloro-2-fluorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3k)



It was obtained as yellow solid having melting point 202-204 °C with 83% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (d, *J* = 5.0 Hz, 1H), 7.87 (d, *J* = 4.5 Hz, 1H), 7.68 (t, *J* = 8.0 Hz, 2H), 7.57 (d, *J* = 8.6 Hz, 1H), 7.54 (s, 1H), 7.53 (s, 1H), 7.38 – 7.33 (m, 1H), 7.28 (d, *J* = 7.2 Hz, 1H), 7.17 (dd, *J* = 8.3, 2.0 Hz, 1H), 7.11 (dd, *J* = 9.8, 1.9 Hz, 1H), 3.62 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*)) δ 192.14, 161.09 (d, *J* = 261.0 Hz), 156.71, 154.47, 139.65, 139.08 (d, *J* = 10.3 Hz), 136.40, 133.58, 133.16, 132.91 (d, *J* = 2.9 Hz), 131.94, 130.80, 130.43 (d, *J* = 15.6 Hz), 129.34, 128.90, 128.88, 124.98 (d, *J* = 11.6 Hz), 124.52, 124.48, 123.80, 117.29 (d, *J* = 25.3 Hz), 113.69, 29.36.
^{19}F NMR (377 MHz, Chloroform-*d*) δ -107.29.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}BrClN_2O_2$:393.0806; found:393.0803.

3-(2-(3-chloro-4-fluorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3l)

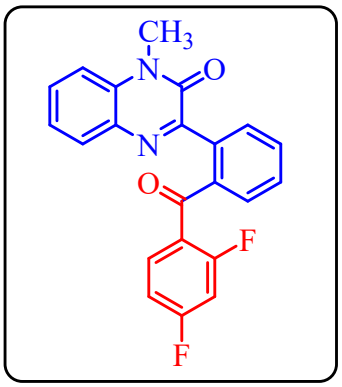


It was obtained as yellow solid having melting point 186-188 °C with 73% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.96 (d, *J* = 6.3 Hz, 2H), 7.83 (d, *J* = 8.0 Hz, 1H), 7.75 (t, *J* = 7.8 Hz, 1H), 7.69 – 7.64 (m, 3H), 7.56 – 7.48 (m, 1H), 7.34 (d, *J* = 7.7 Hz, 1H), 7.26 (d, *J* = 8.8 Hz, 1H), 7.15 (t, *J* = 8.6 Hz, 1H), 3.58 (s, 3H).
^{13}C NMR (101 MHz, Chloroform-*d*) δ 194.21, 160.68 (d, *J* = 256.0 Hz), 156.11, 154.51, 138.99, 136.65, 134.93 (d, *J* = 3.6 Hz), 133.55, 133.17, 132.85, 131.52, 131.11, 130.68 (d, *J* = 8.7 Hz), 130.39, 130.17, 129.33, 128.99, 128.52, 123.96, 121.50 (d, *J* = 18.2 Hz), 116.48 (d, *J* = 21.6 Hz), 113.84, 29.48.

^{19}F NMR (376 MHz, Chloroform-*d*) δ -108.52.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}BrClN_2O_2$:393.0806; found:393.0799.

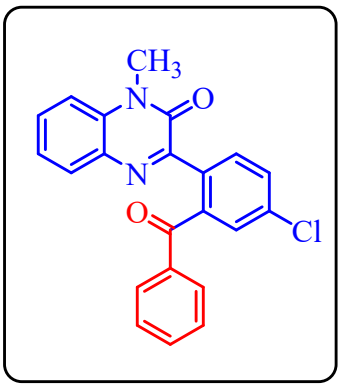
3-(2-(2,4-difluorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3m)



It was obtained as yellow solid having melting point 178-180 °C with 81% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (d, *J* = 2.3 Hz, 1H), 7.87 (s, 1H), 7.76 (dd, *J* = 15.9, 7.5 Hz, 1H), 7.67 (ddd, *J* = 7.9, 5.5, 3.3 Hz, 1H), 7.57 (d, *J* = 8.6 Hz, 1H), 7.53 (d, *J* = 3.2 Hz, 2H), 7.38 – 7.33 (m, 1H), 7.28 (d, *J* = 8.4 Hz, 1H), 6.91 (t, *J* = 8.3 Hz, 1H), 6.82 (td, *J* = 9.8, 9.1, 2.4 Hz, 1H), 3.62 (s, 3H).
^{13}C NMR (101 MHz, Chloroform-*d*) δ 192.14, 165.34 (dd, *J* = 255.7, 11.6 Hz), 162.15 (dd, *J* = 260.3, 12.6 Hz), 156.83, 154.57, 139.93, 136.47, 133.87 (dd, *J* = 10.2, 3.5 Hz), 131.92, 130.89, 130.57, 130.41, 130.18, 129.41, 128.95, 128.52, 123.87, 122.99 (d, *J* = 11.6 Hz), 113.78, 111.57 (dd, *J* = 21.7, 3.7 Hz), 104.91 (t, *J* = 25.5 Hz), 29.44.
^{19}F NMR (377 MHz, Chloroform-*d*) δ -102.87 (dt, *J* = 15.4, 7.9 Hz), -104.87 (q, *J* = 10.3 Hz).
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}F_2N_2O_2$:377.1102; found:377.1088.

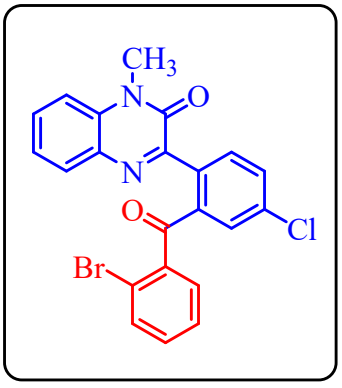
3-(2-benzoyl-4-chlorophenyl)-1-methylquinoxalin-2(1H)-one (3n)



It was obtained as white solid having melting point 128-130 °C with 74% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.96 (d, *J* = 8.3 Hz, 1H), 7.87 – 7.81 (m, 2H), 7.78 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.62 (dd, *J* = 8.3, 2.2 Hz, 1H), 7.56 – 7.51 (m, 2H), 7.51 – 7.48 (m, 1H), 7.40 (t, *J* = 7.6 Hz, 2H), 7.31 (td, *J* = 7.8, 7.3, 1.2 Hz, 1H), 7.23 (d, *J* = 8.4 Hz, 1H), 3.56 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.48, 155.08, 154.39, 141.42, 137.13, 135.46, 134.98, 133.50, 133.02, 132.82, 132.27, 130.93, 130.79, 130.37, 130.12, 129.29, 128.39, 123.93, 113.77, 29.43.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{15}ClN_2O_2$:375.0900; found:375.0889.

3-(2-(2-bromobenzoyl)-4-chlorophenyl)-1-methylquinoxalin-2(1H)-one (3o)

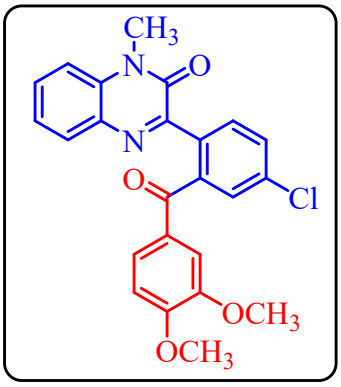


It was obtained as yellow solid having melting point 152-154 °C with 64% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 8.1 Hz, 1H), 7.73 (d, *J* = 8.2 Hz, 1H), 7.69 (dd, *J* = 7.6, 1.8 Hz, 1H), 7.64 (dd, *J* = 8.1, 2.2 Hz, 1H), 7.62 – 7.58 (m, 1H), 7.56 (d, *J* = 7.0 Hz, 1H), 7.45 (d, *J* = 2.2 Hz, 1H), 7.36 (t, *J* = 7.6 Hz, 2H), 7.32 – 7.25 (m, 2H), 3.62 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 194.41, 156.73, 154.58, 140.19, 138.49, 135.79, 135.50, 134.01, 133.74, 133.30, 132.44,

132.30, 132.22, 131.74, 130.76, 130.60, 130.49, 127.09, 123.94, 121.24, 113.82, 29.48.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}BrClN_2O_2$:453.0005; found:453.0003.

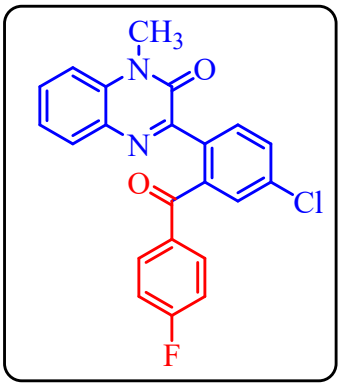
-(4-chloro-2-(3,4-dimethoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3p)



It was obtained as yellow solid having melting point 196-198 °C with 86% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 8.1 Hz, 1H), 7.78 (d, *J* = 8.1 Hz, 1H), 7.62 – 7.57 (m, 2H), 7.53 (t, *J* = 7.8 Hz, 1H), 7.39 (d, *J* = 6.5 Hz, 2H), 7.36 – 7.28 (m, 1H), 7.24 (d, *J* = 8.4 Hz, 1H), 6.80 (d, *J* = 8.9 Hz, 1H), 3.88 (s, 3H), 3.86 (s, 3H), 3.58 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 194.18, 155.17, 154.32, 153.03, 148.88, 141.56, 135.41, 134.98, 133.47, 133.02, 132.14, 130.78, 130.64, 130.36, 130.08, 129.30, 125.47, 123.91, 113.80, 111.48, 109.91, 56.14, 56.04, 29.43.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{24}H_{19}ClN_2O_4$:435.1112; found:435.1116.

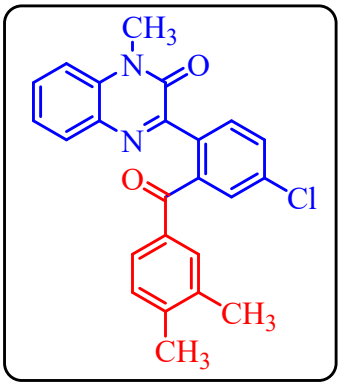
3-(4-chloro-2-(4-fluorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3q)



It was obtained as yellow solid having melting point 168-170 °C with 81% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.98 (d, *J* = 8.3 Hz, 1H), 7.87 (dd, *J* = 8.6, 5.6 Hz, 2H), 7.77 (d, *J* = 8.0 Hz, 1H), 7.62 (dd, *J* = 8.3, 2.2 Hz, 1H), 7.55 (t, *J* = 7.9 Hz, 1H), 7.50 (d, *J* = 2.1 Hz, 1H), 7.35 – 7.30 (m, 1H), 7.26 (d, *J* = 8.5 Hz, 1H), 7.08 (t, *J* = 8.6 Hz, 2H), 3.59 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 193.97, 165.57 (d, *J* = 254.6 Hz), 132.70 (d, *J* = 9.3 Hz), 141.27, 135.51, 134.83, 133.48, 133.00, 130.93 (d, *J* = 5.3 Hz), 132.39, 130.95, 130.90, 130.63, 130.35, 128.96, 125.89, 124.01, 115.60 (d, *J* = 21.8 Hz), 113.89, 113.83, 29.46.
^{19}F NMR (377 MHz, Chloroform-*d*) δ -105.40 – -105.52 (m).
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}ClFN_2O_2$:393.0806; found:393.0802.

3-(4-chloro-2-(3,4-dimethylbenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3r)

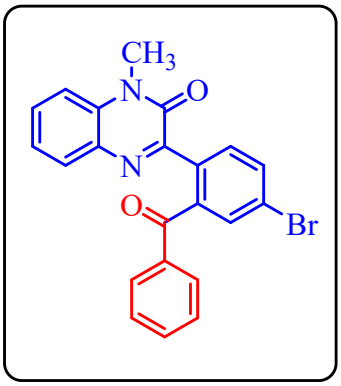


It was obtained as yellow solid having melting point 106-108 °C with 81% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.90 (d, *J* = 8.2 Hz, 1H), 7.80 (d, *J* = 8.0 Hz, 1H), 7.60 (d, *J* = 8.2 Hz, 2H), 7.57 (d, *J* = 7.7 Hz, 1H), 7.54 (d, *J* = 2.2 Hz, 1H), 7.51 (d, *J* = 7.1 Hz, 1H), 7.32 (t, *J* = 7.6 Hz, 1H), 7.23 (d, *J* = 8.4 Hz, 1H), 7.16 (d, *J* = 7.8 Hz, 1H), 3.56 (s, 3H), 2.27 (s, 3H), 2.24 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.31, 155.53, 154.36, 142.45, 141.58, 136.79, 135.28, 135.06, 134.80, 133.53, 133.07,

132.16, 131.20, 130.81, 130.68, 130.38, 129.62, 129.35, 128.13, 123.86, 113.72, 29.42, 20.15, 19.83.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{24}H_{19}ClN_2O_2$:403.1213; found:403.1209.

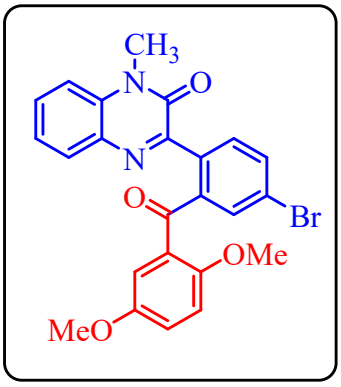
3-(2-benzoyl-4-bromophenyl)-1-methylquinoxalin-2(1H)-one (3s)



It was obtained as yellow solid having melting point 224-226 °C with 70% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.06 (d, *J* = 1.9 Hz, 1H), 7.82 (ddd, *J* = 9.5, 8.2, 1.5 Hz, 3H), 7.65 (dd, *J* = 8.2, 2.0 Hz, 1H), 7.56 – 7.51 (m, 1H), 7.49 (t, *J* = 7.4 Hz, 1H), 7.42 (d, *J* = 8.2 Hz, 1H), 7.39 (t, *J* = 7.5 Hz, 2H), 7.33 (td, *J* = 7.8, 7.3, 1.2 Hz, 1H), 7.25 – 7.22 (m, 1H), 3.56 (s, 3H).
^{13}C NMR (101 MHz, Chloroform-*d*) δ 195.99, 155.32, 154.34, 138.57, 138.50, 137.37, 133.80, 133.65, 133.10, 132.73, 132.13, 130.96, 130.92, 130.54, 130.20, 128.36, 125.74, 123.99, 113.82, 29.46.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{15}BrN_2O_2$:419.0395; found:419.0390.

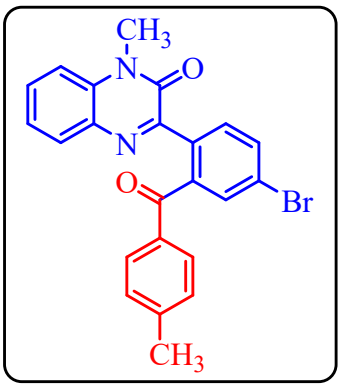
3-(4-bromo-2-(2,5-dimethoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3t)



It was obtained as yellow solid having melting point 178-180 °C with 65% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.83 – 7.78 (m, 2H), 7.73 (dd, *J* = 8.2, 2.0 Hz, 1H), 7.63 (d, *J* = 8.1 Hz, 1H), 7.57 – 7.47 (m, 1H), 7.30 (d, *J* = 8.1 Hz, 1H), 7.20 (d, *J* = 7.3 Hz, 1H), 7.07 (d, *J* = 3.2 Hz, 1H), 6.79 (dd, *J* = 9.0, 3.2 Hz, 1H), 6.63 (d, *J* = 9.0 Hz, 1H), 3.67 (s, 3H), 3.57 (s, 3H), 3.55 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 193.98, 156.42, 154.42, 153.04, 152.71, 142.17, 135.40, 134.07, 133.59, 133.06, 132.43, 131.67, 130.64, 130.33, 127.78, 123.74, 123.54, 119.71, 115.19, 113.66, 113.05, 56.31, 55.82, 29.23.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{24}H_{19}BrN_2O_4$:479.0606; found:479.0597.

3-(4-bromo-2-(4-methylbenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3u)

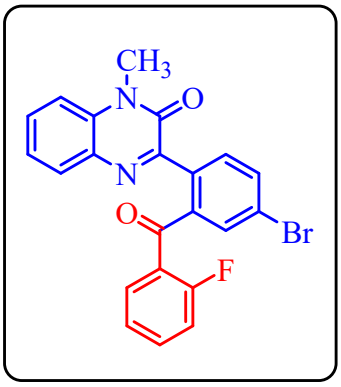


It was obtained as yellow solid having melting point 218-220 °C with 68% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.86 (d, *J* = 8.2 Hz, 1H), 7.79 (d, *J* = 8.0 Hz, 1H), 7.77 (d, *J* = 2.1 Hz, 1H), 7.74 (d, *J* = 8.0 Hz, 2H), 7.67 (d, *J* = 2.1 Hz, 1H), 7.53 (td, *J* = 7.9, 7.3, 1.5 Hz, 1H), 7.32 (t, *J* = 7.7 Hz, 1H), 7.25 – 7.20 (m, 3H), 3.57 (s, 3H), 2.38 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.05, 155.38, 154.35, 143.72, 141.81, 135.47, 134.47, 133.79, 133.58, 133.11, 132.42, 132.06, 130.75, 130.38, 129.15, 123.92, 123.51, 113.77, 29.46, 21.83.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{17}BrN_2O_2$:433.0552; found:433.0547.

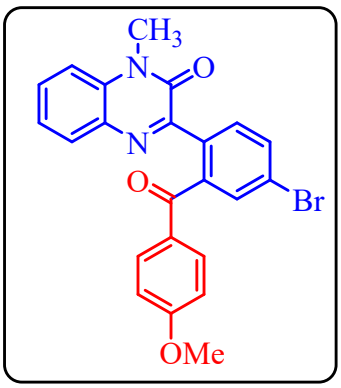
3-(4-bromo-2-(2-fluorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3v)



It was obtained as yellow solid having melting point 186-188 °C with 56% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.84 (d, *J* = 7.7 Hz, 1H), 7.81 (d, *J* = 6.0 Hz, 1H), 7.78 (dd, *J* = 8.2, 1.9 Hz, 1H), 7.72 (td, *J* = 7.4, 1.8 Hz, 1H), 7.68 (s, 1H), 7.55 (td, *J* = 7.9, 7.3, 1.6 Hz, 1H), 7.45 (qd, *J* = 7.1, 1.8 Hz, 1H), 7.37 – 7.31 (m, 1H), 7.28 – 7.22 (m, 1H), 7.18 (t, *J* = 8.1 Hz, 1H), 7.08 – 7.03 (m, 1H), 3.60 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 191.78, 161.31 (d, *J* = 257.7 Hz), 155.55, 154.39, 141.88, 135.11, 134.54, 134.31 (d, *J* = 8.7 Hz), 133.60, 133.11, 132.41, 132.00, 131.74, 130.82, 130.46, 125.80 (d, *J* = 11.1 Hz), 124.16 (d, *J* = 3.6 Hz), 123.85 (d, *J* = 22.5 Hz), 116.77 (d, *J* = 21.7 Hz), 113.78, 29.47.
^{19}F NMR (377 MHz, Chloroform-*d*) δ -109.48 (dd, *J* = 10.9, 6.2 Hz).
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}ClFN_2O_2$:437.0301; found:433.0298.

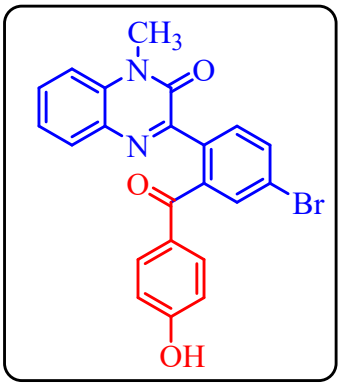
3-(4-bromo-2-(4-methoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3w)



It was obtained as white solid having melting point 194-196 °C with 69% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.86 (d, *J* = 8.3 Hz, 1H), 7.83 (d, *J* = 8.8 Hz, 1H), 7.78 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.75 (dd, *J* = 8.2, 2.0 Hz, 1H), 7.68 (d, *J* = 2.1 Hz, 1H), 7.53 (td, *J* = 8.0, 7.3, 1.6 Hz, 1H), 7.34 – 7.28 (m, 1H), 7.24 (d, *J* = 8.4 Hz, 1H), 6.89 (d, *J* = 8.8 Hz, 2H), 3.83 (s, 3H), 3.57 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 194.05, 163.39, 155.34, 154.32, 141.91, 135.40, 133.62, 133.53, 133.08, 132.52, 132.40, 131.93, 130.74, 130.39, 129.84, 123.91, 123.48, 113.79, 113.70, 55.58, 29.45.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{17}BrN_2O_3$:449.0501; found:449.0500.

3-(4-bromo-2-(4-hydroxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3x)

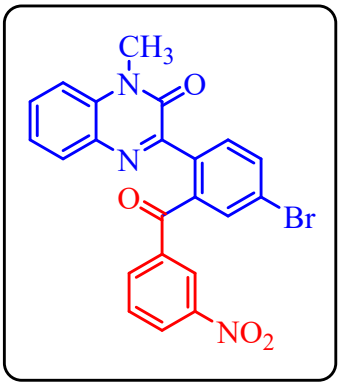


It was obtained as yellow solid having melting point 260-262 °C with 58% yield.

^{1}H NMR (400 MHz, DMSO-d_6) δ 10.39 (s, 1H), 7.90 (d, *J* = 8.3 Hz, 1H), 7.83 (d, *J* = 8.3 Hz, 2H), 7.68 (d, *J* = 7.9 Hz, 1H), 7.63 (d, *J* = 7.8 Hz, 2H), 7.57 (d, *J* = 8.5 Hz, 2H), 7.52 (d, *J* = 8.3 Hz, 2H), 7.37 (t, *J* = 7.6 Hz, 2H), 6.80 (s, 2H), 6.78 (s, 2H), 3.51 (s, 6H).
^{13}C NMR (100 MHz, DMSO-d_6) δ 192.73, 161.98, 154.80, 153.56, 141.78, 135.12, 133.20, 133.09, 132.73, 132.32, 132.19, 130.95, 129.33, 127.80, 123.77, 122.50, 115.07, 114.84, 29.23.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{15}BrN_2O_3$:435.0344; found:435.0342.

3-(4-chloro-2-(3-methoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (3y)

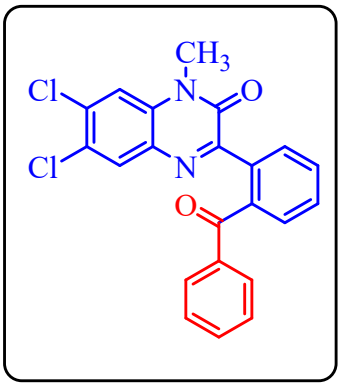


It was obtained as yellow solid having melting point 178-180 ^{o}C with 68% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.71 (s, 1H), 8.37 (dd, *J* = 8.2, 2.4 Hz, 1H), 8.16 (d, *J* = 7.7 Hz, 1H), 7.98 (d, *J* = 8.3 Hz, 1H), 7.82 (dd, *J* = 8.3, 2.0 Hz, 1H), 7.78 (d, *J* = 8.0 Hz, 1H), 7.66 – 7.59 (m, 2H), 7.56 (td, *J* = 7.9, 7.3, 1.5 Hz, 1H), 7.34 (t, *J* = 7.7 Hz, 1H), 7.26 (d, *J* = 8.3 Hz, 1H), 3.57 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 192.94, 154.31, 154.21, 148.33, 140.53, 138.71, 135.66, 135.12, 134.55, 133.47, 132.98, 132.91, 131.36, 131.18, 130.38, 129.67, 127.09, 124.83, 124.23, 123.96, 113.92, 29.55.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}BrN_3O_4$:464.0246; found:464.0246.

3-(2-benzoylphenyl)-6,7-dichloro-1-methylquinoxalin-2(1H)-one (3z)

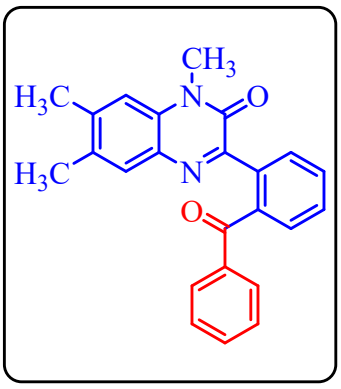


It was obtained as yellow solid having melting point 164-166 ^{o}C with 80% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.89 (s, 1H), 7.87 (d, *J* = 7.7 Hz, 1H), 7.84 (s, 1H), 7.82 (s, 1H), 7.66 (t, *J* = 7.4 Hz, 1H), 7.58 (d, *J* = 6.0 Hz, 1H), 7.55 (d, *J* = 7.6 Hz, 1H), 7.51 (d, *J* = 7.7 Hz, 1H), 7.41 (t, *J* = 7.6 Hz, 2H), 7.33 (s, 1H), 3.52 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.82, 158.31, 154.08, 139.77, 137.65, 136.35, 134.50, 133.03, 132.66, 132.29, 131.31, 131.07, 130.81, 130.26, 129.77, 129.58, 128.33, 127.57, 115.26, 29.65.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{14}Cl_2N_2O_2$:409.0511; found:409.0511.

3-(2-benzoylphenyl)-1,6,7-trimethylquinoxalin-2(1H)-one (3aa)



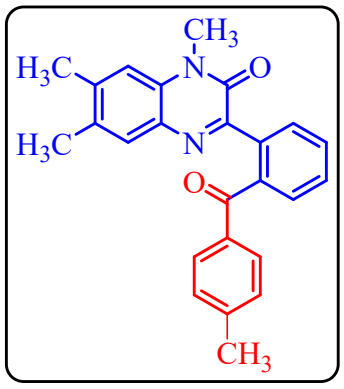
H^+

It was obtained as yellow solid having melting point 218-220 ^{o}C with 47% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 7.7 Hz, 1H), 7.82 (d, *J* = 6.9 Hz, 2H), 7.63 (td, *J* = 7.5, 1.5 Hz, 1H), 7.57 (s, 1H), 7.55 (s, 1H), 7.51 (d, *J* = 7.4 Hz, 1H), 7.49 – 7.43 (m, 1H), 7.36 (t, *J* = 7.6 Hz, 2H), 6.99 (s, 1H), 3.53 (s, 3H), 2.39 (s, 3H), 2.32 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.94, 155.18, 154.60, 140.43, 139.70, 137.94, 137.02, 132.64, 132.32, 131.64, 131.60, 131.02, 130.73, 130.37, 130.13, 129.45, 128.96, 128.13, 114.24, 29.25, 20.69, 19.27.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{24}H_{20}N_2O_2$:369.1598; found:369.1597.

1,6,7-trimethyl-3-(2-(4-methylbenzoyl)phenyl)quinoxalin-2(1H)-one (3ab)



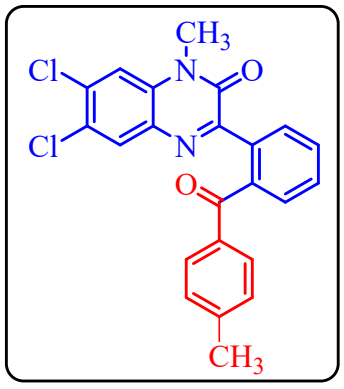
It was obtained as yellow solid having melting point 216-218 °C with 37% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (d, *J* = 7.7 Hz, 1H), 7.74 (d, *J* = 8.2 Hz, 2H), 7.62 (td, *J* = 7.5, 1.6 Hz, 1H), 7.58 (s, 1H), 7.54 (dd, *J* = 7.7, 1.6 Hz, 1H), 7.49 (td, *J* = 7.4, 1.3 Hz, 1H), 7.18 (d, *J* = 8.0 Hz, 2H), 7.00 (s, 1H), 3.54 (s, 3H), 2.39 (s, 3H), 2.36 (s, 3H), 2.33 (s, 3H).

^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.69, 155.42, 154.63, 143.11, 140.36, 139.92, 137.05, 135.25, 132.64, 131.72, 131.68, 130.92, 130.75, 130.42, 129.41, 128.93, 128.86, 114.26, 29.32, 21.76, 20.72, 19.30.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{25}H_{22}N_2O_2$:383.1754; found:383.1753.

6,7-dichloro-1-methyl-3-(2-(4-methylbenzoyl)phenyl)quinoxalin-2(1H)-one (3ac)



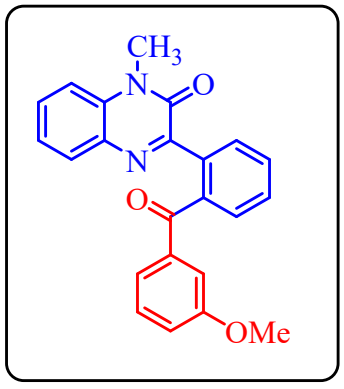
It was obtained as yellow solid having melting point 186-188 °C with 54% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.91 (s, 1H), 7.85 (d, *J* = 7.6 Hz, 1H), 7.75 (d, *J* = 8.2 Hz, 2H), 7.64 (td, *J* = 7.3, 1.8 Hz, 1H), 7.58 – 7.50 (m, 2H), 7.34 (s, 1H), 7.23 (d, *J* = 7.8 Hz, 2H), 3.52 (s, 3H), 2.40 (s, 3H).

^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.51, 158.47, 154.03, 143.52, 139.91, 136.31, 134.85, 134.39, 133.03, 132.29, 131.19, 131.04, 130.77, 130.49, 129.67, 129.46, 129.07, 127.49, 115.25, 29.67, 21.81.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{16}Cl_2N_2O_2$:423.0662; found:423.0656.

3-(2-(3-methoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (5a)



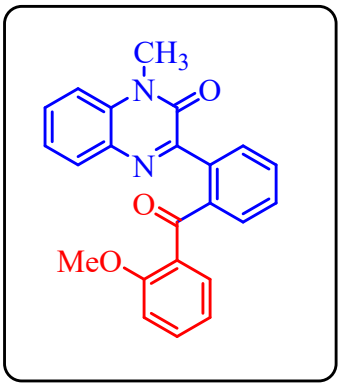
It was obtained as yellow solid having melting point 144-146 °C with 75% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 7.7 Hz, 1H), 7.83 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.65 (td, *J* = 7.5, 1.5 Hz, 1H), 7.61 (d, *J* = 7.6 Hz, 1H), 7.54 (d, *J* = 7.5 Hz, 1H), 7.51 (d, *J* = 7.1 Hz, 1H), 7.38 (d, *J* = 7.5 Hz, 1H), 7.37 (s, 1H), 7.32 (t, *J* = 8.3 Hz, 1H), 7.27 (d, *J* = 7.9 Hz, 1H), 7.24 (d, *J* = 7.1 Hz, 1H), 7.01 (dd, *J* = 8.8, 2.2 Hz, 1H), 3.77 (s, 3H), 3.58 (s, 3H).

^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.80, 158.39, 158.22, 154.72, 140.09, 137.12, 133.64, 133.21, 132.72, 131.79, 131.73, 130.31, 130.26, 130.18, 129.16, 127.87, 123.61, 119.98, 113.63, 111.36, 55.72, 29.30.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{18}N_2O_3$:371.1396; found:371.1389.

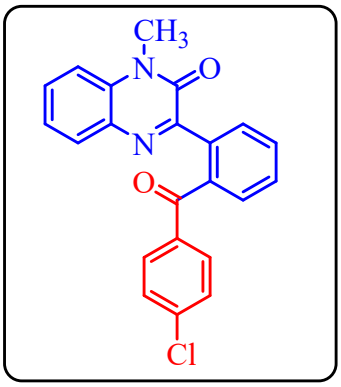
3-(2-(2-methoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (5b)



It was obtained as white solid having melting point 154-156 °C with 72% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.87 (dd, *J* = 8.0, 1.6 Hz, 1H), 7.72 (d, *J* = 7.0 Hz, 1H), 7.62 (d, *J* = 7.4 Hz, 2H), 7.56 (dd, *J* = 7.7, 1.9 Hz, 1H), 7.52 (d, *J* = 1.9 Hz, 1H), 7.49 (d, *J* = 8.9 Hz, 1H), 7.33 (d, *J* = 7.3 Hz, 1H), 7.30 (d, *J* = 5.9 Hz, 1H), 7.22 (d, *J* = 8.4 Hz, 1H), 6.89 (t, *J* = 7.5 Hz, 1H), 6.79 (d, *J* = 8.4 Hz, 1H), 3.68 (s, 3H), 3.58 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.80, 158.39, 158.22, 154.72, 140.09, 137.12, 133.64, 133.21, 132.72, 131.79, 131.73, 130.31, 130.26, 130.18, 129.16, 127.87, 123.61, 119.98, 113.63, 111.36, 55.72, 29.30.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{18}N_2O_3$:371.1396; found:371.1392.

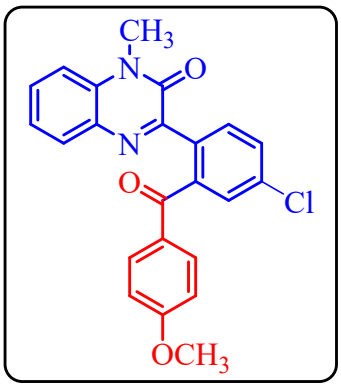
3-(2-(4-chlorobenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (5c)



It was obtained as yellow solid having melting point 146-148 °C with 65% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.95 (d, *J* = 7.5 Hz, 1H), 7.83 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.81 (d, *J* = 2.0 Hz, 1H), 7.79 (d, *J* = 1.8 Hz, 1H), 7.68 – 7.64 (m, 1H), 7.56 – 7.52 (m, 2H), 7.52 (s, 1H), 7.38 (d, *J* = 2.0 Hz, 1H), 7.37 (d, *J* = 1.9 Hz, 1H), 7.33 (td, *J* = 8.1, 7.7, 1.2 Hz, 1H), 7.26 (d, *J* = 8.5 Hz, 1H), 3.58 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.71, 156.35, 154.52, 139.40, 138.89, 136.70, 136.10, 133.56, 133.17, 131.63, 131.36, 130.95, 130.64, 130.37, 129.25, 129.17, 128.60, 123.90, 113.81, 29.44.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{22}H_{15}ClN_2O_2$:375.0900; found:375.0892.

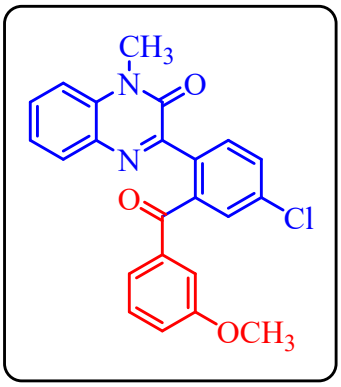
3-(2-(4-methoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (5d)



It was obtained as white solid having melting point 188-190 °C with 65% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 8.3 Hz, 1H), 7.84 (s, 1H), 7.82 (s, 1H), 7.78 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.59 (dd, *J* = 8.3, 2.1 Hz, 1H), 7.56 – 7.50 (m, 2H), 7.31 (td, *J* = 7.8, 1.2 Hz, 1H), 7.24 (d, *J* = 8.5 Hz, 1H), 6.91 (s, 1H), 6.88 (s, 1H), 3.83 (s, 3H), 3.57 (s, 3H).
^{13}C NMR (100 MHz Chloroform-*d*) δ 194.18, 163.41, 155.30, 154.38, 141.78, 135.32, 134.96, 133.56, 133.10, 132.53, 132.25, 130.73, 130.64, 130.41, 129.89, 129.14, 123.91, 113.79, 113.71, 55.59, 29.46.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{17}ClN_2O_3$:405.1006; found:405.1003.

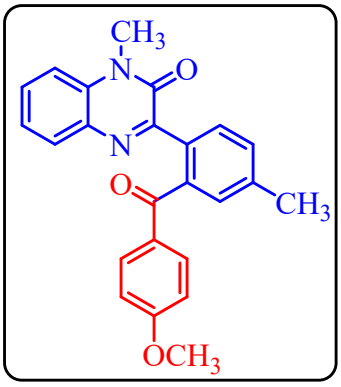
3-(4-chloro-2-(3-methoxybenzoyl)phenyl)-1-methylquinoxalin-2(1H)-one (5e)



It was obtained as yellow solid having melting point 150-152 °C with 59% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.95 (d, *J* = 8.3 Hz, 1H), 7.78 (dd, *J* = 8.0, 1.6 Hz, 1H), 7.61 (dd, *J* = 8.3, 2.2 Hz, 1H), 7.57 (d, *J* = 2.2 Hz, 1H), 7.53 (td, *J* = 7.9, 7.2, 1.5 Hz, 1H), 7.37 – 7.31 (m, 3H), 7.30 – 7.27 (m, 1H), 7.25 – 7.22 (m, 1H), 7.02 (dd, *J* = 7.5, 2.1 Hz, 1H), 3.78 (s, 3H), 3.58 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.26, 159.57, 155.07, 154.38, 141.39, 138.56, 135.53, 135.02, 133.52, 133.02, 132.21, 130.94, 130.82, 130.39, 129.41, 129.37, 123.93, 123.06, 119.66, 113.79, 113.63, 55.51, 29.43.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{17}ClN_2O_3$:405.1006; found:405.1003.

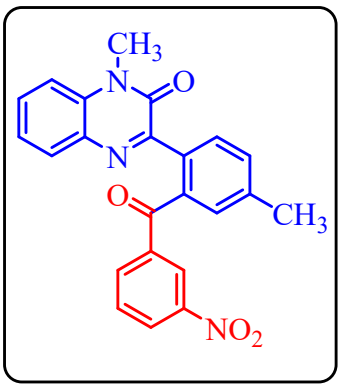
3-(2-(4-methoxybenzoyl)-4-methylphenyl)-1-methylquinoxalin-2(1H)-one (5f)



It was obtained as white solid having melting point 162-164 °C with 82% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.85 (d, *J* = 7.9 Hz, 1H), 7.83 (s, 1H), 7.81 (s, 1H), 7.78 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.49 (td, *J* = 8.0, 7.3, 1.6 Hz, 1H), 7.43 (d, *J* = 9.8 Hz, 1H), 7.37 (d, *J* = 1.8 Hz, 1H), 7.31 – 7.26 (m, 1H), 7.21 (d, *J* = 8.4 Hz, 1H), 6.87 (s, 1H), 6.85 (s, 1H), 3.81 (s, 3H), 3.56 (s, 3H), 2.44 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.84, 163.03, 156.50, 154.59, 140.17, 139.42, 133.94, 133.51, 133.18, 132.43, 131.34, 130.75, 130.69, 130.26, 130.22, 129.92, 123.65, 113.64, 113.47, 55.51, 29.36, 21.51.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{24}H_{20}N_2O_3$:385.1552; found:385.1543.

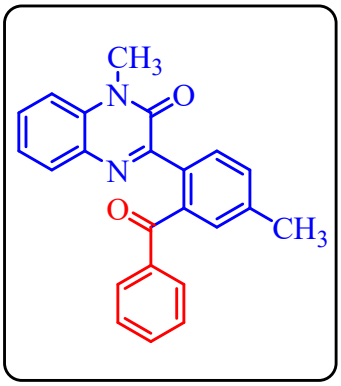
1-methyl-3-(4-methyl-2-(3-nitrobenzoyl)phenyl)quinoxalin-2(1H)-one (5g)



It was obtained as white solid having melting point 184-186 °C with 67% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.70 (s, 1H), 8.33 (d, *J* = 8.3 Hz, 1H), 8.15 (d, *J* = 7.8 Hz, 1H), 7.97 (d, *J* = 7.9 Hz, 1H), 7.79 (d, *J* = 8.0 Hz, 1H), 7.58 (t, *J* = 7.9 Hz, 1H), 7.55 – 7.49 (m, 2H), 7.33 (d, *J* = 8.1 Hz, 1H), 7.30 (s, 1H), 7.24 (d, *J* = 8.4 Hz, 1H), 3.57 (s, 3H), 2.46 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 194.63, 155.43, 154.59, 148.28, 140.03, 139.59, 138.85, 135.62, 133.76, 133.44, 133.08, 132.29, 131.27, 130.66, 130.26, 129.43, 129.40, 126.65, 124.86, 123.99, 113.79, 29.47, 21.54.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{17}N_3O_4$:400.1297; found:400.1291

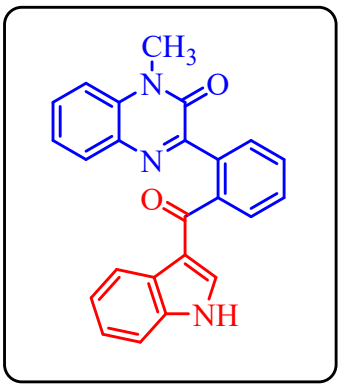
3-(2-benzoyl-4-methylphenyl)-1-methylquinoxalin-2(1H)-one (7a)



It was obtained as yellow solid having melting point 144-146 °C with 80% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.87 (d, *J* = 7.8 Hz, 1H), 7.84 (s, 1H), 7.82 (s, 1H), 7.79 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.53 – 7.48 (m, 1H), 7.46 (s, 1H), 7.45 (s, 1H), 7.37 (t, *J* = 7.7 Hz, 3H), 7.30 (t, *J* = 7.0 Hz, 1H), 7.22 (d, *J* = 8.4 Hz, 1H), 3.57 (s, 3H), 2.44 (s, 3H).
^{13}C NMR (100 MHz, Chloroform-*d*) δ 197.15, 156.36, 154.67, 139.91, 139.60, 138.10, 134.06, 133.53, 133.19, 132.31, 131.65, 130.76, 130.30, 130.16, 130.10, 128.17, 123.70, 113.64, 29.35, 21.50.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{23}H_{18}N_2O_2$:355.1447; found:355.1426.

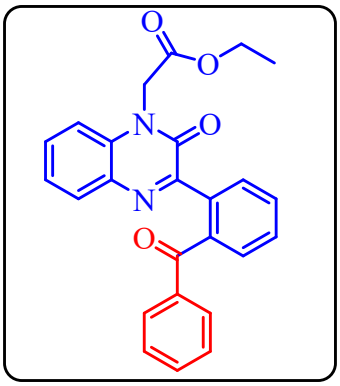
3-(2-(1H-indole-3-carbonyl)phenyl)-1-methylquinoxalin-2(1H)-one (8)



It was obtained as white solid having melting point 266-268 °C with 64% yield.

^{1}H NMR (400 MHz, DMSO-d_6) δ 11.99 (s, 1H), 8.00 (d, *J* = 7.9 Hz, 1H), 7.90 (s, 1H), 7.79 – 7.72 (m, 2H), 7.68 (t, *J* = 7.3 Hz, 1H), 7.62 (q, *J* = 7.0 Hz, 2H), 7.49 (d, *J* = 11.2 Hz, 2H), 7.36 (t, *J* = 7.7 Hz, 1H), 7.21 (t, *J* = 7.6 Hz, 1H), 7.13 (t, *J* = 7.6 Hz, 1H), 3.46 (s, 3H).
^{13}C NMR (101 MHz, DMSO- d_6) δ 189.93, 157.68, 153.67, 141.20, 136.61, 136.37, 135.55, 133.29, 132.43, 130.57, 130.36, 130.08, 129.31, 129.11, 128.74, 126.28, 123.52, 122.92, 121.66, 121.39, 115.44, 114.70, 112.20, 29.03.
HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{24}H_{17}N_3O_2$:380.1399; found:380.1391.

Ethyl 2-(3-(2-benzoylphenyl)-2-oxoquinoxalin-1(2H)-yl)acetate (9)

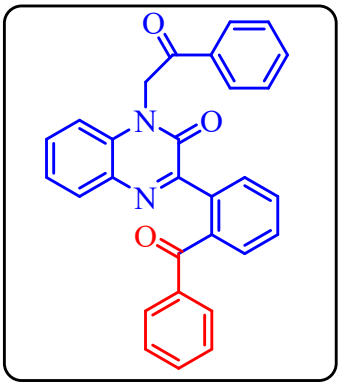


It was obtained as yellow solid having melting point 160-162 °C with 77% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.98 (d, *J* = 7.6 Hz, 1H), 7.84 (d, *J* = 7.3 Hz, 3H), 7.66 (t, *J* = 8.3 Hz, 1H), 7.58 – 7.52 (m, 2H), 7.48 (td, *J* = 6.8, 5.2, 3.2 Hz, 2H), 7.39 (t, *J* = 7.6 Hz, 2H), 7.32 (t, *J* = 7.6 Hz, 1H), 7.02 (d, *J* = 8.4 Hz, 1H), 4.90 (s, 2H), 4.17 (q, *J* = 7.1 Hz, 2H), 1.20 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.88, 167.12, 156.49, 154.23, 139.67, 137.69, 136.51, 133.25, 132.69, 132.52, 131.23, 130.99, 130.71, 130.64, 130.25, 130.21, 129.60, 129.31, 128.26, 124.08, 113.17, 62.07, 43.80, 14.16.
HRMS (ESI$^+$): m/z [M+Na]$^+$ calculated for $C_{25}H_{20}N_2O_4$:435.1315; found:435.1314.

3-(2-benzoylphenyl)-1-(2-oxo-2-phenylethyl)quinoxalin-2(1H)-one (10)



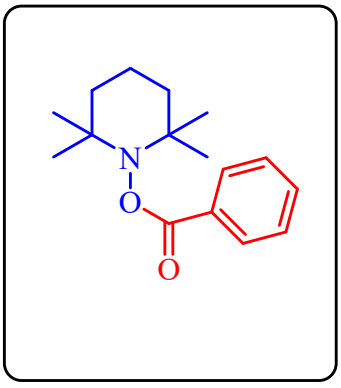
It was obtained as yellow solid having melting point 150-152 °C with 69% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.98 (m, *J* = 7.8 Hz, 3H), 7.84 (d, *J* = 7.7 Hz, 3H), 7.68 – 7.62 (m, 1H), 7.59 (d, *J* = 7.4 Hz, 1H), 7.56 – 7.50 (m, 2H), 7.47 (m, *J* = 7.4 Hz, 3H), 7.38 (t, *J* = 7.5 Hz, 3H), 7.28 (m, *J* = 9.3 Hz, 1H), 6.87 (d, *J* = 8.2 Hz, 1H), 5.59 (s, 2H).

^{13}C NMR (100 MHz, Chloroform-*d*) δ 197.01, 191.15, 156.31, 154.38, 139.65, 137.77, 136.62, 134.60, 134.29, 133.36, 132.97, 132.50, 131.23, 131.11, 130.65, 130.52, 130.23, 129.58, 129.23, 129.06, 128.26, 123.91, 113.61, 48.74.

HRMS (ESI$^+$): m/z [M+Na]$^+$ calculated for $C_{29}H_{20}N_2O_3$:467.1366; found:467.1358.

2,2,6,6-tetramethylpiperidin-1-yl benzoate (11a)



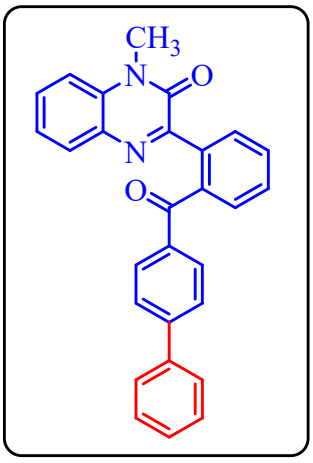
It was obtained as white solid having melting point 88-90 °C with 30% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.09 (d, *J* = 7.2 Hz, 2H), 7.58 (t, *J* = 7.4 Hz, 1H), 7.47 (t, *J* = 7.6 Hz, 2H), 1.83 – 1.74 (m, 2H), 1.70 (d, *J* = 13.0 Hz, 1H), 1.59 (d, *J* = 12.5 Hz, 2H), 1.47 (d, *J* = 12.7 Hz, 1H), 1.28 (s, 6H), 1.13 (s, 6H).

^{13}C NMR (101 MHz, Chloroform-*d*) δ 166.30, 132.76, 129.59, 129.46, 128.35, 60.29, 38.93, 31.85, 20.73, 16.88.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{16}H_{23}NO_2$:262.1807; found:262.1791.

3-(2-([1,1'-biphenyl]-4-carbonyl)phenyl)-1-methylquinoxalin-2(1H)-one (18)



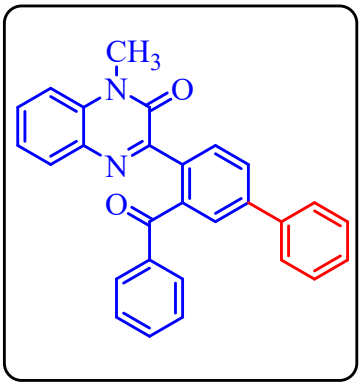
It was obtained as White solid having melting point 198-200 °C with 55% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.94 (t, *J* = 7.6 Hz, 3H), 7.86 (dd, *J* = 8.0, 1.5 Hz, 1H), 7.67 (td, *J* = 7.5, 1.4 Hz, 1H), 7.65 – 7.60 (m, 3H), 7.59 – 7.55 (m, 2H), 7.55 – 7.49 (m, 1H), 7.45 (t, *J* = 7.4 Hz, 2H), 7.38 (t, *J* = 7.3 Hz, 1H), 7.36 – 7.31 (m, 1H), 7.23 (d, *J* = 8.5 Hz, 1H), 3.57 (s, 3H).

^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.48, 156.78, 154.59, 145.17, 140.20, 139.80, 136.88, 136.53, 133.62, 133.25, 131.22, 130.84, 130.50, 130.41, 129.51, 129.20, 129.01, 128.19, 127.38, 126.93, 123.80, 113.75, 29.41.

HRMS (ESI$^+$): m/z [M+H]$^+$ calculated for $C_{28}H_{20}N_2O_2$:417.1598; found: 417.1611.

3-(3-benzoyl-[1,1'-biphenyl]-4-yl)-1-methylquinoxalin-2(1H)-one (19)



It was obtained as yellow solid having melting point 206-208 °C with 60% yield.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.07 (d, *J* = 8.0 Hz, 1H), 7.92 – 7.87 (m, 3H), 7.84 – 7.79 (m, 2H), 7.63 (d, *J* = 7.0 Hz, 2H), 7.56 – 7.48 (m, 2H), 7.48 – 7.43 (m, 2H), 7.42 – 7.36 (m, 3H), 7.33 (td, *J* = 7.6, 1.2 Hz, 1H), 7.25 (d, *J* = 9.4 Hz, 1H), 3.59 (s, 3H).

^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.87, 156.10, 154.62, 142.24, 140.41, 139.89, 137.78, 135.59, 133.55, 133.20, 132.55, 131.38, 130.52, 130.36, 130.21, 129.53, 129.09, 128.31, 128.18, 128.16, 127.40, 123.82, 113.73, 29.42.

HRMS (ESI^{+}): m/z [M+H]$^{+}$ calculated for $C_{28}H_{20}N_2O_2$:417.1598; found: 417.1611.

Important Crystal Data of Compound 3a

CCDC deposition number	2162471
Empirical Formula	$C_{22}H_{16}N_2O_2$
Formula weight	340.37
Temperature (K)	298
Crystal System	orthorhombic
Space Group	P n a 21
Unit Cell Dimension	a/Å = 24.354(3) b/Å = 8.7486(14) c/Å = 16.091(2) α/° = 90 β/° = 90 γ/° = 90
Volume $Å^3$	3428.4(8)
Z	8
Density Calculated g/cm^3	1.319
Absorption coefficient (μ) mm^{-1}	0.086
F (000)	1424.0
Radiation	MoKα (λ = 0.71073)
2Θ range for data collection/°	6.376 to 52.044
Index ranges	-28 ≤ h ≤ 28 -10 ≤ k ≤ 10 -19 ≤ l ≤ 19
Reflection Collected	40622
Independent Reflections	6041 [R_{int} = 0.12, R_{sigma} = 0.1518]
Data/Restraints/parameter s	6041/1/469
Goodness of fit on F^2	0.882
Final R indices [I>=2sigma(I)]	R_1 = 0.0780, wR_2 = 0.1990
R indices (all data)	R_1 = 0.2110, wR_2 = 0.1990
Largest difference peak and hole [e $Å^{-3}$]	0.214/-0.175

Copies of ^{1}H NMR, ^{13}C NMR and ^{19}F NMR Spectra

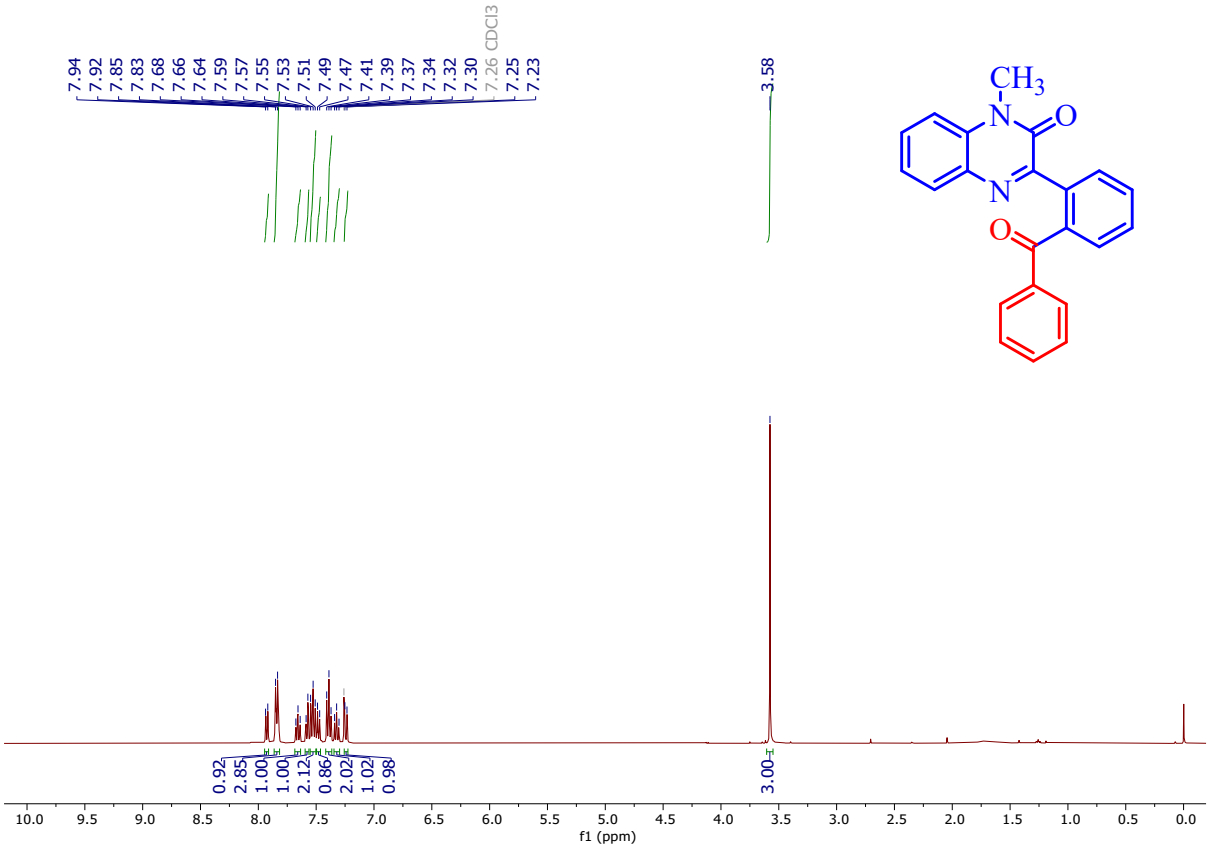


Figure 1: ^{1}H NMR spectrum of compound **3a** (400 MHz, $CDCl_3$).

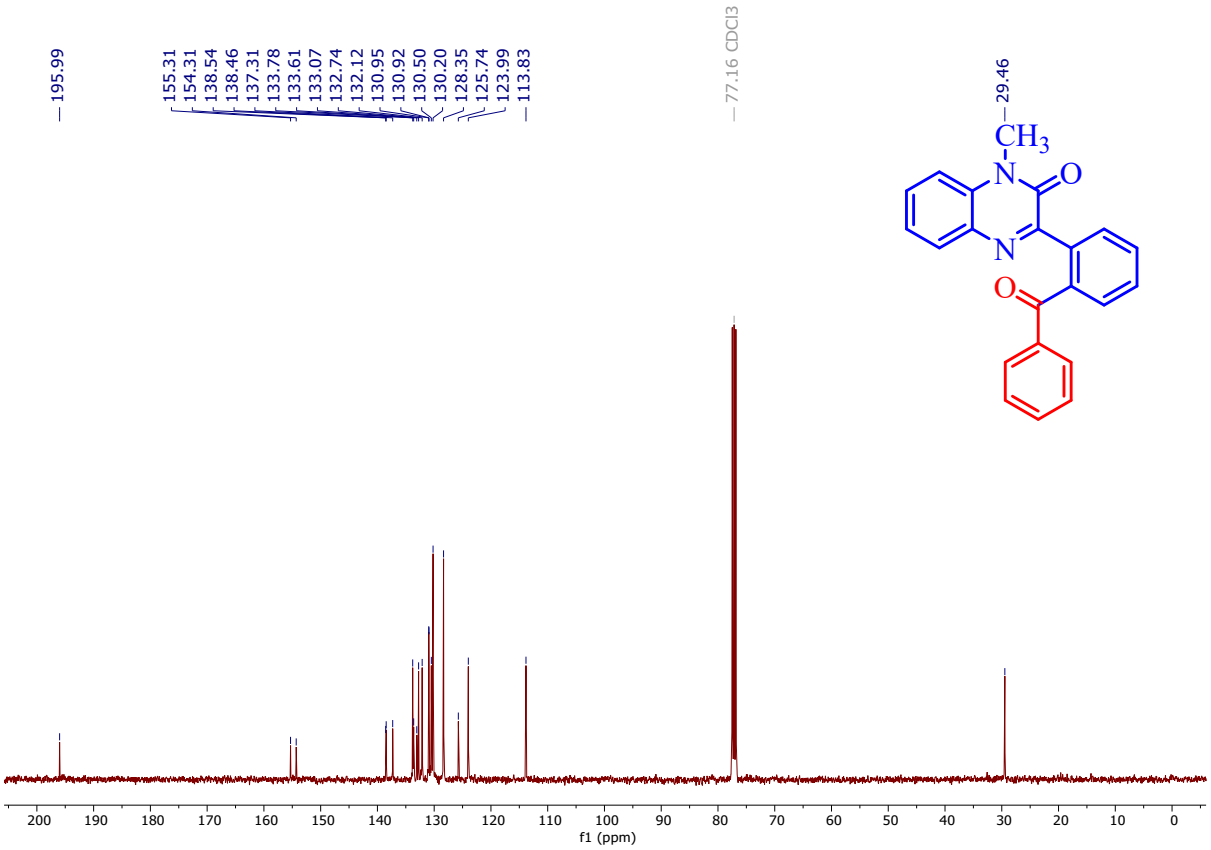


Figure 2: ^{13}C NMR spectrum of compound **3a** (100 MHz, $CDCl_3$).

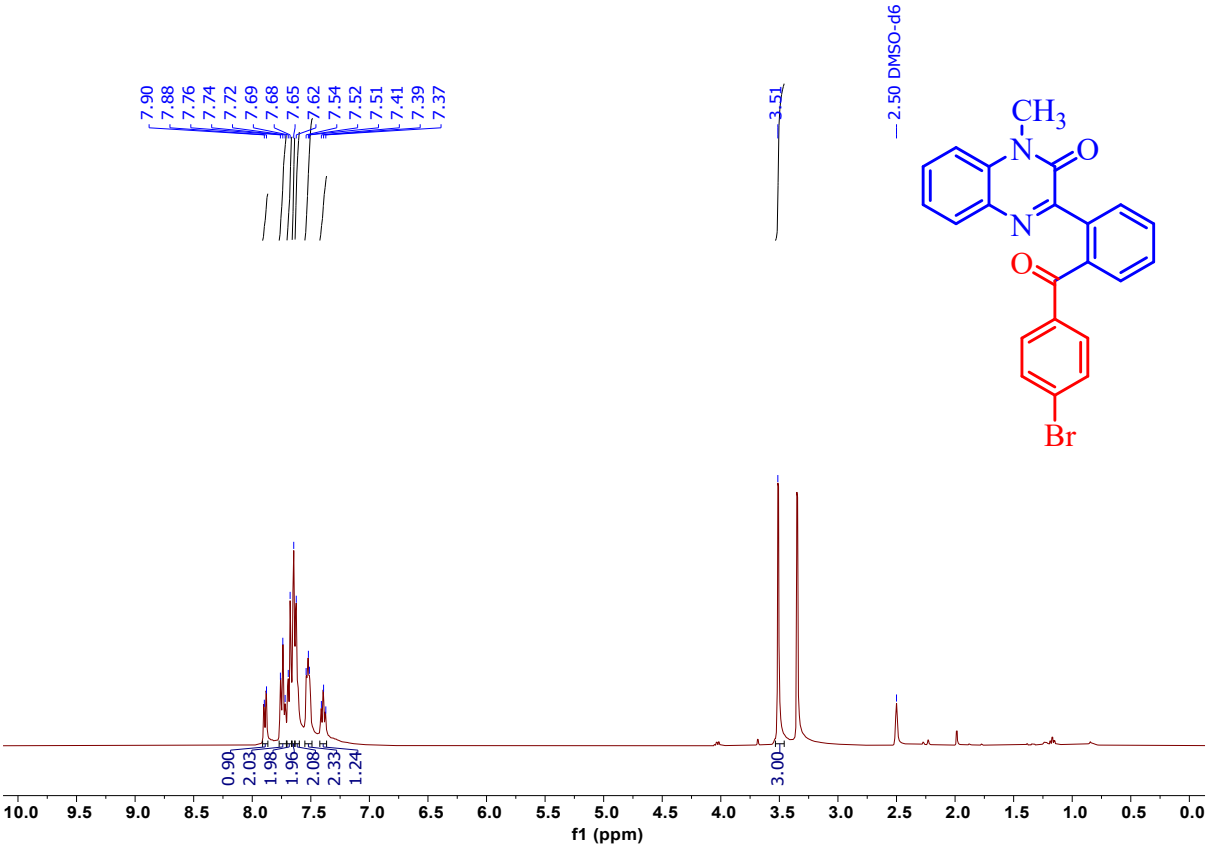


Figure 3: ^{1}H NMR spectrum of compound **3b** (400 MHz, DMSO-d_6).

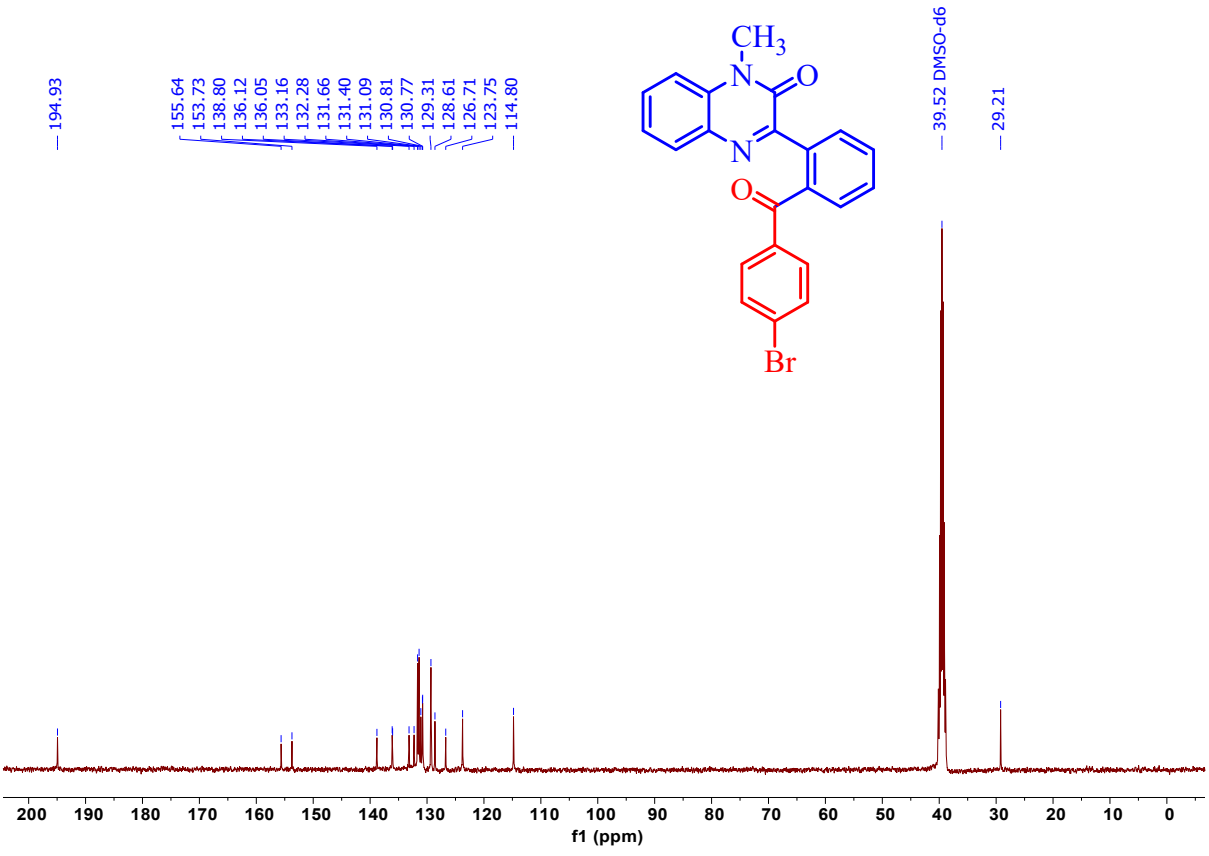


Figure 4: ^{13}C NMR spectrum of compound **3b** (100 MHz, DMSO-d_6).

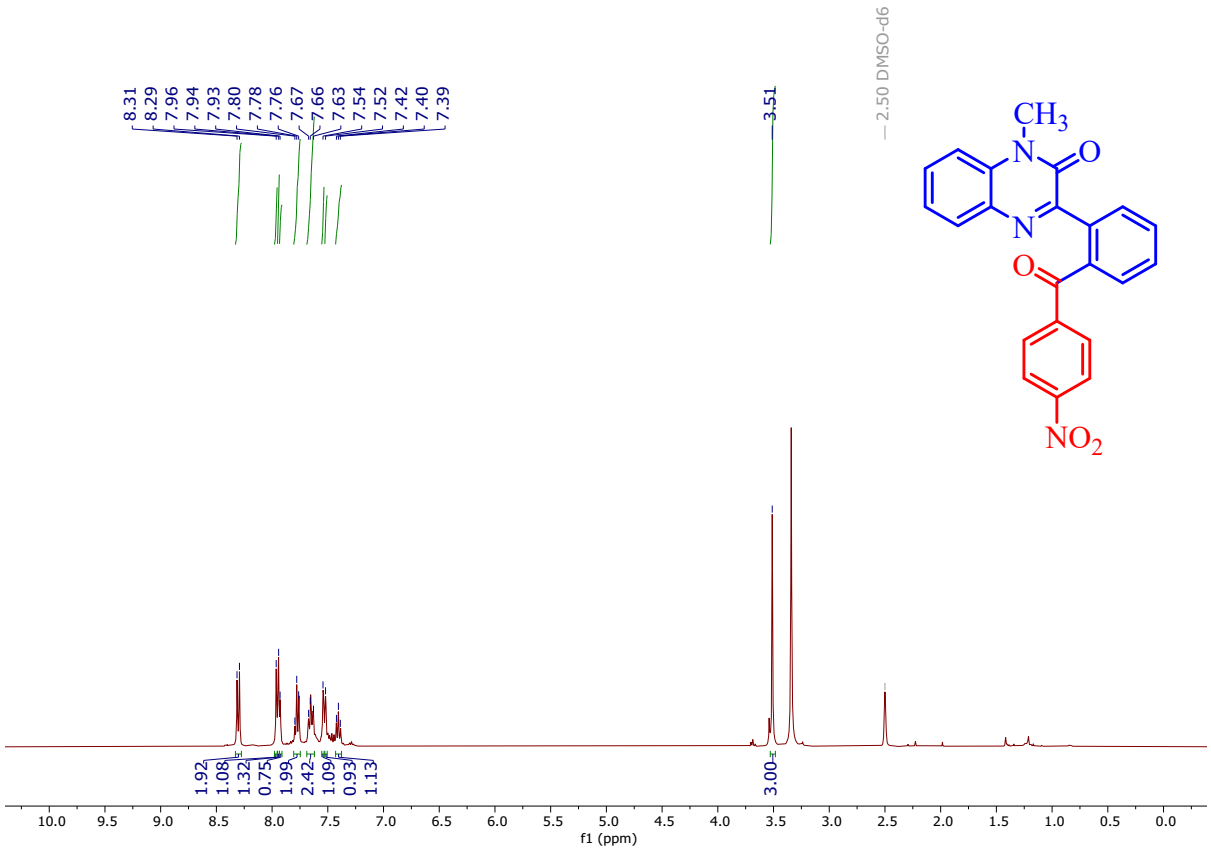


Figure 5: ^{1}H NMR spectrum of compound **3c** (400 MHz, DMSO-d_6).

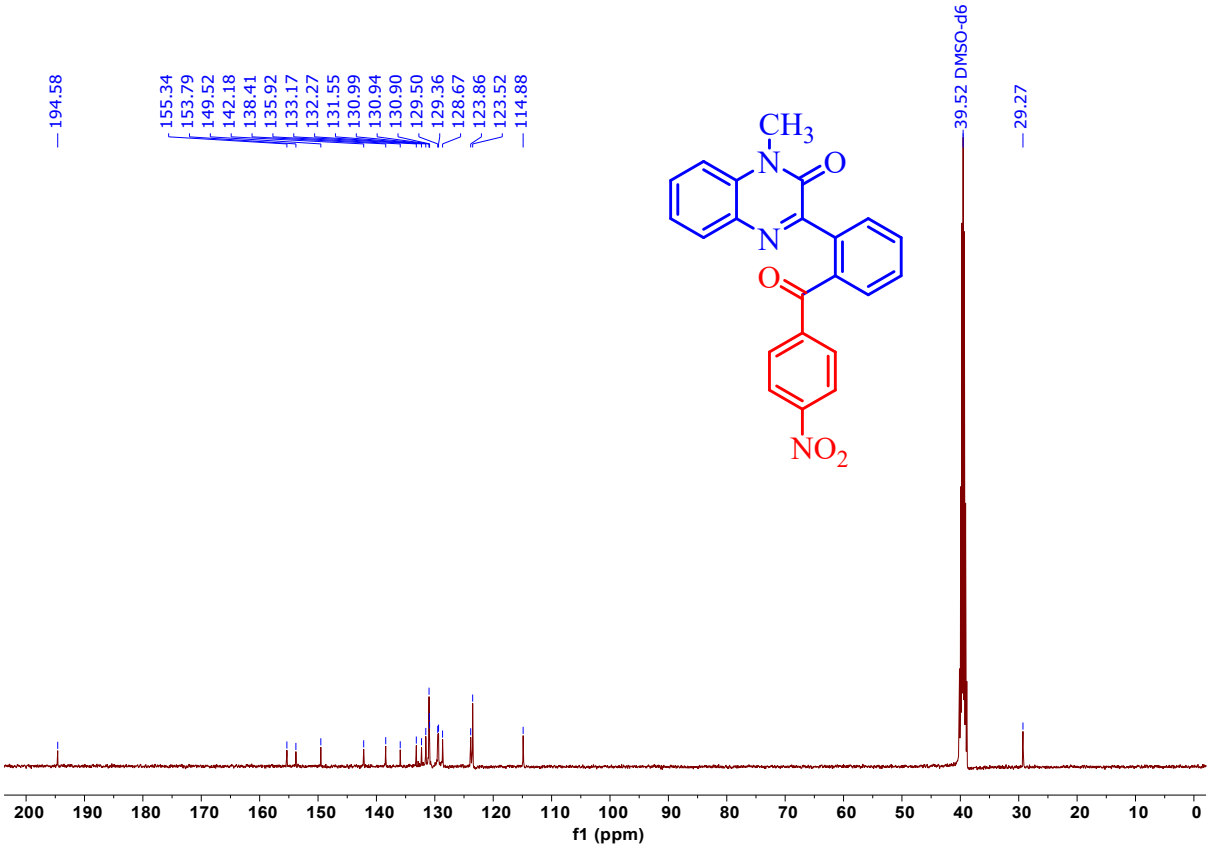


Figure 6: ^{13}C NMR spectrum of compound **3c** (100 MHz, DMSO-d_6).

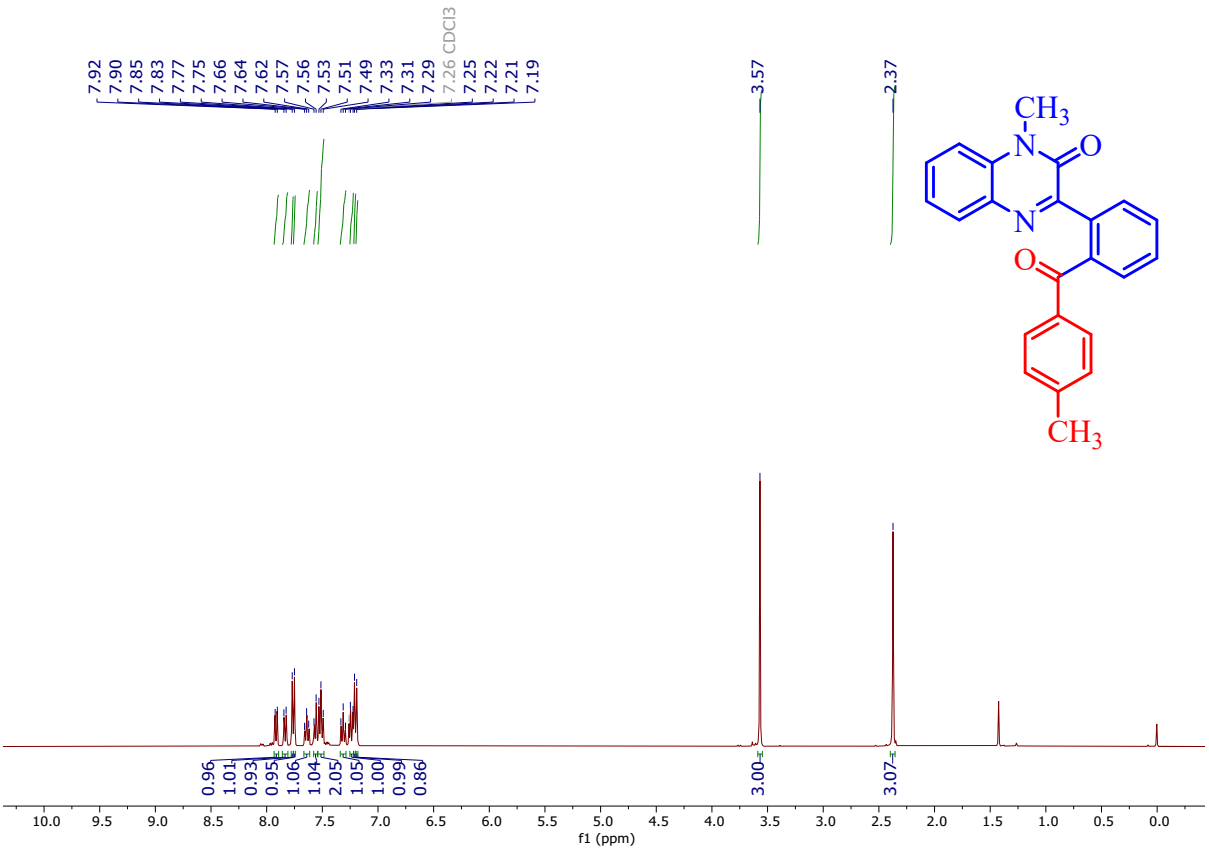


Figure 7: ^{1}H NMR spectrum of compound **3d** (400 MHz, $CDCl_3$).

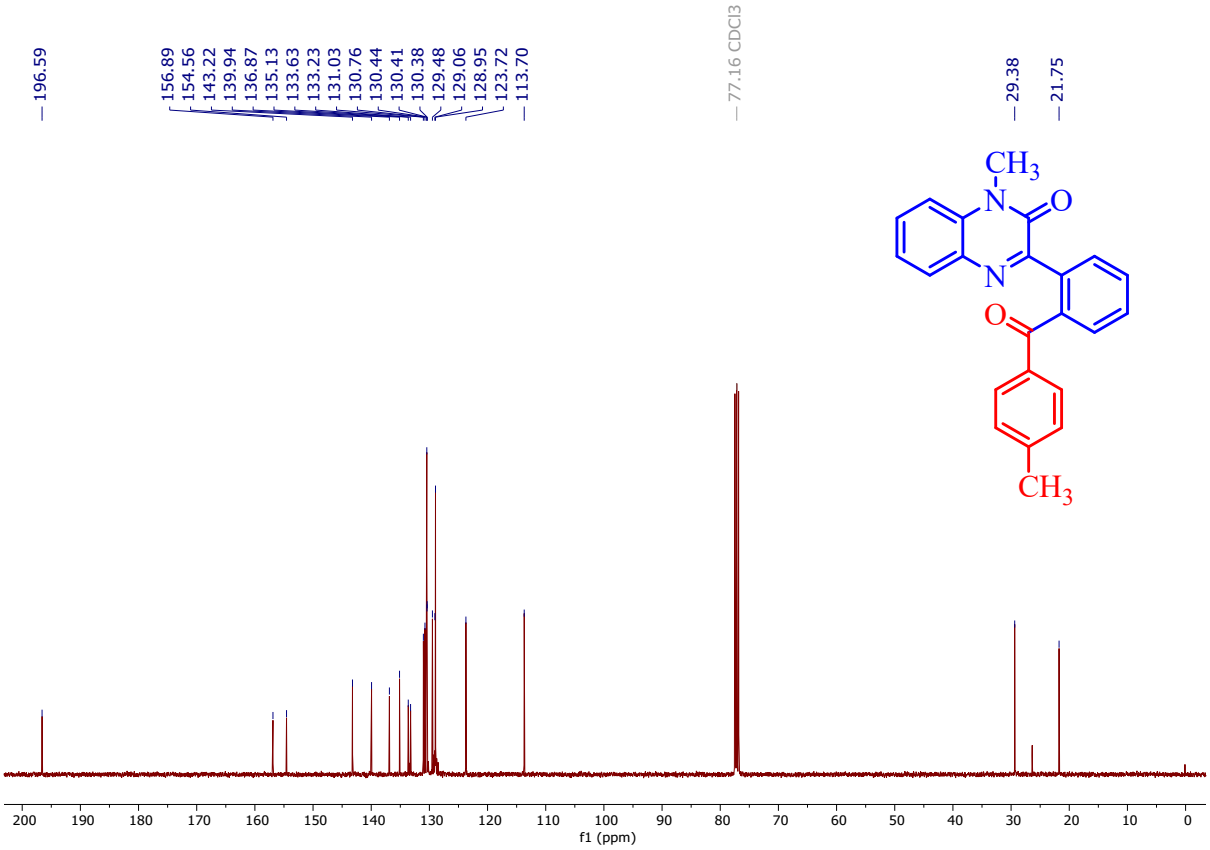


Figure 8: ^{13}C NMR spectrum of compound **3d** (100 MHz, $CDCl_3$).

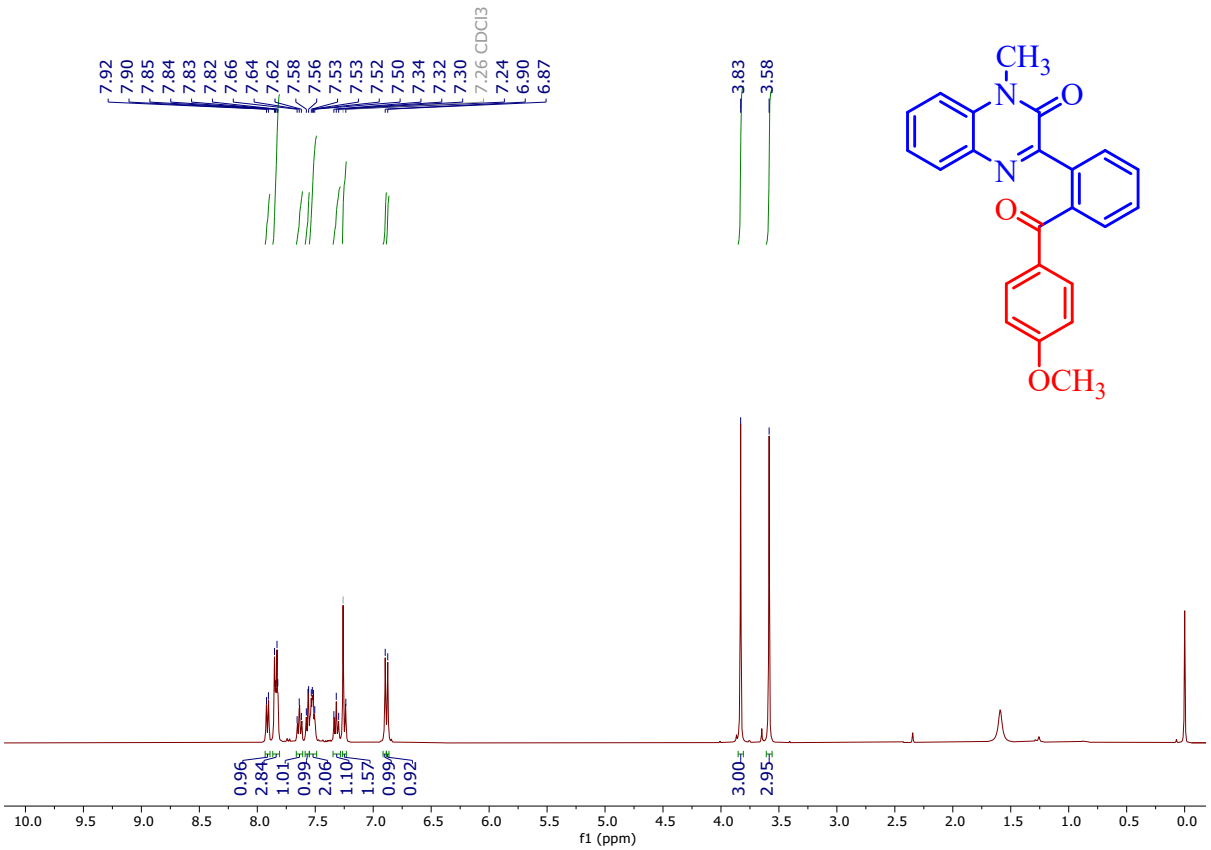


Figure 9: ^{1}H NMR spectrum of compound **3e** (400 MHz, $CDCl_3$).

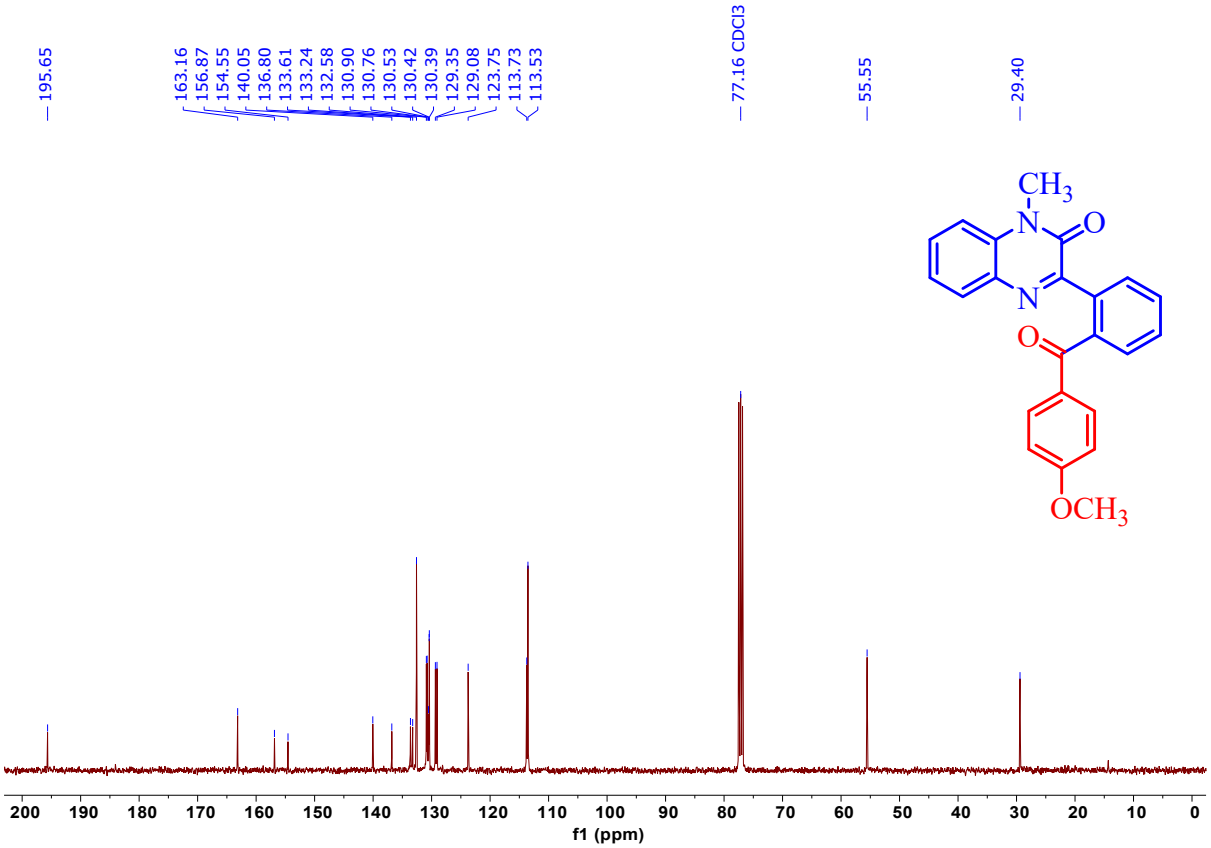


Figure 10: ^{13}C NMR spectrum of compound **3e** (100 MHz, $CDCl_3$).

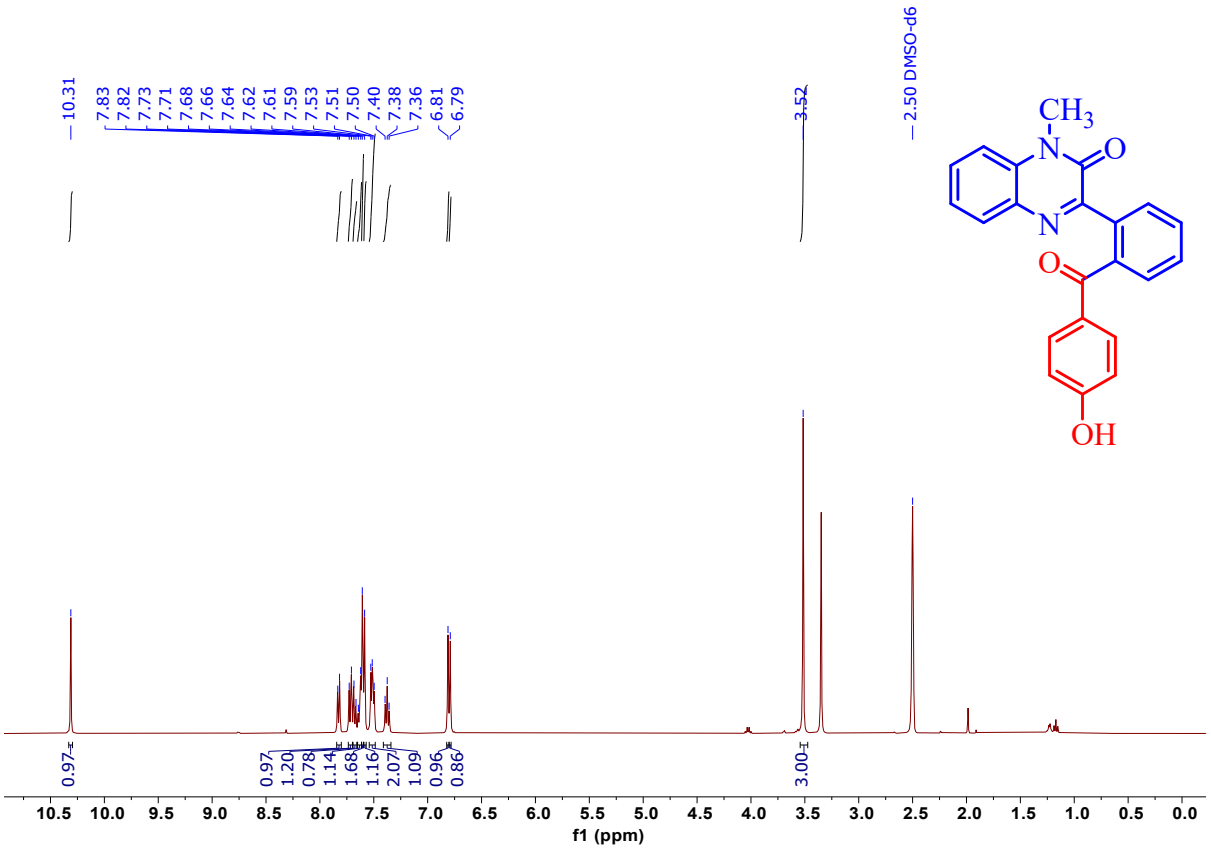


Figure 11: ^{1}H NMR spectrum of compound **3f** (400 MHz, DMSO-d_6).

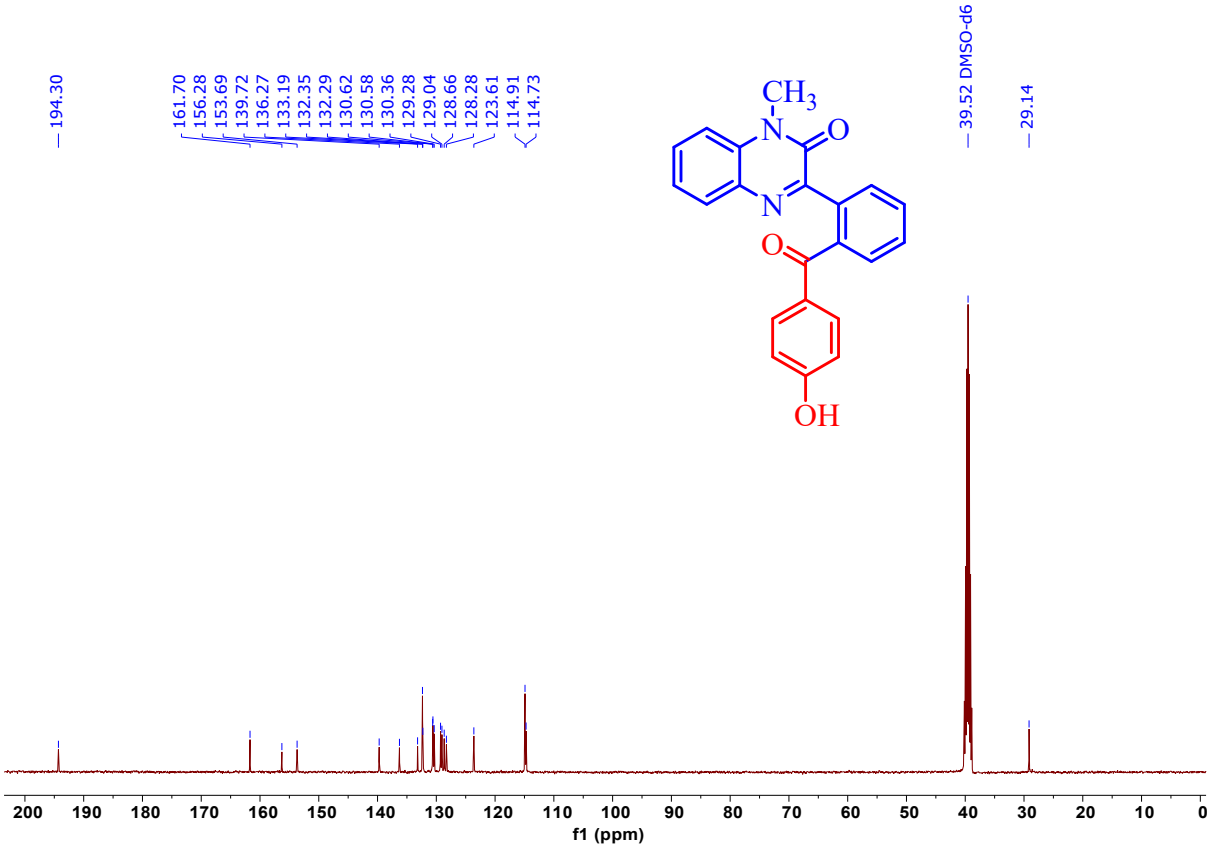


Figure 12: ^{13}C NMR spectrum of compound **3f** (100 MHz, DMSO-d_6).

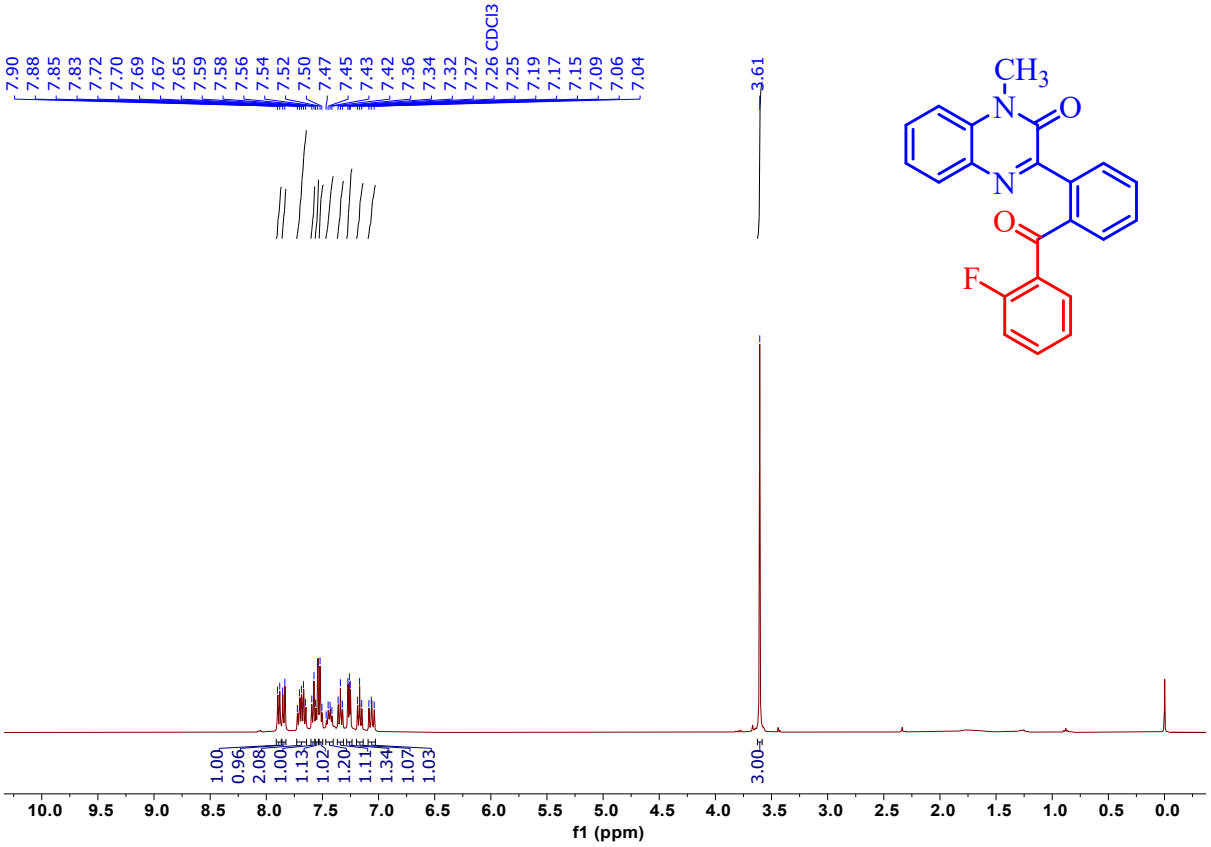


Figure 13: ^{1}H NMR spectrum of compound **3g** (400 MHz, $CDCl_3$).

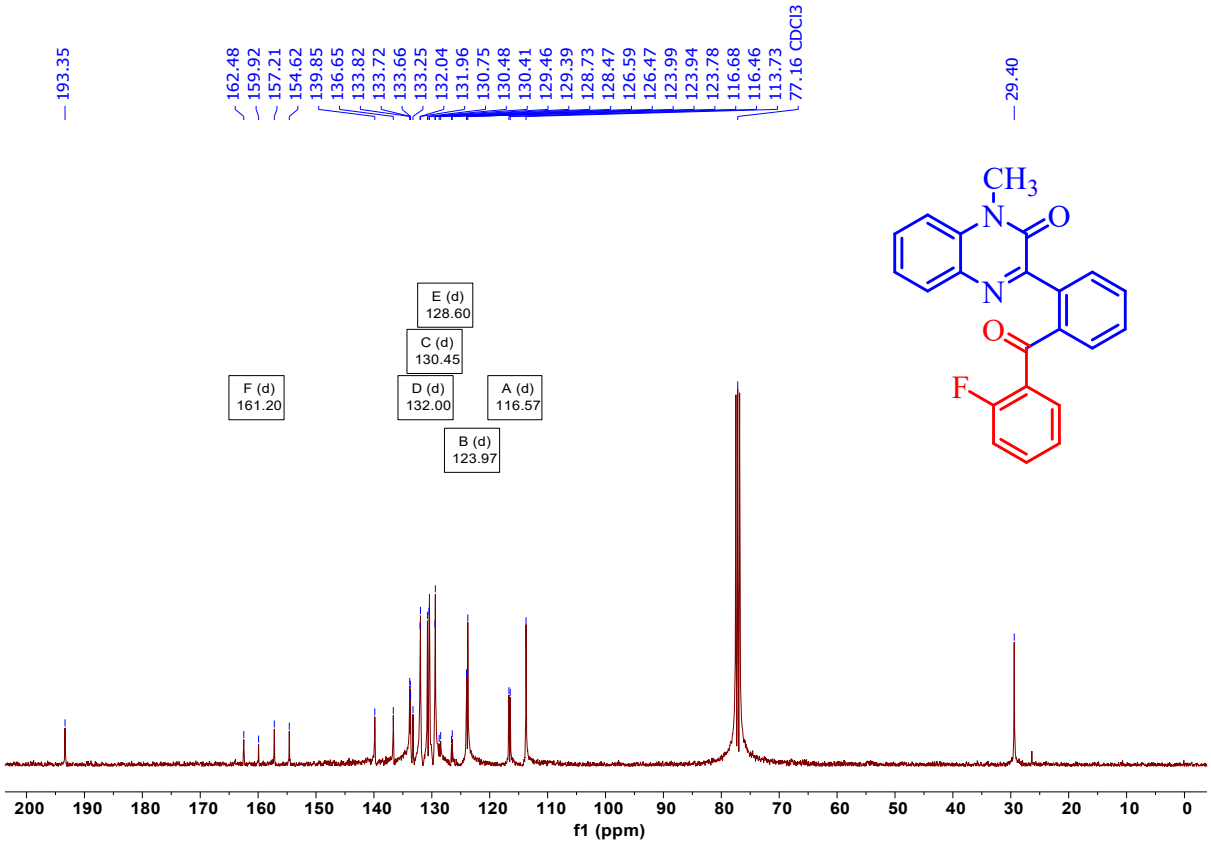


Figure 14: ^{13}C NMR spectrum of compound **3g** (100 MHz, $CDCl_3$).

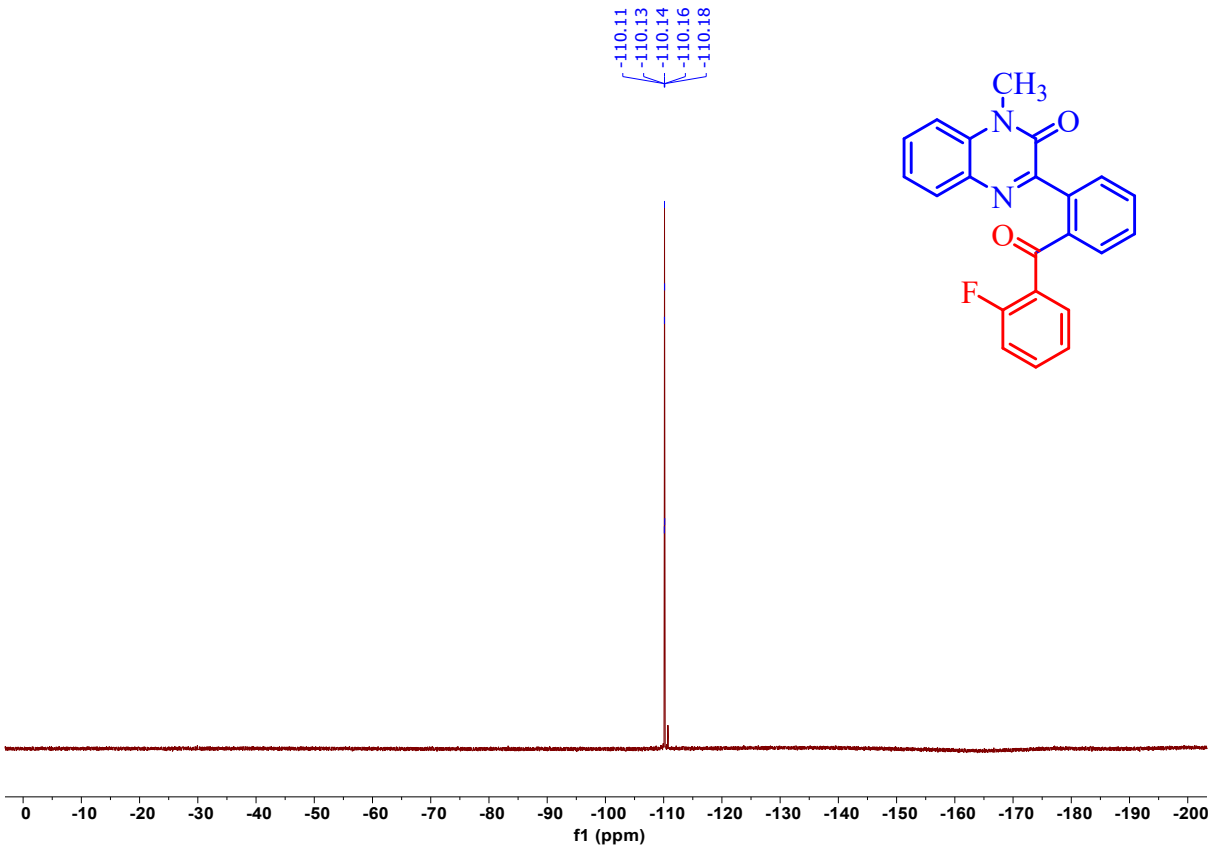


Figure 15: ^{19}F NMR spectrum of compound **3g** (377 MHz, $CDCl_3$).

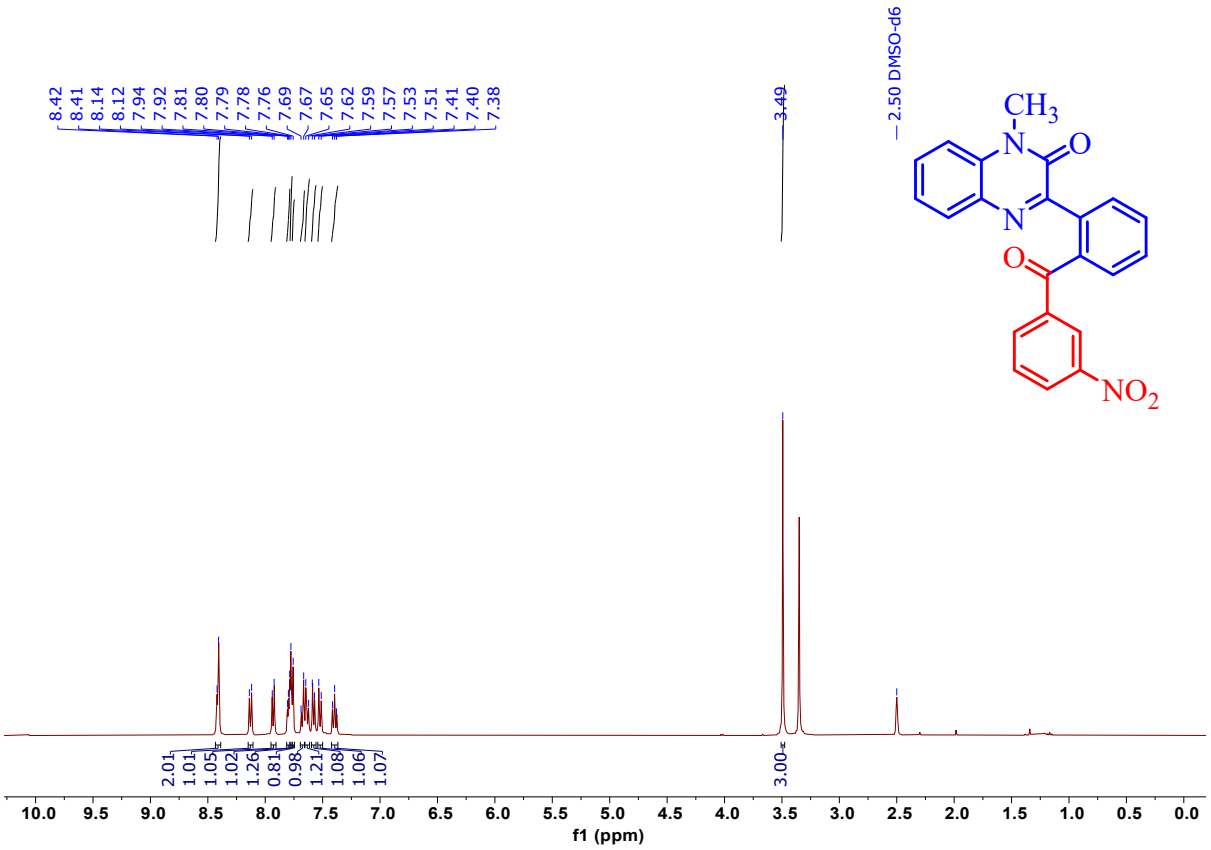


Figure 16: ^{1}H NMR spectrum of compound **3h** (400 MHz, DMSO-d_6).

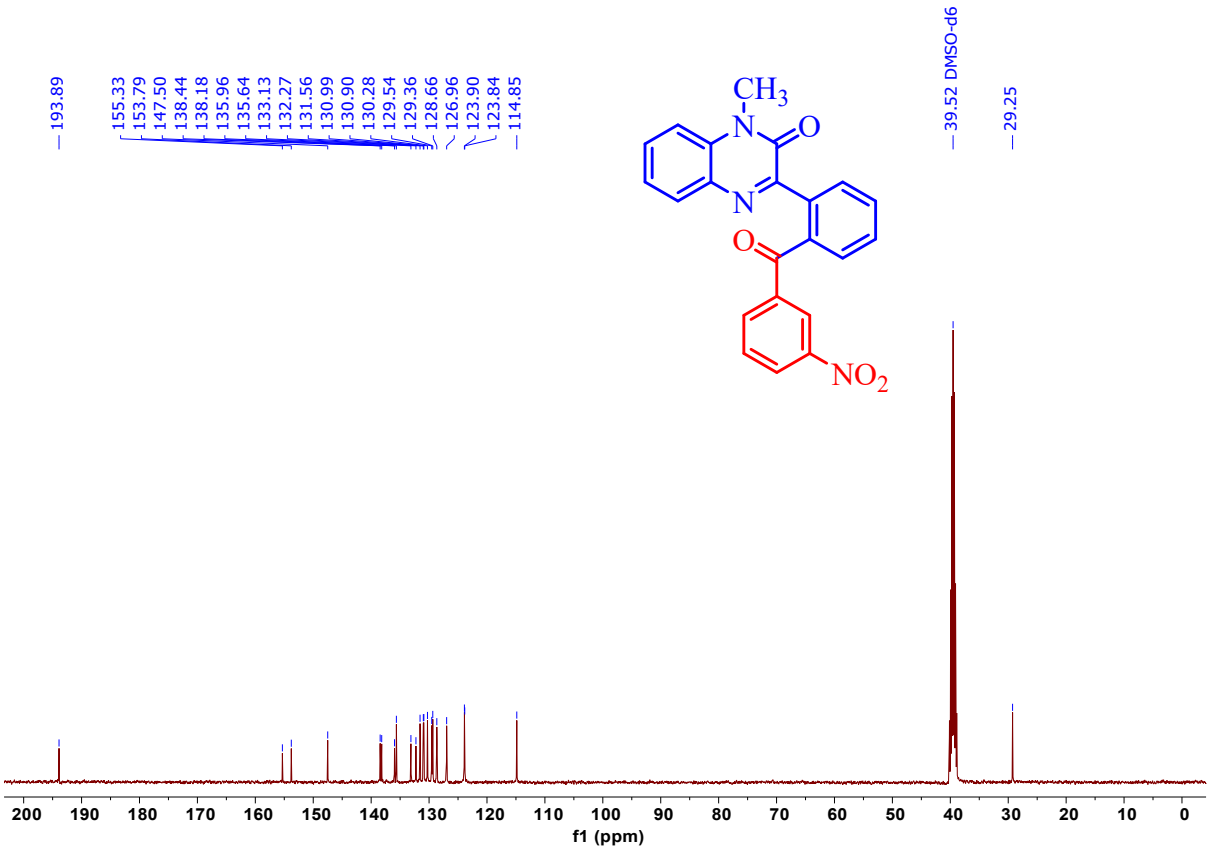


Figure 17: ^{13}C NMR spectrum of compound **3h** (100 MHz, DMSO-d_6).

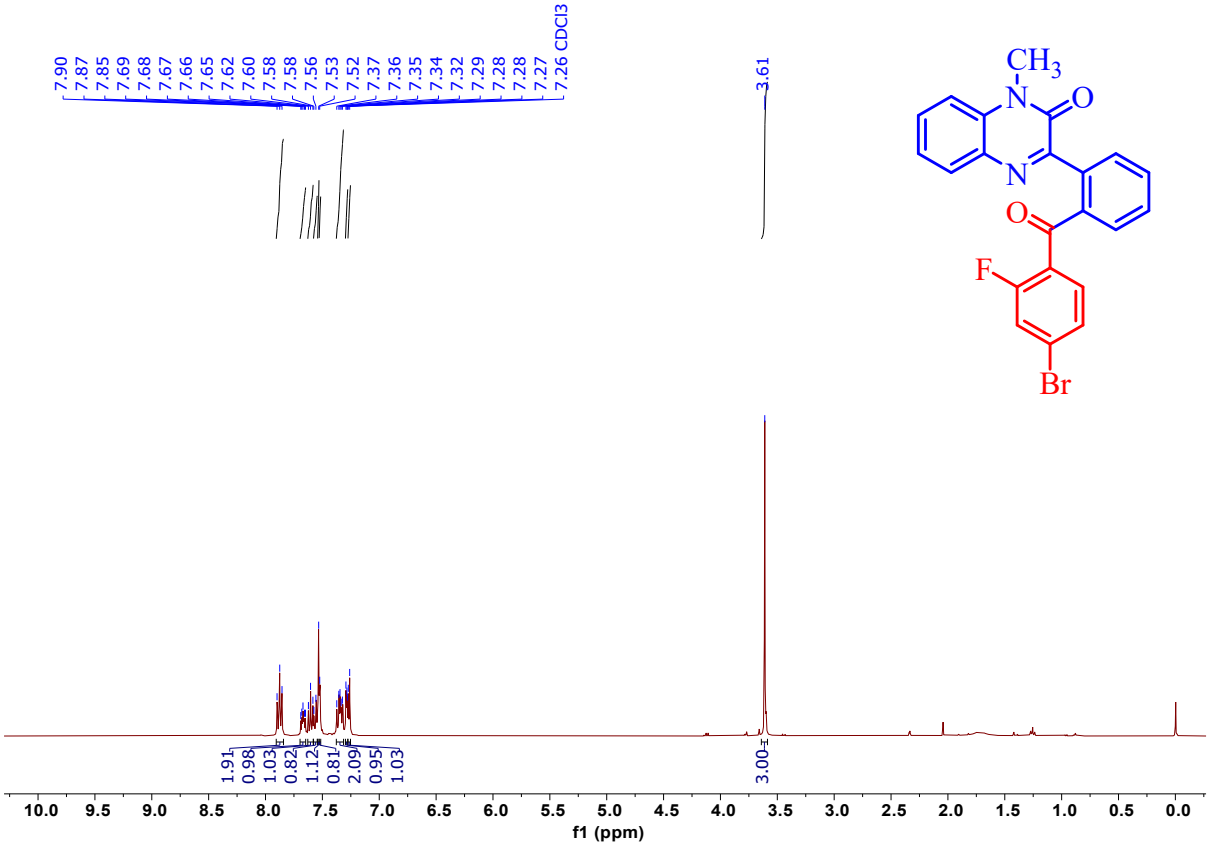


Figure 18: ^{1}H NMR spectrum of compound **3i** (400 MHz, $CDCl_3$).

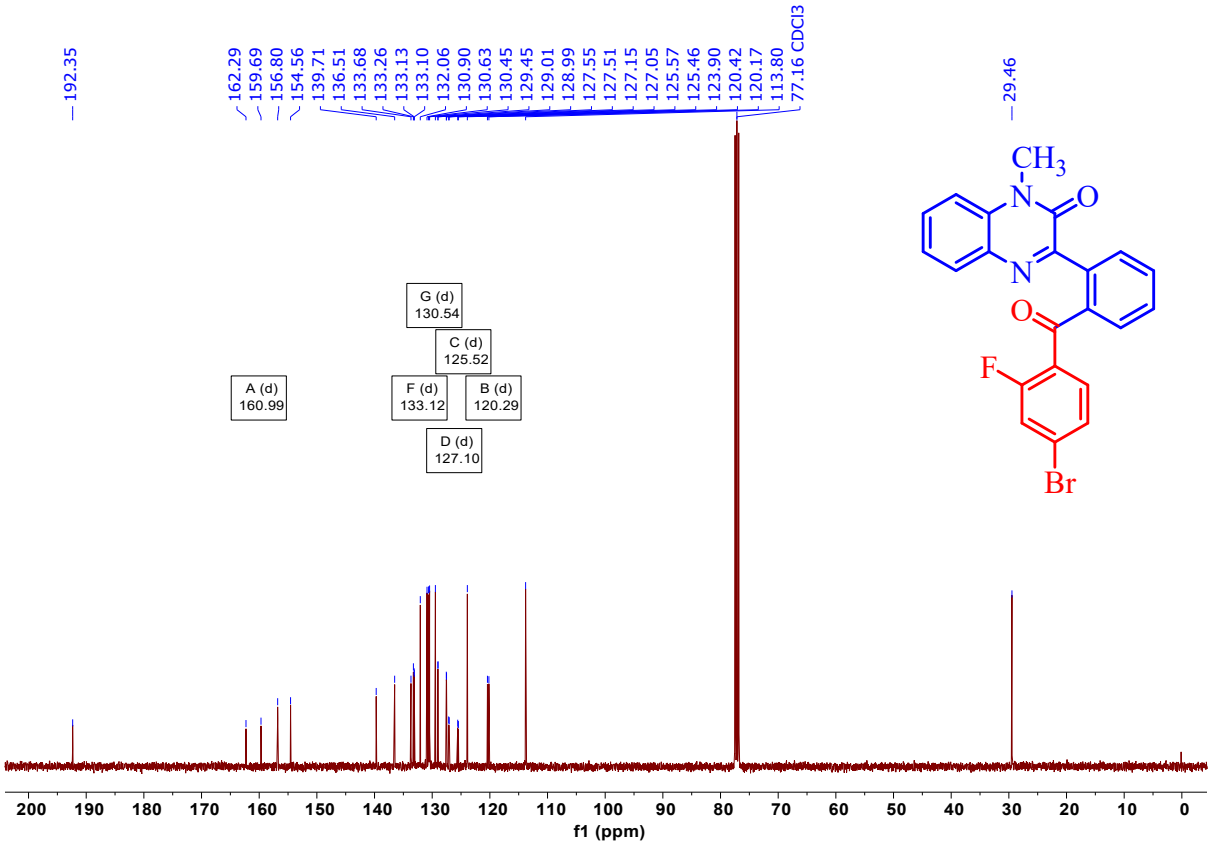


Figure 19: ^{13}C NMR spectrum of compound **3i** (100 MHz, $CDCl_3$).

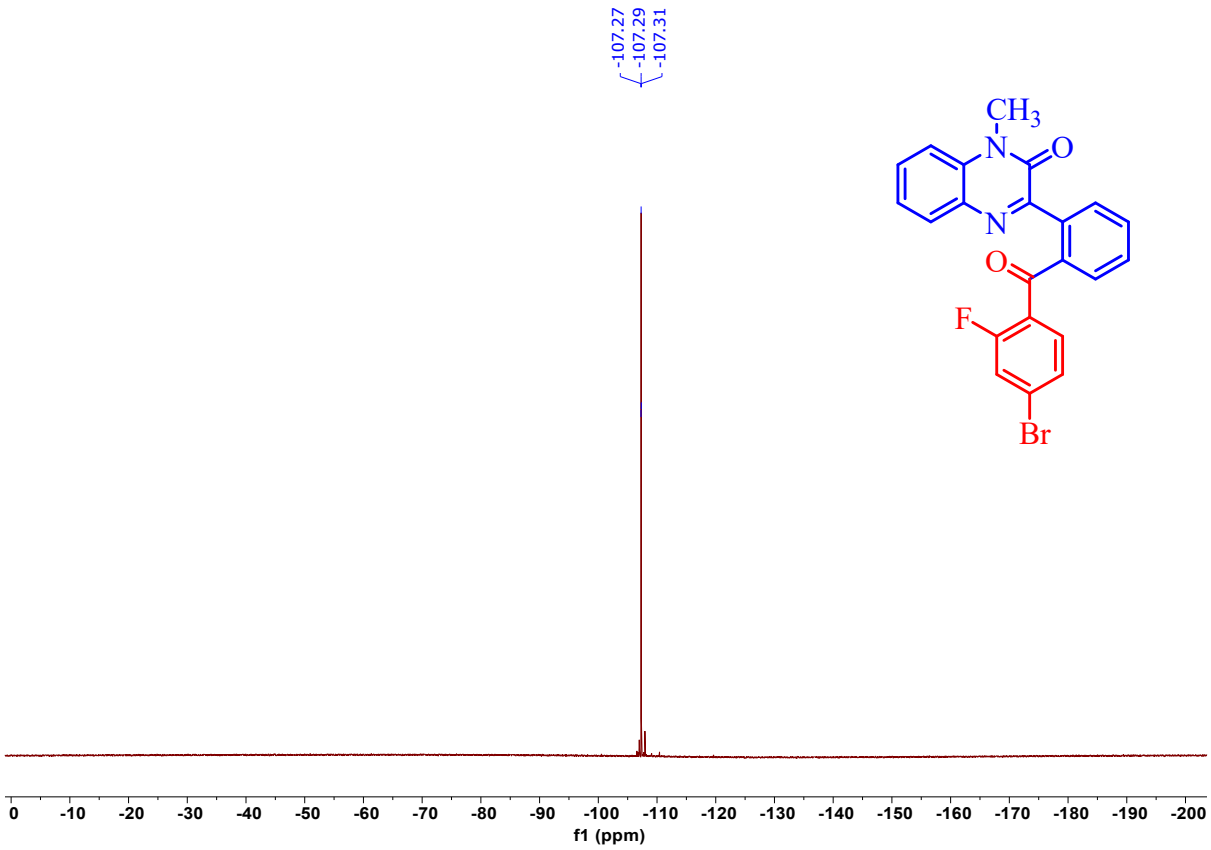


Figure 20: ^{19}F NMR spectrum of compound **3i** (377 MHz, $CDCl_3$).

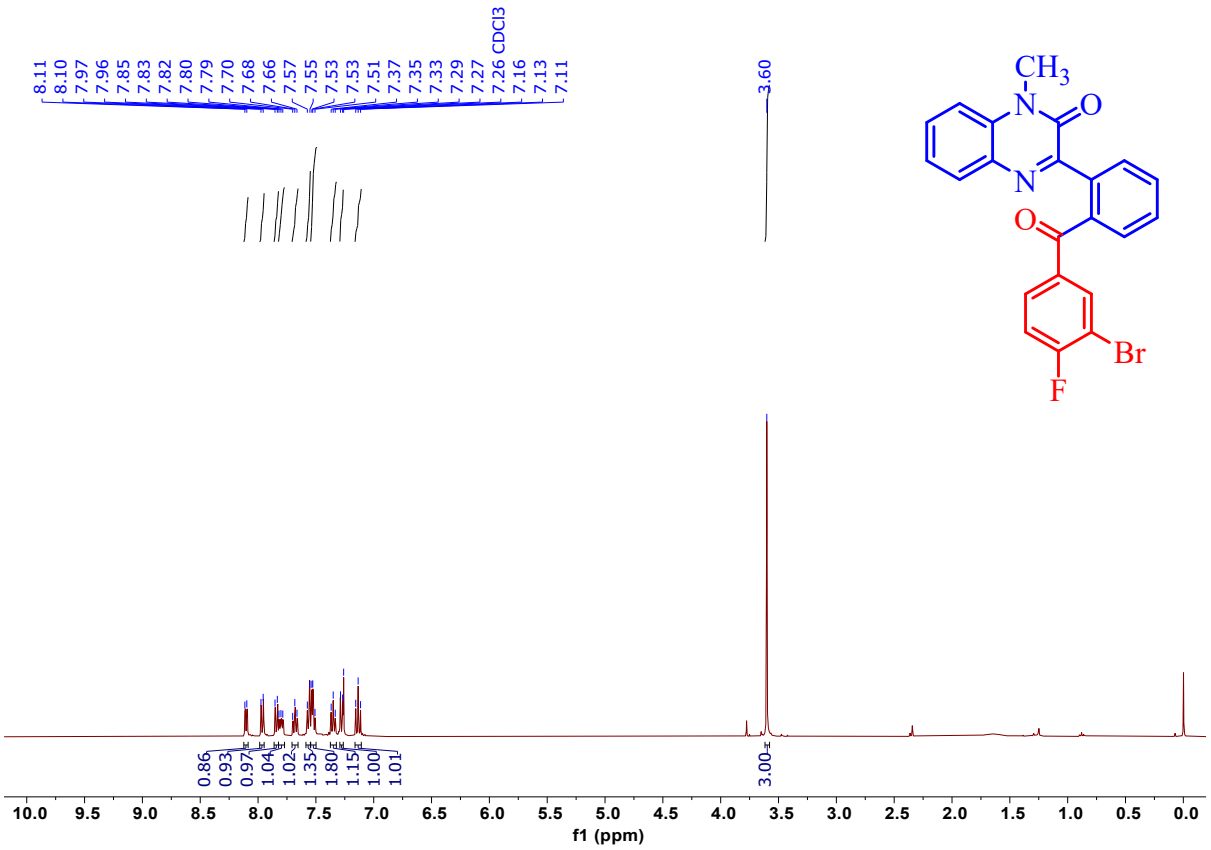


Figure 21: ^{1}H NMR spectrum of compound **3j** (400 MHz, $CDCl_3$).

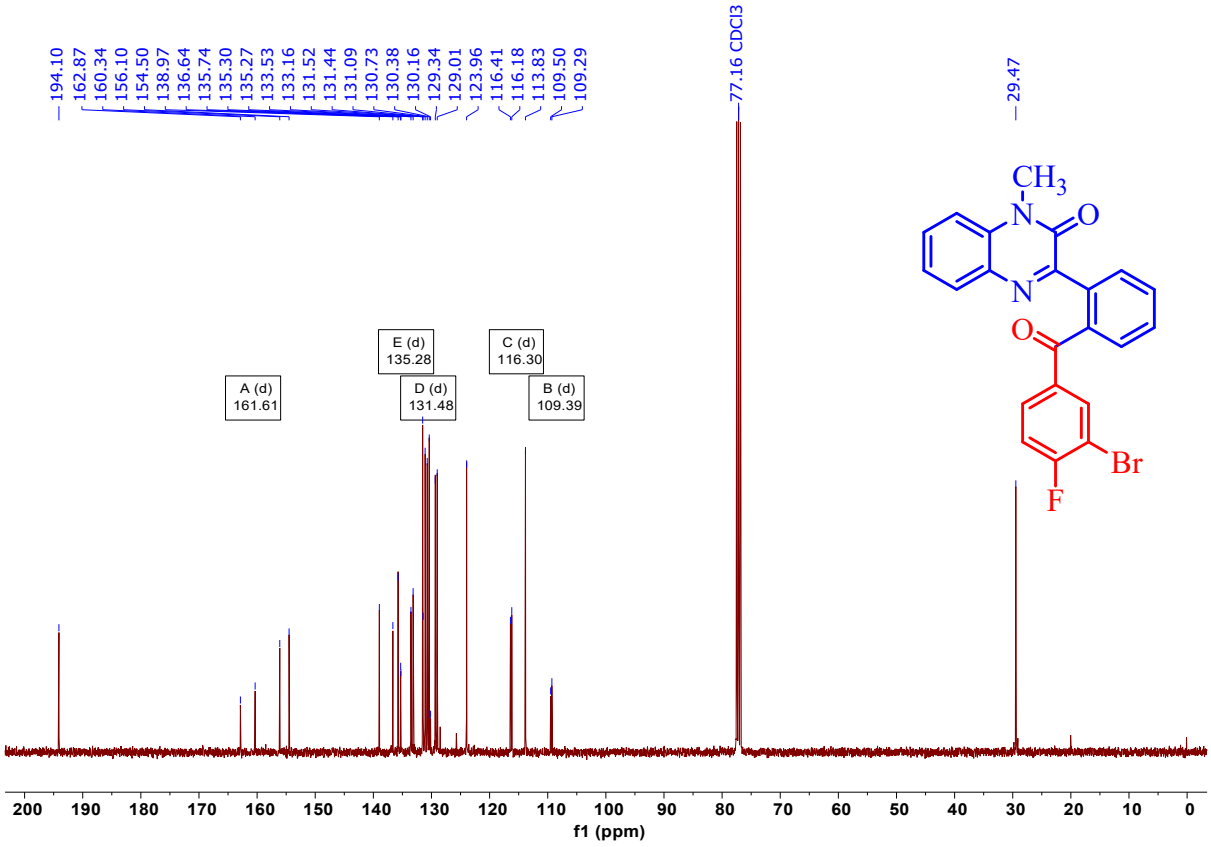


Figure 22: ^{13}C NMR spectrum of compound **3j** (100 MHz, $CDCl_3$).

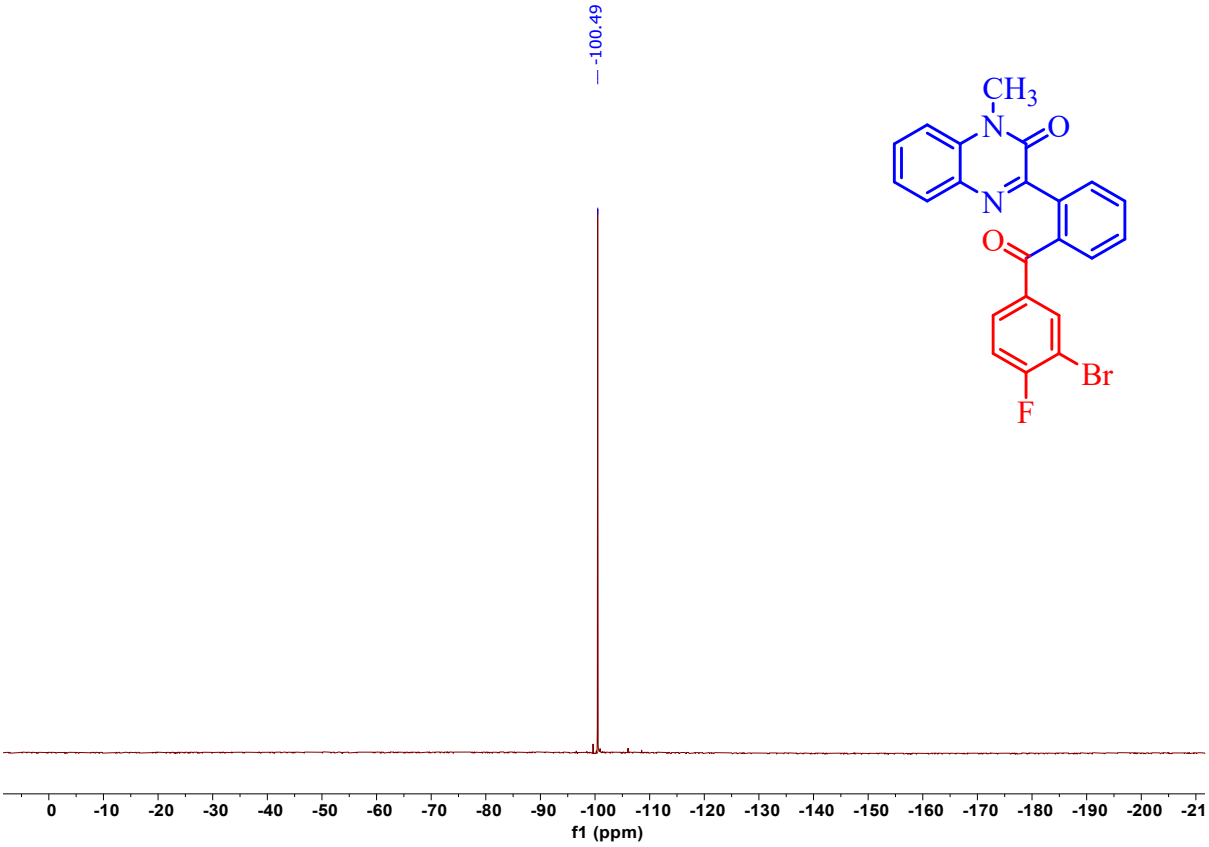


Figure 23: ^{19}F NMR spectrum of compound **3j** (377 MHz, $CDCl_3$).

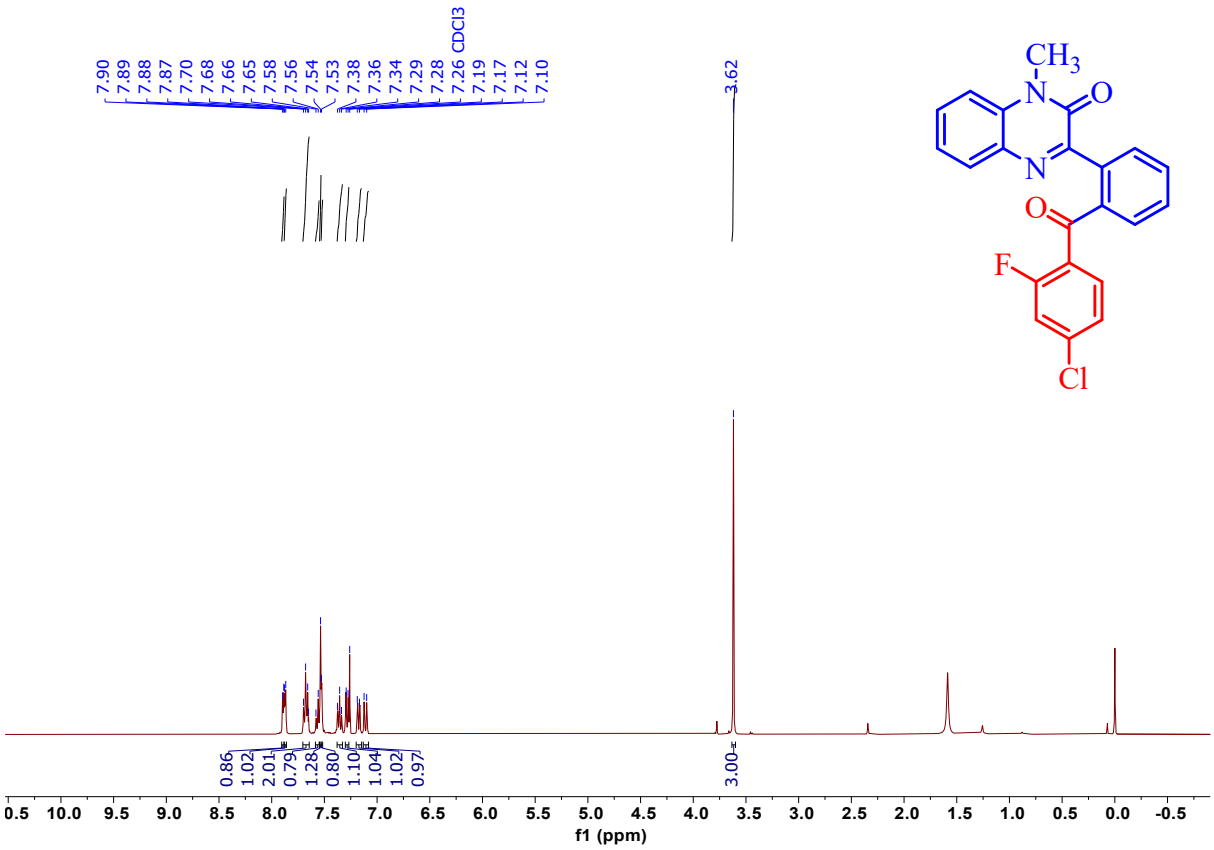


Figure 24: ^{1}H NMR spectrum of compound **3k** (400 MHz, $CDCl_3$).

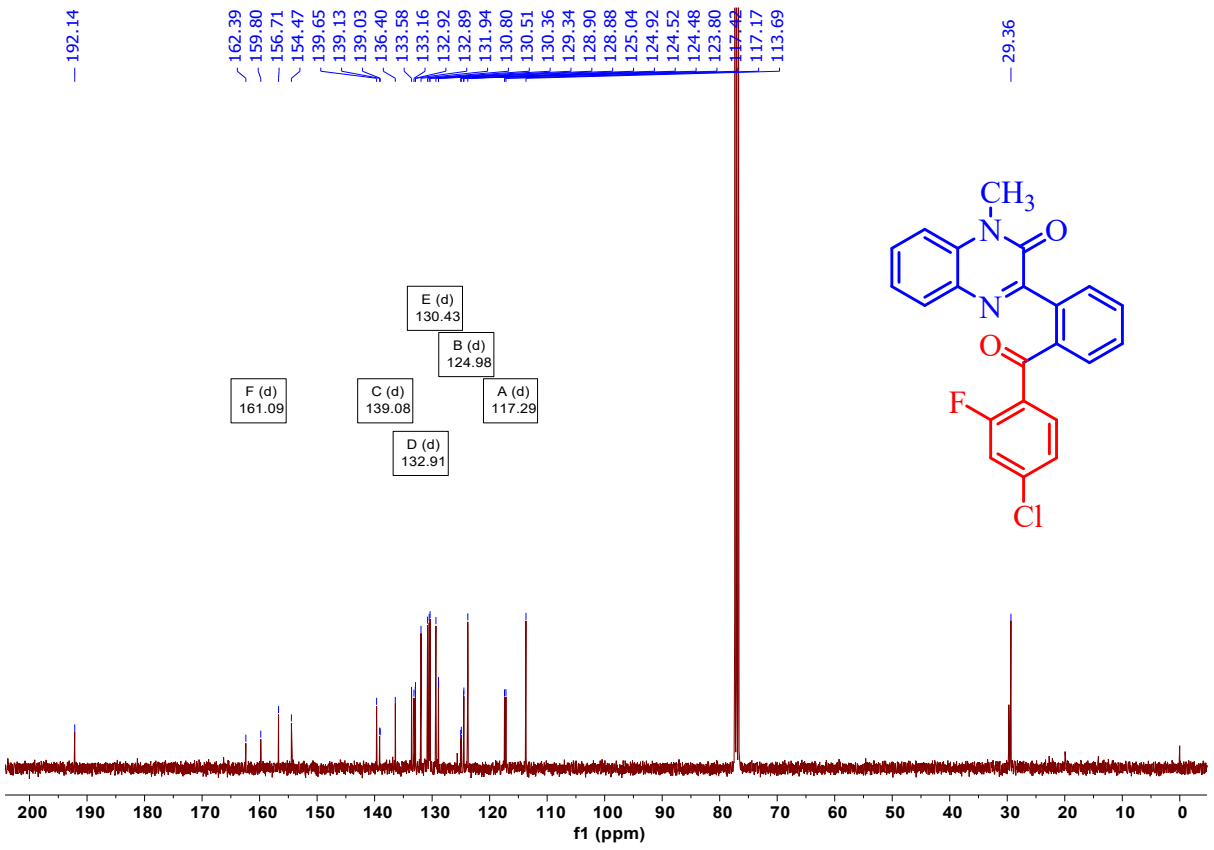


Figure 25: ^{13}C NMR spectrum of compound **3k** (100 MHz, $CDCl_3$).

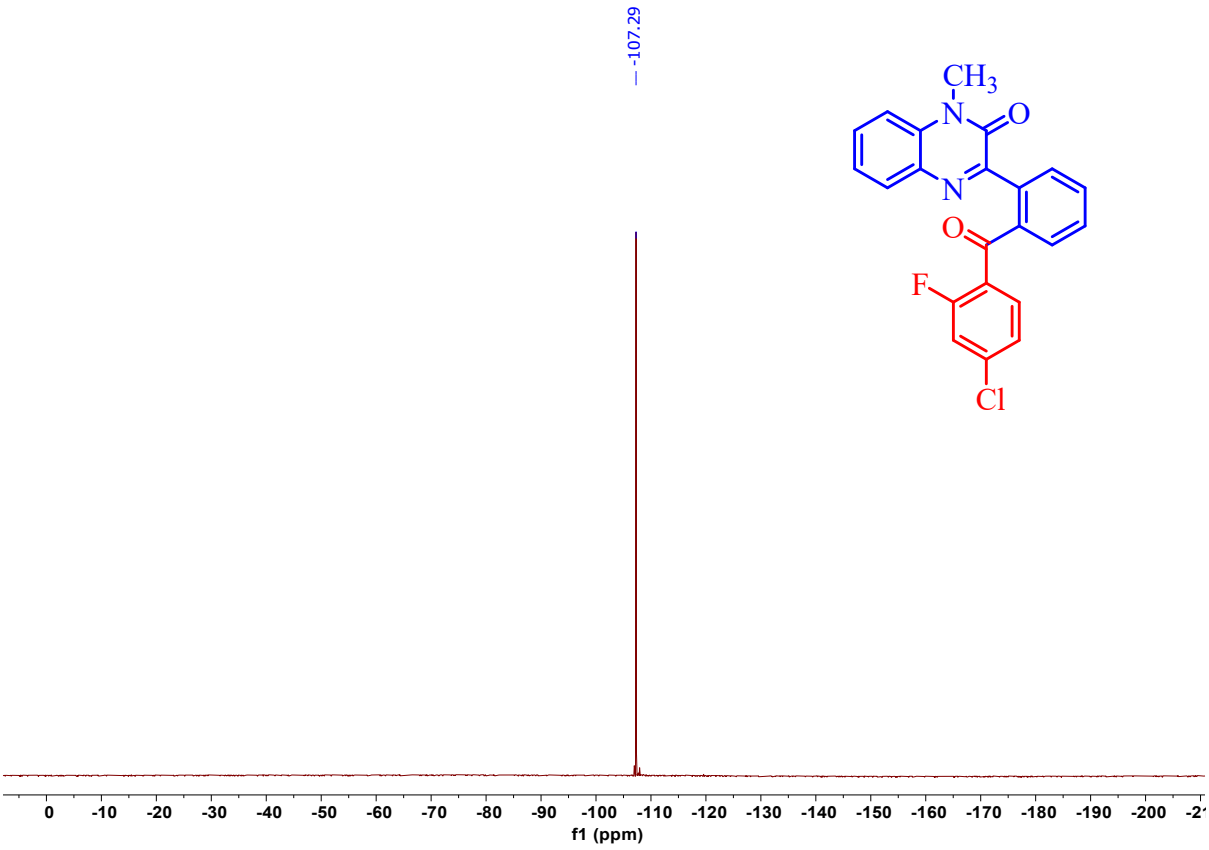


Figure 26: ^{19}F NMR spectrum of compound **3k** (377 MHz, $CDCl_3$).

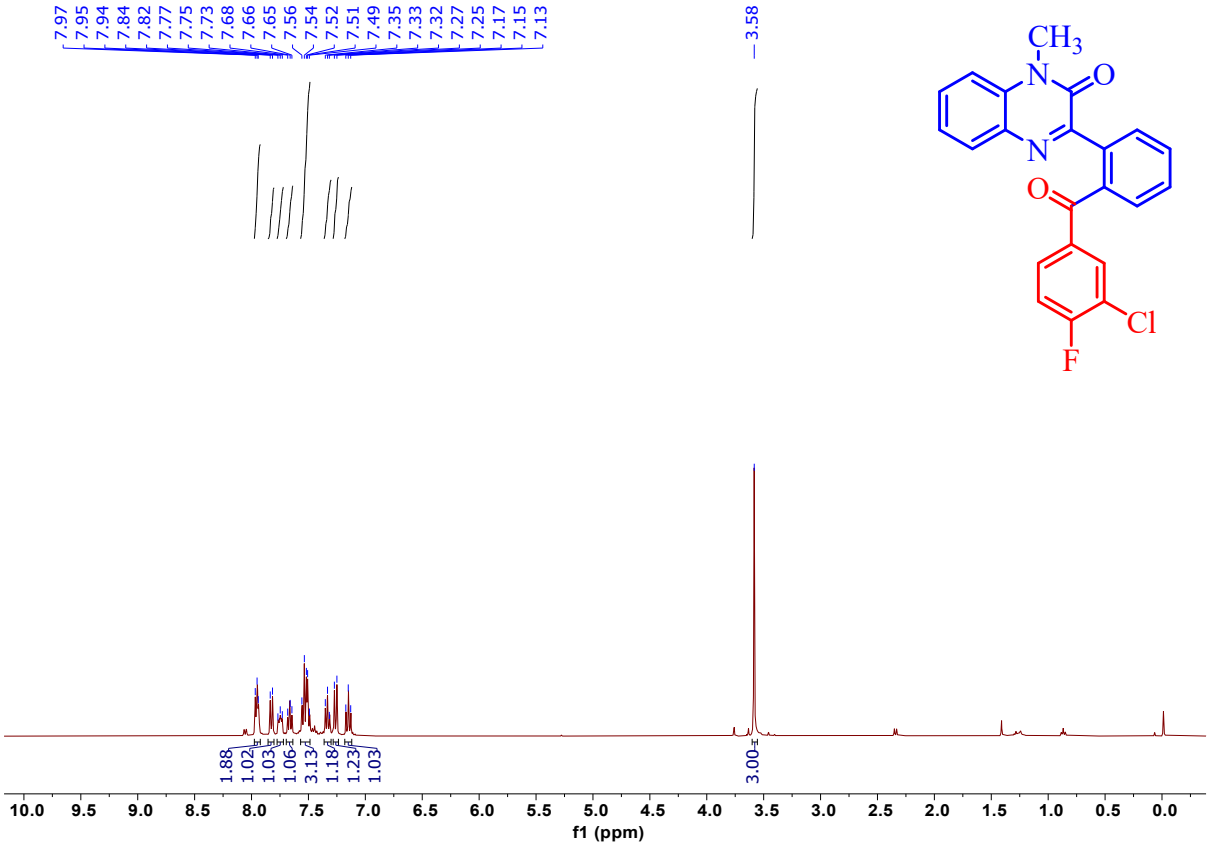


Figure 27: ^{1}H NMR spectrum of compound **3l** (400 MHz, $CDCl_3$).

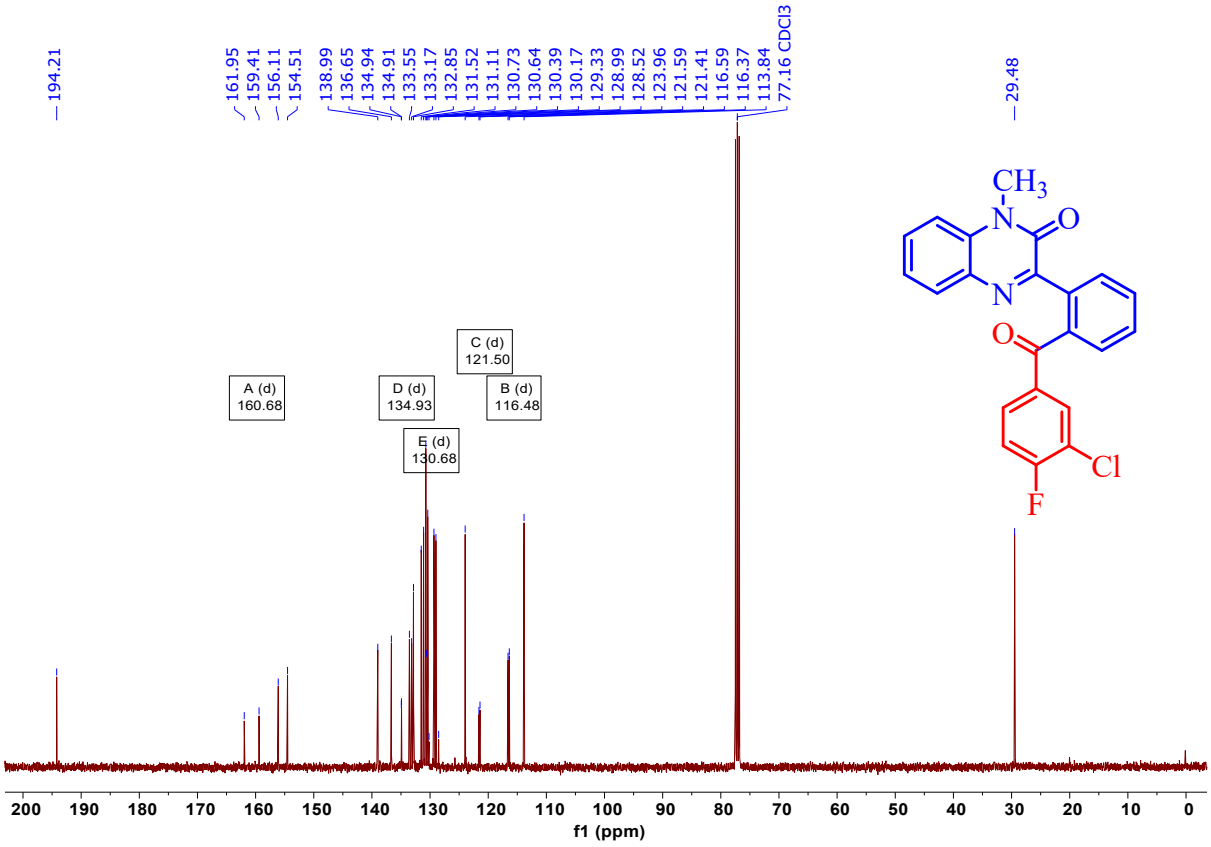


Figure 28: ^{13}C NMR spectrum of compound **3l** (100 MHz, $CDCl_3$).

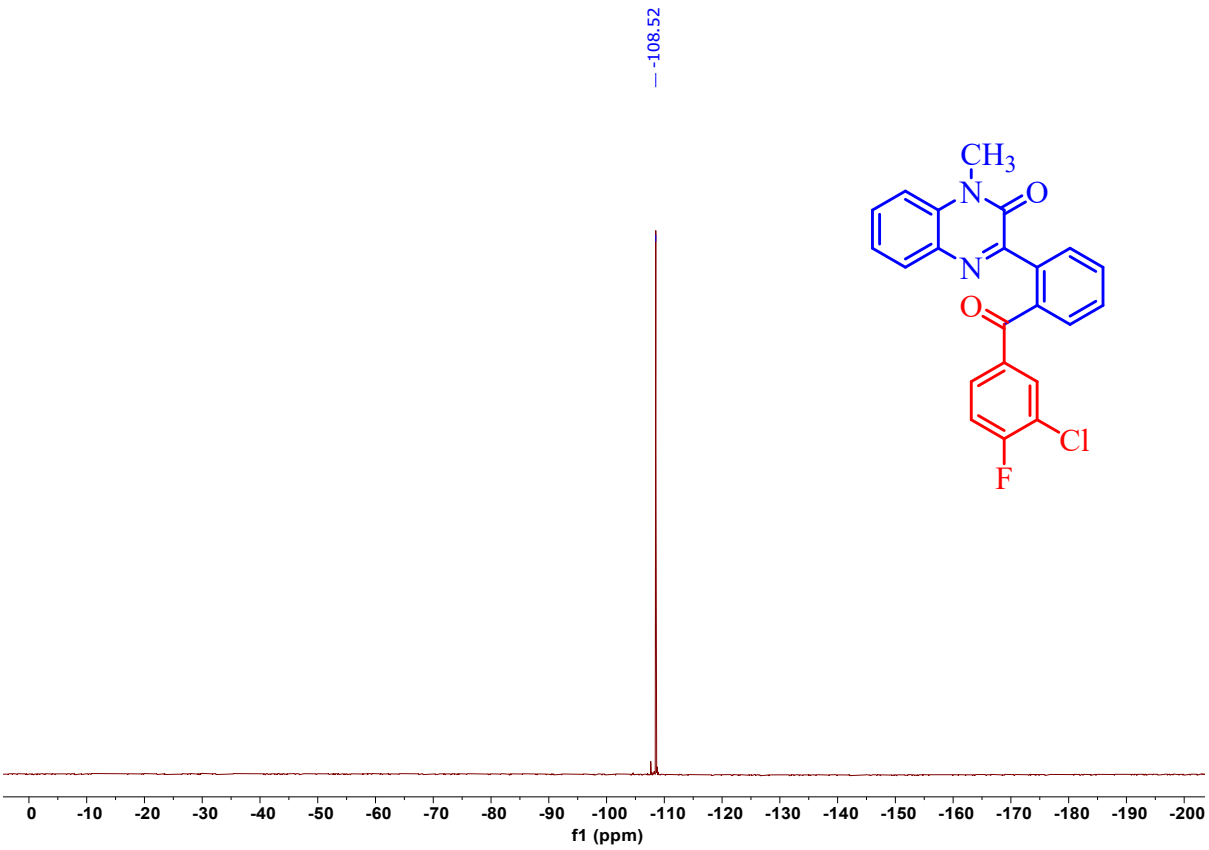


Figure 29: ^{19}F NMR spectrum of compound **3l** (377 MHz, $CDCl_3$).

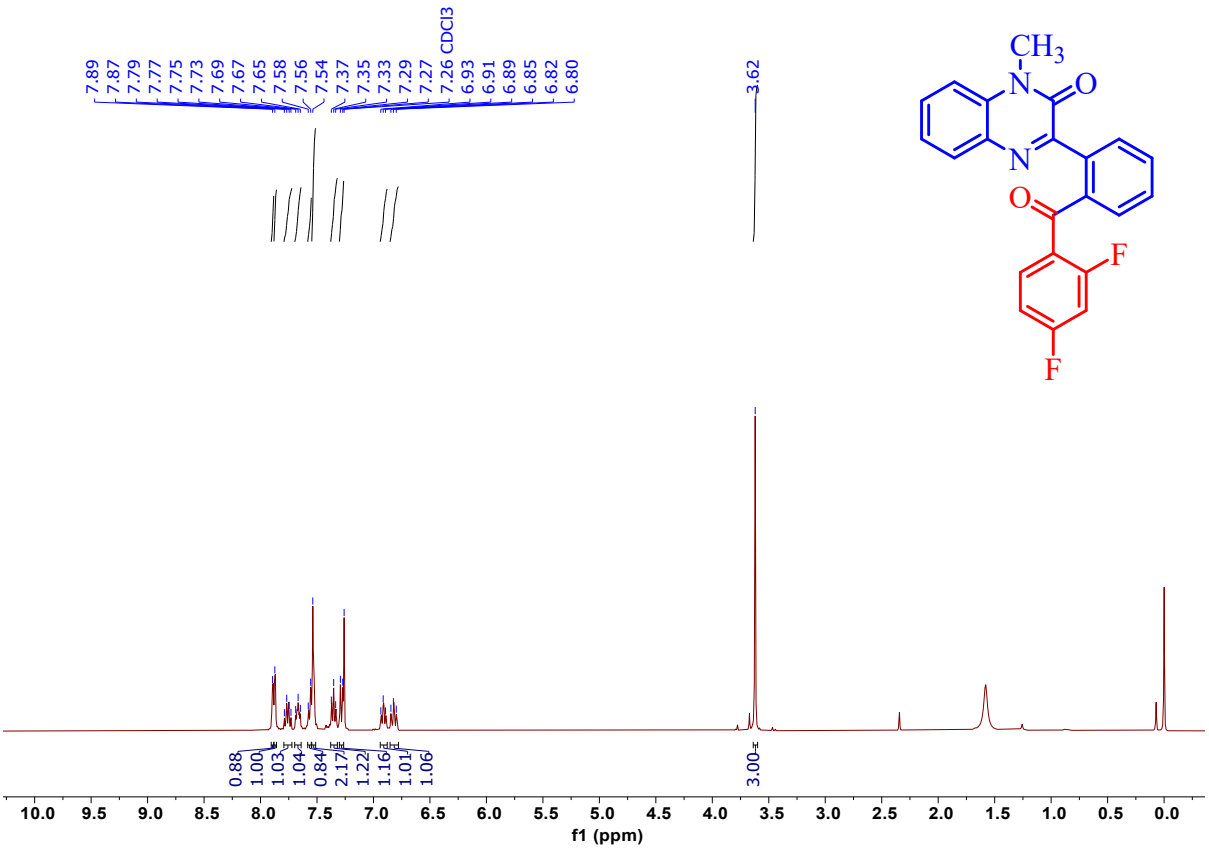


Figure 30: ^{1}H NMR spectrum of compound **3m** (400 MHz, $CDCl_3$).

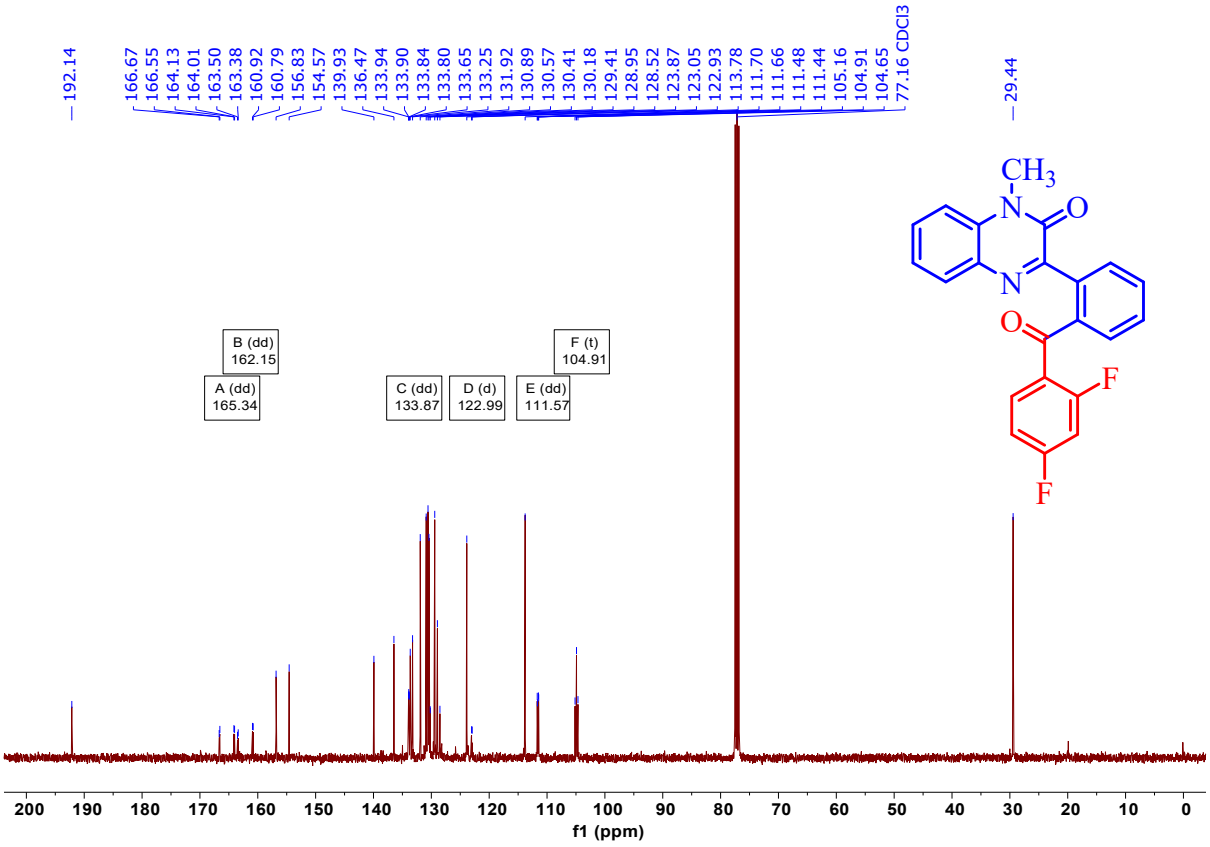


Figure 31: ^{13}C NMR spectrum of compound **3m** (100 MHz, $CDCl_3$).

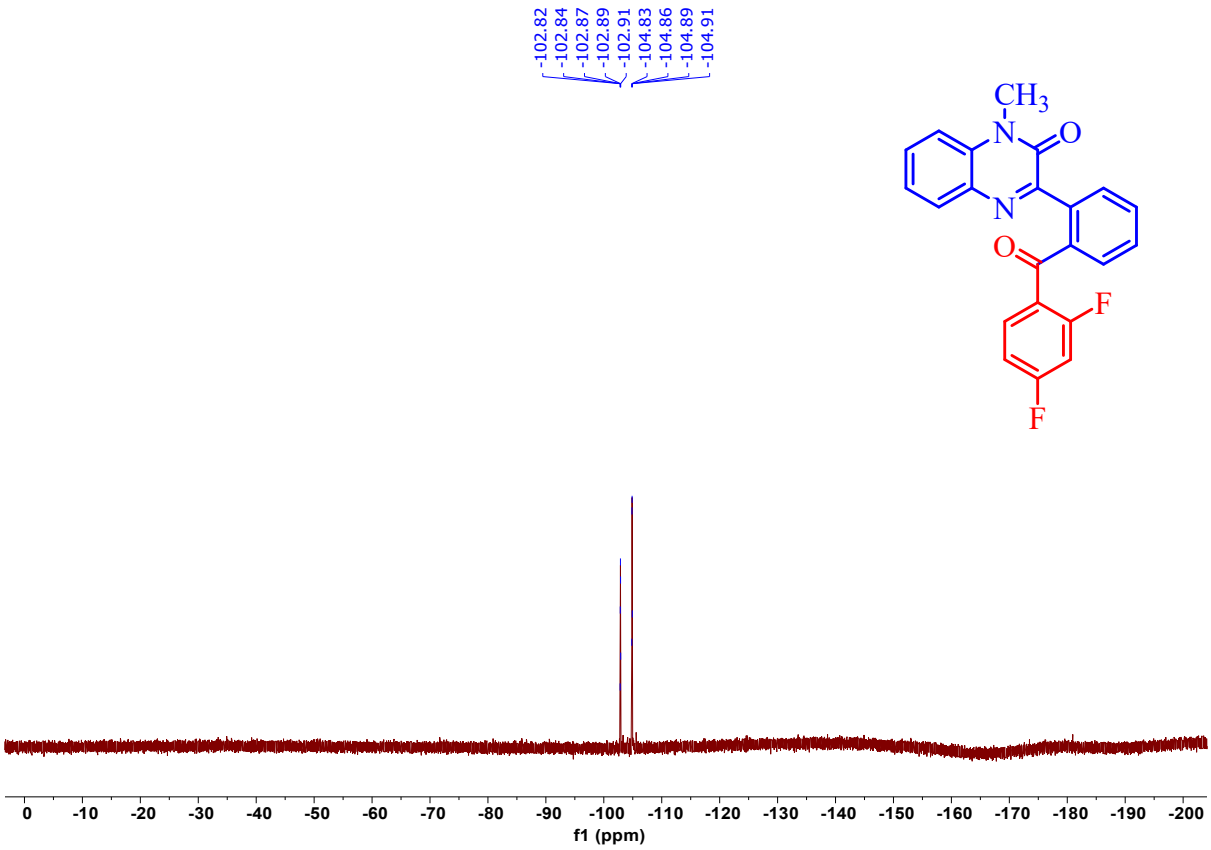


Figure 32: ^{19}F NMR spectrum of compound **3m** (377 MHz, $CDCl_3$).

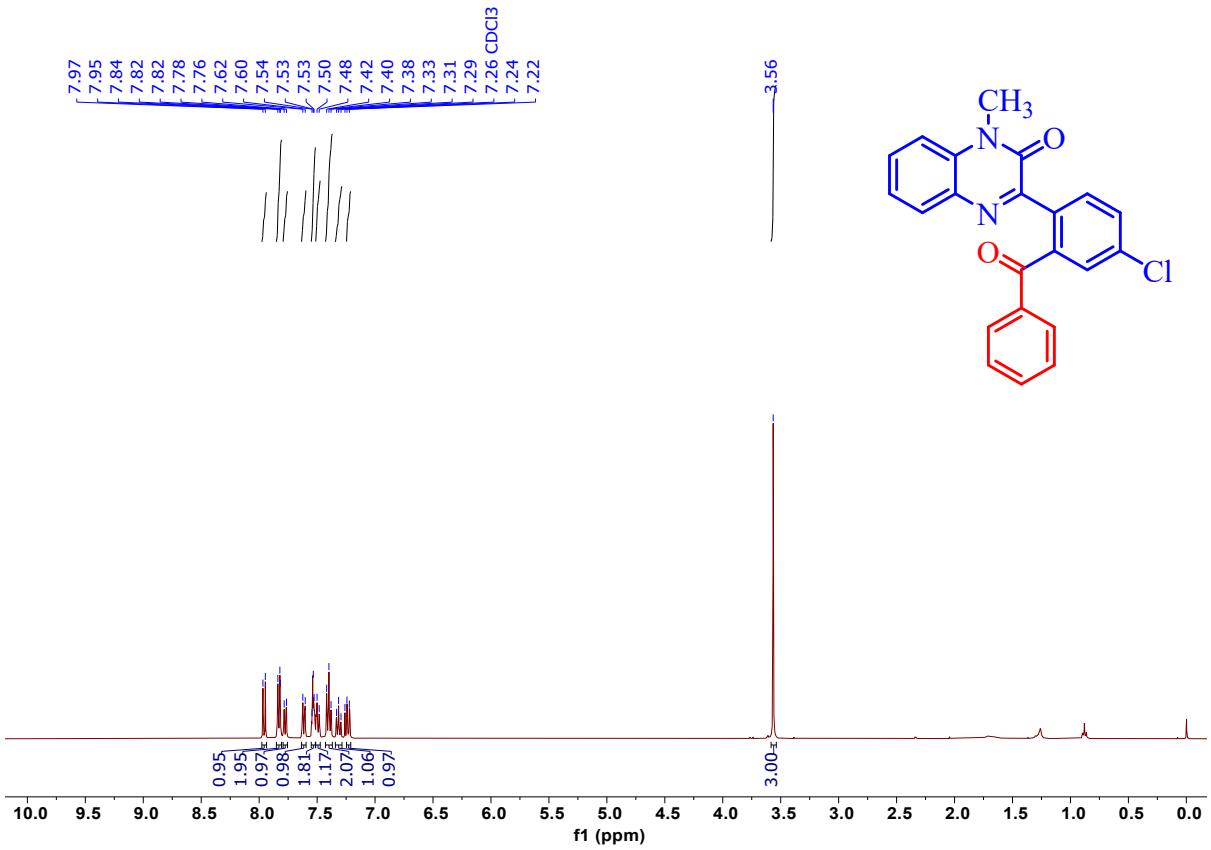


Figure 33: ^{1}H NMR spectrum of compound **3n** (400 MHz, $CDCl_3$).

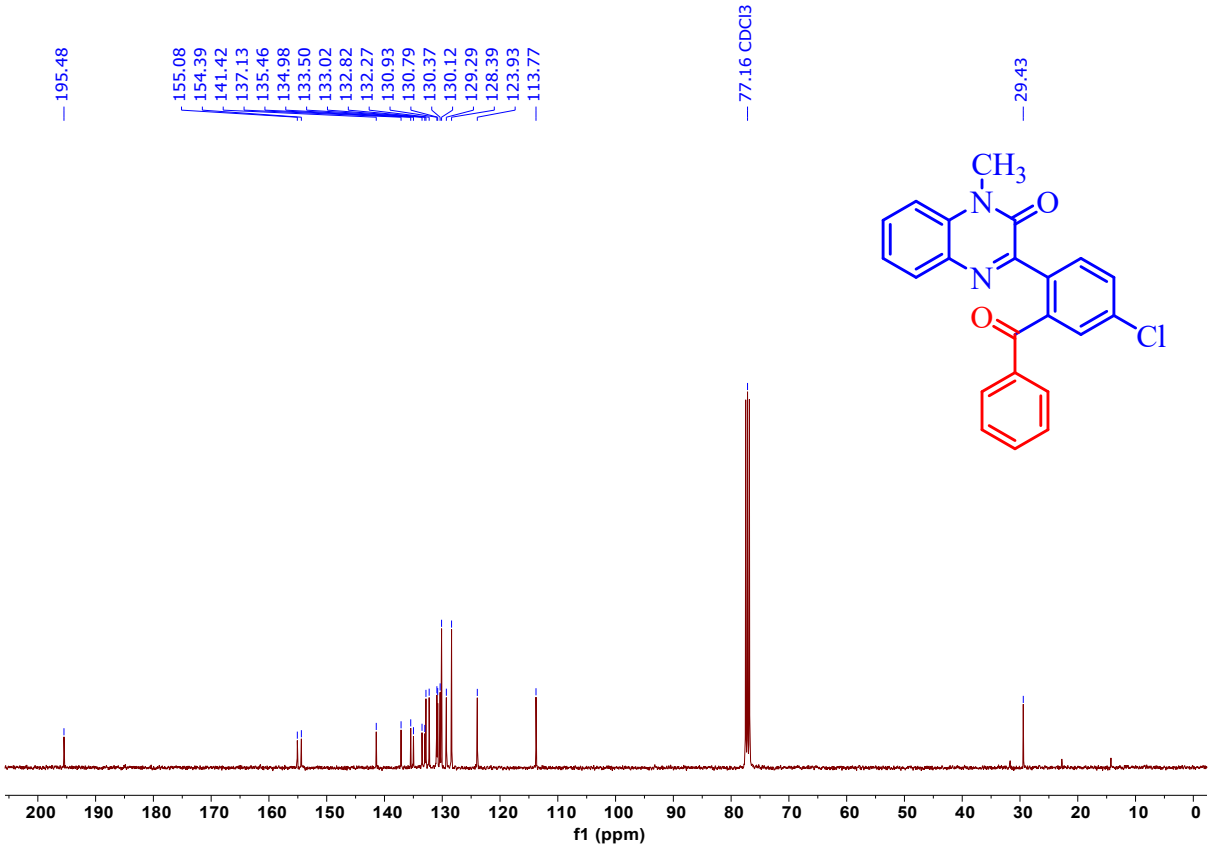


Figure 34: ^{13}C NMR spectrum of compound **3n** (100 MHz, $CDCl_3$).

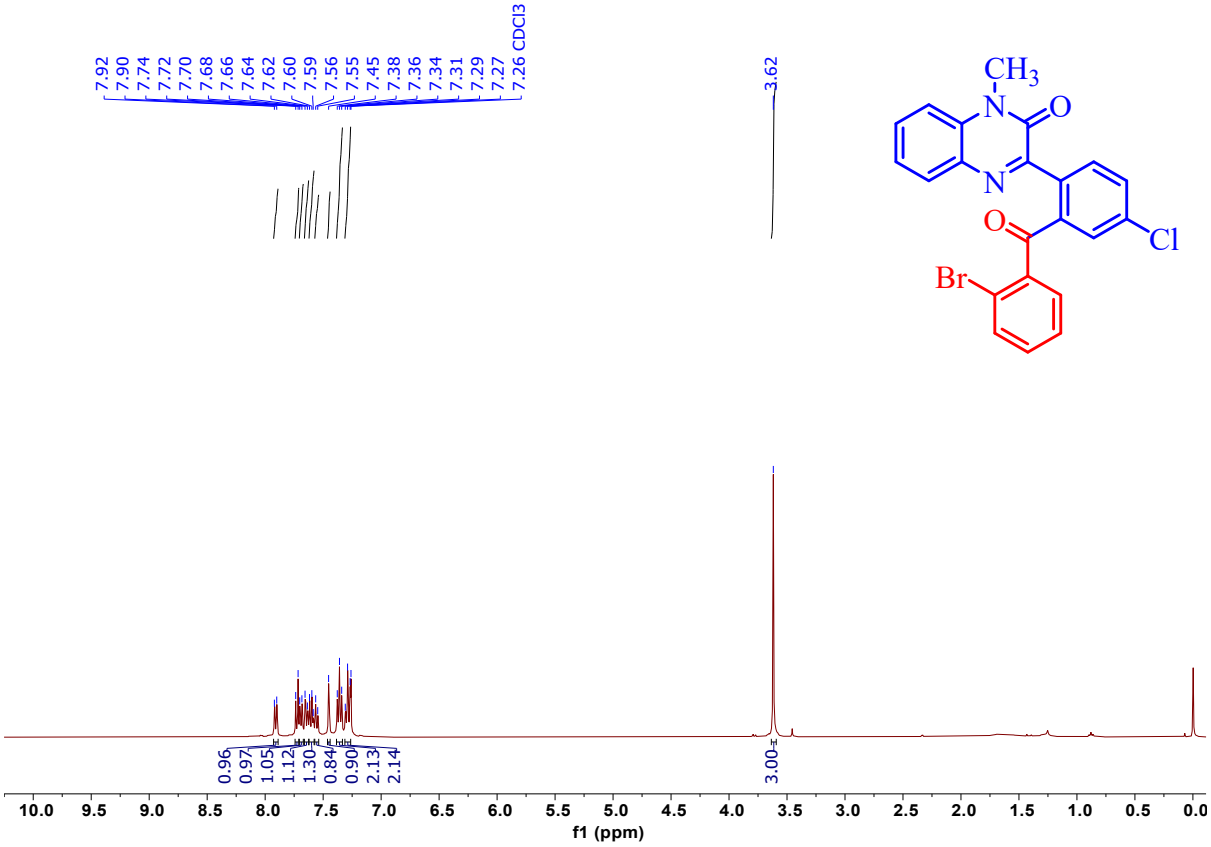


Figure 35: ^{1}H NMR spectrum of compound **3o** (400 MHz, $CDCl_3$).

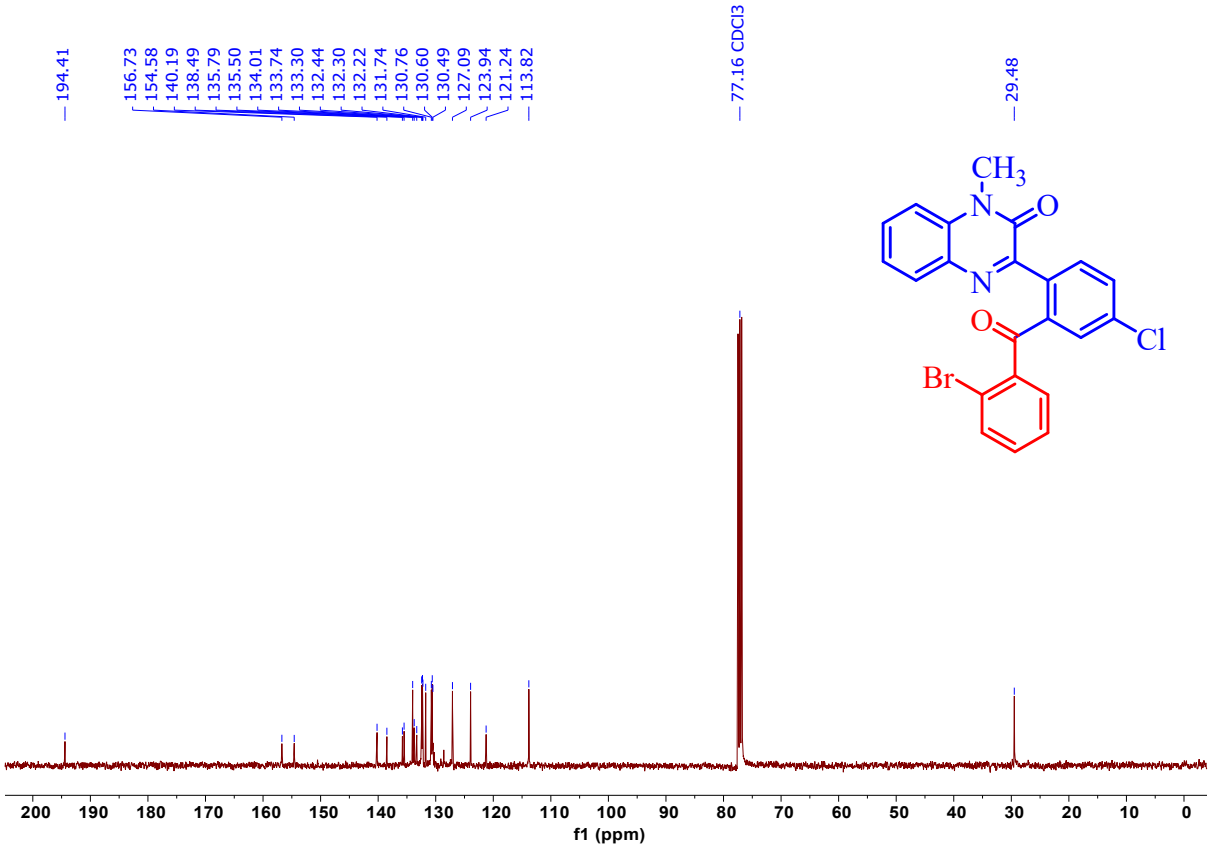


Figure 36: ^{13}C NMR spectrum of compound **3o** (100 MHz, $CDCl_3$).

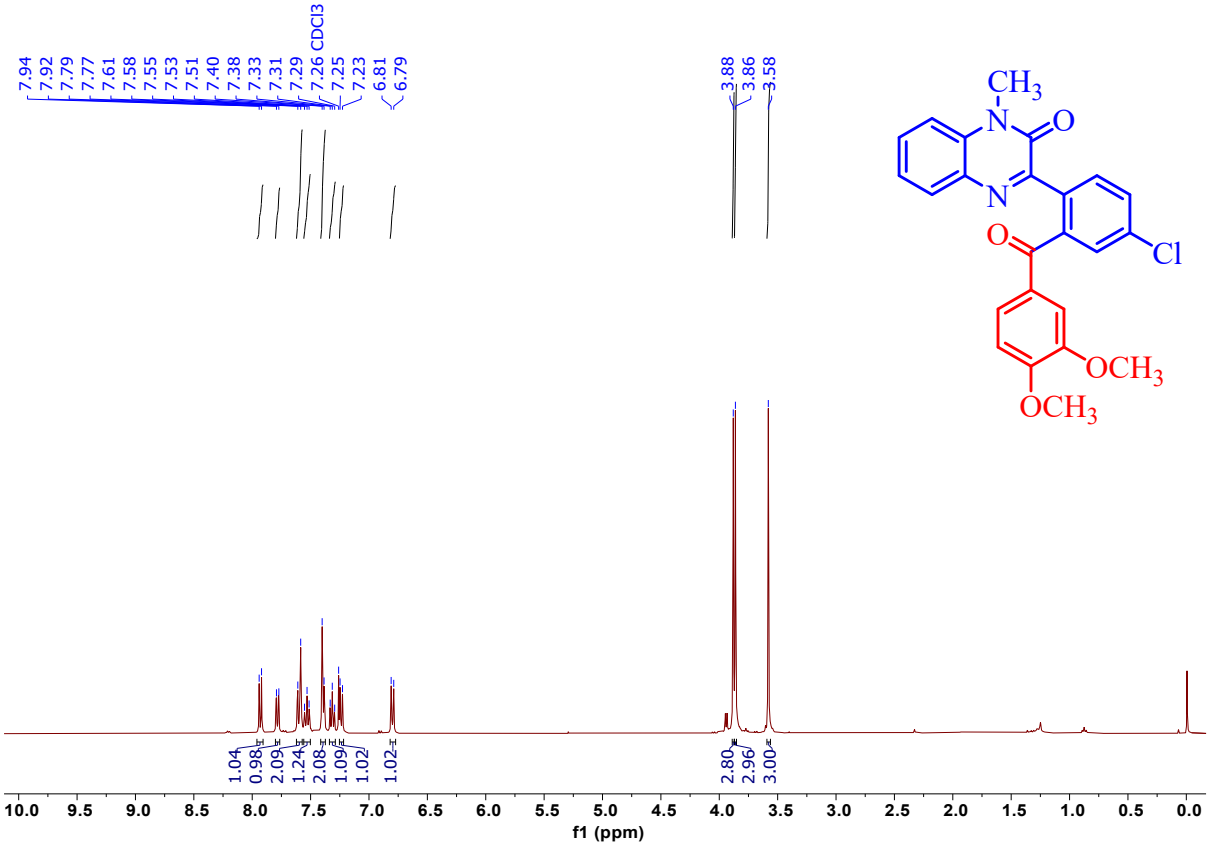


Figure 37: ^{1}H NMR spectrum of compound **3p** (400 MHz, $CDCl_3$).

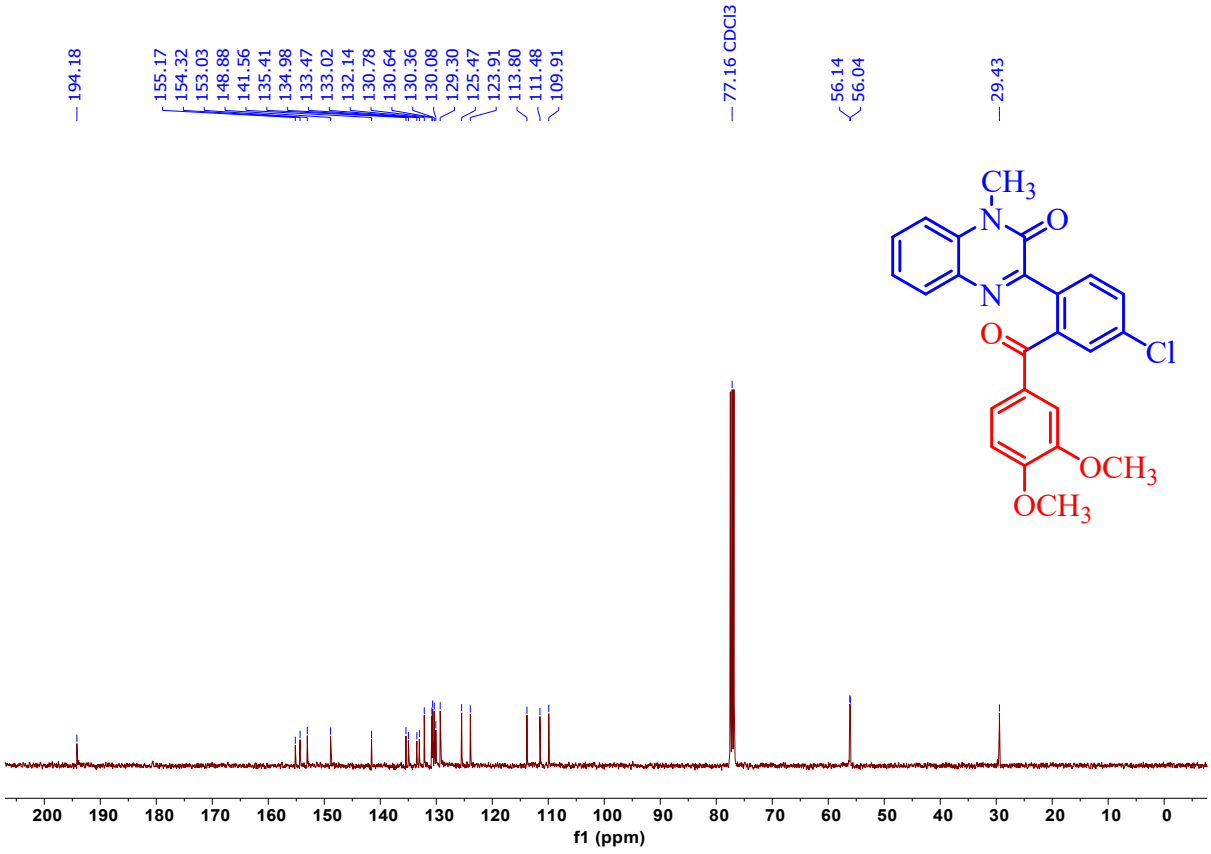


Figure 38: ^{13}C NMR spectrum of compound **3p** (100 MHz, $CDCl_3$).

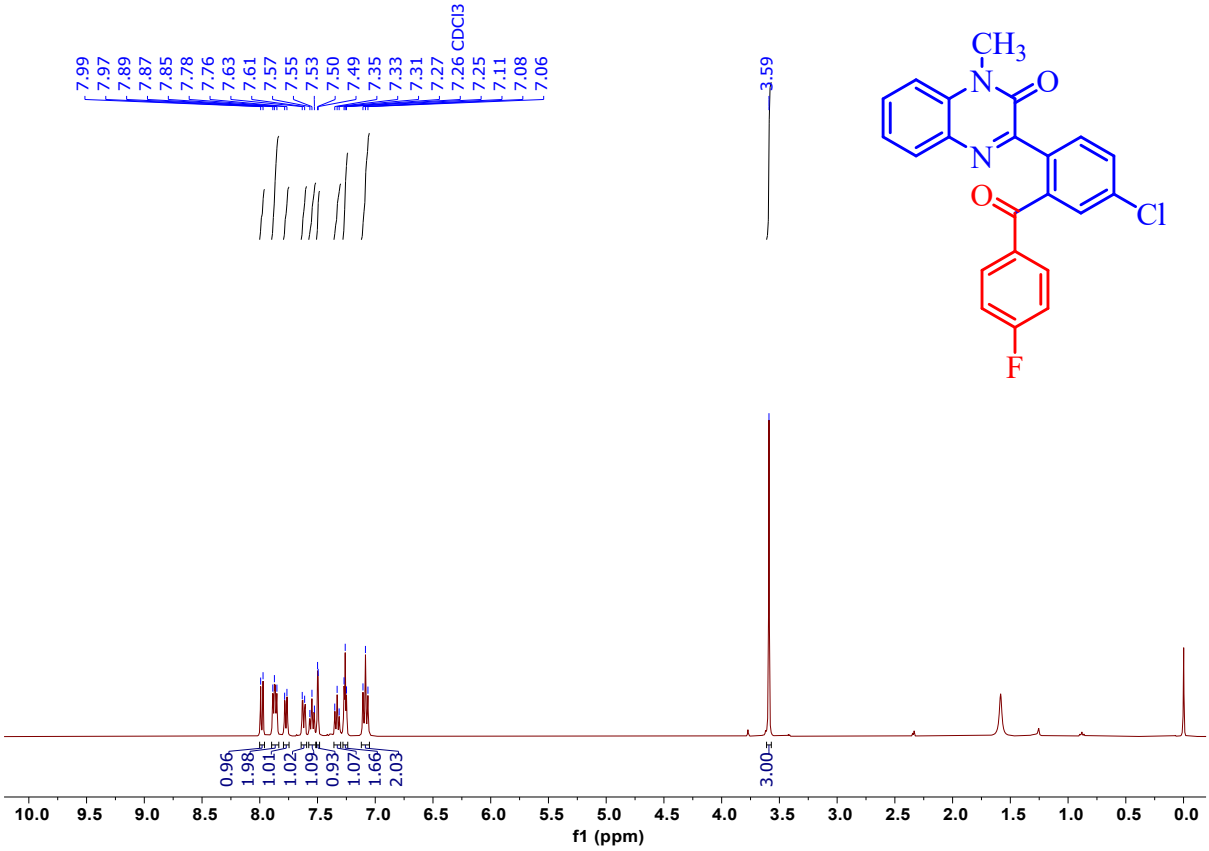


Figure 39: ^{1}H NMR spectrum of compound **3q** (400 MHz, $CDCl_3$).

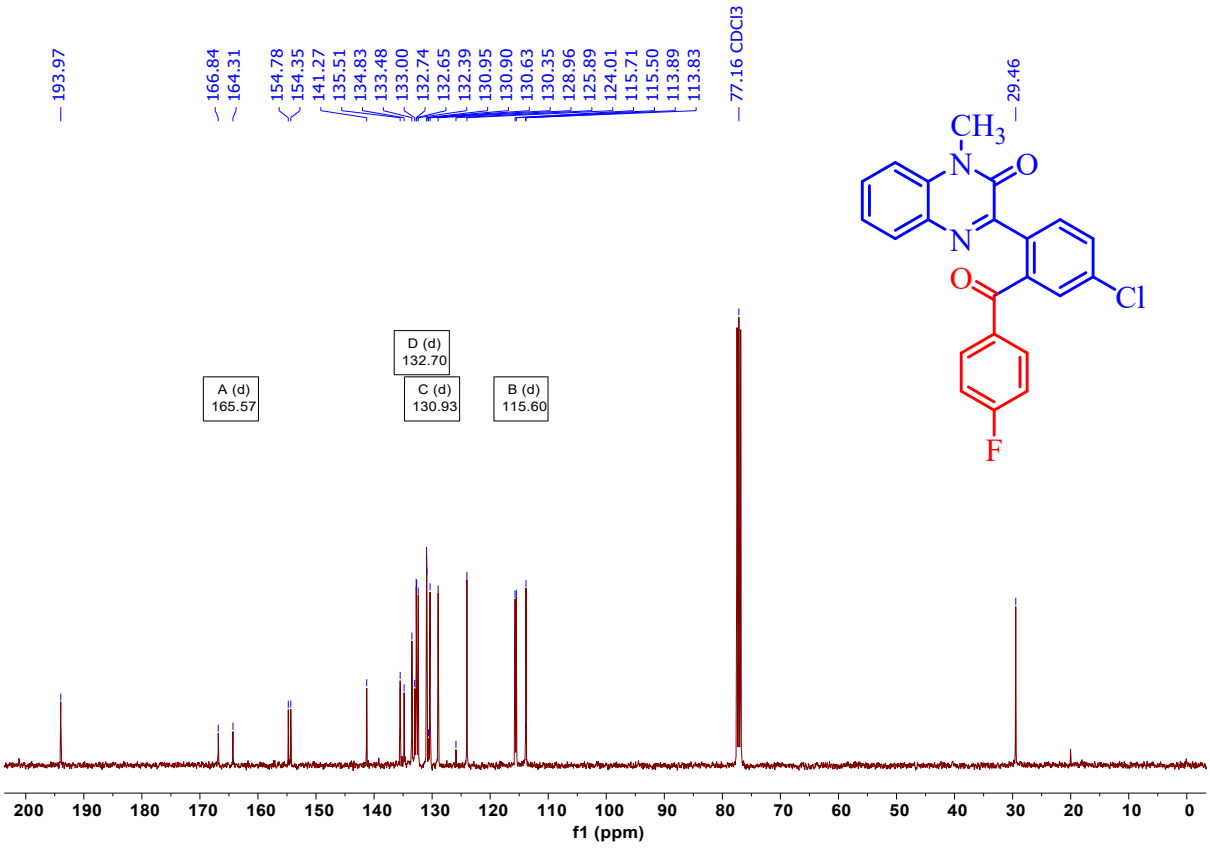


Figure 40: ^{13}C NMR spectrum of compound **3q** (100 MHz, $CDCl_3$).

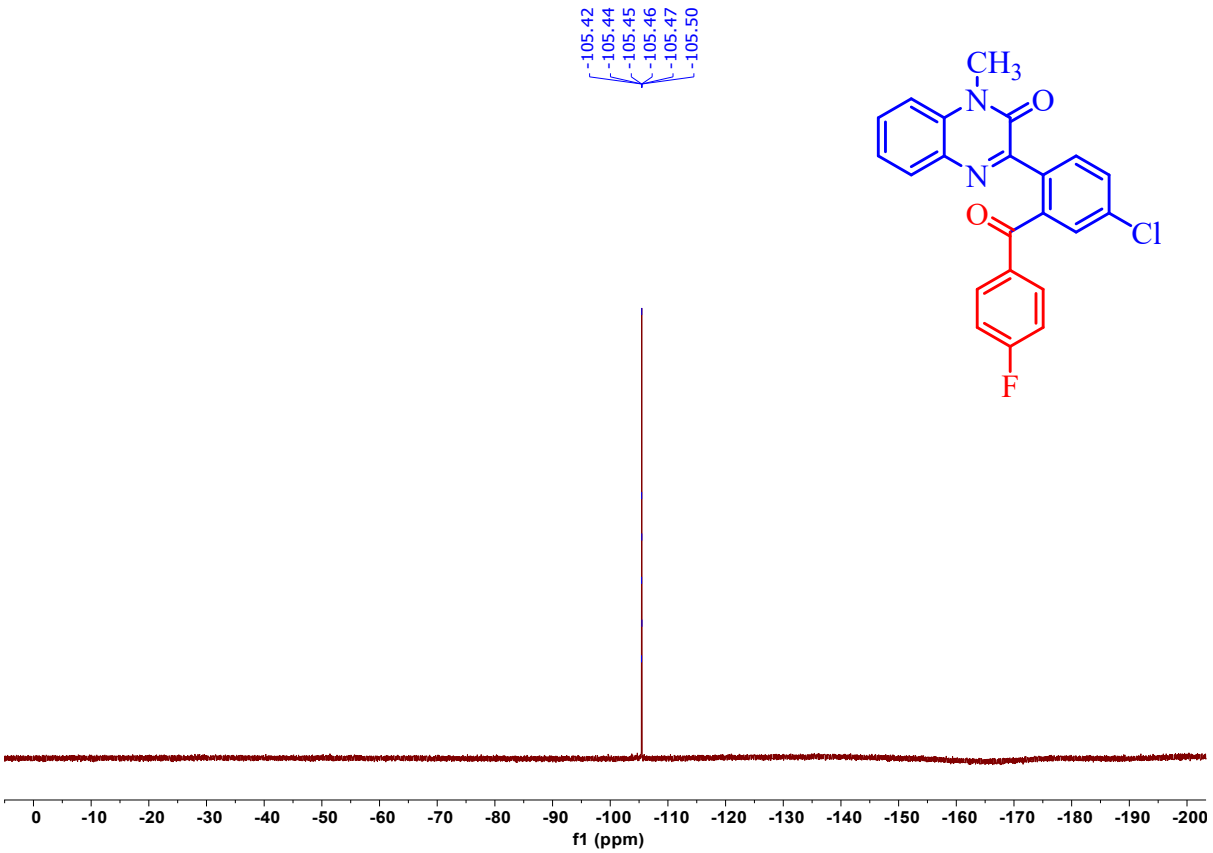


Figure 41: ^{19}F NMR spectrum of compound **3q** (377 MHz, $CDCl_3$).

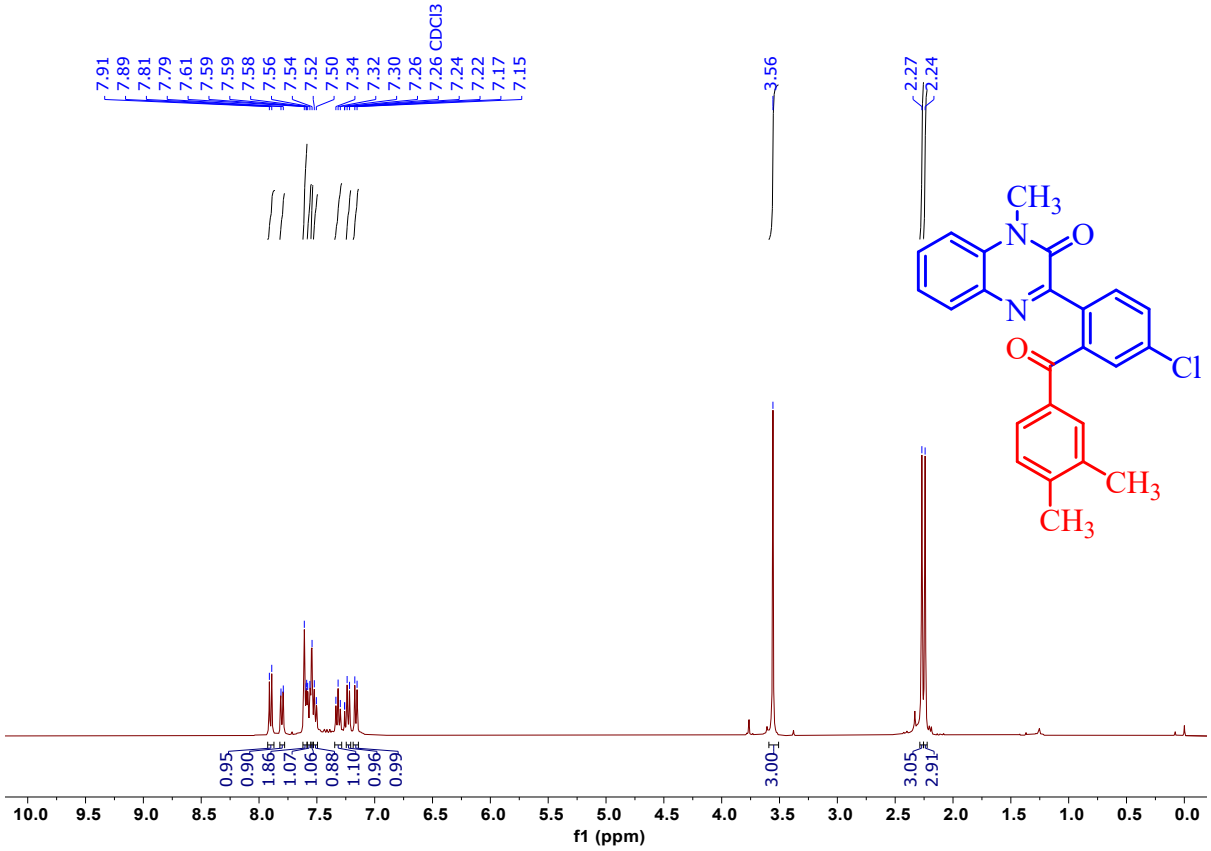


Figure 42: ^{1}H NMR spectrum of compound **3r** (400 MHz, $CDCl_3$).

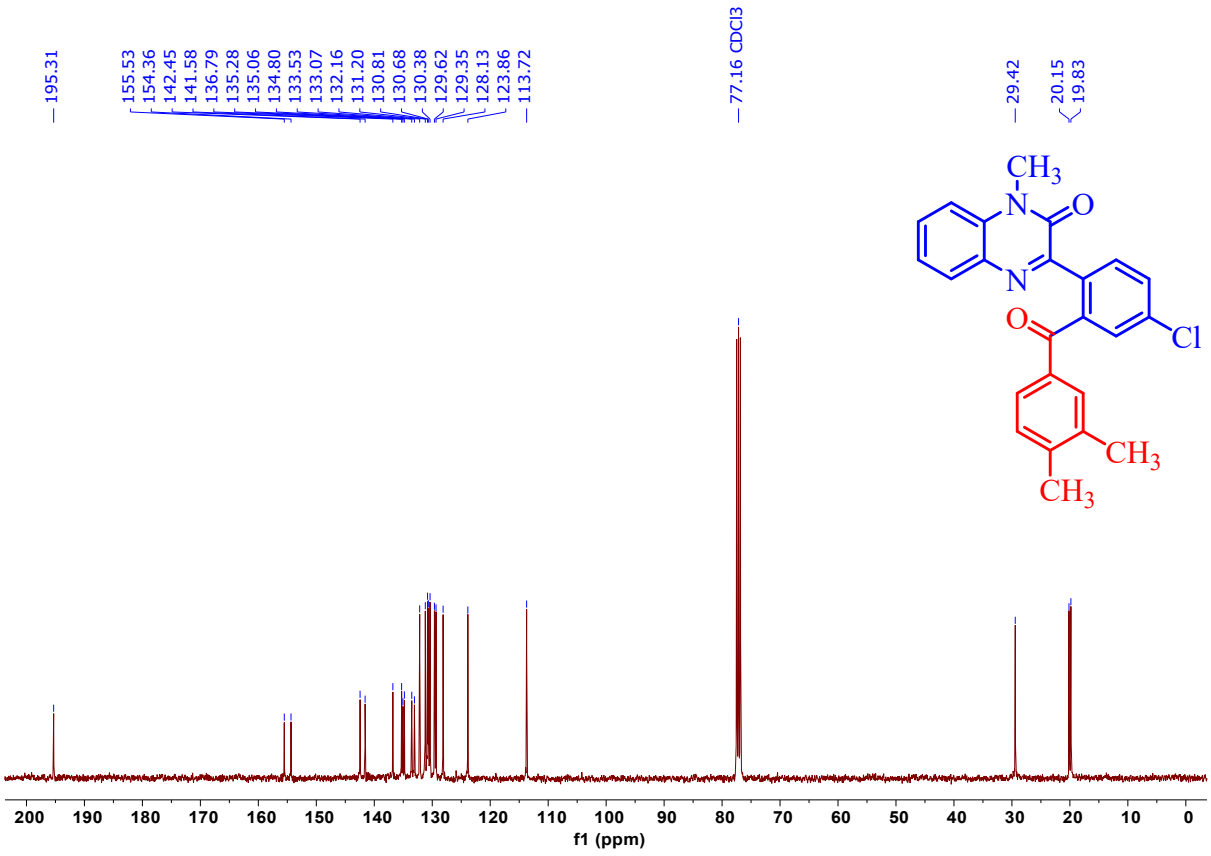


Figure 43: ^{13}C NMR spectrum of compound **3r** (100 MHz, $CDCl_3$).

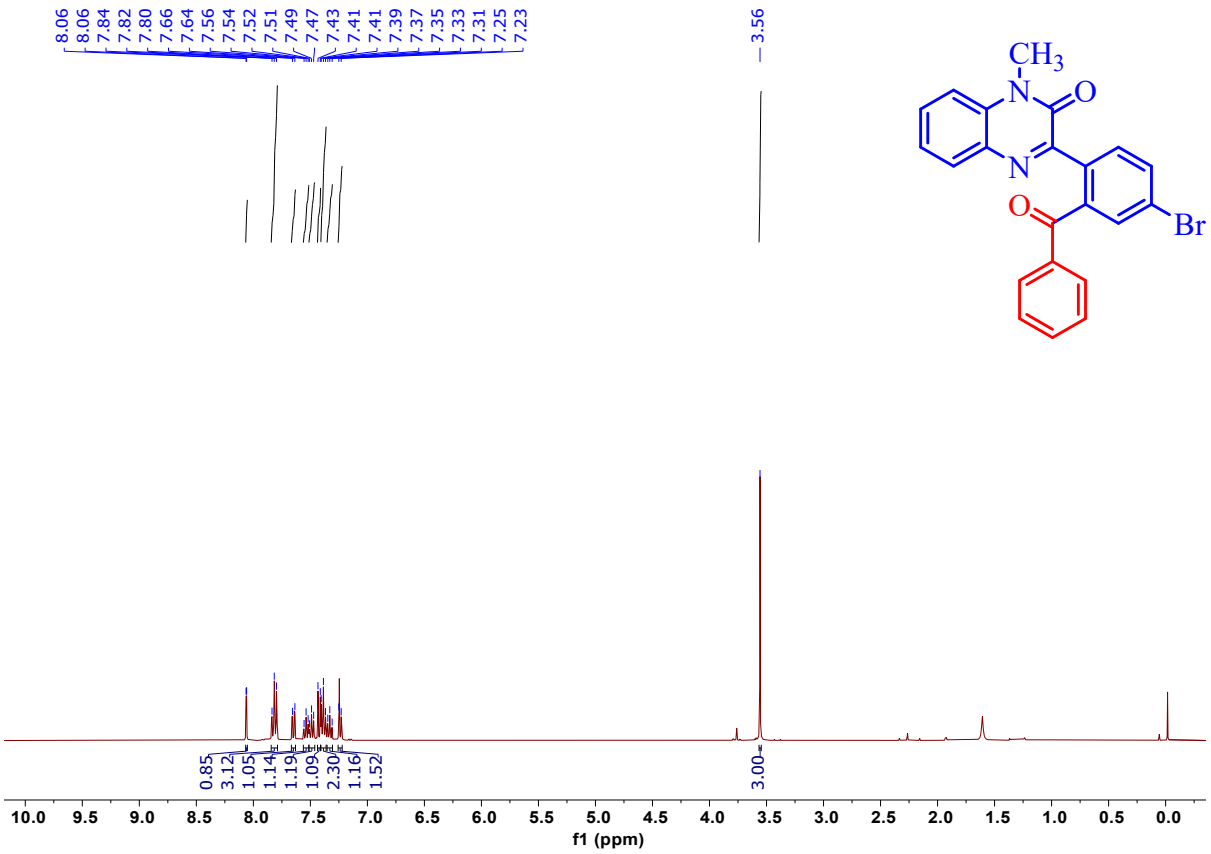


Figure 44: ^{1}H NMR spectrum of compound **3s** (400 MHz, $CDCl_3$).

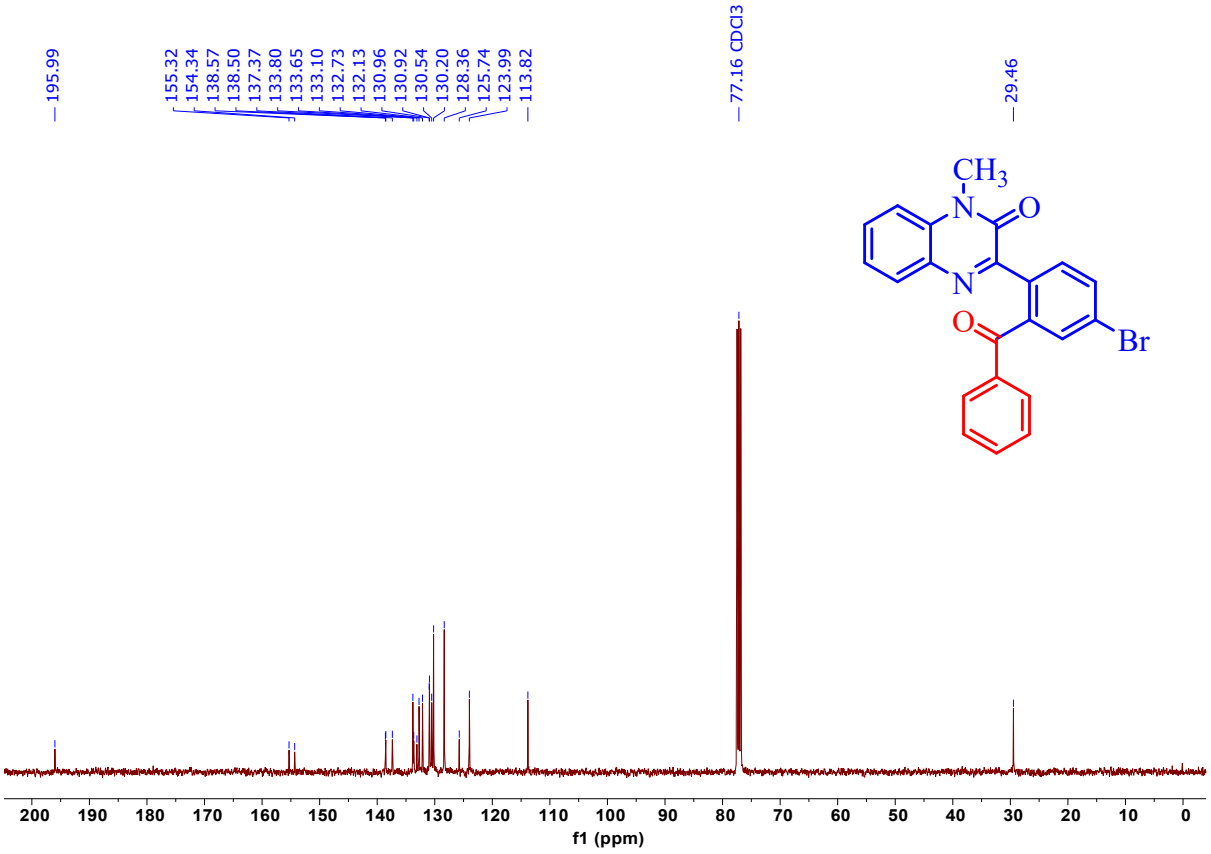


Figure 45: ^{13}C NMR spectrum of compound **3s** (100 MHz, $CDCl_3$).

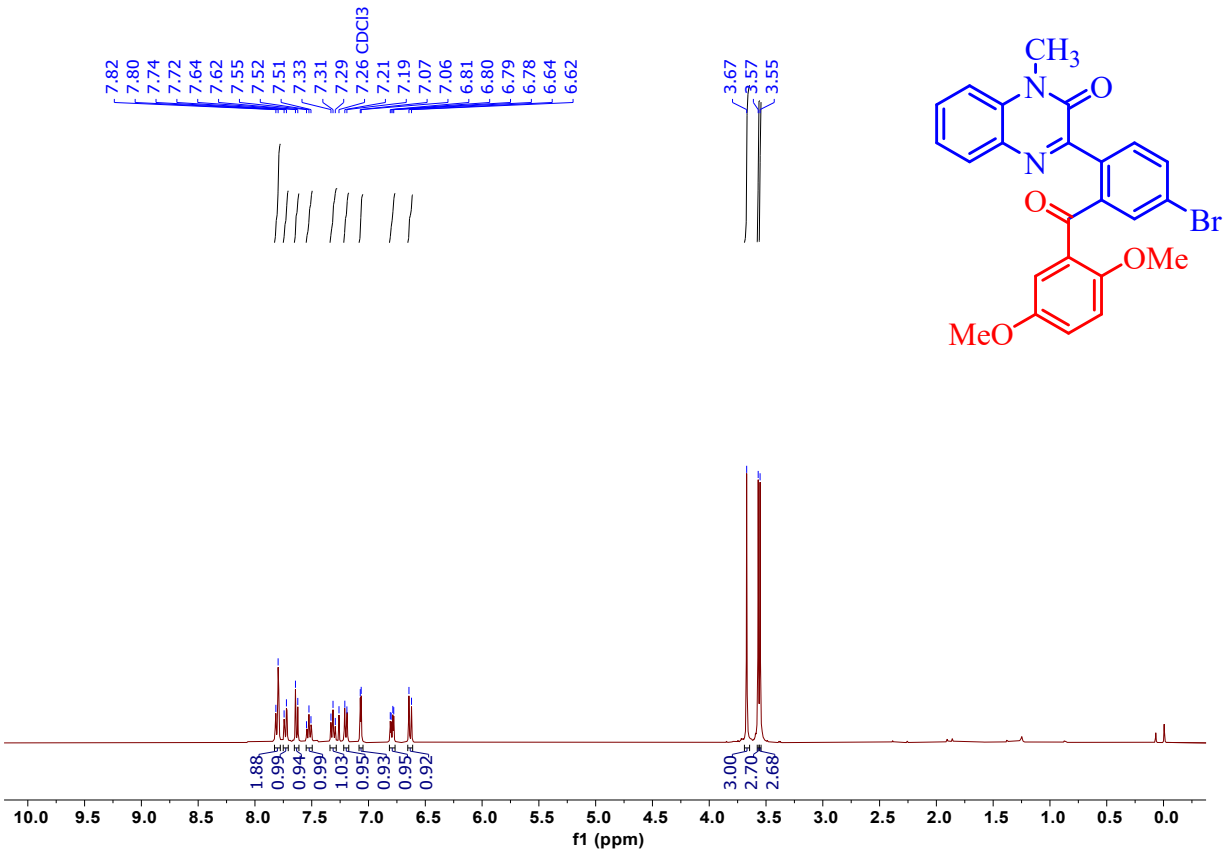


Figure 46: ^{1}H NMR spectrum of compound **3t** (400 MHz, $CDCl_3$).

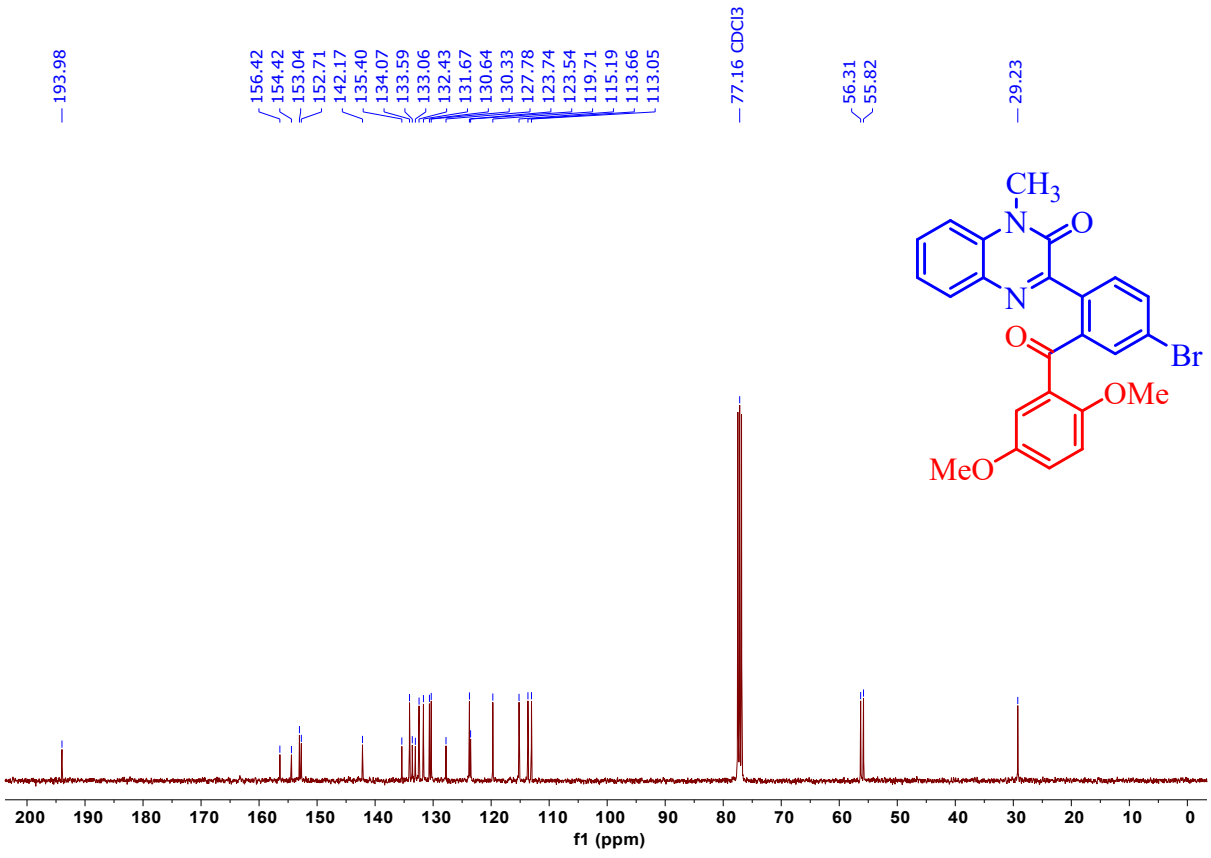


Figure 47: ^{13}C NMR spectrum of compound **3t** (100 MHz, $CDCl_3$).

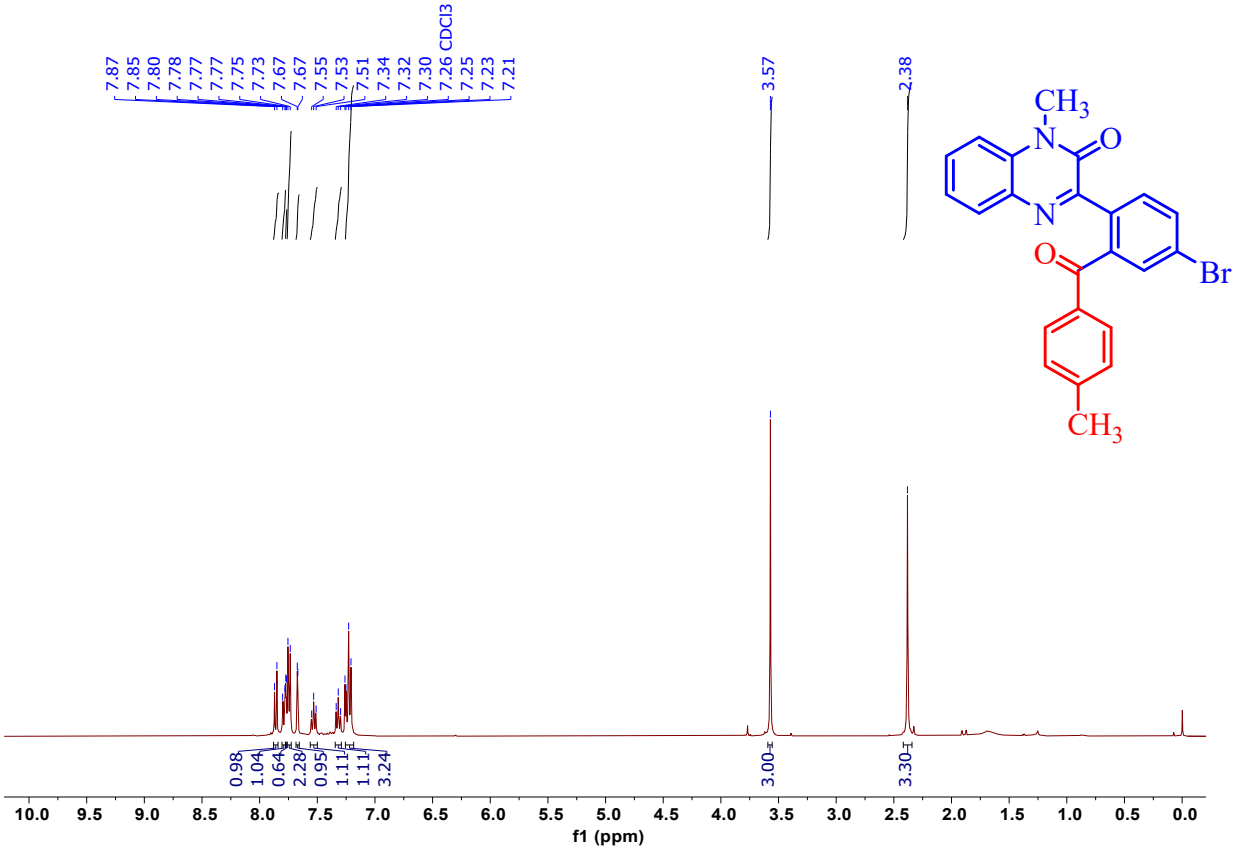


Figure 48: ^{1}H NMR spectrum of compound **3u** (400 MHz, $CDCl_3$).

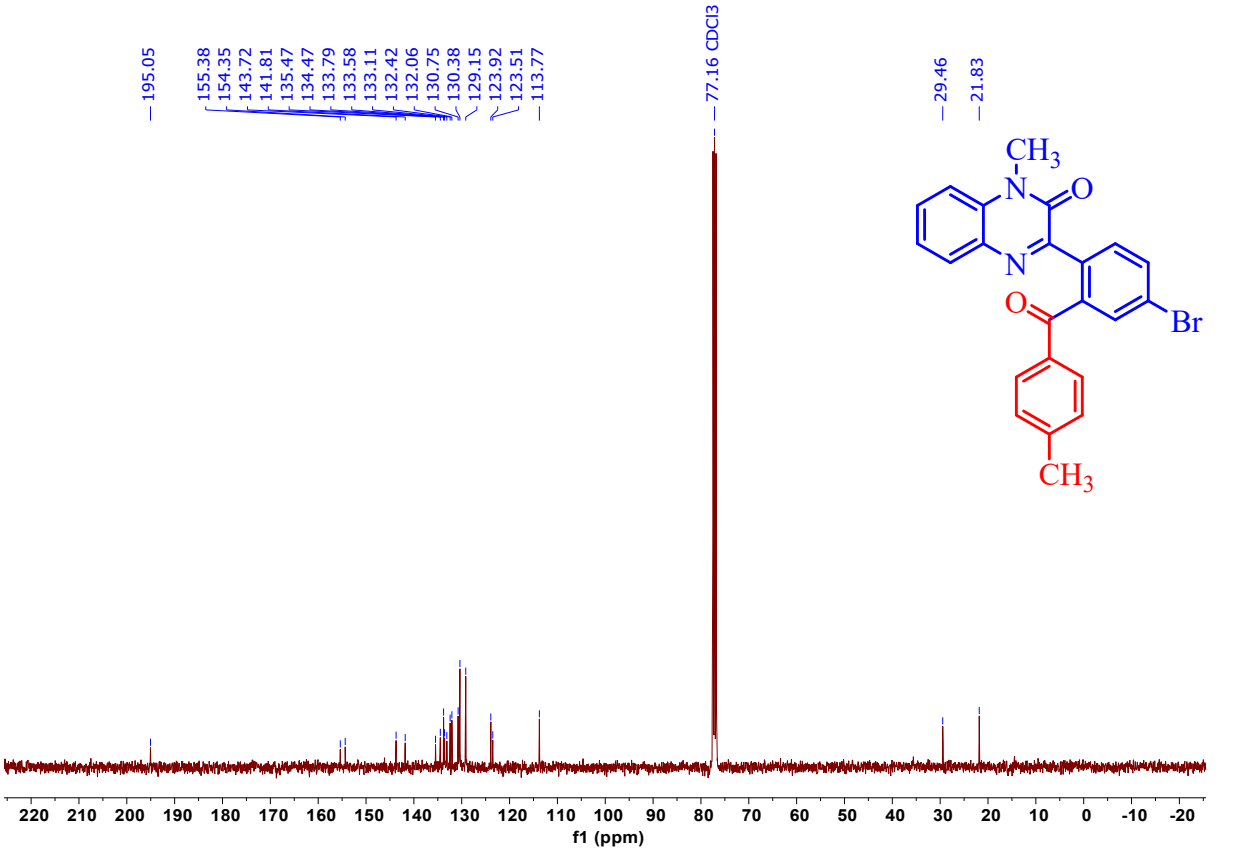


Figure 49: ^{13}C NMR spectrum of compound **3u** (100 MHz, $CDCl_3$).

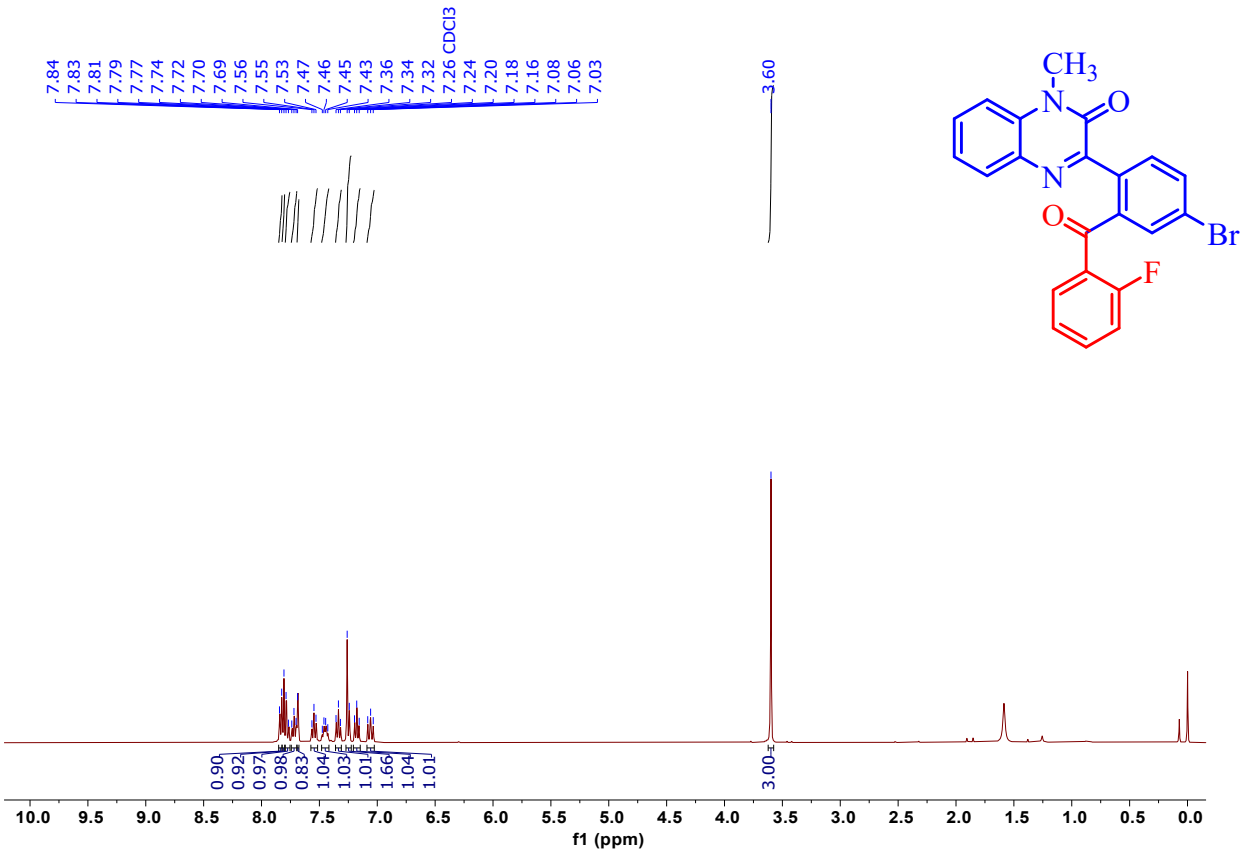


Figure 50: ^{1}H NMR spectrum of compound **3v** (400 MHz, $CDCl_3$).

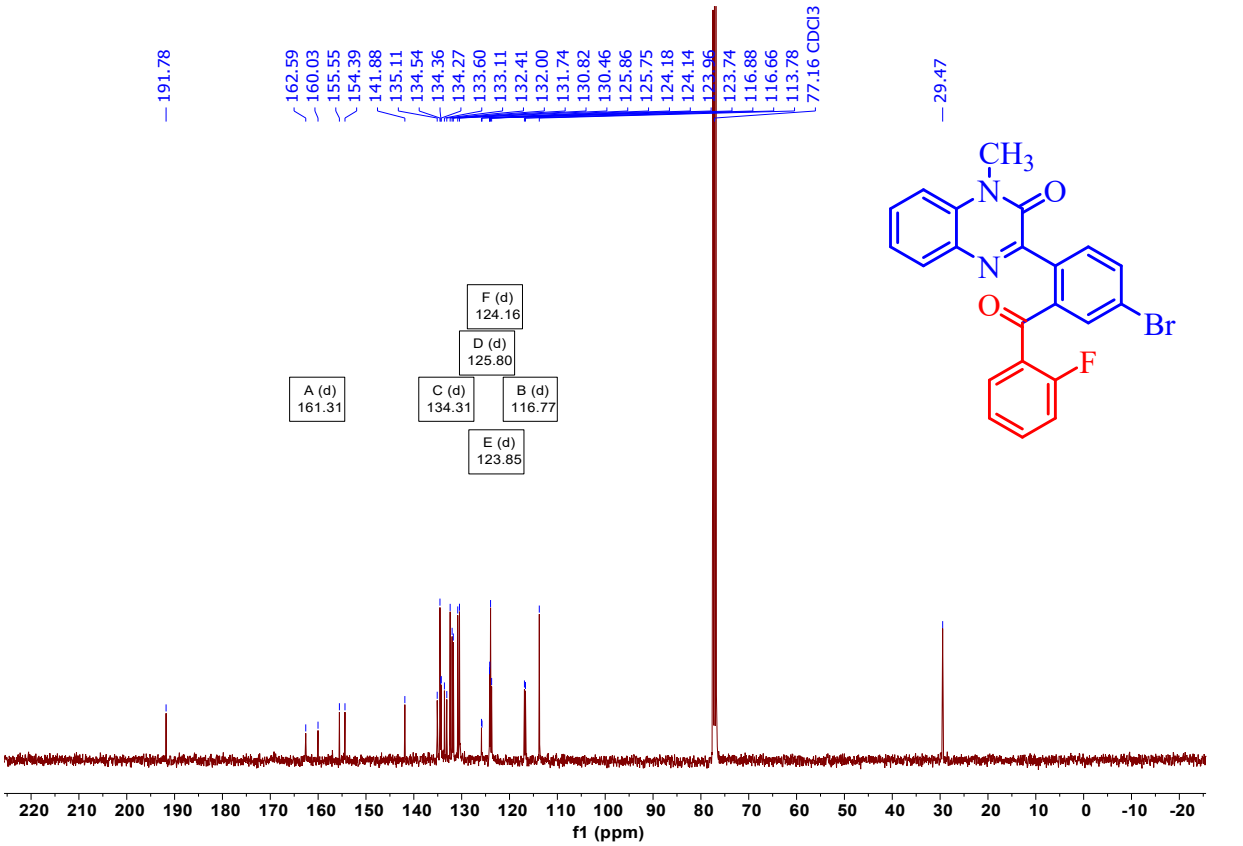


Figure 51: ^{13}C NMR spectrum of compound **3v** (100 MHz, $CDCl_3$).

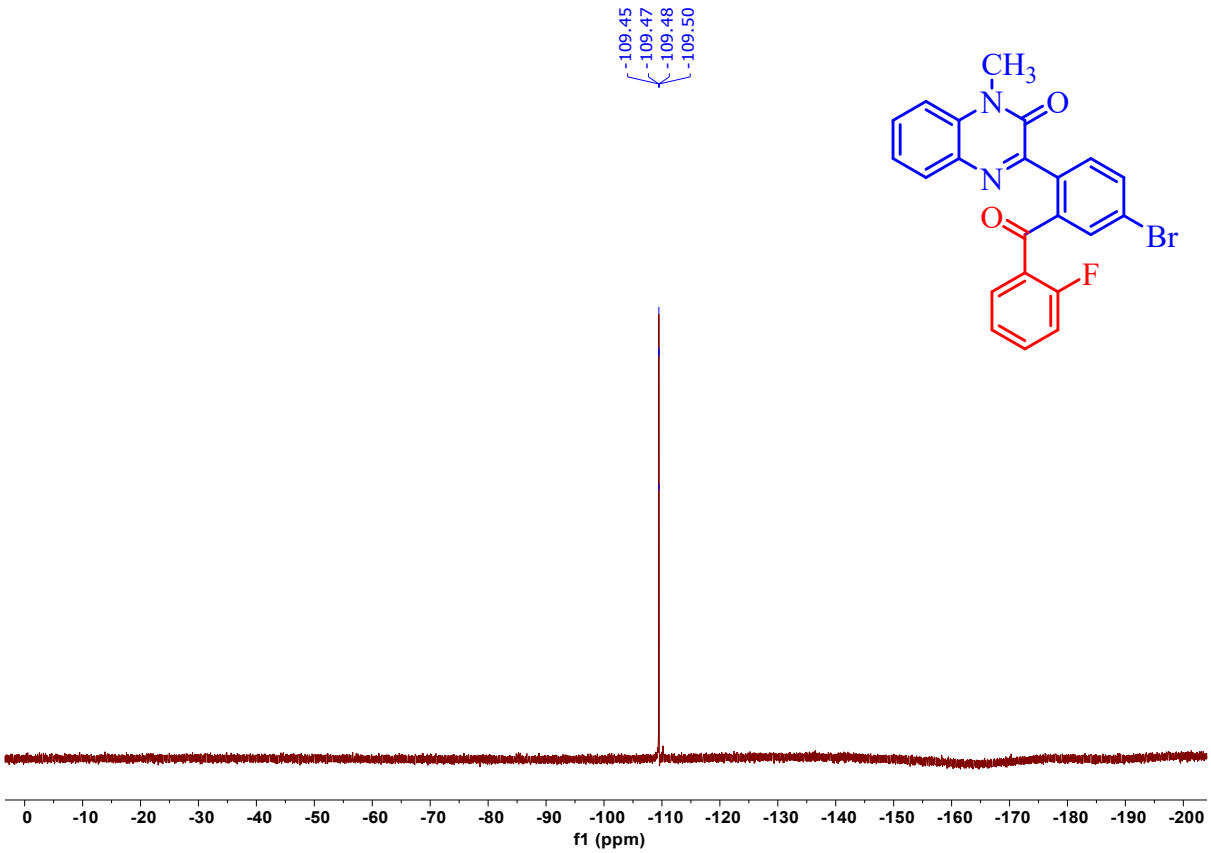


Figure 52: ^{19}F NMR spectrum of compound **3v** (377 MHz, $CDCl_3$).

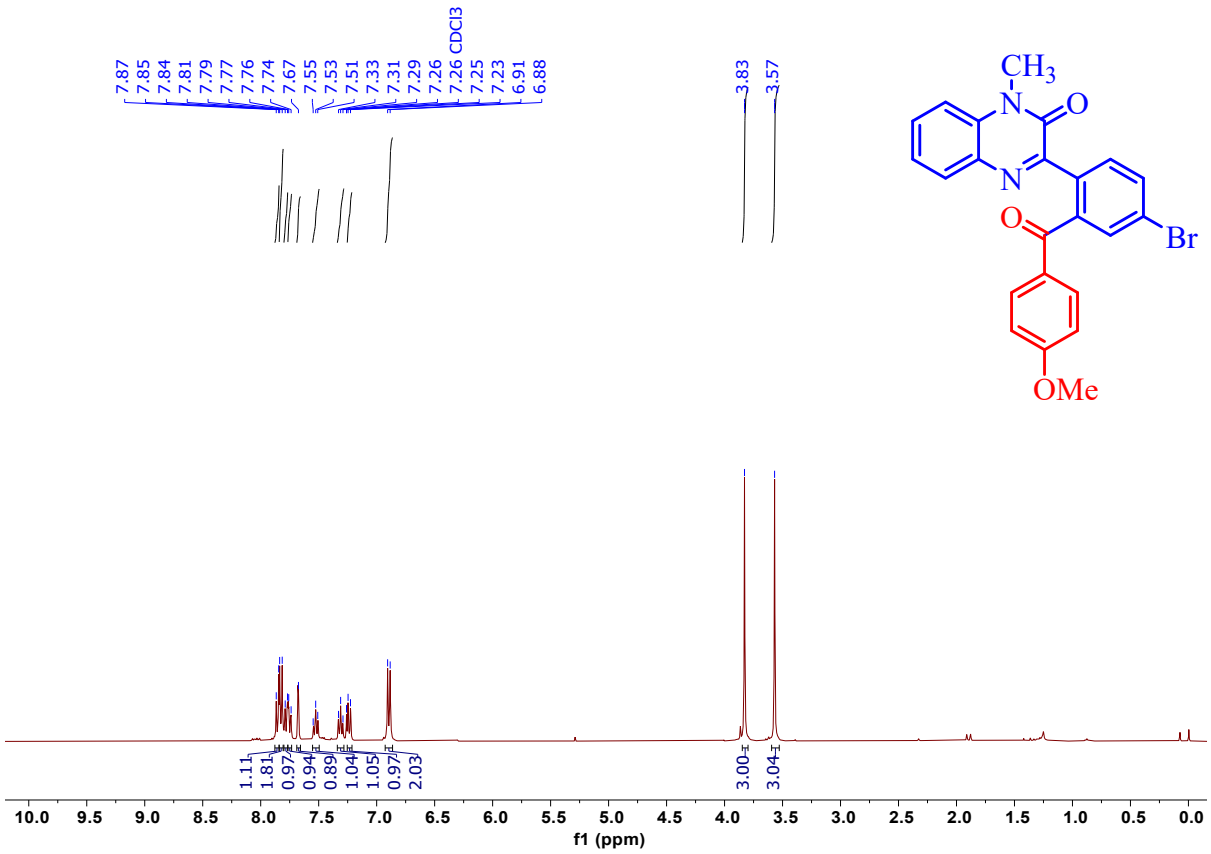


Figure 53: ^{1}H NMR spectrum of compound **3w** (400 MHz, $CDCl_3$).

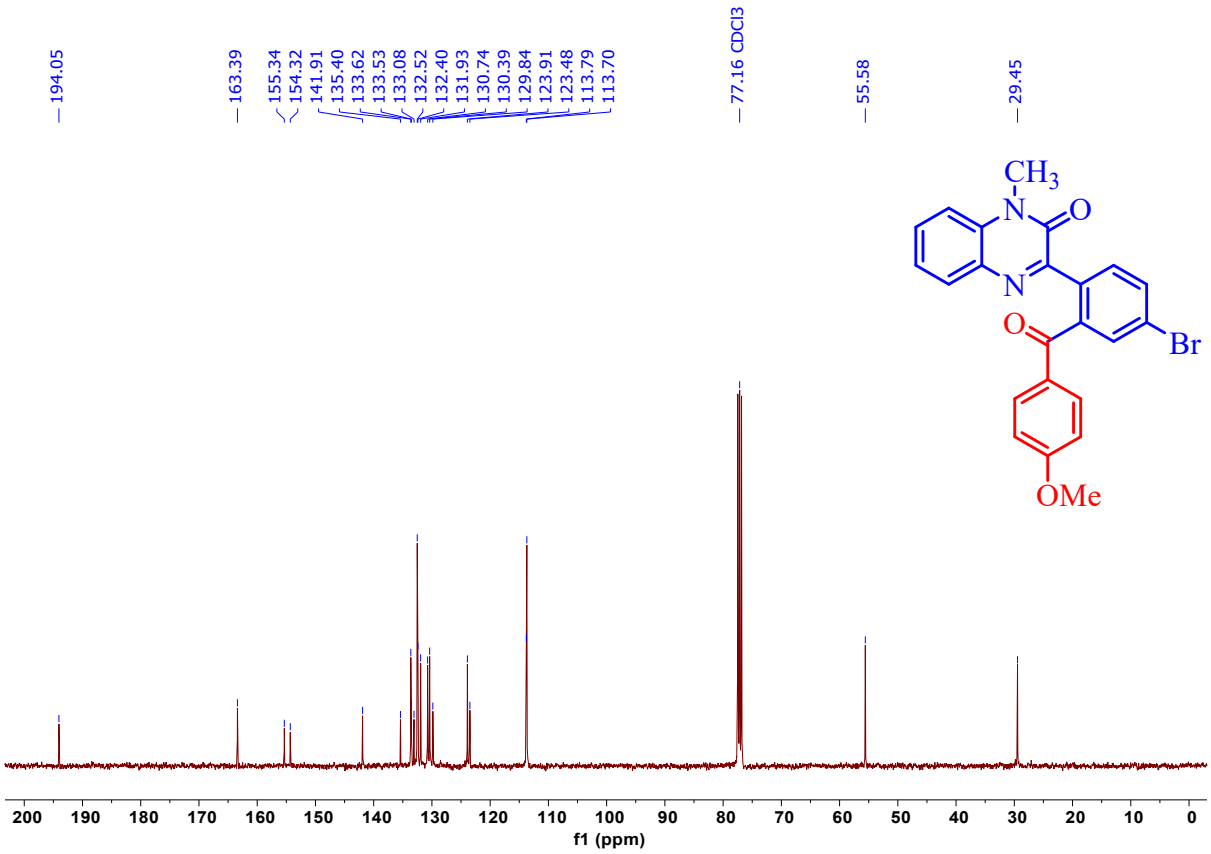


Figure 54: ^{13}C NMR spectrum of compound **3w** (100 MHz, $CDCl_3$).

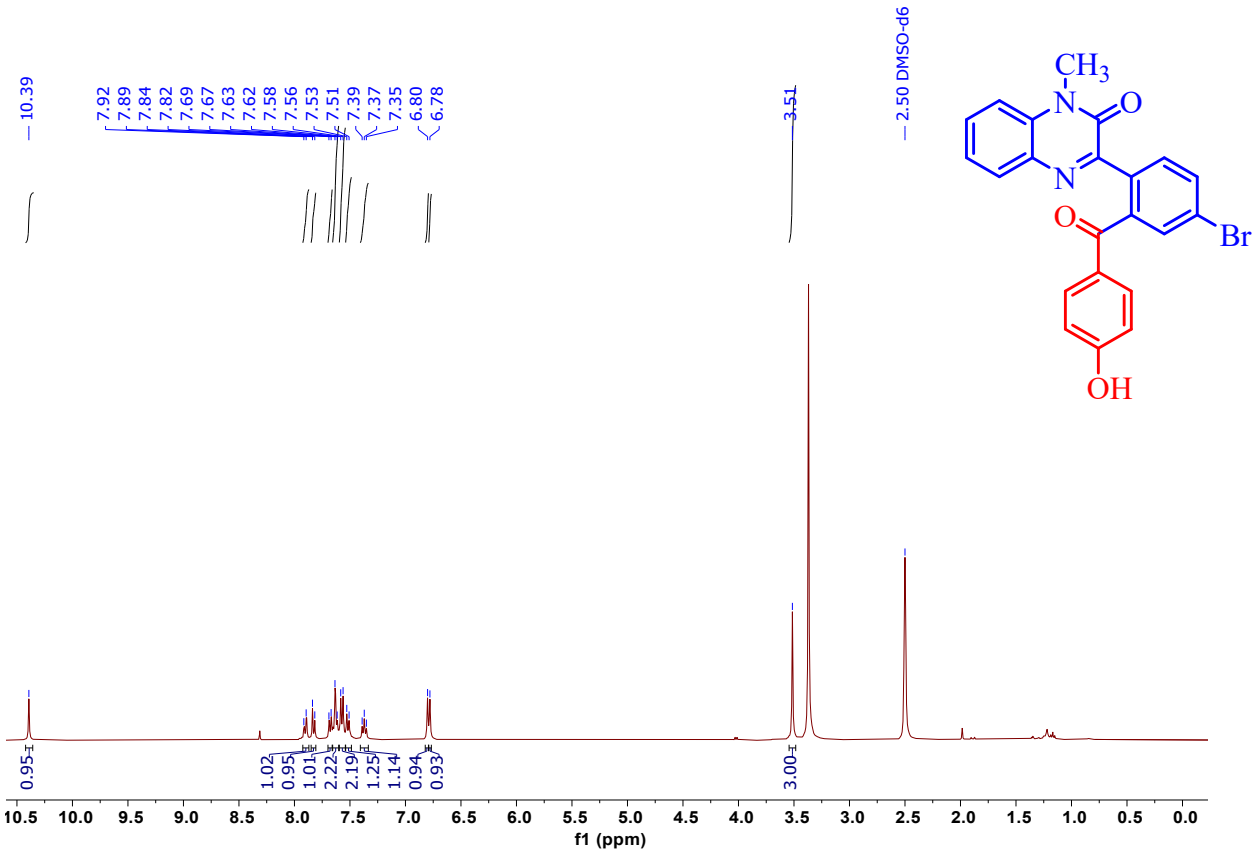


Figure 55: ^{1}H NMR spectrum of compound **3x** (400 MHz, DMSO-d_6).

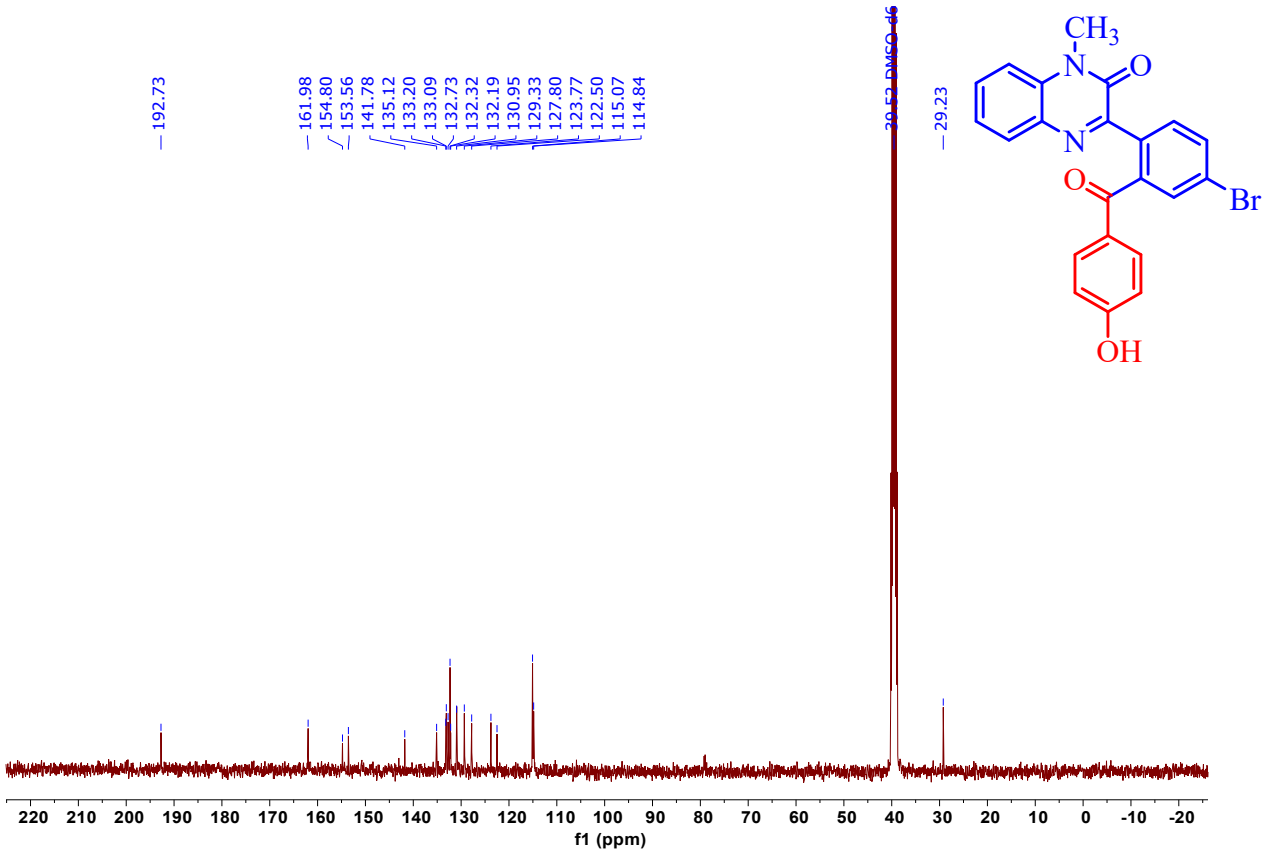


Figure 56: ^{13}C NMR spectrum of compound **3x** (100 MHz, DMSO-d_6).

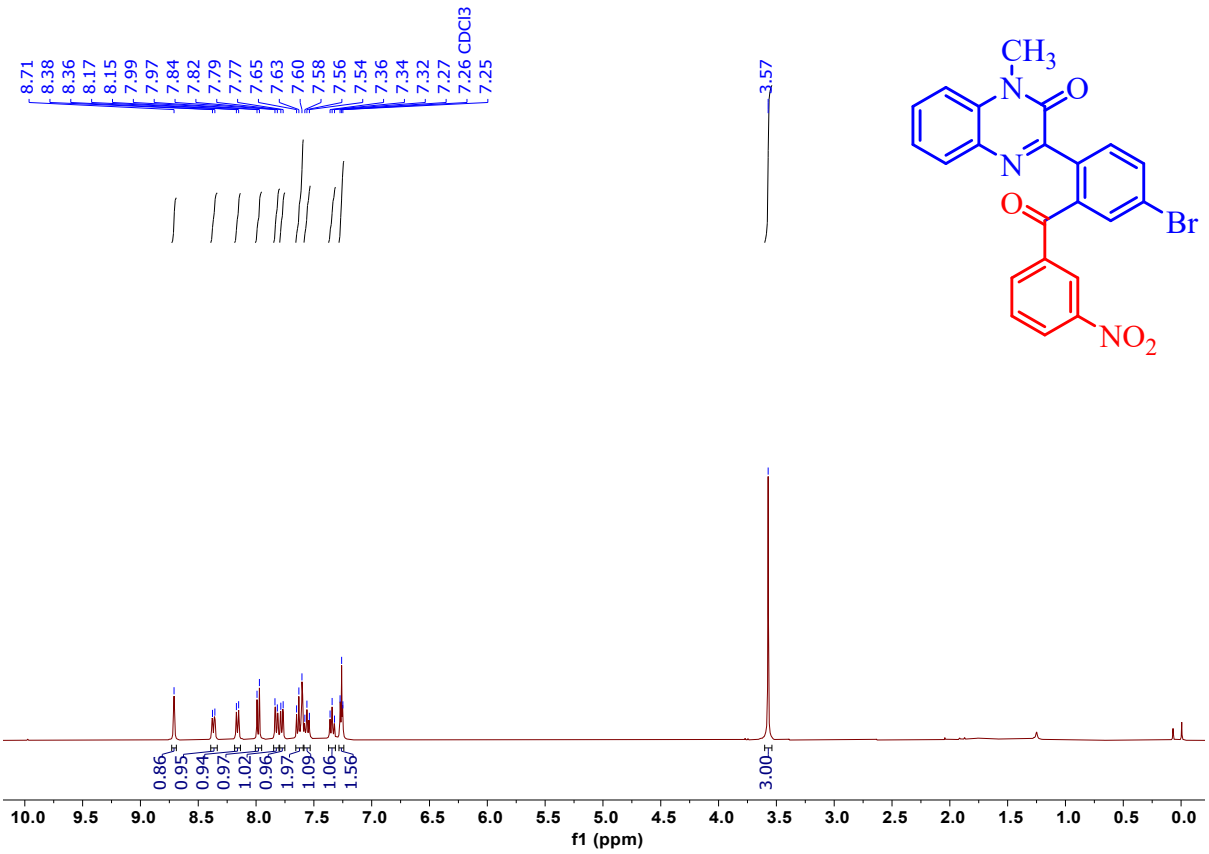


Figure 57: ^{1}H NMR spectrum of compound **3y** (400 MHz, $CDCl_3$).

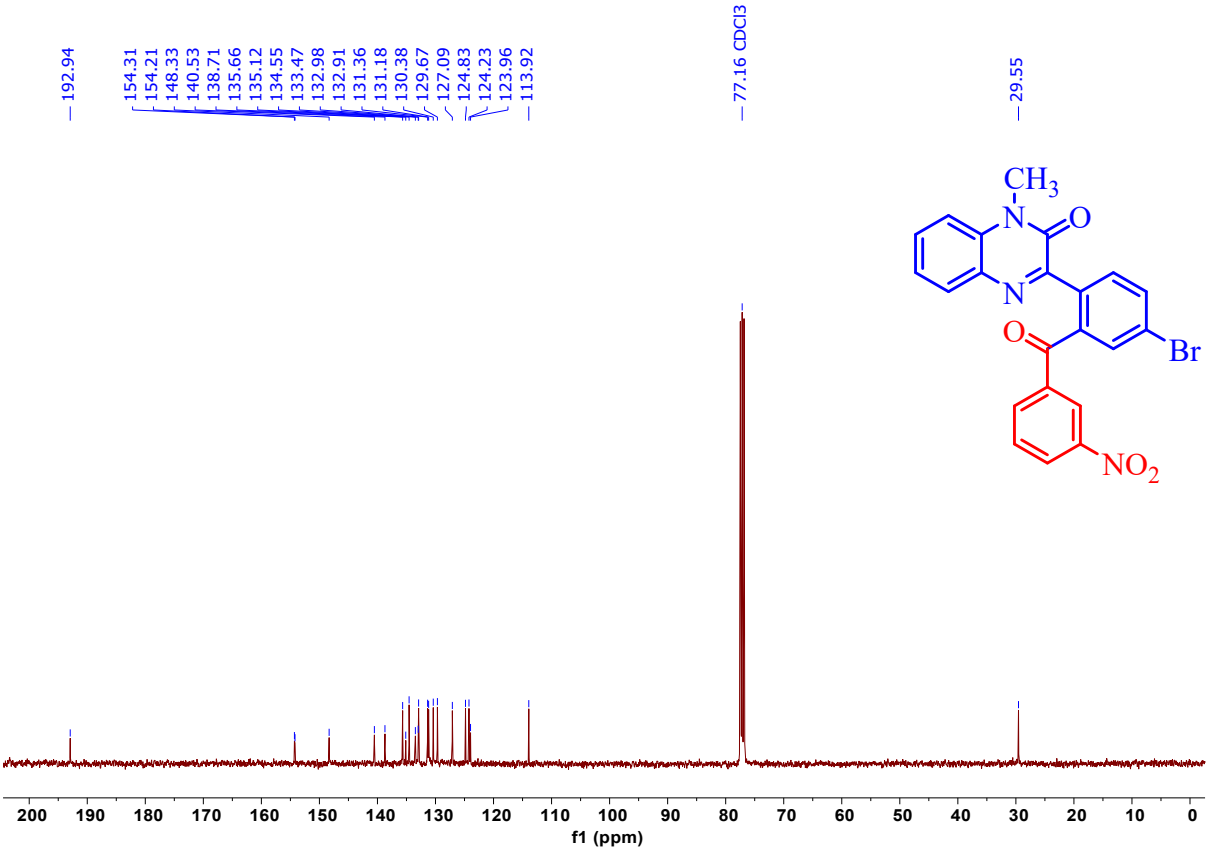


Figure 58: ^{13}C NMR spectrum of compound **3y** (100 MHz, $CDCl_3$).

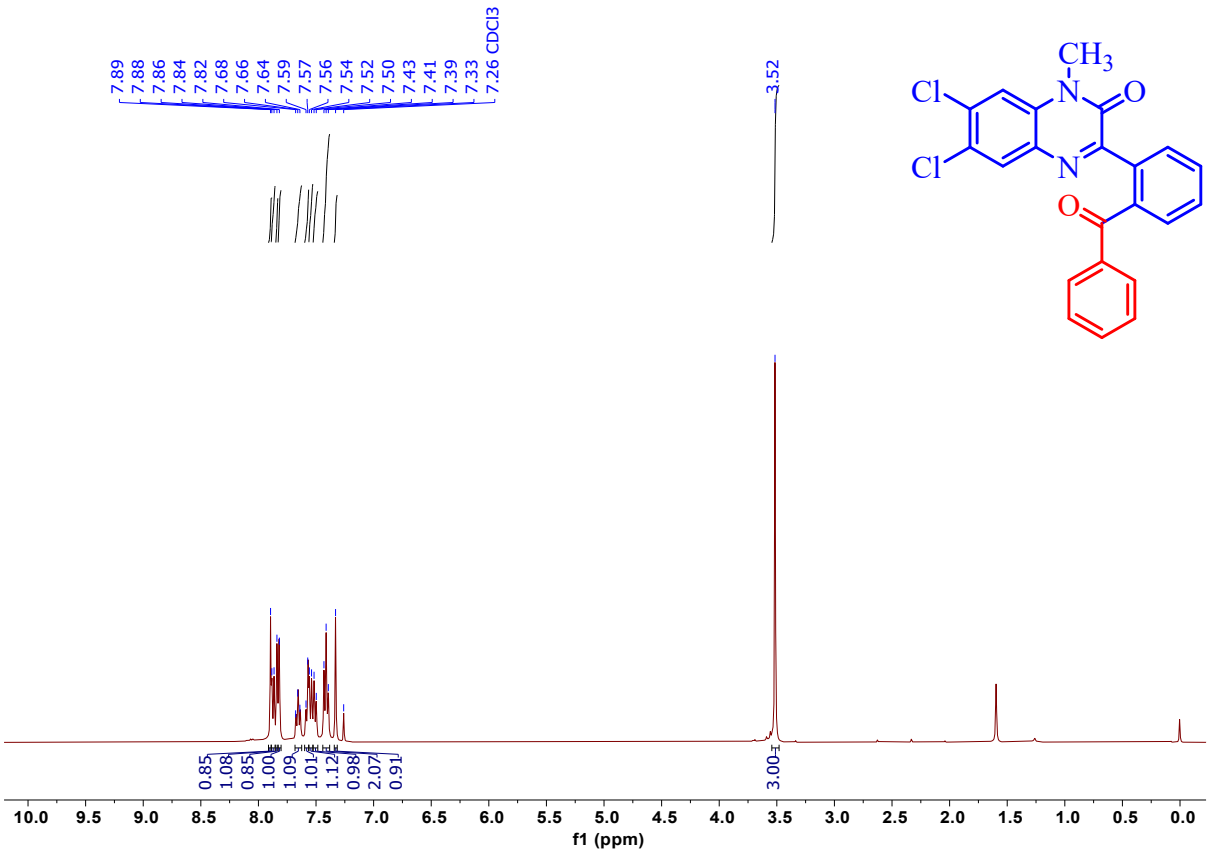


Figure 59: ^{1}H NMR spectrum of compound **3z** (400 MHz, $CDCl_3$).

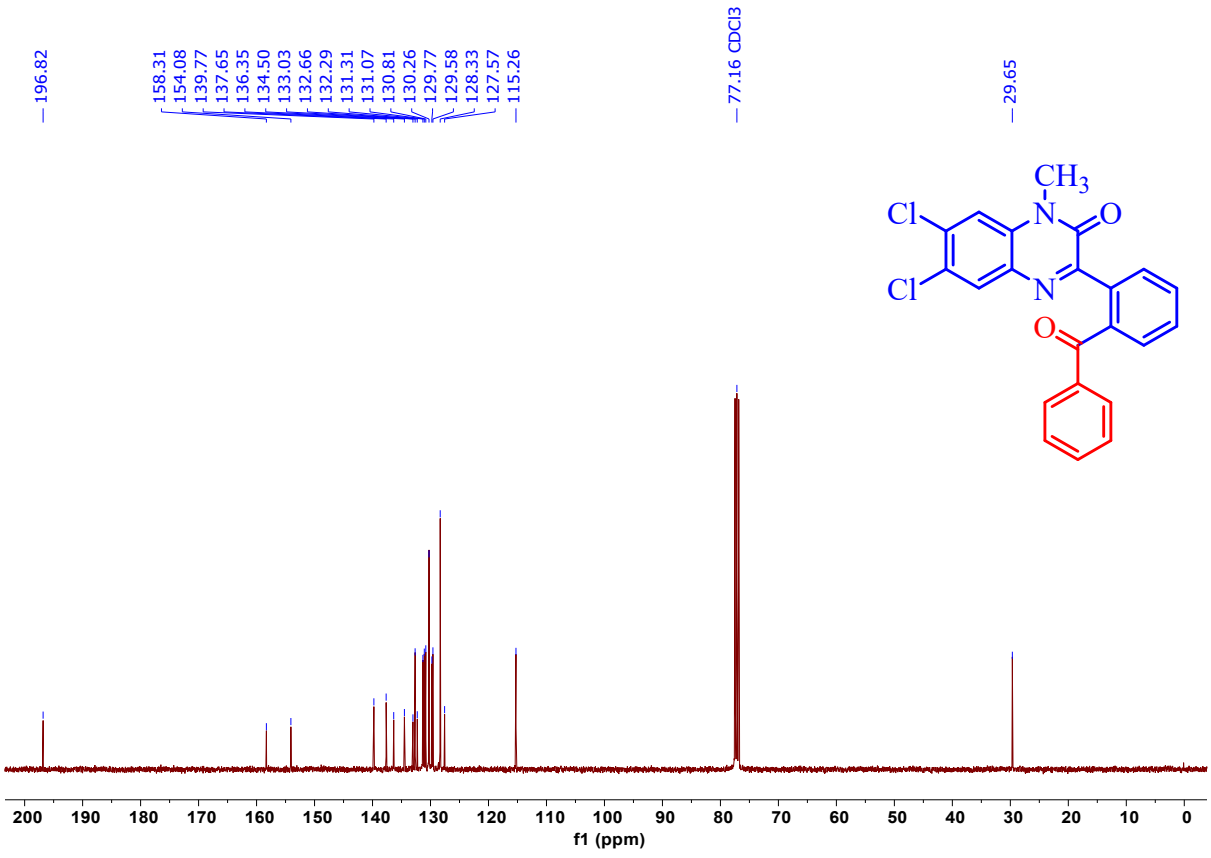


Figure 60: ^{13}C NMR spectrum of compound **3z** (100 MHz, $CDCl_3$).

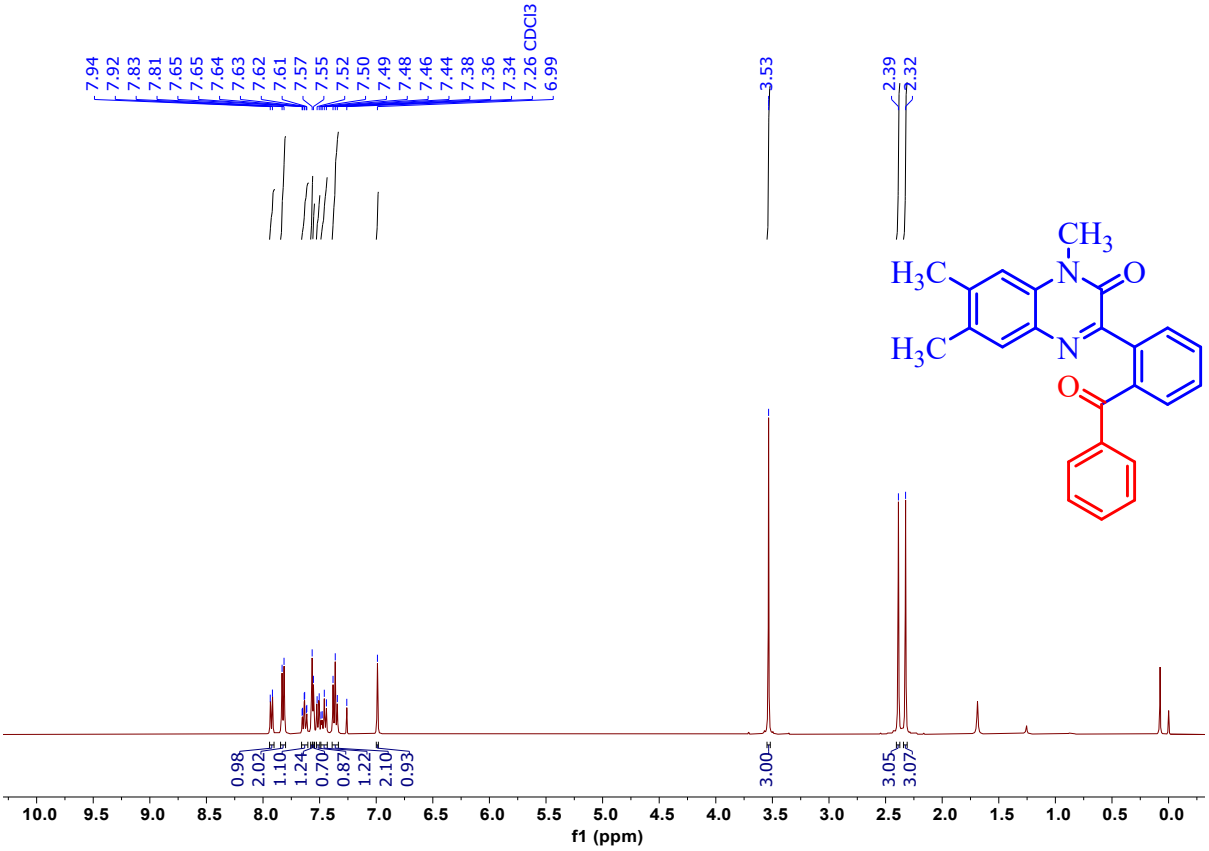


Figure 61: ^{1}H NMR spectrum of compound **3aa** (400 MHz, $CDCl_3$).

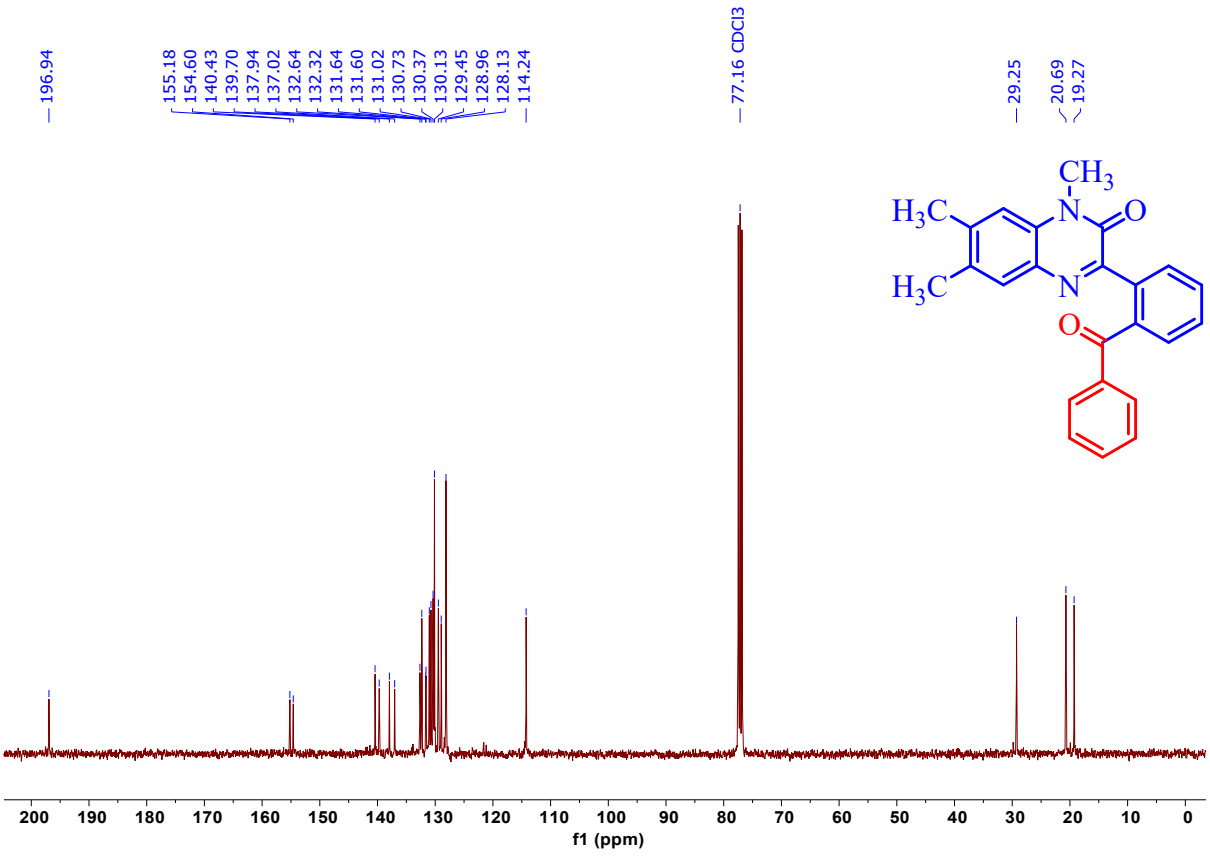


Figure 62: ^{13}C NMR spectrum of compound **3aa** (100 MHz, $CDCl_3$).

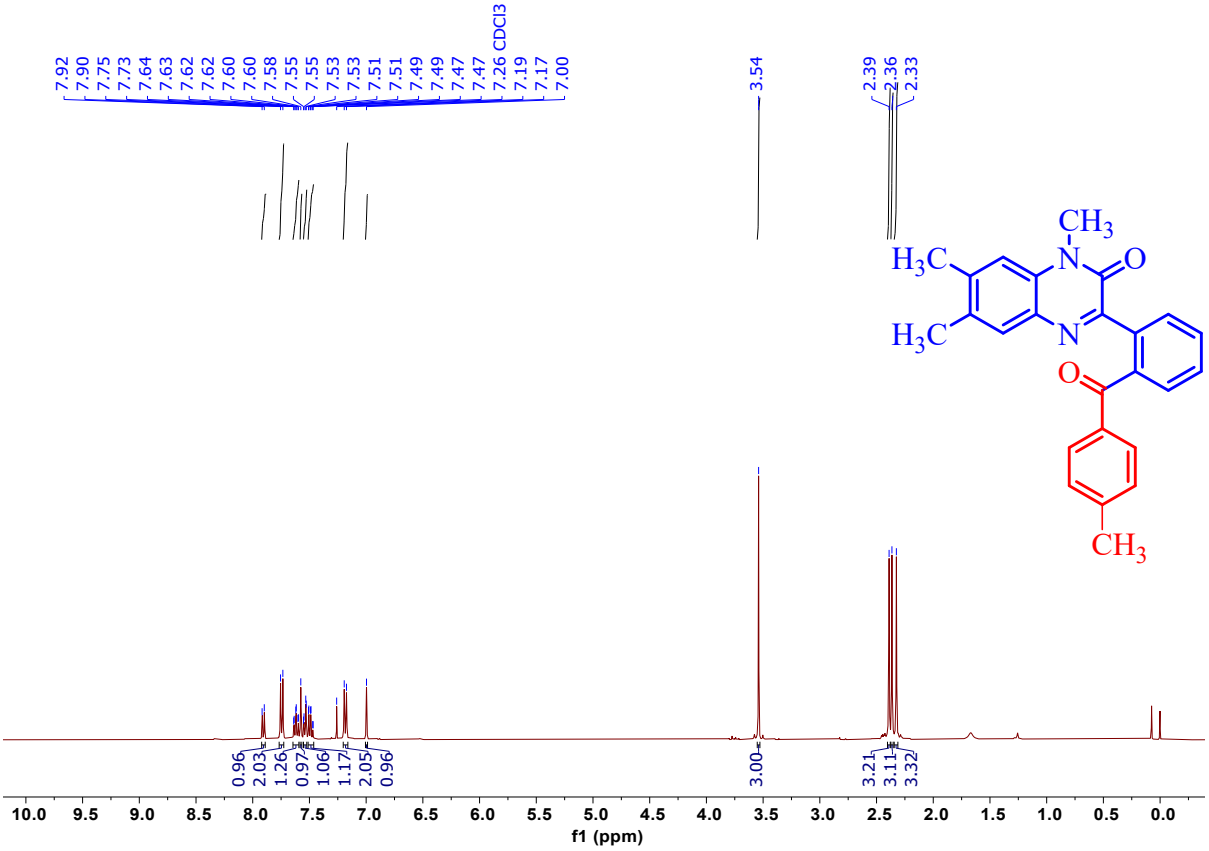


Figure 63: ^{1}H NMR spectrum of compound **3ab** (400 MHz, $CDCl_3$).

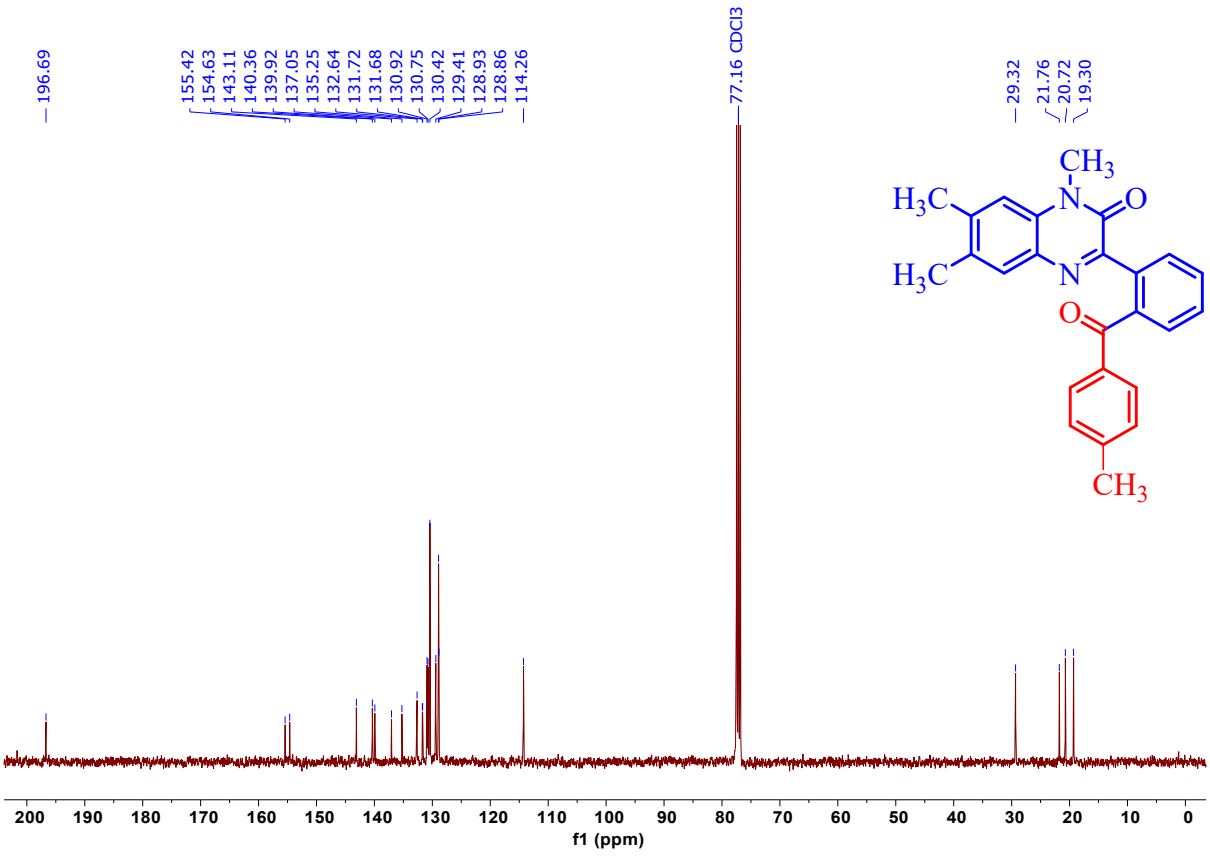


Figure 64: ^{13}C NMR spectrum of compound **3ab** (100 MHz, $CDCl_3$).

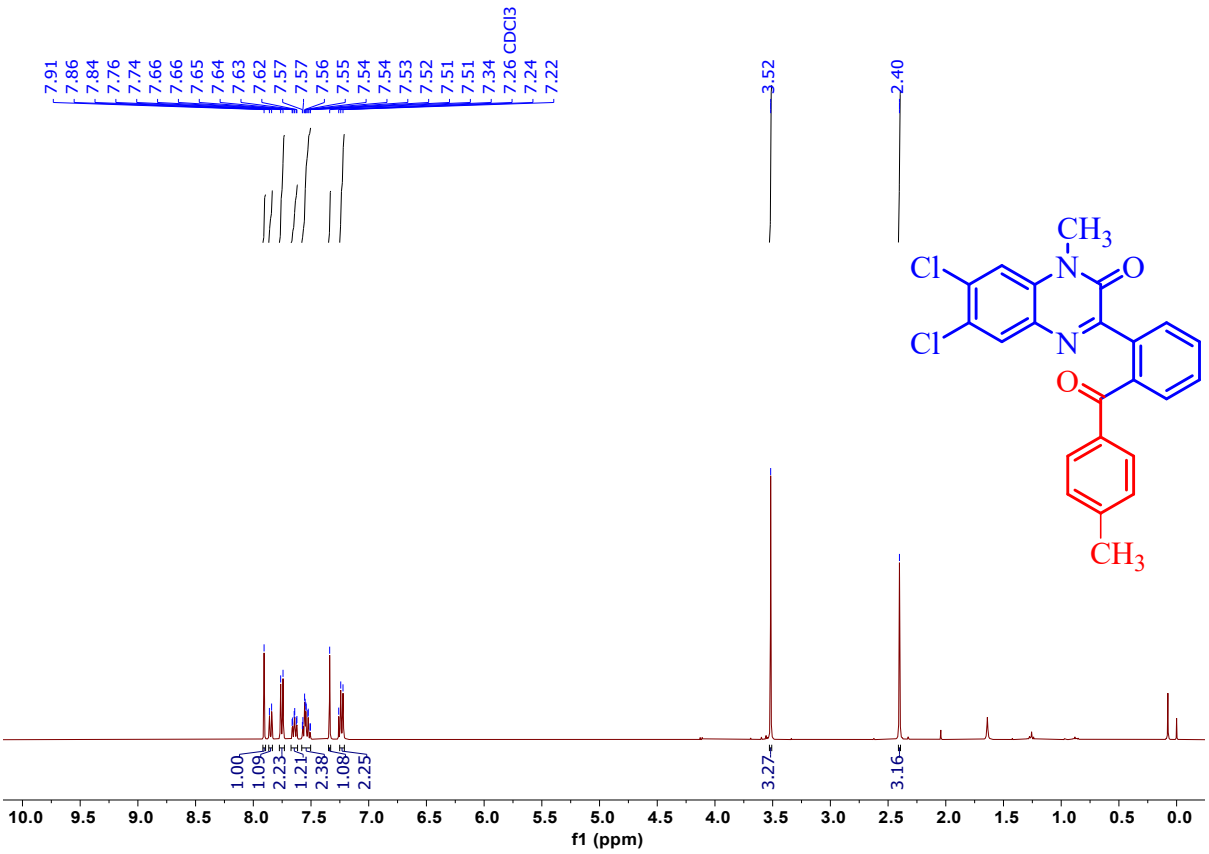


Figure 65: ^{1}H NMR spectrum of compound **3ac** (400 MHz, $CDCl_3$).

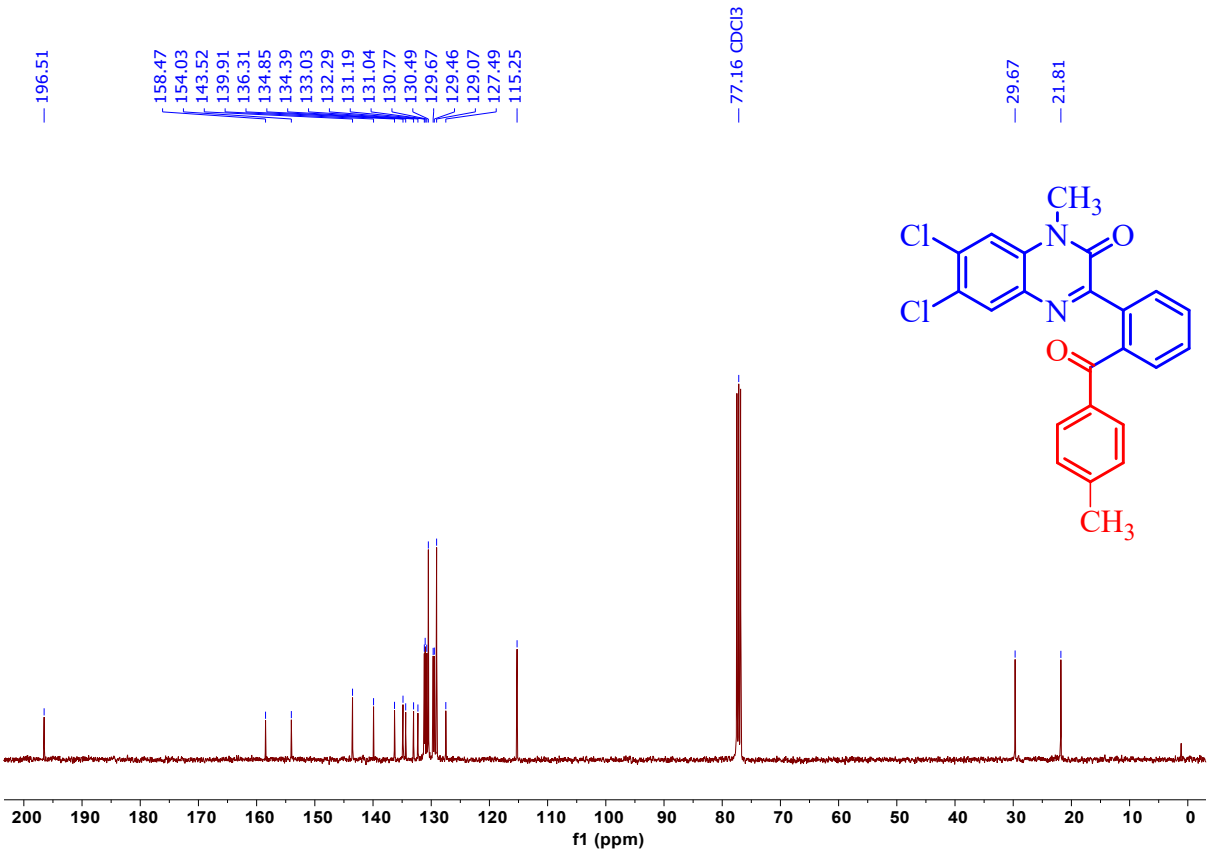


Figure 66: ^{13}C NMR spectrum of compound **3ac** (100 MHz, $CDCl_3$).

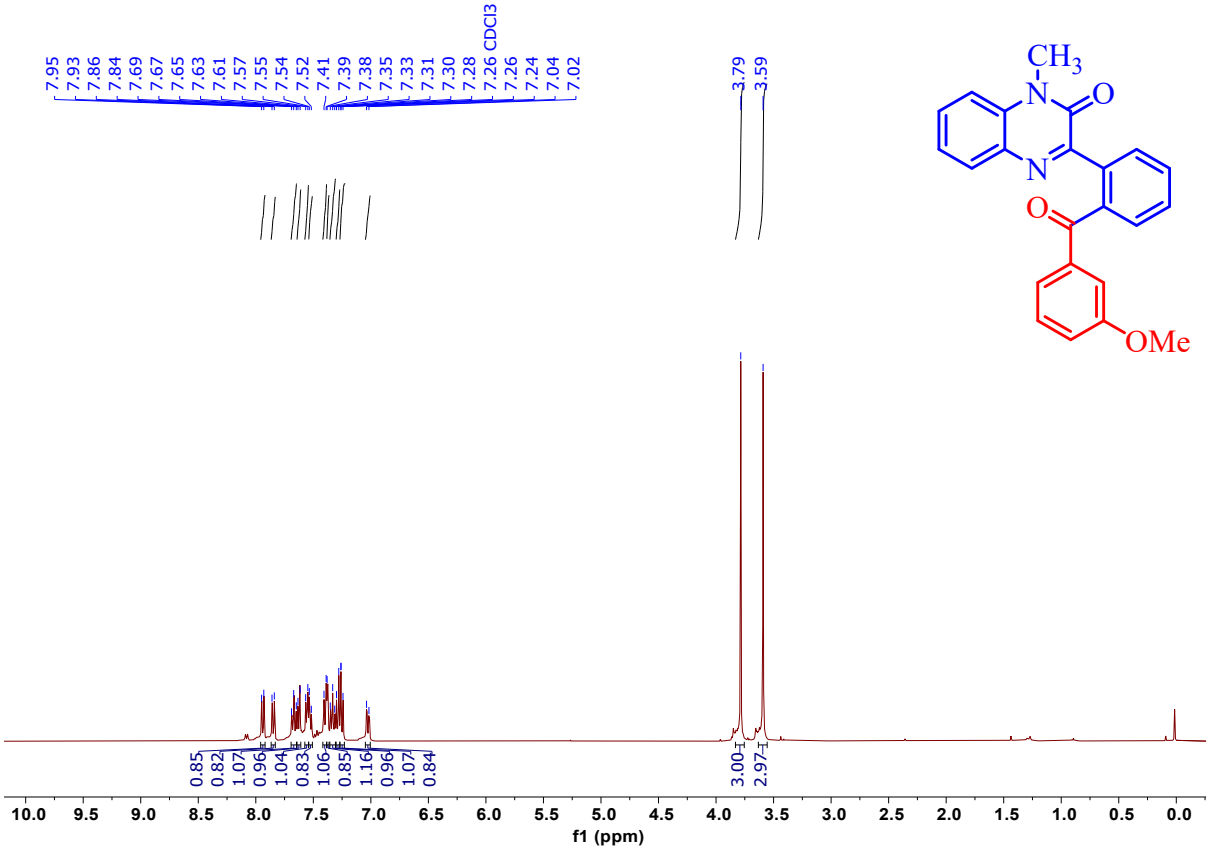


Figure 67: ^{1}H NMR spectrum of compound **5a** (400 MHz, $CDCl_3$).

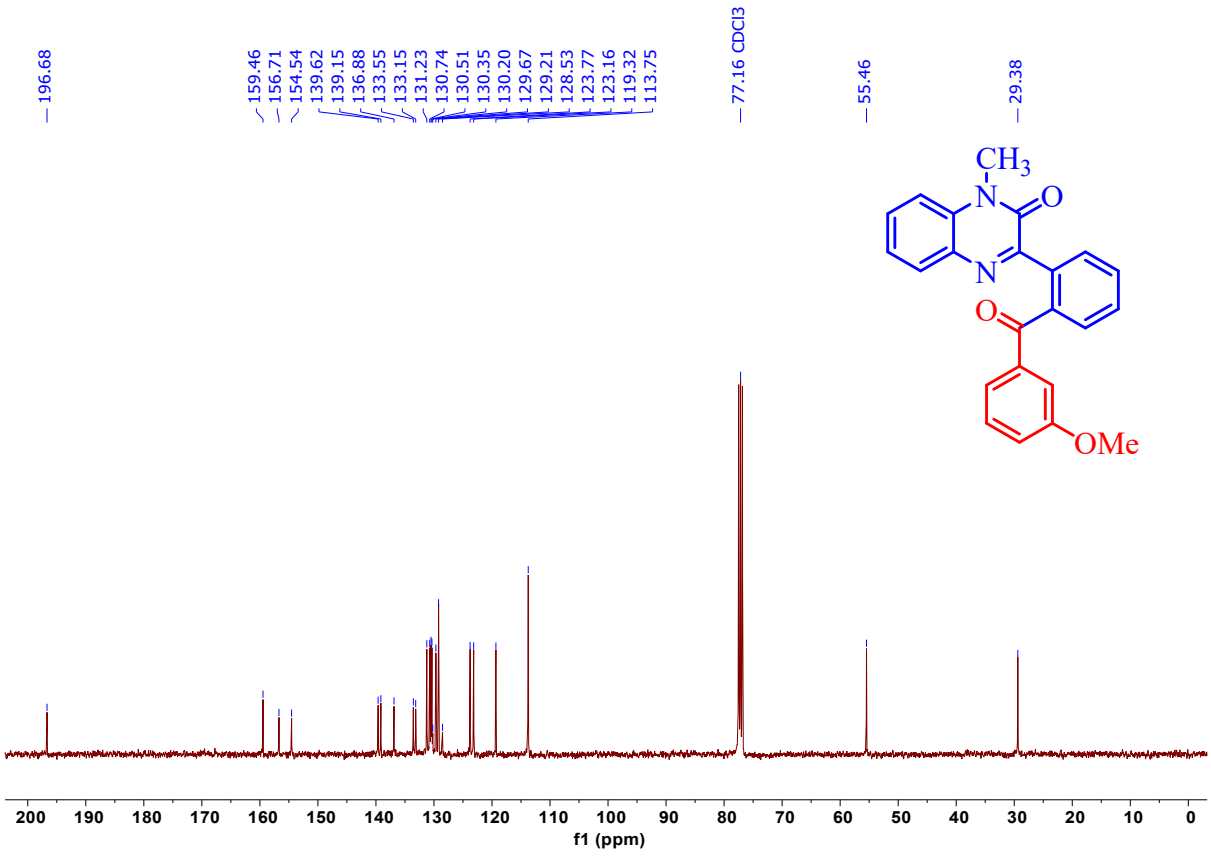


Figure 68: ^{13}C NMR spectrum of compound **5a** (100 MHz, $CDCl_3$).

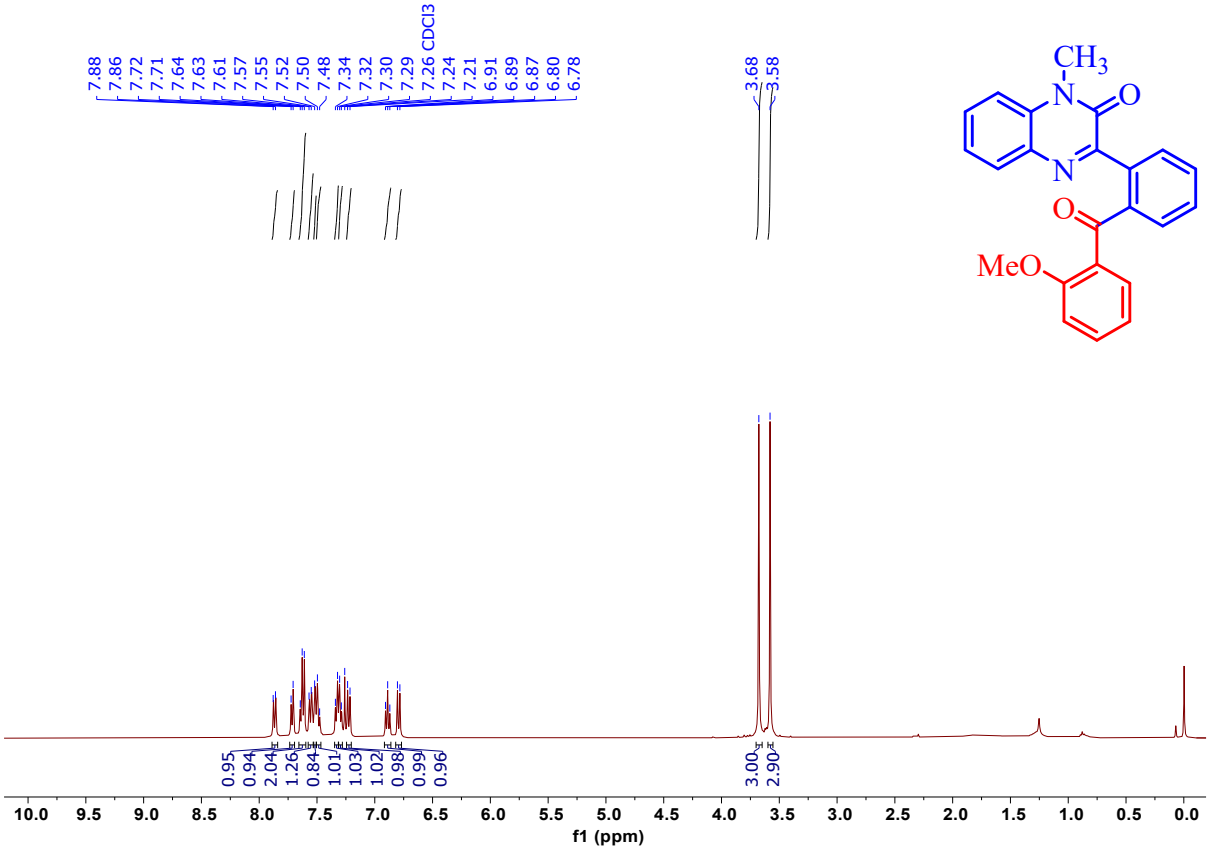


Figure 69: ^{1}H NMR spectrum of compound **5b** (400 MHz, $CDCl_3$).

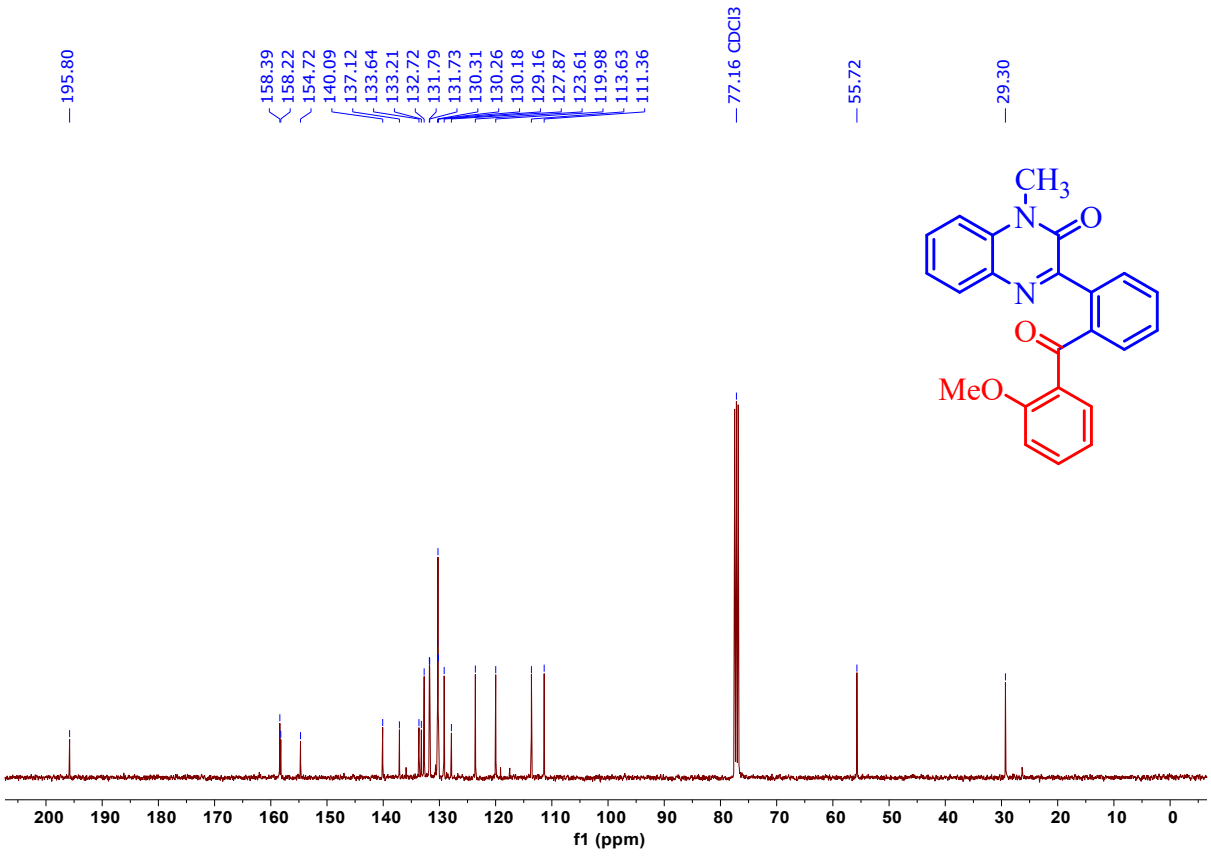


Figure 70: ^{13}C NMR spectrum of compound **5b** (100 MHz, $CDCl_3$).

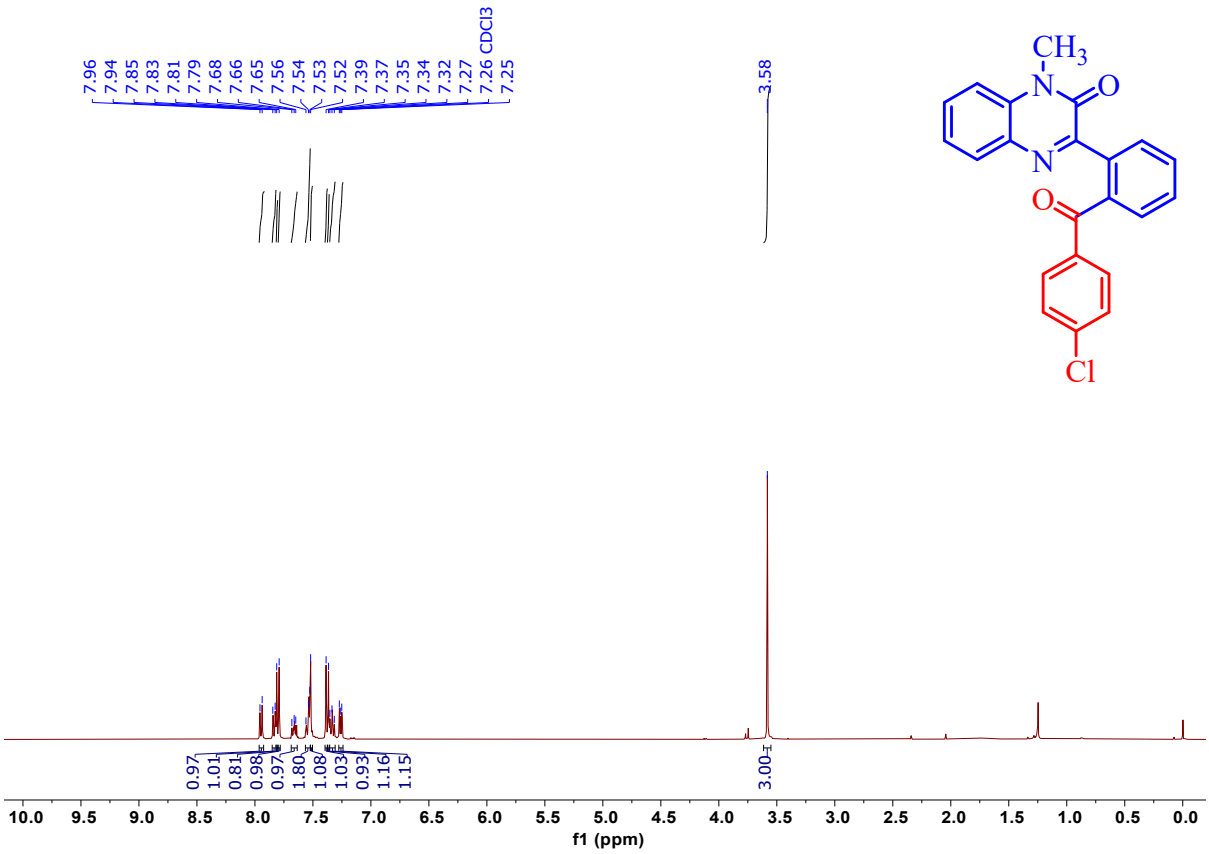


Figure 71: ^{1}H NMR spectrum of compound **5c** (400 MHz, $CDCl_3$).

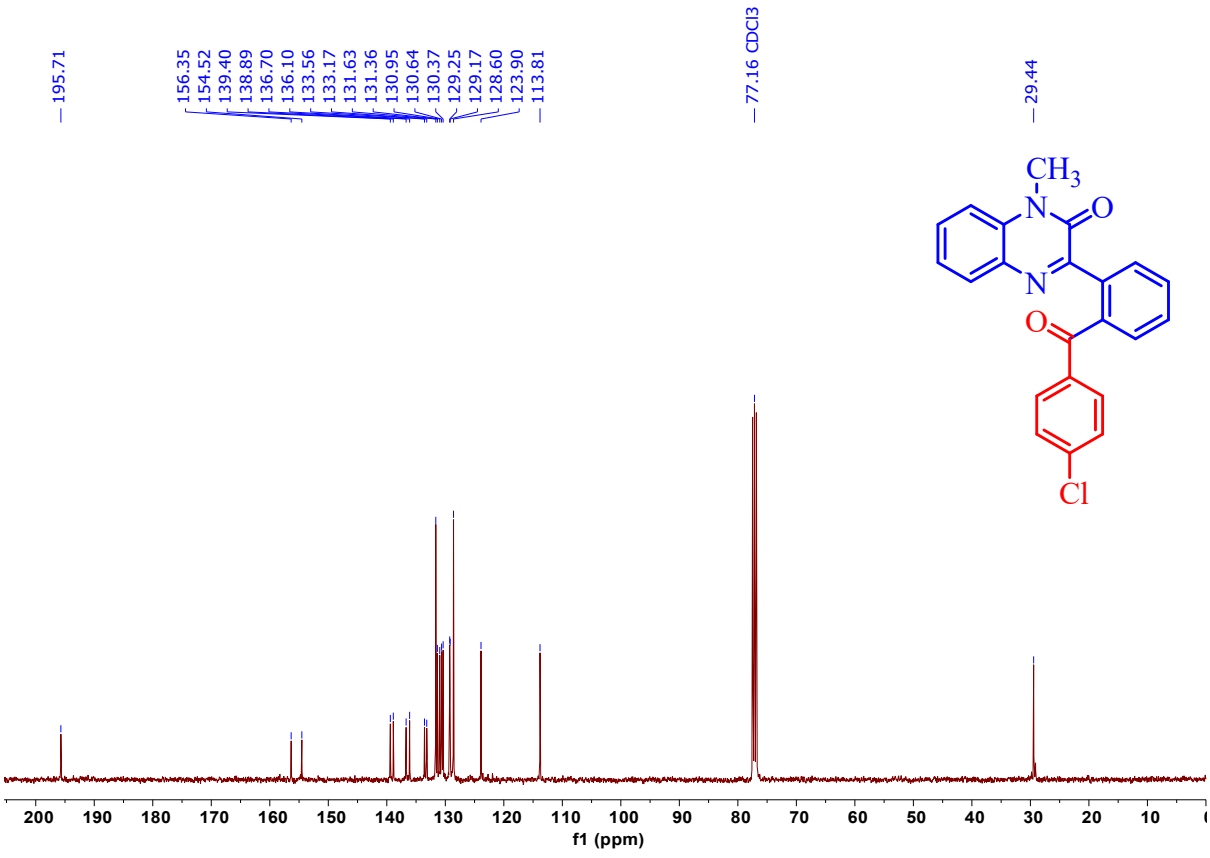


Figure 72: ^{13}C NMR spectrum of compound **5c** (100 MHz, $CDCl_3$).

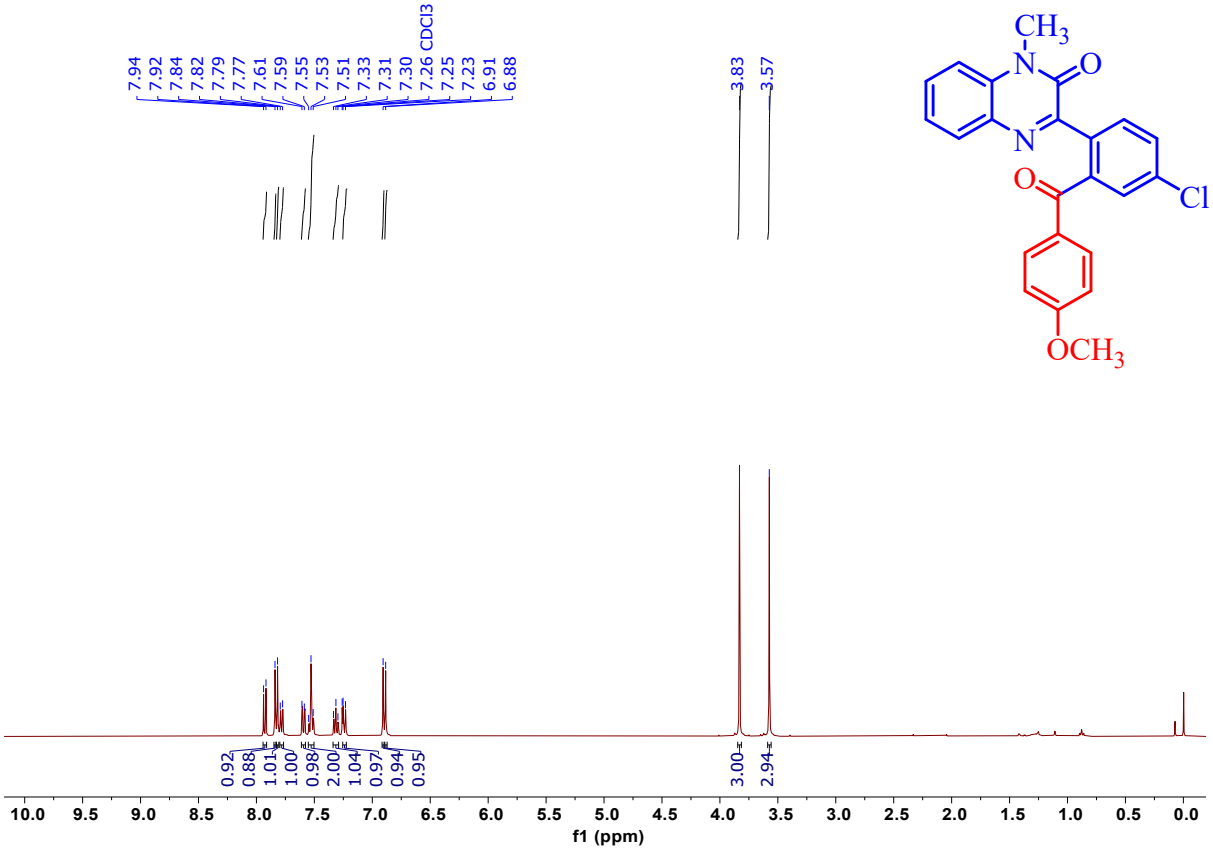


Figure 73: ^{1}H NMR spectrum of compound **5d** (400 MHz, $CDCl_3$).

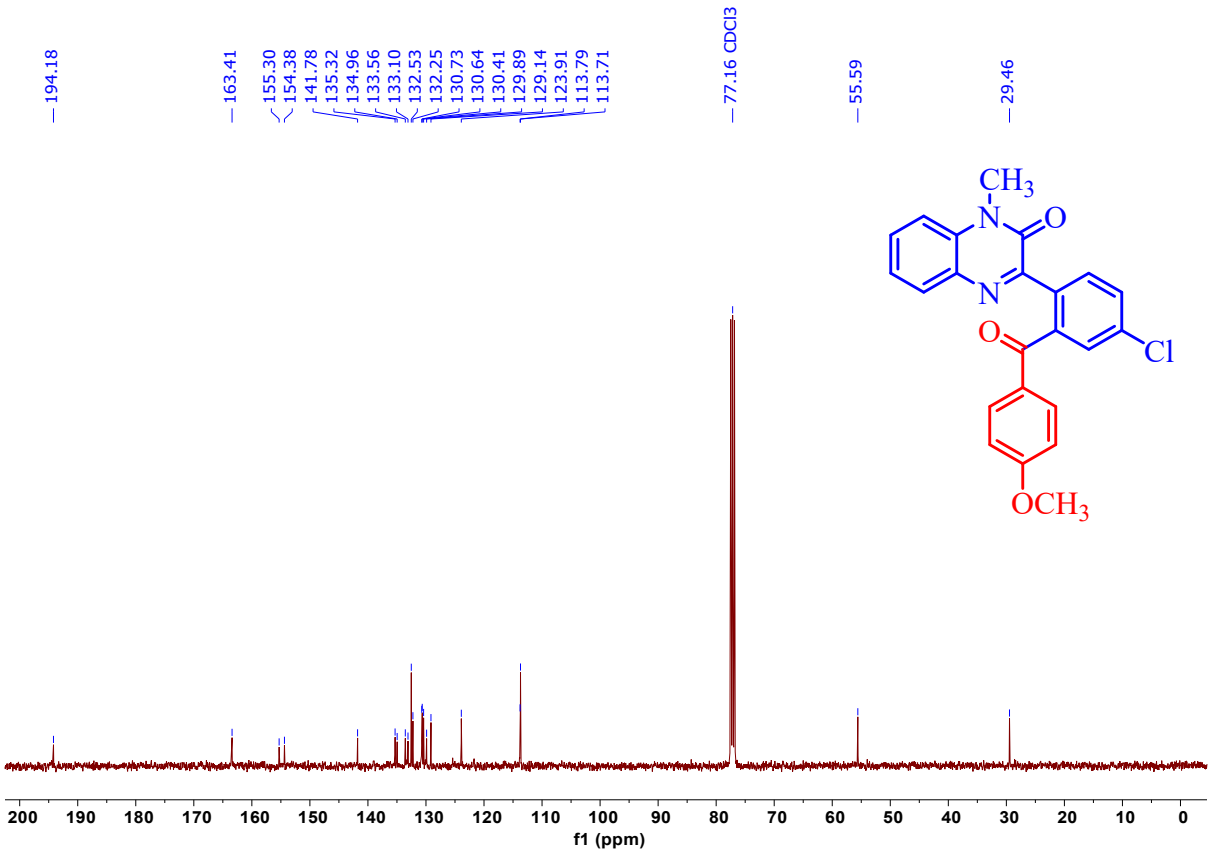


Figure 74: ^{13}C NMR spectrum of compound **5d** (100 MHz, $CDCl_3$).

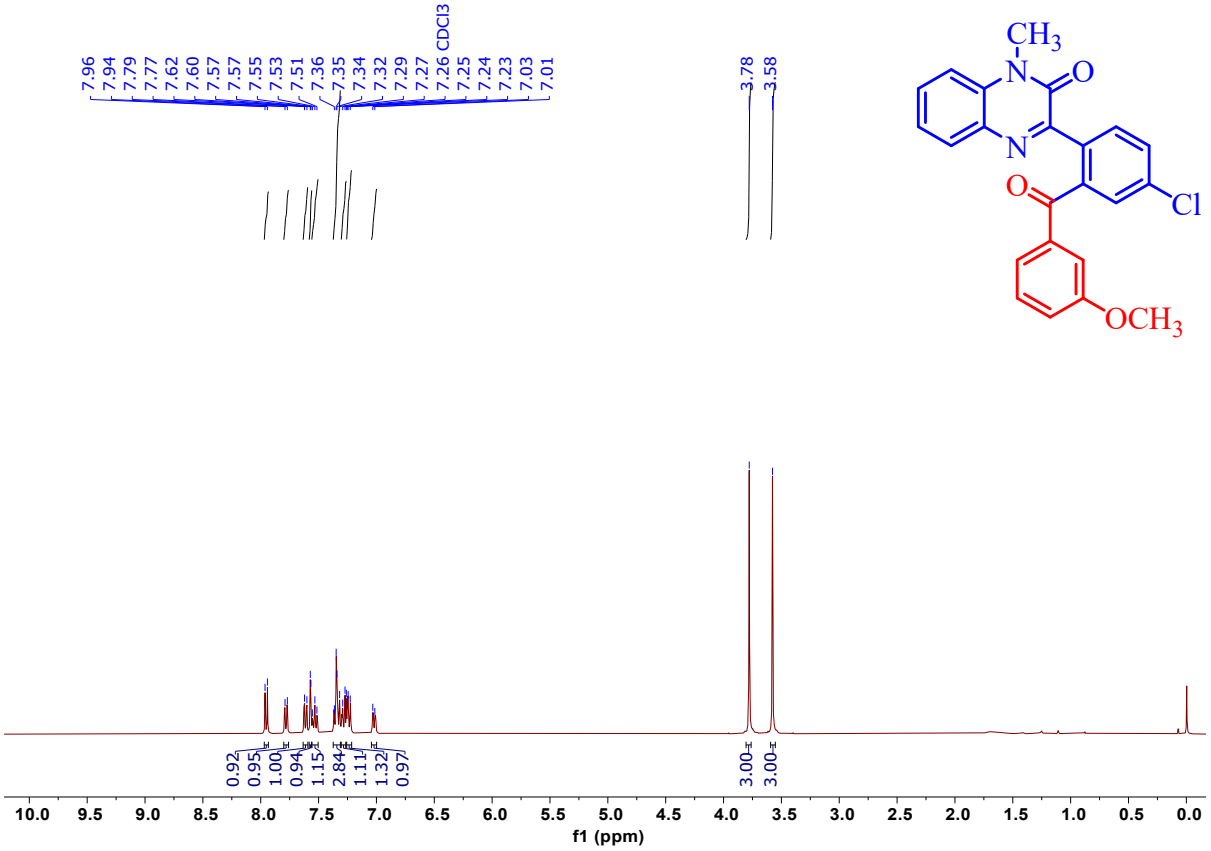


Figure 75: ^{1}H NMR spectrum of compound **5e** (400 MHz, $CDCl_3$).

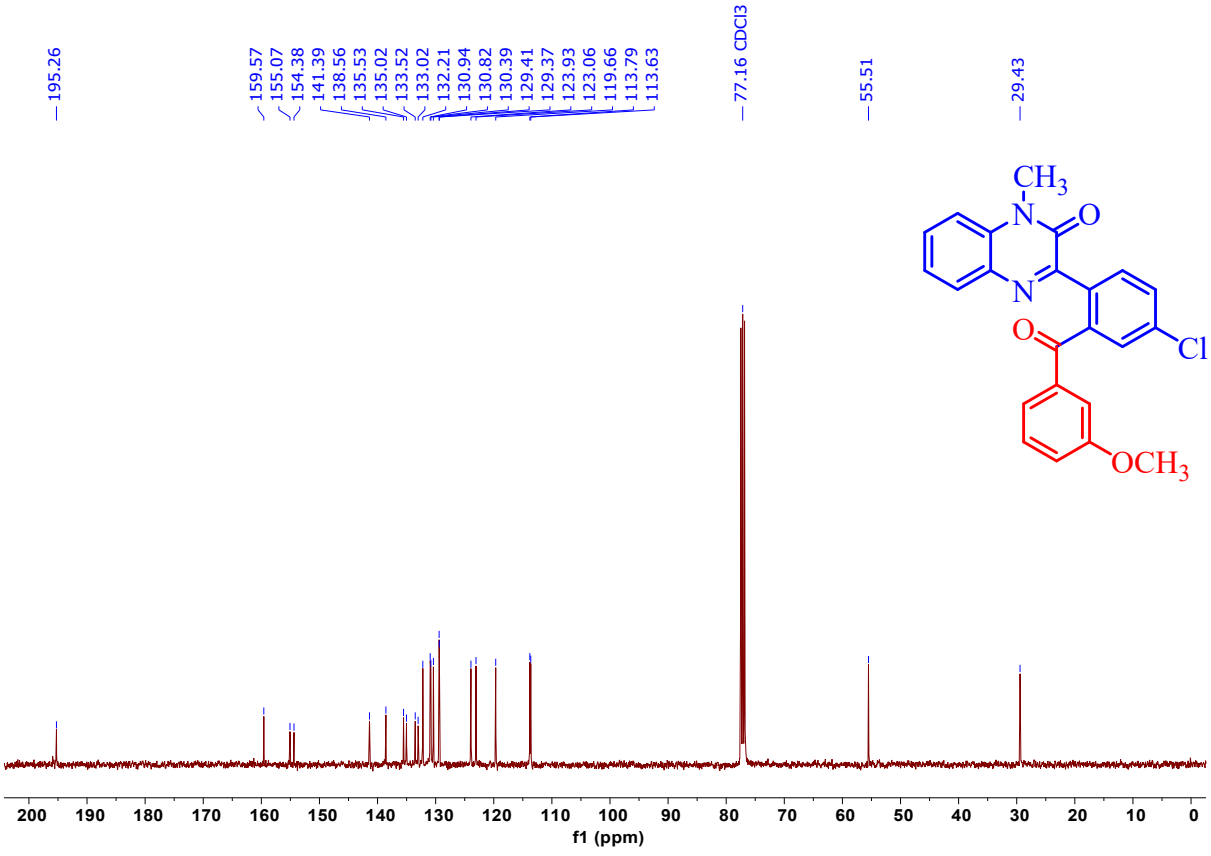


Figure 76: ^{13}C NMR spectrum of compound **5e** (100 MHz, $CDCl_3$).

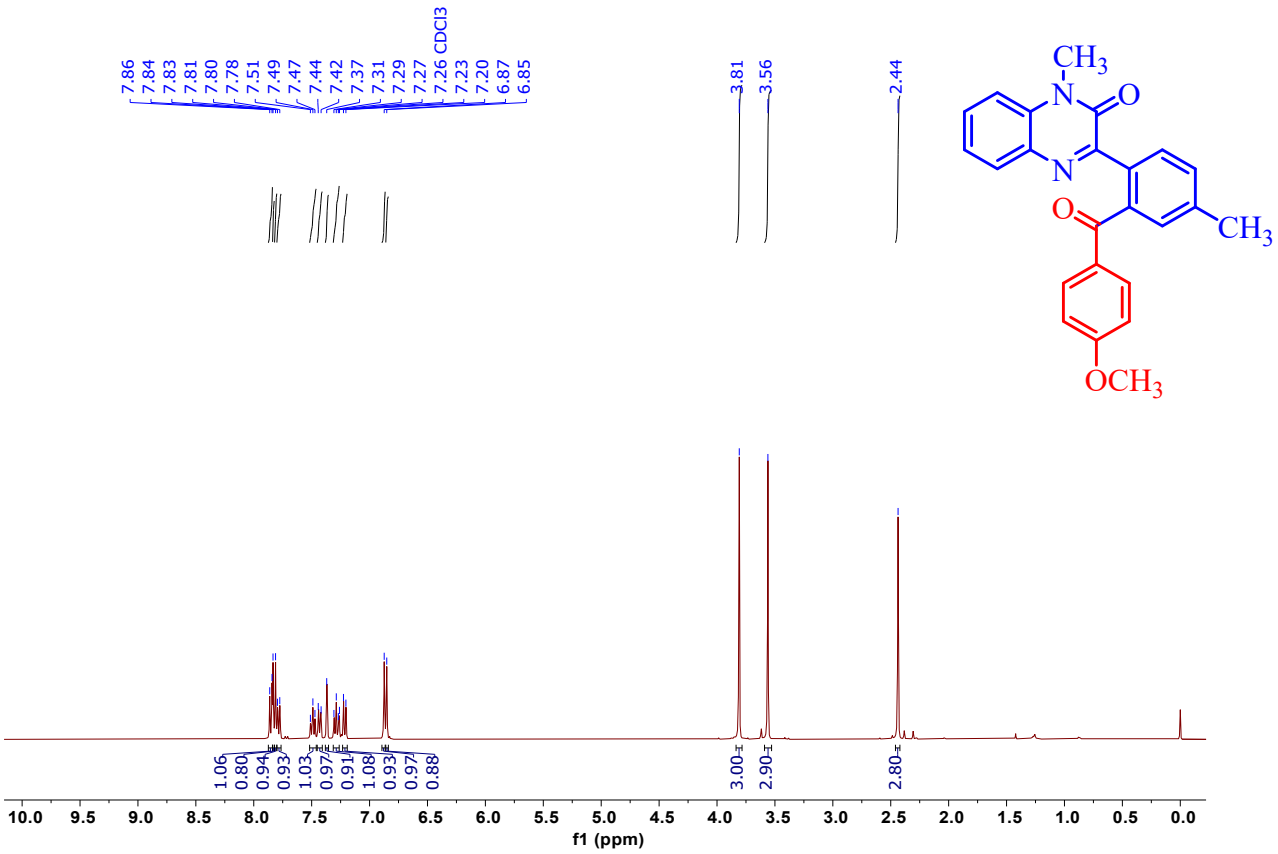


Figure 77: ^{1}H NMR spectrum of compound **5f** (400 MHz, $CDCl_3$).

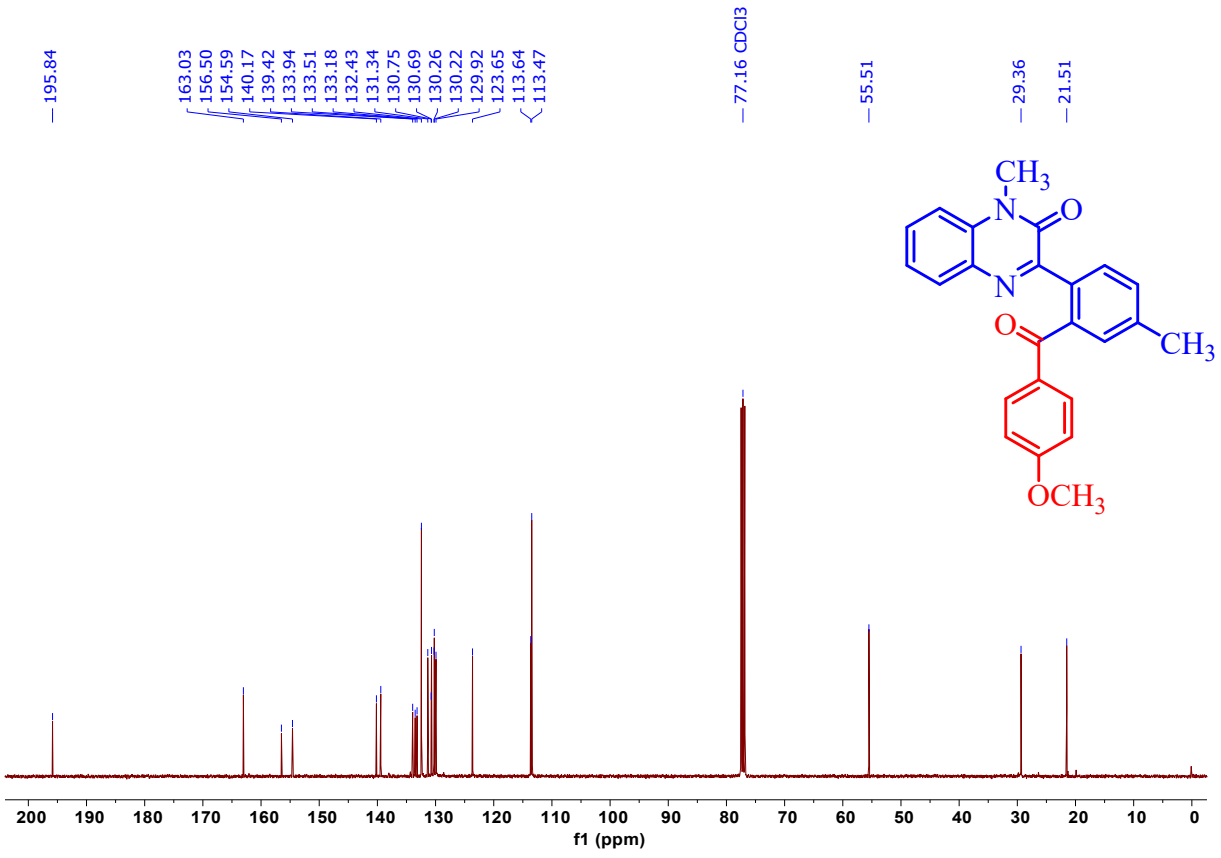


Figure 78: ^{13}C NMR spectrum of compound **5f** (100 MHz, $CDCl_3$).

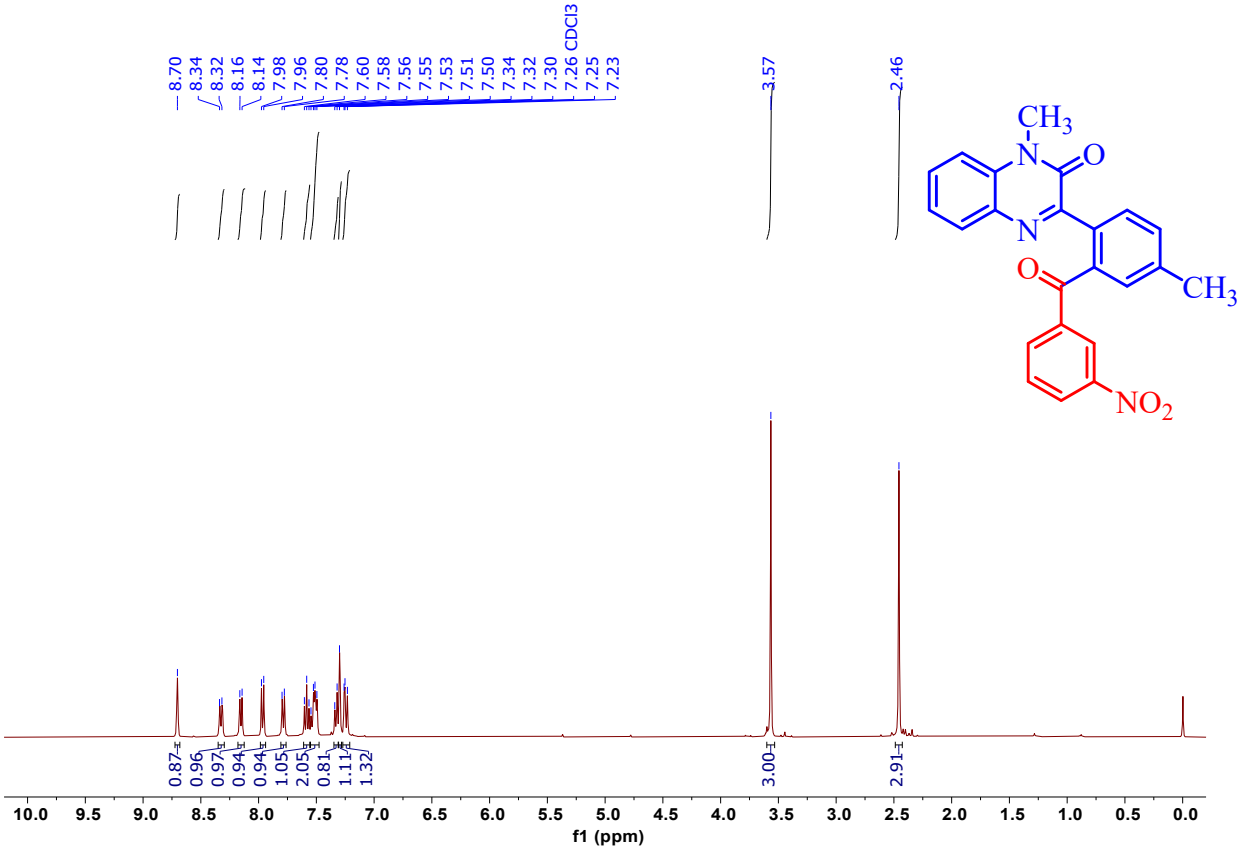


Figure 79: ^{1}H NMR spectrum of compound **5g** (400 MHz, $CDCl_3$).

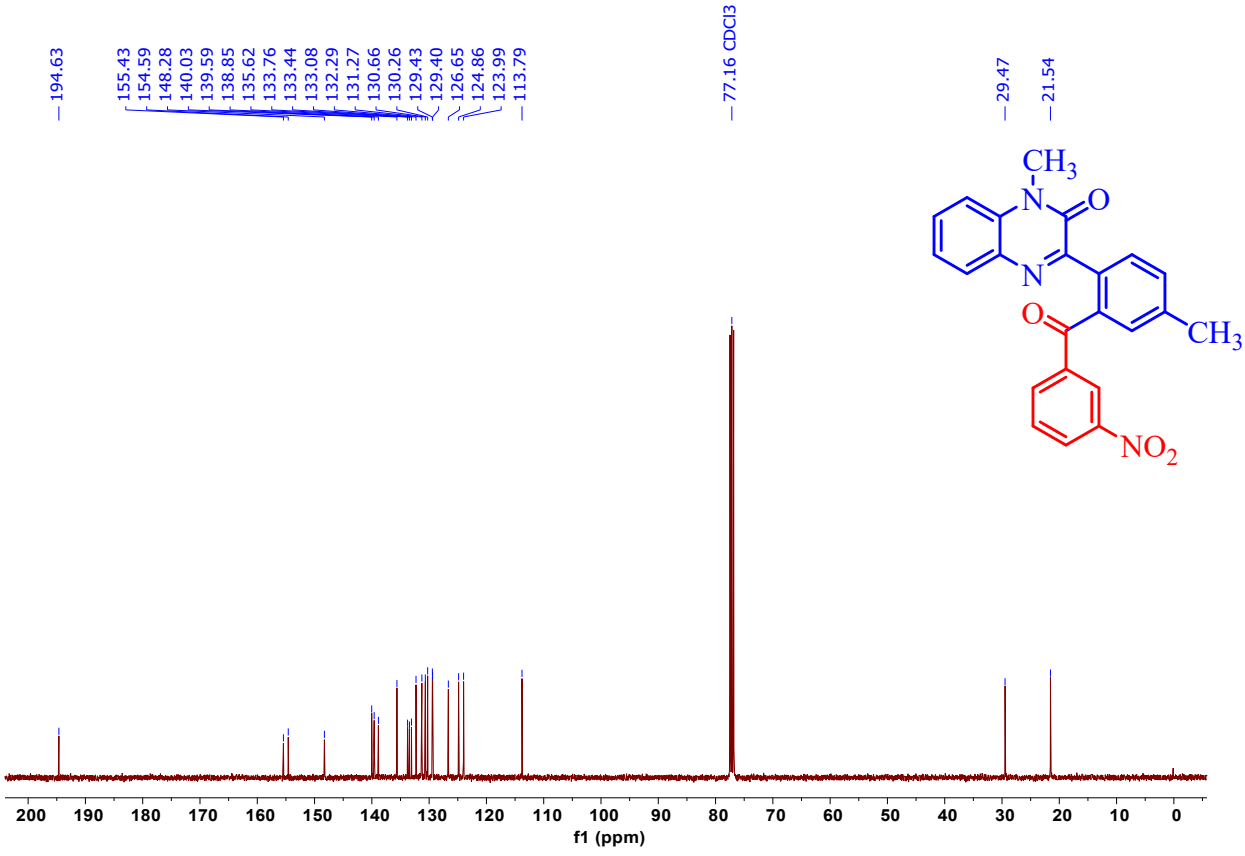


Figure 80: ^{13}C NMR spectrum of compound **5g** (100 MHz, $CDCl_3$).

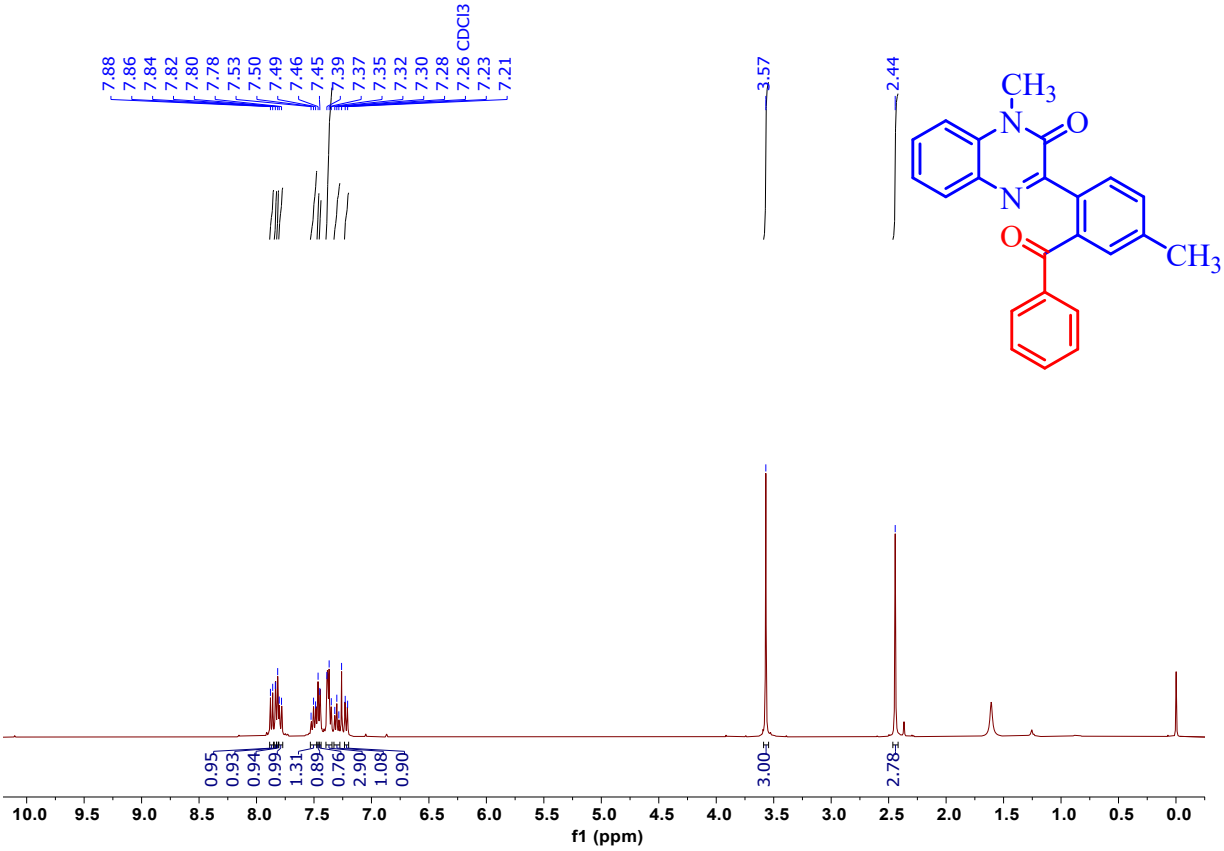


Figure 81: ^{1}H NMR spectrum of compound **7a** (400 MHz, $CDCl_3$).

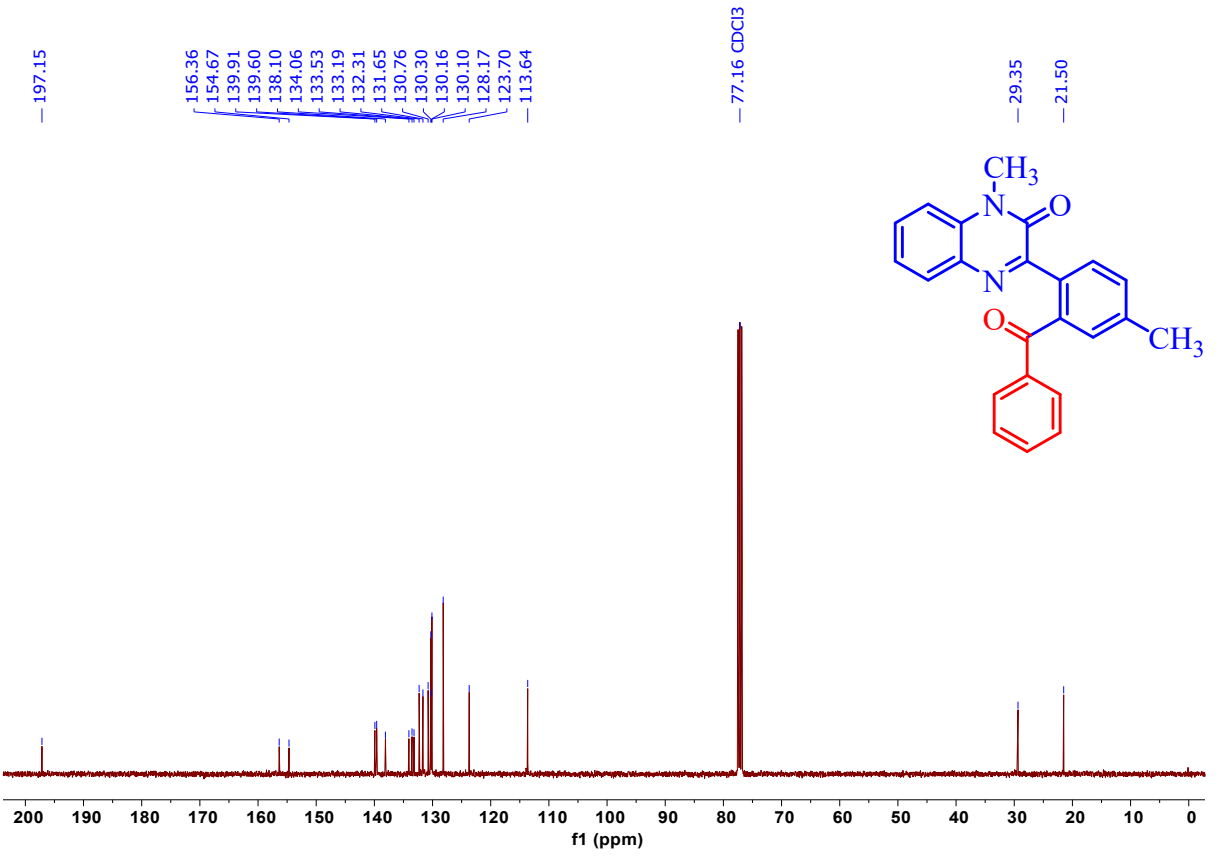


Figure 82: ^{13}C NMR spectrum of compound **7a** (100 MHz, $CDCl_3$).

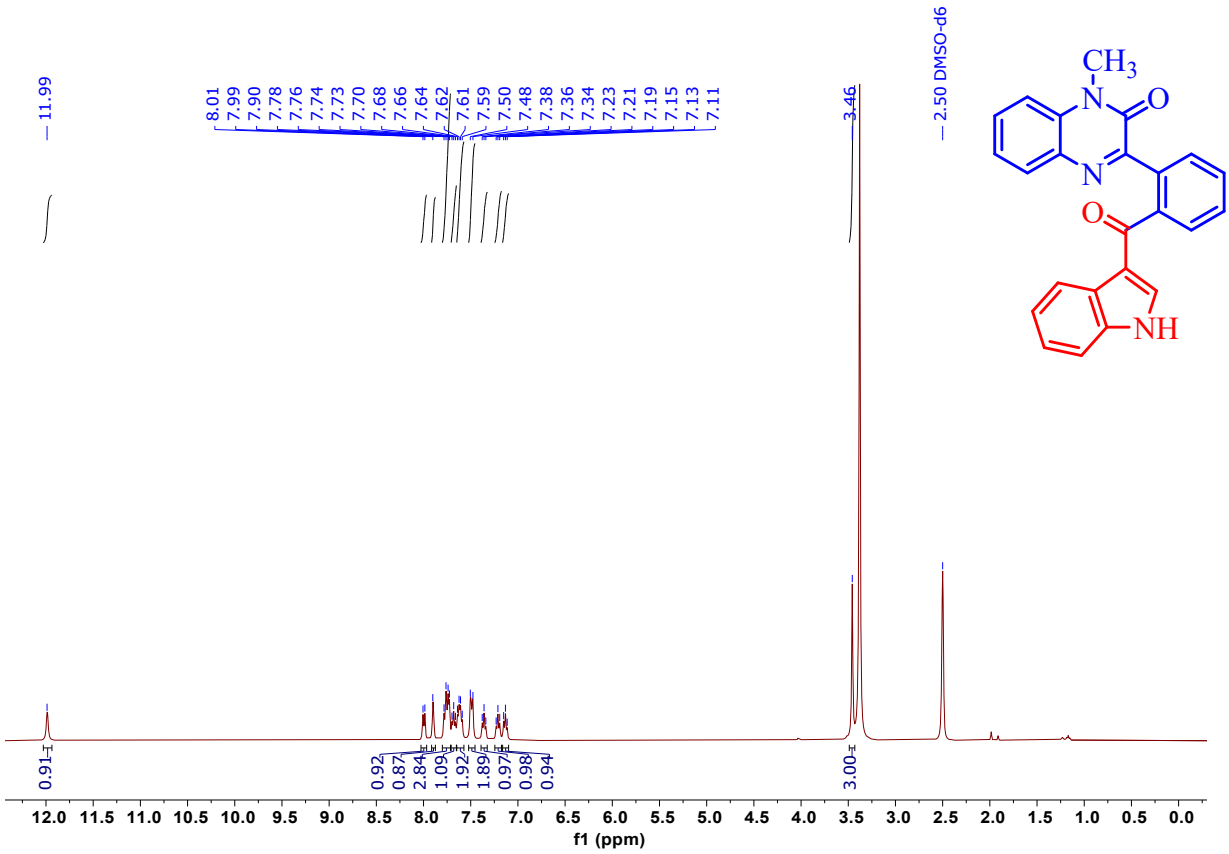


Figure 83: ^{1}H NMR spectrum of compound **8** (400 MHz, DMSO-d_6).

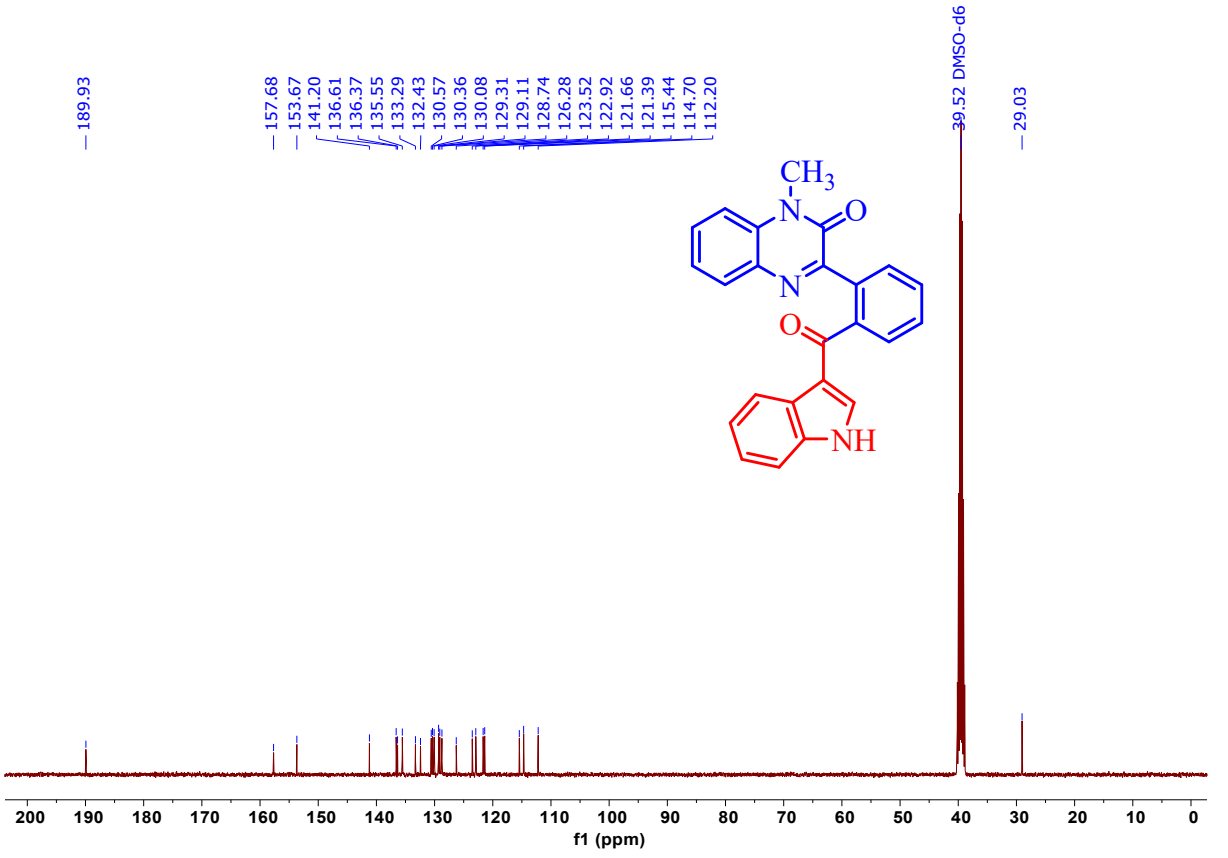


Figure 84: ^{13}C NMR spectrum of compound **8** (100 MHz, DMSO-d_6).

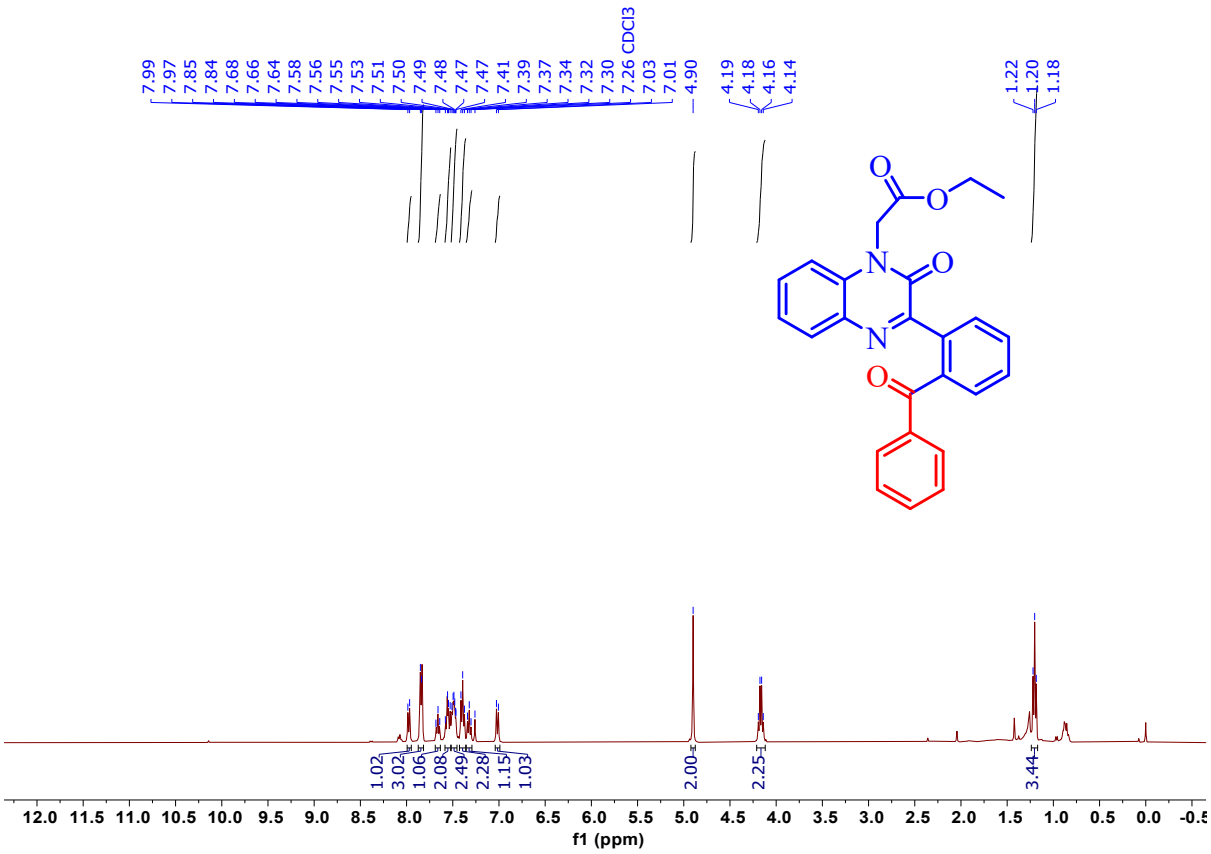


Figure 85: ^{1}H NMR spectrum of compound **9** (400 MHz, $CDCl_3$).

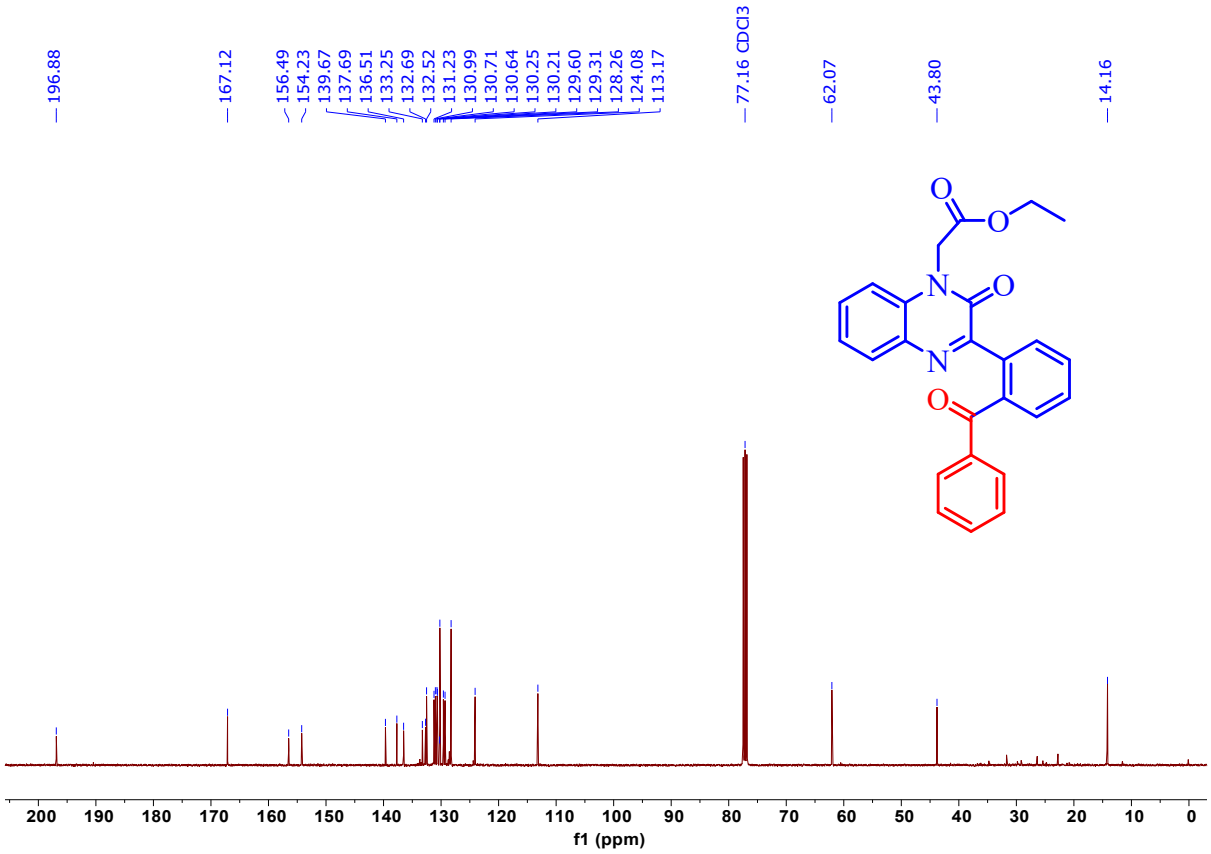


Figure 86: ^{13}C NMR spectrum of compound **9** (100 MHz, $CDCl_3$).

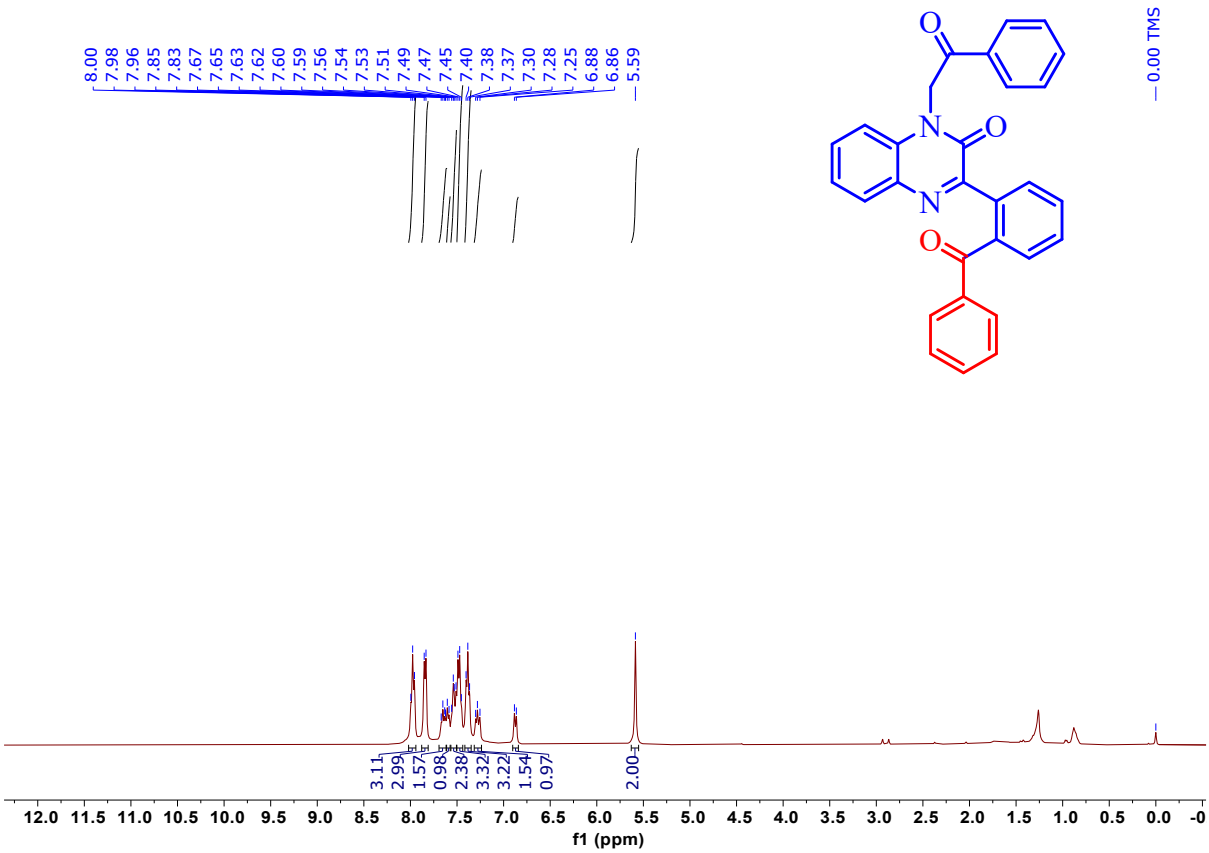


Figure 87: ^{1}H NMR spectrum of compound **10** (400 MHz, $CDCl_3$).

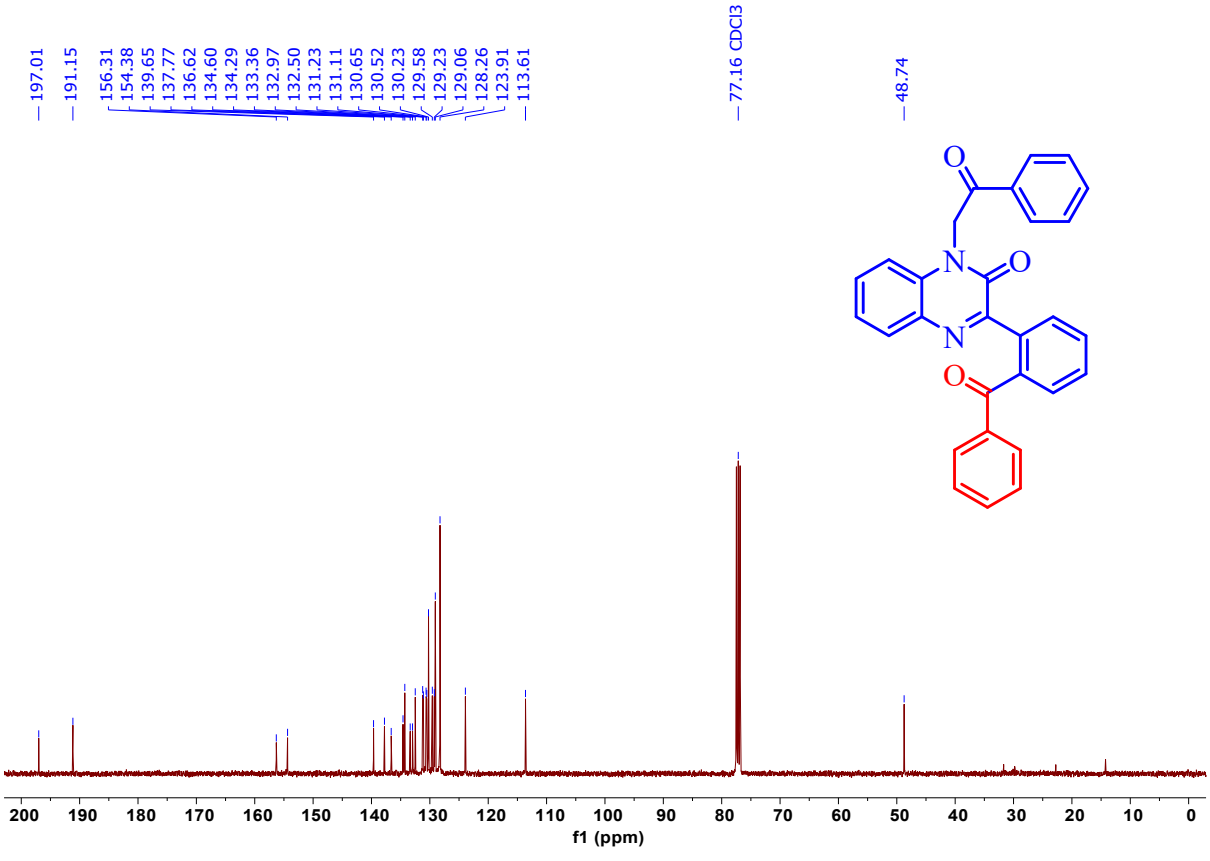


Figure 88: ^{13}C NMR spectrum of compound **10** (100 MHz, $CDCl_3$).

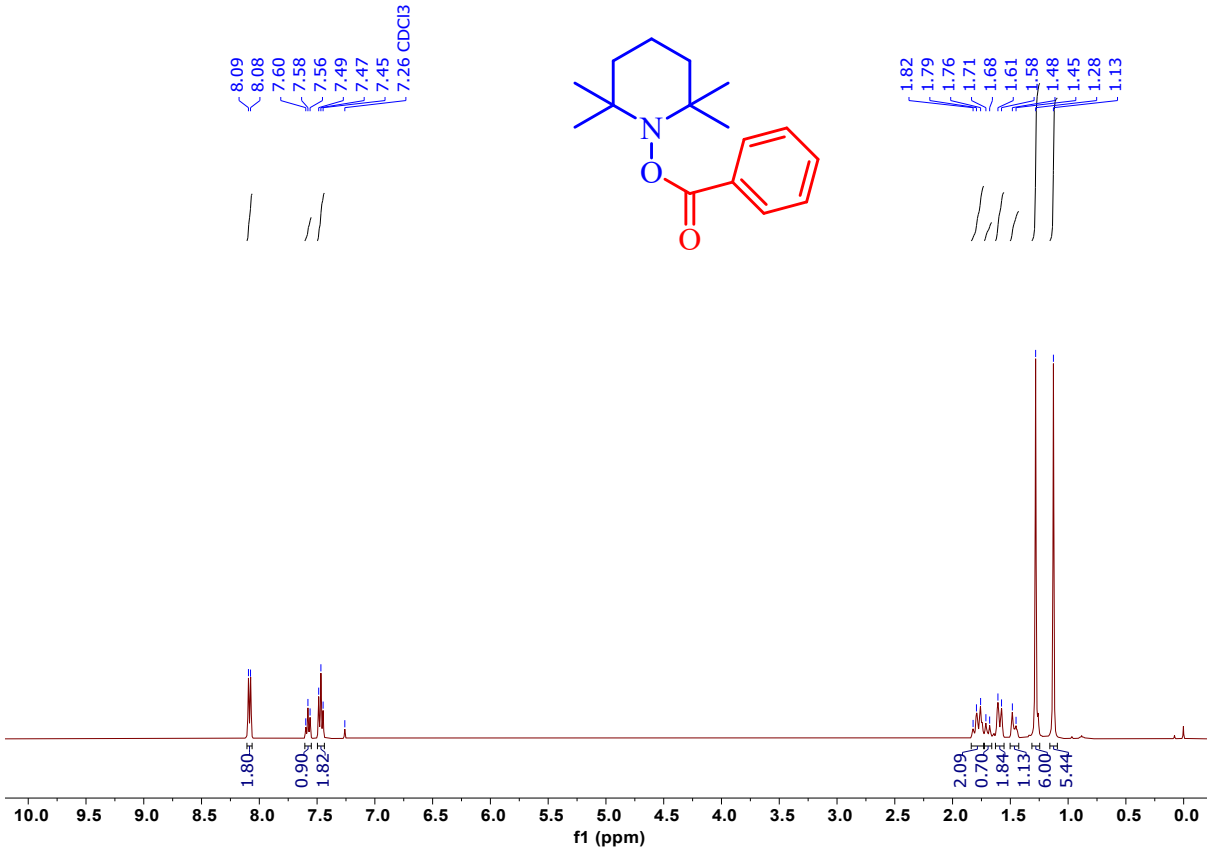


Figure 89: ^{1}H NMR spectrum of compound **11a** (400 MHz, $CDCl_3$).

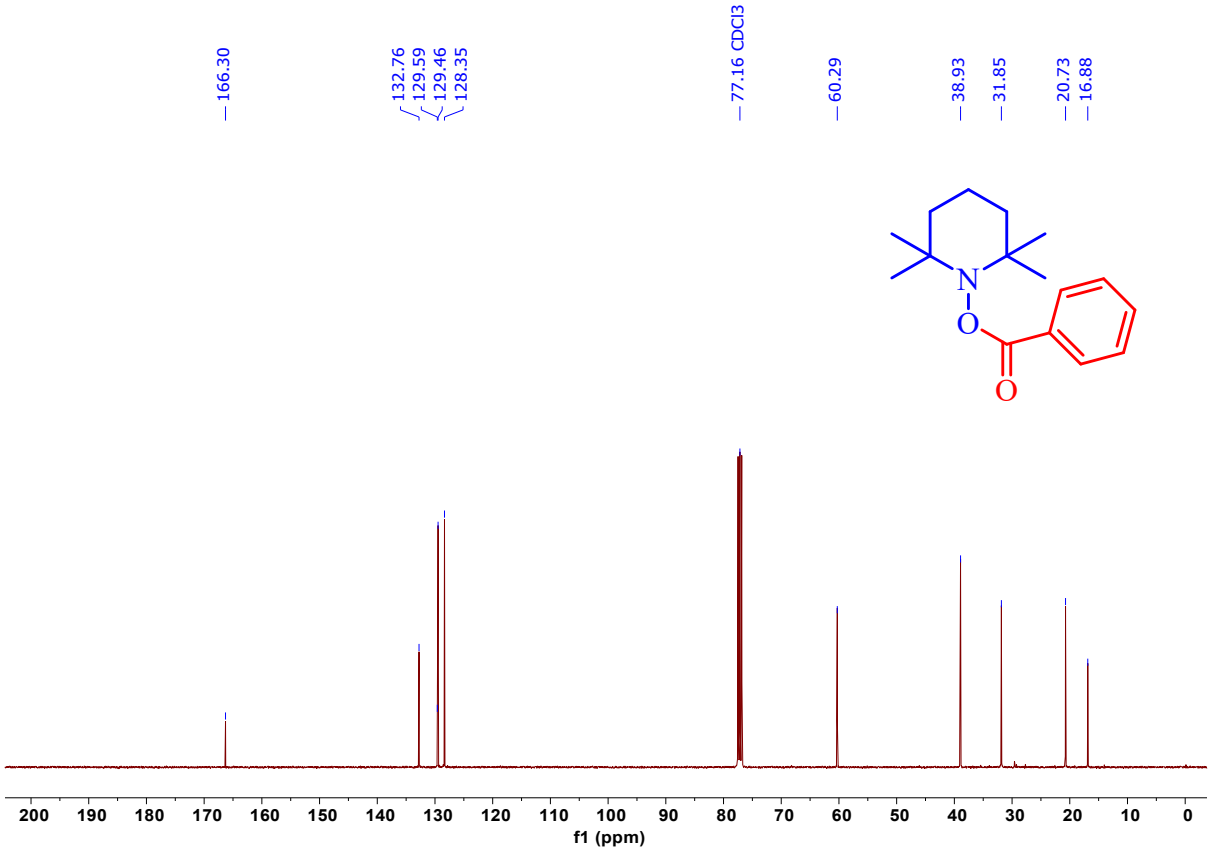


Figure 90: ^{13}C NMR spectrum of compound **11a** (100 MHz, $CDCl_3$).

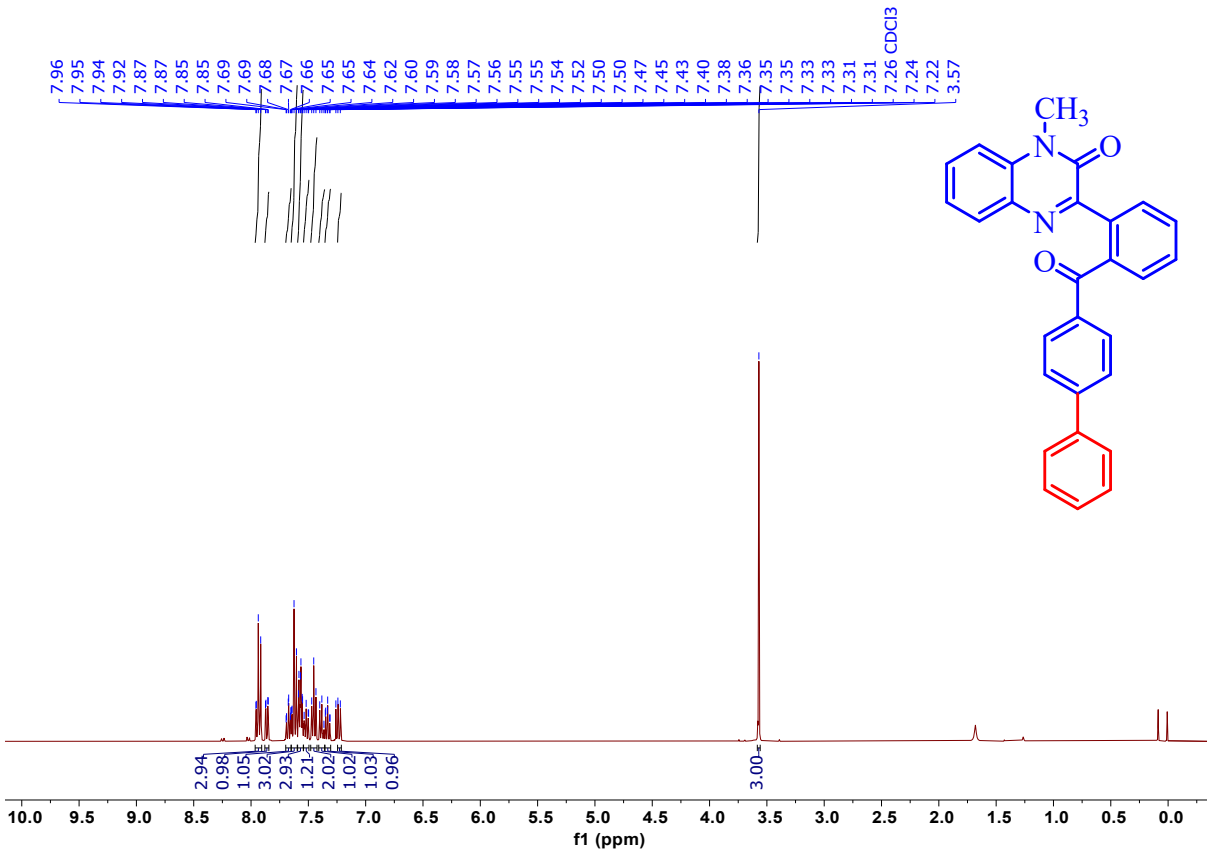


Figure 91: ^{1}H NMR spectrum of compound **18** (400 MHz, $CDCl_3$).

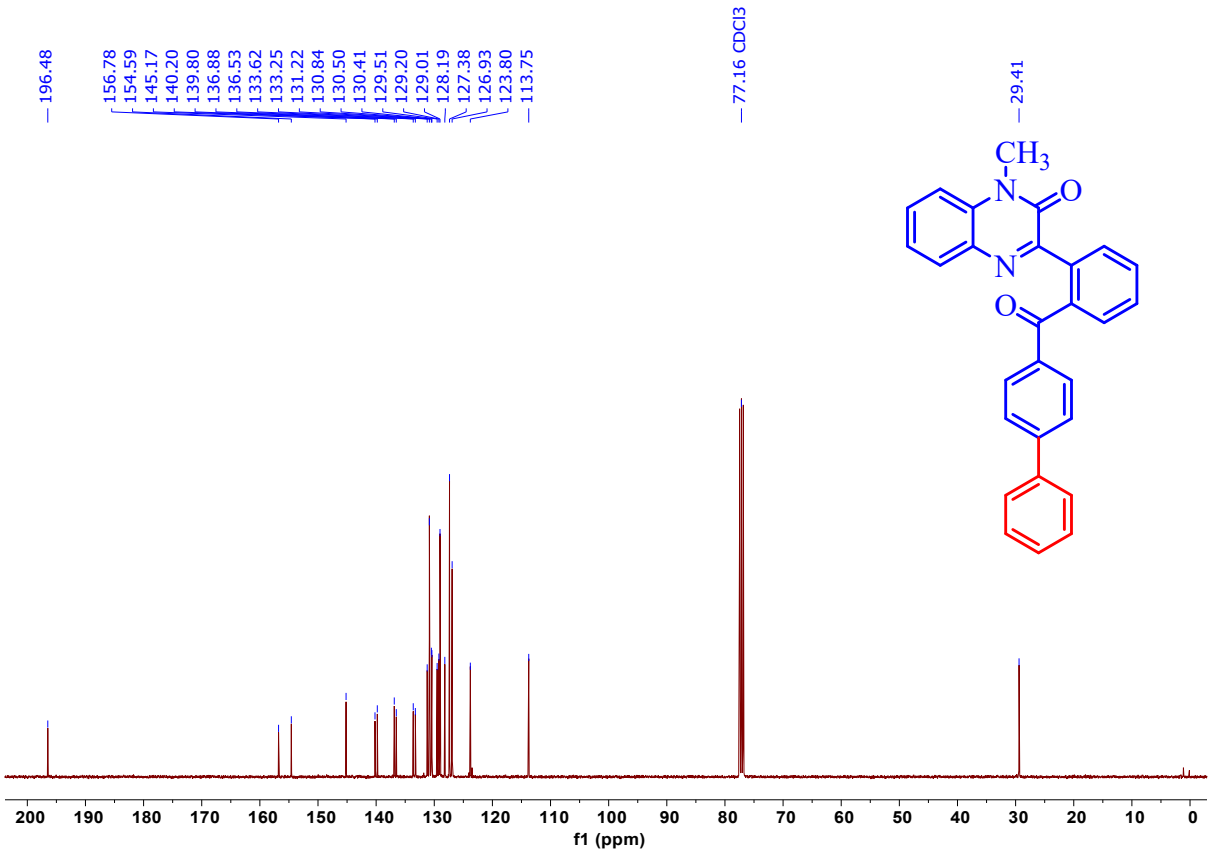


Figure 92: ^{13}C NMR spectrum of compound **18** (100 MHz, $CDCl_3$)

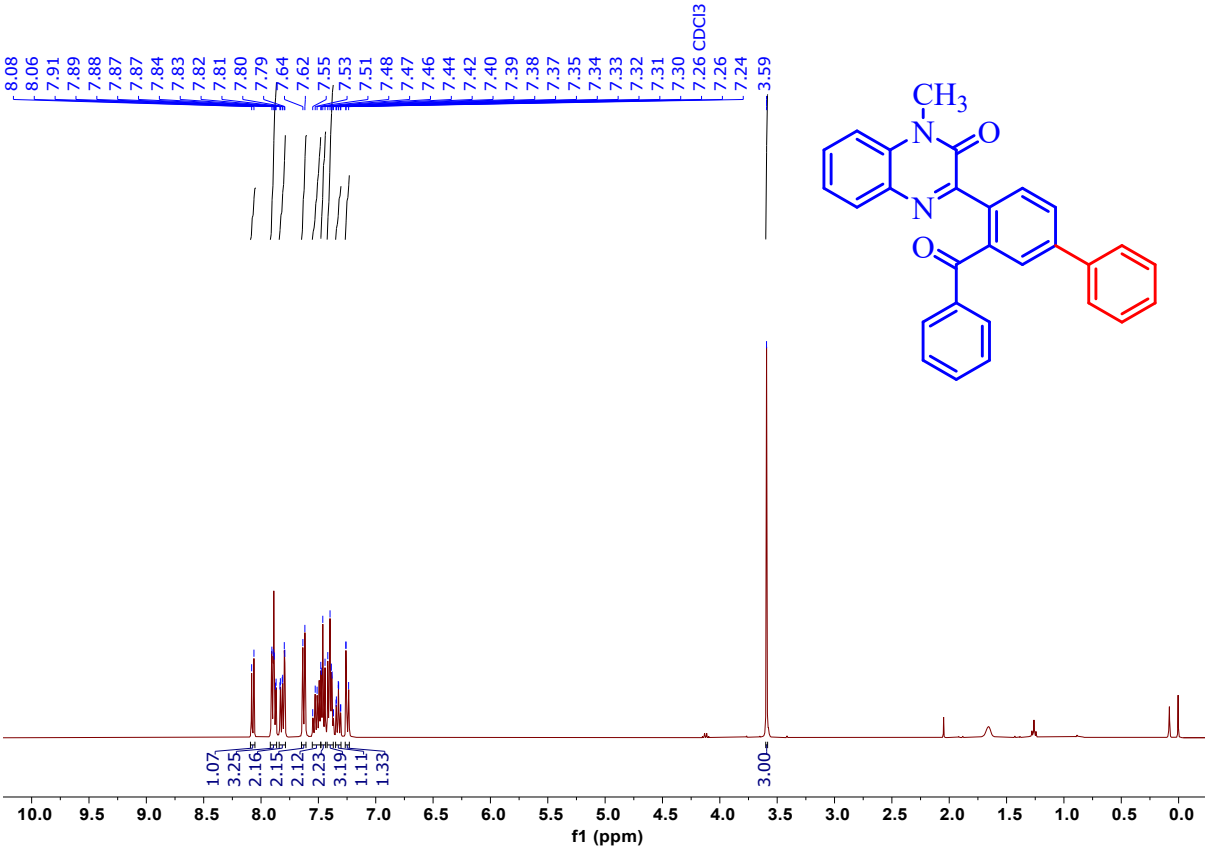


Figure 93: ^{1}H NMR spectrum of compound **19** (400 MHz, $CDCl_3$).

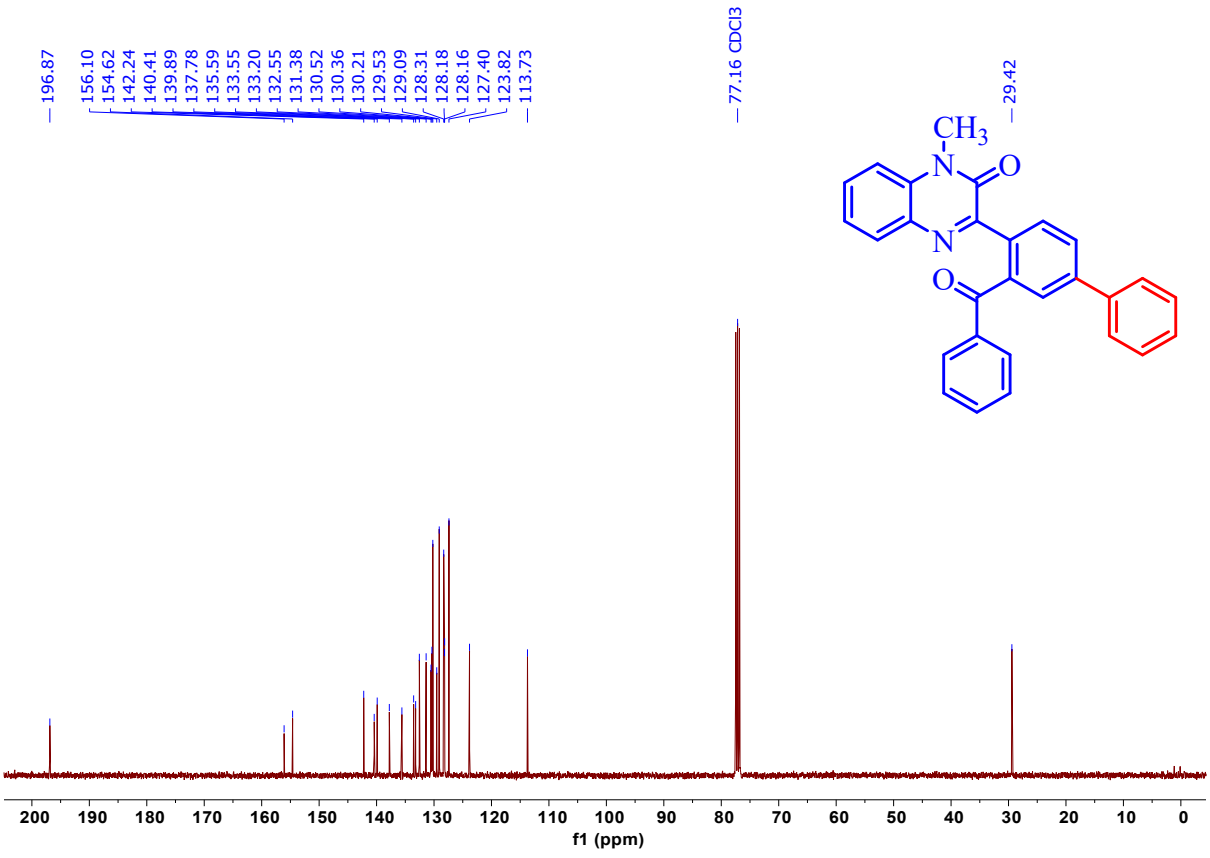


Figure 94: ^{13}C NMR spectrum of compound **19** (100 MHz, $CDCl_3$).