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Supporting Information

PPh_3-Mediated Cascade Reaction of 2-Alkynylnitrobenzenes and 1,2-Diaminoarenes for the Construction of 2-Aryl-3-(2-aminoaryl)quinoxalines

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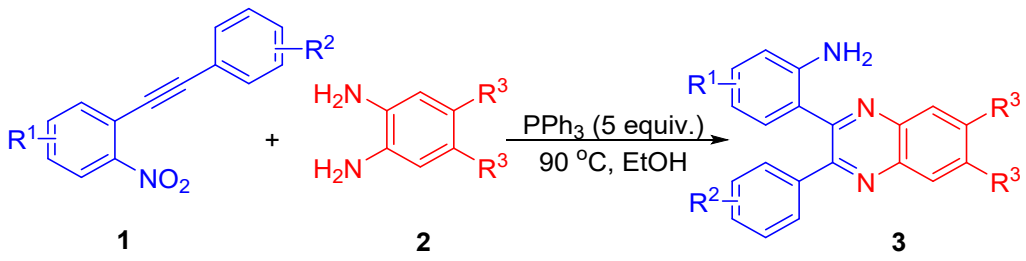
Table of Contents

General considerations

Unless specified, all reagents and starting materials were purchased from commercial sources and used as received. Solvents were purified following standard literature procedures. Analytical thin layer chromatography (TLC) was performed using pre-coated silica gel plate. Visualization was achieved by UV light (254 nm). Flash chromatography was performed using silica gel and a gradient solvent system (Ethyl acetate: Petrol ether as eluant). ^{1}H and ^{13}C NMR spectra were measured on 600 MHz spectrometers. Chemical shifts (ppm) were recorded with tetramethylsilane (TMS) as the internal reference standard. Multiplicities are given as: s (singlet), bs (broad singlet), d (doublet), t (triplet), dd (doublet of doublets) or m (multiplet). The number of protons (n) for a given resonance is indicated by nH and coupling constants are reported as a *J* value in Hz. All the starting materials **1** (1-nitro-2-(phenylethynyl)benzene) were prepared by reported methods[1].

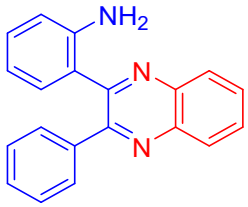
General experimental procedure for the synthesis of product 3



1 **2** **3**

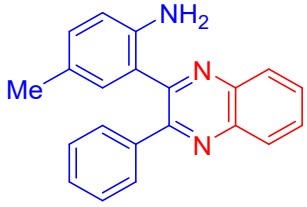
To a 10 mL of test tube was added **1** (0.1 mmol, 1 equiv.), **2** (0.2 mmol, 2 equiv.), PPh_3 (0.5 mmol, 5 equiv.) and EtOH (1 mL). The reaction solution was then stirred at 90 ℃ under N_2 and monitored by TLC analysis. On completion, the reaction mixture was directly subjected to purification by flash column chromatography on silica gel to give the desired product **3**. (eluent: petrol ether: ethyl acetate = 20:1 to 3:1).

Characterization data of product 3



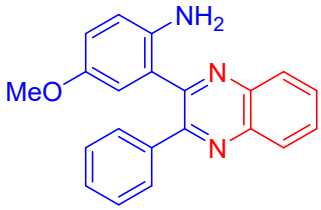
2-(3-Phenylquinoxalin-2-yl) aniline (3aa)

Known compound[2] ; isolated yield=98%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.22–8.15 (m, 1 H), 8.15–8.07 (m, 1 H), 7.81–7.73 (m, 2 H), 7.63–7.55 (m, 2 H), 7.39–7.28 (m, 3 H), 7.17–7.07 (m, 1 H), 6.86 (dd, *J* = 7.7, 1.5 Hz, 1 H), 6.80 (dd, *J* = 8.1, 1.1 Hz, 1 H), 6.59–6.50 (m, 1 H), 4.62 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.3, 152.9, 145.3, 141.0, 140.4, 138.9, 131.7, 129.9, 129.9, 129.5, 129.2, 128.8, 128.6, 128.2, 123.1, 118.0, 116.9.



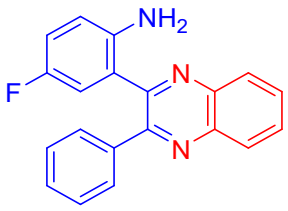
4-Methyl-2-(3-phenylquinoxalin-2-yl) aniline (3ba)

Known compound[2] ; isolated yield = 87%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.21–8.15 (m, 1 H), 8.15–8.08 (m, 1 H), 7.80–7.72 (m, 2 H), 7.62–7.57 (m, 2 H), 7.38–7.29 (m, 3 H), 6.94 (dd, *J* = 8.1, 2.1 Hz, 1 H), 6.73–6.67 (m, 2 H), 4.36 (s, 2 H), 2.03 (s, 3 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.2, 153.1, 142.7, 141.0, 140.5, 138.9, 131.9, 130.6, 129.9, 129.8, 129.4, 129.2, 128.8, 128.7, 128.1, 127.2, 123.4, 117.0, 20.2.



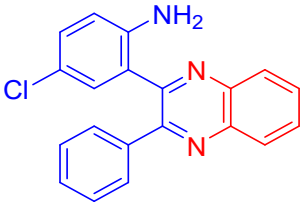
4-Methoxy-2-(3-phenylquinoxalin-2-yl) aniline (3ca)

Known compound[2] ; isolated yield = 98%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.18–8.11 (m, 1 H), 8.09–8.02 (m, 1 H), 7.77–7.69 (m, 2 H), 7.65–7.56 (m, 2 H), 7.43–7.32 (m, 3 H), 6.76 (d, *J* = 8.4 Hz, 1 H), 6.33 (d, *J* = 2.3 Hz, 1 H), 6.13–6.07 (m, 1 H), 4.91 (s, 2 H), 3.75 (s, 3 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 161.0, 154.3, 152.9, 147.2, 140.7, 140.3, 139.3, 133.5, 129.8, 129.6, 129.5, 129.2, 128.7, 128.4, 128.3, 115.8, 104.2, 101.7, 55.1.



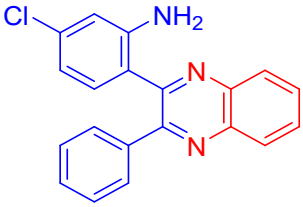
4-Fluoro-2-(3-phenylquinoxalin-2-yl) aniline (3da)

Known compound[2] ; isolated yield = 85%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.22–8.16 (m, 1 H), 8.16–8.08 (m, 1 H), 7.83–7.75 (m, 2 H), 7.59 (dd, *J* = 7.8, 1.8 Hz, 2 H), 7.40–7.31 (m, 3 H), 6.90–6.83 (m, 1 H), 6.73 (dd, *J*=8.9, 4.7 Hz, 1 H), 6.62 (dd, *J*=9.2, 2.9 Hz, 1 H), 4.41 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 155.6 (d, *J* = 236.7 Hz), 154.0, 151.7 (d, *J* = 1.5 Hz), 141.5, 141.2, 140.4, 138.4, 130.3, 130.1, 129.4, 129.3, 129.1, 128.7, 128.4, 124.2 (d, *J* = 7.6 Hz), 117.9 (d, *J* = 7.6 Hz), 117.6 (d, *J* = 23.5 Hz), 116.8 (d, *J* = 23.1 Hz). ^{19}F NMR (565 MHz, $CDCl_3$) δ -126.7.



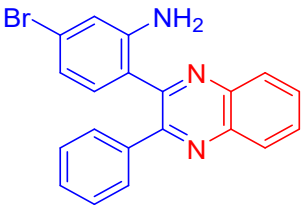
4-Chloro-2-(3-phenylquinoxalin-2-yl) aniline (3ea)

Known compound[2] ; isolated yield = 77%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.21–8.15 (m, 1 H), 8.13–8.07 (m, 1 H), 7.83–7.74 (m, 2 H), 7.62–7.53 (m, 2 H), 7.42–7.32 (m, 3 H), 7.08 (dd, *J* = 8.6, 2.4 Hz, 1 H), 6.88 (d, *J* = 2.4 Hz, 1 H), 6.70 (d, *J* = 8.6 Hz, 1 H), 4.53 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.0, 151.5, 143.9, 141.2, 140.4, 138.3, 131.1, 130.3, 130.1, 129.8, 129.4, 129.3, 129.1, 128.6, 128.4, 124.4, 122.6, 118.0.



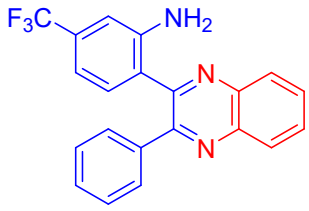
5-Chloro-2-(3-phenylquinoxalin-2-yl) aniline (3fa)

Known compound[2] ; isolated yield = 87%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20–8.13 (m, 1 H), 8.11–8.05 (m, 1 H), 7.81–7.74 (m, 2 H), 7.61–7.52 (m, 2 H), 7.40–7.31 (m, 3 H), 6.80 (d, *J* = 2.0 Hz, 1 H), 6.77 (d, *J* = 8.3 Hz, 1 H), 6.50 (dd, *J* = 8.3, 2.0 Hz, 1 H), 4.82 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.1, 151.9, 146.7, 141.0, 140.2, 138.7, 135.5, 133.0, 130.2, 130.1, 129.5, 129.3, 129.0, 128.5, 128.4, 121.2, 117.9, 116.5.



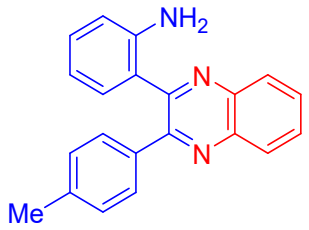
5-Bromo-2-(3-phenylquinoxalin-2-yl) aniline (3ga)

Unknown compound ; isolated yield = 98%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20–8.15 (m, 1 H), 8.11–8.05 (m, 1 H), 7.82–7.72 (m, 2 H), 7.61–7.54 (m, 2 H), 7.42–7.31 (m, 3 H), 6.97 (d, *J* = 1.8 Hz, 1 H), 6.70 (d, *J* = 8.2 Hz, 1 H), 6.67–6.62 (m, 1 H), 4.80 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.0, 151.9, 146.8, 141.0, 140.2, 138.7, 133.1, 130.2, 130.1, 129.5, 129.3, 129.0, 128.5, 128.4, 123.7, 121.6, 120.7, 119.4.



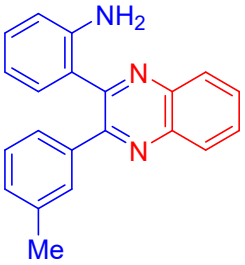
2-(3-Phenylquinoxalin-2-yl)-5-(trifluoromethyl)aniline (3ha)

Unknown compound ; isolated yield = 80%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.24–8.17 (m, 1 H), 8.16–8.07 (m, 1 H), 7.88–7.75 (m, 2 H), 7.60–7.53 (m, 2 H), 7.40–7.32 (m, 3 H), 7.04 (d, *J* = 1.7 Hz, 1 H), 6.96 (d, *J* = 8.0 Hz, 1 H), 6.78 (d, *J* = 8.1 Hz, 1 H), 4.83 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.1, 151.6, 145.7, 141.3, 140.3, 138.4, 132.2, 131.8 (d, *J* = 32.1 Hz), 130.5, 130.3, 129.5, 129.4, 129.2, 128.7, 128.4, 125.9, 123.9 (d, *J* = 272.2 Hz), 114.2 (q, *J* = 3.8 Hz), 113.4 (q, *J* = 3.4 Hz). ^{19}F NMR (565 MHz, $CDCl_3$) δ -63.1.



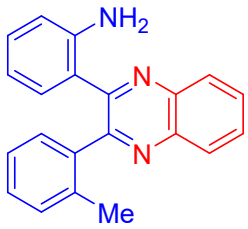
2-(3-(P-tolyl) quinoxalin-2-yl) aniline (3ia)

Known compound[2] ; isolated yield = 96%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.21–8.13 (m, 1 H), 8.13–8.06 (m, 1 H), 7.79–7.70 (m, 2 H), 7.50 (d, *J* = 8.2 Hz, 2 H), 7.17–7.10 (m, 3 H), 6.90 (dd, *J* = 7.7, 1.5 Hz, 1 H), 6.80 (dd, *J* = 8.0, 1.1 Hz, 1 H), 6.62–6.55 (m, 1 H), 4.59 (s, 2 H), 2.35 (s, 3 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.2, 152.9, 145.2, 141.1, 140.3, 138.9, 136.0, 131.6, 129.8, 129.8, 129.7, 129.4, 129.2, 128.9, 128.6, 123.4, 118.0, 116.9, 21.3.



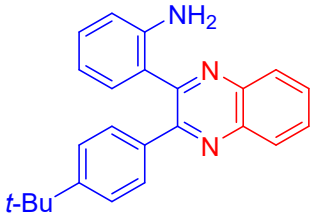
2-(3-(M-tolyl) quinoxalin-2-yl) aniline (3ja)

Known compound[2] ; isolated yield = 97%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.21–8.16 (m, 1 H), 8.13–8.09 (m, 1 H), 7.80–7.72 (m, 2 H), 7.50 (s, 1 H), 7.28 (d, *J* = 6.9 Hz, 1 H), 7.20–7.09 (m, 3 H), 6.90–6.85 (m, 1 H), 6.80 (d, *J* = 7.0 Hz, 1 H), 6.60–6.52 (m, 1 H), 4.61 (s, 2 H), 2.34 (s, 3 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.4, 153.0, 145.3, 141.0, 140.3, 138.7, 137.9, 131.7, 130.1, 129.9, 129.9, 129.8, 129.6, 129.2, 128.6, 127.9, 126.7, 123.2, 117.9, 116.8, 21.4.



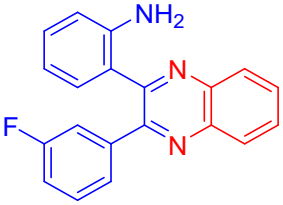
2-(3-(O-tolyl)quinoxalin-2-yl)aniline (3ka)

Known compound[2] ; isolated yield = 40%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20–8.15 (m, 1 H), 8.15–8.08 (m, 1 H), 7.83–7.76 (m, 2 H), 7.39–7.35 (m, 1 H), 7.29–7.20 (m, 2 H), 7.15 (d, *J* = 6.5 Hz, 1 H), 7.09–7.03 (m, 1 H), 6.80–6.71 (m, 2 H), 6.47–6.35 (m, 1 H), 4.93 (s, 2 H), 2.09 (s, 3 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 155.5, 153.6, 145.9, 140.6, 140.3, 138.9, 136.1, 131.3, 130.4, 130.0, 130.0, 129.9, 129.2, 128.6, 128.6, 125.9, 122.0, 117.4, 116.9, 19.4.



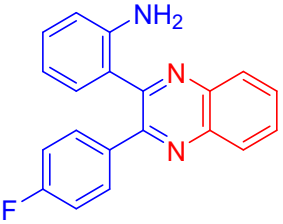
2-(3-(4-(*Tert*-butyl) phenyl) quinoxalin-2-yl) aniline (3la)

Known compound[2] ; isolated yield = 96%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20–8.13 (m, 1 H), 8.13–8.06 (m, 1 H), 7.79–7.70 (m, 2 H), 7.53 (d, *J* = 8.4 Hz, 2 H), 7.36–7.32 (m, 2 H), 7.17–7.10 (m, 1 H), 6.93–6.88 (m, 1 H), 6.84–6.79 (m, 1 H), 6.60–6.53 (m, 1 H), 4.62 (s, 2 H), 1.31 (s, 9 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 154.2, 152.9, 152.0, 145.3, 141.1, 140.3, 136.0, 131.8, 129.9, 129.7, 129.2, 129.2, 128.6, 125.2, 123.4, 118.0, 116.9, 34.6, 31.2.



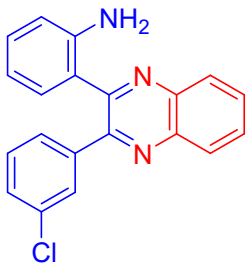
2-(3-(3-Fluorophenyl) quinoxalin-2-yl) aniline (3ma)

Known compound[2] ; isolated yield = 90%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.21–8.13 (m, 1 H), 8.16–8.07 (m, 1 H), 7.82–7.75 (m, 2 H), 7.40–7.35 (m, 1 H), 7.33–7.22 (m, 2 H), 7.19–7.10 (m, 1 H), 7.07–7.01 (m, 1 H), 6.91–6.79 (m, 2 H), 6.61–6.54 (m, 1 H), 4.63 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 162.6 (d, *J* = 246.3 Hz), 152.8, 152.8, 152.7, 145.3, 141.1 (d, *J* = 7.7 Hz), 140.9, 140.5, 131.6, 130.3, 130.1, 129.7 (d, *J* = 7.8 Hz), 129.2, 128.6, 125.4 (d, *J* = 3.0 Hz), 122.7, 118.1, 117.0, 116.5 (d, *J* = 23.2 Hz), 115.8 (d, *J* = 21.1 Hz). ^{19}F NMR (565 MHz, $CDCl_3$) δ -112.8.



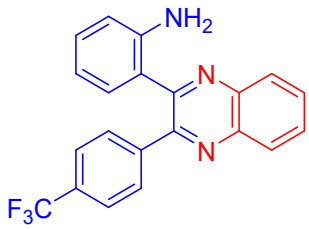
2-(3-(4-Fluorophenyl) quinoxalin-2-yl) aniline (3na)

Known compound[2] ; isolated yield = 97%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20–8.12 (m, 1 H), 8.13–8.06 (m, 1 H), 7.82–7.72 (m, 2 H), 7.61–7.54 (m, 2 H), 7.17–7.10 (m, 1 H), 7.05–6.97 (m, 2 H), 6.89–6.77 (m, 2 H), 6.61–6.55 (m, 1 H), 4.59 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 163.2 (d, *J* = 249.8 Hz), 153.1, 152.7, 145.3, 141.0, 140.4, 134.9 (d, *J* = 3.3 Hz), 131.5 (d, *J* = 8.9 Hz), 130.1, 130.0, 130.0, 129.1, 128.6, 123.0, 118.1, 117.0, 115.3 (d, *J* = 22.1 Hz). ^{19}F NMR (565 MHz, $CDCl_3$) δ -112.1.



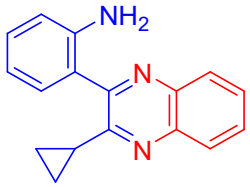
2-(3-(3-Chlorophenyl) quinoxalin-2-yl) aniline (3oa)

Known compound[2] ; isolated yield = 82%; yellow solid;^{1}H NMR (600 MHz, $CDCl_3$) δ 8.19–8.16 (m, 1 H), 8.12–8.10 (m, 1 H), 7.80–7.78 (m, 2 H), 7.71 (t, 1 H), 7.36–7.30 (m, 2 H), 7.20 (t, *J*=7.9 Hz, 1 H), 7.17–7.12 (m, 1 H), 6.86–6.80 (m, 2 H), 6.60–6.56 (m, 1 H), 4.63 (s, 2 H).^{13}C NMR (151 MHz, $CDCl_3$) δ 152.7, 145.3, 140.9, 140.6, 140.5, 134.3, 131.6, 130.3, 130.2, 129.5, 129.3, 128.9, 128.6, 127.8, 122.6, 118.1, 117.0.



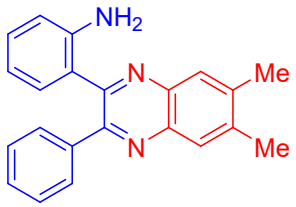
2-(3-(4-(Trifluoromethyl) phenyl) quinoxalin-2-yl) aniline (3pa)

Known compound[2] ; isolated yield = 92%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.21–8.14 (m, 1 H), 8.15–8.09 (m, 1 H), 7.85–7.77 (m, 2 H), 7.72 (d, *J* = 8.1 Hz, 2 H), 7.59 (d, *J* = 8.1 Hz, 2 H), 7.19–7.11 (m, 1 H), 6.85–6.78 (m, 2 H), 6.60–6.53 (m, 1 H), 4.66 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 152.7, 145.4, 142.5, 140.9, 140.6, 131.7, 130.5, 130.3, 129.9, 129.3, 128.7, 125.1 (q, *J* = 4.4 Hz), 124.9, 123.1, 122.5, 118.2, 117.0. ^{19}F NMR (565 MHz, $CDCl_3$) δ -62.6.



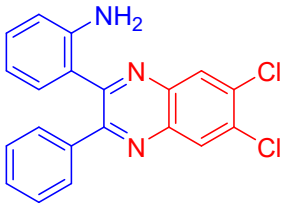
2-(3-Cyclopropylquinoxalin-2-yl) aniline (3qa)

Known compound[2] ; isolated yield = 97%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.03 (dd, *J* = 8.3, 1.5 Hz, 1 H), 7.96 (dd, *J* = 8.4, 1.4 Hz, 1 H), 7.73–7.65 (m, 1 H), 7.68–7.61 (m, 1H), 7.44 (dd, *J* = 7.6, 1.6 Hz, 1 H), 7.29–7.22 (m, 1 H), 6.92–6.85 (m, 2 H), 4.36 (s, 2 H), 2.35–2.28 (m, 1 H), 1.42–1.33 (m, 2 H), 1.11–1.00 (m, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 157.8, 153.3, 145.3, 141.3, 139.8, 130.8, 130.0, 129.5, 128.7, 128.5, 128.4, 122.9, 118.1, 116.9, 15.1, 12.1.



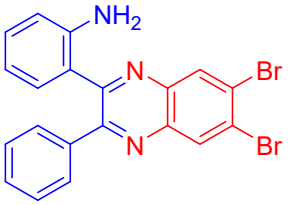
2-(6,7-Dimethyl-3-phenylquinoxalin-2-yl) aniline (3ab)

Known compound[2] ; isolated yield = 97%; yellow solid;^{1}H NMR (600 MHz, $CDCl_3$) δ 7.93 (s, 1 H), 7.85 (s, 1H), 7.62–7.48 (m, 2 H), 7.35–7.26 (m, 3 H), 7.13–7.07 (m, 1 H), 6.85 (dd, *J*=7.7, 1.5 Hz, 1 H), 6.79 (d, *J*=8.0 Hz, 1 H), 6.57–6.51 (m, 1 H), 4.58 (s, 2 H), 2.51 (d, *J*=4.7 Hz, 6 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 153.2, 151.8, 145.2, 140.5, 140.5, 140.0, 139.4, 139.2, 131.7, 129.6, 129.5, 128.5, 128.2, 128.1, 127.6, 123.5, 117.9, 116.8, 20.3.



2-(6,7-Dichloro-3-phenylquinoxalin-2-yl) aniline (3ac)

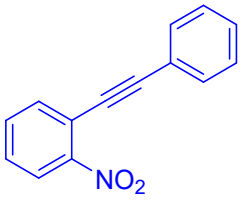
Known compound[2] ; isolated yield = 99%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.27 (s, 1 H), 8.20 (s, 1 H), 7.59–7.53 (m, 2 H), 7.39–7.30 (m, 3 H), 7.18–7.08 (m, 1 H), 6.88–6.75 (m, 2 H), 6.57–6.51 (m, 1 H), 4.66 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 155.3, 154.1, 145.4, 139.7, 139.0, 138.3, 134.4, 131.8, 130.4, 129.8, 129.5, 129.3, 129.1, 128.3, 122.3, 118.0, 117.1.



2-(6,7-Dibromo-3-phenylquinoxalin-2-yl) aniline (3ad)

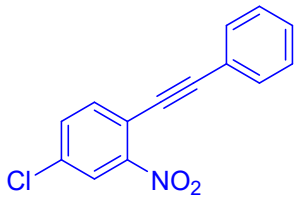
Known compound[2] ; isolated yield = 85%; yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.47 (s, 1 H), 8.40 (s, 1 H), 7.59–7.51 (m, 2 H), 7.40–7.29 (m, 3 H), 7.17–7.10 (m, 1 H), 6.86–6.78 (m, 2 H), 6.58–6.50 (m, 1 H), 4.67 (s, 2 H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 155.4, 154.3, 145.5, 140.2, 139.5, 138.3, 133.3, 132.6, 131.8, 130.4, 129.5, 129.3, 128.3, 126.4, 126.4, 122.3, 118.0, 117.1.

Characterization data of product 1



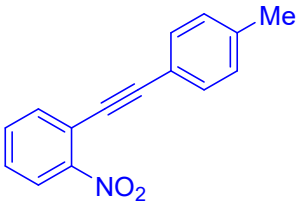
1-Nitro-2-(phenylethynyl)benzene (1a)

Known compound[3] ; isolated yield = 90%; yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 8.3 Hz, 1 H), 7.72 (d, *J* = 7.7 Hz, 1 H), 7.60 (s, 3 H), 7.46 (t, *J* = 7.8 Hz, 1 H), 7.39 (s, 3 H).



4-Chloro-2-nitro-1-(phenylethynyl)benzene (1f)

Known compound[3] ; isolated yield = 85%; yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (s, 1 H), 7.65 (d, *J* = 10.7 Hz, 1 H), 7.57 (d, *J* = 8.3 Hz, 3 H), 7.39 (s, 3 H).



1-Nitro-2-(p-tolylethynyl)benzene (1i)

Known compound[3] ; isolated yield = 88%; yellow solid; ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.12–8.04 (m, 1 H), 7.70 (d, *J* = 7.8 Hz, 1 H), 7.62–7.54 (m, 1 H), 7.53–7.40 (m, 3 H), 7.19 (d, *J* = 7.7 Hz, 2 H), 2.39 (s, 3 H).

Copy of ^{1}H ,^{13}C and ^{19}F NMR spectra of product 3

Figure 1. ^{1}H and ^{13}C NMR Spectra of **2-(3-phenylquinoxalin-2-yl) aniline (3aa)**

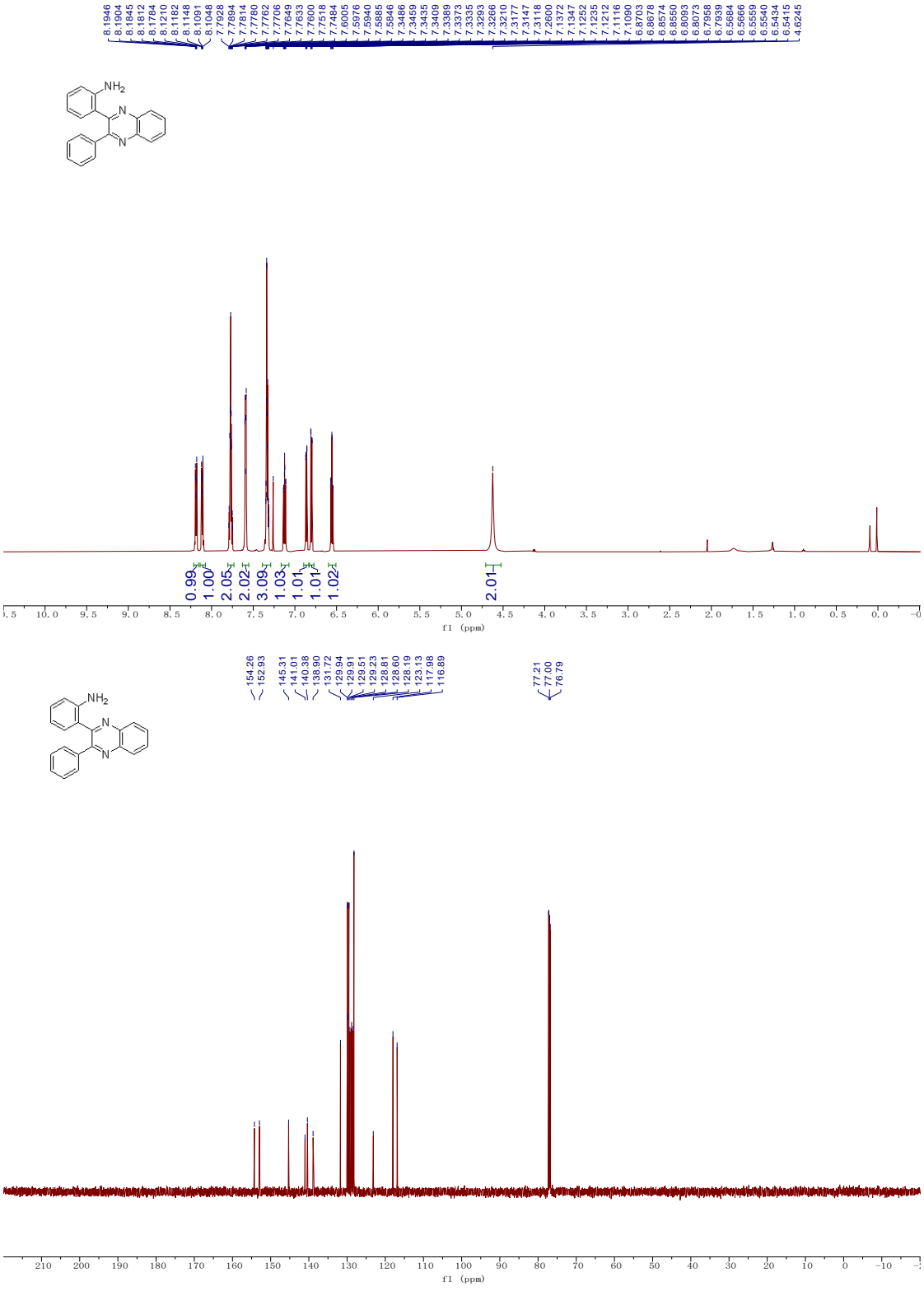


Figure 2. ^{1}H and ^{13}C NMR Spectra of **4-methyl-2-(3-phenylquinoxalin-2-yl) aniline (3ba)**

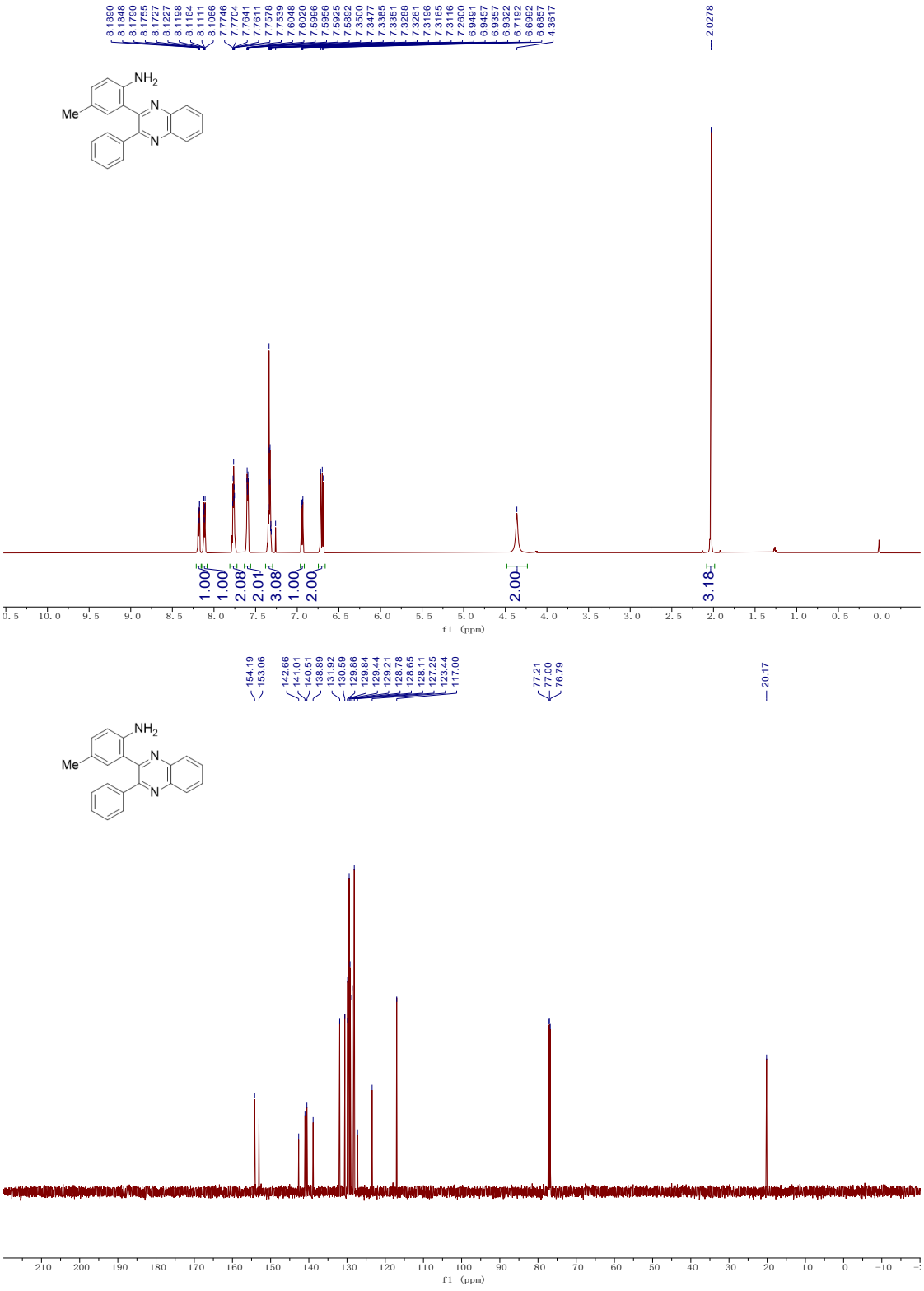


Figure 3. ^{1}H and ^{13}C NMR Spectra of **4-methoxy-2-(3-phenylquinoxalin-2-yl) aniline (3ca)**

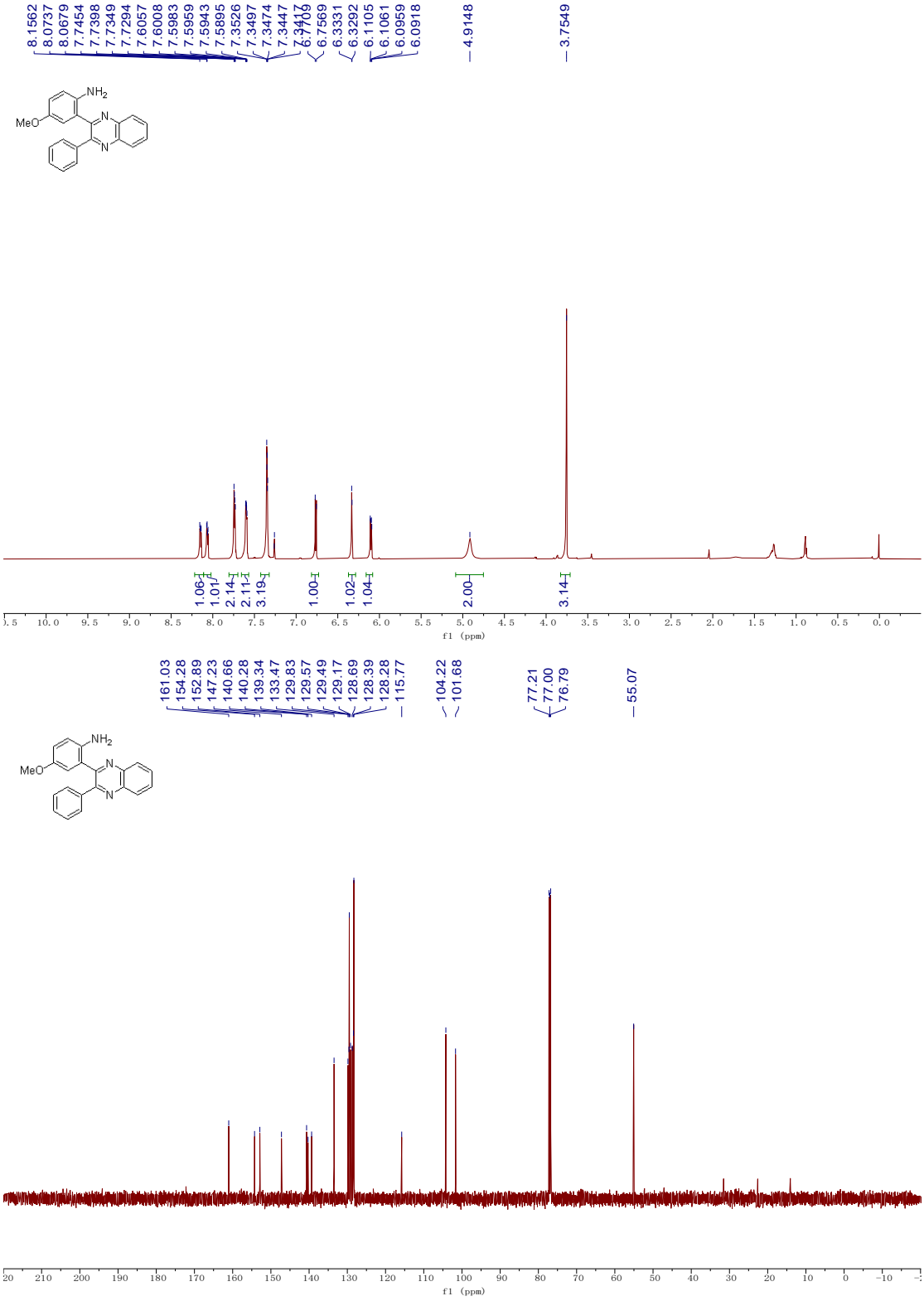
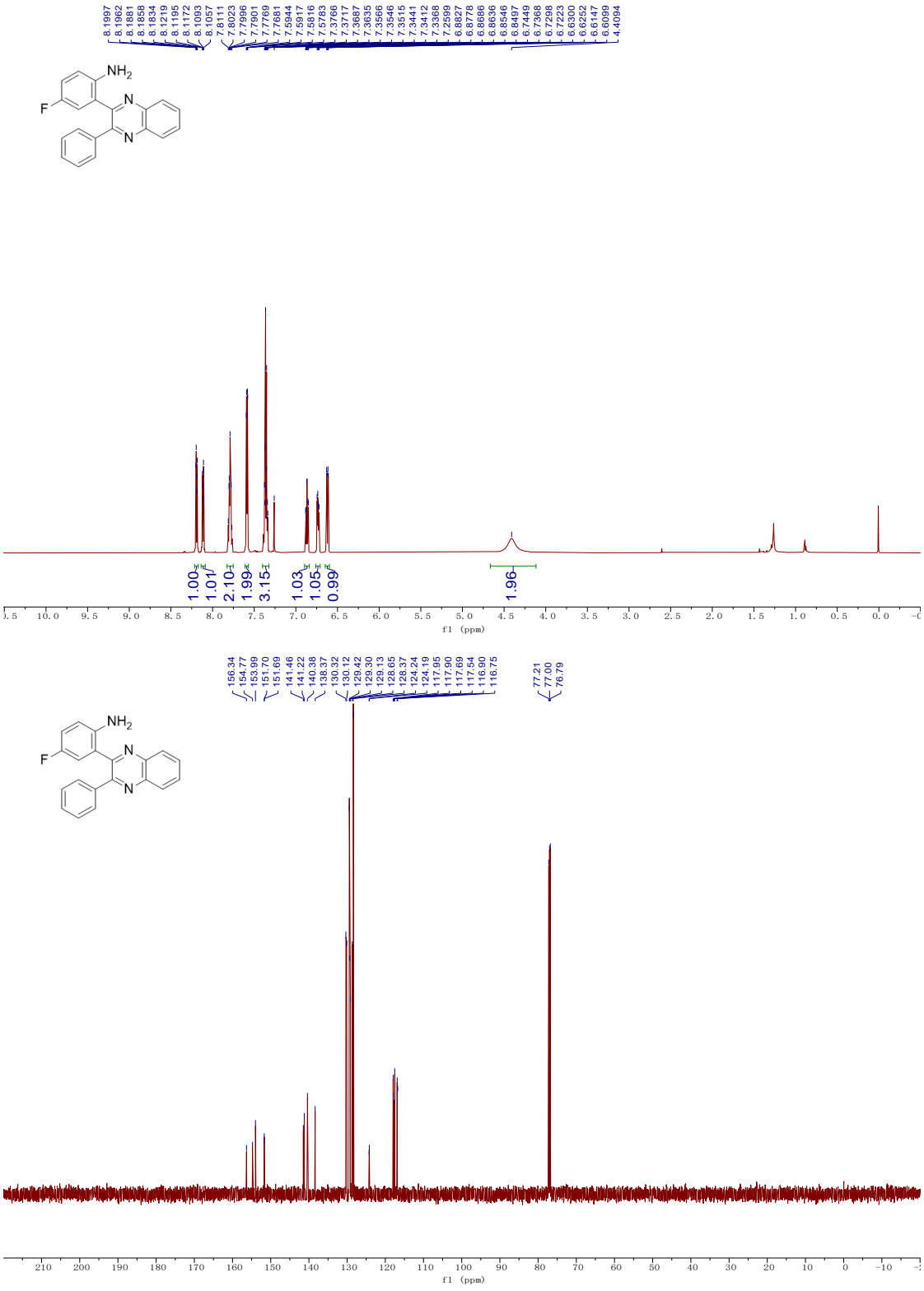
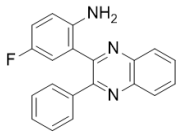


Figure 4. ^{1}H, ^{13}C and ^{19}F NMR Spectra of **4-fluoro-2-(3-phenylquinoxalin-2-yl) aniline (3da)**




NH2
F
N
N

-126.74
110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160
f1 (ppm)

Figure 5. ^{1}H and ^{13}C NMR Spectra of **4-chloro-2-(3-phenylquinoxalin-2-yl) aniline (3ea)**

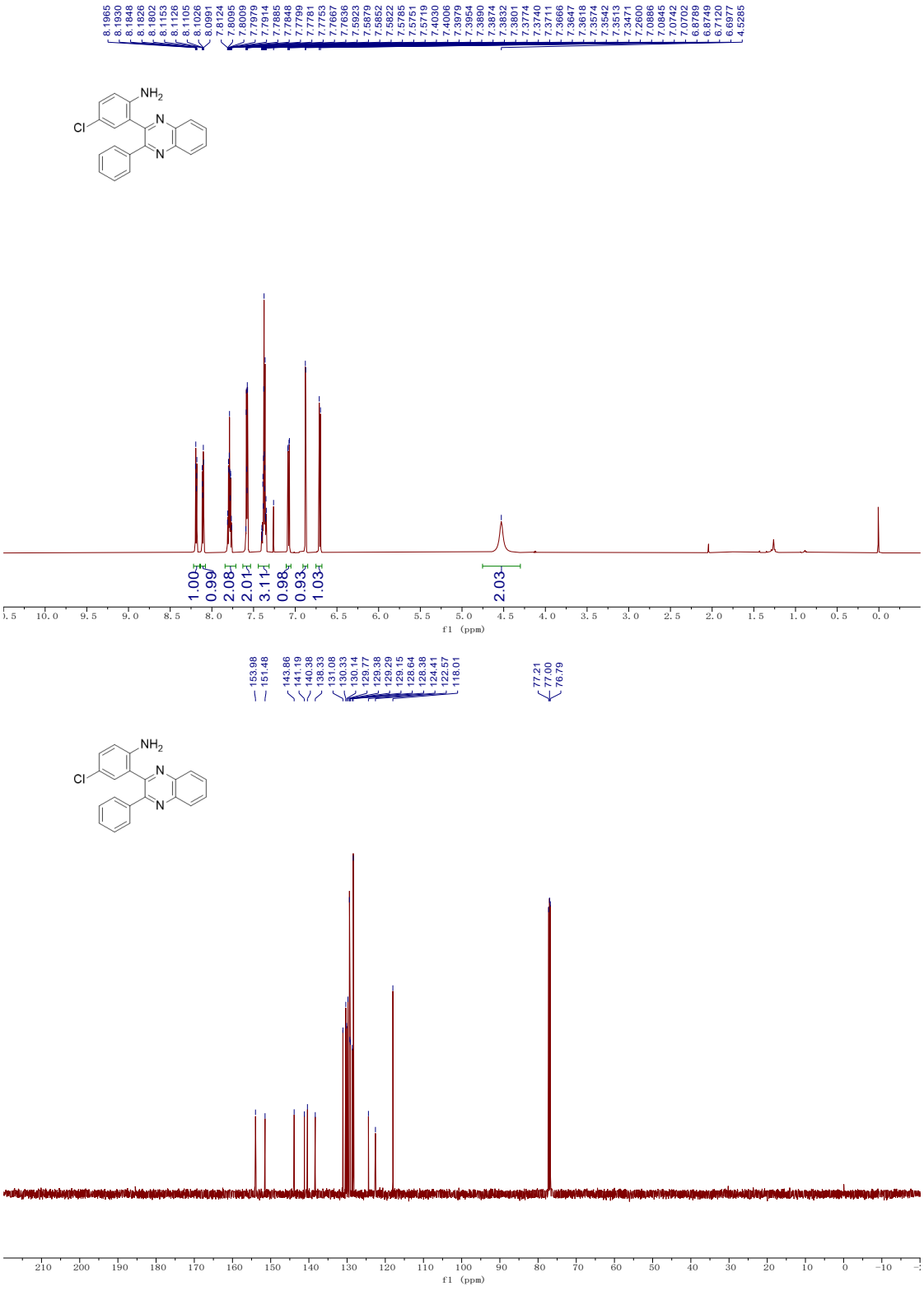


Figure 6. ^{1}H and ^{13}C NMR Spectra of **5-chloro-2-(3-phenylquinoxalin-2-yl) aniline (3fa)**

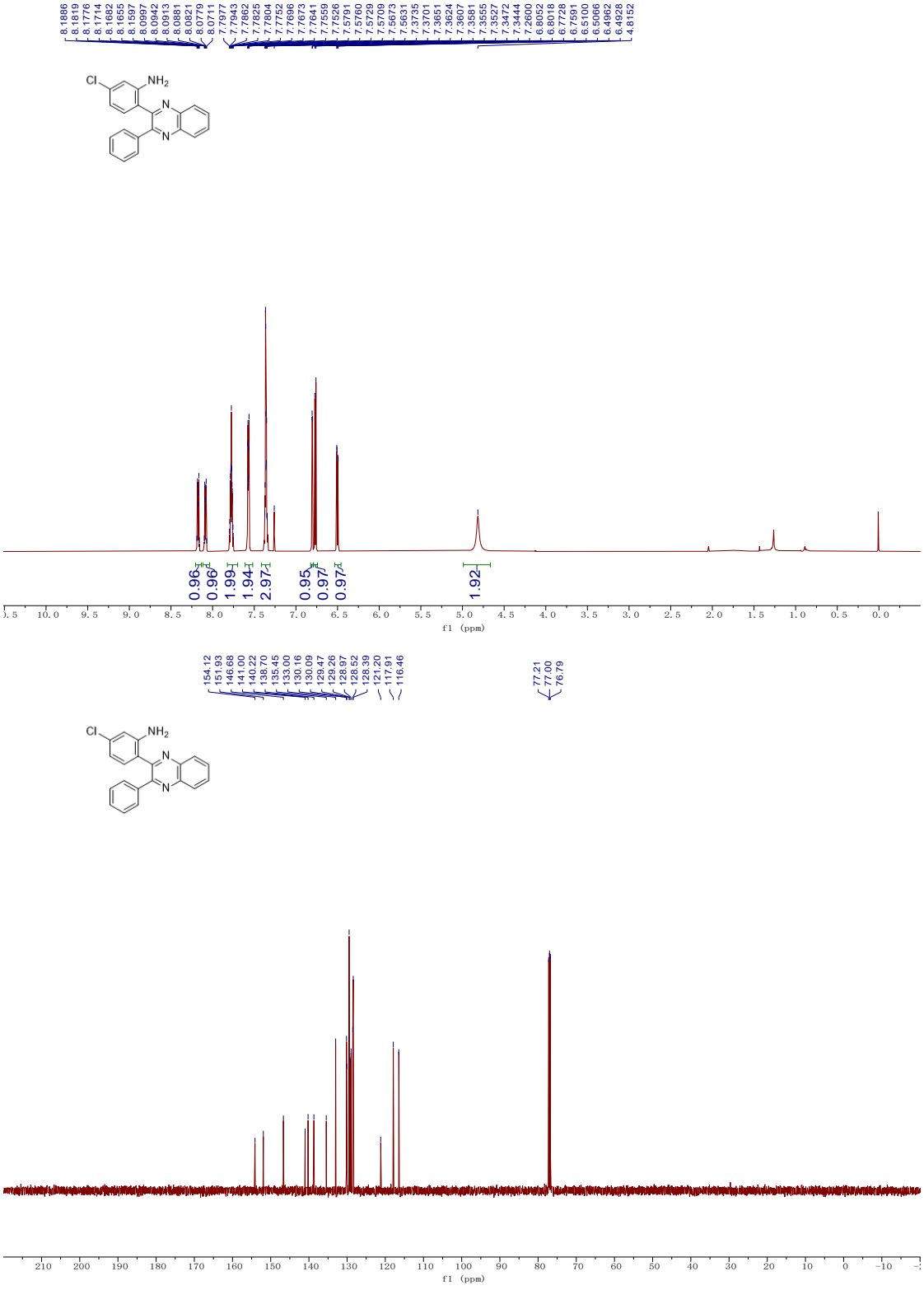


Figure 7. ^{1}H and ^{13}C NMR Spectra of **5-bromo-2-(3-phenylquinoxalin-2-yl) aniline (3ga)**

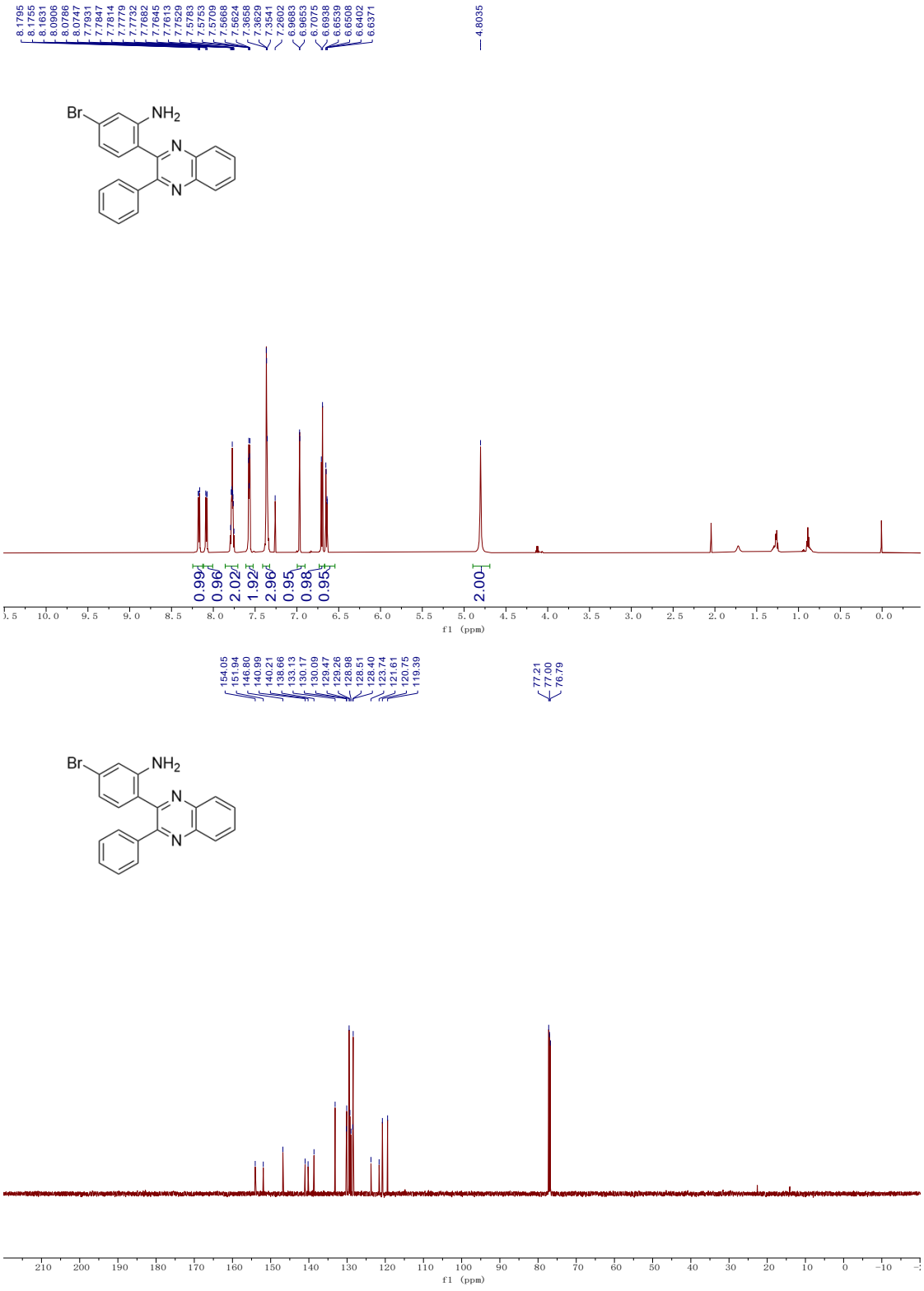
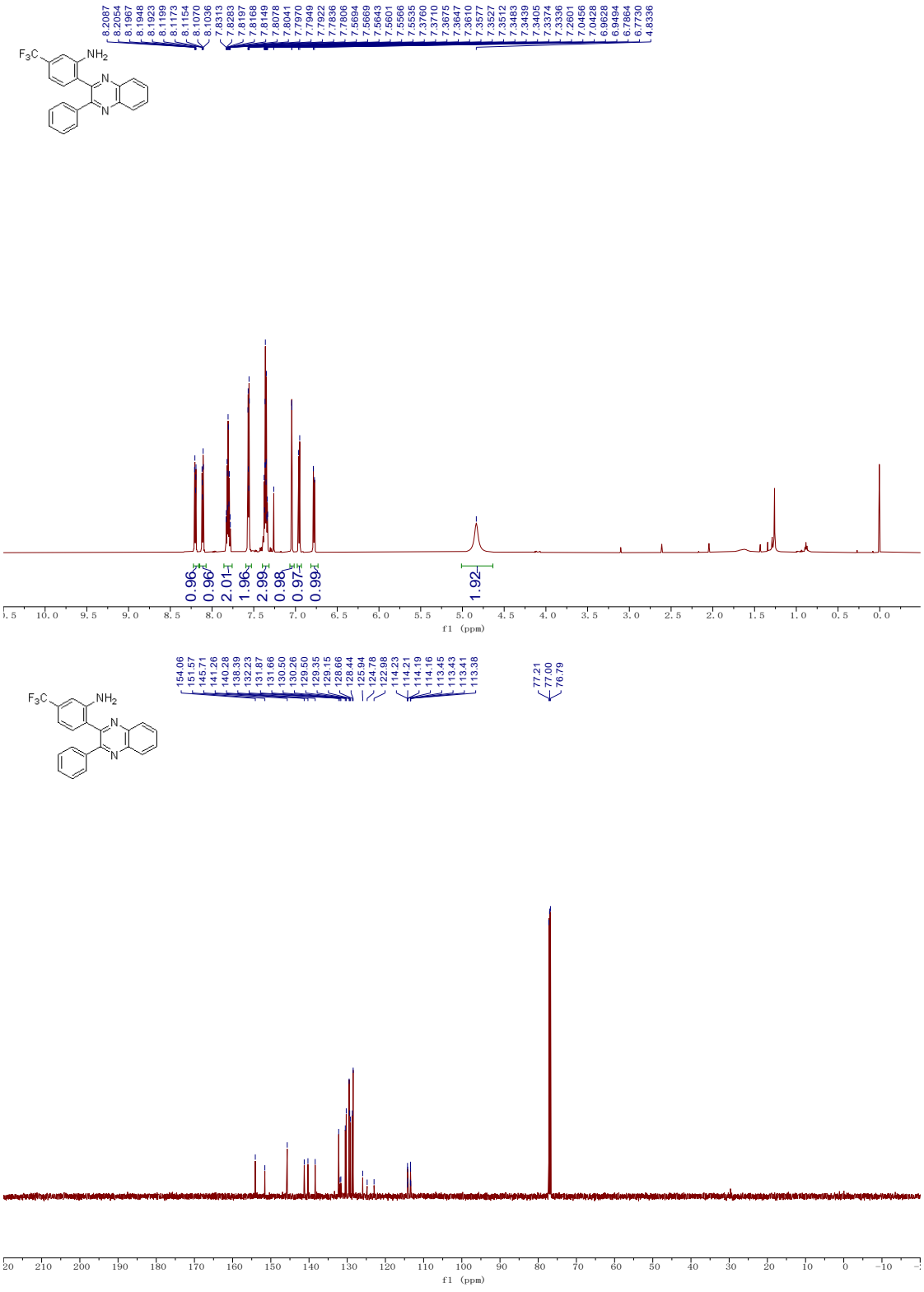


Figure 8. ^{1}H, ^{13}C NMR and ^{19}F Spectra of **2-(3-phenylquinoxalin-2-yl)-5-(trifluoromethyl)aniline (3ha)**



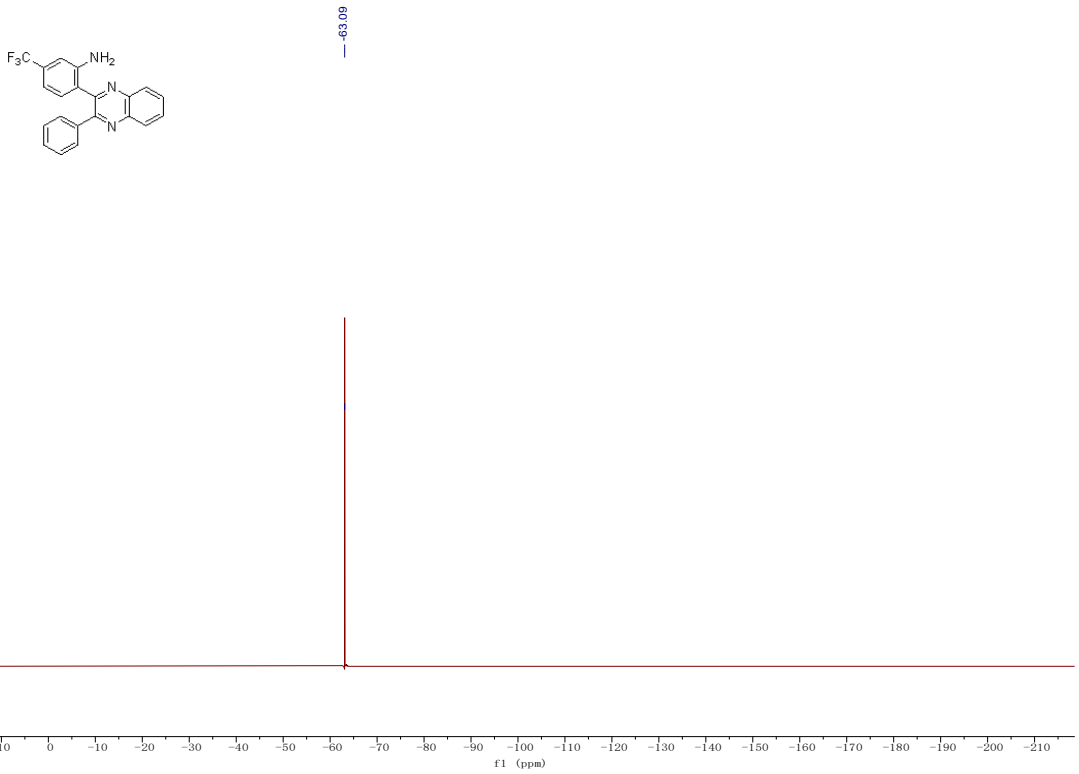

F3C
NH2
N
N
-63.09
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)

Figure 9. ^{1}H and ^{13}C NMR Spectra of **2-(3-(p-tolyl) quinoxalin-2-yl) aniline (3ia)**

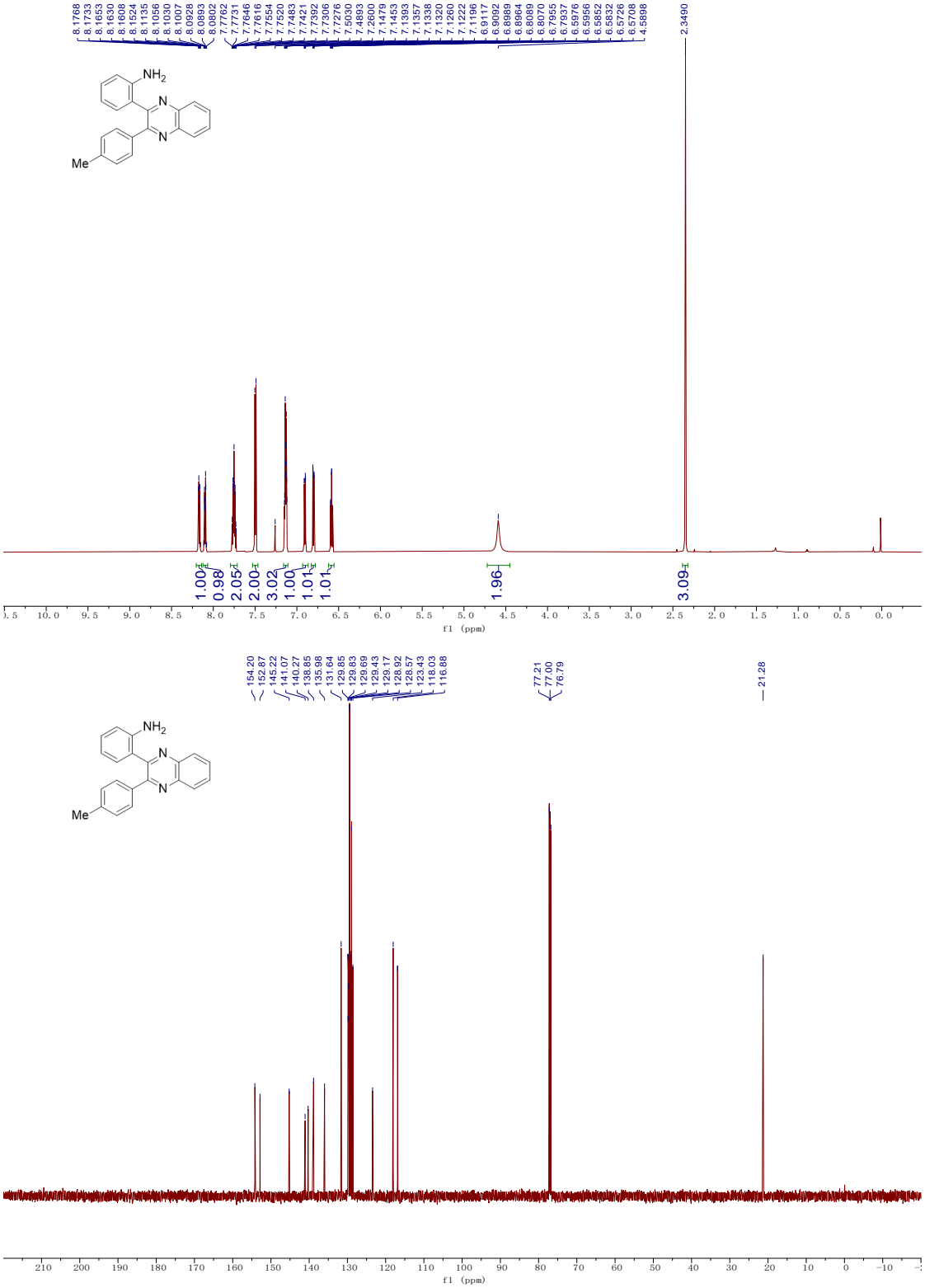


Figure 10. ^{1}H and ^{13}C NMR Spectra of **2-(3-(m-tolyl) quinoxalin-2-yl) aniline (3ja)**

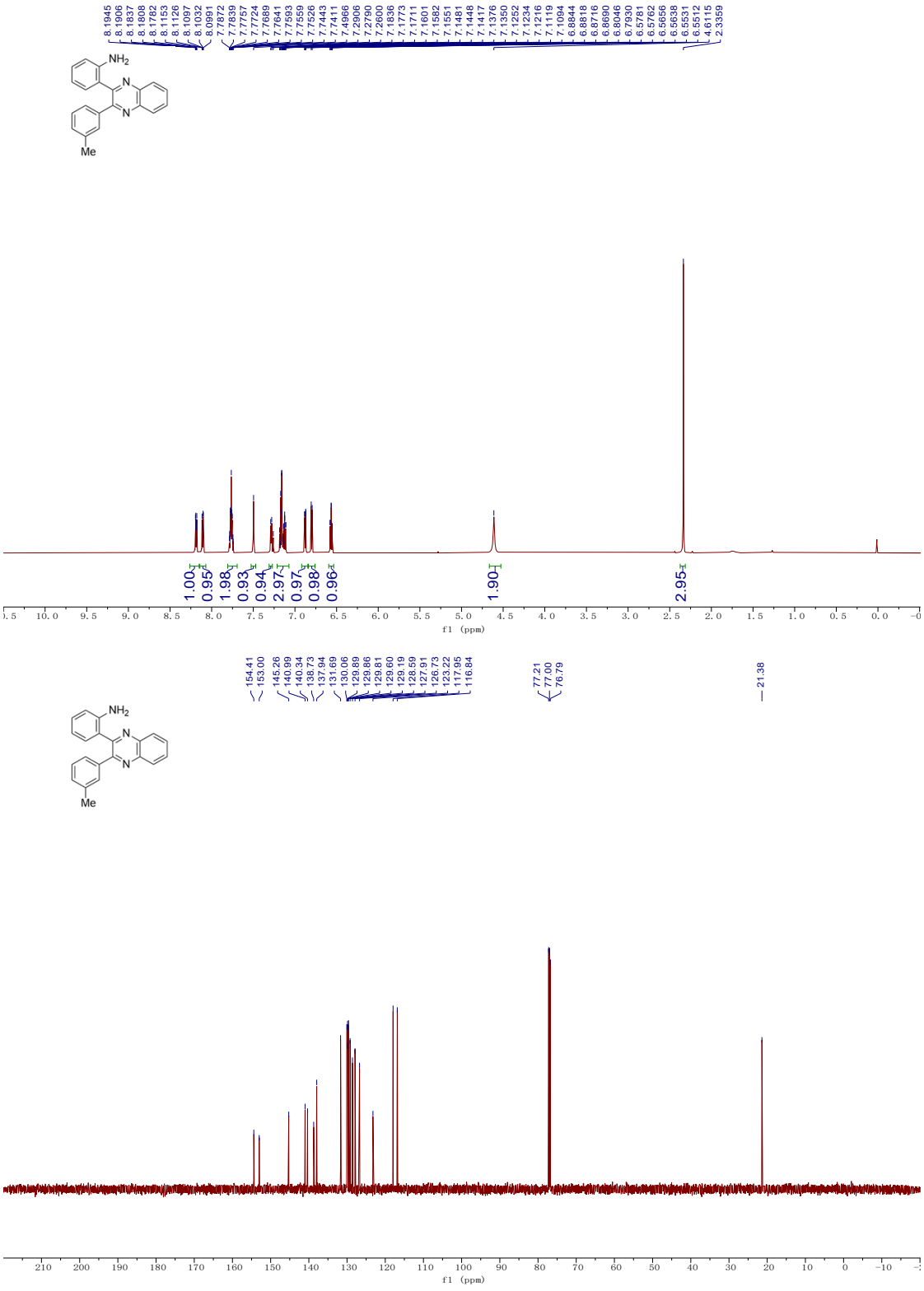


Figure 11. ^{1}H and ^{13}C NMR Spectra of **2-(3-(o-tolyl)quinoxalin-2-yl)aniline (3ka)**

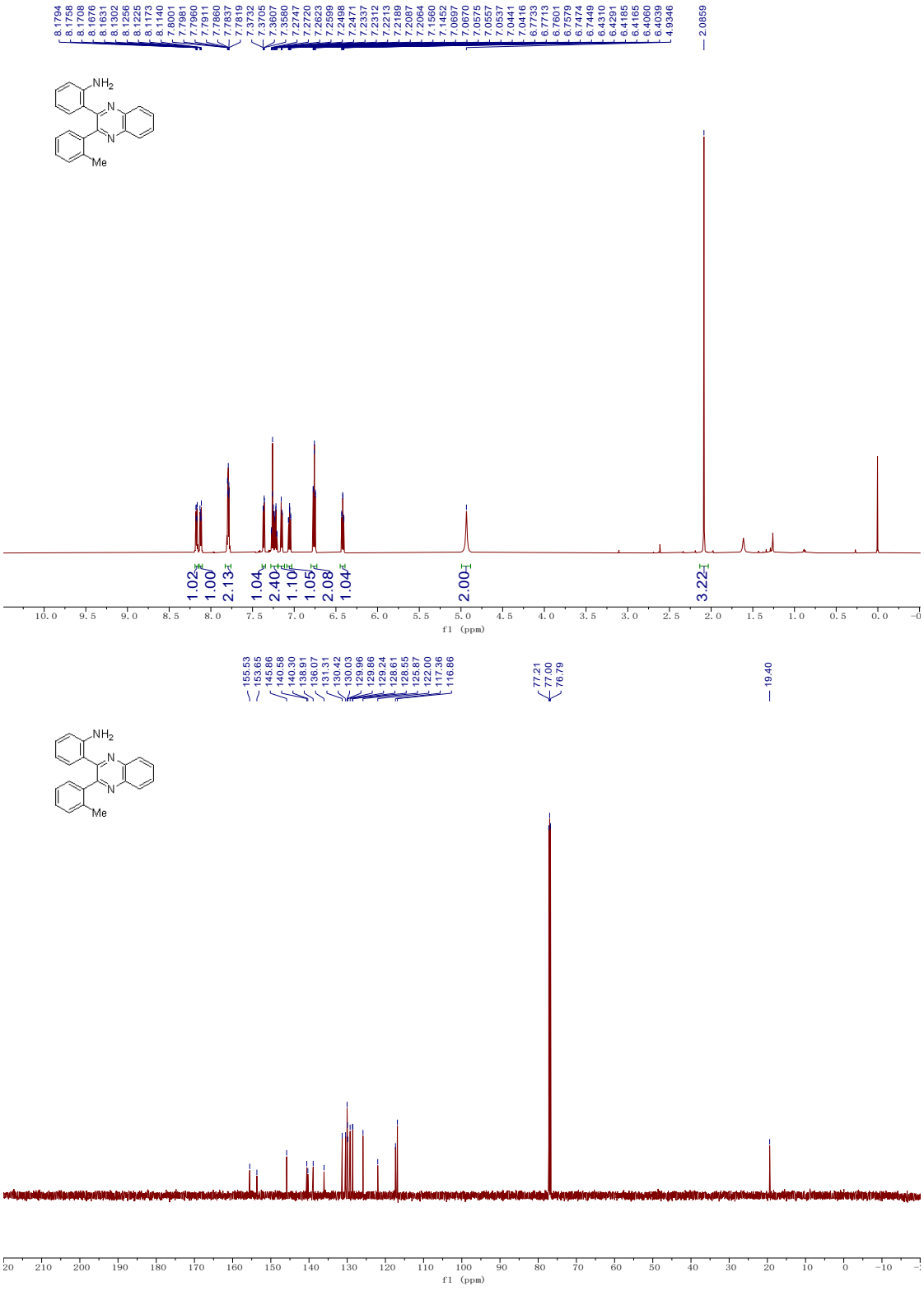


Figure 12. ^{1}H and ^{13}C NMR Spectra of **2-(3-(4-(*tert*-butyl) phenyl) quinoxalin-2-yl) aniline (3la)**

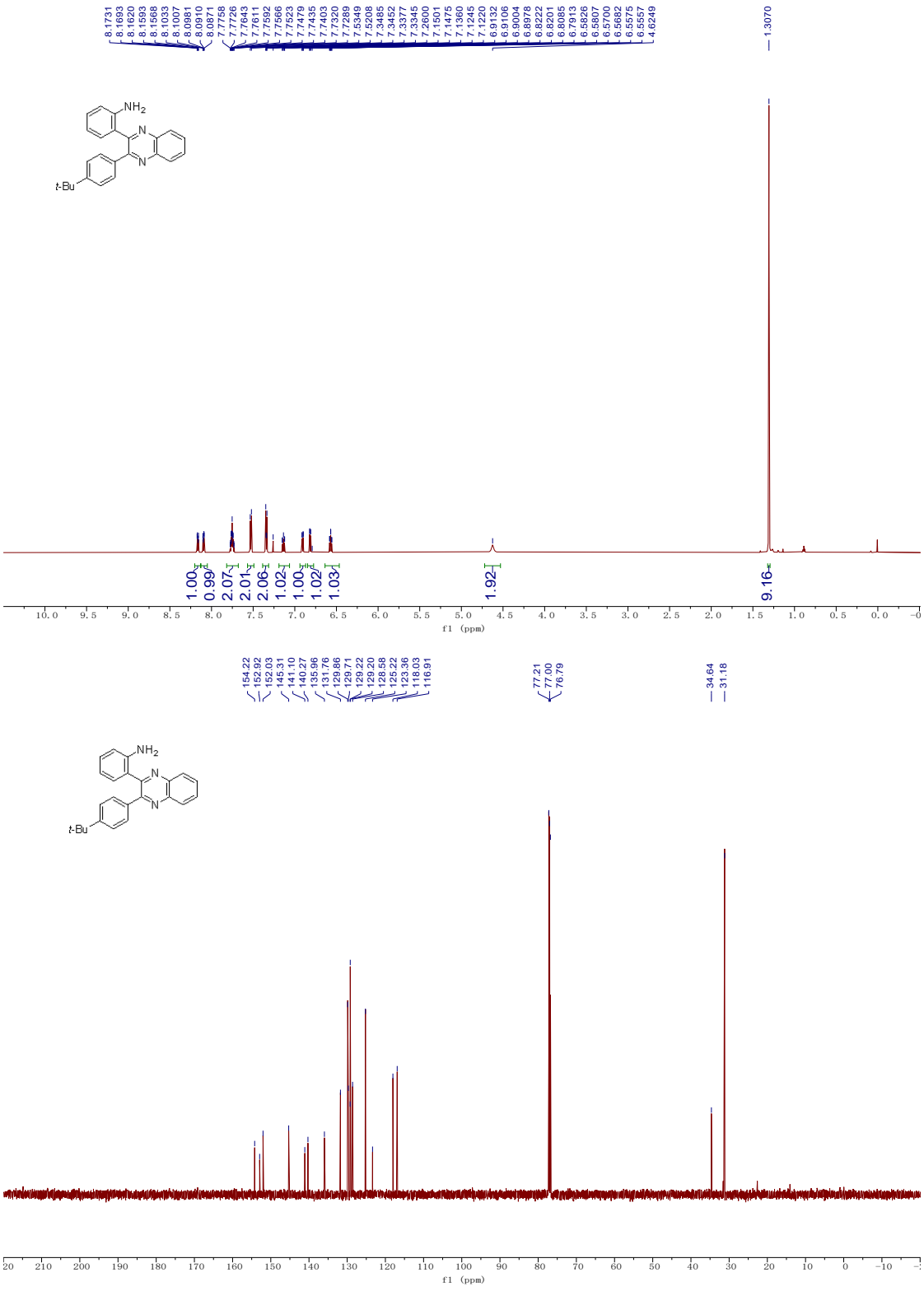
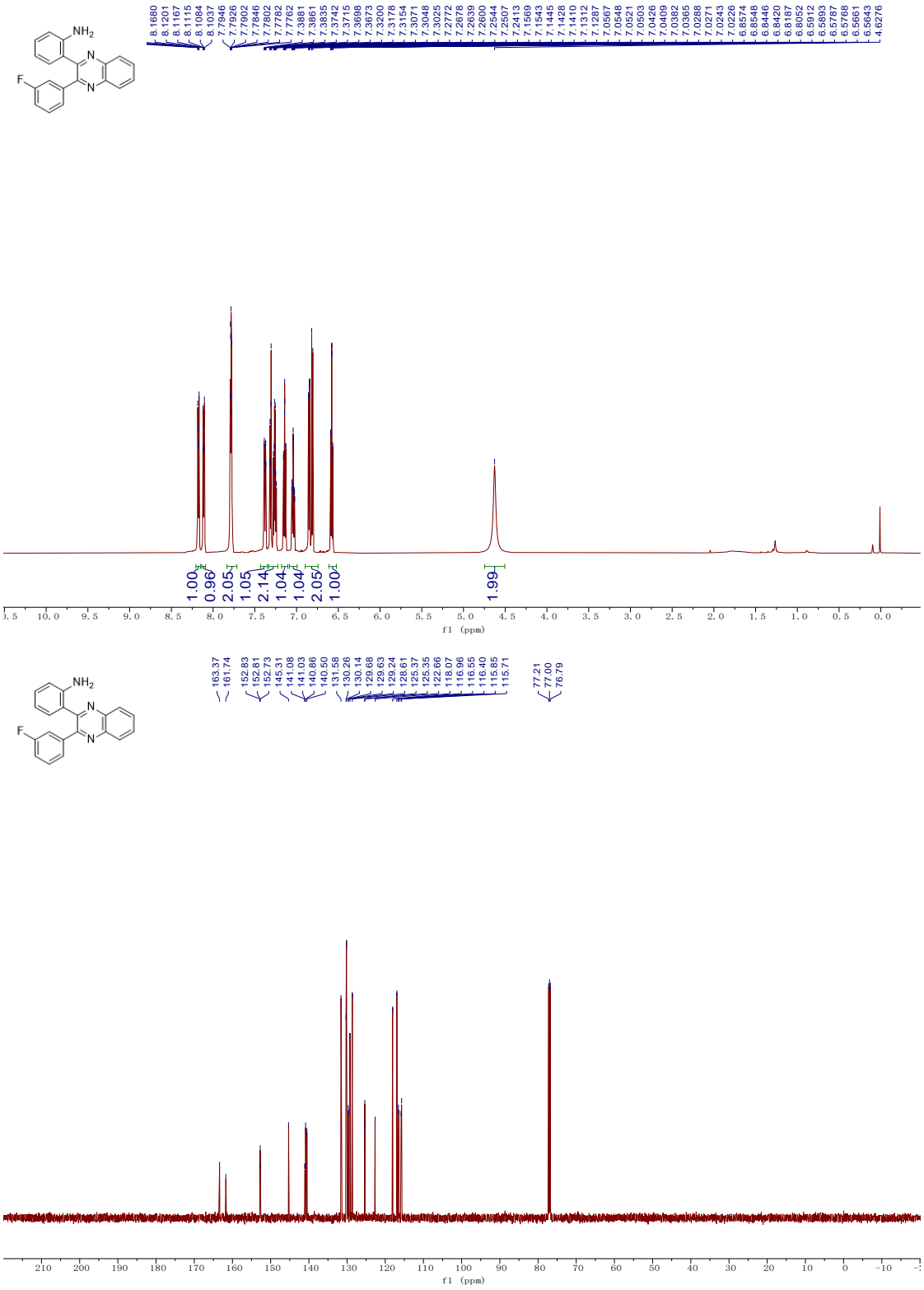
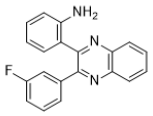


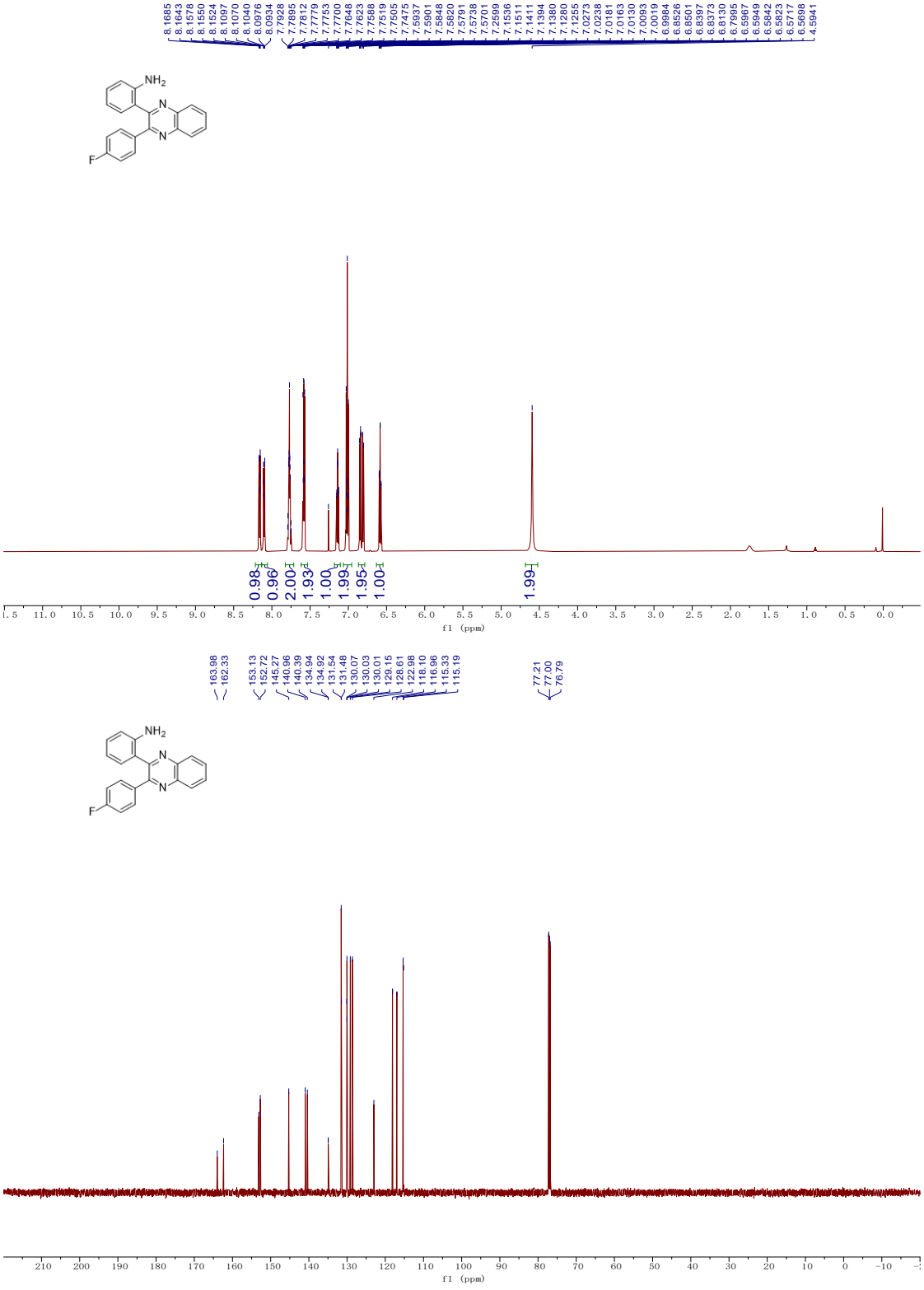
Figure 13. ^{1}H, ^{13}C and ^{19}F NMR Spectra of **2-(3-(3-fluorophenyl) quinoxalin-2-yl) aniline (3ma)**




NH2
N
N
F

-112.77
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)

Figure 14. ^{1}H, ^{13}C and ^{19}F NMR Spectra of **2-(3-(4-fluorophenyl) quinoxalin-2-yl) aniline (3na)**



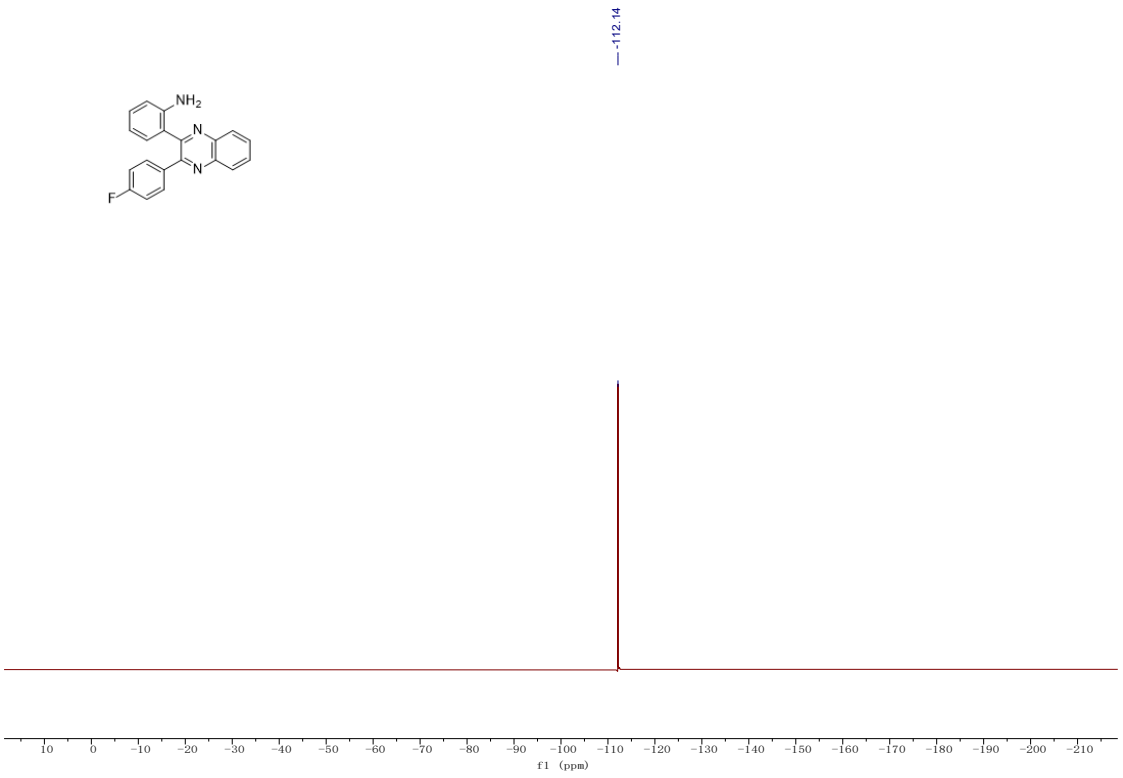

-112.14
NH2
N
N
F
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)

Figure 15. ^{1}H and ^{13}C NMR Spectra of **2-(3-(3-chlorophenyl) quinoxalin-2-yl) aniline (3oa)**

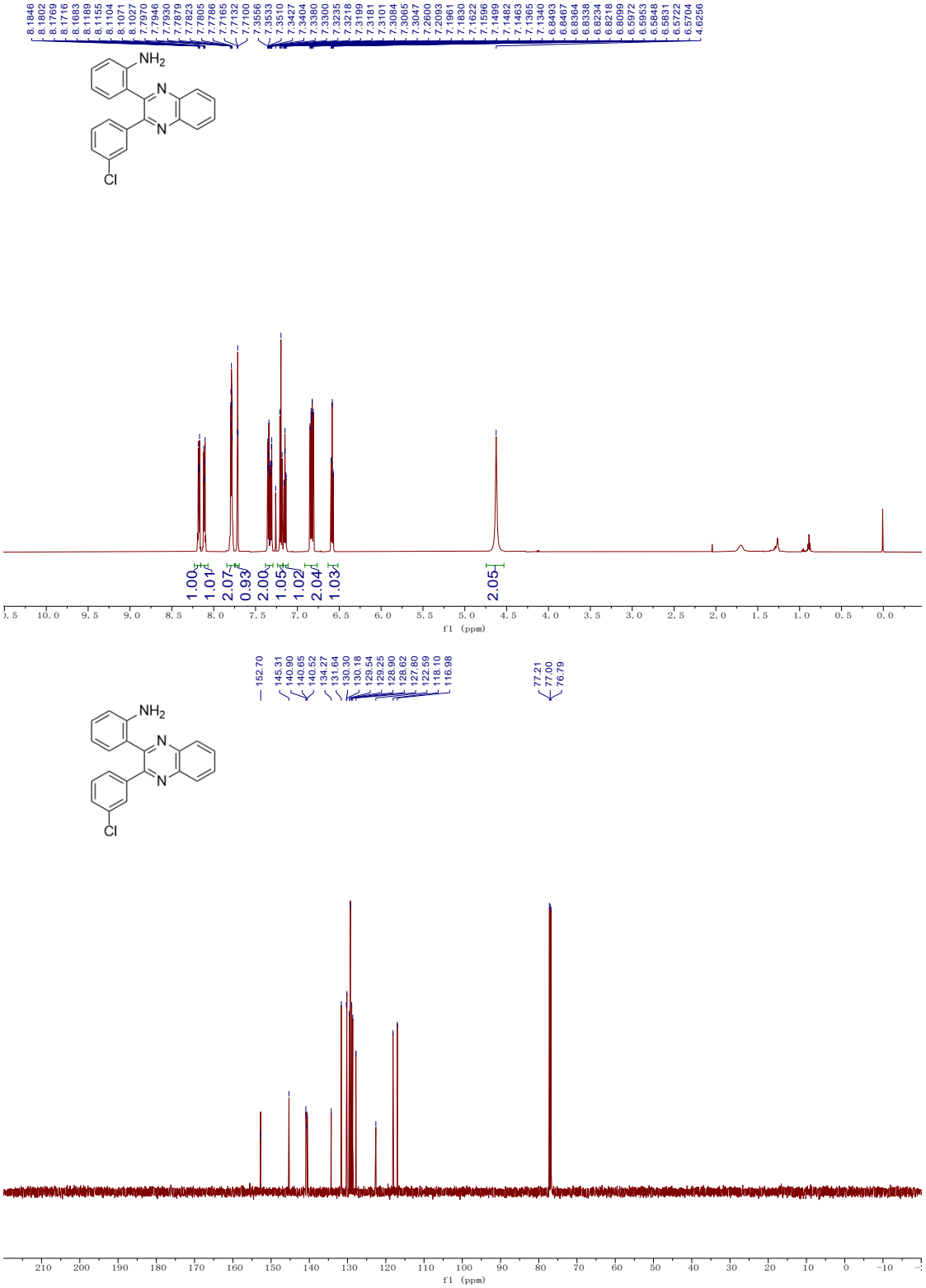
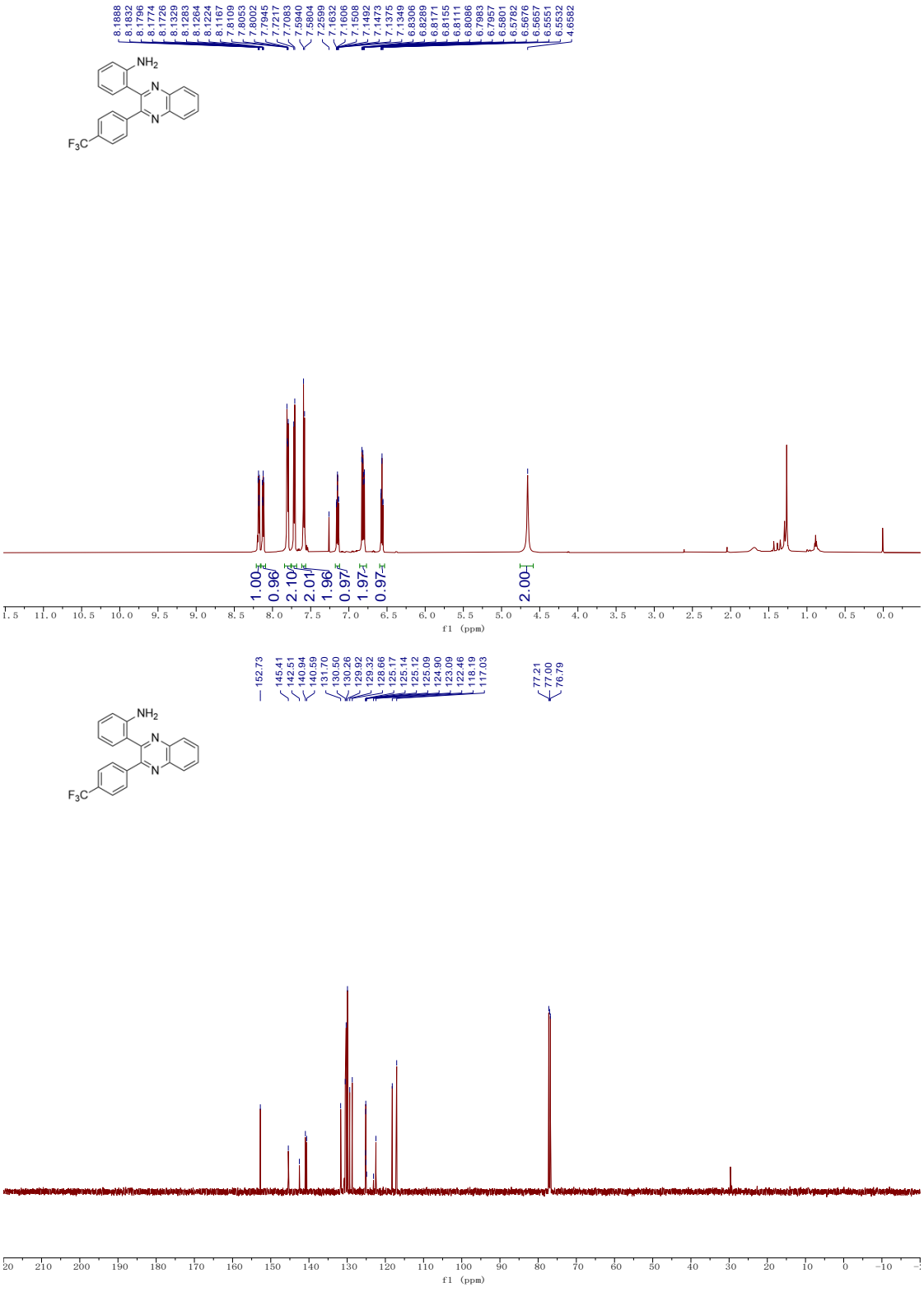


Figure 16. ^{1}H, ^{13}C and ^{19}F NMR Spectra of **2-(3-(4-(trifluoromethyl) phenyl) quinoxalin-2-yl) aniline(3pa)**



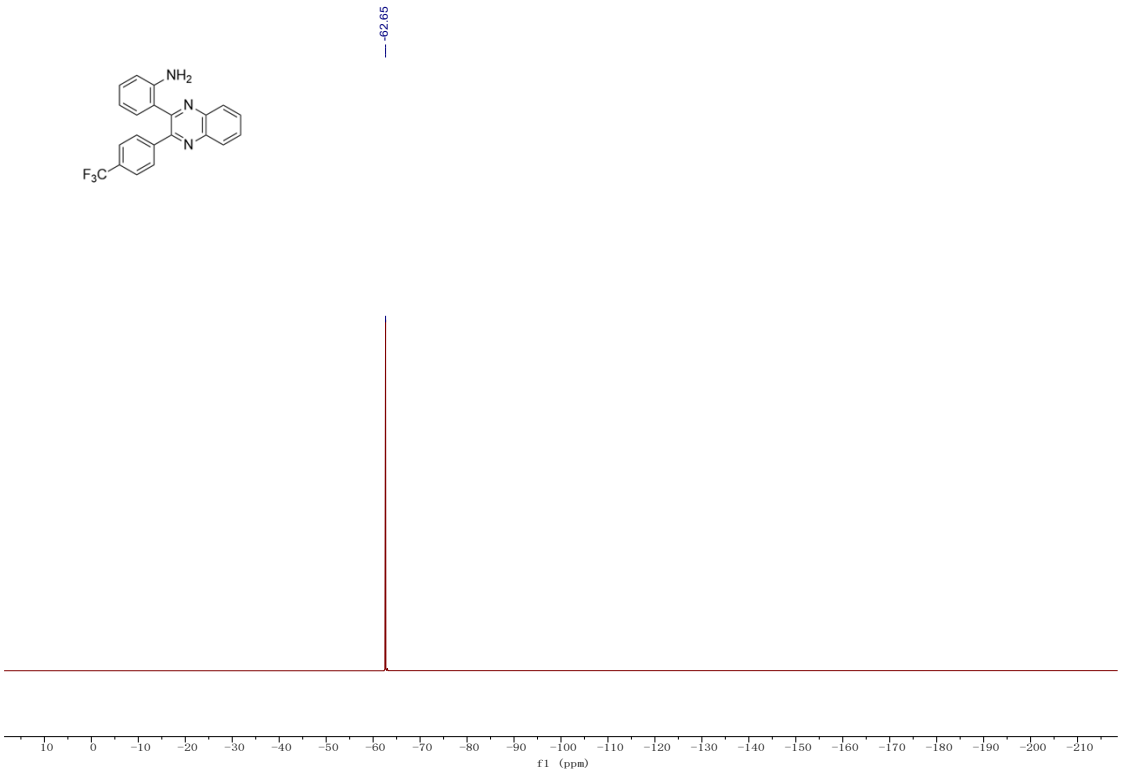

-62.65
NH2
N
N
F3C
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)

Figure 17. ^{1}H and ^{13}C NMR Spectra of **2-(3-cyclopropylquinoxalin-2-yl) aniline (3qa)**

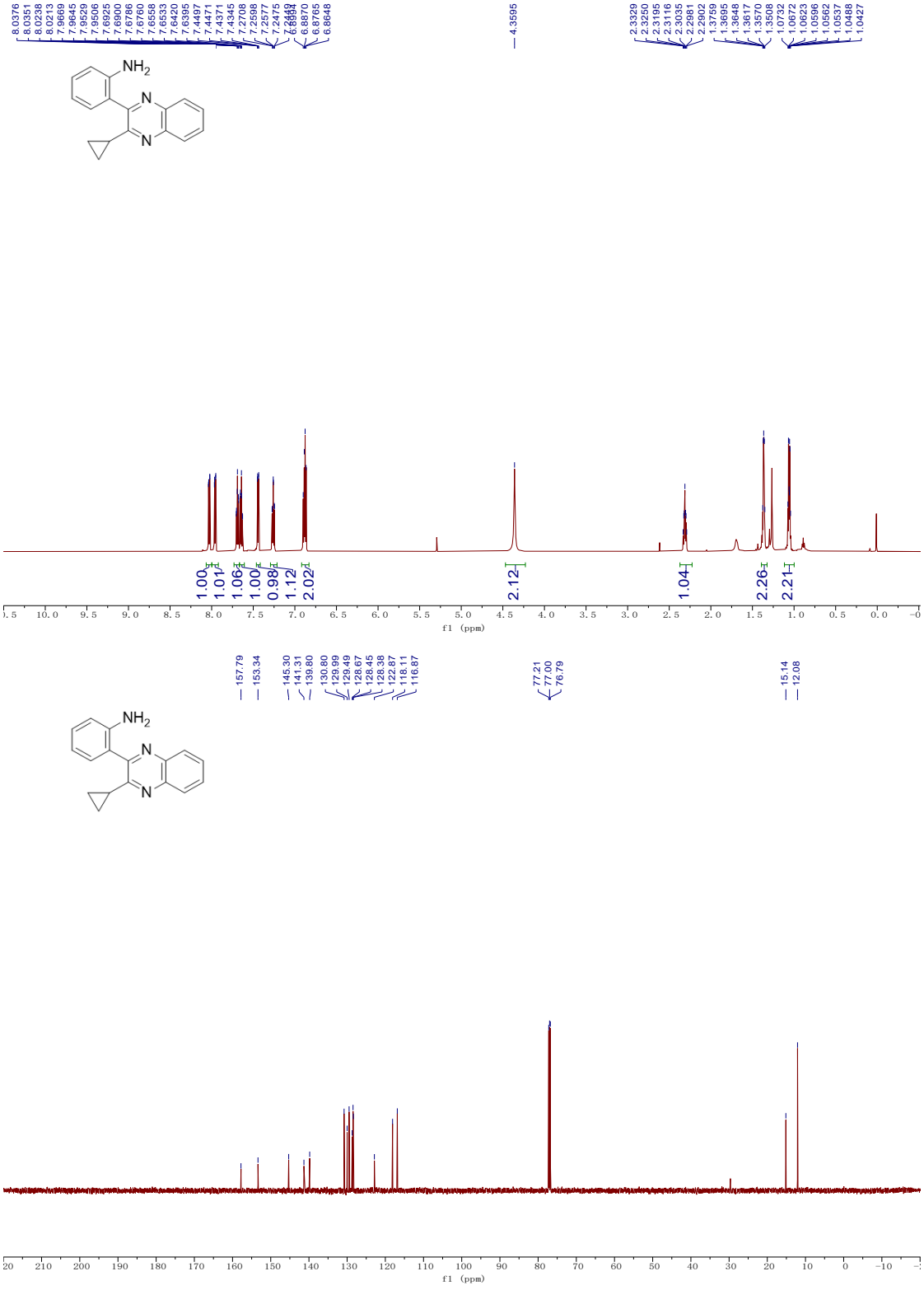


Figure 18. ^{1}H and ^{13}C NMR Spectra of **2-(6,7-dimethyl-3-phenylquinoxalin-2-yl) aniline (3ab)**

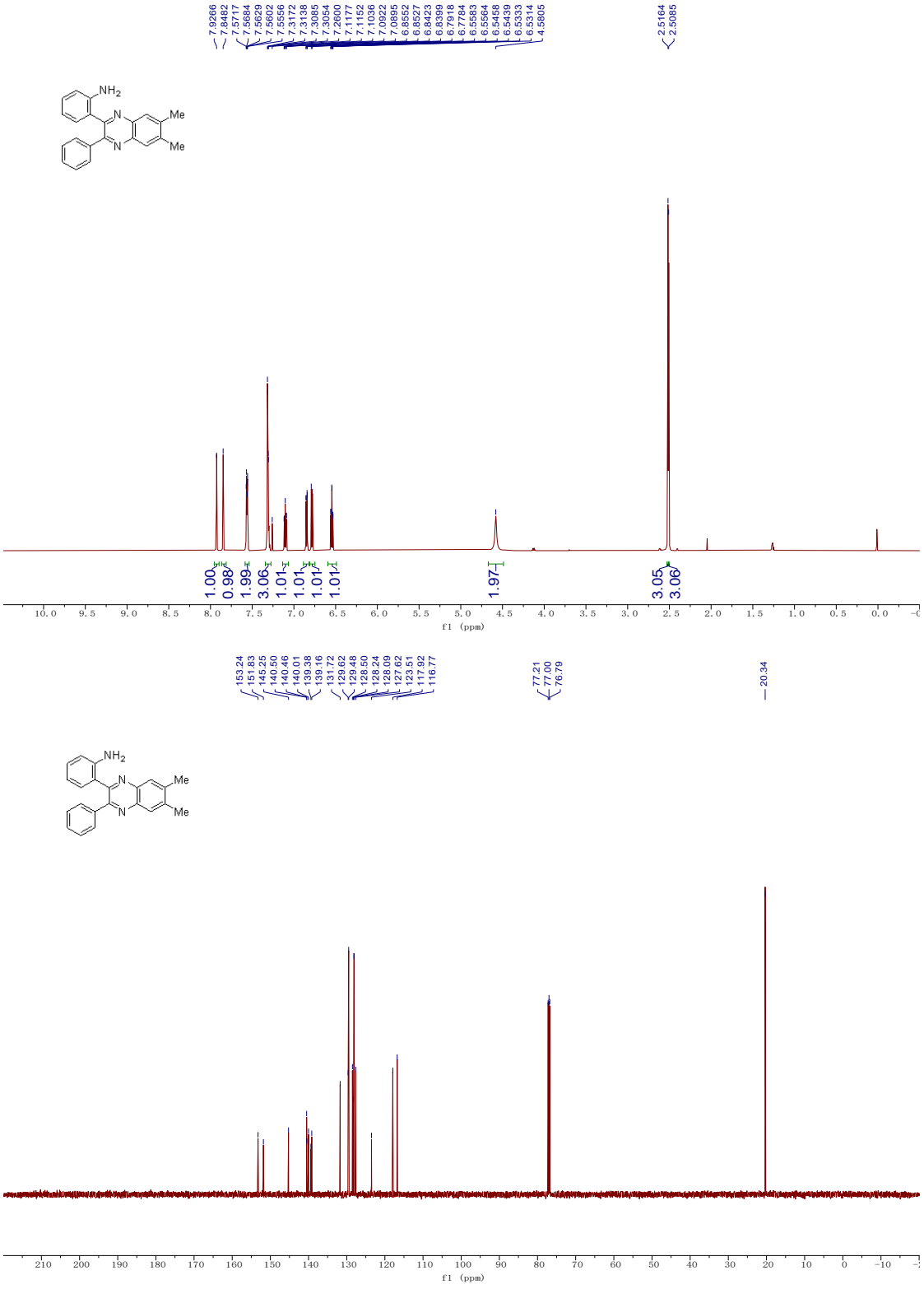


Figure 19. ^{1}H and ^{13}C NMR Spectra of **2-(6,7-dichloro-3-phenylquinoxalin-2-yl) aniline (3ac)**

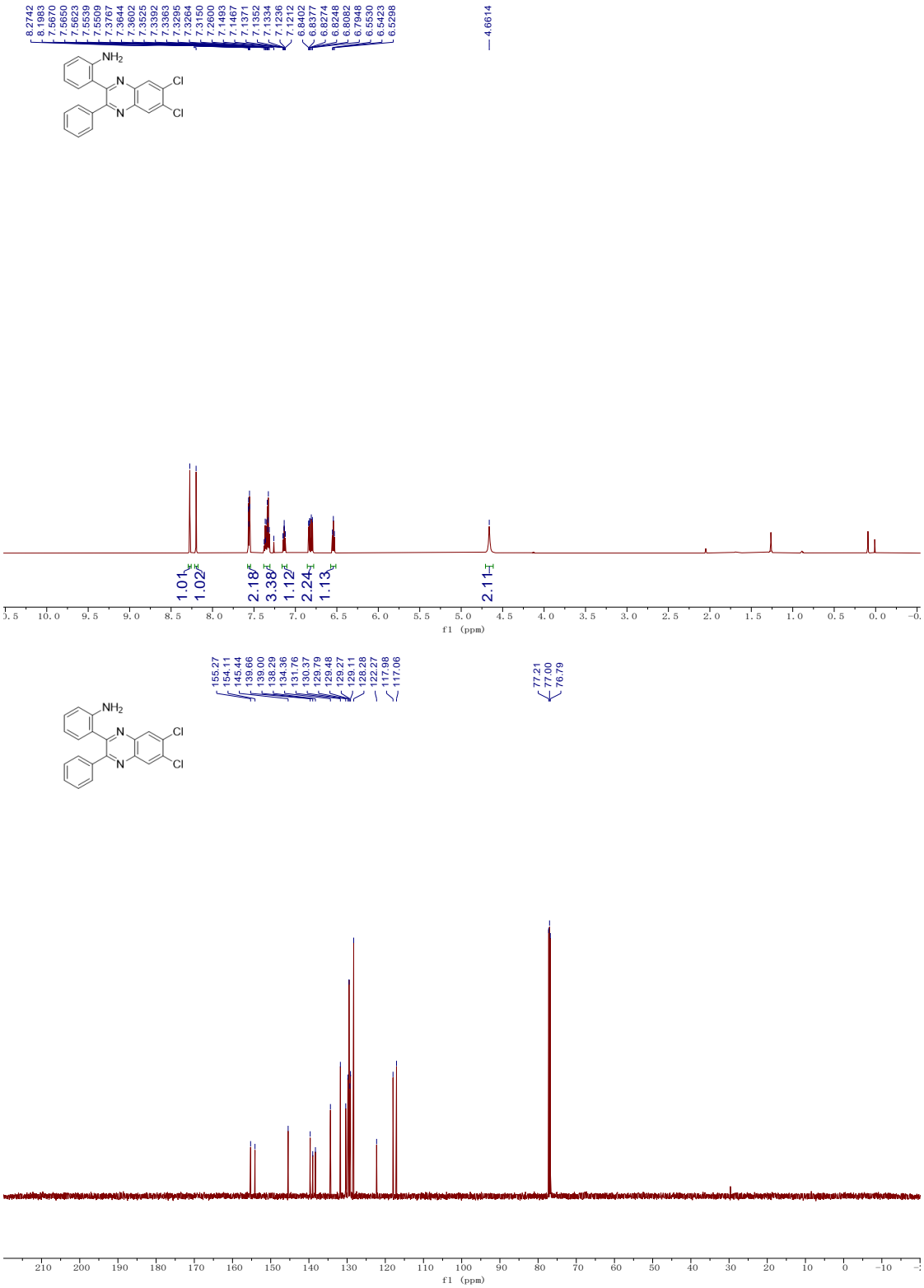
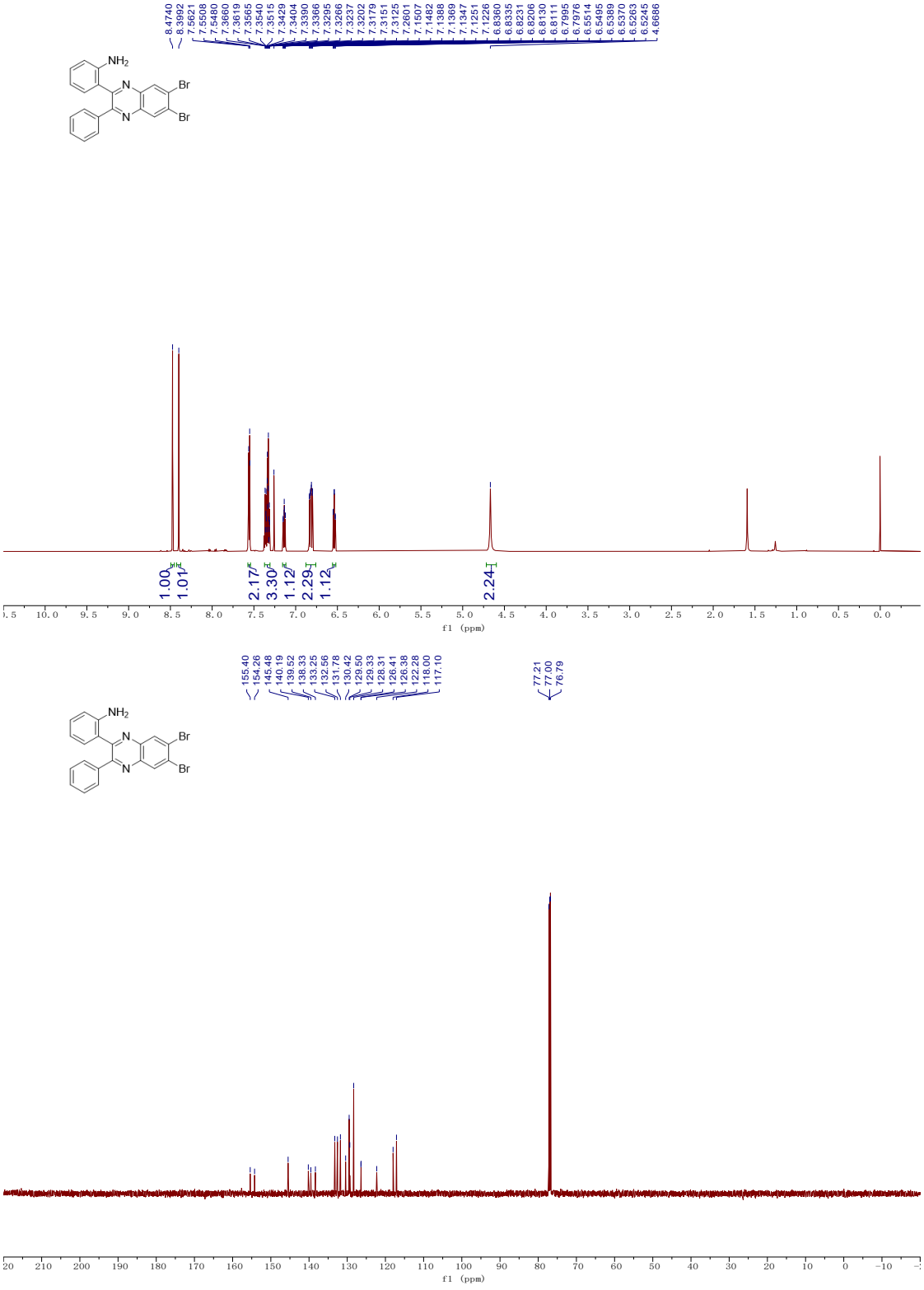


Figure 20. ^{1}H and ^{13}C NMR Spectra of **2-(6,7-dibromo-3-phenylquinoxalin-2-yl) aniline (3ad)**



Copy of ^{1}H NMR spectra of product 1

Figure 21. ^{1}H NMR Spectra of **1-nitro-2-(phenylethynyl)benzene (1a)**

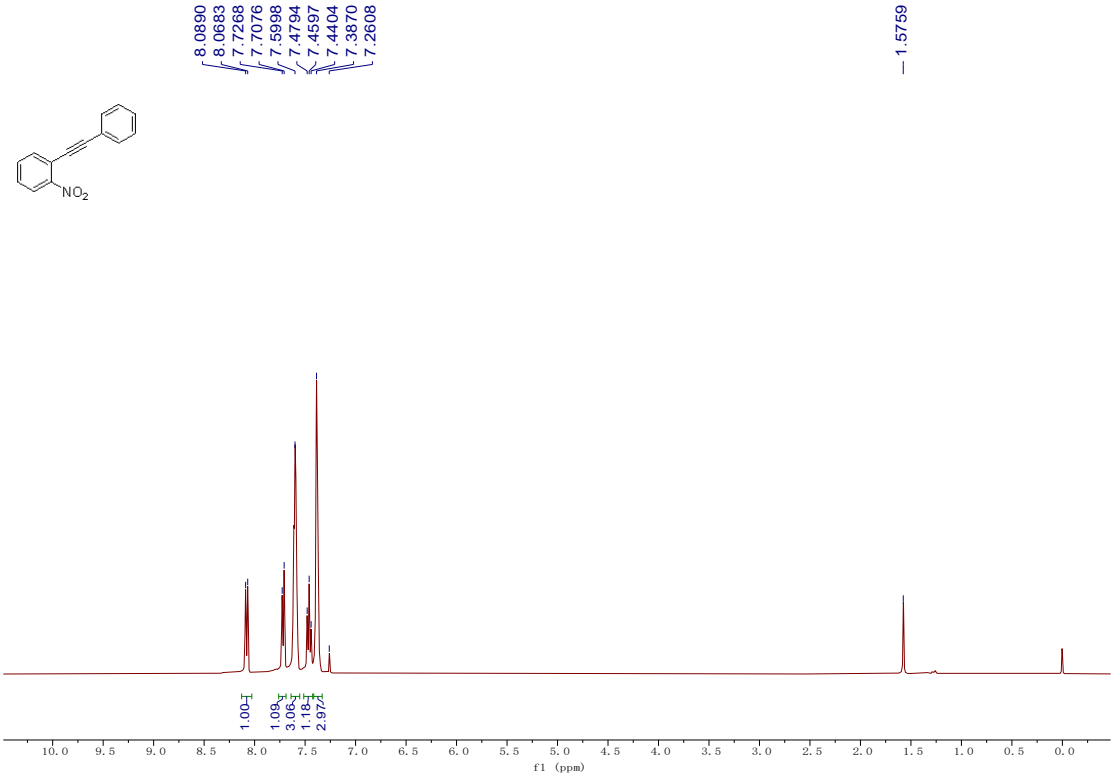


Figure 22. ^{1}H NMR Spectra of **4-chloro-2-nitro-1-(phenylethynyl)benzene (1f)**

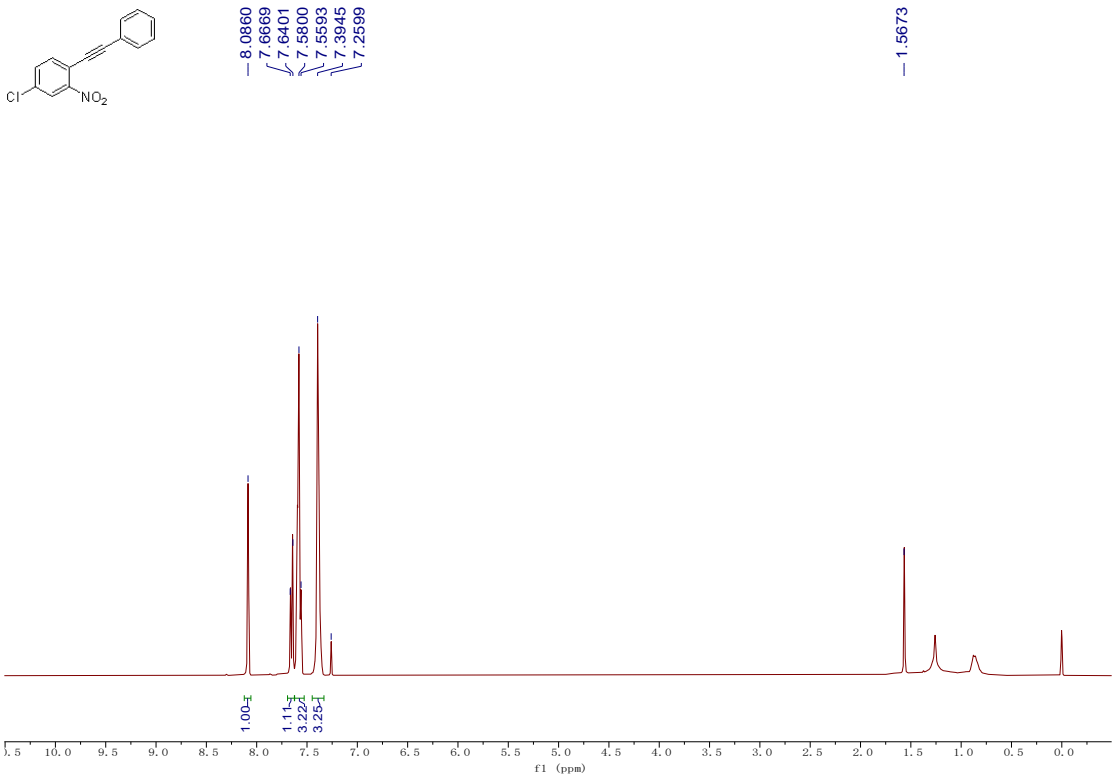
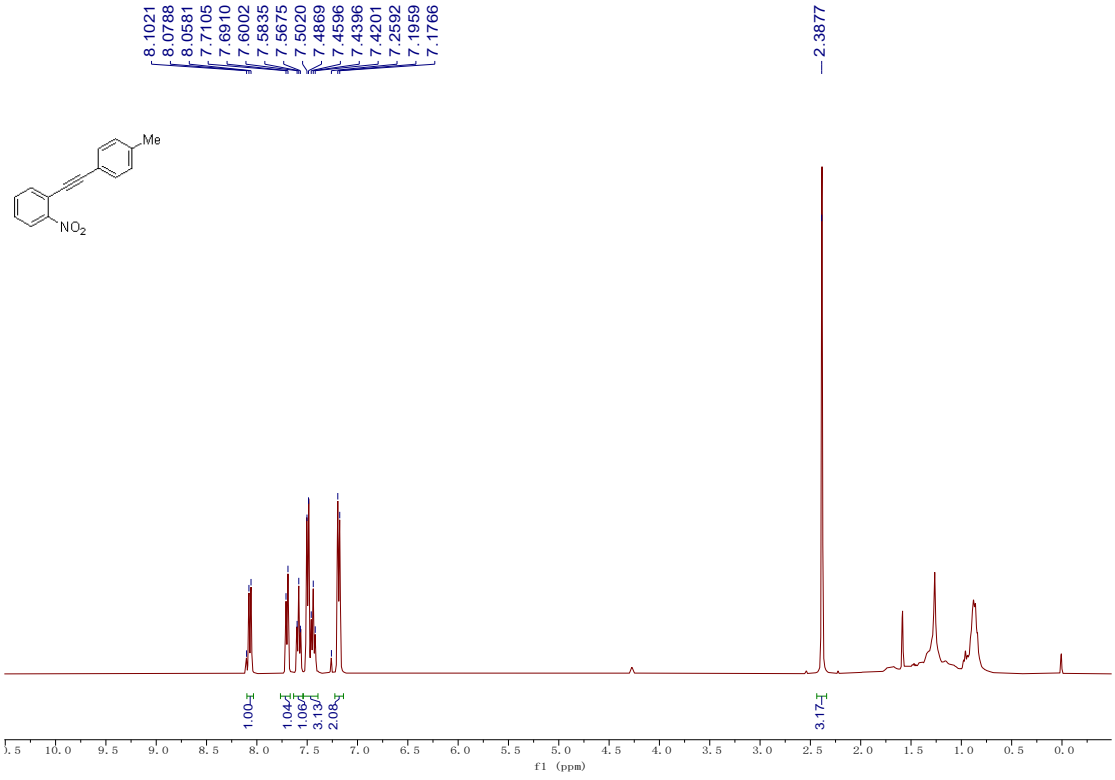


Figure 23. ^{1}H NMR Spectra of **1-nitro-2-(p-tolylethynyl)benzene (1i)**



References

1. (a) A. Wetzel and F. Gagosz, *Angew. Chem.Int. Ed.*, 2011, **50**, 7354-7358; (b) N. A. Bumagin, L. I. Sukhomlinova, E. V. Luzikova, T. P. Tolstaya and I. P. Beletskaya, *Tetrahedron Lett.*, 1996, **37**, 897-900.
2. J. Yan, L. Zheng, J. Wang, X. Liu and Y. Hu, *J. Org. Chem.*, 2022, **87**, 6347-6351.
3. Y. Q. Yu, X. Chen, Q. L. Wu, D. Liu, L. Hu, L. Yu, Z. Tan, Q. W. Gui and G. G. Zhu, *J. Org. Chem.*, 2018, **83**, 8556-8566.