Cascade Reaction of Isatins with 1,1-Enediamines: Synthesis of Multi-substituted Quinoline-4-carboxamides

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Supporting Information

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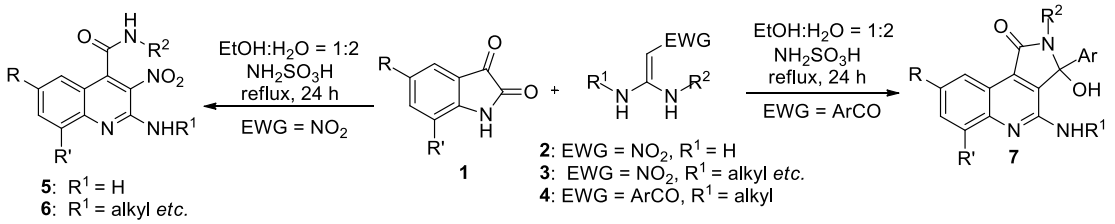
General Information

All compounds were fully characterised by spectroscopic data. The NMR spectra were recorded on a Bruker DRX500 & DRX600. Chemical shifts (δ) are expressed in ppm, J values are given in Hz, and deuterated DMSO-d_6 & $CDCl_3$ were used as solvent. IR spectra were recorded on a FT-IR Thermo Nicolet Avatar 360 using a KBr pellet. The reactions were monitored by thin layer chromatography (TLC) using silica gel GF_{254}. The melting points were determined on a XT-4A melting point apparatus and are uncorrected. HRMs were performed on an Agilent LC/Msd TOF instrument.

The materials were purchased from Adamas-beta Corporation Limited. All chemicals and solvents were used as received without further purification unless otherwise stated. Column chromatography was performed on silica gel (200–300 mesh). Isatins **1** were commercially available reagents, and EDAMs **2-4** were prepared according to the literature.[1]

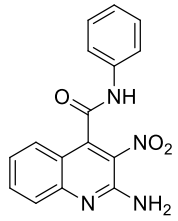
General Procedure for the Preparation of 5–7



Isatins **1** (0.5 mmol) and 1,1-enediamine **2**–**4** (0.5 mmol) were charged into a round bottom flask, then 4 mL mixture solvent ($V_{ethanol}$:V_{H2O}=1:2) was added. Finally, NH_2SO_3H (0.05 mmol) was added to the mixture. The reaction mixture was stirred at reflux until the yellow solution completely changed to red. The mixture was refluxed for about 24 hours. The resulting solvent was cooled to room temperature. The formed precipitate was then filtered and washed with a small amount of ethanol to obtain the pure products **5–7**. The products were further identified by FTIR spectroscopy, NMR spectroscopy and HRMS.

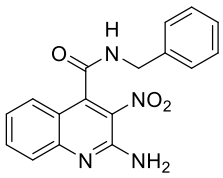
Spectroscopic Data of 5–7

2-Amino-3-nitro-*N*-phenylquinoline-4-carboxamide (5aa): Isatin **1a** (147mg, 1.0 mmol) and (*Z*)-2-nitro-*N*-phenylethene-1,1-diamine **2a** (179mg, 1.0 mmol) were charged into a round bottom flask (25mL), then EtOH (2.8 mL) and H_2O (5.6 mL) were added. Finally, NH_2SO_3H (10mg, 0.1 mmol) was added to the mixture. The reaction mixture was stirred at reflux until the yellow solution completely changed to red. The mixture was refluxed for 24 hours. The resulting solvent was cooled to room temperature. The formed precipitate was then filtered and washed with 1mL ethanol to obtain red solid **5aa** (268mg).



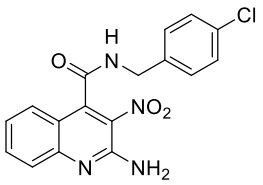
Red solid, 268 mg; Mp: 301.6-302.3 ℃; IR (KBr): 3473, 3252, 3137, 1665, 1631, 1590, 1525, 1319, 1245, 755 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 7.17-7.20 (m, 1H, ArH), 7.37-7.43 (m, 3H, ArH), 7.49 (s, 2H, NH_2), 7.63 (d, J = 8.5 Hz, 2H, ArH), 7.67-7.71 (m, 3H, ArH), 7.76-7.79 (m, 1H, ArH), 10.94 (s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ =118.7, 120.2, 124.6, 124.9, 126.2, 127.3, 128.7, 129.5, 134.1, 138.8, 141.9, 149.9, 150.4, 162.3. HRMS (TOF ES^+): *m/z* calcd for $C_{16}H_{12}N_4O_3$ [$(M+H)^+$], 309.0982; found, 309.0984.

2-Amino-*N*-benzyl-3-nitroquinoline-4-carboxamide (5ab)



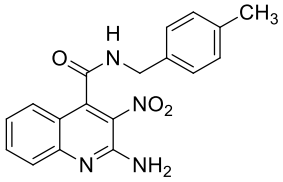
Red solid, 137 mg; Mp: 2292.6-293.2 ℃; IR (KBr): 3474, 3261, 3162, 1639, 1609, 1595, 1553, 1325, 1244, 767, 701 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.55 (d, J = 5.5 Hz, 2H, NCH_2), 7.28-7.33 (m, 4H, ArH), 7.36-7.40 (m, 4H, NH_2, ArH), 7.57-7.62 (m, 2H, ArH), 7.70-7.73 (m, 1H, ArH), 9.36 (t, J = 6.0 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 43.3, 118.9, 124.2, 126.1, 127.3, 127.6, 128.2, 128.7, 128.9, 129.4, 133.6, 138.9, 142.0, 149.6, 150.1, 163.7. HRMS (TOF ES^+): *m/z* calcd for $C_{17}H_{14}N_4O_3$ [$(M+H)^+$], 323.1139; found, 323.1137.

2-Amino-*N*-(4-chlorobenzyl)-3-nitroquinoline-4-carboxamide (5ac)



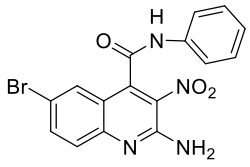
Red solid, 159 mg; Mp: 264.5-265.2 ℃; IR (KBr): 3441, 3277, 1645, 1564, 1511, 1337, 1242, 840 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.55 (d, J = 5.0 Hz, 2H, NCH_2), 7.32-7.36 (m, 3H, NH_2, ArH), 7.42-7.47 (m, 4H, NH_2, ArH), 7.58-7.62 (m, 2H, ArH), 7.71-7.74 (m, 1H, ArH), 9.43 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.6, 118.8, 124.3, 126.1, 127.3, 128.8, 129.3, 130.1, 132.2, 133.7, 138.0, 141.9, 149.6, 150.1, 163.8. HRMS (TOF ES^+): *m/z* calcd for $C_{17}H_{13}ClN_4O_3$ [$(M+H)^+$], 357.0749; found, 357.0748.

2-Amino-*N*-(4-methylbenzyl)-3-nitroquinoline-4-carboxamide (5ae)



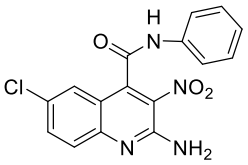
Red solid, 140 mg; Mp: 245.1-245.8 ℃; IR (KBr): 3470, 3266, 3156, 1650, 1593, 1554, 1510, 1322, 1243, 1160, 808, 752 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 2.31 (s, 3H, CH_3), 4.50 (d, J = 5.8 Hz, 2H, NCH_2), 7.18-7.20 (m, 2H, ArH), 7.27-7.29 (m, 2H, ArH), 7.31-7.34 (m, 3H, NH_2, ArH), 7.57-7.62 (m, 2H, ArH), 7.71-7.73 (m, 1H, ArH), 9.34 (t, J = 5.6 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 21.2, 43.0, 118.9, 124.2, 126.1, 127.3, 128.2, 129.4, 133.6, 135.8, 136.7, 142.0, 149.5, 150.1, 163.6. HRMS (TOF ES^+): *m/z* calcd for $C_{18}H_{16}N_4O_3$ [$(M+H)^+$], 337.1295; found, 337.1294.

2-Amino-6-bromo-3-nitro-*N*-phenylquinoline-4-carboxamide (5ba)



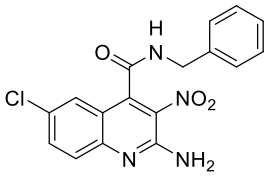
Red solid, 173 mg; Mp: 312.5-313.2 ℃; IR (KBr): 3466, 3282, 3154, 1655, 1635, 1537, 1498, 1330, 1316, 1232, 822, 741 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 7.18-7.21 (m, 1H, ArH), 7.36 (d, J = 11.4 Hz, 1H, ArH), 7.40–7.43 (m, 2H, ArH), 7.47 (s, 2H, NH_2), 7.66-7.74 (m, 4H, ArH), 10.96 (s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 110.0 (d, J = 23.6 Hz), 118.7 (d, J = 8.8 Hz), 120.4, 124.0 (d, J = 26.3 Hz), 125.0, 129.0 (d, J = 8.8 Hz), 129.6 (d, J = 25.0 Hz), 138.6, 141.0 (d, J = 5.0 Hz), 147.1, 150.0, 157.5, 159.4, 161.8. HRMS (TOF ES^+): *m/z* calcd for $C_{16}H_{11}BrN_4O_3$ [$(M+H)^+$], 387.0087; found, 387.0087.

2-Amino-6-chloro-3-nitro-*N*-phenylquinoline-4-carboxamide (5ca)



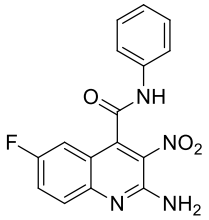
Red solid, 159 mg; Mp: 327.5-328.2 ℃; IR (KBr): 3464, 3279, 3154, 1653, 1636, 1537, 1498, 1445, 1331, 1316, 1231, 824, 742, 687 cm^{-1}; ^{1}H NMR (600 MHz, DMSO-d_6): δ = 7.19-7.21 (m, 1H, ArH), 7.41-7.44 (m, 2H, ArH), 7.61–7.68 (m, 6H, NH_2, ArH), 7.77-7.79 (m, 1H, ArH), 10.98 (s, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 119.2, 120.3, 125.1, 125.3, 128.4, 128.5, 134.2, 138.6, 140.7, 148.4, 150.6, 161.6. HRMS (TOF ES^+): *m/z* calcd for $C_{16}H_{11}ClN_4O_3$ [$(M+H)^+$], 343.0592; found, 343.0591.

2-Amino-*N*-benzyl-6-chloro-3-nitroquinoline-4-carboxamide (5cb)



Red solid, 169 mg; Mp: 282.6-283.4 ℃; IR (KBr): 3466, 3261, 3168, 1650, 1638, 1599, 1537, 1334, 1221, 830, 737, 696 cm^{-1}; ^{1}H NMR (600 MHz, DMSO-d_6): δ = 4.55 (d, J = 5.8 Hz, 2H, NCH_2), 7.31-7.33 (m, 1H, ArH), 7.39–7.40 (m, 4H, ArH), 7.46 (s, 2H, NH_2), 7.51 (d, J = 2.3 Hz, 1H, ArH), 7.58-7.60 (m, 1H, ArH), 7.72-7.74 (m, 1H, ArH), 9.47 (t, J = 5.9 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 43.3, 119.4, 125.5, 127.7, 128.1, 128.2, 128.3, 128.9, 130.1, 133.8, 138.9, 140.8, 148.0, 150.3, 163.2. HRMS (TOF ES^+): *m/z* calcd for $C_{17}H_{13}ClN_4O_3$ [$(M+H)^+$], 357.0749; found, 357.0743.

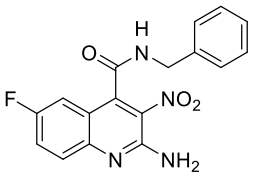
2-Amino-6-fluoro-3-nitro-*N*-phenylquinoline-4-carboxamide (5da)



Red solid, 155 mg; Mp: 319.4-320.1 ℃; IR (KBr): 3458, 3246, 3162, 1648, 1597, 1538, 1407, 1333, 1233, 894, 744, 691 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 7.19-7.21 (m, 1H, ArH), 7.41-7.44 (m, 2H, ArH), 7.57–7.68 (m, 4H, ArH), 7.76 (s, 2H, NH_2), 7.88 (d, J = 8.0 Hz, 1H, ArH), 10.99 (s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 116.5, 119.8, 120.3, 125.1, 128.5 (d, J

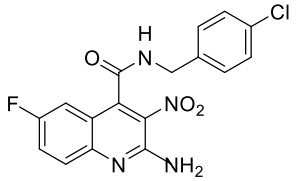
= 7.5 Hz), 129.5, 129.6, 136.7, 138.6, 140.6, 148.6, 150.6, 161.6 . HRMS (TOF ES^+): *m/z* calcd for $C_{16}H_{11}FN_4O_3$ [$(M+H)^+$], 327.0888; found, 327.02890.

2-Amino-*N*-benzyl-6-fluoro-3-nitroquinoline-4-carboxamide (5db)



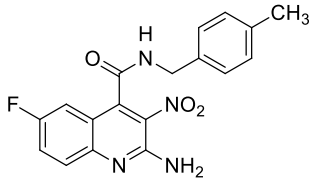
Red solid, 162 mg; Mp: 266.5-267.0 ℃; IR (KBr): 3471, 3282, 3158, 1648, 1556, 1511, 1412, 1332, 1320, 1225, 1183, 827, 699 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.55 (d, *J* = 5.5 Hz, 2H, NCH_2), 7.25 (d, *J* = 9.5 Hz, 1H, ArH), 7.33-7.40 (m, 7H, NH_2, ArH), 7.63-7.69 (m, 2H, ArH), 9.45 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 43.3, 110.2 (d, *J* = 23.8 Hz), 118.9 (d, *J* = 10.0 Hz), 123.5 (d, *J* = 26.3 Hz), 127.7, 128.2, 128.8 (d, *J* = 8.8 Hz), 128.9, 130.2, 138.8, 141.1 (d, *J* = 6.3 Hz), 146.7, 149.7, 157.3, 159.2, 163.2. HRMS (TOF ES^+): *m/z* calcd for $C_{17}H_{13}FN_4O_3$ [$(M+H)^+$], 341.1044; found, 341.1040.

2-Amino-*N*-(4-chlorobenzyl)-6-fluoro-3-nitroquinoline-4-carboxamide (5dc)



Red solid, 180 mg; Mp: 287.8-288.3 ℃; IR (KBr): 3471, 3249, 3164, 1649, 1600, 1556, 1332, 1228, 1183, 829 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.54 (d, *J* = 5.0 Hz, 2H, NCH_2), 7.23 (d, *J* = 9.5 Hz, 1H, ArH), 7.34 (m, 2H, NH_2), 7.41-7.47 (m, 4H, ArH), 7.63-7.69 (m, 2H, ArH), 9.47 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.6, 110.1 (d, *J* = 23.8 Hz), 118.8 (d, *J* = 10.0 Hz), 123.6 (d, *J* = 25.0 Hz), 128.8, 130.2, 132.3, 137.9, 141.0 (d, *J* = 6.3 Hz), 146.7, 149.7, 157.3, 159.2, 163.3. HRMS (TOF ES^+): *m/z* calcd for $C_{17}H_{12}ClFN_4O_3$ [$(M+H)^+$], 375.0655; found, 375.0653.

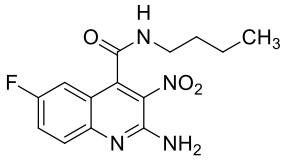
2-Amino-6-fluoro-*N*-(4-methylbenzyl)-3-nitroquinoline-4-carboxamide (5de)



Red solid, 168 mg; Mp: 271.8-272.5 ℃; IR (KBr): 3474, 3261, 3158, 1649, 1597, 1555, 1512,

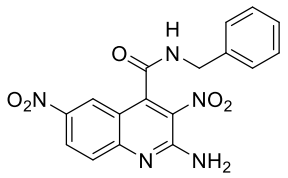
1409, 1332, 1321, 1226, 1182, 828, 791 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.31 (s, 3H, $ArCH_3$), 4.49 (d, J = 6.0 Hz, 2H, NCH_2), 7.18-7.28 (m, 7H, NH_2, ArH), 7.63-7.65 (m, 2H, ArH), 9.36 (t, J = 6.0 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.2, 43.1, 110.2 (J = 23.8 Hz), 118.9, 123.5 (d, J = 25.0 Hz), 128.2, 128.8 (d, J = 8.8 Hz), 129.4, 130.2, 135.8, 136.8, 141.2, 146.7, 149.7, 157.3, 159.2, 163.1. HRMS (TOF ES^+): m/z calcd for $C_{18}H_{15}FN_4O_3$ [$(M+H)^+$], 355.1201; found, 355.1197.

2-Amino-*N*-butyl-6-fluoro-3-nitroquinoline-4-carboxamide (5df)



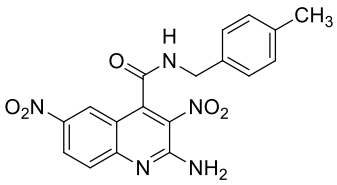
Red solid, 138 mg; Mp: 234.1-234.8 ℃; IR (KBr): 3473, 3269, 3157, 1645, 1556, 1511, 1332, 1245, 827, 622 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 0.93 (t, J = 7.4 Hz, 3H, CH_3), 1.35-1.39 (m, 2H, CH_2), 1.50-1.54 (m, 2H, CH_2), 3.30-3.33 (m, 2H, NCH_2), 7.29-7.31 (m, 3H, NCH_2, ArH), 7.63-7.69 (m, 2H, ArH), 8.91 (t, J = 5.6 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 14.1, 20.0, 31.1, 39.2, 110.2 (d, J = 22.5 Hz), 118.8 (d, J = 10.5 Hz) , 123.5 (d, J = 25.5 Hz), 128.8 (d, J = 9.0 Hz), 130.4, 141.4 (d, J = 6.0 Hz), 146.6, 149.7, 157.5, 159.1, 162.9. HRMS (TOF ES^+): m/z calcd for $C_{14}H_{15}FN_4O_3$ [$(M+H)^+$], 307.1201; found, 307.1200.

2-Amino-*N*-benzyl-3,6-dinitroquinoline-4-carboxamide (5eb)



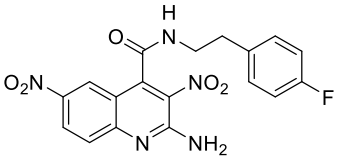
Gray solid, 158 mg; Mp: 290.5-291.2 ℃; IR (KBr): 3443, 3286, 3175, 1650, 1600, 1564, 1513, 1366, 1244, 840, 739, 697 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 4.59 (br, 2H, NCH_2), 7.31-7.34 (m, 1H, ArH), 7.39–7.43 (m, 4H, ArH), 7.68-7.70 (d, J = 9.3 Hz, 1H, ArH), 8.01 (br, 2H, NH_2), 8.40-8.42 (m, 1H, ArH), 8.48-8.49 (m, 1H, ArH), 9.59 (t, J = 5.8 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 43.4, 117.3, 124.2, 126.8, 127.5, 127.7, 128.1, 128.7, 129.0, 131.0, 138.7, 142.7, 142.8, 152.1, 162.5. HRMS (TOF ES^+): m/z calcd for $C_{17}H_{13}N_5O_5$ [$(M+H)^+$], 368.0989; found, 368.0992.

2-Amino-*N*-(4-methylbenzyl)-3,6-dinitroquinoline-4-carboxamide (5ee)



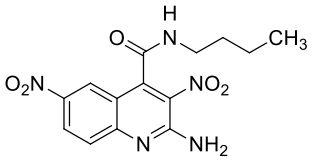
Gray solid, 162 mg; Mp: 317.0-317.6 ℃; IR (KBr): 3443, 3256, 3176, 1648, 1604, 1514, 1338, 1244, 840, 740 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 2.32 (s, 3H, $ArCH_3$), 4.53 (br, 2H, NCH_2), 7.19-7.21 (m, 2H, ArH), 7.29–7.30 (m, 2H, ArH), 7.69 (d, J = 9.3 Hz, 1H, ArH), 8.01 (br, 2H, NH_2), 8.39-8.41 (m, 1H, ArH), 8.47-8.48 (m, 1H, ArH), 9.53 (t, J = 5.8 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 21.2, 43.1, 117.3, 124.2, 126.7, 127.5, 128.1, 128.2, 129.3, 129.5, 131.0, 135.6, 136.9, 142.7, 142.8, 152.1, 162.4. HRMS (TOF ES^+): *m/z* calcd for $C_{18}H_{15}N_5O_5$ [$(M+H)^+$], 382.1146; found, 382.1148.

2-Amino-*N*-(4-fluorophenethyl)-3,6-dinitroquinoline-4-carboxamide (5eg)



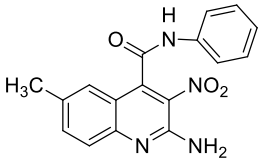
Gray solid, 176 mg; Mp: 274.0-274.6 ℃; IR (KBr): 3461, 3299, 3162, 1643, 1617, 1554, 1511, 1347, 1241, 1206, 848, 831, 735 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.86-2.87 (m, 2H, CH_2), 3.60-3.61 (m, 2H, CH_2), 7.09-7.12 (m, 2H, ArH), 7.31-7.34 (m, 2H, ArH), 7.68 (d, J = 9.0 Hz, 1H, ArH), 8.00 (br, 2H, NH_2), 8.36-7.41 (m, 2H, ArH), 9.12 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 34.2, 41.1, 115.5 (d, J = 21.3 Hz), 117.2, 124.2, 126.8, 127.4, 130.9 (d, J = 7.5 Hz), 131.0, 135.4, 135.5, 142.8, 152.1 (d, J = 5.0 Hz), 160.5, 162.4, 162.5. HRMS (TOF ES^+): *m/z* calcd for $C_{18}H_{14}FN_5O_5$ [$(M+H)^+$], 400.1052; found, 400.1045.

2-Amino-*N*-butyl-3,6-dinitroquinoline-4-carboxamide (5ef)



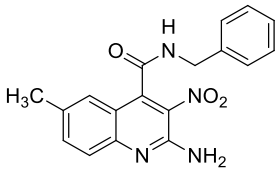
Gray solid, 143 mg; Mp: 293.8-294.3 ℃; IR (KBr): 3441, 3277, 1645, 1564, 1511, 1337, 1242, 840 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 0.94 (t, J = 7.0 Hz, 3H, CH_3), 1.38-1.43 (m, 2H, CH_2), 1.53-1.57 (m, 2H, CH_2), 3.34-3.36 (m, 2H, CH_2), 7.70 (d, J = 9.5 Hz, 1H, ArH), 7.98 (br, 2H, NH_2), 8.41 (d, J = 9.0 Hz, 1H, ArH), 8.49 (s, 1H, ArH), 9.05 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 14.1, 20.0, 31.1, 39.8, 117.2, 124.2, 126.7, 127.5, 131.0, 142.8, 142.9, 152.1, 162.3. HRMS (TOF ES^+): *m/z* calcd for $C_{14}H_{15}N_5O_5$ [$(M+H)^+$], 334.1146; found, 334.1143.

2-Amino-6-methyl-3-nitro-*N*-phenylquinoline-4-carboxamide (5fa)



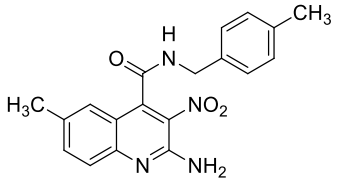
Red solid, 129 mg; Mp: 294.5-295.1 ℃; IR (KBr): 3462, 3280, 3158, 1659, 1635, 1316, 1236, 820, 745, 690 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.39 (s, 3H, CH_3), 7.17-7.20 (m, 1H, ArH), 7.38-7.44 (m, 5H, NH_2, ArH), 7.54-7.56 (m, 1H, ArH), 7.61-7.63 (m, 1H, ArH), 7.68-7.70 (m, 2H, ArH), 10.89 (s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.4, 118.7, 120.3, 124.8, 125.5, 126.1, 128.7, 129.5, 133.9, 136.3, 138.9, 141.2, 148.6, 149.9, 162.4. HRMS (TOF ES^+): *m/z* calcd for $C_{17}H_{14}N_4O_3$ [$(M+H)^+$], 323.1139; found, 323.1133.

2-Amino-*N*-benzyl-6-methyl-3-nitroquinoline-4-carboxamide (5fb)



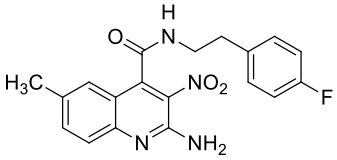
Red solid, 141 mg; Mp: 230.6-231.4 ℃; IR (KBr): 3467, 3258, 3166, 1656, 1597, 1532, 1324, 1228, 827, 733 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 2.32 (s, 3H, CH_3), 4.55 (d, *J* = 4.1 Hz, 2H, NCH_2), 7.24 (s, 2H, NH_2), 7.30-7.33 (m, 2H, ArH), 7.39-7.43 (m, 4H, ArH), 7.49-7.50 (m, 1H, ArH), 7.55-7.57 (m, 1H, ArH), 9.39 (t, *J* = 5.9 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 21.3, 43.2, 118.9, 125.8, 126.0, 127.6, 128.3, 128.9, 129.2, 133.4, 135.8, 139.1, 141.4, 148.2, 149.7, 163.8. HRMS (TOF ES^+): *m/z* calcd for $C_{18}H_{16}N_4O_3$ [$(M+H)^+$], 337.1295; found, 337.1291.

2-Amino-6-methyl-*N*-(4-methylbenzyl)-3-nitroquinoline-4-carboxamide (5fe)



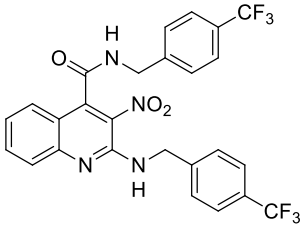
Red solid, 142 mg; Mp: 273.7-274.2 ℃; IR (KBr): 3464, 3279, 3154, 1653, 1636, 1537, 1498, 1445, 1331, 1316, 1231, 824, 742, 687 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 2.32 (s, 6H, CH_3), 4.50 (d, *J* = 2.8 Hz, 2H, NCH_2), 7.20-7.23 (m, 4H, NH_2, ArH), 7.28-7.31 (m, 3H, ArH), 7.48-7.50 (m, 1H, ArH), 7.55-7.57 (m, 1H, ArH), 9.33 (t, *J* = 5.9 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 21.2, 43.0, 118.9, 125.8, 126.0, 128.0, 128.3, 129.2, 129.4, 133.3, 135.8, 136.1, 136.7, 141.5, 148.2, 149.7, 163.7. HRMS (TOF ES^+): *m/z* calcd for $C_{19}H_{18}N_4O_3$ [$(M+H)^+$], 351.1452; found, 351.1452.

2-Amino-*N*-(4-fluorophenethyl)-6-methyl-3-nitroquinoline-4-carboxamide (5fg)



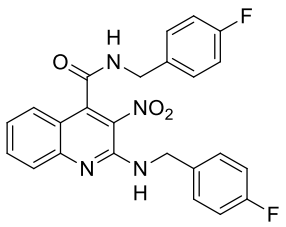
Red solid, 147 mg; Mp: 253.8-254.3 ℃; IR (KBr): 3465, 3309, 3156, 1651, 1624, 1591, 1532, 1509, 1336, 1319, 1235, 1213, 819 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 2.33 (s, 3H, CH_3), 2.87 (s, 2H, CH_2), 3.60 (s, 2H, CH_2), 7.13-7.16 (m, 3H, ArH), 7.20 (s, 2H, NH_2), 7.33-7.36 (m, 2H, ArH), 7.47-7.48 (m, 1H, ArH), 7.54-7.56 (m, 1H, ArH), 8.92 (t, *J* = 5.5 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 21.3, 34.1, 40.2, 115.5 (d, *J* = 21.0 Hz), 118.7, 125.9 (d, *J* = 16.5 Hz), 129.4, 130.9 (d, *J* = 10.5 Hz), 133.3, 135.7, 135.8(d, *J* = 9.0 Hz), 141.6, 148.1, 149.6, 160.6, 162.2, 163.7. HRMS (TOF ES^+): *m/z* calcd for $C_{19}H_{17}FN_4O_3$ [$(M+H)^+$], 369.1357; found, 369.1353.

3-Bitro-*N*-(4-(trifluoromethyl)benzyl)-2-(4-(trifluoromethyl)benzylamino)quinoline-4-carboxamide (6aa)



Yellow solid, 216mg; Mp: 219.7–219.9 ℃; IR (KBr): 3422, 2923, 1618, 1384, 1331, 1115, 615 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.64 (d, *J* = 6.0 Hz, 2H, NCH_2), 4.83 (d, *J* = 5.5 Hz, 2H, NCH_2), 7.32 (q, *J* = 1.0 Hz, 1H, ArH), 7.56–7.73 (m, 9H, ArH),7.75 (d, *J* = 8.0 Hz, 2H, ArH), 8.34 (t, *J* = 5.5 Hz, 1H, NH), 9.46 (t, *J* = 5.5 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.9, 44.3, 118.6, 125.7 (d, *J* = 270.0 Hz), 125.5 (d, *J* = 3.75 Hz), 125.7 (d, *J* = 3.75 Hz), 127.8 (d, *J* = 267.5 Hz), 127.3, 128.6, 129.9, 133.8, 141.7, 143.7, 145.3, 147.9, 149.0, 163.8. HRMS (TOF ES^+): *m/z* calcd for $C_{26}H_{18}F_6N_4O_3$ [$(M+H)^+$], 549.1356; found, 549.1355.

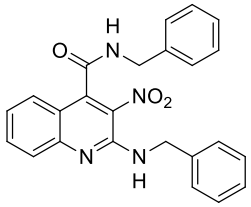
***N*-(4-Fluorobenzyl)-2-(4-fluorobenzylamino)-3-nitroquinoline-4-carboxamide (6ab)**



Yellow solid, 199mg; Mp: 183.4–183.5 ℃; IR (KBr): 3427, 2924, 2853, 1652, 1595, 1221, 1121, 819, 759 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 4.52 (d, *J* = 5.64 Hz, 2H, NCH_2), 4.74 (d, *J* =

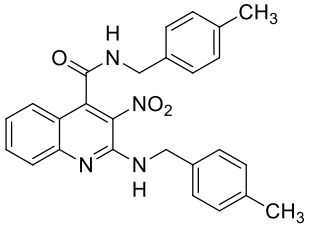
5.64 Hz, 2H, NCH_2), 7.11–7.72 (m, 12H, ArH), 8.22 (t, *J* = 5.88 Hz, 1H, NH), 9.37 (t, *J* = 5.76 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 42.5, 43.9, 115.4 (q, *J* = 21.0 Hz), 118.6, 124.4, 126.7, 127.3, 130.0 (q, *J* = 30.0 Hz), 133.7, 135.0 (d, *J* = 3.0 Hz), 136.3 (d, *J* = 3.0 Hz) , 141.8, 147.8, 149.0, 161.6 (d, *J* = 241.5 Hz), 161.9 (d, *J* = 241.5 Hz), 163.6. HRMS (TOF ES^+): *m/z* calcd for $C_{24}H_{18}F_2N_4O_3$ [$(M+H)^+$], 449.1420; found, 449.1419.

_N_-Benzyl-2-(benzylamino)-3-nitroquinoline-4-carboxamide (6ac)



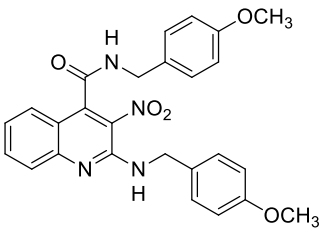
Yellow solid, 161mg; Mp: 195.2–195.3 ℃; IR (KBr): 3417, 2924, 1638, 1618, 1115, 614 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.55 (d, *J* = 5.5 Hz, 2H, NCH_2), 4.77 (d, *J* = 5.5 Hz, 2H, NCH_2), 7.22 (s, 1H, ArH), 7.30-7.33 (m, 4H, ArH), 7.38 (t, *J* = 3.0 Hz, 4H, ArH), 7.43 (s, 2H, ArH), 7.59 (t, *J* = 7.5 Hz, 2H, ArH), 7.71 (s, 1H, ArH), 8.17 (br, 1H, NH), 9.35 (br, 1H, CONH), 7.57–7.70 (m, 4H, ArH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 44.5, 45.5, 118.8, 124.5, 126.8, 127.0, 127.5, 127.9, 128.0, 128.4, 128.7, 128.9, 134.0, 137.0, 138.3, 142.8, 148.4, 150.2, 164.4. HRMS (TOF ES^+): *m/z* calcd for $C_{24}H_{20}N_4O_3$ [$(M+H)^-$], 411.1457; found, 411.1465.

_N_-(4-Methylbenzyl)-2-(4-methylbenzylamino)-3-nitroquinoline-4-carboxamide (6ad)



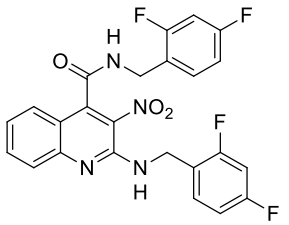
Yellow solid, 187mg; Mp: 208.6–208.7 ℃; IR (KBr): 3425, 3296, 2923, 1656, 1617, 1535, 1447, 1114, 758, 620 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 2.24 (s, 3H, CH_3), 2.50 (s, 3H, CH_3), 4.50 (d, *J* = 5.76 Hz, 2H, NCH_2), 4.70 (d, *J* = 5.70 Hz, 2H, NCH_2), 7.10 (d, *J* = 7.86 Hz, 2H, ArH), 7.17 (d, *J* = 7.86 Hz, 2H, ArH) 7.26 (d, *J* = 7.98 Hz, 2H, ArH) 7.30 (d, *J* = 7.80 Hz, 3H, ArH), 7.69 (s, 1H, ArH), 8.11 (br, 1H, NH), 9.31 (br, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 21.1 (d, *J* = 6.0 Hz), 43.0, 44.3, 118.6, 124.3, 126.7, 127.3, 128.0 (d, *J* = 19.5 Hz), 129.2, 129.4, 129.9, 133.6, 135.8, 136.2, 136.7, 137.0, 141.8, 147.9, 149.1, 163.5. HRMS (TOF ES^+): *m/z* calcd for $C_{26}H_{24}N_4O_3$ [$(M+H)^+$], 441.1921; found, 441.1920.

_N_-(4-Methoxybenzyl)-2-(4-methoxybenzylamino)-3-nitroquinoline-4-carboxamide (6ae)



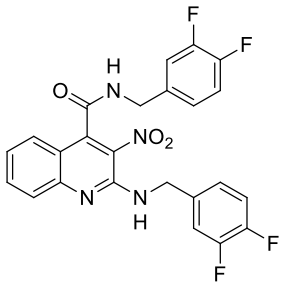
Red solid, 240mg; Mp: 214.4–214.6 ℃; IR (KBr): 3434, 2922, 1639, 1602, 1514, 1252, 1176, 1035 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 4.80 (t, J = 14.2 Hz, 6H, OCH_3), 4.70 (d, J = 5.4 Hz, 2H, NCH_2), 4.77 (d, J = 5.3 Hz, 2H, NCH_2), 6.87–6.90 (q, J = 8.6 Hz, 4H, ArH), 7.25-7.29(m, 2H, ArH), 7.32–7.36 (m, 4H, ArH), 7.63–7.65 (q, J = 5.3 Hz, 2H, ArH), 7.66 (br, 1H, NH), 7.69 (d, J = 8.4 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 44.0, 45.0, 114.1, 114.3, 118.9, 124.4, 126.9(d, J = 21.0 Hz), 127.6, 129.1, 129.3, 129.7, 130.5, 134.0, 142.8, 148.4, 150.3, 159.1, 159.4, 164.3. HRMS (TOF ES^+): *m/z* calcd for $C_{26}H_{24}N_4O_5$ [$(M+H)^-$], 471.1675; found, 411.1675.

_N_-(2,4-Difluorobenzyl)-2-(2,4-difluorobenzylamino)-3-nitroquinoline-4-carboxamide (6af)



Yellow solid, 220mg; Mp: 184.3–184.5 ℃; IR (KBr): 3422, 2922, 1639, 1602, 1514, 1252, 1176 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 4.54 (d, J = 5.58 Hz, 2H, NCH_2), 4.75 (d, J = 5.5 Hz, 2H, NCH_2), 7.00–7.02 (m, 1H, ArH), 7.11–7.15 (m, 1H, ArH), 7.19–7.23 (m, 1H, ArH), 7.26–7.28 (m, 1H, ArH), 7.31–7.34 (m, 1H, ArH), 7.48–7.55 (m, 3H, ArH), 7.57 (d, J = 8.3 Hz, 1H, ArH), 7.70–7.72 (m, 1H, ArH), 8.20 (t, J = 5.8 Hz, 1H, NH), 9.35 (br, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 36.8 (d, J = 3.0 Hz), 38.1 (d, J = 3.0 Hz), 103.8 (m, J = 25.5 Hz), 111.5 (m, J = 3.0 Hz), 118.7, 121.7 (q, J = 4.5 Hz), 123.1 (q, J = 3.0 Hz), 124.5, 126.7, 127.2, 129.8, 131.2 (q, J = 6.0 Hz), 132.1 (m, J = 4.5 Hz), 133.8, 141.8, 147.8, 149.0, 161.2 (d, J = 387.0 Hz), 161.3 (d, J = 387.0 Hz), 161.9 (d, J = 310.0 Hz), 162.0 (d, J = 310.5 Hz), 163.6. HRMS (TOF ES^+): *m/z* calcd for $C_{24}H_{16}F_4N_4O_3$ [$(M+H)^-$], 483.1086; found, 483.1081.

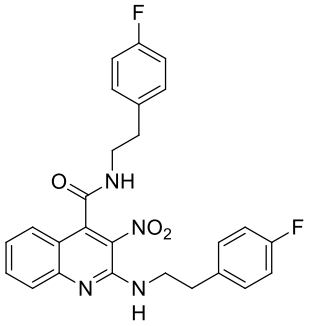
_N_-(3,4-Difluorobenzyl)-2-(3,4-difluorobenzylamino)-3-nitroquinoline-4-carboxamide (6ag)



Yellow solid, 218mg; Mp: 185.0–185.3 ℃; IR (KBr): 3419, 3269, 1645, 1597, 1520, 1288 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.55 (d, J = 5.5 Hz, 2H, NCH_2), 4.73 (d, J = 6.0 Hz, 2H,

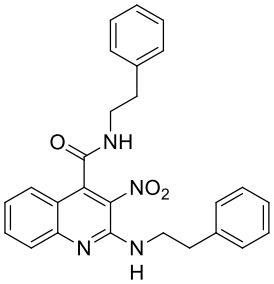
NCH_2), 7.23–7.26 (m, 1H, ArH), 7.28 (t, *J* = 8.0 Hz, 1H, ArH), 7.33–7.37 (m, 2H, ArH), 7.40–7.51 (m, 3H, ArH), 7.61 (d, *J* = 8.5 Hz, 2H, ArH), 7.71–7.74 (m, 1H, ArH), 8.27 (t, *J* = 6.0 Hz, 1H, NH), 9.40 (t, *J* = 5.5 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.2, 43.7, 117.0 (m, *J* = 6.3 Hz), 118.6, 124.6, 124.7 (d, *J* = 3.8 Hz), 124.8, 124.9 (q, *J* = 3.8 Hz), 126.7, 127.3, 129.8, 133.8, 136.4 (t, *J* = 5.0 Hz), 138.1 (t, *J* = 5.0 Hz), 141.7, 147.7 (d, *J* = 6.3 Hz), 148.6 (d, *J* = 10.0 Hz), 148.8 (d, *J* = 242.5 Hz), 149.0 (d, *J* = 243.8 Hz), 149.7 (d, *J* = 255.0 Hz), 149.7 (d, *J* = 256.0 Hz), 150.1, 150.6, 163.7. HRMS (TOF ES$^+$): *m/z* calcd for $C_{24}H_{16}F_4N_4O_3$ [(M+H)$^-$], 483.1086; found, 483.1084.

_N_-(4-Fluorophenethyl)-2-(4-fluorophenethylamino)-3-nitroquinoline-4-carboxamide (6ah)



Red solid, 205mg; Mp: 155.5–155.6 ℃; IR (KBr): 3409, 2927, 1675, 1600, 1510, 1218, 1158, 835, 614 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.85 (t, *J* = 7.0 Hz, 2H, CH_2), 2.94 (t, *J* = 7.0 Hz, 2H, CH_2), 3.59 (d, *J* = 5.5 Hz, 2H, NCH_2), 3.73-3.77 (m, 2H, NCH_2), 7.12–7.16 (m, 4H, ArH), 7.22–7.26 (m, 1H, ArH), 7.32–7.36 (m, 5H, ArH), 7.63–7.66 (m, 2H, ArH), 7.71–7.74 (m, 1H, NH), 8.90 (t, *J* = 6.0 Hz, 1H, CONH), 7.70 (s, 2H, ArH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 34.5 (d, *J* = 3.0 Hz), 41.1, 43.0, 115.4 (d, *J* = 18.0 Hz), 115.5 (d, *J* = 18.0 Hz), 118.6, 124.3, 126.9, 127.0, 127.6, 130.2 (q, *J* = 7.5 Hz), 134.0 (t, *J* = 3.0 Hz), 134.7 (d, *J* = 3.0 Hz), 142.8, 148.6, 150.4, 161.7 (d, *J* = 244.5 Hz), 161.8 (d, *J* = 243.0 Hz), 164.6. HRMS (TOF ES$^+$): *m/z* calcd for $C_{26}H_{22}F_2N_4O_3$ [(M+H)$^+$], 477.1733; found, 477.1735.

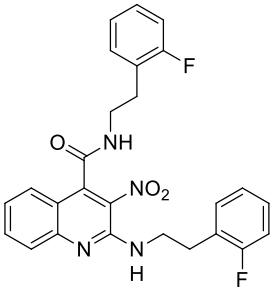
3-Nitro-_N_-phenethyl-2-(phenethylamino)quinoline-4-carboxamide (6ai)



Yellow solid, 176mg; Mp: 155.5–155.6 ℃; IR (KBr): 3426, 2923, 1667, 1600, 1546, 1470, 1118, 749, 710 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.87 (d, *J* = 6.0 Hz, 2H, CH_2), 2.95 (t, *J* = 7.0

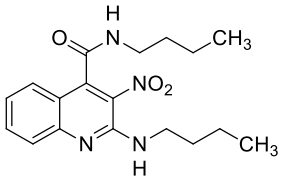
Hz, 2H, CH_2), 3.6 (s, 2H, NCH_2), 3.75–3.78 (m, 2H, NCH_2), 7.22–7.27 (m, 3H, ArH), 7.29–7.37 (m, 9H, ArH), 7.65 (d, J = 7.5 Hz, 2H, ArH), 7.70 (t, J = 7.5 Hz, 1H, NH). 8.94 (t, J = 5.0 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 35.0, 35.1, 40.9, 43.1, 118.4, 124.1, 126.6 (d, J = 12.5 Hz), 127.6, 128.9, 129.2 (d, J = 15.0 Hz), 129.8, 133.7, 139.6, 140.1, 142.2, 148.1, 149.3, 163.6. HRMS (TOF ES$^+$): *m/z* calcd for $C_{26}H_{24}N_4O_3$ [(M+H)$^-$], 439.1770; found, 439.1776.

***N*-(2-Fluorophenethyl)-2-(2-fluorophenethylamino)-3-nitroquinoline-4-carboxamide (6aj)**



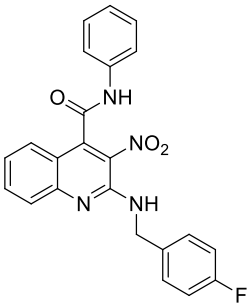
Yellow solid, 202mg; Mp: 152.3–152.3 ℃; IR (KBr): 3417, 1640, 1384, 1119, 753 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.85 (t, J = 7.0 Hz, 2H, CH_2), 2.94 (t, J = 7.0 Hz, 2H, CH_2), 3.59 (d, J = 5.5 Hz, 2H, NCH_2), 3.73–3.77 (m, 2H, NCH_2), 7.12–7.16 (m, 4H, ArH), 7.22–7.26 (m, 1H, ArH), 7.32–7.36 (m, 5H, ArH). 7.63–7.69 (m, 2H, ArH), 7.71–7.74 (m, 1H, NH), 8.90 (t, J = 6.0 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 28.8, 29.1, 40.0, 41.8, 115.3, 115.7, 118.6, 124.3, 126.7, 127.1, 128.5, 131.2 (d, J = 13.5 Hz), 134.0, 148.6, 150.3, 161.4 (d, J = 243.0 Hz), 164.7. HRMS (TOF ES$^+$): *m/z* calcd for $C_{26}H_{22}F_2N_4O_3$ [(M+H)$^+$], 477.1733; found, 477.1726.

***N*-Butyl-2-(butylamino)-3-nitroquinoline-4-carboxamide (6ak)**



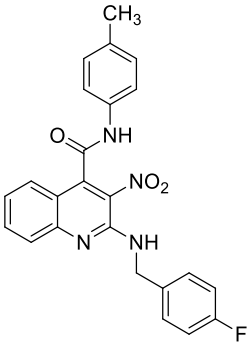
Red solid, 158mg; Mp: 128.0–128.3 ℃; IR (KBr): 3427, 2959, 2931, 2872, 1645, 1603, 757 cm^{-1}; ^{1}H NMR (500 MHz, $CDCl_3$): δ = 1.0 (q, J = 7.5 Hz, 6H, CH_3), 1.43–1.52 (m, 4H, CH_2), 1.67–1.75 (m, 4H, CH_2), 3.52–3.56 (m, 2H, NCH_2), 3.60–3.63 (m, 2H, NCH_2), 6.49 (br, 1H, NH), 7.18 (t, J = 8.0 Hz, 1H, ArH), 7.34 (br, 1H, CONH), 7.55–7.62 (m, 3H, ArH); ^{13}C NMR (125 MHz, $CDCl_3$): δ = 13.7 (d, J = 12.5 Hz), 20.2 (d, J = 8.8 Hz), 31.2 (d, J = 1.3 Hz), 40.0, 41.2, 118.5, 124.0, 126.3 , 127.1 (d, J = 10.0 Hz), 133.8, 143.1, 148.7, 150.1, 164.6. HRMS (TOF ES$^+$): *m/z* calcd for $C_{18}H_{24}N_4O_3$ [(M+H)$^+$], 345.1921; found, 345.1919.

***N*-(4-Fluorobenzyl)-3-nitro-2-(phenylamino)quinoline-4-carboxamide (6al)**



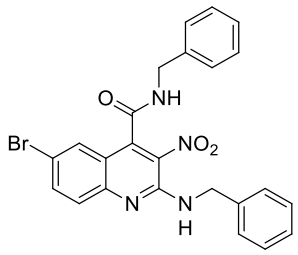
Red solid, 121mg; Mp: 147.2–148.5 ℃; IR (KBr): 3455, 1638, 1332, 1119 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 4.47(d, J= 6.0 Hz, 2H, NCH_2), 7.03 (s, 1H, ArH), 7.14 (t, J= 8.5 Hz,2H, ArH), 7.29–7.32 (m, 2H, ArH), 7.36–7.39 (m, 3H, ArH), 7.60–7.66 (m, 2H, ArH), 7.72–7.74 (m, 2H, ArH), 9.21 (s, 1H, NH), 9.43 (s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.6, 115.5(d, J= 21.3 Hz), 119.5, 121.6, 123.7, 125.6, 127.1(d, J= 11.3 Hz), 129.1, 130.2(d, J= 7.5 Hz), 131.1, 133.7, 135.0, 139.9, 141.4, 145.2, 147.9, 160.9(d, J= 245.0 Hz), 163.2. HRMS (TOF ES^+): *m/z* calcd for $C_{23}H_{17}FN_4O_3$ [$(M+H)^+$], 417.1357; found, 417.1360.

_N_-(4-Fluorobenzyl)-3-nitro-2-(_p_-tolylamino)quinoline-4-carboxamide (6am)



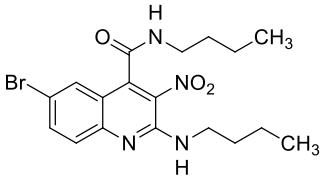
Red solid, 133mg; Mp: 175.2–176.5 ℃; IR (KBr): 3455, 1638, 1332, 1119 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.23(s, 3H, CH_3),4.47(d, J= 5.5 Hz, 2H, NCH_2), 7.10–7.17 (m, 4H, ArH), 7.34–7.39 (m, 3H, ArH), 7.58–7.61 (m, 4H, ArH), 7.68–7.71 (m, 1H, ArH), 9.13 (s, 1H, NH), 9.40 (t, J= 6.0 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.0, 42.6, 115.6(d, J= 21.3 Hz), 119.6, 121.9, 125.3, 127.1, 129.5, 130.2(d, J= 7.5 Hz), 131.0, 132.8, 133.7, 135.1, 137.3, 141.4, 145.4, 148.1, 161.0(d, J= 241.3 Hz), 163.3. HRMS (TOF ES^+): *m/z* calcd for $C_{24}H_{19}FN_4O_3$ [$(M+H)^+$], 431.1514; found, 431.1519.

_N_-Benzyl-2-(benzylamino)-6-bromo-3-nitroquinoline-4-carboxamide (6bc)



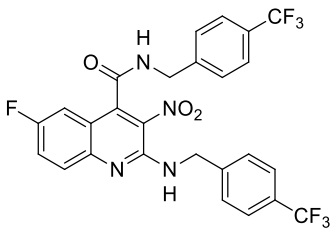
Red solid, 196mg; Mp: 201.5–201.7 ℃; IR (KBr): 3414, 2924, 1638, 1617, 1110, 803, 619, 477 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.53 (d, J = 5.0 Hz, 2H, NCH_2), 4.73 (d, J = 5.0 Hz, 2H, NCH_2), 7.21 (t, J = 7.0 Hz, 1H, ArH), 7.31 (d, J = 7.0 Hz, 3H, ArH), 7.38–7.43 (m, 6H, ArH), 7.52–7.54 (d, 1H, ArH), 7.65 (d, J = 1.5 Hz, 1H, ArH), 7.79 (q, J = 2.0 Hz, 1H, ArH), 8.28 (t, J = 6.0 Hz, 1H, NH), 9.44 (t, J = 5.5 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 43.3, 44.6, 116.3, 119.8, 127.2, 127.7, 128.0, 128.2, 128.7, 128.9 (d, J = 7.5 Hz), 130.6, 136.3, 138.8, 139.9, 140.4, 147.7, 148.2, 162.9. HRMS (TOF ES^+): *m/z* calcd for $C_{24}H_{19}BrN_4O_3$ [$(M+H)^-$], 489.0564; found, 489.0562.

6-Bromo-*N*-butyl-2-(butylamino)-3-nitroquinoline-4-carboxamide (6bk)



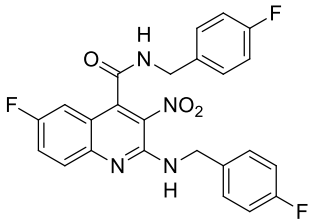
Yellow solid, 194mg; Mp: 161.4–161.5 ℃; IR (KBr): 3445, 2926, 1643, 1605, 1384, 1119 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 0.91 (m, J = 3.5 Hz, 6H, CH_3), 1.34 (q, J = 7.0 Hz, 4H, CH_2), 1.50 (t, J = 7.5 Hz, 2H, CH_2), 1.59 (t, J = 7.5 Hz, 2H, CH_2), 3.30 (d, J = 6.0 Hz, 2H, NCH_2), 3.52 (d, J = 6.0 Hz, 2H, NCH_2), 7.54 (s, 1H, ArH), 7.63 (s, 1H, ArH), 7.69 (d, J = 1.0 Hz, 1H, NH), 7.80 (d, J = 1.5 Hz, 1H, NH), 8.92 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 14.0 (d, J = 18.8 Hz), 20.0 (d, J = 15.0 Hz), 30.9 (d, J = 13.8 Hz), 39.2, 41.0, 115.9, 119.5, 128.7 (d, J = 16.3 Hz), 130.7, 136.2, 140.6, 147.9, 148.4, 162.9. HRMS (TOF ES^+): *m/z* calcd for $C_{18}H_{23}BrN_4O_3$ [$(M+H)^-$], 421.0875; found, 421.0880.

6-Fluoro-3-nitro-*N*-(4-(trifluoromethyl)benzyl)-2-(4 (trifluoromethyl)benzylamino)quinolone -4-carboxamide (6da)



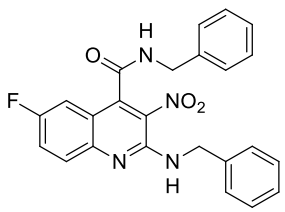
Yellow solid, 258mg; Mp: 193.2–193.5 ℃; IR (KBr): 3455, 1638, 1332, 1119 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 4.64 (d, J = 4.7 Hz, 2H, NCH_2), 4.82 (d, J = 5.2Hz, 2H, NCH_2), 7.24 (d, J = 9.1 Hz, 1H, ArH), 7.61–7.68 (m, 8H, ArH), 7.76 (d, J = 8.0 Hz, 2H, ArH), 8.33 (t, J = 5.2 Hz, 1H, NH), 9.52 (t, J = 5.3 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 43.0, 44.3, 110.2 (d, J = 22.5 Hz), 118.7 (d, J = 10.5 Hz), 123.5 (d, J = 24.0 Hz), 123.9 (d, J = 9.0 Hz),125.5 (d, J = 4.5 Hz), 127.5 , 127.8, 128.0, 128.3, 128.5, 128.6, 129.0, 129.3 (d, J = 9.0 Hz), 130.7, 140.8 (d, J = 4.5 Hz), 144.4 (d, J = 228.0 Hz), 146.8 (d, J = 208.5 Hz), 158.5 (d, J = 241.5 Hz), 163.3. HRMS (TOF ES^+): *m/z* calcd for $C_{26}H_{17}F_7N_4O_3$ [$(M+H)^+$], 567.1262; found, 567.1262.

6-Fluoro-*N*-(4-fluorobenzyl)-2-(4-fluorobenzylamino)-3-nitroquinoline-4-carboxamide (6db)



Yellow solid, 210mg; Mp: 193.0–193.2 ℃; IR (KBr): 3428, 3263, 1642, 1602, 1559, 1512, 1436, 1403, 1385, 1241, 1219, 1182, 1159, 1121, 831, 490 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.51 (d, J = 5.5 Hz, 2H, NCH_2), 4.70 (d, J = 6.0 Hz, 2H, NCH_2), 7.10 (t, J = 8.5 Hz, 2H, ArH), 7.19–7.23 (m, 3H, ArH), 7.40 (q, J = 5.5 Hz, 2H, ArH), 7.46 (q, J = 6.0 Hz, 2H, ArH), 7.65 (t, J = 2.5 Hz, 2H, ArH), 8.19 (br, 1H, NH), 9.40 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.6, 43.9, 110.2 (d, J = 23.8 Hz), 115.4 (q, J = 21.3 Hz), 118.7 (d, J = 10.0 Hz), 123.6 (d, J = 26.3 Hz), 129.3 (d, J = 8.8 Hz), 130.0 (d, J = 8.8 Hz), 130.3 (d, J = 8.8 Hz), 130.7, 135.0 (d, J = 2.5 Hz), 136.2 (d, J = 2.5 Hz) , 140.9 (d, J = 5.0 Hz), 146.1, 147.5, 158.4 (d, J = 241.3 Hz), 161.6(d, J = 240.0 Hz), 160.9 (d, J = 241.3 Hz), 163.1. HRMS (TOF ES^+): *m/z* calcd for $C_{24}H_{17}F_3N_4O_3$ [$(M+H)^-$], 465.1175; found, 465.1180.

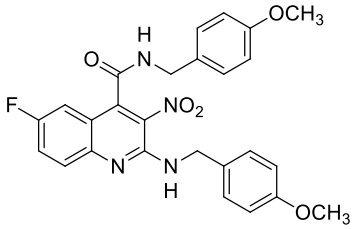
***N*-Benzyl-2-(benzylamino)-6-fluoro-3-nitroquinoline-4-carboxamide (6dc)**



Yellow solid, 172mg; Mp: 183.0–183.2 ℃; IR (KBr): 3420, 1640, 1385, 1113 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.54 (d, J = 5.5 Hz, 2H, NCH_2), 4.74 (d, J = 6.0 Hz, 2H, NCH_2), 7.23–7.45 (m, 11H, ArH), 7.63 (t, J = 5.5 Hz, 2H, ArH), 8.16 (br, 1H, NH), 9.46 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 43.3, 44.6, 110.2 (d, J = 23.8 Hz), 118.7 (d, J = 8.8 Hz),

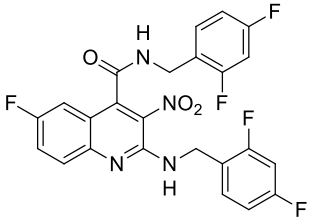
120.6, 123.4 (d, *J* = 25.0 Hz), 127.2, 127.7, 128.0 (d, *J* = 25.0 Hz), 128.7, 128.9, 129.3 (d, *J* = 8.8 Hz), 130.8, 138.8, 140.0, 140.9 (d, *J* = 5.0 Hz), 146.2, 147.6, 158.3 (d, *J* = 241.3 Hz), 163.1. HRMS (TOF ES$^+$): *m/z* calcd for $C_{24}H_{19}FN_4O_3$ [(M+H)$^+$], 431.1514; found, 431.1514.

6-Fluoro-*N*-(4-methoxybenzyl)-2-(4-methoxybenzylamino)-3-nitroquinoline-4-carboxamide (6de)



Red solid, 203mg; Mp: 190.7–190.9 ℃; IR (KBr): 3417, 2924, 1639, 1615, 1561, 1514, 1440, 1404, 1385, 1332, 1247, 1177, 1113, 600, 485 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 3.70 (s, 3H, OCH_3), 3.75 (s, 3H, OCH_3), 4.45 (d, *J* = 5.5 Hz, 2H, NCH_2), 4.66 (d, *J* = 5.5 Hz, 2H, NCH_2), 6.85 (d, *J* = 9.0 Hz, 2H, ArH), 6.93 (d, *J* = 8.5 Hz, 2H, ArH), 7.19 (q, *J* = 2.5 Hz, 1H, ArH), 7.29 (d, *J* = 8.5 Hz, 2H, ArH), 7.35 (d, *J* = 4.5 Hz, 2H, ArH), 7.63–7.67 (m, 2H, ArH), 8.05 (t, *J* = 6.0 Hz, 1H, NH), 9.31 (t, *J* = 5.5 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.8, 44.1, 55.5 (d, *J* = 12.5 Hz), 110.2 (d, *J* = 23.8 Hz), 114.1 (d, *J* = 26.3 Hz), 118.6 (d, *J* = 10.0 Hz), 123.3 (d, *J* = 25.0 Hz), 129.2 (d, *J* = 8.8 Hz), 129.5 (d, *J* = 15.0 Hz), 130.7, 131.9, 140.9 (d, *J* = 6.3 Hz), 146.2, 147.5, 158.3 (d, *J* = 241.3 Hz), 158.7, 159.0, 163.0. HRMS (TOF ES$^+$): *m/z* calcd for $C_{26}H_{23}FN_4O_5$ [(M+H)$^-$], 489.1574; found, 489.1582.

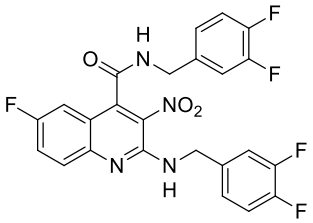
***N*-(2,4-Difluorobenzyl)-2-(2,4-difluorobenzylamino)-6-fluoro-3-nitroquinoline-4-carbox-amide (6df)**



Yellow solid, 216mg; Mp: 186.0–186.2 ℃; IR (KBr): 3443, 3257, 1642, 1605, 1561, 1507, 1441, 1404, 1355, 1336, 1275, 1239, 1185, 1141, 1099, 983, 616 cm^{-1}; ^{19}F NMR (475 MHz, DMSO-d_6): δ = -116.8, -114.3 (d, *J* = 4.8 Hz), -113.8 (d, *J* = 4.8 Hz), -112.4 (d, *J* = 4.8 Hz), -111.2 (d, *J* = 9.5 Hz); ^{1}H NMR (500 MHz, DMSO-d_6): δ = 4.55 (d, *J* = 5.0 Hz, 2H, NCH_2), 4.73 (d, *J* = 5.0 Hz, 2H, NCH_2), 7.00 (d, *J* = 1.5 Hz, 1H, ArH), 7.13 (d, *J* = 1.5 Hz, 1H, ArH), 7.20–7.24 (t, 2H, ArH), 7.28 (s, 1H, ArH), 7.50–7.54 (q, 2H, ArH), 7.64 (d, *J* = 7.0 Hz, 2H, ArH), 8.18 (br, 1H, NH), 9.40 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 36.9 (d, *J* = 3.8 Hz), 38.2, 103.8 (d, *J* = 26.3 Hz), 104.1 (t, *J* = 13.8 Hz), 104.5, 110.2 (d, *J* = 23.8 Hz), 111.5 (d, *J* = 2.5 Hz), 111.6 (d, *J* = 3.8 Hz), 111.7 (d, *J* = 2.5 Hz), 111.9 (d, *J* = 2.5 Hz), 118.8 (d, *J* = 10.0 Hz), 122.4 (d, *J* = 187.5 Hz), 123.5, 123.7, 129.3 (d, *J* = 8.8 Hz), 130.6, 131.2 (d, *J* = 6.3 Hz), 131.3 (q, *J* = 6.3 Hz), 132.2 (d, *J* = 6.3 Hz), 132.3 (d, *J* = 6.3 Hz), 140.9 (d, *J* = 6.3 Hz), 146.1, 147.4, 158.5 (d, *J* = 242.5 Hz), 159.8 (d, *J* = 7.5 Hz), 159.9 (d, *J* = 7.5 Hz), 161.7 (d, *J* = 242.5 Hz), 161.8 (d, *J* = 243.8 Hz),

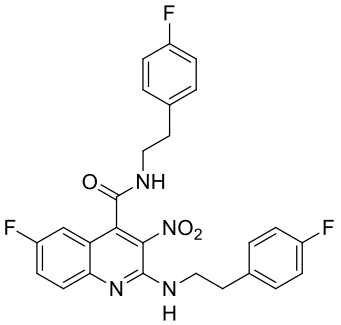
162.7 (d, *J* = 12.5 Hz), 163.1 (t, *J* = 6.3 Hz), 163.2. HRMS (TOF ES$^+$): *m/z* calcd for $C_{24}H_{15}F_5N_4O_3$ [(M+H)$^+$], 503.1137; found, 503.1136.

(*N*-(3,4-Difluorobenzyl)-2-(3,4-difluorobenzylamino)-6-fluoro-3-nitroquinoline-4-carbox-amide (6dg)



Yellow solid, 221mg; Mp: 187.3–187.4 ℃; IR (KBr): 3420, 1639, 1616, 1118, 620 cm^{-1}; ^{19}F NMR (475 MHz, DMSO-d_6): δ = -141.7 (d, *J* = 23.8 Hz), -141.0 (d, *J* = 23.8 Hz), -139.2 (d, *J* = 19.0 Hz), -138.9 (d, *J* = 38.0 Hz), -116.8; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 4.54 (d, *J* = 5.0 Hz, 2H, NCH_2), 4.70 (d, *J* = 5.5 Hz, 2H, NCH_2), 7.25–7.29 (q, 3H, ArH), 7.34–7.43 (m, 1H, ArH), 7.44–7.48 (t, 3H, ArH), 7.66 (m, *J* = 4.5 Hz, 2H, ArH), 8.25 (d, *J* = 5.5 Hz, 1H, NH), 9.44 (d, *J* = 5.5 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.3, 43.7, 110.2 (d, *J* = 23.8 Hz), 117.0, 117.1 (d, *J* = 16.3 Hz), 117.5 (d, *J* = 16.3 Hz), 117.8 (d, *J* = 17.5 Hz), 118.7 (d, *J* = 10.0 Hz), 123.5 (d, *J* = 26.3 Hz), 124.7 (q, *J* = 2.5 Hz), 125.0 (q, *J* = 2.5 Hz), 129.3 (d, *J* = 8.8 Hz), 130.7, 136.6 (t, *J* = 5.0 Hz), 138.0 (t, *J* = 3.8 Hz), 140.8 (d, *J* = 5.0 Hz), 146.1, 147.4, 147.8 (d, *J* = 12.5 Hz), 149.1 (d, *J* = 242.5 Hz), 149.2 (d, *J* = 242.5 Hz), 149.6 (d, *J* = 243.8 Hz), 149.7 (d, *J* = 245.0 Hz), 149.8 (d, *J* = 243.8 Hz), 158.5 (d, *J* = 241.3 Hz), 163.3. HRMS (TOF ES$^+$): *m/z* calcd for $C_{24}H_{15}F_5N_4O_3$ [(M+H)$^+$], 503.1137; found, 503.1135.

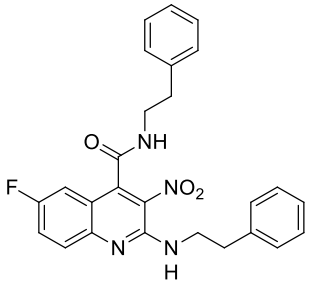
6-Fluoro-*N*-(4-fluorophenethyl)-2-(4-fluorophenethylamino)-3-nitroquinoline-4-carboxamide (6dh)



Yellow solid, 208mg; Mp: 181.0–181.1 ℃; IR (KBr): 3414, 1638, 1617, 1120, 620, 475 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.85 (s, 2H, CH_2), 2.92 (t, *J* = 7.0 Hz, 2H, CH_2), 3.59 (s, 2H, NCH_2), 3.71 (d, *J* = 6.5 Hz, 2H, NCH_2), 6.91 (dr, 1H, NH), 7.11–7.15 (m, 4H, ArH), 7.31–7.35 (m, 4H, ArH), 7.61–7.75 (m, 2H, ArH), 7.75 (dr, 1H, NH), 8.95(s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 34.0 (d, *J* = 8.8 Hz), 40.8, 43.1, 110.3 (d, *J* = 23.8 Hz), 115.4 (d, *J* = 21.3 Hz), 118.4 (d, *J* = 10.0 Hz), 123.3 (d, *J* = 26.3 *Hz*), 129.2 (d, *J* = 8.8 Hz), 130.7, 130.9 (d, *J* = 7.5 Hz), 135.6 (d, *J* = 2.5 Hz), 136.2 (d, *J* = 2.5 Hz), 141.1 (d, *J* = 5.0 Hz), 146.3, 147.7, 158.2 (d, *J* =

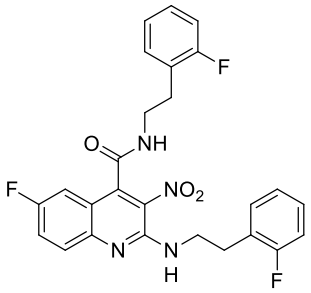
240.0 Hz), 161.3 (d, J = 240.0 Hz), 161.5 (d, J = 240.0 Hz), 163.1. HRMS (TOF ES$^+$): *m/z* calcd for $C_{26}H_{21}F_3N_4O_3$ [(M+H)$^-$], 495.1639; found, 495.1636.

6-Fluoro-3-nitro-*N*-phenethyl-2-(phenethylamino)quinoline-4-carboxamide (6di)



Red solid, 186mg; Mp: 158.5–158.7 ℃; IR (KBr): 3414, 2934, 1644, 1606, 1555, 1223, 828, 699, 471 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.86 (t, J = 6.0 Hz, 2H, CH_2), 2.94 (t, J = 7.5 Hz, 2H, CH_2), 3.6 (d, J = 5.0 Hz, 2H, NCH_2), 3.74 (d, J = 6.0 Hz, 2H, NCH_2), 7.23 (t, J = 3.5 Hz, 1H, ArH), 7.25 (s, 2H, ArH), 7.31 (d, J = 4.5 Hz, 8H, ArH), 7.63 (s, 2H, ArH) 7.64 (br, 1H, NH), 8.99 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 34.9 (d, J = 13.8 Hz), 40.9, 43.2, 110.4 (d, J = 22.5 Hz), 118.4 (d, J = 10.0 Hz), 123.3 (d, J = 26.3 Hz), 126.6 (d, J = 18.8 Hz), 128.8 (d, J = 2.5 Hz), 129.2 (d, J = 5.0 Hz), 130.7, 139.5, 140.1, 141.3, 146.4, 147.7, 158.5 (d, J = 241.3 Hz), 163.1. HRMS (TOF ES$^+$): *m/z* calcd for $C_{26}H_{23}FN_4O_3$ [(M+H)$^+$], 459.1827; found, 495.1826.

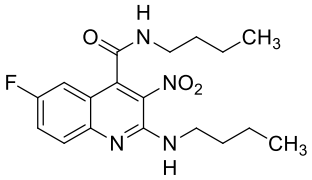
6-Fluoro-*N*-(2-fluorophenethyl)-2-(2-fluorophenethylamino)-3-nitroquinoline-4-carboxamide (6dj)



Yellow solid, 205mg; Mp: 160.2–160.3 ℃; IR (KBr): 3431, 2032, 1641, 1606, 1229, 753, 613, 467 cm^{-1}; ^{1}H NMR (600 MHz, DMSO-d_6): δ = 2.92 (d, J = 6.1 Hz, 2H, CH_2), 3.00 (t, J = 7.1 Hz, 2H, CH_2), 3.61 (d, J = 4.8 Hz, 2H, NCH_2), 3.75 (d, J = 6.5 Hz, 2H, NCH_2), 7.07 (d, J = 6.8 Hz, 1H, ArH), 7.14–7.17 (t, 4H, ArH), 7.17 (d, J = 4.0 Hz, 2H, ArH), 7.37 (t, 2H, ArH), 7.66–7.69 (m, 2H, ArH, NH), 7.70 (br, 1H, NH), 9.04 (br, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 28.3, 28.5, 39.9, 41.8, 110.3 (d, J = 24.0 Hz), 115.5 (d, J = 15.0 Hz), 115.6 (d, J = 13.5 Hz), 118.4 (d, J = 10.5 Hz), 123.3 (d, J = 25.5 Hz), 124.8 (t, J = 3.0 Hz), 126.0 (d, J = 16.5 Hz), 126.6 (d, J = 16.5 Hz), 128.7 (d, J = 7.5 Hz), 128.9 (d, J = 7.5 Hz), 129.2 (d, J = 7.5 Hz), 130.7, 131.6 (d, J = 4.5 Hz), 131.7 (d, J = 4.5 Hz), 141.1 (d, J = 4.5 Hz), 146.3, 147.7, 158.3 (d, J = 241.5 Hz),

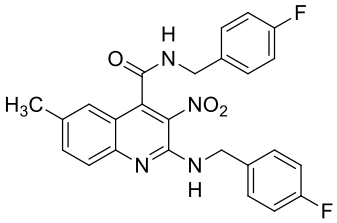
161.3 (d, *J* = 241.5 Hz), 161.3 (d, *J* = 241.5 Hz), 163.2. HRMS (TOF ES^+): *m/z* calcd for $C_{26}H_{21}F_3N_4O_3$ [$(M+H)^+$], 495.1639; found, 495.1634.

***N*-Butyl-2-(butylamino)-6-fluoro-3-nitroquinoline-4-carboxamide (6dk)**



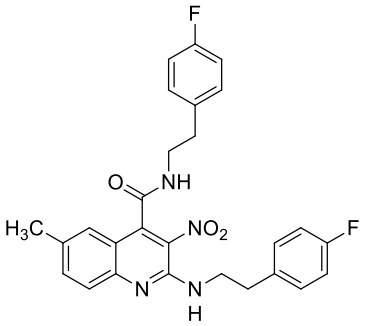
Red solid, 172mg; Mp: 126.0–126.2 ℃; IR (KBr): 3418, 2960, 1643, 1609, 1442, 604 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 0.91 (m, *J* = 1.8 Hz, 6H, CH_3), 1.35 (m, *J* = 7.1 Hz, 4H, CH_2), 1.60 (t, *J* = 7.3 Hz, 2H, CH_2), 3.29 (q, *J* = 6.4 Hz, 2H, NCH_2), 3.51 (q, *J* = 6.5 Hz, 2H, NCH_2), 7.27 (t, *J* = 7.4 Hz, 1H, ArH), 7.49 (t, *J* = 5.2 Hz, 1H, NH), 7.65 (t, *J* = 1.4 Hz, 1H, ArH), 7.67 (br, 1H, NH), 8.89 (t, *J* = 5.2 Hz, 1H, CONH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 14.0 (d, *J* = 25.5 Hz), 20.0 (d, *J* = 18.0 Hz), 31.0 (t, *J* = 9.0 Hz), 39.2, 40.9, 110.2 (d, *J* = 22.5 Hz), 118.3 (d, *J* = 10.5 Hz), 123.1 (d, *J* = 25.5 Hz), 129.2 (d, *J* = 9.0 Hz), 130.9, 141.0 (d, *J* = 4.5 Hz), 146.4, 147.8, 158.2 (d, *J* = 241.5 Hz), 162.9. HRMS (TOF ES^+): *m/z* calcd for $C_{18}H_{23}FN_4O_3$ [$(M+H)^+$], 363.1827; found, 363.1830.

***N*-(4-Fluorobenzyl)-2-(4-fluorobenzylamino)-6-methyl-3-nitroquinoline-4-carboxamide (6fb)**



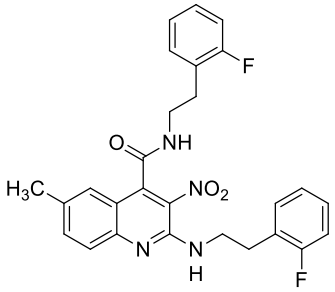
Red solid, 189mg; Mp: 237.4–237.5 ℃; IR (KBr): 3415, 2924, 1654, 1638, 1596, 1385, 1159, 831, 607 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.32 (s, 3H, CH_3), 4.51 (d, *J* = 5.5 Hz, 2H, NCH_2), 4.71 (d, *J* = 5.0 Hz, 2H, NCH_2), 7.10 (t, *J* = 8.5 Hz, 2H, ArH), 7.18–7.25 (m, 4H, ArH), 7.42–7.54 (m, 5H, ArH), 8.13 (br, 1H, NH), 9.35 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.2, 42.5, 43.9, 115.2 (d, *J* = 21.3 Hz), 115.5 (d, *J* = 21.3 Hz), 116.0 (d, *J* = 21.3 Hz), 118.6, 125.7, 126.6, 128.9 (d, *J* = 8.8 Hz), 129.1 (d, *J* = 8.8 Hz), 129.7, 130.0 (d, *J* = 8.8 Hz), 130.3 (d, *J* = 8.8 Hz), 133.6, 135.3 (d, *J* = 2.5 Hz), 135.8, 136.4 (d, *J* = 2.5 Hz) , 141.2, 147.5 (d, *J* = 17.5 Hz), 151.2, 161.6 (d, *J* = 240.0 Hz), 161.9 (d, *J* = 241.3 Hz), 163.7. HRMS (TOF ES^+): *m/z* calcd for $C_{25}H_{20}F_2N_4O_3$ [$(M+H)^-$], 461.1425; found, 461.1429.

***N*-(4-Fluorophenethyl)-2-(4-fluorophenethylamino)-6-methyl-3-nitroquinoline-4-carbox-amide (6fh)**



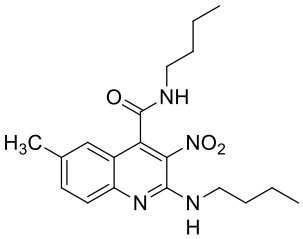
Red solid, 206mg; Mp: 151.7–151.9 ℃; IR (KBr): 3416, 1745, 1618, 1509, 1491, 1124, 606 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.33 (s, 3H, CH_3), 2.86 (s, 2H, CH_2), 2.92 (t, J = 7.5 Hz, 2H, CH_2), 3.58 (s, 2H, NCH_2), 3.71 (d, J = 6.5 Hz, 2H, NCH_2), 7.11–7.15 (m, 5H, ArH, NH), 7.32 (q, J = 5.5 Hz, 4H, ArH), 7.55 (d, J = 9.0 Hz, 3H, ArH), 8.88 (s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.3, 34.1, 40.8, 43.1, 115.4 (q, J = 1.3 Hz), 118.3, 125.9, 126.6, 129.8, 130.7, 130.9 (d, J = 8.8 Hz), 133.4, 135.8 (d, J = 10.0 Hz), 136.3, 141.5, 147.7 (d, J = 15.0 Hz), 161.3 (d, J = 240.0 Hz), 161.4 (d, J = 240.0 Hz), 163.7. HRMS (TOF ES^+): *m/z* calcd for $C_{27}H_{24}F_2N_4O_3$ [$(M+H)^-$], 491.1889; found, 491.1888.

_N_-(2-Fluorophenethyl)-2-(2-fluorophenethylamino)-6-methyl-3-nitroquinoline-4-carbox-amide (6fj)



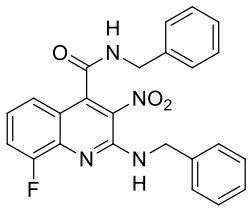
Yellow solid, 199mg; Mp: 143.2–143.4 ℃; IR (KBr): 3433, 3294, 2925, 1643, 1598, 1506, 1228, 1111, 753 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.35 (s, 3H, CH_3), 2.92 (s, 2H, CH_2), 2.99 (t, J = 7.0 Hz, 2H, CH_2), 3.59 (d, J = 4.5 Hz, 2H, NCH_2), 3.73 (q, J = 6.5 Hz, 2H, NCH_2), 7.15–7.20 (m, 4H, ArH), 7.24–7.31 (m, 3H, ArH), 7.36 (q, J = 8.5 Hz, 2H, ArH), 7.41 (s, 2H, ArH), 7.61 (t, J = 5.5 Hz, 1H, NH), 8.95 (t, J = 5.5 Hz, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.3, 28.3 (d, J = 7.5 Hz), 39.9, 41.7, 115.5 (d, J = 7.5 Hz), 115.5 (d, J = 8.8 Hz), 118.3, 124.8 (d, J = 2.5 Hz), 125.9, 126.1 (d, J = 15.0 Hz), 126.6 (t, J = 13.8 Hz), 128.7 (d, J = 7.5 Hz), 128.9 (d, J = 7.5 Hz), 129.8, 131.5 (d, J = 5.0 Hz), 131.7 (d, J = 5.0 Hz), 133.5, 135.8, 141.5, 147.7 (d, J = 11.3 Hz), 161.3 (d, J = 242.5 Hz), 163.8. HRMS (TOF ES^+): *m/z* calcd for $C_{27}H_{24}F_2N_4O_3$ [$(M+H)^+$], 491.1889; found, 491.1885.

_N_-Butyl-2-(butylamino)-6-methyl-3-nitroquinoline-4-carboxamide (6fk)



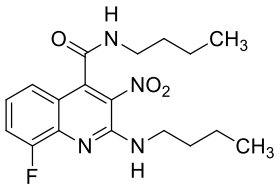
Red solid, 163mg; Mp: 135.0–135.2 ℃; IR (KBr): 3414, 2930, 1638, 1617, 1121, 618 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 0.91 (t, J = 7.0 Hz, 6H, CH_3), 1.35 (q, J = 7.5 Hz, 4H, CH_2), 1.51 (t, J = 7.5 Hz, 2H, CH_2), 1.60 (t, J = 7.0 Hz, 2H, CH_2), 2.39 (s, 3H, CH_3), 3.27 (q, J = 6.0 Hz, 2H, NCH_2), 3.51 (t, J = 6.0 Hz, 2H, NCH_2), 7.37 (s, 1H, ArH), 7.42 (s, 1H, ArH), 7.53 (s, 1H, ArH), 7.55 (s, 1H, NH), 8.80 (br, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 14.1 (d, J = 20.0 Hz), 20.0 (d, J = 13.8 Hz), 31.1, 39.2, 40.9, 118.3, 125.9, 126.5, 129.9, 133.2, 135.7, 141.5, 147.9, 163.5. HRMS (TOF ES^+): *m/z* calcd for $C_{19}H_{26}N_4O_3$ [$(M+H)^+$], 359.2078; found, 359.2078.

_N_-Benzyl-2-(benzylamino)-8-fluoro-3-nitroquinoline-4-carboxamide (6gc)



Yellow solid, 176mg; Mp: 182.5–185.6 ℃; IR (KBr): 3415, 2924, 1639, 1617, 1177, 620, 480 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ = 4.49 (q, J = 4.7 Hz, 2H, NCH_2), 4.71 (t, J = 9.6 Hz, 2H, NCH_2), 7.10 (t, J = 7.4 Hz, 3H, ArH), 7.17 (d, J = 6.3 Hz, 2H, ArH), 7.19-7.32 (m, 1H, ArH), 7.41 (t, J = 4.7 Hz, 2H, ArH), 7.47 (t, J = 4.8 Hz, 2H, ArH), 7.59 (t, J = 4.0 Hz, 2H, ArH), 7.69 (q, J = 6.0 Hz, 1H, ArH), 8.21 (t, J = 4.9 Hz, 1H, NH), 9.35 (t, J = 4.8 Hz, 1H, CONH); ^{13}C NMR (125 MHz, $CDCl_3$): δ = 44.5, 45.7, 117.7, 117.8, 120.6, 122.7 (d, J = 5.0 Hz), 123.7 (d, J = 7.5 Hz), 127.6, 128.0 (d, J = 12.5 Hz), 128.3 (d, J = 21.3 Hz), 128.7, 128.9, 136.8, 137.9, 138.3, 140.1 (d, J = 12.5 Hz), 142.6, 148.3, 155.9 (d, J = 253.8 Hz), 163.9. HRMS (TOF ES^+): *m/z* calcd for $C_{24}H_{20}FN_4O_3$ [$(M+H)^-$], 429.1363; found, 429.1370.

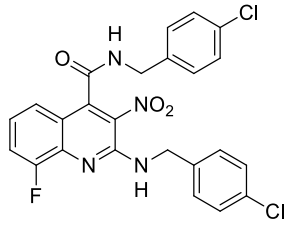
_N_-Butyl-2-(butylamino)-8-fluoro-3-nitroquinoline-4-carboxamide (6gk)



Red solid, 161mg; Mp: 122.7–122.8 ℃; IR (KBr): 3418, 2960, 1645, 1607, 1564, 1461, 1178, 617 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 0.91 (q, J = 7.0 Hz, 6H, CH_3), 1.34–1.49 (m, 4H, CH_2), 1.51 (t, J = 7.0 Hz, 2H, CH_2), 1.60–1.66 (m, J = 7.0 Hz, 2H, CH_2), 3.29 (d, J = 6.0 Hz, 2H,

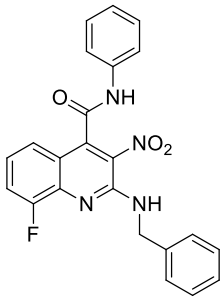
NCH_2), 3.56 (d, *J* = 6.0 Hz, NCH_2), 7.27 (q, *J* = 8.0 Hz, 1H, ArH), 7.43 (d, *J* =8.0 Hz, 1H, ArH), 7.54 (t, *J* =10.5 Hz, 1H, ArH), 7.69 (t, *J* = 5.0 Hz, 1H, NH), 8.88 (d, *J* = 5.0 Hz, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 14.1 (d, *J* = 12.5 Hz), 20.0 (d, *J* = 8.8 Hz), 30.8, 31.1, 39.2, 41.0, 117.3 (d, *J* = 17.5 Hz), 120.2, 123.2(d, *J* = 3.8 Hz), 123.4 (d, *J* = 7.5 Hz), 131.0, 138.9 (d, *J* = 11.3 Hz), 141.3, 148.1, 155.6 (d, *J* = 251.3 Hz), 162.9. HRMS (TOF ES$^+$): *m/z* calcd for $C_{18}H_{23}FN_4O_3$ [(M+H)$^-$], 361.1676; found, 361.1684.

_N_-(4-Chlorobenzyl)-2-(4-chlorobenzylamino)-8-fluoro-3-nitroquinoline-4-carboxamide (6gn)



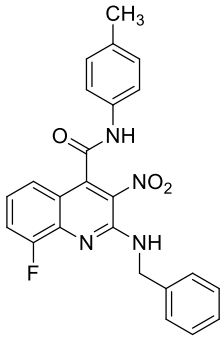
Yellow solid, 187mg; Mp: 214.5–214.6 ℃; IR (KBr): 3442, 2925, 1645, 1605, 1348, 799 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 4.53 (d, *J* = 5.5 Hz, 2H, NCH_2), 4.72 (d, *J* = 5.5 Hz, 2H, NCH_2), 7.28–7.31 (m, 1H, ArH), 7.32–7.57 (m, 9H, ArH), 7.59 (s, 1H, ArH), 8.44 (t, *J* = 5.5 Hz, 1H, NH), 9.42 (t, *J* = 5.5 Hz, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.6, 44.2, 117.6 (d, *J* = 17.5 Hz), 120.5, 123.1 (d, J = 3.75 Hz), 123.9 (d, *J* = 7.5 Hz), 128.5, 128.8, 129.8, 130.1 (d, *J* = 16.25 Hz), 130.8, 132.3, 137.8, 138.7 (t, *J* = 11.25 Hz), 141.3, 147.8, 155.6 (d, *J* = 251.3 Hz), 163.2. HRMS (TOF ES$^+$): *m/z* calcd for $C_{24}H_{17}Cl_2FN_4O_3$ [(M+H)$^-$], 497.0583; found, 497.0588.

_N_-Benzyl-8-fluoro-3-nitro-2-(phenylamino)quinoline-4-carboxamide (6go)



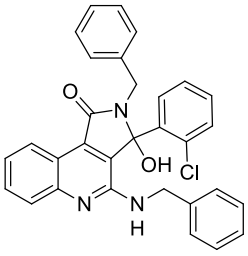
Red solid, 144mg; Mp: 218.2–219.5 ℃; IR (KBr): 3455, 1638, 1332, 1119 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 4.80 (s, 2H, NCH_2), 7.18–7.25 (m, 2H, ArH), 7.32–7.53 (m, 6H, ArH), 7.52–7.65 (m, 3H, ArH), 7.61–7.67 (m, 2H, ArH),8.53 (t, *J*= 5.5 Hz, 1H, NH), 10.95 (s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 44.8, 117.8(d, *J* = 17.5 Hz), 120.3, 123.1 (d, *J* = 5.0 Hz), 124.2 (d, *J* = 7.5 Hz), 125.0, 127.3, 128.4(d, *J* = 22.5 Hz), 129.5(d, *J* = 17.5 Hz), 130.3, 138.6, 139.1(d, *J* = 11.3 Hz), 139.7, 141.3, 148.1, 154.6(d, *J* = 251.3 Hz), 161.7. HRMS (TOF ES$^+$): *m/z* calcd for $C_{23}H_{17}FN_4O_3$ [(M+H)$^+$], 417.1357; found, 417.1362.

_N_-Benzyl-8-fluoro-3-nitro-2-(*p*-tolylamino)quinoline-4-carboxamide (6gp)



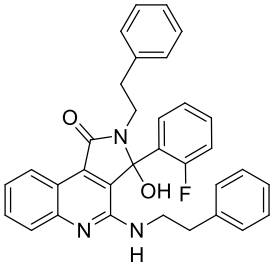
Red solid, 142mg; Mp: 220.2–221.5 ℃; IR (KBr): 3455, 1638, 1332, 1119 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.31(s, 3H, CH_3), 4.79 (s, 2H, NCH_2), 7.20–7.25 (m, 3H, ArH), 7.31–7.35 (m, 3H, ArH), 7.49–7.54 (m, 5H, ArH), 7.60–7.63 (m, 1H, ArH), 8.50 (t, J= 6.0 Hz, 1H, NH), 10.84 (s, 1H, CONH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.0, 44.8, 117.8(d, J = 17.5 Hz), 120.3, 123.1 (d, J = 3.8 Hz), 124.1 (d, J = 6.3 Hz), 127.3, 128.4(d, J = 22.5 Hz), 129.9, 130.3, 134.1, 136.1, 139.1(d, J = 11.3 Hz), 139.8, 141.3, 148.1, 154.6(d, J = 251.3 Hz), 161.4. HRMS (TOF ES^+): *m/z* calcd for $C_{24}H_{19}FN_4O_3$ [$(M+H)^+$], 431.1514; found, 431.1520.

2-Benzyl-4-(benzylamino)-3-(2-chlorophenyl)-3-hydroxy-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]-quinolin-1-one (7aa)



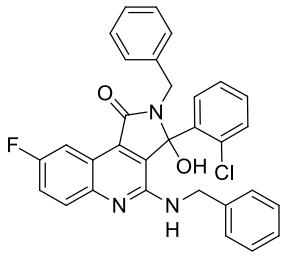
Yellow solid, 177mg; Mp: 223.7–224.8 ℃; IR (KBr): 3419, 1704, 1636, 1532, 1435, 1135, 772, 698 cm^{-1}; ^{1}H NMR (600 MHz, DMSO-d_6): δ = 4.38 (s, 2H, CH_2), 4.47–4.50 (m, 1H, CH_2), 4.78–4.82 (m, 1H, CH_2), 5.58 (t, J = 5.9 Hz, 1H, NH), 6.89–6.90 (m, 2H, ArH), 7.11–7.16 (m, 9H, ArH), 7.36–7.38 (m, 2H, ArH), 7.46–7.49 (m, 1H, ArH), 7.58–7.62 (m, 3H, ArH), 8.38–8.40 (m, 1H, ArH), 8.71–8.73 (m, 1H, OH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 42.6, 43.6, 87.8, 118.7, 123.5, 123.9, 126.7, 126.9, 127.1, 128.0, 128.1, 128.5, 128.6, 130.2, 130.5, 131.2, 131.3, 131.4, 131.7, 133.3, 135.8, 137.6, 140.2, 149.2, 150.8, 168.7. HRMS (TOF ES^+): *m/z* calcd for $C_{31}H_{24}ClN_3O_2$ [$(M+H)^+$], 506.1630; found, 506.1624.

3-(2-Fluorophenyl)-3-hydroxy-2-phenethyl-4-(phenethylamino)-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7ab)



Yellow solid, 176mg; Mp: 210.7–212.8 ℃; IR (KBr): 3456, 1688, 1612, 1529, 1453, 1214, 1118, 774, 700 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 2.48–2.51 (m, 1H, CH_2), 2.74–2.76 (m, 2H, CH_2), 2.84–2.89 (m, 1H, CH_2), 3.18–3.23 (m, 1H, CH_2), 3.48–3.53 (m, 1H, CH_2), 3.60–3.63 (m, 1H, CH_2), 3.72–3.75 (m, 1H, CH_2), 5.30 (t, J = 5.4 Hz, 1H, NH), 7.04–7.10 (m, 5H, ArH), 7.17–7.22 (m, 2H, ArH), 7.25–7.28 (m, 4H, ArH), 7.38–7.41 (m, 2H, ArH), 7.48–7.51 (m, 1H, ArH), 7.58 (s, 1H, ArH), 7.63–7.66 (m, 1H, ArH), 7.72–7.73 (m, 1H, ArH), 8.10–8.12 (m, 1H, ArH), 8.74–8.75 (s, 1H, OH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 34.6, 35.3, 40.6, 42.3, 86.6, 116.6, 116.8, 118.5, 123.5, 123.9, 124.5, 124.6, 125.4, 126.5, 126.7, 128.7, 128.9, 129.0 (d, J = 13.5 Hz), 130.2, 130.5, 130.8, 131.9, 132.0, 134.2, 139.3, 139.8, 149.3, 151.0, 158.5 (d, J = 262.5 Hz), 167.0. HRMS (TOF ES^+): *m/z* calcd for $C_{33}H_{29}FN_3O_2$ [$(M+H)^+$], 518.2238; found, 518.2234.

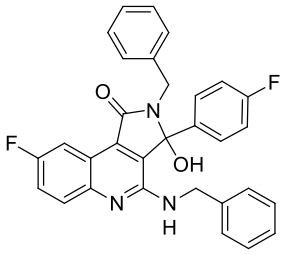
2-Benzyl-4-(benzylamino)-3-(2-chlorophenyl)-8-fluoro-3-hydroxy-2,3-dihydro-1*H*-pyrrolo[3, 4-*c*]quinolin-1-one (7da)



Yellow solid, 186mg; Mp: 214.7–216.8 ℃; IR (KBr): 3430, 1676, 1635, 1617, 1525, 1407, 1226, 1158 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 4.38 (s, 2H, CH_2), 4.46–4.50 (m, 1H, CH_2), 4.76–4.80 (m, 1H, CH_2), 5.61 (d, J = 5.5 Hz, 1H, NH), 6.89–6.90 (m, 2H, ArH), 7.13–7.16 (m, 9H, ArH), 7.36–7.39 (m, 1H, ArH), 7.47–7.52 (m, 2H, ArH), 7.63–7.69 (m, 2H, ArH), 8.35–8.37 (m, 1H, ArH), 8.38–8.40 (m, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.6, 43.6, 87.9, 107.4, 107.6, 118.5, 118.6, 119.8, 120.0, 126.9, 127.2, 128.1 (d, J = 5.0 Hz), 128.5, 128.6, 128.9,129.0, 131.1 (d, J = 3.8 Hz), 131.3, 131.4, 131.6, 133.0, 135.5, 137.4, 140.1, 146.3, 150.5, 157.4 (d, J = 238.8 Hz), 167.8. HRMS (TOF ES^+): *m/z* calcd for $C_{31}H_{23}ClFN_3O_2$ [$(M+H)^+$], 524.1536; found, 5241543.

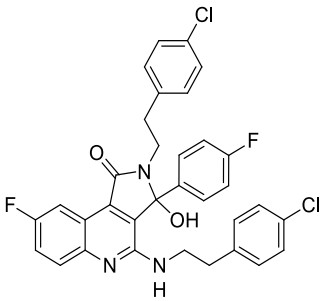
2-Benzyl-4-(benzylamino)-8-fluoro-3-(4-fluorophenyl)-3-hydroxy-2,3-dihydro-1*H*-pyrrolo-[3,

4-*c*]quinolin-1-one (7dc)



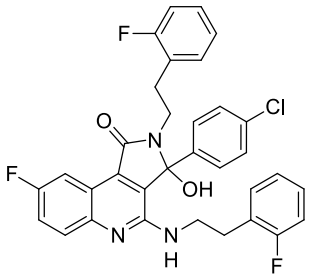
White solid, 176mg; Mp: 207.7–208.8 ℃; IR (KBr): 3442, 1684, 1634, 1534, 1407, 1232, 1177 cm^{-1}; ^{19}F NMR (475 MHz, DMSO-d_6): δ = -118.0, -113.8; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 4.28–4.31 (m, 1H, CH_2), 4.44–4.51 (m, 1H, CH_2), 4.53–4.54 (m, 1H, CH_2), 4.76–4.80 (m, 1H, CH_2), 5.97 (t, 1H, J = 6.0 Hz, NH), 6.93–6.94 (m, 2H, ArH), 7.06–7.17 (m, 10H, ArH), 7.41 (s, 2H, ArH), 7.49–7.53 (m, 2H, ArH), 7.63–7.67 (m, 2H, ArH), 8.37–8.39 (m, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 42.6, 43.6, 89.2, 107.6, 107.8, 115.6, 115.8, 118.3 (d, J = 11.3 Hz), 119.8, 120.0, 126.9, 127.1 (d, J = 7.5 Hz), 128.3, 128.4 (d, J = 2.5 Hz), 128.8 (d, J = 8.8 Hz), 129.2 (d, J =8.8 Hz), 132.7, 133.0, 133.3 (d, J = 5.0 Hz), 138.0, 140.2, 146.3, 150.5, 157.4 (d, J = 238.8 Hz), 161.7 (d, J = 243.8 Hz), 166.8. HRMS (TOF ES^+): *m/z* calcd for $C_{31}H_{24}F_2N_3O_2$ [$(M+H)^-$], 508.1830; found, 508.1831.

2-(4-Chlorophenethyl)-4-((4-chlorophenethyl)amino)-8-fluoro-3-(4-fluorophenyl)-3-hydroxy-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7dd)



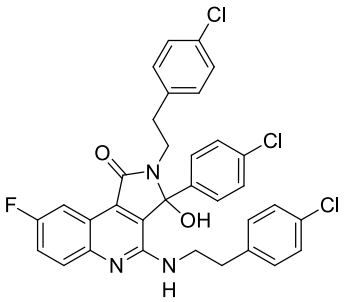
White solid, 187mg; Mp: 158.7–159.8℃; IR (KBr): 3415, 1680, 1637, 1619, 1535, 1409, 1231, 1178 cm^{-1}; ^{19}F NMR (475 MHz, DMSO-d_6): δ = -118.0, -113.2; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.77 (s, 3H, CH_2), 3.16 (s, 1H, CH_2), 3.49–3.56 (m, 3H, CH_2), 3.73–3.75 (m, 1H, CH_2), 5.36 (s, 1H, NH), 7.04–7.16 (m, 6H, ArH), 7.26–7.30 (m, 4H, ArH), 7.39 (s, 2H, ArH), 7.52–7.56 (m, 2H, ArH), 7.76–7.77 (m, 1H, ArH), 8.37–8.38 (m, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 34.0, 34.3, 40.5, 41.9, 89.1, 107.5, 107.8, 115.9, 116.1, 118.2, 119.8, 120.0, 128.6, 128.8, 130.7, 130.9, 131.1, 131.4, 132.5, 133.0, 133.3, 138.3, 138.8, 146.4, 150.5, 157.4 (d, J = 240.0 Hz), 161.7 (d, J = 243.8 Hz), 166.5. HRMS (TOF ES^+): *m/z* calcd for $C_{33}H_{26}Cl_2F_2N_3O_2$ [$(M+H)^+$], 604.1365; found, 604.1359.

3-(4-Chlorophenyl)-8-fluoro-2-(2-fluorophenethyl)-4-((2-fluorophenethyl)amino)-3-hydroxy-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7de)



White solid, 191mg; Mp: 186.7–188.8 ℃; IR (KBr): 3446, 1684, 1637, 1531, 1407, 1243, 1188 cm^{-1}; ^{19}F NMR (475 MHz, DMSO-d_6): δ = -118.7(d, J = 14.3 Hz), -118.0; ^{1}H NMR (500 MHz, DMSO-d_6): δ = 2.58 (d, 1H, J = 3.5 Hz, CH_2), 2.78–2.79 (m, 1H, CH_2), 2.85–2.89 (m, 2H, CH_2), 3.15 (s, 1H, CH_2), 3.51–3.58 (m, 2H, CH_2), 3.76–3.78 (m, 1H, CH_2), 5.49 (d, 1H, J = 5.0 Hz, NH), 7.02–7.03 (m, 2H, ArH), 7.07–7.10 (m, 3H, ArH), 7.16–7.25 (m, 3H, ArH), 7.38 (s, 4H, ArH), 7.57 (s, 2H, ArH), 7.74–7.76 (m, 1H, ArH), 8.37–8.39 (m, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 28.2 (d, J = 5.0 Hz), 39.0, 41.0, 89.1, 107.5, 107.7, 115.4, 115.5, 115.7, 118.1, 118.2, 119.9, 120.1, 124.7 (d, J = 3.8 Hz), 124.9 (d, J = 3.8 Hz), 125.7, 125.9, 126.3, 126.5, 128.4 (d, J = 8.8 Hz), 128.5, 128.9 (d, J = 8.8 Hz), 129.2, 131.3 (d, J = 5.0 Hz), 131.4 (d, J = 5.0 Hz), 132.3, 133.4 (d, J = 5.0 Hz), 134.0, 136.0, 146.4, 150.6, 157.4 (d, J = 240.0 Hz), 160.0 (d, J = 241.3 Hz), 160.1 (d, J = 241.3 Hz), 166.5. HRMS (TOF ES^+): *m/z* calcd for $C_{33}H_{26}ClF_3N_3O_2$ [$(M+H)^+$], 588.1660; found, 588.1664.

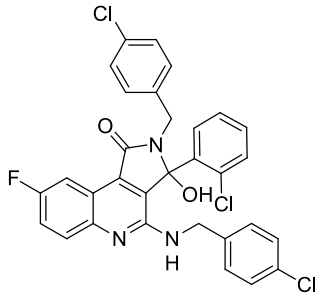
2-(4-Chlorophenethyl)-4-((4-chlorophenethyl)amino)-3-(4-chlorophenyl)-8-fluoro-3-hydroxy-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7df)



White solid, 198mg; Mp: 205.7–206.8 ℃; IR (KBr): 3419, 1677, 1638, 1539, 1403, 1245, 1178 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ =2.56–2.57 (m, 1H, CH_2), 2.73–2.81 (m, 3H, CH_2), 3.13 (s, 1H, CH_2), 3.48–3.56 (m, 2H, CH_2), 3.73–3.74 (m, 1H, CH_2), 5.38 (t, 1H, J = 5.5 Hz, NH), 7.04–7.05 (m, 2H, ArH), 7.09–7.11 (m, 2H, ArH), 7.24–7.30 (m, 4H, ArH), 7.34–7.39 (m, 4H, ArH), 7.53–7.57 (m, 2H, ArH), 7.73–7.76 (m, 1H, ArH), 8.35–8.37 (m, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 33.9, 34.3, 41.4, 42.0, 89.1, 107.5, 107.7, 118.1, 118.2, 119.9, 120.1, 128.4, 128.6, 128.8 (d, J = 12.5 Hz), 129.0, 129.2, 130.7, 130.9, 131.1, 131.4, 132.3, 133.4, 134.0, 136.0, 138.3, 138.9, 146.4, 150.5, 157.4 (d, J = 240.0 Hz), 166.5. HRMS (TOF ES^+): *m/z* calcd for

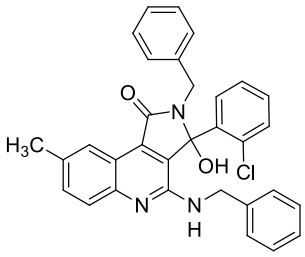
$C_{33}H_{26}Cl_3FN_3O_2$ [$(M+H)^+$], 620.1069; found, 620.1071.

2-(4-Chlorobenzyl)-4-((4-chlorobenzyl)amino)-3-(2-chlorophenyl)-8-fluoro-3-hydroxy-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7dg)



Yellow solid, 195mg; Mp: 300.7–302.8 ℃; IR (KBr): 3417, 1696, 1636, 1534, 1403, 1174, 1088 cm^{-1}; ^1H NMR (600 MHz, DMSO-d_6): δ = 4.37 (s, 2H, CH_2), 4.43–4.47 (m, 1H, CH_2), 4.73–4.77 (m, 1H, CH_2), 5.80–5.82 (s, 1H, NH), 6.91–6.92 (m, 2H, ArH), 7.13–7.20 (m, 6H, ArH), 7.39–7.41 (m, 1H, ArH), 7.49–7.53 (m, 2H, ArH), 7.65–7.67 (m, 2H, ArH), 8.33–8.35 (m, 1H, ArH), 8.40–8.41 (s, 1H, OH); ^{13}C NMR (150 MHz, DMSO-d_6): δ = 41.9, 43.0, 87.8, 107.4, 107.6, 118.5, 118.6, 119.9, 120.1, 128.1, 128.2, 128.4, 128.8, 128.9, 129.0, 130.5, 131.0, 131.1, 131.4 (d, J = 3.0 Hz), 131.6 (d, J = 4.5 Hz), 131.9, 132.8, 135.4, 136.4, 139.5, 146.2, 150.4, 157.6 (d, J = 238.5 Hz), 167.7. HRMS (TOF ES^+): *m/z* calcd for $C_{31}H_{21}Cl_3FN_3O_2$ [$(M+H)^+$], 592.0756; found, 592.0754.

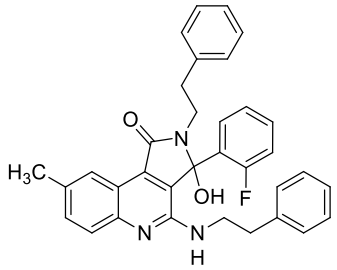
2-Benzyl-4-(benzylamino)-3-(2-chlorophenyl)-3-hydroxy-8-methyl-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7fa)



Yellow solid, 177mg; Mp: 193.5–195.8 ℃; IR (KBr): 3429, 1703, 1636, 1522, 1134, 745, 698 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.45 (s, 3H, CH_3), 4.36 (s, 2H, CH_2), 4.45–4.52 (m, 1H, CH_2), 4.75–4.82 (m, 1H, CH_2), 5.46 (t, J = 5.9 Hz, 1H, NH), 6.88–6.90 (m, 2H, ArH), 7.11–7.15 (m, 9H, ArH), 7.35–7.40 (m, 1H, ArH), 7.44–7.45 (m, 2H, ArH), 7.53–7.57 (m, 2H, ArH), 8.38–8.40 (m, 1H, ArH), 8.52 (s, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.5, 42.6, 43.6, 87.8, 118.7, 123.0, 126.5, 126.9 (d, J = 3.8 Hz), 127.1, 128.1 (d, J = 8.8 Hz), 128.5, 128.6, 130.0, 131.2, 131.3, 131.7, 132.4, 132.7, 133.5, 135.3, 137.6, 140.3, 147.6, 150.4, 168.2. HRMS (TOF ES^+):

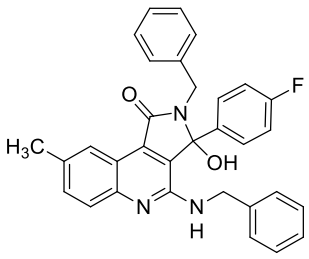
m/z calcd for $C_{32}H_{26}ClN_3O_2$ [$(M+H)^+$], 520.1786; found, 520.1788.

3-(2-Fluorophenyl)-3-hydroxy-8-methyl-2-phenethyl-4-(phenethylamino)-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7fb)



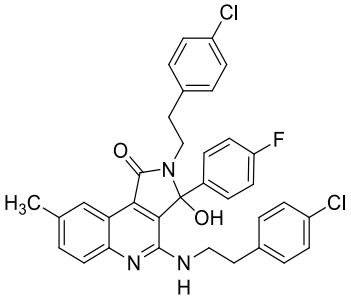
Yellow solid, 191mg; Mp: 213.4–215.6 ℃; IR (KBr): 3433, 1673, 1634, 1617, 1521, 1396, 1221, 1118, 766, 751 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.47–2.50 (m, 4H, CH_3, CH_2), 2.71–2.74 (m, 2H, CH_2), 2.82–2.84 (m, 1H, CH_2), 3.17–3.21 (m, 1H, CH_2), 3.46–3.50 (m, 1H, CH_2), 3.58–3.60 (m, 1H, CH_2), 3.68–3.72 (m, 1H, CH_2), 5.17 (t, *J* = 5.5 Hz, 1H, NH), 7.02–7.09 (m, 5H, ArH), 7.16–7.21 (m, 2H, ArH), 7.24–7.27 (m, 4H, ArH), 7.36–7.39 (m, 1H, ArH), 7.46–7.48 (m, 2H, ArH), 7.54 (s, 1H, ArH), 7.61–7.63 (m, 1H, ArH), 8.06–8.10 (m, 1H, ArH), 8.53 (s, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.5, 34.6, 35.3, 40.6, 42.3, 86.6, 116.6, 116.8, 118.5, 123.0, 124.6, 124.7, 125.3 (d, *J* = 3.8 Hz), 126.5, 126.7, 128.7, 128.8, 128.9, 129.0, 130.2, 130.7, 131.8, 131.9, 132.4, 132.6, 133.7(d, *J* = 2.5 Hz), 139.3, 139.9, 147.7, 150.6, 158.3 (d, *J* = 247.5 Hz), 167.1. HRMS (TOF ES^+): *m/z* calcd for $C_{34}H_{30}FN_3O_2$ [$(M+H)^+$], 532.2395; found, 532.2393.

2-Benzyl-4-(benzylamino)-3-(4-fluorophenyl)-3-hydroxy-8-methyl-2,3-dihydro-1*H*-pyrrolo-[3,4-*c*]quinolin-1-one (7fc)



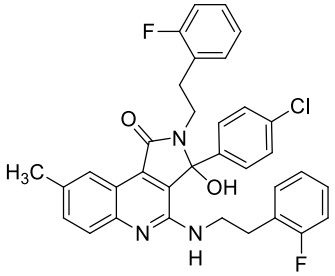
Yellow solid, 199mg; Mp: 204.7–206.8 ℃; IR (KBr): 3419, 1636, 1619, 1526, 1403, 1228, 1158 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.45 (s, 3H, CH_3), 4.27–4.30 (m, 1H, CH_2), 4.42–4.53 (m, 2H, CH_2), 4.76–4.80 (m, 1H, CH_2), 5.81 (t, 1H, *J* = 6.0 Hz, NH), 6.92–6.94 (m, 2H, ArH), 7.04–7.08 (m, 2H, ArH), 7.12–7.19 (m, 9H, ArH), 7.36–7.39 (m, 2H, ArH), 7.43–7.57 (m, 3H, ArH), 8.54 (s, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.5, 42.5, 43.6, 89.1, 115.6, 115.8, 118.3 (d, *J* = 11.3 Hz), 123.1, 126.4, 126.8, 127.1 128.3, 128.4 (d, *J* = 3.8 Hz), 129.1 (d, *J* =7.5 Hz), 131.8, 132.4, 132.7, 133.0, 133.4, 138.2, 140.4, 147.6, 150.3, 161.7 (d, *J* = 243.8 Hz), 167.2. HRMS (TOF ES^+): *m/z* calcd for $C_{32}H_{27}FN_3O_2$ [$(M+H)^+$], 504.2082; found, 504.2081.

2-(4-Chlorophenethyl)-4-((4-chlorophenethyl)amino)-3-(4-fluorophenyl)-3-hydroxy-8-methyl-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7fd)



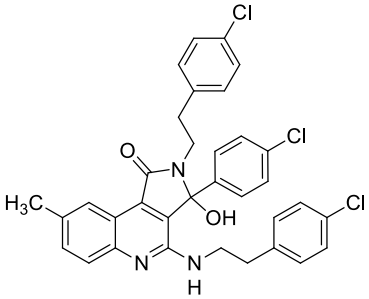
Yellow solid, 204mg; Mp: 140.7–142.8 ℃; IR (KBr): 3430, 1676, 1635, 1617, 1525, 1407, 1226, 1158 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.47 (s, 3H, CH_3), 2.76–2.77 (m, 3H, CH_2), 3.01 (s, 1H, CH_2), 3.47–3.55 (m, 3H, CH_2), 3.72–3.74 (m, 1H, CH_2), 5.22 (s, 1H, NH), 7.06–7.09 (m, 6H, ArH), 7.25–7.34 (m, 6H, ArH), 7.46–7.48 (m, 2H, ArH), 7.61–7.63 (m, 1H, ArH), 8.54 (s, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.5, 34.0, 34.4, 40.6, 41.9, 89.0, 115.9, 116.0, 118.2, 123.0, 126.5, 128.6, 128.8, 130.7, 130.9, 131.1, 131.4, 131.5, 132.4, 132.7, 133.1, 133.5, 138.4, 138.9, 147.7, 150.4, 161.6 (d, J = 243.8 Hz), 166.9. HRMS (TOF ES^+): *m/z* calcd for $C_{34}H_{29}Cl_2FN_3O_2$ [$(M+H)^+$], 600.1615; found, 600.1615.

3-(4-Chlorophenyl)-2-(2-fluorophenethyl)-4-((2-fluorophenethyl)amino)-3-hydroxy-8-methyl-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7fe)



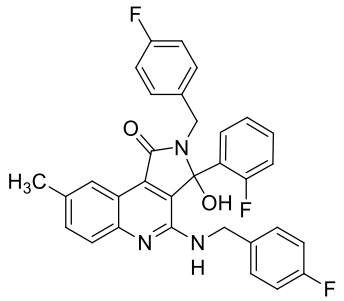
Yellow solid, 207mg; Mp: 188.7–190.8 ℃; IR (KBr): 3438, 1633, 1618, 1529, 1401, 1230, 1173 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.51(m, 3H, CH_3), 2.51–2.59 (m, 1H , CH_2), 2.60–2.62 (m, 1H, CH_2), 2.78–2.90 (m, 2H, CH_2), 3.11–3.17 (m, 1H, CH_2), 3.47–3.59 (m, 2H, CH_2), 3.73–3.77 (m, 1H, CH_2), 5.34 (t, 1H, J = 5.5 Hz, NH), 7.01–7.11 (m, 5H, ArH), 7.16–7.25 (m, 3H, ArH), 7.26–7.27 (m, 4H, ArH), 7.34–7.51 (m, 2H, ArH), 7.50–7.62 (m, 1H, ArH), 8.54 (s, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.5, 28.3, 39.0, 41.0, 89.0, 115.4, 115.5, 115.7, 118.2, 123.0, 124.7 (d, J = 3.8 Hz), 124.9 (d, J = 2.5 Hz), 125.8, 126.0, 126.4, 126.5, 128.3, 128.5 (d, J = 7.5 Hz), 128.9 (d, J = 8.8 Hz), 129.1, 131.3 (d, J = 5.0 Hz), 131.4 (t, J = 5.0 Hz), 132.5, 132.7, 133.2, 133.8, 136.4, 147.7, 150.4, 160.0 (d, J = 241.3 Hz), 160.1 (d, J = 241.3 Hz), 166.9. HRMS (TOF ES^+): *m/z* calcd for $C_{34}H_{29}ClF_2N_3O_2$ [$(M+H)^+$], 584.1911; found, 584.1912.

2-(4-Chlorophenethyl)-4-((4-chlorophenethyl)amino)-3-(4-chlorophenyl)-3-hydroxy-8-methyl-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7ff)



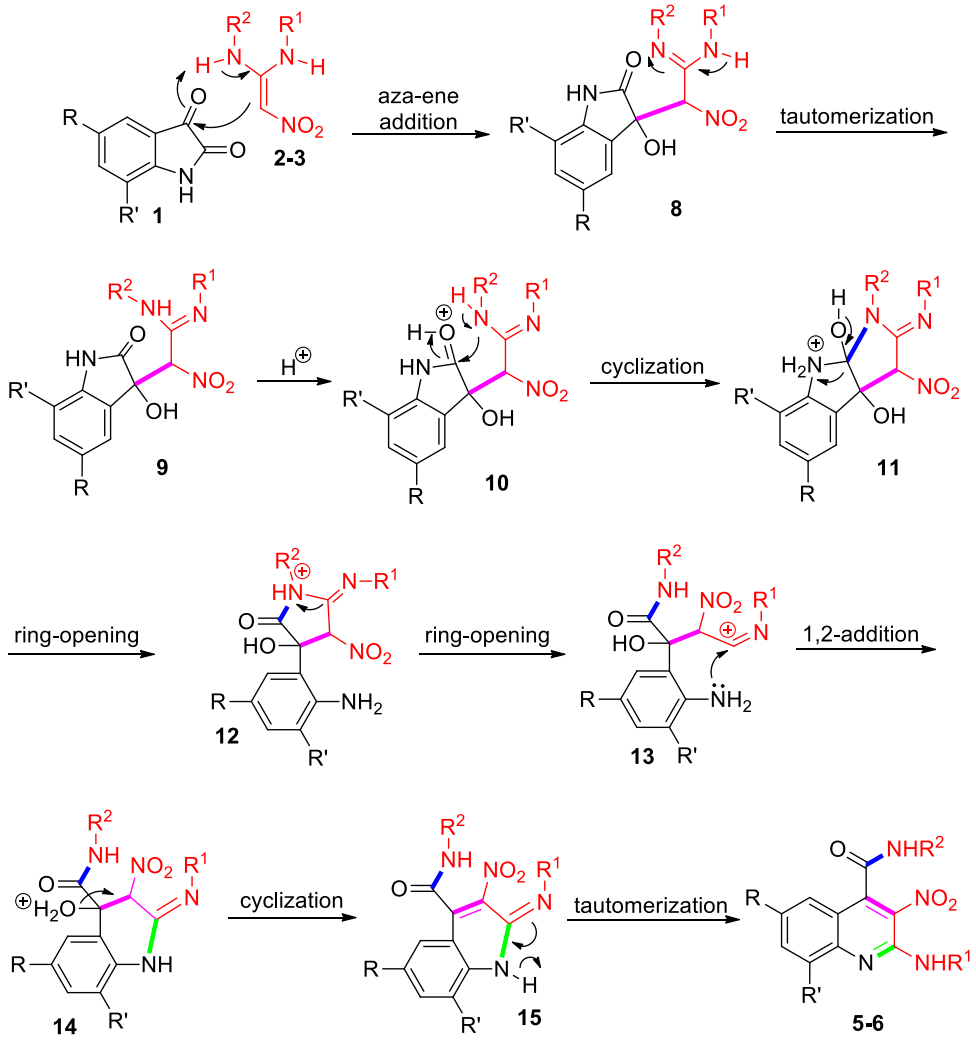
Yellow solid, 215mg; Mp: 178.7–180.8 ℃; IR (KBr): 3430, 1712, 1636, 1618, 1529, 1406, 1174, 1119 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ =2.47 (s, 3H, CH_3), 2.58 (s, 1H, CH_2), 2.73–2.80 (m, 3H, CH_2), 3.15 (s, 1H, CH_2), 3.54 (s, 2H, CH_2), 3.72 (s, 1H, CH_2), 5.25 (d, 1H, J = 5.5 Hz, NH), 7.05–7.10 (m, 4H, ArH), 7.11–7.38 (m, 8H, ArH), 7.47–7.51 (m, 2H, ArH), 7.61–7.62 (m, 1H, ArH), 8.53 (s, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.5, 34.0, 34.4, 40.0, 42.0, 89.0, 118.2, 123.0, 126.8, 128.4, 128.6, 128.8 129.1, 130.7, 130.9, 131.1, 131.4, 132.5, 132.7, 133.2, 133.8, 136.0, 138.5, 138.4, 139.0, 147.7, 150.4, 166.9. HRMS (TOF ES^+): *m/z* calcd for $C_{34}H_{29}Cl_3N_3O_2$ [$(M+H)^+$], 616.1320; found, 616.1321.

2-(4-Fluorobenzyl)-4-((4-fluorobenzyl)amino)-3-(2-fluorophenyl)-3-hydroxy-8-methyl-2,3-dihydro-1*H*-pyrrolo[3,4-*c*]quinolin-1-one (7fh)



Yellow solid, 186mg; Mp: 225.7–227.8 ℃; IR (KBr): 3432, 1684, 1633, 1511, 1223, 1119, 818, 758 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ = 2.45 (s, 3H, CH_3), 4.34–4.37 (m, 1H, CH_2), 4.45–4.48 (m, 2H, CH_2), 4.70–4.78 (m, 1H, CH_2), 5.79 (s, 1H, NH), 6.75–6.82 (m, 1H, ArH), 6.92–6.95 (m, 6H, ArH), 7.15–7.17 (m, 2H, ArH), 7.28 (s, 1H, ArH), 7.43 (s, 1H, ArH), 7.44–7.45 (m, 1H, ArH), 7.52–7.54 (m, 1H, ArH), 7.64 (s, 1H, ArH), 8.15 (s, 1H, ArH), 8.52 (s, 1H, OH); ^{13}C NMR (125 MHz, DMSO-d_6): δ = 21.5, 41.6, 42.9, 86.4, 114.8, 115.0 (d, J = 8.8 Hz), 115.2, 116.2, 116.3, 118.5, 122.9, 124.5 (d, J = 8.8 Hz), 125.0, 126.5, 128.9, 129.0, 130.4, 130.5, 130.7, 131.6, 131.7, 132.4, 132.8, 133.8, 134.1 (d, J = 3.8 Hz), 136.6 (d, J = 2.5 Hz), 147.5, 150.2, 158.1 (d, J = 247.5 Hz), 160.4 (d, J = 240.0 Hz), 160.5 (d, J = 240.0 Hz), 167.4. HRMS (TOF ES^+): *m/z* calcd for $C_{32}H_{24}F_3N_3O_2$ [$(M+H)^+$], 540.1893; found, 540.1894.

Scheme S1. Mechanism of the cascade reaction



A hypothetical mechanism of the cascade reaction is shown in Scheme 2. Initially, the isatins **1** react with the EDAMs **2** *via* aza-ene addition to form the intermediates **8**. Next, the intermediate compounds **9** are obtained from compounds **8** by tautomerization. Then, intermediates **9** obtain one proton to give the intermediates **10**. Compounds **10** undergo intramolecular cyclization to produce intermediates **11**. Subsequently, compounds **11** are converted into the intermediates **12** *via* a ring-opening reaction. Intermediates **13** are formed from the intermediates **12** *via* another ring-opening reaction. The amino groups of intermediates **13** attack the imine ion to generate the intermediates **14**, which then undergo a cyclization reaction to produce intermediates **15**. Ultimately, intermediates **15** form compounds **5–6** by tautomerization.

X-ray Structure and Data[2] of 5ab, 6go and 7fc

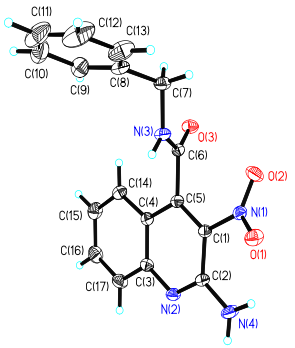


Figure S1. X-Ray crystal structure of **5ab**

Table S1. Crystal data and structure refinement for **5ab**

Identification code	ysj_0m	
Empirical formula	C17 H14 N4 O3	
Formula weight	322.32	
Temperature	296.15 K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	P 1 21/c 1	
Unit cell dimensions	a = 9.4009(11) Å	α= 90 °.
	b = 9.7452(11) Å	β= 102.4860(10) °.
	c = 16.927(2)	γ = 90 °.
Volume	1514.1(3) $Å^3$	
Z	4	
Density (calculated)	1.414 Mg/m^3	
Absorption coefficient	0.100 mm^{-1}	
F(000)	672	
Theta range for data collection	2.465 to 27.589 °.	
Index ranges	-12<=h<=12, -12<=k<=12, -21<=l<=21	
Reflections collected	11771	
Independent reflections	3339 [R(int) = 0.0267]	
Completeness to theta = 25.242 °	99.9 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.7456 and 0.6956	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	3339 / 0 / 217	
Goodness-of-fit on F^2	1.020	
Final R indices [I>2sigma(I)]	R1 = 0.0418, wR2 = 0.1006	
R indices (all data)	R1 = 0.0618, wR2 = 0.1105	
Extinction coefficient	n/a	
Largest diff. peak and hole	0.202 and -0.207 $e.Å^{-3}$	

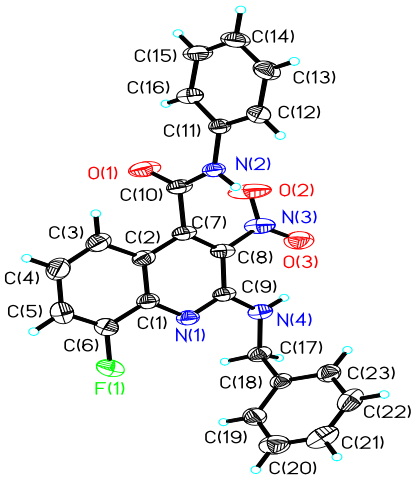


Figure S2. X-Ray crystal structure of **6go**

Table S2. Crystal data and structure refinement for **6go**

Identification code	1
Empirical formula	C_{25} H_{23} F N_4 O_4S
Formula weight	494.53
Temperature	293(2) K
Wavelength	0.71073 A
Crystal system, space group	Monoclinic, P2(1)/c
Unit cell dimensions	a = 10.547(2) A alpha = 90 deg.
	b = 11.191(2) A beta = 91.115(3) deg.
	c = 20.185(4) A gamma = 90 deg.
Volume	2382.0(8) A^3
Z, Calculated density	4, 1.379 Mg/m^3
Absorption coefficient	0.184 mm^-1
F(000)	1032
Theta range for data collection	1.931 to 28.199 deg.
Limiting indices	-13<=h<=13, -14<=k<=14, -20<=l<=26
Reflections collected / unique	15800 / 5562 [R(int) = 0.0350]
Completeness to theta = 25.242	99.8 %
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	5562 / 0 / 325
Goodness-of-fit on F^2	1.050
Final R indices [I>2sigma(I)]	R1 = 0.0664, wR2 = 0.1588
R indices (all data)	R1 = 0.1170, wR2 = 0.1897
Extinction coefficient	n/a
Largest diff. peak and hole	0.861 and -0.738 e.A^-3

Table S3. Bond lengths [A] and angles [deg] for **6go**

F(1)-C(6)	1.359(4)	C(6)-C(5)-C(4)	119.2(3)
O(1)-C(10)	1.219(3)	C(6)-C(5)-H(5)	120.4
O(2)-N(3)	1.208(3)	C(4)-C(5)-H(5)	120.4
O(3)-N(3)	1.215(3)	C(5)-C(6)-F(1)	119.6(3)
N(1)-C(9)	1.319(4)	C(5)-C(6)-C(1)	123.2(3)
N(1)-C(1)	1.361(4)	F(1)-C(6)-C(1)	117.2(3)
N(2)-C(10)	1.333(3)	C(8)-C(7)-C(2)	119.1(2)
N(2)-C(11)	1.416(3)	C(8)-C(7)-C(10)	123.8(3)
N(2)-H(2)	0.8600	C(2)-C(7)-C(10)	117.0(3)
N(3)-C(8)	1.453(4)	C(7)-C(8)-N(3)	118.7(2)
N(4)-C(9)	1.347(4)	C(7)-C(8)-C(9)	120.9(3)
N(4)-C(17)	1.465(3)	N(3)-C(8)-C(9)	120.4(3)
N(4)-H(4)	0.8600	N(1)-C(9)-N(4)	117.0(2)
C(1)-C(6)	1.404(4)	N(1)-C(9)-C(8)	120.1(3)
C(1)-C(2)	1.422(4)	N(4)-C(9)-C(8)	122.9(3)
C(2)-C(3)	1.419(4)	O(1)-C(10)-N(2)	126.3(2)
C(2)-C(7)	1.422(4)	O(1)-C(10)-C(7)	119.1(3)
C(3)-C(4)	1.354(5)	N(2)-C(10)-C(7)	114.4(2)
C(3)-H(3)	0.9300	C(12)-C(11)-C(16)	119.6(3)
C(4)-C(5)	1.407(5)	C(12)-C(11)-N(2)	117.3(2)
C(4)-H(4A)	0.9300	C(16)-C(11)-N(2)	123.1(3)
C(5)-C(6)	1.356(5)	C(11)-C(12)-C(13)	120.3(3)
C(5)-H(5)	0.9300	C(11)-C(12)-H(12)	119.9
C(7)-C(8)	1.369(4)	C(13)-C(12)-H(12)	119.9
C(7)-C(10)	1.527(3)	C(14)-C(13)-C(12)	120.1(3)
C(8)-C(9)	1.454(3)	C(14)-C(13)-H(13)	119.9
C(11)-C(12)	1.385(4)	C(12)-C(13)-H(13)	119.9
C(11)-C(16)	1.386(4)	C(15)-C(14)-C(13)	119.7(3)
C(12)-C(13)	1.386(4)	C(15)-C(14)-H(14)	120.2
C(12)-H(12)	0.9300	C(13)-C(14)-H(14)	120.2
C(13)-C(14)	1.381(5)	C(14)-C(15)-C(16)	120.9(3)
C(13)-H(13)	0.9300	C(14)-C(15)-H(15)	119.5
C(14)-C(15)	1.369(5)	C(16)-C(15)-H(15)	119.5
C(14)-H(14)	0.9300	C(11)-C(16)-C(15)	119.4(3)
C(15)-C(16)	1.392(4)	C(11)-C(16)-H(16)	120.3
C(15)-H(15)	0.9300	C(15)-C(16)-H(16)	120.3
C(16)-H(16)	0.9300	N(4)-C(17)-C(18)	114.4(2)
C(17)-C(18)	1.504(4)	N(4)-C(17)-H(17A)	108.7
C(17)-H(17A)	0.9700	C(18)-C(17)-H(17A)	108.7
C(17)-H(17B)	0.9700	N(4)-C(17)-H(17B)	108.7
C(18)-C(19)	1.380(4)	C(18)-C(17)-H(17B)	108.7
C(18)-C(23)	1.382(4)	H(17A)-C(17)-H(17B)	107.6
C(19)-C(20)	1.375(5)	C(19)-C(18)-C(23)	118.3(3)
C(19)-H(19)	0.9300	C(19)-C(18)-C(17)	120.1(3)
C(20)-C(21)	1.359(6)	C(23)-C(18)-C(17)	121.6(3)
C(20)-H(20)	0.9300	C(20)-C(19)-C(18)	121.3(3)
C(21)-C(22)	1.392(5)	C(20)-C(19)-H(19)	119.3
C(21)-H(21)	0.9300	C(18)-C(19)-H(19)	119.3
C(22)-C(23)	1.382(5)	C(21)-C(20)-C(19)	120.3(4)
C(22)-H(22)	0.9300	C(21)-C(20)-H(20)	119.8
C(23)-H(23)	0.9300	C(19)-C(20)-H(20)	119.8
S(0AA)-O(4)	1.371(4)	C(20)-C(21)-C(22)	119.6(3)
S(0AA)-C(25)	1.541(6)	C(20)-C(21)-H(21)	120.2
S(0AA)-C(24)	1.663(5)	C(22)-C(21)-H(21)	120.2
S(1AA)-O(4)	1.489(3)	C(23)-C(22)-C(21)	119.8(3)

S(1AA)-C(24)	1.777(4)	C(23)-C(22)-H(22)	120.1
S(1AA)-C(25)	1.778(4)	C(21)-C(22)-H(22)	120.1
C(24)-H(24A)	0.9600	C(22)-C(23)-C(18)	120.6(3)
C(24)-H(24B)	0.9600	C(22)-C(23)-H(23)	119.7
C(24)-H(24C)	0.9600	C(18)-C(23)-H(23)	119.7
C(24)-H(24D)	0.9600	O(4)-S(0AA)-C(25)	128.3(4)
C(24)-H(24E)	0.9600	O(4)-S(0AA)-C(24)	117.0(3)
C(24)-H(24F)	0.9600	C(25)-S(0AA)-C(24)	112.8(3)
C(25)-H(25A)	0.9600	O(4)-S(1AA)-C(24)	104.7(2)
C(25)-H(25B)	0.9600	O(4)-S(1AA)-C(25)	106.4(2)
C(25)-H(25C)	0.9600	C(24)-S(1AA)-C(25)	97.3(2)
C(25)-H(25D)	0.9600	S(0AA)-C(24)-H(24A)	109.5
C(25)-H(25E)	0.9600	S(0AA)-C(24)-H(24B)	109.5
C(25)-H(25F)	0.9600	H(24A)-C(24)-H(24B)	109.5
C(9)-N(1)-C(1)	119.4(2)	S(0AA)-C(24)-H(24C)	109.5
C(10)-N(2)-C(11)	127.3(2)	H(24A)-C(24)-H(24C)	109.5
C(10)-N(2)-H(2)	116.3	H(24B)-C(24)-H(24C)	109.5
C(11)-N(2)-H(2)	116.3	S(1AA)-C(24)-H(24D)	109.5
O(2)-N(3)-O(3)	122.0(3)	S(1AA)-C(24)-H(24E)	109.5
O(2)-N(3)-C(8)	118.4(3)	H(24D)-C(24)-H(24E)	109.5
O(3)-N(3)-C(8)	119.5(2)	S(1AA)-C(24)-H(24F)	109.5
C(9)-N(4)-C(17)	122.3(3)	H(24D)-C(24)-H(24F)	109.5
C(9)-N(4)-H(4)	118.9	H(24E)-C(24)-H(24F)	109.5
C(17)-N(4)-H(4)	118.9	S(0AA)-C(25)-H(25A)	109.5
N(1)-C(1)-C(6)	119.0(3)	S(0AA)-C(25)-H(25B)	109.5
N(1)-C(1)-C(2)	124.3(3)	H(25A)-C(25)-H(25B)	109.5
C(6)-C(1)-C(2)	116.7(3)	S(0AA)-C(25)-H(25C)	109.5
C(3)-C(2)-C(1)	119.8(3)	H(25A)-C(25)-H(25C)	109.5
C(3)-C(2)-C(7)	124.0(3)	H(25B)-C(25)-H(25C)	109.5
C(1)-C(2)-C(7)	116.2(3)	S(1AA)-C(25)-H(25D)	109.5
C(4)-C(3)-C(2)	120.4(3)	S(1AA)-C(25)-H(25E)	109.5
C(4)-C(3)-H(3)	119.8	H(25D)-C(25)-H(25E)	109.5
C(2)-C(3)-H(3)	119.8	S(1AA)-C(25)-H(25F)	109.5
C(3)-C(4)-C(5)	120.6(3)	H(25D)-C(25)-H(25F)	109.5
C(3)-C(4)-H(4A)	119.7	H(25E)-C(25)-H(25F)	109.5
C(5)-C(4)-H(4A)	119.7		

Symmetry transformations used to generate equivalent atoms:

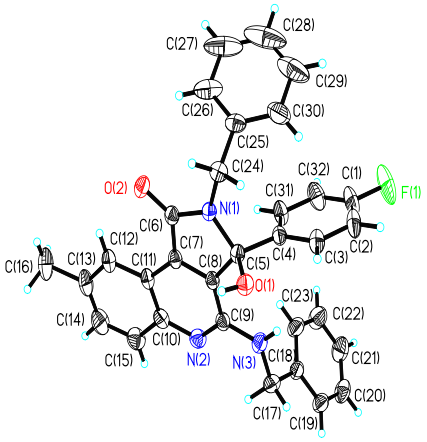


Figure S3. X-Ray crystal structure of **7fc**

Table S4. Crystal data and structure refinement for **7fc**

Identification code	ysj_0m
Empirical formula	$C_{32}H_{26}FN_3O_2$
Formula weight	503.56
Temperature	296.15K
Wavelength	0.71073 A
Crystal system, space group	Monoclinic, P1211
Unit cell dimensions	a = 14.536(2) A alpha = 90 deg.
	b = 10.3088(16) A beta =111.418(2) deg.
	c = 18.813(3) A gamma = 90 deg.
Volume	2624.4(7) A^3
Z, Calculated density	4, 1.274 Mg/m^3
Absorption coefficient	0.085 mm^-1
F(000)	1056
Theta range for data collection	1.163 to 27.503 deg.
Limiting indices	-18<=h<=18, -13<=k<=12, -24<=l<=23
Reflections collected / unique	21192 / 10967 [R(int) = 0.0247]
Completeness to theta = 25.242	99.9 %
Absorption coefficient	Semi-empirical from equivalents
Max. and min. transmission	0.7456 and 0.6983
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	10967 / 1 / 689
Goodness-of-fit on F^2	0.999
Final R indices [I>2sigma(I)]	R1 = 0.0445, wR2 = 0.0838
R indices (all data)	R1 = 0.0815, wR2 = 0.0960
Absolute structure parameter	0.0(4)
Extinction coefficient	n/a
Largest diff. peak and hole	0.128 and -0.179 e.A^-3

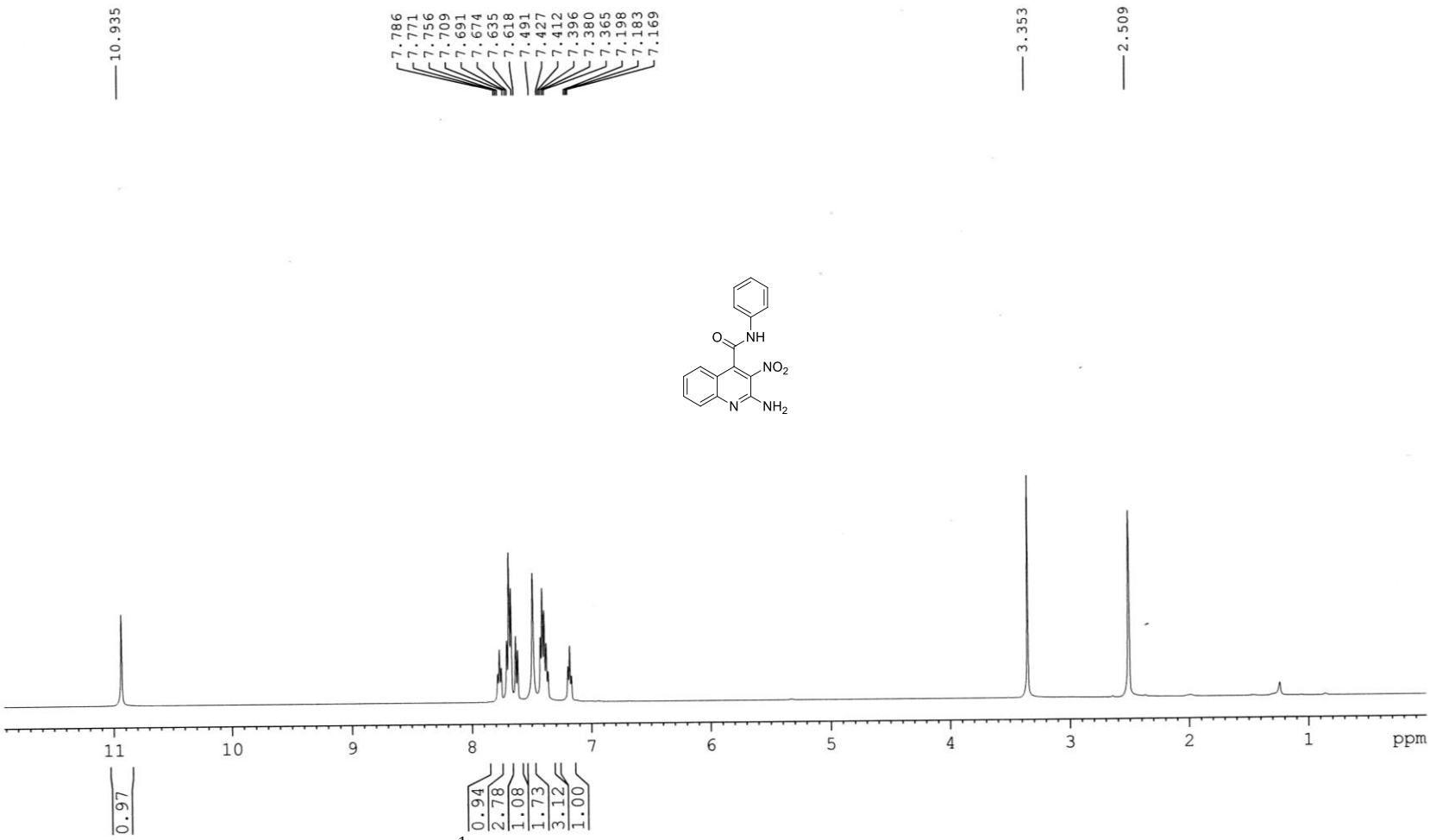


Figure S4. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5aa**

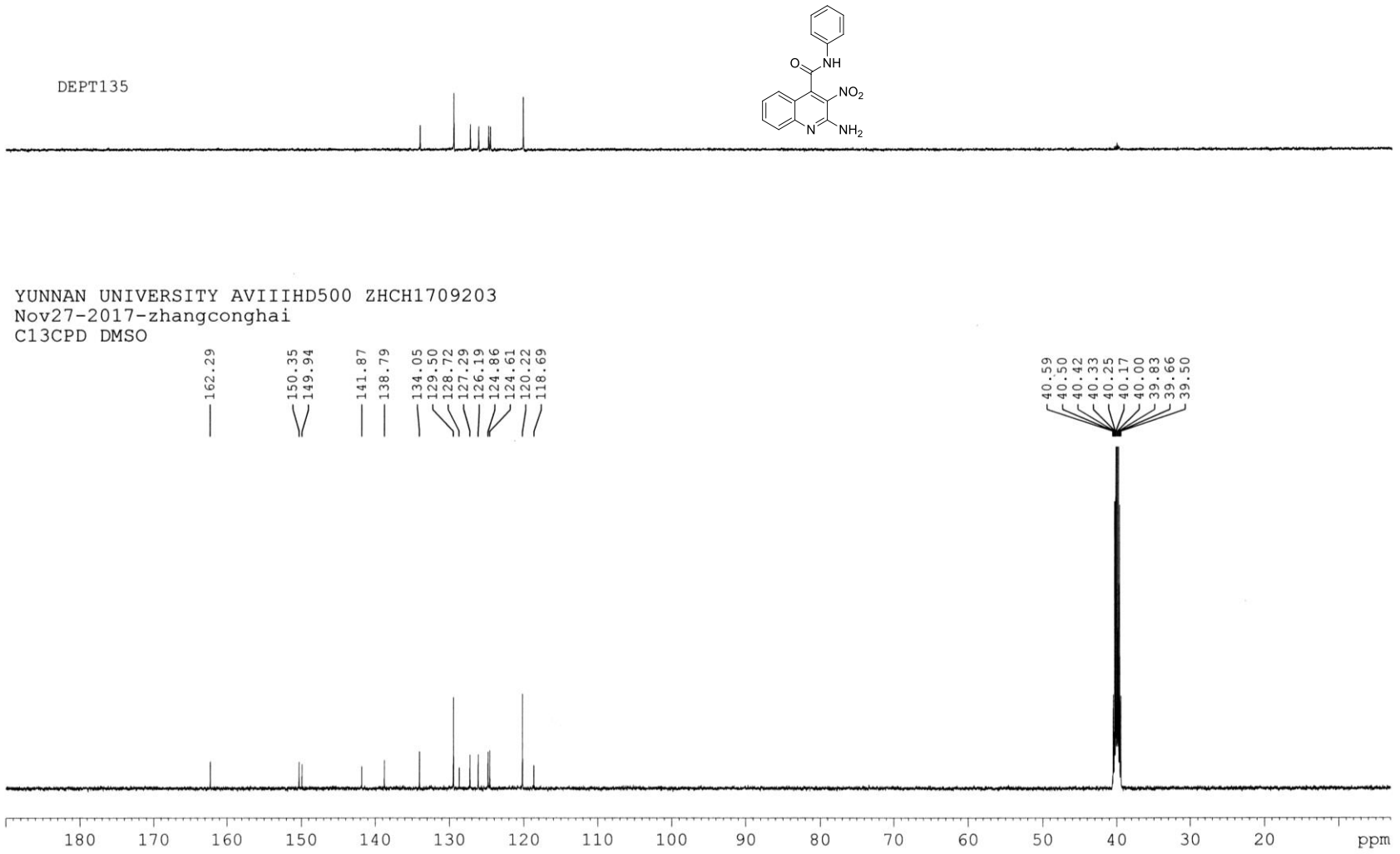


Figure S5. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5aa**

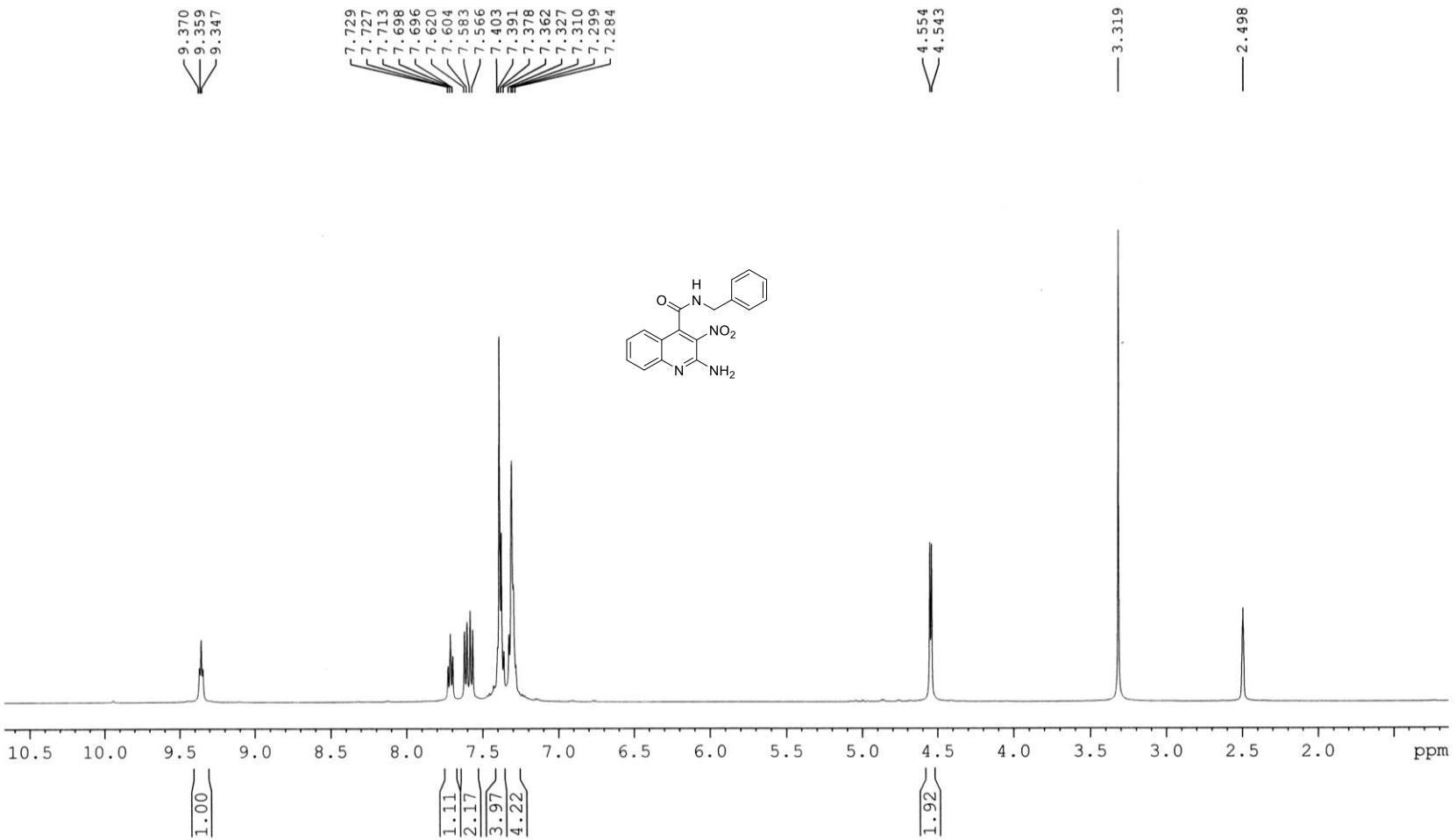


Figure S6. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5ab**

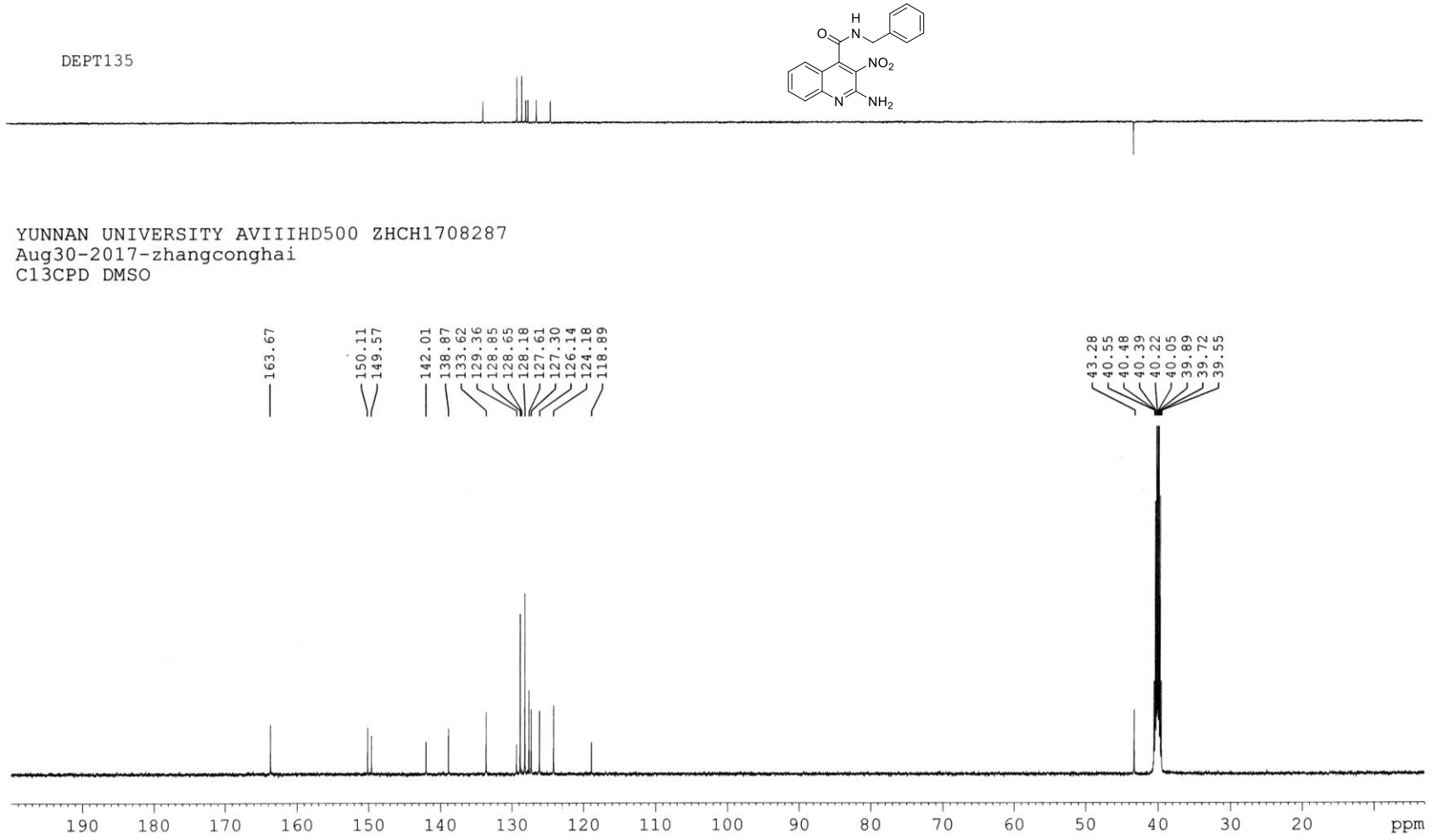


Figure S7. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5ab**

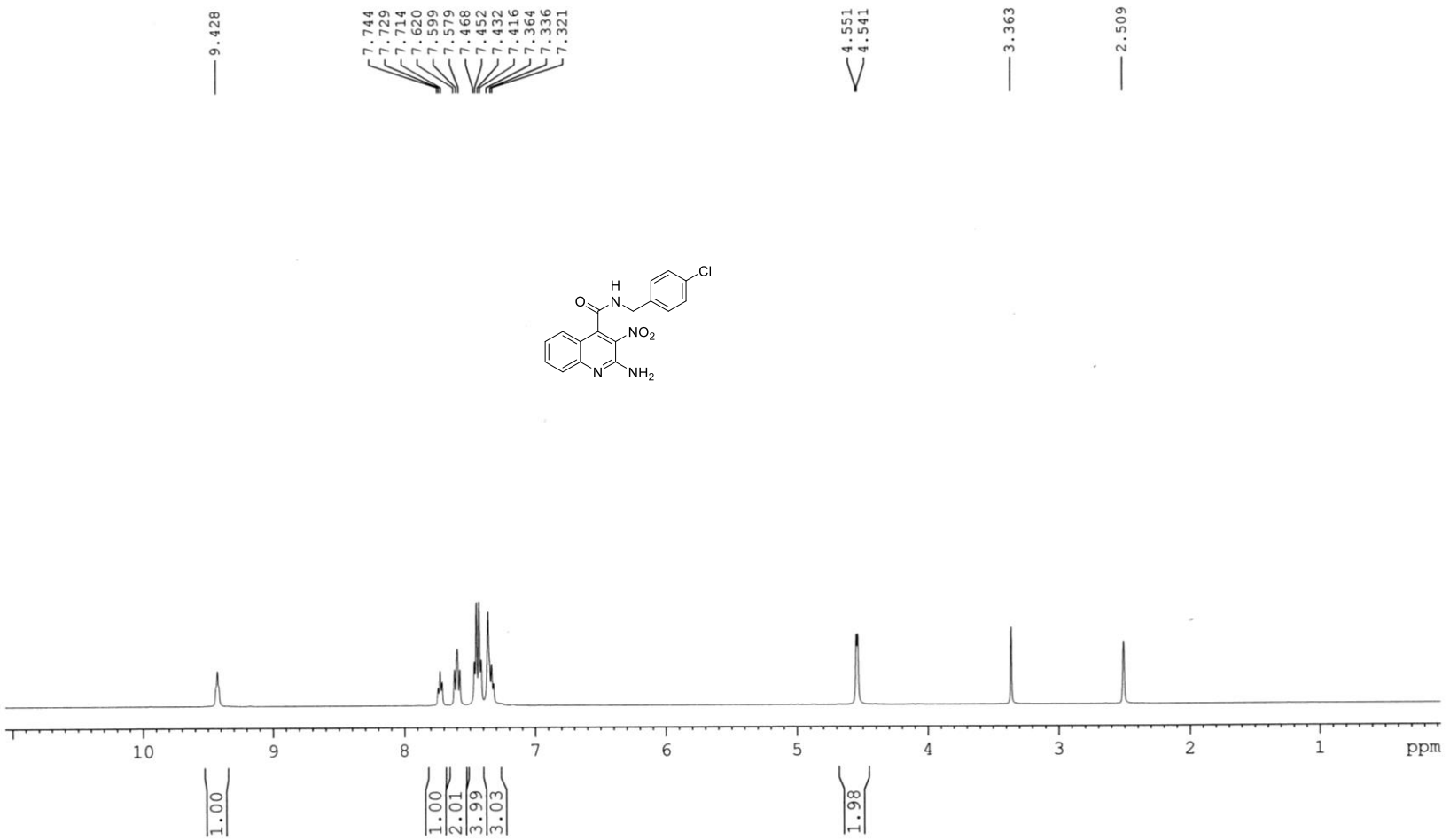


Figure S8. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5ac**

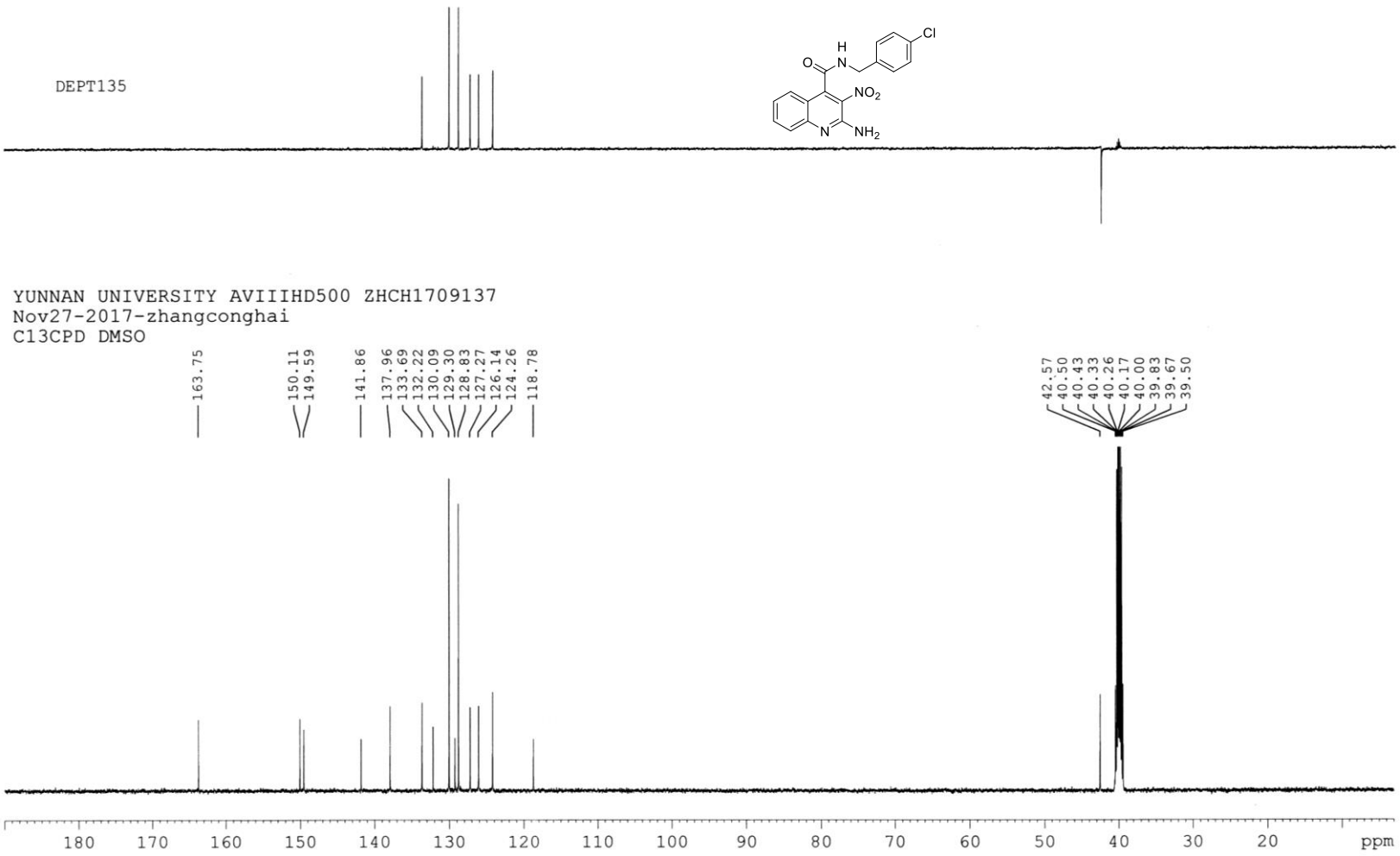


Figure S9. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5ac**

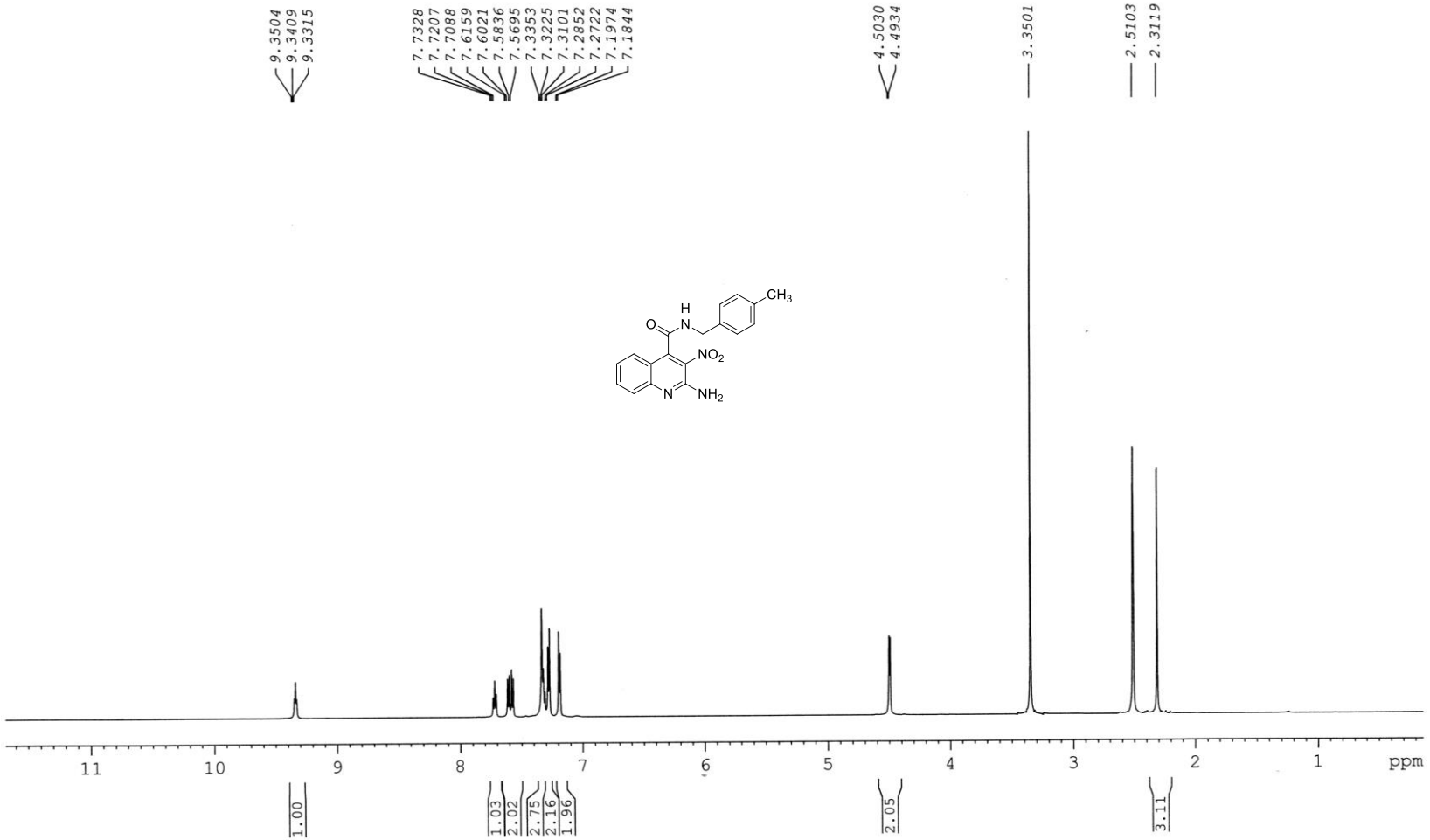


Figure S10. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5ae**

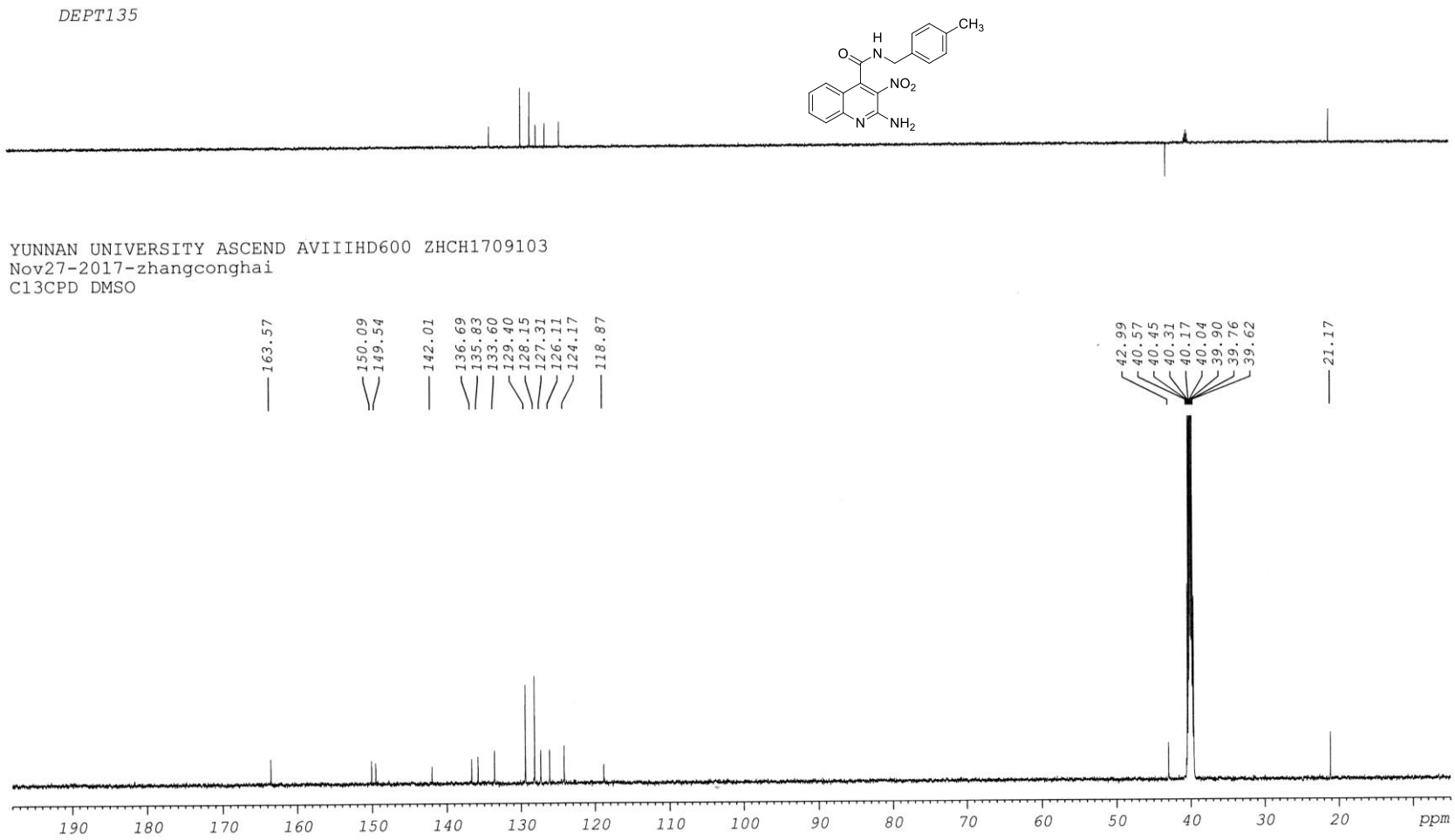


Figure S11. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5ae**

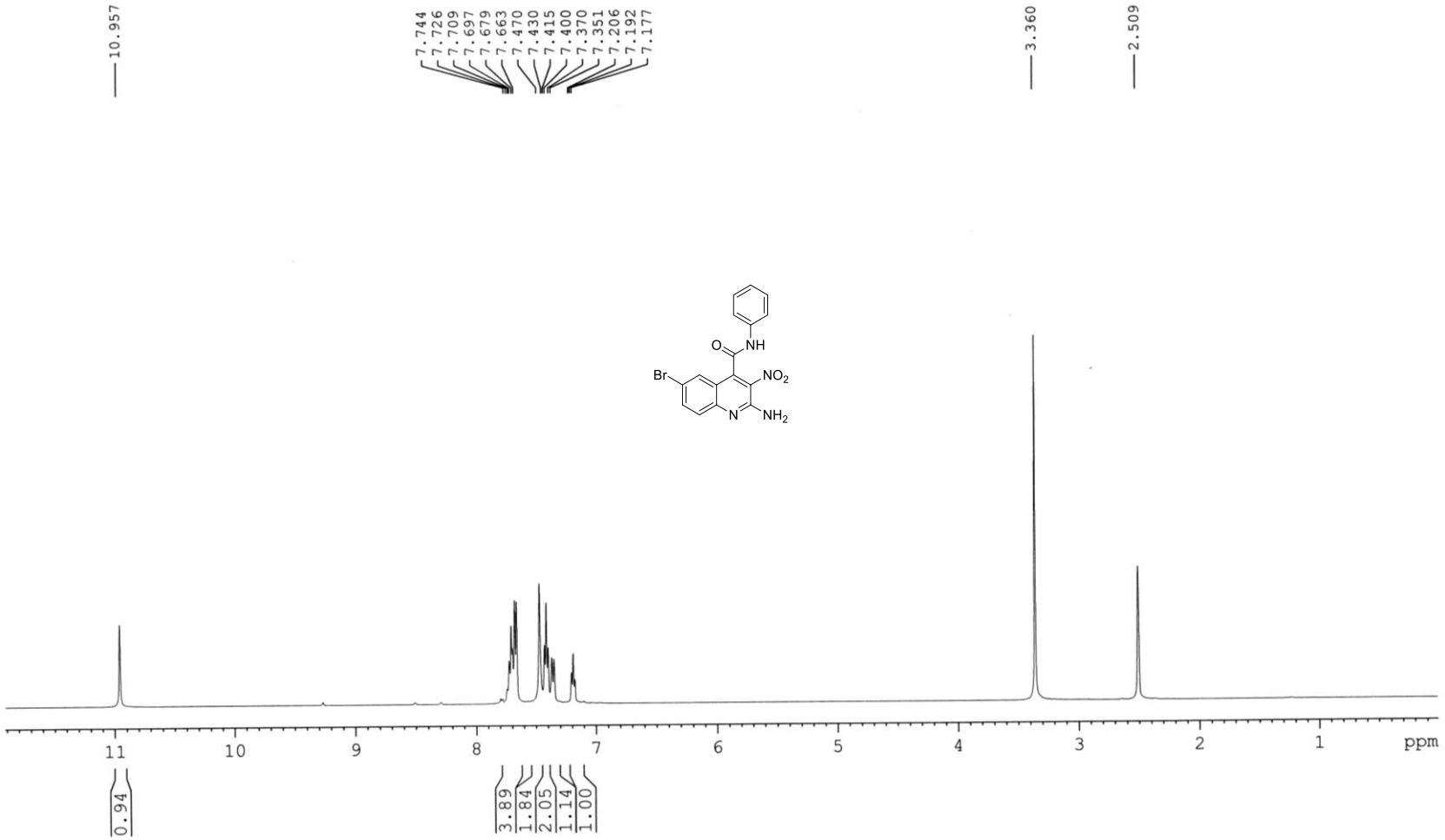


Figure S12. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5ba**

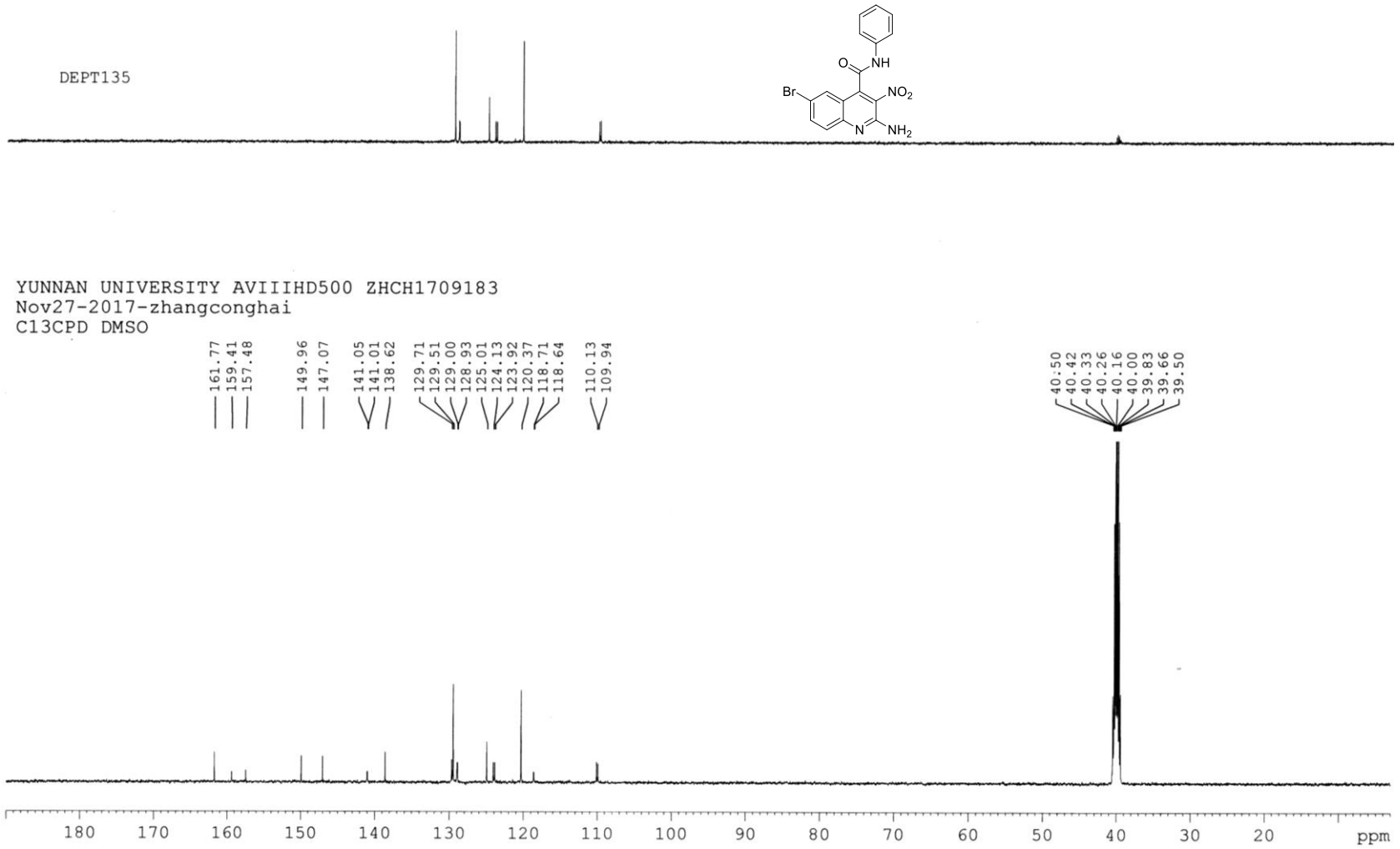


Figure S13. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5ba**

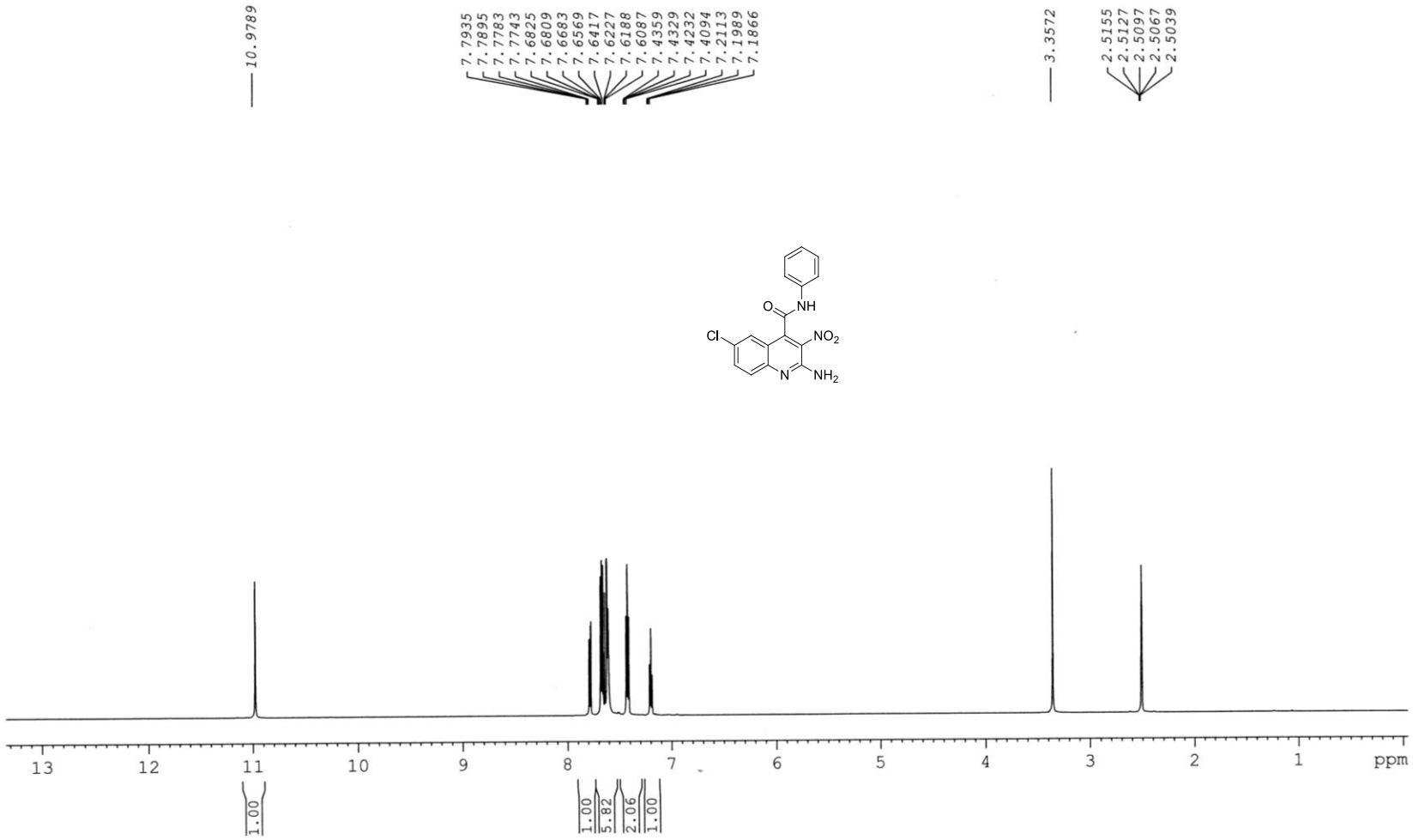


Figure S14. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5ca**

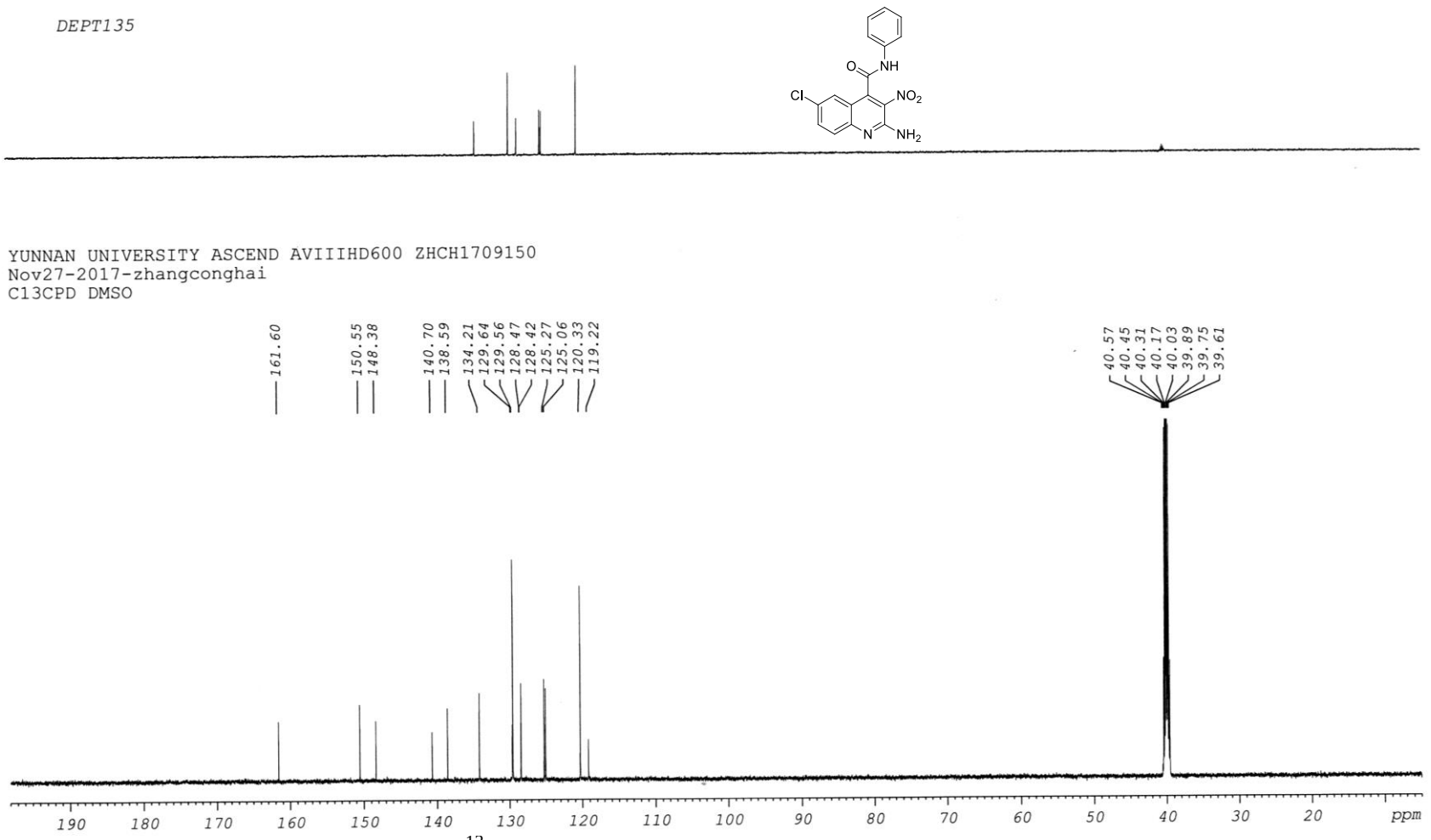


Figure S15. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5ca**

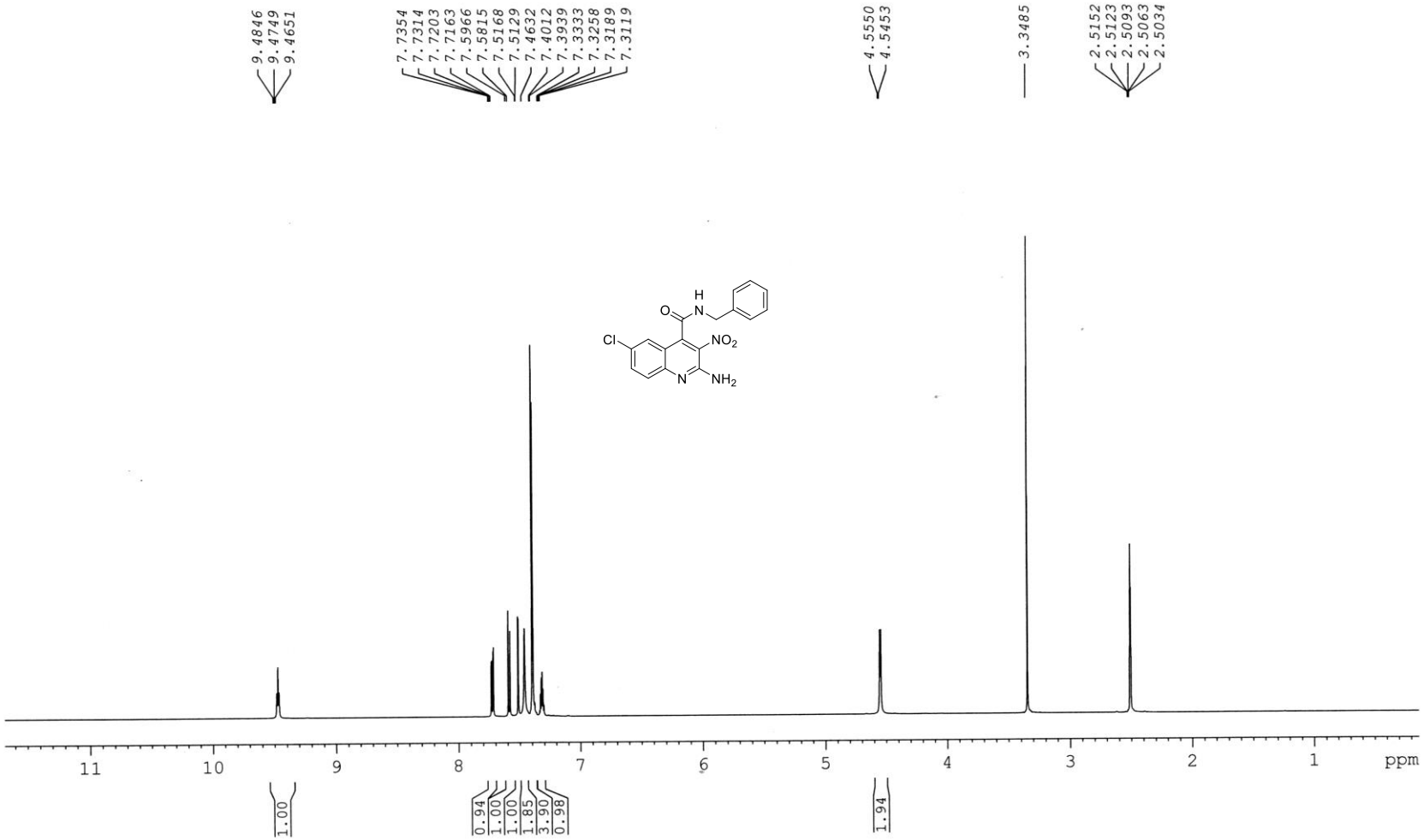


Figure S16. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5cb**

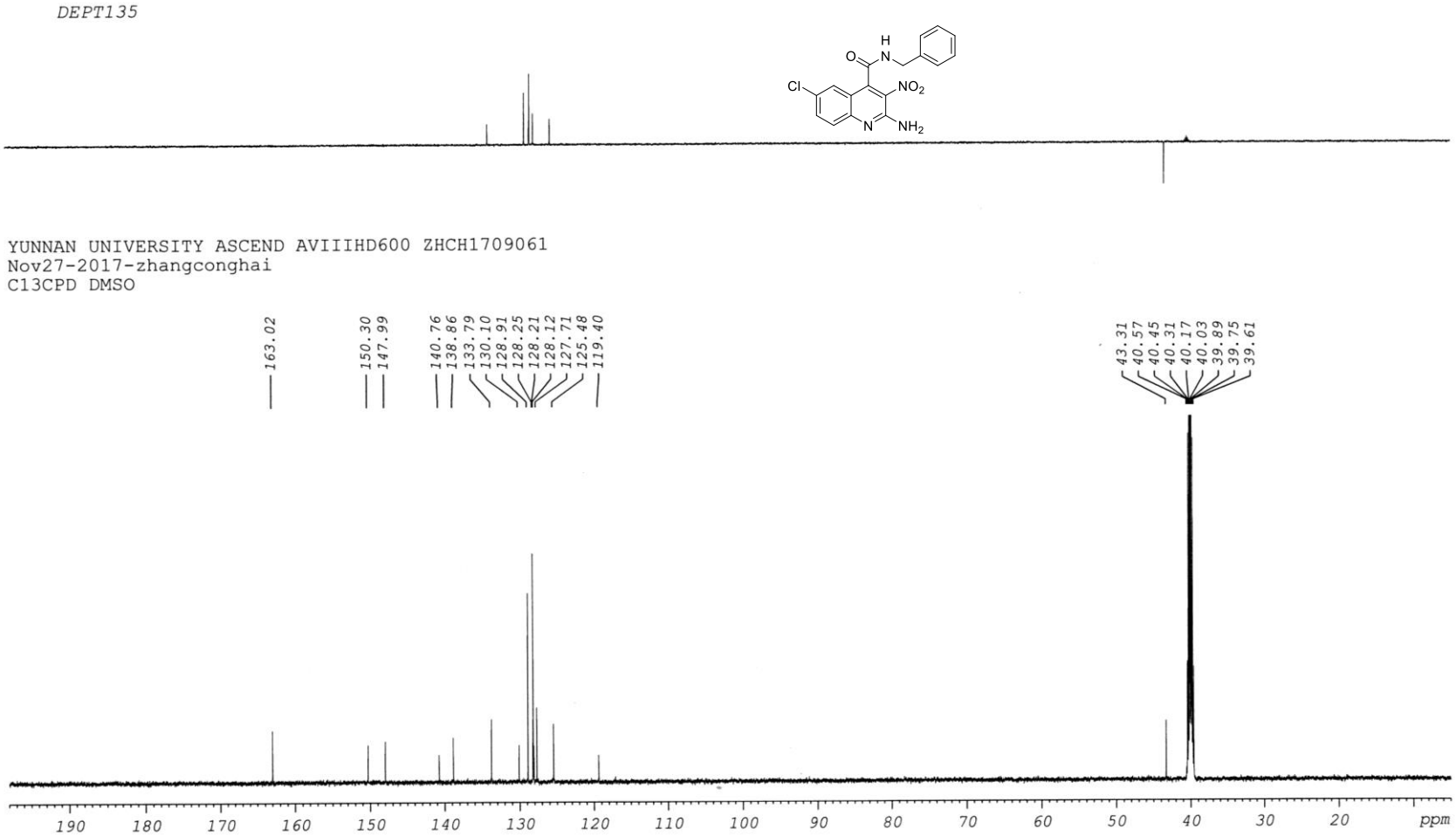


Figure S17. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5cb**

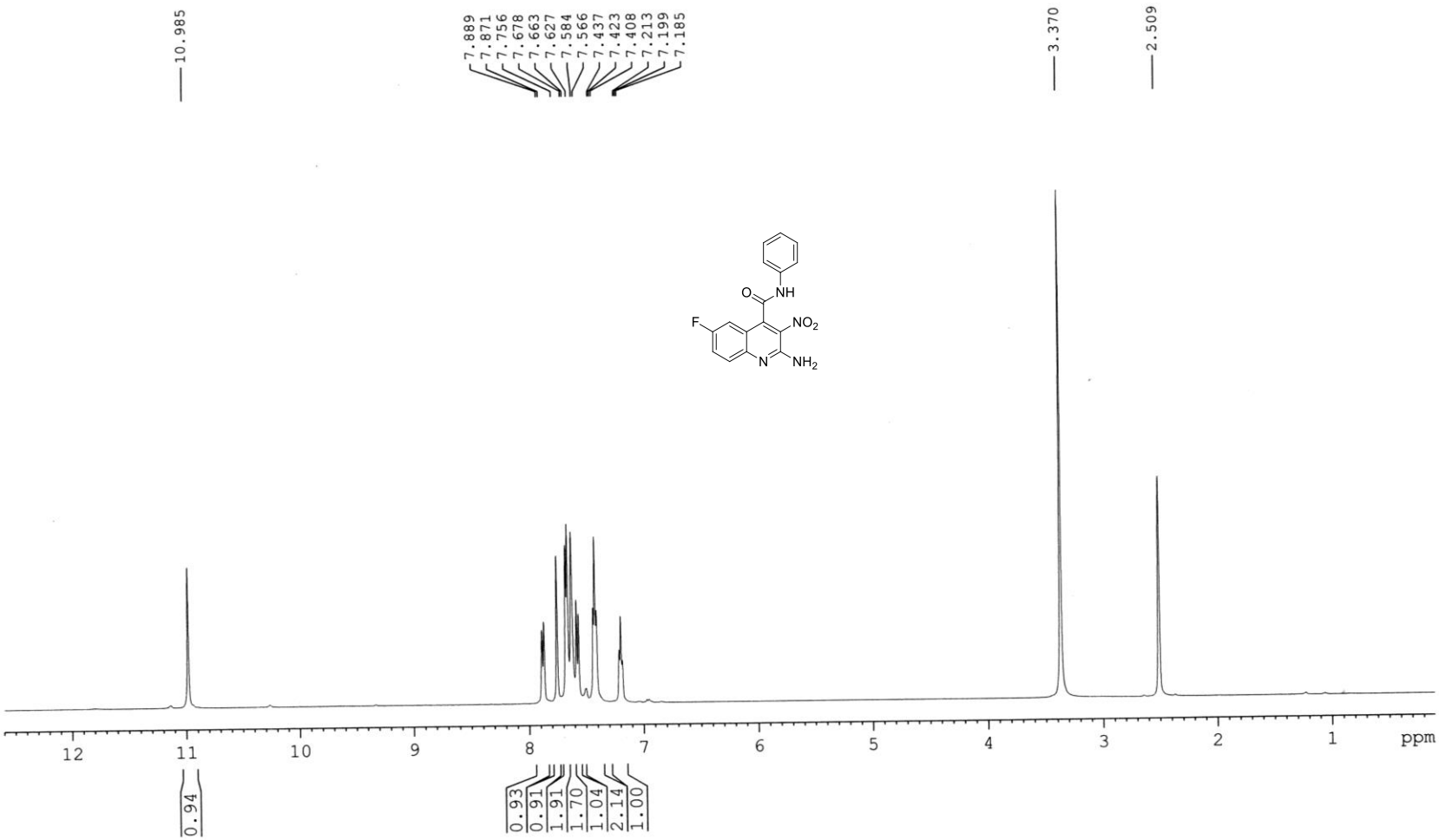


Figure S18. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5da**

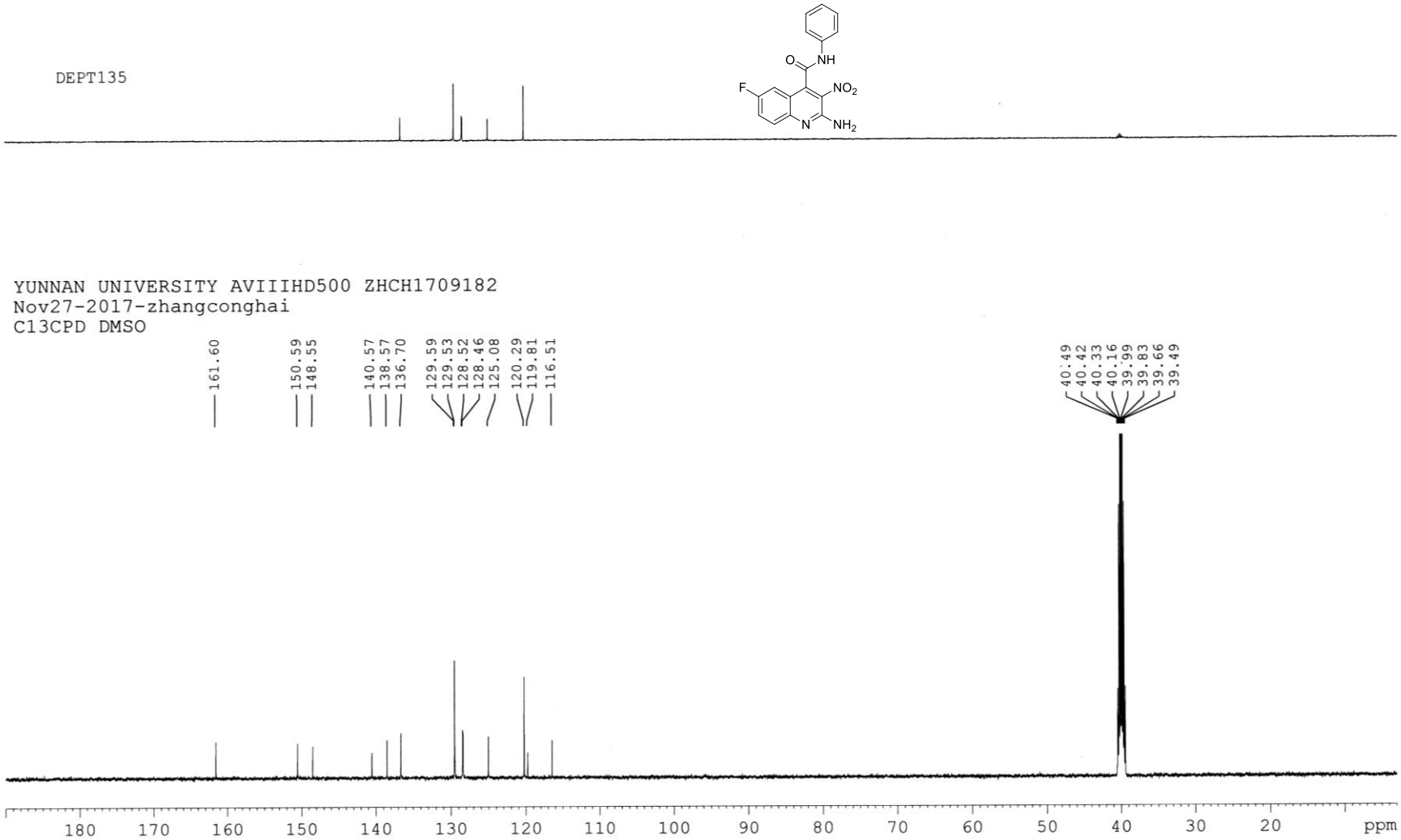


Figure S19. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5da**

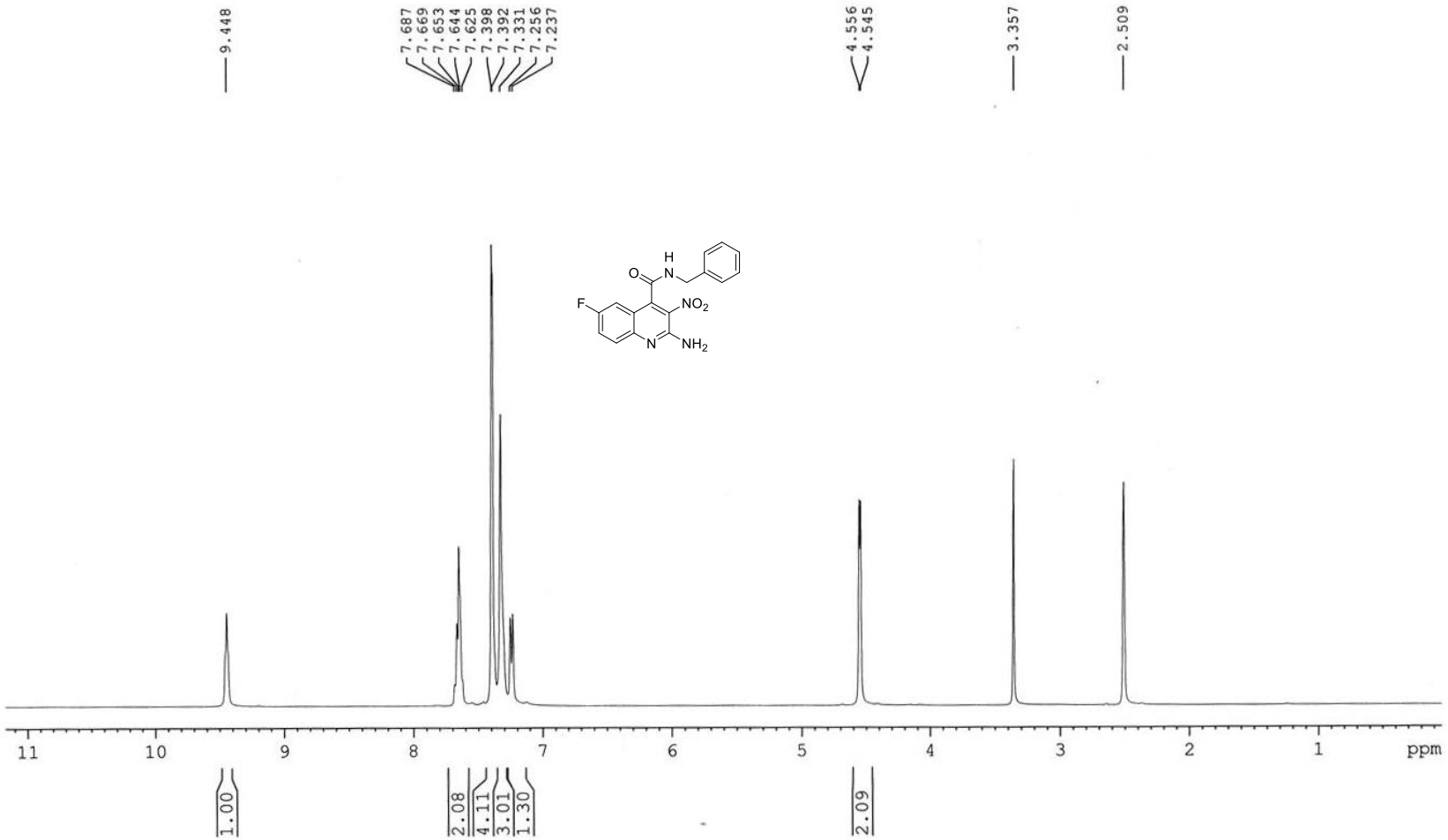


Figure S20. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5db**

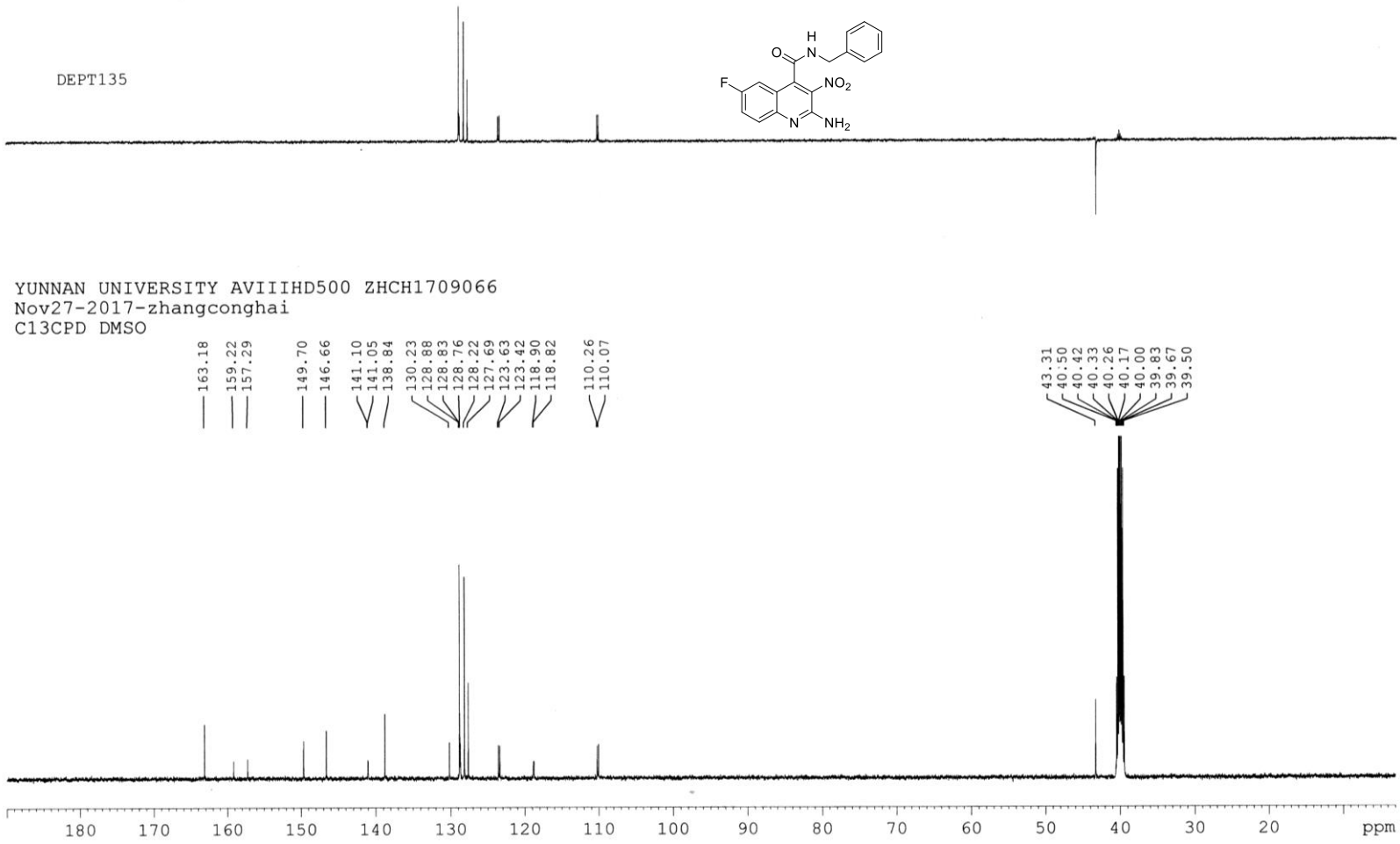


Figure S21. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5db**

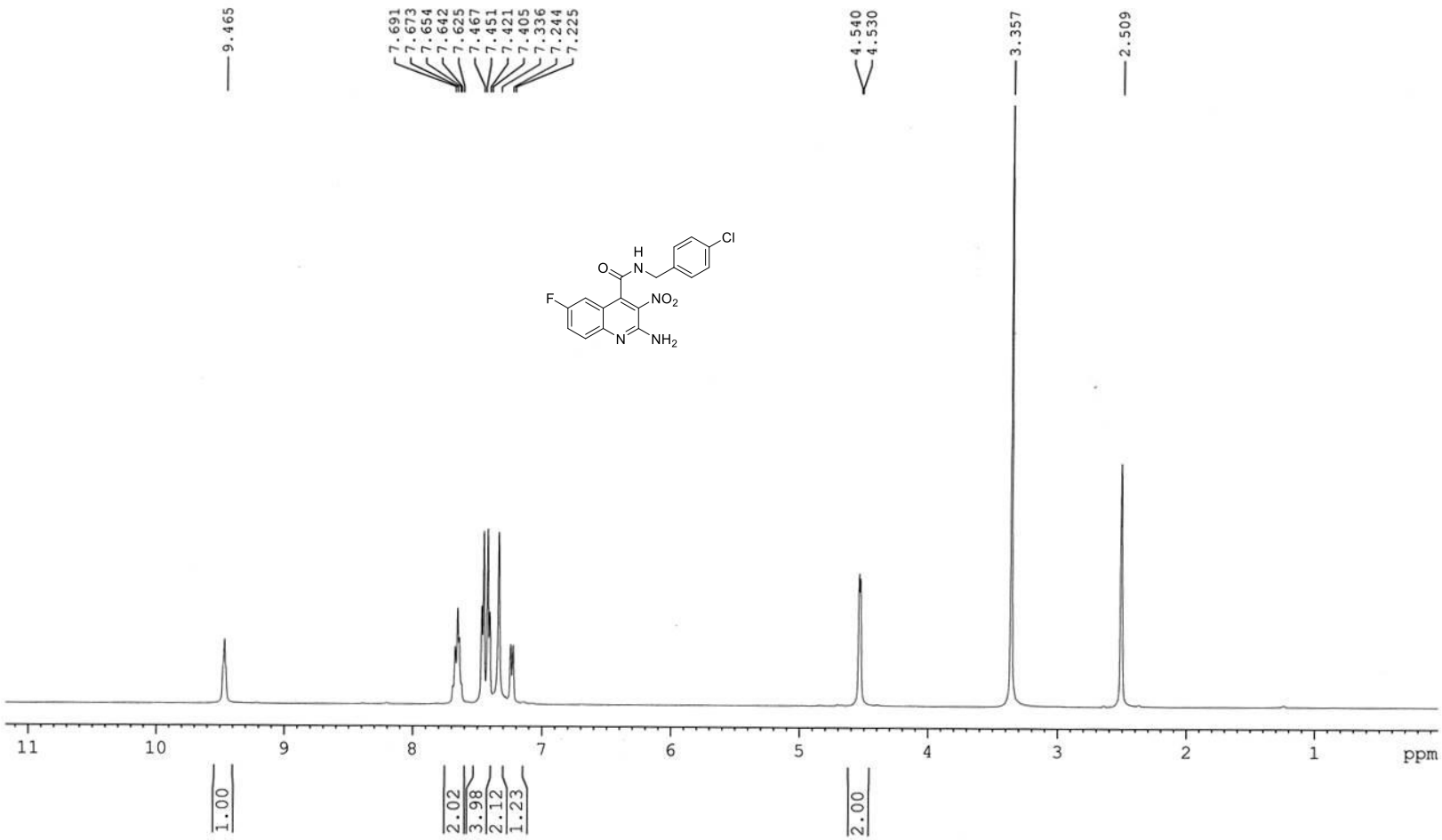


Figure S22. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5dc**

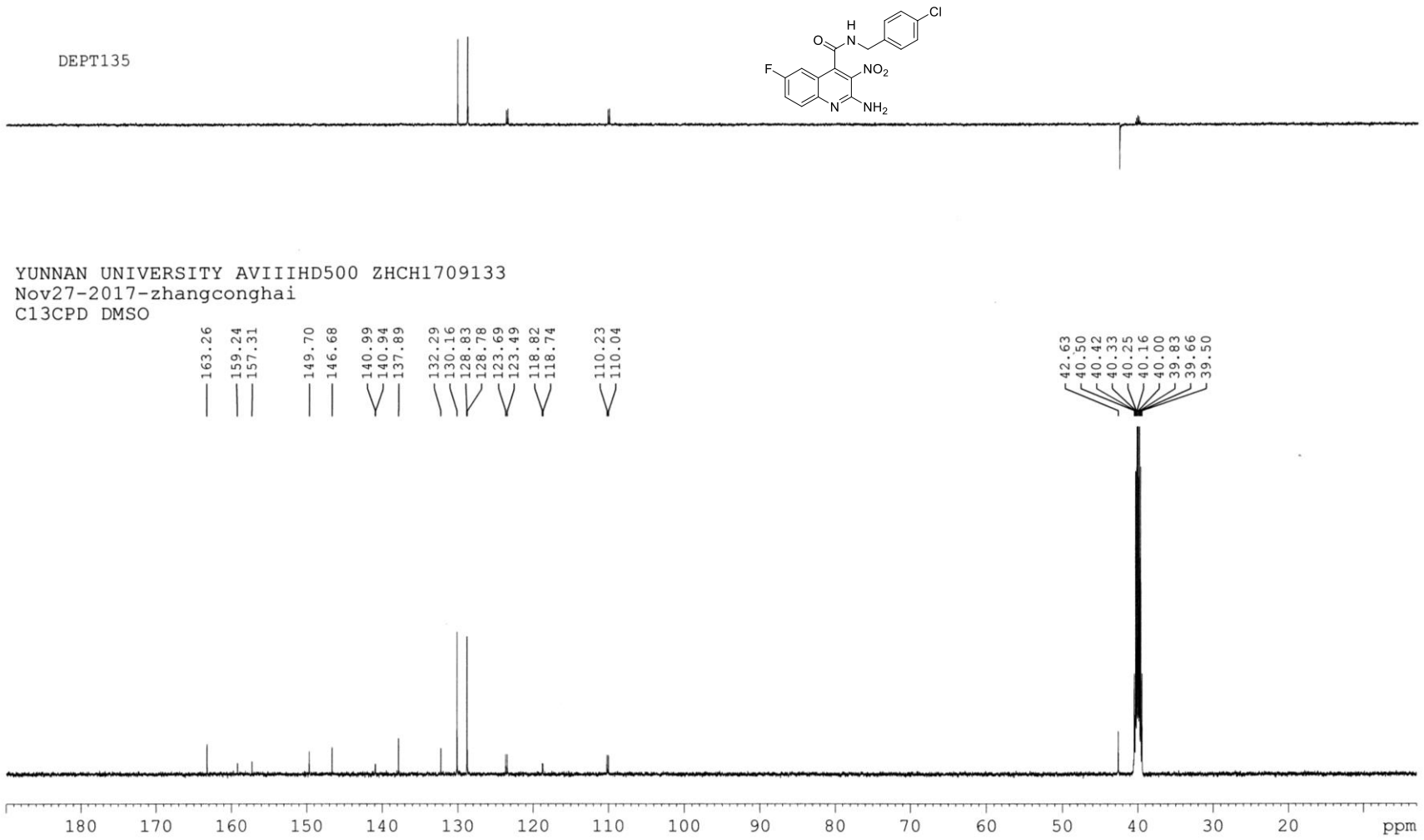


Figure S23. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5dc**

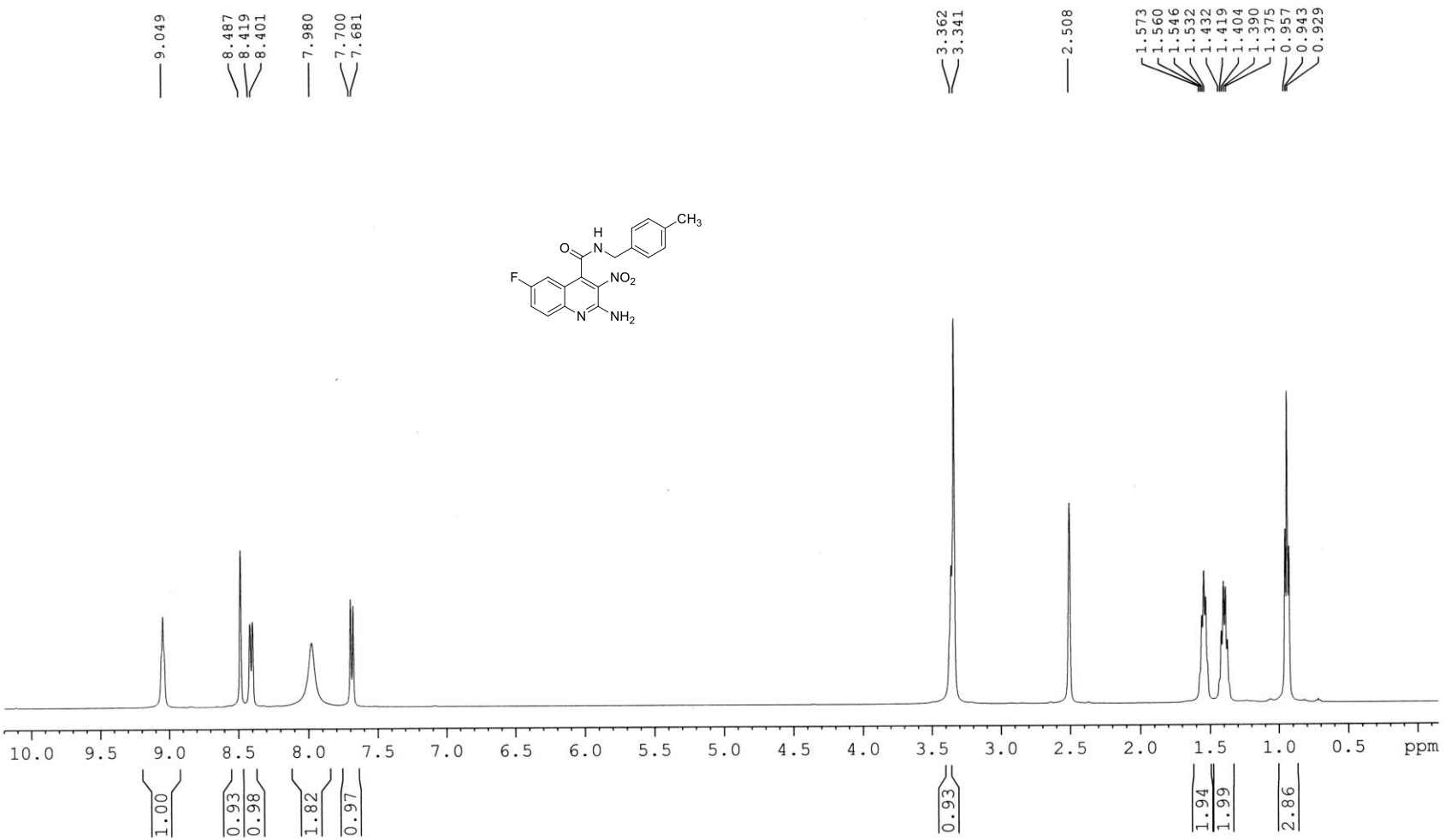


Figure S24. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5de**

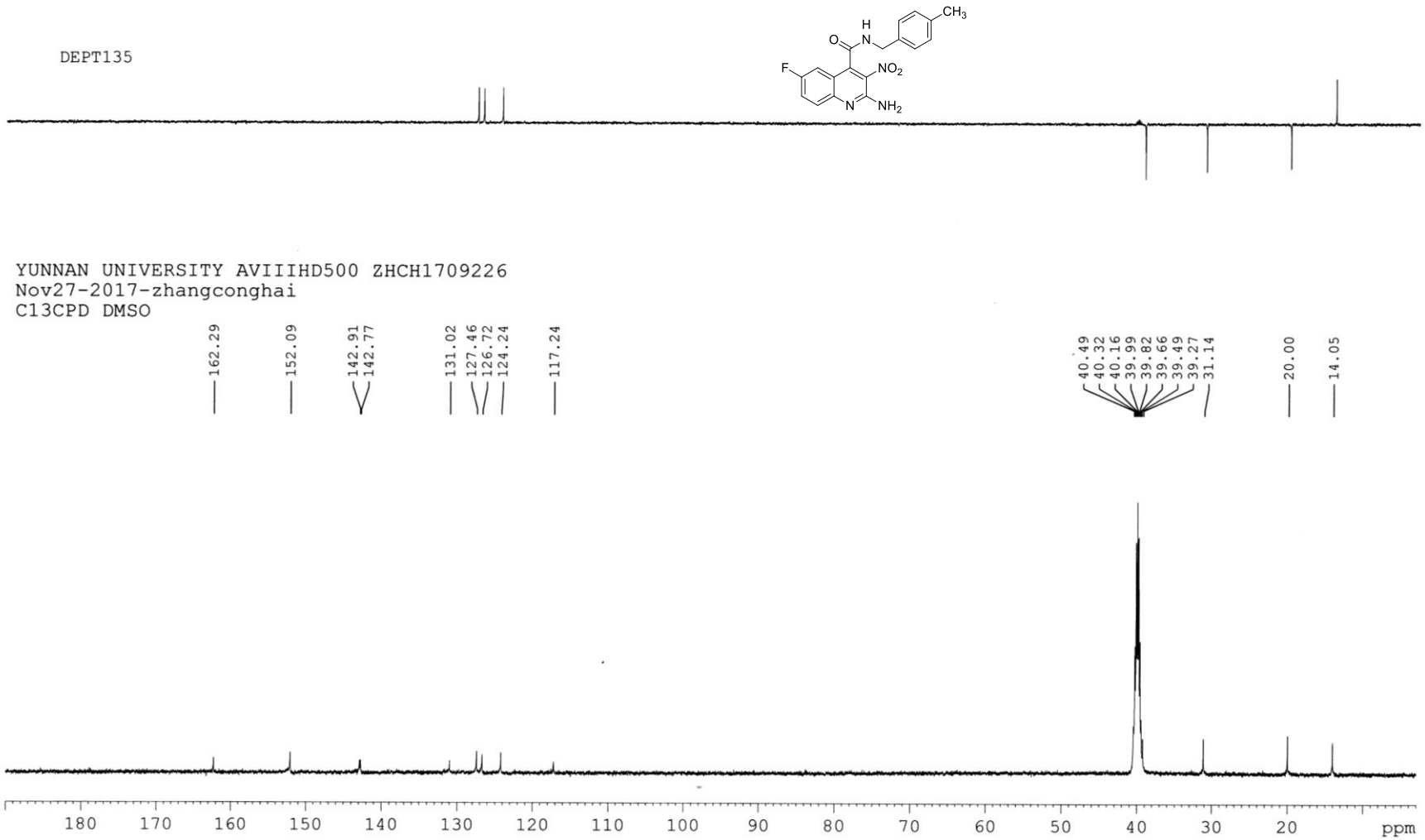


Figure S25. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5de**

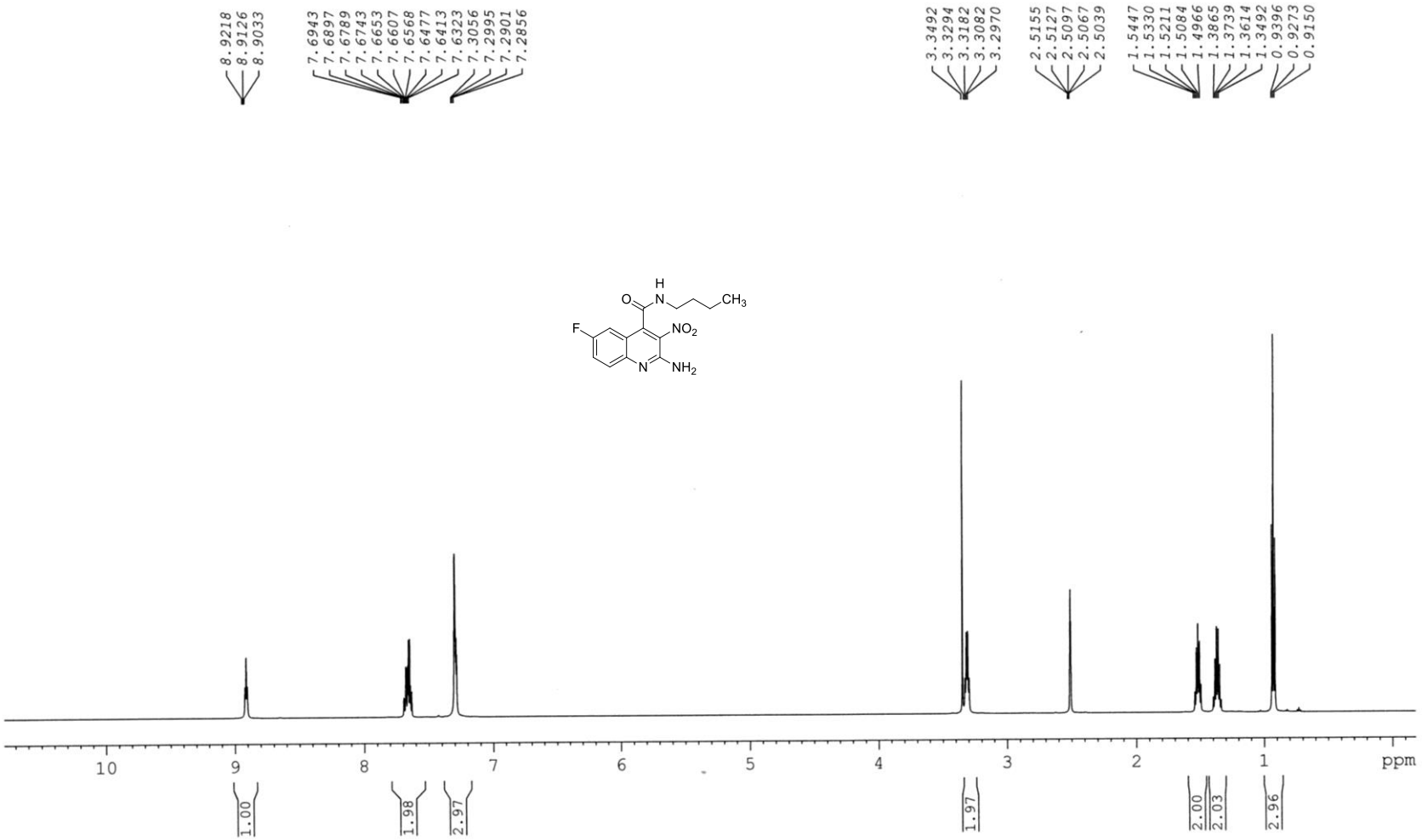


Figure S26. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5df**

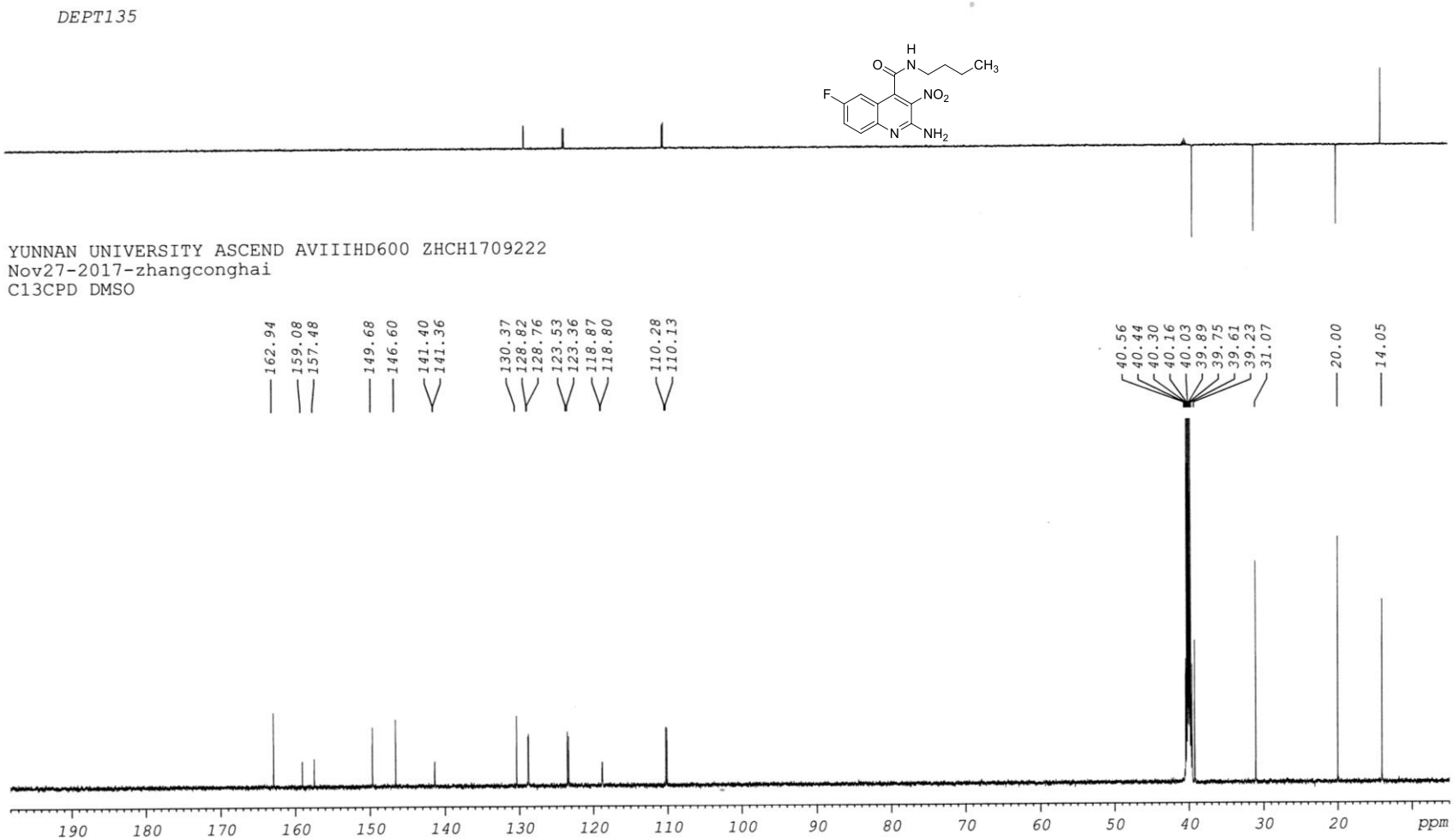


Figure S27. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5df**

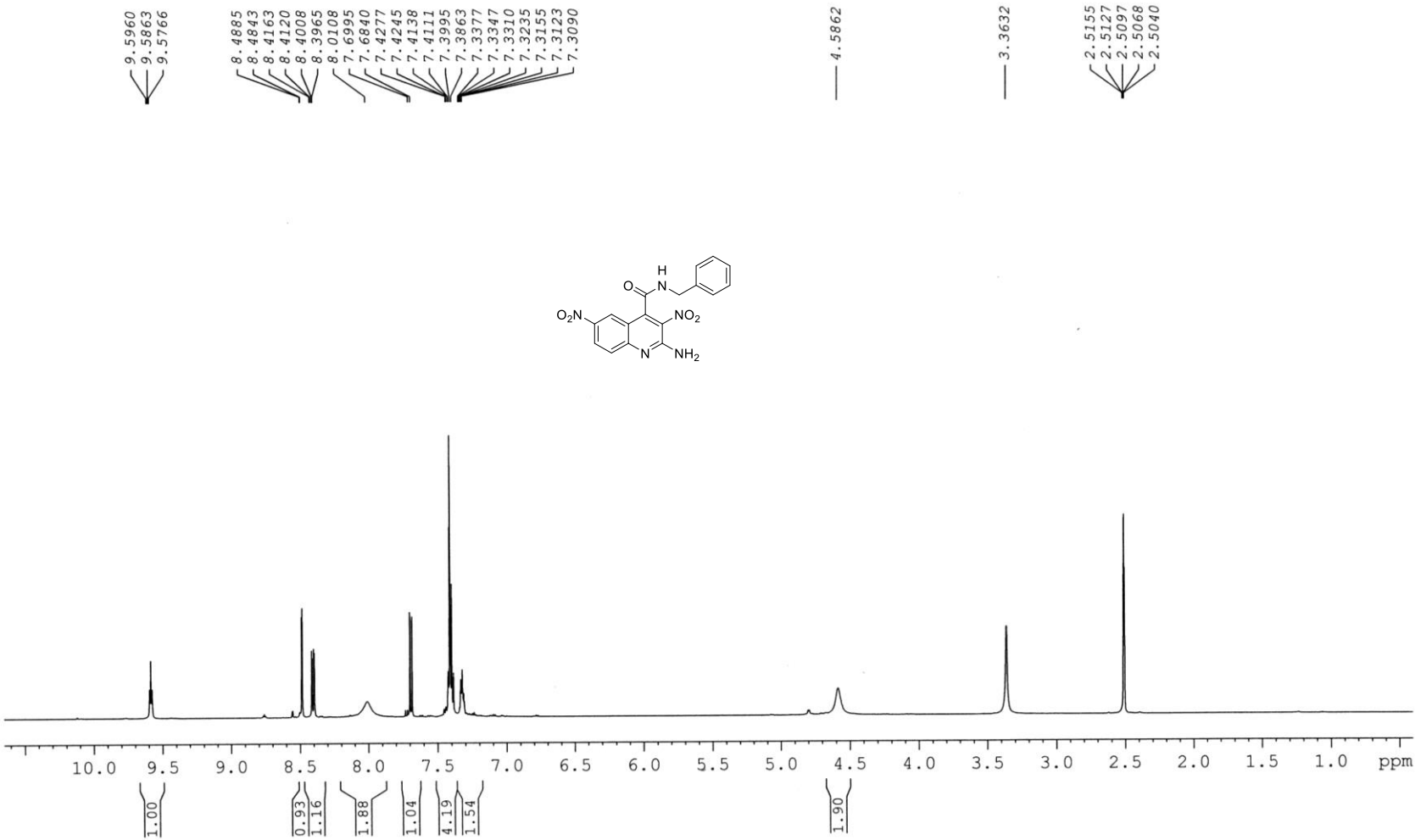


Figure S28. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5eb**

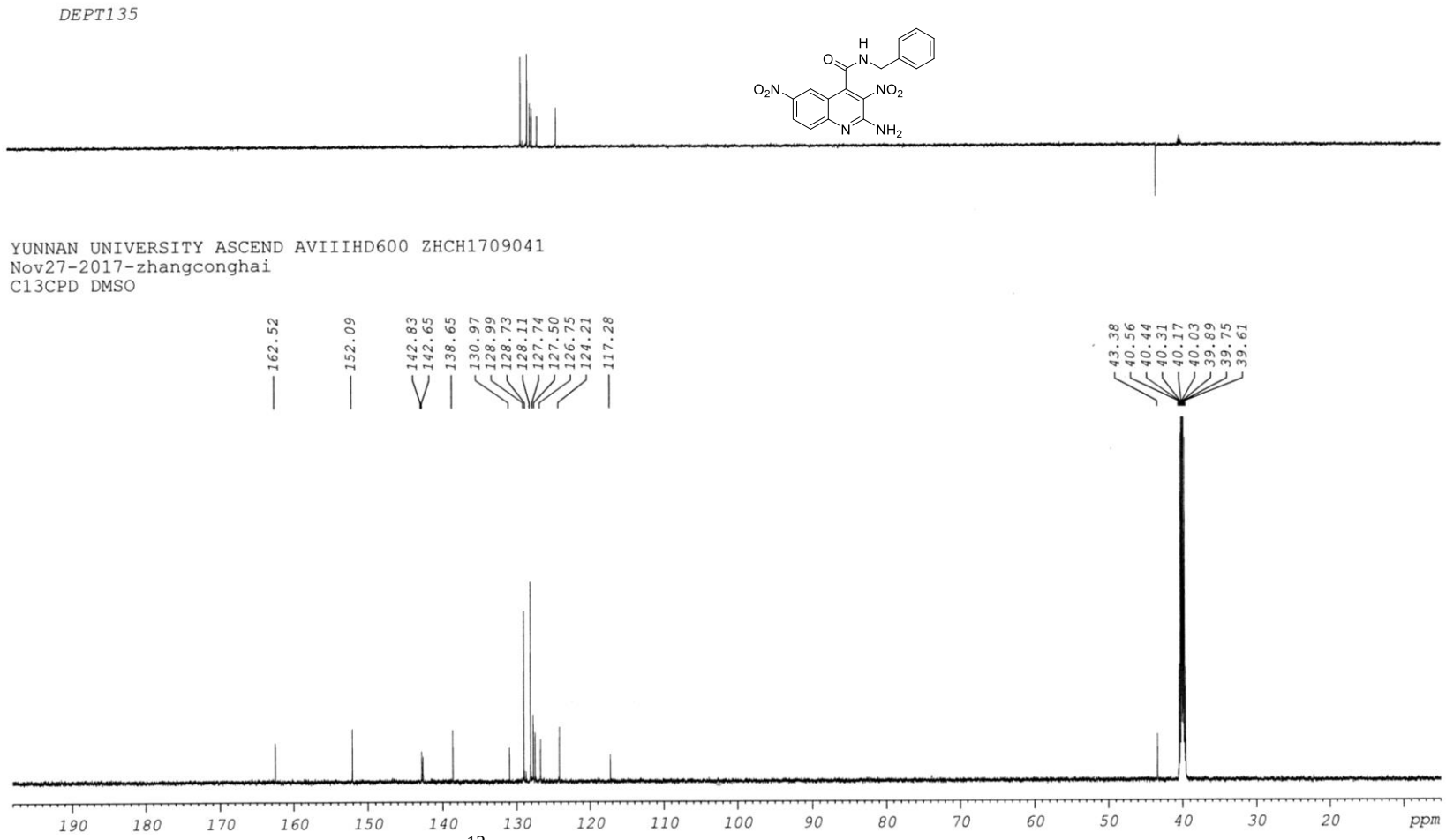


Figure S29. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5eb**

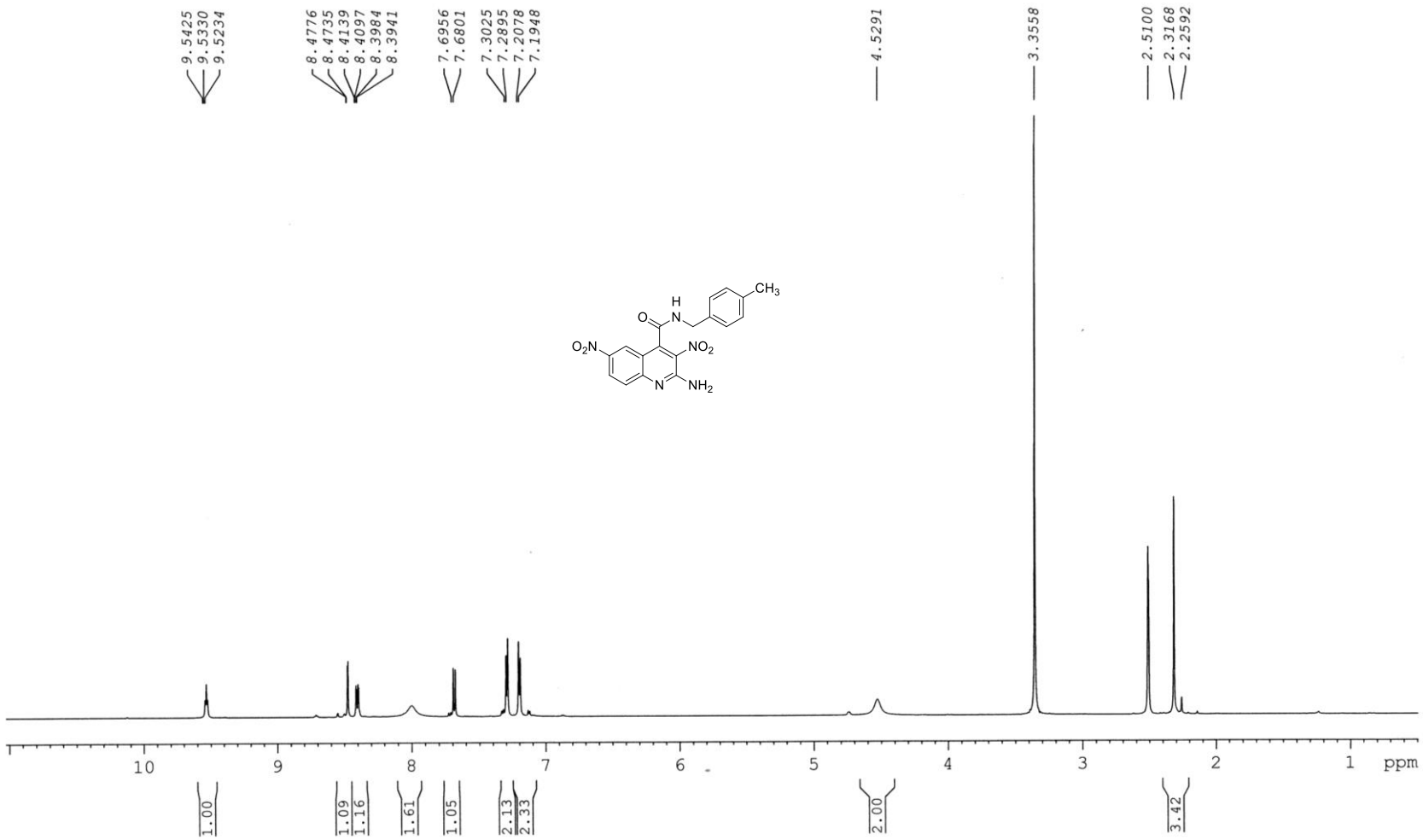


Figure S30. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5ee**

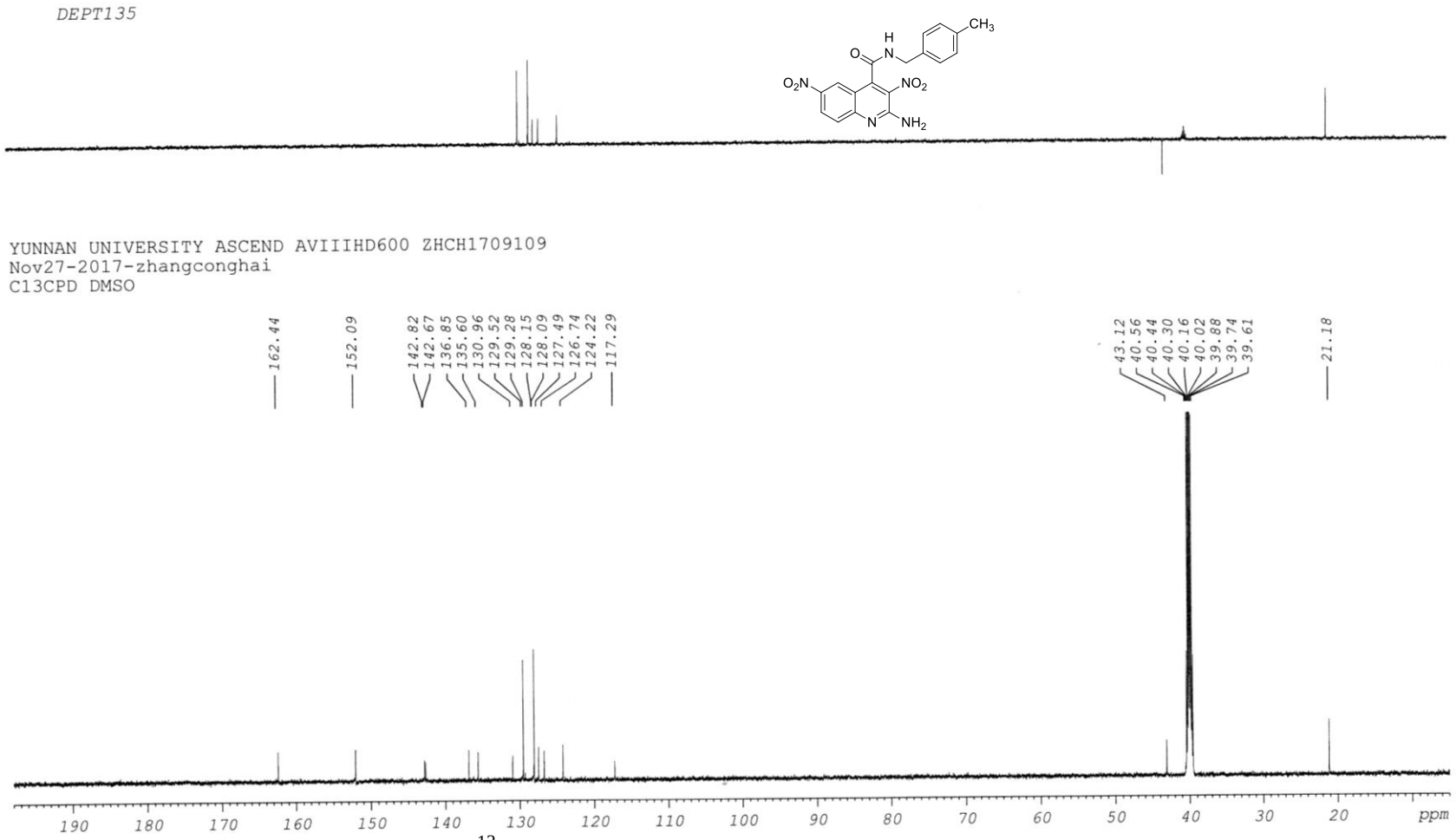


Figure S31. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5ee**

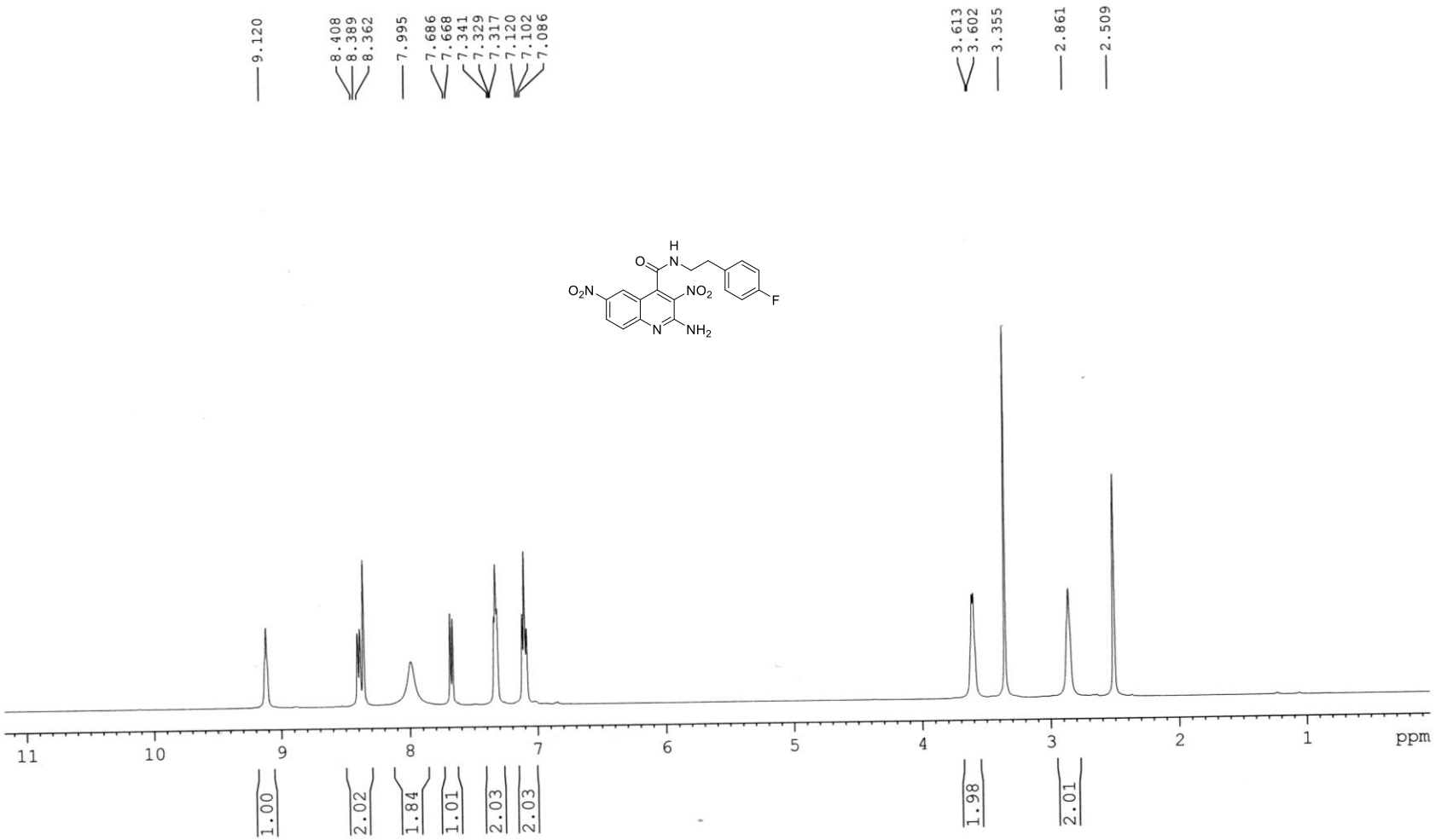


Figure S32. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5eg**

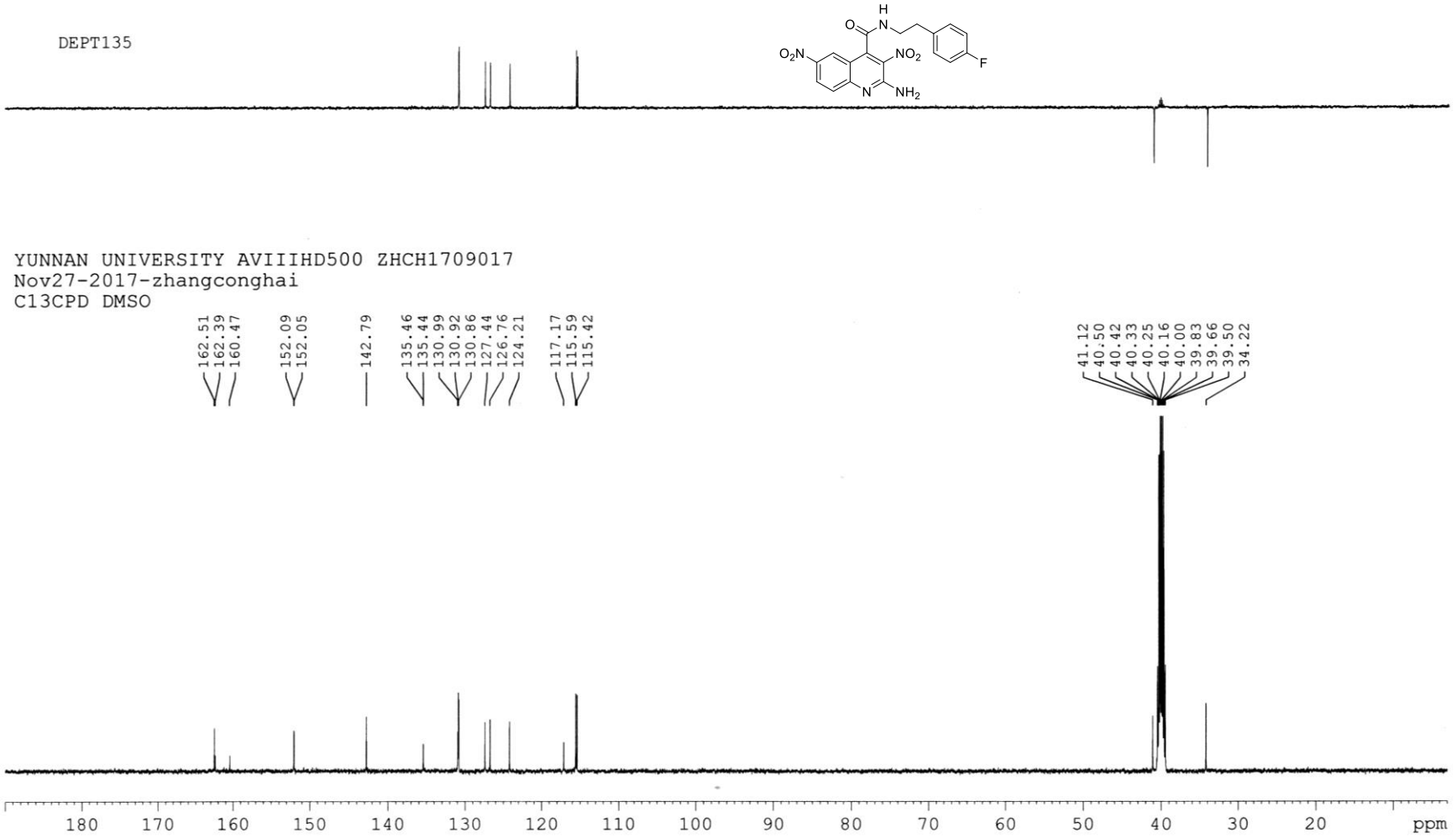


Figure S33. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5eg**

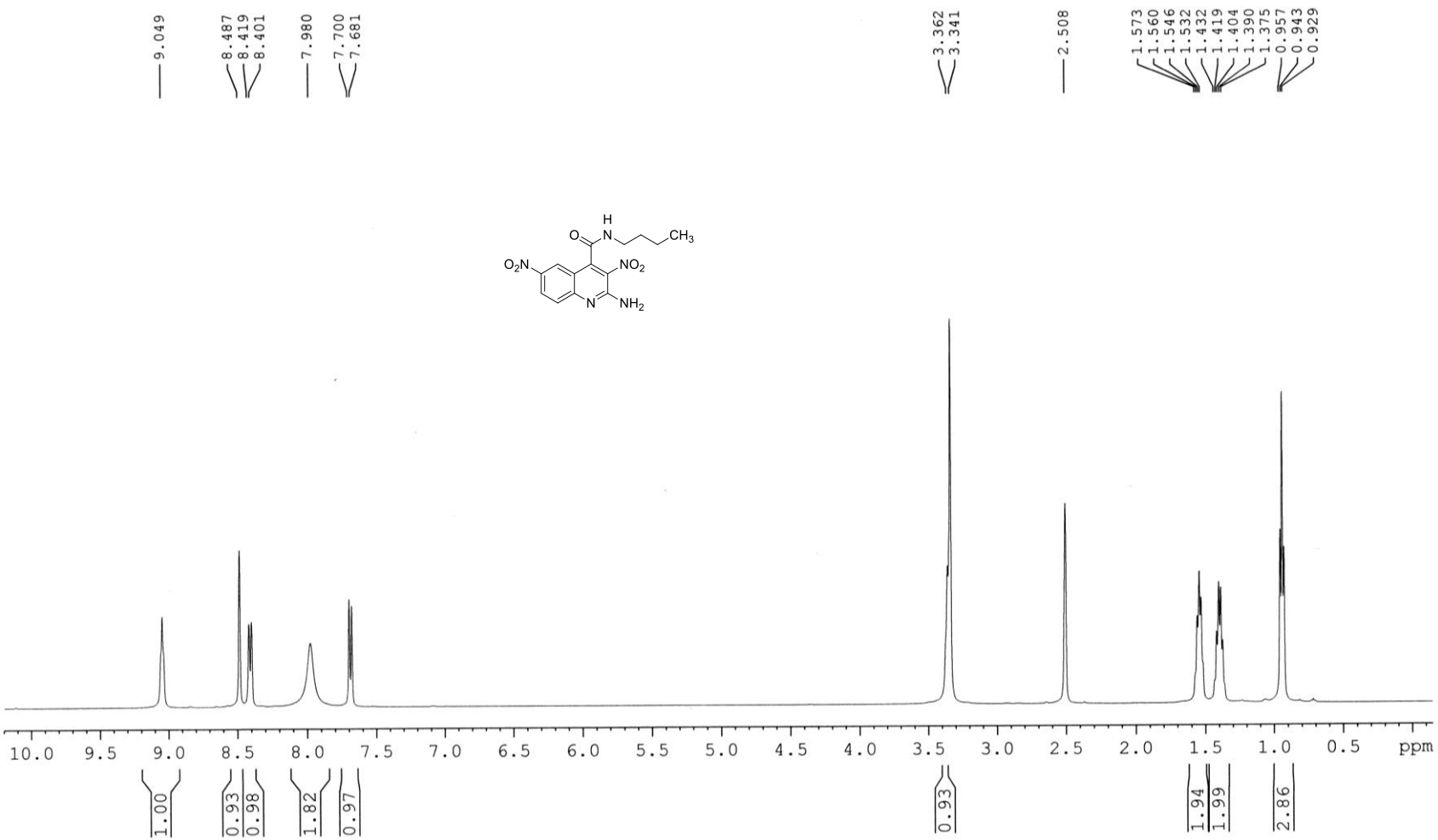


Figure S34. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5ef**

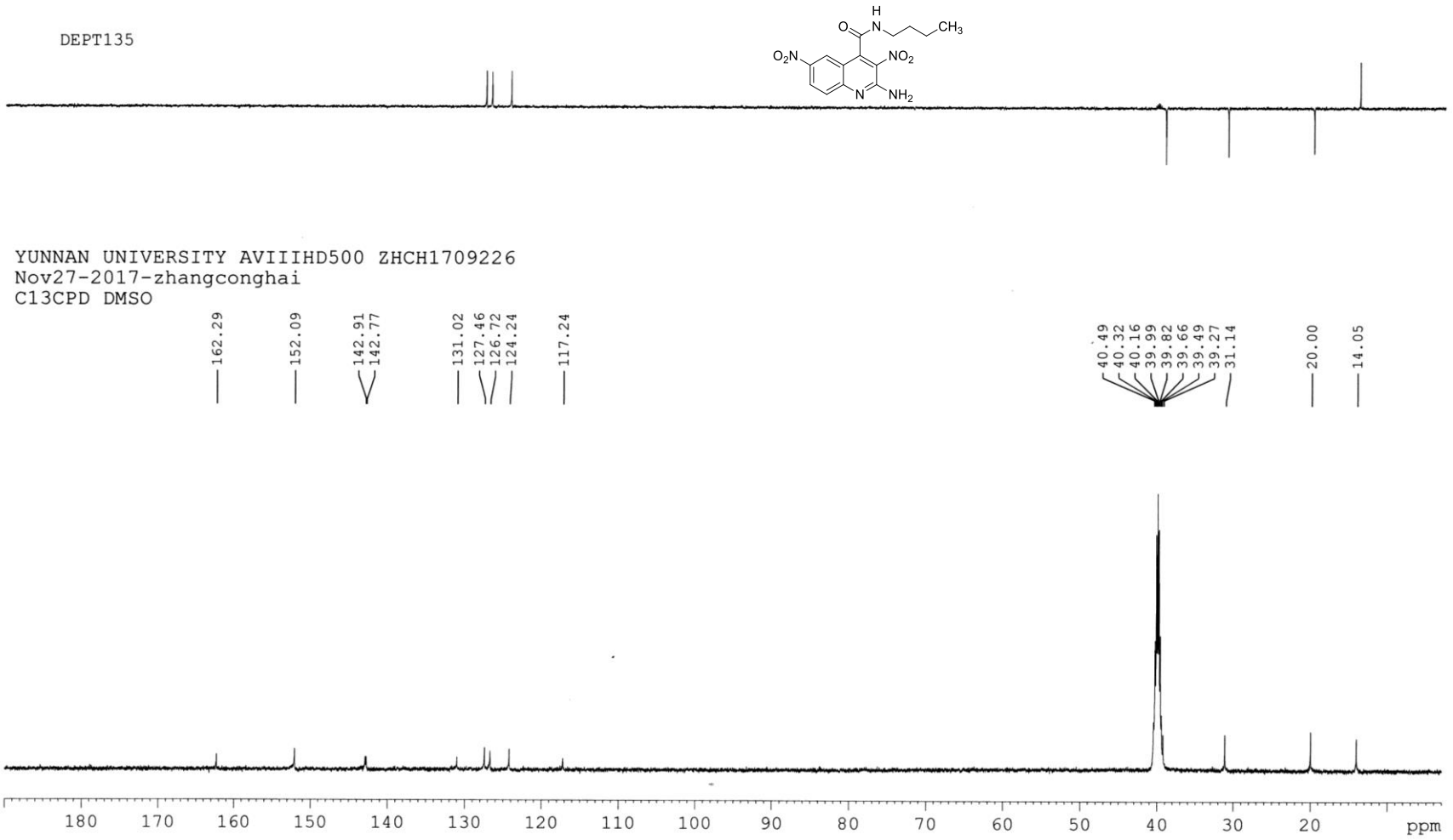


Figure S35. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5ef**

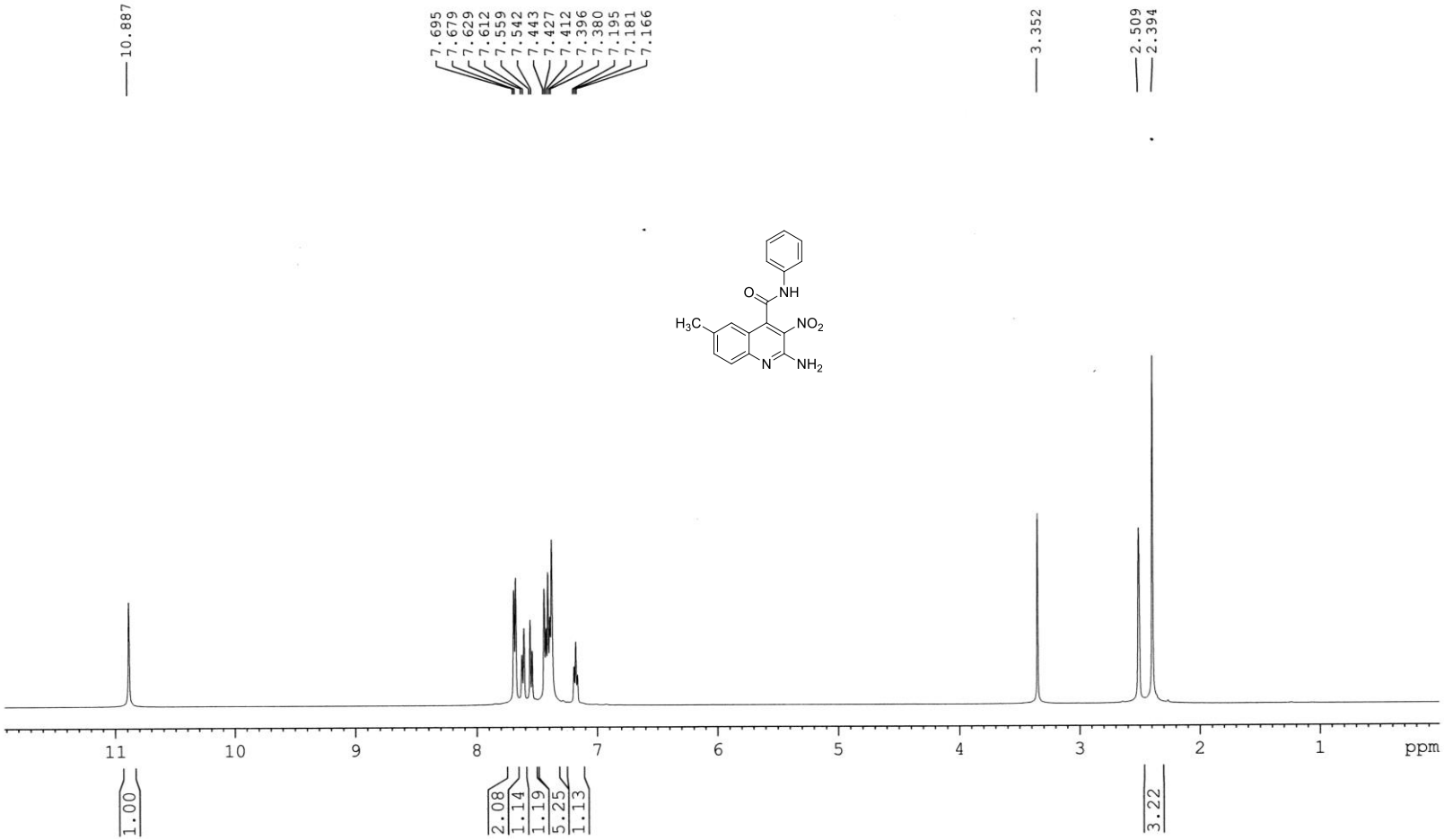


Figure S36. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **5fa**

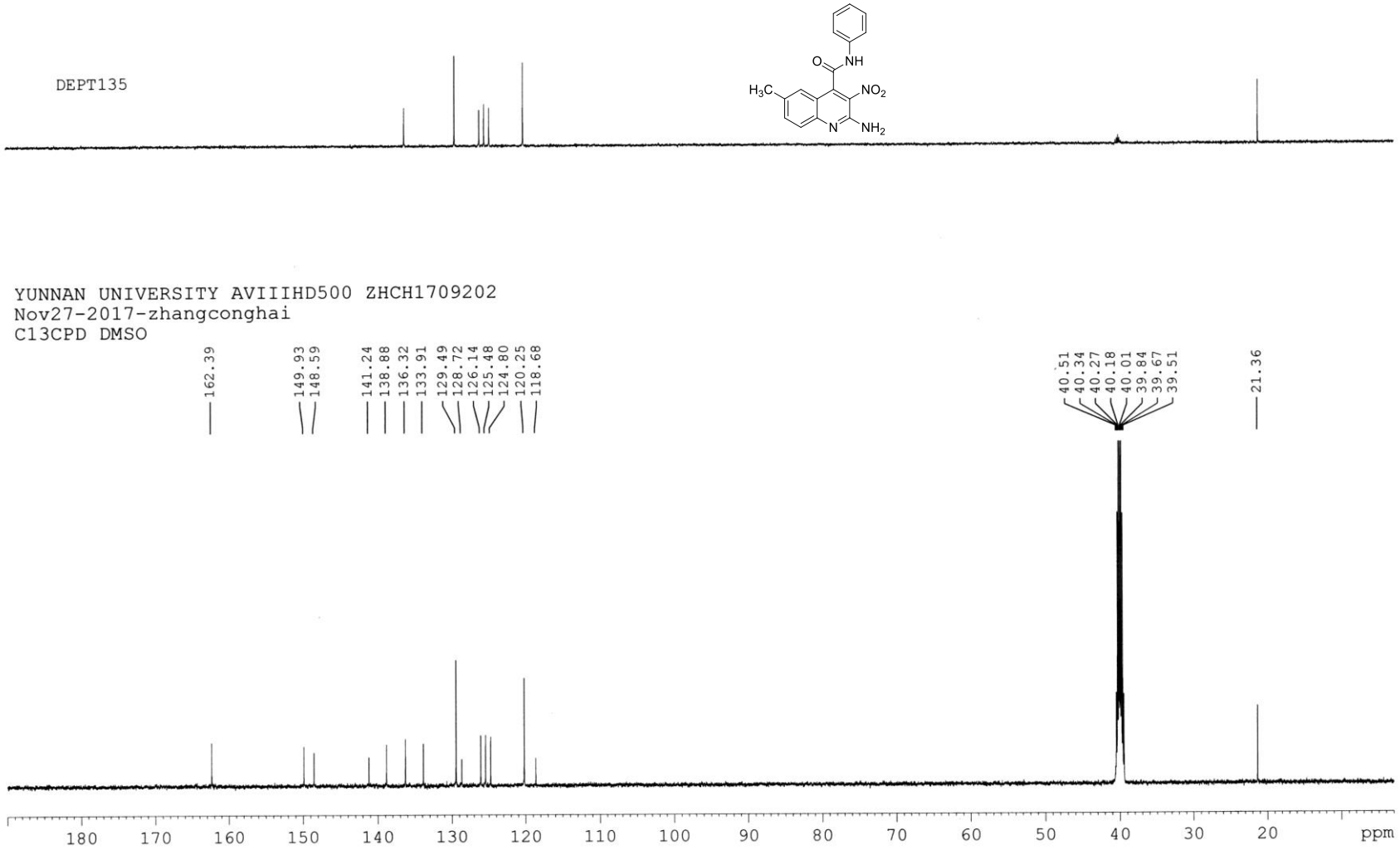


Figure S37. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **5fa**

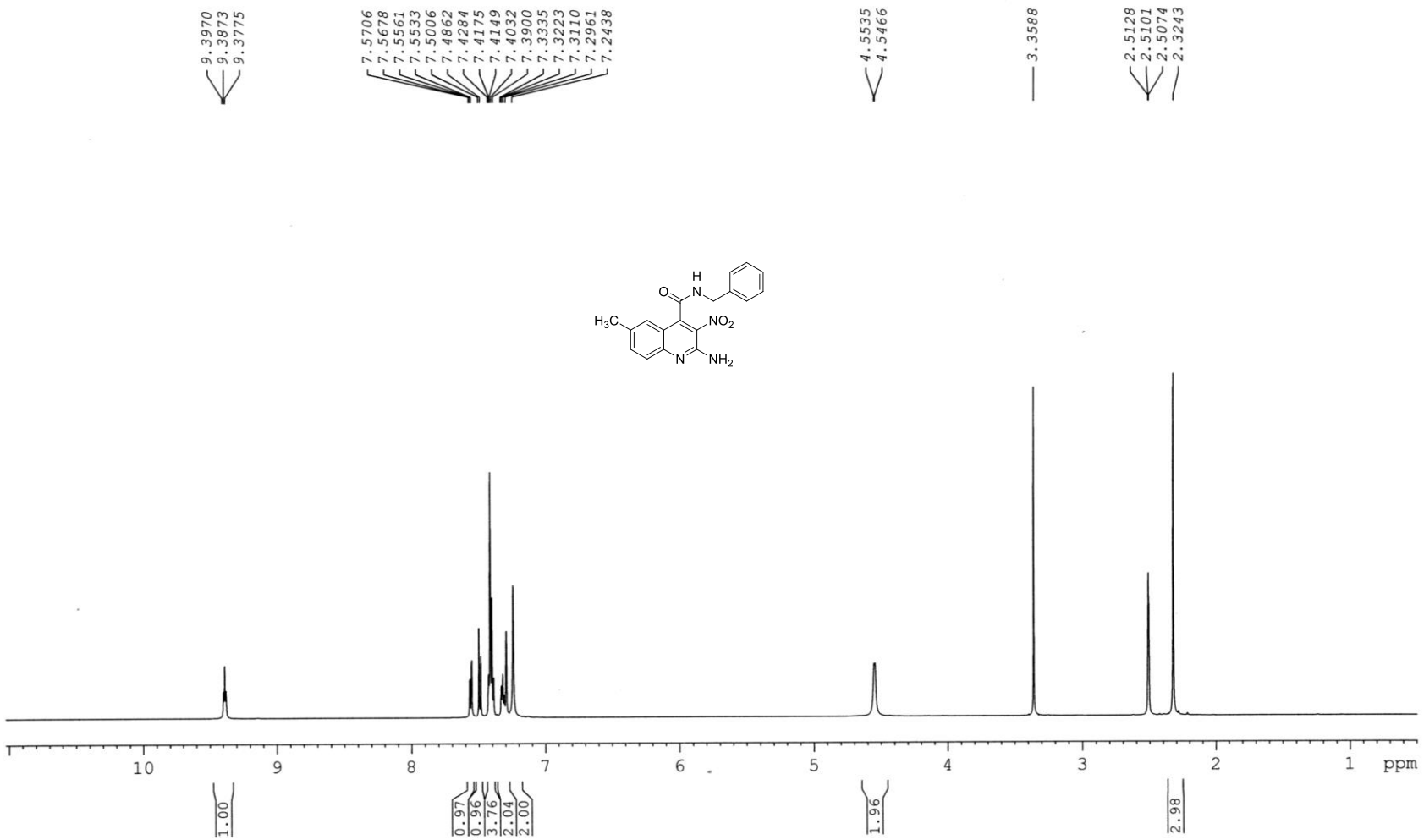


Figure S38. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5fb**

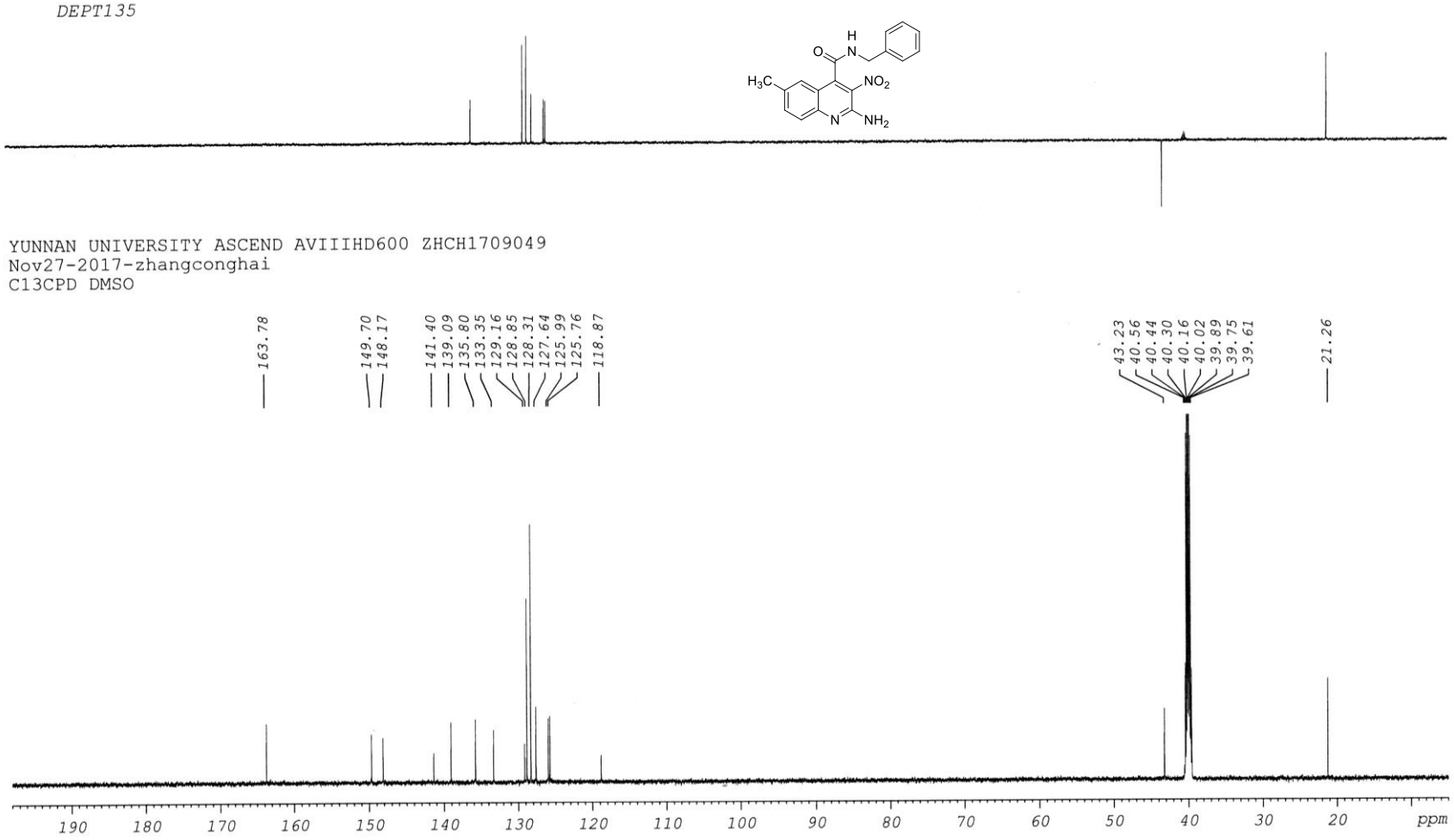


Figure S39. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5fb**

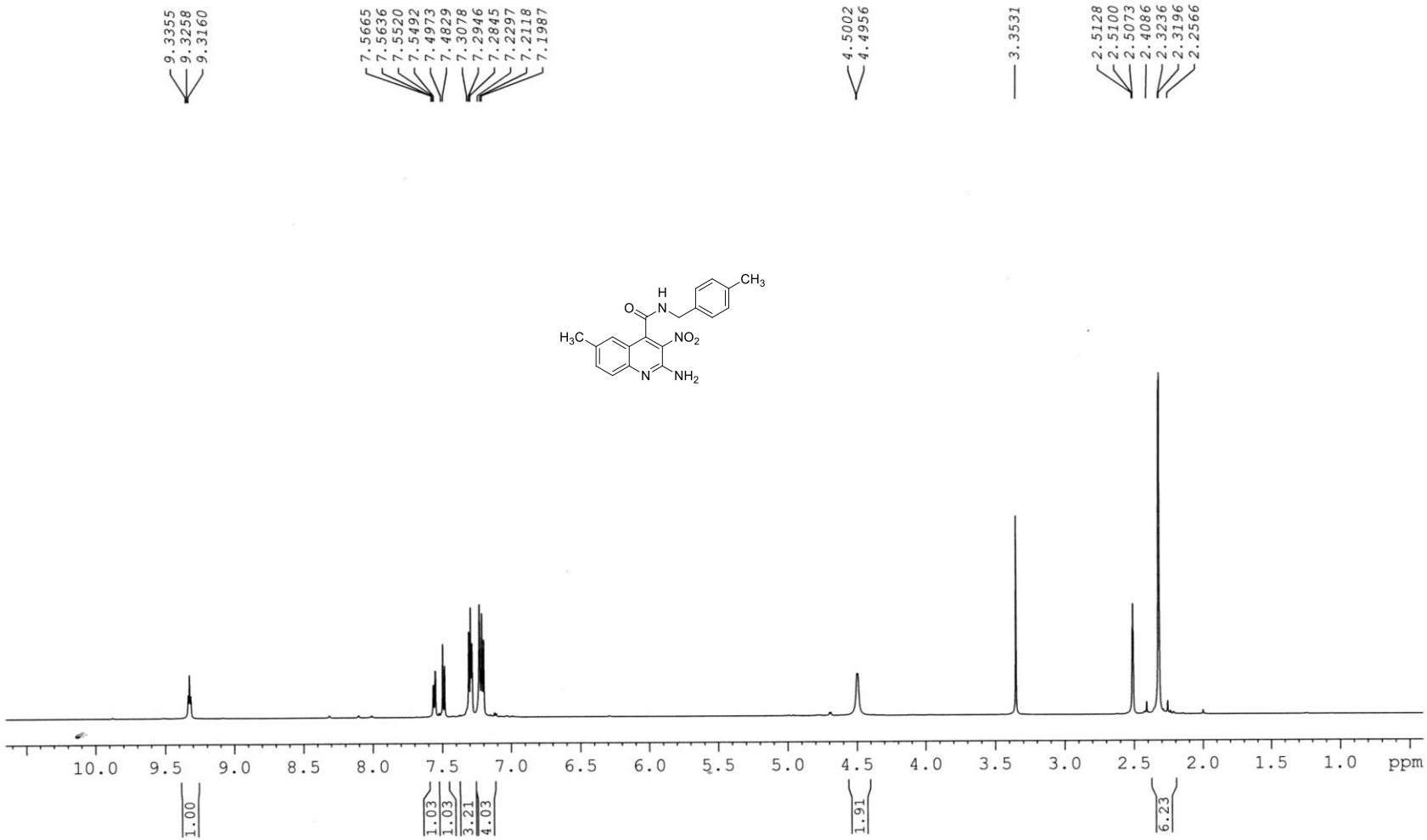


Figure S40. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5fe**

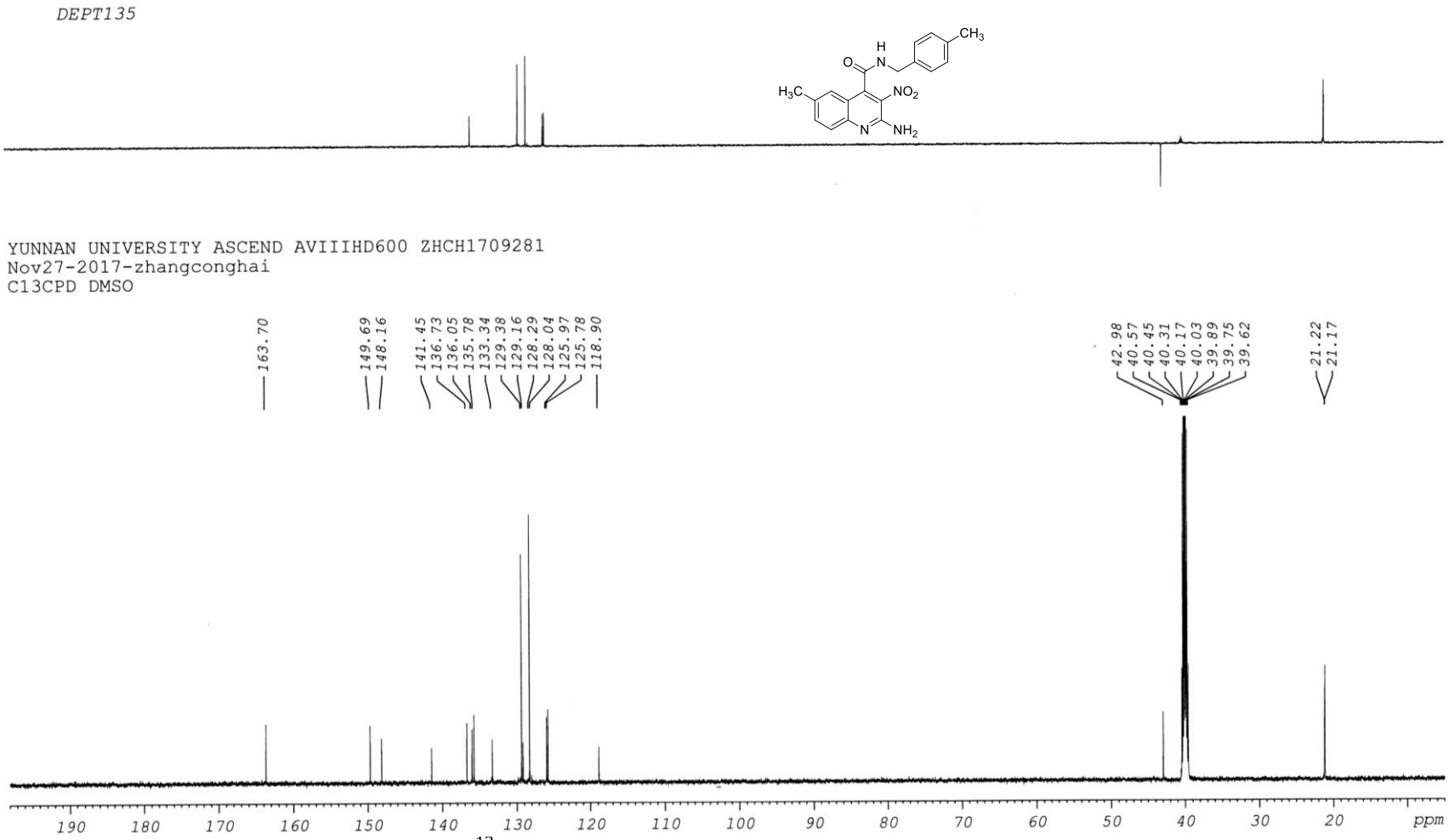


Figure S41. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5fe**

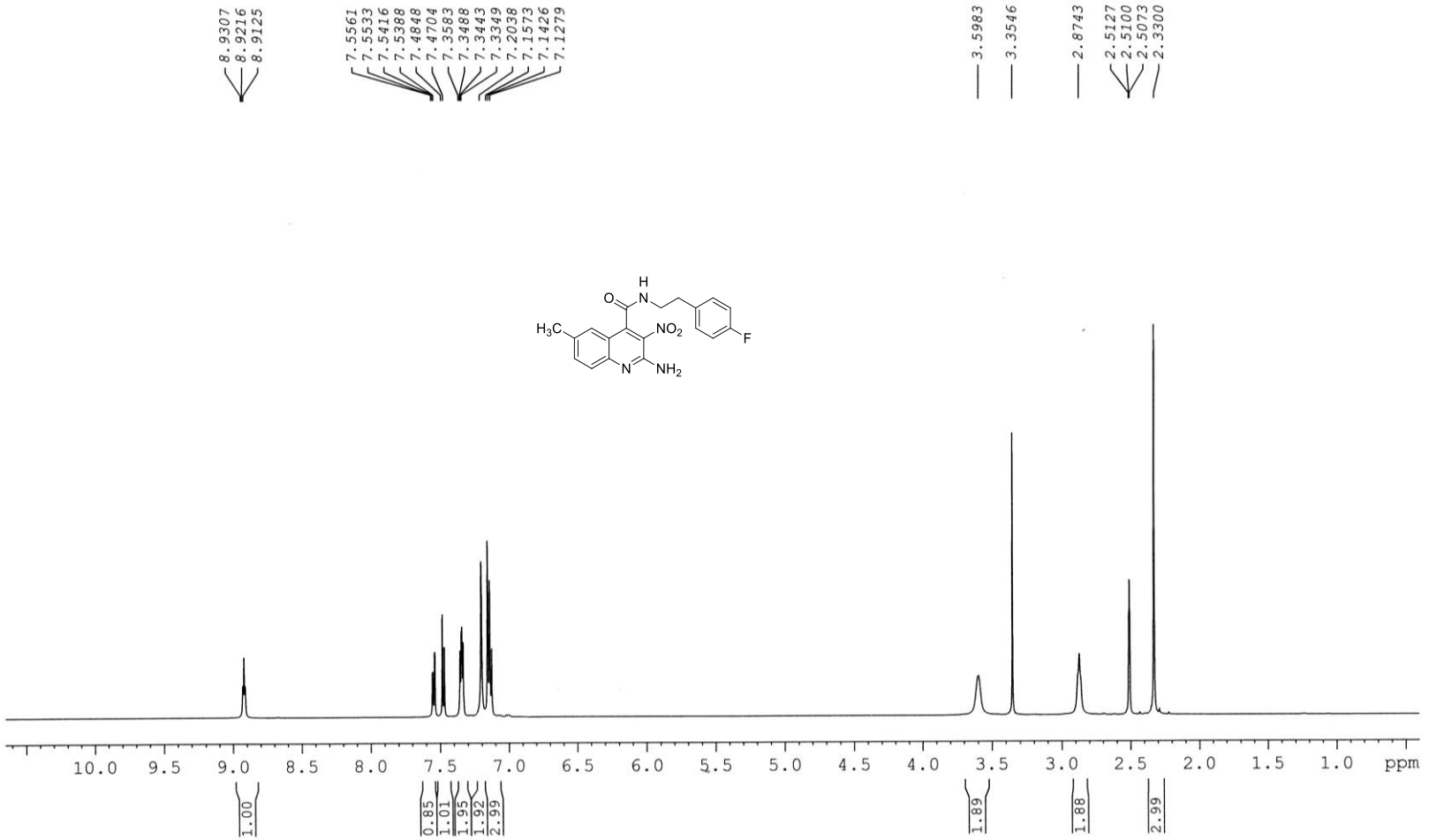


Figure S42. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **5fg**

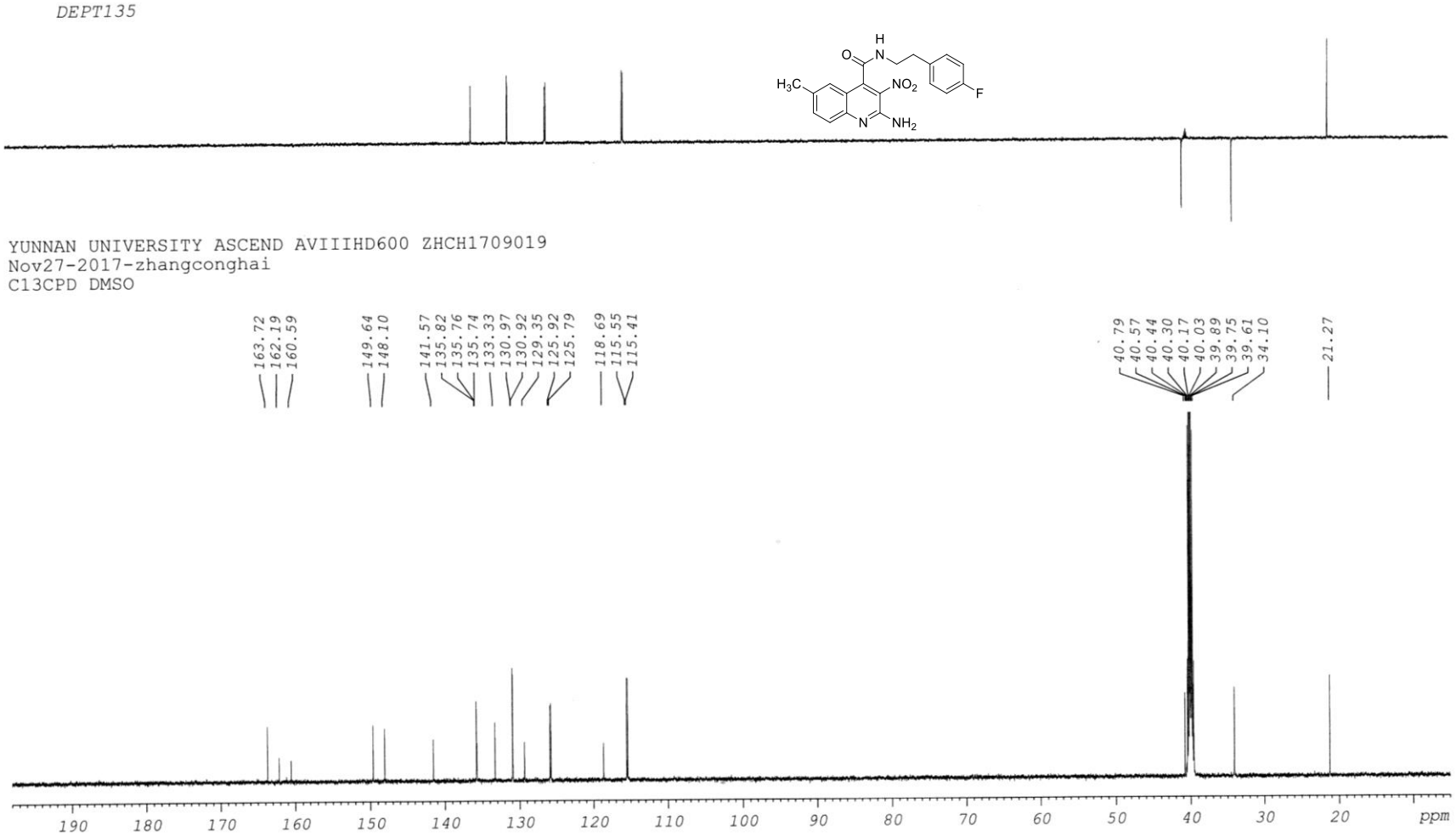


Figure S43. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **5fg**

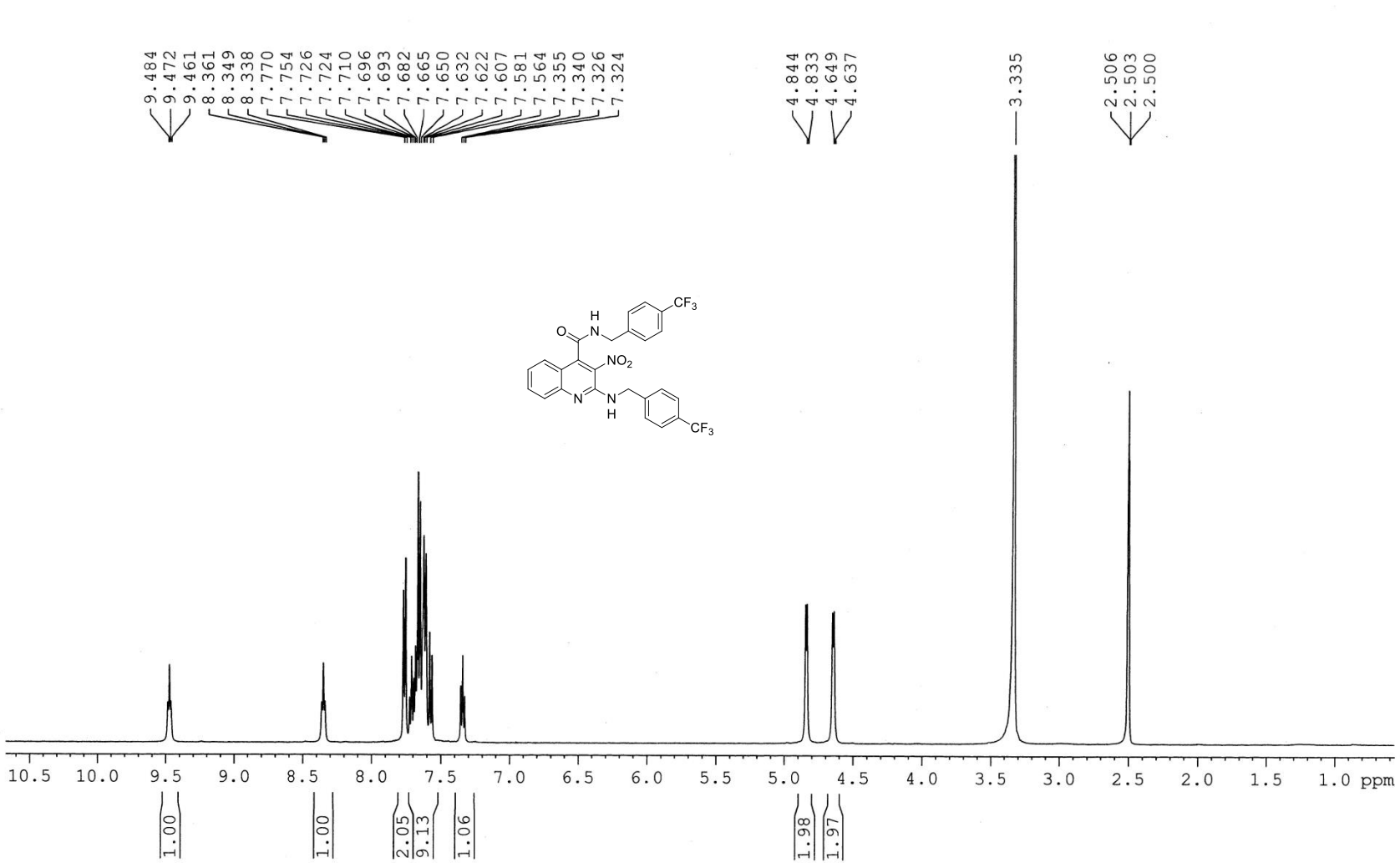


Figure S44. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6aa**

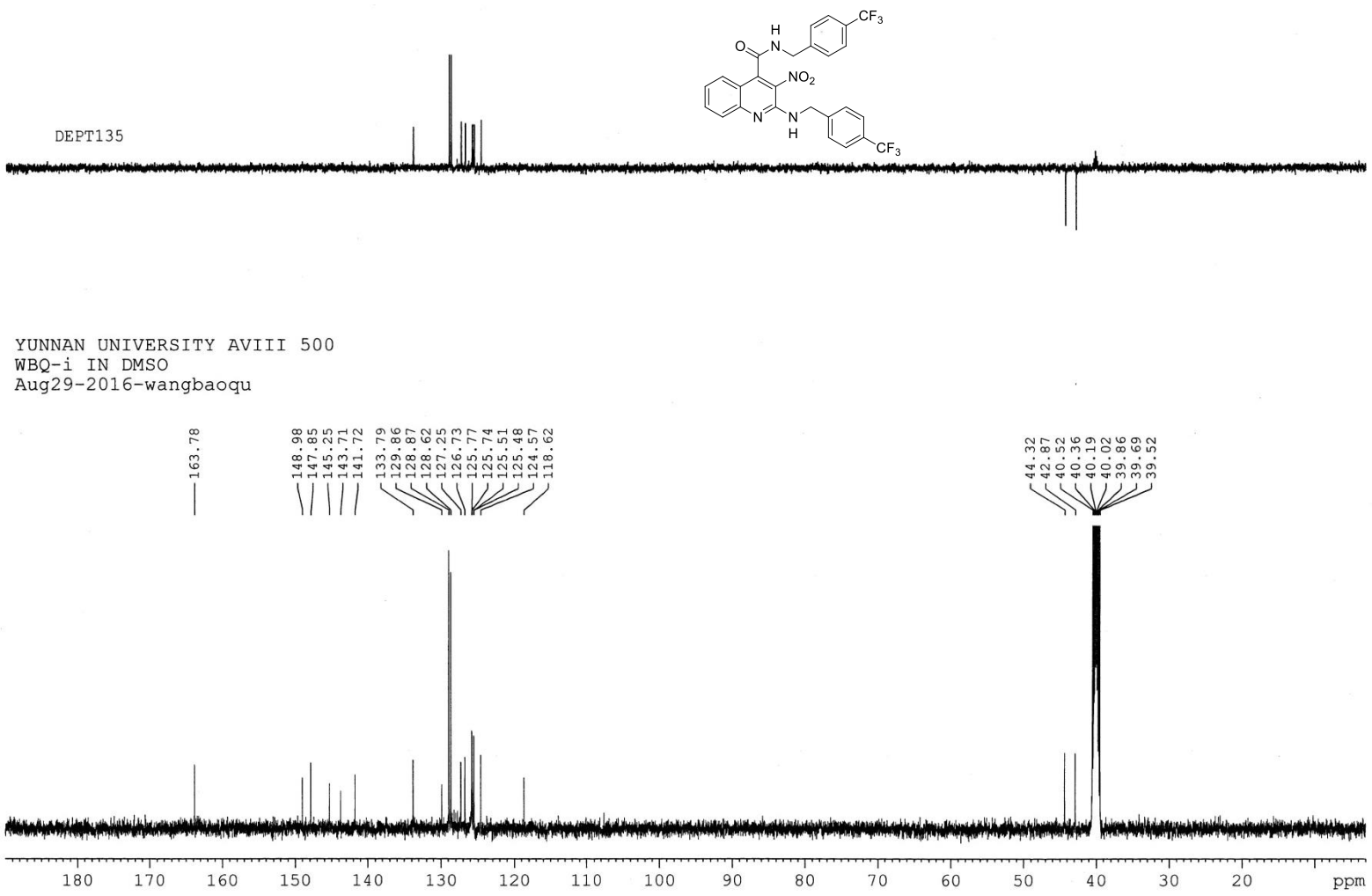


Figure S45. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6aa**

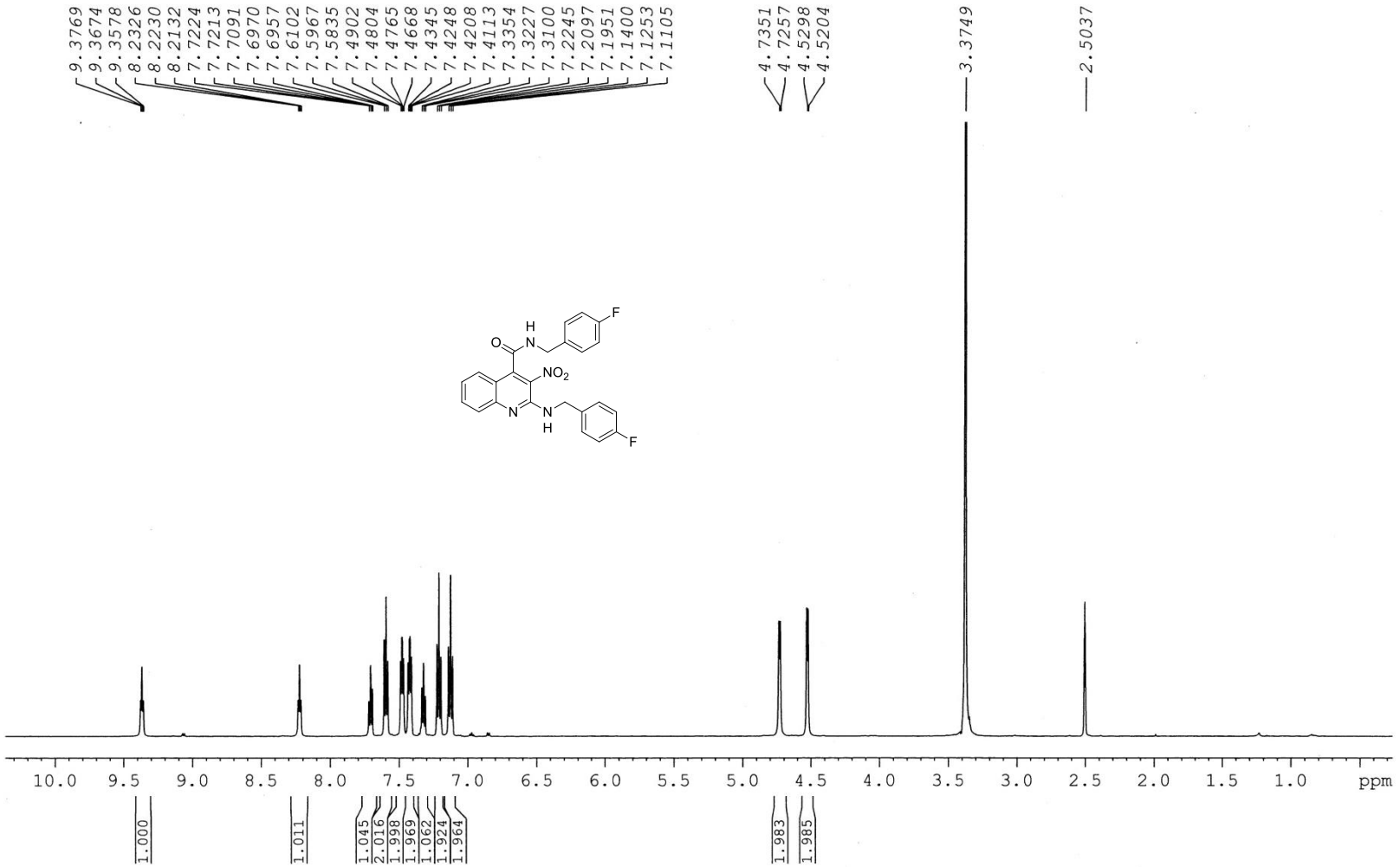


Figure S46. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **6ab**

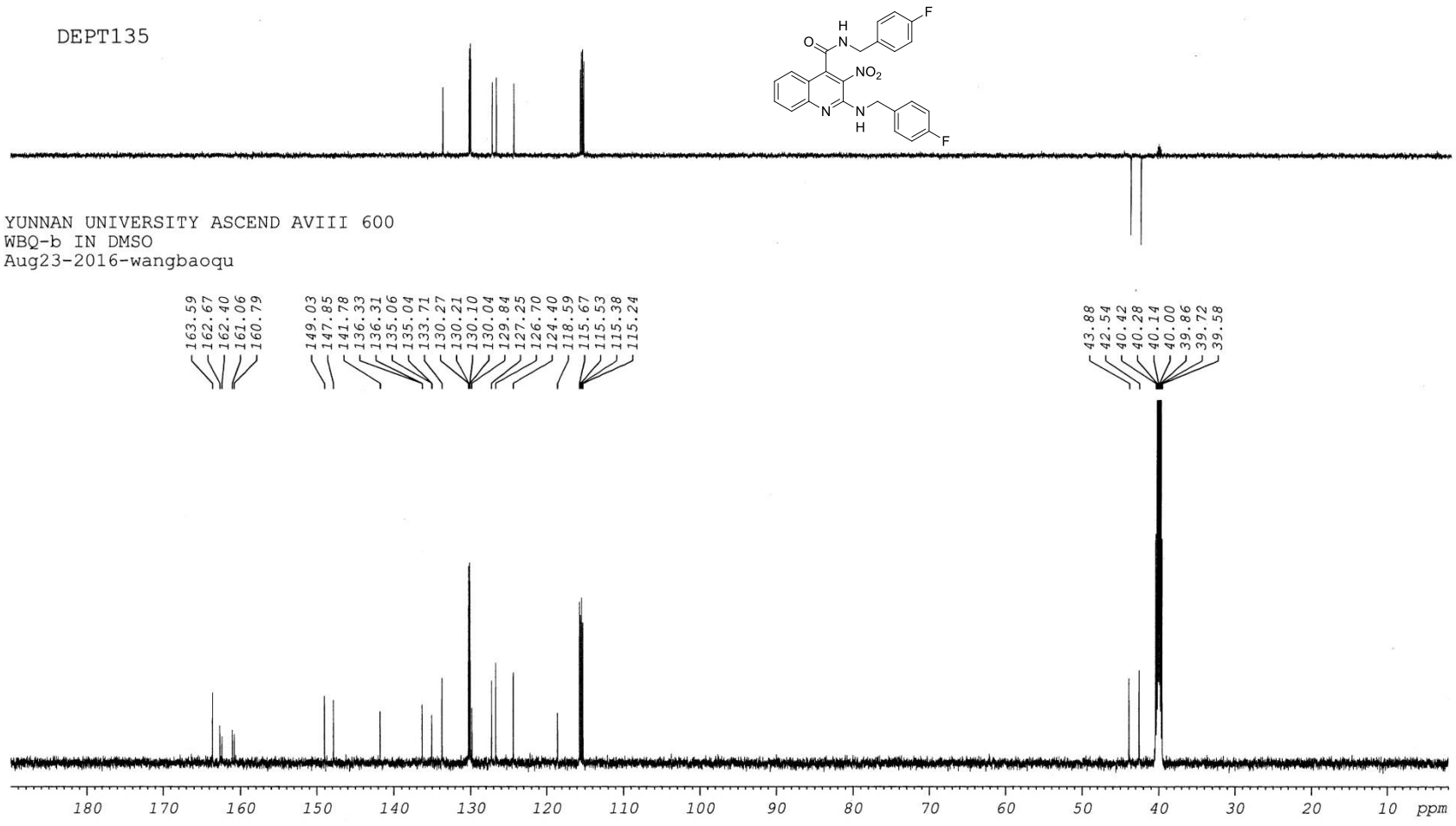


Figure S47. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **6ab**

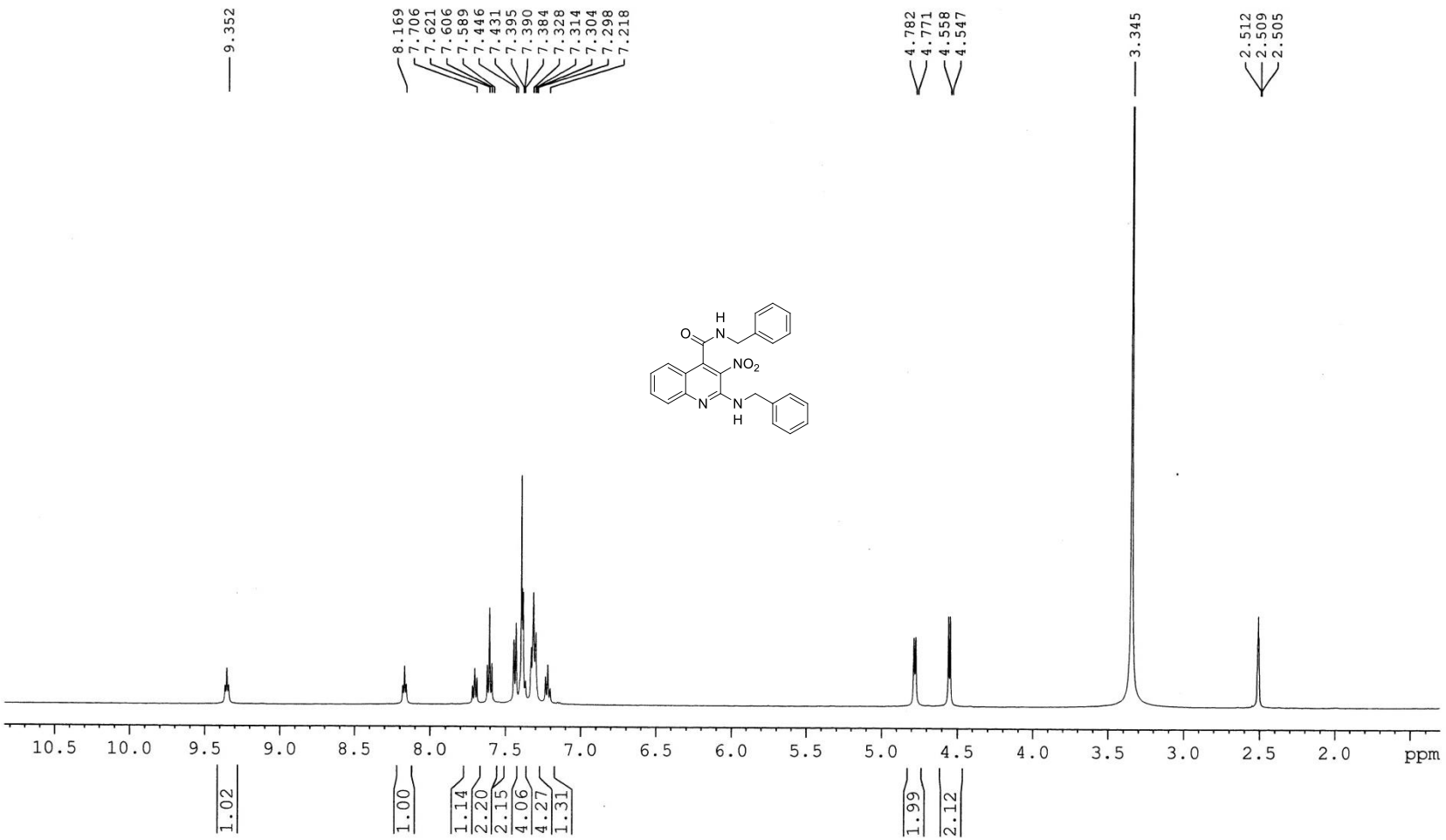


Figure S48. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6ac**

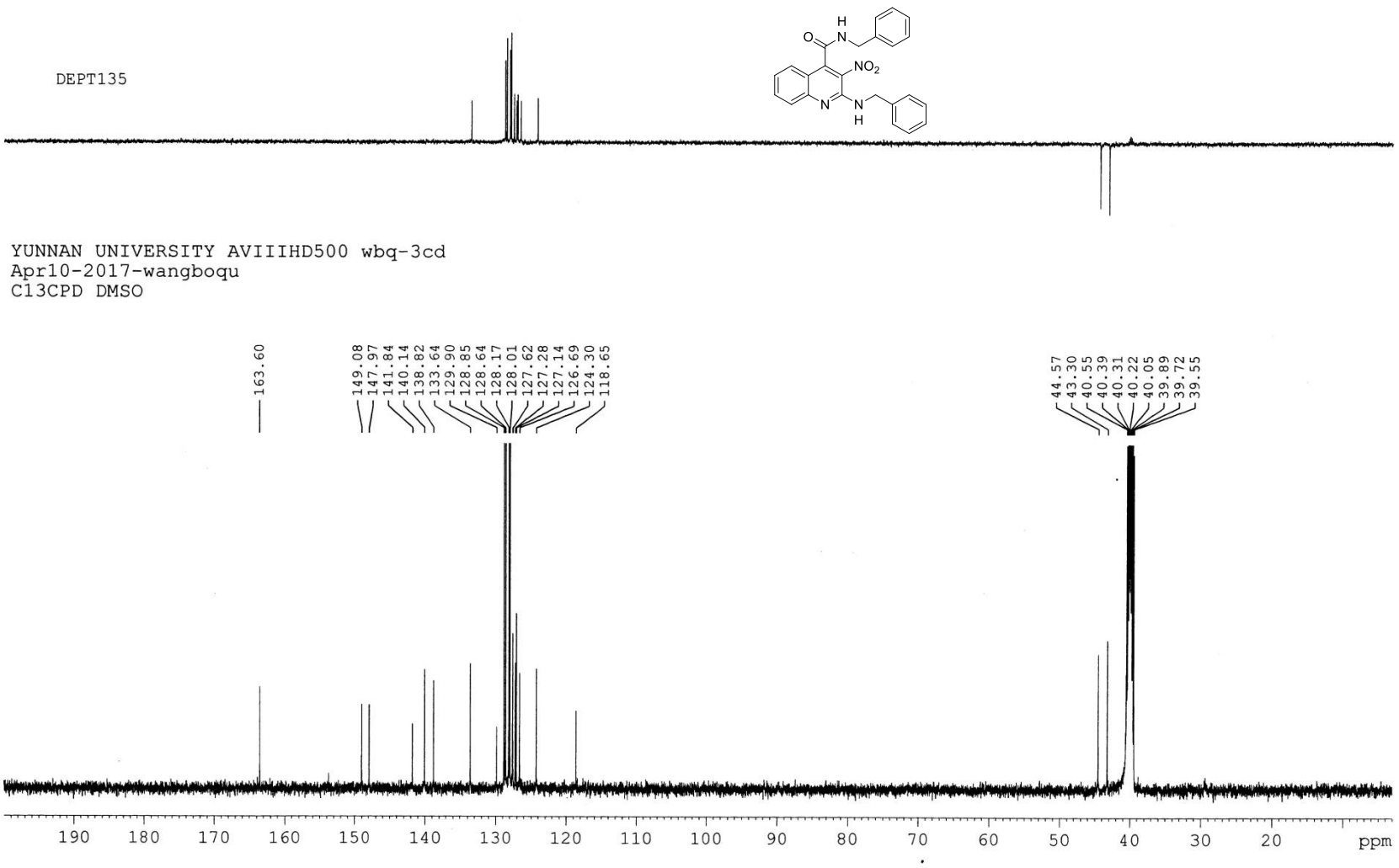


Figure S49. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6ac**

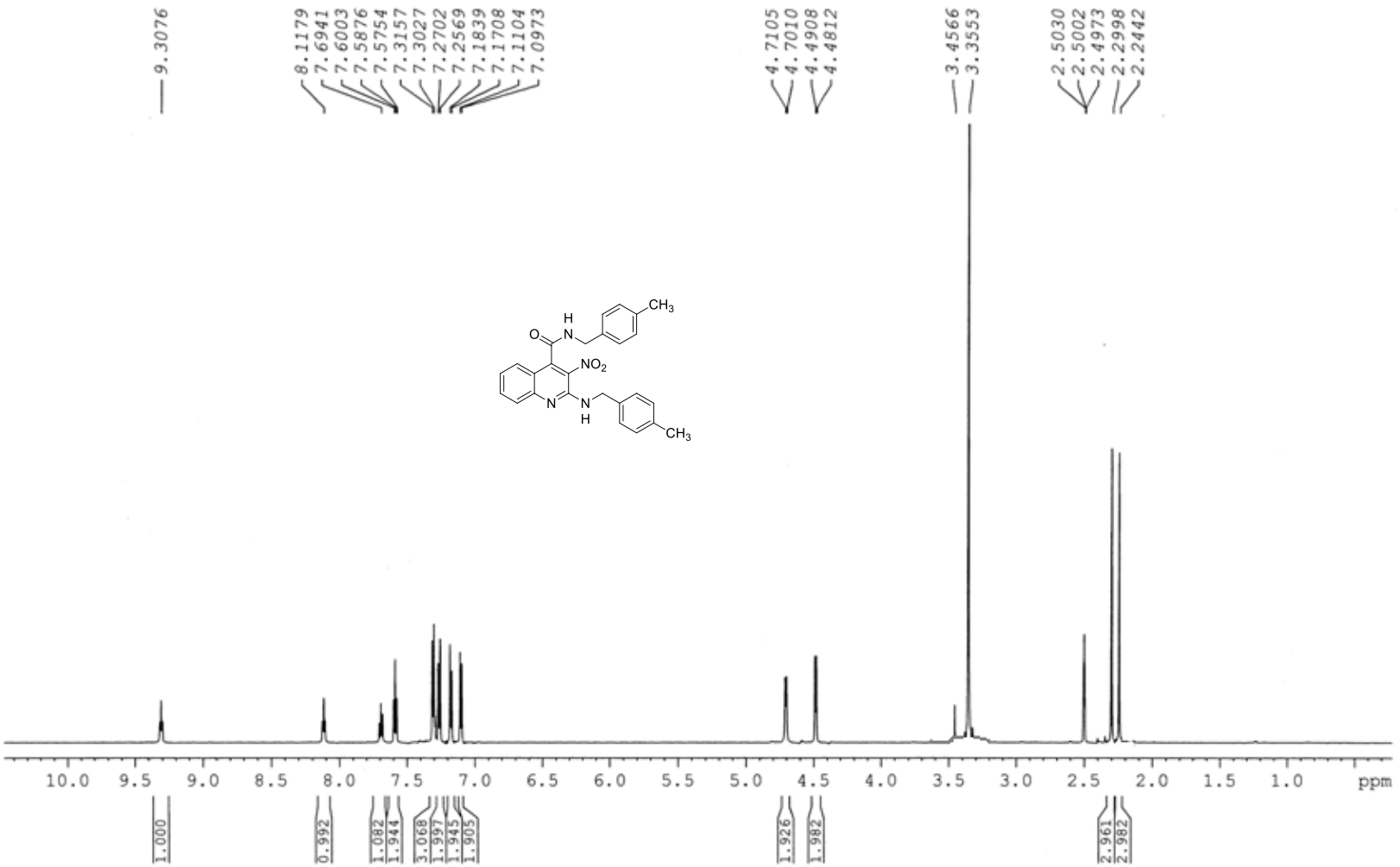


Figure S50. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **6ad**

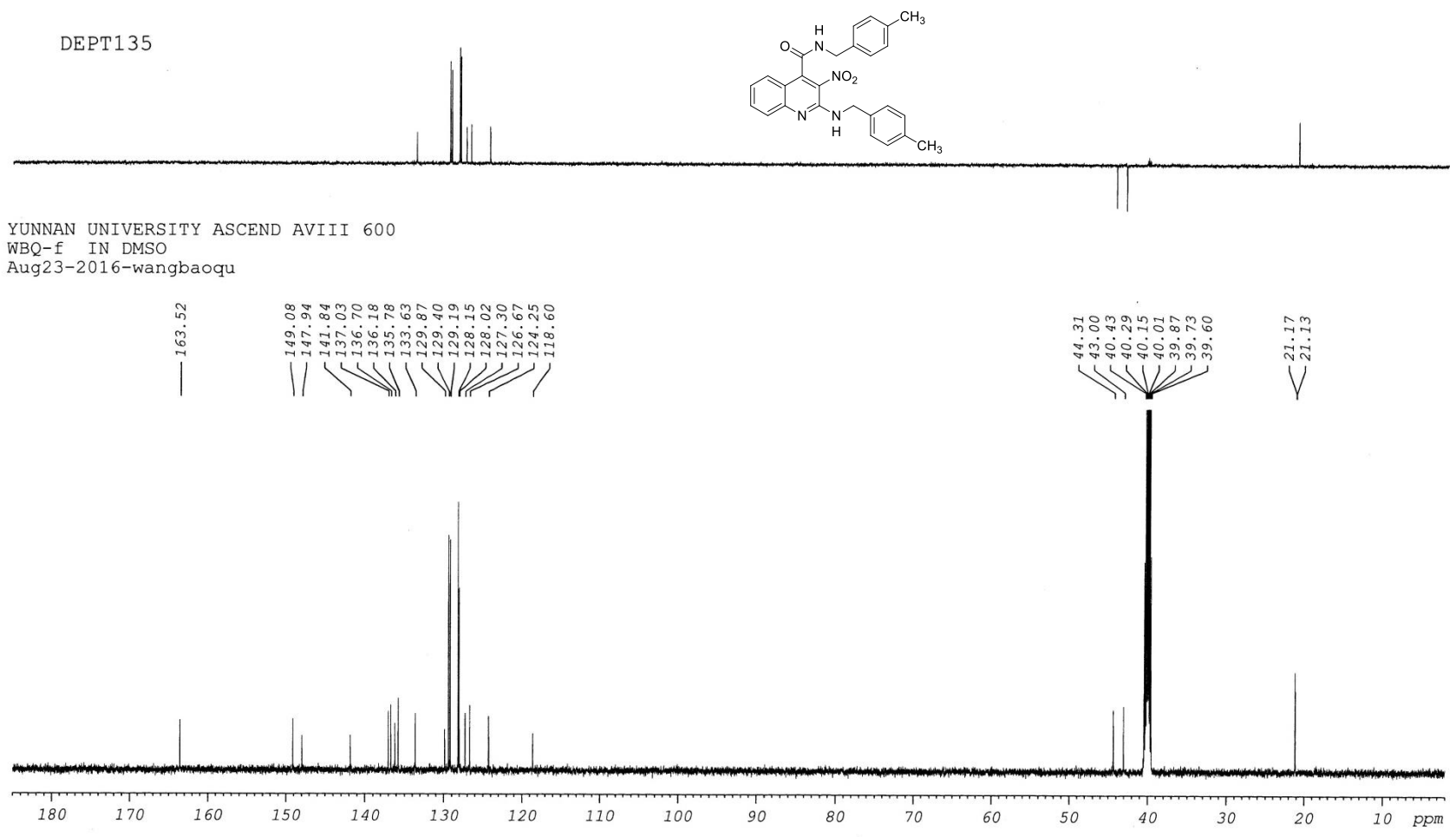


Figure S51. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **6ad**

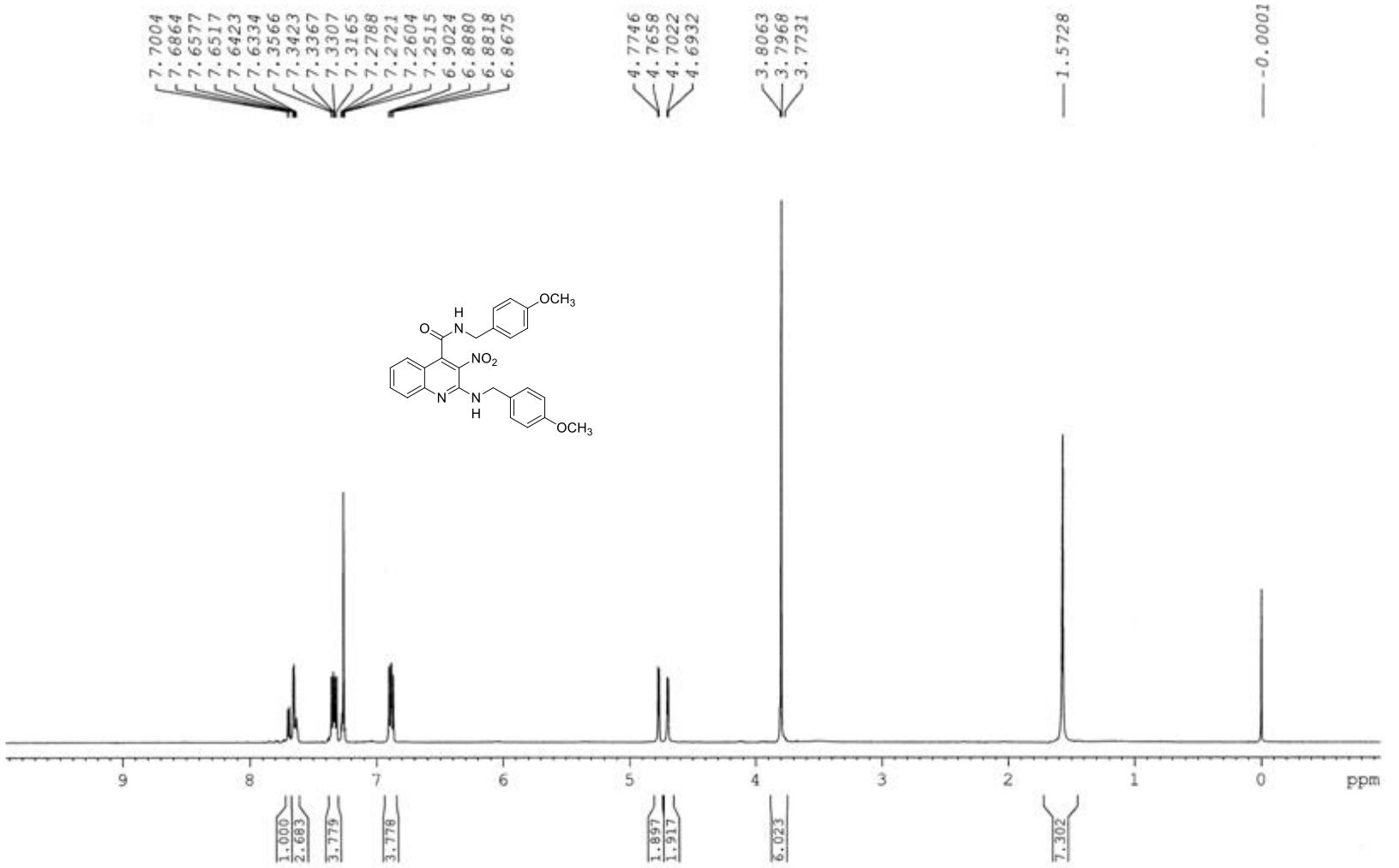


Figure S52. ^{1}H NMR (600 MHz, $CDCl_3$) spectra of compound **6ae**

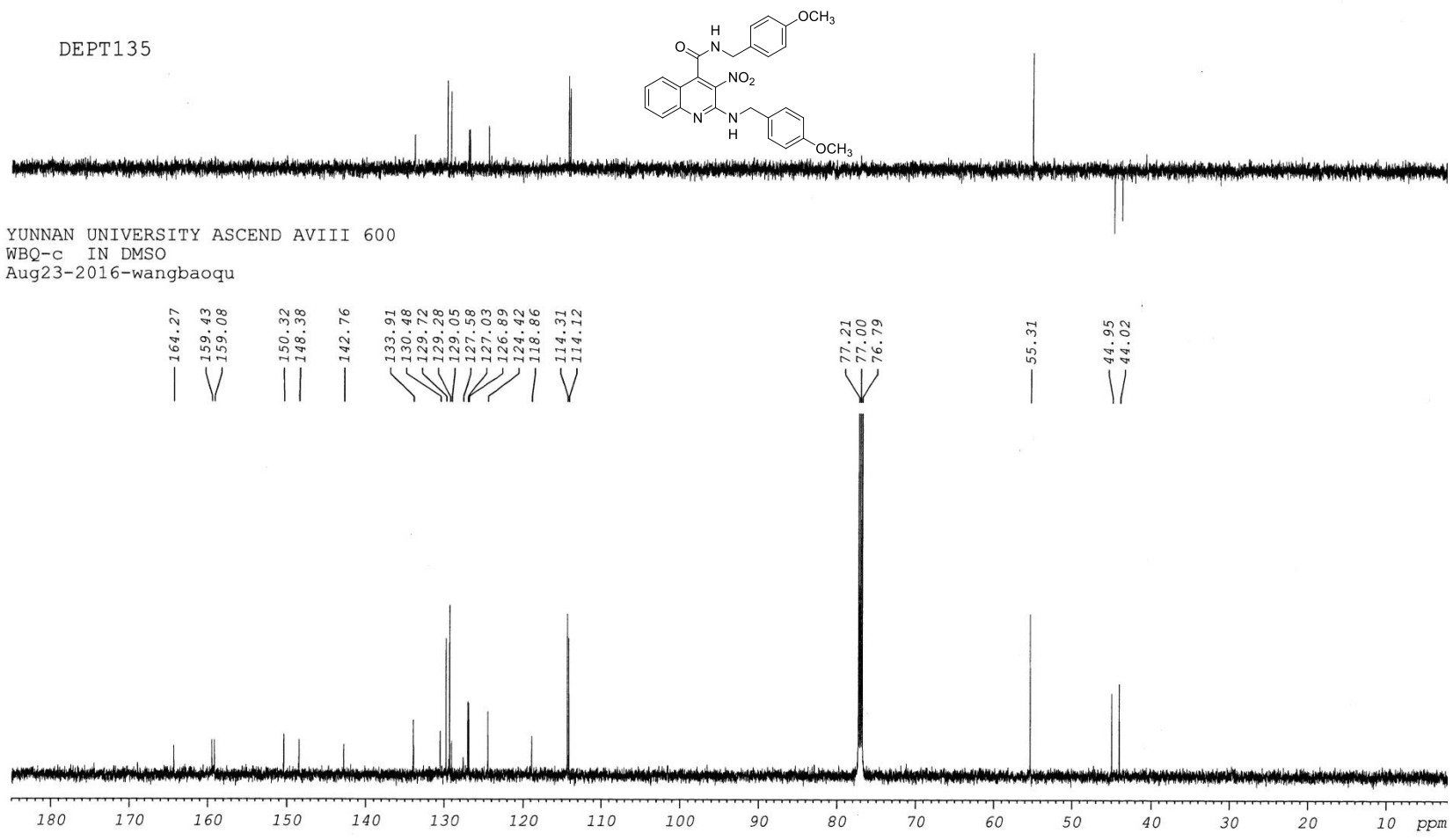


Figure S53. ^{13}C NMR (150 MHz, $CDCl_3$) spectra of compound **6ae**

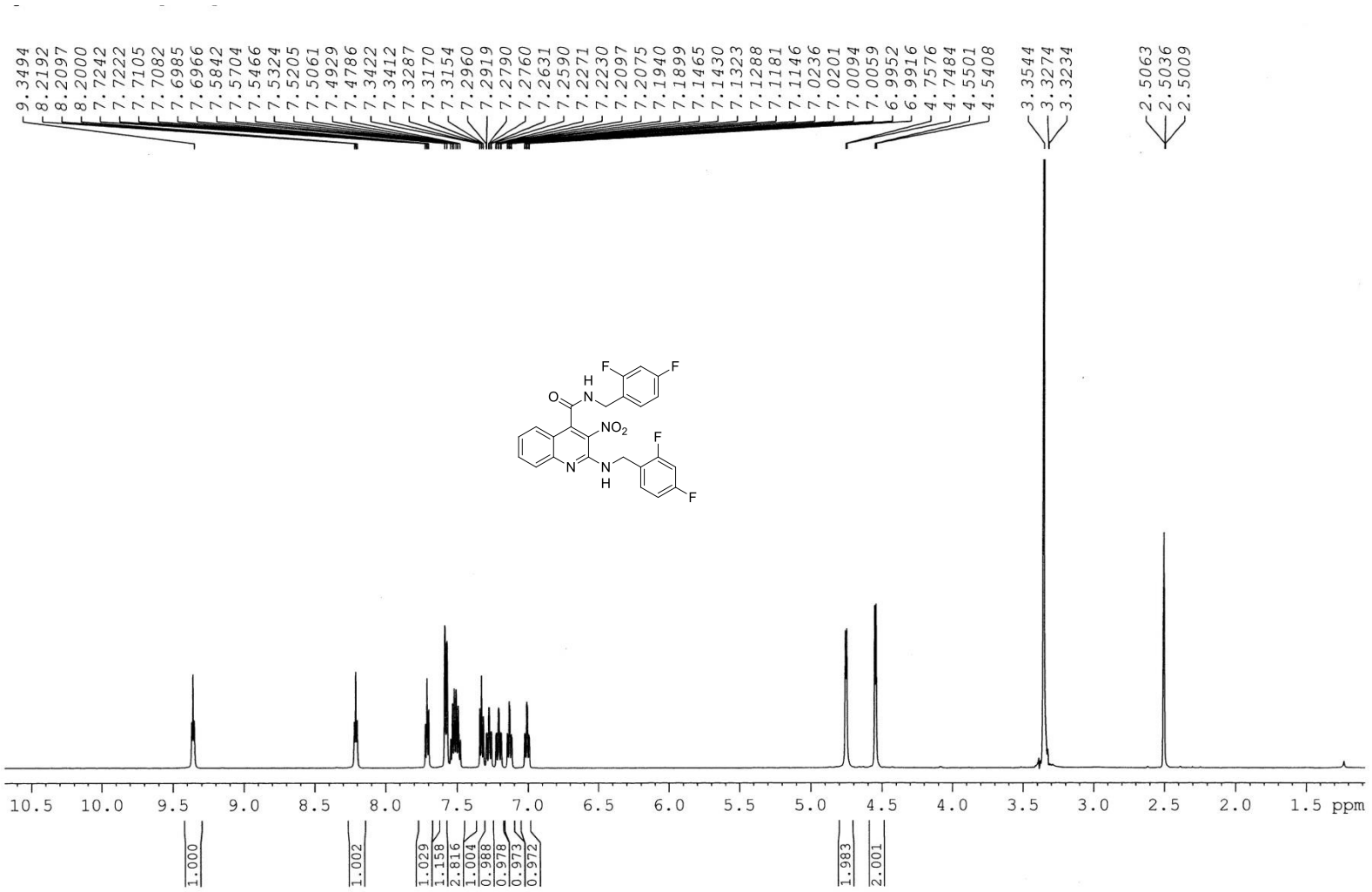


Figure S54. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **6af**

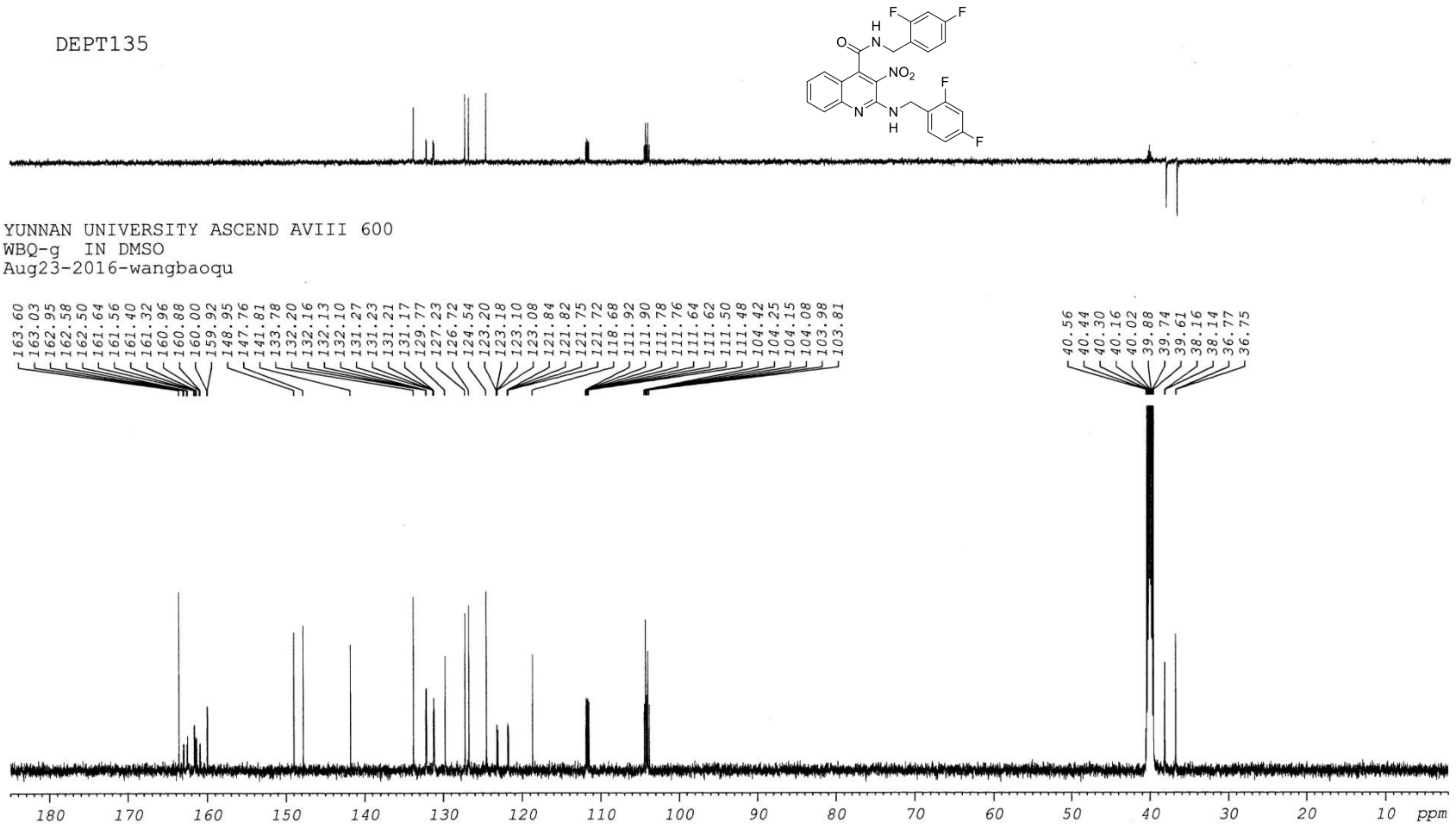


Figure S55. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **6af**

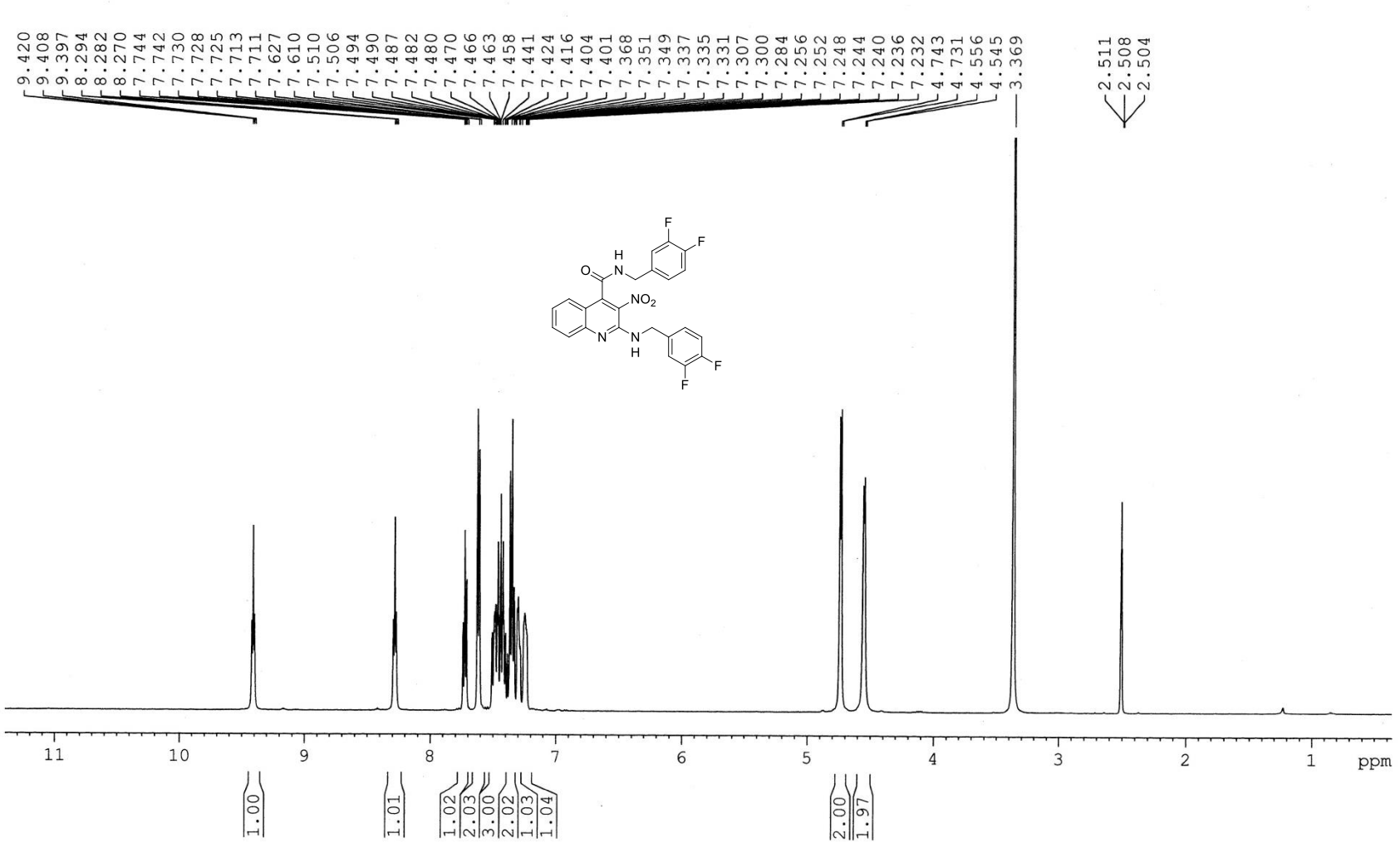


Figure S56. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6ag**

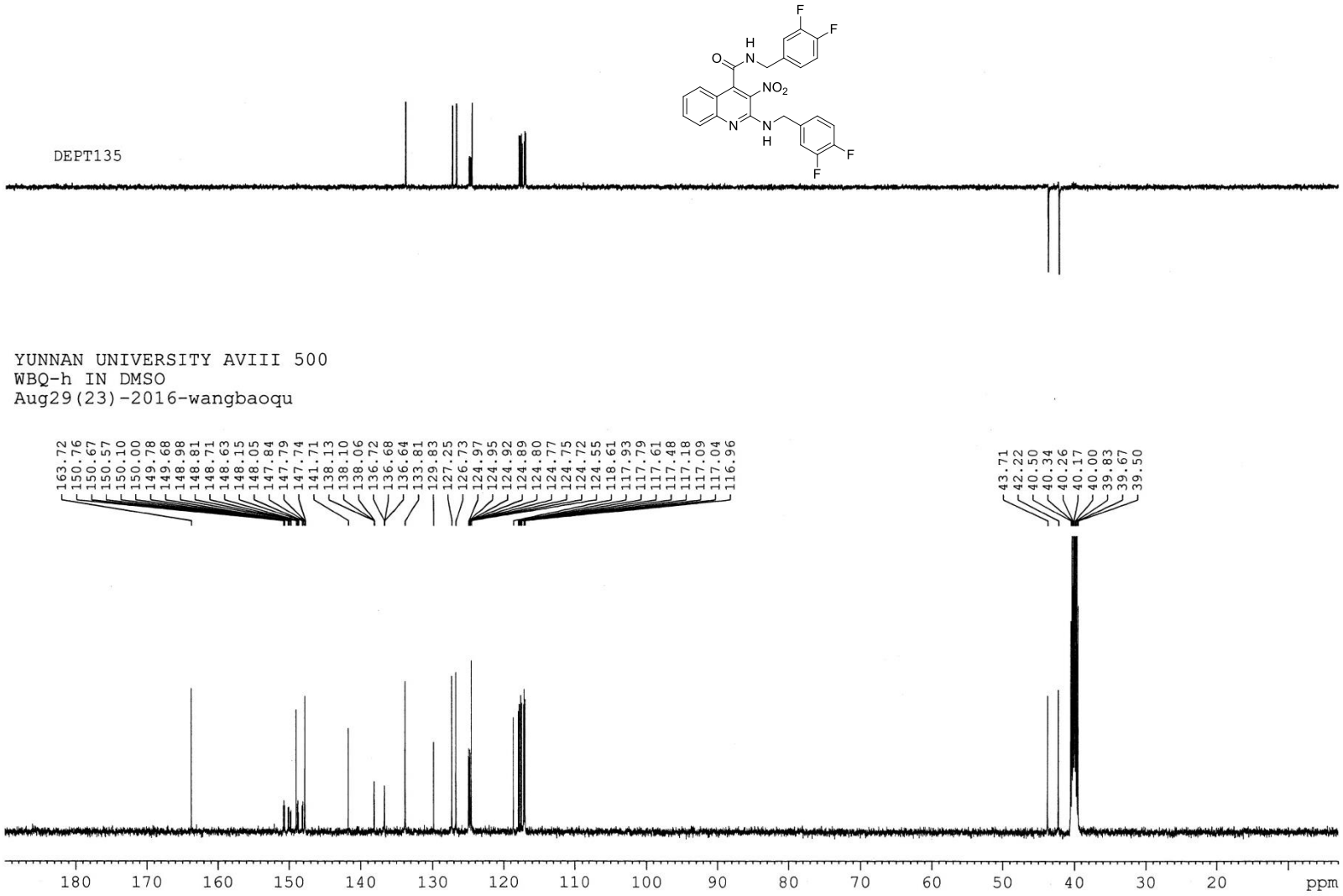


Figure S57. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6ag**

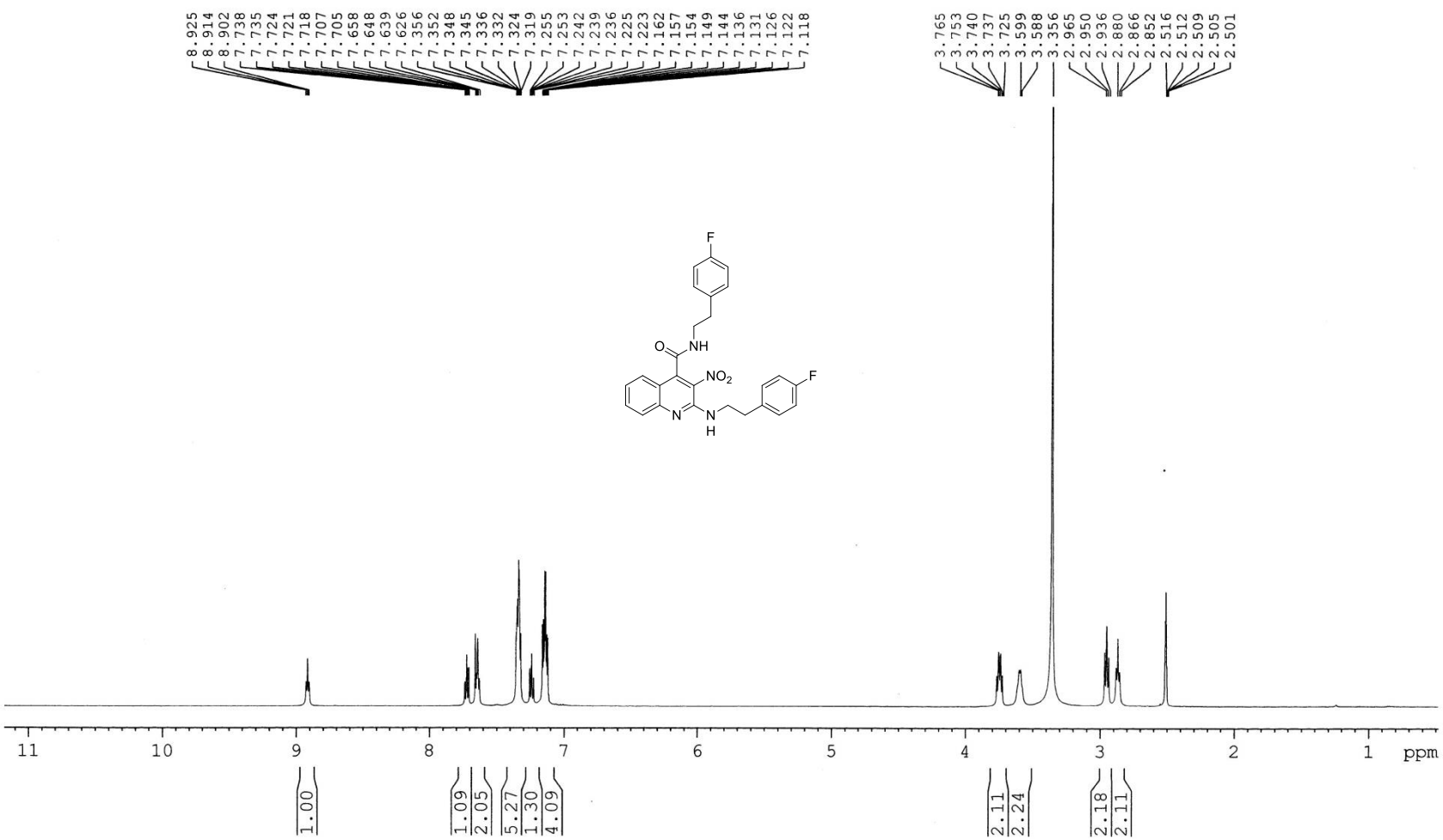


Figure S58. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6ah**

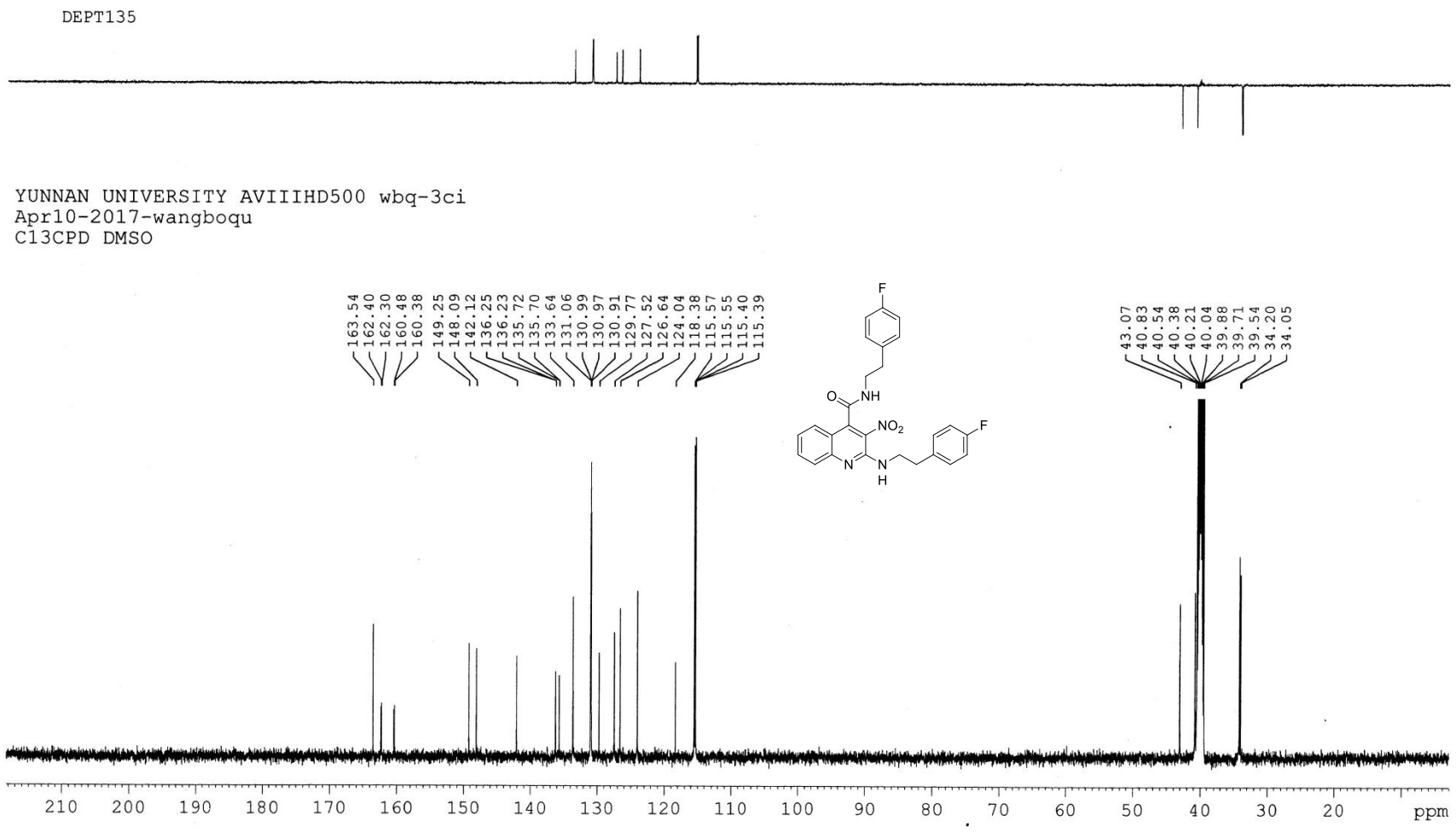


Figure S59. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6ah**

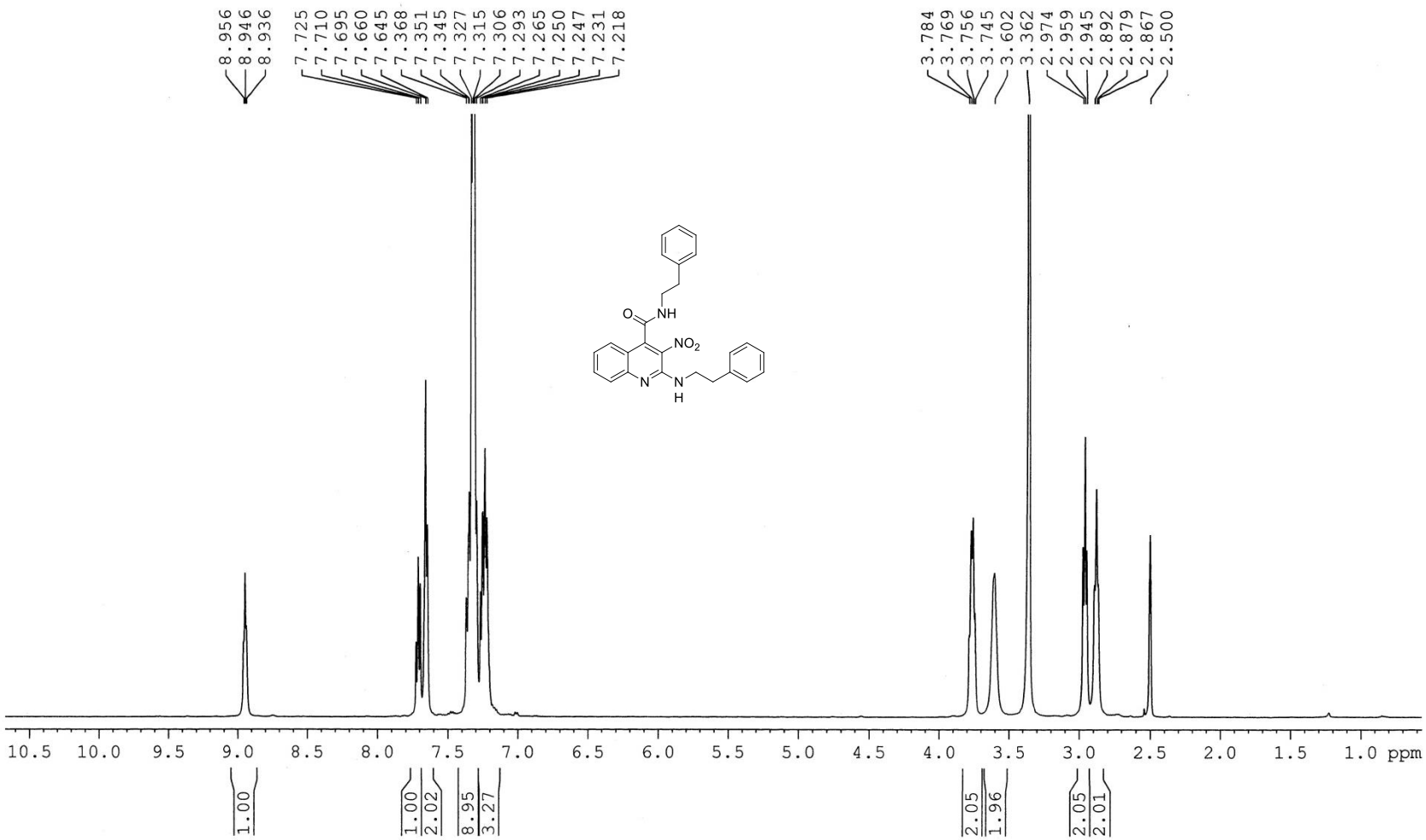


Figure S60. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6ai**

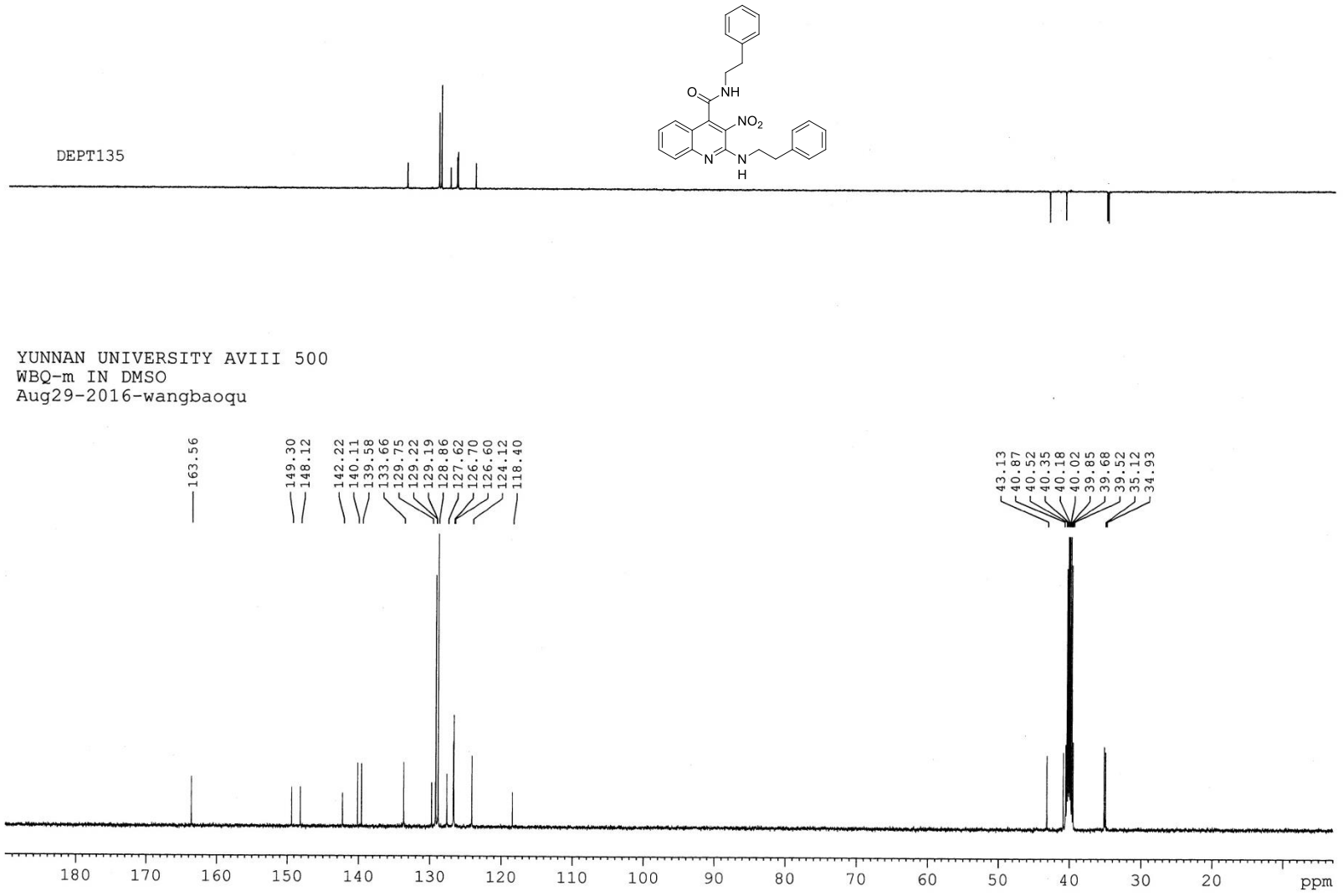


Figure S61. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6ai**

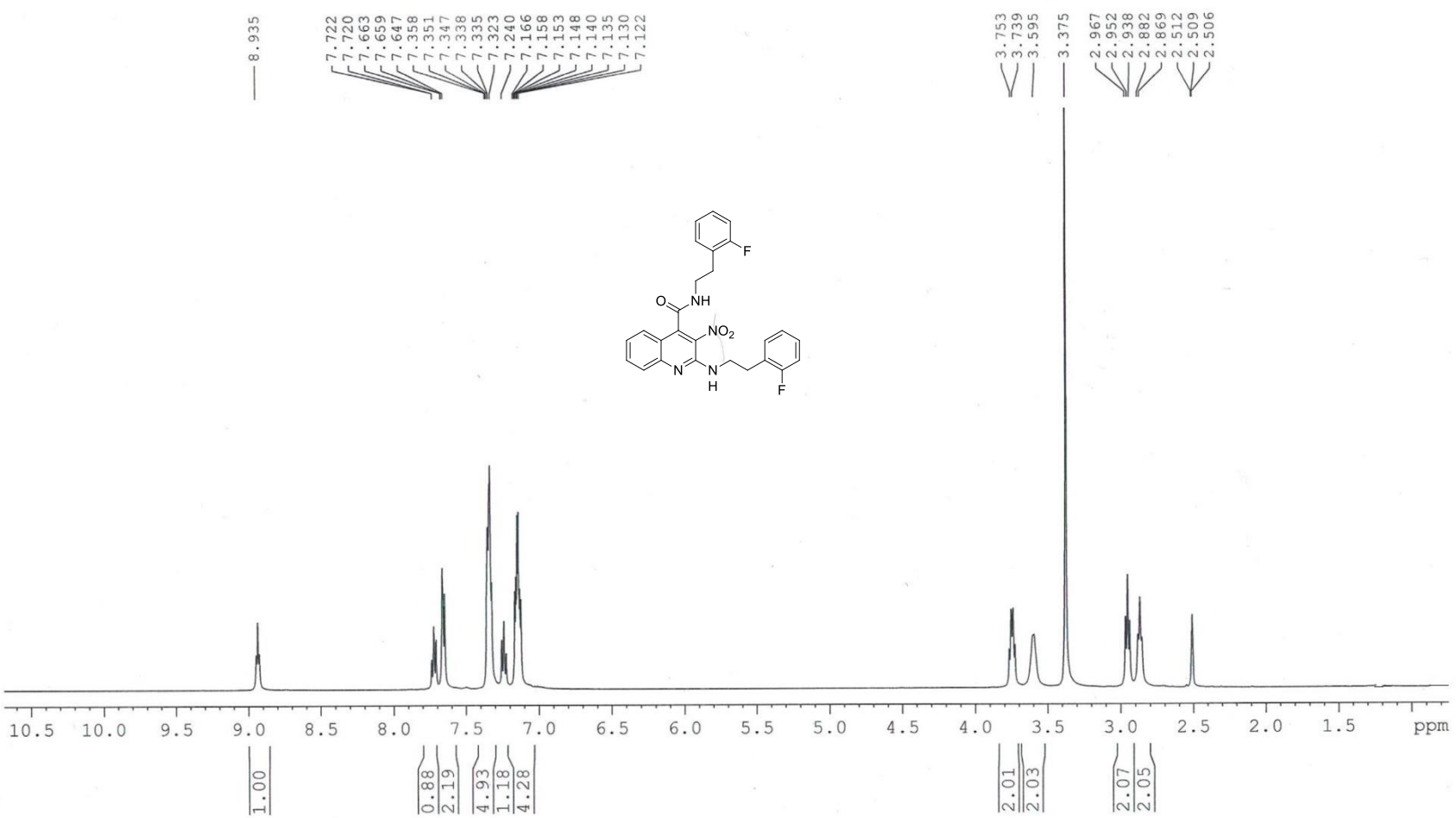


Figure S62. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6aj**

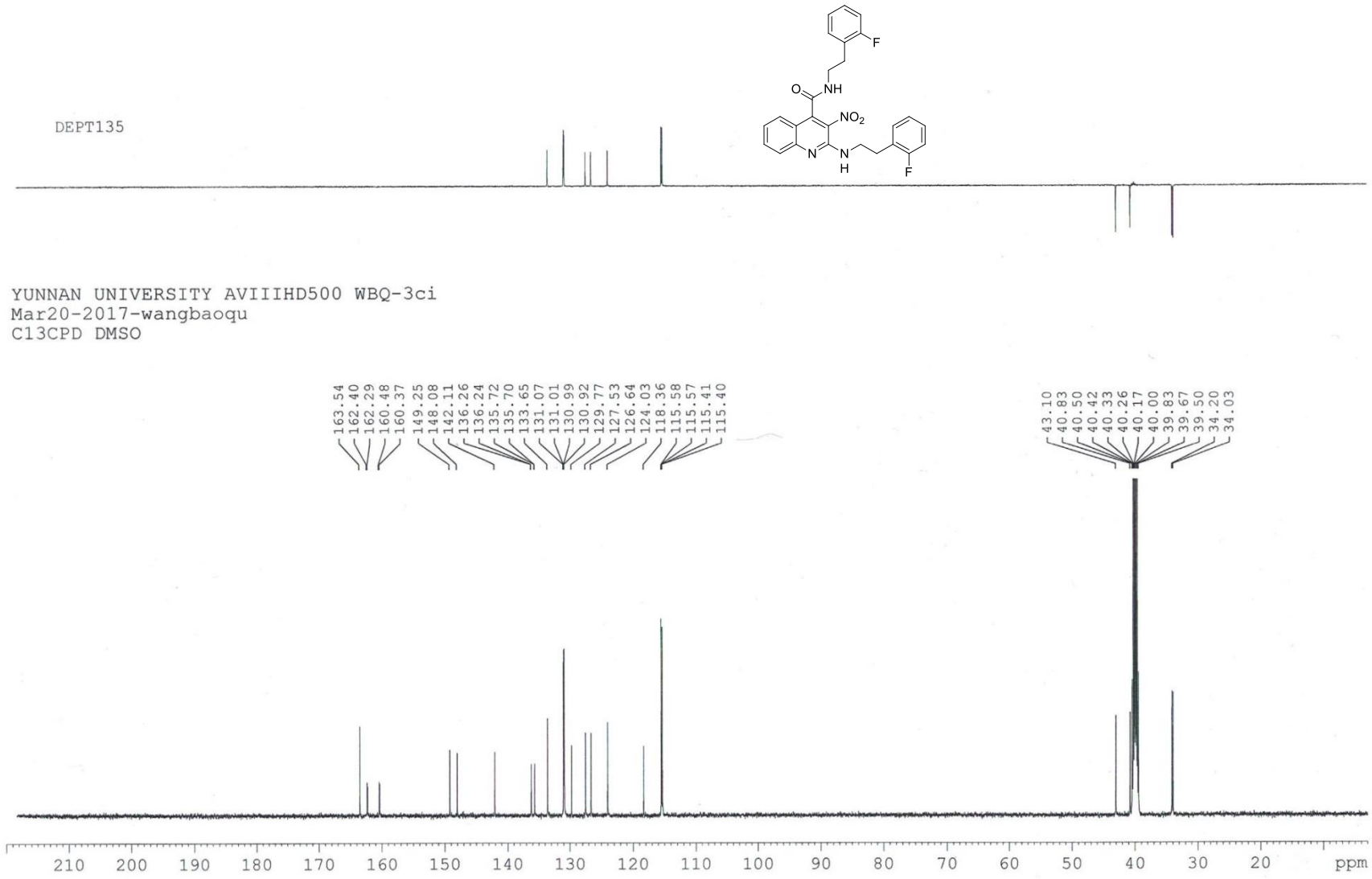


Figure S63. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6aj**

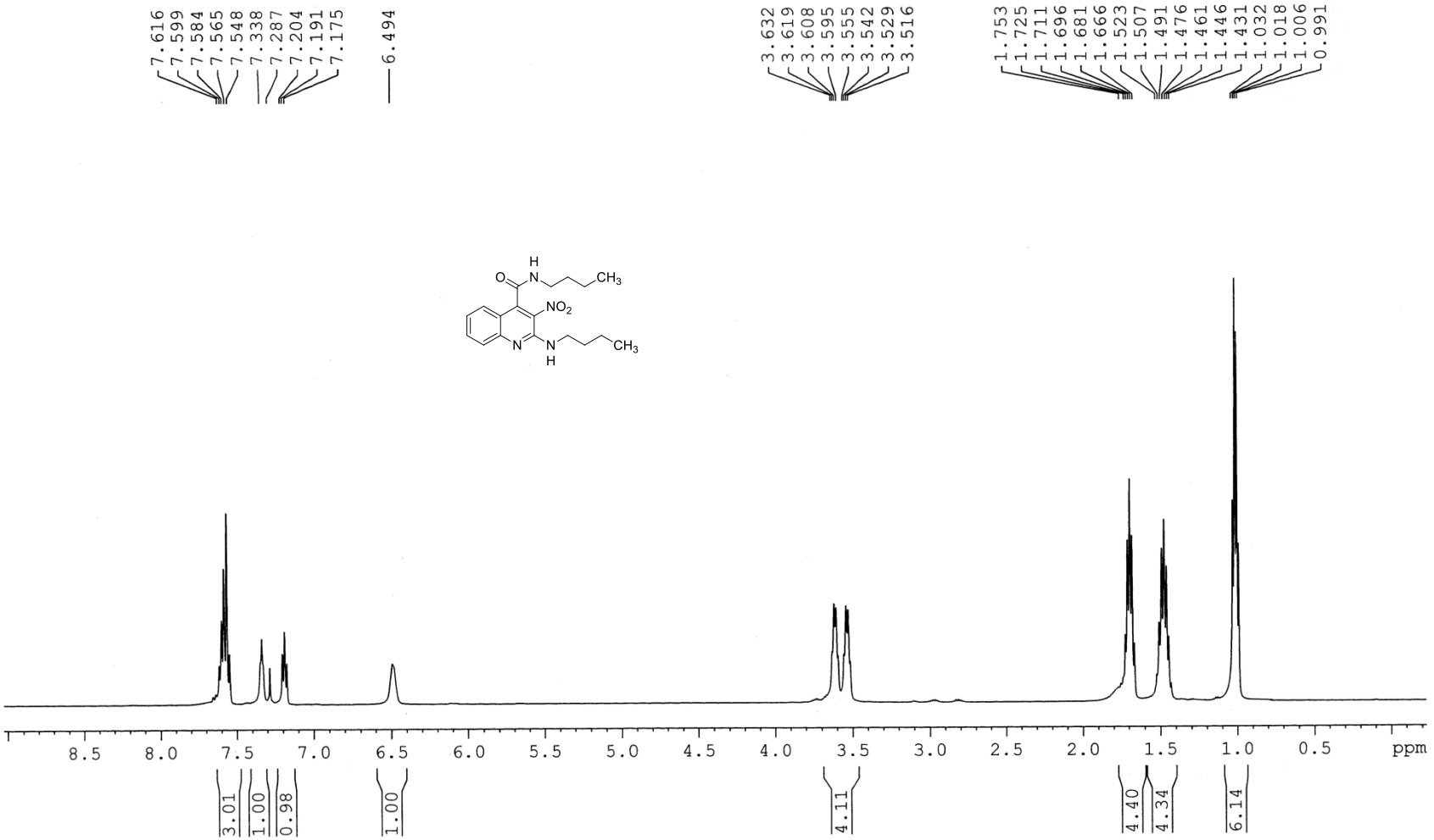


Figure S64. ^{1}H NMR (500 MHz, $CDCl_3$) spectra of compound **6ak**

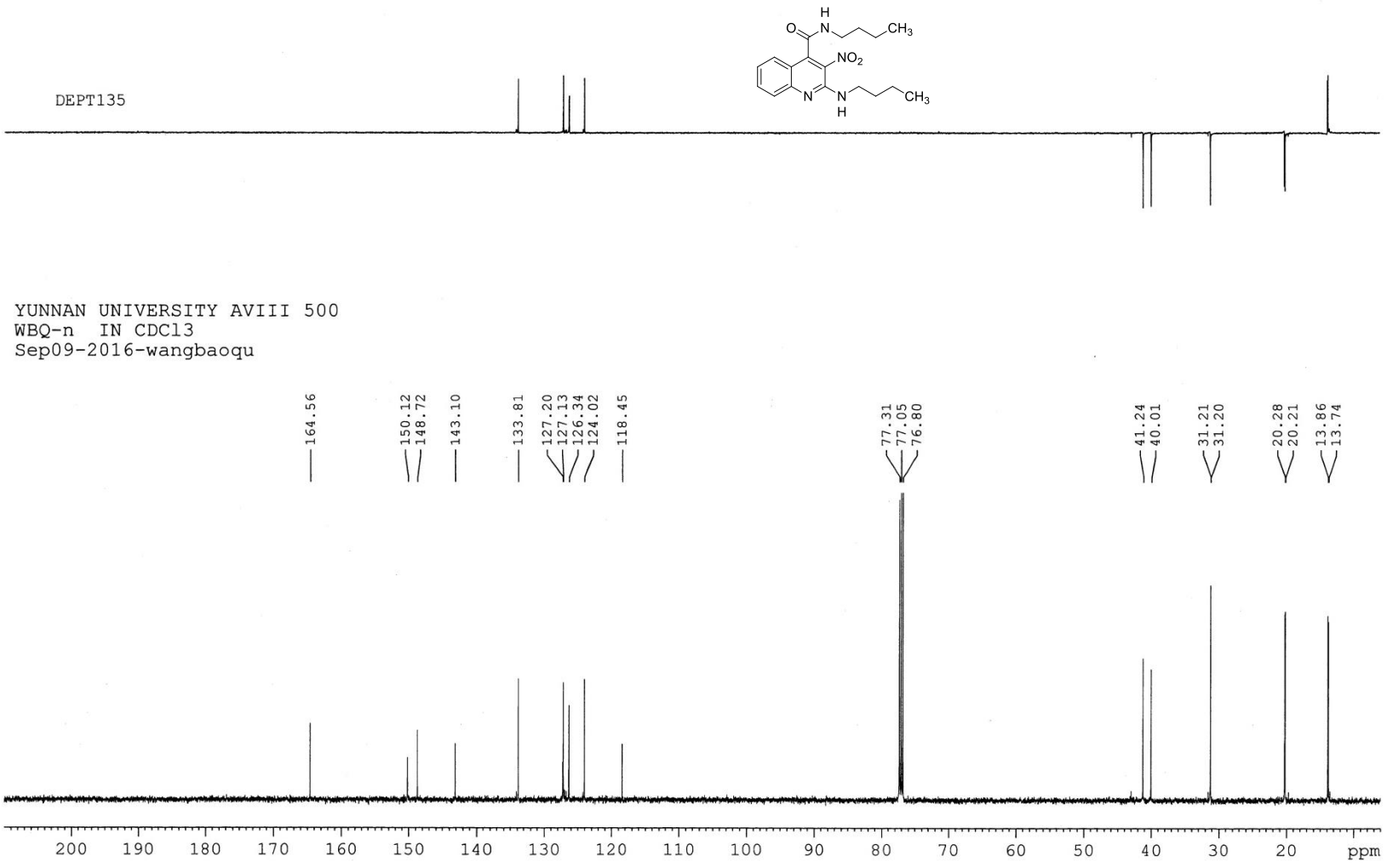


Figure S65. ^{13}C NMR (125 MHz, $CDCl_3$) spectra of compound **6ak**

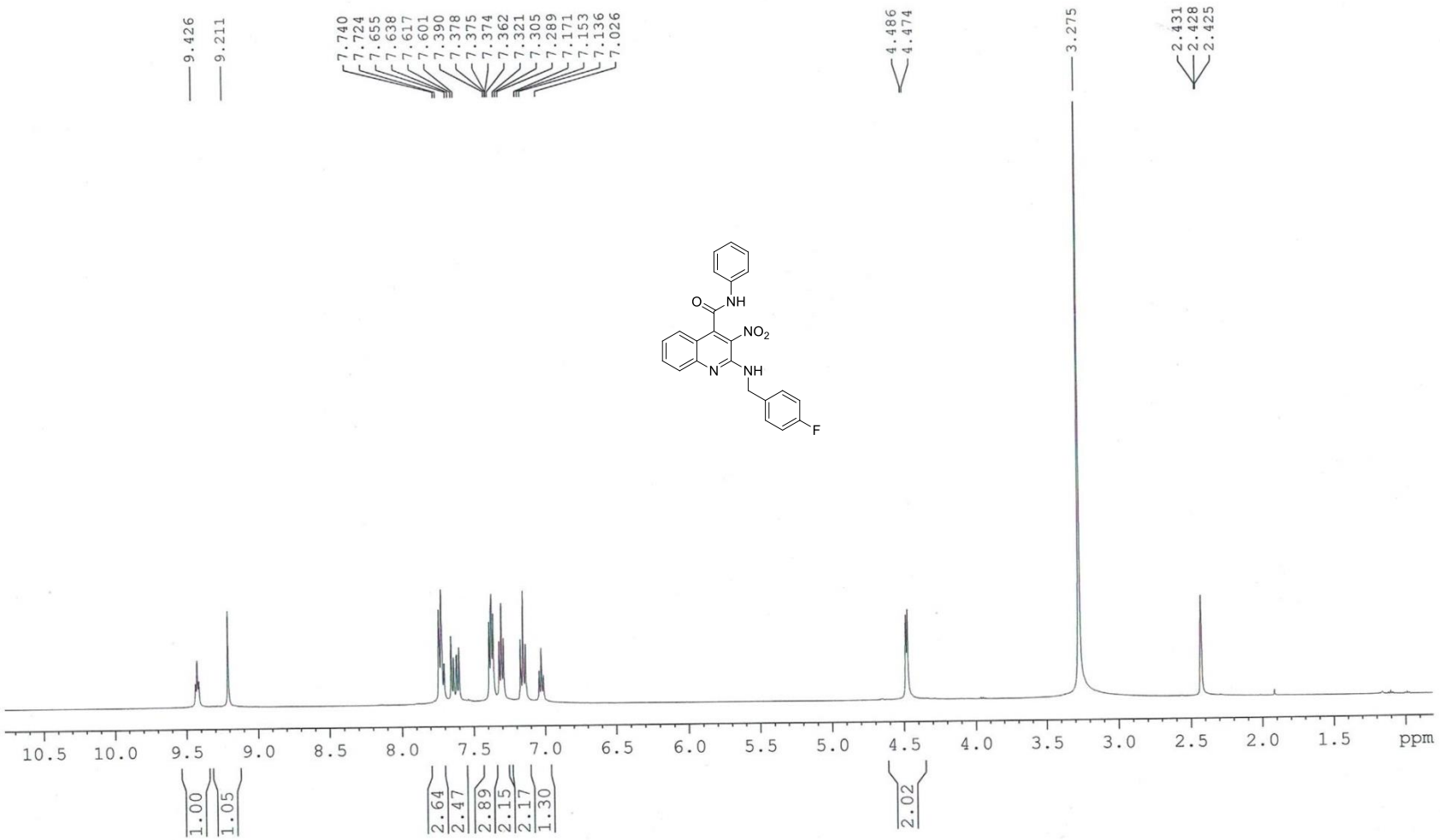


Figure S66. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6al**

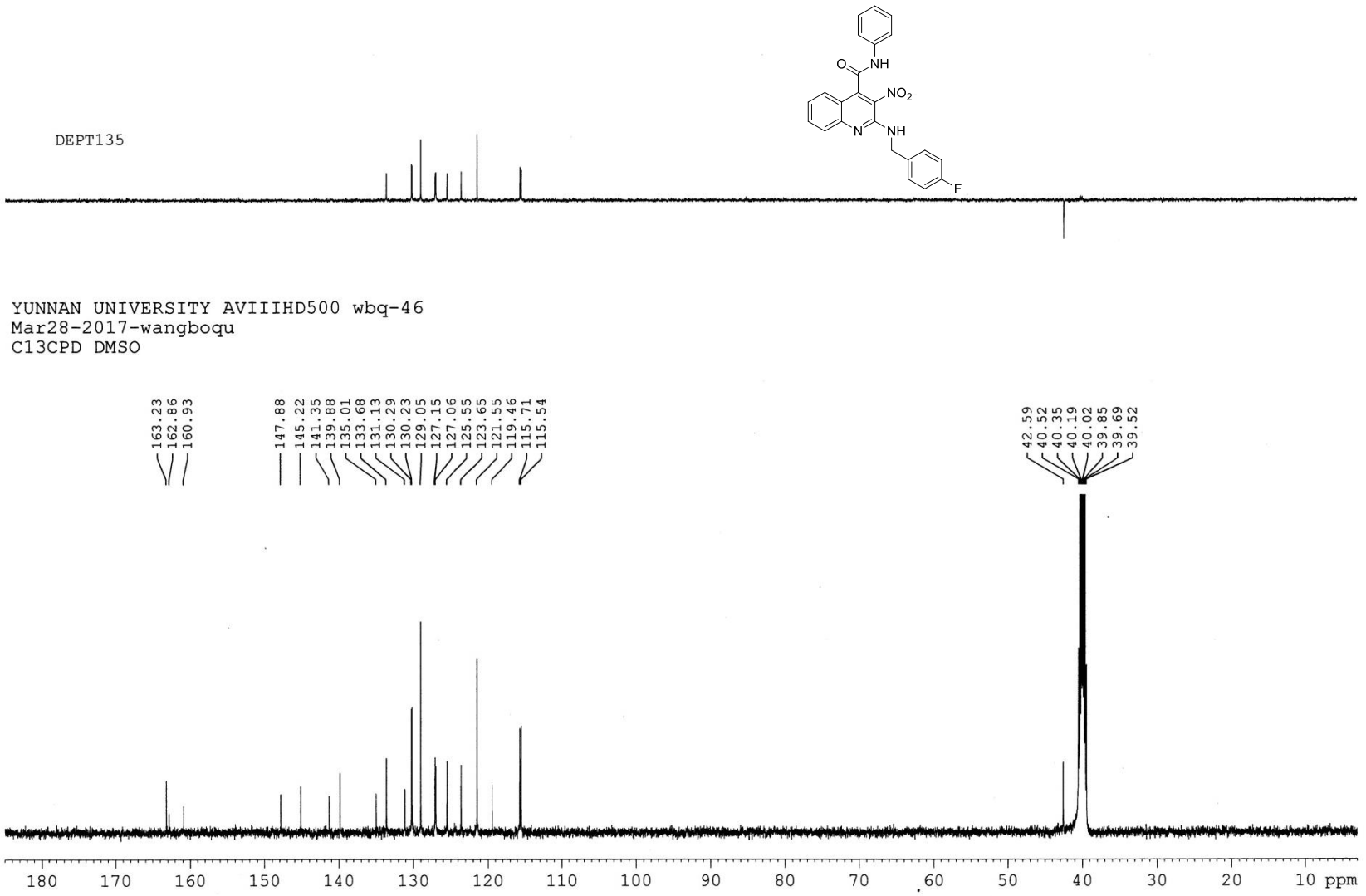


Figure S67. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6al**

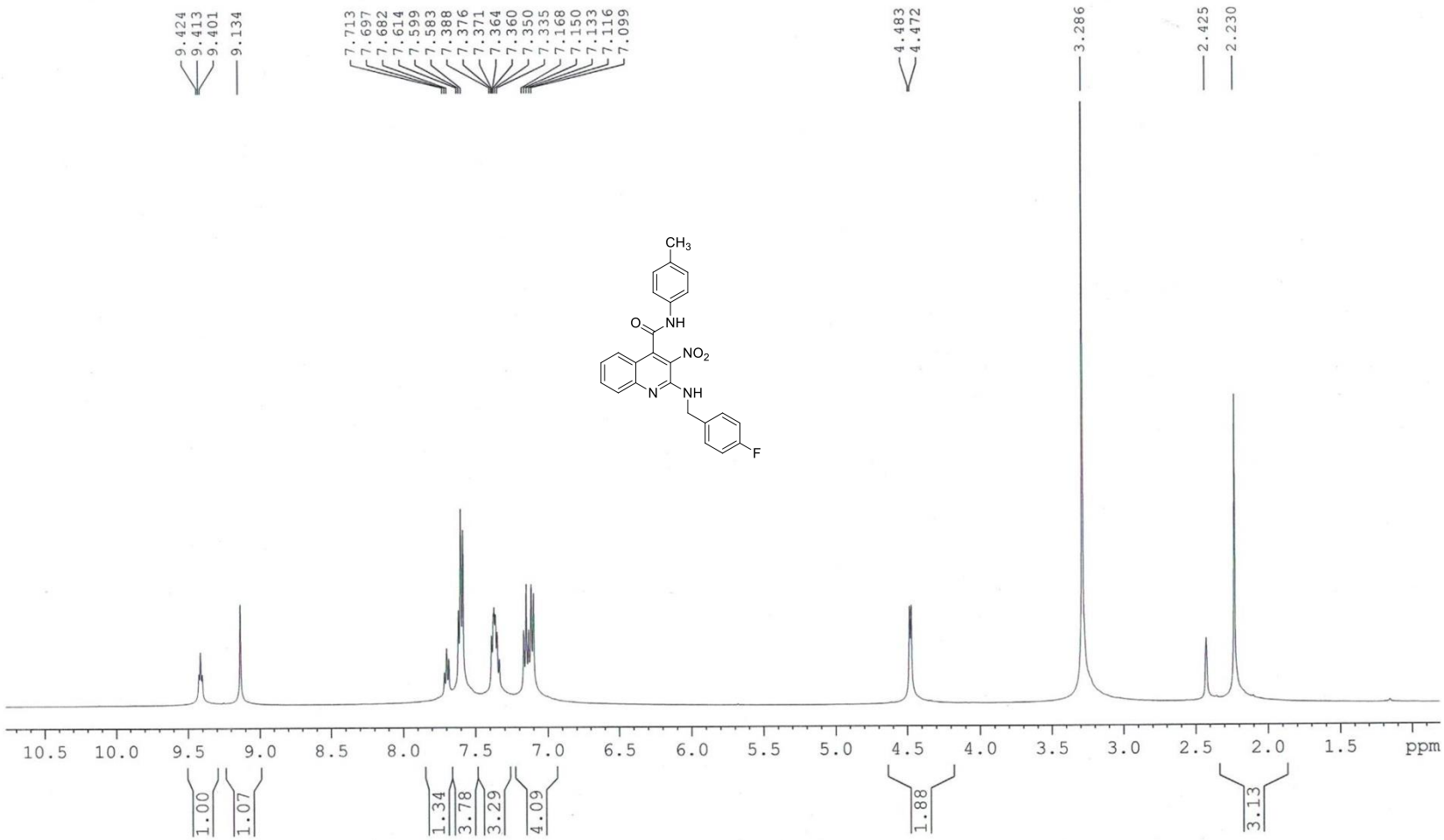


Figure S68. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6am**

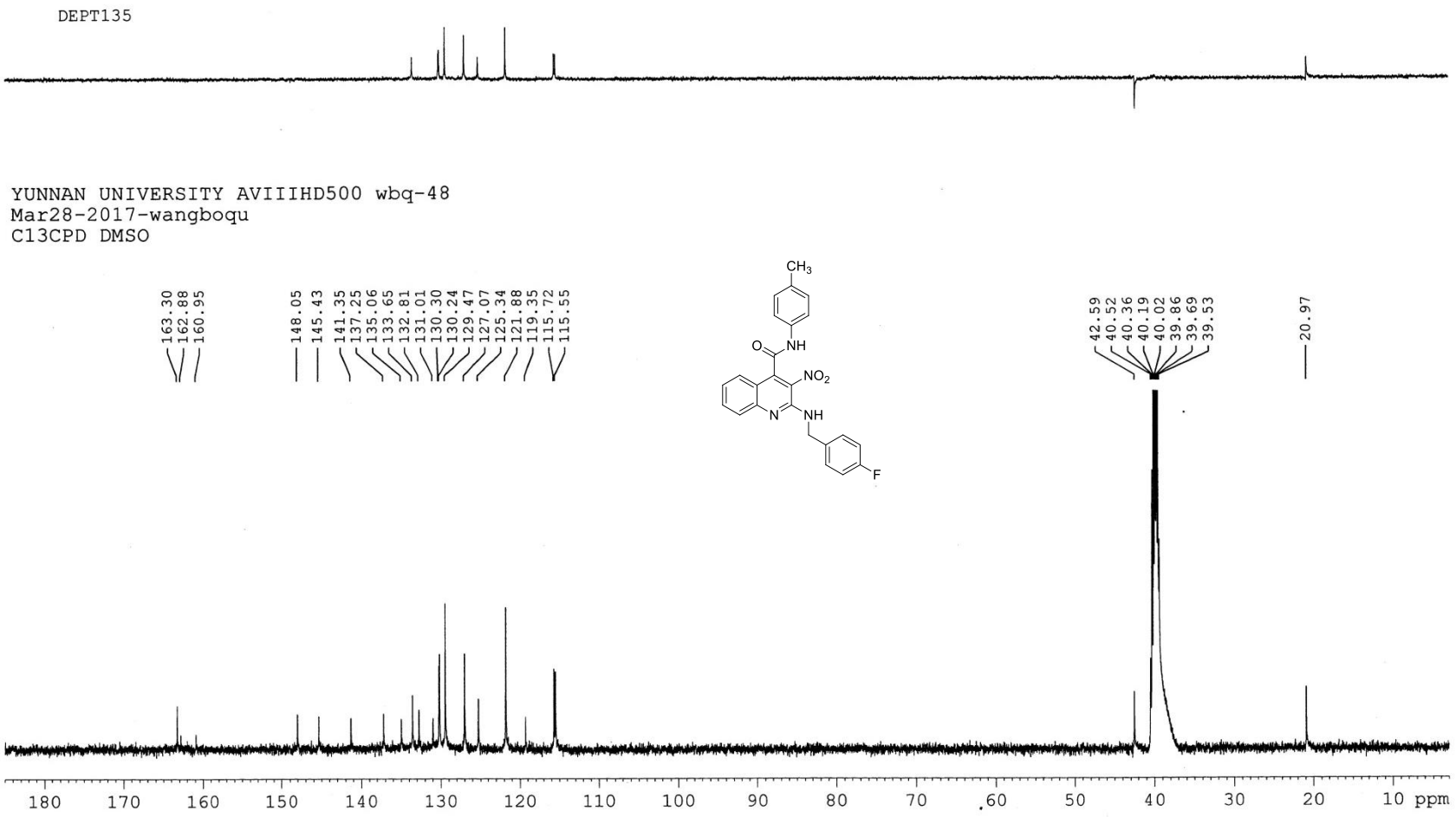


Figure S69. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6am**

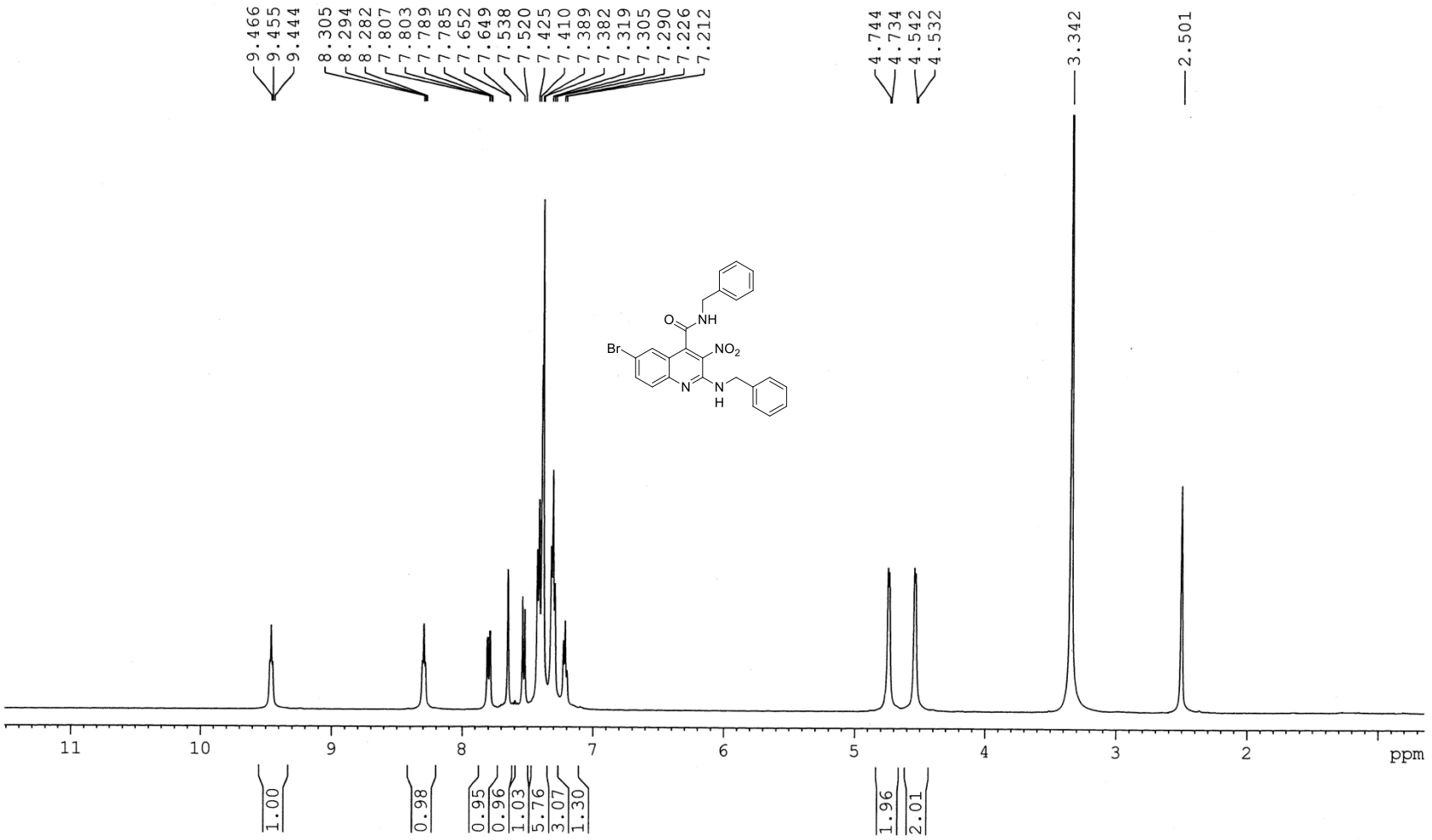


Figure S70. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6bc**

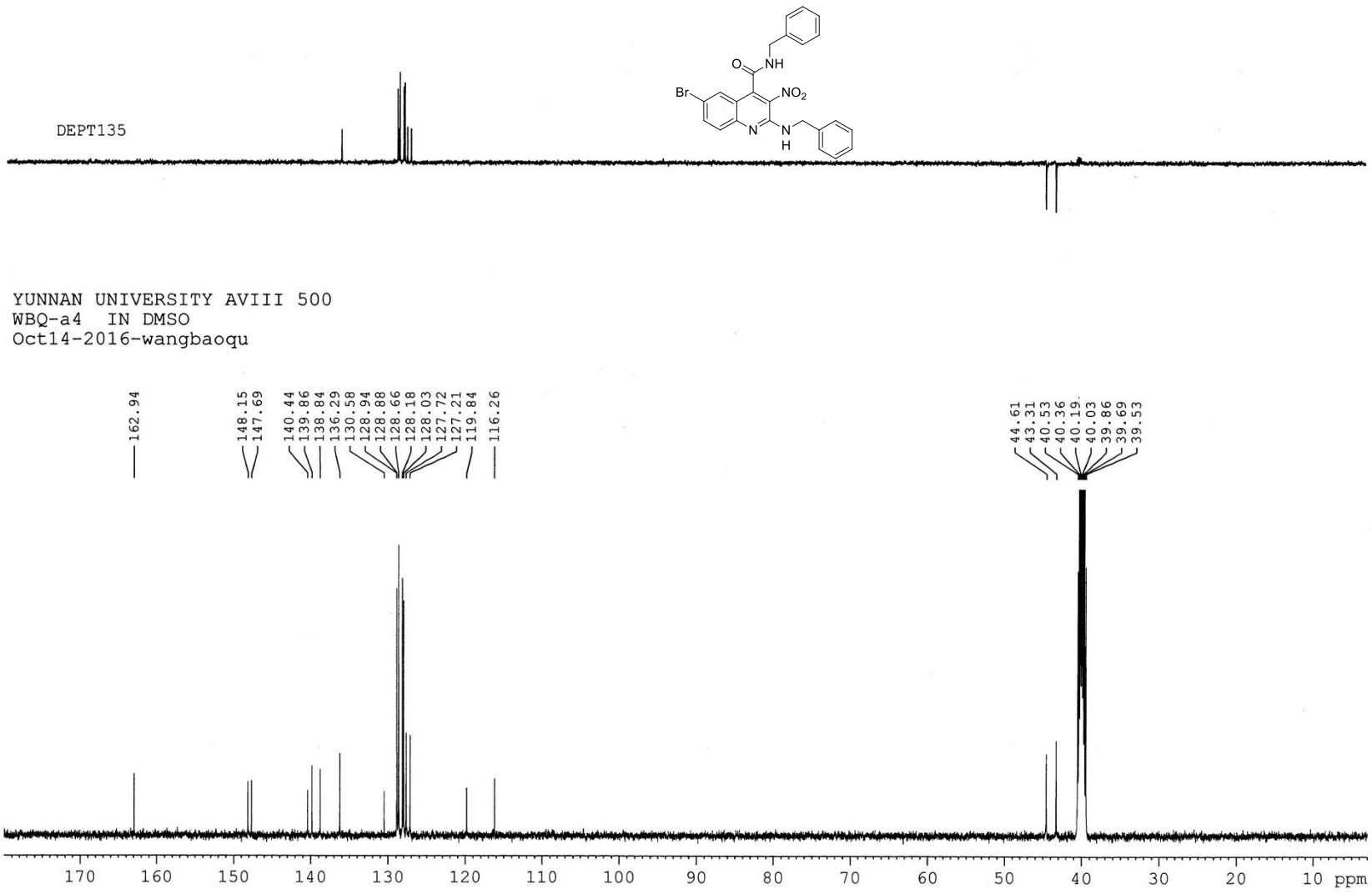


Figure S71. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6bc**

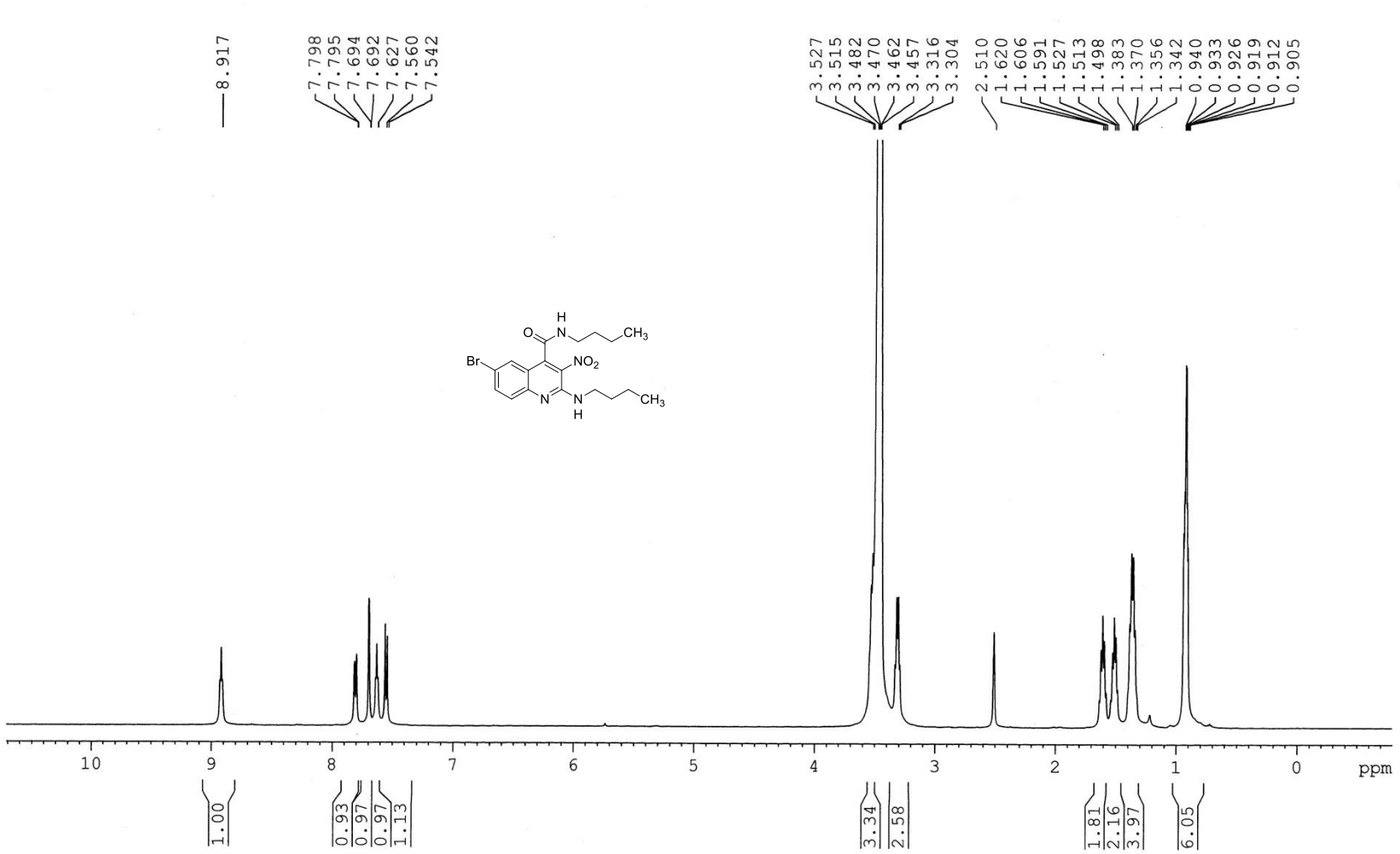


Figure S72. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6bk**

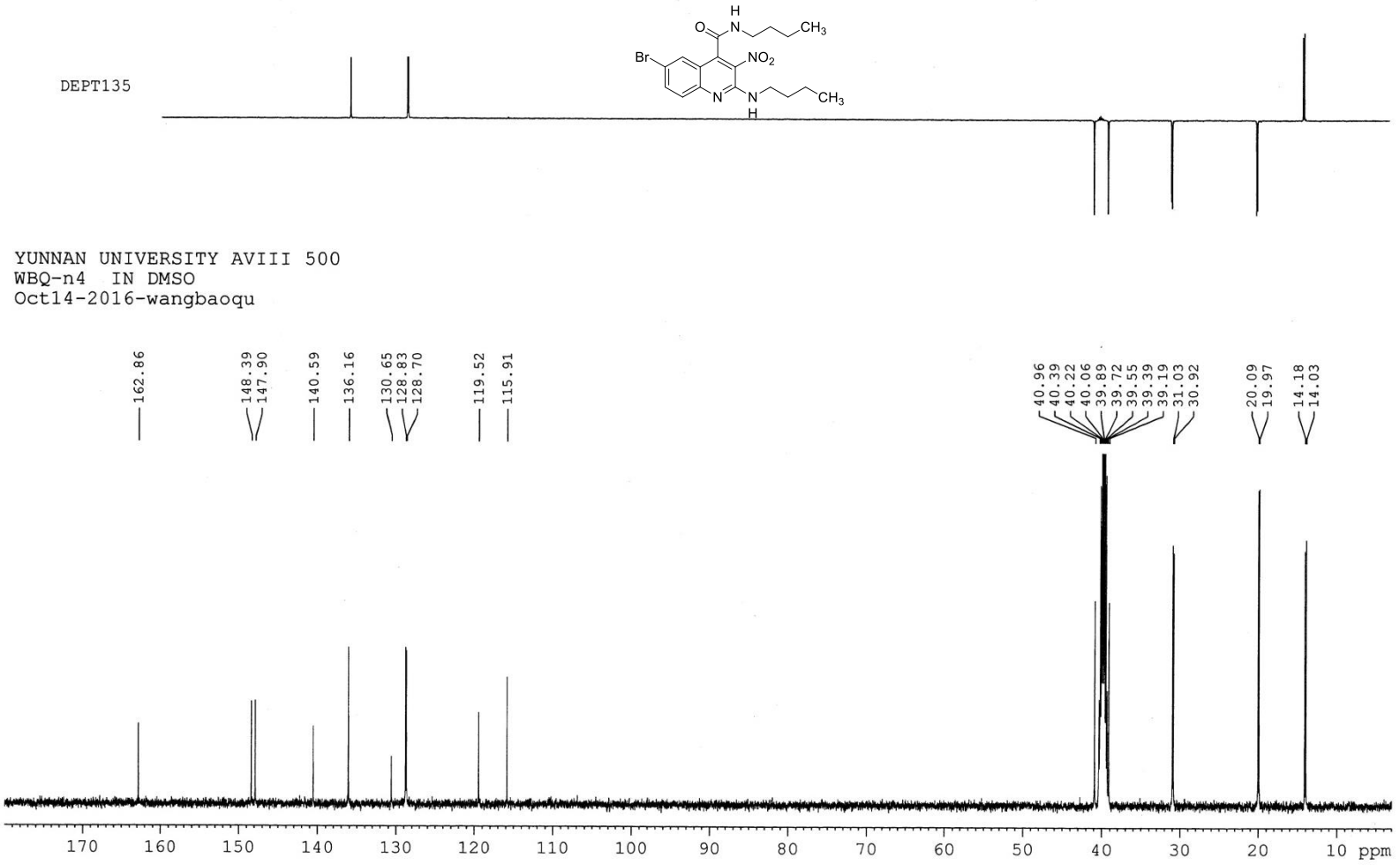


Figure S73. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6bk**

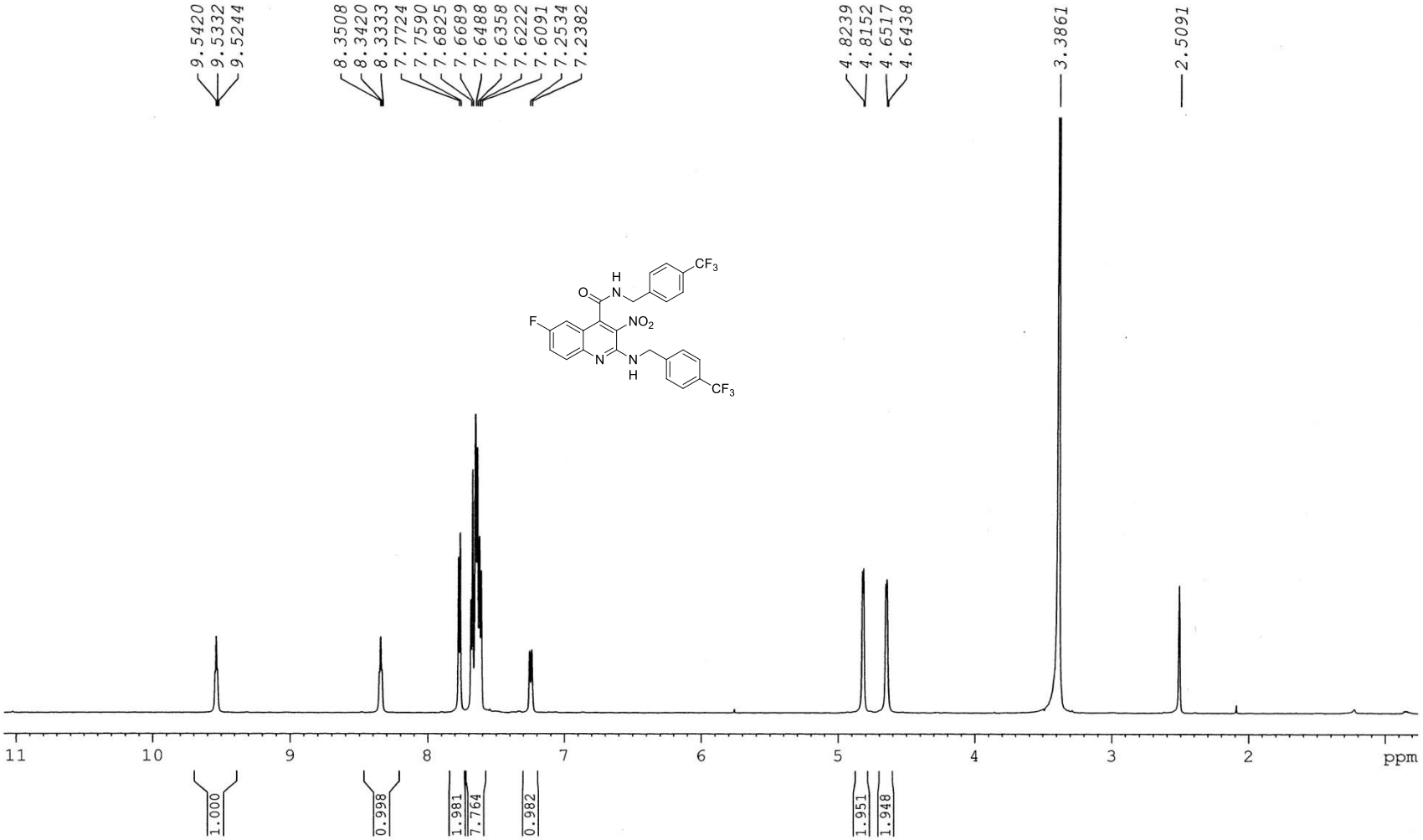


Figure S74. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **6da**

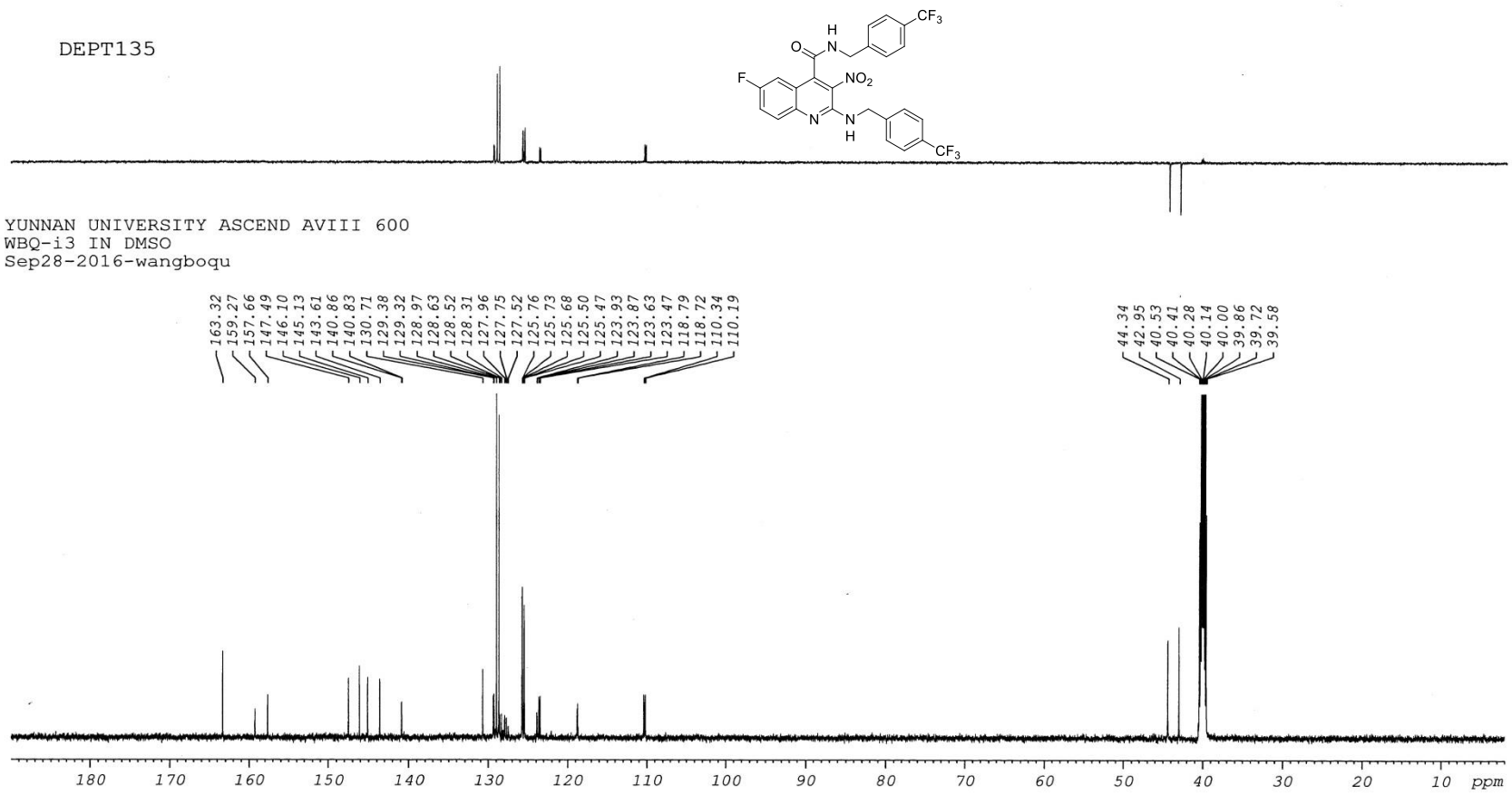


Figure S75. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **6da**

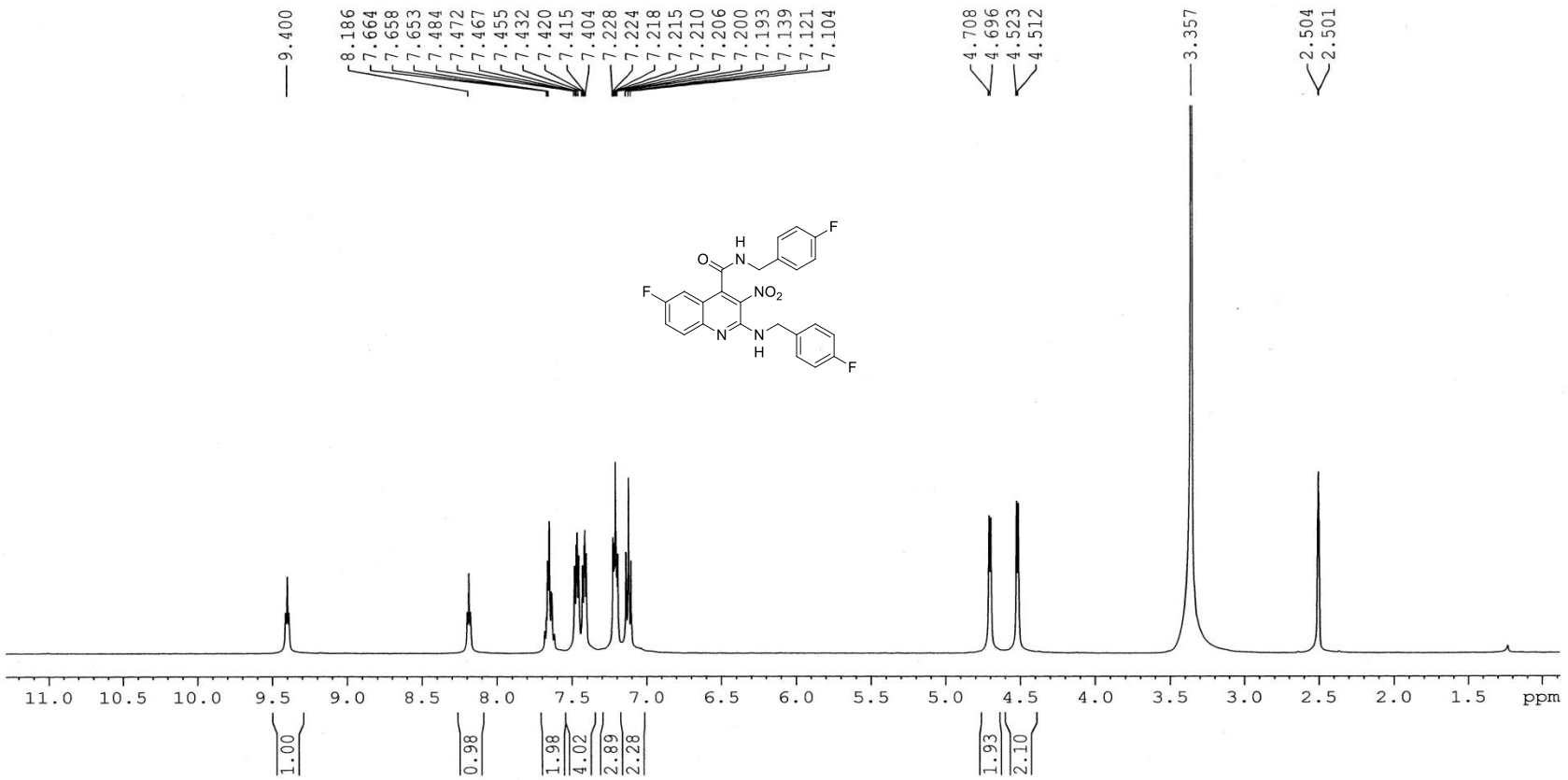


Figure S76. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6db**

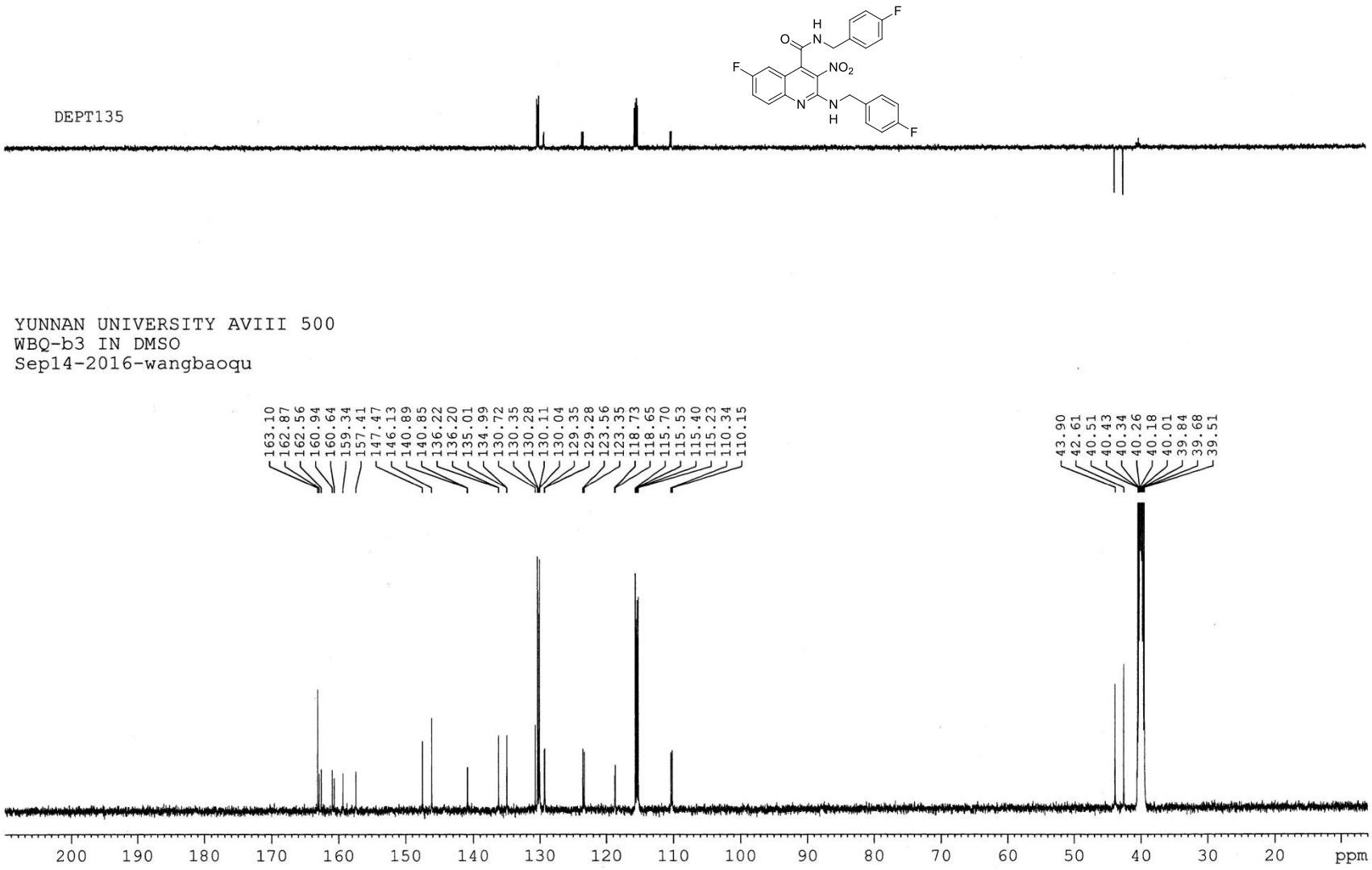


Figure S77. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6db**

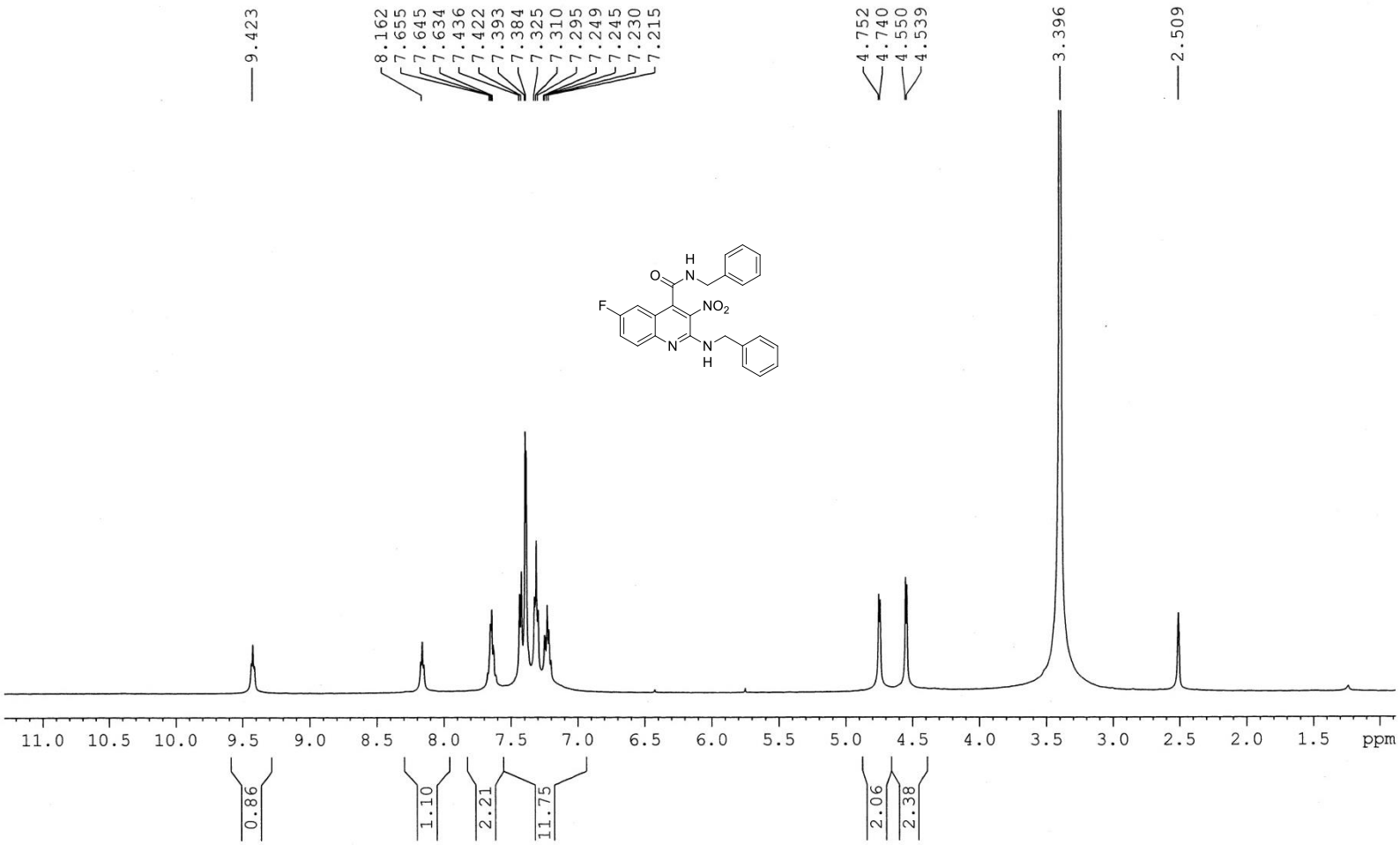


Figure S78. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6dc**

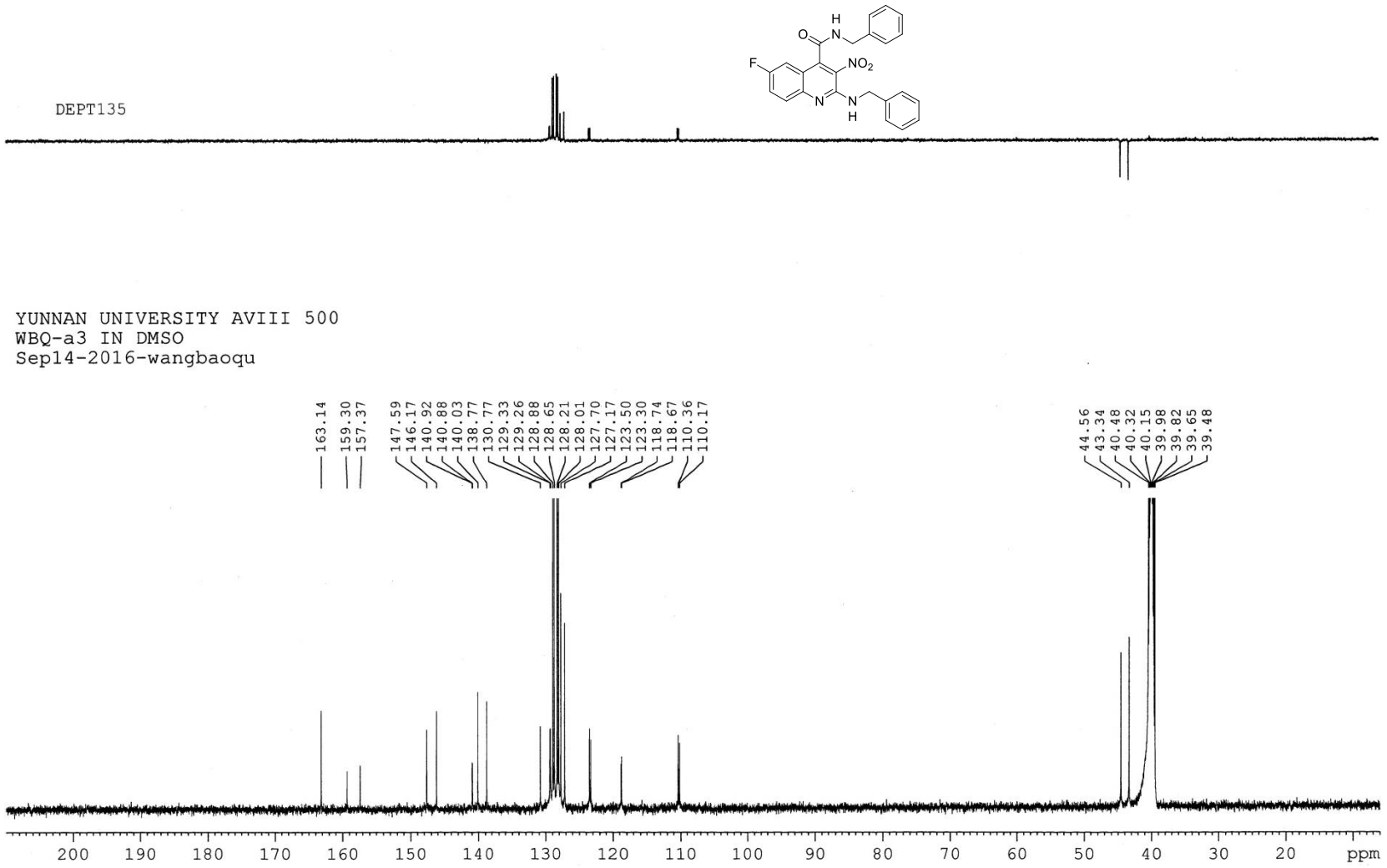


Figure S79. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6dc**

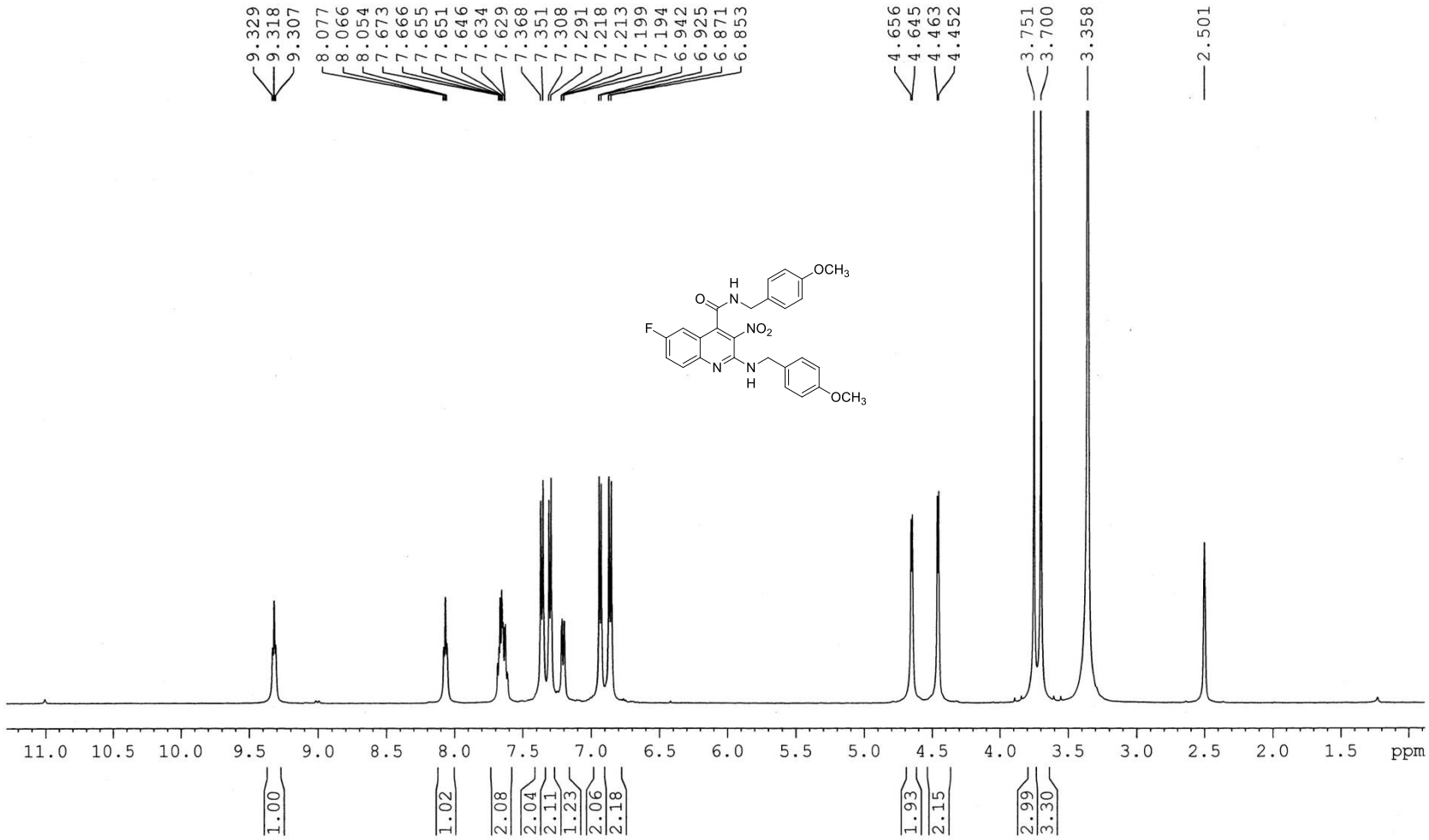


Figure S80. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6de**

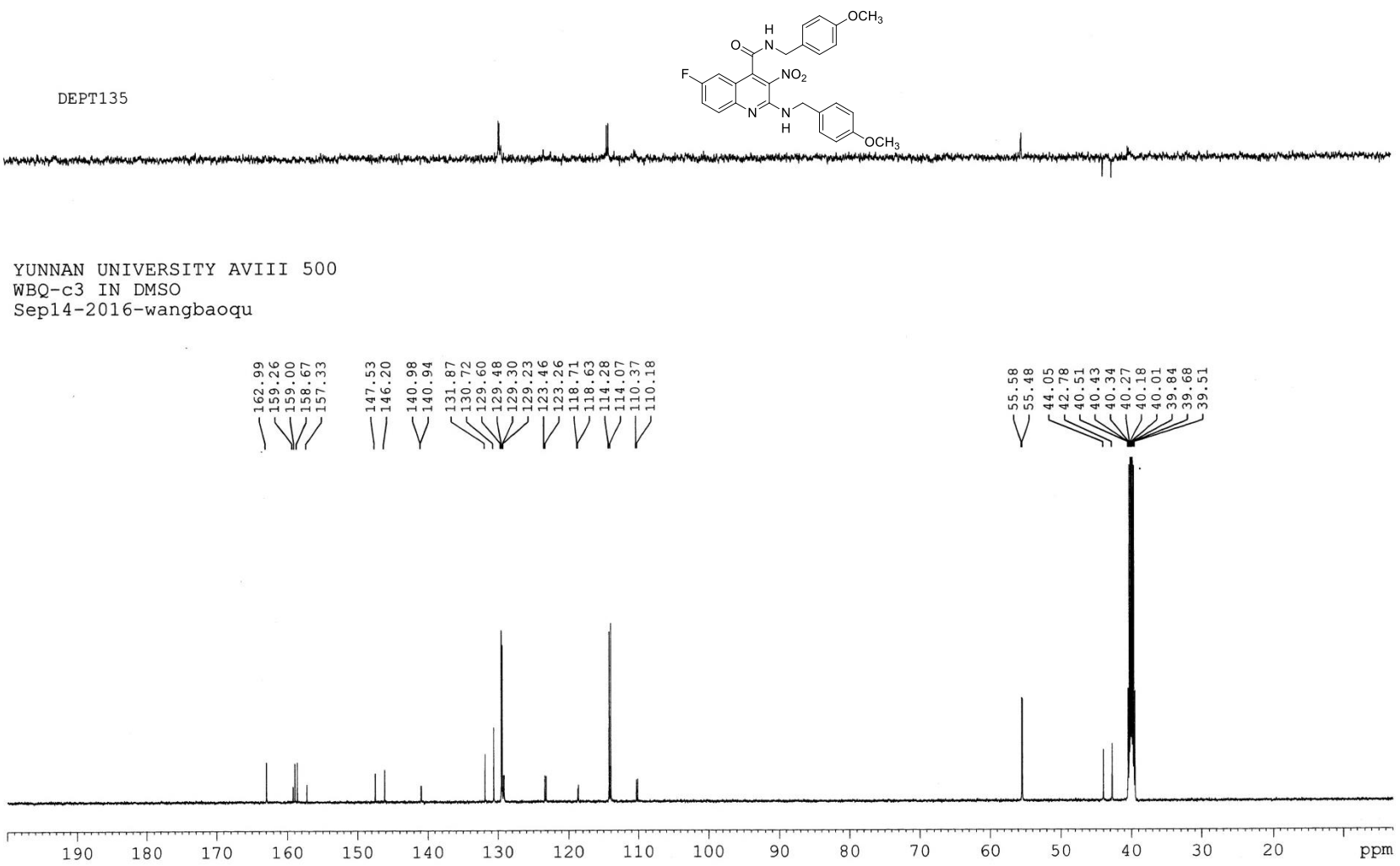


Figure S81. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6de**

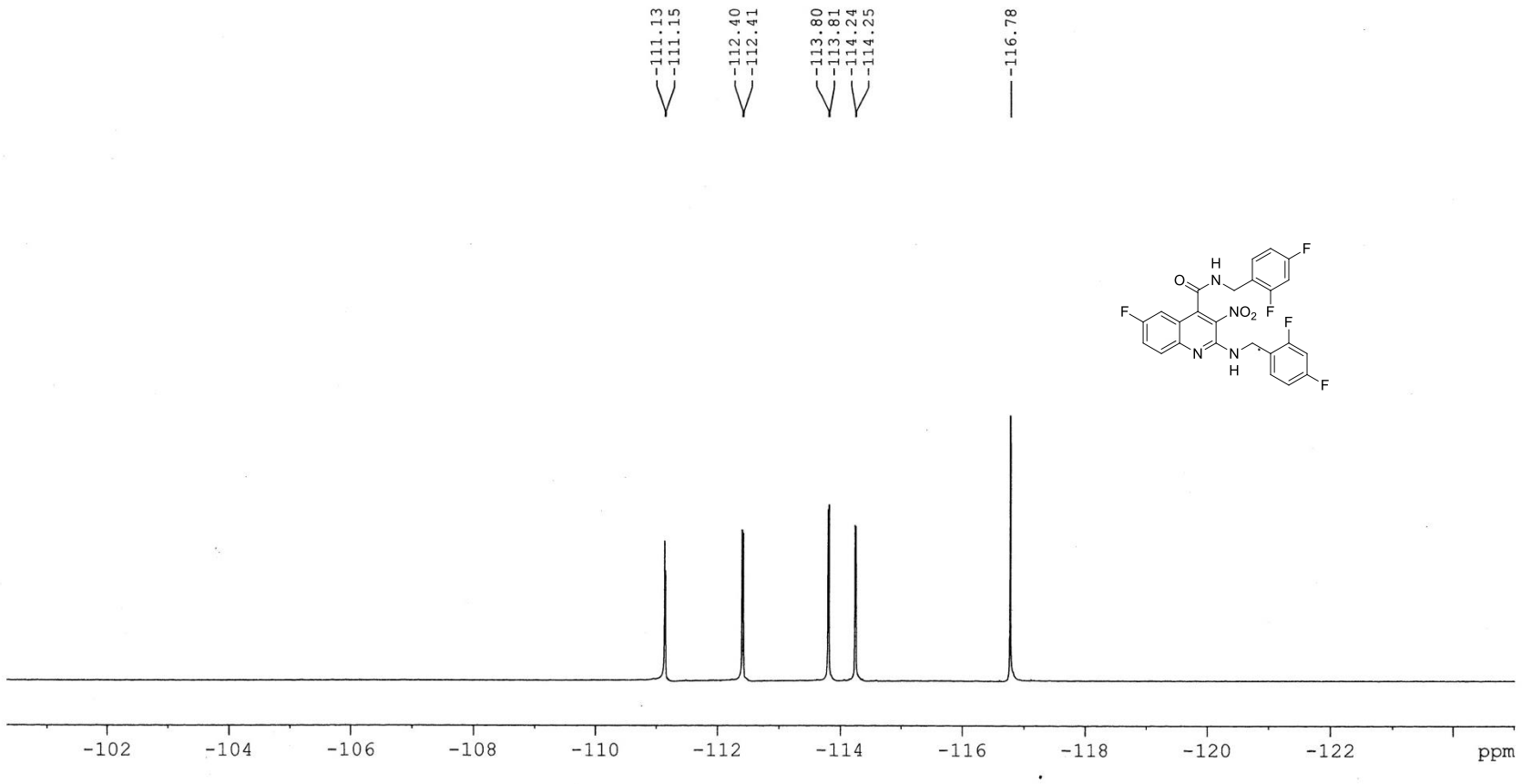


Figure S82. ^{19}F NMR (475 MHz, DMSO-d_6) spectra of compound **6df**

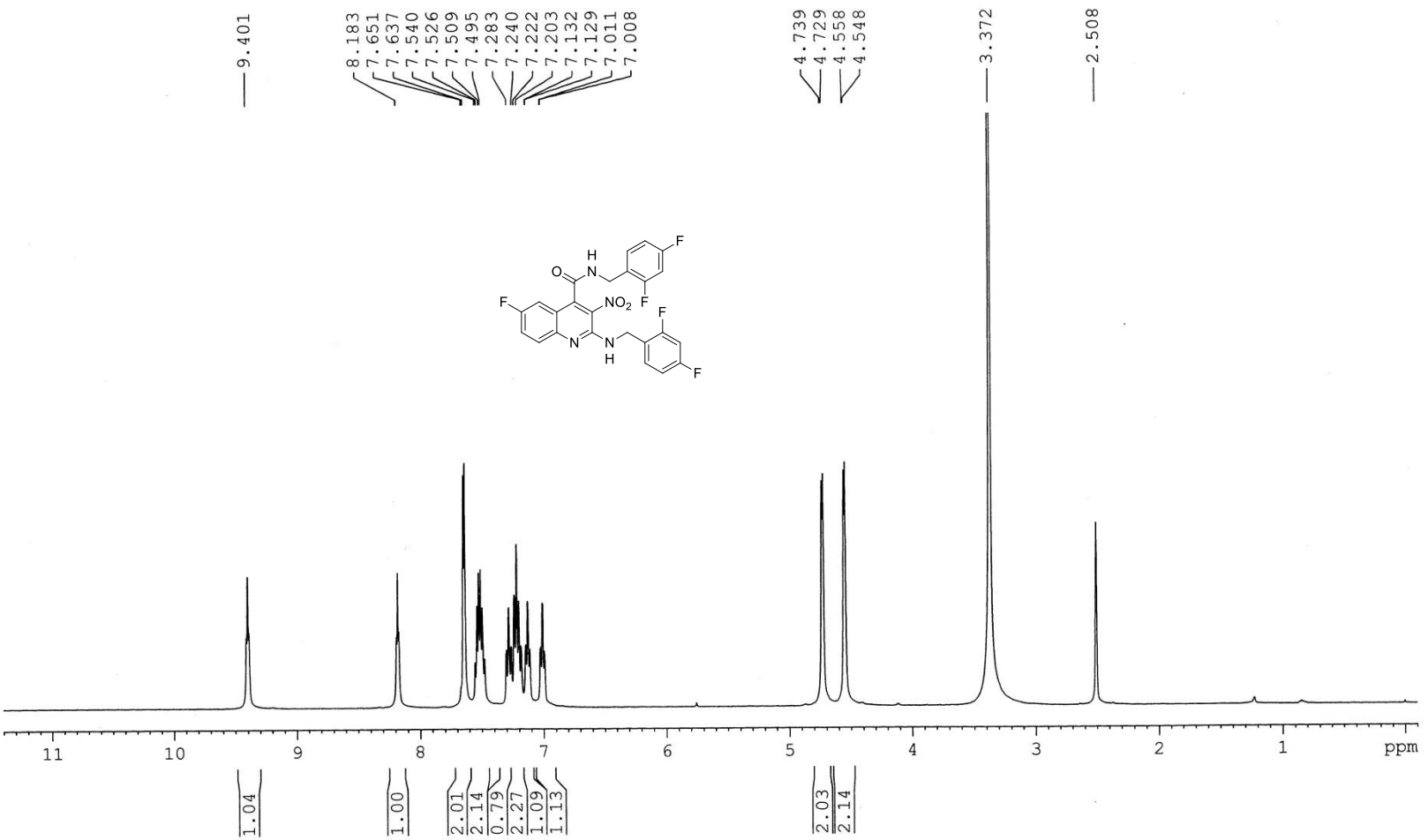


Figure S83. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6df**

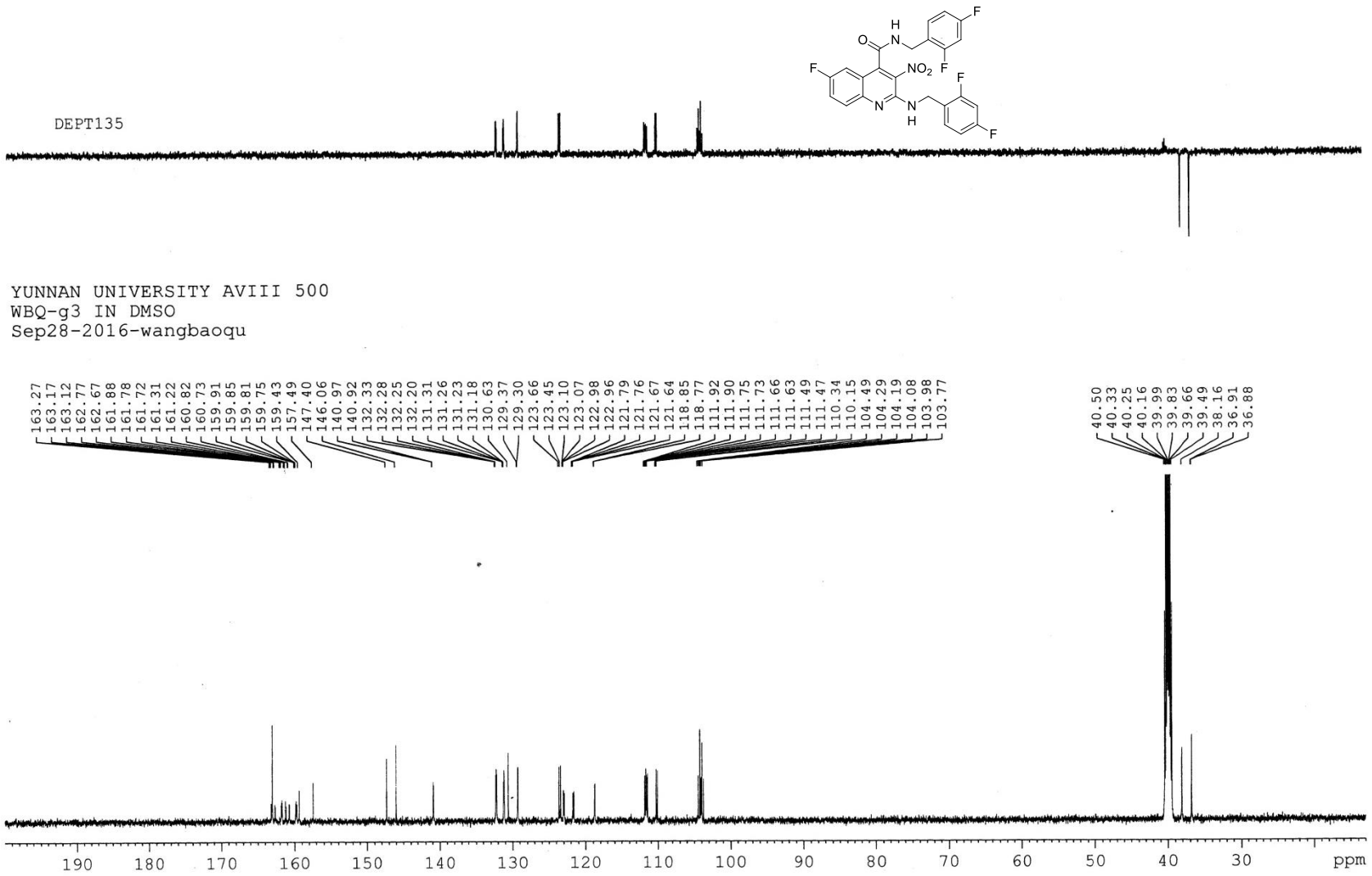


Figure S84. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6df**

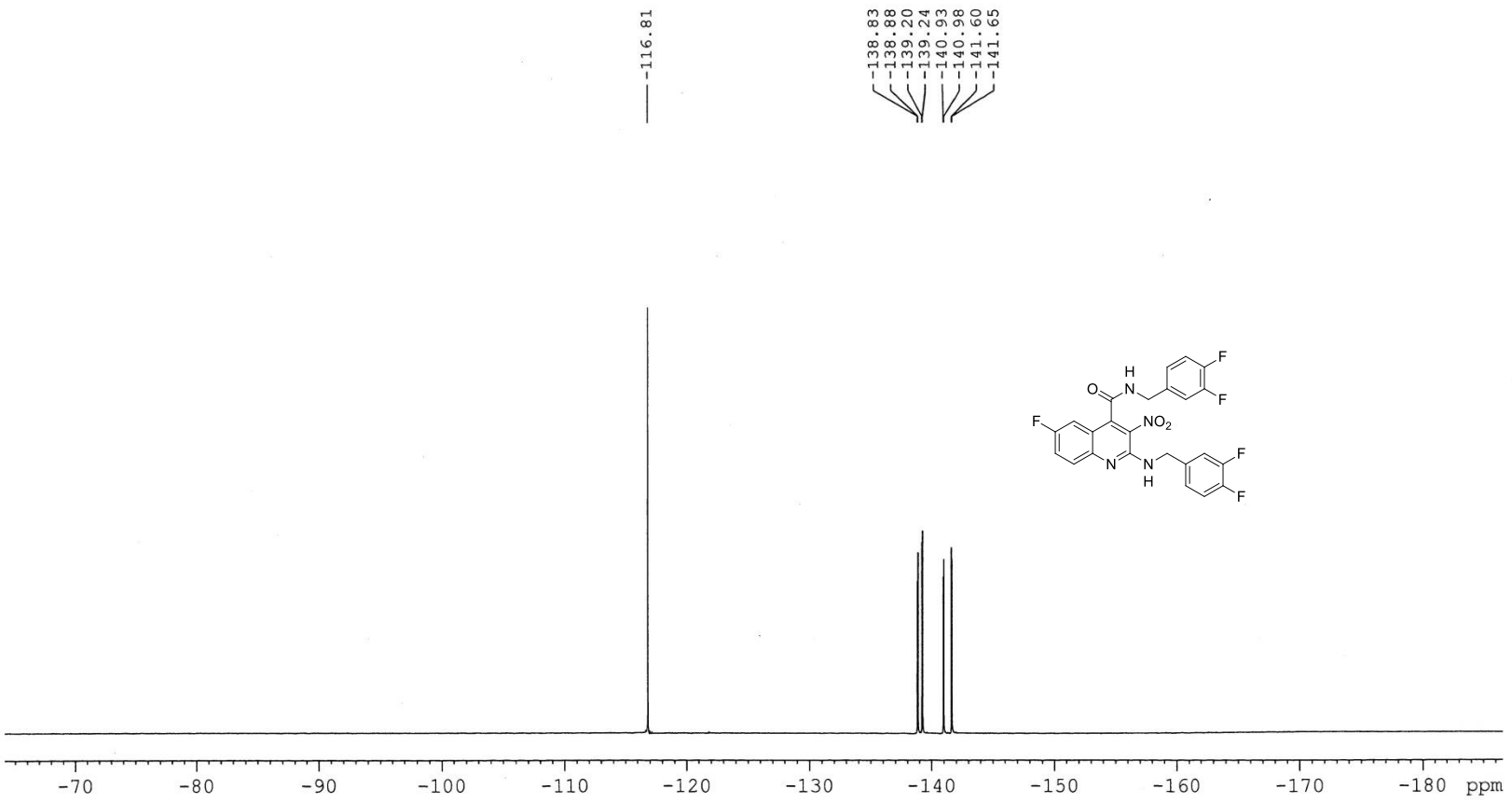


Figure S85. ^{19}F NMR (475 MHz, DMSO-d_6) spectra of compound **6dg**

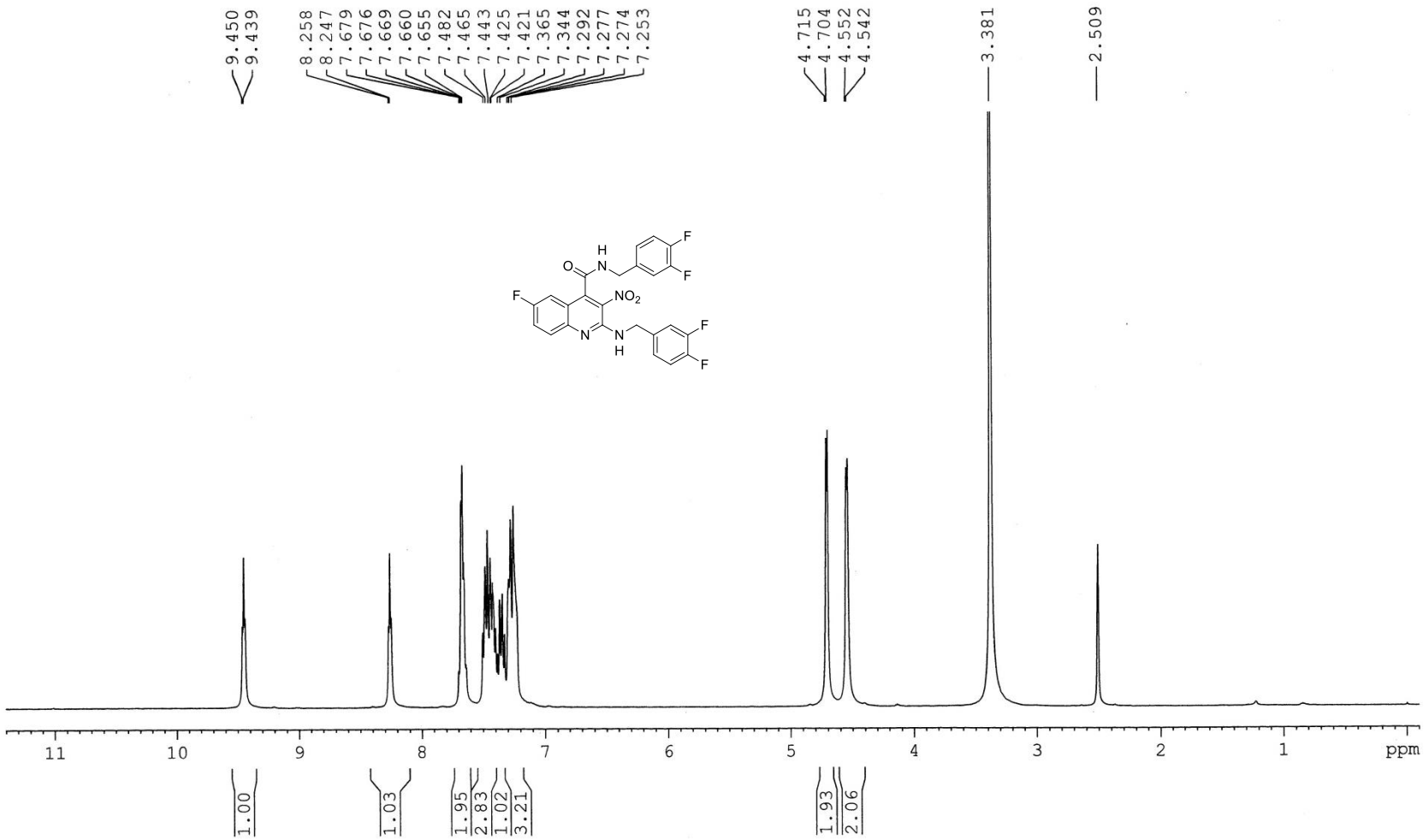


Figure S86. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6dg**

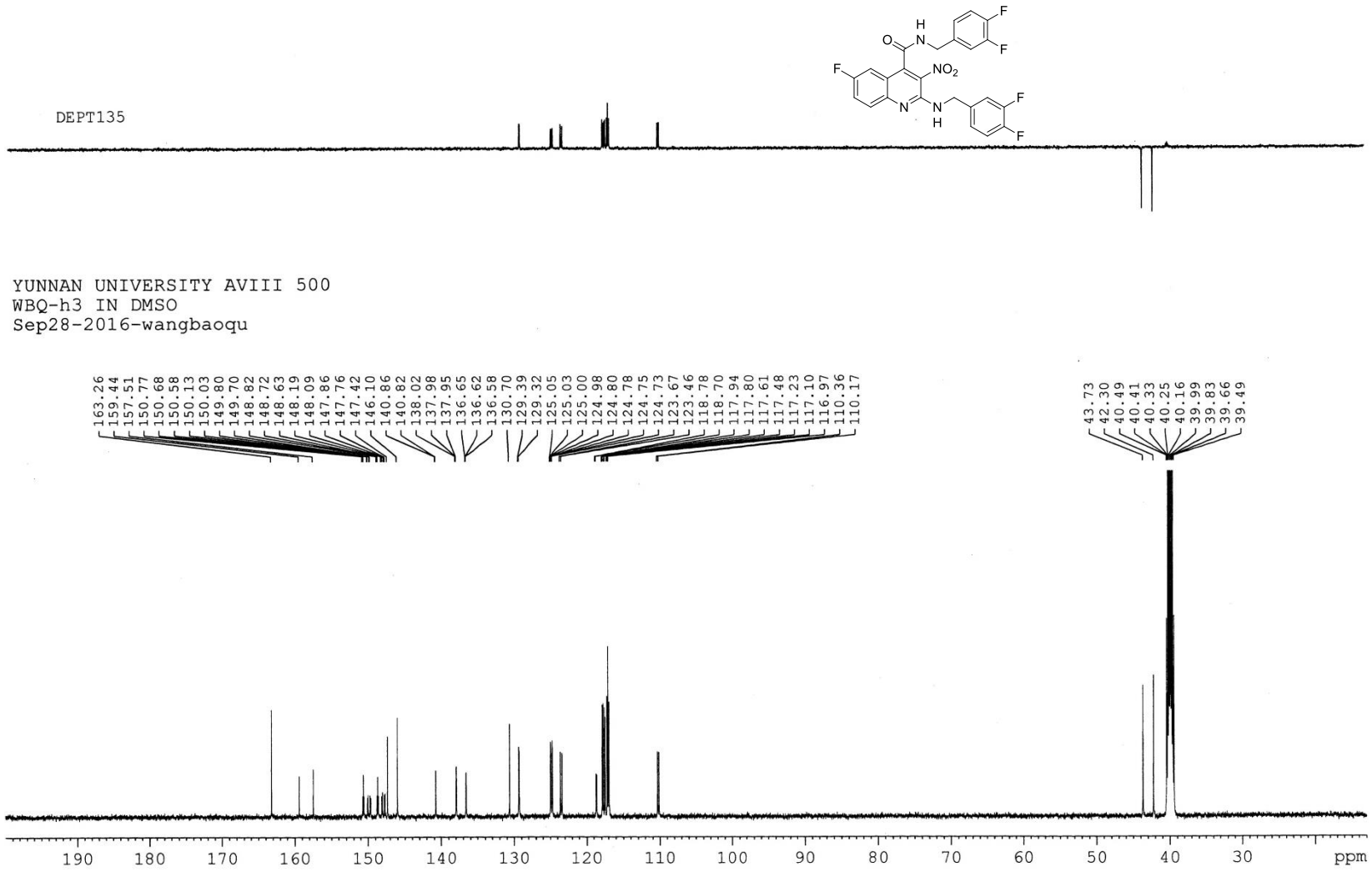


Figure S87. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6dg**

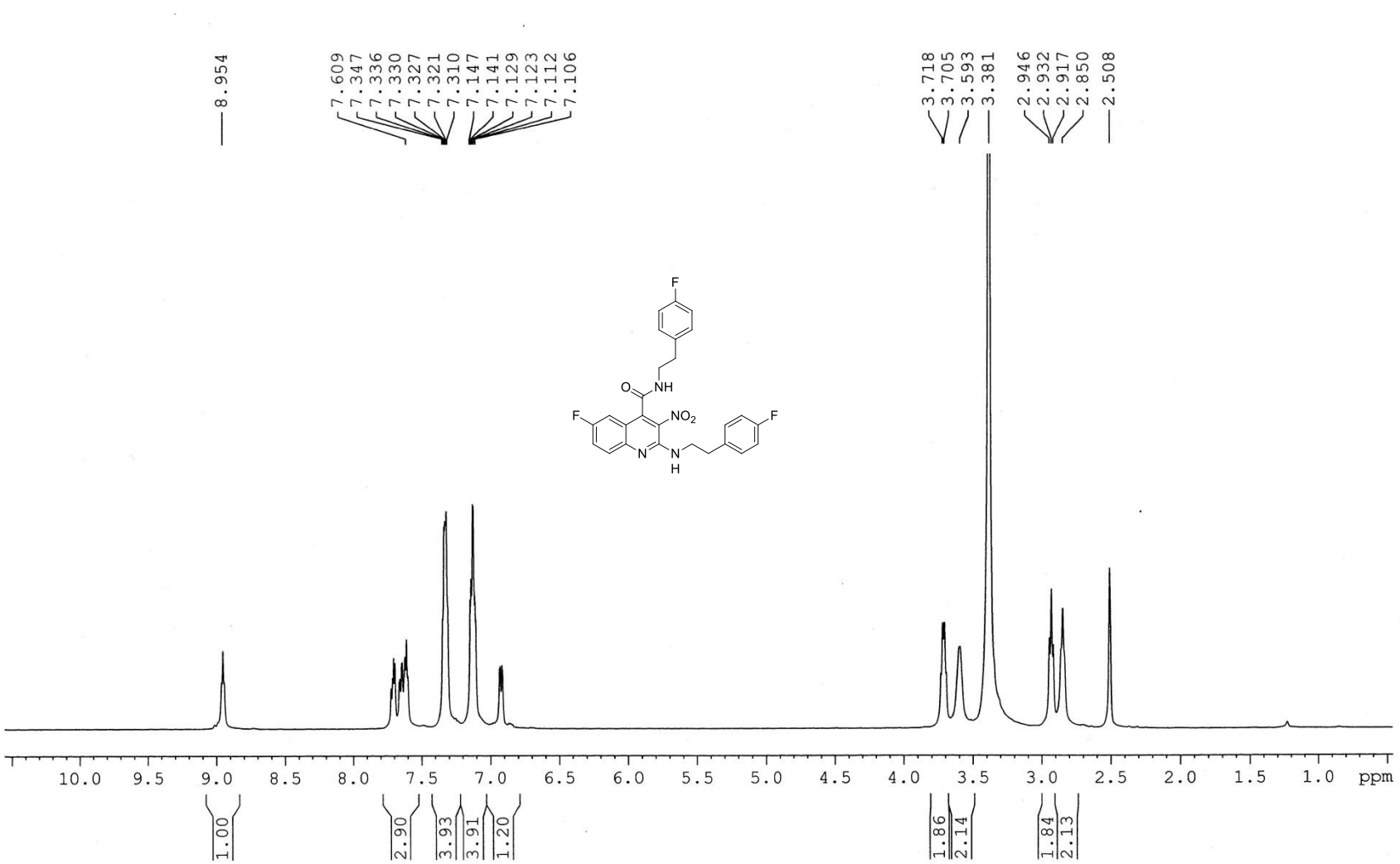


Figure S88. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6dh**

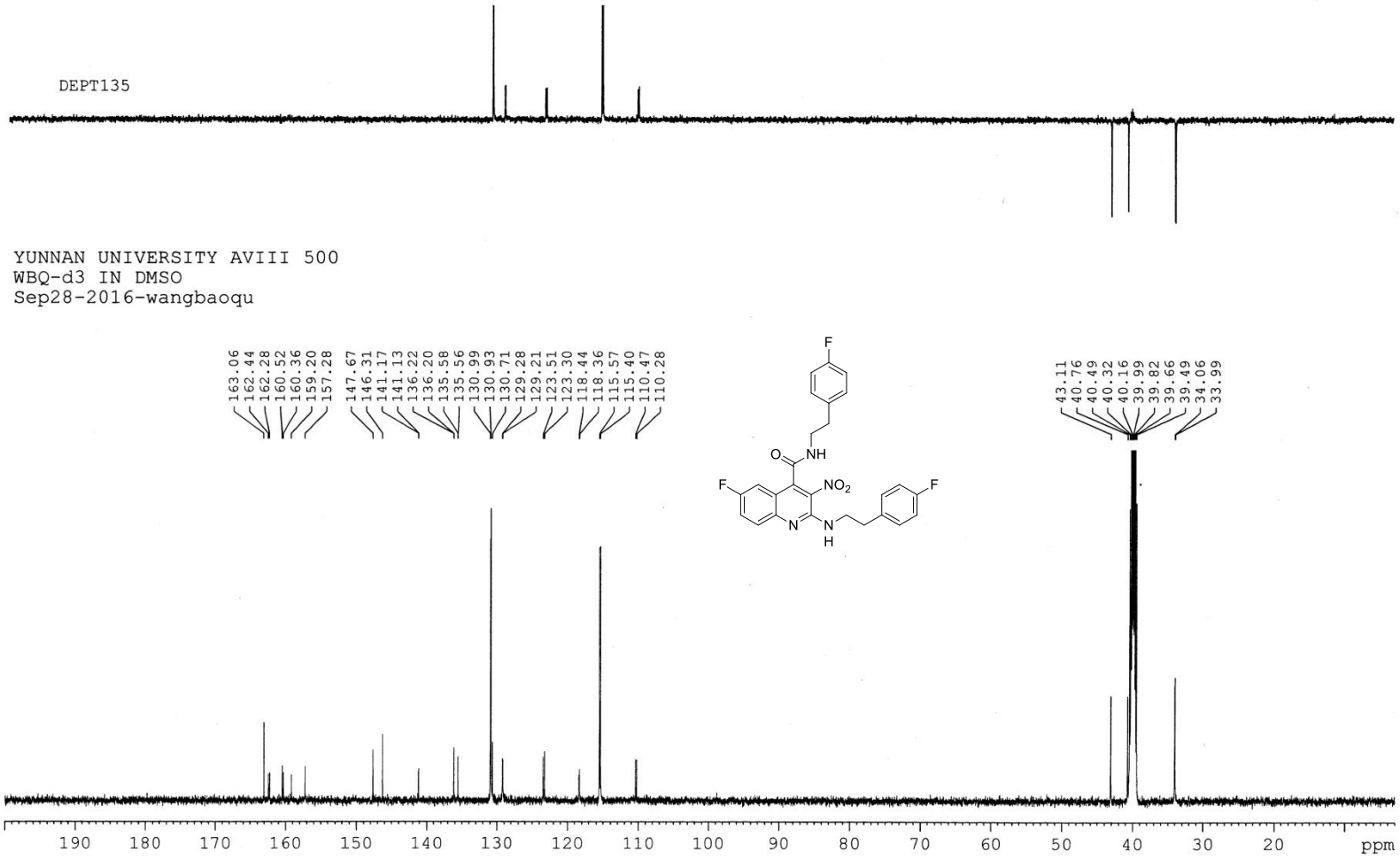


Figure S89. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6dh**

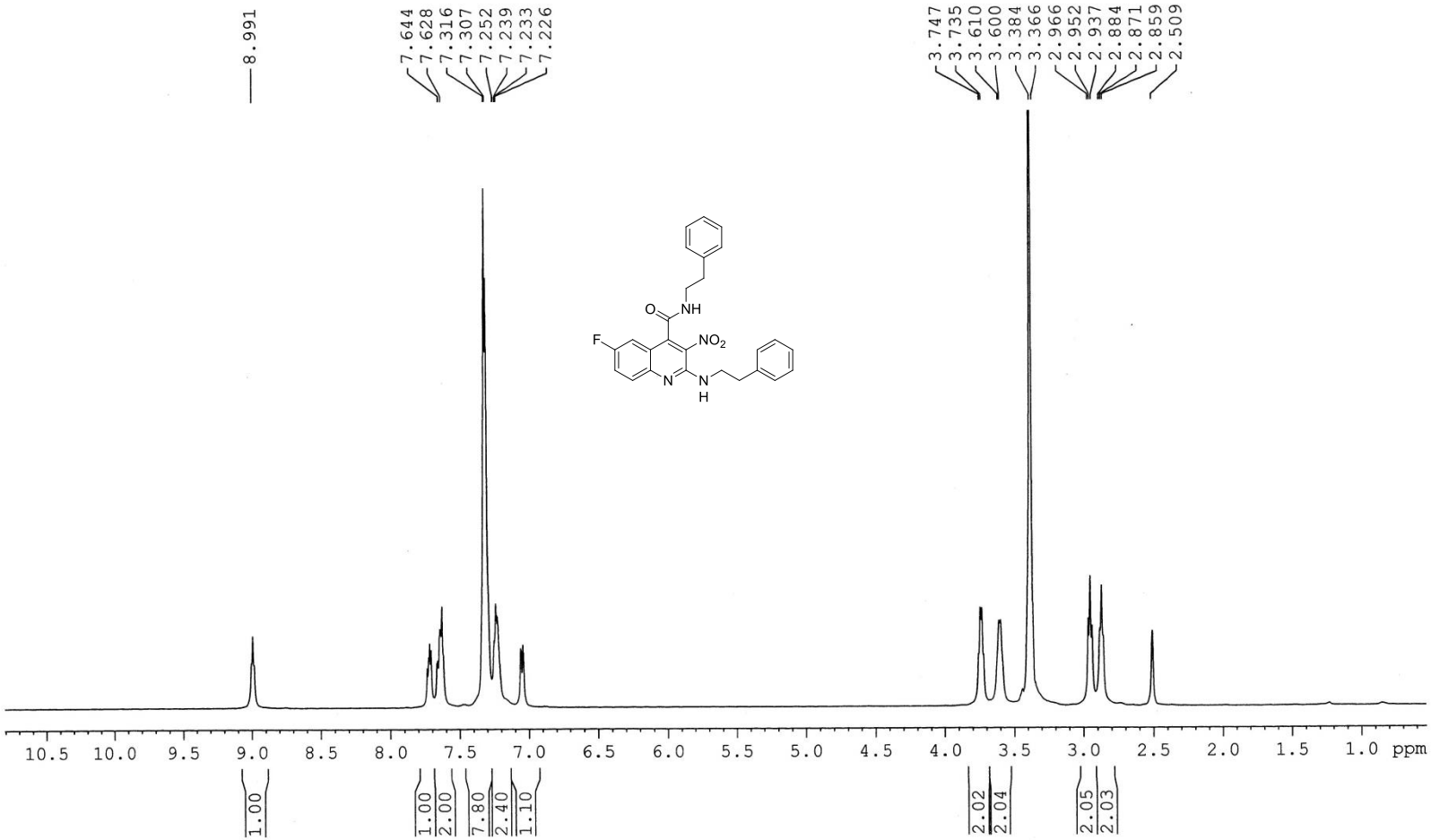


Figure S90. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6di**

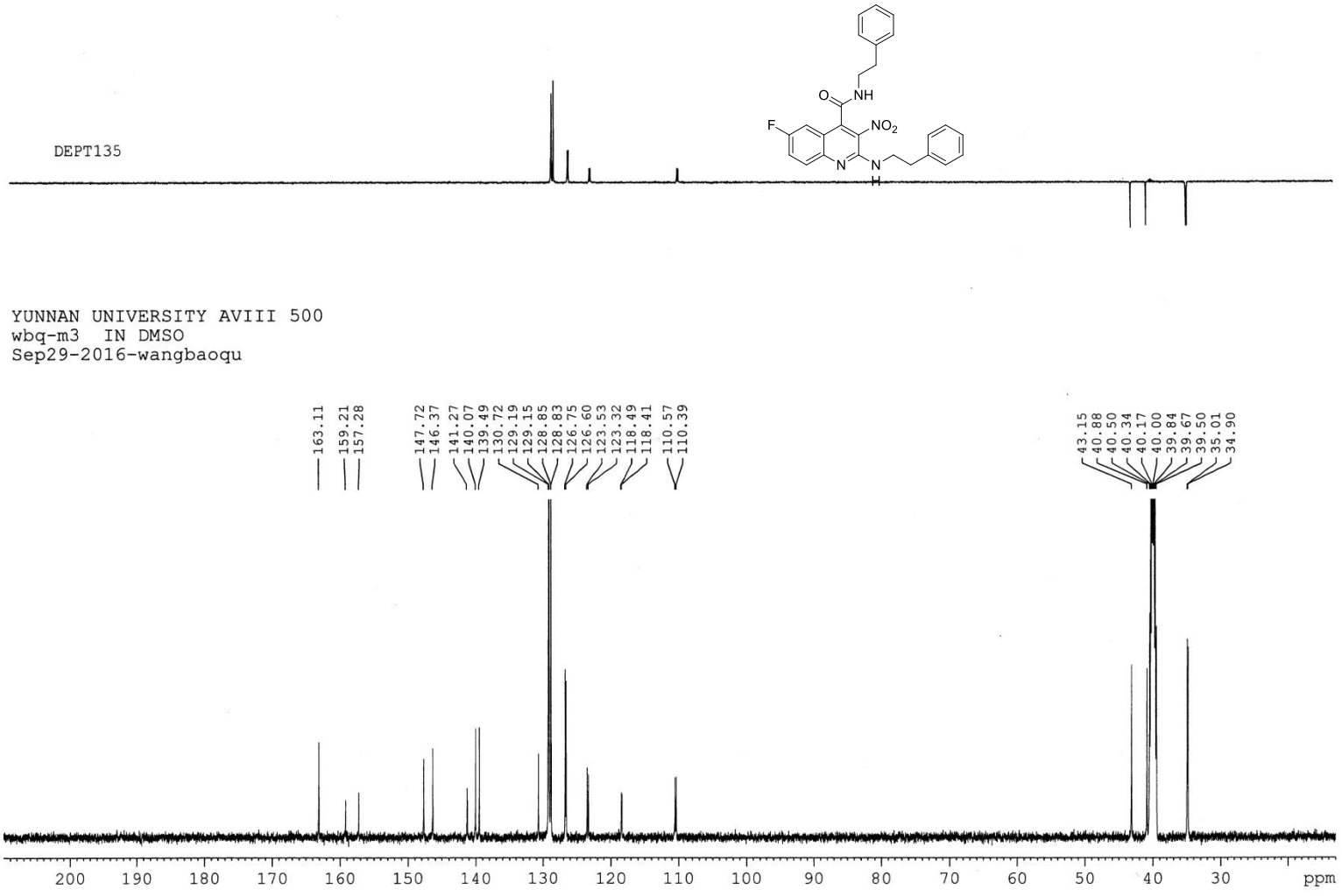


Figure S91. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6di**

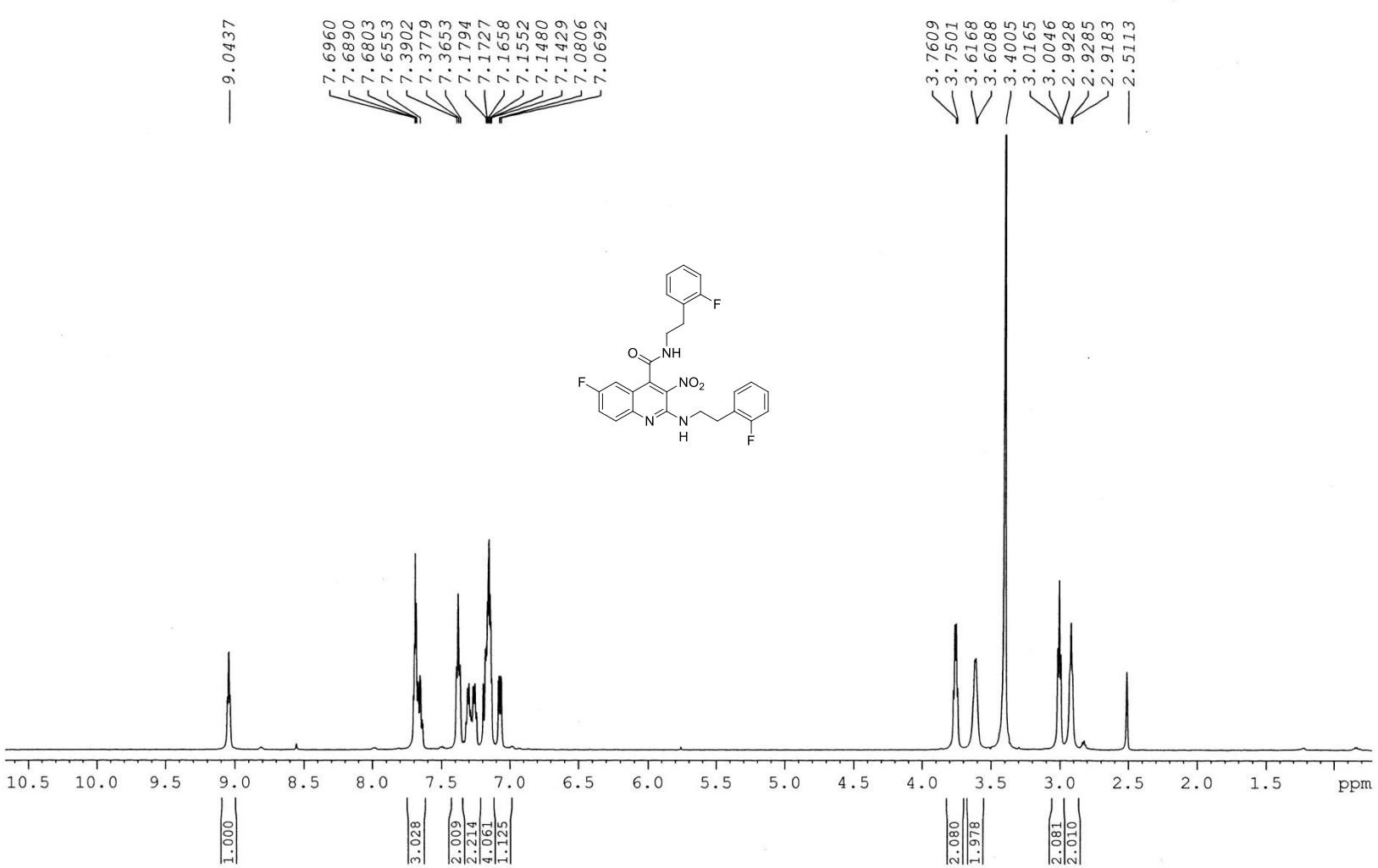


Figure S92. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **6dj**

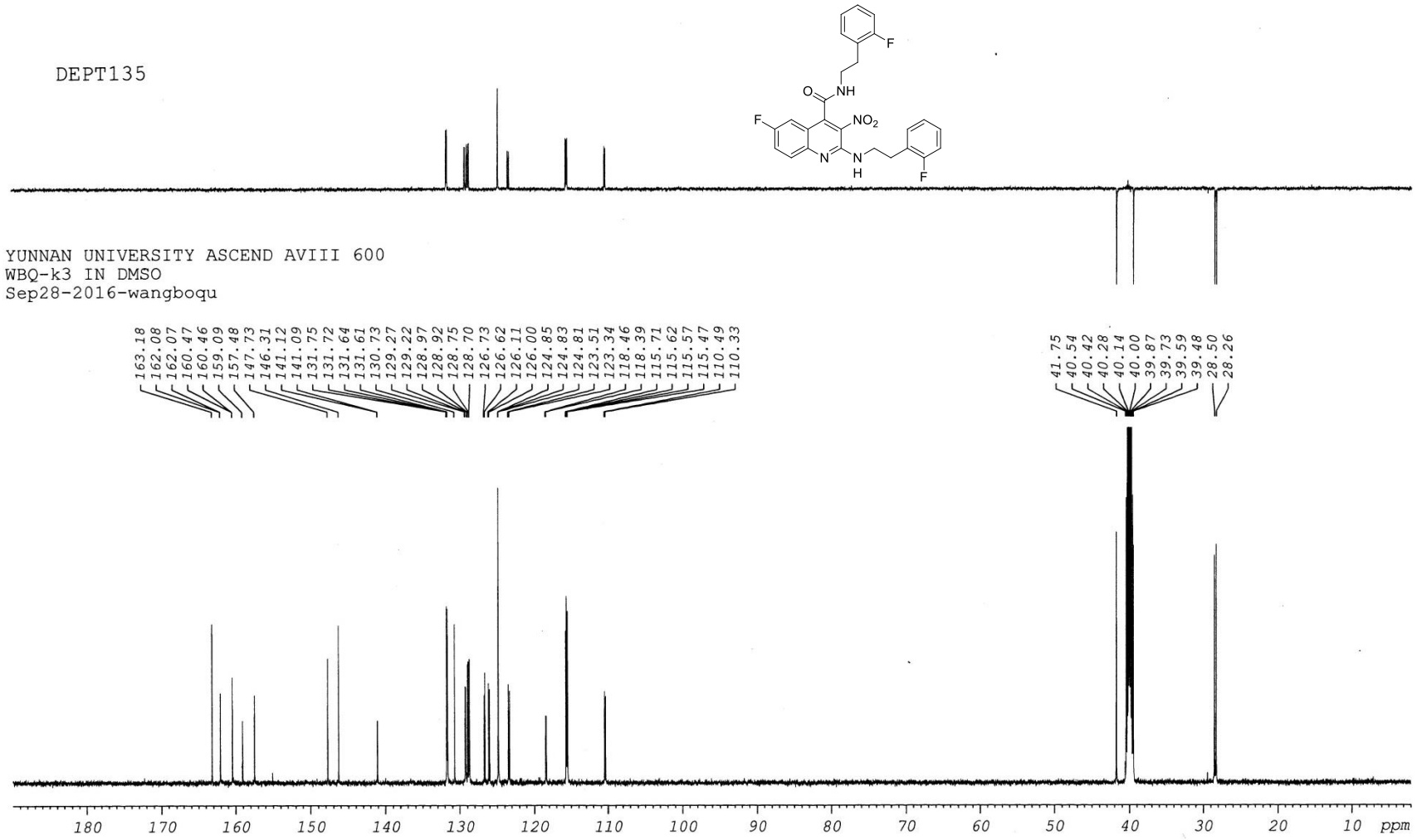


Figure S93. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **6dj**

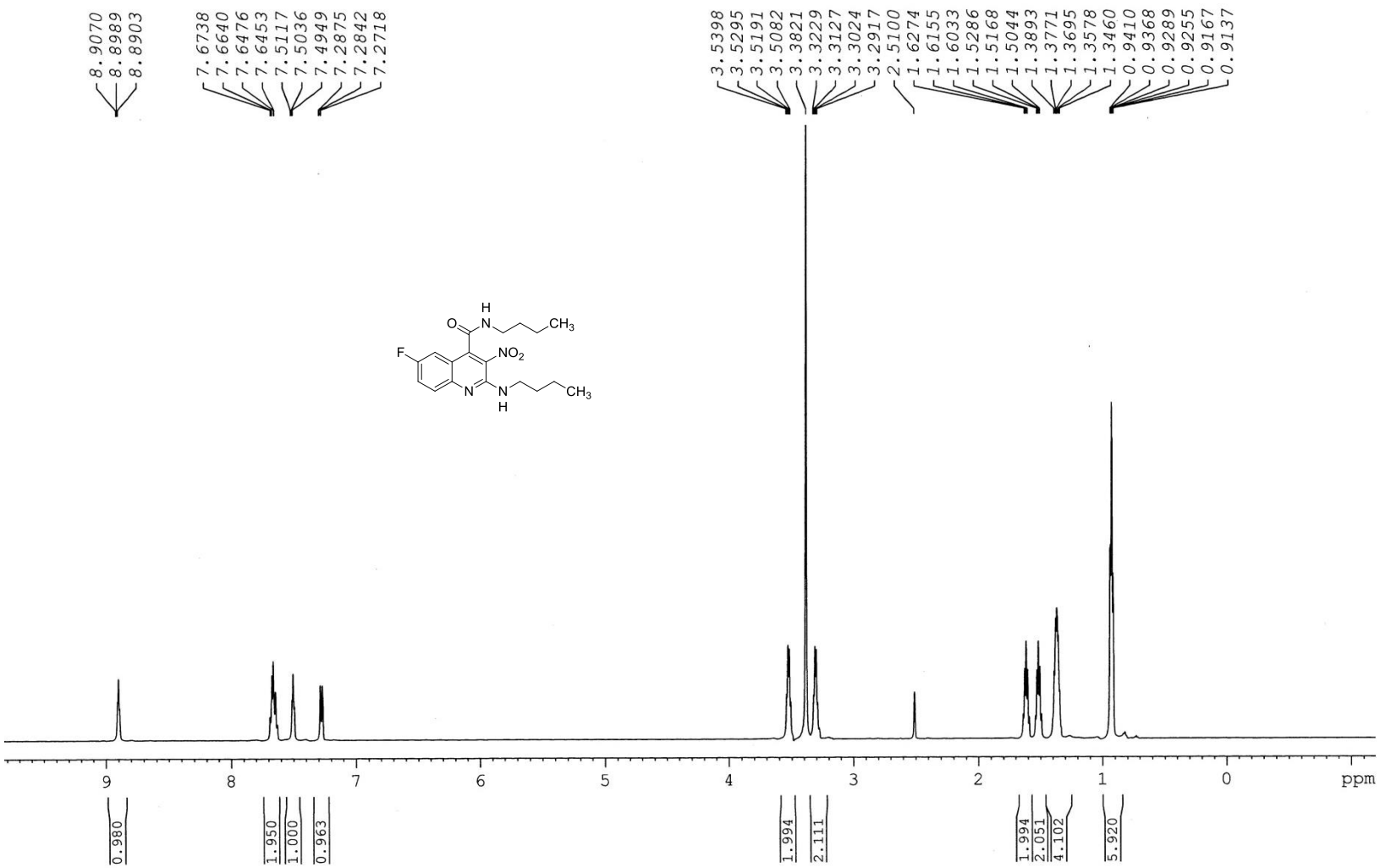


Figure S94. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **6dk**

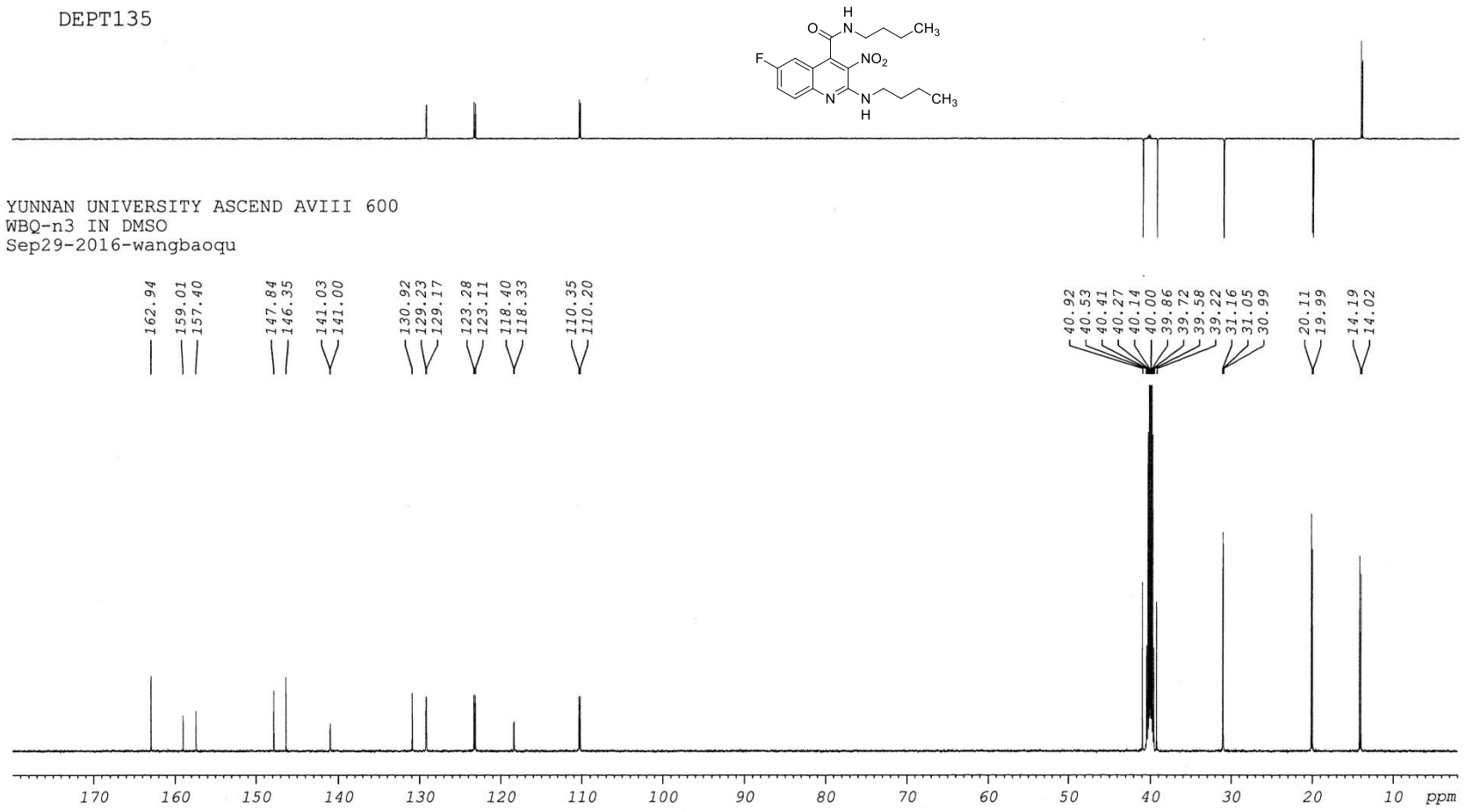


Figure S95. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **6dk**

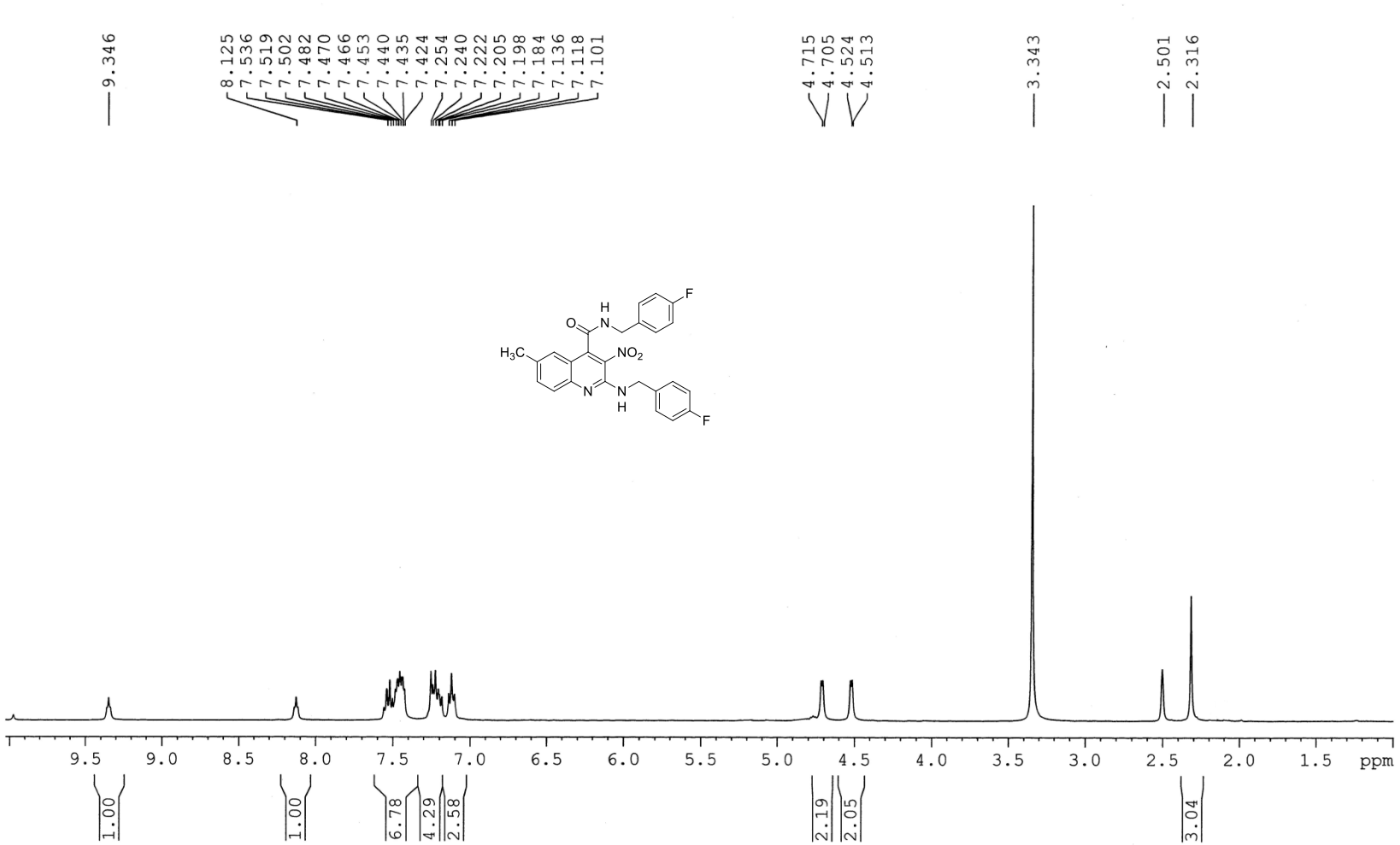


Figure S96. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6fb**

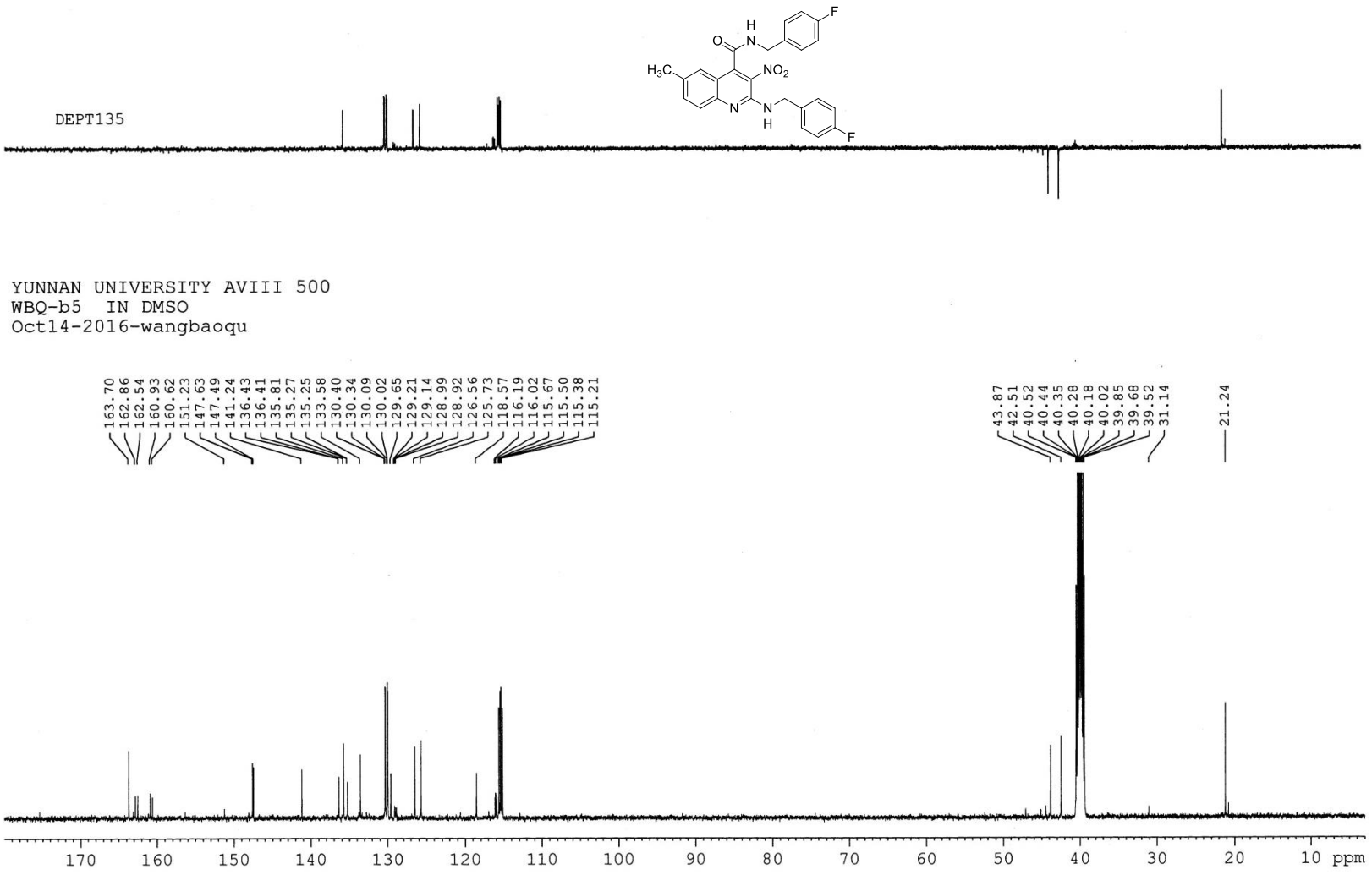


Figure S97. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6fb**

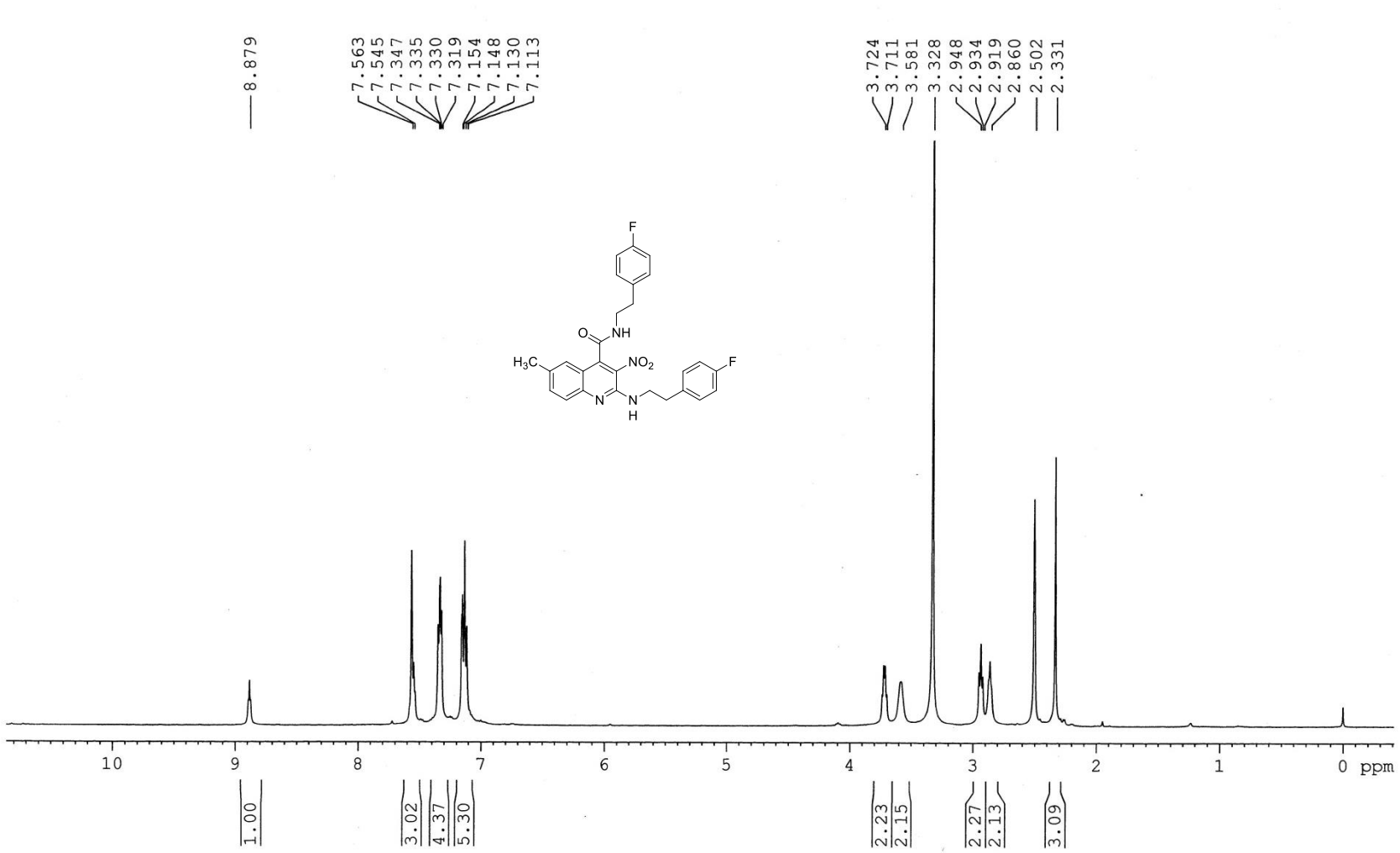


Figure S98. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6fh**

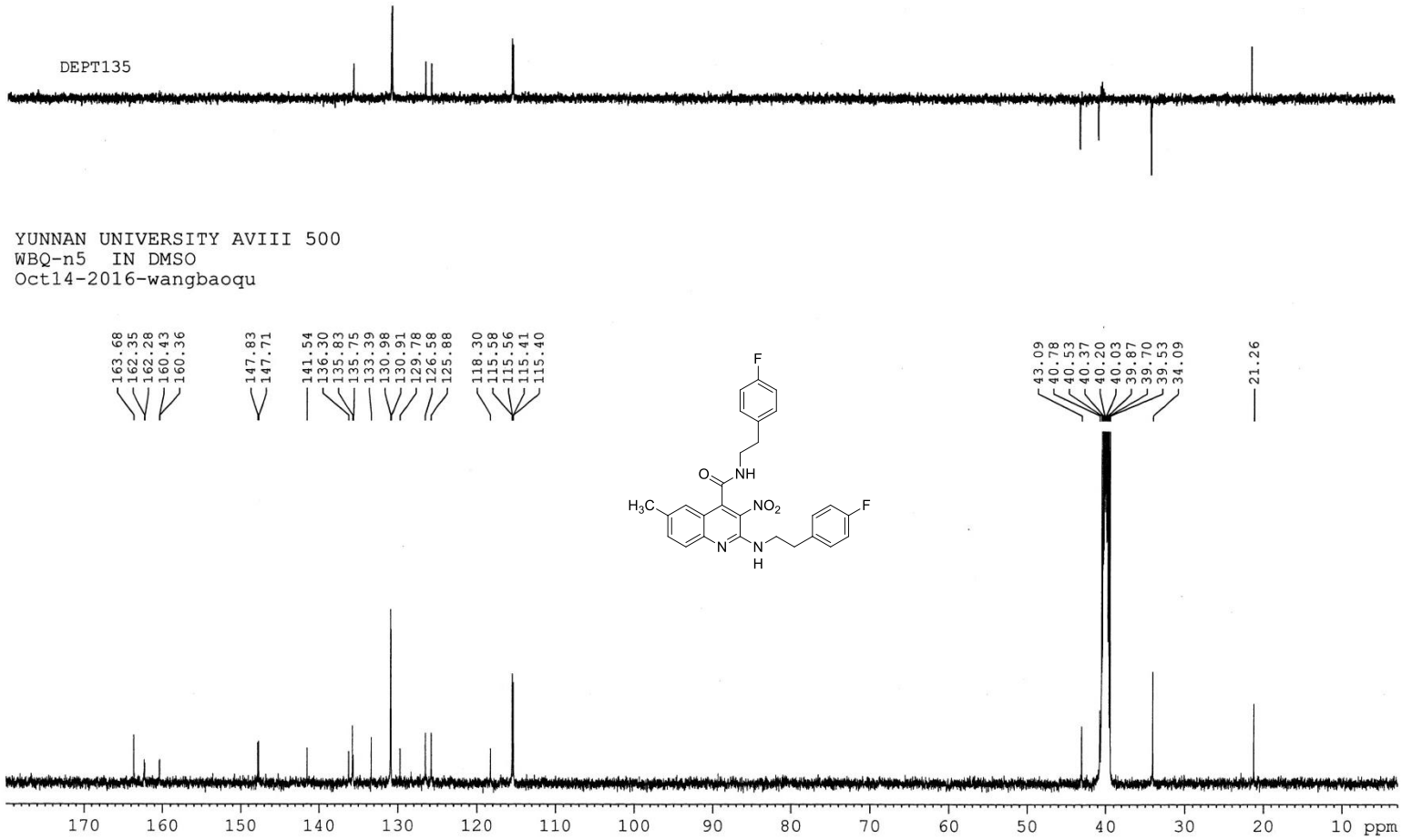


Figure S99. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6fh**

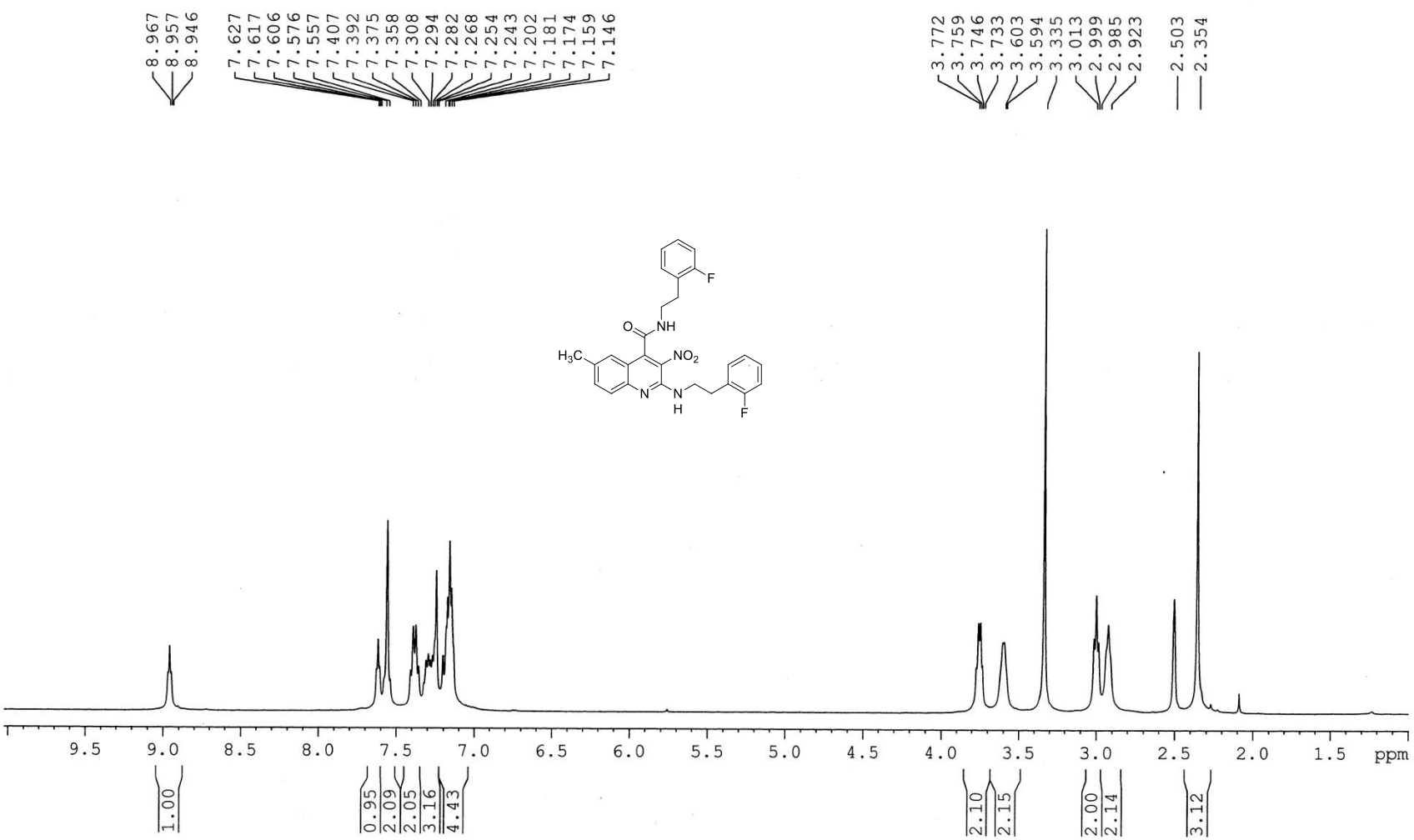


Figure S100. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6fj**

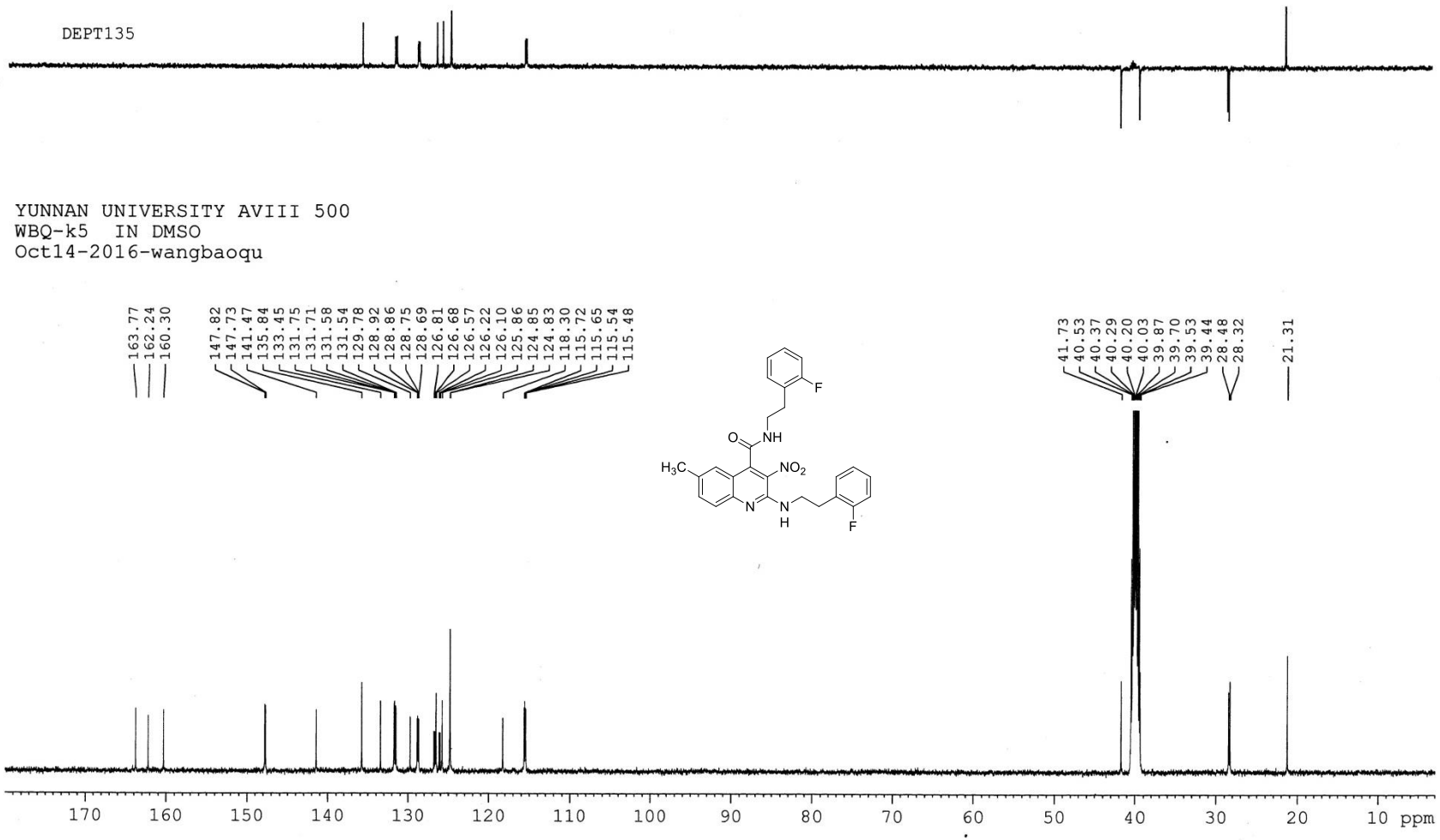


Figure S101. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6fj**

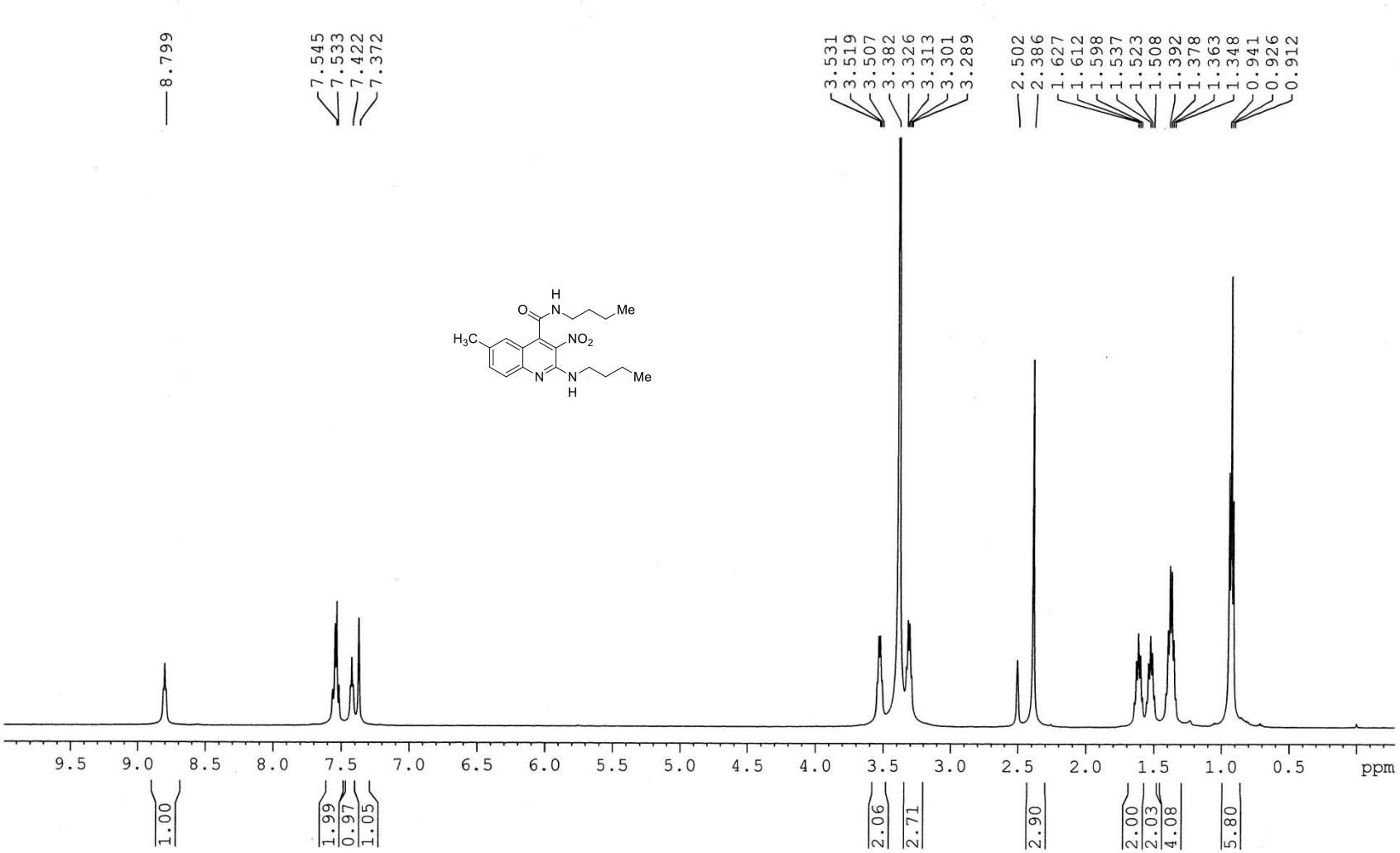


Figure S102. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6fk**

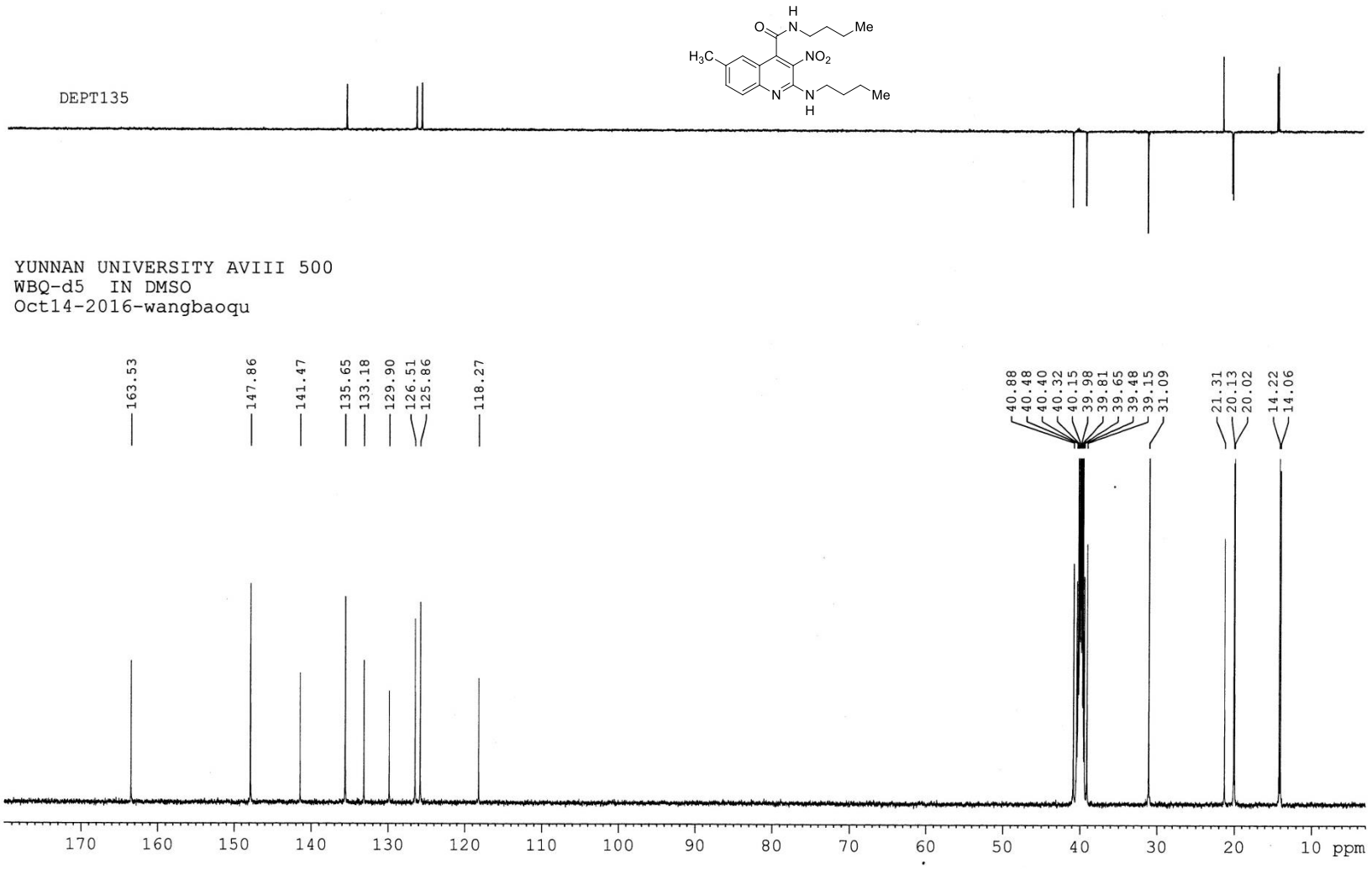


Figure S103. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6fk**

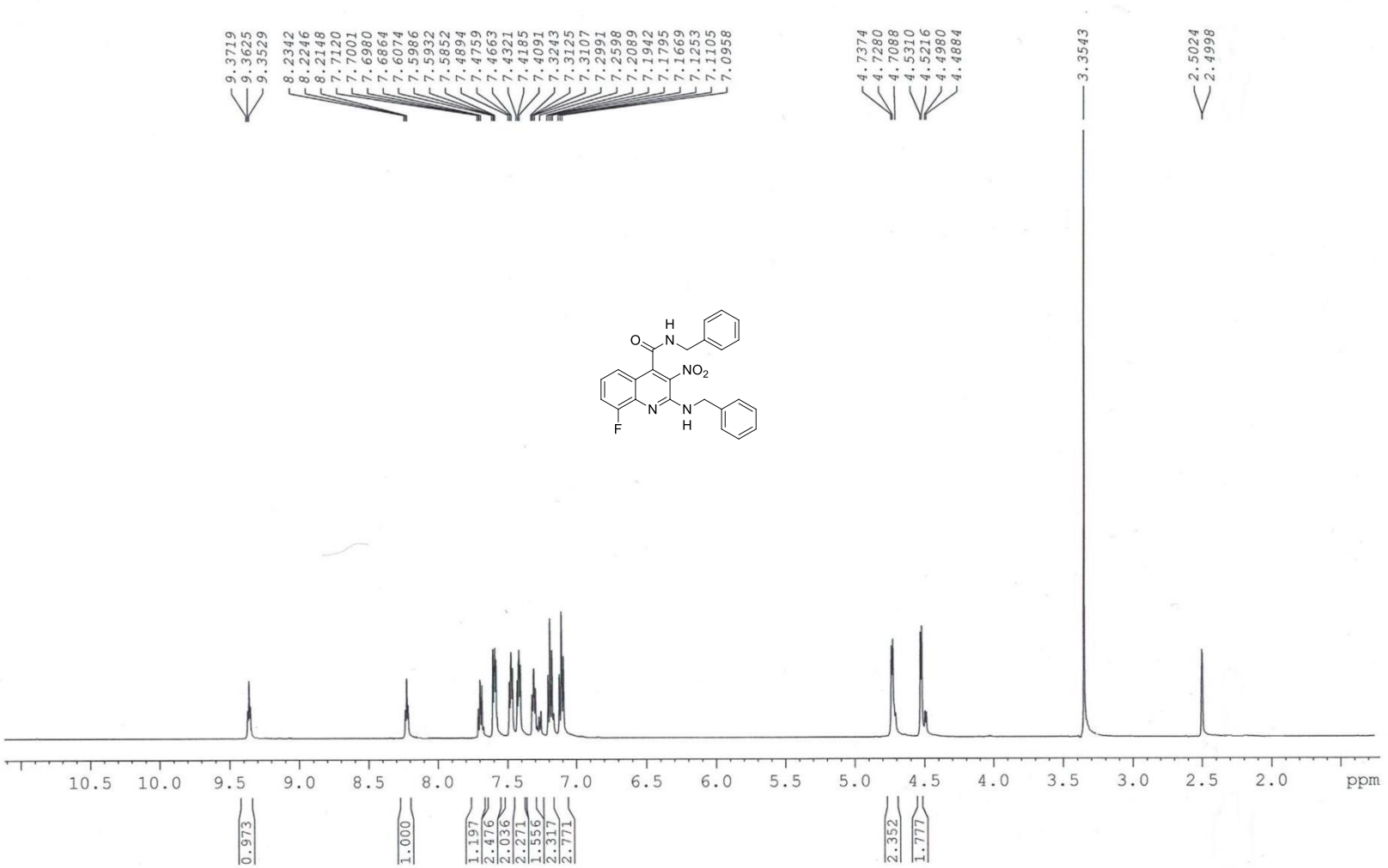


Figure S104. ^{1}H NMR (500 MHz, $CDCl_3$) spectra of compound **6gc**

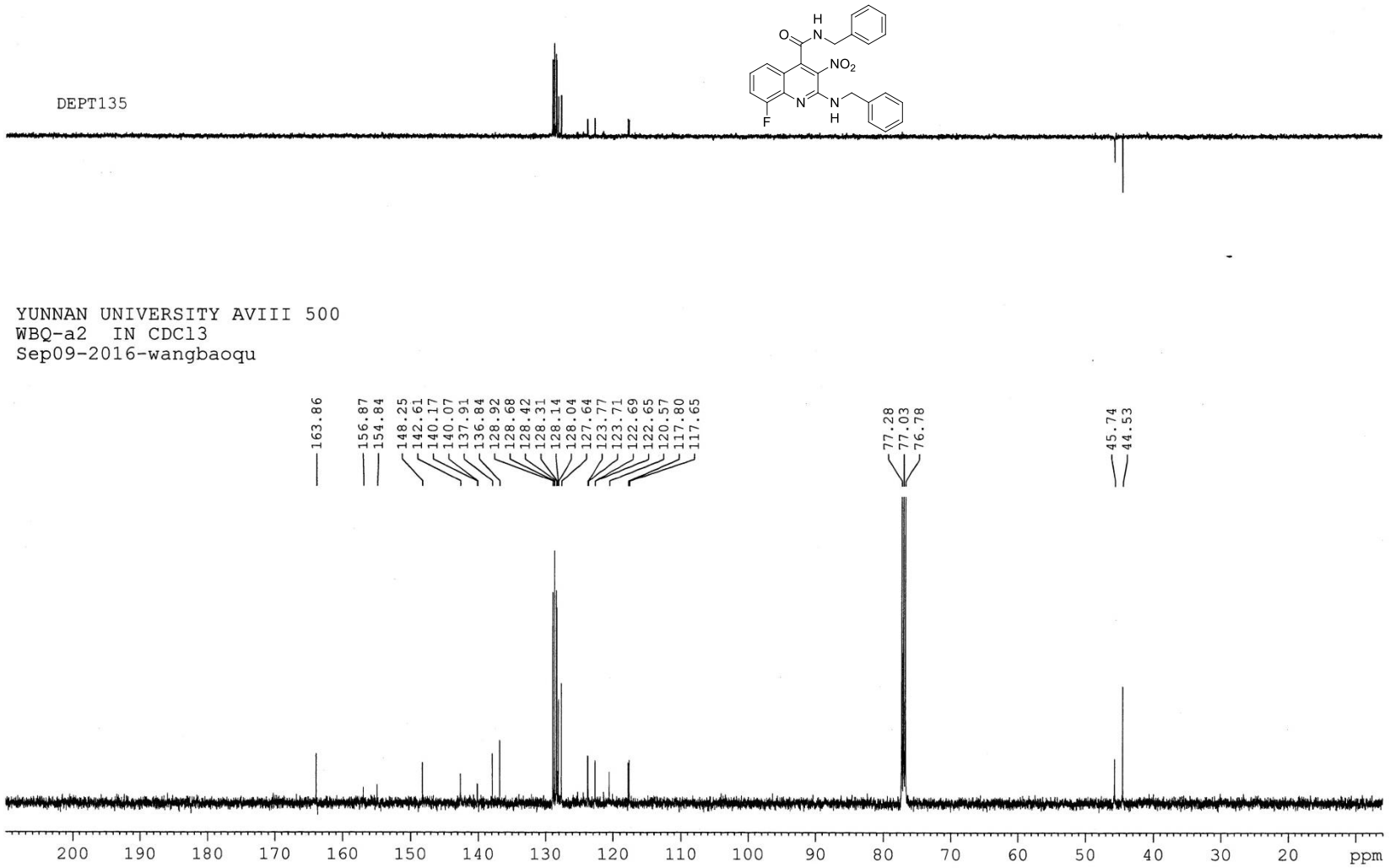


Figure S105. ^{13}C NMR (125 MHz, $CDCl_3$) spectra of compound **6gc**

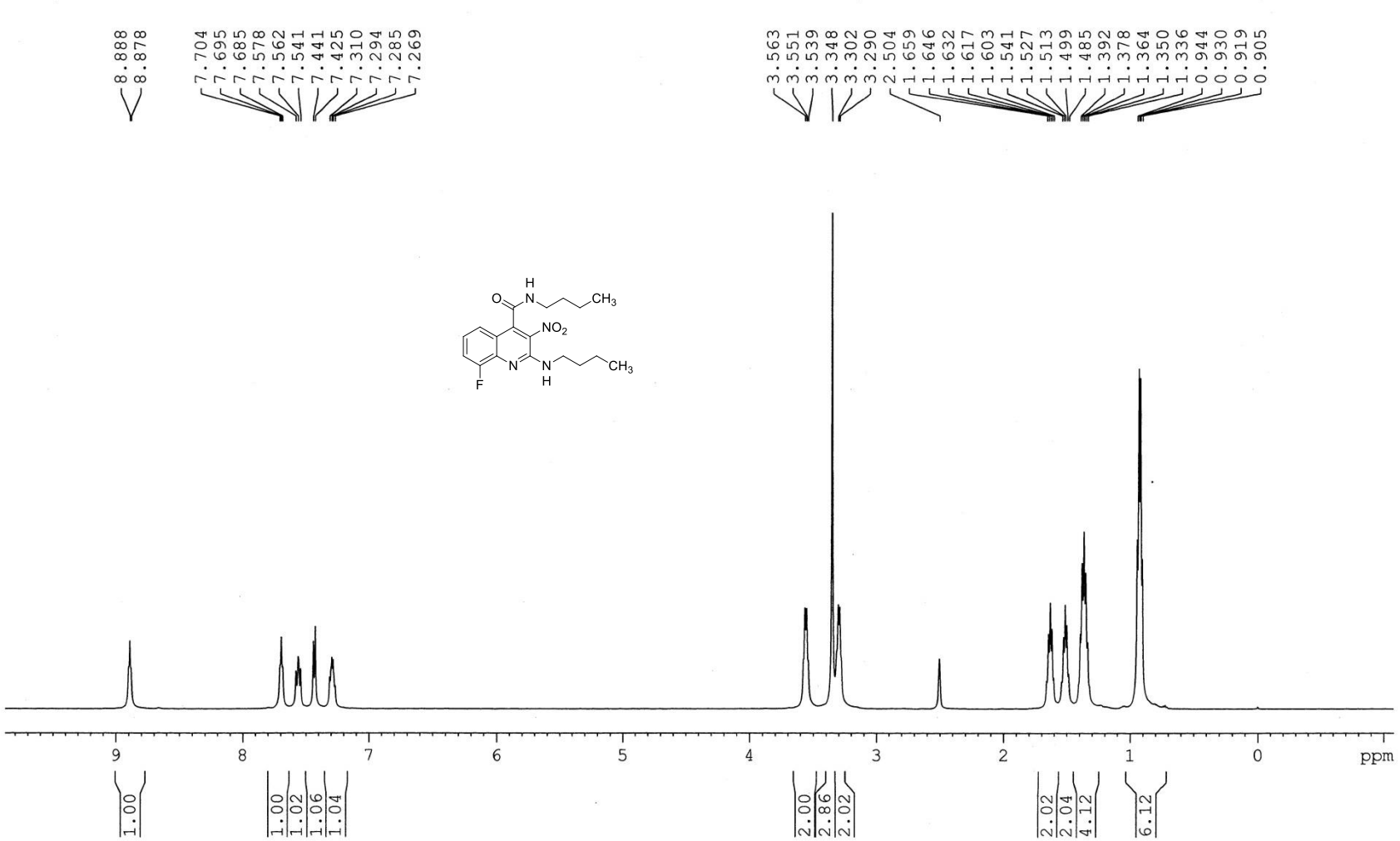


Figure S106. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6gk**

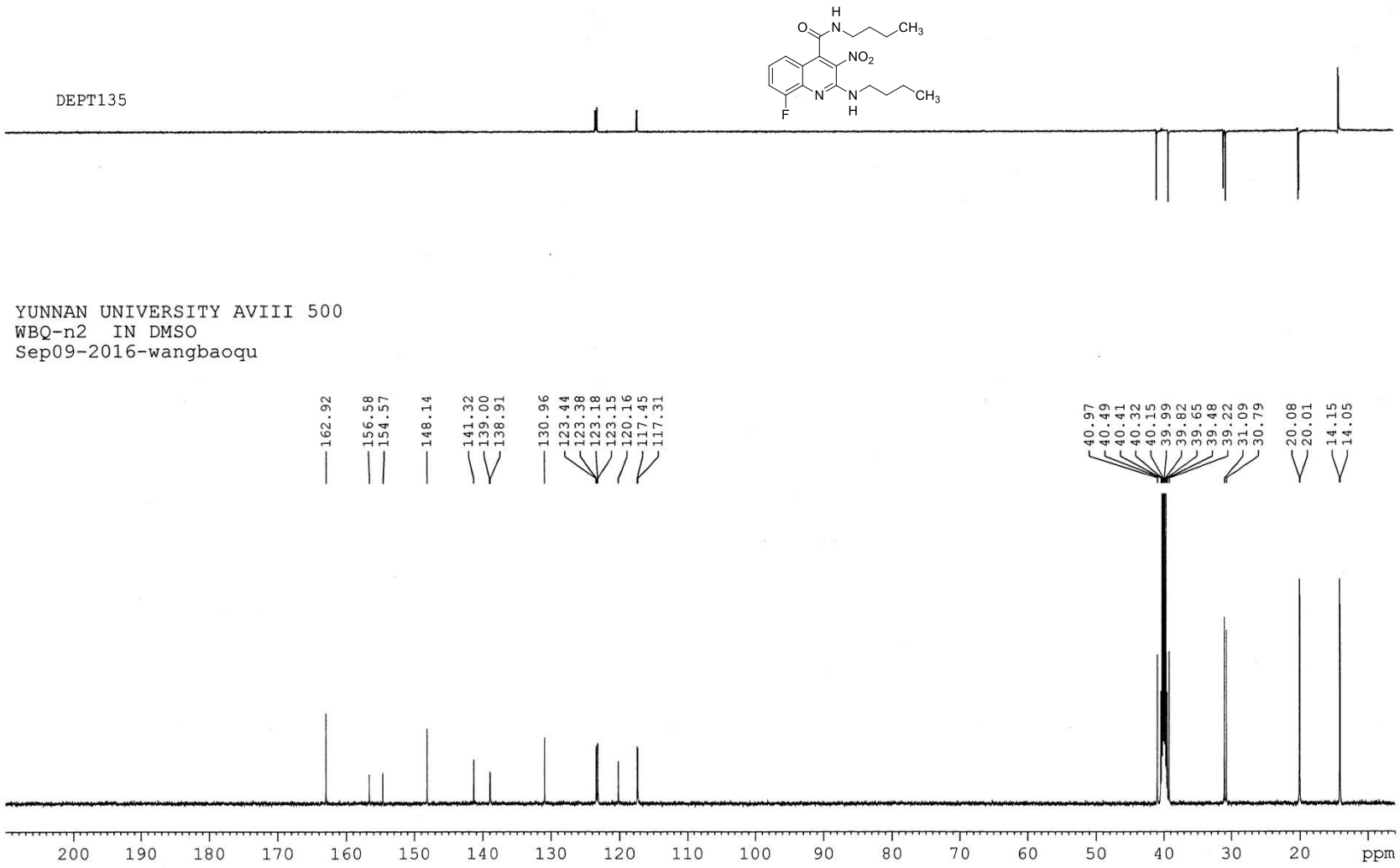


Figure S107. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6gk**

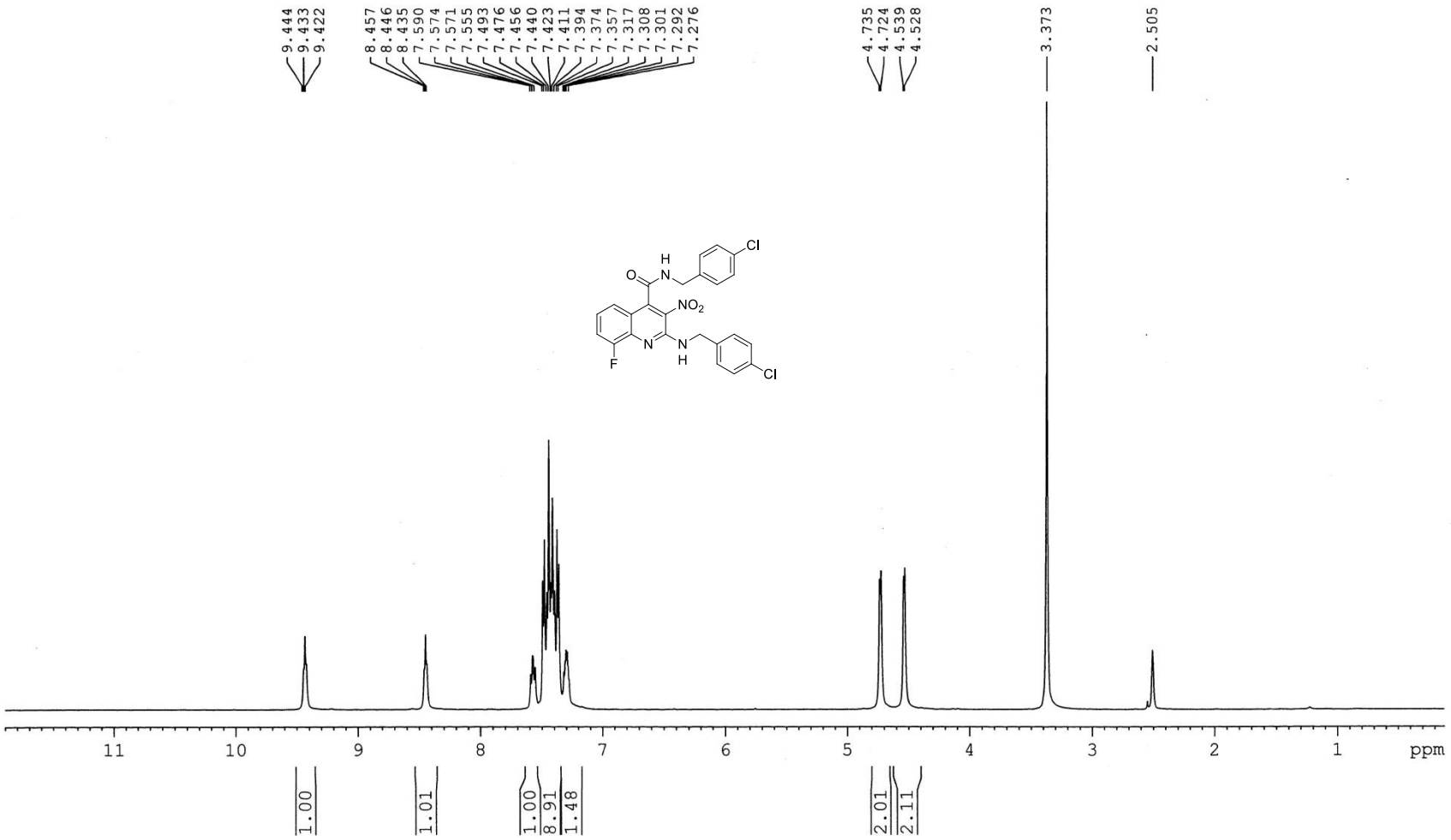


Figure S108. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6gn**

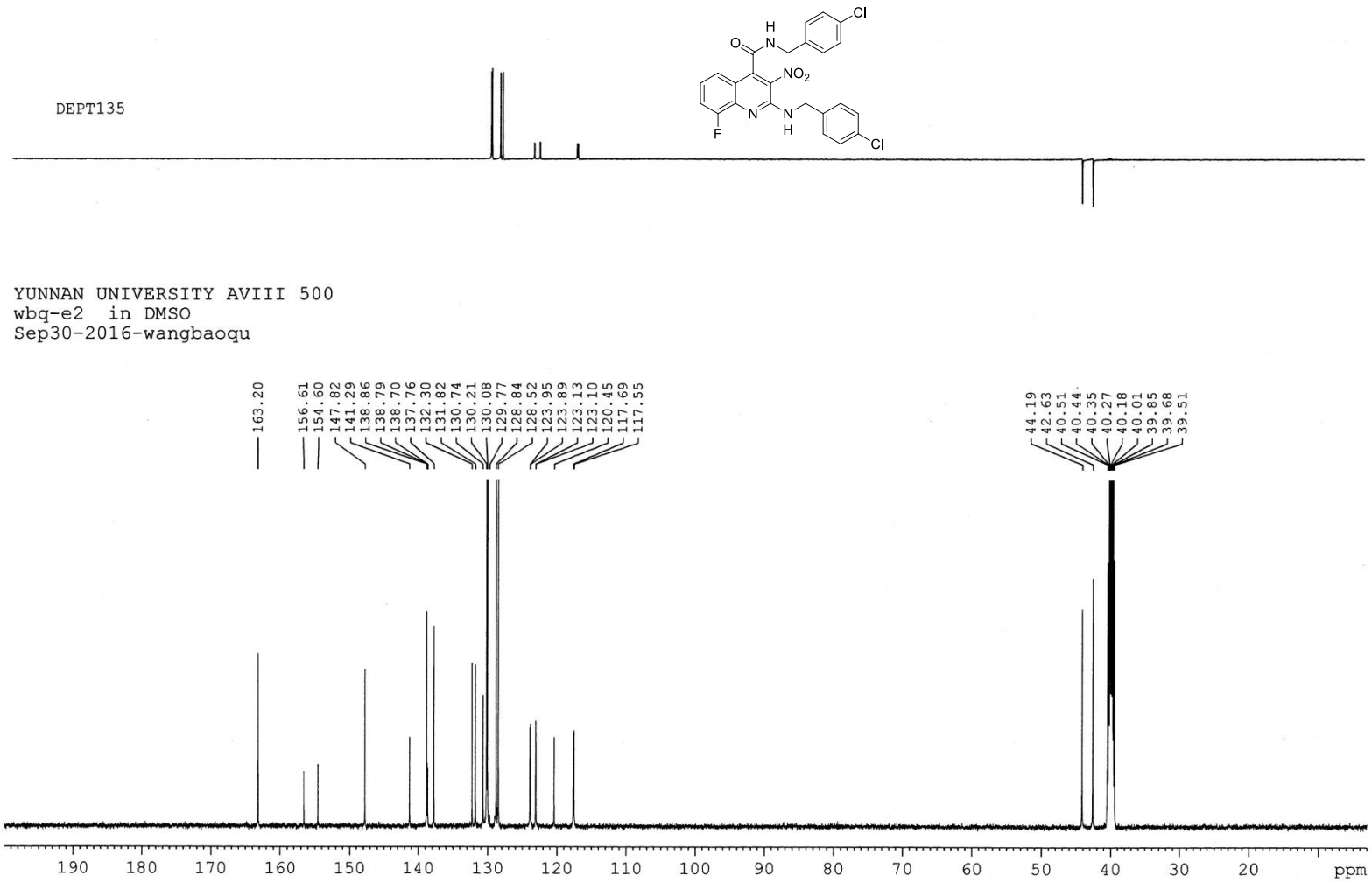


Figure S109. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6gn**

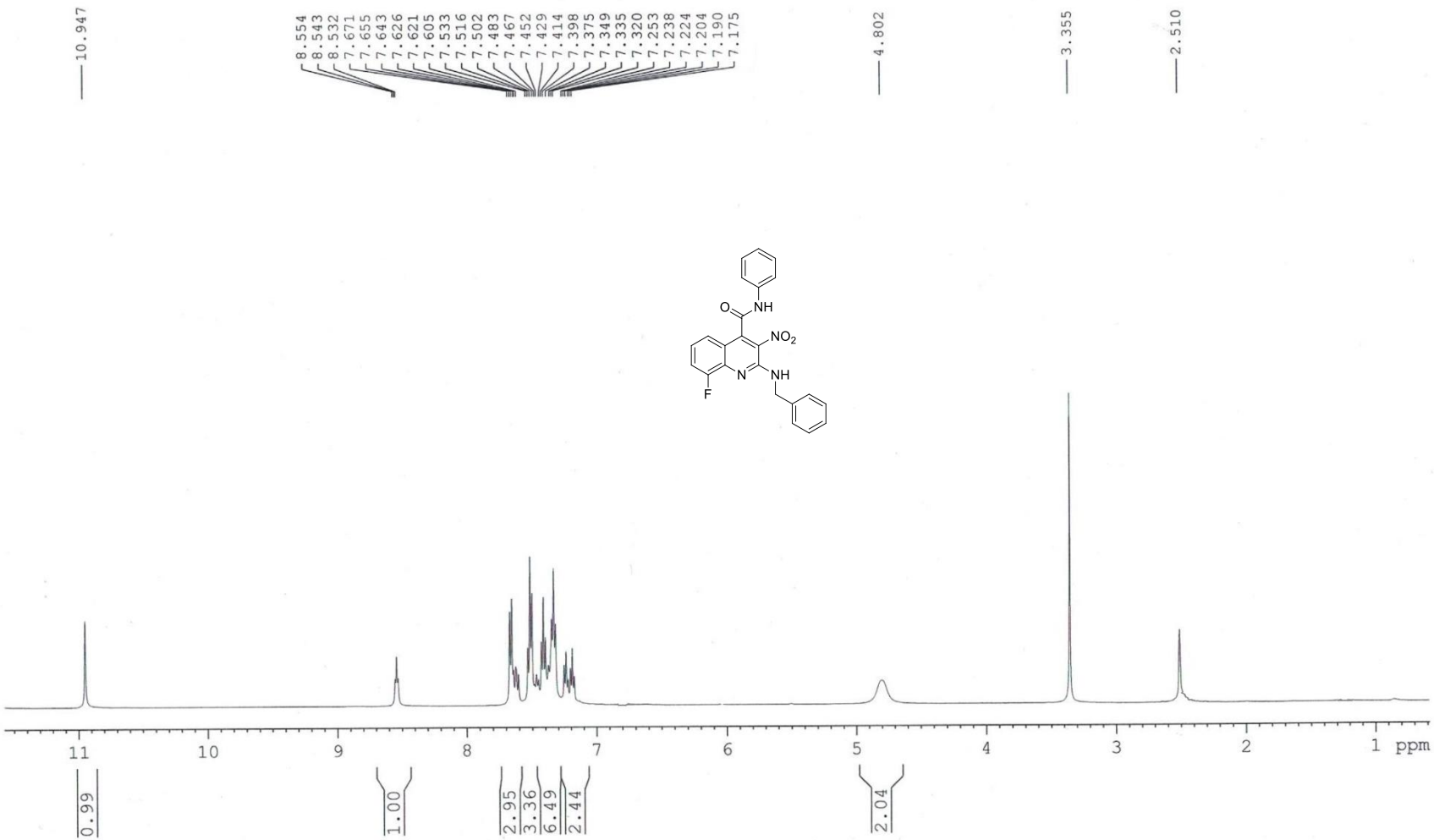


Figure S110. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6go**

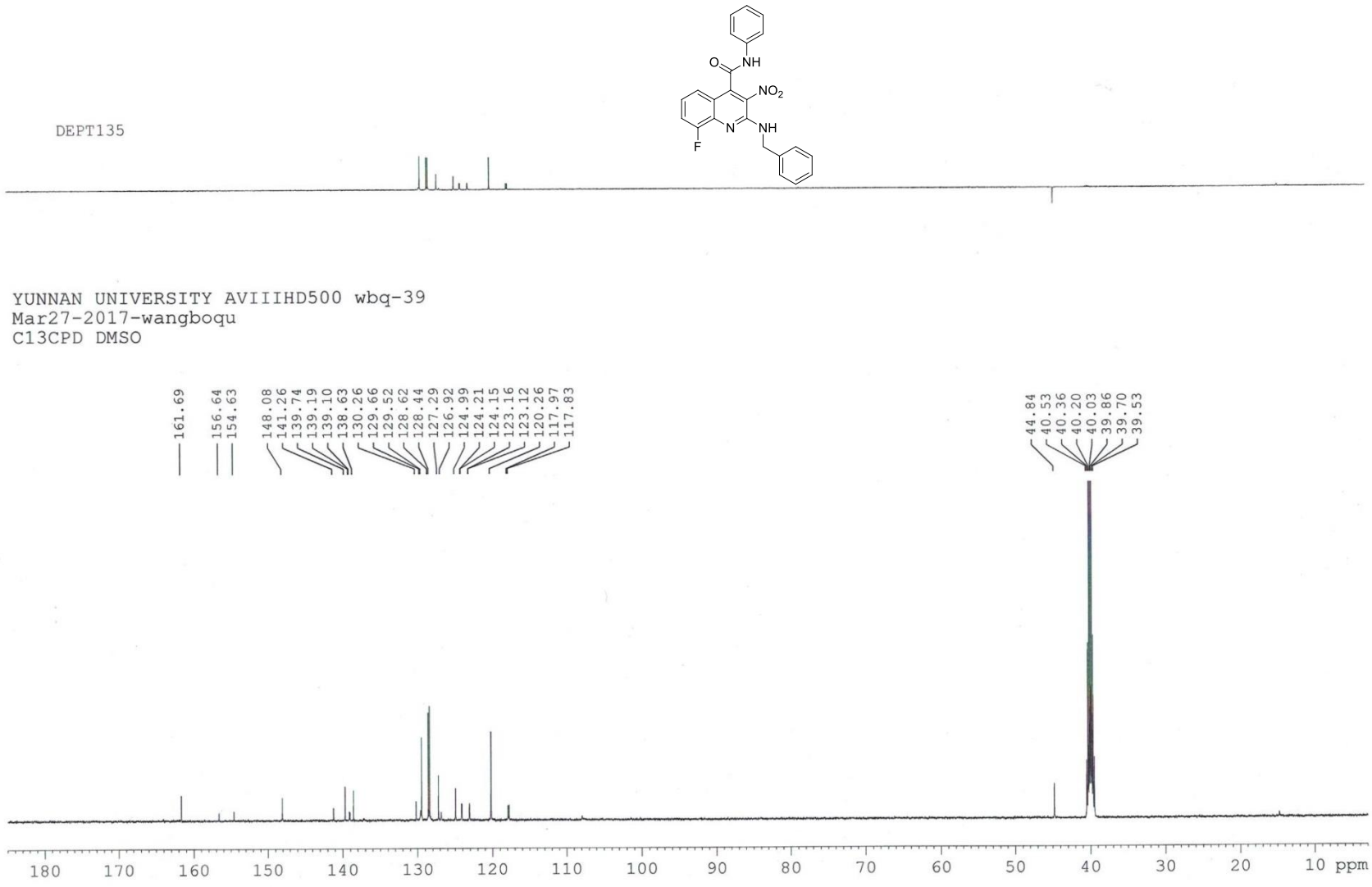


Figure S111. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6go**

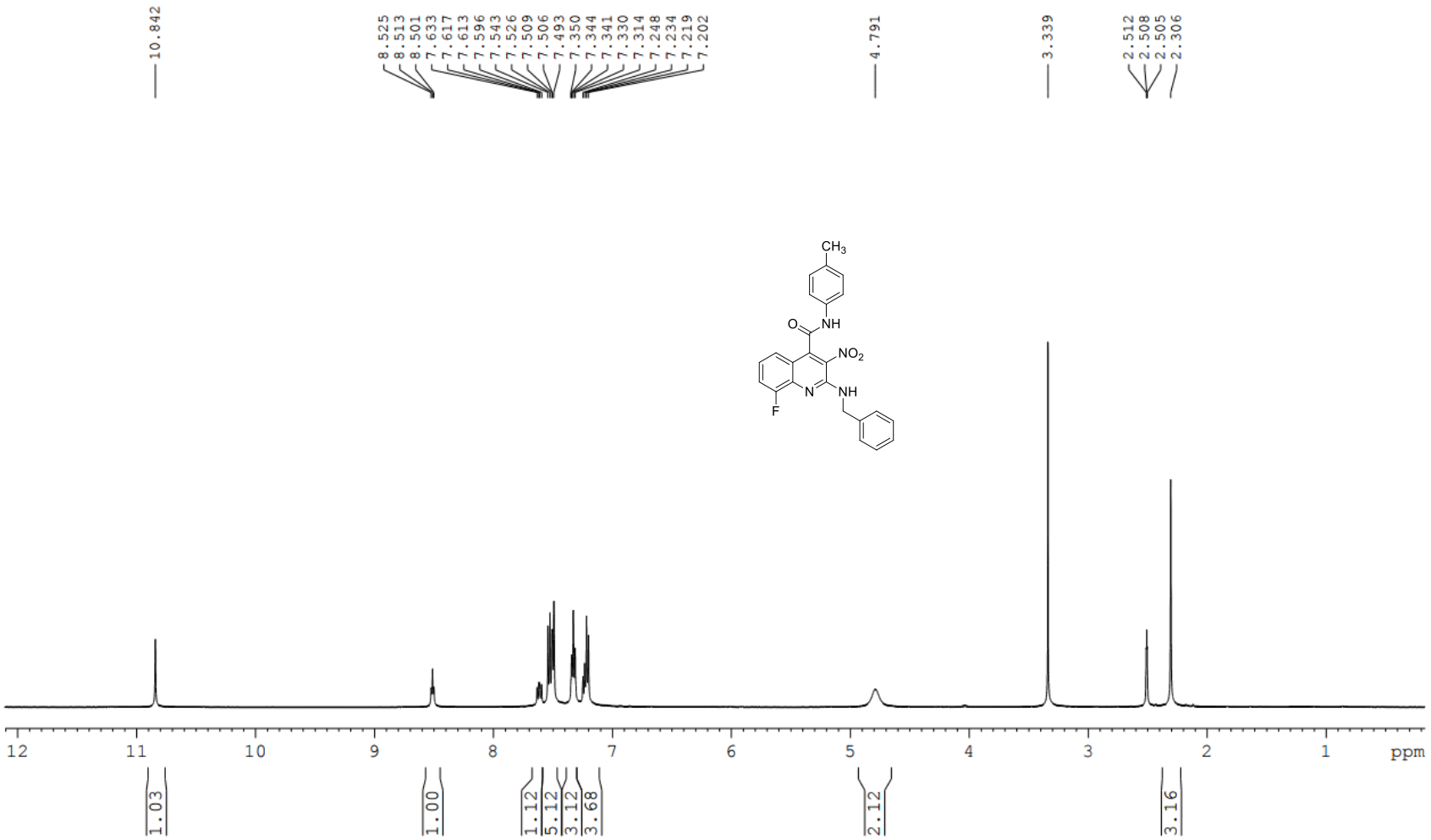


Figure S112. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **6gp**

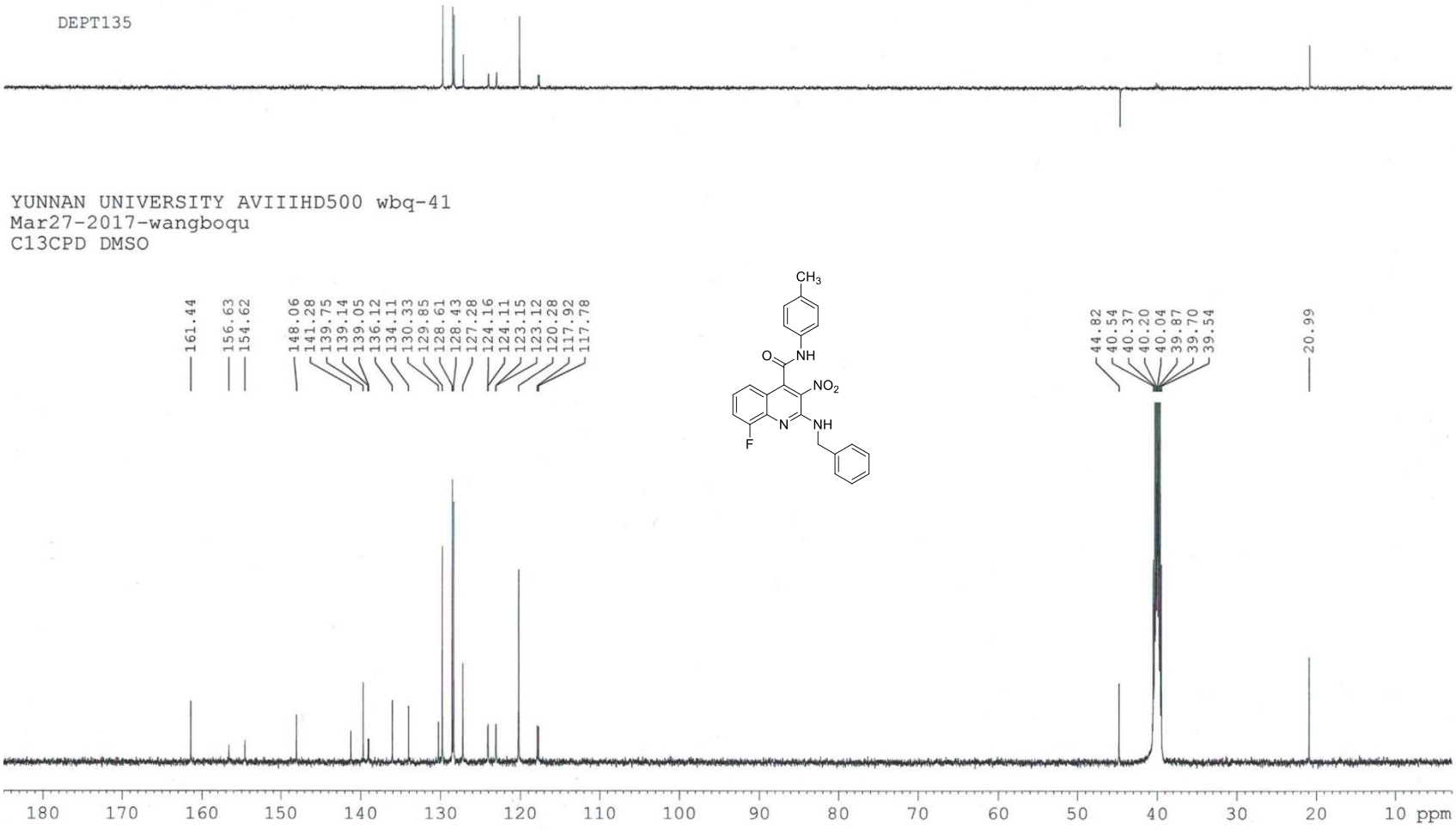


Figure S113. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **6gp**

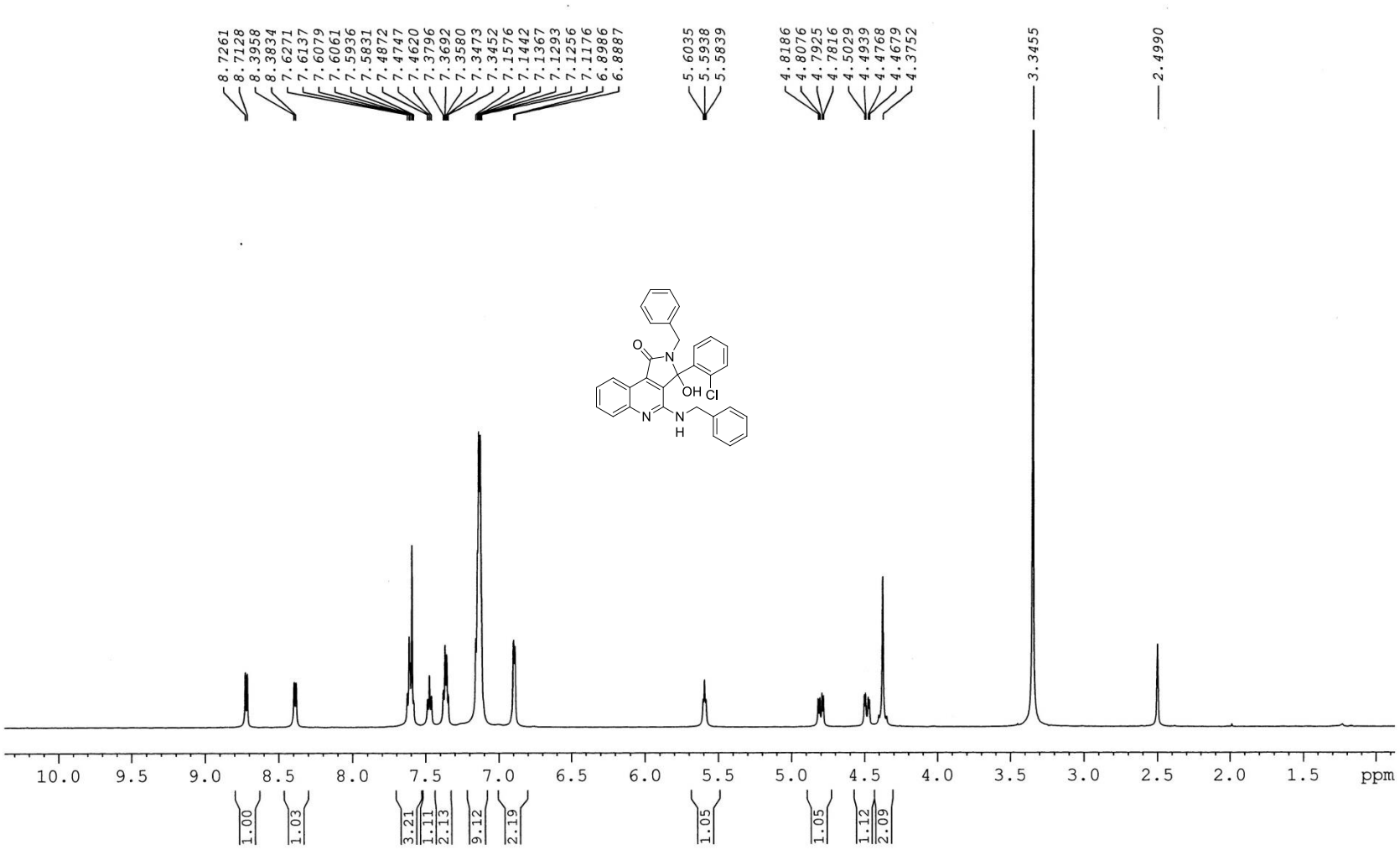


Figure S114. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **7aa**

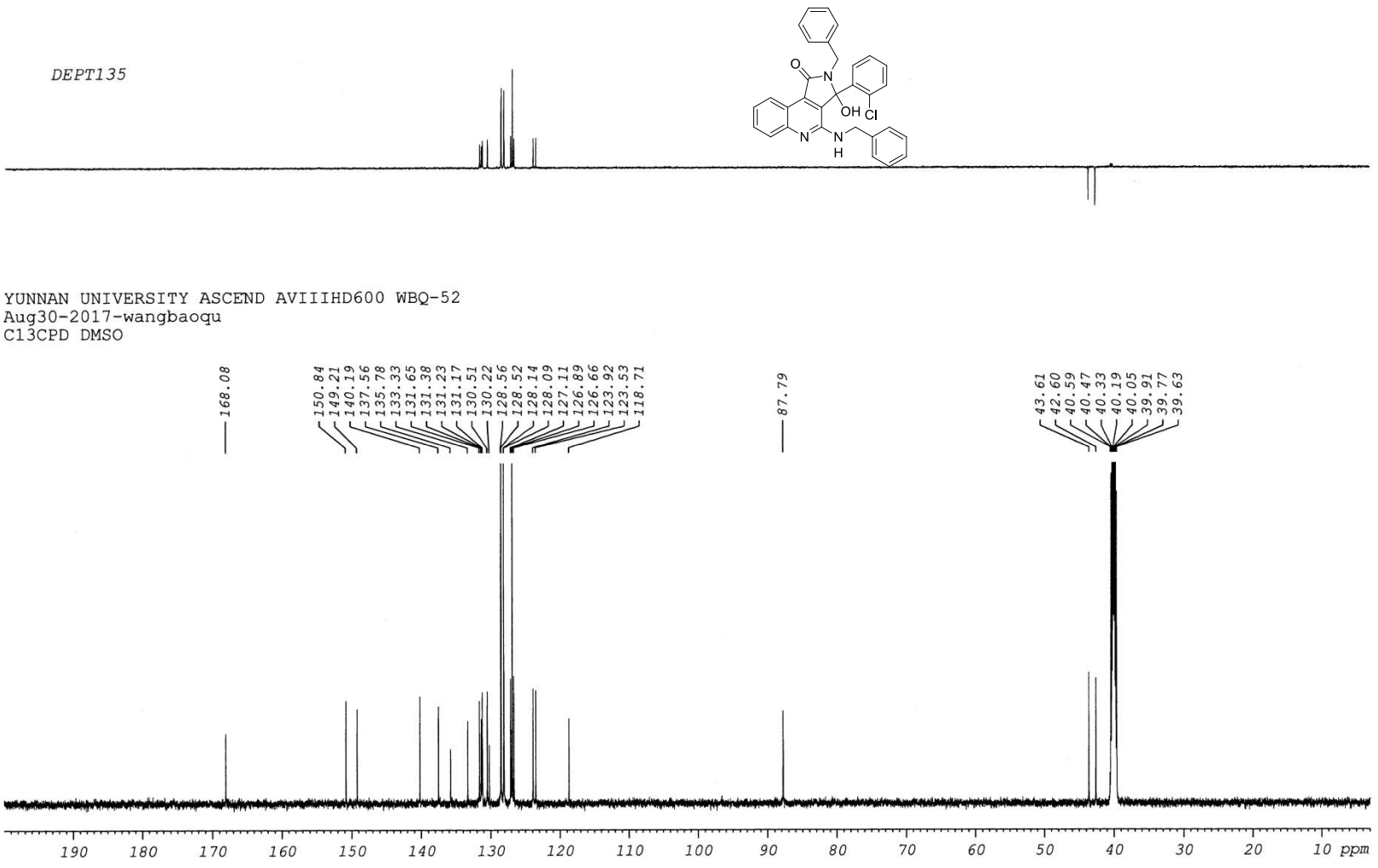


Figure S115. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **7aa**

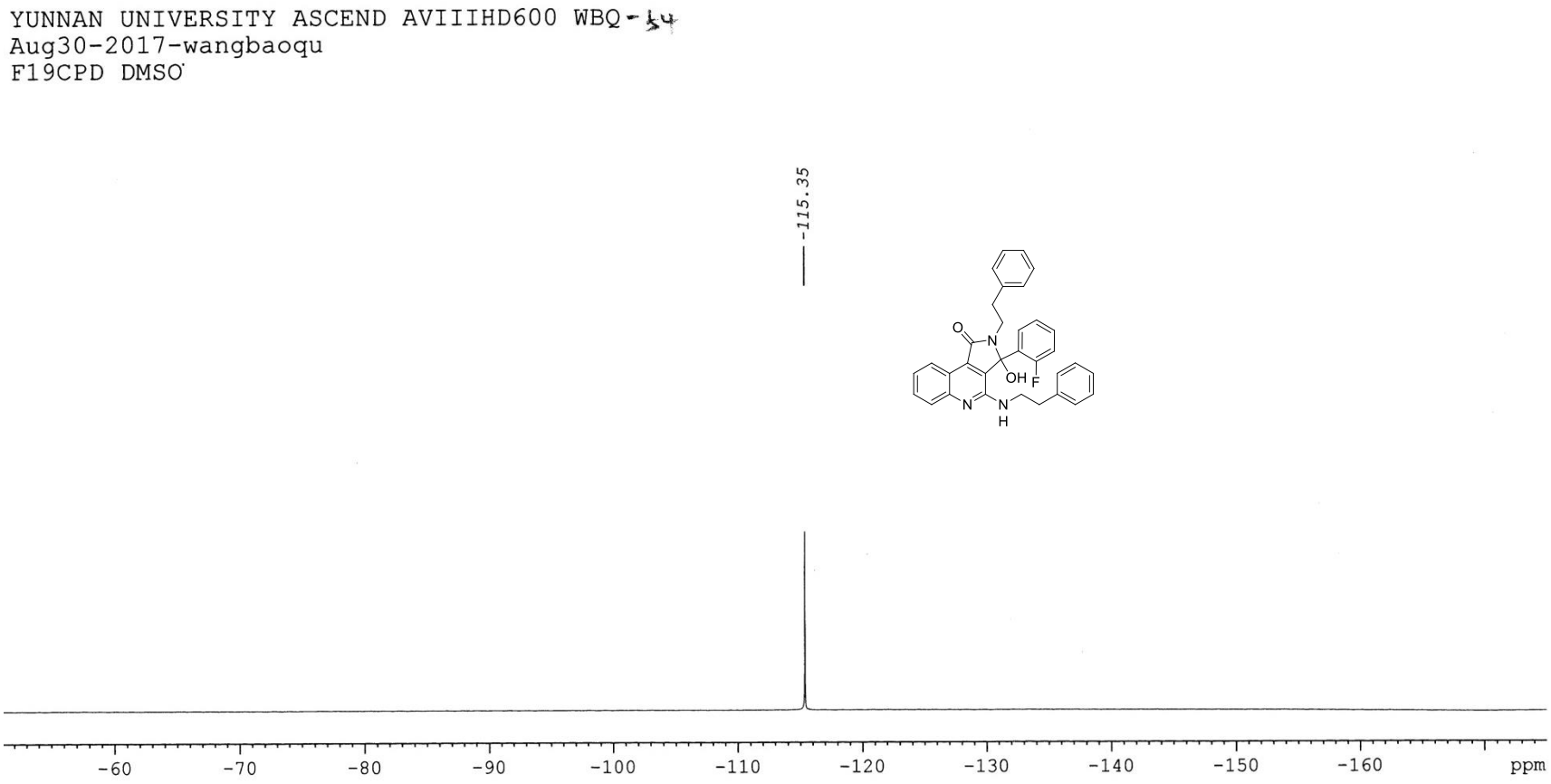


Figure S116. ^{19}F NMR (575 MHz, DMSO-d_6) spectra of compound **7ab**

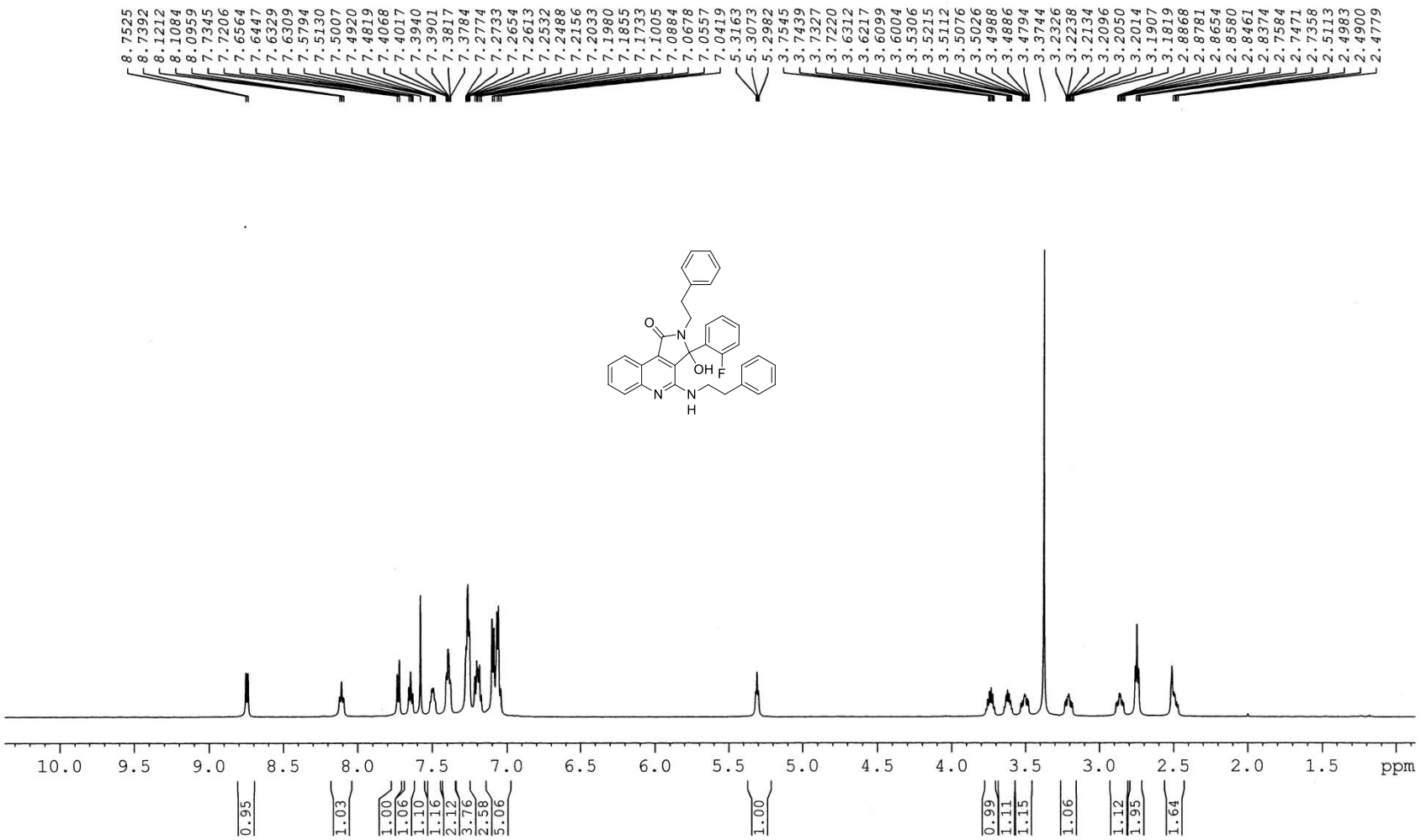


Figure S117. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **7ab**

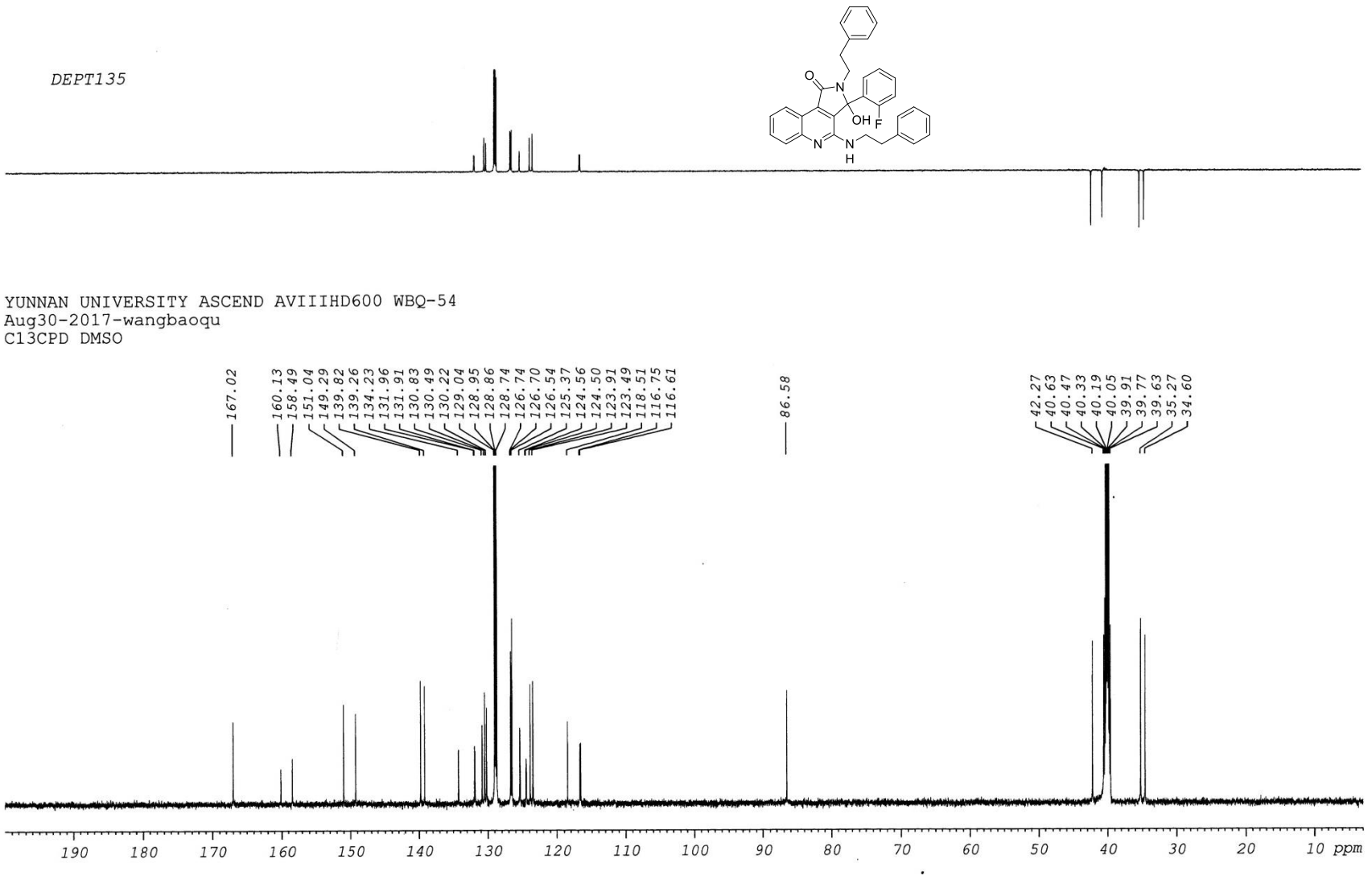


Figure S118. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **7ab**

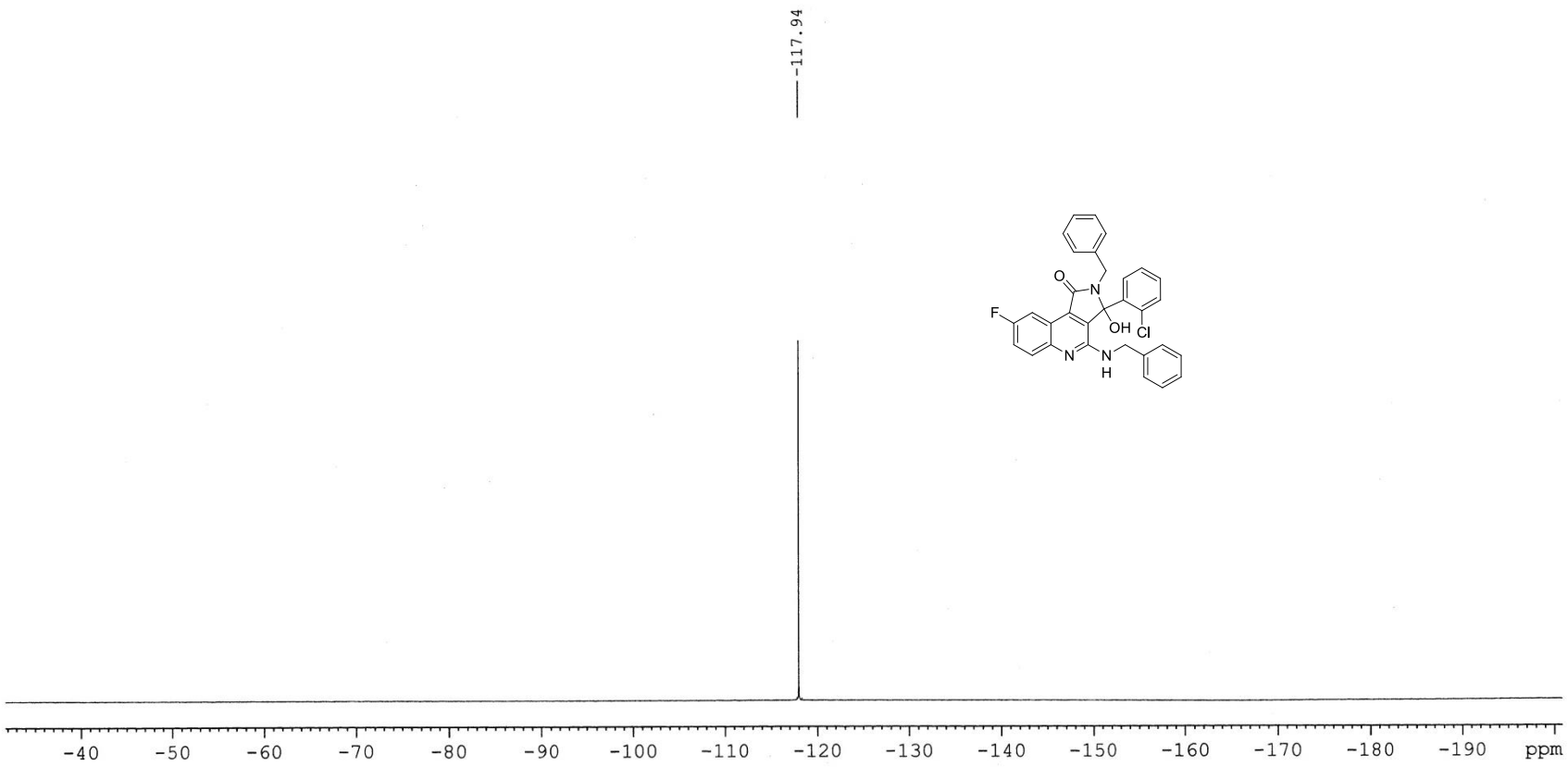


Figure S119. ^{19}F NMR (475 MHz, DMSO-d_6) spectra of compound **7da**

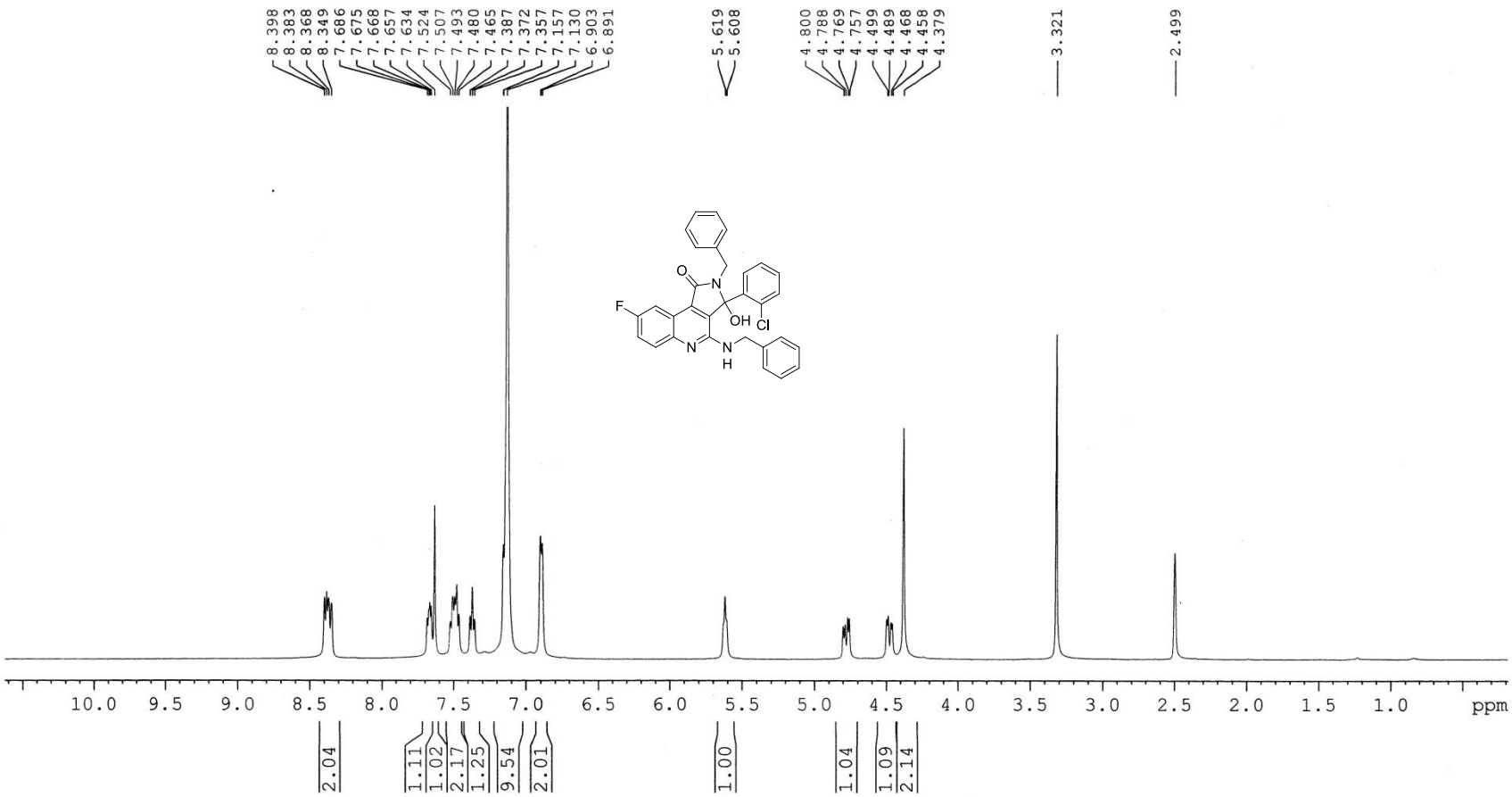


Figure S120. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7da**

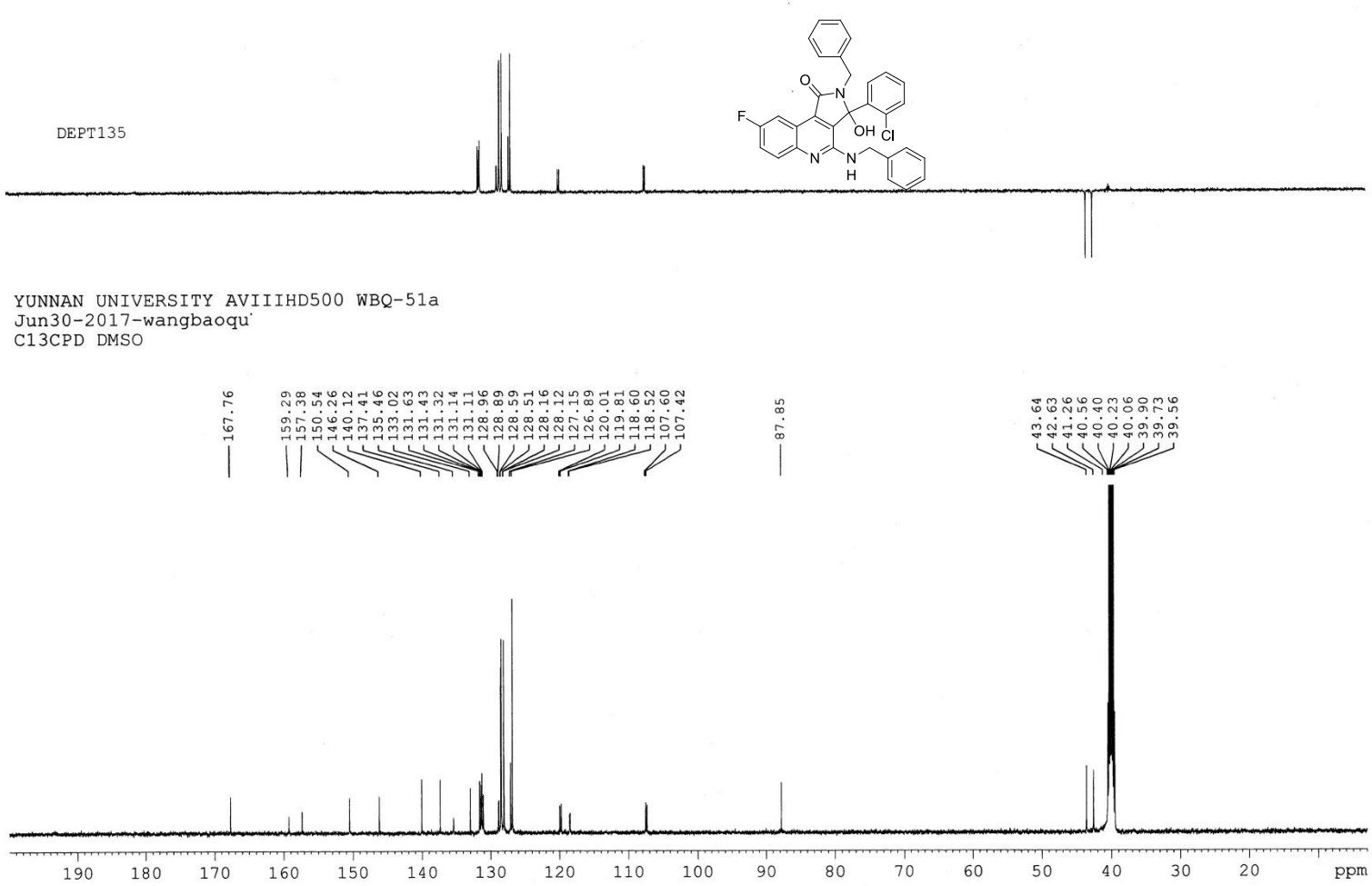


Figure S121. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7da**

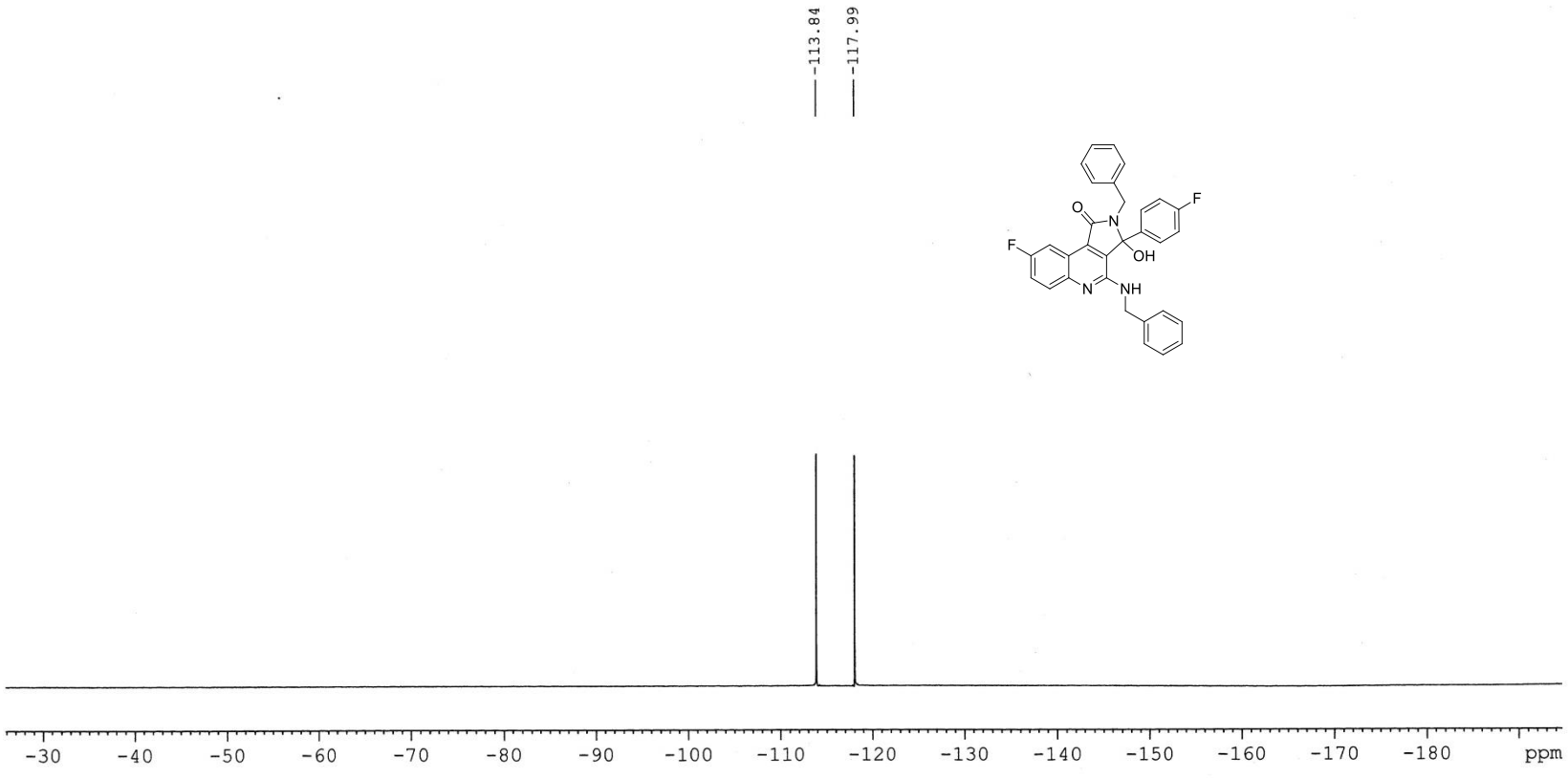


Figure S122. ^{19}F NMR (475 MHz, DMSO-d_6) spectra of compound **7dc**

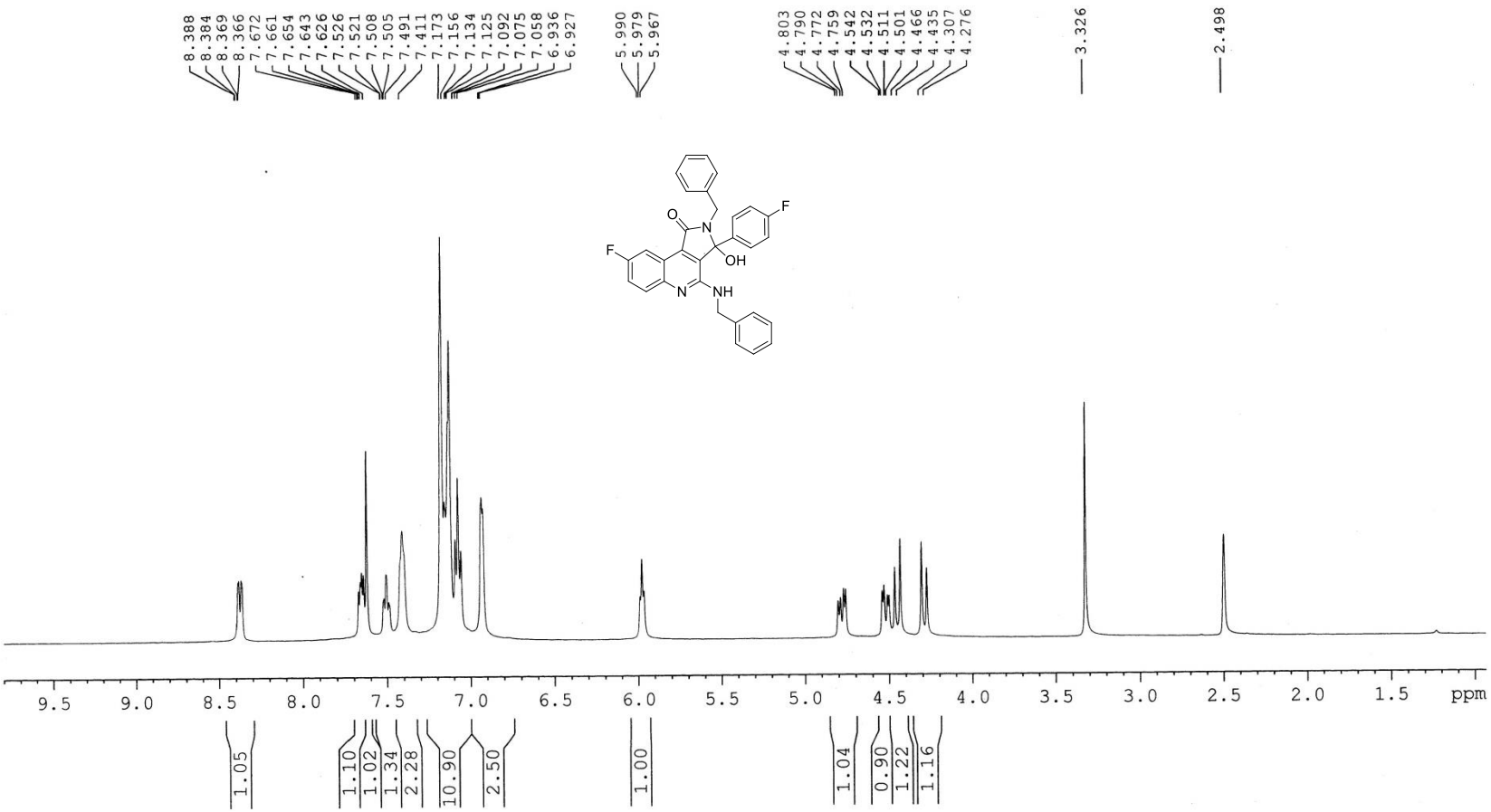


Figure S123. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7dc**

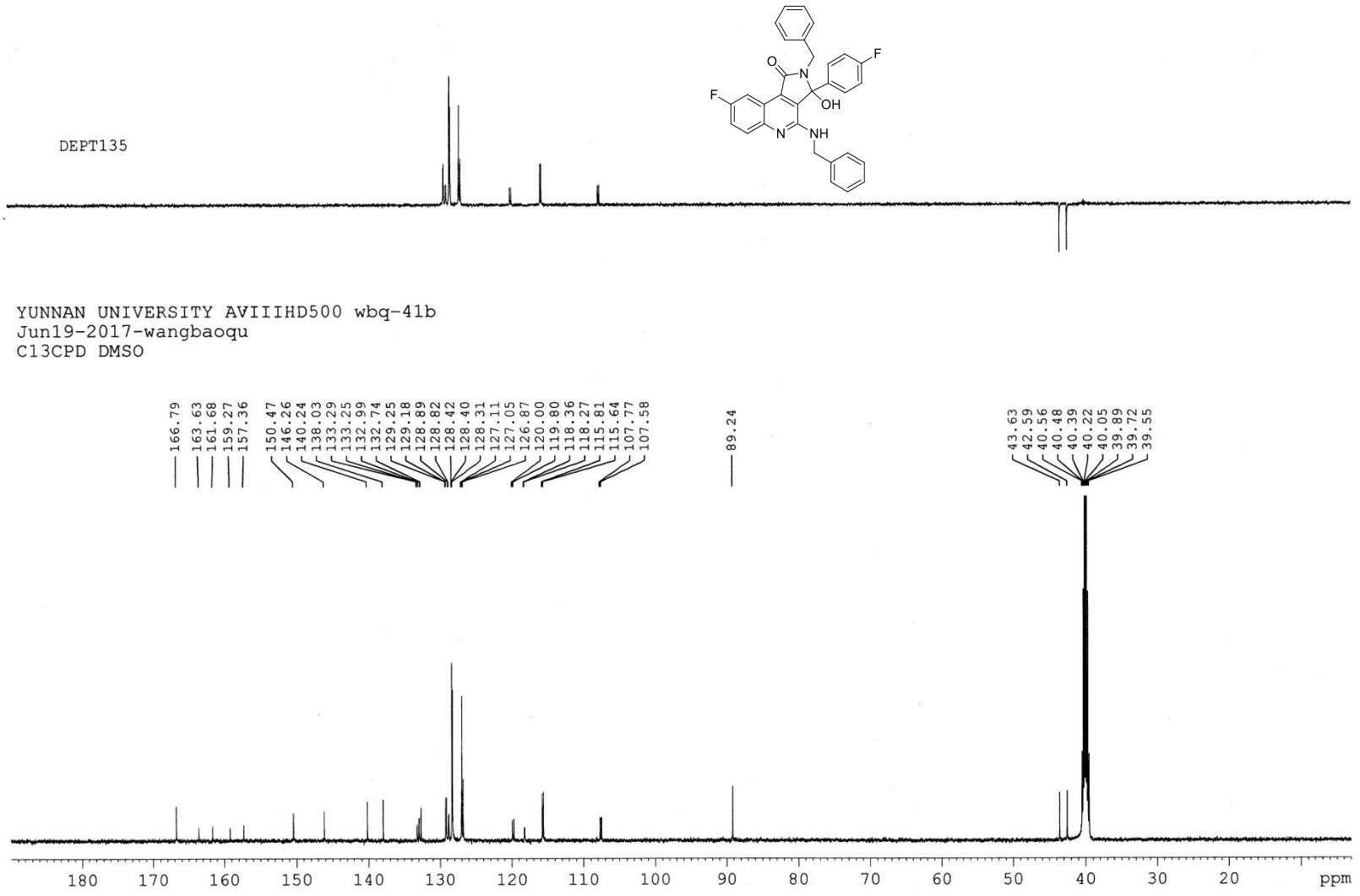


Figure S124. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7dc**

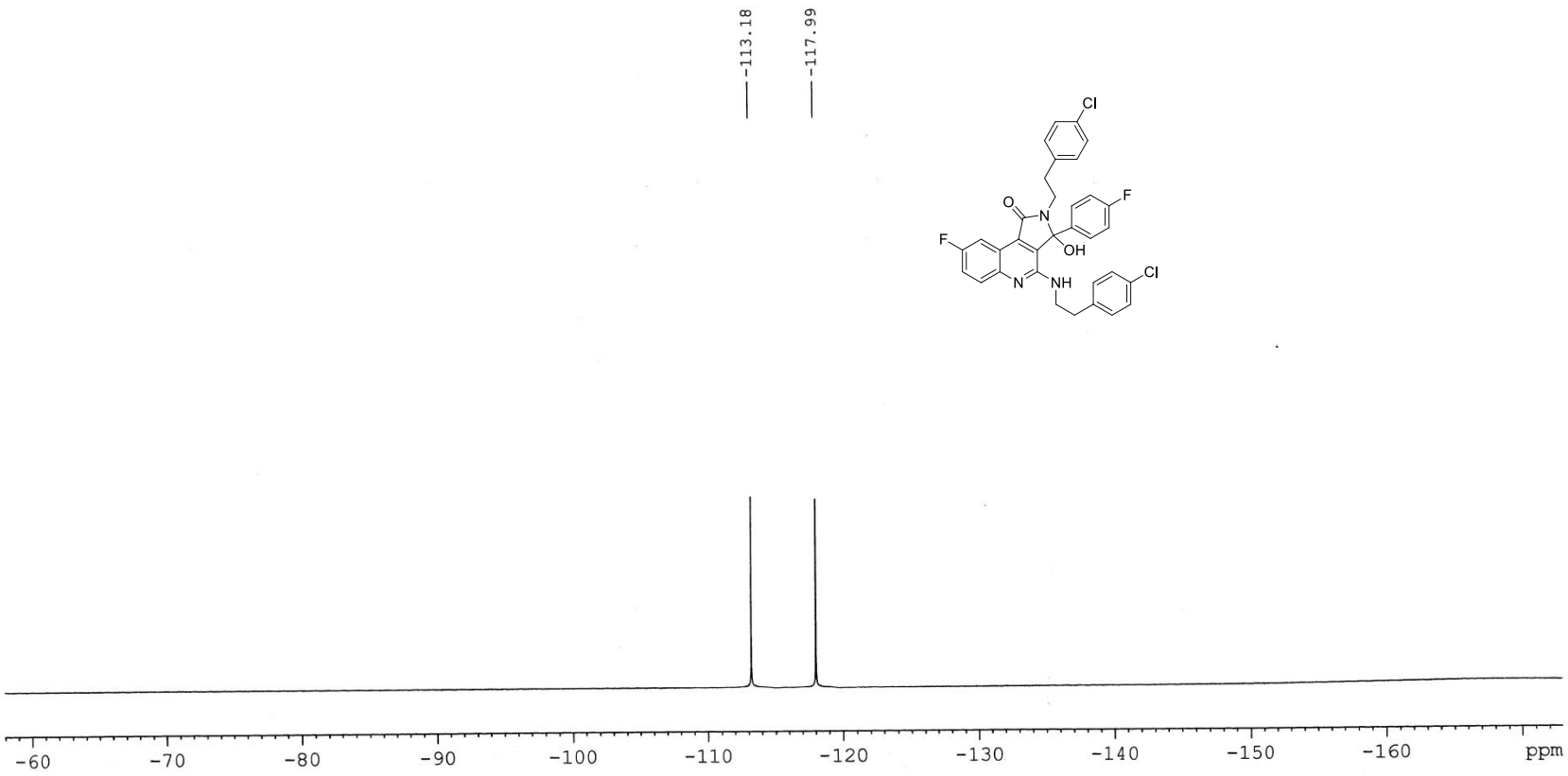


Figure S125. ^{19}F NMR (475 MHz, DMSO-d_6) spectra of compound **7dd**

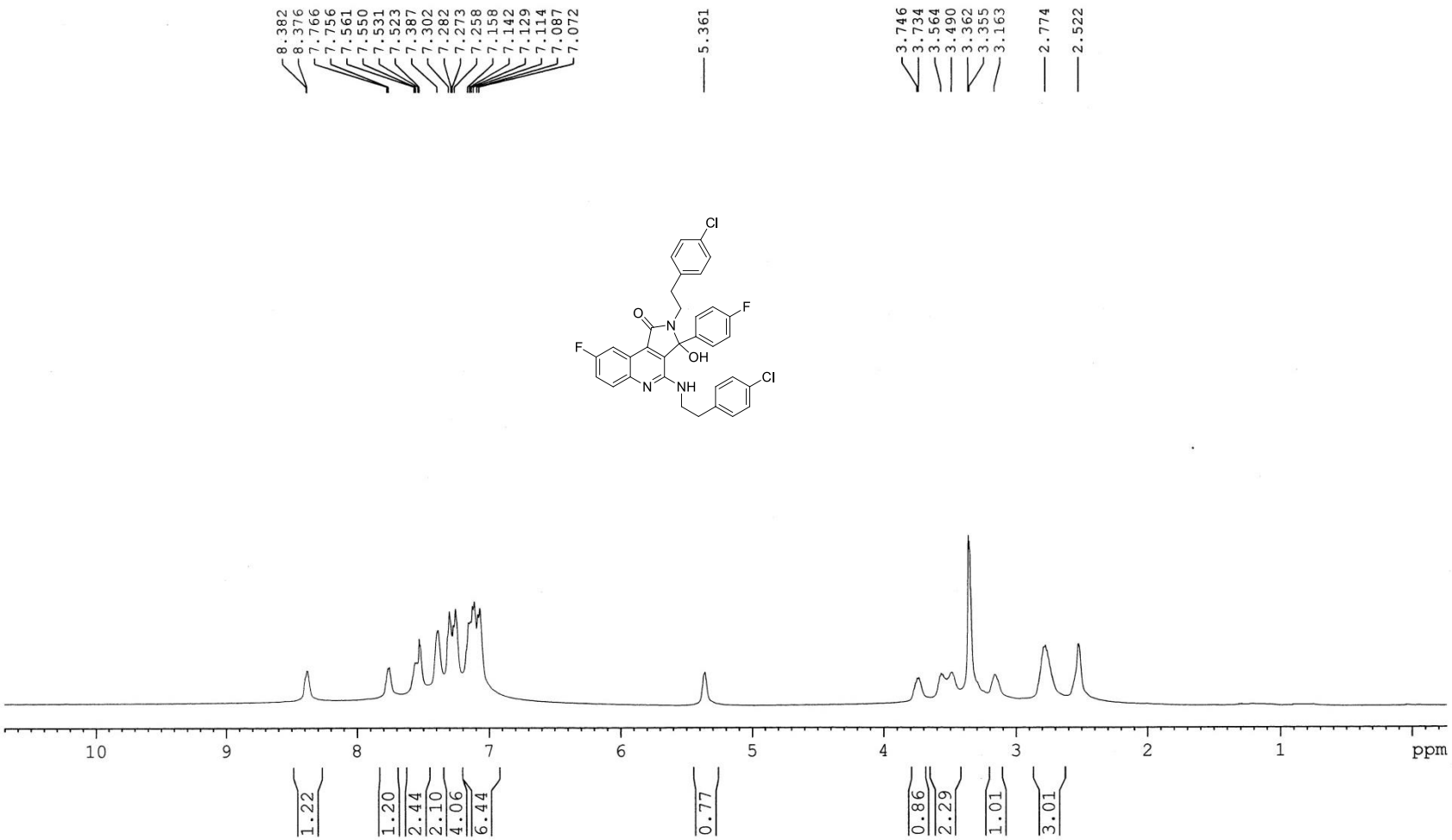


Figure S126. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7dd**

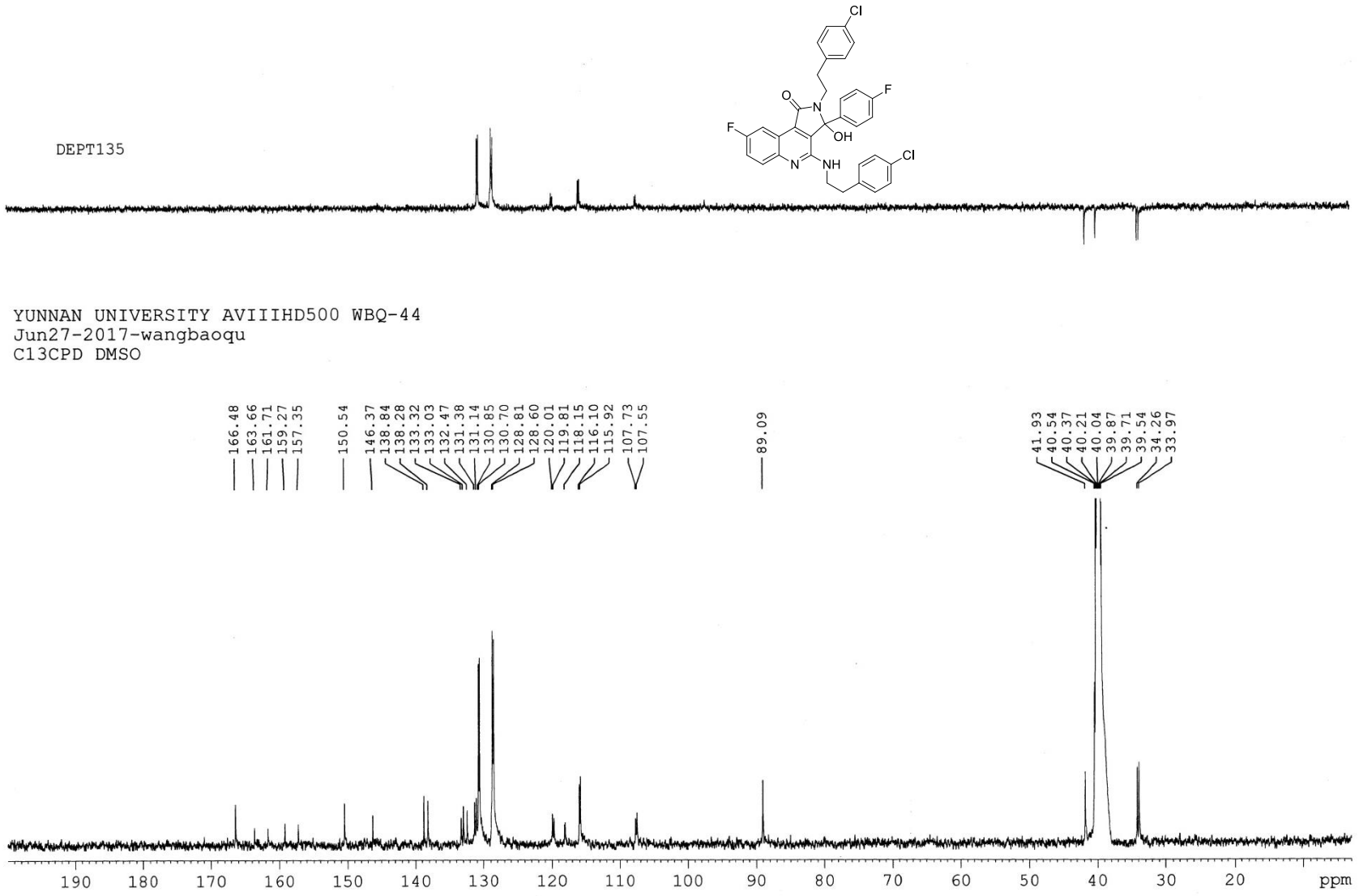


Figure S127. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7dd**

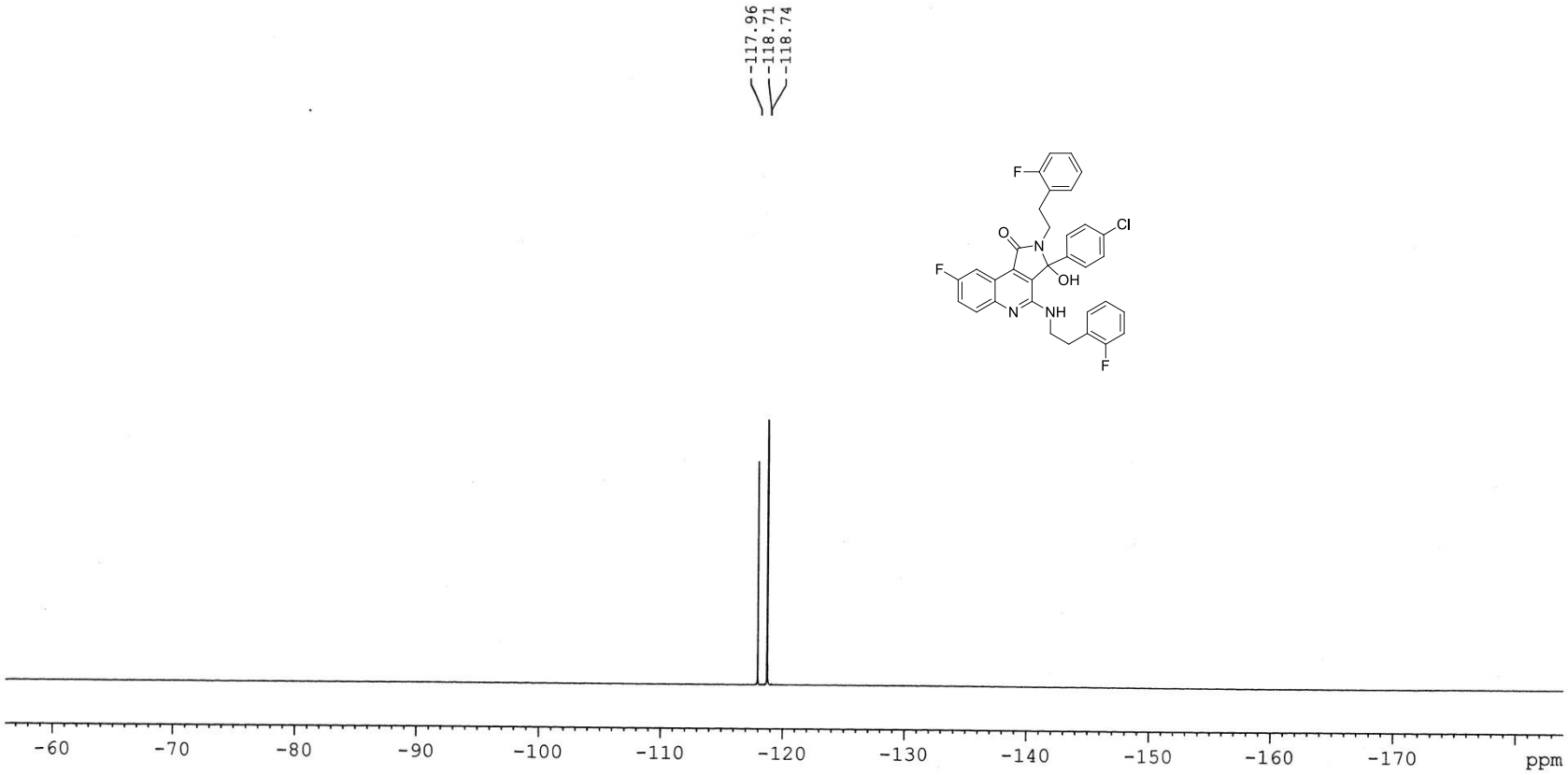


Figure S128. ^{19}F NMR (475 MHz, DMSO-d_6) spectra of compound **7de**

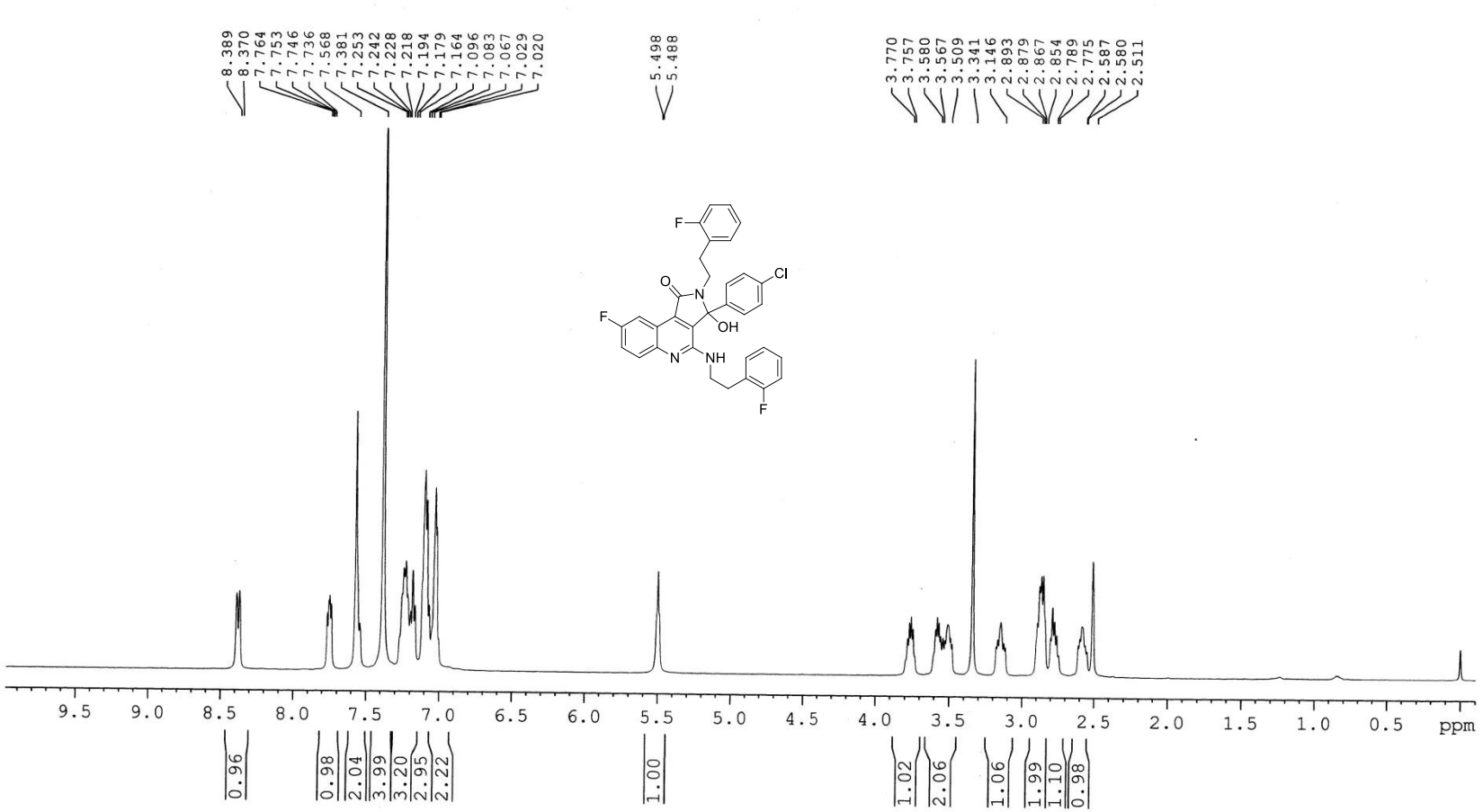


Figure S129. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7de**

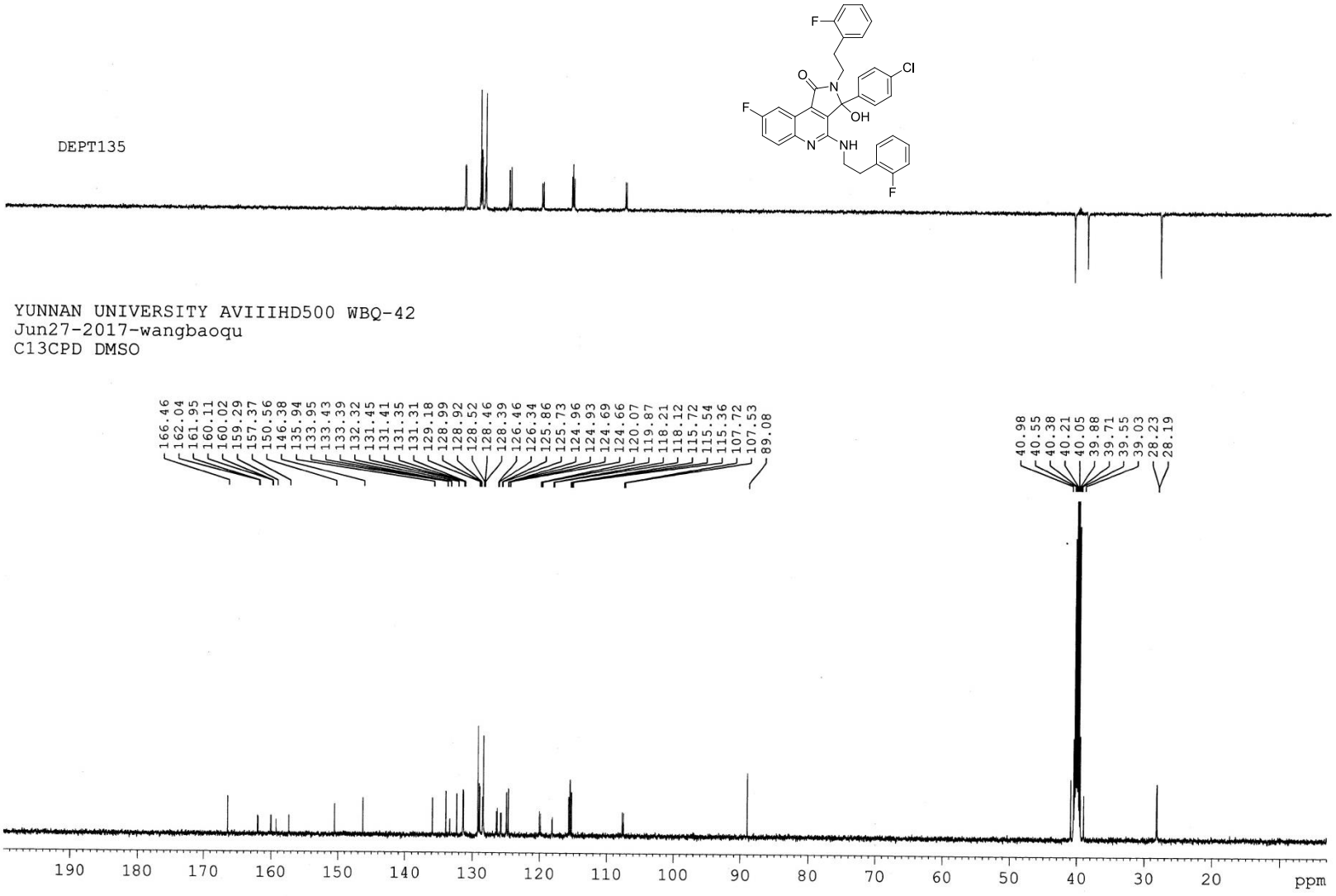


Figure S130. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7de**

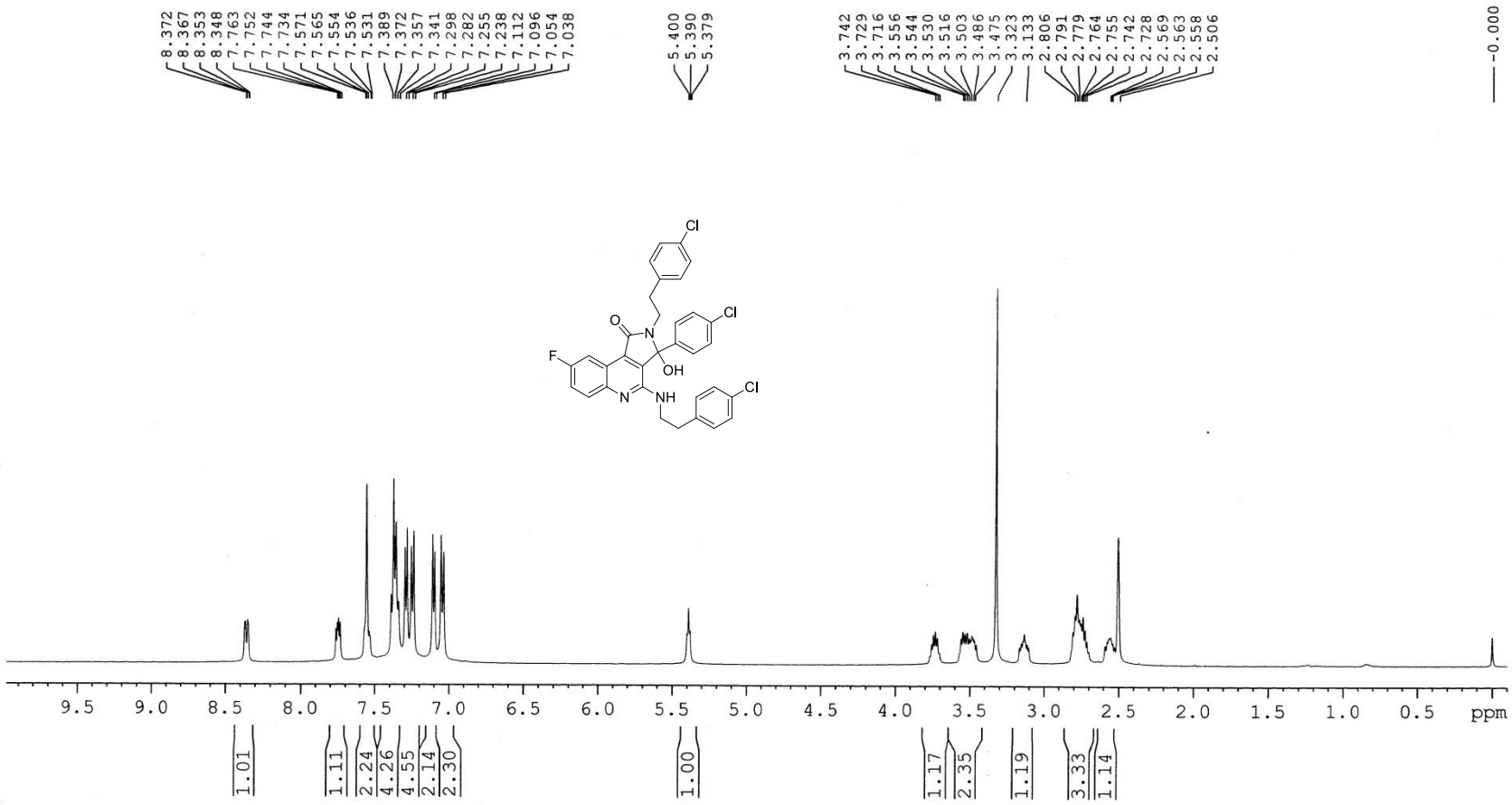


Figure S131. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7df**

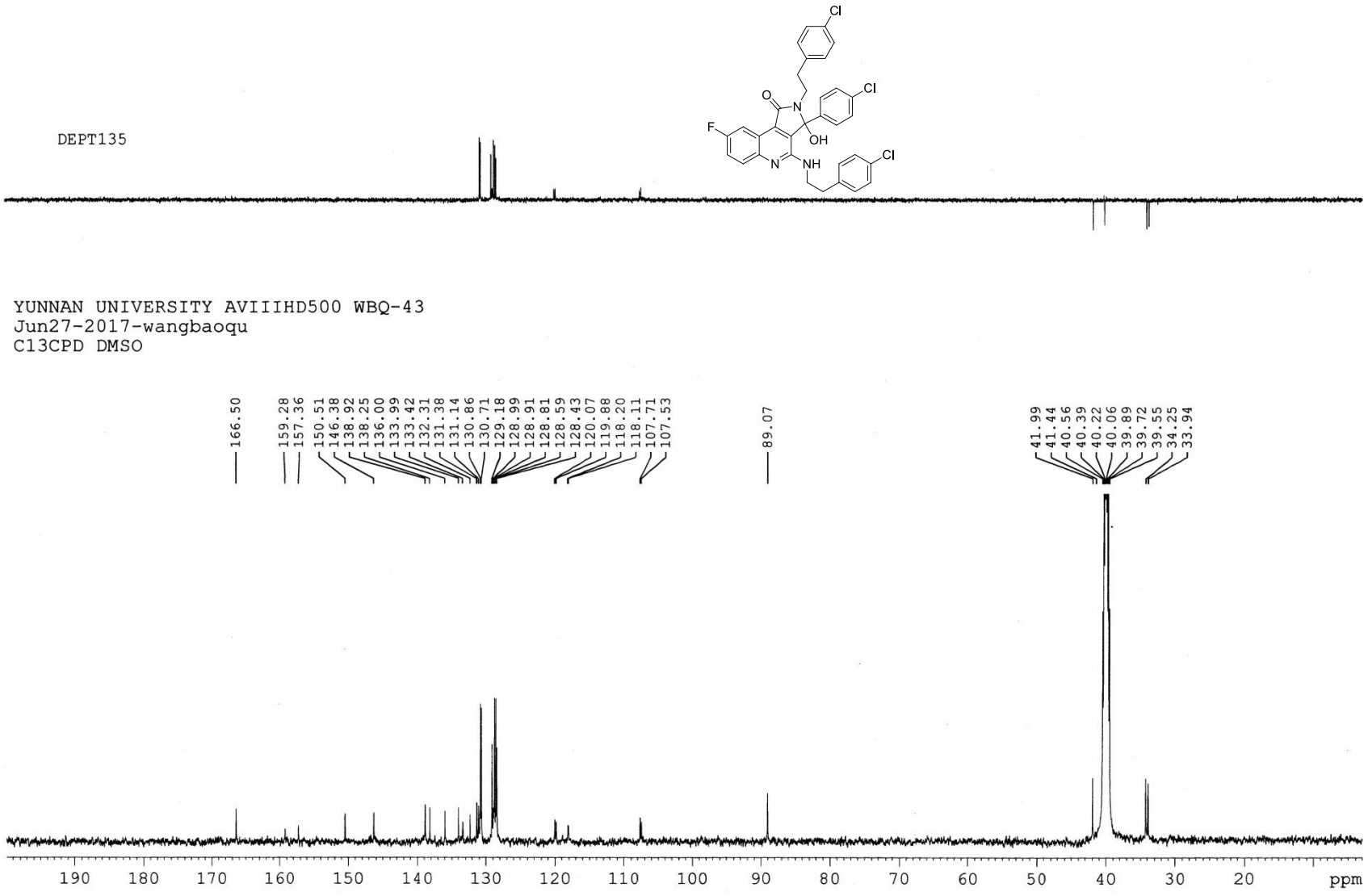


Figure S132. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7df**

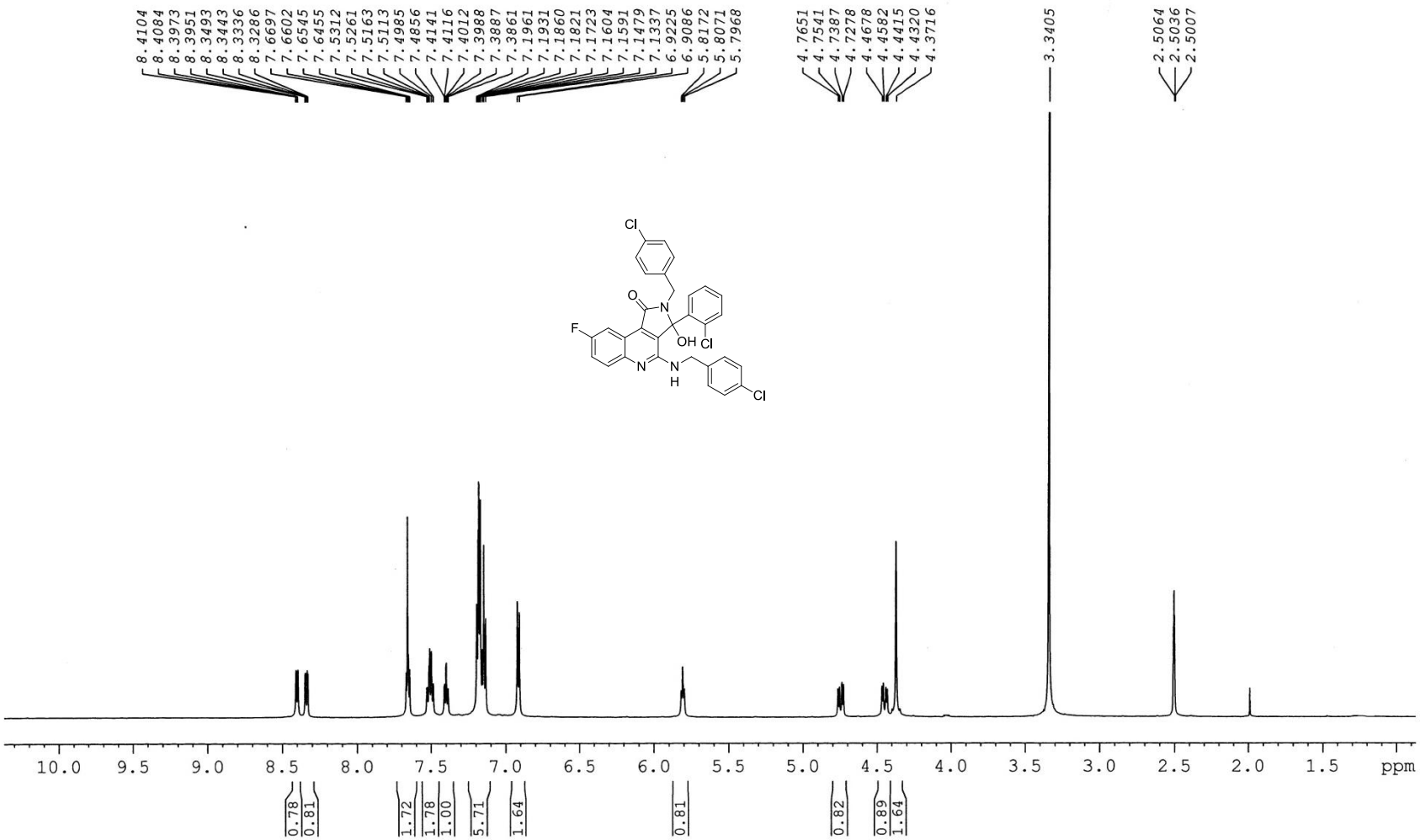


Figure S133. ^{1}H NMR (600 MHz, DMSO-d_6) spectra of compound **7dg**

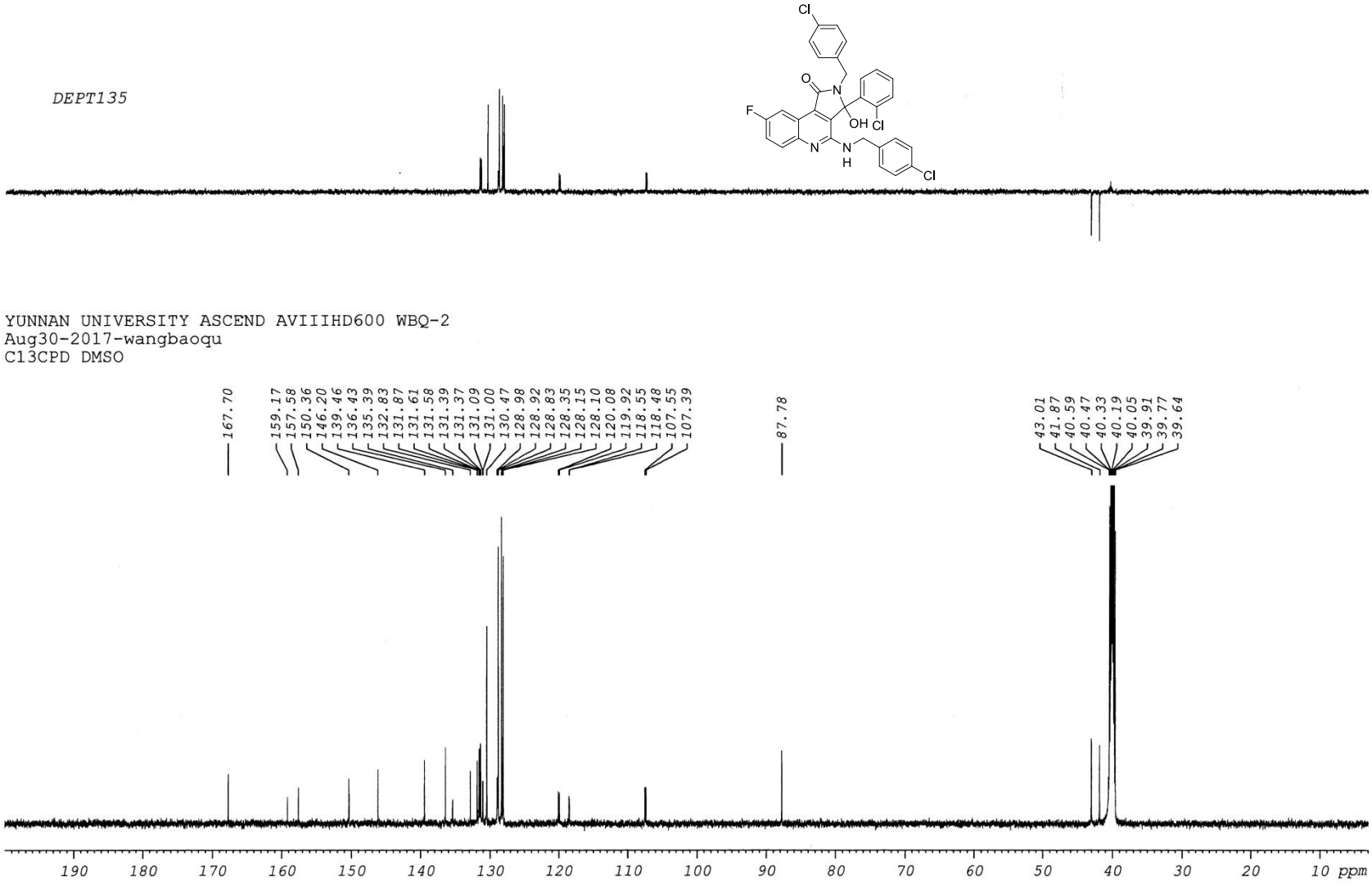


Figure S134. ^{13}C NMR (150 MHz, DMSO-d_6) spectra of compound **7dg**

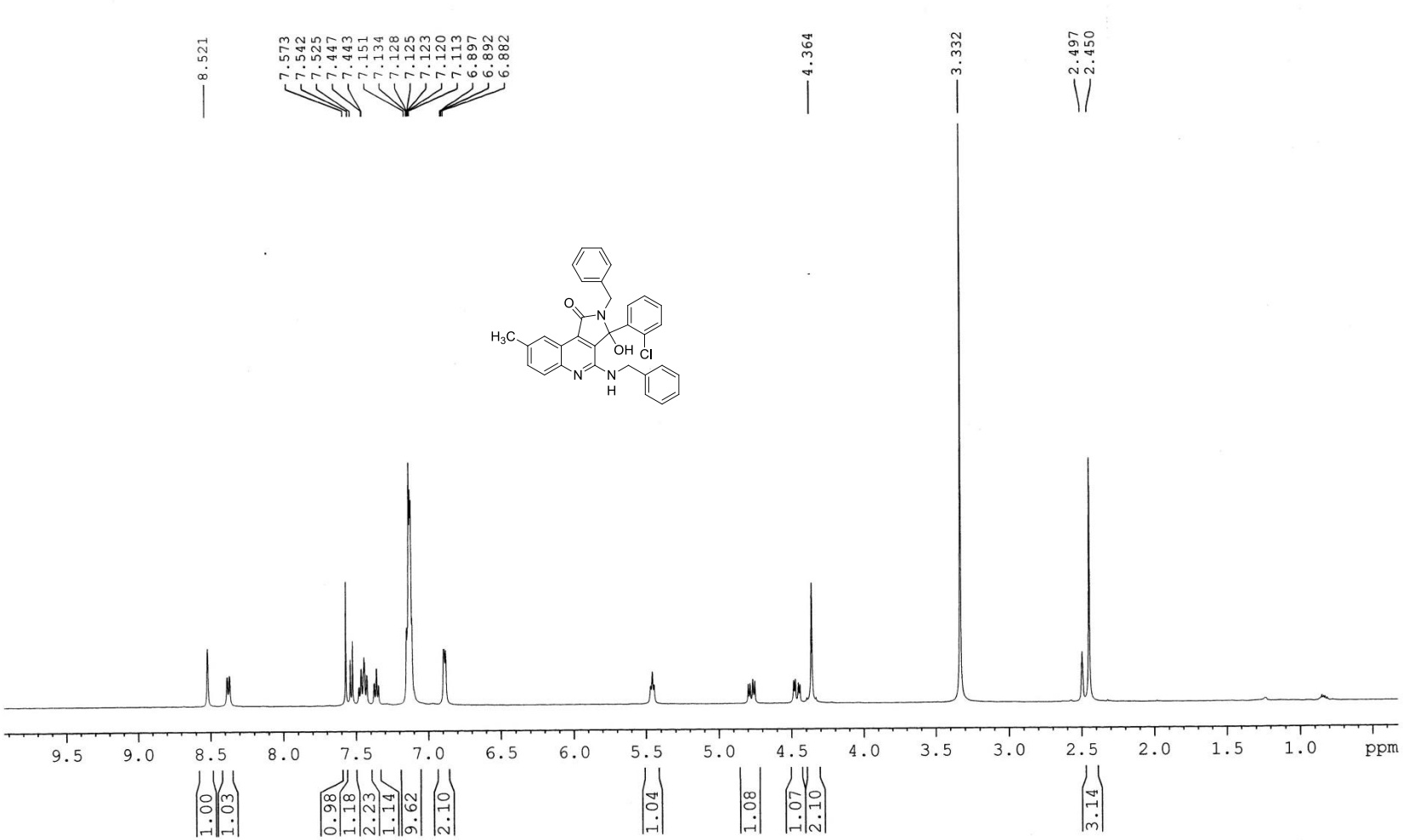


Figure S135. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7fa**

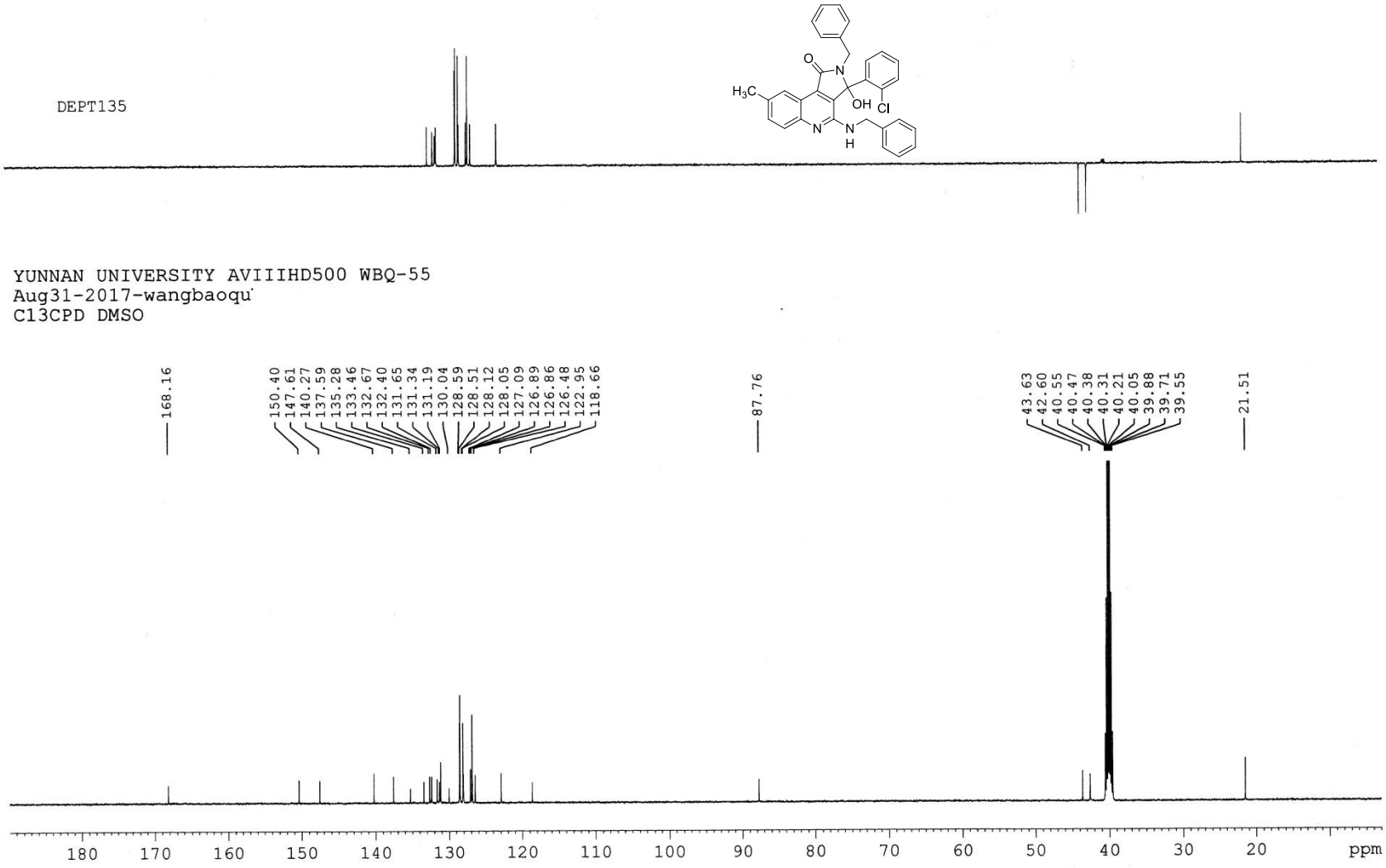


Figure S136. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7fa**

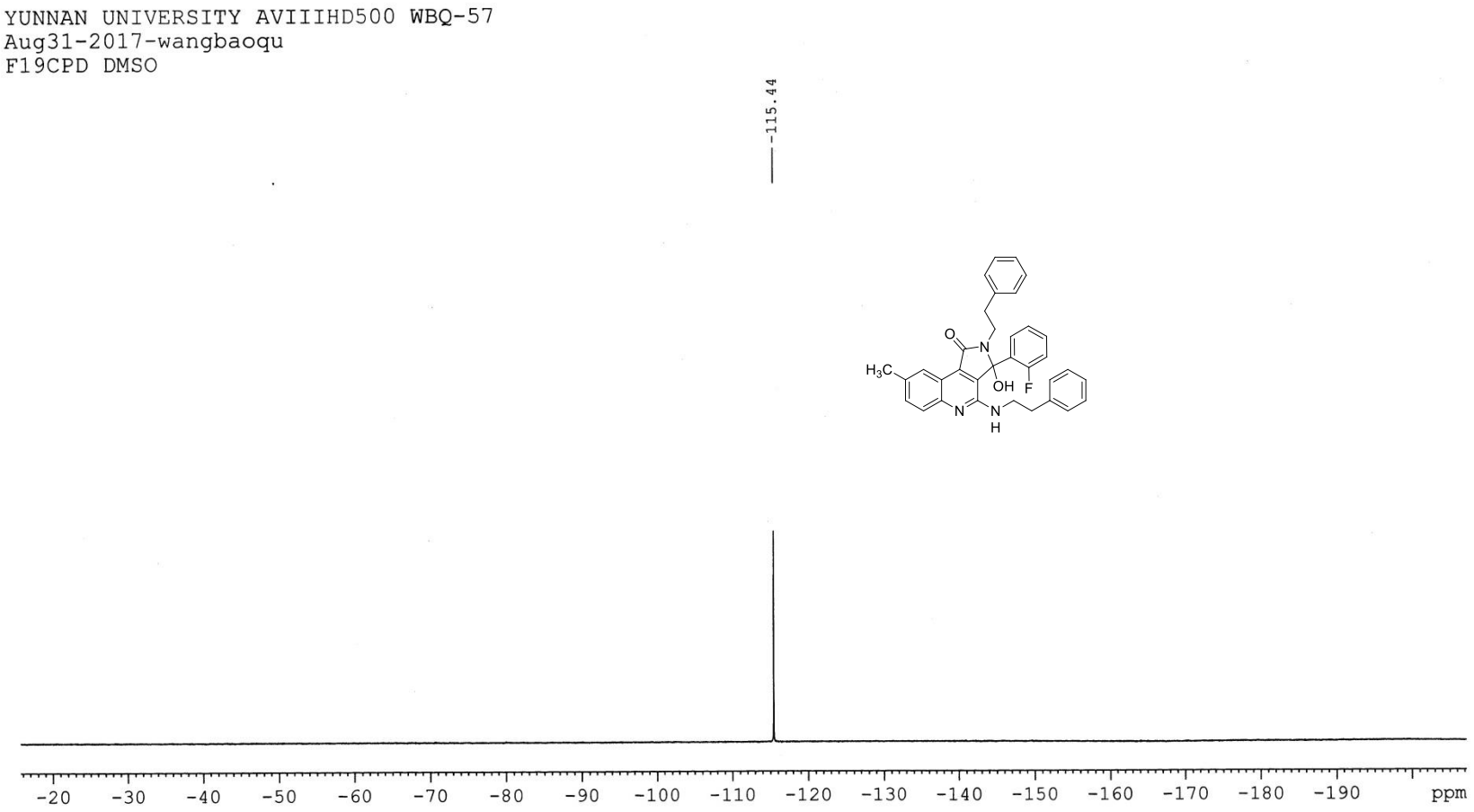


Figure S137. ^{19}F NMR (475 MHz, DMSO-d_6) spectra of compound **7fb**

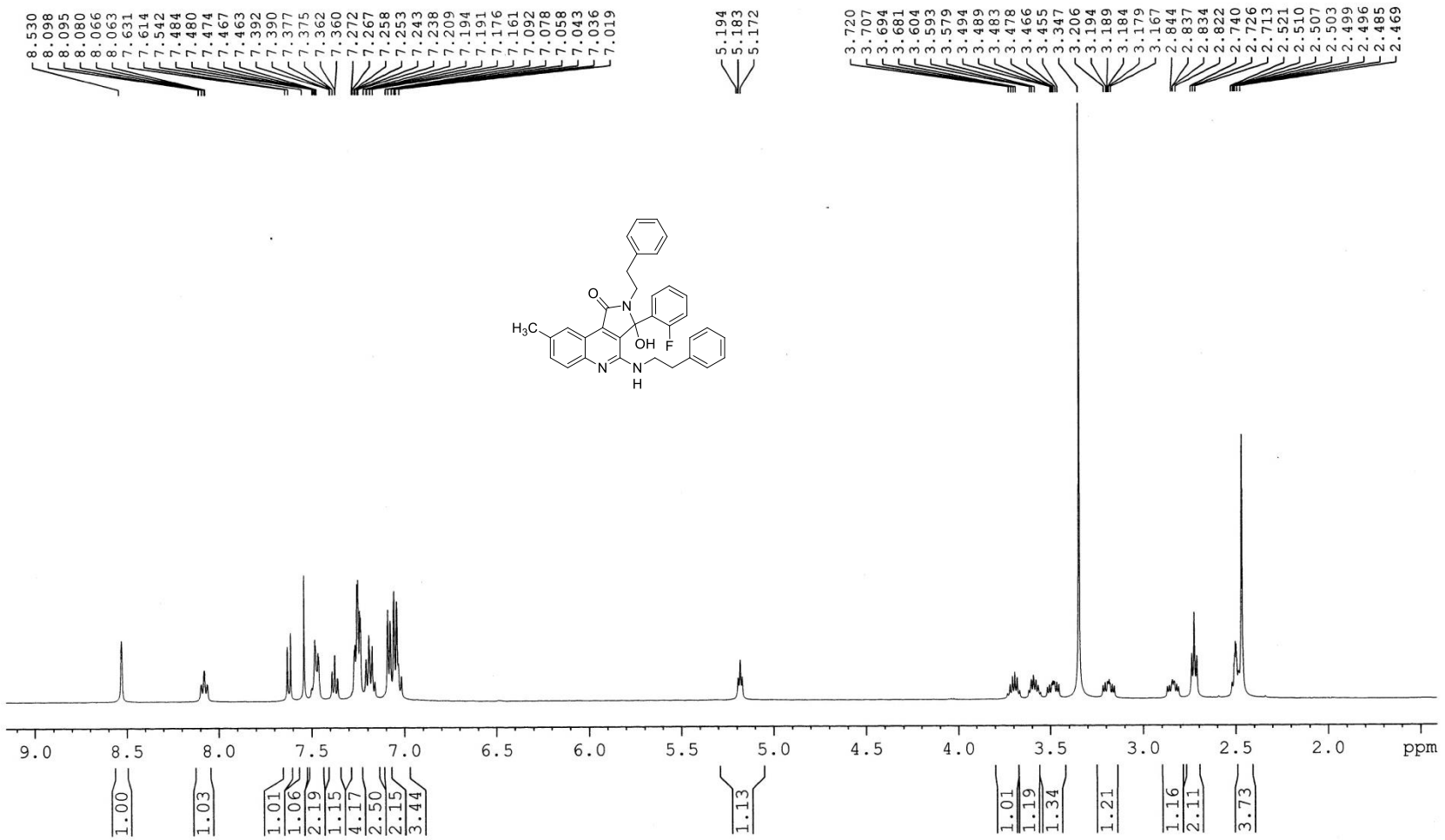


Figure S138. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7fb**

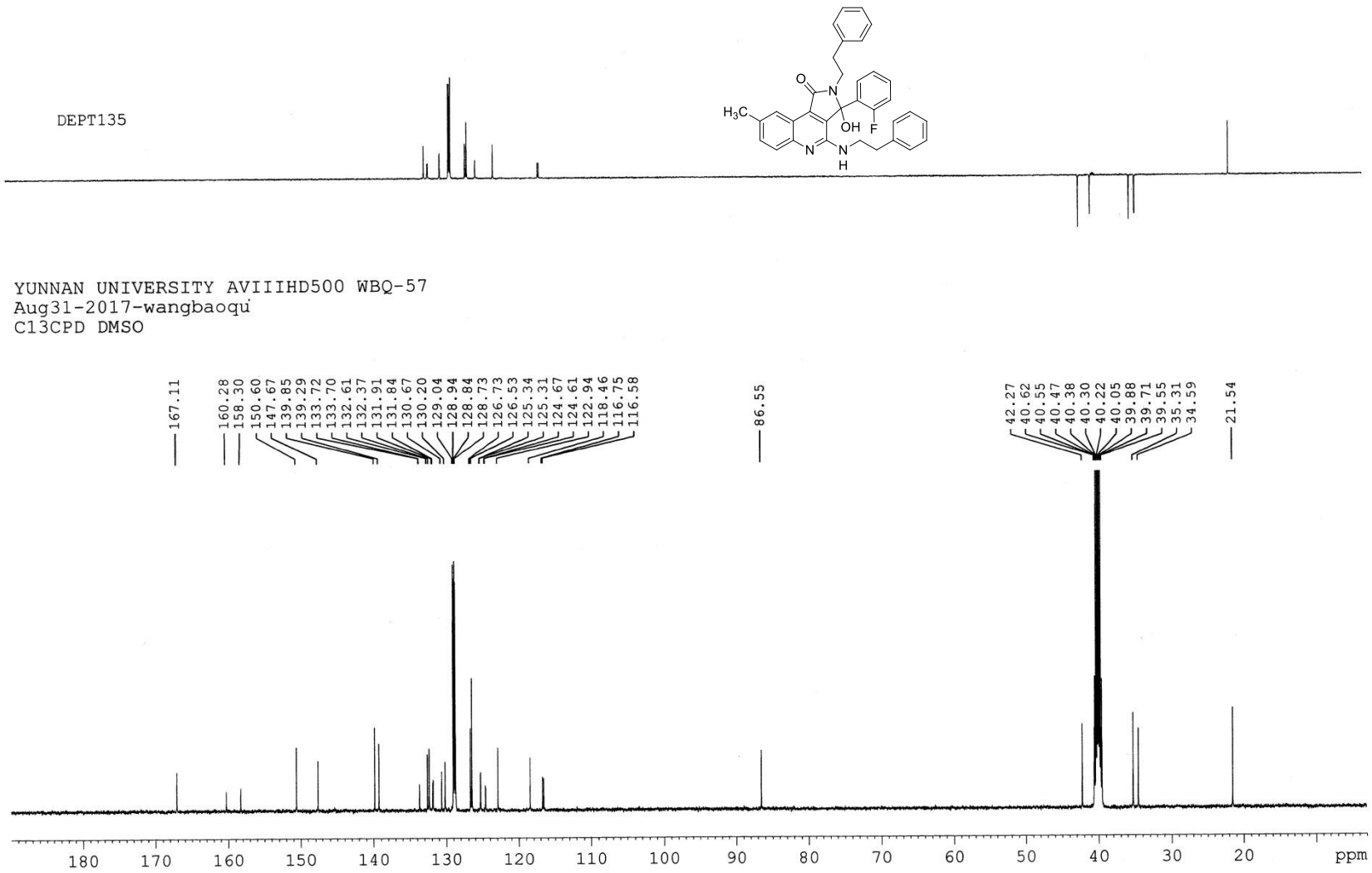


Figure S139. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7fb**

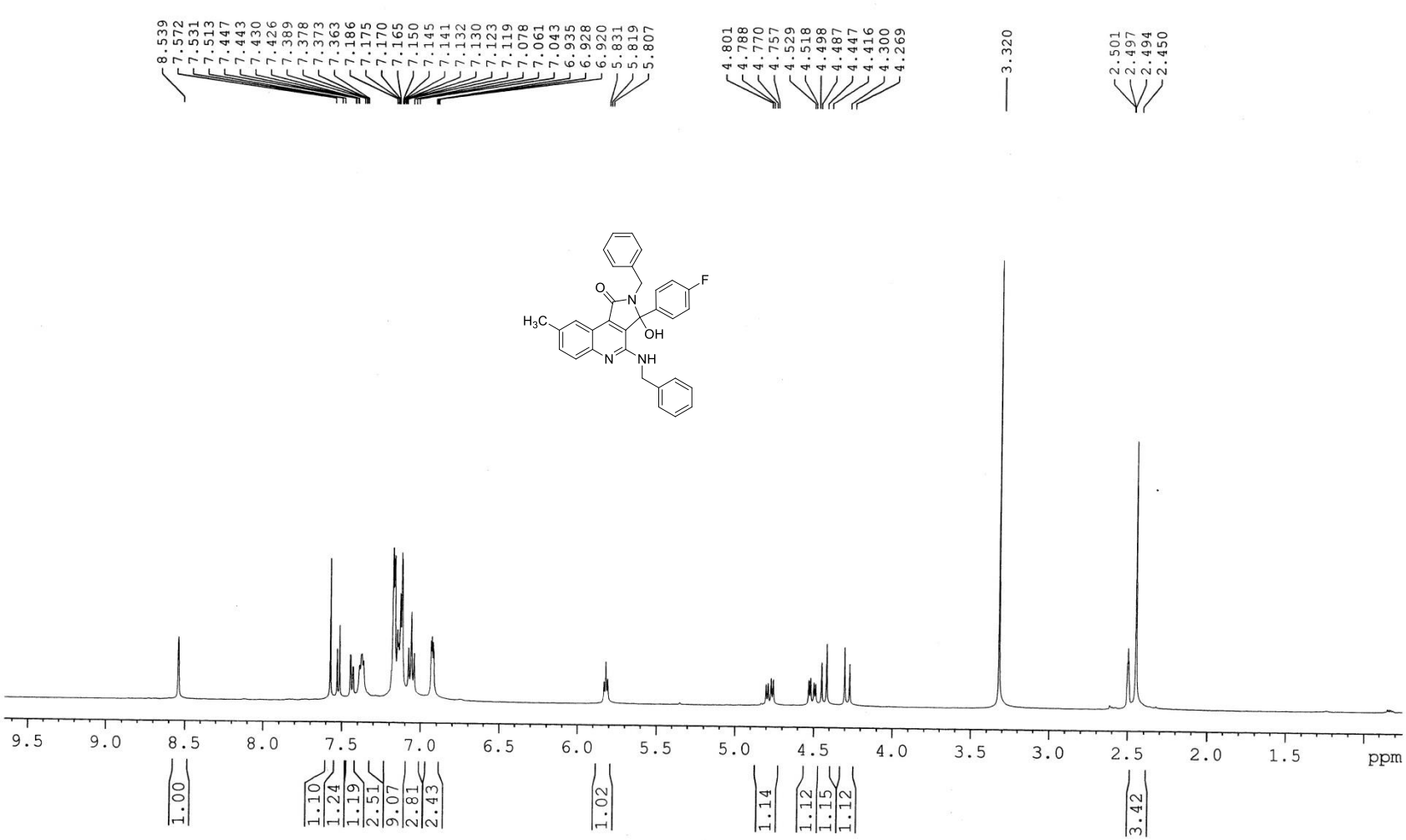


Figure S140. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7fc**

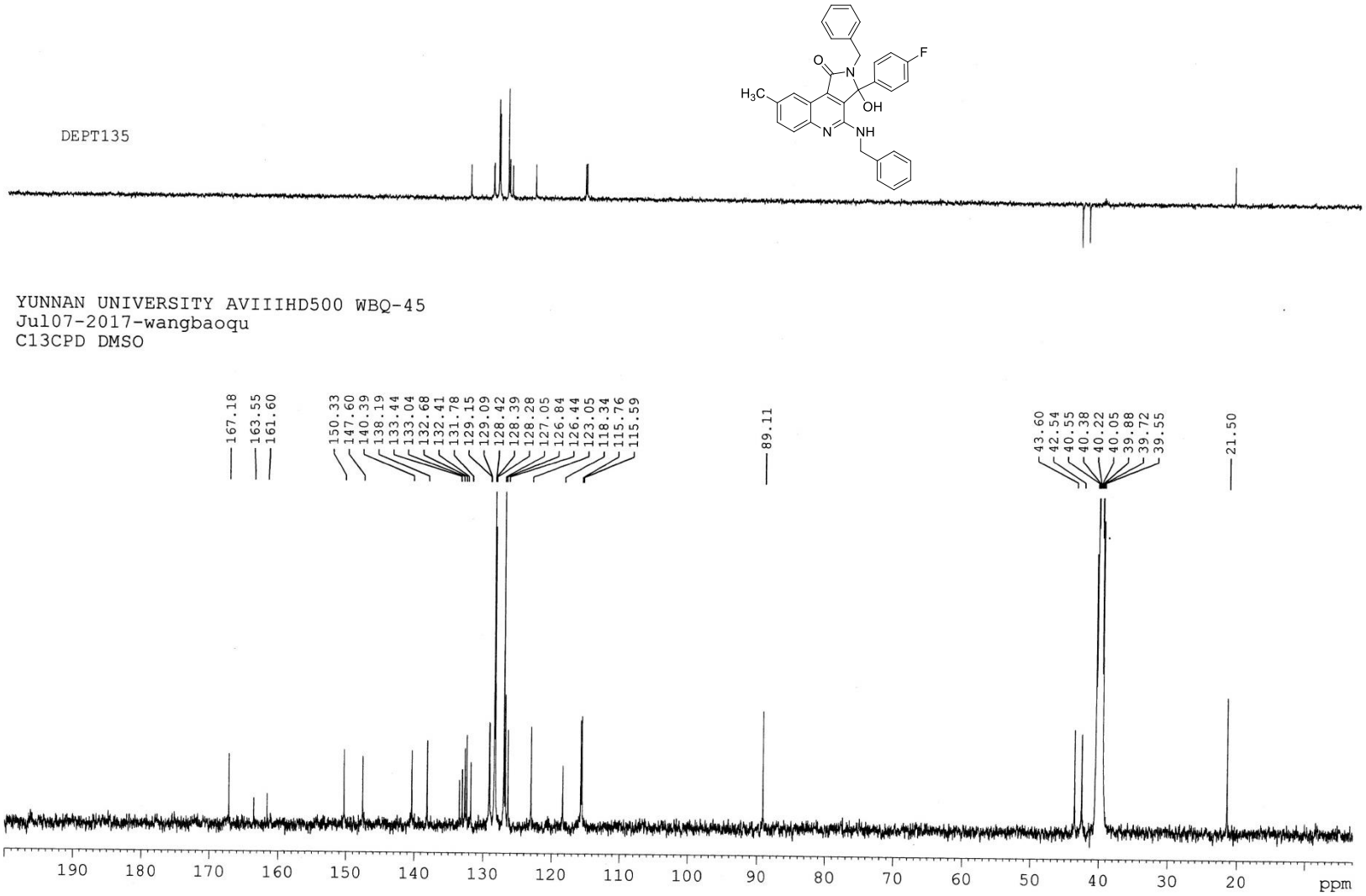


Figure S141. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7fc**

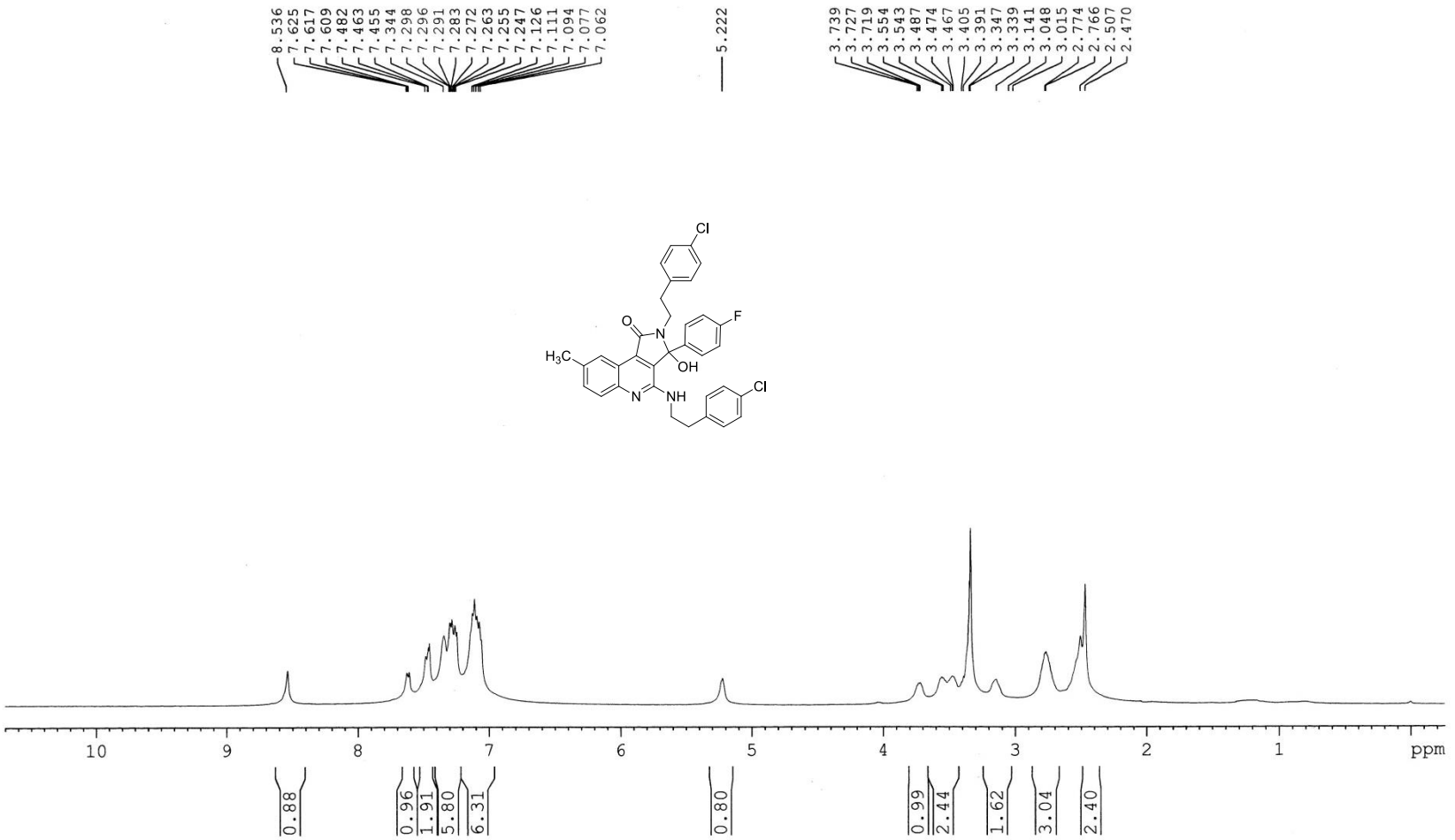


Figure S142. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7fd**

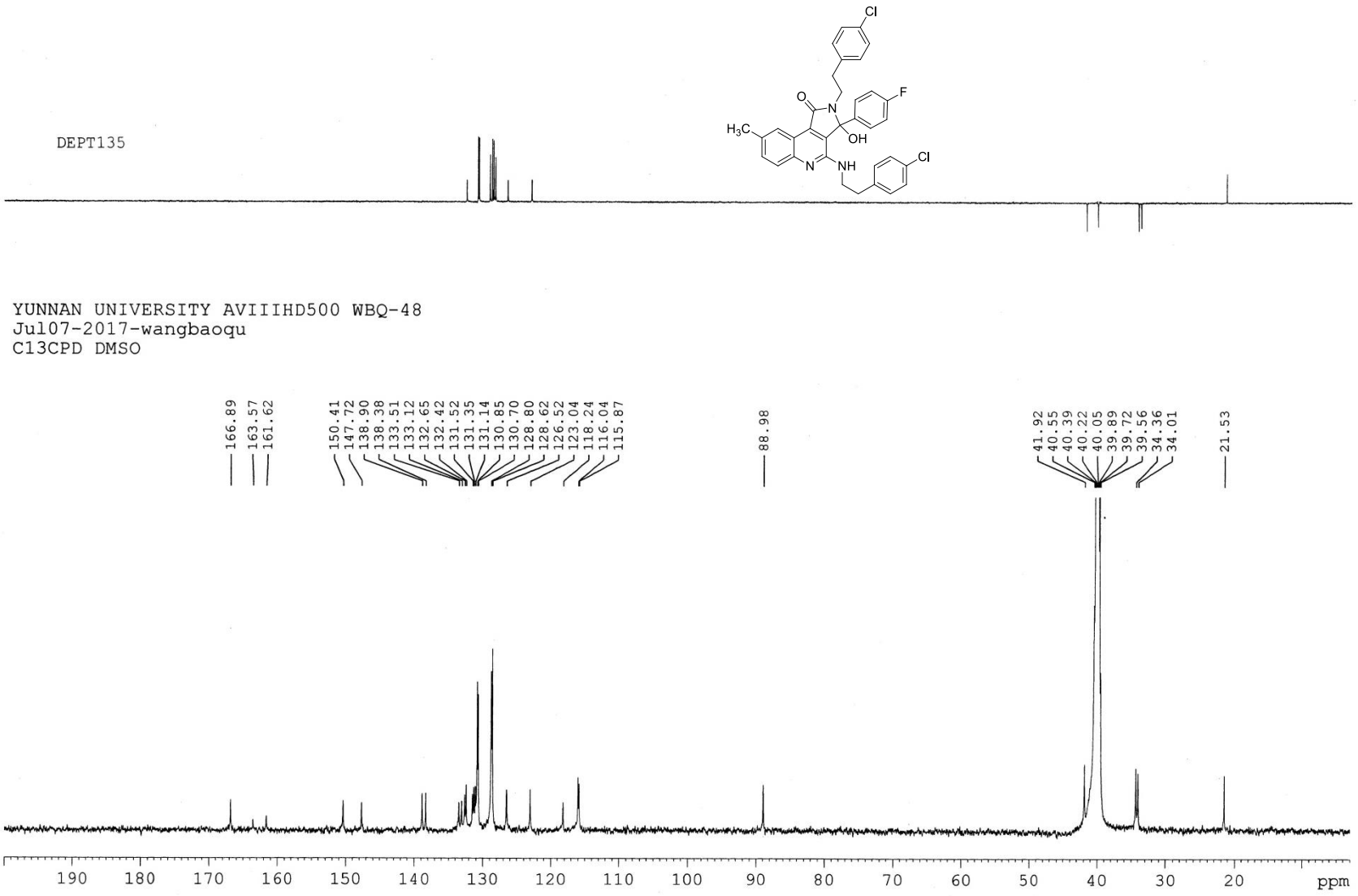


Figure S143. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7fd**

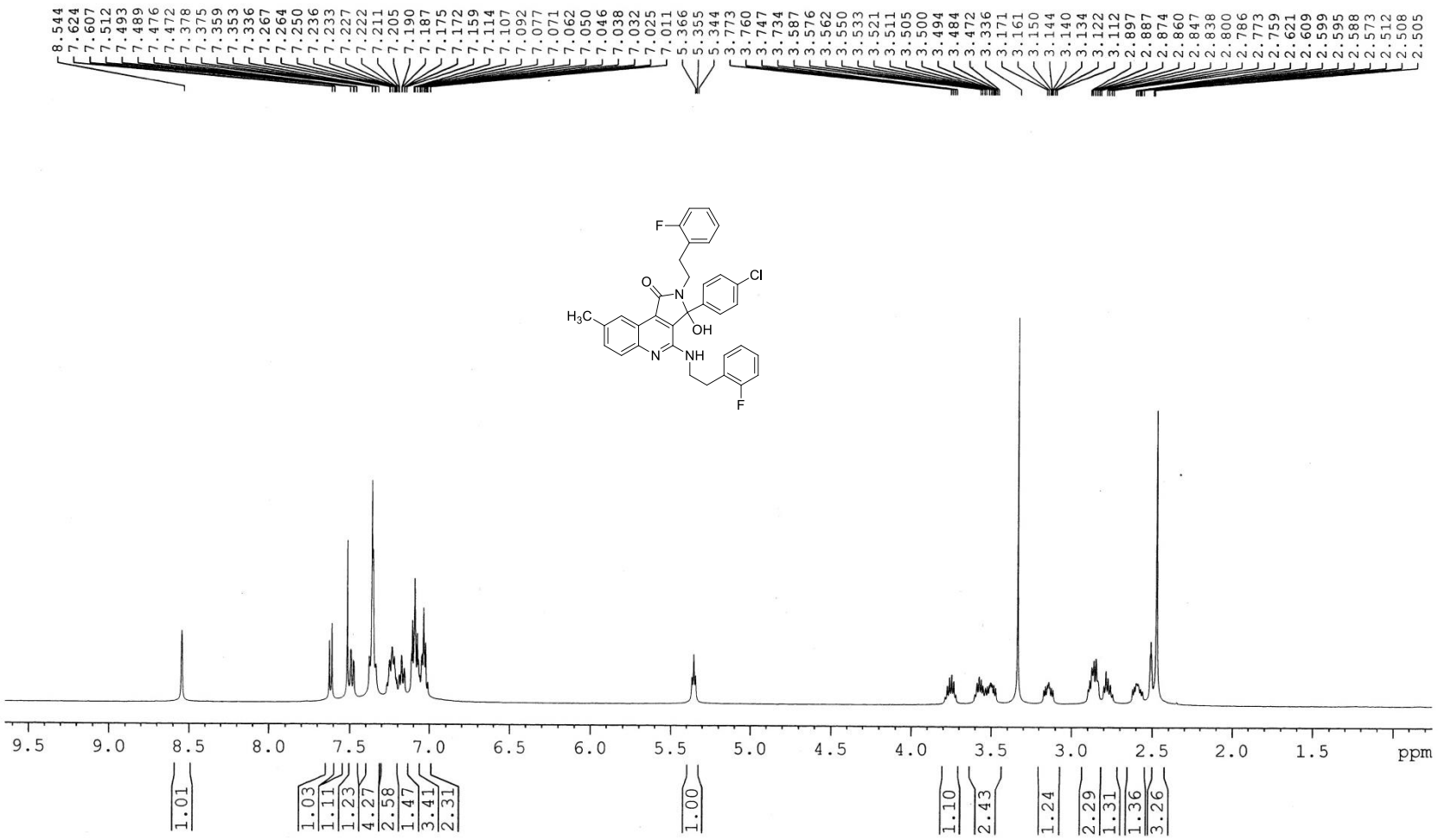


Figure S144. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7fe**

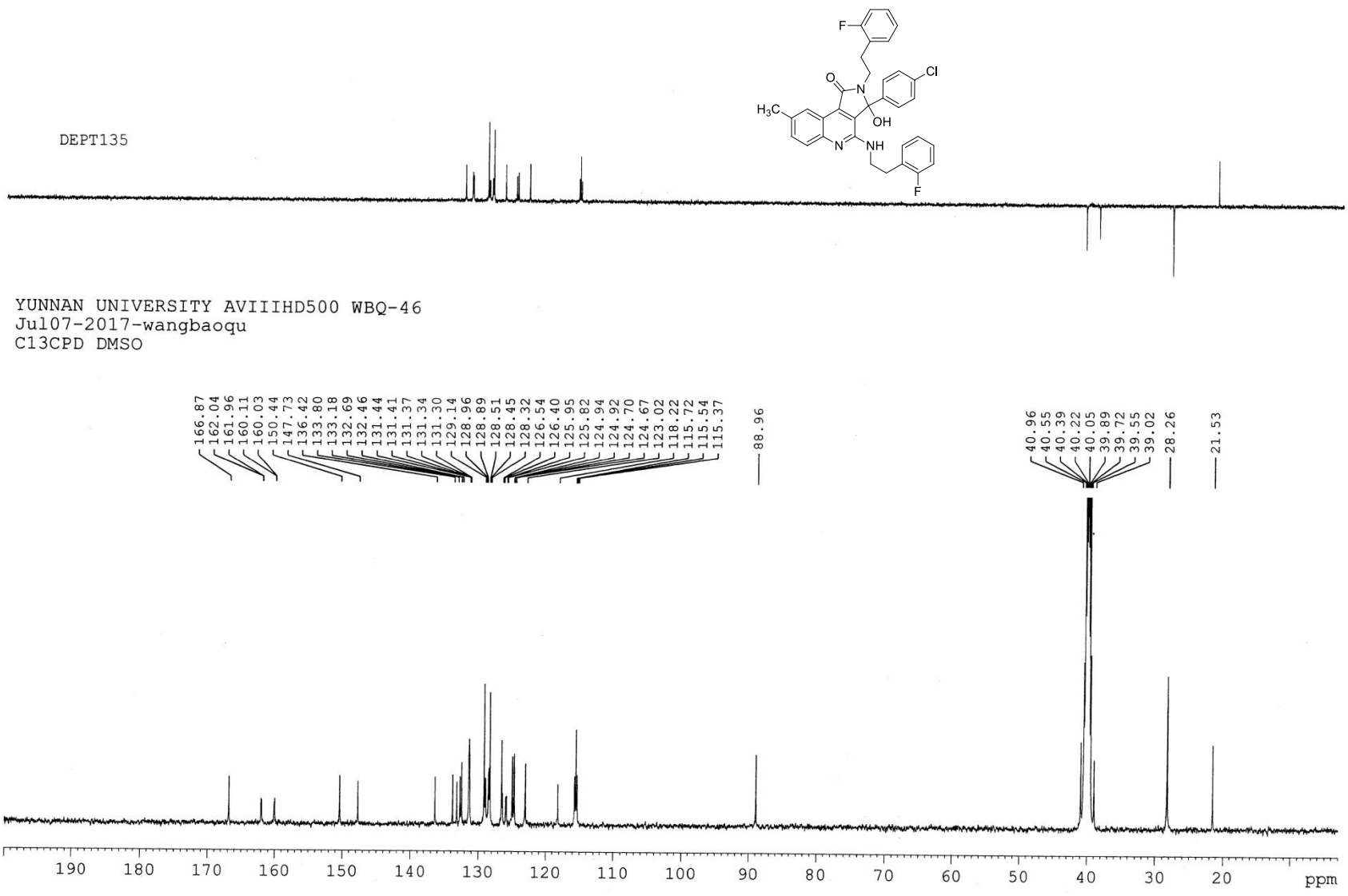


Figure S145. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7fe**

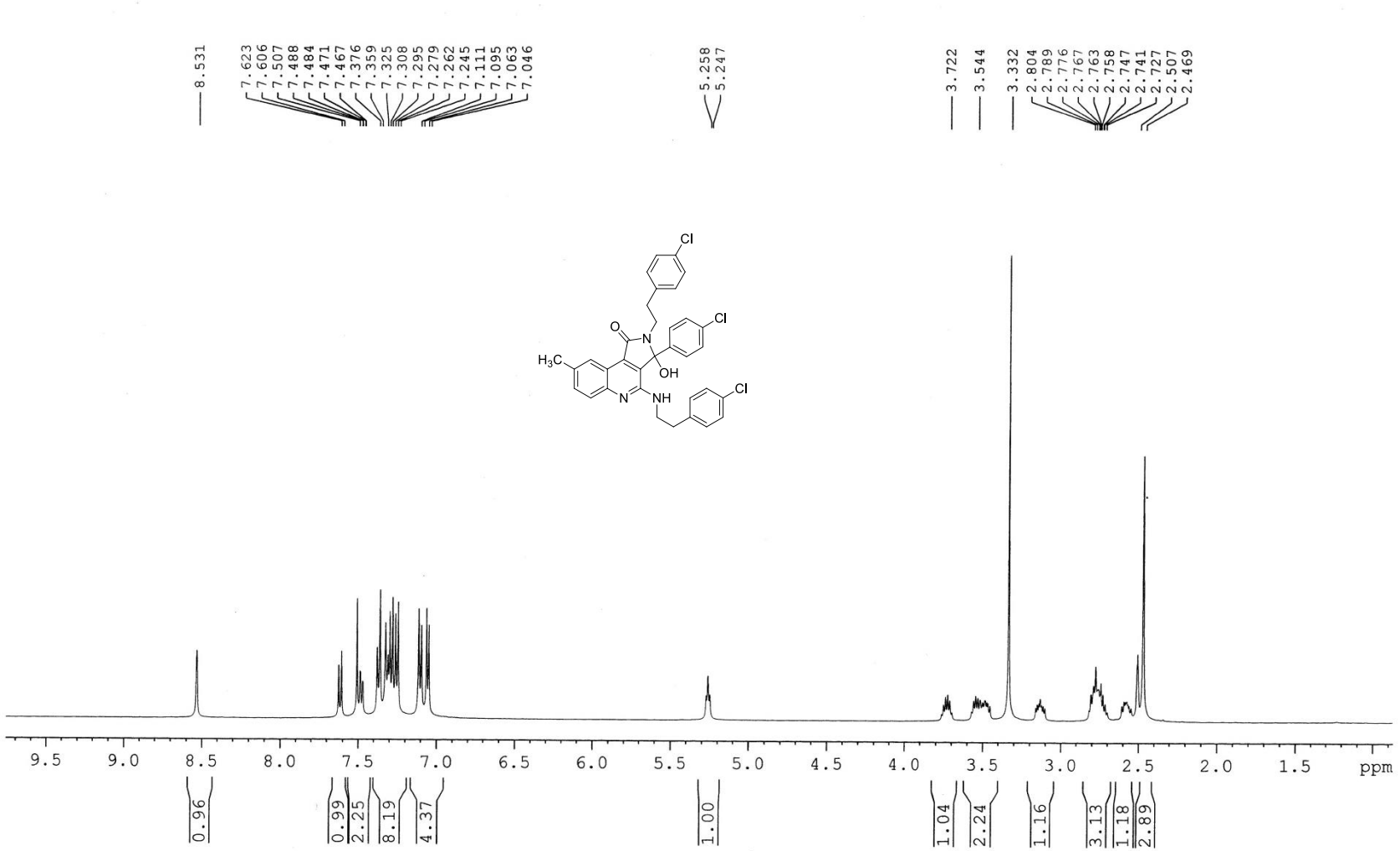


Figure S146. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7ff**

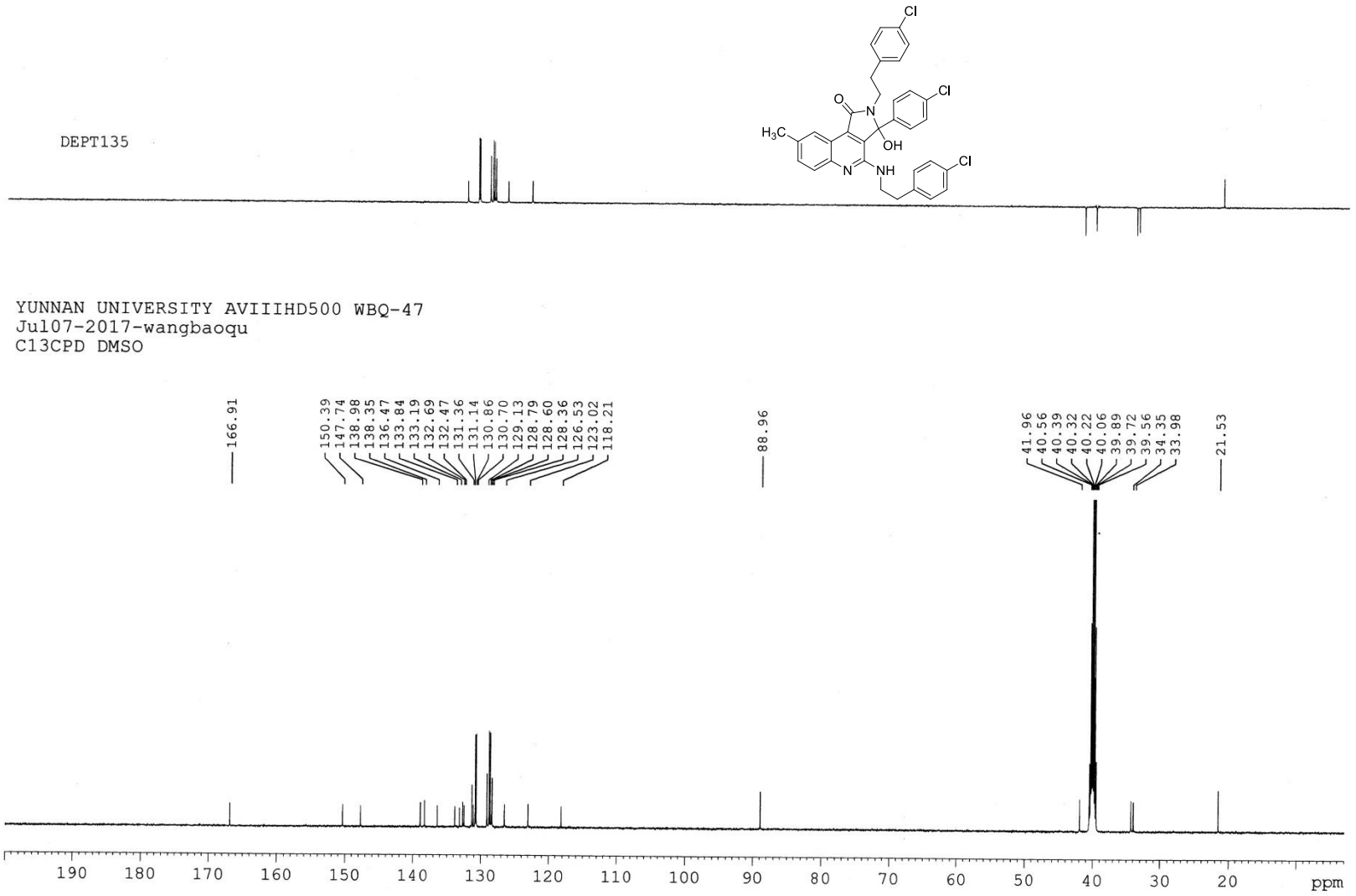


Figure S147. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7ff**

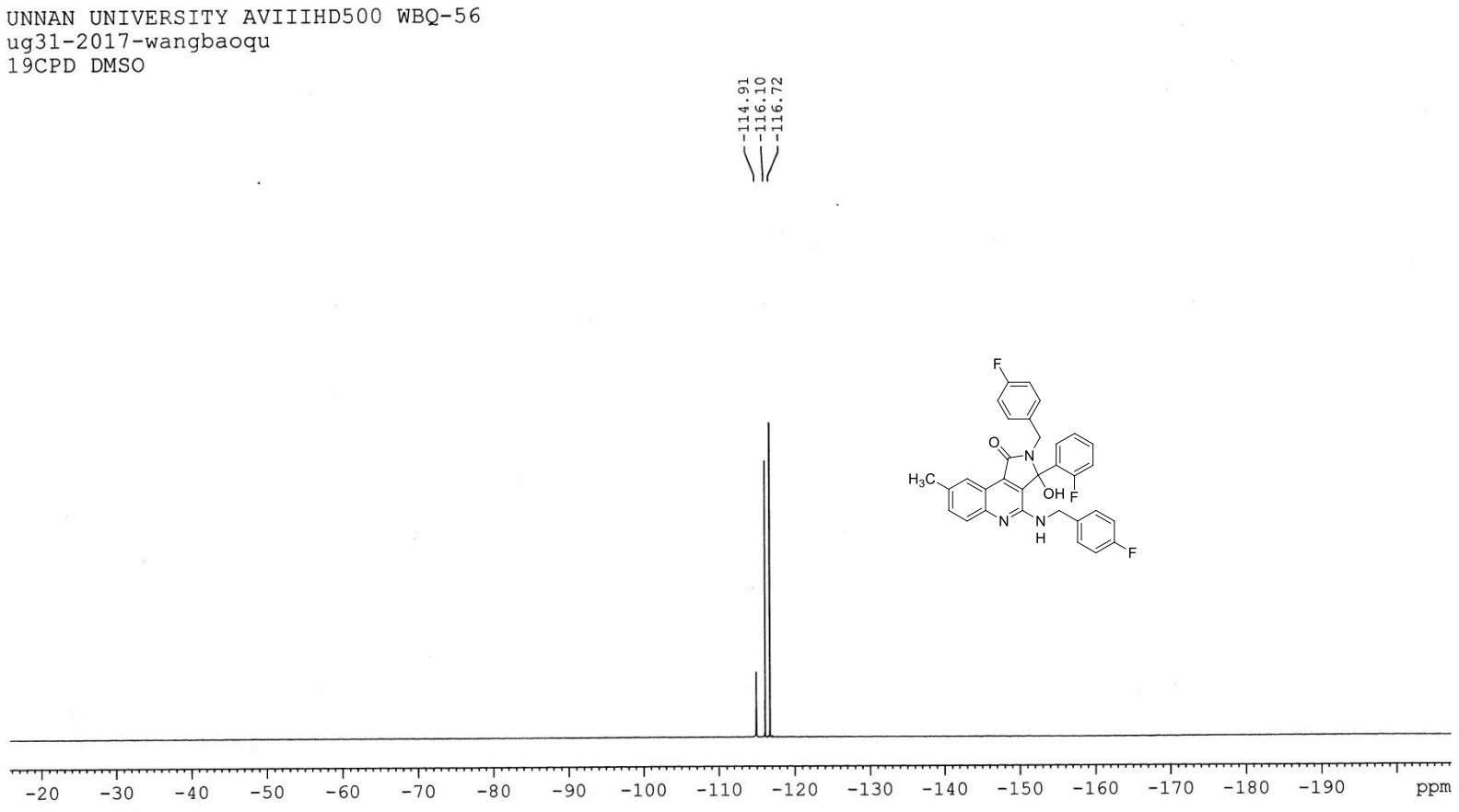


Figure S148. ^{19}F NMR (475 MHz, DMSO-d_6) spectra of compound **7fh**

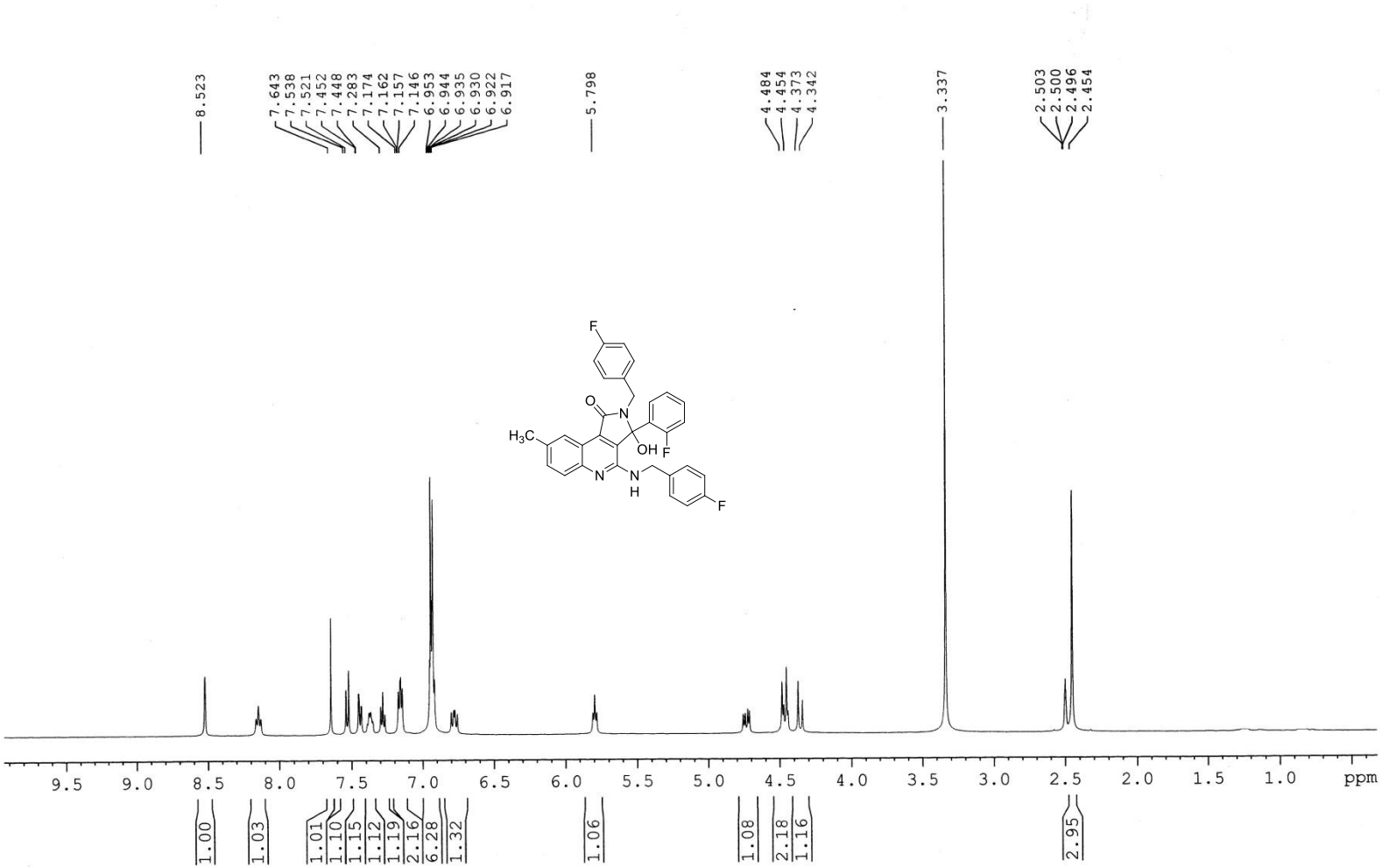


Figure S149. ^{1}H NMR (500 MHz, DMSO-d_6) spectra of compound **7fh**

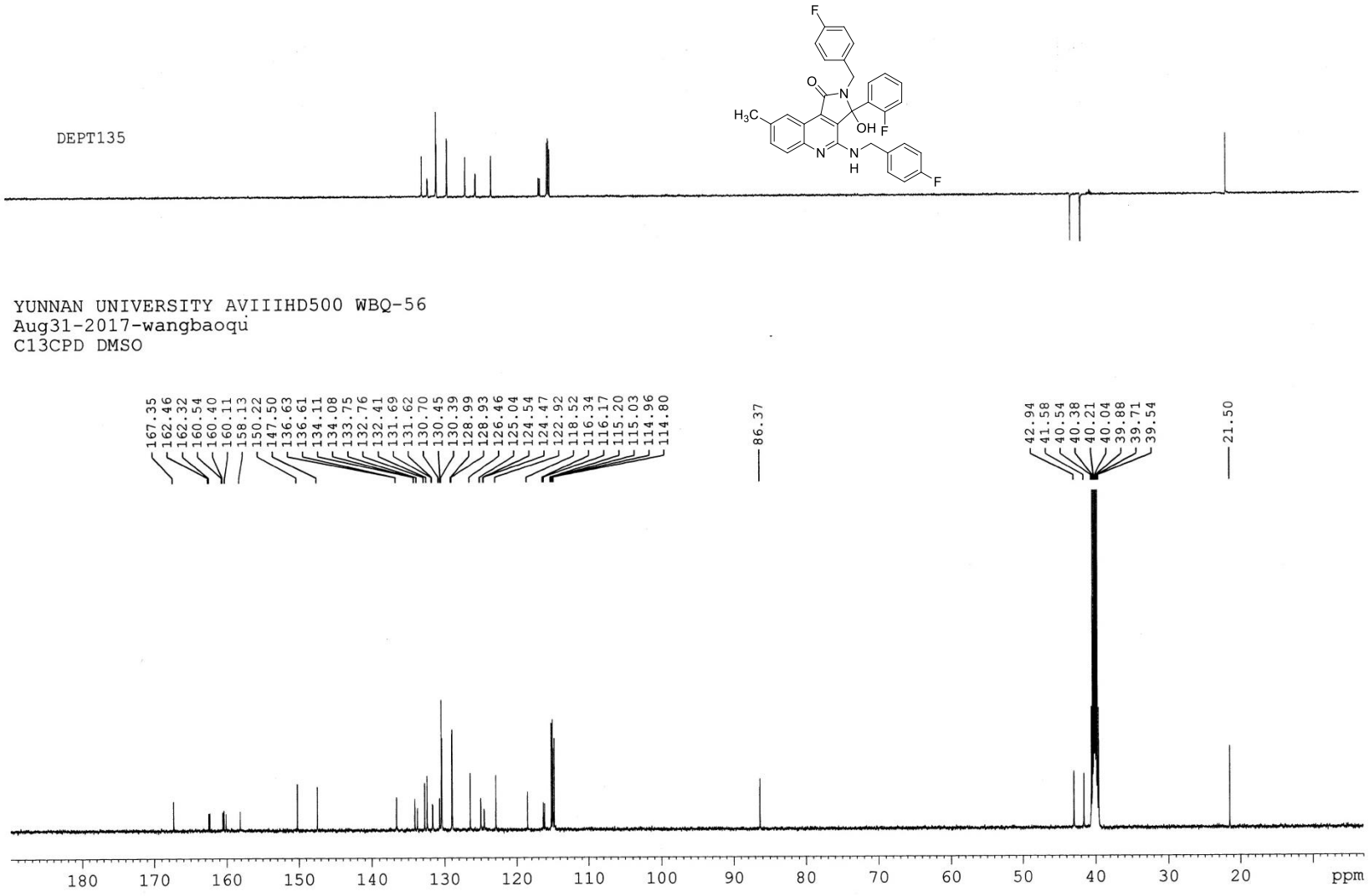


Figure S150. ^{13}C NMR (125 MHz, DMSO-d_6) spectra of compound **7fh**

References and Notes

1. (a) da Silva, R. C.; da Silva, P. G.; Sangi, D. P.; Pontes, J. G.; Ferreira, A. G.; Corrêa, A. G.; Paixão, M. W. *Tetrahedron* **2013**, *69*, 9007; (b) Du, X.-X.; Huang, R.; Yang, C.-L.; Lin, J.; Yan, S.-J. *RSC Adv.* **2017**, *7*, 40067.

2. CCDC1588348, CCDC1588350 and CCDC1588444 contain the supplementary crystallographic data for compound **5ab**, **6go** and **7fc**. These data can be obtained free of charge from The Cambridge Crystallographic Data Center *via*www.ccdc.cam.ac.uk/data_request/cif