

## Supporting Information

### Sustainable and fast synthesis of functionalized quinoxalines promoted by natural deep eutectic solvents (NADESS)

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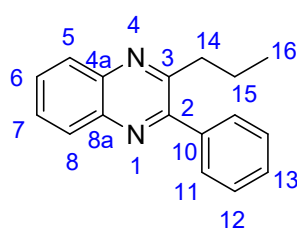
#### General Remarks

<sup>1</sup>H NMR analyses were recorded at 400 MHz on a Varian Mercury Plus 400. <sup>13</sup>C NMR analyses were recorded at 100 MHz. IR spectra were recorded with a PerkinElmer FTIR spectrometer Spectrum Two UATR. Microanalyses were performed with a CHNS-O analyzer Model EA 1108 from Fisons Instruments. GS-MS analyses were obtained on a Hewlett–Packard GC/MS 6890N that works with the EI technique (70 eV). Diketones **1** were synthesized according to reported literature procedure.<sup>1</sup> 4,5-Dibromobenzene-1,2-diamine was prepared by following the procedure reported by Chen *et al.*<sup>2</sup>

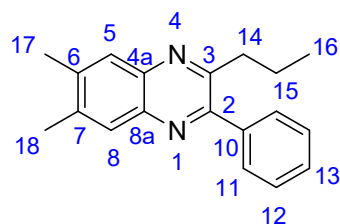
#### General procedure for the synthesis of quinoxaline derivatives **3a-q**.

A suspension of the proper diketone **1** (0.3 mmol) in ChCl/H<sub>2</sub>O (1:3.33, 30 μL) and diamine **2** (0.3 mmol) was stirred for 5 minutes at room temperature. Then, the reaction was extracted with EtOAc (3 x 1 mL), the combined organic layer dried over Na<sub>2</sub>SO<sub>4</sub>, filtered and the solvent removed under reduced pressure to give the product **3**.

#### Spectroscopic data of compounds **3a-q**.

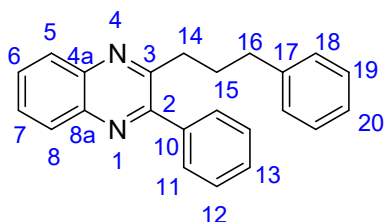


Compound **3a**. Yield 95%, 71 mg. Orange oil. IR (cm<sup>-1</sup>, neat): 699, 760, 1006, 1331, 1481, 1561, 2871, 2931, 2961, 3060. <sup>1</sup>H-NMR (CDCl<sub>3</sub>, 400MHz) δ: 0.91 (t, *J* = 7.4Hz, 3H, -CH<sub>3</sub>), 1.74-1.79 (m, 2H, -CH<sub>2</sub>-CH<sub>3</sub>), 3.00-3.04 (m, 2H, Ar-CH<sub>2</sub>), 7.47-7.54 (m, 3H, H13+H12), 7.59-7.62 (m, 2H, H6+H7), 7.69-7.76 (m, 2H, 2H11), 8.07-8.12 (m, 2H, H5+H8). <sup>13</sup>C-NMR (CDCl<sub>3</sub>, 100MHz) δ: 14.3 (C16), 22.6 (C15), 38.2 (C14), 128.7 (C11), 128.8 (C7), 129.0 (C6), 129.41 (C13), 129.43 (C12), 129.9 (C8), 130.27 (C5), 139.4 (C10), 140.9 (C8a), 141.6 (C4a), 155.3 (C2), 156.3 (C3). GC-MS (70eV): *m/z*: 248 ([M<sup>+</sup>], 18), 232 (12), 219 (100), 205 (6), 77 (14). Anal. Calcd. for C<sub>17</sub>H<sub>16</sub>N<sub>2</sub> (248.13) C, 82.22; H, 6.49; N, 11.28. Found: C, 82.26; H, 6.52; N, 11.31.



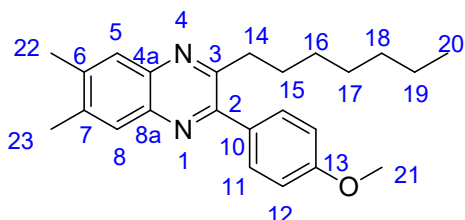
Compound **3b**. Yield 94%, 78mg. Orange oil. IR (cm<sup>-1</sup>, neat): 703, 767, 868, 1002, 1333, 1450, 1482, 2872, 2929, 2961, 3030, 3058. <sup>1</sup>H-NMR (CDCl<sub>3</sub>, 400MHz) δ: 0.89 (t, *J* = 7.4Hz, 3H, -CH<sub>3</sub>), 1.71-1.76 (m, 2H, -CH<sub>2</sub>-CH<sub>3</sub>), 2.47 (s, 3H, Ar-CH<sub>3</sub>), 2.49 (s, 3H, Ar-CH<sub>3</sub>), 2.96-3.00 (m, 2H, Ar-CH<sub>2</sub>), 7.46-7.52 (m, 3H, H13+H12), 7.57-7.59 (m, 2H, H11), 7.83 (m, 2H, H5+H8). <sup>13</sup>C-NMR (CDCl<sub>3</sub>, 100MHz) δ: 14.3 (C16), 20.5 (C17), 20.6 (C18), 22.7 (C15), 38.0 (C14), 127.7 (C11), 128.4 (C8), 128.7 (C5), 128.8 (C13), 129.1 (C12), 130.4 (C10), 139.6 (C8a), 139.9 (C4a), 140.3 (C7) 140.4 (C6), 154.3 (C2), 155.1 (C3). GC-MS (70eV): *m/z*: 276 ([M<sup>+</sup>], 19), 275 (24),

261 (9), 247 (100), 233 (5), 77 (9). Anal. Calcd. for C<sub>19</sub>H<sub>20</sub>N<sub>2</sub> (276.16) C, 82.57; H, 7.29; N, 10.14. Found: 82.62; H, 7.33; N, 10.17.



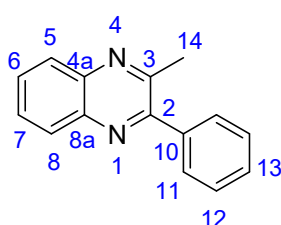
Compound **3c**. Yield 94%, 91mg. Orange solid, m.p. = 106-108°C. IR (cm<sup>-1</sup>, neat): 695, 767, 1006, 1107, 1220, 1317, 1450, 2856, 2917, 2957, 3022, 3054. <sup>1</sup>H-NMR (CDCl<sub>3</sub>, 400MHz) δ: 2.04-2.12 (m, 2H, CH<sub>2</sub>-CH<sub>2</sub>-CH<sub>2</sub>), 2.63 (t, *J* = 7.7Hz, 2H, Ar-CH<sub>2</sub>-CH<sub>2</sub>), 3.09 (m, 2H, -CH<sub>2</sub>-CH<sub>2</sub>-Ph), 7.08 (d, *J* = 7.7Hz, 2H, H18), 7.14-7.17 (m, 1H, H20), 7.21-7.26 (m, 2H, H19), 7.48-7.50 (m, 3H, H13+H12), 7.55-7.57 (m, 2H, H6+H7), 7.70-7.77 (m, 2H, H11), 8.08-8.13 (m, 2H, H5+H8). <sup>13</sup>C-NMR (CDCl<sub>3</sub>, 100MHz) δ: 30.57 (C15), 35.7 (C14),

35.8 (C16), 126.0 (C20), 128.5 (C11), 128.6 (C18), 128.7 (C19), 128.8 (C13), 129.0 (C12), 129.1 (C7), 129.4 (C6), 129.5 (C8), 130.0 (C5), 139.1 (C10), 140.9 (C17), 141.6 (C8a), 142.0 (C4a), 155.2 (C2), 156.0 (C3). GC-MS (70eV): *m/z*: 323 (1), 219 (100), 77 (6). Anal. Calcd. for C<sub>23</sub>H<sub>20</sub>N<sub>2</sub> (324.16) C, 85.15; H 6.21; N, 8.63. Found: C, 85.20; H 6.24; N, 8.66.



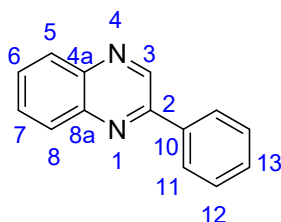
Compound **3d**. Yield 90%, 98mg. Brown solid, m.p. = 47-50°C. IR (cm<sup>-1</sup>, neat): 404, 578, 619, 828, 872, 1001, 1173, 1253 (C-O), 1335, 1465, 1513, 2847, 2915, 2948, 2965. <sup>1</sup>H-NMR (CDCl<sub>3</sub>, 400MHz) δ: 0.86 (t, *J* = 7.0, 3H, -CH<sub>3</sub>), 1.20-1.31 (m, 8H, -(CH<sub>2</sub>)<sub>4</sub>-), 1.71-1.74 (m, 2H, Ar-CH<sub>2</sub>-CH<sub>2</sub>-), 2.48 (s, 3H, Ar-CH<sub>3</sub>), 2.50 (s, 3H, Ar-CH<sub>3</sub>), 3.02-3.04 (m, 2H, Ar-CH<sub>2</sub>-CH<sub>2</sub>-), 3.89 (s, 3H, O-CH<sub>3</sub>), 7.04 (d, *J* = 8.5Hz, 2H, H12), 7.56-7.57 (d, *J* = 8.5Hz, 2H, H11), 7.84 (m, 2H, H5+H8). <sup>13</sup>C-

NMR (CDCl<sub>3</sub>, 100MHz) δ: 14.0 (C20), 20.2 (C22), 20.3 (C23), 22.6 (C19), 28.9 (C18), 29.1 (C17), 29.4 (C16), 31.6 (C15), 36.0 (C14), 55.3 (C21), 113.9 (C12), 127.5 (C8), 128.1 (C5), 130.3 (C11), 131.9 (C10), 139.4 (C8a), 139.7 (C4a), 139.8 (C7), 140.1 (C6), 153.7 (C2), 155.3 (C3), 160.0 (C13). GC-MS (70eV): *m/z*: 362 ([M<sup>+</sup>], 5), 333 (2), 305 (2), 278 (100), 247 (26), 77 (5). Anal. Calcd. for C<sub>24</sub>H<sub>30</sub>N<sub>2</sub>O (362.23) C, 79.52; H, 8.34; N, 7.73. Found: C, 79.48; H, 8.31; N, 7.70.



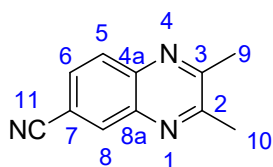
Compound **3e**. Yield 91%, 60mg. orange oil. IR (cm<sup>-1</sup>, neat): 437, 576, 698, 759, 1005, 1191, 1342, 1444, 1482, 2853, 2925, 2959, 3059. <sup>1</sup>H-NMR (CDCl<sub>3</sub>, 400MHz) δ: 2.81 (s, 3H, -CH<sub>3</sub>), 7.52-7.55 (m, 3H, H13+H12), 7.67-7.69 (m, 2H, H6+H7), 7.74-7.77 (m, 2H, H11), 8.08-8.15 (m, 2H, H5+H8). <sup>13</sup>C-NMR (CDCl<sub>3</sub>, 100MHz) δ: 24.3 (C14), 128.3 (C11), 128.5 (C7), 128.9 (C6), 129.0 (C13), 129.2 (C8), 129.3 (C5), 129.7 (C12), 139.1 (C10), 141.0 (C8a), 141.2 (C4a), 152.5 (C2), 154.9 (C3). GC-MS (70eV): *m/z*: 220 ([M<sup>+</sup>], 63), 219 (100), 205 (4), 77 (12). Anal. Calcd. for C<sub>15</sub>H<sub>12</sub>N<sub>2</sub> (220.10)

C, 81.79; H, 5.49; N, 12.72. Found: C, 81.84; H, 5.52; N, 12.75.



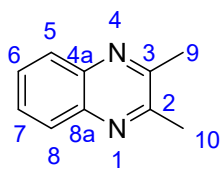
Compound **3f**. Yield 93%, 57mg. white solid, m.p. = 60-62°C. IR (cm<sup>-1</sup>, neat): 408, 552, 686, 766, 956, 1028, 1048, 1313, 1488, 1547, 3061. <sup>1</sup>H-NMR (CDCl<sub>3</sub>, 400MHz) δ: 7.54-7.60 (m, 3H, H13+H12), 7.76-7.80 (m, 2H, H6+H7), 8.14-8.19 (m, 2H, H11), 8.22 (d, *J* = 7.3Hz, 2H, H5+H8), 9.35 (s, 1H, H3). <sup>13</sup>C-NMR (CDCl<sub>3</sub>, 100MHz) δ: 127.5 (C11), 129.1 (C13), 129.5 (C6+C7), 129.6 (C12), 130.1 (C8), 130.2 (C5), 136.8 (C10), 141.6 (C8a), 142.3 (C4a), 143.3, (C2) 151.8 (C3). GC-MS (70eV): *m/z*: 206 ([M<sup>+</sup>], 100), 179 (54), 76 (27). Anal. Calcd. for C<sub>14</sub>H<sub>10</sub>N<sub>2</sub> (206.04) C, 81.53; H, 4.89; N, 13.58.

Found: C, 81.49; H, 4.86; N, 13.55.

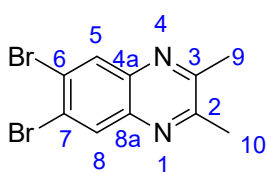


Compound **3g**. Yield 92%, 50mg. orange oil. IR (cm<sup>-1</sup>, neat): 418, 612, 731, 846, 907, 1165, 1328, 1372, 1397, 1625, 2224 (C≡N), 2922. <sup>1</sup>H-NMR (CDCl<sub>3</sub>, 400MHz) δ: 2.78 (s, 3H, Ar-CH<sub>3</sub>), 2.79 (s, 3H, Ar-CH<sub>3</sub>), 7.81-7.83 (m, 1H, H6), 8.07 (m, 1H, H5), 8.35 (d,

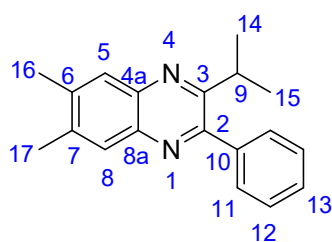
$J = 1.7\text{Hz}$ , 1H, H8).  $^{13}\text{C-NMR}$  ( $\text{CDCl}_3$ , 100MHz)  $\delta$ : 23.2 (C10), 23.4 (C9), 112.2 (C7), 118.2 (C11), 129.8 (C6), 129.9 (C5), 134.3 (C8), 140.2 (C8a), 142.6 (C4a), 155.9 (C2), 156.72 (C3). GC-MS (70eV):  $m/z$ : 183 ( $[\text{M}^+]$ , 61), 142 (100), 102 (16). ). Anal. Calcd. for  $\text{C}_{11}\text{H}_9\text{N}_3$  (183.08) C, 72.11; H, 4.95; N, 22.94. Found: C, 72.16; H, 4.98; N, 22.97.



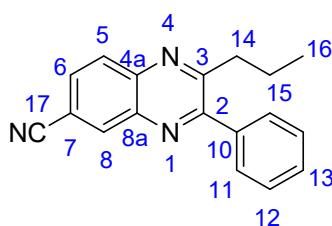
Compound **3h**. Yield 96%, 45mg. dark orange solid, m.p. 69-72°C. IR ( $\text{cm}^{-1}$ , neat): 745, 761, 1023, 1272, 1400, 1450, 2850, 2921, 3063.  $^1\text{H-NMR}$  ( $\text{CDCl}_3$ , 400MHz)  $\delta$ : 2.75 (s, 6H, Ar- $\text{CH}_3$ ), 7.67-7.69 (m, 2H, H6+H7), 7.99-8.01 (m, 2H, H5+H8).  $^{13}\text{C-NMR}$  ( $\text{CDCl}_3$ , 100MHz)  $\delta$ : 23.1 (C9+C10), 128.3 (C5+C8), 128.8 (C6+C7), 141.0 (C4a+C8a), 153.5 (C2+C3). GC-MS (70eV):  $m/z$ : 158 ( $[\text{M}^+]$ , 84), 117 (100), 76 (26). Anal. Calcd. for  $\text{C}_{10}\text{H}_{10}\text{N}_2$  (158.08) C, 75.92; H, 6.37; N, 17.71. Found: C, 75.96; H, 6.40; N, 17.68.



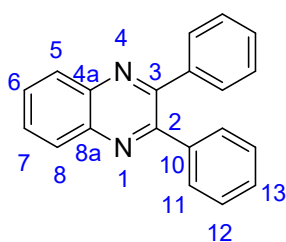
Compound **3i**. Yield 91%, 85mg. orange solid, m.p. = 168-170°C. IR ( $\text{cm}^{-1}$ , neat): 430, 739, 872, 1165, 1317, 1394, 1456, 2850, 2918.  $^1\text{H-NMR}$  ( $\text{CDCl}_3$ , 400MHz)  $\delta$ : 2.73 (s, 6H, Ar- $\text{CH}_3$ ), 8.30 (s, 2H, H5+H8).  $^{13}\text{C-NMR}$  ( $\text{CDCl}_3$ , 100MHz)  $\delta$ : 23.2 (C9+C10), 125.0 (C6+C7), 132.5 (C5+C8), 140.4 (C4a+C8a), 155.0 (C2+C3). GC-MS (70eV):  $m/z$ : 316 ( $[\text{M}^+]$ , 100), 275 (73), 234 (25), 155 (15), 74 (23). Anal. Calcd. for  $\text{C}_{10}\text{H}_8\text{Br}_2\text{N}_2$  (313.90) C, 38.01; H, 2.55; N, 8.87. Found: C, 38.06; H, 2.58; N, 8.84.



Compound **3j**. Yield 93%, 77mg. Brown solid, m.p. = 78-82°C. IR ( $\text{cm}^{-1}$ , neat): 410, 611, 699, 871, 1002, 1084, 1211, 1322, 1446, 1483, 2869, 2929, 2966.  $^1\text{H-NMR}$  ( $\text{CDCl}_3$ , 400MHz)  $\delta$ : 1.32 (s, 3H, - $\text{CH-CH}_3$ ), 1.34 (s, 3H, - $\text{CH-CH}_3$ ), 2.50 (s, 3H, Ar- $\text{CH}_3$ ), 2.51 (s, 3H, Ar- $\text{CH}_3$ ), 3.46-3.52 (m, 1H, - $\text{CH-}$ ), 7.49-7.54 (m, 3H, H13+H12), 7.58-7.60 (m, 2H, H11), 7.88 (m, 2H, H5+H8).  $^{13}\text{C-NMR}$  ( $\text{CDCl}_3$ , 100MHz)  $\delta$ : 20.2 (C16), 20.3 (C17), 22.3 (C14+C15), 31.8 (C9), 127.8 (C11), 128.1 (C13), 128.4 (C7), 128.5 (C6), 128.9 (C12), 139.4 (C10), 139.5 (C8), 139.6 (C5), 139.9 (C8a), 140.7 (C4a), 153.6 (C2), 159.7 (C3). GC-MS (70eV):  $m/z$ : 276 ( $[\text{M}^+]$ , 84), 275 (100), 261 (33.), 247 (21), 233 (10), 77 (12). Anal. Calcd. for  $\text{C}_{19}\text{H}_{20}\text{N}_2$  (276.16) C, 82.57; H, 7.26; N, 10.14. Found: C, 82.61; H, 7.29; N, 10.17.



Compound **3k + 3k'** (mixture of regioisomers). Yield 92%, 75mg. Brown oil. IR ( $\text{cm}^{-1}$ , neat): 687, 768, 1003, 2228 ( $\text{C}\equiv\text{N}$ ), 2944, 3015.  $^1\text{H-NMR}$  ( $\text{CDCl}_3$ , 400MHz)  $\delta$ : 0.92 (t,  $J = 7.4\text{Hz}$ , 3H, - $\text{CH}_3$ ), 1.76-1.82 (m, 2H, - $\text{CH}_2\text{-CH}_2\text{-CH}_3$ ), 3.03-3.07 (m, 2H, - $\text{CH}_2\text{-CH}_2\text{-CH}_3$ ), 7.53-7.56 (m, 3H, H12+H13), 7.60-7.62 (m, 2H, H11), 7.85-7.89 (m, 1H, H5), 8.15-8.19 (m, 1H, H6), 8.45-8.46 (m, 1H, H8).  $^{13}\text{C-NMR}$  ( $\text{CDCl}_3$ , 100MHz)  $\delta$ : 10.3 (C16), 18.1 (C15), 18.2, 34.4 (C14), 34.5, 108.8 (C7), 109.2, 114.5 (C17), 124.9 (C13), 125.0 (C11), 125.1, 125.7 (C12), 125.8, 126.3 (C6), 126.5, 126.7 (C5), 127.0, 130.9 (C8), 131.4, 134.4 (C8a), 134.5, 138.5 (C4a), 139.1, 153.3 (C2), 153.9, 154.7 (C3), 155.6. GC-MS (70eV):  $m/z$ : 248 ( $[\text{M}^+]$ , 12), 258 (16), 244 (100), 230 (6), 77 (8). Anal. Calcd. for  $\text{C}_{18}\text{H}_{15}\text{N}_3$  (273.12) C, 79.10; H, 5.53; N, 15.37. Found: 79.15; H, 5.50; N, 15.33.



Compound **3l**. Yield 94%, 79mg. yellow oil. IR ( $\text{cm}^{-1}$ , neat): 541, 597, 920, 977, 1057, 1221, 1283, 1442, 1478, 3034, 3059.  $^1\text{H-NMR}$  ( $\text{CDCl}_3$ , 400MHz)  $\delta$ : 7.32-7.37 (m, 6H, C12+C13), 7.52-7.54 (m, 4H, C11), 7.76-7.79 (m, 2H, C6+C7), 8.18-8.20 (m, 2H, C5+C8).  $^{13}\text{C-NMR}$  ( $\text{CDCl}_3$ , 100MHz)  $\delta$ : 128.2 (C11), 128.8 (C13), 129.2 (C12), 129.8 (C5+C8), 129.9 (C6+C7), 139.0 (C10), 141.2 (C4a+C8a), 153.4 (C2+C3). GC-MS (70eV):  $m/z$ : 282 ( $[\text{M}^+]$ , 100), 205 (4), 179 (34), 76 (17). Anal. Calcd. for  $\text{C}_{20}\text{H}_{14}\text{N}_2$  (282.11) C, 85.08; H, 5.00; N, 9.92. Found: C, 85.03; H, 4.96; N, 9.89.

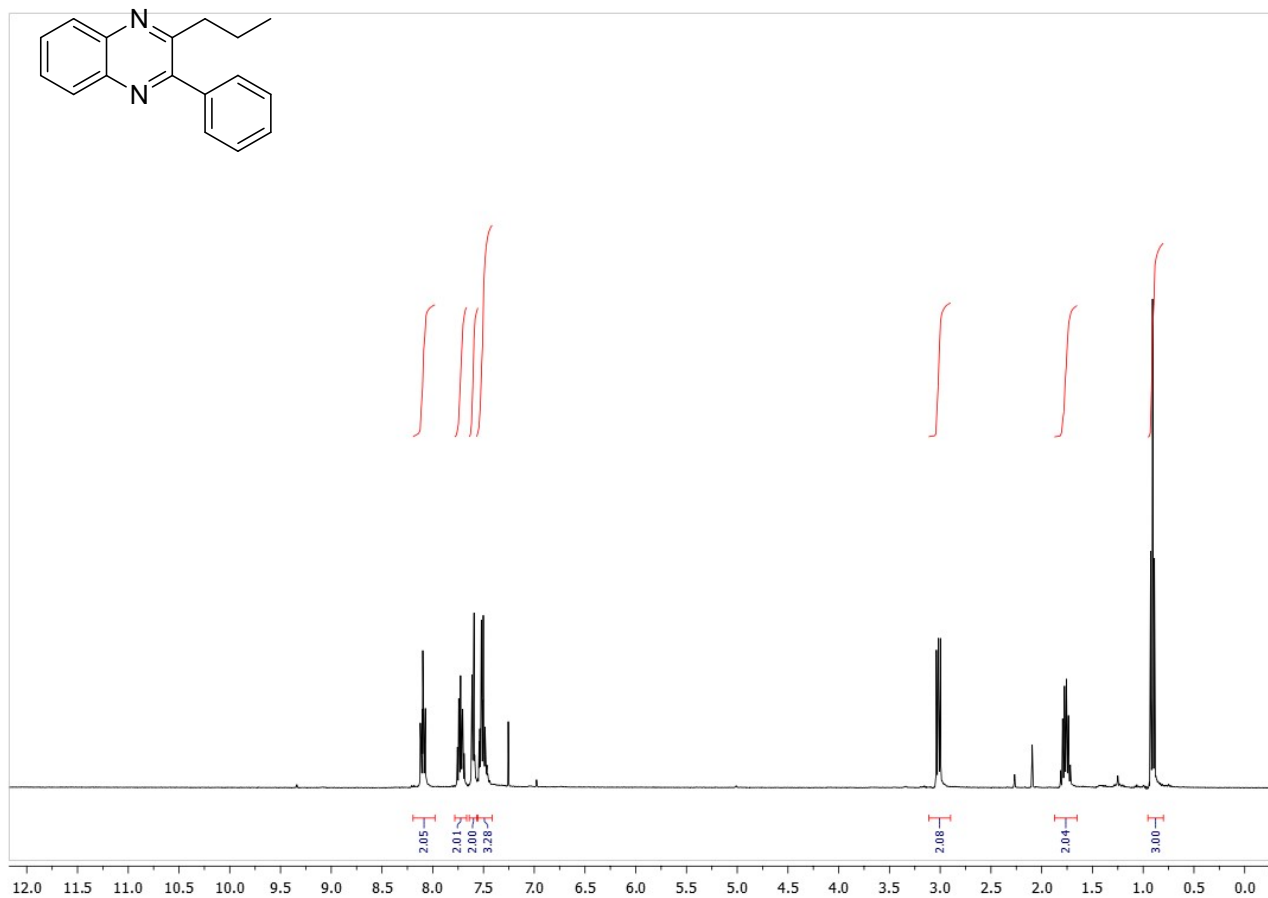


4.99 (m, 2H, H20), 5.73-5.81 (m, 1H, H19), 7.20-7.24 (m 2H, H12), 7.58-7.61 (m, 2H, H11), 7.85 (bs, 2H, H5+H8). <sup>13</sup>C-NMR (CDCl<sub>3</sub>, 100MHz) δ: 20.2 (CH<sub>3</sub>), 20.3 (CH<sub>3</sub>), 28.5 (C15), 28.8 (C17), 28.9 (C16), 33.5 (C18), 35.8 (C14), 114.3 (C12), 114.4 (C12), 115.6 (C20), 127.6 (C8), 128.1 (C5), 130.8 (C11), 130.9 (C10), 138.9(C7), 139.6 (C19), 139.7 (C6), 140.3 (C8a), 140.4 (C4a), 153.0 (C2), 154.9 (C3), 162.0 (C13), 164.0 (C13). GC-MS (70eV): *m/z*: 348 ([M<sup>+</sup>], (5)), 307 (6), 279 (23), 265 (100), 77 (6). Anal. Calcd. for C<sub>23</sub>H<sub>25</sub>FN<sub>2</sub> (348.20) C, 79.28; H, 7.23; N, 8.04. Found: ) C, 79.33; H, 7.26; N, 8.01.

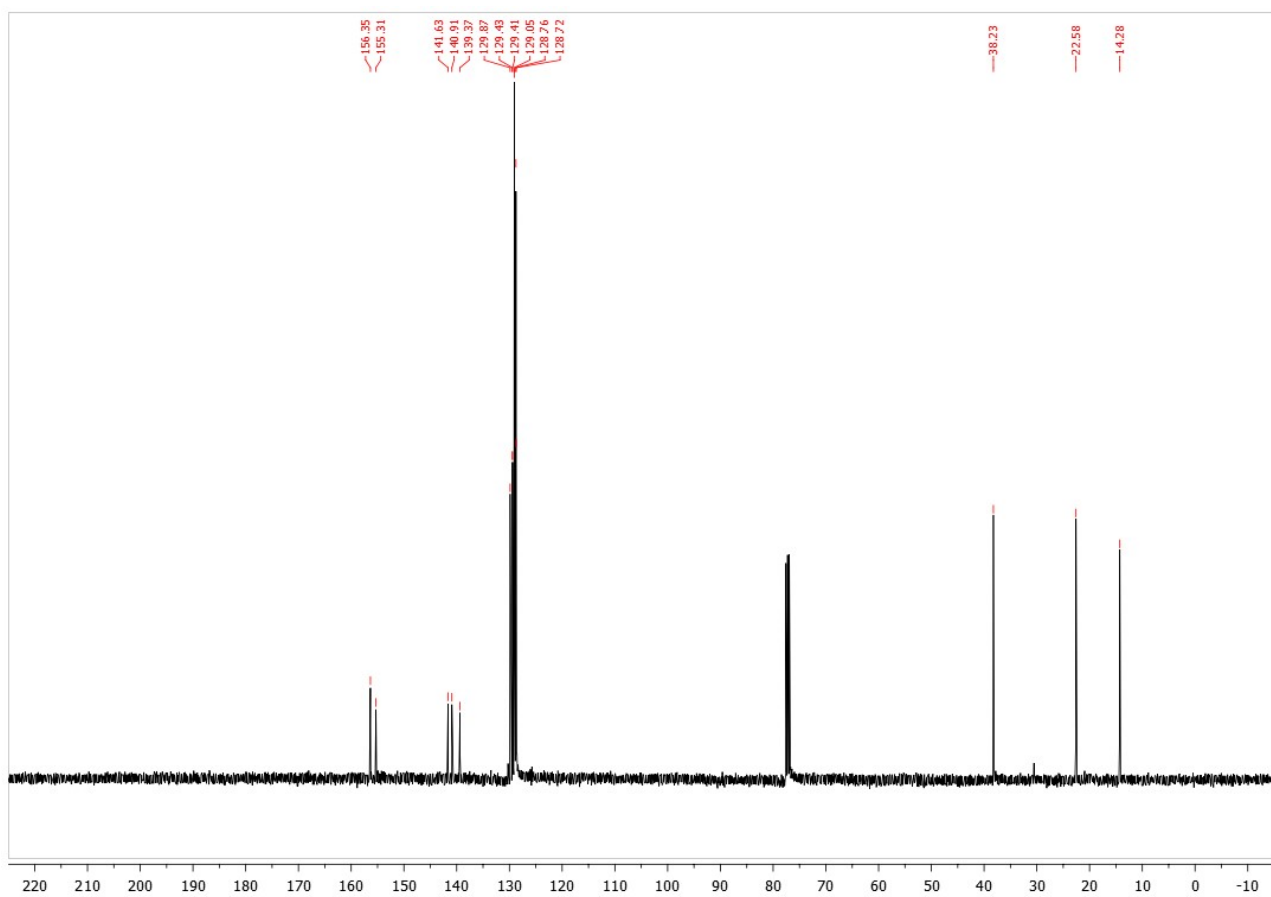
1 A. Palmieri, S. Gabrielli, S. Sampaolesi and R. Ballini, *RCS Adv.*, 2015, **5**, 36652-36655.

2 S. Chen, F. S. Raad, M. Ahmida, B. L. Kaafarani and S. H. Eichhorn, *Org. Lett.* 2013, **15**, 558-561.

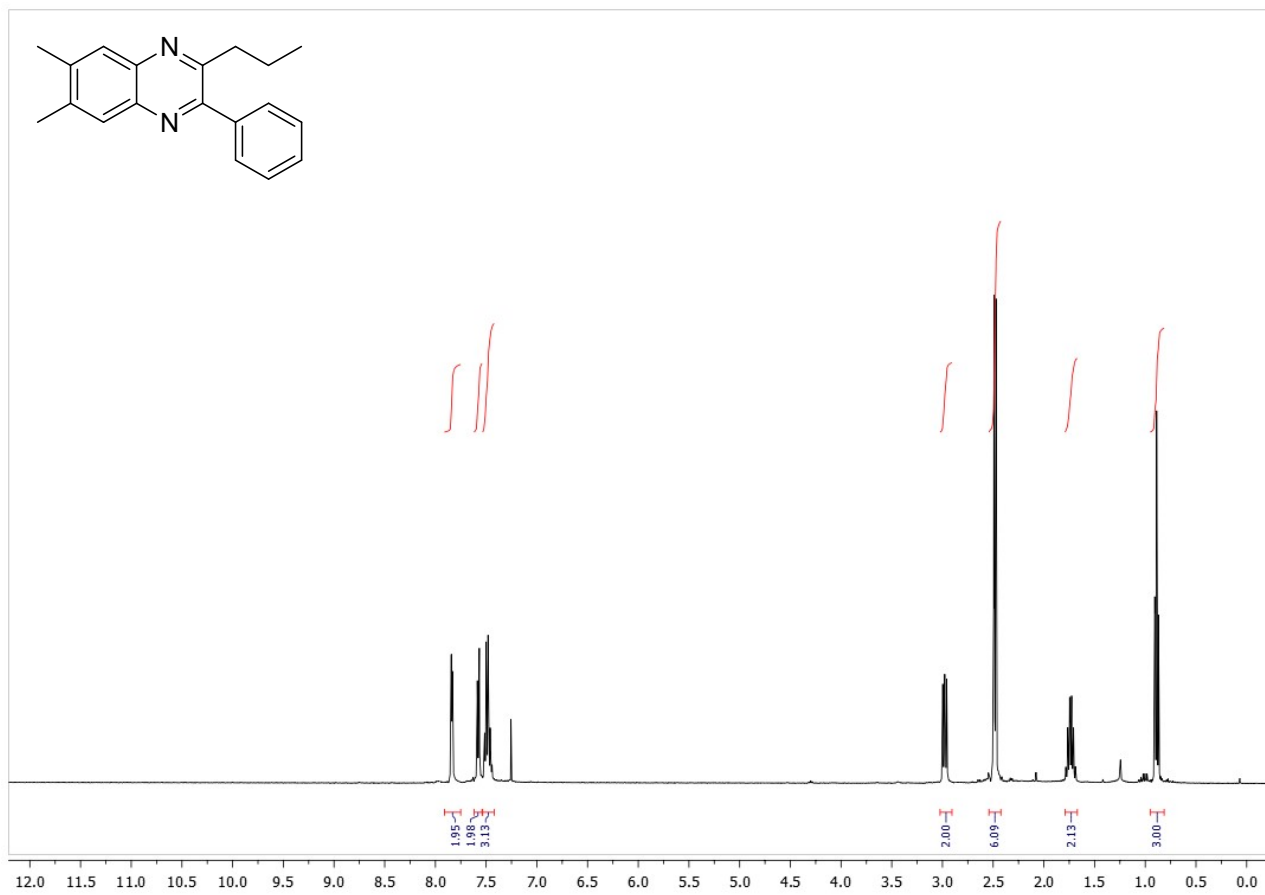
<sup>1</sup>H-NMR spectrum of compound **3a**.



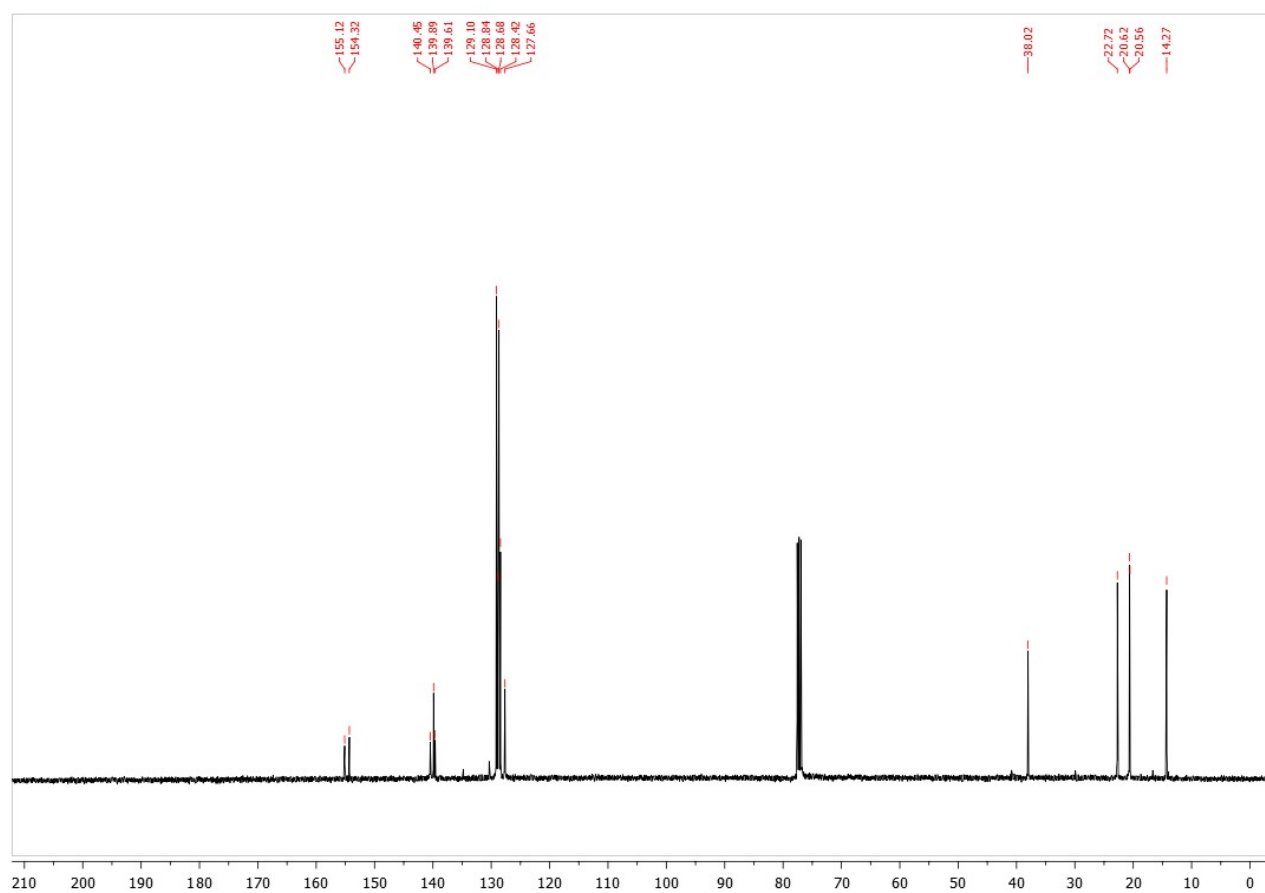
<sup>13</sup>C-NMR spectrum of compound **3a**.



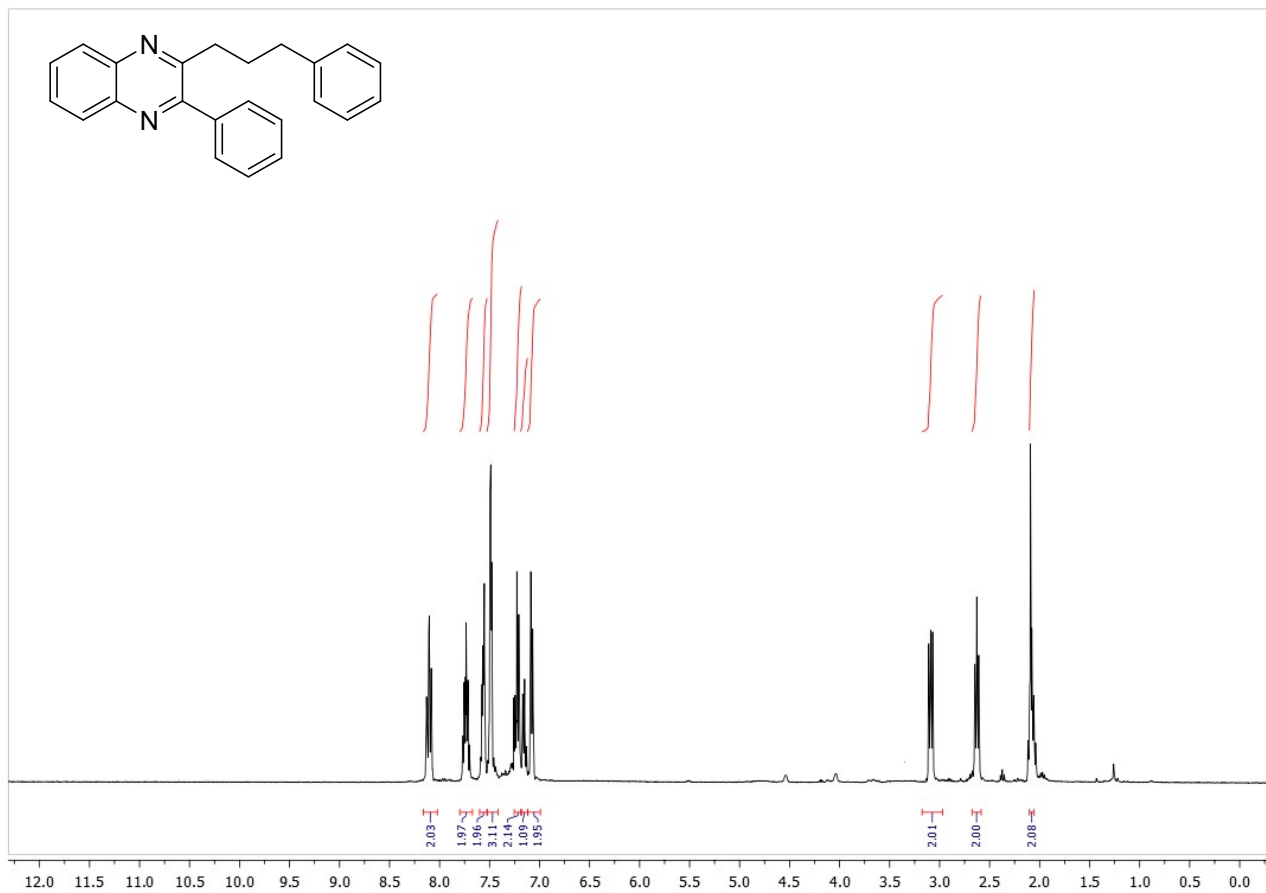
<sup>1</sup>H-NMR spectrum of compound **3b**.



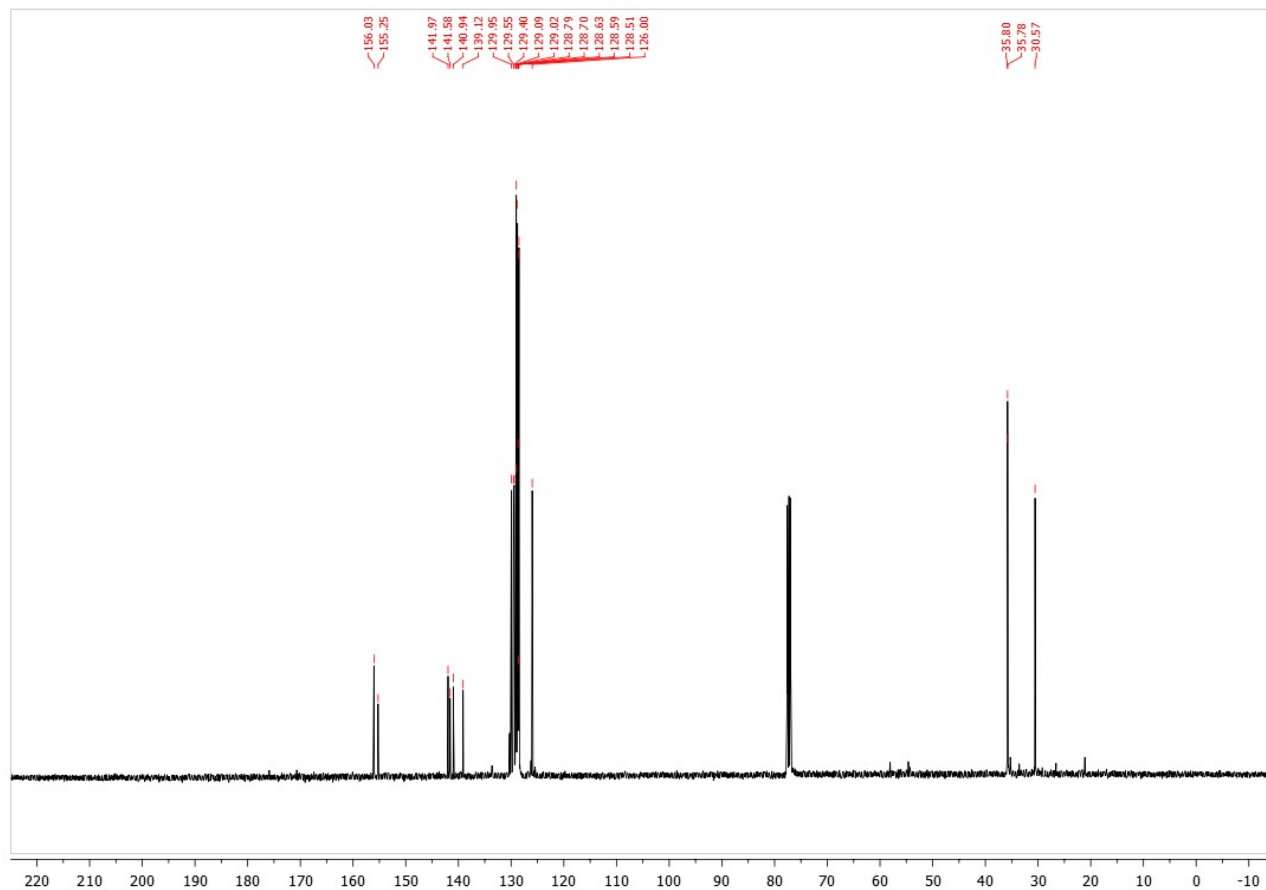
<sup>13</sup>C-NMR spectrum of compound **3b**.



<sup>1</sup>H-NMR spectrum of compound **3c**.

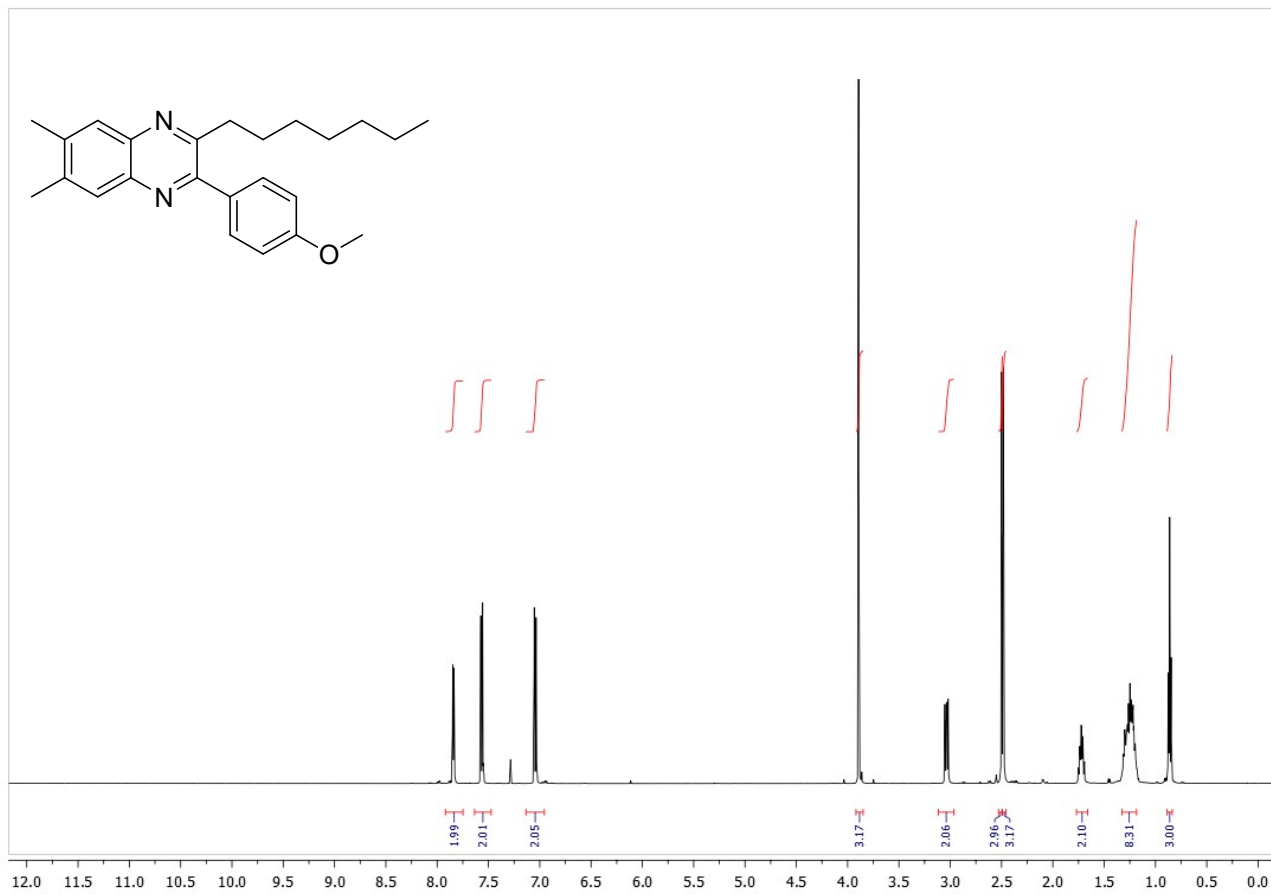


<sup>13</sup>C-NMR spectrum of compound **3c**.

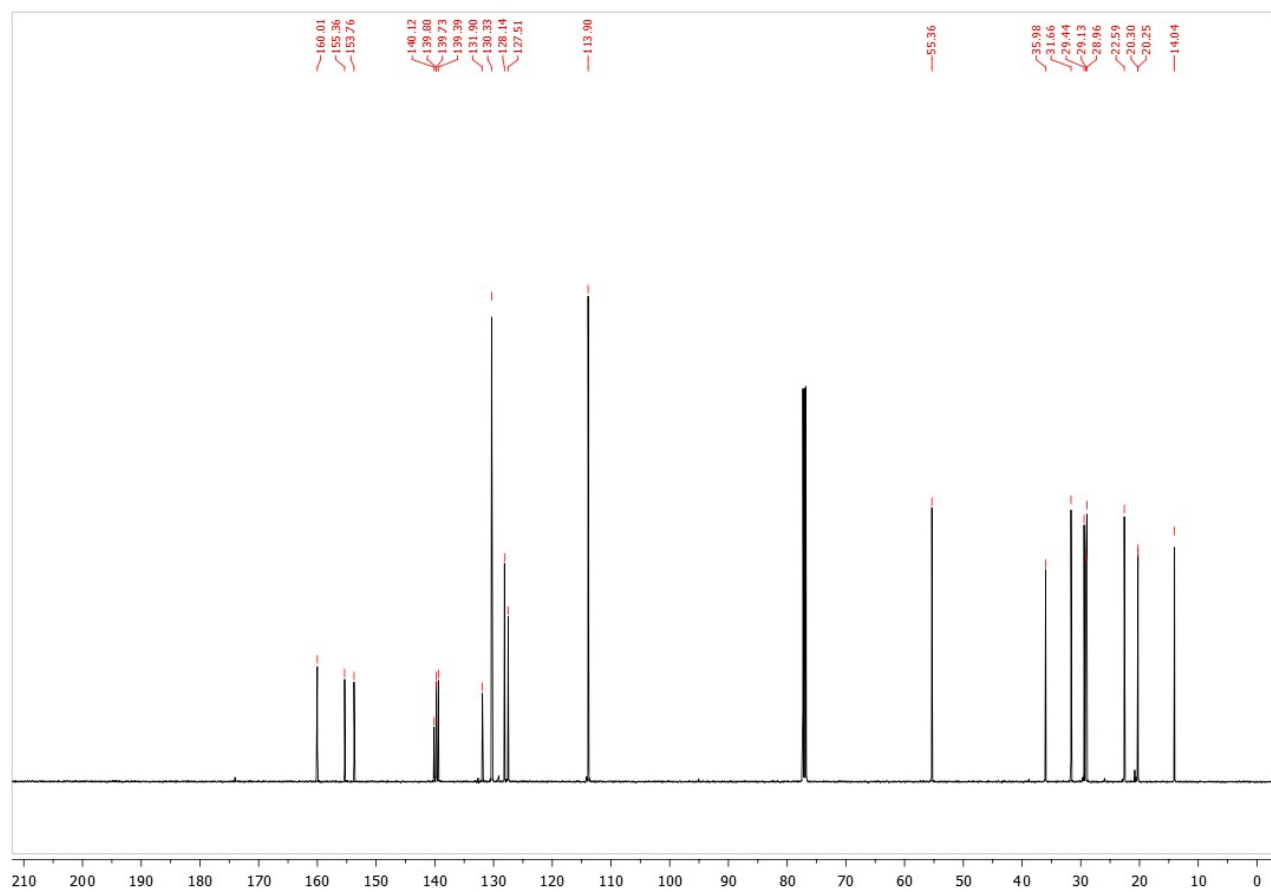




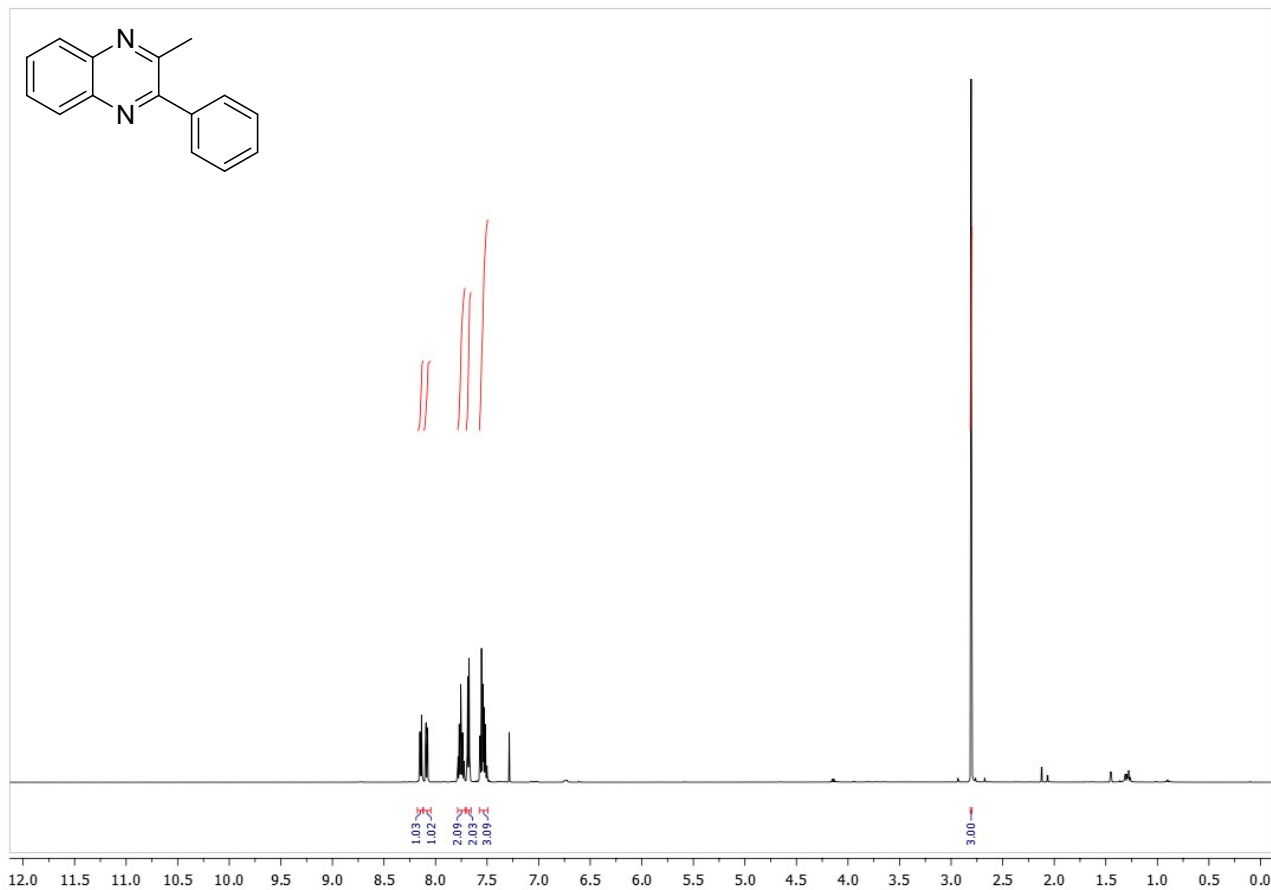
<sup>1</sup>H-NMR spectrum of compound **3d**.



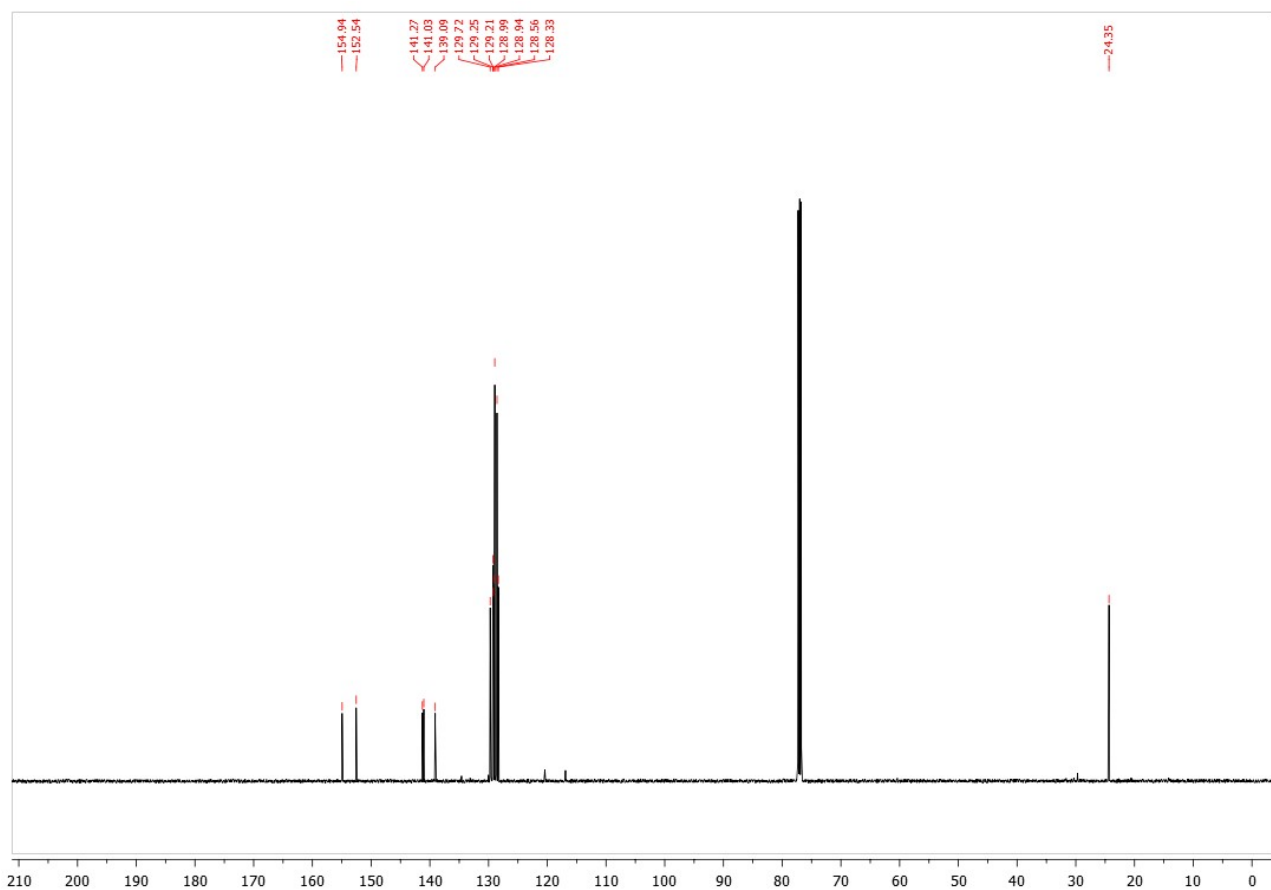
<sup>13</sup>C-NMR spectrum of compound **3d**.



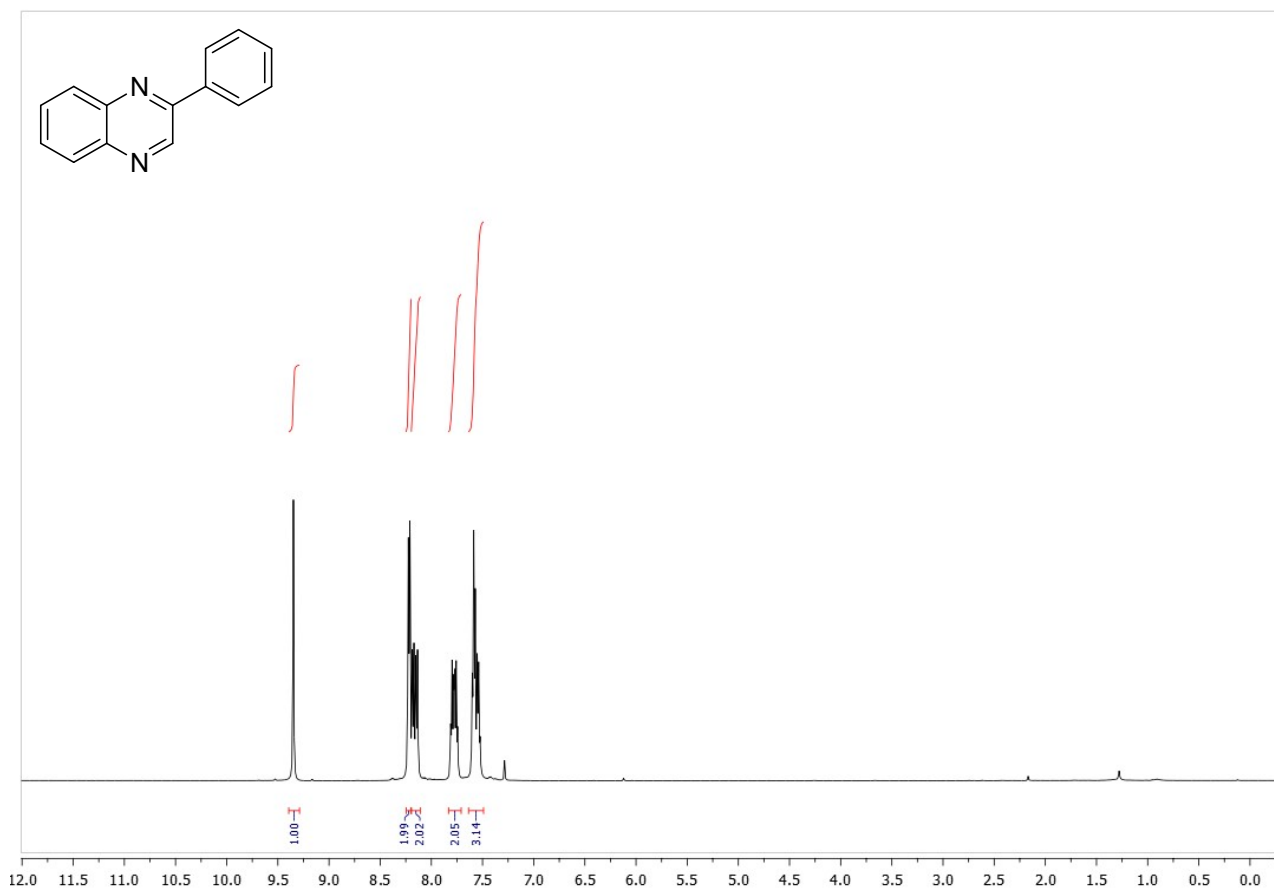
<sup>1</sup>H-NMR spectrum of compound **3e**



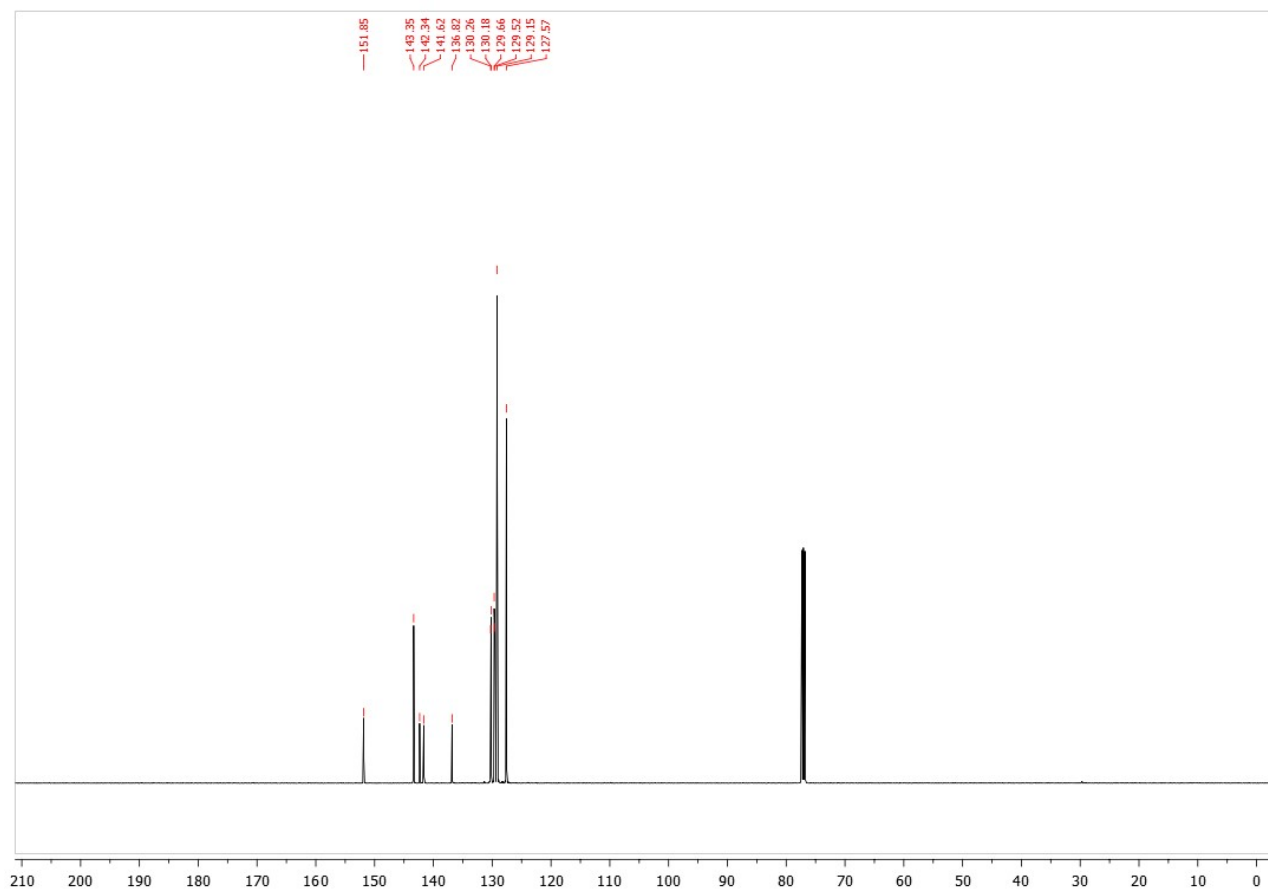
<sup>13</sup>C-NMR spectrum of compound **3e**.



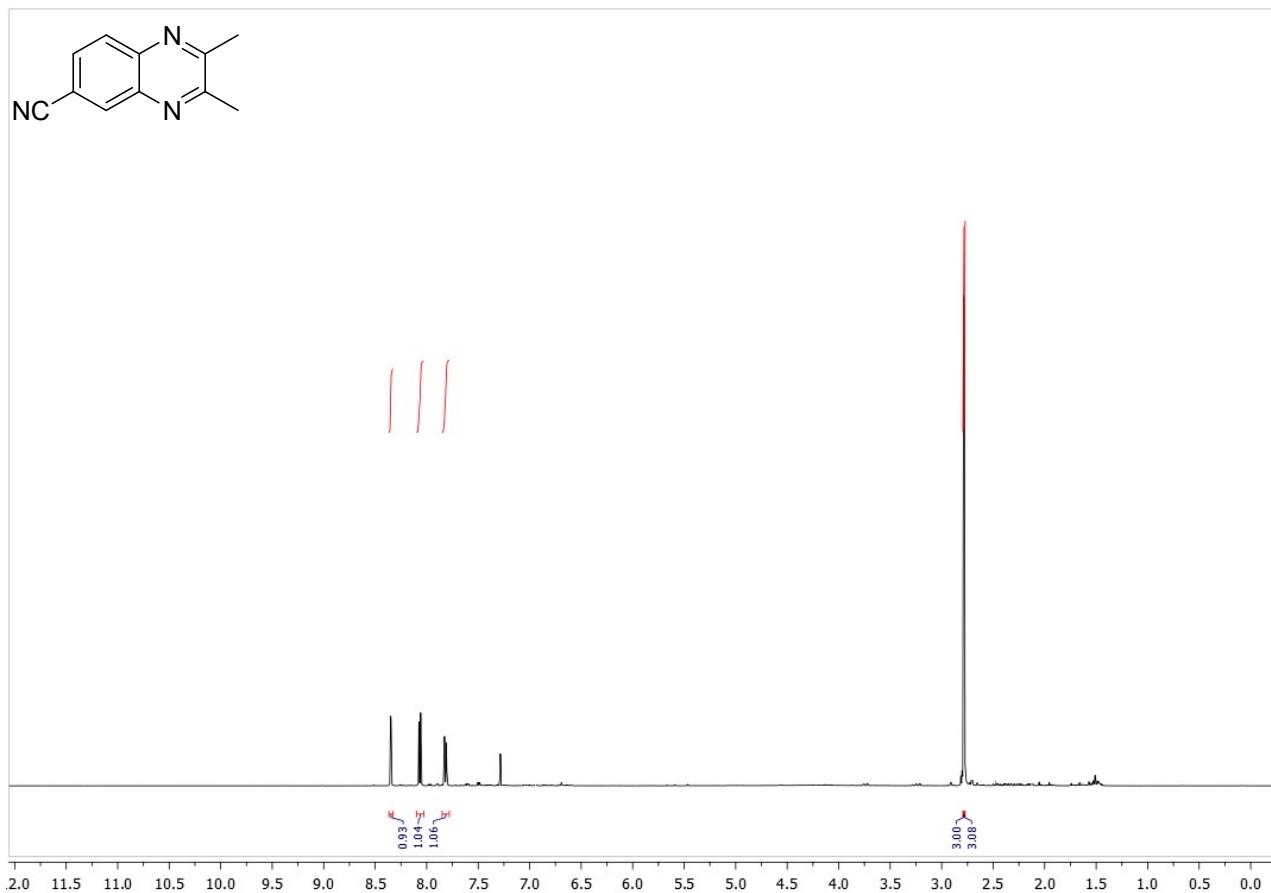
<sup>1</sup>H-NMR spectrum of compound **3f**



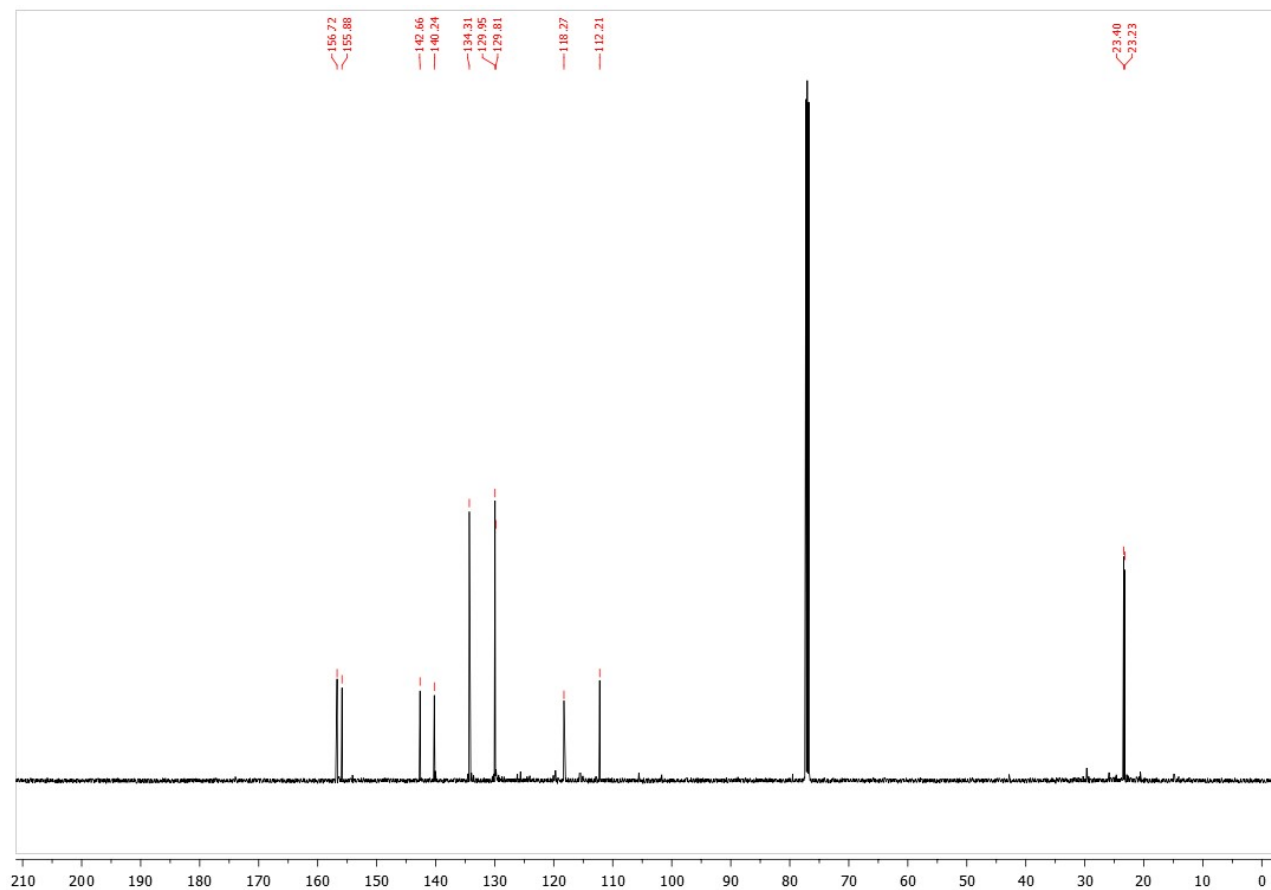
<sup>13</sup>C-NMR spectrum of compound **3f**.



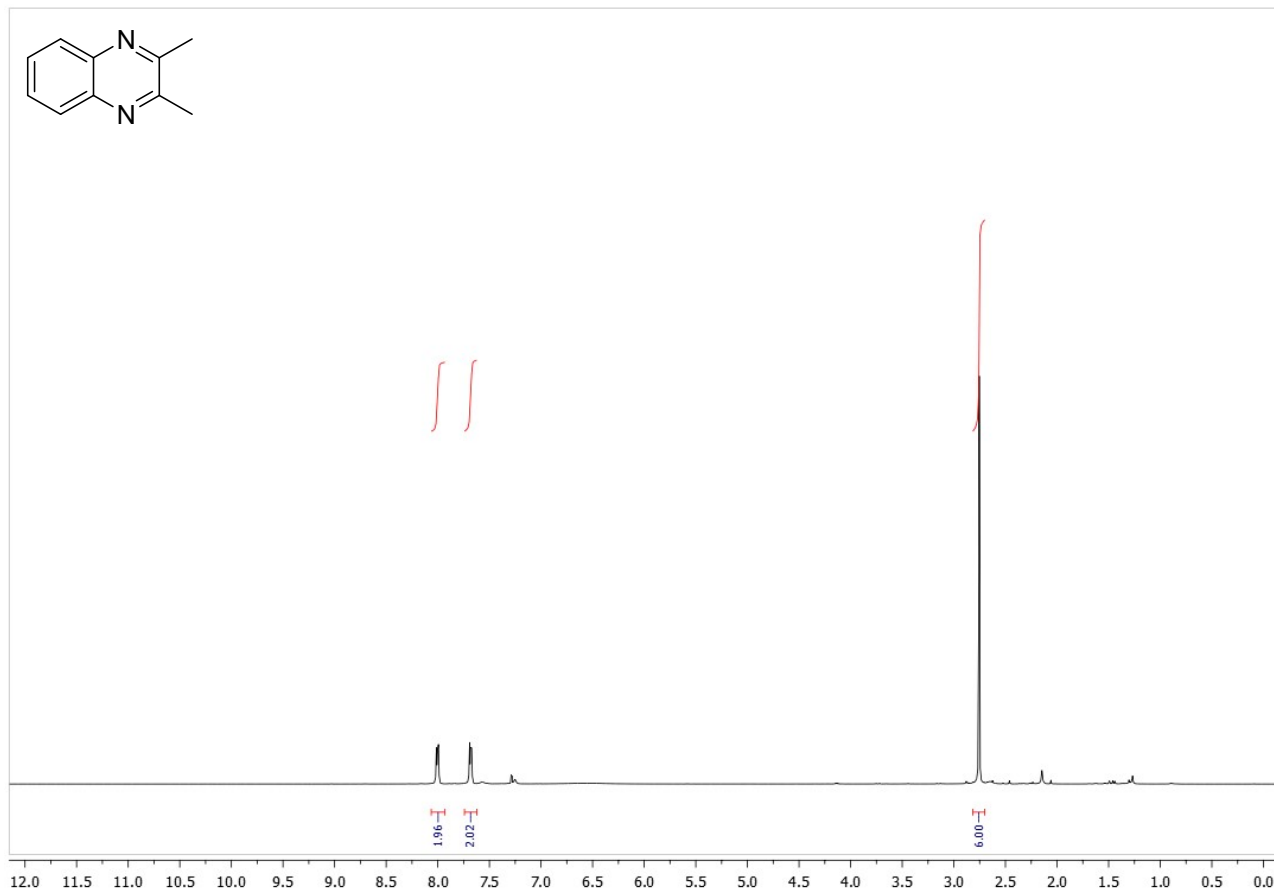
<sup>1</sup>H-NMR spectrum of compound **3g**



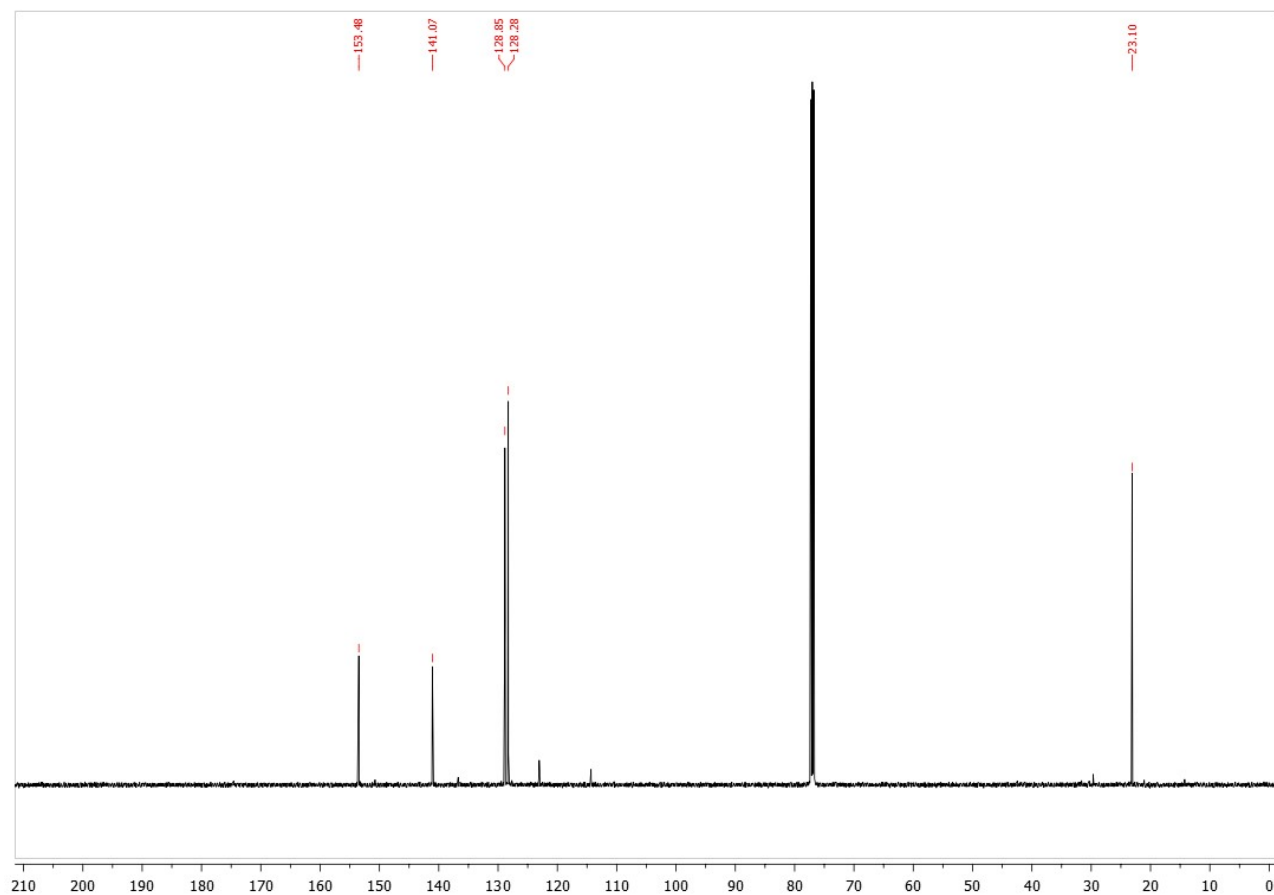
<sup>13</sup>C-NMR spectrum of compound **3g**.



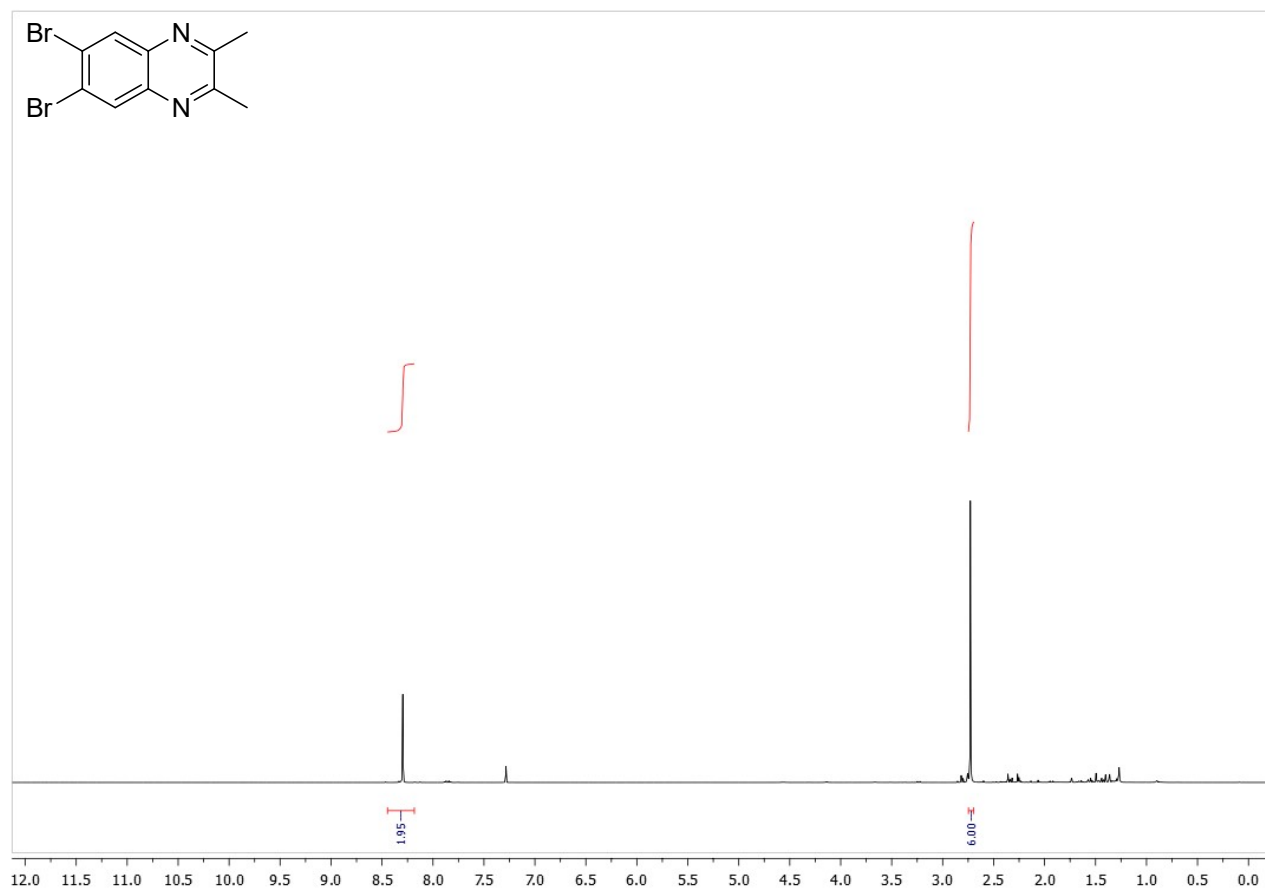
<sup>1</sup>H-NMR spectrum of compound **3h**.



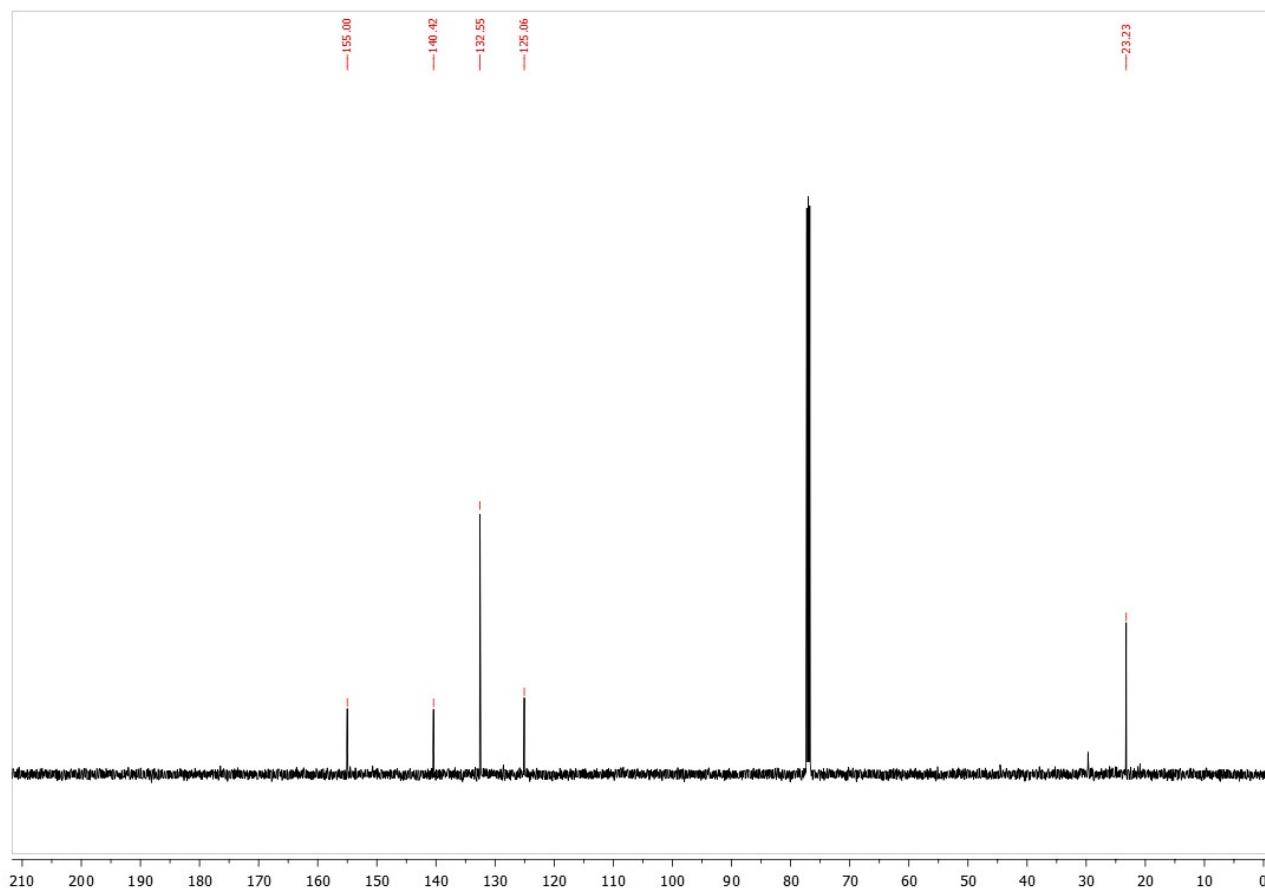
<sup>13</sup>C-NMR spectrum of compound **3h**.



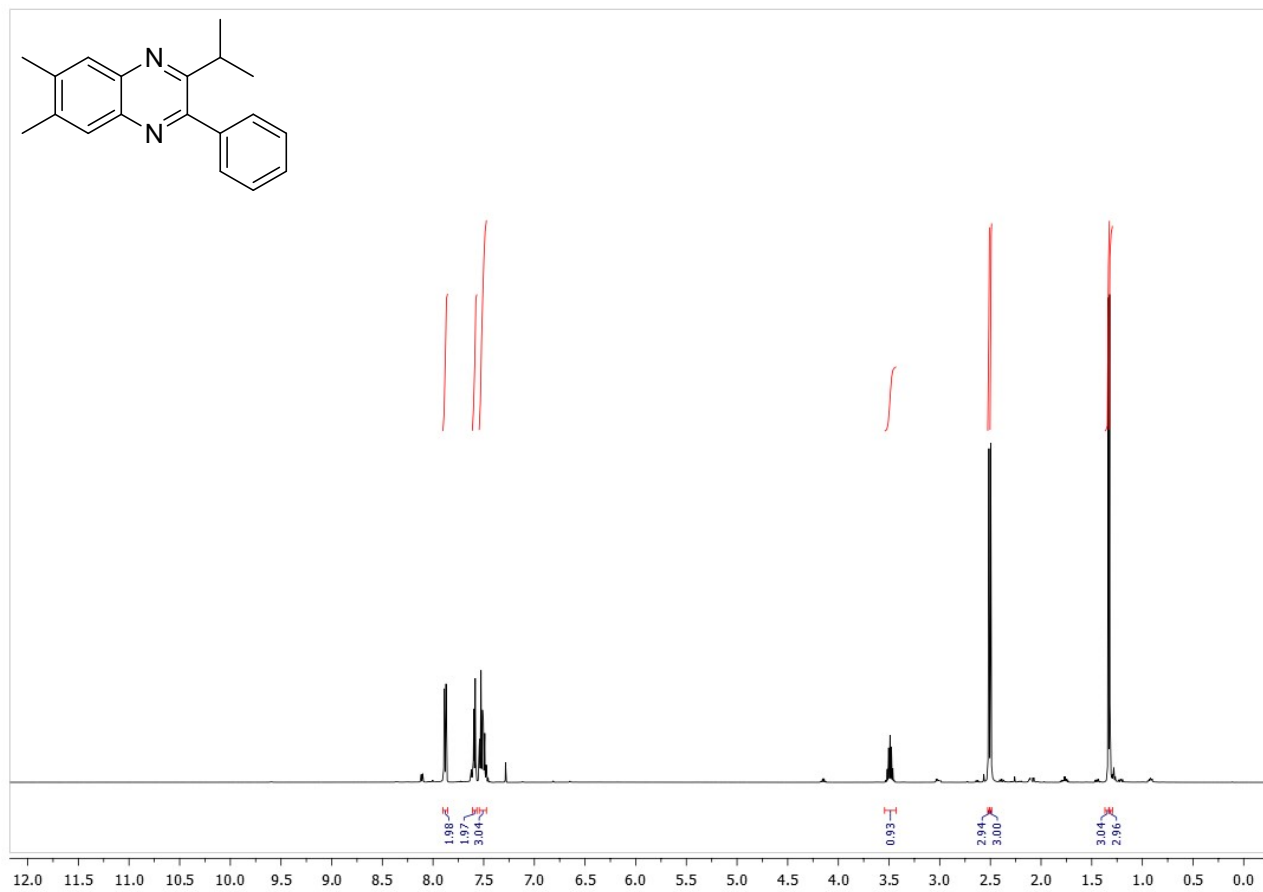
<sup>1</sup>H-NMR spectrum of compound **3i**



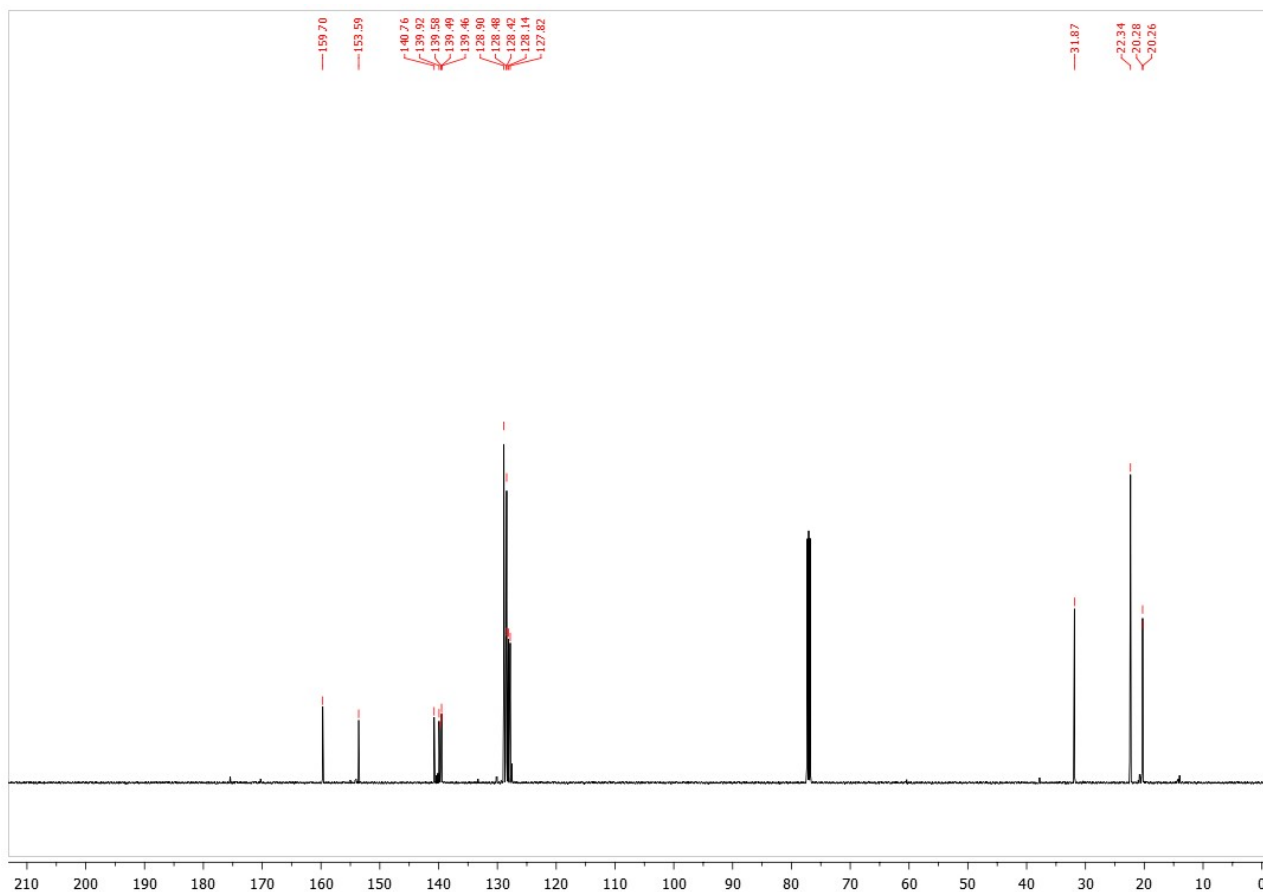
<sup>13</sup>C-NMR spectrum of compound **3i**.



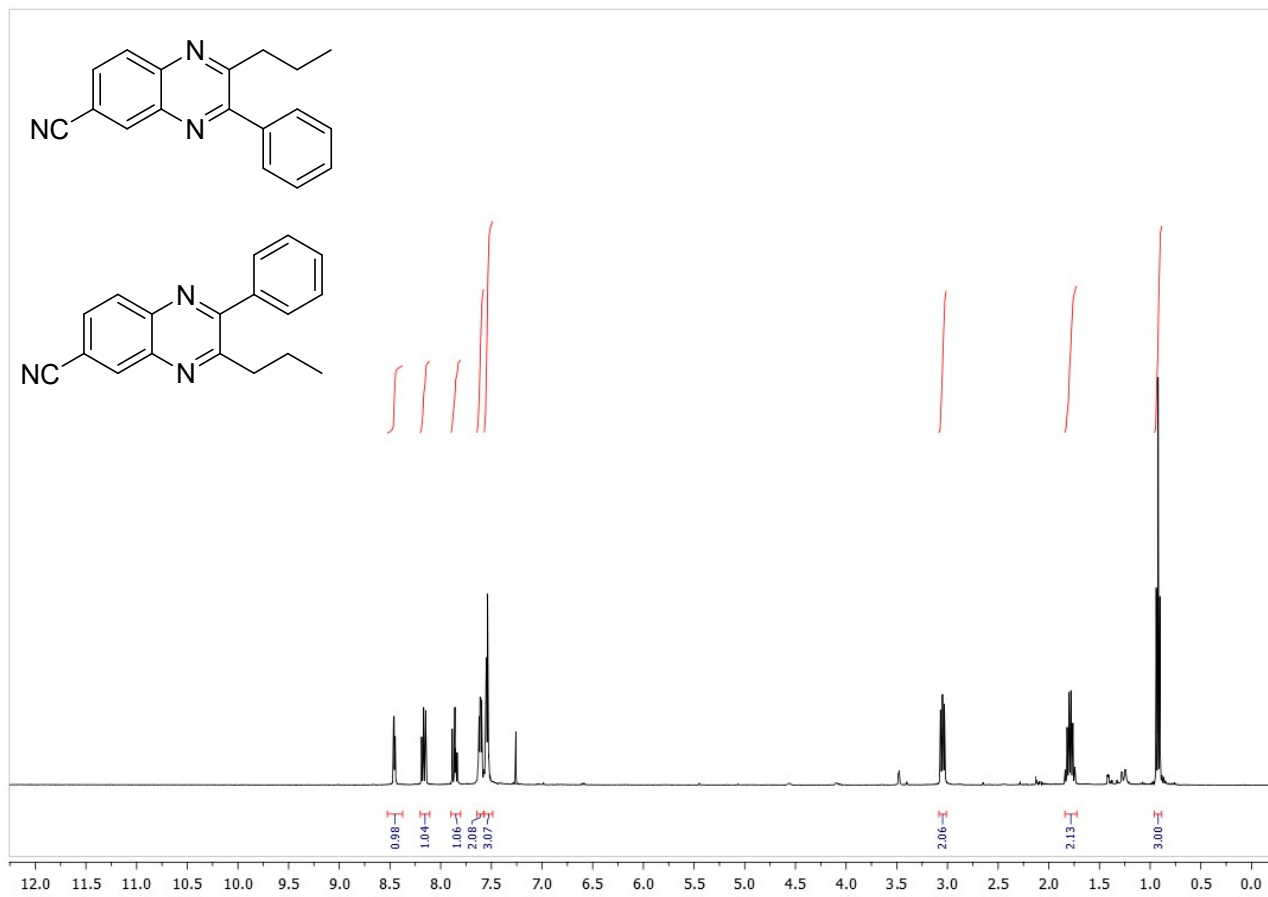
<sup>1</sup>H-NMR spectrum of compound **3j**.



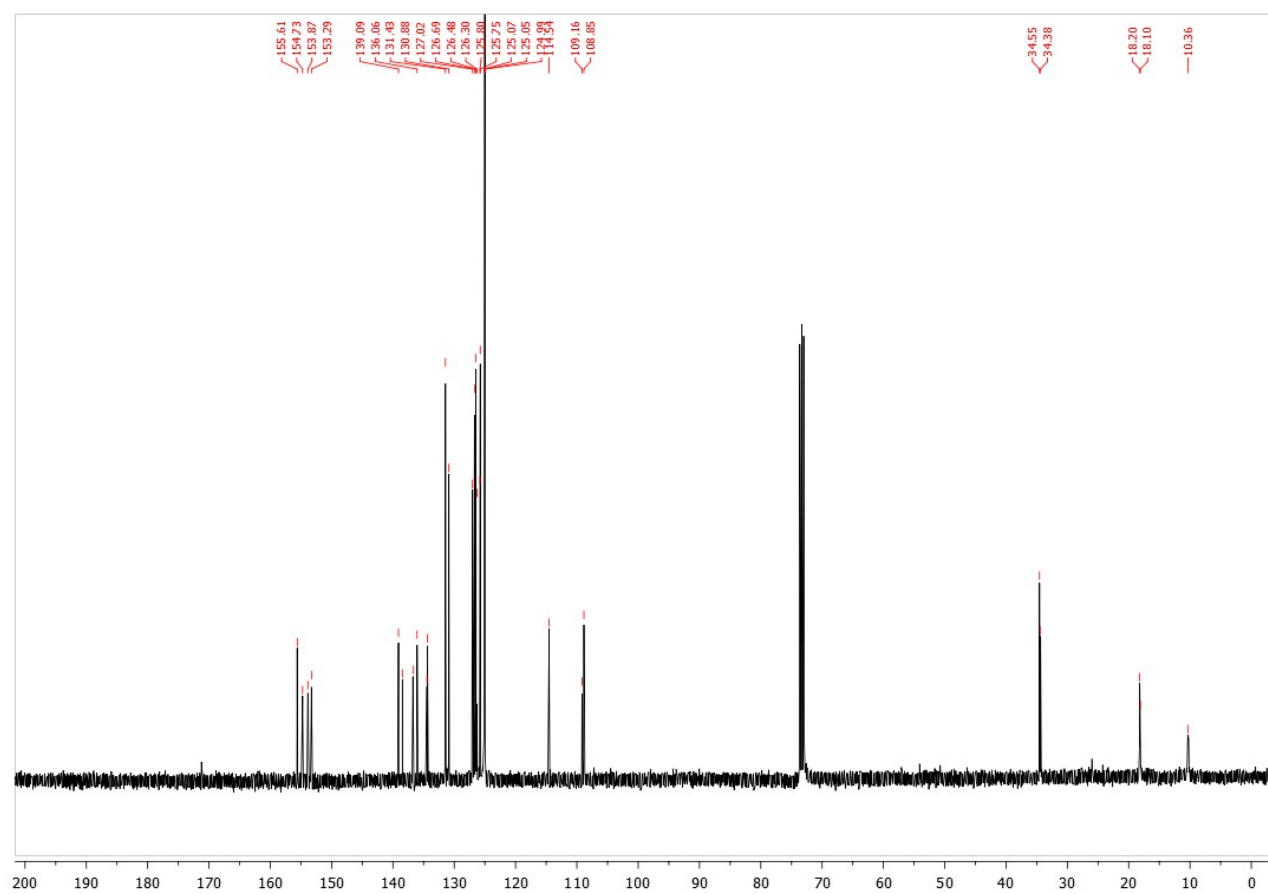
<sup>13</sup>C-NMR spectrum of compound **3j**.



<sup>1</sup>H-NMR spectrum of compound **3k** + **3k'**.

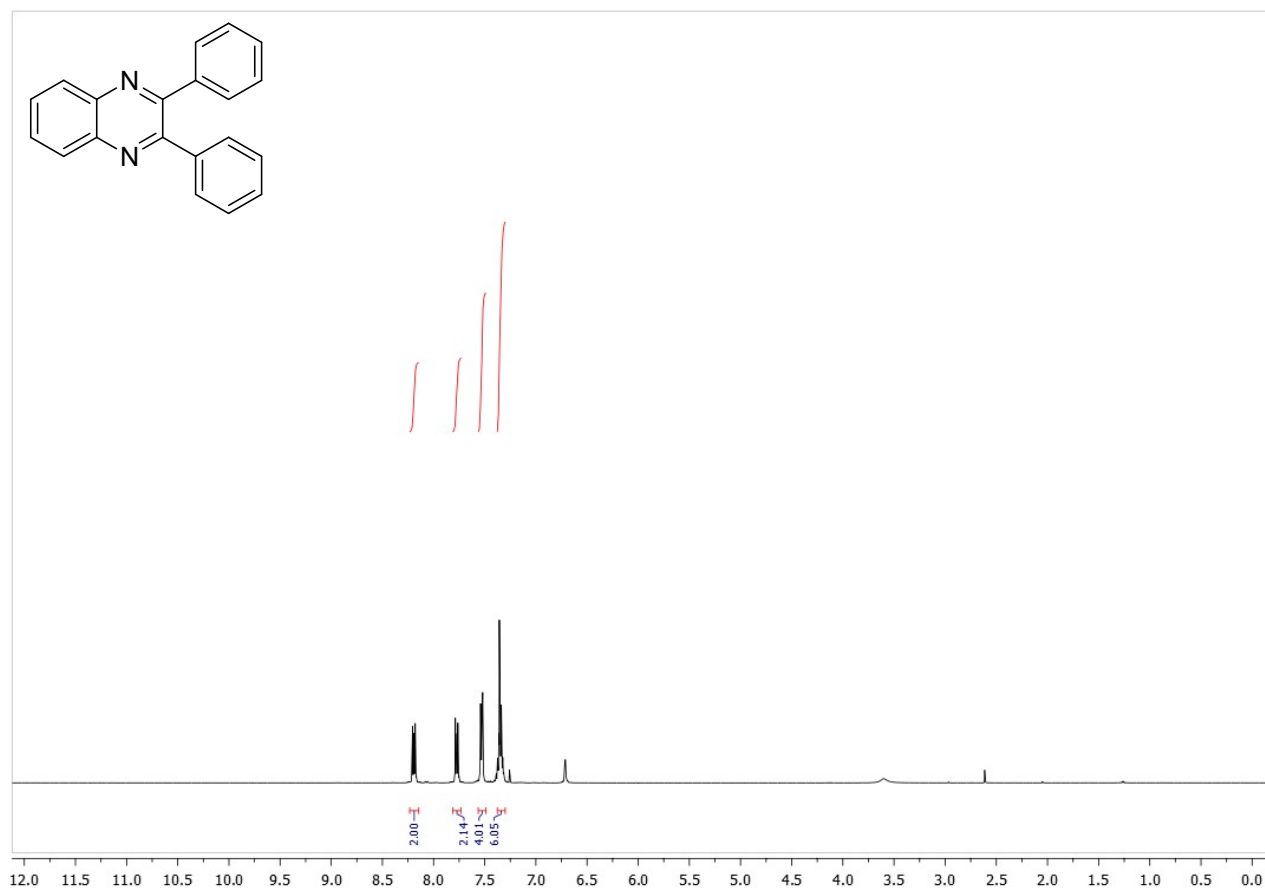


<sup>13</sup>C-NMR spectrum of compound **3k** + **3k'**.

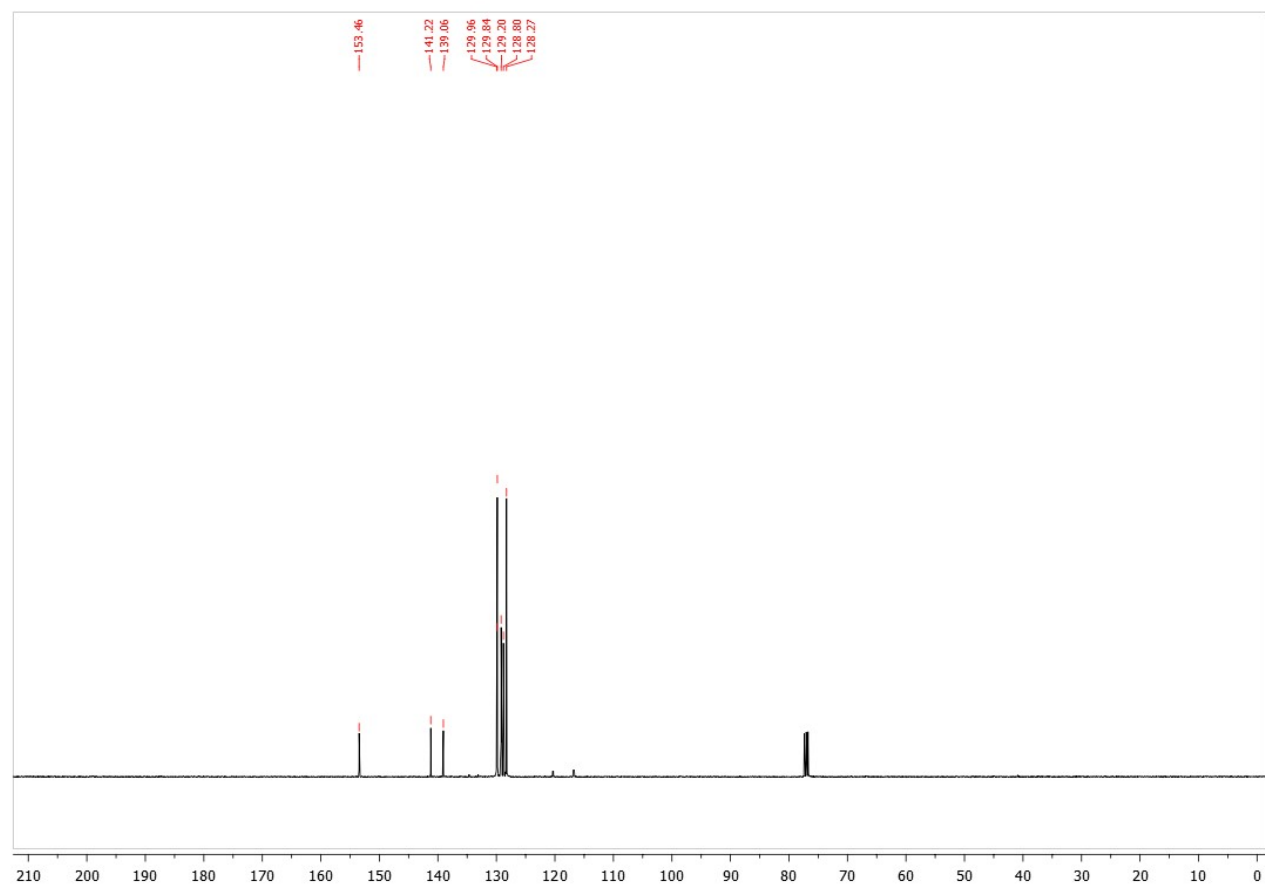




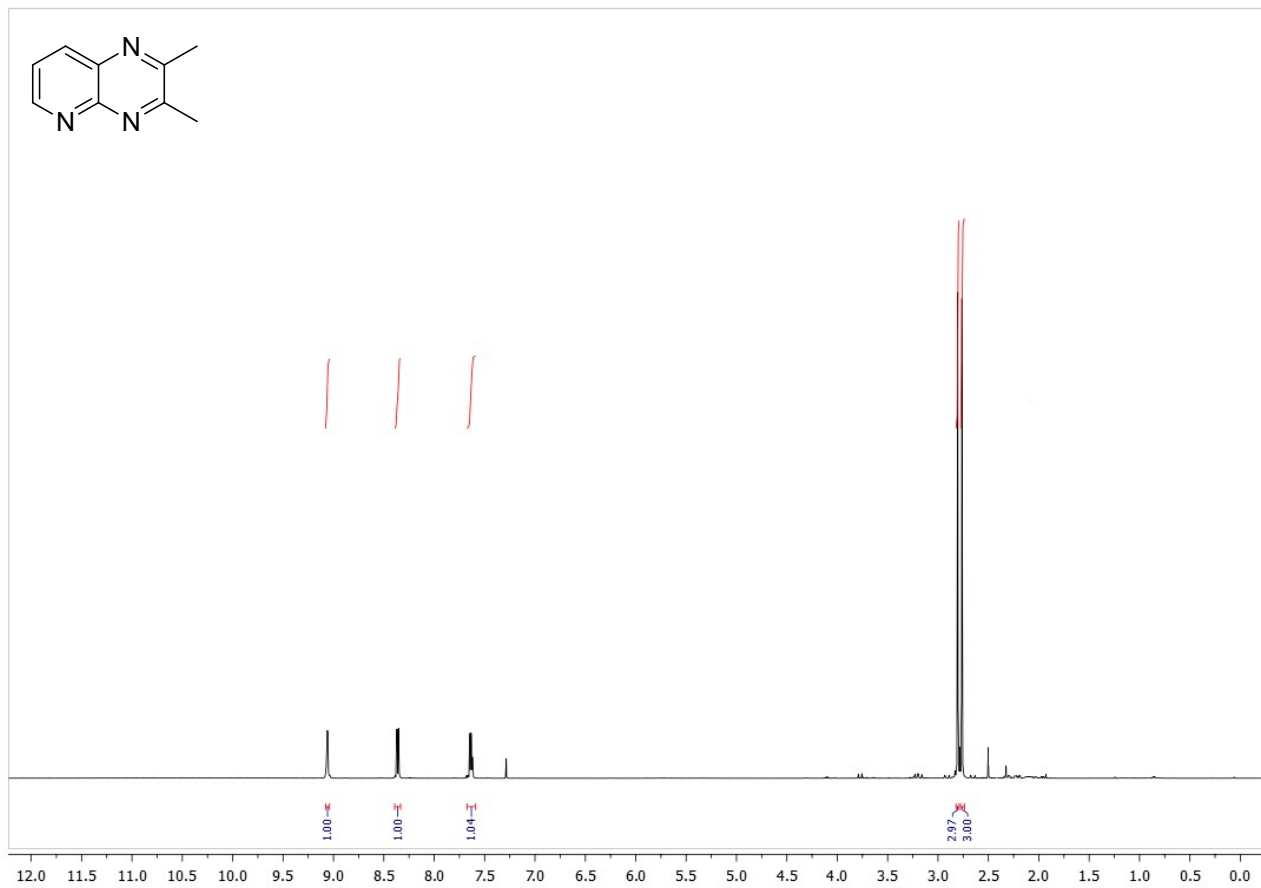
<sup>1</sup>H-NMR spectrum of compound **3I**



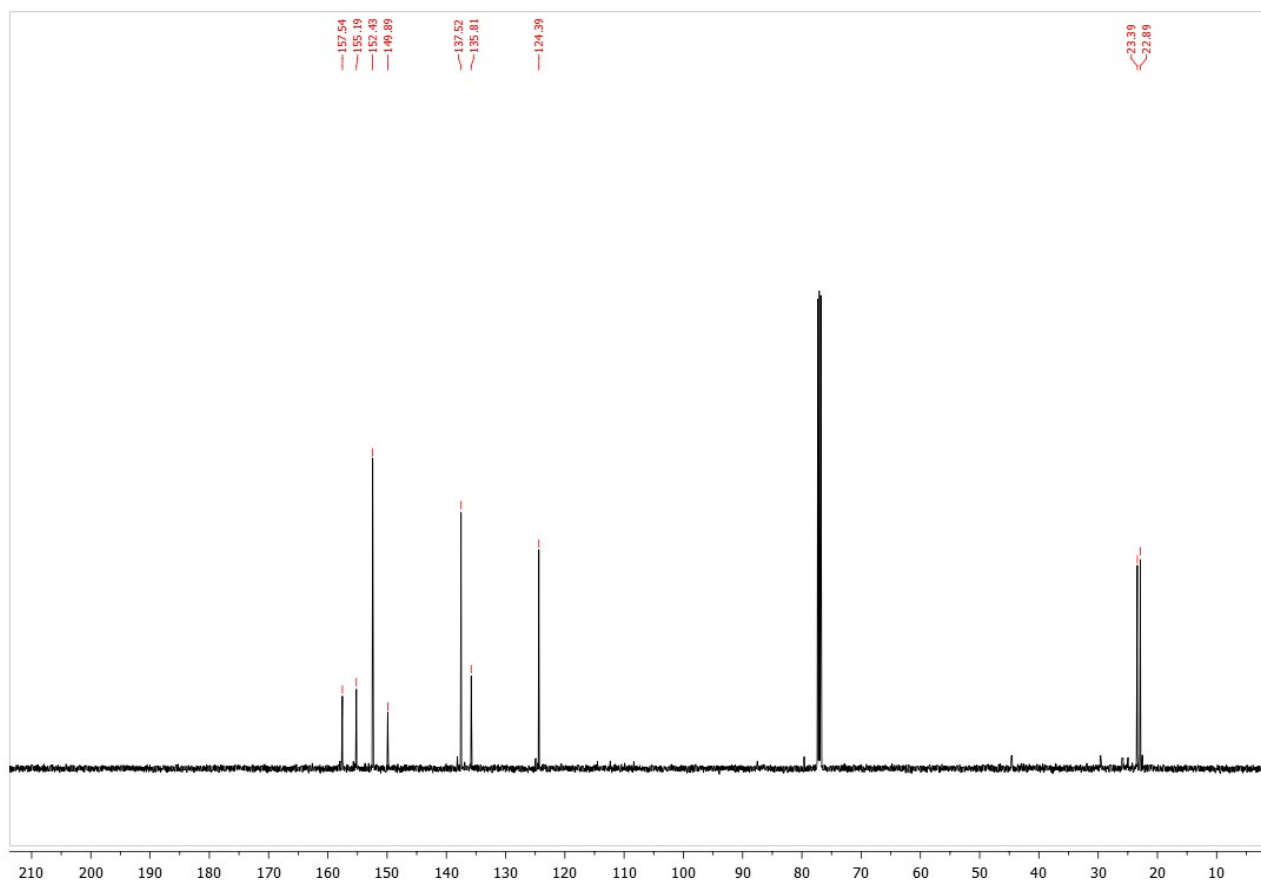
<sup>13</sup>C-NMR spectrum of compound **3I**.



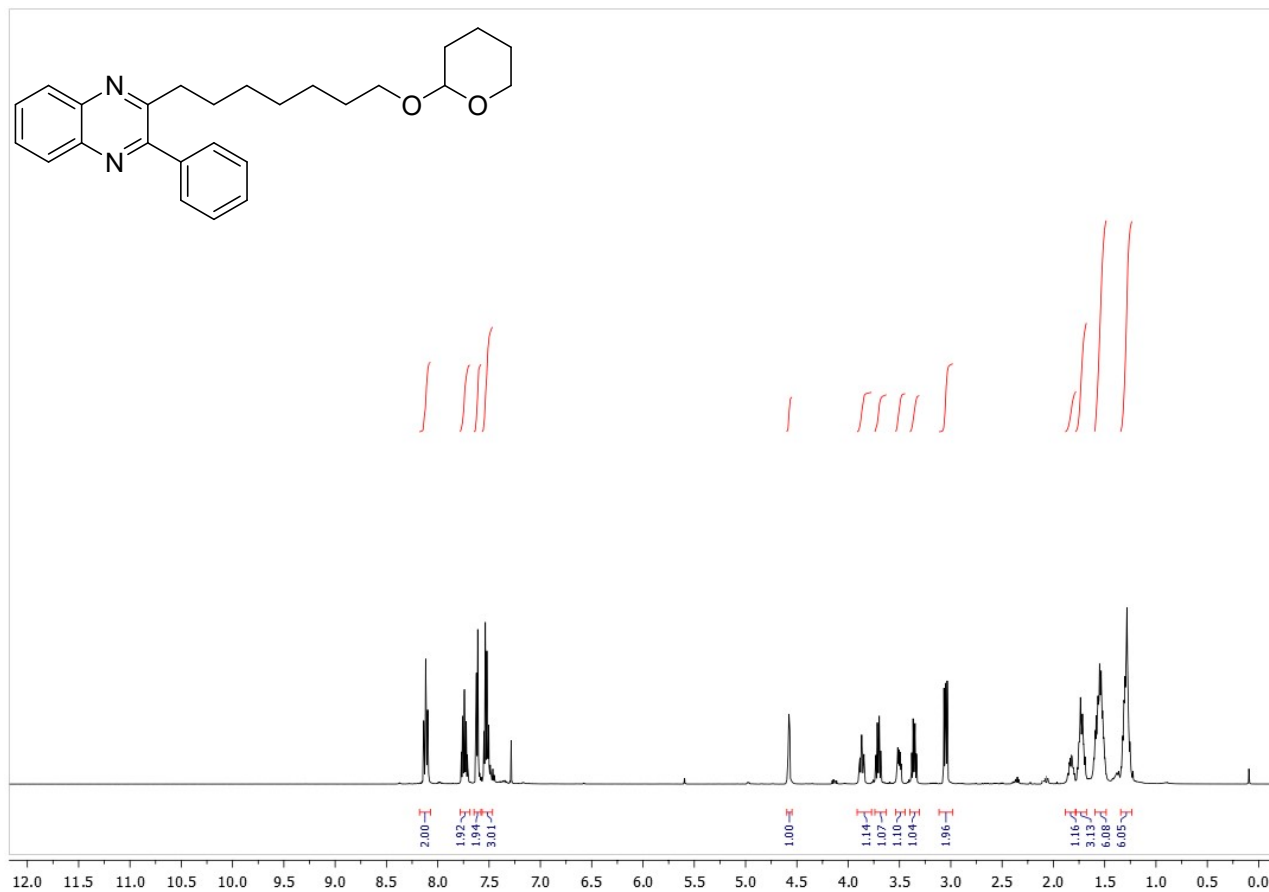
<sup>1</sup>H-NMR spectrum of compound **3m**



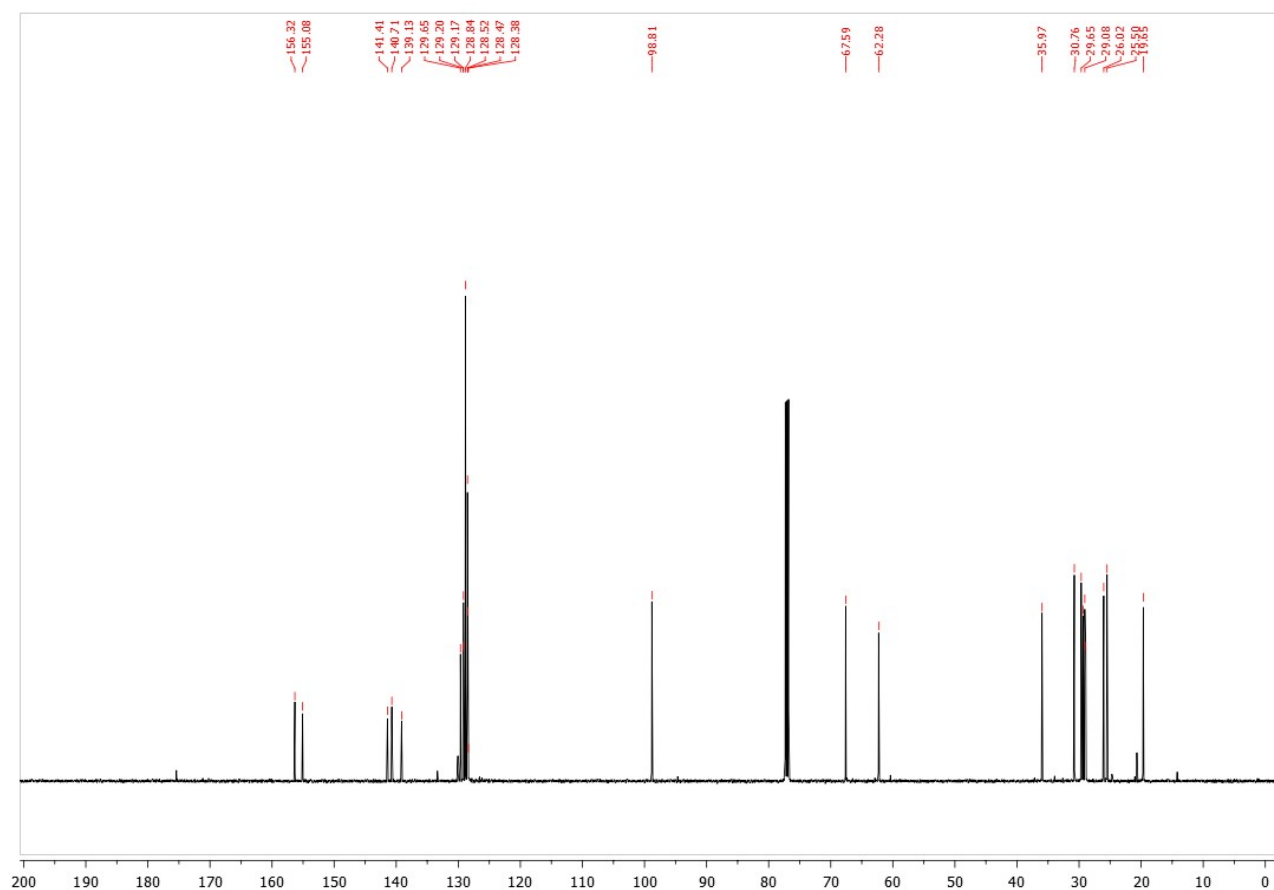
<sup>13</sup>C-NMR spectrum of compound **3m**.



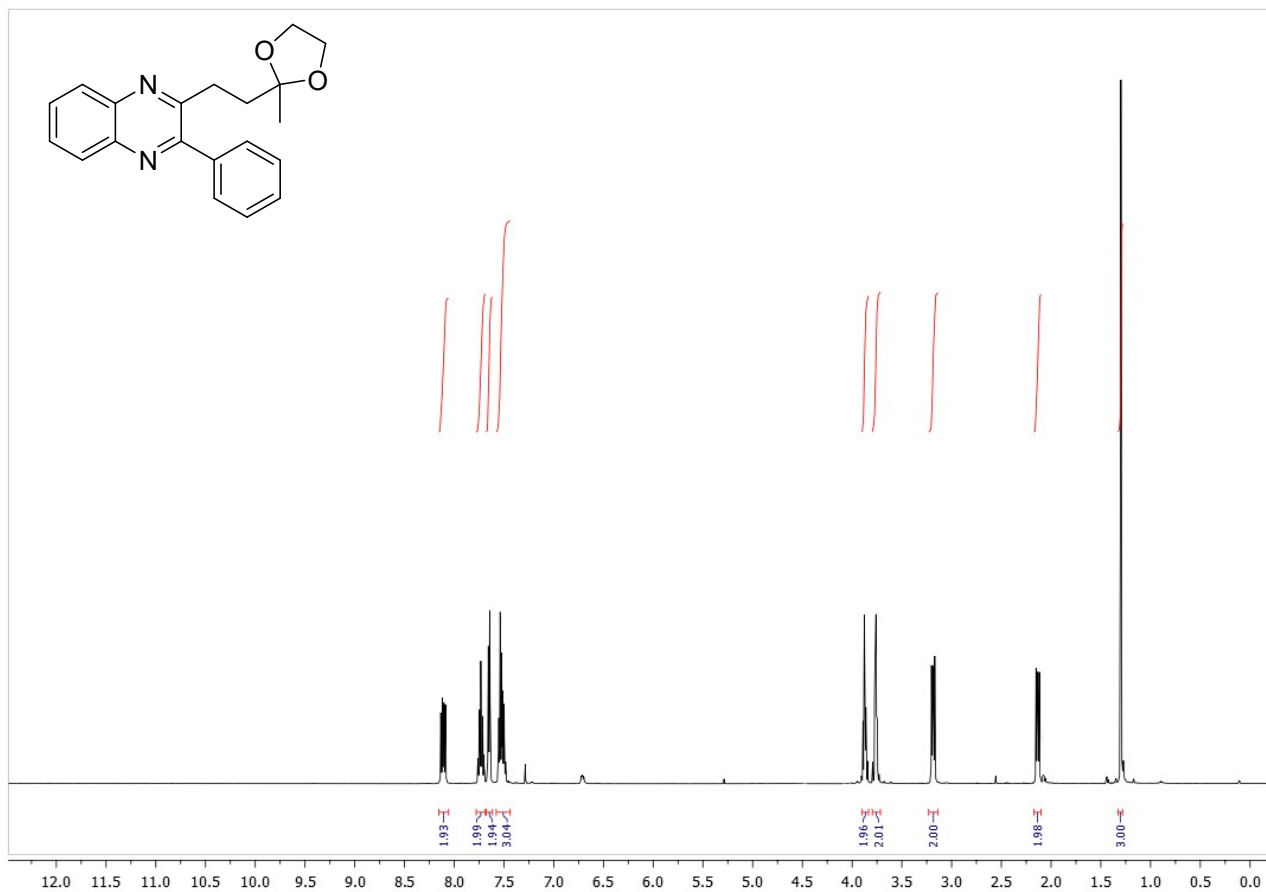
<sup>1</sup>H-NMR spectrum of compound **3n**



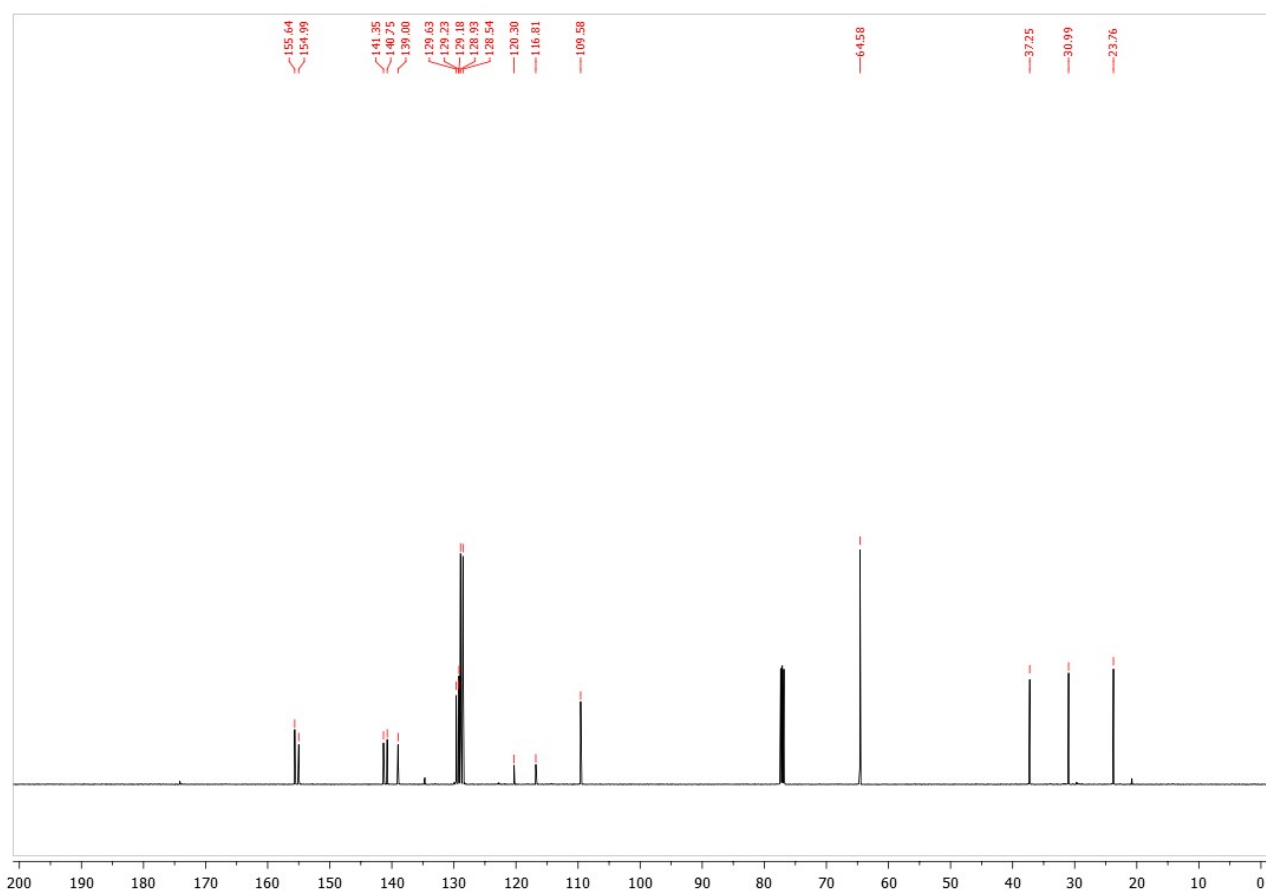
<sup>13</sup>C-NMR spectrum of compound **3n**.



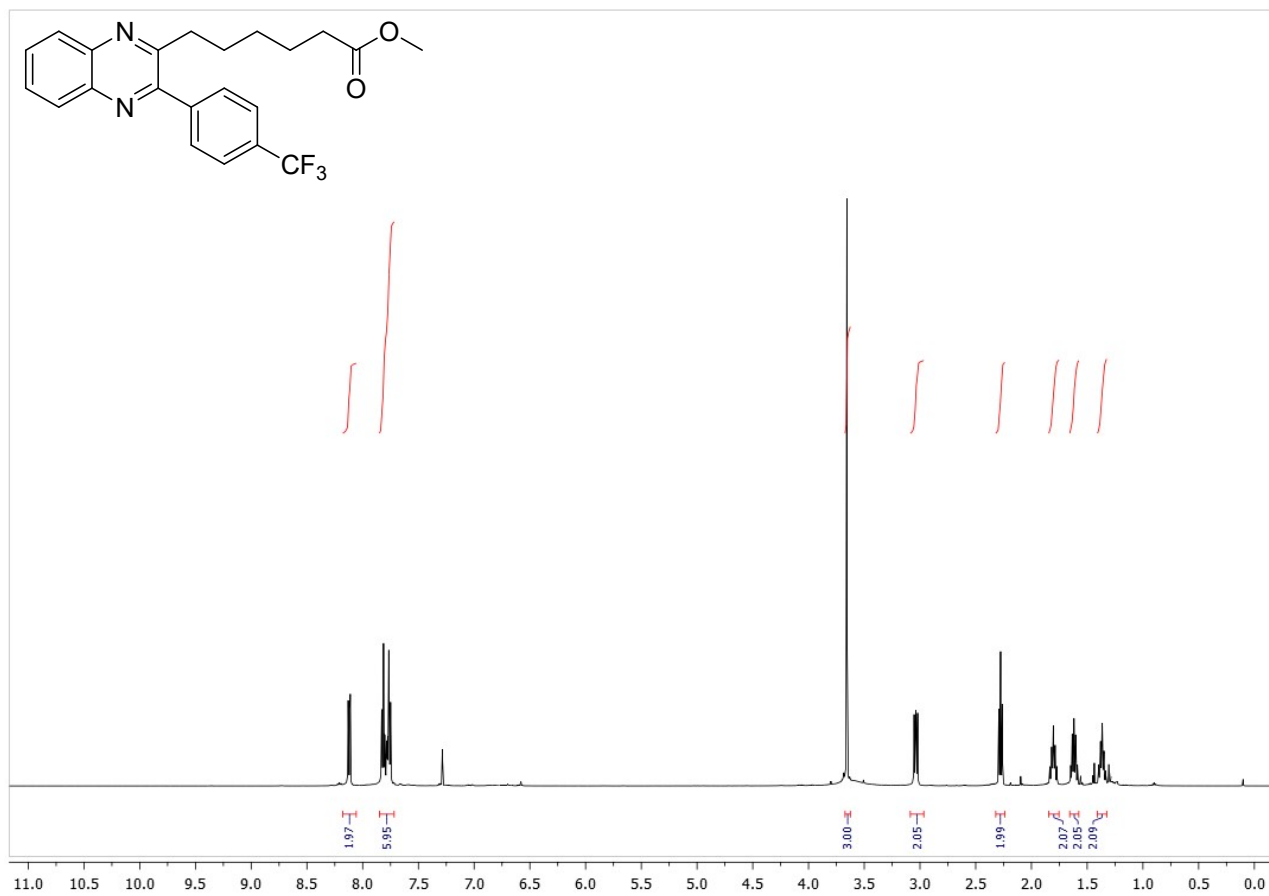
<sup>1</sup>H-NMR spectrum of compound **3o**.



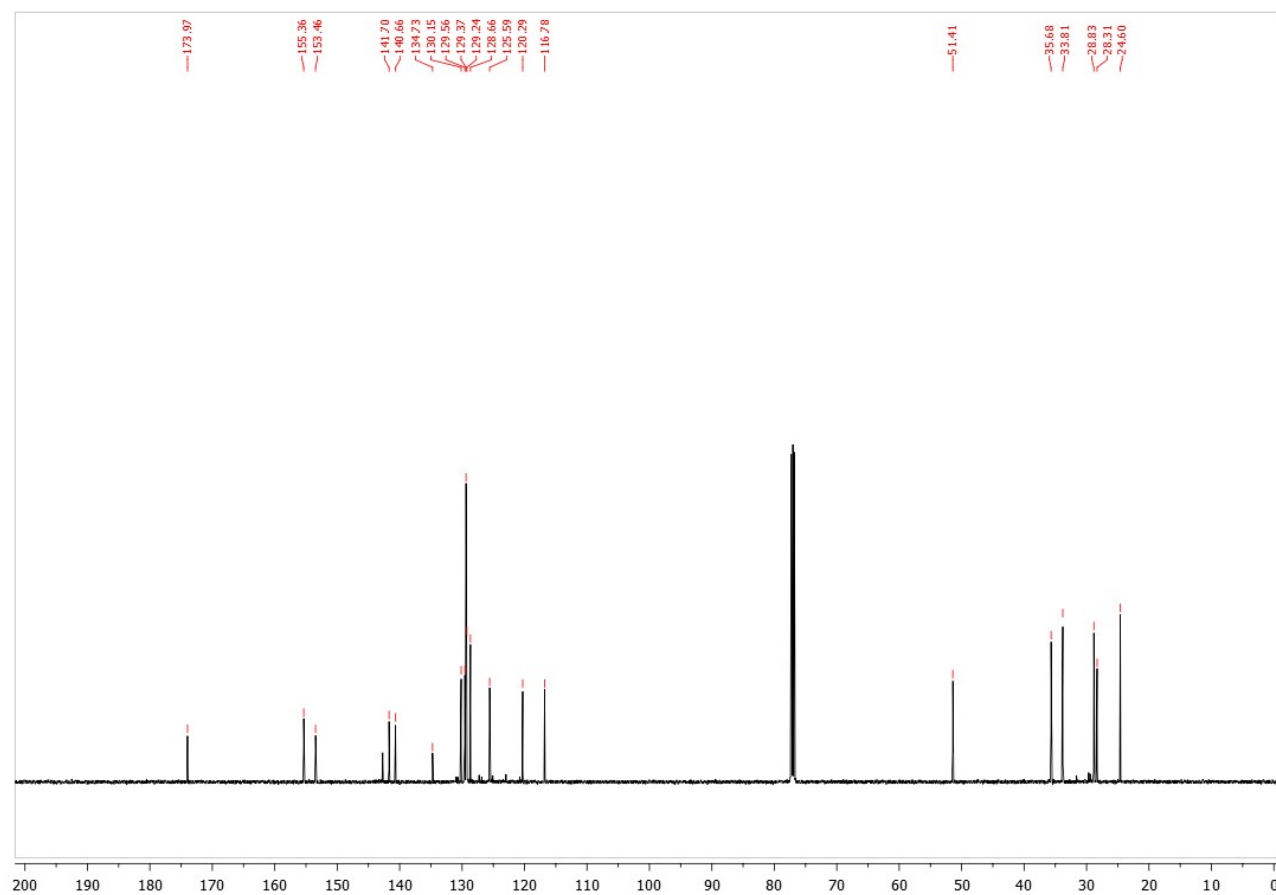
<sup>13</sup>C-NMR spectrum of compound **3o**.



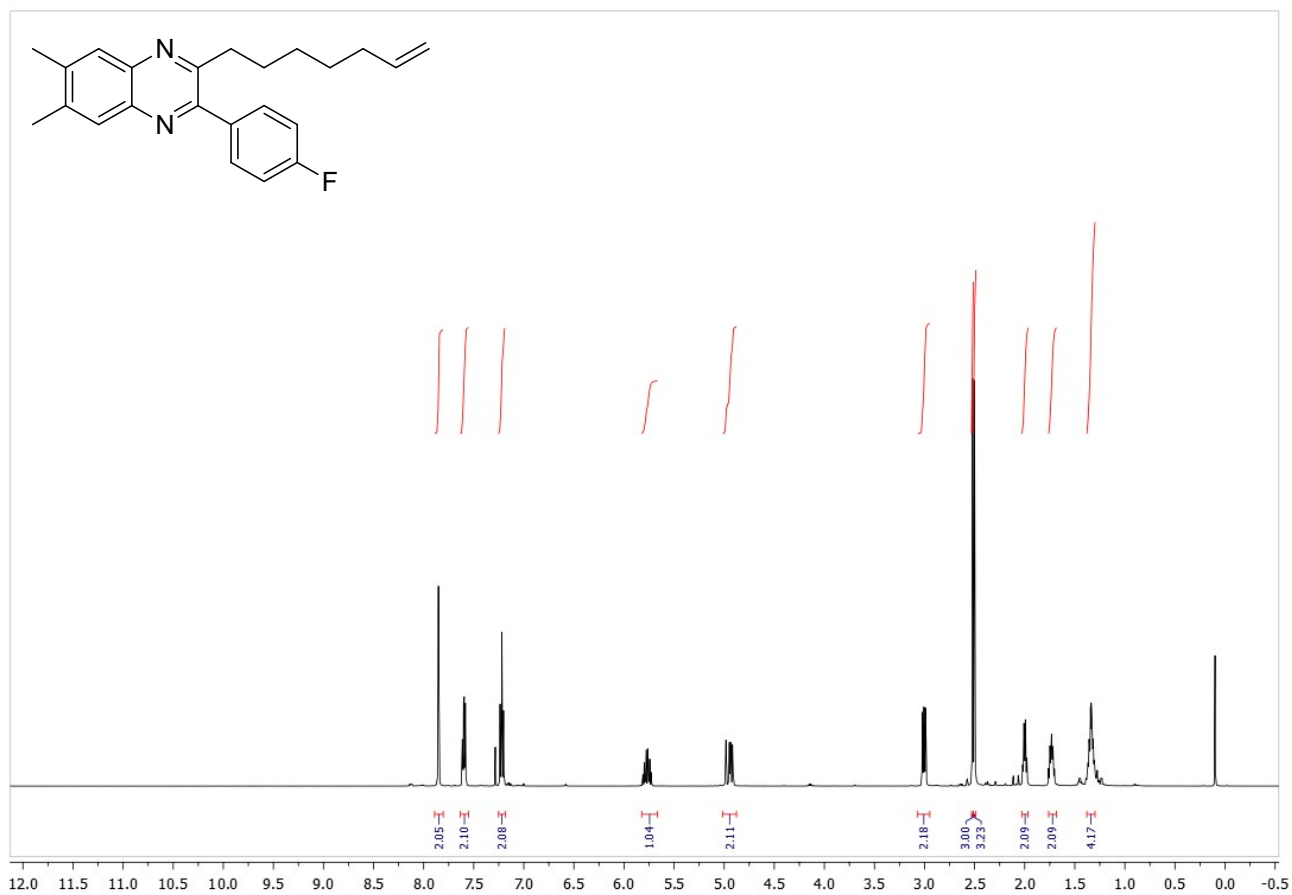
<sup>1</sup>H-NMR spectrum of compound **3p**.



<sup>13</sup>C-NMR spectrum of compound **3p**.



<sup>1</sup>H-NMR spectrum of compound **3q**.



<sup>13</sup>C-NMR spectrum of compound **3q**.

