

# One-pot Synthesis of Unsymmetrical Squaramides

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## ELECTRONIC SUPPLEMENTARY INFORMATION (ESI)

**General Experimental Methods.** Purification of reaction products was carried out in same cases by flash chromatography using silica-gel (0.063-0.200 mm). Analytical thin layer chromatography was performed on 0.25 mm silica gel 60-F plates. ESI ionization method and mass analyzer type MicroTof-Q were used for the HRMS measurements. <sup>1</sup>H NMR spectra were recorded at 400 and 300 MHz; <sup>13</sup>C APT-NMR spectra were recorded at 100 and 75 MHz; DMSO-*d*<sub>6</sub> and CDCl<sub>3</sub> as the solvents. Chemical shifts were reported in the  $\delta$  scale relative to residual CHCl<sub>3</sub> (7.26 ppm) and DMSO (2.50 ppm) for <sup>1</sup>H NMR and to the central line of CHCl<sub>3</sub> (77 ppm) and DMSO (39.43 ppm) for <sup>13</sup>C APT-NMR.

**Materials.** All commercially available solvents and reagents were used as received. The <sup>1</sup>H and <sup>13</sup>C APT-NMR spectra for compounds **5ag**,<sup>[1]</sup> **5cg**,<sup>[2]</sup> **5aj**,<sup>[3]</sup> **5cj**,<sup>[3]</sup> **5gj**,<sup>[4]</sup> **5ak**,<sup>[3]</sup> **5ck**,<sup>[3]</sup> **5gl**,<sup>[5]</sup> **5gg**,<sup>[6]</sup> **5ig**,<sup>[7]</sup> **5ai**,<sup>[1]</sup> **10**,<sup>[8]</sup> **14**,<sup>[9]</sup> and **18**<sup>[10]</sup> are consistent with values previously reported in the literature.

<sup>1</sup> H. Konishi, T. Y. Lam, J. P. Malerich and V. H. Rawal, *Org. Lett.*, 2010, **12**, 2028.

<sup>2</sup> Y. Zhu, J. P. Malerich and V. H. Rawal, *Angew. Chem. Int. Ed.*, 2010, **49**, 153.

<sup>3</sup> W. Yang and D.-M. Du, *Org. Lett.*, 2010, **12**, 5450.

<sup>4</sup> H. Jiang, M. W. Paixão, D. Monge and K. A. Jørgensen, *J. Am. Chem. Soc.*, 2010, **132**, 2775.

<sup>5</sup> J. P. Malerich, K. Hagihara and V. H. Rawal, *J. Am. Chem. Soc.*, 2008, **130**, 14416.

<sup>6</sup> R. Baran, E. Veverková, A. Škvorcová and R. Šebesta, *Org. Biomol. Chem.*, 2013, **11**, 7705.

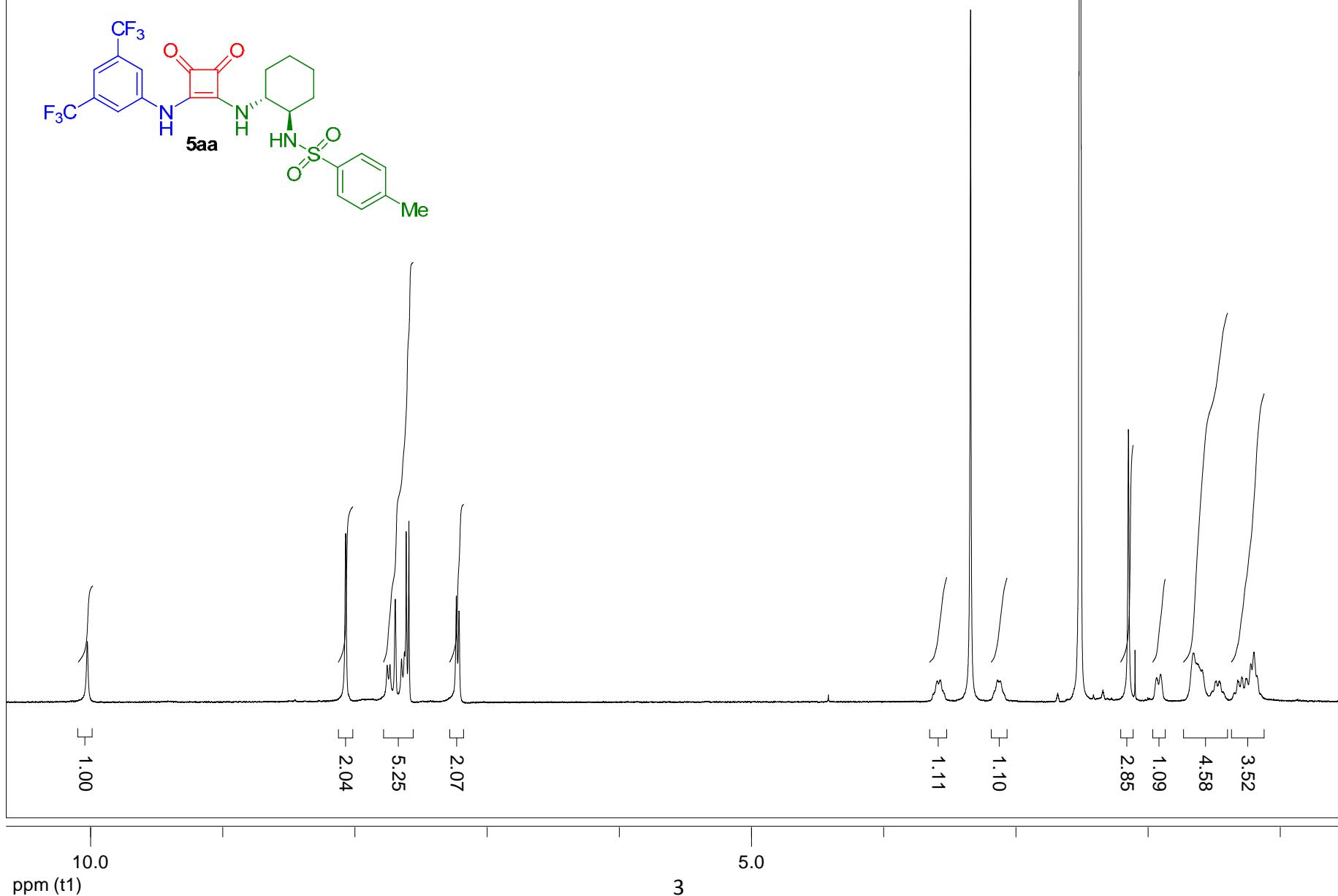
<sup>7</sup> W. Yang and D.-M. Du, *Org. Biomol. Chem.*, 2012, **10**, 6876.

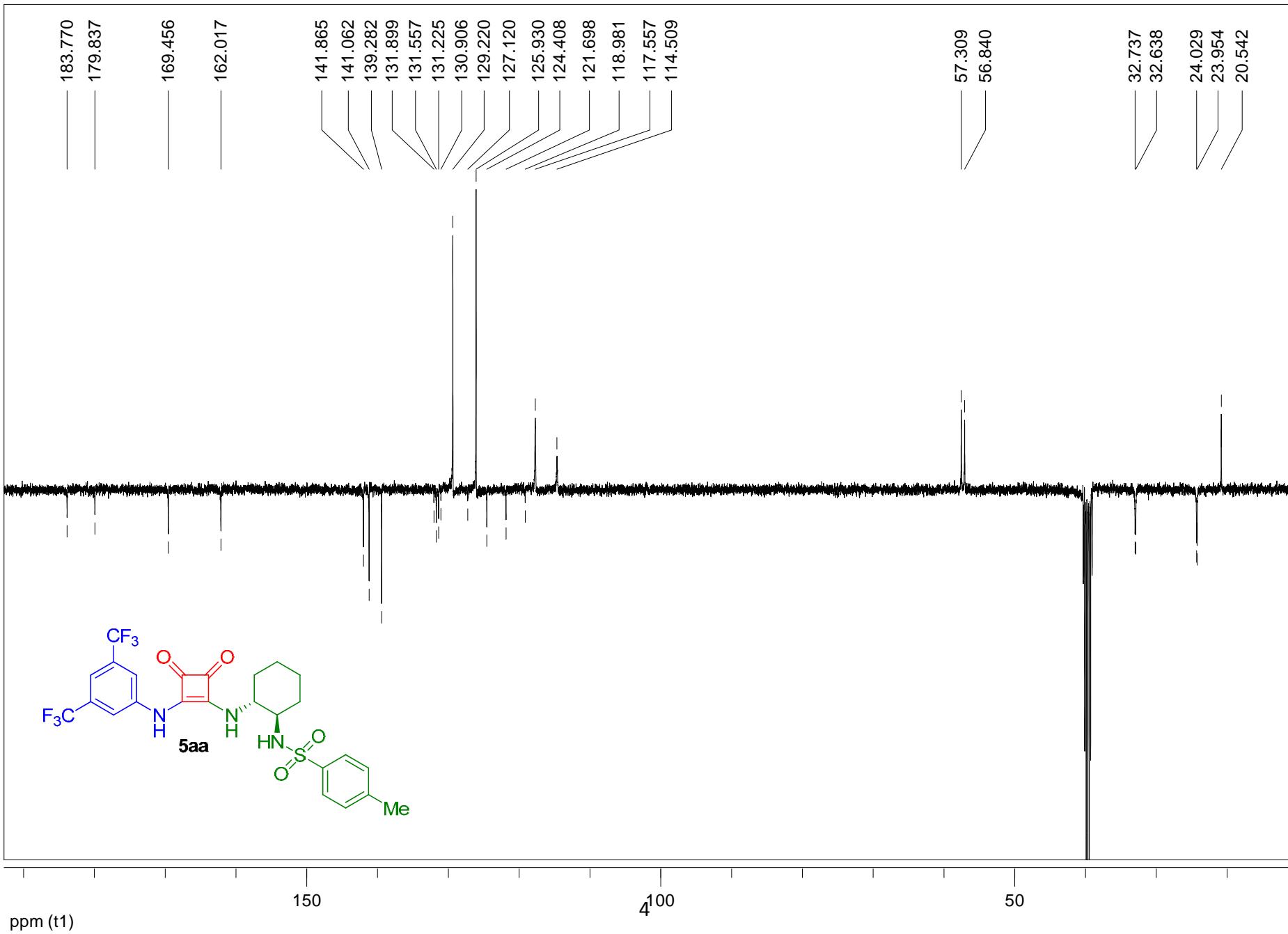
<sup>8</sup> F. Olmo, C. Rotger, I. Ramírez-Macías, L. Martínez, C. Marín, L. Carreras, K. Urbanová, M. Vega, G. Chaves-Lemaur, A. Sampedro, M. J. Rosales, M. Sánchez-Moreno and A. Costa, *J. Med. Chem.*, 2014, **57**, 987.

<sup>9</sup> J. A. Butera, M. M. Antane, S. A. Antane, T. M. Argentieri, C. Freedeen, R. F. Graceffa, B. H. Hirth, D. Jenkins, J. R. Lennox, E. Matelan, N. W. Norton, D. Quagliato, J. H. Sheldon, W. Spinelli, D. Warga, A. Wojdan and M. Woods, *J. Med. Chem.*, 2000, **43**, 1187.

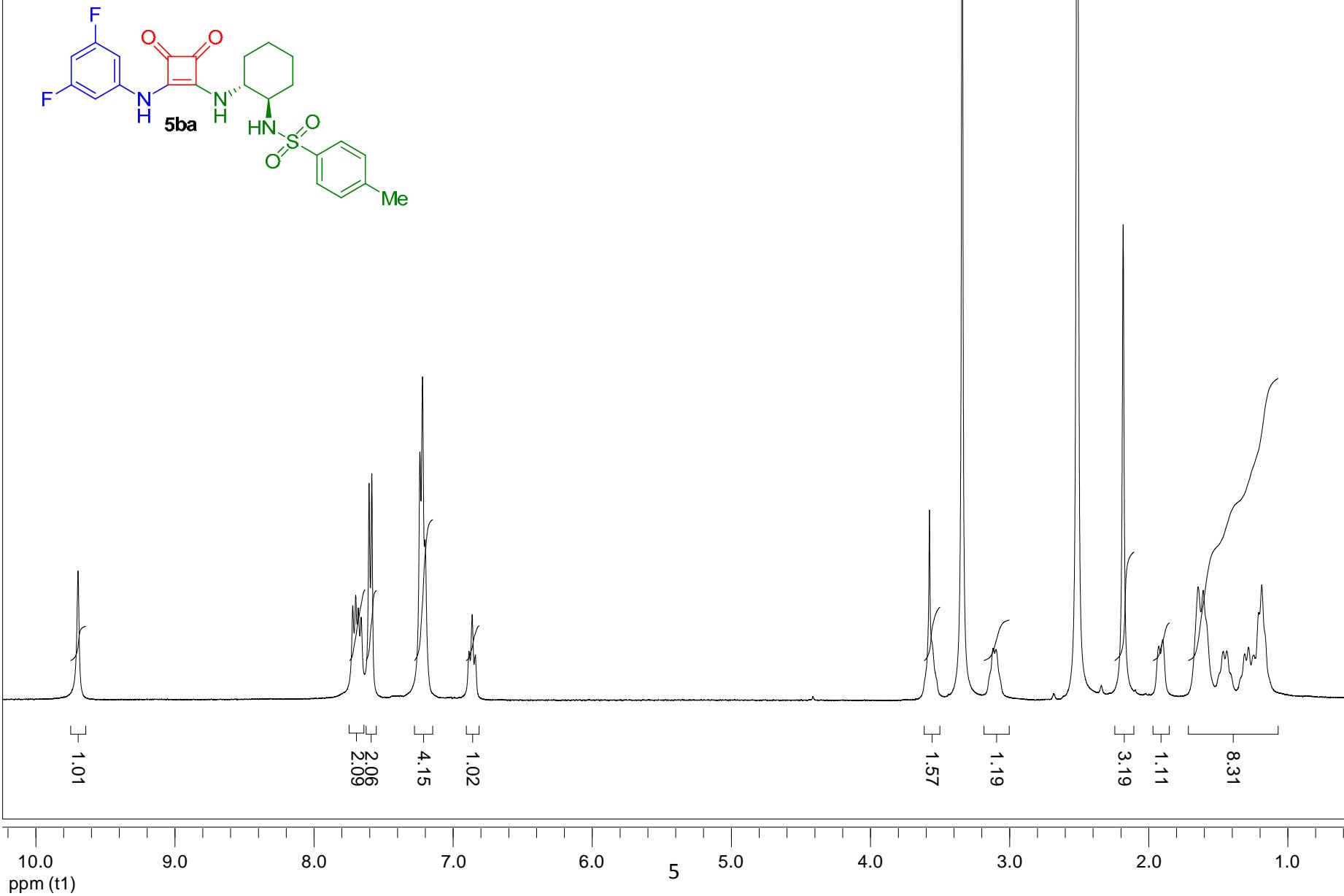
<sup>10</sup> A. M. Gilbert, M. M. Antane, T. M. Argentieri, J. A. Butera, G. D. Francisco, C. Freedeen, E. G. Gundersen, R. F. Graceffa, D. Herbst, B. H. Hirth, J. R. Lennox, G. McFarlane, N. W. Norton, D. Quagliato, J. H. Sheldon, D. Warga, A. Wojdan and M. Woods, *J. Med. Chem.*, 2000, **43**, 1203.

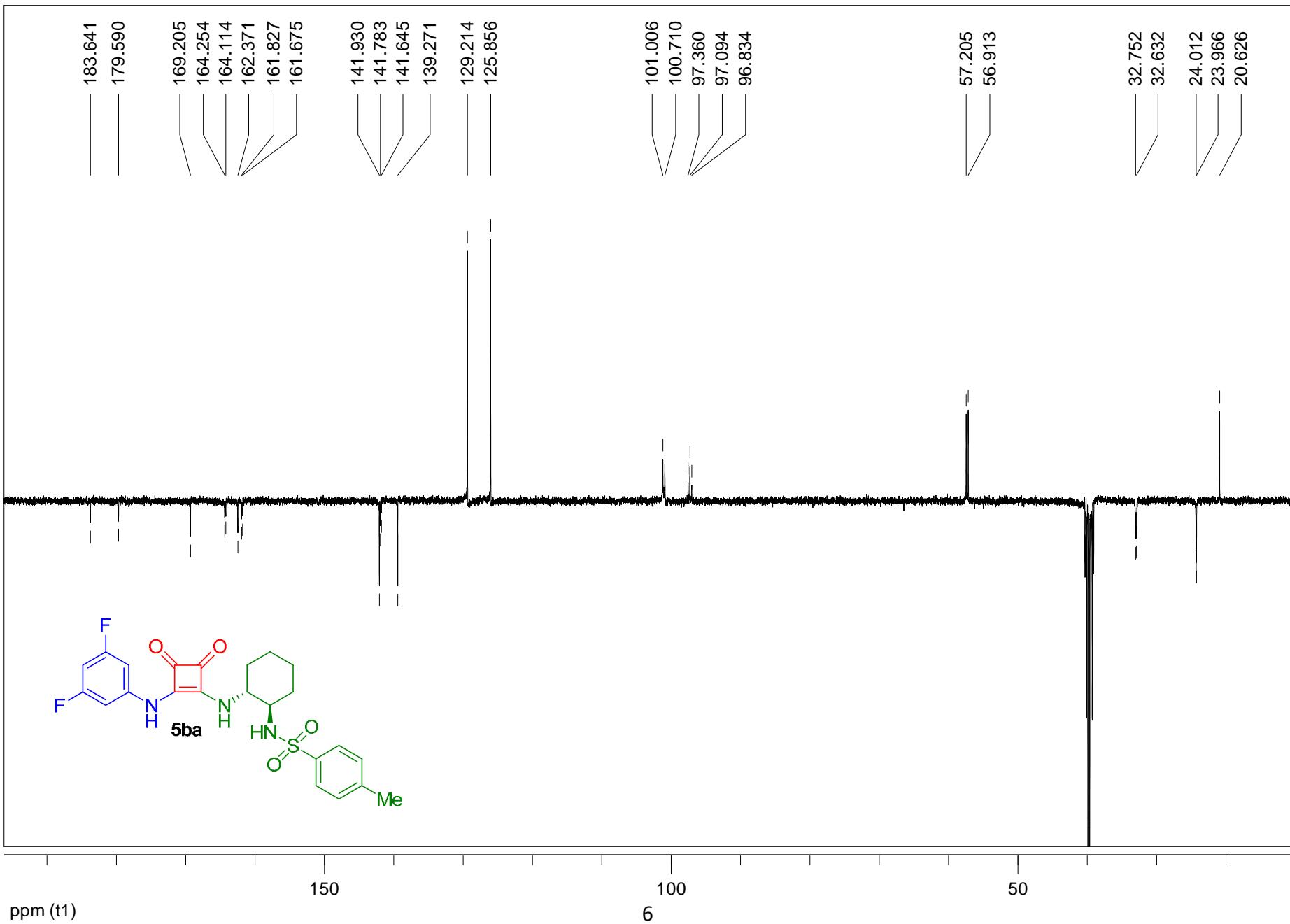
**Figure S1.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5aa**



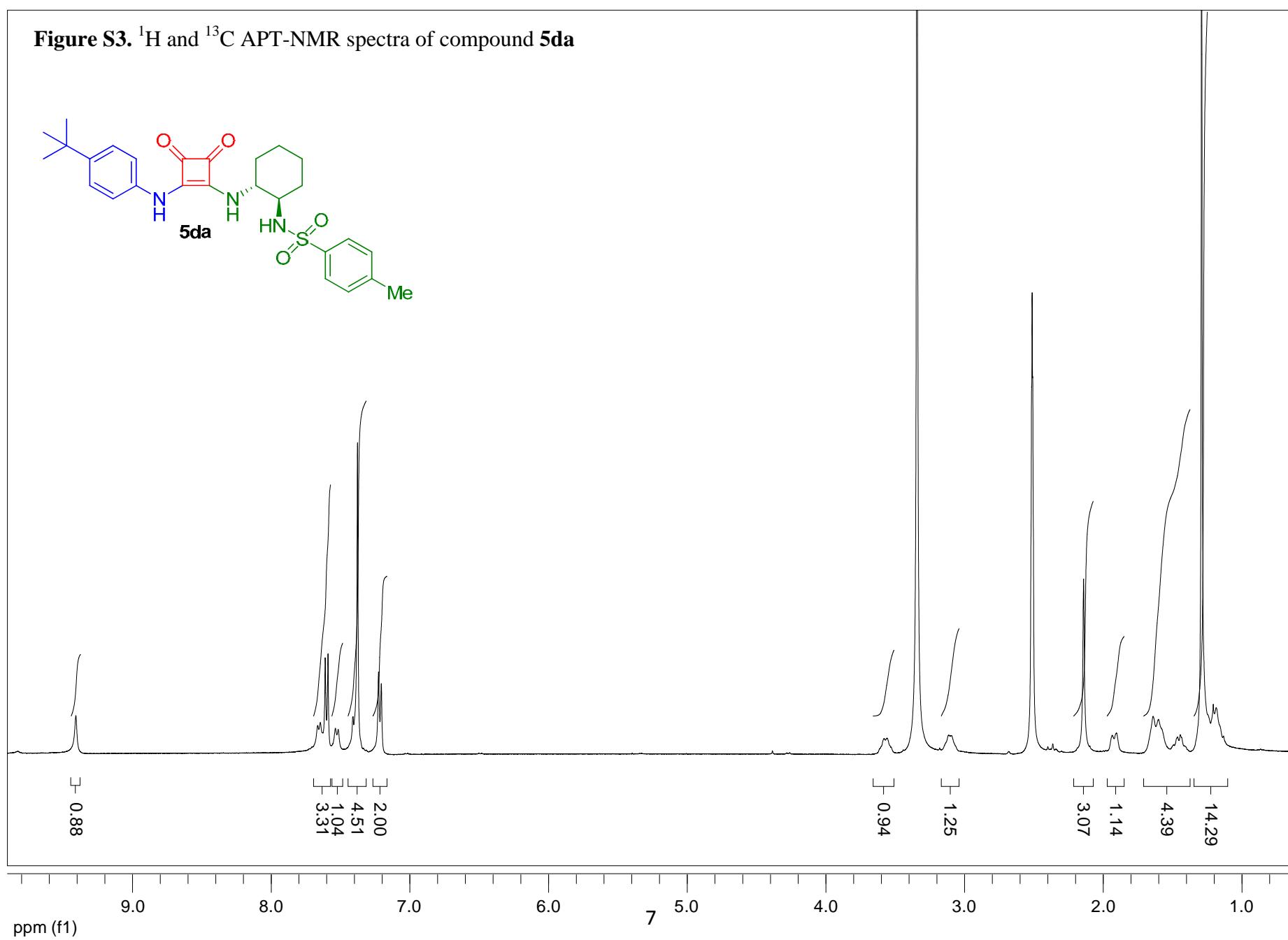


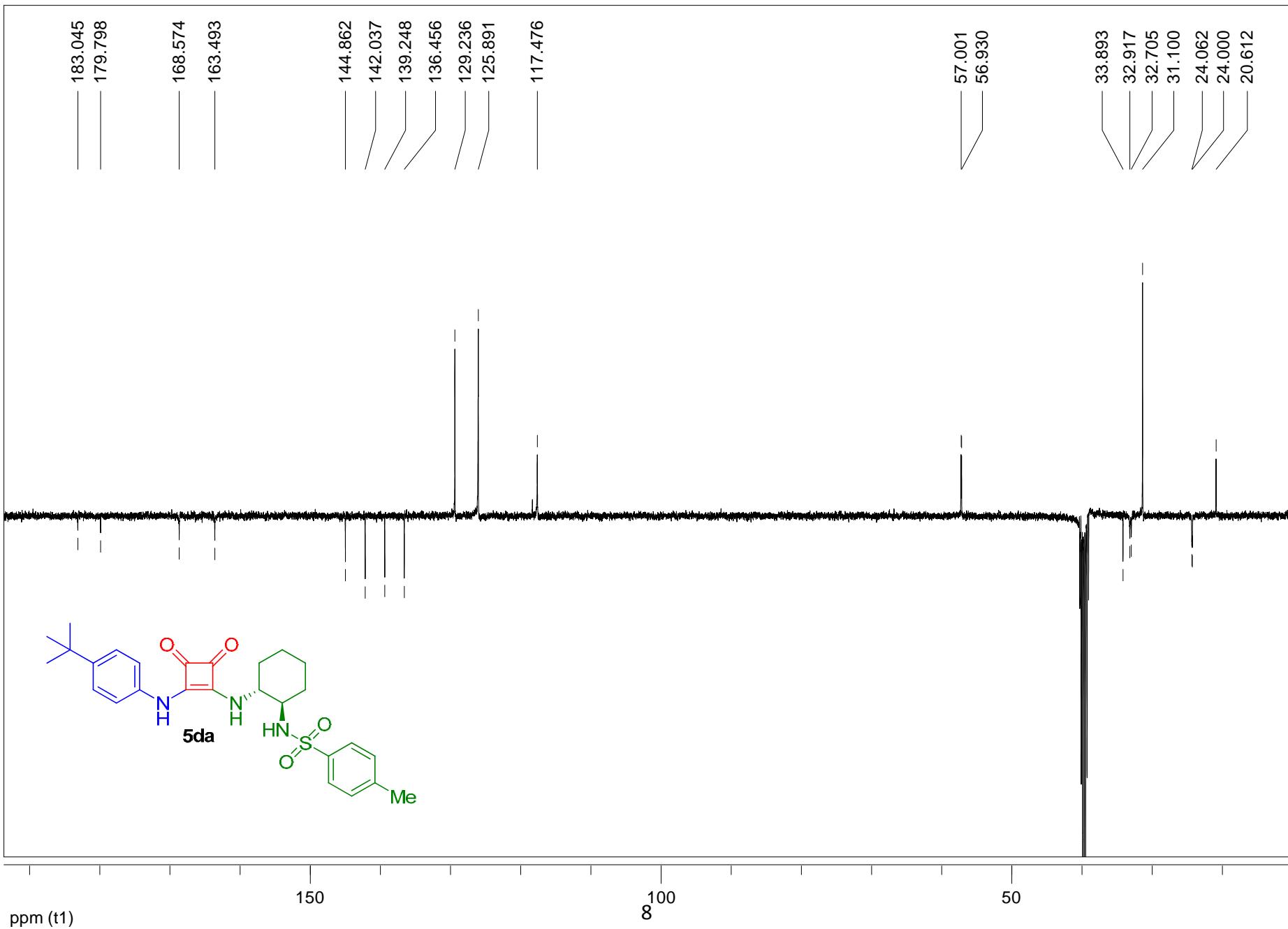
**Figure S2.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5ba**



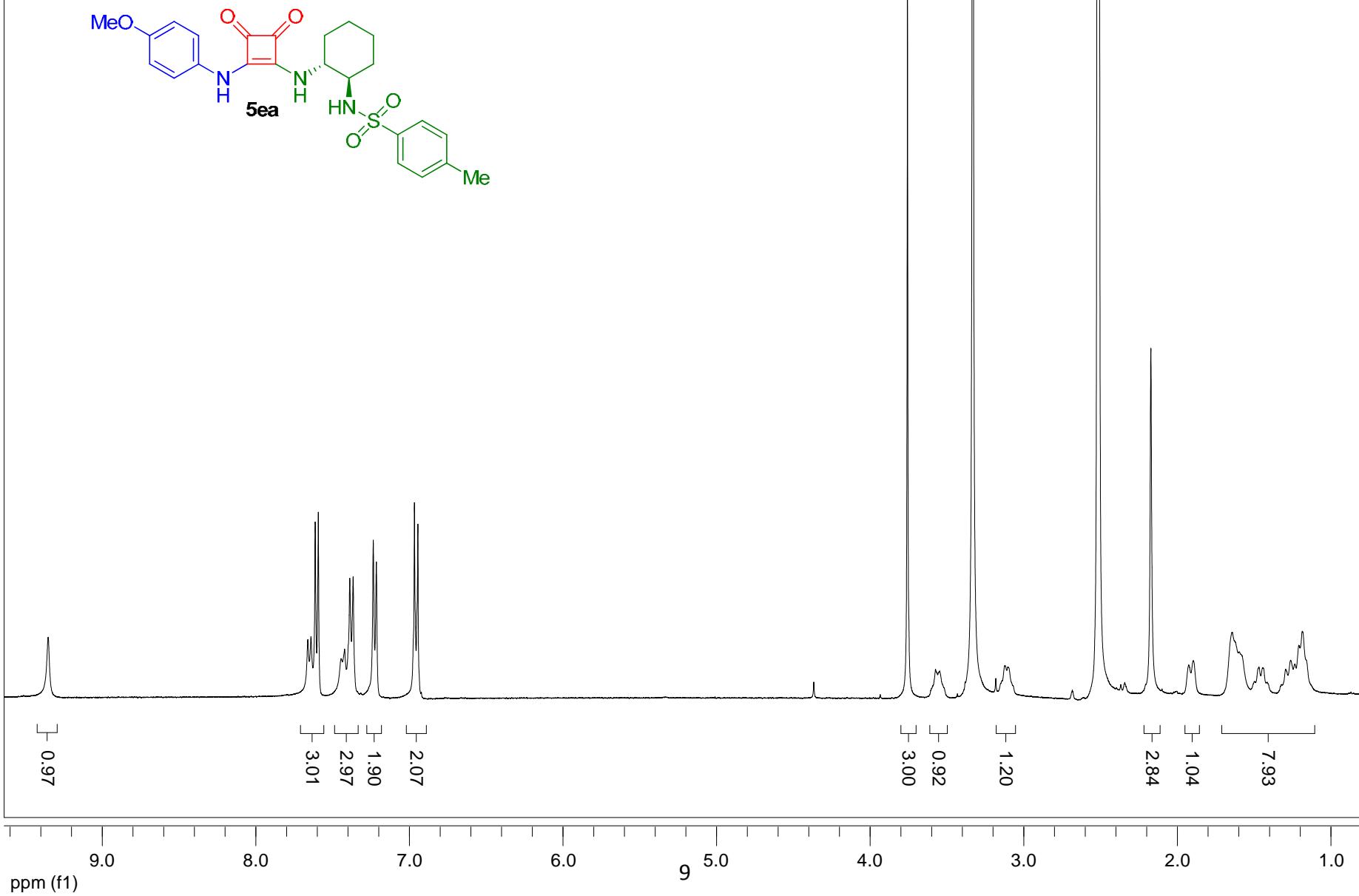


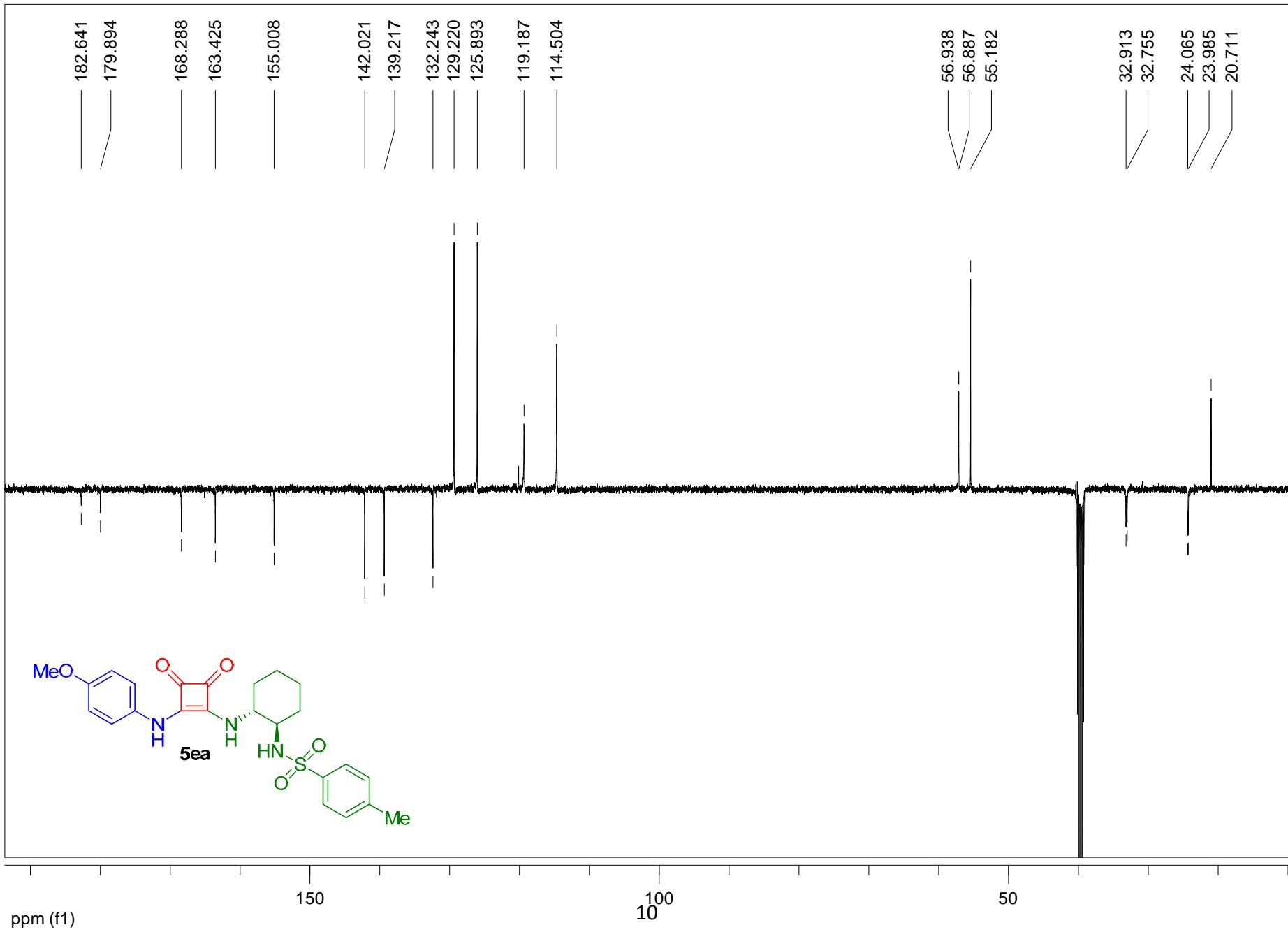
**Figure S3.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5da**



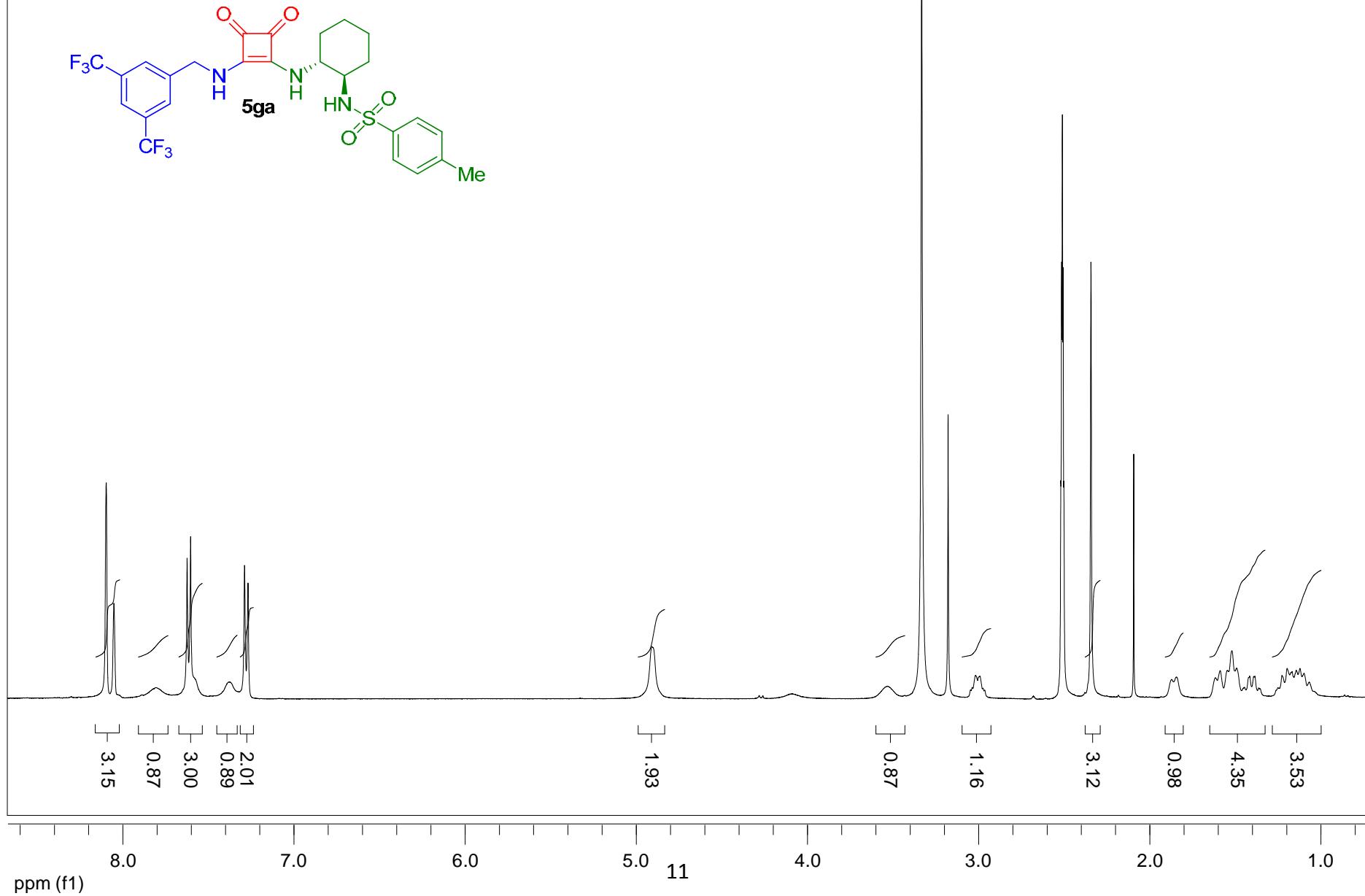


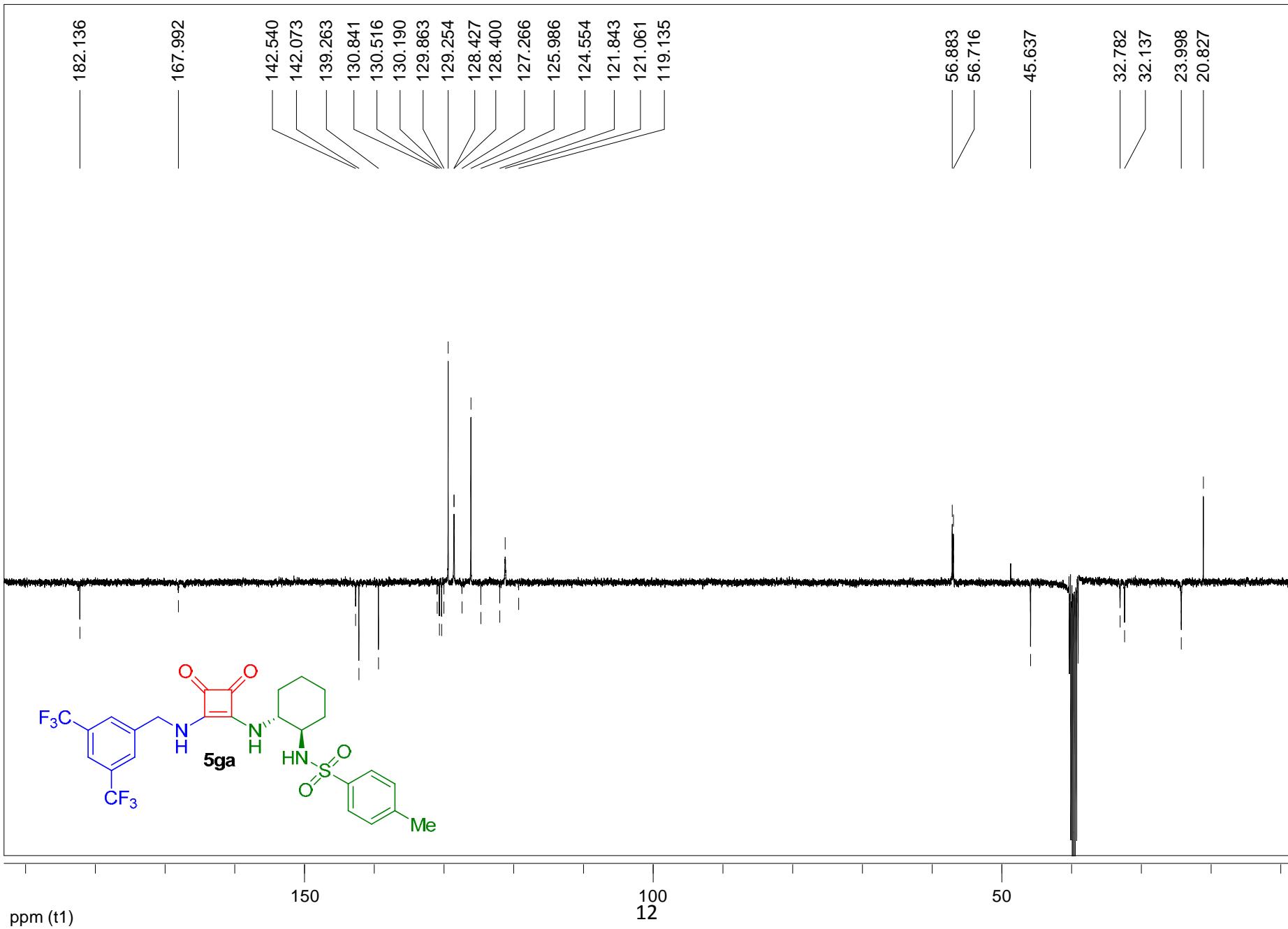
**Figure S4.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5ea**



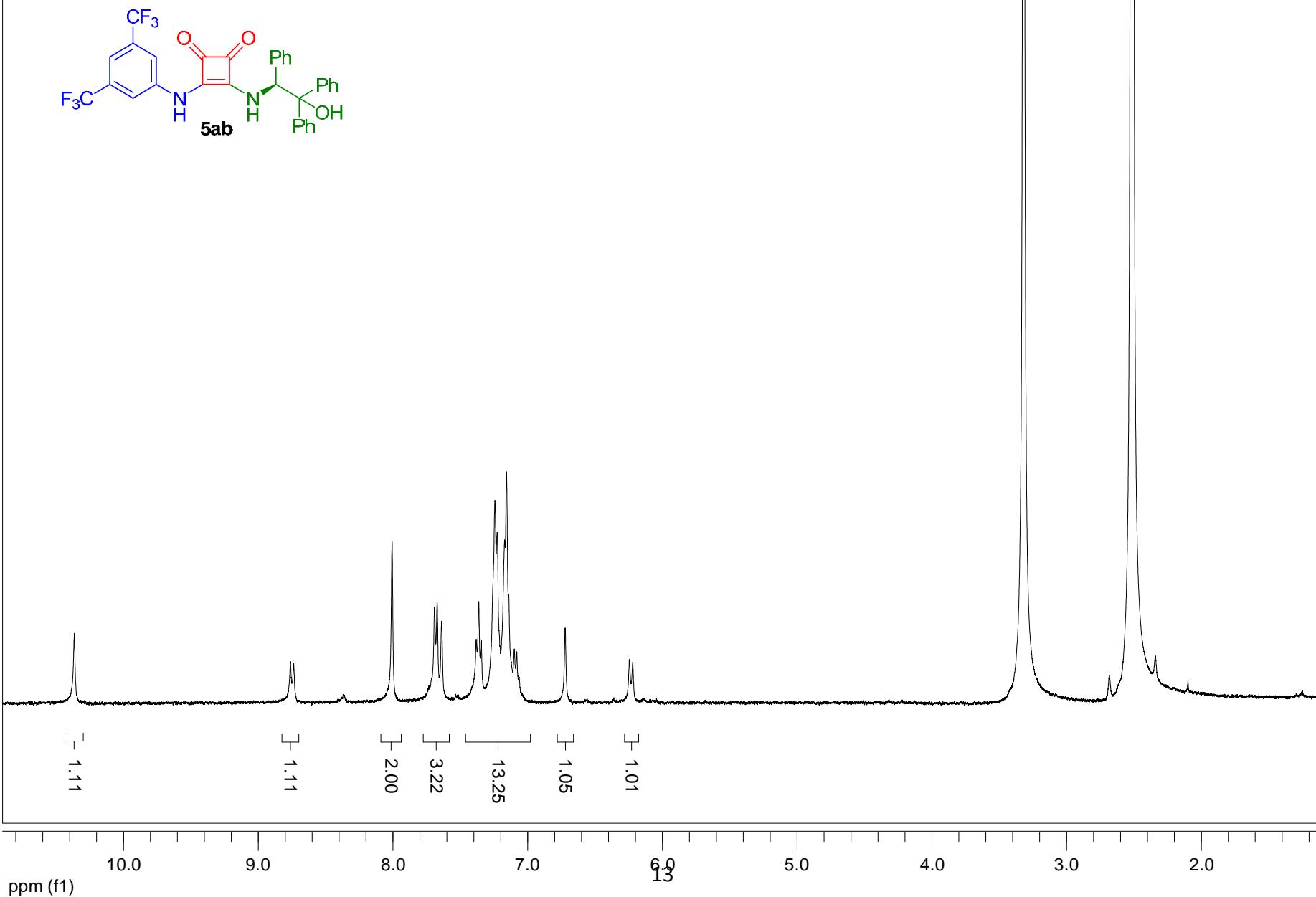


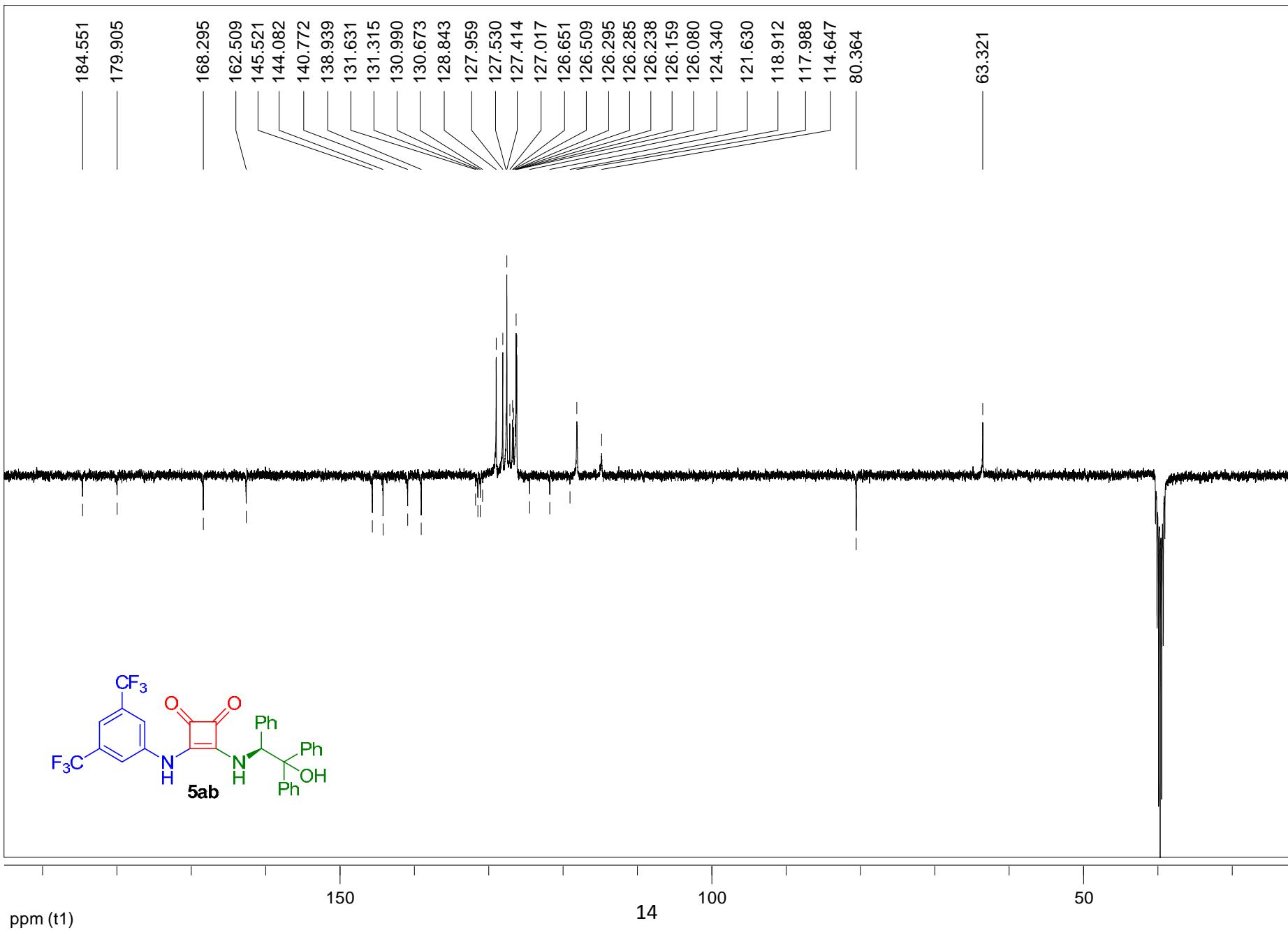
**Figure S5.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5ga**



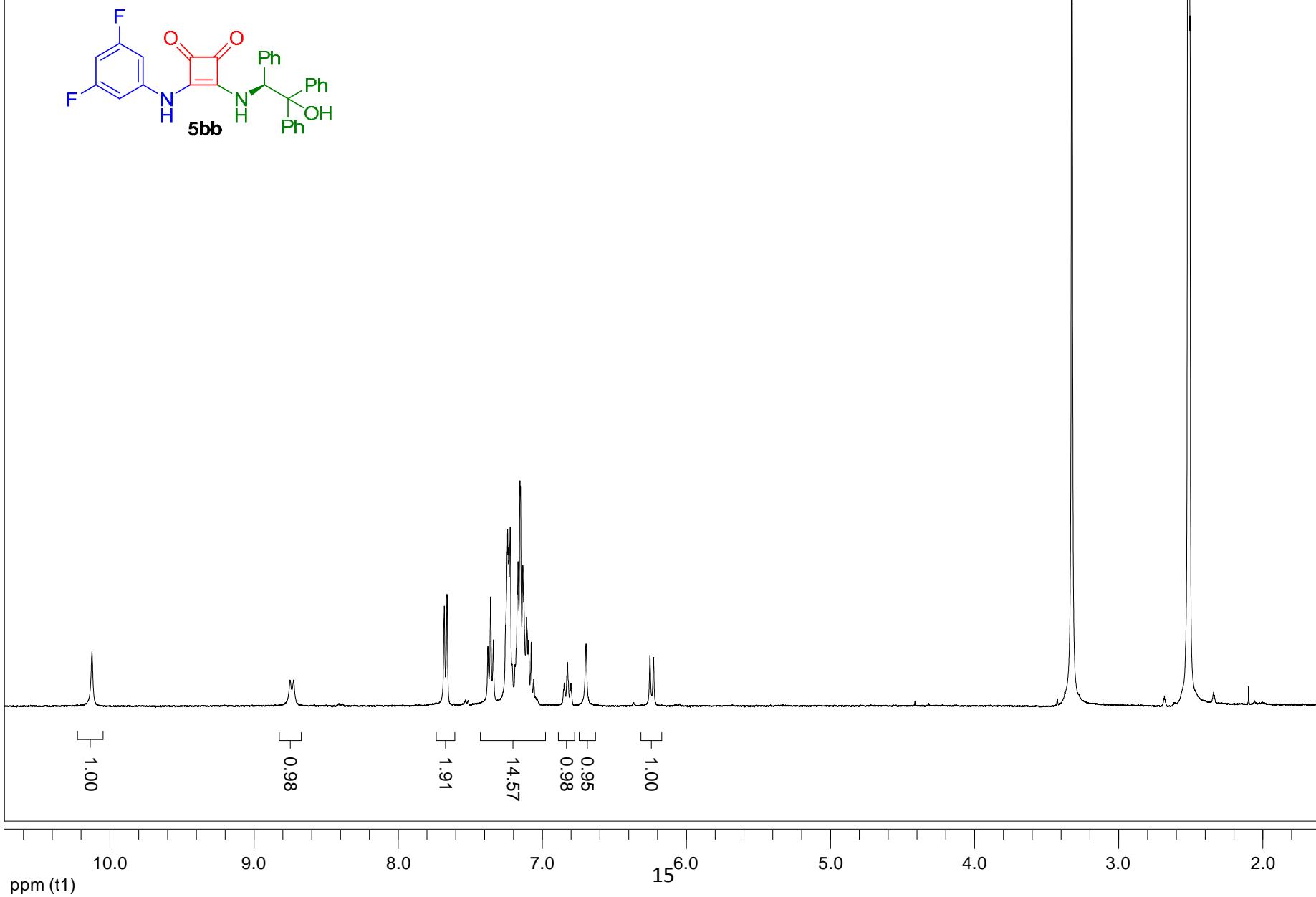


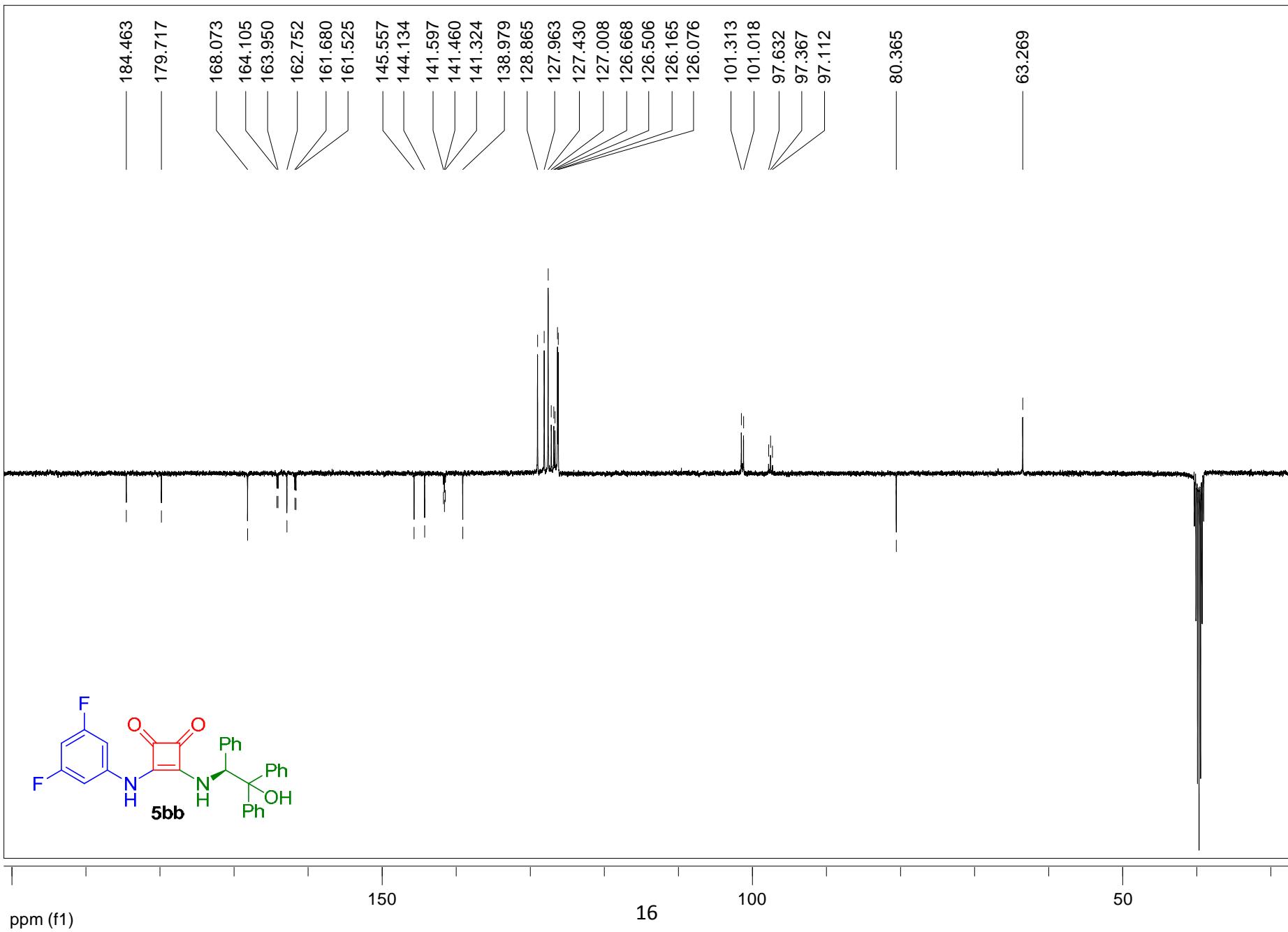
**Figure S6.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5ab**



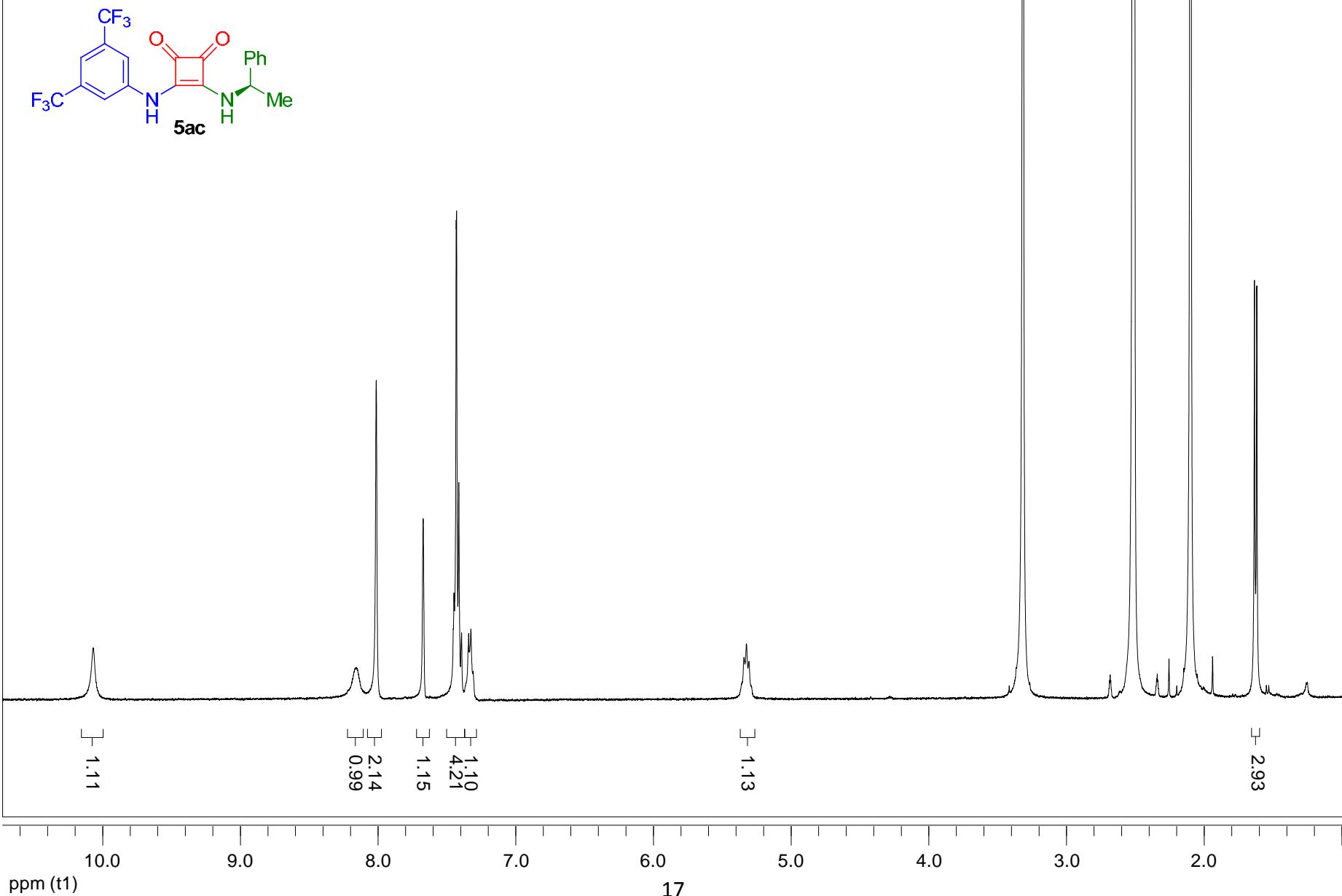


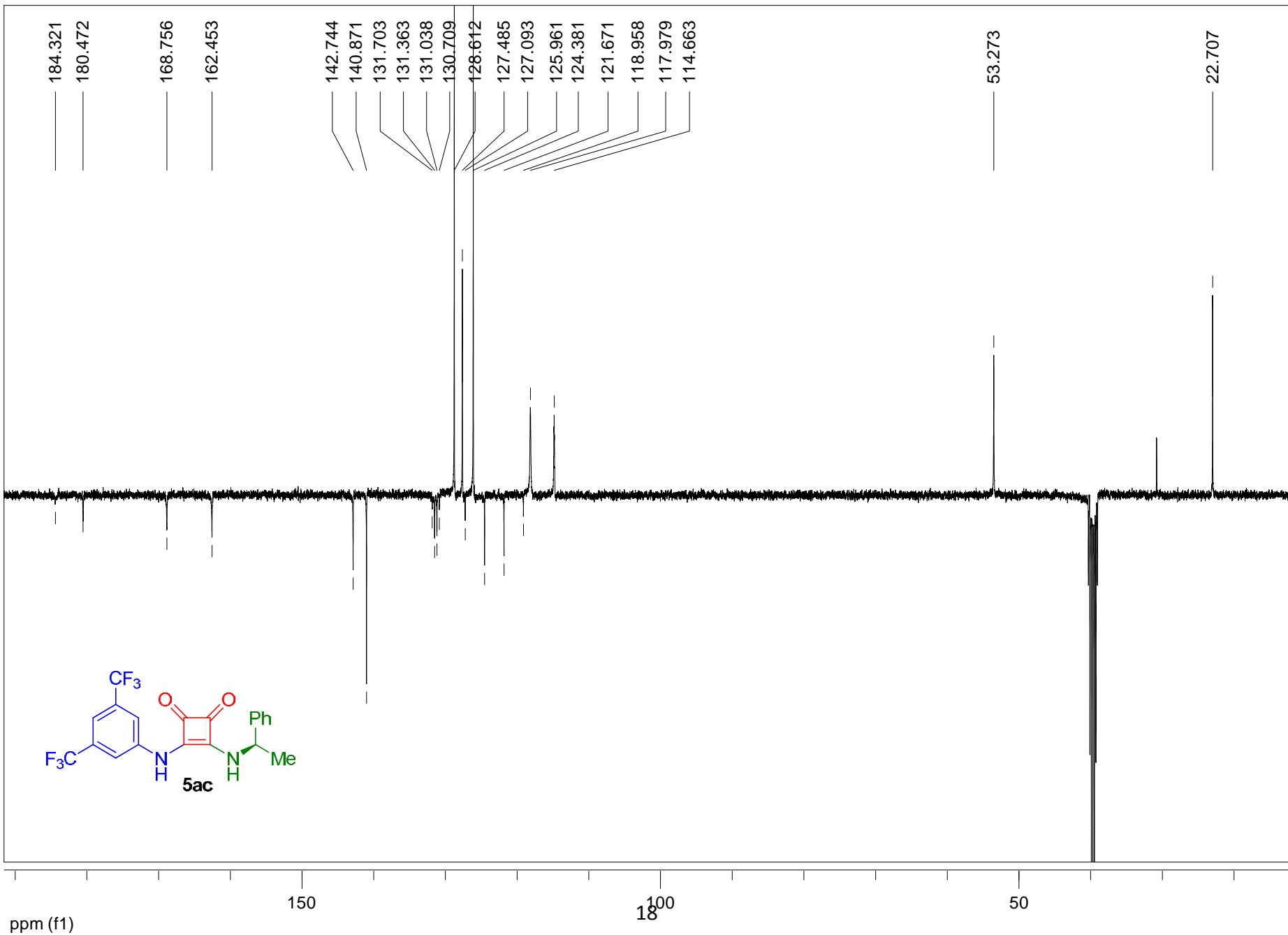
**Figure S7.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5bb**



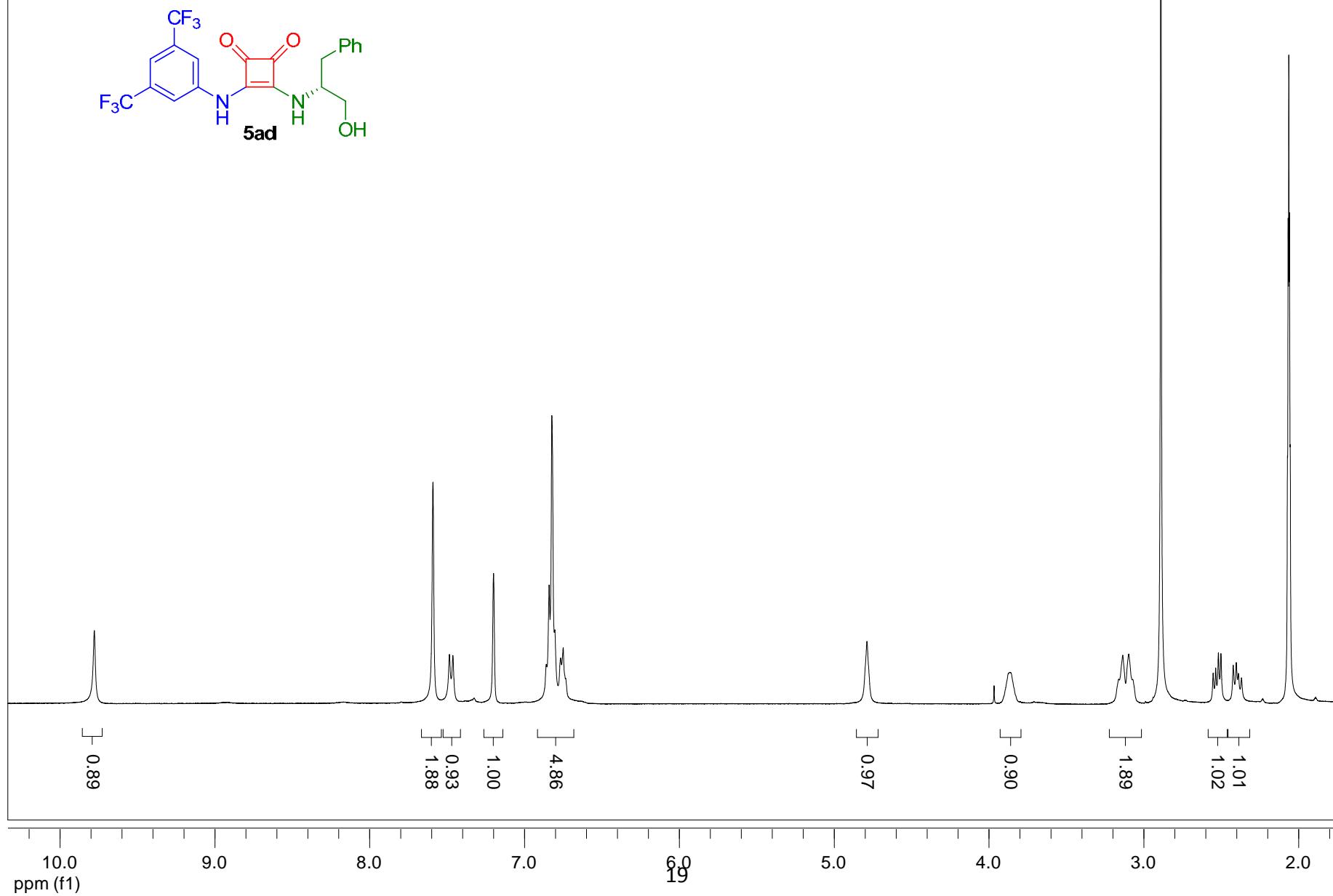


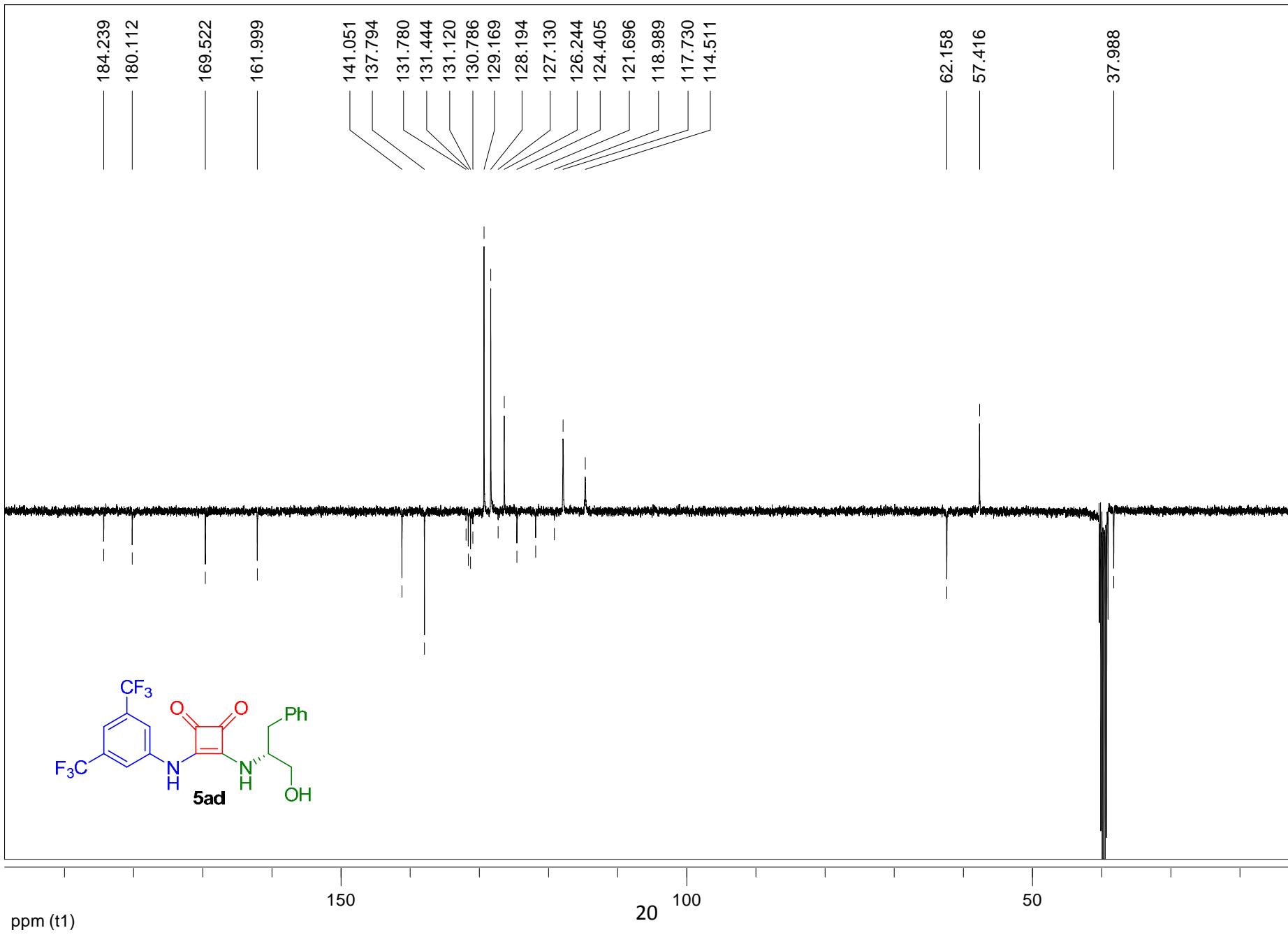
**Figure S8.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5ac**



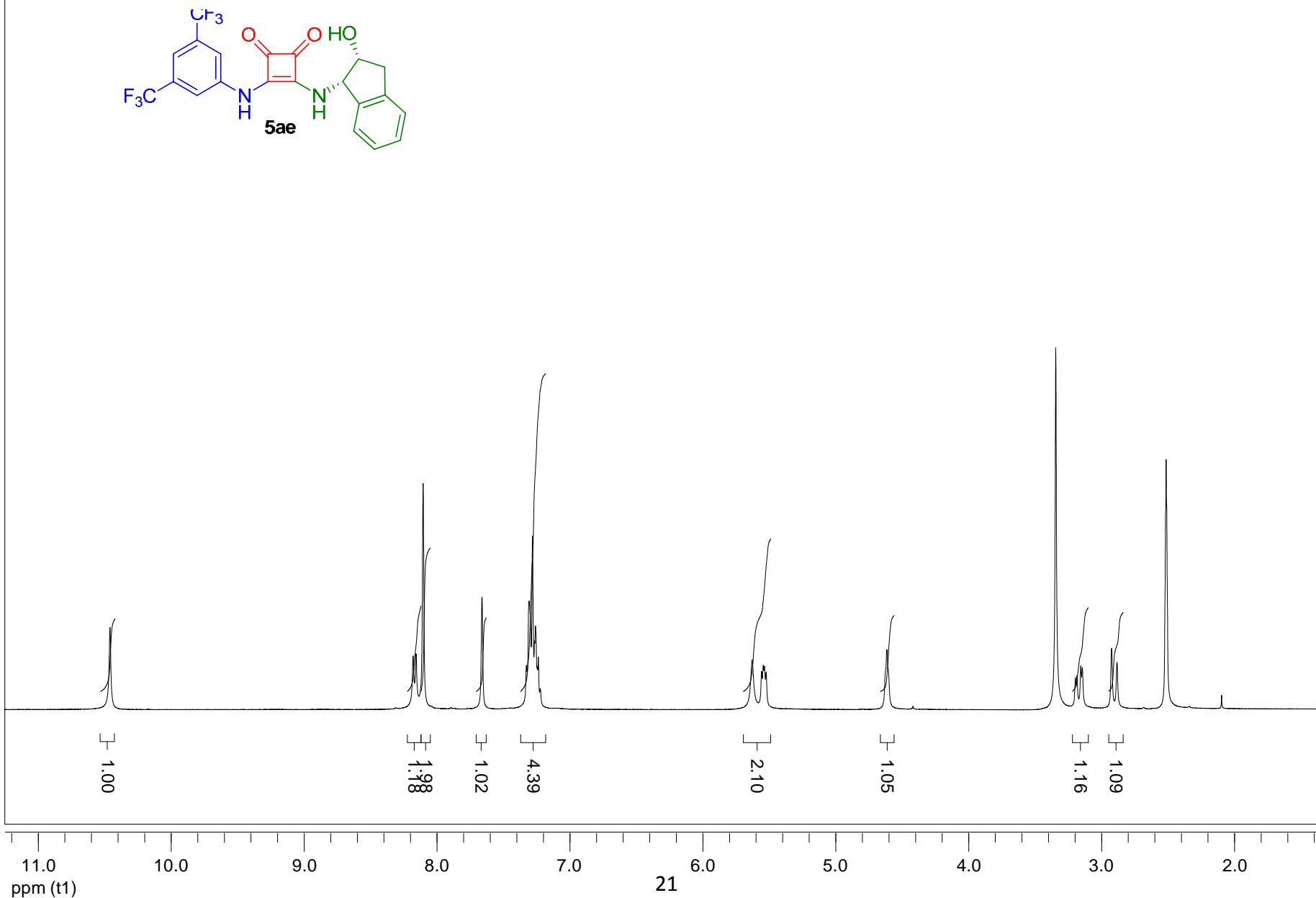


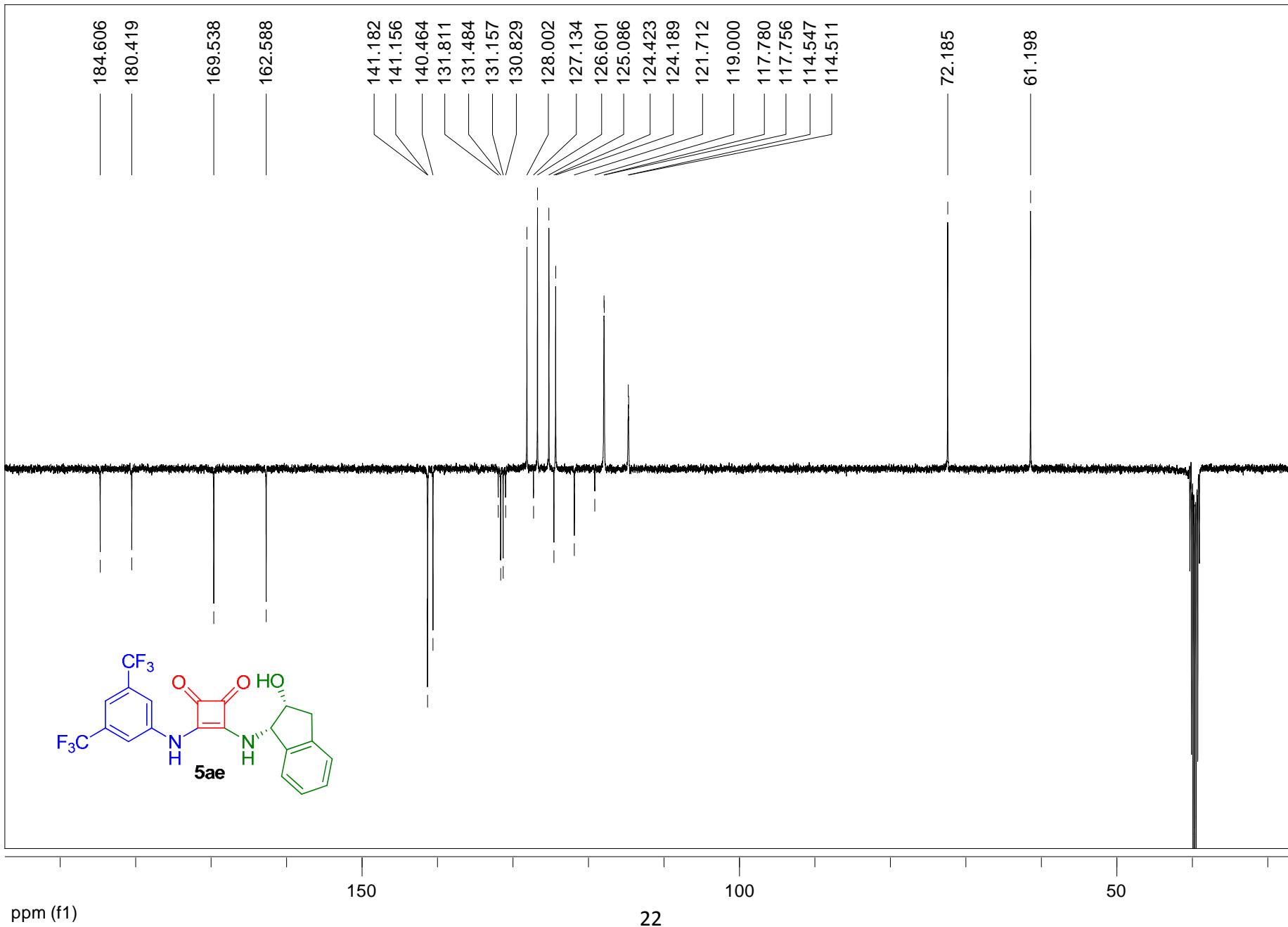
**Figure S9.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5ad**



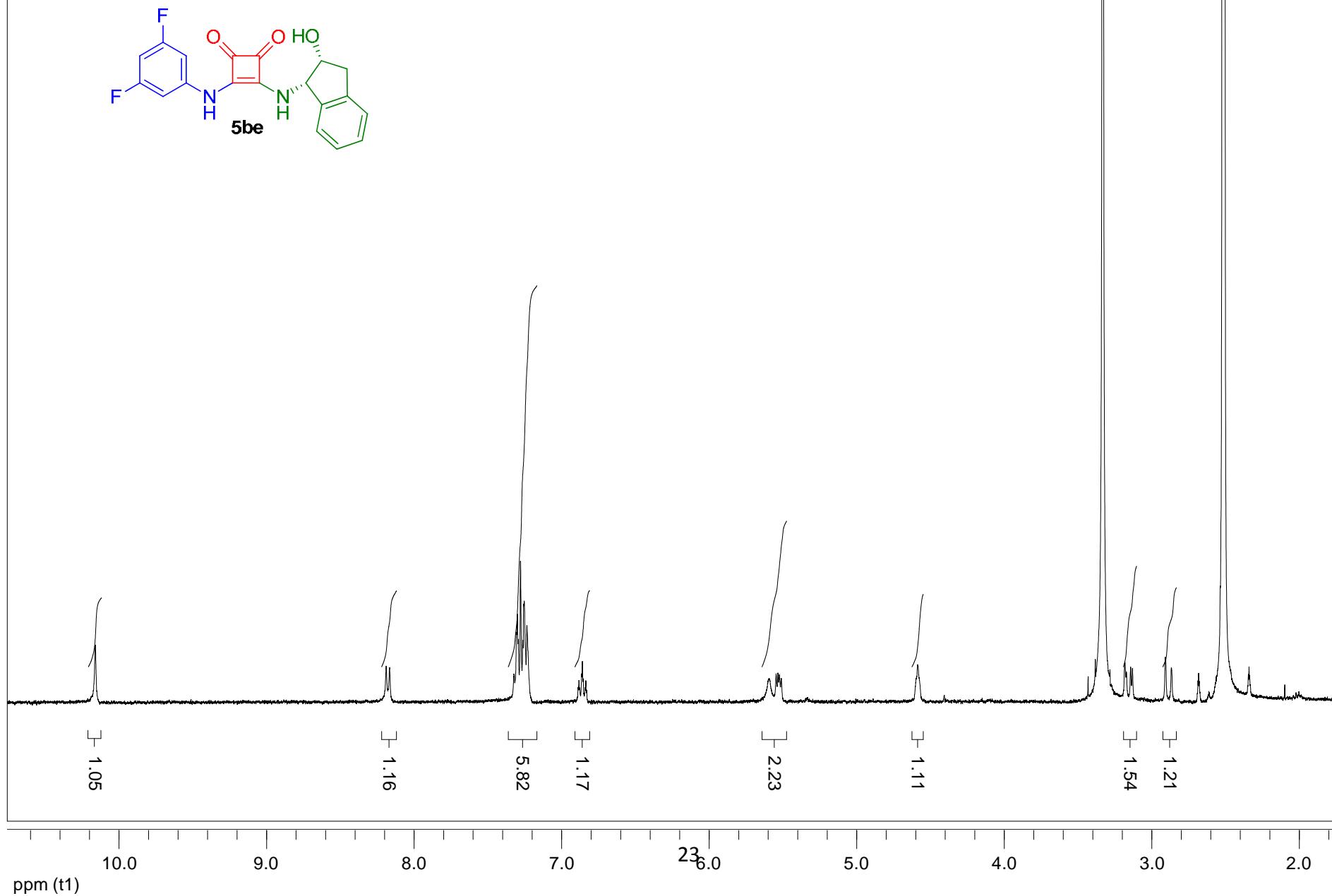


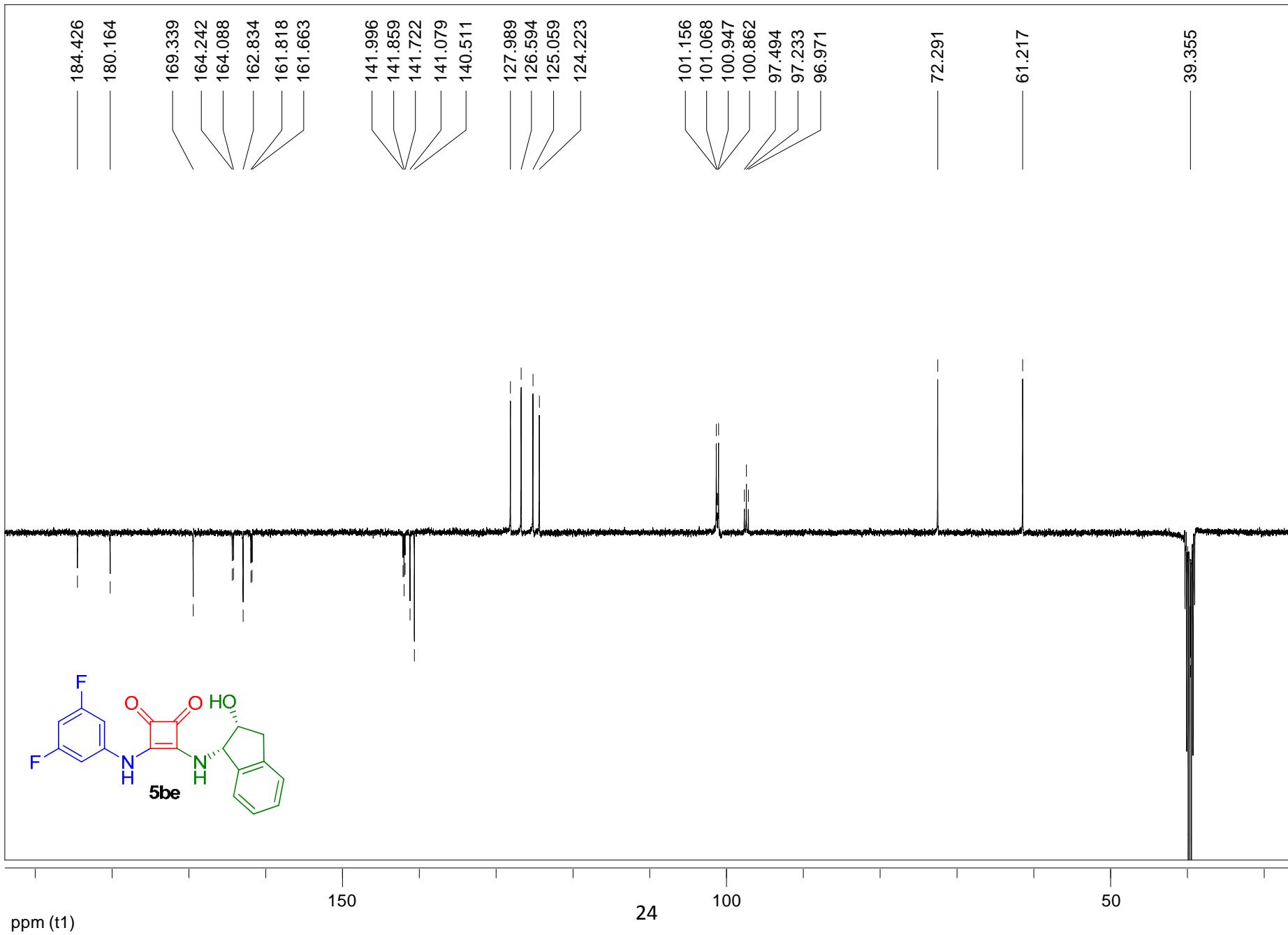
**Figure S10.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5ae**



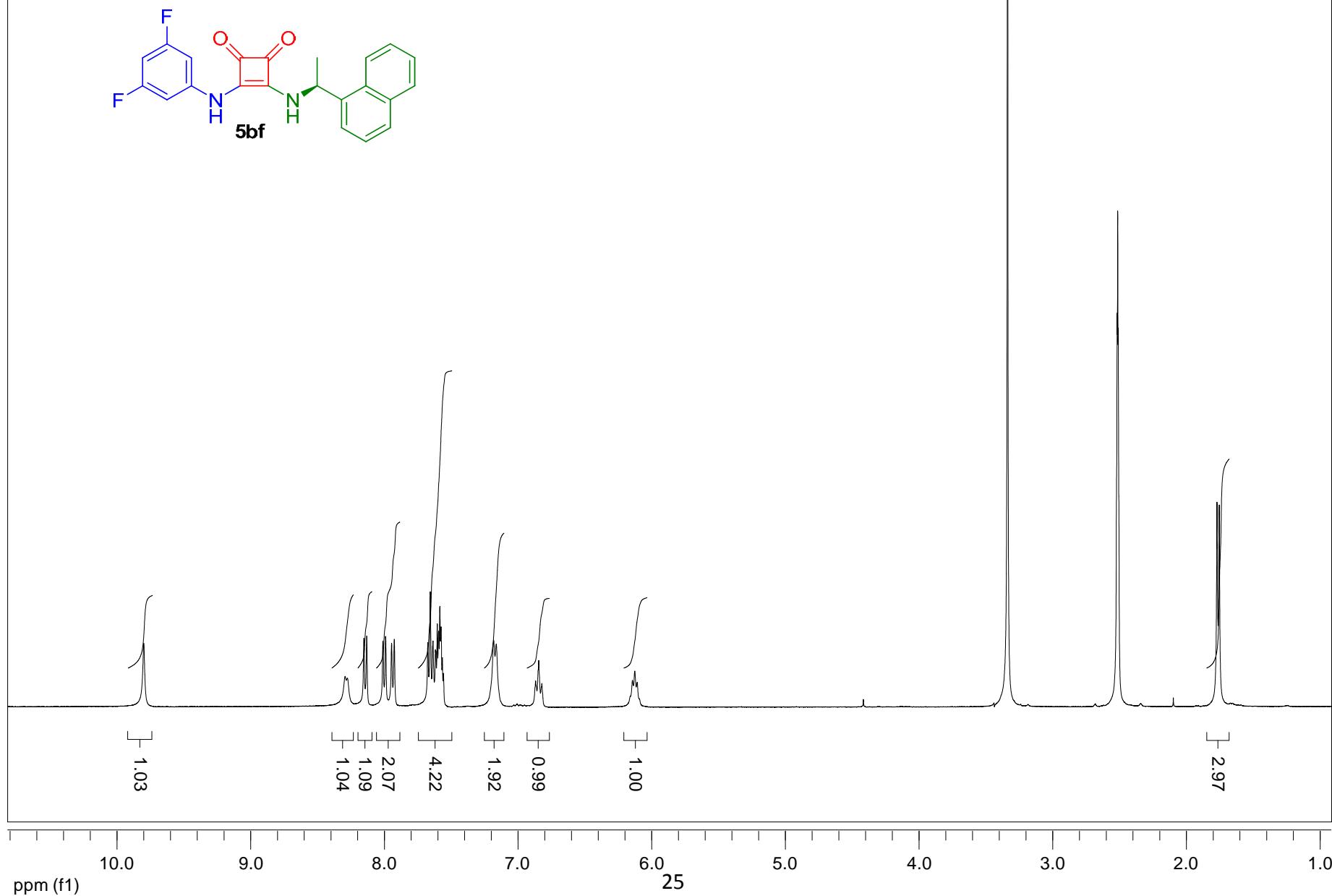


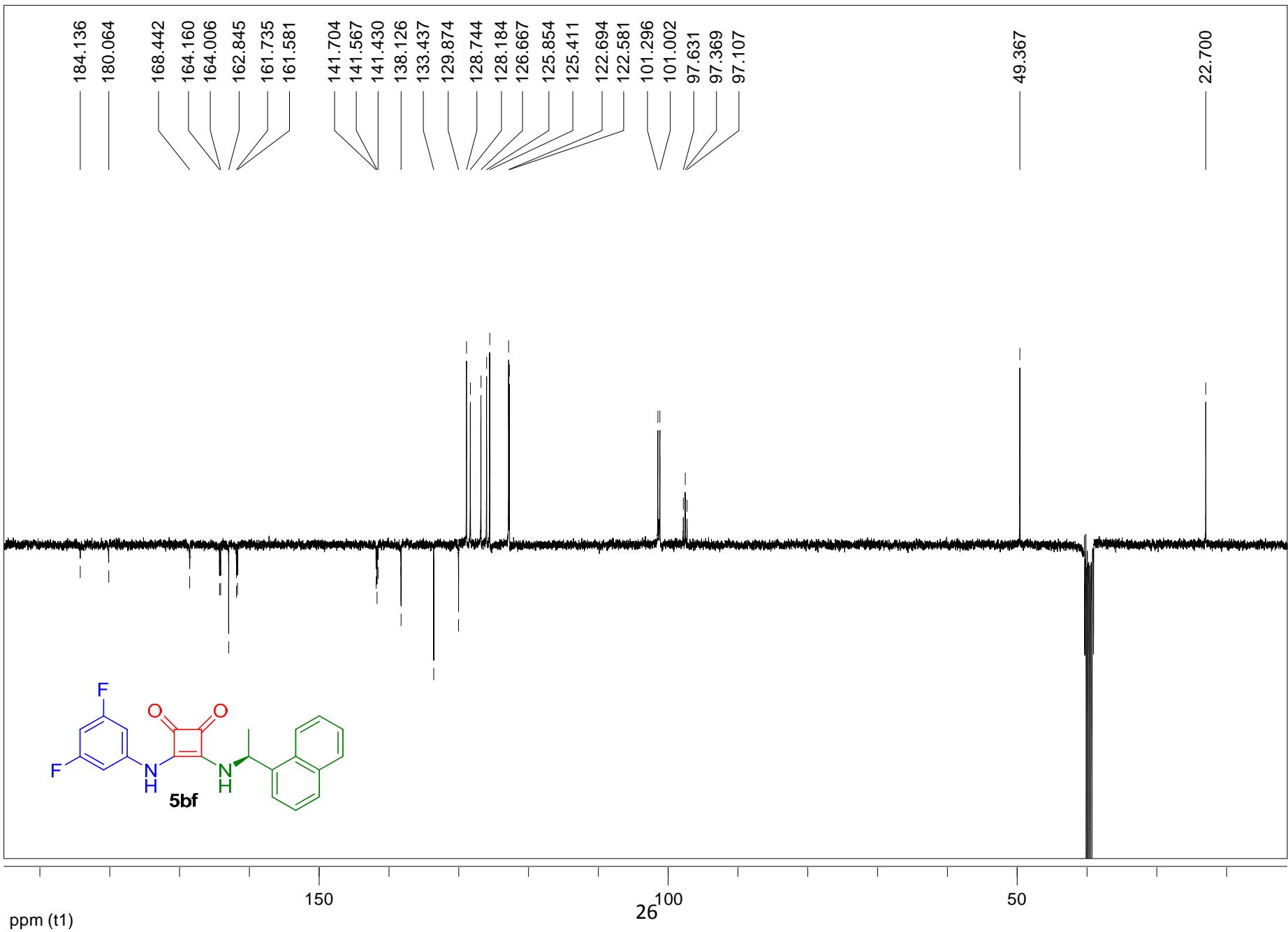
**Figure S11.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5be**



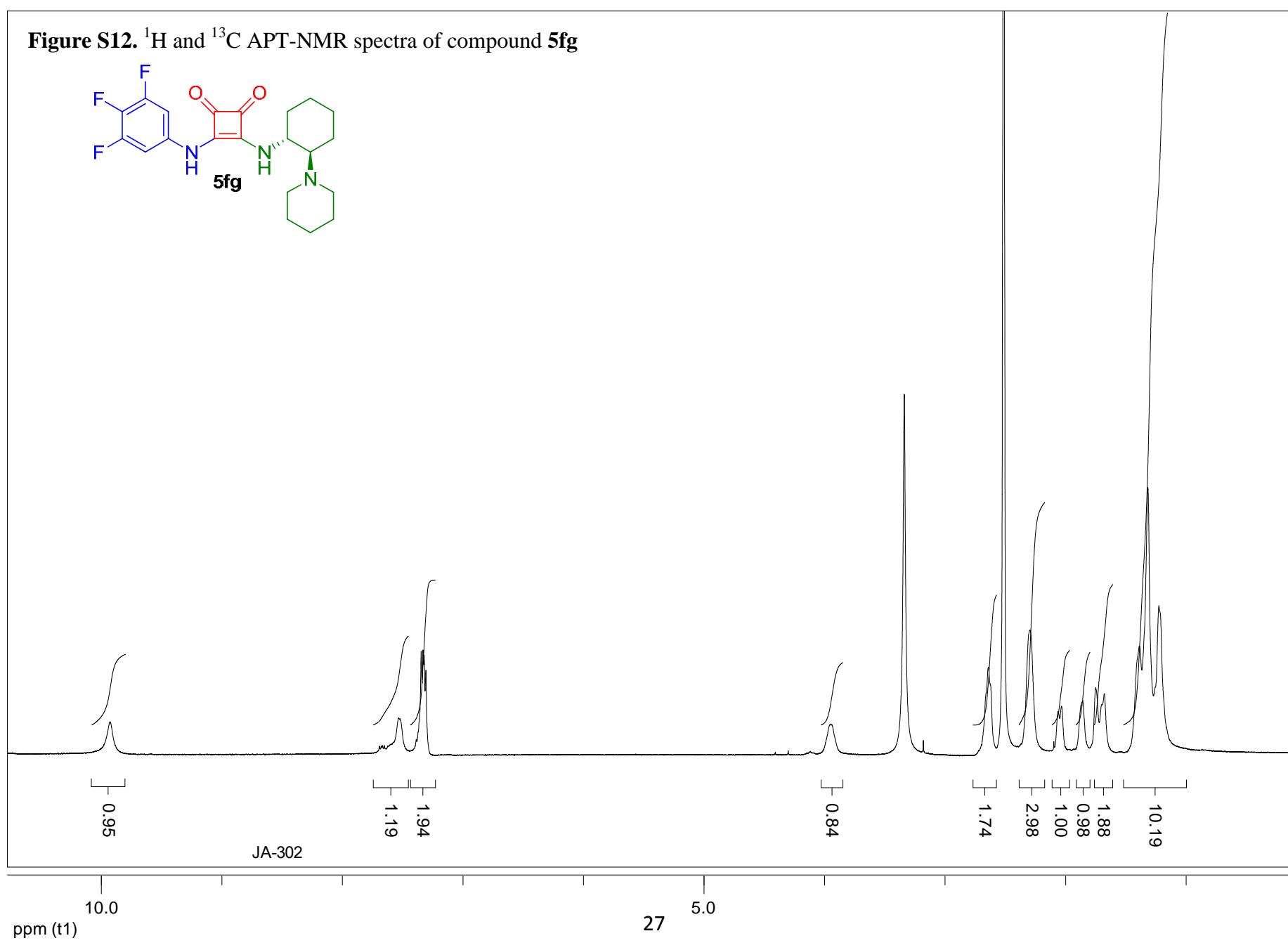


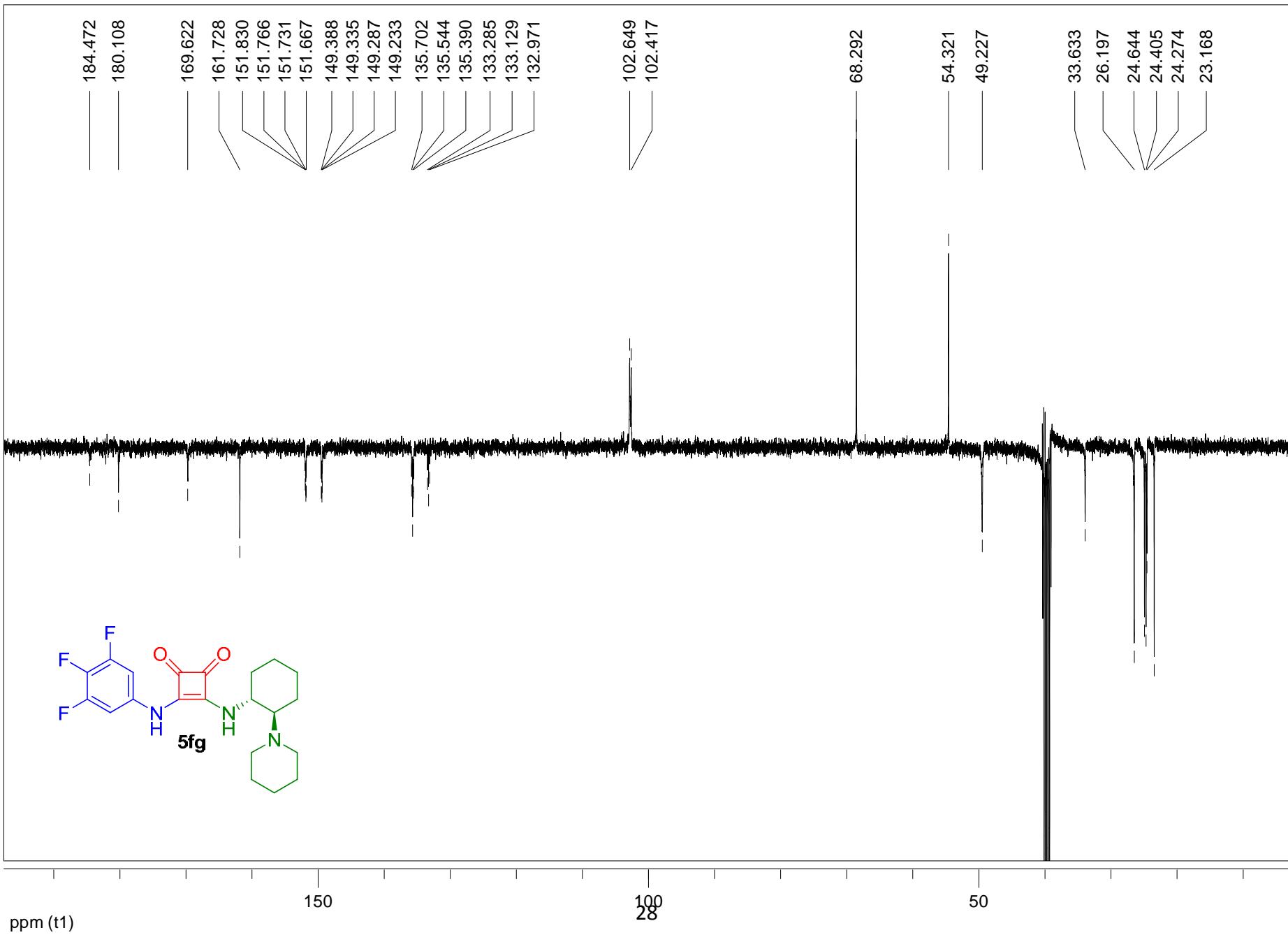
**Figure S12.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5bf**



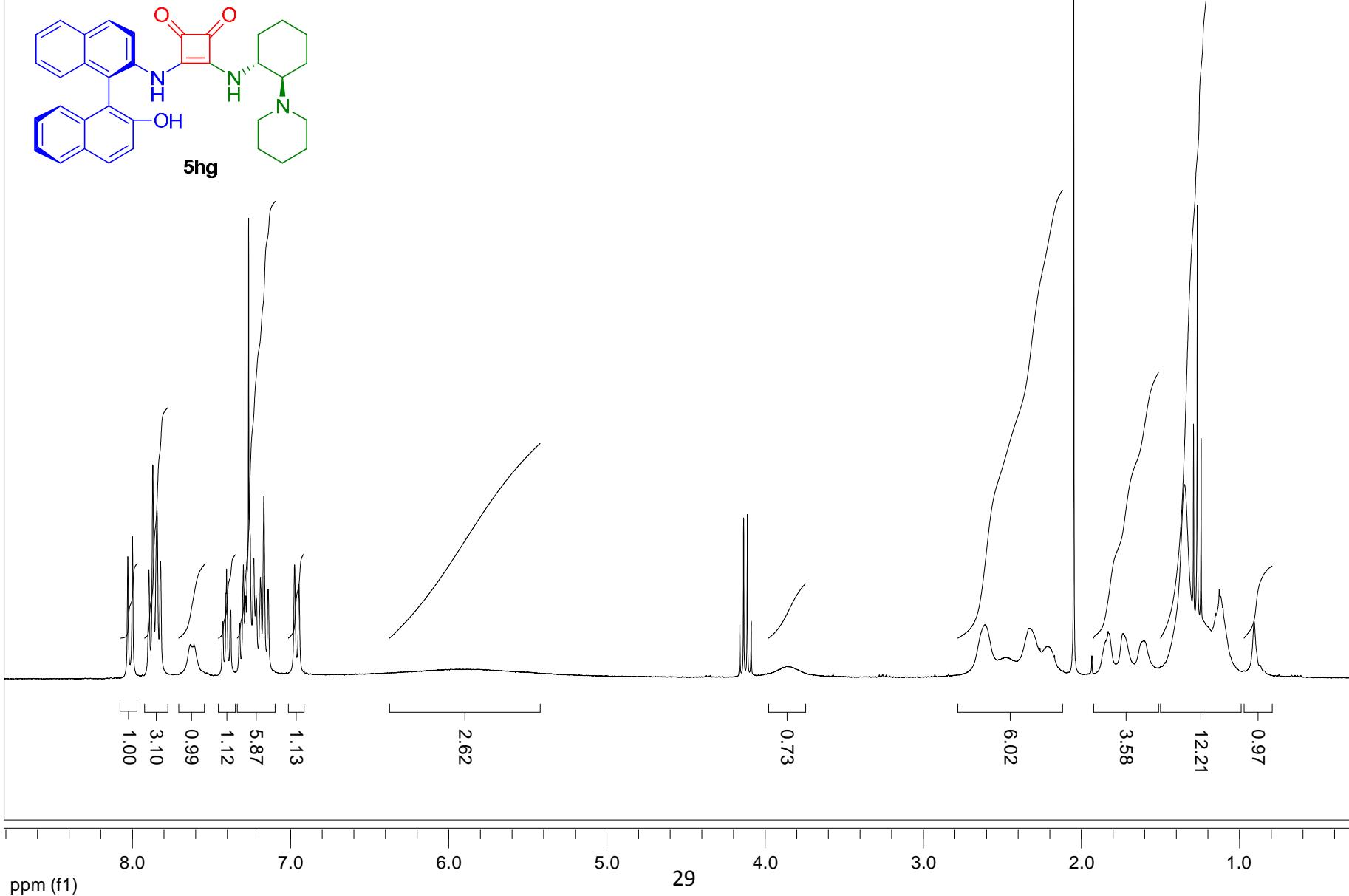


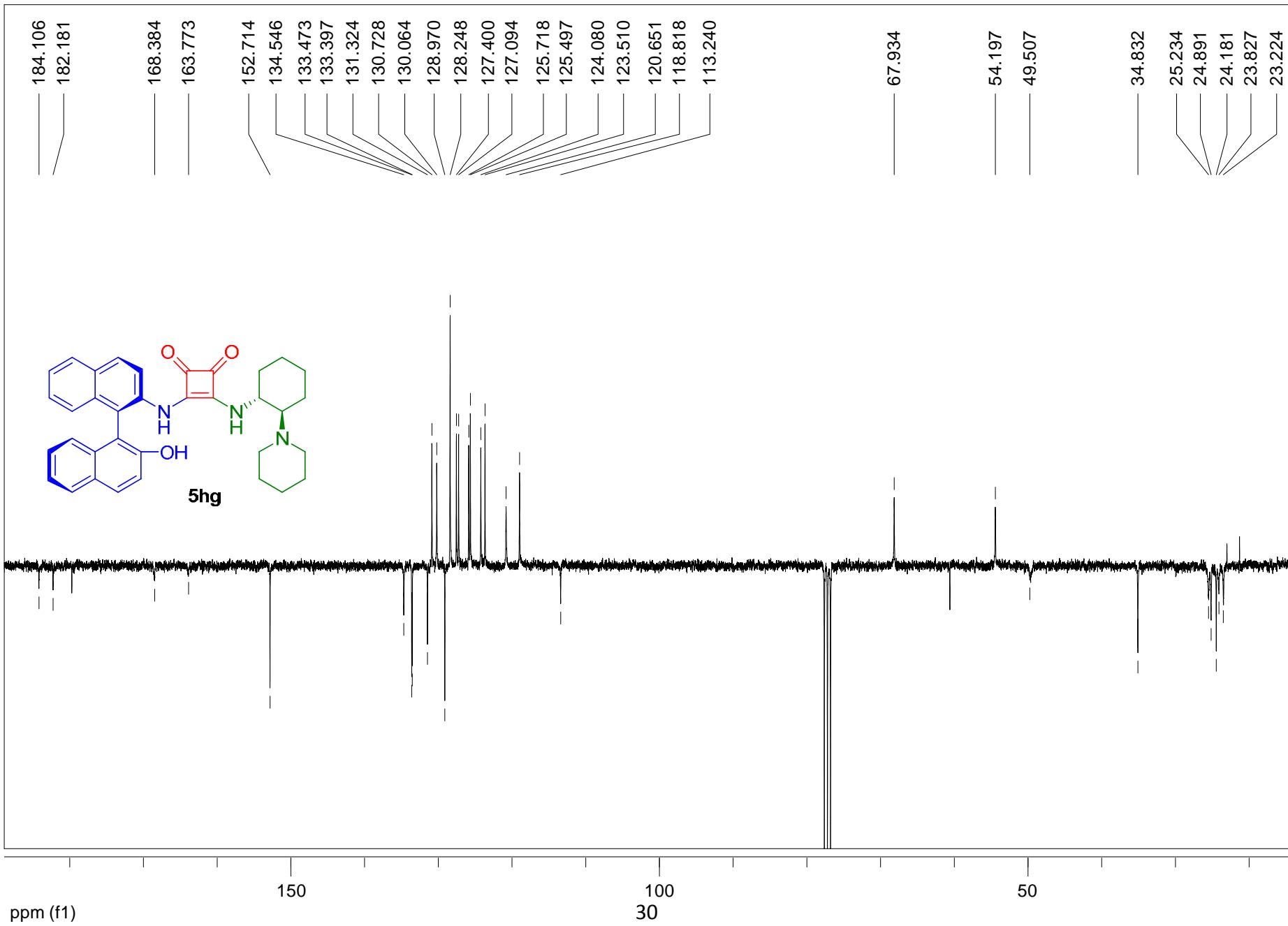
**Figure S12.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5fg**





**Figure S12.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5hg**





**Figure S12.**  $^1\text{H}$  and  $^{13}\text{C}$  APT-NMR spectra of compound **5hh**

