

Electronic Supplementary Information (ESI)

**Tungsten-catalyzed continuous-flow oxidation of sulfides to sulfones with
hydrogen peroxide**

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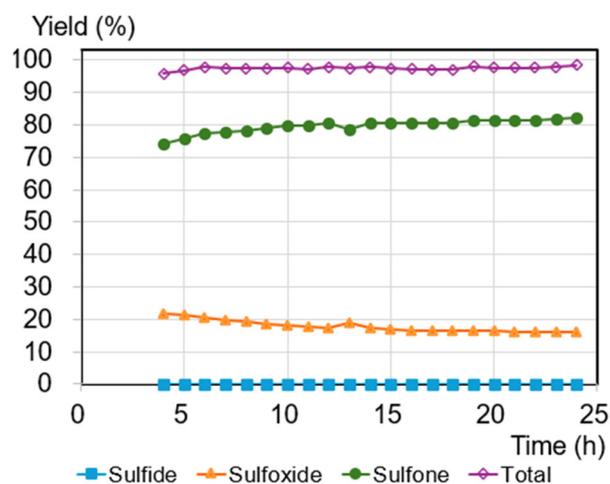
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1. Time course curves of continuous-flow oxidation of diphenyl sulfide **2a**

a)



b)

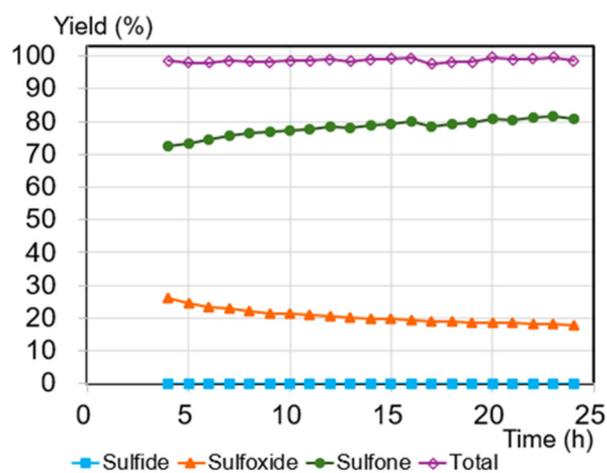
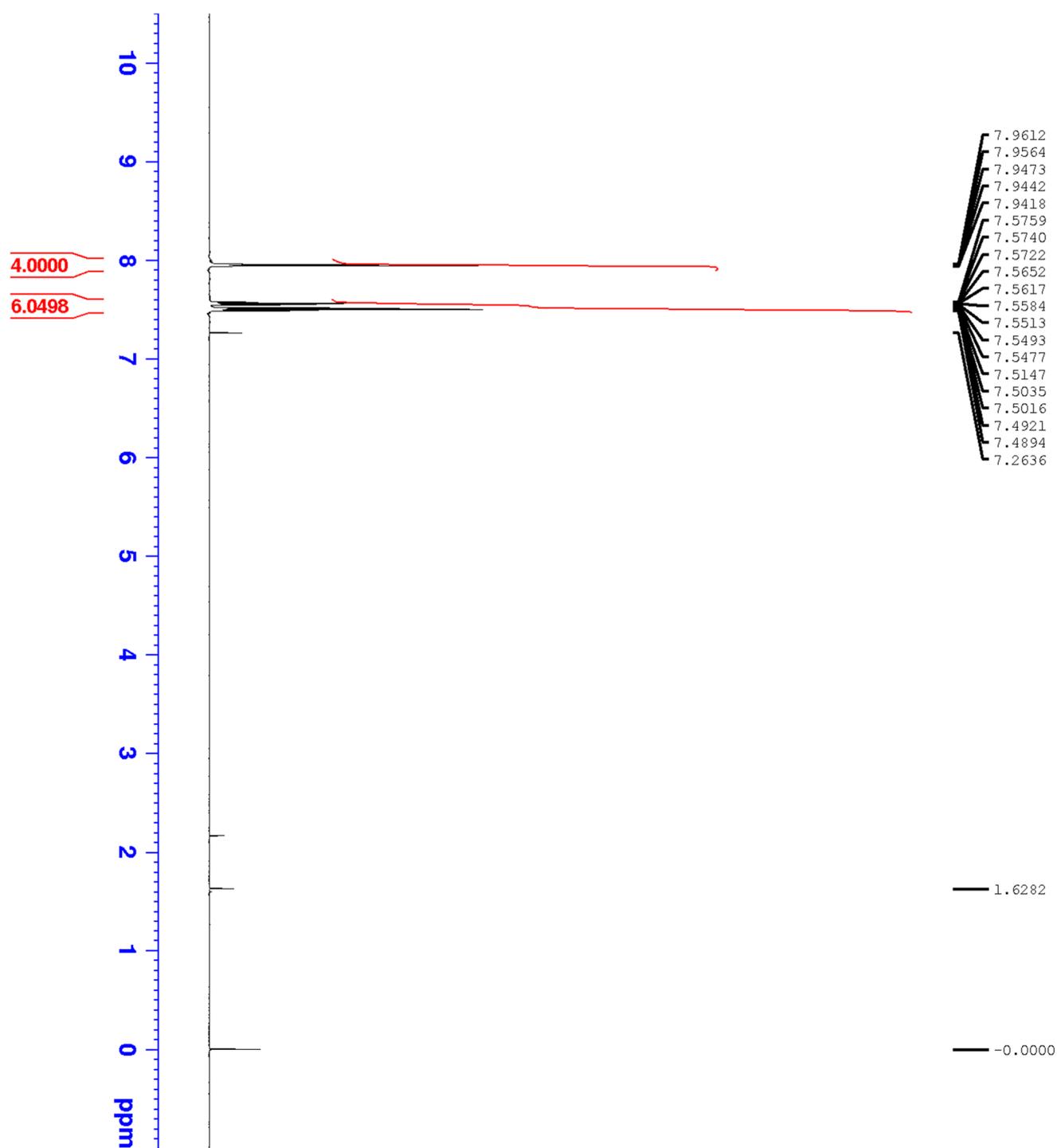


Fig. ESI 1 Continuous-flow oxidation of diphenyl sulfide **2a** with H₂O₂. a) Time course curve of oxidation of **2a** using 2.0 eq. of H₂O₂. b) Time course curve of oxidation of **2a** using WO(O₂)₂-bpy **1** as a catalyst under the SV_{mol} value of 32 which corresponds to about half amount of a catalyst **1** of Figure 2 and Table 1.

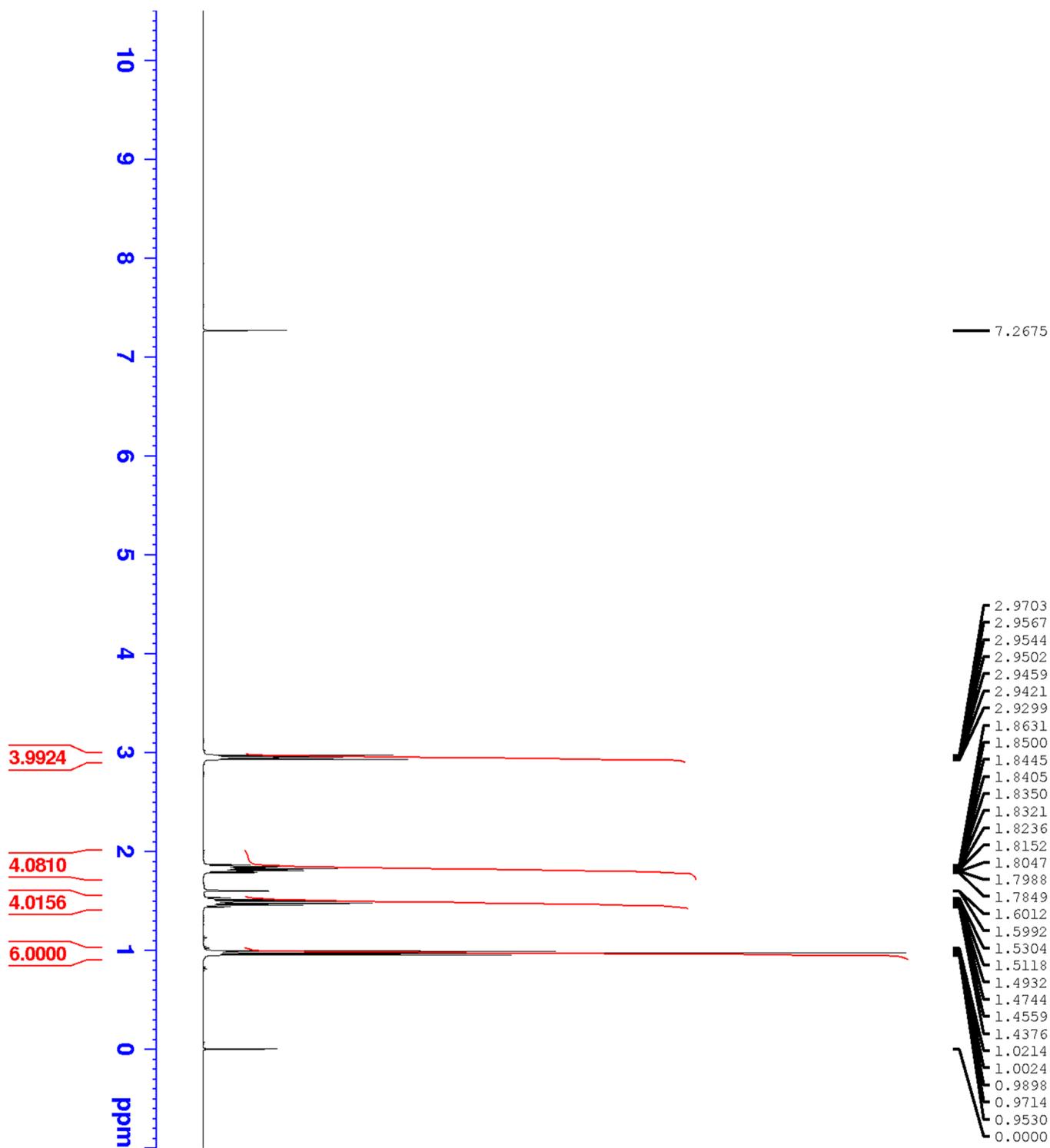
2. ¹H NMR spectra for sulfones 4a–4m

¹H NMR spectra were measured with a Bruker AV III 400 spectrometer. ¹H NMR spectra of isolated sulfones **4a**,¹ **4b**,¹ **4c**,² **4d**,³ **4e**,⁴ **4f**,¹ **4g**,¹ **4h**,⁴ **4i**,¹ **4j**,¹ **4k**,¹ **4l**⁵ and **4m**² are in accordance with those reported in the literature.

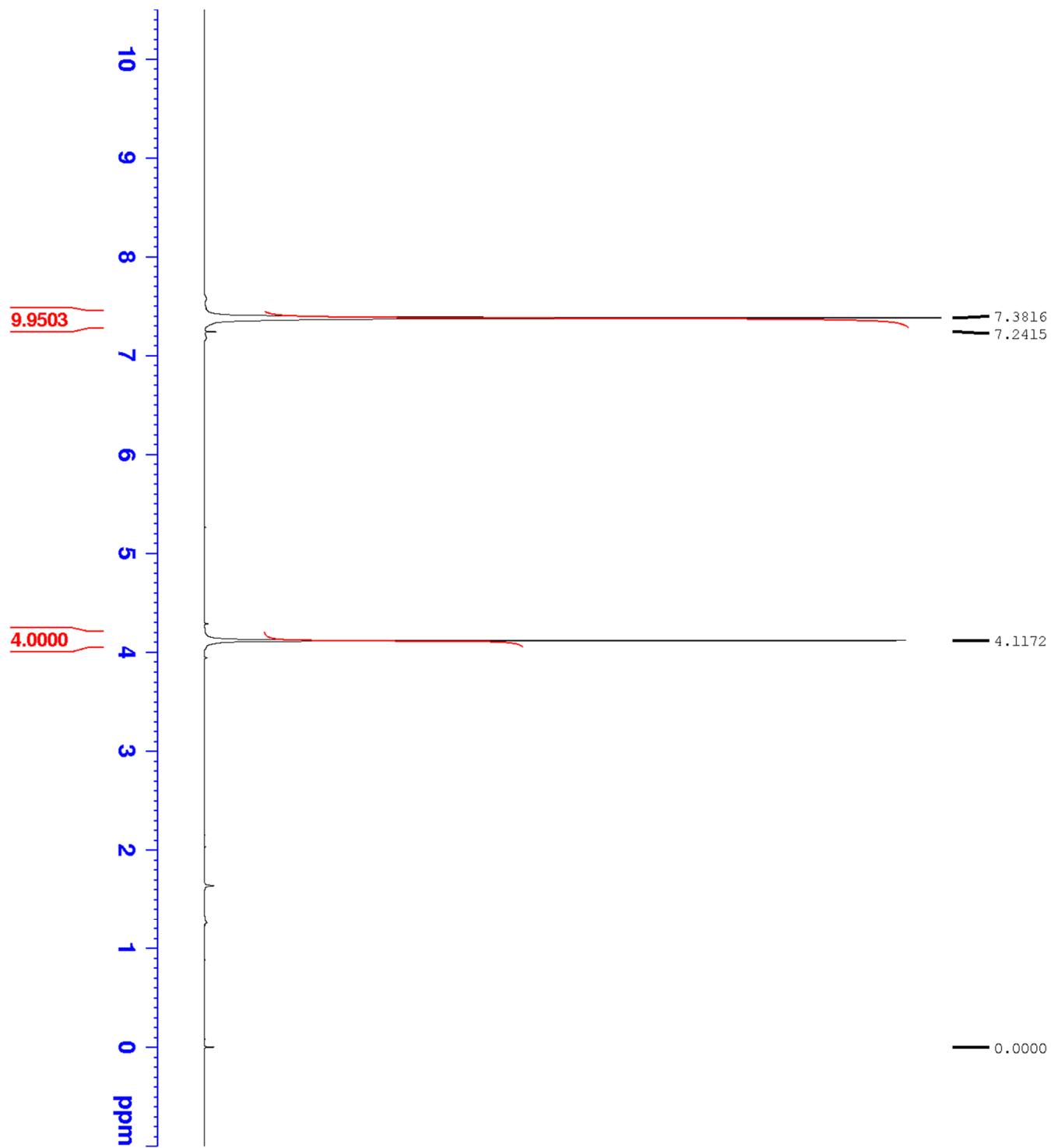
¹H NMR spectrum of diphenyl sulfone **4a** in CDCl₃



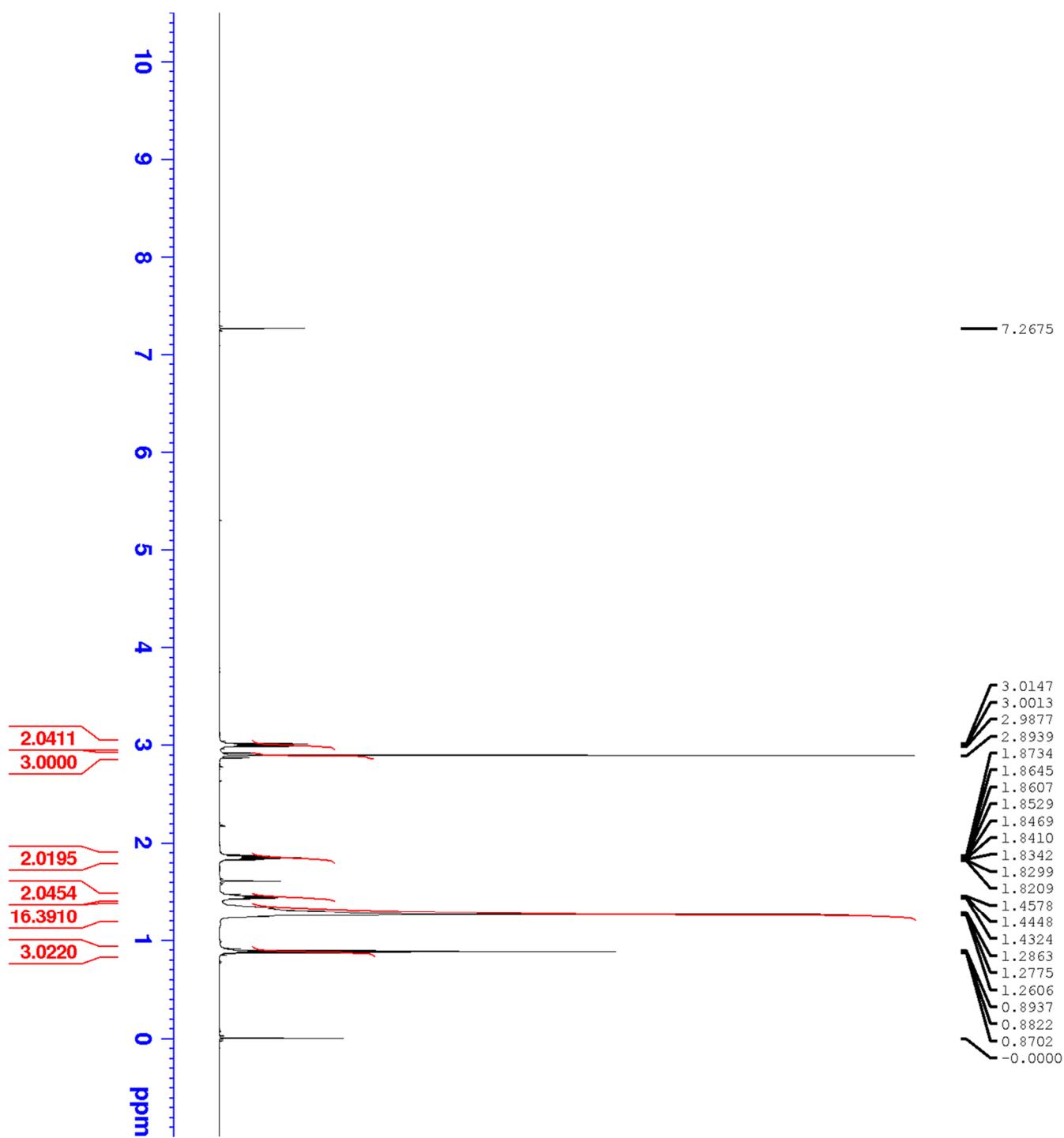
^1H NMR spectrum of dibutyl sulfone **4b** in CDCl_3



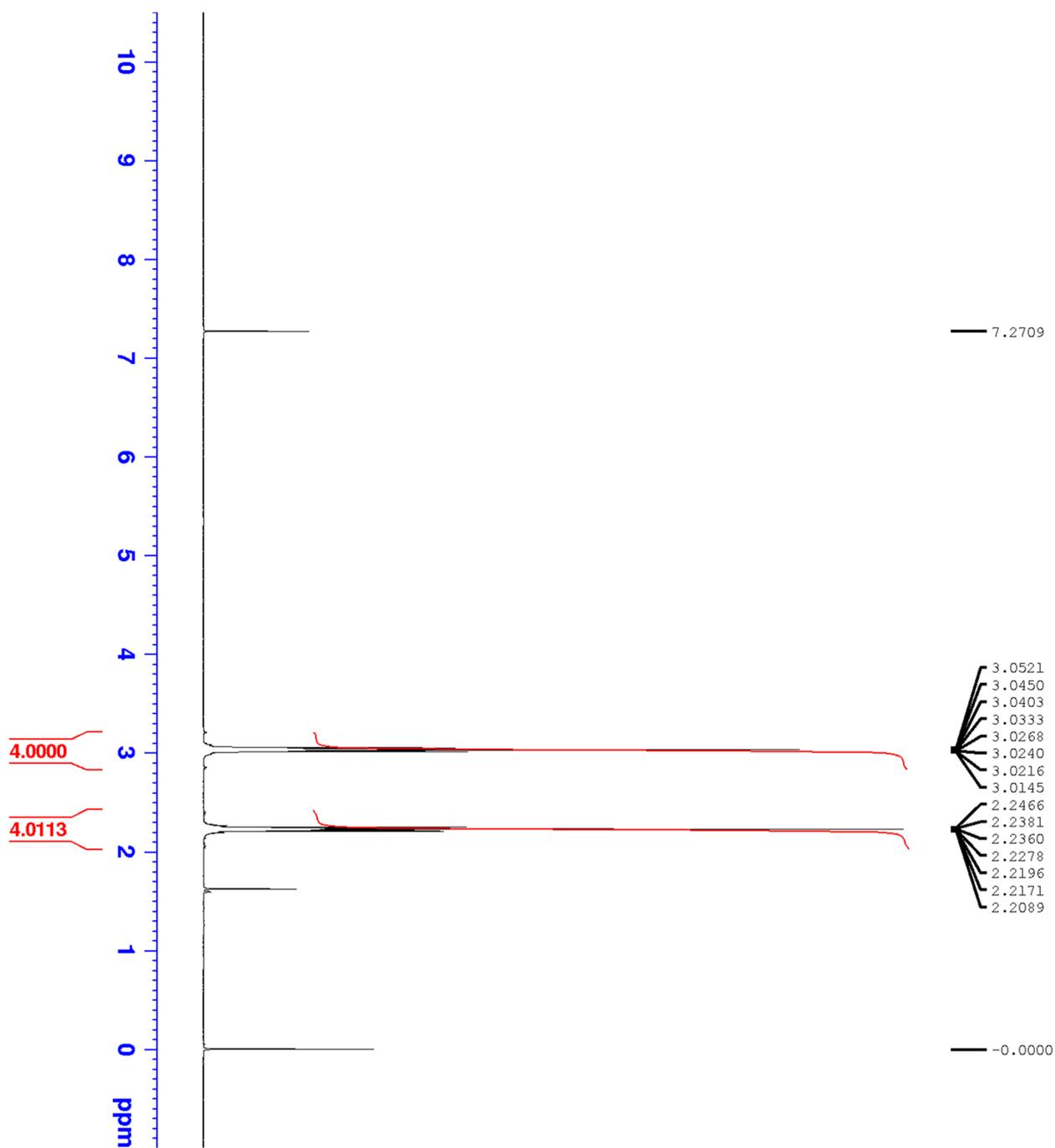
^1H NMR spectrum of dibenzyl sulfone **4c** in CDCl_3



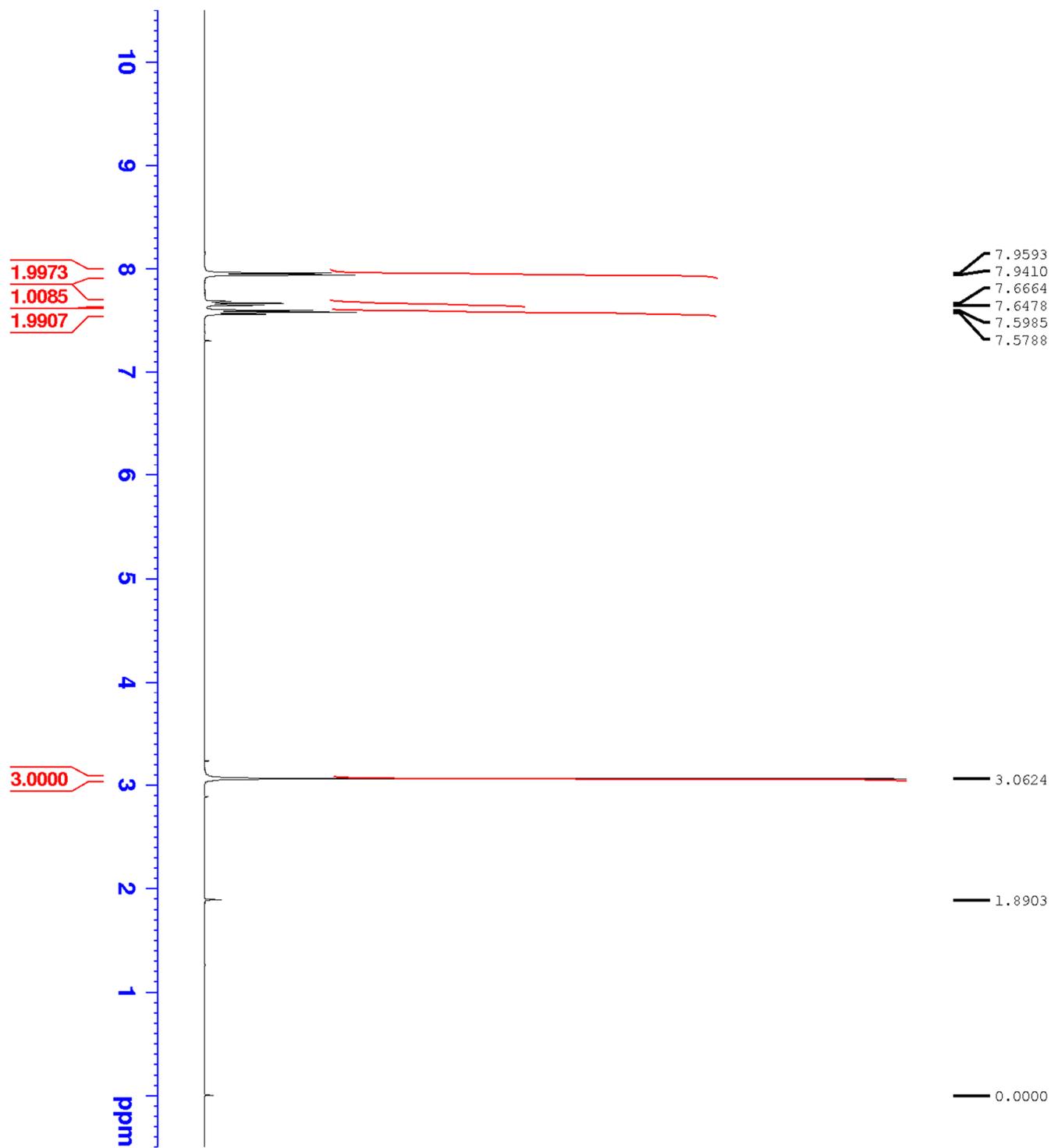
^1H NMR spectrum of dodecyl methyl sulfone **4d** in CDCl_3



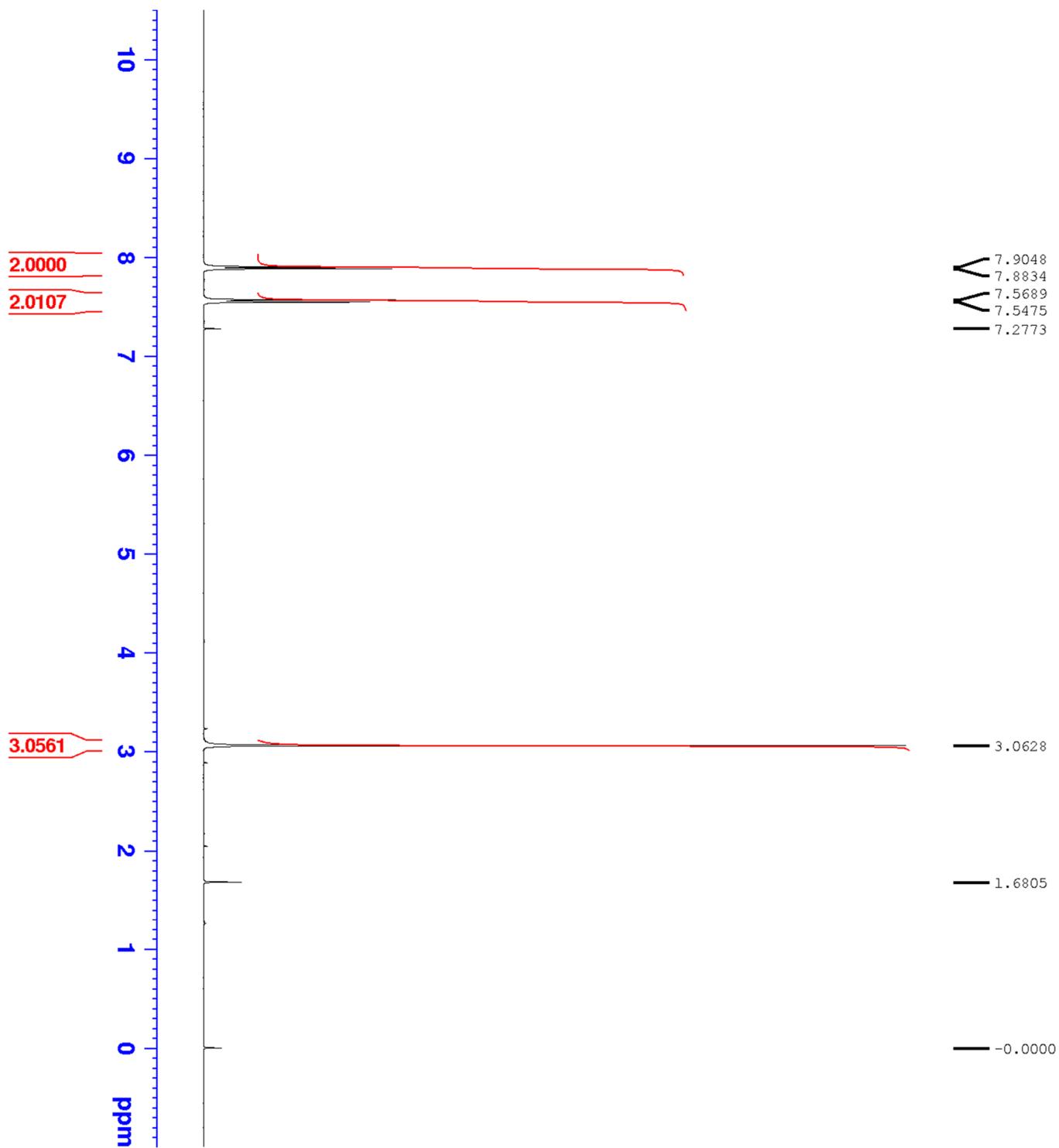
^1H NMR spectrum of thiacyclopentane 1,1-dioxide **4e** in CDCl_3



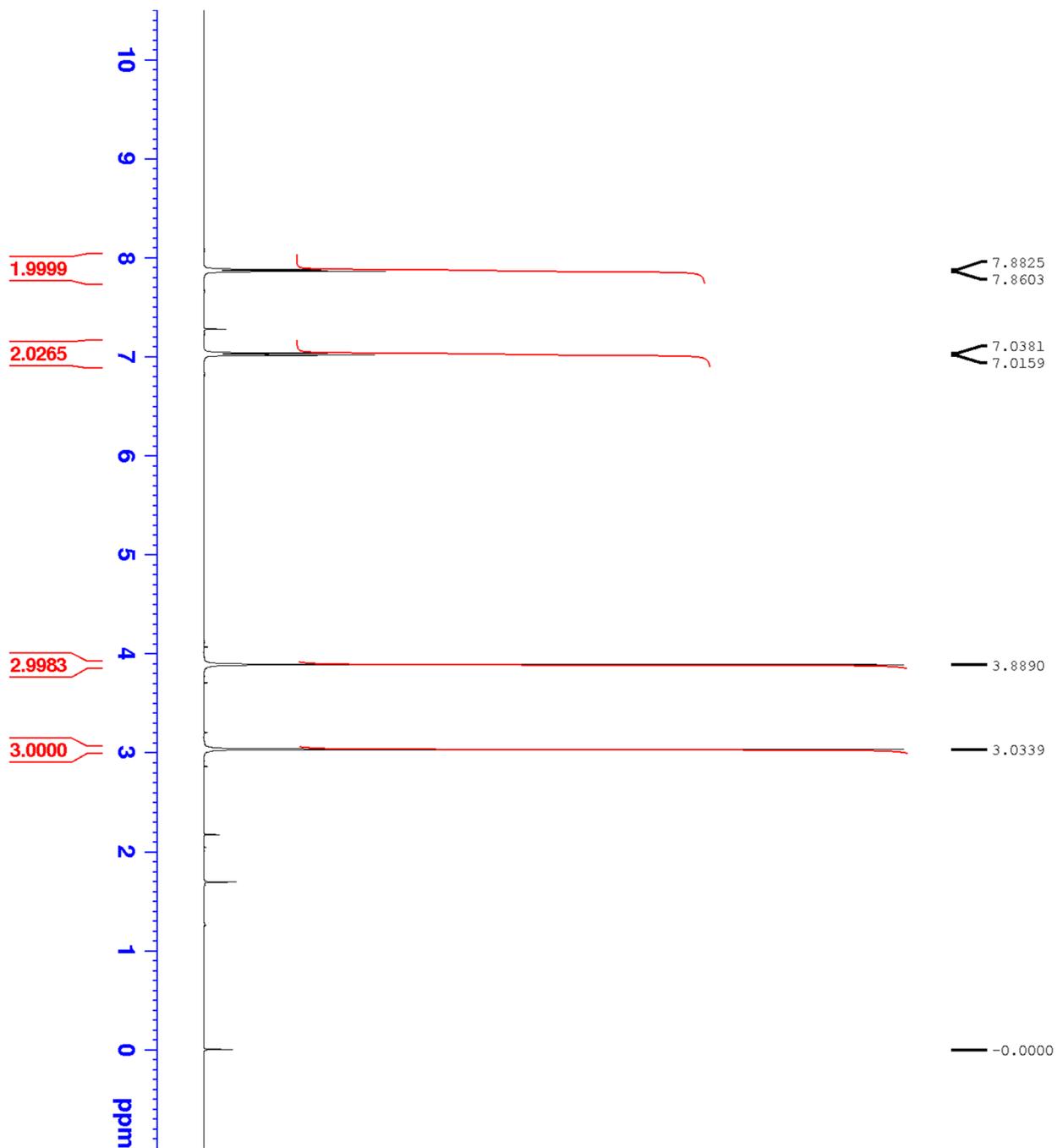
^1H NMR spectrum of methyl phenyl sulfone **4f** in CDCl_3



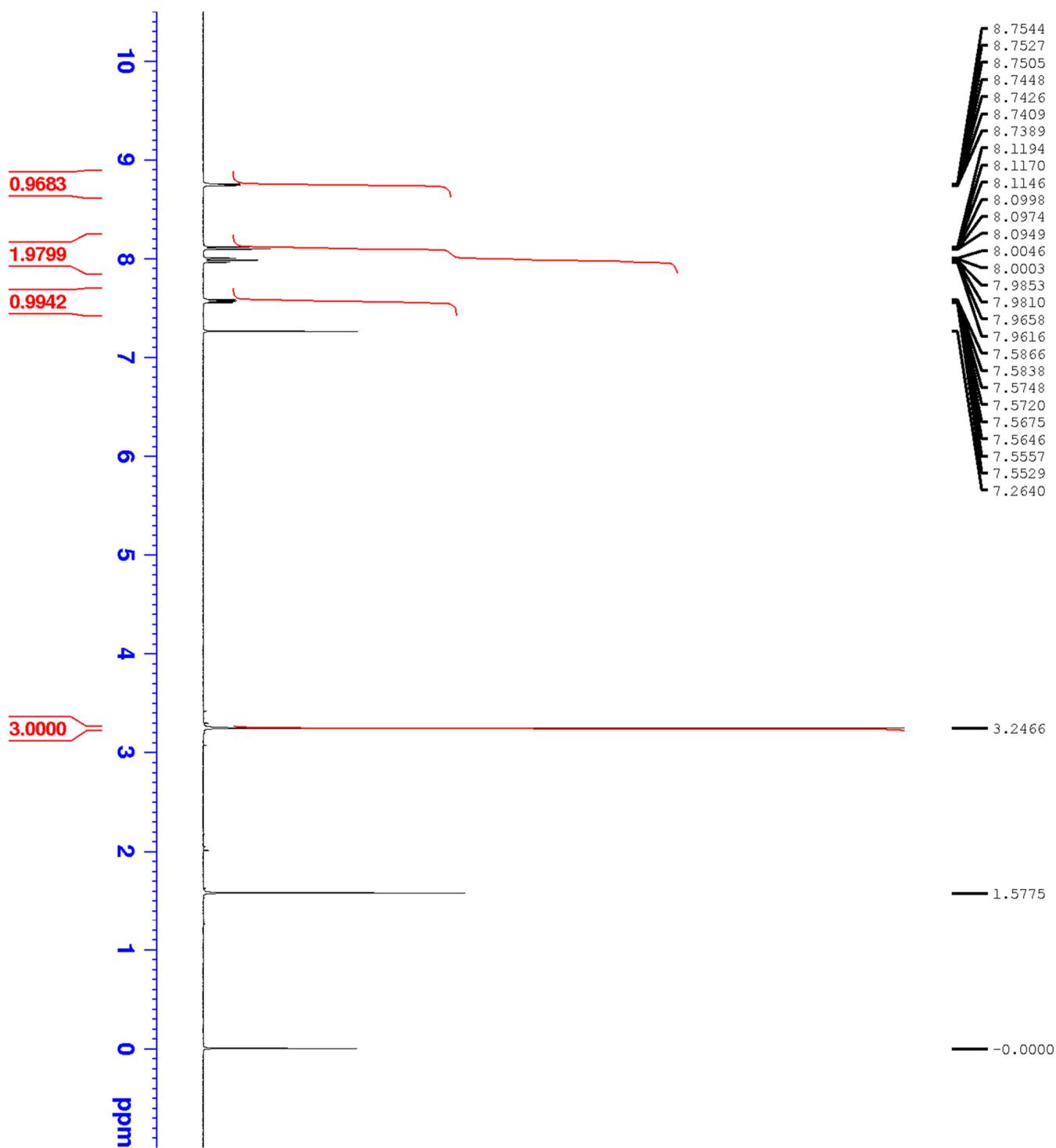
^1H NMR spectrum of 4-chlorophenyl methyl sulfone **4g** in CDCl_3



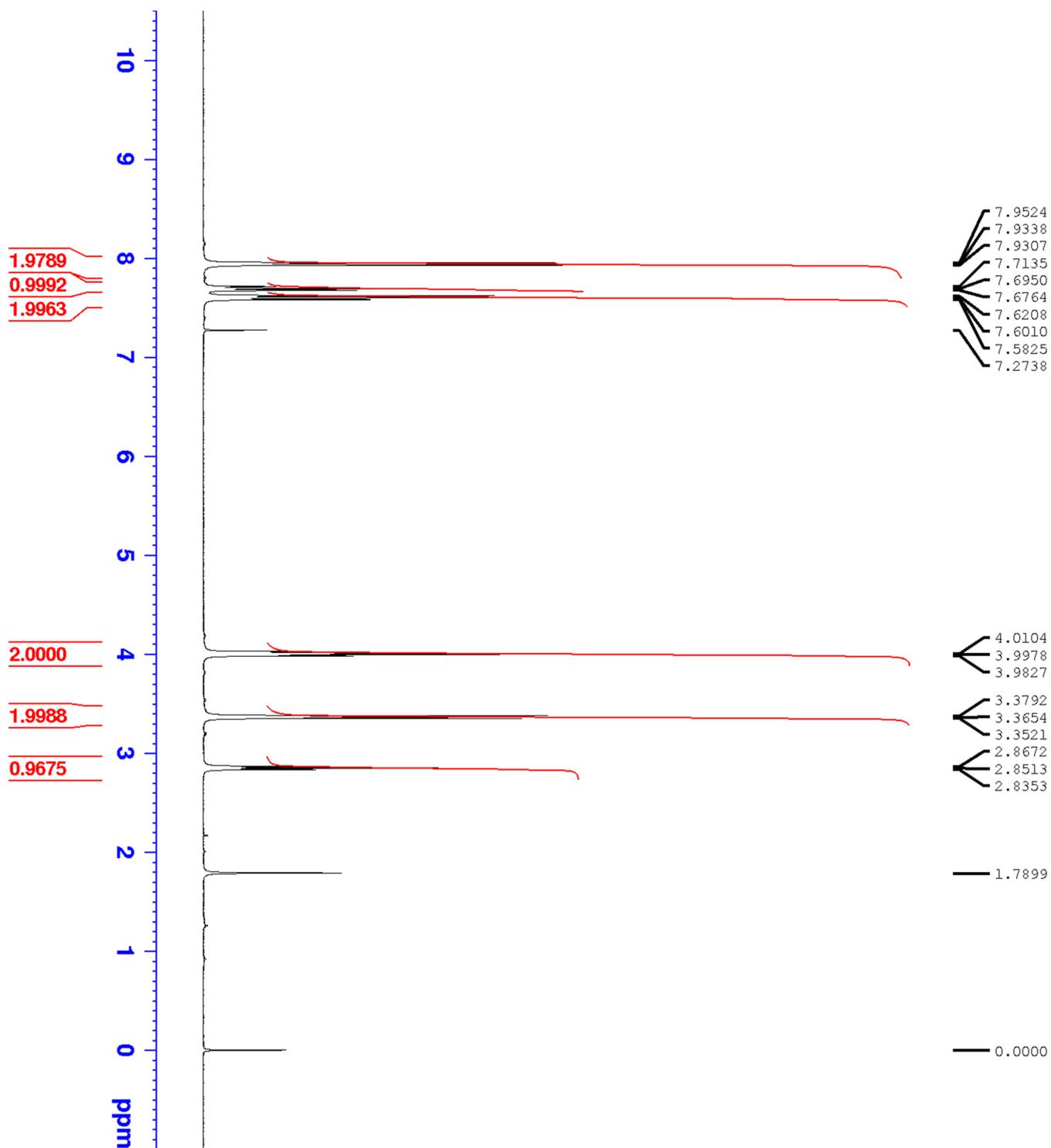
^1H NMR spectrum of 4-methoxyphenyl methyl sulfone **4h** in CDCl_3



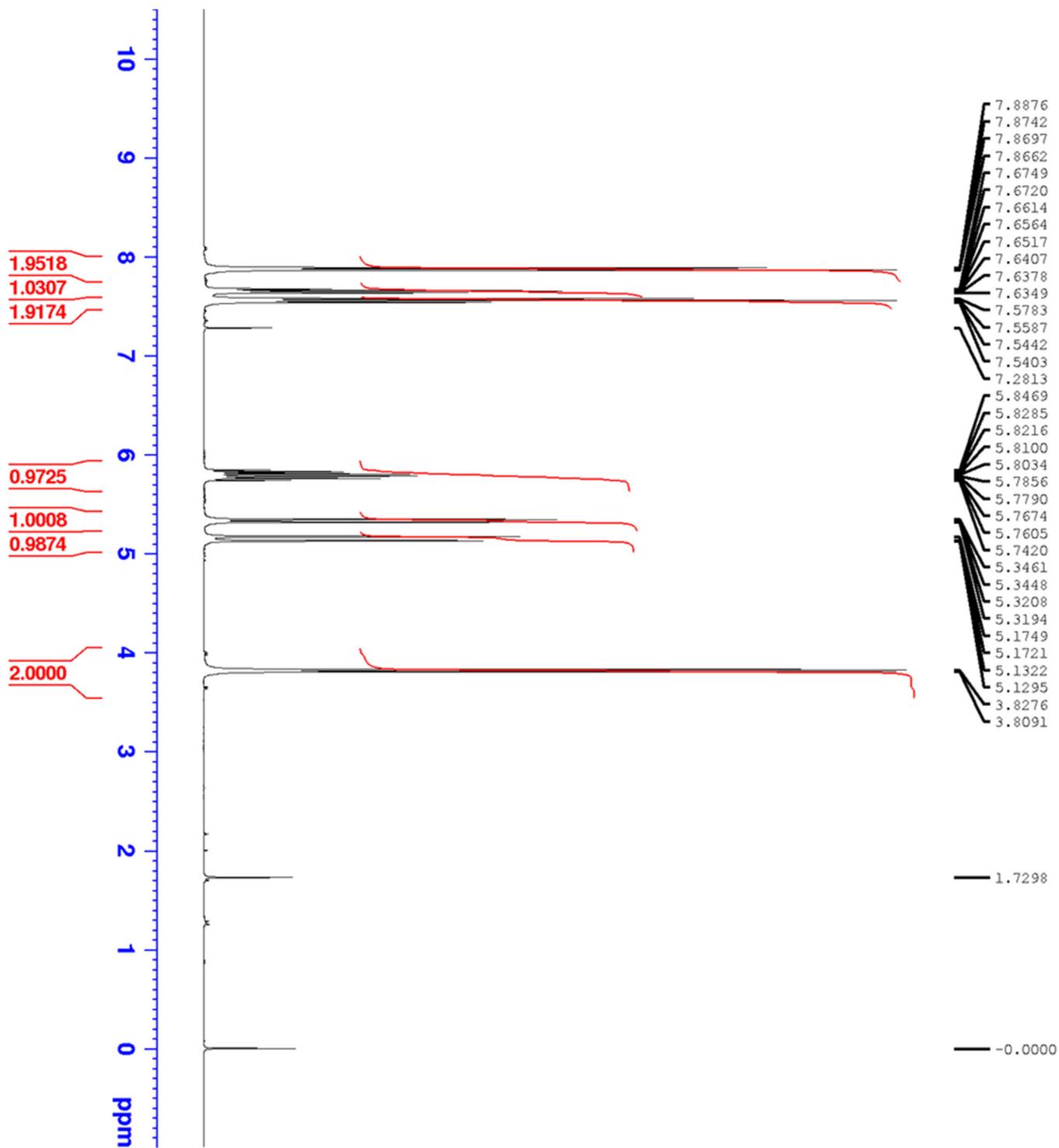
^1H NMR spectrum of 2-(methylsulfonyl)pyridine **4i** in CDCl_3



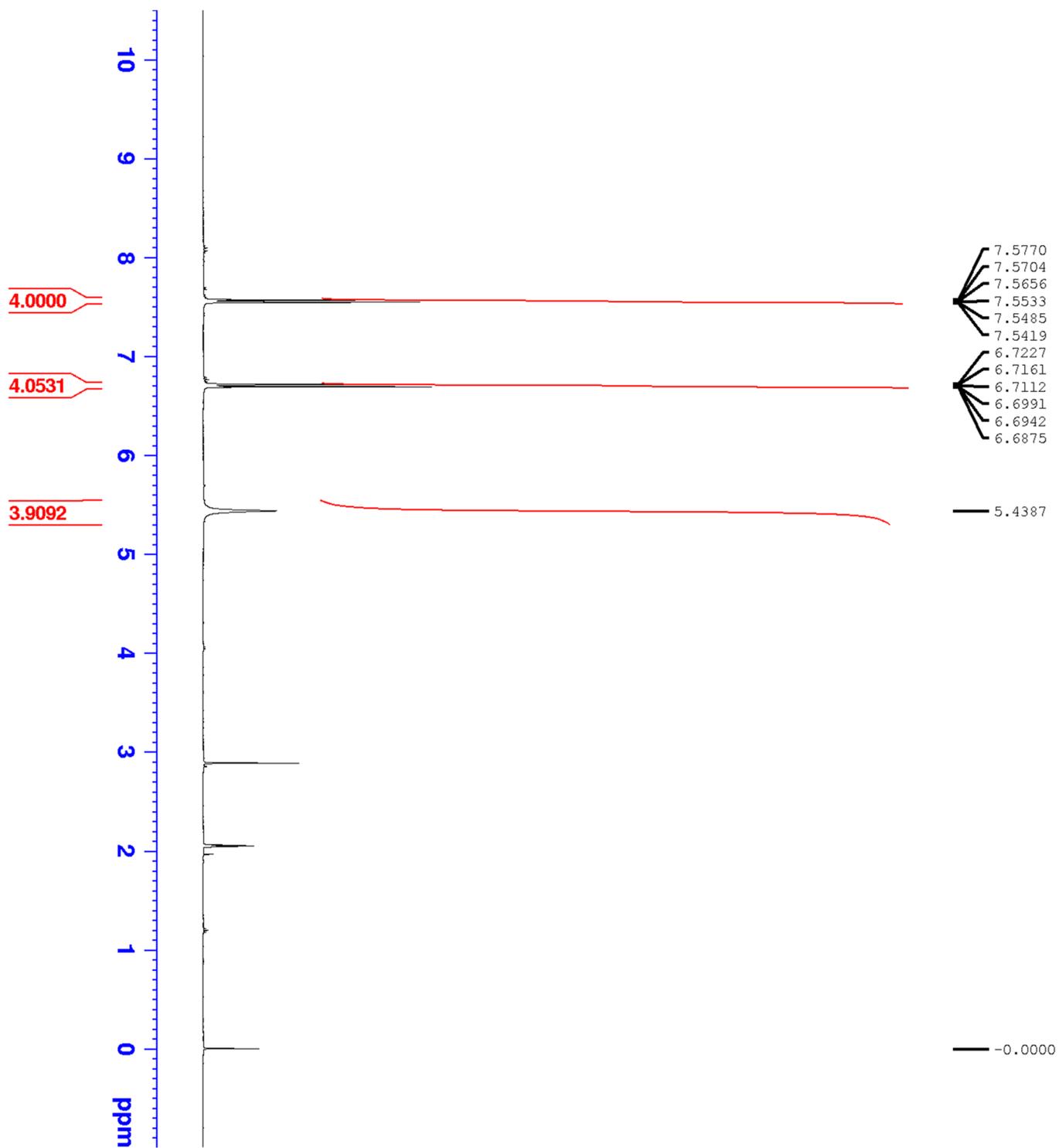
^1H NMR spectrum of 2-(phenylsulfonyl)ethanol **4j** in CDCl_3



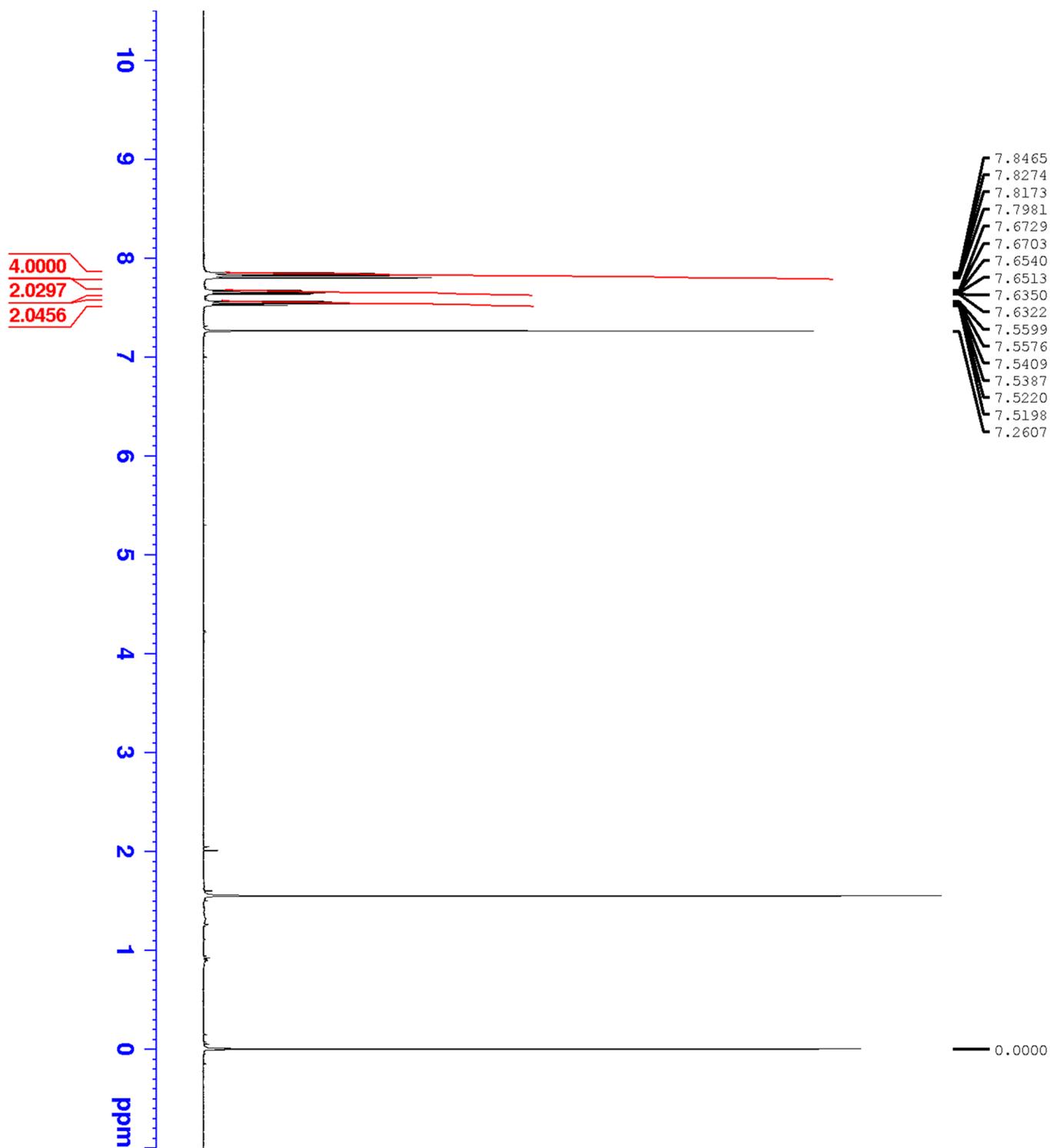
^1H NMR spectrum of phenyl 2-propenyl sulfone **4k** in CDCl_3



^1H NMR spectrum of bis(4-aminophenyl) sulfone **4I** in CD_3COCD_3



^1H NMR spectrum of dibenzothiophene-5,5-dioxide **4m** in CDCl_3



3. References

- 1 Y. Kon, T. Yokoi, M. Yoshioka, S. Tanaka, Y. Uesaka, T. Mochizuki, K. Sato and T. Tatsumi, *Tetrahedron*, 2014, **70**, 7584–7592.
- 2 M. F.-Collinet, B. Hong, L. Leclercq, P. L. Alsters, J.-M. Aubry and V. N.-Rataj, *Adv. Synth. Catal.*, 2013, **355**, 409–420.
- 3 B. M. Choudary, B. Bharathi, C. V. Reddy and M. L. Kantam, *J. Chem. Soc., Perkin Trans. 1*, **2002**, 2069–2074.
- 4 N. Fukuda and T. Ikemoto, *J. Org. Chem.*, 2010, **75**, 4629–4631.
- 5 Y. Yang, Z. Chen and Y. Rao, *Chem. Commun.*, 2014, **50**, 15037–15040.