Supporting Information for

Dictazoles: Potential Vinyl Cyclobutane Biosynthetic Precursors to the Dictazolines.

Jingqiu Dai, Jorge I. Jiménez, Michelle Kelly, Philip G. Williams

Department of Chemistry, University of Hawai`i at Manoa, Honolulu, Hawai`i, 96822, The Cancer Research Center of Hawai`i, 651 Ilalo Street, Honolulu, Hawai`i 96813, National Centre for Aquatic Biodiversity and Biosecurity, National Institute of Water and Atmospheric Research Ltd, Newmarket, Auckland, New Zealand, and AgraQuest, Inc., 1540 Drew Avenue, Davis, CA, 95618

Table of Contents

General methods. Optical rotations were measured on a polarimeter at the sodium line (589 nm). IR bands were measured as a thin film on a CaF2 disc. NMR spectra were acquired on a 500 MHz spectrometer operating at 500 or 125 MHz using the residual solvent signals as an internal reference (CD3OD δ_H 3.30 ppm, δ_C 49.0 ppm). High-resolution mass spectral data were obtained on a LC-MSD-TOF using the ESI or APCI mode.

Collection and Identification. M. Kelly, National Institute of Water and Atmospheric Research, New Zealand, identified the sponge. The sponge sample was collected from Hospital Point on Solarte Isle, Boca del Toro, on the northwest coast of Panama, from a depth of 2-3 m, on January 8, 2000. In life, the sponge forms a thick encrusting pad with raised oscules and a honeycombed to conulose surface. The color in life is pinkish brown, darkening to wood brown out of the water. The texture is springy, and the sponge exudes slime. Large dark brown laminated and pithed fibers dominate the skeleton, and are concentrated at the surface. The sponge is most closely comparable to Smenospongia cerebriformis (Duchassaing & Michelotti, 1864) (Order Dictyoceratida: Family Thorectidae). A voucher specimen has been deposited in the Natural History Museum, London (BMHN 2000.12.11.6).

Extraction and Isolation. The freeze-dried sponge (114 g) was exhaustively extracted with 1:1 i-PrOH:CH2Cl2 (3 x 3 L) to afford 14.85 g of lipophilic extract. Partitioning using a modified Kupchan procedure yielded four fractions of 6.07, 1.88, 2.94 and 5.78 g from the hexane, dichloromethane, n-butanol and water phases. The organic residue from the n-BuOH phase (2.94 g) was separated on a Sephadex LH-20 column (1300 x 30 mm) eluting with MeOH (flowrate 1.74 mL/min). The resulting thirty-three fractions were analyzed by TLC and pooled based on the results into seven fractions.

Sephadex fraction 2 (582.5 mg) was chromatographed on a Si gel flash column (6.0 g) eluting with a gradient of CH2Cl2-MeOH. LC-MS analysis of the resulting fractions indicated one contained a series of halogenated compounds. Separation of this fraction by RP-HPLC [Luna C8, 250 x 10 mm, a linear gradient from 10-50% MeCN in water with 0.1 % formic acid in both solvents over 40 min, flow rate 3 mL/min, PDA and ELSD detection] afforded Dictazoline D (**6**, t_R 26.9 min, 0.3 mg) and Dictazoline E (**7**, t_R 23.5 min, 0.5 mg).

Sephadex fraction 4 (598.4 mg) was chromatographed on a Si gel flash column (6.0 g) eluting with a gradient of CH2Cl2-MeOH. Separation of the fifth fraction from this silica flash column by RP-HPLC [Luna C8, 250 x 10

mm, a linear gradient from 15-35% MeCN in water with 0.1 % formic acid in both solvents over 40 min, flow rate 3 mL/min, PDA and ELSD detection] afforded Dictazole B (**2**, t_R 29.0 min, 0.8 mg) and a fraction containing Dictazoline C (**5**). Further purification of **5** by RP-HPLC [Luna C8, 250 x 10 mm, a linear gradient from 10-30% MeCN in water with 0.1 % formic acid in both solvents over 40 min, flow rate 3 mL/min, PDA and ELSD detection] afforded dictazoline C (**5**, t_R 28.5 min, 1.5 mg). Fraction 6 (40.0 mg) from the silica flash column of Sephadex fraction 4 was also purified by RP-HPLC [Luna C8, 250 x 10 mm, a linear gradient from 5-40% MeCN in water with 0.1 % formic acid in both solvents over 40 min, flow rate 3 mL/min, PDA and ELSD detection] to afford **1** (t_R 35.0 min, 4.5 mg).

Dictazole A (**1**, 4.5 mg, 3.0 x 10^{-2} % yield): colorless powder; $[\alpha]_D^{22}$ +8.5 (*c* 0.2, MeOH); UV (MeOH) λmax (log ε) 223 (2.5) 284 (2.4) nm; IR (CaF_2) ν_{max} 3337, 1643, 1592, 1352 cm^{-1}; See Table S1 (DMSO-d_6) and Table S2 (MeOH-d_4) for tabulated spectral data; HRESI-TOFMS *m/z* 561.1206 $[M + H]^+$ [Calcd for $C_{26}H_{24}{}^{81}BrN_8O_2^+$, 561.1185, +3.7 ppm].

Dictazole B (**2**, 0.8 mg, 5.0 x 10^{-3} % yield): colorless powder; $[\alpha]_D^{22}$ -42.5 (*c* 0.2, MeOH); UV (MeOH) λmax (log ε) 228 (2.5) 288 (1.9) nm; IR (CaF_2) ν_{max} 3392, 1653, 1591, 1352 cm^{-1}; See Table S3 for tabulated spectral data; HRESI-TOFMS *m/z* $[M + H]^+$ 651.0490 [Calcd for $C_{27}H_{25}{}^{79}Br_2N_8O_2^+$, 651.0467, +3.5 ppm].

Dictazoline C (**5**, 1.5 mg, 1.0 x 10^{-2} % yield): colorless powder; $[\alpha]_D^{22}$ -19.2 (*c* 0.2, MeOH); UV (MeOH) λmax (log ε) 225 (2.6) 289 (1.9) nm; IR (CaF_2) ν_{max} 3542, 1646 cm^{-1}; See Table S4 for tabulated spectral data; HRESI-TOFMS *m/z* 559.1221 $[M + H]^+$ [Calcd for $C_{26}H_{24}{}^{79}BrN_8O_2^+$, 559.1206, +2.8 ppm].

Dictazoline D (**6**, 2.5 mg, 1.7 x 10^{-2} % yield): colorless powder; $[\alpha]_D^{22}$ -1.1 (*c* 0.1, MeOH); UV (MeOH) λmax (log ε) 283 (9.14) nm; IR (CaF_2) ν_{max} 3422, 2930, 1656, 1586 cm^{-1}; See Table S5 for tabulated spectral data; HRESI-TOFMS *m/z* 573.1352 $[M + H]^+$ [Calcd for $C_{27}H_{26}{}^{79}BrN_8O_2^+$, 573.1362, -1.7 ppm].

Dictazoline E (**7**, 0.5 mg, 3.4 x 10^{-3} % yield): colorless powder; $[\alpha]_D^{22}$ -22.5 (*c* 0.2, MeOH); UV (MeOH) λmax (log ε) 220 (4.6) 283 (3.8) nm; IR (CaF_2) νmax 3542, 1646 cm^{-1}; See Table S5 for tabulated spectral data; HRESI-TOFMS *m/z* 495.2279 $[M + H]^+$ [Calcd for $C_{27}H_{27}N_8O_2^+$, 495.2257, +4.4 ppm].

Table S1. NMR Spectroscopic Data (500 MHz) for Dictazole A (**1**) in DMSO-d_6

Position	δ_C	δ_H, mult (*J* in Hz)	HMBC	ROESY
2	124.6, CH	7.15, s		H-8, H-15’
3	106.5, C		H-2, H-4, H-8	
3a	126.4, C		H-2, H-4, H-5, H-7, H-8	
4	119.5, CH	7.25, d (8.3)		H-8, H-14’
5	121.9, CH	7.07, d (8.3)		
6	114.2, C		H-4, H-5, H-7	
7	114.3, CH	7.54, s		
7a	136.3, C		H-2, H-4	
8	43.4, CH	4.46, s	H-8’	H-2, H-14’
9	67.2, C		H-8’, H-8, H-10	
10		8.16, s		H-2’
11	170.9, C		H-10	
13	188.4, C		H-8, H-8’, H-10	
2’	123.6, CH	7.13, s		H-8, H-10
3’	105.9, C		H-2’, H-4’, H-8	
3a’	127.4, C		H-2’, H-4’, H-5’, H-7’, H-8’	
4’	117.7, CH	7.31, d (8.0)		H-8, H-14'
5’	119.1, CH	6.95, t (8.0)		
6’	121.6, CH	7.05, t (8.0)		
7’	111.7, CH	7.32, d (8.0)		
7a’	135.3, C		H-2’, H-4’, H-6’	
8’	43.6, CH	4.49, s	H-8’	H-2’, H-14’
9’	72.7, C		H-8, H-8’, H-14’	
11’	153.5, C		H-14', H-15’	
13’	172.5, C		H-8, H-8', H-15’	
14'	25.8, CH_3	3.21, s		H-4’, H-8’, H-4, H-8
15’	25.1, CH_3	2.73, s		H-2

Table S2. NMR Spectroscopic Data (500 MHz) for Dictazole A (**1**) in MeOH-d_4

Position	δ_C	δ_H, mult (*J* in Hz)	HMBC	ROESY
2	125.4, CH	7.17, s		H-15’
3	106.7, C		H-2, H-4, H-8	
3a	127.4, C		H-2, H-5, H-7, H-8	
4	120.0, CH	7.27, d (7.9)		H-14’
5	123.7, CH	7.11, d (7.9)		
6	116.4, C		H-7	
7	115.4, CH	7.50, s		
7a	138.0, C		H-2, H-4, H-7	
8	45.7, CH	4.82, s		H-8’, H-14’
9	74.6, C		H-8’, H-8	
11	157.0, C			
13	173.8, C			
2’	124.5, CH	7.16, s		
3’	106.1, C		H-2’, H-4’, H-8’	
3a’	128.4, C		H-2’, H-5’, H-7’, H-8’	
4’	118.4, CH	7.36, d (8.0)		H-14'
5’	120.6, CH	7.00, t (8.0)		
6’	123.1, CH	7.10, t (8.0)		
7’	112.5, CH	7.33, d (8.0)		
7a’	137.2, C		H-2’, H-4’, H-6’	
8’	45.4, CH	4.78, s		H-8, H-14’
9’	74.6, C		H-8, H-8’, H-14’	
11’	157.0, C		H-14', H-15’	
13’	173.8, C		H-8, H-8', H-15’	
14'	27.1, CH_3	3.51, s		H-4’, H-8’, H-4, H-8
15’	25.9, CH_3	2.94, s		H-2’

Table S3. NMR Spectroscopic Data (500 MHz) for Dictazole B (**2**) in DMSO-d_6

Position	δ_C	δ_H, mult (*J* in Hz)	HMBC	ROESY
2	124.6, CH	7.42, s		
3	106.7, C		H-2, H-4, H-8	
3a	126.4, C		H-2, H-5, H-7, H-8	
4	118.4, CH	6.78, d (7.9)		H-8
5	121.7, CH	7.05, dd (7.9, 2.1)		
6	114.0, C		H-4, H-5, H-7	
7	114.2, CH	7.52, d (2.1)		
7a	136.9, C		H-2, H-4	
8	44.5, CH	5.01, s		H-4, H-14
9	68.5, C		H-8', H-8, H-14	
11	170.3, C		H-14	
13	188.0, C		H-8, H-8'	
14	28.5, CH_3	3.09, s		H-8
2'	123.5, CH	7.14, s		H-15'
3'	107.3, C		H-2', H-4', H-8'	
3a'	125.8, C		H-2', H-5', H-7', H-8'	
4'	119.2, CH	6.91, d (7.9)		
5'	121.5, CH	7.02, dd (7.9, 2.1)		
6'	114.0, C		H-4', H-5', H-7'	
7'	114.2, CH	7.54, d (2.1)		
7a'	137.0, C		H-2', H-4'	
8'	45.9, CH	5.09, s		H-14'
9'	66.5, C		H-8, H-8', H-14'	
11'	153.8, C		H-14', H-15'	
13'	174.6, C		H-8, H-8', H-15'	
14'	27.5, CH_3	3.04, s		H-8'
15'	25.2, CH_3	3.00, s		H-2'

Table S4. NMR Spectroscopic Data (500 MHz) for Dictazoline C (**5**) in MeOH-d_4

Position	δ_C	δ_H, mult (*J* in Hz)	HMBC	ROESY
2	128.2, C		H-8, H-8’	
3	114.2, C		H-8	
3a	128.2, C		H-8	
4	120.9, CH	7.48, d (8.0)		H-8α
5	123.7, CH	7.20, dd (8.0, 1.6)		
6	115.5, C		H-4, H-5, H-7	
7	115.2, CH	7.48, d (1.6)		
7a	139.9, C		H-4, H-7	
8	32.8, CH_2	3.13, d (16.4)		H-4
		3.56, d (16.4)		H-8'
9	71.5, C		H-8, H-8’	
11	157.9, C			
13	174.6, C		H-8	
2’	123.0, CH	7.05, s		H-15'
3’	106.5, C		H-2’, H-8’	
3a’	129.6, C		H-2', H-8'	
4’	118.8, CH	7.64, d (8.0)		H-14'
5’	120.2, CH	7.02, t (8.0)		
6’	122.5, CH	7.08, t (8.0)		
7’	112.2, CH	7.29, d (8.0)		
7a’	136.4, C		H-4’, H-7’	
8’	40.7, CH	4.43, s		H-8β, H14'
9’	71.0, C		H-8’, H-14'	
11’	157.9, C		H-14', H-15'	
13’	174.6, C		H-8', H-15'	
14'	26.0, CH_3	2.86, s		H-4', H-8'
15’	25.0, CH_3	2.88, s		H-2'

Table S5. ^{1}H and ^{13}C NMR Spectroscopic Data (500 MHz) for Dictazoline C-E (**5-7**) in MeOH-d_4

Dictazoline C			Dictazoline D		Dictazoline E	
C/H	δ_C	δ_H, mult (*J* in Hz)	δ_C	δ_H, mult (*J* in Hz)	δ_C	δ_H, mult (*J* in Hz)
2	128.2, C		129.1, C		127.9, C	
3	114.2, C		112.5, C		112.4, C	
3a	128.2, C		126.5, C		127.8, C	
4	120.9, CH	7.48, d (8.0)	120.9, CH	7.48, d (8.4)	119.6, CH	7.54, (d, 7.9)
5	123.7, CH	7.20, dd (8.0, 1.6)	123.8, CH	7.21, d (8.4)	120.6, CH	7.09, (t, 7.9)
6	115.5, C		116.0, C		124.4, CH	7.20, (t, 7.9)
7	115.2, CH	7.48, d (1.6)	115.2, CH	7.50, br. s	112.6, CH	7.33, (d, 7.9)
7a	139.9, C		139.0, C		139.5, C	
8	32.8, CH_2	3.13, d (16.4)	31.9, CH_2	3.33, d (16.4)	32.5, CH_2	3.28, (d, 15.5)
		3.56, d (16.4)		3.68, d (16.4)		3.67, (d, 15.5)
9	71.5, C		69.0, C		69.0, C	
11	157.9, C		159.5, C		159.4, C	
13	174.6, C		174.8, C		175.6, C	
14						
15			25.4, CH_3	2.71, s	25.6, CH_3	2.68, s
2’	123.0, CH	7.05, s	123.0, CH	7.07, s	123.2, CH	7.06, s
3’	106.5, C		106.2, C		106.2, C	
3a’	129.6, C		128.5, C		129.3, C	
4’	118.8, CH	7.64, d (8.0)	118.6, CH	7.62, d (7.9)	118.9, CH	7.61, (d, 7.8)
5’	120.2, CH	7.02, t (8.0)	120.5, CH	7.06, t (7.9)	120.6, CH	7.05, (t, 7.8)
6’	122.5, CH	7.08, t (8.0)	123.2, CH	7.12, t (7.9)	123.2, CH	7.11, (t, 7.8)
7’	112.2, CH	7.29, d (8.0)	112.1, CH	7.32, d (7.9)	112.6, CH	7.31, (d, 7.8)
7a’	136.4, C		136.5, C		136.8, C	
8’	40.7, CH	4.43, s	41.6, CH	4.54, s	42.0, CH	4.51, s
9’	71.0, C		70.3, C		71.1, C	
11’	157.9, C		156.7, C		156.9, C	
13’	174.6, C		174.4, C		175.1, C	
14'	26.0, CH_3	2.86, s	25.8, CH_3	2.87, s	27.0, CH_3	2.86, s
15’	25.0, CH_3	2.88, s	26.8, CH_3	2.98, s	26.0, CH_3	2.97, s

Figure S1. ^{1}H NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)with H_2O suppression

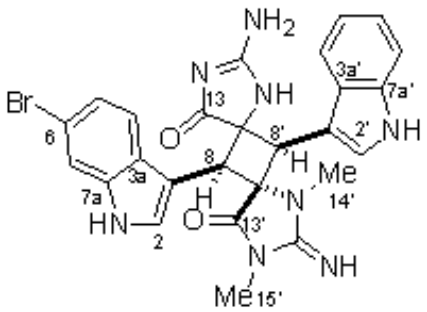


Figure S2. ^{1}H NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)

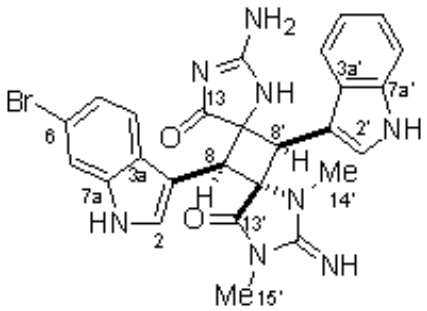


Figure S3. ^{13}C NMR Spectrum at 125 MHz in MeOH-d_4 of Dictazole A (**1**)

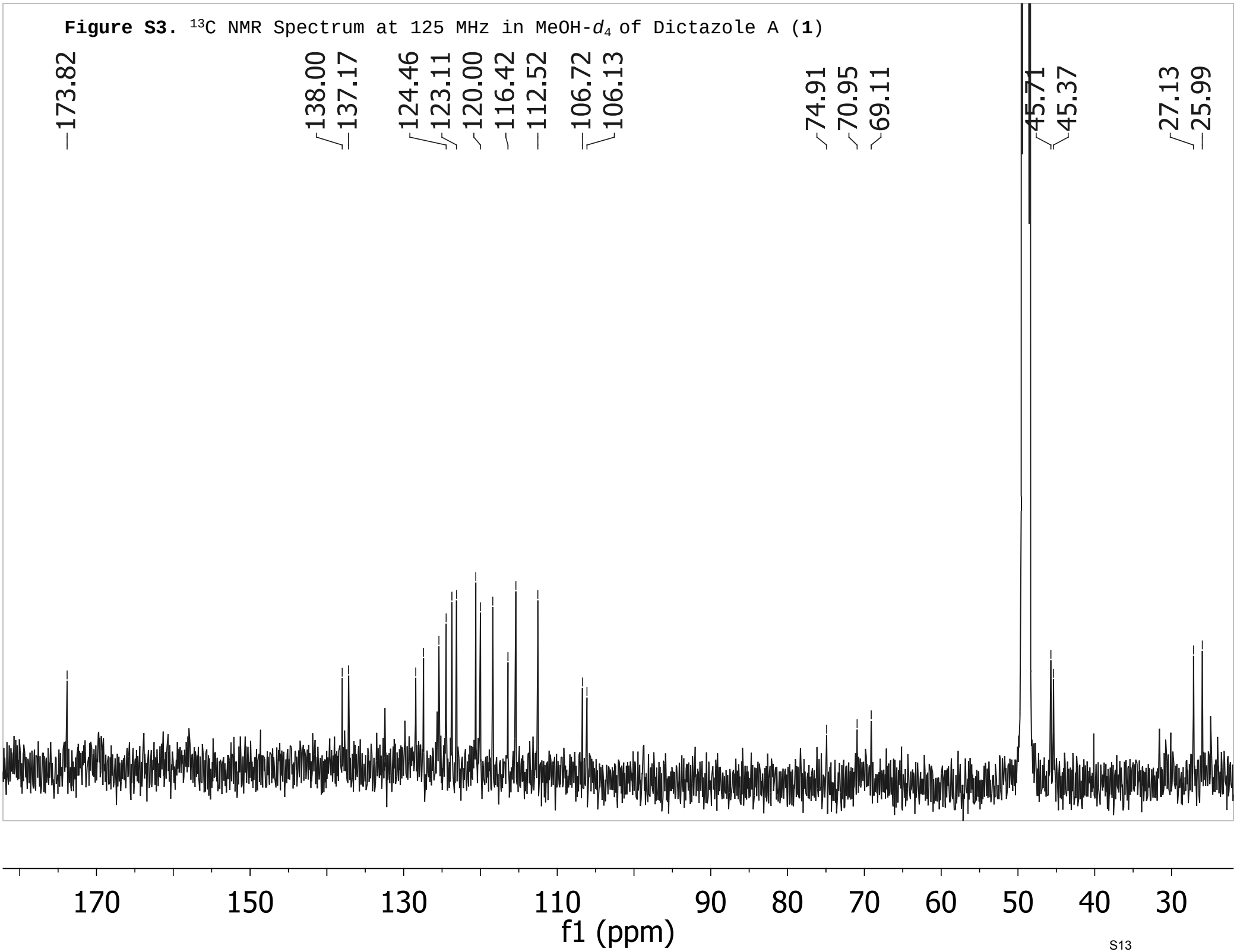


Figure S4. DEPT 90 NMR Spectrum at 125 MHz in MeOH-d_4 of Dictazole A (**1**)

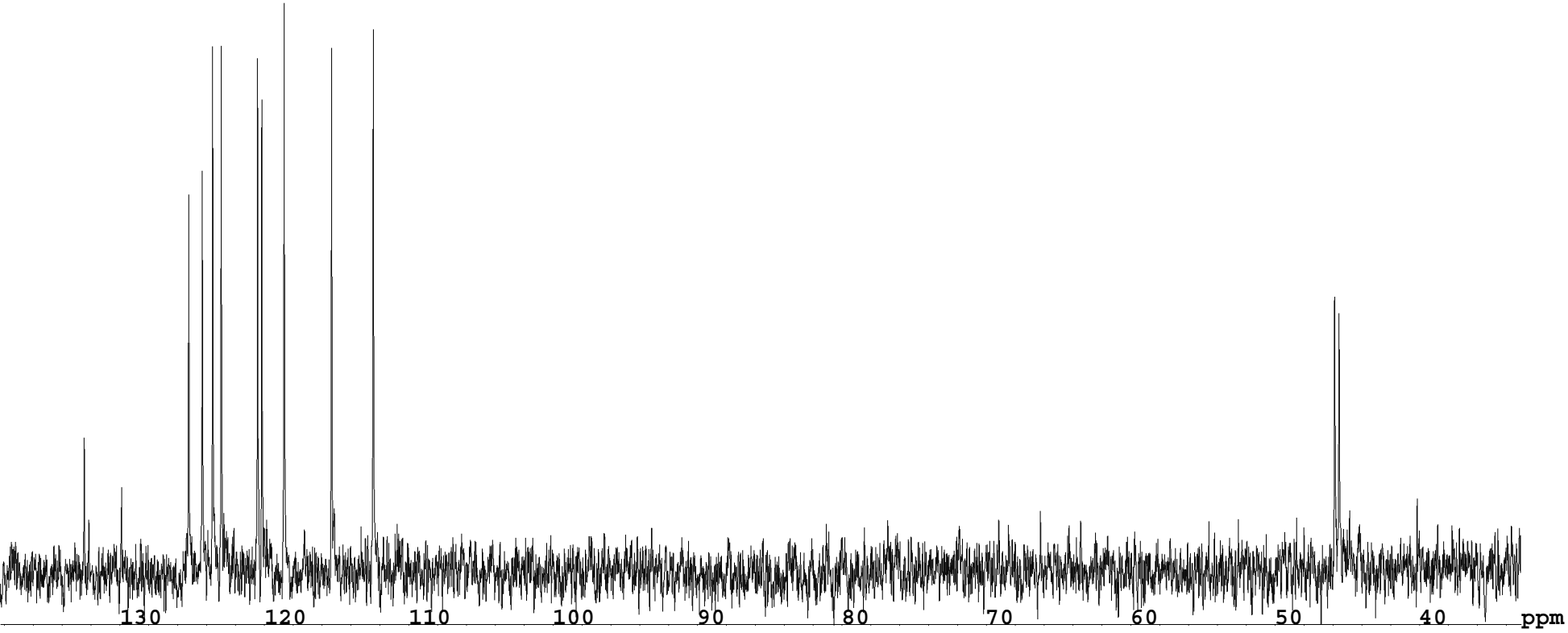


Figure S5. HSQC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)

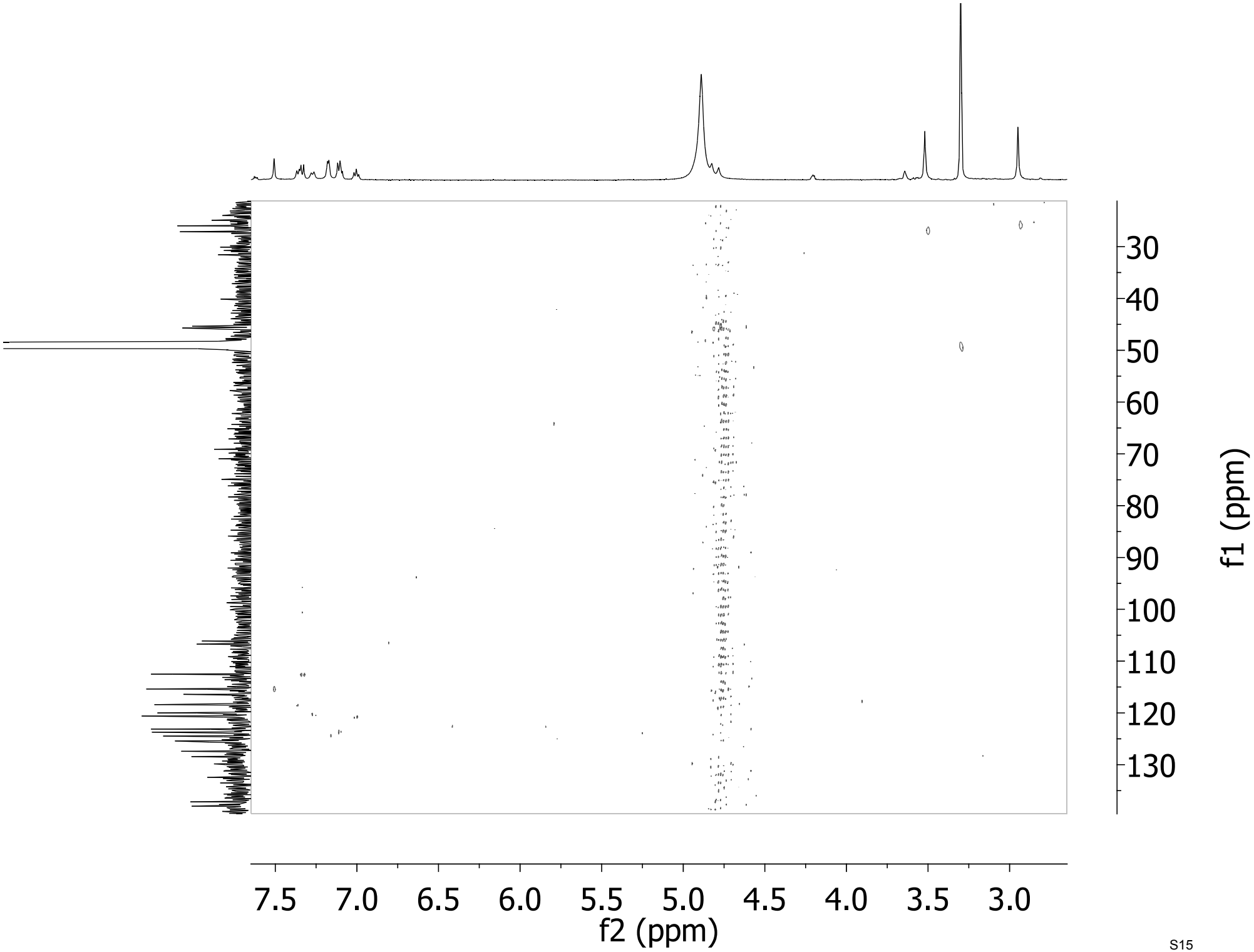


Figure S6. Expansion of HSQC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)

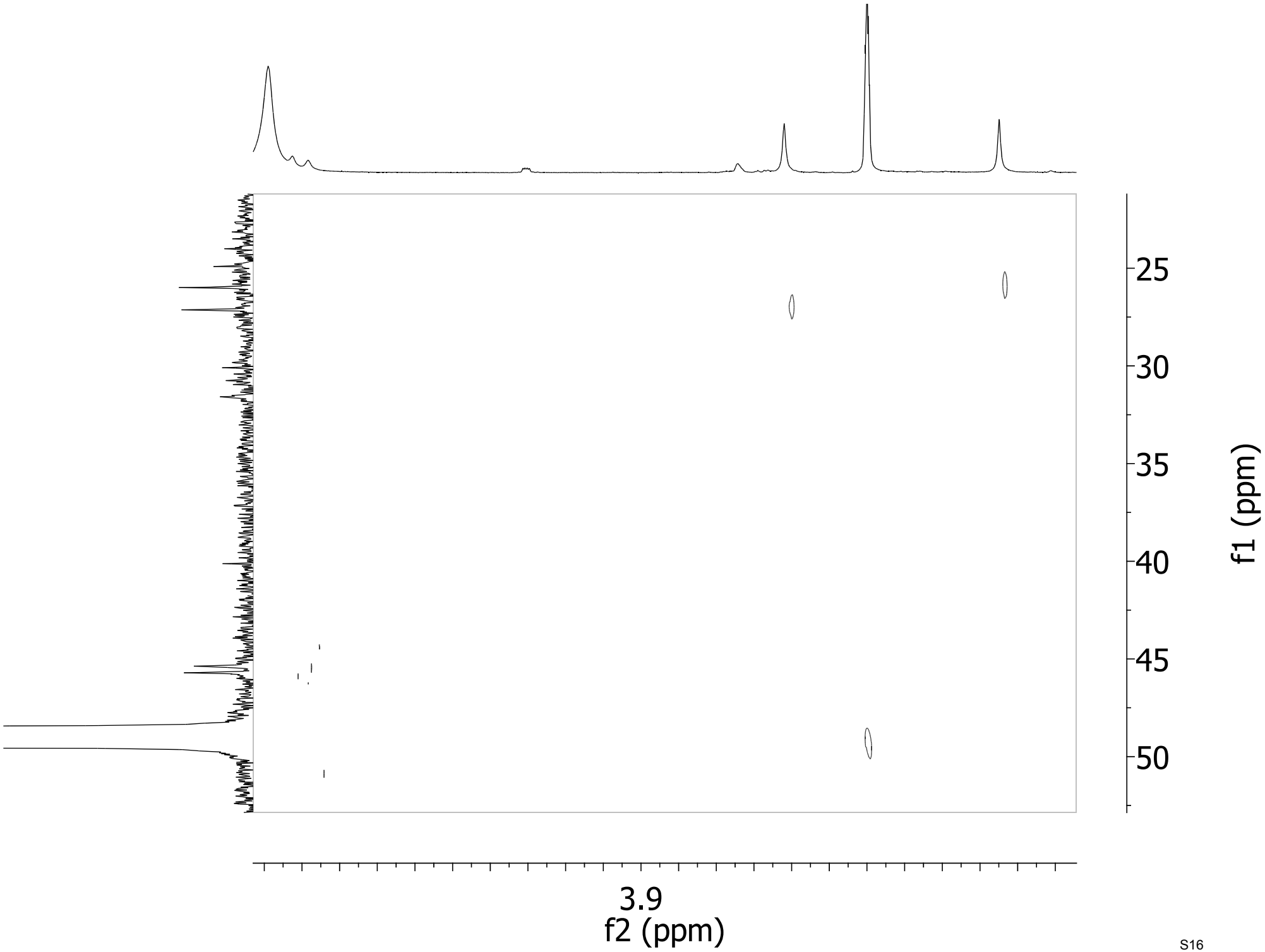


Figure S7. Expansion of HSQC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)

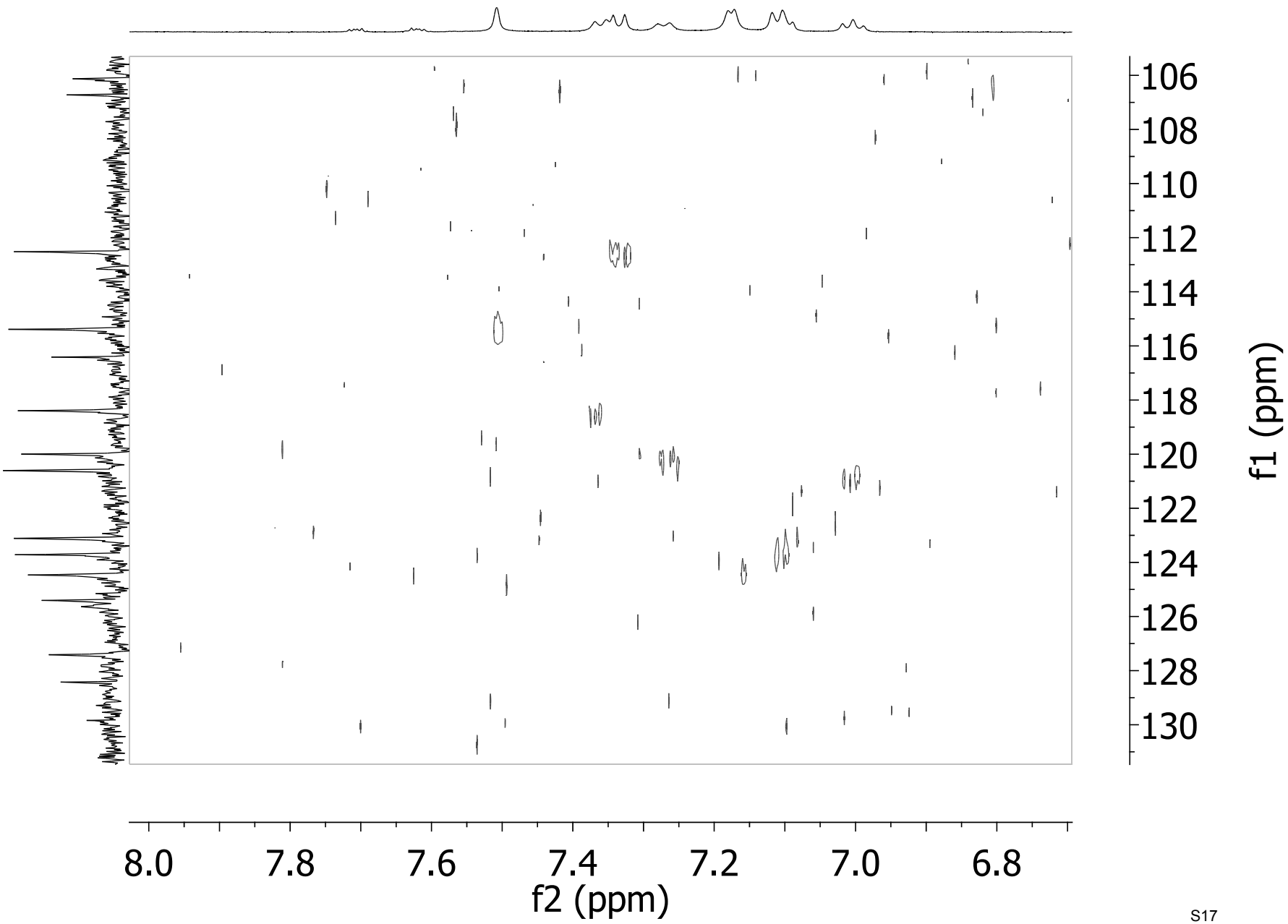


Figure S8. COSY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)

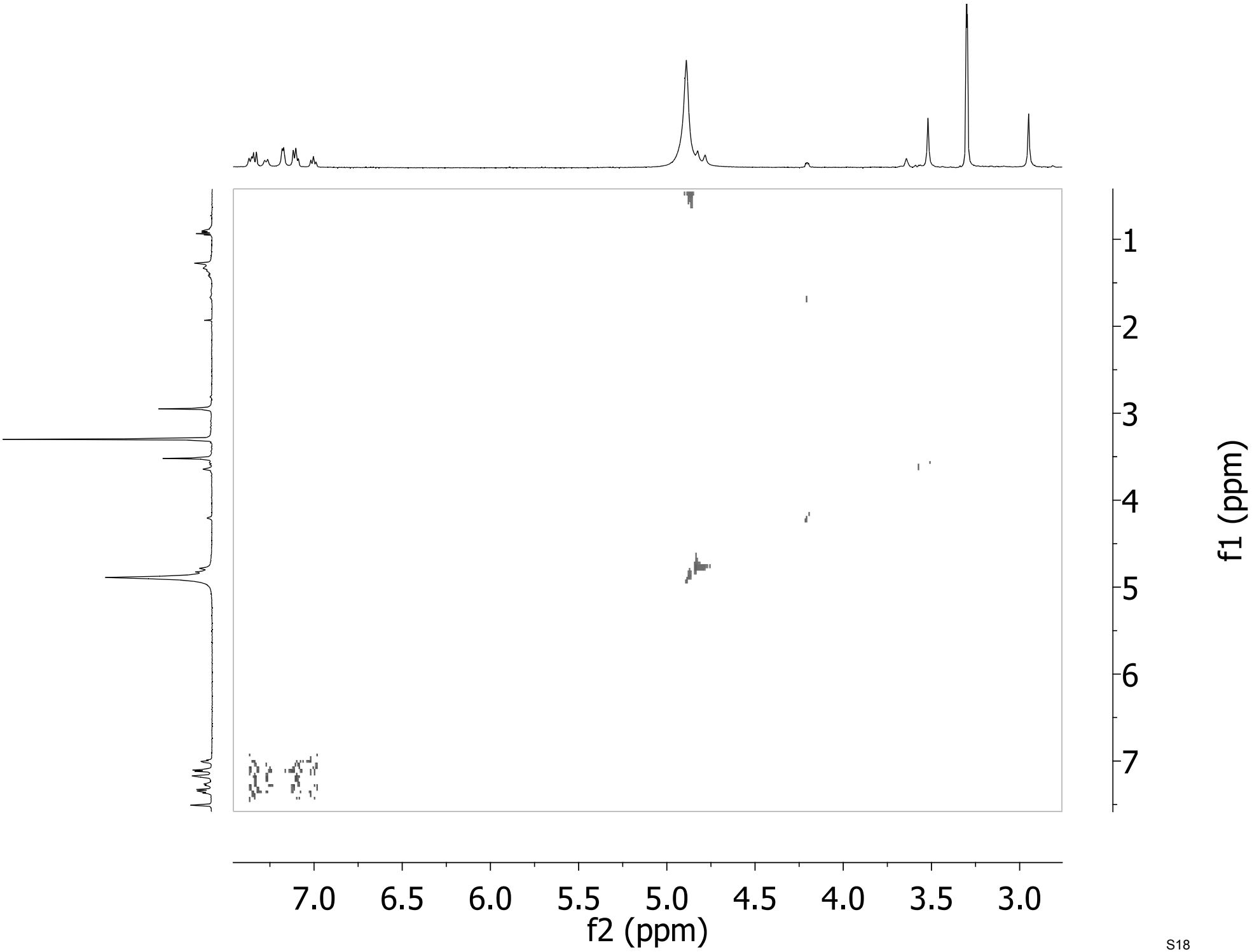


Figure S9. Expansion of COSY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A(**1**)

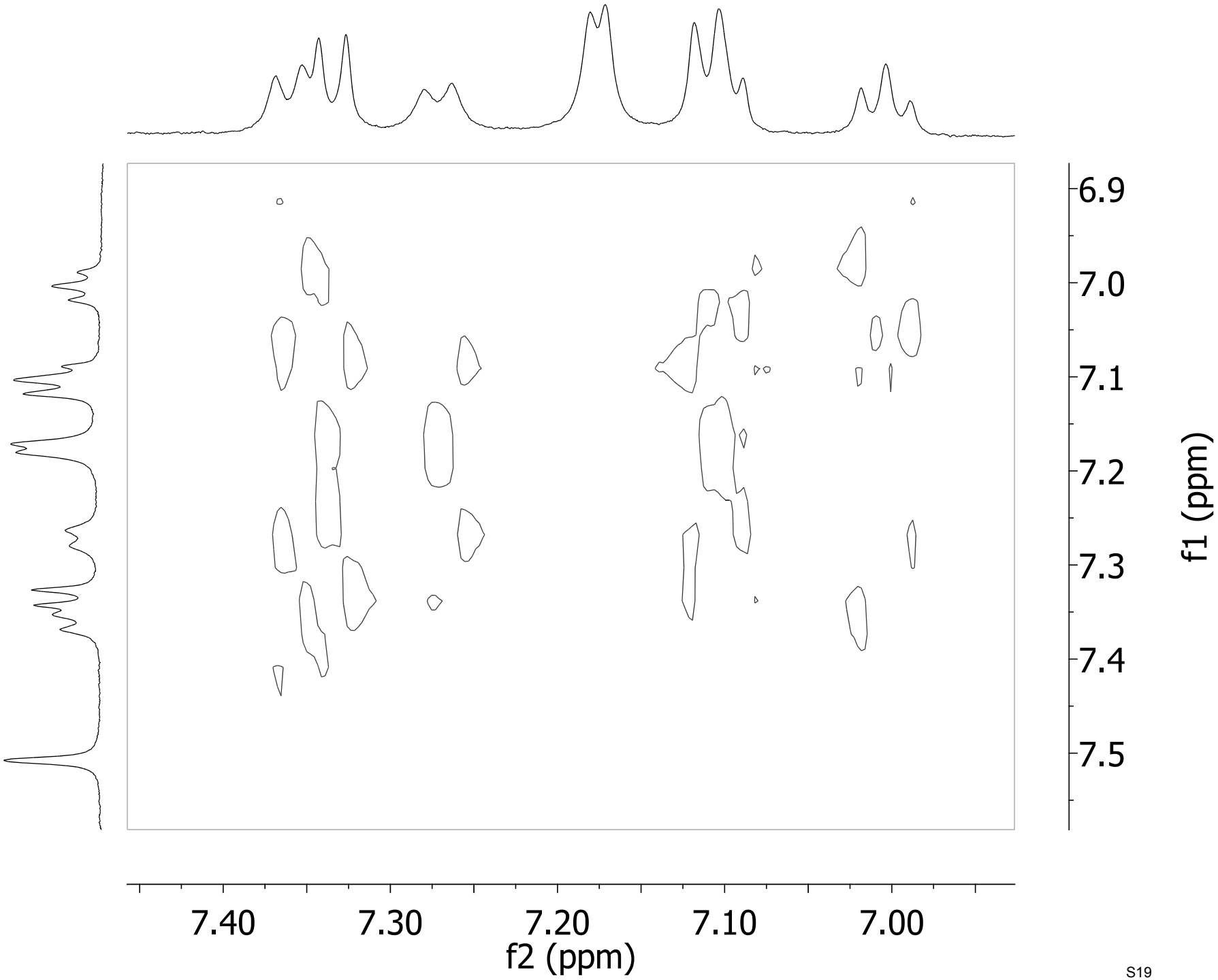


Figure S10. HMBC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)

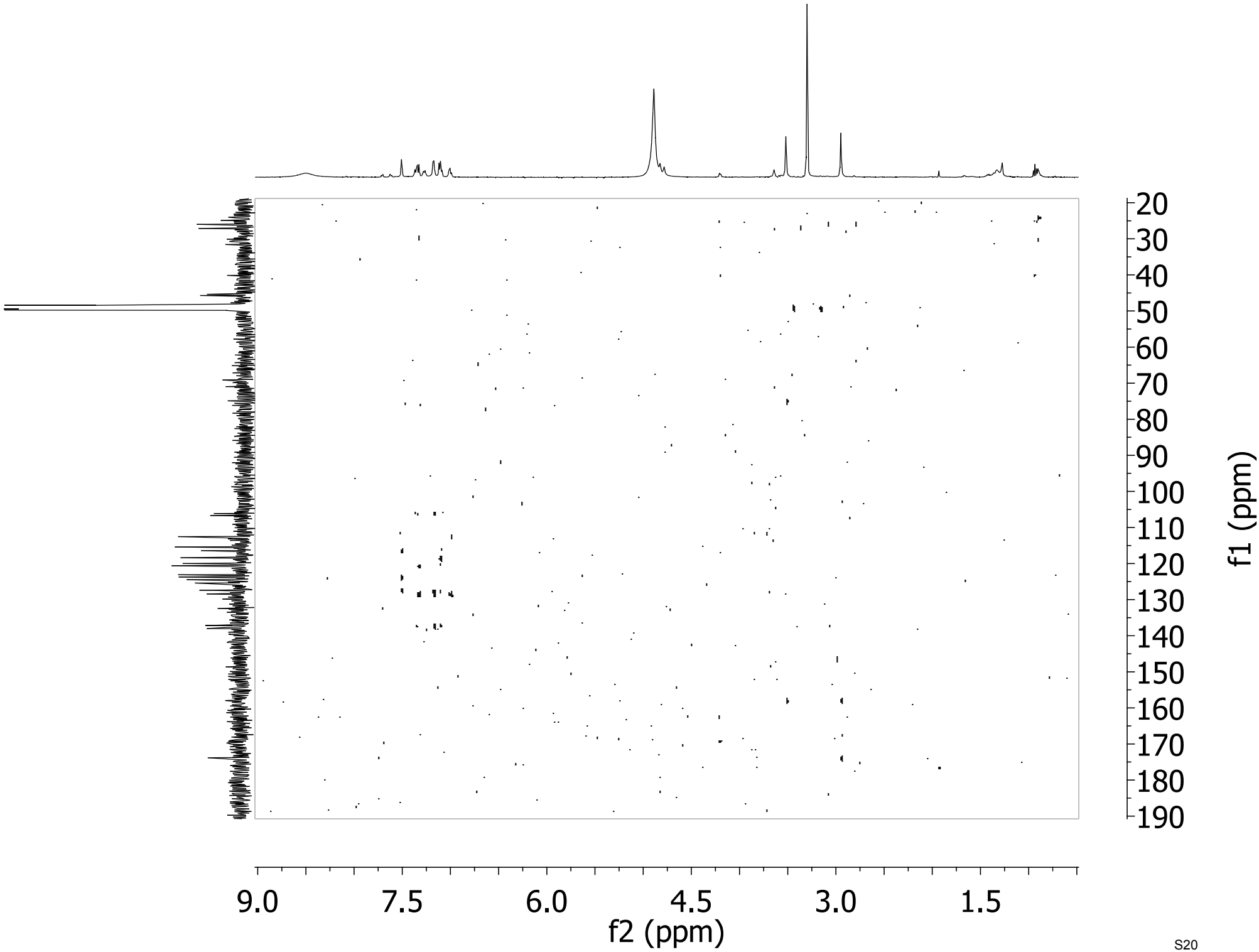


Figure S11. Expansion of HMBC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)

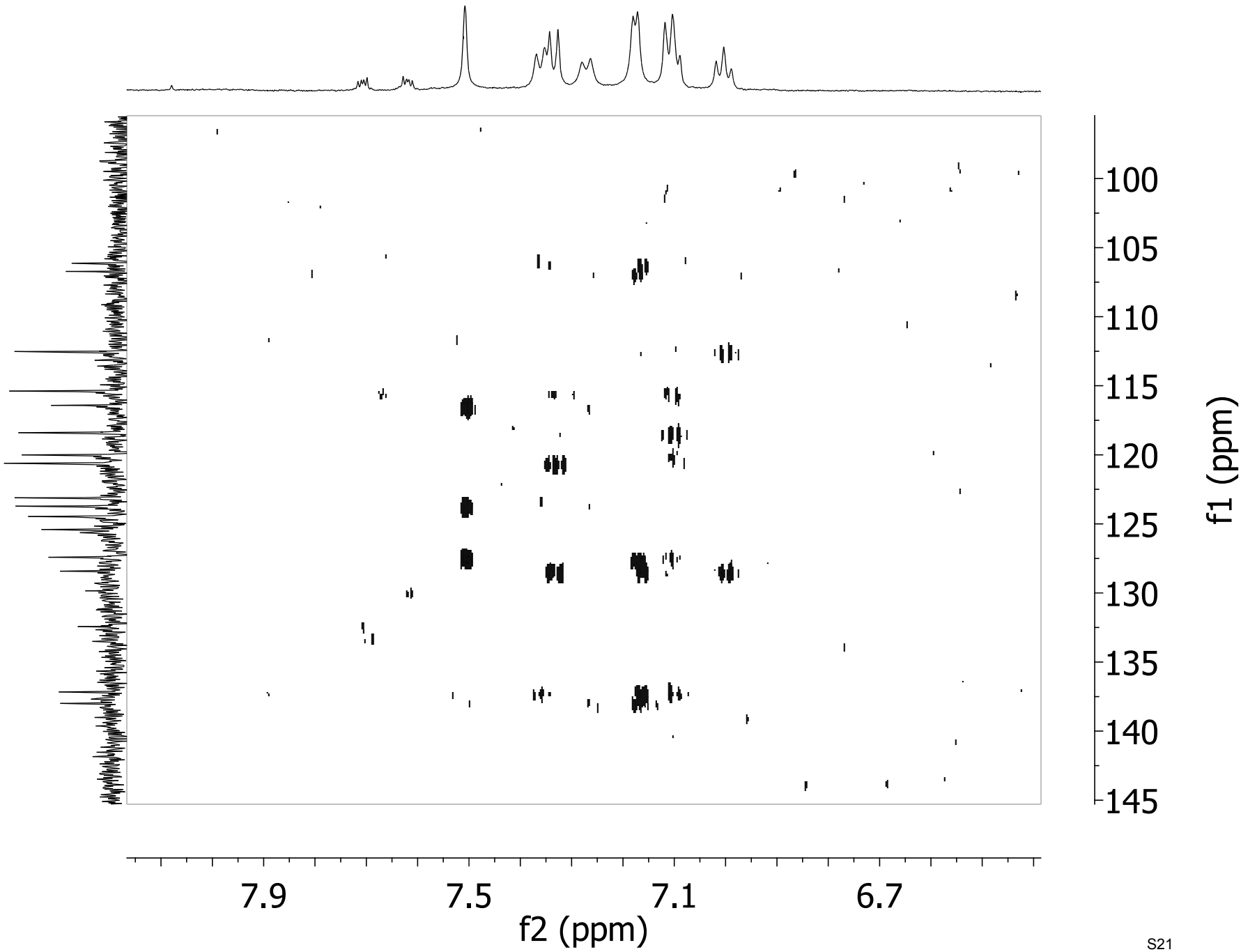


Figure S12. Expansion of HMBC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A(**1**)

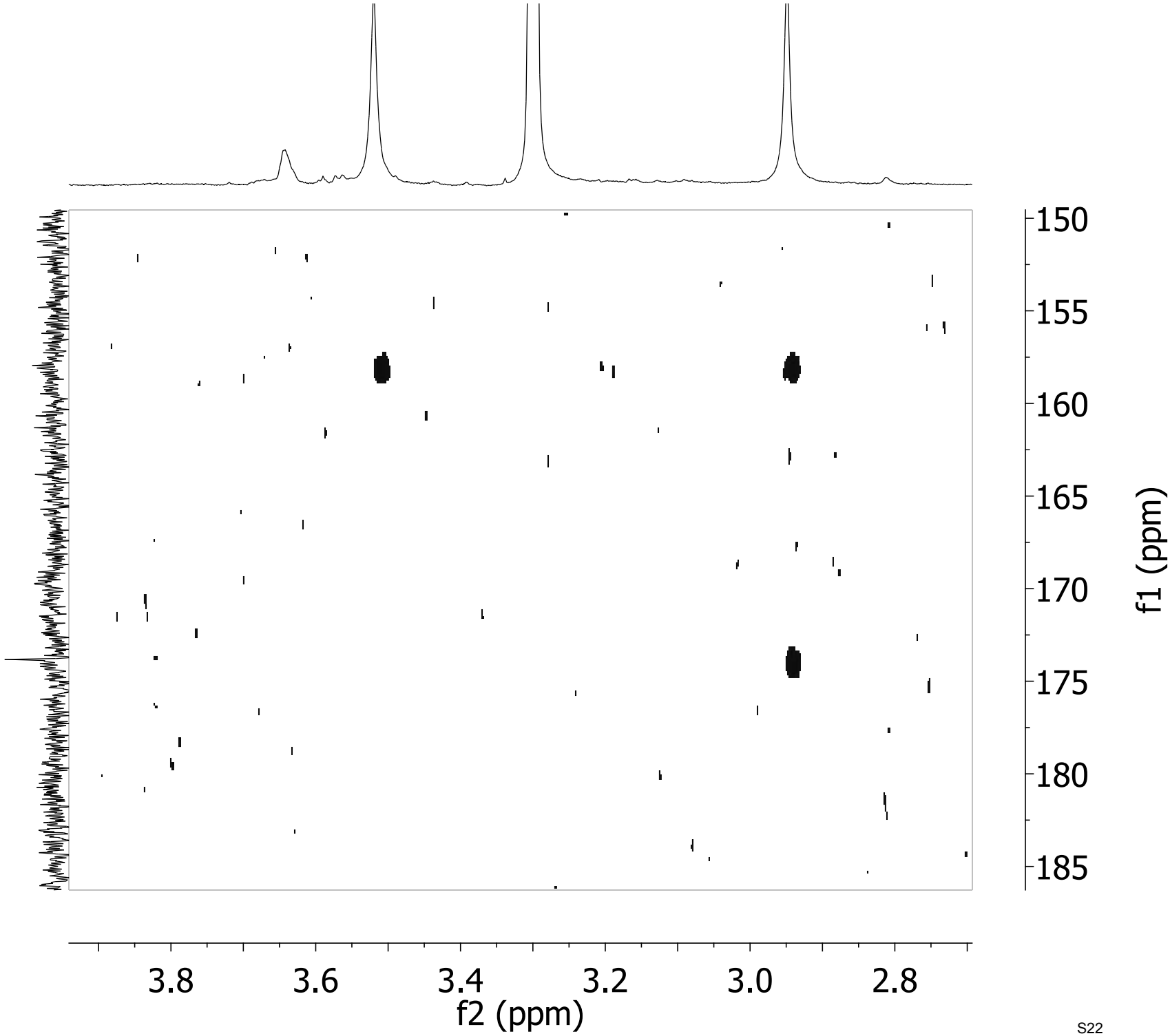


Figure S13. Expansion of HMBC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**)

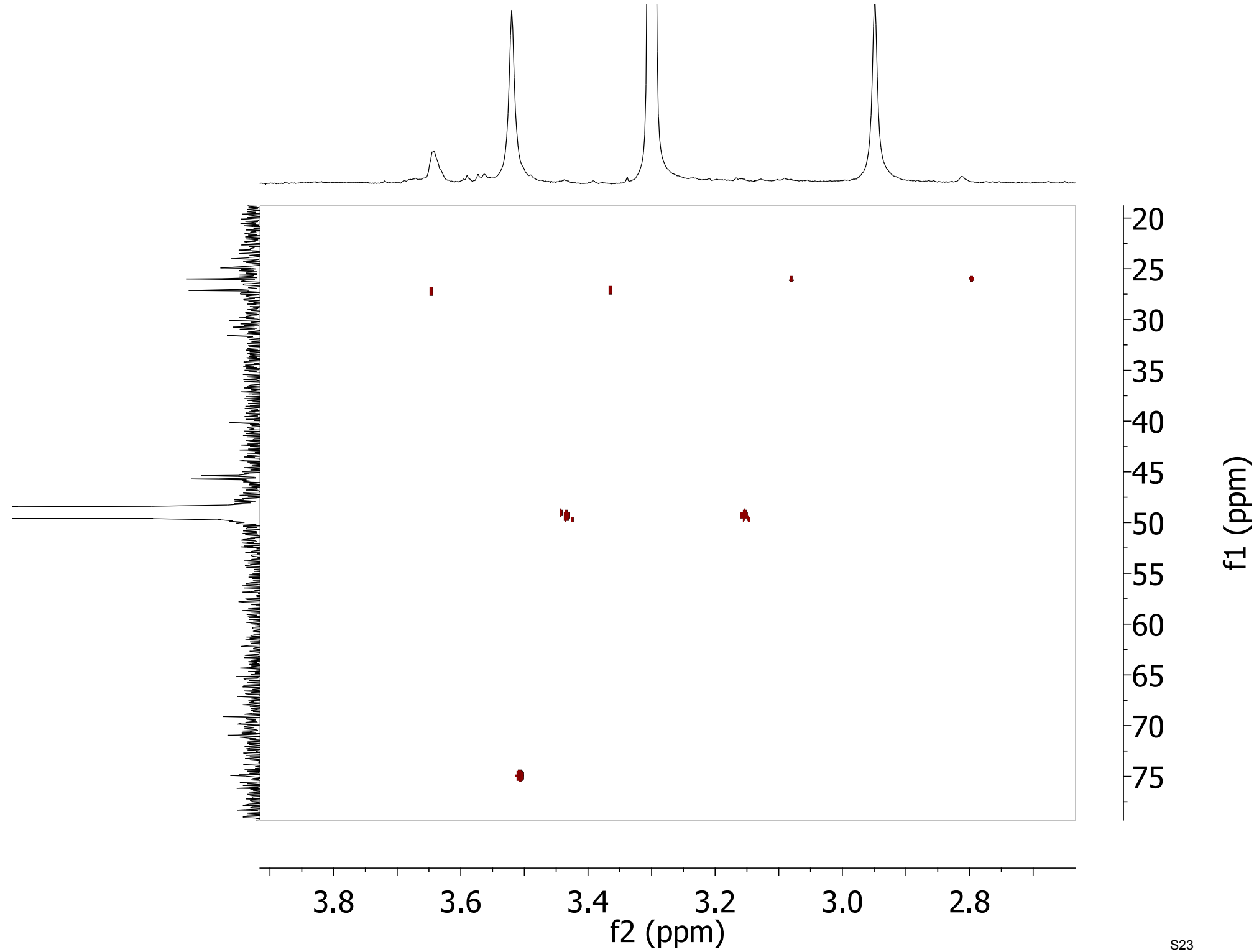
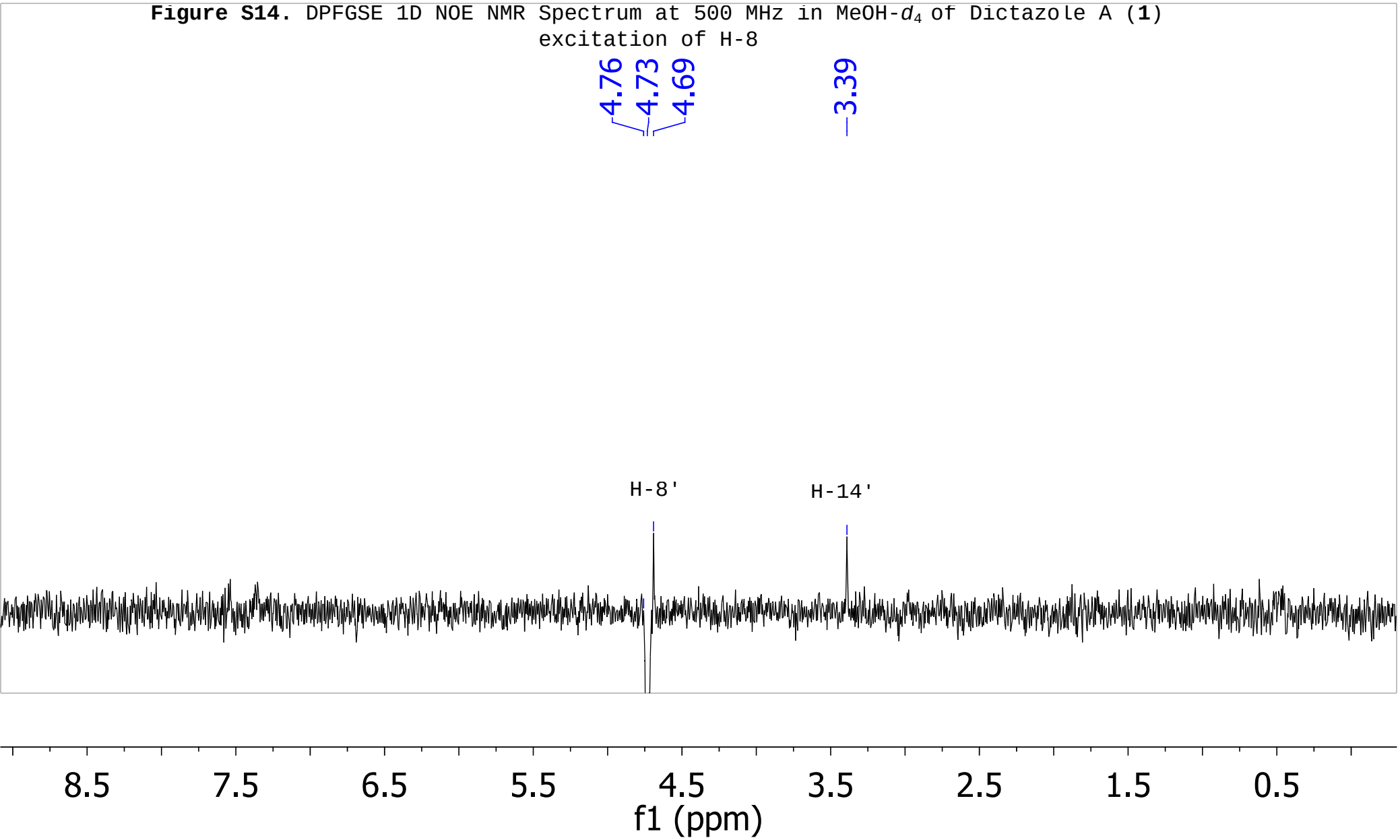
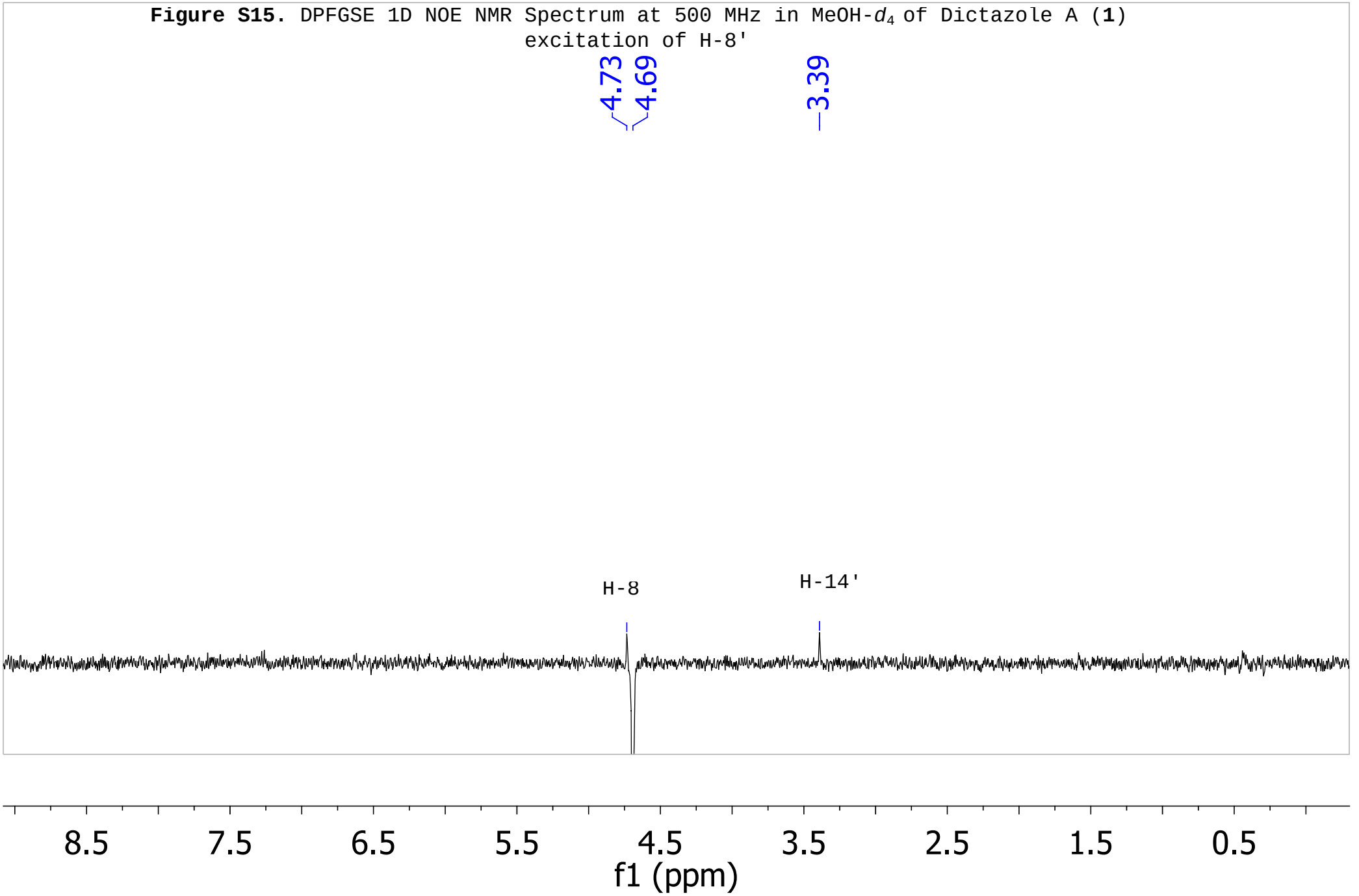


Figure S14. DPFGSE 1D NOE NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**) excitation of H-8



Note: Figure S14 and S15 were recorded along with Figure S1. The N-Me group H-14 has shifted upfield slightly compared to Figure S2.

Figure S15. DPFGSE 1D NOE NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazole A (**1**) excitation of H-8'



Note: Figure S14 and S15 were recorded along with Figure S1. The N-Me group H-14 has shifted upfield slightly compared to Figure S2.

Figure S16. ^{1}H NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

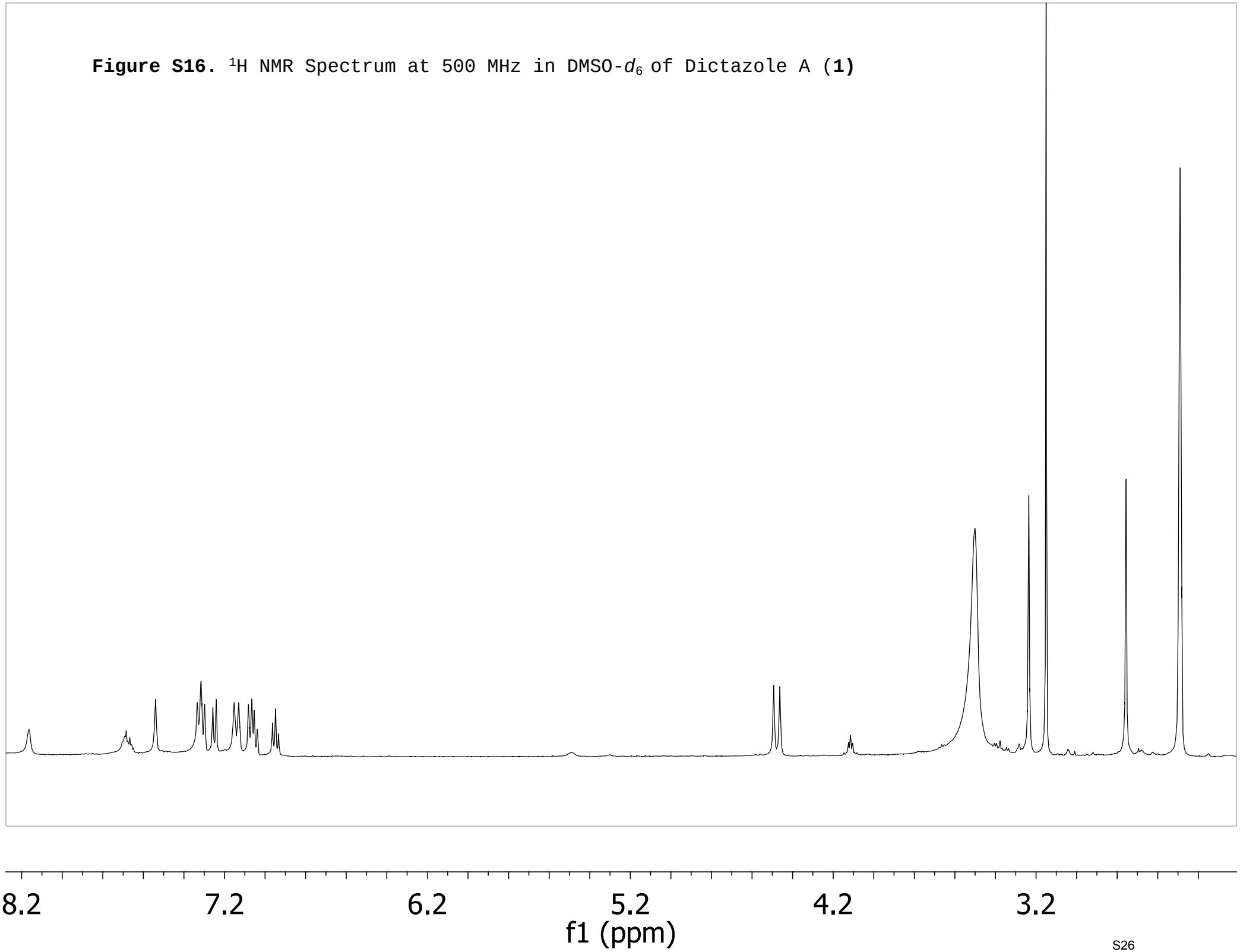


Figure S17. ^{13}C NMR Spectrum at 125 MHz in DMSO-d_6 of Dictazole A (**1**)

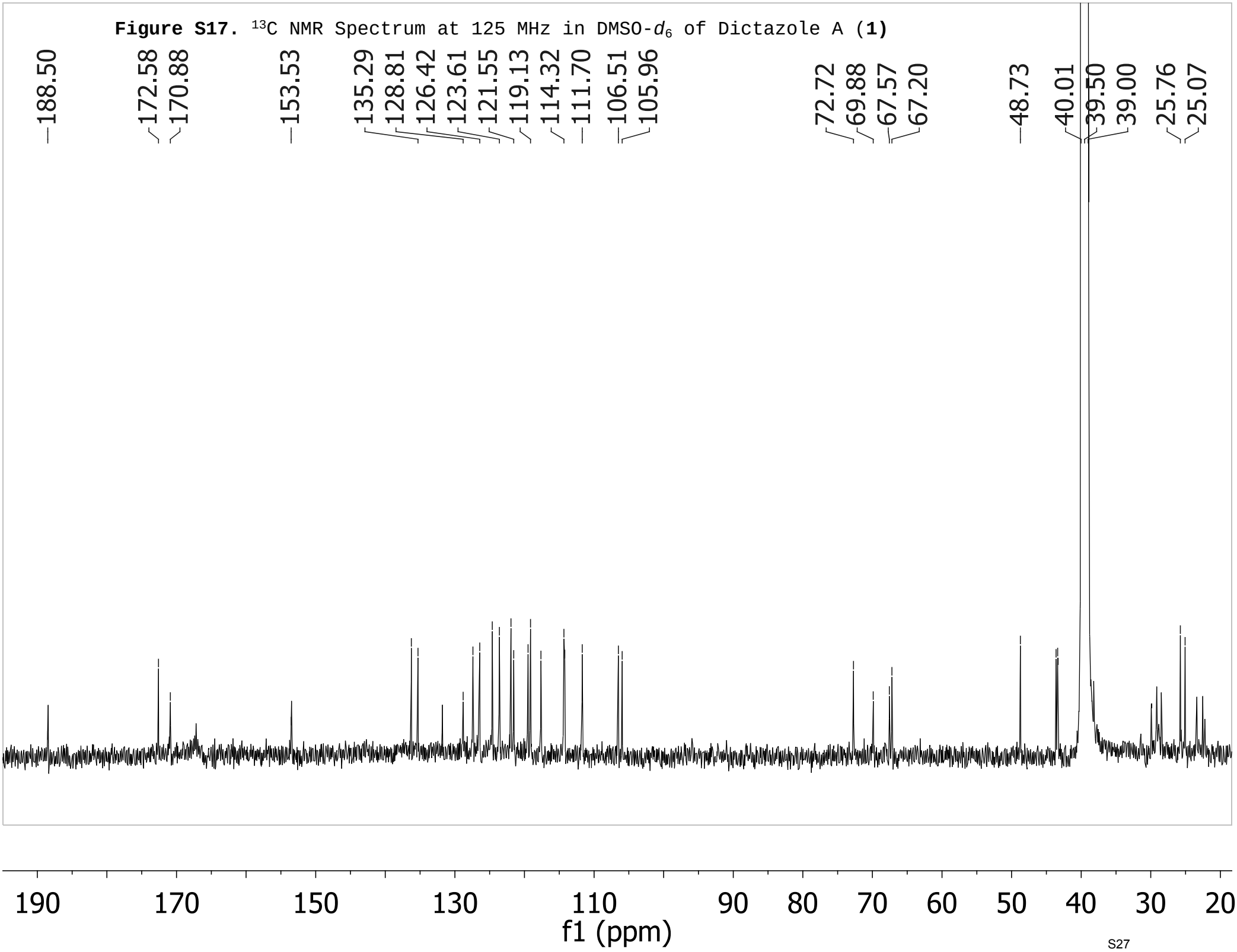


Figure S18. meHSQC NMR Spectrum at 500 MHz in DMSO-d_6 of Dicatzole A (**1**)

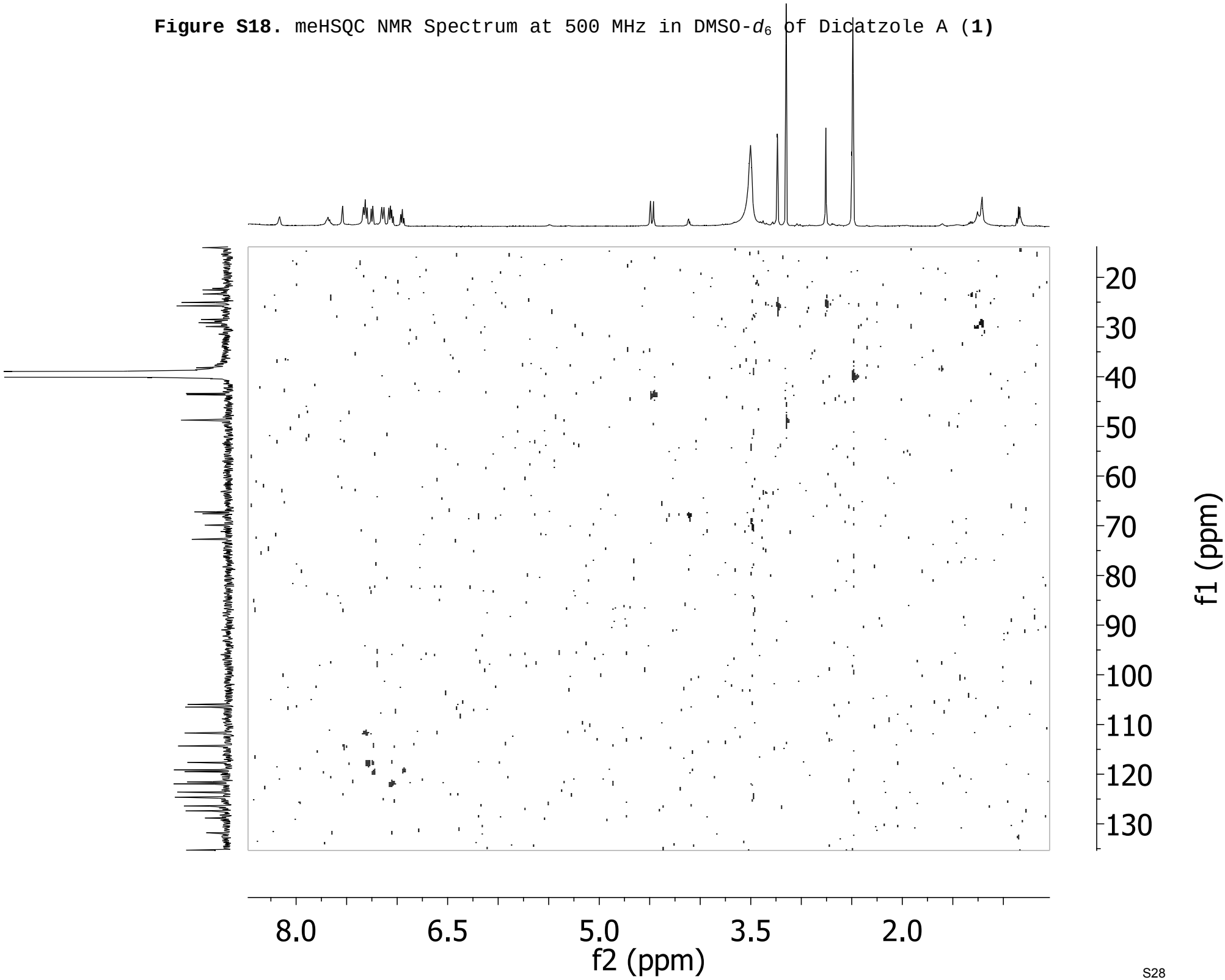


Figure S19. Expansion of meHSQC NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

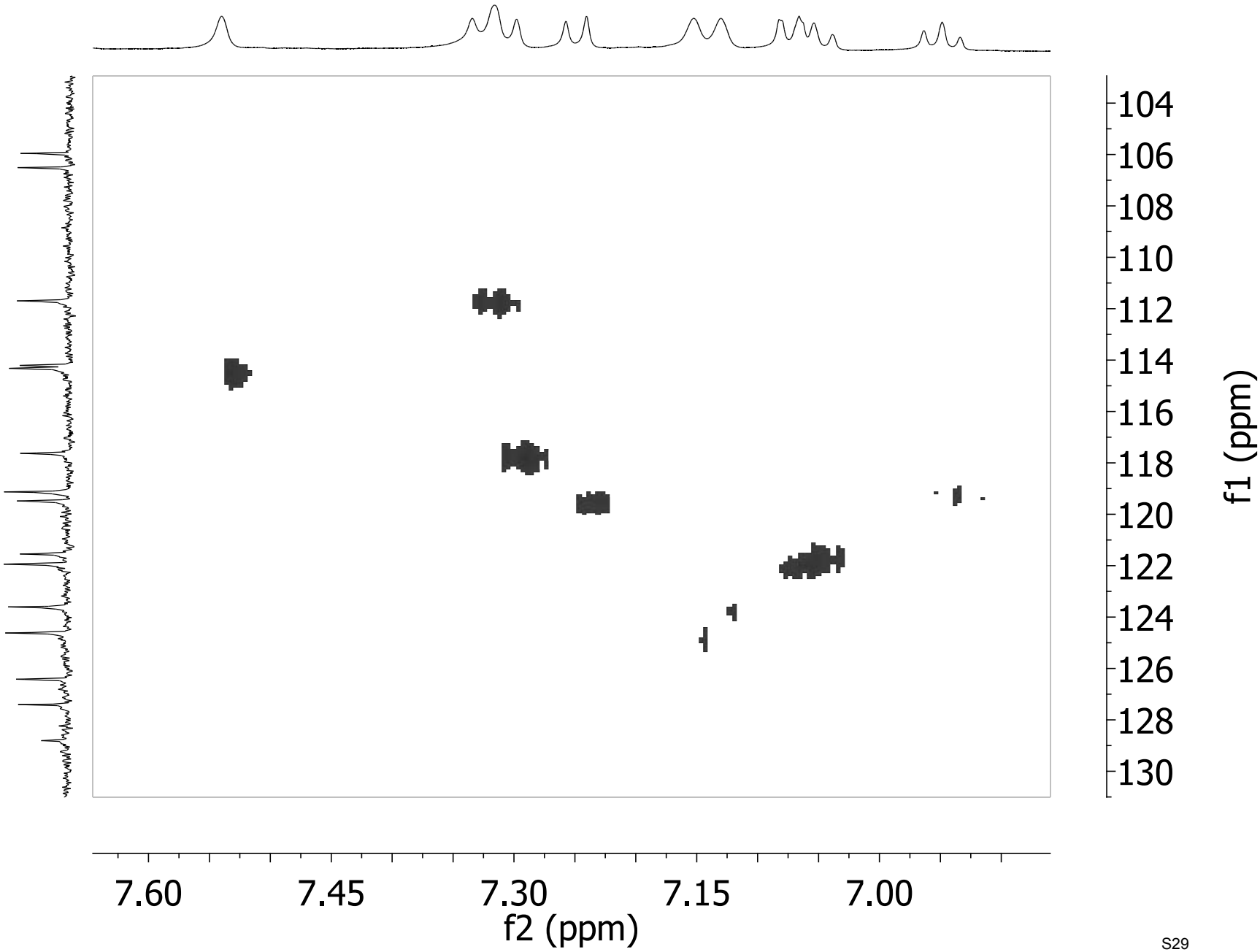


Figure S20. Expansion of meHSQC NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

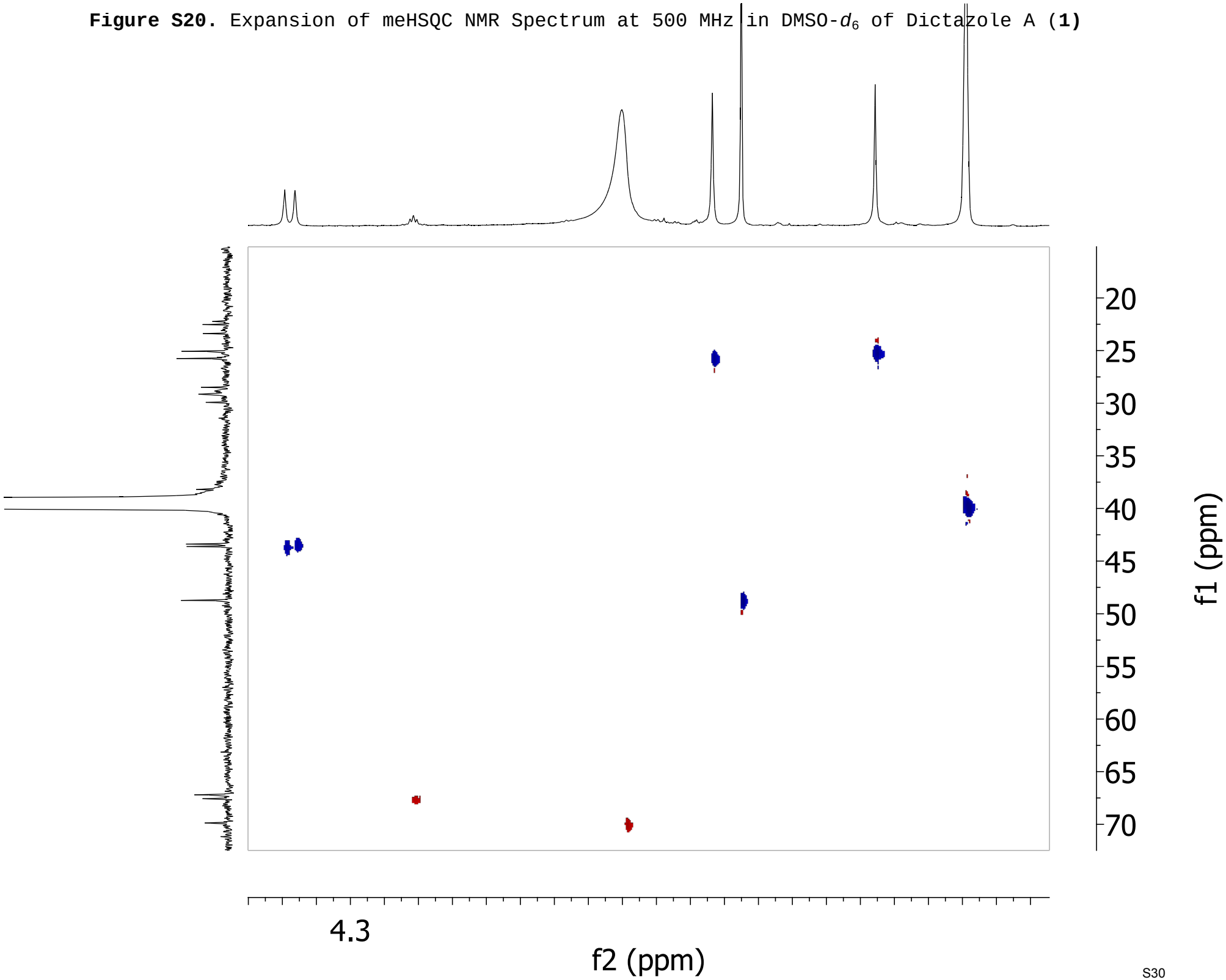


Figure S21. Expansion of meHSQC NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

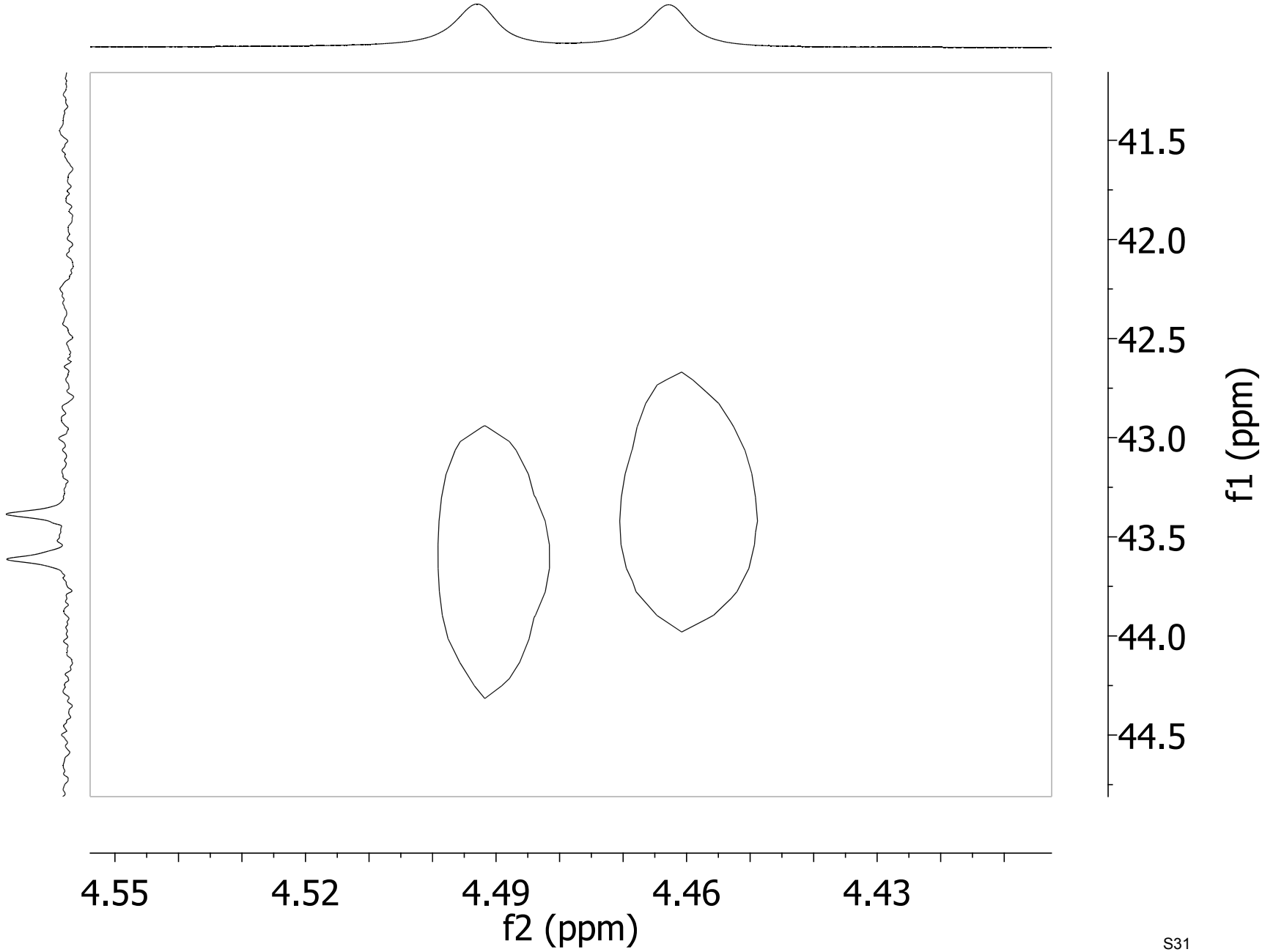


Figure S22. HMBC NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

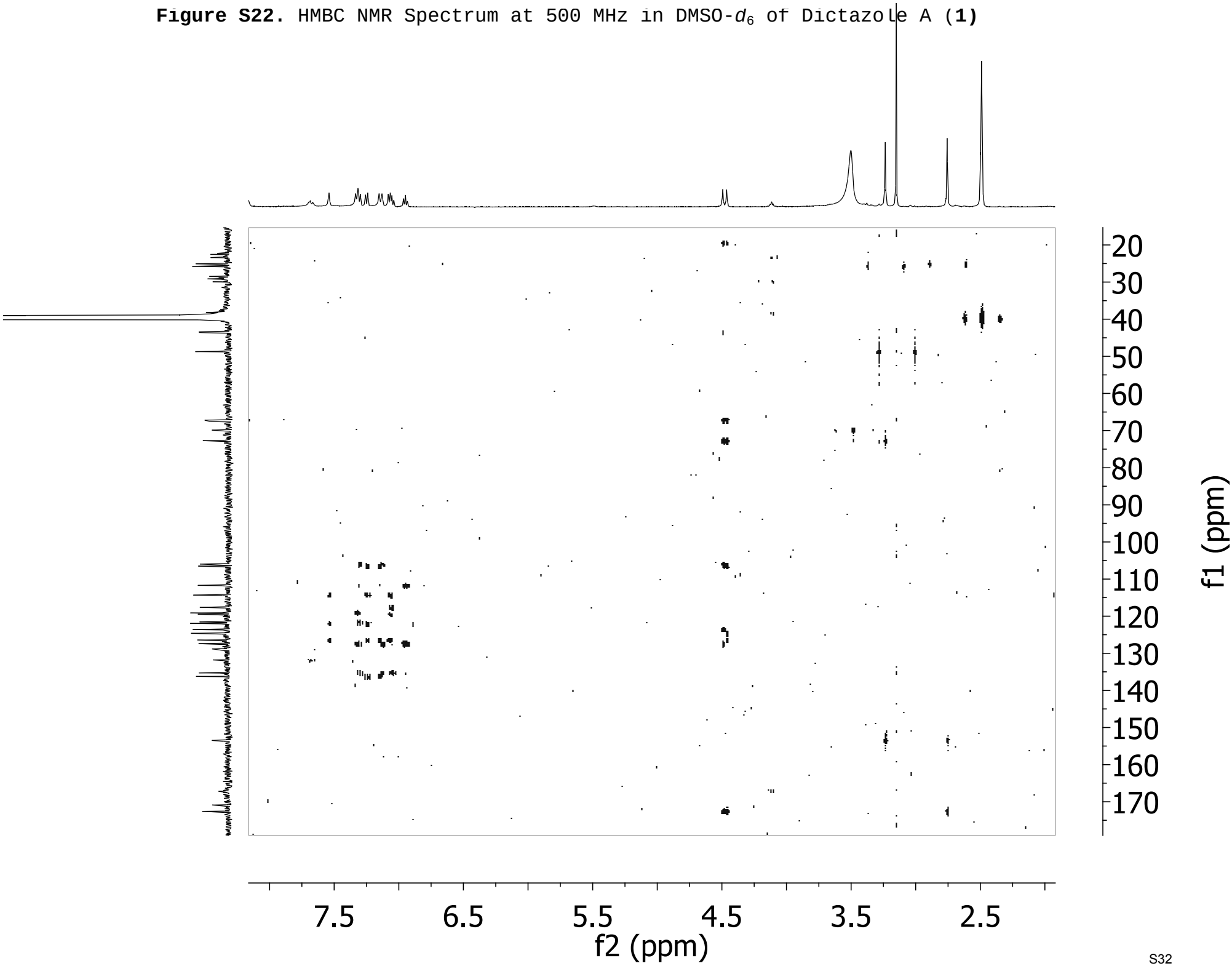


Figure S23. Expansion of HMBC NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

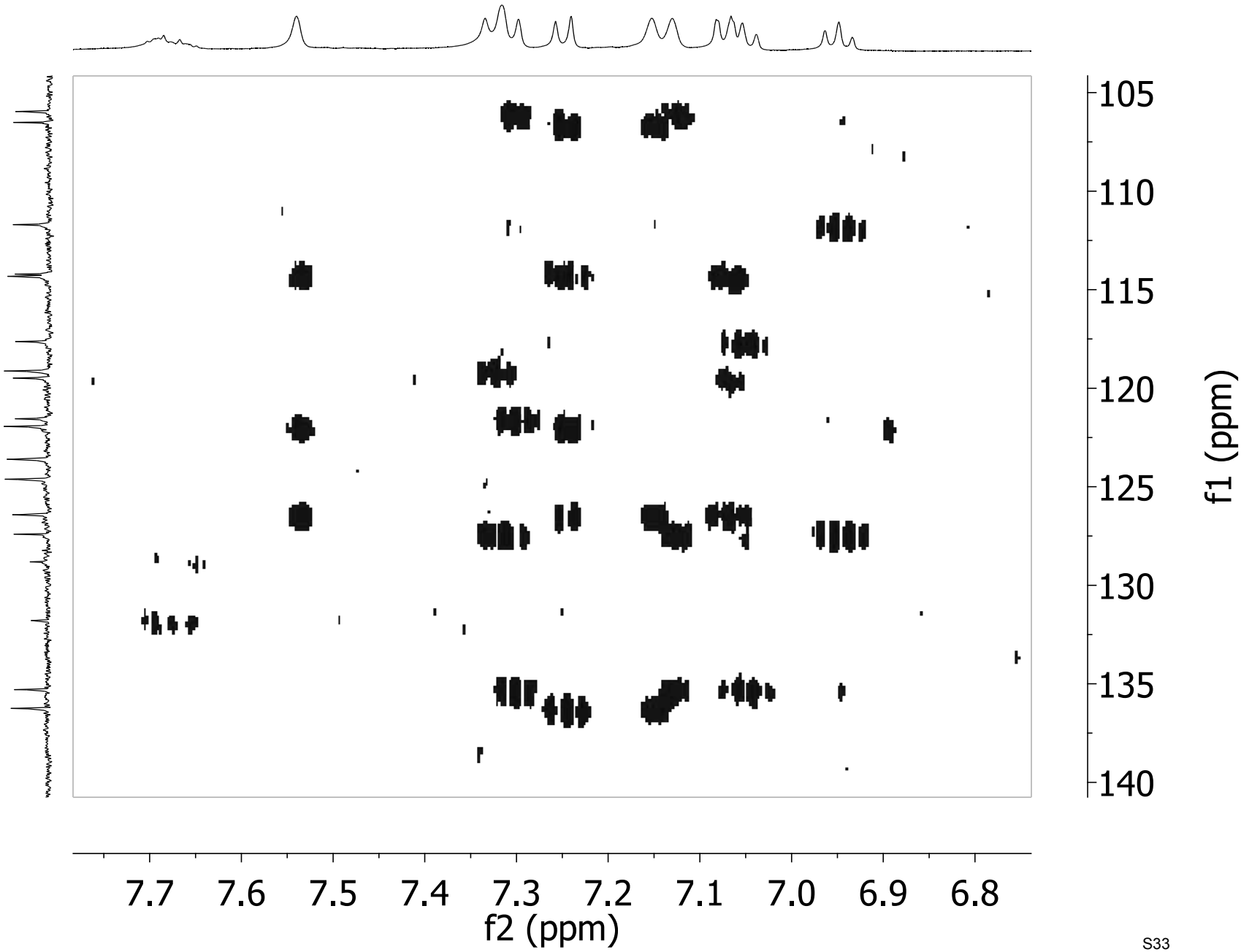


Figure S24. Expansion of HMBC NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

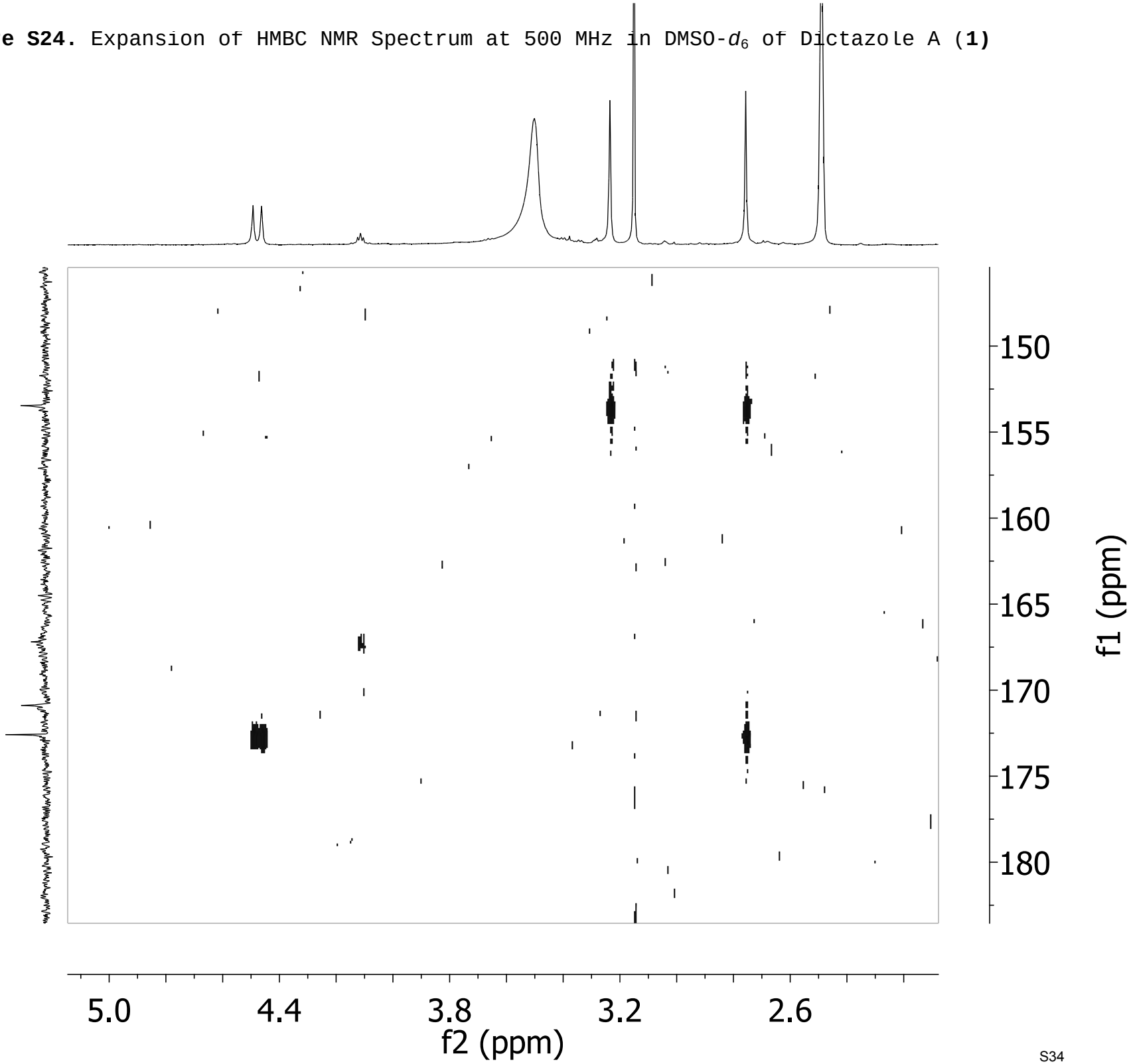


Figure S25. Expansion of HMBC NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

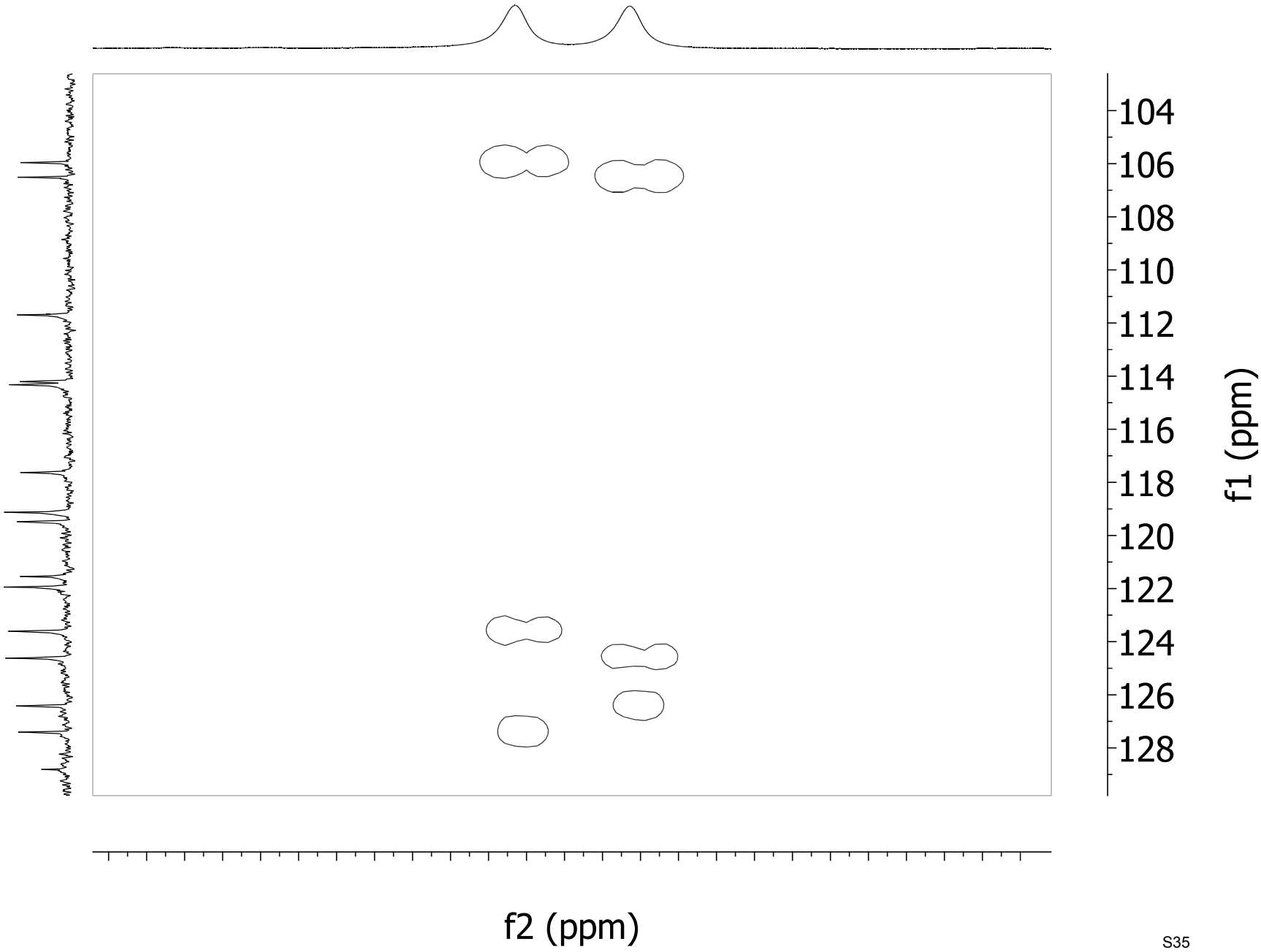


Figure S26. Expansion of HMBC NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole A (**1**)

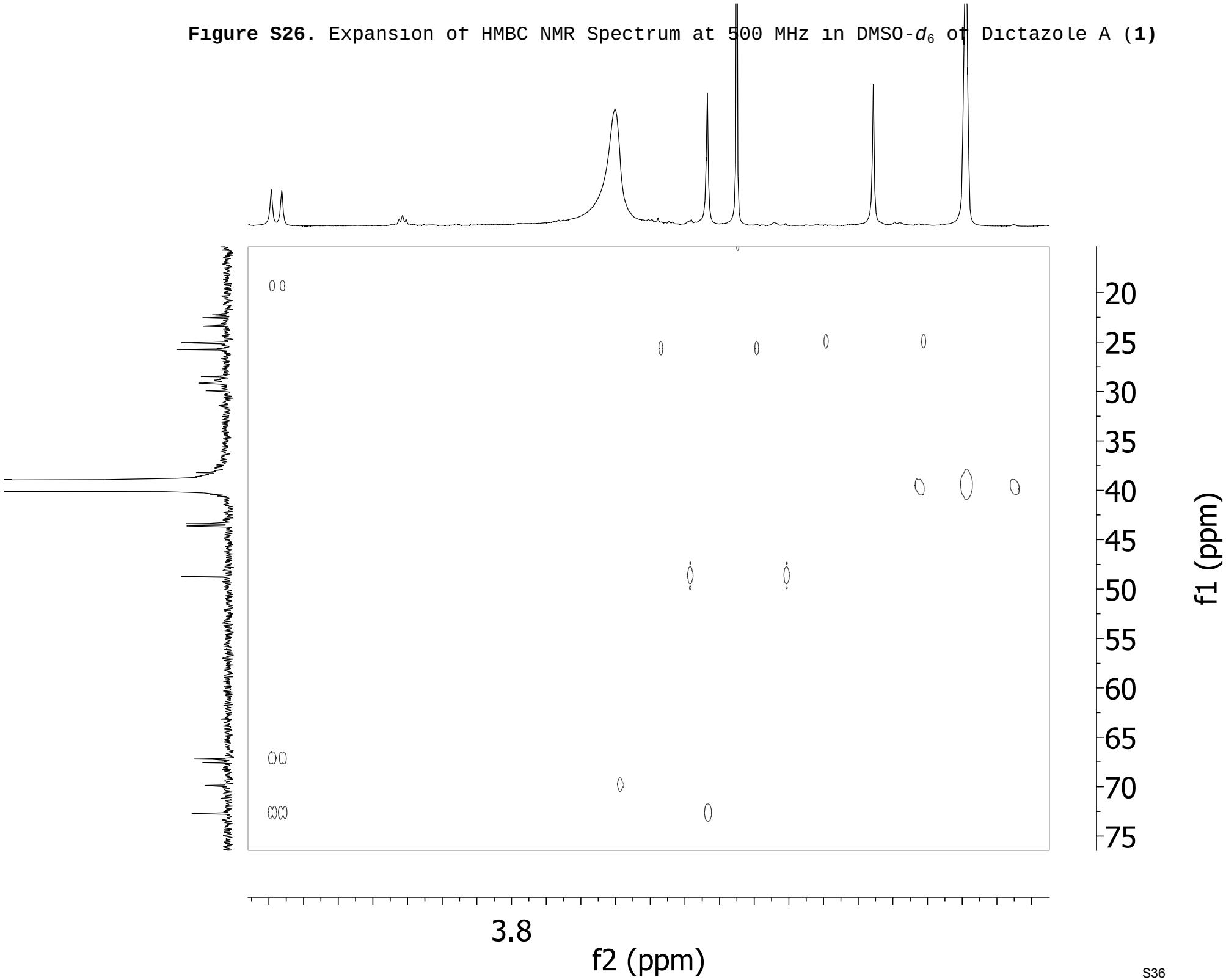


Figure S27. ^{1}H NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

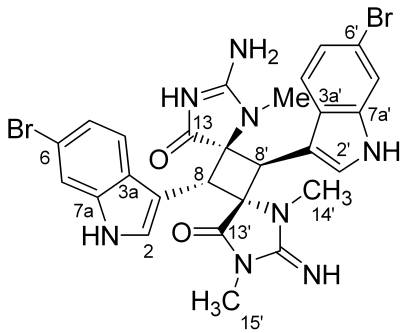


Figure S28. COSY Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

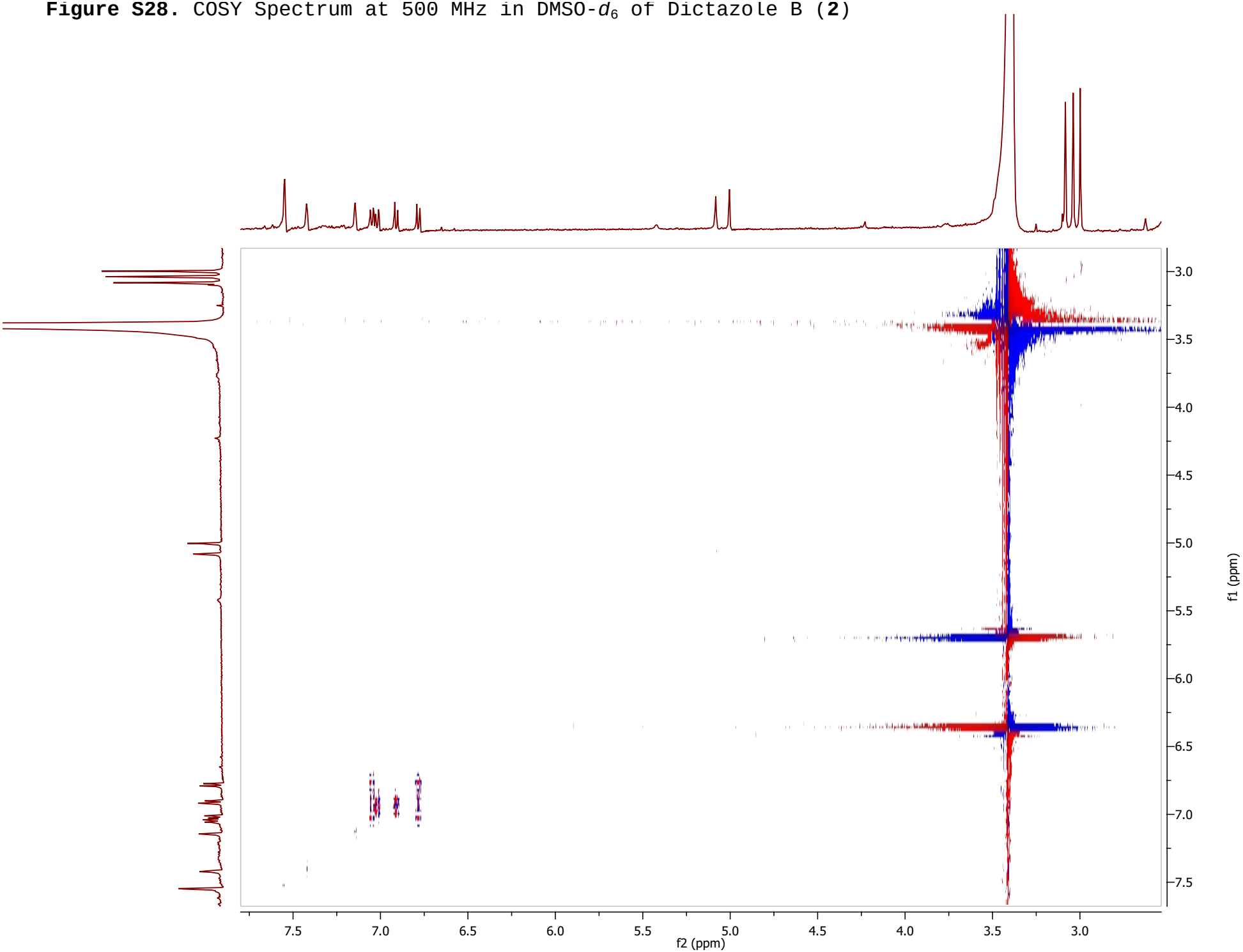


Figure S29. HSQC Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

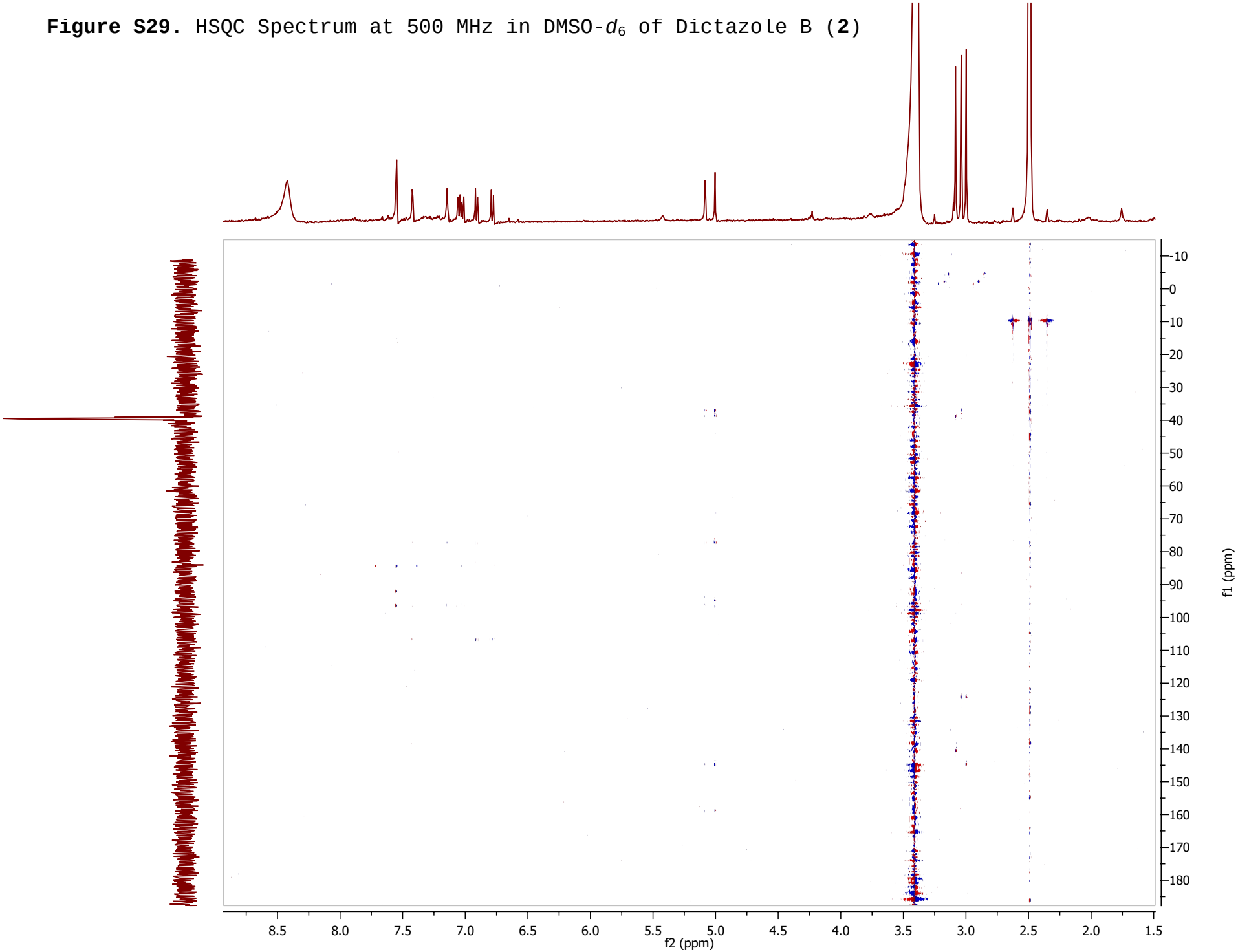


Figure S30. Expansion of HSQC Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

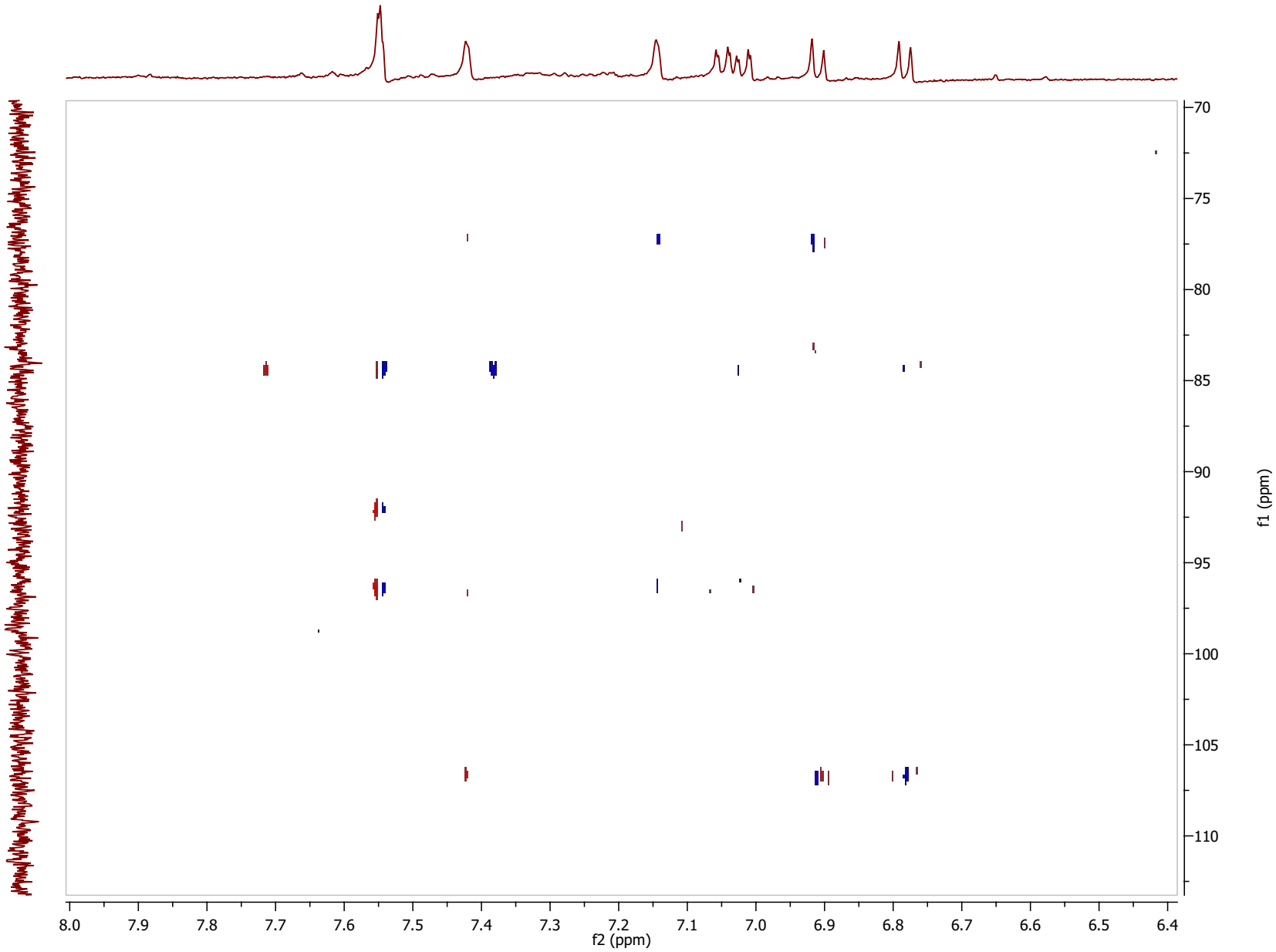


Figure S31. HMBC Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

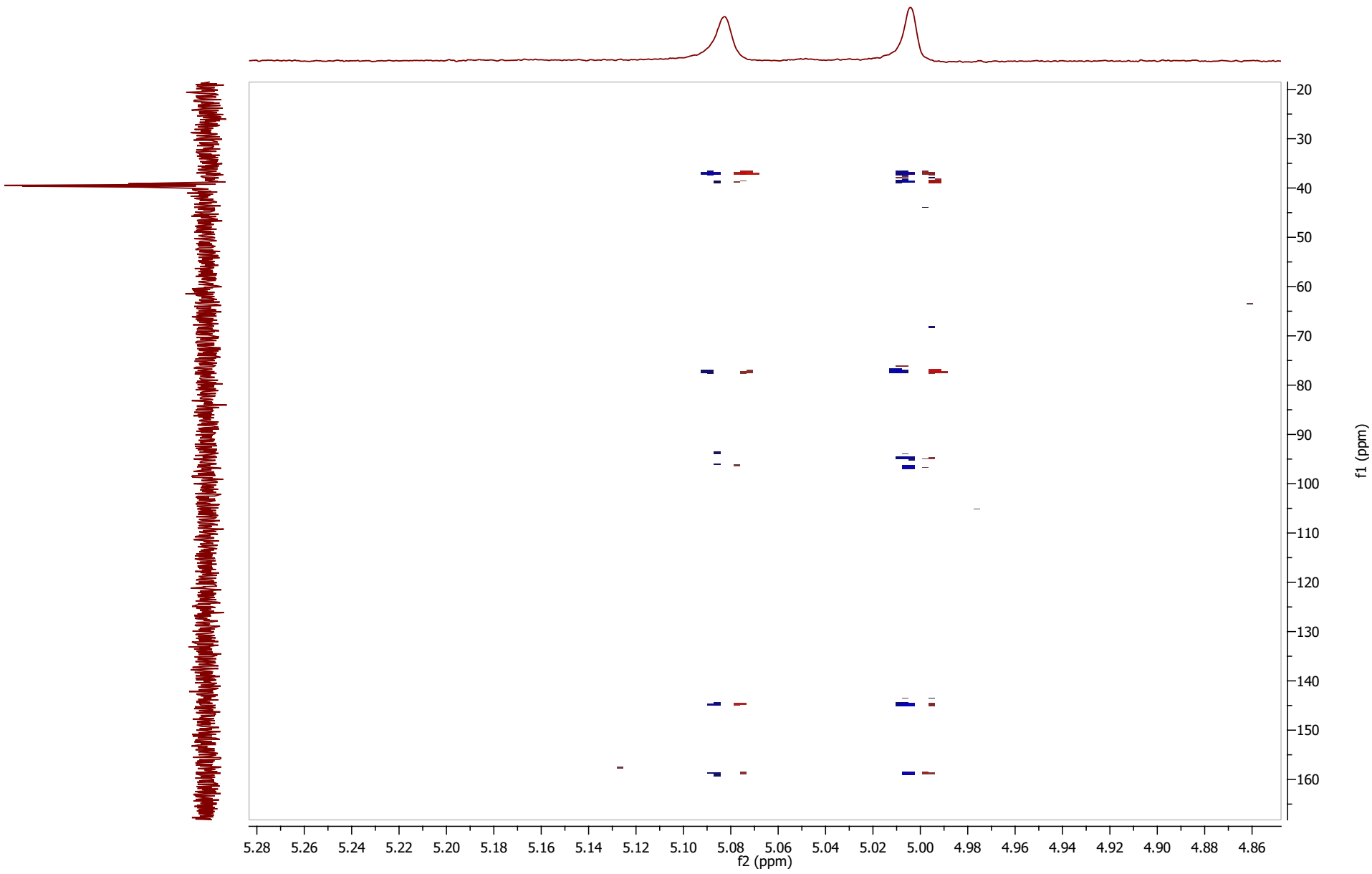


Figure S32. Expansion of HMBC Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

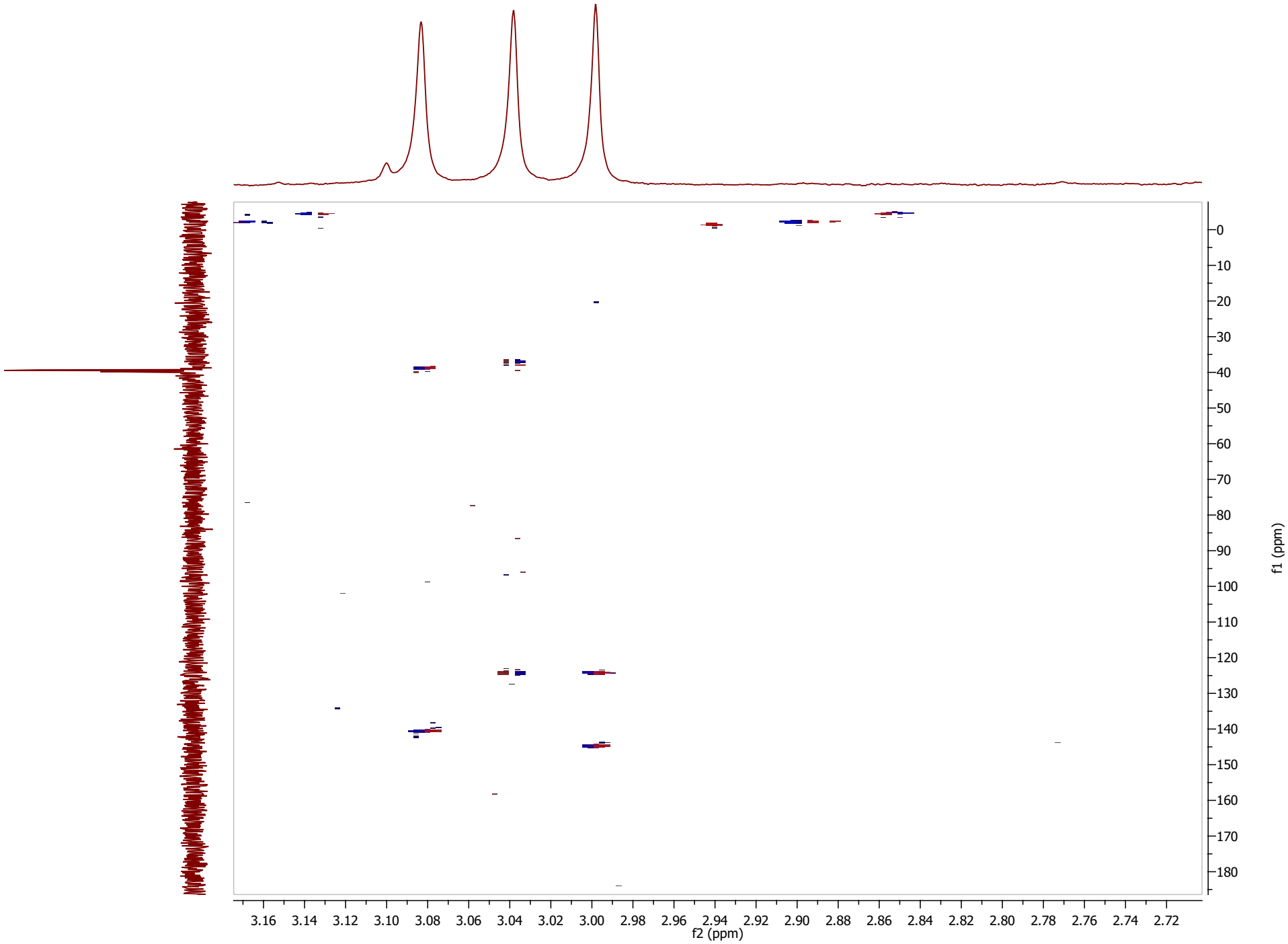


Figure S33. NOESY Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

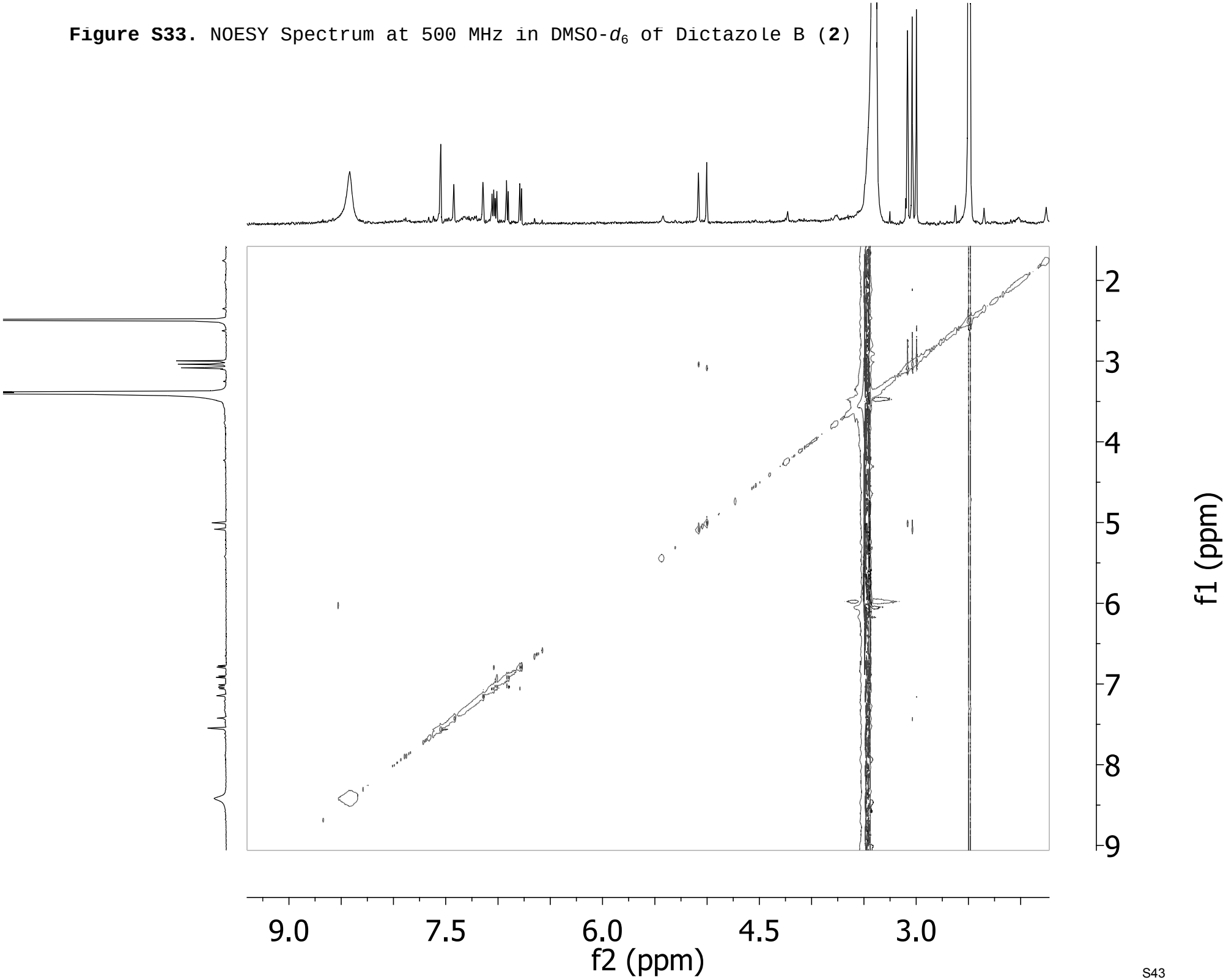


Figure S34. Expansion of NOESY Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

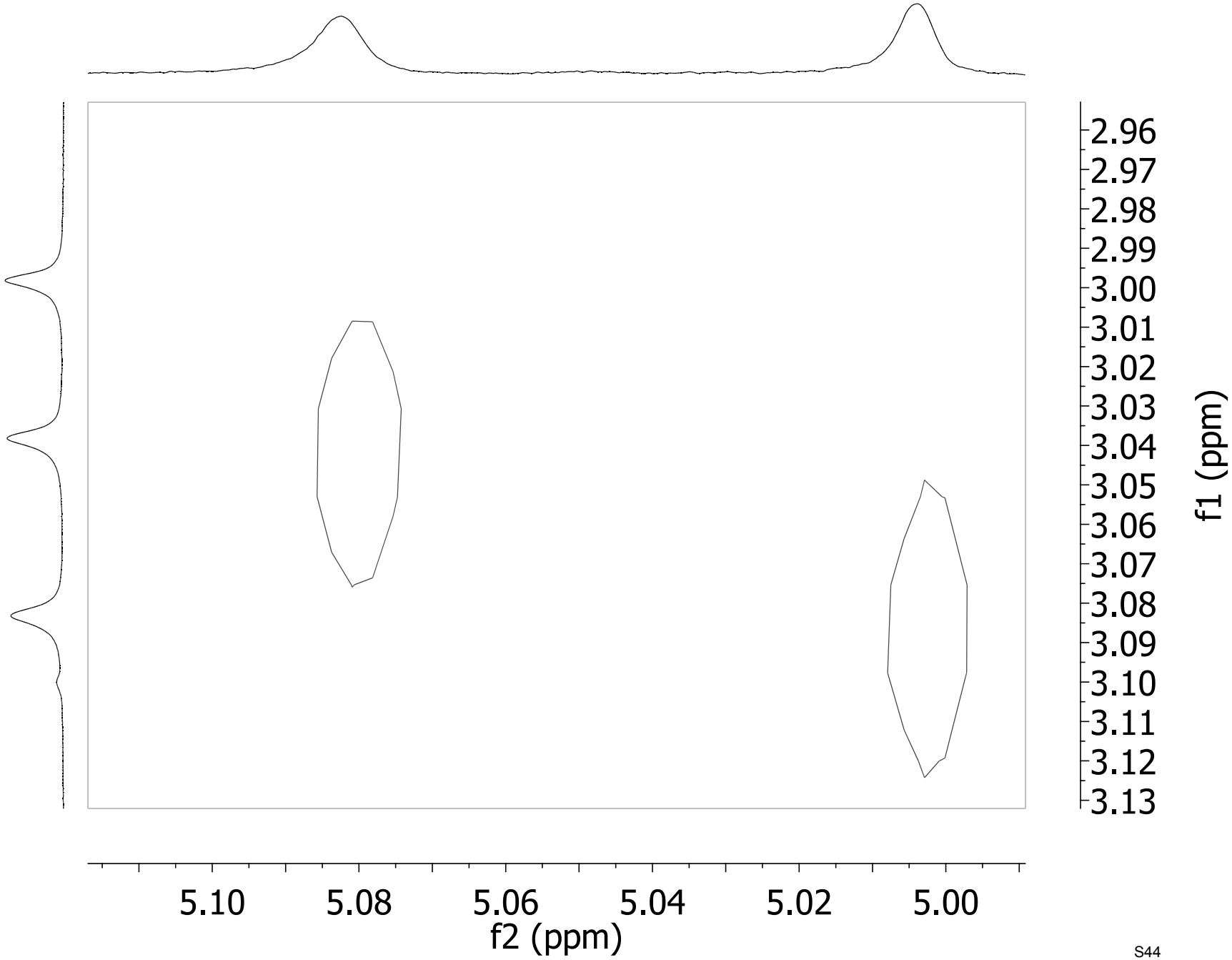


Figure S35. Expansion of NOESY Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

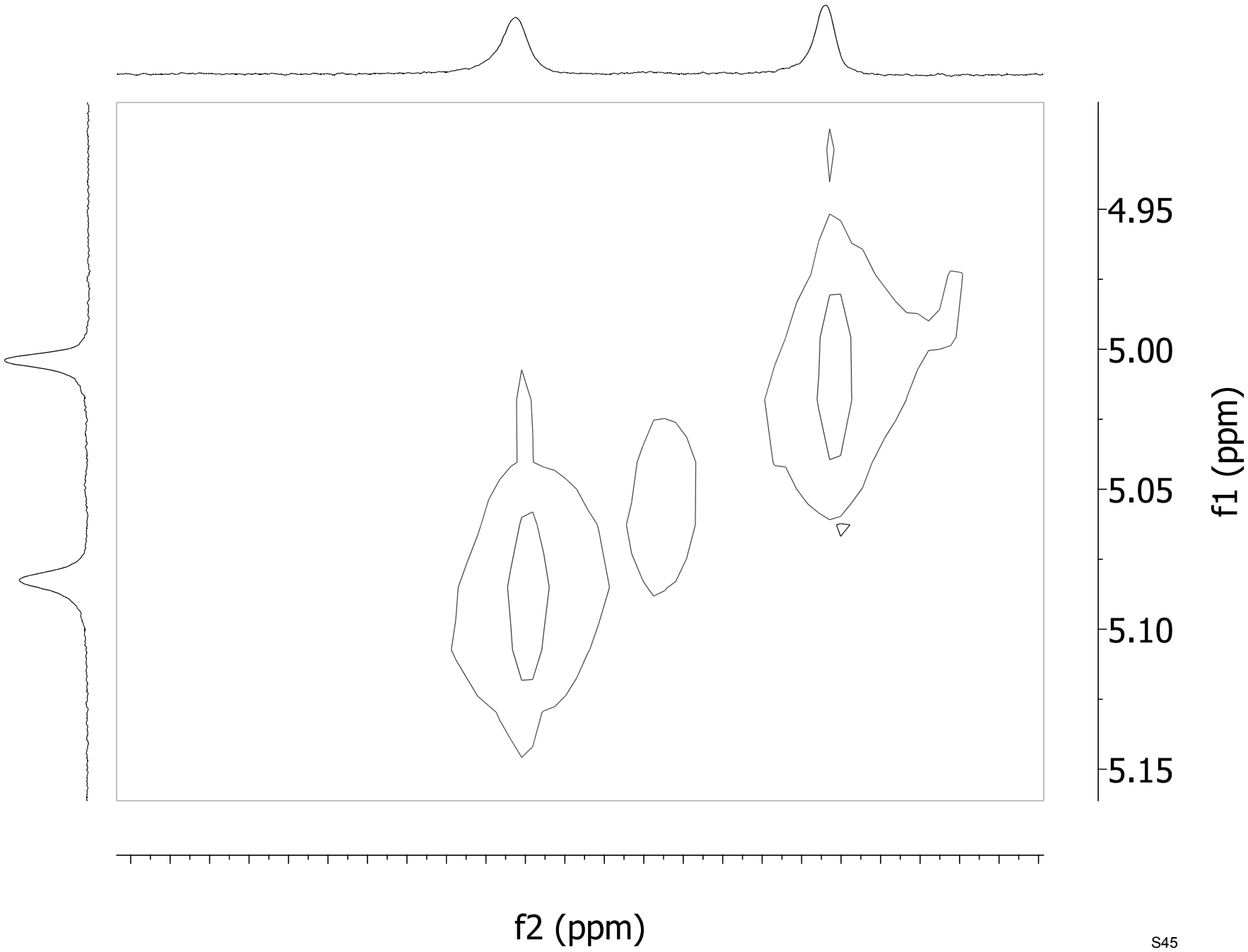


Figure S36. Expansion of NOESY Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

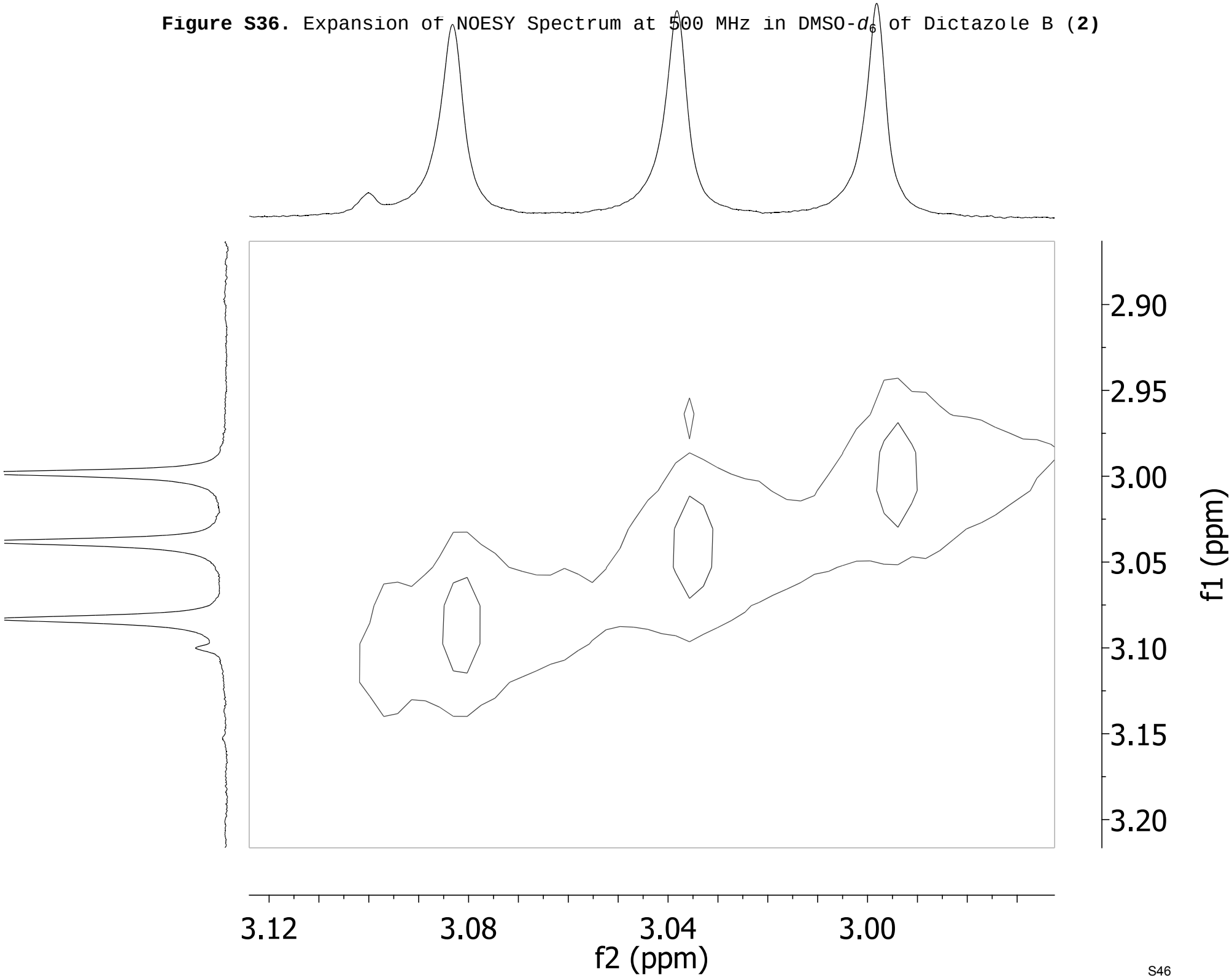


Figure S37. DPFGSE 1D NOE NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**) excitation of H-8

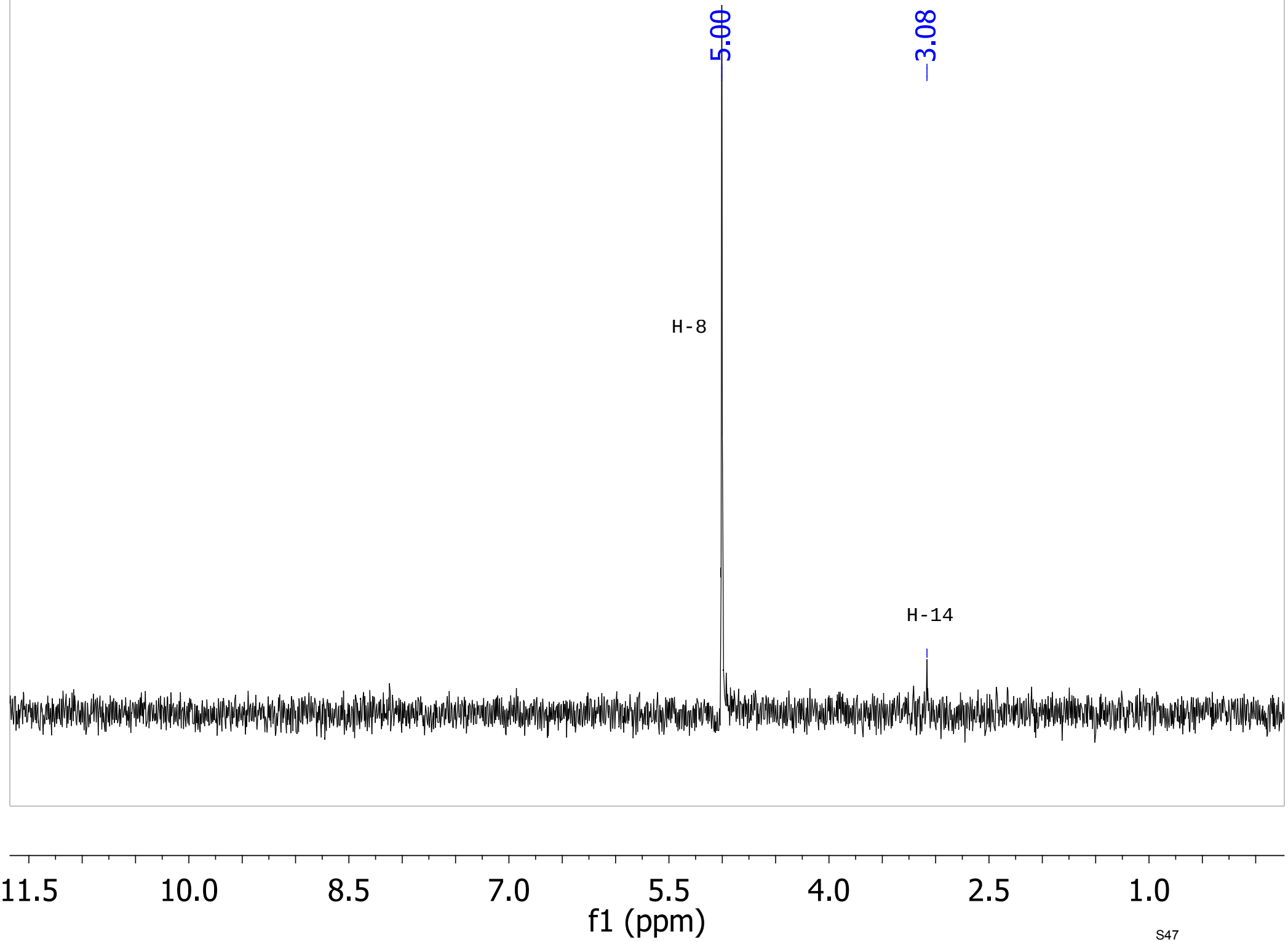


Figure S38. DPFGSE 1D NOE NMR Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**) excitation of H-8'

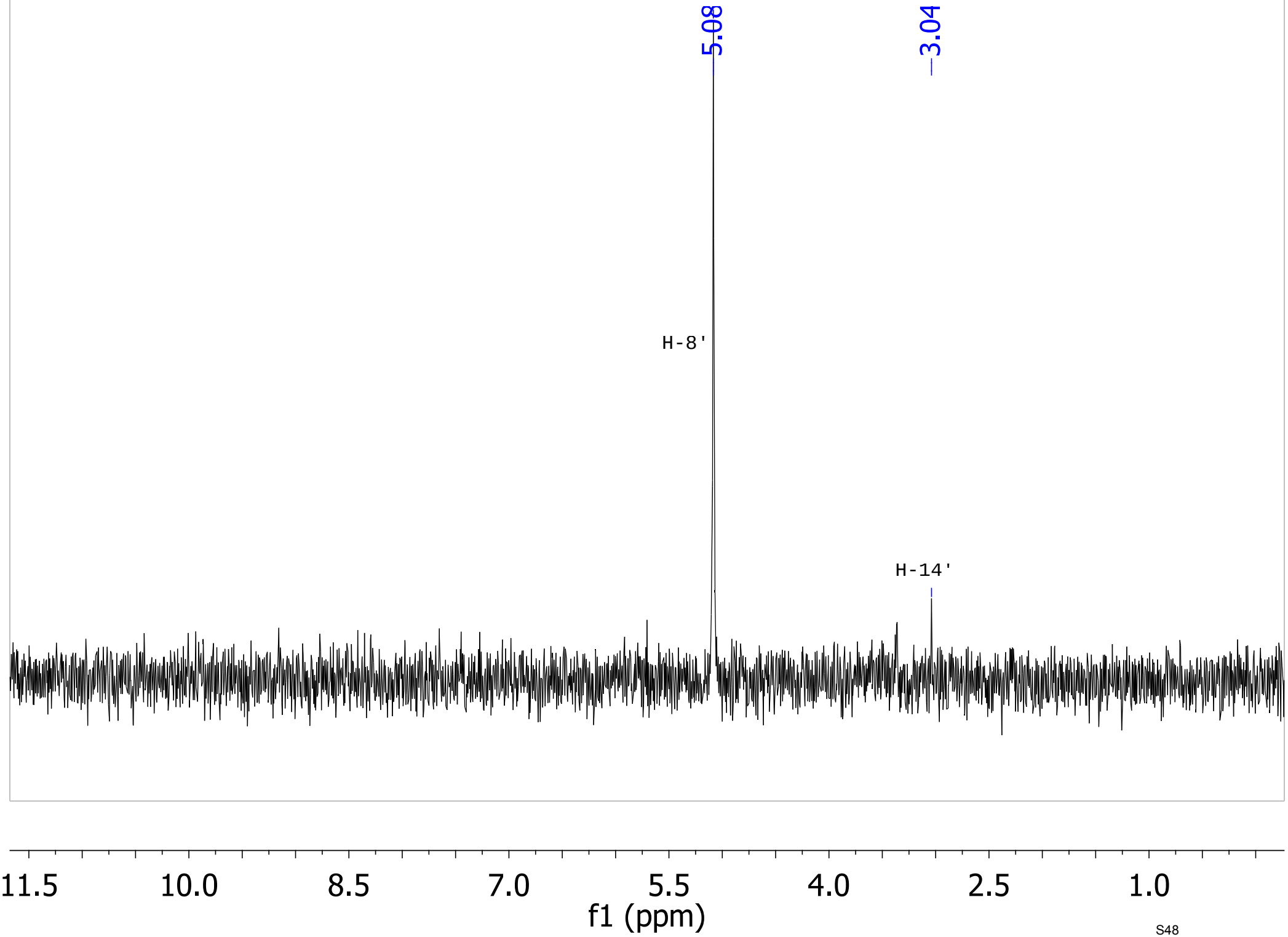


Figure S39. ^{1}H NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**) with water suppression

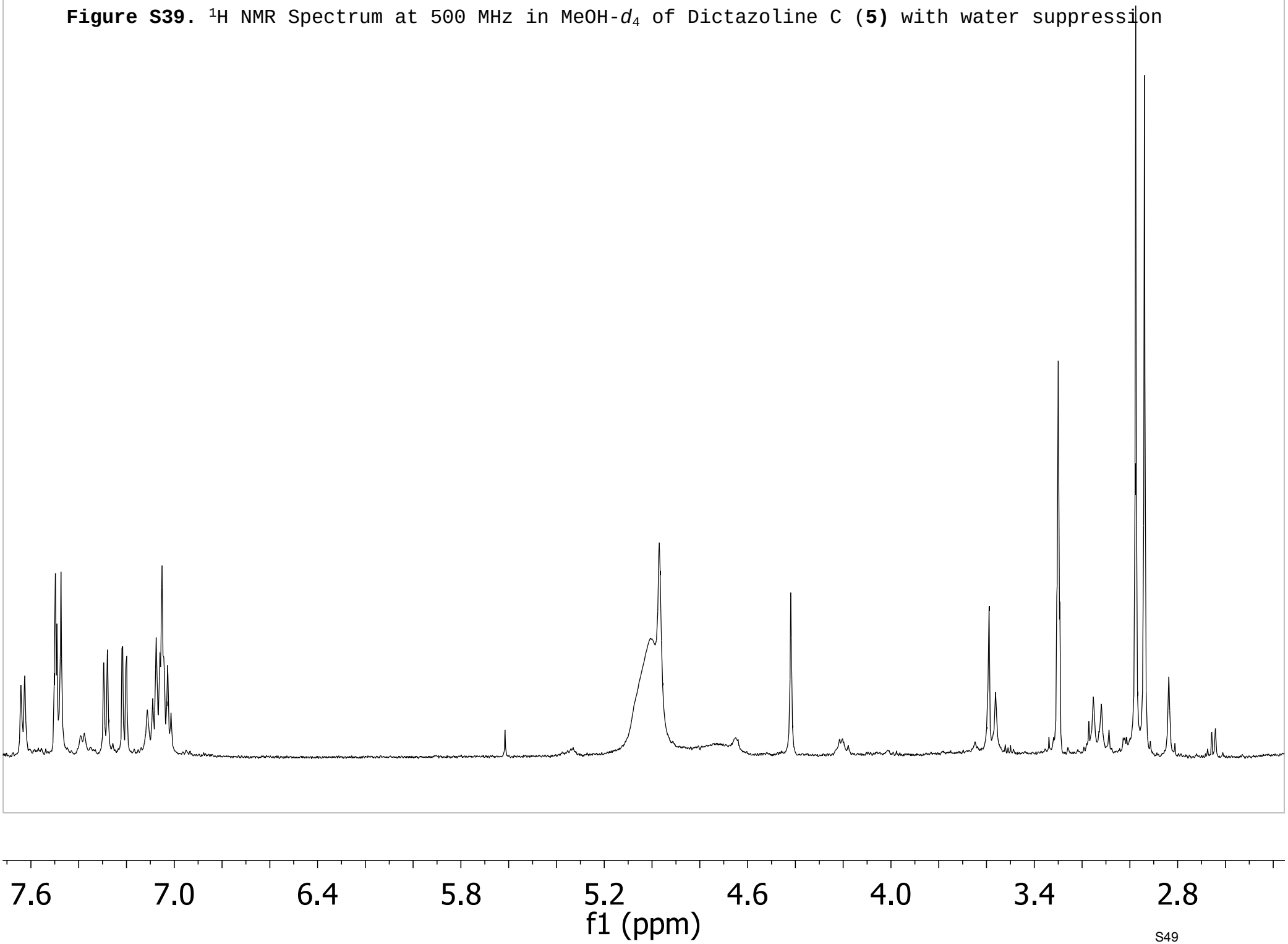


Figure S40. ^{13}C NMR Spectrum at 125 MHz in MeOH-d_4 of Dictazoline C (**5**)

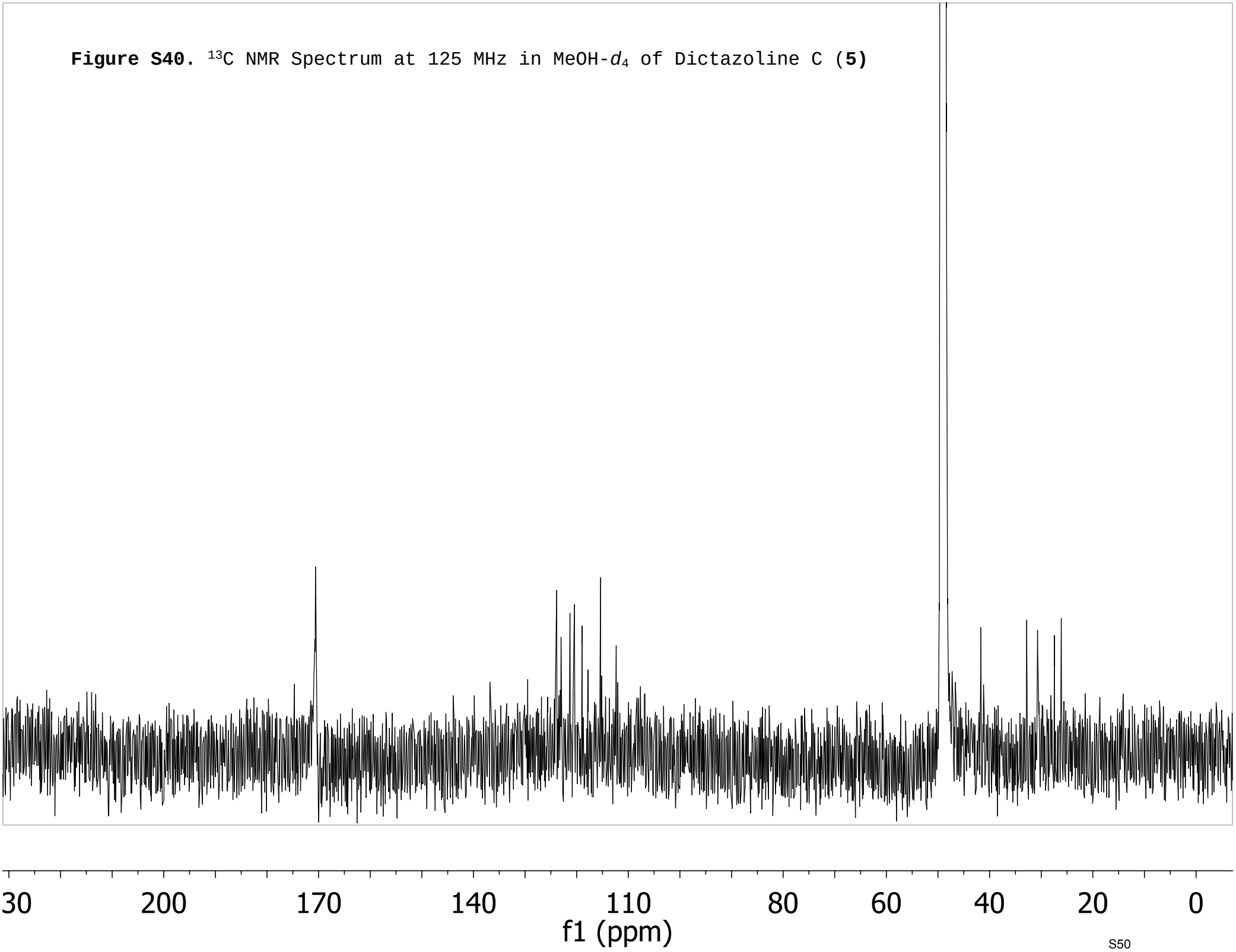


Figure S41. HSQC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

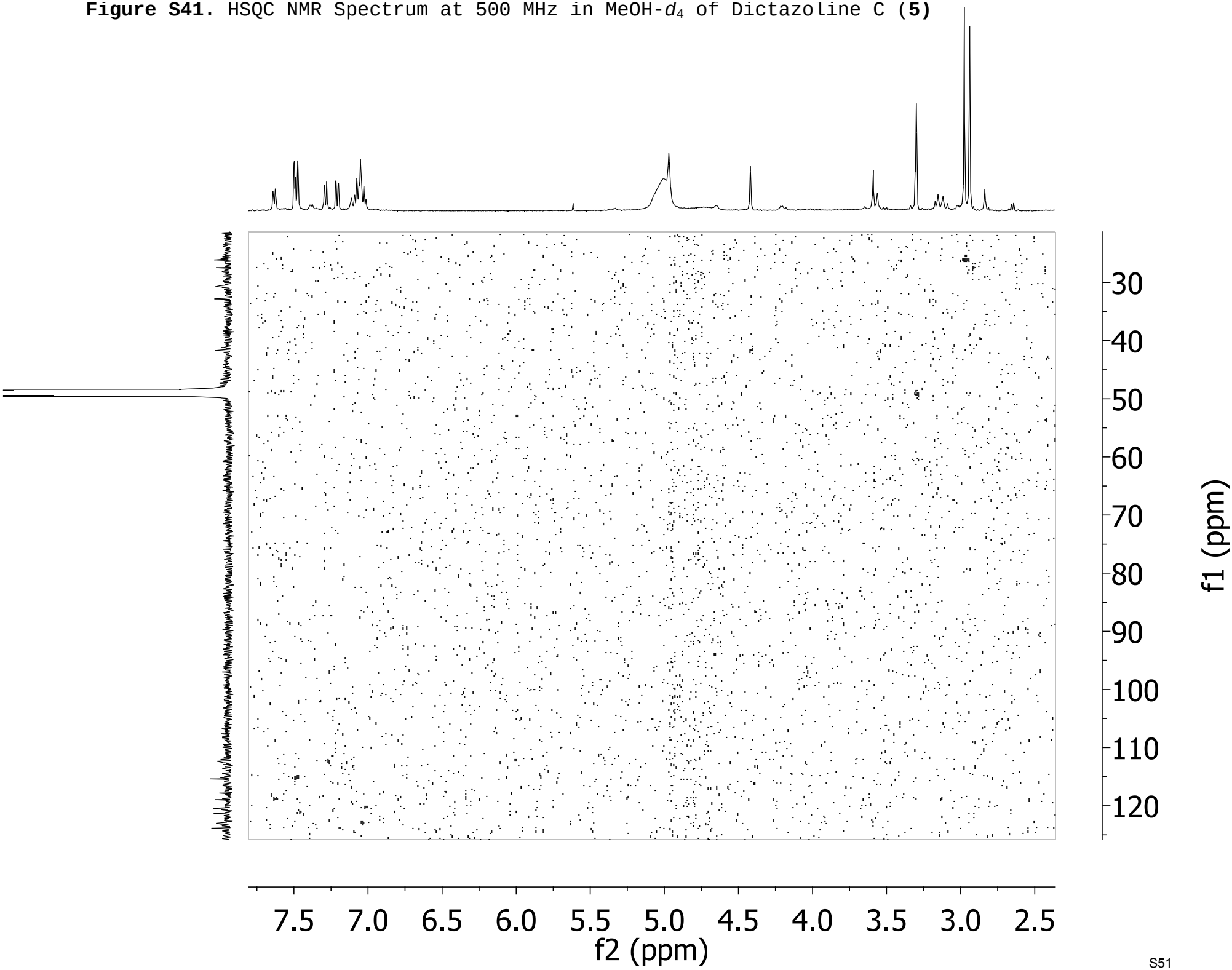


Figure S42. Expansion of HSQC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

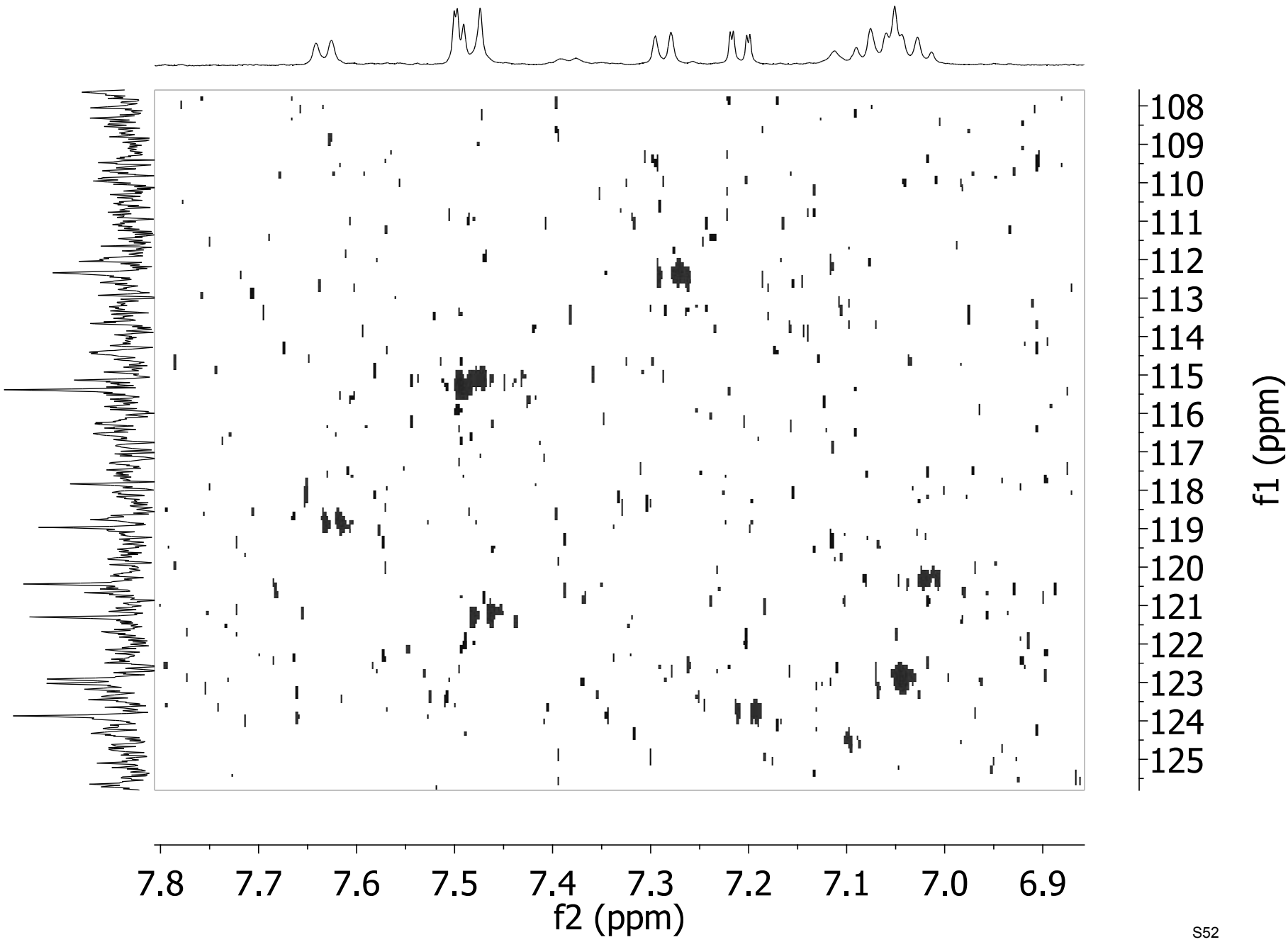


Figure S43. Expansion of HSQC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

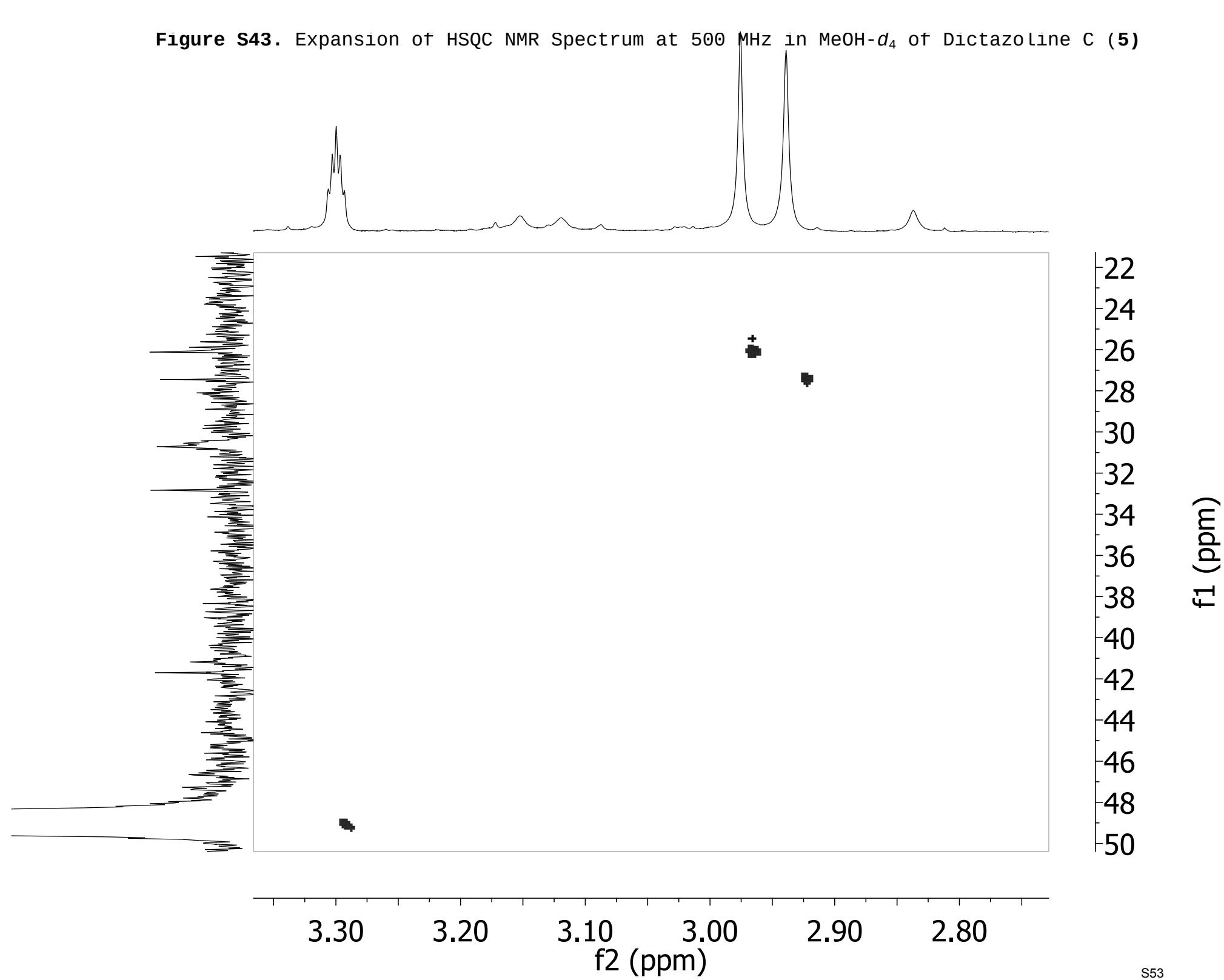


Figure S44. COSY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

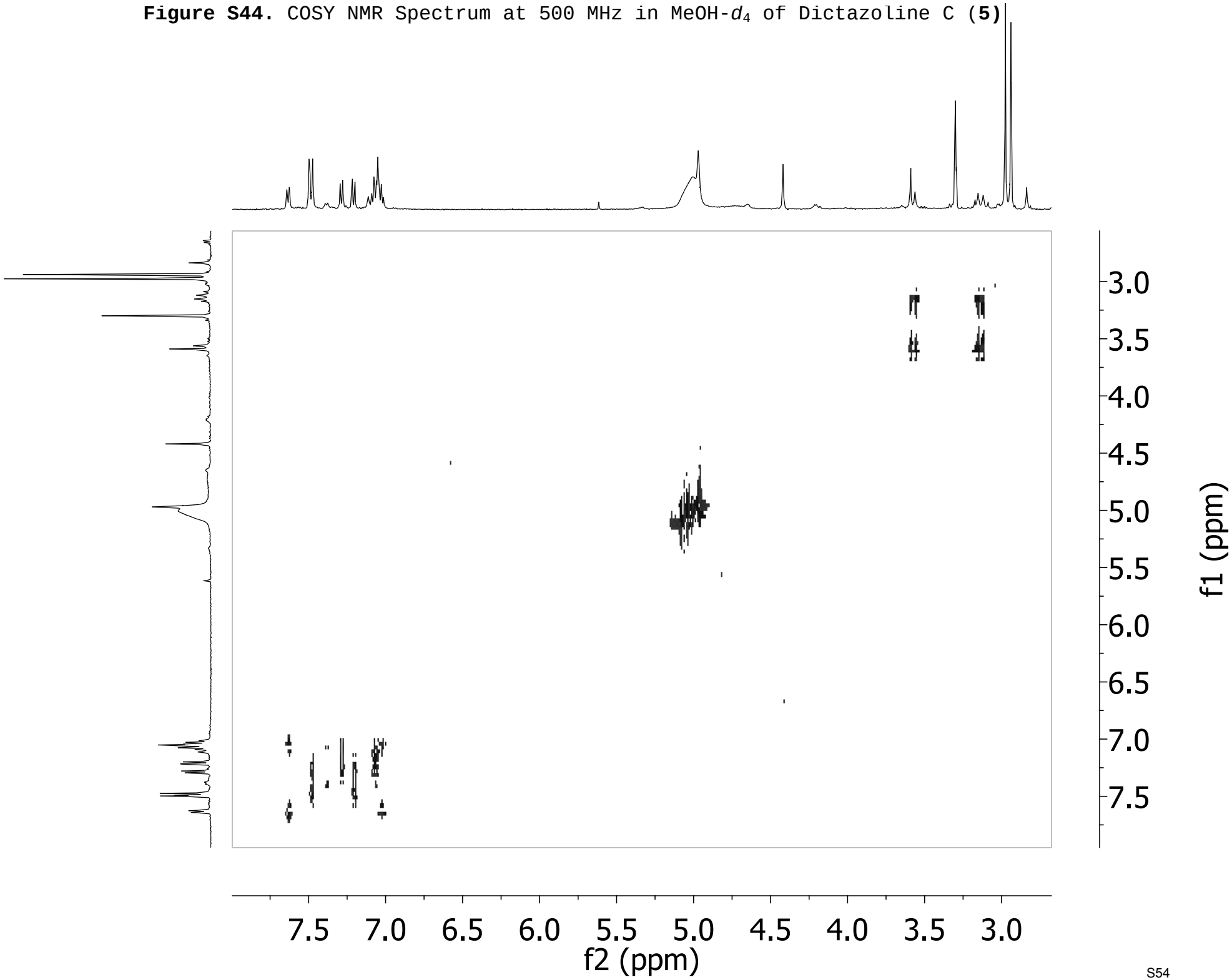


Figure S45. HMBC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

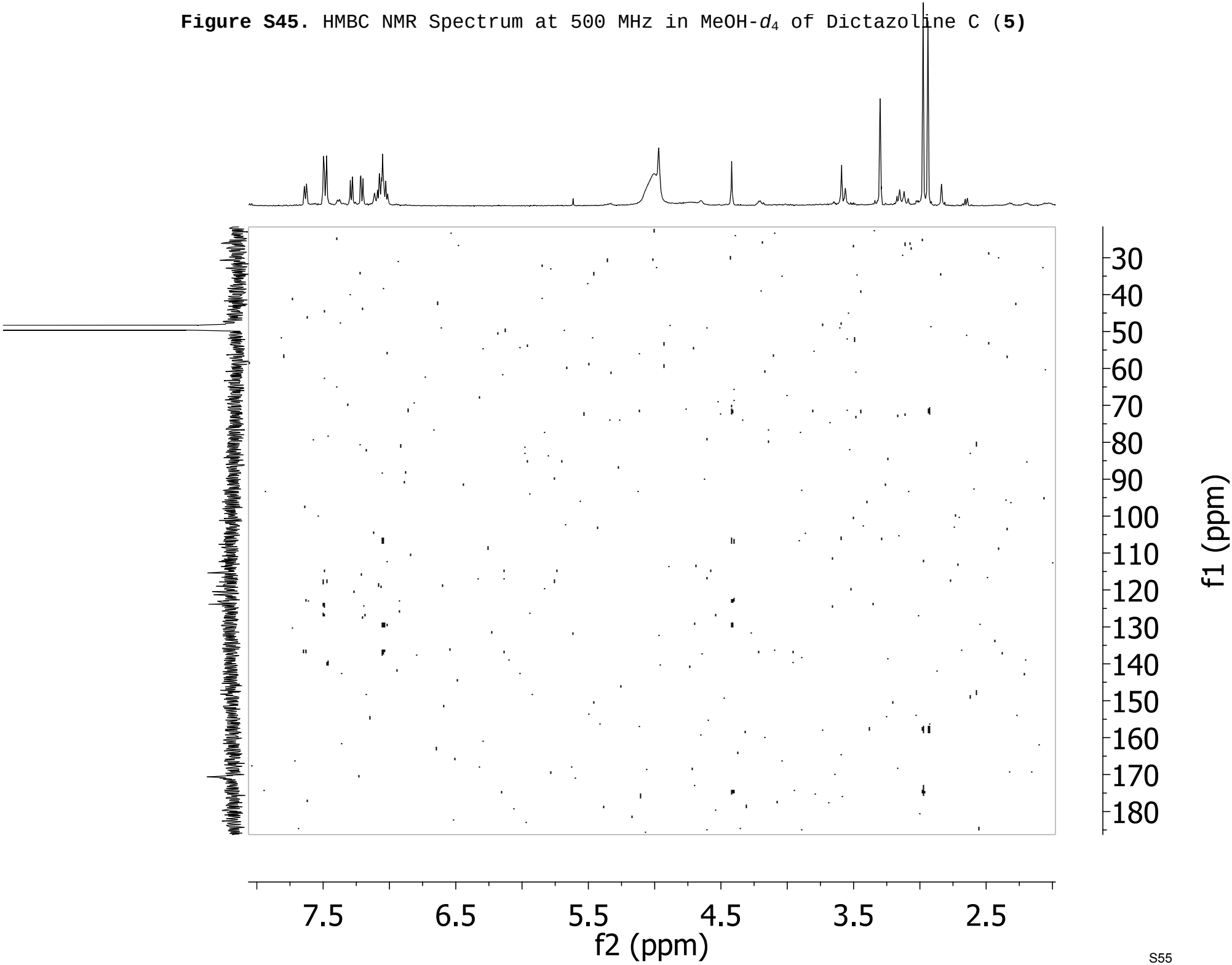


Figure S46. Expansion of HMBC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

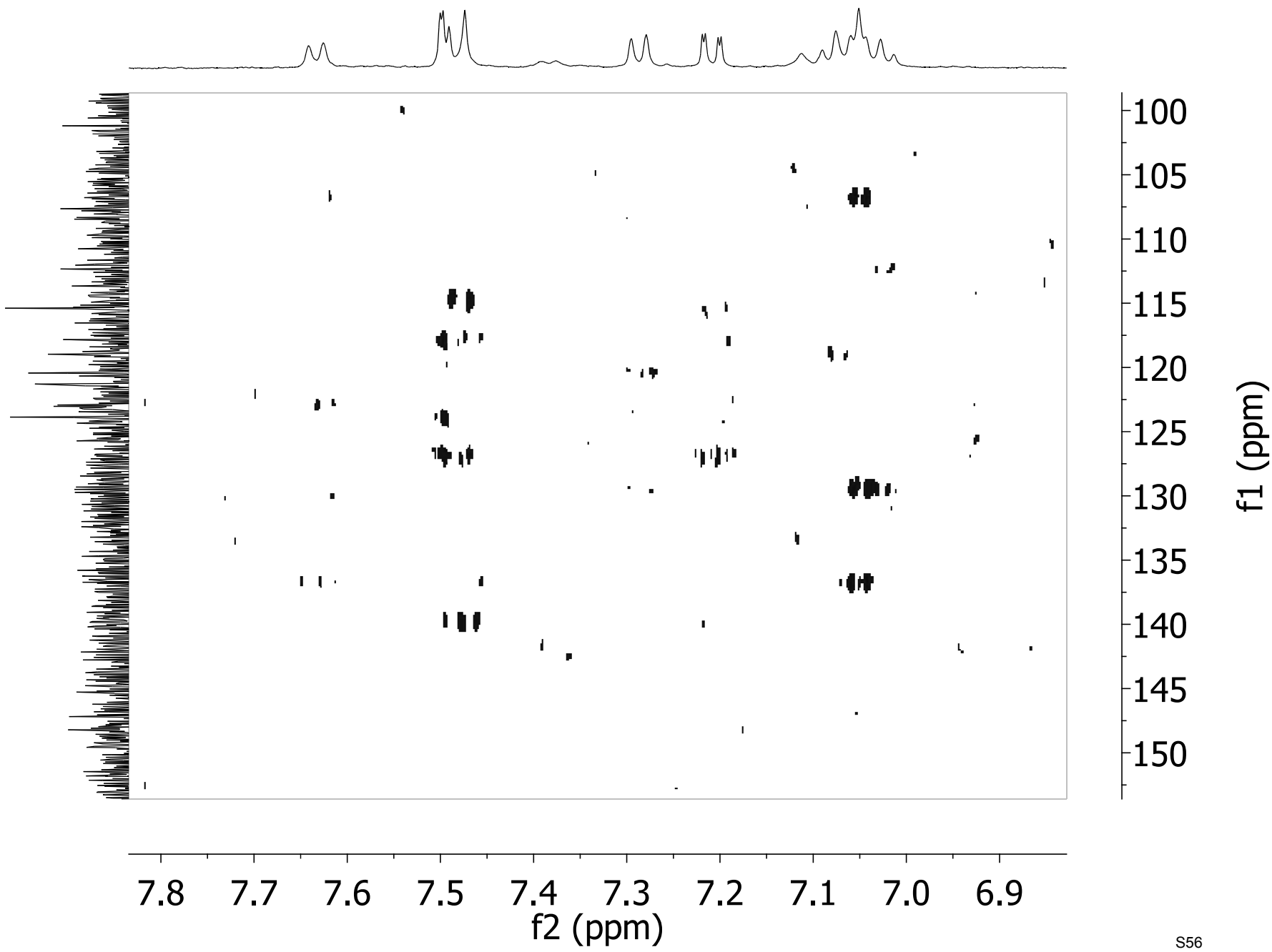


Figure S47. Expansion of HMBC NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

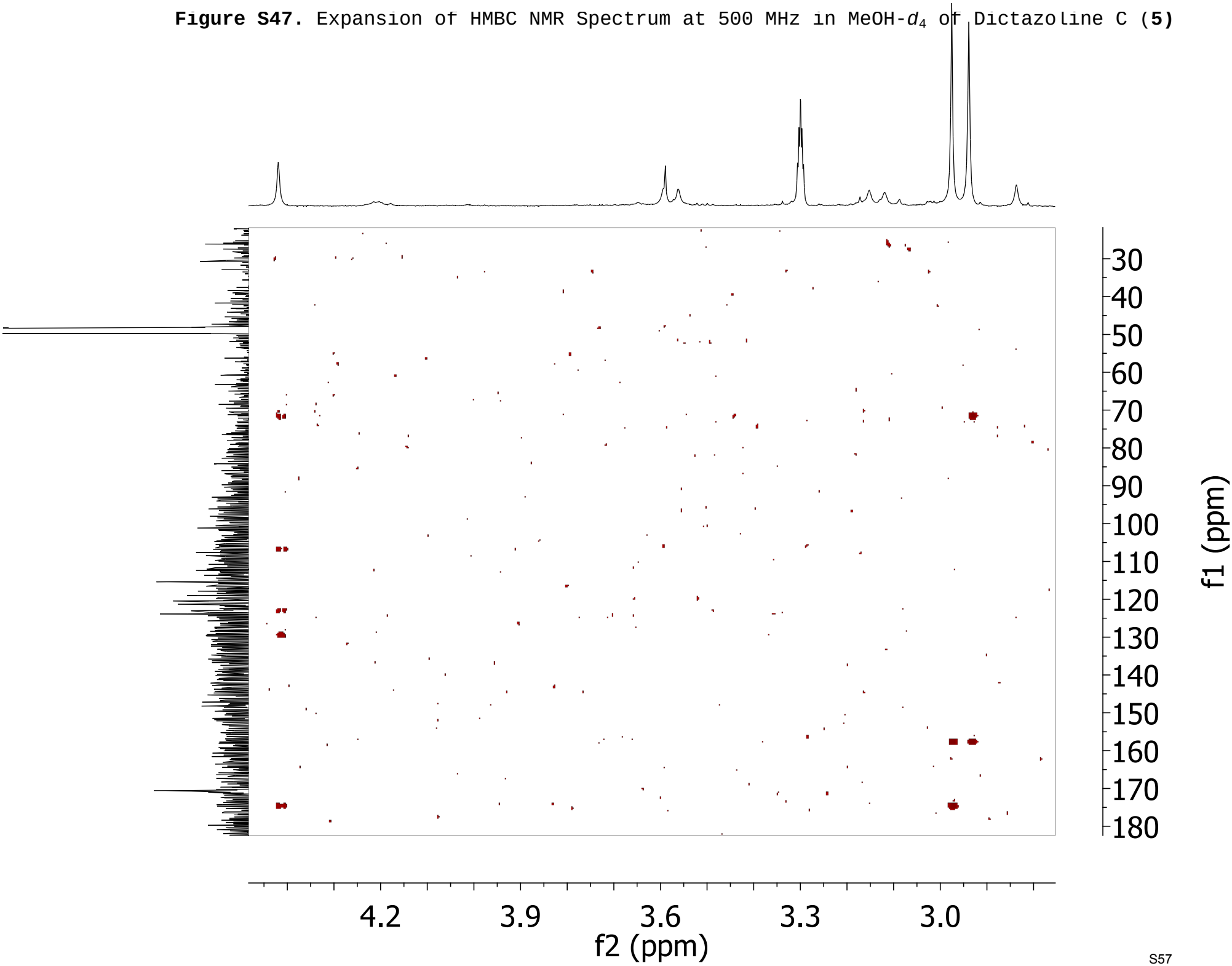


Figure S48. NOESY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

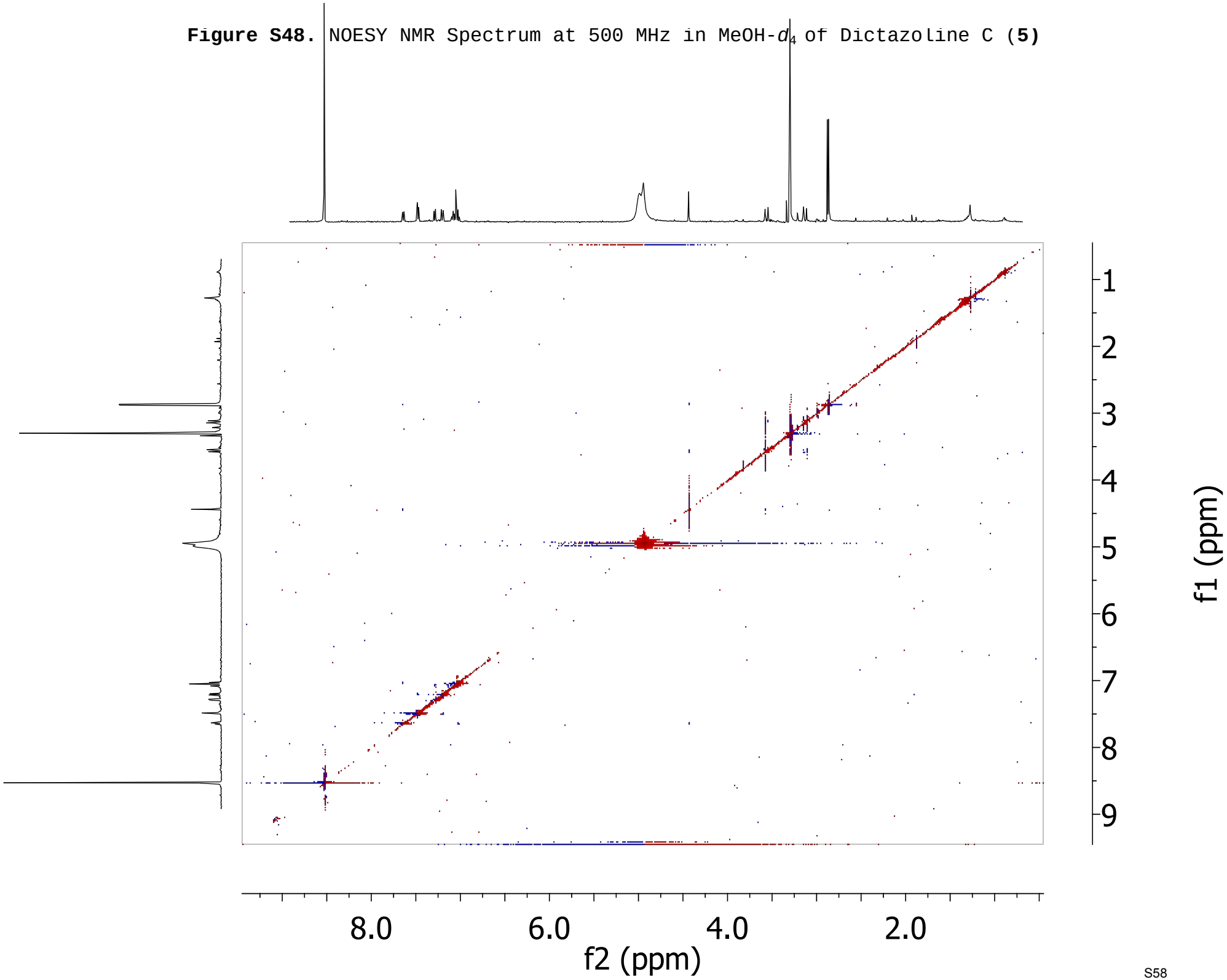


Figure S49. Expansion of NOESY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

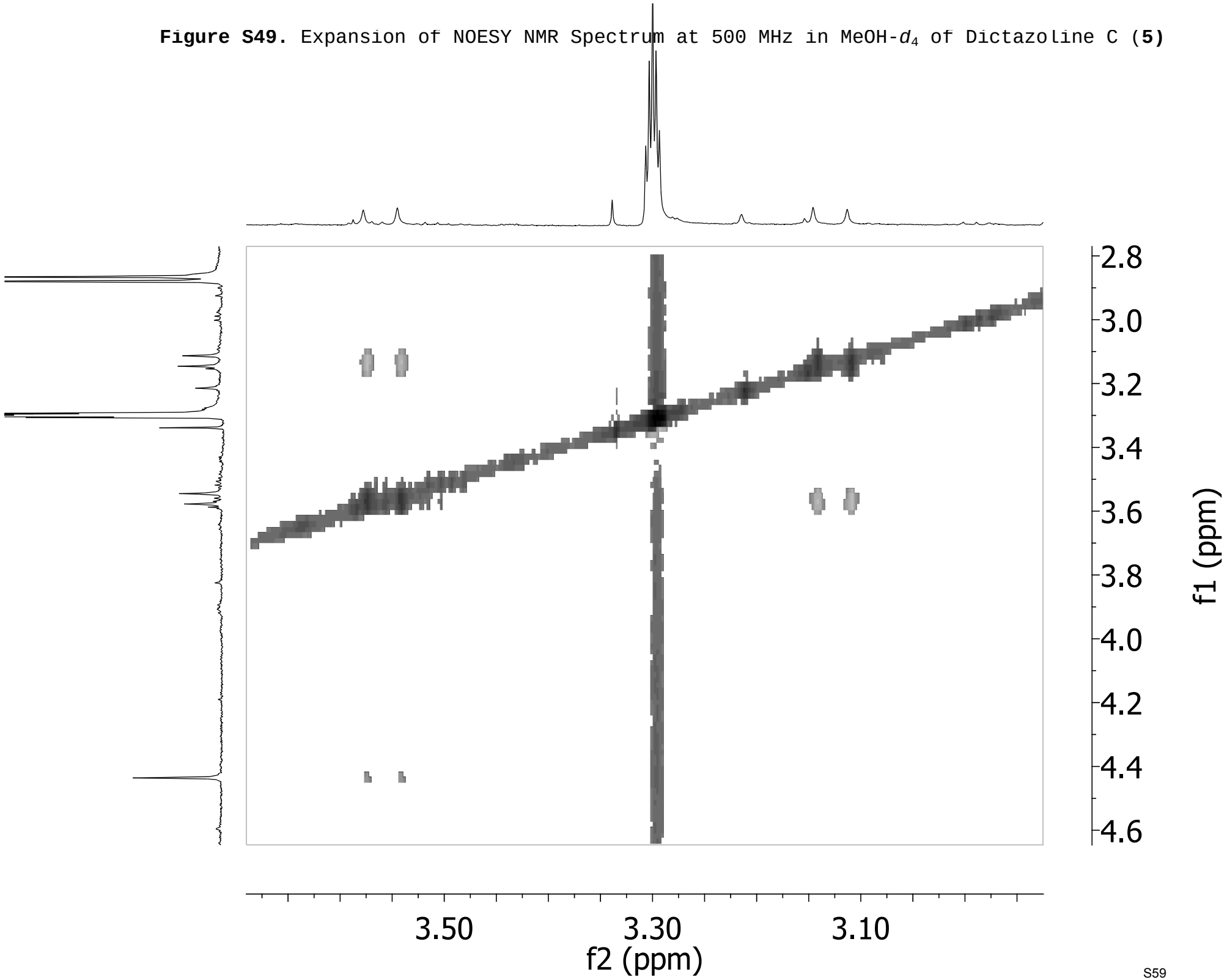


Figure S50. Expansion of NOESY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline C (**5**)

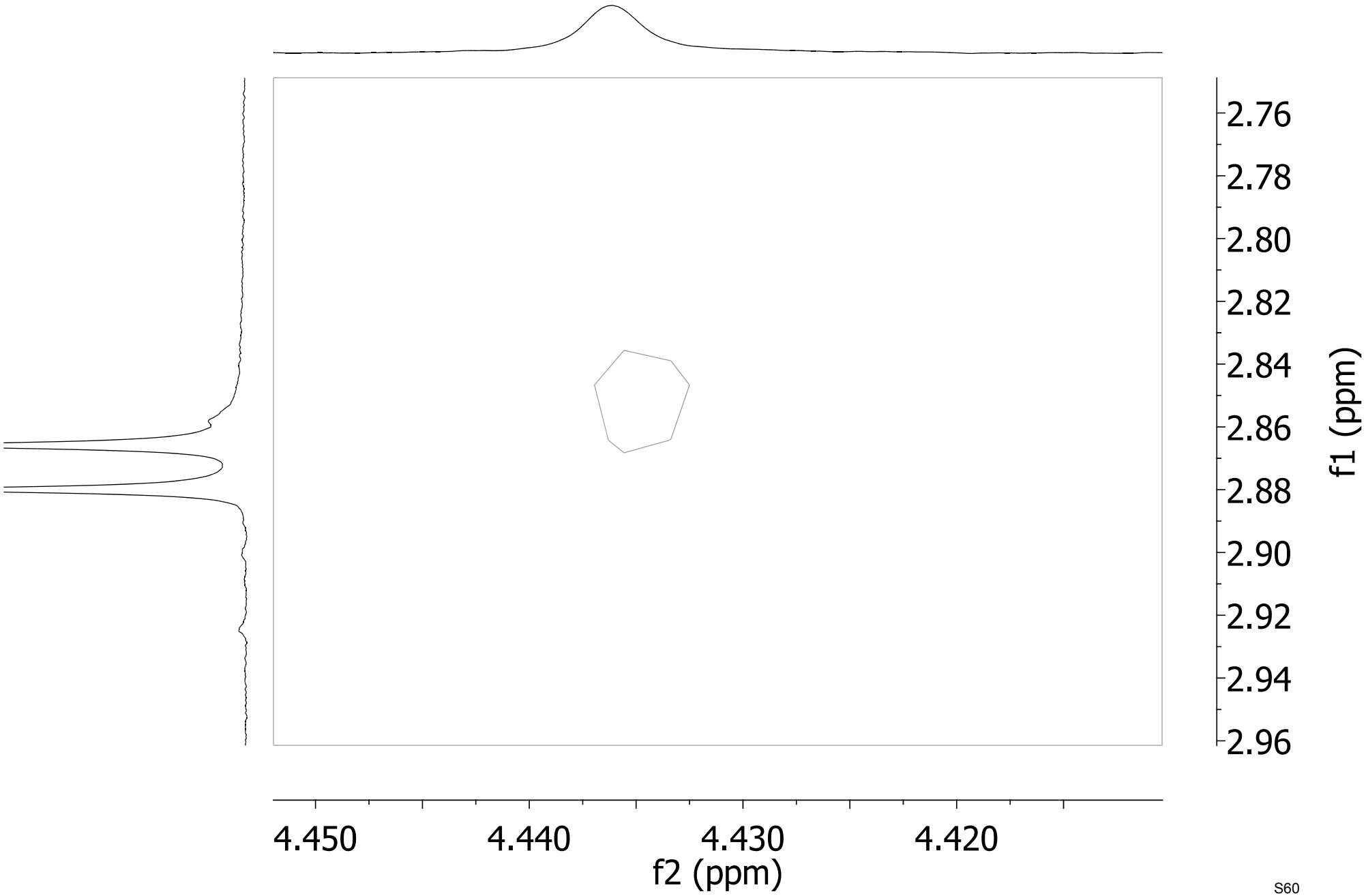


Figure S51. ^{1}H NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline D (**6**)with water suppression

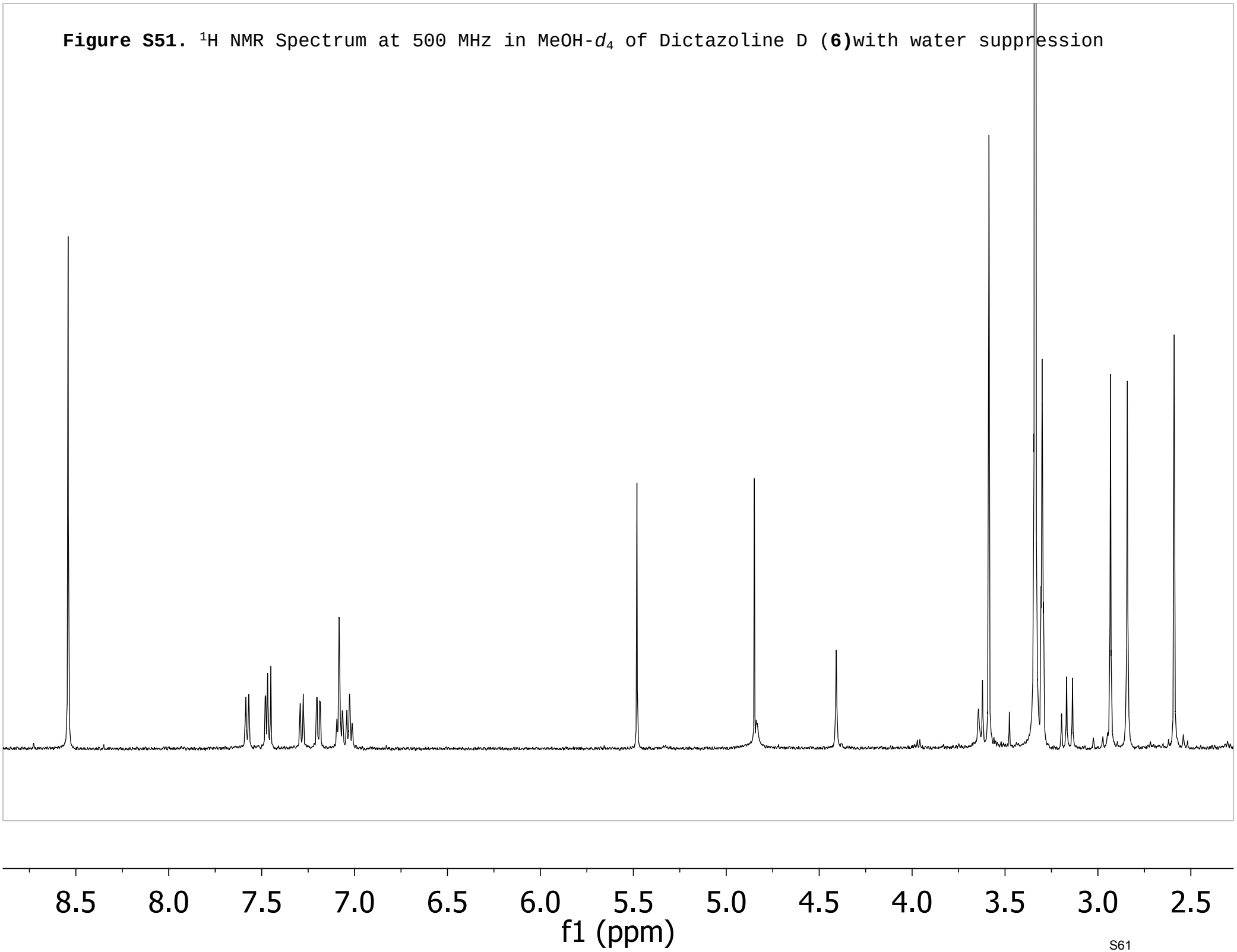


Figure S52. HSQC Spectrum at 500 MHz in DMSO-d_6 of Dictazoline D (**6**)

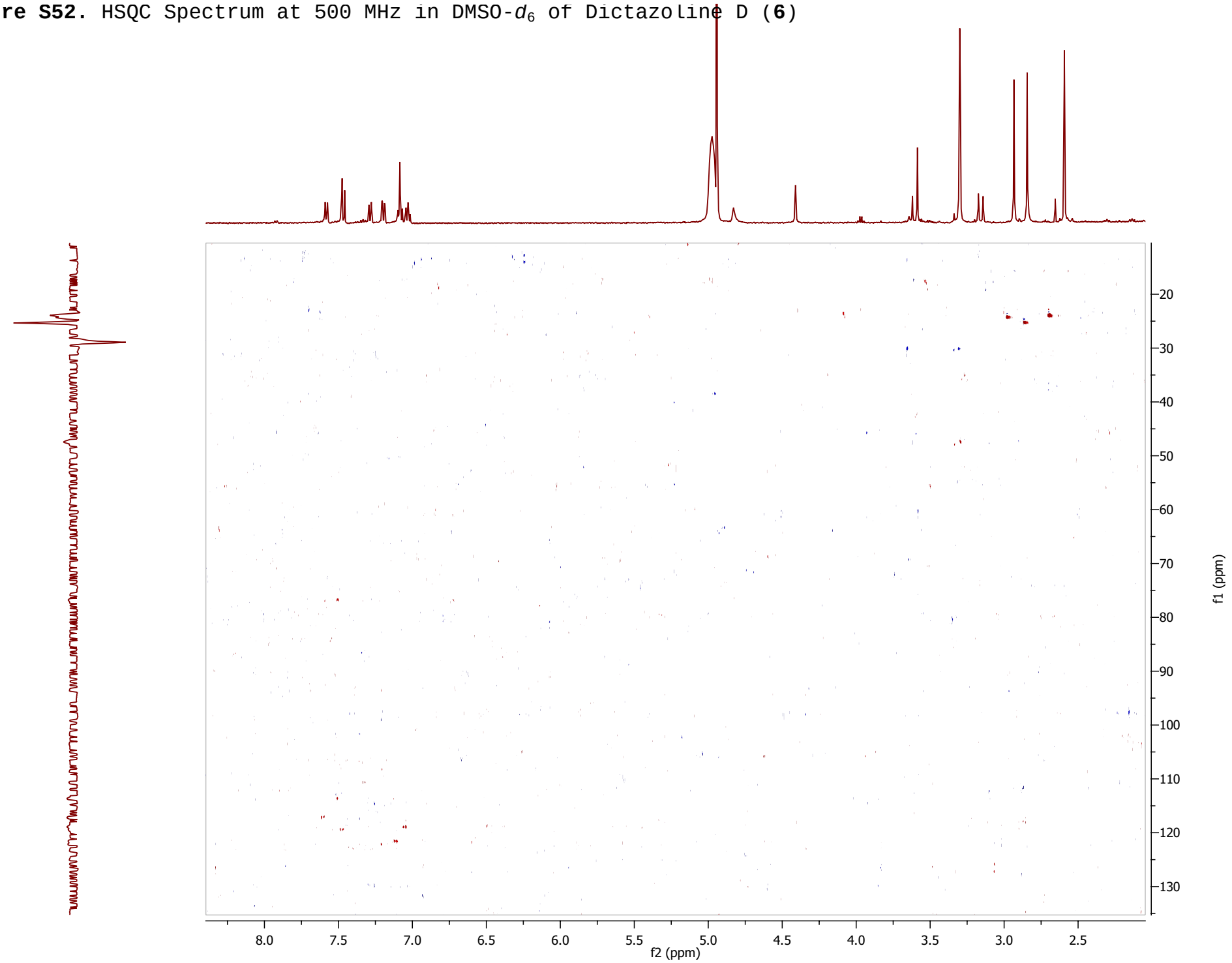


Figure S53. Expansion of HSQC Spectrum at 500 MHz in DMSO-d_6 of Dictazoline D (**6**)

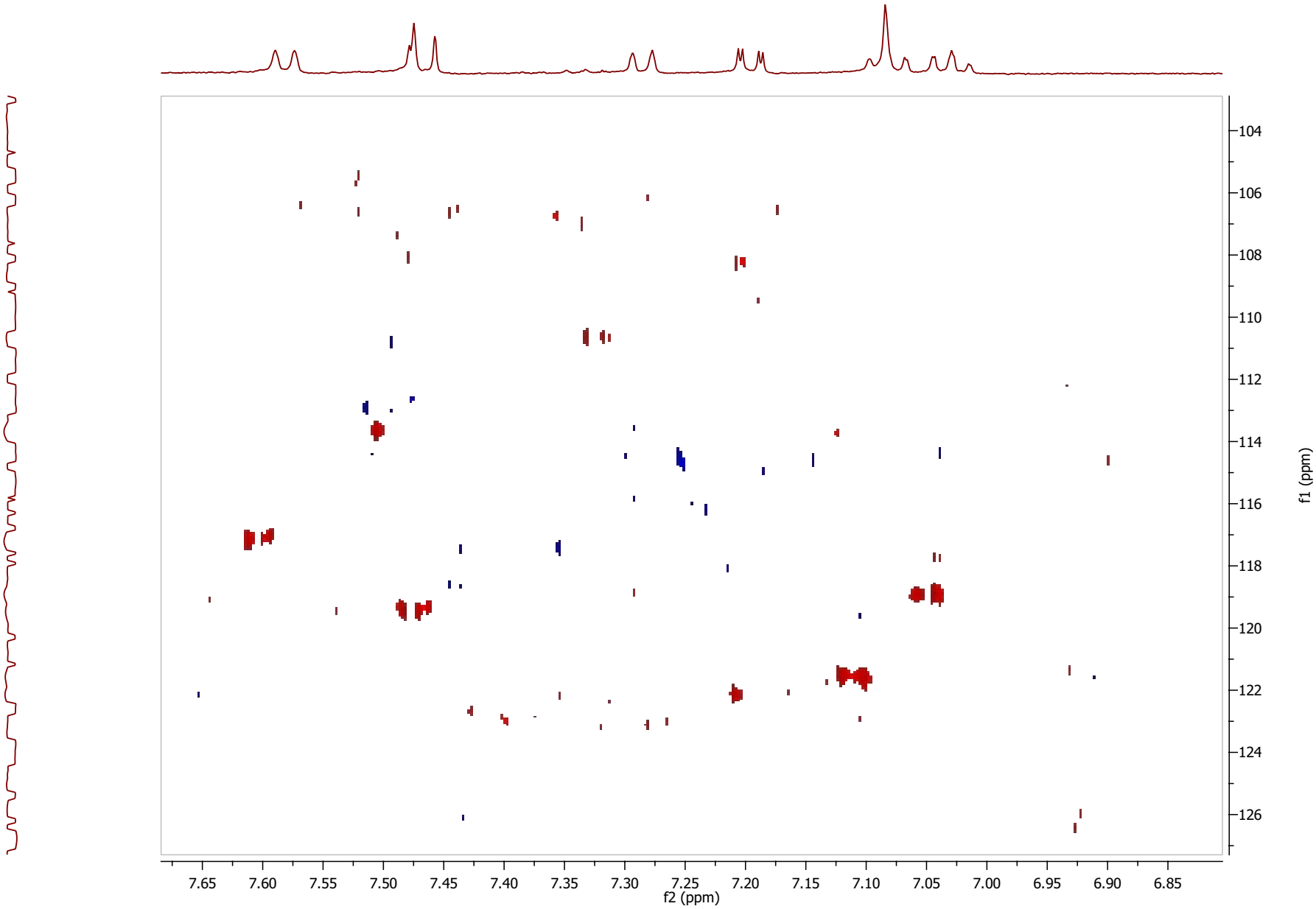


Figure S54. Expansion of HSQC Spectrum at 500 MHz in DMSO-d_6 of Dictazoline D (**6**)

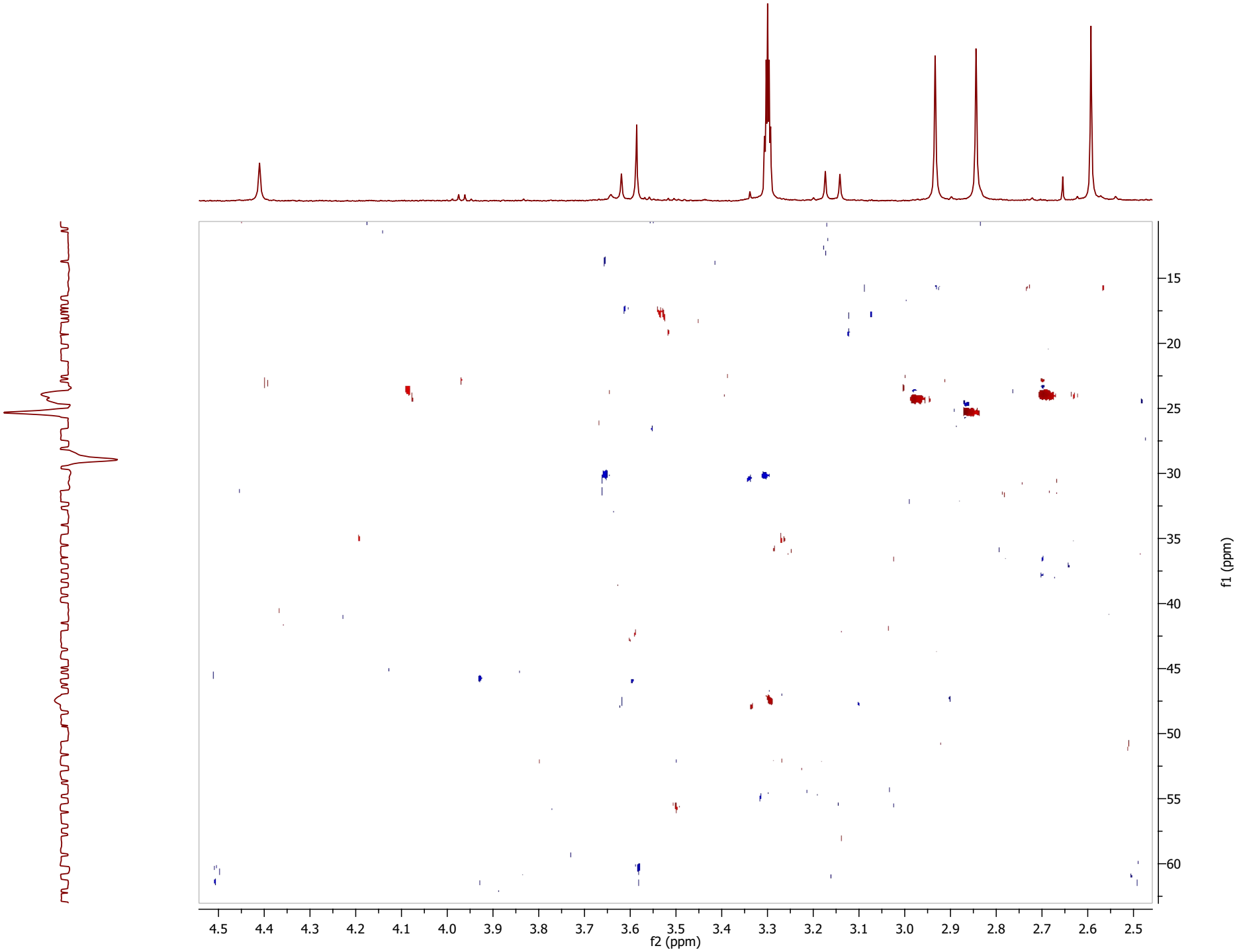


Figure S55. HMBC Spectrum at 500 MHz in DMSO-d_6 of Dictazoline D (**6**)

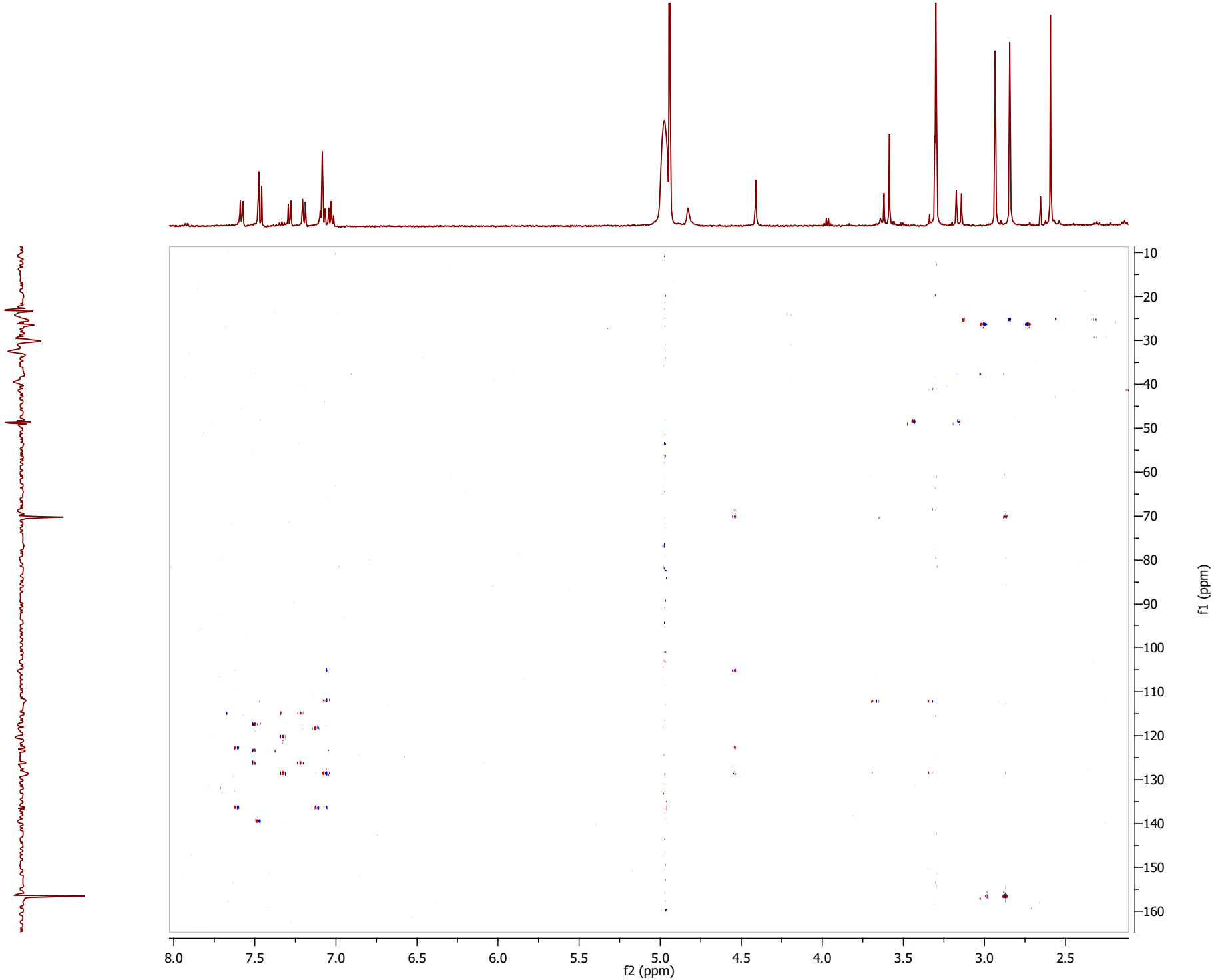


Figure S56. Expansion of HMBC Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

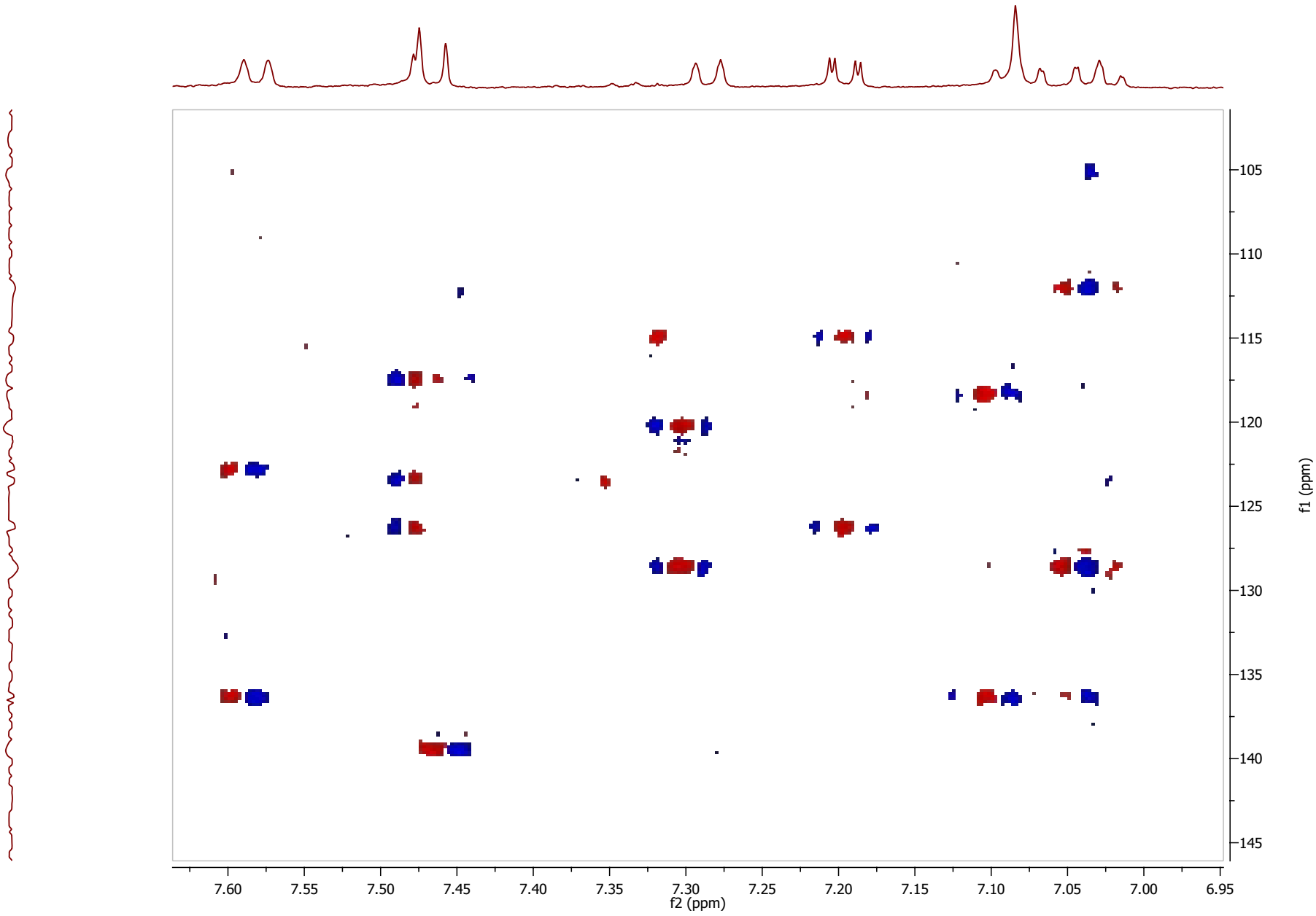


Figure S57. Expansion of HMBC Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

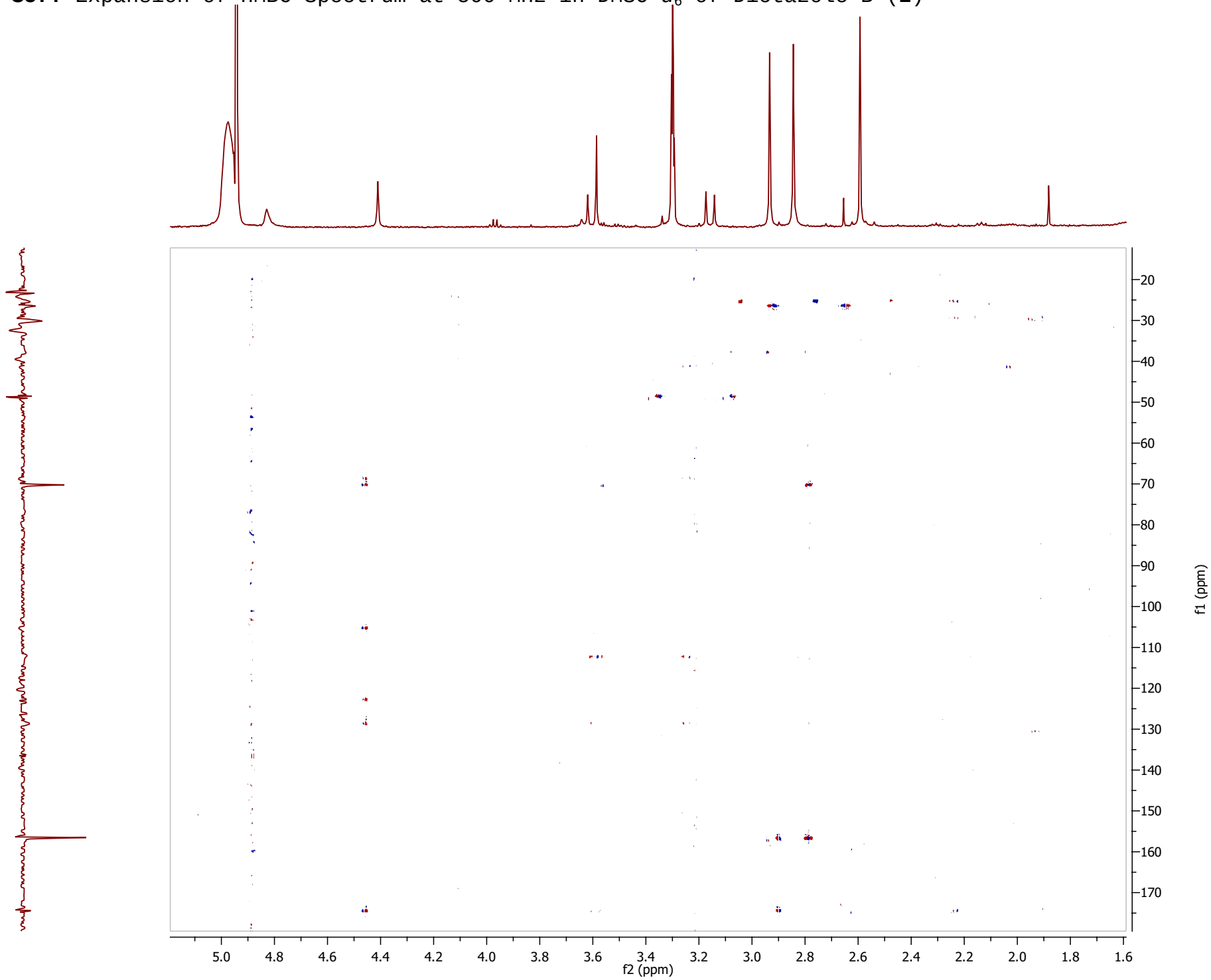


Figure S58. Expansion of HMBC Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

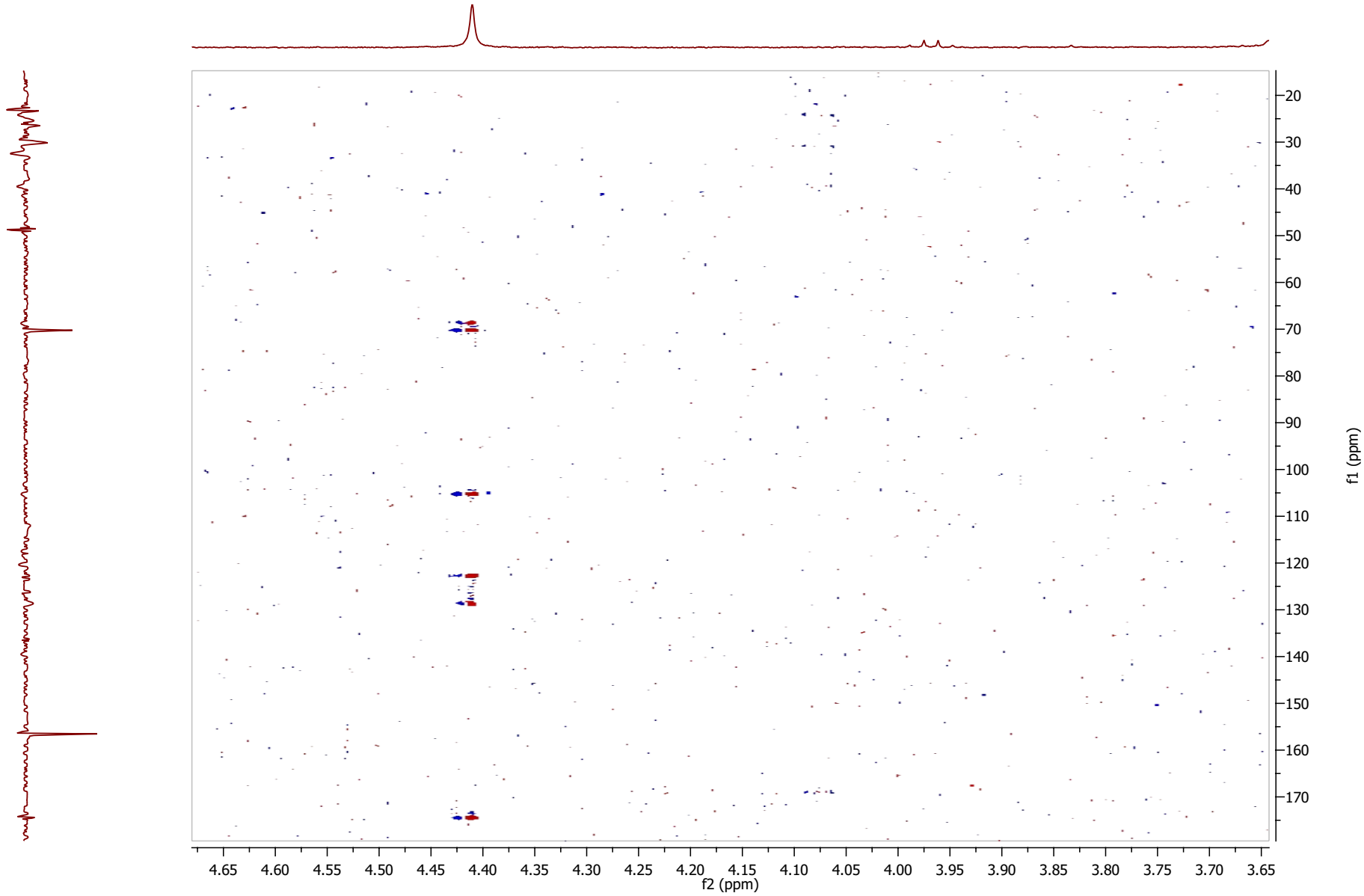


Figure S59. Expansion of HMBC Spectrum at 500 MHz in DMSO-d_6 of Dictazole B (**2**)

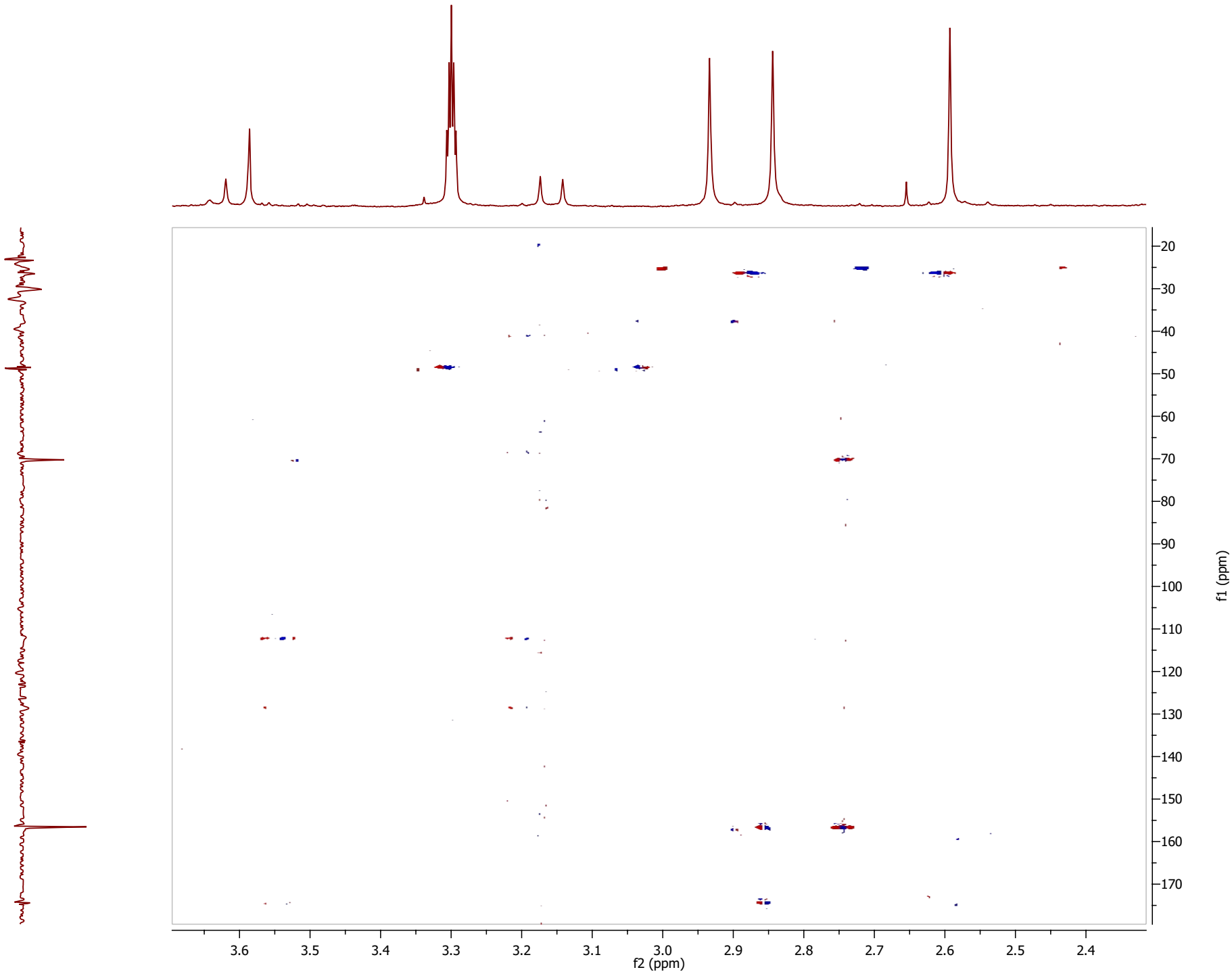


Figure S60. NOESY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline D (**6**)

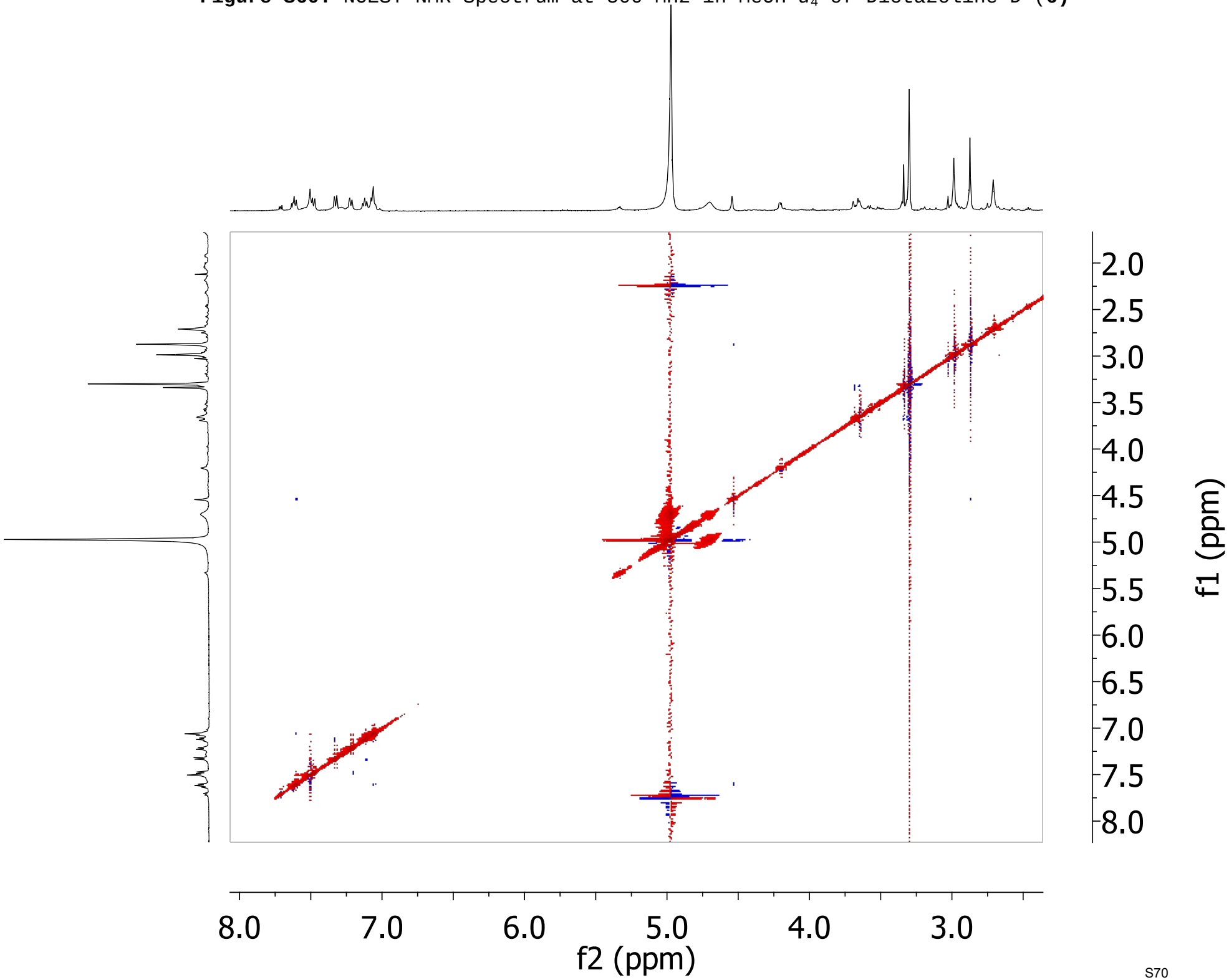


Figure S61. Expansion NOESY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline D (**6**)

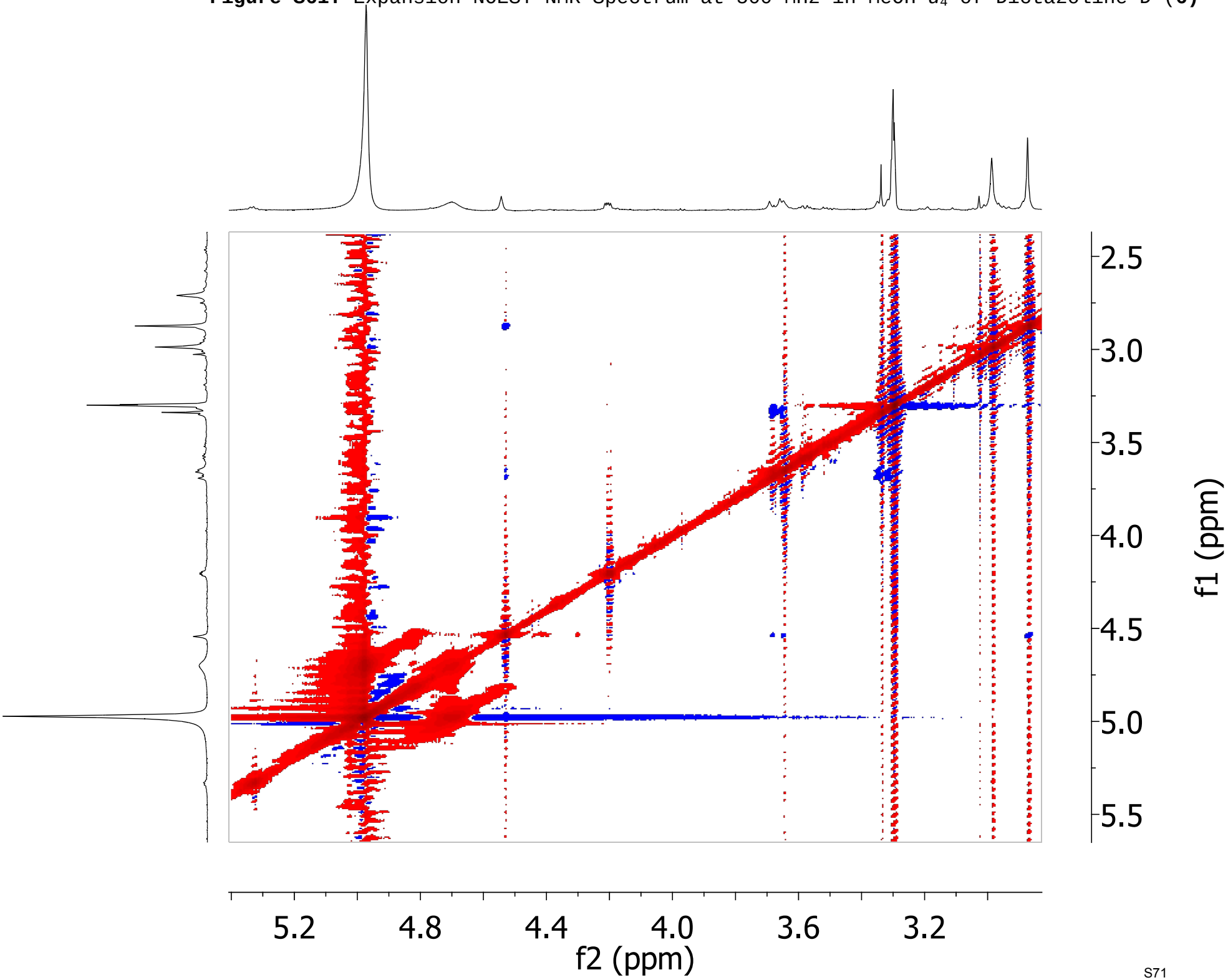


Figure S62. ^{1}H NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline E (**7**) with water suppression

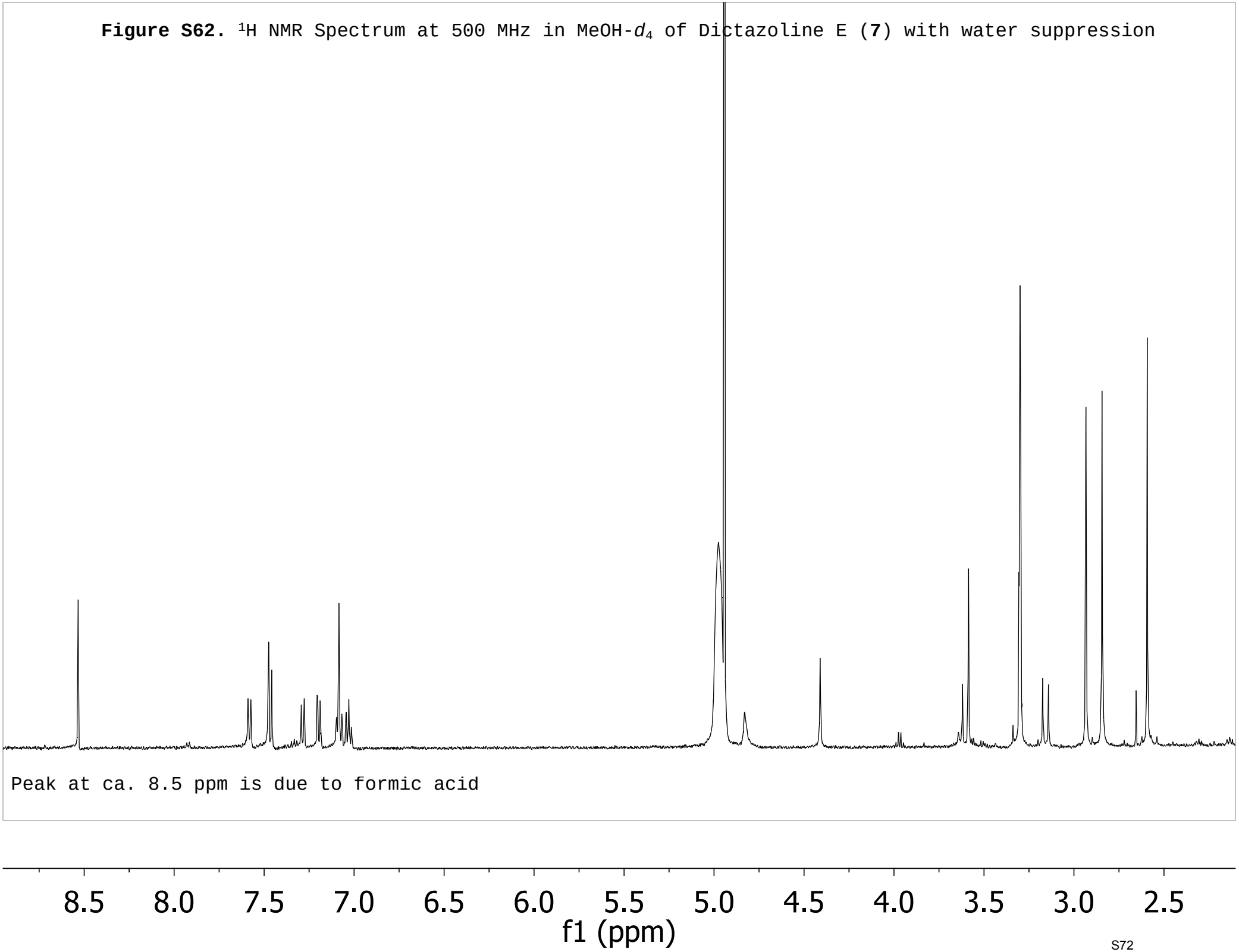


Figure S63. ^{13}C NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline E (7)

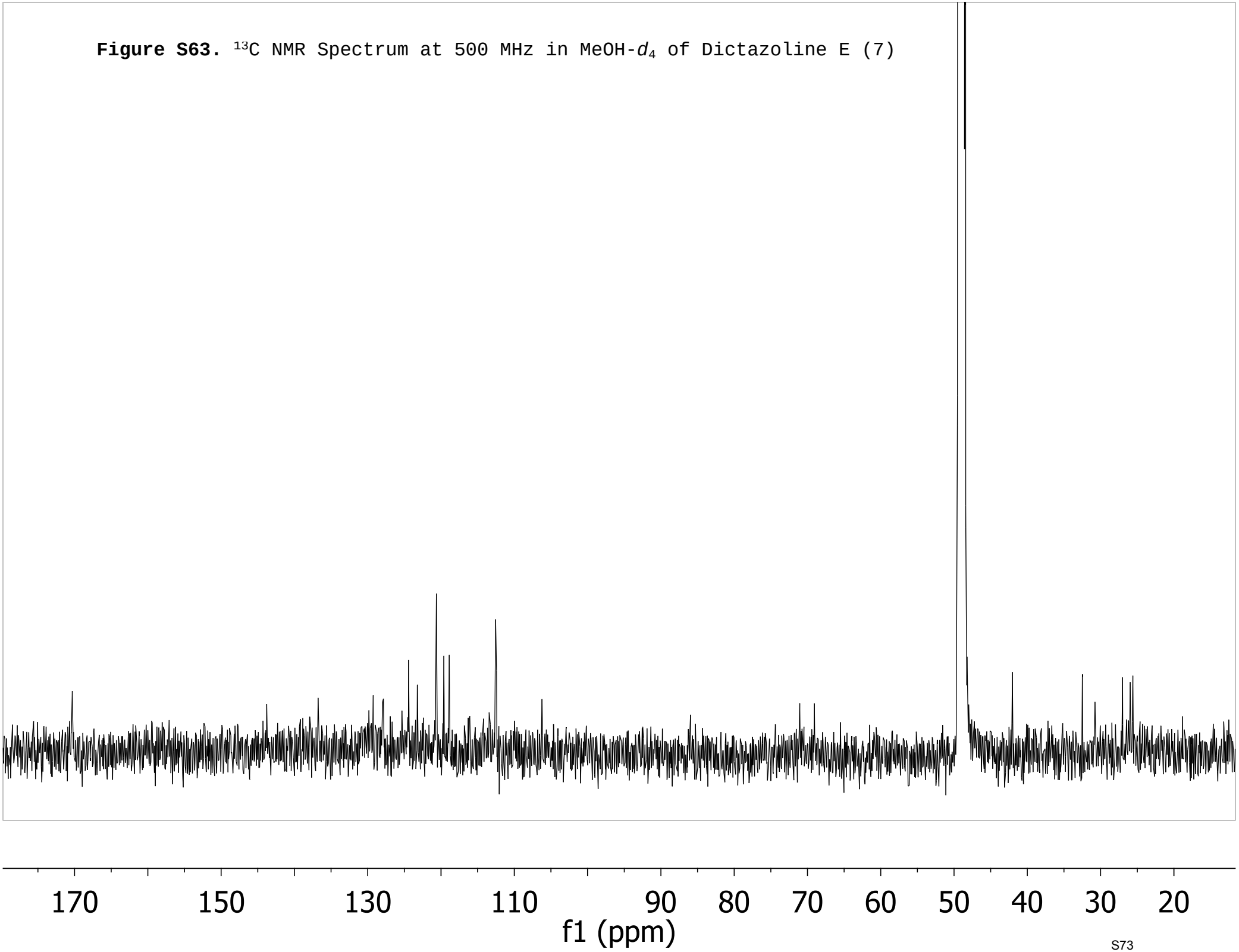


Figure S64. NOESY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline E (**7**)

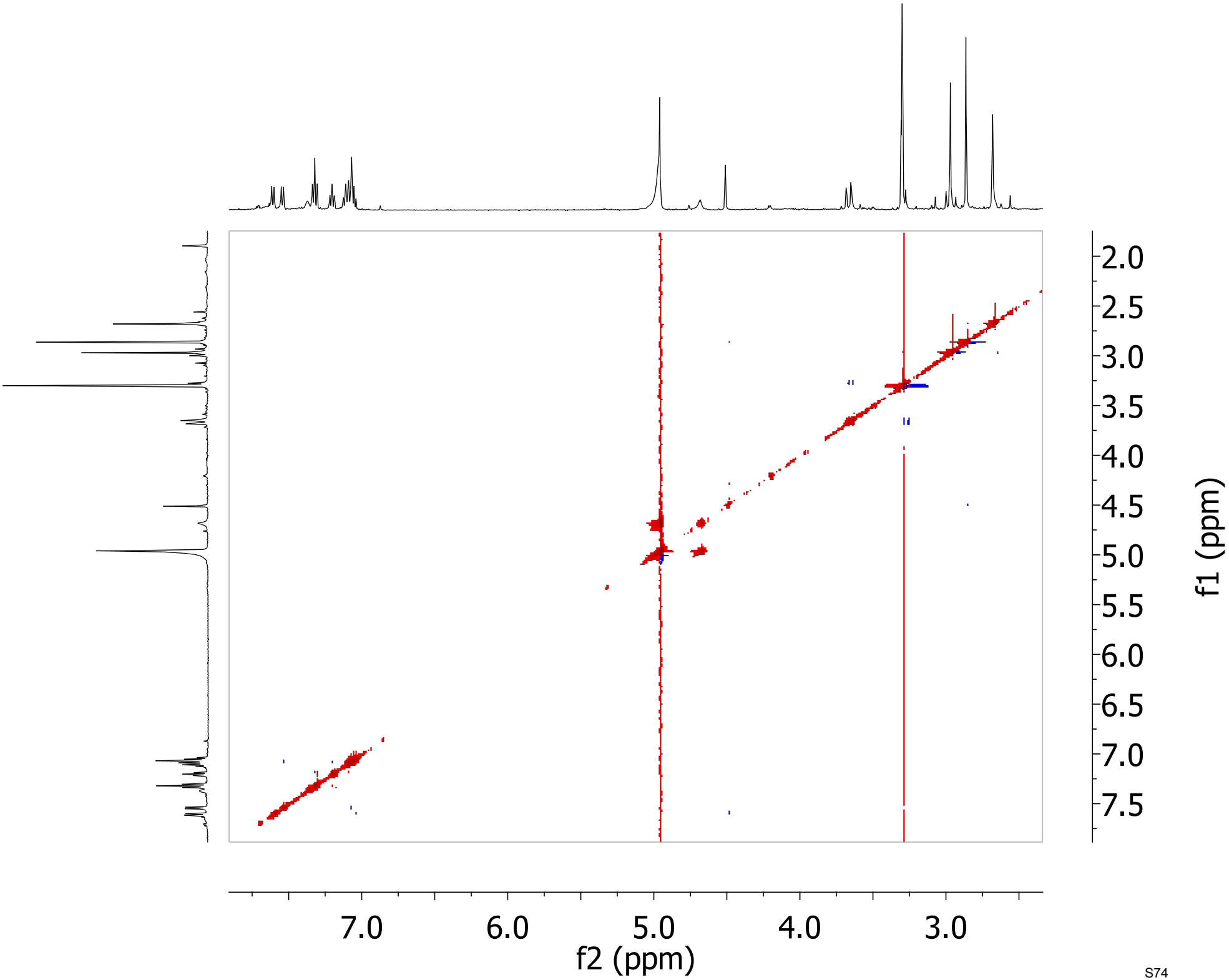


Figure S65. Expansion of NOESY NMR Spectrum at 500 MHz in MeOH-d_4 of Dictazoline E (**7**)

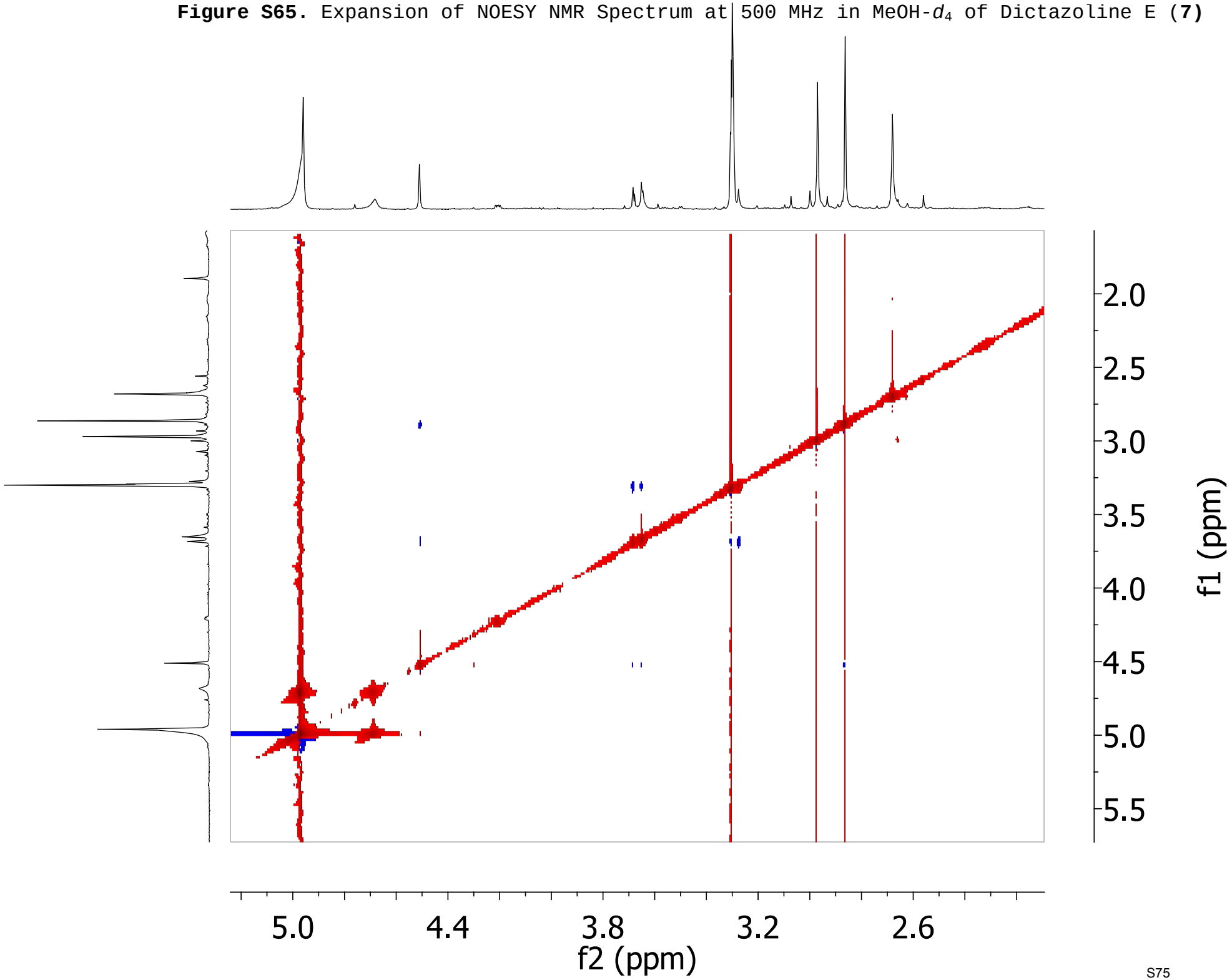


Figure S66. LC-MS Chromatogram of Compound **1** prior to microwave irradiation

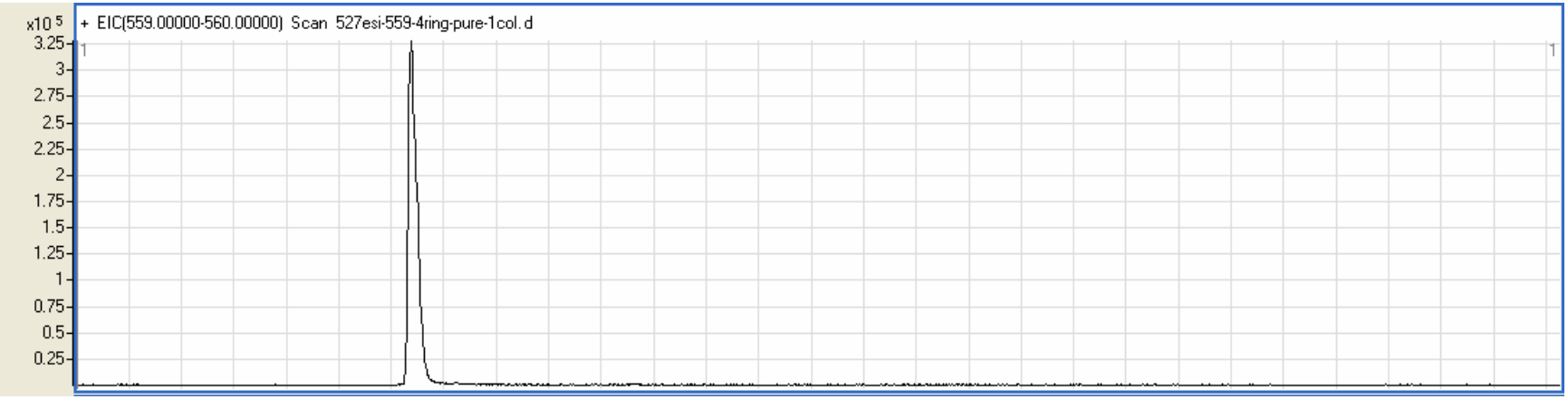
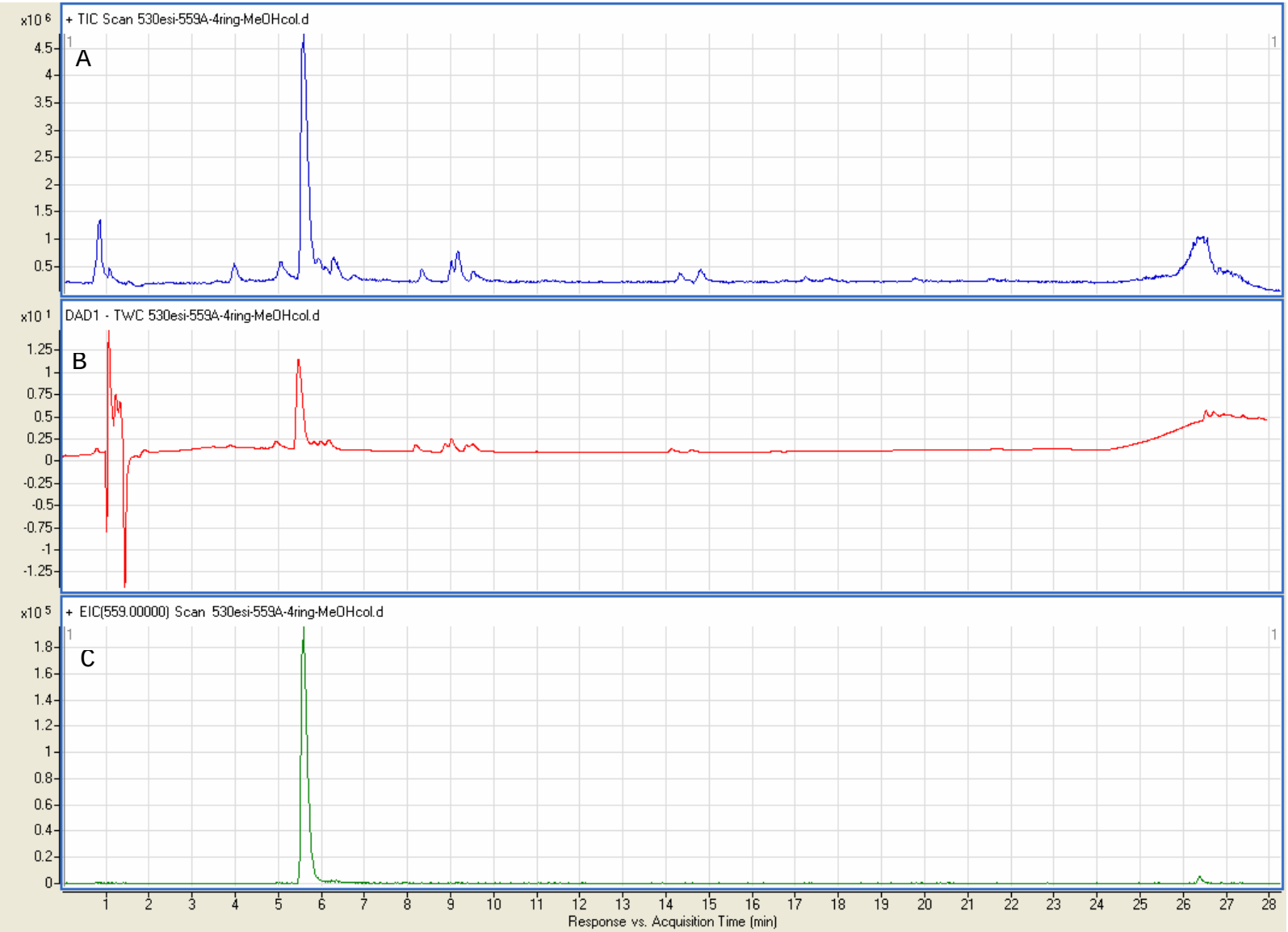
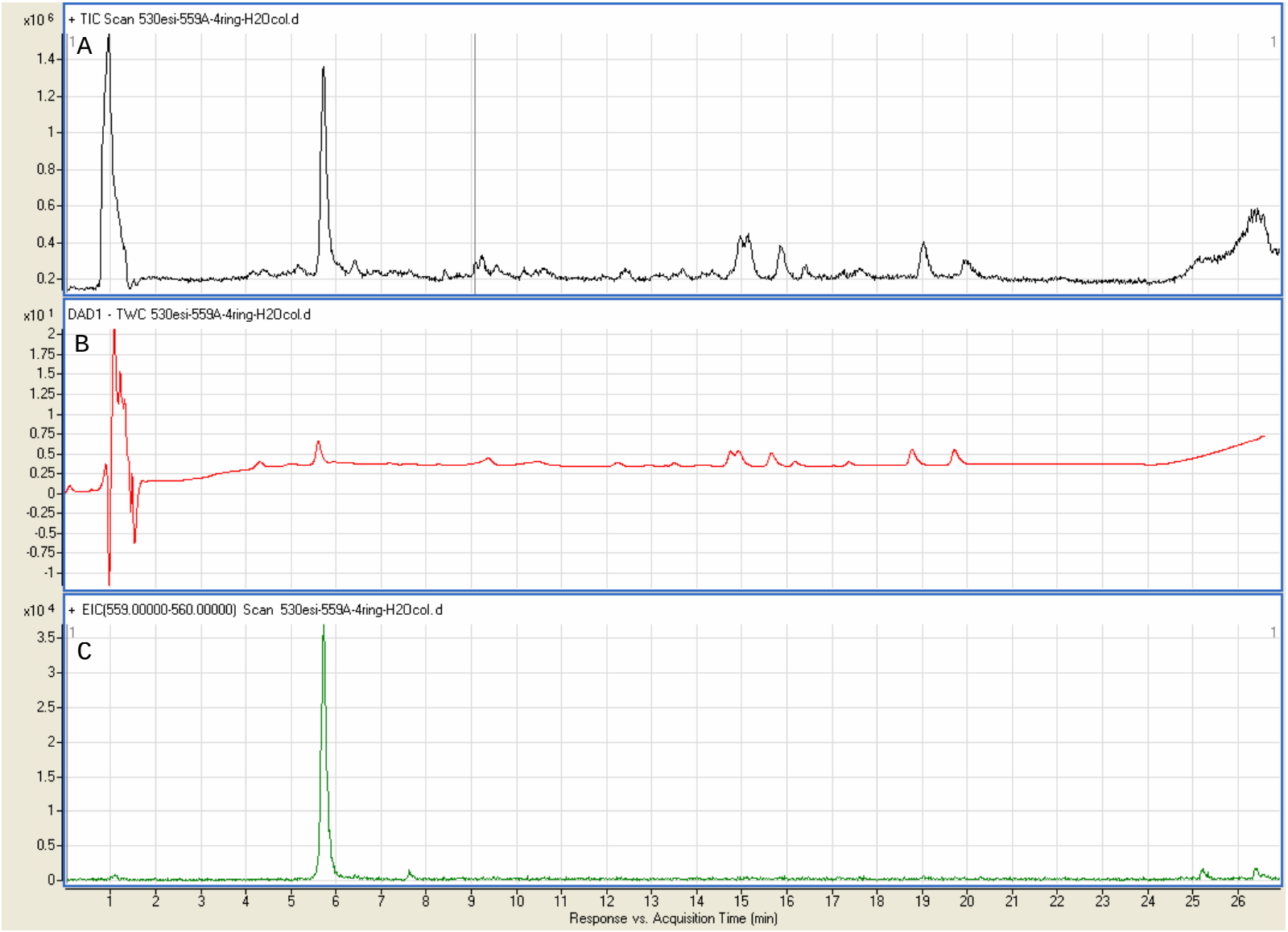


Figure S67. Chromatogram of Compound **1** after heating in Methanol



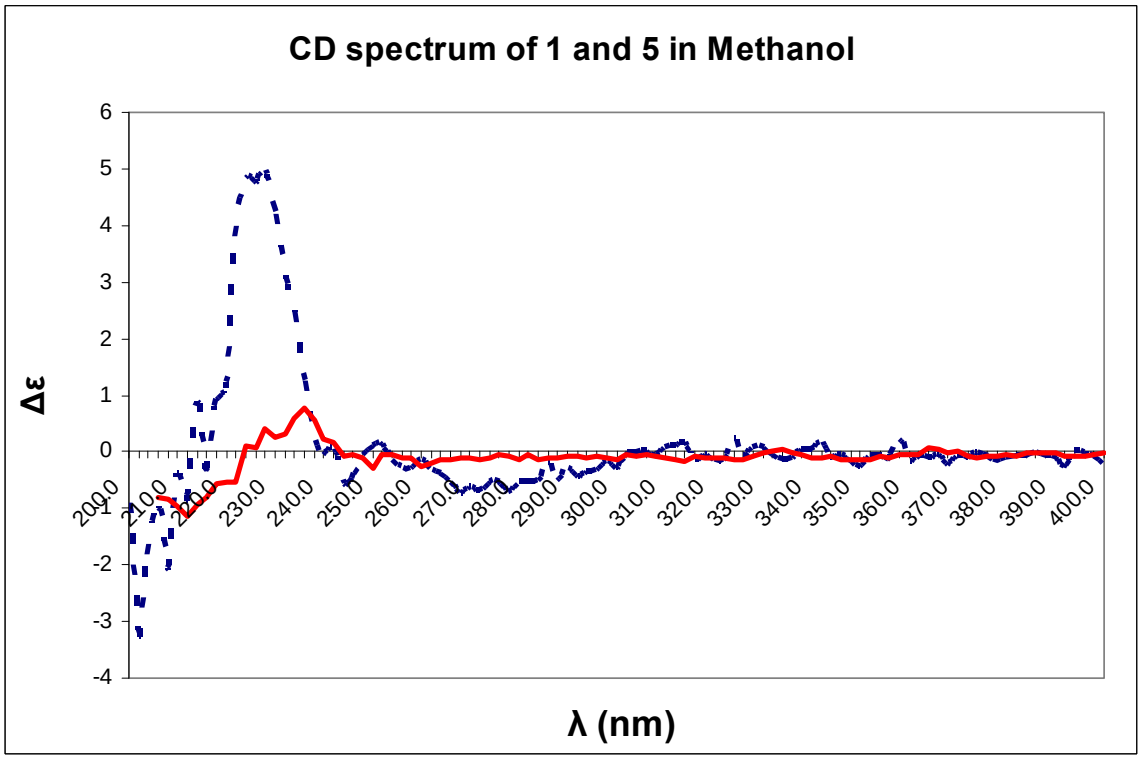
Chromatogram of **1** after microwave irradiation in methanol. A) Total Ion Chromatogram (200-2000 *m/z*) B)Diode Array Chromatogram (200-800 nm)C) Extract Ion Chromatogram (*m/z* 559-560). Column was not overloaded in this initial run. Data from 2nd trial is shown in the paper.

Figure S68. Chromatogram of Compound **1** after heating in Water



Chromatogram of **1** after microwave irradiation in water. A) Total Ion Chromatogram (200-2000 *m/z*) B)Diode Array Chromatogram (200-800 nm)C) Extract Ion Chromatogram (*m/z* 559-560).

Figure S69. CD spectrum of 1 and **5**



CD spectrum of compound **1** (solid red line) and **5** (dashed blue line)