Supporting Information

Enantioselective Total Synthesis of (+)-Arborescidine C and Related Tetracyclic Indole Alkaloids Using Organocatalysis.

Vishal M. Sheth,[†] Bor-Cherng Hong,[*,†] and Gene-Hsiang Lee[‡]

[†]Department of Chemistry and Biochemistry, National Chung Cheng University, Chia-Yi, 621, Taiwan, R.O.C.
[‡]Instrumentation Center, National Taiwan University, Taipei, 106, Taiwan, R.O.C.

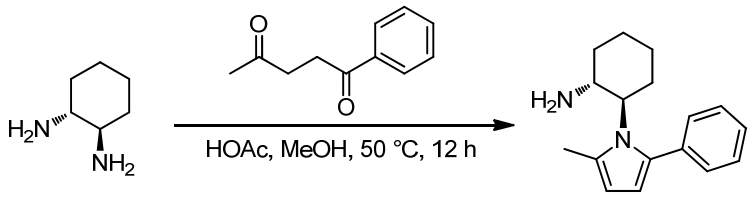
chebch@ccu.edu.tw

SUPPORTING INFORMATION:

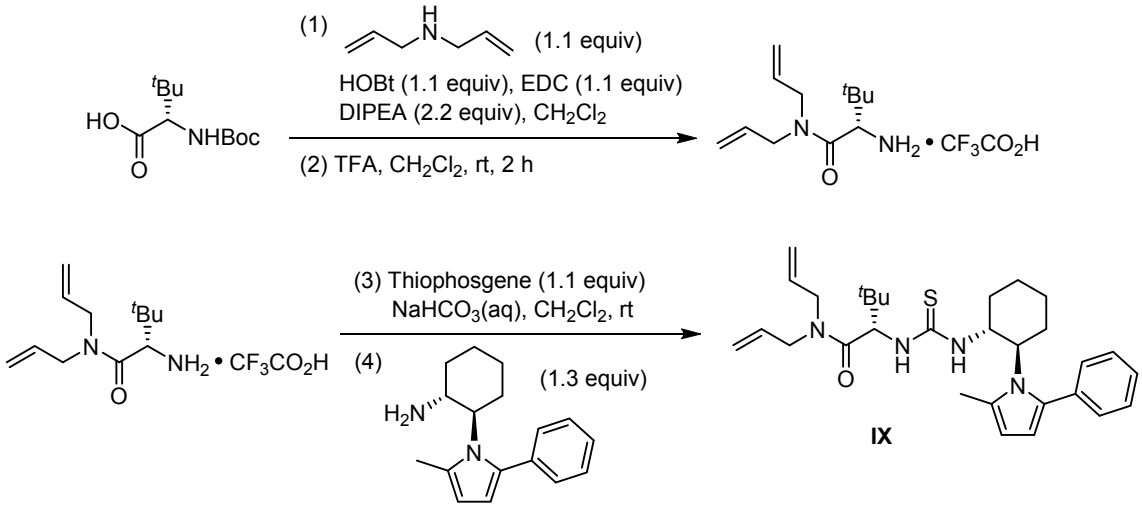
Contents:

General Procedure. All solvents were reagent grade. Reactions were normally carried out under nitrogen atmosphere in glassware. Merck silica gel 60 (particle size 0.04-0.063 mm) was employed for flash chromatography. Melting points are uncorrected. ^{1}H NMR spectra were obtained in $CDCl_3$ unless otherwise noted at 400 MHz (Bruker DPX-400) or 500 MHz (Varian-Unity INOVA-500). ^{13}C NMR spectra were obtained at 100 MHz or 125 MHz. *E.e.* values were measured by HPLC on a chiral column (chiralpak IA, or OD-H, 0.46 cm ID x 25 cm, particle size 5 μ). The flow rate of the indicated elution solvent is maintained at 1 mL/min, and the retention time of a compound is recorded accordingly. HPLC was equipped with the ultraviolet and refractive index detectors. The melting point was recorded on a melting point apparatus (MPA100 – Automated melting point system, Stanford Research Systems, Inc.) and is uncorrected. The optical rotation values were recorded with a Jasco-P-2000 digital polarimeter.

Representative Procedure for the preparation of catalyst IX.[1]



To a solution of (1*R*,2*R*)-cyclohexane-1,2-diamine (160 mg, 1.40 mmol) in methanol (7 mL) was sequentially added acetic acid (80 μL, 1.40 mmol) and 1-phenylpentane-1,4-dione (234 μL, 1.40 mmol). The solution was heated to reflux for 50 °C and stirred for 12 h, followed by cooled to room temperature and concentrated in vacuo. The residue was diluted with CH_2Cl_2 (20 mL), and the solution was washed with an aqueous MeOH solution (4 M, 20 mL). The aqueous solution was extracted twice with CH_2Cl_2 (50 mL). The combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give the crude product, which was directly used for the next-step reaction without further purification.



Step 1: To a suspension of (L)-(*S*)-Boc-*tert*-leucine (200 mg, 0.865 mmol) and 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide (EDC, 148 mg, 0.95 mmol, 1.1 equiv) and 1-hydroxybenzotriazole (HOBt, 128 mg, 0.95 mmol, 1.1 equiv) in CH_2Cl_2 (9 mL) was sequentially added diisopropylethylamine (0.33 mL, 1.89 mmol, 2.2 equiv) and diallylamine (0.12 mL, 0.95 mmol, 1.1 equiv) at room temperature. The reaction solution was stirred at

[1] Catalyst **I** was purchased from Alfa Aesar Chemicals Ltd. Catalyst **II**, **X**, and **XI** was purchased from Sigma-Aldrich Co. LLC. Catalyst **III** was purchased from Strem Chemicals, Inc. Catalyst **XII** was purchased from DAICEL Chiral Technologies Co., Ltd. Catalyst **IV** was prepared from the coupling reaction of (1*R*,2*R*)-cyclohexane-1,2-diamine and (*S*)-*tert*-butyl- 2-(isothiocyanatomethyl)pyrrolidine-1-carboxylate, followed by the deprotection of *tert*-butyl group; for reference, see: J.-R. Chen, Y.-J. Cao, Y.-Q. Zou, F. Tan, L. Fu, X.-Y. Zhu, W.-J. Xiao, *Org. Biomol. Chem.*, 2010, **8**, 1275–1279. Catalyst **V**–**IX** was prepared according to the literature procedure (catalyst **V**–**VIII** are known): (a) M. S.; Taylor, E. N. Jacobsen, *J. Am. Chem. Soc.,* 2004, **126**, 10558–10559. (b) I. T. Raheem, P. S. Thiara, E. A. Peterson, E. N. Jacobsen, *J. Am. Chem. Soc.,* 2007, **129**, 13404–13405. (c) A. R. Brown, C. Uyeda, C. A. Brotherton, E. N. Jacobsen, *J. Am. Chem. Soc.,* 2013, **135**, 6747−6749. Representative procedure for the synthesis of catalyst **IX** is shown herein.

room temperature for 36 h, then diluted with CH_2Cl_2 (20 mL). The solution was washed twice with 1N aqueous HCl solution (10 mL), twice with satuated aqueous $NaHCO_3$ solution (20 mL), brine, and dried over $MgSO_4$. The solution was concentrated in vacuo to give the crude product which was used in the following step without further purification.

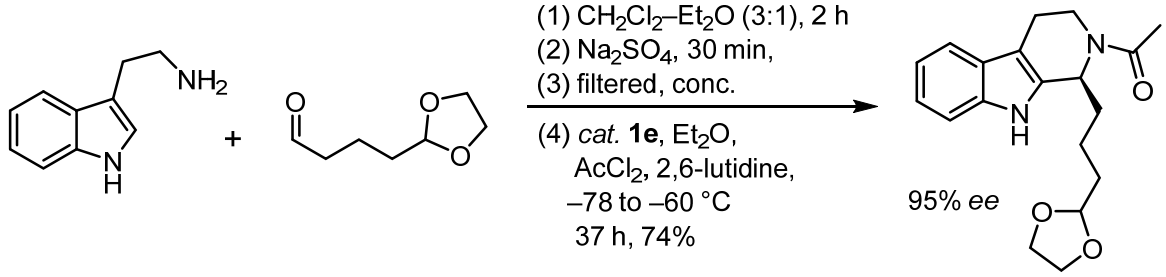
Step 2: To a solution of the above crude product in CH_2Cl_2 (2 mL) was added trifluroacetic acid (330 μL, 4.32 mmol, excess), and the resulting solution was stirred at room temperature for 2h. The solution was concentrated *in vacuo* to yield the crude product, which was used in step 3 without further purification.

Step 3: To a solution of the above crude product in CH_2Cl_2 (6 mL) was added a saturated aqueous $NaHCO_3$solution (6 mL) at 0 °C. The mixture was stirred for 5 mins, then stirring was stopped, and thiophosgene (73 μL, 0.95 mmol, 1.1 equiv) was added to the organic (lower) phase by syringe. The resulting orange mixture was restored to stir at 0 °C for 20 mins. To this mixture was added CH_2Cl_2 (10 mL), and the organic layer was separated. The aqueous layer was extracted twice with CH_2Cl_2 (15 mL). The combined organic extracts were dried over $MgSO_4$ and concentrated in vacuo to give the crude product as a yellow oil, which was used in step 4 immediately, without further purification.

Step 4: To a solution of the above crude product in CH_2Cl_2 (1 mL) was added by syringe of a solution of (1*R*,2*R*)-2-(2-methyl-5-phenyl-1*H*-pyrrol-1-yl)cyclohexanamine (283 mg, 1.11 mmol 1.3 equiv) in CH_2Cl_2 solution (2 mL, including the rinsing of the round bottom flask) at room temperature. The resulting solution was stirred at room temperature for 15 h, and then concentrated *in vacuo* to give the residue. The crude product was purified by flash column chromatography with 10% to 15% EtOAc-hexane (R_f = 0.38 for **IX** in 20 % EtOAc-hexane) to afford the product **IX** as a yellow foam (375 mg, 85% yield from Boc-*tert*-leucine).

Selected spectroscopic data for **IX**: IR (neat): 3297, 3075, 2936, 2861, 1629, 1521, 1446, 1416, 1364, 1321, 1231, 925, 755, 701 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.42 – 7.39 (m, 2 H), 7.32 – 7.28 (m, 3 H), 5.99 (brs, 2 H), 5.84 – 5.67 (m, 3 H), 5.22 – 5.02 (m, 5 H), 4.48 (brs, 1 H), 4.22 – 3.96 (m, 4 H), 3.72 – 3.65 (m, 1 H), 2.46 (s, 3 H), 2.28 – 2.16 (m, 3 H), 1.90 – 1.64 (m, 4 H), 1.42 – 1.20 (m, 2 H), 0.94 (s, 9 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 181.9 (C), 171,5 (C), 135.8 (C), 134.3 (C), 133.4 (two CH), 132.7 (two CH), 130.0 (C), 129.5 (CH), 128.8 (CH), 127.0 (CH), 118.4 (CH_2), 117.6 (CH_2), 110.0 (CH), 108.7 (CH), 60.0 (CH), 59.6 (CH), 56.0 (CH), 50.3 (CH_2), 47.3 (CH_2), 36.1 (C), 33.7 (CH_2), 32.3 (CH_2), 26.7 (three CH_3), 25.7 (CH_2), 24.6 (CH_2), 15.4 (CH_3); MS (*m/z*, relative intensity): 508 (M^++2, 4), 507 (M^++1, 14), 506 (M^+, 40), 411 (22), 410 (78), 409 (17), 348 (9), 297 (48), 253 (15), 237 (100), 157 (34), 86 (67); exact mass calculated for $C_{30}H_{42}N_4OS$ (M^+): 506.3079; found: 506.3076.

Preparation of adduct 6.

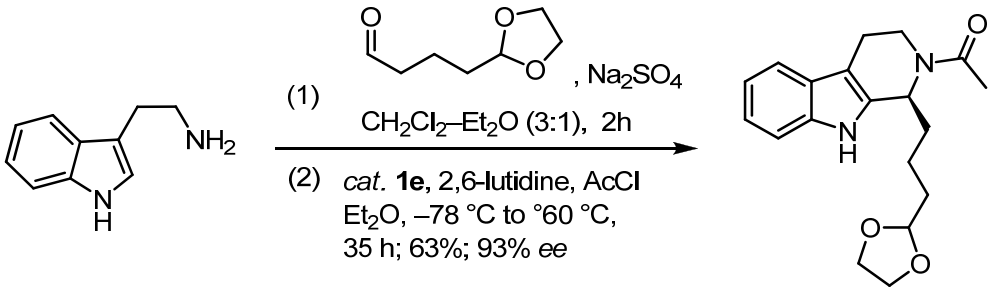


2a **6**

To a solution of tryptamine (40 mg, 0.25 mmol) in CH_2Cl_2 (6 mL) was added a solution of aldehyde **2a**[1] (36 mg, 0.25 mmol) in CH_2Cl_2 (3 mL), followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, followed by the addition of Na_2SO_4 (500 mg), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The resulting solution was filtered by cannula transfer, and the remaining was rinsed twice with dichloromethane (2 x 5 mL). The combined solution was concentrated *in vacuo* to give the crude imine as a pale yellow oil, which was immediately dissolved in Et_2O (15 mL) for the next step reaction. To this solution was added catalyst **IX** (6.5 mg, 0.013 mmol, 5 mol %) and 2,6-lutidine (29 μL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added acetyl chloride (18 μL, 0.25 mmol, 1.0 equiv), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 37 h. The resulting heterogeneous mixture was allowed to warm to room temperature and stirred for 30 mins followed by concentration in *vacuo*. The crude product was purified by flash column chromatography with 50 to 60% EtOAc-hexane (R_f = 0.40 in 80% EtOAc-hexane) to afford product **6** (61 mg, 74% yield) as a white solid. M.p. 169–170 °C; $[\alpha]_D^{25}$ 100.6 (*c* 1, $CHCl_3$). The enantiomeric excess was determined to be 95 % by HPLC with chiral column CHIRALPAK® IA, 12% *i*-PrOH/n-hexane, flow rate 1.0 mL, λ = 254 nm (t_{major} = 22.2 min, t_{minor} = 25.0 min). IR (neat): 3276, 3008, 2951, 2923, 2888, 1619, 1447, 1361, 1301, 1231, 1140, 1031, 945, 746 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): the compound exists as a 4:1 mixture of amide rotamers, signals corresponding to the major rotamer: δ 8.46 (brs, 1 H), 7.43 (d, J = 8.0 Hz, 1 H), 7.29 (d, J = 8.0 Hz, 1 H), 7.16 – 7.04 (m, 2 H), 5.78 (t, J = 8.0 Hz, 1 H), 4.86 (t, J = 4.5 Hz, 1 H), 4.00 – 3.80 (m, 5 H), 3.56 – 3.45 (m, 1 H), 2.86 – 2.74 (m, 2 H), 2.21 (s, 3 H), 2.00 – 1.55 (m, 6 H); ^{13}C NMR (125 MHz, $CDCl_3$) signals corresponding to the major rotamer: δ 169.6 (C), 136.0 (C), 134.5 (C), 126.6 (C), 121.7 (CH), 119.4 (CH), 117.9 (CH), 110.9 (CH), 107.4 (C), 104.4 (CH), 64.84 (CH_2), 64.78 (CH_2), 48.6 (CH), 41.1 (CH_2), 34.0 (CH_2), 33.2 (CH_2), 22.0 (CH_2), 21.9 (CH_3), 20.5 (CH_2); MS (*m/z*, relative intensity): 329 (M^++1, 4), 328 (15), 285 (3), 213 (74), 171 (70), 101 (36), 73 (36), 58 (100); exact mass calculated for $C_{19}H_{24}O_3N_2$ (M^+): 328.1789; found: 328.1787.

[1] For best results, the aldehyde was used immediately after purification.

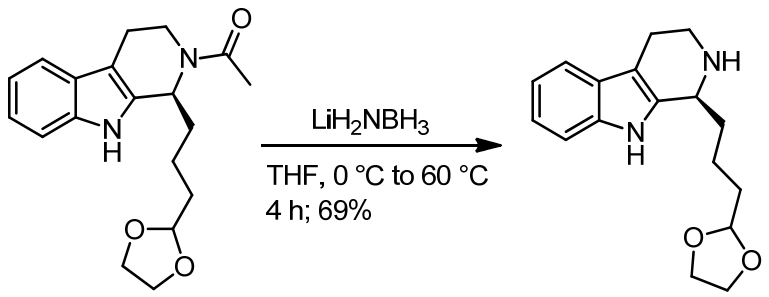
One-pot operation of the preparation of adduct 6.



6

To a solution of tryptamine (40 mg, 0.25 mmol) in CH_2Cl_2 (6 mL) was added dropwise a solution of aldehyde **2a** (36 mg, 0.25 mmol) in CH_2Cl_2 (3 mL), followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, followed by the addition of Na_2SO_4 (500 mg), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The resulting solution was carefully concentrated *in vacuo* and applied in high vacuum for complete removal of solvent. The crude imine, as a pale yellow oil, was diluted with Et_2O (15 mL). To this solution was added catalyst **IX** (6.5 mg, 0.013 mmol, 5 mol %) and 2,6-lutidine (29 µL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added acetyl chloride (18 µL, 0.25 mmol, 1.0 equiv), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 35 h. The resulting heterogeneous mixture was allowed to warm to room temperature and stirred for 30 mins followed by concentration *in vacuo*. The crude product was purified by flash column chromatography with 50 to 60% EtOAc-hexane (R_f = 0.40 in 80% EtOAc-hexane) to afford product **6** (52 mg, 63% yield) as a white solid. The enantiomeric excess was determined to be 93 % by chiral HPLC with chiral column CHIRALPAK® IA.

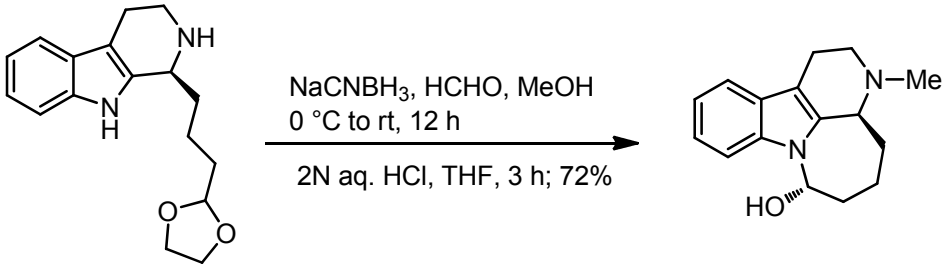
Preparation of amine 10.



6 **10**

To a solution of diisopropylamine (0.61 mL, 4.35 mmol, 7.1 equiv) in THF (4.4 mL) was added a solution of *n*-butyllithium (2.04 mL, 2.15 M in hexane, 4.39 mmol, 7.2 equiv) at –78 °C and stirred at the same temperature for 10 min, followed by warm up to 0 °C and stirred for 15 min. To this solution was added borane-ammonia complex (118 mg, 90% purity, 3.44 mmol, 5.6 equiv), and the suspension solution was stirred at 0 °C for 15 min, followed by warm up to room temperature and stirred for additional 10 min. To the solution was added **6 (**200 mg, 0.609 mmol) at 0 °C and stirred for 2 min, followed by heating up to 60 °C and stirred for 4 h. The resulting suspension was cooled to 0°C and the reaction was quenched by dropwise addition of 2N aqueous HCl solution (10 mL), followed by stirring for 30 min. The pH value of the solution was adjusted to 8 by the addition of saturated aqueous $NaHCO_3$. The reaction mixture was extracted five times with ethyl acetate (5 x 20 mL), and the combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give the residue. The crude product was purified by flash column chromatography with 5 to 10% MeOH-CH_2Cl_2 (R_f = 0.38 in 20% MeOH-CH_2Cl_2) to afford product **10** (120 mg, 69% yield) as a colorless oil. Selected spectroscopic data for **10**: $[\alpha]_D^{25}$ –51.2 (*c* 0.65, MeOH); IR (neat): 3169, 2922, 2767, 1583, 1456, 1307, 1140, 943, 741 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.93 (brs, 1 H), 7.46 (d, *J* = 8.0 Hz, 1 H), 7.29 (d, *J* = 7.5 Hz, 1 H), 7.14 – 7.05 (m, 2 H), 4.87 (t, *J* = 4.5 Hz, 1 H), 4.08 – 4.04 (m, 1 H), 3.98 – 3.95 (m, 2 H), 3.87 – 3.83 (m, 2 H), 3.35 – 3.30 (m, 1 H), 3.05 – 2.98 (m, 1 H), 2.75 – 2.69 (m, 2 H), 1.94 – 1.86 (m, 1 H), 1.78 – 1.60 (m, 6 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 136.1 (C), 135.6 (C), 127.5 (C), 121.5 (CH), 119.3 (CH), 118.0 (CH), 110.7 (CH), 109.1 (C), 104.4 (CH), 64.88 (CH_2), 64.86 (two CH_2), 52.4 (CH) 42.5 (CH_2), 34.6 (CH_2), 33.4 (CH_2), 22.7 (CH_2), 20.2 (CH_2); MS (*m/z*, relative intensity): 286 (M^+, 10), 285 (M^+-1, 4), 241 (2), 184 (6), 172 (23), 171 (100), 144 (11), 115 (4), 99 (3), 73 (8); exact mass calculated for $C_{17}H_{22}O_2N_2$ (M^+): 286.1681; found: 286.1681.

Preparation of 5.



10 **5**

To a solution of **10** (90 mg, 0.314 mmol) in methanol (3.2 mL) was added $NaCNBH_3$ (50 mg, 0.80 mmol) at 0 °C. The resulting solution was stirred at 0 °C for 5 min followed by the addition of 37% aqueous HCHO solution (3 mL). The solution was stirred at room temperature for 12 h until the completion of the reaction, as monitored by TLC. The solution was concentrated *in vacuo* to give the residue. The residue was dissolved in THF (3.2 mL), followed by the addition of an aqueous solution of 2N HCl (3 mL), and the reaction mixture was stirred for 3 h at room temperature. The reaction was quenched with the addition of solid $NaHCO_3$ and the pH value of the solution was adjusted to 8. The reaction mixture was extracted with EtOAc (3 x 15 mL), and the combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 10% MeOH–CH_2Cl_2 (R_f = 0.45 in 15% MeOH–CH_2Cl_2) to afford product **5** (58 mg, 72% yield) as a white solid. M.p. 143–144 °C, lit.[2] 140–142 °C. The enantiomeric excess was determined to be 97 % by HPLC analysis with chiral column CHIRALCEL® OD-H, 10% (10% MeOH–EtOAc) / 90% Hexane, flow rate 1.0 mL, λ = 280 nm (t_{major} = 12.3 min, t_{minor} = 19.2 min). Selected spectroscopic data for **10**: $[\alpha]_D^{25}$ +3.0 (*c* 1, $CHCl_3$), lit.[2] $[\alpha]_D^{25}$ = +3.2; IR (neat): 3337, 3053, 2928, 2854, 1464, 1262, 1103, 1020, 802, 739 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.43 (d, J = 7.5 Hz, 1 H), 7.25 (d, J = 8.5 Hz, 1 H), 7.14 (dd, J = 7.5, 8.5 Hz, 1 H), 7.07 (dd, J = 7.5, 8.5 Hz, 1 H), 6.18 (d, J = 3.0 Hz, 1 H), 3.63 (d, J = 11.5 Hz, 1 H), 3.03 – 2.96 (m, 1 H), 2.80 – 2.62 (m, 3 H), 2.47 (s, 3 H), 2.35 – 2.07 (m, 3 H), 1.82 – 1.75 (m, 1 H), 1.67 – 1.59 (m, 1 H), 1.47 – 1.37 (m, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 137.4 (C), 136.0 (C), 126.7 (C), 121.2 (CH), 119.3 (CH), 118.2 (CH), 108.8 (C), 108.4 (CH), 76.4 (CH), 61.6 (CH), 50.9 (CH_2) 42.7 (CH_3), 34.3 (CH_2), 32.7 (CH_2), 20.4 (CH_2), 20.2 (CH_2); MS (*m/z*, relative intensity): 257 (M^++1, 20), 256 (100), 255 (68), 227 (11), 213 (98), 185 (63), 184 (80), 183 (60), 156 (40), 143 (30); exact mass calculated for $C_{16}H_{20}ON_2$ (M^+): 256.1576; found: 256.1575.

[2] Pravat, M.; Argade, N. P. *J. Org. Chem.* **2013**, *78*, 6802 – 6808.

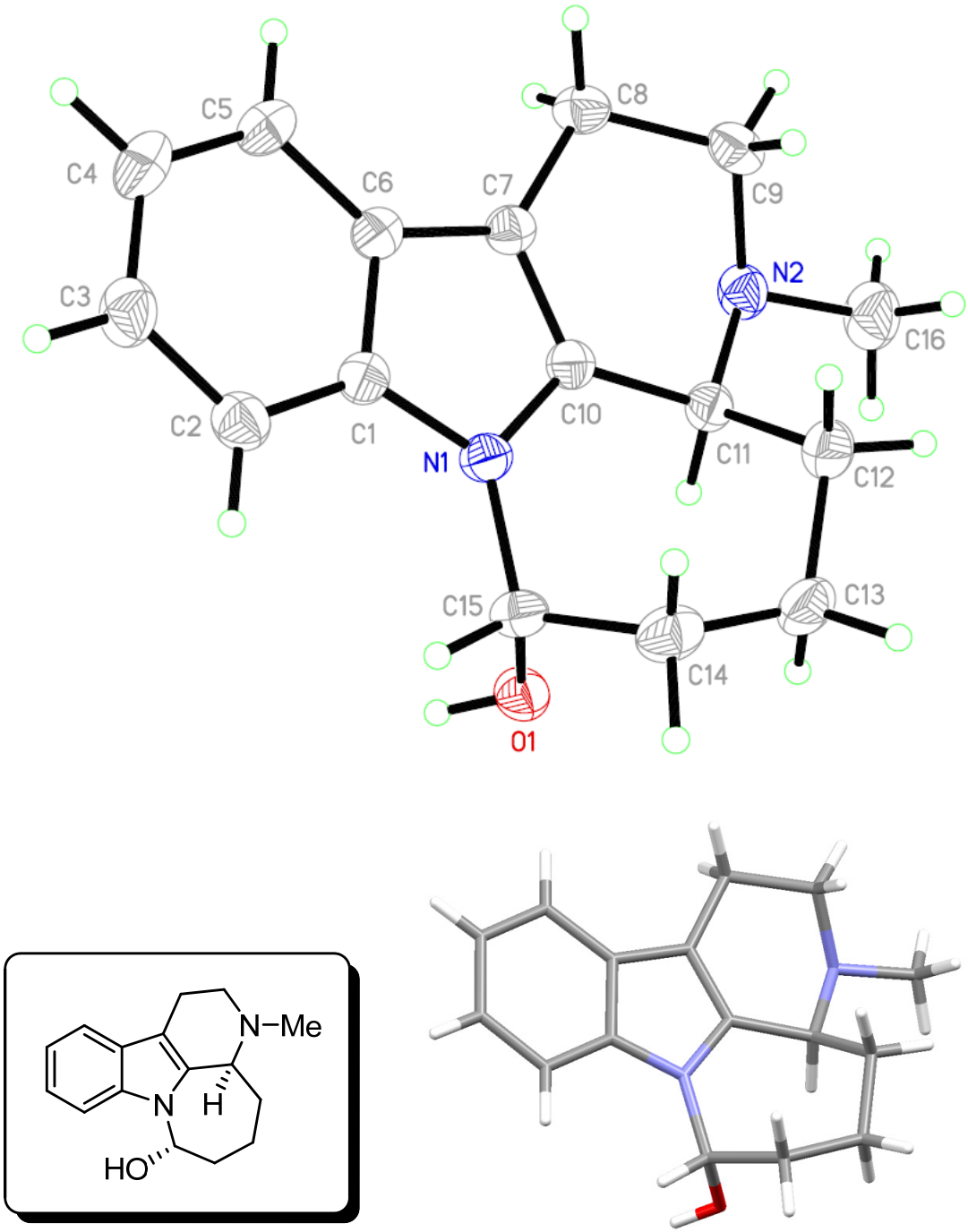


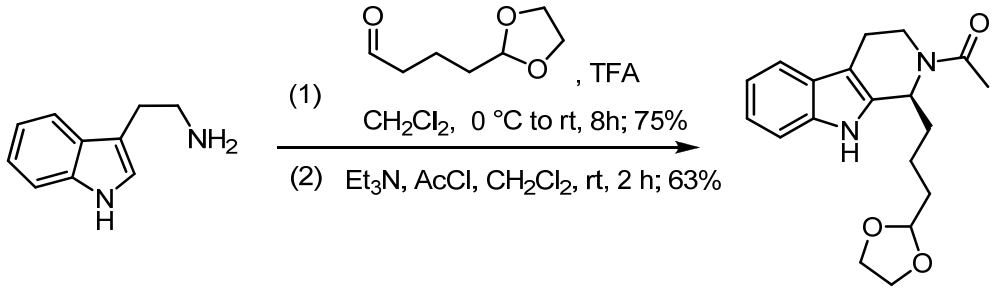
Figure S1. ORTEP and Stereo plots for X-ray crystal structures of (+)-**5**.

CCDC 1523958 contains the supplementary crystallographic data for (+)-**5**. These data can be obtained free of charge from the Cambridge Crystallographic Data Centre via www.ccdc.cam.ac.uk/data_request/cif.

Table S1. Crystal data and structure refinement for (+)-5, ic18036.

Identification code	ic18036	
Empirical formula	$C_{16}H_{20}N_2O$	
Formula weight	256.34	
Temperature	200(2) K	
Wavelength	1.54178 Å	
Crystal system	Monoclinic	
Space group	$P2_1$	
Unit cell dimensions	a = 8.1090(2) Å	α= 90°.
	b = 9.1450(2) Å	β= 96.4248(6)°.
	c = 9.2939(2) Å	γ = 90°.
Volume	684.88(3) Å^3	
Z	2	
Density (calculated)	1.243 Mg/m^3	
Absorption coefficient	0.614 mm^{-1}	
F(000)	276	
Crystal size	0.333 x 0.096 x 0.074 mm^3	
Theta range for data collection	4.788 to 69.997°.	
Index ranges	-9<=h<=9, -11<=k<=11, -11<=l<=11	
Reflections collected	4672	
Independent reflections	2573 [R(int) = 0.0123]	
Completeness to theta = 67.679°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.7533 and 0.5807	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	2573 / 1 / 175	
Goodness-of-fit on F^2	1.045	
Final R indices [I>2sigma(I)]	R1 = 0.0254, wR2 = 0.0657	
R indices (all data)	R1 = 0.0258, wR2 = 0.0662	
Absolute structure parameter	0.05(6)	
Extinction coefficient	0.0119(13)	
Largest diff. peak and hole	0.167 and -0.130 e.Å^{-3}	

General procedure for Preparation of racemic compound (representative procedure for the preparation of (±)-6 and (±)-5:



(±)-**6**

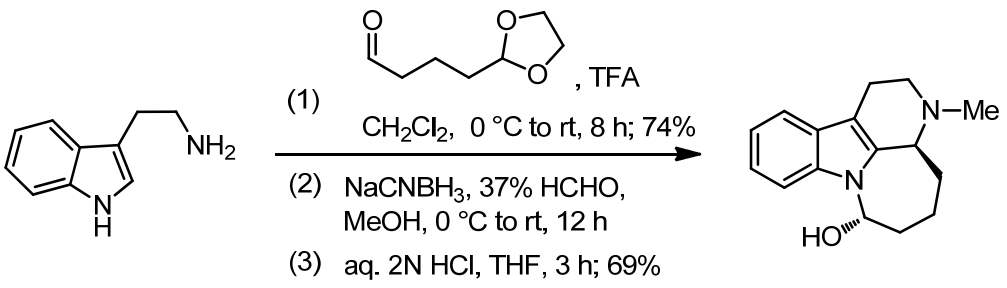
Step 1:

A solution of tryptamine (30 mg, 0.187 mmol) and aldehyde **2a**[3] (27 mg, 0.187 mmol) in CH_2Cl_2 (2 mL) was stirred at 0 °C, followed by the addition of a solution of trifluoroacetic acid (32 mg, 0.28 mmol, 1.5 equiv) in CH_2Cl_2 (0.5 mL) and sodium sulfate (100 mg). The mixture was vigorously stirred at 0 °C and gradually warm up to room temperature for 8 h until the completion of the reaction, monitored by TLC. The reaction was quenched by the addition of saturated aqueous $NaHCO_3$ solution (10 mL). The reaction mixture was extracted with CH_2Cl_2 (5 mL x 3), and the combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 10% EtOAc-hexane (R_f = 0.38 in 20% MeOH-CH_2Cl_2) to afford product **10** (40 mg, 75% yield).

Step 2:

To a solution of **10** (25 mg, 0.087 mmol) and triethylamine (36 µL, 0.26 mmol, 3 equiv) in CH_2Cl_2 (0.4 mL) was added acetyl chloride (12 µL, 0.17 mmol, 1.9 equiv) at room temperature, and the solution was stirred for 2h until the completion of the reaction, monitored by TLC. The reaction mixture was diluted with water and extracted with CH_2Cl_2. The organic layer was washed with brine and dried over $MgSO_4$ to give the residue. The crude product was purified by flash column chromatography with 50–60 % ethyl acetate in hexane, (R_f = 0.40 in 80 % EtOAc-hexane) to afford **6** (18 mg, 63 % yield)

[3] For best results, the aldehyde was used immediately after purification.



(±)-**5**

Step 1:

Followed the same procedure as mentioned in the previous reaction to give **10.**

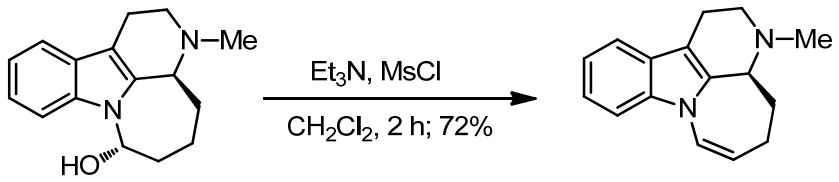
Step 2:

To a solution of **10** (60 mg, 0.21 mmol) in MeOH (2.1 mL) was added $NaCNBH_3$ (39 mg, 0.62 mmol, 3.0 equiv) at 0 °C, followed by the addition of 37% HCHO (2.1 mL). The solution was gradually warm up to room temperature and stirred for 12 h. The solution was concentrated *in vacuo* to give a residue.

Step 3:

To this residue was diluted with THF (2.1 mL) and added an aqueous 2N HCl solution (2.1 mL). The resulting mixture was stirred at room temperature for 3 h. The reaction was quenched by the addition of $NaHCO_3$ (solid), and the pH of the solution was adjusted to 8. The mixture was extracted with EtOAc, and the combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 7% MeOH–CH_2Cl_2 (R_f = 0.45 in 15% MeOH–CH_2Cl_2) to afford product **5** (37 mg, 69% yield).

Preparation of 11.

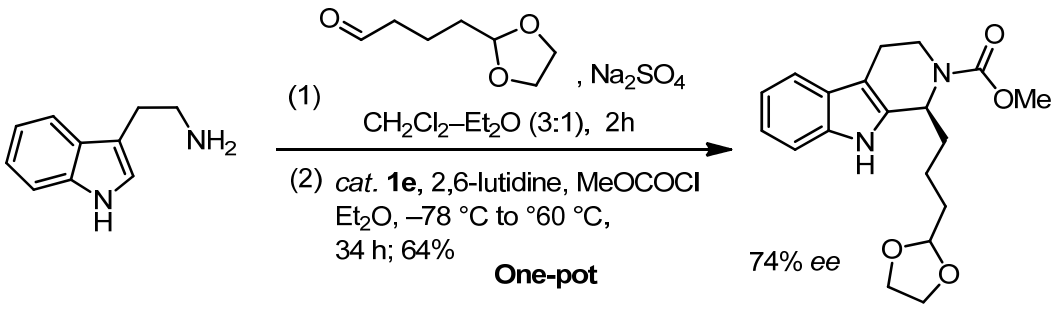


5 **11**

To a solution of **5** (30 mg, 0.117 mmol) and Et_3N (46 μL, 0.33 mmol) in CH_2Cl_2 (3.2 mL) was added methanesulfonyl chloride (14 μL, 0.18 mmol) at 0 °C. The resulting solution was stirred at 0 °C to room temperature for 2h. The reaction was quenched by the addition of water (2 mL), and the mixture was extracted with CH_2Cl_2 (3 x 5 mL). The organic solution was washed with saturated aqueous $NaHCO_3$ solution, brine, dried over Na_2SO_4, and the solution was concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 7% MeOH–CH_2Cl_2 (R_f = 0.7 in 15% MeOH–CH_2Cl_2) to afford product **11** (20 mg, 72% yield) as a white solid. M.p. 99–100 °C; lit.[4] 98–100 °C. Selected spectroscopic data for **11**: $[\alpha]_D^{26}$ +60.6 (*c* 1, $CHCl_3$), lit.[5] $[\alpha]_D$ +61 (*c* 1, $CHCl_3$), lit.[4] $[\alpha]_D^{25}$ +62.1 (*c* 0.36, $CHCl_3$); IR (neat): 2956, 2920, 1459, 1378, 1260, 1092, 1022, 802 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.46 (d, J = 8.0 Hz, 1 H), 7.32 (d, J = 8.5 Hz, 1 H), 7.19 (dd, J = 7.5, 7.5 Hz, 1 H), 7.12 (dd, J = 7.5, 7.5 Hz, 1 H), 6.91 (d, J = 10.0 Hz, 1 H), 5.07 – 5.02 (m, 1 H), 3.40 (d, J = 10.0 Hz, 1 H), 3.16 – 3.10 (m, 1 H), 2.96 – 2.88 (m, 1 H), 2.75 – 2.66 (m, 2 H), 2.57 – 2.49 (m, 1 H), 2.53 (s, 3 H), 2.45 – 2.30 (m, 2 H), 1.92 – 1.83 (m, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$):[4] δ 137.3 (C), 136.1 (C), 126.9 (C), 122.0 (CH), 121.8 (CH), 120.1 (CH), 118.2 (CH), 110.0 (CH), 109.2 (C), 109.1 (CH), 62.5 (CH), 52.9 (CH_2), 42.5 (CH_3), 30.0 (CH_2), 28.0 (CH_2), 20.7 (CH_2); MS (*m/z*, relative intensity): 238 (M^+, 100), 237 (87), 209 (30), 195 (89), 194 (62), 180 (26), 167 (33), 71 (27); exact mass calculated for $C_{16}H_{18}N$ (M^+): 238.1470; found: 238.1472.

[4] Mondal, P.; Argade, N. P. *J. Org. Chem.* **2013**, *78*, 6802−6808.
[5] Santos, L. S.; Theoduloz, C.; Pilli, R. A.; Rodriguez, J. *Eur. J. Med. Chem.* **2009**, *44*, 3810 – 3815.

Another one-pot Preparation of 3.



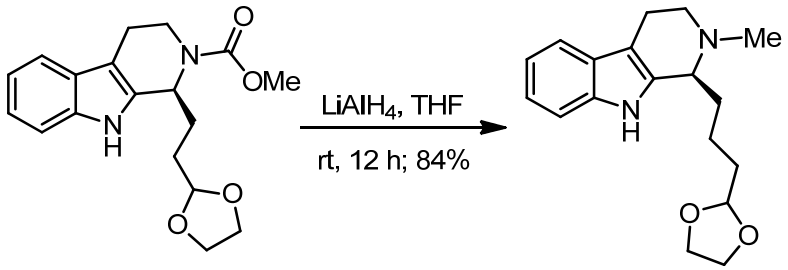
3

To a solution of tryptamine (40 mg, 0.25 mmol) in CH_2Cl_2 (6 mL) was added a solution of aldehyde **2a**[6] (36 mg, 0.25 mmol) in CH_2Cl_2 (3 mL), followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, prior to the addition of Na_2SO_4 (500 mg), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The resulting solution was filtered by cannula transfer, and the remaining was rinsed twice with dichloromethane (2 x 5 mL). The combined solution was concentrated *in vacuo* to give the crude imine as a pale yellow oil, which was immediately dissolved in Et_2O (10 mL) for the next step reaction. To this solution was added catalyst **IX** (6.5 mg, 0.013 mmol, 5 mol %) and 2,6-lutidine (29 μL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added methyl choloroformate (19.3μL, 0.25 mmol), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 30 h. The resulting heterogeneous mixture was allowed to warm to room temperature and stirred for 30 mins followed by concentration in *vacuo*. The crude product was purified by flash column chromatography with 25 to 30% EtOAc-hexane (R_f = 0.35 in 50% EtOAc-hexane) to afford product **3** (55 mg, 64% yield) as a colorless oil; $[\alpha]_D^{27}$ = +47.5 (c = 1 in $CHCl_3$). The enantiomeric excess was determined to be 74 % by HPLC with chiral column CHIRALPAK® IA, 15% *i*-PrOH/*n*-hexane, flow rate 1.0 mL, λ = 254 nm (t_{major} = 22.6 min, t_{minor} = 12.7 min). IR (neat): 3321, 2958, 2924, 2856, 1680, 1450, 1410, 1261, 1229, 1110, 1029, 800, 745 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): the compound exists as a nearly 1.2:1 mixture of amide rotamers, signals corresponding to the major rotamer: δ 8.23 (br s, 1 H), 7.45 (brs, 1 H), 7.28 (d, J = 8.5 Hz, 1 H), 7.16 – 7.04 (m, 2 H), 5.33 (brs, 1 H), 4.87 (t, J = 4.5 Hz, 1 H), 4.49 (d, J = 10.5 Hz, 1 H), 4.03 – 3.92 (m, 2 H), 3.91 – 3.80 (m, 2 H), 3.73 (brs, 3 H), 3.26 – 3.10 (m, 1 H), 2.88 – 2.64 (m, 2 H), 1.94 – 1.55 (m, 6 H); ^{13}C NMR (125 MHz, $CDCl_3$) signals corresponding to the major rotamer: δ 156.5 (C), 135.9 (C), 134.3 (C), 126.7 (C), 121.7 (CH), 119.4 (CH), 118.0 (CH), 110.8 (CH), 108.2 (C), 104.4 (CH), 64.8 (two CH_2), 52.7 (CH_3), 51.2 (CH), 38.6 (CH_2), 34.2 (CH_2), 33.2 (CH_2), 21.0 (CH_2), 20.4 (CH_2); MS (*m/z*, relative intensity): 344 (M^+, 9), 299 (3), 245 (3), 229 (100),

[6] For best results, the aldehyde was used immediately after purification.

169 (8), 149 (4), 97 (4); exact mass calculated for $C_{19}H_{24}N_2O_4$ (M^+): 344.1736; found: 344.1739.

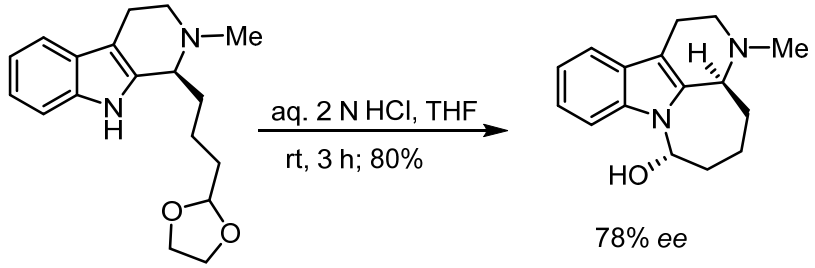
Preparation of 4.



3 **4**

To a solution of **3** (30 mg, 0.087 mmol) in THF (1 mL) was added $LiAlH_4$ (8.3 mg, 0.22 mmol, 2.5 equiv) at 0 °C, and the reaction mixture was stirred for 12 h and gradually warm up to room temperature. The reaction was quenched by the addition of EtOAc, followed by the addition of water (1 mL) and 15 aqueous NaOH solution (1 mL), and the solution was stirred at room temperature for 20 min. The mixture was extracted with EtOAc (2 x 5 mL), and the combined organic solution was washed with brine (4 mL) and dried over $MgSO_4$. The solution was concentrated in vacuo to give the residue. The crude product was purified by flash column chromatography with 2-5% MeOH-CH_2Cl_2 (R_f = 0.36 in 2% MeOH-CH_2Cl_2) to afford product **4** (22 mg, 84% yield) as a colorless oil. Selected spectroscopic data for **4**: $[\alpha]_D^{27}$= +54.5 (*c* 1, $CHCl_3$); IR (neat): 3337, 2961, 2927, 1454, 1260, 1092, 1024, 800 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.99 (br s, 1 H), 7.46 (d, *J* = 7.5 Hz, 1 H), 7.28 (d, *J* = 8.0 Hz, 1 H), 7.12 (dd, *J* = 7.5, 8.0 Hz, 1 H), 7.07 (dd, *J* = 7.5, 8.0 Hz, 1 H), 4.83 (t, *J* = 4.5 Hz, 1 H), 3.99 – 3.93 (m, 2 H), 3.89 – 3.81 (m, 2 H), 3.51 (t, *J* = 5.5 Hz, 1 H), 3.18 – 3.12 (m, 1 H), 2.82 – 2.68 (m, 3 H), 2.46 (s, 3 H), 1.95 – 1.59 (m, 5 H), 1.52 – 1.44 (m, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 136.0 (C), 134.8 (C), 127.3 (C), 121.3 (CH), 119.2 (CH), 118.0 (CH), 110.7 (CH), 108.3 (C), 104.7 (CH), 64.84 (CH_2), 64.80 (CH_2), 59.8 (CH), 49.6 (CH_2), 41.9 (CH_3), 33.4 (CH_2), 32.5 (CH_2), 19.9 (CH_2), 19.0 (CH_2); MS (*m/z*, relative intensity): 300 (M^+, 2), 299 (M^+-1, 1), 255 (1), 200 (1), 186 (14), 185 (100), 144 (6), 129 (3), 73 (8); exact mass calculated for $C_{18}H_{24}N_2O_2$ (M^+): 300.1838; found: 300.1837.

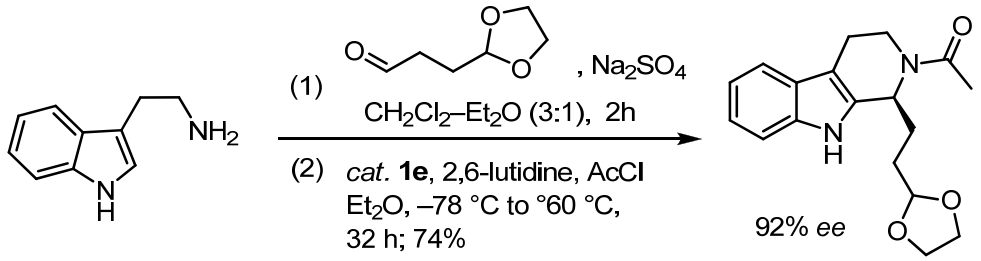
Preparation of 5



4 **5**

To a solution of **4** (10 mg, 0.033 mmol) in THF (0.34 mL) was added an aqueous solution of 2N HCl (0.34 mL), and the reaction mixture was stirred for 3 h at room temperature. The reaction mixture was diluted with the addition of water (2 mL), and the reaction was quenched by the addition of saturated aqueous $NaHCO_3$ solution (2 mL). The reaction mixture was stirred for 10 min, followed by the extraction with EtOAc (2 x 10 mL). The combined organic extracts were washed with brine, dried over $MgSO_4$ and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 7% MeOH–CH_2Cl_2 (R_f = 0.45 in 15% MeOH–CH_2Cl_2) to afford product **5** (6.8 mg, 80% yield) as a white solid. The enantiomeric excess was determined to be 78 % by HPLC analysis with chiral column CHIRALCEL® OD-H, 10% (10% MeOH–EtOAc) / 90% Hexane, flow rate 1.0 mL, λ = 280 nm (t_{major} = 12.5 min, t_{minor} = 19.5 min).

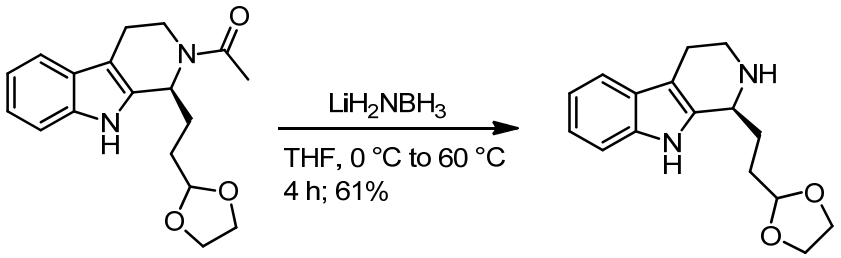
Preparation of adduct 8.



8

To a solution of tryptamine (40 mg, 0.25 mmol) in CH_2Cl_2 (6 mL) was added a solution of aldehyde **2c** (32.5 mg, 0.25 mmol in CH_2Cl_2 (3 mL), followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, prior to the addition of Na_2SO_4 (500 mg), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The resulting solution was filtered by cannula transfer to a flame dried 25 mL round-bottomed flask, and the remaining was rinsed twice with dichloromethane (2 x 5 mL). The combined solution was concentrated *in vacuo* to give the crude imine as a pale yellow oil, which was immediately dissolved in Et_2O (15 mL) for the next step reaction. To this solution was added catalyst **IX** (6.5 mg, 0.0125 mmol, 5 mol %) and 2,6-lutidine (29 μL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added acetyl chloride (18 μL, 0.25 mmol, 1.0 equiv), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 32 h. The resulting heterogeneous mixture was then allowed to warm to room temperature and stirred for 30 mins followed by concentration in *vacuo*. The crude product was purified by flash column chromatography with 50 to 60% EtOAc-hexane (R_f = 0.38 in 80% EtOAc-hexane) to afford product **8** (58 mg, 74% yield) as a white solid. M.p. 187–188 °C; $[\alpha]_D^{27}$ +94 (*c* 1, $CHCl_3$). The enantiomeric excess was determined to be 92 % by HPLC with chiral column CHIRALPAK® IA, 12% *i*-PrOH/n-hexane, flow rate 1.0 mL, λ = 275 nm (t_{major} = 25.1 min, t_{minor} = 32.1 min). IR (neat): 3274, 2965, 2924, 2888, 1619, 1439, 1137, 1026, 800, 745 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): the compound exists as a 3:1 mixture of amide rotamers, signals corresponding to the major rotamer: δ 8.56 (br s, 1 H), 7.43 (d, J = 7.5 Hz, 1 H), 7.30 (d, J = 7.5 Hz, 1 H), 7.18 – 7.03 (m, 2 H), 5.81 (t, J = 7.0 Hz, 1 H), 4.98 (brs, 1 H), 5.04 – 4.89 (m, 1 H), 4.13 – 3.82 (m, 4 H), 3.56 – 3.46 (m, 1 H), 2.89 – 2.65 (m, 2 H), 2.19 (s, 3 H), 2.08 – 1.73 (m, 4 H).; ^{13}C NMR (125 MHz, $CDCl_3$) signals corresponding to the major rotamer: δ 169.4 (C), 135.9 (C), 134.3 (C), 126.6 (C), 121.7 (CH), 119.3 (CH), 117.9 (CH), 111.0 (CH), 107.4 (C), 104.1 (CH), 65.1 (CH_2), 64.8 (CH_2) 48.2 (CH), 40.8 (CH_2), 29.8 (CH_2), 28.2 (CH_2), 22.0 (CH_2), 21.8 (CH_3); MS (*m/z*, relative intensity): 314 (M^+, 10), 271 (10), 226 (55), 213 (90), 183 (11), 171 (100), 169 (17), 144 (6), 115 (3), 73 (6); exact mass calculated for $C_{18}H_{22}N_2O_3$ (M^+): 314.1630; found: 314.1631.

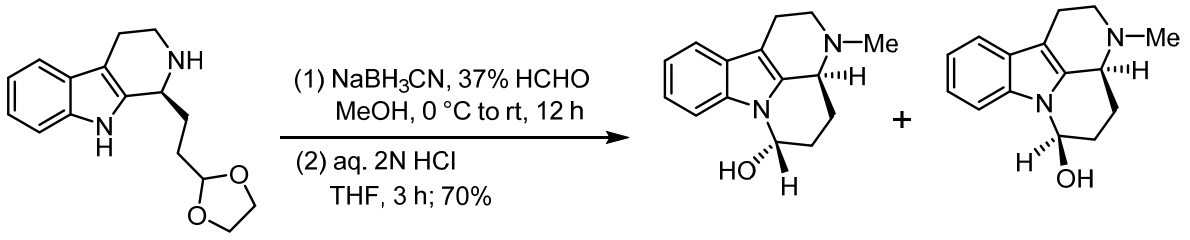
Preparation of amine 17.



8 **17**

To a solution of diisopropylamine (0.513 mL, 3.66 mmol, 7.2 equiv) in THF (3.6 mL) was added a solution of *n*-butyllithium (1.46 mL, 2.5 M in hexane, 3.65 mmol, 7.2 equiv) at –78 °C and stirred a the same temperature for 10 min, followed by warming up to 0 °C and stirred for 15 min. To this solution was added borane-ammonia complex (98 mg, 90% purity, 2.86 mmol, 5.6 equiv), and the suspension solution was stirred at 0 °C for 15 min, followed by warming up to room temperature and stirred for additional 10 min. To the solution was added **8** (160 mg, 0.50 mmol) at 0 °C and stirred for 2 min, followed by heating up to 60 °C and stirred for 4 h. The resulting suspension was cooled to 0°C and the reaction was quenched by dropwise addition of 2N aqueous HCl solution (10 mL), followed by stirring for 30 min. The pH value of the solution was adjusted to 8 by the addition of saturated aqueous $NaHCO_3$. The reaction mixture was extracted five times with ethyl acetate (5 x 10 mL), and the combined organic extracts were dried over sodium sulfate and concentrated *in vacuo* to give the residue. The crude product was purified by flash column chromatography with 5 to 10% MeOH-CH_2Cl_2 (R_f = 0.3 in 20% MeOH-CH_2Cl_2) to afford product **17** (85 mg, 61% yield) as a colorless oil. Selected spectroscopic data for **17**: $[\alpha]_D^{27}$ –19.9 (*c* 1, MeOH); IR (neat): 3400, 3311, 3055, 2927, 2888, 1452, 1301, 1139, 1028, 945, 743 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 8.08 (br s, 1 H), 7.46 (d, J = 8.0 Hz, 1 H), 7.29 (d, J = 8.0 Hz, 1 H), 7.12 (dd, J = 7.5, 7.5 Hz, 1 H), 7.07 (dd, J = 7.5, 7.5 Hz, 1 H), 4.93 (t, J = 4.0 Hz, 1 H), 4.15 – 4.07 (m, 1 H), 4.03 – 3.94 (m, 2 H), 3.90 – 3.83 (m, 2 H), 3.35 – 3.28 (m, 1 H), 3.06 – 3.00 (m, 1 H), 2.77 – 2.66 (m, 2 H), 2.05 – 1.73 (m, 5 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 136.0 (C), 135.7 (C), 127.5 (C), 121.5 (CH), 119.3 (CH), 118.0 (CH), 110.7 (CH), 109.1 (C), 104.3 (CH), 65.0 (two CH_2), 52.0 (CH), 42.2 (CH_2), 29.6 (CH_2), 28.8 (CH_2), 22.7 (CH_2); MS (*m/z*, relative intensity): 272 (M^+, 5), 271 (M^+-1, 2), 184 (3), 172 (10), 171 (100), 169 (5), 144 (3), 115 (1), 99 (2); exact mass calculated for $C_{16}H_{20}N_2O_2$ (M^+): 272.1525; found: 272.1526.

Preparation of 18 and 19.



17 **18** **19**

To a solution of **17** (80 mg, 0.29 mmol) in methanol (3.0 mL) was added $NaCNBH_3$ (46 mg, 0.73 mmol, 2.5 equiv) at 0 °C. The resulting solution was stirred at 0 °C for 5 min followed by the addition of 37% aqueous HCHO solution (3 mL). The solution was stirred at room temperature for 12 h until the completion of the reaction, as monitored by TLC. The solution was concentrated *in vacuo* to give the residue, and the residue. To the solution of the above residue in THF (3 mL) was added an aqueous solution of 2N HCl (3 mL), and the reaction mixture was stirred for 3 h at room temperature. The reaction was quenched with $NaHCO_3$ and the pH value of the solution was adjusted to 8 . The reaction mixture was extracted with EtOAc (3 x 15 mL). The combined organic extracts were dried over Na_2SO_4 and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 7% MeOH–CH_2Cl_2 (For **18**: R_f = 0.45; for **19**: R_f = 0.42 in 8% MeOH–CH_2Cl_2, twice developing) to afford product **18** (28 mg, 39% yield) and **19** (22 mg, 31% yield) as white solids.

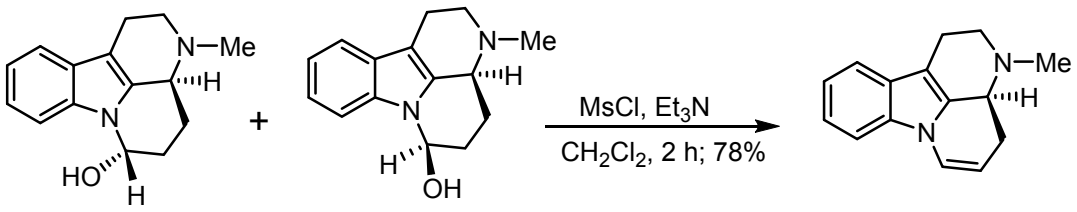
Selected data for **18**: M.p. 187–189 °C. Lit.[7] 184–186 °C. $[\alpha]_D^{27}$ +12.7 (*c* 1, $CHCl_3$); IR (neat): 3343, 3050, 2956, 2923, 2852, 1457, 1375, 1310, 1266, 1086, 1015, 802, 746 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.66 (d, *J* = 7.0 Hz, 1 H), 7.44 (d, *J* = 7.0 Hz, 1 H), 7.18 – 7.05 (m, 2 H), 5.48 (dd, J = 9.0, 5.5 Hz, 1 H), 3.18 – 3.02 (m, 2 H), 2.95 – 2.83 (m, 1 H), 2.73 – 2.66 (m, 1 H), 2.65 – 2.57 (m, 1 H), 2.55 – 2.48 (m, 1 H), 2.43 (s, 3 H), 2.23 – 2.18 (m, 1 H), 1.80 – 1.70 (m, 2 H), 1.35 – 1.24 (m, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 137.9 (C), 135.1 (C), 128.2 (C), 121.6 (CH), 120.3 (CH), 118.1 (CH), 111.9 (CH), 107.1 (C), 78.8 (CH), 60.1 (CH), 54.3 (CH_2), 42.3 (CH_3), 33.3 (CH_2), 26.1 (CH_2), 21.5 (CH_2); MS (*m/z*, relative intensity): 242 (M^+, 26), 241 (M^+-1, 19), 213 (9), 199 (100), 180 (25), 171 (17), 156 (17), 143 (27), 58 (38); exact mass calculated for $C_{15}H_{18}N_2O$ (M^+): 242.1419; found: 242.1420.

Selected data for **19**: M.p. 175–176 °C. Lit.[7] 174–176 °C. $[\alpha]_D^{27}$ –7.5 (*c* 1, $CHCl_3$); IR (neat): 3327, 3050, 2956, 2924, 2852, 1456, 1310, 1263, 1086, 1015, 801, 745 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.47 (d, *J* = 7.5 Hz, 1 H), 7.41 (d, *J* = 7.5 Hz, 1 H), 7.15 (dd, *J* = 7.5, 7.5 Hz, 1 H), 7.09 (dd, *J* = 7.5, 7.5 Hz, 1 H), 5.81 (d, *J* = 2.5 Hz, 1 H), 3.05 – 3.00 (m, 1 H), 2.97 – 2.82 (m, 2 H), 2.71 – 2.63 (m, 1 H), 2.54 – 2.44 (m, 1 H), 2.13 – 2.05 (m, 1 H), 2.02 (s, 3 H), 2.00 – 1.93 (m, 1 H), 1.58 – 1.48 (m, 1 H), 1.05 – 0.95 (m, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 135.9 (C), 133.2 (C), 128.0 (C), 121.2 (CH), 119.9 (CH), 118.1 (CH), 111.2 (CH),

[7] Achenbach, H.; Düthorn, B.; Waibel, R. *Liebigs* Ann. *Chem.* **1992**, 1159 – 1164.

106.0 (C), 74.4 (CH), 60.6 (CH) 54.8 (CH_2), 41.9 (CH_3), 31.3 (CH_2), 21.2 (CH_2), 20.1 (CH_2).

Preparation of 20.

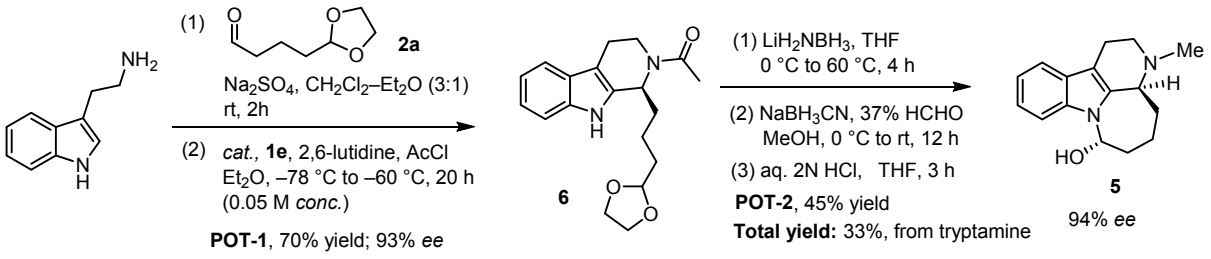


18 **19** **20**

To a solution of **18** and **19** (25 mg, 0.103 mmol) and Et_3N (44 μL, 0.32 mmol) in CH_2Cl_2 (3.2 mL) was added methanesulfonyl chloride (12 μL, 0.155 mmol) at 0 °C. The resulting solution was stirred at 0 °C to room temperature for 2 h. The reaction was quenched by the addition of water (2 mL), and the mixture was extracted with CH_2Cl_2 (3 x 5 mL). The organic solution was washed with saturated aqueous $NaHCO_3$ solution, brine, dried over Na_2SO_4, and the solution was concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 7% MeOH–CH_2Cl_2 (R_f = 0.5 in 10% MeOH–CH_2Cl_2) to afford product **20** (18 mg, 78% yield) as a colorless oil. Selected spectroscopic data for **20**: $[\alpha]_D^{27}$ +47.0 (*c* 1, $CHCl_3$); IR (neat): 3050, 2923, 2848, 1644, 1462, 1304, 1263, 1060, 806, 739, 721 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.45 (d, J = 7.5 Hz, 1 H), 7.30 (d, J = 7.5 Hz, 1 H), 7.16 (dd, J = 7.5, 7.5 Hz, 1 H), 7.09 (dd, J = 7.5, 7.5 Hz, 1 H), 7.02 – 7.00 (m, 1 H), 5.24 – 5.19 (m, 1 H), 3.44 – 3.40 (m, 1 H), 3.20 – 3.16 (m, 1 H), 3.04 – 2.98 (m, 1 H), 2.78 – 2.60 (m, 3 H), 2.49 (s, 3 H), 2.20 – 2.12 (m, 1 H);[8] ^{13}C NMR (125 MHz, $CDCl_3$): δ 134.7 (C), 131.9 (C), 127.7 (C), 122.3 (CH), 121.7 (CH), 120.0 (CH), 118.6 (CH), 108.6 (CH), 107.8 (C), 105.4 (CH), 57.2 (CH), 55.0 (CH_2), 42.5 (CH_3), 26.4 (CH_2), 21.5 (CH_2); MS (*m/z*, relative intensity): 224 (M^+, 23), 223 (M^+-1, 18), 181 (36), 180 (100), 167 (2), 152 (2); exact mass calculated for $C_{15}H_{16}N_2$ (M^+): 224.1313; found: 224.1315.

[8] Achenbach, H.; Düthorn, B.; Waibel, R. *Liebigs* Ann. *Chem.* **1992**, 1159 – 1164.

General procedure for the two-pot synthesis of (+)-5:



POT-1 as previously described:

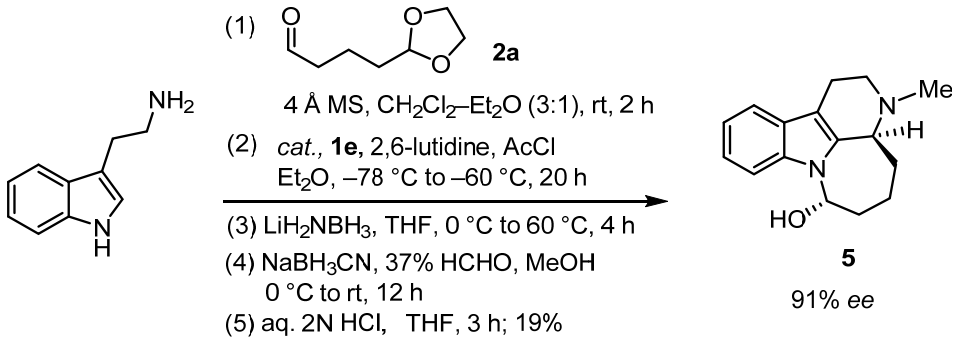
To a solution of tryptamine (40 mg, 0.25 mmol) in CH_2Cl_2 (6 mL) was added dropwise a solution of aldehyde **2a** (36 mg, 0.25 mmol) in CH_2Cl_2 (3 mL), followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, followed by the addition of Na_2SO_4 (500 mg), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The resulting solution was carefully concentrated *in vacuo* and applied in high vacuum for the complete removal of solvent. The crude imine, as a pale yellow oil, was diluted with Et_2O (5 mL). To this solution was added catalyst **IX** (6.5 mg, 0.013 mmol, 5 mol %) and 2,6-lutidine (29 µL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added acetyl chloride (18 µL, 0.25 mmol, 1.0 equiv), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 20 h. The resulting heterogeneous mixture was allowed to warm to room temperature and stirred for 30 mins followed by concentration *in vacuo*. The crude product was purified by flash column chromatography with 50 to 60% EtOAc-hexane (R_f = 0.40 in 80% EtOAc-hexane) to afford product **6** (52 mg, 63% yield) as a white solid. The enantiomeric excess was determined to be 93 % by chiral HPLC with chiral column CHIRALPAK® IA.

POT-2:

To a solution of diisopropylamine (0.18 mL, 1.28 mmol, 7.0 equiv) in THF (1.3 mL) was added a solution of *n*-butyllithium (0.52 mL, 2.5 M in hexane, 1.3 mmol, 7.1 equiv) at –78 °C and stirred at the same temperature for 10 min, followed by warm up to 0 °C and stirred for 15 min. To this solution was added borane-ammonia complex (35 mg, 90% purity, 1.02 mmol, 5.6 equiv), and the suspension solution was stirred at 0 °C for 15 min, followed by warm up to room temperature and stirred for additional 10 min. To this solution was added **6 (**60 mg, 0.183 mmol) at 0 °C and stirred for 2 min, followed by heating up to 60 °C and stirred for 4 h. The resulting suspension was cooled to 0°C and the reaction was quenched by dropwise addition of 6N aqueous HCl solution until the pH value of the reaction mixture reached to 1-2, followed by stirring for 30 min. The pH value of the solution was adjusted to 8 by the addition of $NaHCO_3$. The reaction mixture was then carefully concentrated *in*

vacuo with a rotary evaporator, followed by connecting to high vacuum pump for 30 min. The crude mixture was then dissolved in MeOH (1.8 mL), and the reaction mixture was cooled to 0 °C for 5 min. To this solution was added $NaCNBH_3$ (46 mg, 0.753 mmol), followed by the addition of 37% aqueous HCHO solution (1.8 mL). The solution was stirred at room temperature for 12 h until the completion of the reaction, as monitored by TLC. The methanol was removed *in vacuo*, and the crude mixture was dissolved in THF (1.8 mL). To this solution was added an aqueous solution of 2N HCl (4 mL), and the reaction mixture was stirred for 3 h at room temperature. The reaction was quenched with the addition of solid $NaHCO_3$ and the pH value of the solution was adjusted to 8 . The reaction mixture was extracted with EtOAc (3 x 15 mL), and the combined organic extracts were dried over Na_2SO_4 and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 7% MeOH–CH_2Cl_2 (R_f = 0.45 in 15% MeOH–CH_2Cl_2) to afford the product (+)-**5** as a white solid (21 mg, 45% yield from **6**, and 33% yield from the starting tryptamine). The enantiomeric excess was determined to be 94 % by HPLC analysis with chiral column CHIRALCEL® OD-H, 10% (10% MeOH–EtOAc)/90% Hexane.

General procedure for the one-pot synthesis of (+)-5:

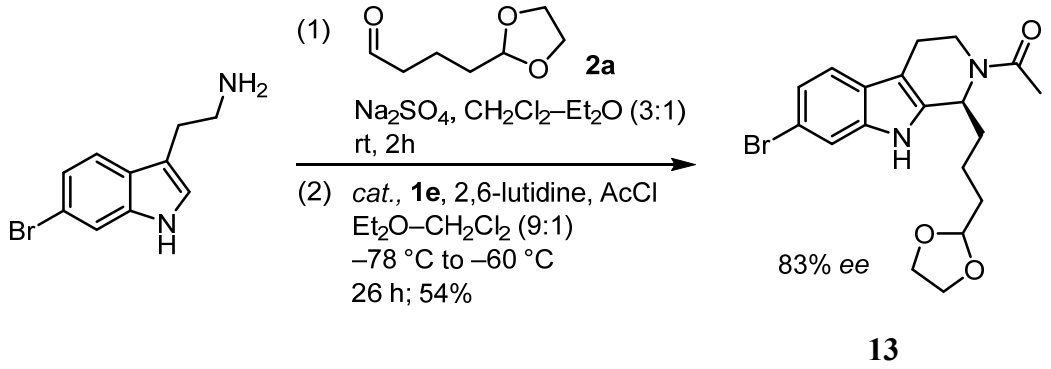


In a flame-dried 20-mL pear-shaped flask, a solution of tryptamine (40 mg, 0.25 mmol, 1.0 eq) in CH_2Cl_2 (6 mL) was prepared. To this solution was added dropwise via syringe a solution of aldehyde **2a** (36 mg, 0.25 mmol) in CH_2Cl_2 (3 mL) at room temperature, followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, followed by the addition of 4 Å molecular sieves (purchased from Aldrich®, beads, 4-8 mesh, *ca.*500 mg, around 10-12 beads), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The molecular sieve beads were removed by forceps, which were rinsed before removing from the flask (*ca.* 3 mL CH_2Cl_2 for rinsing). The resulting solution was concentrated *in vacuo*, yielding the imine as a pale yellow oil, which was immediately dissolved in Et_2O (5 mL) for the next-step reaction. To this solution was

added catalyst **IX** (6.5 mg, 0.013 mmol, 5 mol %) and 2,6-lutidine (29 μL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added dropwise acetyl chloride (18 μL, 0.25 mmol, 1.0 equiv), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 20 h. The resulting heterogeneous mixture was allowed to warm to room temperature and stirred for 30 mins followed by concentration *in vacuo*, furnishing crude **6**.

In a separated round-bottom flask, to a solution of diisopropylamine (0.25 mL, 1.78 mmol, 7.1 equiv) in THF (0.5 mL) was added a solution of *n*-butyllithium (0.72 mL, 2.5 M in hexane, 1.8 mmol, 7.2 equiv) at –78 °C and stirred at the same temperature for 10 min, followed by warm up to 0 °C and stirred for 15 min. To this solution was added borane-ammonia complex (48 mg, 90% purity, 1.40 mmol, 5.6 equiv), and the suspension solution was stirred at 0 °C for 15 min, followed by warm up to room temperature and stirred for additional 20 min. The lithium amidotrihydroborate (LiH_2NBH_3) solution was carefully transferred under nitrogen pressure (rinsed with 0.5 mL THF) to pre-cooled flask containing a solution of crude **6** in THF (0.5 mL) at 0 °C. The resulting solution was stirred for 2 min, followed by heating up to 60 °C and stirred for 4 h. Subsequently, the resulting suspension was cooled to 0°C, and the reaction was quenched by dropwise addition of 6N aqueous HCl solution until the pH value of the reaction mixture reached to 1-2, followed by stirring for 30 min. Later, the pH value of the solution was adjusted to 8 by the addition of solid $NaHCO_3$. The reaction mixture was then carefully concentrated *in vacuo* with a rotary evaporator, followed by connecting to high vacuum pump for 30 min. The crude mixture was then dissolved in MeOH (1.6 mL), and the reaction mixture was cooled to 0 °C for 5 min. To this solution was added $NaCNBH_3$ (47 mg, 0.75 mmol), followed by the addition of 37% aqueous HCHO solution (1.6 mL). The solution was stirred at room temperature for 12 h until the completion of the reaction, as monitored by TLC. The methanol was removed *in vacuo*, and the crude mixture was dissolved in THF (1 mL). To this solution was added an aqueous solution of 2N HCl (3 mL), and the reaction mixture was stirred for 3 h at room temperature. The reaction was quenched with the addition of solid $NaHCO_3$ and the pH value of the solution was adjusted to 8 . The reaction mixture was extracted with EtOAc (3 x 15 mL), and the combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 7% MeOH–CH_2Cl_2 (R_f = 0.45 in 15% MeOH–CH_2Cl_2) to afford the product (+)-**5** as a white solid (12 mg, 19% yield from the starting tryptamine). The enantiomeric excess was determined to be 91 % by HPLC analysis with chiral column CHIRALCEL® OD-H, 10% (10% MeOH–EtOAc)/90% Hexane.

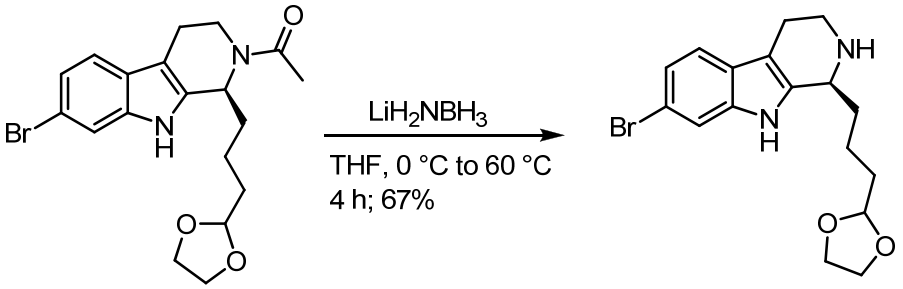
Preparation of 13.



13

To a solution of 6-bromotryptamine (59.5 mg, 0.25 mmol) in CH_2Cl_2 (6 mL) was added a solution of aldehyde **2a** (36 mg, 0.25 mmol) in CH_2Cl_2 (3 mL), followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, prior to the addition of Na_2SO_4 (500 mg), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The resulting solution was filtered by cannula transfer, and the remaining was rinsed twice with dichloromethane (2 x 5 mL). The combined solution was concentrated *in vacuo* to give the crude imine as a pale yellow oil, which was immediately dissolved in Et_2O (4.5 mL) and CH_2Cl_2 (0.5 mL) for the next step reaction. To this solution was added catalyst **IX** (6.5 mg, 0.013 mmol, 5 mol %) and 2,6-lutidine (29 μL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added acetyl chloride (18 μL, 0.25 mmol, 1.0 equiv), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 26 h. The resulting heterogeneous mixture was allowed to warm to room temperature and stirred for 30 mins followed by concentration in *vacuo*. The crude product was purified by flash column chromatography with 50 to 60% EtOAc-hexane (R_f = 0.42 in 90% EtOAc-hexane) to afford product **13** (55 mg, 54% yield) as a white solid. M.p. 143–144 °C; $[\alpha]_D^{27}$ +20.3 (*c* 1, $CHCl_3$). The enantiomeric excess was determined to be 83 % by HPLC analysis with chiral column CHIRALPAK® IA, 12% *i*-PrOH/n-hexane, flow rate 1.0 mL, λ = 254 nm (t_{major} = 29.9 min, t_{minor} = 22.6 min). IR (neat): 3281, 2961, 2924, 2854, 1630, 1614, 1446, 1262, 1095, 1022, 800 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): the compound exists as a 5:1 mixture of amide rotamers, signals corresponding to the major rotamer: δ 8.66 (br s, 1 H), 7.42 (d, J = 1.7 Hz,1 H), 7.26 (d, J = 8.5 Hz, 1 H), 7.15 (dd, J = 8.5, 1.7 Hz, 1 H), 5.75 (t, J = 7.5 Hz, 1 H), 4.85 (t, J = 4.5 Hz, 1 H), 4.02 – 3.81 (m, 5 H), 3.52 – 3.44 (m, 1 H), 2.80 – 2.71 (m, 2 H), 2.20 (s, 3 H), 2.00 – 1.52 (m, 6 H); ^{13}C NMR (125 MHz, $CDCl_3$) signals corresponding to the major rotamer: δ 169.6 (C), 136.8 (C), 135.2 (C), 125.5 (C), 122.6 (CH), 119.1 (CH), 115.0 (C), 113.8 (CH), 107.6 (C), 104.4 (CH), 64.9 (CH_2), 64.8 (CH_2), 48.4 (CH), 41.0 (CH_2), 33.8 (CH_2), 33.1 (CH_2), 22.0 (CH_2), 21.9 (CH_3), 20.4 (CH_2); MS (*m/z*, relative intensity): 408 (M^++2, 22), 406 (M^+, 22), 365 (22), 363 (27), 293 (96), 291 (100), 251 (78), 250 (17), 249 (90), 212 (8), 170 (15), 168 (11), 143 (9), 99 (6), 73 (24); exact mass calculated for $C_{19}H_{23}BrN_2O_3$ (M^+): 406.0892; found: 406.0898.

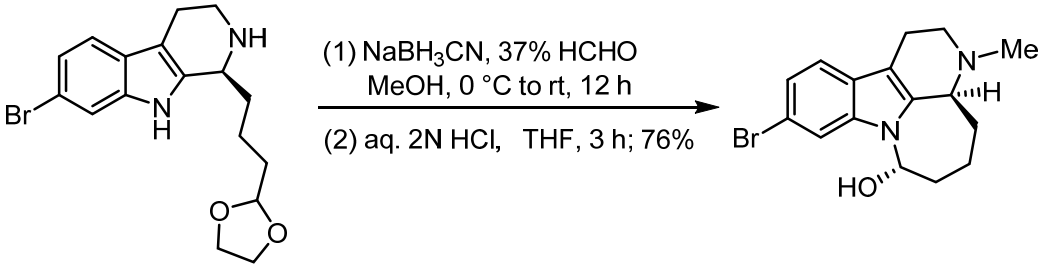
Preparation of Bromoindole 14.



13 **14**

To a solution of diisopropylamine (0.125 mL, 0.892 mmol, 6.6 equiv) in THF (1.2 mL) was added a solution of *n*-butyllithium (0.35 mL, 2.5 M in hexane, 0.875 mmol, 6.5 equiv) at –78 °C, and the solution was stirred at the same temperature for 10 min, followed by warm up to 0 °C and stirred for 15 min. To this solution was added borane-ammonia complex (24 mg, 90% purity, 0.63 mmol, 4.7 equiv), and the suspension solution was stirred at 0 °C for 15 min, followed by warm up to room temperature and stirred for additional 10 min. To the solution was added **13 (**50 mg, 0.123 mmol) at 0 °C and stirred for 2 min, followed by heating up to 60 °C and stirred for 4 h. The resulting suspension was cooled to 0°C and the reaction was quenched by dropwise addition of 2N aqueous HCl solution (10 mL), followed by stirring for 30 min. The pH value of the solution was adjusted to 8 by the addition of saturated aqueous $NaHCO_3$. The reaction mixture was extracted five times with ethyl acetate (5 x 10 mL), and the combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give the residue. The crude product was purified by flash column chromatography with 5 to 10% MeOH-CH_2Cl_2 (R_f = 0.36 in 20% MeOH-CH_2Cl_2) to afford product **14** (30 mg, 67% yield) as a colorless oil. Selected spectroscopic data for **14**: $[\alpha]_D^{27}$ –13.1 (*c* 1, MeOH); IR (neat): 3416, 3267, 2923, 2852, 2783, 1619, 1558, 1463, 1436, 1364, 1140, 1047, 800, 755 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 8.07 (br s, 1 H), 7.42 (s, 1 H), 7.29 (d, J = 8.5 Hz, 1 H), 7.16 (d, J = 8.5 Hz, 1 H), 4.87 (t, J = 4.5 Hz, 1 H), 4.05 – 4.02 (m, 1 H), 4.00 – 3.95 (m, 2 H), 3.88 – 3.82 (m, 2 H), 3.34 – 3.27 (m, 1 H), 3.03 – 2.96 (m, 1 H), 2.74 – 2.62 (m, 2 H), 1.90 – 1.55 (m, 7 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 136.8 (C), 136.5 (C), 126.4 (C), 122.5 (CH), 119.2 (CH), 114.7 (C), 113.6 (CH), 109.2 (C), 104.4 (CH), 64.89 (CH_2), 64.87 (CH_2) 52.2 (CH) 42.2 (CH_2), 34.4 (CH_2), 33.3 (CH_2), 22.5 (CH_2), 20.2 (CH_2); MS (*m/z*, relative intensity): 366 (M^++2, 7), 364 (M^+, 7), 264 (3), 262 (3), 251 (93), 249 (100), 234 (4), 170 (8), 143 (4), 99 (2), 73 (5); exact mass calculated for $C_{17}H_{21}BrN_2O_2$ (M^+): 364.0786; found: 364.0779.

Preparation of arborescidine C (15).



14 **15**

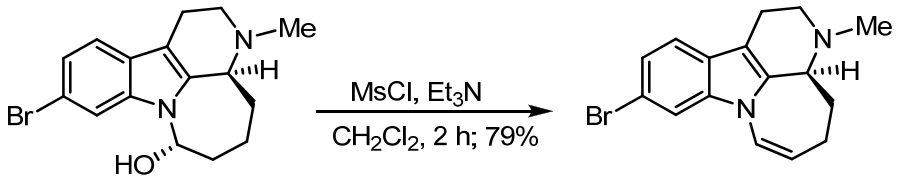
To a solution of **14** (20 mg, 0.055 mmol) in methanol (0.55 mL) was added $NaCNBH_3$ (9 mg, 0.143 mmol, 2.6 equiv) at 0 °C. The resulting solution was stirred at 0 °C for 5 min followed by the addition of 37% aqueous HCHO solution (0.55 mL, excess). The solution was stirred at room temperature for 12 h until the completion of the reaction, as monitored by TLC. The solution was concentrated *in vacuo* to give the residue. The residue was dissolved in THF (0.55 mL), followed by the addition of an aqueous solution of 2N HCl (0.55 mL), and the reaction mixture was stirred for 3 h at room temperature. The reaction was quenched with the addition of solid $NaHCO_3$ and the pH value of the solution was adjusted to 8. The reaction mixture was extracted with EtOAc (3 x 5 mL), and the combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 8% MeOH–CH_2Cl_2 (R_f = 0.47 in 15% MeOH–CH_2Cl_2) to afford product **15** (14 mg, 76% yield) as a white solid. M.p. 173–174 °C, lit.[9] 172–173 °C. Selected spectroscopic data for **15**: $[\alpha]_D^{27}$ +3.1 (*c* 1, $CHCl_3$), lit.[9] $[\alpha]_D^{25}$ +3.0. lit.[10] $[\alpha]_D$ +3.3 (*c* 1, $CHCl_3$).The enantiomeric excess was determined to be 86 % by HPLC analysis with chiral column CHIRALCEL® OD-H, 10% (10% MeOH–EtOAc) / 90% Hexane, flow rate 0.5 mL, λ = 280 nm (t_{major} = 17.2 min, t_{minor} = 19.5 min). IR (neat): 3319, 2924, 2852, 1609, 1469, 1439, 1314, 1106, 799, 756 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.42 (d, *J* = 1.5 Hz, 1 H), 7.25 (d, *J* = 8.0 Hz, 1 H), 7.15 (dd, *J* = 8.0, 1.5 Hz, 1 H), 6.07 (dd, *J* = 4.8, 1.5 Hz, 1 H), 3.59 (d, *J* = 10.5 Hz, 1 H), 2.98 – 2.93 (m, 1 H), 2.70 – 2.63 (m, 3 H), 2.44 (s, 3 H), 2.34 – 2.26 (m, 1 H), 2.24 – 2.17 (m, 1 H), 2.15 – 2.05 (m, 1 H), 1.82 – 1.74 (m, 1 H), 1.62 – 1.54 (m, 1 H), 1.44 – 1.34 (m, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 138.2 (C), 136.8 (C), 125.6 (C), 122.5 (CH), 119.4 (CH), 114.8 (C), 111.6 (CH), 108.9 (C), 76.6 (CH), 61.2 (CH), 50.4 (CH_2) 42.7 (CH_3), 34.3 (CH_2), 31.8 (CH_2), 20.2 (CH_2), 20.1 (CH_2); MS (*m/z*, relative intensity): 336 (M^++2, 16), 334 (M^+, 16), 317 (15), 291 (17), 265 (85), 263 (100), 184 (8), 154 (9); exact mass calculated for $C_{16}H_{19}BrN_2O$ (M^+): 334.0681; found: 334.0674.

[9] Chbani, M.; Pais, M.; Delauneux, J.-M.; Debitus, C. *J. Nat. Prod.* **1993**, *56*, 99 – 104.
[10] Santos, L. S.; Theoduloz, C.; Pilli, R. A.; Rodriguez, J. *Eur. J. Med. Chem.* **2009**, *44*, 3810–3815.

Table S2. ^{13}C NMR chemical shift comparison of the synthetic **15** with the natural product reported.

Synthetic	Reported
138.2	137.5
136.8	136.9
125.6	125.2
122.4	122.1
119.4	119.1
114.7	114.5
111.6	111.6
108.8	108
76.7	77.2
61.1	61.2
50.3	50.2
42.6	42.1
34.2	34.2
31.8	32.1
20.1	20
20.1	19.5

Preparation of 16



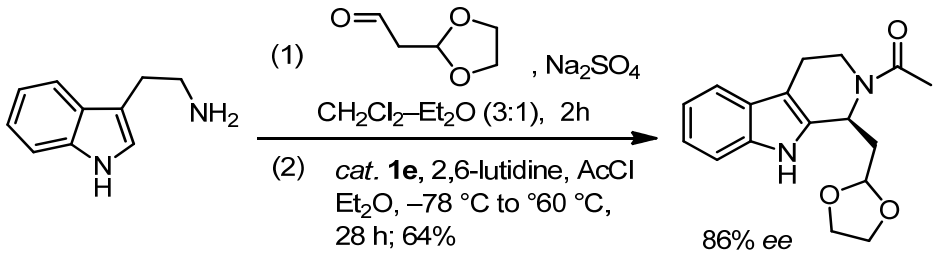
15 **16**

To a solution of **15** (20 mg, 0.06 mmol) and Et_3N (25 μL, 0.18 mmol) in CH_2Cl_2 (0.6 mL) was added methanesulfonyl chloride (6.8 μL, 0.088 mmol) at 0 °C. The resulting solution was stirred at 0 °C to room temperature for 2h. The reaction was quenched by the addition of water (1 mL), and the mixture was extracted with CH_2Cl_2 (2 x 5 mL). The organic solution was washed with saturated aqueous $NaHCO_3$ solution (5 mL), brine (5 mL), dried

over $MgSO_4$, and the solution was concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 3 to 5% MeOH–CH_2Cl_2 (R_f = 0.46 in 10% MeOH–CH_2Cl_2) to afford product **16** (15 mg, 79% yield) as a colorless oil. Selected spectroscopic data for **16**: $[\alpha]_D^{27}$ +63 (*c* 1, $CHCl_3$), lit.[11] $[\alpha]_D$ +70 (*c* 0.6, $CHCl_3$); lit.[12] $[\alpha]_D$ –70 (*c* 0.6, $CHCl_3$) for its enantiomer. IR (neat): 2924, 2852, 1608, 1468, 1314, 1222, 1106, 799, 756 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.48 (d, J = 1.5 Hz, 1 H), 7.32 (d, J = 8.5 Hz, 1 H), 7.22 (dd, J = 8.5, 1.5 Hz, 1 H), 6.82 (dt, J = 9.8, 2.0 Hz, 1 H), 5.13 – 5.07 (m, 1 H), 3.38 (d, J = 10.0 Hz, 1 H), 3.17 – 3.10 (m, 1 H), 2.92 – 2.85 (m, 1 H), 2.75 – 2.65 (m, 2 H), 2.54 (s, 3 H), 2.58 – 2.50 (m, 1 H), 2.45 – 2.39 (m, 1 H), 2.38 – 2.32 (m, 1 H), 1.92 – 1.83 (m, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 138.0 (C), 136.9 (C), 125.8 (C), 123.3 (CH), 121.7 (CH), 119.3 (CH), 115.3 (C), 112.4 (CH), 111.2 (CH), 109.3 (C), 62.4 (CH), 52.6 (CH_2), 42.4 (CH_3), 29.9 (CH_2), 27.9 (CH_2), 20.6 (CH_2); MS (*m/z*, relative intensity): 318 (M^++2, 97), 317 (M^+, 100), 316 (99), 315 (89), 289 (34), 287 (34), 275 (80), 274 (55), 273 (83), 272 (41), 260 (23); exact mass calculated for $C_{16}H_{17}BrN_2$ (M^+): 316.0575; found: 316.0582.

[11] Chbani, M.; Pais, M.; Delauneux, J.-M.; Debitus, C. *J. Nat. Prod.* **1993**, *56*, 99 – 104.
[12] Santos, L. S.; Pilli, R. A.; Rawal, V. H. *J. Org. Chem.* **2004**, *69*, 1283 – 1289.

Preparation of 7



7

To a solution of tryptamine (40 mg, 0.25 mmol) in CH_2Cl_2 (6 mL) was added a solution of aldehyde **2b** (29 mg, 0.25 mmol)[13] in CH_2Cl_2 (3 mL), followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, prior to the addition of Na_2SO_4 (500 mg), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The resulting solution was filtered by cannula transfer to a flame dried 25 mL round-bottomed flask, and the remaining was rinsed twice with CH_2Cl_2 (2 x 5 mL). The combined solution was concentrated *in vacuo* to give the crude imine as a pale yellow oil, which was immediately dissolved in Et_2O (10 mL) for the next step reaction. To this solution was added catalyst **IX** (6.5 mg, 0.0125 mmol, 5 mol %) and 2,6-lutidine (29 μL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added acetyl chloride (18 μL, 0.25 mmol, 1.0 equiv), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 28 h. The resulting heterogeneous mixture was then allowed to warm to room temperature and stirred for 30 mins followed by concentration in *vacuo*. The crude product was purified by flash column chromatography with 50 to 60% EtOAc-hexane (R_f = 0.35 in 80% EtOAc-hexane) to afford product **7** (48 mg, 64% yield) as a white solid. M.p. 197–198 °C; $[\alpha]_D^{27}$ +125 (*c* 1, $CHCl_3$). The enantiomeric excess was determined to be 86 % by HPLC with chiral column CHIRALPAK® IA, 12% *i*-PrOH/n-hexane, flow rate 1.0 mL, λ = 280 nm (t_{major} = 27.1 min, t_{minor} = 37.8 min). IR (neat): 3395, 3271, 2956, 2924, 2893, 2852, 1620, 1426, 1233, 1136, 1031, 746 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): the compound exists as a 2:1 mixture of amide rotamers, signals corresponding to the major rotamer: δ 8.74 (br s, 1 H), 7.44 (d, J = 7.5 Hz, 1 H), 7.32 (d, J = 8.0 Hz, 1 H), 7.18 – 7.12 (m, 1 H), 7.11 – 7.05 (m, 1 H), 5.85 (t, J = 6.5 Hz, 1 H), 5.16 (t, J = 5.0 Hz, 1 H), 5.11 – 5.04 (m, 1 H), 4.14 – 3.88 (m, 4 H), 3.49 – 3.41 (m, 1 H), 2.93 – 2.66 (m, 2 H), 2.19 (s, 3 H), 2.30 – 2.14 (m, 2 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 169.1 (C), 136.0 (C), 134.0 (C), 126.5 (C), 121.7 (CH), 119.3 (CH), 117.9 (CH), 111.0 (CH), 107.5 (C), 102.7 (CH), 64.9 (OCH_2), 64.9 (OCH_2), 45.3 (CH), 41.5 (CH_2), 39.0 (CH_2), 22.0 (CH_2), 21.8 (CH_3); ^{13}C NMR (125 MHz, $CDCl_3$), signals corresponding to the major rotamer: δ 169.1 (C), 136.0 (C), 134.0 (C), 126.5 (C), 121.7 (CH), 119.3 (CH),

[13] For best results, the aldehyde was used immediately after purification.

117.9 (CH), 111.0 (CH), 107.5 (C), 102.7 (CH), 65.0 (two CH_2), 45.3 (CH), 41.6 (CH_2), 39.0 (CH_2), 22.0 (CH_2), 21.8 (CH_3); MS (*m/z*, relative intensity): 300 (M^+, 77), 239 (7), 225 (10), 213 (100), 203 (31), 171 (94), 161 (40), 144 (38), 135 (75), 127 (39), 77 (38), 73 (42); exact mass calculated for $C_{17}H_{20}N_2O_3$ (M^+): 300.1474; found: 300.1480.

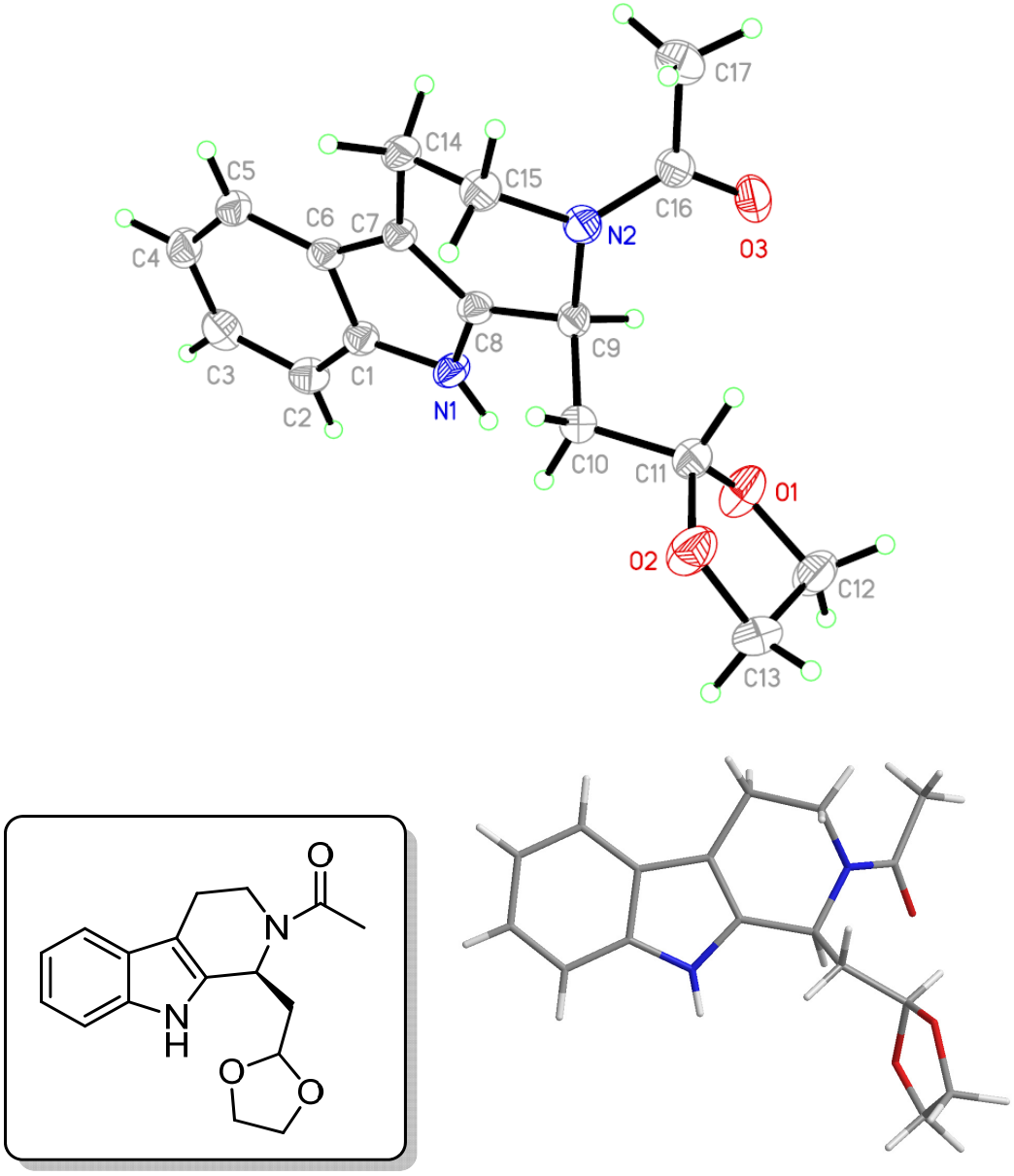


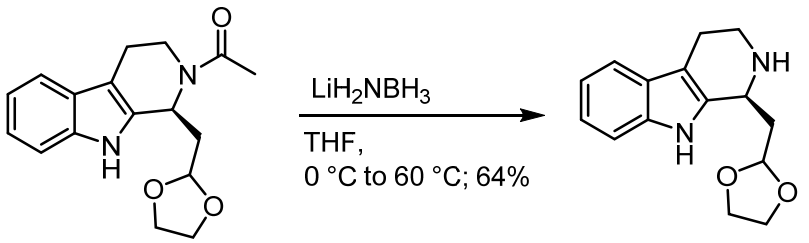
Figure S2. ORTEP and Stereo plots for X-ray crystal structures of (+)-**7**.

CCDC 1523959 contains the supplementary crystallographic data for (+)-**7**. These data can be obtained free of charge from the Cambridge Crystallographic Data Centre via www.ccdc.cam.ac.uk/data_request/cif.

Table S3. Crystal data and structure refinement for (+)-7, ic17656.

Identification code	ic17656	
Empirical formula	$C_{17}H_{20}N_2O_3$	
Formula weight	300.35	
Temperature	200(2) K	
Wavelength	1.54178 Å	
Crystal system	Orthorhombic	
Space group	$P2_12_12_1$	
Unit cell dimensions	a = 5.86390(10) Å	α= 90°.
	b = 8.5853(2) Å	β= 90°.
	c = 29.2551(6) Å	γ = 90°.
Volume	1472.80(5) $Å^3$	
Z	4	
Density (calculated)	1.355 Mg/m^3	
Absorption coefficient	0.760 mm^{-1}	
F(000)	640	
Crystal size	0.270 x 0.220 x 0.040 mm^3	
Theta range for data collection	3.021 to 69.983°.	
Index ranges	-7<=h<=6, -10<=k<=10, -35<=l<=35	
Reflections collected	9796	
Independent reflections	2801 [R(int) = 0.0157]	
Completeness to theta = 67.679°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.7533 and 0.5897	
Refinement method	Full-matrix least-squares on F^2	
Data / restraints / parameters	2801 / 2 / 207	
Goodness-of-fit on F^2	1.253	
Final R indices [I>2sigma(I)]	R1 = 0.0354, wR2 = 0.0902	
R indices (all data)	R1 = 0.0361, wR2 = 0.0909	
Absolute structure parameter	0.02(5)	
Extinction coefficient	n/a	
Largest diff. peak and hole	0.295 and -0.271 $e.Å^{-3}$	

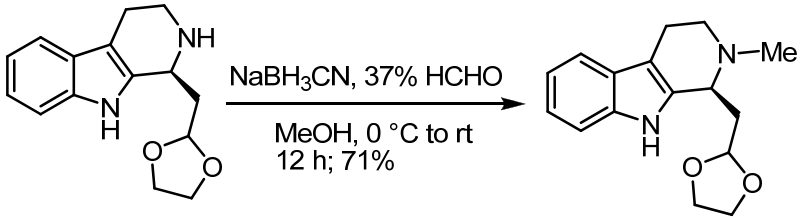
Preparation of 7



7 **21**

To a solution of diisopropylamine (0.2 mL, 1.43 mmol, 7.1 equiv) in THF (2 mL) was added a solution of *n*-butyllithium (0.57 mL, 2.5 M in hexane, 1.43 mmol, 7.1 equiv) at –78 °C and stirred a the same temperature for 10 min, followed by warming up to 0 °C and stirred for 15 min. To this solution was added borane-ammonia complex (38 mg, 90% purity, 1.0 mmol, 5.0 equiv), and the suspension solution was stirred at 0 °C for 15 min, followed by warming up to room temperature and stirred for additional 10 min. Subsequently, the solution was cooled to 0 °C. To the solution was added **7** (60 mg, 0.20 mmol) at 0 °C and stirred for 2 min, followed by heating up to 60 °C and stirred for 4 h. The resulting suspension was cooled to 0°C and the reaction was quenched by dropwise addition of 2N aqueous HCl solution (5 mL), followed by stirring for 30 min. The pH value of the solution was adjusted to 8 by the addition of saturated aqueous $NaHCO_3$. The reaction mixture was extracted five times with ethyl acetate (5 x 10 mL), and the combined organic extracts were dried over sodium sulfate and concentrated *in vacuo* to give the residue. The crude product was purified by flash column chromatography with 5 to 10% MeOH-CH_2Cl_2 (R_f = 0.4 in 20% MeOH-CH_2Cl_2) to afford product **21** (33 mg, 64% yield) as a pale yellow oil. Selected spectroscopic data for **21**: $[\alpha]_D^{27}$ –25.9 (*c* 1, MeOH); IR (neat): 3390, 2961, 2924, 2890, 1603, 1453, 1260, 1137, 1113, 1017, 799, 743 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 8.75 (br, s, 1 H), 7.46 (d, J = 8.0 Hz, 1 H), 7.30 (d, J = 8.0 Hz, 1H), 7.12 (dd, J = 7.5, 7.5 Hz, 1 H), 7.06 (dd, J = 7.5, 7.5 Hz, 1 H), 5.10 (t, J = 3.8 Hz, 1 H), 4.30 (br. s, 1 H), 4.11 – 4.02 (m, 2 H), 3.98 – 3.90 (m, 2 H), 3.36 – 3.31 (m, 1 H), 3.08 – 3.00 (m, 1 H), 2.80 – 2.68 (m, 2 H), 2.38 – 2.15 (m, 3 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 135.6 (C), 135.5 (C), 127.3 (C), 121.4 (CH), 119.1 (CH), 118.0 (CH), 110.9 (CH), 108.5 (C), 102.8 (CH), 65.1 (CH_2), 65.0 (CH_2), 48.7 (CH) 42.9 (CH_2), 39.1 (CH_2), 22.4 (CH_2); MS (*m/z*, relative intensity): 258 (M^+, 23), 213 (5), 172 (13), 171 (100), 156 (10), 144 (9), 135 (7), 115 (4), 73 (10); exact mass calculated for $C_{15}H_{18}N_2O_2$ (M+): 258.1368; found: 258.1364.

Preparation of 22

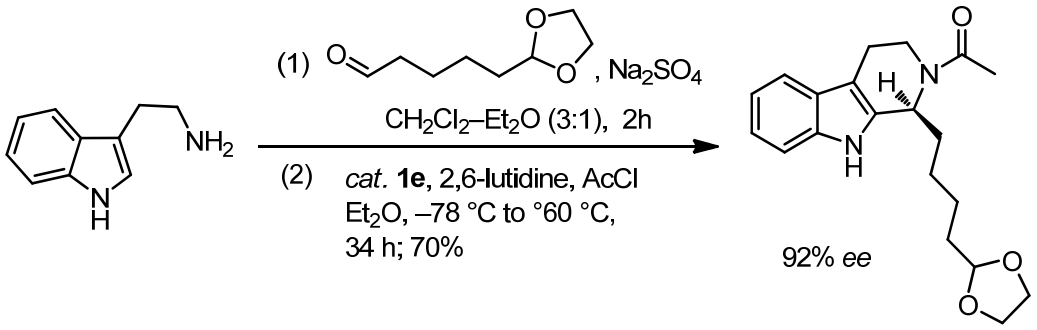


21 **22**

To a solution of **21** (100 mg, 0.387 mmol) in methanol (3.8 mL) was added $NaCNBH_3$ (61 mg, 0.97 mmol) at 0 °C. The resulting solution was stirred at 0 °C for 5 min followed by the addition of 37% aqueous HCHO solution (3 mL, excess). The solution was stirred at room temperature for 12 h until the completion of the reaction, as monitored by TLC. The solution was concentrated *in vacuo* to remove MeOH, and the residue was diluted with water. The mixture was extracted with EtOAc (15 mL x 3), and the combined organic extracts were dried over $MgSO_4$ and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 10% MeOH–CH_2Cl_2 (R_f = 0.45 in 15% MeOH–CH_2Cl_2) to afford product **22** (75 mg, 71% yield) as a colorless oil. Selected spectroscopic data for **22**: $[\alpha]_D^{27}$ +43.3 (*c* 1, $CHCl_3$); IR (neat): 3397, 3053, 2933, 2889, 1453, 1324, 1136, 1064, 1025, 944, 742 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 8.75 (br s, 1 H), 7.47 (d, J = 8.0 Hz, 1 H), 7.31 (d, J = 8.0 Hz, 1 H), 7.14 – 7.04 (m, 2 H), 5.09 (dd, J = 5.0, 3.0 Hz, 1 H), 4.14 – 4.06 (m, 2 H), 3.98 – 3.95 (m, 2 H), 3.68 – 3.65 (m, 1 H), 3.16 – 3.11 (m, 1 H), 2.80 – 2.72 (m, 3 H), 2.48 (s, 3 H) 2.39 – 2.35 (m, 1 H), 2.14 – 2.09 (m, 1 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 135.8 (C), 135.4 (C), 126.9 (C), 121.2 (CH), 119.0 (CH), 118.0 (CH), 110.8 (CH), 107.3 (C), 103.0 (CH), 65.2 (CH_2), 65.1 (CH_2) 55.4 (CH), 50.9 (CH_2), 42.1 (CH_3), 37.6 (CH_2), 19.7 (CH_2); MS (*m/z*, relative intensity): 272 (M^+, 4), 229 (1), 186 (10), 185 (100), 156 (4), 144 (2), 73 (7); exact mass calculated for $C_{16}H_{20}N_2O_2$ (M+): 272.1525; found: 272.1522.

(Treatment of **22** with 2N HCl did not proceed the cyclization process as observed in the prior examples, probably due to the difficulty in the ring-strain formation. Hence, the product at this stage was isolated and characterized).

Preparation of 9



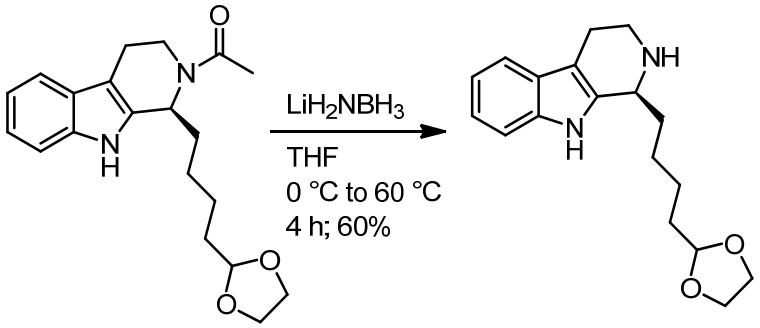
9

To a solution of tryptamine (40 mg, 0.25 mmol) in CH_2Cl_2 (6 mL) was added a solution of aldehyde **2d**[14] (40 mg, 0.25 mmol) in CH_2Cl_2 (3 mL), followed by the addition of Et_2O (3 mL). The solution was stirred at room temperature for 2 h, prior to the addition of sodium sulfate (500 mg), and the mixture was vigorously stirred at the same temperature for an additional 30 min. The resulting solution was filtered by cannula transfer, and the remaining was rinsed twice with dichloromethane (2 x 5 mL). The combined solution was concentrated *in vacuo* to give the crude imine as a pale yellow oil, which was immediately dissolved in Et_2O (15 mL) for the next step reaction. To this solution was added catalyst **IX** (6.5 mg, 0.013 mmol, 5 mol %) and 2,6-lutidine (29 μL, 0.25 mmol, 1.0 equiv) at –78 °C, and the solution was stirred for 5 min. To the reaction mixture was added acetyl chloride (18 μL, 0.25 mmol, 1.0 equiv), and the resulting solution was stirred at –78 °C for 10 min, followed by warming to –60 °C and stirred at the same temperature for 34 h. The resulting heterogeneous mixture was allowed to warm to room temperature and stirred for 30 mins followed by concentration in *vacuo*. The crude product was purified by flash column chromatography with 50 to 60% EtOAc-hexane (R_f = 0.30 in 80% EtOAc-hexane) to afford product **9** (60 mg, 70% yield) as a white solid. M.p. 154–155 °C; $[\alpha]_D^{25}$ 100.7 (*c* 1, $CHCl_3$). The enantiomeric excess was determined to be 92 % by HPLC with chiral column CHIRALPAK® IA, 12% *i*-PrOH/n-hexane, flow rate 1.0 mL, λ = 254 nm (t_{major} = 22.8 min, t_{minor} = 31.5 min). IR (neat): 3278, 3008, 2950, 2886, 1619, 1447, 1231, 1140, 1031, 945, 746 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): the compound exists as a 5:1 mixture of amide rotamers, signals corresponding to the major rotamer: δ 8.47 (s, 1 H), 7.43 (d, J = 7.8 Hz, 1 H), 7.29 (d, J = 8.0 Hz, 1 H), 7.17 – 7.03 (m, 2 H), 5.76 (dd, J = 8.7, 5.6 Hz, 1 H), 4.81 (t, J = 4.8 Hz, 1 H), 4.01 – 3.78 (m, 5 H), 3.53 – 3.44 (m, 1 H), 2.87 – 2.64 (m, 2 H), 2.21 (s, 3 H), 1.94 – 1.40 (m, 8 H); ^{13}C NMR (125 MHz, $CDCl_3$) signals corresponding to the major rotamer: δ 169.6 (C), 136.0 (C), 134.7 (C), 126.6 (C), 121.6 (CH), 119.4 (CH), 117.8 (CH), 110.9 (CH), 107.3 (C), 104.4 (CH), 64.8 (two CH_2), 48.9 (CH), 41.0 (CH_2), 34.3 (CH_2), 33.5 (CH_2), 26.0 (CH_2), 23.9

[14] For best results, the aldehyde was used immediately after purification.

(CH_2), 22.0 (CH_2), 21.9 (CH_3); MS (*m/z*, relative intensity): 342 (M^+, 23), 299 (4), 297 (3), 255 (5), 214 (11), 213 (100), 171 (65), 169 (10), 144 (5), 115 (5), 97 (7), 73 (11); exact mass calculated for $C_{20}H_{26}N_2O_3$ (M^+): 342.1943; found: 342.1944.

Preparation of 23.

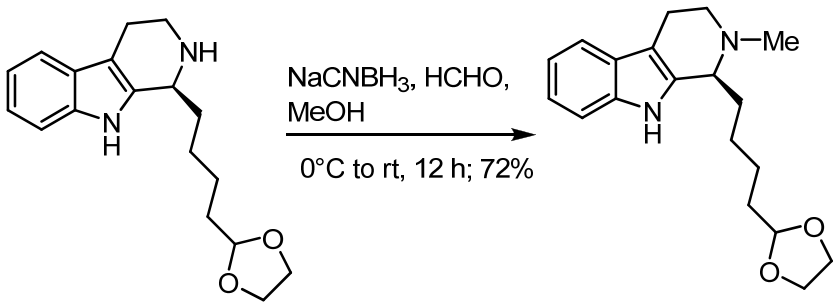


9 **23**

To a solution of diisopropylamine (0.50 mL, 3.57 mmol, 7.2 equiv) in THF (3.5 mL) was added a solution of *n*-butyllithium (1.42 mL, 2.5 M in hexane, 3.55 mmol, 7.2 equiv) at –78 °C and stirred at the same temperature for 10 min, followed by warm up to 0 °C and stirred for 15 min. To this solution was added borane-ammonia complex (95.5 mg, 90% pure, 2.78 mmol, 5.6 equiv), and the suspension solution was stirred at 0 °C for 15 min, followed by warm up to room temperature and stirred for additional 10 min. To the solution was added **9** (170 mg, 0.496 mmol) at 0 °C and stirred for 2 min, followed by heating up to 60 °C and stirred for 4 h. The resulting suspension was cooled to 0°C and the reaction was quenched by dropwise addition of 2N aqueous HCl solution (10 mL), followed by stirring for 30 min. The pH value of the solution was adjusted to 8 by the addition of saturated aqueous $NaHCO_3$. The reaction mixture was extracted five times with ethyl acetate (5 x 20 mL), and the combined organic extracts were dried over sodium sulfate and concentrated *in vacuo* to give the residue. The crude product was purified by flash column chromatography with 5 to 10% MeOH-CH_2Cl_2 (R_f = 0.4 in 20% MeOH-CH_2Cl_2) to afford product **23** (90 mg, 60% yield) as a colorless oil. Selected spectroscopic data for **23**: $[\alpha]_D^{27}$ –29.8 (*c* 1, MeOH); IR (neat): 3404, 3329, 2941, 2859, 1453, 1139, 1027, 945, 803, 743 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.98 (br, s, 1 H), 7.46 (d, *J* = 8.0 Hz, 1 H), 7.28 (d, *J* = 8.0 Hz, 1 H), 7.15 – 7.05 (m, 2 H), 4.85 (t, *J* = 4.7 Hz, 1 H), 4.06 – 4.01 (m, 1 H), 3.98 – 3.95 (m, 2 H), 3.86 – 3.82 (m, 2 H), 3.36 – 3.30 (m, 1 H), 3.04 – 2.96 (m, 1 H), 2.75 – 2.67 (m, 2 H), 1.96 – 1.80 (m, 2 H), 1.73 – 1.64 (m, 3 H), 1.60 – 1.45 (m, 4 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 136.2 (C), 135.6 (C), 127.4 (C), 121.4 (CH), 119.2 (CH), 118.0 (CH), 110.7 (CH), 108.9 (C), 104.4 (CH), 64.8 (two CH_2), 52.4 (CH) 42.5 (CH_2), 34.7 (CH_2), 33.5 (CH_2), 25.6 (CH_2), 24.0 (CH_2), 22.6 (CH_2); MS (*m/z*,

relative intensity): 300 (M^+, 4), 299 (1), 198 (1), 184 (1), 172 (10), 171 (100), 144 (3), 73 (5); exact mass calculated for $C_{18}H_{24}N_2O_2$ (M^+): 300.1838; found: 300.1838.

Preparation of indole 24.



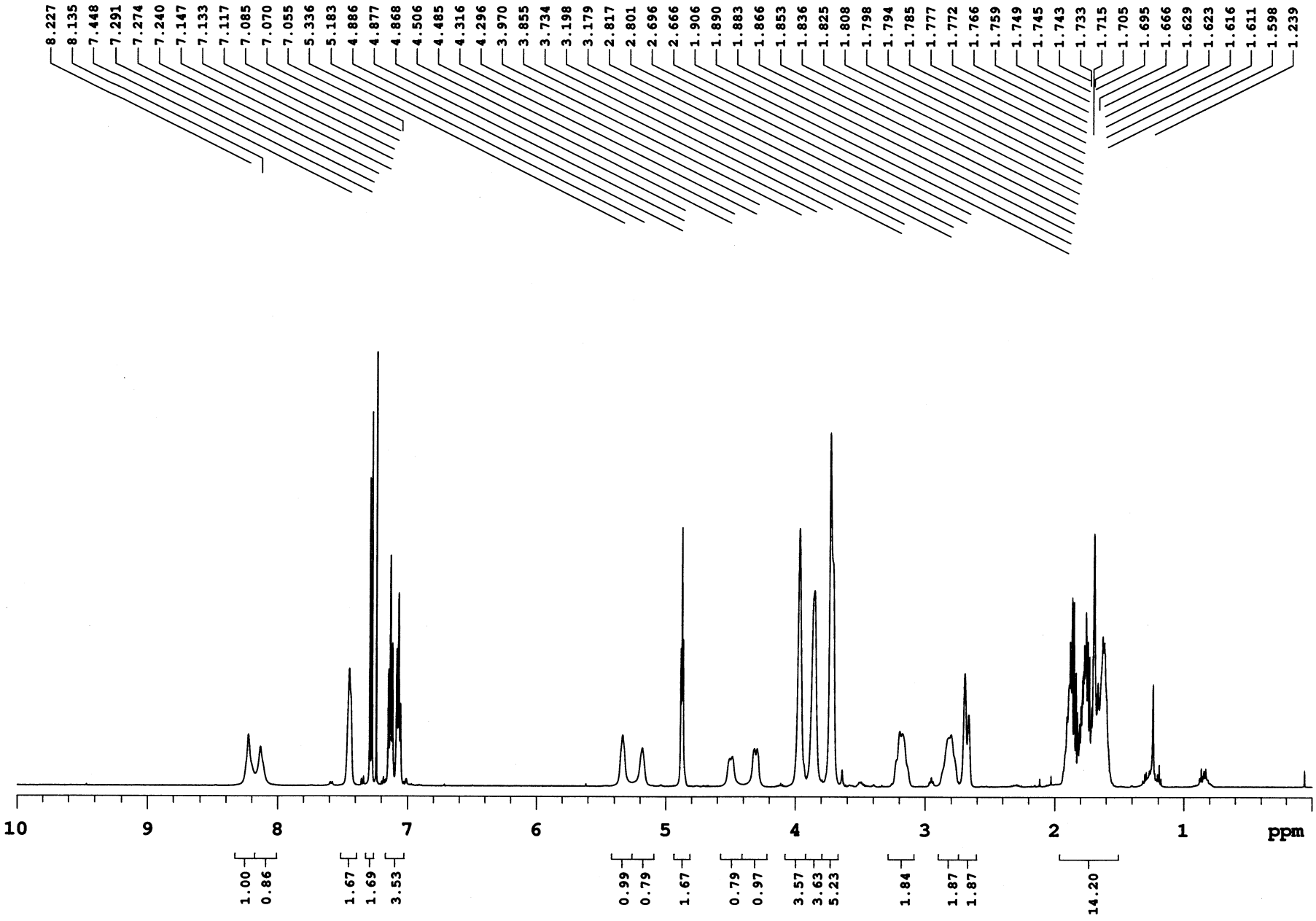
23 **24**

To a solution of **23** (90 mg, 0.3 mmol) in methanol (3.0 mL) was added $NaCNBH_3$ (50 mg, 0.796 mmol) at 0 °C. The resulting solution was stirred at 0 °C for 5 min followed by the addition of 37% aqueous HCHO solution (3 mL, excess). The solution was stirred at room temperature for 12 h until the completion of the reaction, as monitored by TLC. The solution was concentrated *in vacuo* to remove MeOH. The residue was diluted with water, and the reaction mixture was extracted with EtOAc (3 x 15 mL), and the combined organic extracts were dried over Na_2SO_4 and concentrated *in vacuo* to give a residue. The crude product was purified by flash column chromatography with 5 to 10% MeOH–CH_2Cl_2 (R_f = 0.4 in 15% MeOH–CH_2Cl_2) to afford product **24** (68 mg, 72% yield) as a colorless oil. Selected spectroscopic data for **24**: $[\alpha]_D^{25}$ +4 (*c* 1, $CHCl_3$); IR (neat): 3250, 3056, 2927, 2859, 1678, 1463, 1453, 1140, 1031, 745 cm^{-1}; ^1H NMR (500 MHz, $CDCl_3$): δ 7.86 (br s, 1 H), 7.47 (d, J = 8.0 Hz, 1 H), 7.29 (d, J = 8.0 Hz, 1 H), 7.15 – 7.06 (m, 2 H), 4.84 (t, J = 4.5 Hz, 1H), 3.98 – 3.92 (m, 2 H), 3.87 – 3.80 (m, 2 H), 3.49 (t, J = 5.0 Hz, 1H), 3.19 – 3.10 (m, 1 H), 2.80 – 2.70 (m, 3 H), 2.45 (s, 3 H), 1.95 – 1.84 (m, 1 H), 1.79 – 1.62 (m, 3 H), 1.56 – 1.30 (m, 4 H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 135.9 (C), 134.9 (C), 127.3 (C), 121.2 (CH), 119.2 (CH), 118.0 (CH), 110.6 (CH), 108.3 (C), 104.5 (CH), 64.80 (CH_2), 64.79 (CH_2), 59.9 (CH), 49.9 (CH_2), 42.0 (CH_3), 33.5 (CH_2), 32.7 (CH_2), 25.0 (CH_2), 24.1 (CH_2), 19.2 (CH_2); exact mass calculated for $C_{19}H_{26}N_2O_2$ (M^+):314.1994; found: 314.1987.

(Treatment of **24** with 2N HCl did not proceed the cyclization process as observed in the prior examples, probably due to the difficulty in the formation of medium-size macrocycles. Hence, the product at this stage was isolated and characterized).

Vms-03-126

Sample Name	**Vms-03-126**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-05-25**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-126/PROTON_06

Fig S36. 1H NMR (CDCl3, 500 MHz) of compound 3.

Plot date 2016-06-30

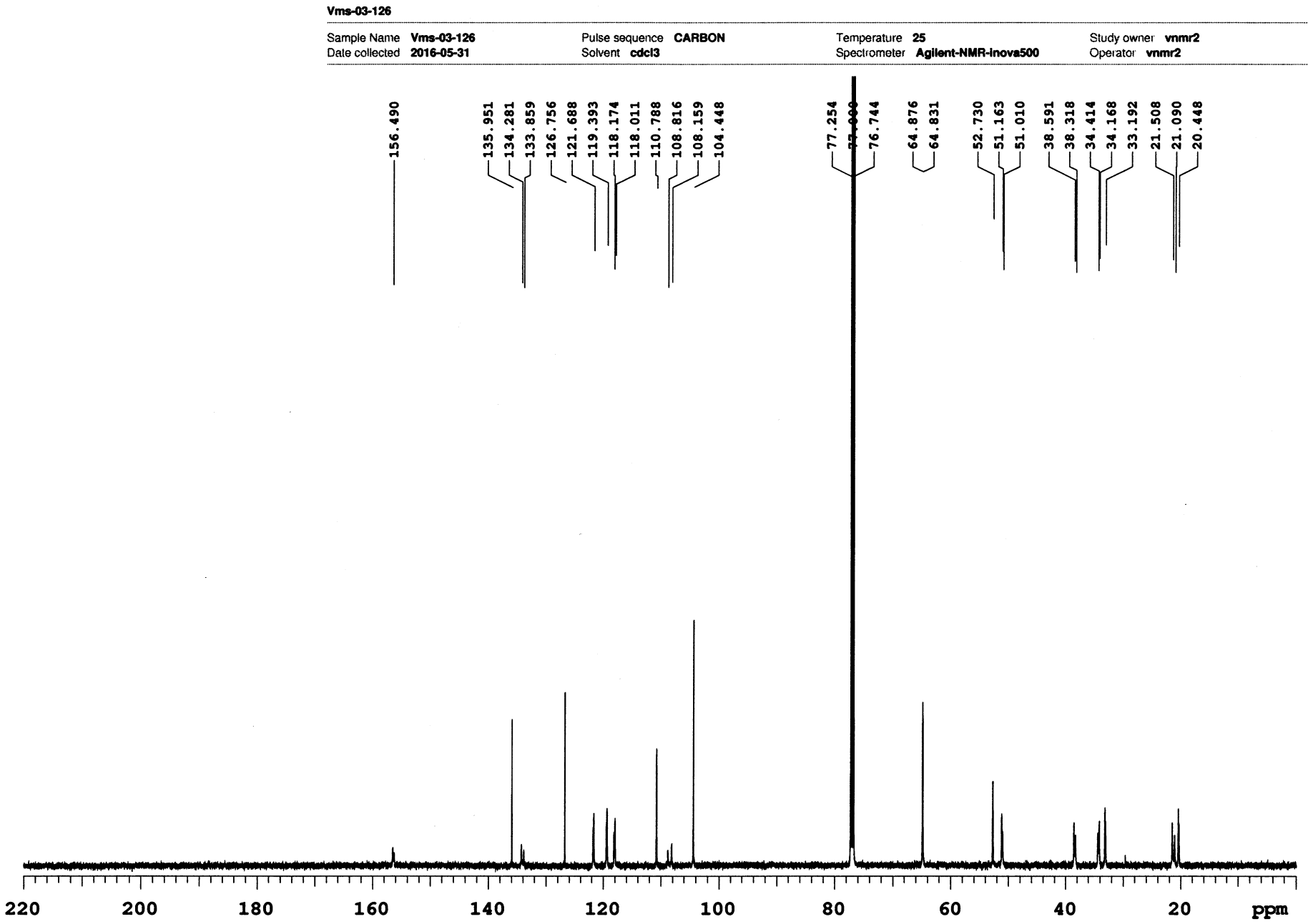


Fig S37. 13C NMR (CDCl3, 125 MHz) of compound 3.

Vms-03-126

Sample Name **Vms-03-126**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-06-01**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

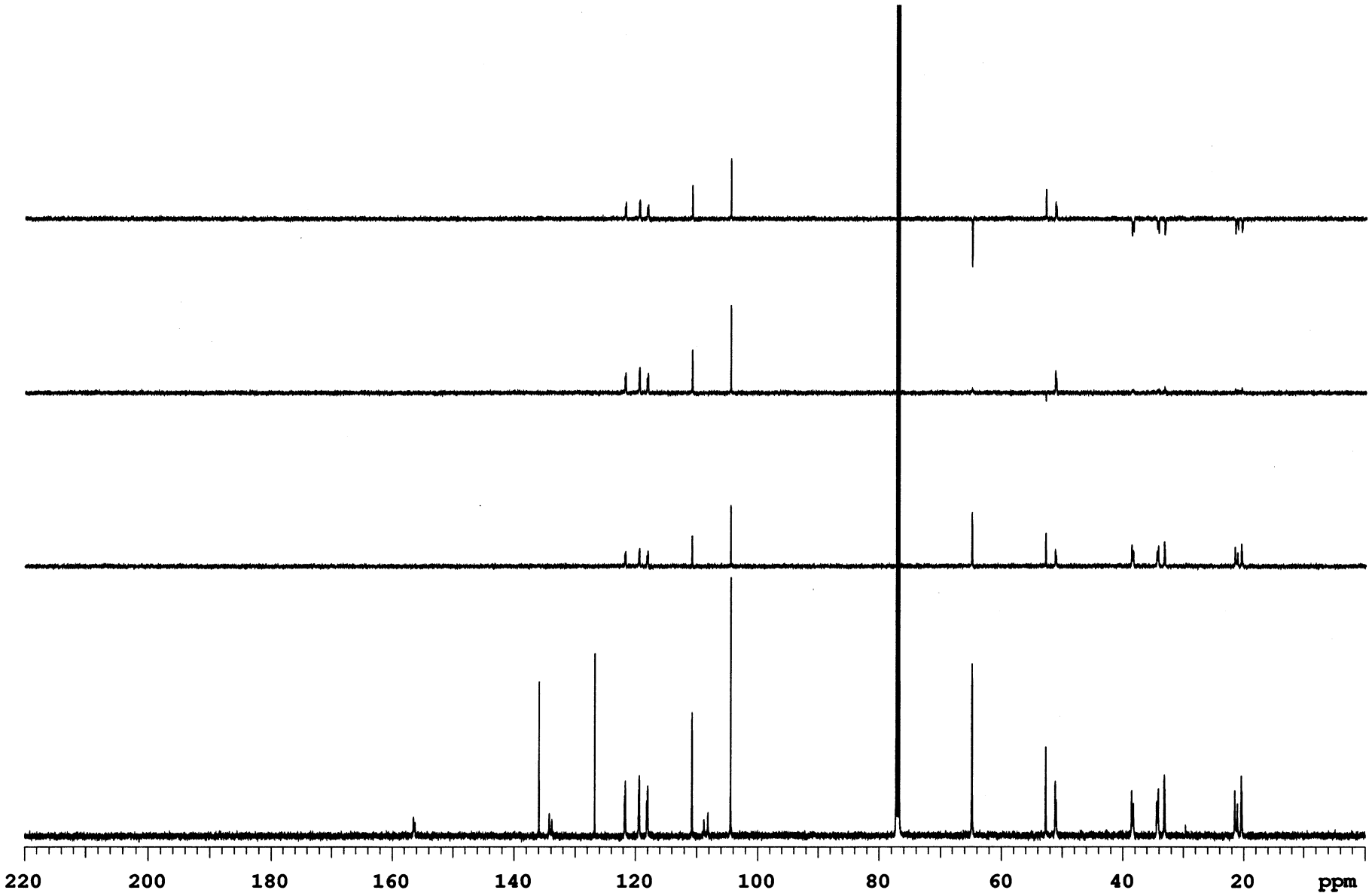


Fig S38. DEPT of compound 3.

Vms-03-126

Sample Name **Vms-03-126**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-06-01**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

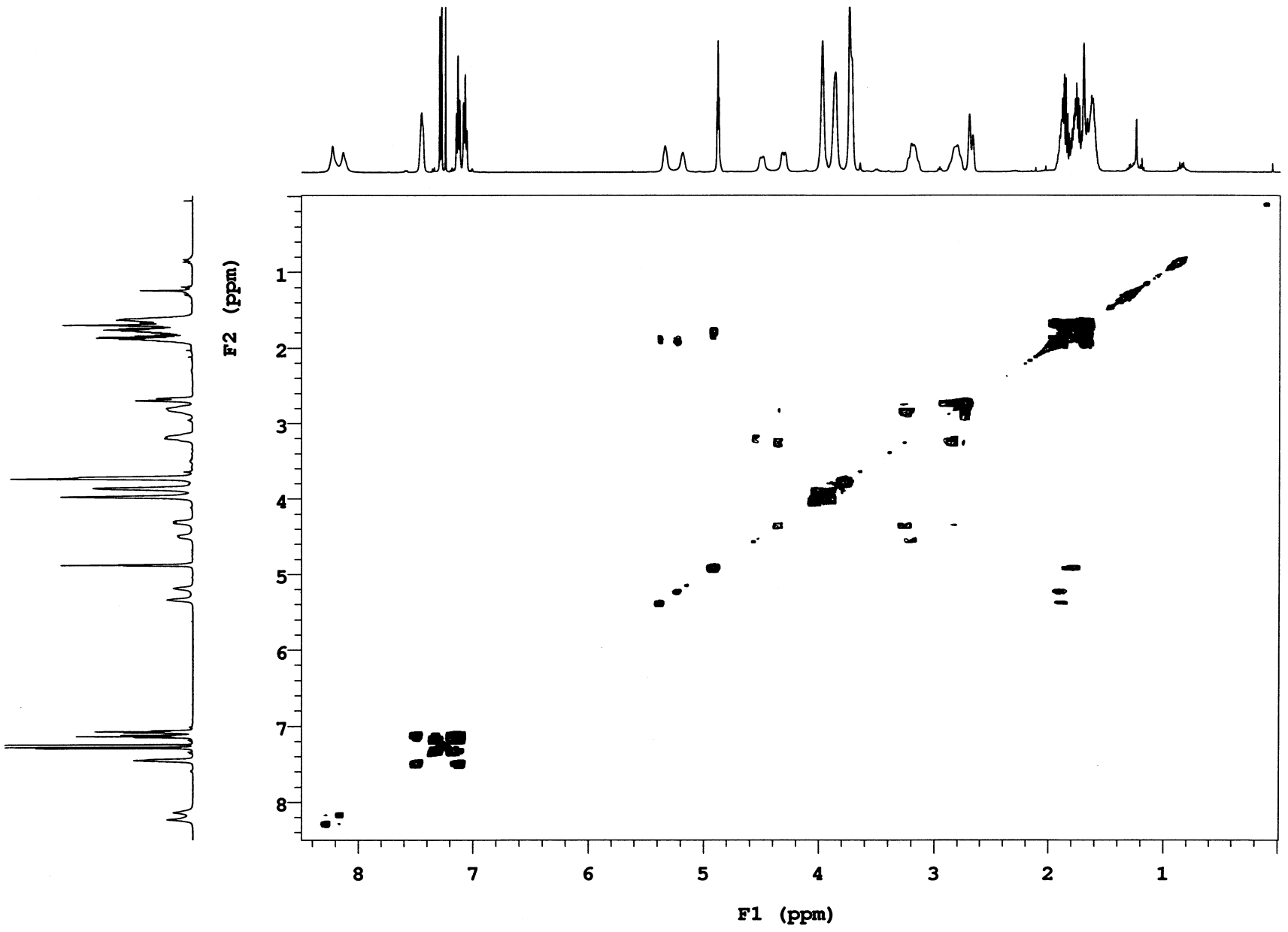


Fig S39. COSY of compound 3.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-126/gCOSY_03

Plot date 2016-06-30

Vms-03-126

Sample Name	**Vms-03-126**	Pulse sequence	**NOESY**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-06-01**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

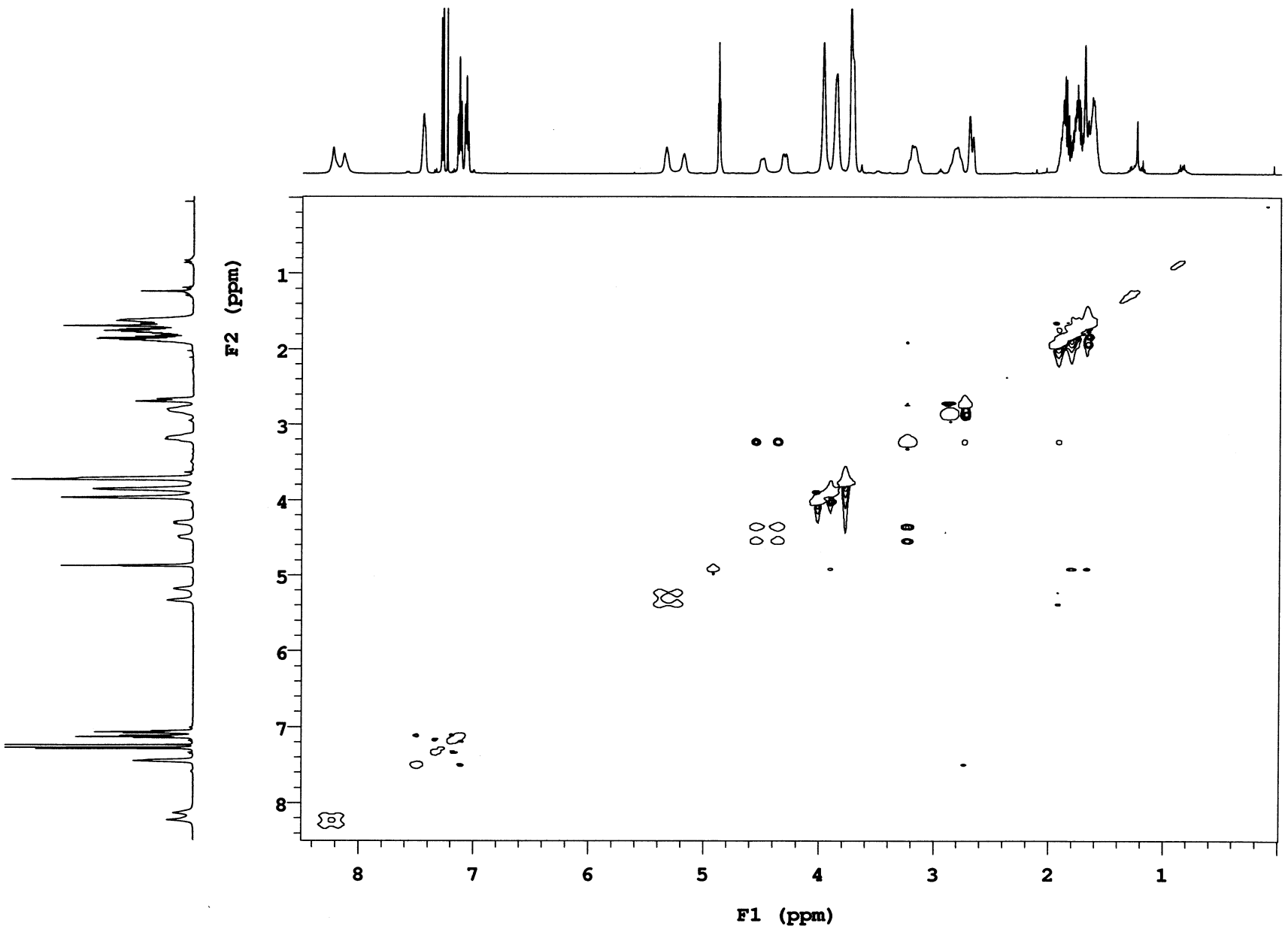


Fig S40. NOESY of compound 3.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-126/NOESY_03

Plot date 2016-06-30

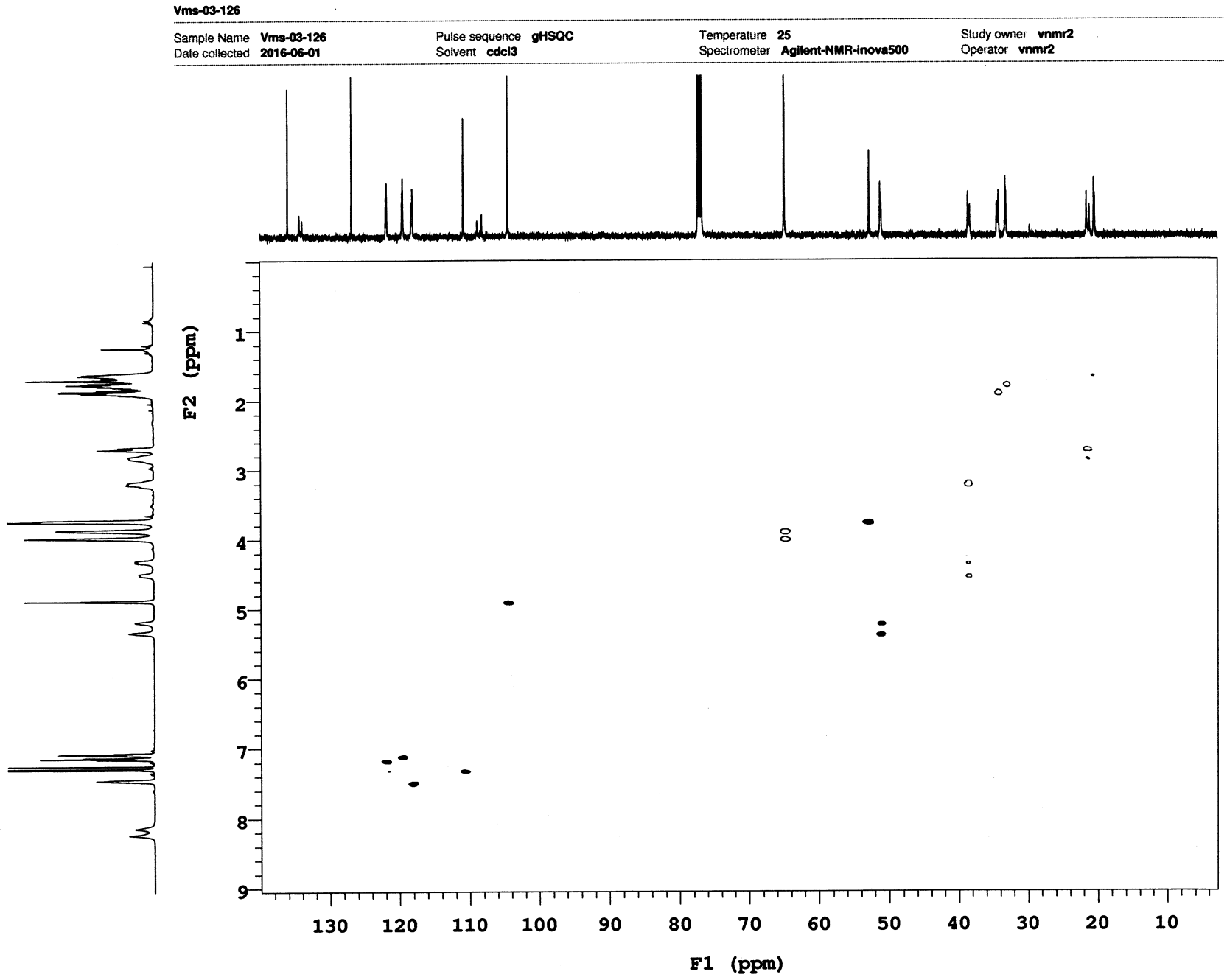


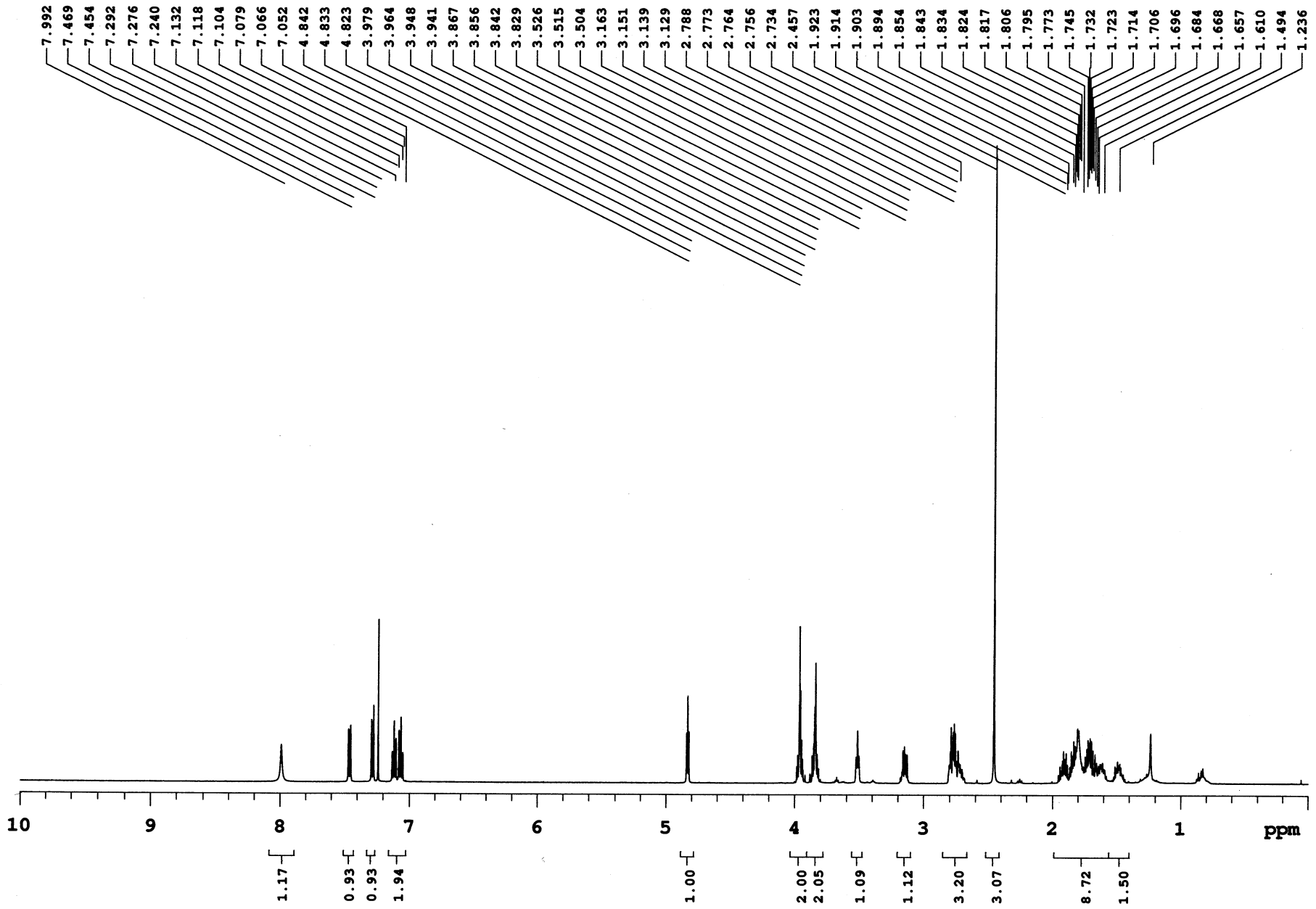
Fig S41. HSQC of compound 3.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-126/gHSQC_03

Plot date 2016-06-30

Vms-03-127

Sample Name	**Vms-03-127**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-05-29**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-127/PROTON_05.fid

Fig S42. 1H NMR (CDCl3, 500 MHz) of compound 4.

Plot date 2016-10-17

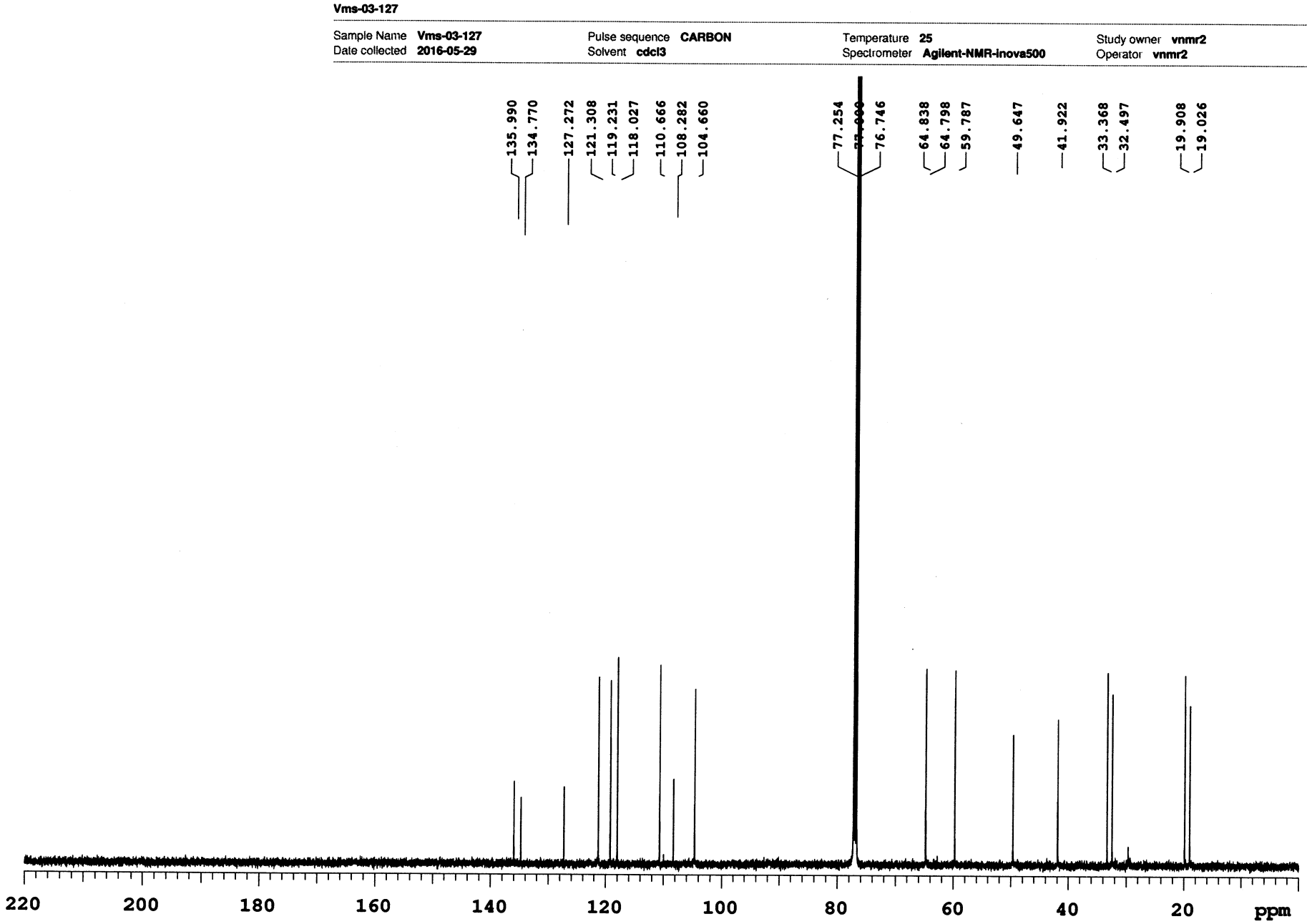


Fig S43. 13C NMR (CDCl3, 125 MHz) of compound 4.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-127/CARBON_01.fid

Plot date 2016-06-30

Vms-03-127

Sample Name **Vms-03-127** | Pulse sequence **DEPT** | Temperature **25** | Study owner **vnmr2**
Date collected **2016-05-29** | Solvent **cdcl3** | Spectrometer **Agilent-NMR-inova500** | Operator **vnmr2**

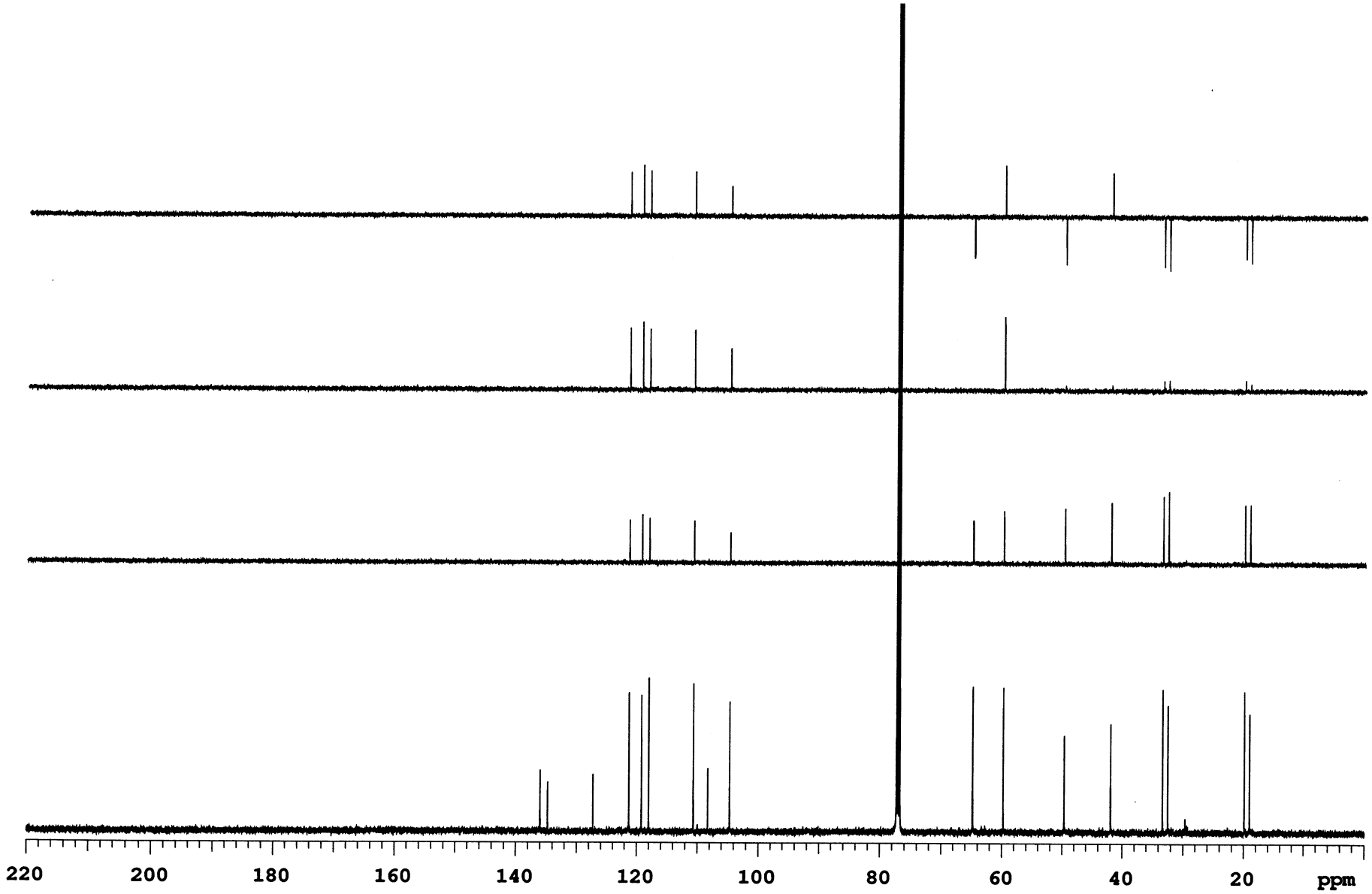


Fig S44. DEPT of compound 4.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-127/DEPT_01.fid

Plot date 2016-06-30

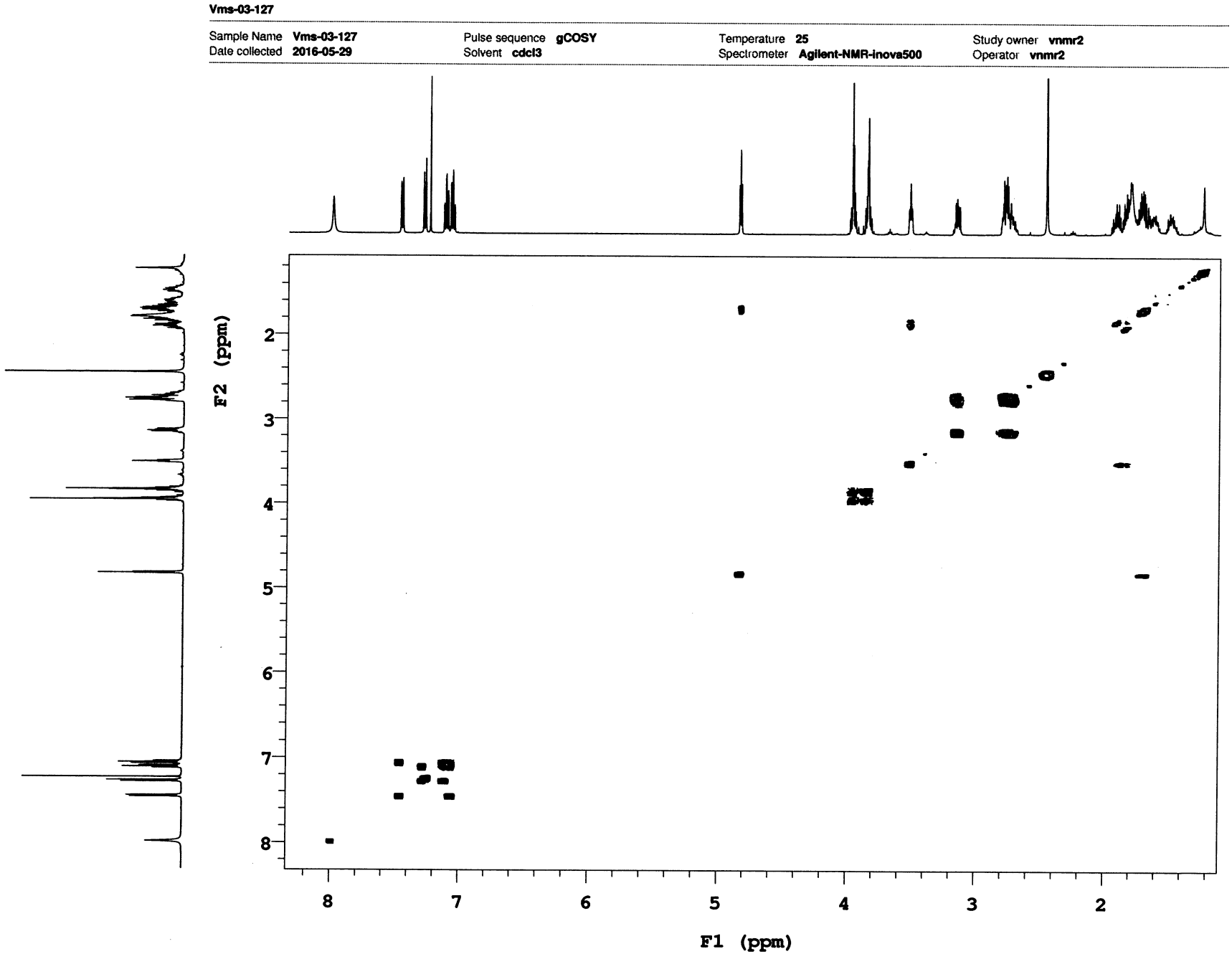


Fig S45. COSY of compound 4.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-127/gCOSY_01.fid

Plot date 2016-06-30

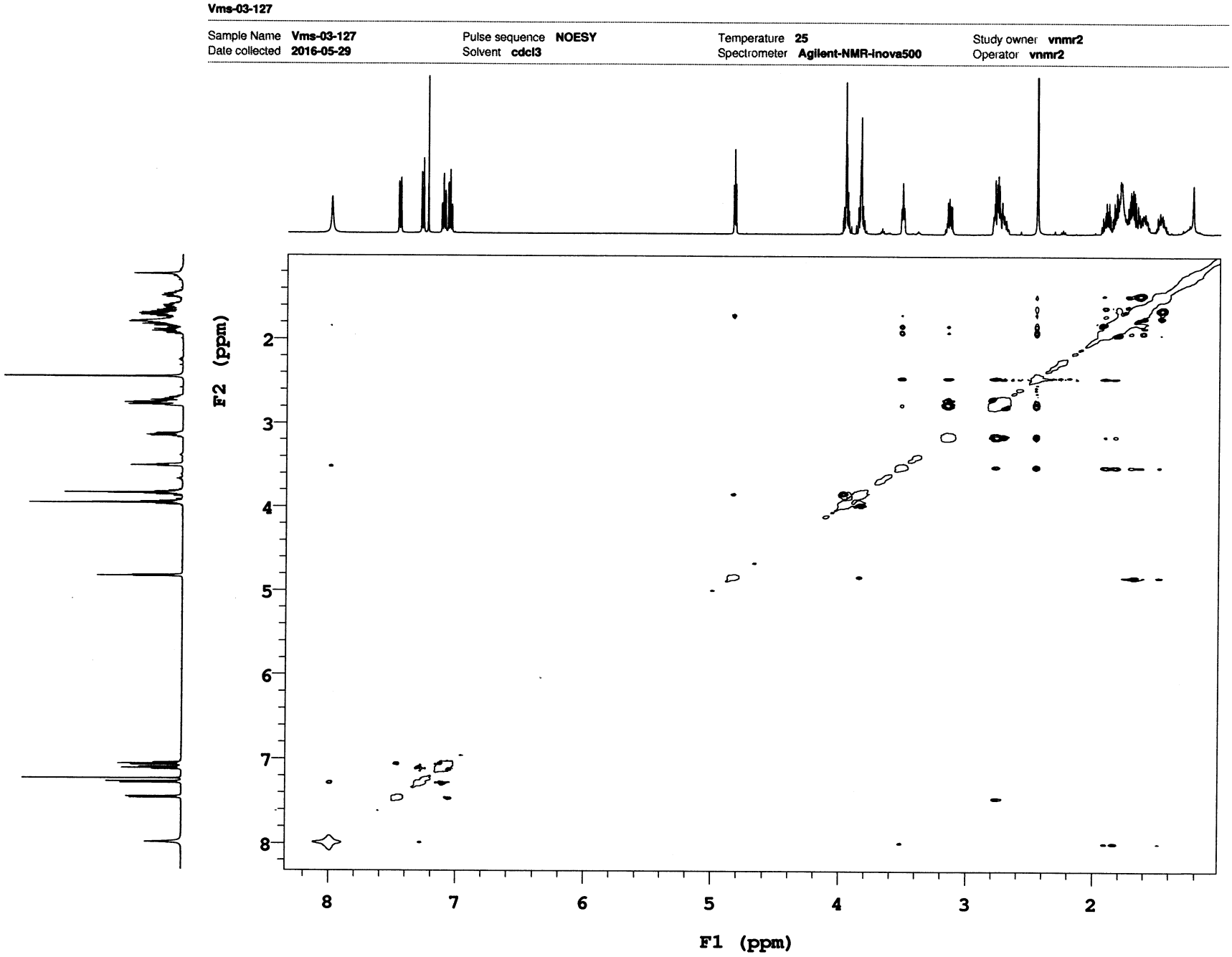


Fig S46. NOESY of compound 4.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-127/NOESY_01.fid

Plot date 2016-06-30

Vms-03-127

Sample Name **Vms-03-127** | Pulse sequence **gHSQC** | Temperature **25** | Study owner **vnmr2**
Date collected **2016-07-08** | Solvent **cdcl3** | Spectrometer **Agilent-NMR-inova500** | Operator **vnmr2**

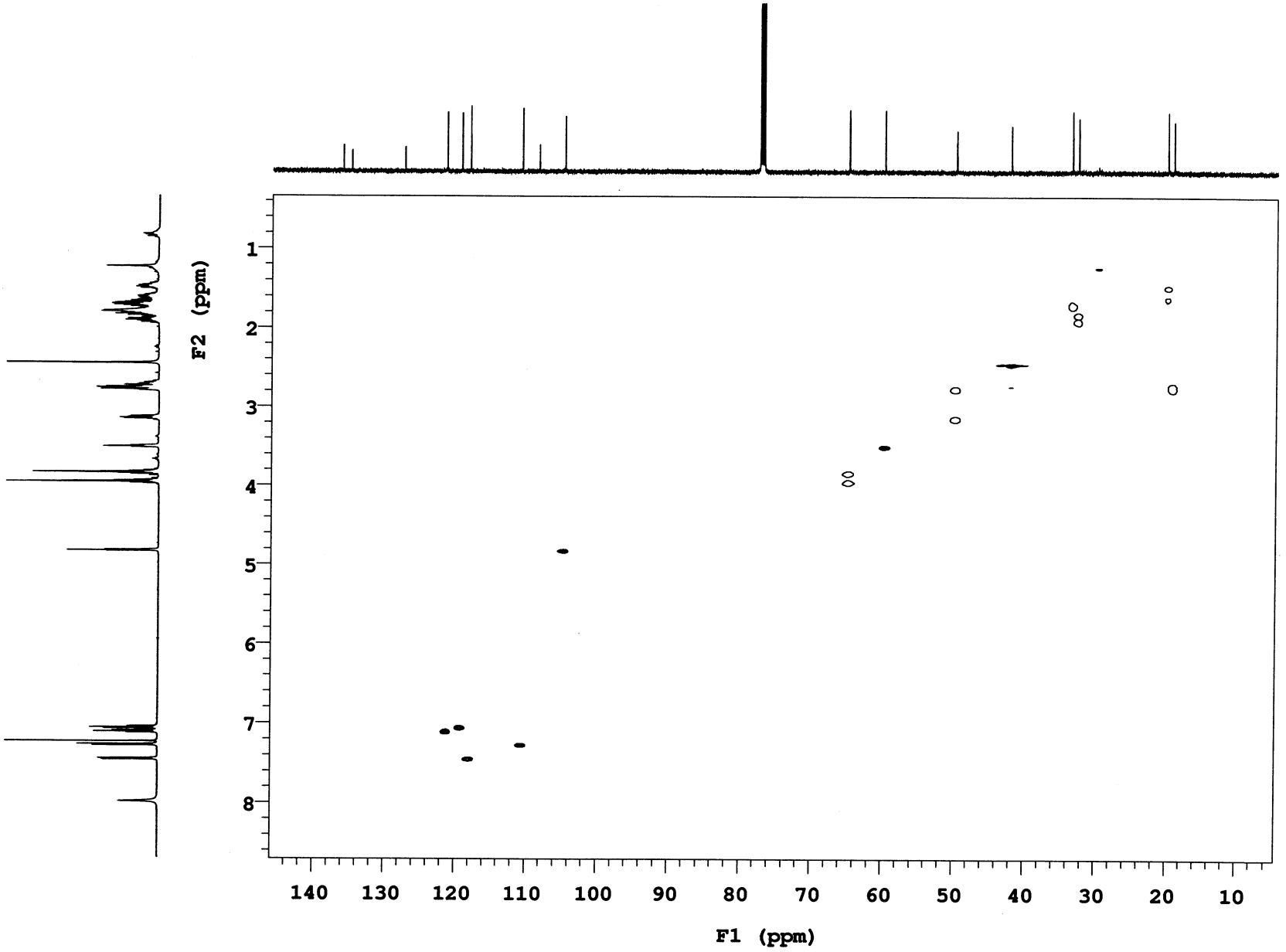
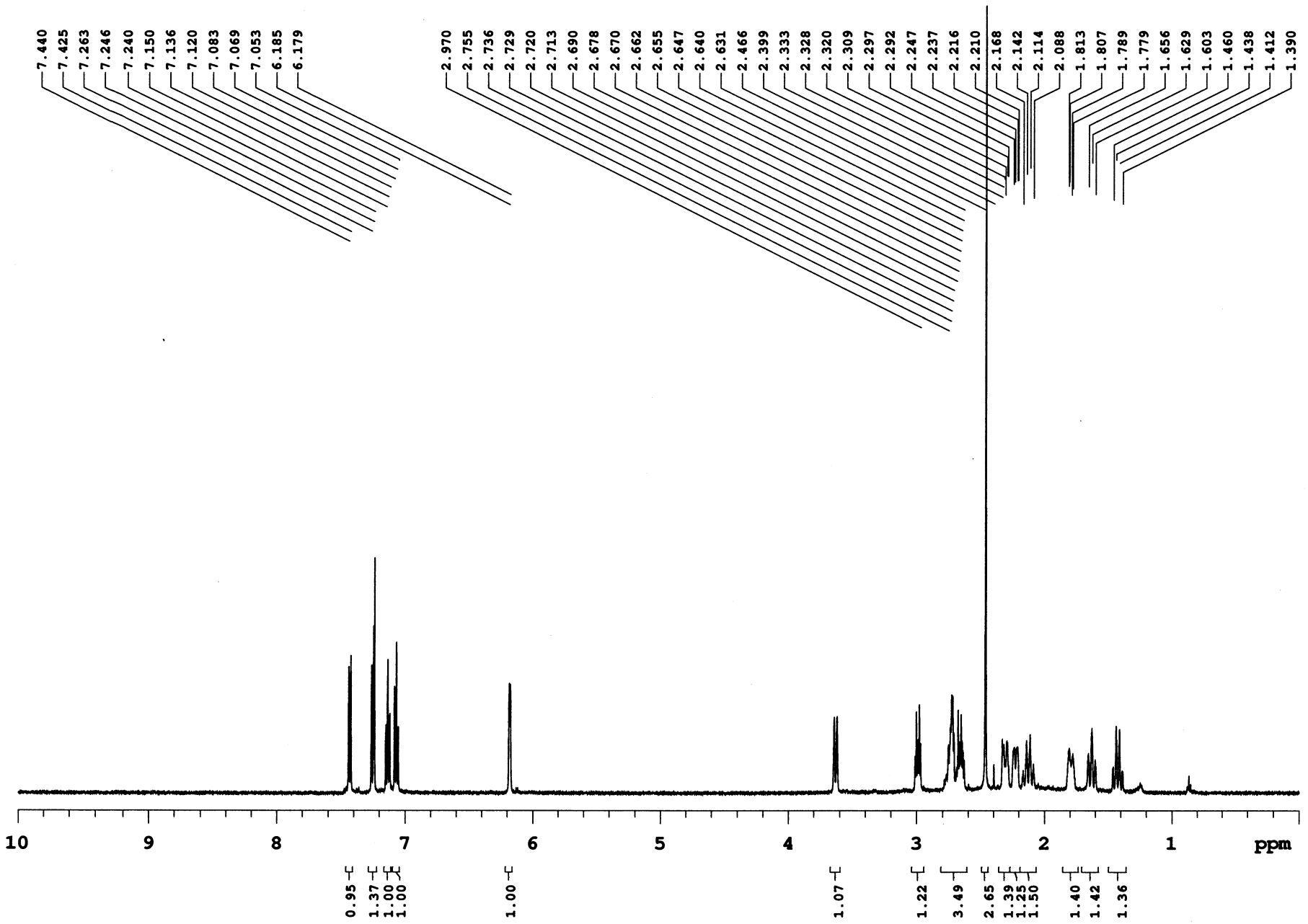


Fig S47. HSQC of compound 4.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-127/gHSQC_03

Plot date 2016-07-08



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-212/H1.fid

Fig S48. 1H NMR (CDCl3, 500 MHz) of compound 5.

Plot date 2016-05-13

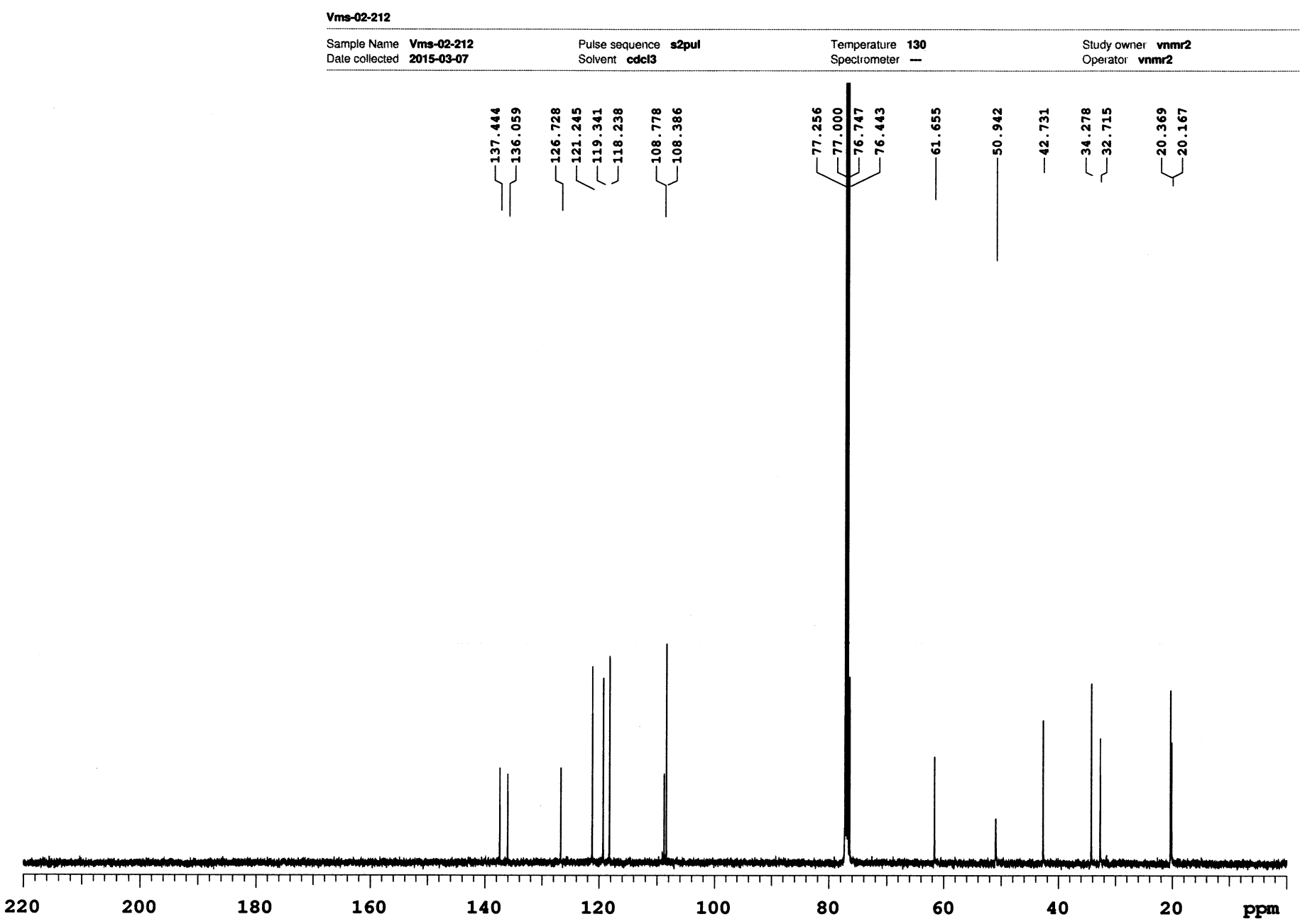


Fig S49. 13C NMR (CDCl3, 125 MHz) of compound 5.

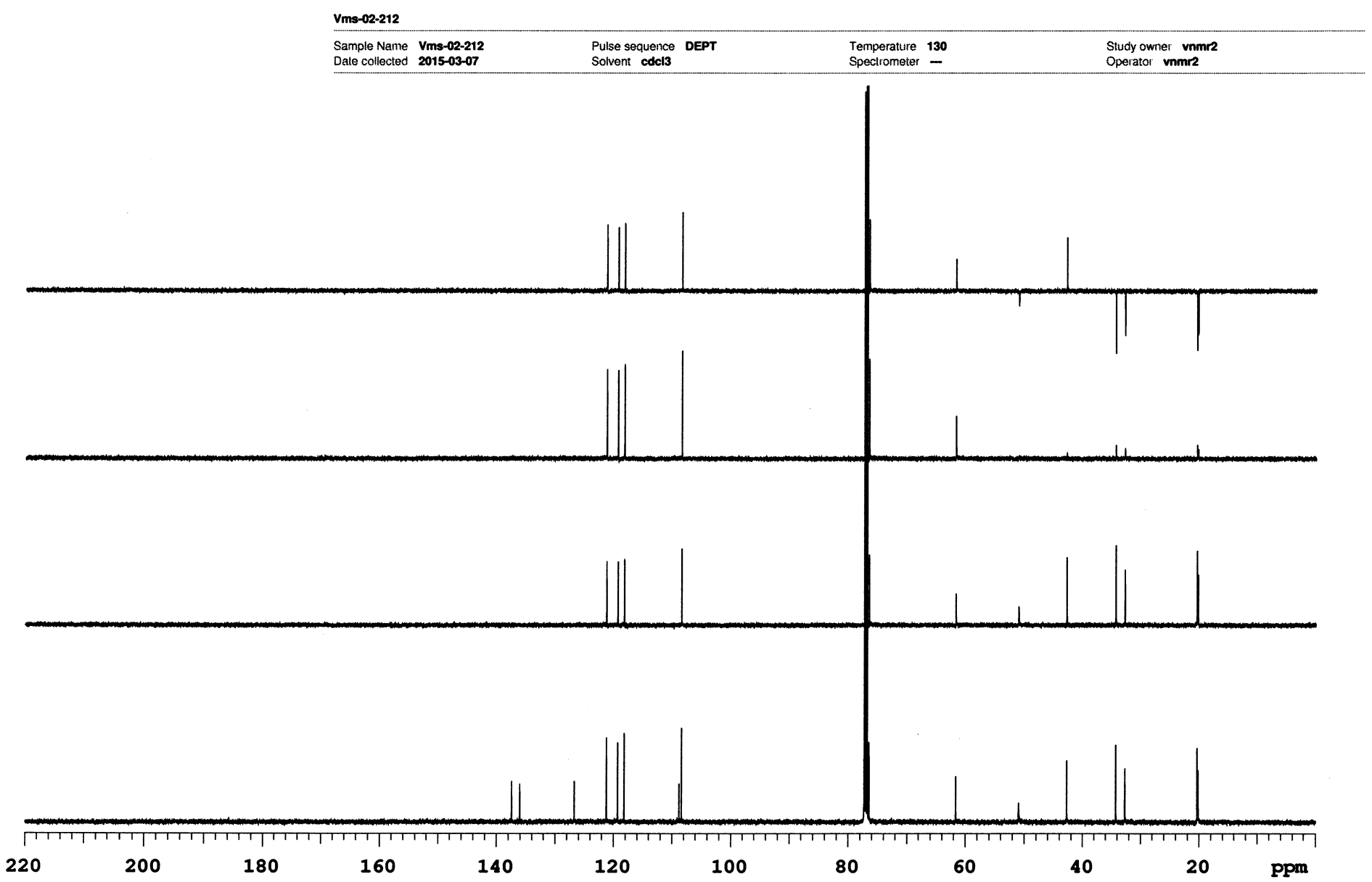


Fig S50. DEPT of compound 5.

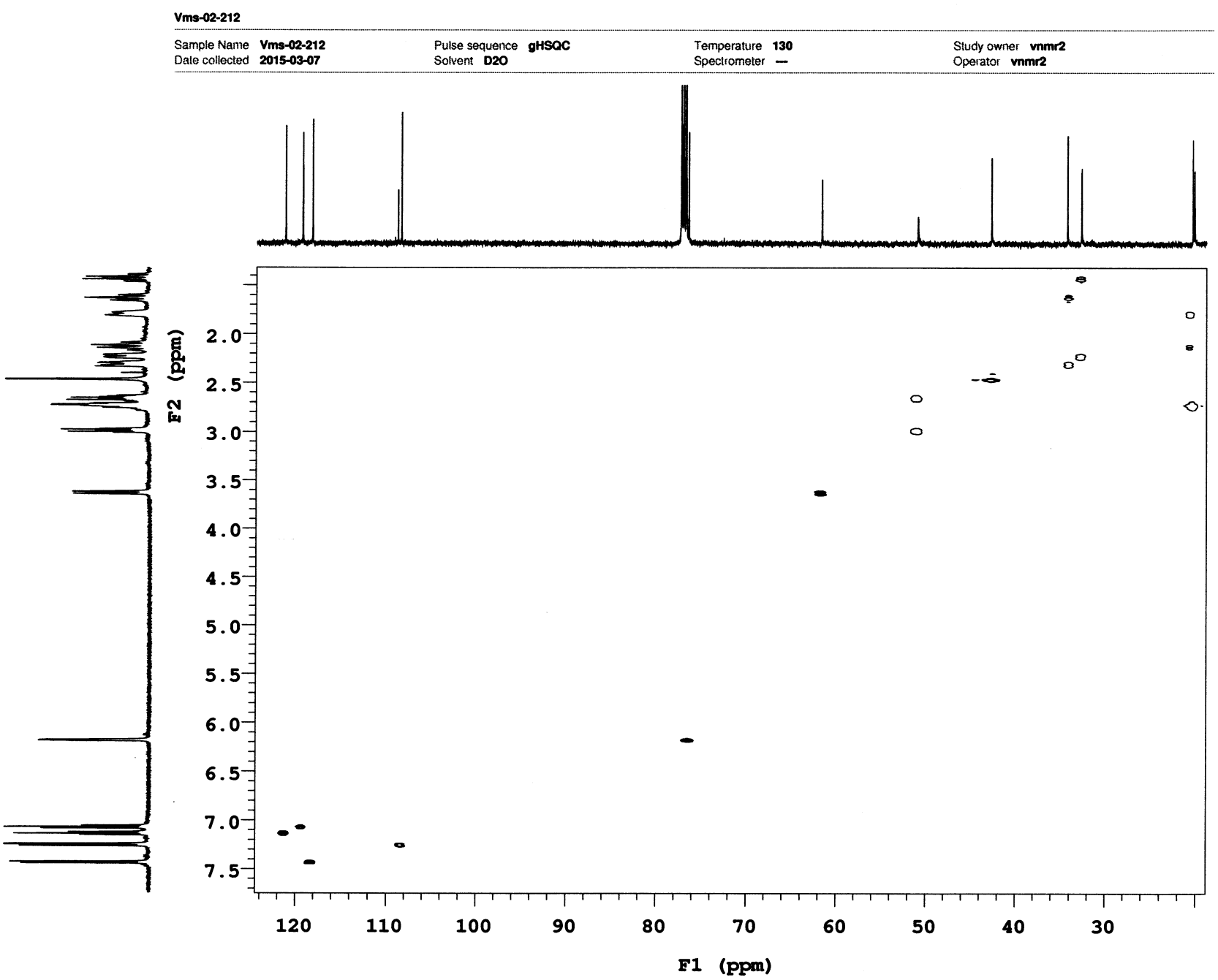


Fig S51. HSQC of compound 5.

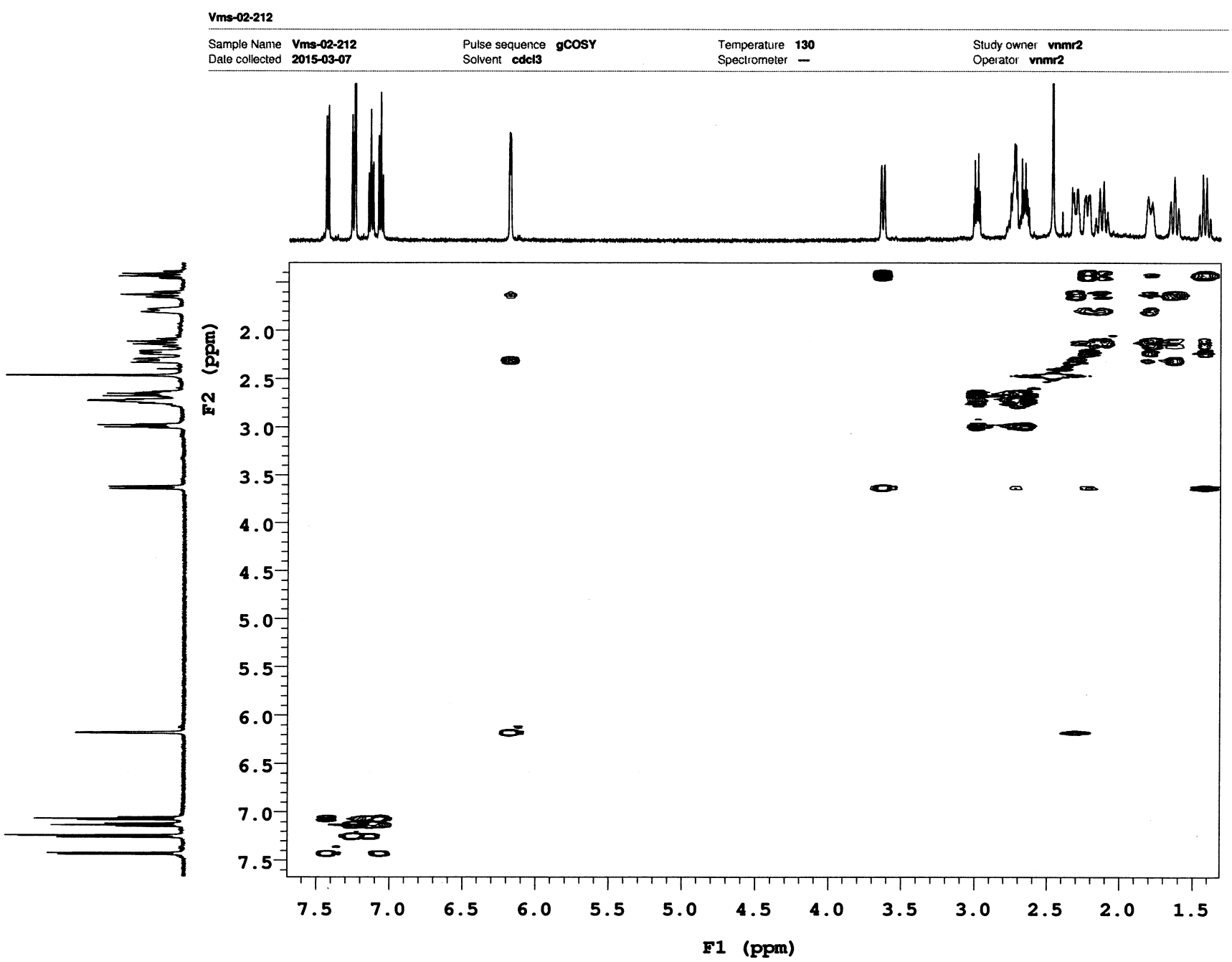


Fig S52. COSY of compound 5.

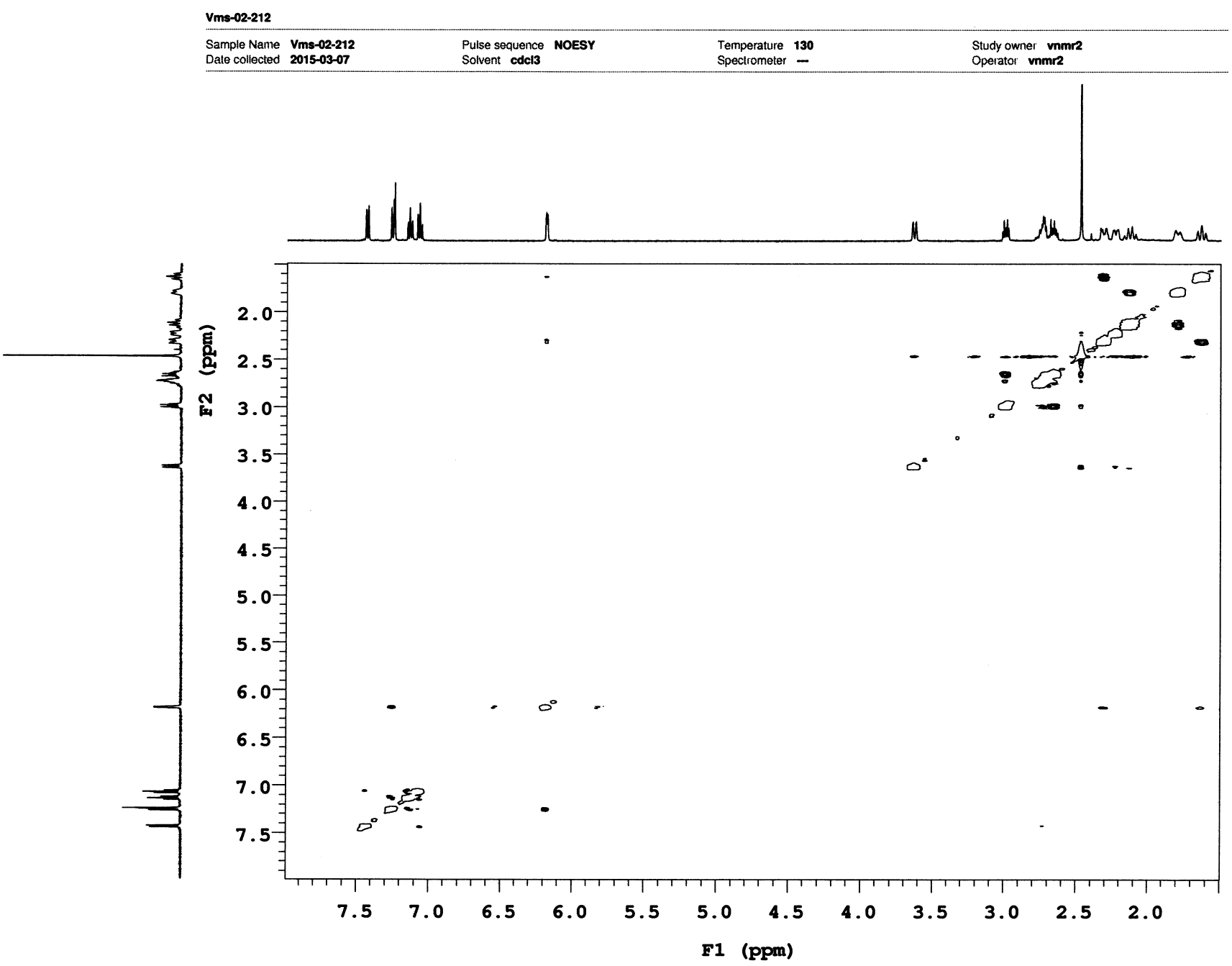
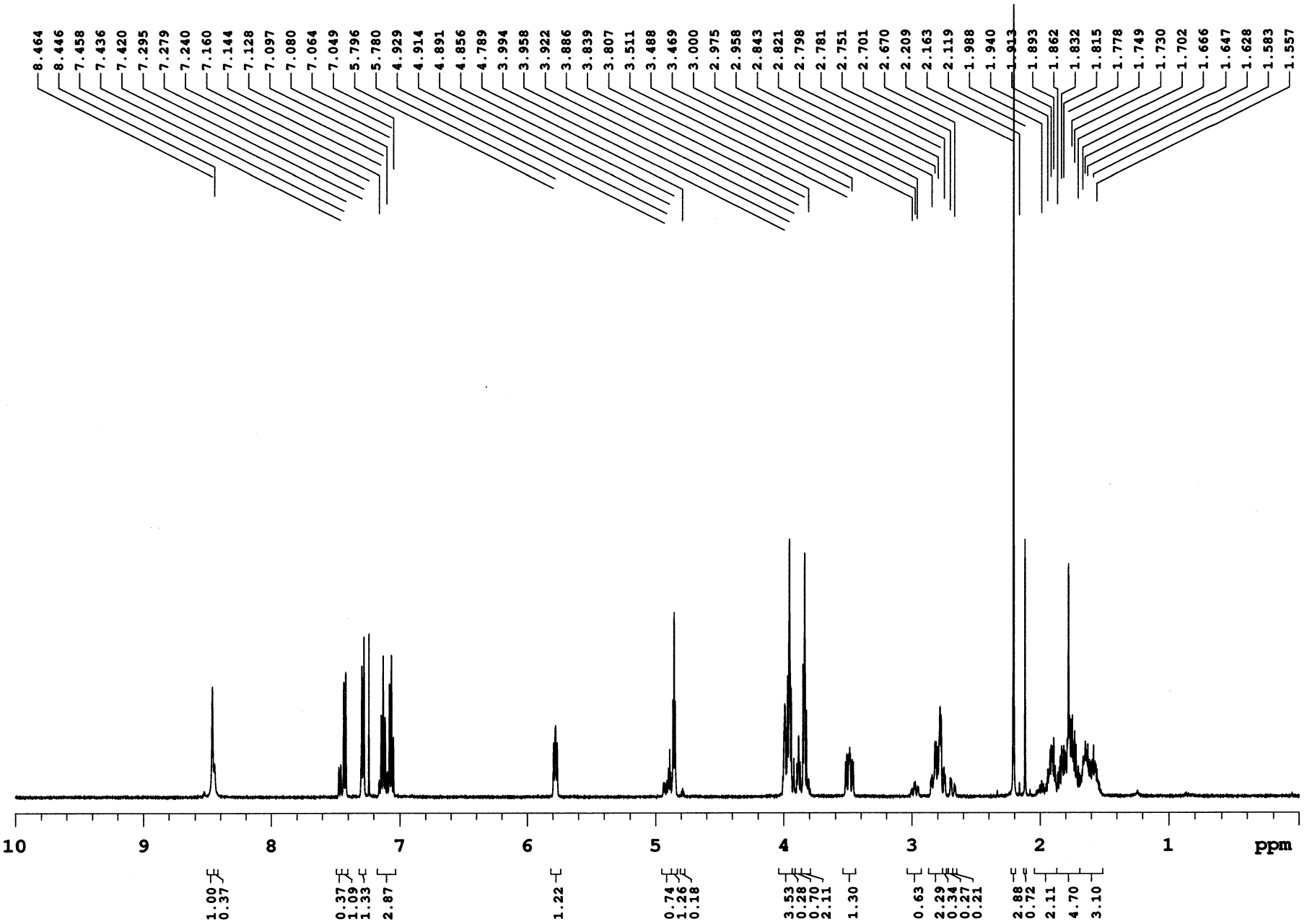


Fig S53. NOESY of compound 5.

Vms-02-185

Sample Name **Vms-02-185**	Pulse sequence **s2pul**	Temperature **25**	Study owner **vnmr2**
Date collected **2014-12-17**	Solvent **cdcl3**	Spectrometer **—**	Operator **vnmr2**



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-185/H1.fid

Fig S54 1H NMR (CDCl3, 500 MHz) of compound 6.

Plot date 2016-05-13

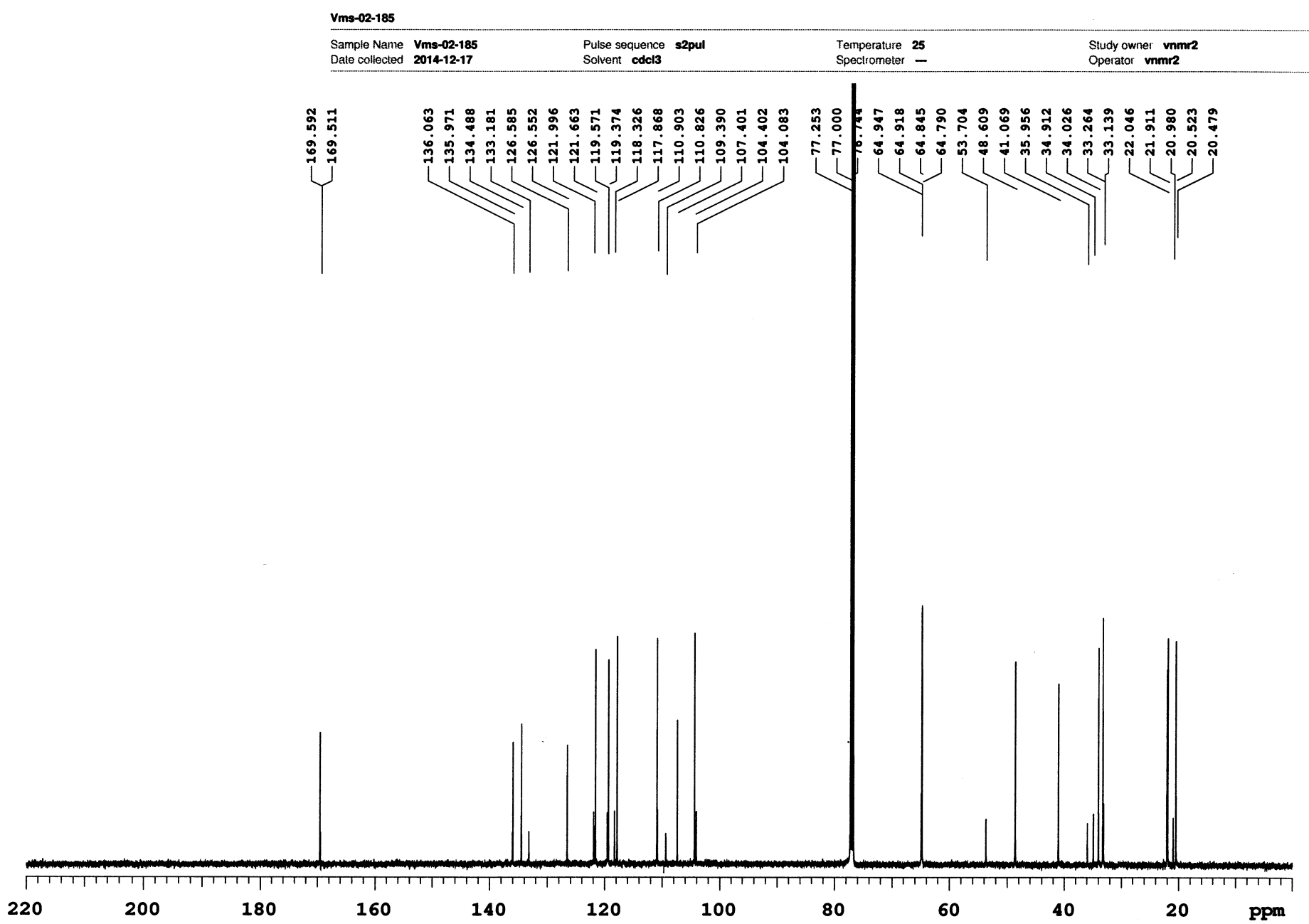


Fig S55. 13C NMR (CDCl3, 125 MHz) of compound 6.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-185/C13.fid

Plot date 2016-05-13

Vms-02-185

Sample Name **Vms-02-185**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2014-12-17**	Solvent **cdcl3**	Spectrometer **---**	Operator **vnmr2**

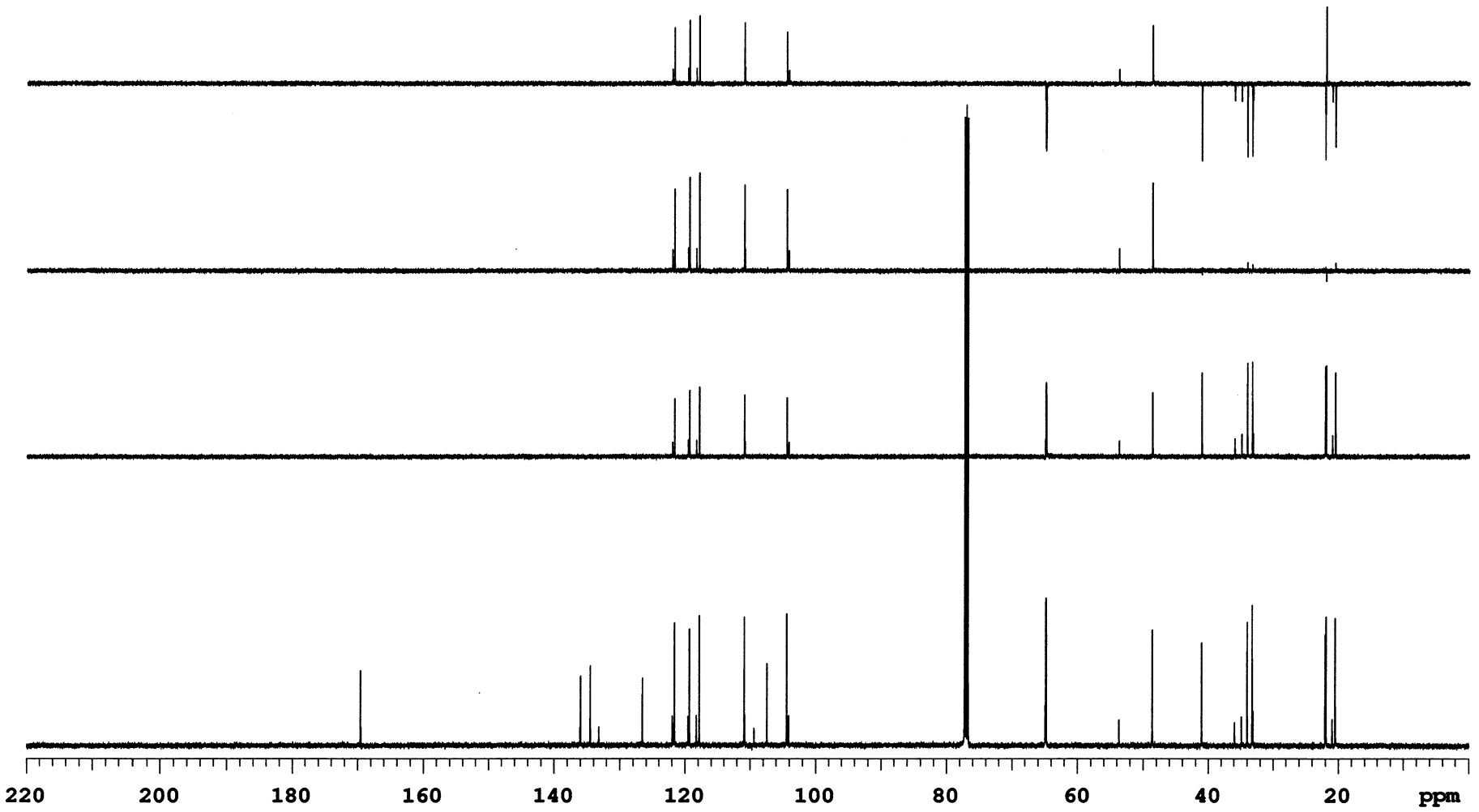


Fig S56. DEPT of compound 6.

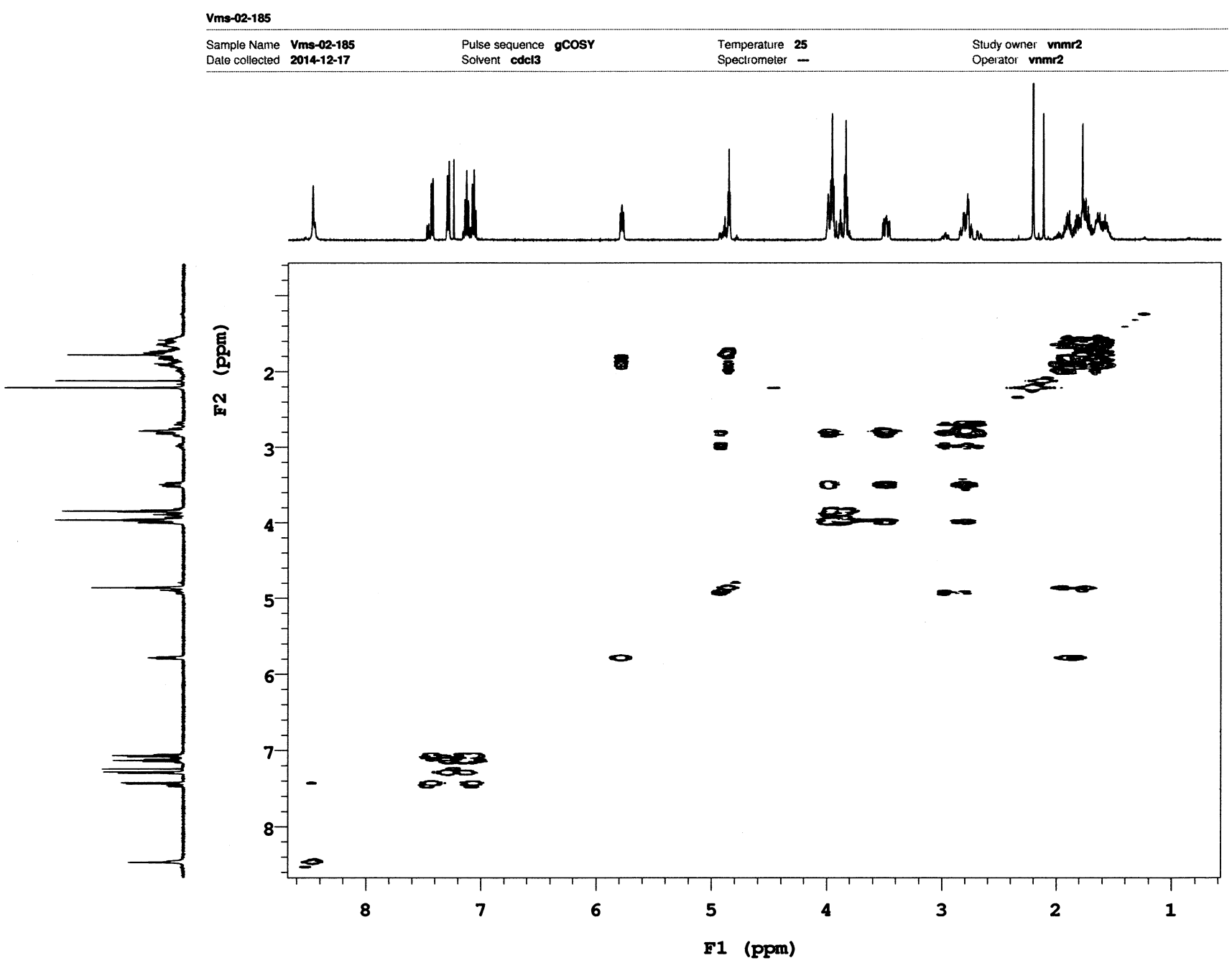


Fig S57. COSY of compound 6.

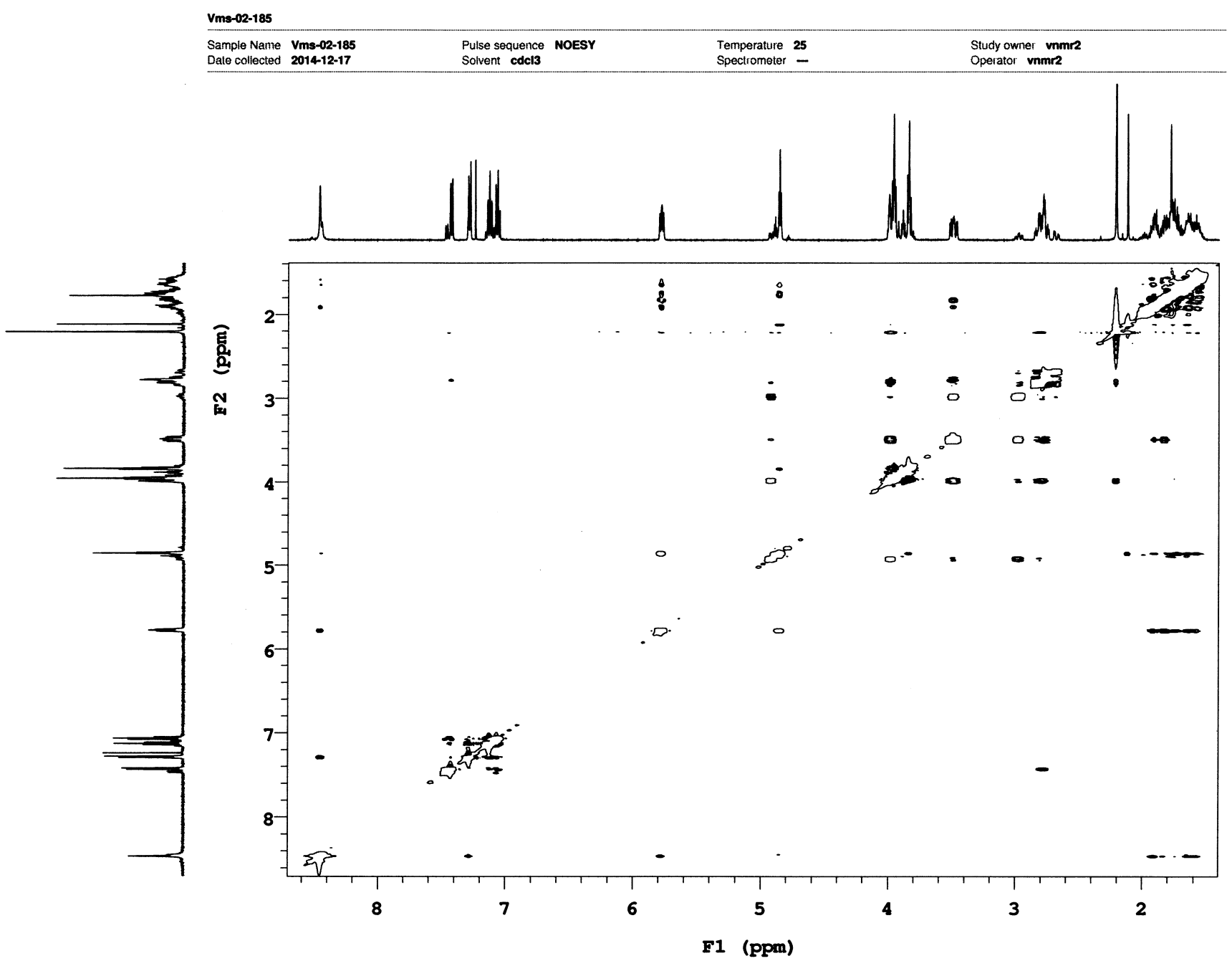


Fig S58. NOESY of compound 6.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-185/NOESY.fid

Plot date 2016-05-13

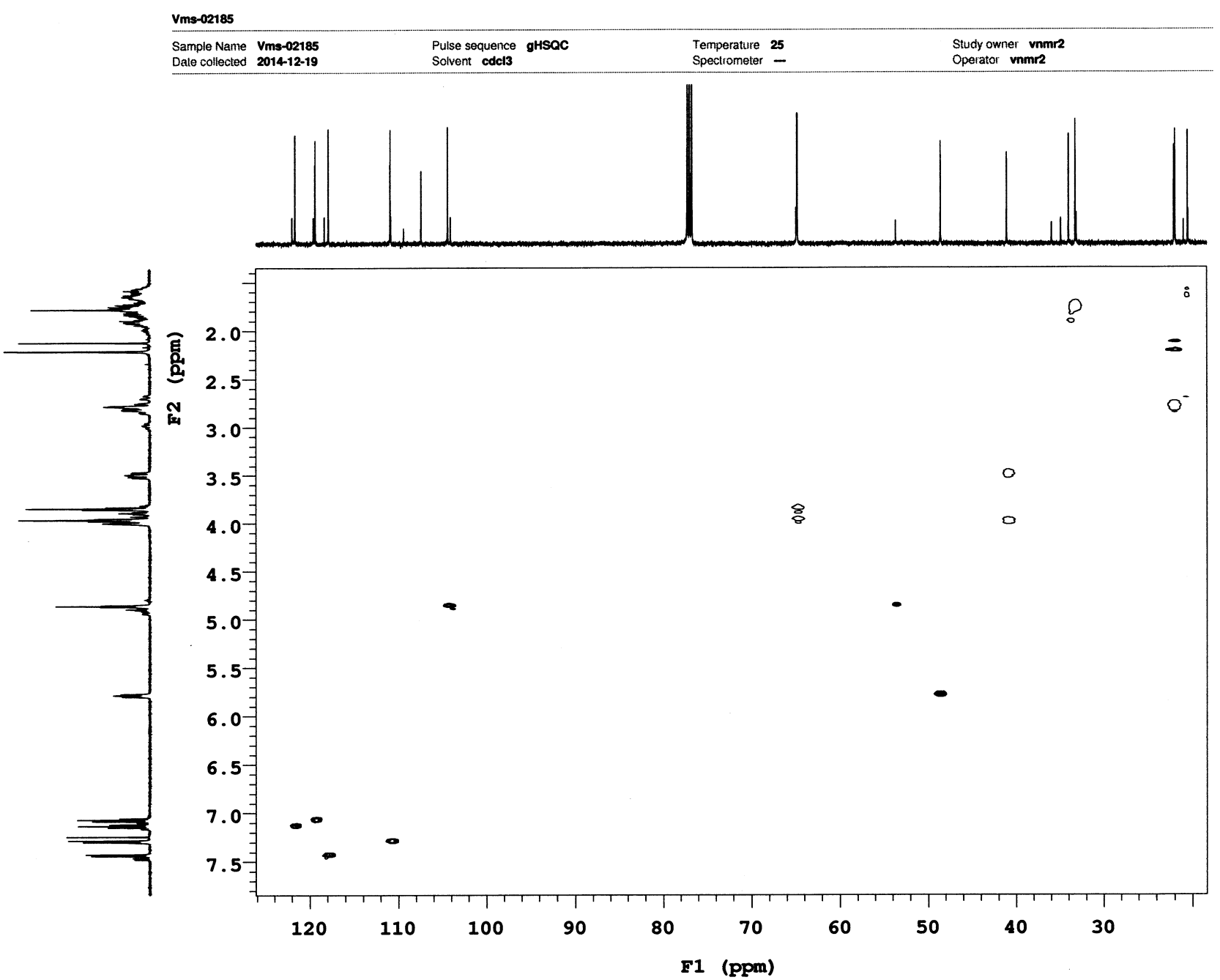
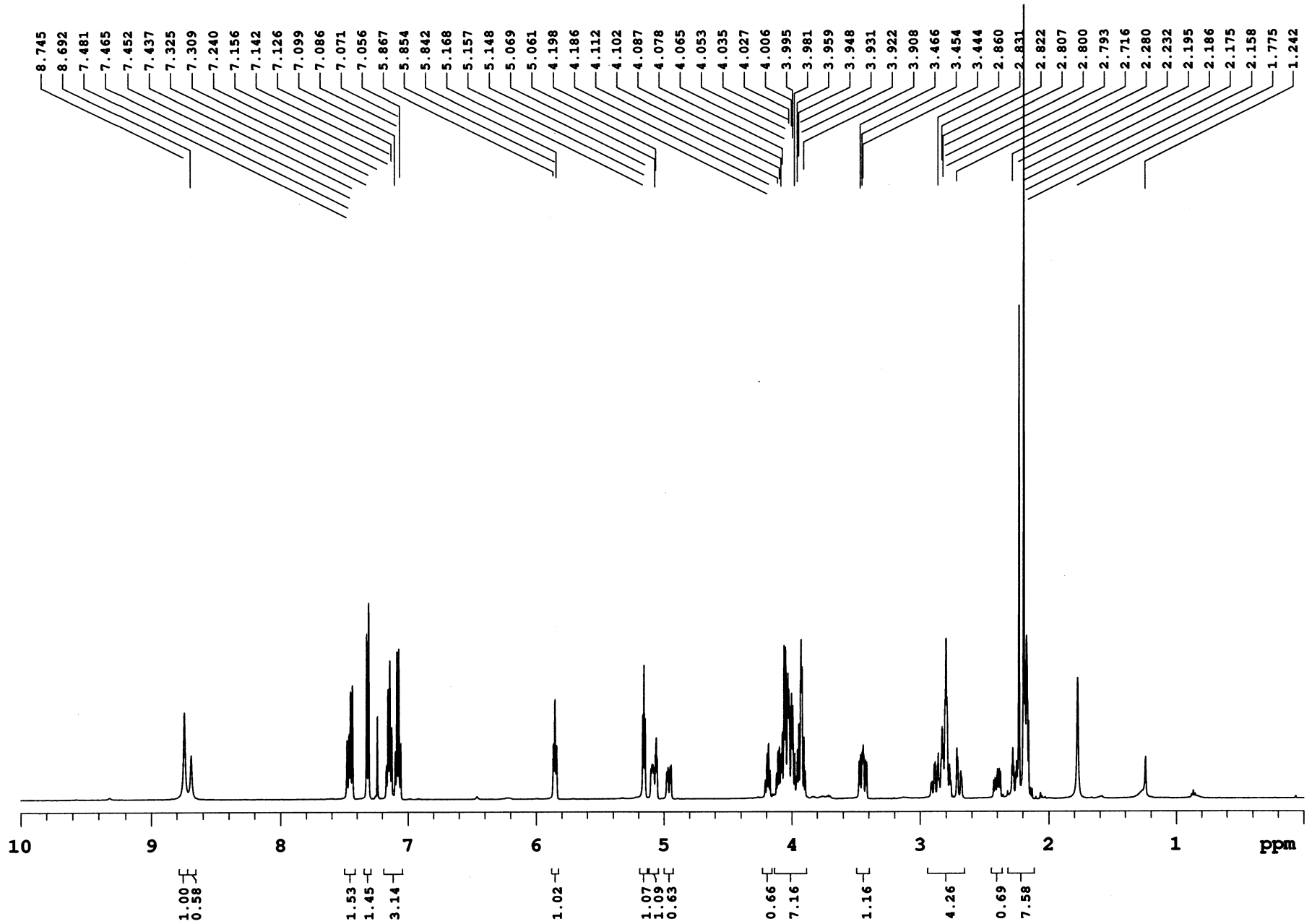


Fig S59. HSQC of compound 6.

Vms-03-053

Sample Name	**Vms-03-053**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-01-05**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-053/PROTON_03.fid

Fig S60. 1H NMR (CDCl3, 500 MHz) of compound 7.

Plot date 2016-05-10

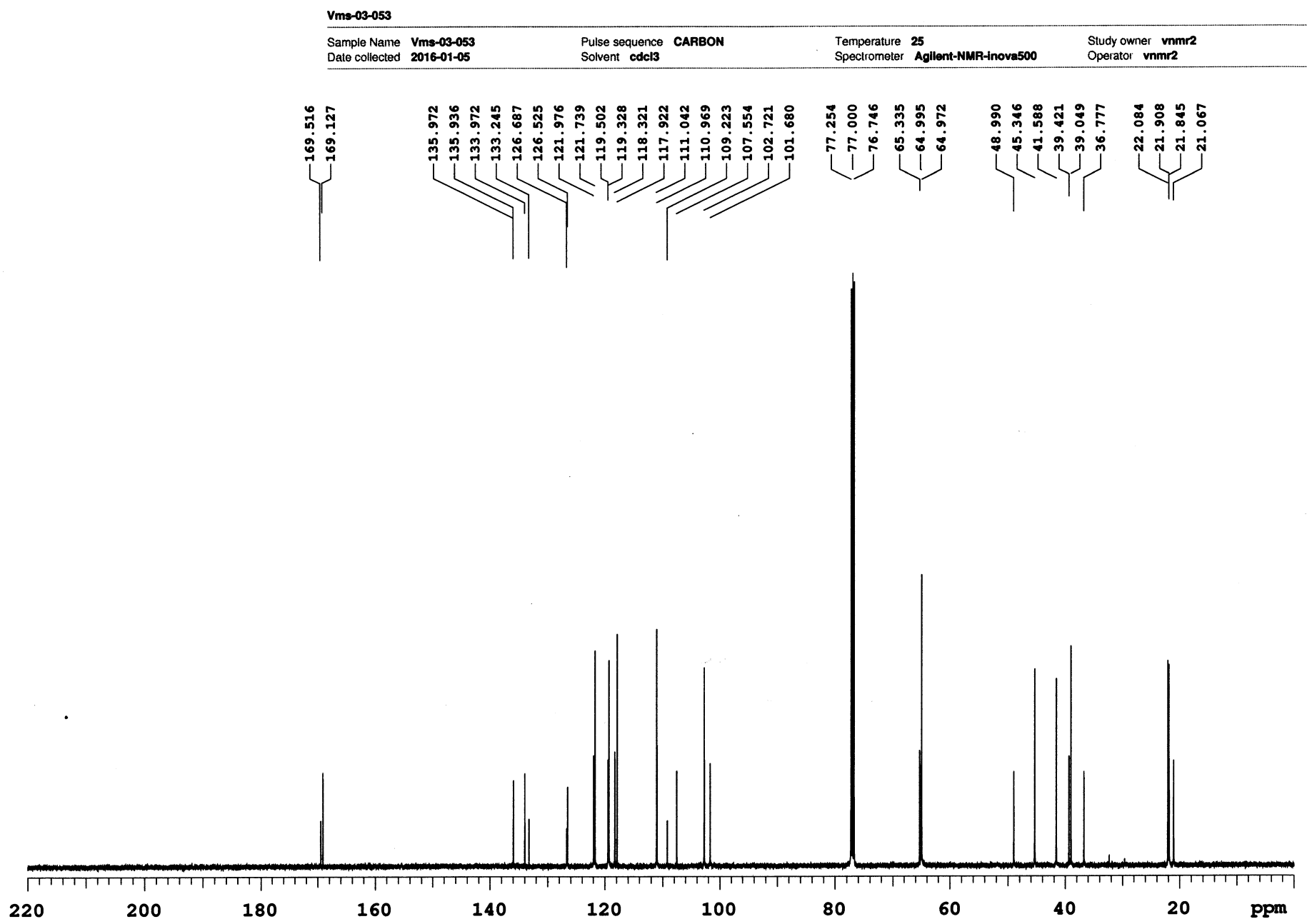


Fig S61. 13C NMR (CDCl3, 125 MHz) of compound 7.

Vms-03-053

Sample Name **Vms-03-053**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-06**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

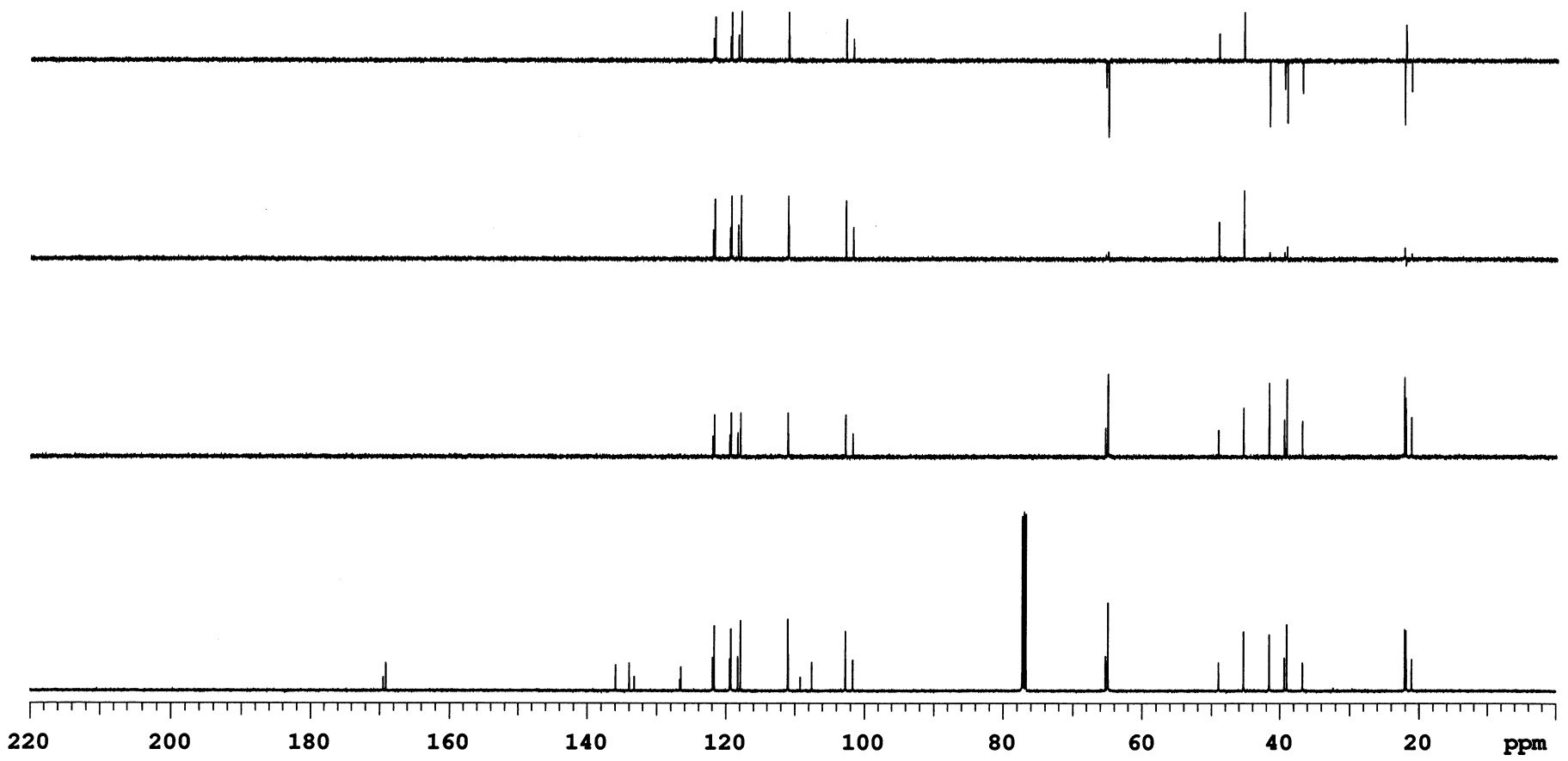


Fig S62. DEPT of compound 7.

Vms-03-053

Sample Name **Vms-03-053**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-06**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

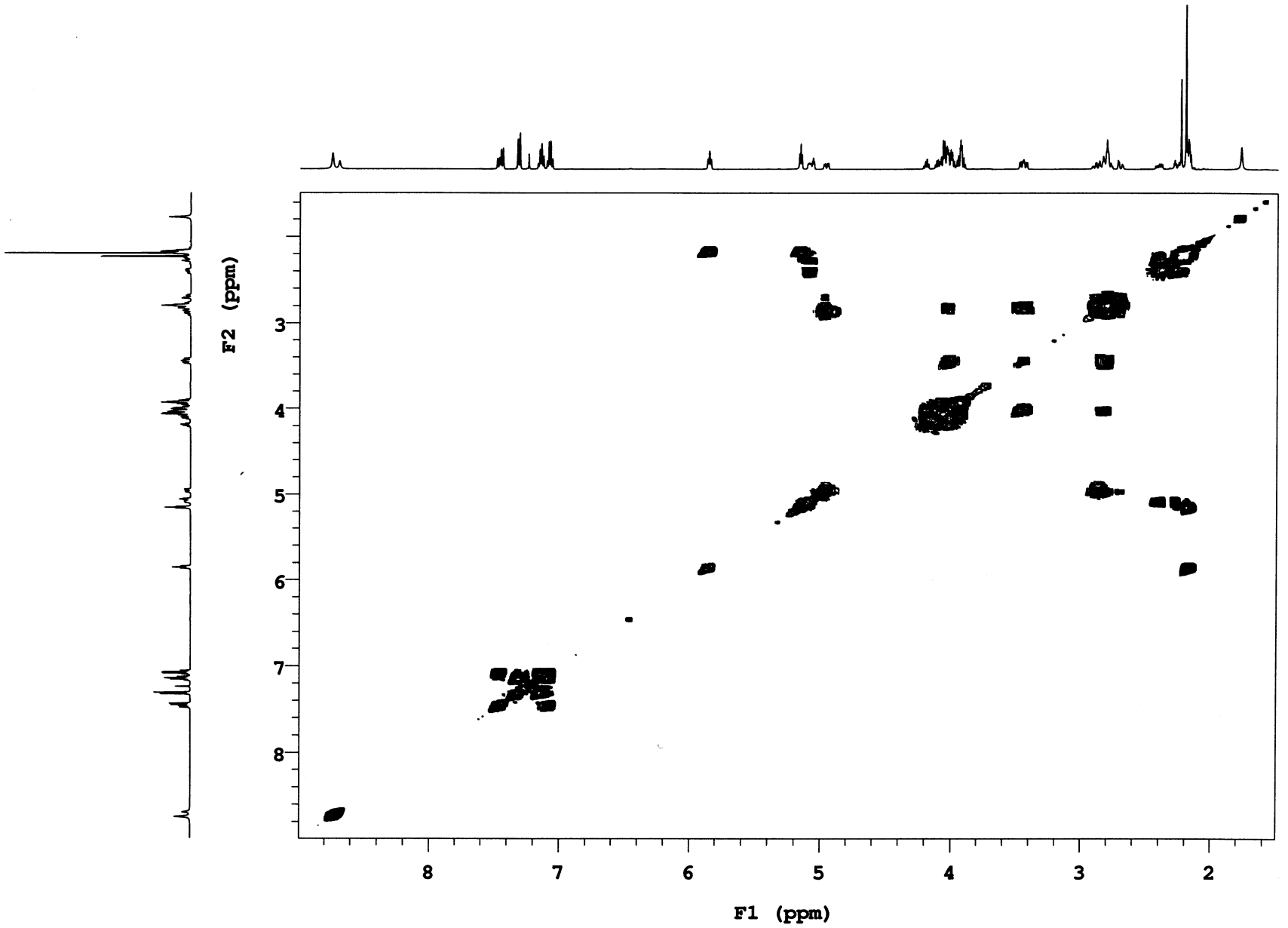


Fig S63 COSY of compound 7.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-053/gCOSY_01

Plot date 2016-01-06

Vms-03-053

Sample Name **Vms-03-053**	Pulse sequence **NOESY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-06**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

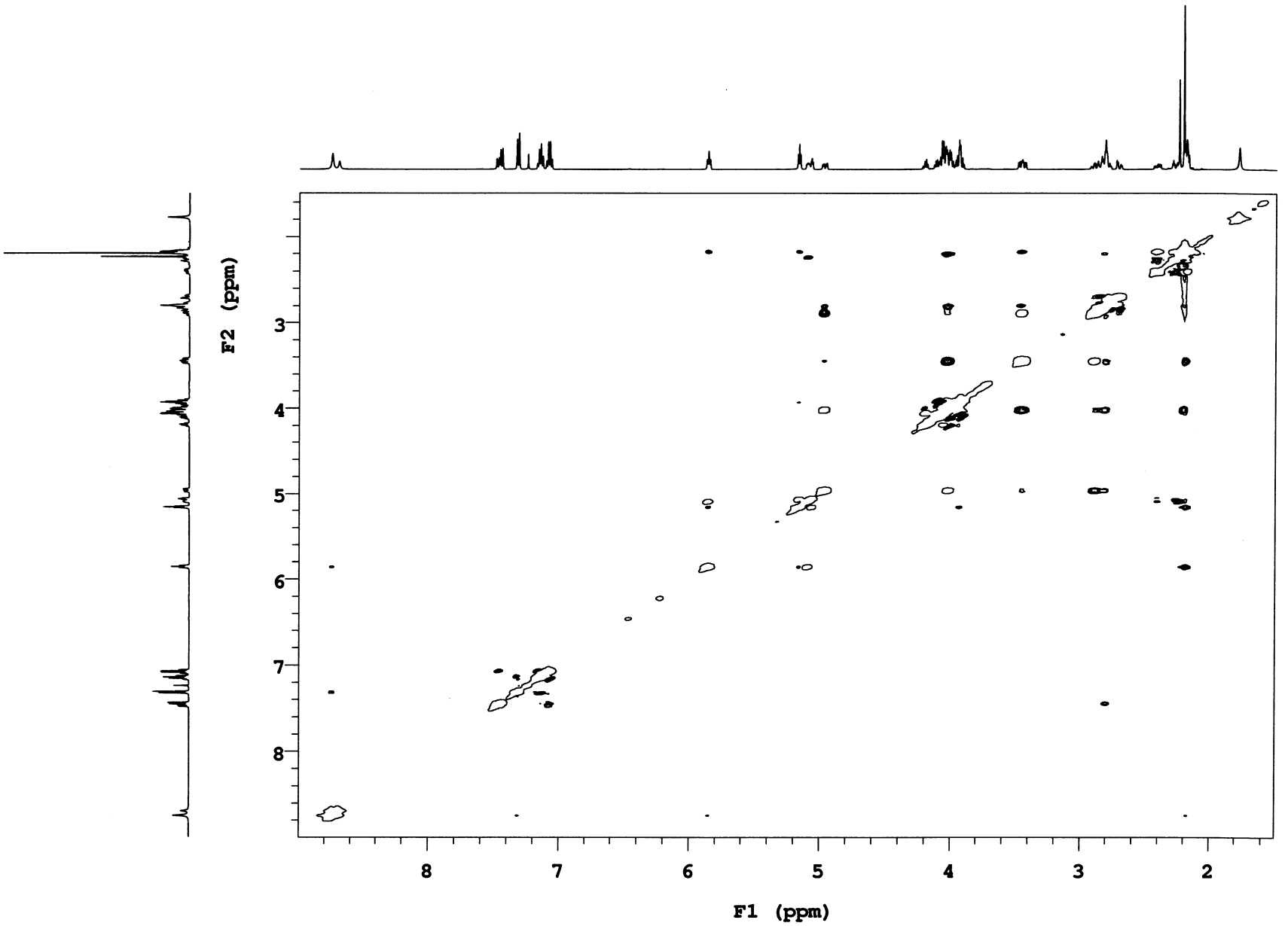


Fig S64. NOESY of compound 7.

Vms-03-053

Sample Name **Vms-03-053**	Pulse sequence **gHSQC**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-06**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

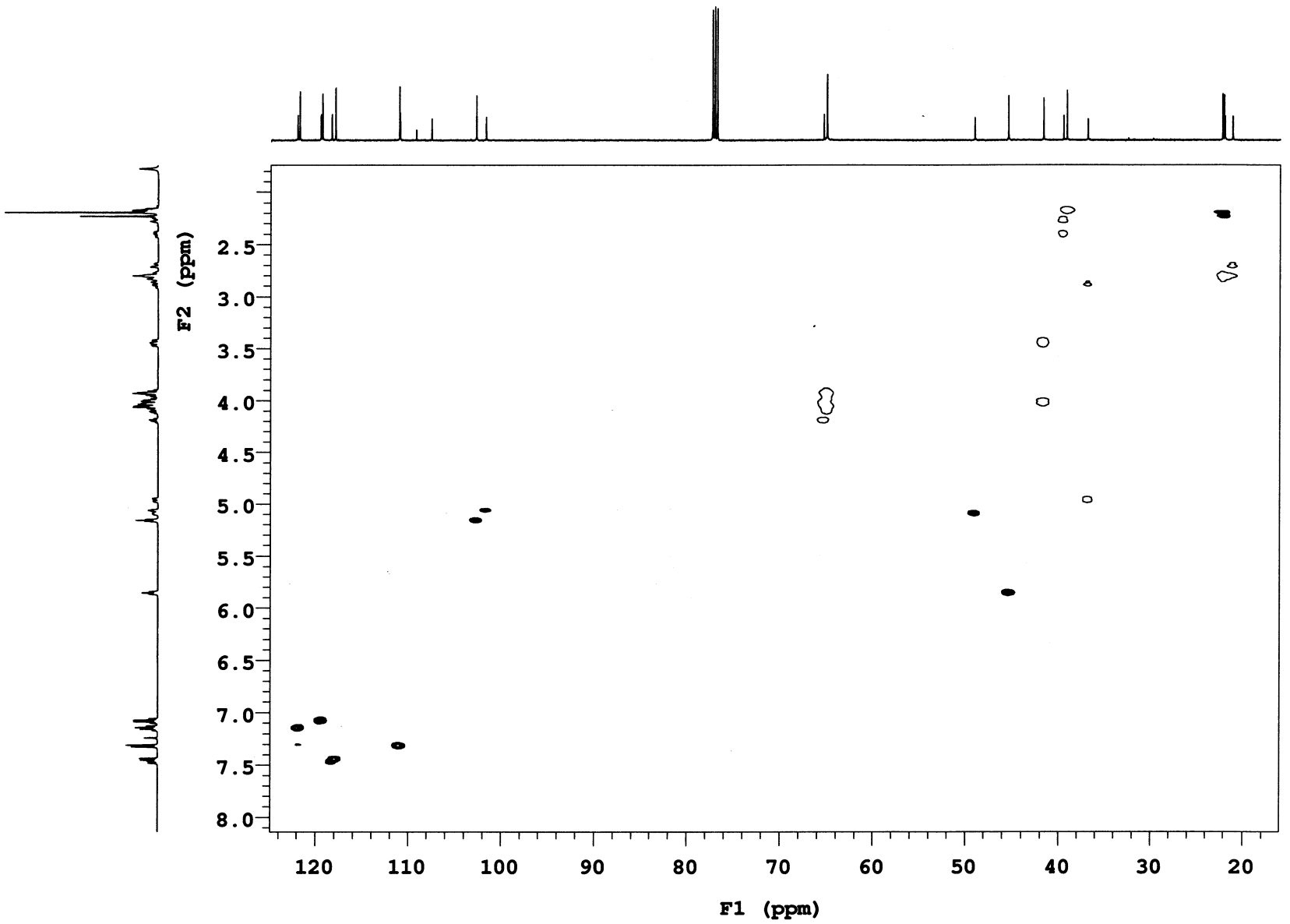
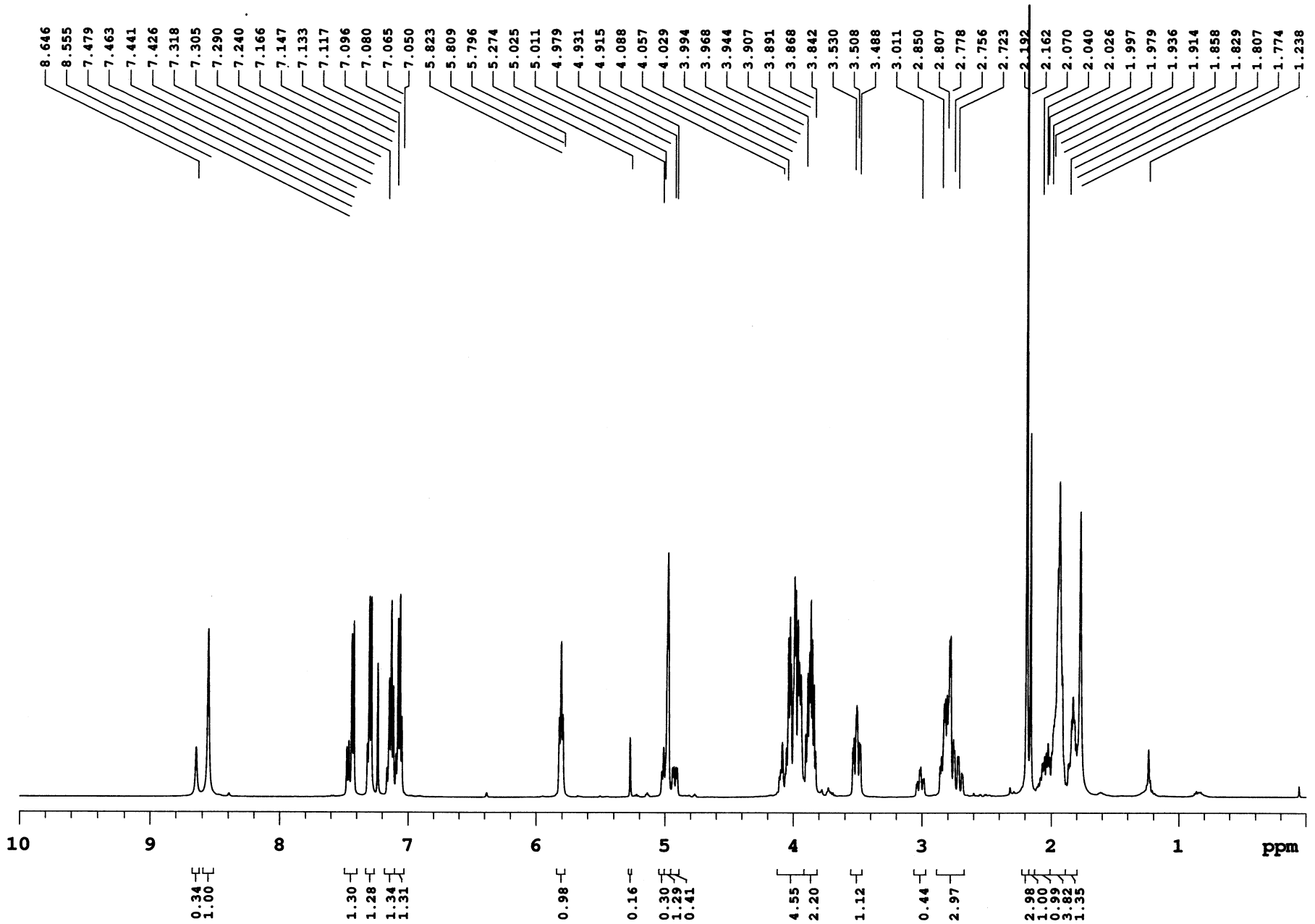


Fig S65. HSQC of compound 7.

Vms-03-038

Sample Name	Vms-03-038	Pulse sequence	PROTON	Temperature	25	Study owner	vnmr2
Date collected	2015-12-21	Solvent	cdcl3	Spectrometer	Agilent-NMR-inova500	Operator	vnmr2



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-038/PROTON_06.fid

Fig S66. 1H NMR (CDCl3, 500 MHz) of compound 8.

Plot date 2016-05-10

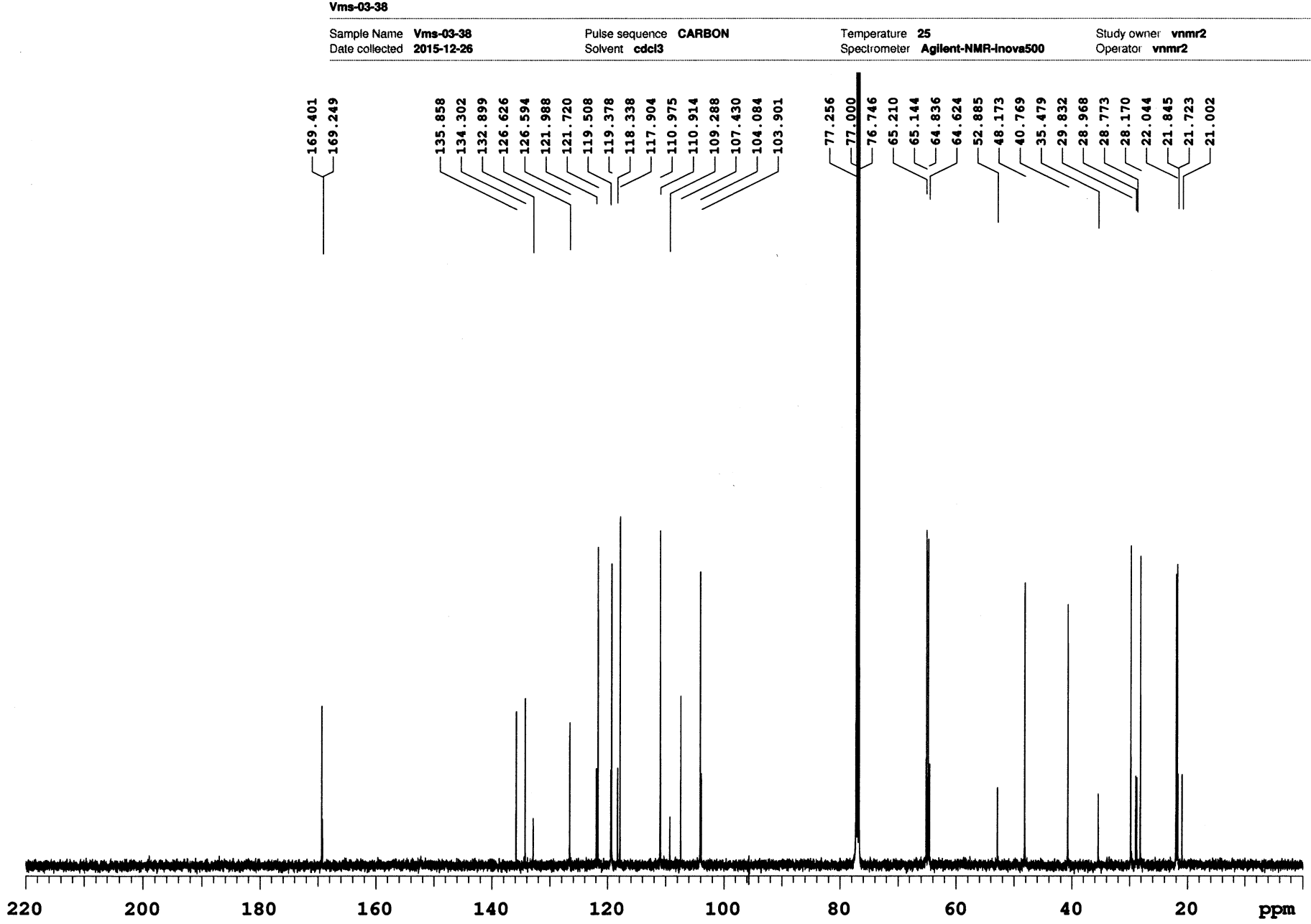


Fig S67. 13C NMR (CDCl3, 125 MHz) of compound 8.

Vms-03-38

Sample Name **Vms-03-38**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-12-26**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

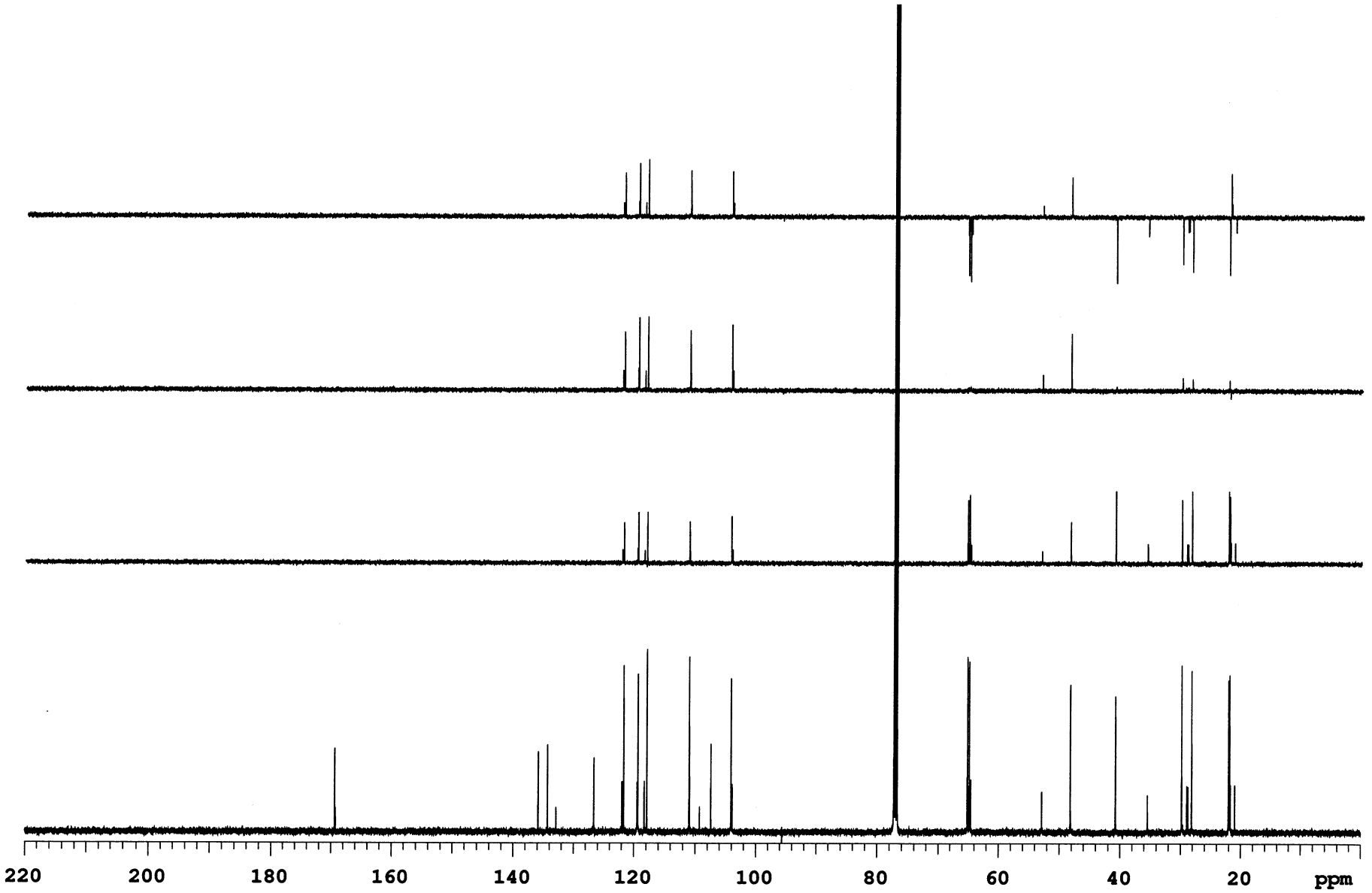


Fig S68. DEPT of compound 8.

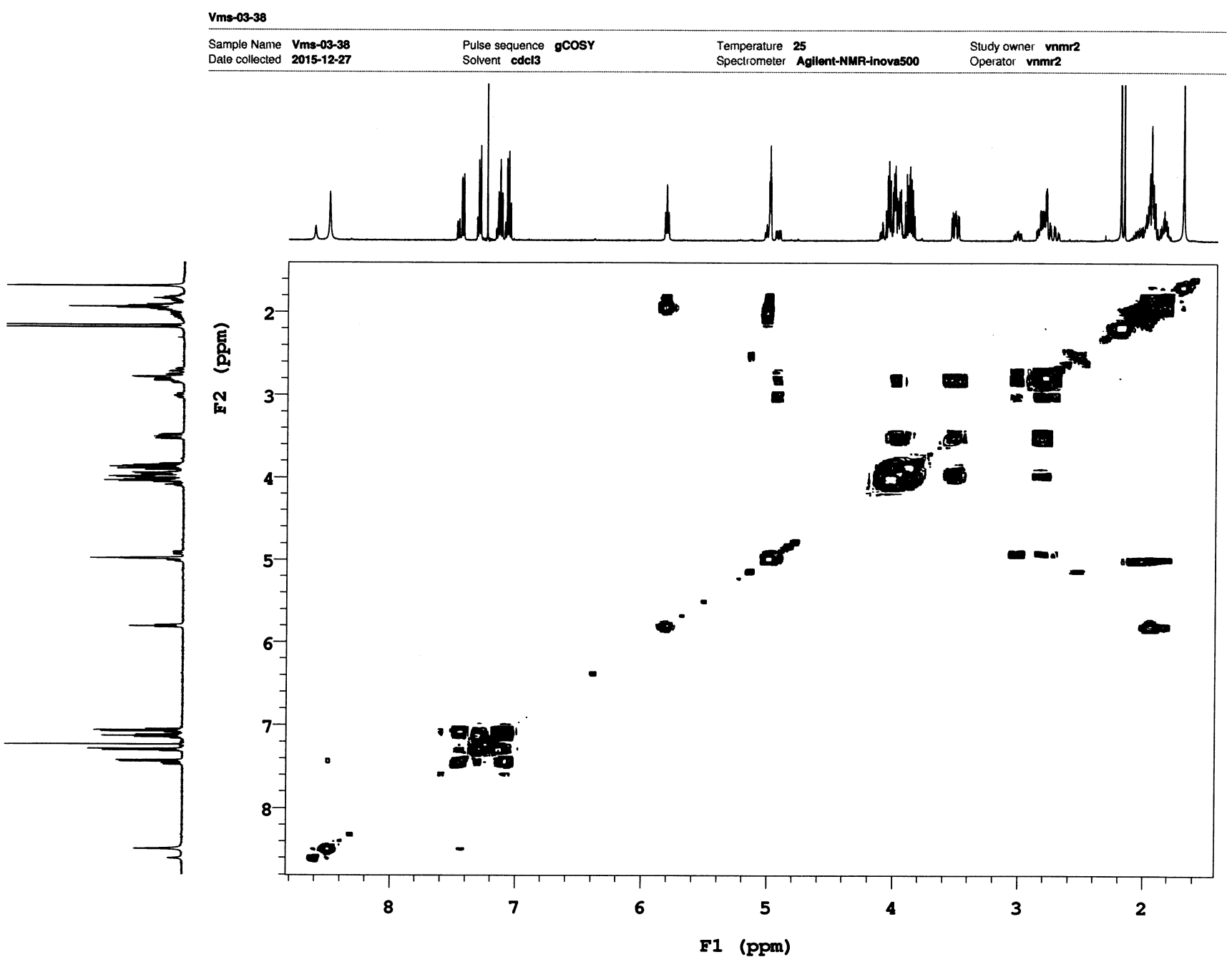


Fig S69. COSY of compound 8.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-38/gCOSY_01.fid

Plot date 2015-12-28

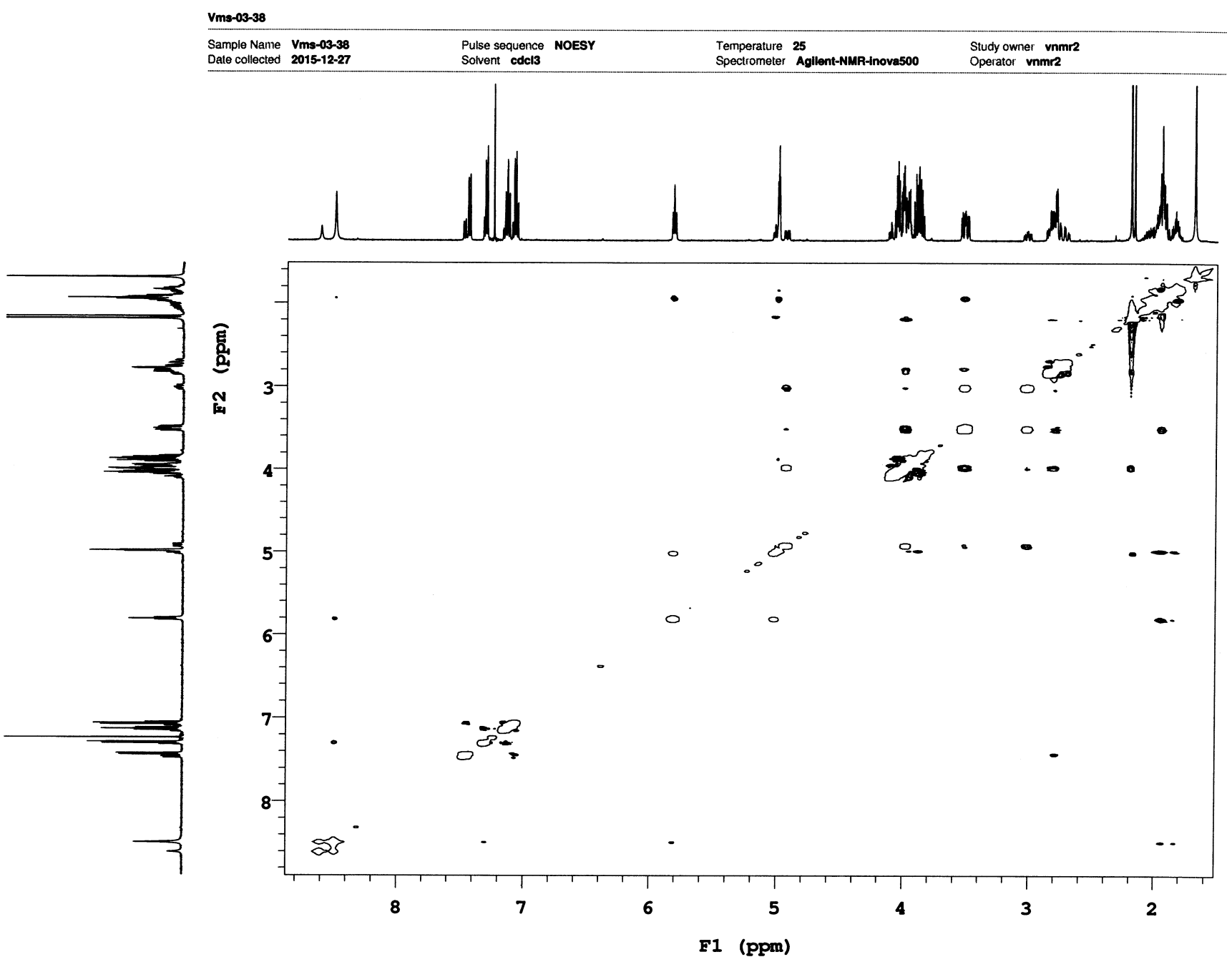


Fig S70. NOESY of compound 8.

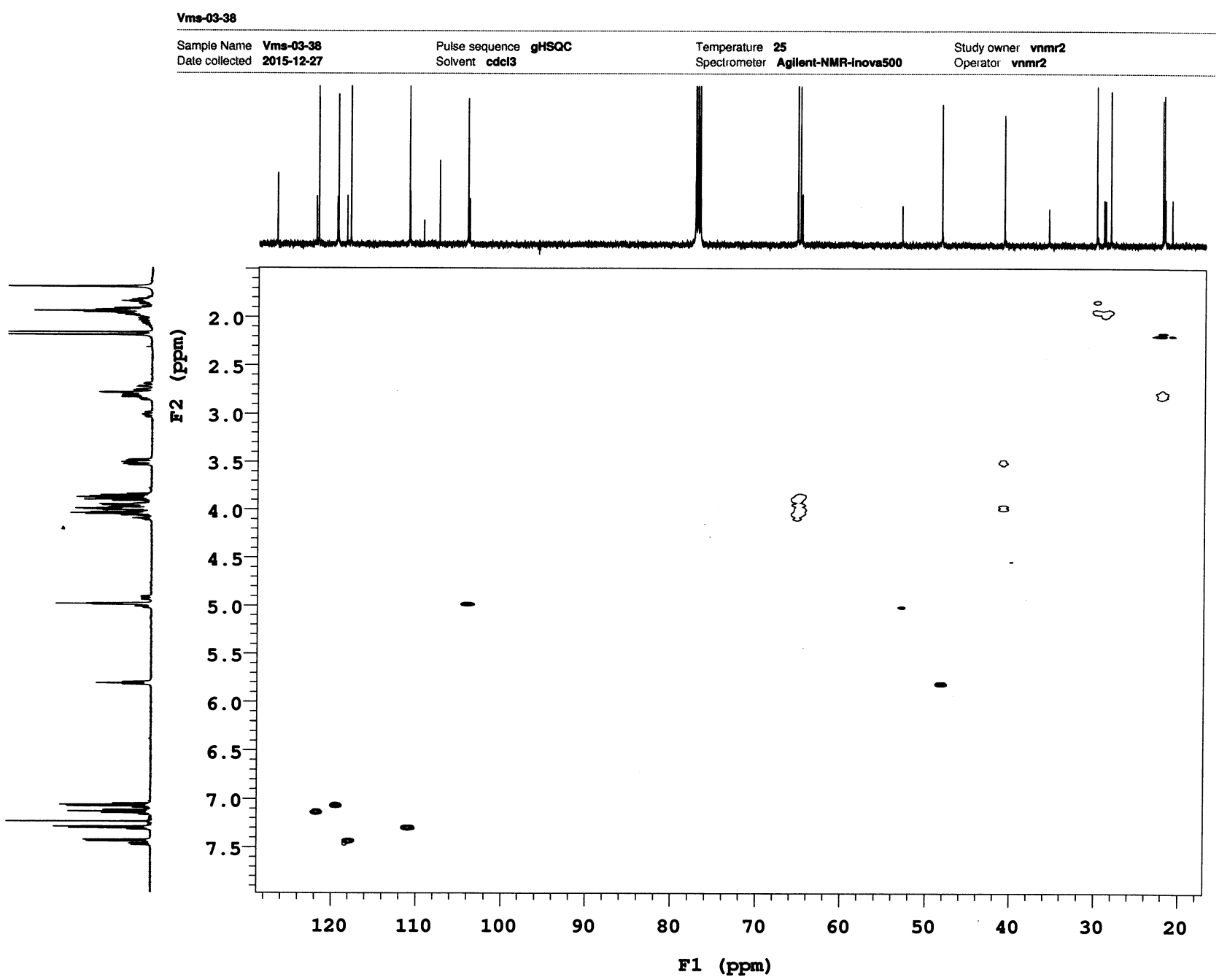


Fig S71. HSQC of compound 8.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-38/gHSQC_01.fid

Plot date 2015-12-28

Vms-03-046

Sample Name	**Vms-03-046**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2015-12-28**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

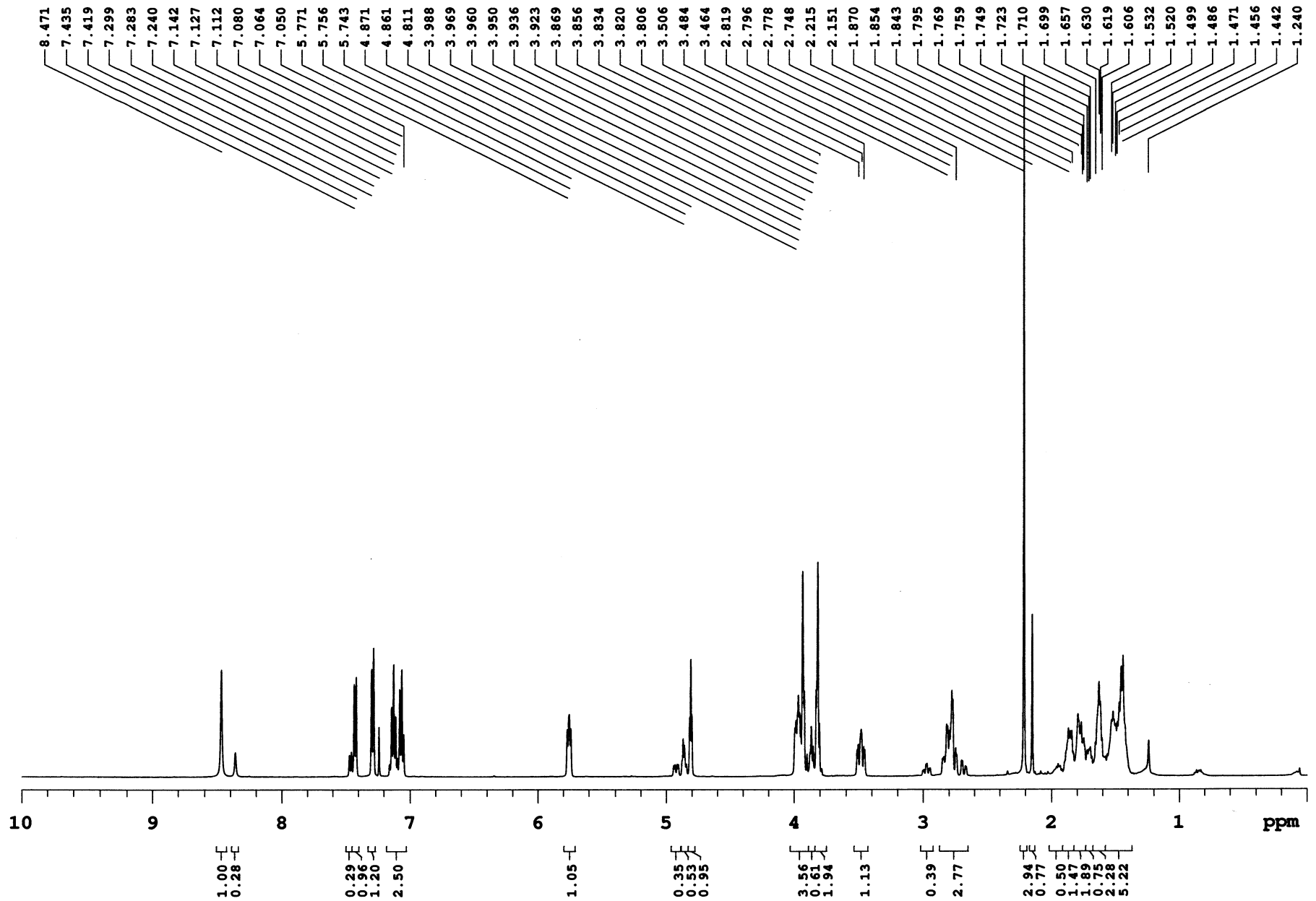


Fig S72. 1H NMR (CDCl3, 500 MHz) of compound 9.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-046/PROTON_02.fid

Plot date 2016-05-10

Vms-03-046

Sample Name	**Vms-03-046**	Pulse sequence	**CARBON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2015-12-28**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

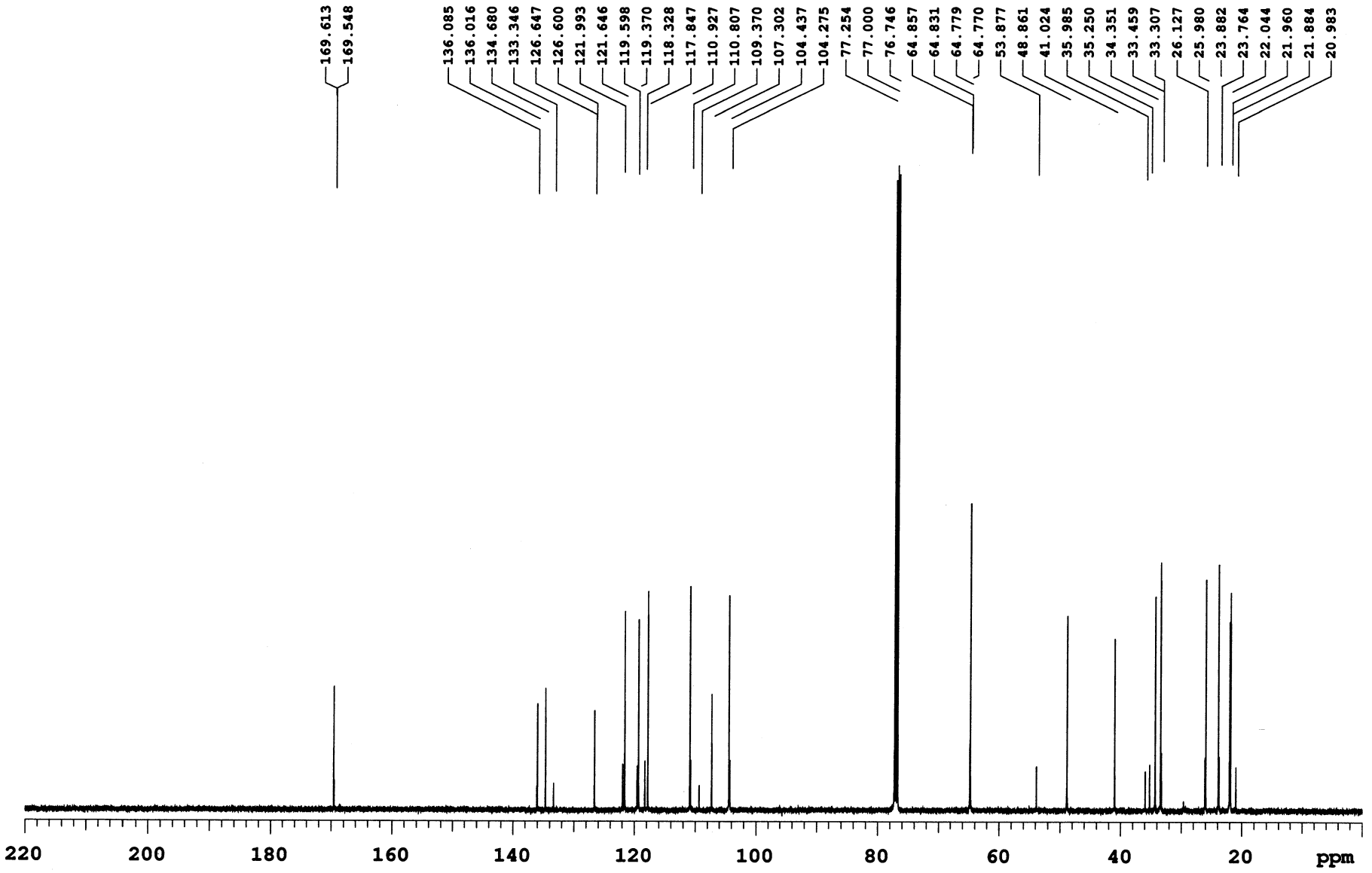


Fig S73. 13C NMR (CDCl3, 125 MHz) of compound 9.

Vms-03-046

Sample Name **Vms-03-046**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-12-29**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

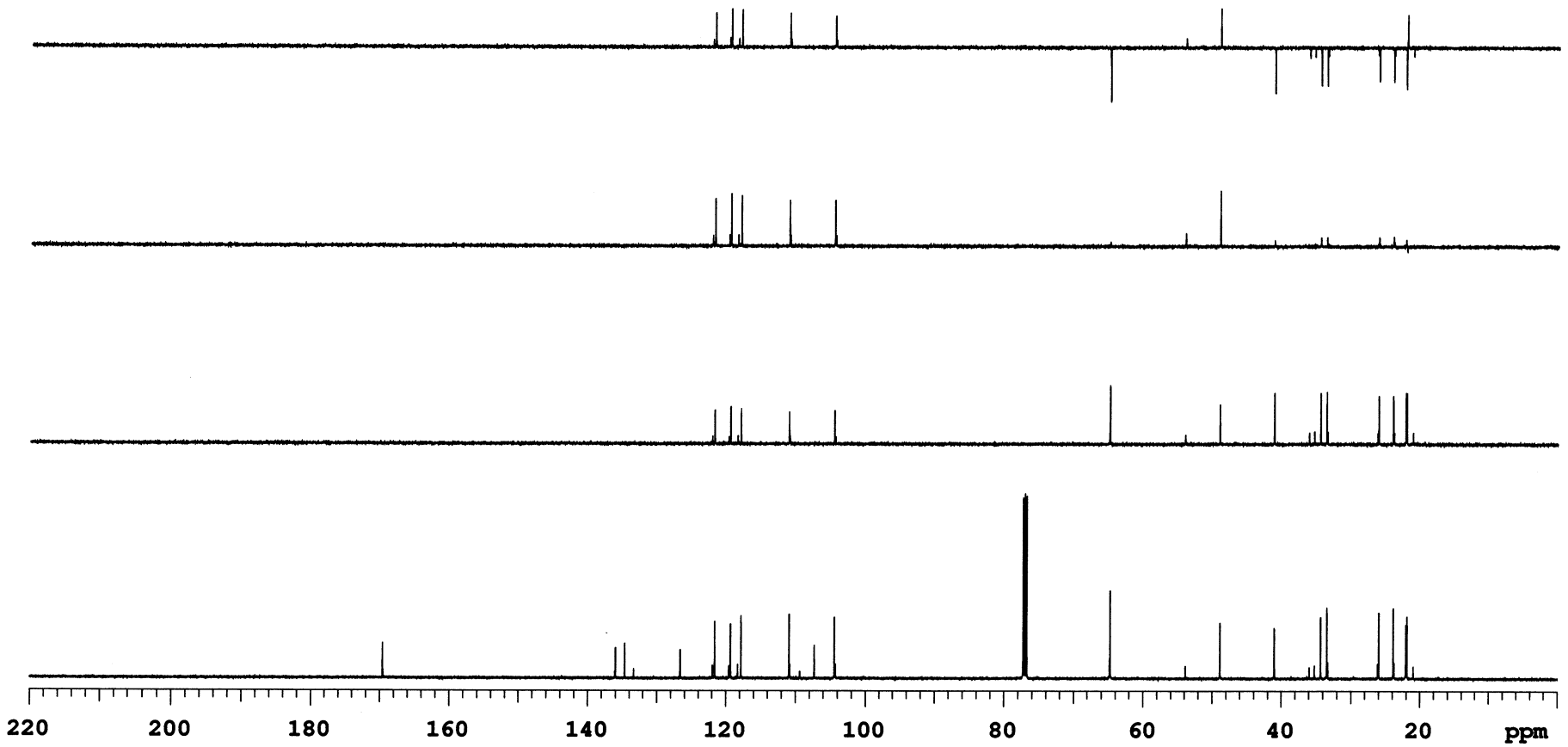


Fig S74. DEPT of compound 9.

Vms-03-046

Sample Name **Vms-03-046**	Pulse sequence **gHSQC**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-12-29**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

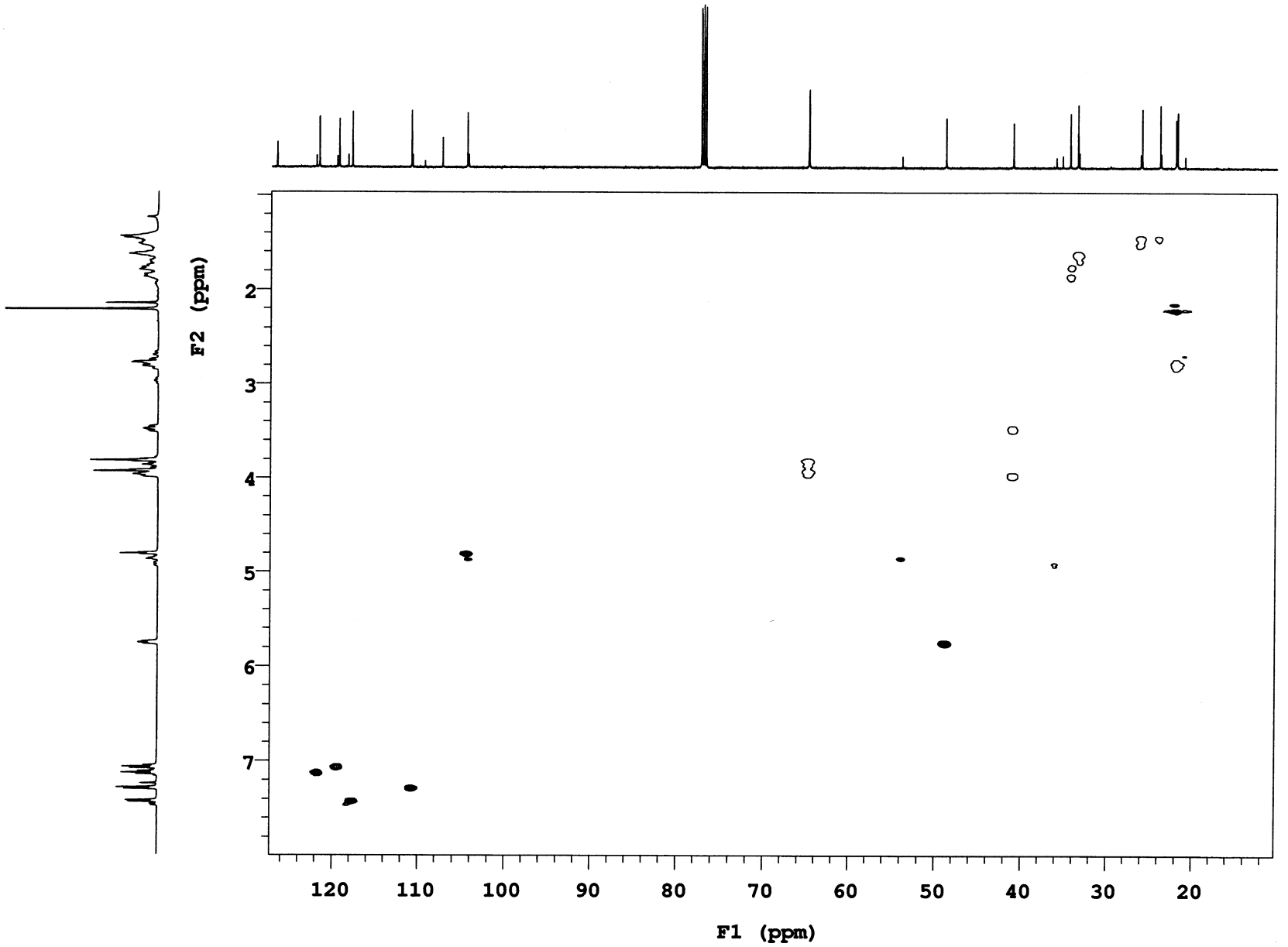


Fig S75. HSQC of compound 9.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-046/gHSQC_01

Plot date 2015-12-29

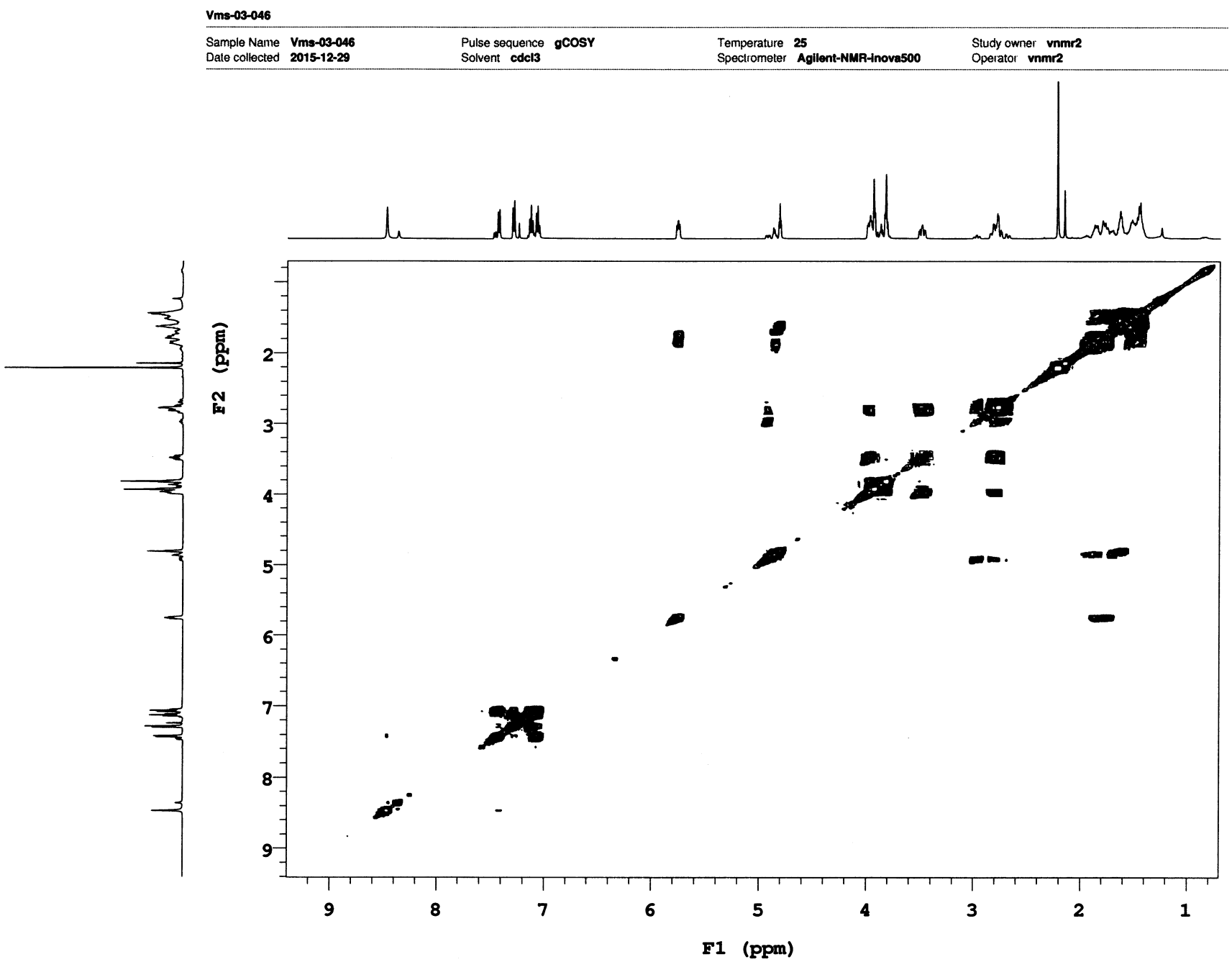


Fig S76. COSY of compound 9.

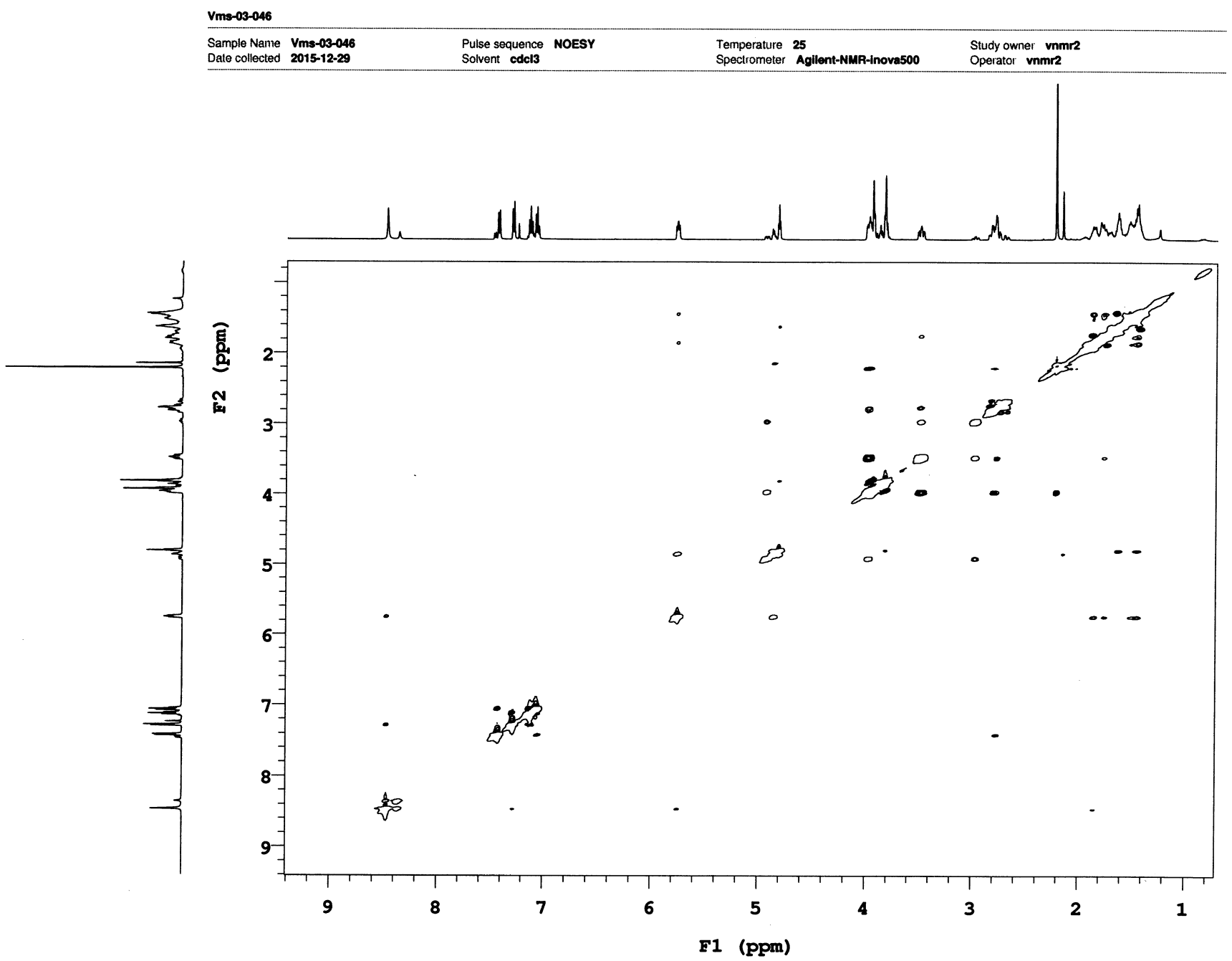


Fig S77. NOESY of compound 9.

Vms-02-209

Sample Name	**Vms-02-209**	Pulse sequence	**s2pul**	Temperature	**130**	Study owner	**vnmr2**
Date collected	**2015-03-02**	Solvent	**cdcl3**	Spectrometer	**---**	Operator	**vnmr2**

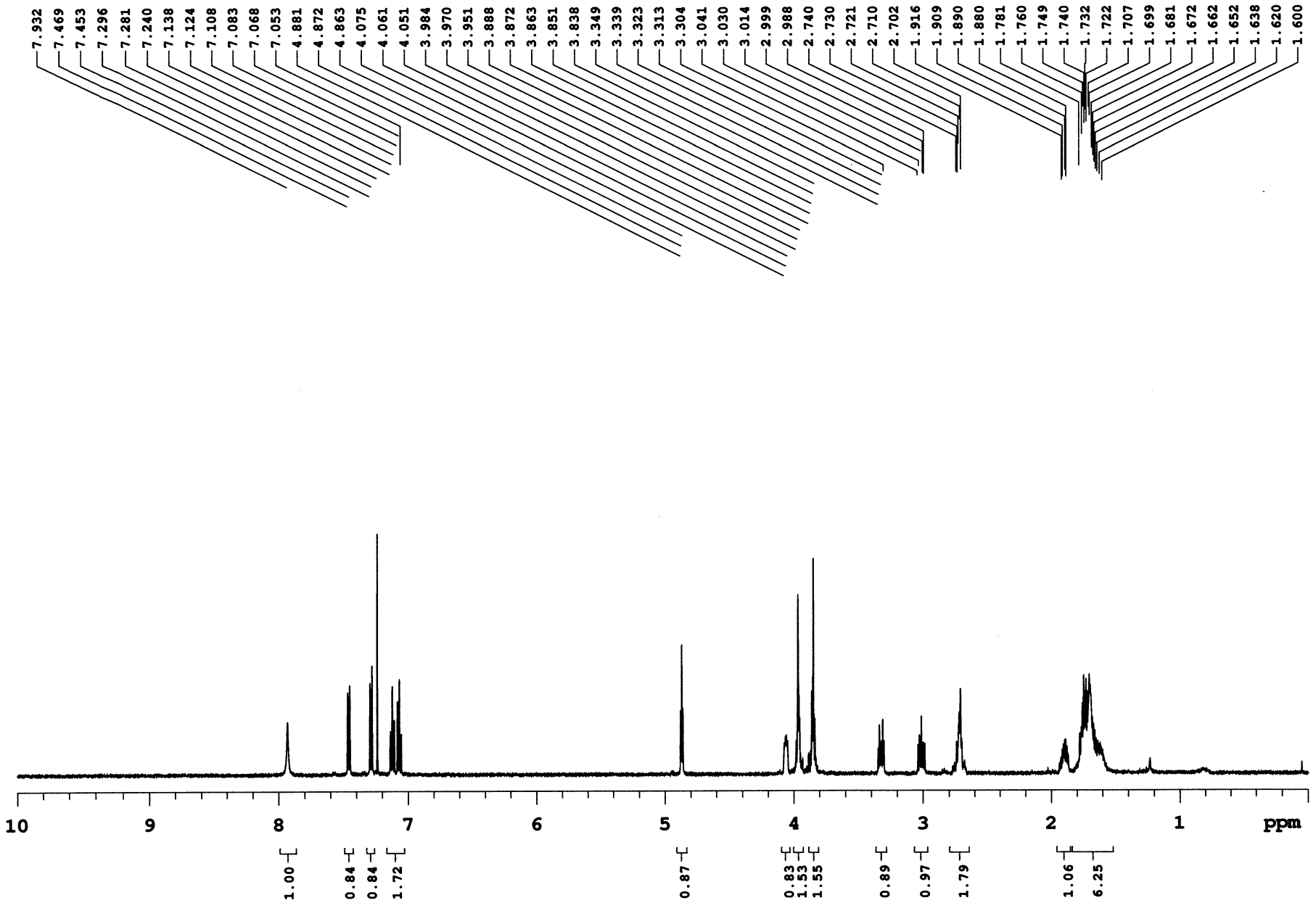


Fig S78. 1H NMR (CDCl3, 500 MHz) of compound 10.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-209/20150304/H1.fid

Plot date 2016-05-13

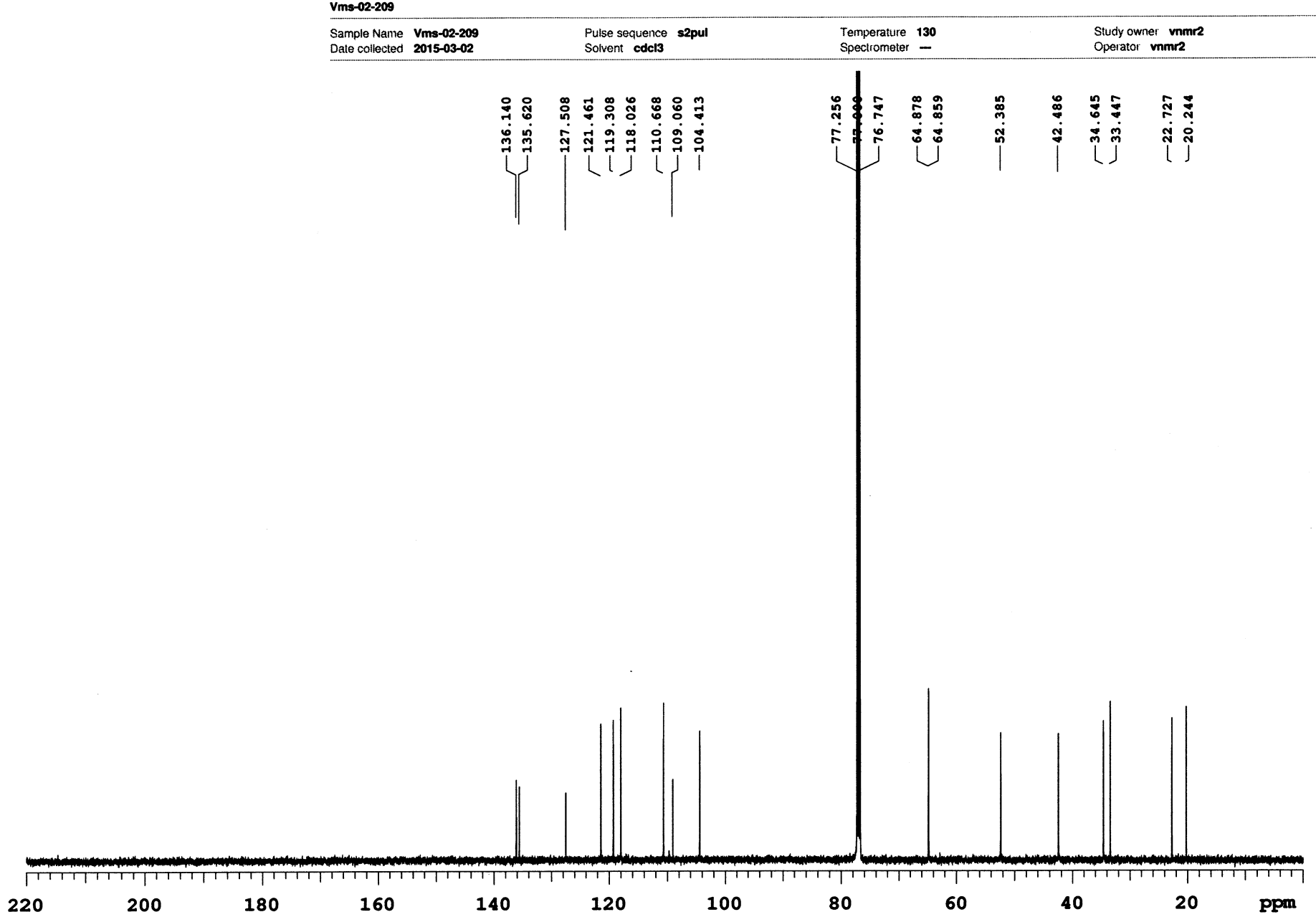


Fig S79. 13C NMR (CDCl3, 125 MHz) of compound 10.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-209/20150304/C13.fid

Plot date 2016-05-13

Vms-02-209

Sample Name **Vms-02-209**	Pulse sequence **DEPT**	Temperature **130**	Study owner **vnmr2**
Date collected **2015-03-03**	Solvent **cdcl3**	Spectrometer **---**	Operator **vnmr2**

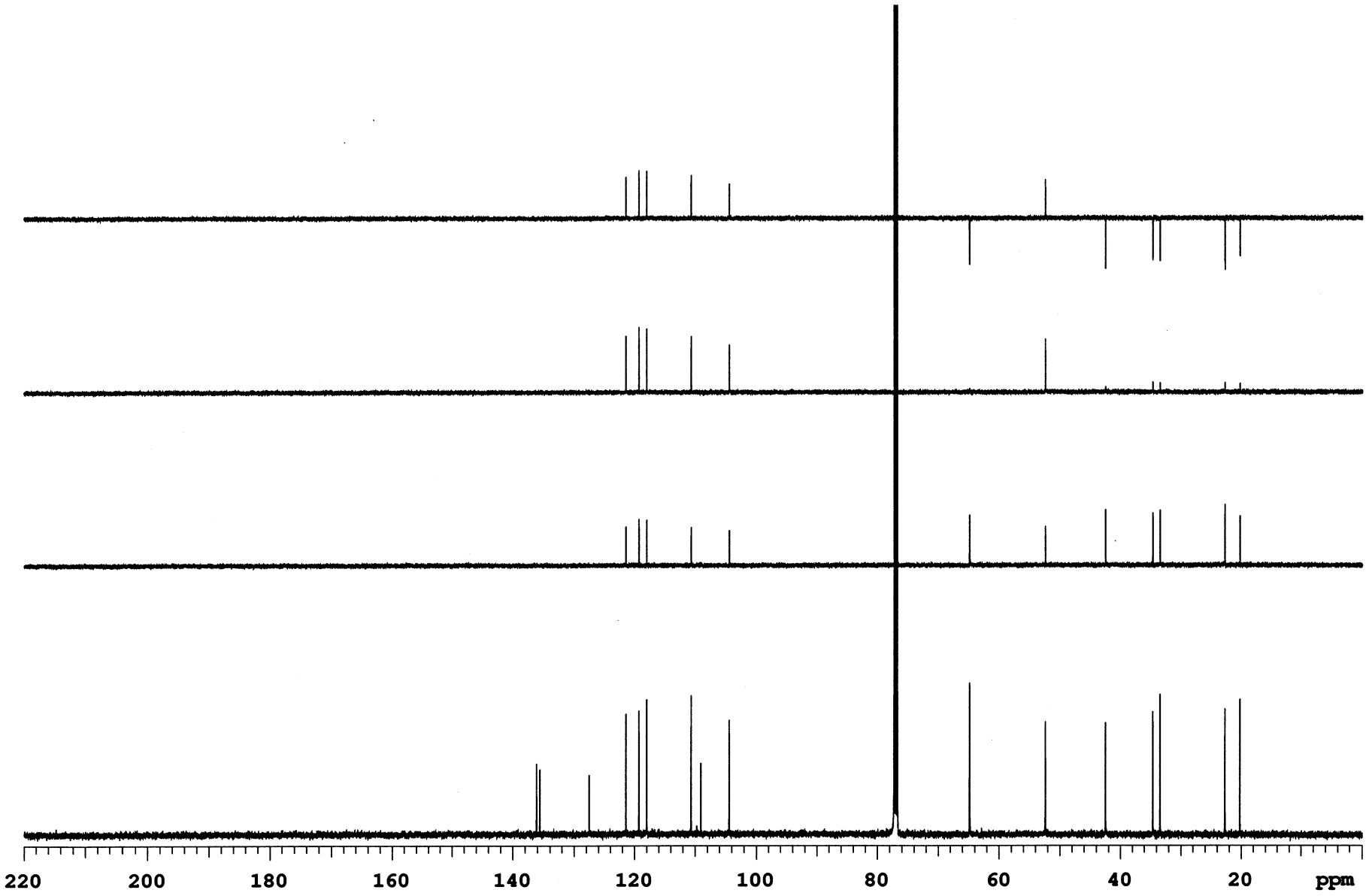


Fig S80. DEPT of compound 10.

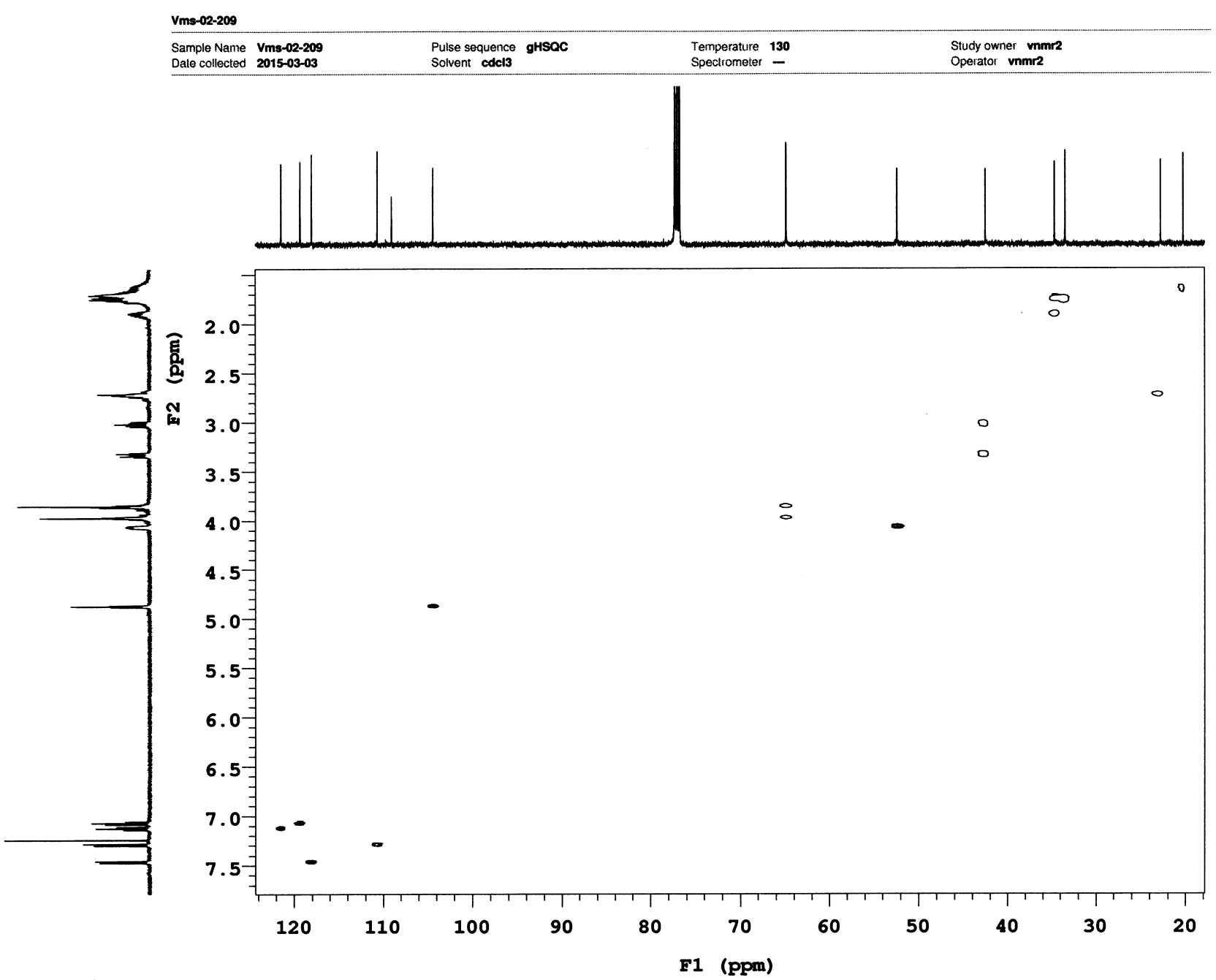


Fig S81. HSQC of compound 10.

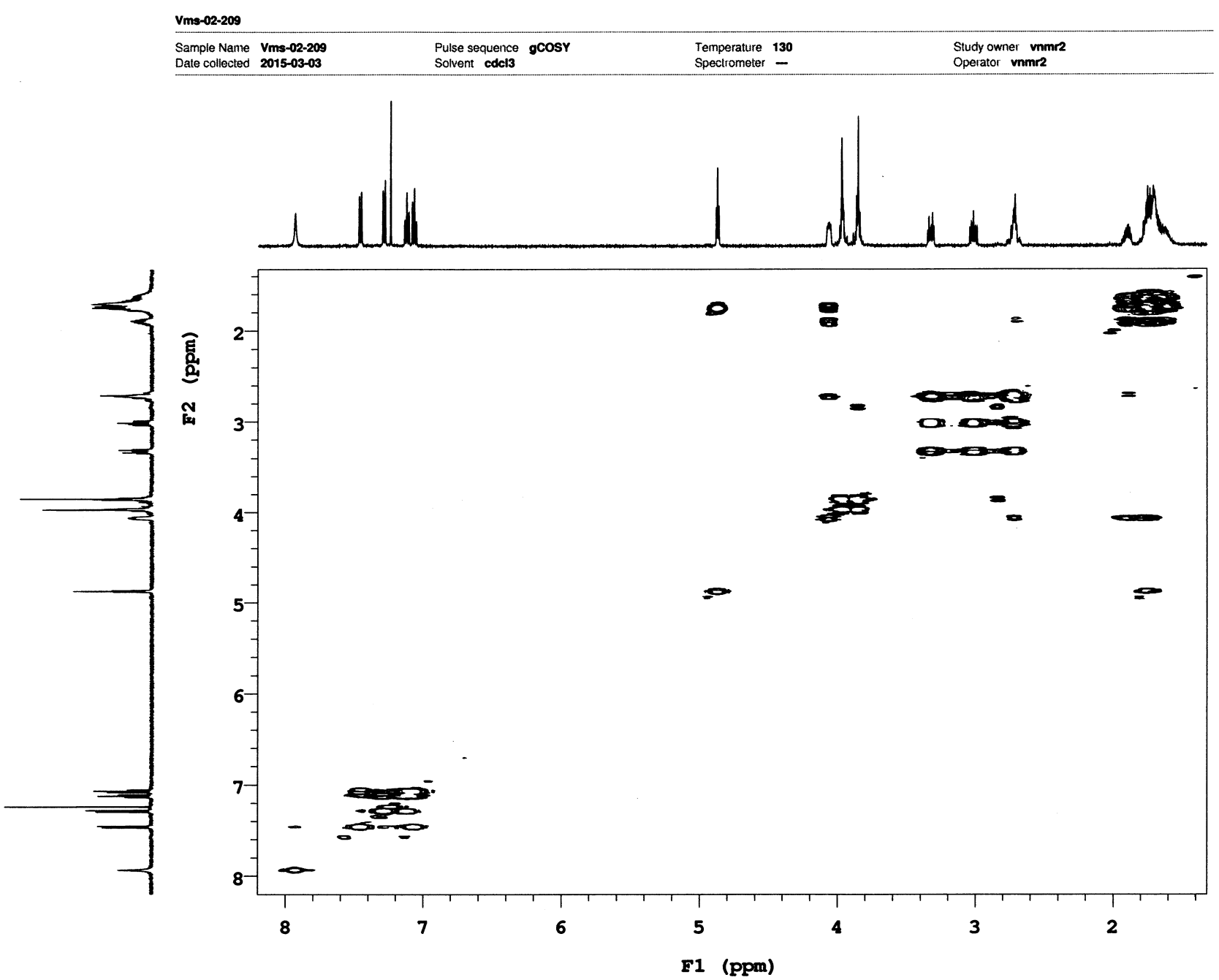


Fig S82. COSY of compound 10.

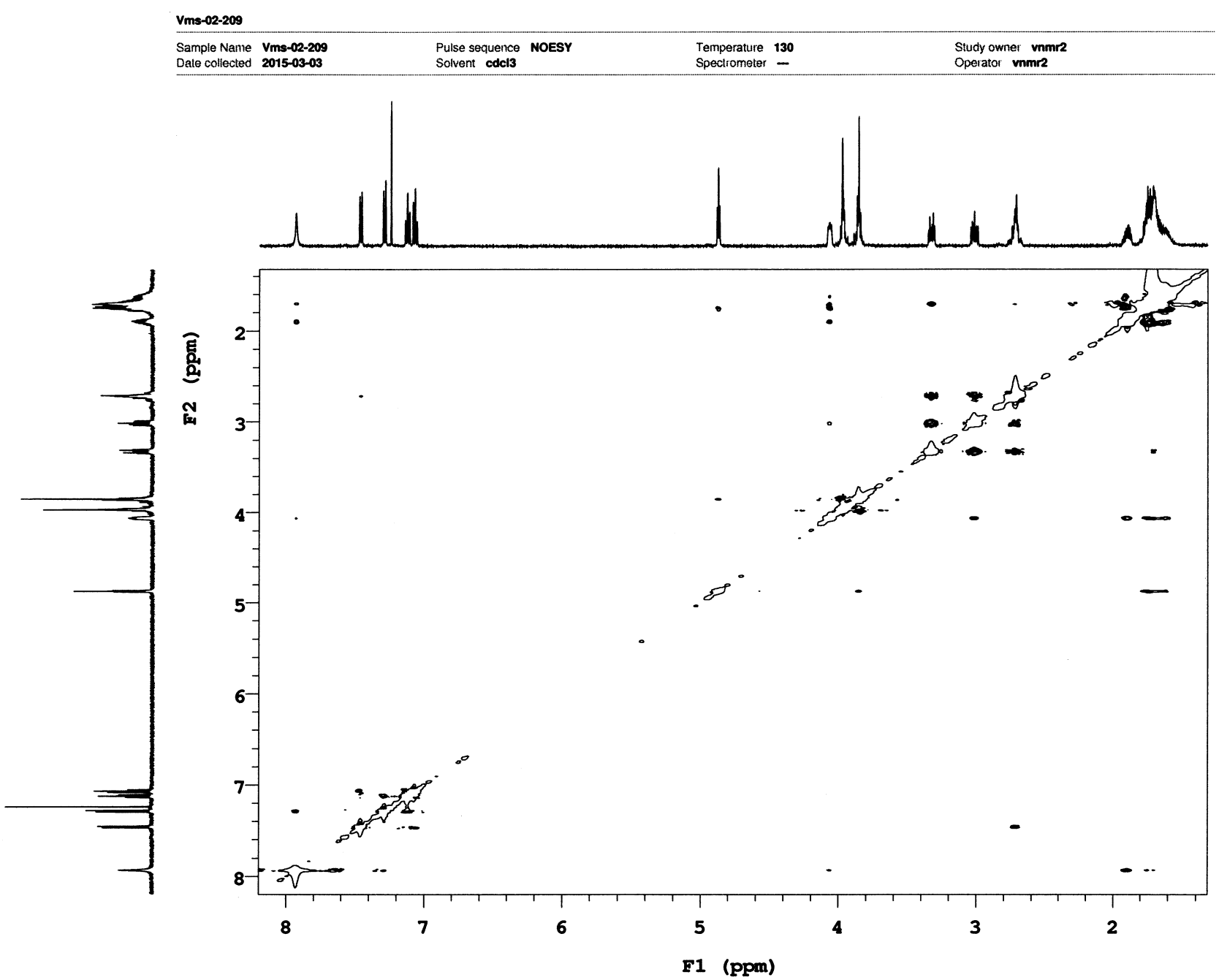


Fig S83. NOESY of compound 10.

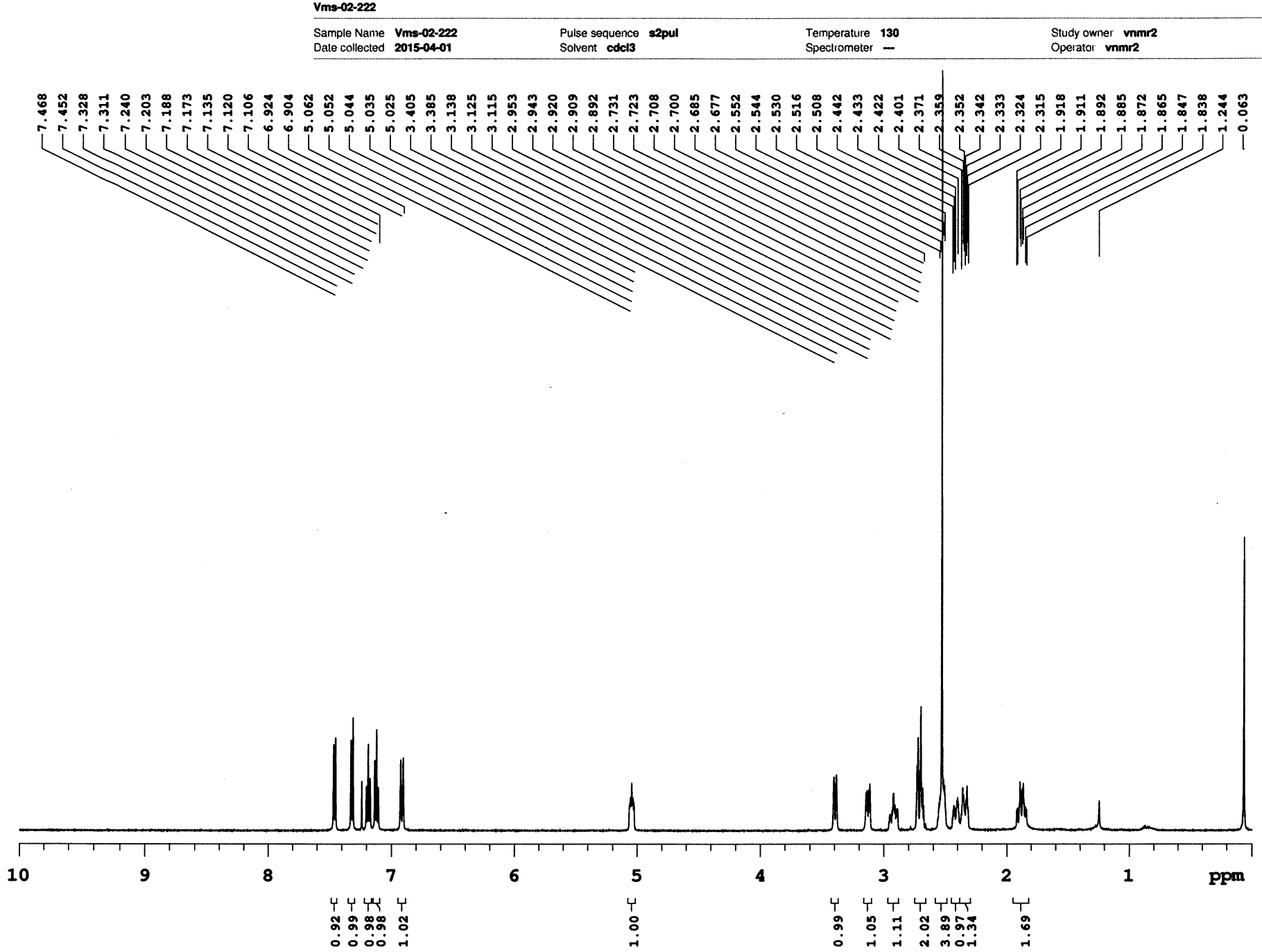


Fig S84. 1H NMR (CDCl3, 500 MHz) of compound 11.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-222/H1.fid

Plot date 2016-05-13

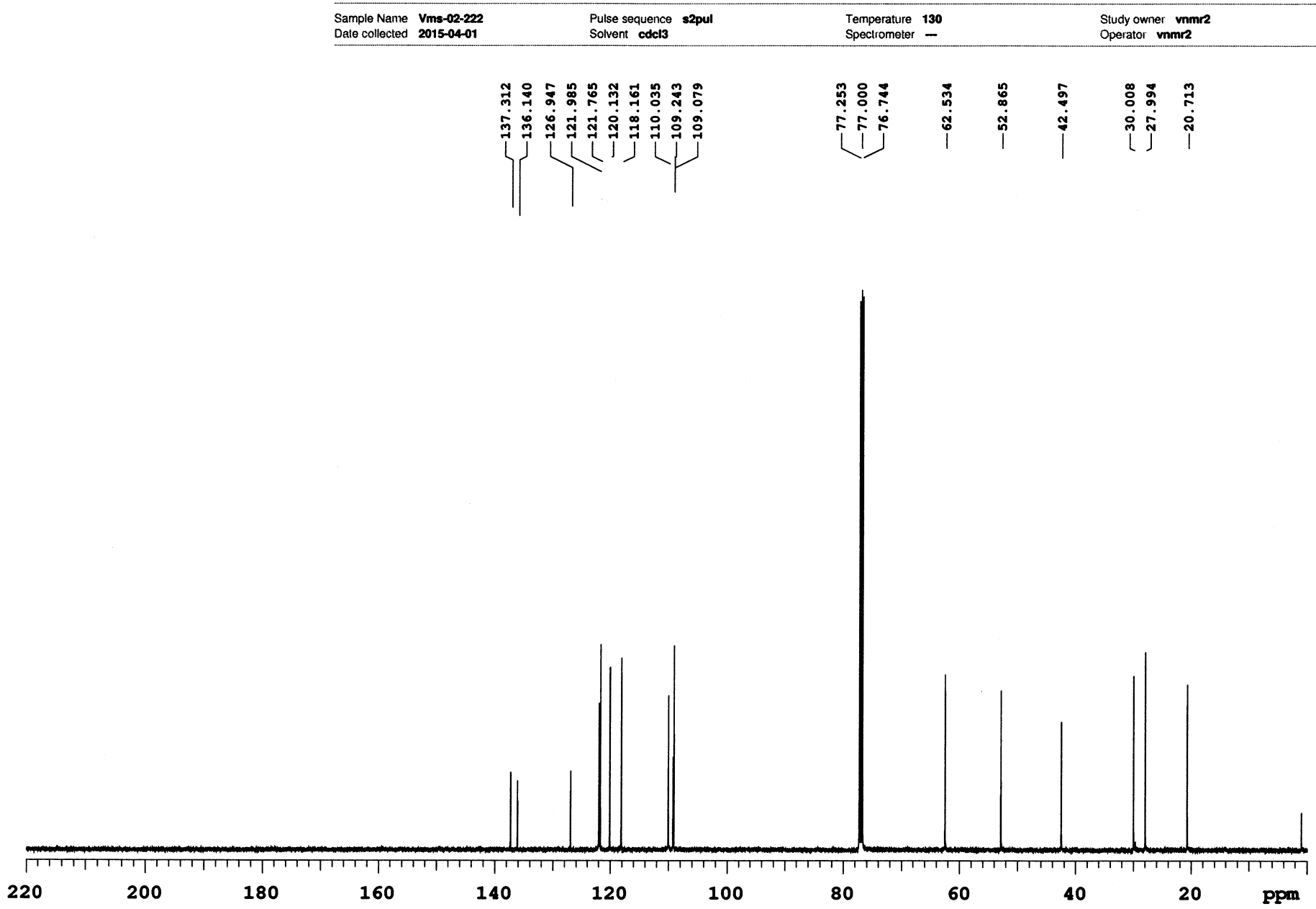


Fig S85. 13C NMR (CDCl3, 125 MHz) of compound 11.

Vms-02-222

Sample Name **Vms-02-222**	Pulse sequence **DEPT**	Temperature **130**	Study owner **vnmr2**
Date collected **2015-04-01**	Solvent **cdcl3**	Spectrometer **—**	Operator **vnmr2**

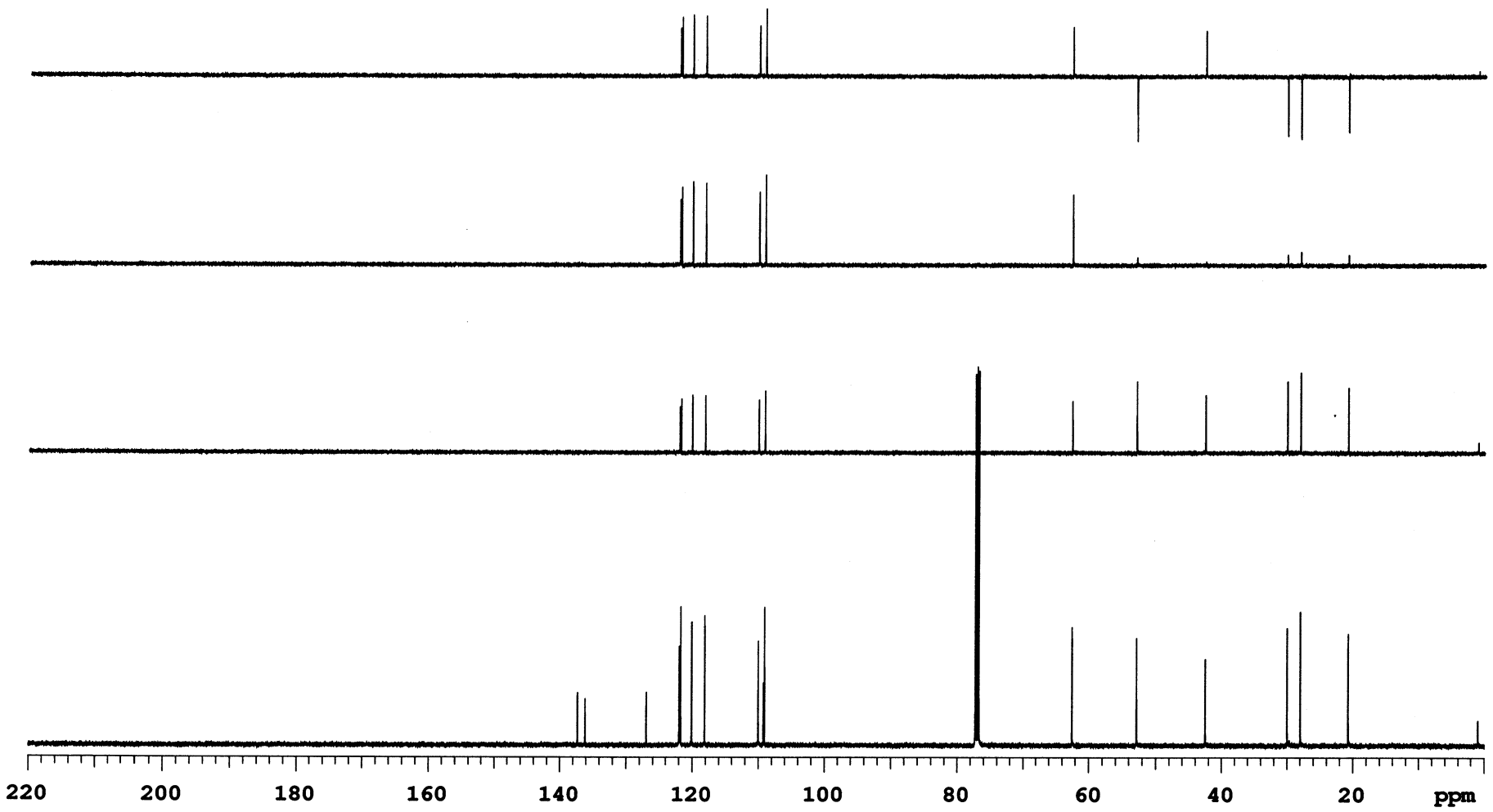


Fig S86. DEPT of compound 11.

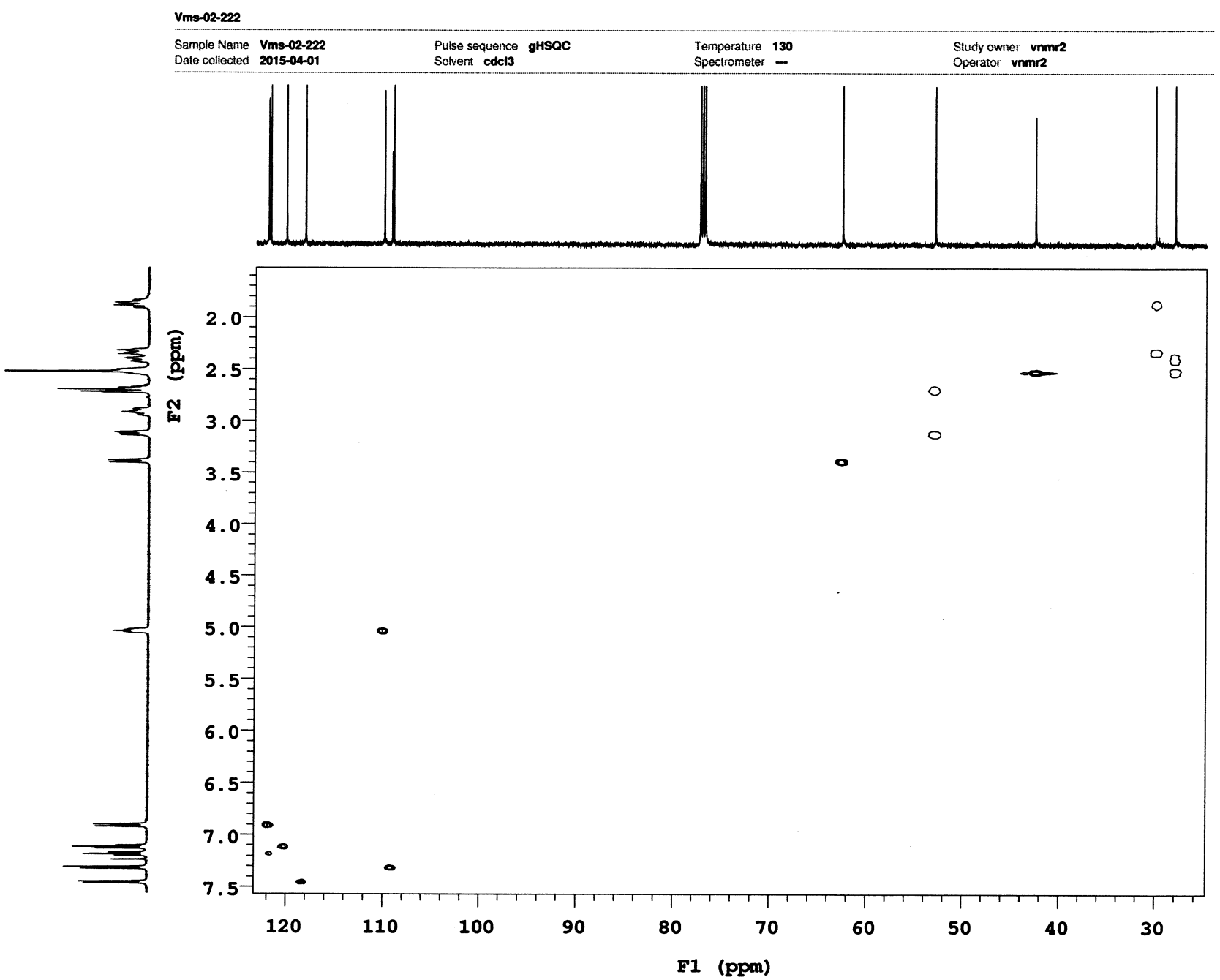


Fig S87. HSQC of compound 11.

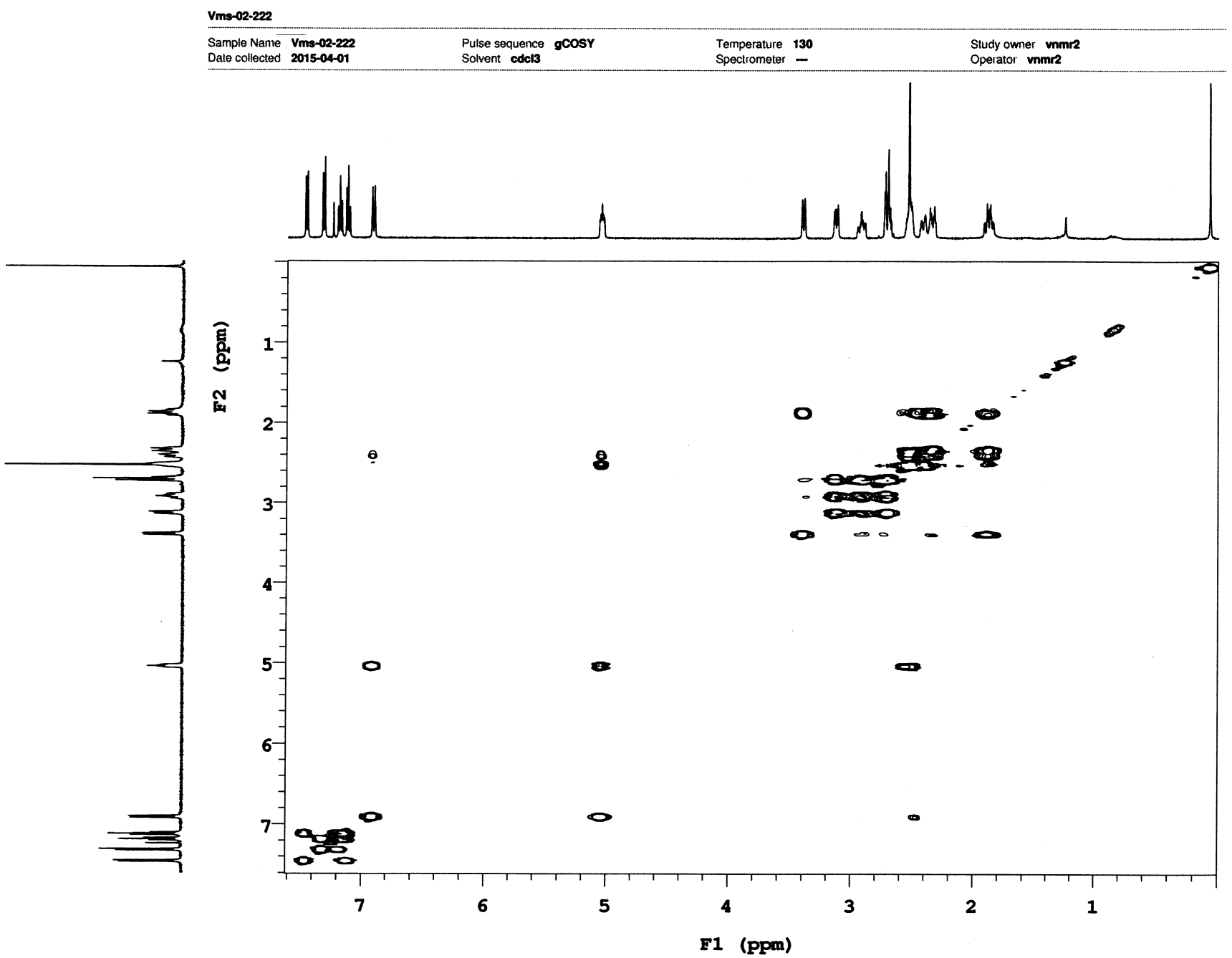


Fig S88. COSY of compound 11.

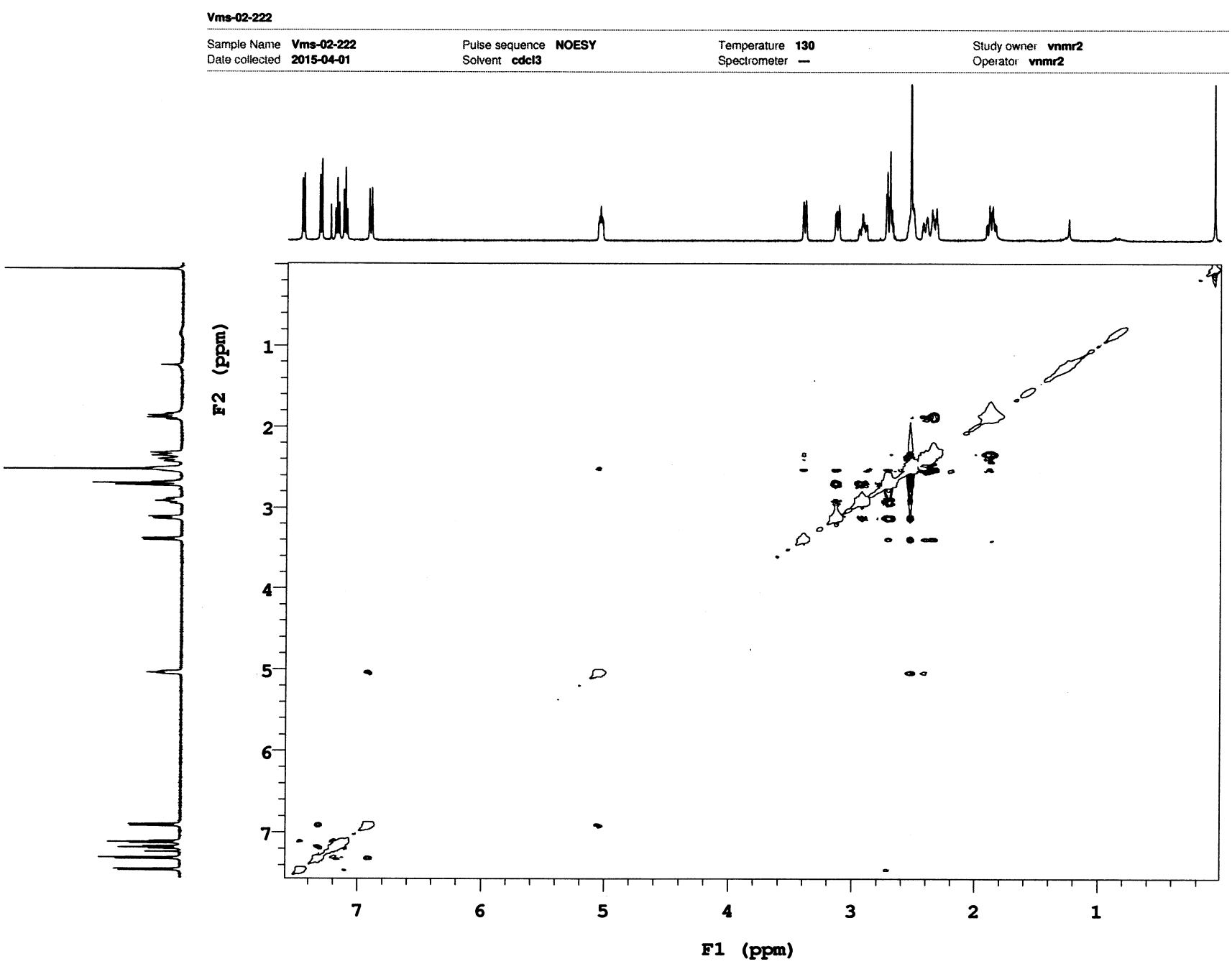
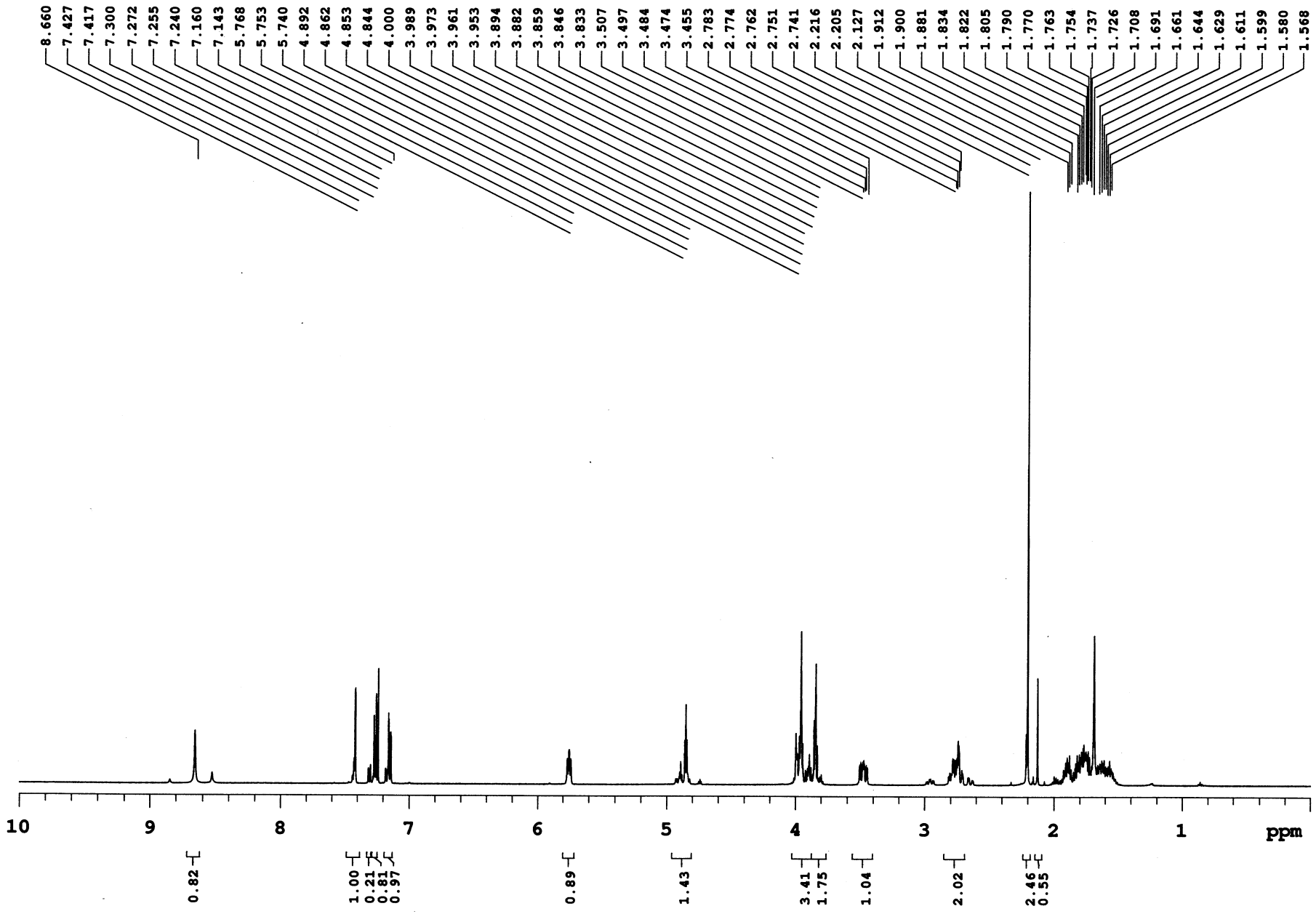


Fig S89. NOESY of compound 11.

Vms-03-131

Sample Name	**Vms-03-131**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-07-26**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-131/PROTON_04.fid

Fig S90. 1H NMR (CDCl3, 500 MHz) of compound 13.

Plot date 2016-10-17

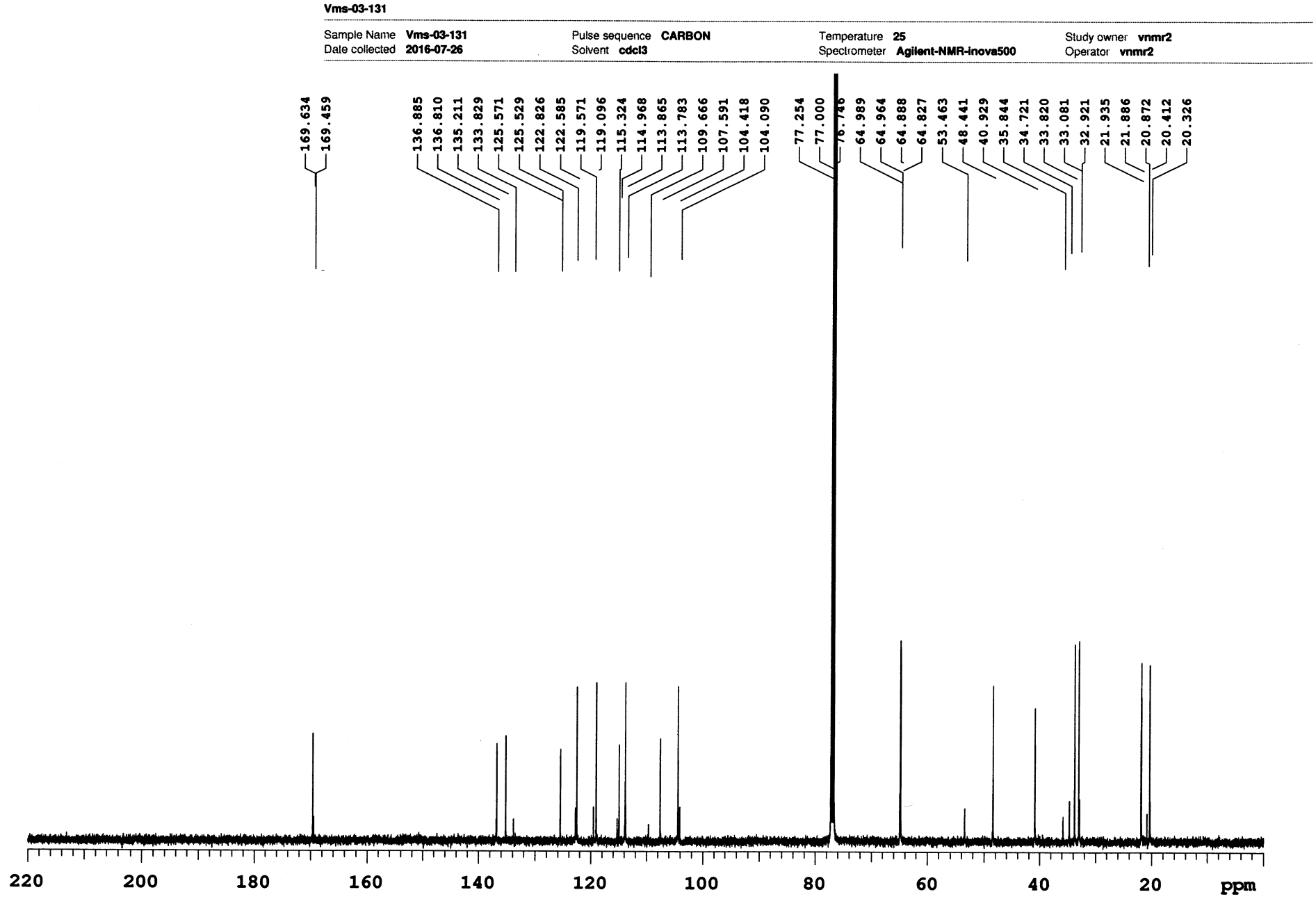


Fig S91. 13C NMR (CDCl3, 125 MHz) of compound 13.

Vms-03-131

Sample Name **Vms-03-131**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-07-26**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

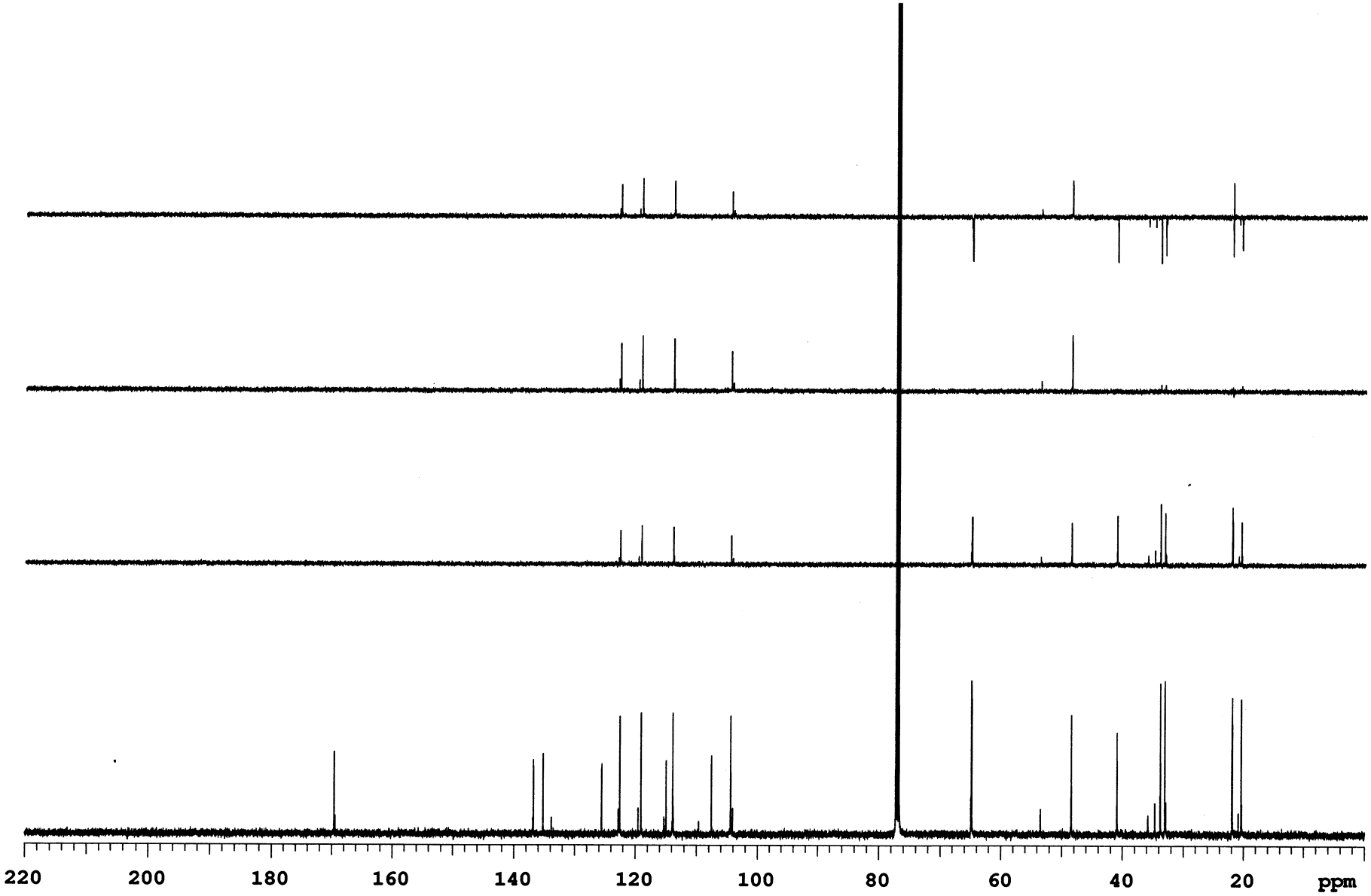


Fig S92. DEPT of compound 13.

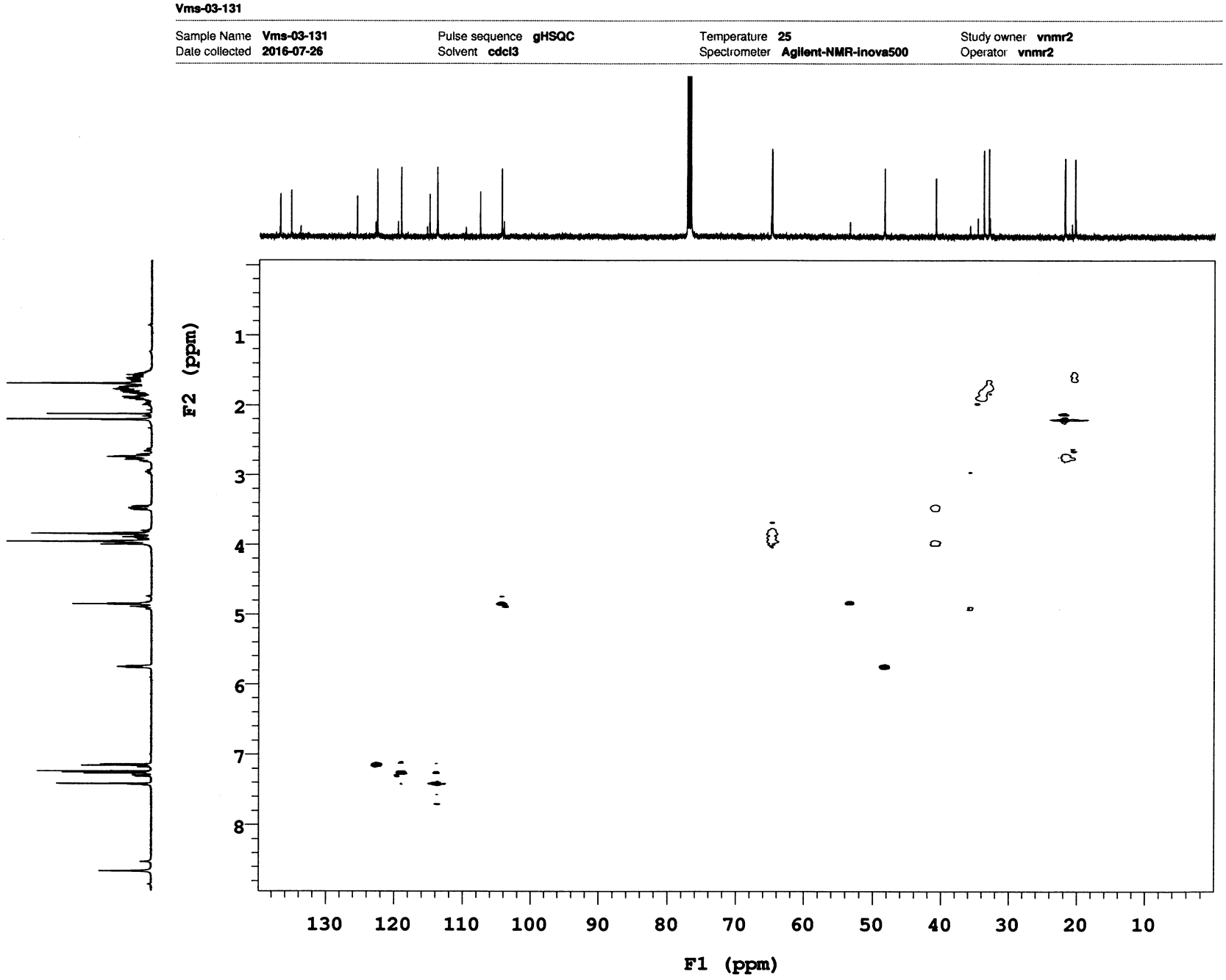


Fig S93. HSQC of compound 13.

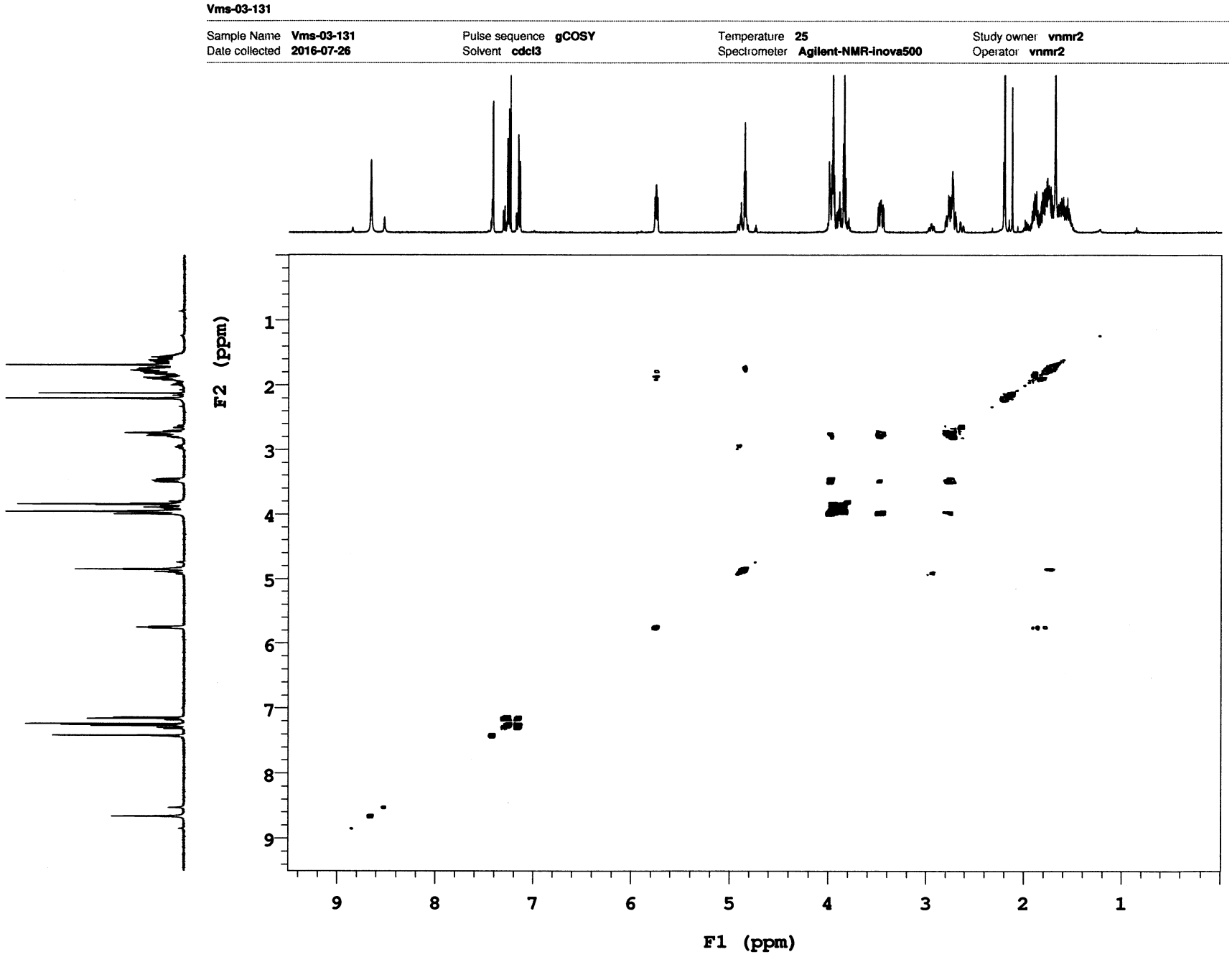


Fig S94. COSY of compound 13.

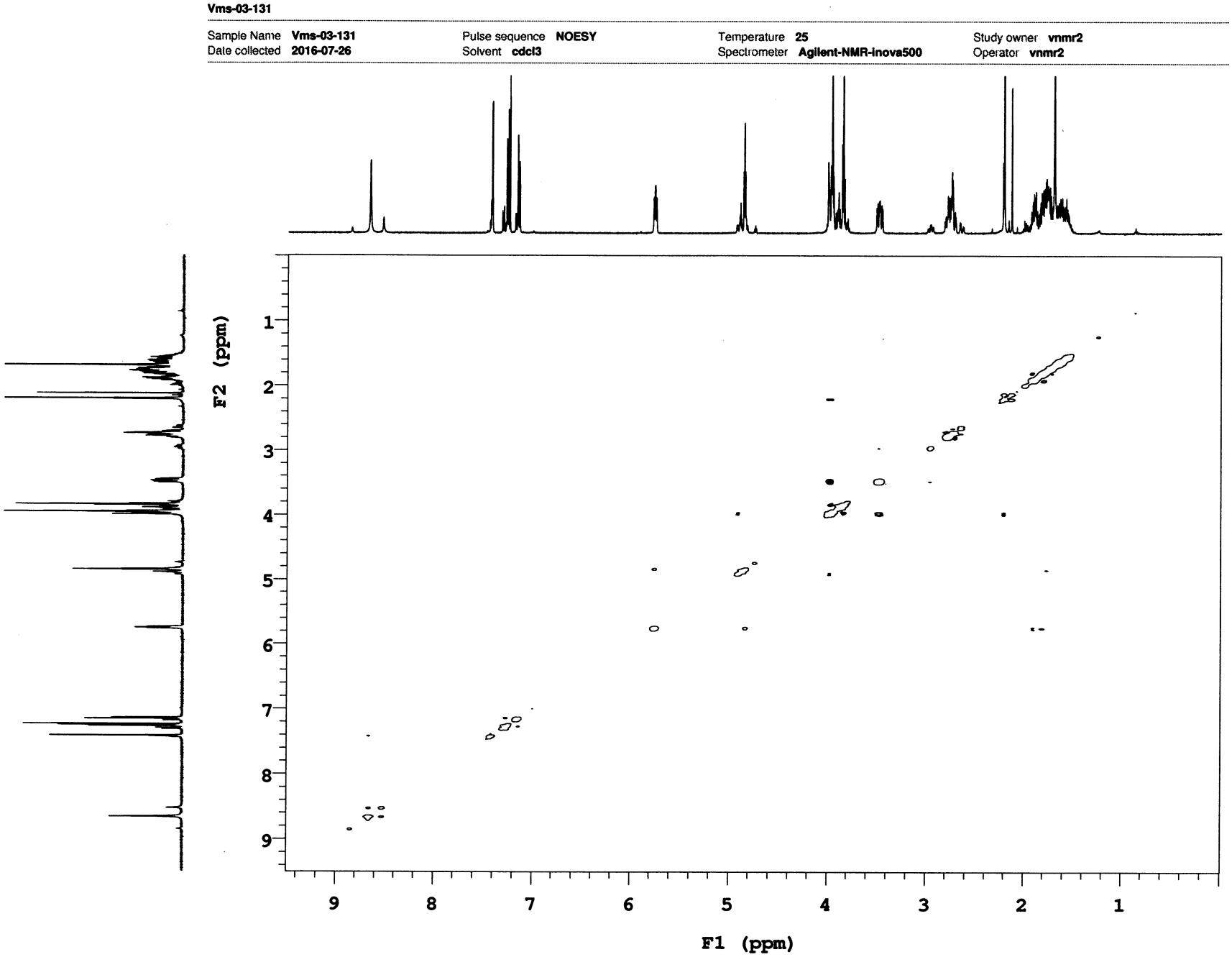


Fig S95. NOESY of compound 13.

Vms-03-097

Sample Name	Vms-03-097	Pulse sequence	PROTON	Temperature	25	Study owner	vnmr2
Date collected	2016-07-06	Solvent	cdcl3	Spectrometer	Agilent-NMR-inova500	Operator	vnmr2

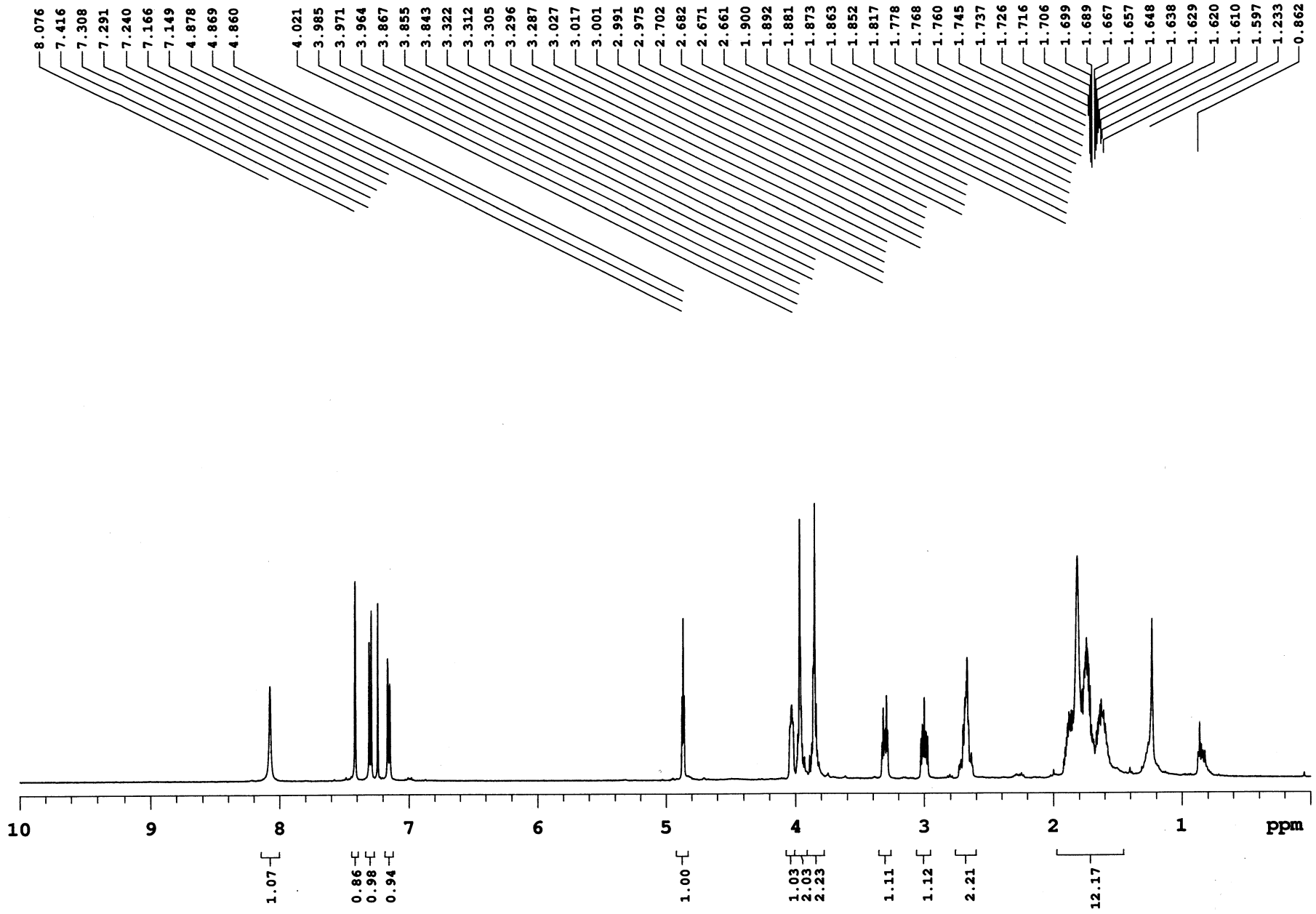


Fig S96. 1H NMR (CDCl3, 500 MHz) of compound 14.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-097/PROTON_04.fid

Plot date 2016-10-23

Vms-03-097

Sample Name	**Vms-03-097**	Pulse sequence	**CARBON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-07-05**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

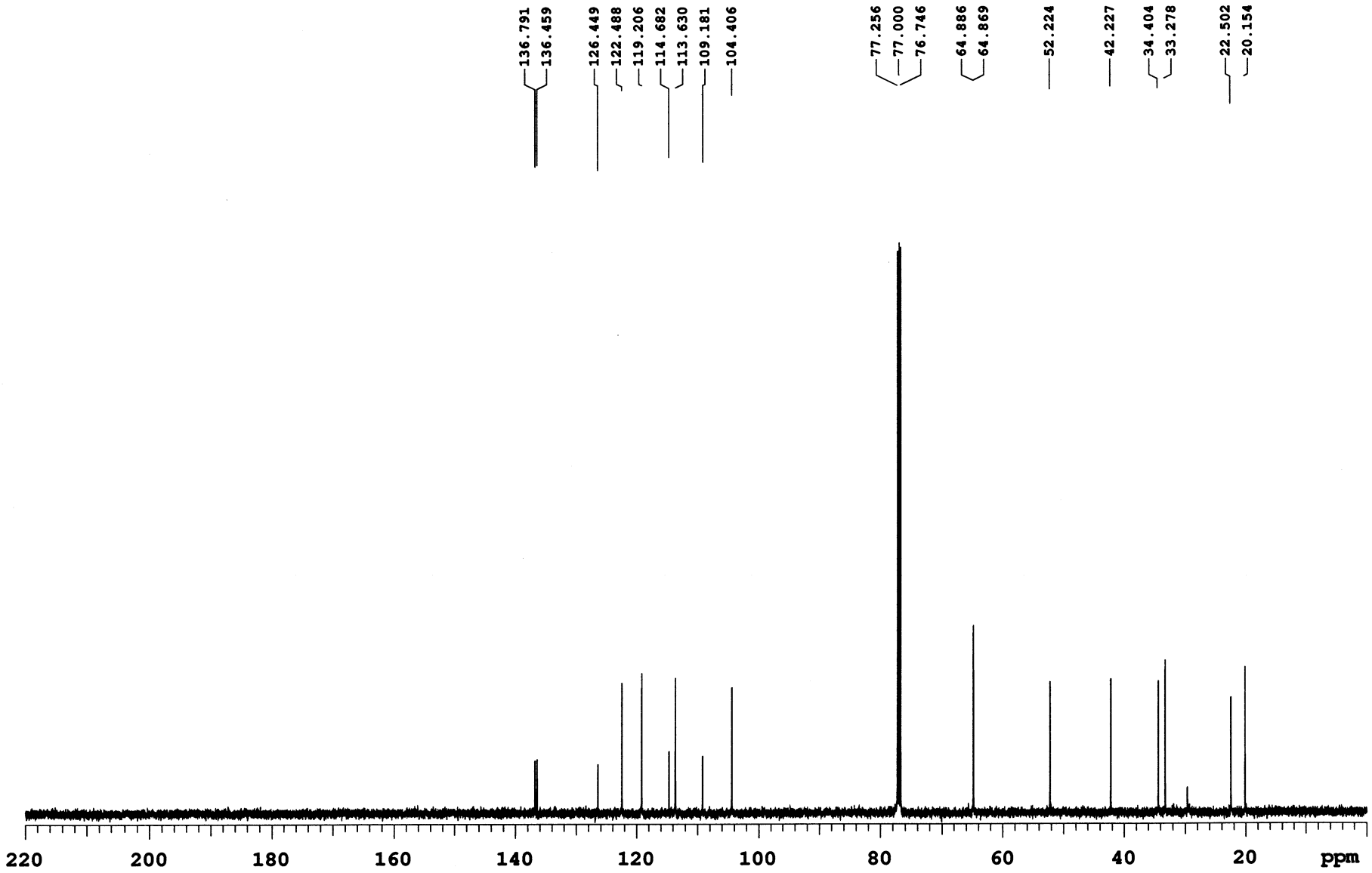


Fig S97. 13C NMR (CDCl3, 125 MHz) of compound 14.

Vms-03-097

Sample Name **Vms-03-097**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-07-05**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

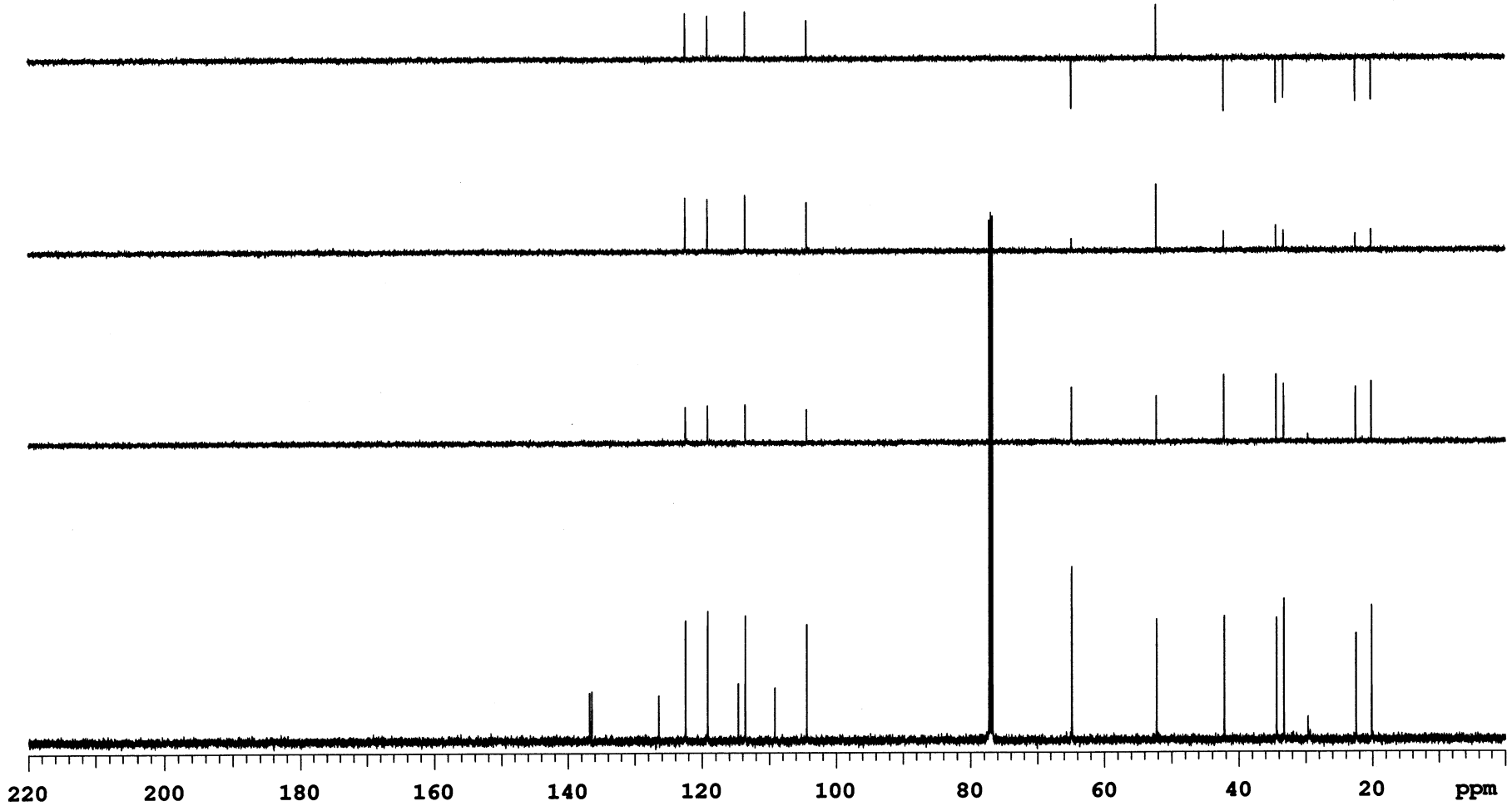


Fig S98. DEPT of compound 14.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-097/DEPT_01.fid

Plot date 2016-10-23

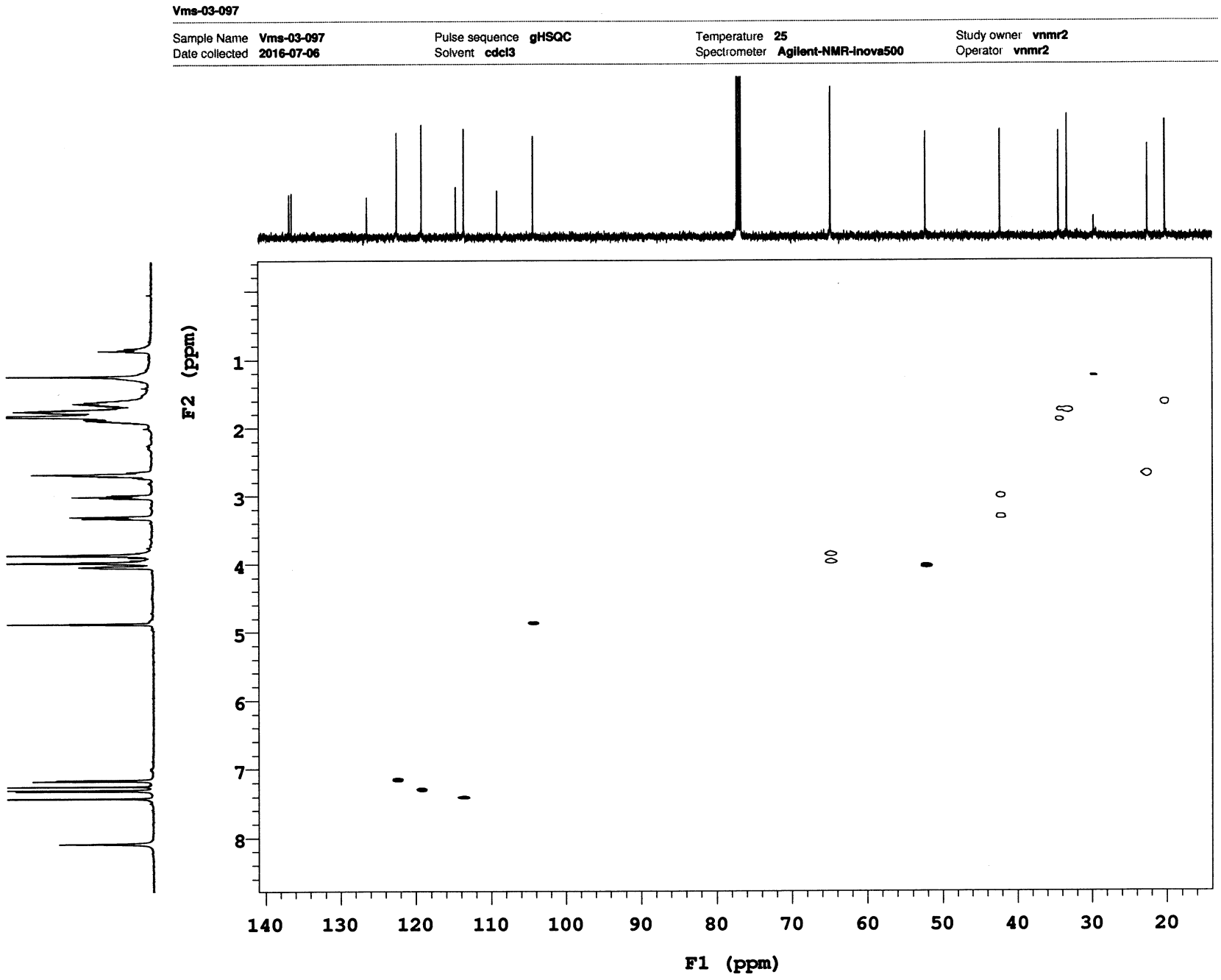


Fig S99. HSQC of compound 14.

Vms-03-097

Sample Name **Vms-03-097** | Pulse sequence **gCOSY** | Temperature **25** | Study owner **vnmr2**
Date collected **2016-07-05** | Solvent **cdcl3** | Spectrometer **Agilent-NMR-inova500** | Operator **vnmr2**

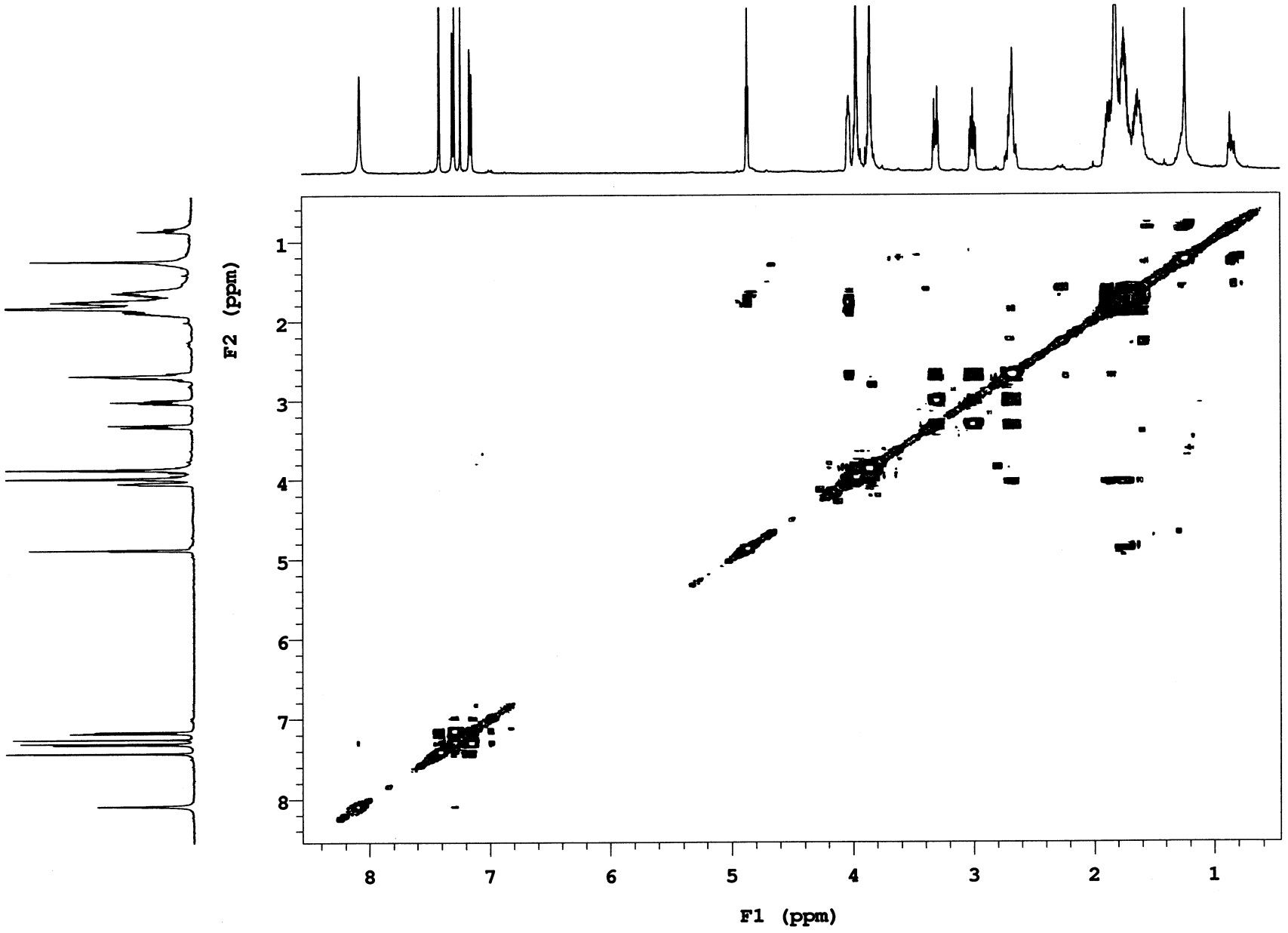


Fig S100. COSY of compound 14.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-097/gCOSY_01.fid

Plot date 2016-10-23

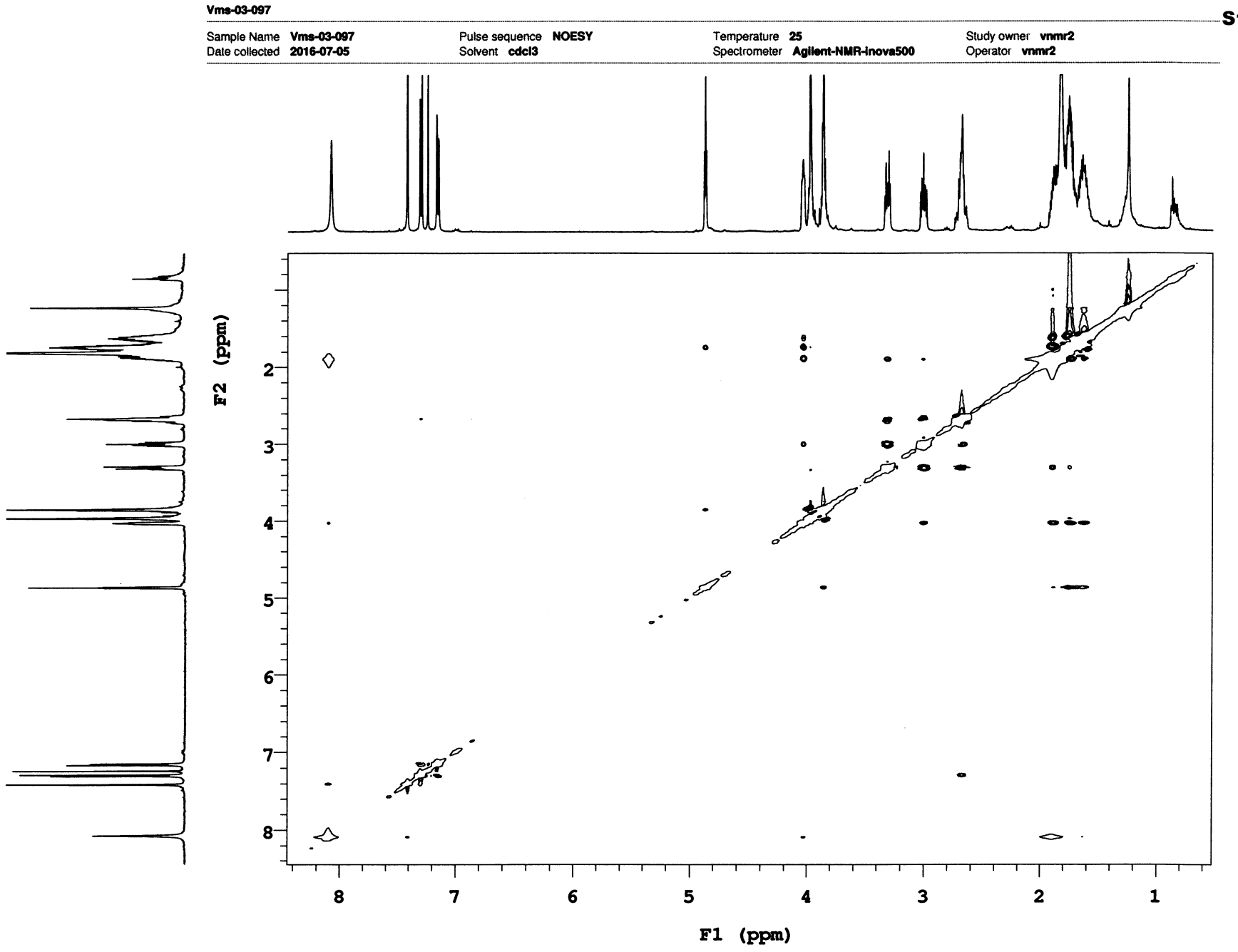
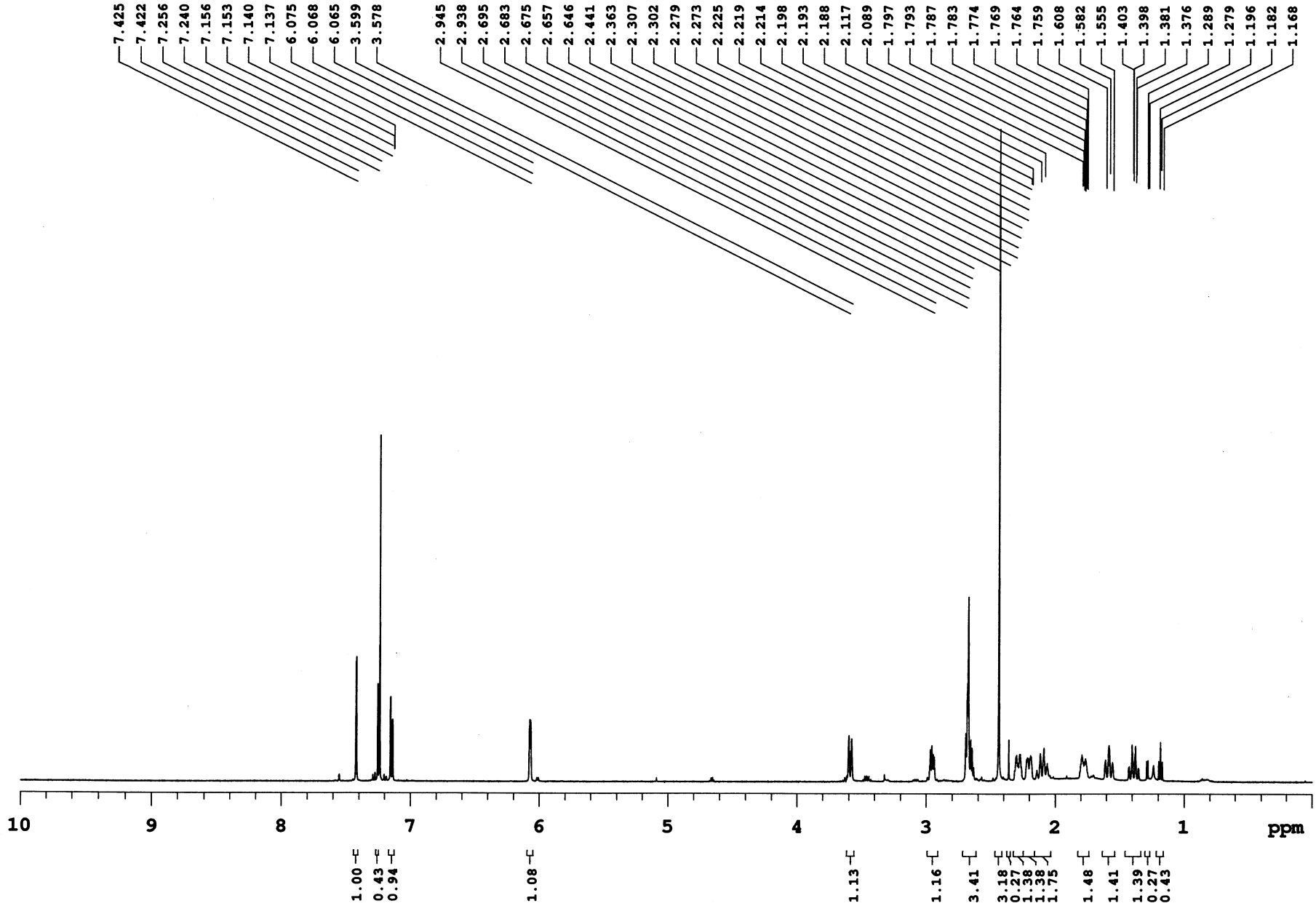


Fig S101. NOESY of compound 14.

Vms-03-102

Sample Name	**Vms-03-102**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-07-13**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-102/PROTON_03.fid

Fig S102. 1H NMR (CDCl3, 500 MHz) of compound 15.

Plot date 2016-10-17

Vms-03-102

Sample Name **Vms-03-102** | Pulse sequence **CARBON** | Temperature **25** | Study owner **vnmr2**
Date collected **2016-07-13** | Solvent **cdcl3** | Spectrometer **Agilent-NMR-inova500** | Operator **vnmr2**

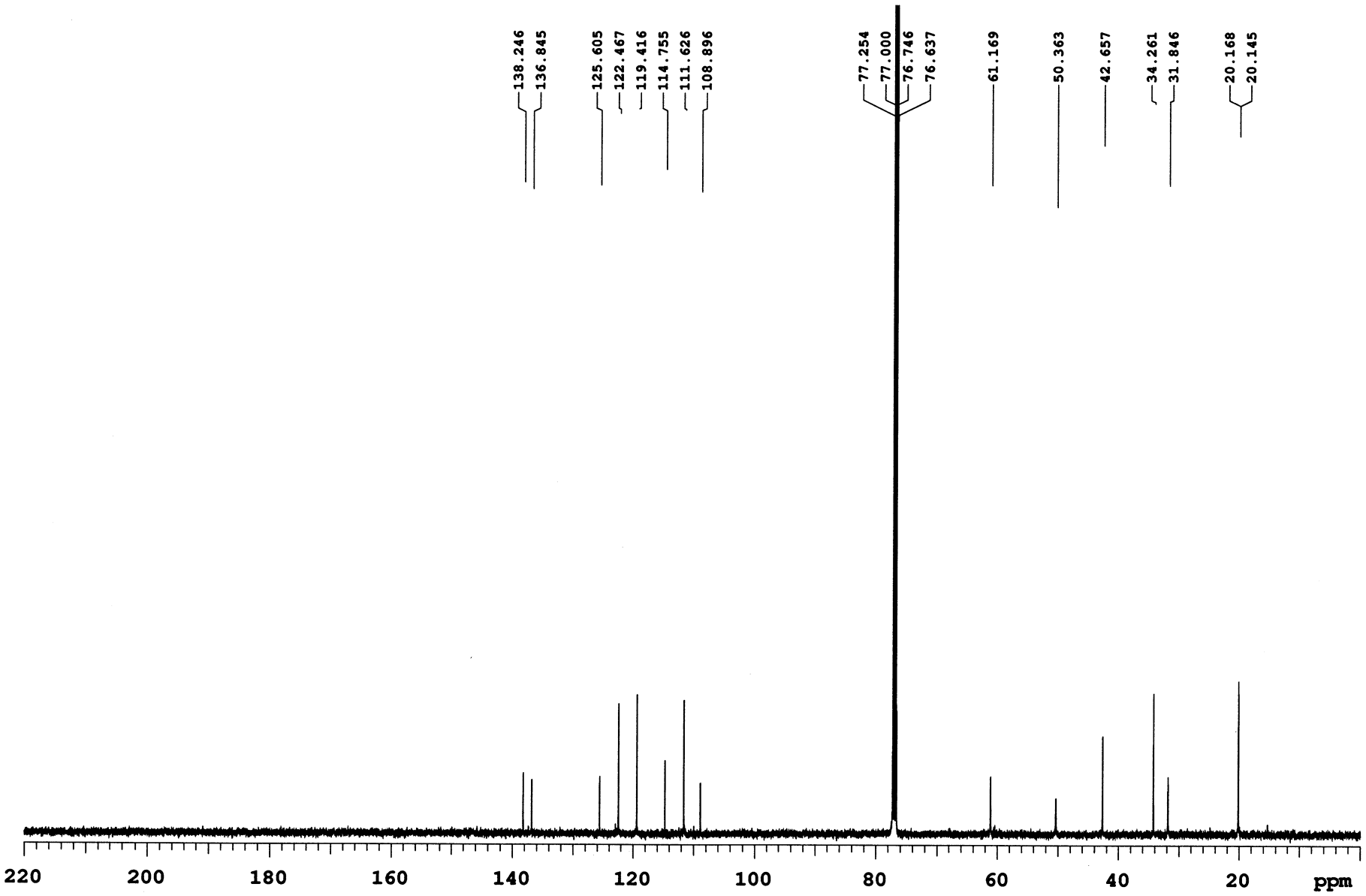


Fig S103. 13C NMR (CDCl3, 125 MHz) of compound 15.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-102/CARBON_02

Plot date 2016-07-14

Vms-03-102

Sample Name **Vms-03-102**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-07-14**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

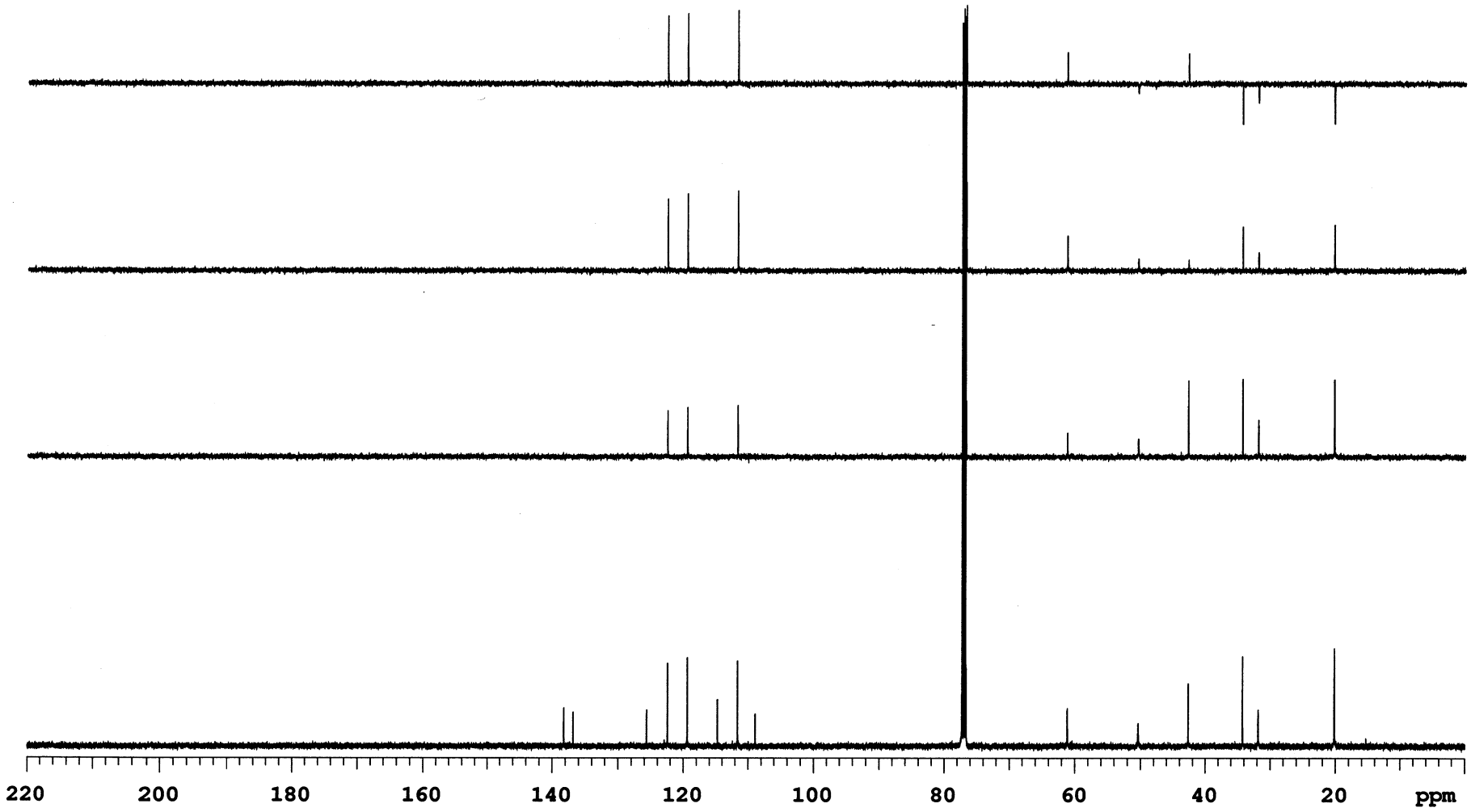


Fig S104. DEPT of compound 15.

Vms-03-102

Sample Name **Vms-03-102**	Pulse sequence **gHSQC**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-07-14**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

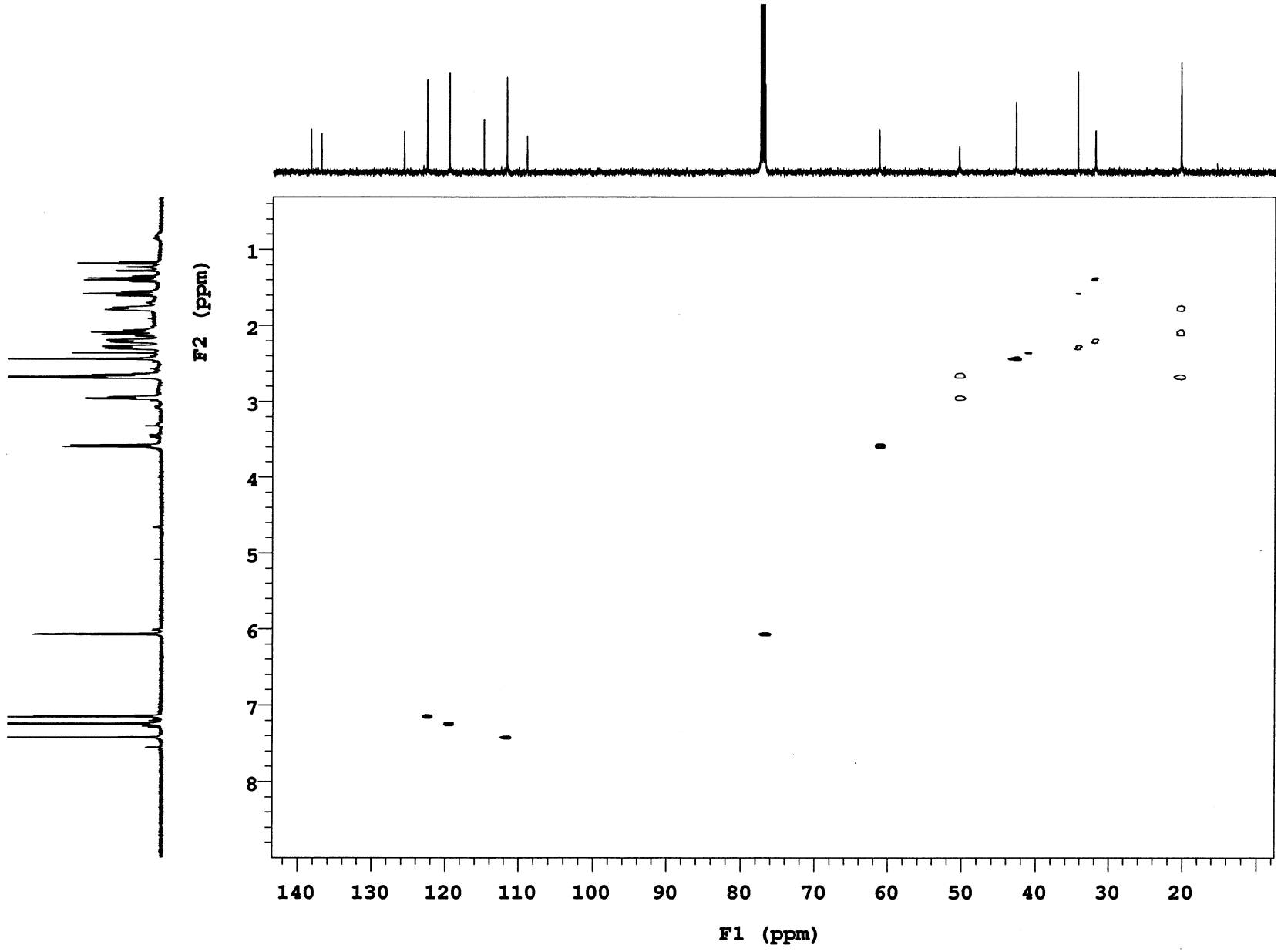


Fig S105. HSQC of compound 15.

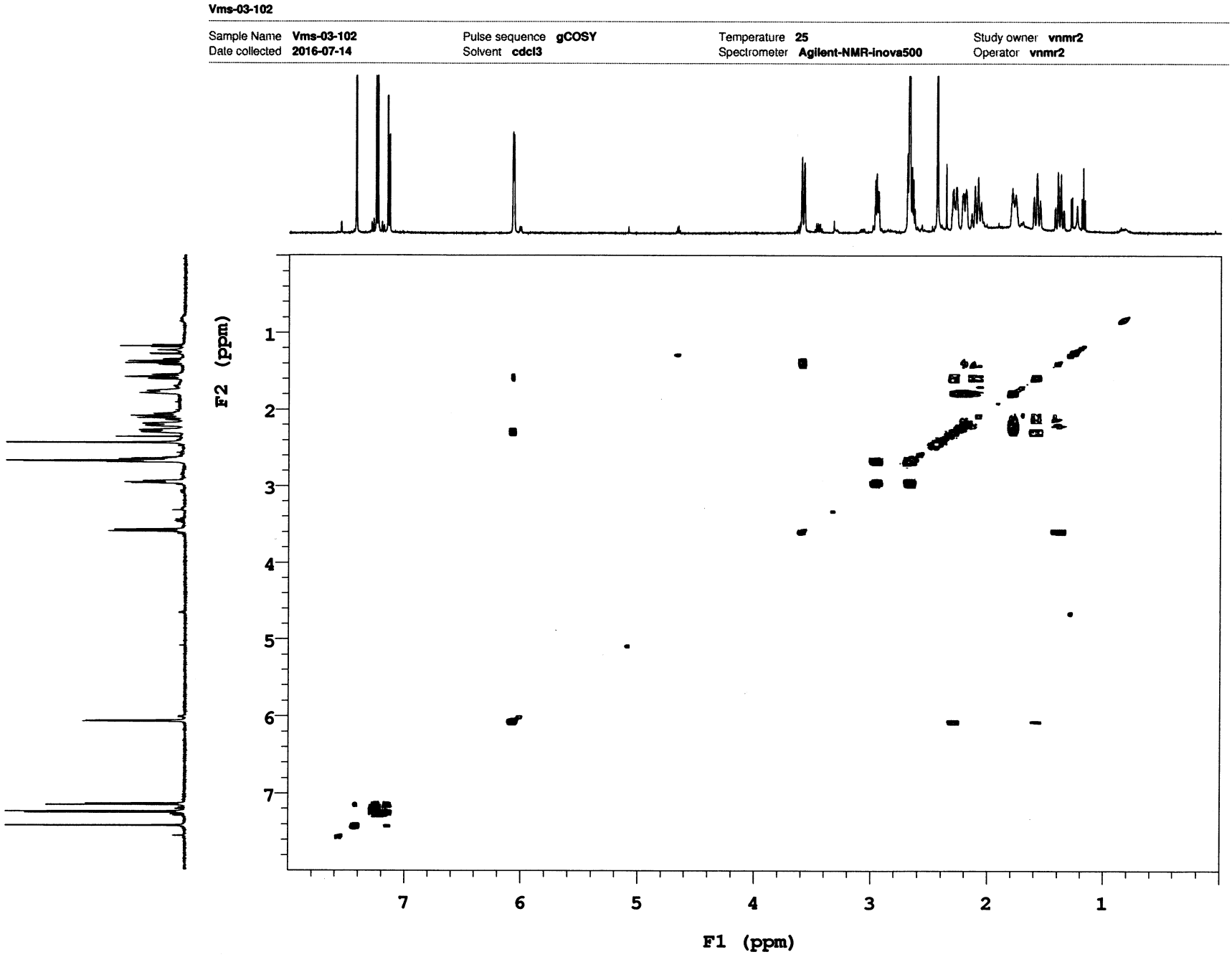


Fig S106. COSY of compound 15.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-102/gCOSY_01.fid

Plot date 2016-07-16

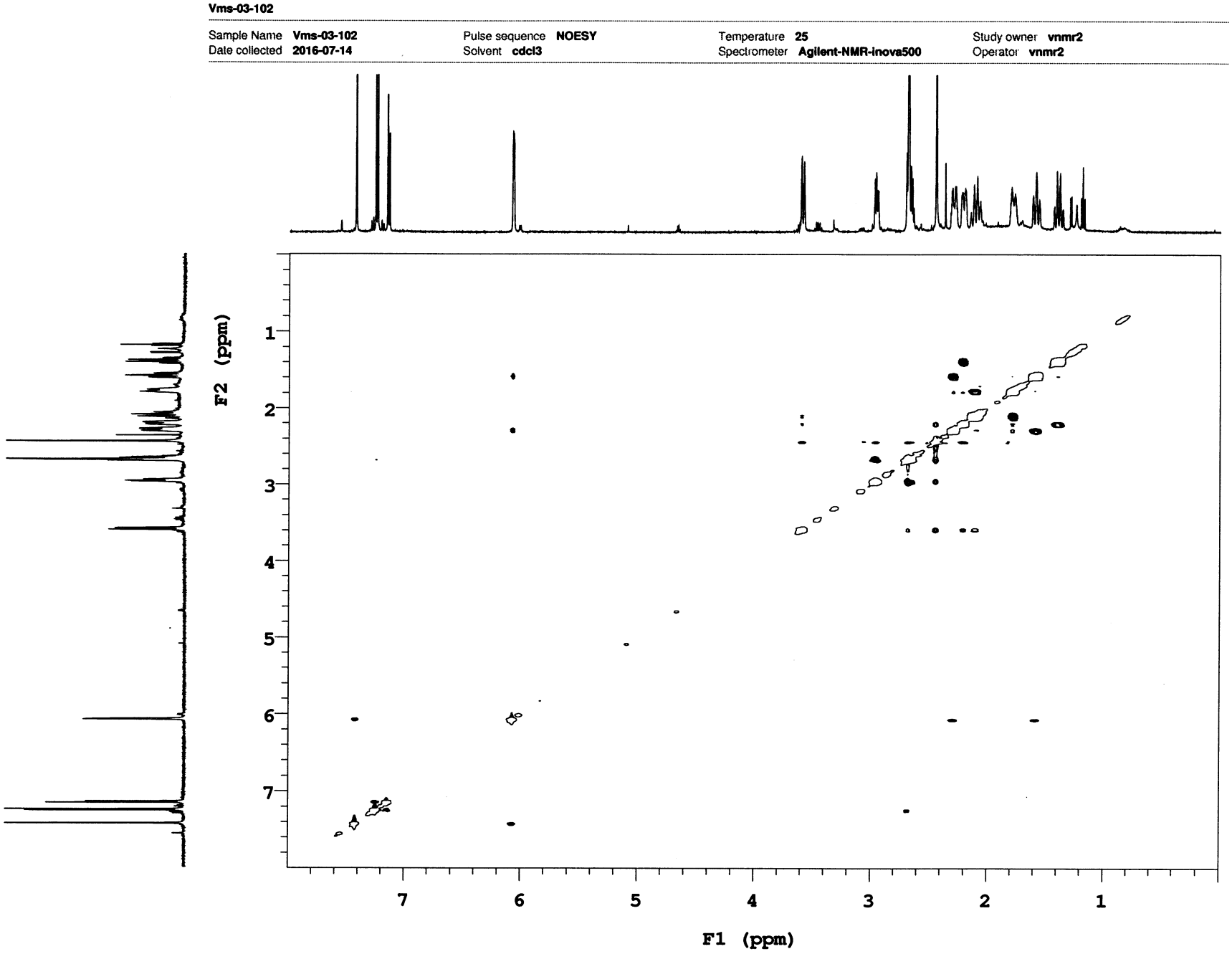


Fig S107. NOESY of compound 15.

Vms-03-138

Sample Name	**Vms-03-138**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-08-05**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

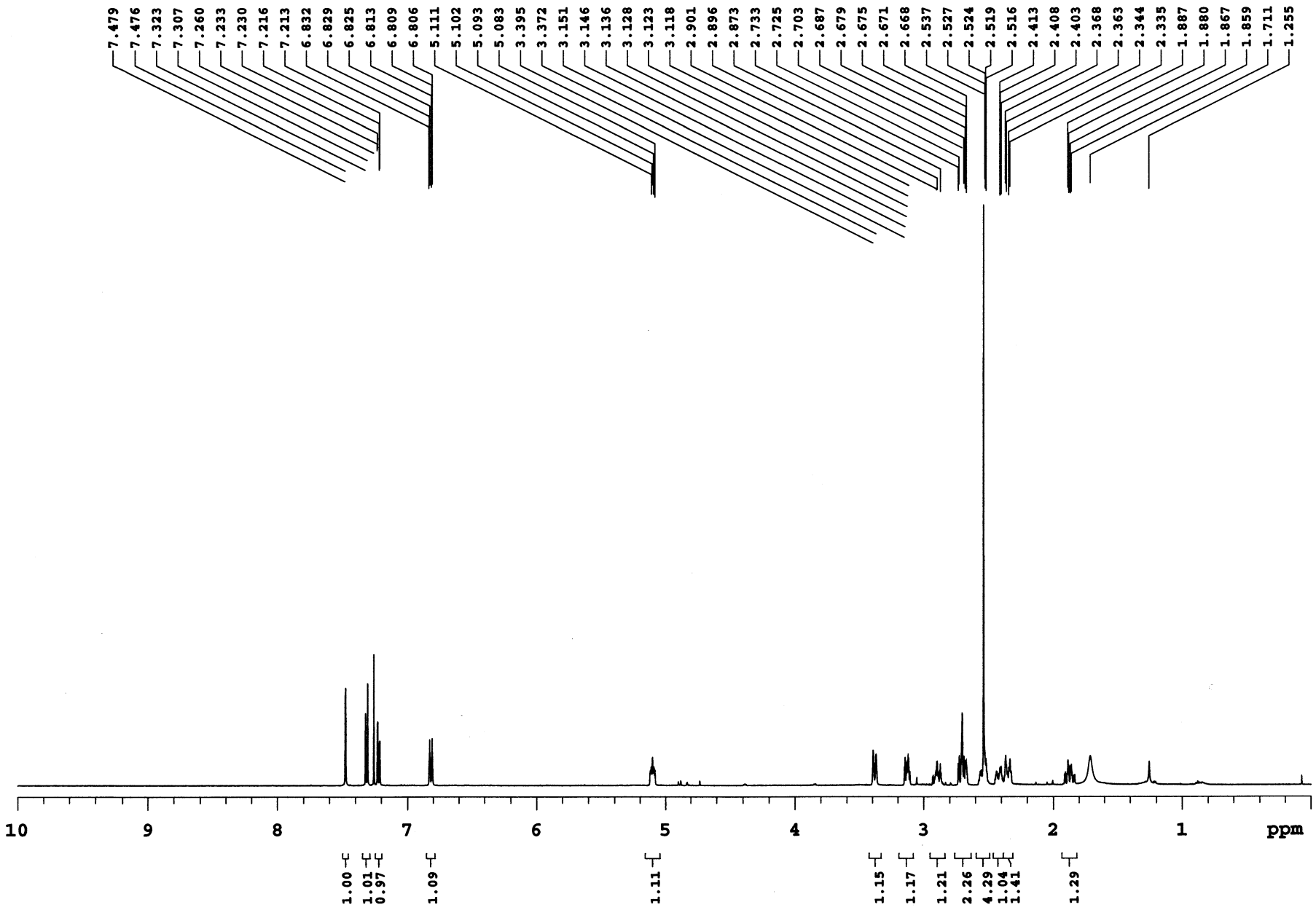


Fig S108. 1H NMR (CDCl3, 500 Hz) of compound 16.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-138/PROTON_03.fid

Plot date 2016-12-05

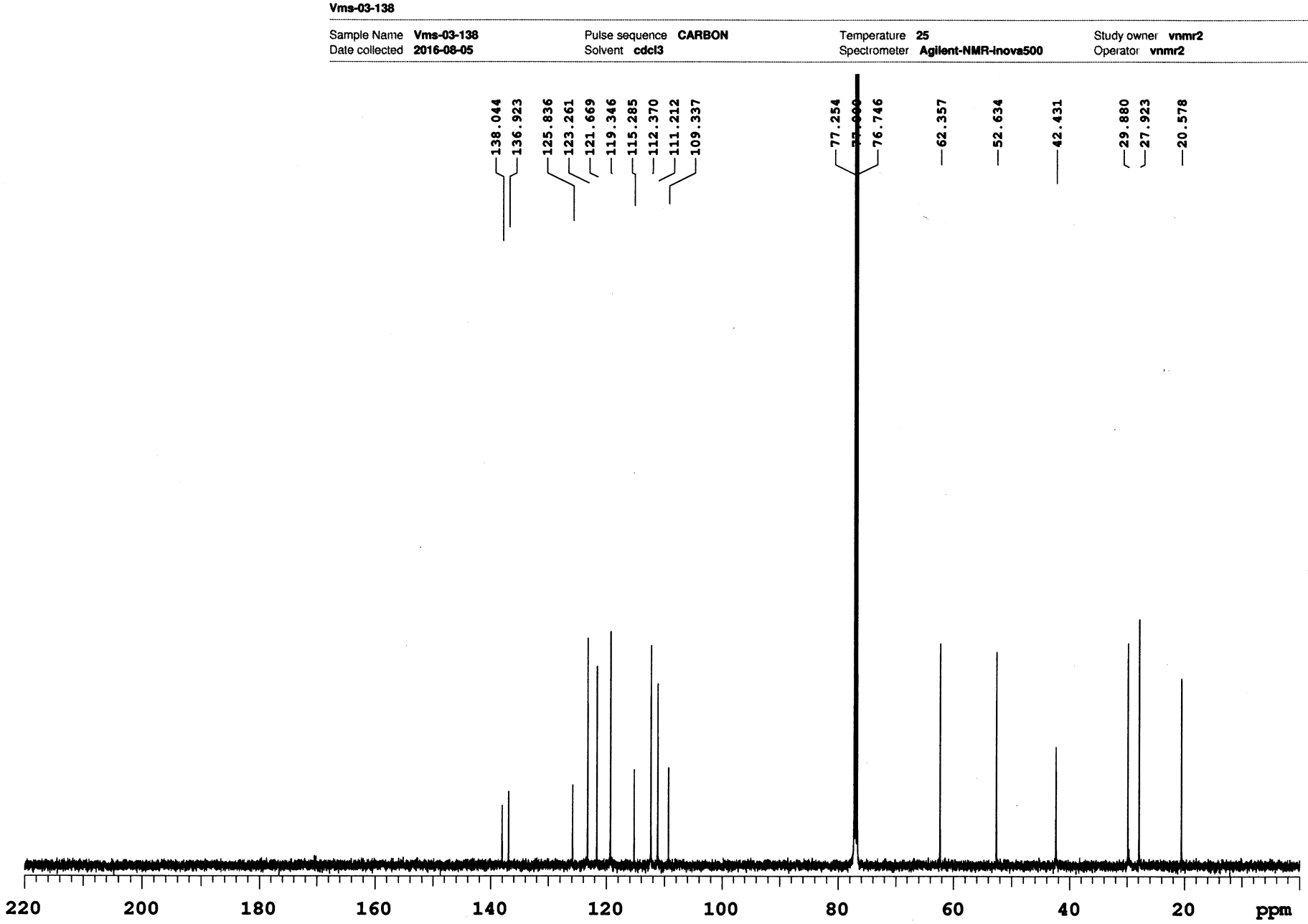


Fig S109. 13C NMR (CDCl3, 125 MHz) of compound 16.

Vms-03-138

Sample Name **Vms-03-138**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-08-05**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

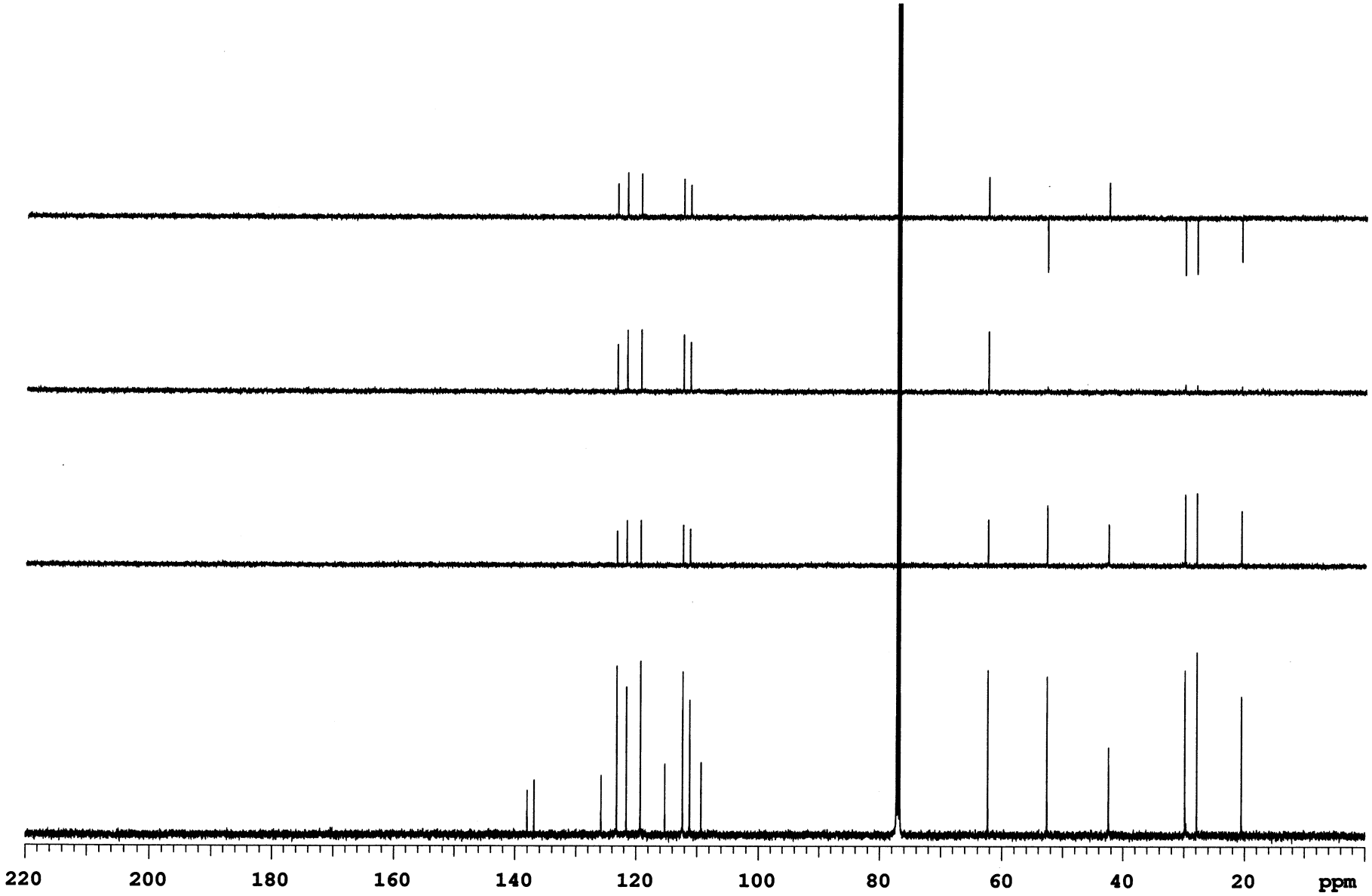


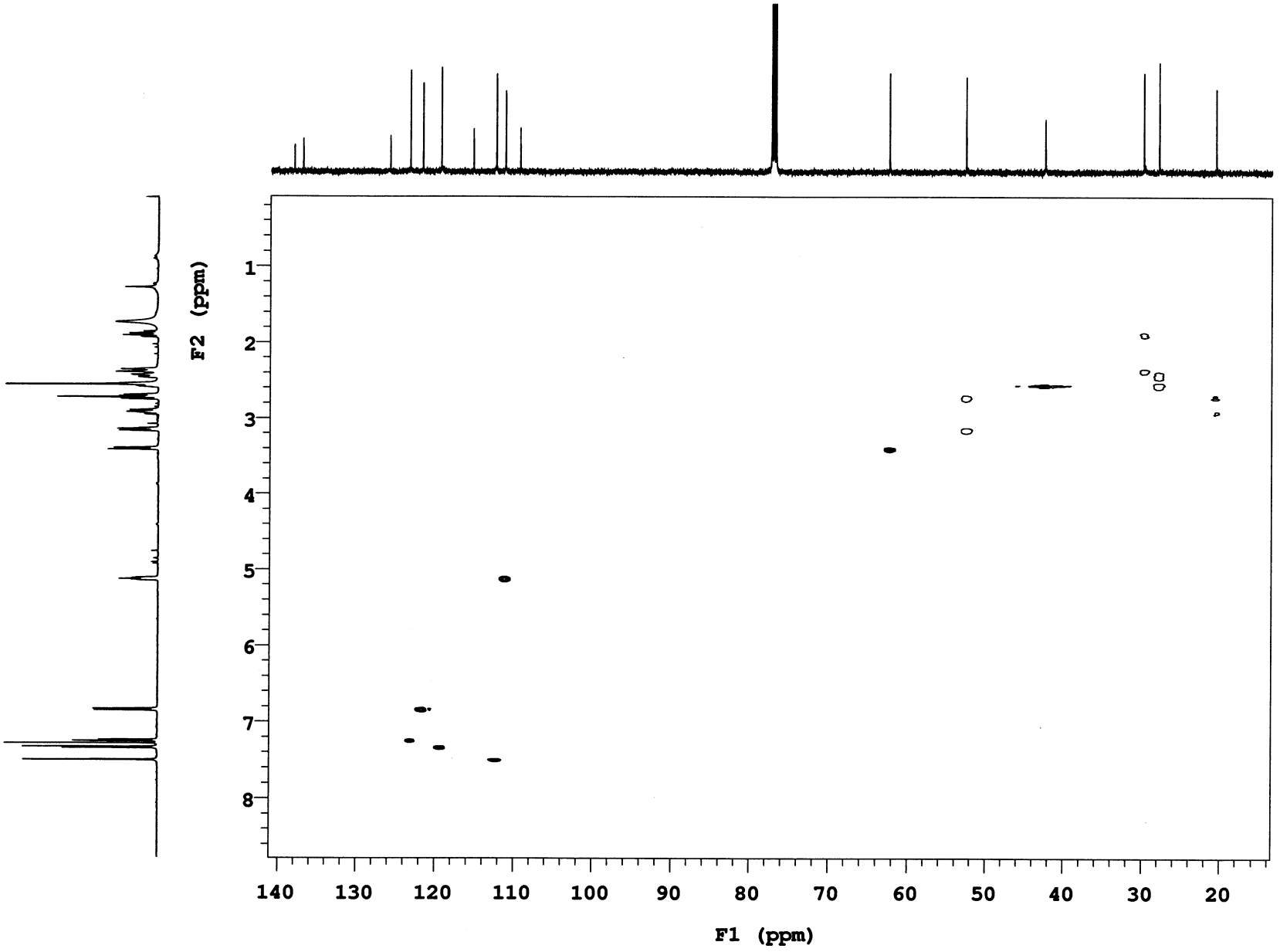
Fig S110. DEPT of compound 16.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-138/DEPT_01.fid

Plot date 2016-10-17

Vms-03-138

Sample Name	**Vms-03-138**	Pulse sequence	**gHSQC**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-08-05**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**



Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-138/gHSQC_01.fid

Fig S111. HSQC of compound 16.

Plot date 2016-10-17

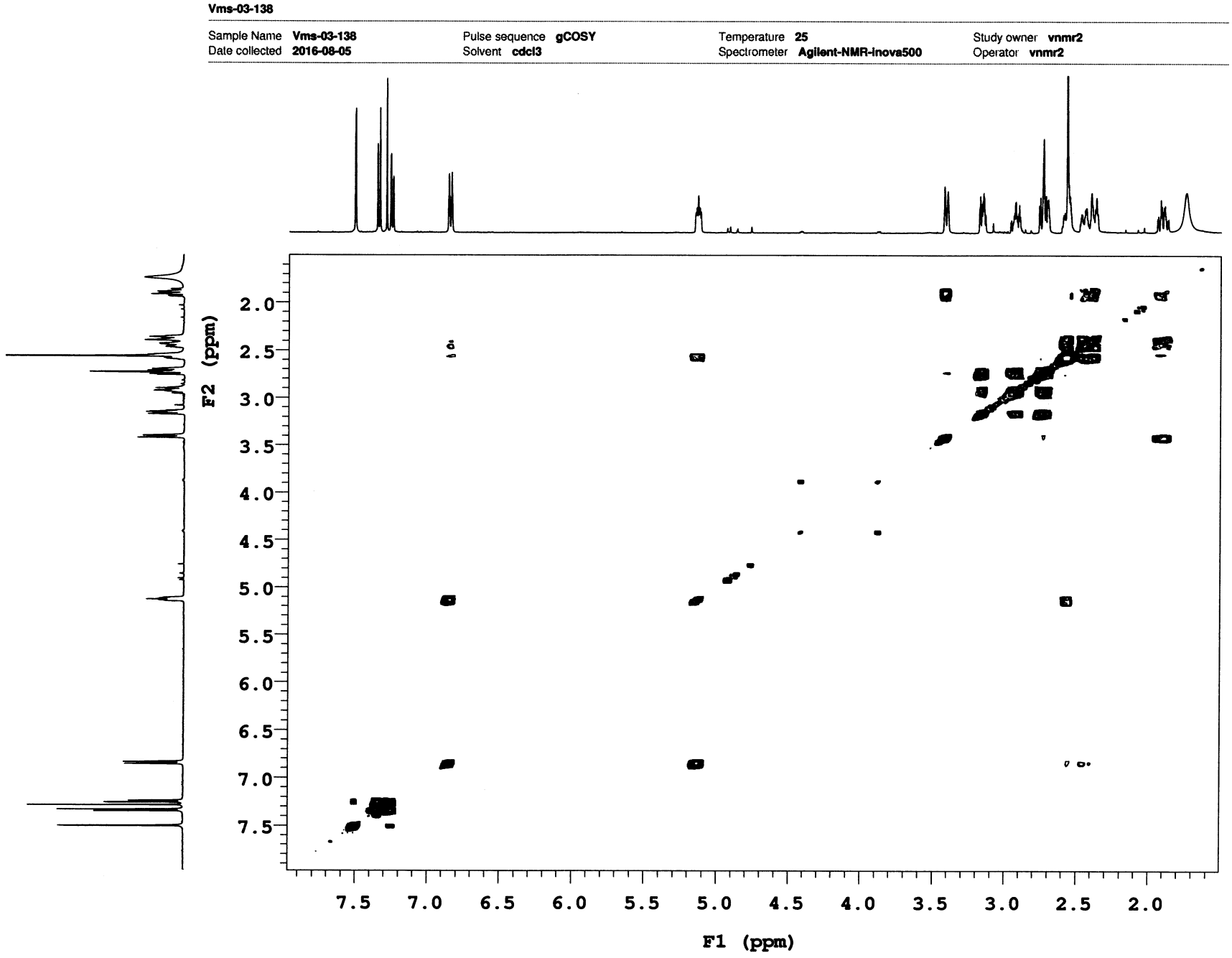


Fig S112. COSY of compound 16.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-138/gCOSY_01.fid

Plot date 2016-10-17

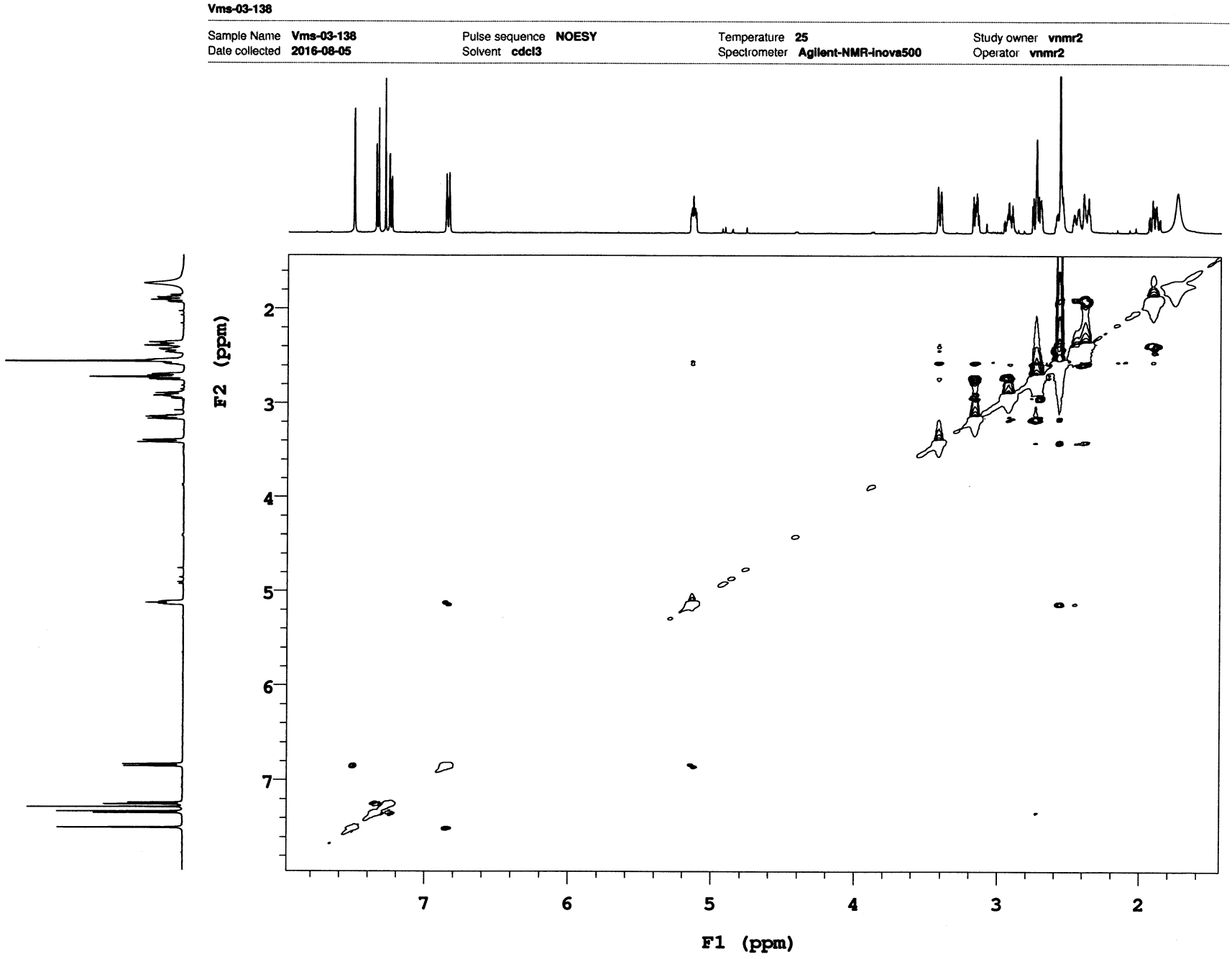


Fig S113. NOESY of compound 16.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-138/NOESY_01.fid

Plot date 2016-10-17

Vms-03-039

Sample Name **Vms-03-039**	Pulse sequence **PROTON**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-10-23**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

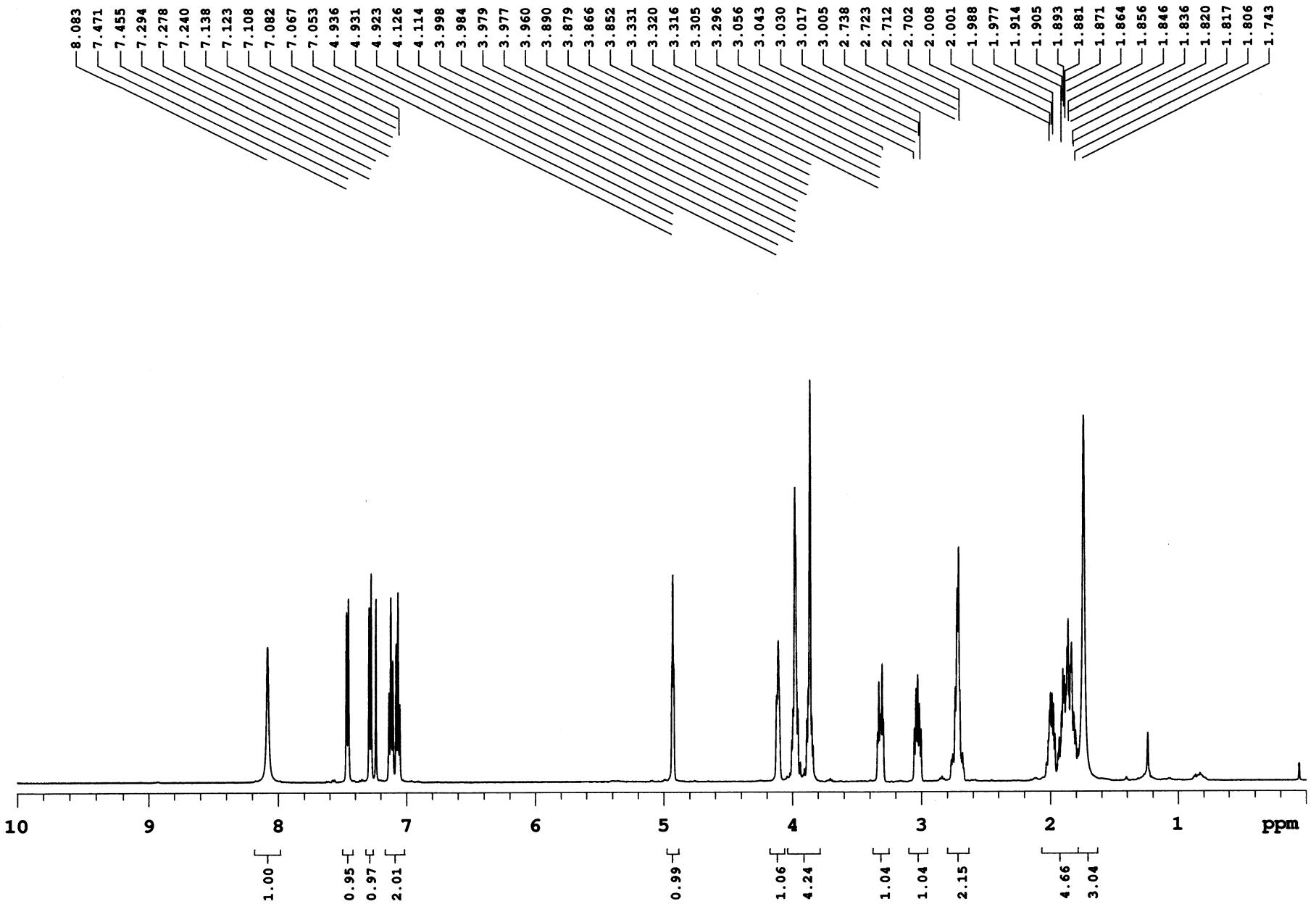


Fig S114. 1H NMR (CDCl3, 500 MHz) of compound 17.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-039/PROTON_03.fid

Plot date 2016-05-10

Vms-03-039

Sample Name **Vms-03-039**	Pulse sequence **CARBON**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-10-22**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

Agilent Technologies

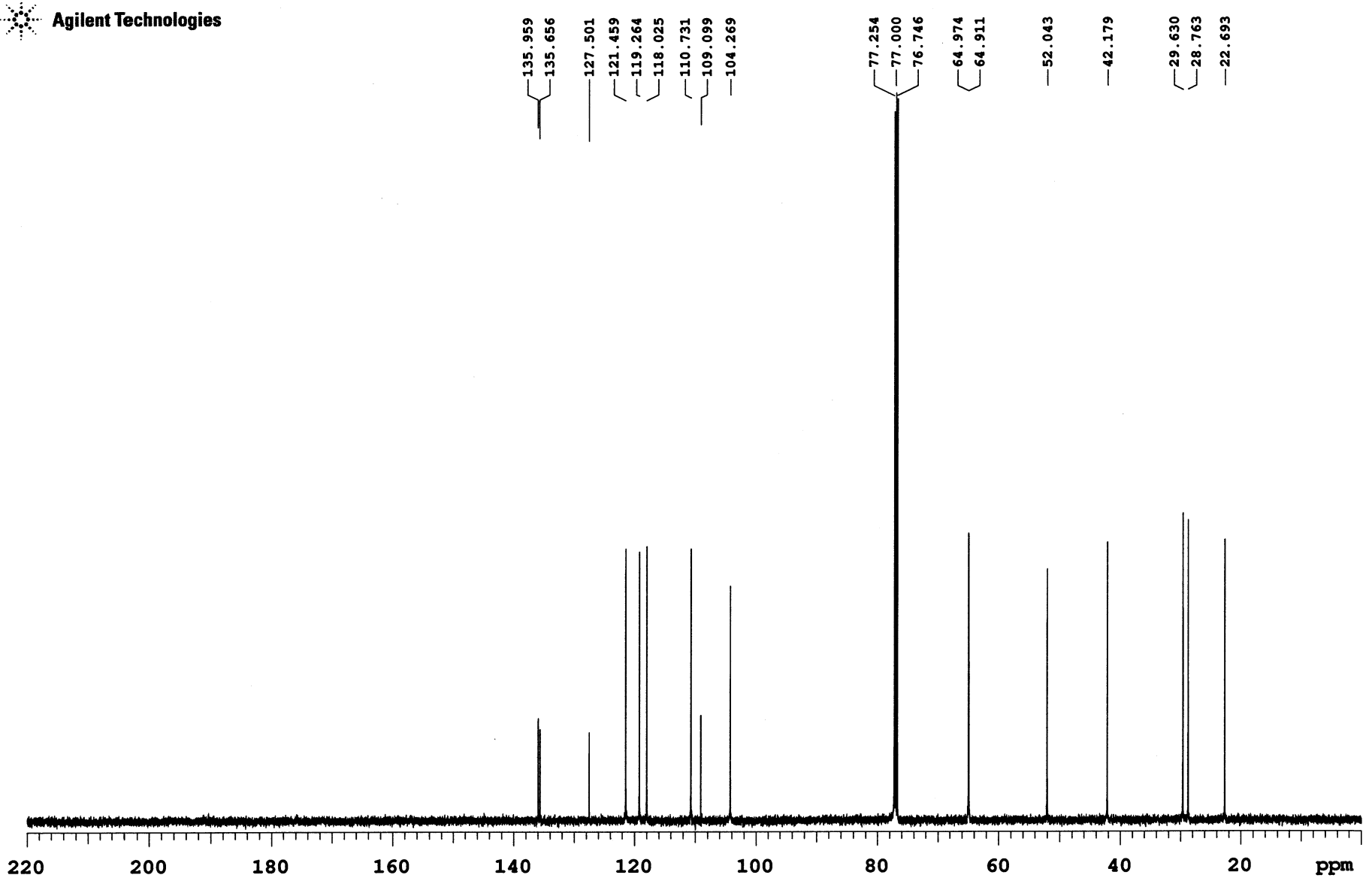


Fig S115. 13C NMR (CDCl3, 125 MHz) of compound 17.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-039/CARBON_01

Plot date 2015-10-26

Vms-03-039

Sample Name **Vms-03-039**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-10-22**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

Agilent Technologies

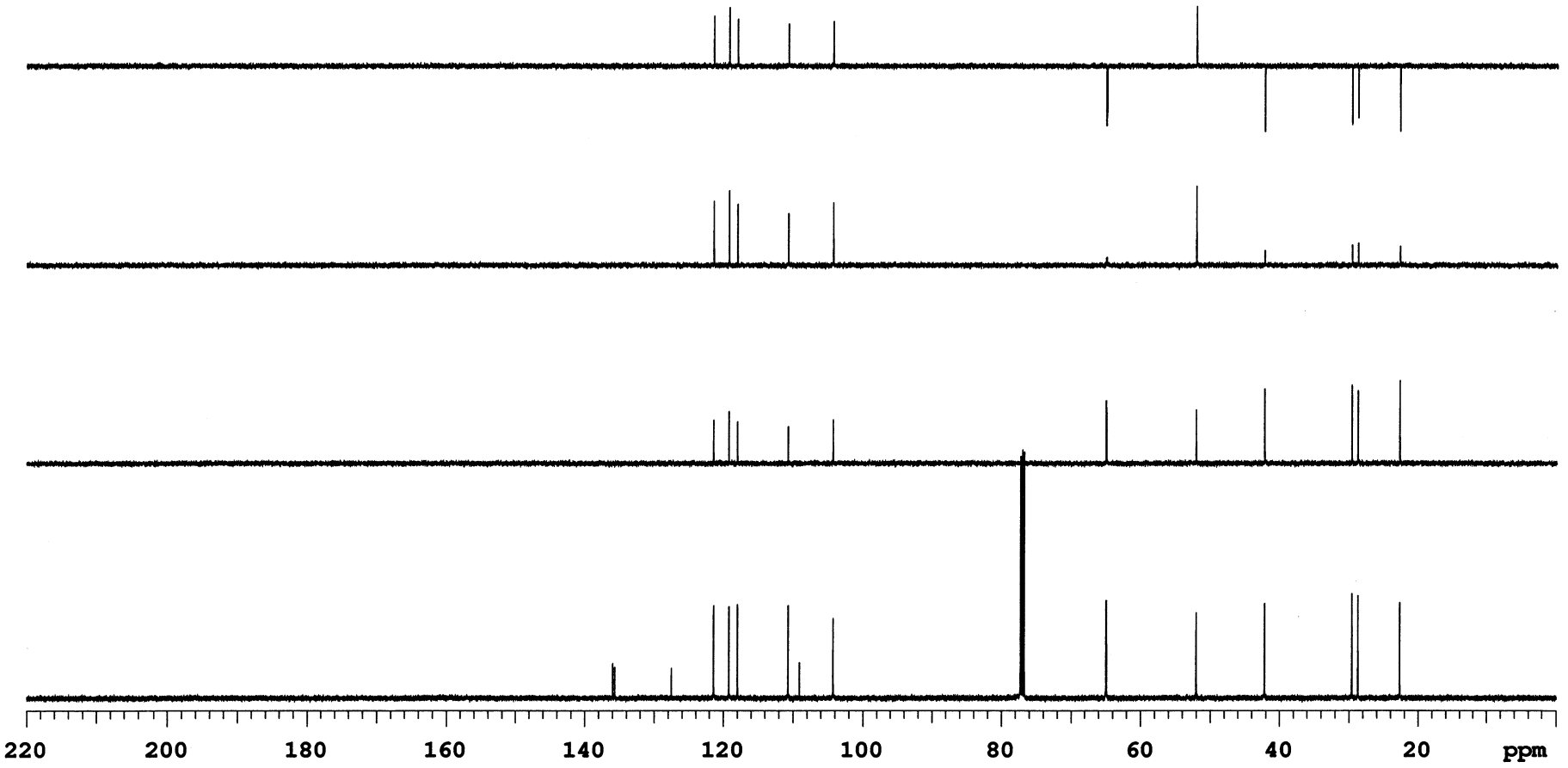


Fig S116. DEPT of compound 17.

Vms-03-039

Sample Name **Vms-03-039**	Pulse sequence **gHSQC**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-10-23**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

Agilent Technologies

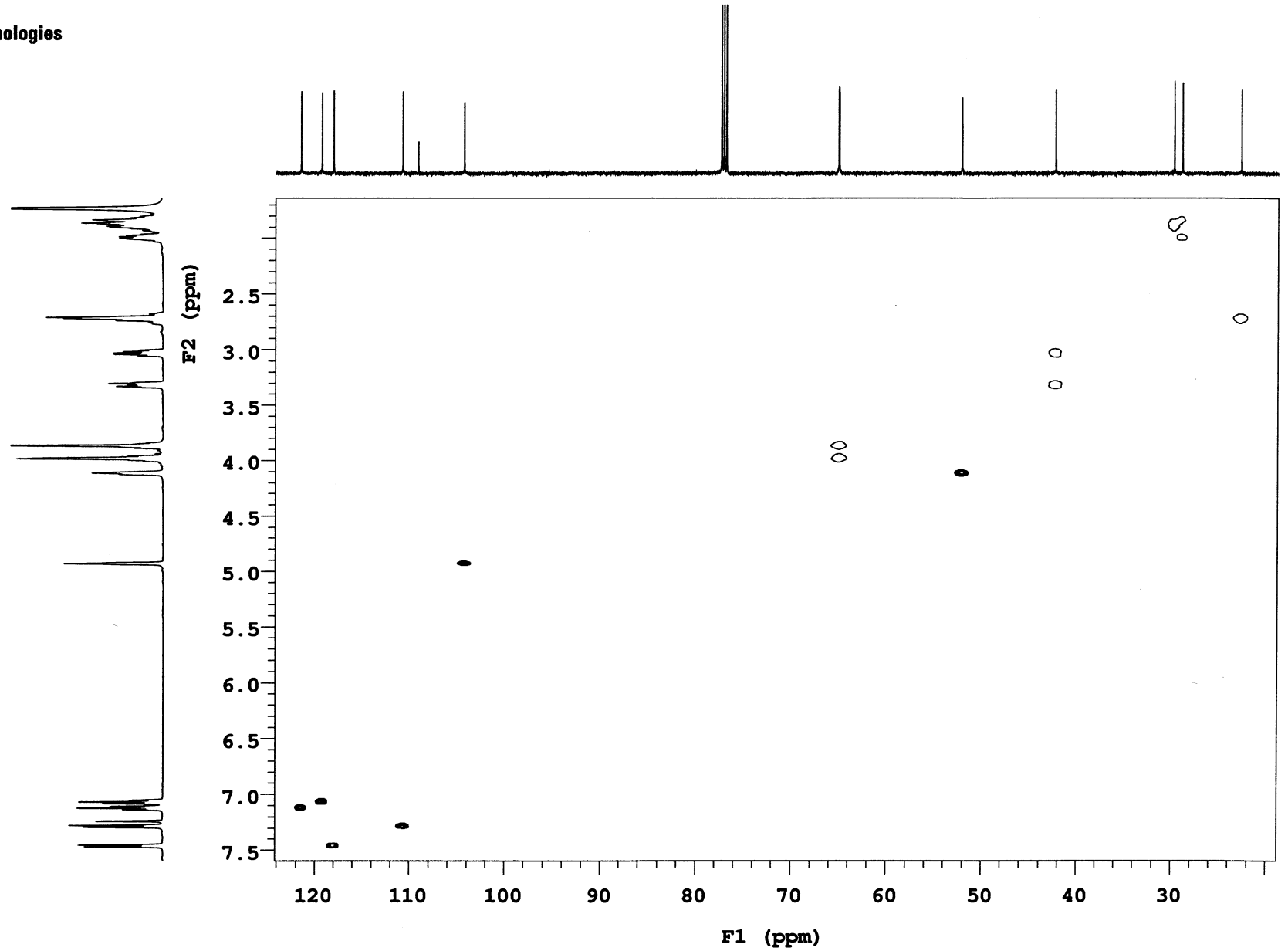


Fig S117. HSQC of compound 17.

Vms-03-039

Sample Name **Vms-03-039**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-10-22**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

Agilent Technologies

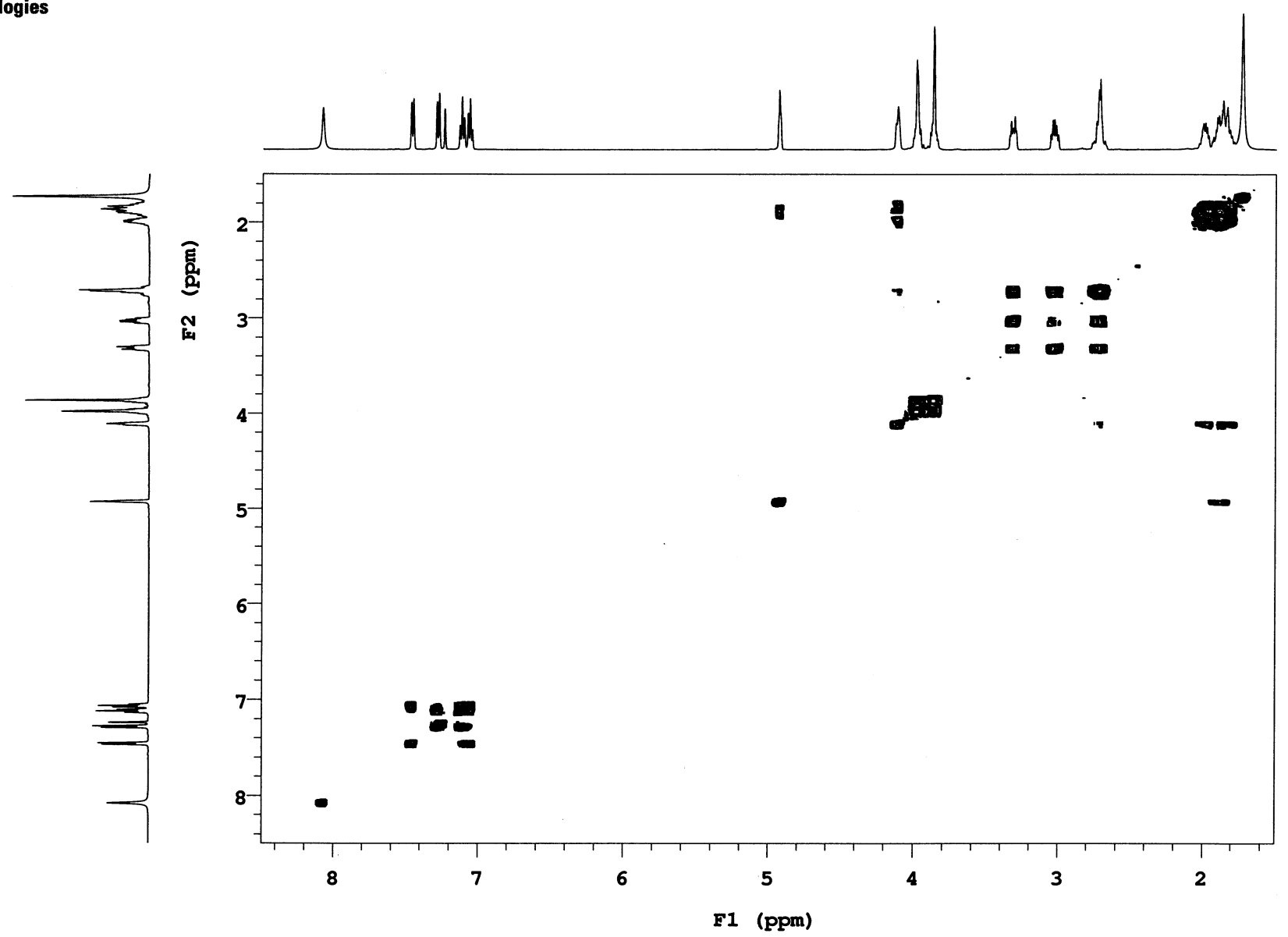


Fig S118. COSY of compound 17.

Vms-03-039

Sample Name **Vms-03-039**	Pulse sequence **NOESY**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-10-22**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

Agilent Technologies

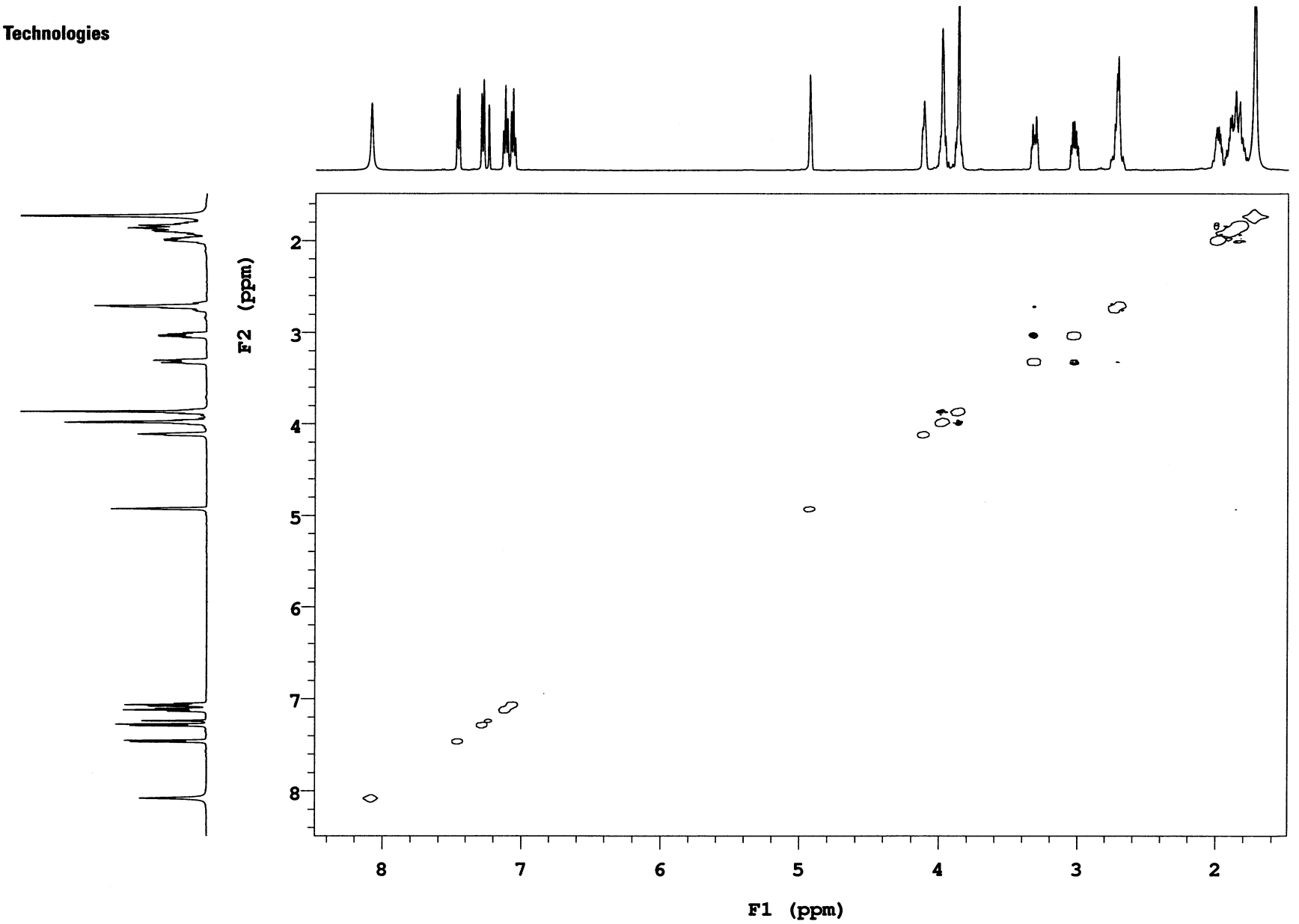


Fig S119. NOESY of compound 17.

Vms-03-87-F1

Sample Name	Vms-03-87-F1	Pulse sequence	PROTON	Temperature	25	Study owner	vnmr2
Date collected	2016-01-29	Solvent	cdcl3	Spectrometer	Agilent-NMR-inova500	Operator	vnmr2

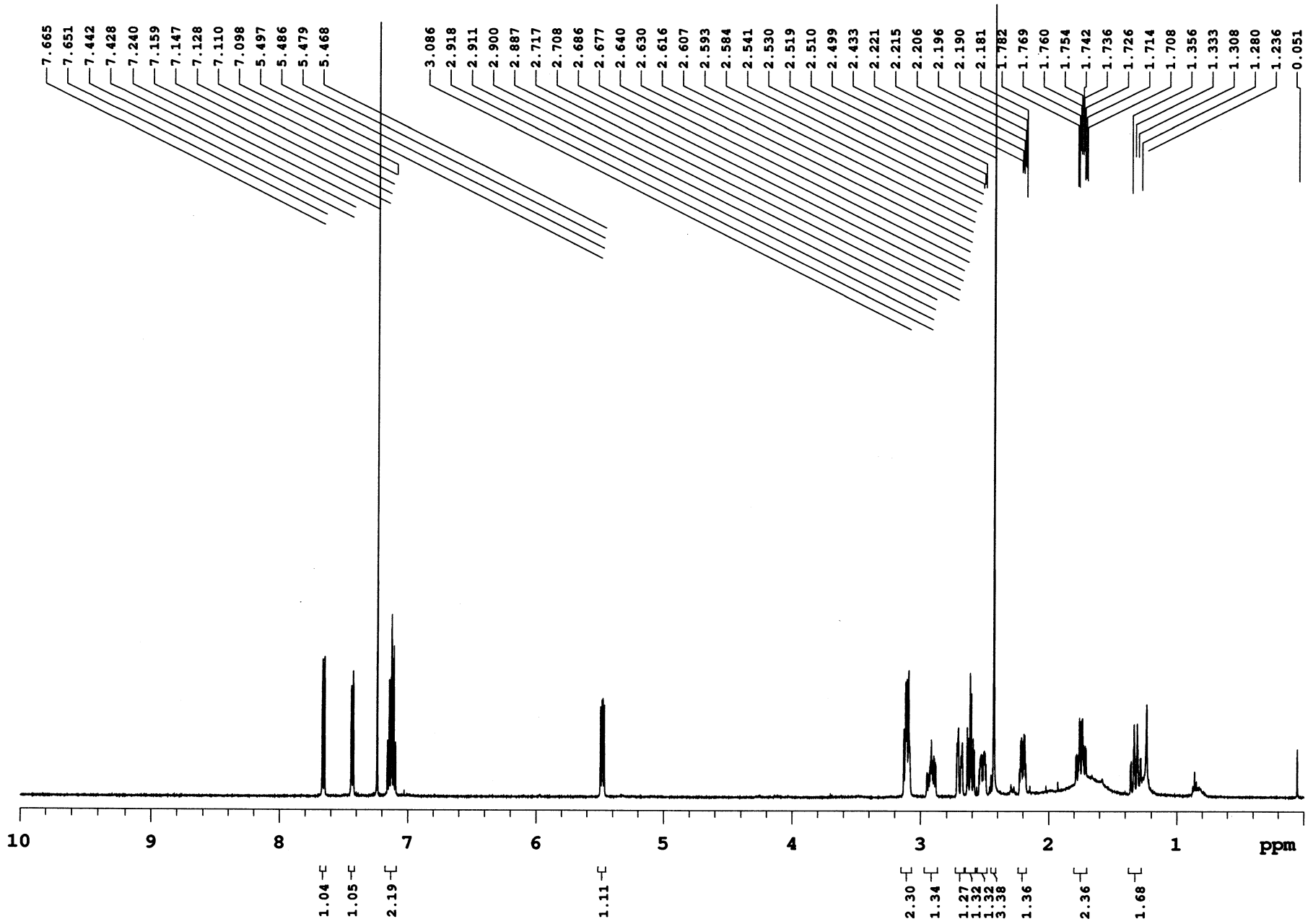


Fig S120. 1H NMR (CDCl3, 500 MHz) of compound 18.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-87-F1/PROTON_07.fid

Plot date 2016-05-10

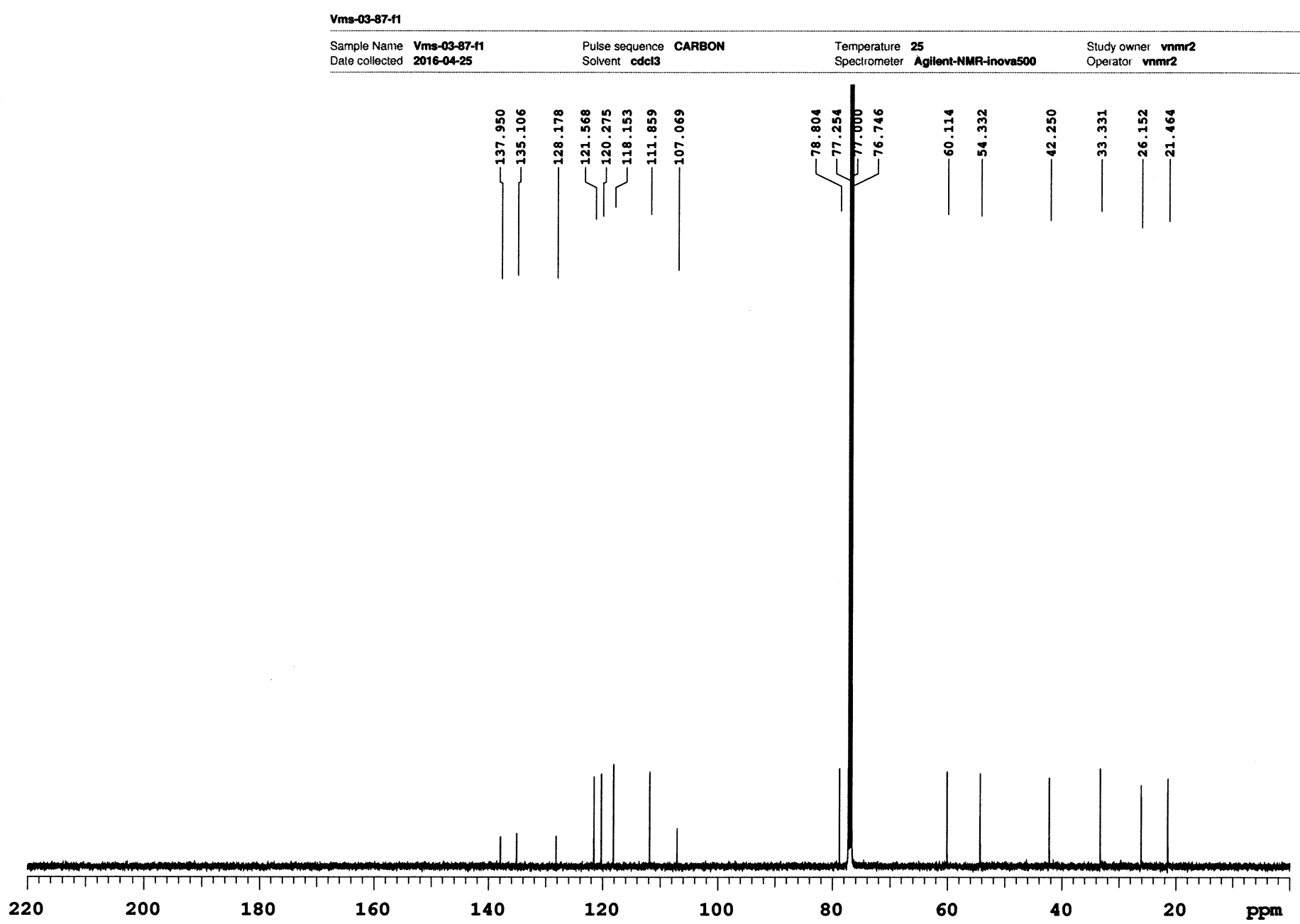


Fig S121. 13C NMR (CDCl3, 125 MHz) of compound 18.

Vms-03-87-f1

Sample Name **Vms-03-87-f1**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-04-25**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

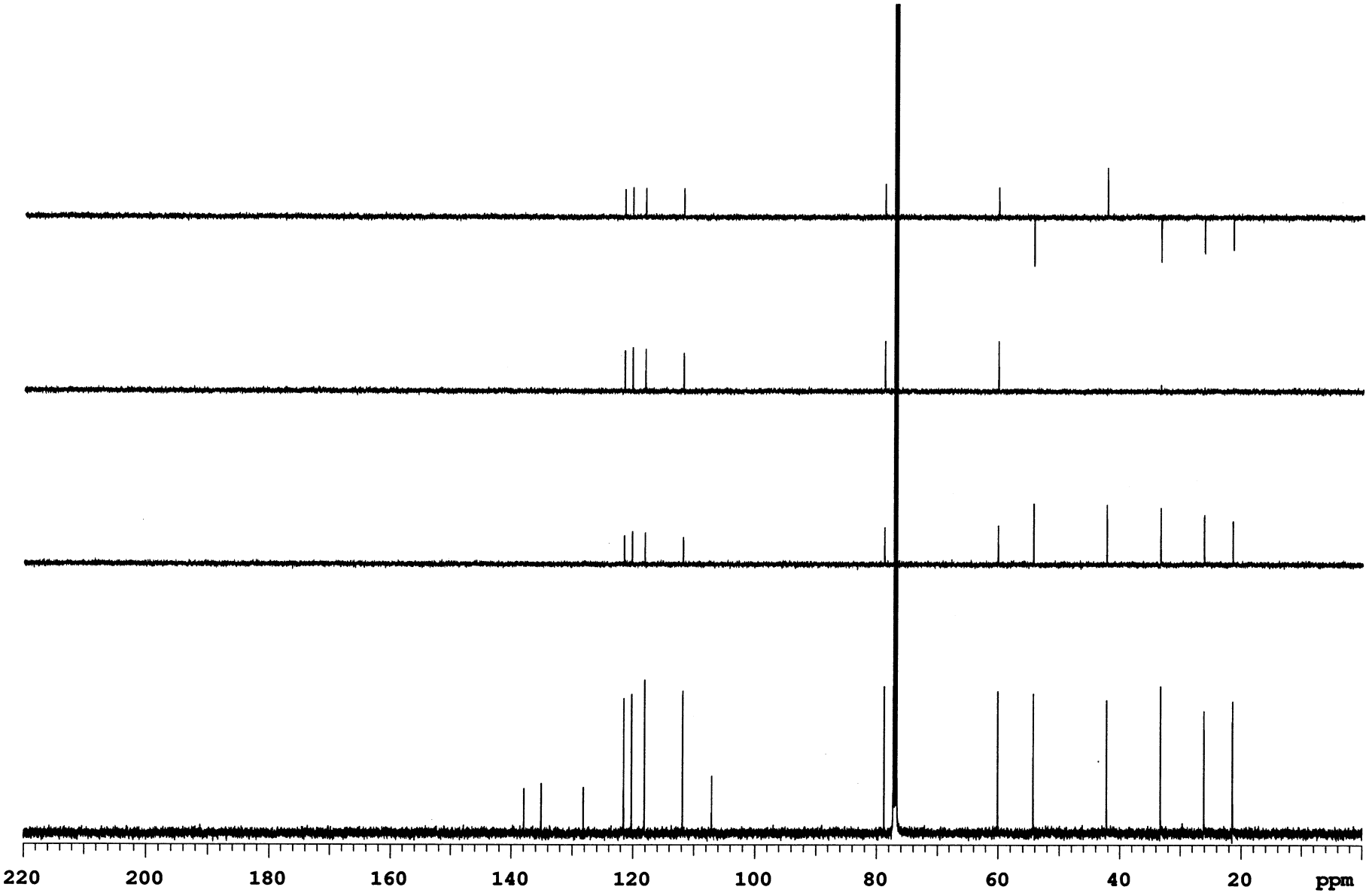


Fig S122. DEPT of compound 18.

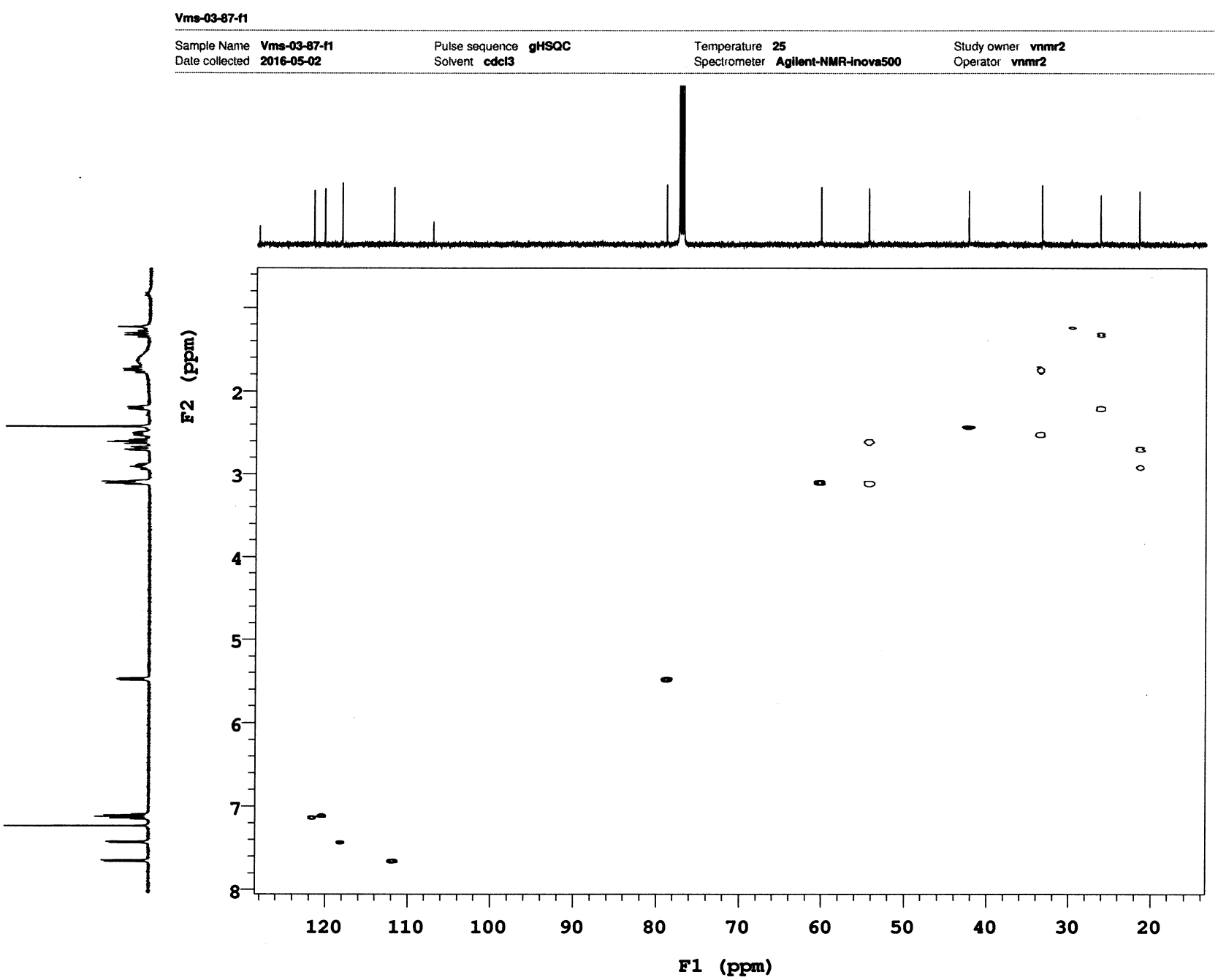


Fig S123. HSQC of compound 18.

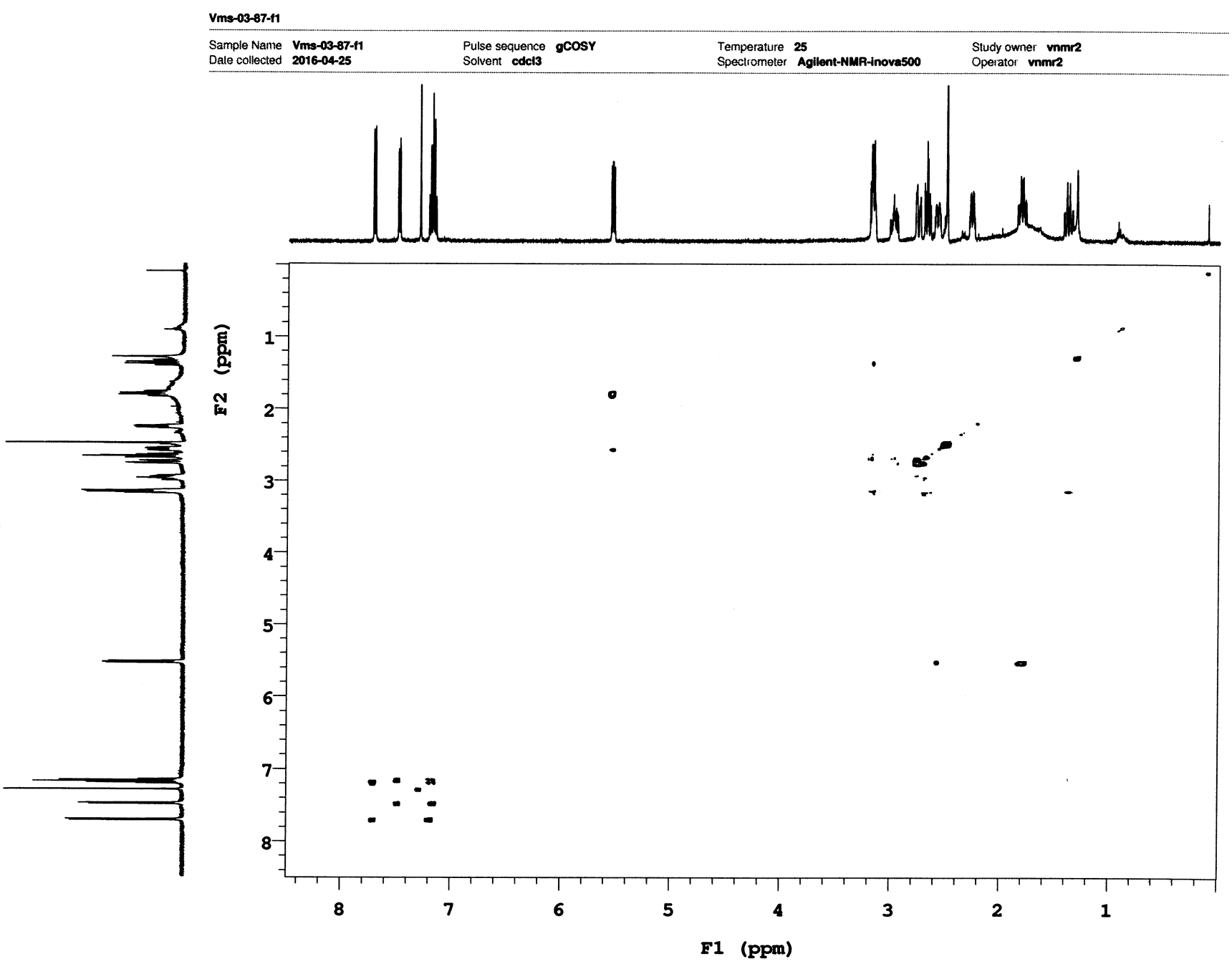


Fig S124. COSY of compound 18.

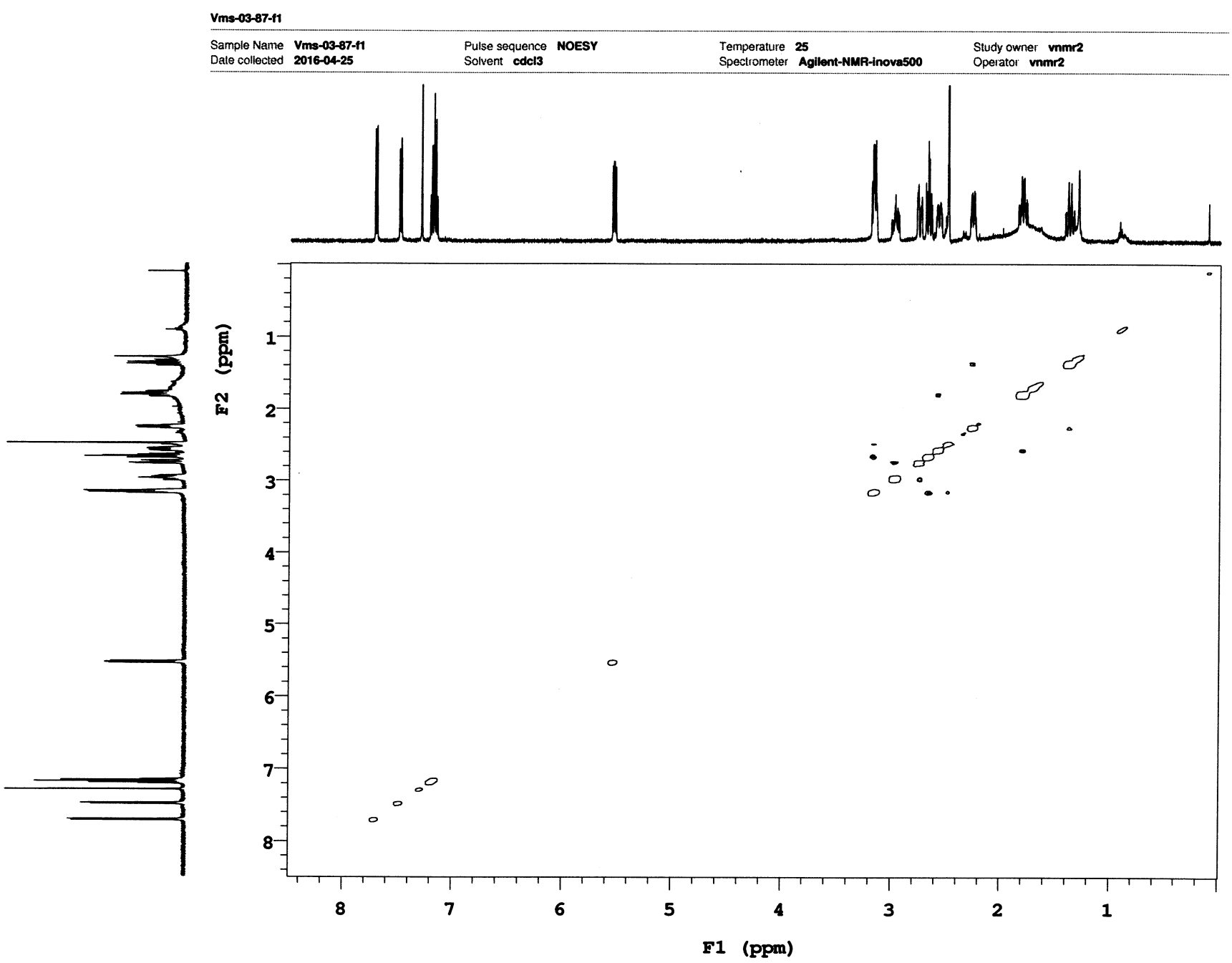


Fig S125. NOESY of compound 18.

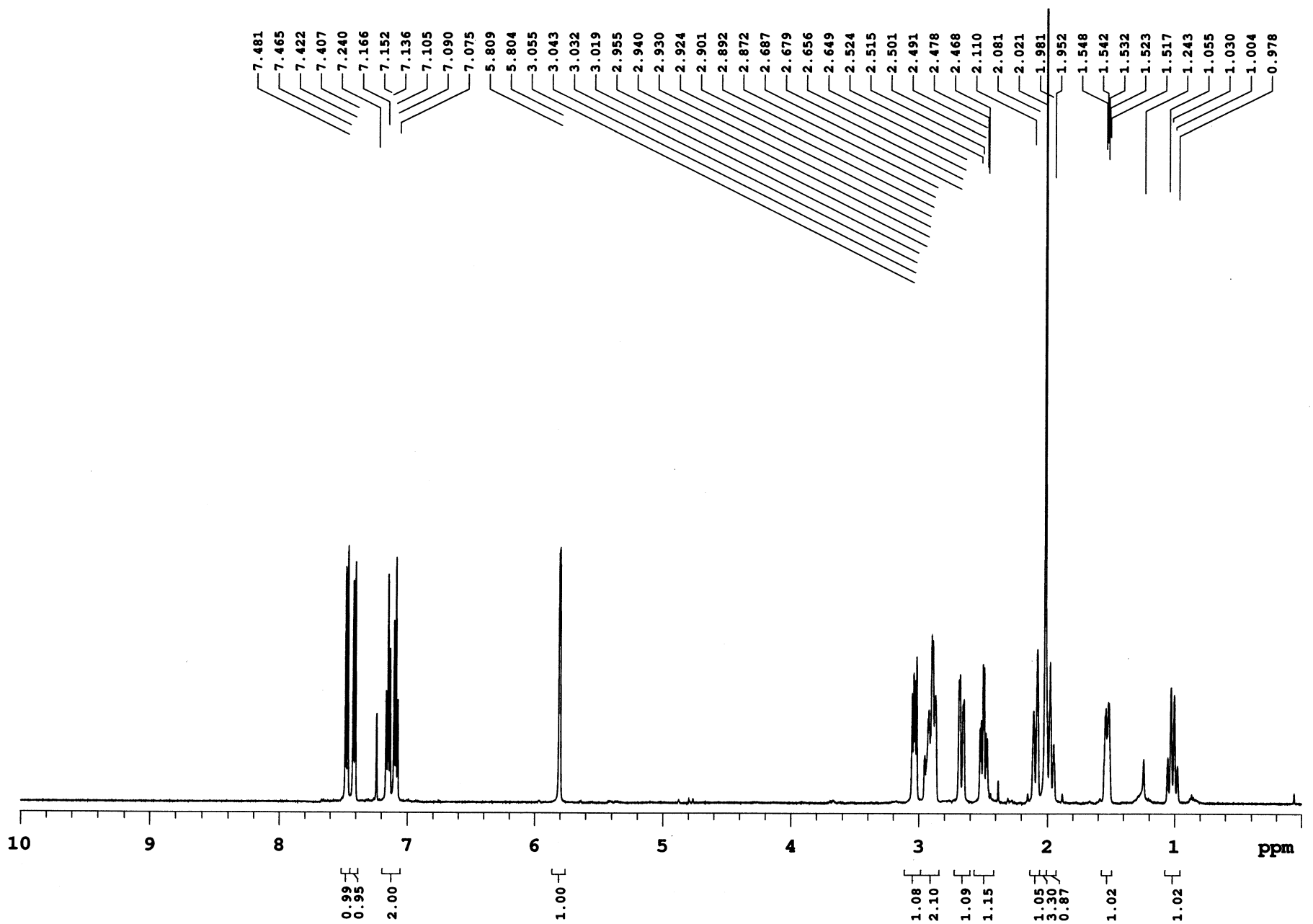


Fig S126. 1H NMR (CDCl3, 500 MHz) of compound 19.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-87-f2/PROTON_03.fid

Plot date 2016-05-10

Vms-03-087-f2

Sample Name **Vms-03-087-f2**
Date collected **2016-02-01**
Pulse sequence **CARBON**
Solvent **cdcl3**
Temperature **25**
Spectrometer **Agilent-NMR-inova500**
Study owner **vnmr2**
Operator **vnmr2**

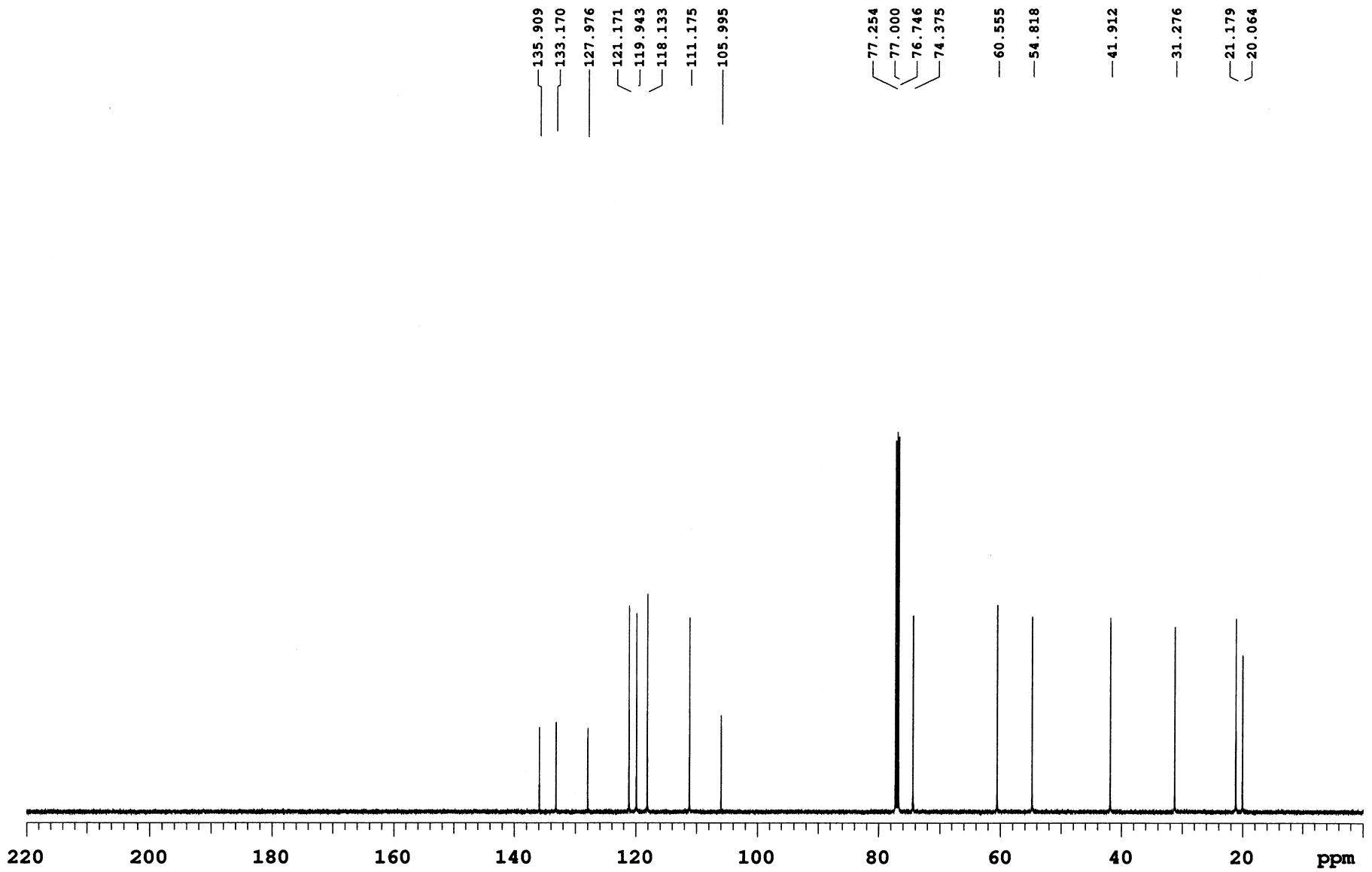


Fig S127. 13C NMR (CDCl3, 125 MHz) of compound 19.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-087-f2/CARBON_01

Plot date 2016-02-02

Vms-03-087-f2

Sample Name **Vms-03-087-f2**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-02-02**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

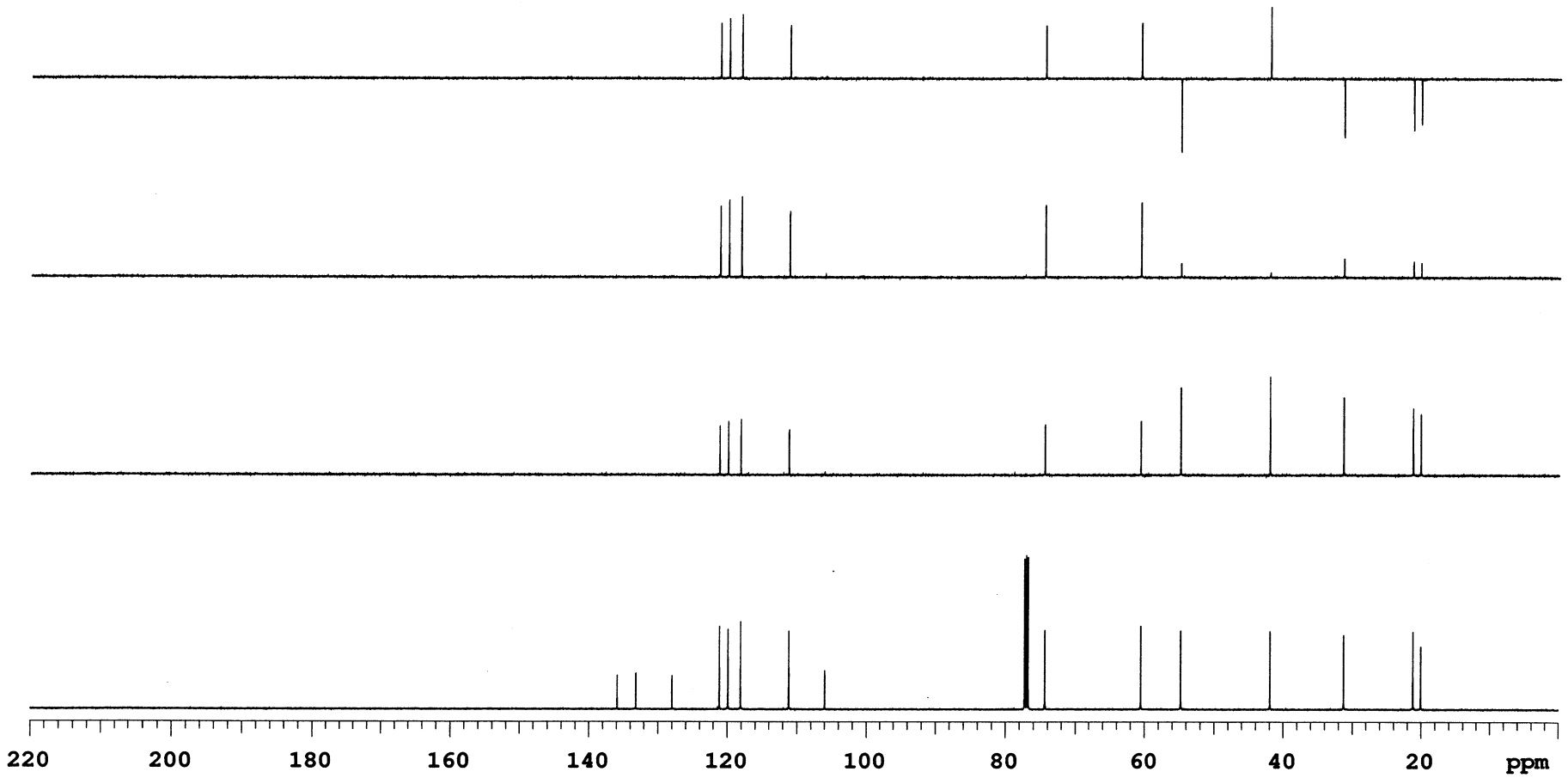


Fig S128. DEPT of compound 19.

Vms-03-087-f2

Sample Name **Vms-03-087-f2**	Pulse sequence **gHSQC**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-02-02**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

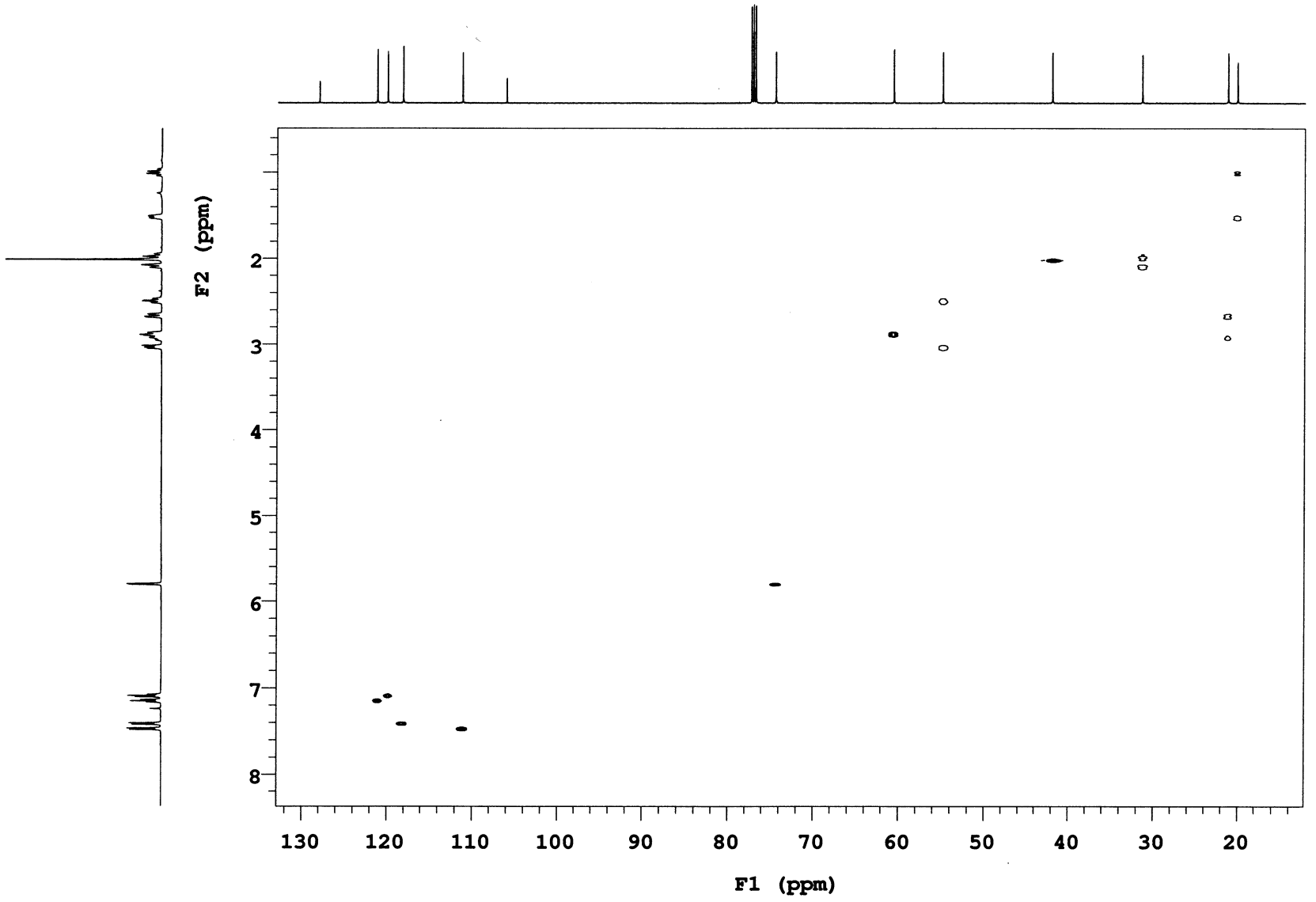


Fig S129. HSQC of compound 19.

Vms-03-087-f2

Sample Name **Vms-03-087-f2**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-02-02**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

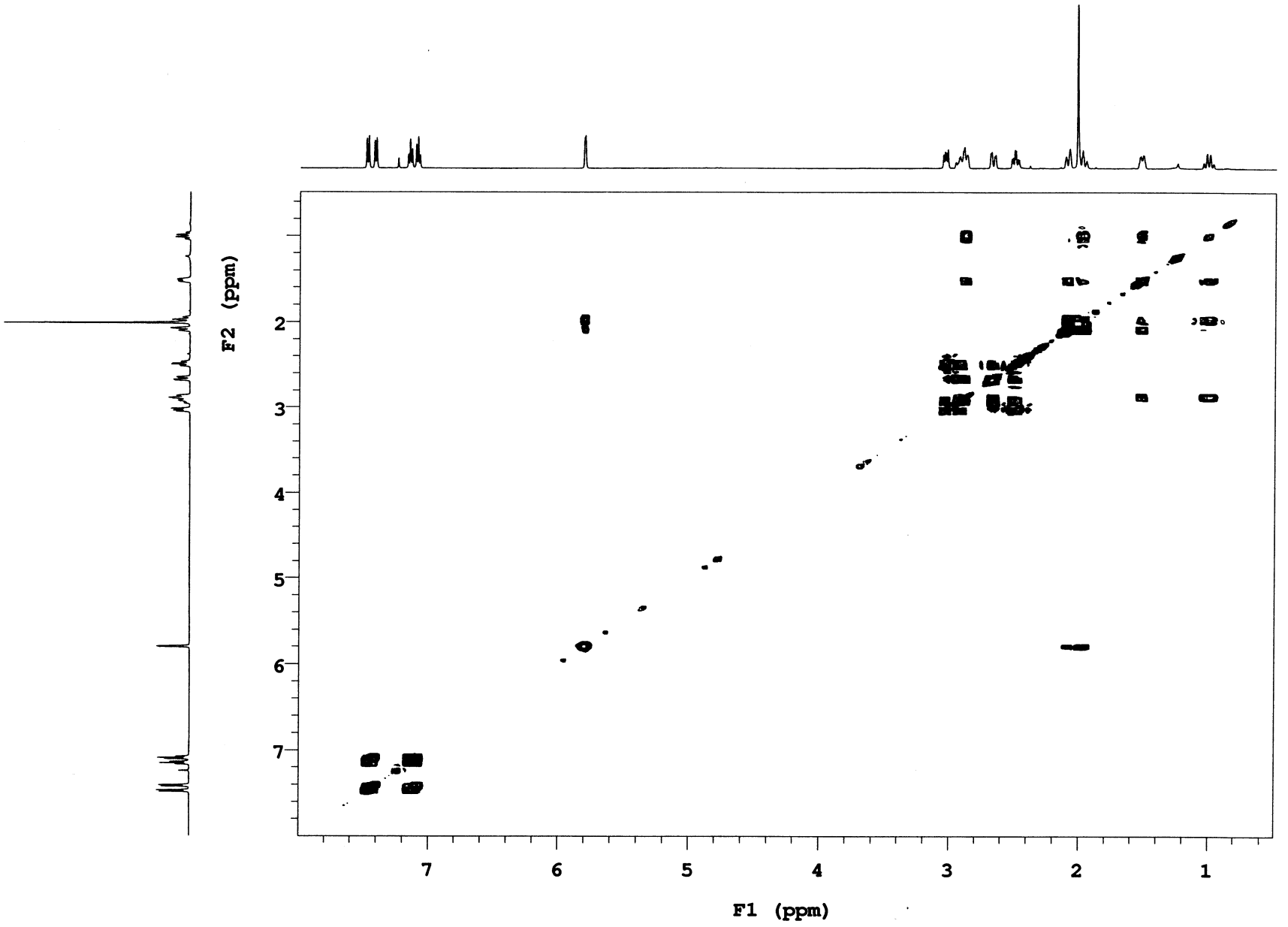


Fig S130. COSY of compound 19.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-087-f2/gCOSY_01

Plot date 2016-02-02

Vms-03-087-f2

Sample Name **Vms-03-087-f2**	Pulse sequence **NOESY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-02-02**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

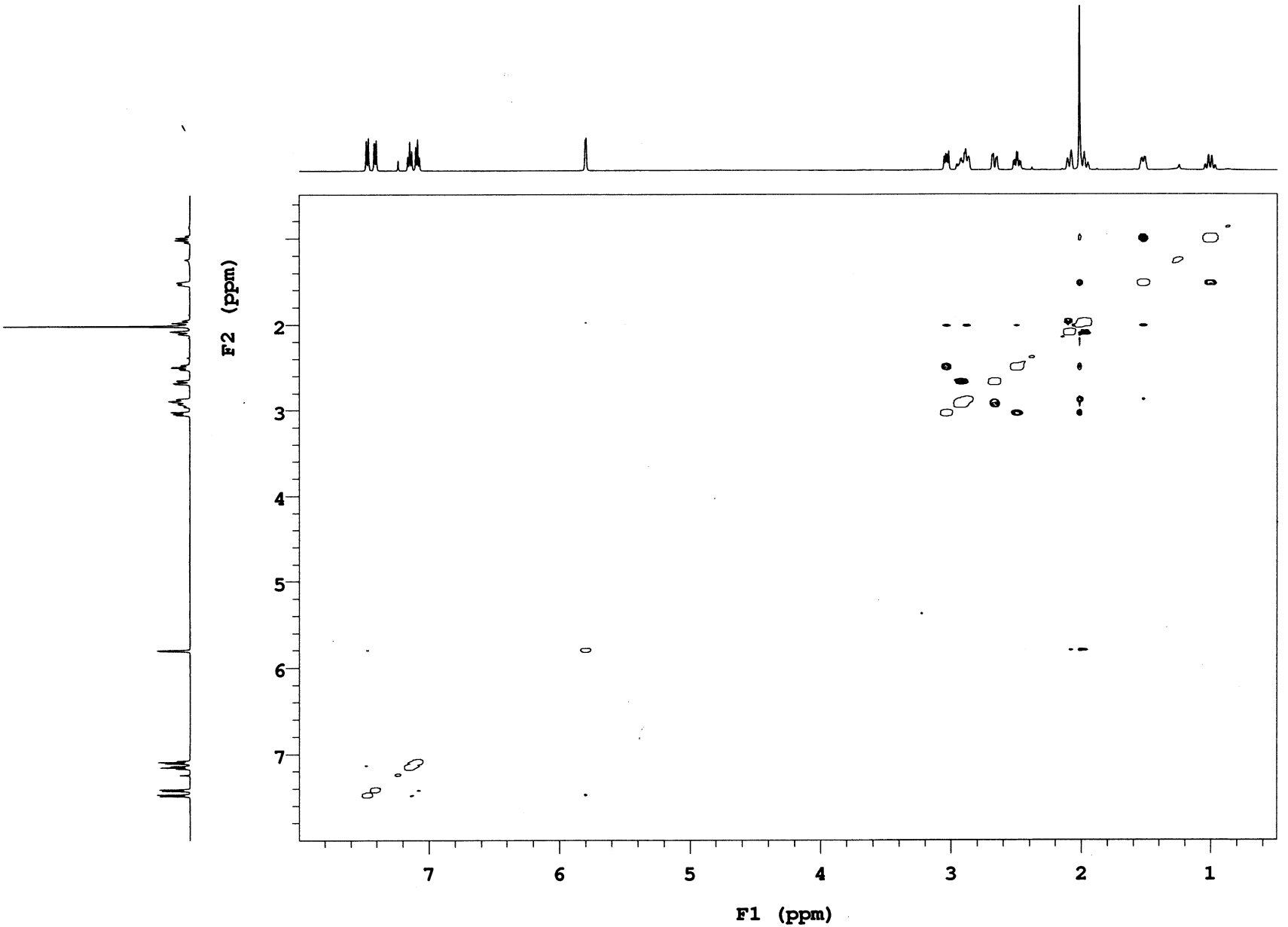


Fig S131. NOESY of compound 19.

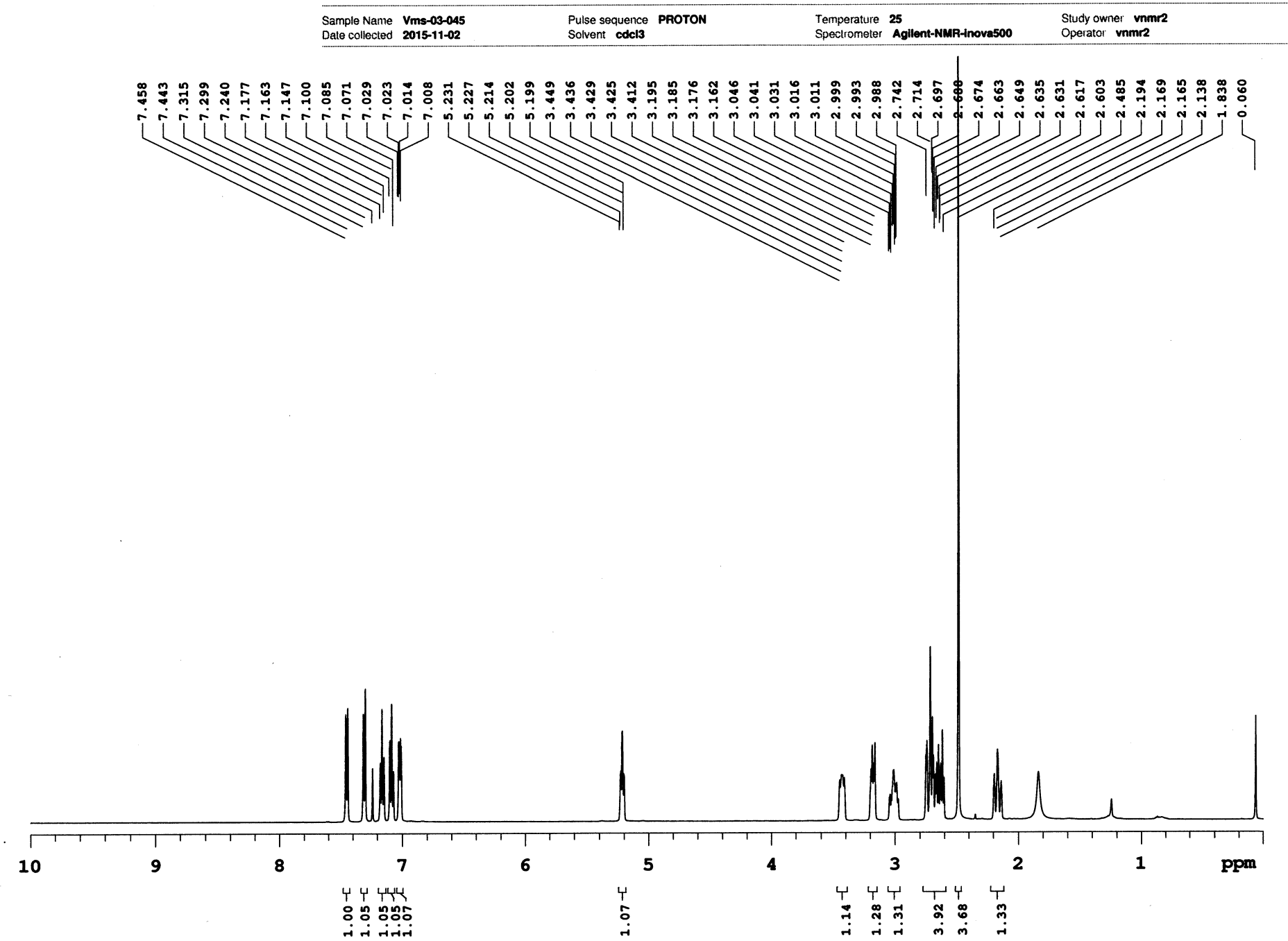


Fig S132. 1H NMR (CDCl3, 500 MHz) of compound 20.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-045/PROTON_02.fid

Plot date 2016-05-10

Vms-03-045

Sample Name	**Vms-03-045**	Pulse sequence	**CARBON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2015-11-02**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

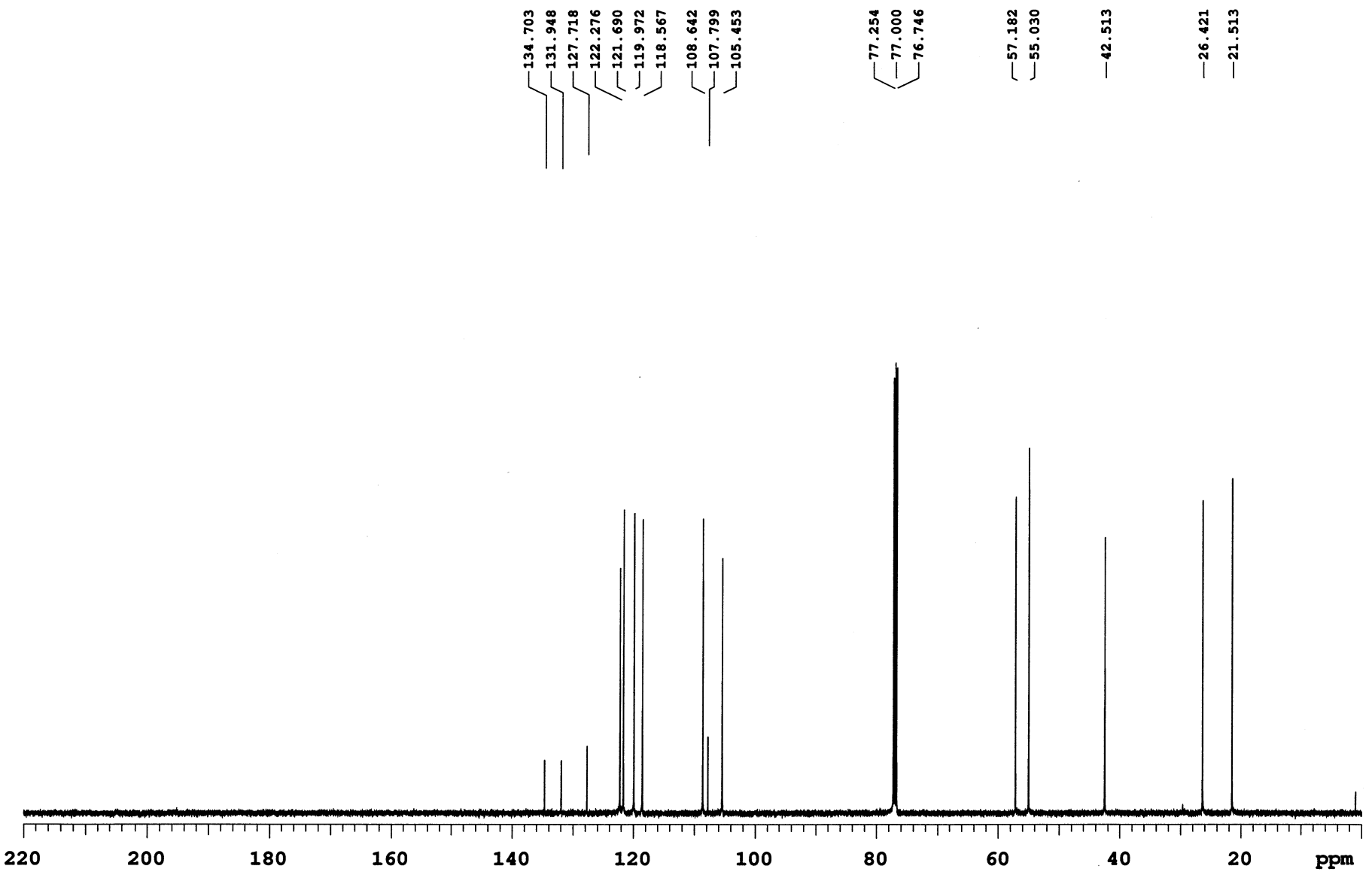


Fig S133. 13C NMR (CDCl3, 125 MHz) of compound 20.

Vms-03-045

Sample Name **Vms-03-045**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-11-02**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

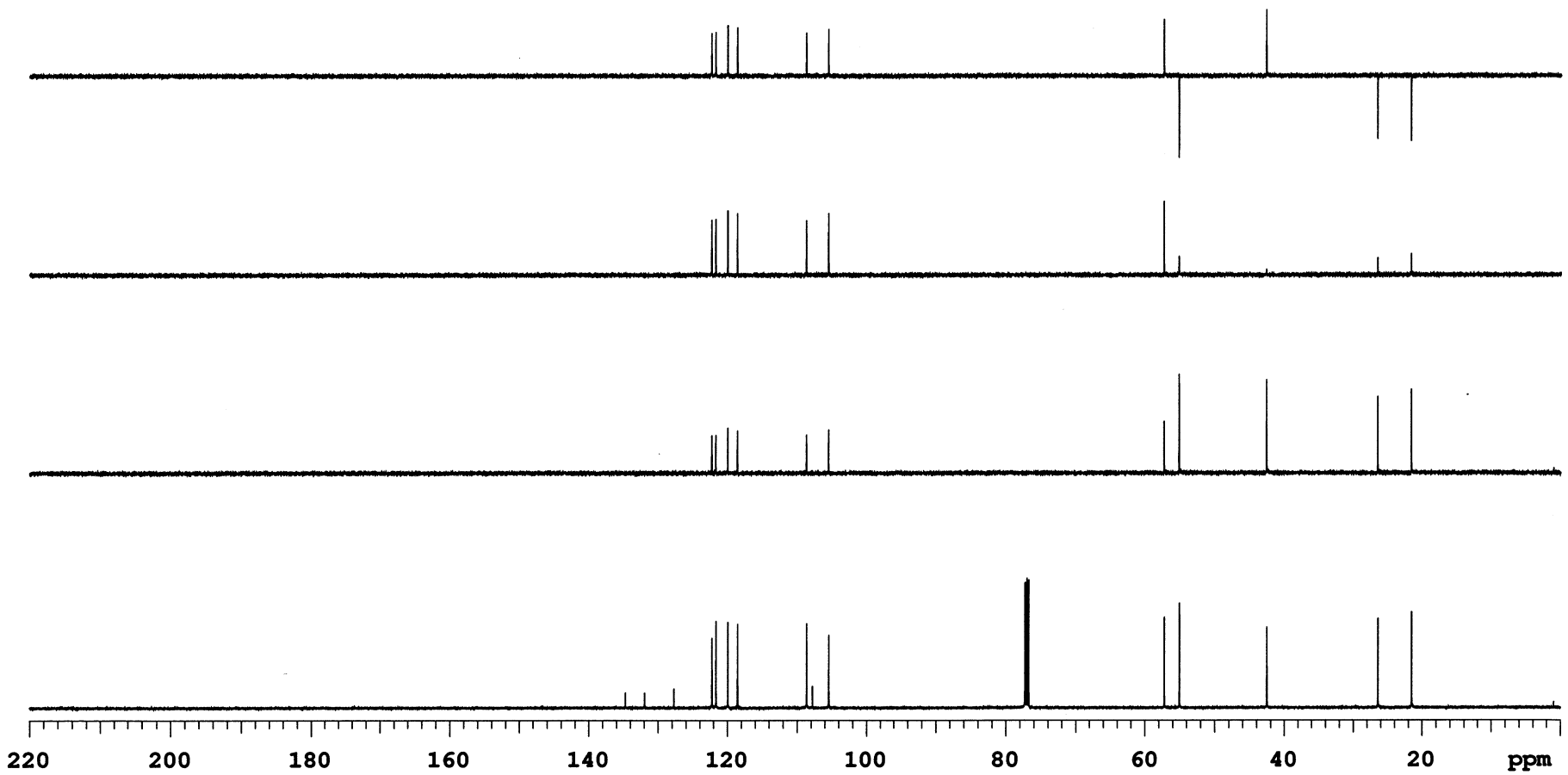


Fig S134. DEPT of compound 20.

Vms-03-045

Sample Name **Vms-03-045**	Pulse sequence **gHSQC**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-11-03**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

Agilent Technologies

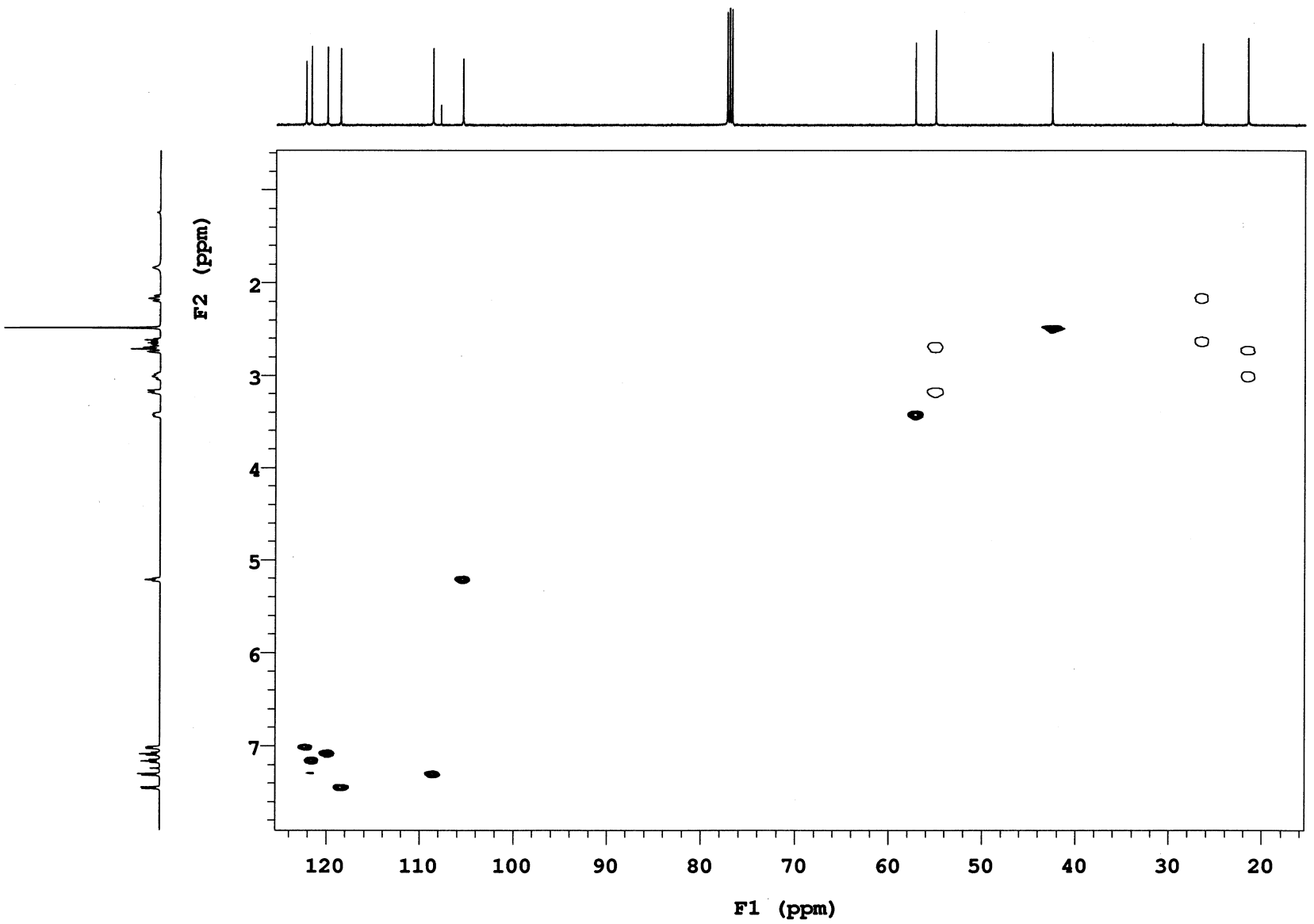


Fig S135. HSQC of compound 20.

Vms-03-045

Sample Name **Vms-03-045**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2015-11-03**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

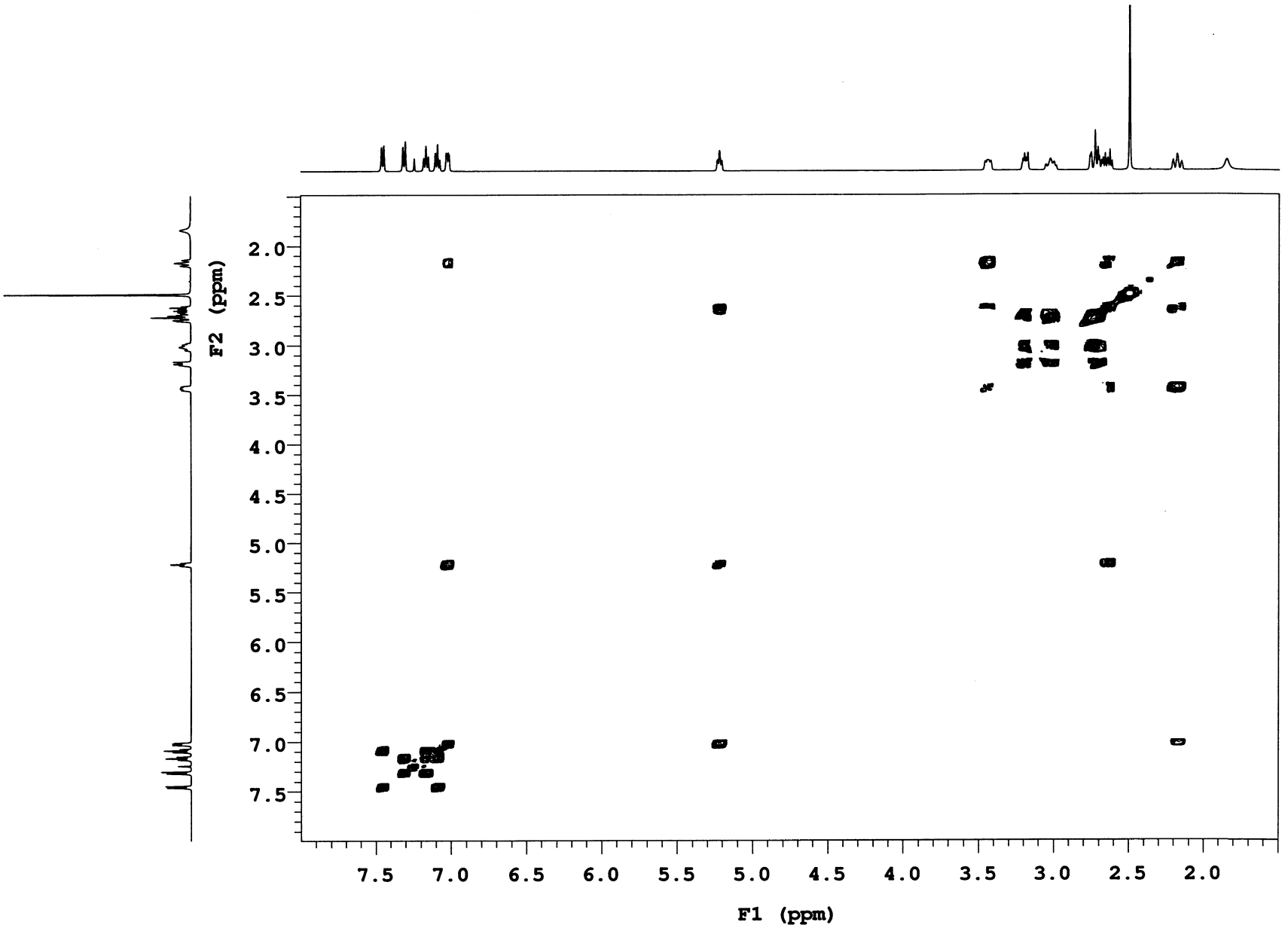


Fig S136. COSY of compound 20.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-045/gCOSY_01

Plot date 2015-11-03

Vms-03-045

Sample Name	**Vms-03-045**	Pulse sequence	**NOESY**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2015-11-03**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

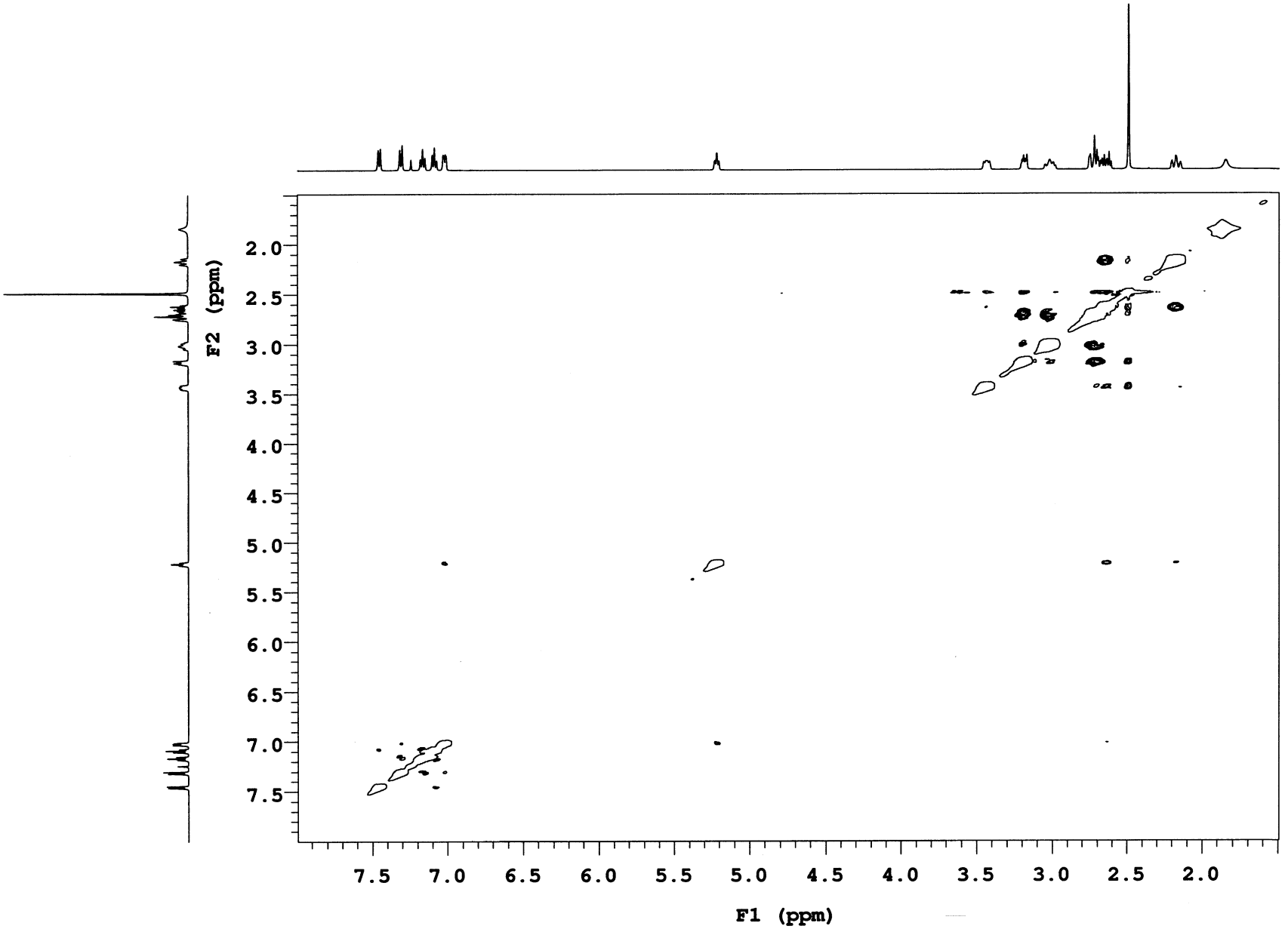


Fig S137. NOESY of compound 20.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-045/NOESY_01

Plot date 2015-11-03

Vms-03-103

Sample Name **Vms-03-103**	Pulse sequence **PROTON**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-03-28**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

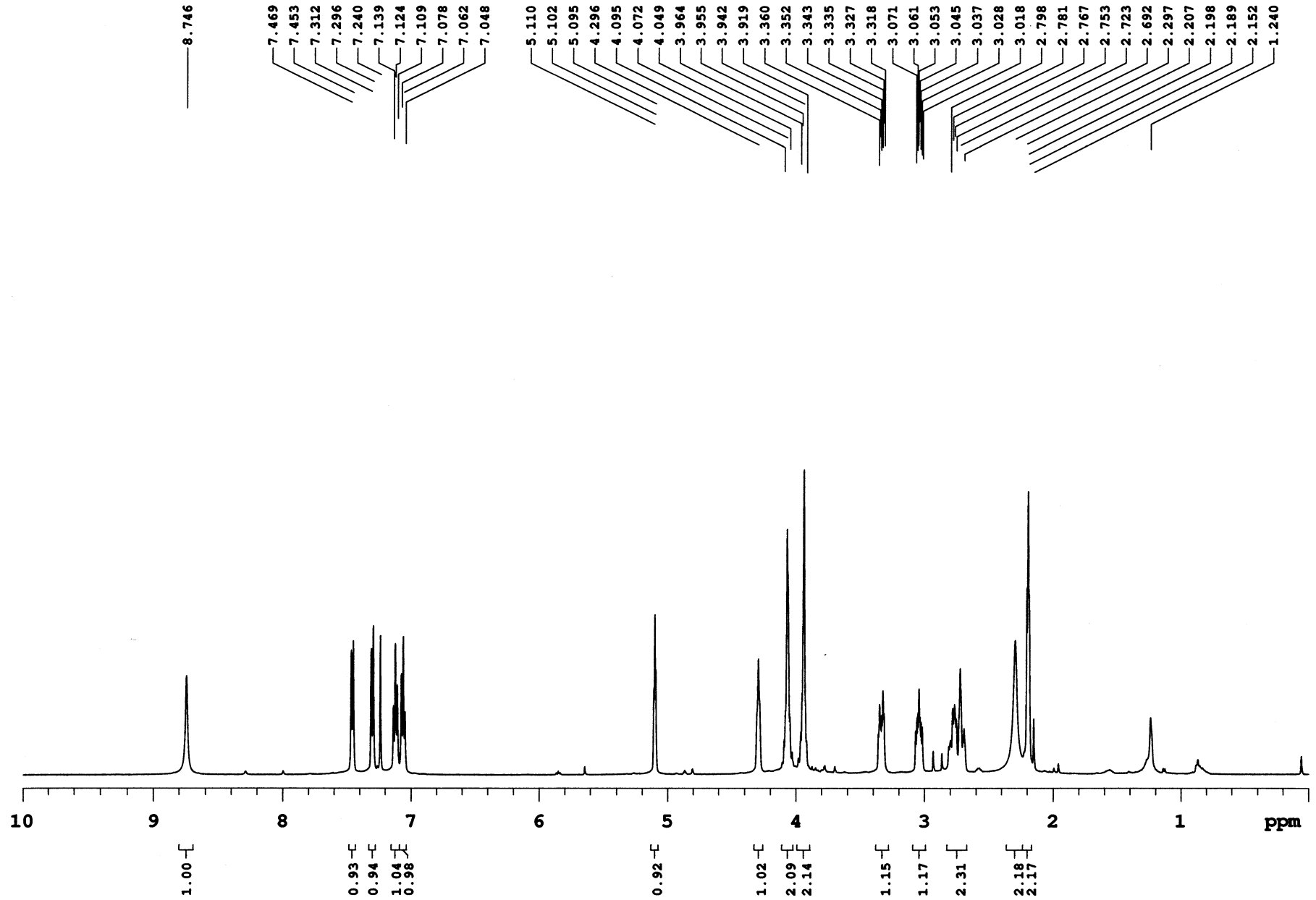


Fig S138. 1H NMR (CDCl3, 500 MHz) of compound 21.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-103-all/PROTON_24.fid

Plot date 2016-05-10

Vms-03-103

Sample Name **Vms-03-103** | Pulse sequence **CARBON** | Temperature **25** | Study owner **vnmr2**
Date collected **2016-03-28** | Solvent **cdcl3** | Spectrometer **Agilent-NMR-inova500** | Operator **vnmr2**

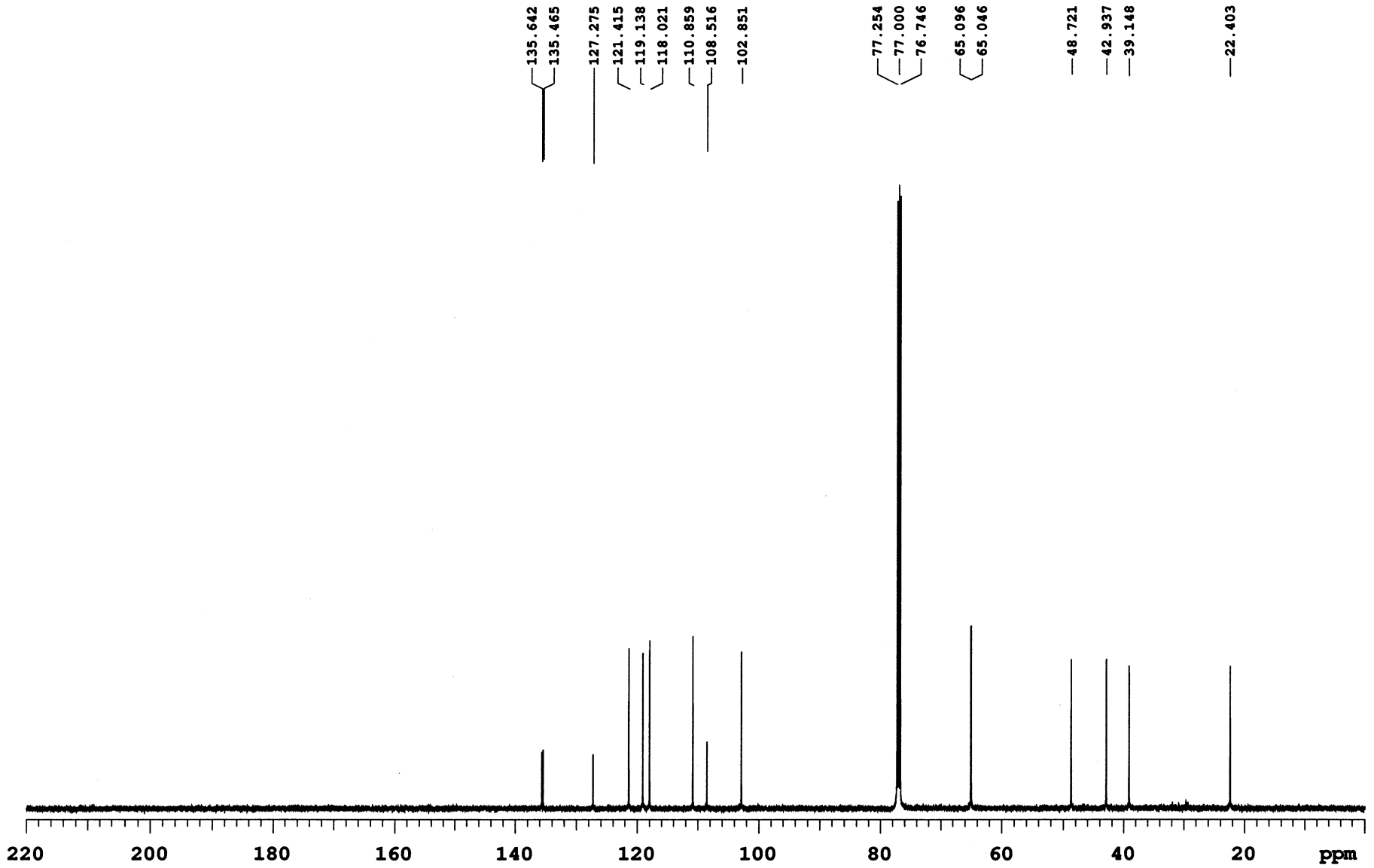


Fig S139. 13C NMR (CDCl3, 125 MHz) of compound 21.

Vms-03-103

Sample Name **Vms-03-103**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-03-29**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

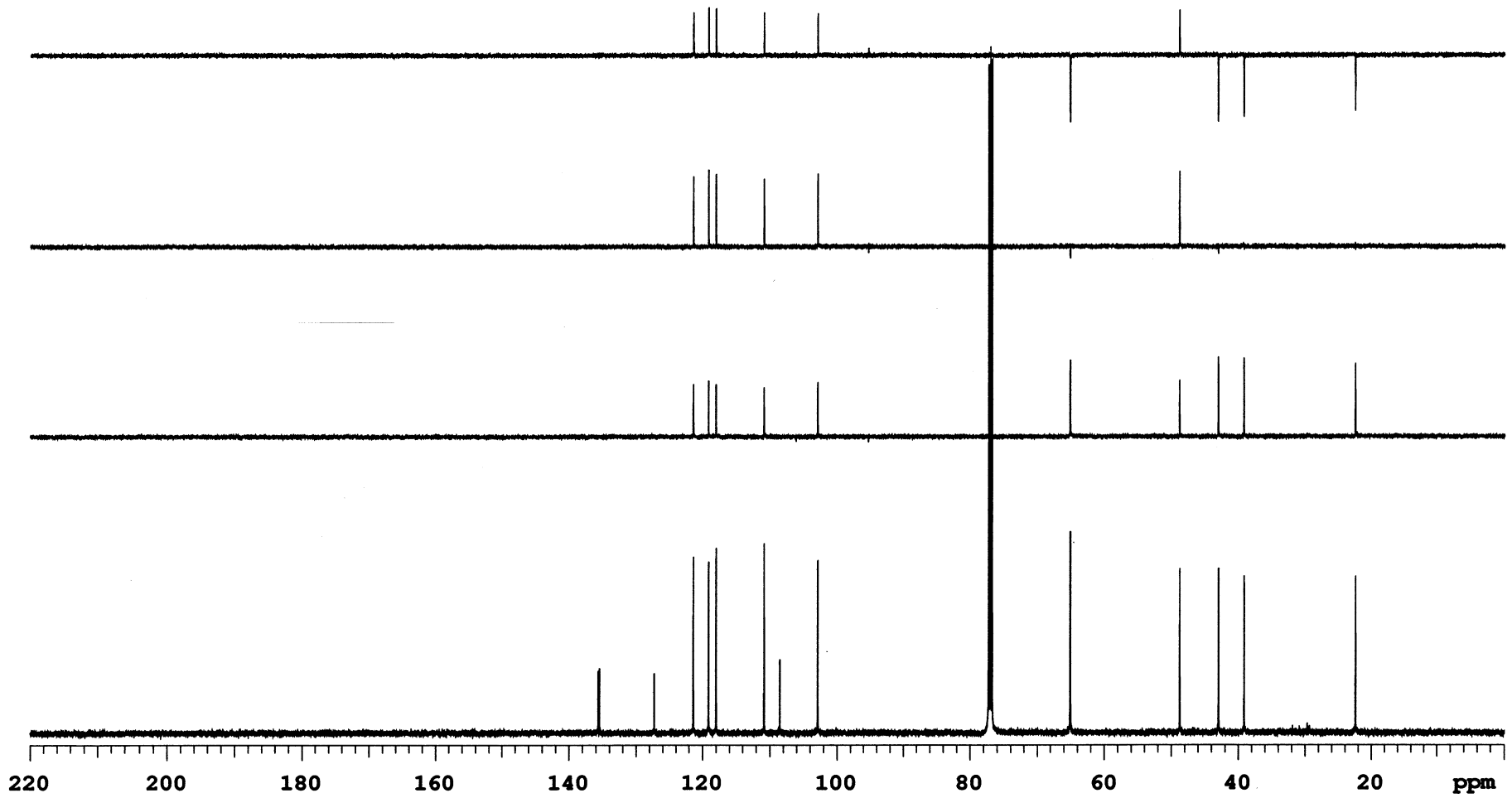


Fig S140. DEPT of compound 21.

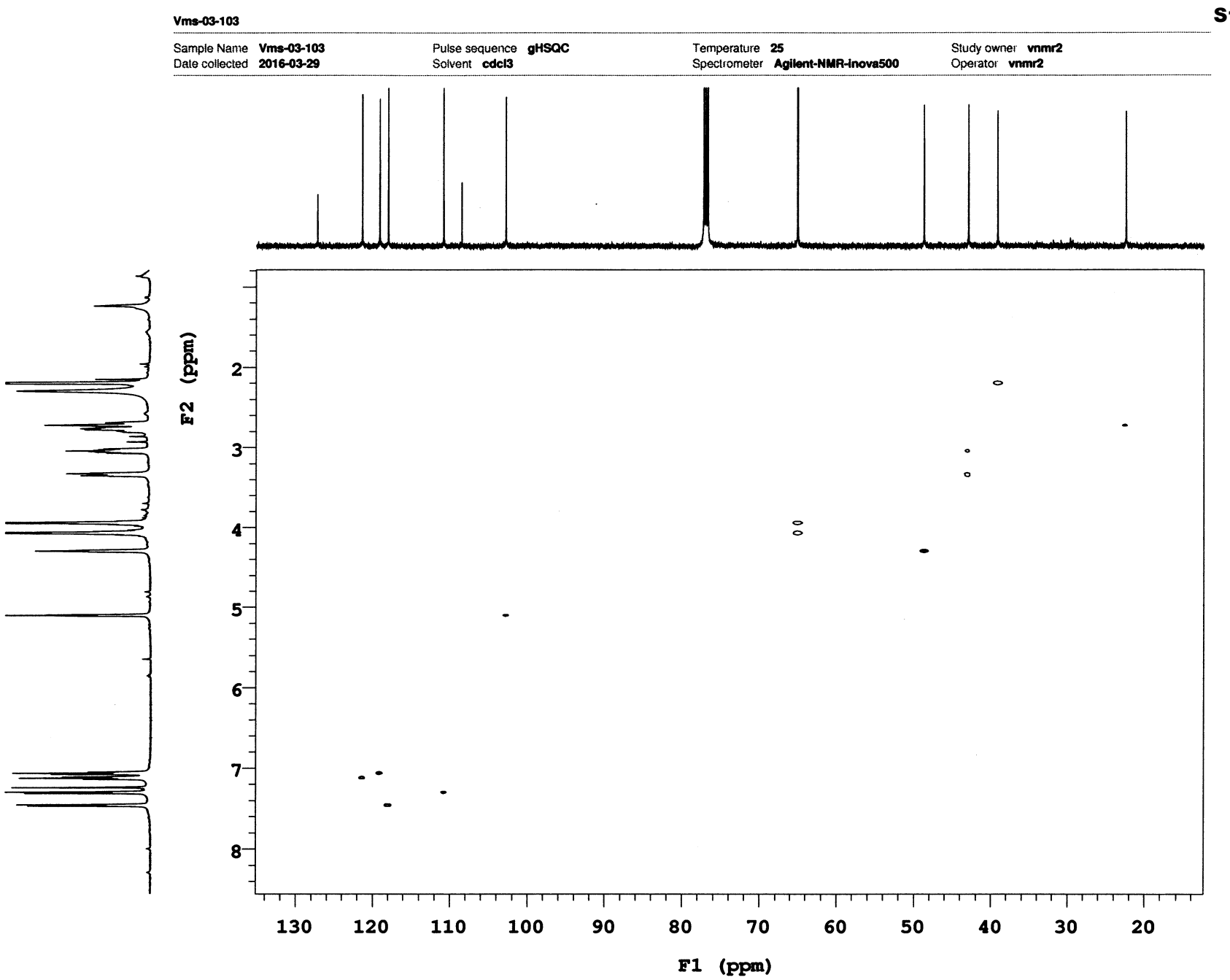


Fig S141. HSQC of compound 21.

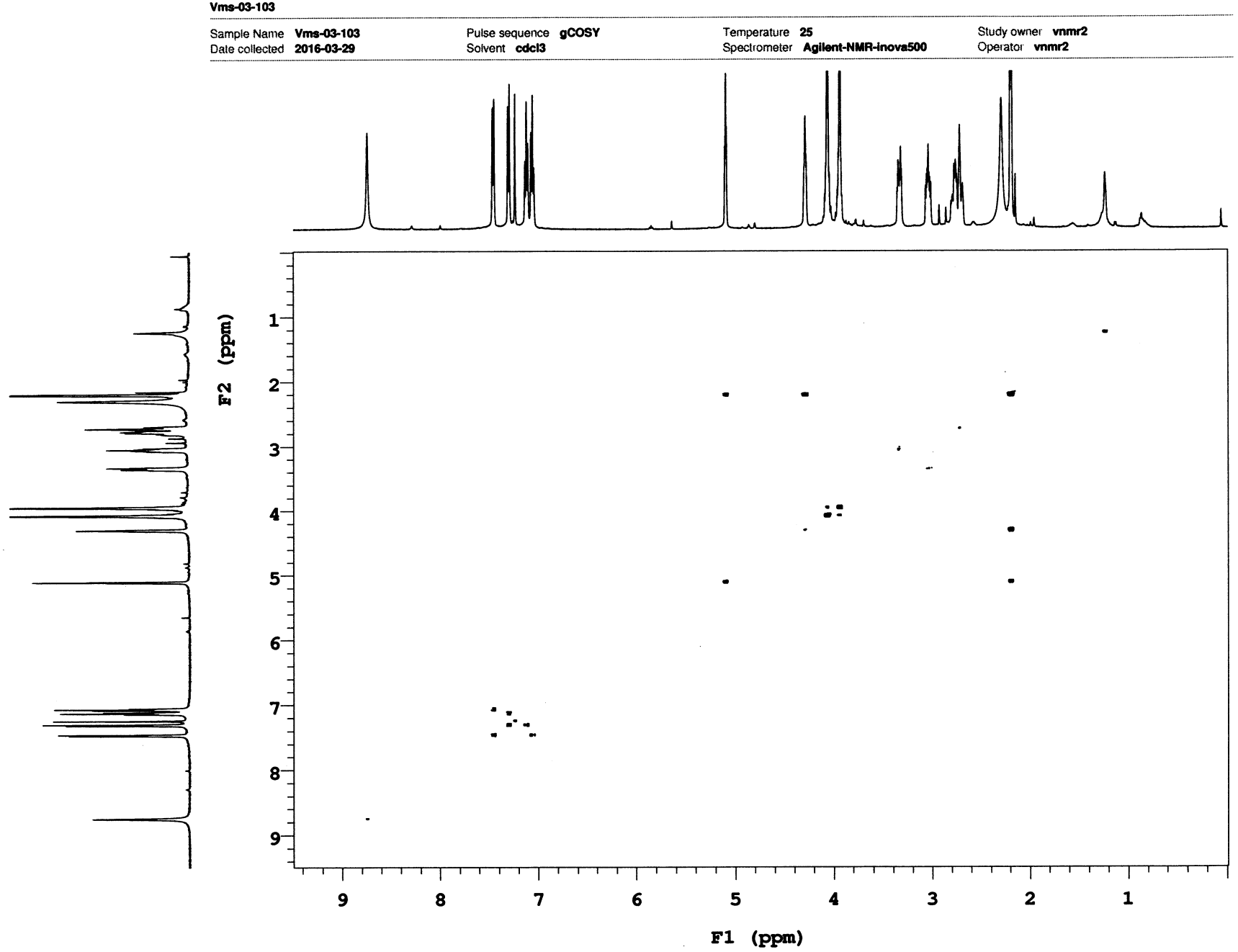


Fig S142. COSY of compound 21.

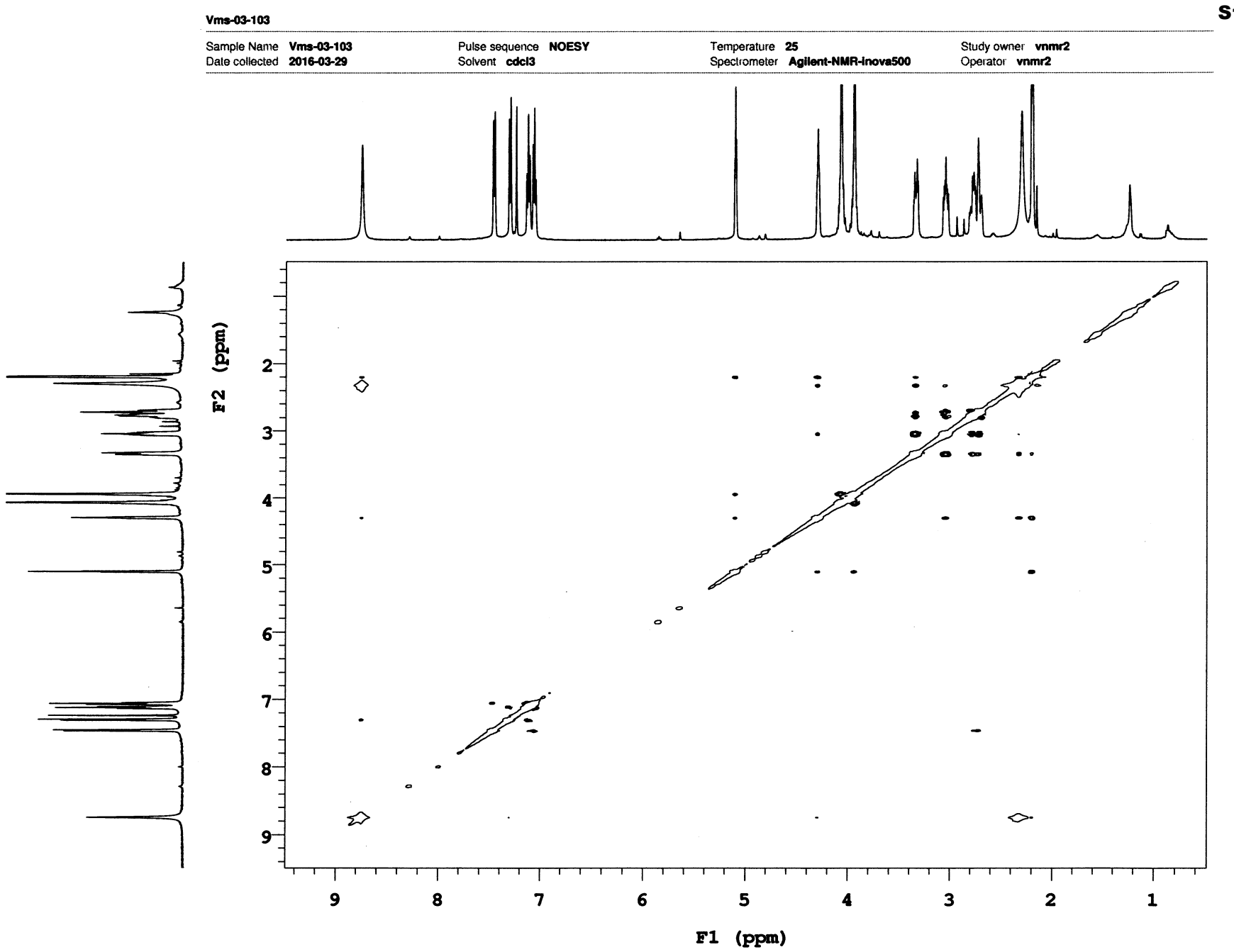


Fig S143. NOESY of compound 21.

Vms-03-108

Sample Name	**Vms-03-108**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-04-18**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

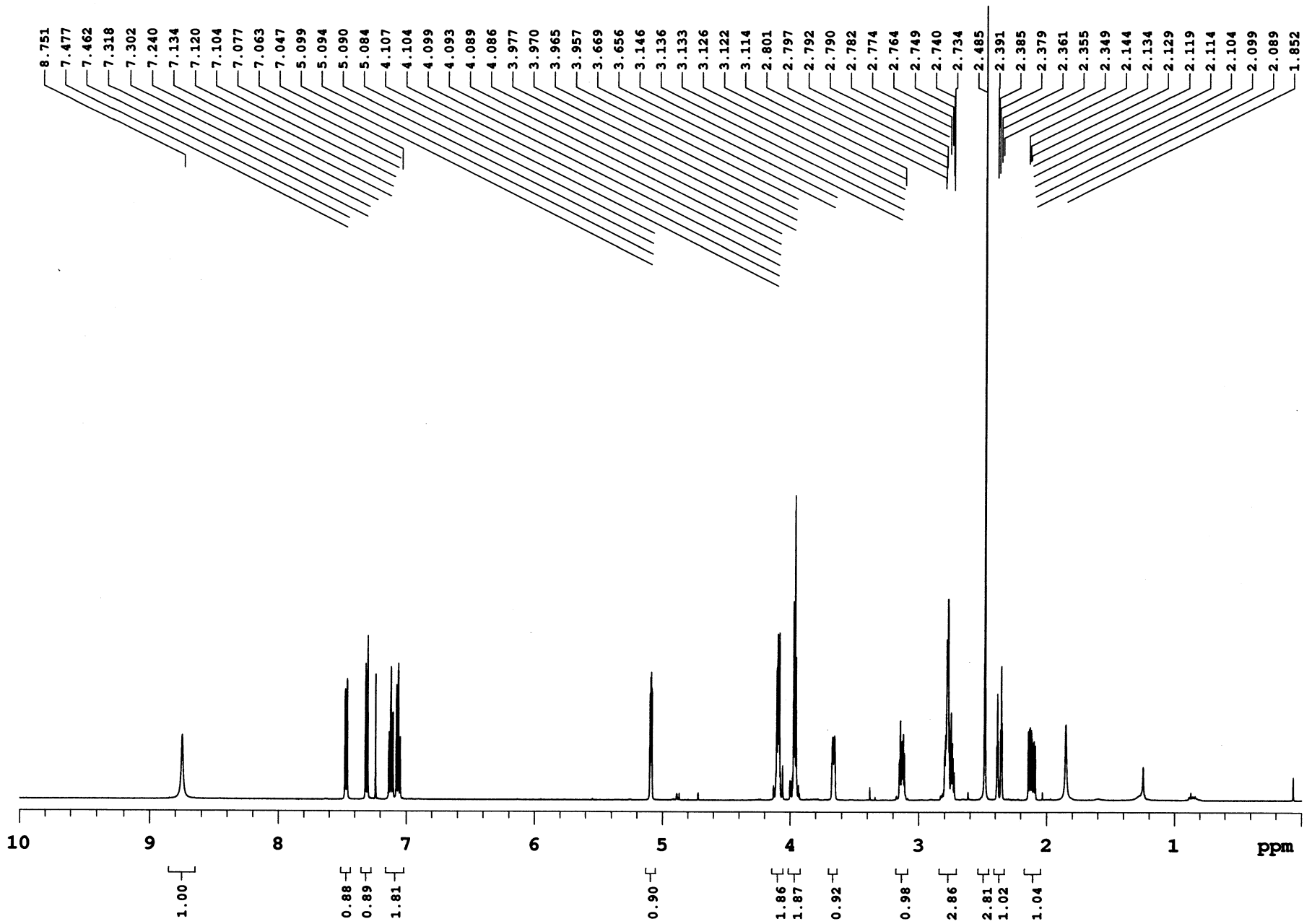


Fig S144. 1H NMR (CDCl3, 500 MHz) of compound 22.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-108/PROTON_07.fid

Plot date 2016-05-10

Vms-03-108

Sample Name **Vms-03-108**	Pulse sequence **CARBON**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-04-18**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

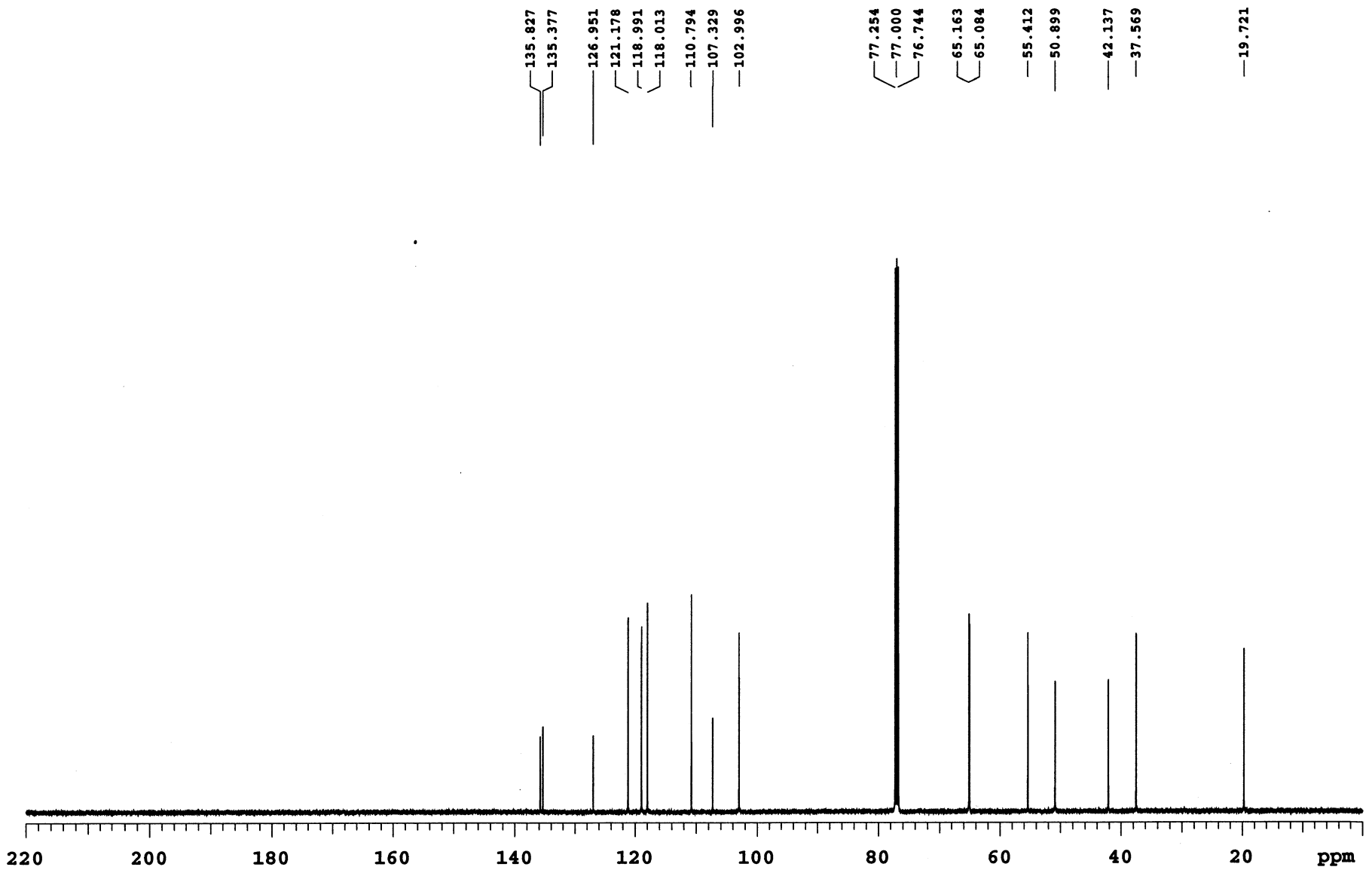


Fig S145. 13C NMR (CDCl3, 125 MHz) of compound 22.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-108/CARBON_01

Plot date 2016-04-18

Vms-03-108

Sample Name **Vms-03-108**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-04-18**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

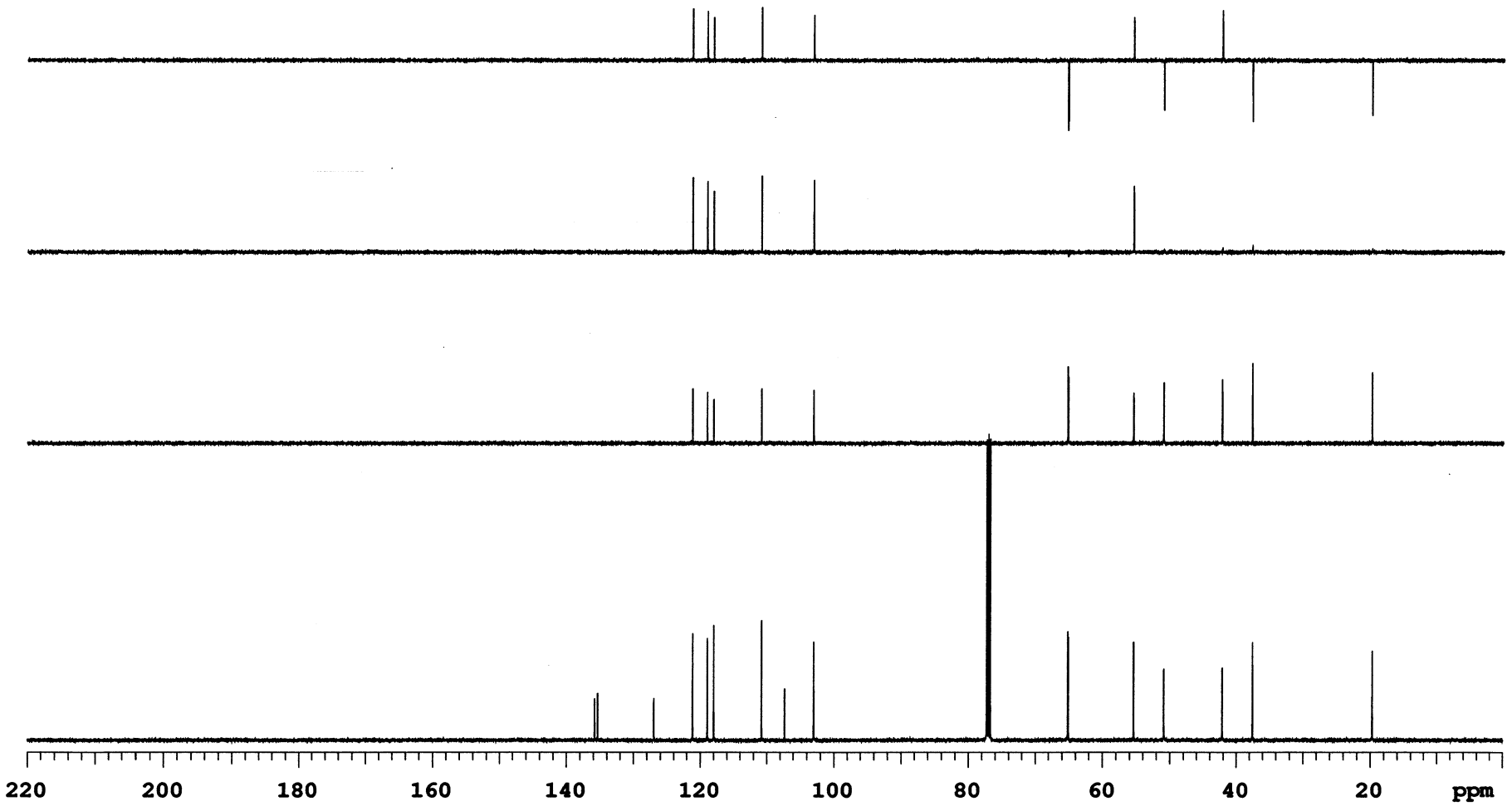


Fig S146. DEPT of compound 22.

Vms-03-108

Sample Name **Vms-03-108** | Pulse sequence **gHSQC** | Temperature **25** | Study owner **vnmr2**
Date collected **2016-04-18** | Solvent **cdcl3** | Spectrometer **Agilent-NMR-inova500** | Operator **vnmr2**

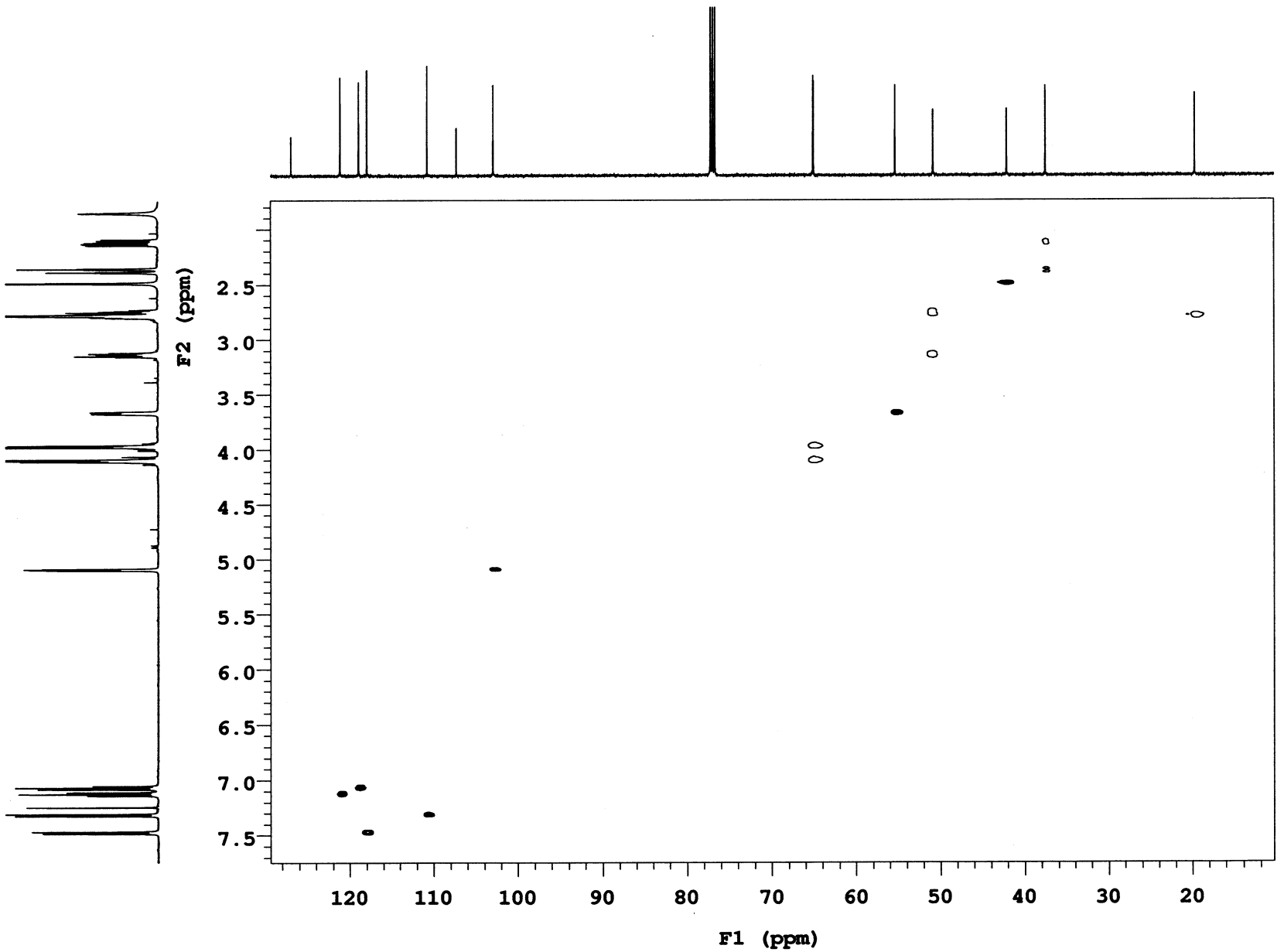


Fig S147. HSQC of compound 22.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-108/gHSQC_01

Plot date 2016-04-18

Vms-03-108

Sample Name **Vms-03-108**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-04-18**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

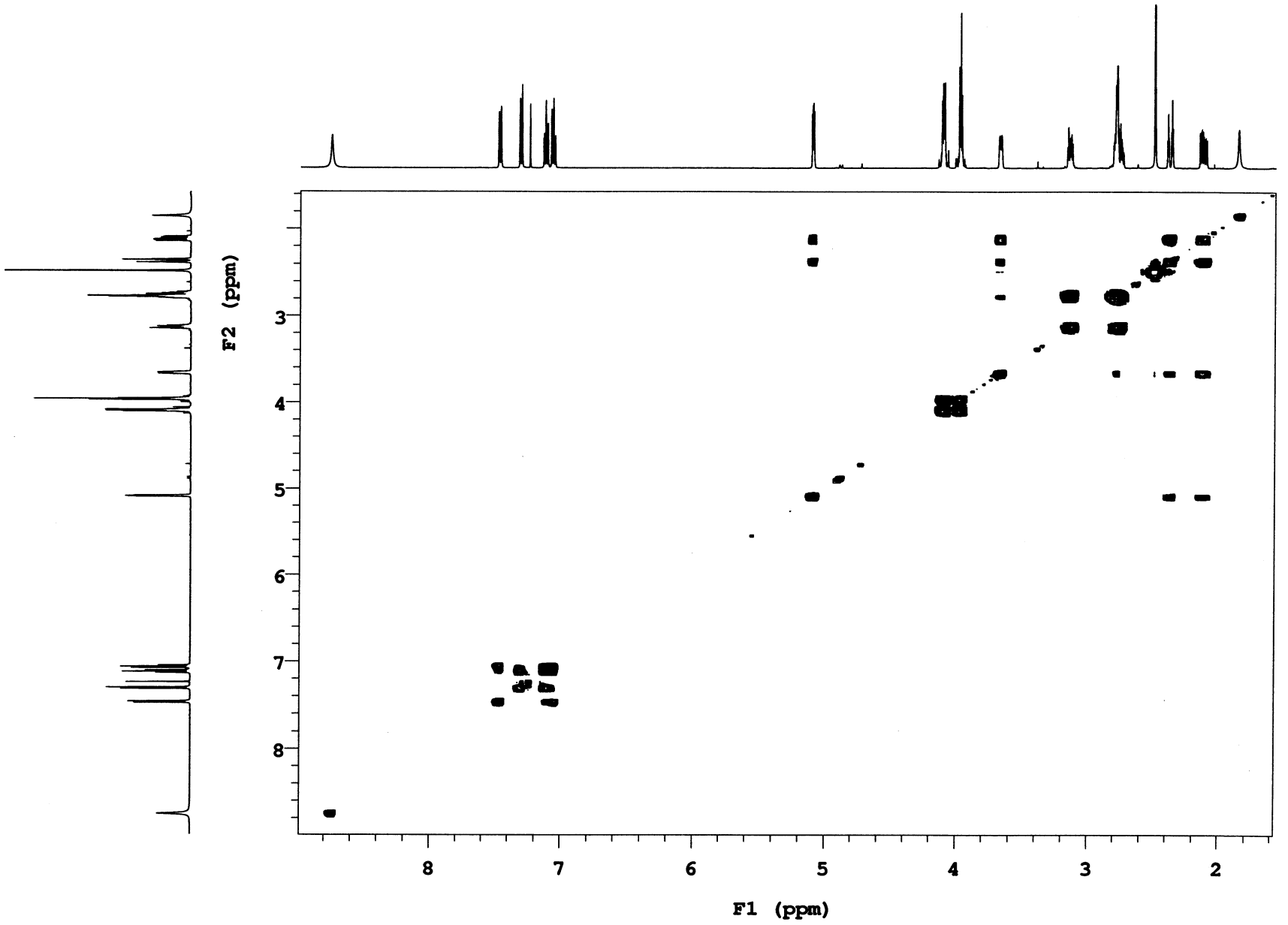


Fig S148. COSY of compound 22.

Vms-03-108

Sample Name **Vms-03-108**	Pulse sequence **NOESY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-04-18**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

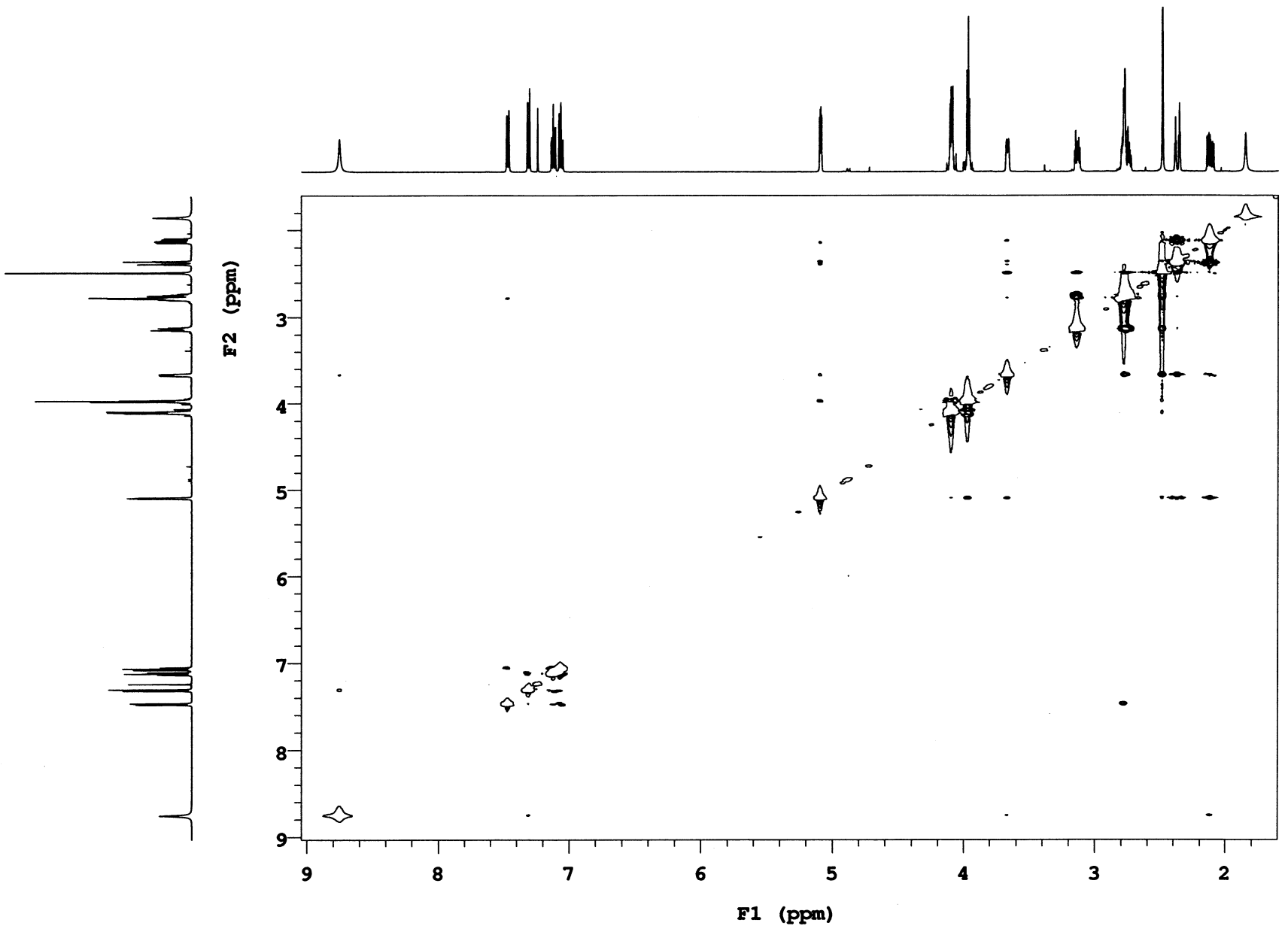


Fig S149. NOESY of compound 22.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-108/NOESY_01

Plot date 2016-04-18

Vms-03-047

Sample Name	**Vms-03-047**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2015-12-31**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

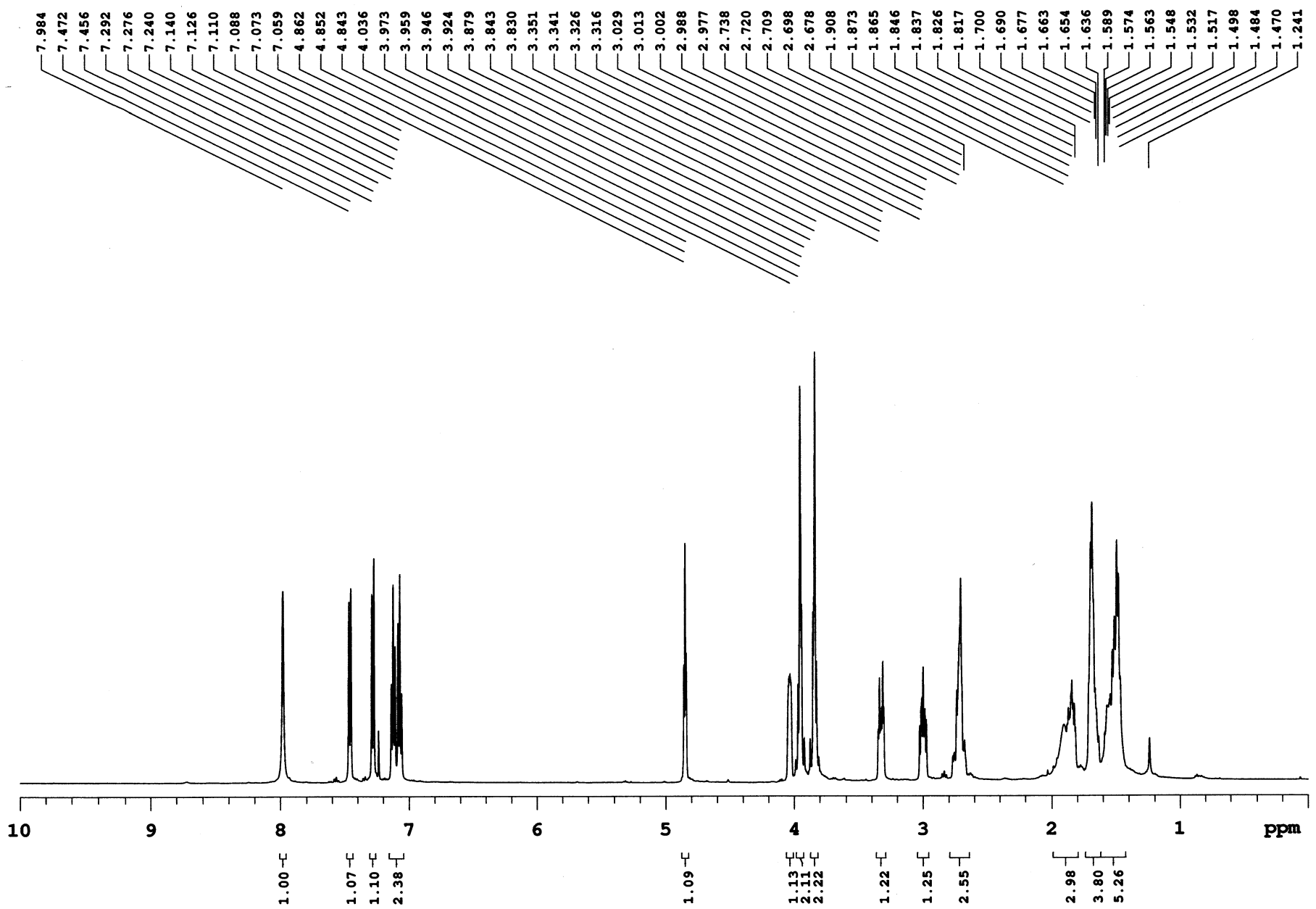


Fig S150. 1H NMR (CDCl3, 500 MHz) of compound 23.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-047/PROTON_02.fid

Plot date 2016-05-10

Vms-03-047

Sample Name	**Vms-03-047**	Pulse sequence	**CARBON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2015-12-31**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

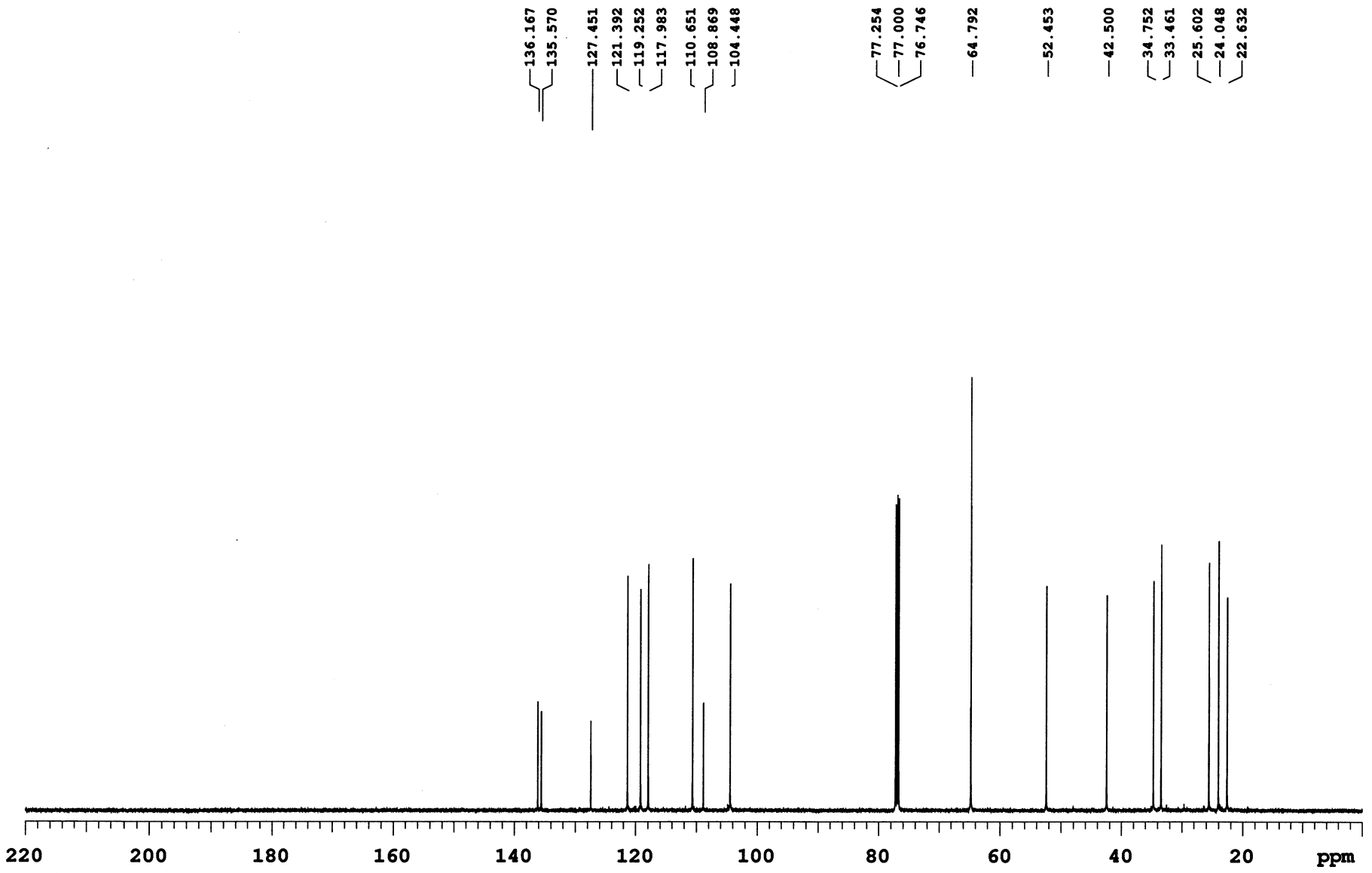


Fig S151. 13C NMR (CDCl3, 125 MHz) of compound 23.

Vms-03-047

Sample Name **Vms-03-047**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-01**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

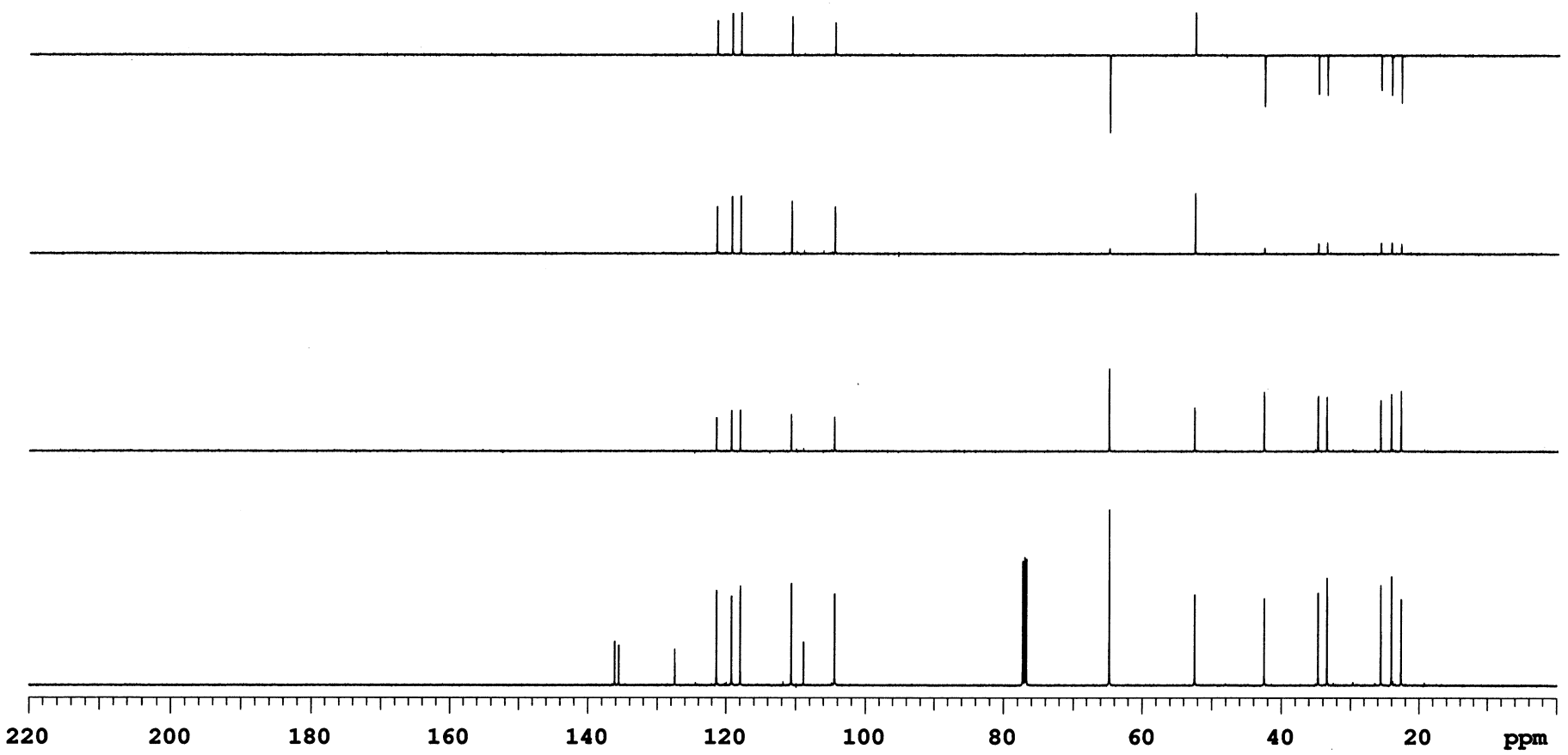


Fig S152. DEPT of compound 23.

Vms-03-047

Sample Name **Vms-03-047**	Pulse sequence **gHSQC**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-01**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

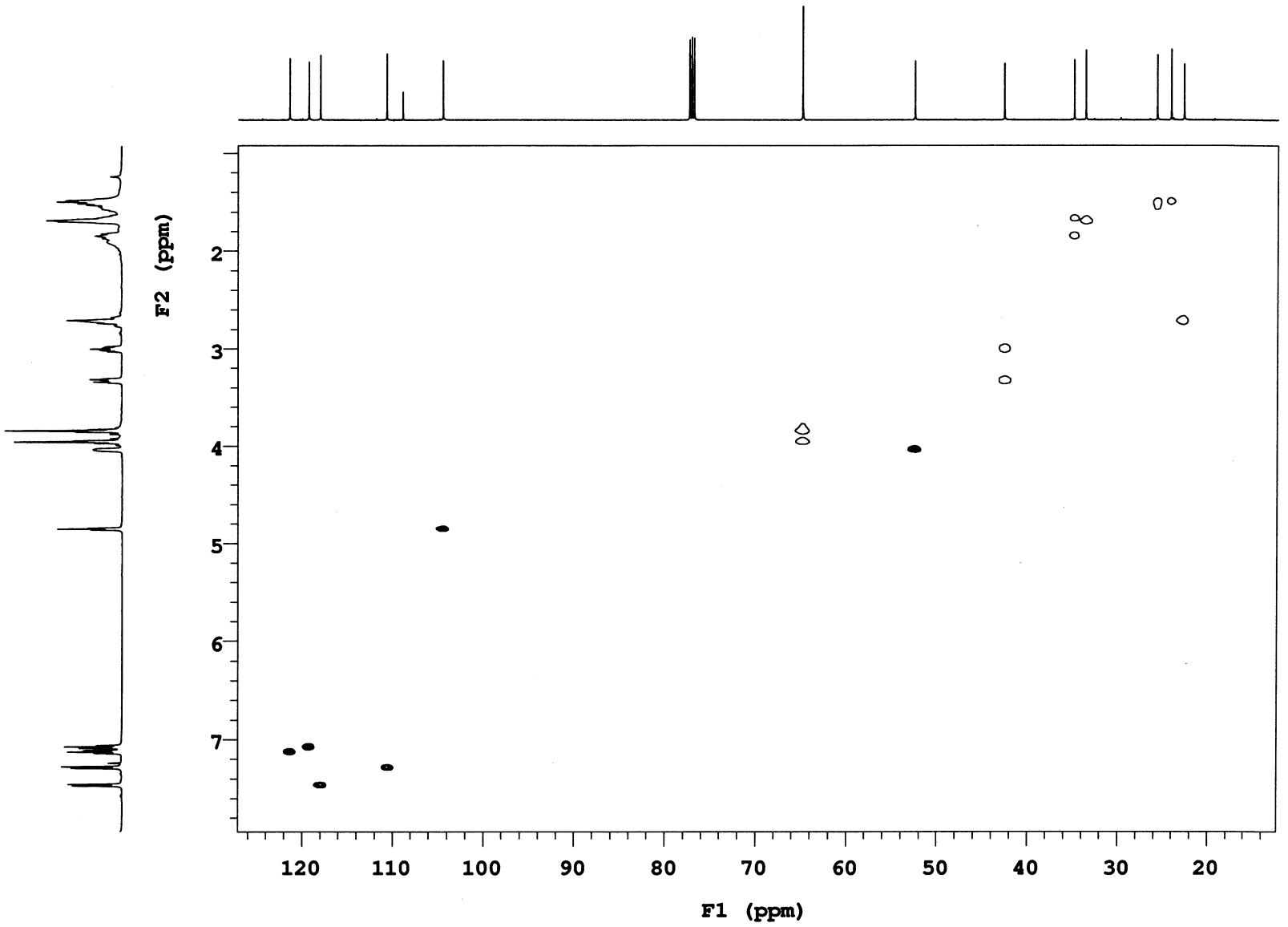


Fig S153. HSQC of compound 23.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-047/gHSQC_01

Plot date 2016-01-04

Vms-03-047

Sample Name **Vms-03-047**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-01**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

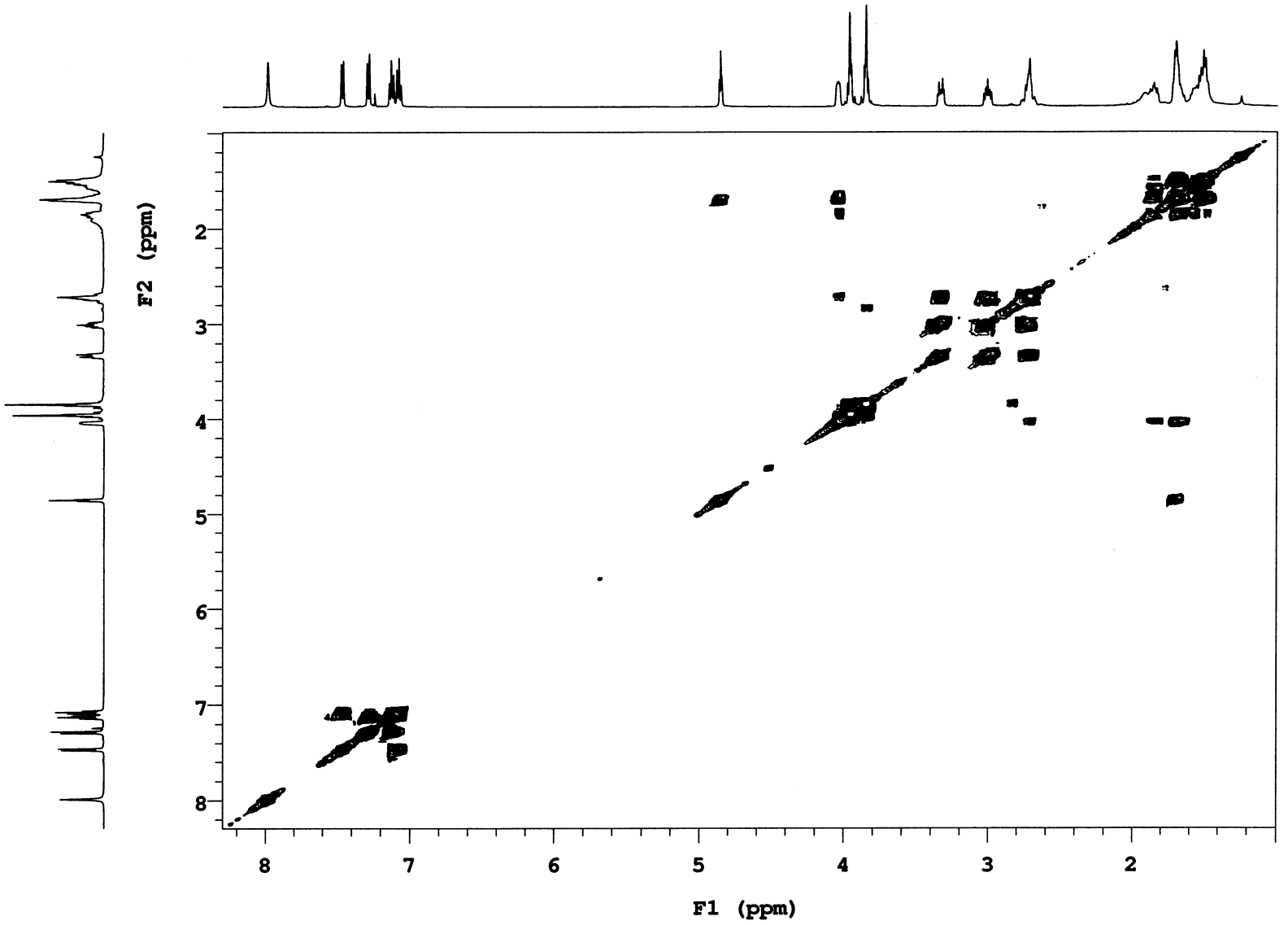


Fig S154. COSY of compound 23.

Vms-03-047

Sample Name **Vms-03-047**	Pulse sequence **NOESY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-01**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

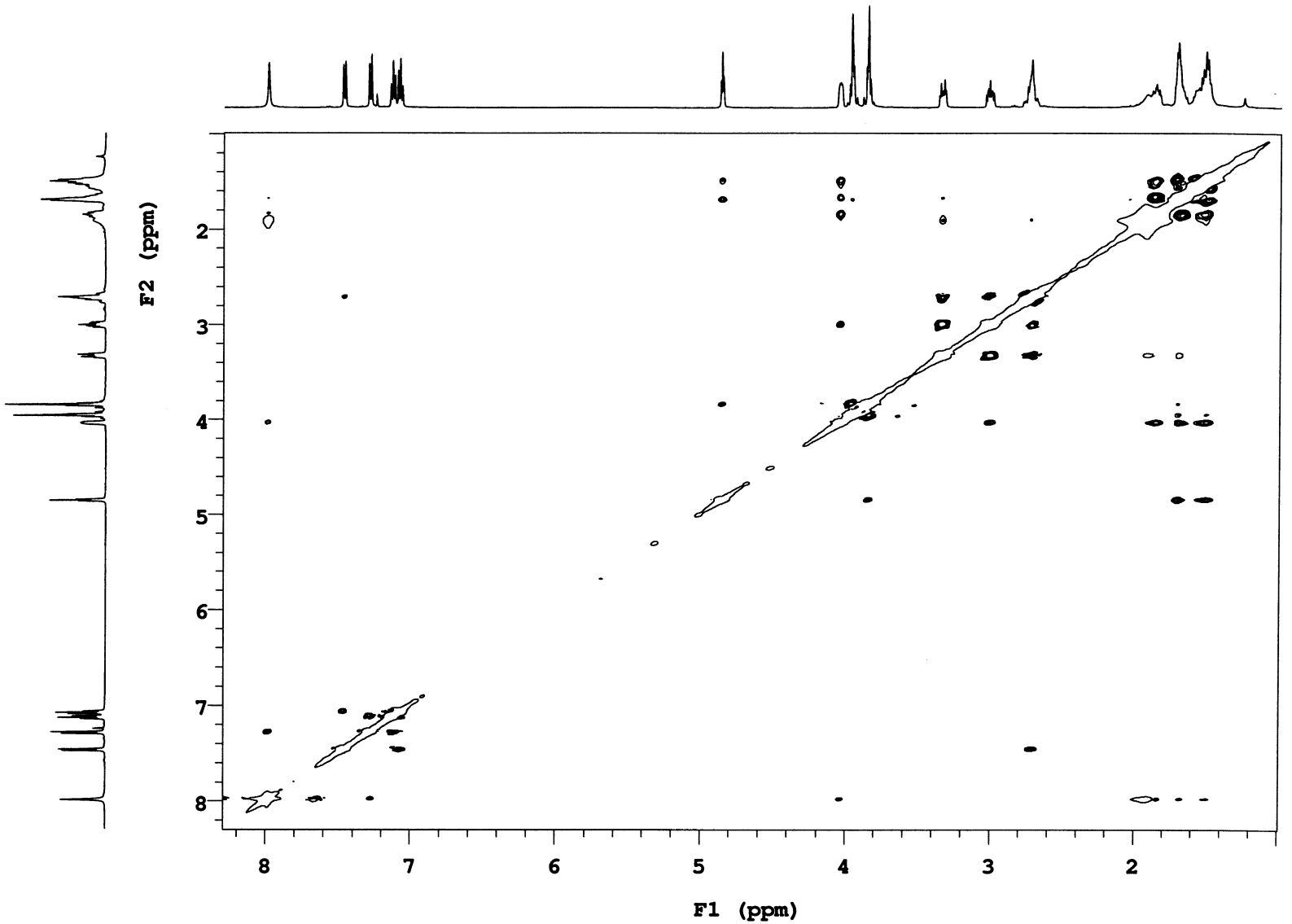


Fig S155. NOESY of compound 23.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-047/NOESY_01

Plot date 2016-01-04

Vms-03-050

Sample Name **Vms-03-050** | Pulse sequence **PROTON** | Temperature **25** | Study owner **vnmr2**
Date collected **2016-01-13** | Solvent **cdcl3** | Spectrometer **Agilent-NMR-inova500** | Operator **vnmr2**

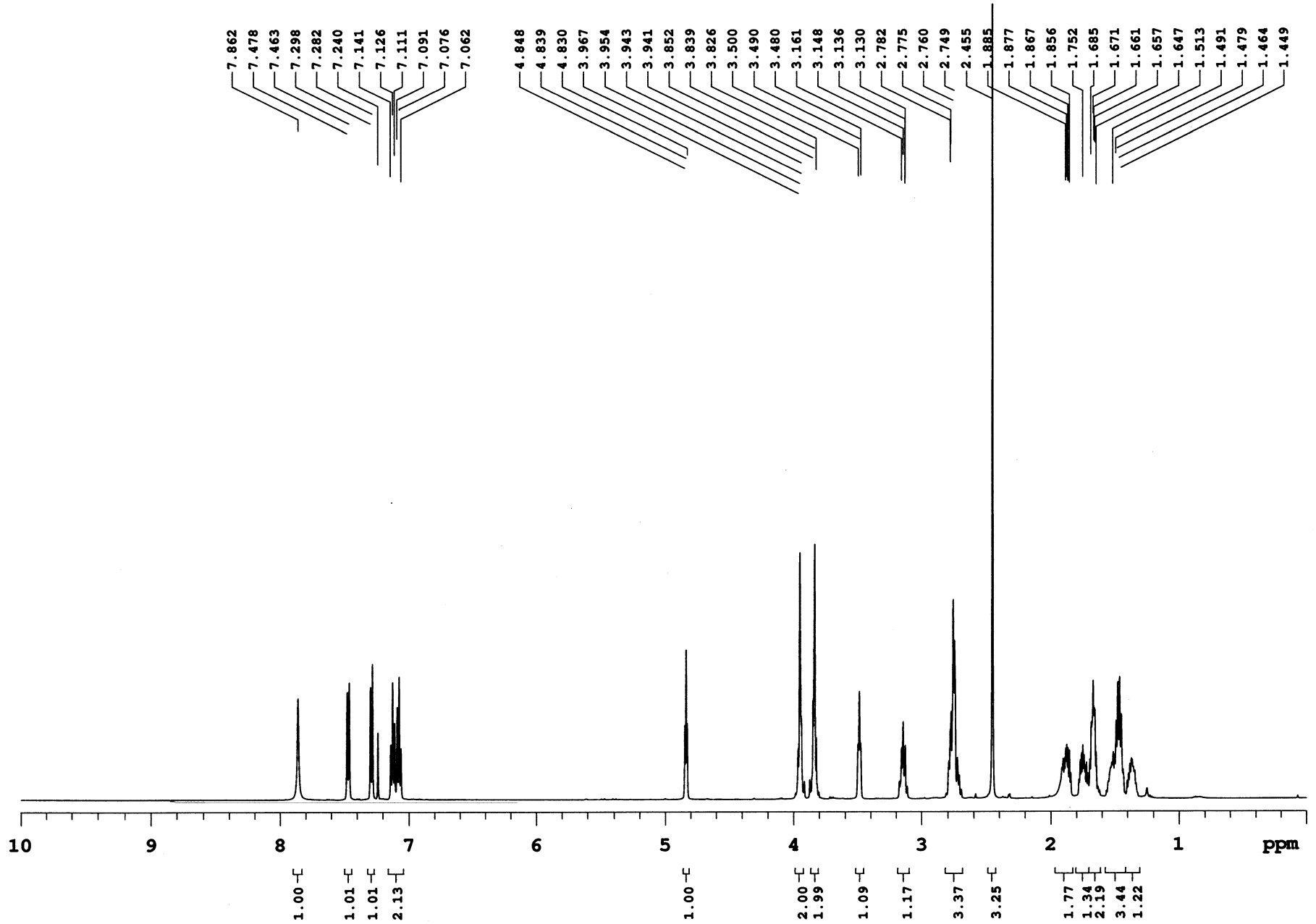


Fig S156. 1H NMR (CDCl3, 500 MHz) of compound 24.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-050/PROTON_01.fid

Plot date 2016-05-10

Vms-03-050

Sample Name **Vms-03-050**	Pulse sequence **CARBON**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-13**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

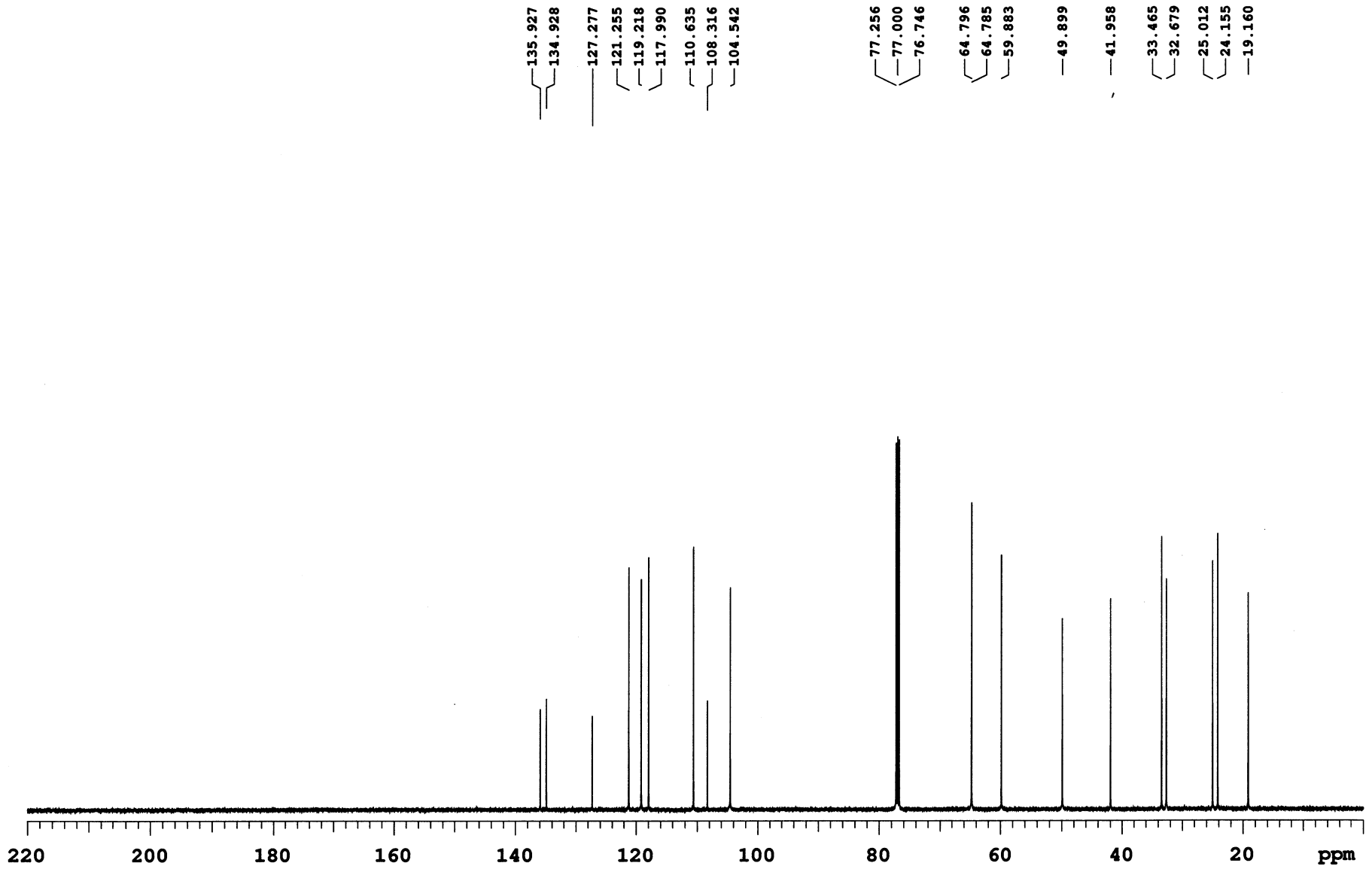


Fig S157. 13C NMR (CDCl3, 125 MHz) of compound 24.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-050/CARBON_01

Plot date 2016-01-14

Vms-03-050

Sample Name **Vms-03-050**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-14**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

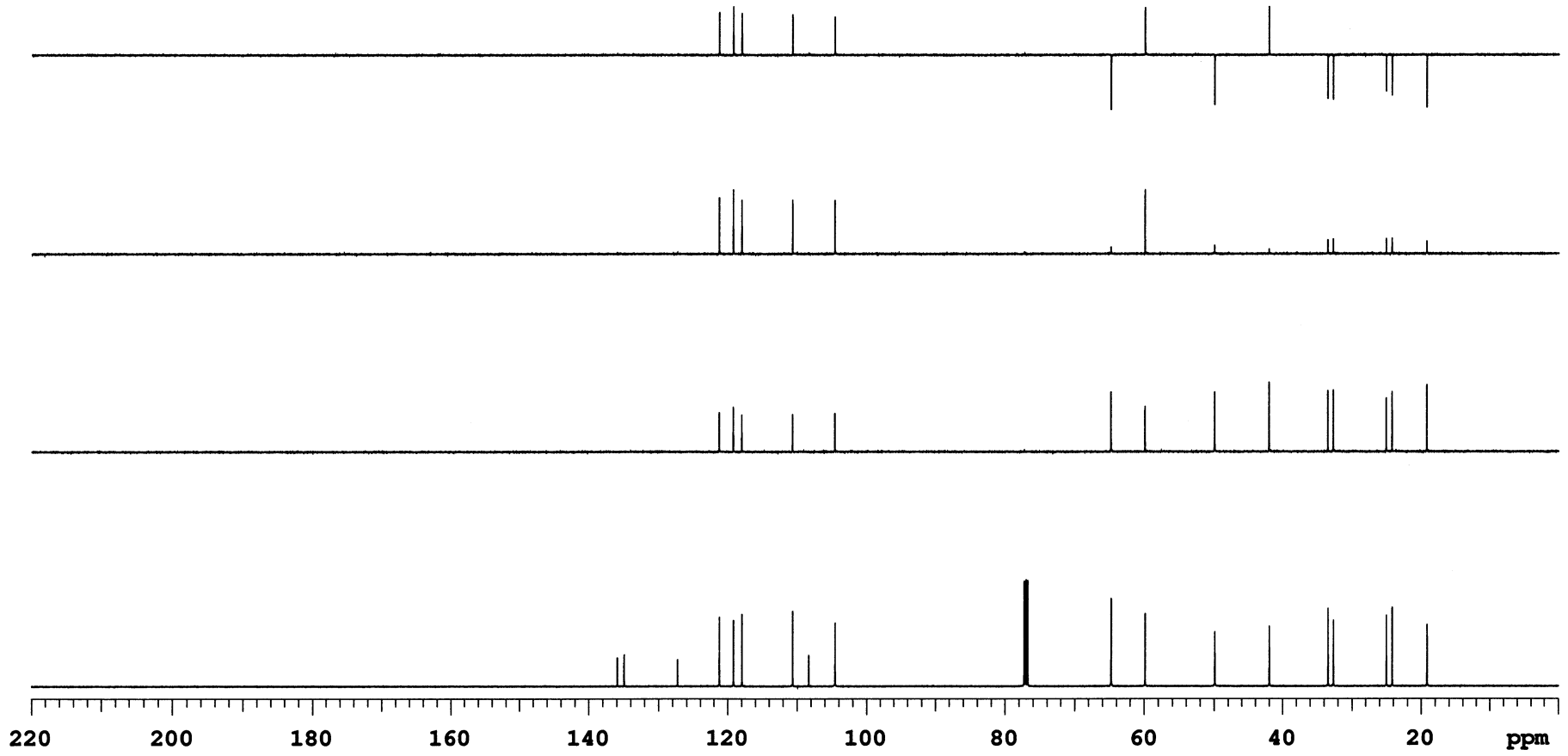


Fig S158. DEPT of compound 24.

Vms-03-050

Sample Name **Vms-03-050**	Pulse sequence **gHSQC**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-14**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

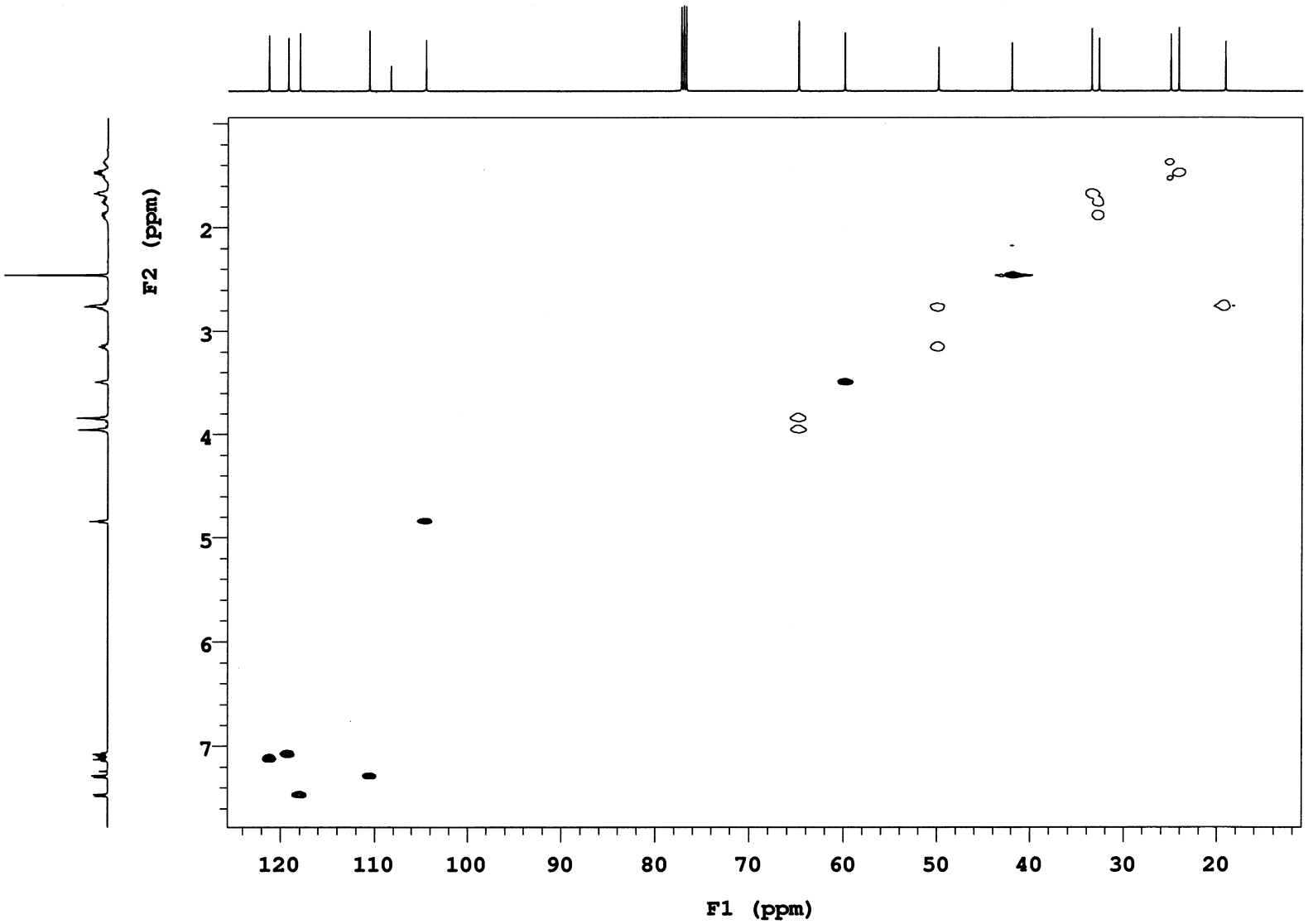


Fig S159. HSQC of compound 24.

Vms-03-050

Sample Name **Vms-03-050**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-14**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

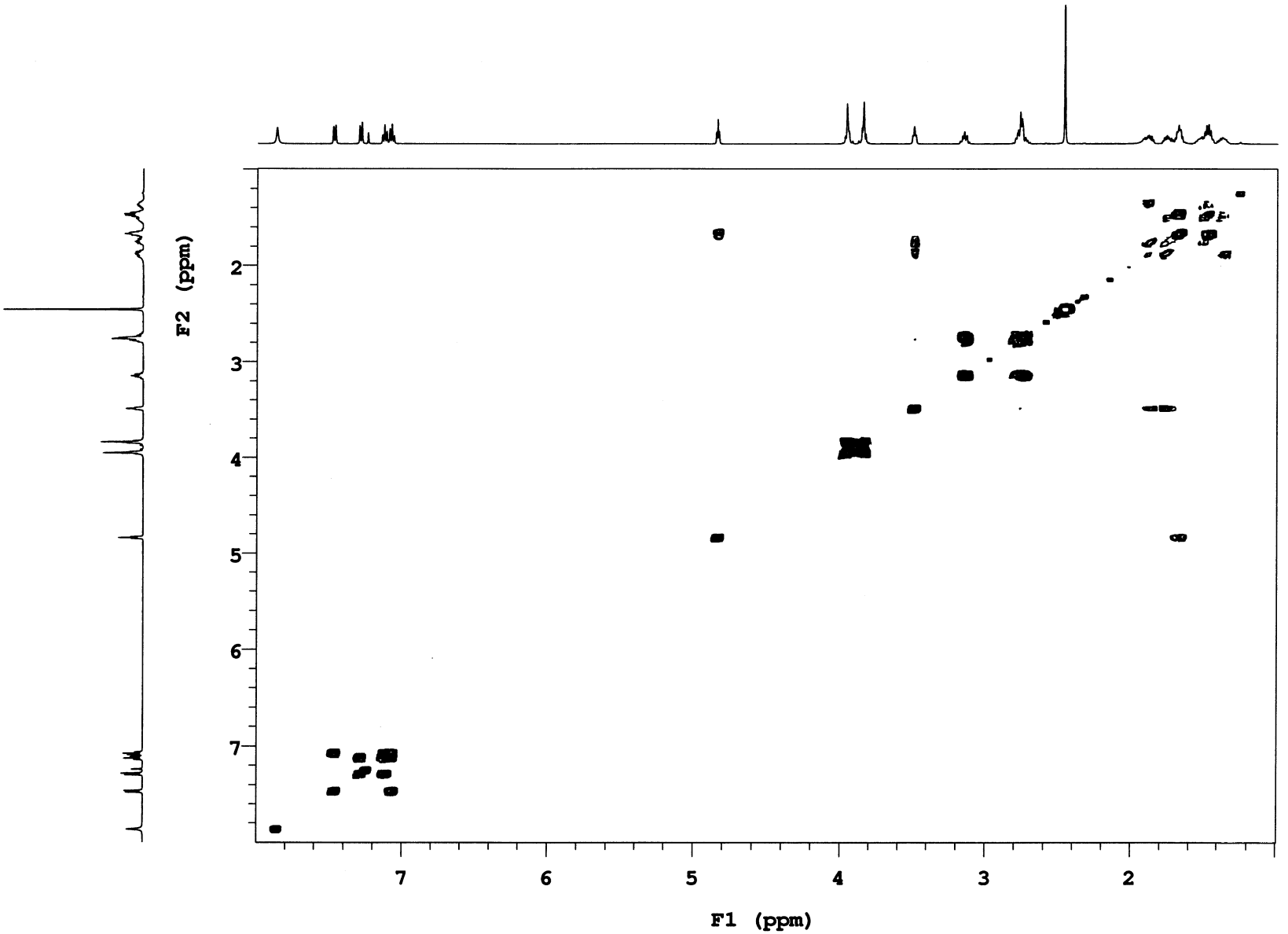


Fig S160. COSY of compound 24.

Vms-03-050

Sample Name **Vms-03-050**	Pulse sequence **NOESY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-01-14**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

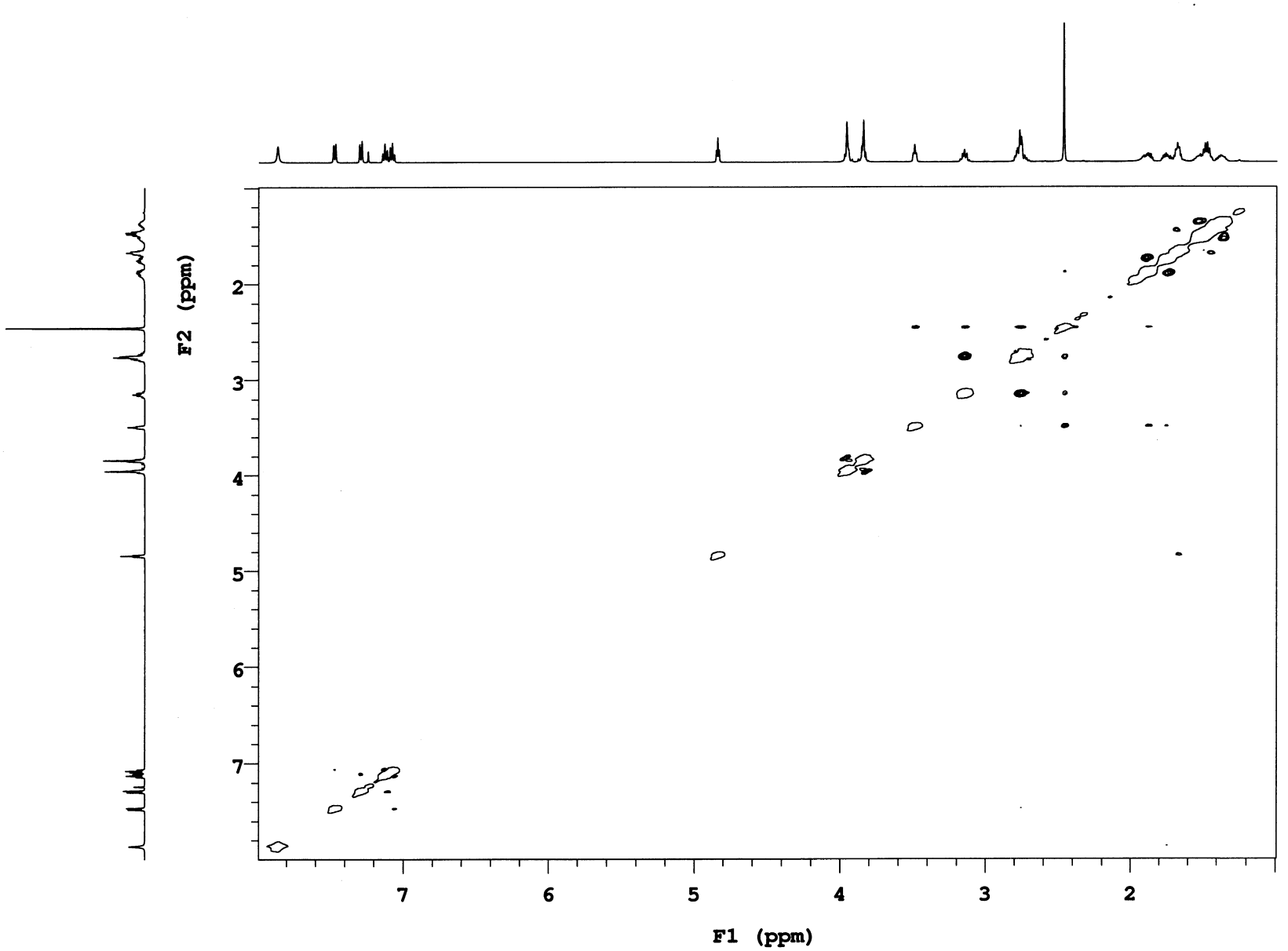


Fig S161. NOESY of compound 24.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-03-050/NOESY_01

Plot date 2016-01-14

Vms-02-182

Sample Name	**Vms-02-182**	Pulse sequence	**PROTON**	Temperature	**25**	Study owner	**vnmr2**
Date collected	**2016-05-30**	Solvent	**cdcl3**	Spectrometer	**Agilent-NMR-inova500**	Operator	**vnmr2**

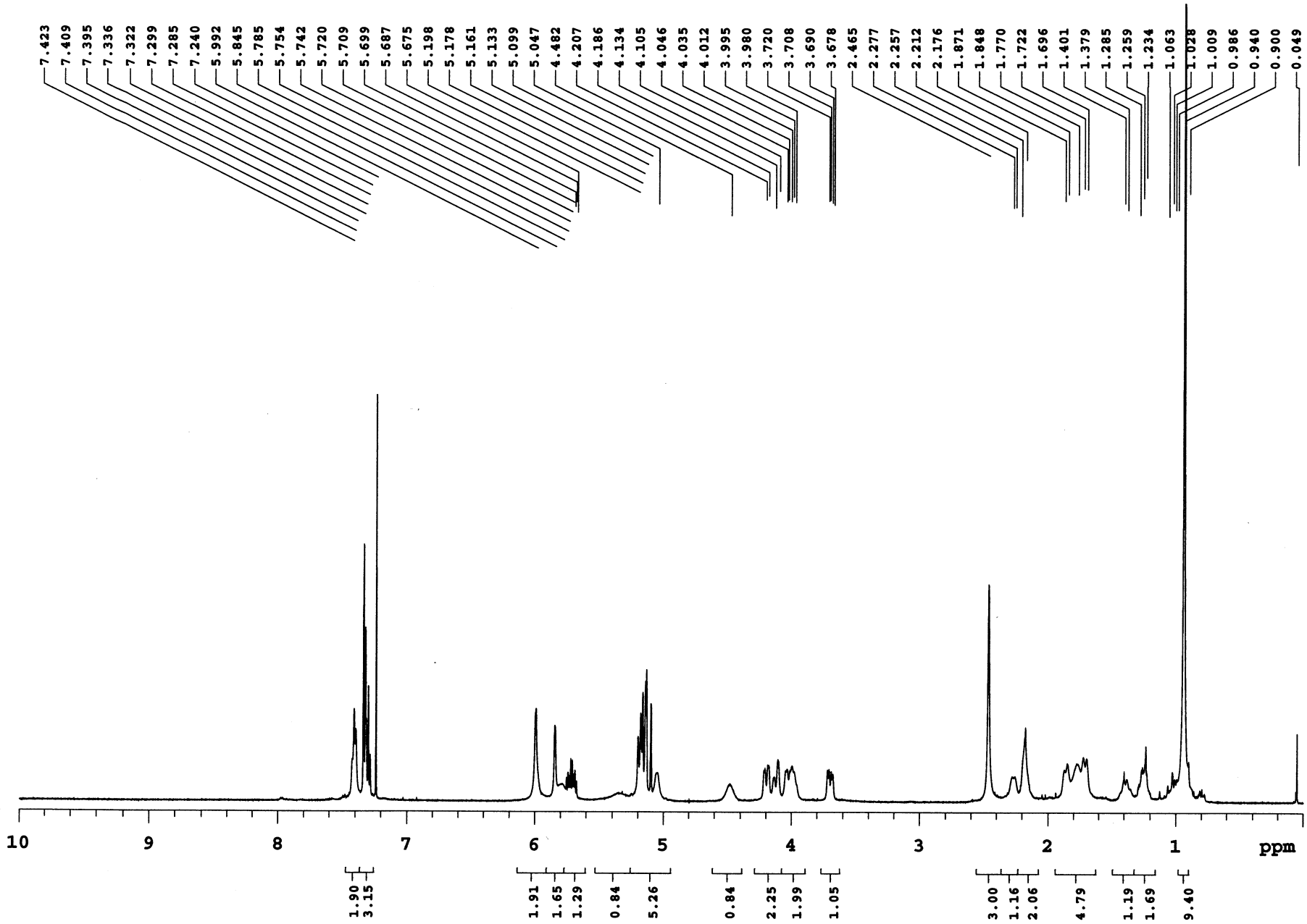


Fig S162. 1H NMR (CDCl3, 500 MHz) of catalyst IX.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-182/PROTON_12.fid

Plot date 2016-06-30

Vms-02-182

Sample Name **Vms-02-182**
Date collected **2016-05-30**

Pulse sequence **CARBON**
Solvent **cdcl3**

Temperature **25**
Spectrometer **Agilent-NMR-inova500**

Study owner **vnmr2**
Operator **vnmr2**

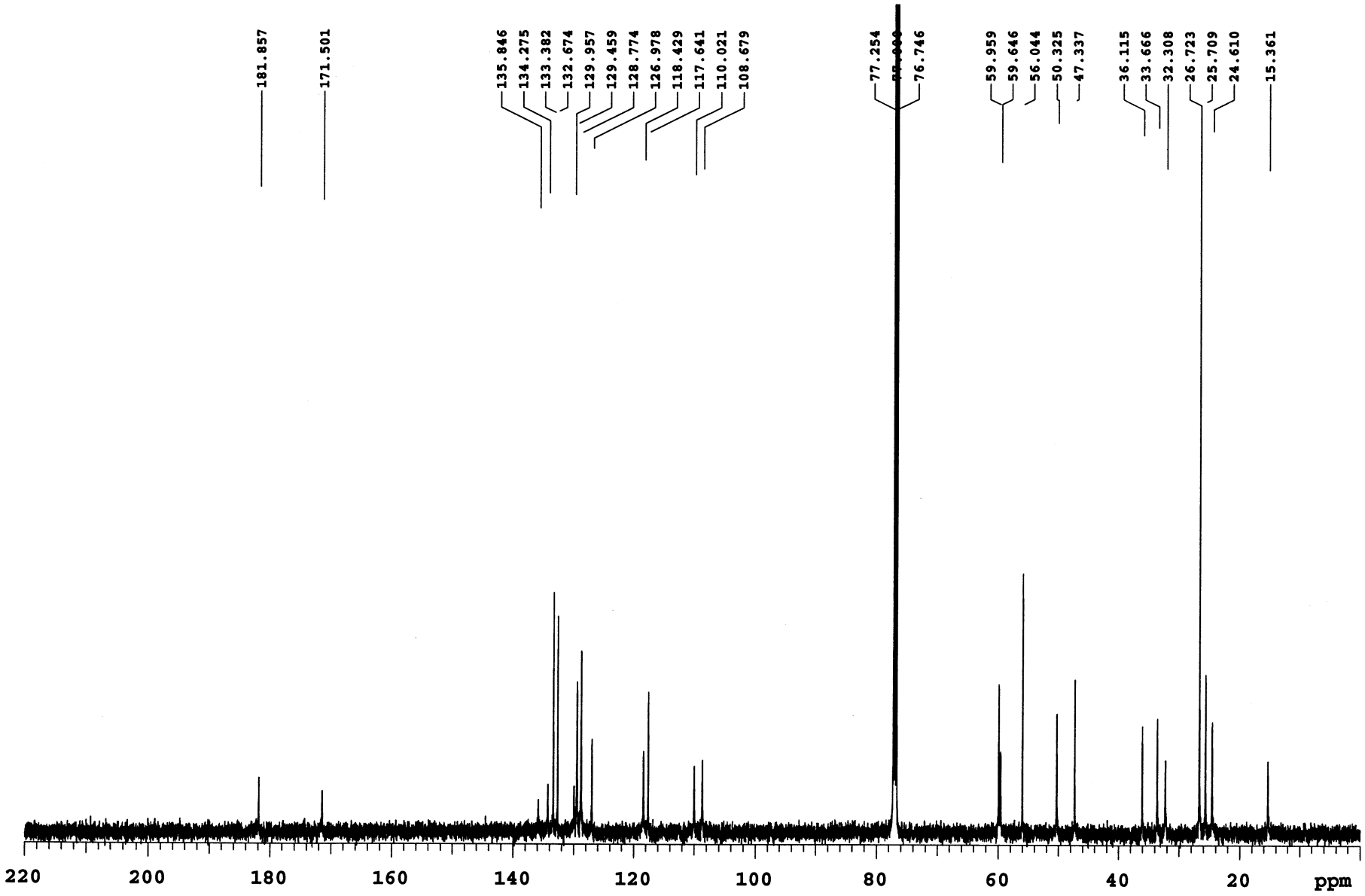


Fig S163. 13C NMR (CDCl3, 125 MHz) of catalyst IX.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-182/CARBON_01.fid

Plot date 2016-06-30

Vms-02-182

Sample Name **Vms-02-182**	Pulse sequence **DEPT**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-05-30**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

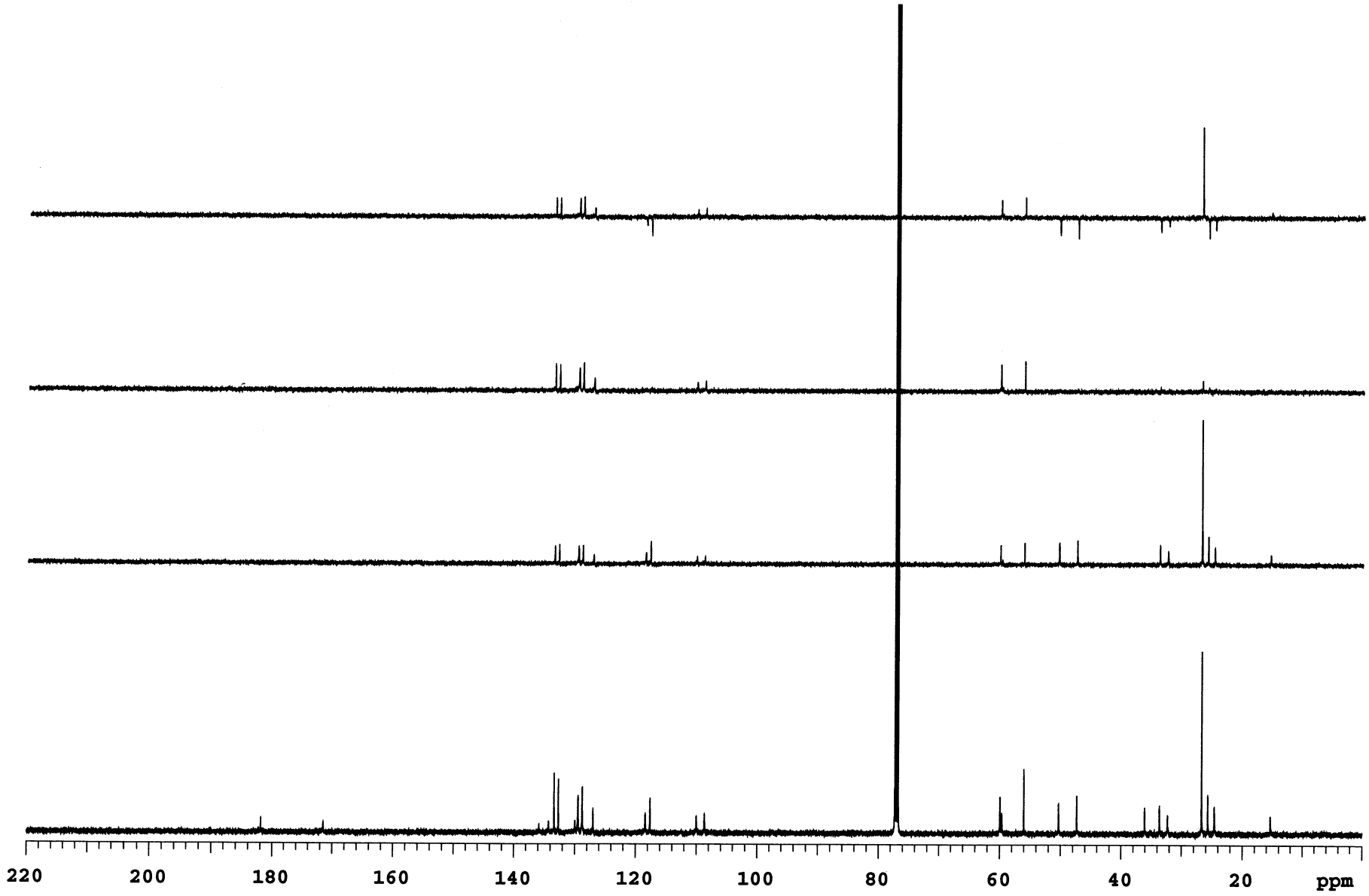


Fig S164. DEPT of catalyst IX.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-182/DEPT_01.fid

Plot date 2016-06-30

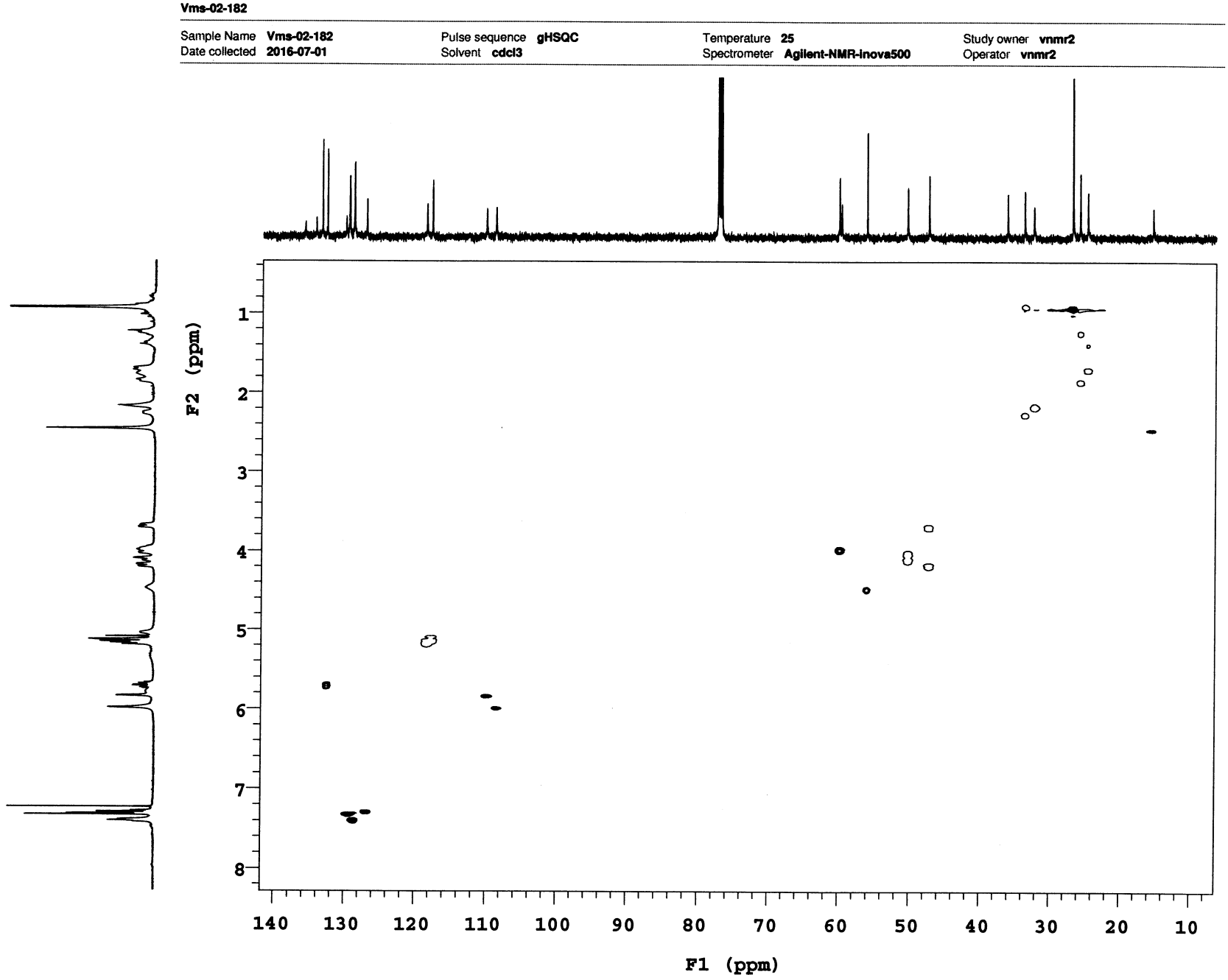


Fig S165. HSQC of catalyst IX.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-182/gHSQC_02

Plot date 2016-07-05

Vms-02-182

Sample Name **Vms-02-182**	Pulse sequence **gCOSY**	Temperature **25**	Study owner **vnmr2**
Date collected **2016-05-30**	Solvent **cdcl3**	Spectrometer **Agilent-NMR-inova500**	Operator **vnmr2**

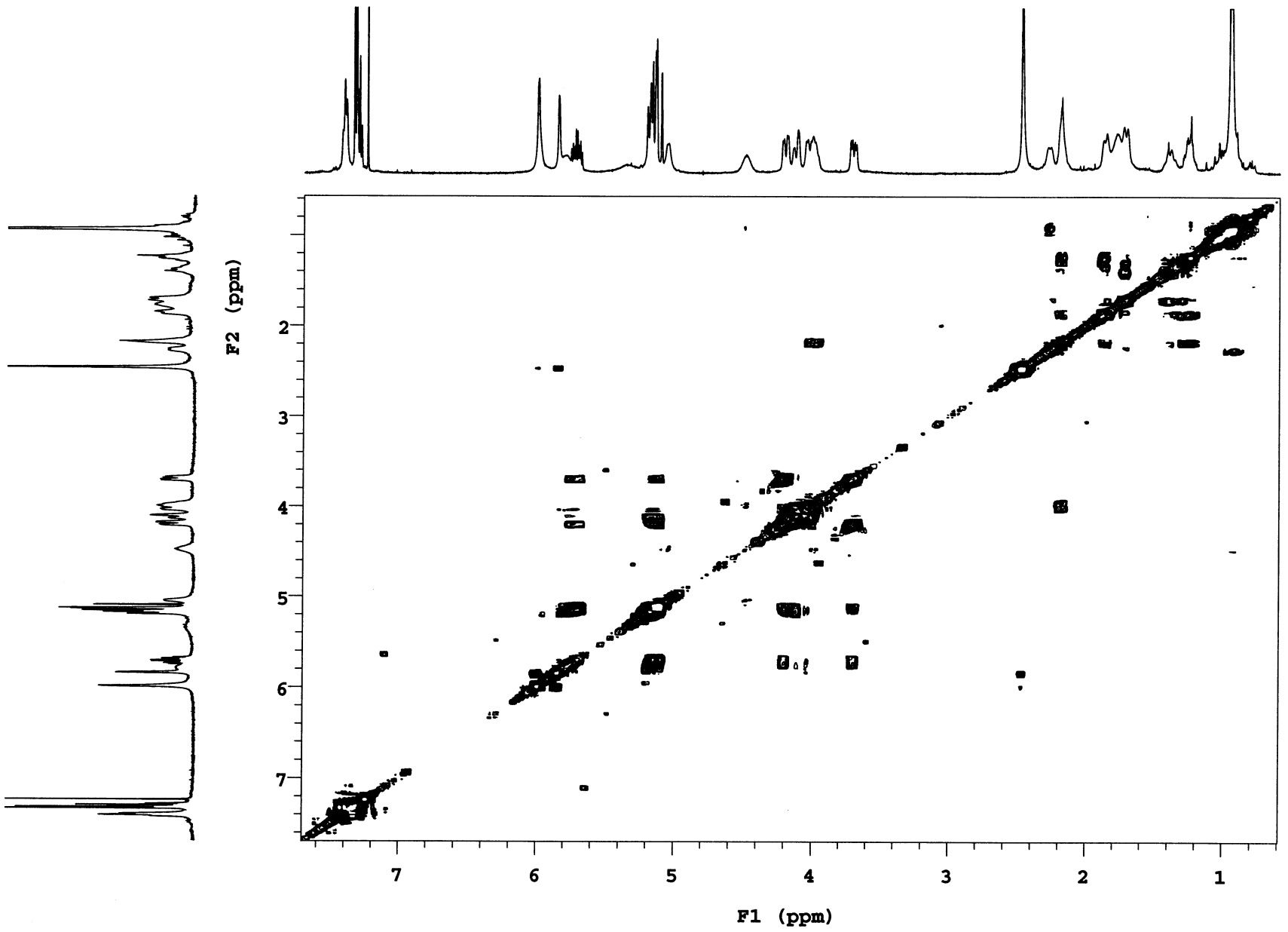


Fig S166. COSY of catalyst IX.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-182/gCOSY_01.fid

Plot date 2016-06-30

Vms-02-182

Sample Name **Vms-02-182** Pulse sequence **NOESY** Temperature **25** Study owner **vnmr2**
Date collected **2016-05-30** Solvent **cdcl3** Spectrometer **Agilent-NMR-inova500** Operator **vnmr2**

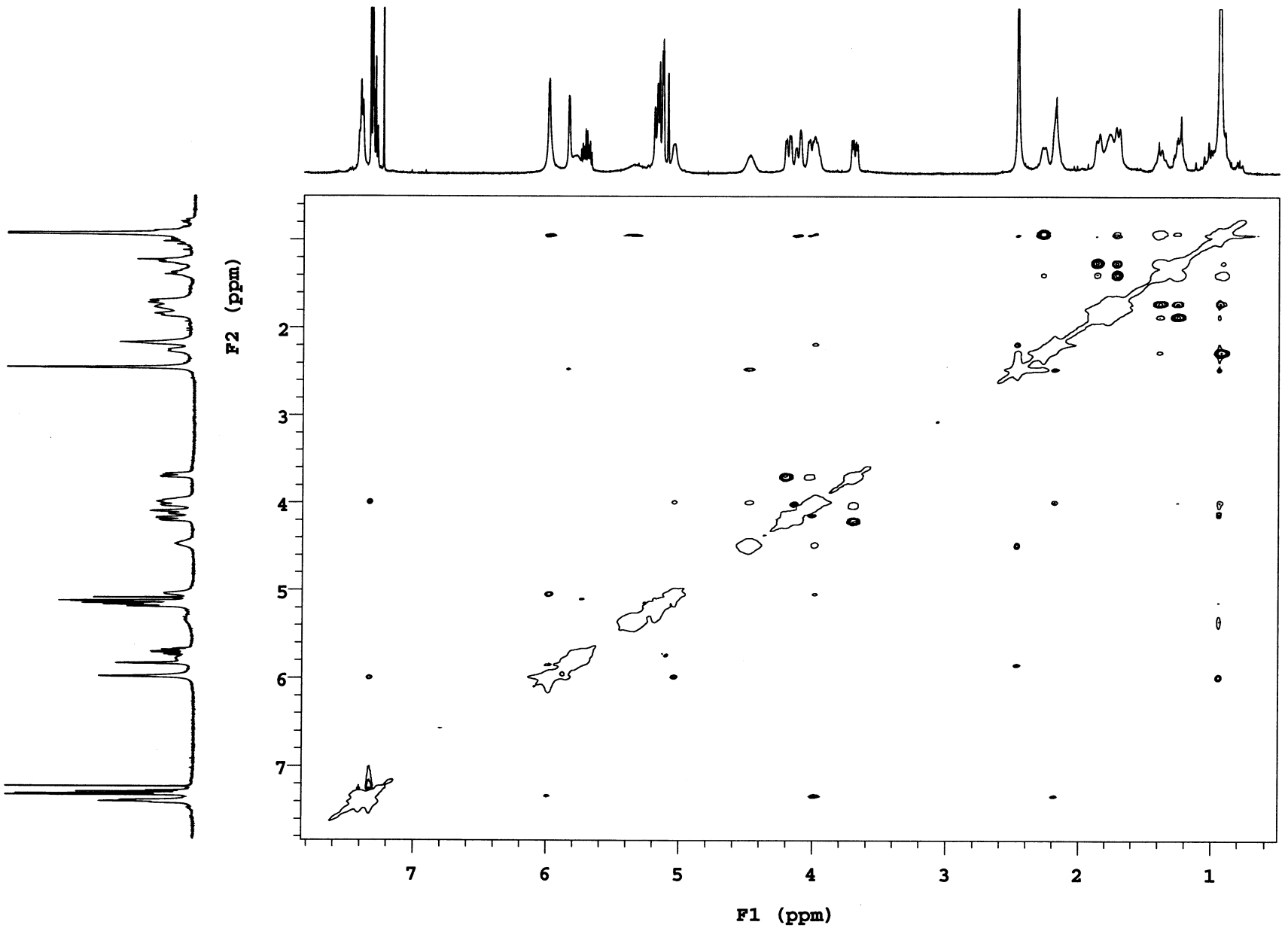


Fig S167. NOESY of catalyst IX.

Data file /home/vnmr2/vnmrsys/data/511/Vms/Vms-02-182/NOESY_01.fid

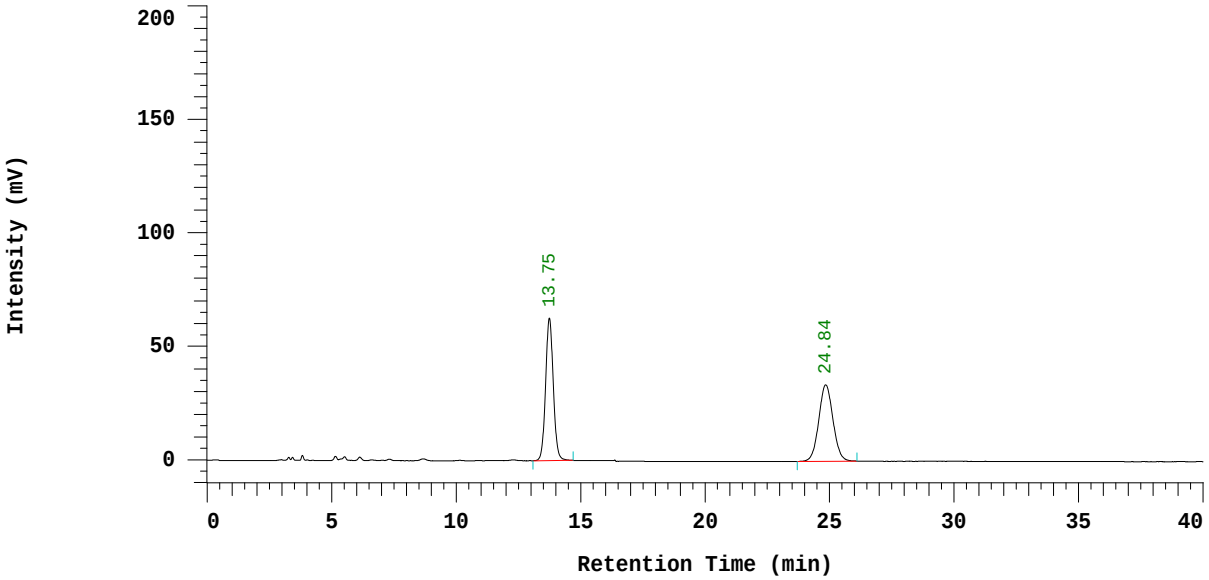
Plot date 2016-06-30

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/06/13 04:00 下午
Reported Date and Time: 2014/06/13 04:48 下午
Processed Date and Time: 2014/06/13 04:48 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0004\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0004
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-118 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	13.75	1321629	62790	49.997
2	24.84	1321762	33646	50.003
		2643391	96436	100.000

Peak rejection level: 200000

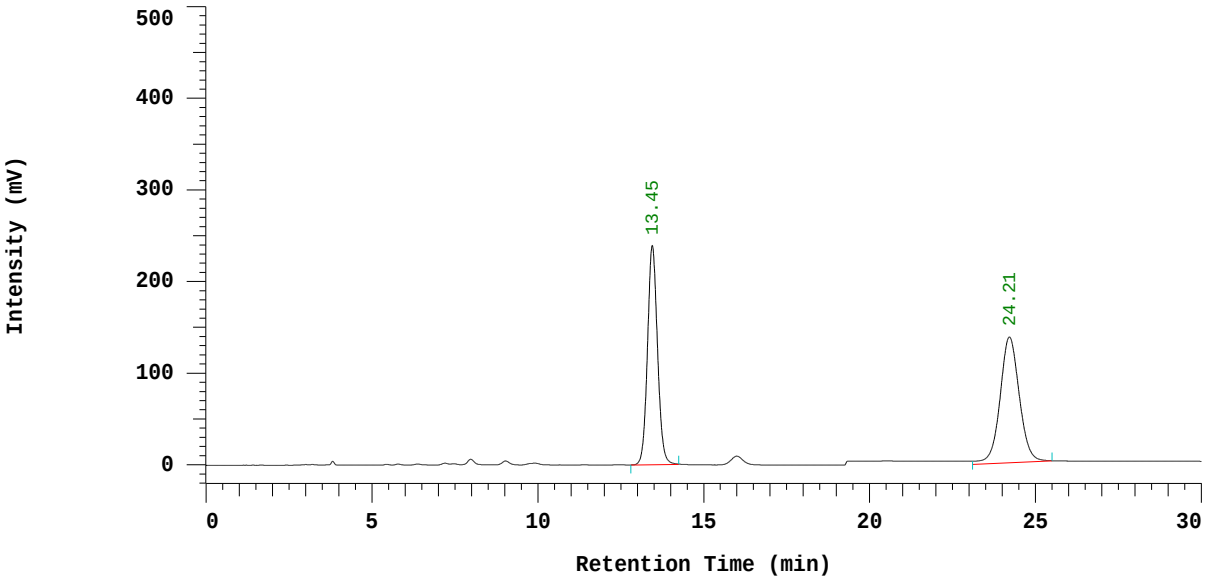
Fig S168. HPLC analysis of the racemic compound 3, for comparison (Table 1).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 06/17/2014 10:15 PM
Reported Date and Time: 11/27/2016 05:00 PM
Processed Date and Time: 11/27/2016 04:59 PM
Data Path: D:\Vishal\DATA\0006\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0006
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-114 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	13.45	4974439	239189	47.382
2	24.21	5524184	137211	52.618
		10498623	376400	100.000

Peak rejection level: 200

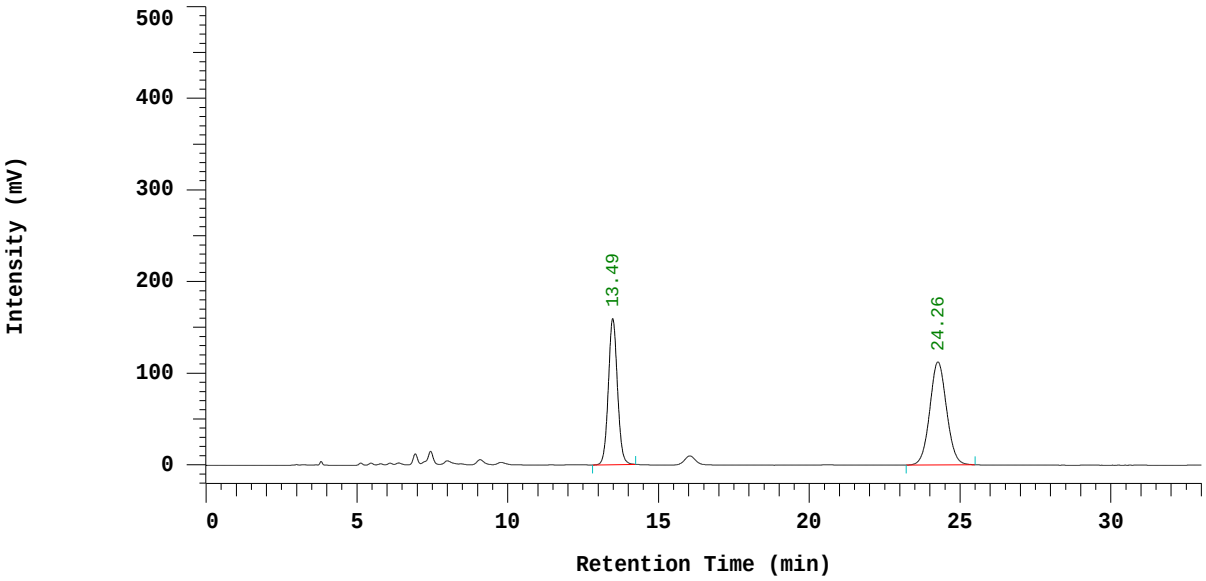
Fig S169. HPLC analysis of the chiral compound 3 obtained, (Table 1, entry 1).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 06/17/2014 09:30 PM
Reported Date and Time: 11/27/2016 04:55 PM
Processed Date and Time: 11/27/2016 04:52 PM
Data Path: D:\Vishal\DATA\0005\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0005
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-112 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	13.49	3311058	159545	43.349
2	24.26	4327153	112378	56.651
		7638211	271923	100.000

Peak rejection level: 200

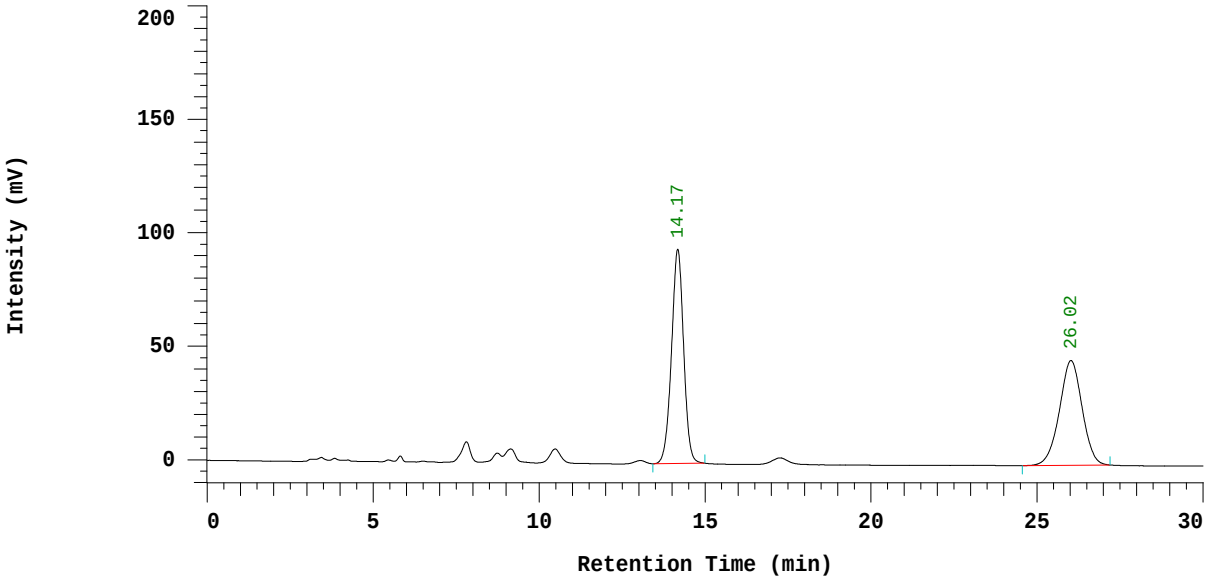
Fig S170. HPLC analysis of the chiral compound 3 obtained, (Table 1, entry 2).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/08/12 03:31 下午
Reported Date and Time: 2014/08/12 04:15 下午
Processed Date and Time: 2014/08/12 04:15 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0015\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0015
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-140 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	14.17	2369457	94344	52.060
2	26.02	2181951	46172	47.940
		4551408	140516	100.000

Peak rejection level: 200000

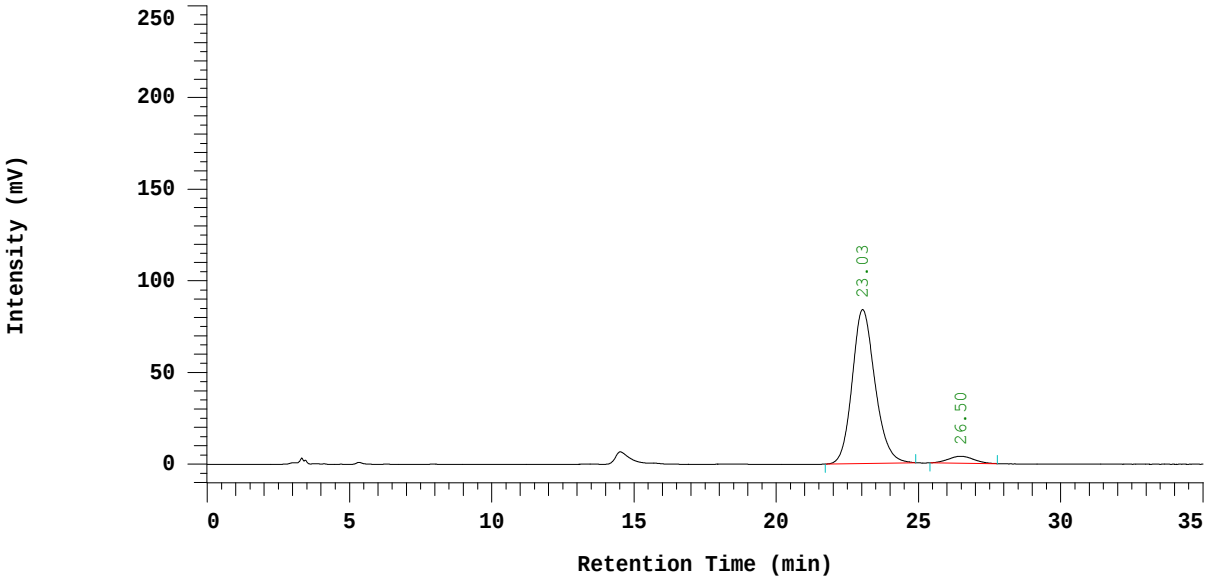
Fig S171. HPLC analysis of the chiral compound 3 obtained, (Table 1, entry 3).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/10/23 03:43 下午 Reported Date and Time: 2014/10/23 05:09 下午
Processed Date and Time: 2014/10/23 05:08 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0025\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1 Series: 0025
Application(data): Vishal Vial Number: 2
Sample Name: VMS-02-170 (Chiral) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	23.03	4665197	83961	95.156
2	26.50	237484	3836	4.844
		4902681	87797	100.000

Peak rejection level: 200000

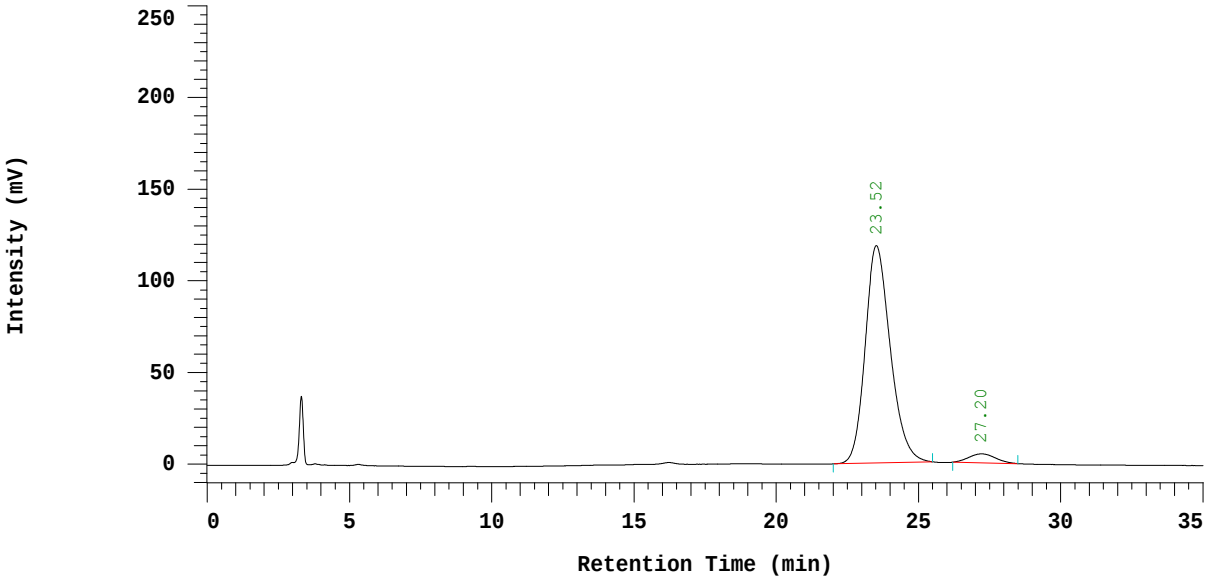
Fig S172. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 1).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/11/11 01:19 下午
Reported Date and Time: 2014/11/11 06:03 下午
Processed Date and Time: 2014/11/11 06:02 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0027\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0027
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-176 (chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	23.52	7252040	118504	95.748
2	27.20	322013	4938	4.252
		7574053	123442	100.000

Peak rejection level: 200000

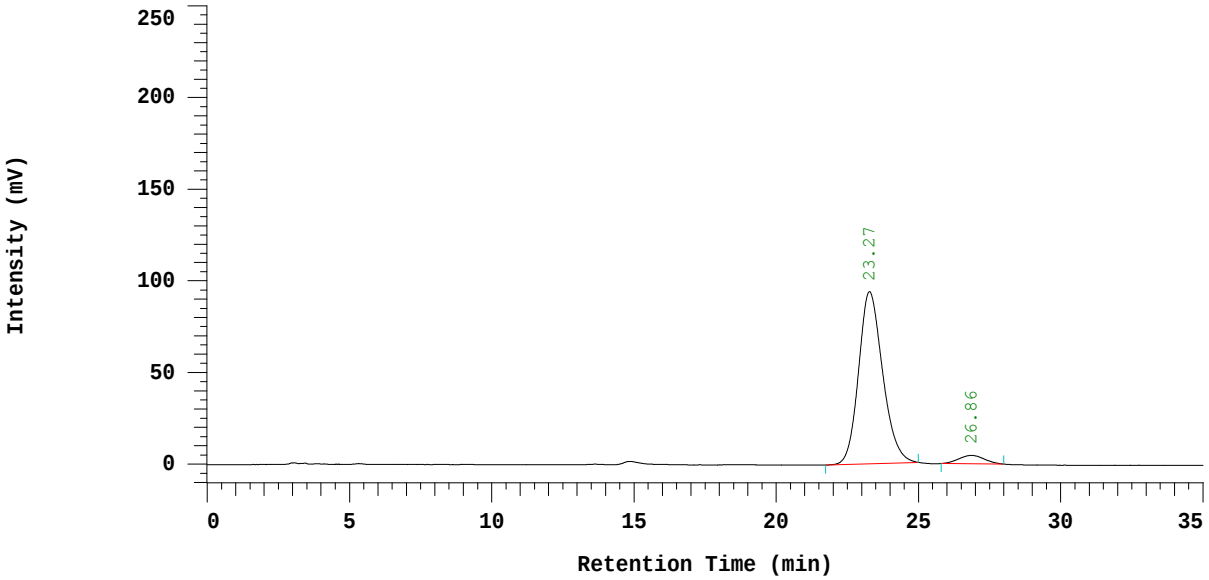
Fig S173. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 2).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/11/11 12:07 下午 Reported Date and Time: 2014/11/11 05:11 下午
Processed Date and Time: 2014/11/11 05:11 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0028\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1 Series: 0028
Application(data): Vishal Vial Number: 1
Sample Name: VMS-02-177 (chiral) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	23.27	5501566	93895	95.089
2	26.86	284160	4579	4.911
		5785726	98474	100.000

Peak rejection level: 200000

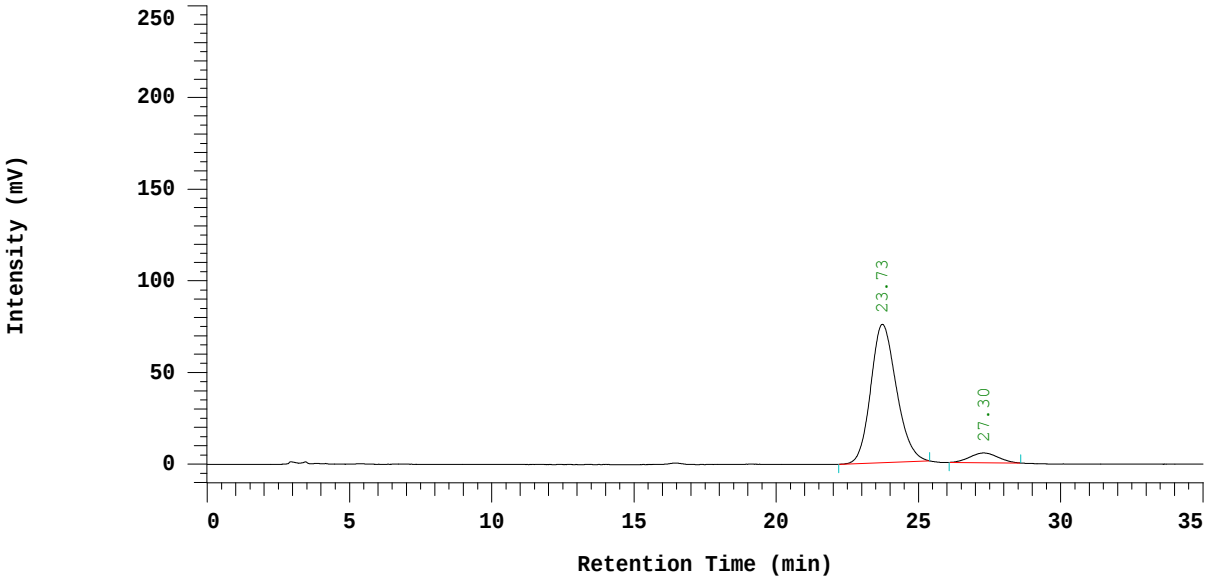
Fig S174. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 3)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/11/11 02:13 下午 Reported Date and Time: 2014/11/11 05:17 下午
Processed Date and Time: 2014/11/11 05:16 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0029\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1 Series: 0029
Application(data): Vishal Vial Number: 1
Sample Name: VMS-02-178 (chiral) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	23.73	4708871	75414	92.675
2	27.30	372179	5398	7.325
		5081050	80812	100.000

Peak rejection level: 200000

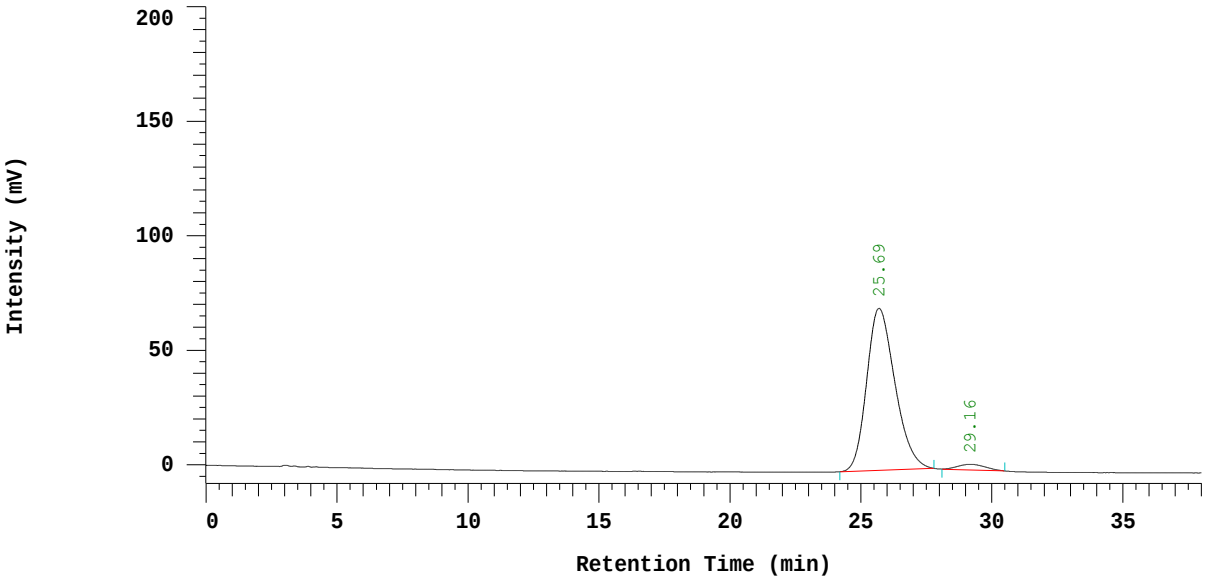
Fig S175. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 4)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 12/15/2014 04:34 PM
Reported Date and Time: 05/14/2016 05:44 PM
Processed Date and Time: 05/14/2016 05:42 PM
Data Path: D:\Vishal\DATA\0032\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0032
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-185 (chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.69	5280223	70680	96.758
2	29.16	176921	2431	3.242
		5457144	73111	100.000

Peak rejection level: 200

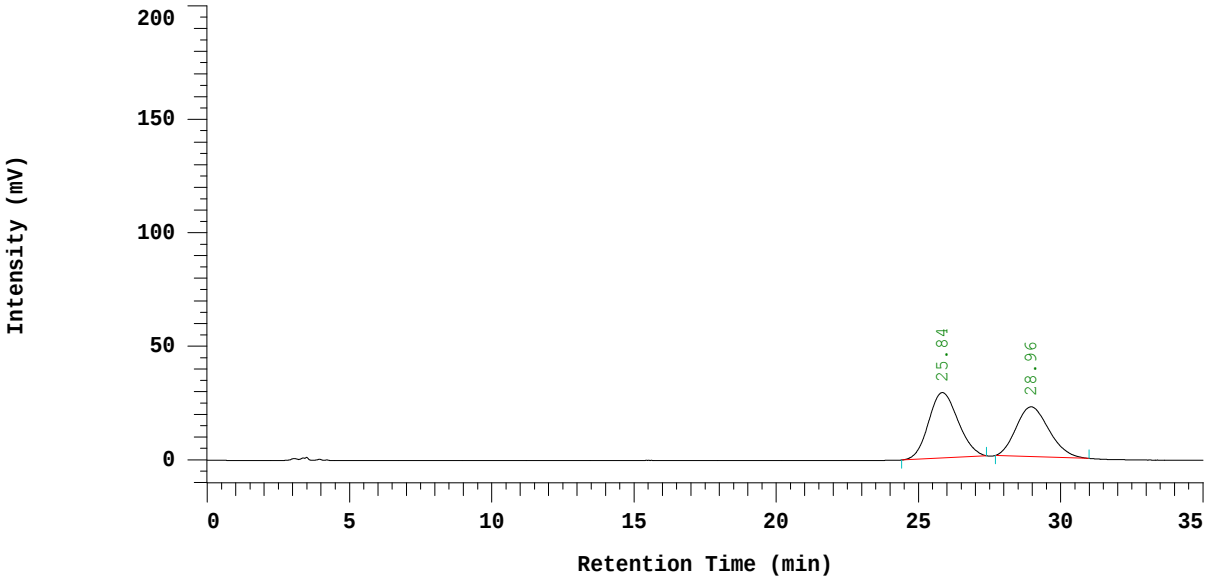
Fig S176. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 5)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/12/15 03:22 下午
Reported Date and Time: 2014/12/16 02:35 下午
Processed Date and Time: 2014/12/16 02:33 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0033\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1 Series: 0033
Application(data): Vishal Vial Number: 1
Sample Name: VMS-02-187 (chiral) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.84	2061647	28778	53.977
2	28.96	1757846	21928	46.023
		3819493	50706	100.000

Peak rejection level: 200000

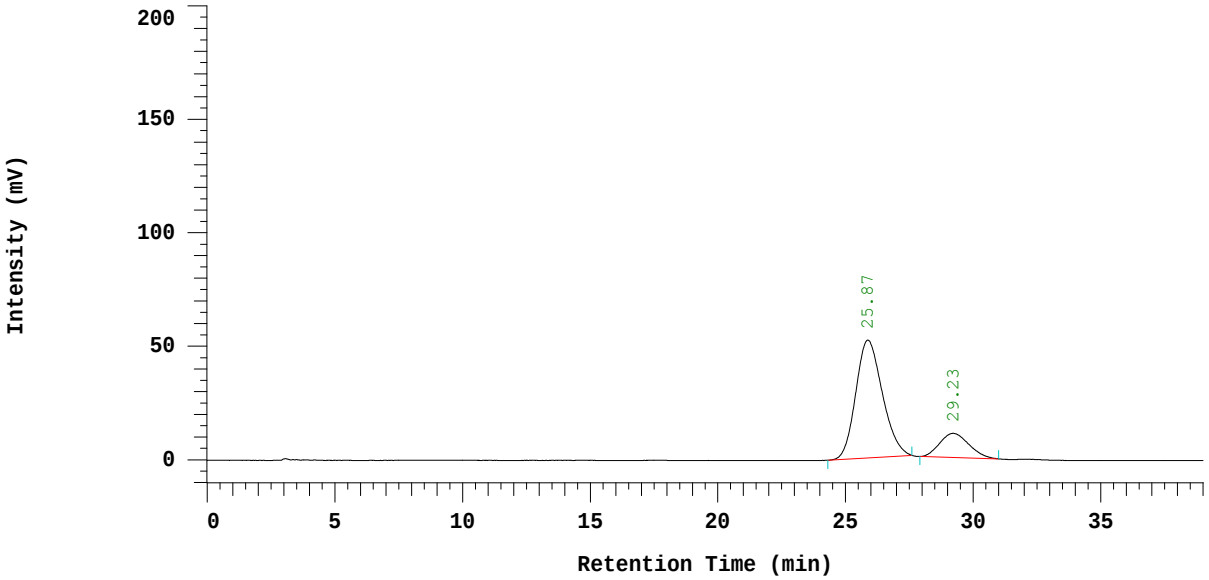
Fig S177. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 10)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/12/15 06:10 下午 Reported Date and Time: 2014/12/16 03:40 下午
Processed Date and Time: 2014/12/16 03:39 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0034\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1 Series: 0034
Application(data): Vishal Vial Number: 1
Sample Name: VMS-02-189 (chiral) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.87	3742431	51867	81.608
2	29.23	843453	10666	18.392
		4585884	62533	100.000

Peak rejection level: 200000

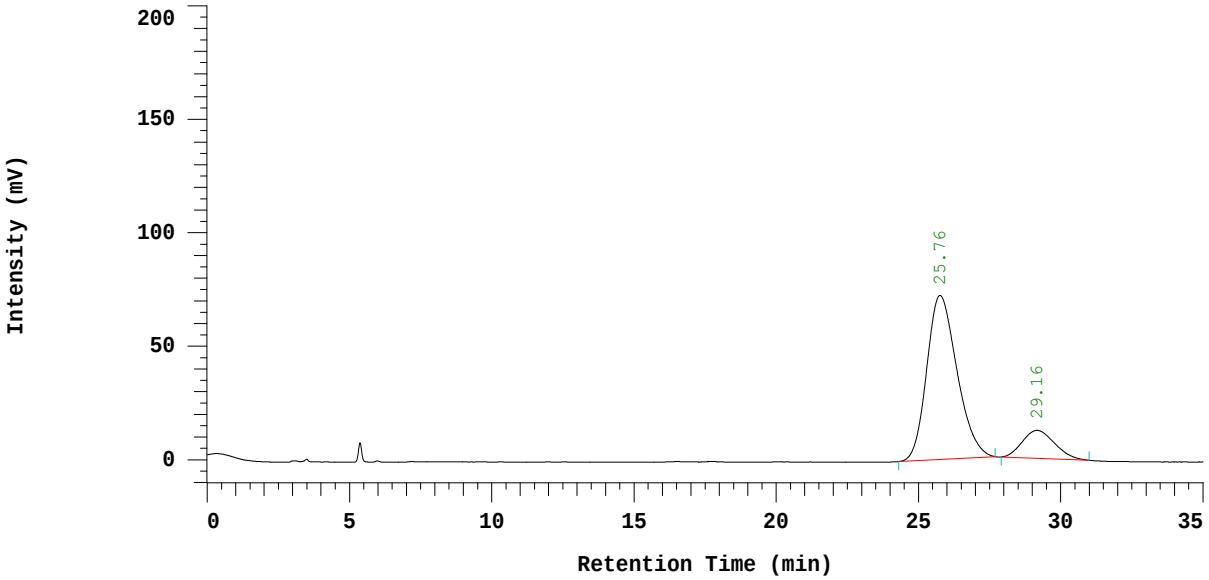
Fig S178. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 11)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2014/12/15 06:58 下午 Reported Date and Time: 2014/12/16 03:45 下午
Processed Date and Time: 2014/12/16 03:43 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0035\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1 Series: 0035
Application(data): Vishal Vial Number: 1
Sample Name: VMS-02-190 (chiral) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.76	5297594	72196	84.455
2	29.16	975095	12344	15.545
		6272689	84540	100.000

Peak rejection level: 200000

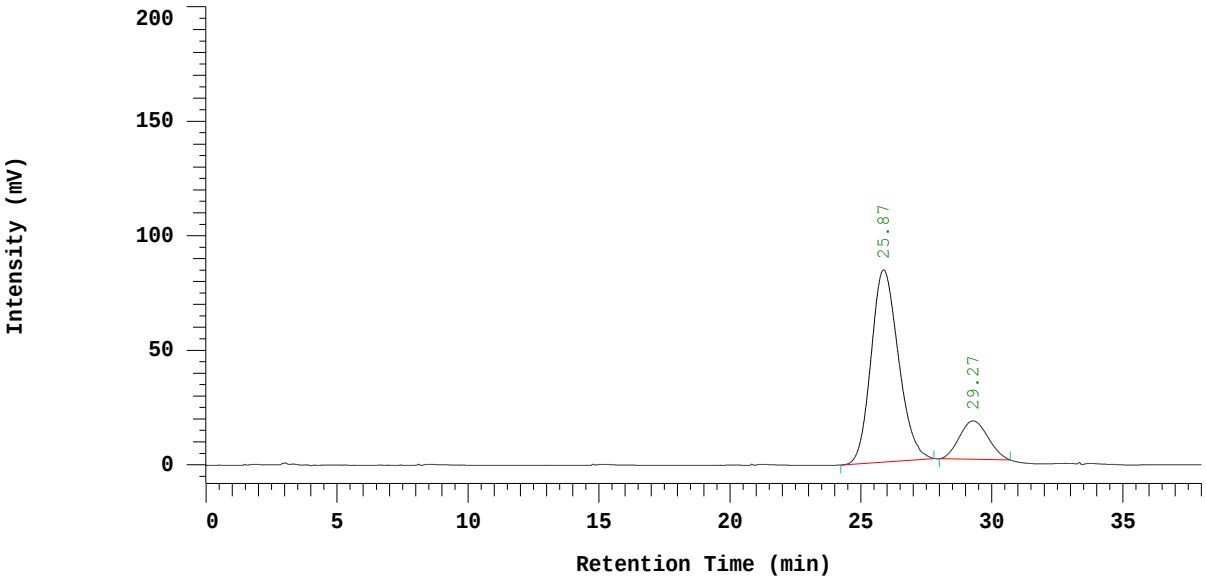
Fig S179. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 12)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/06/2015 06:40 PM
Reported Date and Time: 05/14/2016 06:07 PM
Processed Date and Time: 05/14/2016 06:06 PM
Data Path: D:\Vishal\DATA\0038\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0038
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-194 (chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.87	6060854	83901	82.729
2	29.27	1265296	16756	17.271
		7326150	100657	100.000

Peak rejection level: 200

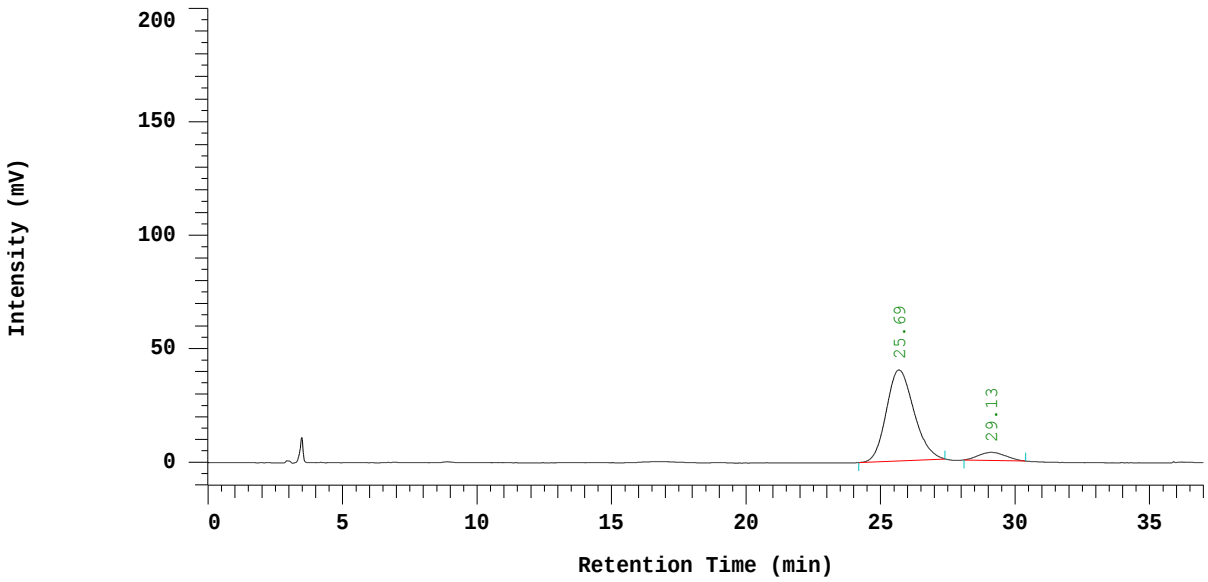
Fig S180. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 13)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/06/2015 03:49 PM
Reported Date and Time: 05/24/2016 11:36 AM
Processed Date and Time: 05/24/2016 11:35 AM
Data Path: D:\Vishal\DATA\0037\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0037
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-195 (chiral) -30 degree
Vial Type: UNK
Volume: 20.0 ul
Injection from this vial: 1 of 1
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.69	2839140	40067	91.995
2	29.13	247043	3545	8.005
		3086183	43612	100.000

Peak rejection level: 200

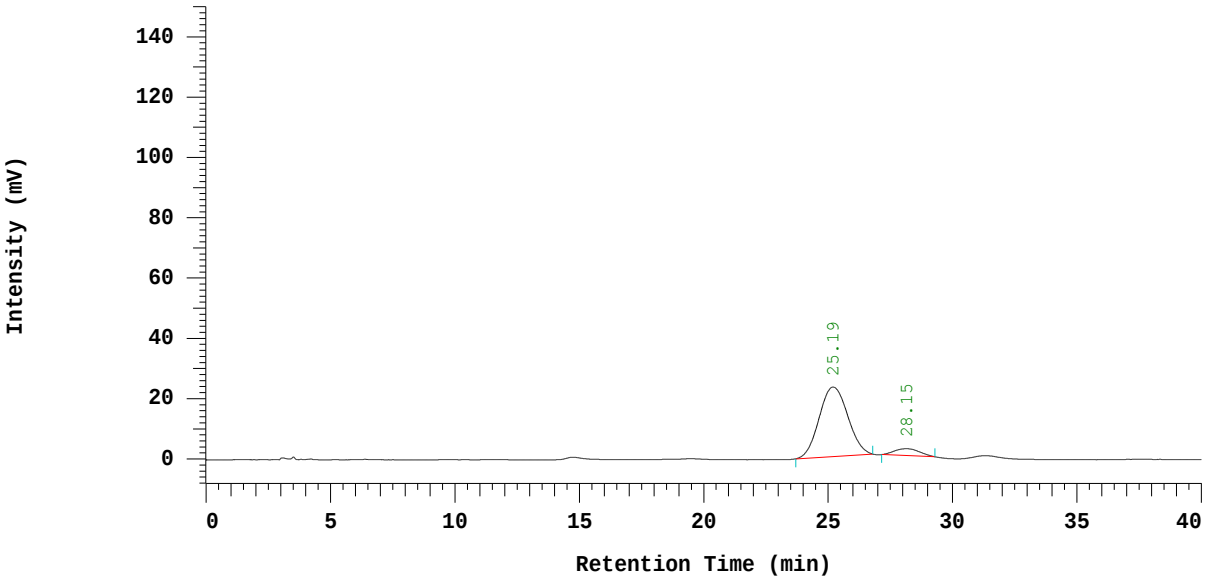
Fig S181. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 14)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 03/14/2016 05:02 PM
Reported Date and Time: 05/14/2016 06:22 PM
Processed Date and Time: 05/14/2016 06:21 PM
Data Path: D:\Vishal\DATA\0105\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0105
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-104 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.19	1832986	23034	91.943
2	28.15	160615	2295	8.057
		1993601	25329	100.000

Peak rejection level: 200

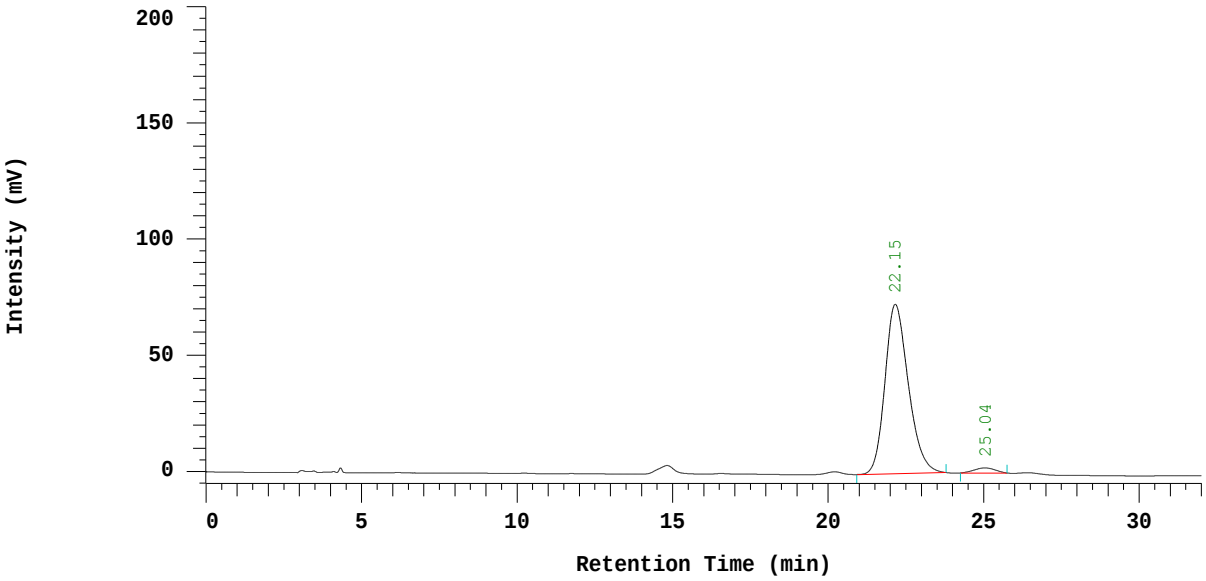
Fig S182. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 15)

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 02:07 AM
Reported Date and Time: 05/14/2016 04:29 PM
Processed Date and Time: 05/14/2016 04:28 PM
Data Path: D:\Vishal\DATA\0108\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0108
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-82 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.15	3794976	72846	97.409
2	25.04	100938	2167	2.591
		3895914	75013	100.000

Peak rejection level: 200

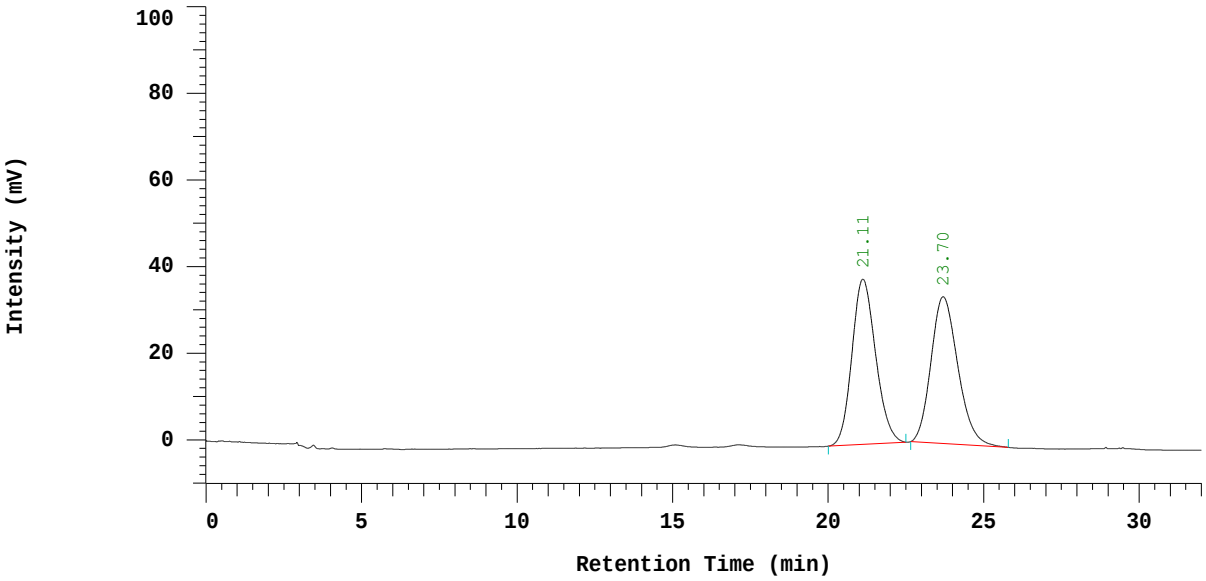
Fig S183. HPLC analysis of the chiral compound 6 obtained (Table 2, entry 16).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 01:34 AM
Reported Date and Time: 05/14/2016 04:10 PM
Processed Date and Time: 05/14/2016 04:08 PM
Data Path: D:\Vishal\DATA\0107\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0107
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-82 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	21.11	2012084	38115	49.794
2	23.70	2028757	33882	50.206
		4040841	71997	100.000

Peak rejection level: 200

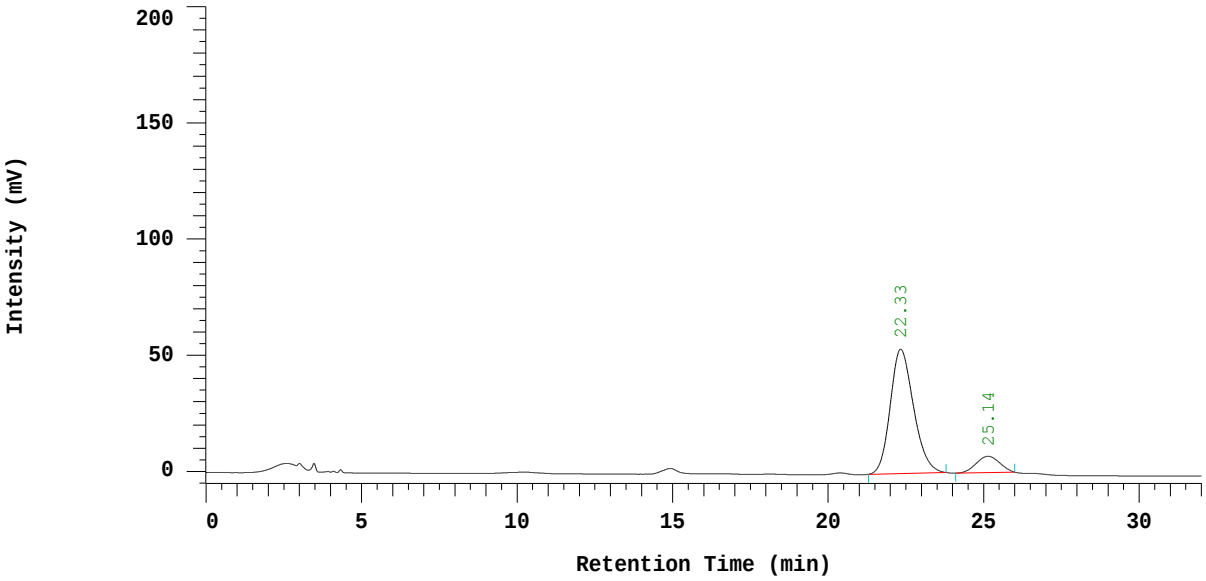
Fig S184. HPLC analysis of the racemic compound 6 obtained, for comparison (Table 2, entry 16).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 02:40 AM
Reported Date and Time: 05/14/2016 04:37 PM
Processed Date and Time: 05/14/2016 04:37 PM
Data Path: D:\Vishal\DATA\0109\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0109
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-03-82 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.33	2772258	53455	88.317
2	25.14	366712	7017	11.683
		3138970	60472	100.000

Peak rejection level: 200

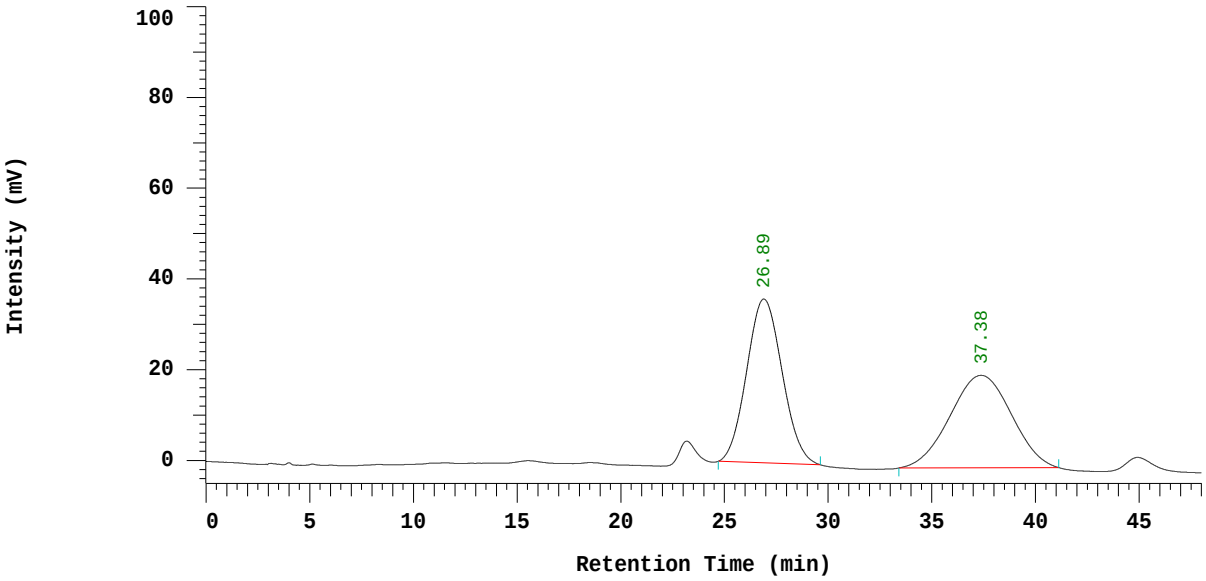
Fig S185. HPLC analysis of the co-injection of racemic and chiral compound 6 obtained, for comparison (Table 2, entry 16).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/15/2016 01:16 PM
Reported Date and Time: 02/19/2016 04:04 PM
Processed Date and Time: 02/19/2016 04:04 PM
Data Path: D:\Vishal\DATA\0010\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0010
Application(data): Vishal
Vial Number: 1
Sample Name: Vms-02-93 (racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	26.89	4276846	36095	50.517
2	37.38	4189227	20385	49.483
		8466073	56480	100.000

Peak rejection level: 200

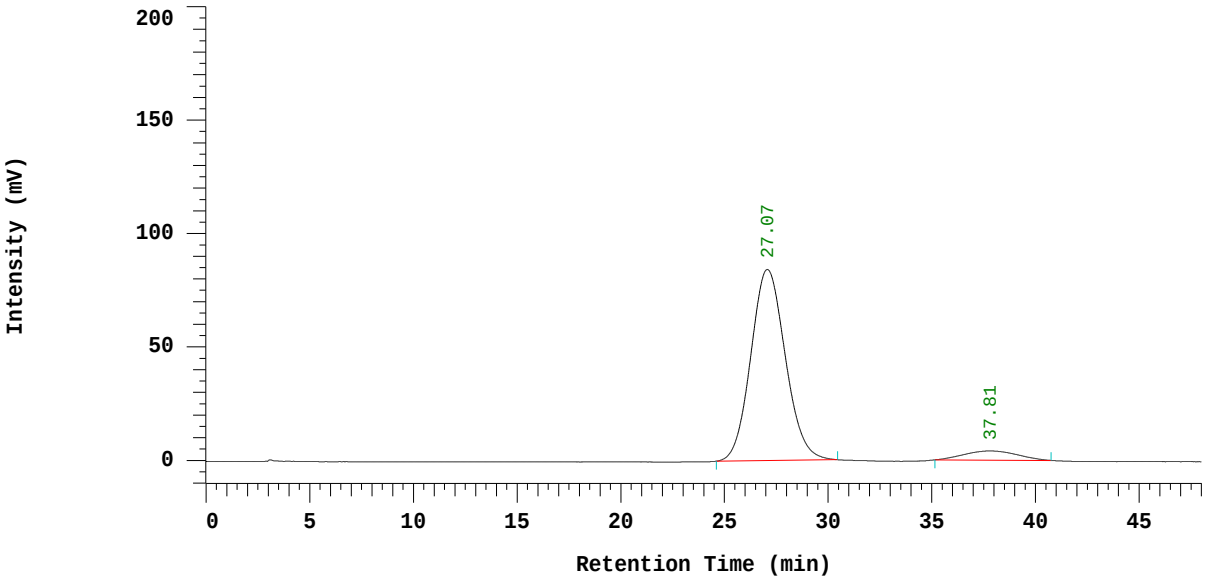
Fig S186. HPLC analysis of the racemic compound 7, for comparison (Table 3, entry 1).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/15/2016 02:05 PM
Reported Date and Time: 02/19/2016 04:15 PM
Processed Date and Time: 02/19/2016 04:15 PM
Data Path: D:\Vishal\DATA\0011\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0011
Application(data): Vishal
Vial Number: 2
Sample Name: Vms-02-93 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	27.07	9693128	84224	93.099
2	37.81	718542	4042	6.901
		10411670	88266	100.000

Peak rejection level: 200

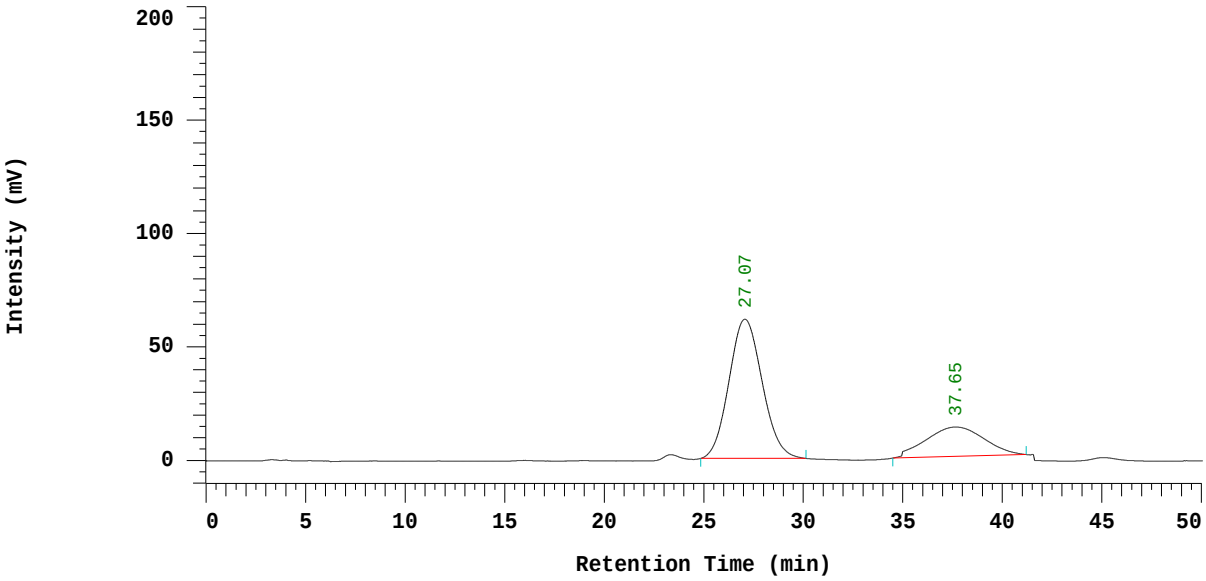
Fig S187. HPLC analysis of the chiral compound 7 obtained (Table 3, entry 1).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/15/2016 12:54 PM
Reported Date and Time: 02/19/2016 03:35 PM
Processed Date and Time: 02/19/2016 03:35 PM
Data Path: D:\Vishal\DATA\0012\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0012
Application(data): Vishal
Vial Number: 3
Sample Name: Vms-02-93 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	27.07	7076176	61329	72.937
2	37.65	2625599	12958	27.063
		9701775	74287	100.000

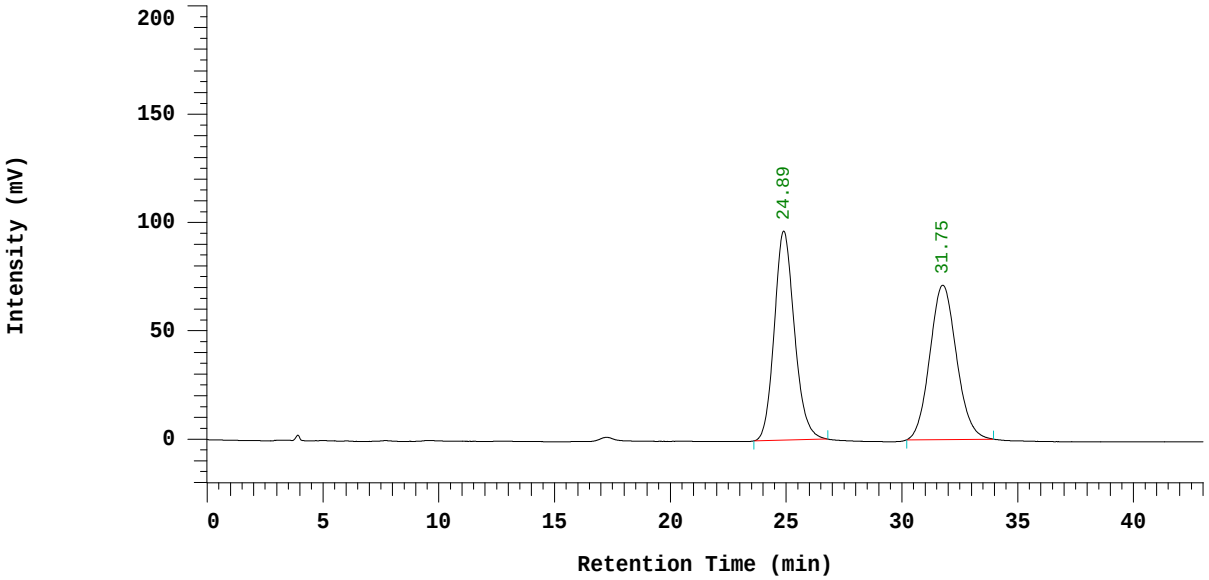
Peak rejection level: 200

Fig S188. HPLC analysis of the co-injection of racemic and chiral compound 7 obtained, for comparison (Table 3, entry 1).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2015/12/23 03:54 下午 Reported Date and Time: 2015/12/24 03:08 下午
Processed Date and Time: 2015/12/24 03:08 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0090\
Processing Method: test-IPA/Hx
System (acquisition): Sys 1 Series: 0090
Application(data): Vishal Vial Number: 1
Sample Name: VMS-03-77 (Racemic) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx
Column Type: ODH Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	24.89	5773328	96406	50.487
2	31.75	5661936	71249	49.513
		11435264	167655	100.000

Peak rejection level: 200000

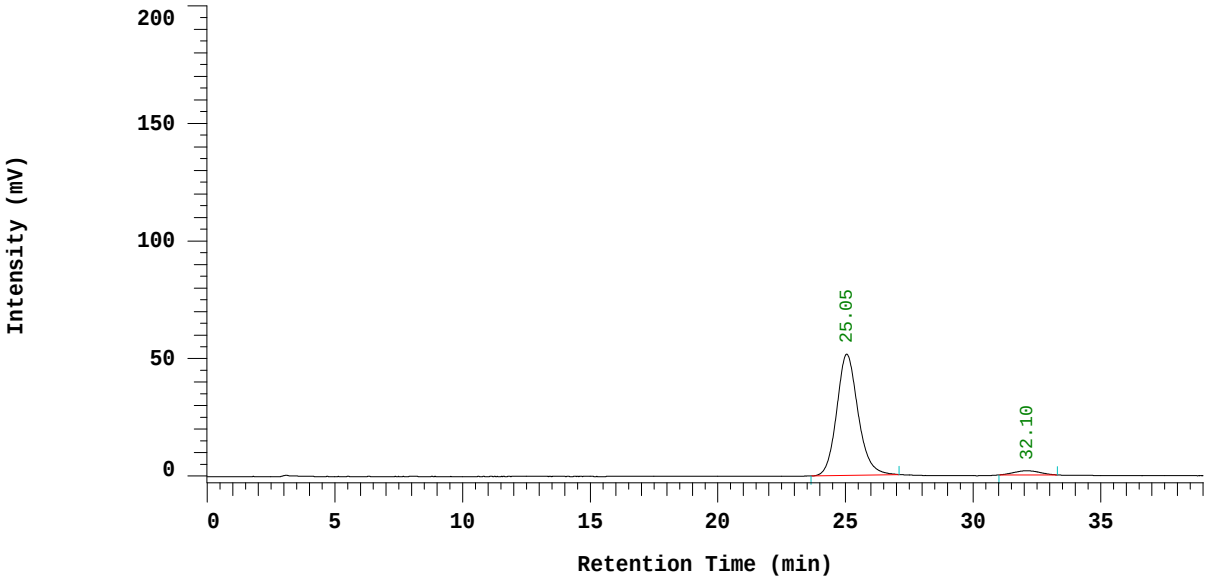
Fig S189. HPLC analysis of the racemic compound 8, for comparison (Table 3, entry 2).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2015/12/23 04:38 下午
Reported Date and Time: 2015/12/24 03:19 下午
Processed Date and Time: 2015/12/24 03:18 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0091\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1 Series: 0091
Application(data): Vishal Vial Number: 2
Sample Name: VMS-03-77 (Chiral) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx
Column Type: ODH Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.05	2979369	51548	95.930
2	32.10	126415	1820	4.070
		3105784	53368	100.000

Peak rejection level: 200

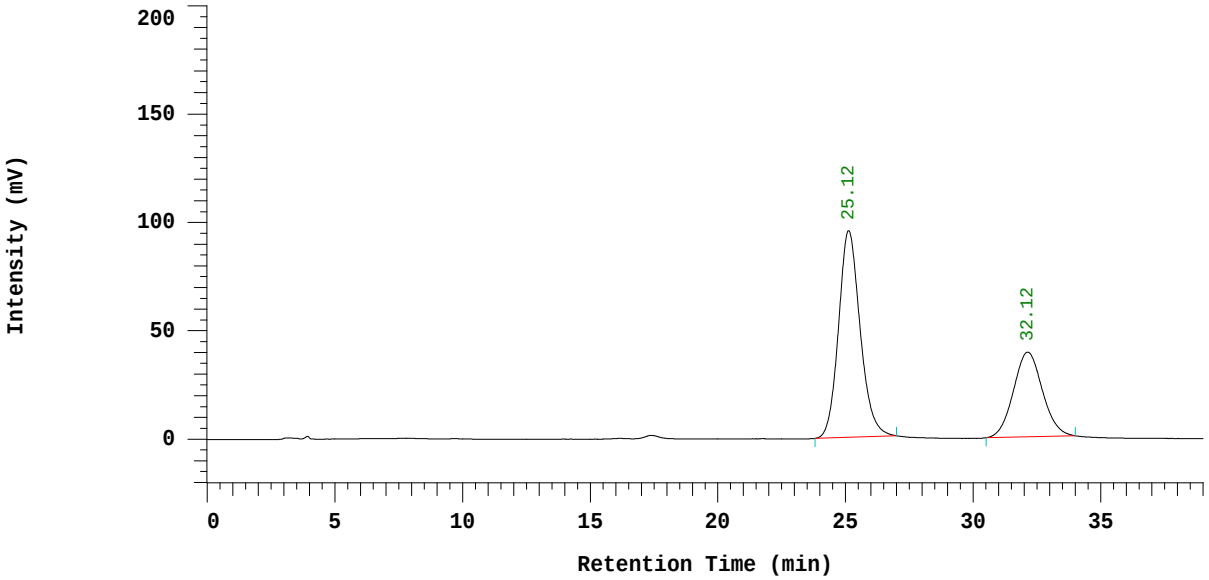
Fig S190. HPLC analysis of the chiral compound 8 obtained (Table 3, entry 2).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2015/12/23 05:18 下午 Reported Date and Time: 2015/12/24 03:21 下午
Processed Date and Time: 2015/12/24 03:21 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0092\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1 Series: 0092
Application(data): Vishal Vial Number: 3
Sample Name: VMS-03-77 (Co) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx
Column Type: ODH Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.12	5561870	95329	64.470
2	32.12	3065152	39008	35.530
		8627022	134337	100.000

Peak rejection level: 200000

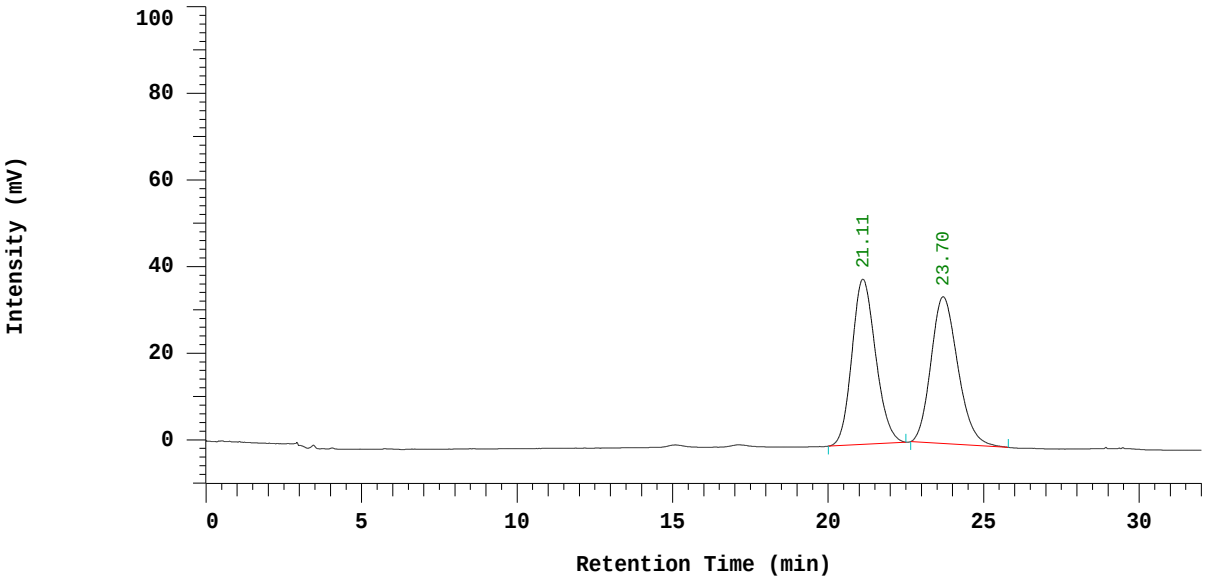
Fig S191. HPLC analysis of the co-injection of racemic and chiral compound 8 obtained, for comparison (Table 3, entry 2).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 01:34 AM
Reported Date and Time: 05/14/2016 04:10 PM
Processed Date and Time: 05/14/2016 04:08 PM
Data Path: D:\Vishal\DATA\0107\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0107
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-82 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	21.11	2012084	38115	49.794
2	23.70	2028757	33882	50.206
		4040841	71997	100.000

Peak rejection level: 200

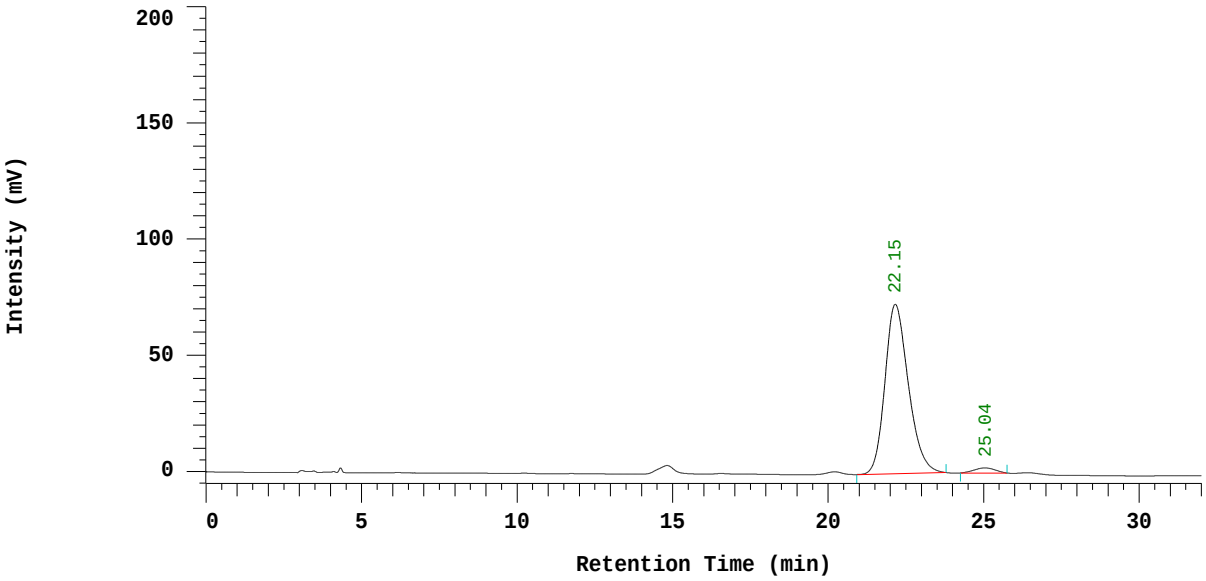
Fig S192. HPLC analysis of the racemic compound 6, for comparison (Table 3, entry 3).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 02:07 AM
Reported Date and Time: 05/14/2016 04:29 PM
Processed Date and Time: 05/14/2016 04:28 PM
Data Path: D:\Vishal\DATA\0108\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0108
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-82 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.15	3794976	72846	97.409
2	25.04	100938	2167	2.591
		3895914	75013	100.000

Peak rejection level: 200

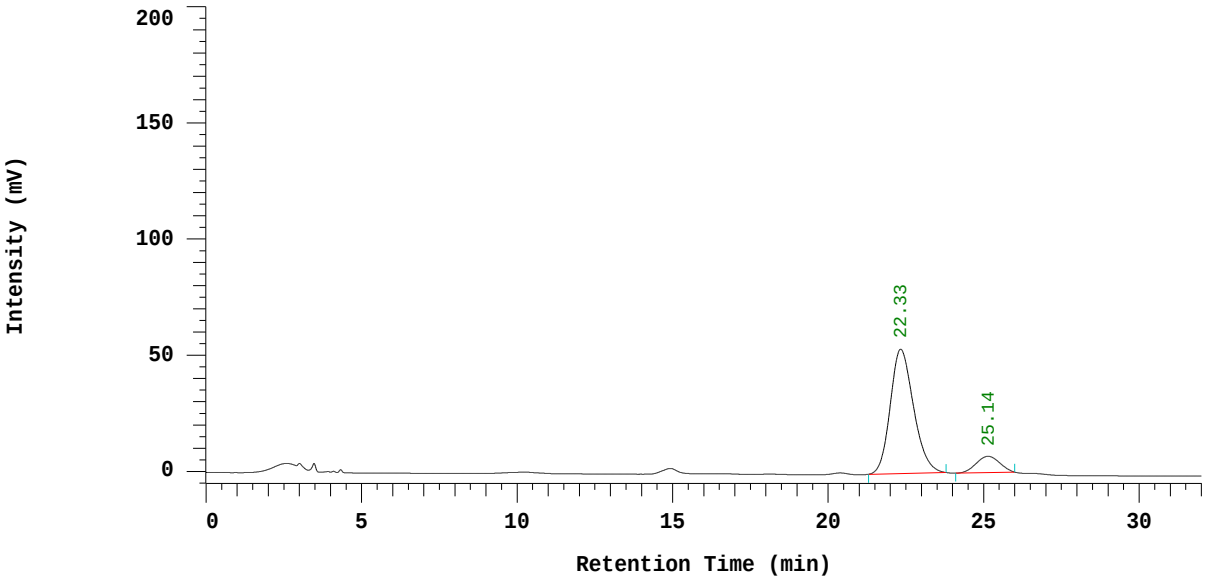
Fig S193. HPLC analysis of the chiral compound 6 obtained (Table 3, entry 3).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 02:40 AM
Reported Date and Time: 05/14/2016 04:37 PM
Processed Date and Time: 05/14/2016 04:37 PM
Data Path: D:\Vishal\DATA\0109\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0109
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-03-82 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.33	2772258	53455	88.317
2	25.14	366712	7017	11.683
		3138970	60472	100.000

Peak rejection level: 200

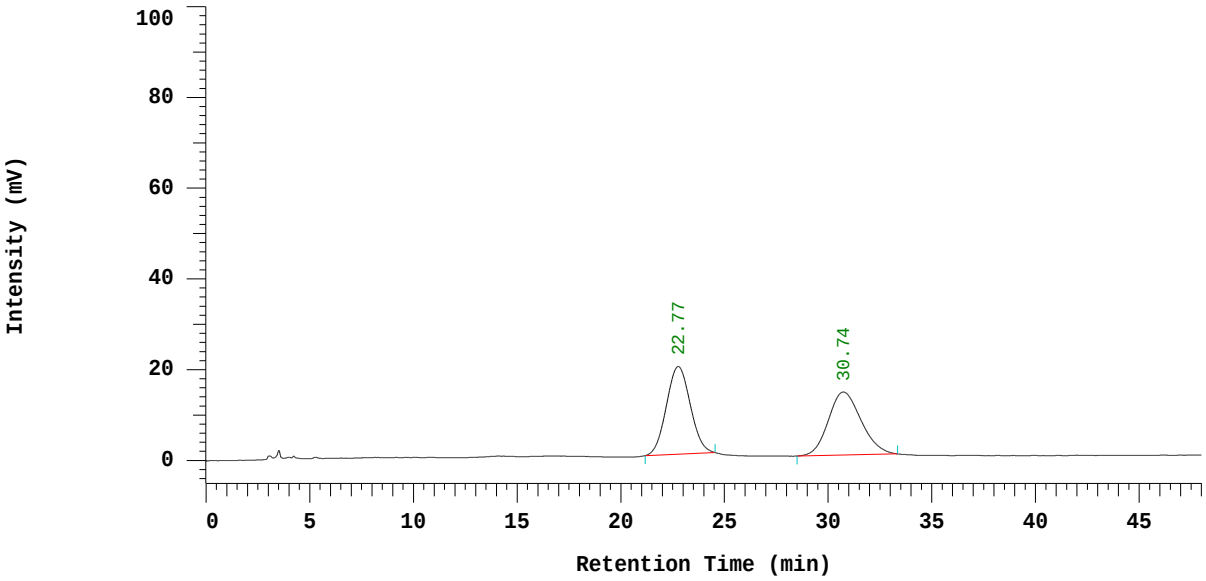
Fig S194. HPLC analysis of the co-injection of racemic and chiral compound 6 obtained, for comparison (Table 3, entry 3).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/18/2016 09:38 PM
Reported Date and Time: 01/18/2016 11:14 PM
Processed Date and Time: 01/18/2016 11:13 PM
Data Path: D:\Vishal\DATA\0004\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0004
Application(data): Vishal
Vial Number: 1
Sample Name: Vms-02-86 (racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.77	1538422	19308	50.387
2	30.74	1514814	13880	49.613
		3053236	33188	100.000

Peak rejection level: 200000

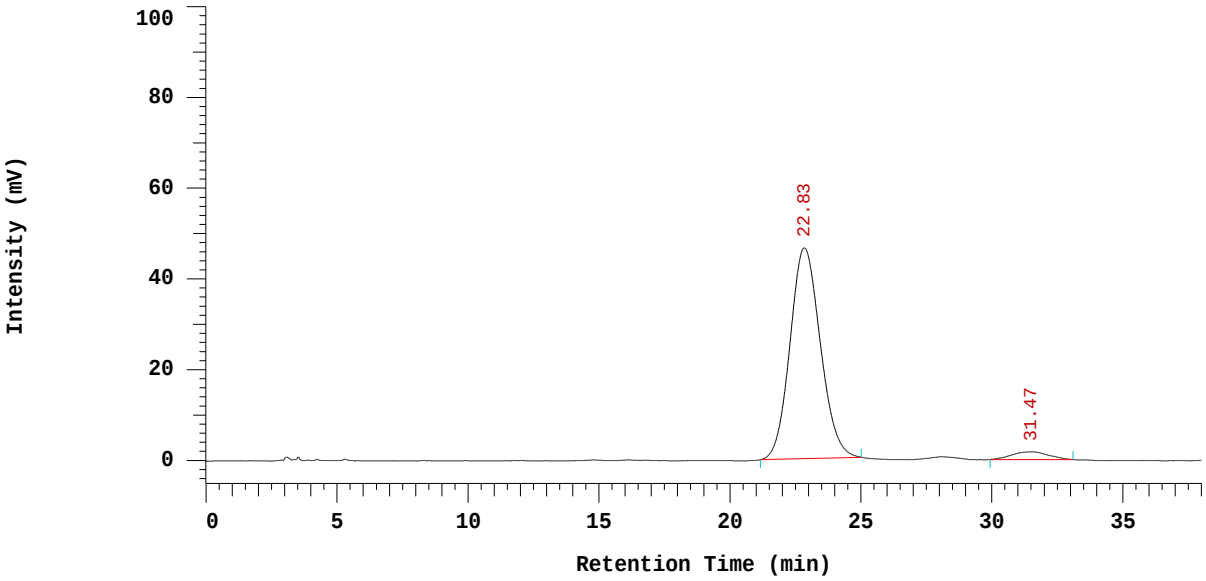
Fig S195. HPLC analysis of the racemic compound 9, for comparison (Table 3, entry 4).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/18/2016 10:28 PM
Reported Date and Time: 01/18/2016 11:23 PM
Processed Date and Time: 01/18/2016 11:21 PM
Data Path: D:\Vishal\DATA\0005\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0005
Application(data): Vishal
Vial Number: 2
Sample Name: Vms-02-86 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.83	3722748	46434	95.758
2	31.47	164898	1707	4.242
		3887646	48141	100.000

Peak rejection level: 200

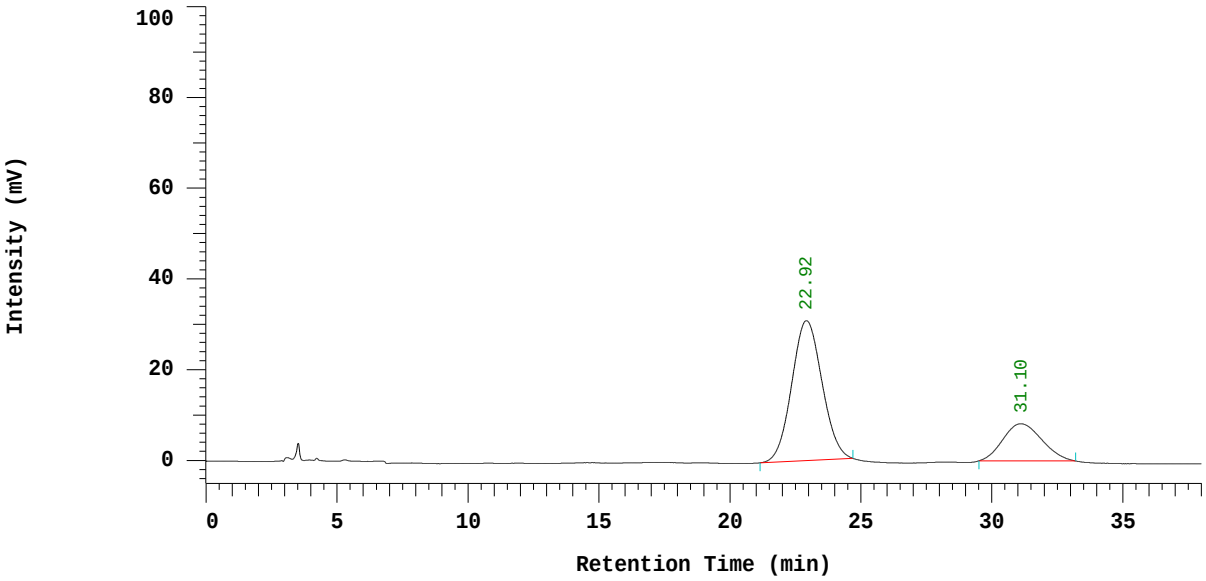
Fig S196. HPLC analysis of the chiral compound 9 obtained (Table 3, entry 4).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/18/2016 11:07 PM
Reported Date and Time: 01/18/2016 11:54 PM
Processed Date and Time: 01/18/2016 11:54 PM
Data Path: D:\Vishal\DATA\0006\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0006
Application(data): Vishal
Vial Number: 3
Sample Name: Vms-02-86 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.92	2468967	30831	74.532
2	31.10	843644	8178	25.468
		3312611	39009	100.000

Peak rejection level: 200

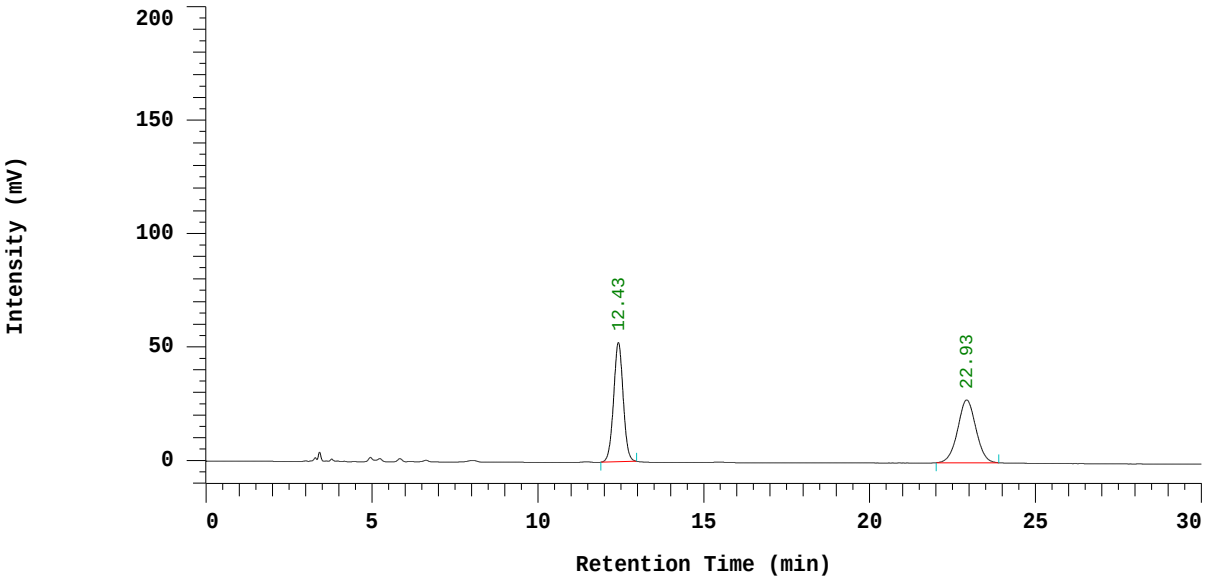
Fig S197. HPLC analysis of the co-injection of racemic and chiral compound 9 obtained, for comparison (Table 3, entry 4).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/26/2016 04:25 PM
Reported Date and Time: 05/26/2016 05:27 PM
Processed Date and Time: 05/26/2016 05:25 PM
Data Path: D:\Vishal\DATA\0119\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0119
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-126 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.43	1045912	52593	49.848
2	22.93	1052299	27685	50.152
		2098211	80278	100.000

Peak rejection level: 200000

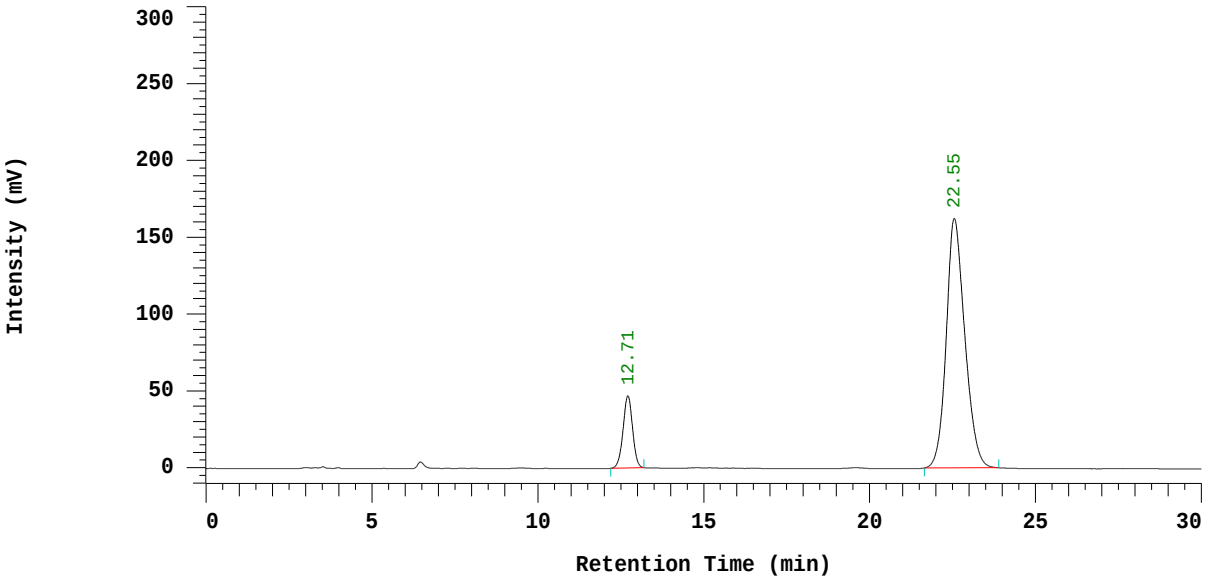
Fig S198. HPLC analysis of the racemic compound 3, for comparison (Table 3, entry 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 06/04/2016 04:05 PM
Reported Date and Time: 06/04/2016 04:42 PM
Processed Date and Time: 06/04/2016 04:41 PM
Data Path: D:\Vishal\DATA\0127\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0127
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-126 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.71	928066	47025	12.870
2	22.55	6282838	162336	87.130
		7210904	209361	100.000

Peak rejection level: 100000

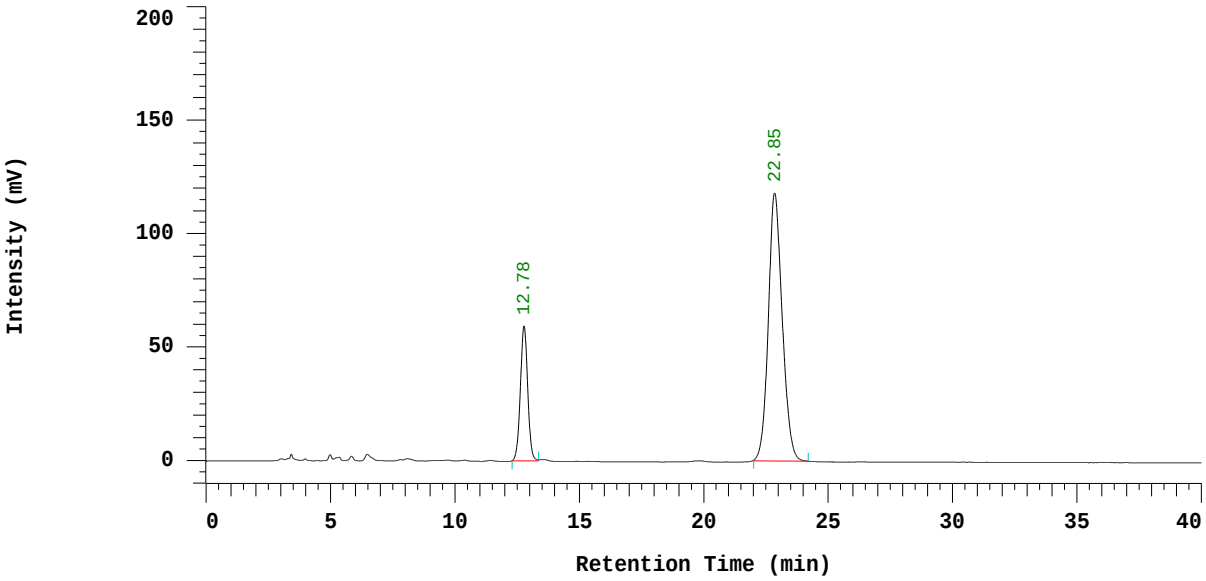
Fig S199. HPLC analysis of the chiral compound 3 obtained (Table 3, entry 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 06/04/2016 04:36 PM
Reported Date and Time: 06/04/2016 05:19 PM
Processed Date and Time: 06/04/2016 05:18 PM
Data Path: D:\Vishal\DATA\0128\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0128
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-03-126 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.78	1195196	59471	20.827
2	22.85	4543626	117992	79.173
		5738822	177463	100.000

Peak rejection level: 100000

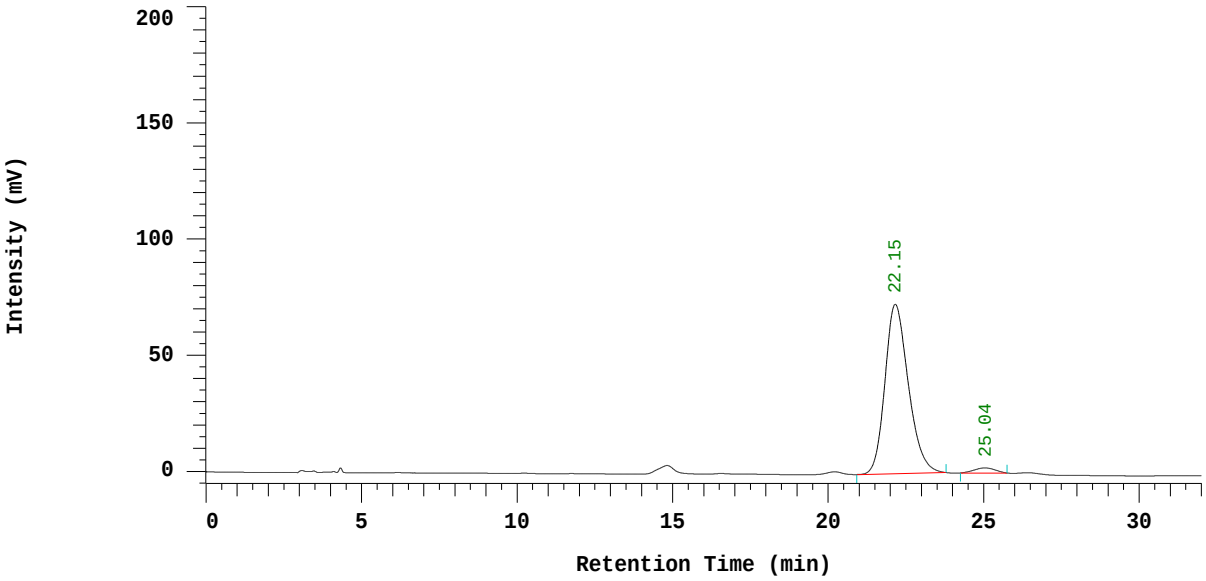
Fig S200. HPLC analysis of the co-injection of racemic and chiral compound 3 obtained, for comparison (Table 3, entry 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 02:07 AM
Reported Date and Time: 05/14/2016 04:29 PM
Processed Date and Time: 05/14/2016 04:28 PM
Data Path: D:\Vishal\DATA\0108\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0108
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-82 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.15	3794976	72846	97.409
2	25.04	100938	2167	2.591
		3895914	75013	100.000

Peak rejection level: 200

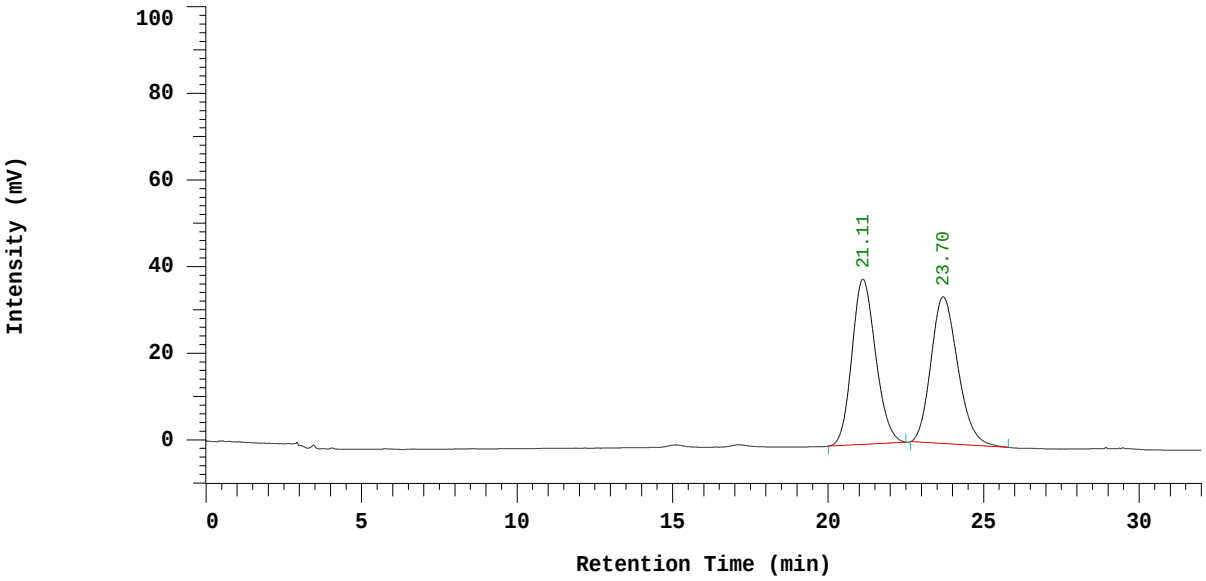
Fig S201. HPLC analysis of the chiral compound 6 obtained, (Scheme 4A, two-pot).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 01:34 AM
Reported Date and Time: 05/14/2016 04:10 PM
Processed Date and Time: 05/14/2016 04:08 PM
Data Path: D:\Vishal\DATA\0107\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0107
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-82 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	21.11	2012084	38115	49.794
2	23.70	2028757	33882	50.206
		4040841	71997	100.000

Peak rejection level: 200

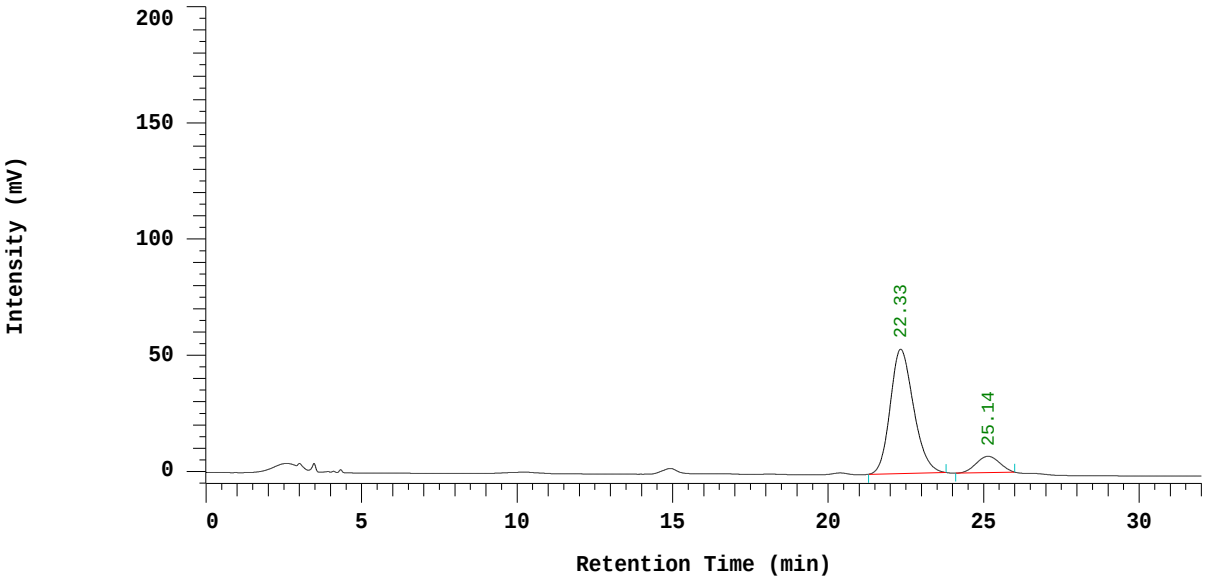
Fig S202. HPLC analysis of the racemic compound 6, for comparison (Scheme 4A, two-pot).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/14/2016 02:40 AM
Reported Date and Time: 05/14/2016 04:37 PM
Processed Date and Time: 05/14/2016 04:37 PM
Data Path: D:\Vishal\DATA\0109\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0109
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-03-82 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.33	2772258	53455	88.317
2	25.14	366712	7017	11.683
		3138970	60472	100.000

Peak rejection level: 200

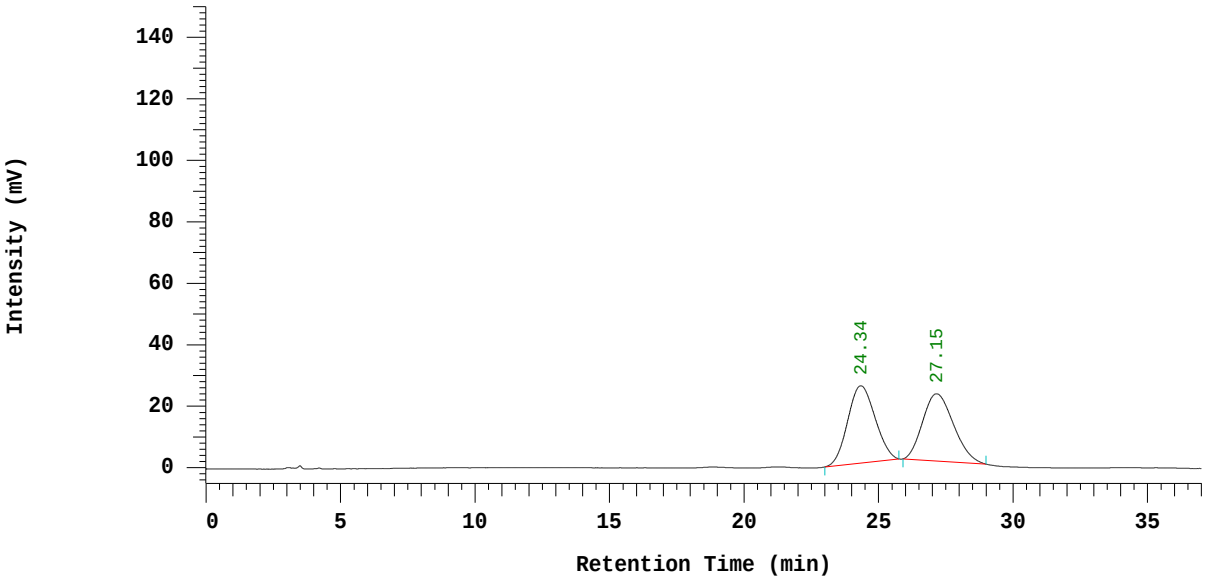
Fig S203. HPLC analysis of the co-injection of racemic and chiral compound 6 obtained, for comparison (Scheme 4A, two-pot).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/23/2016 03:19 PM
Reported Date and Time: 02/23/2016 04:06 PM
Processed Date and Time: 02/23/2016 04:06 PM
Data Path: D:\Vishal\DATA\0101\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0101
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-99 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	24.34	1765012	25126	50.316
2	27.15	1742841	21866	49.684
		3507853	46992	100.000

Peak rejection level: 200

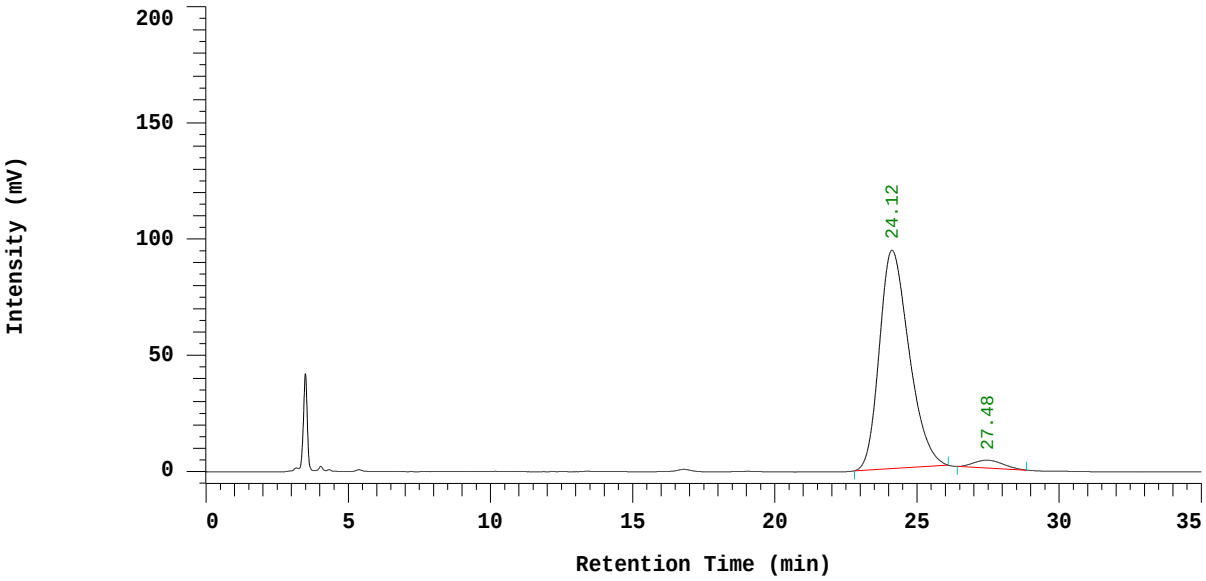
Fig S204. HPLC analysis of the racemic compound 6, for comparison (Scheme 4A, one-pot).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/23/2016 03:57 PM
Reported Date and Time: 02/23/2016 08:33 PM
Processed Date and Time: 02/23/2016 08:33 PM
Data Path: D:\Vishal\DATA\0102\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0102
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-99 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	24.12	6787934	93881	96.554
2	27.48	242246	3385	3.446
		7030180	97266	100.000

Peak rejection level: 200

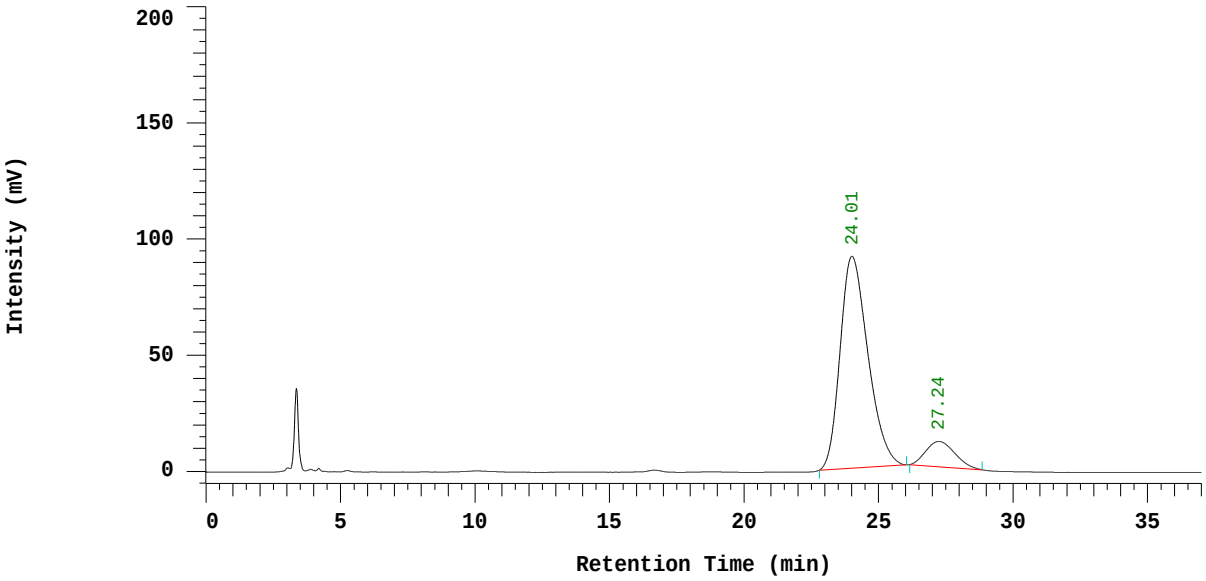
Fig S205. HPLC analysis of the chiral compound 6 obtained (Scheme 4A, one-pot).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/23/2016 04:33 PM
Reported Date and Time: 02/23/2016 08:34 PM
Processed Date and Time: 02/23/2016 08:34 PM
Data Path: D:\Vishal\DATA\0103\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0103
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-03-99 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	24.01	6520314	91111	88.897
2	27.24	814334	10850	11.103
		7334648	101961	100.000

Peak rejection level: 200

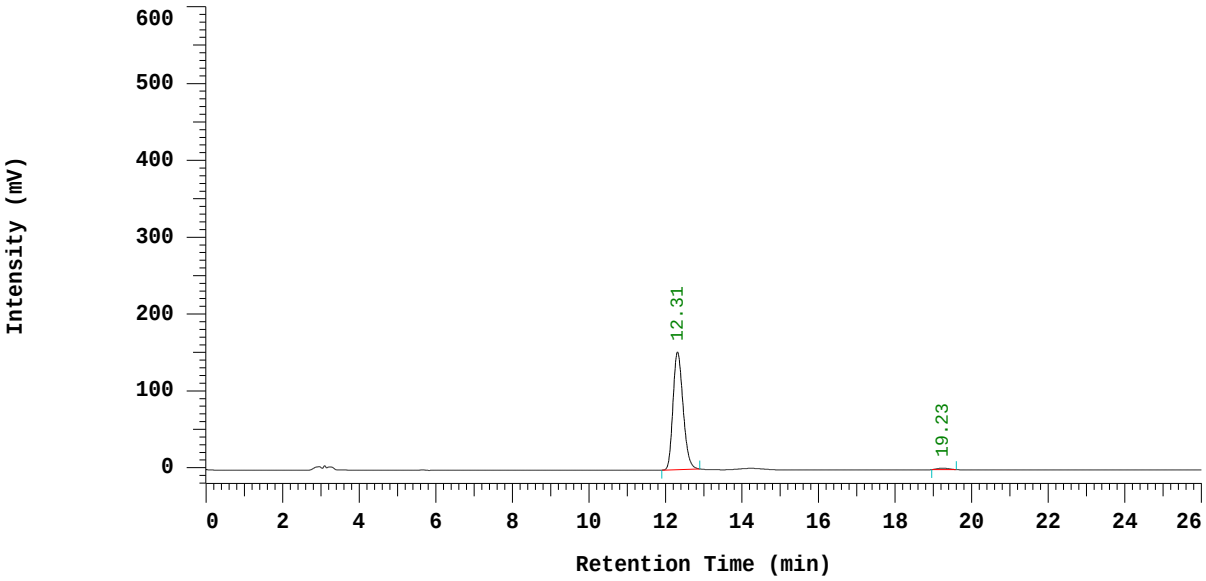
Fig S206. HPLC analysis of the co-injection of racemic and chiral compound 6 obtained, for comparison (Scheme 4A, one-pot).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 08/26/2016 05:15 PM
Reported Date and Time: 08/31/2016 05:20 PM
Processed Date and Time: 08/31/2016 05:19 PM
Data Path: D:\Vishal\DATA\0171\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0171
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-02-221 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.31	2778998	152864	98.600
2	19.23	39450	1864	1.400
		2818448	154728	100.000

Peak rejection level: 200

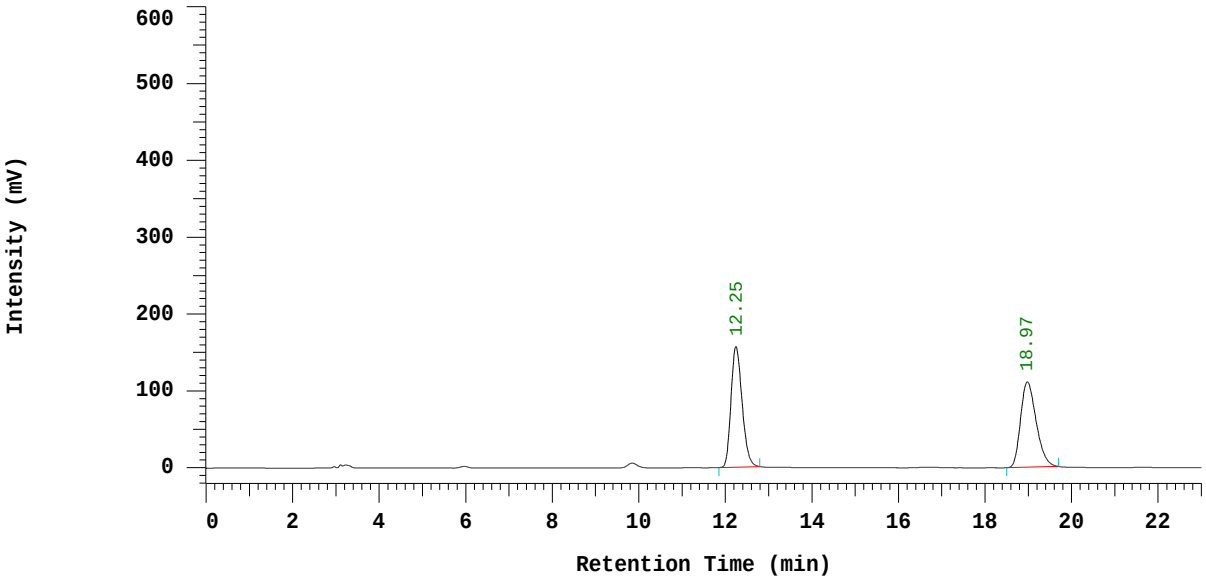
Fig S207. HPLC analysis of the chiral compound 5 obtained, (Scheme 4A).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 08/26/2016 04:51 PM
Reported Date and Time: 08/31/2016 05:14 PM
Processed Date and Time: 08/31/2016 05:12 PM
Data Path: D:\Vishal\DATA\0170\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0170
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-221 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.25	2783267	156703	50.033
2	18.97	2779574	111041	49.967
		5562841	267744	100.000

Peak rejection level: 200

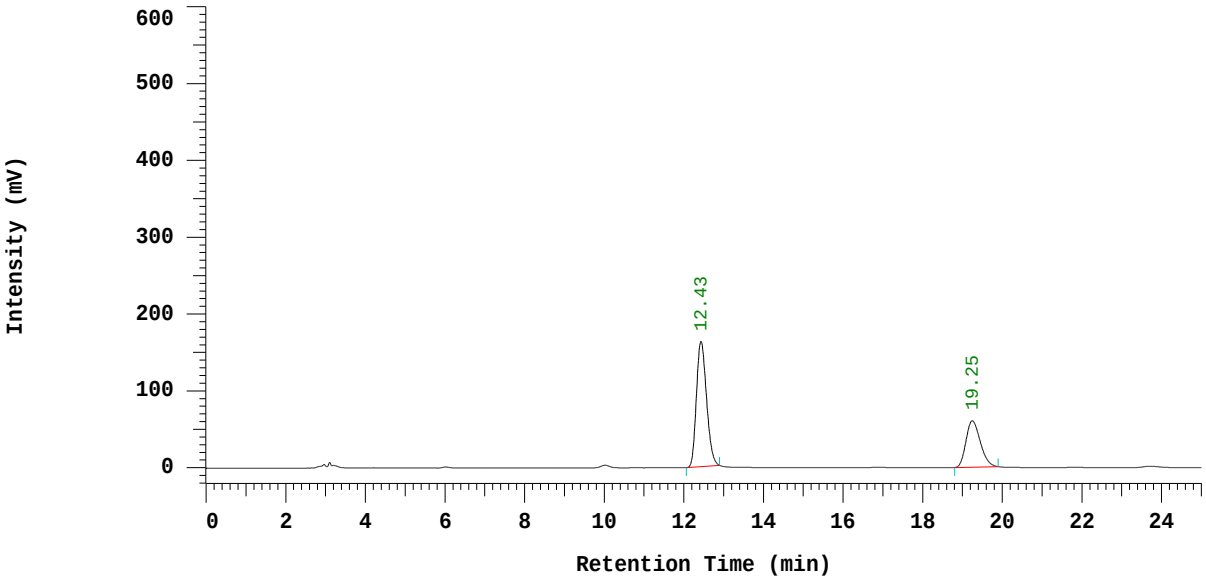
Fig S208. HPLC analysis of the racemic compound 5, for comparison (Scheme 4A).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 08/26/2016 05:42 PM
Reported Date and Time: 08/31/2016 05:22 PM
Processed Date and Time: 08/31/2016 05:22 PM
Data Path: D:\Vishal\DATA\0172\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0172
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-02-221 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.43	2863860	162884	65.538
2	19.25	1505885	60399	34.462
		4369745	223283	100.000

Peak rejection level: 200

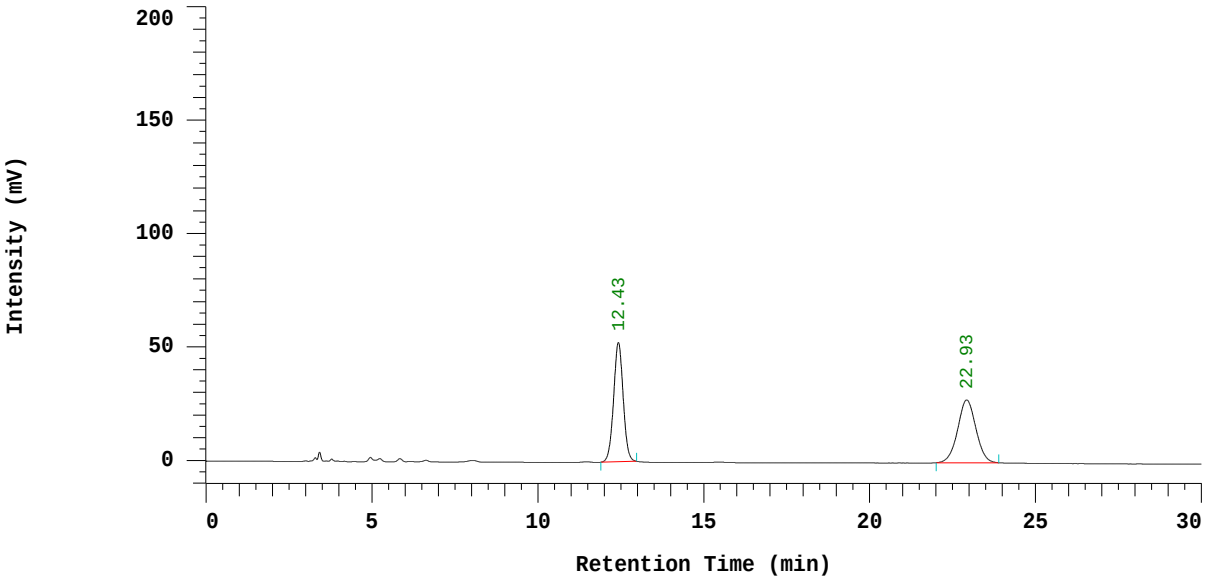
Fig S209. HPLC analysis of the co-injection of racemic compound 5 and chiral compound 5 obtained, for comparison (Scheme 4A).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 05/26/2016 04:25 PM
Reported Date and Time: 05/26/2016 05:27 PM
Processed Date and Time: 05/26/2016 05:25 PM
Data Path: D:\Vishal\DATA\0119\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0119
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-126 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.43	1045912	52593	49.848
2	22.93	1052299	27685	50.152
		2098211	80278	100.000

Peak rejection level: 200000

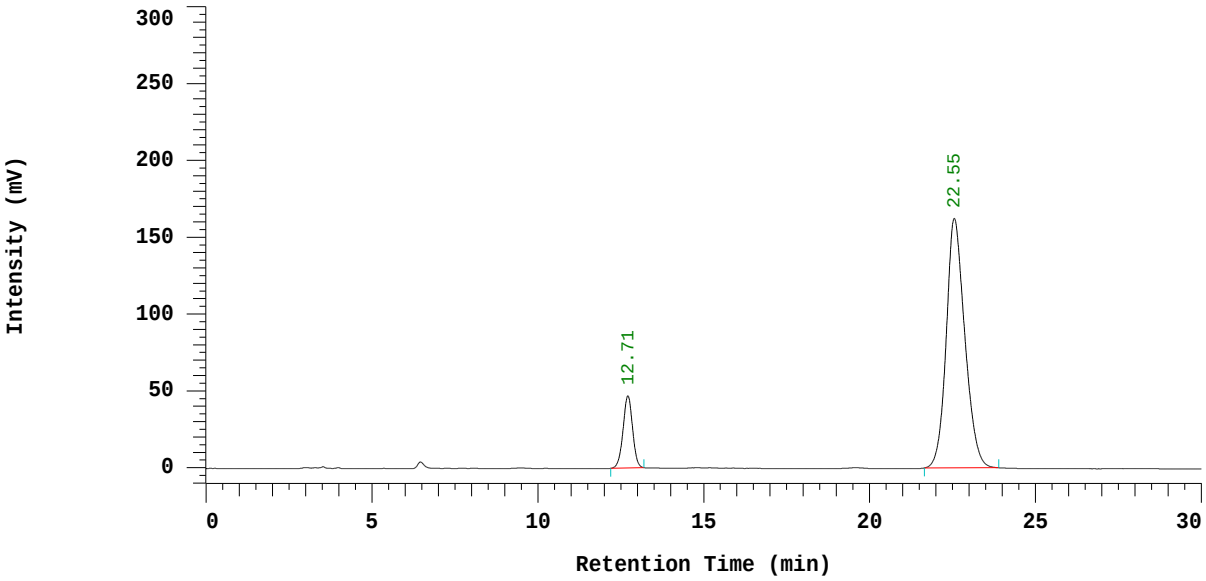
Fig S210. HPLC analysis of the racemic compound 3, for comparison (Scheme 4B).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 06/04/2016 04:05 PM
Reported Date and Time: 06/04/2016 04:42 PM
Processed Date and Time: 06/04/2016 04:41 PM
Data Path: D:\Vishal\DATA\0127\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0127
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-126 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.71	928066	47025	12.870
2	22.55	6282838	162336	87.130
		7210904	209361	100.000

Peak rejection level: 100000

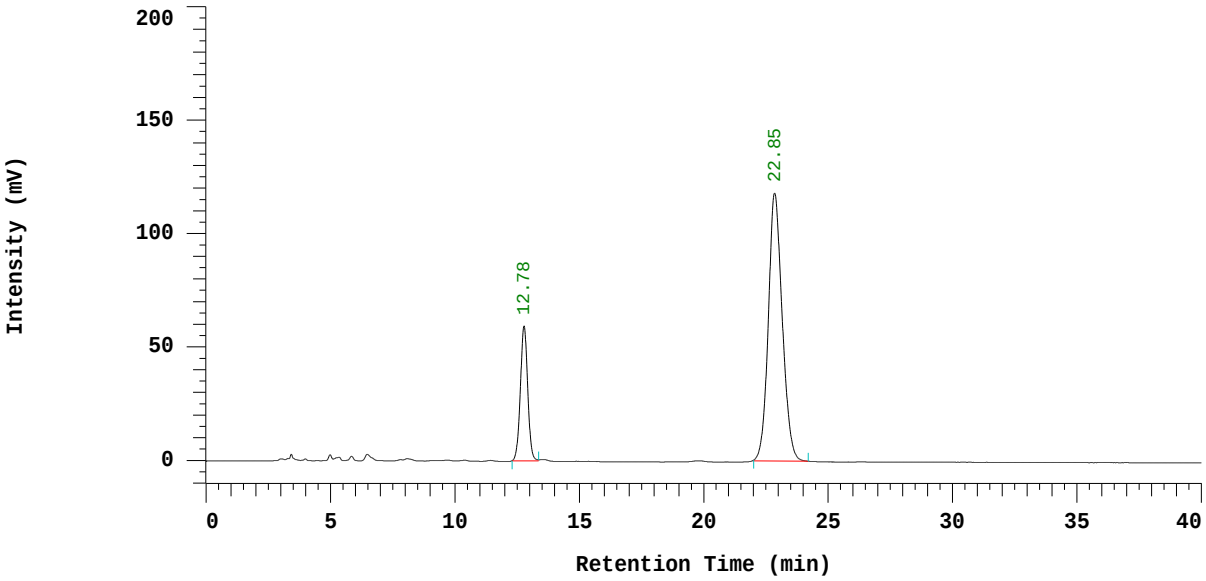
Fig S211. HPLC analysis of the chiral compound 3 obtained (Scheme 4B).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 06/04/2016 04:36 PM
Reported Date and Time: 06/04/2016 05:19 PM
Processed Date and Time: 06/04/2016 05:18 PM
Data Path: D:\Vishal\DATA\0128\
Processing Method: test-IPA/Hx 1

System (acquisition): Sys 1
Series: 0128
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-03-126 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 15%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 1
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.78	1195196	59471	20.827
2	22.85	4543626	117992	79.173
		5738822	177463	100.000

Peak rejection level: 100000

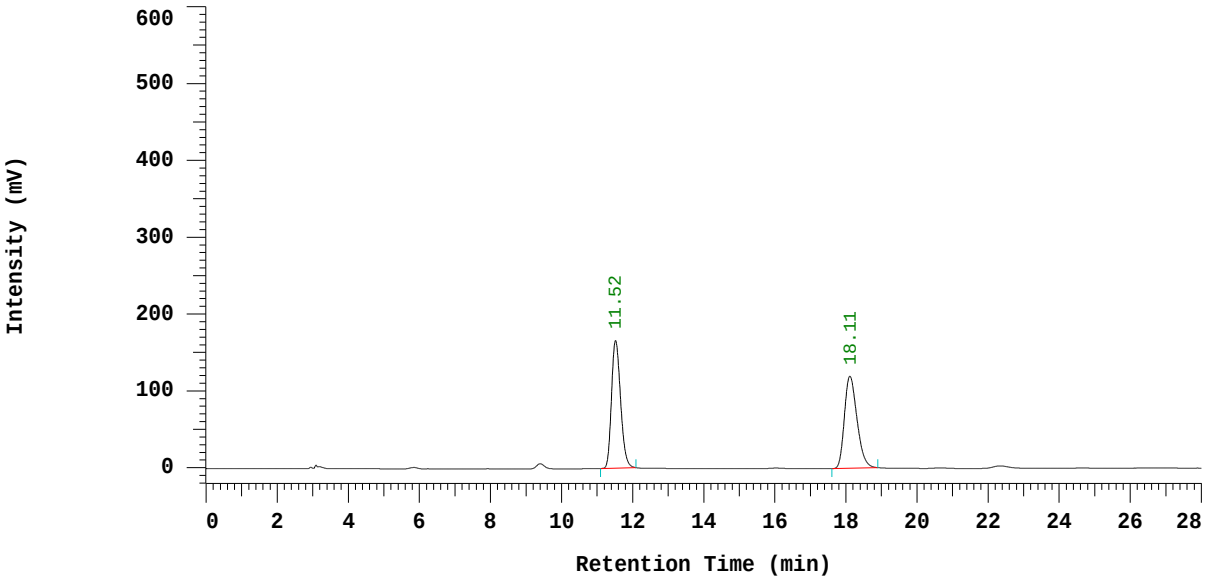
Fig S212. HPLC analysis of the co-injection of racemic compound 3 and chiral compound 3, for comparison (Scheme 4B).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 10/25/2016 06:59 PM
Reported Date and Time: 10/25/2016 07:32 PM
Processed Date and Time: 10/25/2016 07:31 PM
Data Path: D:\Vishal\DATA\0174\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0174
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-145 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	11.52	2915957	166162	49.905
2	18.11	2927011	119772	50.095
		5842968	285934	100.000

Peak rejection level: 200

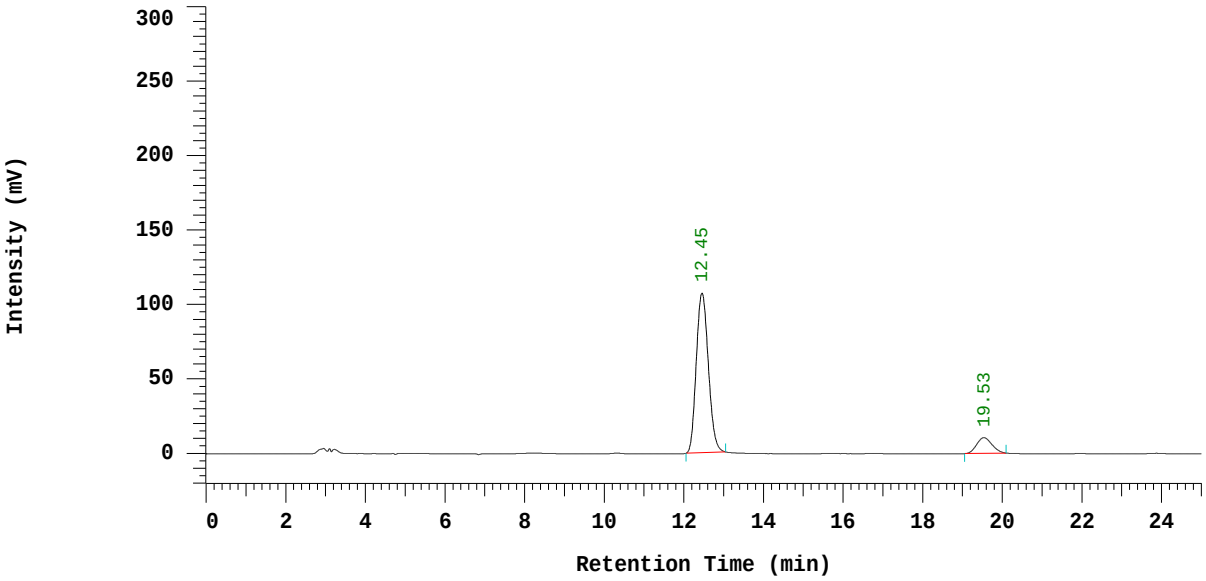
Fig S213. HPLC analysis of the racemic compound 5, for comparison (Scheme 4B).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 10/25/2016 11:32 PM
Reported Date and Time: 10/25/2016 11:20 PM
Processed Date and Time: 10/25/2016 11:20 PM
Data Path: D:\Vishal\DATA\0179\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0179
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-145 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.45	2255084	107241	88.984
2	19.53	279180	10529	11.016
		2534264	117770	100.000

Peak rejection level: 200

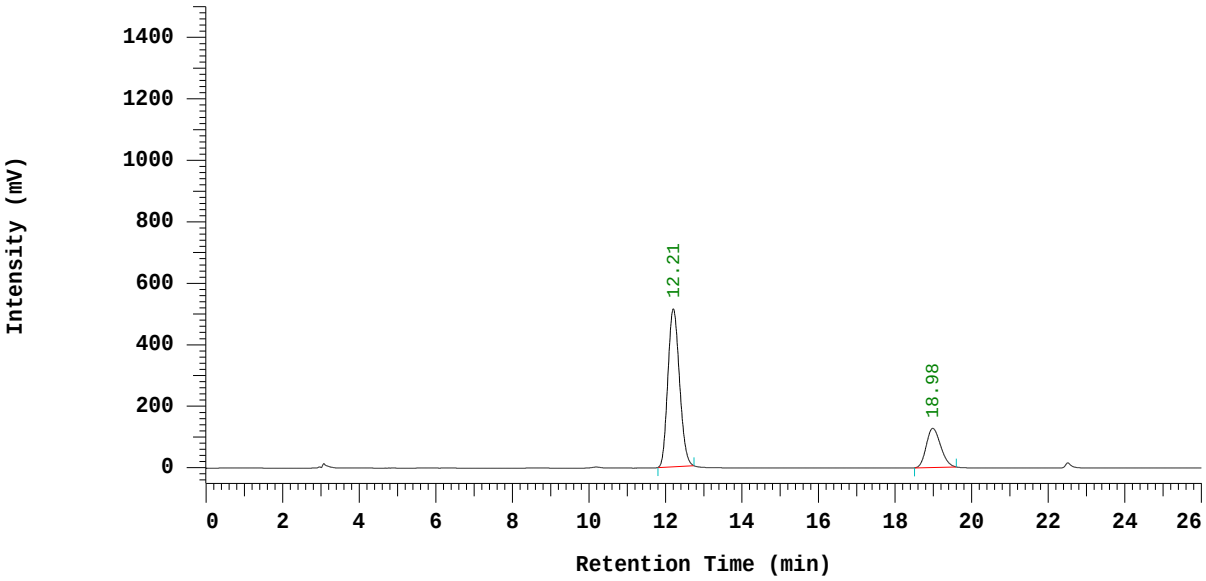
Fig S214. HPLC analysis of the chiral compound 5 obtained (Scheme 4B).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 10/25/2016 10:31 PM
Reported Date and Time: 10/25/2016 11:11 PM
Processed Date and Time: 10/25/2016 11:10 PM
Data Path: D:\Vishal\DATA\0177\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0177
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-145 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.21	10775515	513484	76.555
2	18.98	3300017	127375	23.445
		14075532	640859	100.000

Peak rejection level: 200

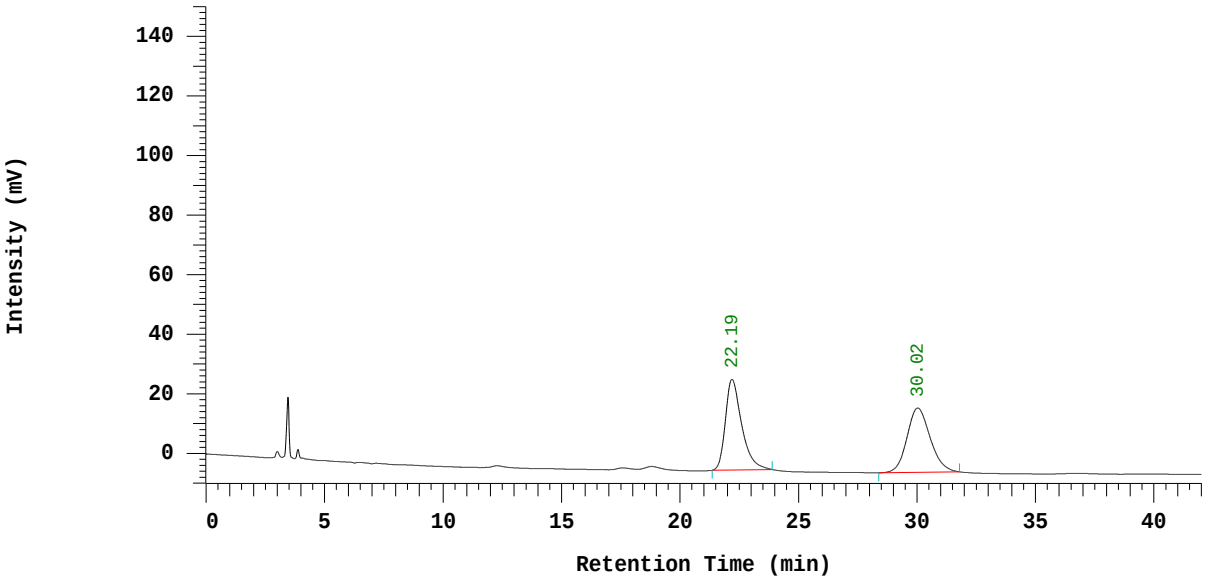
Fig S215. HPLC analysis of the co-injection of racemic compound 5 and chiral compound 5, for comparison (Scheme 4B).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 07/14/2016 08:51 PM
Reported Date and Time: 07/15/2016 12:12 PM
Processed Date and Time: 07/15/2016 12:10 PM
Data Path: D:\Vishal\DATA\0129\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0129
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-02-231 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.19	1445793	30474	49.743
2	30.02	1460742	21612	50.257
		2906535	52086	100.000

Peak rejection level: 200

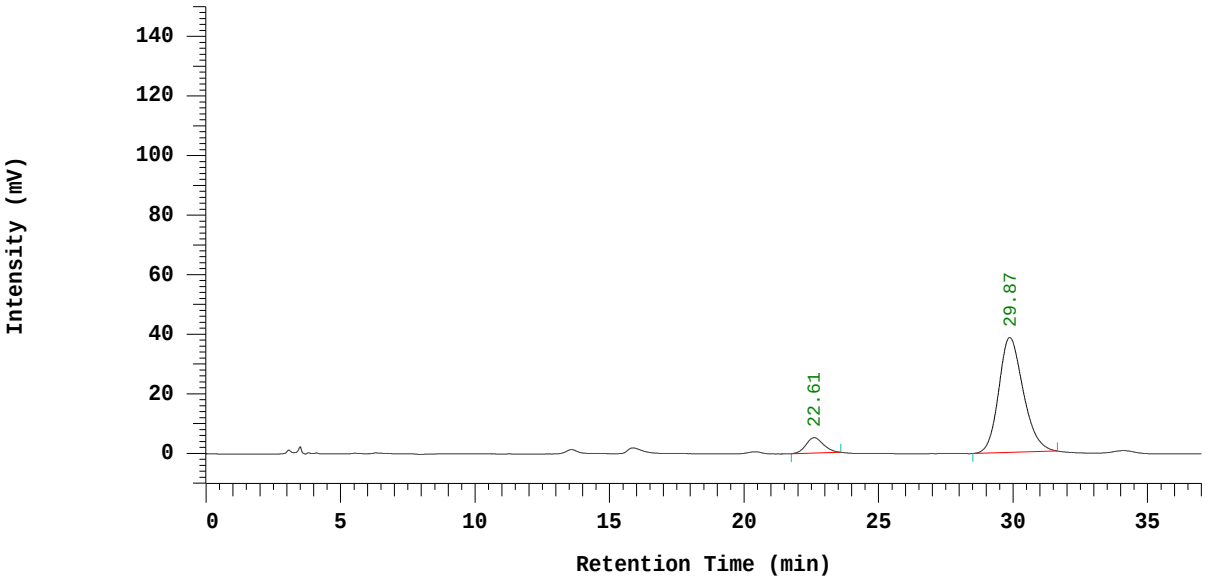
Fig S216. HPLC analysis of the racemic compound 13, for comparison (Scheme 4C).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 07/15/2016 04:19 PM
Reported Date and Time: 07/15/2016 05:01 PM
Processed Date and Time: 07/15/2016 05:00 PM
Data Path: D:\Vishal\DATA\0132\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0132
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-131 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.61	231445	5181	8.679
2	29.87	2435199	38614	91.321
		2666644	43795	100.000

Peak rejection level: 200

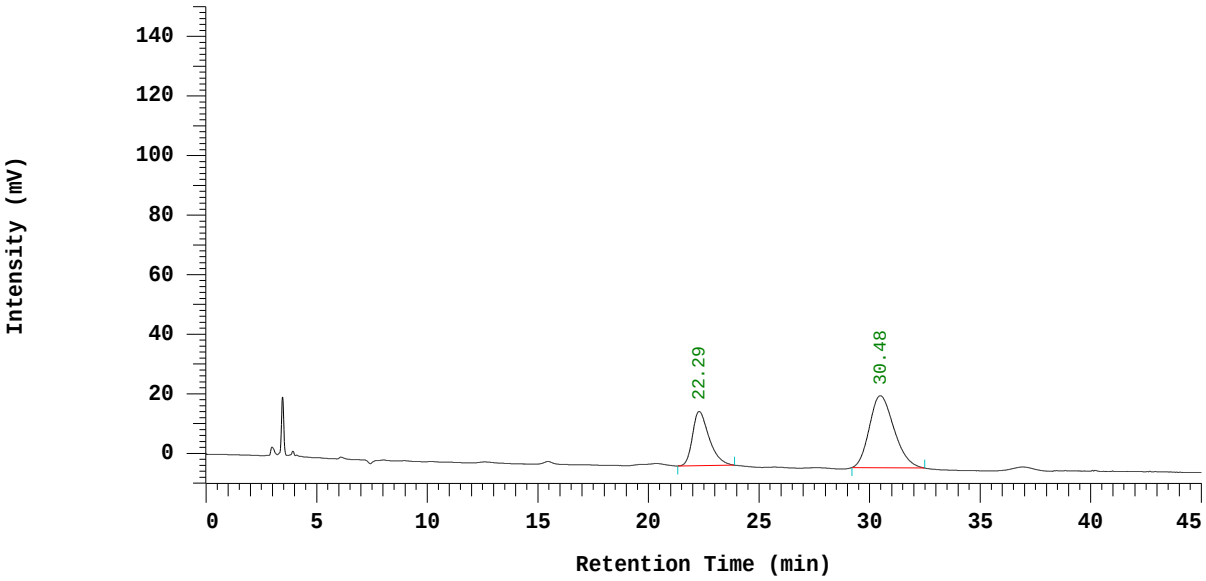
Fig S217. HPLC analysis of the chiral compound 13 obtained (Scheme 4C).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 10/12/2016 09:41 PM
Reported Date and Time: 10/12/2016 10:35 PM
Processed Date and Time: 10/12/2016 10:35 PM
Data Path: D:\Vishal\DATA\0173\
Processing Method: test-IPA/Hx 2

System (acquisition): Sys 1
Series: 0173
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-131 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12%IPA+HX 1.0mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx 2
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.29	945288	18208	33.580
2	30.48	1869766	24199	66.420
		2815054	42407	100.000

Peak rejection level: 200

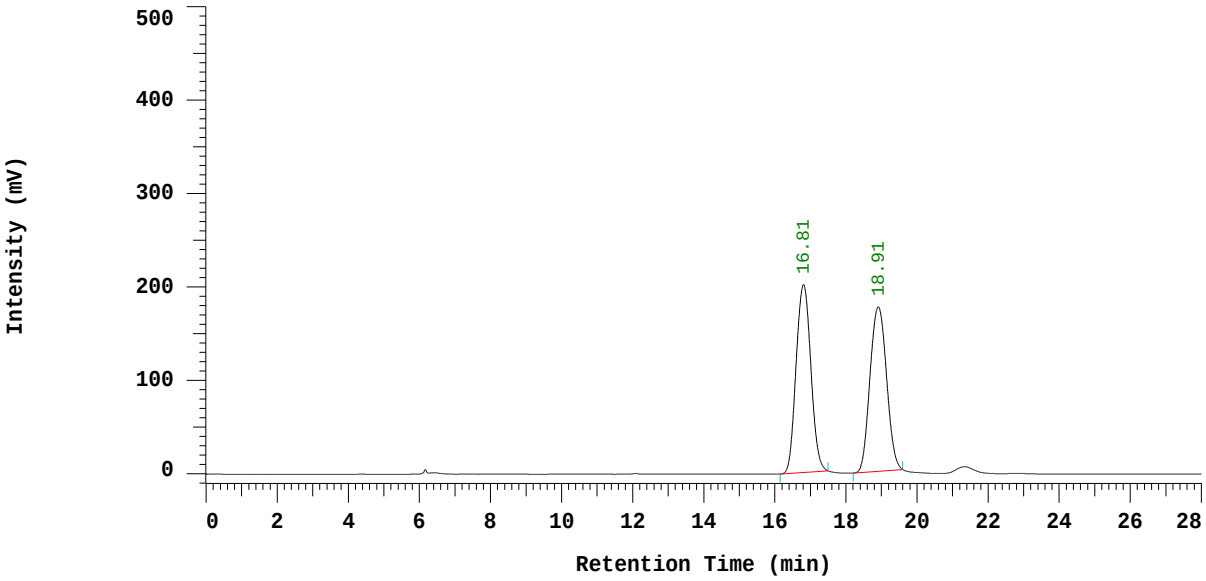
Fig S218. HPLC analysis of the co-injection of racemic and chiral compound 13 obtained, for comparison (Scheme 4C).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 07/28/2016 11:00 PM
Reported Date and Time: 07/28/2016 11:52 PM
Processed Date and Time: 07/28/2016 11:51 PM
Data Path: D:\Vishal\DATA\0156\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0156
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-137 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 0.5mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 300 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 300 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	16.81	5766163	200963	50.451
2	18.91	5663082	175864	49.549
		11429245	376827	100.000

Peak rejection level: 200000

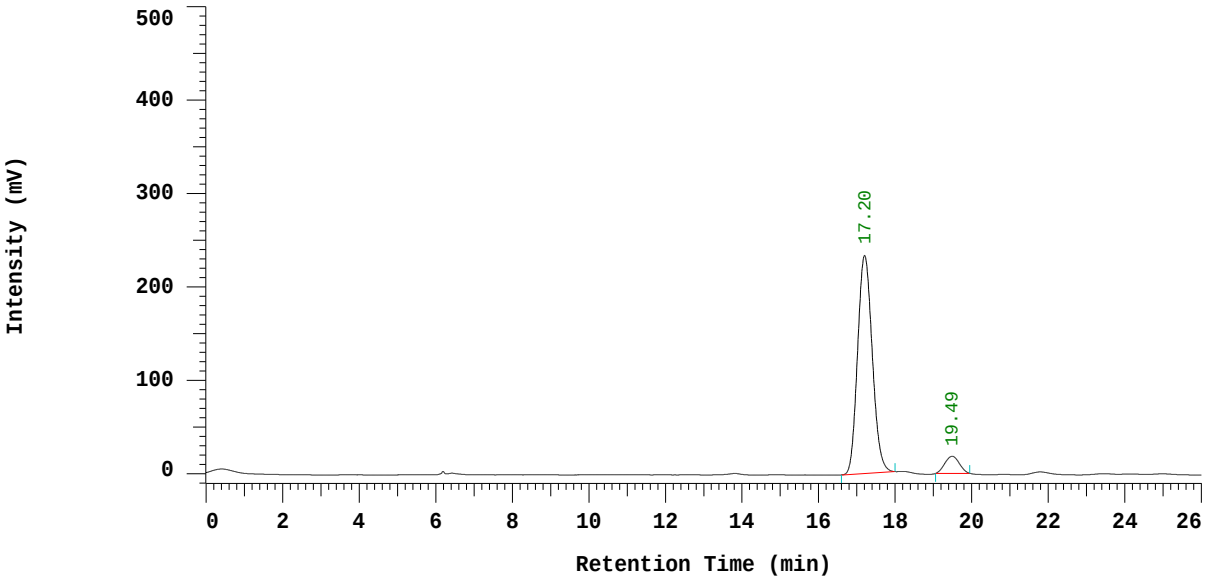
Fig S219. HPLC analysis of the racemic compound 15, for comparison (Scheme 4C).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 07/28/2016 11:29 PM
Reported Date and Time: 07/29/2016 12:02 AM
Processed Date and Time: 07/29/2016 12:01 AM
Data Path: D:\Vishal\DATA\0157\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0157
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-137 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 0.5mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 300 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 300 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	17.20	6184025	233262	92.799
2	19.49	479853	18334	7.201
		6663878	251596	100.000

Peak rejection level: 200000

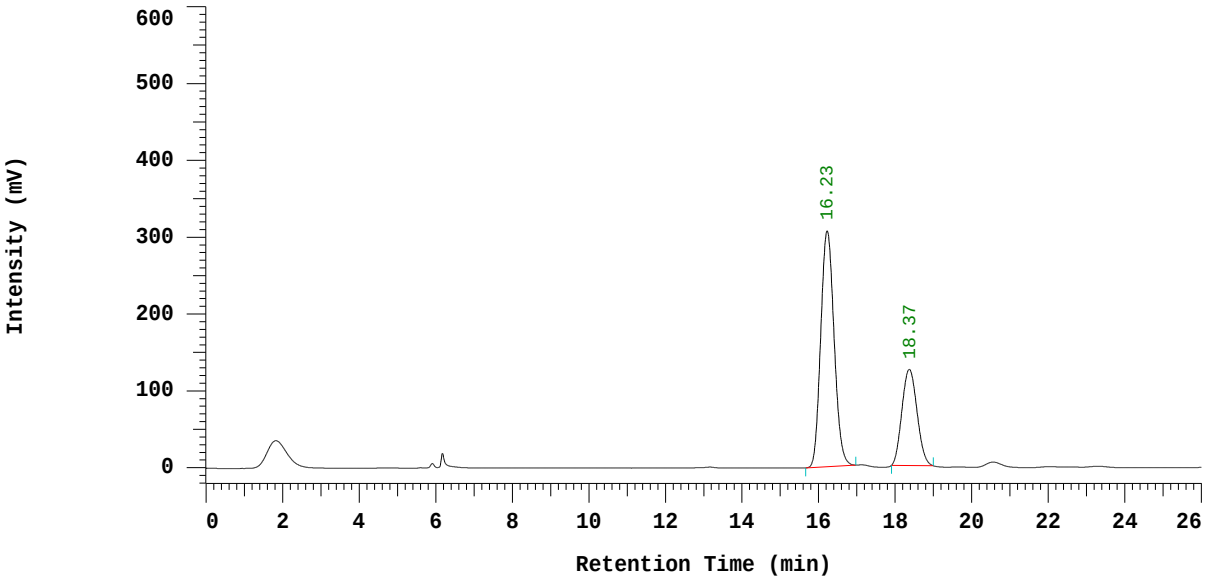
Fig S220. HPLC analysis of the chiral compound 15 obtained (Scheme 4C).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 08/26/2016 04:15 PM
Reported Date and Time: 08/31/2016 05:09 PM
Processed Date and Time: 08/31/2016 05:09 PM
Data Path: D:\Vishal\DATA\0169\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0169
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-03-137 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 0.5mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	16.23	7407414	306879	68.412
2	18.37	3420239	125167	31.588
		10827653	432046	100.000

Peak rejection level: 200

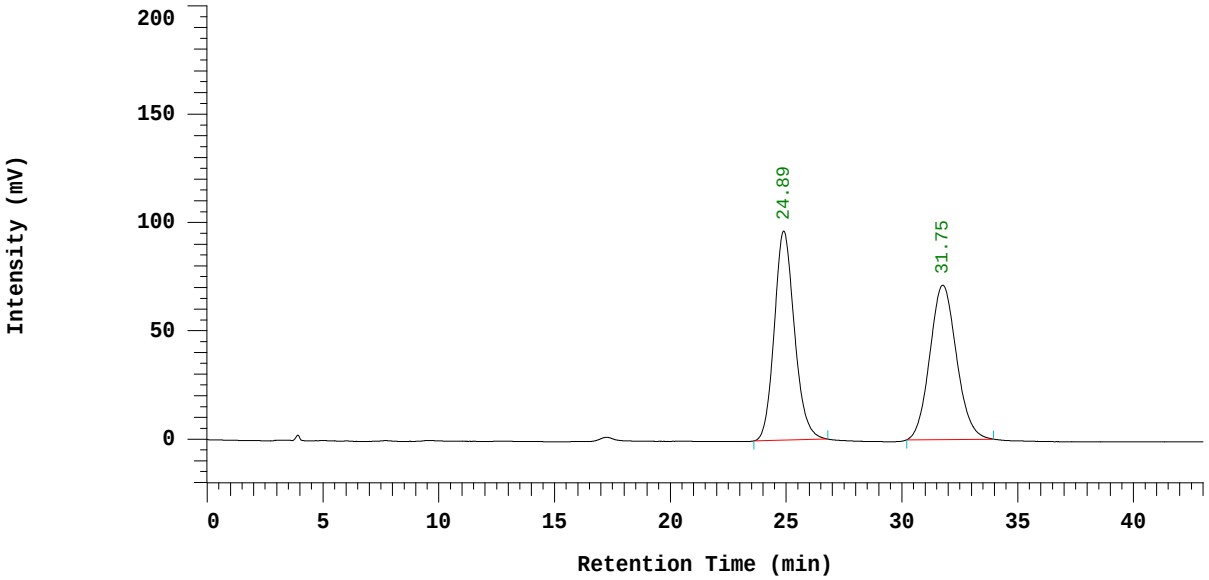
Fig S221. HPLC analysis of the co-injection of racemic compound 15 and chiral compound 15, for comparison (Scheme 4C).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2015/12/23 03:54 下午 Reported Date and Time: 2015/12/24 03:08 下午
Processed Date and Time: 2015/12/24 03:08 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0090\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1 Series: 0090
Application(data): Vishal Vial Number: 1
Sample Name: VMS-03-77 (Racemic) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx
Column Type: ODH Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	24.89	5773328	96406	50.487
2	31.75	5661936	71249	49.513
		11435264	167655	100.000

Peak rejection level: 200000

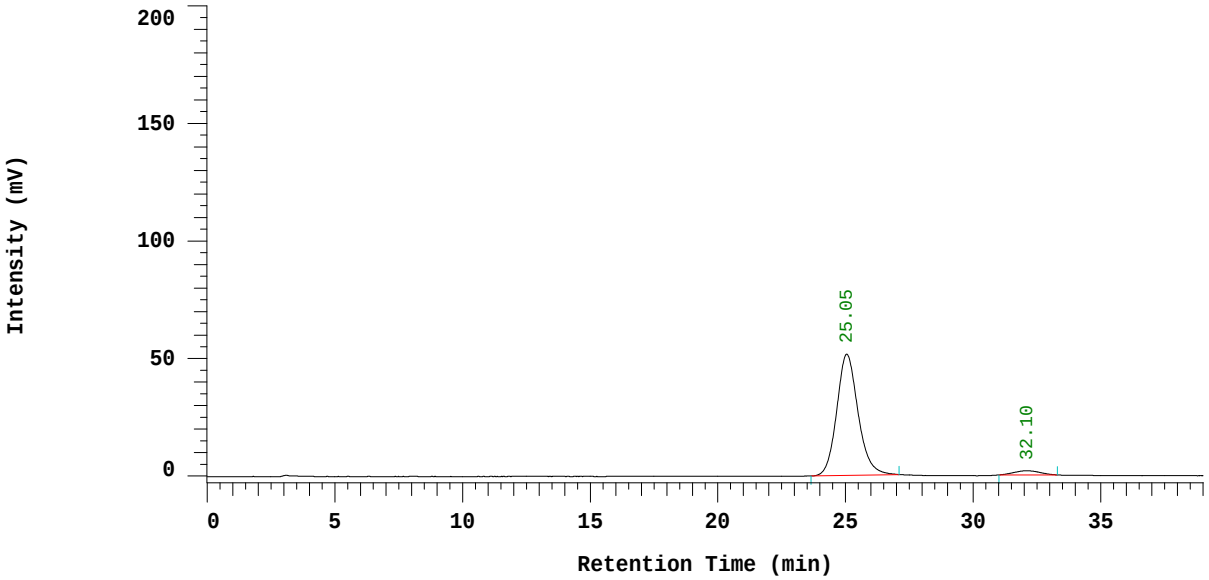
Fig S222. HPLC analysis of the racemic compound 8, for comparison (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2015/12/23 04:38 下午 Reported Date and Time: 2015/12/24 03:19 下午
Processed Date and Time: 2015/12/24 03:18 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0091\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1 Series: 0091
Application(data): Vishal Vial Number: 2
Sample Name: VMS-03-77 (Chiral) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx
Column Type: ODH Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.05	2979369	51548	95.930
2	32.10	126415	1820	4.070
		3105784	53368	100.000

Peak rejection level: 200

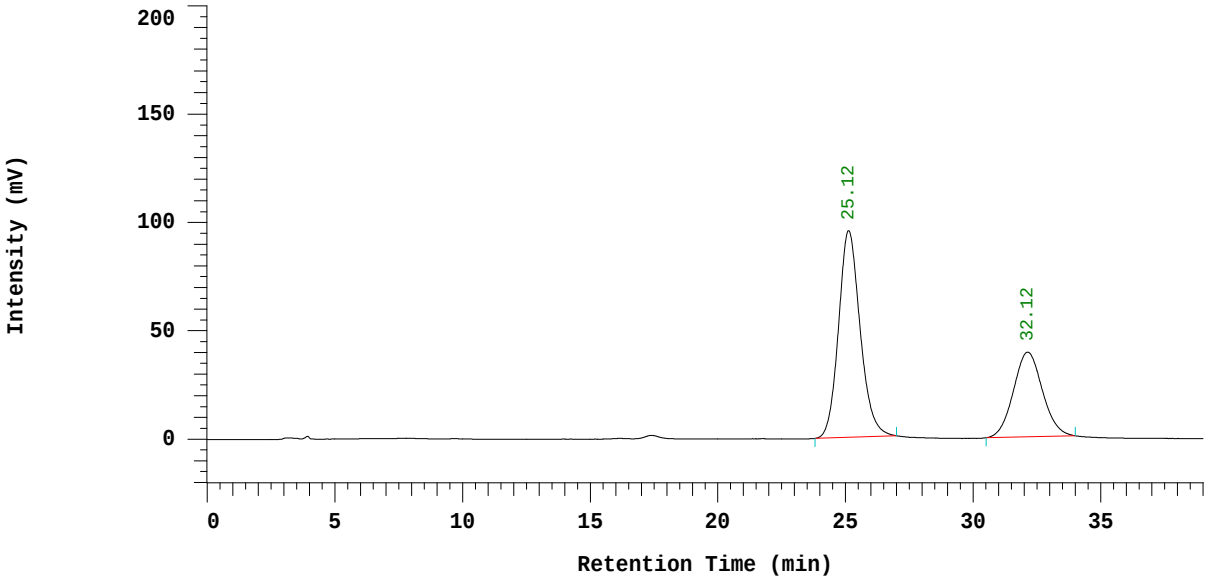
Fig S223. HPLC analysis of the chiral compound 8 obtained (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 2015/12/23 05:18 下午 Reported Date and Time: 2015/12/24 03:21 下午
Processed Date and Time: 2015/12/24 03:21 下午
Data Path: C:\WIN32APP\D2000HSM\Vishal\DATA\0092\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1 Series: 0092
Application(data): Vishal Vial Number: 3
Sample Name: VMS-03-77 (Co) Vial Type: UNK
Injection from this vial: 1 of 1 Volume: 20.0 ul
Sample Description: 12%IPA+HX 1mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 275 nm



Processing Method: test-IPA/Hx
Column Type: ODH Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 275 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	25.12	5561870	95329	64.470
2	32.12	3065152	39008	35.530
		8627022	134337	100.000

Peak rejection level: 200000

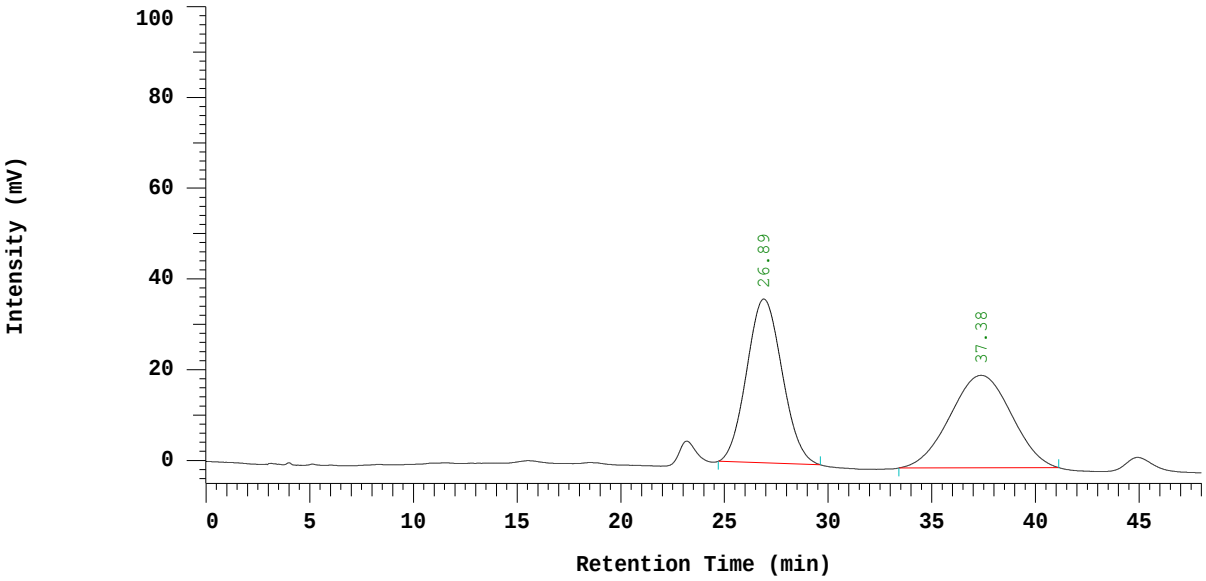
Fig S224. HPLC analysis of the co-injection of racemic compound 8 and chiral compound 8, for comparison (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/15/2016 01:16 PM
Reported Date and Time: 02/19/2016 04:04 PM
Processed Date and Time: 02/19/2016 04:04 PM
Data Path: D:\Vishal\DATA\0010\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0010
Application(data): Vishal
Vial Number: 1
Sample Name: Vms-02-93 (racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	26.89	4276846	36095	50.517
2	37.38	4189227	20385	49.483
		8466073	56480	100.000

Peak rejection level: 200

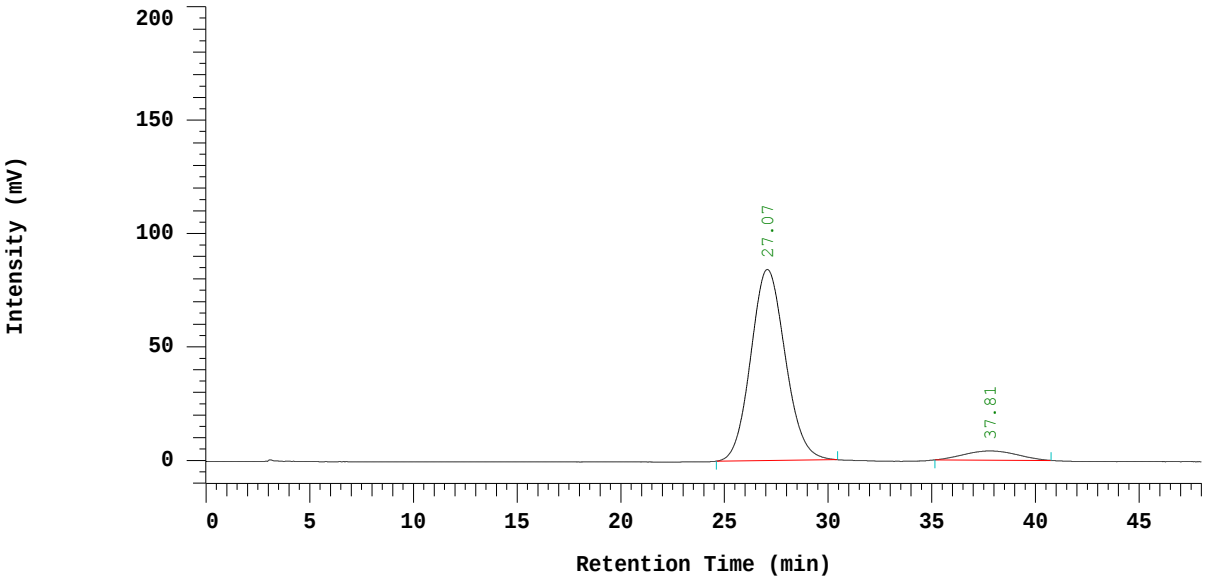
Fig S225. HPLC analysis of the racemic compound 7, for comparison (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/15/2016 02:05 PM
Reported Date and Time: 02/19/2016 04:15 PM
Processed Date and Time: 02/19/2016 04:15 PM
Data Path: D:\Vishal\DATA\0011\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0011
Application(data): Vishal
Vial Number: 2
Sample Name: Vms-02-93 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	27.07	9693128	84224	93.099
2	37.81	718542	4042	6.901
		10411670	88266	100.000

Peak rejection level: 200

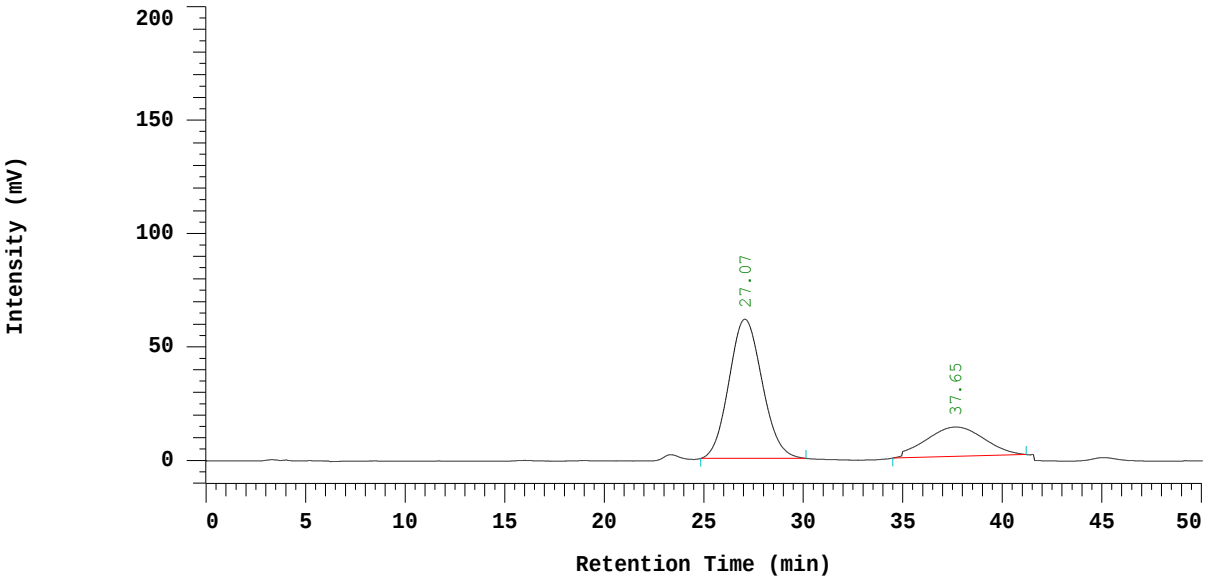
Fig S226. HPLC analysis of the chiral compound 7 obtained (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 02/15/2016 12:54 PM
Reported Date and Time: 02/19/2016 03:35 PM
Processed Date and Time: 02/19/2016 03:35 PM
Data Path: D:\Vishal\DATA\0012\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0012
Application(data): Vishal
Vial Number: 3
Sample Name: Vms-02-93 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	27.07	7076176	61329	72.937
2	37.65	2625599	12958	27.063
		9701775	74287	100.000

Peak rejection level: 200

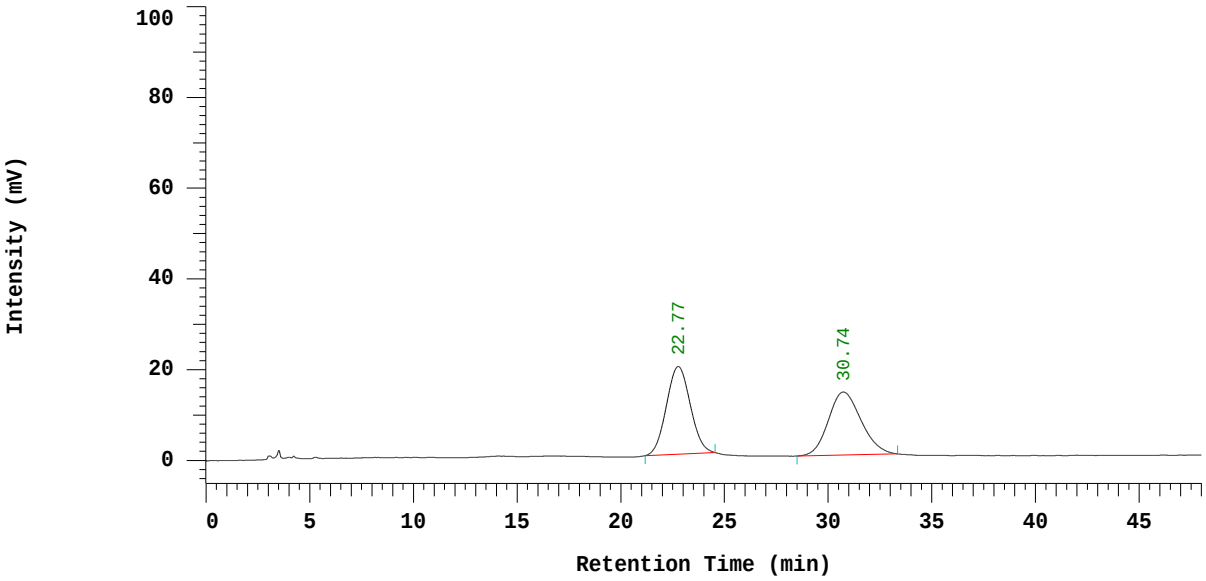
Fig S227. HPLC analysis of the co-injection of racemic compound 7 and chiral compound 7, for comparison (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/18/2016 09:38 PM
Reported Date and Time: 01/18/2016 11:14 PM
Processed Date and Time: 01/18/2016 11:13 PM
Data Path: D:\Vishal\DATA\0004\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0004
Application(data): Vishal
Vial Number: 1
Sample Name: Vms-02-86 (racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.77	1538422	19308	50.387
2	30.74	1514814	13880	49.613
		3053236	33188	100.000

Peak rejection level: 200000

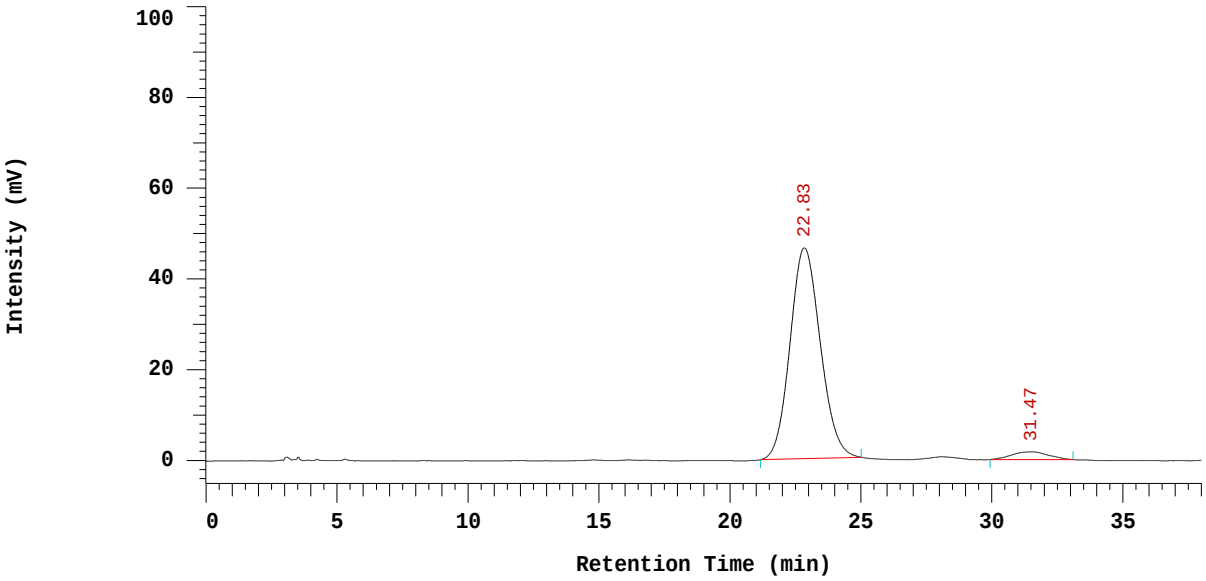
Fig S228. HPLC analysis of the racemic compound 9, for comparison (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/18/2016 10:28 PM
Reported Date and Time: 01/18/2016 11:23 PM
Processed Date and Time: 01/18/2016 11:21 PM
Data Path: D:\Vishal\DATA\0005\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0005
Application(data): Vishal
Vial Number: 2
Sample Name: Vms-02-86 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.83	3722748	46434	95.758
2	31.47	164898	1707	4.242
		3887646	48141	100.000

Peak rejection level: 200

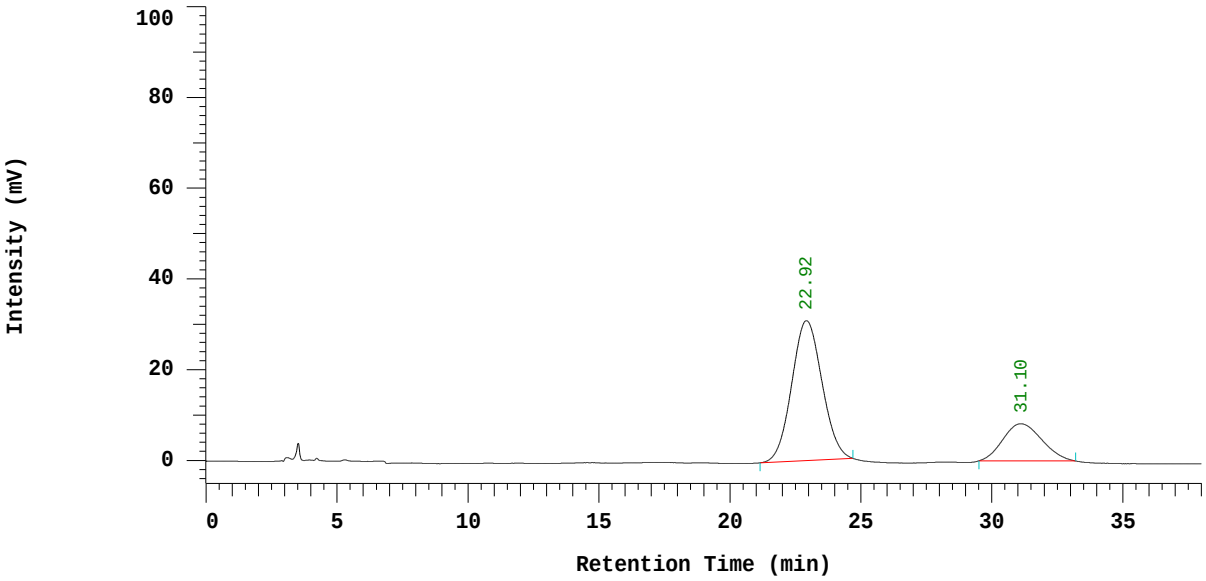
Fig S229. HPLC analysis of chiral compound 9 obtained (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/18/2016 11:07 PM
Reported Date and Time: 01/18/2016 11:54 PM
Processed Date and Time: 01/18/2016 11:54 PM
Data Path: D:\Vishal\DATA\0006\
Processing Method: test-IPA/Hx

System (acquisition): Sys 1
Series: 0006
Application(data): Vishal
Vial Number: 3
Sample Name: Vms-02-86 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 12% IPA+HX 1.0 mL/MIN COL-IA

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test-IPA/Hx
Column Type: IA
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	22.92	2468967	30831	74.532
2	31.10	843644	8178	25.468
		3312611	39009	100.000

Peak rejection level: 200

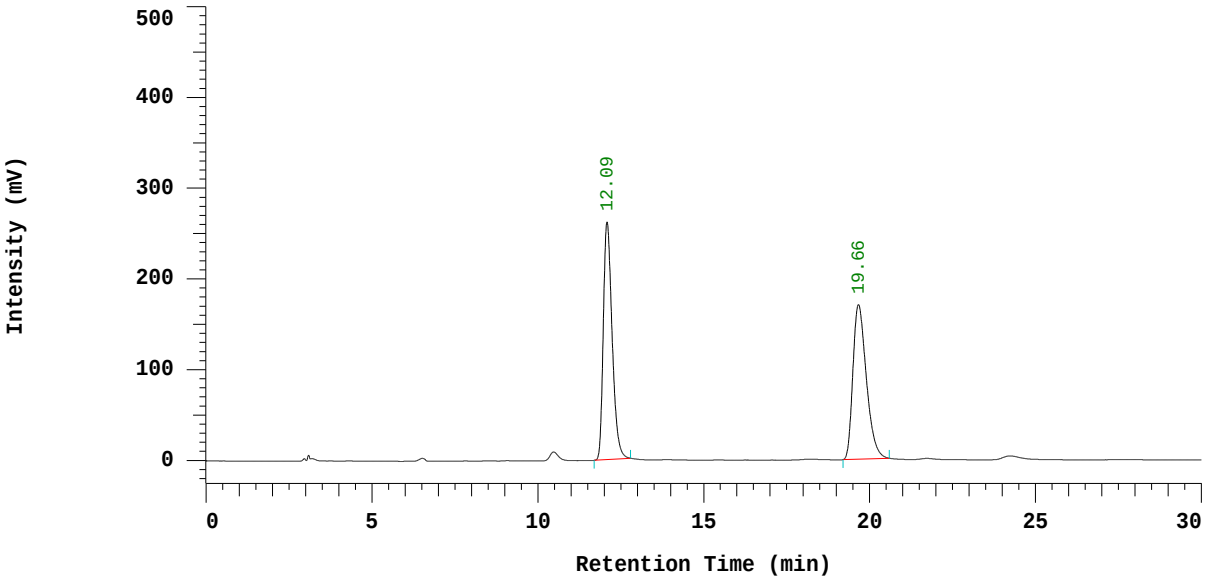
Fig S230. HPLC analysis of the co-injection of racemic compound 9 and chiral compound 9, for comparison (Scheme 5).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/21/2017 09:12 PM
Reported Date and Time: 01/21/2017 10:32 PM
Processed Date and Time: 01/21/2017 10:31 PM
Data Path: D:\Vishal\DATA\0180\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0180
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-162 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.09	4784614	261723	50.162
2	19.66	4753796	170175	49.838
		9538410	431898	100.000

Peak rejection level: 200

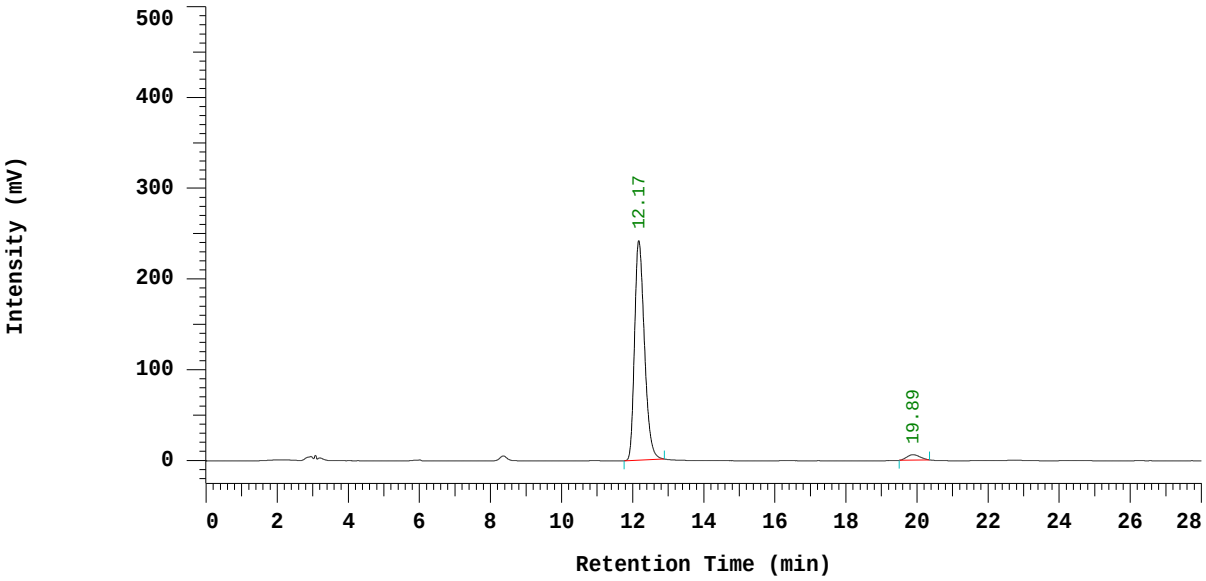
Fig S231. HPLC analysis of the racemic compound 5, for comparison (Scheme 6, two-pot synthesis).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/21/2017 10:50 PM
Reported Date and Time: 01/21/2017 11:38 PM
Processed Date and Time: 01/21/2017 11:37 PM
Data Path: D:\Vishal\DATA\0183\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0183
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-159 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 0.5mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.17	4634602	241797	96.819
2	19.89	152247	5977	3.181
		4786849	247774	100.000

Peak rejection level: 200

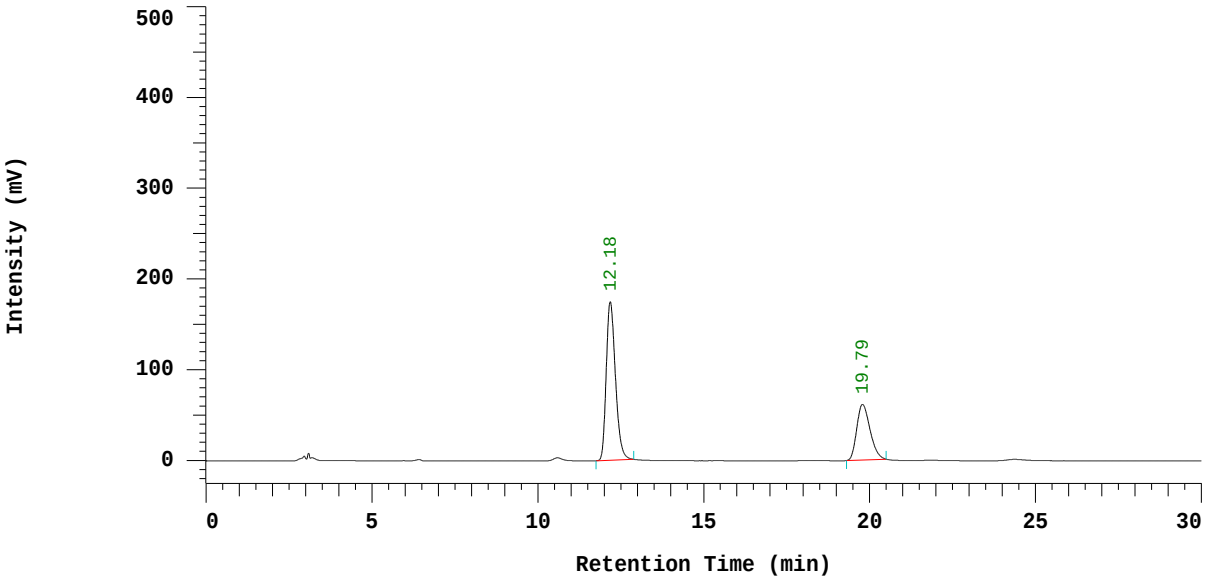
Fig S232. HPLC analysis of the chiral compound 5 obtained (Scheme 6, two-pot synthesis).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/21/2017 11:29 PM
Reported Date and Time: 01/22/2017 12:01 AM
Processed Date and Time: 01/22/2017 12:01 AM
Data Path: D:\Vishal\DATA\0184\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0184
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-159 (CO)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 0.5mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.18	3337619	174661	66.342
2	19.79	1693296	61264	33.658
		5030915	235925	100.000

Peak rejection level: 200

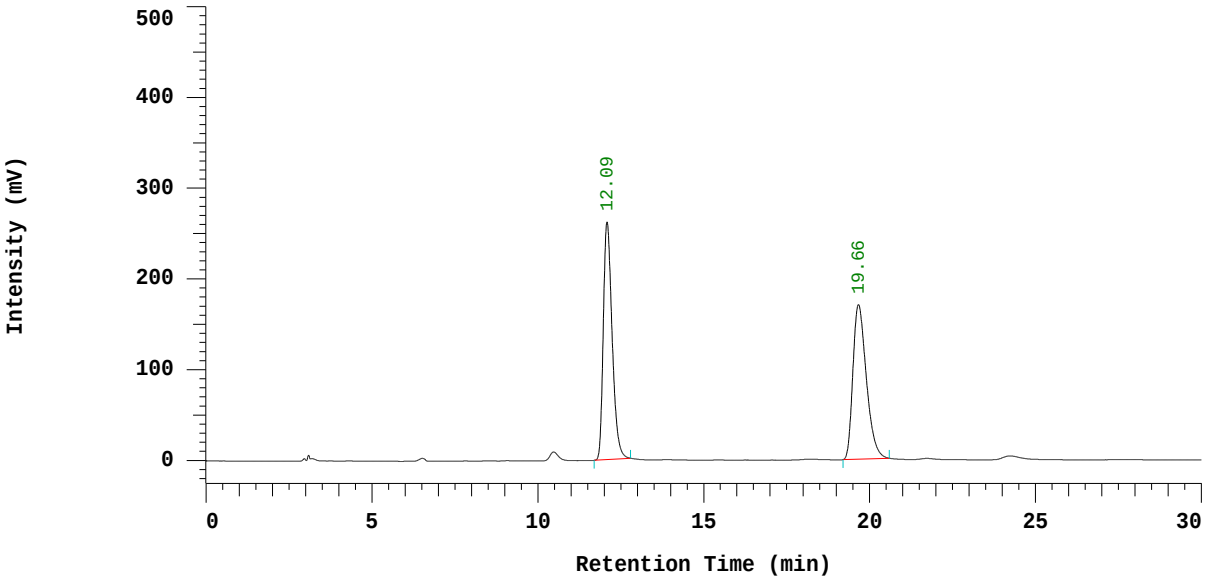
Fig S233. HPLC analysis of the co-injection of racemic compound 5 and chiral compound 5, for comparison (Scheme 6, two-pot synthesis).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/21/2017 09:12 PM
Reported Date and Time: 01/21/2017 10:32 PM
Processed Date and Time: 01/21/2017 10:31 PM
Data Path: D:\Vishal\DATA\0180\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0180
Application(data): Vishal
Vial Number: 1
Sample Name: VMS-03-162 (Racemic)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.09	4784614	261723	50.162
2	19.66	4753796	170175	49.838
		9538410	431898	100.000

Peak rejection level: 200

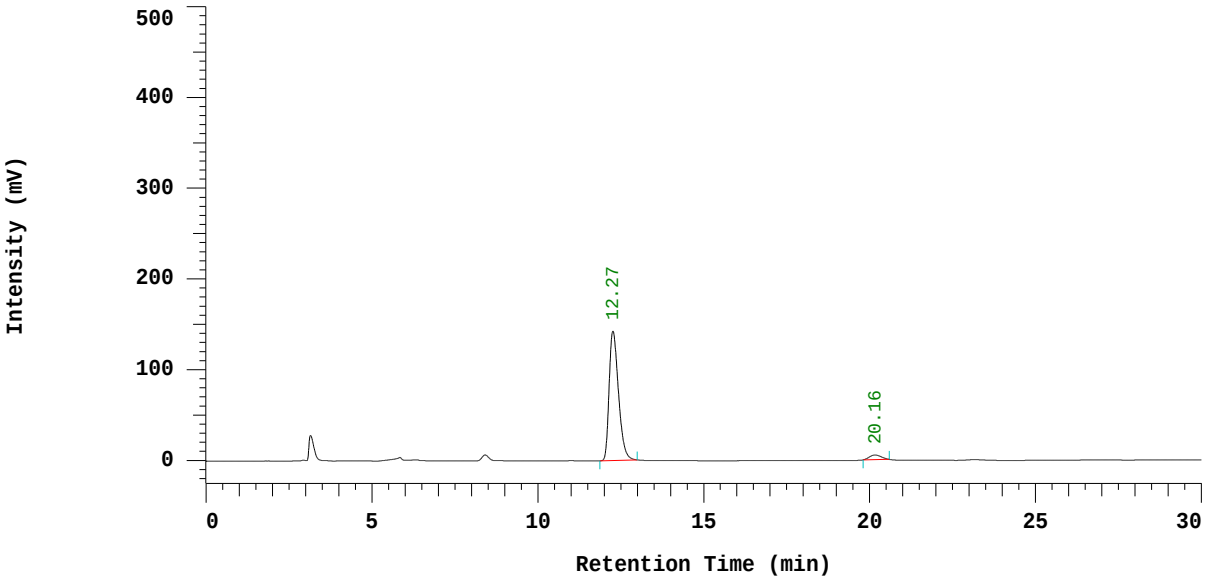
Fig S234. HPLC analysis of the racemic compound 5, for comparison (Scheme 6, one-pot synthesis).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/21/2017 09:43 PM
Reported Date and Time: 01/21/2017 10:28 PM
Processed Date and Time: 01/21/2017 10:27 PM
Data Path: D:\Vishal\DATA\0181\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0181
Application(data): Vishal
Vial Number: 2
Sample Name: VMS-03-162 (Chiral)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 254 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 254 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.27	2765468	142571	95.595
2	20.16	127445	5144	4.405
		2892913	147715	100.000

Peak rejection level: 200

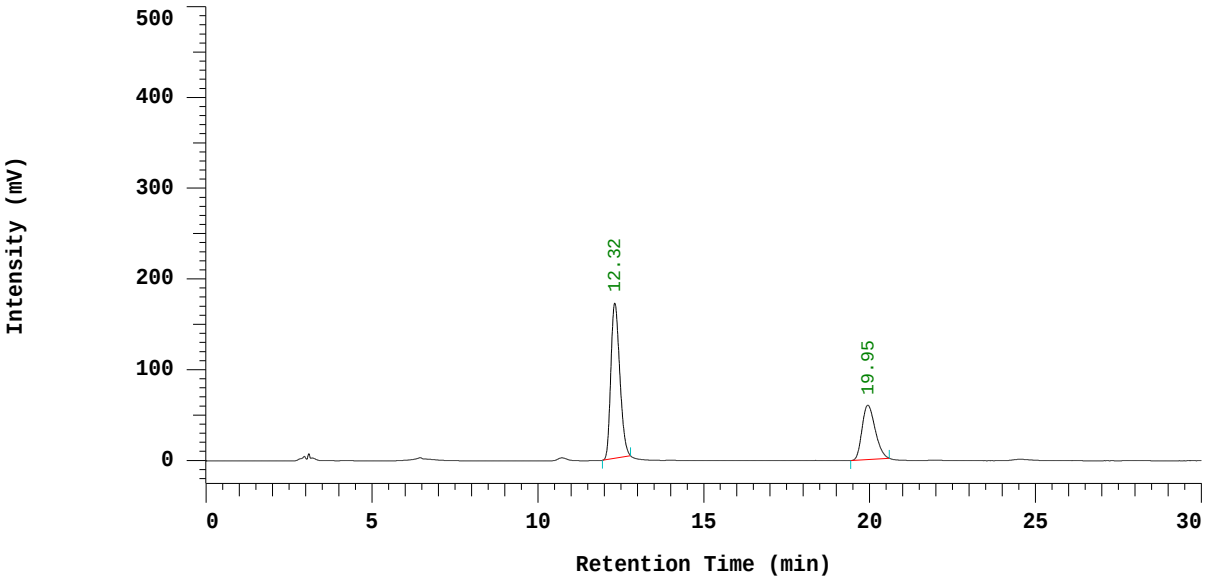
Fig S235. HPLC analysis of the chiral compound 5 obtained (Scheme 6, one-pot synthesis).

D-2000 Elite HPLC System Manager Report

Analyzed Date and Time: 01/21/2017 10:15 PM
Reported Date and Time: 01/21/2017 11:14 PM
Processed Date and Time: 01/21/2017 11:13 PM
Data Path: D:\Vishal\DATA\0182\
Processing Method: test- 10% MeOH/EA/Hx 7

System (acquisition): Sys 1
Series: 0182
Application(data): Vishal
Vial Number: 3
Sample Name: VMS-03-162 (Co)
Vial Type: UNK
Injection from this vial: 1 of 1
Volume: 20.0 ul
Sample Description: 10%me/ea+HX 1mL/MIN COL-ODH

Chrom Type: Fixed WL Chromatogram, 280 nm



Processing Method: test- 10% MeOH/EA/Hx 7
Column Type: ODH
Method Developer: Vishal
Method Description:

Chrom Type: Fixed WL Chromatogram, 280 nm
Peak Quantitation: AREA
Calculation Method: EXT-STD
Scale Factor 1: 1.000

No.	RT	Area	Height	Area %
1	12.32	3168152	171056	65.931
2	19.95	1637094	59904	34.069
		4805246	230960	100.000

Peak rejection level: 200

Fig S236. HPLC analysis of the co-injection of racemic compound 5 and chiral compound 5, for comparison (Scheme 6, one-pot synthesis).