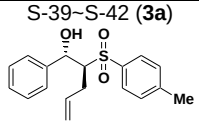
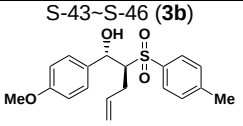
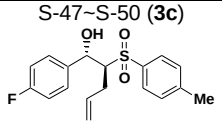
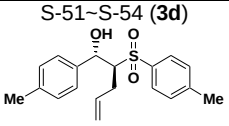
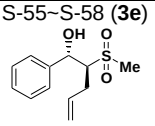
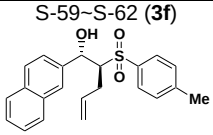
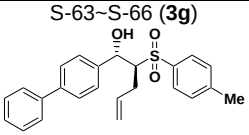
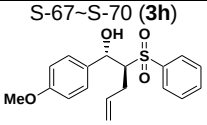
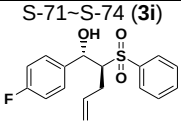
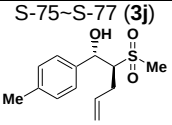
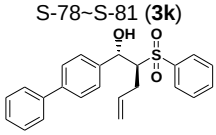
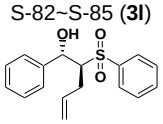
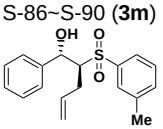
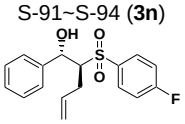
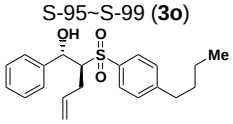
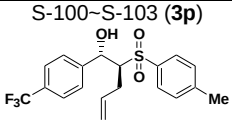
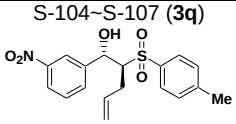
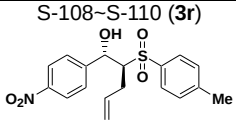
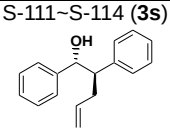
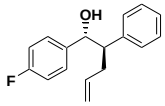
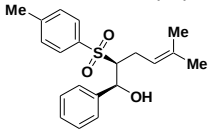
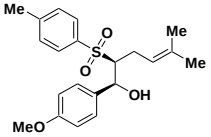
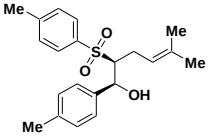
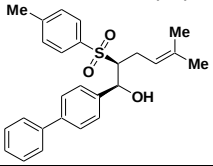
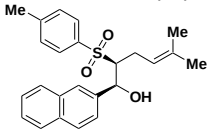
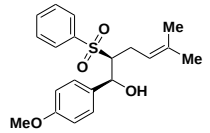
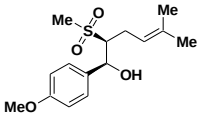
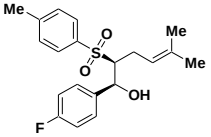
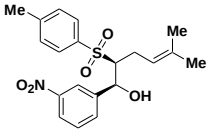
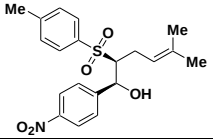
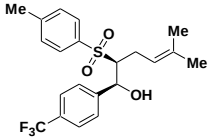
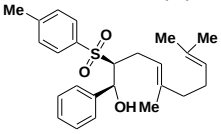
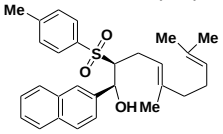
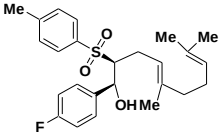
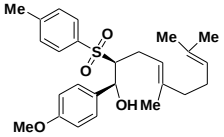
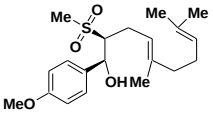
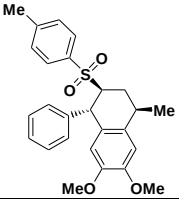
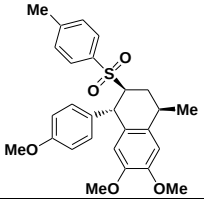
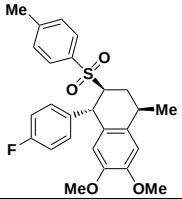
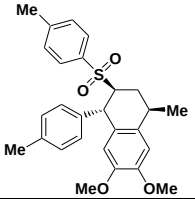
Supporting Information

Synthesis of Substituted Tetralins and Benzosuberans via $BF_3{\cdot}OEt_2$ Mediated Formal (4+2) and (5+2) Stereocontrolled Cycloaddition of 4-Alkenols with Veratrol

Meng-Yang Chang* and Yu-Chieh Cheng

(1) ^{1}H &^{13}C NMR spectroscopic data (pages S-3~S-38)

(2) Additional scanned photocopies (pages S-39~S-351)

S-39~S-42 (**3a**) 	S-43~S-46 (**3b**) 	S-47~S-50 (**3c**) 	S-51~S-54 (**3d**) 	S-55~S-58 (**3e**) 
S-59~S-62 (**3f**) 	S-63~S-66 (**3g**) 	S-67~S-70 (**3h**) 	S-71~S-74 (**3i**) 	S-75~S-77 (**3j**) 
S-78~S-81 (**3k**) 	S-82~S-85 (**3l**) 	S-86~S-90 (**3m**) 	S-91~S-94 (**3n**) 	S-95~S-99 (**3o**) 
S-100~S-103 (**3p**) 	S-104~S-107 (**3q**) 	S-108~S-110 (**3r**) 	S-111~S-114 (**3s**) 	S-115~S-118 (**3t**) 
S-119~S-122 (**4a**) 	S-123~S-126 (**4b**) 	S-127~S-129 (**4c**) 	S-130~S-133 (**4d**) 	S-134~S-137 (**4e**) 
S-138~S-141 (**4f**) 	S-142~S-144 (**4g**) 	S-145~S-148 (**4h**) 	S-149~S-152 (**4i**) 	S-153~S-155 (**4j**) 
S-156~S-158 (**4k**) 	S-159~S-162 (**4l**) 	S-163~S-166 (**4m**) 	S-167~S-170 (**4n**) 	S-171~S-174 (**4o**) 
S-175~S-177 (**4p**) 	S-178~S-181 (**5a**) 	S-182~S-185 (**5b**) 	S-186~S-189 (**5c**) 	S-190~S-193 (**5d**) 
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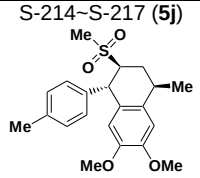
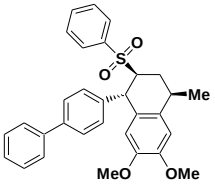
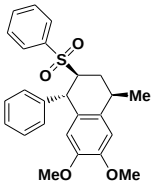
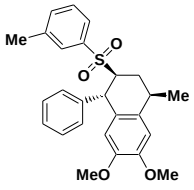
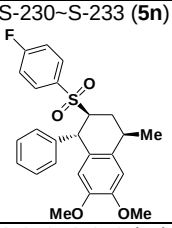
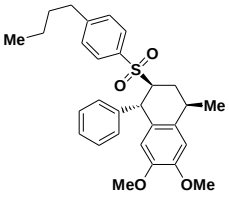
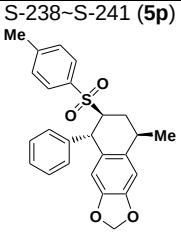
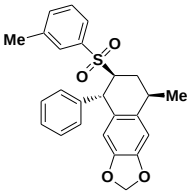
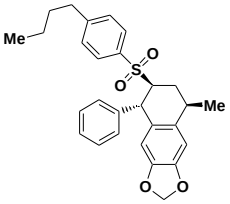
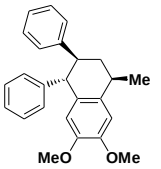
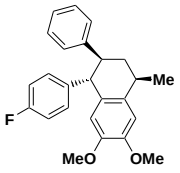
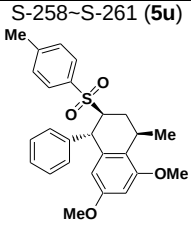
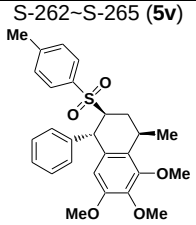
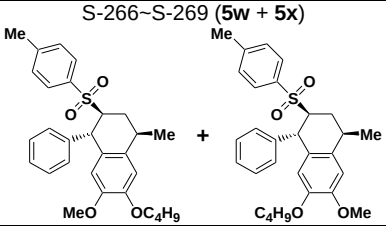
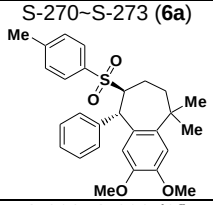
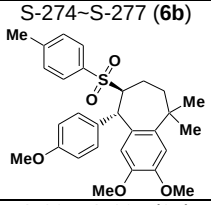
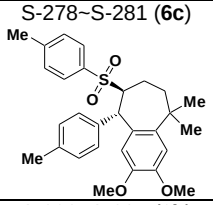
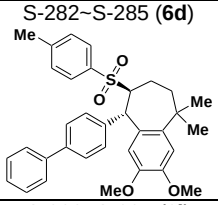
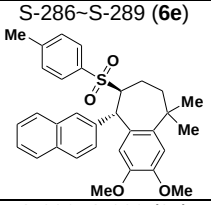
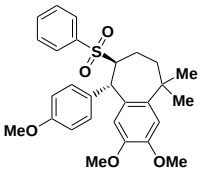
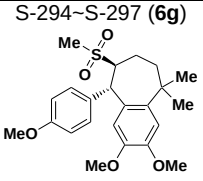
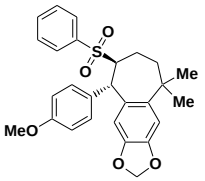
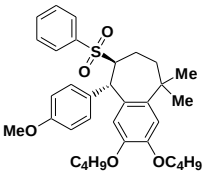
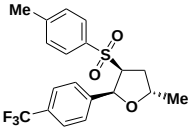
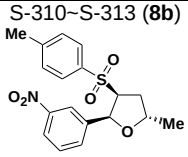
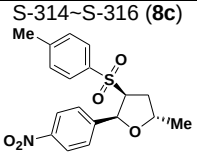
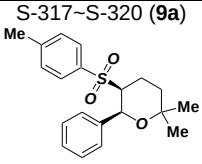
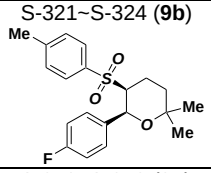
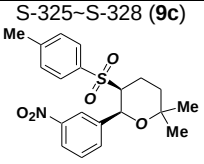
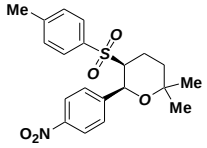
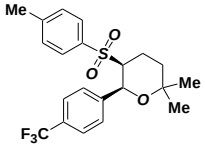
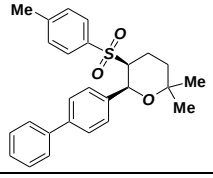
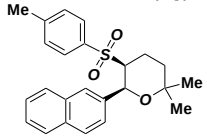
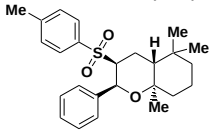
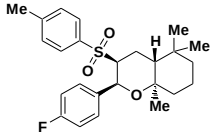
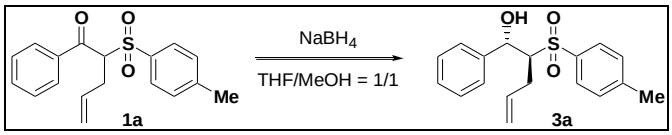
S-214~S-217 (**5j**) 	S-218~S-221 (**5k**) 	S-222~S-225 (**5l**) 	S-226~S-229 (**5m**) 	S-230~S-233 (**5n**) 
S-234~S-237 (**5o**) 	S-238~S-241 (**5p**) 	S-242~S-245 (**5q**) 	S-246~S-249 (**5r**) 	S-250~S-253 (**5s**) 
S-254~S-257 (**5t**) 	S-258~S-261 (**5u**) 	S-262~S-265 (**5v**) 	S-266~S-269 (**5w** + **5x**) 	
S-270~S-273 (**6a**) 	S-274~S-277 (**6b**) 	S-278~S-281 (**6c**) 	S-282~S-285 (**6d**) 	S-286~S-289 (**6e**) 
S-290~S-293 (**6f**) 	S-294~S-297 (**6g**) 	S-298~S-301 (**6h**) 	S-302~S-305 (**6i**) 	S-306~S-309 (**8a**) 
S-310~S-313 (**8b**) 	S-314~S-316 (**8c**) 	S-317~S-320 (**9a**) 	S-321~S-324 (**9b**) 	S-325~S-328 (**9c**) 
S-329~S-331 (**9d**) 	S-332~S-335 (**9e**) 	S-336~S-339 (**9f**) 	S-340~S-343 (**9g**) 	S-344~S-347 (**10a**) 
S-348~S-351 (**10b**) 				

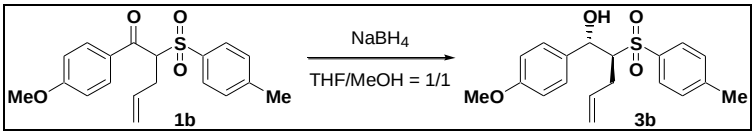
1. Experimental section

1.1. General. All other reagents and solvents were obtained from commercial sources and used without further purification. Reactions were routinely carried out under an atmosphere of dry nitrogen with magnetic stirring. Products in organic solvents were dried with anhydrous magnesium sulfate before concentration in vacuo. Melting points were determined with a SMP3 melting apparatus. ^{1}H and ^{13}C NMR spectra were recorded on a Varian INOVA-400 spectrometer operating at 400 and at 100 MHz, respectively. Chemical shifts (δ) are reported in parts per million (ppm) and the coupling constants (*J*) are given in Hertz. High resolution mass spectra (HRMS) were measured with a mass spectrometer Finnigan/Thermo Quest MAT 95XL. X-ray crystal structures were obtained with an Enraf-Nonius FR-590 diffractometer (CAD4, Kappa CCD). Elemental analyses were carried out with Heraeus Vario III-NCSH, Heraeus CHN-OS-Rapid Analyzer or Elementar Vario EL III.

1.2. A representative synthetic procedure of compounds 3a-t is as follows: $NaBH_4$ (100 mg, 3.0 mmol) was added to a solution of **1a**-**t** (1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C. The reaction mixture was stirred for 1 h at 0 ^{o}C and the solvent was concentrated. The residue was diluted with water (10 mL) and the mixture was extracted with CH_2Cl_2 (3 x 20 mL). The combined organic layers were washed with brine, dried, filtered and evaporated to afford crude product. Purification on silica gel (hexanes/EtOAc = 5/1~3/1) afforded **3a**-**t**.

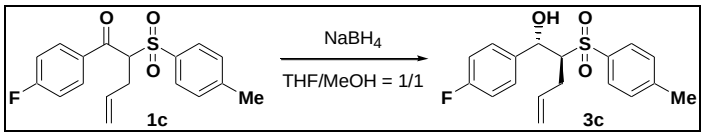


1.2.1. 1-Phenyl-2-(toluene-4-sulfonyl)pent-4-en-1-ol (3a). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1a** (314 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 4/1) afforded **3a** (92%, 291 mg). Colorless solid; mp = 79-80 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^{+}+1) calcd for $C_{18}H_{21}O_3S$ 317.1212, found 317.1218; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.78 (d, *J* = 8.4 Hz, 2H), 7.36-7.27 (m, 7H), 5.25-5.15 (m, 1H), 5.05 (d, *J* = 8.4 Hz, 1H), 4.72 (dq, *J* = 1.2, 10.4 Hz, 1H), 4.58 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.20 (br s, 1H), 3.44-3.39 (m, 1H), 2.46 (s, 3H), 2.32-2.25 (m, 1H), 2.12-2.05 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 145.09, 139.44, 135.22, 133.04, 129.81 (2x), 128.82 (2x), 128.51 (3x), 127.31 (2x), 117.52, 73.08, 70.39, 31.11, 21.64; Anal. Calcd for $C_{18}H_{20}O_3S$: C, 68.33; H, 6.37. Found: C, 68.58; H, 6.46.

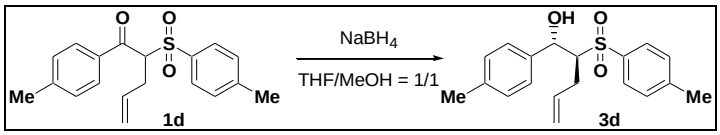


1.2.2. 1-(4-Methoxyphenyl)-2-(toluene-4-sulfonyl)pent-4-en-1-ol (3b). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1b** (344 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **3b** (93%, 322 mg). Colorless oil; HRMS (ESI, M^{+}+1) calcd for

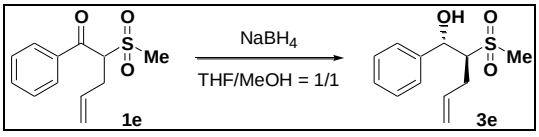
$C_{19}H_{23}O_4S$ 347.1317, found 347.1315; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.79 (d, *J* = 8.0 Hz, 2H), 7.35 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 8.4 Hz, 2H), 6.83 (d, *J* = 8.8 Hz, 2H), 5.27-5.17 (m, 1H), 5.01 (d, *J* = 8.4 Hz, 1H), 4.73 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.59 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.34 (br s, 1H), 3.78 (s, 3H), 3.41-3.36 (m, 1H), 2.46 (s, 3H), 2.30-2.23 (m, 1H), 2.12-2.03 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.73, 145.07, 135.28, 133.15, 131.65, 129.81 (2x), 128.84 (2x), 128.51 (2x), 117.45, 113.88 (2x), 72.69, 70.56, 55.26, 31.20, 21.66; Anal. Calcd for $C_{19}H_{22}O_4S$: C, 65.87; H, 6.40. Found: C, 65.55; H, 6.70.



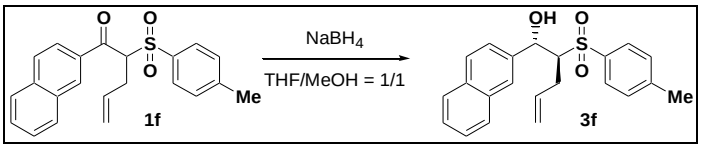
1.2.3. 1-(4-Fluorophenyl)-2-(toluene-4-sulfonyl)pent-4-en-1-ol (3c). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1c** (332 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3c** (86%, 287 mg). Colorless solid; mp = 82-83 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{18}H_{20}FO_3S$ 335.1117, found 335.1118; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.77 (d, *J* = 8.4 Hz, 2H), 7.36 (d, *J* = 8.0 Hz, 2H), 7.30-7.23 (m, 2H), 7.01-6.96 (m, 2H), 5.26-5.16 (m, 1H), 5.06 (d, *J* = 8.8 Hz, 1H), 4.74 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.59 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.46 (br s, 1H), 3.40-3.35 (m, 1H), 2.46 (s, 3H), 2.34-2.27 (m, 1H), 2.11-2.03 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.69 (d, *J* = 245.6 Hz), 145.27, 135.34 (d, *J* = 3.0 Hz), 135.03, 132.83, 129.88 (2x), 129.01 (d, *J* = 7.6 Hz, 2x), 128.81 (2x), 117.70, 115.40 (d, *J* = 21.3 Hz, 2x), 72.37, 70.30, 31.05, 21.66.



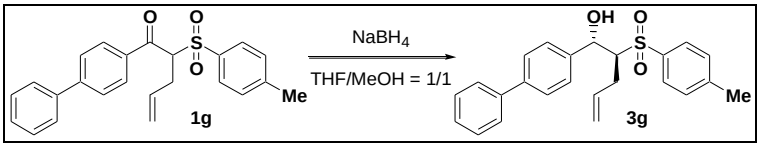
1.2.4. 2-(Toluene-4-sulfonyl)-1-*p*-tolylpent-4-en-1-ol (3d). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1d** (328 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3d** (93%, 307 mg). Colorless oil; HRMS (ESI, M^++1) calcd for $C_{19}H_{23}O_3S$ 331.1368, found 331.1366; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.77 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.17 (d, *J* = 8.4 Hz, 2H), 7.09 (d, *J* = 8.4 Hz, 2H), 5.30-5.20 (m, 1H), 5.02 (d, *J* = 8.4 Hz, 1H), 4.75 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.61 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.32 (br s, 1H), 3.44-3.39 (m, 1H), 2.45 (s, 3H), 2.31 (s, 3H), 2.30-2.24 (m, 1H), 2.14-2.07 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 144.95, 138.22, 136.48, 135.35, 133.15, 129.71 (2x), 129.12 (2x), 128.76 (2x), 127.11 (2x), 117.47, 72.82, 70.36, 31.07, 21.60, 21.08; Anal. Calcd for $C_{19}H_{22}O_3S$: C, 69.06; H, 6.71. Found: C, 69.38; H, 6.87.



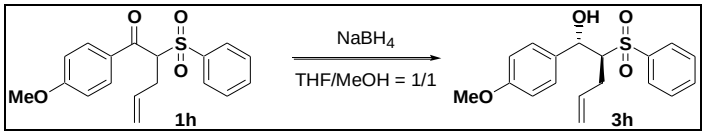
1.2.5. 2-Methanesulfonyl-1-phenylpent-4-en-1-ol (3e). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1e** (238 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3e** (87%, 209 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{12}H_{17}O_3S$ 241.0899, found 241.0902; ^1H NMR (400 MHz, $CDCl_3$): δ 7.40-7.38 (m, 4H), 7.35-7.29 (m, 1H), 5.69 (br s, 1H), 5.63-5.52 (m, 1H), 5.03-4.95 (m, 2H), 3.13 (dt, *J* = 1.6, 7.2 Hz, 1H), 2.94 (s, 3H), 2.87 (d, *J* = 2.8 Hz, 1H), 2.64 (dt, *J* = 1.6, 6.8 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 139.90, 134.72, 128.68 (2x), 128.07, 125.67 (2x), 117.70, 70.29, 70.22, 40.65, 27.05; Anal. Calcd for $C_{12}H_{16}O_3S$: C, 59.97; H, 6.71. Found: C, 60.21; H, 6.82.



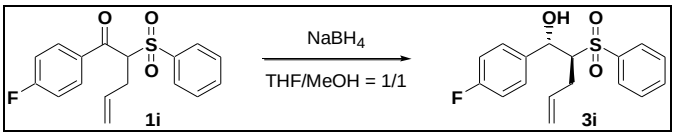
1.2.6. 1-Naphthalen-2-yl-2-(toluene-4-sulfonyl)pent-4-en-1-ol (3f). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1f** (364 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3f** (90%, 329 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{22}H_{23}O_3S$ 367.1368, found 367.1369; ^1H NMR (400 MHz, $CDCl_3$): δ 7.80-7.71 (m, 6H), 7.50-7.45 (m, 2H), 7.38 (dd, *J* = 1.6, 8.4 Hz, 1H), 7.24 (d, *J* = 8.4 Hz, 2H), 5.37-5.27 (m, 1H), 5.24 (d, *J* = 8.0 Hz, 1H), 4.74 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.63 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.50 (br s, 1H), 3.58-3.53 (m, 1H), 2.43-2.36 (m, 1H), 2.38 (s, 3H), 2.26-2.19 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 145.01, 136.80, 135.36, 133.25, 133.07, 132.97, 129.68 (2x), 128.70 (2x), 128.46, 127.99, 127.60, 126.64, 126.30, 126.27, 124.28, 117.89, 72.99, 69.96, 30.97, 21.57.



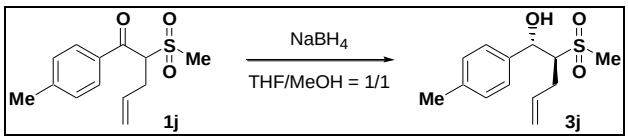
1.2.7. 1-Biphenyl-4-yl-2-(toluene-4-sulfonyl)pent-4-en-1-ol (3g). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1g** (390 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3g** (92%, 361 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{24}H_{25}O_3S$ 393.1524, found 393.1528; ^1H NMR (400 MHz, $CDCl_3$): δ 7.77 (d, *J* = 8.4 Hz, 2H), 7.57-7.50 (m, 4H), 7.46-7.41 (m, 2H), 7.37-7.32 (m, 5H), 5.38-5.28 (m, 1H), 5.13 (d, *J* = 8.0 Hz, 1H), 4.79 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.68 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.20 (br s, 1H), 3.51-3.46 (m, 1H), 2.43 (s, 3H), 2.42-2.36 (m, 1H), 2.25-2.17 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 145.01, 141.29, 140.43, 138.48, 135.37, 133.06, 129.78 (2x), 128.75 (2x), 128.73 (2x), 127.59 (2x), 127.44, 127.13 (2x), 126.99 (2x), 117.75, 72.63, 70.19, 30.99, 21.60; Anal. Calcd for $C_{24}H_{24}O_3S$: C, 73.44; H, 6.16. Found: C, 73.52; H, 6.23.



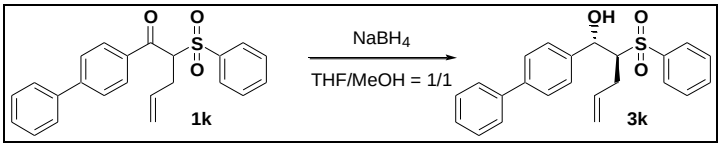
1.2.8. 2-Benzenesulfonyl-1-(4-methoxyphenyl)pent-4-en-1-ol (3h). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1h** (330 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **3h** (90%, 299 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{18}H_{21}O_4S$ 333.1161, found 333.1162; ^1H NMR (400 MHz, $CDCl_3$): δ 7.91-7.88 (m, 2H), 7.67-7.63 (m, 1H), 7.57-7.53 (m, 2H), 7.21 (d, *J* = 8.8 Hz, 2H), 6.82 (d, *J* = 8.8 Hz, 2H), 5.30-5.19 (m, 1H), 5.04 (d, *J* = 8.4 Hz, 1H), 4.75 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.60 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.20 (br s, 1H), 3.77 (s, 3H), 3.45-3.40 (m, 1H), 2.32-2.25 (m, 1H), 2.15-2.08 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.65, 138.52, 133.84, 133.00, 131.56, 129.09 (2x), 128.68 (2x), 128.40 (2x), 117.56, 113.84 (2x), 72.54, 70.43, 55.21, 31.03.



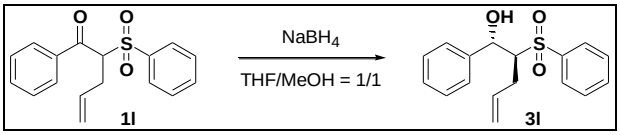
1.2.9. 2-Benzenesulfonyl-1-(4-fluorophenyl)pent-4-en-1-ol (3i). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1i** (318 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3i** (87%, 278 mg). Colorless solid; mp = 106-107 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{17}H_{18}FO_3S$ 321.0961, found 321.0965; ^1H NMR (400 MHz, $CDCl_3$): δ 7.90-7.87 (m, 2H), 7.69-7.64 (m, 1H), 7.58-7.53 (m, 2H), 7.30-7.25 (m, 2H), 7.01-6.95 (m, 2H), 5.28-5.18 (m, 1H), 5.09 (d, *J* = 8.0 Hz, 1H), 4.76 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.60 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.35 (br s, 1H), 3.44-3.39 (m, 1H), 2.36-2.29 (m, 1H), 2.16-2.08 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.64 (d, *J* = 245.6 Hz), 138.27, 135.28 (d, *J* = 3.0 Hz), 134.01, 132.70, 129.20 (2x), 128.93 (d, *J* = 8.3 Hz, 2x), 128.68 (2x), 117.84, 115.40 (d, *J* = 21.3 Hz, 2x), 72.24, 70.22, 30.92; Anal. Calcd for $C_{17}H_{17}FO_3S$: C, 63.73; H, 5.35. Found: C, 63.87; H, 5.28.



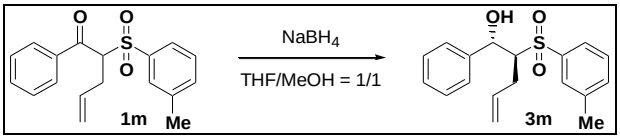
1.2.10. 2-Methanesulfonyl-1-*p*-tolylpent-4-en-1-ol (3j). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1j** (252 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3j** (90%, 229 mg). Colorless oil; HRMS (ESI, M^++1) calcd for $C_{13}H_{19}O_3S$ 255.1055, found 255.1056; ^1H NMR (400 MHz, $CDCl_3$): δ 7.25-7.17 (m, 5H), 5.72-5.62 (m, 1H), 5.01 (br s, 1H), 4.99 (br s, 1H), 4.90 (dq, *J* = 1.6, 17.2 Hz, 1H), 3.30-3.25 (m, 1H), 2.97 (s, 3H), 2.48-2.32 (m, 2H), 2.35 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 138.61, 137.11, 133.17, 129.46 (2x), 126.87 (2x), 118.49, 72.74, 68.95, 44.00, 29.68, 21.12; Anal. Calcd for $C_{13}H_{18}O_3S$: C, 61.39; H, 7.13. Found: C, 61.53; H, 7.34.



1.2.11. 2-Benzenesulfonyl-1-biphenyl-4-ylpent-4-en-1-ol (3k). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1k** (376 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 4/1) afforded **3k** (92%, 348 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{23}H_{23}O_3S$ 379.1368, found 379.1370; ^1H NMR (400 MHz, $CDCl_3$): δ 7.90-7.87 (m, 2H), 7.67-7.62 (m, 1H), 7.60-7.50 (m, 6H), 7.46-7.42 (m, 2H), 7.38-7.33 (m, 3H), 5.39-5.29 (m, 1H), 5.16 (d, *J* = 8.0 Hz, 1H), 4.80 (dq, *J* = 1.6, 10.4 Hz, 1H), 4.70 (dq, *J* = 1.6, 16.8 Hz, 1H), 4.33 (br s, 1H), 3.52 (dq, *J* = 1.6, 11.6 Hz, 1H), 2.45-2.38 (m, 1H), 2.29-2.22 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 141.34, 140.43, 138.58, 138.42, 133.82, 132.97, 129.13 (2x), 128.78 (2x), 128.66 (2x), 127.55 (2x), 127.47, 127.19 (2x), 127.00 (2x), 117.93, 72.58, 70.19, 30.93; Anal. Calcd for $C_{23}H_{22}O_3S$: C, 72.99; H, 5.86. Found: C, 72.80; H, 6.16.

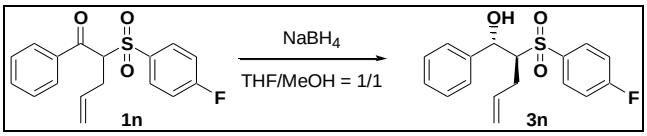


1.2.12. 2-Benzenesulfonyl-1-phenylpent-4-en-1-ol (3l). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1l** (300 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 4/1) afforded **3l** (92%, 278 mg). Colorless solid; mp = 106-107 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{17}H_{19}O_3S$ 303.1055, found 303.1057; ^1H NMR (400 MHz, $CDCl_3$): δ 7.90-7.87 (m, 2H), 7.67-7.62 (m, 1H), 7.56-7.52 (m, 2H), 7.30-7.25 (m, 5H), 5.29-5.19 (m, 1H), 5.09 (d, *J* = 8.4 Hz, 1H), 4.74 (dq, *J* = 1.2, 11.2 Hz, 1H), 4.60 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.20 (br s, 1H), 3.49-3.44 (m, 1H), 2.36-2.28 (m, 1H), 2.18-2.11 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 139.36, 138.46, 133.86, 132.89, 129.10 (2x), 128.65 (2x), 128.49, 128.48 (2x), 127.18 (2x), 117.66, 72.91, 70.25, 30.93; Anal. Calcd for $C_{17}H_{18}O_3S$: C, 67.52; H, 6.00. Found: C, 67.67; H, 6.28.

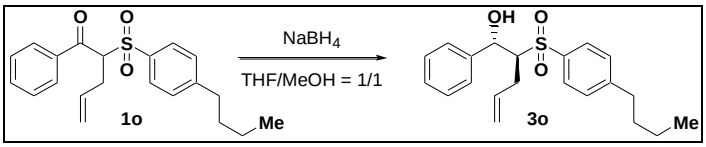


1.2.13. 1-Phenyl-2-(toluene-3-sulfonyl)pent-4-en-1-ol (3m). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1m** (314 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 4/1) afforded **3m** (94%, 297 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{18}H_{21}O_3S$ 317.1212, found 317.1213; ^1H NMR (400 MHz, $CDCl_3$): δ 7.70-7.67 (m, 1H), 7.66 (s, 1H), 7.45-7.40 (m, 2H), 7.31-7.25 (m, 5H), 5.29-5.19 (m, 1H), 5.09 (d, *J* = 8.0 Hz, 1H), 4.75 (dq, *J* = 1.6, 10.4 Hz, 1H), 4.61 (dq, *J* = 1.6, 16.8 Hz, 1H), 4.20 (br s, 1H), 3.48-3.43 (m, 1H), 2.43 (s, 3H), 2.38-2.30 (m, 1H), 2.19-2.11 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 139.44, 139.41, 138.24,

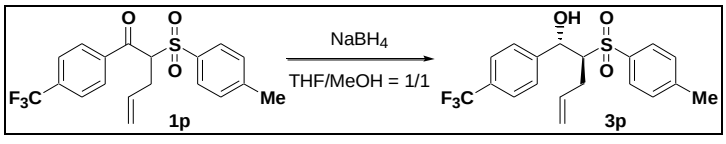
134.71, 133.02, 128.99, 128.94, 128.46, 128.45 (2x), 127.19 (2x), 125.80, 117.63, 72.88, 70.21, 30.97, 21.28; Anal. Calcd for $C_{18}H_{20}O_3S$: C, 68.33; H, 6.37. Found: C, 68.23; H, 6.48.



1.2.14. 2-(4-Fluorobenzenesulfonyl)-1-phenylpent-4-en-1-ol (3n). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1n** (318 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3n** (90%, 288 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{17}H_{18}FO_3S$ 321.0961, found 321.0965; ^1H NMR (400 MHz, $CDCl_3$): δ 7.89-7.84 (m, 2H), 7.31-7.23 (m, 5H), 7.20-7.14 (m, 2H), 5.38-5.28 (m, 1H), 5.06 (d, *J* = 8.0 Hz, 1H), 4.80 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.68 (dq, *J* = 1.2, 16.8 Hz, 1H), 3.90 (br s, 1H), 3.50-3.45 (m, 1H), 2.38-2.26 (m, 1H), 2.25-2.19 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 165.66 (d, *J* = 254.7 Hz), 139.42, 134.96 (d, *J* = 3.0 Hz), 132.78, 131.50 (d, *J* = 9.9 Hz, 2x), 128.45 (2x), 128.43, 127.00 (2x), 117.87, 116.25 (d, *J* = 22.7 Hz, 2x), 72.73, 70.28, 30.76.

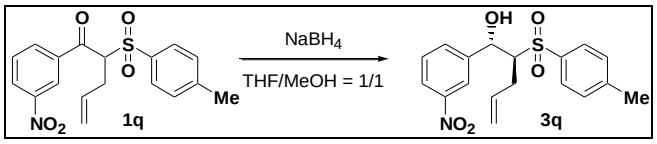


1.2.15. 2-(4-Butylbenzenesulfonyl)-1-phenylpent-4-en-1-ol (3o). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1o** (356 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3o** (95%, 340 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{21}H_{27}O_3S$ 359.1681, found 359.1687; ^1H NMR (400 MHz, $CDCl_3$): δ 7.73 (d, *J* = 8.4 Hz, 2H), 7.27 (d, *J* = 8.4 Hz, 2H), 7.25-7.19 (m, 5H), 5.25-5.14 (m, 1H), 5.02 (d, *J* = 8.4 Hz, 1H), 4.68 (dq, *J* = 1.2, 10.0 Hz, 1H), 4.55 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.00 (br s, 1H), 3.43-3.38 (m, 1H), 2.63 (t, *J* = 8.0 Hz, 2H), 2.31-2.24 (m, 1H), 2.12-2.05 (m, 1H), 1.60-1.53 (m, 2H), 1.35-1.26 (m, 2H), 0.89 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 149.70, 139.42, 135.41, 132.97, 129.00 (2x), 128.62 (2x), 128.30 (2x), 128.27, 127.11 (2x), 72.78, 70.11, 35.40, 32.90, 30.86, 29.50, 22.05, 13.68.

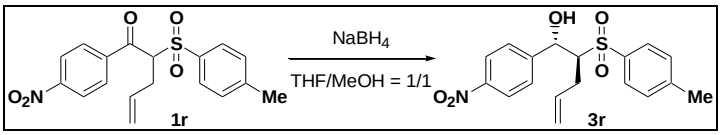


1.2.16. 2-(Toluene-4-sulfonyl)-1-(4-trifluoromethylphenyl)pent-4-en-1-ol (3p). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1p** (382 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3p** (89%, 342 mg). Colorless solid; mp = 103-104 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{19}H_{20}F_3O_3S$ 385.1085, found 385.1087; ^1H NMR (400 MHz, $CDCl_3$): δ 7.65 (d, *J* = 8.4 Hz, 2H), 7.49 (d, *J* = 8.4 Hz, 2H), 7.38 (d, *J* = 8.4 Hz, 2H), 7.27 (d, *J* = 8.4 Hz, 2H), 5.40-5.30 (m, 1H), 5.14 (d, *J* = 7.2 Hz, 1H), 4.84

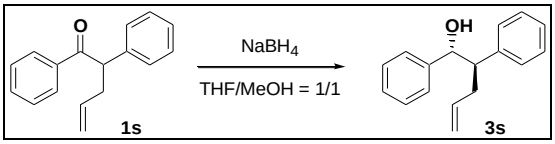
(dq, *J* = 1.2, 10.0 Hz, 1H), 4.73 (dq, *J* = 1.2, 16.8 Hz, 1H), 4.48 (br s, 1H), 3.48-3.43 (m, 1H), 2.52-2.44 (m, 1H), 2.42 (s, 3H), 2.29-2.21 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 145.22, 143.61, 135.18, 132.63, 129.81 (2x), 128.53 (2x), 127.32 (2x), 125.31 (d, *J* = 3.8 Hz, 2x), 125.23 (d, *J* = 3.7 Hz, 2x), 118.32, 71.91, 69.45, 30.58, 21.53.



1.2.17. 1-(3-Nitrophenyl)-2-(toluene-4-sulfonyl)pent-4-en-1-ol (3q). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1q** (359 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3q** (86%, 310 mg). Colorless solid; mp = 121-122 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{18}H_{20}NO_5S$ 362.1062, found 362.1063; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.11-8.07 (m, 2H), 7.69 (d, *J* = 8.4 Hz, 3H), 7.48 (d, *J* = 8.0 Hz, 1H), 7.31 (d, *J* = 8.0 Hz, 2H), 5.39-5.28 (m, 1H), 5.19 (dd, *J* = 4.0, 7.2 Hz, 1H), 4.83 (dq, *J* = 1.2, 10.4 Hz, 1H), 4.70 (dq, *J* = 1.2, 17.2 Hz, 1H), 4.57 (d, *J* = 4.4 Hz, 1H), 3.50-3.45 (m, 1H), 2.51-2.45 (m, 1H), 2.43 (s, 3H), 2.27-2.19 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 148.10, 145.48, 141.89, 134.88, 133.14, 132.42, 129.96 (2x), 129.40, 128.61 (2x), 123.12, 122.10, 118.51, 71.71, 69.23, 30.68, 21.60; Anal. Calcd for $C_{18}H_{19}NO_5S$: C, 59.82; H, 5.30. Found: C, 59.95; H, 5.48.

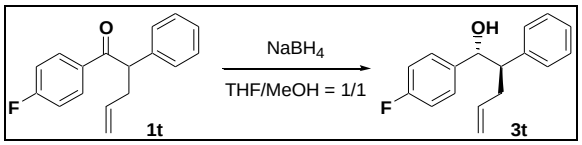


1.2.18. 1-(4-Nitrophenyl)-2-(toluene-4-sulfonyl)pent-4-en-1-ol (3r). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1r** (359 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3r** (72%, 260 mg). Colorless solid; mp = 142-143 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{18}H_{20}NO_5S$ 362.1062, found 362.1063; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.12 (d, *J* = 8.8 Hz, 2H), 7.69 (d, *J* = 8.4 Hz, 2H), 7.47 (d, *J* = 8.8 Hz, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 5.37-5.26 (m, 1H), 5.21 (d, *J* = 7.2 Hz, 1H), 4.84 (dq, *J* = 1.2, 10.4 Hz, 1H), 4.72 (dq, *J* = 1.2, 17.2 Hz, 1H), 4.53 (br s, 1H), 3.47-3.42 (m, 1H), 2.49-2.41 (m, 1H), 2.44 (s, 3H), 2.26-2.17 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 146.84, 145.57, 134.88, 132.40, 130.86, 129.93 (2x), 128.65 (2x), 127.99 (2x), 123.52 (2x), 118.59, 71.79, 69.37, 30.65, 21.63.



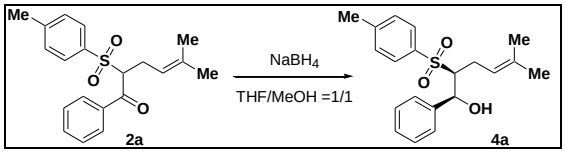
1.2.19. 1,2-Diphenylpent-4-en-1-ol (3s). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1s** (236 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3s** (80%, 190 mg). Colorless solid; mp = 50-51 ^{o}C (recrystallized

from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{17}H_{19}O$ 239.1436, found 239.1441; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.37-7.14 (m, 10H), 5.57-5.47 (m, 1H), 5.01-5.83 (m, 2H), 4.80 (d, *J* = 8.0 Hz, 1H), 3.00-2.95 (m, 1H), 2.39-2.24 (m, 2H), 1.80 (br s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 142.43, 140.39, 136.14, 128.93 (2x), 128.45 (2x), 128.26 (2x), 127.77, 126.95, 126.85 (2x), 116.23, 77.91, 53.95, 36.39.

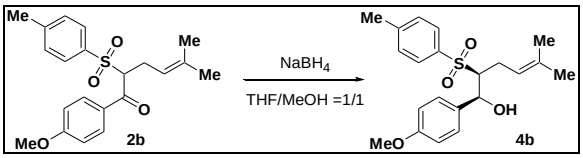


1.2.20. 1-(4-Fluorophenyl)-2-phenylpent-4-en-1-ol (3t). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **1t** (254 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **3t** (82%, 210 mg). Colorless solid; mp = 54-55 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{17}H_{18}FO$ 257.1342, found 257.1345; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.36-7.32 (m, 2H), 7.30-7.19 (m, 5H), 7.06-7.01 (m, 2H), 5.59-5.48 (m, 1H), 4.92-4.85 (m, 2H), 4.78 (d, *J* = 7.2 Hz, 1H), 2.96-2.90 (m, 1H), 2.39-2.26 (m, 2H), 1.95 (br s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.18 (d, *J* = 244.1 Hz), 140.02, 138.11 (d, *J* = 3.1 Hz), 135.92, 128.85 (2x), 128.40 (2x), 128.15 (d, *J* = 8.3 Hz, 2x), 126.94, 116.27, 114.96 (d, *J* = 21.2 Hz, 2x), 77.02, 53.94, 36.20.

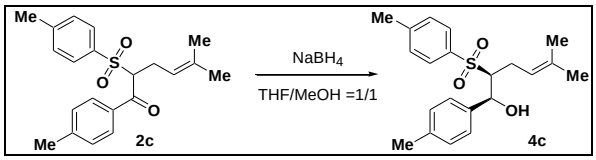
1.3. A representative synthetic procedure of compounds 4a-p is as follows: $NaBH_4$ (100 mg, 3.0 mmol) was added to a solution of **2a**-**p** (1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C. The reaction mixture was stirred for 1 h at 0 ^{o}C and the solvent was concentrated. The residue was diluted with water (10 mL) and the mixture was extracted with CH_2Cl_2 (3 x 20 mL). The combined organic layers were washed with brine, dried, filtered and evaporated to afford crude product. Purification on silica gel (hexanes/EtOAc = 5/1~3/1) afforded **4a**-**p**.



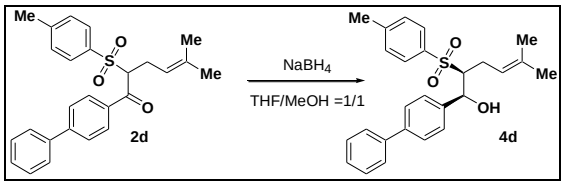
1.3.1. 5-Methyl-1-phenyl-2-(toluene-4-sulfonyl)hex-4-en-1-ol (4a). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2a** (342 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4a** (90%, 310 mg). Colorless solid; mp = 84-85 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{20}H_{25}O_3S$ 345.1524, found 345.1530; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, *J* = 8.0 Hz, 2H), 7.33 (d, *J* = 8.4 Hz, 2H), 7.30-7.24 (m, 5H), 5.07 (d, *J* = 8.4 Hz, 1H), 4.50 (br s, 1H), 4.43 (br t, *J* = 6.8 Hz, 1H), 3.41-3.35 (m, 1H), 2.45 (s, 3H), 2.29-2.21 (m, 1H), 2.02-1.94 (m, 1H), 1.38 (s, 3H), 1.15 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 144.91, 139.68, 135.54, 134.14, 129.71 (2x), 128.73 (2x), 128.43 (2x), 128.34, 127.25 (2x), 119.19, 73.07, 70.94, 25.75, 25.46, 21.61, 17.27.



1.3.2. 1-(4-Methoxyphenyl)-5-methyl-2-(toluene-4-sulfonyl)hex-4-en-1-ol (4b). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2b** (372 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **4b** (92%, 344 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{21}H_{27}O_4S$ 375.1630, found 375.1632; ^1H NMR (400 MHz, $CDCl_3$): δ 7.75 (d, *J* = 8.0 Hz, 2H), 7.32 (d, *J* = 8.0 Hz, 2H), 7.20 (d, *J* = 8.8 Hz, 2H), 6.80 (d, *J* = 8.8 Hz, 2H), 5.03 (d, *J* = 8.8 Hz, 1H), 4.48-4.44 (m, 1H), 4.45 (br s, 1H), 3.75 (s, 3H), 3.38-3.33 (m, 1H), 2.42 (s, 3H), 2.29-2.18 (m, 1H), 2.00-1.93 (m, 1H), 1.39 (d, *J* = 1.6 Hz, 3H), 1.16 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.42, 144.72, 135.53, 133.75, 131.81, 129.56 (2x), 128.58 (2x), 128.31 (2x), 119.22, 113.65 (2x), 72.49, 70.91, 55.11, 25.66, 25.36, 21.47, 17.21.

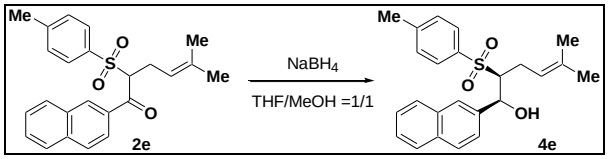


1.3.3. 5-Methyl-2-(toluene-4-sulfonyl)-1-*p*-tolylhex-4-en-1-ol (4c). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2c** (356 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 6/1) afforded **4c** (94%, 337 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{21}H_{27}O_3S$ 359.1681, found 359.1685; ^1H NMR (400 MHz, $CDCl_3$): δ 7.74 (d, *J* = 8.4 Hz, 2H), 7.30 (d, *J* = 8.0 Hz, 2H), 7.16 (d, *J* = 8.0 Hz, 2H), 7.07 (d, *J* = 8.0 Hz, 2H), 5.03 (d, *J* = 8.4 Hz, 1H), 4.47 (br t, *J* = 6.8 Hz, 1H), 4.00 (br s, 1H), 3.40-3.35 (m, 1H), 2.42 (s, 3H), 2.29 (s, 3H), 2.26-2.20 (m, 1H), 2.03-1.96 (m, 1H), 1.38 (s, 3H), 1.16 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 144.68, 137.86, 136.67, 135.62, 133.79, 129.53 (2x), 128.92 (2x), 128.56 (2x), 126.99 (2x), 119.22, 72.70, 70.83, 25.61, 25.35, 21.47, 20.97, 17.19.

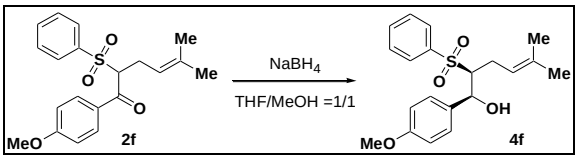


1.3.4. 1-Biphenyl-4-yl-5-methyl-2-(toluene-4-sulfonyl)hex-4-en-1-ol (4d). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2d** (418 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4d** (88%, 370 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{26}H_{29}O_3S$ 421.1837, found 421.1841; ^1H NMR (400 MHz, $CDCl_3$): δ 7.66 (d, *J* = 8.4 Hz, 2H), 7.57-7.30 (m, 11H), 5.15 (d, *J* = 8.0 Hz, 1H), 4.57-4.53 (m, 1H), 3.80 (br s, 1H), 3.49-3.44 (m, 1H), 2.42 (s, 3H), 2.39-2.32 (m, 1H), 2.16-2.08 (m, 1H), 1.41 (d, *J* = 1.2 Hz, 3H), 1.22 (s, 3H); ^{13}C

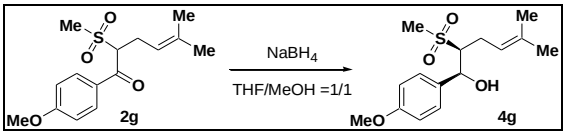
NMR (100 MHz, $CDCl_3$): δ 144.77, 141.04, 140.50, 138.70, 135.55, 134.13, 129.61 (2x), 128.68 (2x), 128.57 (2x), 127.51 (2x), 127.30, 126.97 (2x), 126.89 (2x), 119.18, 72.57, 70.71, 25.54, 25.42, 21.49, 17.29.



1.3.5. 5-Methyl-1-naphthalen-2-yl-2-(toluene-4-sulfonyl)hex-4-en-1-ol (4e). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2e** (392 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4e** (88%, 347 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{24}H_{27}O_3S$ 395.1681, found 395.1685; ^1H NMR (400 MHz, $CDCl_3$): δ 7.68-7.70 (m, 6H), 7.47-7.43 (m, 2H), 7.39 (dd, *J* = 1.6, 8.4 Hz, 1H), 7.19 (d, *J* = 8.0 Hz, 2H), 5.27 (d, *J* = 8.0 Hz, 1H), 4.57-4.54 (m, 1H), 4.60 (br s, 1H), 3.57-3.52 (m, 1H), 2.41-2.35 (m, 1H), 2.33 (s, 3H), 2.18-2.11 (m, 1H), 1.31 (d, *J* = 0.8 Hz, 3H), 1.12 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 144.63, 136.95, 135.54, 134.12, 133.03, 132.85, 129.40 (2x), 128.41 (2x), 128.06, 127.78, 127.38, 126.35, 126.02, 125.97, 124.23, 119.00, 72.78, 70.31, 25.42, 25.23, 21.34, 17.20.

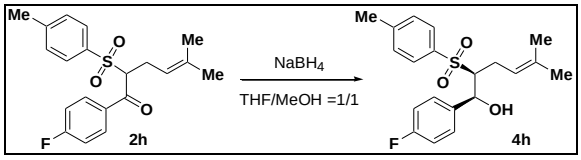


1.3.6. 2-Benzenesulfonyl-1-(4-methoxyphenyl)-5-methylhex-4-en-1-ol (4f). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2f** (358 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4f** (90%, 324 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{20}H_{25}O_4S$ 361.1474, found 361.1483; ^1H NMR (400 MHz, $CDCl_3$): δ 7.91-7.86 (m, 2H), 7.65-7.61 (m, 1H), 7.56-7.51 (m, 2H), 7.22-7.18 (m, 2H), 6.81 (d, *J* = 8.8 Hz, 2H), 5.06 (d, *J* = 8.4 Hz, 1H), 4.48-4.43 (m, 1H), 4.00 (br s, 1H), 3.76 (s, 3H), 3.41-3.36 (m, 1H), 2.28-2.21 (m, 1H), 2.03-1.96 (m, 1H), 1.38 (d, *J* = 1.2 Hz, 3H), 1.16 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.51, 138.79, 134.08, 133.69, 131.78, 128.99 (2x), 128.55 (2x), 128.34 (2x), 119.12, 113.77 (2x), 72.49, 70.95, 55.20, 25.70, 25.45, 17.27.

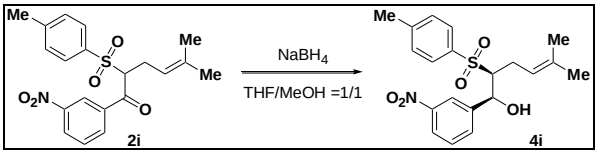


1.3.7. 2-Methanesulfonyl-1-(4-methoxyphenyl)-5-methylhex-4-en-1-ol (4g). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2g** (296 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4g** (92%, 274 mg). Colorless gum; HRMS (ESI, M^++1)

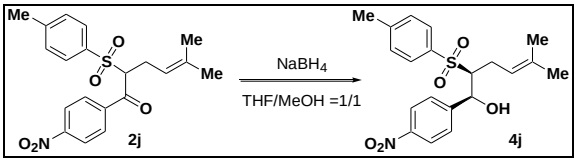
calcd for $C_{15}H_{23}O_4S$ 299.1317, found 299.1320; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.23 (d, *J* = 8.4 Hz, 2H), 6.86 (d, *J* = 8.4 Hz, 2H), 4.96 (d, *J* = 8.8 Hz, 1H), 4.95 (br t, *J* = 6.8 Hz, 1H), 4.52 (br s, 1H), 3.77 (s, 3H), 3.21-3.16 (m, 1H), 2.94 (s, 3H), 2.37-2.23 (m, 2H), 1.58 (s, 3H), 1.32 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.60, 134.70, 132.44, 128.12 (2x), 119.04, 113.99 (2x), 72.52, 69.65, 55.21, 43.73, 25.60, 25.26, 17.47.



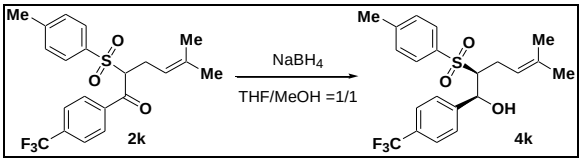
1.3.8. 1-(4-Fluorophenyl)-5-methyl-2-(toluene-4-sulfonyl)hex-4-en-1-ol (4h). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2h** (360 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4h** (90%, 326 mg). Colorless solid; mp = 88-89 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{20}H_{24}FO_3S$ 363.1430, found 363.1436; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.76 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 8.4 Hz, 2H), 7.30-7.25 (m, 2H), 7.00-6.94 (m, 2H), 5.09 (d, *J* = 8.4 Hz, 1H), 4.49-4.45 (m, 1H), 4.17 (br s, 1H), 3.39-3.34 (m, 1H), 2.44 (s, 3H), 2.30-2.22 (m, 1H), 2.04-1.96 (m, 1H), 1.41 (d, *J* = 1.2 Hz, 3H), 1.18 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.40 (d, *J* = 244.9 Hz), 144.92, 135.57 (d, *J* = 3.1 Hz), 135.29, 134.11, 129.62 (2x), 128.84 (d, *J* = 8.3 Hz, 2x), 128.55 (2x), 118.93, 115.08 (d, *J* = 21.3 Hz, 2x), 72.15, 70.68, 25.48, 25.32, 21.44, 17.18; Anal. Calcd for $C_{20}H_{23}FO_3S$: C, 66.27; H, 6.40. Found: C, 66.38; H, 6.25.



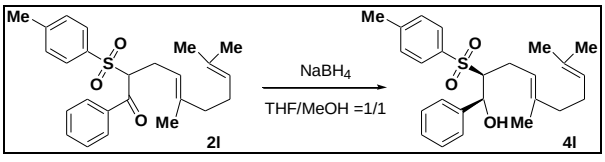
1.3.9. 5-Methyl-1-(3-nitrophenyl)-2-(toluene-4-sulfonyl)hex-4-en-1-ol (4i). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2i** (387 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **4i** (82%, 319 mg). Colorless solid; mp = 121-122 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{20}H_{24}NO_5S$ 390.1375, found 390.1382; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.07-8.05 (m, 2H), 7.69-7.66 (m, 3H), 7.47-7.43 (m, 1H), 7.28 (d, *J* = 8.0 Hz, 2H), 5.19 (d, *J* = 7.2 Hz, 1H), 4.57-4.52 (m, 1H), 4.00 (br s, 1H), 3.45-3.40 (m, 1H), 2.40 (s, 3H), 2.40-2.31 (m, 1H), 2.18-2.11 (m, 1H), 1.41 (d, *J* = 0.8 Hz, 3H), 1.22 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.95, 145.22, 142.12, 135.31, 135.11, 133.07, 129.78 (2x), 129.24, 128.48 (2x), 122.88, 122.02, 118.45, 71.63, 69.80, 25.42, 25.18, 21.48, 17.39.



1.3.10. 5-Methyl-1-(4-nitrophenyl)-2-(toluene-4-sulfonyl)hex-4-en-1-ol (4j). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2j** (387 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **4j** (70%, 272 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{20}H_{24}NO_5S$ 390.1375, found 390.1378; ^1H NMR (400 MHz, $CDCl_3$): δ 8.11 (d, *J* = 8.8 Hz, 2H), 8.68 (d, *J* = 8.4 Hz, 2H), 7.47 (d, *J* = 8.8 Hz, 2H), 7.30 (d, *J* = 8.0 Hz, 2H), 5.21 (d, *J* = 7.2 Hz, 1H), 4.55-4.51 (m, 1H), 4.50 (br s, 1H), 3.42-3.37 (m, 1H), 2.43 (s, 3H), 2.39-2.32 (m, 1H), 2.19-2.11 (m, 1H), 1.43 (d, *J* = 1.2 Hz, 3H), 1.27 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.20, 135.45, 135.17, 130.86, 129.82 (2x), 128.77, 128.58 (2x), 127.92 (2x), 123.39 (2x), 118.51, 71.79, 70.06, 25.29 (2x), 21.60, 17.52.

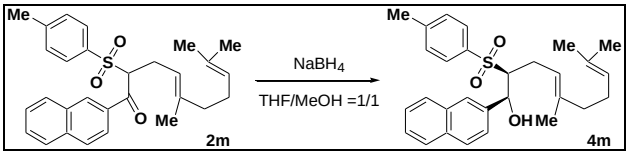


1.3.11. 5-Methyl-2-(toluene-4-sulfonyl)-1-(4-trifluoromethylphenyl)hex-4-en-1-ol (4k). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2k** (410 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4k** (83%, 342 mg). Colorless solid; mp = 98-99 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{21}H_{24}F_3O_3S$ 413.1398, found 413.1401; ^1H NMR (400 MHz, $CDCl_3$): δ 7.66 (d, *J* = 8.0 Hz, 2H), 7.49 (d, *J* = 8.4 Hz, 2H), 7.38 (d, *J* = 8.0 Hz, 2H), 7.27 (d, *J* = 8.4 Hz, 2H), 5.15 (d, *J* = 7.6 Hz, 1H), 4.51 (br t, *J* = 8.4 Hz, 1H), 4.50 (br s, 1H), 3.42-3.37 (m, 1H), 2.42 (s, 3H), 2.40-2.36 (m, 1H), 2.19-2.11 (m, 1H), 1.42 (d, *J* = 0.8 Hz, 3H), 1.26 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 145.10, 143.84, 135.35, 135.10, 130.40, 130.09, 129.76 (2x), 128.52 (2x), 127.35 (2x), 125.19 (q, *J* = 3.8 Hz, 2x), 118.78, 72.03, 70.19, 25.45, 25.24, 21.53, 17.43; Anal. Calcd for $C_{21}H_{23}F_3O_3S$: C, 61.15; H, 5.62. Found: C, 61.30; H, 5.33.

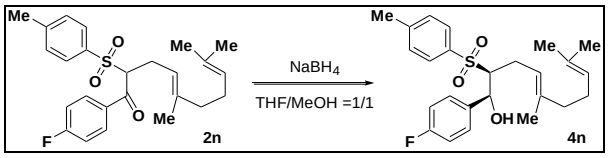


1.3.12. 5,9-Dimethyl-1-phenyl-2-(toluene-4-sulfonyl)deca-4,8-dien-1-ol (4l). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2l** (410 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4l** (80%, 330 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{25}H_{33}O_3S$ 413.2150, found 413.2155; ^1H NMR (400 MHz, $CDCl_3$): δ 7.78-7.75 (m, 2H),

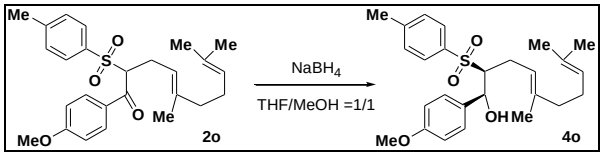
7.34-7.24 (m, 7H), 5.07 (d, *J* = 8.4 Hz, 1H), 4.97-4.93 (m, 1H), 4.45-4.41 (m, 1H), 4.00 (br s, 1H), 3.40-3.35 (m, 1H), 2.44 (s, 3H), 2.32-2.25 (m, 1H), 2.04-1.97 (m, 1H), 1.85-1.76 (m, 2H), 1.71-1.67 (m, 2H), 1.65 (d, *J* = 0.8 Hz, 3H), 1.55 (s, 3H), 1.14 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 144.91, 139.68, 137.75, 135.43, 131.40, 129.70 (2x), 128.71 (2x), 128.40 (2x), 128.29, 127.21 (2x), 123.93, 118.79, 73.01, 71.00, 39.27, 26.08, 25.59, 25.54, 21.57, 17.59, 15.67; Anal. Calcd for $C_{25}H_{32}O_3S$: C, 72.78; H, 7.82. Found: C, 72.92; H, 8.02.



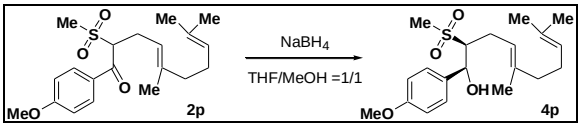
1.3.13. 5,9-Dimethyl-1-naphthalen-2-yl-2-(toluene-4-sulfonyl)deca-4,8-dien-1-ol (4m). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2m** (460 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4m** (82%, 379 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{29}H_{35}O_3S$ 463.2307, found 463.2309; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.79-7.70 (m, 6H), 7.49-7.44 (m, 2H), 7.39 (dd, *J* = 2.4, 8.4 Hz, 1H), 7.22 (d, *J* = 8.4 Hz, 2H), 5.26 (d, *J* = 8.0 Hz, 1H), 4.94-4.89 (m, 1H), 4.60 (br s, 1H), 4.57-4.53 (m, 1H), 3.54-3.49 (m, 1H), 2.42-2.38 (m, 1H), 2.38 (s, 3H), 2.20-2.12 (m, 1H), 1.78-1.72 (m, 2H), 1.64 (s, 3H), 1.64-1.56 (m, 2H), 1.52 (s, 3H), 1.14 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 144.82, 138.07, 137.06, 135.62, 133.18, 133.00, 131.41, 129.59 (2x), 128.59 (2x), 128.27, 127.92, 127.53, 126.46, 126.20, 126.14, 124.31, 123.91, 118.75, 72.94, 70.56, 39.23, 26.03, 25.59, 25.45, 21.50, 17.60, 15.81.



1.3.14. 1-(4-Fluorophenyl)-5,9-dimethyl-2-(toluene-4-sulfonyl)deca-4,8-dien-1-ol (4n). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2n** (428 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^{o}C for 1 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **4n** (86%, 370 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{25}H_{32}FO_3S$ 431.2056, found 431.2052; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.78-7.73 (m, 2H), 7.34 (d, *J* = 8.4 Hz, 2H), 7.30-7.25 (m, 2H), 7.00-6.94 (m, 2H), 5.07 (d, *J* = 8.4 Hz, 1H), 4.97-4.93 (m, 1H), 4.44 (br t, *J* = 7.2 Hz, 1H), 4.40 (br s, 1H), 3.36-3.31 (m, 1H), 2.45 (s, 3H), 2.32-2.25 (m, 1H), 2.04-1.96 (m, 1H), 1.83-1.78 (m, 2H), 1.71-1.65 (m, 2H), 1.64 (d, *J* = 1.2 Hz, 3H), 1.52 (s, 3H), 1.17 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.55 (d, *J* = 245.6 Hz), 145.08, 137.99, 135.64 (d, *J* = 3.0 Hz), 135.32, 131.53, 129.78 (2x), 128.90 (d, *J* = 8.3 Hz, 2x), 128.71 (2x), 123.85, 118.65, 115.26 (d, *J* = 21.3 Hz, 2x), 72.32, 70.97, 39.29, 26.10, 25.60, 25.51, 21.59, 17.57, 15.74.

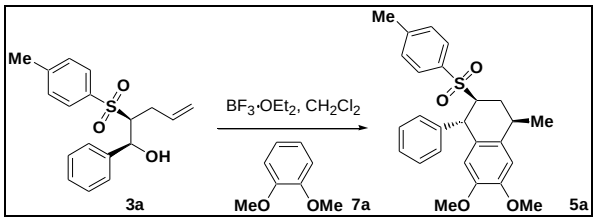


1.3.15. 1-(4-Methoxyphenyl)-5,9-dimethyl-2-(toluene-4-sulfonyl)deca-4,8-dien-1-ol (4o). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2o** (440 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 4/1) afforded **4o** (86%, 380 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{26}H_{35}O_4S$ 443.2256, found 443.2261; ^1H NMR (400 MHz, $CDCl_3$): δ 7.77 (d, *J* = 8.4 Hz, 2H), 7.34 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 8.4 Hz, 2H), 6.81 (d, *J* = 8.8 Hz, 2H), 5.03 (d, *J* = 8.4 Hz, 1H), 4.98-4.93 (m, 1H), 4.60 (br s, 1H), 4.45 (dt, *J* = 1.2, 7.2 Hz, 1H), 3.77 (br s, 3H), 3.37-3.32 (m, 1H), 2.45 (s, 3H), 2.30-2.22 (m, 1H), 2.01-1.94 (m, 1H), 1.86-1.77 (m, 2H), 1.72-1.62 (m, 2H), 1.62 (d, *J* = 1.2 Hz, 3H), 1.55 (s, 3H), 1.16 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.60, 144.90, 137.61, 135.58, 131.94, 131.45, 129.72 (2x), 128.77 (2x), 128.43 (2x), 123.98, 118.97, 113.83 (2x), 72.66, 71.22, 55.24, 39.33, 26.14, 25.70, 25.63, 21.62, 17.61, 15.78.

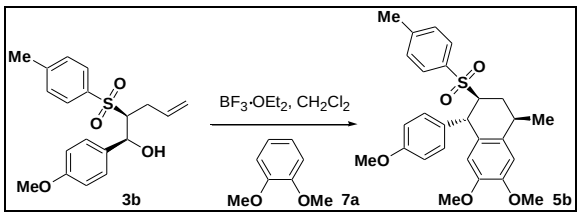


1.3.16. 2-Methanesulfonyl-1-(4-methoxyphenyl)-5,9-dimethyldeca-4,8-dien-1-ol (4p). According to the general procedure, reaction was performed in the presence of $NaBH_4$ (100 mg, 3.0 mmol) and **2p** (364 mg, 1.0 mmol) in a co-solvent of THF (5 mL) and MeOH (5 mL) at 0 ^oC for 1 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **4p** (87%, 318 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{20}H_{31}O_4S$ 367.1943, found 367.1946; ^1H NMR (400 MHz, $CDCl_3$): δ 7.18 (d, *J* = 8.4 Hz, 2H), 6.80 (d, *J* = 8.8 Hz, 2H), 4.97 (br t, *J* = 6.8 Hz, 1H), 4.91-4.87 (m, 2H), 3.83 (br s, 1H), 3.71 (s, 3H), 3.15-3.11 (m, 1H), 2.90 (s, 3H), 2.32-2.17 (m, 2H), 1.94-1.89 (m, 2H), 1.88-1.77 (m, 2H), 1.60 (s, 3H), 1.52 (s, 3H), 1.26 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.32, 137.77, 132.44, 131.10, 128.01 (2x), 123.82, 118.91, 113.69 (2x), 72.29, 69.44, 54.92, 43.50, 39.26, 26.03, 25.37, 23.78, 17.36, 15.55.

1.4. A representative synthetic procedure of compounds 5a-x is as follows: $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol) was added to a solution of **3a**-**o**, **3s**-**t** (0.2 mmol) and **7a**-**e** (0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC. The reaction mixture was stirred at 25 ^oC for 20 h. The reaction mixture was concentrated and the residue was diluted with water (10 mL) and the mixture was extracted with CH_2Cl_2 (3 x 20 mL). The combined organic layers were washed with brine, dried, filtered and evaporated to afford crude product under reduced pressure. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5a**-**x**.

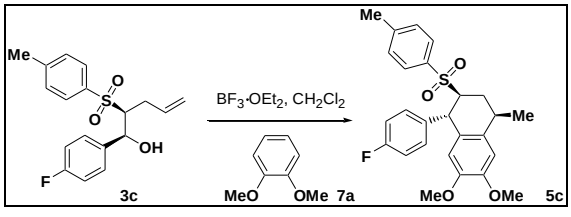


1.4.1. 6,7-Dimethoxy-4-methyl-1-phenyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5a). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3a** (63 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5a** (90%, 78 mg). Colorless solid; mp = 131-132 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{26}H_{29}O_4S$ 437.1787, found 437.1791; ^1H NMR (400 MHz, $CDCl_3$): δ 7.58 (d, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 7.14-7.09 (m, 3H), 6.95-6.93 (m, 2H), 6.76 (s, 1H), 6.26 (s, 1H), 4.55 (d, *J* = 8.0 Hz, 1H), 3.86 (s, 3H), 3.84-3.76 (m, 1H), 3.59 (s, 3H), 2.97-2.92 (m, 1H), 2.45-2.34 (m, 1H), 2.39 (s, 3H), 1.73 (q, *J* = 12.4 Hz, 1H), 1.39 (d, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.58, 147.51, 144.39, 144.15, 135.47, 133.00, 129.83, 129.49 (2x), 128.64 (2x), 128.59 (2x), 128.45 (2x), 126.40, 112.78, 108.14, 67.56, 55.88, 55.67, 45.09, 32.75, 31.49, 21.53, 20.37.



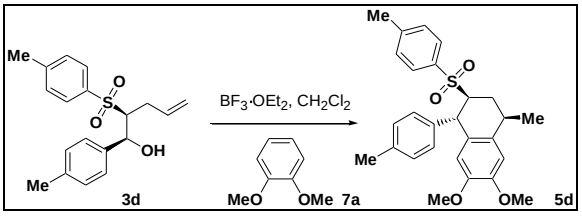
1.4.2.

6,7-Dimethoxy-1-(4-methoxyphenyl)-4-methyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5b). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3b** (69 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5b** (92%, 86 mg). Colorless solid; mp = 124-125 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{27}H_{31}O_5S$ 467.1892, found 467.1893; ^1H NMR (400 MHz, $CDCl_3$): δ 7.55 (d, *J* = 8.0 Hz, 2H), 7.17 (d, *J* = 8.0 Hz, 2H), 6.85 (d, *J* = 8.8 Hz, 2H), 6.75 (s, 1H), 6.63 (d, *J* = 8.8 Hz, 2H), 6.24 (s, 1H), 4.49 (d, *J* = 8.4 Hz, 1H), 3.85 (s, 3H), 3.84-3.74 (m, 1H), 3.74 (s, 3H), 3.59 (s, 3H), 2.98-2.93 (m, 1H), 2.43-2.40 (m, 1H), 2.38 (s, 3H), 1.72 (q, *J* = 12.4 Hz, 1H), 1.39 (d, *J* = 6.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 158.11, 147.51, 147.43, 143.91, 136.17, 135.70, 132.82, 130.21, 129.66 (2x), 129.40 (2x), 128.52 (2x), 113.77 (2x), 112.66, 108.15, 67.63, 55.86, 55.67, 55.12, 44.56, 32.68, 31.63, 21.50, 20.54.

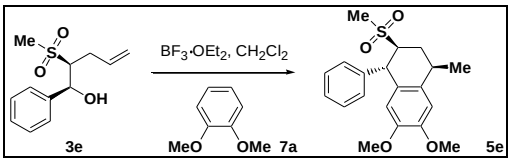


1.4.3.

1-(4-Fluorophenyl)-6,7-dimethoxy-4-methyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5c). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3c** (67 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5c** (89%, 81 mg). Colorless solid; mp = 120-121 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{26}H_{28}FO_4S$ 455.1692, found 455.1697; ^1H NMR (400 MHz, $CDCl_3$): δ 7.55 (d, *J* = 8.4 Hz, 2H), 7.19 (d, *J* = 8.0 Hz, 2H), 7.95-6.89 (m, 2H), 6.83-6.77 (m, 2H), 6.76 (s, 1H), 6.19 (s, 1H), 4.54 (d, *J* = 8.4 Hz, 1H), 3.85 (s, 3H), 3.76-3.70 (m, 1H), 3.58 (s, 3H), 2.98-2.92 (m, 1H), 2.44-2.36 (m, 1H), 2.39 (s, 3H), 1.72 (q, *J* = 12.4 Hz, 1H), 1.39 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 161.42 (d, *J* = 244.1 Hz), 147.66, 147.51, 144.28, 140.02 (d, *J* = 3.0 Hz), 135.48, 132.86, 130.23 (d, *J* = 7.6 Hz, 2x), 130.13, 129.49 (2x), 128.50 (2x), 115.21 (d, *J* = 21.2 Hz, 2x), 112.58, 108.22, 67.60, 55.85, 55.66, 44.59, 32.68, 31.65, 21.49, 20.53.

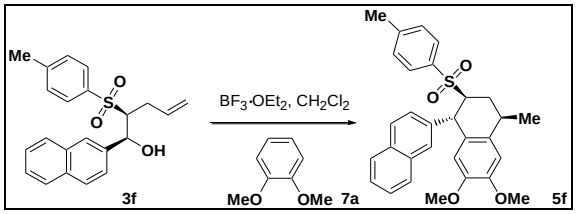


1.4.4. 6,7-Dimethoxy-4-methyl-2-(toluene-4-sulfonyl)-1-*p*-tolyl-1,2,3,4-tetrahydronaphthalene (5d). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3d** (66 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5d** (88%, 79 mg). Colorless solid; mp = 77-78 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{27}H_{31}O_4S$ 451.1943, found 451.1943; ^1H NMR (400 MHz, $CDCl_3$): δ 7.56 (d, *J* = 8.4 Hz, 2H), 7.17 (d, *J* = 8.0 Hz, 2H), 6.91 (d, *J* = 8.0 Hz, 2H), 6.82 (d, *J* = 8.0 Hz, 2H), 6.76 (s, 1H), 6.27 (s, 1H), 4.80 (d, *J* = 7.6 Hz, 1H), 3.85 (s, 3H), 3.84-3.75 (m, 1H), 3.60 (s, 3H), 2.98-2.92 (m, 1H), 2.42-2.35 (m, 1H), 2.39 (s, 3H), 2.25 (s, 3H), 1.72 (q, *J* = 12.4 Hz, 1H), 1.39 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.54, 147.47, 144.00, 141.16, 136.03, 135.58, 132.94, 130.03, 129.39 (2x), 129.10 (2x), 128.60 (2x), 128.46 (2x), 112.75, 108.15, 67.62, 55.88, 55.69, 44.80, 32.71, 31.54, 21.53, 20.96, 20.43.

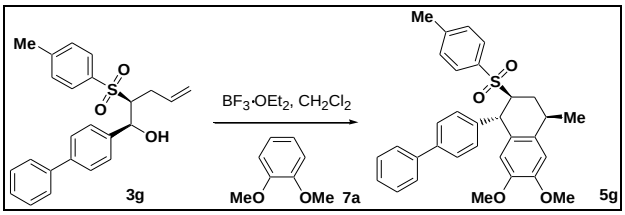


1.4.5. 2-Methanesulfonyl-6,7-dimethoxy-4-methyl-1-phenyl-1,2,3,4-tetrahydronaphthalene (5e). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3e** (48 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5e** (82%, 59 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{20}H_{25}O_4S$ 361.1474, found 361.1478; ^1H NMR (400 MHz, $CDCl_3$): δ 7.36-7.32 (m, 2H), 7.30-7.22 (m, 3H), 6.79 (s, 1H), 6.20 (s, 1H), 4.53 (d, *J* = 9.6 Hz, 1H), 3.87 (s,

3H), 3.56 (s, 3H), 3.57-3.51 (m, 1H), 3.10-3.04 (m, 1H), 2.70-2.65 (m, 1H), 2.19 (s, 3H), 1.72 (q, *J* = 12.4 Hz, 1H), 1.44 (d, *J* = 6.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.68, 147.34, 143.66, 132.65, 129.59, 129.32 (2x), 129.11 (2x), 127.49, 112.53, 108.37, 67.17, 55.78, 55.62, 46.78, 41.15, 32.10, 30.54, 21.03.



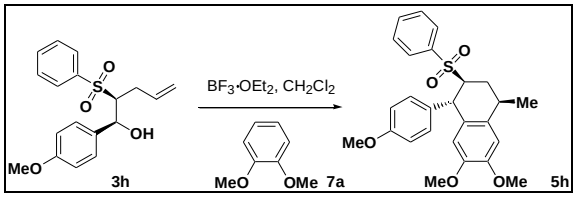
1.4.6. 6,7-Dimethoxy-4-methyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydro[1,2']binaphthalenyl (5f). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3f** (73 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5f** (83%, 81 mg). Colorless solid; mp = 148-149 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{30}H_{31}O_4S$ 487.1943, found 487.1944; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.69 (d, *J* = 8.8 Hz, 1H), 7.63 (d, *J* = 8.8 Hz, 1H), 7.52 (d, *J* = 8.4 Hz, 1H), 7.46-7.39 (m, 4H), 7.33 (d, *J* = 1.2 Hz, 1H), 6.96 (dd, *J* = 2.0, 8.8 Hz, 1H), 6.86 (d, *J* = 8.0 Hz, 2H), 6.81 (s, 1H), 6.24 (s, 1H), 4.67 (d, *J* = 8.8 Hz, 1H), 3.92-3.90 (m, 1H), 3.87 (s, 3H), 3.49 (s, 3H), 3.11-3.06 (m, 1H), 2.60 (dt, *J* = 4.0, 12.4 Hz, 1H), 2.12 (s, 3H), 1.84 (q, *J* = 12.4 Hz, 1H), 1.46 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.68, 147.51, 143.92, 140.78, 135.82, 133.08, 132.97, 132.20, 129.69, 129.09 (2x), 128.47, 128.34, 128.18 (2x), 127.71, 127.42, 126.16, 126.01, 125.70, 112.83, 108.35, 66.99, 55.88, 55.71, 46.03, 31.93 (2x), 21.28, 20.77.



1.4.7.

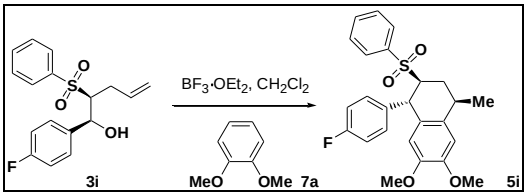
1-Biphenyl-4-yl-6,7-dimethoxy-4-methyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5g). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3g** (78 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5g** (86%, 88 mg). Colorless solid; mp = 162-163 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{32}H_{33}O_4S$ 513.2100, found 513.2107; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.56 (d, *J* = 8.0 Hz, 2H), 7.53-7.50 (m, 2H), 7.44-7.40 (m, 2H), 7.35-7.33 (m, 1H), 7.33 (d, *J* = 8.4 Hz, 2H), 7.14 (d, *J* = 8.0 Hz, 2H), 7.01 (d, *J* = 8.4 Hz, 2H), 6.79 (s, 1H), 6.29 (s, 1H), 4.60 (d, *J* = 8.0 Hz, 1H), 3.87 (s, 3H), 3.86-3.78 (m, 1H), 3.60 (s, 3H), 3.03-2.98 (m, 1H), 2.51-2.46 (m, 1H), 2.31 (s, 3H), 1.78 (q, *J* = 12.4 Hz, 1H), 1.42 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.64, 147.49, 144.02, 143.08, 140.56, 139.30, 135.75, 132.97, 129.75, 129.42 (2x), 129.13 (2x), 128.71 (2x), 128.47 (2x), 127.23, 127.04 (2x),

126.85 (2x), 112.72, 108.23, 67.46, 55.87, 55.71, 45.11, 32.44, 31.71, 21.48, 20.55. Single-crystal X-Ray diagram: crystal of compound **5g** was grown by slow diffusion of EtOAc into a solution of compound **5g** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/c, *a* = 12.1307(4) Å, *b* = 11.0079(3) Å, *c* = 20.0330(5) Å, *V* = 2589.42(13) Å^3, *Z* = 4, d_{calcd} = 1.315 mg/cm^3, *F*(000) = 1088, 2θ range 1.734~26.423^o, R indices (all data) R1 = 0.0487, wR2 = 0.1140.



1.4.8.

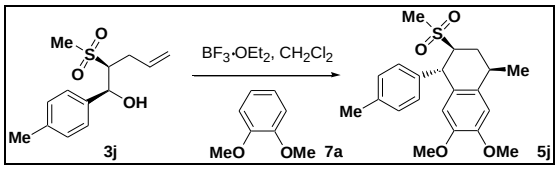
2-Benzenesulfonyl-6,7-dimethoxy-1-(4-methoxyphenyl)-4-methyl-1,2,3,4-tetrahydronaphthalene (5h). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3h** (66 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5h** (86%, 78 mg). Colorless solid; mp = 149-150 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{26}H_{29}O_5S$ 453.1736, found 453.1742; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.66-7.64 (m, 2H), 7.52-7.45 (m, 1H), 7.39-7.35 (m, 2H), 6.84 (d, *J* = 8.8 Hz, 2H), 6.75 (s, 1H), 6.61 (d, *J* = 8.8 Hz, 2H), 6.23 (s, 1H), 4.51 (d, *J* = 8.4 Hz, 1H), 3.85 (s, 3H), 3.83-3.76 (m, 1H), 3.73 (s, 3H), 3.58 (s, 3H), 3.00-2.95 (m, 1H), 2.45 (dt, *J* = 4.4, 12.8 Hz, 1H), 1.75 (q, *J* = 12.4 Hz, 1H), 1.40 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 158.09, 147.53, 147.42, 138.84, 135.83, 132.94, 130.12, 129.68 (2x), 128.85, 128.73 (2x), 128.38 (2x), 113.81 (2x), 112.61, 108.19, 67.53, 55.84, 55.65, 55.12, 44.65, 32.47, 31.68, 20.59.



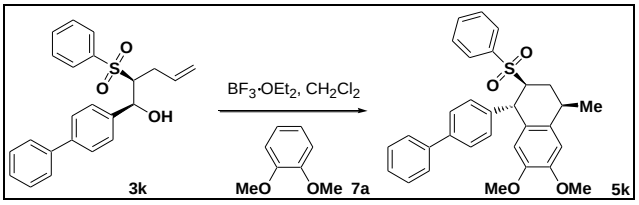
1.4.9.

2-Benzenesulfonyl-1-(4-fluorophenyl)-6,7-dimethoxy-4-methyl-1,2,3,4-tetrahydronaphthalene (5i). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3i** (64 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5i** (87%, 77 mg). Colorless solid; mp = 117-118 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{25}H_{26}FO_4S$ 441.1536, found 441.1541; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.67-7.65 (m, 2H), 7.55-7.52 (m, 1H), 7.42-7.38 (m, 2H), 6.93-6.87 (m, 2H), 6.81-6.77 (m, 2H), 6.76 (s, 1H), 6.18 (s, 1H), 4.56 (d, *J* = 8.4 Hz, 1H), 3.85 (s, 3H), 3.79-3.73 (m, 1H), 3.58 (s, 3H), 3.00-2.94 (m, 1H), 2.43 (dt, *J* = 4.0, 8.0 Hz, 1H), 1.75 (q, *J* = 12.4 Hz, 1H), 1.40 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 161.48 (d, *J* = 244.5 Hz), 147.72, 147.54, 139.75 (d, *J* = 3.8 Hz), 138.67, 133.21, 132.81, 130.30 (d, *J* = 7.6 Hz, 2x), 129.61, 128.87 (2x), 128.40 (2x), 115.29 (d, *J* = 21.2 Hz, 2x), 112.55, 108.28, 67.56, 55.87,

55.68, 44.72, 32.52, 31.73, 20.62.

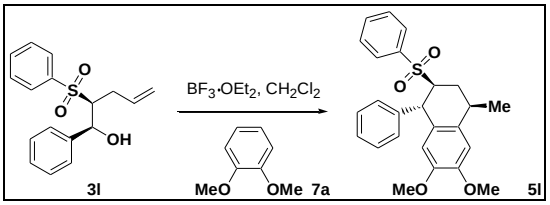


1.4.10. 2-Methanesulfonyl-6,7-dimethoxy-4-methyl-1-*p*-tolyl-1,2,3,4-tetrahydronaphthalene (5j). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3j** (51 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5j** (84%, 63 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{21}H_{27}O_4S$ 375.1630, found 375.1633; ^1H NMR (400 MHz, $CDCl_3$): δ 7.15-7.10 (m, 4H), 6.79 (s, 1H), 6.22 (s, 1H), 4.48 (d, *J* = 9.6 Hz, 1H), 3.86 (s, 3H), 3.57 (s, 3H), 3.55-3.48 (m, 1H), 3.09-3.03 (m, 1H), 2.69-2.64 (m, 1H), 2.32 (s, 3H), 2.20 (s, 3H), 1.70 (q, *J* = 12.8 Hz, 1H), 1.43 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.65, 147.35, 140.52, 137.13, 132.62, 129.86, 129.75 (2x), 129.15 (2x), 112.61, 108.41, 67.21, 55.78, 55.67, 46.41, 41.23, 32.10, 30.52, 21.03, 21.01.

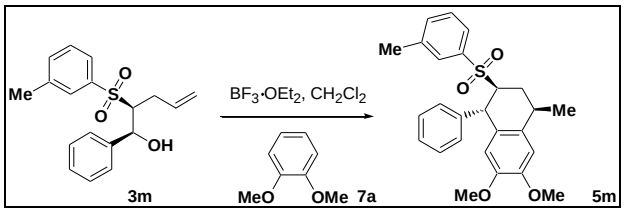


1.4.11.

2-Benzenesulfonyl-1-biphenyl-4-yl-6,7-dimethoxy-4-methyl-1,2,3,4-tetrahydronaphthalene (5k). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3k** (76 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5k** (89%, 89 mg). Colorless solid; mp = 175-176 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{31}H_{31}O_4S$ 499.1943, found 499.1950; ^1H NMR (400 MHz, $CDCl_3$): δ 7.68-7.66 (m, 2H), 7.51-7.41 (m, 5H), 7.36-7.29 (m, 5H), 6.99 (d, *J* = 8.4 Hz, 2H), 6.79 (s, 1H), 6.28 (s, 1H), 4.62 (d, *J* = 8.4 Hz, 1H), 3.92-3.89 (m, 1H), 3.87 (s, 3H), 3.59 (s, 3H), 3.06-3.00 (m, 1H), 2.54-2.49 (m, 1H), 1.81 (q, *J* = 12.4 Hz, 1H), 1.43 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.68, 147.51, 142.87, 140.58, 139.33, 138.84, 132.92, 129.67, 129.14 (2x), 128.77 (3x), 128.73 (2x), 128.40 (2x), 127.22, 127.10 (2x), 126.84 (2x), 112.70, 108.28, 67.44, 55.87, 55.71, 45.17, 32.30, 31.74, 21.59; Anal. Calcd for $C_{31}H_{30}O_4S$: C, 74.67; H, 6.06. Found: C, 74.88; H, 6.25.

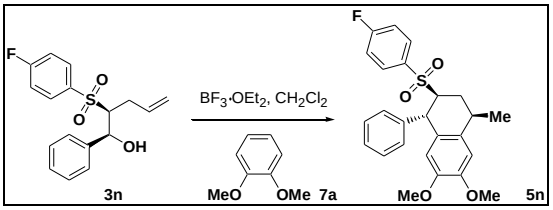


1.4.12. 2-Benzenesulfonyl-6,7-dimethoxy-4-methyl-1-phenyl-1,2,3,4-tetrahydronaphthalene (5l). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3l** (60 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5l** (82%, 69 mg). Colorless solid; mp = 140-141 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{25}H_{27}O_4S$ 423.1630, found 423.1632; ^1H NMR (400 MHz, $CDCl_3$): δ 7.69-7.67 (m, 2H), 7.52-7.46 (m, 1H), 7.39-7.35 (m, 2H), 7.13-7.05 (m, 3H), 6.95-6.90 (m, 2H), 6.77 (s, 1H), 6.24 (s, 1H), 4.57 (d, *J* = 8.0 Hz, 1H), 3.87-3.81 (m, 1H), 3.85 (s, 3H), 3.58 (s, 3H), 3.00-2.94 (m, 1H), 2.42 (dt, *J* = 4.4, 12.8 Hz, 1H), 1.77 (q, *J* = 12.8 Hz, 1H), 1.40 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.57, 147.46, 144.03, 138.58, 133.14, 132.88, 129.72, 128.81 (2x), 128.59 (2x), 128.47 (2x), 128.46 (2x), 126.56, 112.68, 108.13, 67.39, 55.84, 55.62, 45.18, 32.50, 31.52, 20.43.



1.4.13.

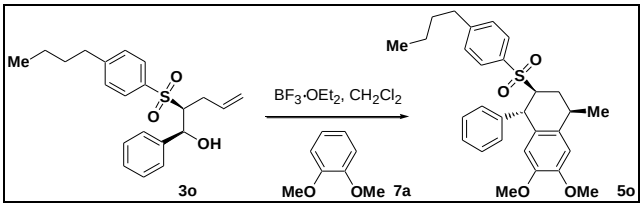
6,7-Dimethoxy-4-methyl-1-phenyl-2-(toluene-3-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5m). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3m** (63 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5m** (86%, 75 mg). Colorless solid; mp = 149-150 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{26}H_{29}O_4S$ 437.1787, found 437.1785; ^1H NMR (400 MHz, $CDCl_3$): δ 7.51-7.49 (m, 1H), 7.39 (s, 1H), 7.29-7.24 (m, 2H), 7.11-7.04 (m, 3H), 6.94-6.90 (m, 2H), 6.77 (s, 1H), 6.23 (s, 1H), 4.55 (d, *J* = 8.4 Hz, 1H), 3.87-3.81 (m, 1H), 3.85 (s, 3H), 3.57 (s, 3H), 3.01-2.95 (m, 1H), 2.45 (dt, *J* = 4.4, 12.8 Hz, 1H), 2.30 (s, 3H), 1.76 (q, *J* = 12.8 Hz, 1H), 1.41 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.54, 147.42, 143.97, 138.93, 138.50, 133.94, 132.85, 129.81, 128.78, 128.62 (2x), 128.36, 128.29 (2x), 126.52, 125.49, 112.67, 108.14, 67.30, 55.83, 55.61, 45.31, 32.35, 31.58, 21.13, 20.48.



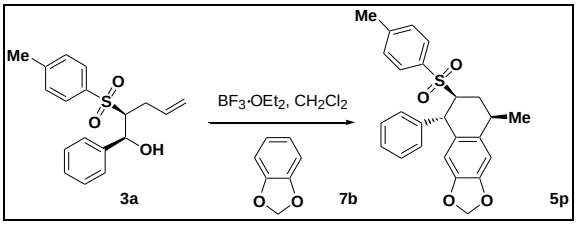
1.4.14.

2-(4-Fluorobenzenesulfonyl)-6,7-dimethoxy-4-methyl-1-phenyl-1,2,3,4-tetrahydronaphthalene (5n). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3n** (64 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5n** (80%, 70 mg). Colorless solid; mp = 174-175 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for

$C_{25}H_{26}FO_4S$ 441.1536, found 441.1532; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.65-7.62 (m, 2H), 7.16-7.07 (m, 3H), 7.03-6.98 (m, 2H), 6.94-6.91 (m, 2H), 6.77 (s, 1H), 6.19 (s, 1H), 4.53 (d, *J* = 8.8 Hz, 1H), 3.85 (s, 3H), 3.85-3.80 (m, 1H), 3.56 (s, 3H), 3.05-2.96 (m, 1H), 2.49 (dt, *J* = 4.0, 12.8 Hz, 1H), 1.77 (q, *J* = 12.8 Hz, 1H), 1.42 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 165.35 (d, *J* = 253.9 Hz), 147.65, 147.50, 143.75, 134.85 (d, *J* = 3.0 Hz), 132.69, 131.20 (d, *J* = 9.1 Hz, 2x), 129.69, 128.74 (2x), 128.53 (2x), 126.70, 116.04 (d, *J* = 22.0 Hz, 2x), 112.64, 108.24, 67.57, 55.87, 55.64, 45.60, 32.26, 31.75, 20.64; Anal. Calcd for $C_{25}H_{25}FO_4S$: C, 68.16; H, 5.72. Found: C, 68.23; H, 5.93.

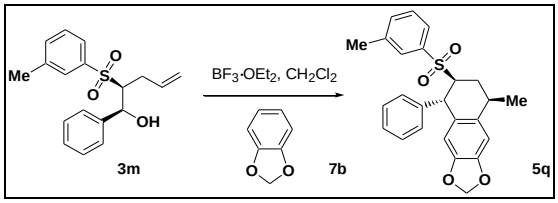


1.4.15. 2-(4-Butylbenzenesulfonyl)-6,7-dimethoxy-4-methyl-1-phenyl-1,2,3,4-tetrahydronaphthalene (5o). According to the general procedure, reaction was performed in the presence of BF_3·OEt_2 (57 mg, 0.4 mmol), **3o** (72 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5o** (86%, 82 mg). Colorless solid; mp = 119-120 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{29}H_{35}O_4S$ 479.2256, found 479.2255; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.58 (d, *J* = 8.4 Hz, 2H), 7.17 (d, *J* = 8.4 Hz, 2H), 7.11-7.06 (m, 3H), 6.93-6.91 (m, 2H), 6.77 (s, 1H), 6.24 (s, 1H), 4.55 (d, *J* = 8.0 Hz, 1H), 3.85 (s, 3H), 3.84-3.79 (m, 1H), 3.58 (s, 3H), 3.00-2.94 (m, 1H), 2.62 (t, *J* = 8.0 Hz, 2H), 2.43 (dt, *J* = 4.4, 12.4 Hz, 1H), 1.76 (q, *J* = 12.8 Hz, 1H), 1.60-1.54 (m, 2H), 1.40 (d, *J* = 6.8 Hz, 3H), 1.38-1.30 (m, 2H), 0.94 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 148.91, 147.53, 147.43, 144.19, 135.70, 132.92, 129.84, 128.81 (2x), 128.58 (2x), 128.53 (2x), 128.39 (2x), 126.43, 112.72, 108.13, 67.39, 55.84, 55.61, 45.22, 35.47, 33.07, 32.48, 31.51, 22.19, 20.41, 13.79.

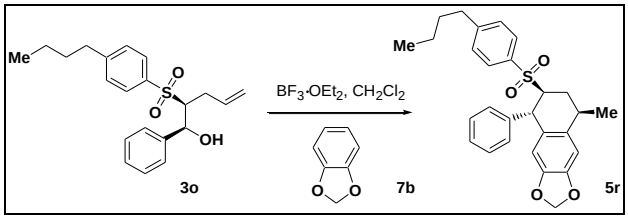


1.4.16. 8-Methyl-5-phenyl-6-(toluene-4-sulfonyl)-5,6,7,8-tetrahydronaphtho[2,3-*d*][1,3]dioxole (5p). According to the general procedure, reaction was performed in the presence of BF_3·OEt_2 (57 mg, 0.4 mmol), **3a** (63 mg, 0.2 mmol) and **7b** (37 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5p** (86%, 72 mg). Colorless solid; mp = 124-125 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{25}H_{25}O_4S$ 421.1474, found 421.1477; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.57 (d, *J* = 8.0 Hz, 2H), 7.18 (d, *J* = 7.6 Hz, 2H), 7.12-7.09 (m, 3H), 6.94-6.91 (m, 2H), 6.76 (s, 1H), 6.27 (s, 1H), 5.85 (d, *J* = 1.6 Hz, 1H), 5.83 (d, *J* = 1.6 Hz, 1H), 4.51 (d, *J* = 7.6 Hz, 1H), 3.83-3.77 (m, 1H), 2.92-2.87 (m, 1H), 2.39 (s, 3H),

2.38-2.33 (m, 1H), 1.72 (q, J = 12.4 Hz, 1H), 1.36 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 146.40, 146.05, 144.31, 144.20, 135.38, 134.31, 130.91, 129.53 (2x), 128.64 (2x), 128.53 (4x), 126.45, 109.77, 105.17, 100.86, 67.46, 45.37, 32.72, 31.72, 21.54, 20.44. Single-crystal X-Ray diagram: crystal of compound **5p** was grown by slow diffusion of EtOAc into a solution of compound **5p** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/c, a = 10.8495(5) Å, b = 9.9471(15) Å, c = 19.6318(10) Å, V = 2111.60(18) Å^3, Z = 4, d_{calcd} = 1.323 mg/cm^3, F(000) = 888, 2θ range 2.082~26.463^o, R indices (all data) R1 = 0.0989, wR2 = 0.1760.

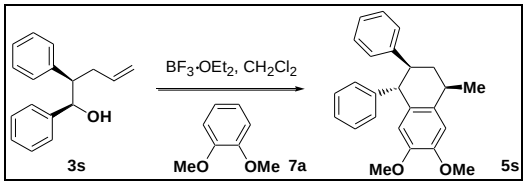


1.4.17. 8-Methyl-5-phenyl-6-(toluene-3-sulfonyl)-5,6,7,8-tetrahydronaphtho[2,3-*d*][1,3]dioxole (5q). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3a** (63 mg, 0.2 mmol) and **7b** (37 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5q** (87%, 73 mg). Colorless solid; mp = 154-155 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{25}H_{25}O_4S$ 421.1474, found 421.1477; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.52-7.49 (m, 1H), 7.40 (s, 1H), 7.30-7.25 (m, 2H), 7.12-7.04 (m, 3H), 6.93-6.90 (m, 2H), 6.77 (s, 1H), 6.25 (s, 1H), 6.85 (d, J = 1.2 Hz, 1H), 5.82 (d, J = 1.2 Hz, 1H), 4.52 (d, J = 8.0 Hz, 1H), 3.87-3.80 (m, 1H), 2.96-2.90 (m, 1H), 2.42 (dt, J = 4.4, 12.8 Hz, 1H), 2.31 (s, 3H), 1.75 (q, J = 12.8 Hz, 1H), 1.37 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 146.39, 146.03, 143.96, 139.01, 138.47, 134.19, 134.00, 130.94, 128.82, 128.69, 128.60 (2x), 128.40 (2x), 126.59, 125.54, 109.69, 105.21, 100.85, 67.26, 45.61, 32.37, 31.84, 21.17, 20.57.

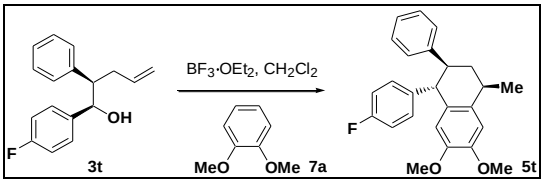


1.4.18. 6-(4-*n*-Butylbenzenesulfonyl)-8-methyl-5-phenyl-5,6,7,8-tetrahydronaphtho[2,3-*d*][1,3]dioxole (5r). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3o** (72 mg, 0.2 mmol) and **7b** (37 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5r** (89%, 82 mg). Colorless solid; mp = 142-143 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{28}H_{31}O_4S$ 463.1943, found 463.1945; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.57 (d, J = 8.4 Hz, 2H), 7.17 (d, J = 8.4 Hz, 2H), 7.11-7.04 (m, 3H), 6.92-6.90 (m, 2H), 6.77 (s, 1H), 6.26 (s, 1H), 5.70 (d, J = 1.6 Hz, 1H), 5.82 (d, J = 1.2 Hz, 1H), 4.51 (d, J = 8.0 Hz, 1H), 3.85-3.79 (m, 1H), 2.94-2.89 (m, 1H), 2.63 (t, J =

8.0 Hz, 2H), 2.41 (dt, *J* = 4.4, 12.4 Hz, 1H), 1.69 (q, *J* = 12.8 Hz, 1H), 1.62-1.53 (m, 2H), 1.37 (d, *J* = 6.8 Hz, 3H), 1.38-1.30 (m, 2H), 0.95 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 148.99, 146.37, 146.01, 144.14, 135.63, 134.26, 130.92, 128.87 (2x), 128.56 (2x), 128.53 (2x), 128.48 (2x), 126.51, 109.72, 105.17, 100.83, 67.34, 45.52, 35.52, 33.12, 32.49, 31.75, 22.23, 20.48, 13.83.

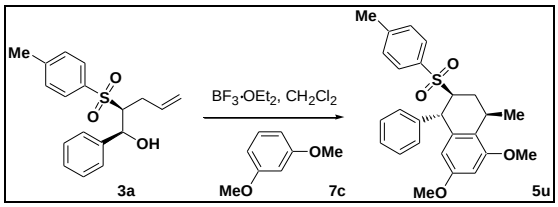


1.4.19. 6,7-Dimethoxy-4-methyl-1,2-diphenyl-1,2,3,4-tetrahydronaphthalene (5s). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3r** (48 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5s** (80%, 57 mg). Colorless solid; mp = 140-141 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{25}H_{27}O_2$ 359.2011, found 359.2017; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.19-7.08 (m, 6H), 7.00-6.97 (m, 2H), 6.89 (s, 1H), 6.87-6.85 (m, 2H), 6.22 (s, 1H), 4.12 (d, *J* = 11.2 Hz, 1H), 3.92 (s, 3H), 3.56 (s, 3H), 3.21-3.15 (m, 1H), 3.06 (dt, *J* = 2.4, 12.8 Hz, 1H), 2.14 (ddd, *J* = 2.8, 5.2, 12.8 Hz, 1H), 1.94 (q, *J* = 12.8 Hz, 1H), 1.42 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.23, 146.80, 145.45, 145.05, 134.14, 132.33, 129.26 (2x), 128.10 (2x), 127.83 (2x), 127.50 (2x), 125.97, 125.87, 112.99, 108.94, 55.84, 55.65, 54.36, 50.37, 40.81, 33.53, 21.69; Anal. Calcd for $C_{25}H_{26}O_2$: C, 83.76; H, 7.31. Found: C, 83.89; H, 7.50. Single-crystal X-Ray diagram: crystal of compound **5s** was grown by slow diffusion of EtOAc into a solution of compound **5s** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/c, *a* = 10.2155(13) Å, *b* = 18.822(2) Å, *c* = 10.6623(15) Å, *V* = 1922.8(4) Å^3, *Z* = 4, d_{calcd} = 1.238 mg/cm^3, *F*(000) = 768, 2*θ* range 2.126~26.390^{o}, R indices (all data) R1 = 0.0583, wR2 = 0.1024.



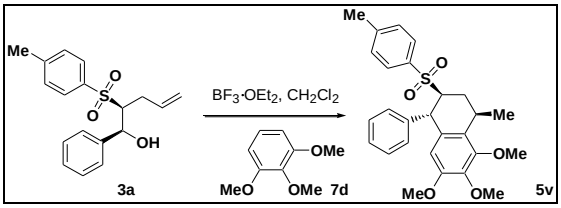
1.4.20. 1-(4-Fluorophenyl)-6,7-dimethoxy-4-methyl-2-phenyl-1,2,3,4-tetrahydronaphthalene (5t). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3t** (51 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5t** (84%, 63 mg). Colorless solid; mp = 172-173 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{25}H_{26}FO_2$ 377.1917, found 377.1924; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.20-7.10 (m, 3H), 6.97-6.95 (m, 2H), 6.88 (s, 1H), 6.81 (br s, 2H), 6.80 (br s, 2H), 6.18 (s, 1H), 4.10 (d, *J* = 10.8 Hz, 1H), 3.91 (s, 3H), 3.57 (s, 3H), 3.21-3.12 (m, 1H), 2.98 (dt, *J* = 2.4, 12.8 Hz, 1H), 2.14 (ddd, *J* = 2.8, 5.2, 12.8 Hz, 1H), 1.93 (q, *J* = 12.8 Hz, 1H), 1.41 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 161.14 (d, *J* = 242.6 Hz), 147.37, 146.87, 144.79, 141.21 (d, *J* = 3.0 Hz), 134.19, 132.01, 130.56 (d, *J* = 7.6 Hz, 2x), 128.11 (2x), 127.47 (2x), 126.11, 114.66 (d, *J* = 21.3 Hz, 2x), 112.83, 109.07, 55.86, 55.68,

53.69, 50.62, 40.70, 33.53, 21.71; Anal. Calcd for $C_{25}H_{25}FO_2$: C, 79.76; H, 6.69. Found: C, 79.62; H, 6.82. Single-crystal X-Ray diagram: crystal of compound **5t** was grown by slow diffusion of EtOAc into a solution of compound **5t** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/c, *a* = 10.3721(7) Å, *b* = 18.7809(11) Å, *c* = 10.7938(6) Å, *V* = 1970.8(2) Å^3, *Z* = 4, d_{calcd} = 1.269 mg/cm^3, *F*(000) = 800, 2θ range 2.095~26.383^o, R indices (all data) R1 = 0.0556, wR2 = 0.1387.



1.4.21.

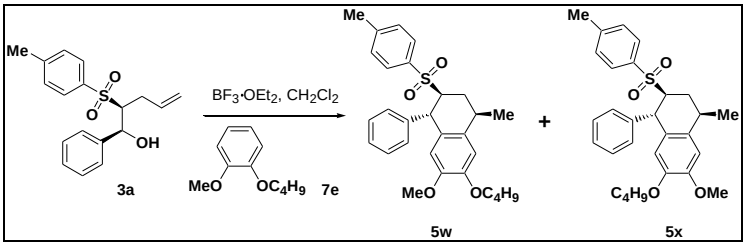
5,7-Dimethoxy-4-methyl-1-phenyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5u). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3a** (63 mg, 0.2 mmol) and **7c** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5u** (84%, 73 mg). Colorless solid; mp = 199-200 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{26}H_{29}O_4S$ 437.1787, found 437.1789; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.47 (d, *J* = 8.0 Hz, 2H), 7.13 (d, *J* = 8.0 Hz, 2H), 7.09-7.01 (m, 3H), 6.79-6.76 (m, 2H), 6.29 (d, *J* = 2.4 Hz, 1H), 5.68 (d, *J* = 2.4 Hz, 1H), 4.39 (d, *J* = 8.4 Hz, 1H), 3.81 (s, 3H), 3.63-3.58 (m, 1H), 3.50 (s, 3H), 3.29-3.23 (m, 1H), 2.61 (ddd, *J* = 4.4, 6.8, 11.2 Hz, 1H), 2.38 (s, 3H), 2.00 (ddd, *J* = 1.6, 6.4, 9.6 Hz, 1H), 1.43 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 158.26, 158.21, 143.58, 142.61, 139.27, 136.61, 129.37 (2x), 129.31 (2x), 128.21 (4x), 126.64, 122.19, 105.66, 97.00, 65.98, 55.18, 54.96, 46.60, 29.72, 27.98, 22.05, 21.52. Single-crystal X-Ray diagram: crystal of compound **5u** was grown by slow diffusion of EtOAc into a solution of compound **5u** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/c, *a* = 23.259(3) Å, *b* = 5.6619(4) Å, *c* = 17.6922(16) Å, *V* = 2155.0(3) Å^3, *Z* = 4, d_{calcd} = 1.346 mg/cm^3, *F*(000) = 928, 2θ range 0.946~26.387^o, R indices (all data) R1 = 0.0841, wR2 = 0.2079.



1.4.22.

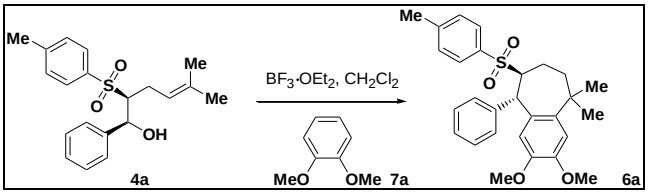
6,7,8-Trimethoxy-4-methyl-1-phenyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5v). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3a** (63 mg, 0.2 mmol) and **7d** (50 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **5v** (80%, 75 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{27}H_{31}O_5S$ 467.1892, found 467.1898; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.55 (d,

J = 8.0 Hz, 2H), 7.18-7.12 (m, 5H), 7.04-7.02 (m, 2H), 5.98 (s, 1H), 4.41 (d, J = 9.2 Hz, 1H), 3.90 (s, 3H), 3.90-3.83 (m, 1H), 3.80 (s, 3H), 3.52 (s, 3H), 3.38-3.34 (m, 1H), 2.37 (s, 3H), 2.21 (dt, J = 3.2, 16.8 Hz, 1H), 2.08 (dt, J = 5.6, 16.8 Hz, 1H), 1.32 (d, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 151.90, 151.45, 150.46, 144.04, 143.90, 140.37, 135.62, 132.19, 129.41 (2x), 129.13 (2x), 128.59 (2x), 128.40 (2x), 126.48, 108.53, 64.08, 60.80, 60.57, 55.69, 45.31, 29.63, 26.64, 21.88, 21.51.



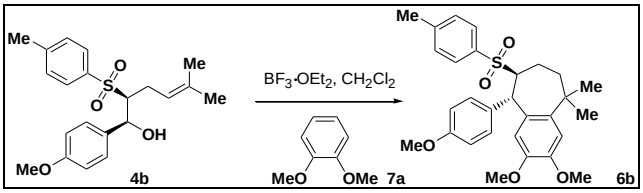
1.4.23. 6-Butoxy-7-methoxy-4-methyl-1-phenyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5w) and **7-Butoxy-6-methoxy-4-methyl-1-phenyl-2-(toluene-4-sulfonyl)-1,2,3,4-tetrahydronaphthalene (5x).** According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **3a** (63 mg, 0.2 mmol) and **7e** (54 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded a mixture of **5w** and **5x** (75%, 72 mg) with a ratio of 2:1. HRMS (ESI, M^++1) calcd for $C_{29}H_{35}O_4S$ 479.2256, found 479.2258; For major product: ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.58-7.56 (m, 2H), 7.18 (d, J = 8.0 Hz, 2H), 7.14-7.08 (m, 3H), 6.95-6.93 (m, 2H), 6.77 (s, 1H), 6.25 (s, 1H), 4.54 (d, J = 7.6 Hz, 1H), 4.01-3.94 (m, 2H), 3.78-3.66 (m, 2H), 3.57 (s, 3H), 2.96-2.92 (m, 1H), 2.42-2.35 (m, 2H), 2.38 (s, 3H), 1.83-1.70 (m, 2H), 1.52-1.43 (m, 2H), 1.40-1.37 (m, 2H), 0.96 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.93, 147.16, 144.40, 135.42, 132.95, 129.79, 129.46 (2x), 128.72, 128.62 (4x), 128.40 (2x), 126.35, 113.26, 109.87, 68.77, 67.55, 55.81, 45.09, 32.75, 31.46, 31.28, 21.52, 20.37, 19.19, 13.86. For minor product: ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.58-7.56 (m, 2H), 7.18 (d, J = 8.0 Hz, 2H), 7.14-7.08 (m, 3H), 6.95-6.93 (m, 2H), 6.76 (s, 1H), 6.24 (s, 1H), 4.52 (d, J = 6.8 Hz, 1H), 4.01-3.94 (m, 2H), 3.83 (s, 3H), 3.78-3.66 (m, 2H), 2.96-2.92 (m, 1H), 2.42-2.35 (m, 2H), 2.38 (s, 3H), 1.83-1.70 (m, 2H), 1.52-1.43 (m, 2H), 1.40-1.37 (m, 2H), 0.86 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.90, 146.95, 144.12, 135.42, 132.82, 129.87, 129.46 (2x), 128.96, 128.62 (4x), 128.40 (2x), 126.35, 114.44, 108.66, 68.41, 67.49, 56.06, 45.13, 32.72, 31.53, 30.90, 21.52, 20.40, 19.03, 13.78.

1.5. A representative synthetic procedure of compounds 6a-i is as follows: $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol) was added to a solution of **4a**-**g** (0.2 mmol) and **7a**-**b**, **7f** (0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C. The reaction mixture was stirred at 25 ^{o}C for 20 h. The reaction mixture was concentrated and the residue was diluted with water (10 mL) and the mixture was extracted with CH_2Cl_2 (3 x 20 mL). The combined organic layers were washed with brine, dried, filtered and evaporated to afford crude product under reduced pressure. Purification on silica gel (hexanes/EtOAc = 5/1~3/1) afforded **6a**-**i**.



1.5.1.

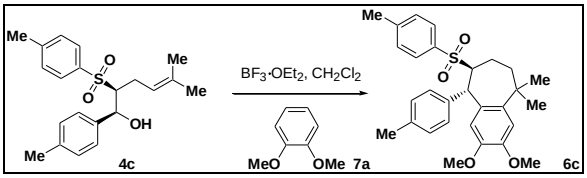
2,3-Dimethoxy-5,5-dimethyl-9-phenyl-8-(toluene-4-sulfonyl)-6,7,8,9-tetrahydro-*5H*-benzocycloheptene (6a). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4a** (69 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **6a** (82%, 76 mg). Colorless solid; mp = 191-192 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{28}H_{33}O_4S$ 465.2100, found 465.2102; ^1H NMR (400 MHz, $CDCl_3$): δ 7.72 (d, *J* = 8.4 Hz, 2H), 7.28 (d, *J* = 8.0 Hz, 2H), 7.23-7.20 (m, 2H), 7.17-7.13 (m, 1H), 6.98 (d, *J* = 8.0 Hz, 2H), 6.91 (s, 1H), 6.45 (s, 1H), 4.97 (d, *J* = 2.4 Hz, 1H), 4.13-4.08 (m, 1H), 3.90 (s, 3H), 3.77 (s, 3H), 2.42 (s, 3H), 2.19-2.10 (m, 1H), 1.94-1.86 (m, 1H), 1.69-1.58 (m, 1H), 1.51-1.45 (m, 1H), 1.34 (s, 3H), 1.17 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 148.11, 146.90, 144.40, 144.29, 139.15, 135.28, 129.62 (2x), 128.83 (2x), 128.31 (2x), 127.40 (2x), 126.69, 126.24, 116.51, 112.83, 69.62, 55.84, 55.71, 48.18, 40.02, 35.47, 32.94, 32.65, 22.01, 21.56; Anal. Calcd for $C_{28}H_{32}O_4S$: C, 72.38; H, 6.94. Found: C, 72.50; H, 7.18. Single-crystal X-Ray diagram: crystal of compound **6a** was grown by slow diffusion of EtOAc into a solution of compound **6a** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the orthorombic crystal system, space group P 21 21 21, *a* = 9.4078(8) Å, *b* = 9.4698(8) Å, *c* = 26.640(2) Å, *V* = 2373.3(4) $Å^3$, *Z* = 4, d_{calcd} = 1.300 mg/cm^3, *F*(000) = 992, 2*θ* range 1.529~26.480^o, R indices (all data) R1 = 0.0368, wR2 = 0.0806.



1.5.2.

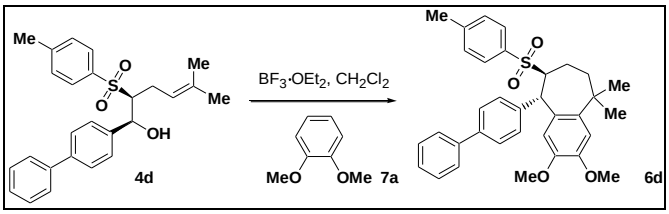
2,3-Dimethoxy-9-(4-methoxyphenyl)-5,5-dimethyl-8-(toluene-4-sulfonyl)-6,7,8,9-tetrahydro-*5H*-benzocycloheptene (6b). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4b** (75 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **6b** (82%, 81 mg). Colorless solid; mp = 123-124 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{29}H_{35}O_5S$ 495.2205, found 495.2209; ^1H NMR (400 MHz, $CDCl_3$): δ 7.67 (d, *J* = 8.4 Hz, 2H), 7.24 (d, *J* = 8.0 Hz, 2H), 6.90 (s, 1H), 6.86 (d, *J* = 8.4 Hz, 2H), 6.72 (d, *J* = 8.8 Hz, 2H), 6.43 (s, 1H), 4.91 (d, *J* = 3.2 Hz, 1H), 4.05-4.01 (m, 1H), 3.87 (s, 3H), 3.74 (s, 3H), 3.73 (s, 3H), 2.39 (s, 3H), 2.21-2.13 (m, 1H), 1.92-1.83 (m, 1H), 1.73-1.67 (m, 1H), 1.57-1.51 (m, 1H), 1.33 (s, 3H), 1.18 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 157.86, 147.87, 146.69, 144.13, 138.98, 135.67, 135.38, 129.44 (2x), 128.57 (2x), 128.43 (2x), 127.13, 116.14, 113.45 (2x), 112.60, 69.34, 55.71, 55.56, 55.06, 47.23, 39.80, 35.32, 32.90, 32.56, 21.94, 21.41. Single-crystal X-Ray diagram: crystal of compound **6b** was grown by slow diffusion of EtOAc into a solution of compound **6b** in

CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the orthorombic crystal system, space group P 21/c, *a* = 10.4874(8) Å, *b* = 11.6664(8) Å, *c* = 24.139(2) Å, *V* = 2953.4(4) Å^3, *Z* = 4, d_{calcd} = 1.112 mg/cm^3, *F*(000) = 1056, 2*θ* range 2.428~26.356^o, R indices (all data) R1 = 0.1542, wR2 = 0.2103.



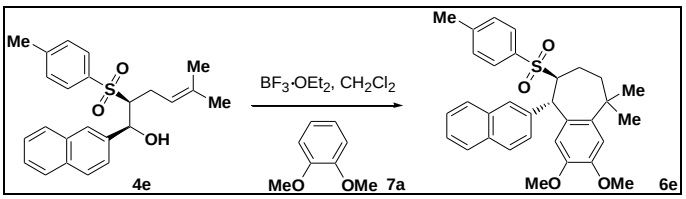
1.5.3.

2,3-Dimethoxy-5,5-dimethyl-8-(toluene-4-sulfonyl)-9-*p*-tolyl-6,7,8,9-tetrahydro-*5H*-benzocycloheptene (6c). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4c** (72 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **6c** (80%, 76 mg). Colorless solid; mp = 158-159 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{29}H_{35}O_4S$ 479.2256, found 479.2258; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.71 (d, *J* = 8.0 Hz, 2H), 7.27 (d, *J* = 8.0 Hz, 2H), 7.01 (d, *J* = 8.0 Hz, 2H), 6.91 (s, 1H), 6.85 (d, *J* = 8.4 Hz, 2H), 6.45 (s, 1H), 4.92 (d, *J* = 2.0 Hz, 1H), 4.11-4.07 (m, 1H), 3.90 (s, 3H), 3.77 (s, 3H), 2.42 (s, 3H), 2.28 (s, 3H), 2.20-2.12 (m, 1H), 1.94-1.87 (m, 1H), 1.70 (dd, *J* = 9.2, 14.8 Hz, 1H), 1.50 (dd, *J* = 9.2, 14.8 Hz, 1H), 1.34 (s, 3H), 1.18 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.98, 146.78, 144.27, 141.09, 139.08, 135.82, 135.31, 129.83 (2x), 128.93 (2x), 128.73 (2x), 127.27 (2x), 126.87, 116.36, 112.70, 69.55, 55.78, 55.64, 47.79, 39.96, 35.41, 32.95, 32.59, 21.91, 21.52, 20.77.



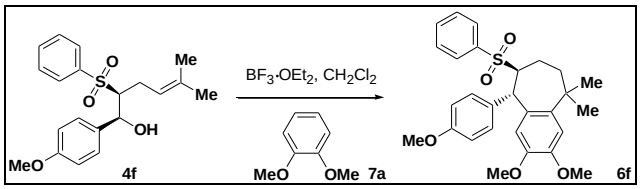
1.5.4.

9-Biphenyl-4-yl-2,3-dimethoxy-5,5-dimethyl-8-(toluene-4-sulfonyl)-6,7,8,9-tetrahydro-*5H*-benzocycloheptene (6d). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4d** (84 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 4/1) afforded **6d** (82%, 89 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{34}H_{37}O_4S$ 541.2413, found 541.2412; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.72 (d, *J* = 8.4 Hz, 2H), 7.56-7.53 (m, 2H), 7.45-7.40 (m, 4H), 7.35-7.31 (m, 1H), 7.28-7.26 (m, 2H), 7.05 (d, *J* = 8.4 Hz, 2H), 6.94 (s, 1H), 6.49 (s, 1H), 5.02 (d, *J* = 3.2 Hz, 1H), 4.16-4.11 (m, 1H), 3.91 (s, 3H), 3.77 (s, 3H), 2.40 (s, 3H), 2.26-2.18 (m, 1H), 1.97-1.89 (m, 1H), 1.74 (dd, *J* = 9.6, 14.8 Hz, 1H), 1.58 (dd, *J* = 9.6, 14.8 Hz, 1H), 1.37 (s, 3H), 1.22 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 148.11, 146.89, 144.32, 143.05, 140.35, 139.18, 139.12, 135.44, 129.60 (2x), 128.74 (4x), 127.99 (2x), 127.27, 126.86 (4x), 126.74, 116.31, 112.78, 69.55, 55.84, 55.71, 47.91, 39.98, 35.57, 33.03, 32.66, 22.03, 21.53.



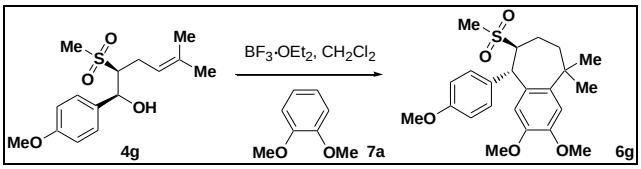
1.5.5.

2,3-Dimethoxy-5,5-dimethyl-9-naphthalen-2-yl-8-(toluene-4-sulfonyl)-6,7,8,9-tetrahydro-*5H*-benzocycloheptene (6e). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4e** (79 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 4/1) afforded **6e** (78%, 80 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{32}H_{35}O_4S$ 515.2256, found 515.2260; ^1H NMR (400 MHz, $CDCl_3$): δ 7.79-7.76 (m, 1H), 7.73 (d, *J* = 8.8 Hz, 1H), 7.69 (d, *J* = 8.0 Hz, 2H), 7.62-7.57 (m, 1H), 7.45-7.40 (m, 2H), 7.28 (dd, *J* = 2.0, 8.8 Hz, 1H), 7.25 (br s, 1H), 7.19 (d, *J* = 8.0 Hz, 2H), 6.96 (s, 1H), 6.51 (s, 1H), 5.17 (d, *J* = 3.2 Hz, 1H), 4.24-4.17 (m, 1H), 3.92 (s, 3H), 3.73 (s, 3H), 2.36 (s, 3H), 2.28-2.19 (m, 1H), 1.95-1.87 (m, 1H), 1.73 (dd, *J* = 9.6, 14.8 Hz, 1H), 1.55 (dd, *J* = 9.6, 14.8 Hz, 1H), 1.38 (s, 3H), 1.23 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 148.13, 146.93, 144.34, 141.24, 139.28, 135.45, 132.98, 131.94, 129.51 (2x), 128.70 (2x), 128.08, 127.73, 127.36, 127.80, 126.69, 126.14, 125.80, 125.77, 116.31, 112.78, 69.47, 55.87, 55.69, 48.36, 40.02, 35.46, 33.03, 32.73, 22.23, 21.49; Anal. Calcd for $C_{32}H_{34}O_4S$: C, 74.68; H, 6.66. Found: C, 74.87; H, 6.91.



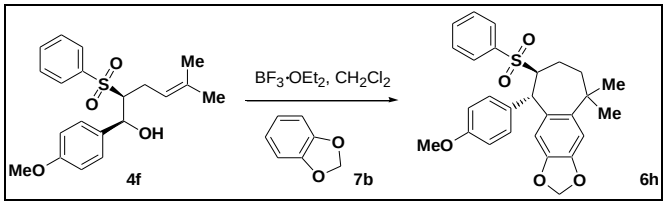
1.5.6.

8-Benzenesulfonyl-2,3-dimethoxy-9-(4-methoxyphenyl)-5,5-dimethyl-6,7,8,9-tetrahydro-5H-benzocycloheptene (6f). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4f** (72 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **6f** (76%, 73 mg). Colorless solid; mp = 167-168 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{28}H_{33}O_5S$ 481.2049, found 481.2054; ^1H NMR (400 MHz, $CDCl_3$): δ 7.79-7.76 (m, 2H), 7.57-7.53 (m, 1H), 7.46-7.42 (m, 2H), 6.89 (s, 1H), 6.87 (d, *J* = 8.8 Hz, 2H), 6.71 (d, *J* = 8.8 Hz, 2H), 6.44 (s, 1H), 4.94 (d, *J* = 3.6 Hz, 1H), 4.09-4.03 (m, 1H), 3.87 (s, 3H), 3.74 (s, 3H), 3.73 (s, 3H), 2.24-2.16 (m, 1H), 1.91-1.84 (m, 1H), 1.75-1.69 (m, 1H), 1.60-1.53 (m, 1H), 1.33 (s, 3H), 1.19 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 157.93, 147.91, 146.73, 139.04, 138.49, 135.41, 133.21, 128.82 (2x), 128.58 (4x), 127.13, 116.07, 113.53 (2x), 112.59, 69.34, 55.75, 55.62, 55.11, 47.17, 39.80, 35.37, 32.97, 32.57, 22.03; Anal. Calcd for $C_{28}H_{32}O_5S$: C, 69.97; H, 6.71. Found: C, 70.17; H, 6.96.



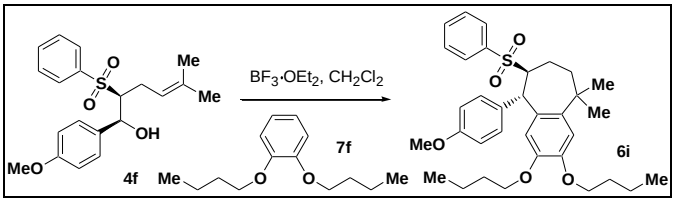
1.5.7.

8-Methanesulfonyl-2,3-dimethoxy-9-(4-methoxyphenyl)-5,5-dimethyl-6,7,8,9-tetrahydro-*5H*-benzocycloheptene (6g). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4g** (60 mg, 0.2 mmol) and **7a** (41 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **6g** (80%, 67 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{23}H_{31}O_5S$ 419.1892, found 419.1897; ^1H NMR (400 MHz, $CDCl_3$): δ 7.01 (d, *J* = 8.4 Hz, 2H), 6.97 (s, 1H), 6.84 (d, *J* = 8.4 Hz, 2H), 6.54 (s, 1H), 4.92 (d, *J* = 3.6 Hz, 1H), 3.95-3.90 (m, 1H), 3.90 (s, 3H), 3.77 (s, 3H), 3.75 (s, 3H), 2.53 (s, 3H), 2.25-2.02 (m, 2H), 1.80 (dd, *J* = 9.2, 14.8 Hz, 1H), 1.64-1.55 (m, 1H), 1.40 (s, 3H), 1.19 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 158.17, 148.27, 147.12, 139.36, 135.54, 128.52 (2x), 126.71, 115.95, 113.82 (2x), 113.04, 68.94, 55.81, 55.78, 55.18, 47.90, 40.05, 38.54, 35.26, 33.10, 32.61, 22.29.



1.5.8.

8-Benzenesulfonyl-9-(4-methoxyphenyl)-5,5-dimethyl-6,7,8,9-tetrahydro-*5H*-1,3-dioxa-cyclohepta[*f*]indene (6h). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4f** (72 mg, 0.2 mmol) and **7b** (37 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **6h** (85%, 79 mg). Colorless gum; HRMS (ESI, M^++1) calcd for $C_{27}H_{29}O_5S$ 465.1736, found 465.1739; ^1H NMR (400 MHz, $CDCl_3$): δ 7.76-7.74 (m, 2H), 7.57-7.53 (m, 1H), 7.46-7.43 (m, 2H), 6.91 (s, 1H), 6.84 (d, *J* = 8.4 Hz, 2H), 6.69 (d, *J* = 8.8 Hz, 2H), 6.45 (s, 1H), 6.90 (d, *J* = 1.2 Hz, 1H), 5.88 (d, *J* = 1.2 Hz, 1H), 4.89 (d, *J* = 4.4 Hz, 1H), 4.12-4.01 (m, 1H), 3.78 (s, 3H), 2.32-2.24 (m, 1H), 1.91-1.50 (m, 3H), 1.35 (s, 3H), 1.19 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 158.00, 147.11, 145.63, 140.54, 138.86, 134.48, 133.13, 128.85 (2x), 128.75 (2x), 128.46 (3x), 113.57 (2x), 112.36, 108.96, 100.98, 68.60, 55.12, 47.17, 39.89, 35.35, 33.13, 32.69, 21.91.

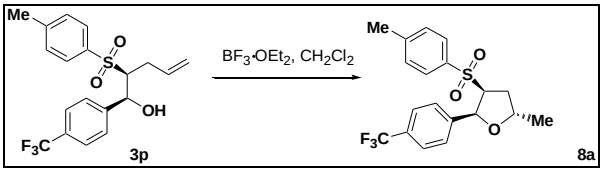


1.5.9.

8-Benzenesulfonyl-2,3-dibutoxy-9-(4-methoxyphenyl)-5,5-dimethyl-6,7,8,9-tetrahydro-*5H*-be

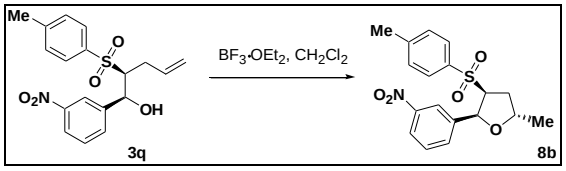
nzocycloheptene (6i). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol), **4f** (72 mg, 0.2 mmol) and **7f** (67 mg, 0.3 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **6i** (85%, 96 mg). Colorless solid; mp = 151-152 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{34}H_{45}O_5S$ 565.2988, found 565.2989; ^1H NMR (400 MHz, $CDCl_3$): δ 7.77-7.75 (m, 2H), 7.57-7.53 (m, 1H), 7.46-7.42 (m, 2H), 6.90 (s, 1H), 6.87 (d, *J* = 8.4 Hz, 2H), 6.71 (d, *J* = 8.0 Hz, 2H), 6.45 (s, 1H), 4.92 (d, *J* = 3.6 Hz, 1H), 4.07-4.04 (m, 1H), 4.00 (t, *J* = 6.4 Hz, 2H), 3.90-3.77 (m, 2H), 3.75 (s, 3H), 2.35-2.17 (m, 1H), 1.93-1.69 (m, 6H), 1.54-1.39 (m, 5H), 1.31 (s, 3H), 1.18 (s, 3H), 1.00 (t, *J* = 6.8 Hz, 3H), 0.92 (t, *J* = 6.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 157.98, 148.08, 147.13, 139.22, 138.68, 135.48, 133.17, 128.82 (2x), 128.74 (2x), 128.70 (2x), 127.62, 118.69, 115.91, 113.56 (2x), 69.46, 69.25, 68.76, 55.18, 47.22, 39.73, 35.50, 33.06, 32.65, 31.50, 31.31, 22.14, 19.23, 19.19, 13.89, 13.84. Single-crystal X-Ray diagram: crystal of compound **6i** was grown by slow diffusion of EtOAc into a solution of compound **6i** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/n, *a* = 10.3966(8) Å, *b* = 11.0245(10) Å, *c* = 26.053(2) Å, *V* = 2984.6(4) $Å^3$, *Z* = 4, d_{calcd} = 1.257 mg/cm^3, *F*(000) = 1216, 2*θ* range 1.564~26.401^o, R indices (all data) R1 = 0.0665, wR2 = 0.1384.

1.6. A representative synthetic procedure of compounds 8a-c is as follows: $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) was added to a solution of **3p**-**r** (0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC. The reaction mixture was stirred at 25 ^oC for 20 h. The reaction mixture was concentrated and the residue was diluted with water (10 mL) and the mixture was extracted with CH_2Cl_2 (3 x 20 mL). The combined organic layers were washed with brine, dried, filtered and evaporated to afford crude product under reduced pressure. Purification on silica gel (hexanes/EtOAc = 5/1~3/1) afforded **8a-c**.

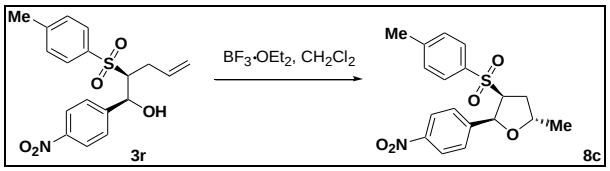


1.6.1. 5-Methyl-3-(toluene-4-sulfonyl)-2-(4-trifluoromethylphenyl)tetrahydrofuran (8a). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **3p** (77 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **8a** (90%, 69 mg). Colorless solid; mp = 151-152 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{19}H_{20}F_3O_3S$ 385.1085, found 385.1088; ^1H NMR (400 MHz, $CDCl_3$): δ 7.33 (d, *J* = 8.8 Hz, 2H), 7.28 (d, *J* = 8.8 Hz, 2H), 7.17 (d, *J* = 8.8 Hz, 2H), 7.03 (d, *J* = 8.8 Hz, 2H), 5.35 (d, *J* = 5.6 Hz, 1H), 4.85-4.80 (m, 1H), 4.17-4.13 (m, 1H), 3.08 (ddd, *J* = 3.6, 6.8, 14.4 Hz, 1H), 2.35 (s, 3H), 2.12 (dt, *J* = 8.0, 14.0 Hz, 1H), 1.35 (d, *J* = 6.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 144.03, 140.32, 136.04, 129.93, 129.47 (2x), 127.67, 127.60 (2x), 127.46 (2x), 124.34 (q, *J* = 3.8 Hz, 2x), 79.49, 74.81, 68.01, 35.30, 21.72, 21.35. Single-crystal X-Ray diagram: crystal of compound **8a** was grown by slow diffusion of EtOAc into a solution of compound **8a** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the orthorhombic crystal system, space group P 21 21 21, *a* = 5.6186(6) Å, *b* = 8.3590(8) Å, *c* = 37.132(3) Å, *V* =

1743.9(3) Å^3, Z = 4, d_{calcd} = 1.464 mg/cm^3, F(000) = 800, 2θ range 1.097~26.447^o, R indices (all data) R1 = 0.0461, wR2 = 0.0961.



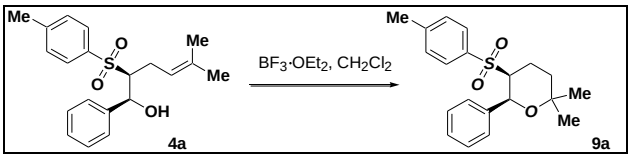
1.6.2. 5-Methyl-2-(3-nitrophenyl)-3-(toluene-4-sulfonyl)tetrahydrofuran (8b). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **3q** (72 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **8b** (92%, 66 mg). Colorless solid; mp = 116-118 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M$^+$+1) calcd for $C_{18}H_{20}NO_5S$ 362.1062, found 362.1068; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.06-8.03 (m, 1H), 7.84-7.82 (m, 1H), 7.76 (br t, J = 2.0 Hz, 1H), 7.44 (t, J = 8.4 Hz, 1H), 7.23 (d, J = 8.4 Hz, 2H), 7.09 (d, J = 8.4 Hz, 2H), 5.41 (d, J = 6.0 Hz, 1H), 4.88-4.80 (m, 1H), 4.23-4.19 (m, 1H), 3.02 (ddd, J = 4.0, 6.8, 14.4 Hz, 1H), 2.33 (s, 3H), 2.10 (dt, J = 7.2, 14.4 Hz, 1H), 1.34 (d, J = 6.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.48, 144.49, 138.62, 136.13, 133.79, 129.65 (2x), 128.73, 127.42 (2x), 122.72, 122.34, 79.09, 75.04, 67.60, 35.32, 21.56, 21.30; Anal. Calcd for $C_{18}H_{19}NO_5S$: C, 59.82; H, 5.30. Found: C, 59.98; H, 5.51. Single-crystal X-Ray diagram: crystal of compound **8b** was grown by slow diffusion of EtOAc into a solution of compound **8b** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/n, a = 11.8500(15) Å, b = 10.4794(13) Å, c = 13.4988(17) Å, V = 1675.5(4) Å^3, Z = 4, d_{calcd} = 1.433 mg/cm^3, F(000) = 760, 2θ range 2.252~26.378^o, R indices (all data) R1 = 0.0484, wR2 = 0.0877.



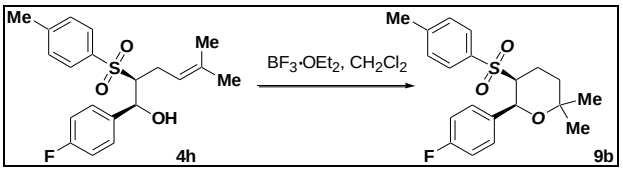
1.6.3. 5-Methyl-2-(4-nitrophenyl)-3-(toluene-4-sulfonyl)tetrahydrofuran (8c). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **3r** (72 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 5/1) afforded **8c** (95%, 69 mg). Colorless solid; mp = 173-174 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M$^+$+1) calcd for $C_{18}H_{20}NO_5S$ 362.1062, found 362.1068; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.00 (d, J = 8.4 Hz, 2H), 7.43 (d, J = 8.4 Hz, 2H), 7.30 (d, J = 8.4 Hz, 2H), 7.12 (d, J = 8.4 Hz, 2H), 5.43 (d, J = 6.0 Hz, 1H), 4.86-4.81 (m, 1H), 4.18-4.14 (m, 1H), 2.99-2.93 (m, 1H), 2.39 (s, 3H), 2.10-2.03 (m, 1H), 1.34 (d, J = 6.0 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 144.68, 143.95, 136.10, 129.60 (2x), 128.27 (2x), 127.67 (2x), 122.76 (2x), 113.99, 79.36, 75.11, 68.04, 35.61, 21.68, 21.52.

1.7. A representative synthetic procedure of compounds 9a-g is as follows: $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) was added to a solution of **4a**, **4d**-**e** and **4h**-**k** (0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C. The

reaction mixture was stirred at 25 ^{o}C for 20 h. The reaction mixture was concentrated and the residue was diluted with water (10 mL) and the mixture was extracted with CH_2Cl_2 (3 x 20 mL). The combined organic layers were washed with brine, dried, filtered and evaporated to afford crude product under reduced pressure. Purification on silica gel (hexanes/EtOAc = 5/1~3/1) afforded **9a**-**g**.

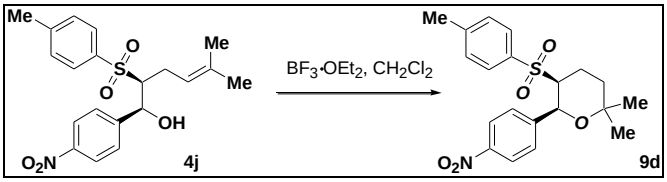


1.7.1. 2,2-Dimethyl-6-phenyl-5-(toluene-4-sulfonyl)tetrahydropyran (9a). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **4a** (69 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **9a** (90%, 62 mg). Colorless solid; mp = 148-149 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{20}H_{25}O_3S$ 345.1524, found 345.1523; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.25-7.20 (m, 2H), 7.14 (d, *J* = 8.4 Hz, 2H), 7.09-7.04 (m, 3H), 6.95 (d, *J* = 8.4 Hz, 2H), 5.09 (d, *J* = 2.8 Hz, 1H), 3.56-3.54 (m, 1H), 2.81-2.77 (m, 1H), 2.31 (s, 3H), 2.21-2.12 (m, 2H), 1.51-1.47 (m, 1H), 1.42 (s, 3H), 1.28 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 142.80, 138.70, 138.46, 128.97 (2x), 127.62 (2x), 127.52 (2x), 126.86, 126.15 (2x), 72.83, 71.01, 62.88, 31.37, 31.09, 21.58, 21.47, 21.35; Anal. Calcd for $C_{20}H_{24}O_3S$: C, 69.73; H, 7.02. Found: C, 69.62; H, 6.91. Single-crystal X-Ray diagram: crystal of compound **9a** was grown by slow diffusion of EtOAc into a solution of compound **9a** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/c, *a* = 6.0190(2) Å, *b* = 22.9167(10) Å, *c* = 13.0996(6) Å, *V* = 1770.47(13) Å^3, *Z* = 4, d_{calcd} = 1.292 mg/cm^3, *F*(000) = 736, 2θ range 1.777~26.462^{o}, R indices (all data) R1 = 0.0407, wR2 = 0.1190.

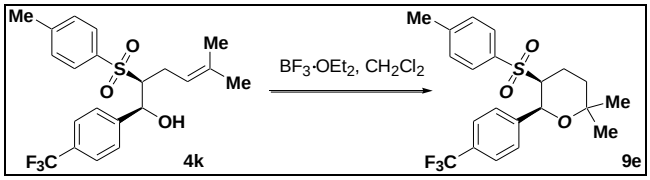


1.7.2. 6-(4-Fluorophenyl)-2,2-dimethyl-5-(toluene-4-sulfonyl)tetrahydropyran (9b). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **4h** (72 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **9b** (92%, 67 mg). Colorless solid; mp = 164-166 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{20}H_{24}FO_3S$ 363.1430, found 363.1436; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.18-7.14 (m, 4H), 7.01 (d, *J* = 8.4 Hz, 2H), 6.75-6.71 (m, 2H), 5.05 (d, *J* = 2.8 Hz, 1H), 3.52-3.50 (m, 1H), 2.79-2.75 (m, 1H), 2.33 (s, 3H), 2.24-2.11 (m, 2H), 1.50-1.46 (m, 1H), 1.41 (s, 3H), 1.28 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 161.88 (d, *J* = 243.3 Hz), 143.15, 138.35, 134.44 (d, *J* = 3.1 Hz), 129.02 (2x), 127.79 (d, *J* = 8.4 Hz, 2x), 127.42 (2x), 114.36 (d, *J* = 22.0 Hz, 2x), 73.00, 70.50, 62.83, 31.25, 31.05, 21.47, 21.36 (2x); Anal. Calcd for $C_{20}H_{23}FO_3S$: C, 66.27; H, 6.40. Found: C, 66.38; H, 6.59.

1.7.3. 2,2-Dimethyl-6-(3-nitrophenyl)-5-(toluene-4-sulfonyl)tetrahydropyran (9c). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **4i** (78 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **9c** (90%, 70 mg). Colorless solid; mp = 185-186 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{20}H_{24}NO_5S$ 390.1375, found 390.1378; ^1H NMR (400 MHz, $CDCl_3$): δ 7.90 (dd, *J* = 0.8, 8.4 Hz, 1H), 7.78 (d, *J* = 8.4 Hz, 1H), 7.75 (br s, 1H), 7.33 (t, *J* = 8.0 Hz, 1H), 7.14 (d, *J* = 8.0 Hz, 2H), 6.95 (d, *J* = 8.0 Hz, 2H), 5.14 (d, *J* = 3.2 Hz, 1H), 3.65-3.63 (m, 1H), 2.76-2.71 (m, 1H), 2.25 (s, 3H), 2.23-2.08 (m, 2H), 1.50-1.45 (m, 1H), 1.40 (s, 3H), 1.26 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 147.32, 143.53, 140.84, 137.92, 132.58, 129.21 (2x), 128.64, 127.18 (2x), 121.80, 121.11, 73.35, 70.07, 61.76, 30.94, 30.88, 21.38, 21.09, 21.03; Anal. Calcd for $C_{20}H_{23}NO_5S$: C, 61.68; H, 5.95. Found: C, 61.85; H, 6.22.

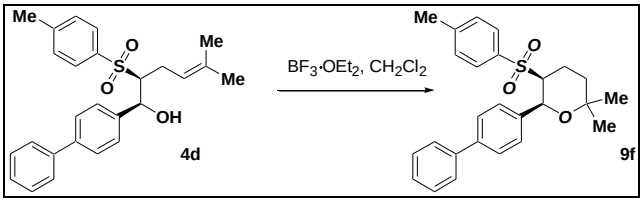


1.7.4. 2,2-Dimethyl-6-(4-nitrophenyl)-5-(toluene-4-sulfonyl)tetrahydropyran (9d). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **4j** (78 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **9d** (94%, 73 mg). Colorless solid; mp = 217-218 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{20}H_{24}NO_5S$ 390.1375, found 390.1380; ^1H NMR (400 MHz, $CDCl_3$): δ 7.90 (d, *J* = 9.2 Hz, 2H), 7.38 (d, *J* = 8.4 Hz, 2H), 7.20 (d, *J* = 8.4 Hz, 2H), 6.99 (d, *J* = 8.0 Hz, 2H), 5.16 (d, *J* = 2.8 Hz, 1H), 3.59-3.56 (m, 1H), 2.77-2.69 (m, 1H), 2.32 (s, 3H), 2.28-2.14 (m, 2H), 1.52-1.48 (m, 1H), 1.43 (s, 3H), 1.30 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 146.89, 146.25, 144.00, 137.84, 129.20 (2x), 127.52 (2x), 127.10 (2x), 122.71 (2x), 73.46, 70.62, 52.23, 30.97 (2x), 21.48, 21.41, 21.38; Anal. Calcd for $C_{20}H_{23}NO_5S$: C, 61.68; H, 5.95. Found: C, 61.92; H, 6.20.

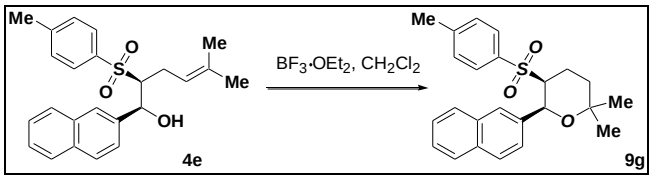


1.7.5. 2,2-Dimethyl-5-(toluene-4-sulfonyl)-6-(4-trifluoromethylphenyl)tetrahydropyran (9e). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **4k** (82 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^oC for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **9e** (90%, 74 mg). Colorless solid; mp = 167-168 ^oC (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{21}H_{24}F_3O_3S$ 413.1398, found 413.1401; ^1H NMR (400 MHz, $CDCl_3$): δ 7.27 (d, *J* = 8.8 Hz, 2H), 7.24 (d, *J* = 8.8 Hz, 2H), 7.10 (d, *J* = 8.4 Hz,

2H), 6.93 (d, *J* = 8.0 Hz, 2H), 5.11 (d, *J* = 2.4 Hz, 1H), 3.58-3.56 (m, 1H), 2.91-2.86 (m, 1H), 2.29 (s, 3H), 2.27-2.15 (m, 2H), 1.53-1.50 (m, 1H), 1.44 (s, 3H), 1.29 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 143.28 (2x), 142.65, 138.09, 129.12 (2x), 128.86, 127.25 (2x), 126.50 (2x), 124.40 (q, *J* = 3.7 Hz, 2x), 73.18, 70.52, 62.19, 31.31, 31.03, 21.41, 21.19, 21.16; Anal. Calcd for $C_{21}H_{23}F_3O_3S$: C, 61.15; H, 5.62. Found: C, 61.30; H, 5.54.



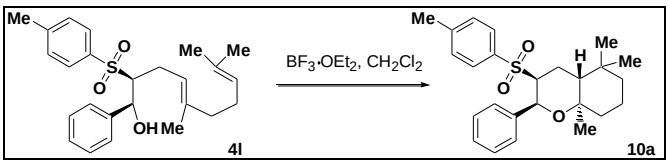
1.7.6. 6-Biphenyl-4-yl-2,2-dimethyl-5-(toluene-4-sulfonyl)tetrahydropyran (9f). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **4d** (84 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **9f** (82%, 69 mg). Colorless solid; mp = 208-209 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{26}H_{29}O_3S$ 421.1837, found 421.1842; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.52-7.43 (m, 4H), 7.38-7.33 (m, 1H), 7.27-7.22 (m, 4H), 7.16 (d, *J* = 8.0 Hz, 2H), 6.91 (d, *J* = 8.0 Hz, 2H), 5.14 (d, *J* = 3.2 Hz, 1H), 3.61-3.59 (m, 1H), 2.94-2.89 (m, 1H), 2.30-2.17 (m, 2H), 2.23 (s, 3H), 1.55-1.51 (m, 1H), 1.46 (s, 3H), 1.32 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 142.69, 140.89, 139.86, 138.59, 137.74, 128.95 (2x), 128.71 (2x), 127.43 (2x), 127.19, 126.89 (2x), 126.58 (2x), 126.27 (2x), 72.94, 70.81, 62.95, 31.53, 31.15, 21.50, 21.33 (2x); Anal. Calcd for $C_{26}H_{28}O_3S$: C, 74.25; H, 6.71. Found: C, 74.55; H, 6.82.



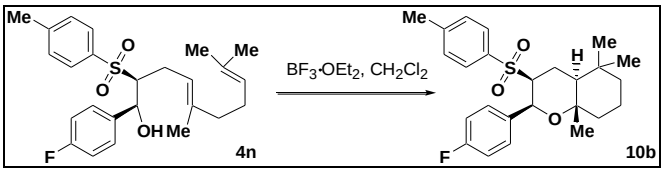
1.7.7. 2,2-Dimethyl-6-naphthalen-2-yl-5-(toluene-4-sulfonyl)tetrahydropyran (9g). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (28 mg, 0.2 mmol) and **4e** (79 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **9g** (84%, 66 mg). Colorless solid; mp = 192-193 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{24}H_{27}O_3S$ 395.1681, found 395.1684; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.69-7.66 (m, 3H), 7.44-7.38 (m, 3H), 7.12 (dd, *J* = 1.2, 8.4 Hz, 1H), 6.97 (d, *J* = 8.4 Hz, 2H), 6.49 (d, *J* = 8.0 Hz, 2H), 5.24 (d, *J* = 2.4 Hz, 1H), 3.64-3.63 (m, 1H), 3.00-2.90 (m, 1H), 2.40-2.22 (m, 2H), 2.02 (s, 3H), 1.57-1.54 (m, 1H), 1.50 (s, 3H), 1.34 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 142.66, 138.11, 135.82, 132.89, 132.69, 128.46 (2x), 127.95, 127.21 (2x), 127.16 (2x), 125.67, 125.58, 125.11, 123.88, 73.06, 71.02, 62.61, 31.57, 31.18, 21.54, 21.22, 21.08; Anal. Calcd for $C_{24}H_{26}O_3S$: C, 73.06; H, 6.64. Found: C, 73.18; H, 6.72.

1.8. A representative synthetic procedure of compounds 10a-b is as follows: $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol) was added to a solution of **4l** and **4n** (0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C. The reaction

mixture was stirred at 25 ^{o}C for 20 h. The reaction mixture was concentrated and the residue was diluted with water (10 mL) and the mixture was extracted with CH_2Cl_2 (3 x 20 mL). The combined organic layers were washed with brine, dried, filtered and evaporated to afford crude product under reduced pressure. Purification on silica gel (hexanes/EtOAc = 5/1~3/1) afforded **10a**-**b**.

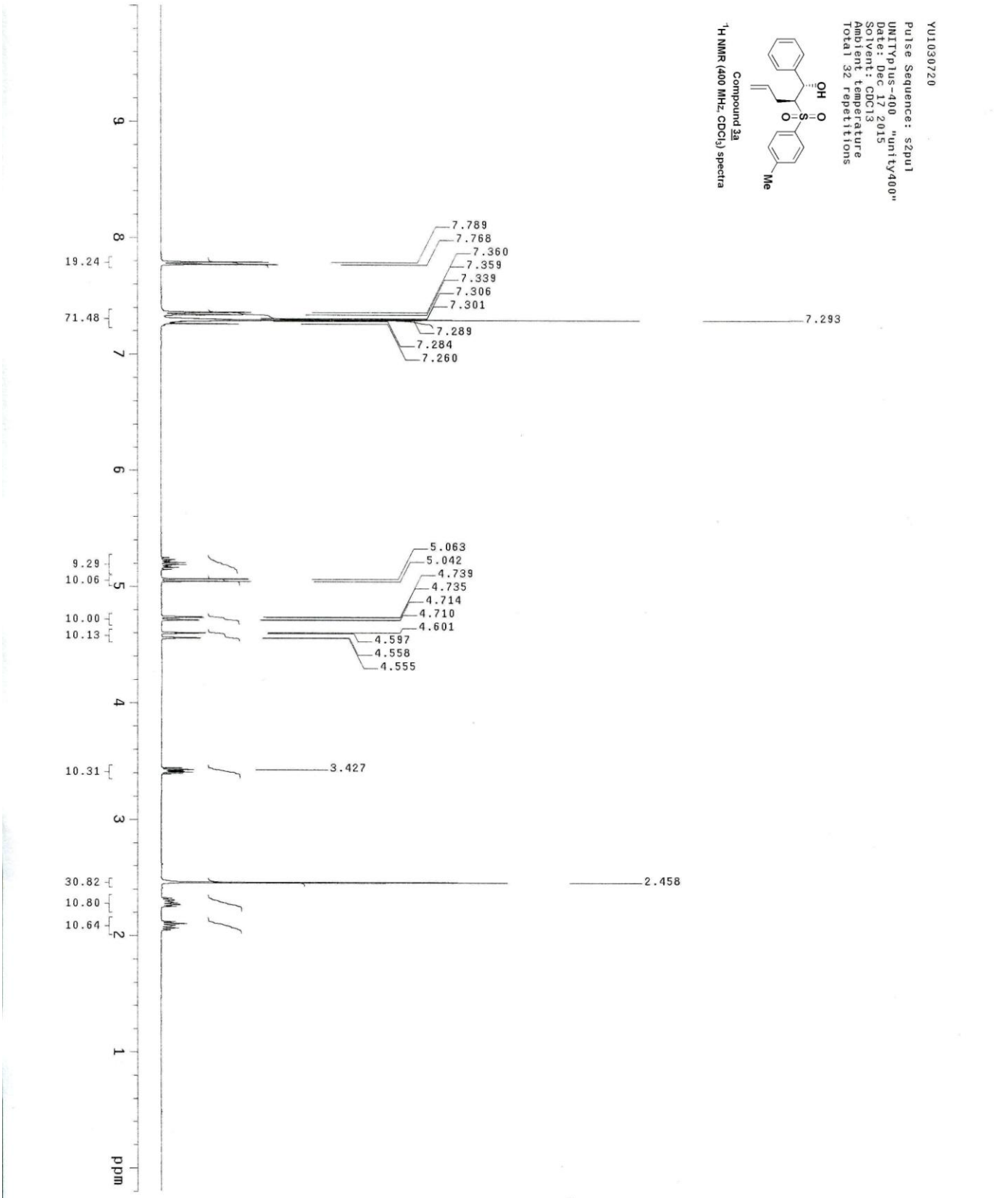


1.8.1. 5,5,8a-Trimethyl-2-phenyl-3-(toluene-4-sulfonyl)octahydrochromene (10a). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol) and **4l** (82 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **10a** (76%, 63 mg). Colorless solid; mp = 224-225 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{25}H_{33}O_3S$ 413.2150, found 413.2155; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.22-7.20 (m, 2H), 7.12-7.04 (m, 5H), 6.96 (d, *J* = 8.4 Hz, 2H), 5.17 (d, *J* = 3.6 Hz, 1H), 3.73-3.70 (m, 1H), 2.79 (d, *J* = 2.4 Hz, 1H), 2.31 (s, 3H), 2.17 (dd, *J* = 2.4, 14.0 Hz, 1H), 1.94 (dt, *J* = 5.2, 14.0 Hz, 1H), 1.81-1.55 (m, 4H), 1.46-1.38 (m, 2H), 1.33 (s, 3H), 1.03 (s, 3H), 0.79 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 142.65, 138.79, 138.77, 128.95 (2x), 127.53 (2x), 127.37 (2x), 126.86, 126.47 (2x), 76.24, 70.53, 65.21, 47.34, 41.27, 39.77, 33.33, 31.53, 21.34, 21.11, 20.23, 20.06, 18.43; Anal. Calcd for $C_{25}H_{32}O_3S$: C, 72.78; H, 7.82. Found: C, 72.62; H, 7.75. Single-crystal X-Ray diagram: crystal of compound **10a** was grown by slow diffusion of EtOAc into a solution of compound **10a** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the orthorhombic crystal system, space group P b c a, *a* = 16.0500(8) Å, *b* = 11.2326(5) Å, *c* = 24.8893(13) Å, *V* = 4487.1(4) Å^3, *Z* = 8, d_{calcd} = 1.221 mg/cm^3, *F*(000) = 1776, 2*θ* range 1.636~26.396^{o}, R indices (all data) R1 = 0.0687, wR2 = 0.1145.



1.8.2. 2-(4-Fluoro-phenyl)-5,5,8a-trimethyl-3-(toluene-4-sulfonyl)octahydrochromene (10b). According to the general procedure, reaction was performed in the presence of $BF_3{\cdot}OEt_2$ (57 mg, 0.4 mmol) and **4n** (86 mg, 0.2 mmol) in CH_2Cl_2 (5 mL) at 25 ^{o}C for 20 h. Purification on silica gel (hexanes/EtOAc = 3/1) afforded **10b** (80%, 69 mg). Colorless solid; mp = 199-200 ^{o}C (recrystallized from hexanes and EtOAc); HRMS (ESI, M^++1) calcd for $C_{25}H_{32}FO_3S$ 431.2056, found 431.2060; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.18-7.13 (m, 4H), 7.02 (d, *J* = 8.0 Hz, 2H), 6.77-6.72 (m, 2H), 5.13 (d, *J* = 3.6 Hz, 1H), 3.69-3.66 (m, 1H), 2.77 (dt, *J* = 2.4, 14.4 Hz, 1H), 2.34 (s, 3H), 2.17 (dd, *J* = 2.8, 14.0 Hz, 1H), 1.93 (dt, *J* = 2.8, 14.0 Hz, 1H), 1.80-1.54 (m, 4H), 1.46-1.39 (m, 2H), 1.33 (s, 3H), 1.02 (s, 3H), 0.78 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 161.95 (d, *J* = 243.4 Hz), 143.07, 138.69, 133.56 (d, *J* = 3.8 Hz), 129.03 (2x), 128.13 (d, *J* = 7.6 Hz, 2x), 127.33 (2x), 114.35 (d, *J* = 21.2 Hz, 2x), 76.47, 70.08, 65.23, 47.27, 41.28, 39.80, 33.38, 31.58, 21.40, 21.00,

20.26, 20.09, 18.46; Anal. Calcd for $C_{25}H_{31}FO_3S$: C, 69.74; H, 7.26. Found: C, 69.86; H, 7.37. Single-crystal X-Ray diagram: crystal of compound **10b** was grown by slow diffusion of EtOAc into a solution of compound **10b** in CH_2Cl_2 to yield colorless prisms. The compound crystallizes in the monoclinic crystal system, space group P 21/n, a = 15.2927(5) Å, b = 18.9203(5) Å, c = 22.9664(7) Å, V = 6644.5(3) Å^3, Z = 12, d_{calcd} = 1.291 mg/cm^3, F(000) = 2760, 2θ range 1.394~26.414^o, R indices (all data) R1 = 0.0514, wR2 = 0.1217.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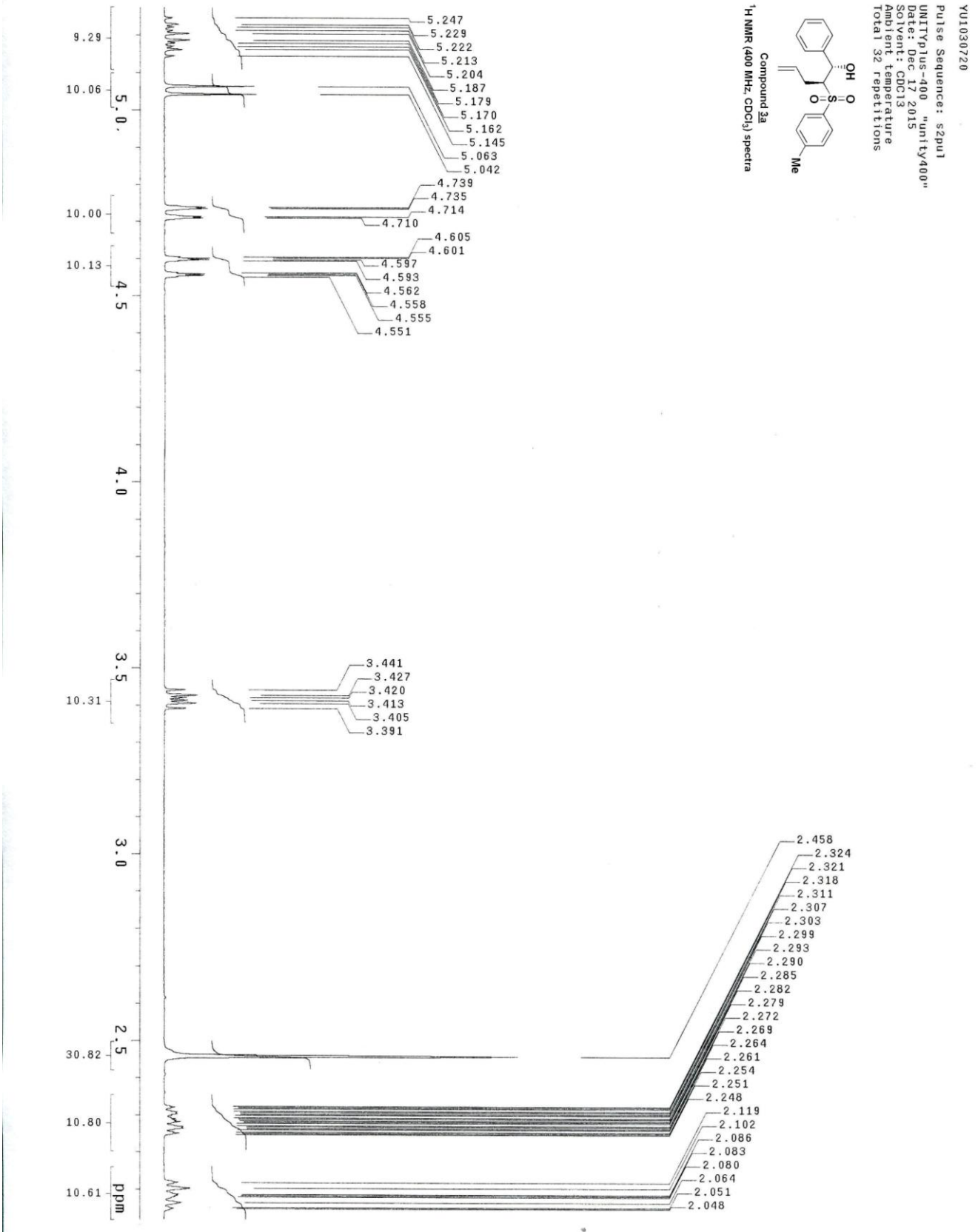
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YU1030720

Pulse Sequence: s2pul

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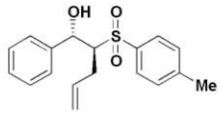
Date: Dec 17 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions



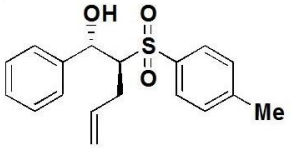
Compound 3a

^{1}H NMR (400 MHz, $CDCl_3$) spectra

YU1030720

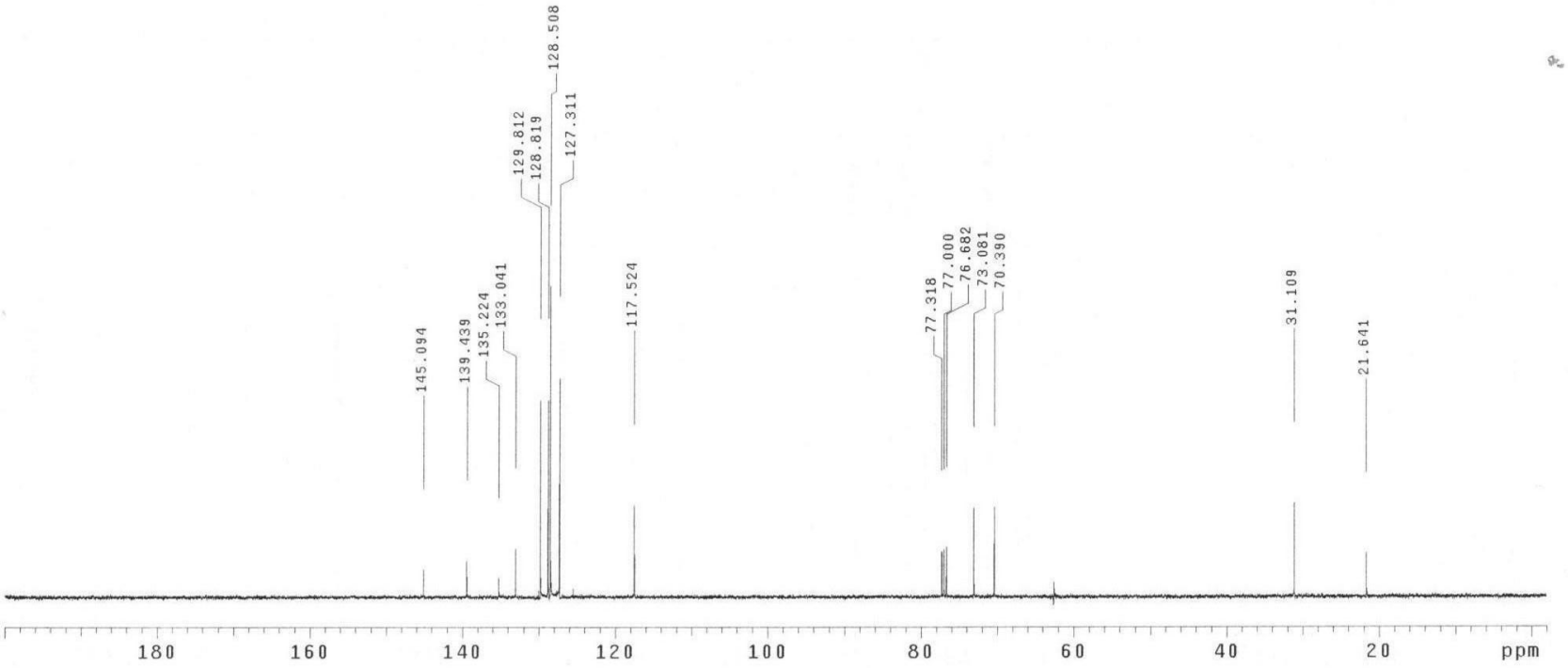
Pulse Sequence: s2pul

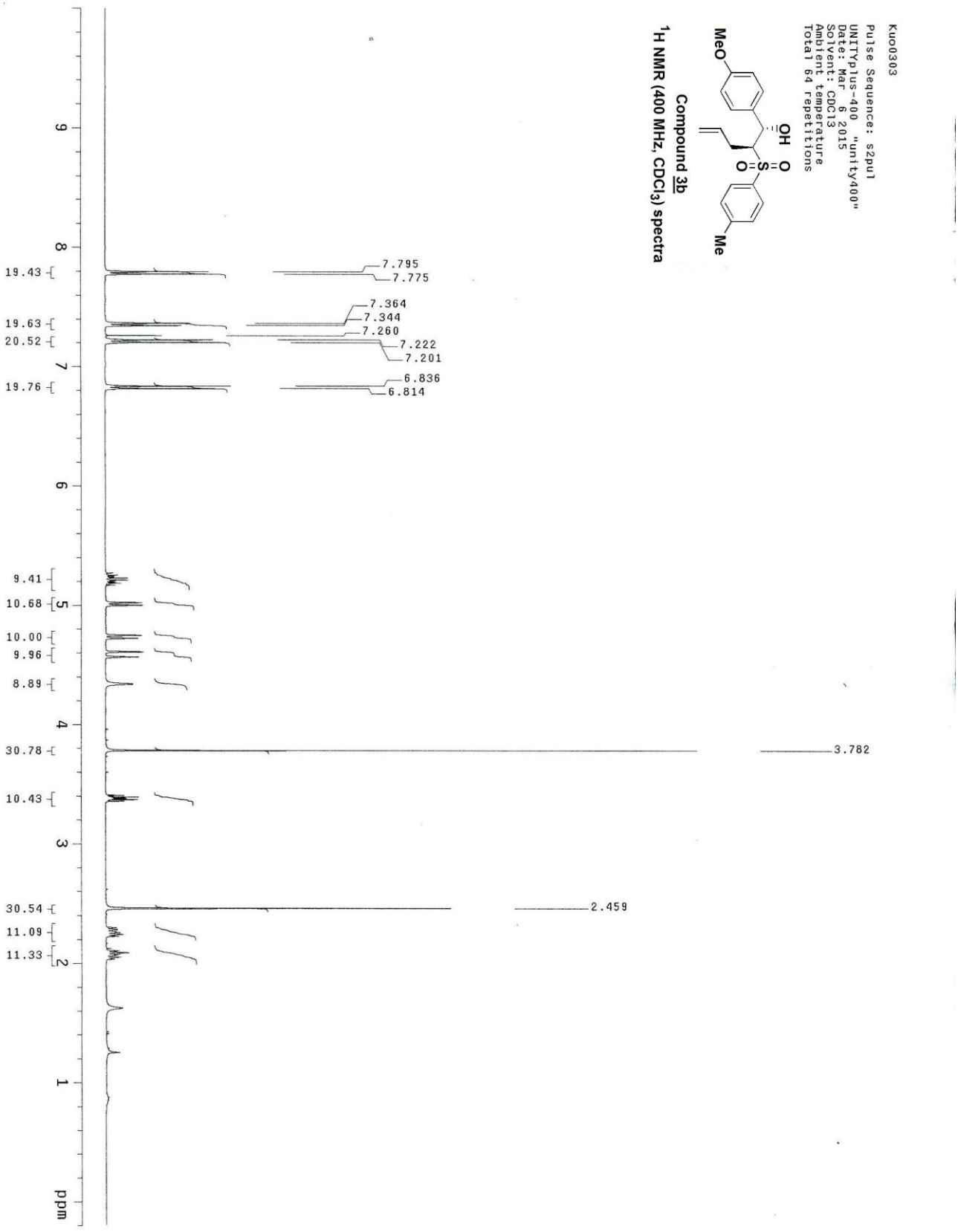
UNITYplus-400 "unity400"
Date: Aug 4 2014
Solvent: CDCl3
Ambient temperature
Total 1184 repetitions

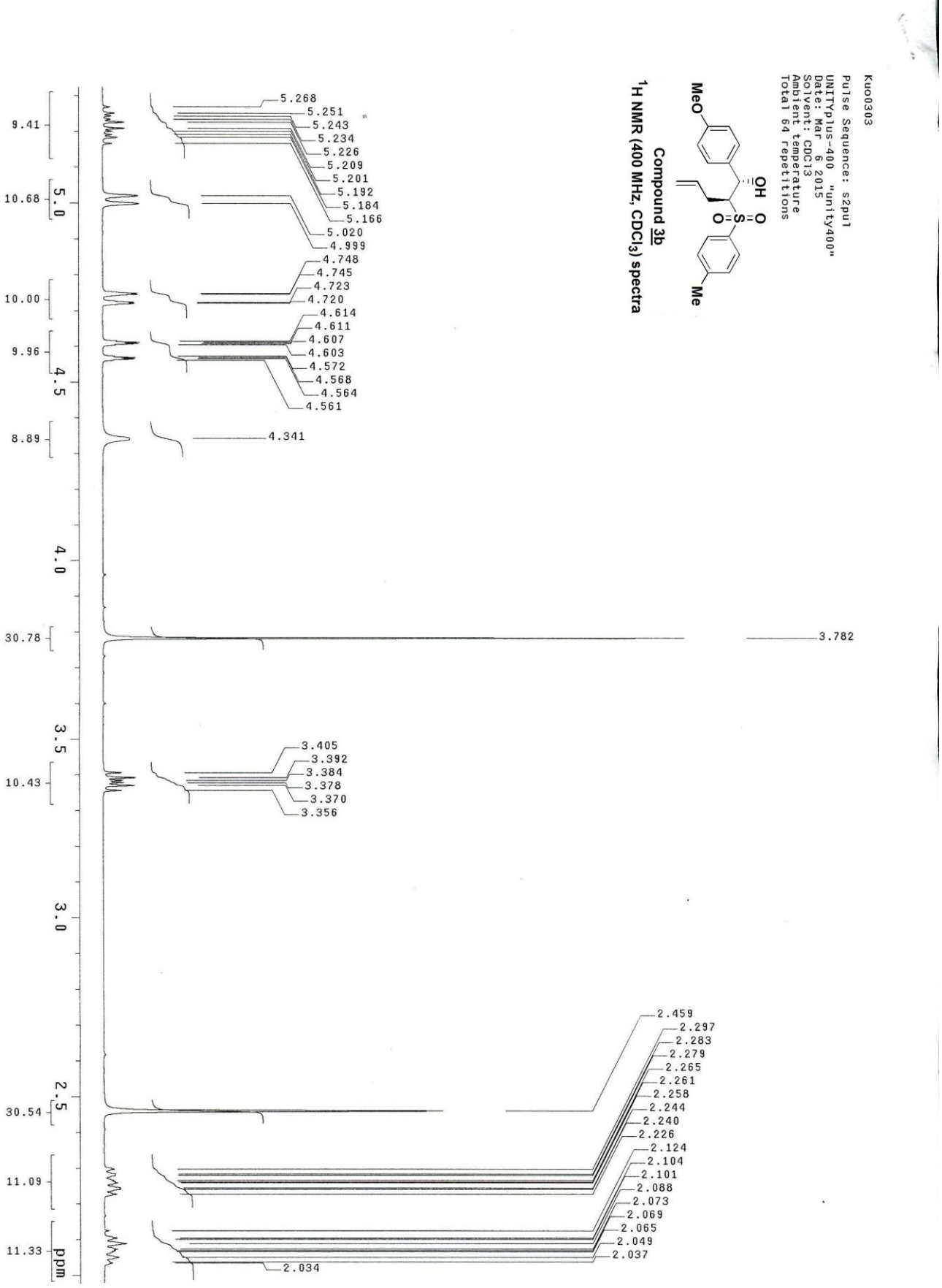


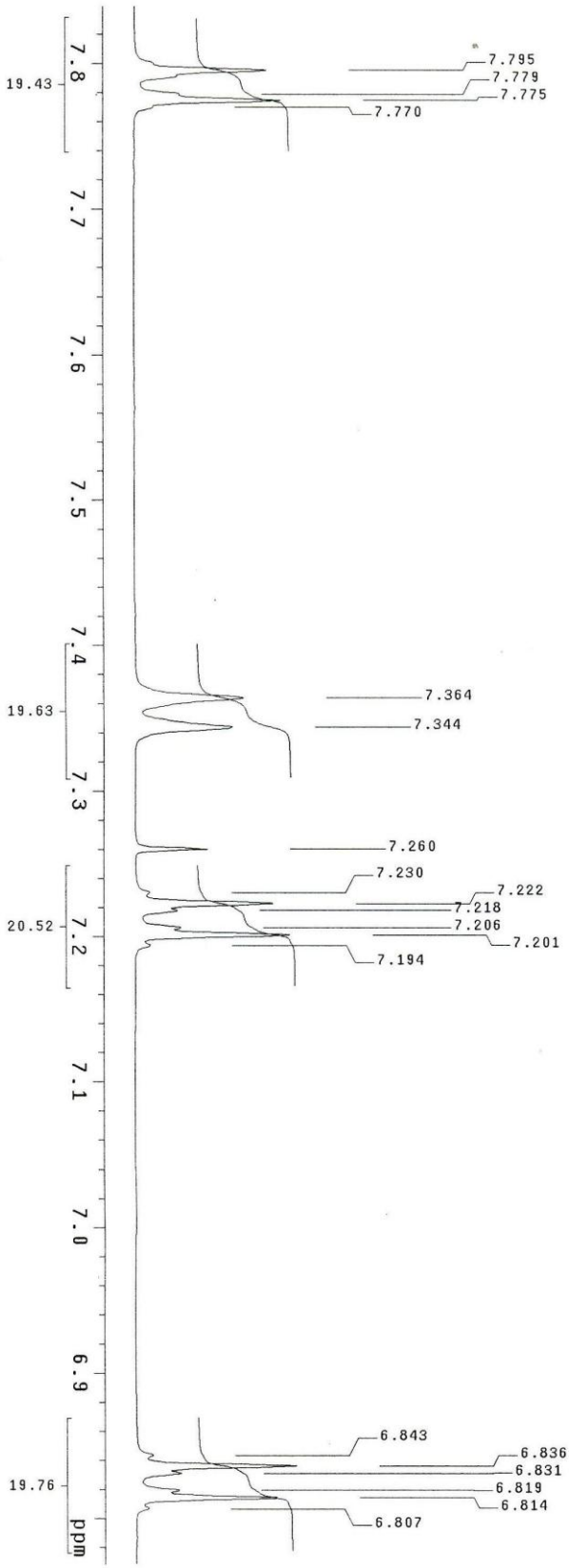
Compound 3a

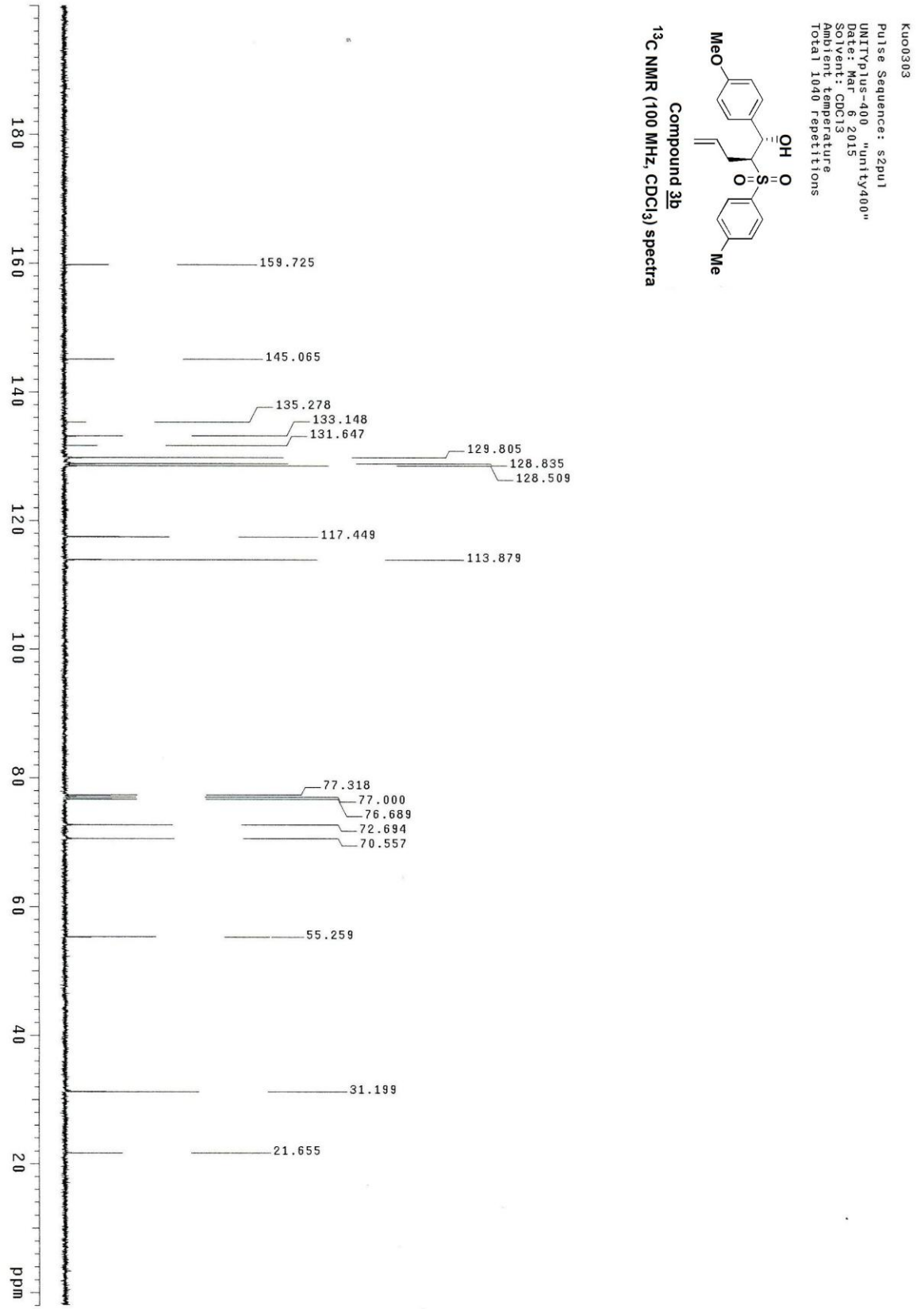
^{13}C NMR (100 MHz, $CDCl_3$) spectra

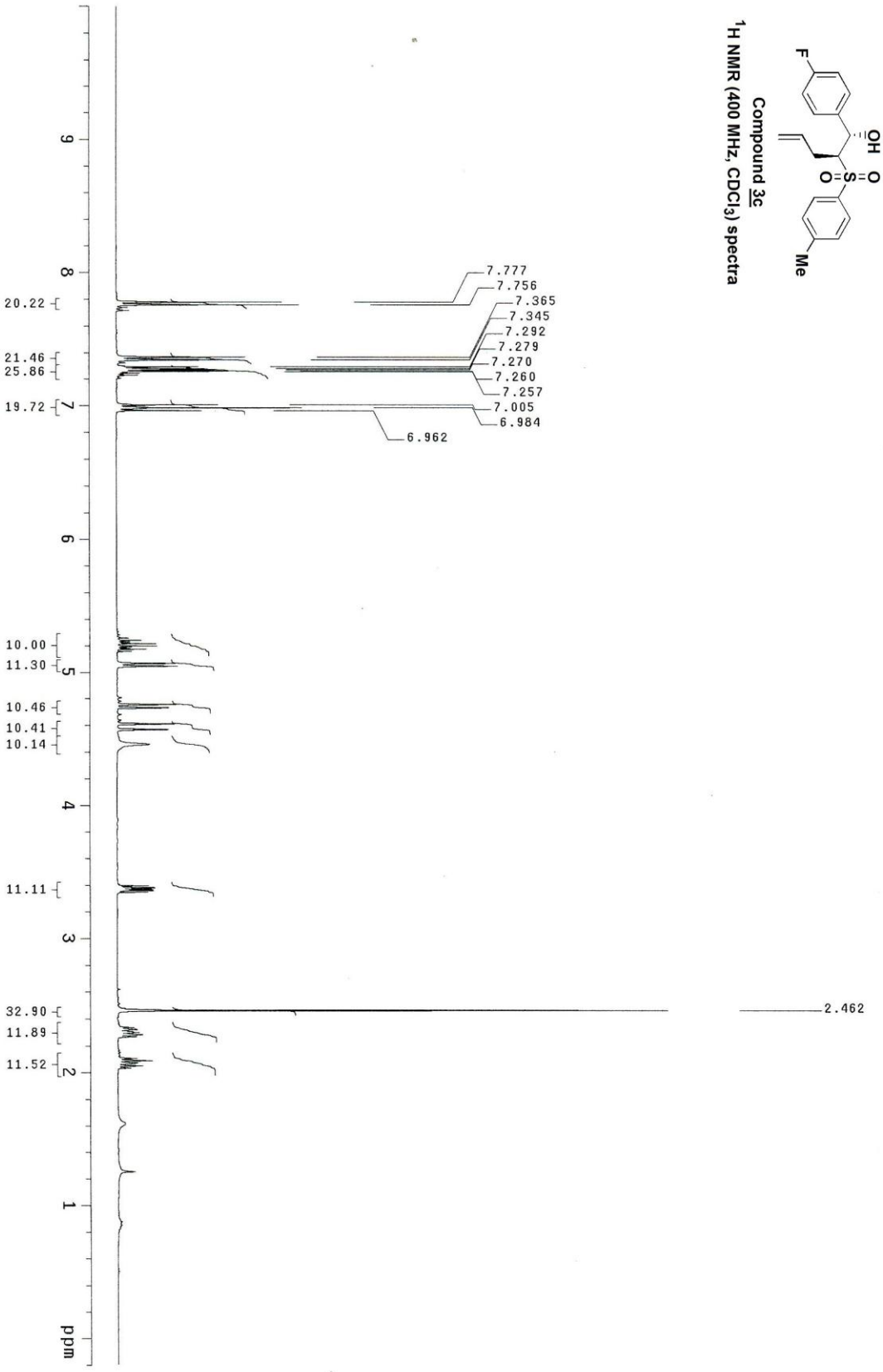


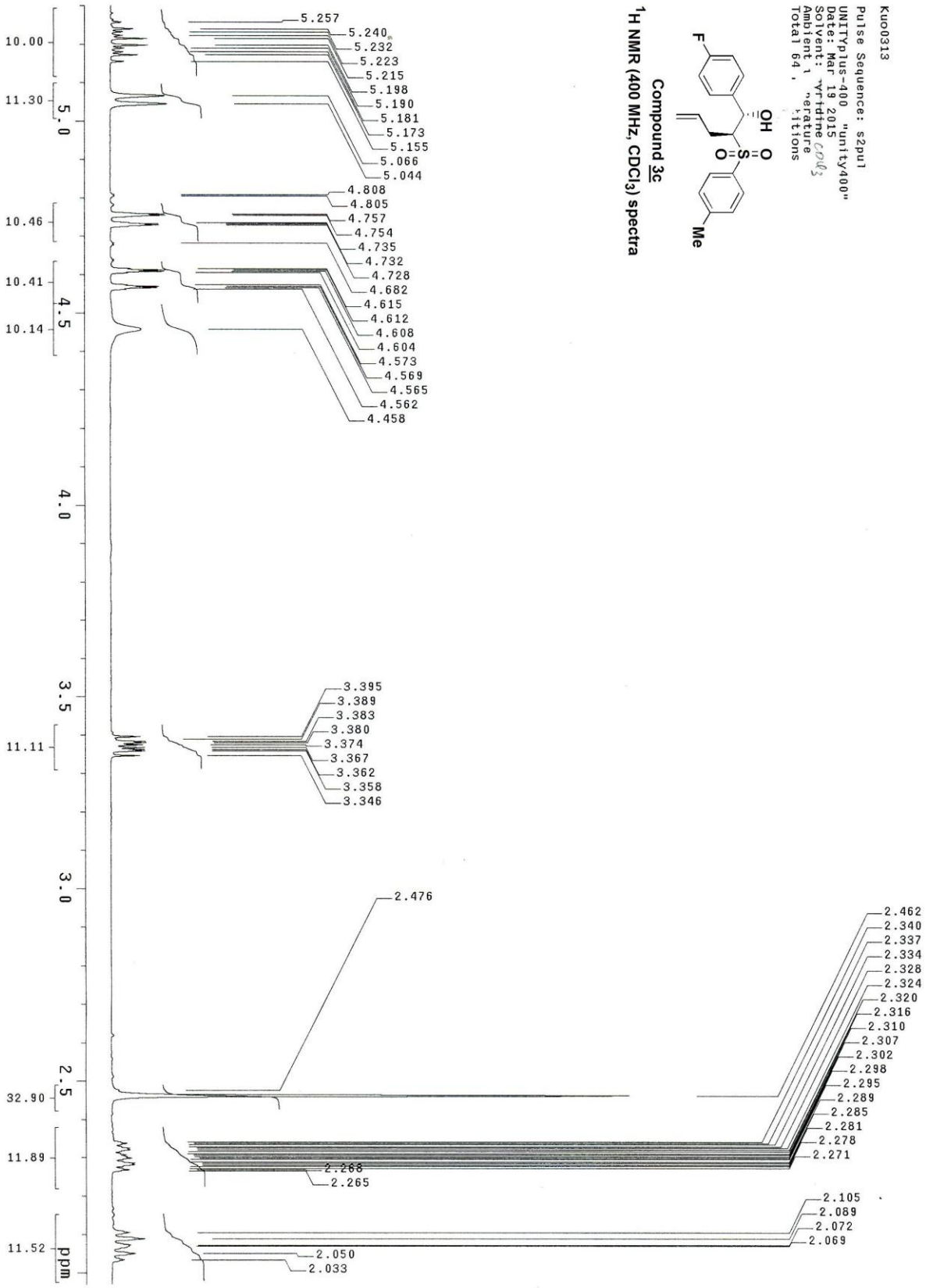

Kuo0303
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 6 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH
O
S
O
Me
Compound 3b
1H NMR (400 MHz, CDCl3) spectra
7.795
7.775
7.364
7.344
7.260
7.222
7.201
6.836
6.814
19.43
19.63
20.52
19.76
9.41
10.68
10.00
9.96
8.89
30.78
10.43
30.54
11.09
11.33
3.782
2.459
ppm

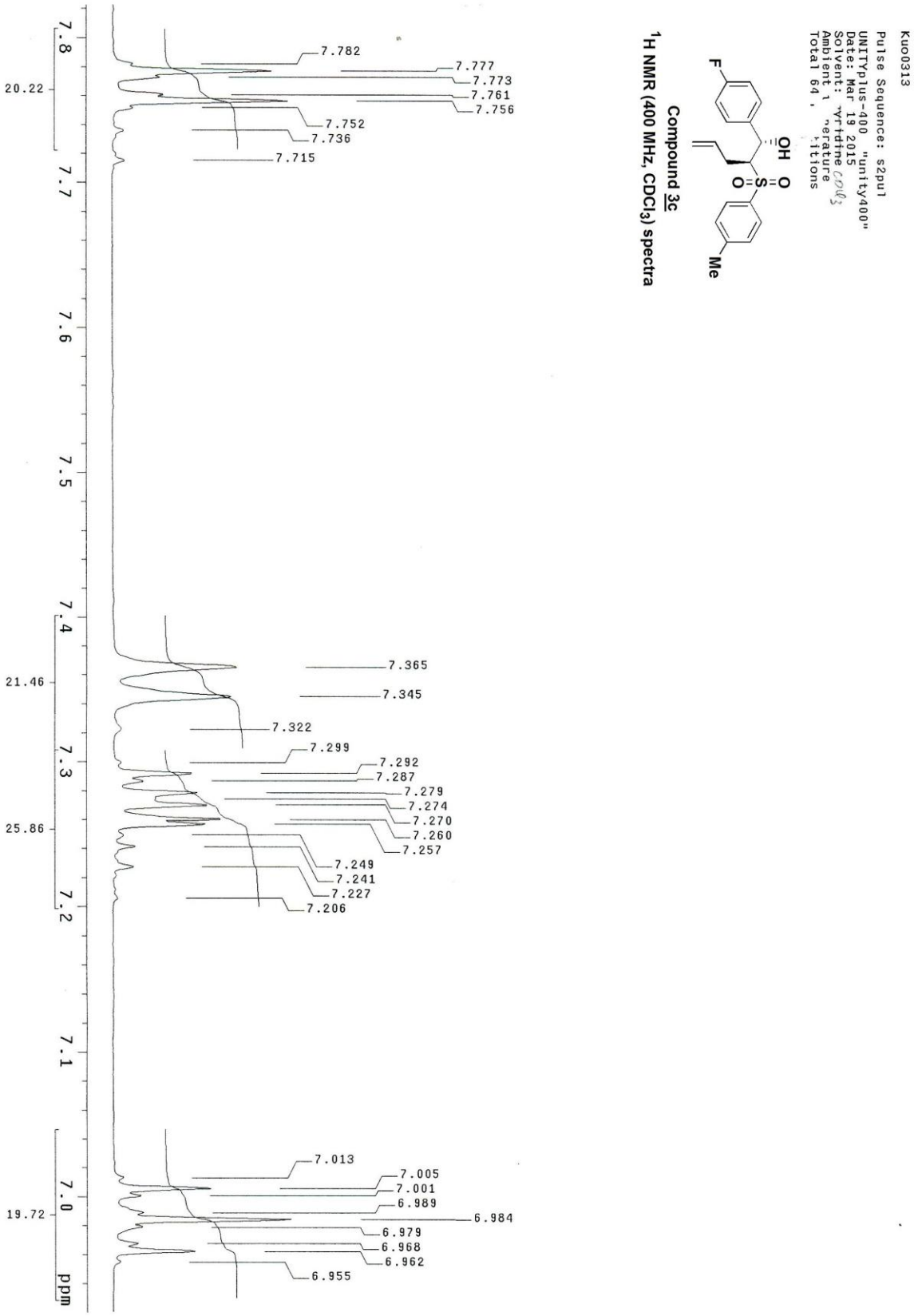

Kuo0303
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 6 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH O
S
O
Me
Compound 3b
1H NMR (400 MHz, CDCl3) spectra
5.268
5.251
5.243
5.234
5.226
5.209
5.201
5.192
5.184
5.166
5.020
4.999
4.748
4.745
4.723
4.720
4.614
4.611
4.607
4.603
4.572
4.568
4.564
4.561
4.341
3.782
3.405
3.392
3.384
3.378
3.370
3.356
2.459
2.297
2.283
2.279
2.265
2.261
2.258
2.244
2.240
2.226
2.124
2.104
2.101
2.088
2.073
2.069
2.065
2.049
2.037
2.034
9.41
10.68
10.00
9.96
8.89
30.78
10.43
30.54
11.09
11.33
5.0
4.5
4.0
3.5
3.0
2.5
ppm

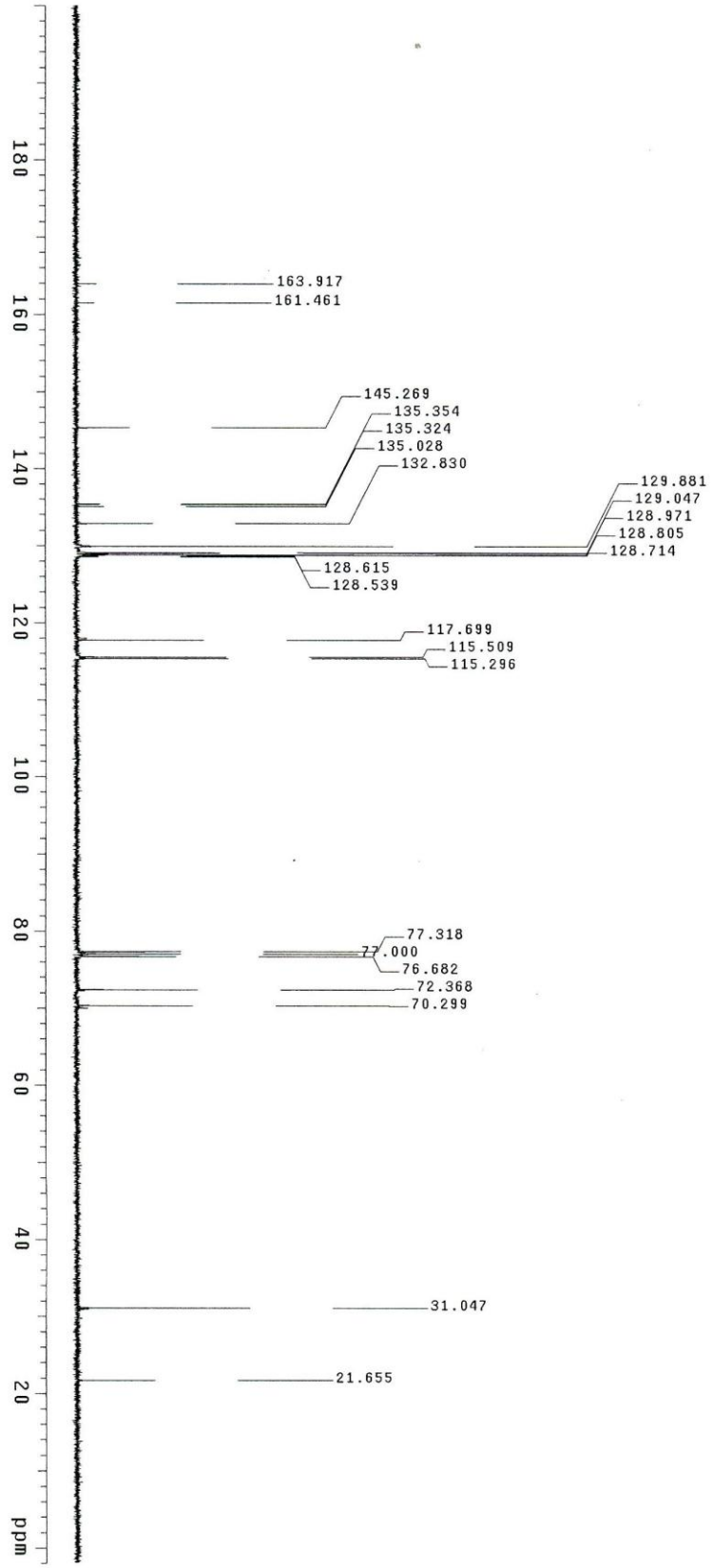

Kuo0303
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 6 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH
O
S
O
Me
Compound 3b
1H NMR (400 MHz, CDCl3) spectra
7.795
7.779
7.775
7.770
7.364
7.344
7.260
7.230
7.222
7.218
7.206
7.201
7.194
6.843
6.836
6.831
6.819
6.814
6.807
19.43
19.63
20.52
19.76
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
ppm

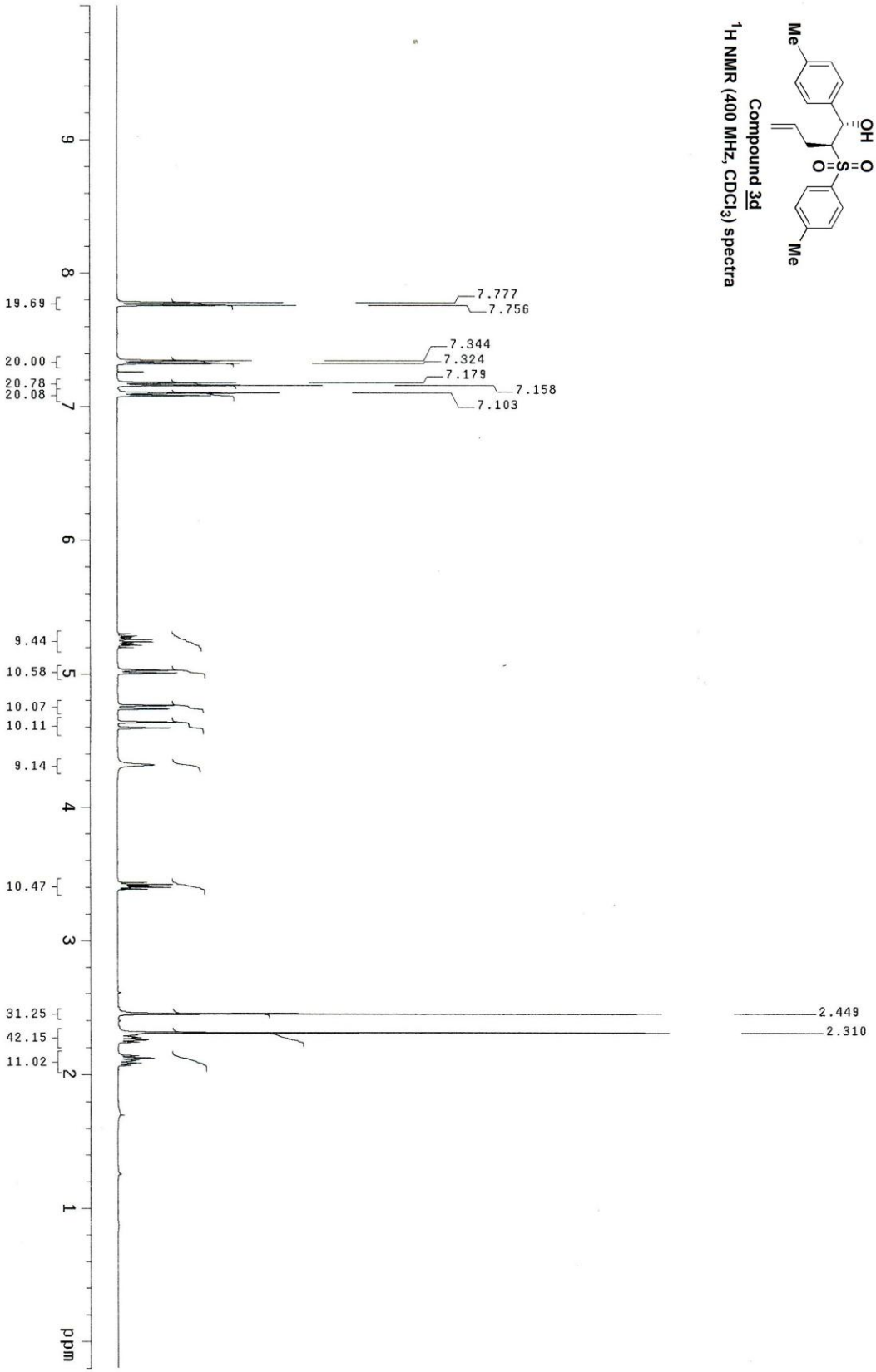

Kuo0303
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 6 2015
Solvent: CDCl3
Ambient temperature
Total 1040 repetitions
MeO
OH
O
S
O
Me
Compound 3b
13C NMR (100 MHz, CDCl3) spectra
159.725
145.065
135.278
133.148
131.647
129.805
128.835
128.509
117.449
113.879
77.318
77.000
76.689
72.694
70.557
55.259
31.199
21.655
180
160
140
120
100
80
60
40
20
ppm

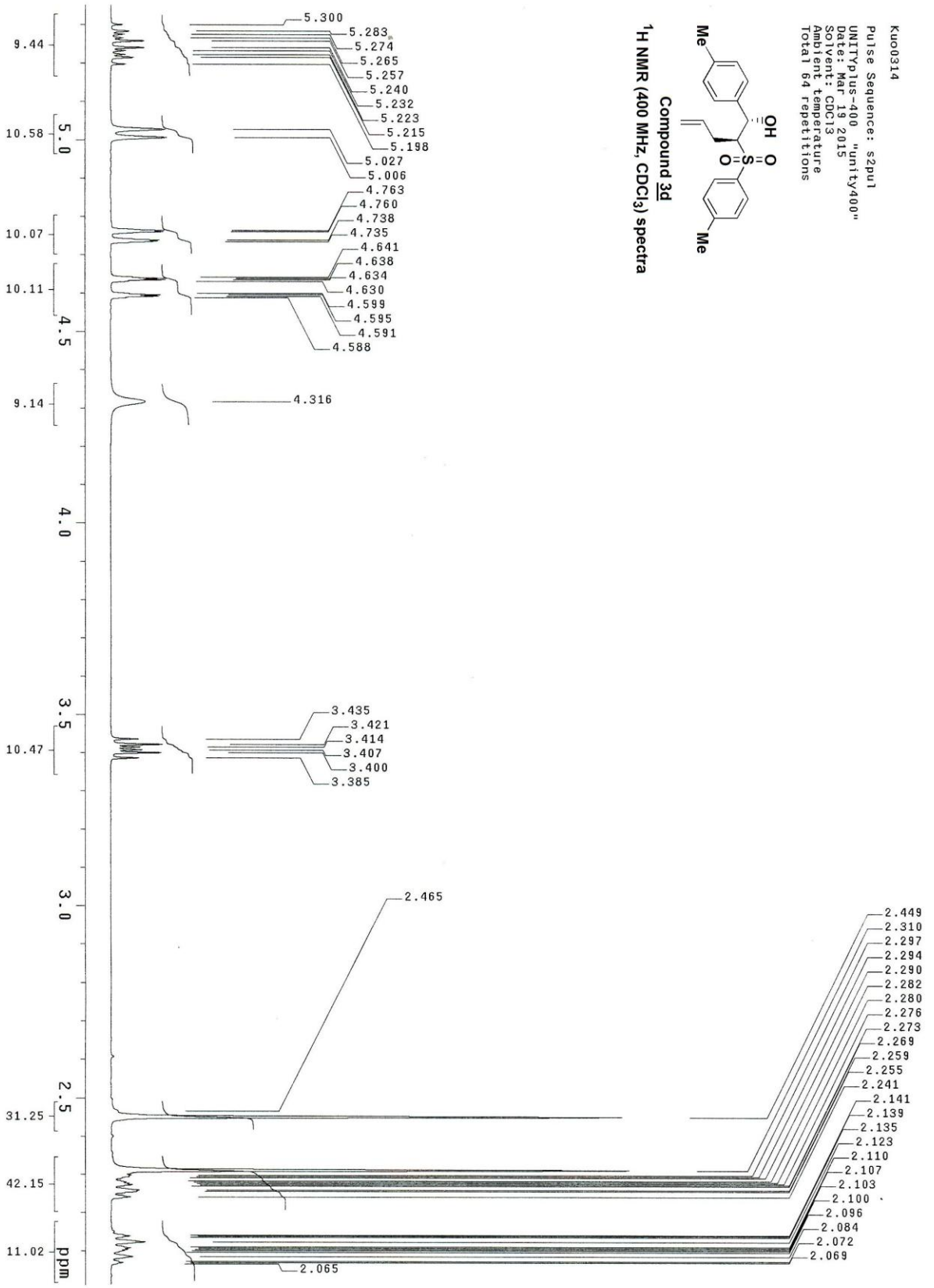

Kuo0313
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: pyridine
Ambient temperature
Total 64 scans
OH O
S
O
F
Me
Compound 3c
1H NMR (400 MHz, CDCl3) spectra
7.777
7.756
7.365
7.345
7.292
7.279
7.270
7.260
7.257
7.005
6.984
6.962
2.462
20.22
21.46
25.86
19.72
10.00
11.30
10.46
10.41
10.14
11.11
32.90
11.89
11.52
ppm


Kuo0313
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: Pyridine CDCl3
Ambient temperature
Total 64 transitions
F
OH O
S
O
Me
Compound 3c
1H NMR (400 MHz, CDCl3) spectra
5.257
5.240
5.232
5.223
5.215
5.198
5.190
5.181
5.173
5.155
5.066
5.044
4.808
4.805
4.757
4.754
4.735
4.732
4.728
4.682
4.615
4.612
4.608
4.604
4.573
4.569
4.565
4.562
4.458
3.395
3.389
3.383
3.380
3.374
3.367
3.362
3.358
3.346
2.476
2.462
2.340
2.337
2.334
2.328
2.324
2.320
2.316
2.310
2.307
2.302
2.298
2.295
2.289
2.285
2.281
2.278
2.271
2.268
2.265
2.105
2.089
2.072
2.069
2.050
2.033
10.00
11.30
10.46
10.41
10.14
11.11
32.90
11.89
11.52
5.0
4.5
4.0
3.5
3.0
2.5
ppm


Kuo0313
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: pyridine
Ambient temperature
Total 64 transitions
F
OH O
S
O
Me
Compound 3c
1H NMR (400 MHz, CDCl3) spectra
7.782
7.777
7.773
7.761
7.756
7.752
7.736
7.715
7.365
7.345
7.322
7.299
7.292
7.287
7.279
7.274
7.270
7.260
7.257
7.249
7.241
7.227
7.206
7.013
7.005
7.001
6.989
6.984
6.979
6.968
6.962
6.955
20.22
21.46
25.86
19.72
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
ppm


Kuo0313
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: CDCl3
Ambient temperature
Total 816 repetitions
F
OH
O
S
O
Me
Compound 3c
13C NMR (100 MHz, CDCl3) spectra
163.917
161.461
145.269
135.354
135.324
135.028
132.830
129.881
129.047
128.971
128.805
128.714
128.615
128.539
117.699
115.509
115.296
77.318
77.000
76.682
72.368
70.299
31.047
21.655
180
160
140
120
100
80
60
40
20
ppm

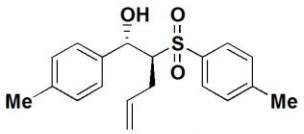

Kuo0314
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH O
S
O
Me
Compound 3d
1H NMR (400 MHz, CDCl3) spectra
7.777
7.756
7.344
7.324
7.179
7.158
7.103
2.449
2.310
19.69
20.00
20.78
20.08
9.44
10.58
10.07
10.11
9.14
10.47
31.25
42.15
11.02
ppm


Kuo0314
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH
O
S
O
Me
Compound 3d
1H NMR (400 MHz, CDCl3) spectra
5.300
5.283
5.274
5.265
5.257
5.240
5.232
5.223
5.215
5.198
5.027
5.006
4.763
4.760
4.738
4.735
4.641
4.638
4.634
4.630
4.599
4.595
4.591
4.588
4.316
3.435
3.421
3.414
3.407
3.400
3.385
2.465
2.449
2.310
2.297
2.294
2.290
2.282
2.280
2.276
2.273
2.269
2.259
2.255
2.241
2.141
2.139
2.135
2.123
2.110
2.107
2.103
2.100
2.096
2.084
2.072
2.069
2.065
9.44
10.58
10.07
10.11
9.14
10.47
31.25
42.15
11.02
5.0
4.5
4.0
3.5
3.0
2.5
ppm

Kuo0314

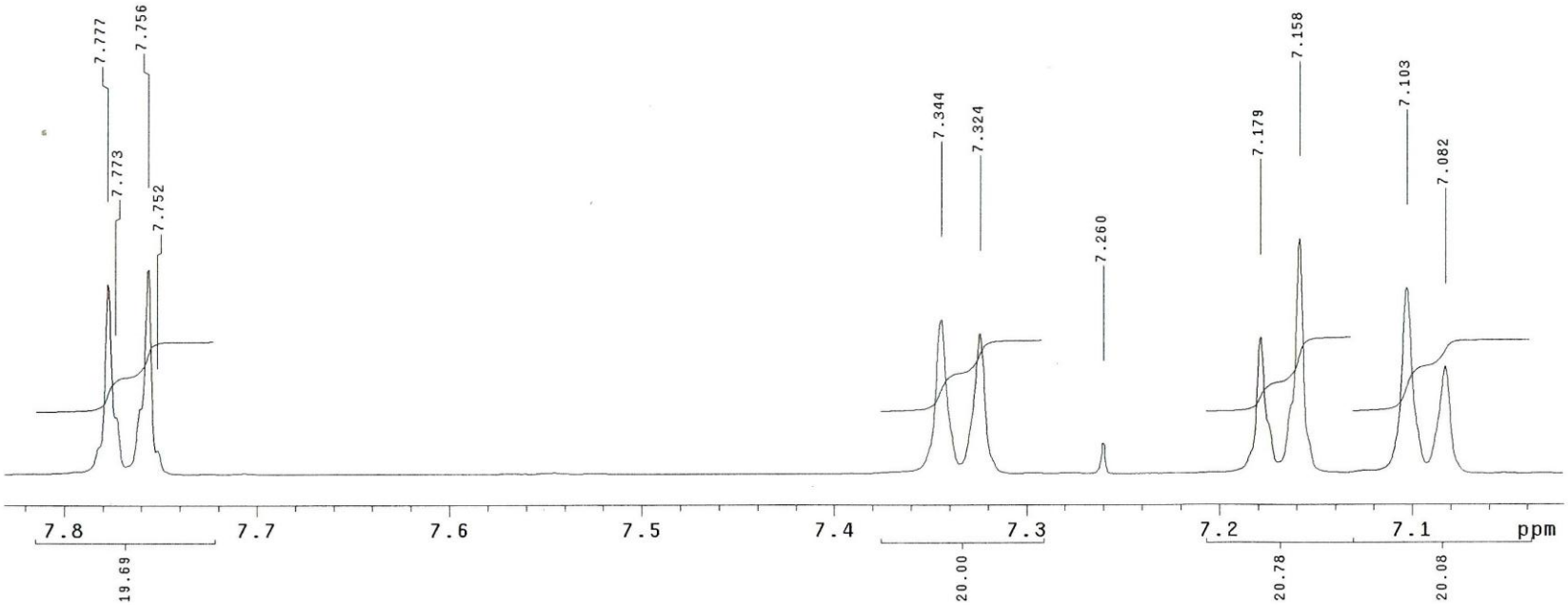
Pulse Sequence: s2pul

UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions



Compound 3d

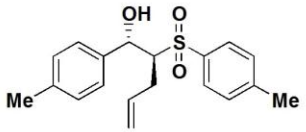
^{1}H NMR (400 MHz, $CDCl_3$) spectra



Kuo0314

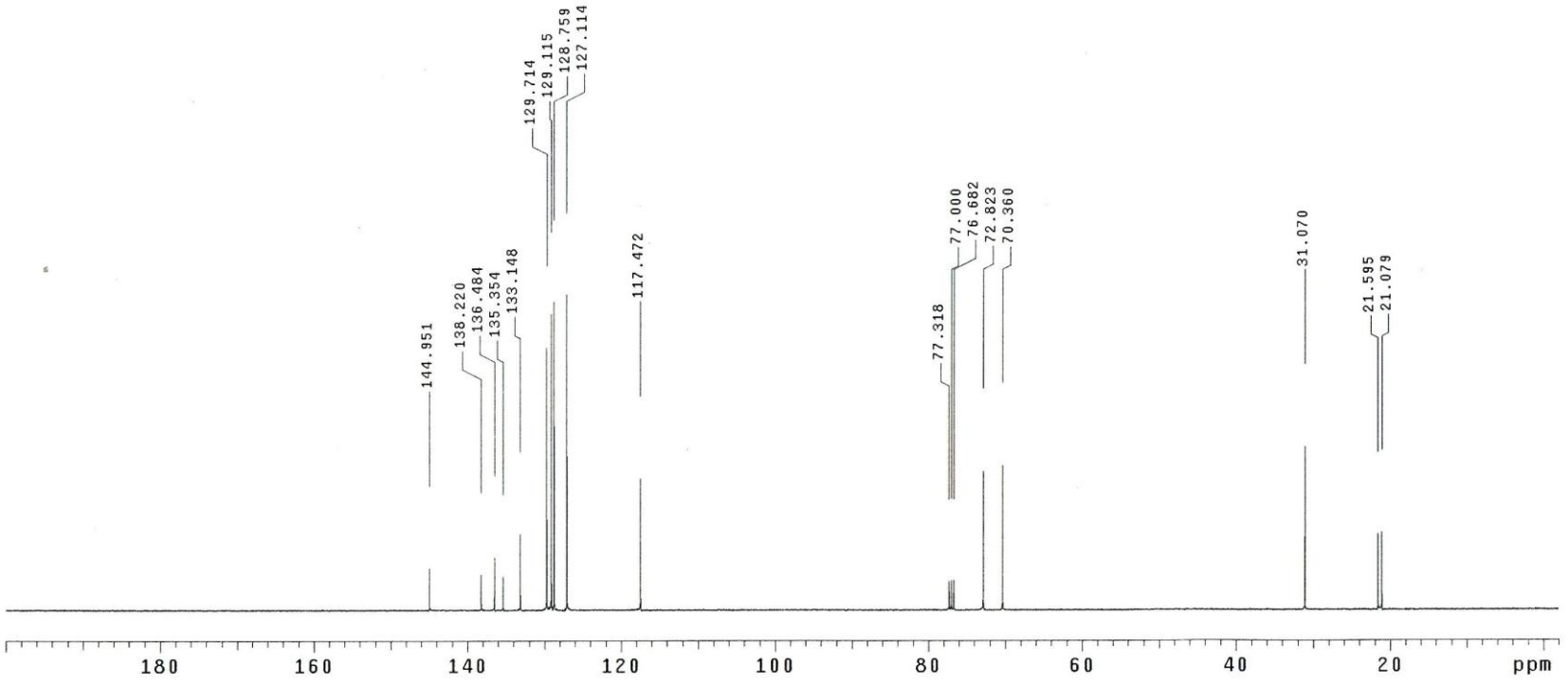
Pulse Sequence: s2pul

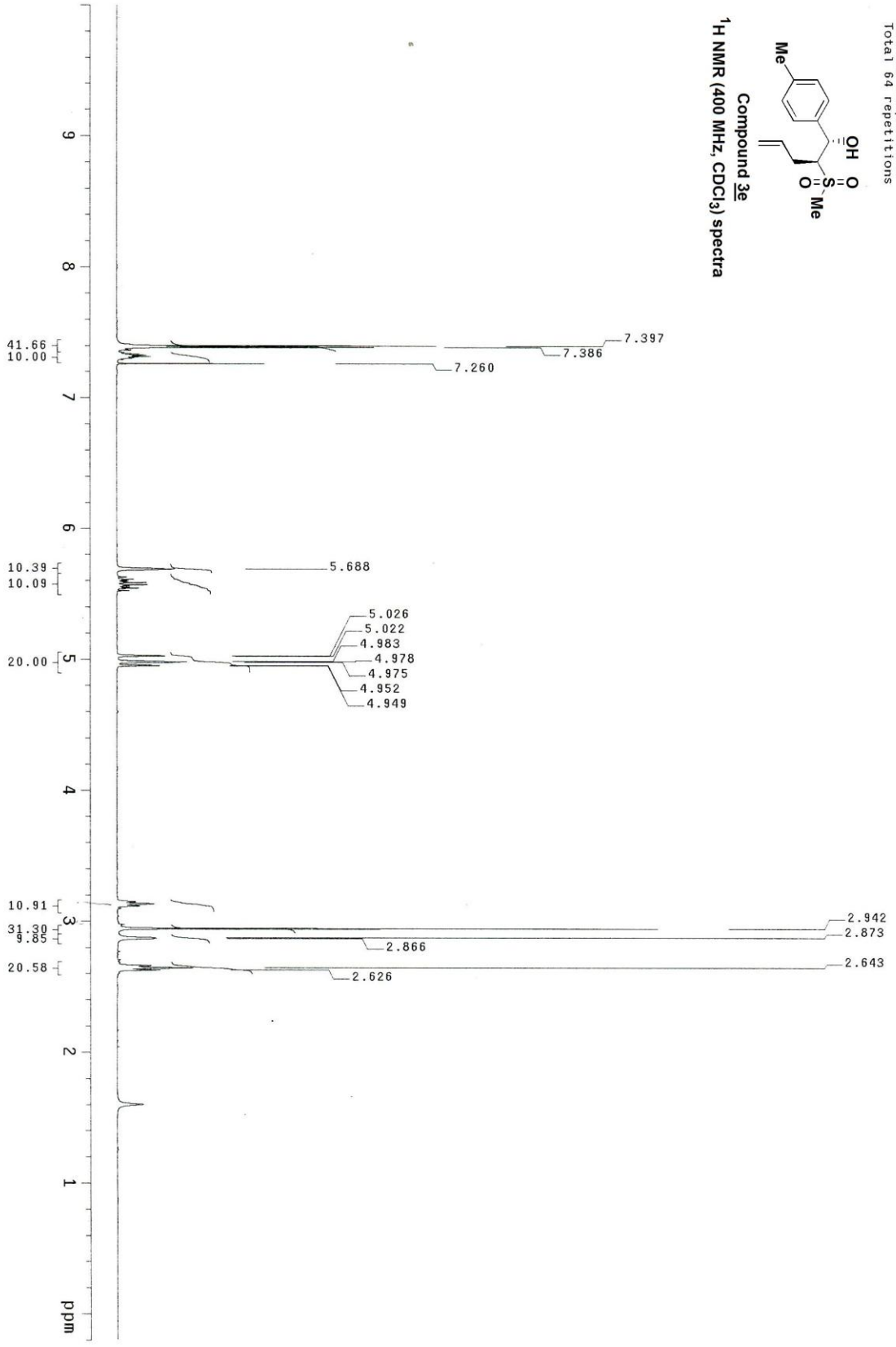
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: CDCl3
Ambient temperature
Total 2256 repetitions

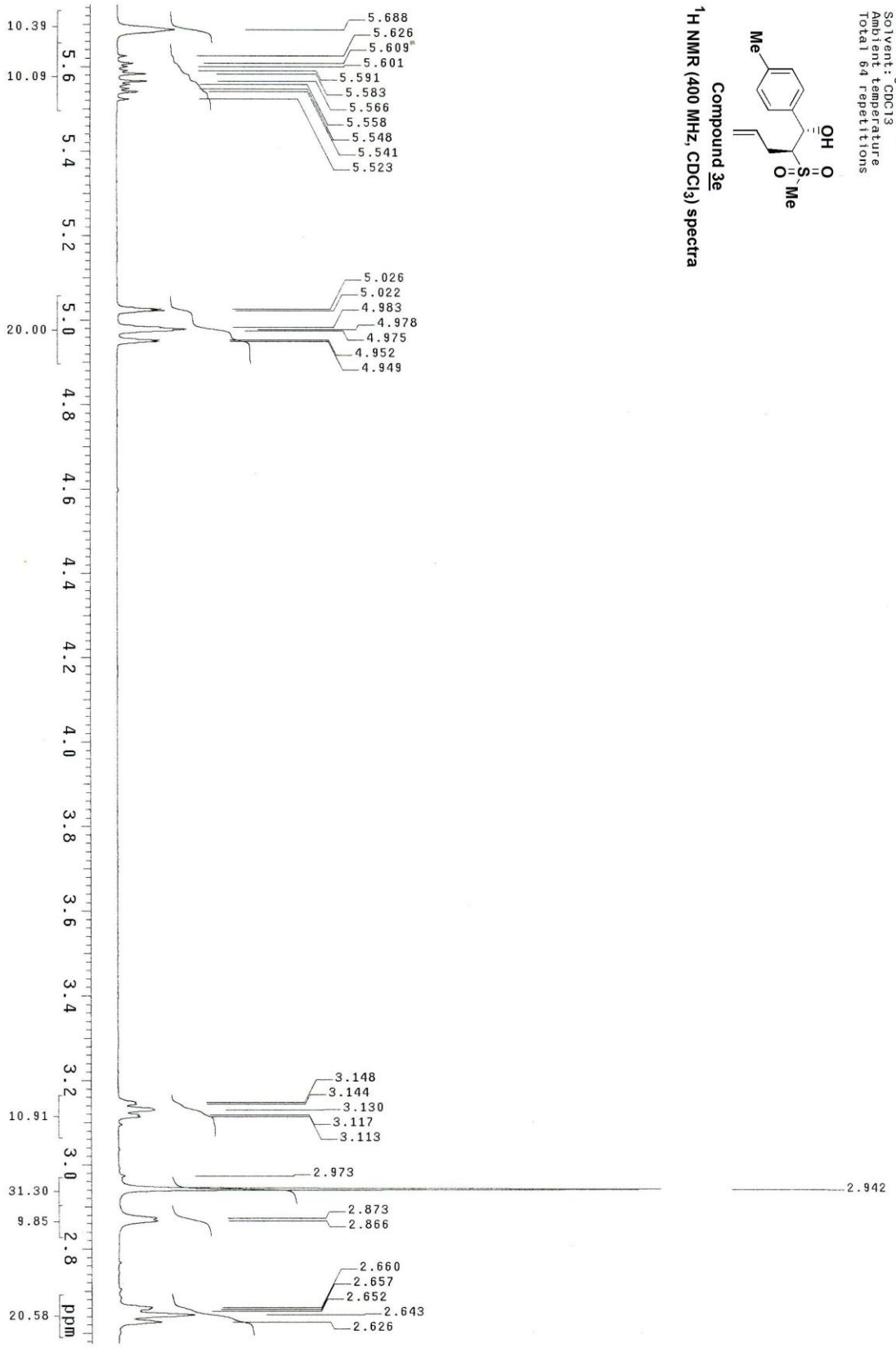


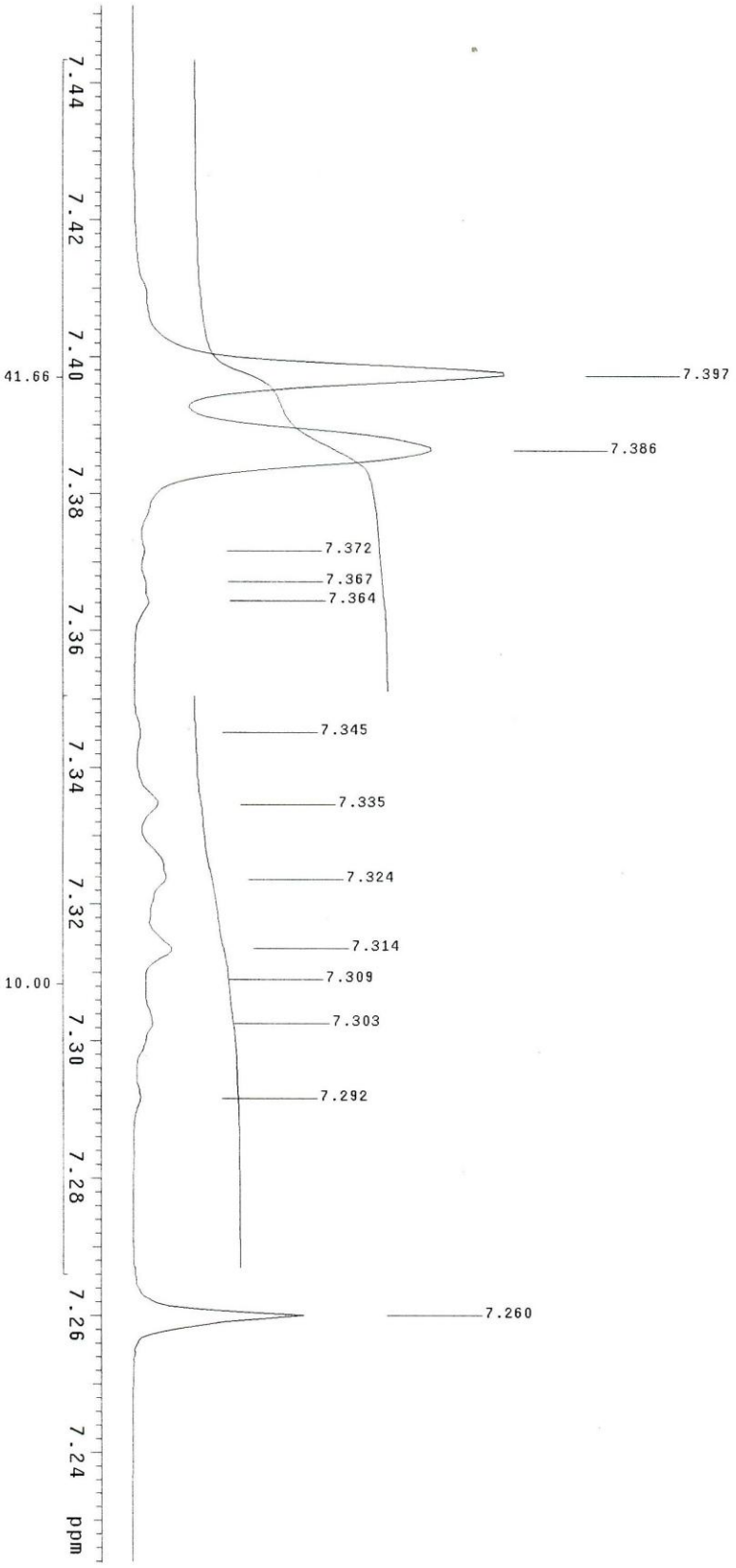
Compound 3d

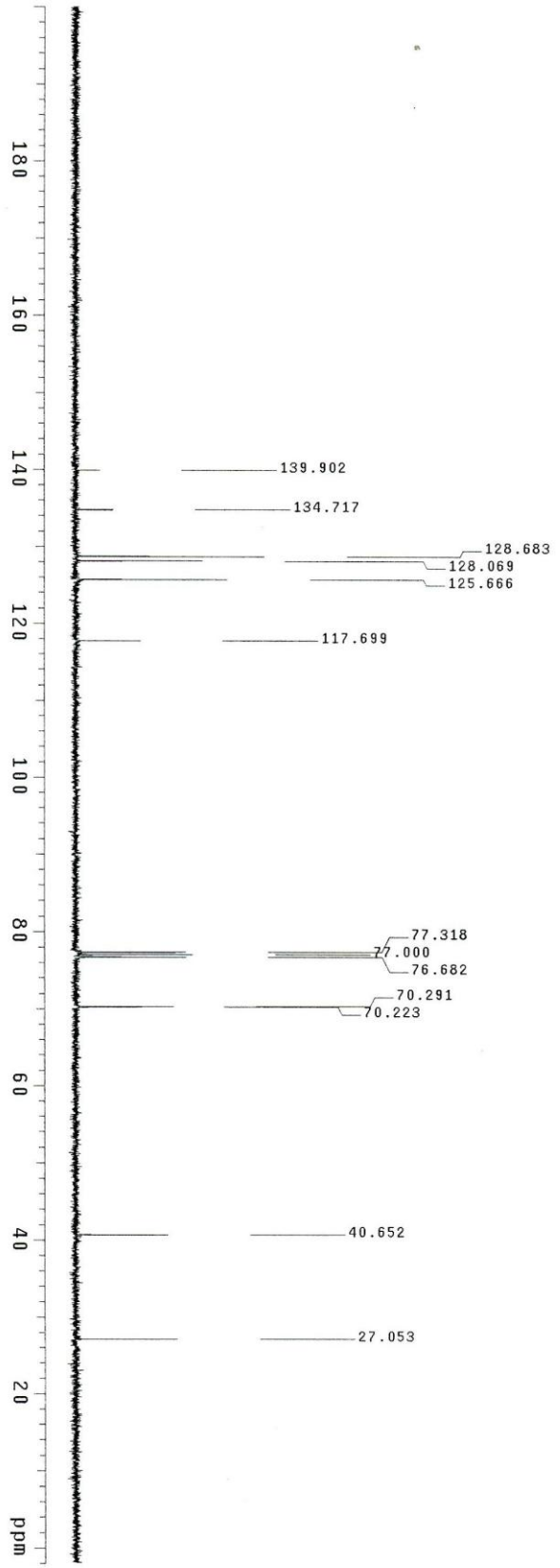
^{13}C NMR (100 MHz, $CDCl_3$) spectra

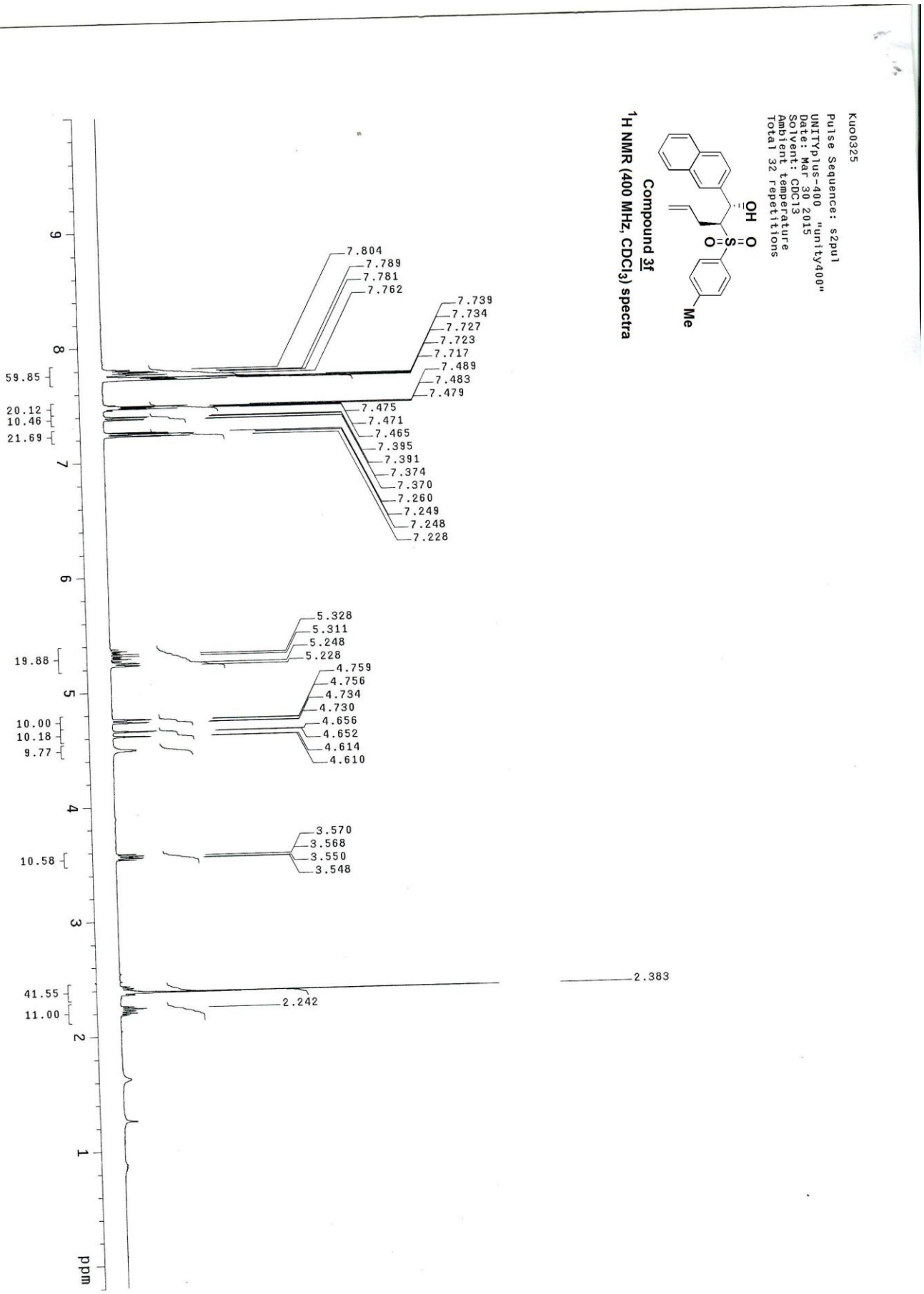


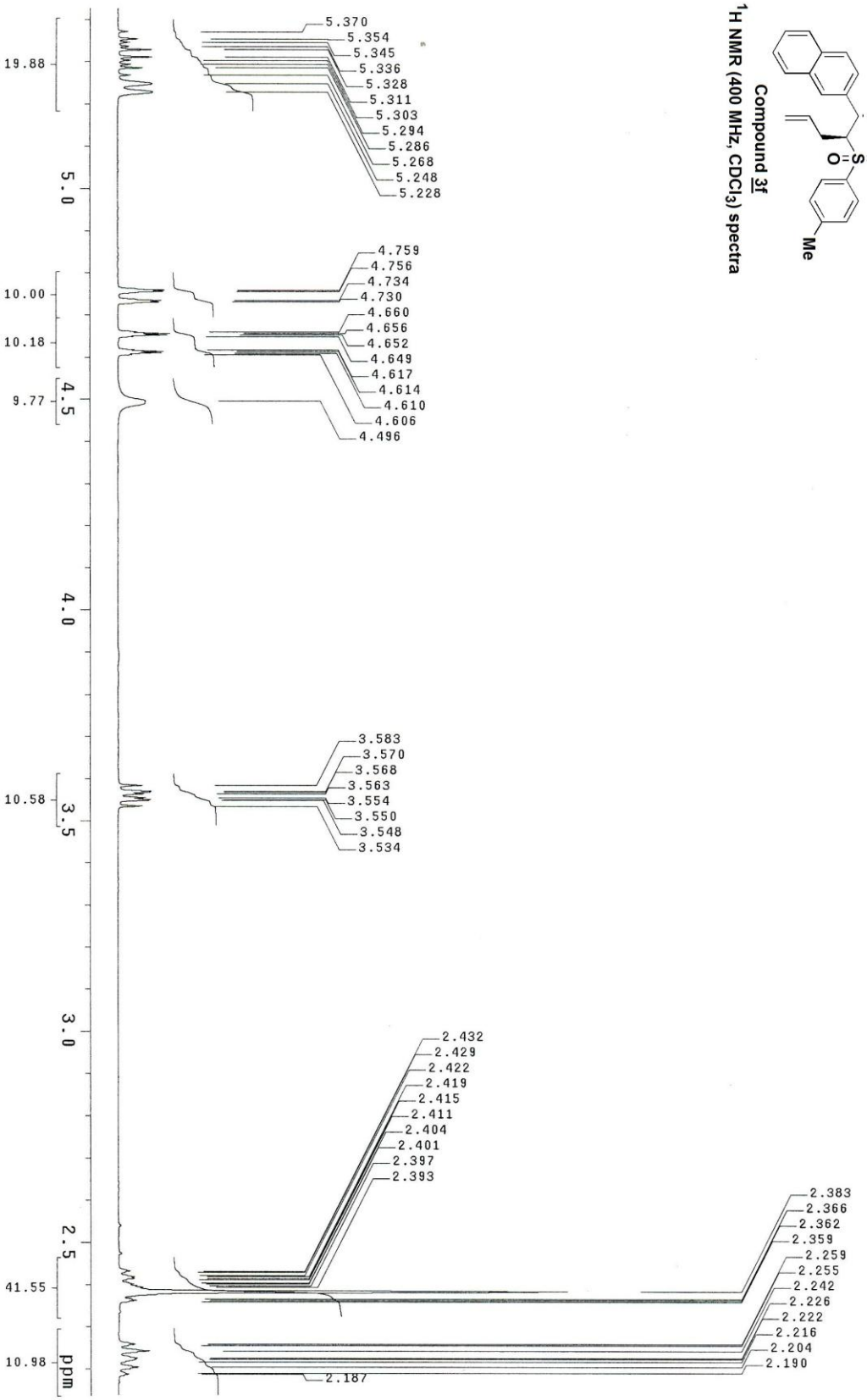

Kuo0801
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH
O
S
O
Me
Compound 3e
1H NMR (400 MHz, CDCl3) spectra
41.66
10.00
7.397
7.386
7.260
10.39
10.09
5.688
20.00
5.026
5.022
4.983
4.978
4.975
4.952
4.949
10.91
31.30
9.85
20.58
2.942
2.873
2.866
2.643
2.626
ppm

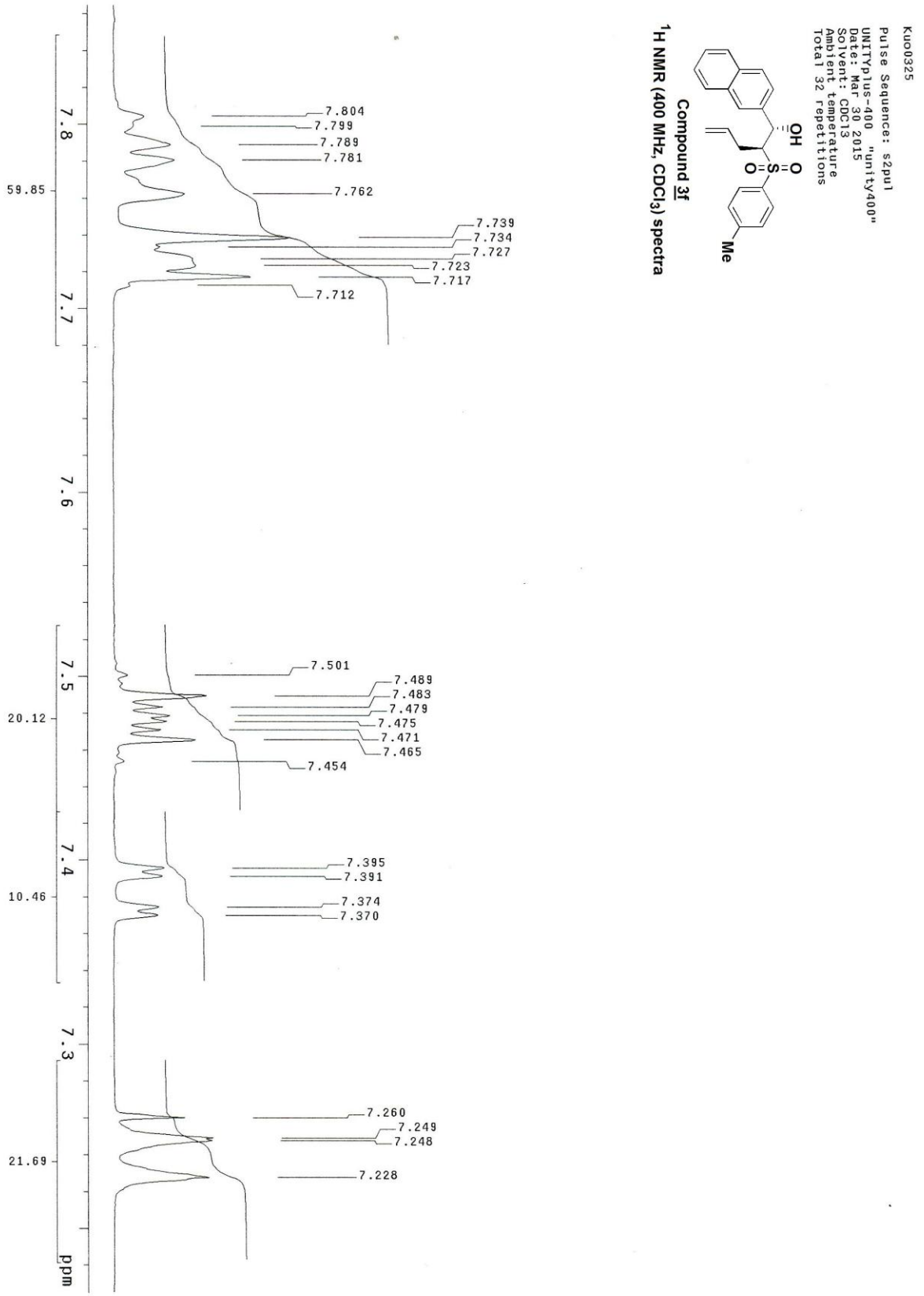

Kuo0801
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH O
S
O Me
Compound 3e
1H NMR (400 MHz, CDCl3) spectra
10.39
10.09
20.00
10.91
31.30
9.85
20.58
5.688
5.626
5.609
5.601
5.591
5.583
5.566
5.558
5.548
5.541
5.523
5.026
5.022
4.983
4.978
4.975
4.952
4.949
3.148
3.144
3.130
3.117
3.113
2.973
2.942
2.873
2.866
2.660
2.657
2.652
2.643
2.626
ppm

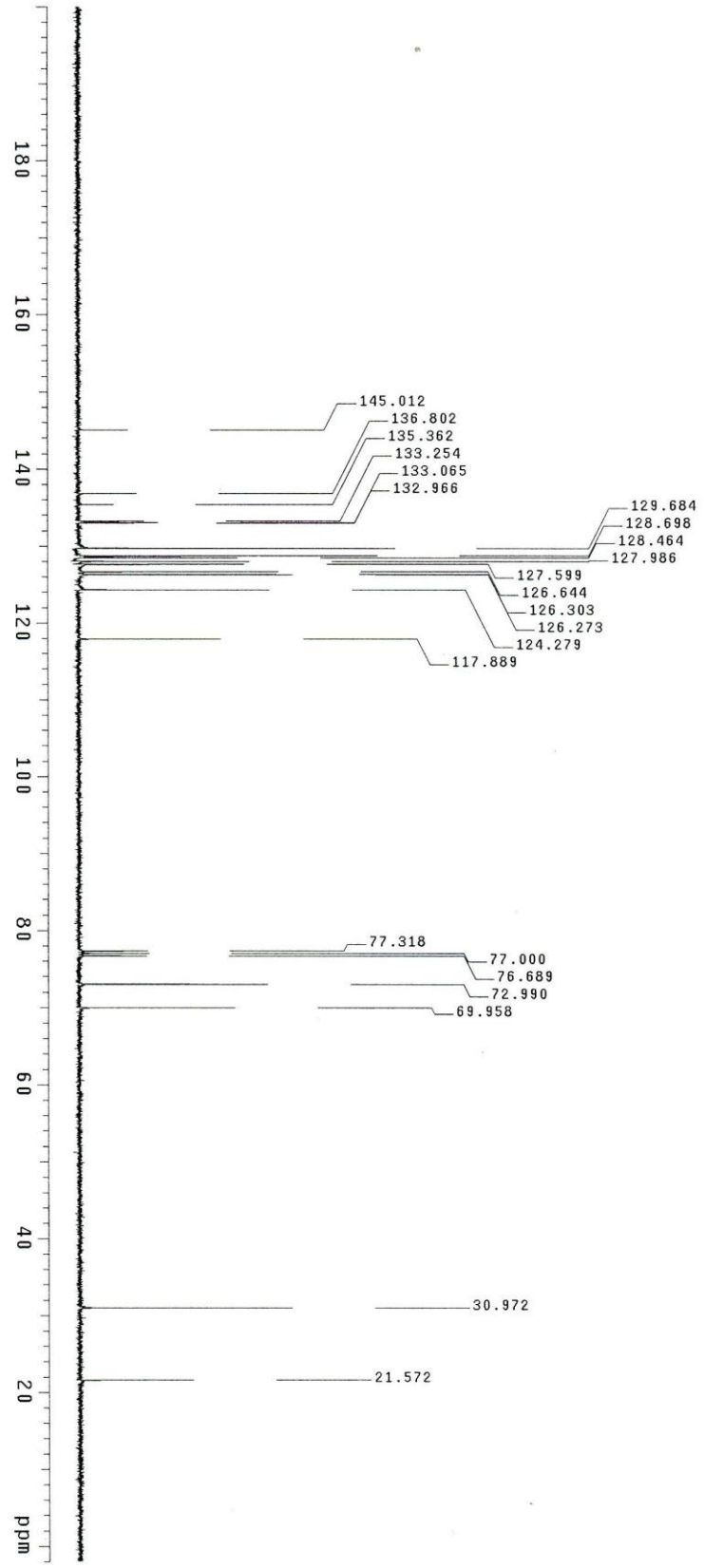

Kuo0801
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH O
S
O Me
Compound 3e
1H NMR (400 MHz, CDCl3) spectra
41.66
10.00
7.397
7.386
7.372
7.367
7.364
7.345
7.335
7.324
7.314
7.309
7.303
7.292
7.260
7.44
7.42
7.40
7.38
7.36
7.34
7.32
7.30
7.28
7.26
7.24
ppm

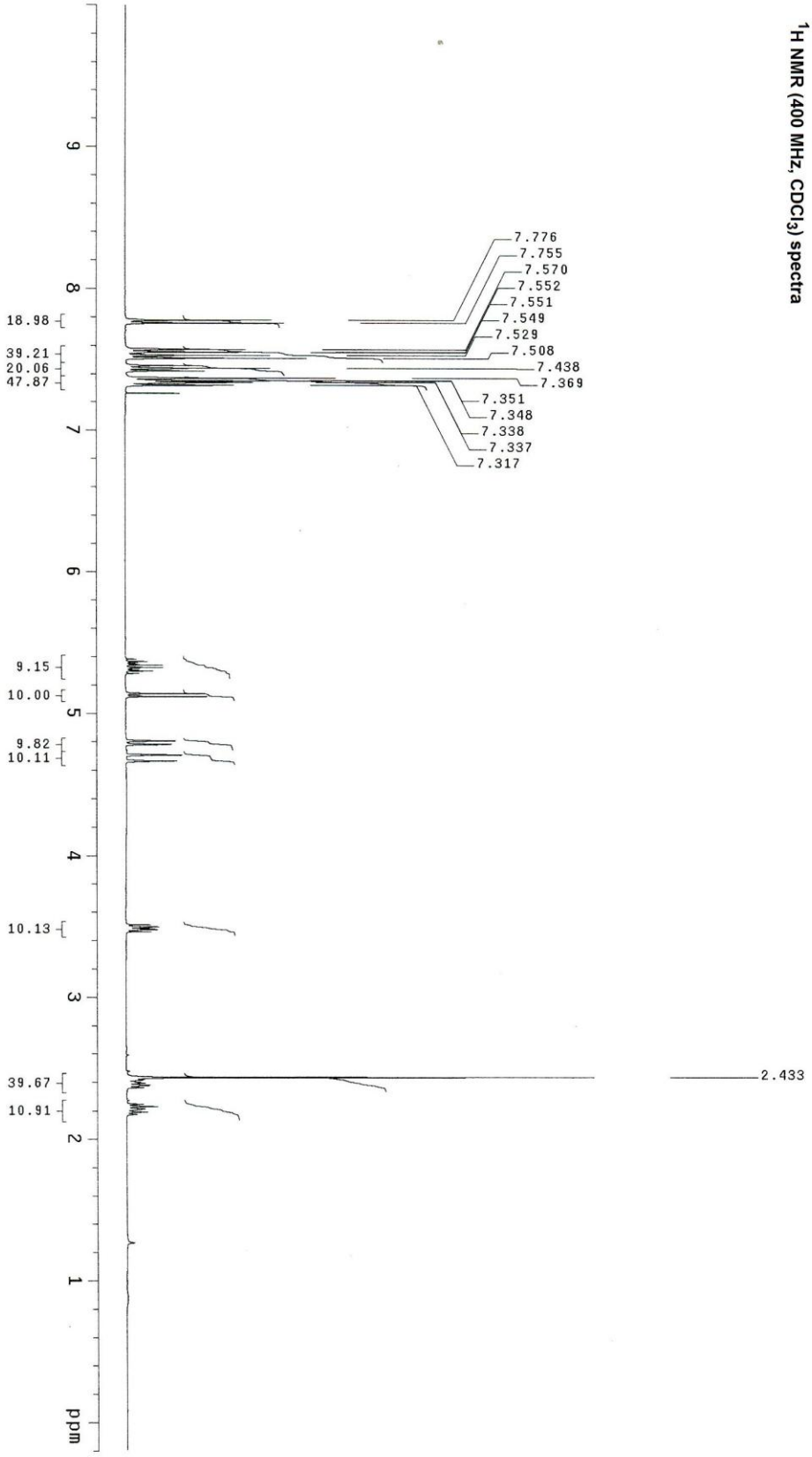

Kuo0801
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 13 2015
Solvent: CDCl3
Ambient temperature
Total 1456 repetitions
Me
OH O
S
O Me
Compound 3e
13C NMR (100 MHz, CDCl3) spectra
180
160
140
120
100
80
60
40
20
ppm
139.902
134.717
128.683
128.069
125.666
117.699
77.318
77.000
76.682
70.291
70.223
40.652
27.053

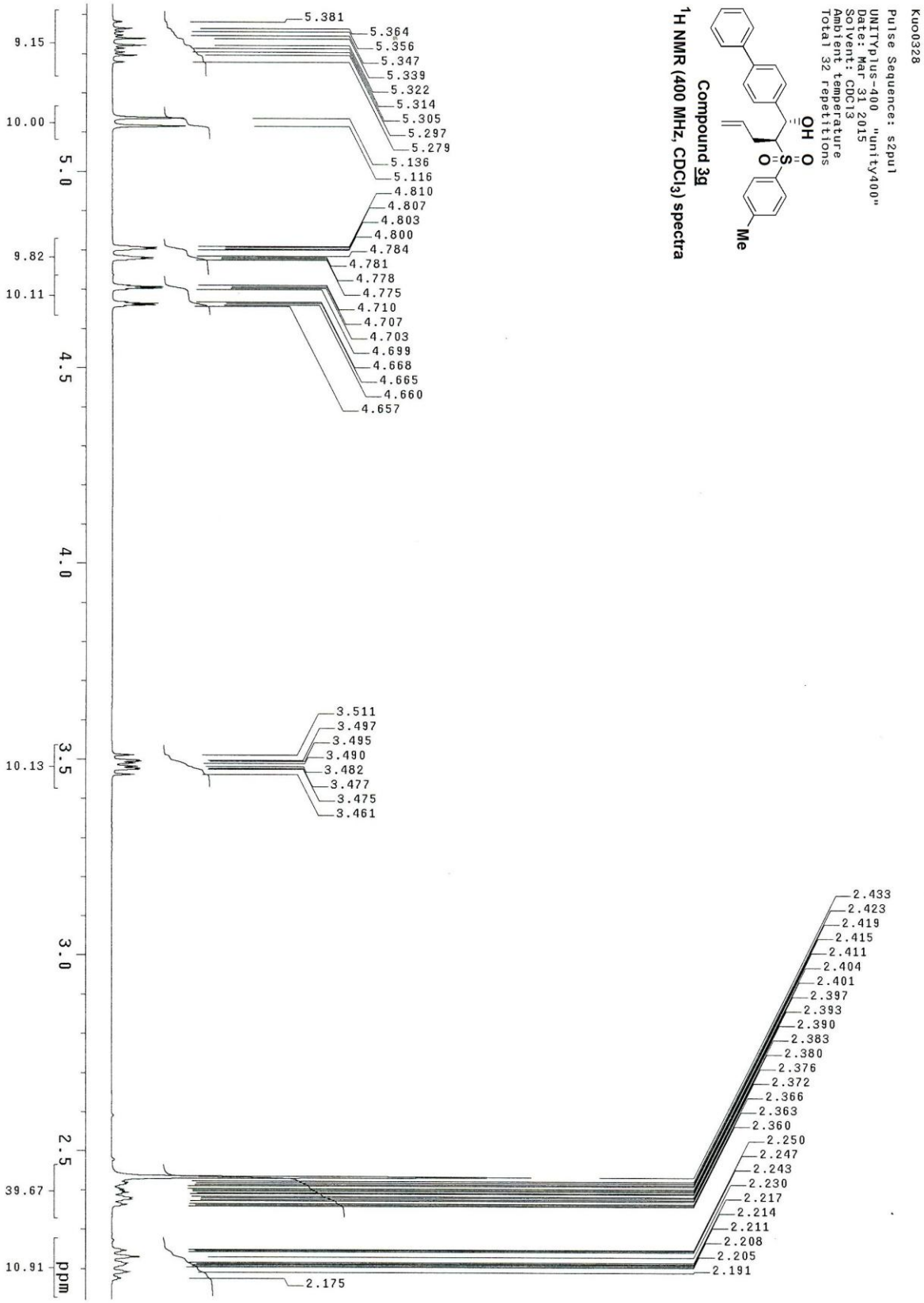

Kuo0325
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 30 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
OH O
S
O
Me
Compound 3f
1H NMR (400 MHz, CDCl3) spectra
7.804
7.789
7.781
7.762
7.739
7.734
7.727
7.723
7.717
7.489
7.483
7.479
7.475
7.471
7.465
7.395
7.391
7.374
7.370
7.260
7.249
7.248
7.228
5.328
5.311
5.248
5.228
4.759
4.756
4.734
4.730
4.656
4.652
4.614
4.610
3.570
3.568
3.550
3.548
2.383
2.242
59.85
20.12
10.46
21.69
19.88
10.00
10.18
9.77
10.58
41.55
11.00
ppm

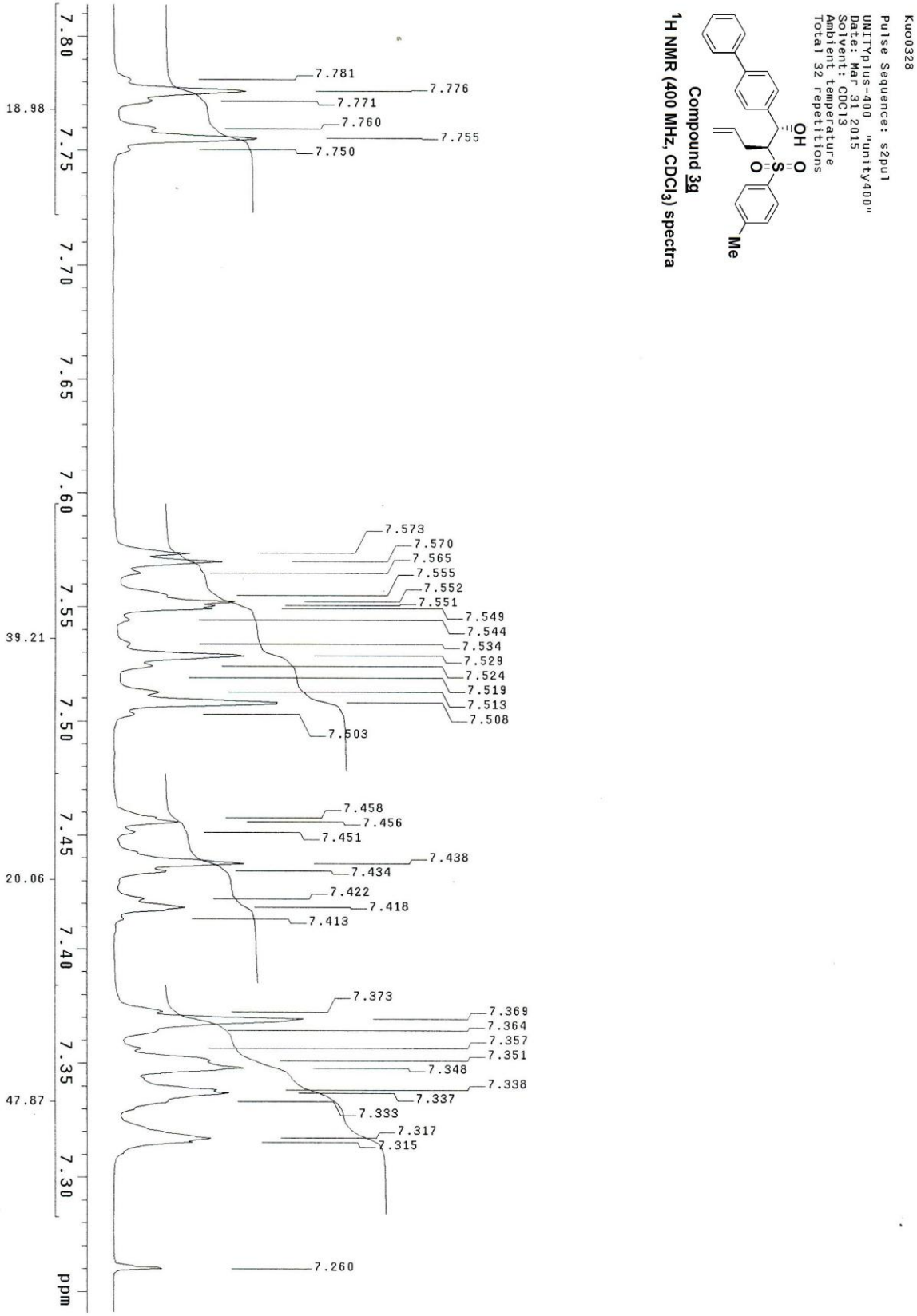

Kuo0325
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 30 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
OH
O
S
O
Me
Compound 3f
1H NMR (400 MHz, CDCl3) spectra
5.370
5.354
5.345
5.336
5.328
5.311
5.303
5.294
5.286
5.268
5.248
5.228
4.759
4.756
4.734
4.730
4.660
4.656
4.652
4.649
4.617
4.614
4.610
4.606
4.496
3.583
3.570
3.568
3.563
3.554
3.550
3.548
3.534
2.432
2.429
2.422
2.419
2.415
2.411
2.404
2.401
2.397
2.393
2.383
2.366
2.362
2.359
2.259
2.255
2.242
2.226
2.222
2.216
2.204
2.190
2.187
19.88
10.00
10.18
9.77
10.58
41.55
10.98
5.0
4.5
4.0
3.5
3.0
2.5
ppm

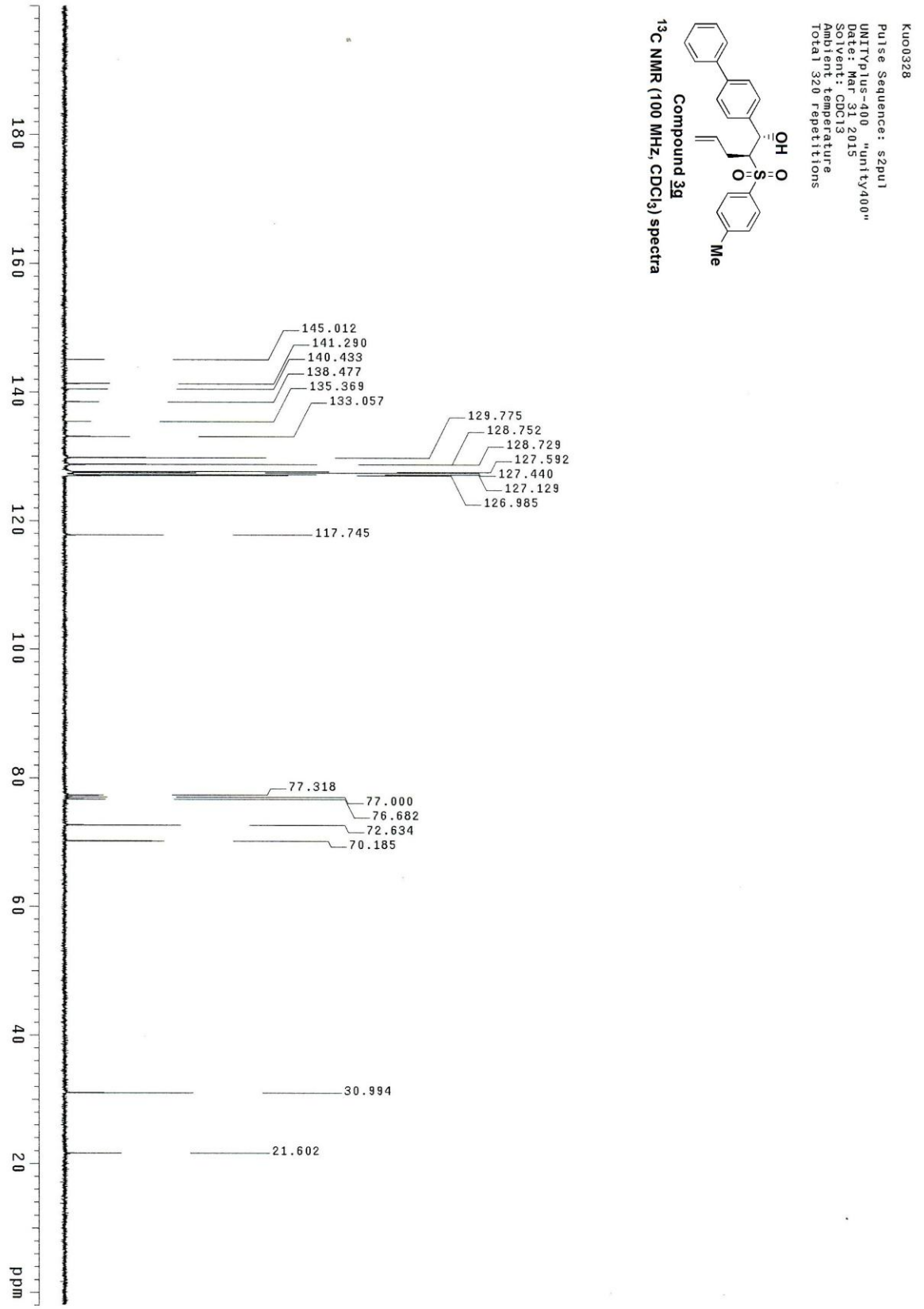

Kuo0325
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 30 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
OH
O
S
O
Me
Compound 3f
1H NMR (400 MHz, CDCl3) spectra
7.804
7.799
7.789
7.781
7.762
7.739
7.734
7.727
7.723
7.717
7.712
7.501
7.489
7.483
7.479
7.475
7.471
7.465
7.454
7.395
7.391
7.374
7.370
7.260
7.249
7.248
7.228
59.85
20.12
10.46
21.69
7.8
7.7
7.6
7.5
7.4
7.3
ppm

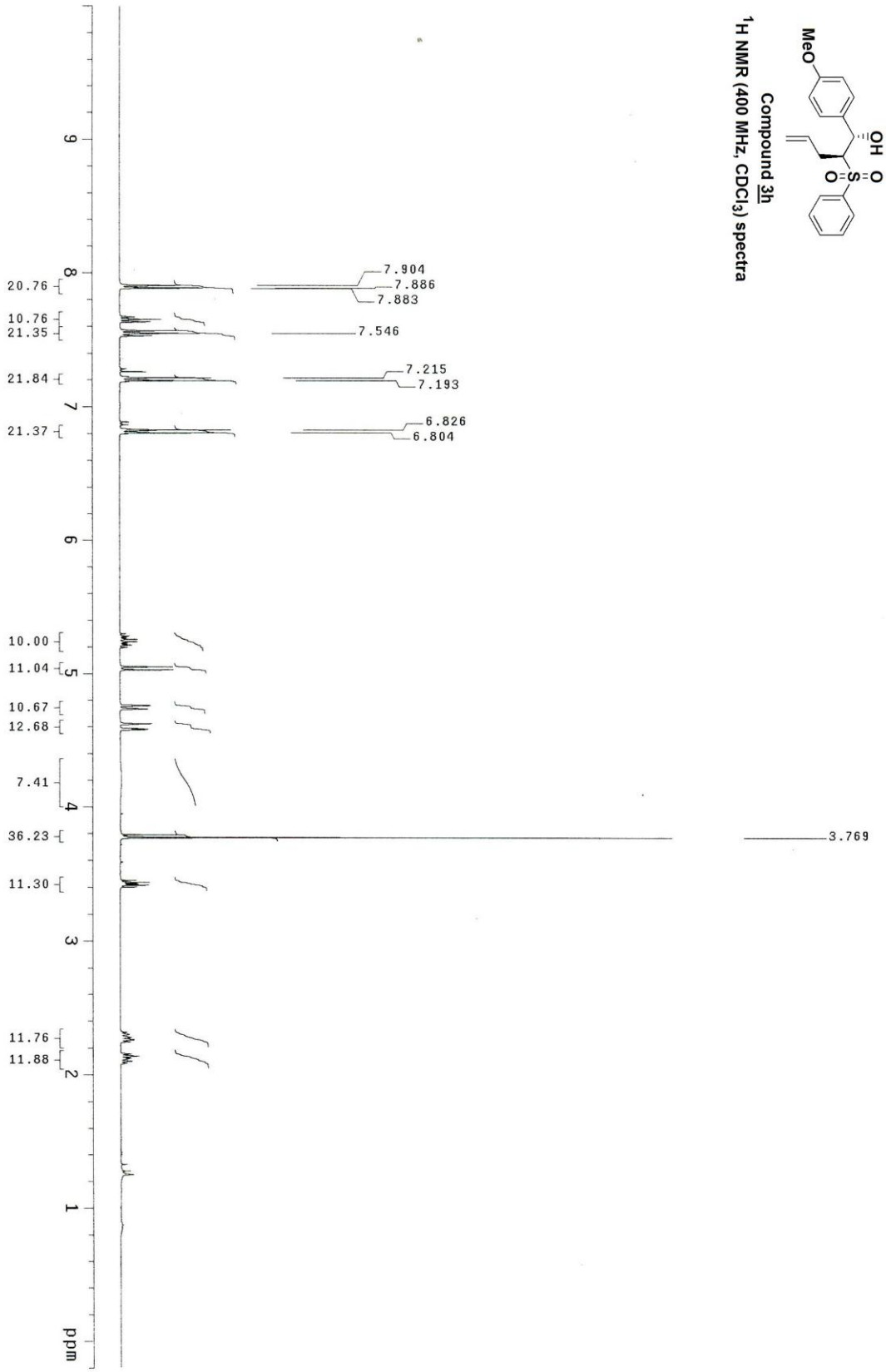

Kuo0325
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 30 2015
Solvent: CDCl3
Ambient temperature
Total 1824 repetitions
OH
O
S
O
Me
Compound 3f
13C NMR (100 MHz, CDCl3) spectra
145.012
136.802
135.362
133.254
133.065
132.966
129.684
128.698
128.464
127.986
127.599
126.644
126.303
126.273
124.279
117.889
77.318
77.000
76.689
72.990
69.958
30.972
21.572
180
160
140
120
100
80
60
40
20
ppm

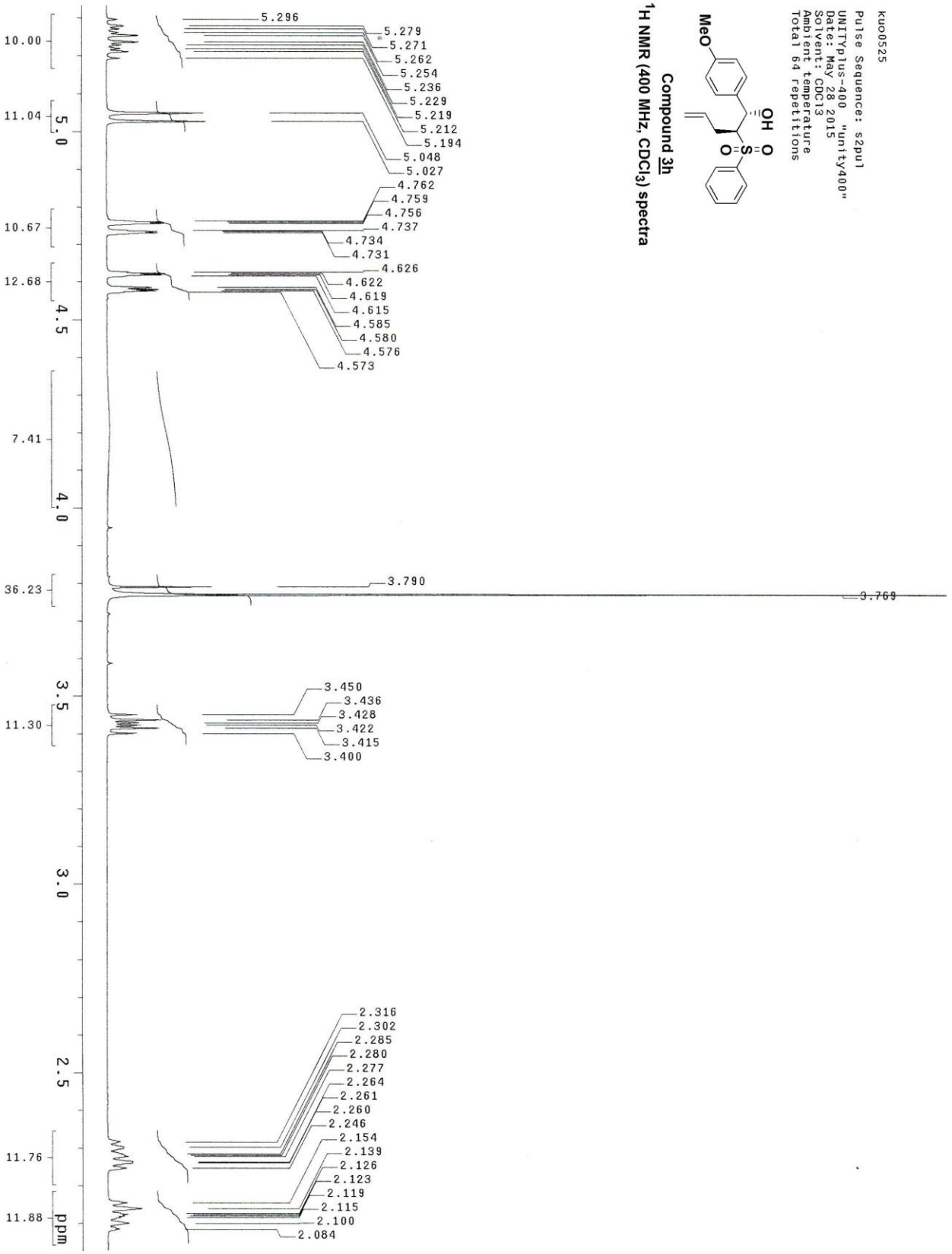

Kuo0328
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 31 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
OH O
S
O
Me
Compound 3g
1H NMR (400 MHz, CDCl3) spectra
7.776
7.755
7.570
7.552
7.551
7.549
7.529
7.508
7.438
7.369
7.351
7.348
7.338
7.337
7.317
2.433
18.98
39.21
20.06
47.87
9.15
10.00
9.82
10.11
10.13
39.67
10.91
ppm

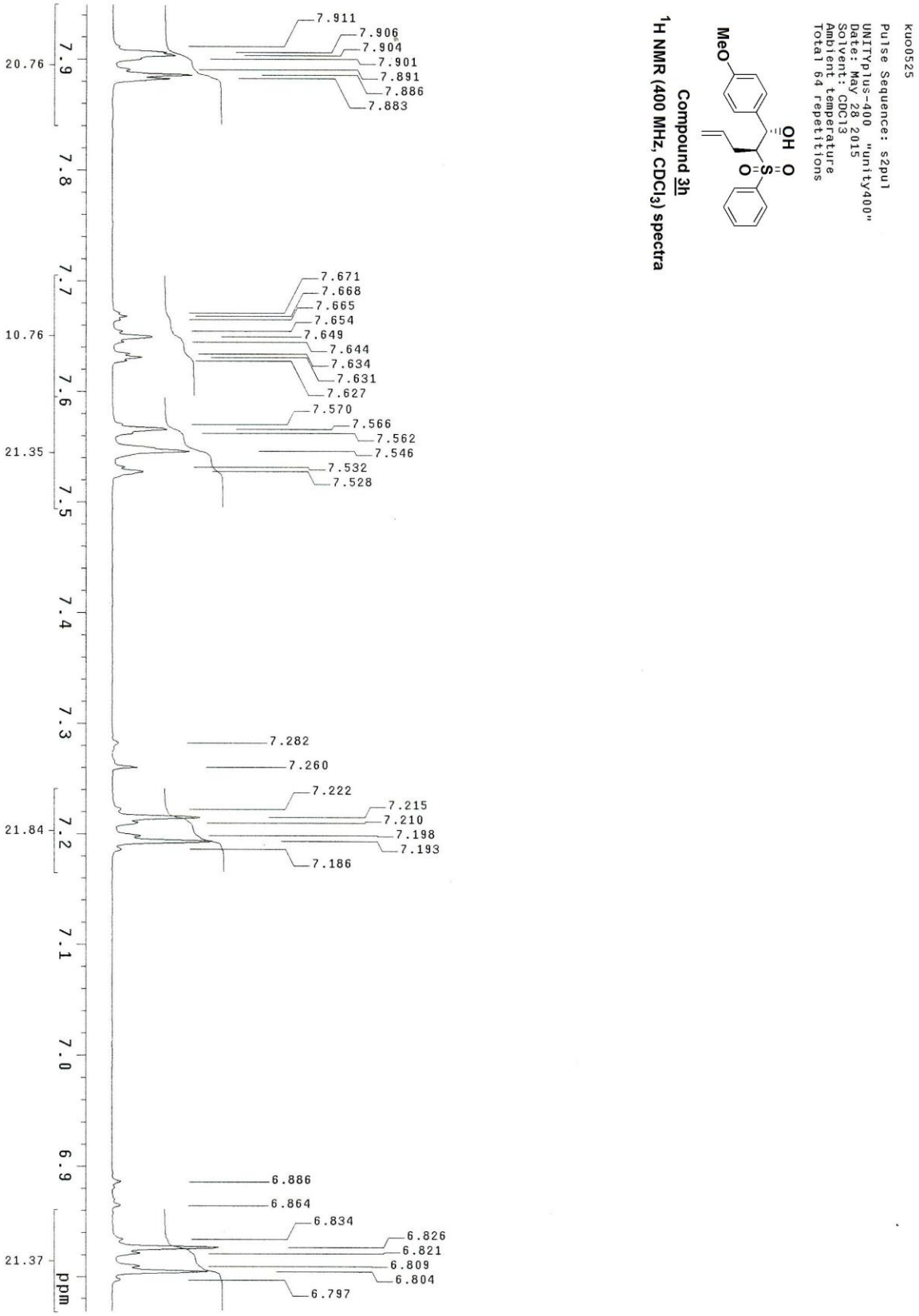

Kuo0328
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 31 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
OH O
S
O
Me
Compound 3g
1H NMR (400 MHz, CDCl3) spectra
5.381
5.364
5.356
5.347
5.339
5.322
5.314
5.305
5.297
5.279
5.136
5.116
4.810
4.807
4.803
4.800
4.784
4.781
4.778
4.775
4.710
4.707
4.703
4.699
4.668
4.665
4.660
4.657
3.511
3.497
3.495
3.490
3.482
3.477
3.475
3.461
2.433
2.423
2.419
2.415
2.411
2.404
2.401
2.397
2.393
2.390
2.383
2.380
2.376
2.372
2.366
2.363
2.360
2.250
2.247
2.243
2.230
2.217
2.214
2.211
2.208
2.205
2.191
2.175
9.15
10.00
9.82
10.11
10.13
39.67
10.91
5.0
4.5
4.0
3.5
3.0
2.5
ppm

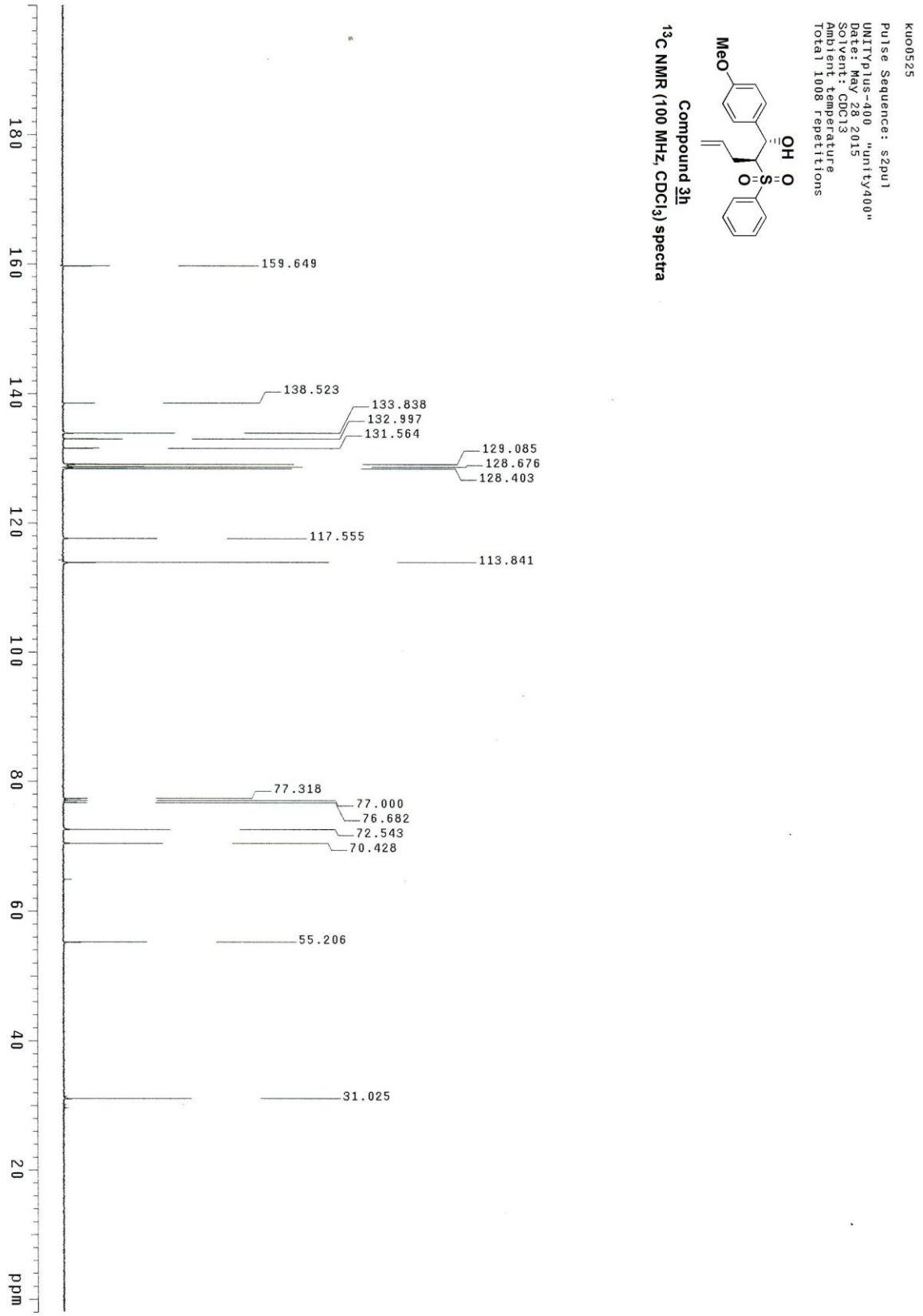

Kuo0328
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 31 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
OH
O
S
O
Me
Compound 3g
1H NMR (400 MHz, CDCl3) spectra
7.781
7.776
7.771
7.760
7.755
7.750
7.573
7.570
7.565
7.555
7.552
7.551
7.549
7.544
7.534
7.529
7.524
7.519
7.513
7.508
7.503
7.458
7.456
7.451
7.438
7.434
7.422
7.418
7.413
7.373
7.369
7.364
7.357
7.351
7.348
7.338
7.337
7.333
7.317
7.315
7.260
18.98
39.21
20.06
47.87
7.80
7.75
7.70
7.65
7.60
7.55
7.50
7.45
7.40
7.35
7.30
ppm

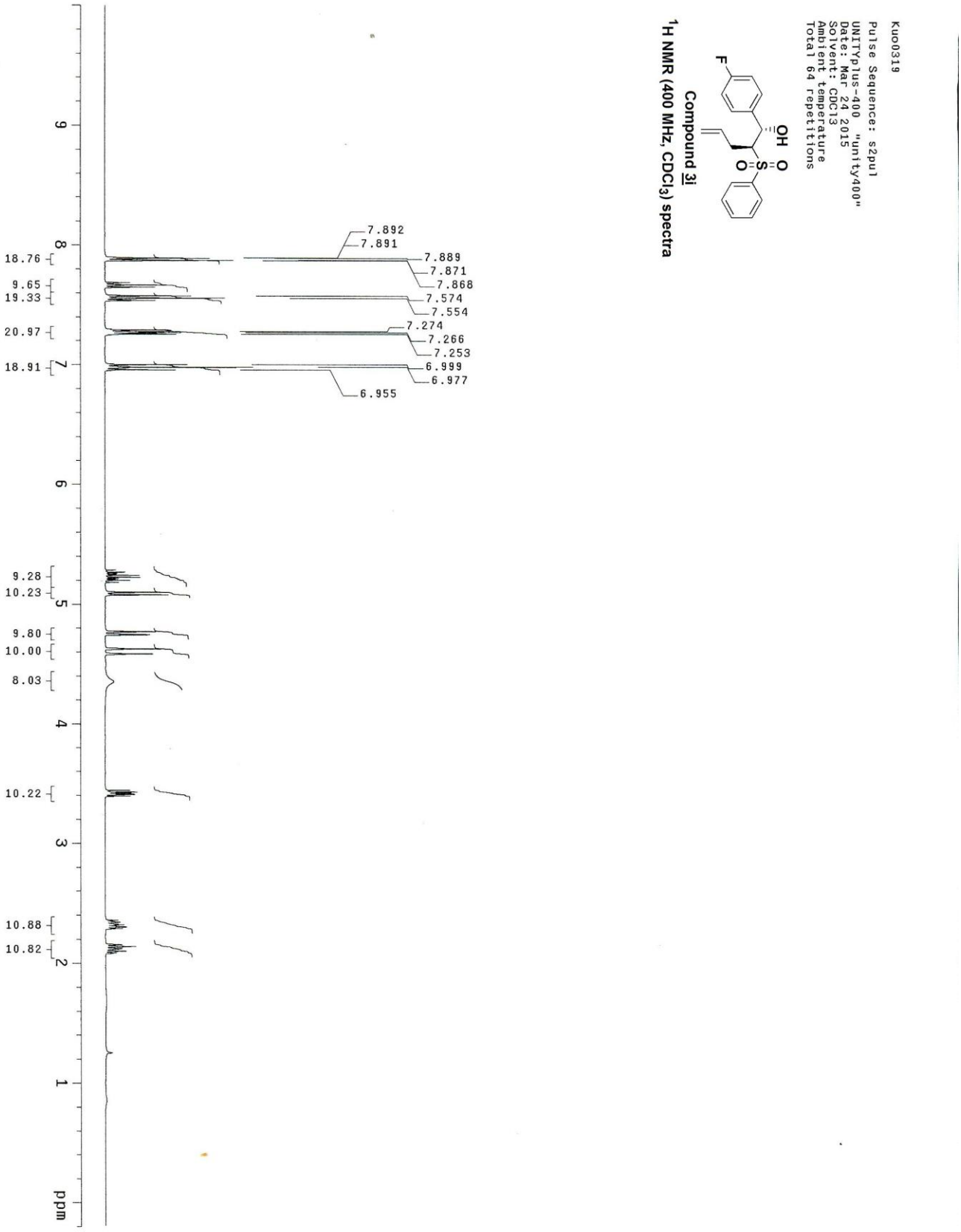

Kuo0328
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 31 2015
Solvent: CDCl3
Ambient temperature
Total 320 repetitions
OH O
O S O
Me
Compound 3g
13C NMR (100 MHz, CDCl3) spectra
145.012
141.290
140.433
138.477
135.369
133.057
129.775
128.752
128.729
127.592
127.440
127.129
126.985
117.745
77.318
77.000
76.682
72.634
70.185
30.994
21.602
180
160
140
120
100
80
60
40
20
ppm

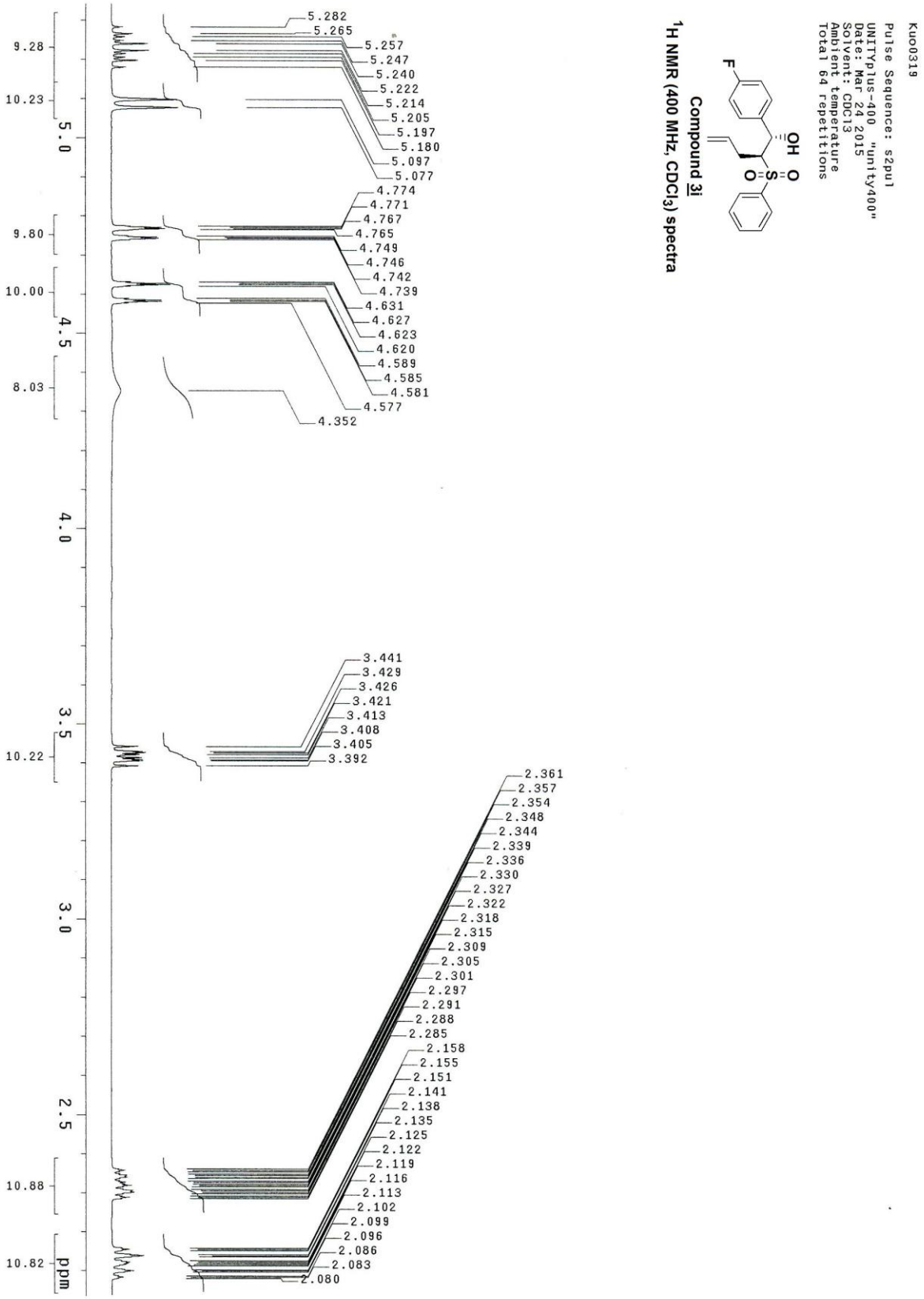

kuo0525
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 28 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH O
S
O
Compound 3h
1H NMR (400 MHz, CDCl3) spectra
7.904
7.886
7.883
7.546
7.215
7.193
6.826
6.804
3.769
20.76
10.76
21.35
21.84
21.37
10.00
11.04
10.67
12.68
7.41
36.23
11.30
11.76
11.88
ppm

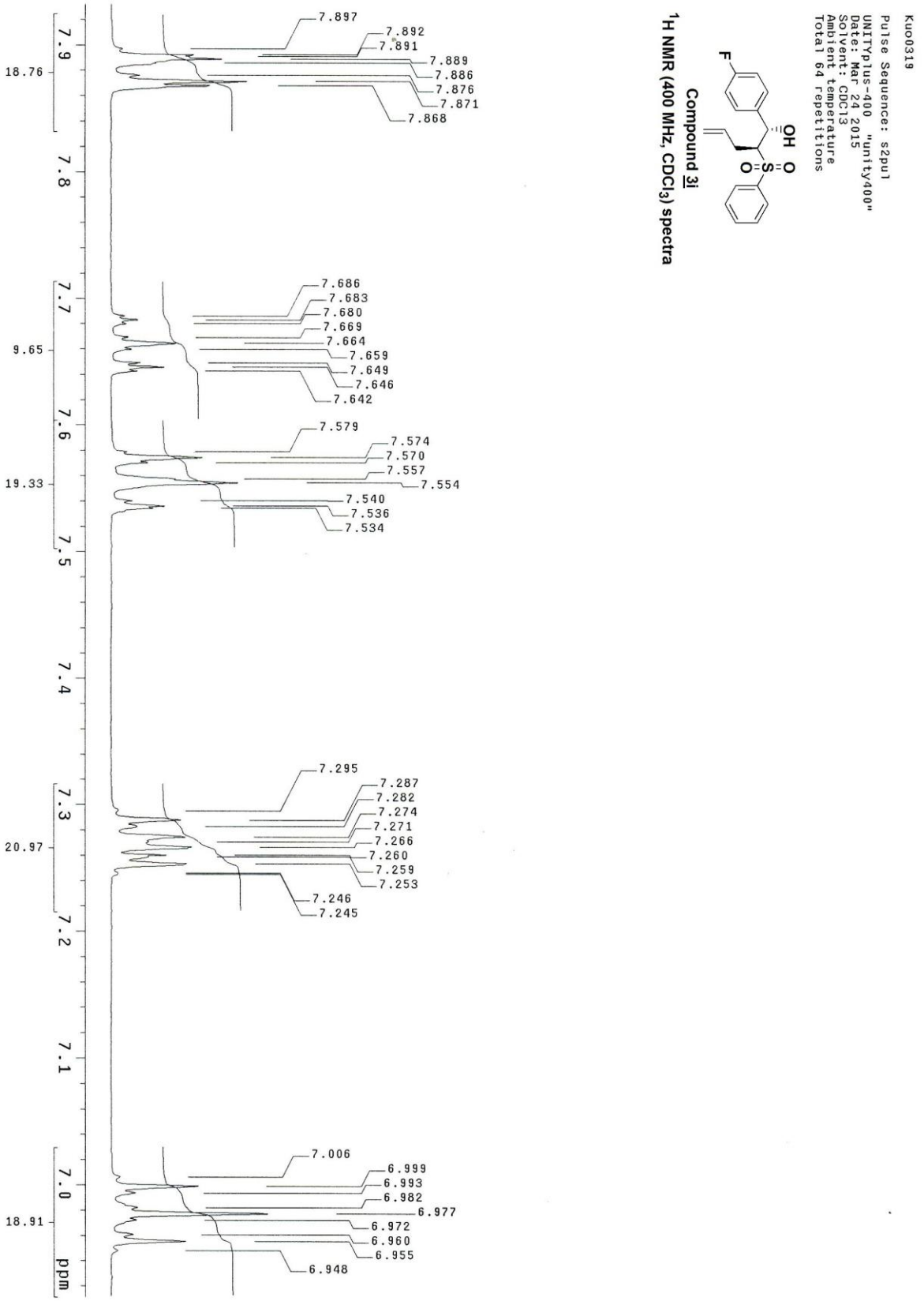

kuo0525
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 28 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH O
S
O
Compound 3h
1H NMR (400 MHz, CDCl3) spectra
5.296
5.279
5.271
5.262
5.254
5.236
5.229
5.219
5.212
5.194
5.048
5.027
4.762
4.759
4.756
4.737
4.734
4.731
4.626
4.622
4.619
4.615
4.585
4.580
4.576
4.573
3.790
3.769
3.450
3.436
3.428
3.422
3.415
3.400
2.316
2.302
2.285
2.280
2.277
2.264
2.261
2.260
2.246
2.154
2.139
2.126
2.123
2.119
2.115
2.100
2.084
10.00
11.04
10.67
12.68
7.41
36.23
11.30
11.76
11.88
5.0
4.5
4.0
3.5
3.0
2.5
ppm

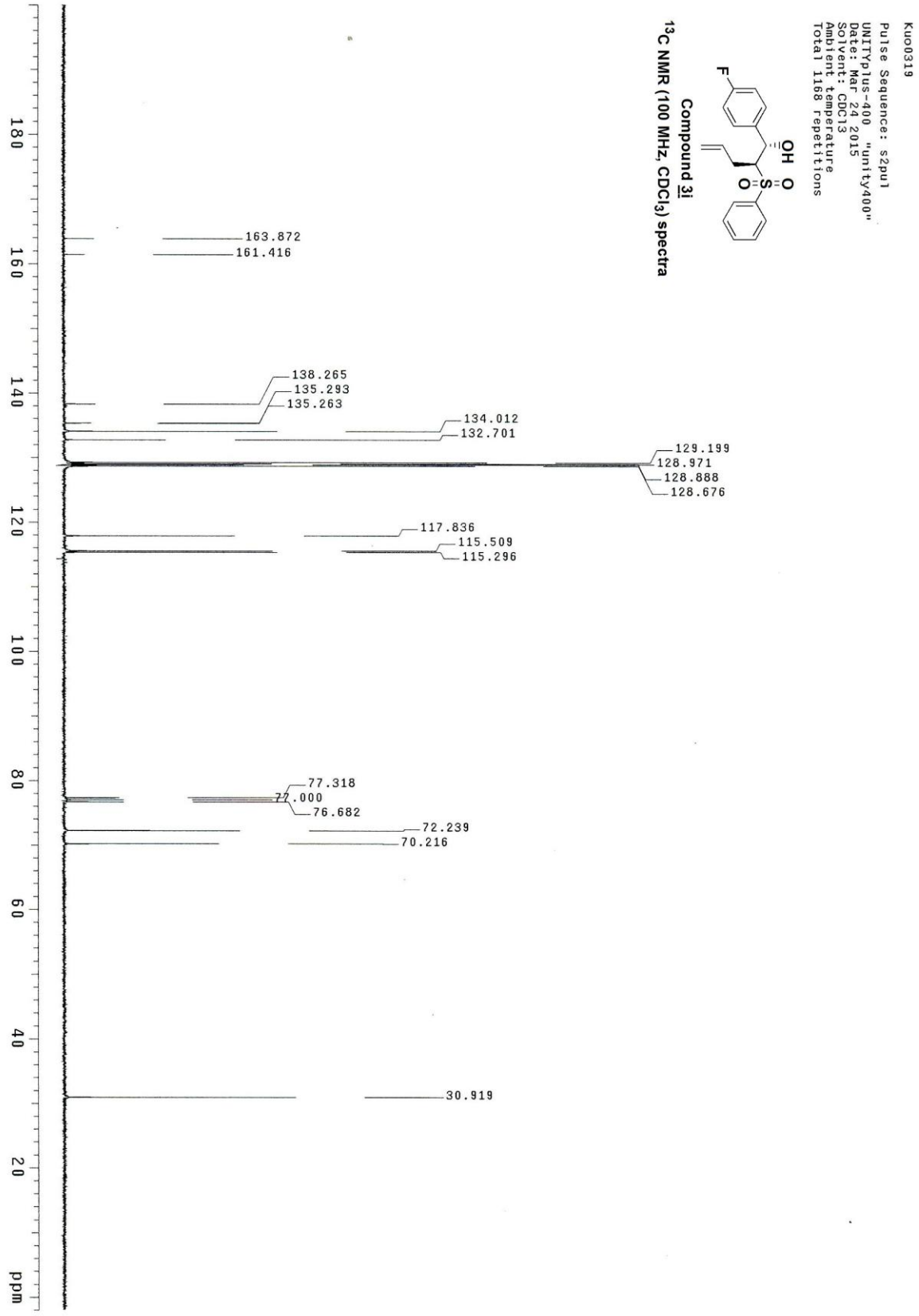

kuo0525
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 28 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH O
S
O
Compound 3h
1H NMR (400 MHz, CDCl3) spectra
7.911
7.906
7.904
7.901
7.891
7.886
7.883
7.671
7.668
7.665
7.654
7.649
7.644
7.634
7.631
7.627
7.570
7.566
7.562
7.546
7.532
7.528
7.282
7.260
7.222
7.215
7.210
7.198
7.193
7.186
6.886
6.864
6.834
6.826
6.821
6.809
6.804
6.797
20.76
10.76
21.35
21.84
21.37
ppm

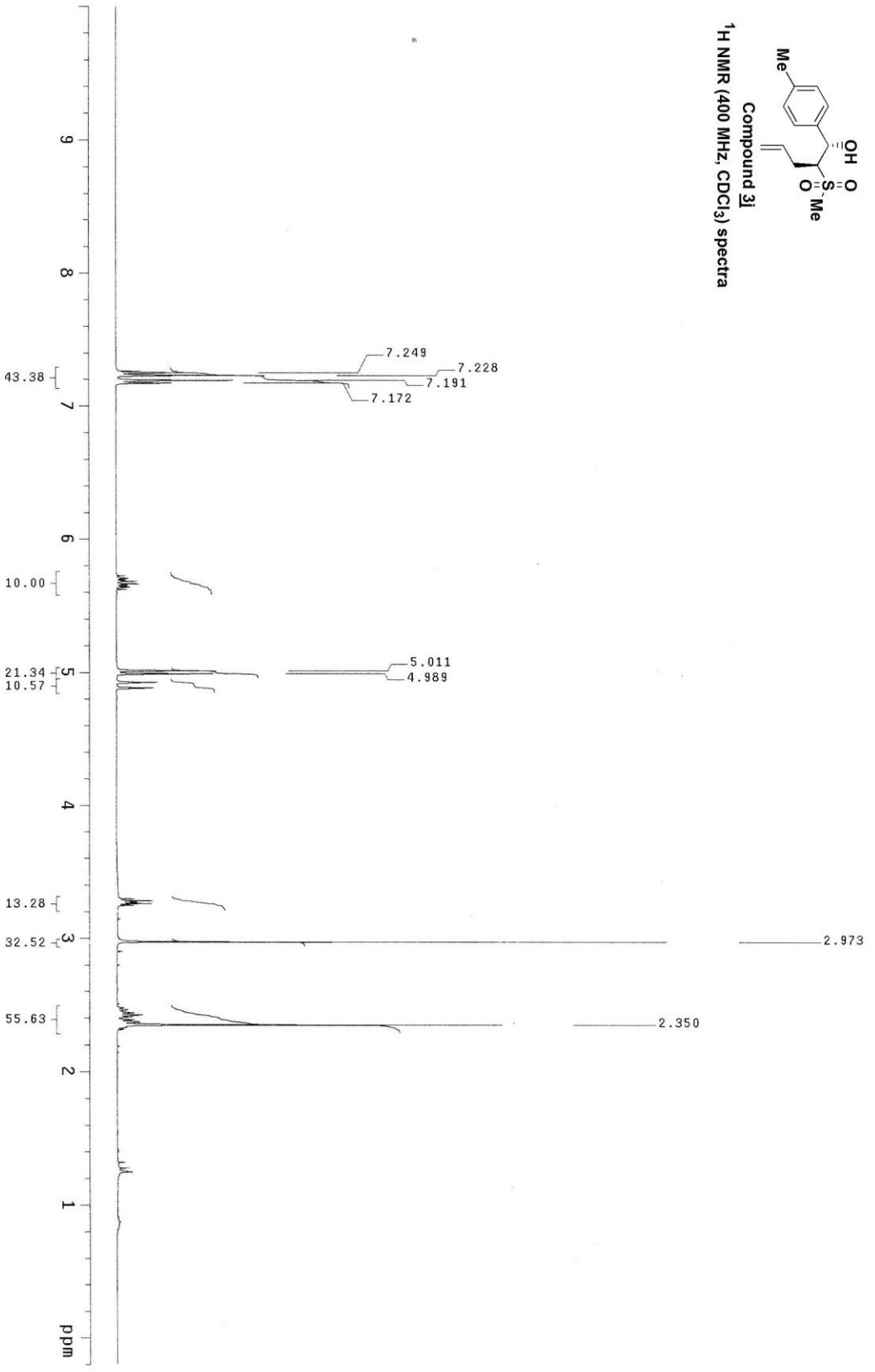

kuo0525
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 28 2015
Solvent: CDCl3
Ambient temperature
Total 1008 repetitions
MeO
OH O
S
O
Compound 3h
13C NMR (100 MHz, CDCl3) spectra
159.649
138.523
133.838
132.997
131.564
129.085
128.676
128.403
117.555
113.841
77.318
77.000
76.682
72.543
70.428
55.206
31.025
180
160
140
120
100
80
60
40
20
ppm

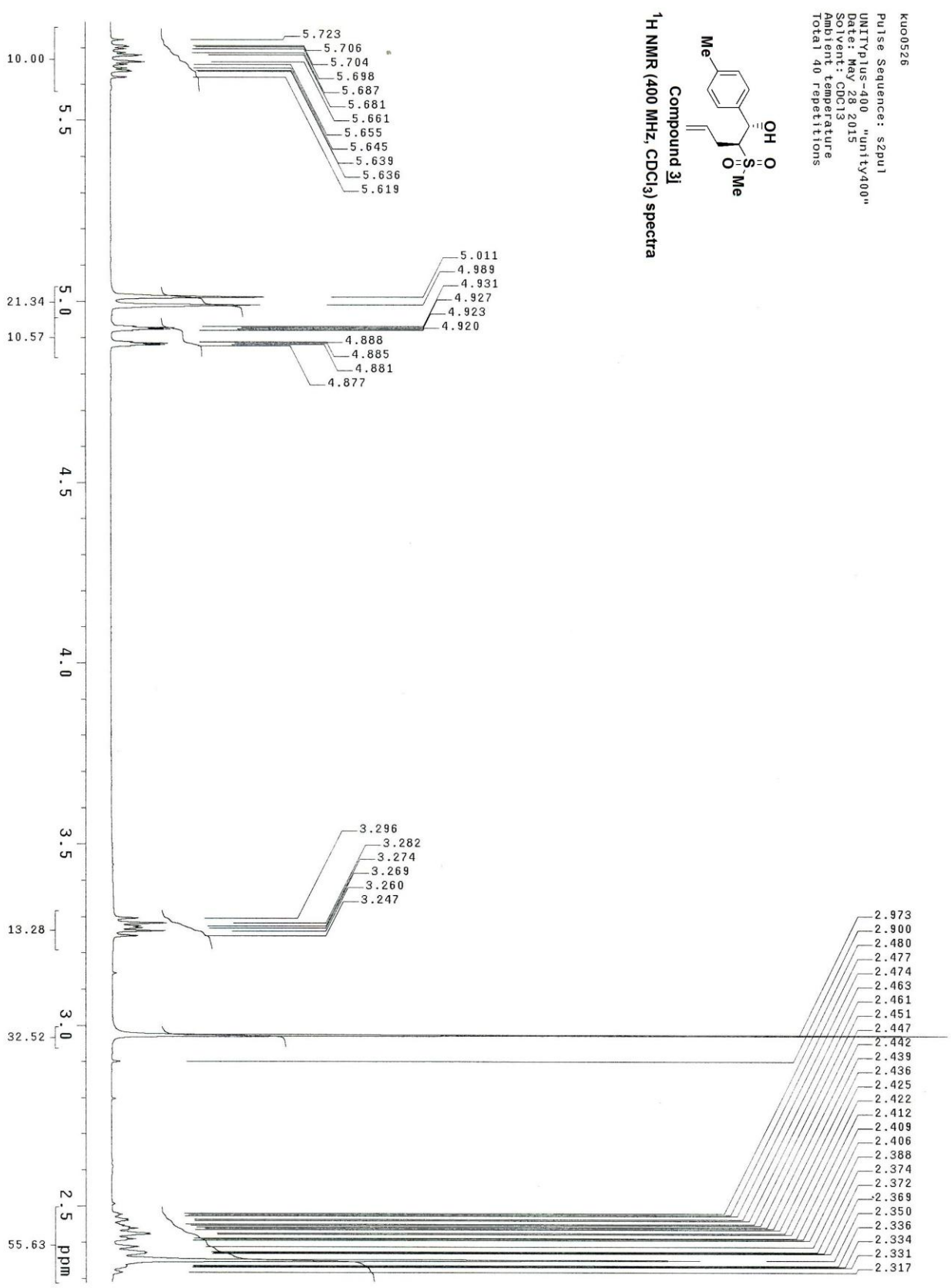

Kuo0319
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
OH O
S
O
Compound 3i
1H NMR (400 MHz, CDCl3) spectra
7.892
7.891
7.889
7.871
7.868
7.574
7.554
7.274
7.266
7.253
6.999
6.977
6.955
18.76
9.65
19.33
20.97
18.91
9.28
10.23
9.80
10.00
8.03
10.22
10.88
10.82
ppm

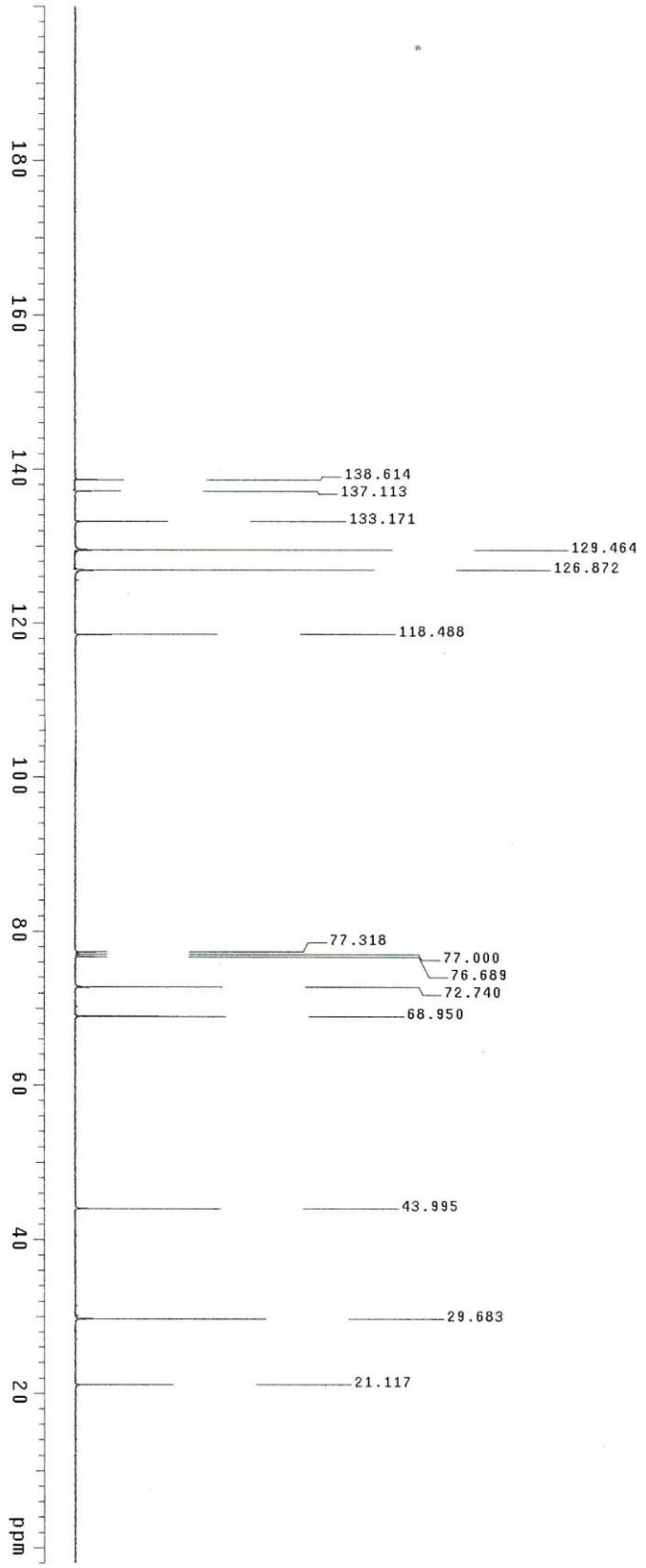

Kuo0319
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
OH O
S
O
Compound 3i
1H NMR (400 MHz, CDCl3) spectra
5.282
5.265
5.257
5.247
5.240
5.222
5.214
5.205
5.197
5.180
5.097
5.077
4.774
4.771
4.767
4.765
4.749
4.746
4.742
4.739
4.631
4.627
4.623
4.620
4.589
4.585
4.581
4.577
4.352
3.441
3.429
3.426
3.421
3.413
3.408
3.405
3.392
2.361
2.357
2.354
2.348
2.344
2.339
2.336
2.330
2.327
2.322
2.318
2.315
2.309
2.305
2.301
2.297
2.291
2.288
2.285
2.158
2.155
2.151
2.141
2.138
2.135
2.125
2.122
2.119
2.116
2.113
2.102
2.099
2.096
2.086
2.083
2.080
9.28
10.23
9.80
10.00
8.03
10.22
10.88
10.82
5.0
4.5
4.0
3.5
3.0
2.5
ppm

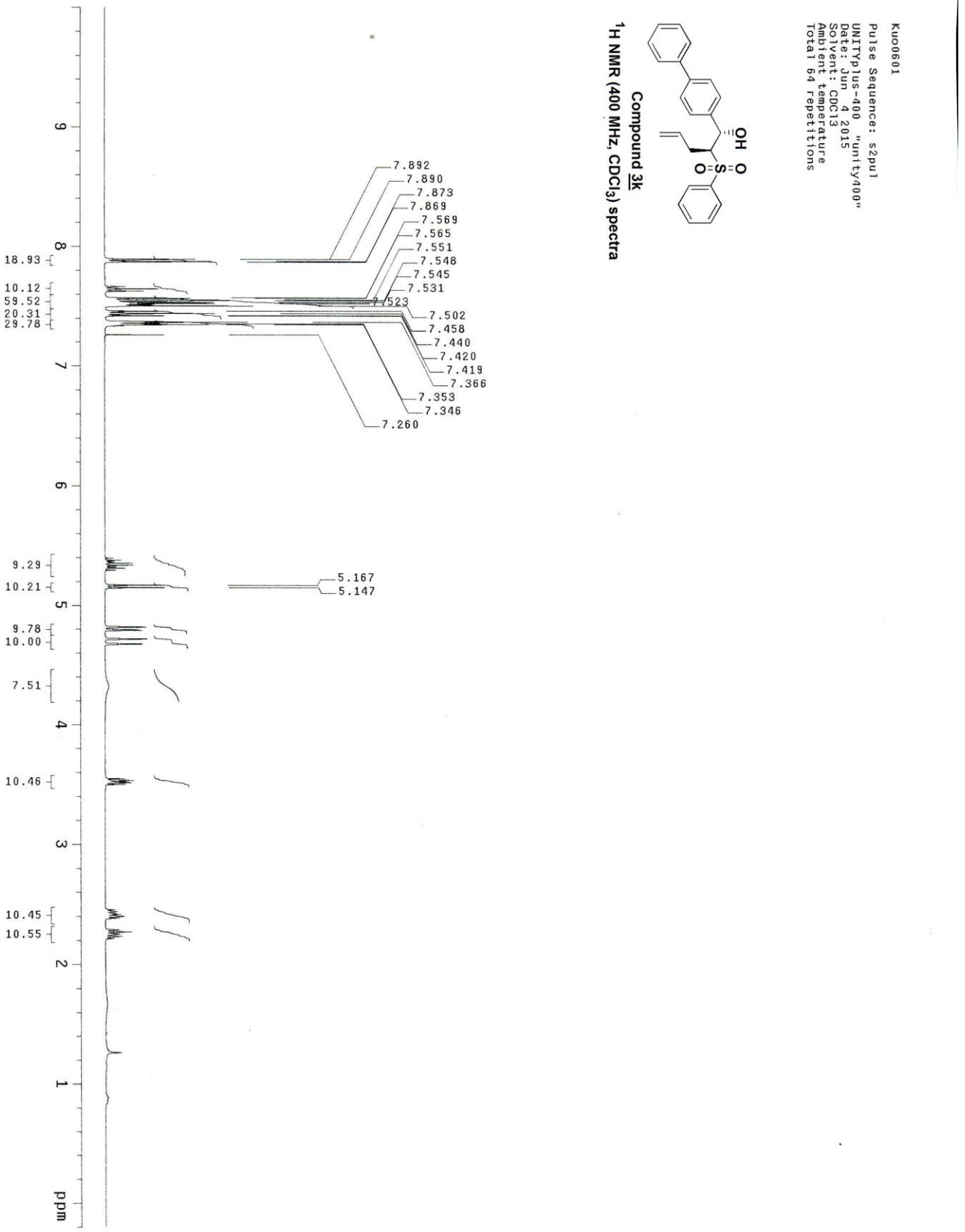

Kuo0319
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
OH O
O S
O
Compound 3i
1H NMR (400 MHz, CDCl3) spectra
7.897
7.892
7.891
7.889
7.886
7.876
7.871
7.868
18.76
7.686
7.683
7.680
7.669
7.664
7.659
7.649
7.646
7.642
9.65
7.579
7.574
7.570
7.557
7.554
7.540
7.536
7.534
19.33
7.295
7.287
7.282
7.274
7.271
7.266
7.260
7.259
7.253
7.246
7.245
20.97
7.006
6.999
6.993
6.982
6.977
6.972
6.960
6.955
6.948
18.91
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
ppm

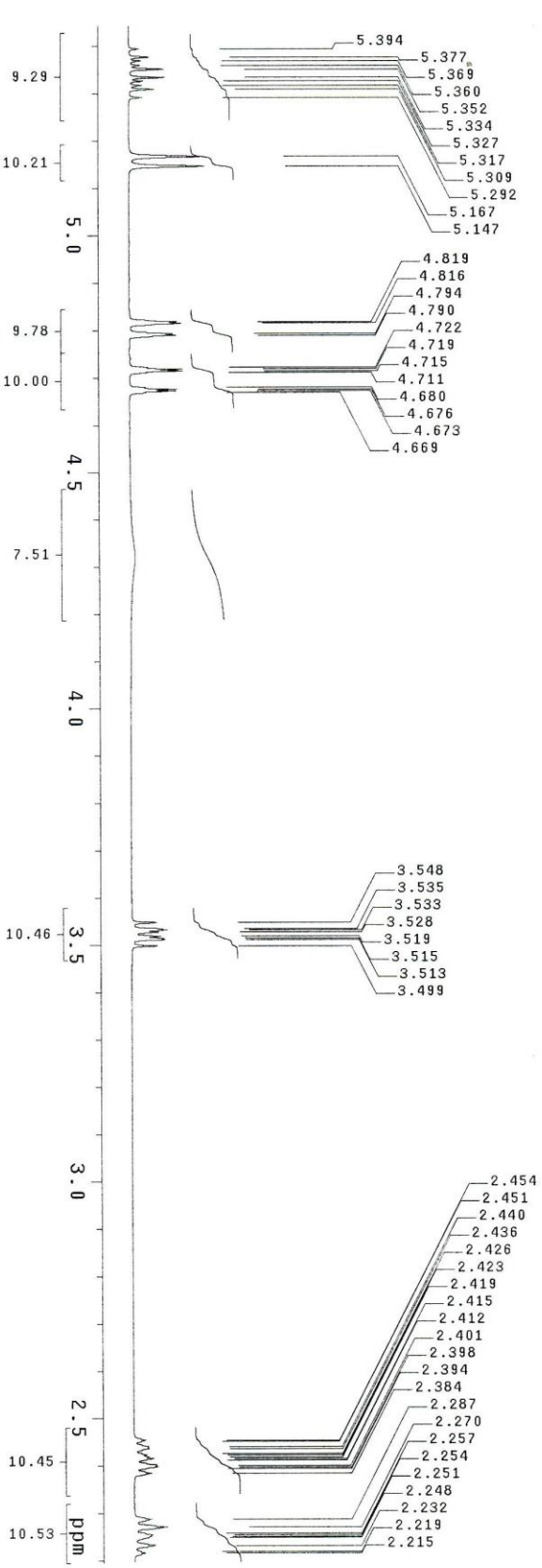

Kuo0319
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 24 2015
Solvent: CDCl3
Ambient temperature
Total 1168 repetitions
Compound 3i
13C NMR (100 MHz, CDCl3) spectra
163.872
161.416
138.265
135.293
135.263
134.012
132.701
129.199
128.971
128.888
128.676
117.836
115.509
115.296
77.318
77.000
76.682
72.239
70.216
30.919
ppm

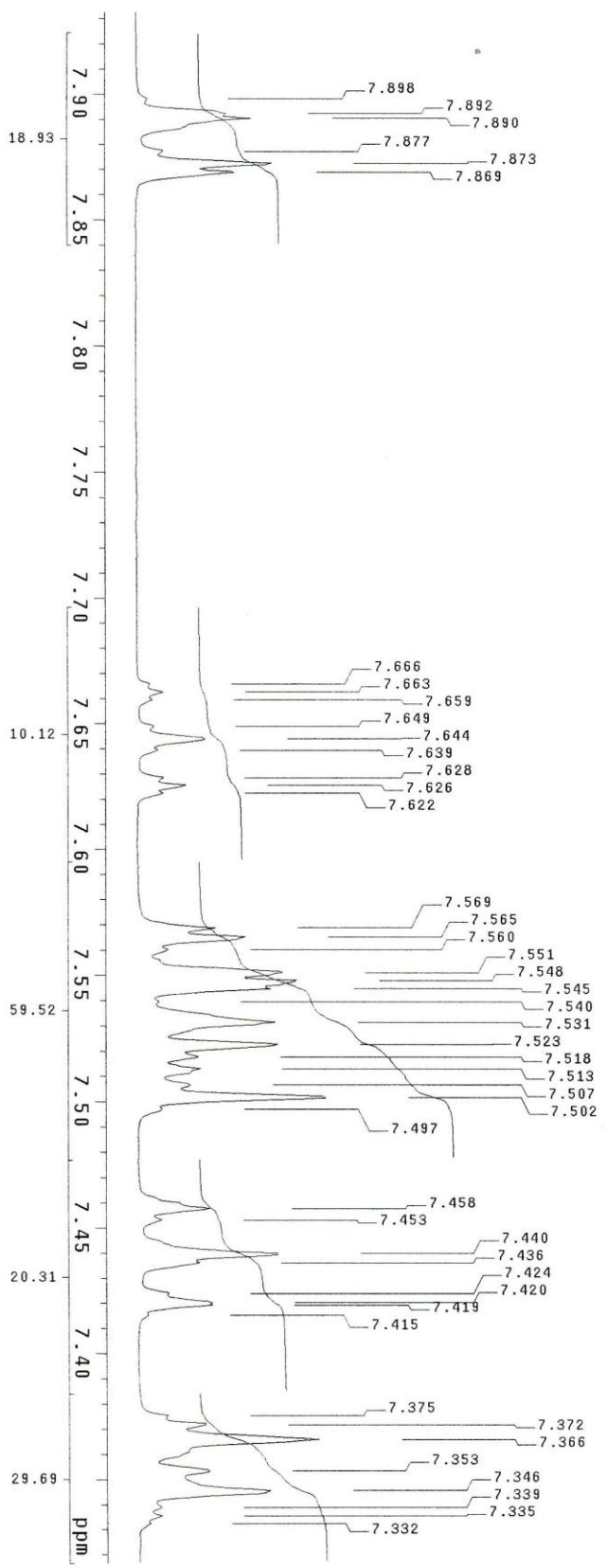

kuo0526
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 28 2015
Solvent: CDCl3
Ambient temperature
Total 40 repetitions
Me
OH O
S
O Me
Compound 3i
1H NMR (400 MHz, CDCl3) spectra
7.249
7.228
7.191
7.172
5.011
4.989
2.973
2.350
43.38
10.00
21.34
10.57
13.28
32.52
55.63
ppm

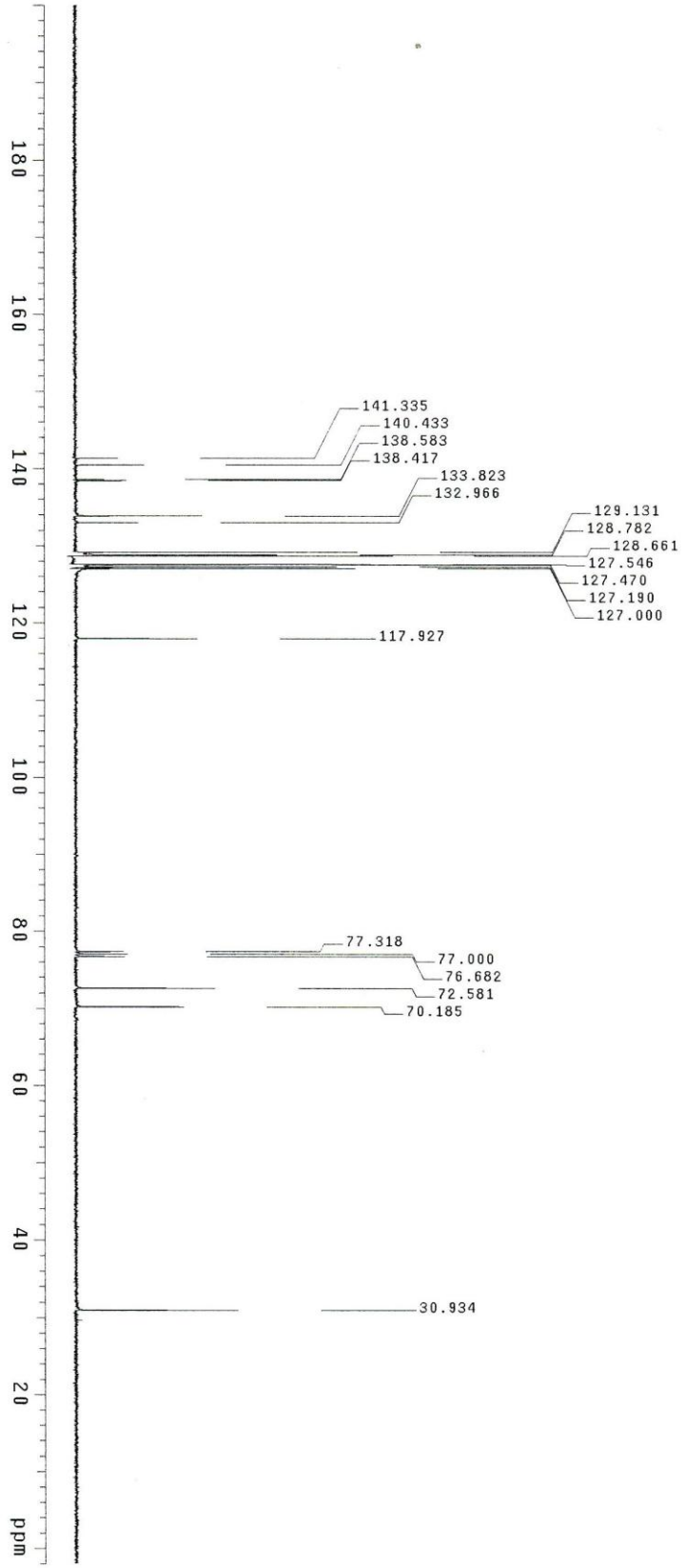

Kuo0526
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 28 2015
Solvent: CDCl3
Ambient temperature
Total 40 repetitions
Me
OH O
S
O Me
Compound 3j
1H NMR (400 MHz, CDCl3) spectra
10.00
21.34
10.57
13.28
32.52
55.63
5.723
5.706
5.704
5.698
5.687
5.681
5.661
5.655
5.645
5.639
5.636
5.619
5.011
4.989
4.931
4.927
4.923
4.920
4.888
4.885
4.881
4.877
3.296
3.282
3.274
3.269
3.260
3.247
2.973
2.900
2.480
2.477
2.474
2.463
2.461
2.451
2.447
2.442
2.439
2.436
2.425
2.422
2.412
2.409
2.406
2.388
2.374
2.372
2.369
2.350
2.336
2.334
2.331
2.317
5.5
5.0
4.5
4.0
3.5
3.0
2.5
ppm

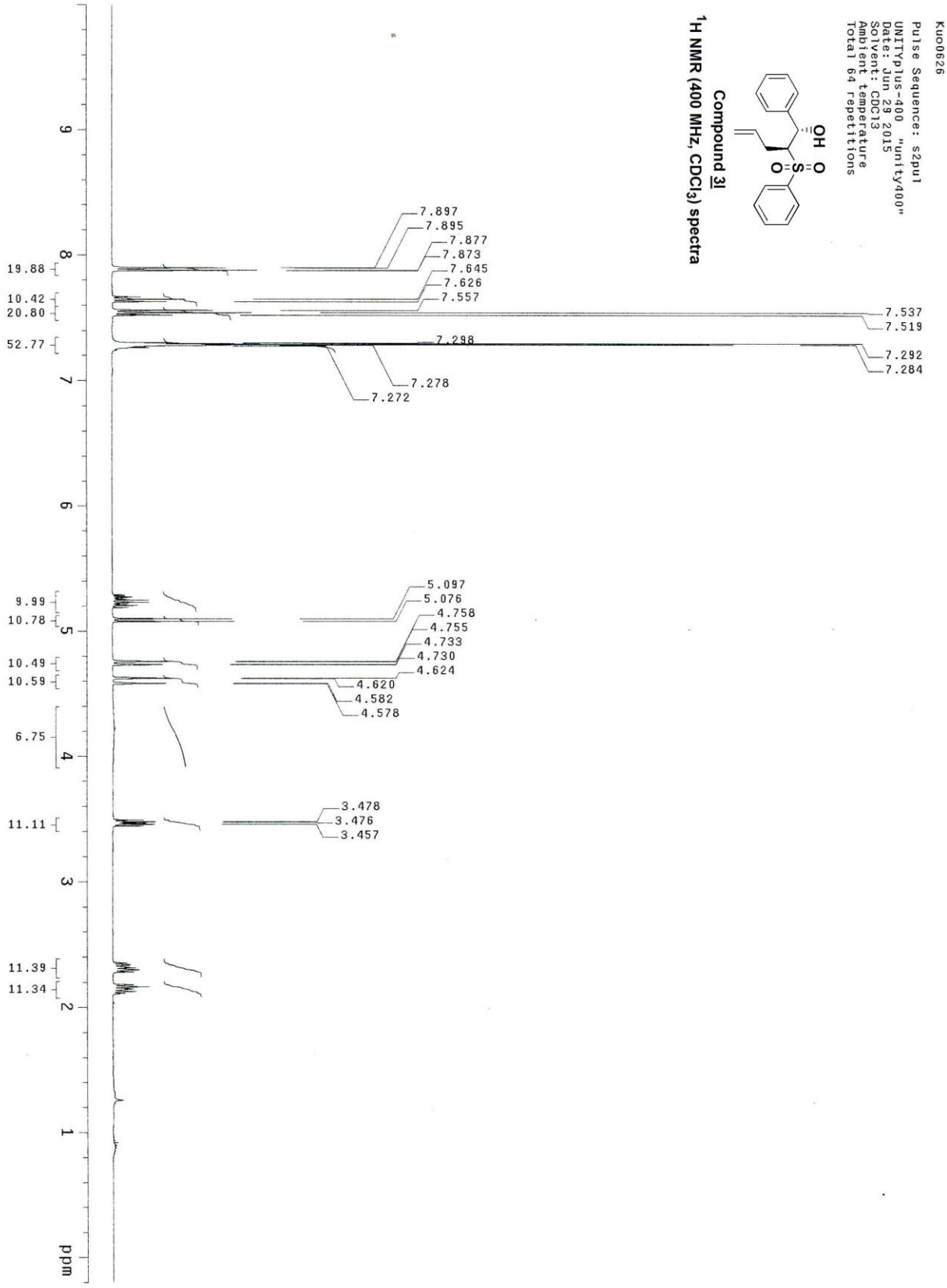

kuo0526
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 28 2015
Solvent: CDCl3
Ambient temperature
Total 3072 repetitions
Me
OH O
S
O Me
Compound 3j
13C NMR (100 MHz, CDCl3) spectra
138.614
137.113
133.171
129.464
126.872
118.488
77.318
77.000
76.689
72.740
68.950
43.995
29.683
21.117
ppm

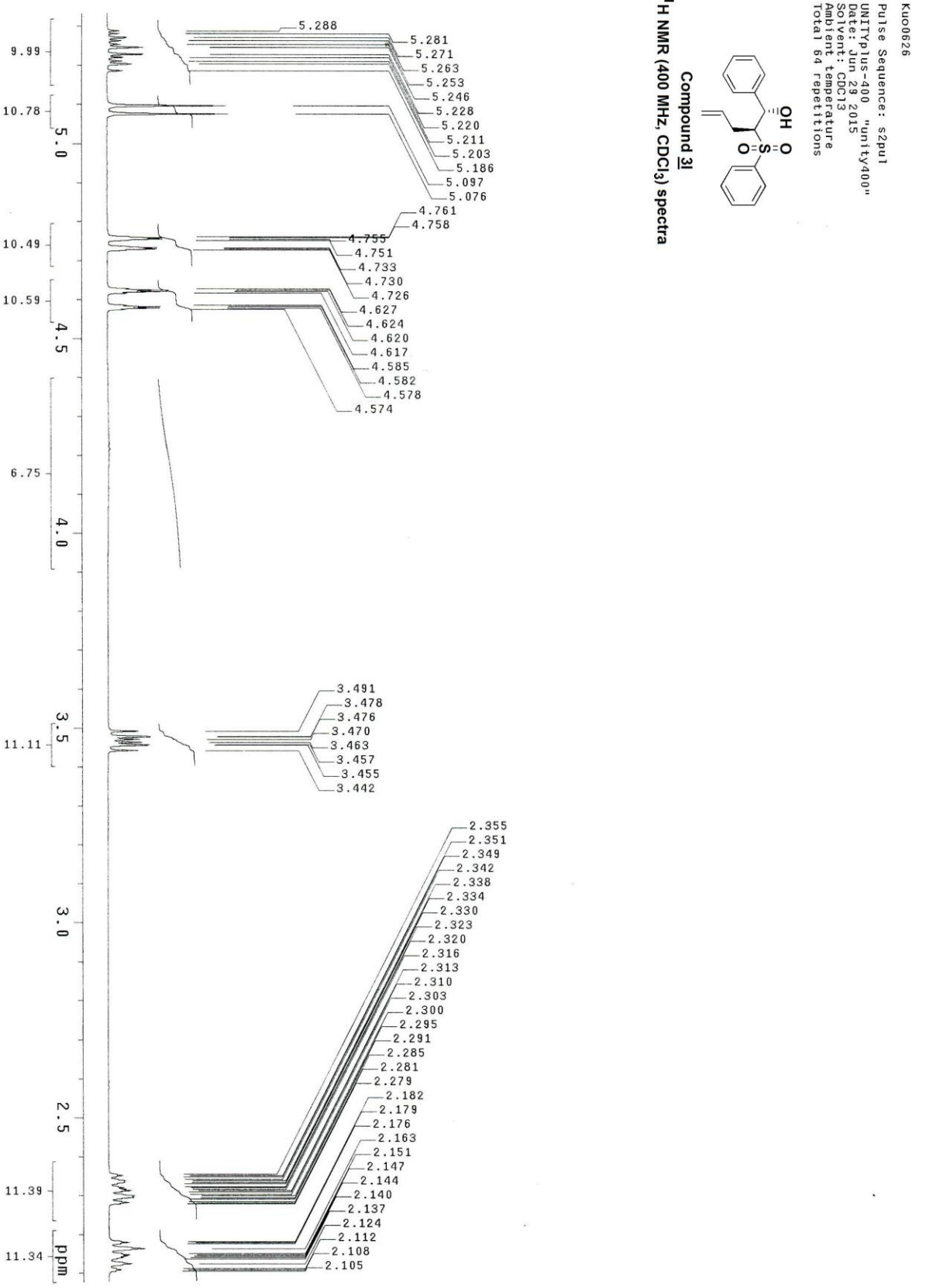

Kuo0601
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 4 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Compound 3k
1H NMR (400 MHz, CDCl3) spectra
7.892
7.890
7.873
7.869
7.569
7.565
7.551
7.548
7.545
7.531
7.523
7.502
7.458
7.440
7.420
7.419
7.366
7.353
7.346
7.260
5.167
5.147
18.93
10.12
59.52
20.31
29.78
9.29
10.21
9.78
10.00
7.51
10.46
10.45
10.55
ppm

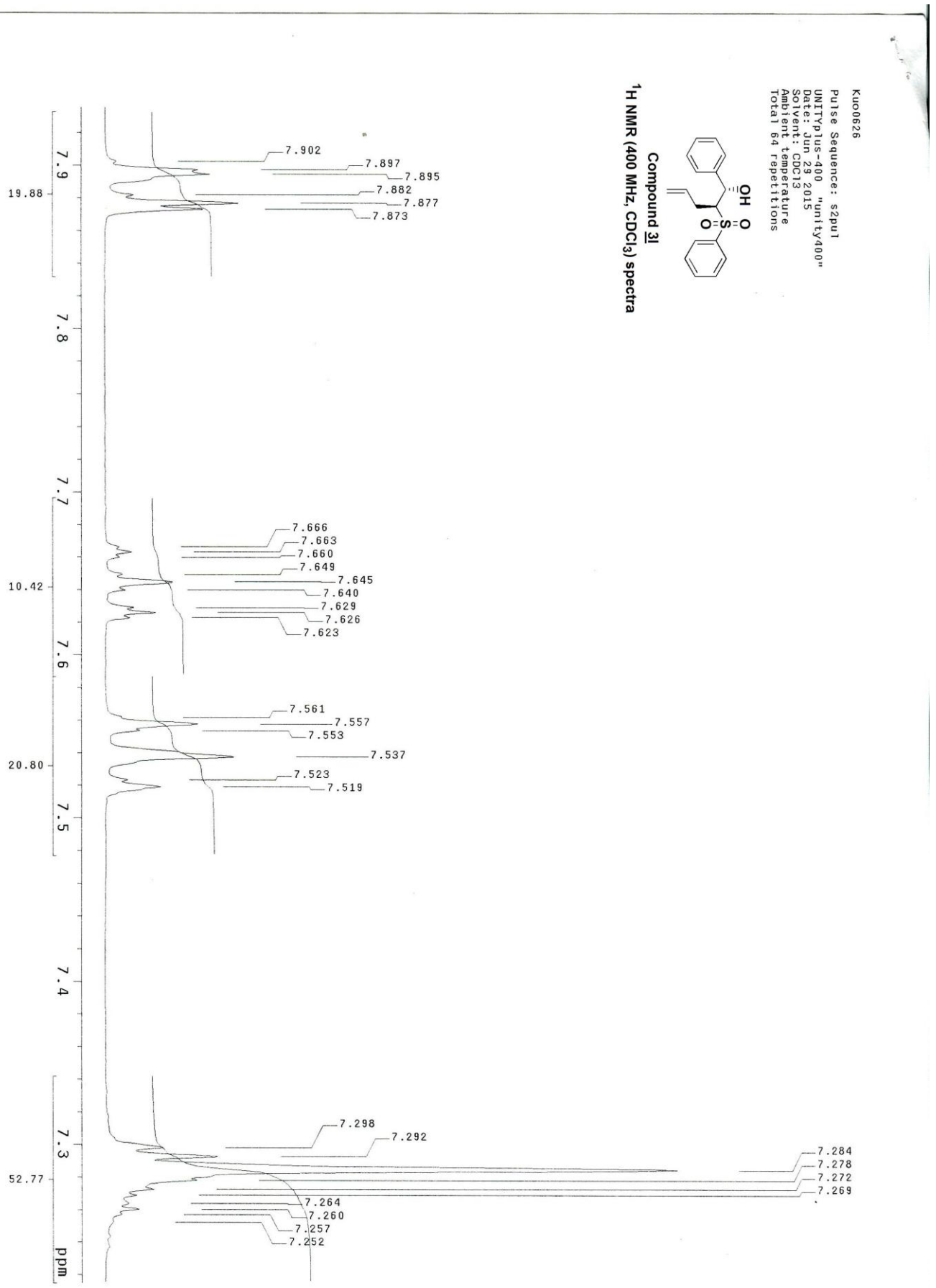

Kuo0601
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 4 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Compound 3k
1H NMR (400 MHz, CDCl3) spectra
5.394
5.377
5.369
5.360
5.352
5.334
5.327
5.317
5.309
5.292
5.167
5.147
4.819
4.816
4.794
4.790
4.722
4.719
4.715
4.711
4.680
4.676
4.673
4.669
3.548
3.535
3.533
3.528
3.519
3.515
3.513
3.499
2.454
2.451
2.440
2.436
2.426
2.423
2.419
2.415
2.412
2.401
2.398
2.394
2.384
2.287
2.270
2.257
2.254
2.251
2.248
2.232
2.219
2.215
9.29
10.21
9.78
10.00
7.51
10.46
10.45
10.53
5.0
4.5
4.0
3.5
3.0
2.5
ppm

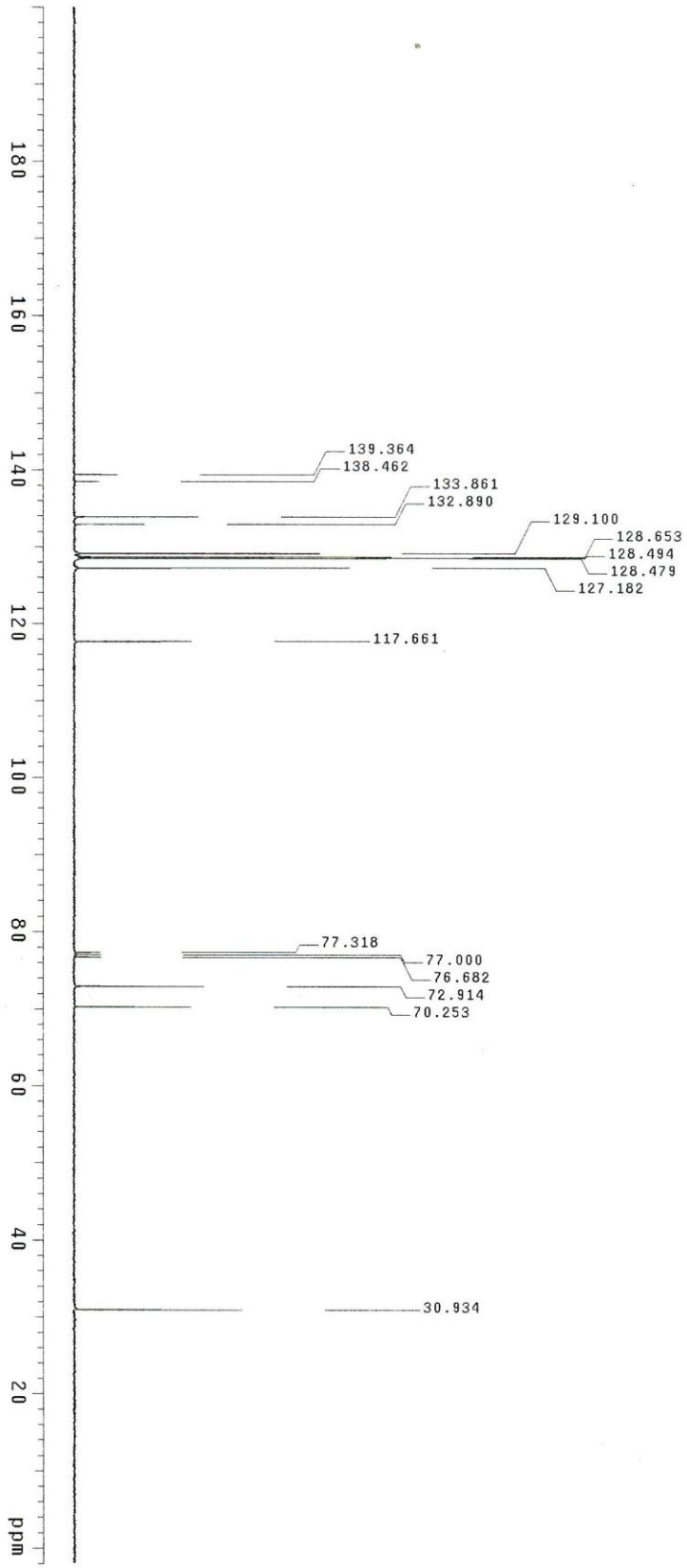

Kuo0601
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 4 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Compound 3k
1H NMR (400 MHz, CDCl3) spectra
7.898
7.892
7.890
7.877
7.873
7.869
7.666
7.663
7.659
7.649
7.644
7.639
7.628
7.626
7.622
7.569
7.565
7.560
7.551
7.548
7.545
7.540
7.531
7.523
7.518
7.513
7.507
7.502
7.497
7.458
7.453
7.440
7.436
7.424
7.420
7.419
7.415
7.375
7.372
7.366
7.353
7.346
7.339
7.335
7.332
18.93
10.12
59.52
20.31
29.69
7.90
7.85
7.80
7.75
7.70
7.65
7.60
7.55
7.50
7.45
7.40
ppm

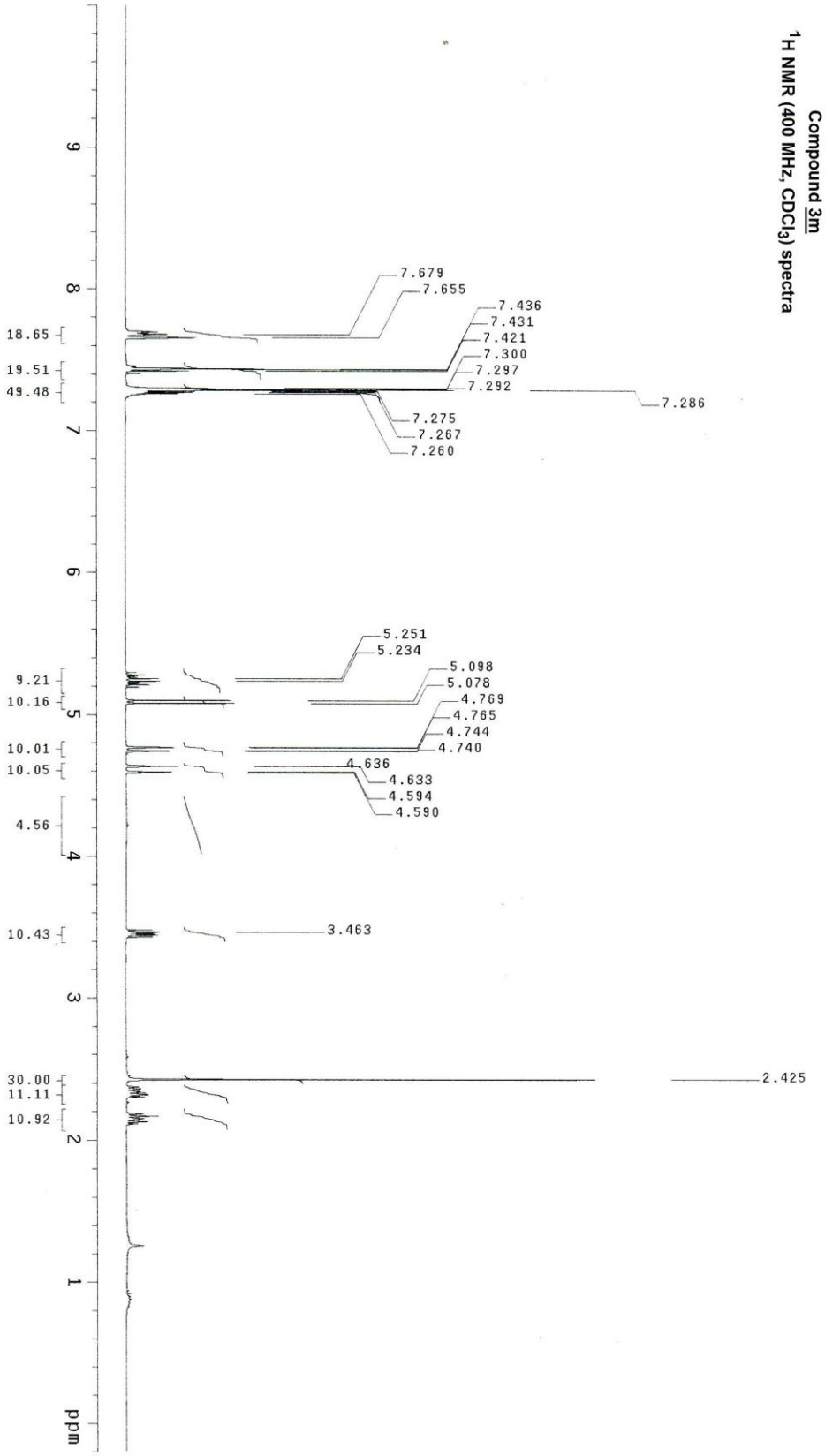

Kuo0601
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 4 2015
Solvent: CDCl3
Ambient temperature
Total 1760 repetitions
OH
O
S
O
Compound 3k
13C NMR (100 MHz, CDCl3) spectra
141.335
140.433
138.583
138.417
133.823
132.966
129.131
128.782
128.661
127.546
127.470
127.190
127.000
117.927
77.318
77.000
76.682
72.581
70.185
30.934
180
160
140
120
100
80
60
40
20
ppm

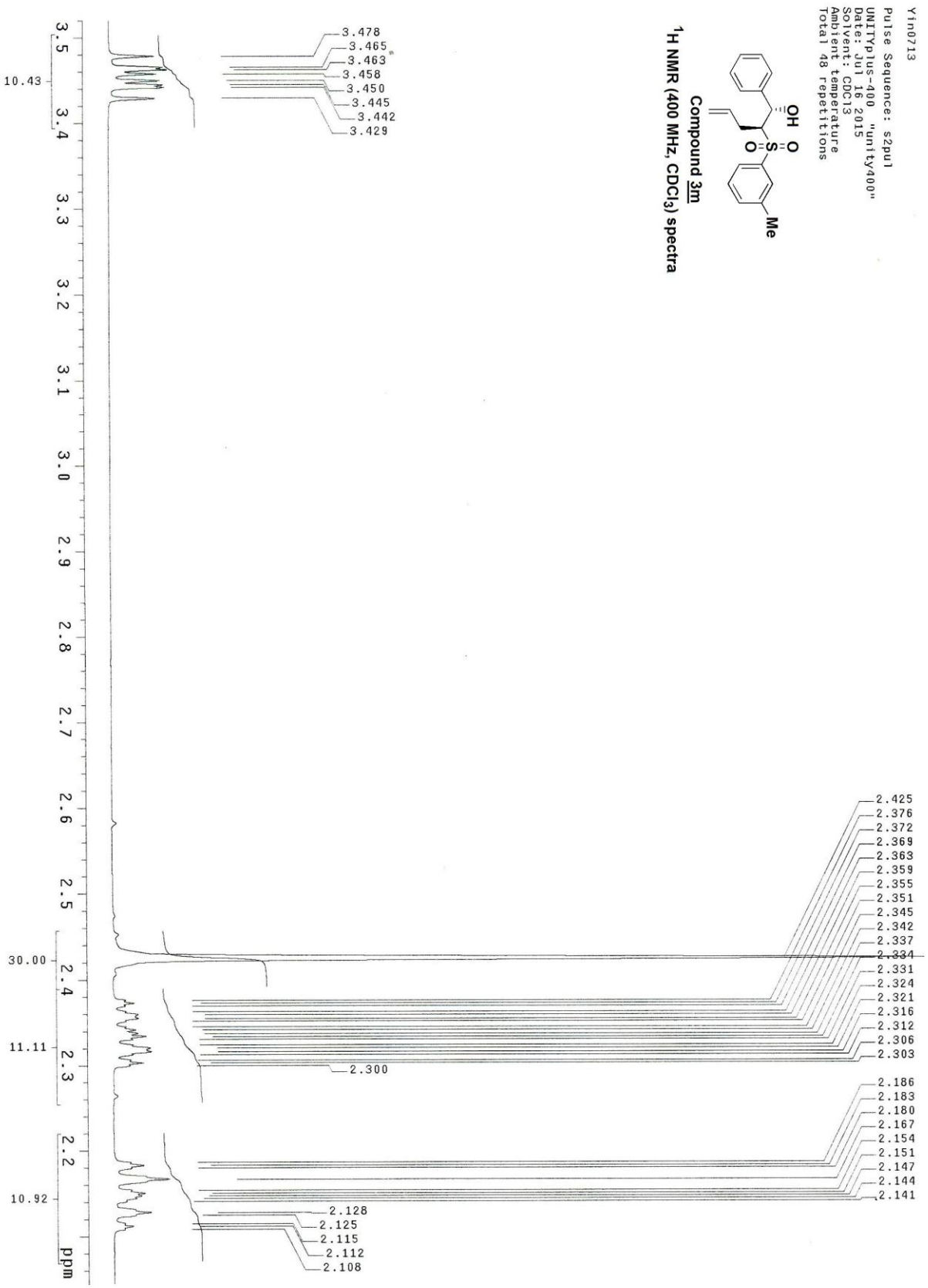

Kuo0626
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 29 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Compound 3l
1H NMR (400 MHz, CDCl3) spectra
7.897
7.895
7.877
7.873
7.645
7.626
7.557
7.537
7.519
7.298
7.292
7.284
7.278
7.272
5.097
5.076
4.758
4.755
4.733
4.730
4.624
4.620
4.582
4.578
3.478
3.476
3.457
19.88
10.42
20.80
52.77
9.99
10.78
10.49
10.59
6.75
11.11
11.39
11.34
ppm


Kuo0626
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 29 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Compound 3l
1H NMR (400 MHz, CDCl3) spectra
5.288
5.281
5.271
5.263
5.253
5.246
5.228
5.220
5.211
5.203
5.186
5.097
5.076
4.761
4.758
4.755
4.751
4.733
4.730
4.726
4.627
4.624
4.620
4.617
4.585
4.582
4.578
4.574
3.491
3.478
3.476
3.470
3.463
3.457
3.455
3.442
2.355
2.351
2.349
2.342
2.338
2.334
2.330
2.323
2.320
2.316
2.313
2.310
2.303
2.300
2.295
2.291
2.285
2.281
2.279
2.182
2.179
2.176
2.163
2.151
2.147
2.144
2.140
2.137
2.124
2.112
2.108
2.105
9.99
10.78
10.49
10.59
6.75
11.11
11.39
11.34
5.0
4.5
4.0
3.5
3.0
2.5
ppm


Kuo0626
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 29 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Compound 3l
1H NMR (400 MHz, CDCl3) spectra
19.88
10.42
20.80
52.77
7.902
7.897
7.895
7.882
7.877
7.873
7.666
7.663
7.660
7.649
7.645
7.640
7.629
7.626
7.623
7.561
7.557
7.553
7.537
7.523
7.519
7.298
7.292
7.284
7.278
7.272
7.269
7.264
7.260
7.257
7.252
7.9
7.8
7.7
7.6
7.5
7.4
7.3
ppm


Kuo0626
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 29 2015
Solvent: CDCl3
Ambient temperature
Total 608 repetitions
OH O
S
O
Compound 3l
13C NMR (100 MHz, CDCl3) spectra
139.364
138.462
133.861
132.890
129.100
128.653
128.494
128.479
127.182
117.661
77.318
77.000
76.682
72.914
70.253
30.934
180
160
140
120
100
80
60
40
20
ppm

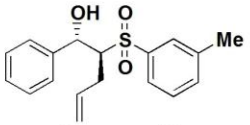

Yin0713
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 48 repetitions
OH
O
S
O
Me
Compound 3m
1H NMR (400 MHz, CDCl3) spectra
7.679
7.655
7.436
7.431
7.421
7.300
7.297
7.292
7.286
7.275
7.267
7.260
5.251
5.234
5.098
5.078
4.769
4.765
4.744
4.740
4.636
4.633
4.594
4.590
3.463
2.425
18.65
19.51
49.48
9.21
10.16
10.01
10.05
4.56
10.43
30.00
11.11
10.92
ppm


Yin0713
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 48 repetitions
OH O
S
O
Me
Compound 3m
1H NMR (400 MHz, CDCl3) spectra
3.478
3.465
3.463
3.458
3.450
3.445
3.442
3.429
10.43
30.00
11.11
10.92
2.425
2.376
2.372
2.369
2.363
2.359
2.355
2.351
2.345
2.342
2.337
2.334
2.331
2.324
2.321
2.316
2.312
2.306
2.303
2.300
2.186
2.183
2.180
2.167
2.154
2.151
2.147
2.144
2.141
2.128
2.125
2.115
2.112
2.108
ppm

Yin0713

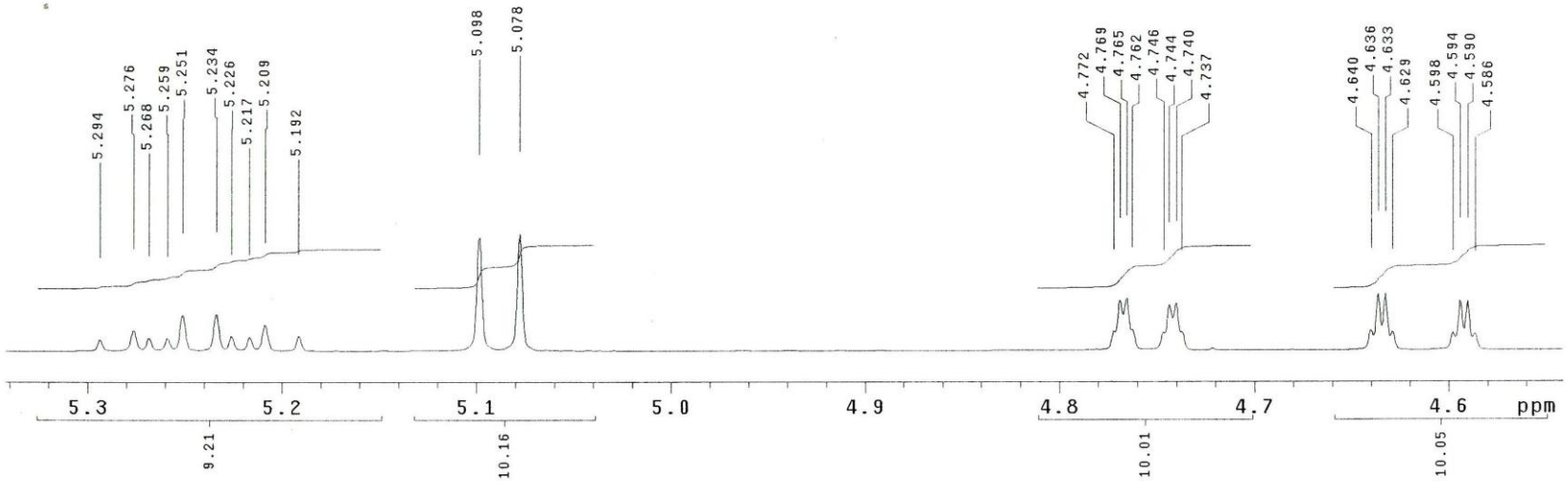
Pulse Sequence: s2pul

UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 48 repetitions



Compound 3m

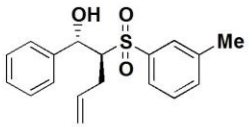
^{1}H NMR (400 MHz, $CDCl_3$) spectra



Yin0713

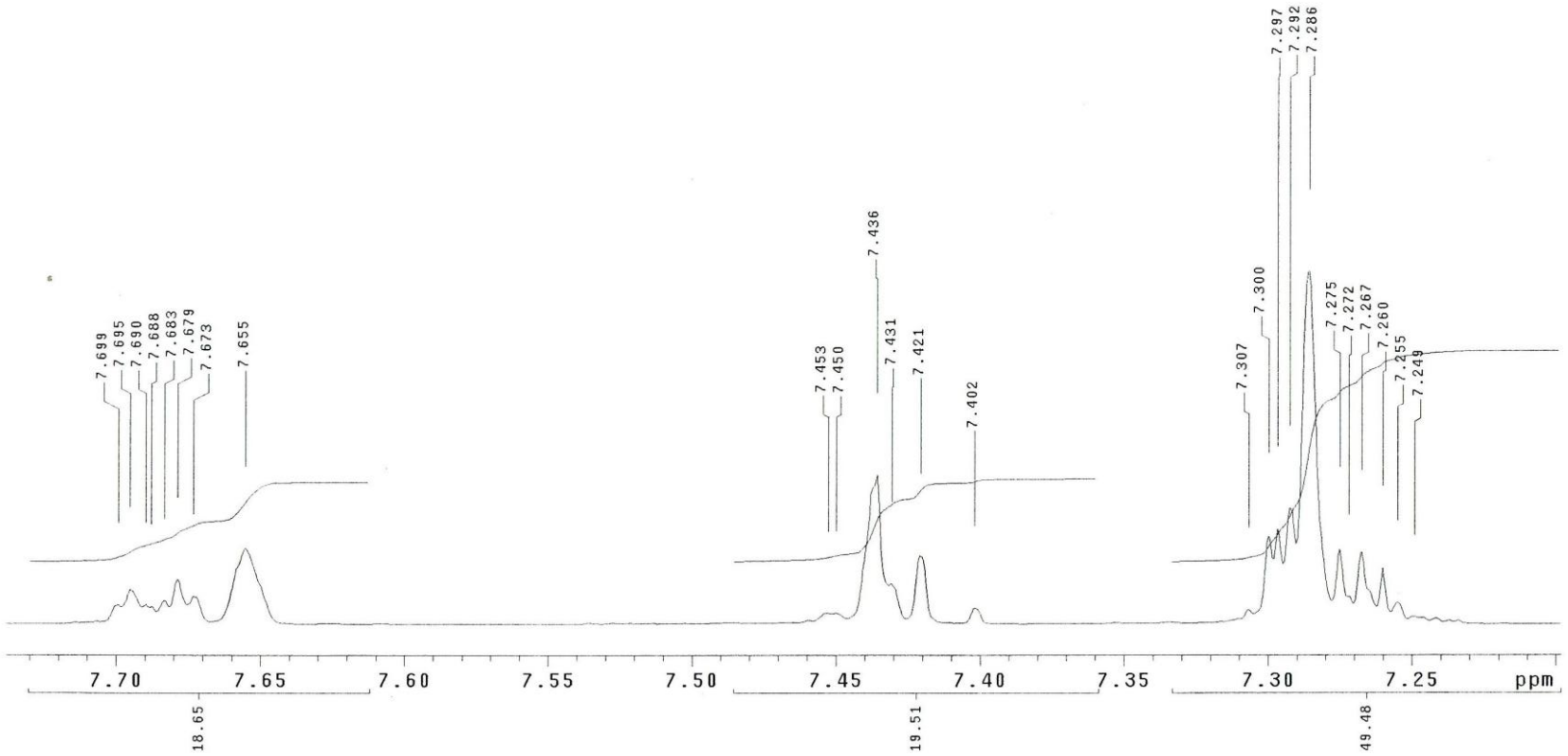
Pulse Sequence: s2pul

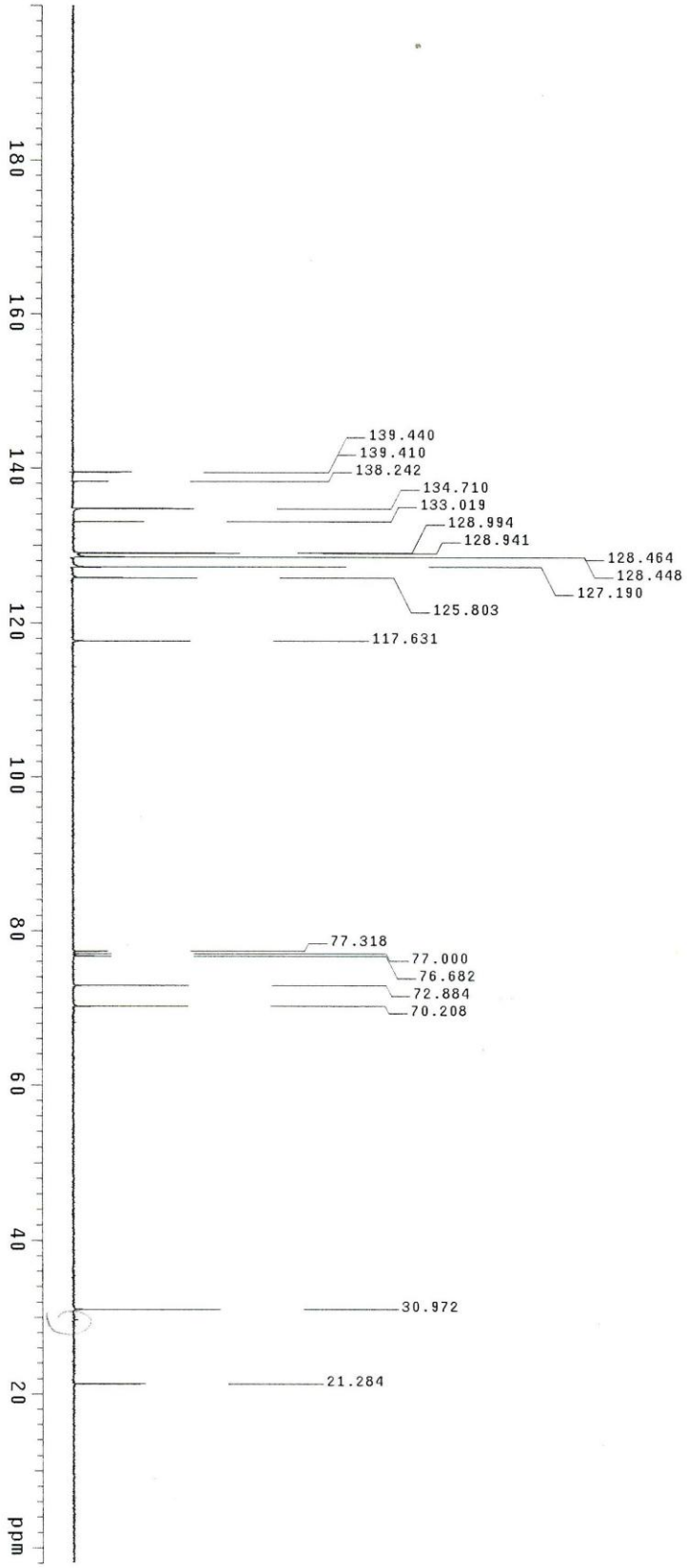
UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 48 repetitions

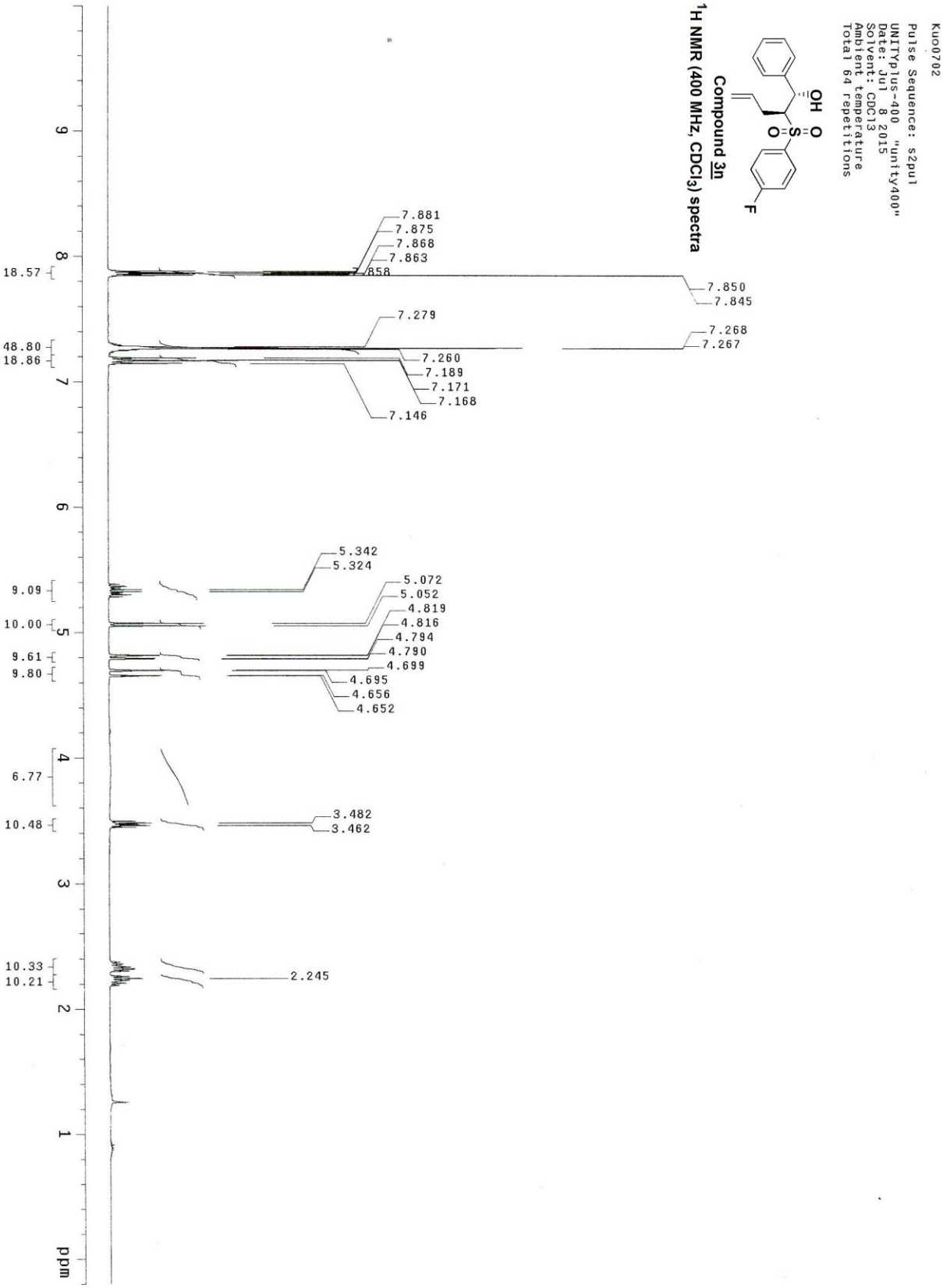


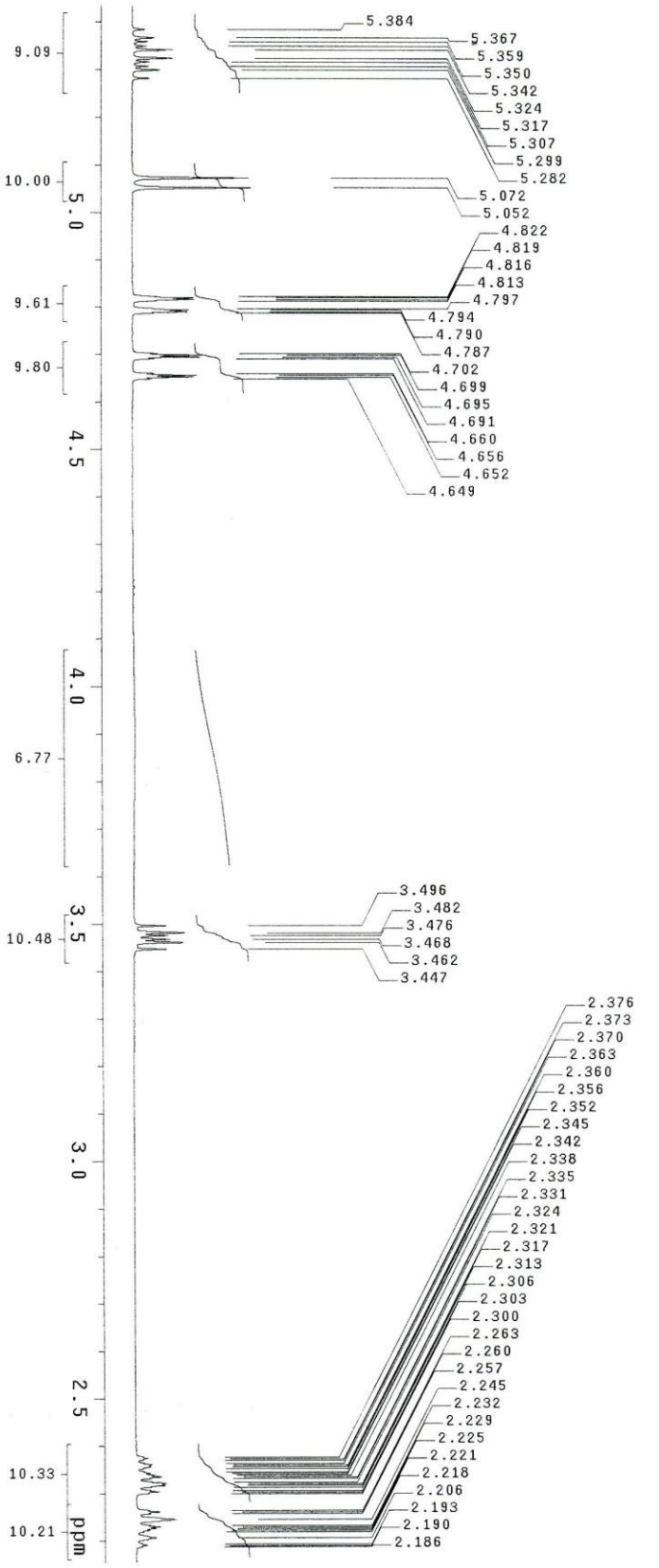
Compound 3m

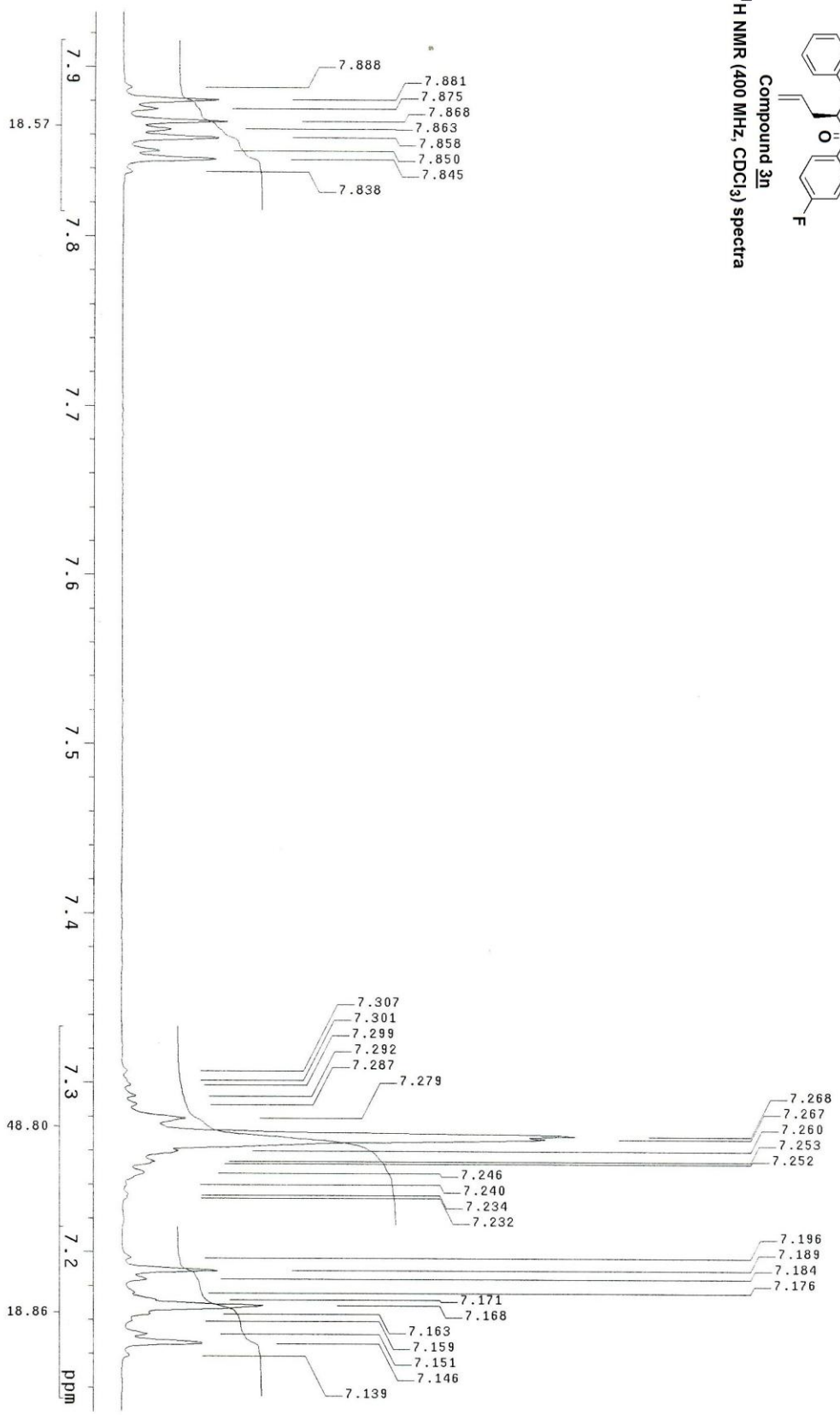
^{1}H NMR (400 MHz, $CDCl_3$) spectra

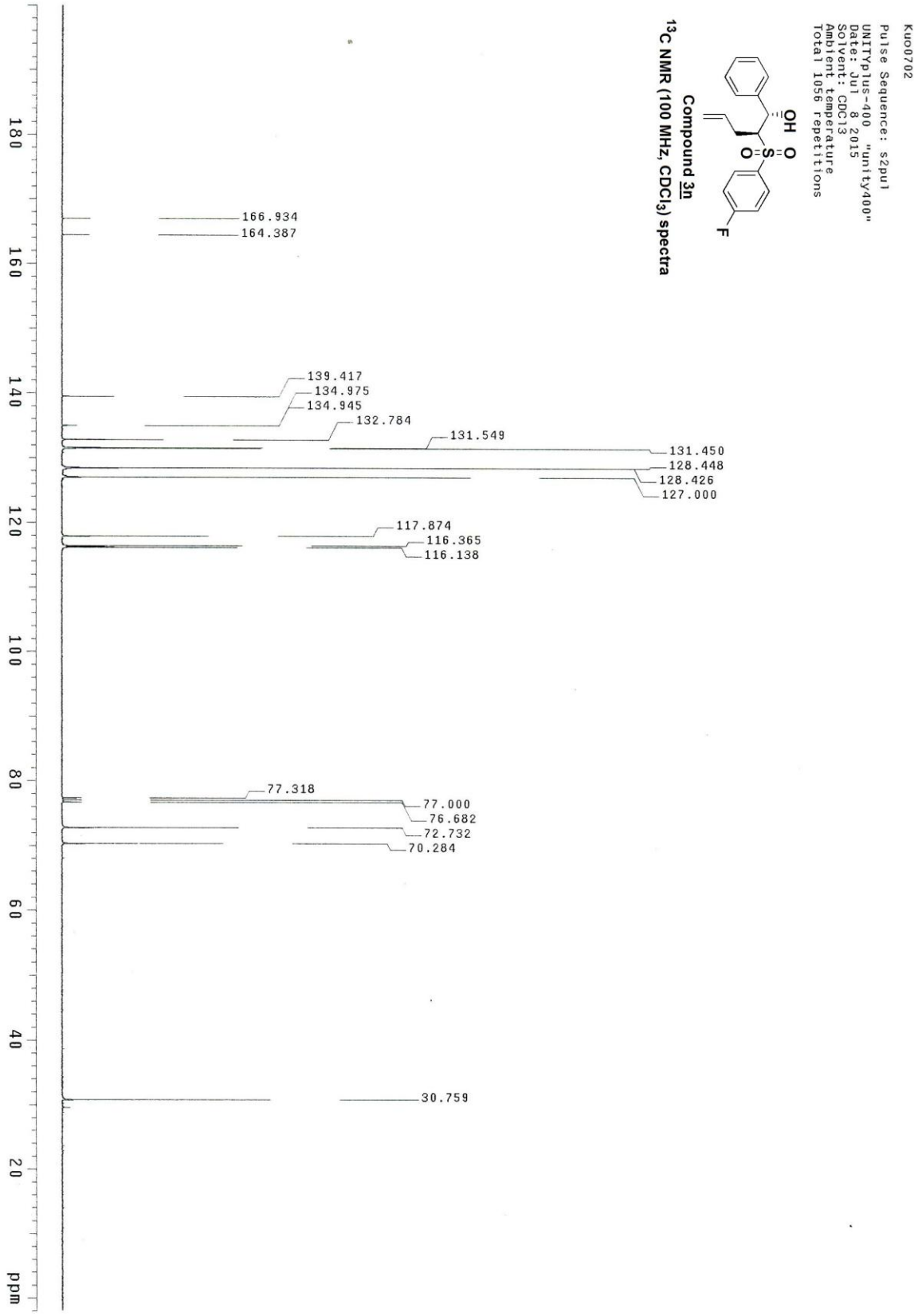


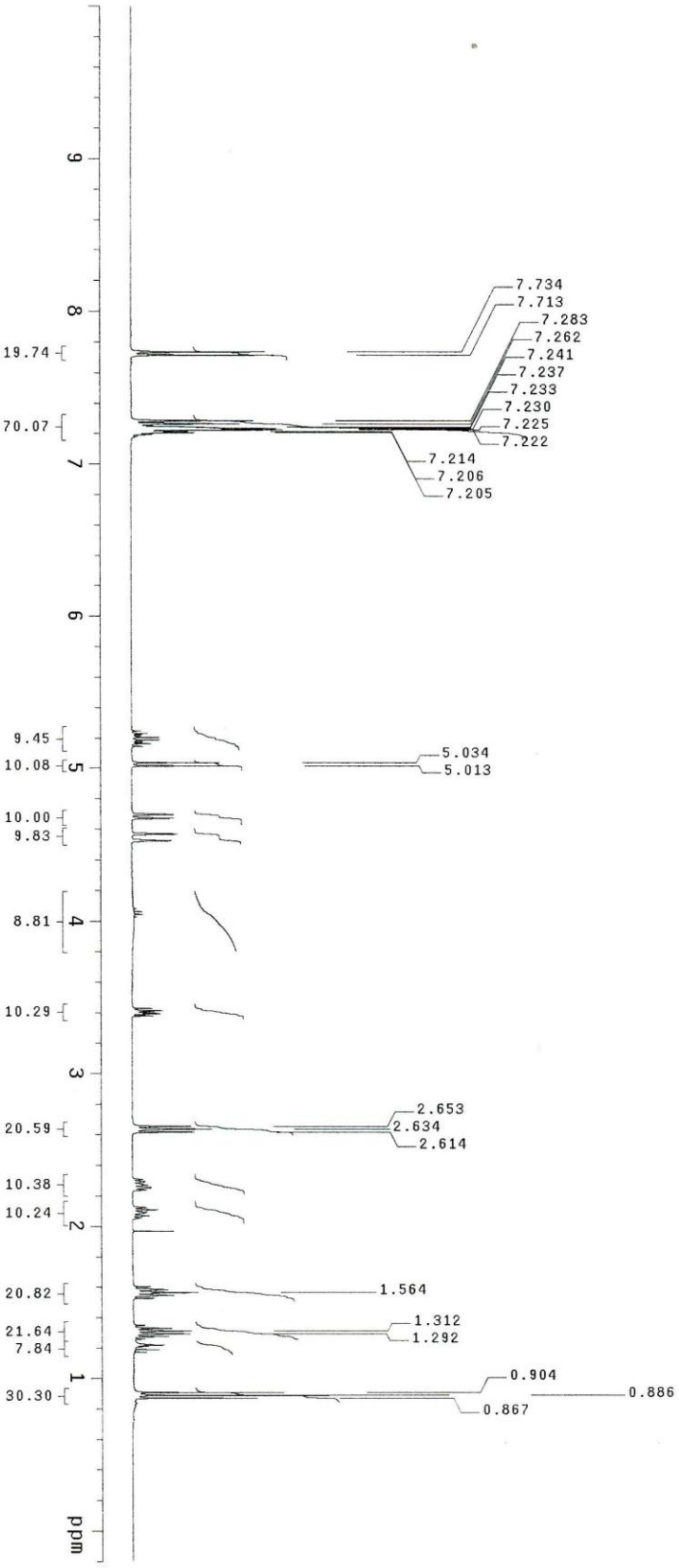

Yin0713
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 1824 repetitions
OH
O
S
O
Me
Compound 3m
13C NMR (100 MHz, CDCl3) spectra
139.440
139.410
138.242
134.710
133.019
128.994
128.941
128.464
128.448
127.190
125.803
117.631
77.318
77.000
76.682
72.884
70.208
30.972
21.284
ppm

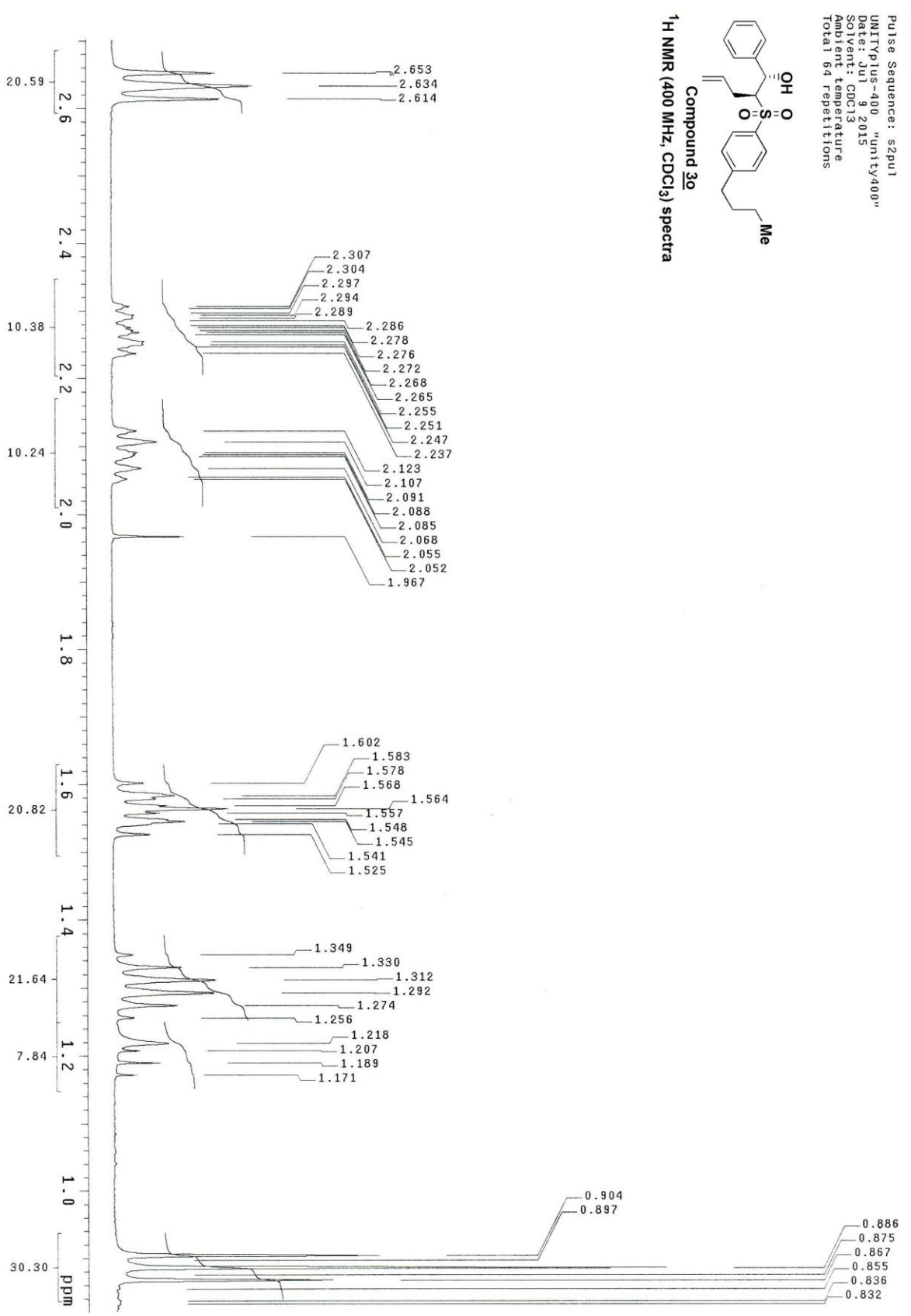

Kuo0702
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 8 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
F
Compound 3n
1H NMR (400 MHz, CDCl3) spectra
7.881
7.875
7.868
7.863
7.858
7.850
7.845
7.279
7.268
7.267
7.260
7.189
7.171
7.168
7.146
5.342
5.324
5.072
5.052
4.819
4.816
4.794
4.790
4.699
4.695
4.656
4.652
3.482
3.462
2.245
18.57
48.80
18.86
9.09
10.00
9.61
9.80
6.77
10.48
10.33
10.21
ppm

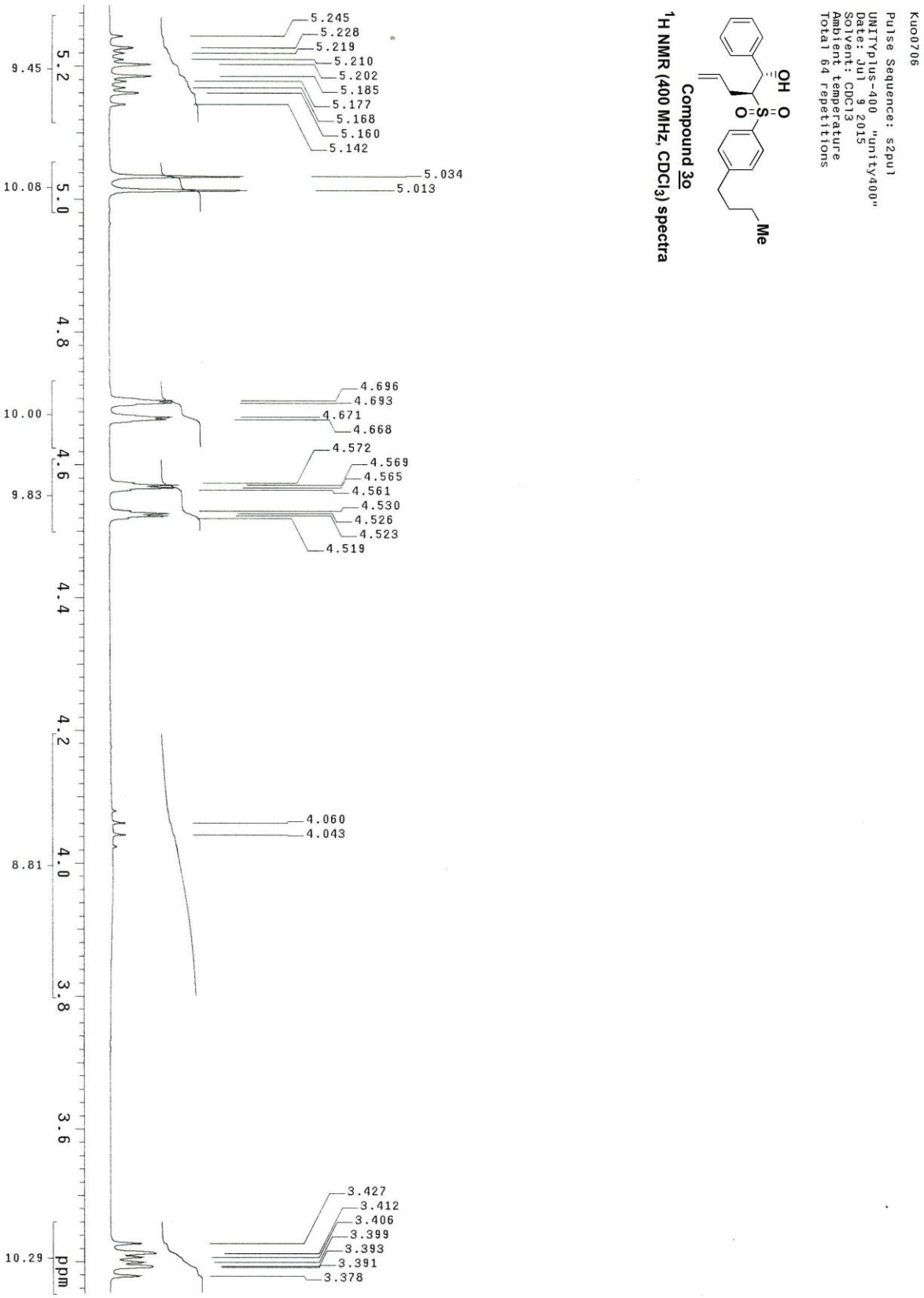

Kuo0702
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 8 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
F
Compound 3n
1H NMR (400 MHz, CDCl3) spectra
5.384
5.367
5.359
5.350
5.342
5.324
5.317
5.307
5.299
5.282
5.072
5.052
4.822
4.819
4.816
4.813
4.797
4.794
4.790
4.787
4.702
4.699
4.695
4.691
4.660
4.656
4.652
4.649
3.496
3.482
3.476
3.468
3.462
3.447
2.376
2.373
2.370
2.363
2.360
2.356
2.352
2.345
2.342
2.338
2.335
2.331
2.324
2.321
2.317
2.313
2.306
2.303
2.300
2.263
2.260
2.257
2.245
2.232
2.229
2.225
2.221
2.218
2.206
2.193
2.190
2.186
9.09
10.00
9.61
9.80
6.77
10.48
10.33
10.21
5.0
4.5
4.0
3.5
3.0
2.5
ppm


Kuo0702
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 8 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH
O
S
O
F
Compound 3n
1H NMR (400 MHz, CDCl3) spectra
18.57
48.80
18.86
7.888
7.881
7.875
7.868
7.863
7.858
7.850
7.845
7.838
7.307
7.301
7.299
7.292
7.287
7.279
7.268
7.267
7.260
7.253
7.252
7.246
7.240
7.234
7.232
7.196
7.189
7.184
7.176
7.171
7.168
7.163
7.159
7.151
7.146
7.139
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
ppm


Kuo0702
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 8 2015
Solvent: CDCl3
Ambient temperature
Total 1056 repetitions
OH O
S
O
F
Compound 3n
13C NMR (100 MHz, CDCl3) spectra
166.934
164.387
139.417
134.975
134.945
132.784
131.549
131.450
128.448
128.426
127.000
117.874
116.365
116.138
77.318
77.000
76.682
72.732
70.284
30.759
180
160
140
120
100
80
60
40
20
ppm

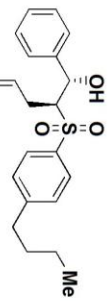

Kuo0706
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Me
Compound 3o
1H NMR (400 MHz, CDCl3) spectra
7.734
7.713
7.283
7.262
7.241
7.237
7.233
7.230
7.225
7.222
7.214
7.206
7.205
5.034
5.013
2.653
2.634
2.614
1.564
1.312
1.292
0.904
0.886
0.867
19.74
70.07
9.45
10.08
10.00
9.83
8.81
10.29
20.59
10.38
10.24
20.82
21.64
7.84
30.30
ppm


Kuo0706
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Me
Compound 3o
1H NMR (400 MHz, CDCl3) spectra
2.653
2.634
2.614
2.307
2.304
2.297
2.294
2.289
2.286
2.278
2.276
2.272
2.268
2.265
2.255
2.251
2.247
2.237
2.123
2.107
2.091
2.088
2.085
2.068
2.055
2.052
1.967
1.602
1.583
1.578
1.568
1.564
1.557
1.548
1.545
1.541
1.525
1.349
1.330
1.312
1.292
1.274
1.256
1.218
1.207
1.189
1.171
0.904
0.897
0.886
0.875
0.867
0.855
0.836
0.832
20.59
10.38
10.24
20.82
21.64
7.84
30.30
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
ppm


Kuo0706
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH O
S
O
Me
Compound 3o
1H NMR (400 MHz, CDCl3) spectra
5.245
5.228
5.219
5.210
5.202
5.185
5.177
5.168
5.160
5.142
5.034
5.013
4.696
4.693
4.671
4.668
4.572
4.569
4.565
4.561
4.530
4.526
4.523
4.519
4.060
4.043
3.427
3.412
3.406
3.399
3.393
3.391
3.378
9.45
10.08
10.00
9.83
8.81
10.29
ppm

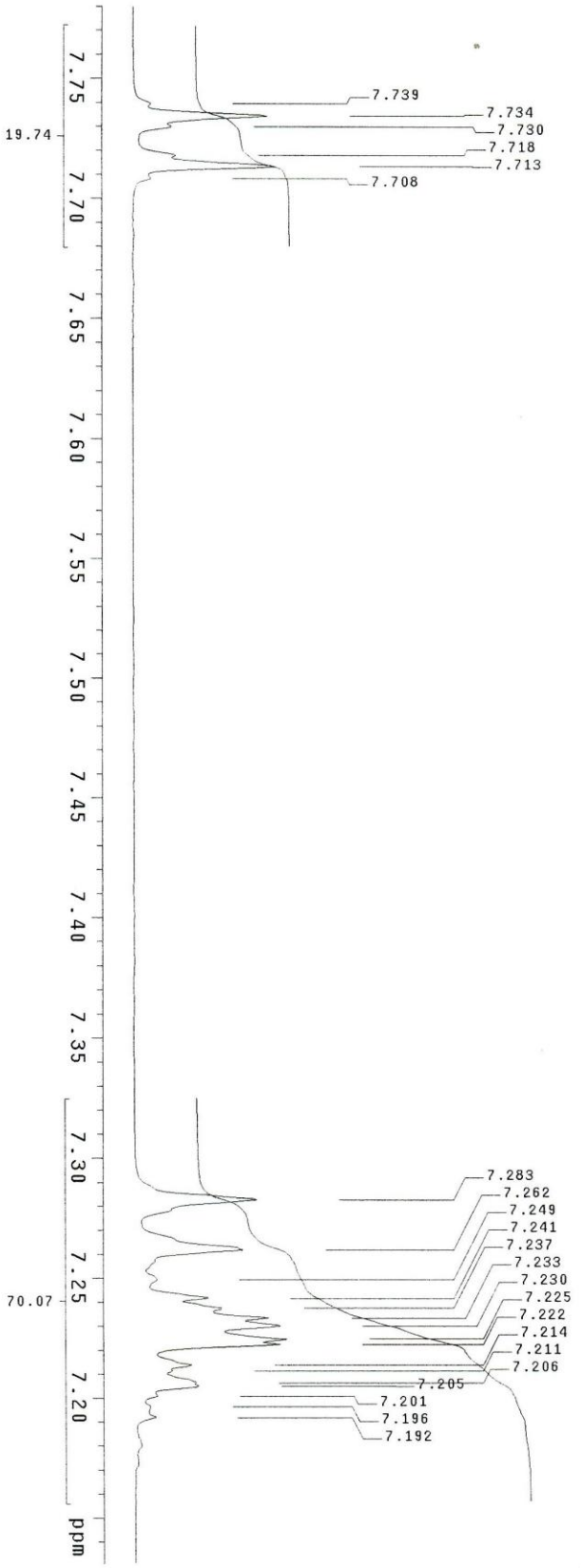
Kuo0706

Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions



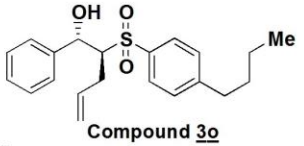
Compound 3o

^{1}H NMR (400 MHz, $CDCl_3$) spectra



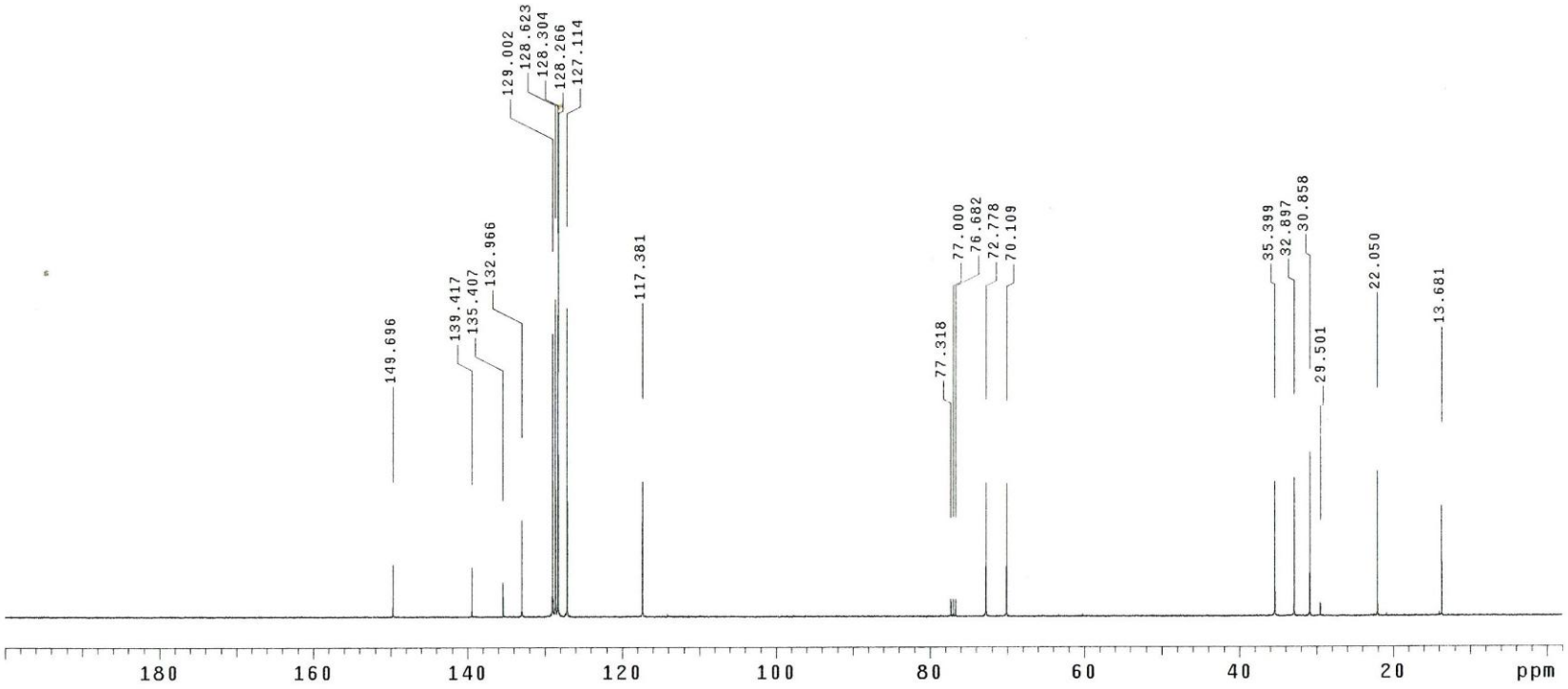
Kuo0706

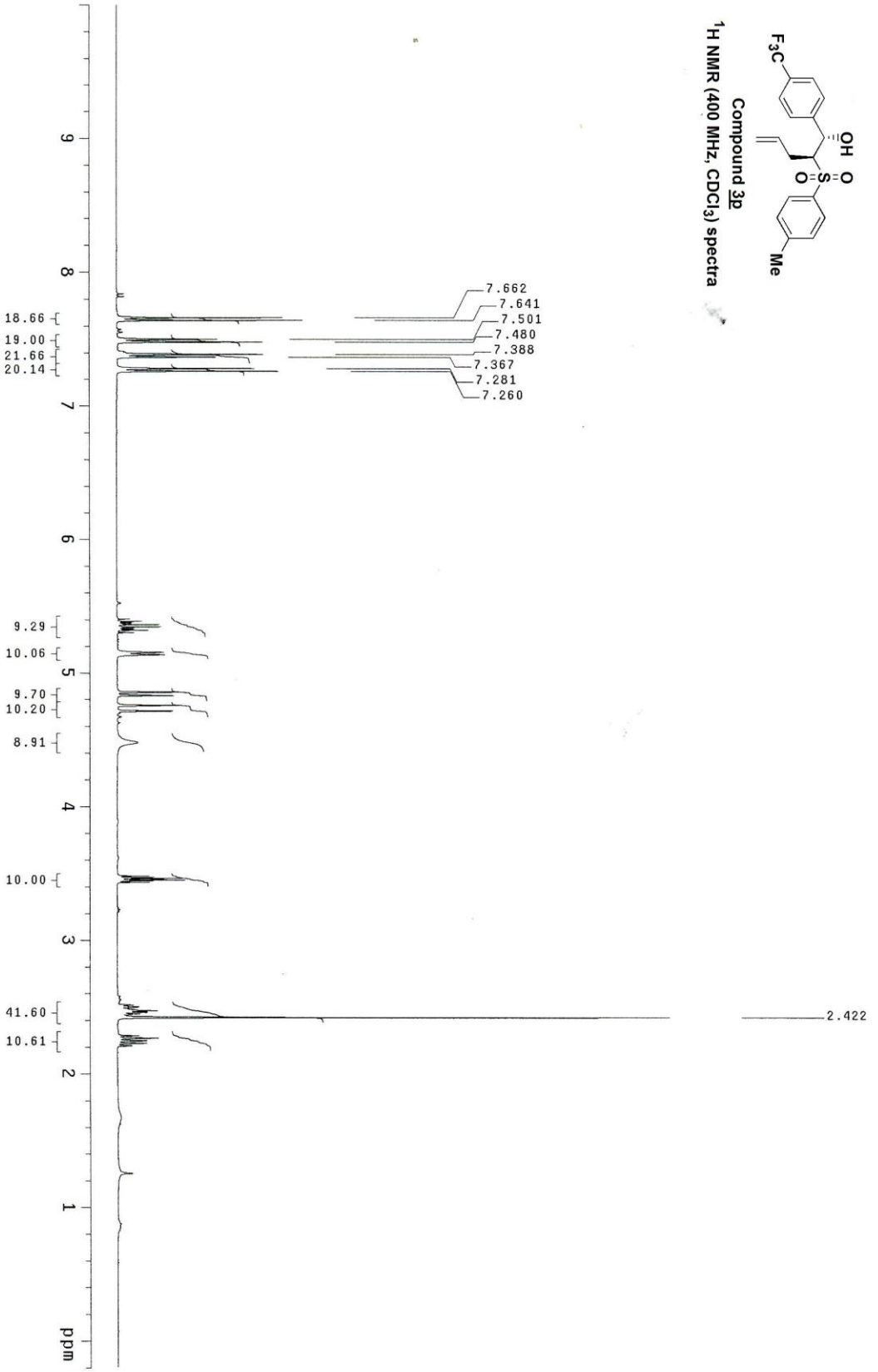
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 416 repetitions

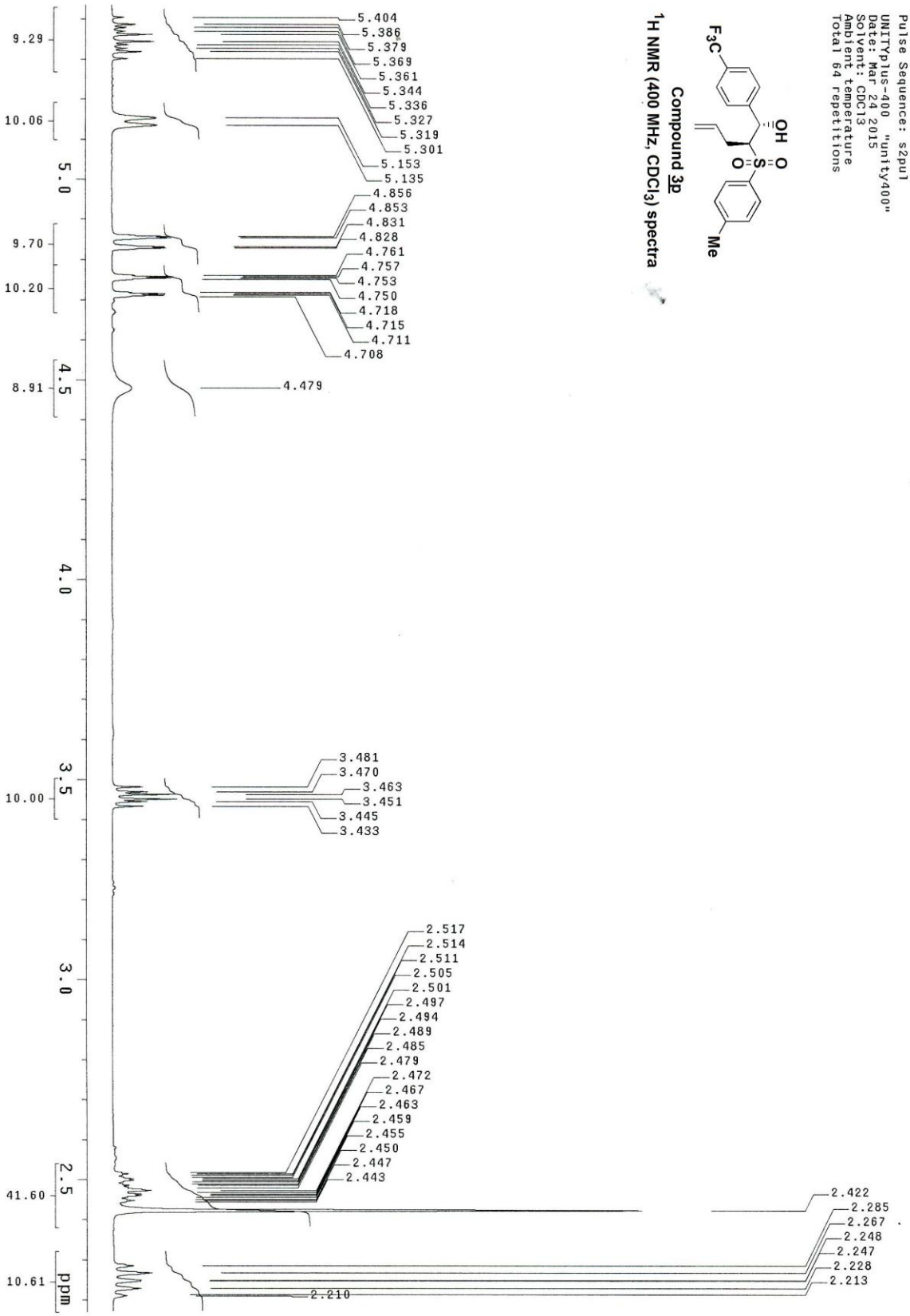


Compound 3o

^{13}C NMR (100 MHz, $CDCl_3$) spectra



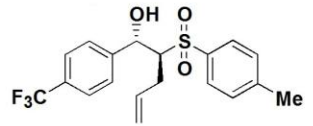

Kuo0321
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F3C
OH O
S
O
Me
Compound 3p
1H NMR (400 MHz, CDCl3) spectra
7.662
7.641
7.501
7.480
7.388
7.367
7.281
7.260
2.422
18.66
19.00
21.66
20.14
9.29
10.06
9.70
10.20
8.91
10.00
41.60
10.61
ppm


Kuo0321
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F3C
OH O
S
O
Me
Compound 3p
1H NMR (400 MHz, CDCl3) spectra
9.29
10.06
9.70
10.20
8.91
10.00
41.60
10.61
5.404
5.386
5.379
5.369
5.361
5.344
5.336
5.327
5.319
5.301
5.153
5.135
4.856
4.853
4.831
4.828
4.761
4.757
4.753
4.750
4.718
4.715
4.711
4.708
4.479
3.481
3.470
3.463
3.451
3.445
3.433
2.517
2.514
2.511
2.505
2.501
2.497
2.494
2.489
2.485
2.479
2.472
2.467
2.463
2.459
2.455
2.450
2.447
2.443
2.422
2.285
2.267
2.248
2.247
2.228
2.213
2.210
5.0
4.0
3.5
3.0
2.5
ppm

Kuo0321

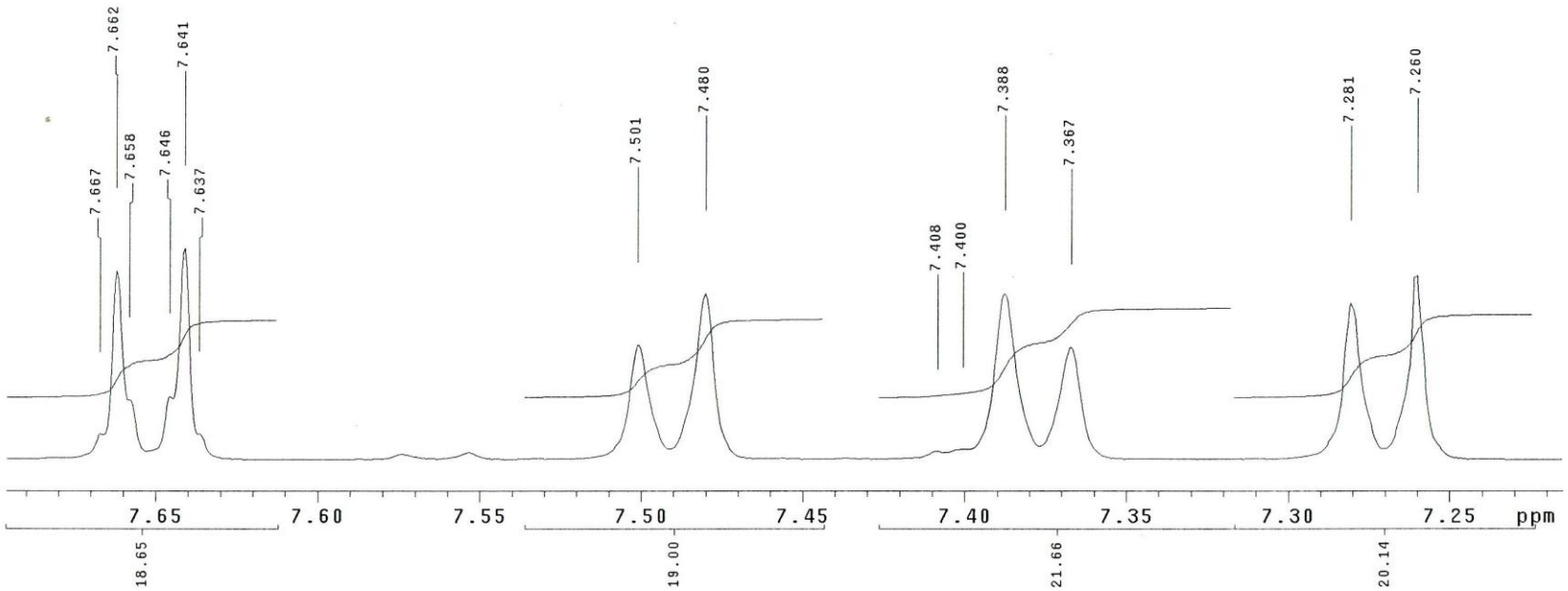
Pulse Sequence: s2pul

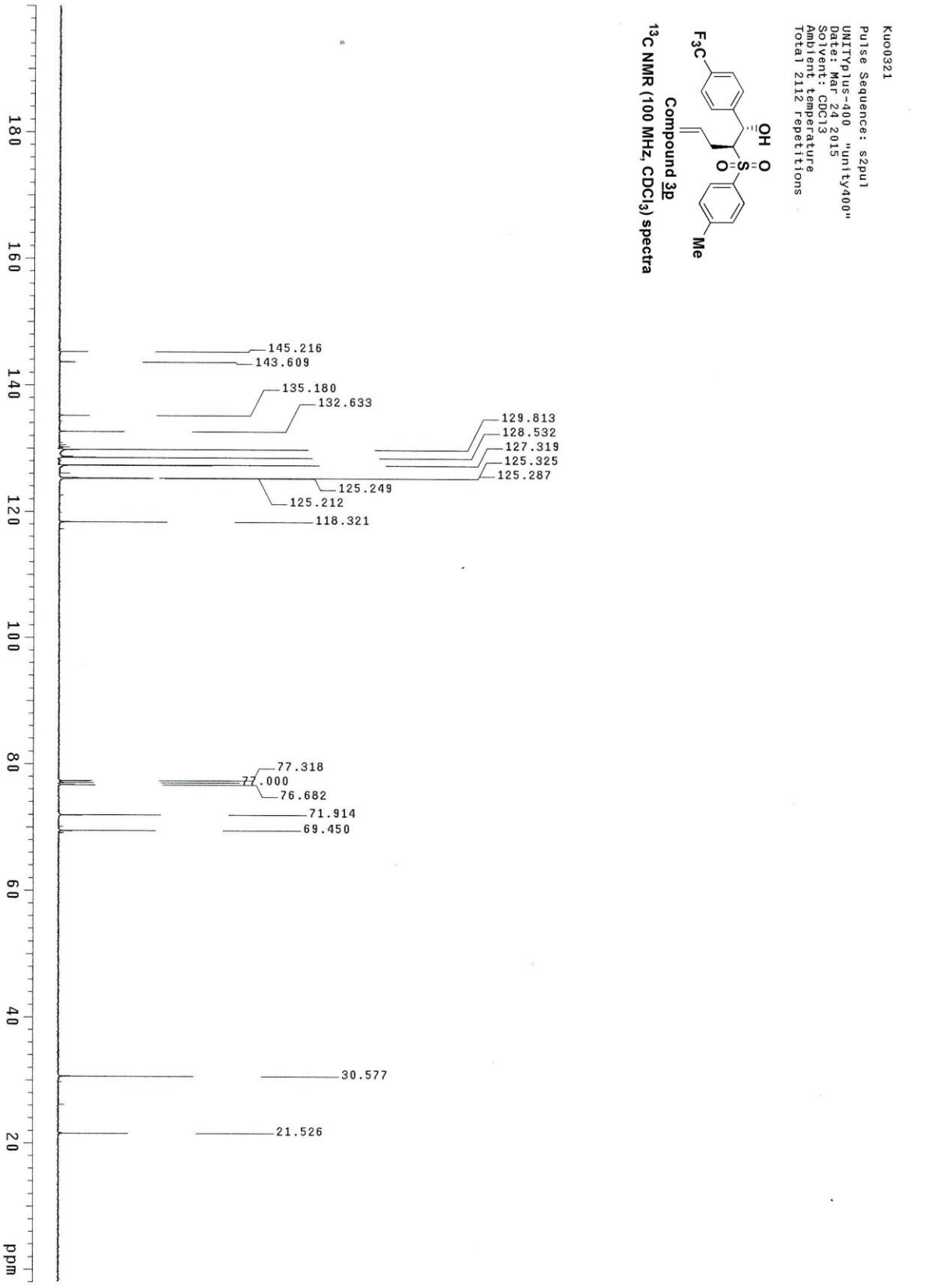
UNITYplus-400 "unity400"
Date: Mar 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

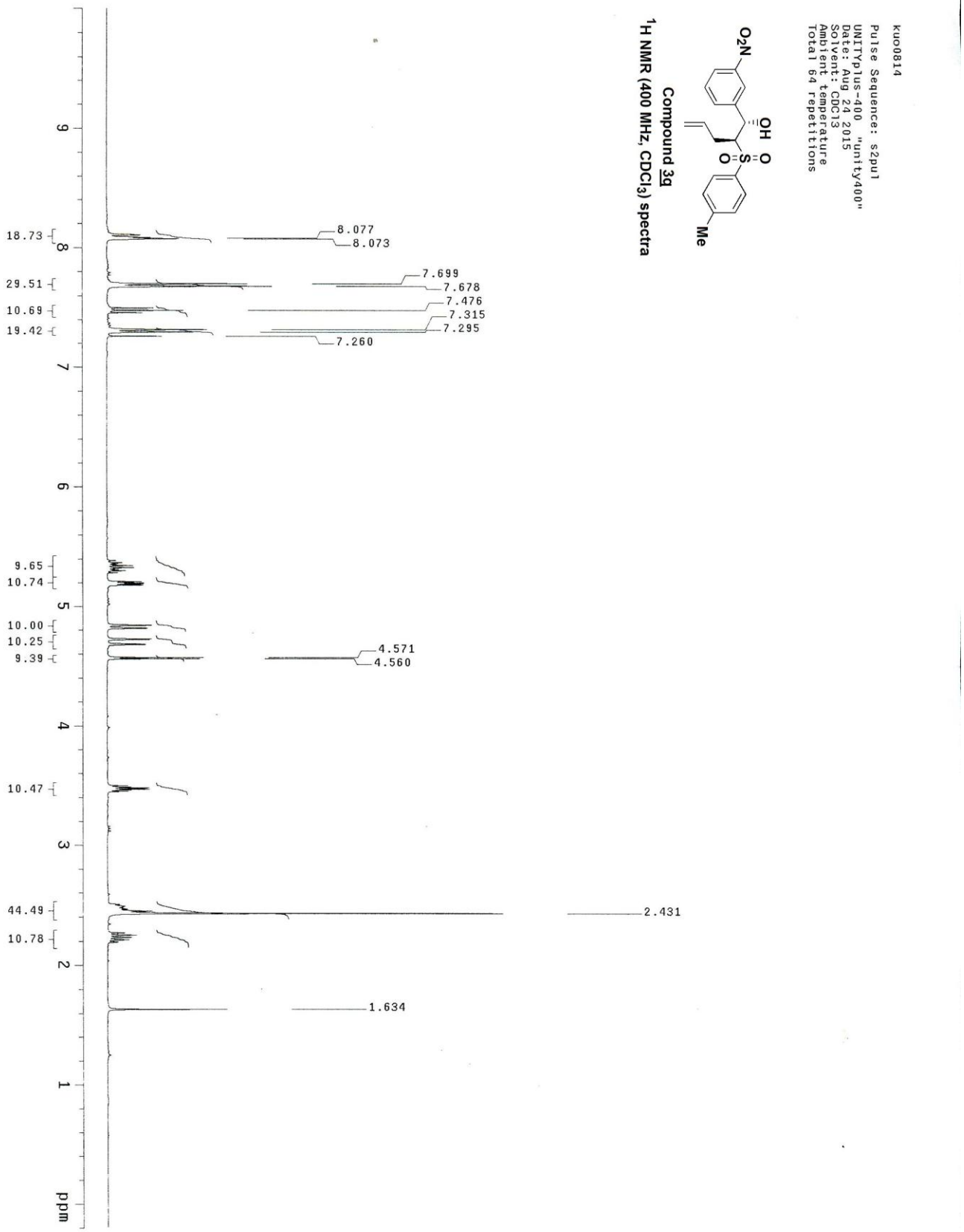


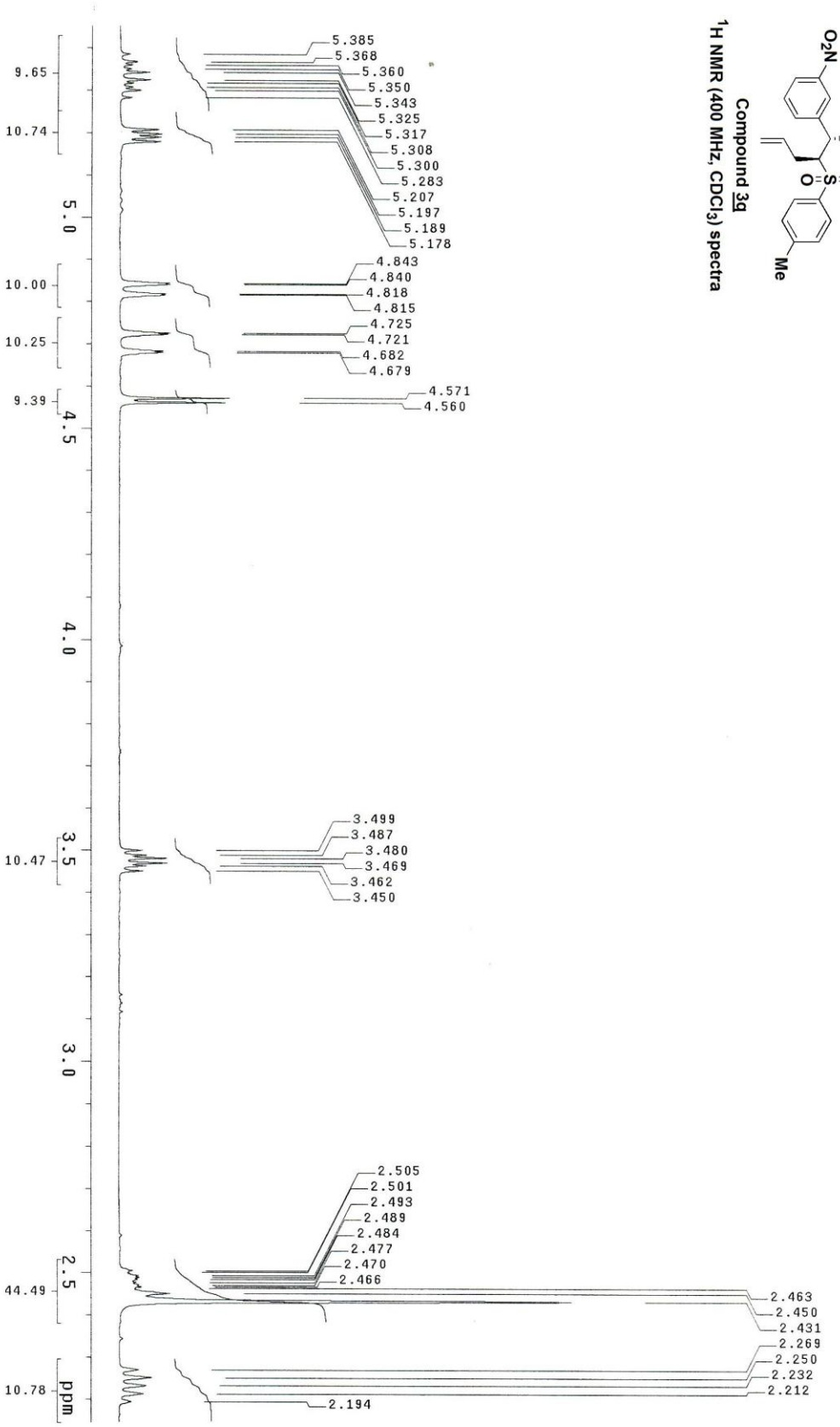
Compound 3p

^{1}H NMR (400 MHz, $CDCl_3$) spectra




Kuo0321
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 24 2015
Solvent: CDCl3
Ambient temperature
Total 2112 repetitions
F3C
OH O
S
O
Me
Compound 3p
13C NMR (100 MHz, CDCl3) spectra
145.216
143.609
135.180
132.633
129.813
128.532
127.319
125.325
125.287
125.249
125.212
118.321
77.318
77.000
76.682
71.914
69.450
30.577
21.526
ppm

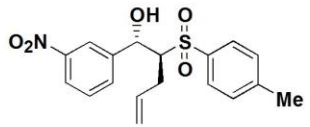

kuo0814
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
O2N
OH O
S
O
Me
Compound 3g
1H NMR (400 MHz, CDCl3) spectra
18.73
29.51
10.69
19.42
9.65
10.74
10.00
10.25
9.39
10.47
44.49
10.78
8.077
8.073
7.699
7.678
7.476
7.315
7.295
7.260
4.571
4.560
2.431
1.634
ppm


kuo0814
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 3q
1H NMR (400 MHz, CDCl3) spectra
O2N
OH O
S
O
Me
5.385
5.368
5.360
5.350
5.343
5.325
5.317
5.308
5.300
5.283
5.207
5.197
5.189
5.178
4.843
4.840
4.818
4.815
4.725
4.721
4.682
4.679
4.571
4.560
3.499
3.487
3.480
3.469
3.462
3.450
2.505
2.501
2.493
2.489
2.484
2.477
2.470
2.466
2.463
2.450
2.431
2.269
2.250
2.232
2.212
2.194
9.65
10.74
10.00
10.25
9.39
10.47
44.49
10.78
5.0
4.5
4.0
3.5
3.0
2.5
ppm

kuo0814

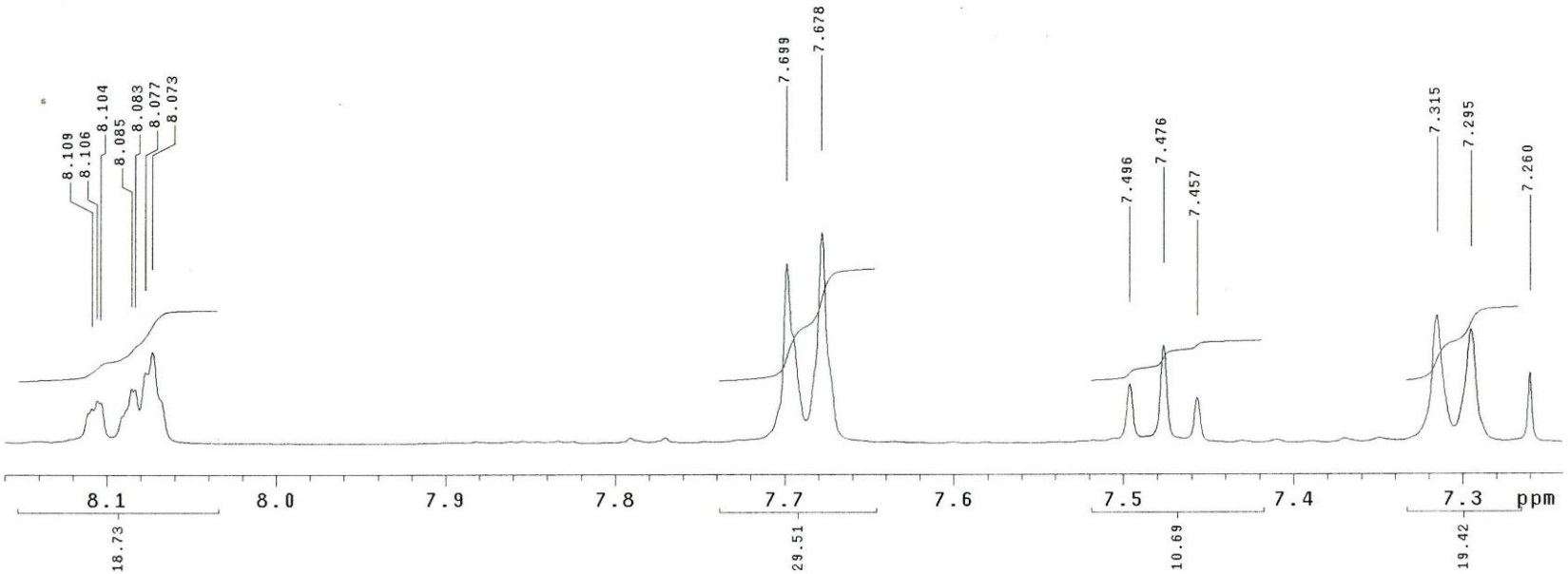
Pulse Sequence: s2pul

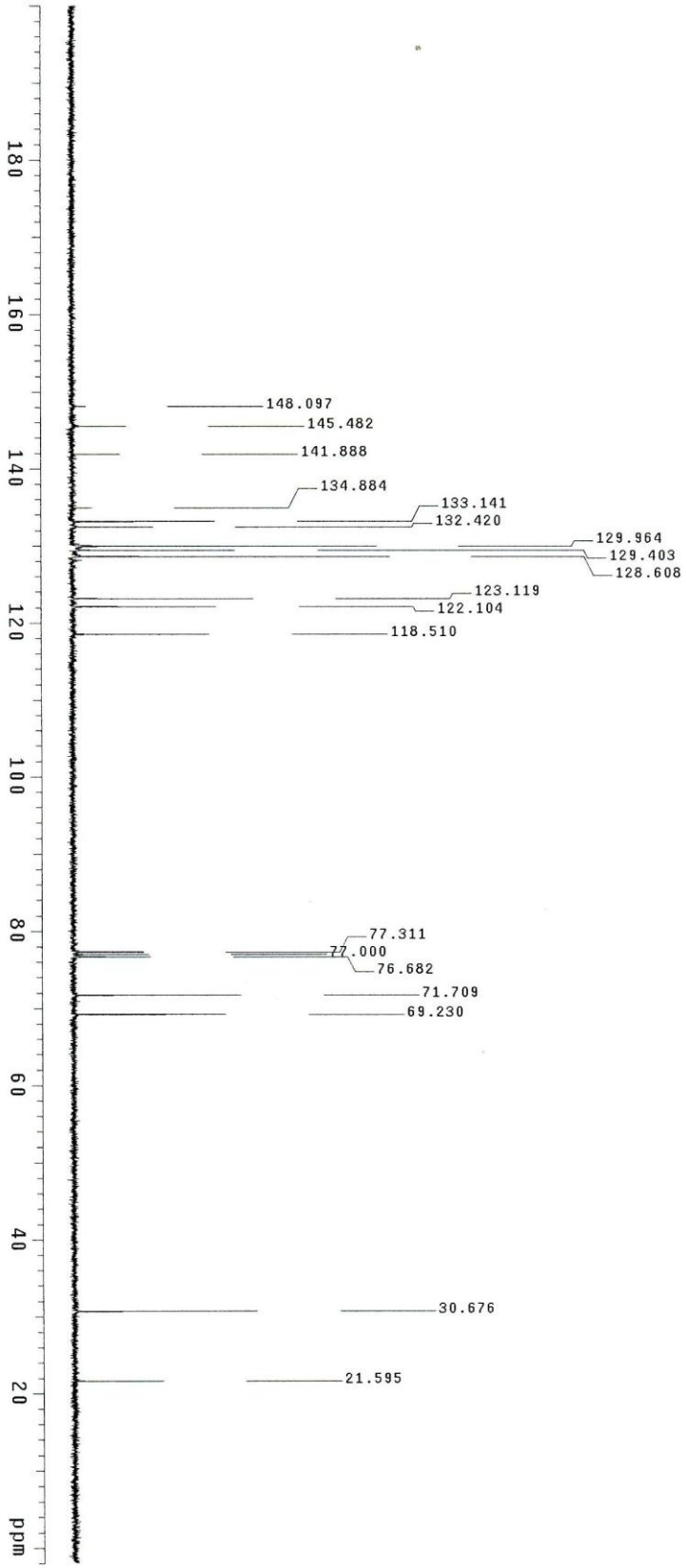
UNITYplus-400 "unity400"
Date: Aug 24 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

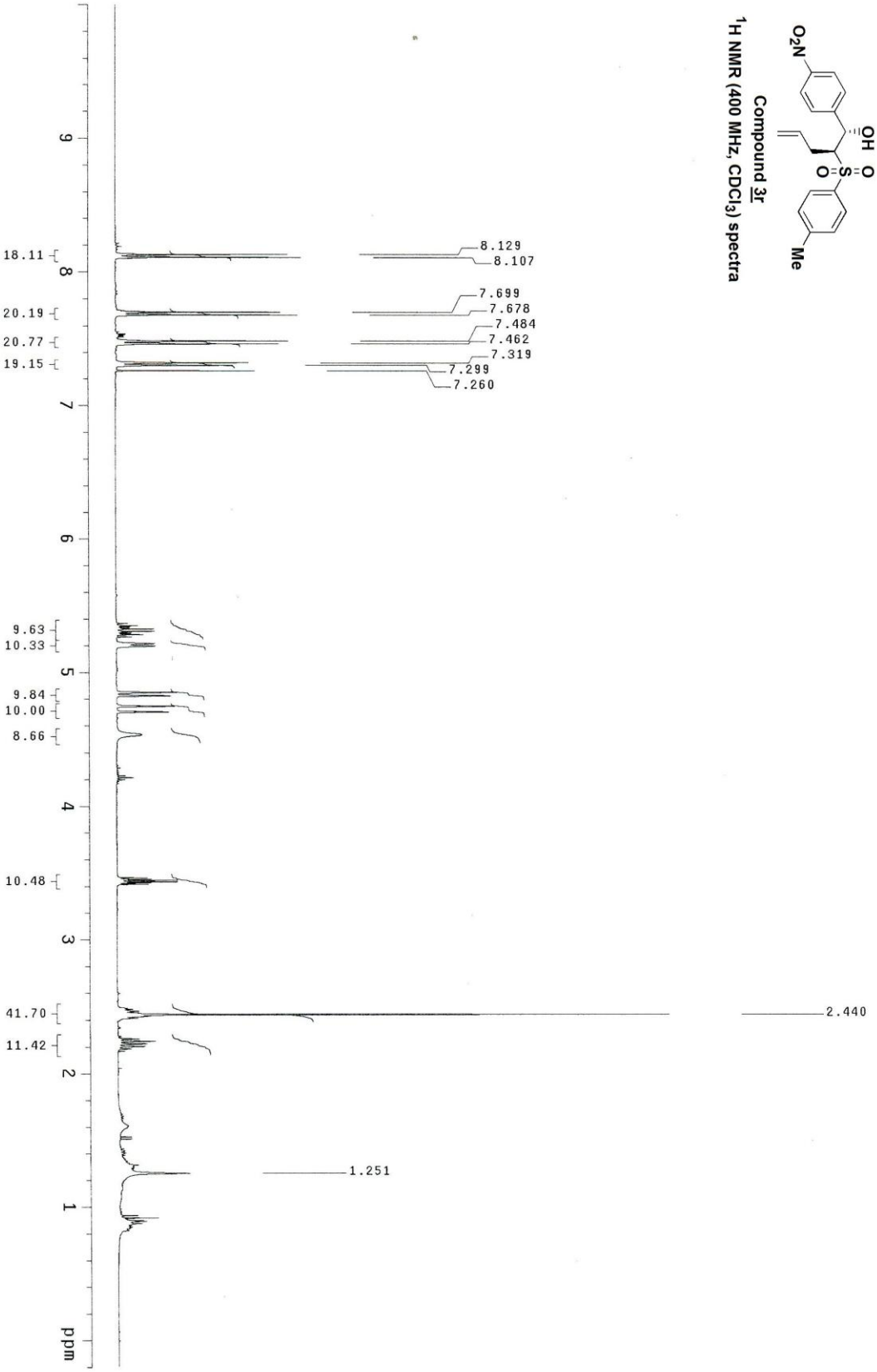


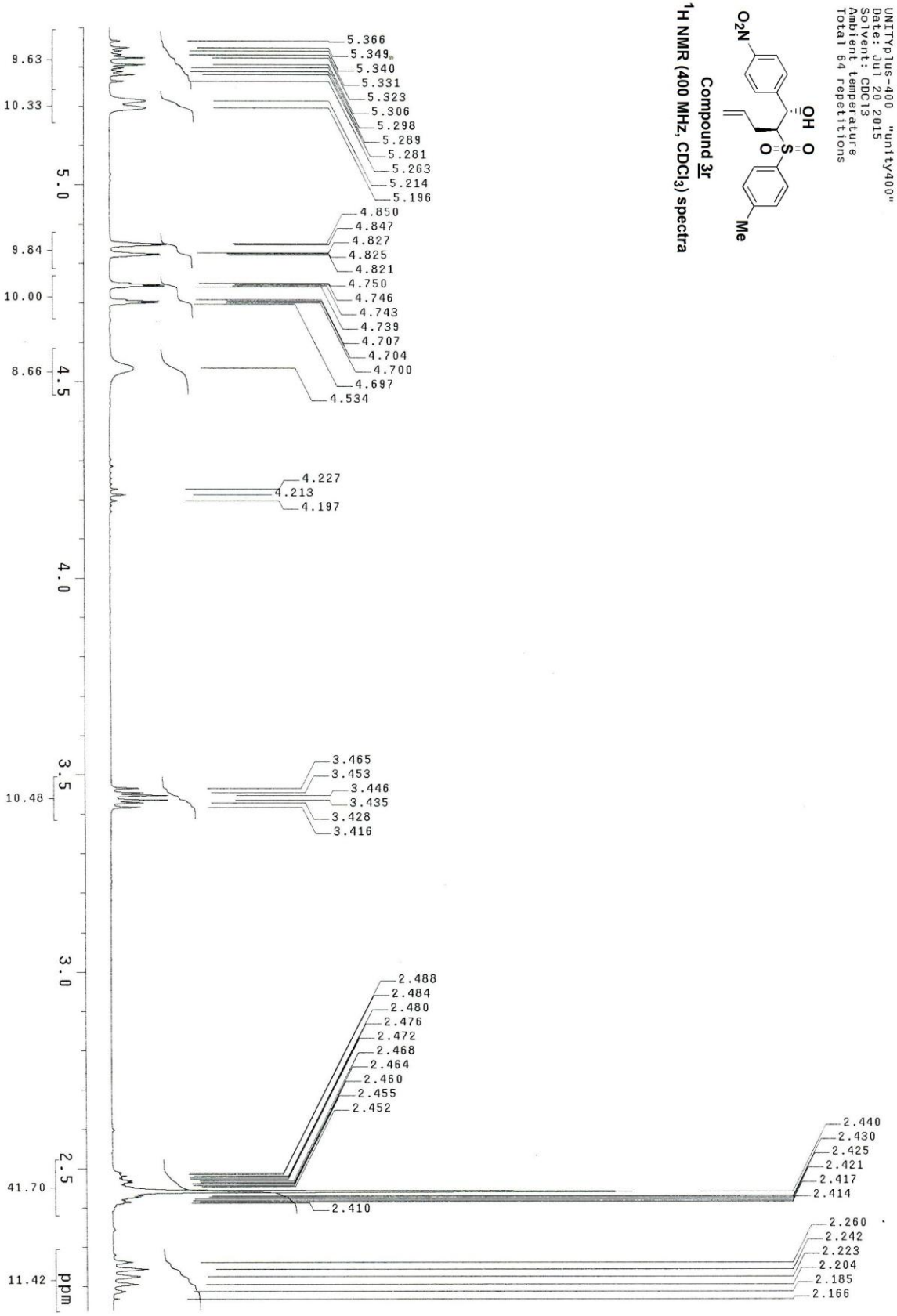
Compound 3q

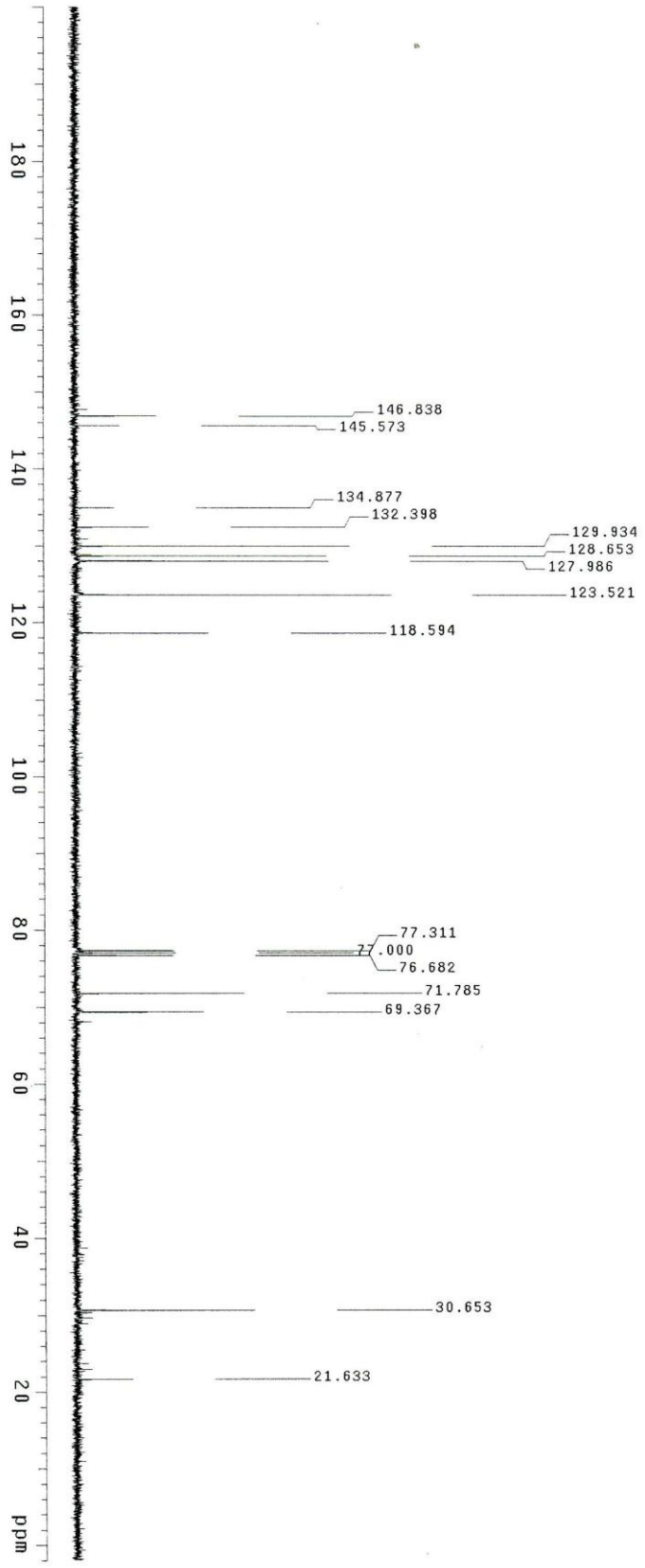
^{1}H NMR (400 MHz, $CDCl_3$) spectra

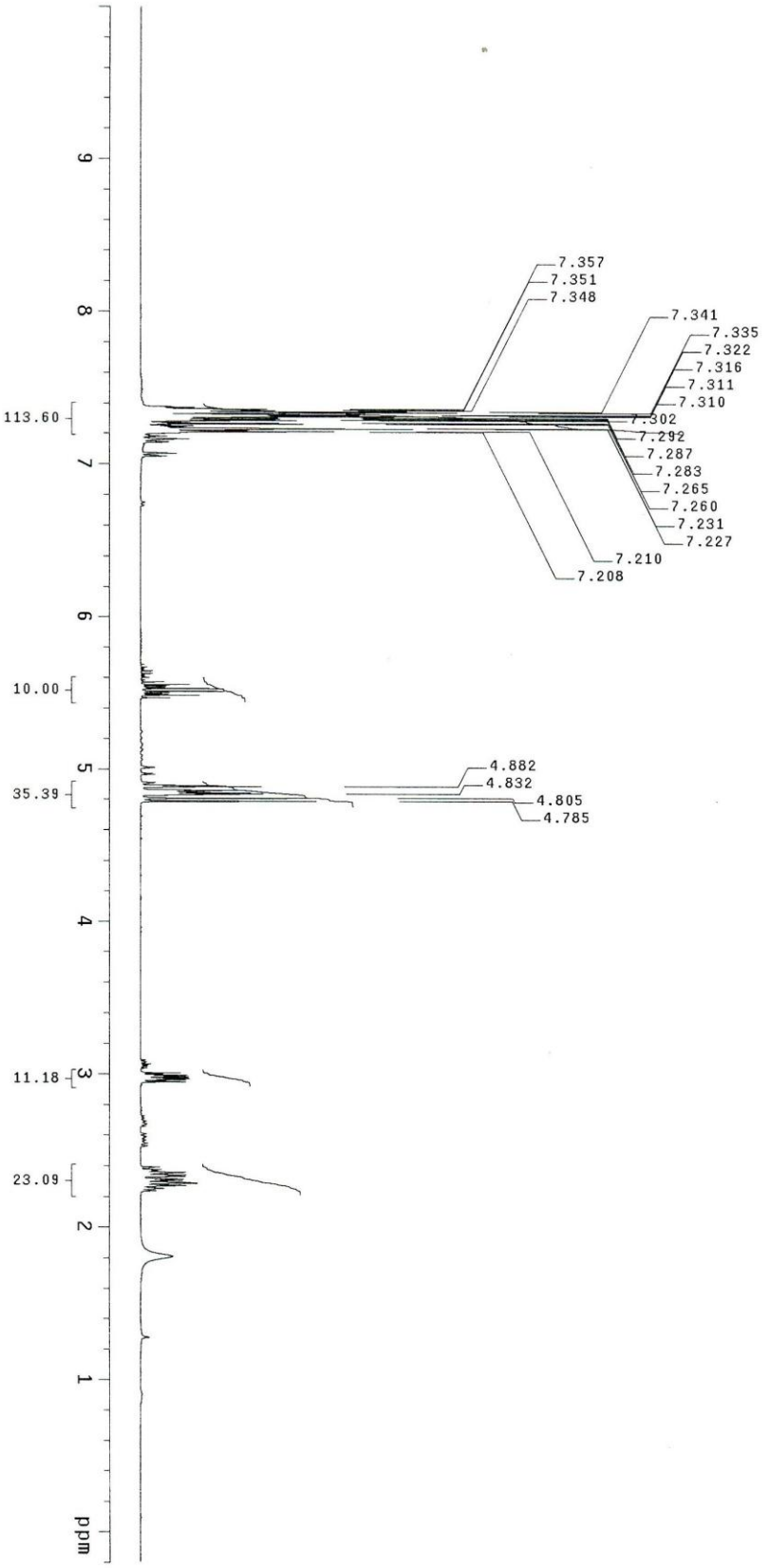


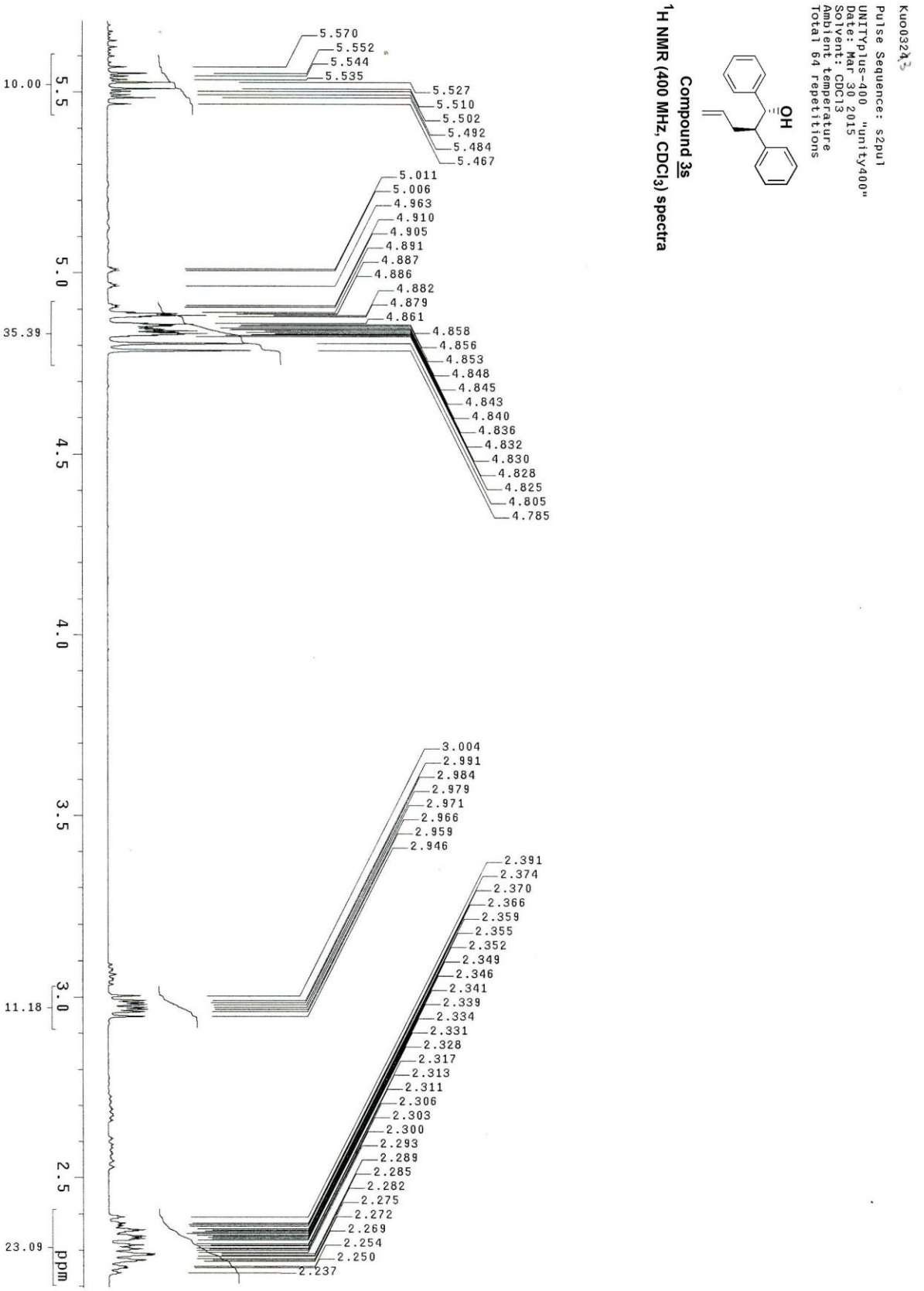

Kuo0814
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 24 2015
Solvent: CDCl3
Ambient temperature
Total 1504 repetitions
O2N
OH O
S
O
Me
Compound 3g
13C NMR (100 MHz, CDCl3) spectra
148.097
145.482
141.888
134.884
133.141
132.420
129.964
129.403
128.608
123.119
122.104
118.510
77.311
77.000
76.682
71.709
69.230
30.676
21.595
180
160
140
120
100
80
60
40
20
ppm

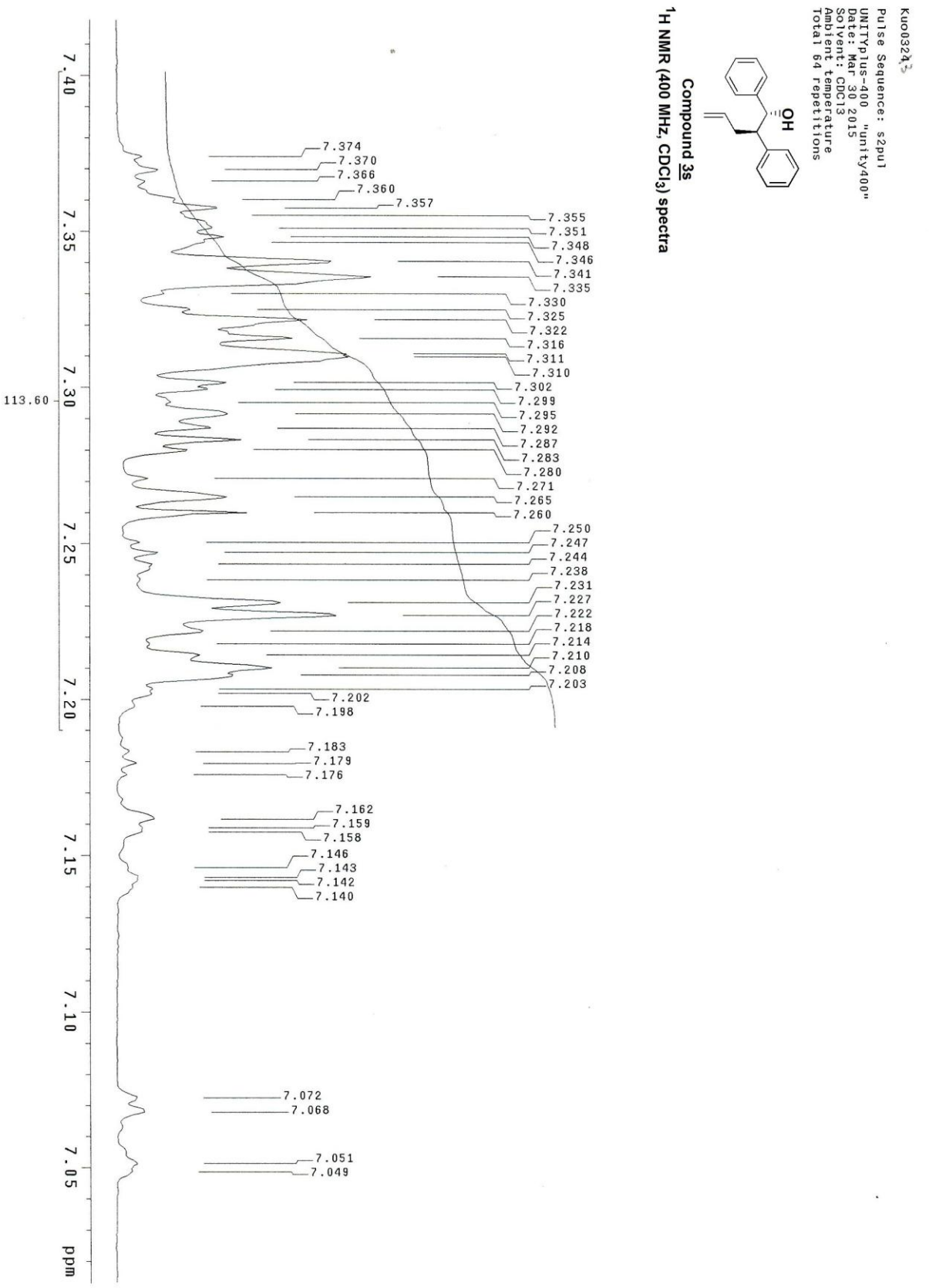

Yin0714-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 20 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
O2N
OH
O
S
O
Me
Compound 3r
1H NMR (400 MHz, CDCl3) spectra
8.129
8.107
7.699
7.678
7.484
7.462
7.319
7.299
7.260
2.440
1.251
18.11
20.19
20.77
19.15
9.63
10.33
9.84
10.00
8.66
10.48
41.70
11.42
ppm

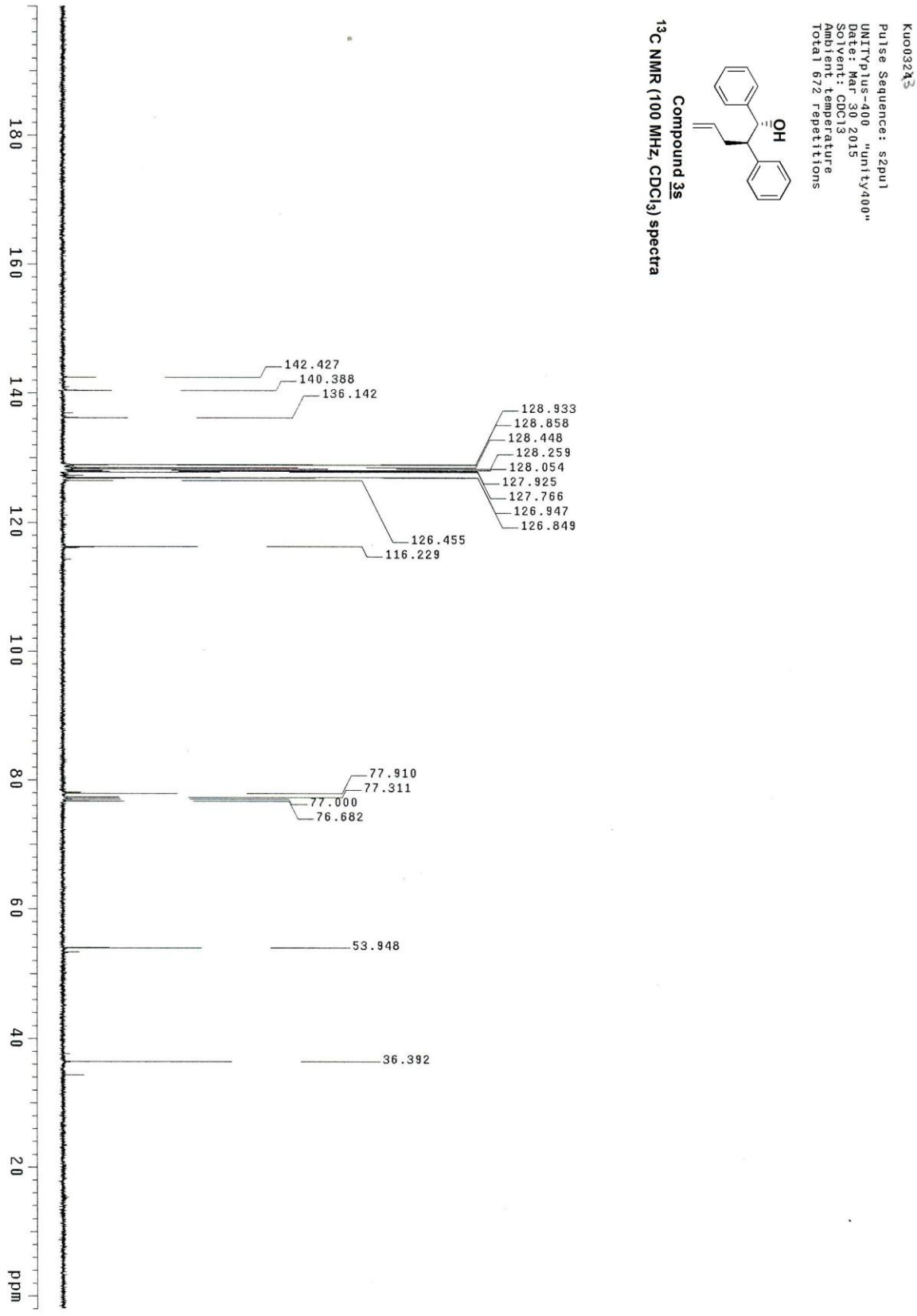

Yin0714-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 20 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
O2N
OH
O
O
S
O
Me
Compound 3r
1H NMR (400 MHz, CDCl3) spectra
5.366
5.349
5.340
5.331
5.323
5.306
5.298
5.289
5.281
5.263
5.214
5.196
4.850
4.847
4.827
4.825
4.821
4.750
4.746
4.743
4.739
4.707
4.704
4.700
4.697
4.534
4.227
4.213
4.197
3.465
3.453
3.446
3.435
3.428
3.416
2.488
2.484
2.480
2.476
2.472
2.468
2.464
2.460
2.455
2.452
2.440
2.430
2.425
2.421
2.417
2.414
2.410
2.260
2.242
2.223
2.204
2.185
2.166
9.63
10.33
9.84
10.00
8.66
10.48
41.70
11.42
5.0
4.5
4.0
3.5
3.0
2.5
ppm

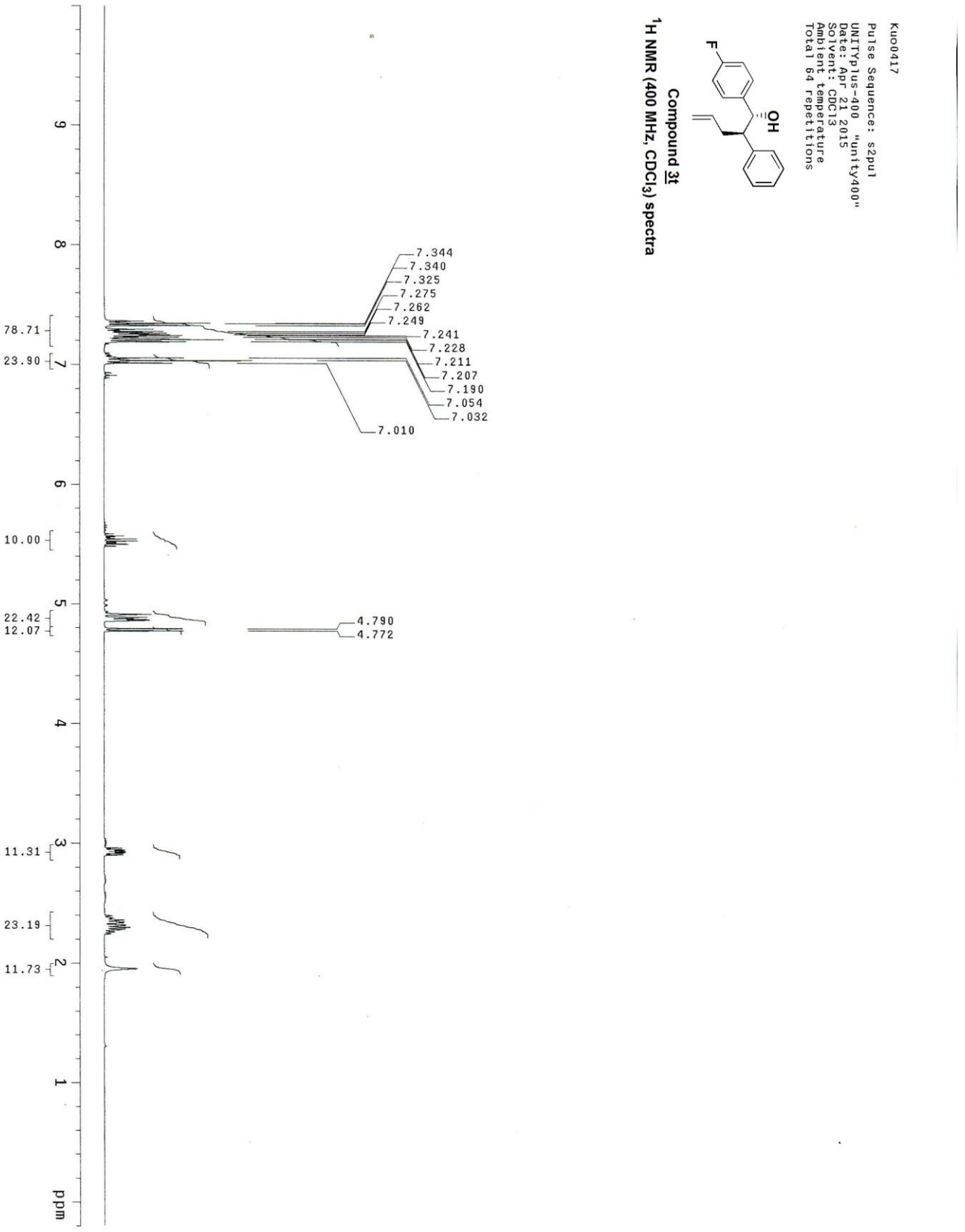

Yin0714-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 20 2015
Solvent: CDCl3
Ambient temperature
Total 1216 repetitions
O2N
OH O
S
O
Me
Compound 3r
13C NMR (100 MHz, CDCl3) spectra
146.838
145.573
134.877
132.398
129.934
128.653
127.986
123.521
118.594
77.311
77.000
76.682
71.785
69.367
30.653
21.633
ppm

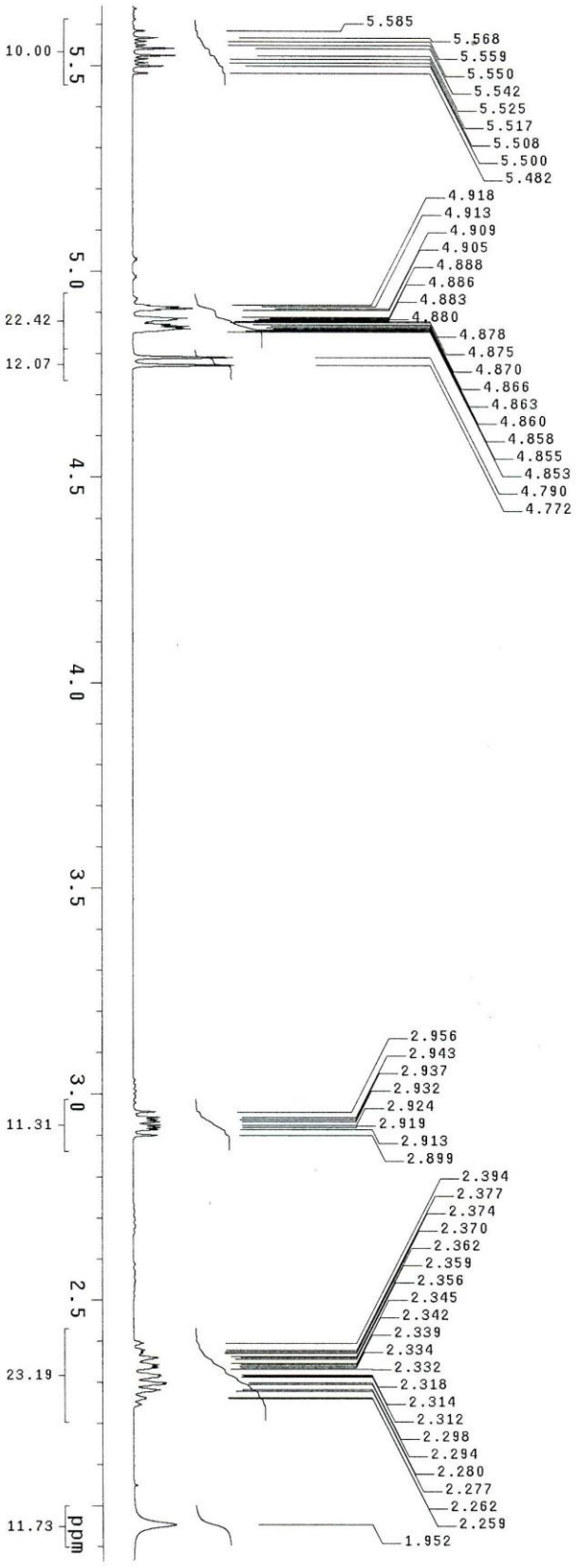

Kuo0324
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 30 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH
Compound 3s
1H NMR (400 MHz, CDCl3) spectra
7.357
7.351
7.348
7.341
7.335
7.322
7.316
7.311
7.310
7.302
7.292
7.287
7.283
7.265
7.260
7.231
7.227
7.210
7.208
4.882
4.832
4.805
4.785
113.60
10.00
35.39
11.18
23.09
ppm


Kuo0324_2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 30 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH
Compound 3s
1H NMR (400 MHz, CDCl3) spectra
5.570
5.552
5.544
5.535
5.527
5.510
5.502
5.492
5.484
5.467
5.011
5.006
4.963
4.910
4.905
4.891
4.887
4.886
4.882
4.879
4.861
4.858
4.856
4.853
4.848
4.845
4.843
4.840
4.836
4.832
4.830
4.828
4.825
4.805
4.785
3.004
2.991
2.984
2.979
2.971
2.966
2.959
2.946
2.391
2.374
2.370
2.366
2.359
2.355
2.352
2.349
2.346
2.341
2.339
2.334
2.331
2.328
2.317
2.313
2.311
2.306
2.303
2.300
2.293
2.289
2.285
2.282
2.275
2.272
2.269
2.254
2.250
2.237
10.00
35.39
11.18
23.09
5.5
5.0
4.5
4.0
3.5
3.0
2.5
ppm


Kuo032413
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 30 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OH
Compound 3s
1H NMR (400 MHz, CDCl3) spectra
113.60
7.374
7.370
7.366
7.360
7.357
7.355
7.351
7.348
7.346
7.341
7.335
7.330
7.325
7.322
7.316
7.311
7.310
7.302
7.299
7.295
7.292
7.287
7.283
7.280
7.271
7.265
7.260
7.250
7.247
7.244
7.238
7.231
7.227
7.222
7.218
7.214
7.210
7.208
7.203
7.202
7.198
7.183
7.179
7.176
7.162
7.159
7.158
7.146
7.143
7.142
7.140
7.072
7.068
7.051
7.049
7.40
7.35
7.30
7.25
7.20
7.15
7.10
7.05
ppm

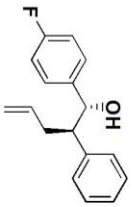

Kuo0323
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 30 2015
Solvent: CDCl3
Ambient temperature
Total 672 repetitions
OH
Compound 3s
13C NMR (100 MHz, CDCl3) spectra
142.427
140.388
136.142
128.933
128.858
128.448
128.259
128.054
127.925
127.766
126.947
126.849
126.455
116.229
77.910
77.311
77.000
76.682
53.948
36.392
180
160
140
120
100
80
60
40
20
ppm


Kuo0417
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 21 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
OH
Compound 3t
1H NMR (400 MHz, CDCl3) spectra
7.344
7.340
7.325
7.275
7.262
7.249
7.241
7.228
7.211
7.207
7.190
7.054
7.032
7.010
4.790
4.772
78.71
23.90
10.00
22.42
12.07
11.31
23.19
11.73
ppm



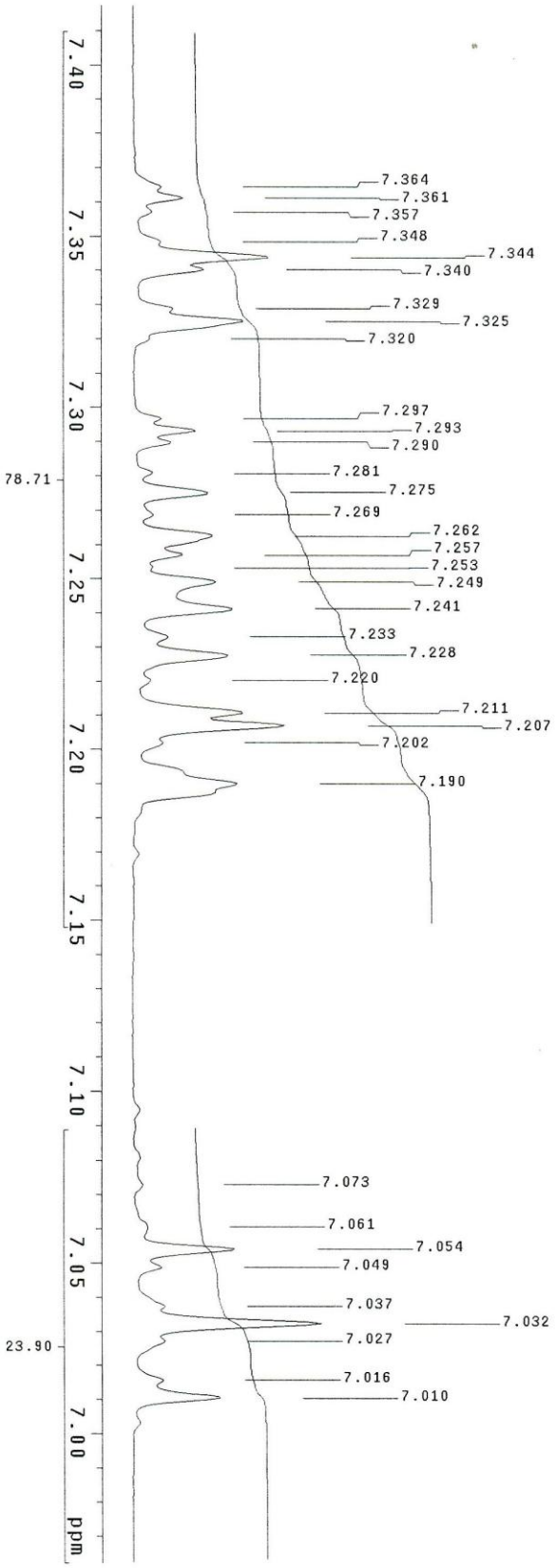
Kuo0417

Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 21 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions



Compound 3t

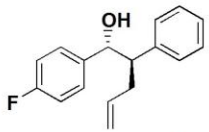
^{1}H NMR (400 MHz, $CDCl_3$) spectra


Kuo0417
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 21 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
OH
Compound 3t
1H NMR (400 MHz, CDCl3) spectra
7.364
7.361
7.357
7.348
7.344
7.340
7.329
7.325
7.320
7.297
7.293
7.290
78.71
7.281
7.275
7.269
7.262
7.257
7.253
7.249
7.241
7.233
7.228
7.220
7.211
7.207
7.202
7.190
7.073
7.061
7.054
7.049
7.037
7.032
7.027
23.90
7.016
7.010
7.40
7.35
7.30
7.25
7.20
7.15
7.10
7.05
7.00
ppm

Kuo0417

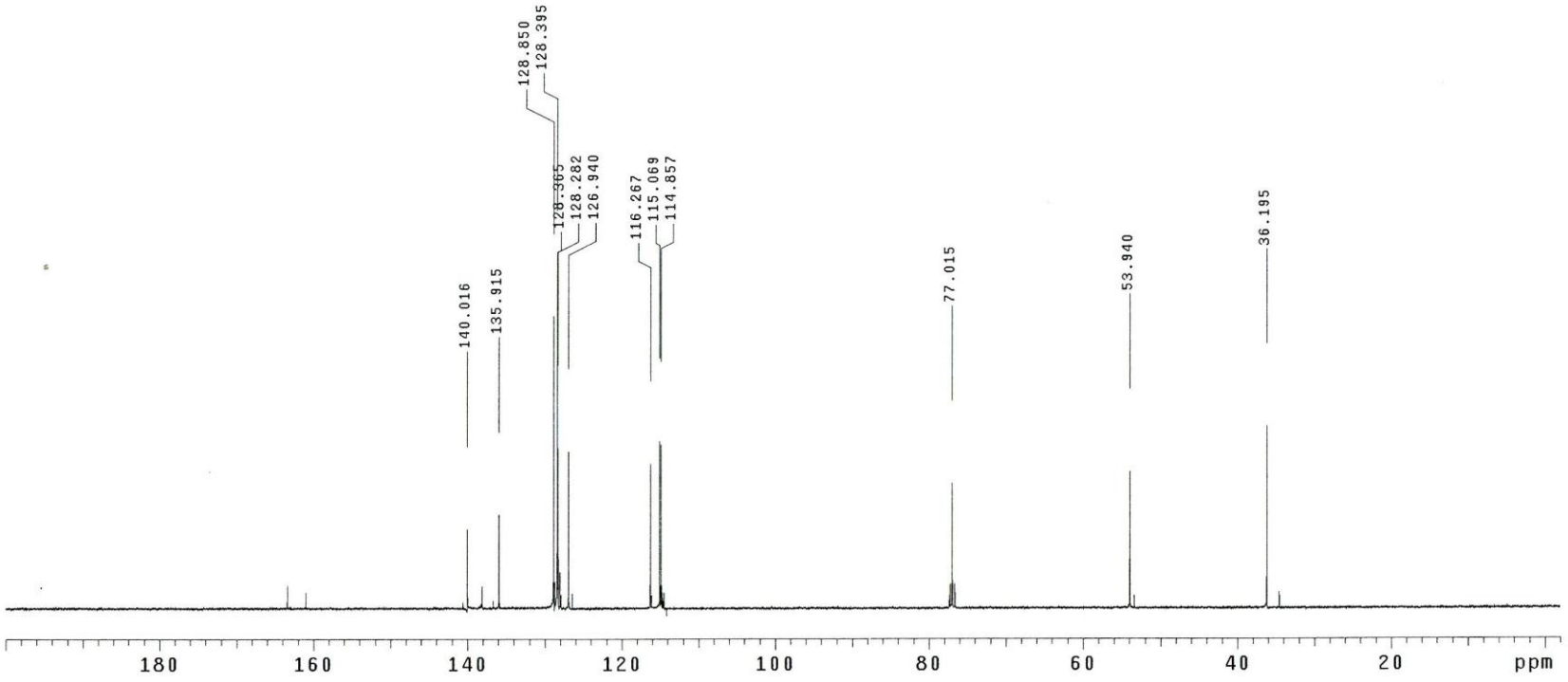
Pulse Sequence: s2pul

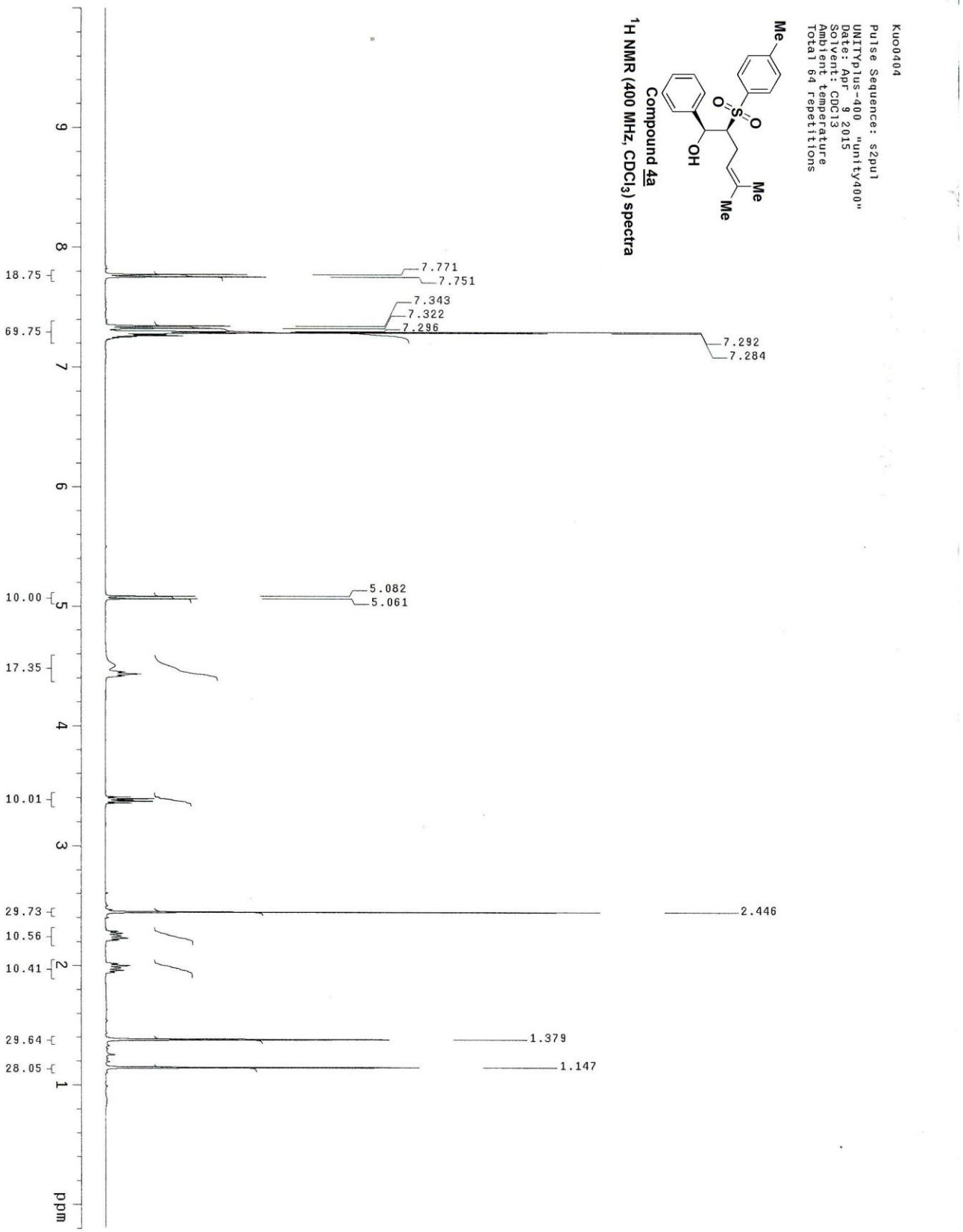
UNITYplus-400 "unity400"
Date: Apr 21 2015
Solvent: CDCl3
Ambient temperature
Total 336 repetitions

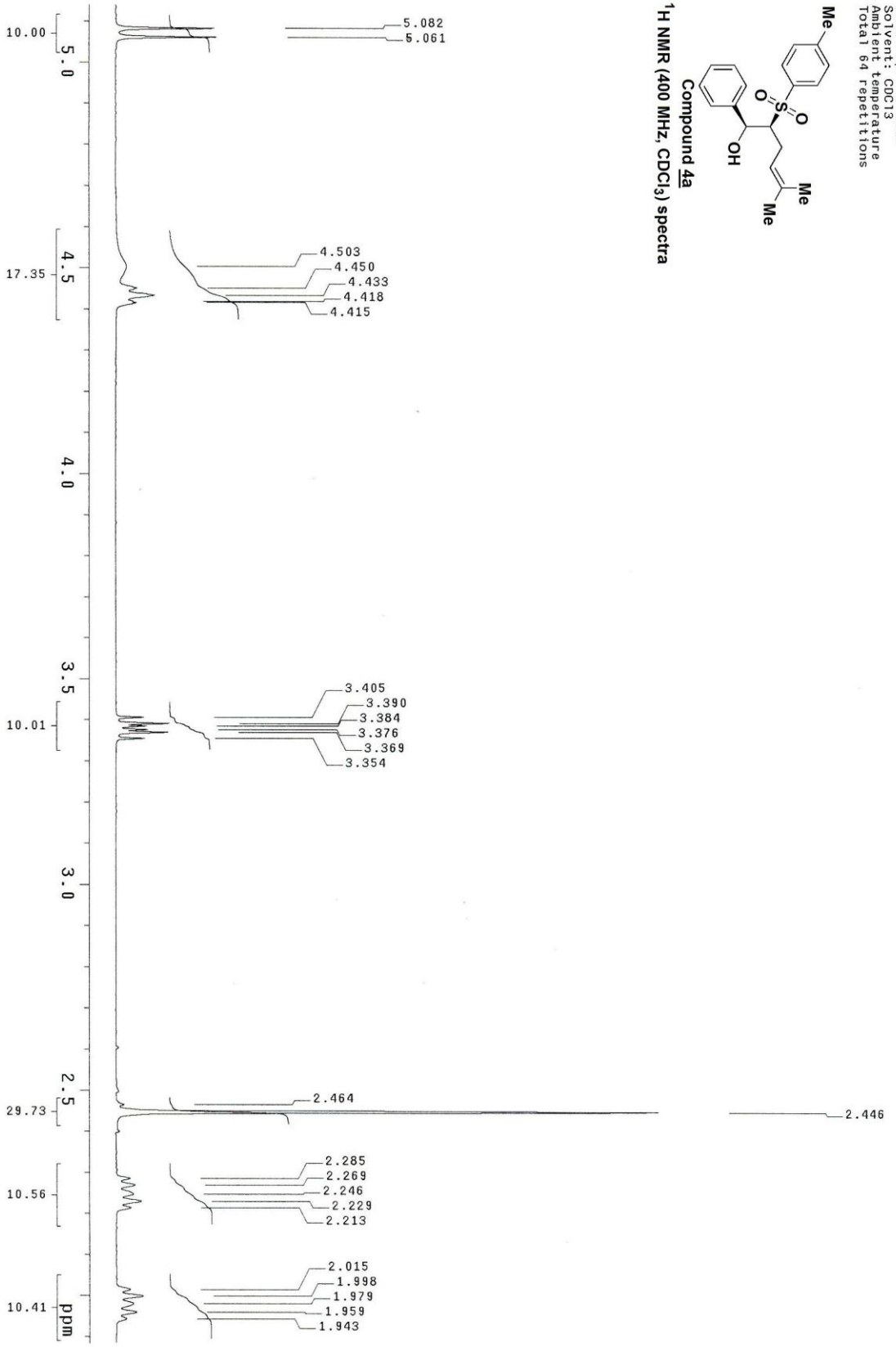


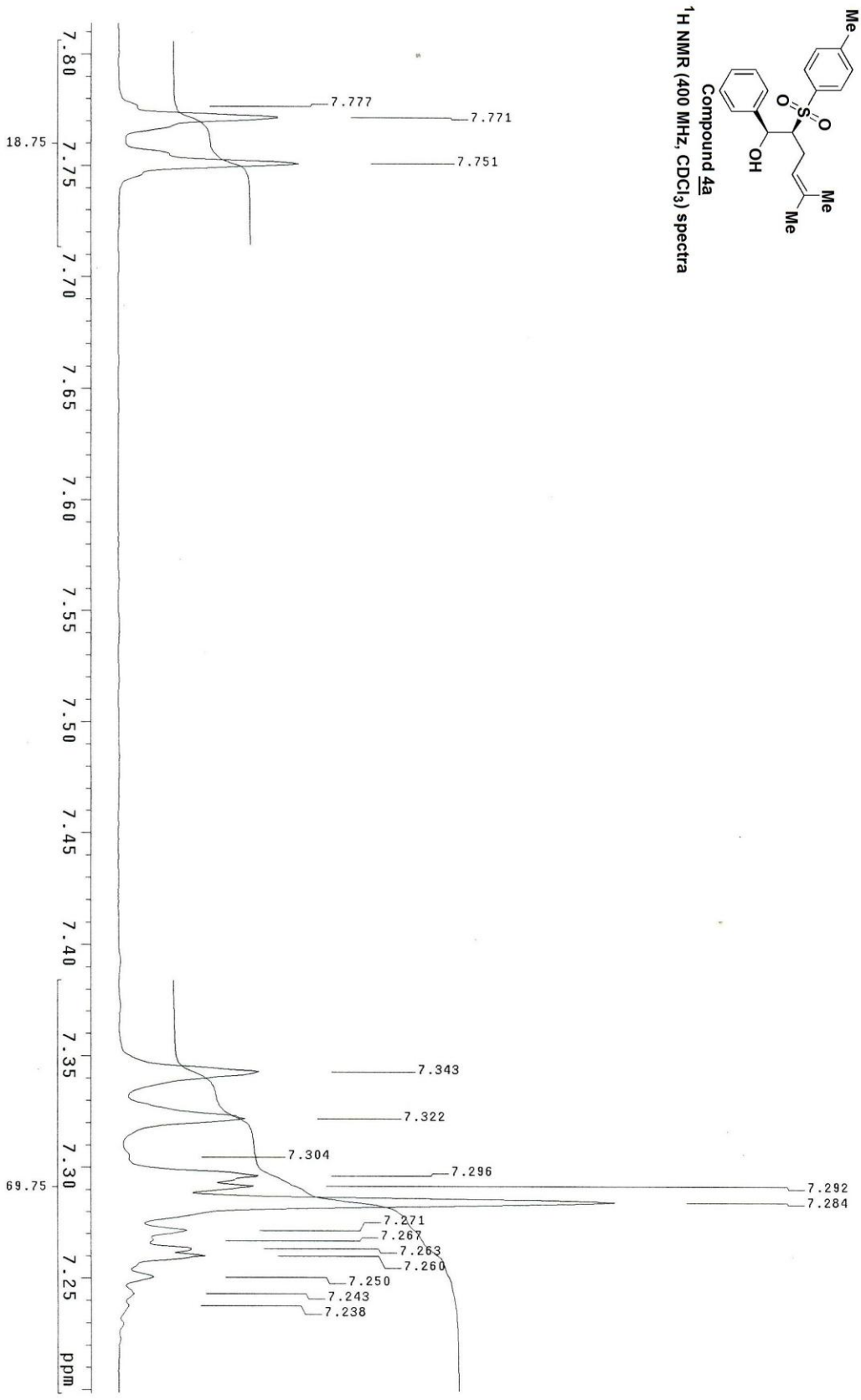
Compound 3t

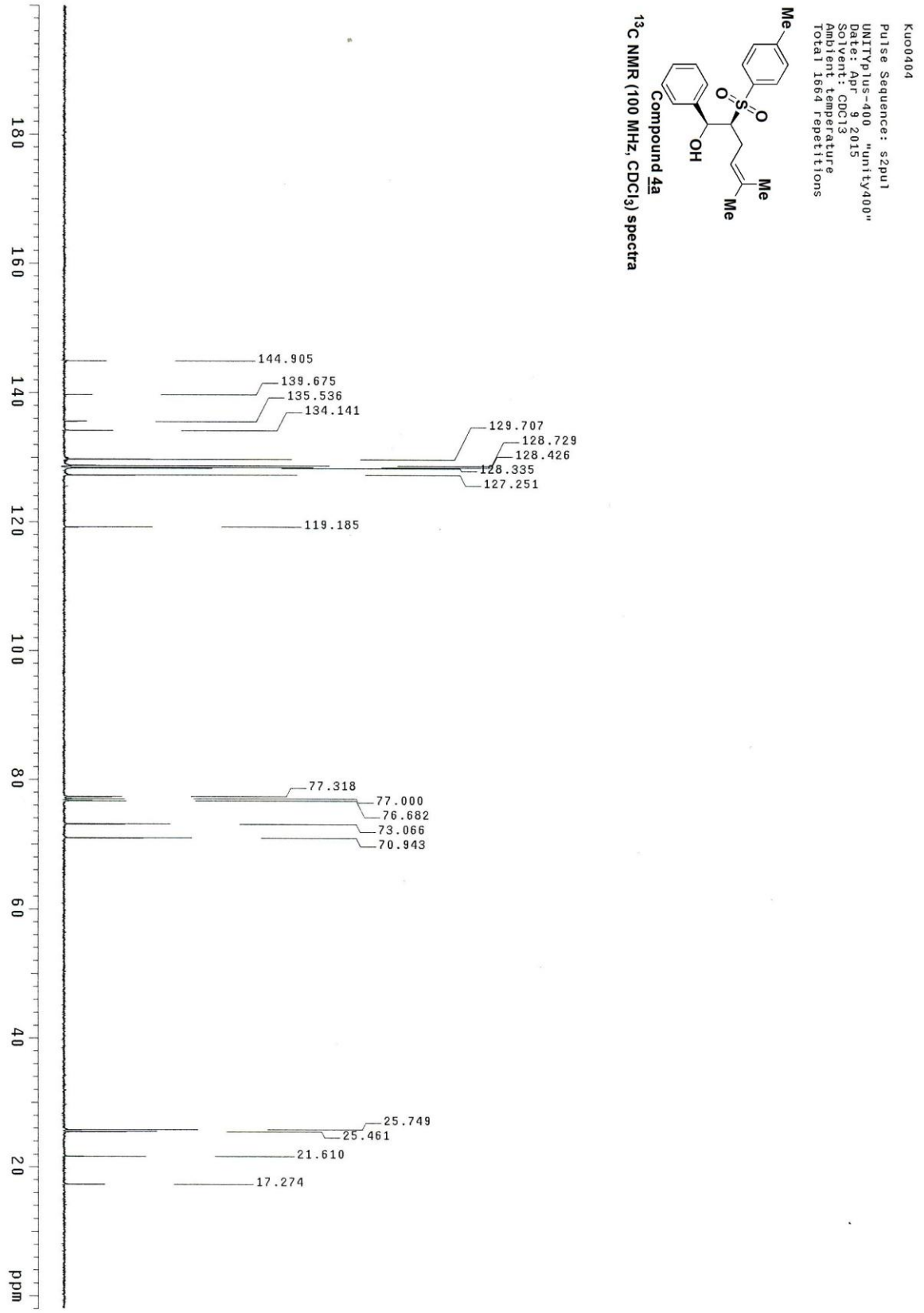
^{13}C NMR (100 MHz, $CDCl_3$) spectra

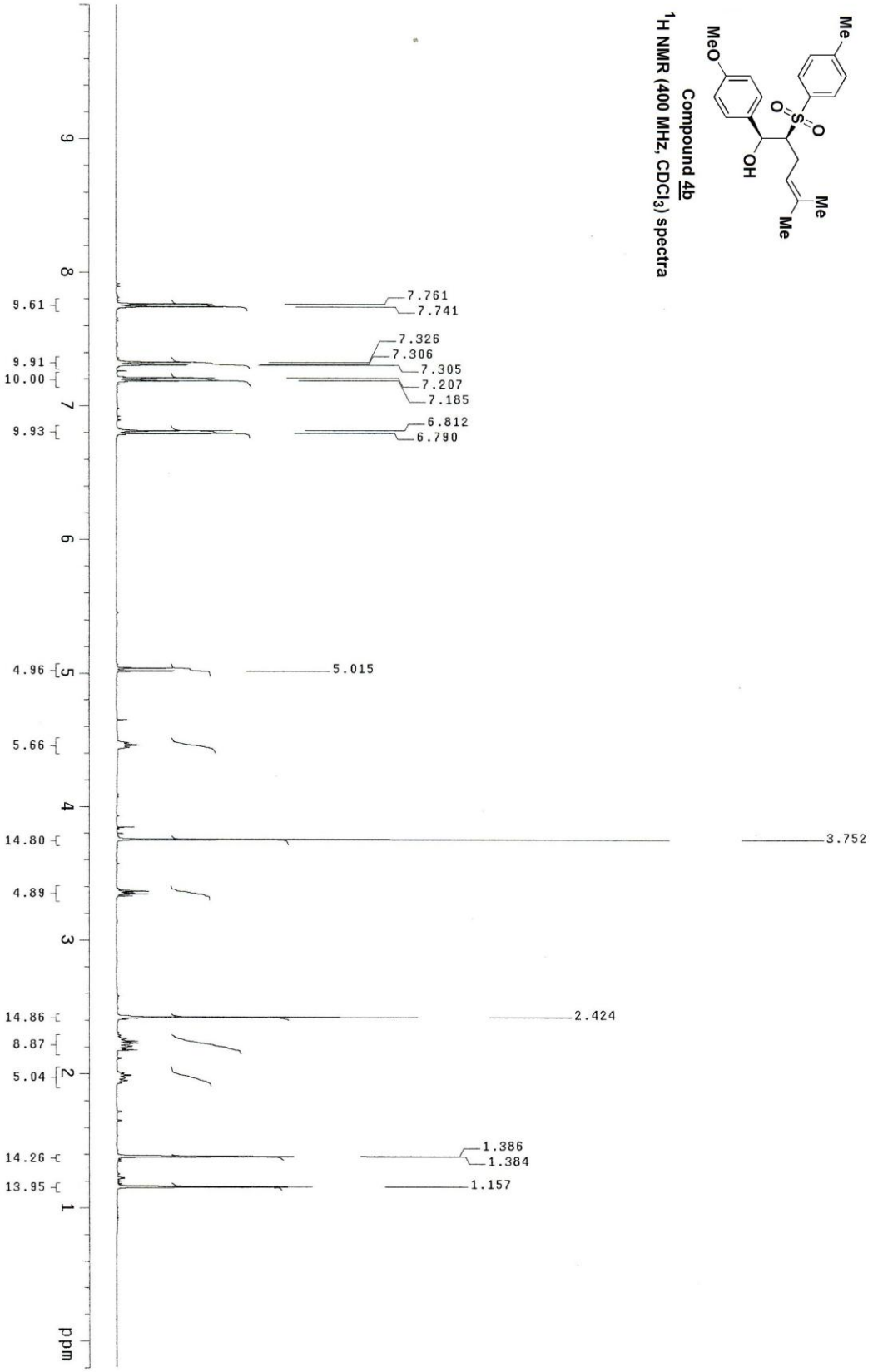


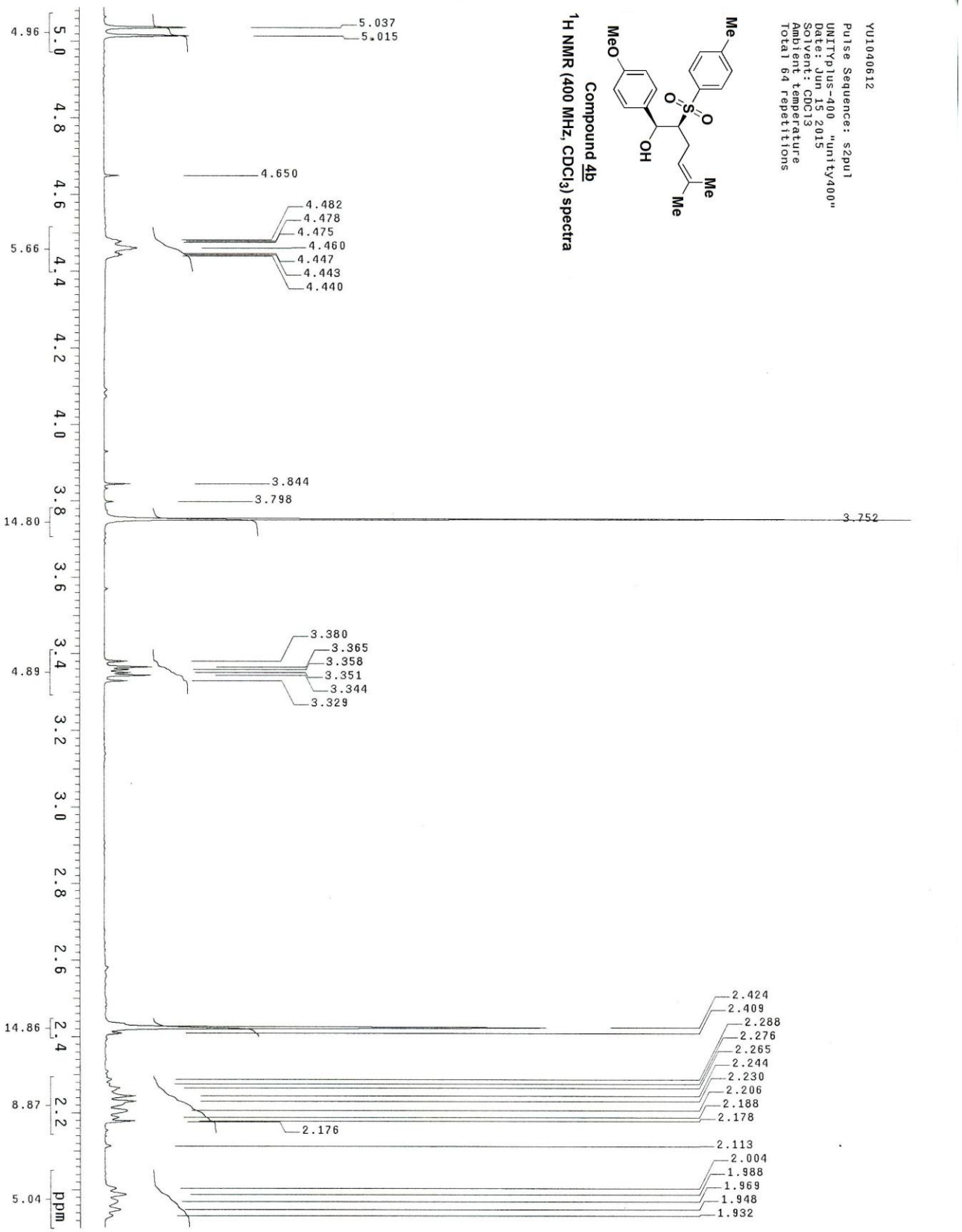

Kuo0404
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
OH
Me
Me
Compound 4a
1H NMR (400 MHz, CDCl3) spectra
7.771
7.751
7.343
7.322
7.296
7.292
7.284
5.082
5.061
2.446
1.379
1.147
18.75
69.75
10.00
17.35
10.01
29.73
10.56
10.41
29.64
28.05
ppm

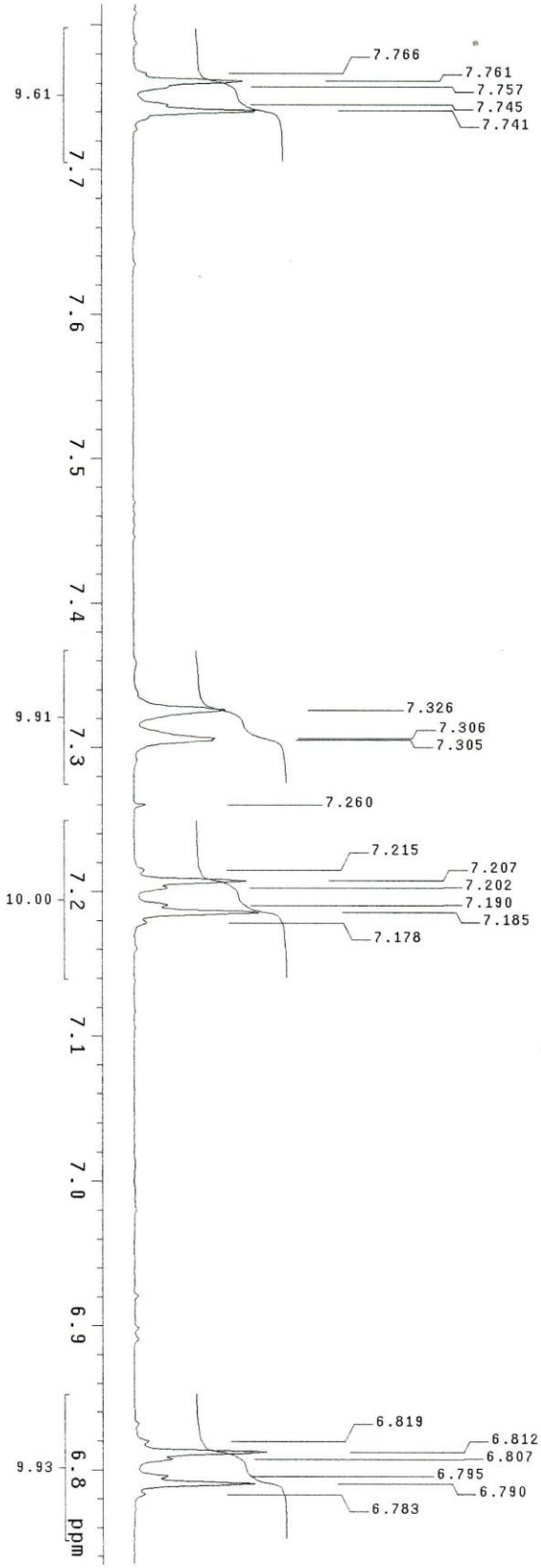

Kuo0404
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
OH
Me
Me
Compound 4a
1H NMR (400 MHz, CDCl3) spectra
10.00
17.35
10.01
29.73
10.56
10.41
5.082
5.061
4.503
4.450
4.433
4.418
4.415
3.405
3.390
3.384
3.376
3.369
3.354
2.464
2.446
2.285
2.269
2.246
2.229
2.213
2.015
1.998
1.979
1.959
1.943
5.0
4.5
4.0
3.5
3.0
2.5
ppm


Kuo0404
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
S
O
O
OH
Me
Me
Compound 4a
1H NMR (400 MHz, CDCl3) spectra
18.75
69.75
7.777
7.771
7.751
7.343
7.322
7.304
7.296
7.292
7.284
7.271
7.267
7.263
7.260
7.250
7.243
7.238
7.80
7.75
7.70
7.65
7.60
7.55
7.50
7.45
7.40
7.35
7.30
7.25
ppm


Kuo0404
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 1664 repetitions
Me
O
S
O
OH
Me
Me
Compound 4a
13C NMR (100 MHz, CDCl3) spectra
144.905
139.675
135.536
134.141
129.707
128.729
128.426
128.335
127.251
119.185
77.318
77.000
76.682
73.066
70.943
25.749
25.461
21.610
17.274
180
160
140
120
100
80
60
40
20
ppm

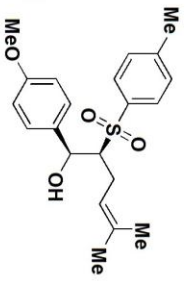

YU1040612
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
MeO
OH
Me
Me
Compound 4b
1H NMR (400 MHz, CDCl3) spectra
9.61
9.91
10.00
9.93
4.96
5.66
14.80
4.89
14.86
8.87
5.04
14.26
13.95
7.761
7.741
7.326
7.306
7.305
7.207
7.185
6.812
6.790
5.015
3.752
2.424
1.386
1.384
1.157
ppm


YU1040612
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
MeO
OH
Me
Me
Compound 4b
1H NMR (400 MHz, CDCl3) spectra
5.037
5.015
4.650
4.482
4.478
4.475
4.460
4.447
4.443
4.440
3.844
3.798
3.752
3.380
3.365
3.358
3.351
3.344
3.329
2.424
2.409
2.288
2.276
2.265
2.244
2.230
2.206
2.188
2.178
2.176
2.113
2.004
1.988
1.969
1.948
1.932
4.96
5.66
14.80
4.89
14.86
8.87
5.04
ppm



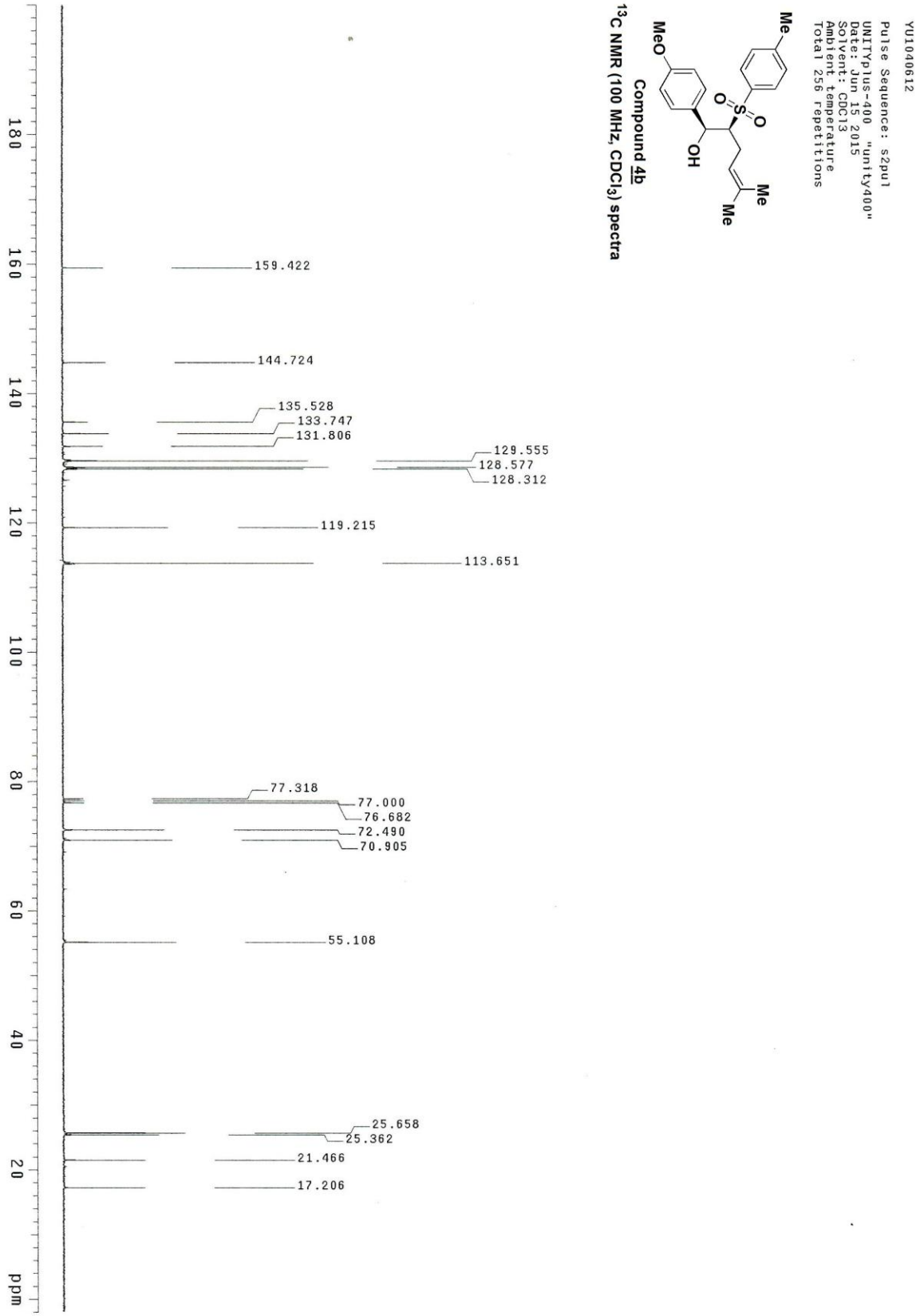
YU1040612

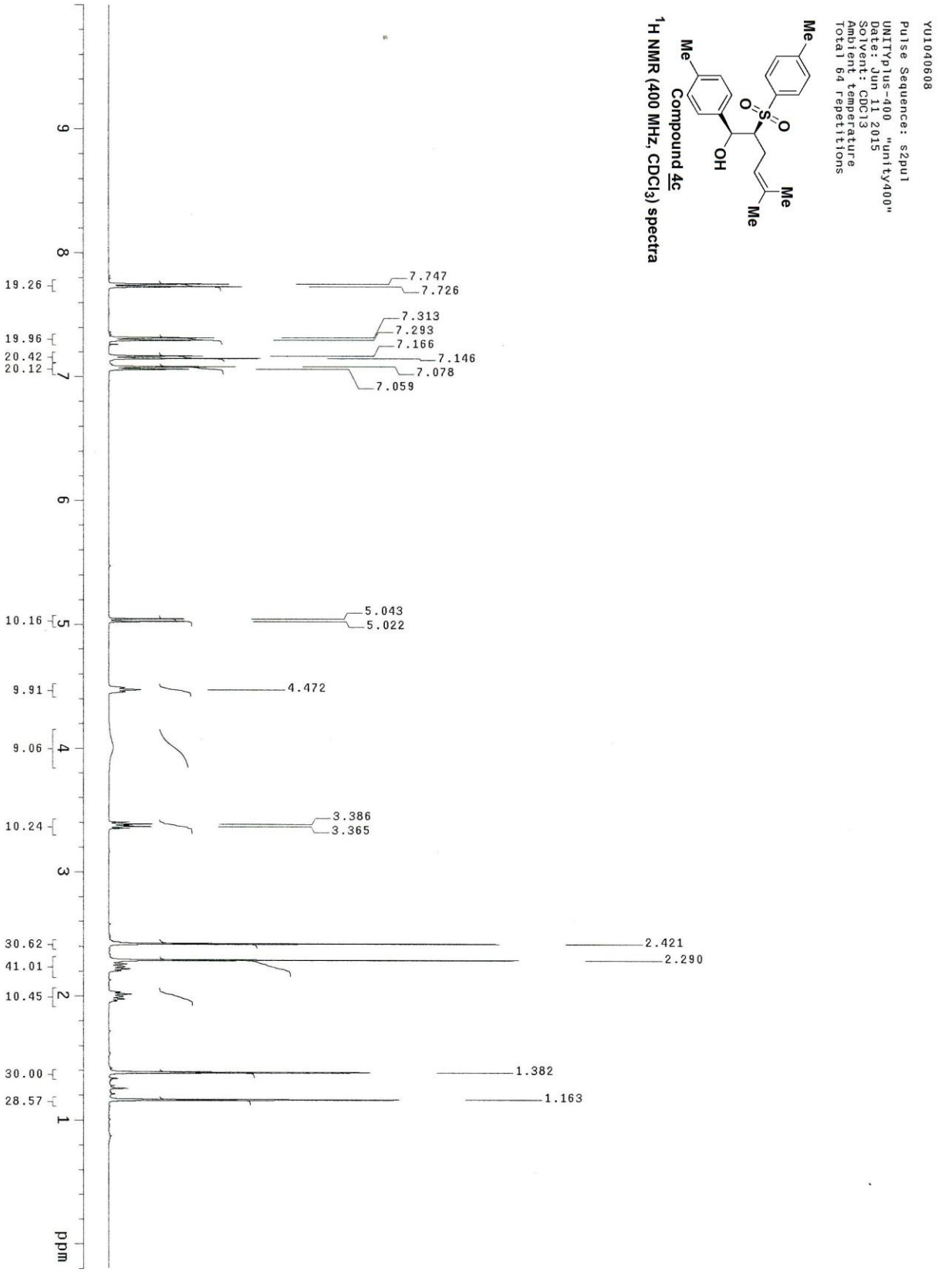
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

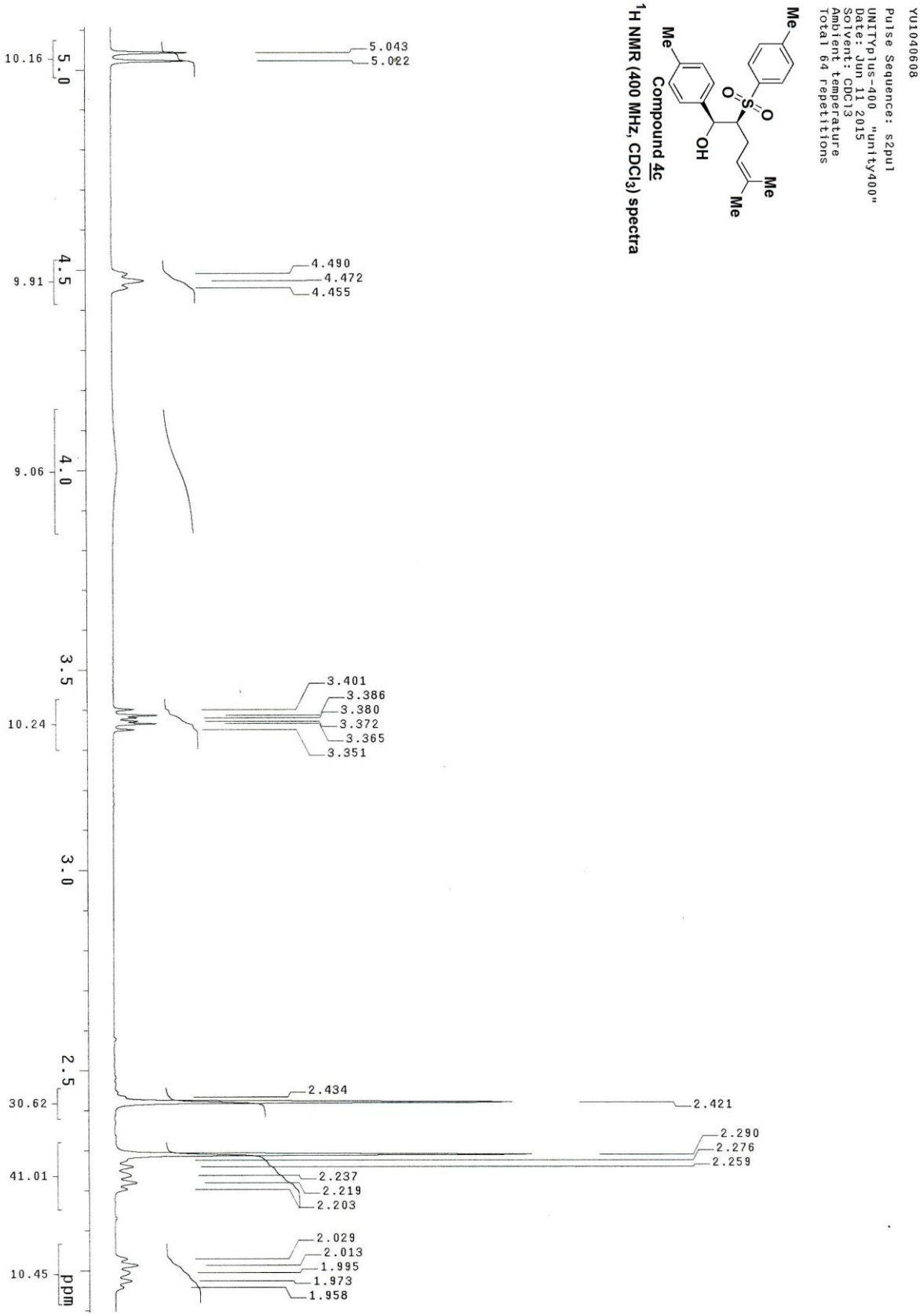


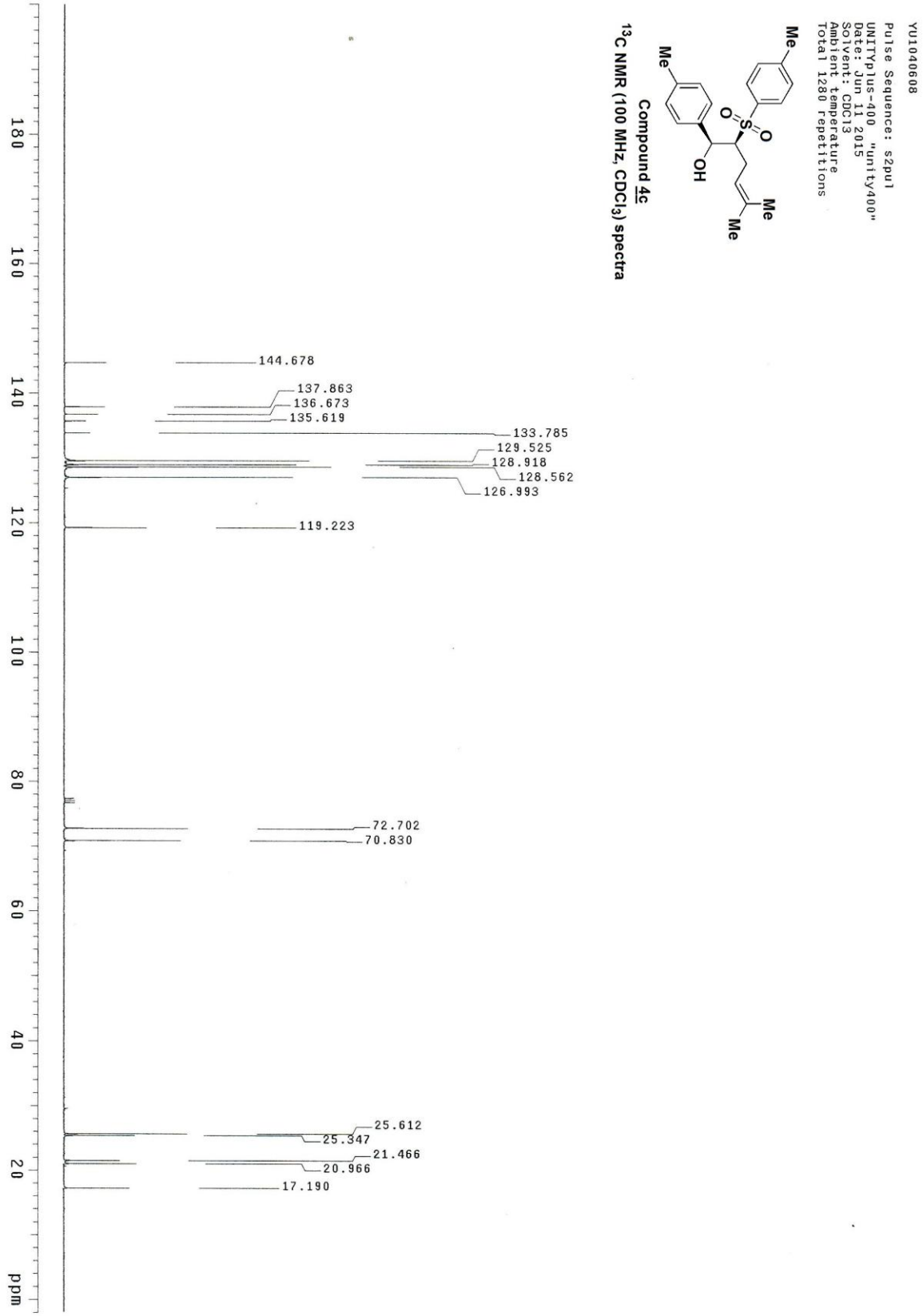
Compound 4b

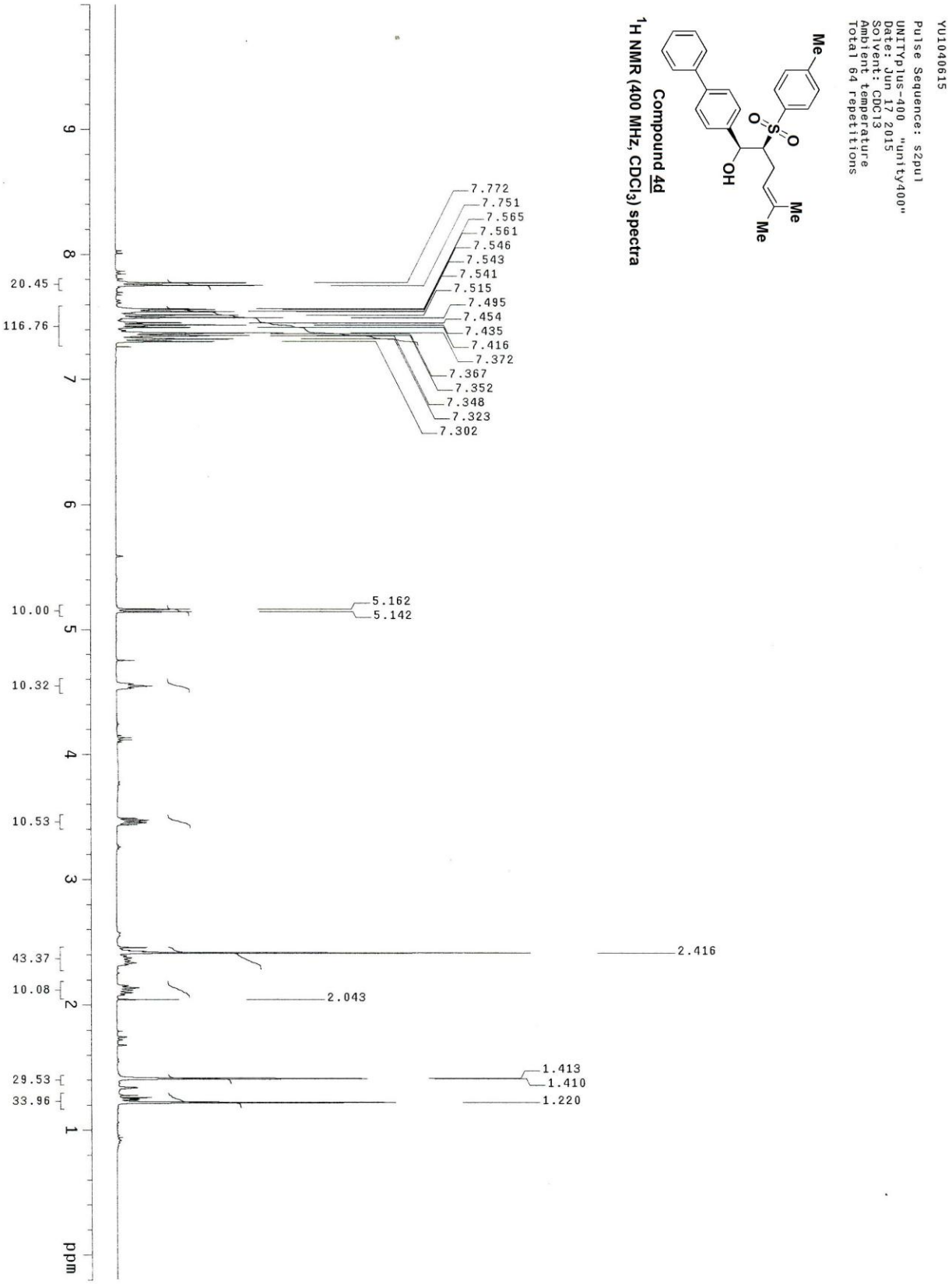
^{1}H NMR (400 MHz, $CDCl_3$) spectra

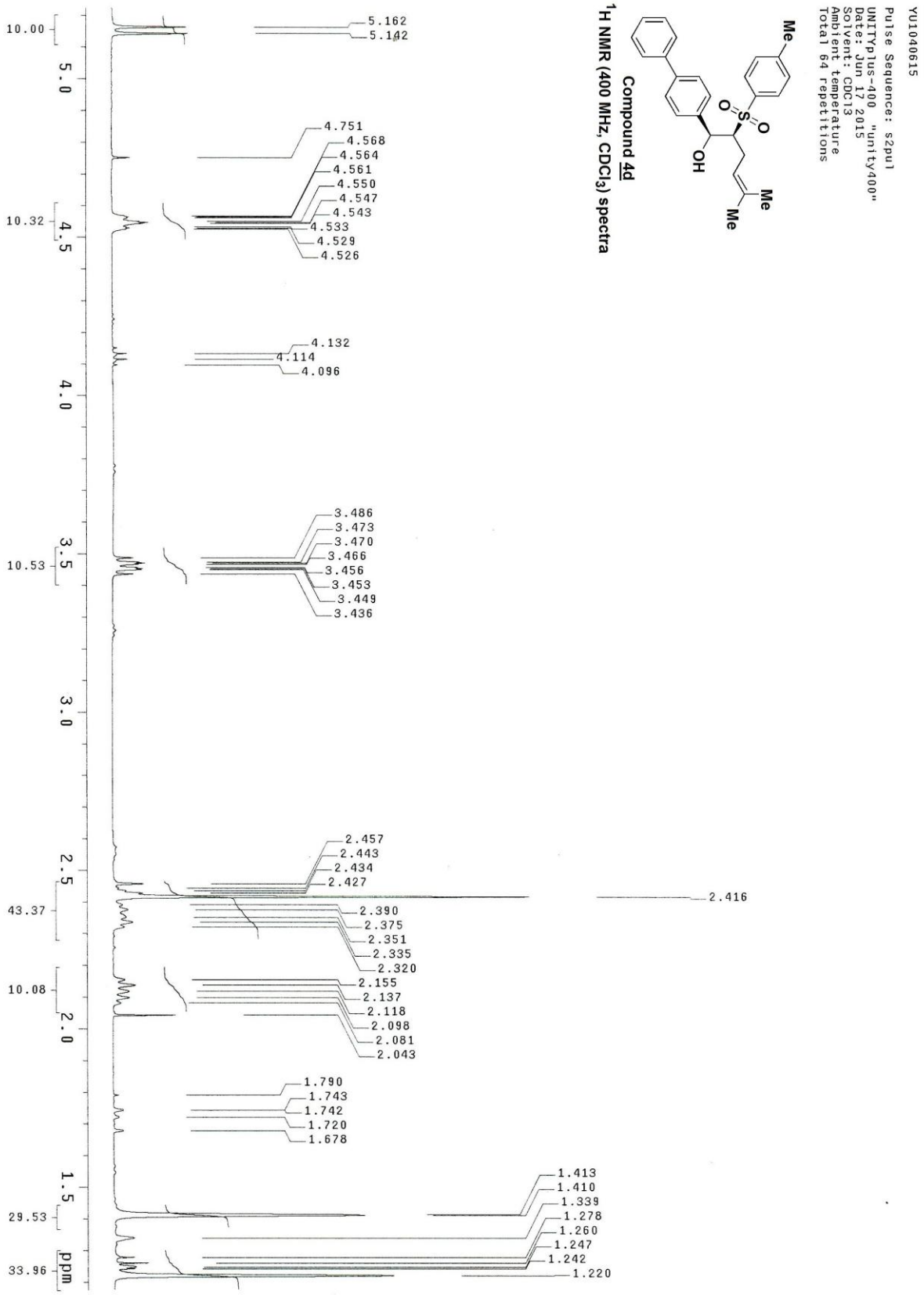

YU1040612
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 256 repetitions
Me
MeO
OH
Me
Me
Compound 4b
13C NMR (100 MHz, CDCl3) spectra
159.422
144.724
135.528
133.747
131.806
129.555
128.577
128.312
119.215
113.651
77.318
77.000
76.682
72.490
70.905
55.108
25.658
25.362
21.466
17.206
180
160
140
120
100
80
60
40
20
ppm

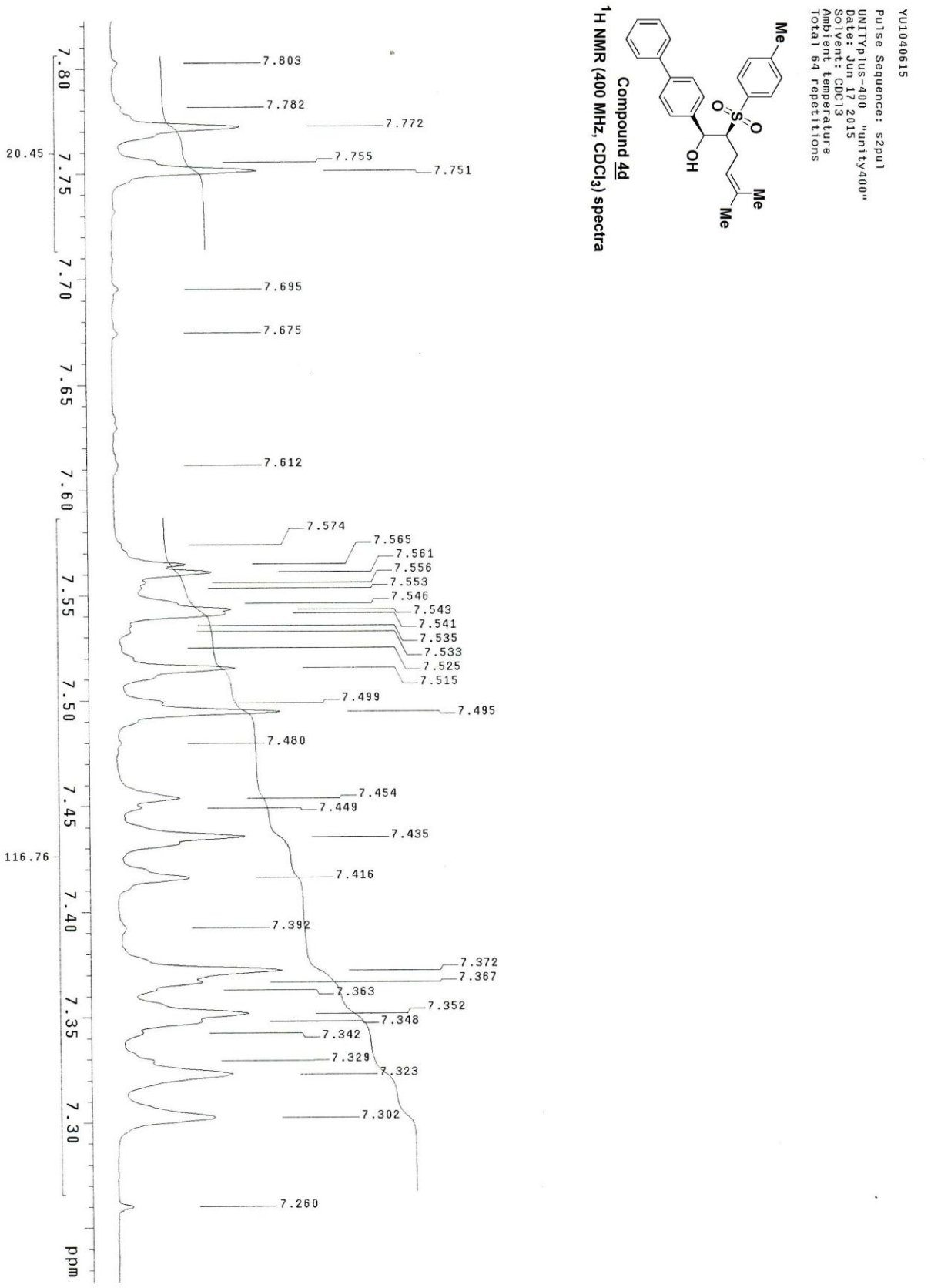

YU1040608
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 11 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
OH
Me
Me
Compound 4c
1H NMR (400 MHz, CDCl3) spectra
19.26
19.96
20.42
20.12
10.16
9.91
9.06
10.24
30.62
41.01
10.45
30.00
28.57
7.747
7.726
7.313
7.293
7.166
7.146
7.078
7.059
5.043
5.022
4.472
3.386
3.365
2.421
2.290
1.382
1.163
ppm

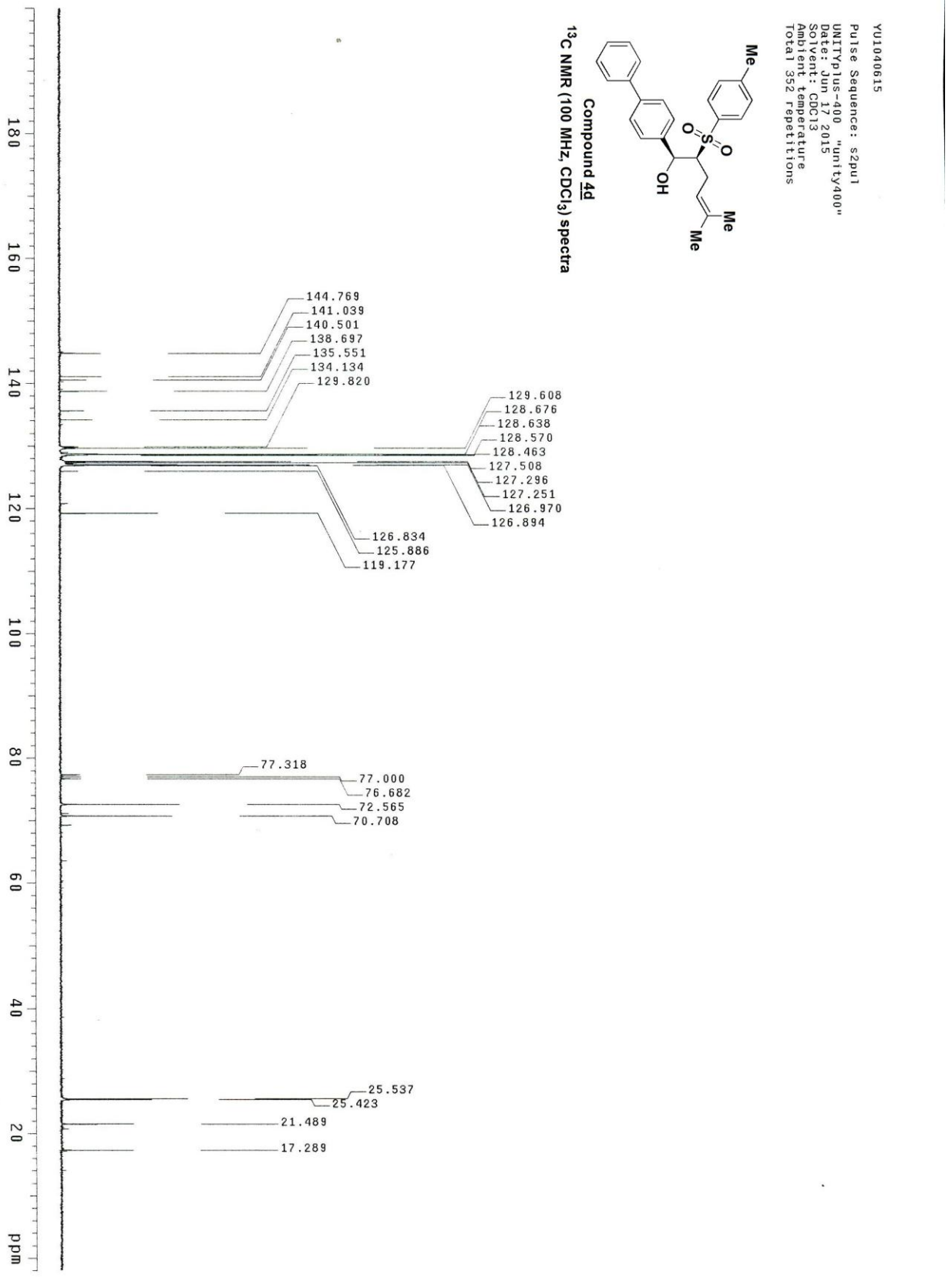

YU1040608
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 11 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
OH
Me
Me
Compound 4c
1H NMR (400 MHz, CDCl3) spectra
10.16
9.91
9.06
10.24
30.62
41.01
10.45
5.0
4.5
4.0
3.5
3.0
2.5
ppm
5.043
5.022
4.490
4.472
4.455
3.401
3.386
3.380
3.372
3.365
3.351
2.434
2.421
2.290
2.276
2.259
2.237
2.219
2.203
2.029
2.013
1.995
1.973
1.958

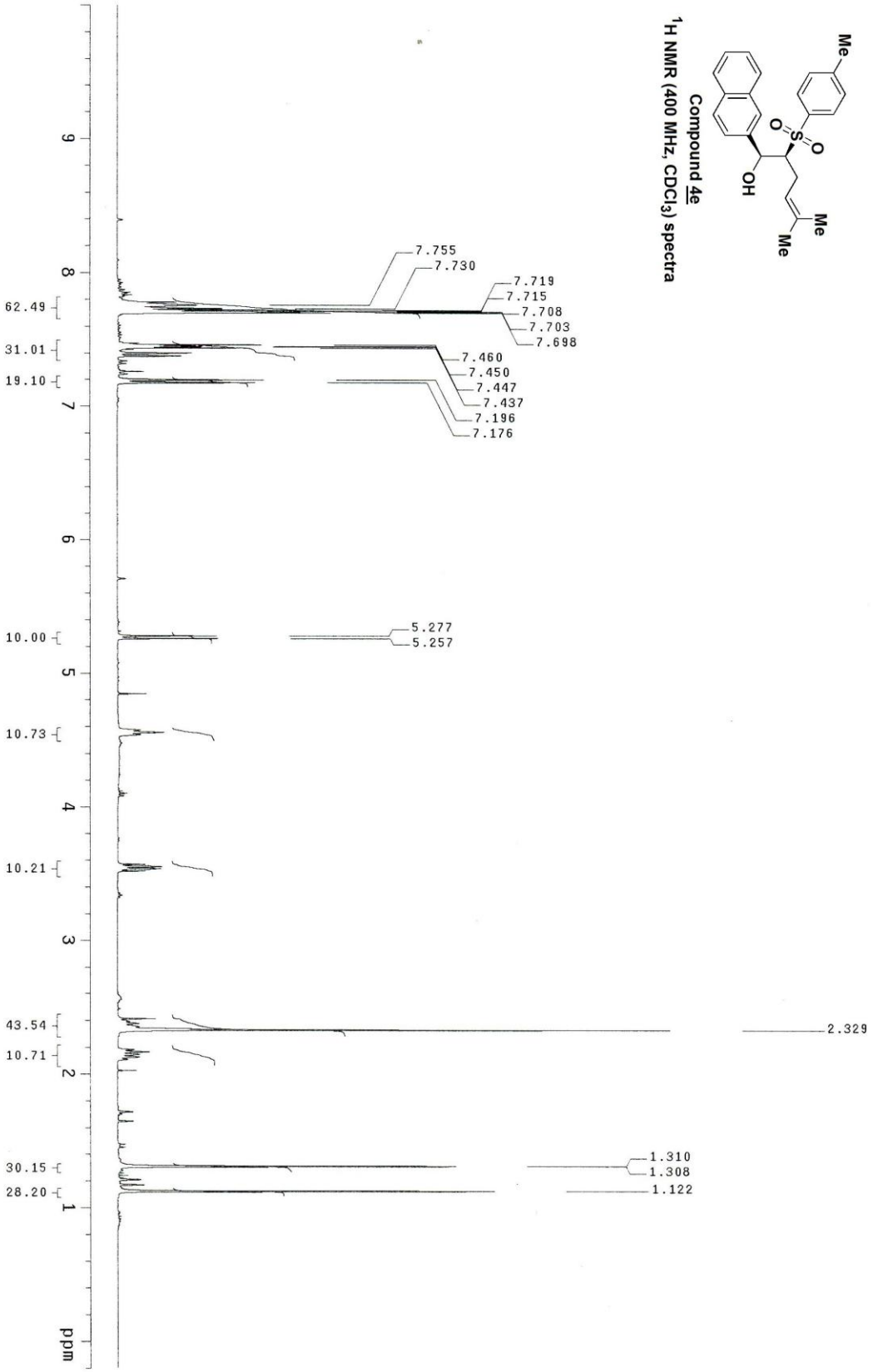

YU1040608
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 11 2015
Solvent: CDCl3
Ambient temperature
Total 1280 repetitions
Me
Me
OH
O
S
O
Me
Me
Compound 4c
13C NMR (100 MHz, CDCl3) spectra
144.678
137.863
136.673
135.619
133.785
129.525
128.918
128.562
126.993
119.223
72.702
70.830
25.612
25.347
21.466
20.966
17.190
180
160
140
120
100
80
60
40
20
ppm

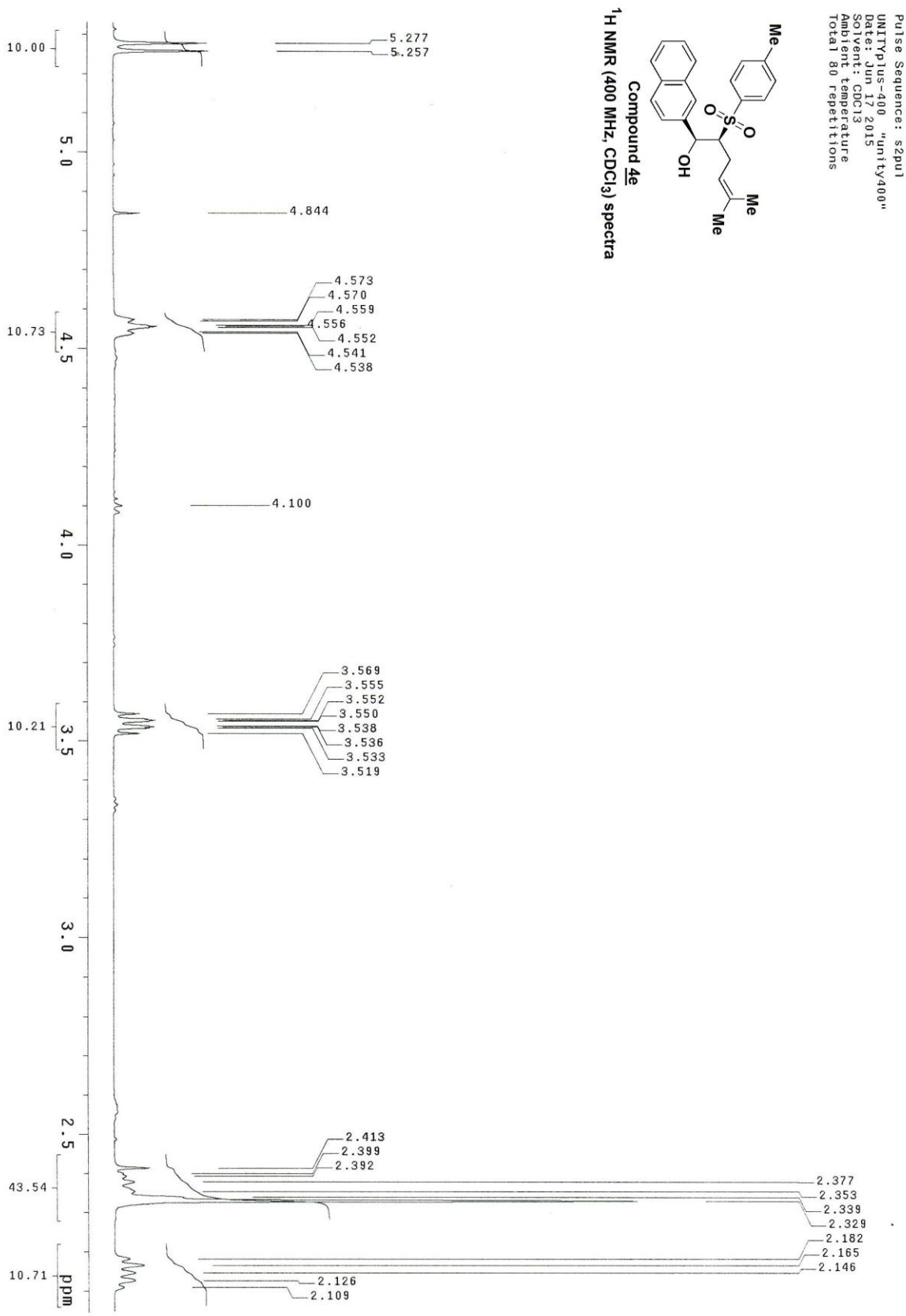

YU1040615
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH
Me
Me
Compound 4d
1H NMR (400 MHz, CDCl3) spectra
7.772
7.751
7.565
7.561
7.546
7.543
7.541
7.515
7.495
7.454
7.435
7.416
7.372
7.367
7.352
7.348
7.323
7.302
5.162
5.142
2.416
2.043
1.413
1.410
1.220
20.45
116.76
10.00
10.32
10.53
43.37
10.08
29.53
33.96
ppm

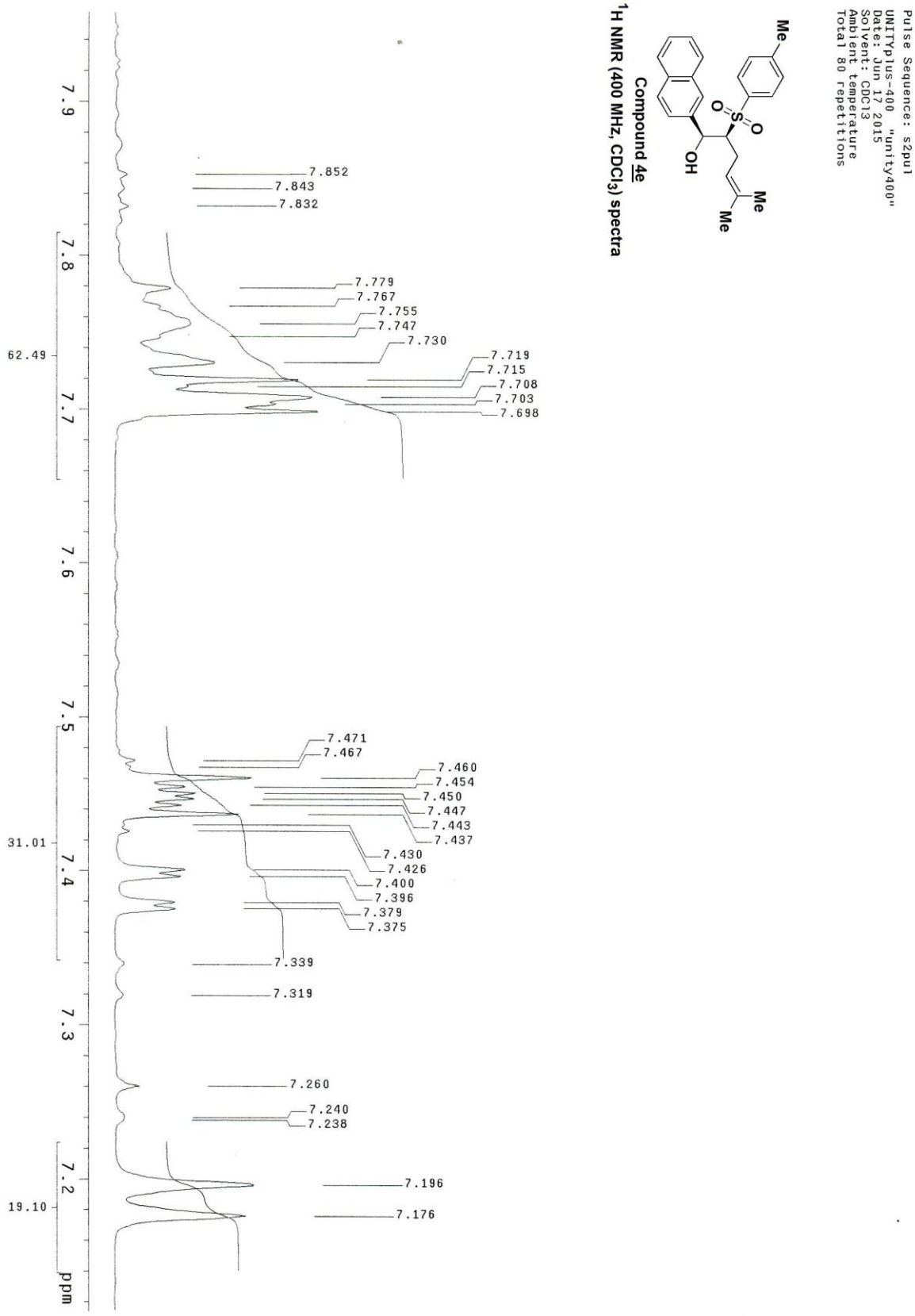

YU1040615
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH
Me
Me
Compound 4d
1H NMR (400 MHz, CDCl3) spectra
5.162
5.142
4.751
4.568
4.564
4.561
4.550
4.547
4.543
4.533
4.529
4.526
4.132
4.114
4.096
3.486
3.473
3.470
3.466
3.456
3.453
3.449
3.436
2.457
2.443
2.434
2.427
2.416
2.390
2.375
2.351
2.335
2.320
2.155
2.137
2.118
2.098
2.081
2.043
1.790
1.743
1.742
1.720
1.678
1.413
1.410
1.339
1.278
1.260
1.247
1.242
1.220
10.00
10.32
10.53
43.37
10.08
29.53
33.96
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm

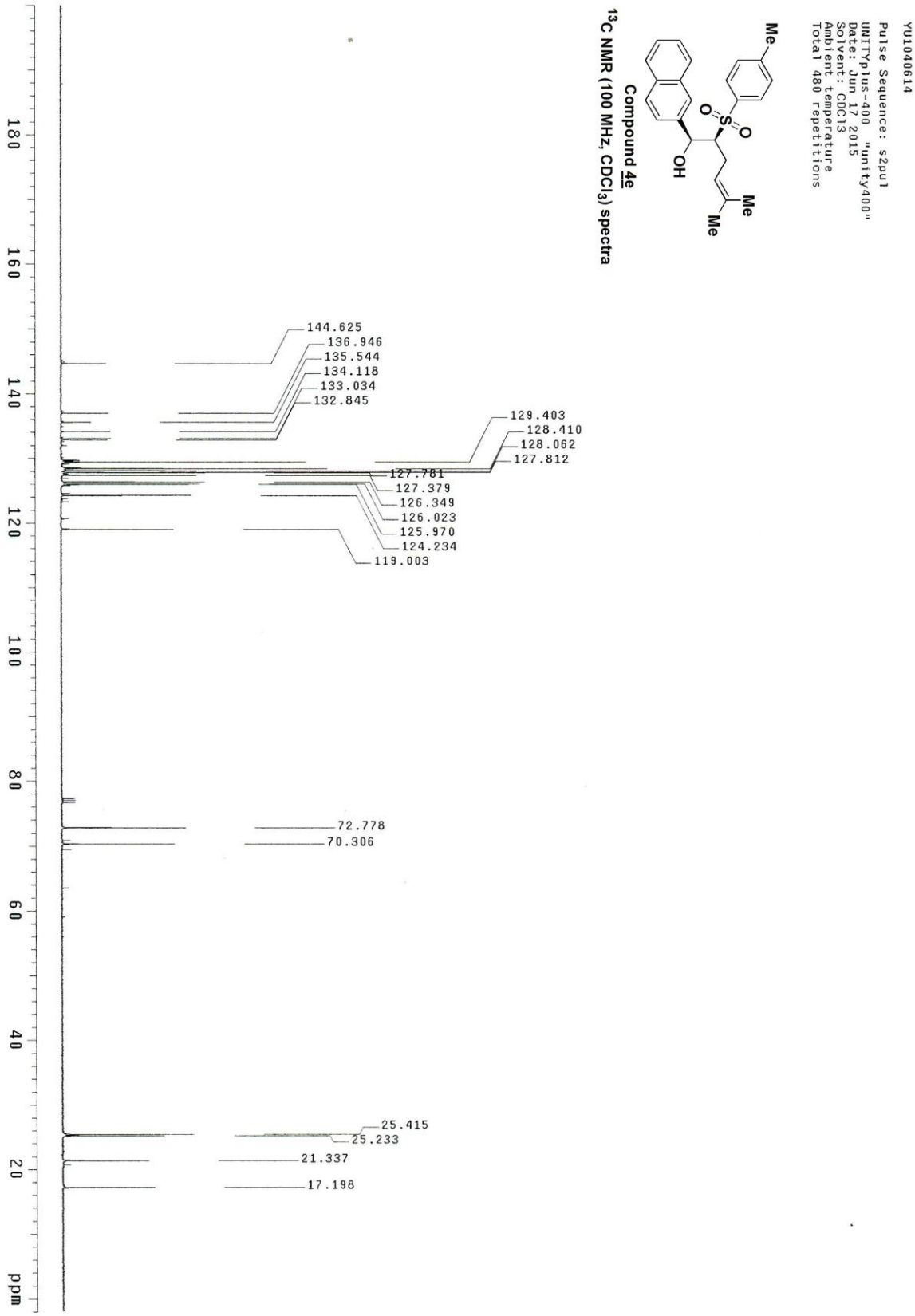

YU1040615
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH
Me
Me
Compound 4d
1H NMR (400 MHz, CDCl3) spectra
20.45
116.76
7.803
7.782
7.772
7.755
7.751
7.695
7.675
7.612
7.574
7.565
7.561
7.556
7.553
7.546
7.543
7.541
7.535
7.533
7.525
7.515
7.499
7.495
7.480
7.454
7.449
7.435
7.416
7.392
7.372
7.367
7.363
7.352
7.348
7.342
7.329
7.323
7.302
7.260
ppm

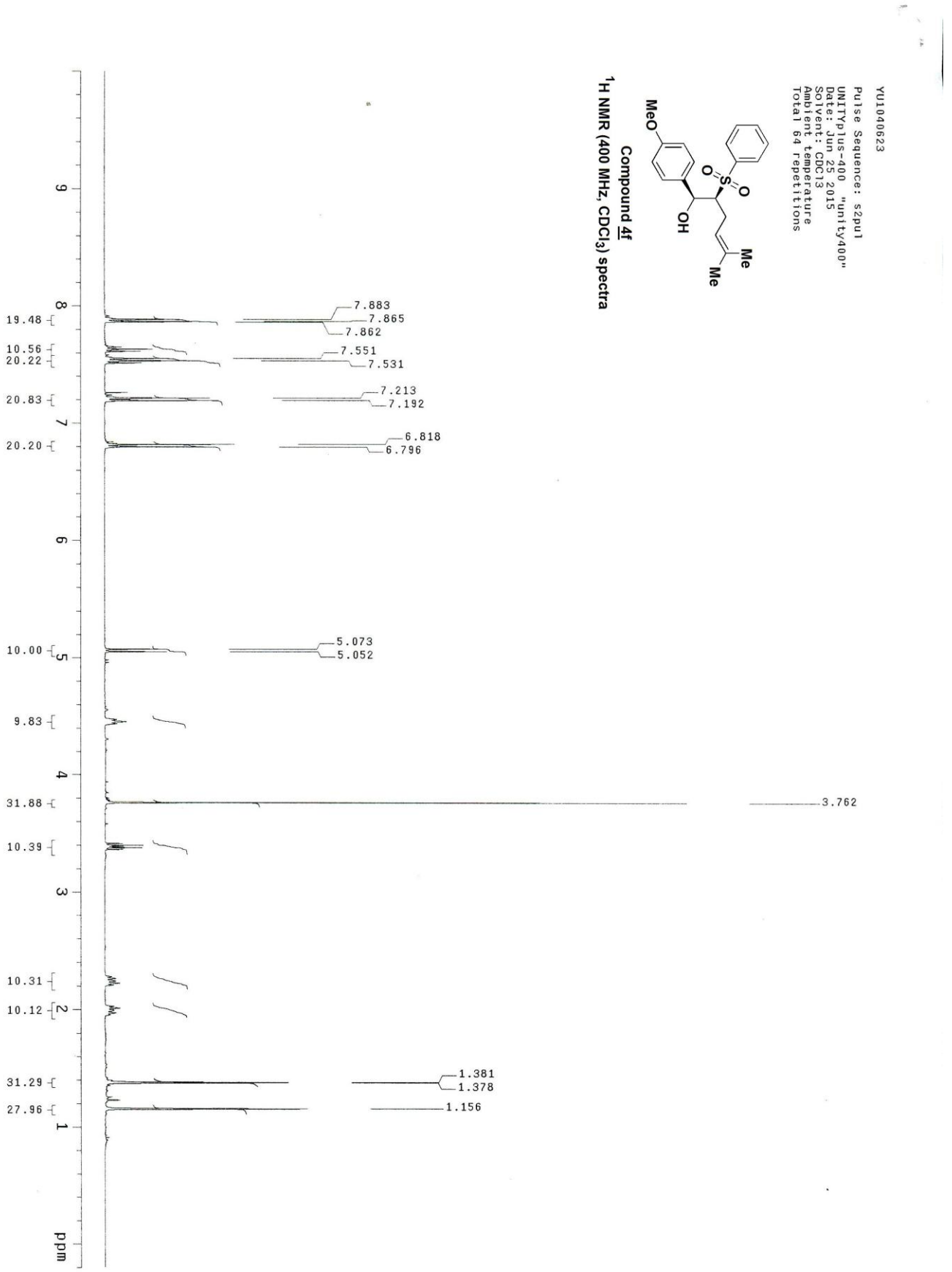

YU1040615
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 352 repetitions
Me
O
S
O
OH
Me
Me
Compound 4d
13C NMR (100 MHz, CDCl3) spectra
144.769
141.039
140.501
138.697
135.551
134.134
129.820
129.608
128.676
128.638
128.570
128.463
127.508
127.296
127.251
126.970
126.894
126.834
125.886
119.177
77.318
77.000
76.682
72.565
70.708
25.537
25.423
21.489
17.289
180
160
140
120
100
80
60
40
20
ppm

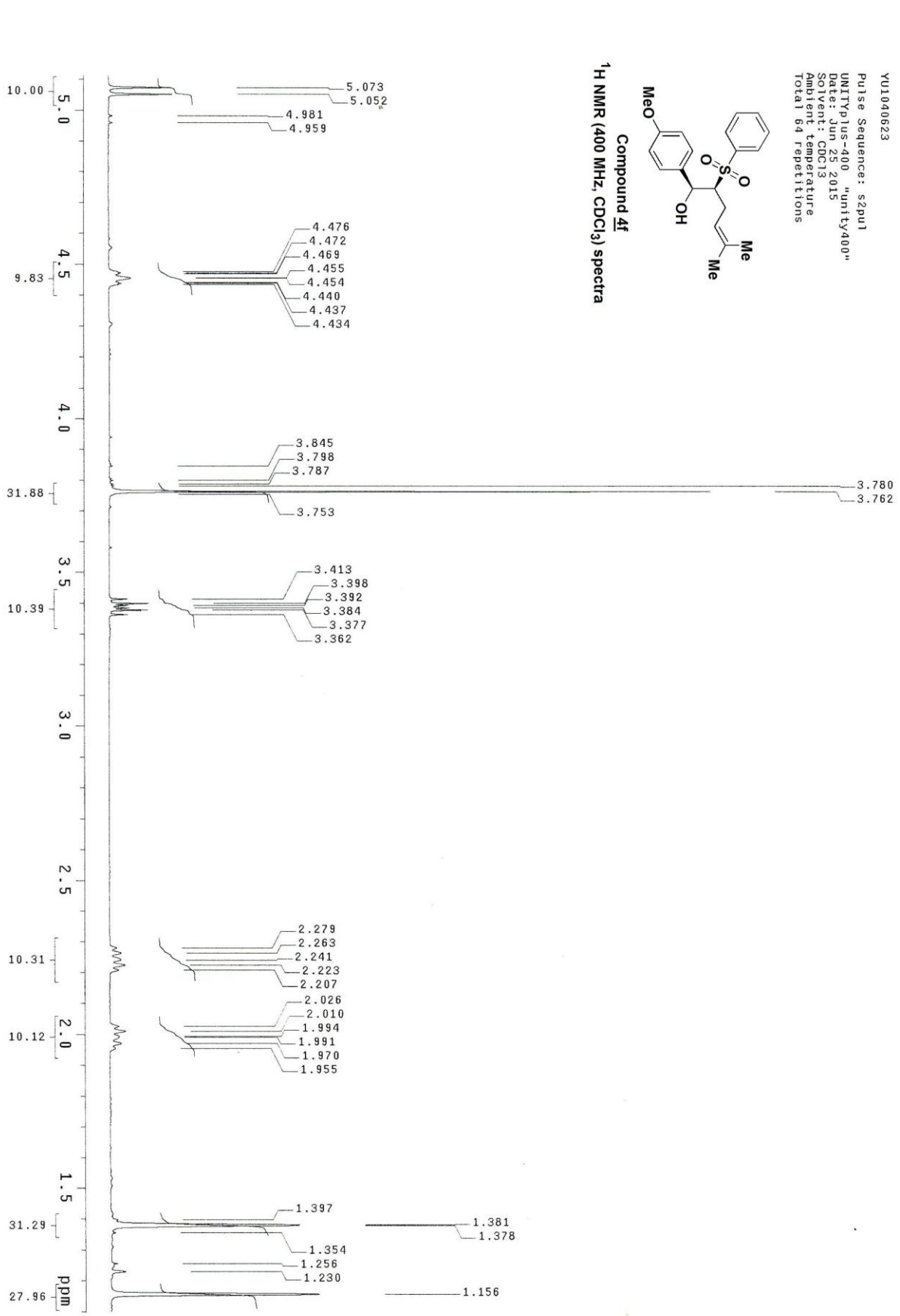

YU1040614
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Me
Me
Me
OH
Compound 4e
1H NMR (400 MHz, CDCl3) spectra
7.755
7.730
7.719
7.715
7.708
7.703
7.698
7.460
7.450
7.447
7.437
7.196
7.176
5.277
5.257
2.329
1.310
1.308
1.122
62.49
31.01
19.10
10.00
10.73
10.21
43.54
10.71
30.15
28.20
ppm


YU1040614
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Me
OH
Me
Me
Compound 4e
1H NMR (400 MHz, CDCl3) spectra
10.00
5.277
5.257
5.0
4.844
4.573
4.570
4.559
4.556
10.73
4.5
4.552
4.541
4.538
4.100
4.0
3.569
3.555
3.552
3.550
10.21
3.5
3.538
3.536
3.533
3.519
3.0
2.5
2.413
2.399
2.392
43.54
2.377
2.353
2.339
2.329
2.182
2.165
2.146
10.71
ppm
2.126
2.109


YU140614
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Me
OH
Me
Me
Compound 4e
1H NMR (400 MHz, CDCl3) spectra
7.852
7.843
7.832
7.779
7.767
7.755
7.747
7.730
7.719
7.715
7.708
7.703
7.698
7.471
7.467
7.460
7.454
7.450
7.447
7.443
7.437
7.430
7.426
7.400
7.396
7.379
7.375
7.339
7.319
7.260
7.240
7.238
7.196
7.176
62.49
31.01
19.10
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
ppm

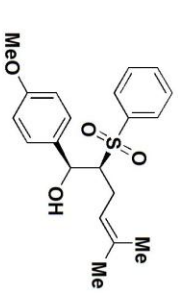

YU1040614
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 480 repetitions
Me
O
S
O
OH
Me
Me
Compound 4e
13C NMR (100 MHz, CDCl3) spectra
144.625
136.946
135.544
134.118
133.034
132.845
129.403
128.410
128.062
127.812
127.781
127.379
126.349
126.023
125.970
124.234
119.003
72.778
70.306
25.415
25.233
21.337
17.198
180
160
140
120
100
80
60
40
20
ppm


YU1040623
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH
O
S
O
Me
Me
Compound 4f
1H NMR (400 MHz, CDCl3) spectra
7.883
7.865
7.862
7.551
7.531
7.213
7.192
6.818
6.796
5.073
5.052
3.762
1.381
1.378
1.156
19.48
10.56
20.22
20.83
20.20
10.00
9.83
31.88
10.39
10.31
10.12
31.29
27.96
ppm


YU1040623
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 4f
1H NMR (400 MHz, CDCl3) spectra
MeO
OH
Me
Me
10.00
9.83
31.88
10.39
10.31
10.12
31.29
27.96
ppm
5.073
5.052
4.981
4.959
4.476
4.472
4.469
4.455
4.454
4.440
4.437
4.434
3.845
3.798
3.787
3.780
3.762
3.753
3.413
3.398
3.392
3.384
3.377
3.362
2.279
2.263
2.241
2.223
2.207
2.026
2.010
1.994
1.991
1.970
1.955
1.397
1.381
1.378
1.354
1.256
1.230
1.156

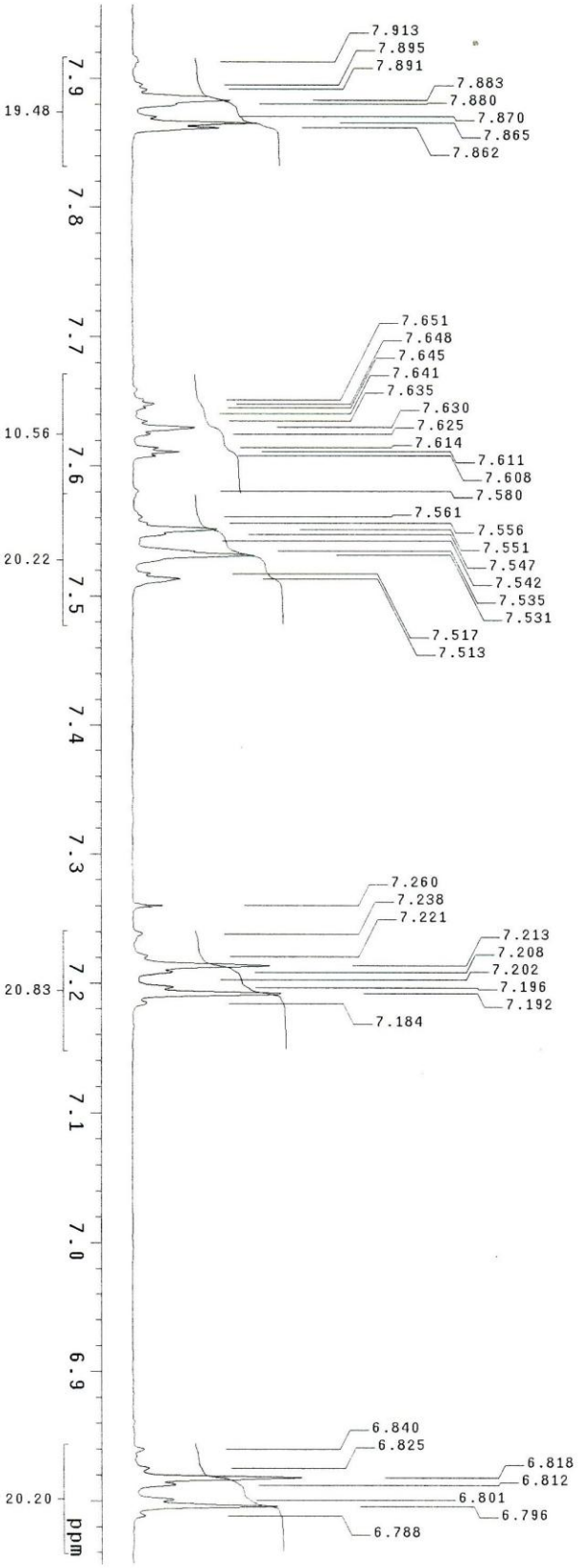
YU1040623

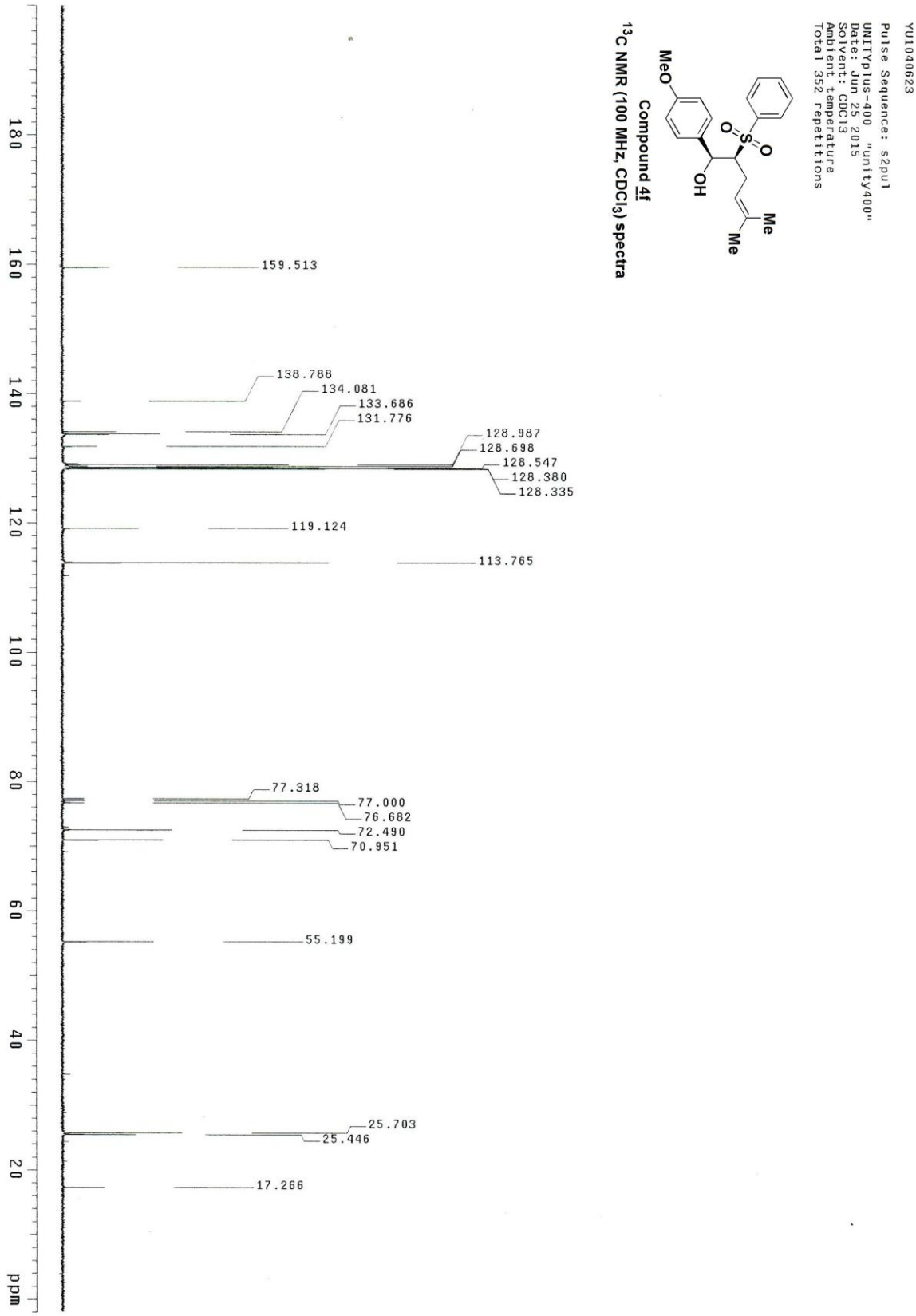
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

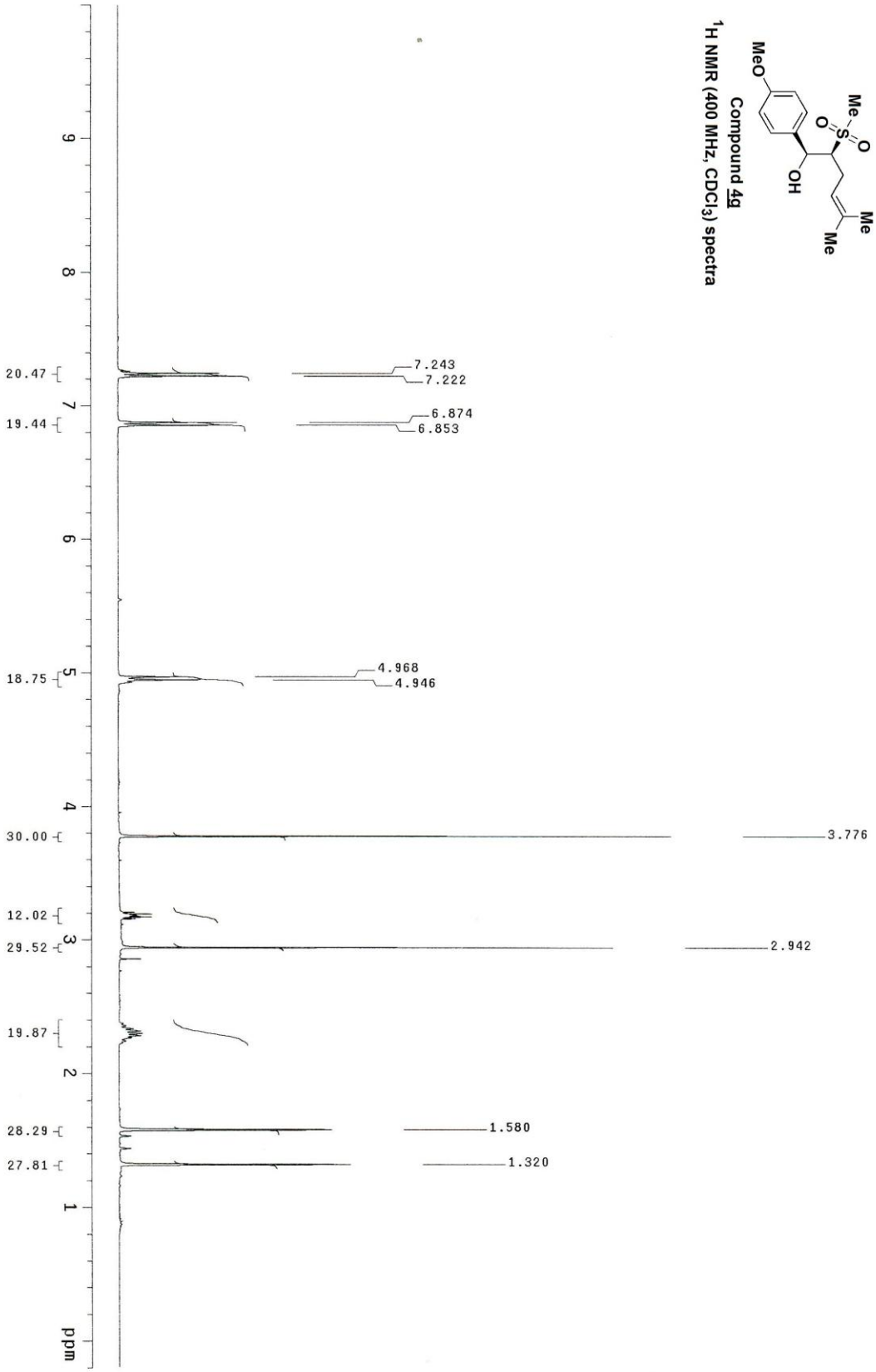


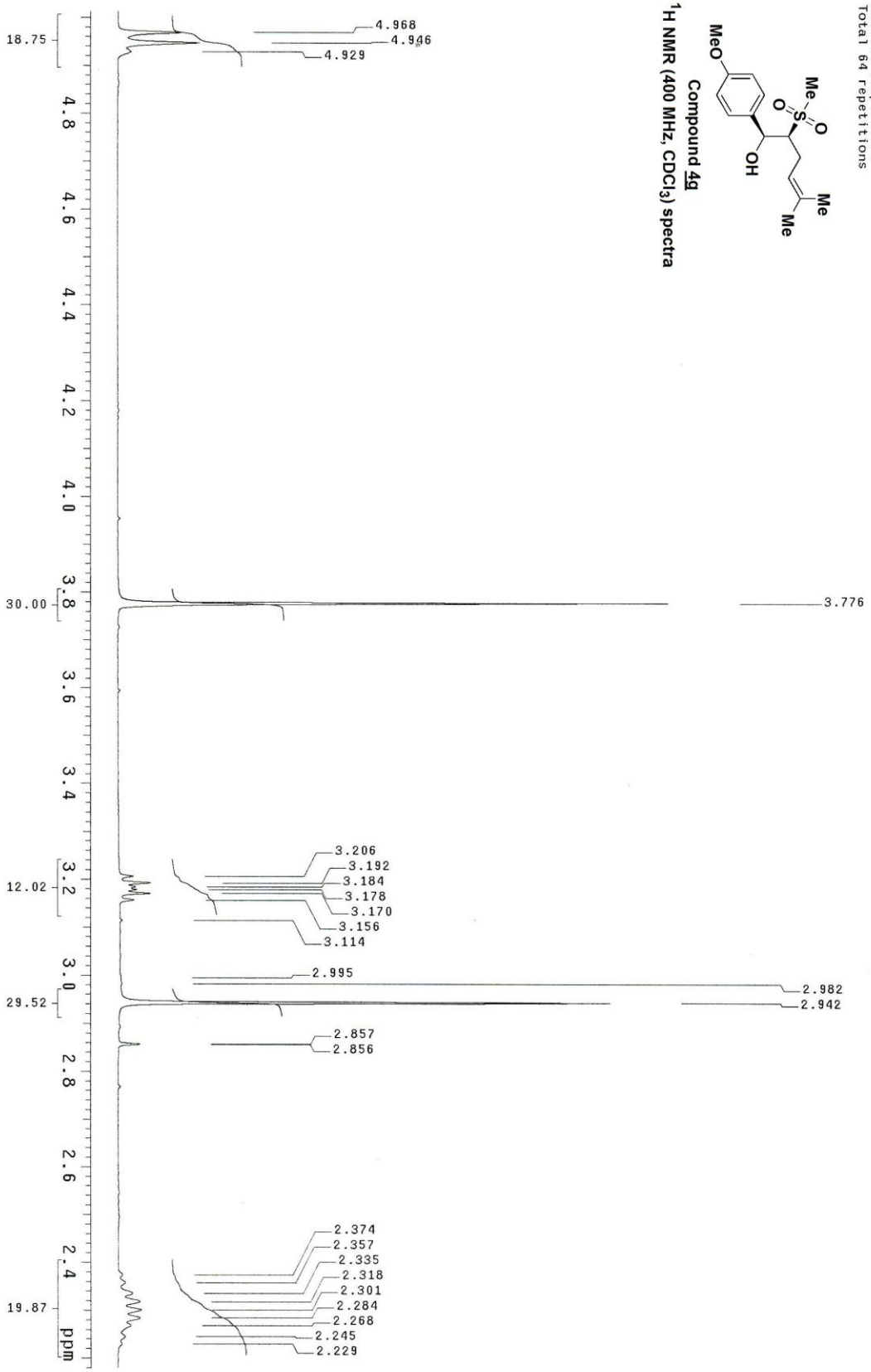
Compound 4f

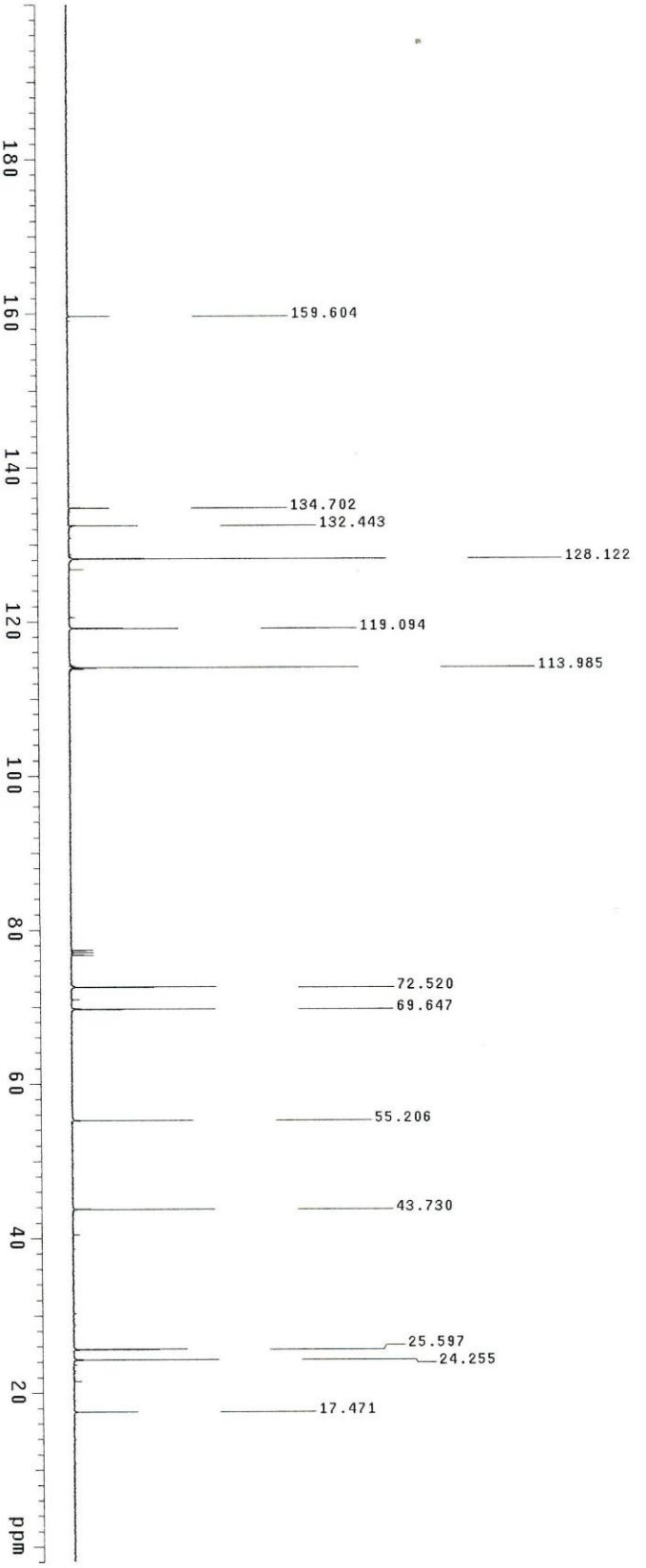
^{1}H NMR (400 MHz, $CDCl_3$) spectra

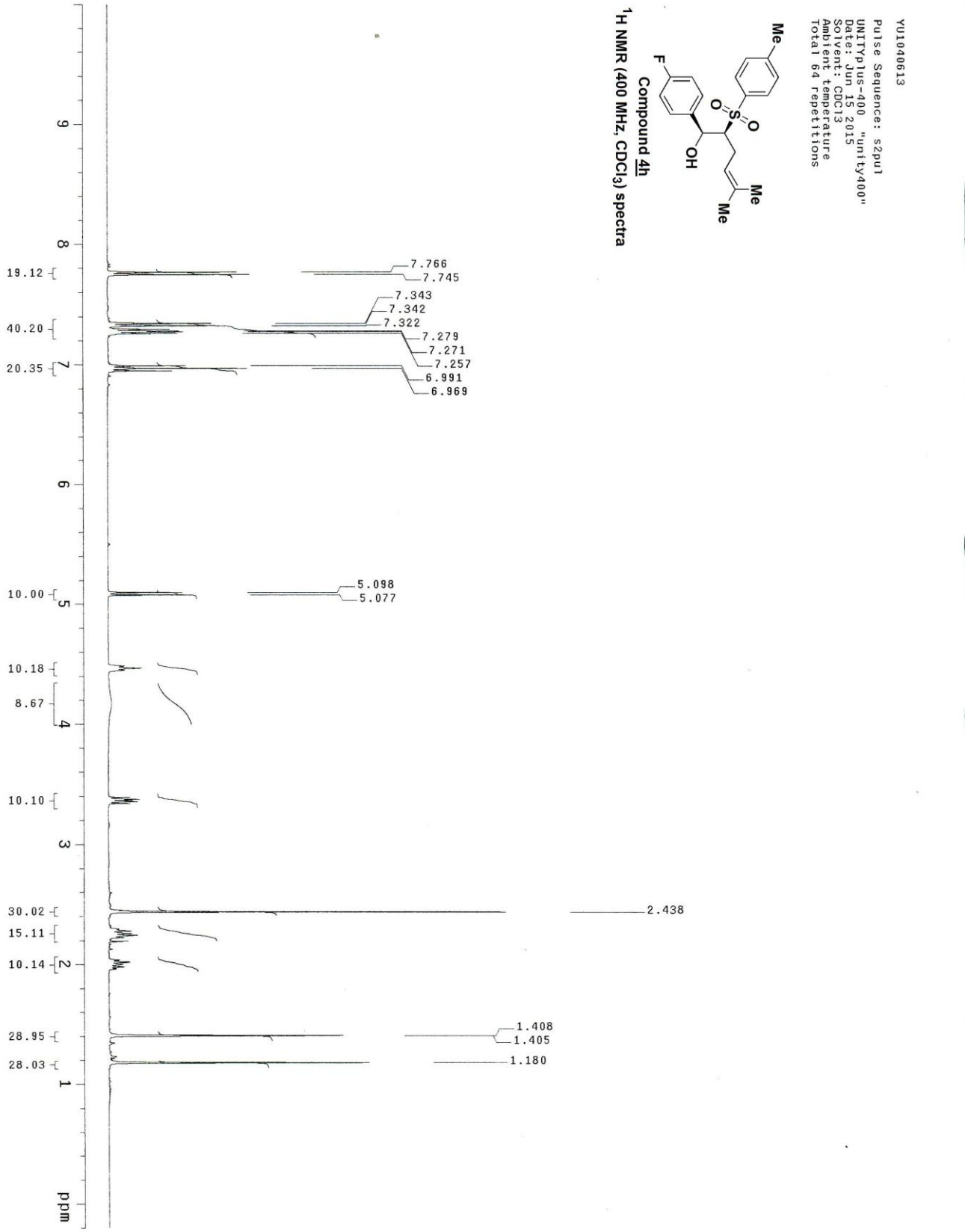


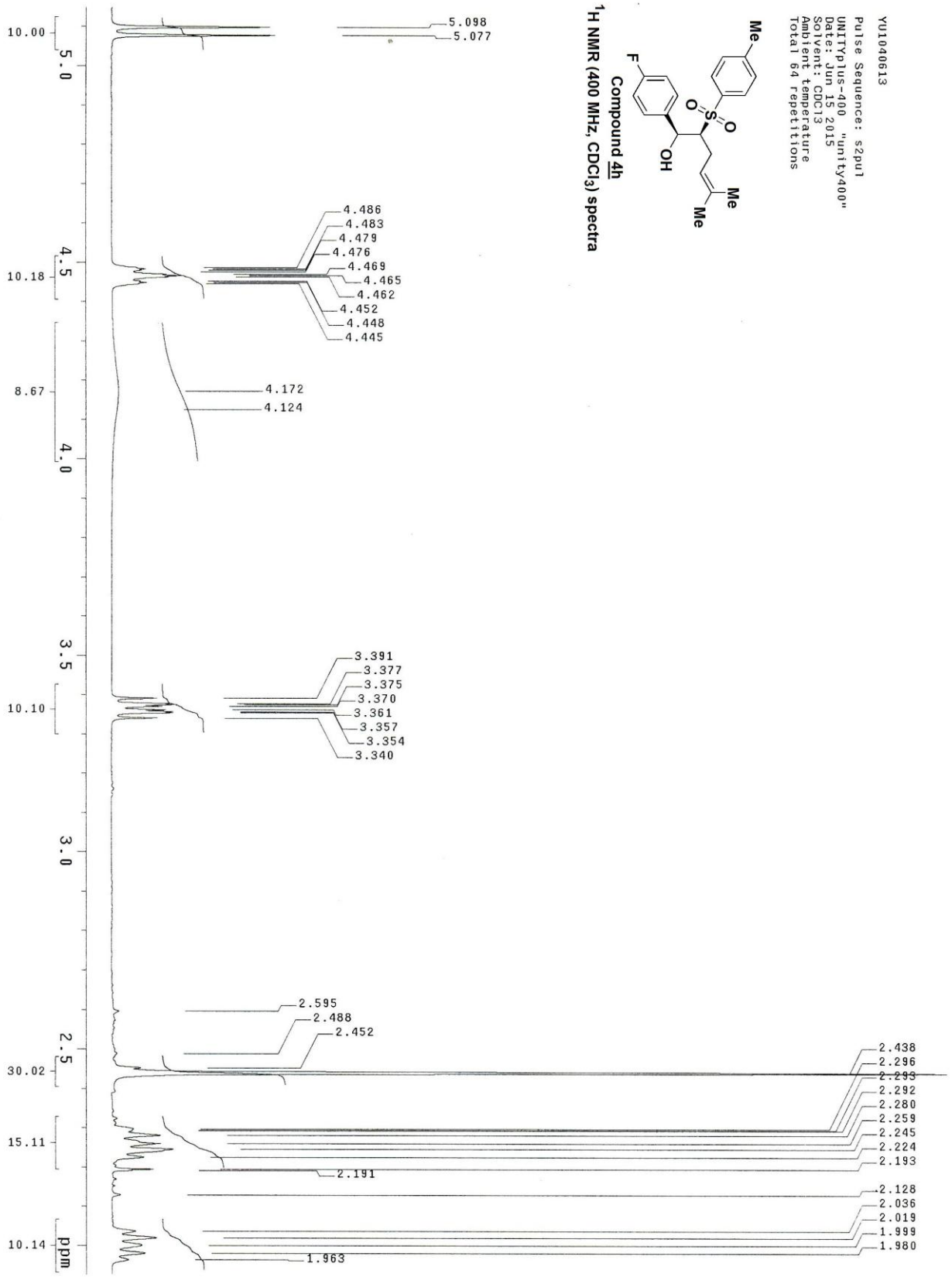

YU1040623
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 352 repetitions
MeO
OH
O
S
O
Me
Me
Compound 4f
13C NMR (100 MHz, CDCl3) spectra
159.513
138.788
134.081
133.686
131.776
128.987
128.698
128.547
128.380
128.335
119.124
113.765
77.318
77.000
76.682
72.490
70.951
55.199
25.703
25.446
17.266
180
160
140
120
100
80
60
40
20
ppm

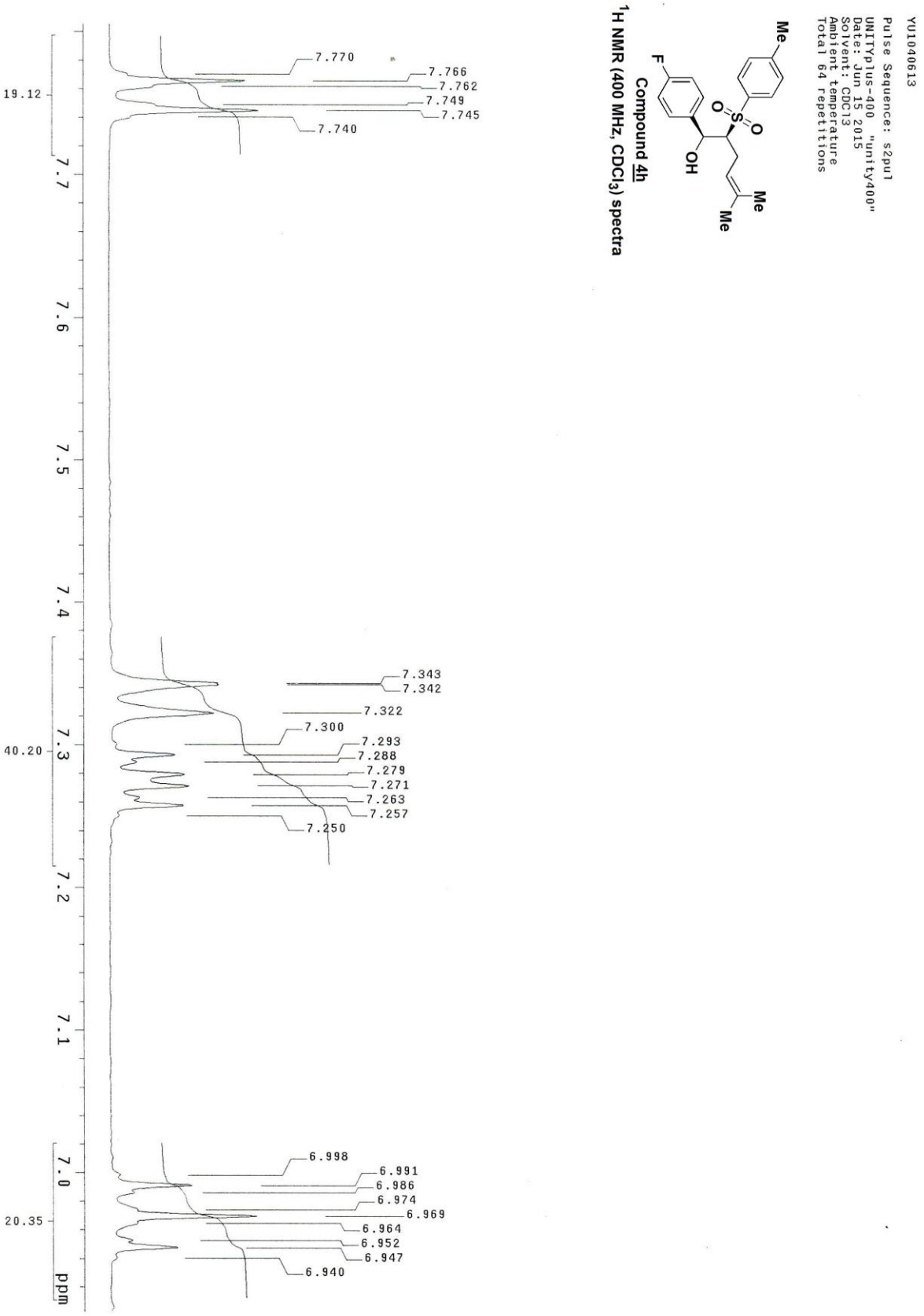

YU1040621
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 18 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH
Me
Me
Me
Compound 4g
1H NMR (400 MHz, CDCl3) spectra
7.243
7.222
6.874
6.853
4.968
4.946
3.776
2.942
1.580
1.320
20.47
19.44
18.75
30.00
12.02
29.52
19.87
28.29
27.81
ppm

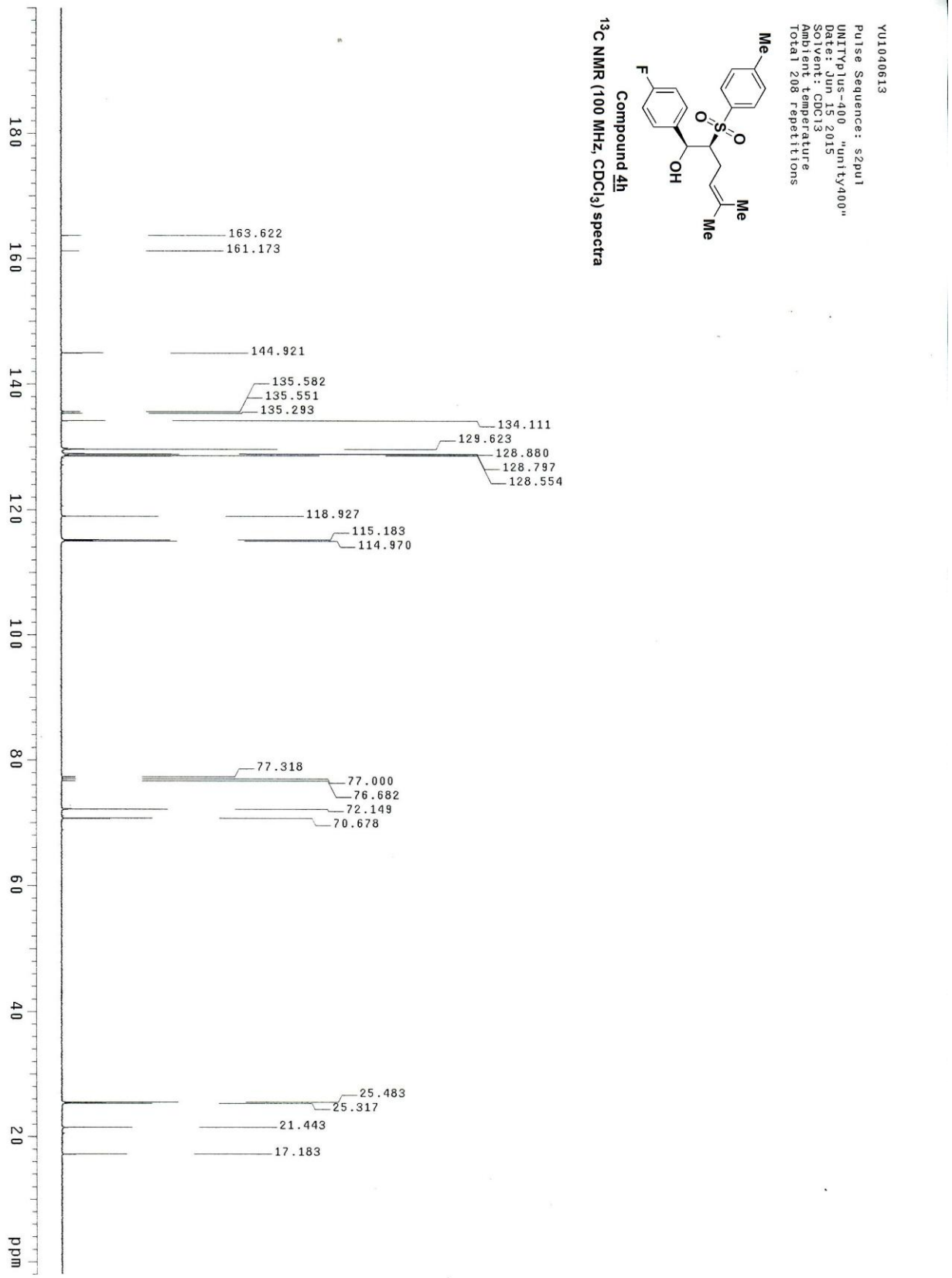

YU1040621
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 18 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH
Me
Me
Me
Compound 4g
1H NMR (400 MHz, CDCl3) spectra
18.75
30.00
12.02
29.52
19.87
4.968
4.946
4.929
3.776
3.206
3.192
3.184
3.178
3.170
3.156
3.114
2.995
2.982
2.942
2.857
2.856
2.374
2.357
2.335
2.318
2.301
2.284
2.268
2.245
2.229
ppm

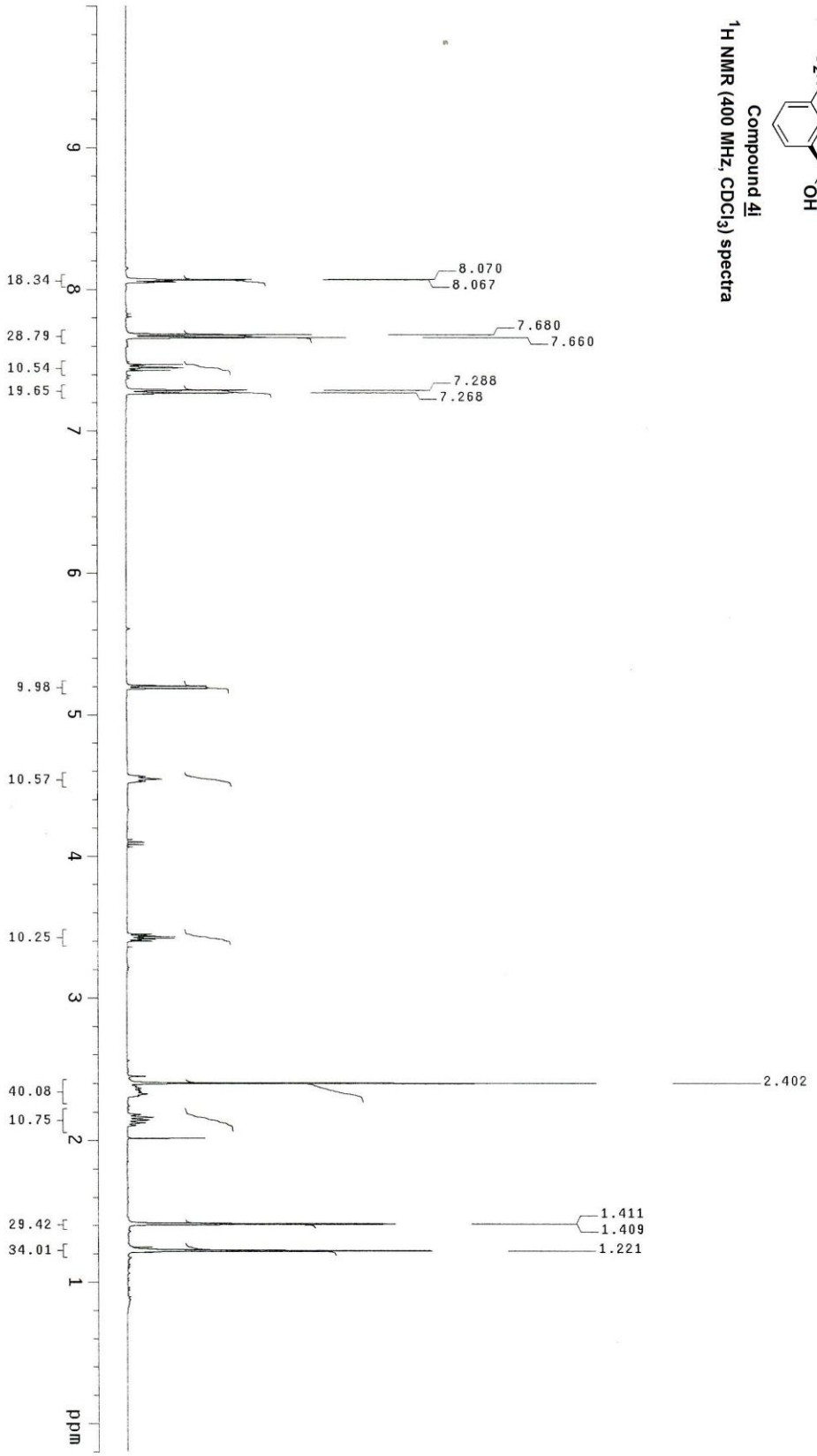

YU1040621
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 18 2015
Solvent: CDCl3
Ambient temperature
Total 64000 repetitions
MeO
OH
Me
Me
Me
Compound 4g
13C NMR (100 MHz, CDCl3) spectra
159.604
134.702
132.443
128.122
119.094
113.985
72.520
69.647
55.206
43.730
25.597
24.255
17.471
ppm

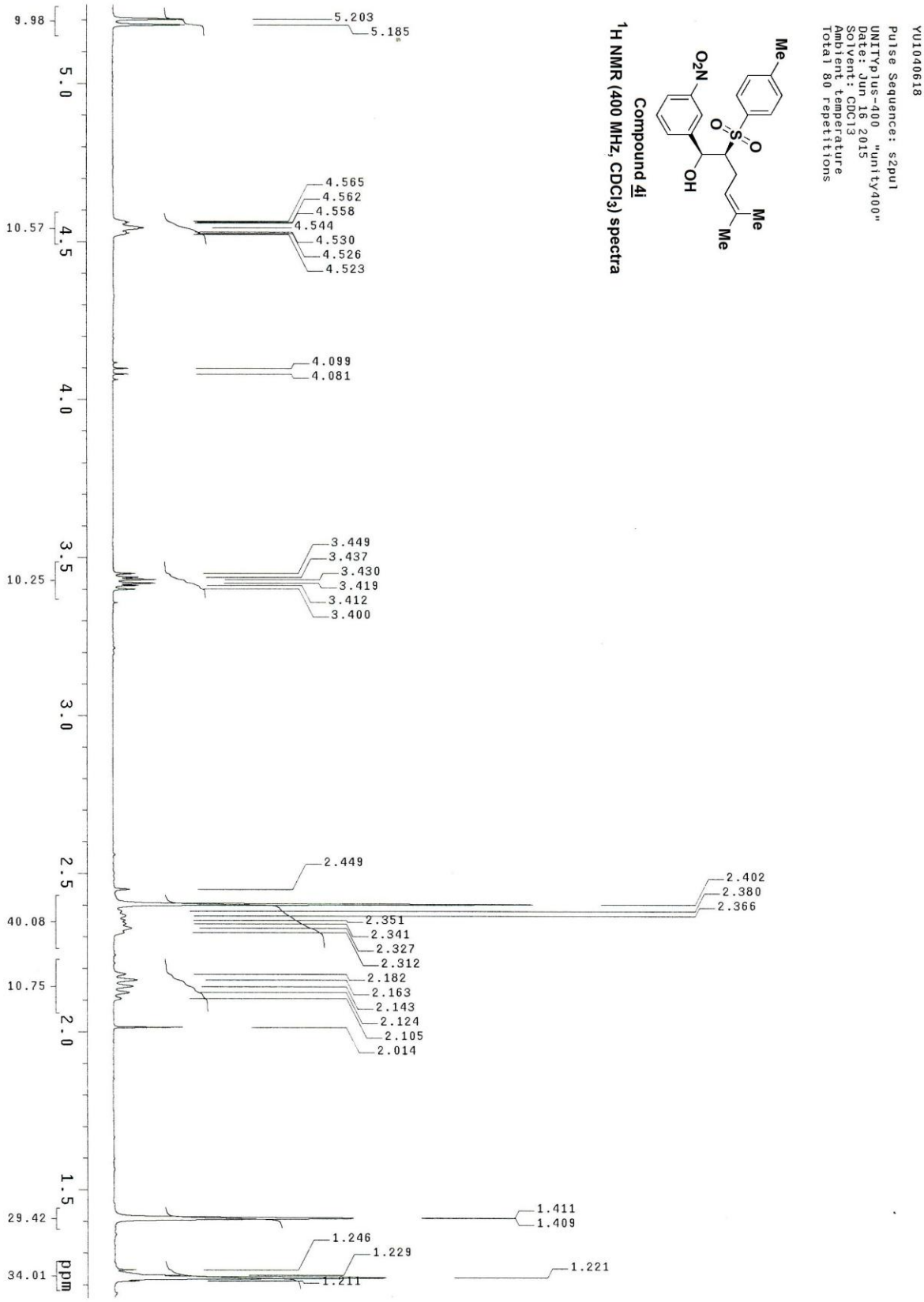

YU1040613
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
F
O
S
O
OH
Me
Me
Compound 4h
1H NMR (400 MHz, CDCl3) spectra
19.12
40.20
20.35
10.00
10.18
8.67
10.10
30.02
15.11
10.14
28.95
28.03
7.766
7.745
7.343
7.342
7.322
7.279
7.271
7.257
6.991
6.969
5.098
5.077
2.438
1.408
1.405
1.180
ppm

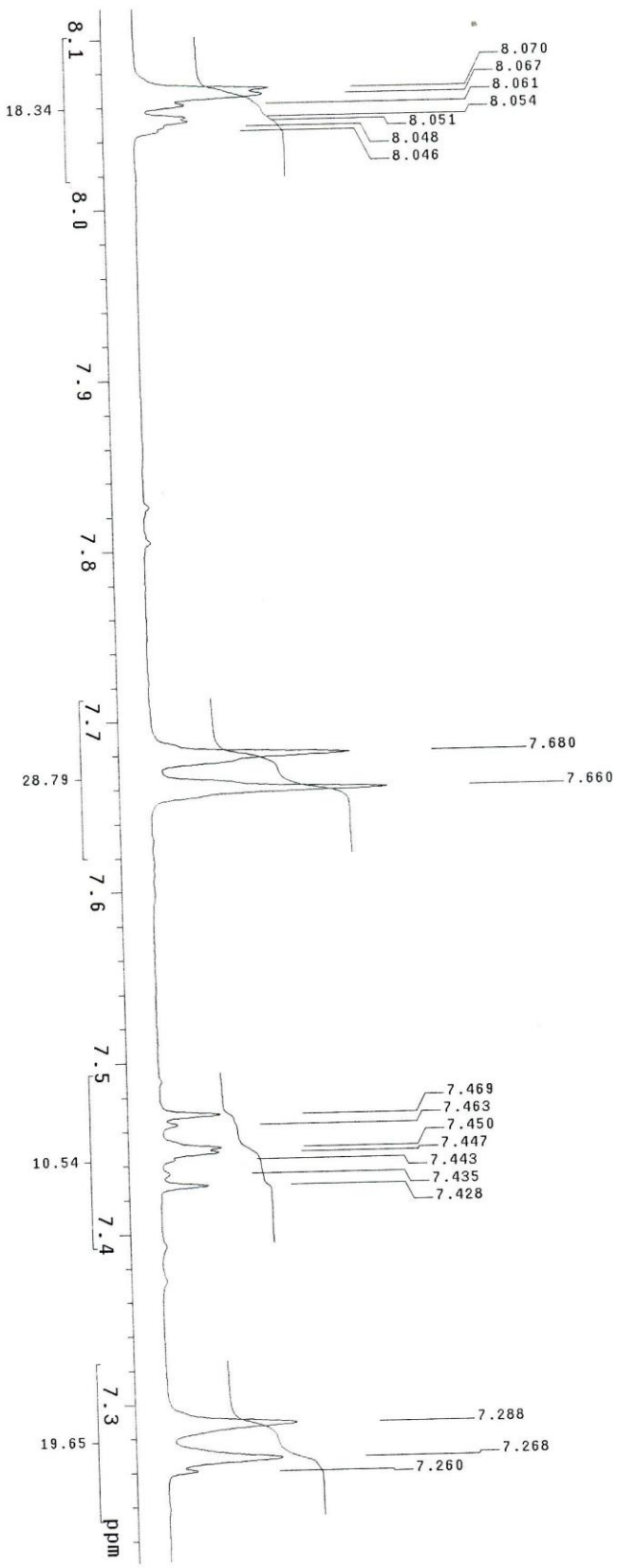

YU1040613
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 4h
1H NMR (400 MHz, CDCl3) spectra
Me
F
OH
Me
Me
10.00
10.18
8.67
10.10
30.02
15.11
10.14
ppm
5.098
5.077
4.486
4.483
4.479
4.476
4.469
4.465
4.462
4.452
4.448
4.445
4.172
4.124
3.391
3.377
3.375
3.370
3.361
3.357
3.354
3.340
2.595
2.488
2.452
2.438
2.296
2.293
2.292
2.280
2.259
2.245
2.224
2.193
2.191
2.128
2.036
2.019
1.999
1.980
1.963

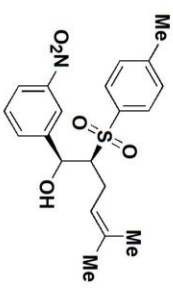

YU1040613
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
F
O
S
O
OH
Me
Me
Compound 4h
1H NMR (400 MHz, CDCl3) spectra
19.12
40.20
20.35
7.770
7.766
7.762
7.749
7.745
7.740
7.343
7.342
7.322
7.300
7.293
7.288
7.279
7.271
7.263
7.257
7.250
6.998
6.991
6.986
6.974
6.969
6.964
6.952
6.947
6.940
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
ppm


YU1040613
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 208 repetitions
Me
F
O
S
O
OH
Me
Me
Compound 4h
13C NMR (100 MHz, CDCl3) spectra
163.622
161.173
144.921
135.582
135.551
135.293
134.111
129.623
128.880
128.797
128.554
118.927
115.183
114.970
77.318
77.000
76.682
72.149
70.678
25.483
25.317
21.443
17.183
180
160
140
120
100
80
60
40
20
ppm


YU1040618
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Me
O2N
O
S
O
OH
Me
Me
Compound 4l
1H NMR (400 MHz, CDCl3) spectra
8.070
8.067
7.680
7.660
7.288
7.268
2.402
1.411
1.409
1.221
18.34
28.79
10.54
19.65
9.98
10.57
10.25
40.08
10.75
29.42
34.01
ppm


YU1040618
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Me
O2N
OH
Me
Me
Compound 4i
1H NMR (400 MHz, CDCl3) spectra
9.98
10.57
10.25
40.08
10.75
29.42
34.01
ppm
5.203
5.185
4.565
4.562
4.558
4.544
4.530
4.526
4.523
4.099
4.081
3.449
3.437
3.430
3.419
3.412
3.400
2.449
2.402
2.380
2.366
2.351
2.341
2.327
2.312
2.182
2.163
2.143
2.124
2.105
2.014
1.411
1.409
1.246
1.229
1.221
1.211



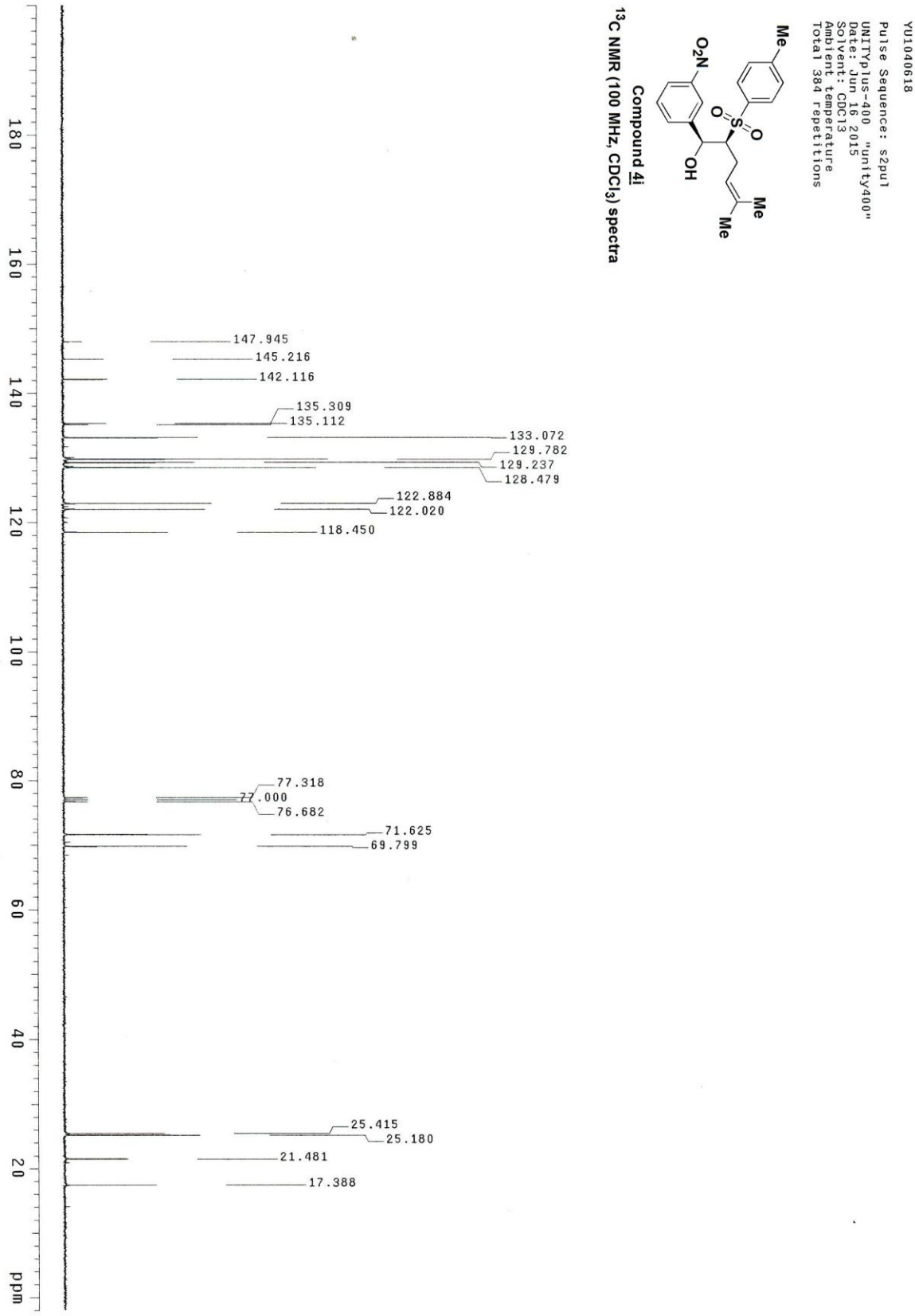


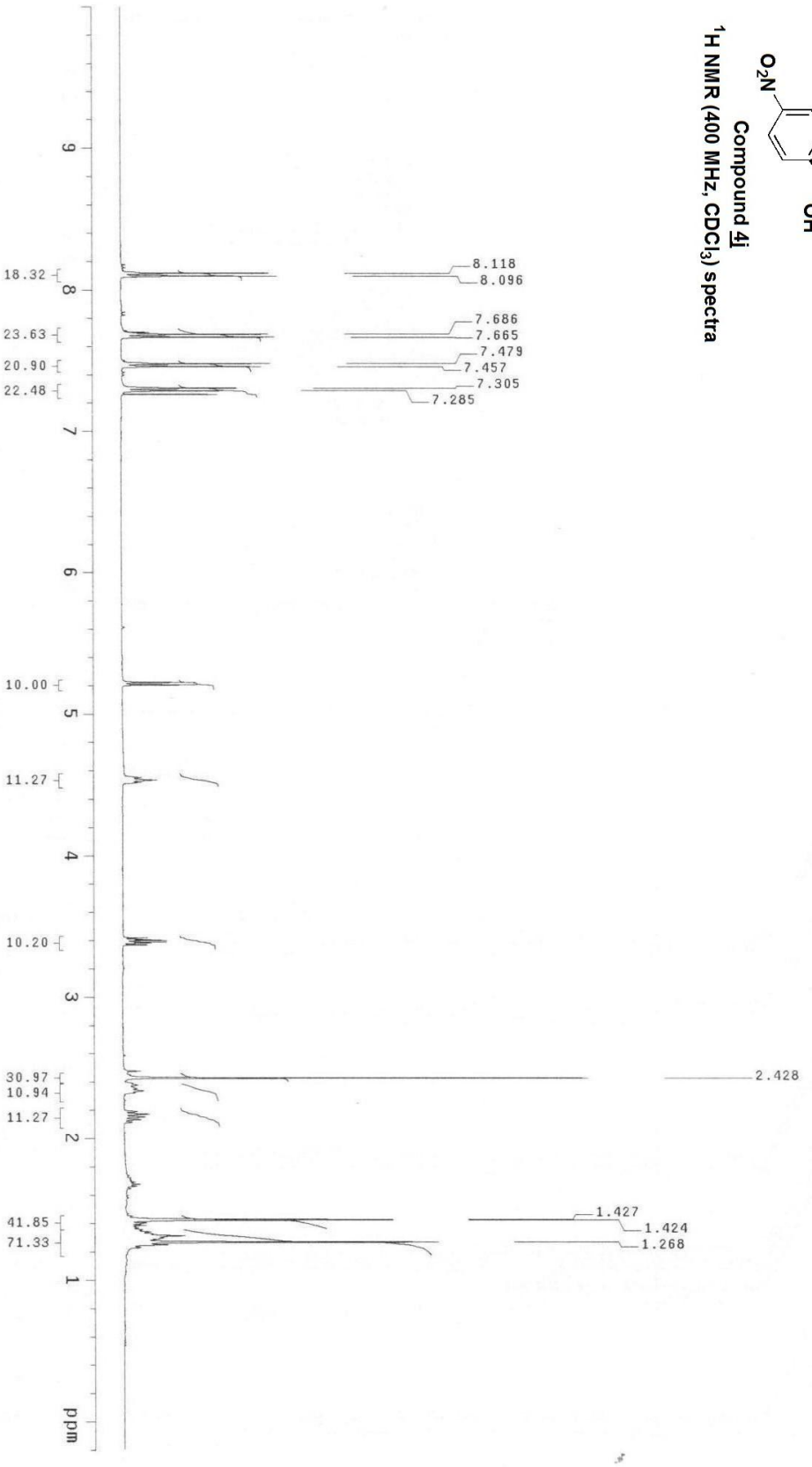
YU1040618

Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions

Compound 4i

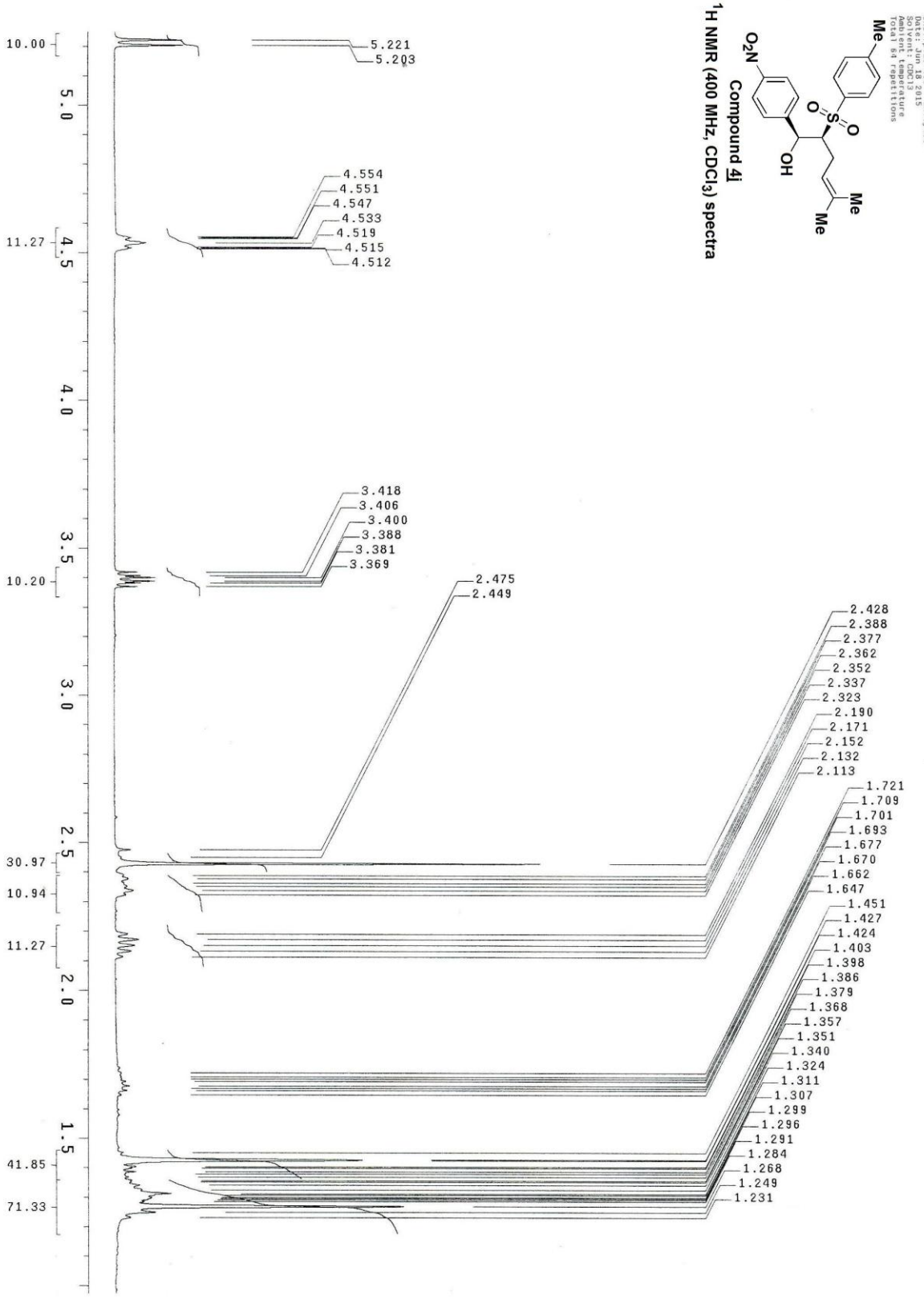
^{1}H NMR (400 MHz, $CDCl_3$) spectra

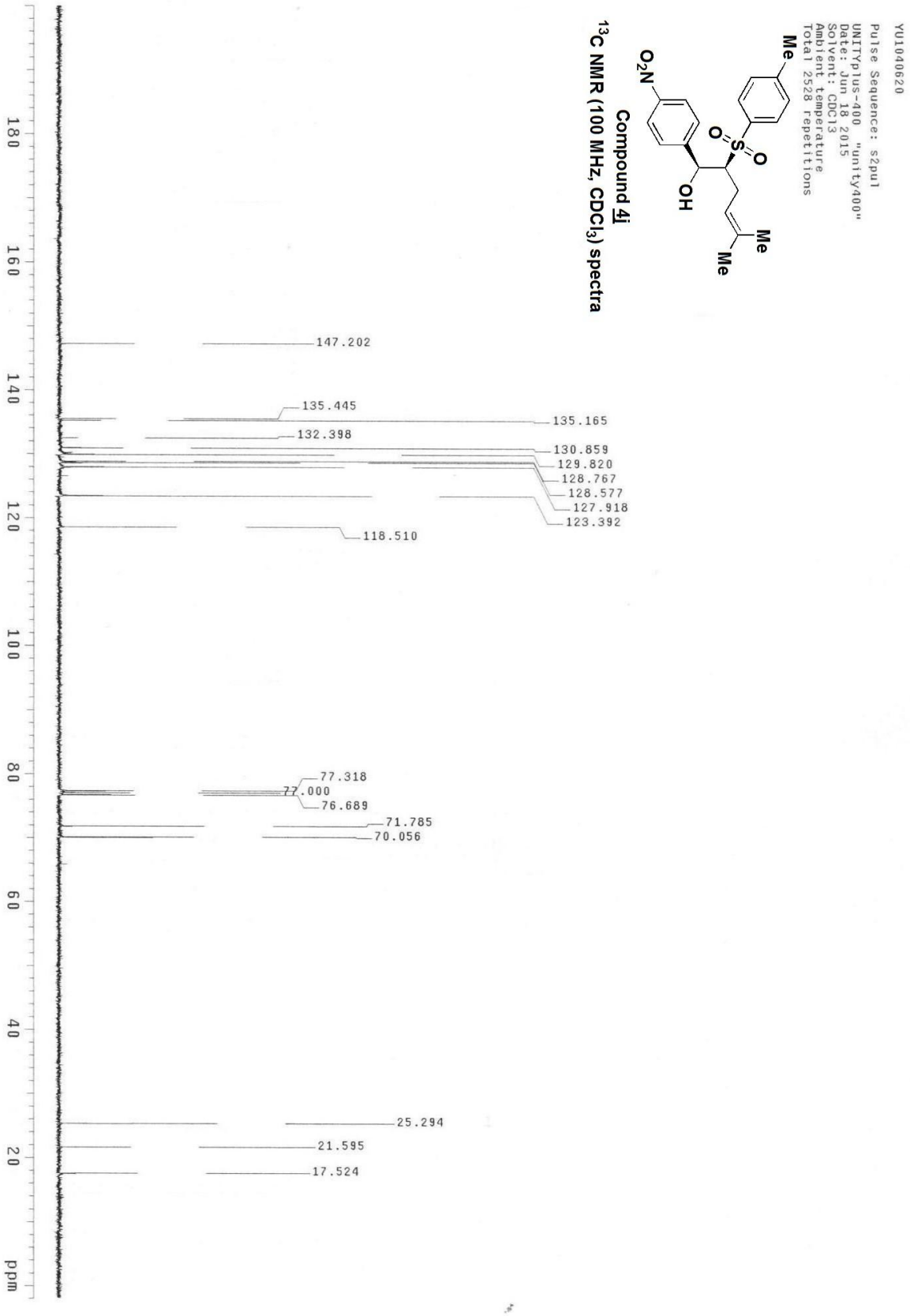

YU1040618
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 384 repetitions
Me
O2N
O
S
O
OH
Me
Me
Compound 4i
13C NMR (100 MHz, CDCl3) spectra
147.945
145.216
142.116
135.309
135.112
133.072
129.782
129.237
128.479
122.884
122.020
118.450
77.318
77.000
76.682
71.625
69.799
25.415
25.180
21.481
17.388
180
160
140
120
100
80
60
40
20
ppm

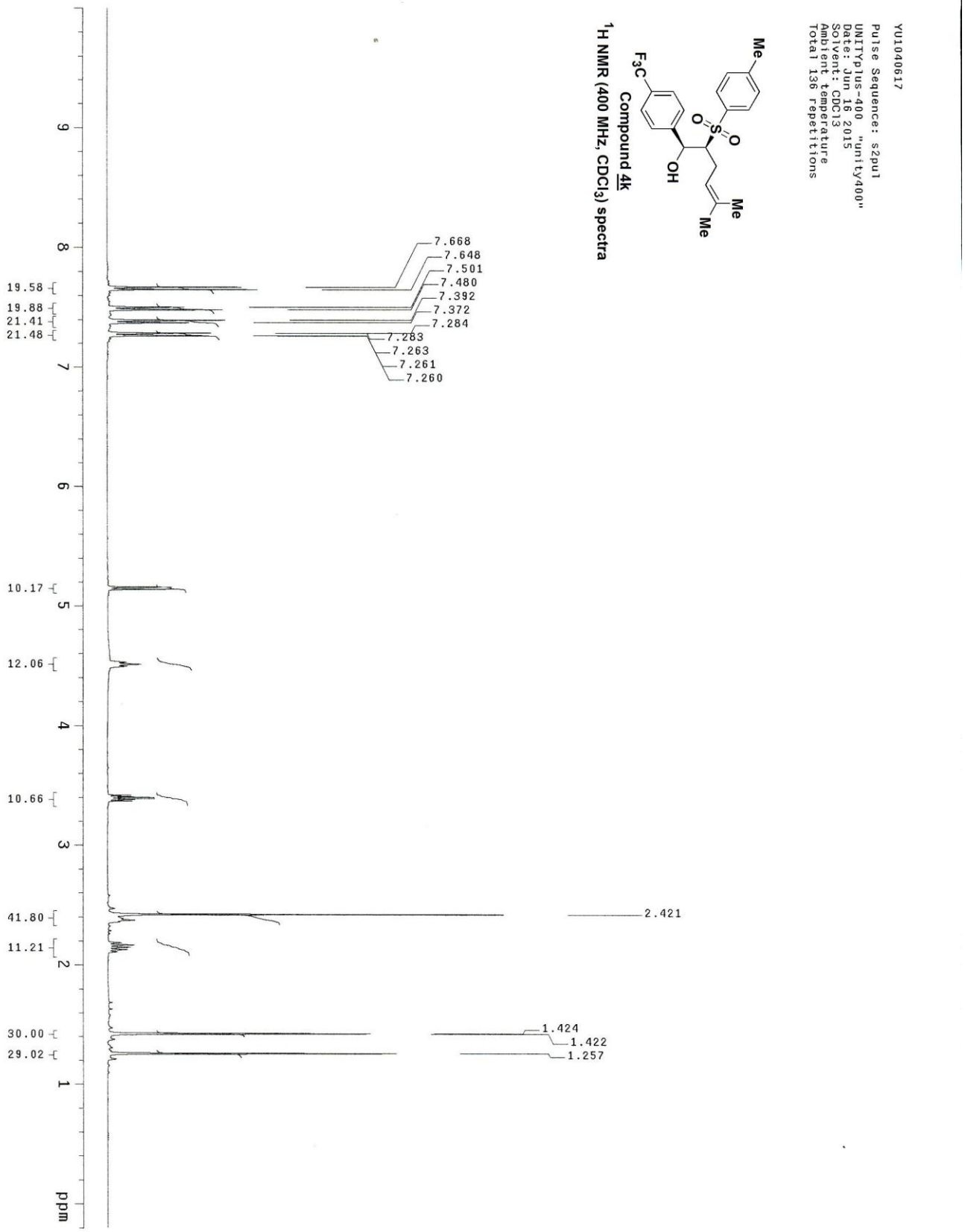


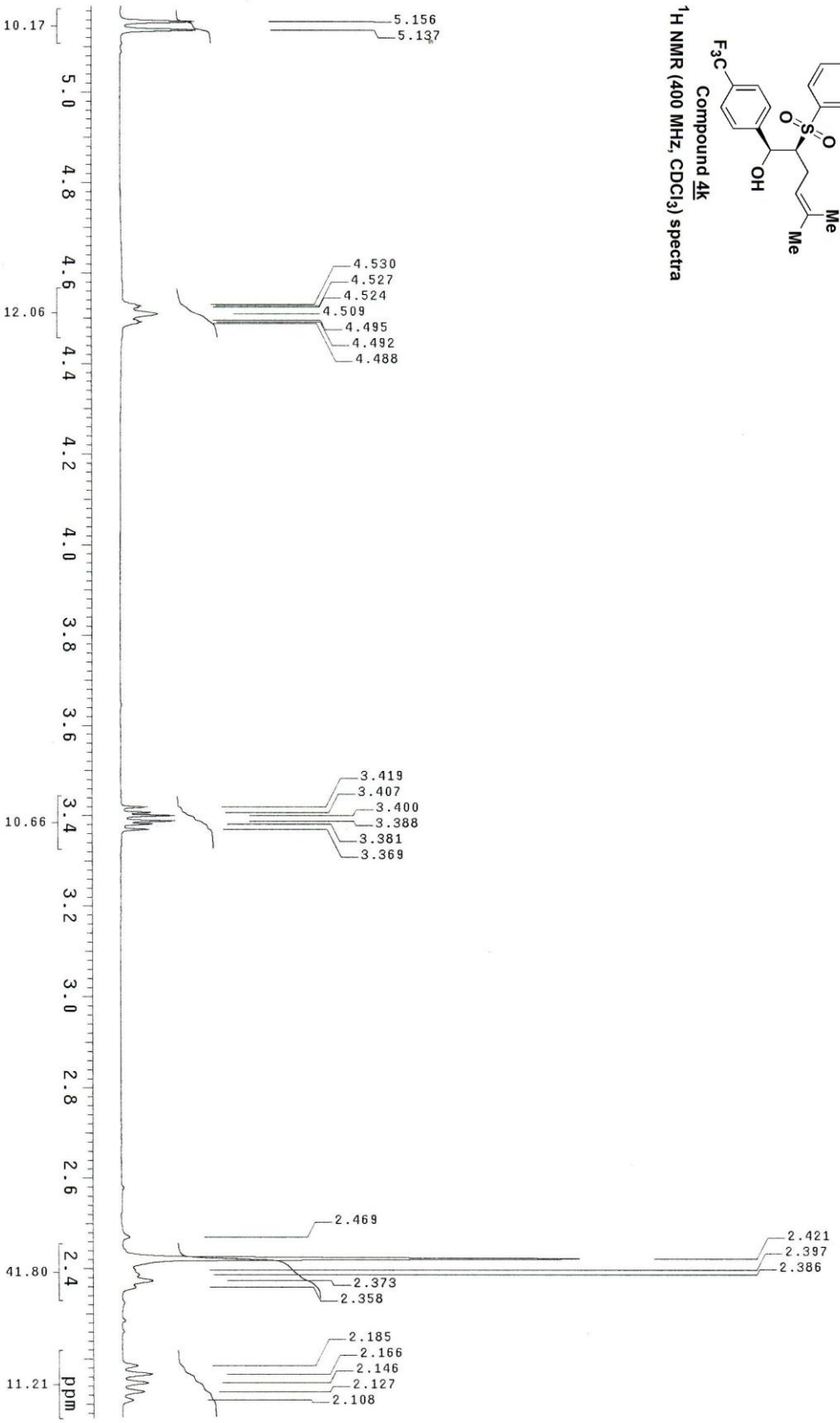
Compound 4i

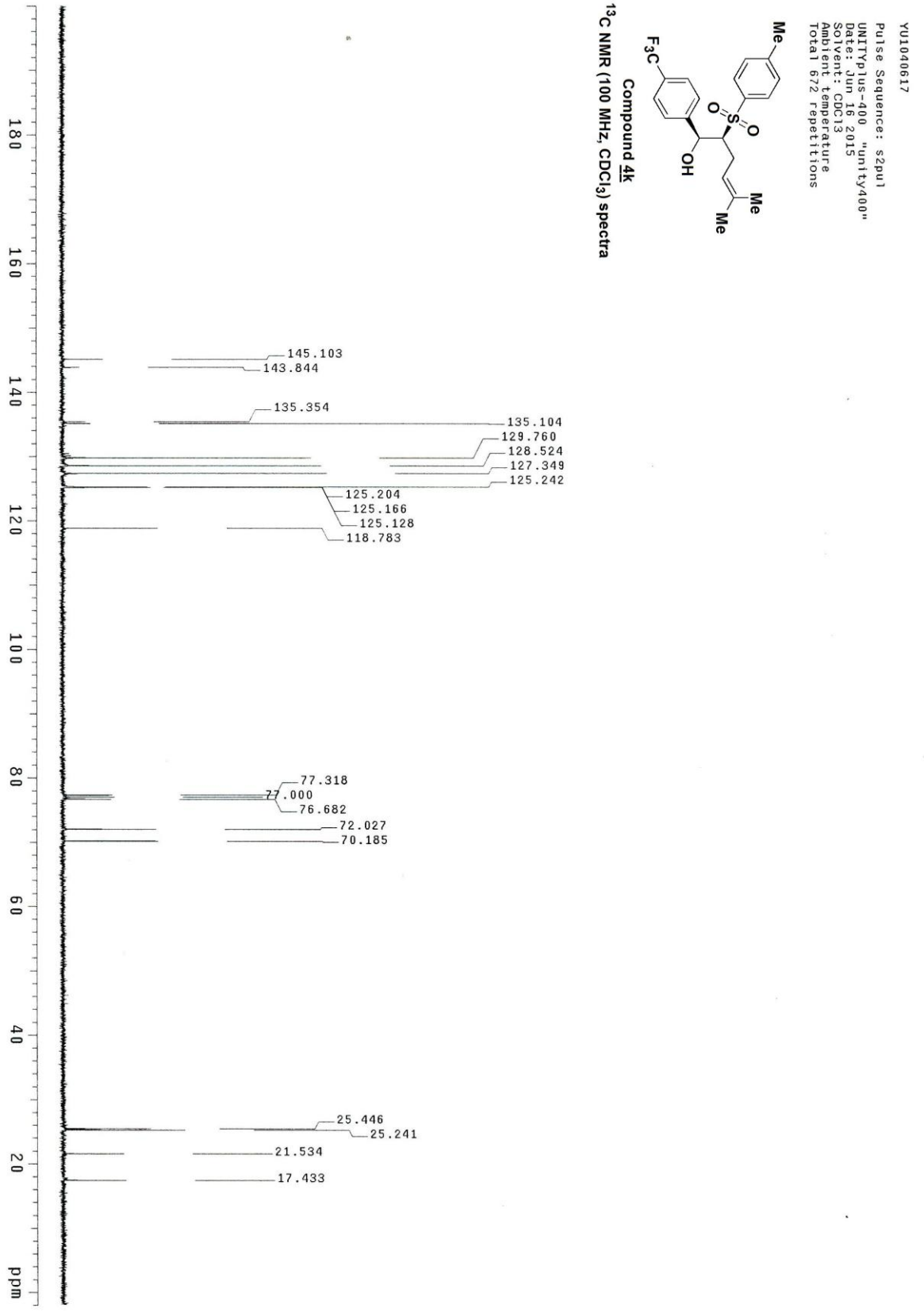
^{1}H NMR (400 MHz, $CDCl_3$) spectra

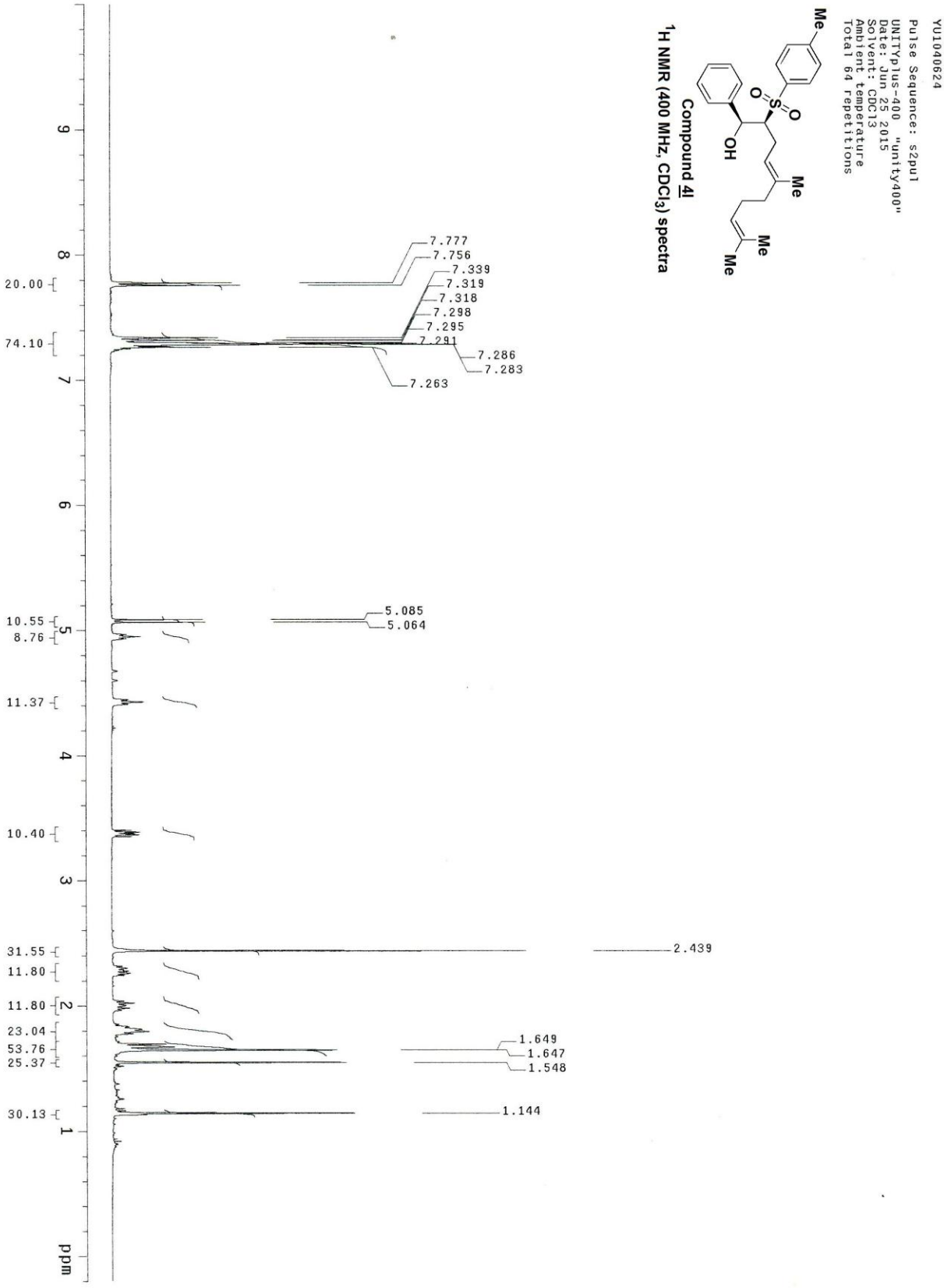

Compound 4j
^{1}H NMR (400 MHz, CDCl$_3$) spectra
O$_2$N
OH
Me
Me
Me
5.221
5.203
4.554
4.551
4.547
4.533
4.519
4.515
4.512
3.418
3.406
3.400
3.388
3.381
3.369
2.475
2.449
2.428
2.388
2.377
2.362
2.352
2.337
2.323
2.190
2.171
2.152
2.132
2.113
1.721
1.709
1.701
1.693
1.677
1.670
1.662
1.647
1.451
1.427
1.424
1.403
1.398
1.386
1.379
1.368
1.357
1.351
1.340
1.324
1.311
1.307
1.299
1.296
1.291
1.284
1.268
1.249
1.231
10.00
11.27
10.20
30.97
10.94
11.27
41.85
71.33

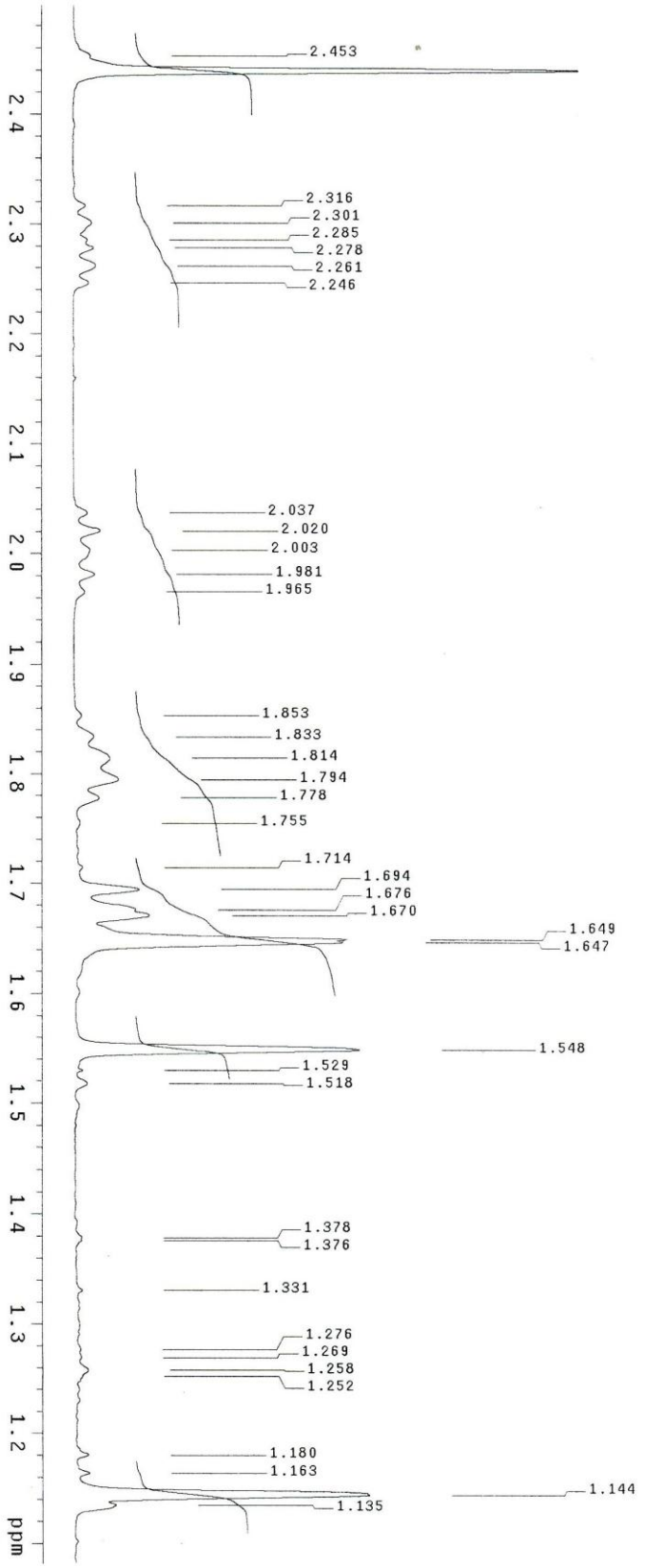

YU1040620
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 18 2015
Solvent: CDCl3
Ambient temperature
Total 2528 repetitions
Me
O2N
O
S
O
OH
Me
Me
Compound 4j
13C NMR (100 MHz, CDCl3) spectra
147.202
135.445
135.165
132.398
130.859
129.820
128.767
128.577
127.918
123.392
118.510
77.318
77.000
76.689
71.785
70.056
25.294
21.595
17.524
180
160
140
120
100
80
60
40
20
ppm

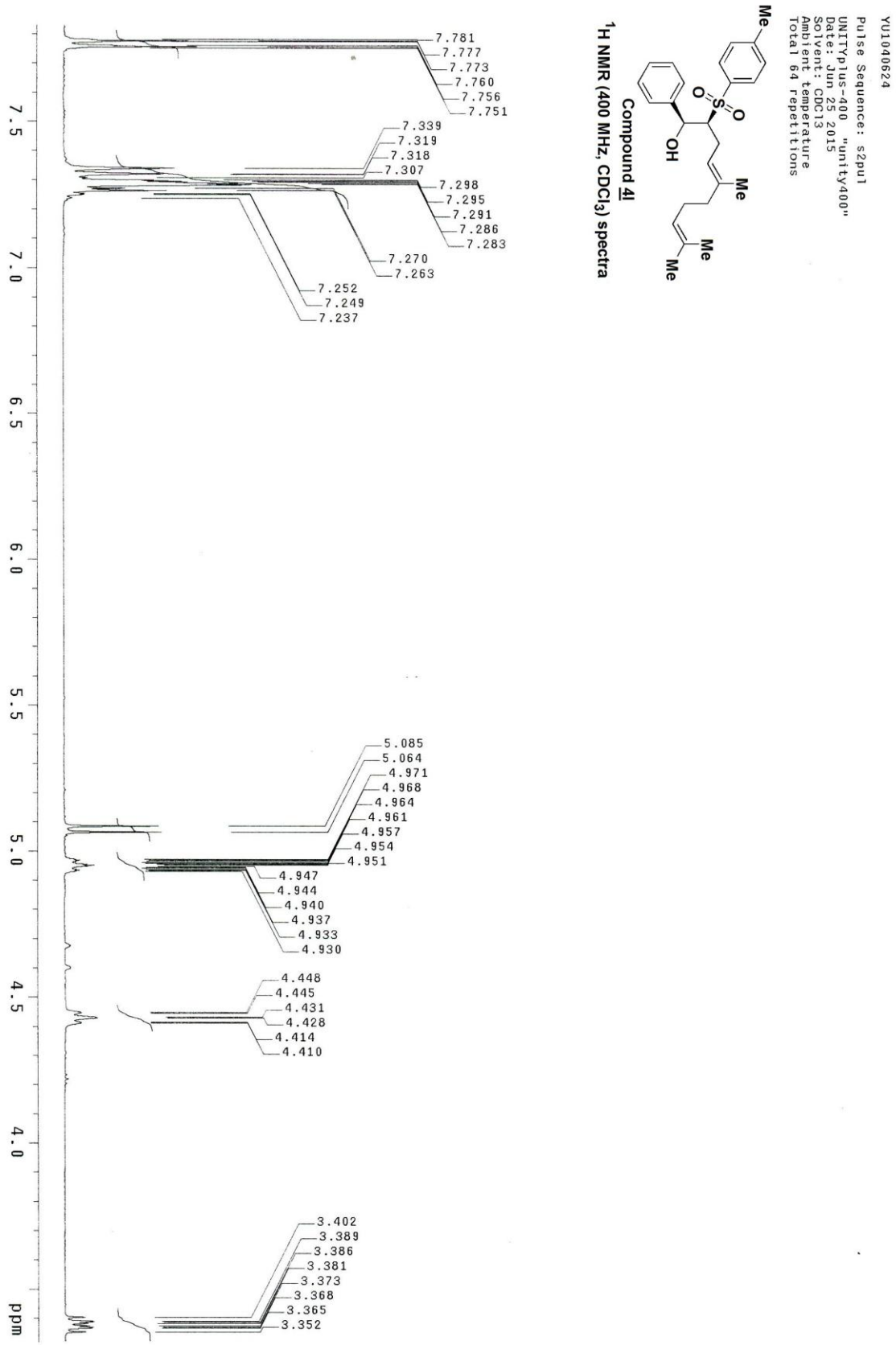

YU1040617
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 136 repetitions
Me
F3C
O
S
O
OH
Me
Me
Compound 4k
1H NMR (400 MHz, CDCl3) spectra
7.668
7.648
7.501
7.480
7.392
7.372
7.284
7.283
7.263
7.261
7.260
19.58
19.88
21.41
21.48
10.17
12.06
10.66
41.80
11.21
30.00
29.02
2.421
1.424
1.422
1.257
ppm


YU1040617
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 136 repetitions
Compound 4k
1H NMR (400 MHz, CDCl3) spectra
Me
F3C
S
O
O
OH
Me
Me
10.17
12.06
10.66
41.80
11.21
5.156
5.137
4.530
4.527
4.524
4.509
4.495
4.492
4.488
3.419
3.407
3.400
3.388
3.381
3.369
2.469
2.421
2.397
2.386
2.373
2.358
2.185
2.166
2.146
2.127
2.108
ppm


YU1040617
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 672 repetitions
Me
F3C
OH
O
S
O
Me
Me
Compound 4k
13C NMR (100 MHz, CDCl3) spectra
145.103
143.844
135.354
135.104
129.760
128.524
127.349
125.242
125.204
125.166
125.128
118.783
77.318
77.000
76.682
72.027
70.185
25.446
25.241
21.534
17.433
180
160
140
120
100
80
60
40
20
ppm


YU1040624
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
OH
Me
Me
Me
Compound 4l
1H NMR (400 MHz, CDCl3) spectra
7.777
7.756
7.339
7.319
7.318
7.298
7.295
7.291
7.286
7.283
7.263
5.085
5.064
2.439
1.649
1.647
1.548
1.144
20.00
74.10
10.55
8.76
11.37
10.40
31.55
11.80
11.80
23.04
53.76
25.37
30.13
ppm

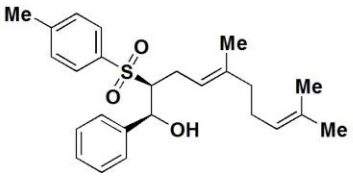

YU1040624
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
OH
Me
Me
Me
Compound 4l
1H NMR (400 MHz, CDCl3) spectra
2.453
2.439
2.316
2.301
2.285
2.278
2.261
2.246
2.037
2.020
2.003
1.981
1.965
1.853
1.833
1.814
1.794
1.778
1.755
1.714
1.694
1.676
1.670
1.649
1.647
1.548
1.529
1.518
1.378
1.376
1.331
1.276
1.269
1.258
1.252
1.180
1.163
1.144
1.135
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
ppm


YU1040624
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OH
O
S
O
Me
Me
Me
Compound 4l
1H NMR (400 MHz, CDCl3) spectra
7.781
7.777
7.773
7.760
7.756
7.751
7.339
7.319
7.318
7.307
7.298
7.295
7.291
7.286
7.283
7.270
7.263
7.252
7.249
7.237
5.085
5.064
4.971
4.968
4.964
4.961
4.957
4.954
4.951
4.947
4.944
4.940
4.937
4.933
4.930
4.448
4.445
4.431
4.428
4.414
4.410
3.402
3.389
3.386
3.381
3.373
3.368
3.365
3.352
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
ppm

YU1040624

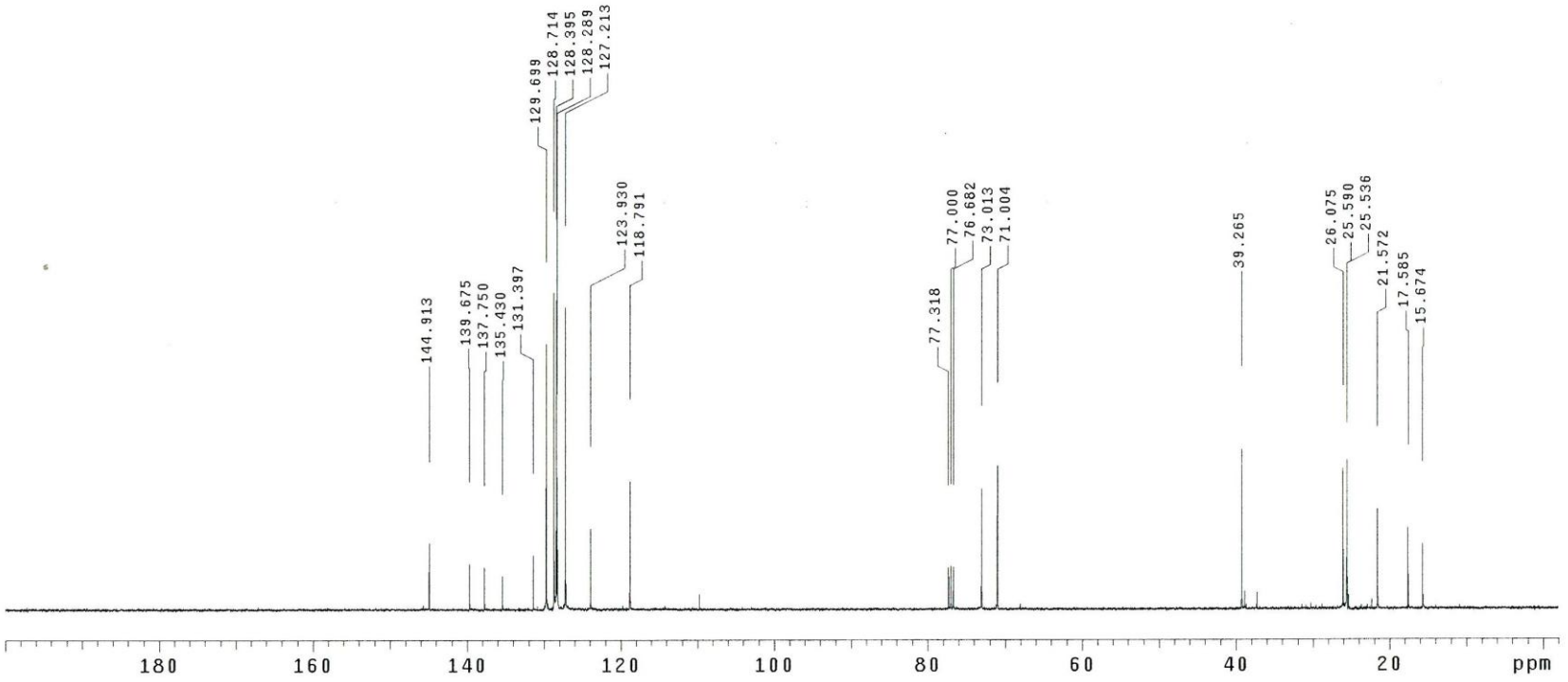
Pulse Sequence: s2pul

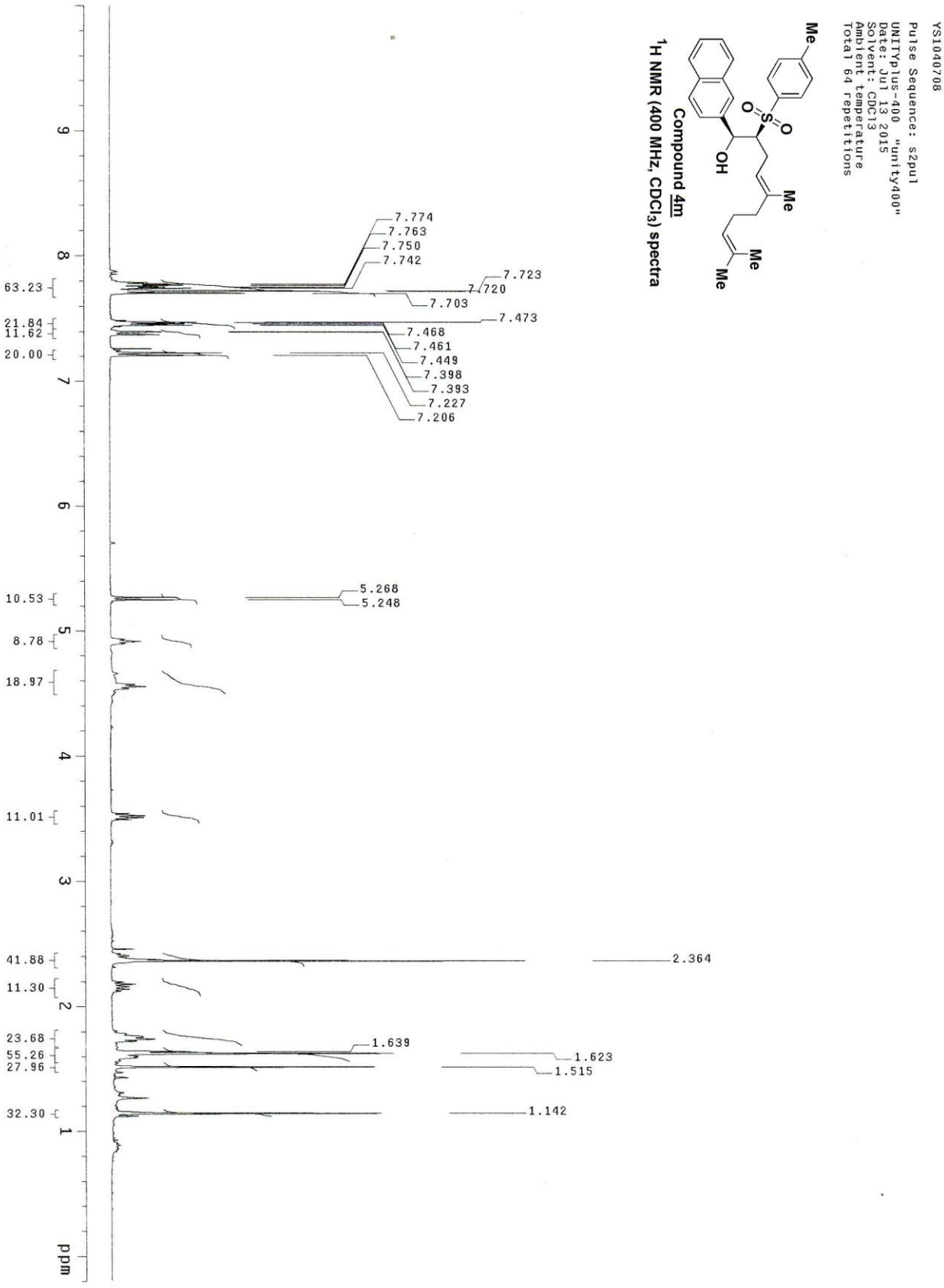
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64000 repetitions

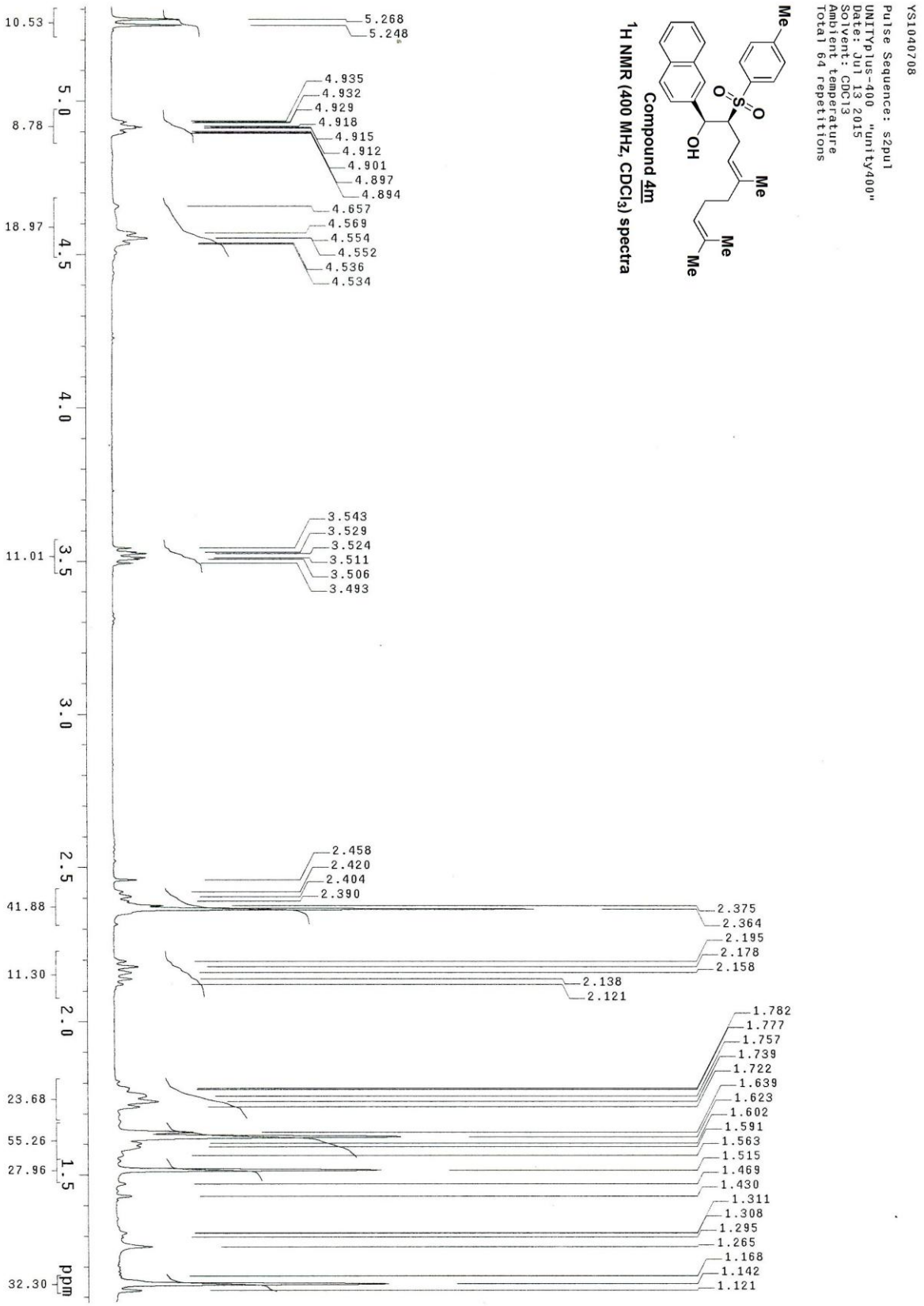


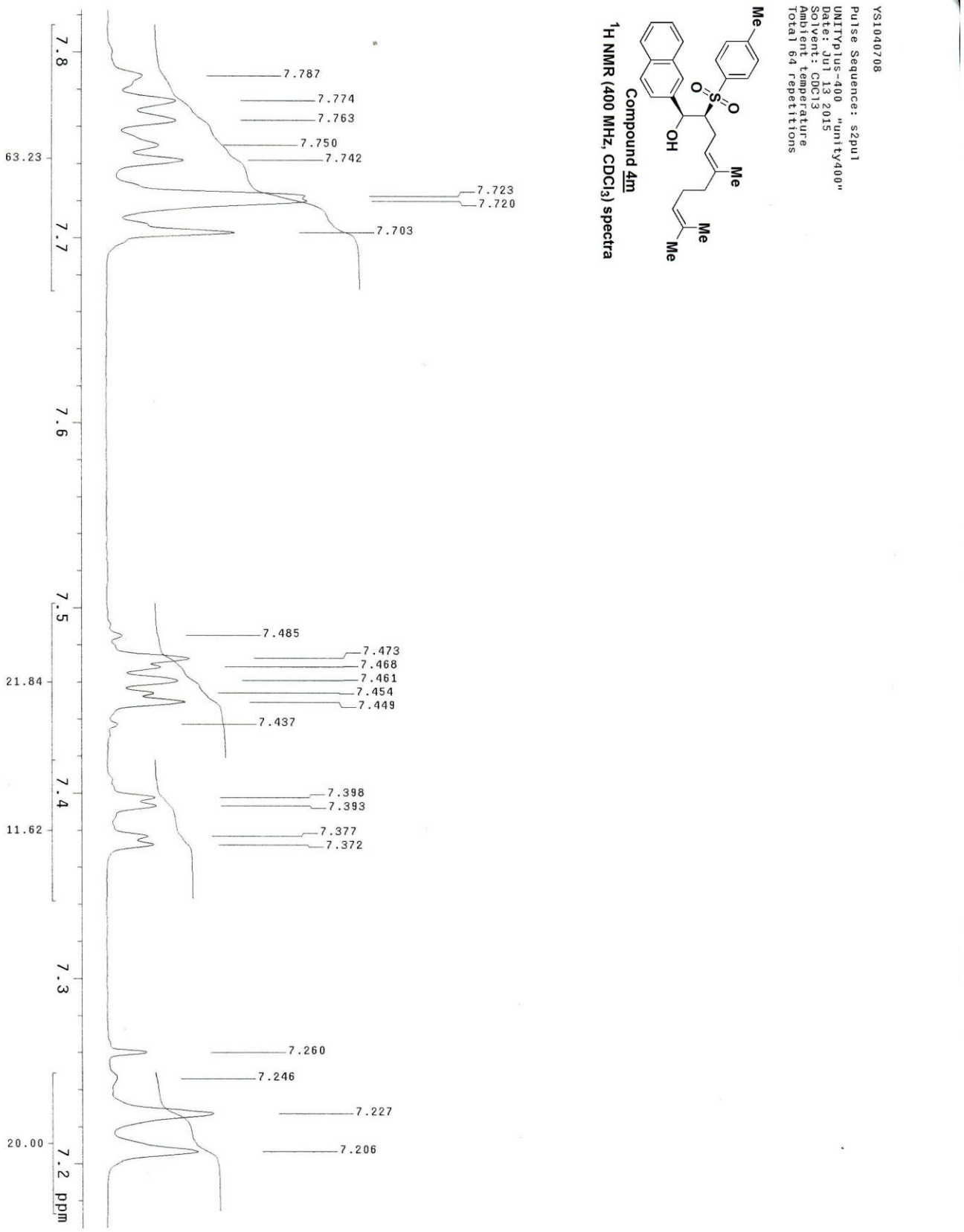
Compound 4l

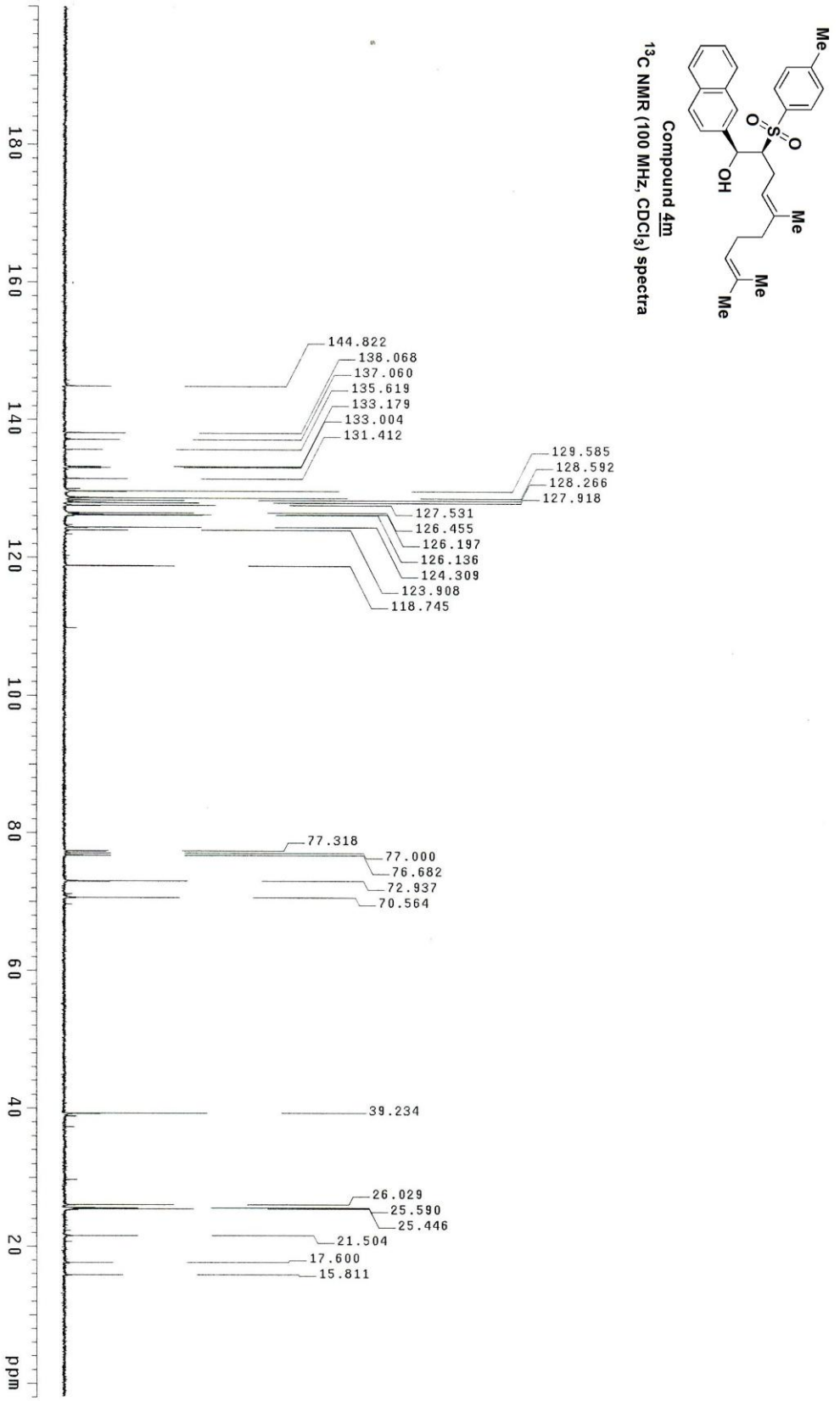
^{13}C NMR (100 MHz, $CDCl_3$) spectra

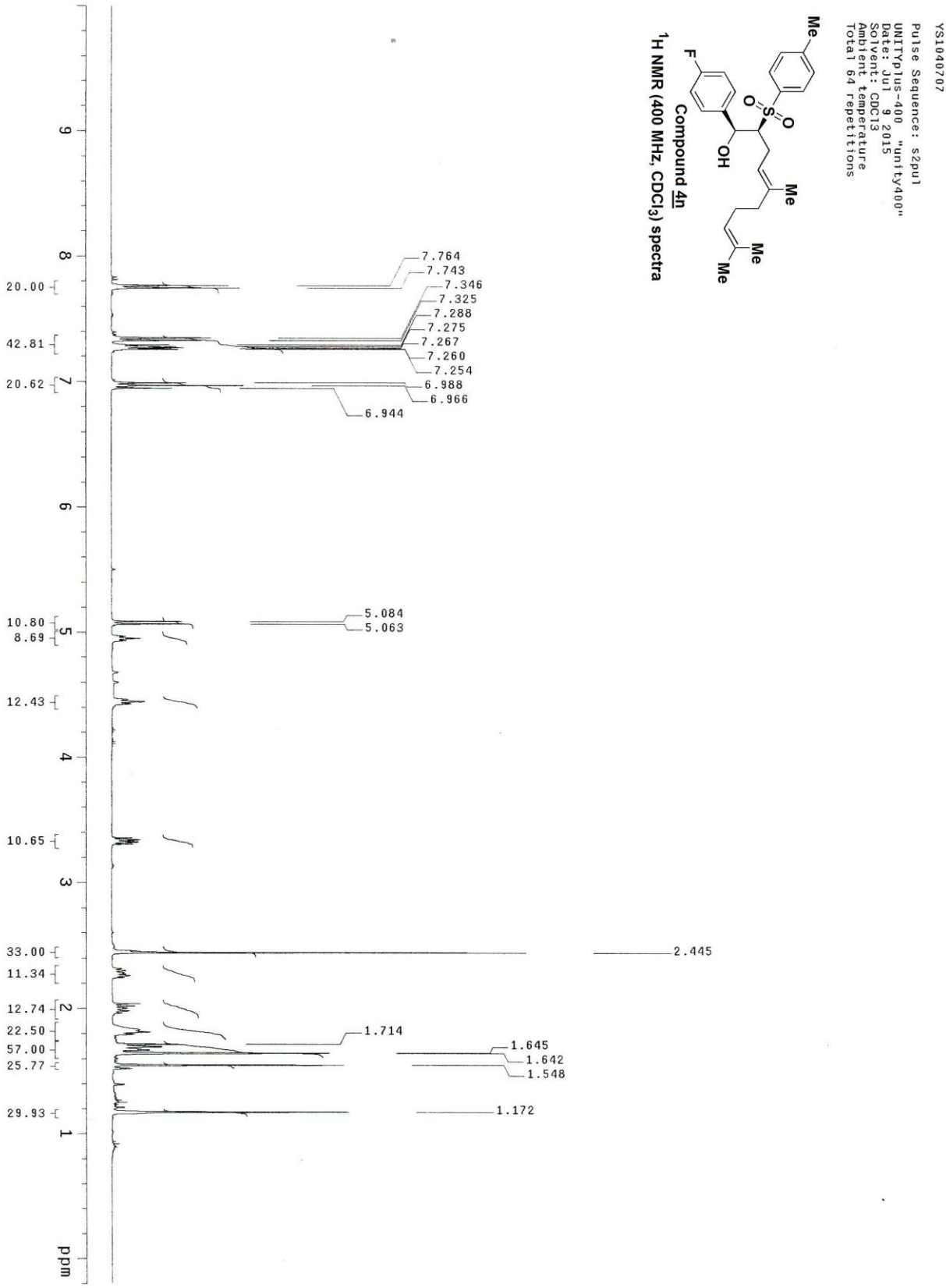


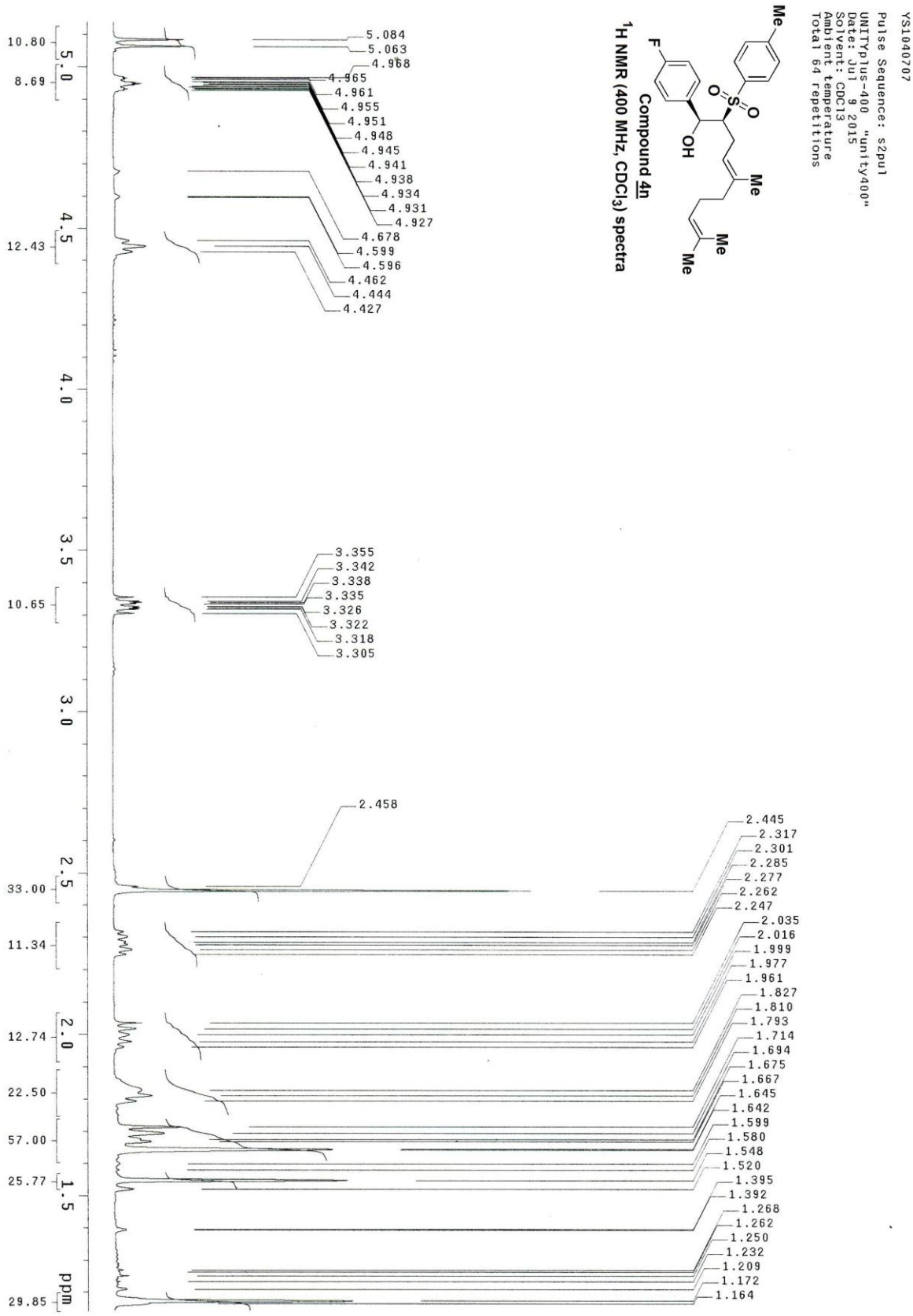

YS1040708
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 4m
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
OH
Me
Me
Me
7.774
7.763
7.750
7.742
7.723
7.720
7.703
7.473
7.468
7.461
7.449
7.398
7.393
7.227
7.206
5.268
5.248
2.364
1.639
1.623
1.515
1.142
63.23
21.84
11.62
20.00
10.53
8.78
18.97
11.01
41.88
11.30
23.68
55.26
27.96
32.30
ppm

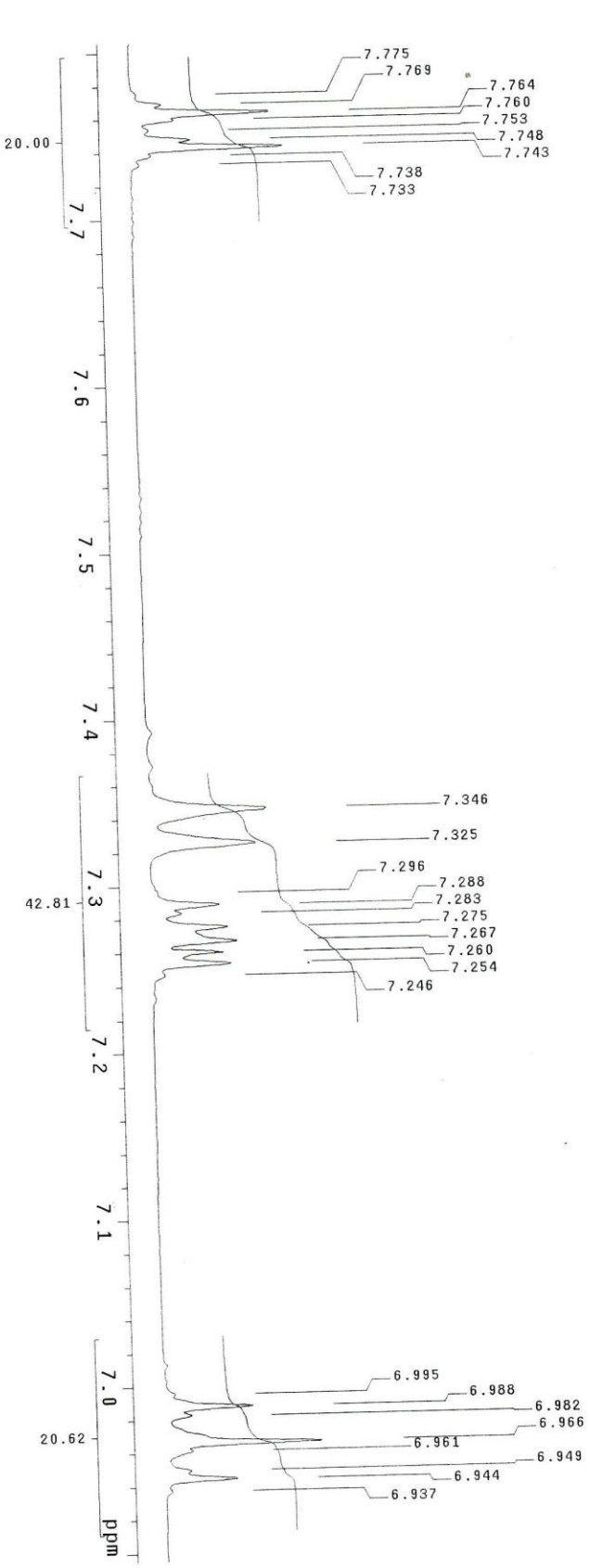

YS1040708
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 4m
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
O
S
O
OH
Me
Me
Me
5.268
5.248
4.935
4.932
4.929
4.918
4.915
4.912
4.901
4.897
4.894
4.657
4.569
4.554
4.552
4.536
4.534
3.543
3.529
3.524
3.511
3.506
3.493
2.458
2.420
2.404
2.390
2.375
2.364
2.195
2.178
2.158
2.138
2.121
1.782
1.777
1.757
1.739
1.722
1.639
1.623
1.602
1.591
1.563
1.515
1.469
1.430
1.311
1.308
1.295
1.265
1.168
1.142
1.121
10.53
8.78
18.97
11.01
41.88
11.30
23.68
55.26
27.96
32.30
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm

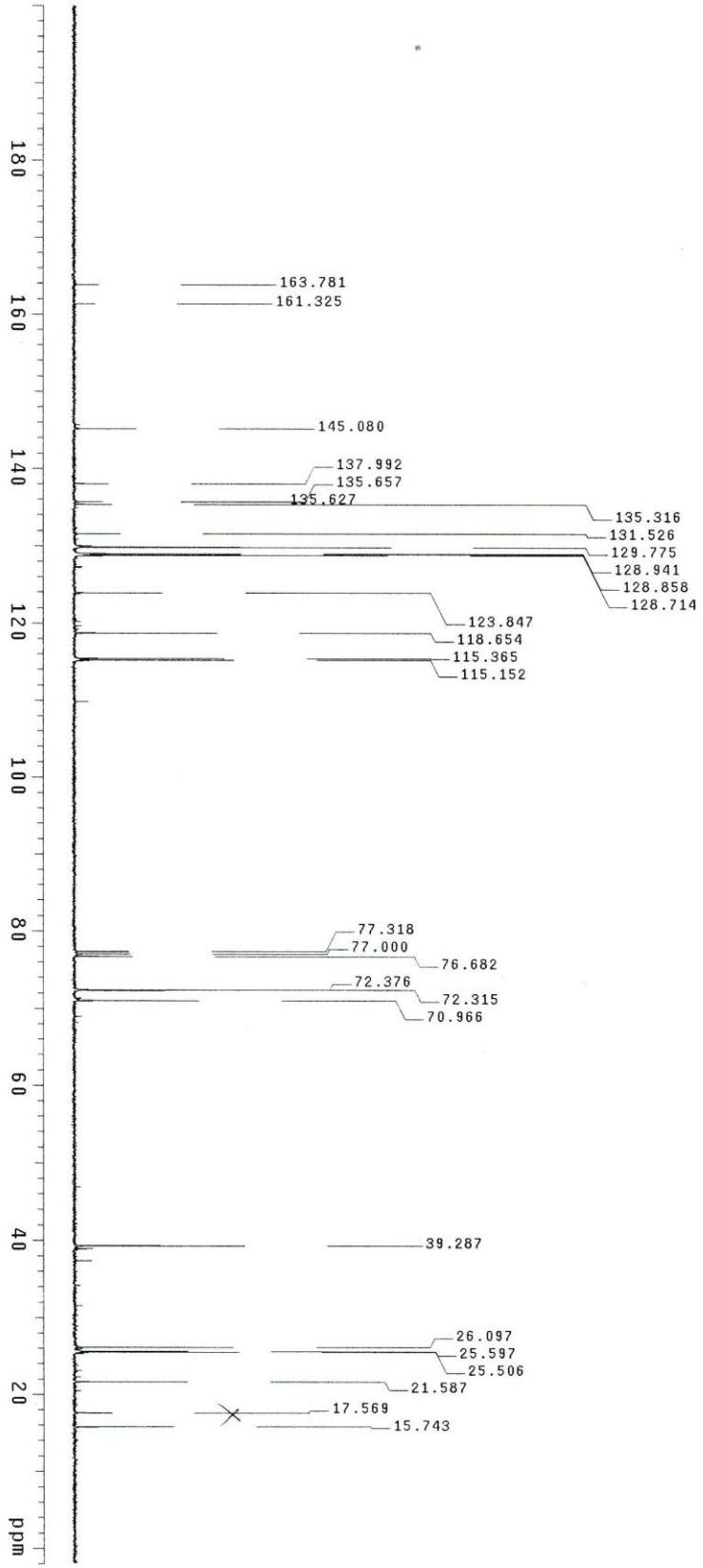

YS1040708
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
OH
Me
Me
Me
Compound 4m
1H NMR (400 MHz, CDCl3) spectra
7.787
7.774
7.763
7.750
7.742
7.723
7.720
7.703
7.485
7.473
7.468
7.461
7.454
7.449
7.437
7.398
7.393
7.377
7.372
7.260
7.246
7.227
7.206
63.23
21.84
11.62
20.00
7.8
7.7
7.6
7.5
7.4
7.3
7.2
ppm

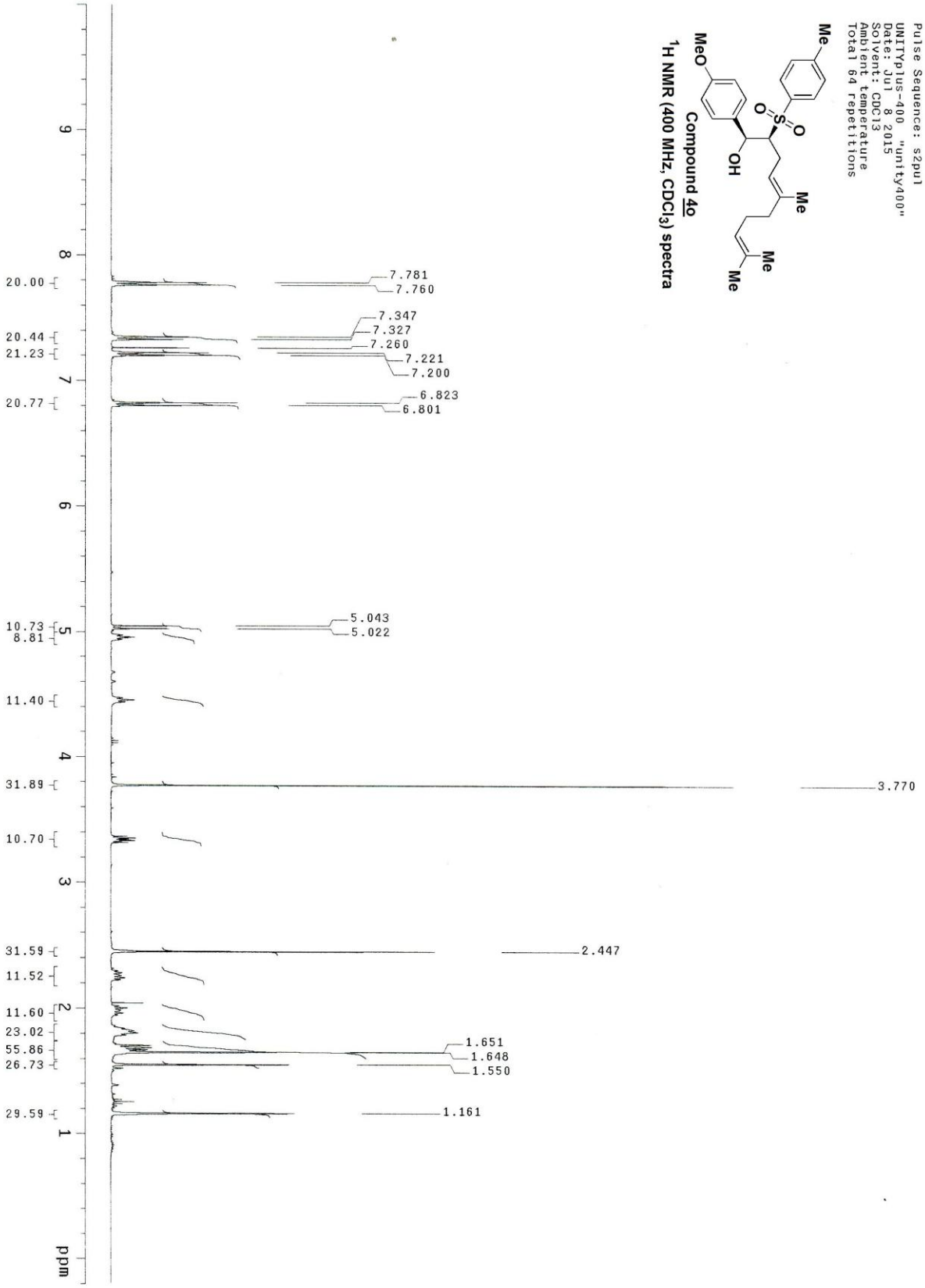

YS1040708
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 1280 repetitions
Me
OH
Me
Me
Me
Compound 4m
13C NMR (100 MHz, CDCl3) spectra
144.822
138.068
137.060
135.619
133.179
133.004
131.412
129.585
128.592
128.266
127.918
127.531
126.455
126.197
126.136
124.309
123.908
118.745
77.318
77.000
76.682
72.937
70.564
39.234
26.029
25.590
25.446
21.504
17.600
15.811
180
160
140
120
100
80
60
40
20
ppm

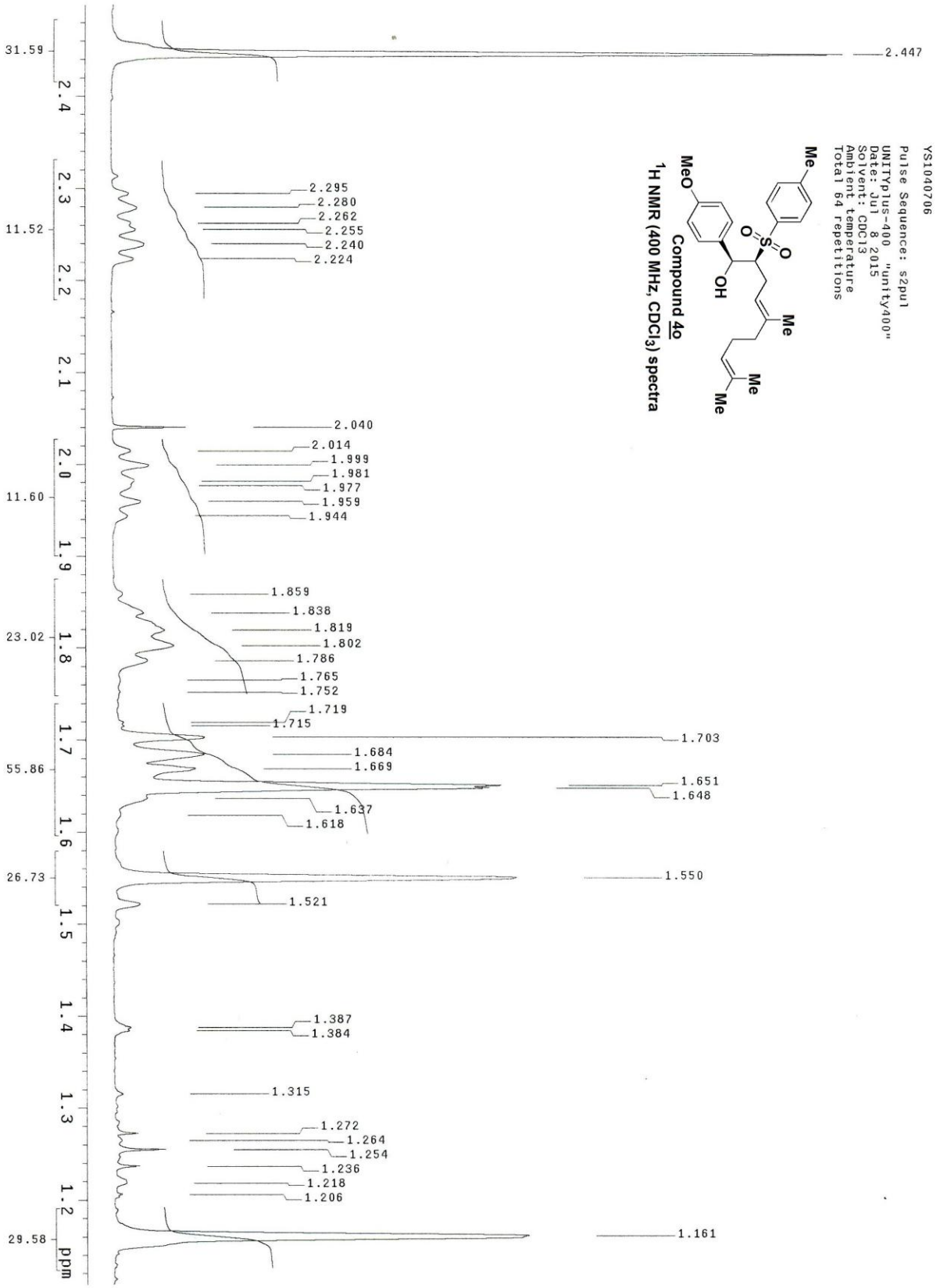

YS1040707
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
F
OH
O
S
O
Me
Me
Me
Compound 4n
1H NMR (400 MHz, CDCl3) spectra
7.764
7.743
7.346
7.325
7.288
7.275
7.267
7.260
7.254
6.988
6.966
6.944
5.084
5.063
2.445
1.714
1.645
1.642
1.548
1.172
20.00
42.81
20.62
10.80
8.69
12.43
10.65
33.00
11.34
12.74
22.50
57.00
25.77
29.93
ppm

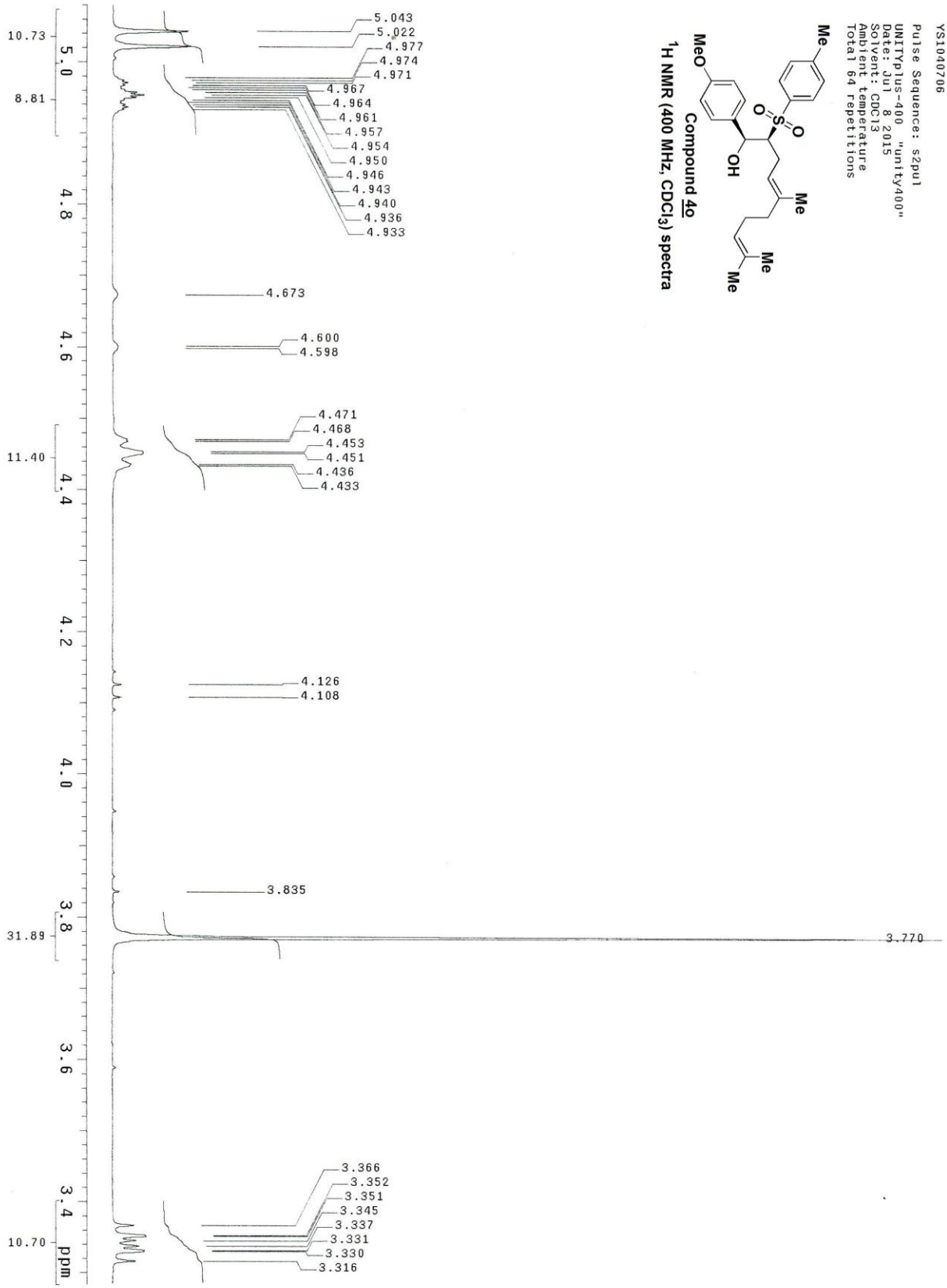

YS1040707
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 4n
1H NMR (400 MHz, CDCl3) spectra
Me
F
O
S
O
OH
Me
Me
Me
5.084
5.063
4.968
4.965
4.961
4.955
4.951
4.948
4.945
4.941
4.938
4.934
4.931
4.927
4.678
4.599
4.596
4.462
4.444
4.427
3.355
3.342
3.338
3.335
3.326
3.322
3.318
3.305
2.458
2.445
2.317
2.301
2.285
2.277
2.262
2.247
2.035
2.016
1.999
1.977
1.961
1.827
1.810
1.793
1.714
1.694
1.675
1.667
1.645
1.642
1.599
1.580
1.548
1.520
1.395
1.392
1.268
1.262
1.250
1.232
1.209
1.172
1.164
10.80
8.69
12.43
10.65
33.00
11.34
12.74
22.50
57.00
25.77
29.85
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm

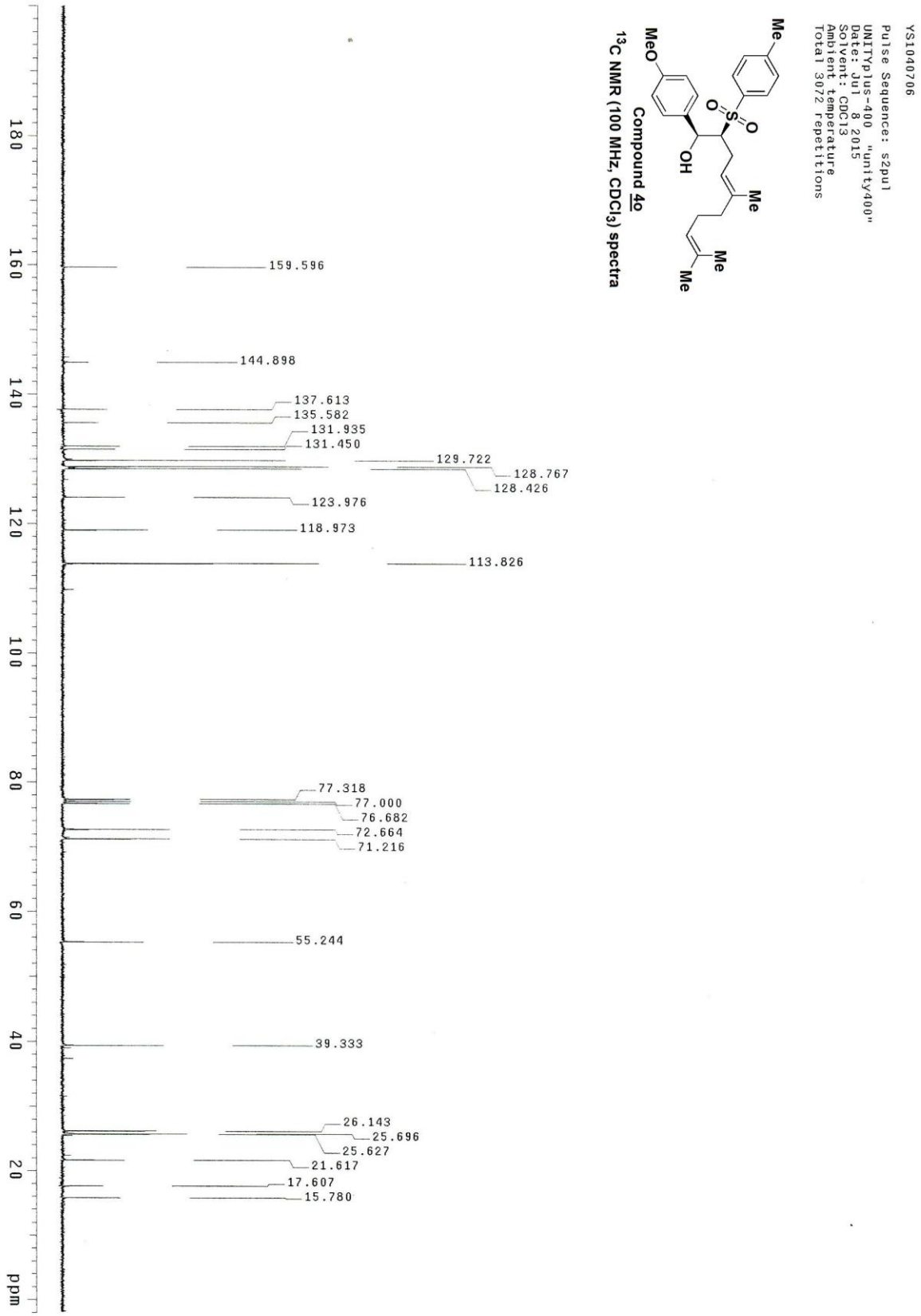

YS1040707
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
F
OH
Me
Me
Me
Compound 4n
1H NMR (400 MHz, CDCl3) spectra
20.00
42.81
20.62
7.775
7.769
7.764
7.760
7.753
7.748
7.743
7.738
7.733
7.346
7.325
7.296
7.288
7.283
7.275
7.267
7.260
7.254
7.246
6.995
6.988
6.982
6.966
6.961
6.949
6.944
6.937
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
ppm

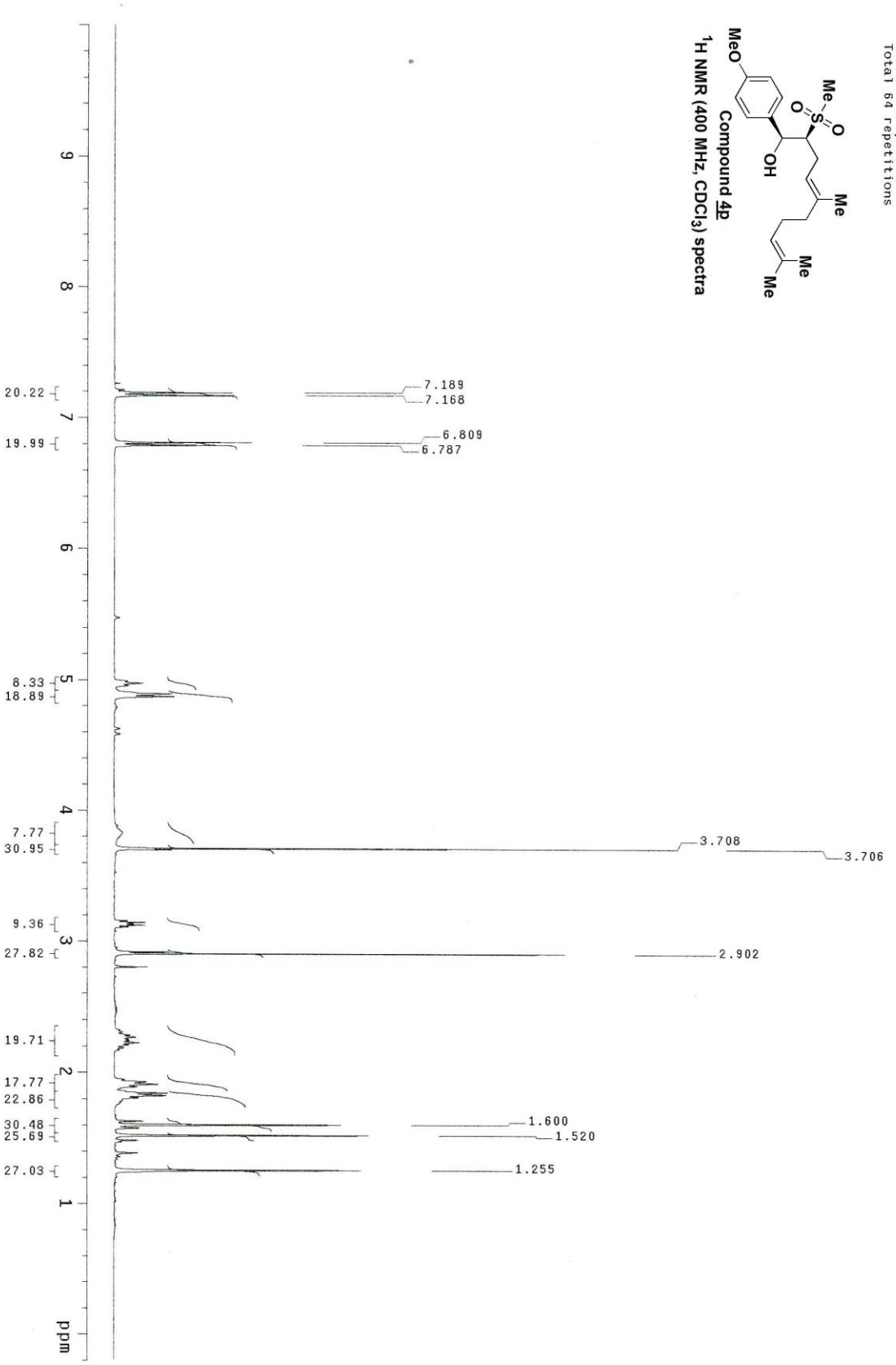

YS1040707
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 9 2015
Solvent: CDCl3
Ambient temperature
Total 1152 repetitions
Me
F
OH
O
S
O
Me
Me
Me
Compound 4n
13C NMR (100 MHz, CDCl3) spectra
163.781
161.325
145.080
137.992
135.657
135.627
135.316
131.526
129.775
128.941
128.858
128.714
123.847
118.654
115.365
115.152
77.318
77.000
76.682
72.376
72.315
70.966
39.287
26.097
25.597
25.506
21.587
17.569
15.743
180
160
140
120
100
80
60
40
20
ppm

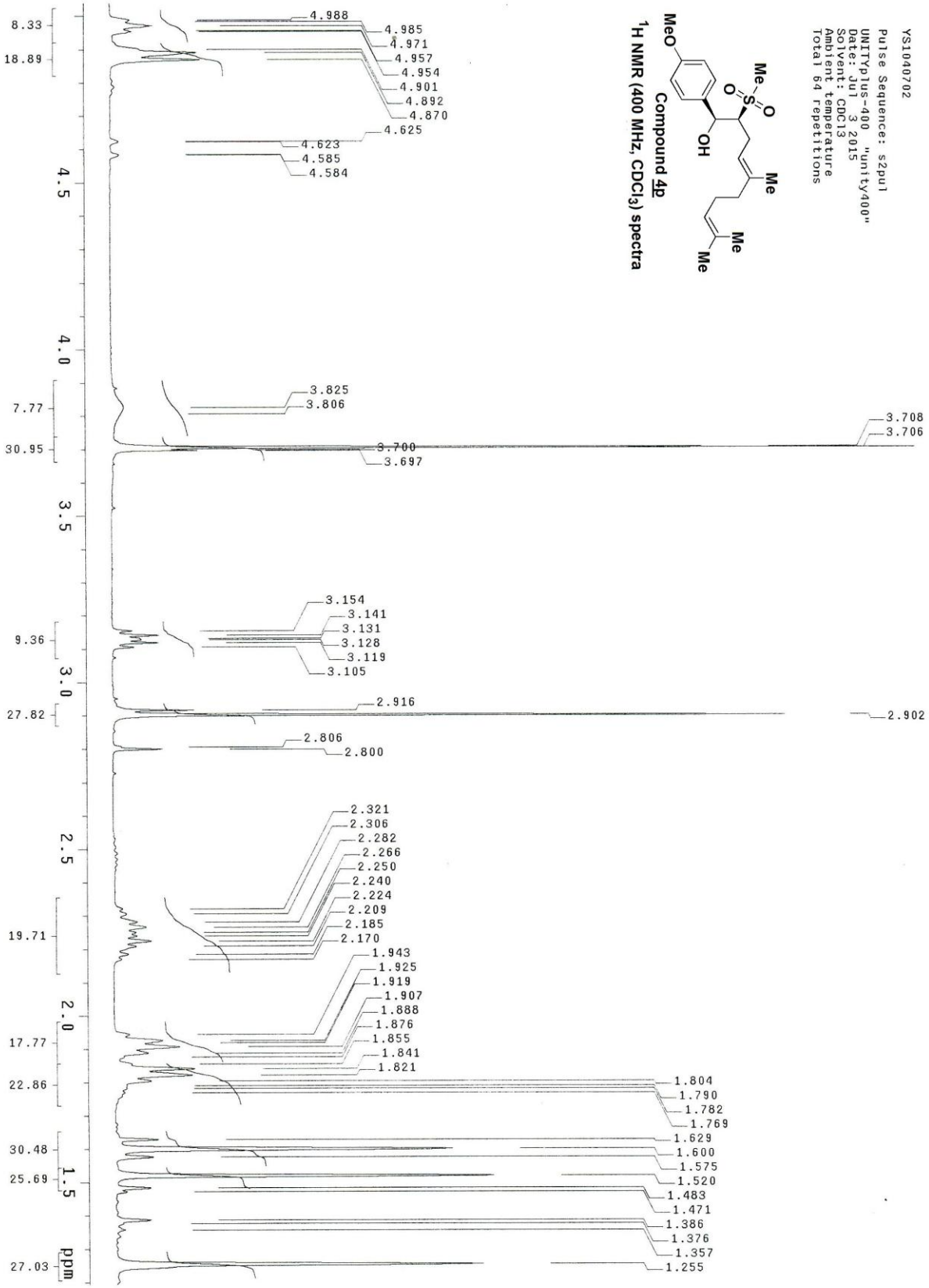

YS1040706
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 8 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
MeO
OH
Me
Me
Me
Compound 4o
1H NMR (400 MHz, CDCl3) spectra
20.00
20.44
21.23
20.77
10.73
8.81
11.40
31.89
10.70
31.59
11.52
11.60
23.02
55.86
26.73
29.59
7.781
7.760
7.347
7.327
7.260
7.221
7.200
6.823
6.801
5.043
5.022
3.770
2.447
1.651
1.648
1.550
1.161
ppm

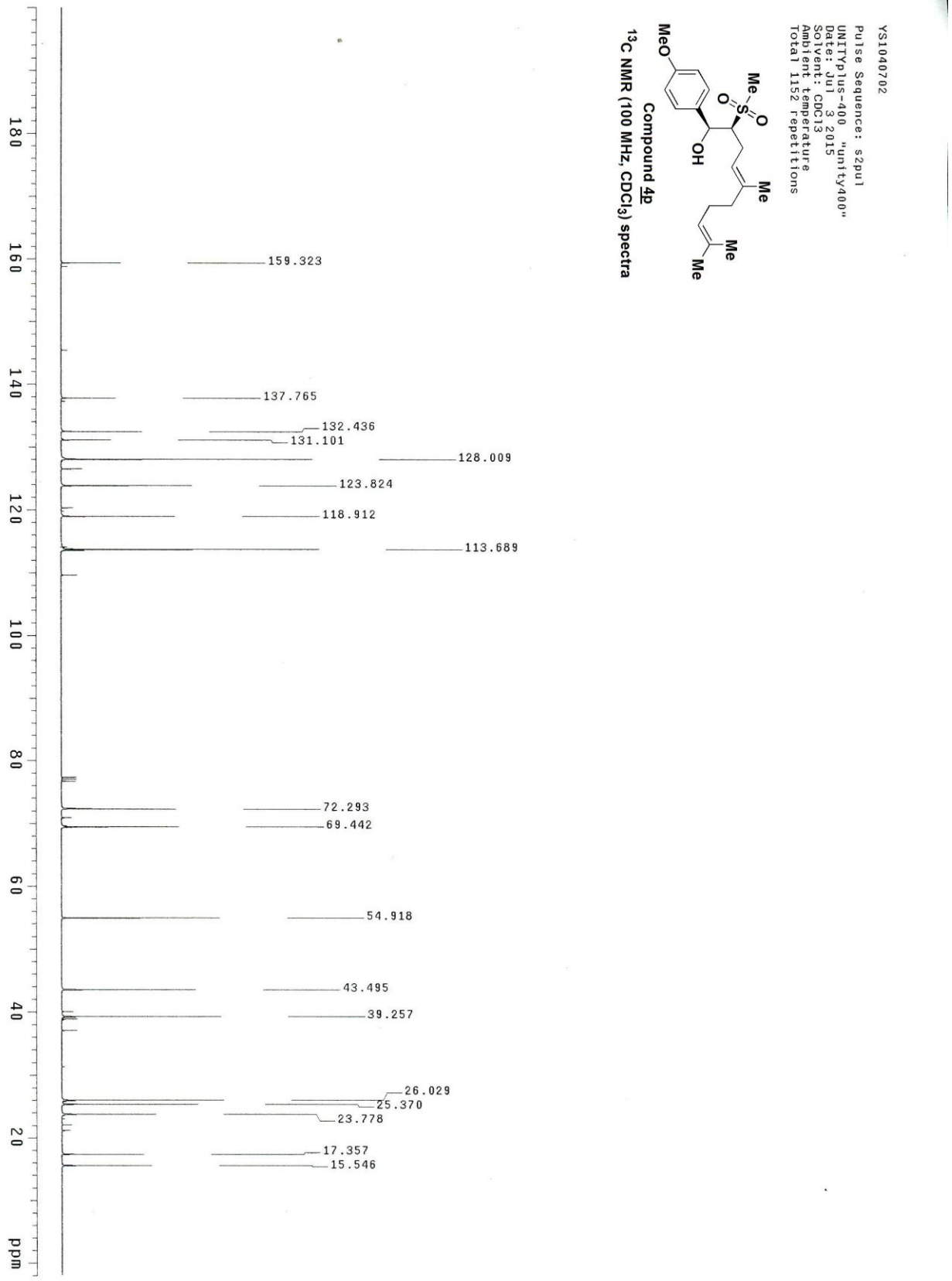

YS1040706
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 8 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
MeO
OH
O
S
O
Me
Me
Me
Compound 4o
1H NMR (400 MHz, CDCl3) spectra
31.59
11.52
11.60
23.02
55.86
26.73
29.58
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
ppm
2.447
2.295
2.280
2.262
2.255
2.240
2.224
2.040
2.014
1.999
1.981
1.977
1.959
1.944
1.859
1.838
1.819
1.802
1.786
1.765
1.752
1.719
1.715
1.703
1.684
1.669
1.651
1.648
1.637
1.618
1.550
1.521
1.387
1.384
1.315
1.272
1.264
1.254
1.236
1.218
1.206
1.161

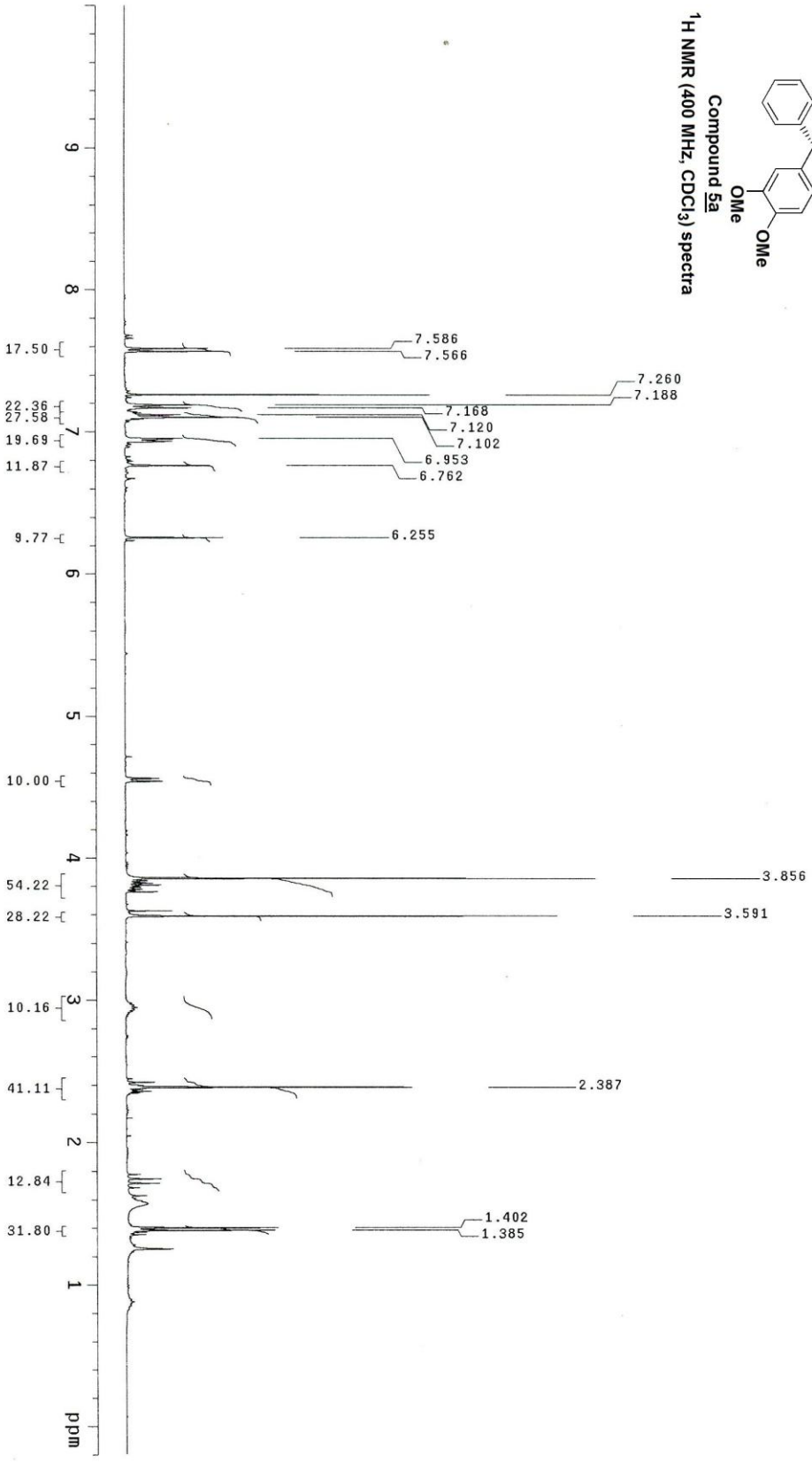

YS1040706
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 8 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
MeO
OH
Me
Me
Me
Compound 4o
1H NMR (400 MHz, CDCl3) spectra
5.043
5.022
4.977
4.974
4.971
4.967
4.964
4.961
4.957
4.954
4.950
4.946
4.943
4.940
4.936
4.933
4.673
4.600
4.598
4.471
4.468
4.453
4.451
4.436
4.433
4.126
4.108
3.835
3.770
3.366
3.352
3.351
3.345
3.337
3.331
3.330
3.316
10.73
8.81
11.40
31.89
10.70
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
ppm

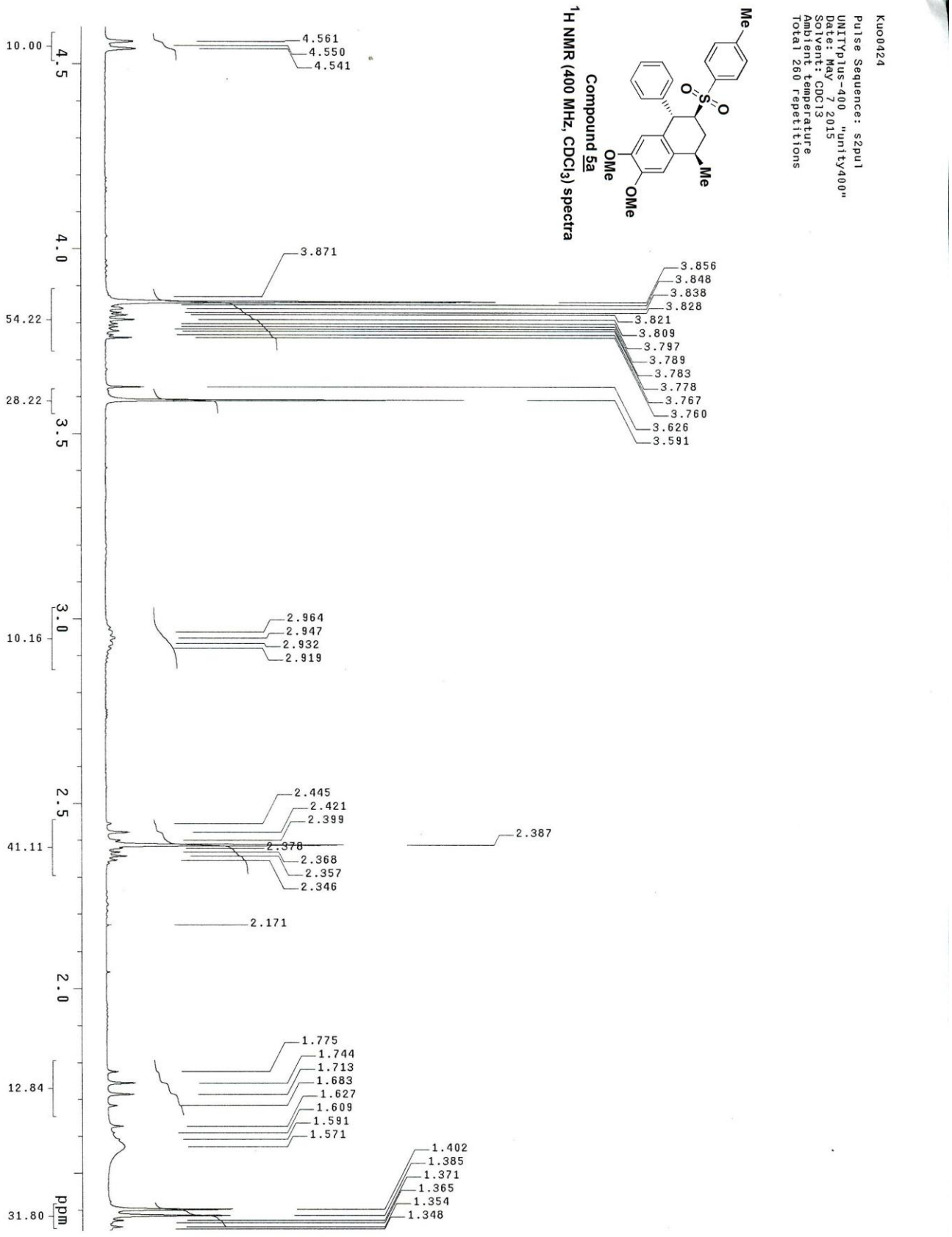

YS1040706
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 8 2015
Solvent: CDCl3
Ambient temperature
Total 3072 repetitions
Me
MeO
OH
O
S
O
Me
Me
Me
Compound 4o
13C NMR (100 MHz, CDCl3) spectra
159.596
144.898
137.613
135.582
131.935
131.450
129.722
128.767
128.426
123.976
118.973
113.826
77.318
77.000
76.682
72.664
71.216
55.244
39.333
26.143
25.696
25.627
21.617
17.607
15.780
180
160
140
120
100
80
60
40
20
ppm

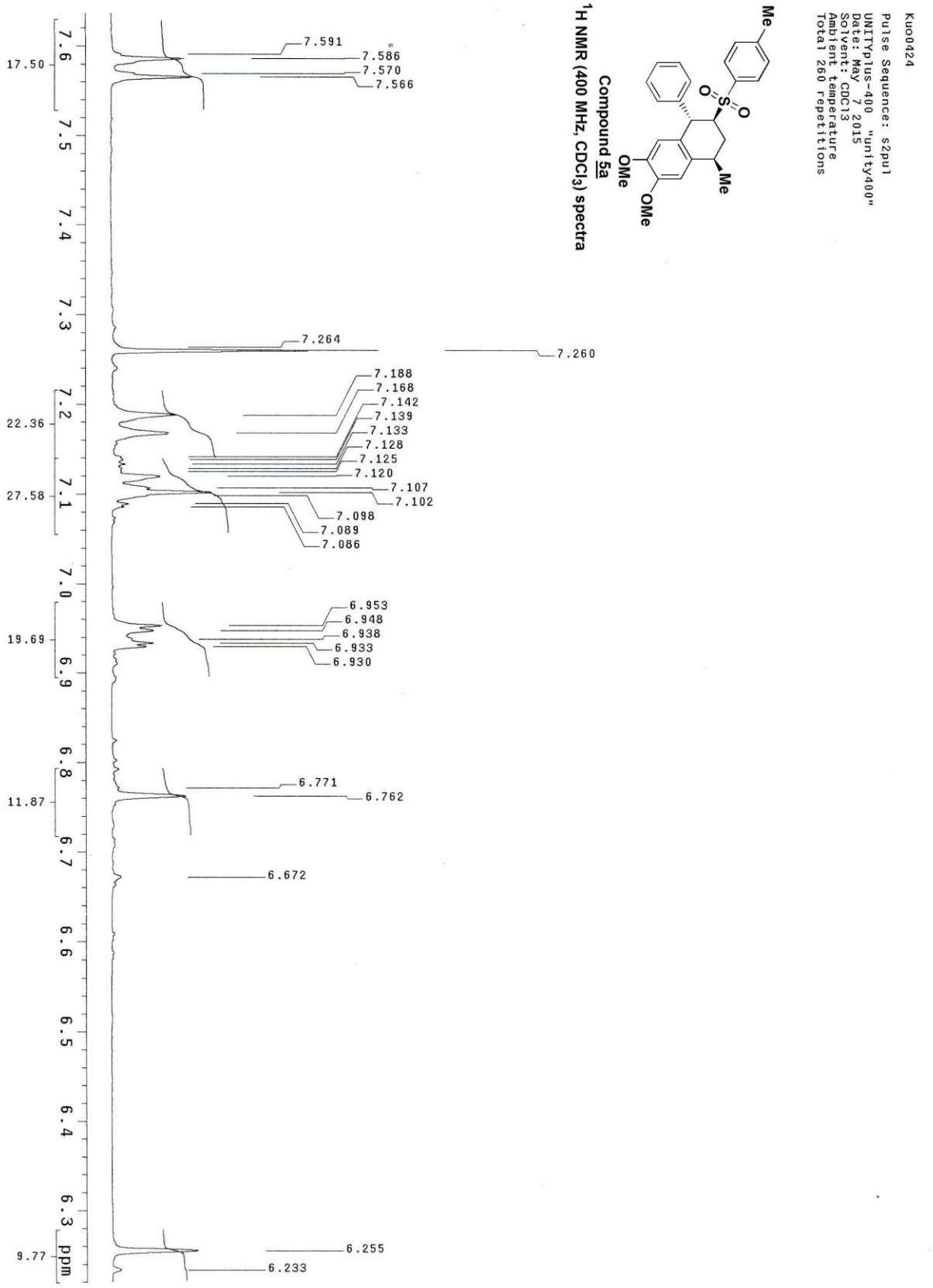

YS1040702
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 3 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
Me
OH
O
S
O
MeO
Compound 4p
1H NMR (400 MHz, CDCl3) spectra
20.22
19.99
8.33
18.89
7.77
30.95
9.36
27.82
19.71
17.77
22.86
30.48
25.69
27.03
7.189
7.168
6.809
6.787
3.708
3.706
2.902
1.600
1.520
1.255
ppm

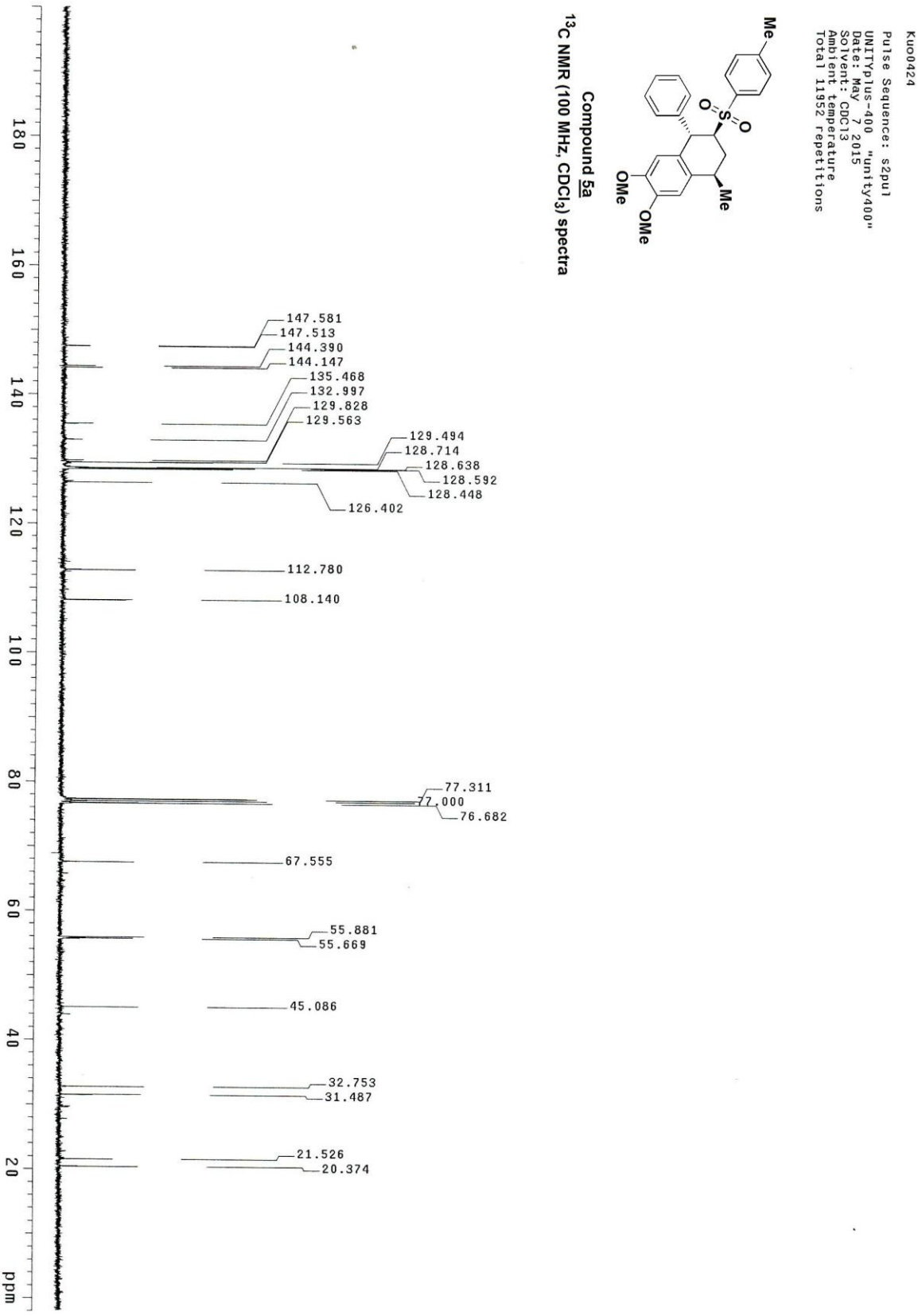

YS1040702
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 3 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OH
Me
Me
Me
Me
Compound 4p
1H NMR (400 MHz, CDCl3) spectra
4.988
4.985
4.971
4.957
4.954
4.901
4.892
4.870
4.625
4.623
4.585
4.584
3.825
3.806
3.708
3.706
3.700
3.697
3.154
3.141
3.131
3.128
3.119
3.105
2.916
2.902
2.806
2.800
2.321
2.306
2.282
2.266
2.250
2.240
2.224
2.209
2.185
2.170
1.943
1.925
1.919
1.907
1.888
1.876
1.855
1.841
1.821
1.804
1.790
1.782
1.769
1.629
1.600
1.575
1.520
1.483
1.471
1.386
1.376
1.357
1.255
8.33
18.89
7.77
30.95
9.36
27.82
19.71
17.77
22.86
30.48
25.69
27.03
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm

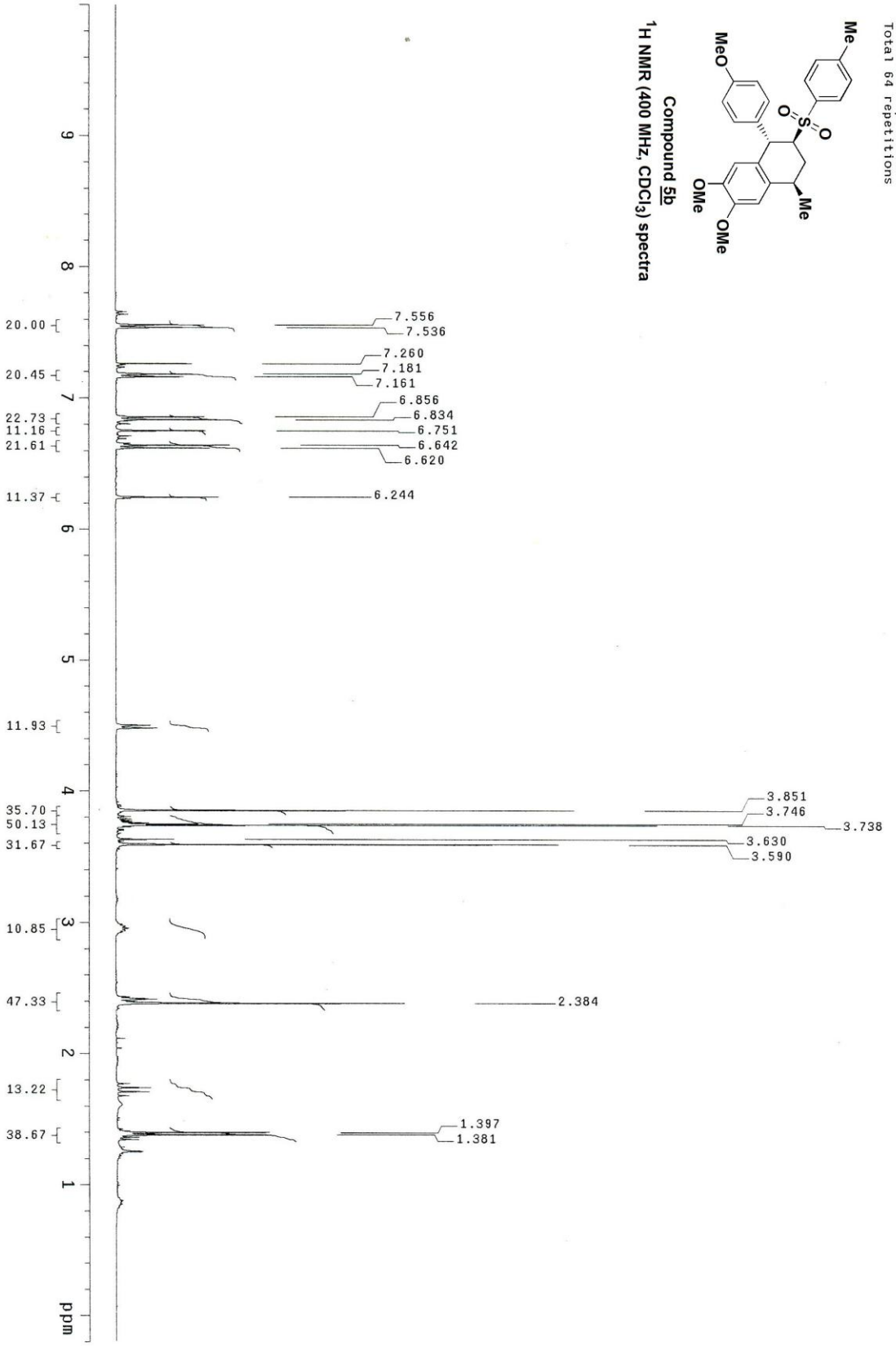

YS1040702
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 3 2015
Solvent: CDCl3
Ambient temperature
Total 1152 repetitions
MeO
OH
Me
Me
Me
Me
Compound 4p
13C NMR (100 MHz, CDCl3) spectra
159.323
137.765
132.436
131.101
128.009
123.824
118.912
113.689
72.293
69.442
54.918
43.495
39.257
26.029
25.370
23.778
17.357
15.546
180
160
140
120
100
80
60
40
20
ppm

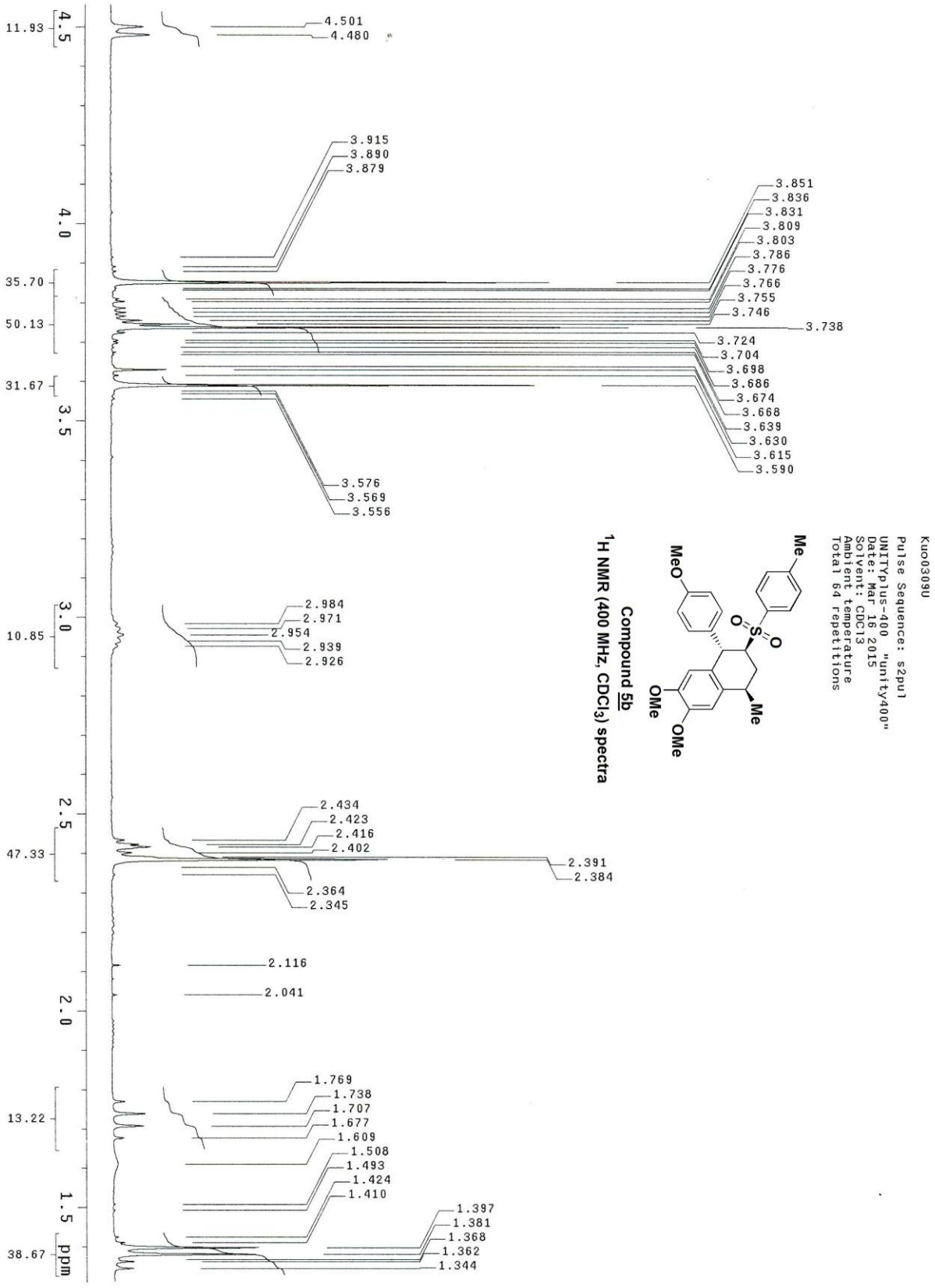

Kuo0424
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 7 2015
Solvent: CDCl3
Ambient temperature
Total 260 repetitions
Me
OMe
OMe
Me
Compound 5a
1H NMR (400 MHz, CDCl3) spectra
17.50
22.36
27.58
19.69
11.87
9.77
10.00
54.22
28.22
10.16
41.11
12.84
31.80
7.586
7.566
7.260
7.188
7.168
7.120
7.102
6.953
6.762
6.255
3.856
3.591
2.387
1.402
1.385
ppm

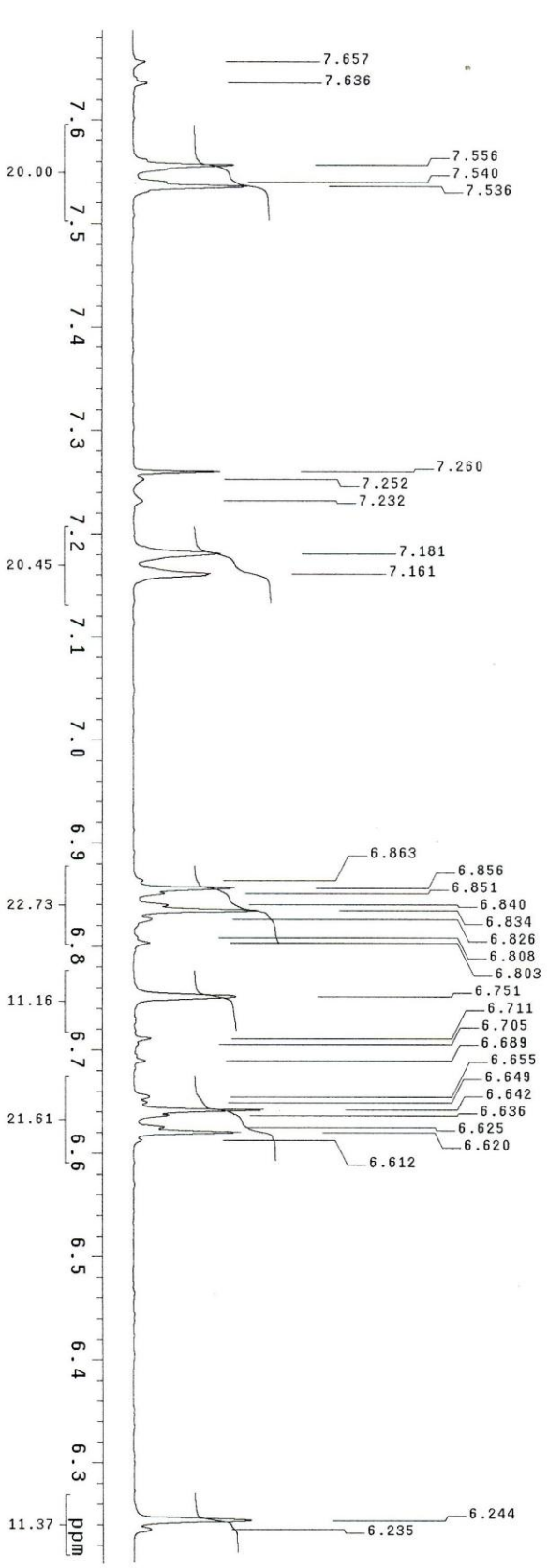

Kuo0424
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 7 2015
Solvent: CDCl3
Ambient temperature
Total 260 repetitions
Compound 5a
1H NMR (400 MHz, CDCl3) spectra
Me
OMe
OMe
Me
4.561
4.550
4.541
3.871
3.856
3.848
3.838
3.828
3.821
3.809
3.797
3.789
3.783
3.778
3.767
3.760
3.626
3.591
2.964
2.947
2.932
2.919
2.445
2.421
2.399
2.387
2.378
2.368
2.357
2.346
2.171
1.775
1.744
1.713
1.683
1.627
1.609
1.591
1.571
1.402
1.385
1.371
1.365
1.354
1.348
10.00
54.22
28.22
10.16
41.11
12.84
31.80
ppm

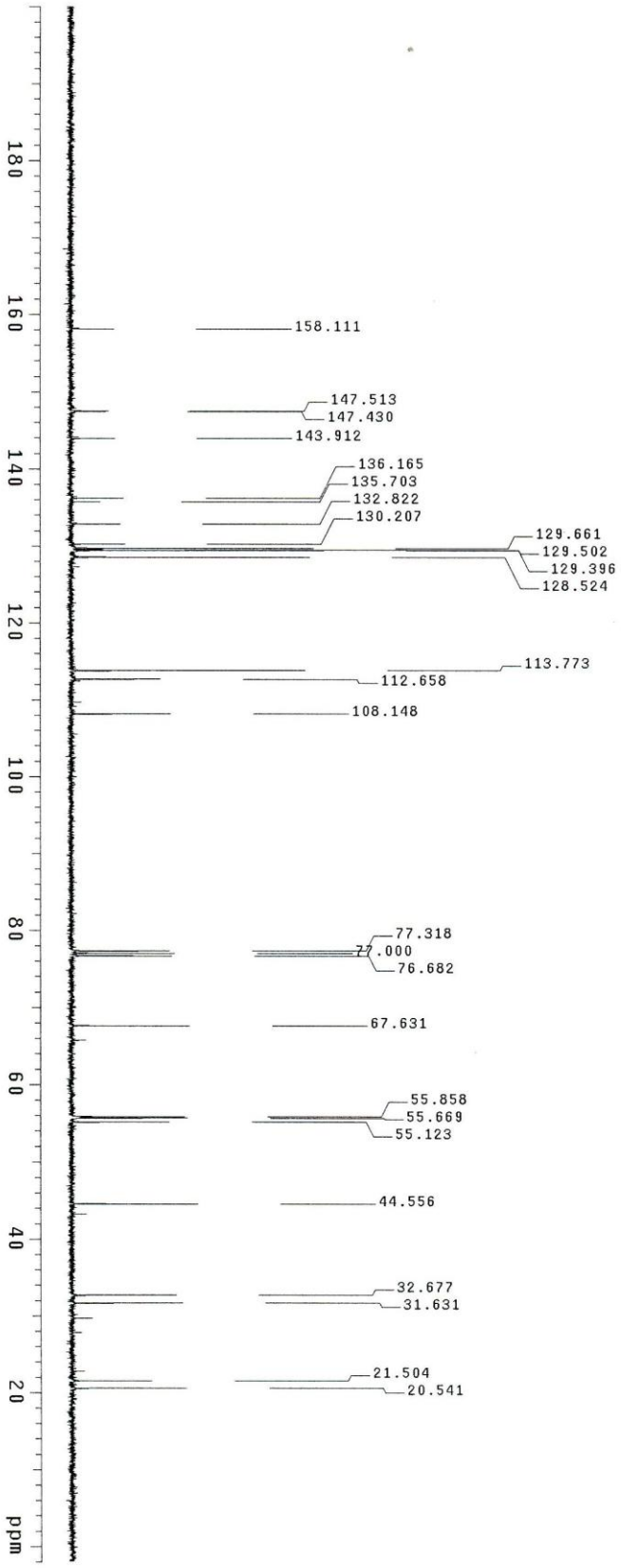

Kuo0424
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 7 2015
Solvent: CDCl3
Ambient temperature
Total 260 repetitions
Me
OMe
OMe
Me
Compound 5a
1H NMR (400 MHz, CDCl3) spectra
7.591
7.586
7.570
7.566
7.264
7.260
7.188
7.168
7.142
7.139
7.133
7.128
7.125
7.120
7.107
7.102
7.098
7.089
7.086
6.953
6.948
6.938
6.933
6.930
6.771
6.762
6.672
6.255
6.233
17.50
22.36
27.58
19.69
11.87
9.77
ppm

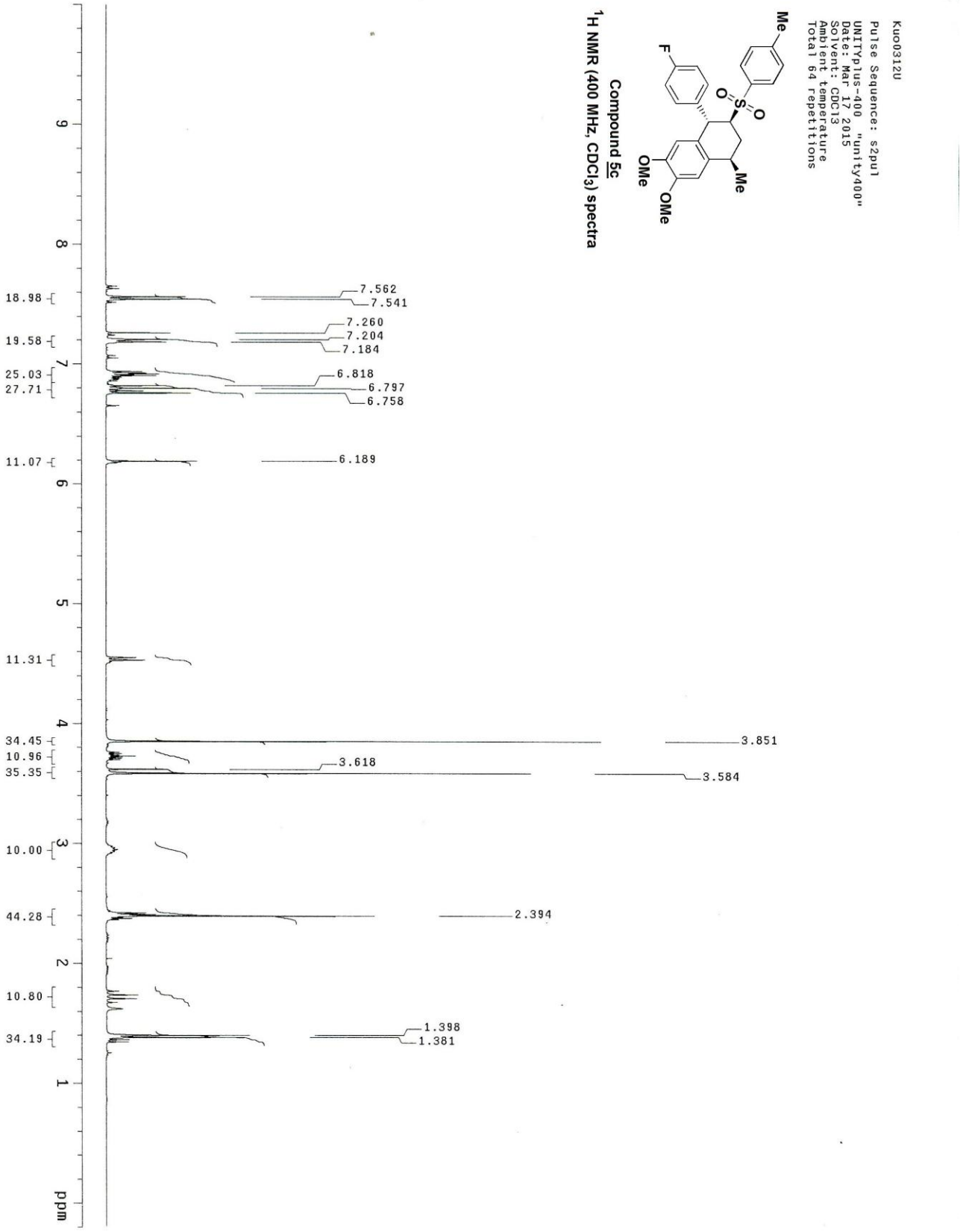

Kuo0424
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 7 2015
Solvent: CDCl3
Ambient temperature
Total 11952 repetitions
Me
OMe
OMe
Me
Compound 5a
13C NMR (100 MHz, CDCl3) spectra
147.581
147.513
144.390
144.147
135.468
132.997
129.828
129.563
129.494
128.714
128.638
128.592
128.448
126.402
112.780
108.140
77.311
77.000
76.682
67.555
55.881
55.669
45.086
32.753
31.487
21.526
20.374
180
160
140
120
100
80
60
40
20
ppm

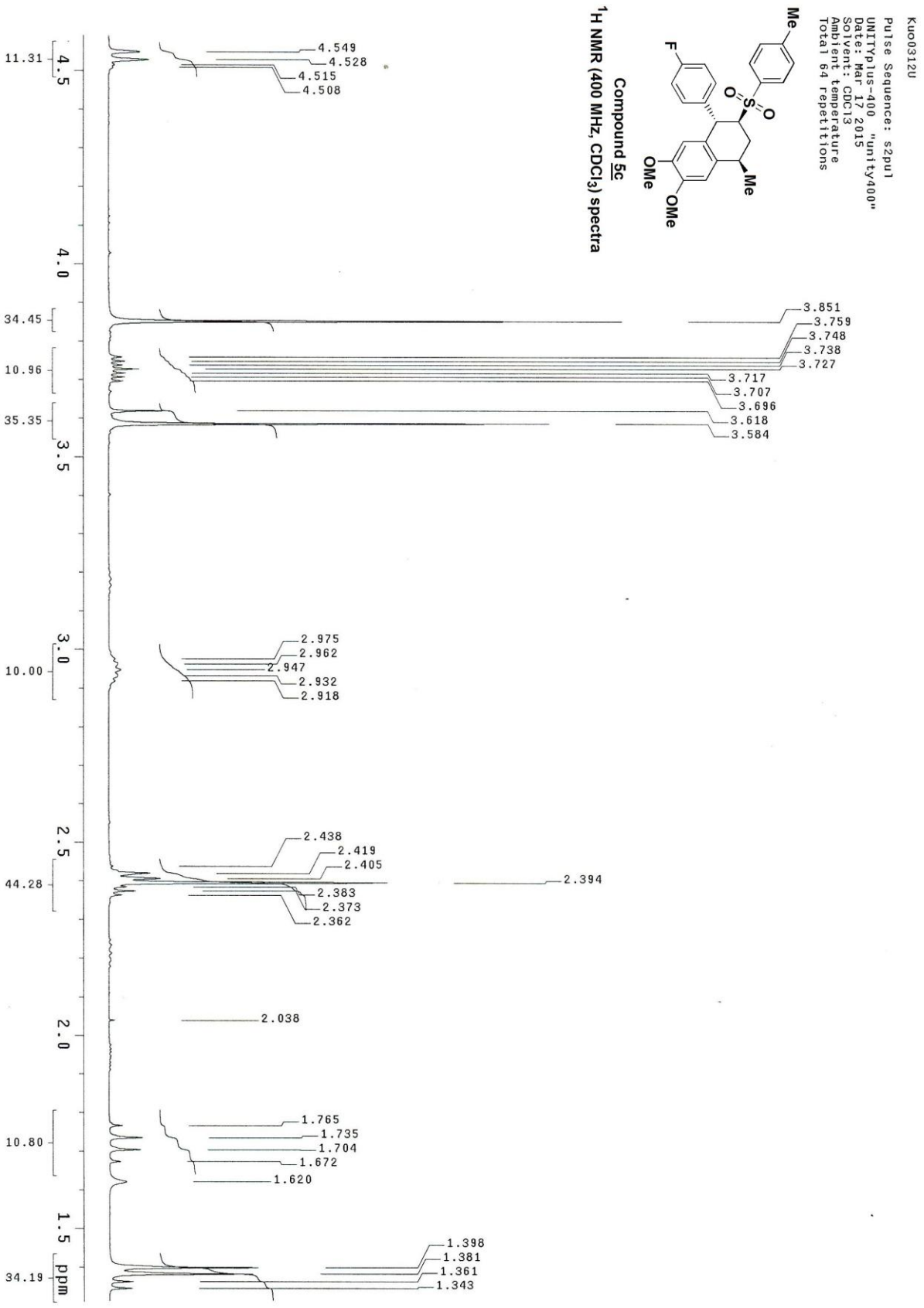

Kuo0309U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 16 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
MeO
OMe
OMe
Me
Compound 5b
1H NMR (400 MHz, CDCl3) spectra
20.00
20.45
22.73
11.16
21.61
11.37
11.93
35.70
50.13
31.67
10.85
47.33
13.22
38.67
7.556
7.536
7.260
7.181
7.161
6.856
6.834
6.751
6.642
6.620
6.244
3.851
3.746
3.738
3.630
3.590
2.384
1.397
1.381
ppm

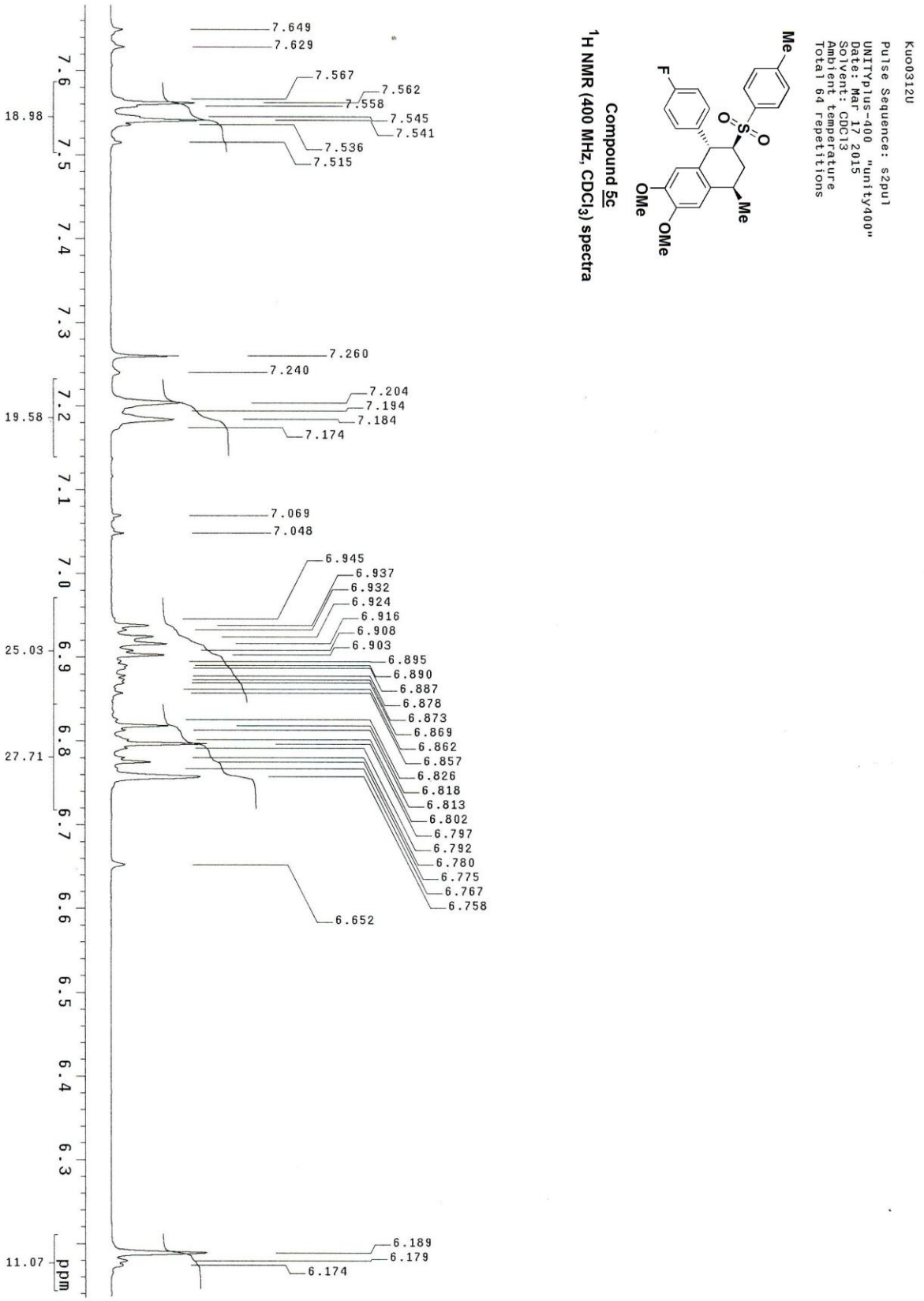

Kuo0309U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 16 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5b
1H NMR (400 MHz, CDCl3) spectra
Me
MeO
OMe
OMe
Me
4.501
4.480
3.915
3.890
3.879
3.851
3.836
3.831
3.809
3.803
3.786
3.776
3.766
3.755
3.746
3.738
3.724
3.704
3.698
3.686
3.674
3.668
3.639
3.630
3.615
3.590
3.576
3.569
3.556
2.984
2.971
2.954
2.939
2.926
2.434
2.423
2.416
2.402
2.391
2.384
2.364
2.345
2.116
2.041
1.769
1.738
1.707
1.677
1.609
1.508
1.493
1.424
1.410
1.397
1.381
1.368
1.362
1.344
11.93
35.70
50.13
31.67
10.85
47.33
13.22
38.67
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm

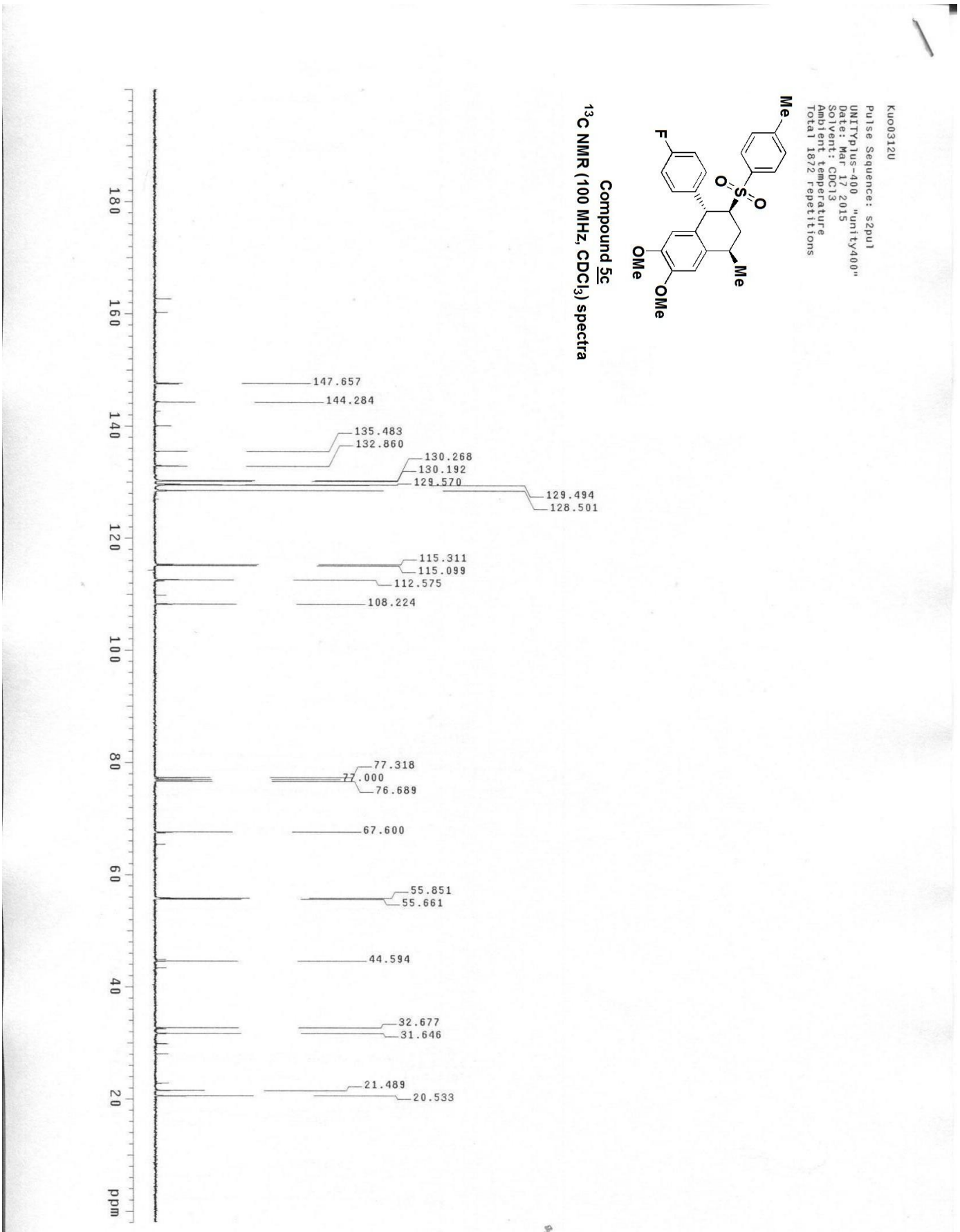

Kuo0309U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 16 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
MeO
OMe
OMe
Me
Compound 5b
1H NMR (400 MHz, CDCl3) spectra
7.657
7.636
7.556
7.540
7.536
7.260
7.252
7.232
7.181
7.161
6.863
6.856
6.851
6.840
6.834
6.826
6.808
6.803
6.751
6.711
6.705
6.689
6.655
6.649
6.642
6.636
6.625
6.620
6.612
6.244
6.235
20.00
20.45
22.73
11.16
21.61
11.37
ppm

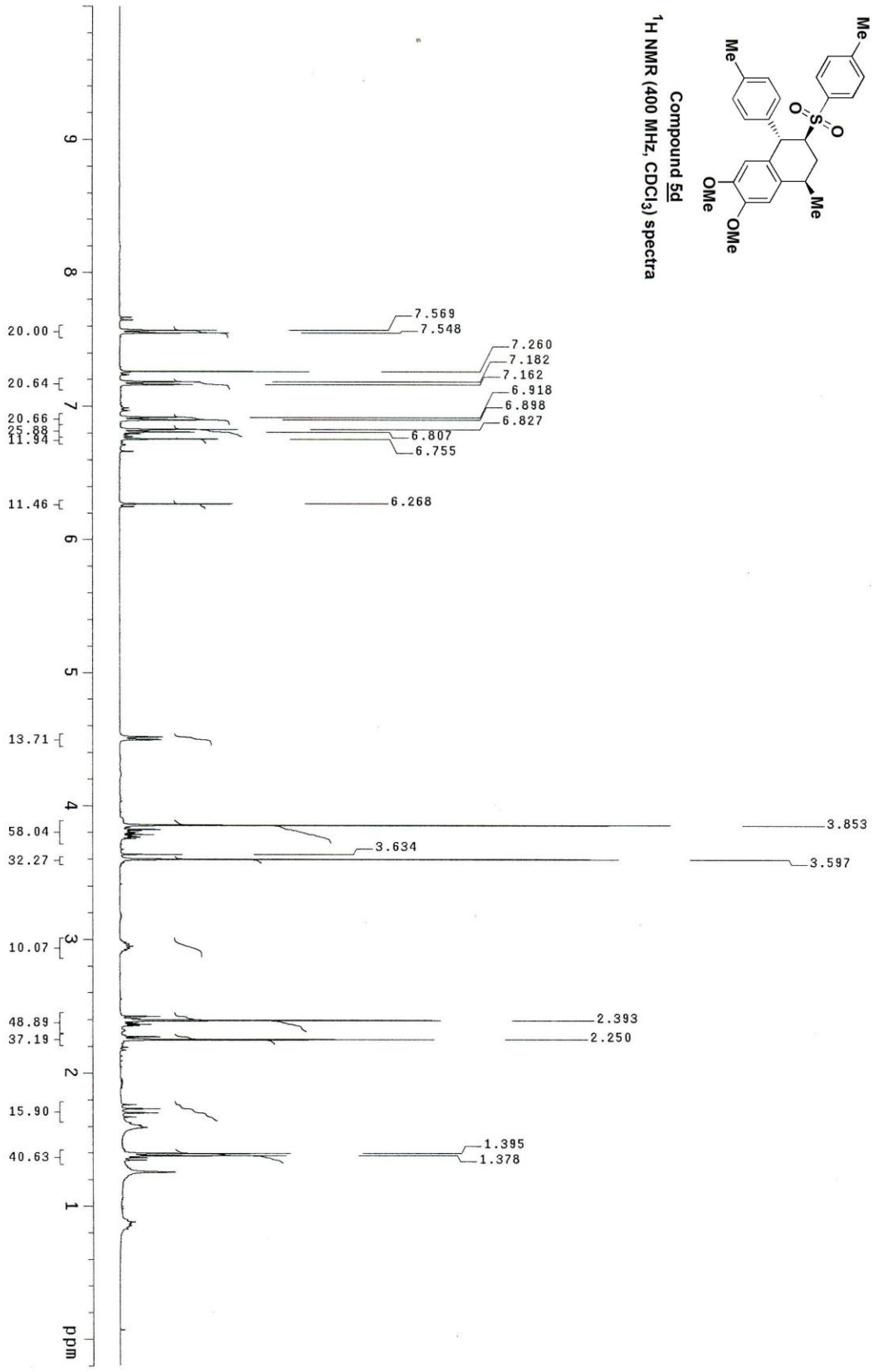

Kuo0309U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 16 2015
Solvent: CDCl3
Ambient temperature
Total 1056 repetitions
Me
MeO
OMe
OMe
Me
Compound 5b
13C NMR (100 MHz, CDCl3) spectra
158.111
147.513
147.430
143.912
136.165
135.703
132.822
130.207
129.661
129.502
129.396
128.524
113.773
112.658
108.148
77.318
77.000
76.682
67.631
55.858
55.669
55.123
44.556
32.677
31.631
21.504
20.541
180
160
140
120
100
80
60
40
20
ppm

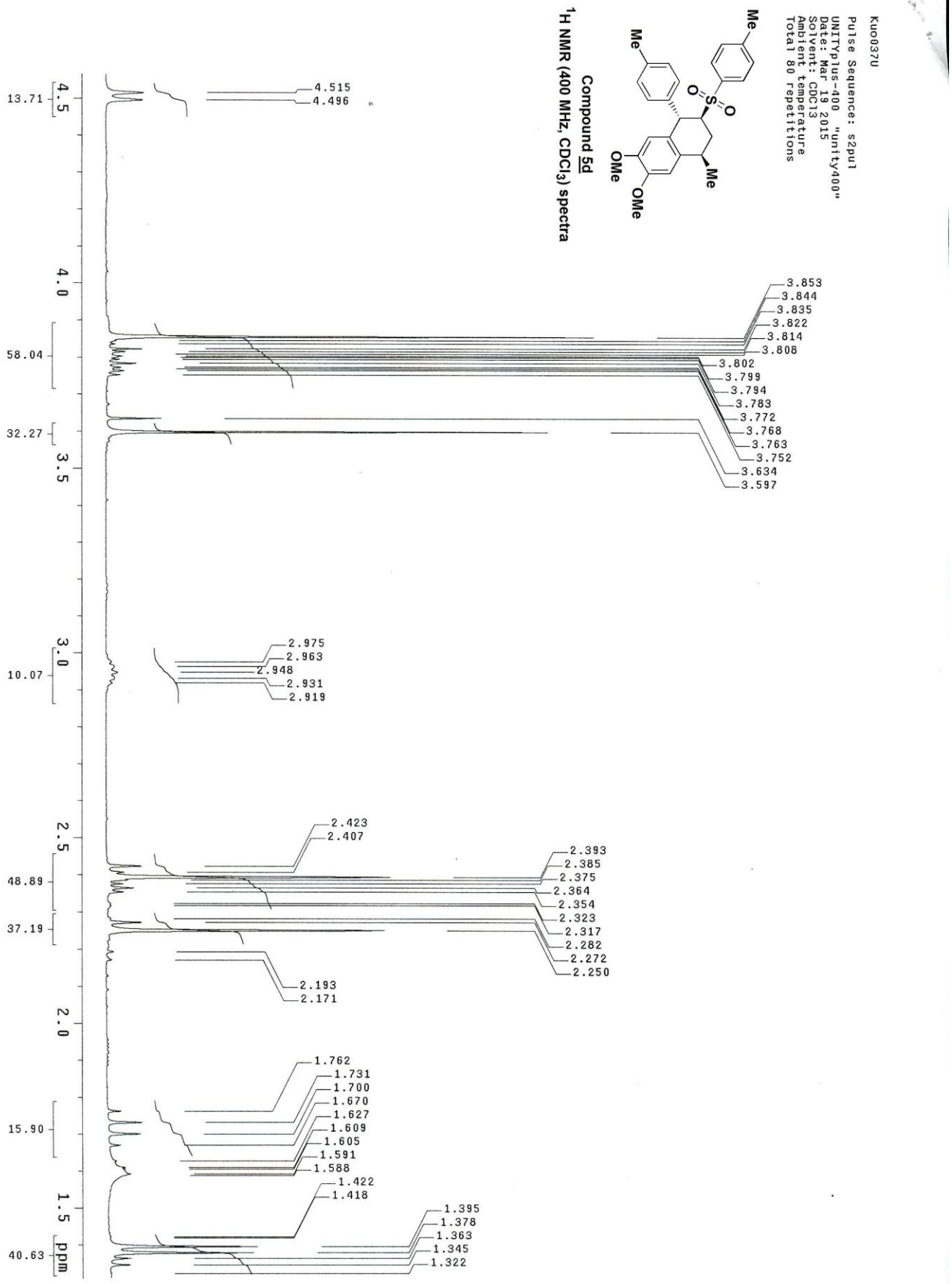

Kuo0312U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
F
O
S
O
OMe
OMe
Me
Compound 5c
1H NMR (400 MHz, CDCl3) spectra
18.98
19.58
25.03
27.71
11.07
11.31
34.45
10.96
35.35
10.00
44.28
10.80
34.19
7.562
7.541
7.260
7.204
7.184
6.818
6.797
6.758
6.189
3.851
3.618
3.584
2.394
1.398
1.381
ppm

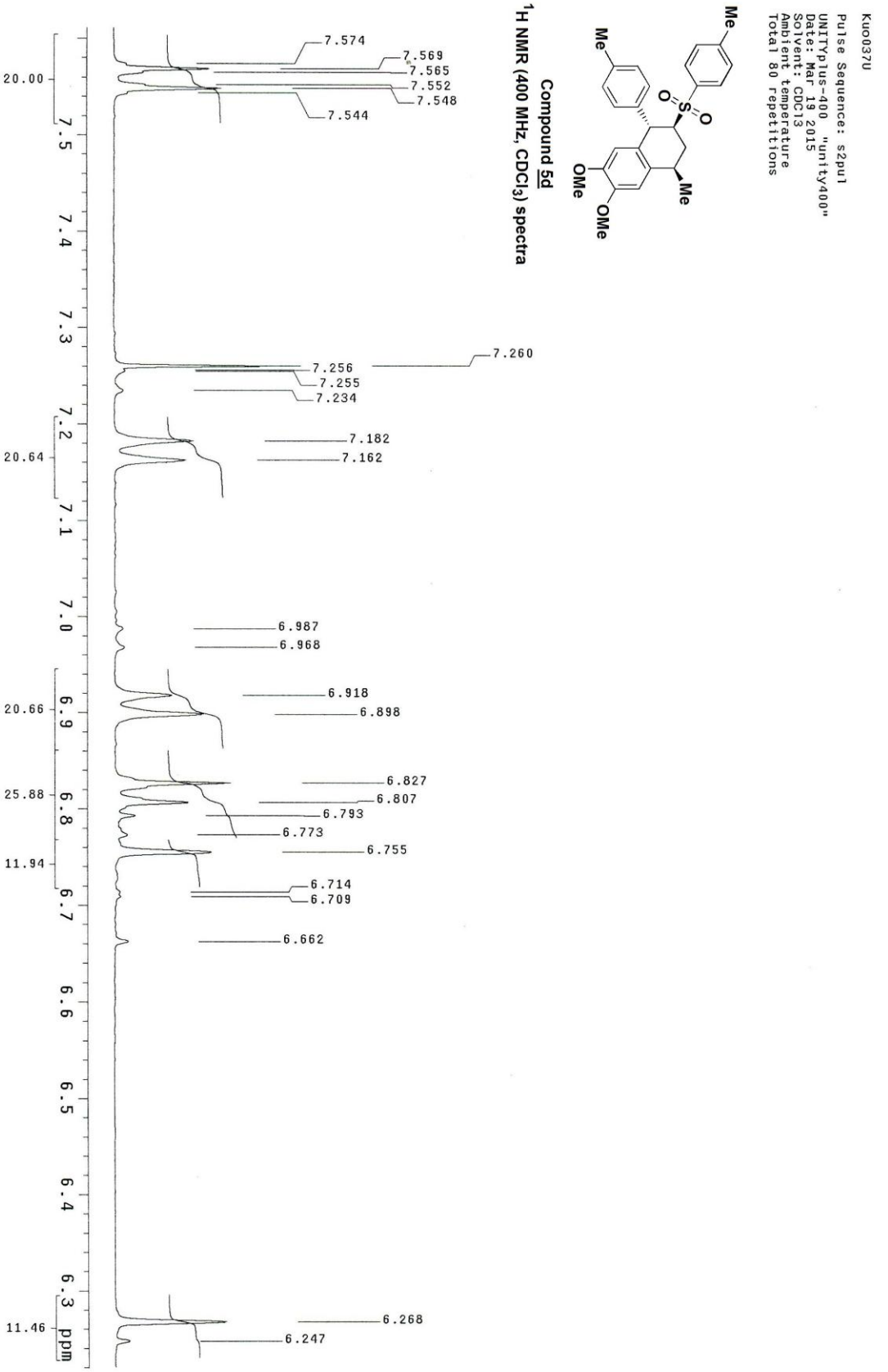

Kuo0312U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5c
1H NMR (400 MHz, CDCl3) spectra
Me
F
O
S
O
OMe
OMe
Me
11.31
4.549
4.528
4.515
4.508
34.45
10.96
35.35
3.851
3.759
3.748
3.738
3.727
3.717
3.707
3.696
3.618
3.584
10.00
2.975
2.962
2.947
2.932
2.918
44.28
2.438
2.419
2.405
2.394
2.383
2.373
2.362
2.038
10.80
1.765
1.735
1.704
1.672
1.620
34.19
1.398
1.381
1.361
1.343
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm

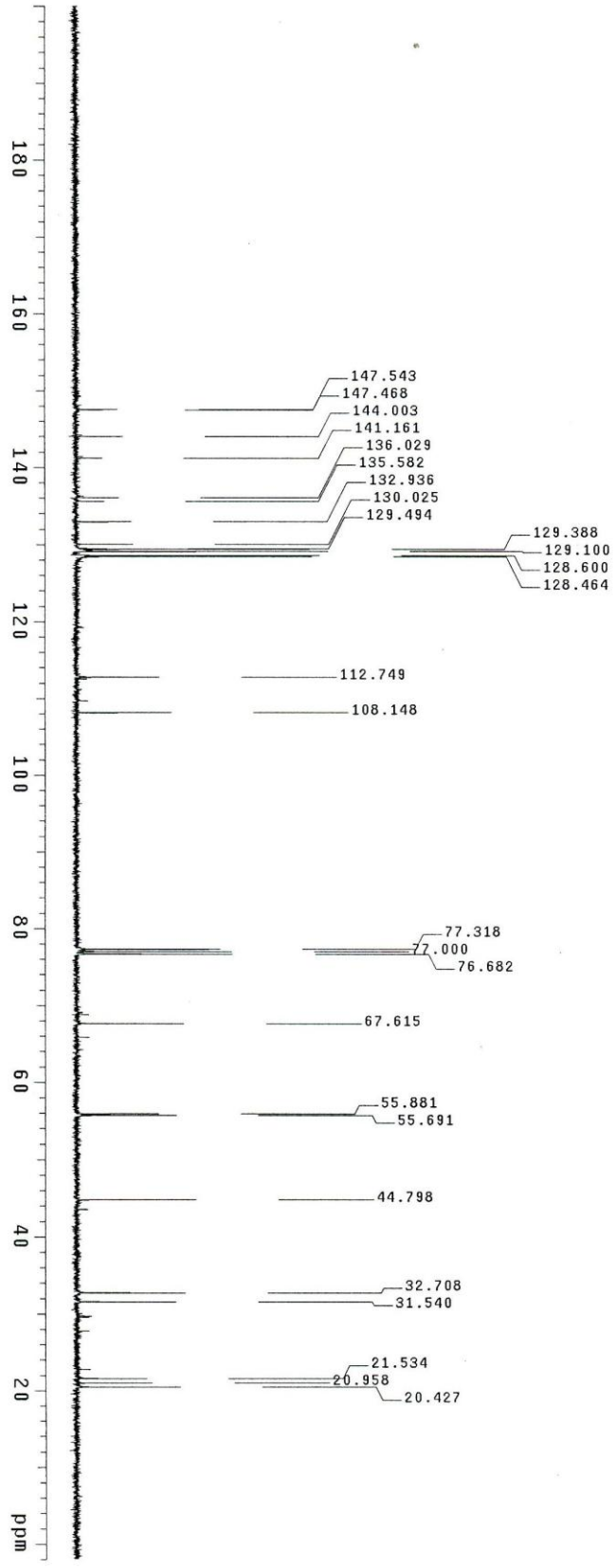

Kuo0312U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
F
O
S
O
OMe
OMe
Me
Compound 5c
1H NMR (400 MHz, CDCl3) spectra
7.649
7.629
7.567
7.562
7.558
7.545
7.541
7.536
7.515
18.98
7.260
7.240
7.204
7.194
7.184
7.174
19.58
7.069
7.048
6.945
6.937
6.932
6.924
6.916
6.908
6.903
25.03
6.895
6.890
6.887
6.878
6.873
6.869
6.862
6.857
6.826
6.818
6.813
6.802
6.797
6.792
6.780
6.775
6.767
6.758
27.71
6.652
6.189
6.179
6.174
11.07
ppm

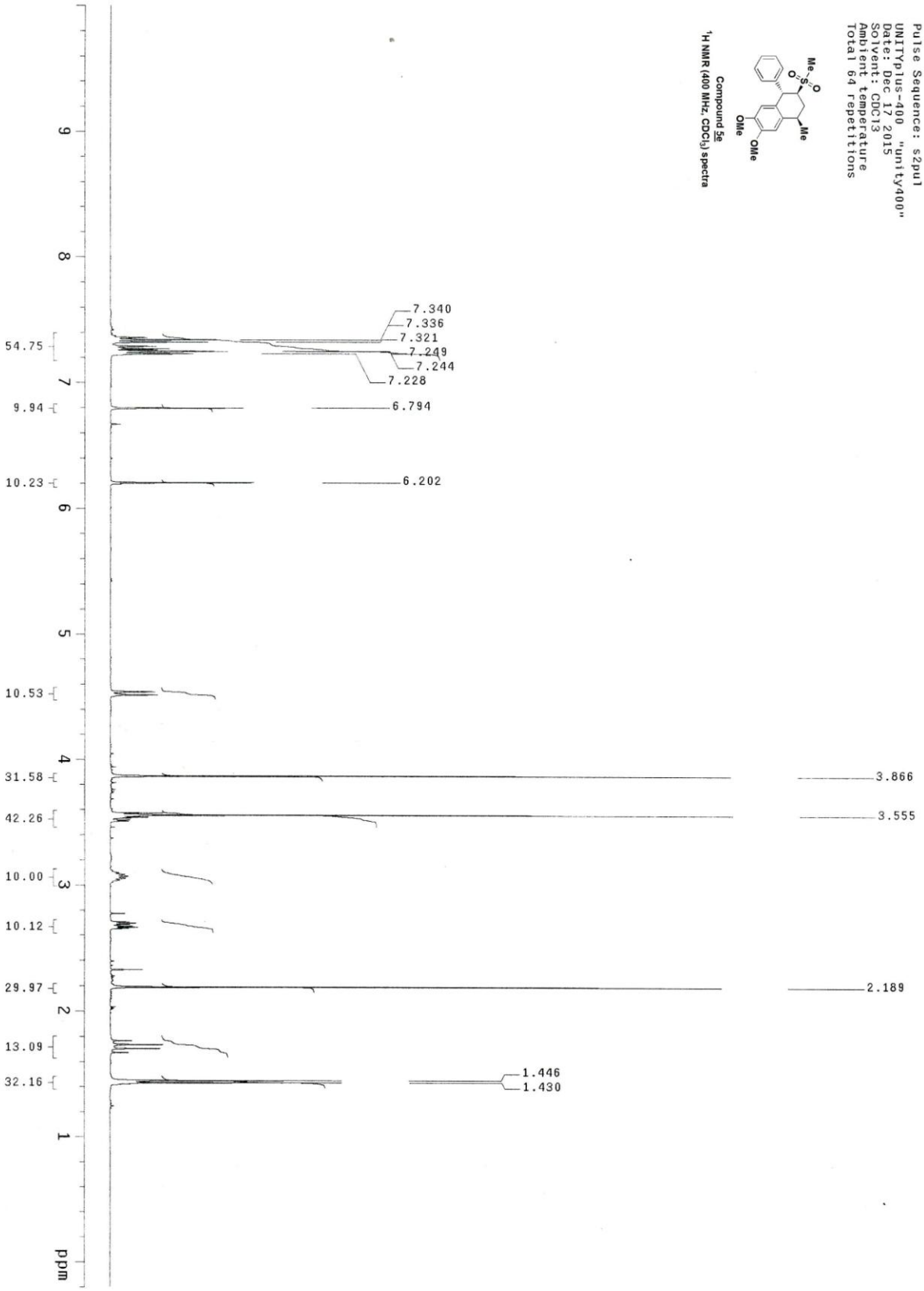

Kuo0312U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 17 2015
Solvent: CDCl3
Ambient temperature
Total 1872 repetitions
Me
F
O
S
O
OMe
OMe
Me
Compound 5c
13C NMR (100 MHz, CDCl3) spectra
147.657
144.284
135.483
132.860
130.268
130.192
129.570
129.494
128.501
115.311
115.099
112.575
108.224
77.318
77.000
76.689
67.600
55.851
55.661
44.594
32.677
31.646
21.489
20.533
180
160
140
120
100
80
60
40
20
ppm

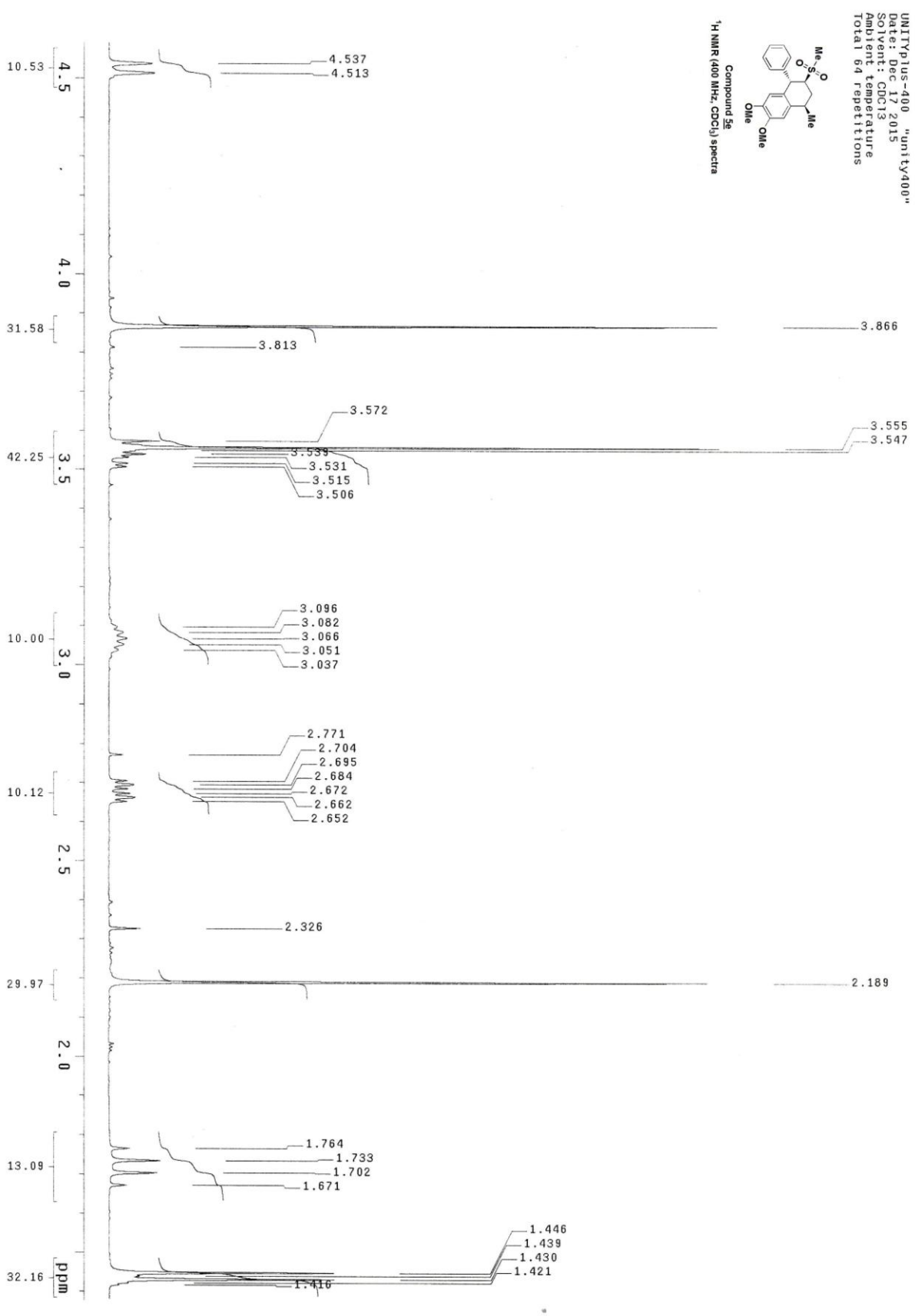

Kuo037U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Me
Me
OMe
OMe
Me
Compound 5d
1H NMR (400 MHz, CDCl3) spectra
7.569
7.548
7.260
7.182
7.162
6.918
6.898
6.827
6.807
6.755
6.268
3.853
3.634
3.597
2.393
2.250
1.395
1.378
20.00
20.64
20.66
25.88
11.94
11.46
13.71
58.04
32.27
10.07
48.89
37.19
15.90
40.63
ppm

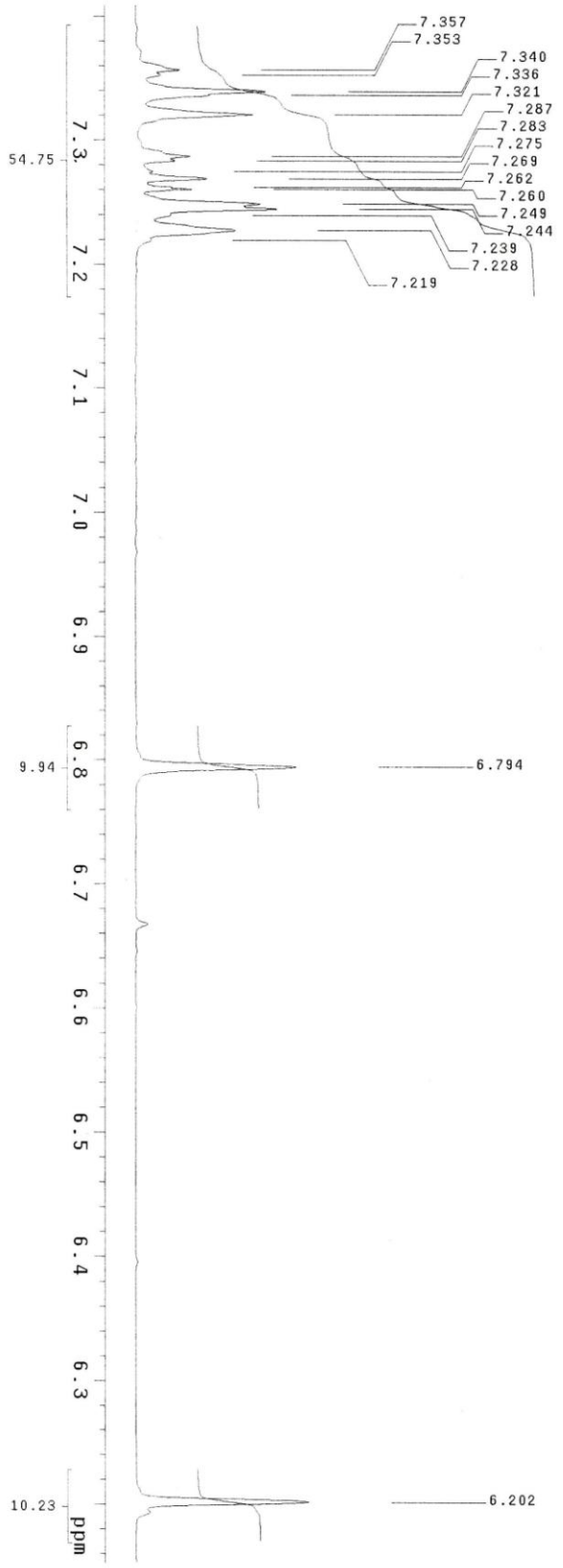

Kuo037U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Compound 5d
1H NMR (400 MHz, CDCl3) spectra
Me
Me
Me
OMe
OMe
13.71
58.04
32.27
10.07
48.89
37.19
15.90
40.63
4.515
4.496
3.853
3.844
3.835
3.822
3.814
3.808
3.802
3.799
3.794
3.783
3.772
3.768
3.763
3.752
3.634
3.597
2.975
2.963
2.948
2.931
2.919
2.423
2.407
2.393
2.385
2.375
2.364
2.354
2.323
2.317
2.282
2.272
2.250
2.193
2.171
1.762
1.731
1.700
1.670
1.627
1.609
1.605
1.591
1.588
1.422
1.418
1.395
1.378
1.363
1.345
1.322
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm


Kuo037U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 19 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Me
Me
Me
OMe
OMe
Compound 5d
1H NMR (400 MHz, CDCl3) spectra
7.574
7.569
7.565
7.552
7.548
7.544
7.260
7.256
7.255
7.234
7.182
7.162
6.987
6.968
6.918
6.898
6.827
6.807
6.793
6.773
6.755
6.714
6.709
6.662
6.268
6.247
20.00
20.64
20.66
25.88
11.94
11.46
ppm


Kuo037U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 20 2015
Solvent: CDCl3
Ambient temperature
Total 5024 repetitions
Me
Me
O
S
O
OMe
OMe
Me
Compound 5d
13C NMR (100 MHz, CDCl3) spectra
147.543
147.468
144.003
141.161
136.029
135.582
132.936
130.025
129.494
129.388
129.100
128.600
128.464
112.749
108.148
77.318
77.000
76.682
67.615
55.881
55.691
44.798
32.708
31.540
21.534
20.958
20.427
180
160
140
120
100
80
60
40
20
ppm


Kuo0929
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Dec 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5e
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
O
S
O
Me
OMe
OMe
7.340
7.336
7.321
7.249
7.244
7.228
6.794
6.202
3.866
3.555
2.189
1.446
1.430
54.75
9.94
10.23
10.53
31.58
42.26
10.00
10.12
29.97
13.09
32.16
ppm

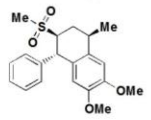

Kuo0929
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Dec 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5e
¹H NMR (400 MHz, CDCl₃) spectra
Me
OMe
OMe
Me
10.53
4.5
4.0
31.58
42.25
3.5
10.00
3.0
10.12
2.5
29.97
2.0
13.09
32.16
ppm
4.537
4.513
3.866
3.813
3.572
3.555
3.547
3.539
3.531
3.515
3.506
3.096
3.082
3.066
3.051
3.037
2.771
2.704
2.695
2.684
2.672
2.662
2.652
2.326
2.189
1.764
1.733
1.702
1.671
1.446
1.439
1.430
1.421
1.416


Kuo0929
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Dec 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
OMe
OMe
Compound 5e
^{1}H NMR (400 MHz, CDCl$_3$) spectra
7.357
7.353
7.340
7.336
7.321
7.287
7.283
7.275
7.269
7.262
7.260
7.249
7.244
7.239
7.228
7.219
6.794
6.202
54.75
9.94
10.23
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
ppm

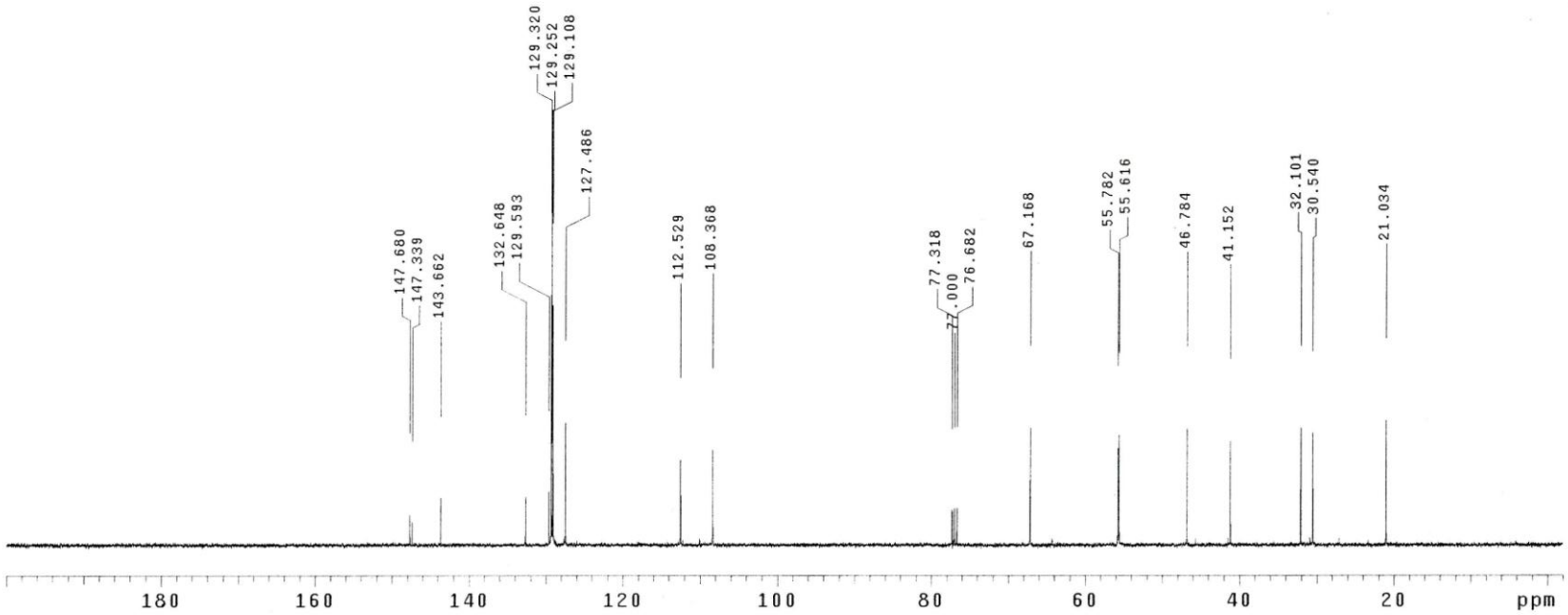
Kuo0929

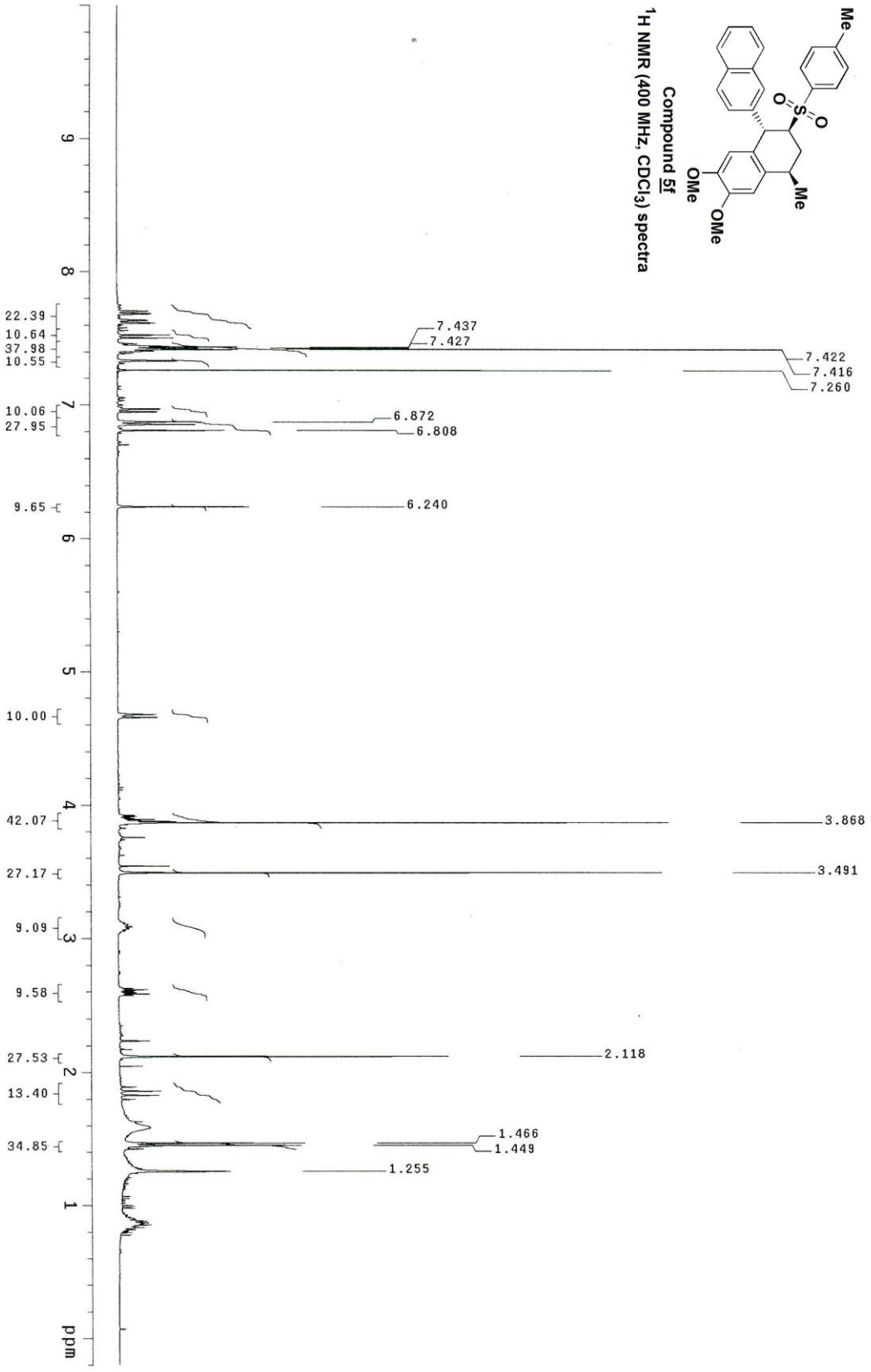
Pulse Sequence: s2pul

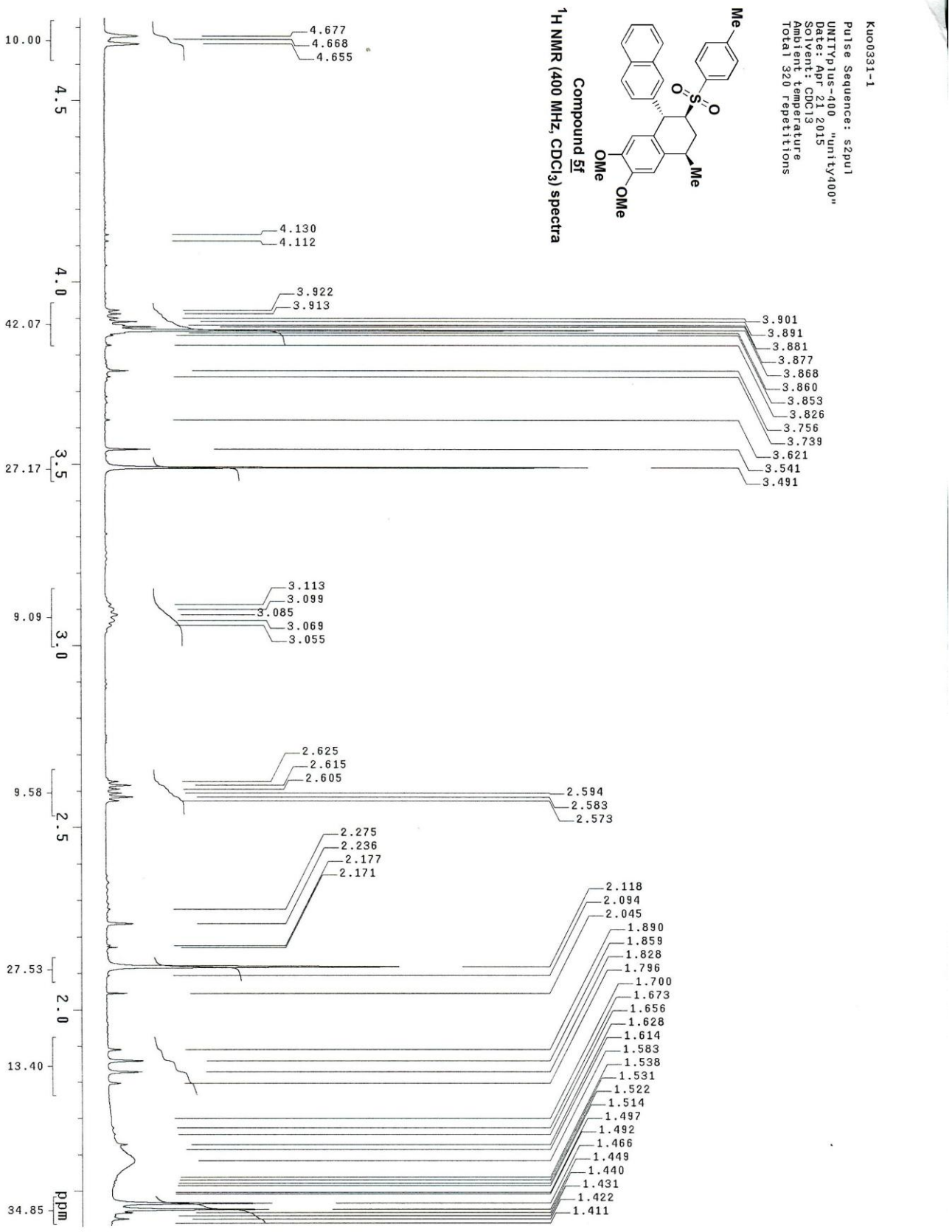
UNITYplus-400 "unity400"
Date: Dec 17 2015
Solvent: CDCl3
Ambient temperature
Total 560 repetitions

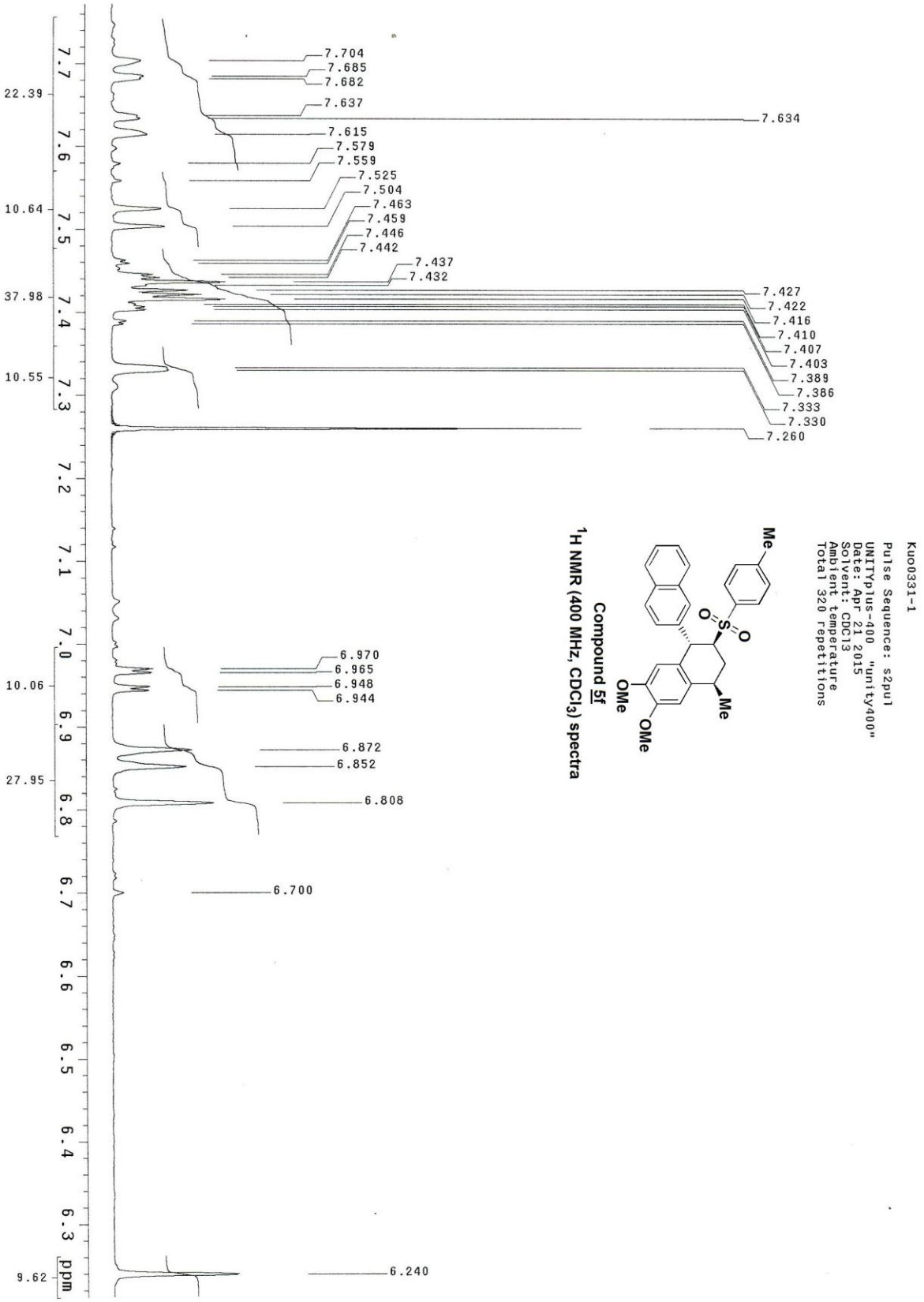


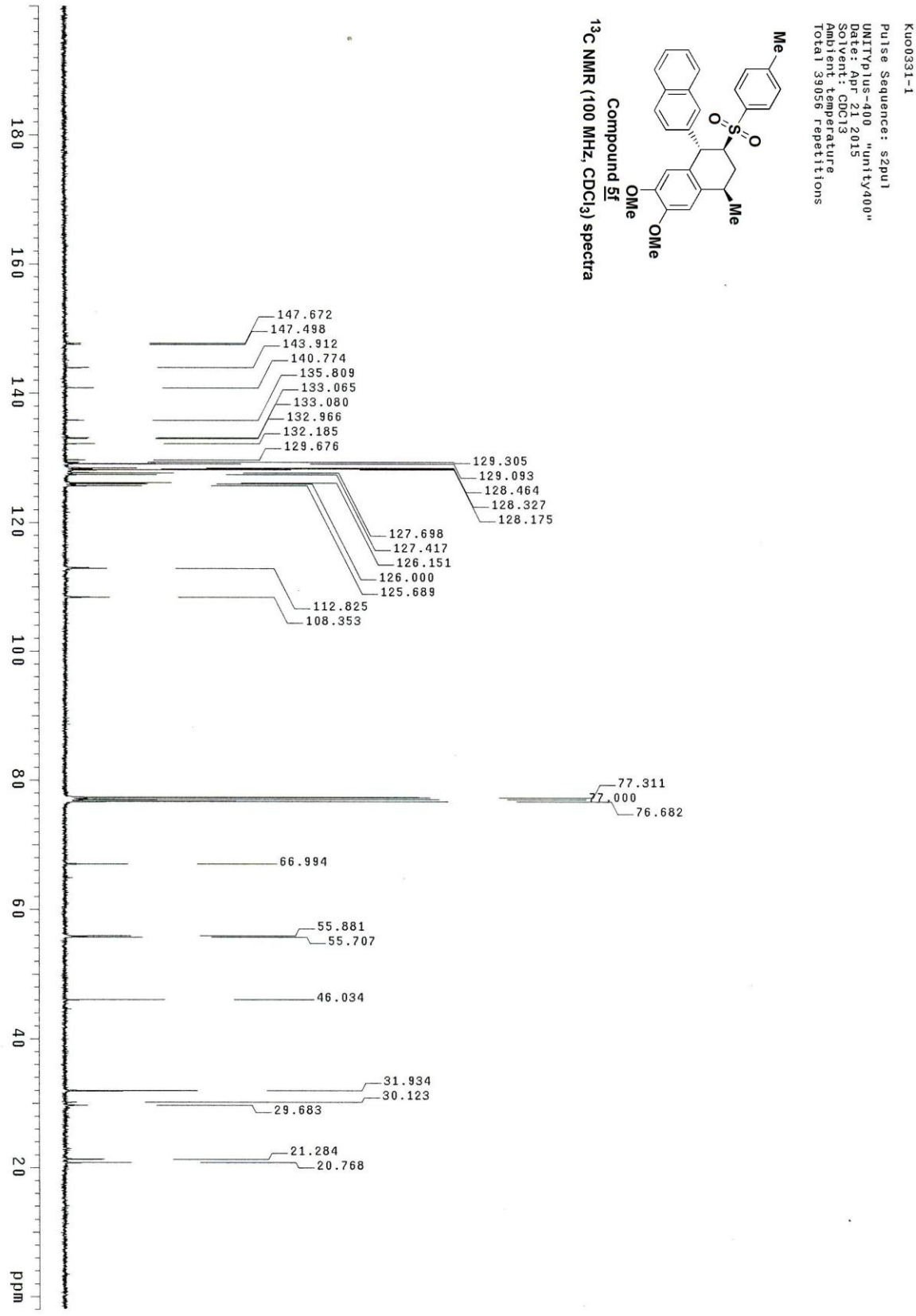
Compound 5e
^{13}C NMR (100 MHz, $CDCl_3$) spectra

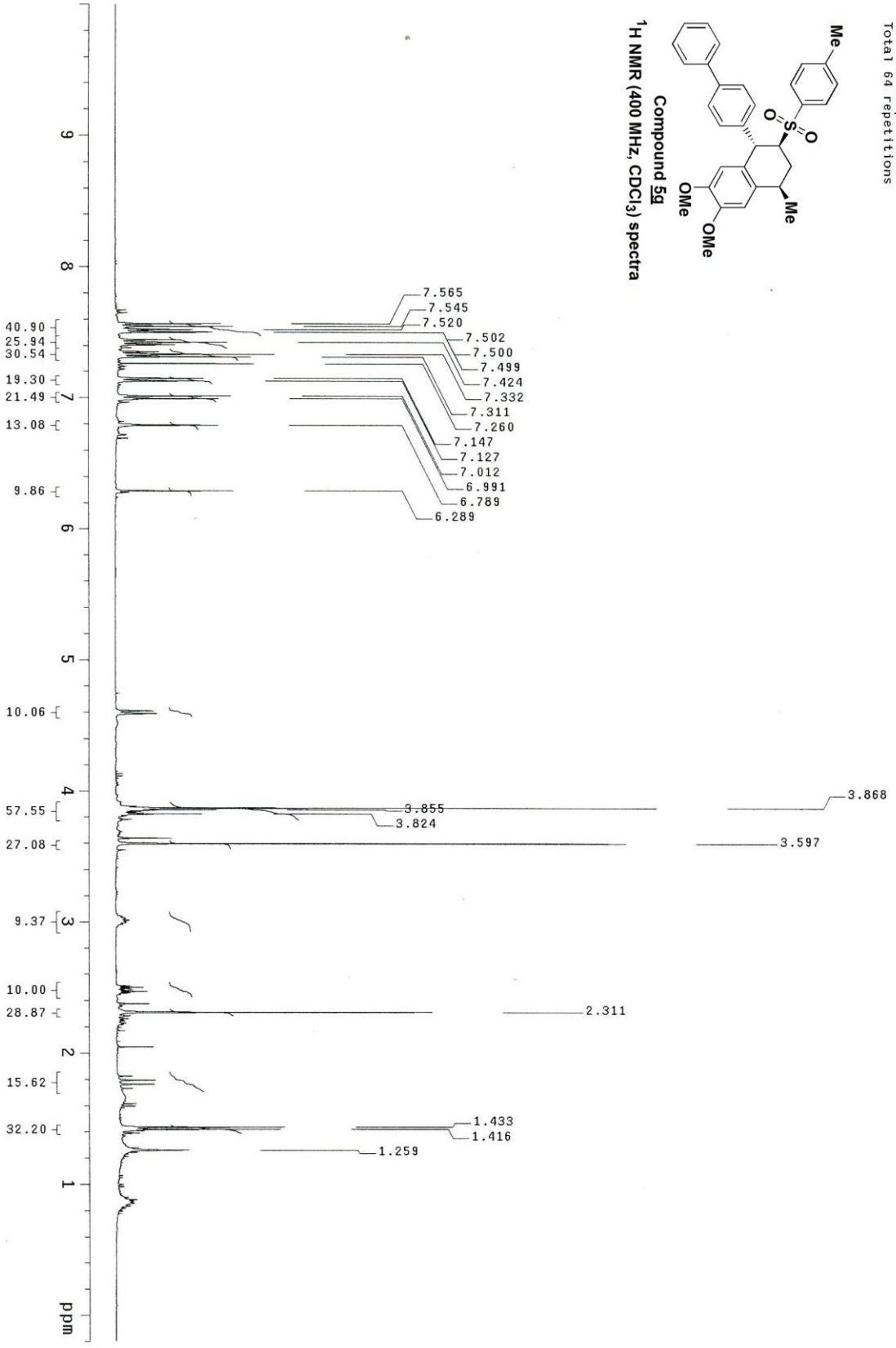


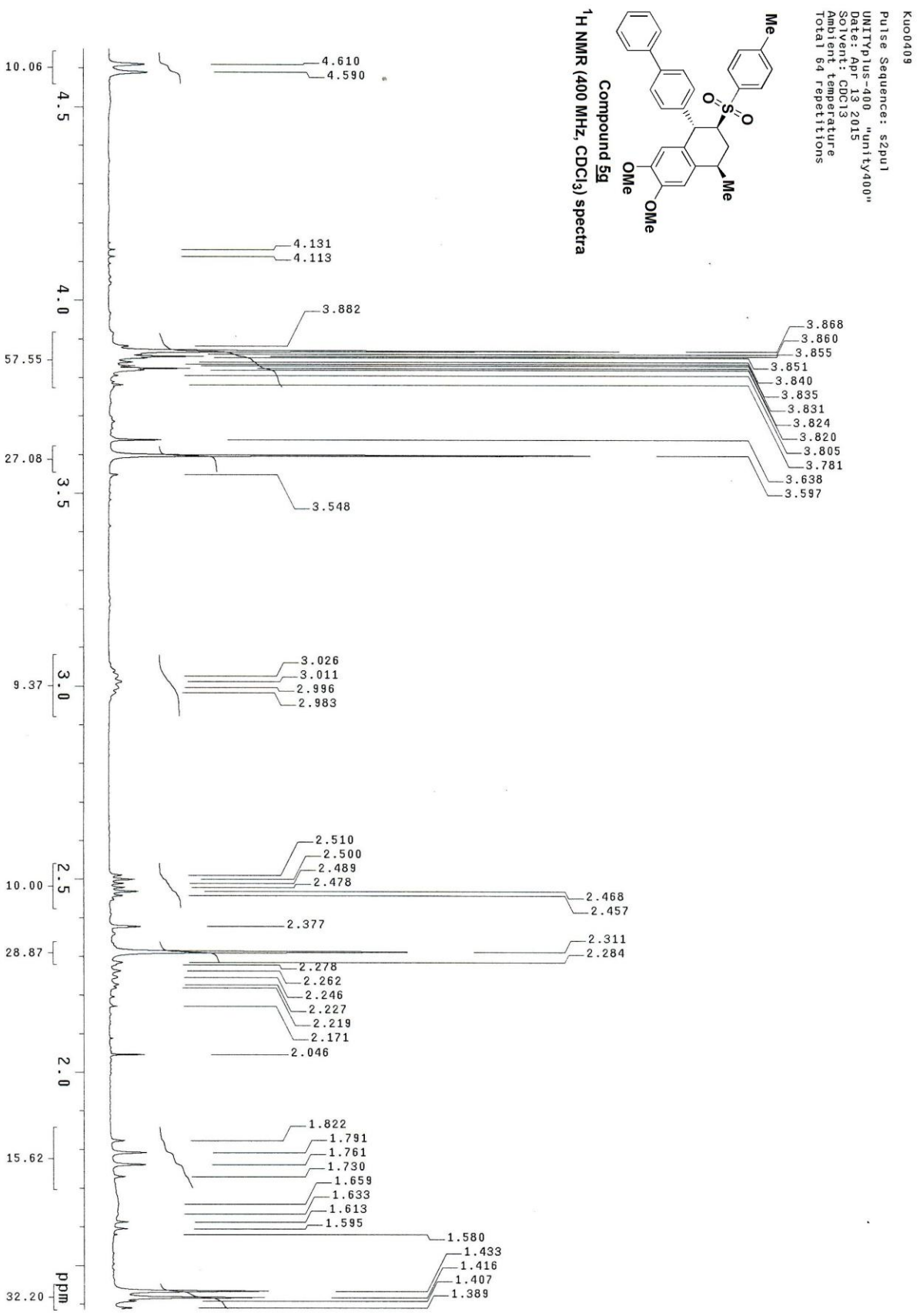

Kuo0331-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 21 2015
Solvent: CDCl3
Ambient temperature
Total 320 repetitions
Compound 5f
1H NMR (400 MHz, CDCl3) spectra
Me
OMe
OMe
Me
7.437
7.427
7.422
7.416
7.260
6.872
6.808
6.240
3.868
3.491
2.118
1.466
1.449
1.255
22.39
10.64
37.98
10.55
10.06
27.95
9.65
10.00
42.07
27.17
9.09
9.58
27.53
13.40
34.85
ppm

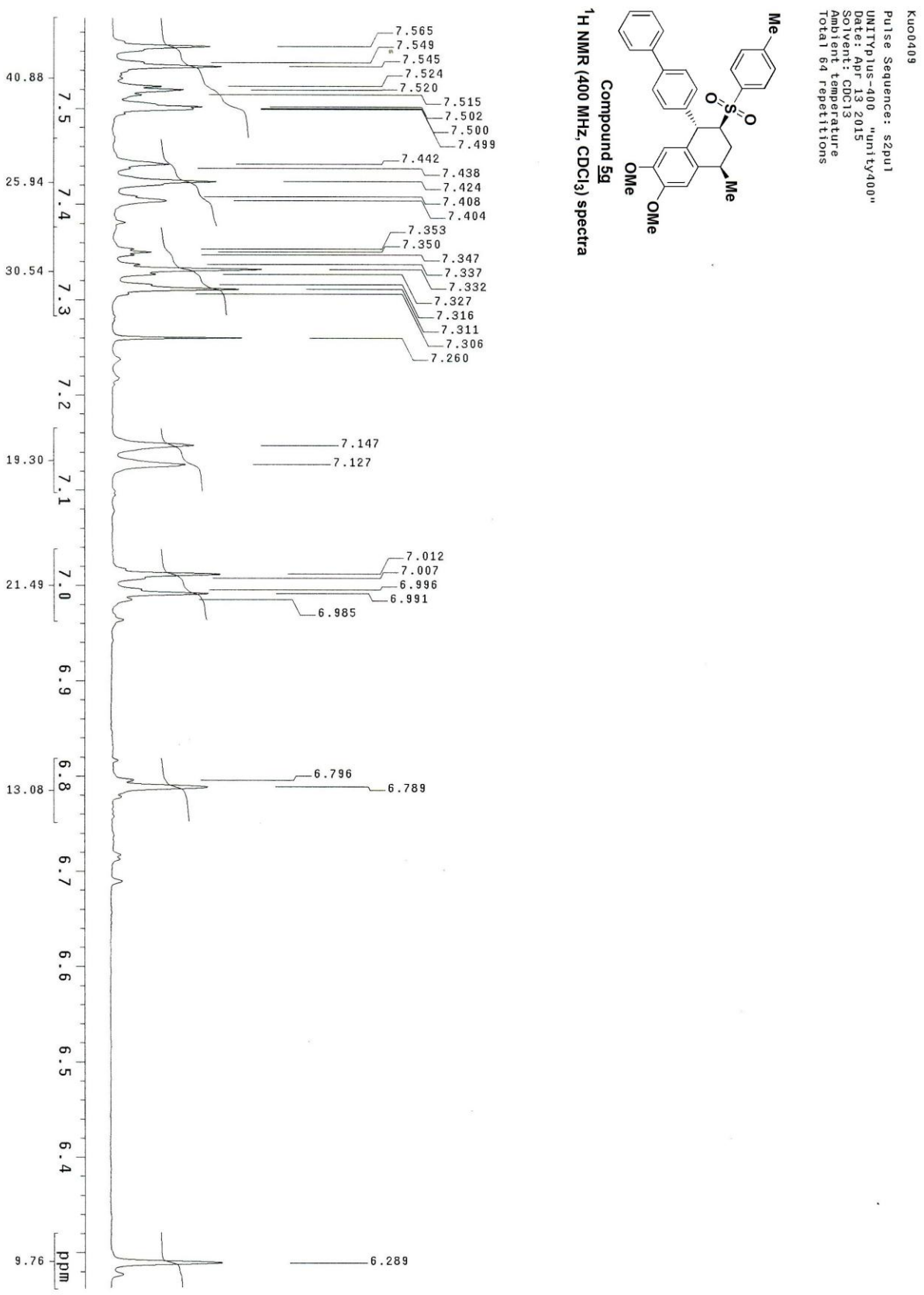

Kuo0331-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 21 2015
Solvent: CDCl3
Ambient temperature
Total 320 repetitions
Compound 5f
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
OMe
OMe
Me
4.677
4.668
4.655
4.130
4.112
3.922
3.913
3.901
3.891
3.881
3.877
3.868
3.860
3.853
3.826
3.756
3.739
3.621
3.541
3.491
3.113
3.099
3.085
3.069
3.055
2.625
2.615
2.605
2.594
2.583
2.573
2.275
2.236
2.177
2.171
2.118
2.094
2.045
1.890
1.859
1.828
1.796
1.700
1.673
1.656
1.628
1.614
1.583
1.538
1.531
1.522
1.514
1.497
1.492
1.466
1.449
1.440
1.431
1.422
1.411
10.00
4.5
4.0
42.07
3.5
27.17
9.09
3.0
9.58
2.5
27.53
2.0
13.40
34.85
ppm

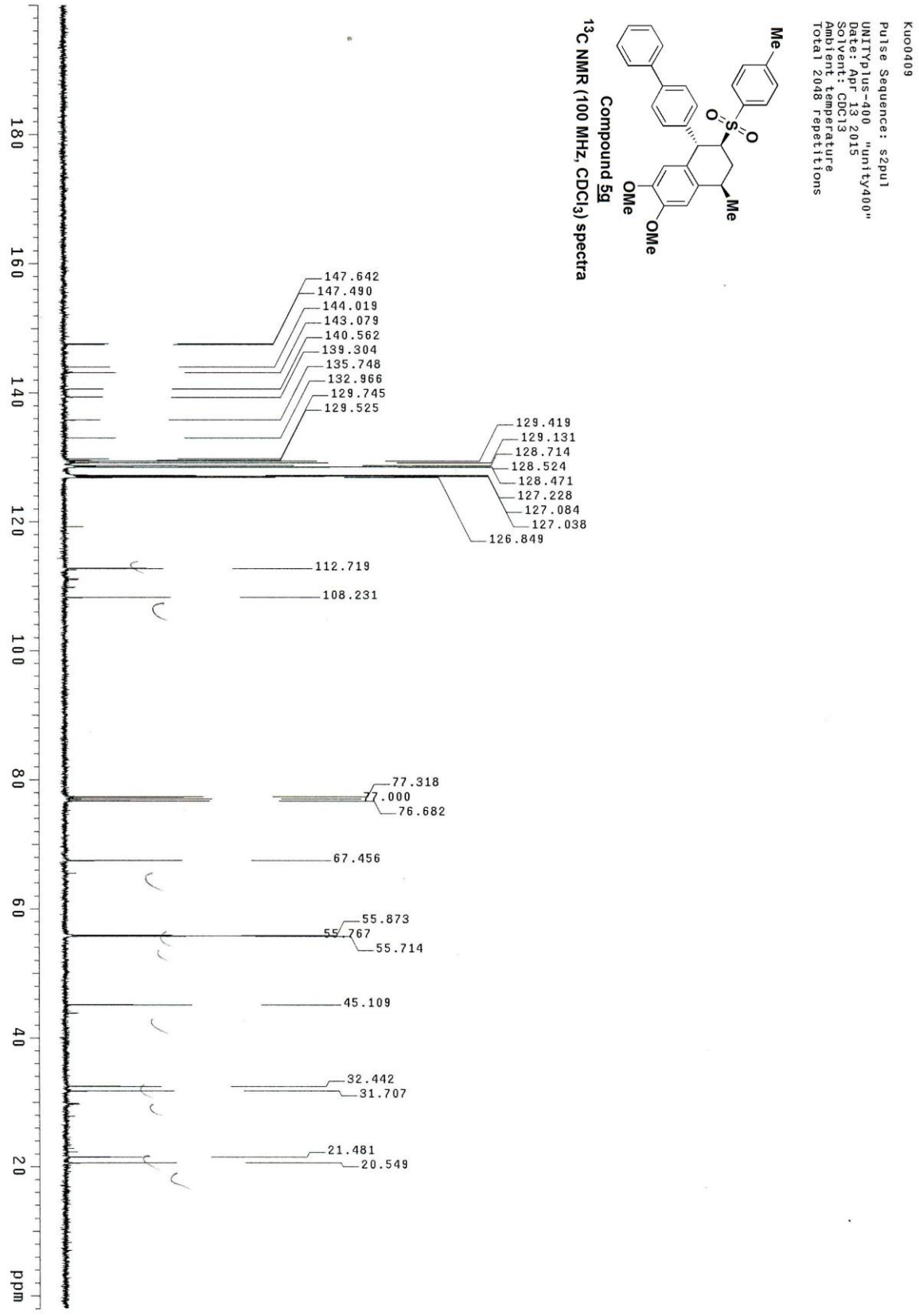

Kuo0331-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 21 2015
Solvent: CDCl3
Ambient temperature
Total 320 repetitions
Compound 5f
1H NMR (400 MHz, CDCl3) spectra
Me
OMe
OMe
Me
7.704
7.685
7.682
7.637
7.634
7.615
7.579
7.559
7.525
7.504
7.463
7.459
7.446
7.442
7.437
7.432
7.427
7.422
7.416
7.410
7.407
7.403
7.389
7.386
7.333
7.330
7.260
6.970
6.965
6.948
6.944
6.872
6.852
6.808
6.700
6.240
22.39
10.64
37.98
10.55
10.06
27.95
9.62
ppm

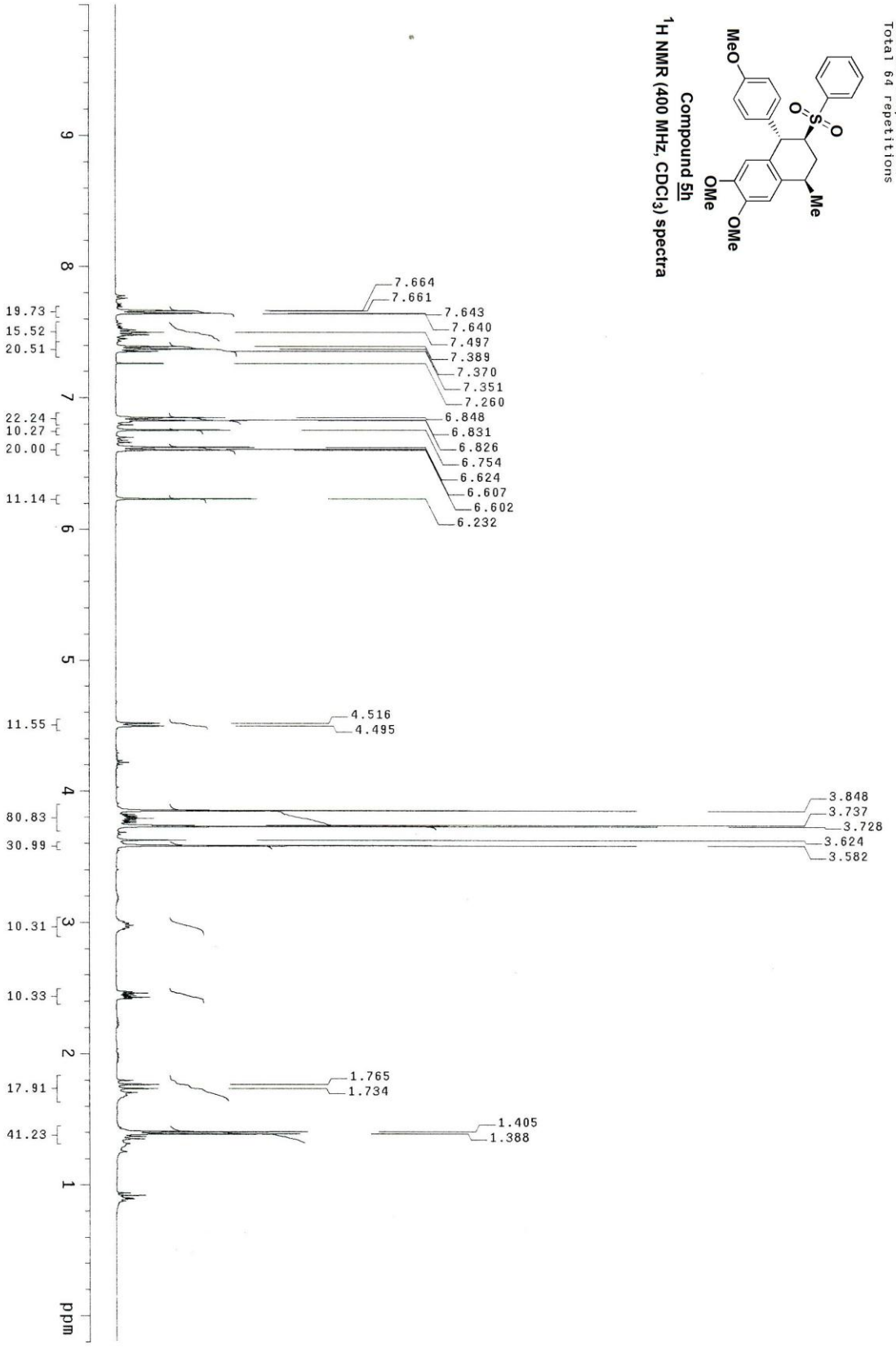

Kuo0331-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 21 2015
Solvent: CDCl3
Ambient temperature
Total 39056 repetitions
Me
OMe
OMe
Me
Compound 5f
13C NMR (100 MHz, CDCl3) spectra
147.672
147.498
143.912
140.774
135.809
133.065
133.080
132.966
132.185
129.676
129.305
129.093
128.464
128.327
128.175
127.698
127.417
126.151
126.000
125.689
112.825
108.353
77.311
77.000
76.682
66.994
55.881
55.707
46.034
31.934
30.123
29.683
21.284
20.768
180
160
140
120
100
80
60
40
20
ppm

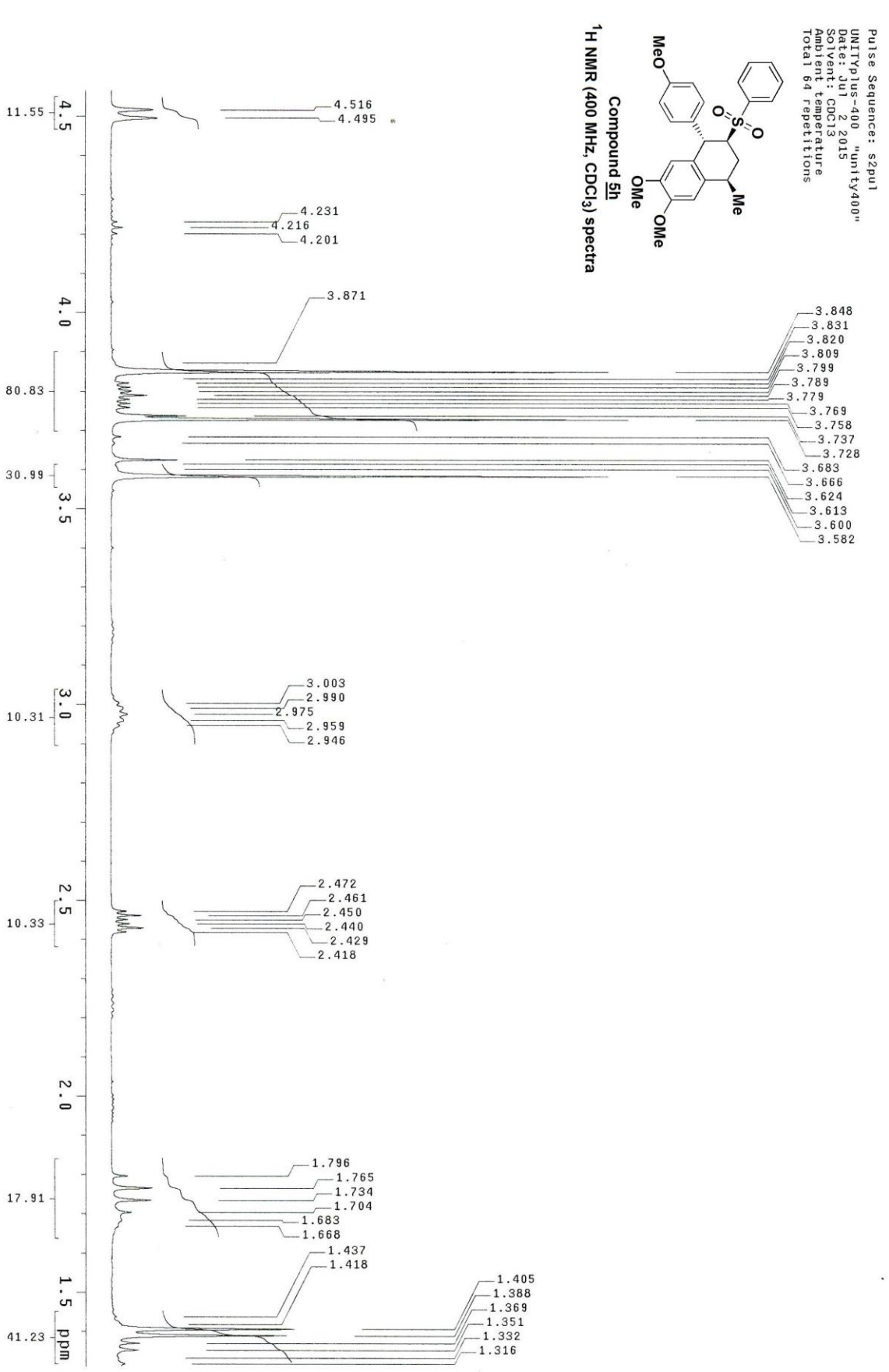

Kuo0409
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
OMe
OMe
Me
Compound 5g
1H NMR (400 MHz, CDCl3) spectra
7.565
7.545
7.520
7.502
7.500
7.499
7.424
7.332
7.311
7.260
7.147
7.127
7.012
6.991
6.789
6.289
3.868
3.855
3.824
3.597
2.311
1.433
1.416
1.259
40.90
25.94
30.54
19.30
21.49
13.08
9.86
10.06
57.55
27.08
9.37
10.00
28.87
15.62
32.20
ppm

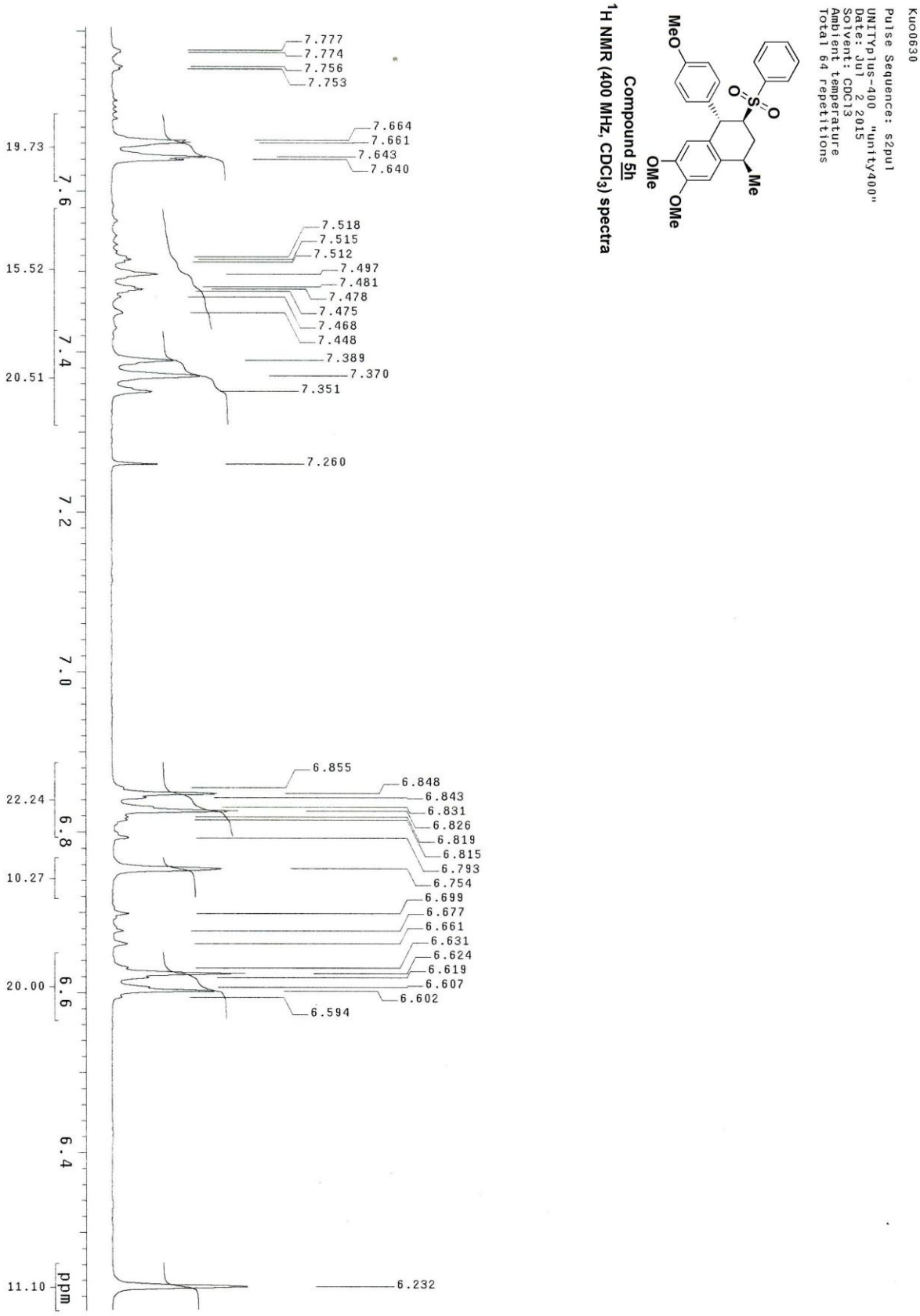

Kuo0409
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5g
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
OMe
OMe
Me
4.610
4.590
4.131
4.113
3.882
3.868
3.860
3.855
3.851
3.840
3.835
3.831
3.824
3.820
3.805
3.781
3.638
3.597
3.548
3.026
3.011
2.996
2.983
2.510
2.500
2.489
2.478
2.468
2.457
2.377
2.311
2.284
2.278
2.262
2.246
2.227
2.219
2.171
2.046
1.822
1.791
1.761
1.730
1.659
1.633
1.613
1.595
1.580
1.433
1.416
1.407
1.389
10.06
57.55
27.08
9.37
10.00
28.87
15.62
32.20
ppm

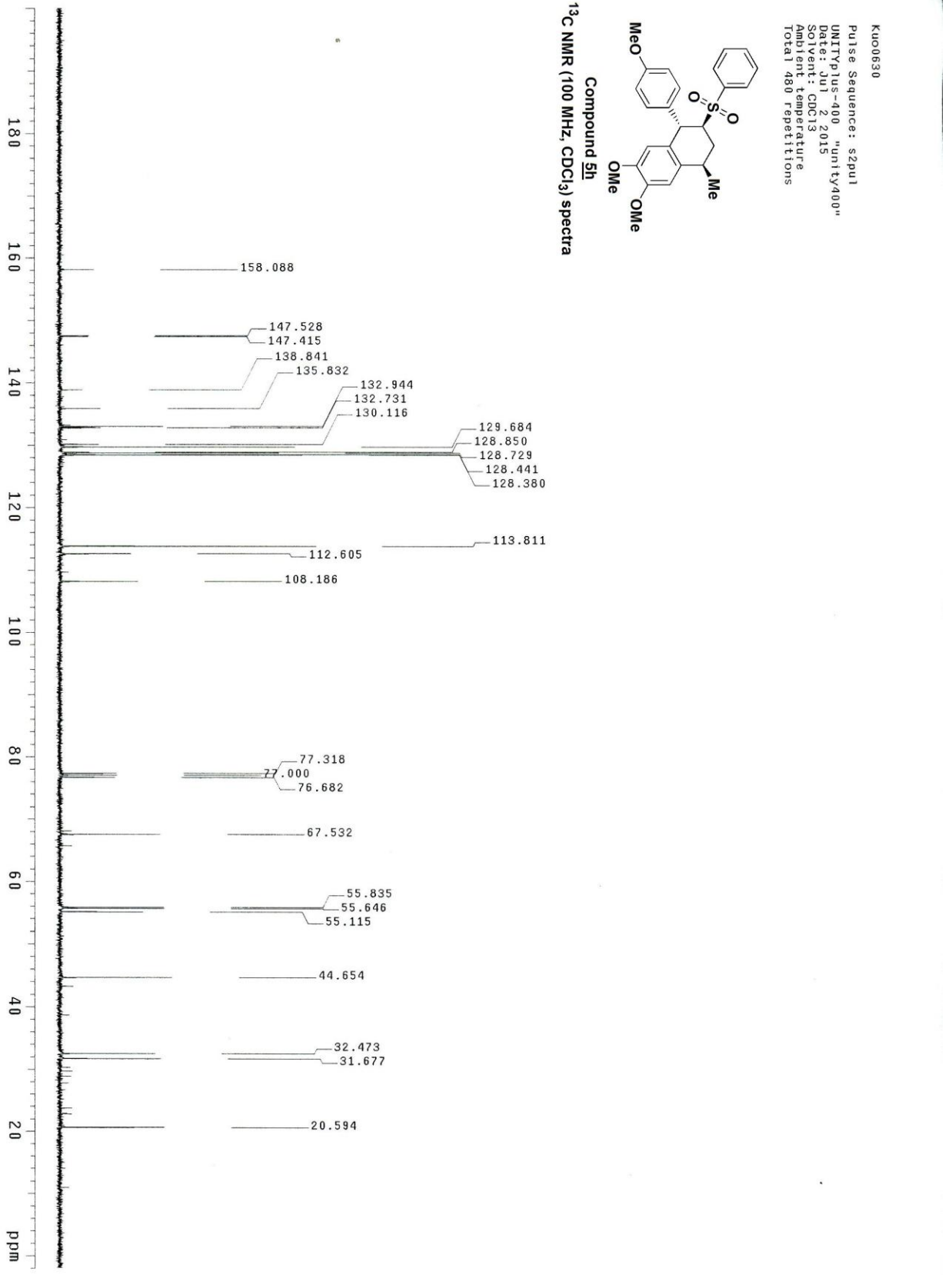

Kuo0409
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
OMe
OMe
Me
Compound 5g
1H NMR (400 MHz, CDCl3) spectra
7.565
7.549
7.545
7.524
7.520
7.515
7.502
7.500
7.499
7.442
7.438
7.424
7.408
7.404
7.353
7.350
7.347
7.337
7.332
7.327
7.316
7.311
7.306
7.260
7.147
7.127
7.012
7.007
6.996
6.991
6.985
6.796
6.789
6.289
40.88
25.94
30.54
19.30
21.49
13.08
9.76
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
ppm

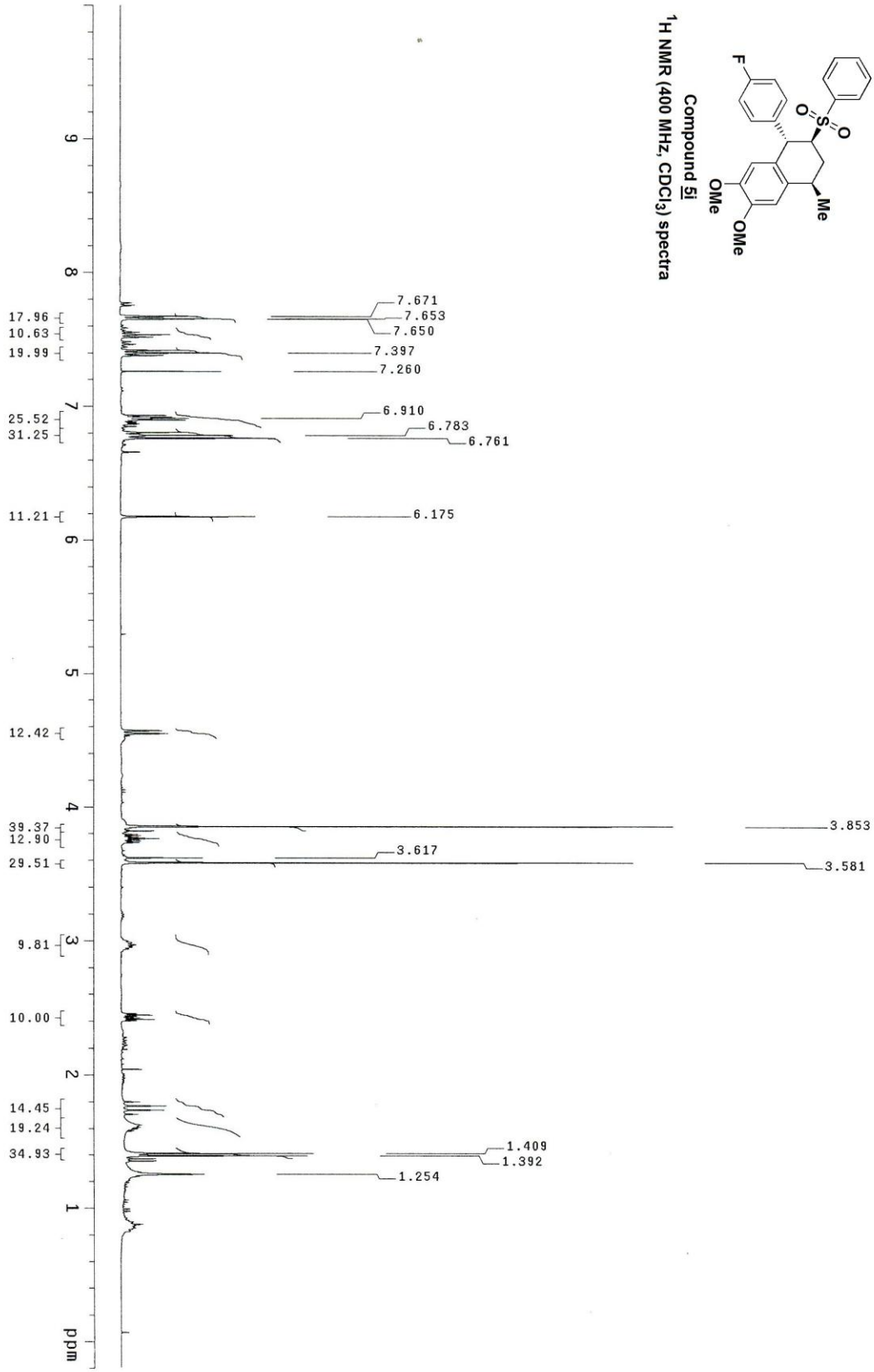

Kuo0409
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 13 2015
Solvent: CDCl3
Ambient temperature
Total 2048 repetitions
Me
O
S
O
OMe
OMe
Me
Compound 5g
13C NMR (100 MHz, CDCl3) spectra
147.642
147.490
144.019
143.079
140.562
139.304
135.748
132.966
129.745
129.525
129.419
129.131
128.714
128.524
128.471
127.228
127.084
127.038
126.849
112.719
108.231
77.318
77.000
76.682
67.456
55.873
55.767
55.714
45.109
32.442
31.707
21.481
20.549
180
160
140
120
100
80
60
40
20
ppm

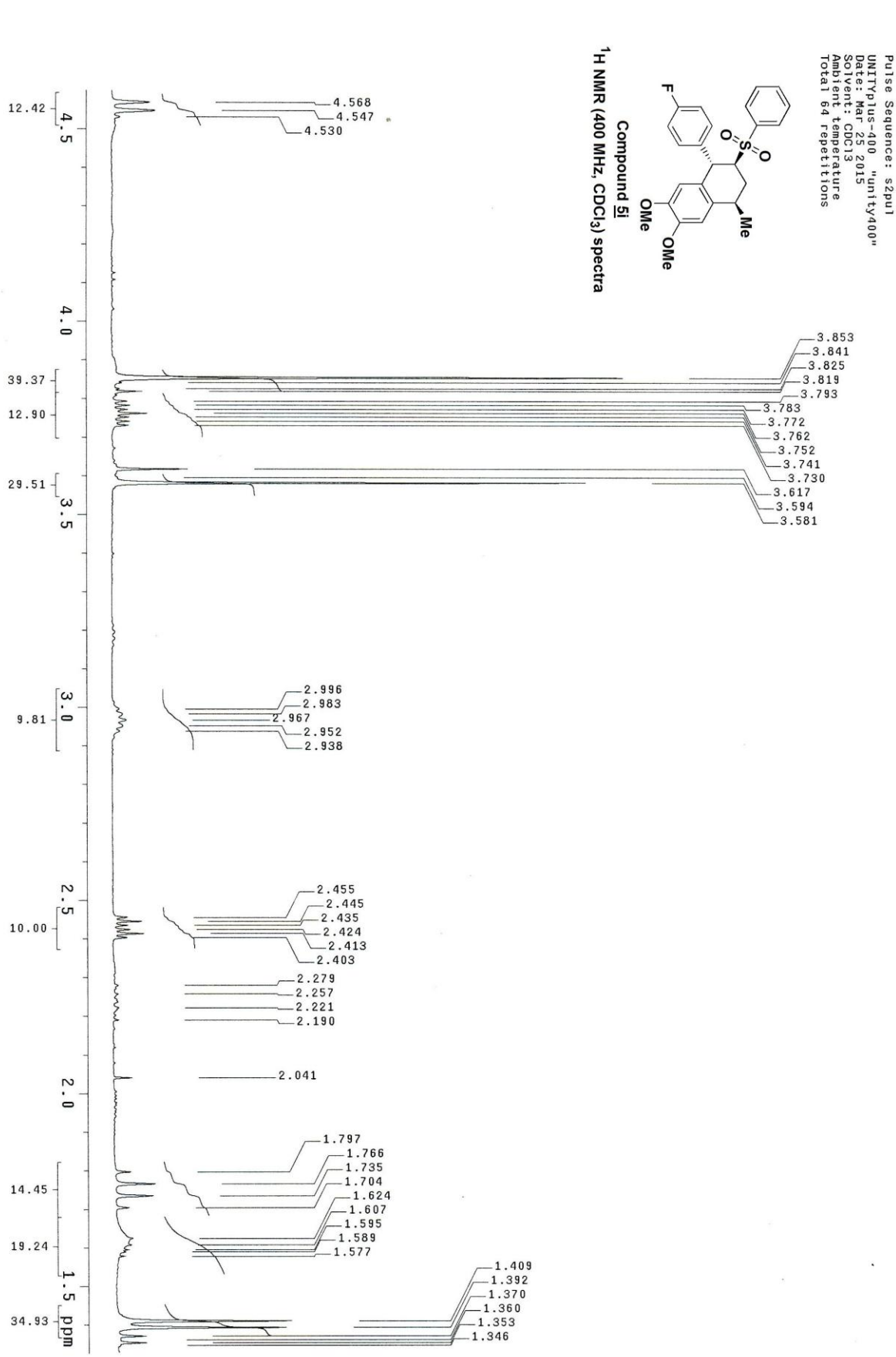

Kuo0630
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OMe
OMe
Me
Compound 5h
1H NMR (400 MHz, CDCl3) spectra
19.73
15.52
20.51
22.24
10.27
20.00
11.14
11.55
80.83
30.99
10.31
10.33
17.91
41.23
7.664
7.661
7.643
7.640
7.497
7.389
7.370
7.351
7.260
6.848
6.831
6.826
6.754
6.624
6.607
6.602
6.232
4.516
4.495
3.848
3.737
3.728
3.624
3.582
1.765
1.734
1.405
1.388
ppm

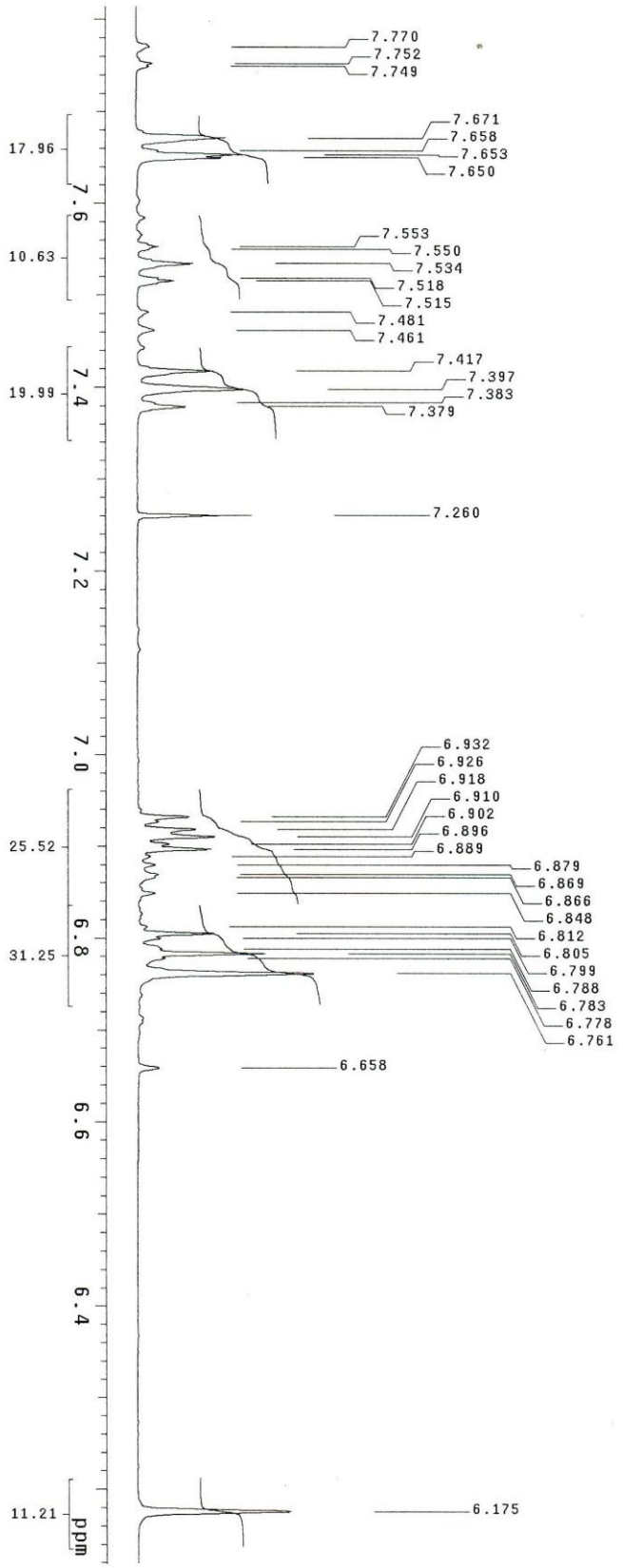

Kuo0630
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OMe
OMe
Me
Compound 5h
1H NMR (400 MHz, CDCl3) spectra
4.516
4.495
4.231
4.216
4.201
3.871
3.848
3.831
3.820
3.809
3.799
3.789
3.779
3.769
3.758
3.737
3.728
3.683
3.666
3.624
3.613
3.600
3.582
3.003
2.990
2.975
2.959
2.946
2.472
2.461
2.450
2.440
2.429
2.418
1.796
1.765
1.734
1.704
1.683
1.668
1.437
1.418
1.405
1.388
1.369
1.351
1.332
1.316
11.55
80.83
30.99
10.31
10.33
17.91
41.23
ppm

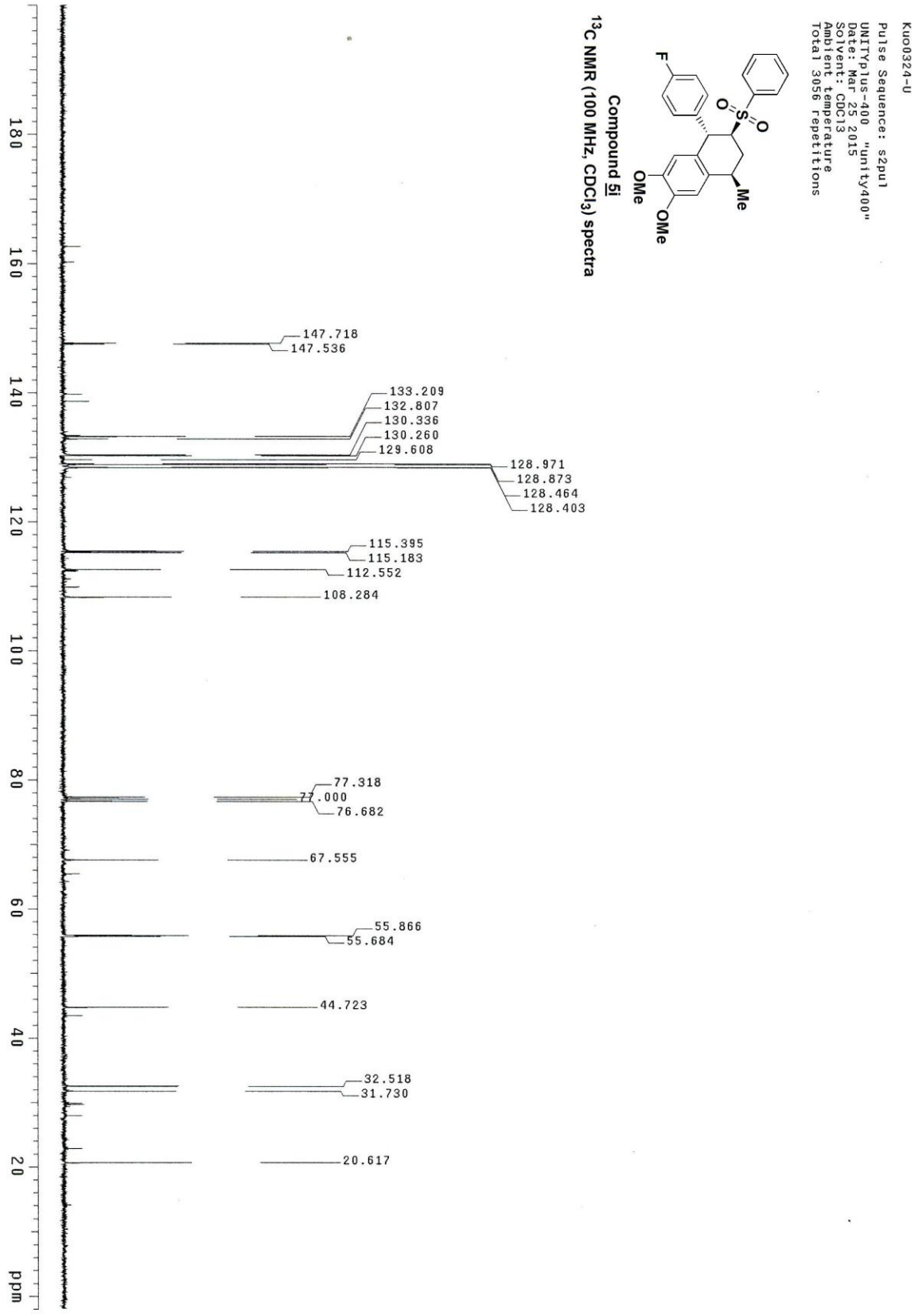

Kuo0630
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OMe
OMe
Me
Compound 5h
1H NMR (400 MHz, CDCl3) spectra
7.777
7.774
7.756
7.753
7.664
7.661
7.643
7.640
7.518
7.515
7.512
7.497
7.481
7.478
7.475
7.468
7.448
7.389
7.370
7.351
7.260
6.855
6.848
6.843
6.831
6.826
6.819
6.815
6.793
6.754
6.699
6.677
6.661
6.631
6.624
6.619
6.607
6.602
6.594
6.232
19.73
15.52
20.51
22.24
10.27
20.00
11.10
7.6
7.4
7.2
7.0
6.8
6.6
6.4
ppm

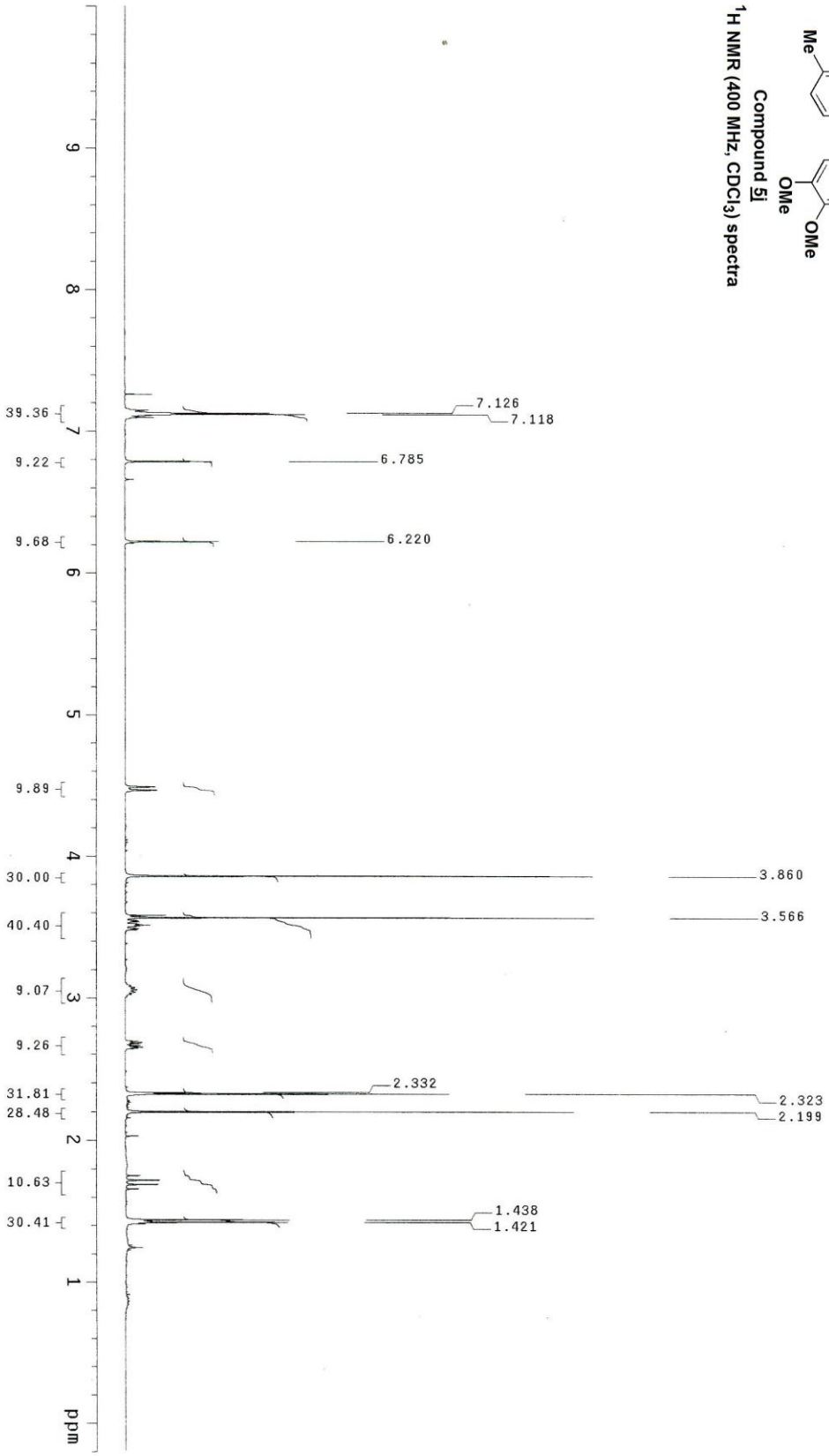

Kuo0630
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 480 repetitions
MeO
OMe
OMe
Me
Compound 5h
13C NMR (100 MHz, CDCl3) spectra
158.088
147.528
147.415
138.841
135.832
132.944
132.731
130.116
129.684
128.850
128.729
128.441
128.380
113.811
112.605
108.186
77.318
77.000
76.682
67.532
55.835
55.646
55.115
44.654
32.473
31.677
20.594
ppm

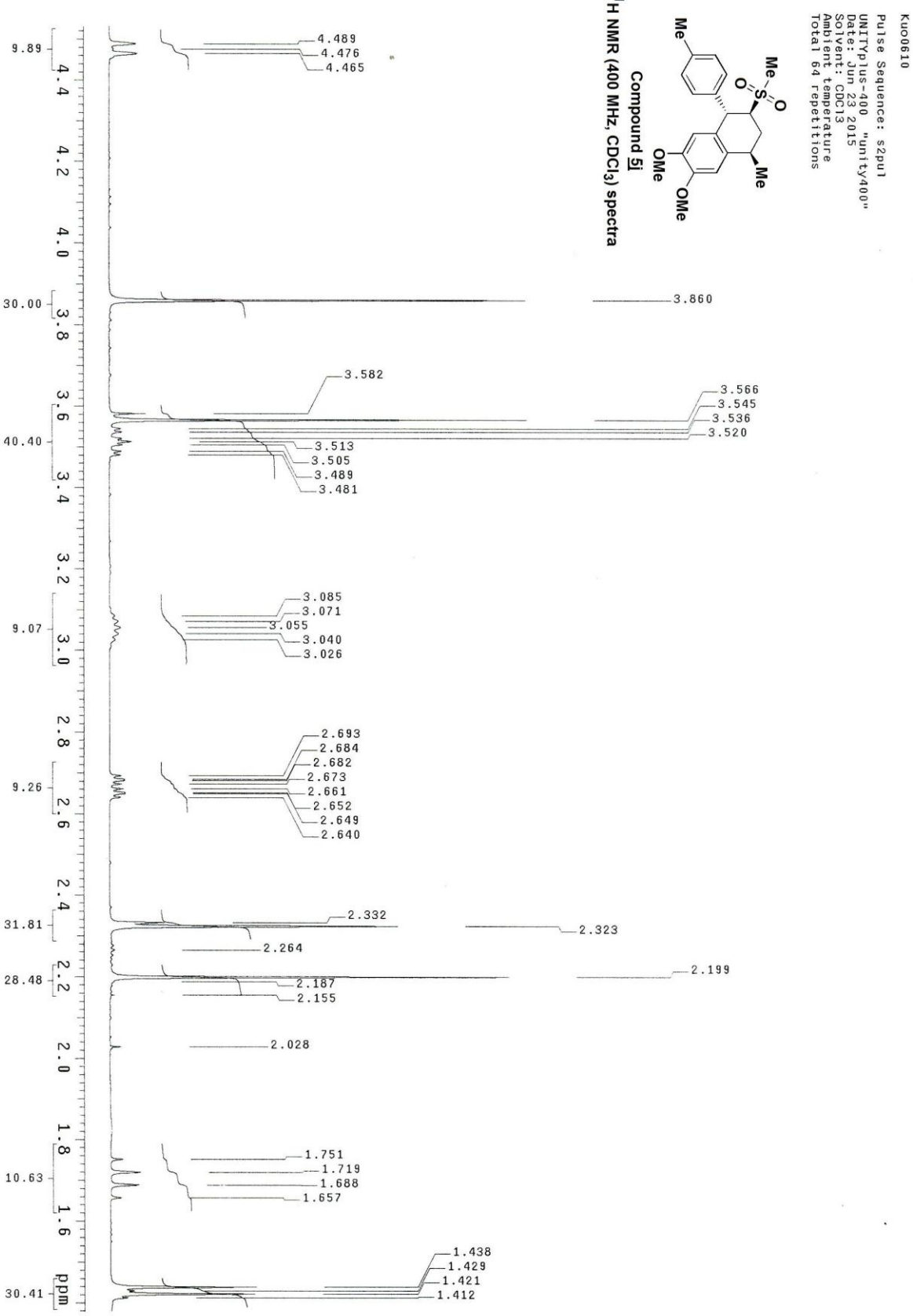

Kuo0324-U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
O
S
O
Me
OMe
OMe
Compound 5i
1H NMR (400 MHz, CDCl3) spectra
7.671
7.653
7.650
7.397
7.260
6.910
6.783
6.761
6.175
3.853
3.617
3.581
1.409
1.392
1.254
17.96
10.63
19.99
25.52
31.25
11.21
12.42
39.37
12.90
29.51
9.81
10.00
14.45
19.24
34.93
ppm

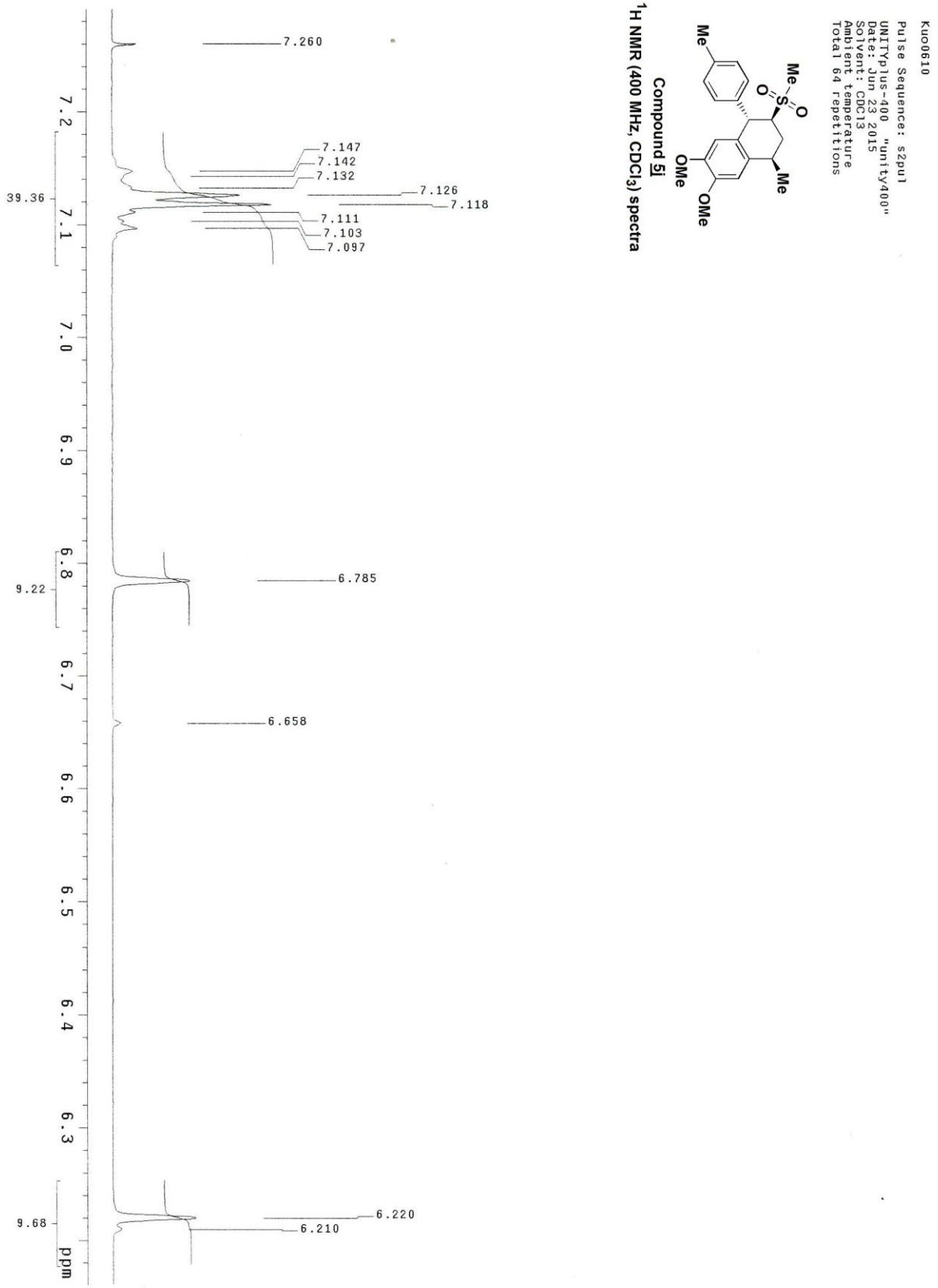

Kuo0324-U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5i
^{1}H NMR (400 MHz, CDCl$_3$) spectra
F
O
S
O
Me
OMe
OMe
12.42
4.568
4.547
4.530
4.0
39.37
12.90
3.853
3.841
3.825
3.819
3.793
3.783
3.772
3.762
3.752
3.741
3.730
29.51
3.617
3.594
3.581
3.5
3.0
9.81
2.996
2.983
2.967
2.952
2.938
2.5
10.00
2.455
2.445
2.435
2.424
2.413
2.403
2.279
2.257
2.221
2.190
2.041
2.0
1.797
1.766
1.735
1.704
1.624
1.607
1.595
1.589
1.577
14.45
19.24
1.409
1.392
1.370
1.360
1.353
1.346
1.5
34.93
ppm

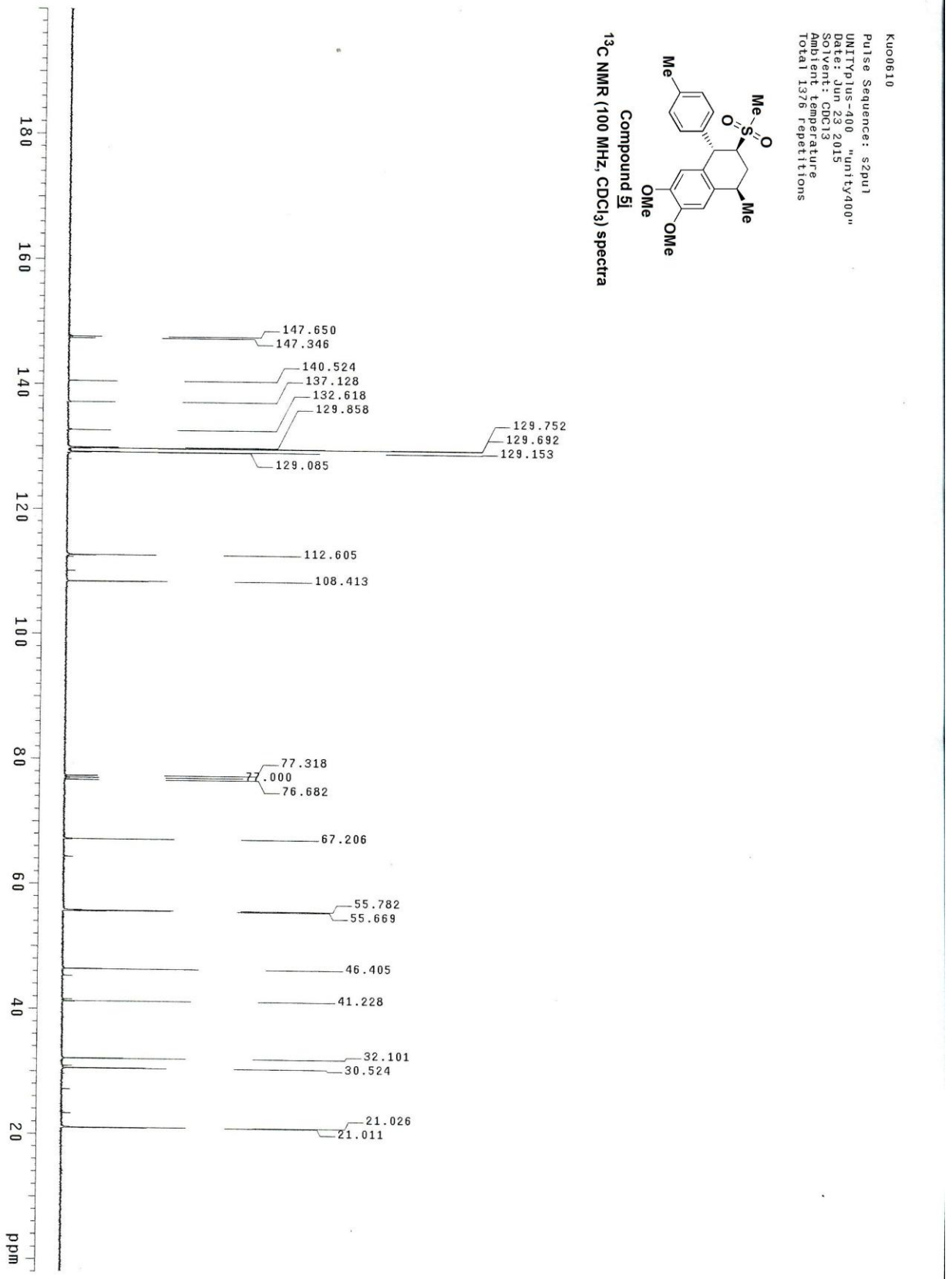

Kuo0324-U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
O
S
O
Me
OMe
OMe
Compound 5i
1H NMR (400 MHz, CDCl3) spectra
7.770
7.752
7.749
7.671
7.658
7.653
7.650
7.553
7.550
7.534
7.518
7.515
7.481
7.461
7.417
7.397
7.383
7.379
7.260
6.932
6.926
6.918
6.910
6.902
6.896
6.889
6.879
6.869
6.866
6.848
6.812
6.805
6.799
6.788
6.783
6.778
6.761
6.658
6.175
17.96
10.63
19.99
25.52
31.25
11.21
7.6
7.4
7.2
7.0
6.8
6.6
6.4
ppm

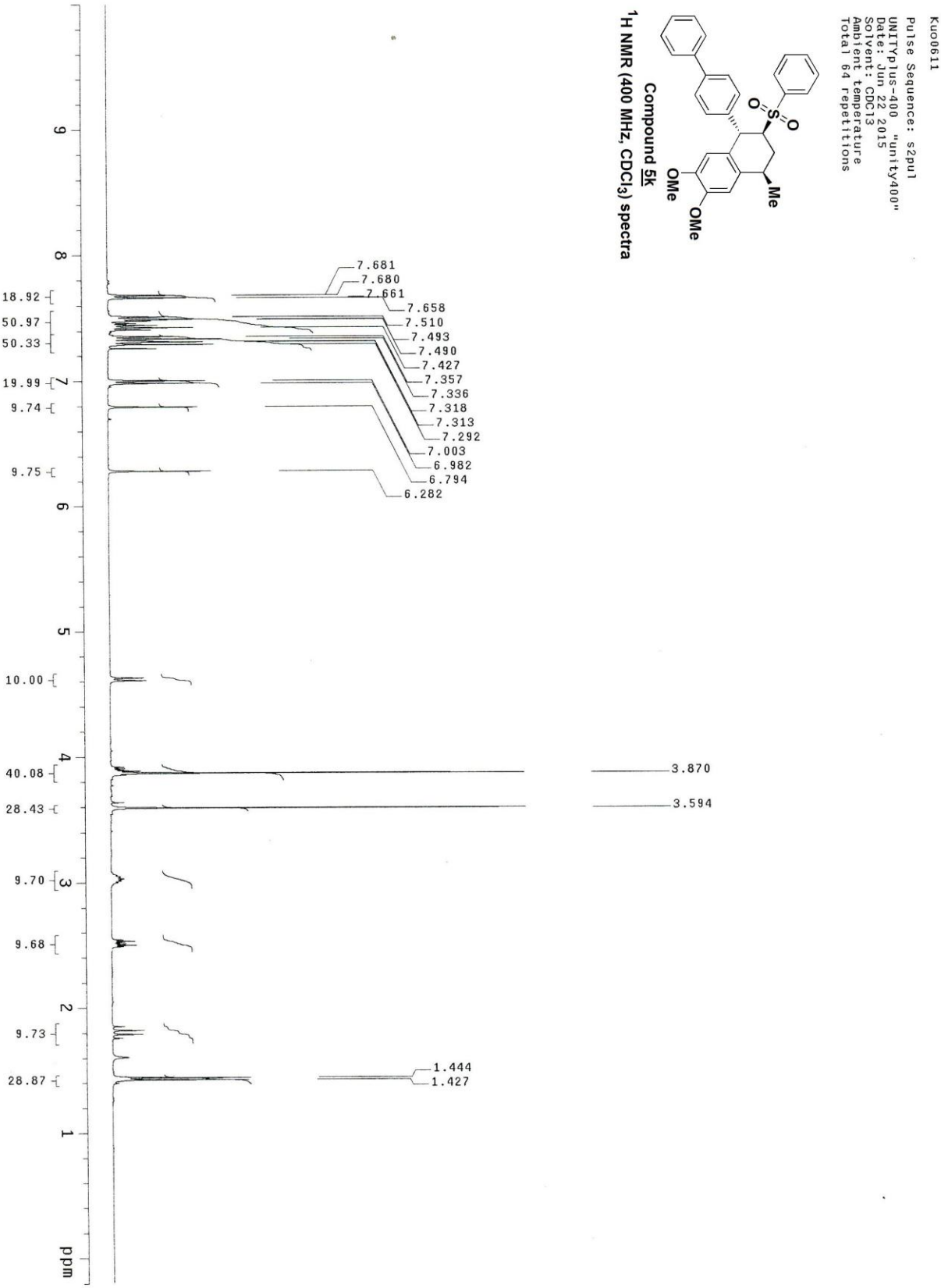

Kuo0324-U
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Mar 25 2015
Solvent: CDCl3
Ambient temperature
Total 3056 repetitions
F
O
S
O
Me
OMe
OMe
Compound 5i
13C NMR (100 MHz, CDCl3) spectra
147.718
147.536
133.209
132.807
130.336
130.260
129.608
128.971
128.873
128.464
128.403
115.395
115.183
112.552
108.284
77.318
77.000
76.682
67.555
55.866
55.684
44.723
32.518
31.730
20.617
180
160
140
120
100
80
60
40
20
ppm

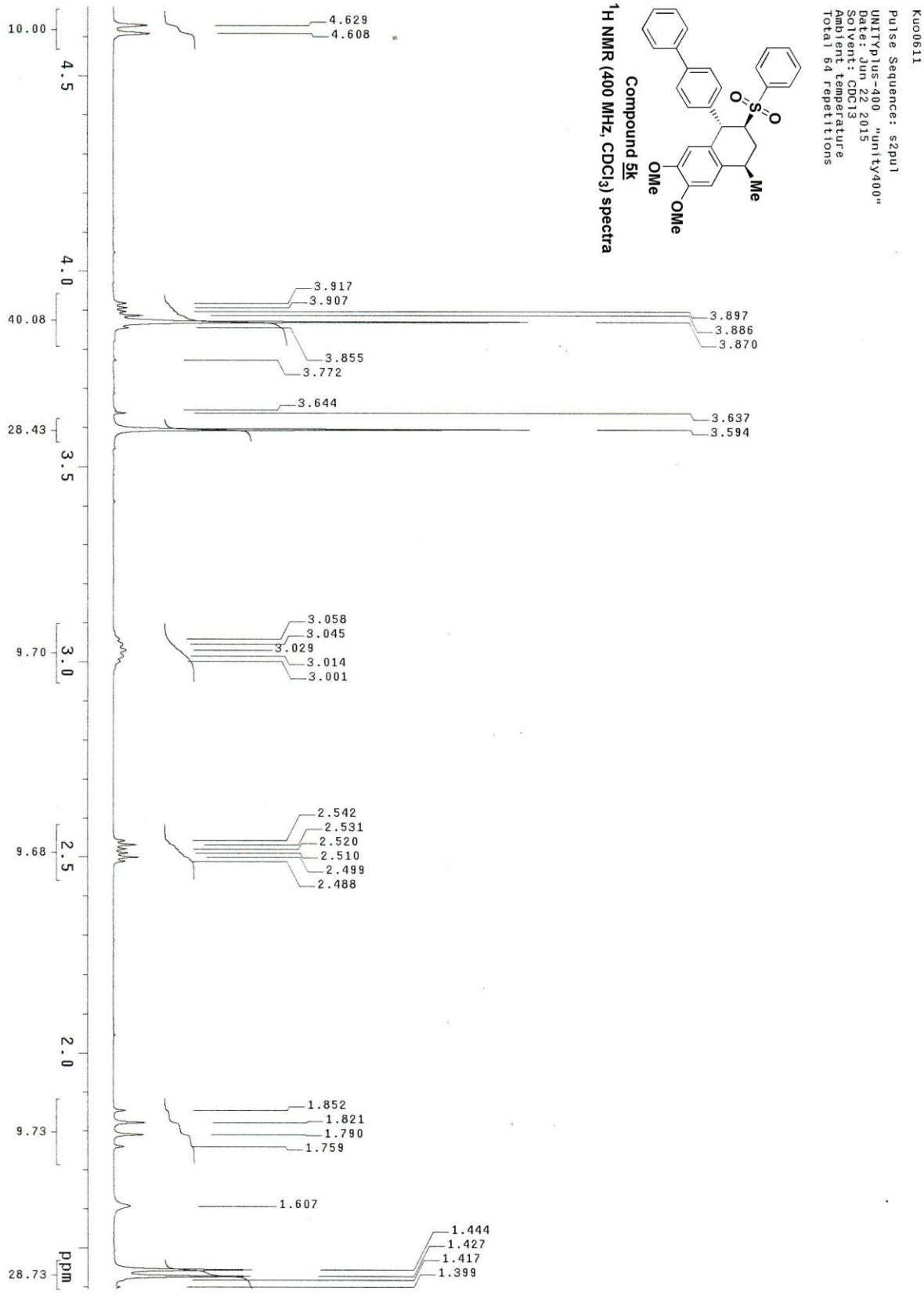

Kuo0610
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 23 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
O
S
O
Me
OMe
OMe
Compound 5j
1H NMR (400 MHz, CDCl3) spectra
39.36
9.22
9.68
9.89
30.00
40.40
9.07
9.26
31.81
28.48
10.63
30.41
7.126
7.118
6.785
6.220
3.860
3.566
2.332
2.323
2.199
1.438
1.421
ppm

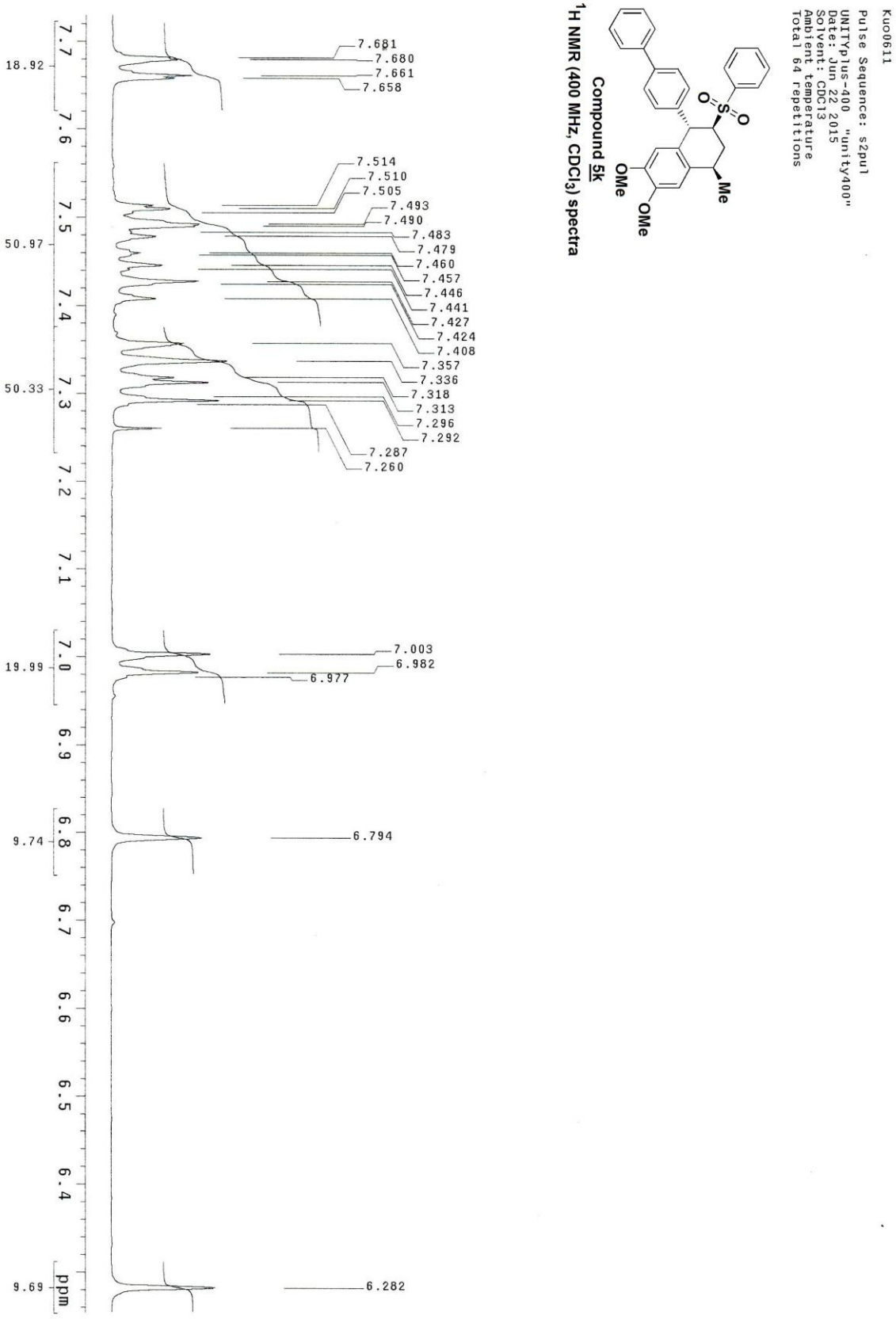

Kuo0610
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 23 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
O
S
O
OMe
OMe
Me
Compound 5i
1H NMR (400 MHz, CDCl3) spectra
9.89
30.00
40.40
9.07
9.26
31.81
28.48
10.63
30.41
4.489
4.476
4.465
3.860
3.582
3.566
3.545
3.536
3.520
3.513
3.505
3.489
3.481
3.085
3.071
3.055
3.040
3.026
2.693
2.684
2.682
2.673
2.661
2.652
2.649
2.640
2.332
2.323
2.264
2.199
2.187
2.155
2.028
1.751
1.719
1.688
1.657
1.438
1.429
1.421
1.412
ppm


Kuo0610
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 23 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
O
S
O
OMe
OMe
Me
Compound 5j
1H NMR (400 MHz, CDCl3) spectra
7.260
7.147
7.142
7.132
7.126
7.118
7.111
7.103
7.097
6.785
6.658
6.220
6.210
39.36
9.22
9.68
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
ppm


Kuo0610
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 23 2015
Solvent: CDCl3
Ambient temperature
Total 1376 repetitions
Me
Me
O
S
O
OMe
OMe
Me
Compound 5j
13C NMR (100 MHz, CDCl3) spectra
147.650
147.346
140.524
137.128
132.618
129.858
129.752
129.692
129.153
129.085
112.605
108.413
77.318
77.000
76.682
67.206
55.782
55.669
46.405
41.228
32.101
30.524
21.026
21.011
180
160
140
120
100
80
60
40
20
ppm


Kuo0611
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5k
1H NMR (400 MHz, CDCl3) spectra
OMe
OMe
Me
7.681
7.680
7.661
7.658
7.510
7.493
7.490
7.427
7.357
7.336
7.318
7.313
7.292
7.003
6.982
6.794
6.282
3.870
3.594
1.444
1.427
18.92
50.97
50.33
19.99
9.74
9.75
10.00
40.08
28.43
9.70
9.68
9.73
28.87
ppm

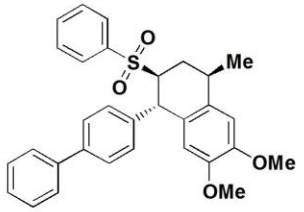

Kuo0611
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5k
1H NMR (400 MHz, CDCl3) spectra
OMe
OMe
Me
4.629
4.608
3.917
3.907
3.897
3.886
3.870
3.855
3.772
3.644
3.637
3.594
3.058
3.045
3.029
3.014
3.001
2.542
2.531
2.520
2.510
2.499
2.488
1.852
1.821
1.790
1.759
1.607
1.444
1.427
1.417
1.399
10.00
40.08
28.43
9.70
9.68
9.73
28.73
ppm


Kuo0611
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5k
1H NMR (400 MHz, CDCl3) spectra
OMe
OMe
Me
7.681
7.680
7.661
7.658
7.514
7.510
7.505
7.493
7.490
7.483
7.479
7.460
7.457
7.446
7.441
7.427
7.424
7.408
7.357
7.336
7.318
7.313
7.296
7.292
7.287
7.260
7.003
6.982
6.977
6.794
6.282
18.92
50.97
50.33
19.99
9.74
9.69
ppm

Kuo0611

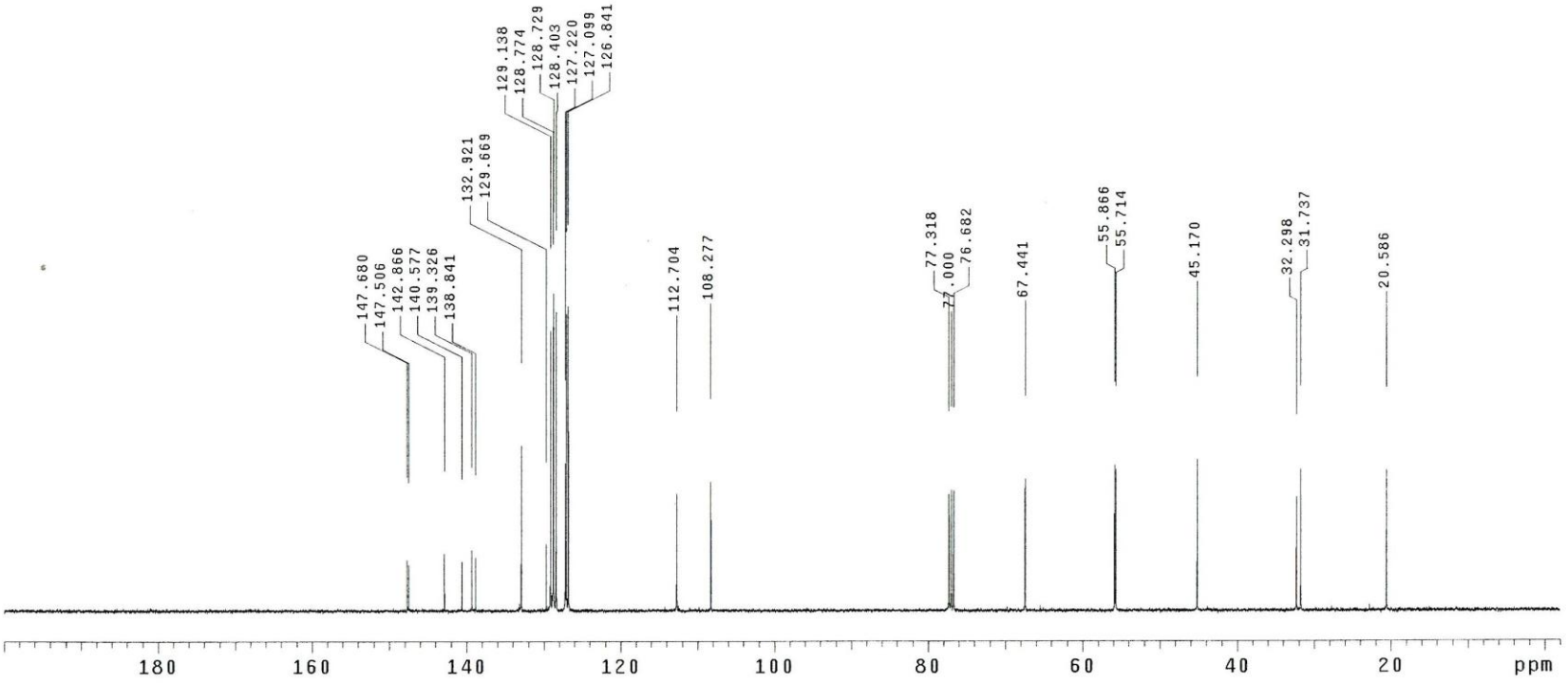
Pulse Sequence: s2pul

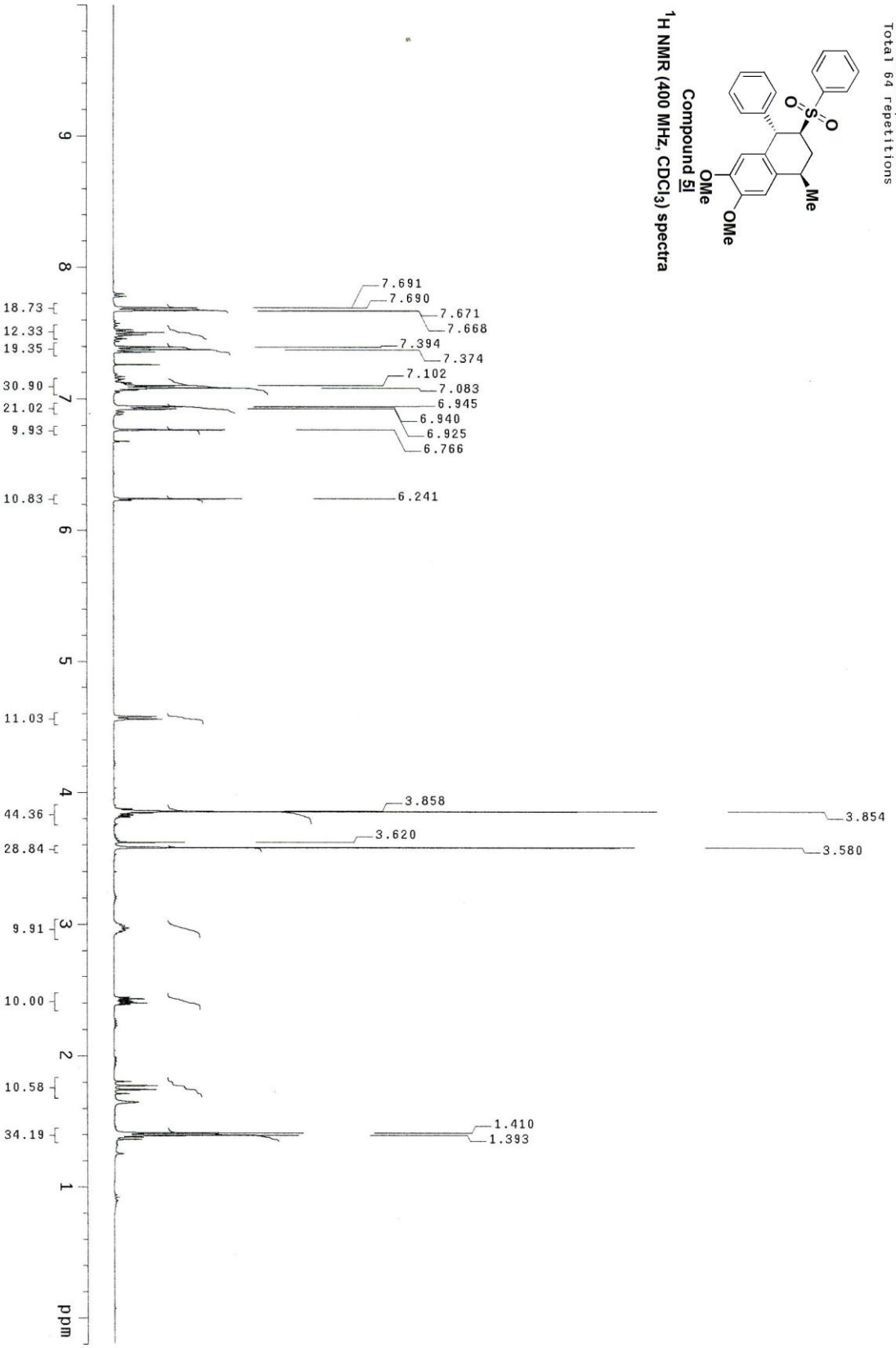
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 3200 repetitions

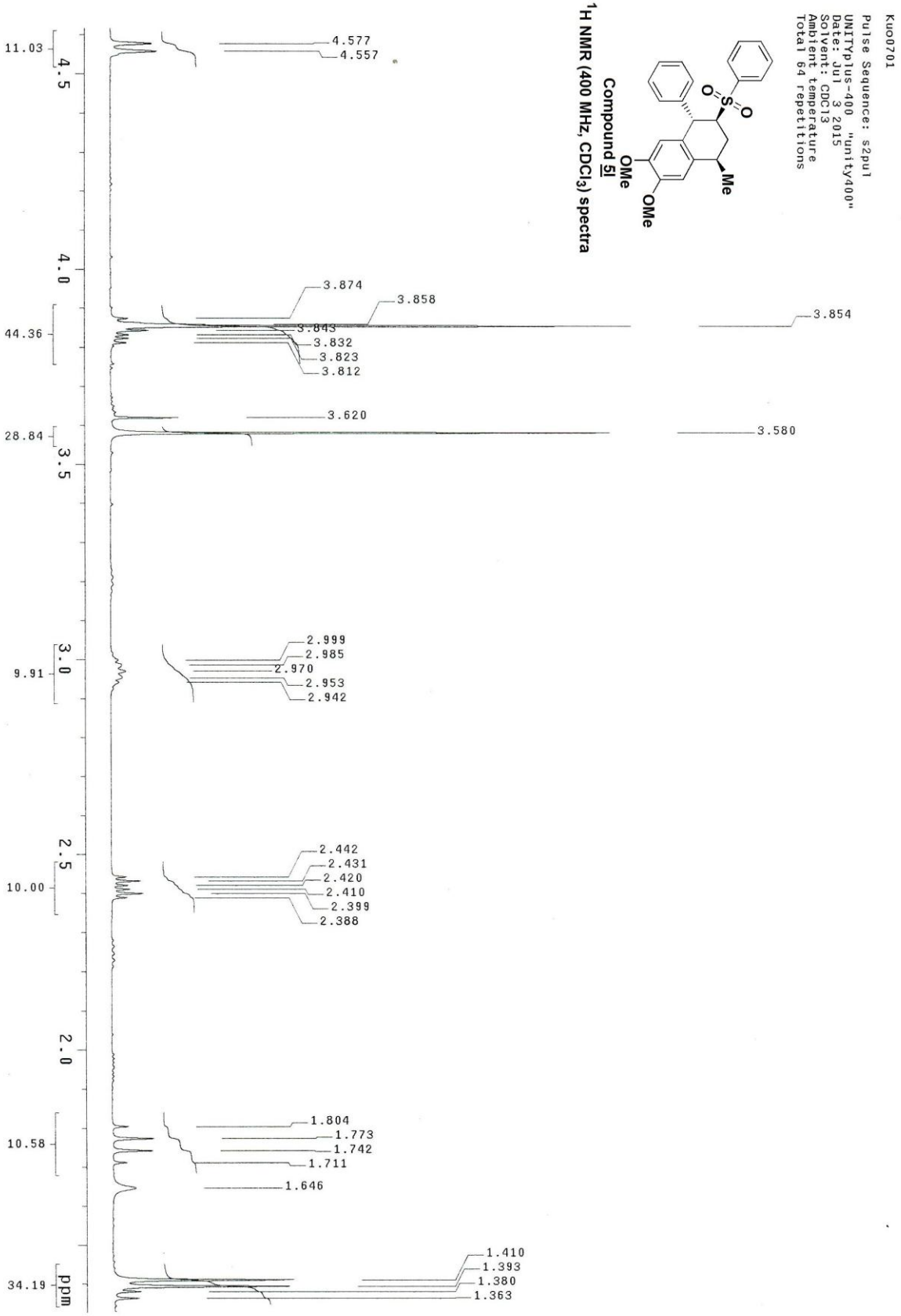


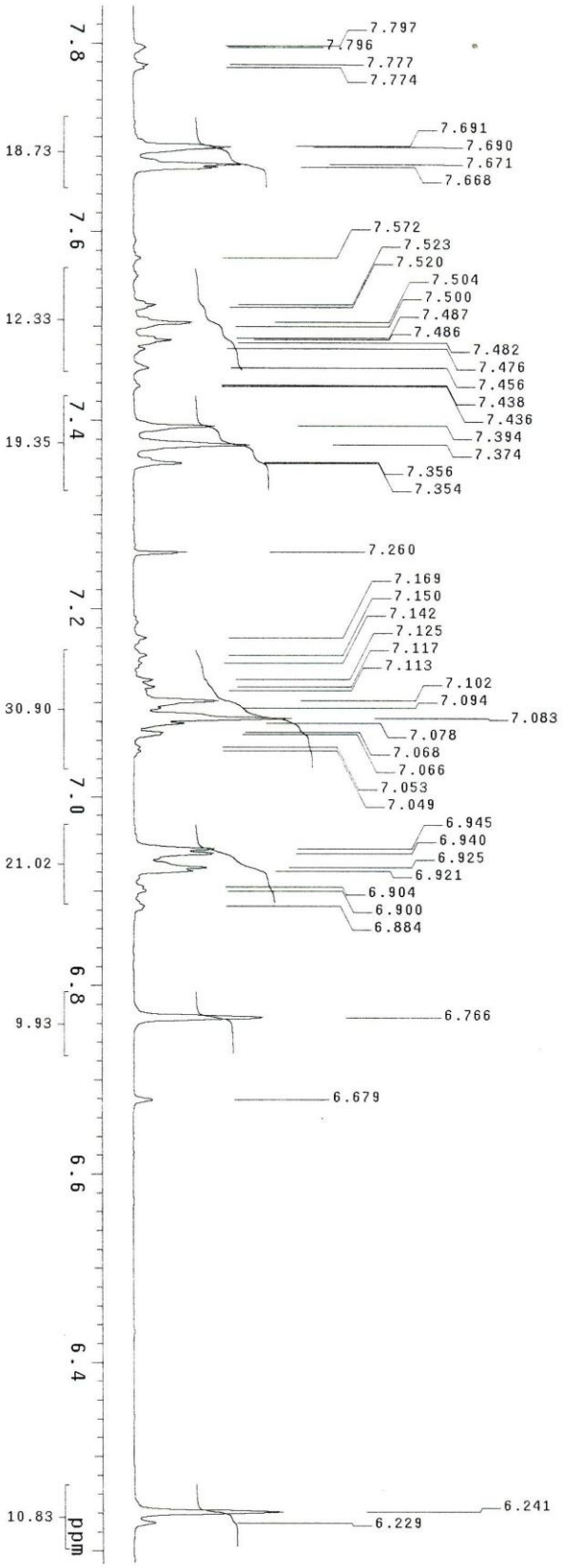
Compound 5k

^{13}C NMR (100 MHz, $CDCl_3$) spectra



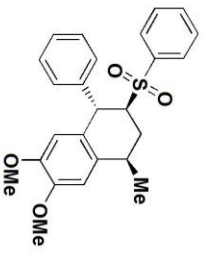

Kuo0701
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 3 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5l
^{1}H NMR (400 MHz, CDCl$_3$) spectra
OMe
OMe
Me
7.691
7.690
7.671
7.668
7.394
7.374
7.102
7.083
6.945
6.940
6.925
6.766
6.241
3.858
3.854
3.620
3.580
1.410
1.393
18.73
12.33
19.35
30.90
21.02
9.93
10.83
11.03
44.36
28.84
9.91
10.00
10.58
34.19
ppm


Kuo0701
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 3 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5l
1H NMR (400 MHz, CDCl3) spectra
OMe
OMe
Me
11.03
44.36
28.84
9.91
10.00
10.58
34.19
4.577
4.557
3.874
3.858
3.854
3.843
3.832
3.823
3.812
3.620
3.580
2.999
2.985
2.970
2.953
2.942
2.442
2.431
2.420
2.410
2.399
2.388
1.804
1.773
1.742
1.711
1.646
1.410
1.393
1.380
1.363
ppm



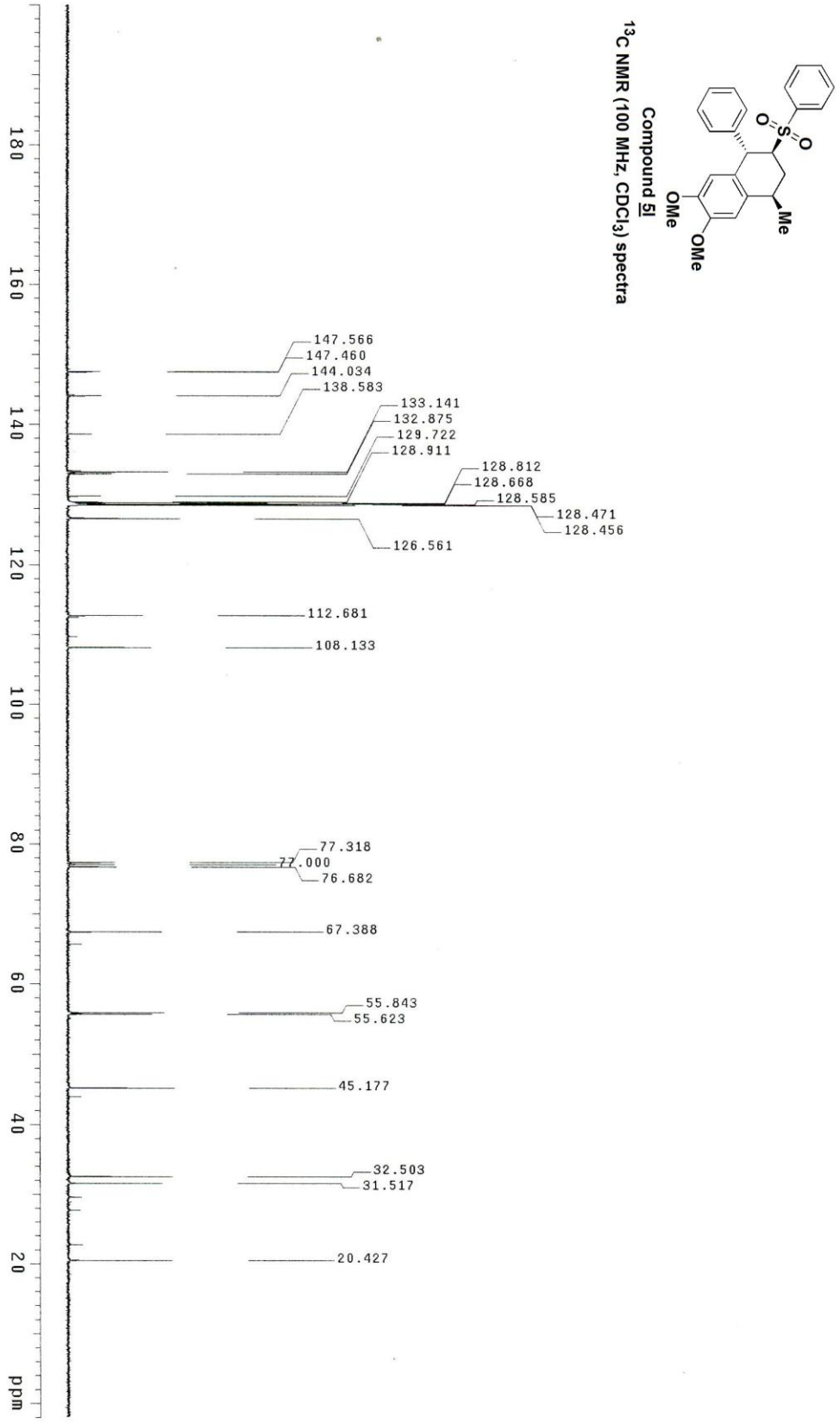
Kuo0701

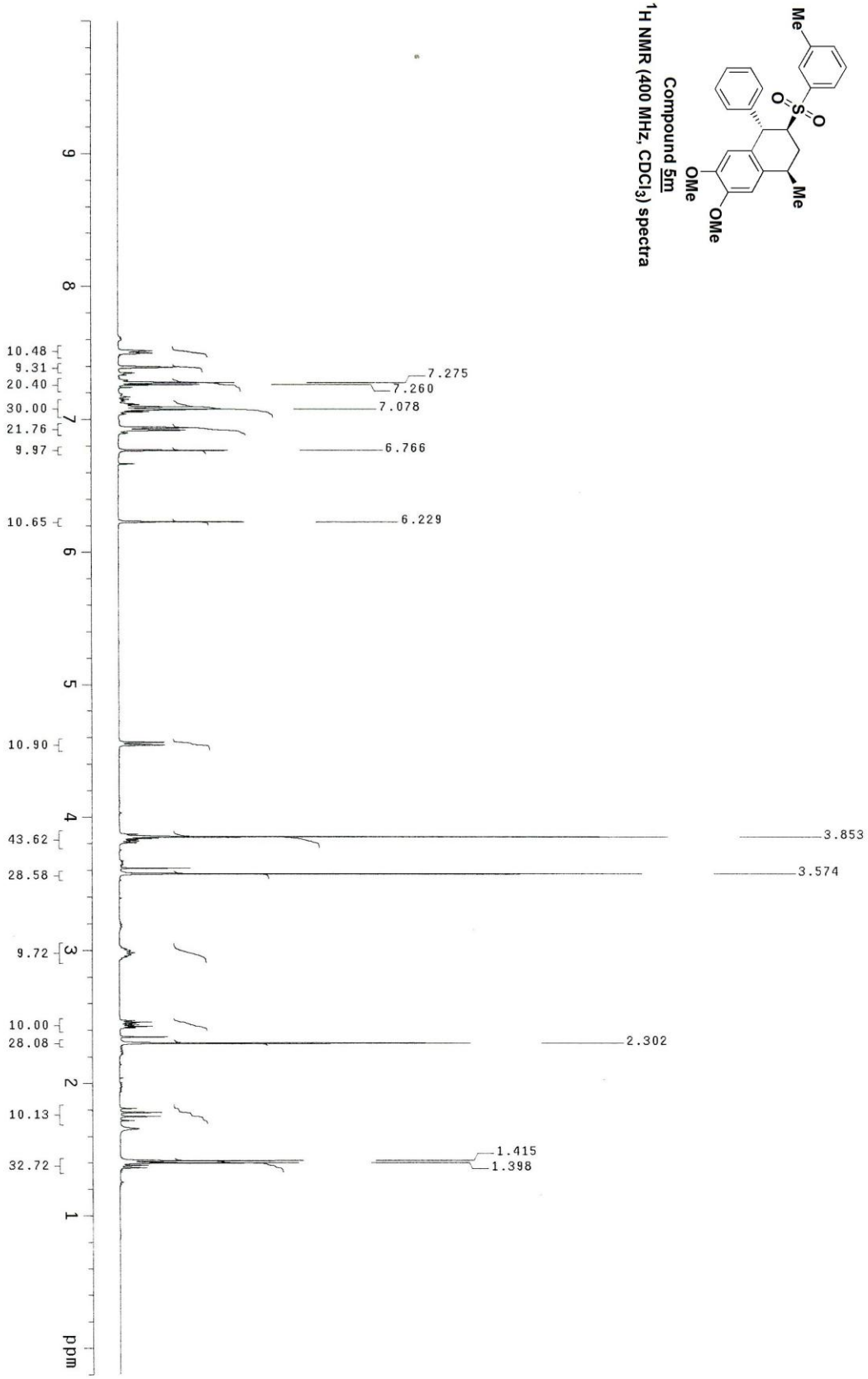
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 3 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

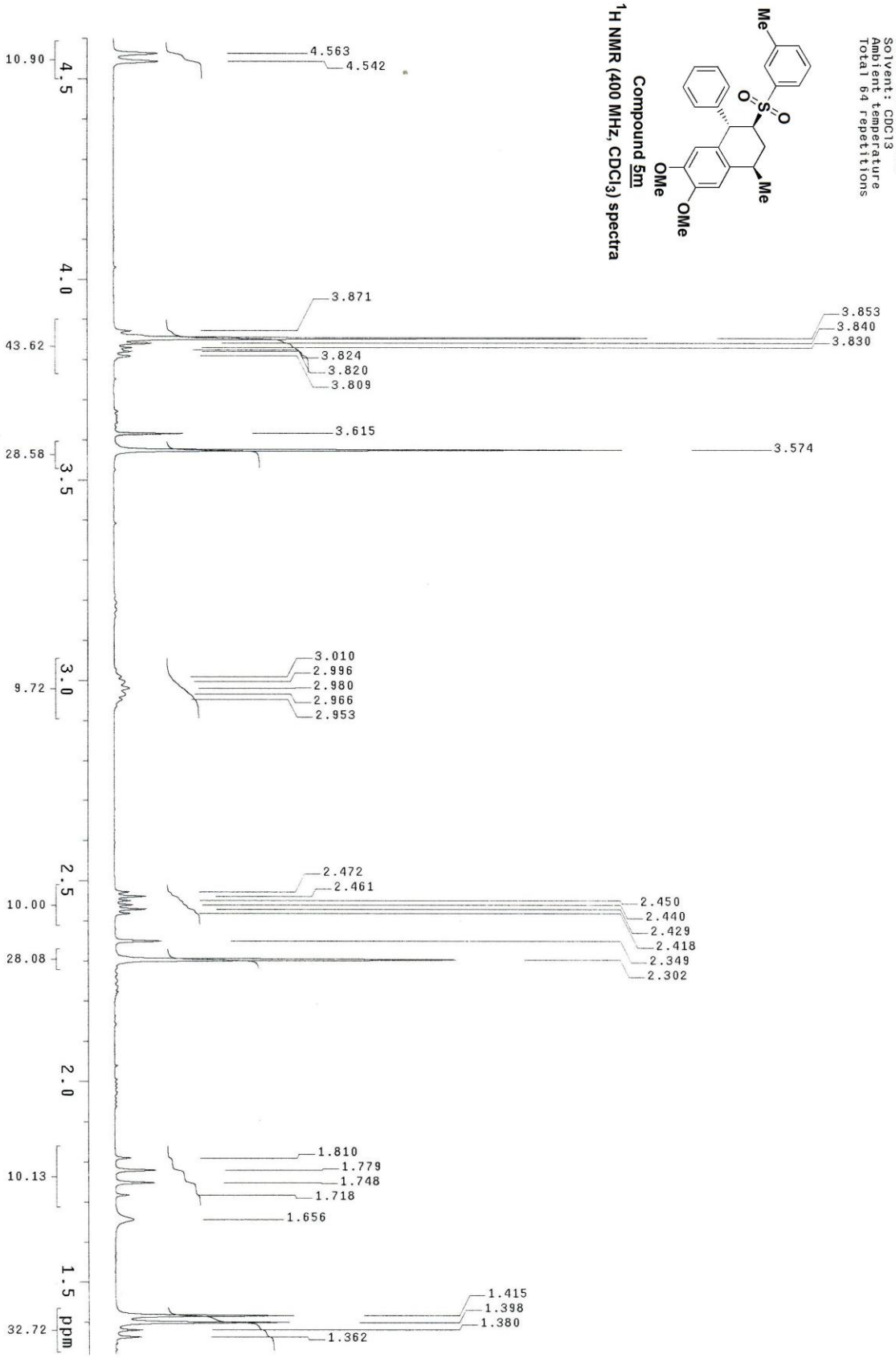


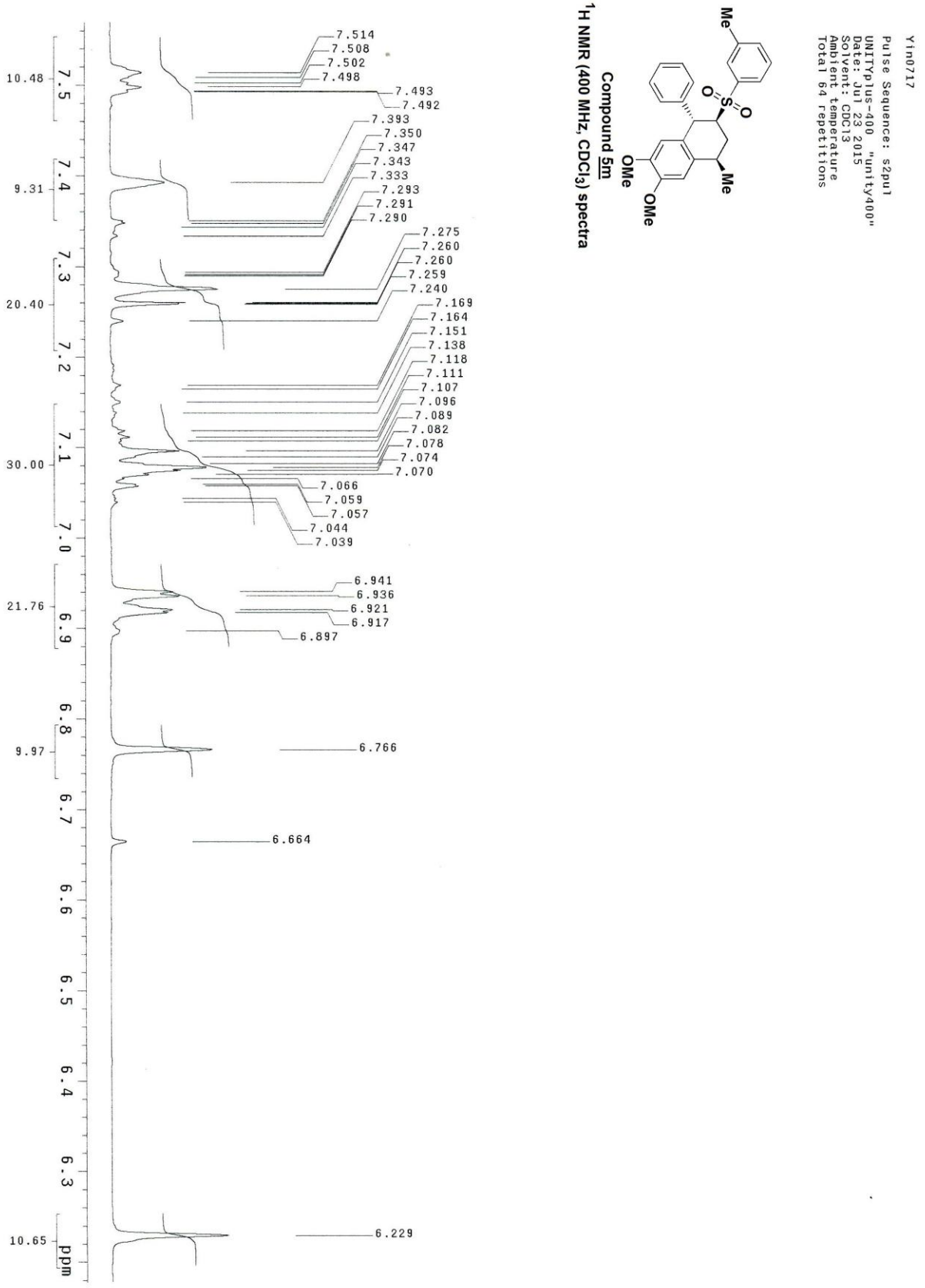
Compound 5l

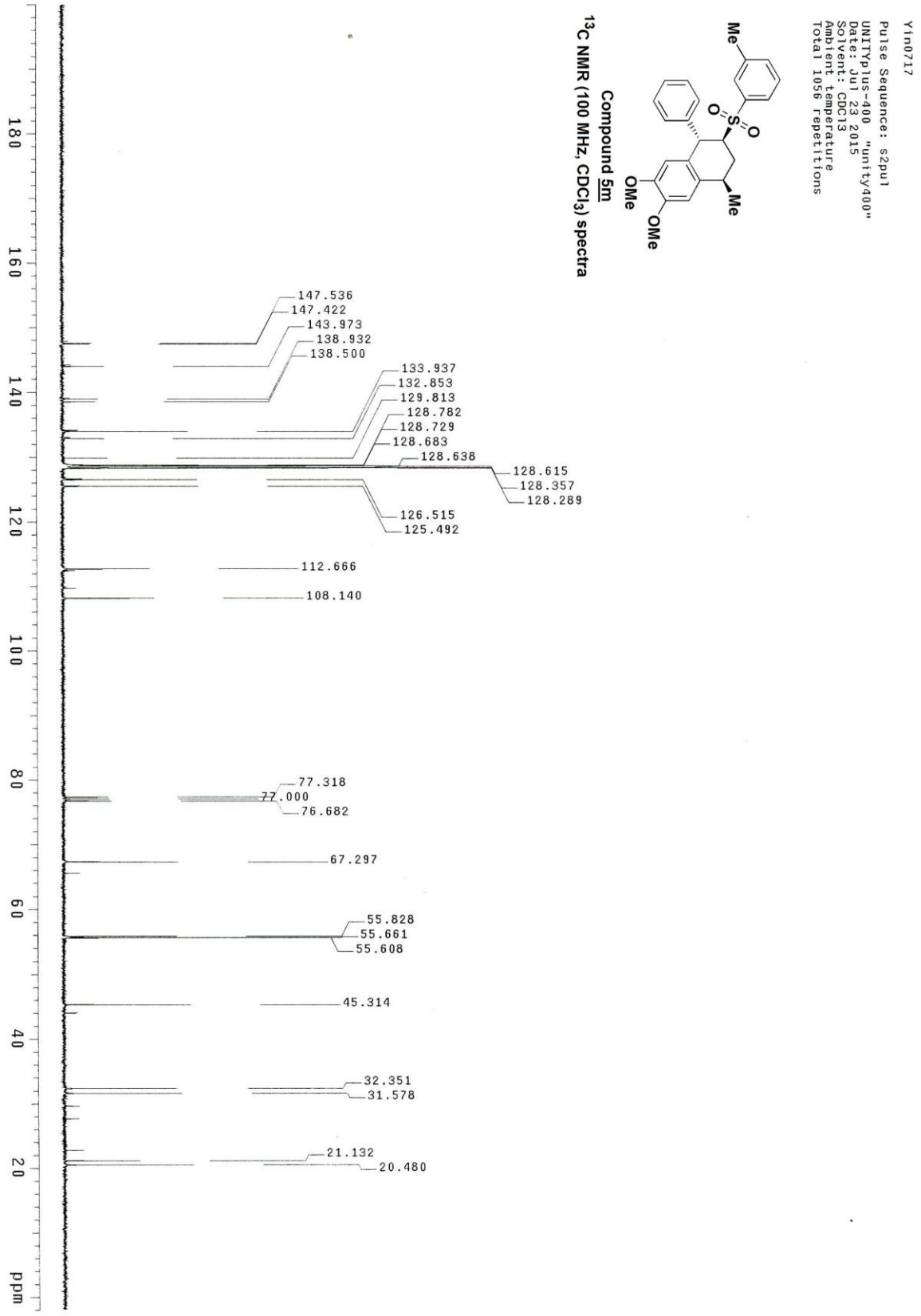
^{1}H NMR (400 MHz, $CDCl_3$) spectra

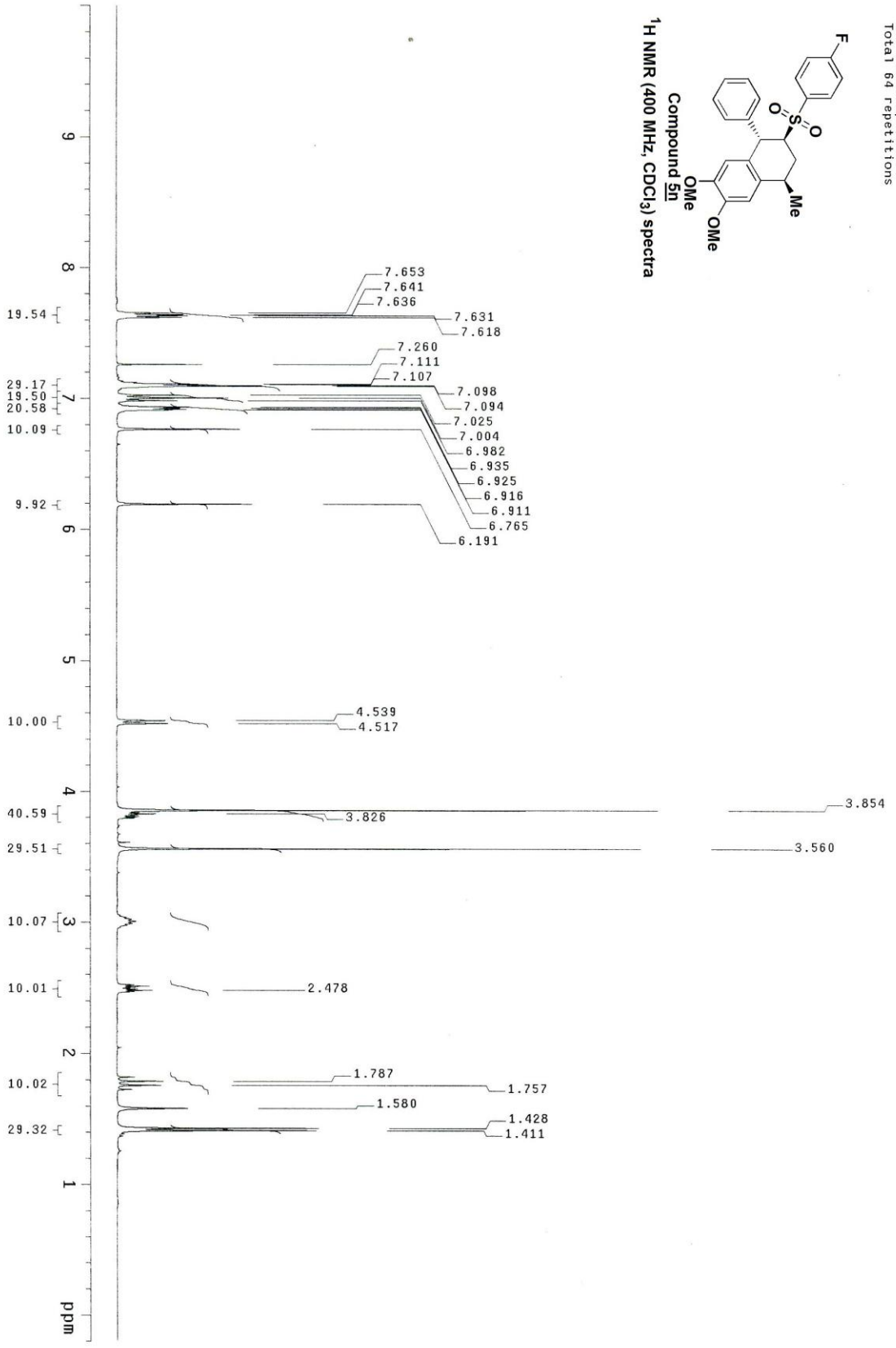

Kuo0701
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 3 2015
Solvent: CDCl3
Ambient temperature
Total 1568 repetitions
Compound 5l
13C NMR (100 MHz, CDCl3) spectra
OMe
OMe
Me
147.566
147.460
144.034
138.583
133.141
132.875
129.722
128.911
128.812
128.668
128.585
128.471
128.456
126.561
112.681
108.133
77.318
77.000
76.682
67.388
55.843
55.623
45.177
32.503
31.517
20.427
ppm

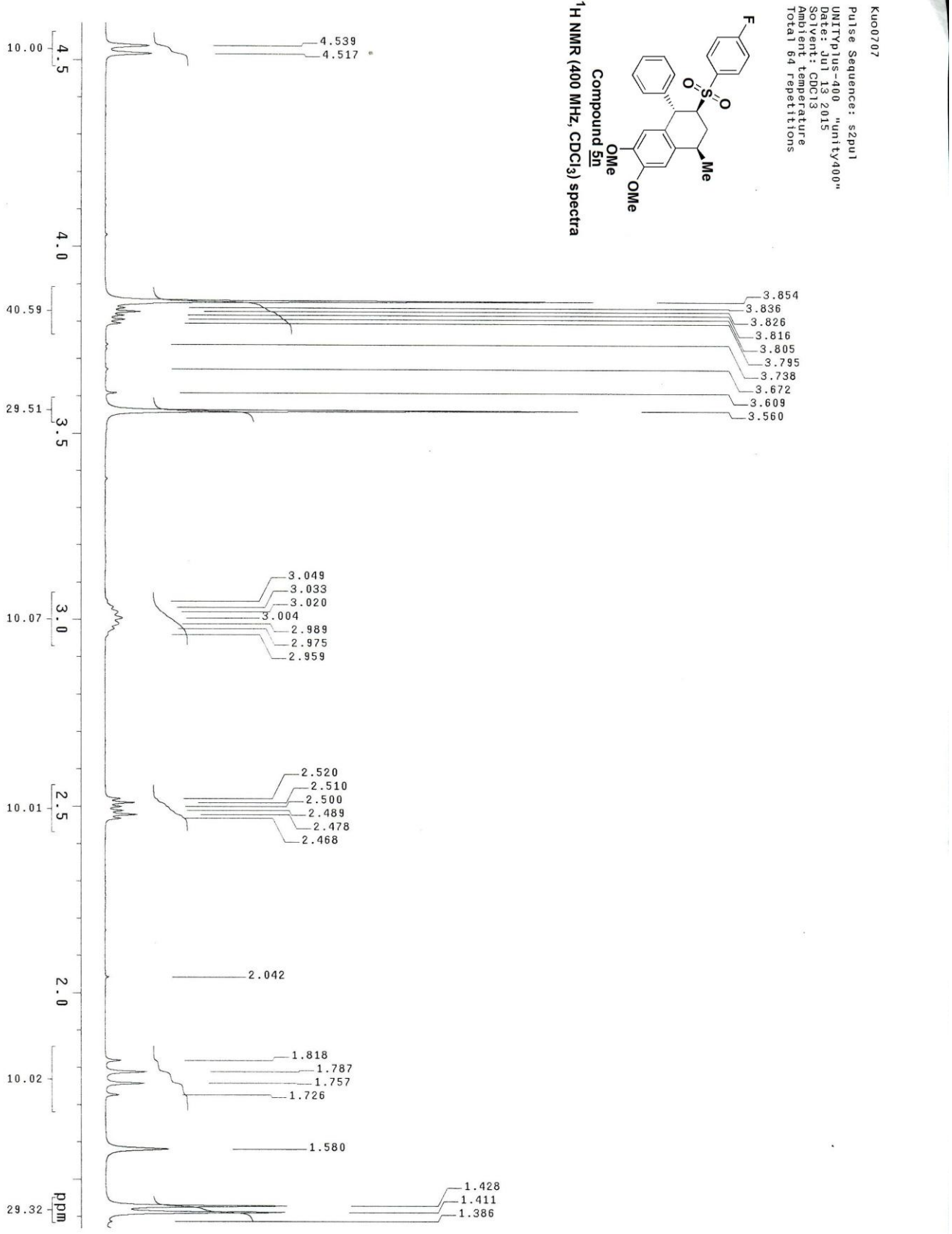

Yin0717
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 23 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5m
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
OMe
OMe
Me
10.48
9.31
20.40
30.00
21.76
9.97
10.65
10.90
43.62
28.58
9.72
10.00
28.08
10.13
32.72
7.275
7.260
7.078
6.766
6.229
3.853
3.574
2.302
1.415
1.398
ppm

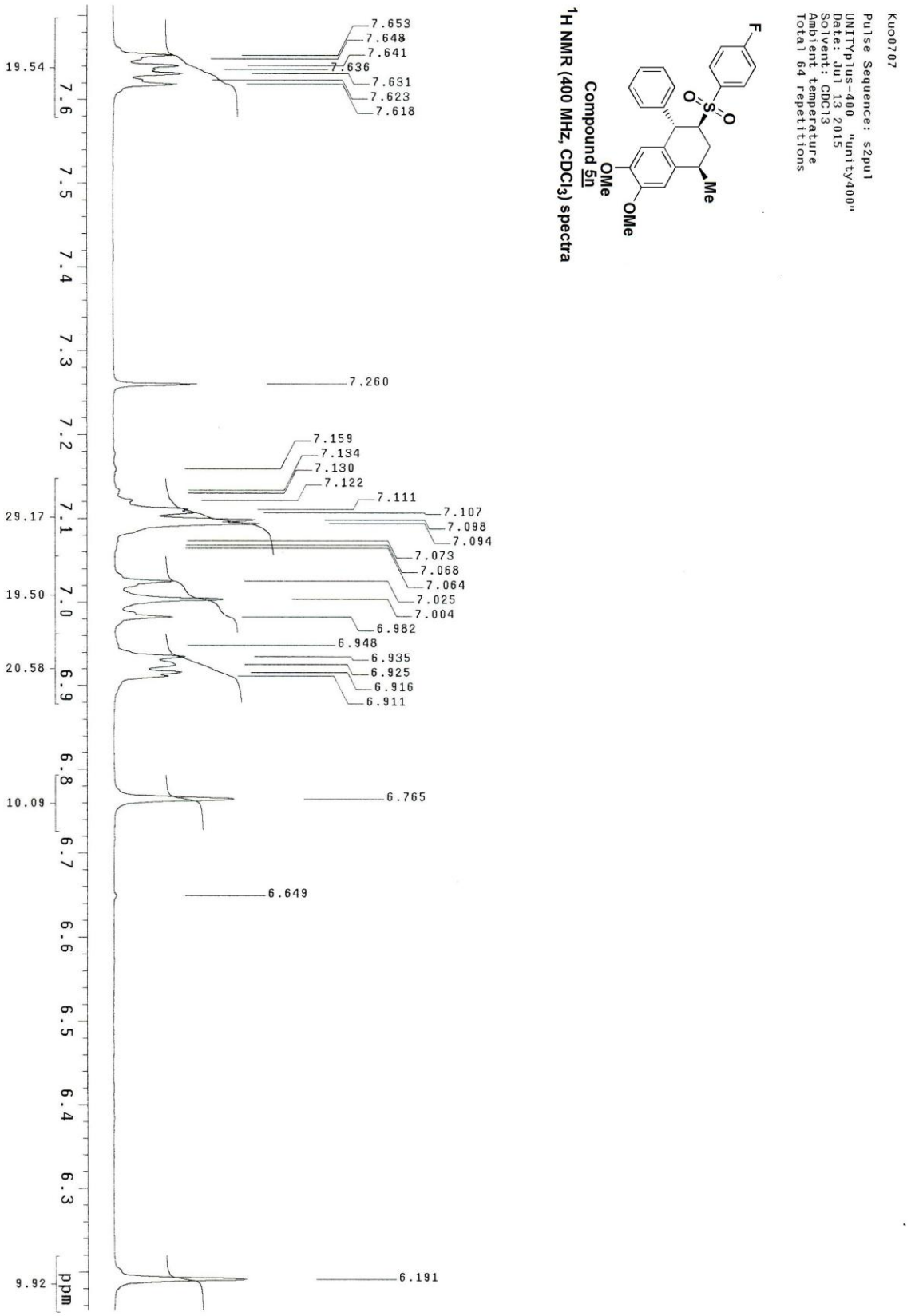

Yin0717
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 23 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5m
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
OMe
OMe
Me
4.563
4.542
3.871
3.853
3.840
3.830
3.824
3.820
3.809
3.615
3.574
3.010
2.996
2.980
2.966
2.953
2.472
2.461
2.450
2.440
2.429
2.418
2.349
2.302
1.810
1.779
1.748
1.718
1.656
1.415
1.398
1.380
1.362
10.90
43.62
28.58
9.72
10.00
28.08
10.13
32.72
ppm


Yin0717
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 23 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
S
O
O
OMe
OMe
Me
Compound 5m
1H NMR (400 MHz, CDCl3) spectra
7.514
7.508
7.502
7.498
7.493
7.492
7.393
7.350
7.347
7.343
7.333
7.293
7.291
7.290
7.275
7.260
7.260
7.259
7.240
7.169
7.164
7.151
7.138
7.118
7.111
7.107
7.096
7.089
7.082
7.078
7.074
7.070
7.066
7.059
7.057
7.044
7.039
6.941
6.936
6.921
6.917
6.897
6.766
6.664
6.229
10.48
9.31
20.40
30.00
21.76
9.97
10.65
ppm


Yin0717
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 23 2015
Solvent: CDCl3
Ambient temperature
Total 1056 repetitions
Me
O
S
O
Me
OMe
OMe
Compound 5m
13C NMR (100 MHz, CDCl3) spectra
147.536
147.422
143.973
138.932
138.500
133.937
132.853
129.813
128.782
128.729
128.683
128.638
128.615
128.357
128.289
126.515
125.492
112.666
108.140
77.318
77.000
76.682
67.297
55.828
55.661
55.608
45.314
32.351
31.578
21.132
20.480
180
160
140
120
100
80
60
40
20
ppm


Kuo0707
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
O
S
O
Me
OMe
OMe
Compound 5n
1H NMR (400 MHz, CDCl3) spectra
7.653
7.641
7.636
7.631
7.618
7.260
7.111
7.107
7.098
7.094
7.025
7.004
6.982
6.935
6.925
6.916
6.911
6.765
6.191
4.539
4.517
3.854
3.826
3.560
2.478
1.787
1.757
1.580
1.428
1.411
19.54
29.17
19.50
20.58
10.09
9.92
10.00
40.59
29.51
10.07
10.01
10.02
29.32
ppm

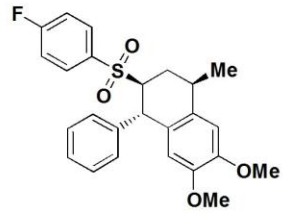

Kuo0707
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
O
S
O
Me
OMe
OMe
Compound 5n
1H NMR (400 MHz, CDCl3) spectra
10.00
4.539
4.517
40.59
3.854
3.836
3.826
3.816
3.805
3.795
3.738
3.672
29.51
3.609
3.560
10.07
3.049
3.033
3.020
3.004
2.989
2.975
2.959
10.01
2.520
2.510
2.500
2.489
2.478
2.468
2.042
10.02
1.818
1.787
1.757
1.726
1.580
29.32
1.428
1.411
1.386
4.5
4.0
3.5
3.0
2.5
2.0
ppm


Kuo0707
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F
O
S
O
Me
OMe
OMe
Compound 5n
1H NMR (400 MHz, CDCl3) spectra
7.653
7.648
7.641
7.636
7.631
7.623
7.618
7.260
7.159
7.134
7.130
7.122
7.111
7.107
7.098
7.094
7.073
7.068
7.064
7.025
7.004
6.982
6.948
6.935
6.925
6.916
6.911
6.765
6.649
6.191
19.54
29.17
19.50
20.58
10.09
9.92
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
ppm

Kuo0707

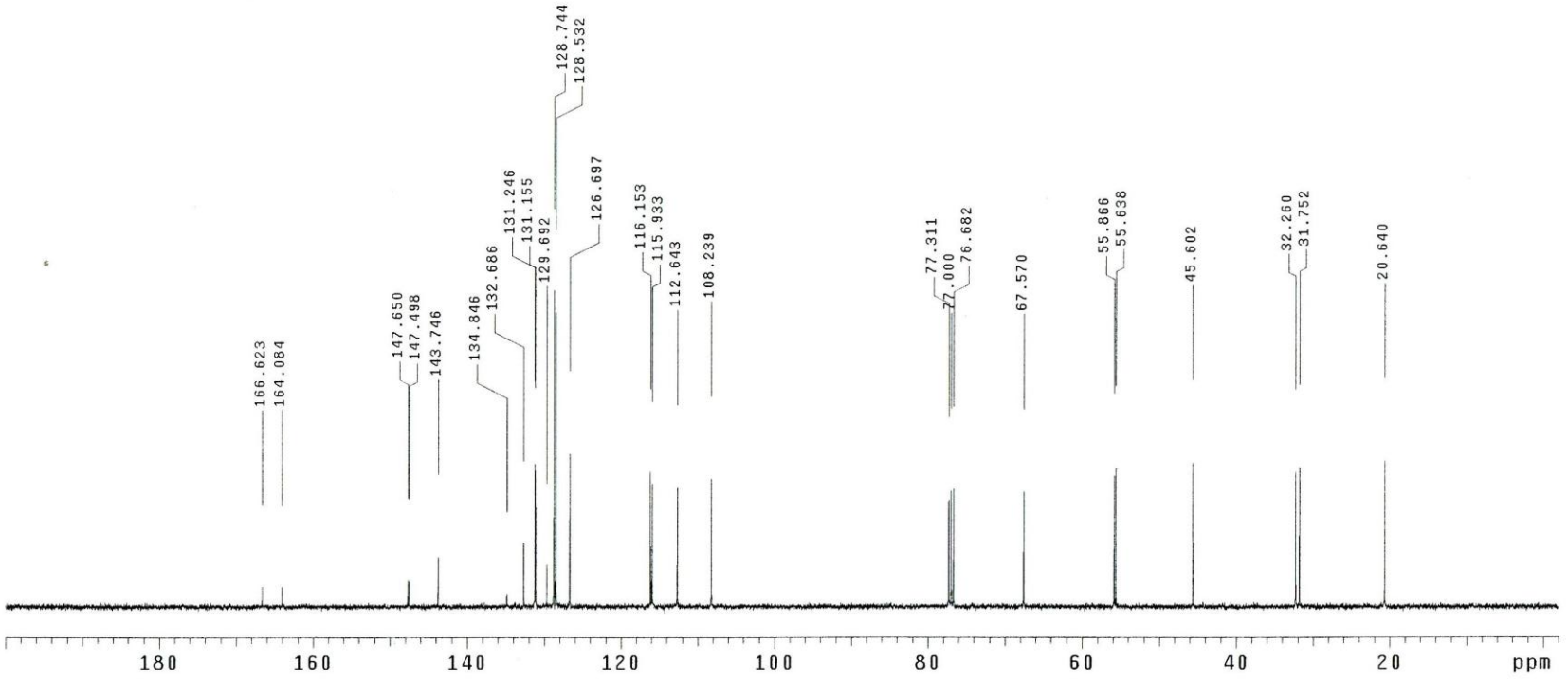
Pulse Sequence: s2pul

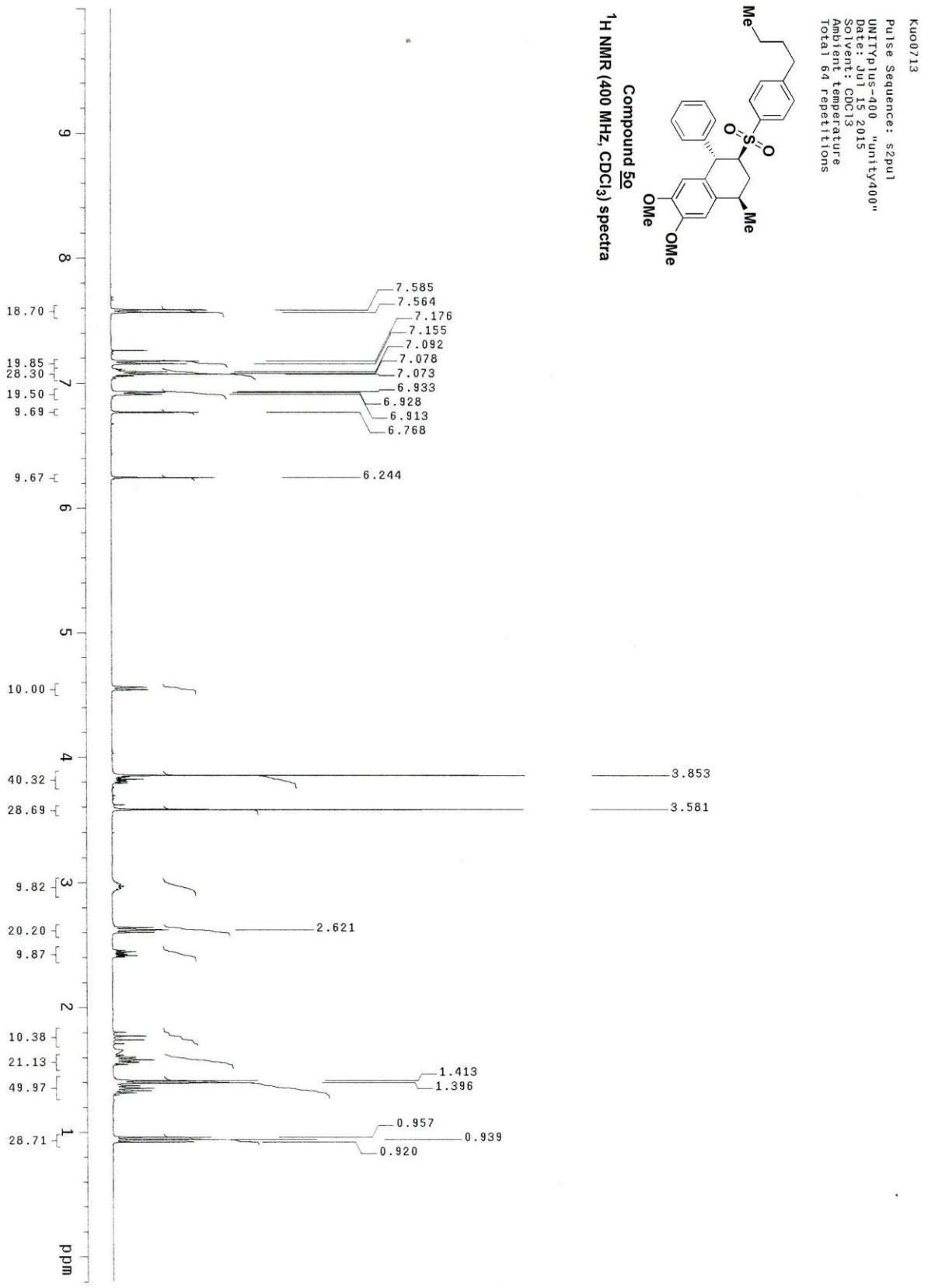
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 3696 repetitions

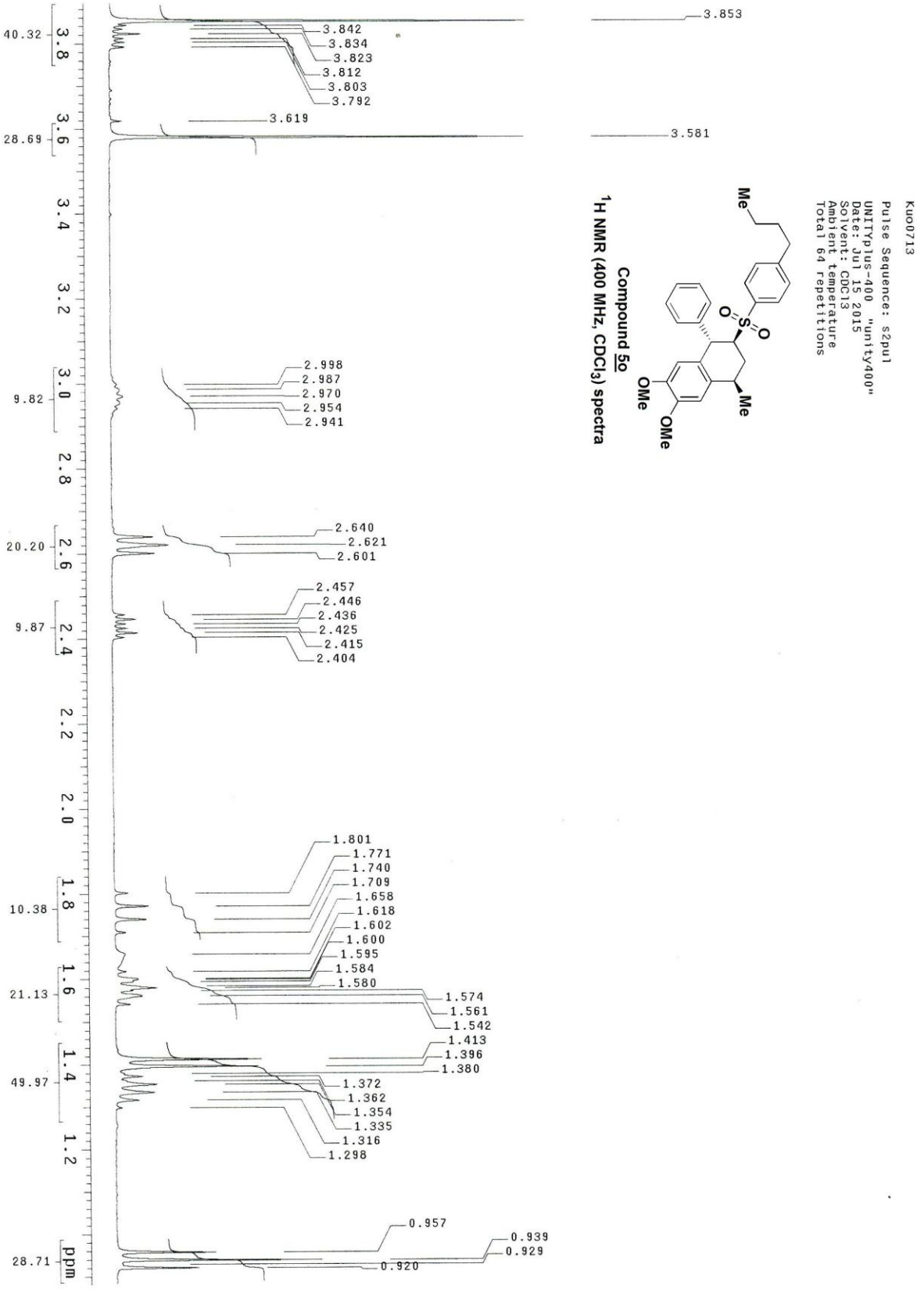


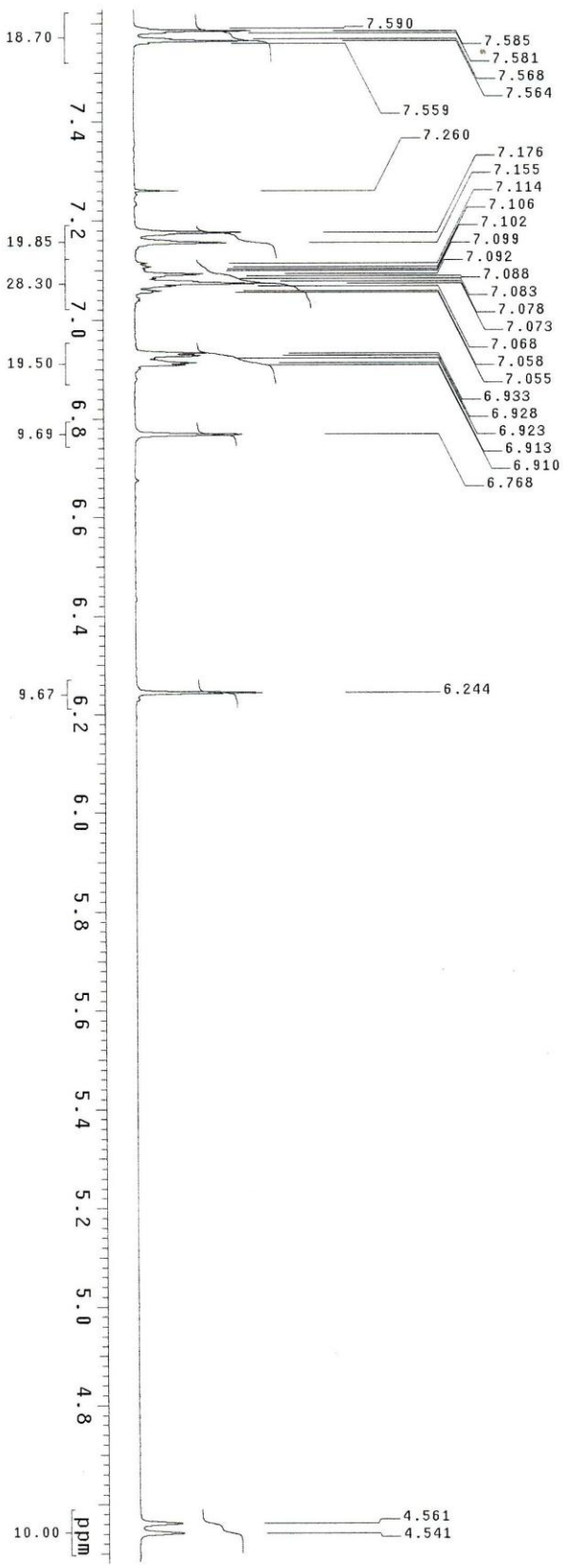
Compound 5n

^{13}C NMR (100 MHz, $CDCl_3$) spectra



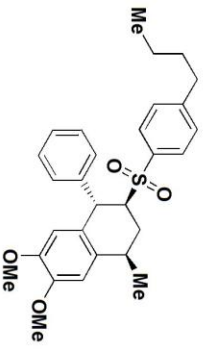

Kuo0713
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
Me
OMe
OMe
Compound 5o
1H NMR (400 MHz, CDCl3) spectra
7.585
7.564
7.176
7.155
7.092
7.078
7.073
6.933
6.928
6.913
6.768
6.244
3.853
3.581
2.621
1.413
1.396
0.957
0.939
0.920
18.70
19.85
28.30
19.50
9.69
9.67
10.00
40.32
28.69
9.82
20.20
9.87
10.38
21.13
49.97
28.71
ppm


Kuo0713
Pulse Sequence: s2pul
UNITyplus-400 "unity400"
Date: Jul 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5o
1H NMR (400 MHz, CDCl3) spectra
Me
O
S
O
OMe
OMe
Me
3.853
3.842
3.834
3.823
3.812
3.803
3.792
3.619
3.581
2.998
2.987
2.970
2.954
2.941
2.640
2.621
2.601
2.457
2.446
2.436
2.425
2.415
2.404
1.801
1.771
1.740
1.709
1.658
1.618
1.602
1.600
1.595
1.584
1.580
1.574
1.561
1.542
1.413
1.396
1.380
1.372
1.362
1.354
1.335
1.316
1.298
0.957
0.939
0.929
0.920
40.32
28.69
9.82
20.20
9.87
10.38
21.13
49.97
28.71
ppm



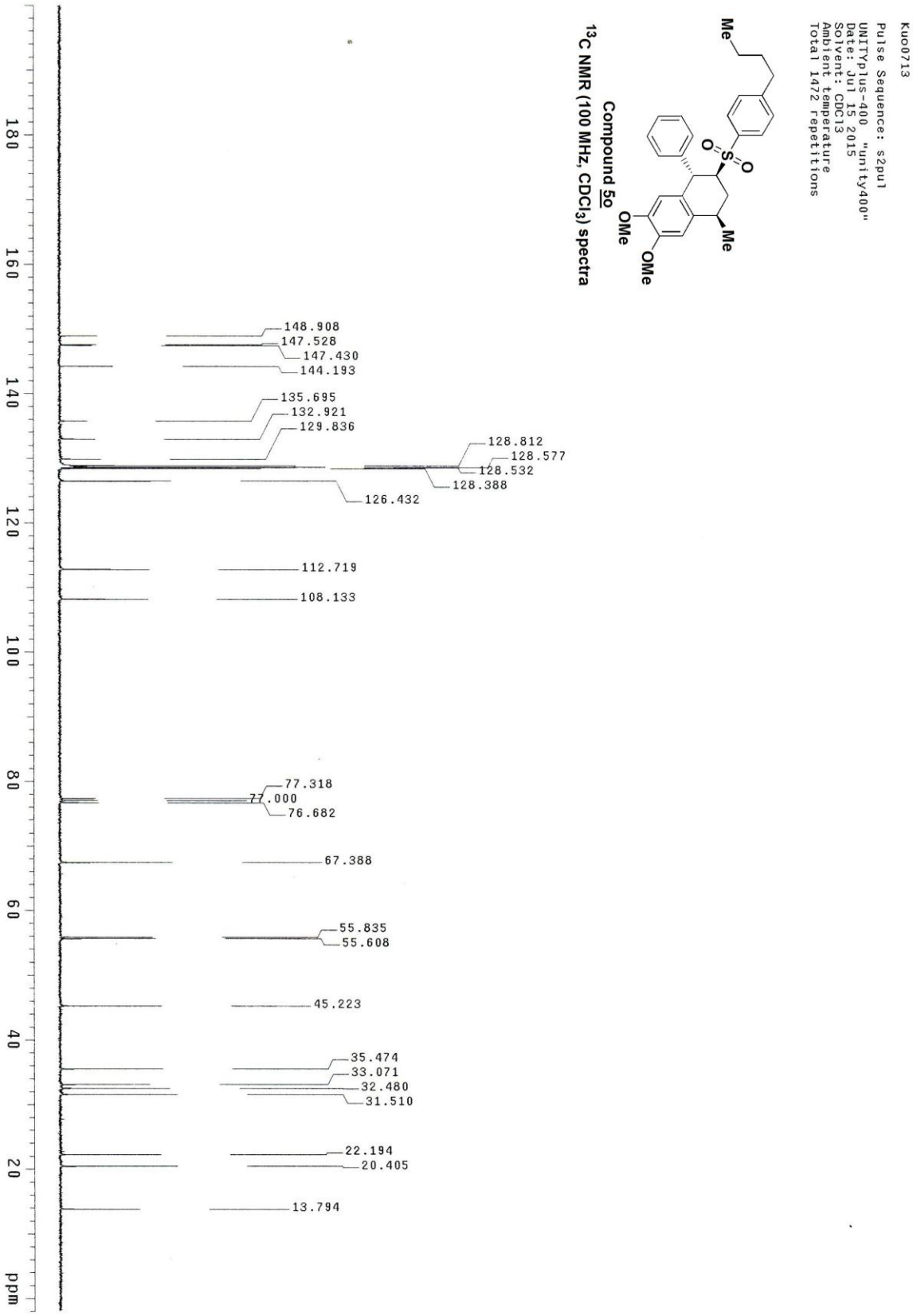
Kuo0713

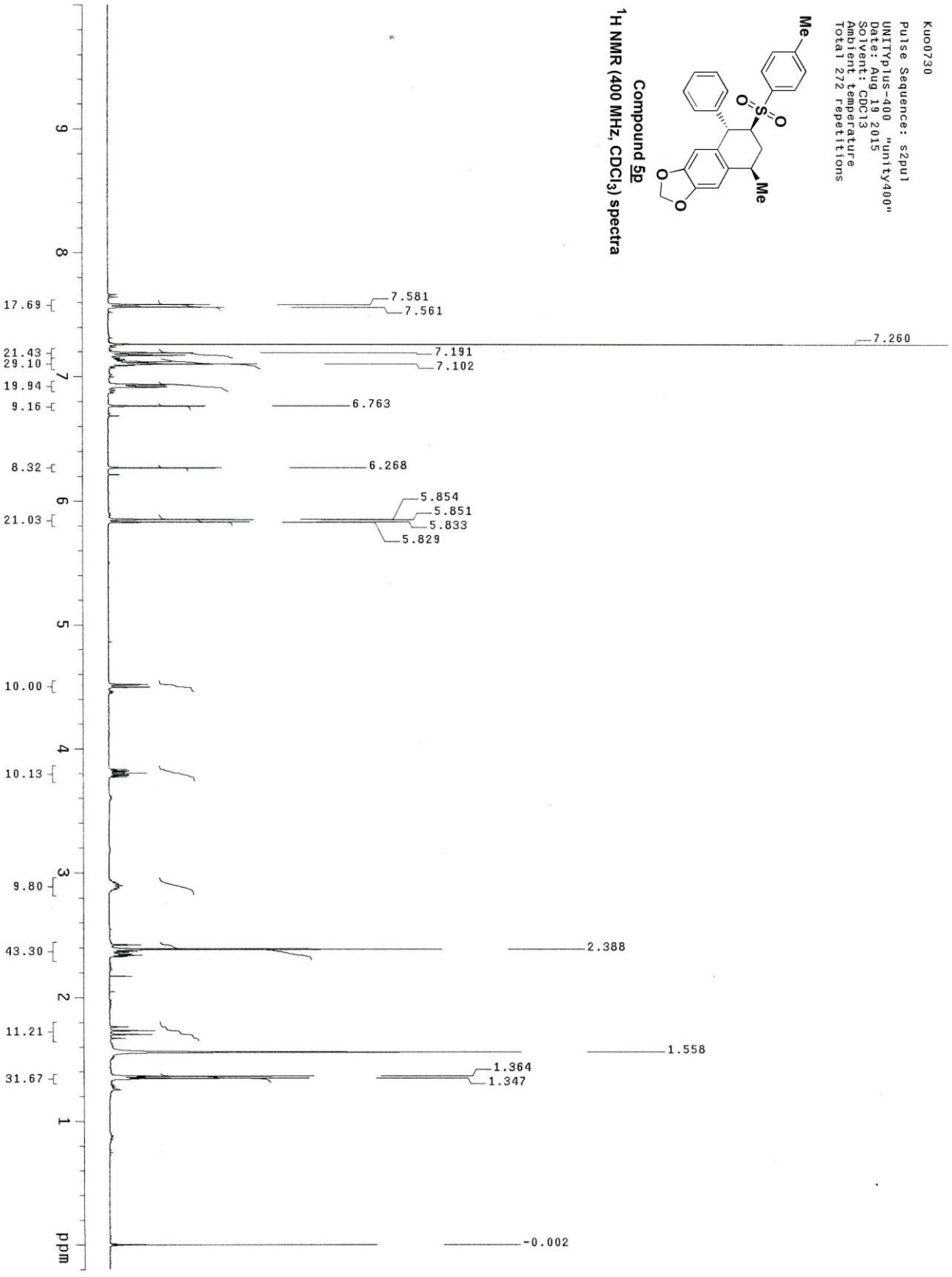
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

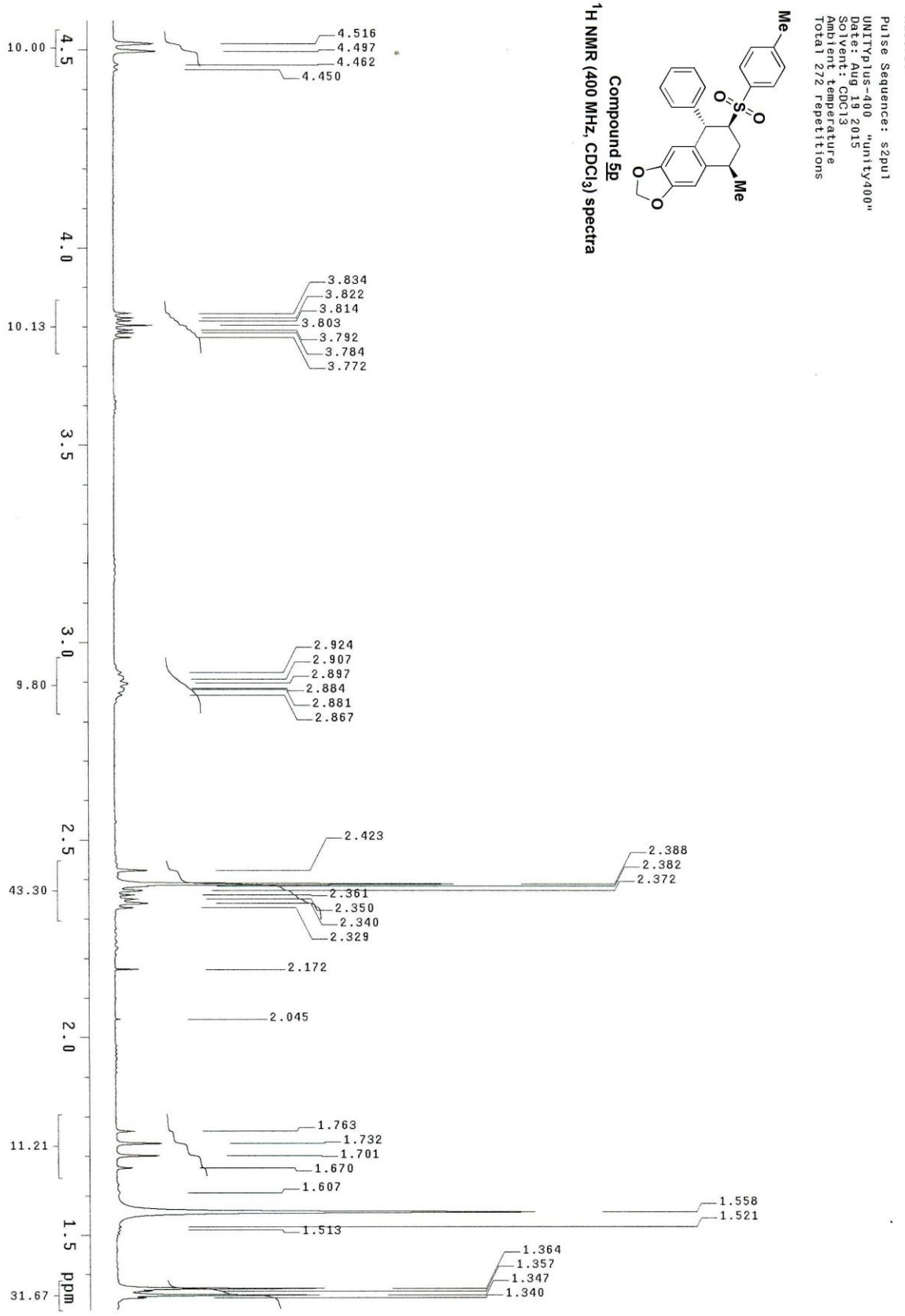


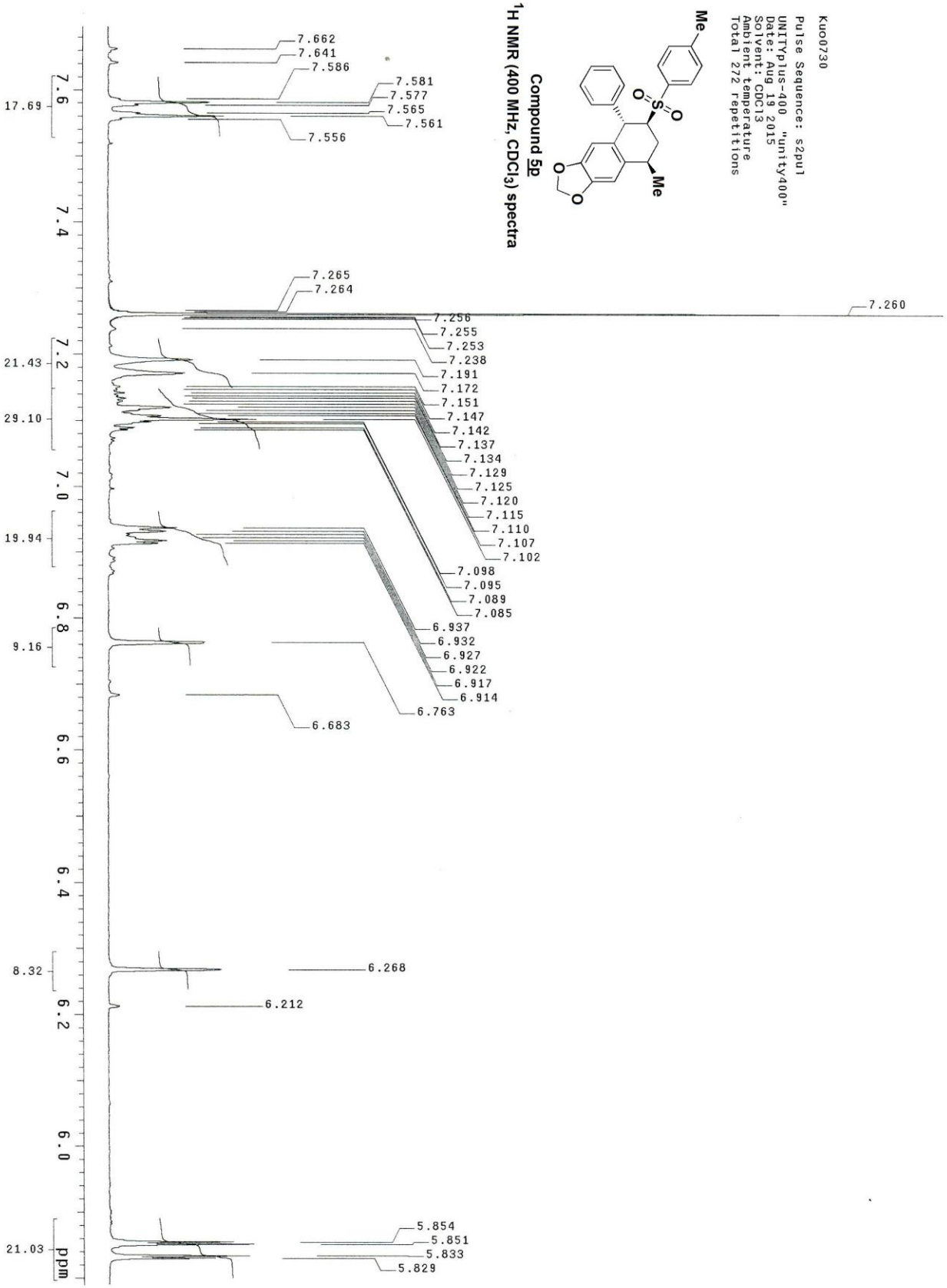
Compound 5o

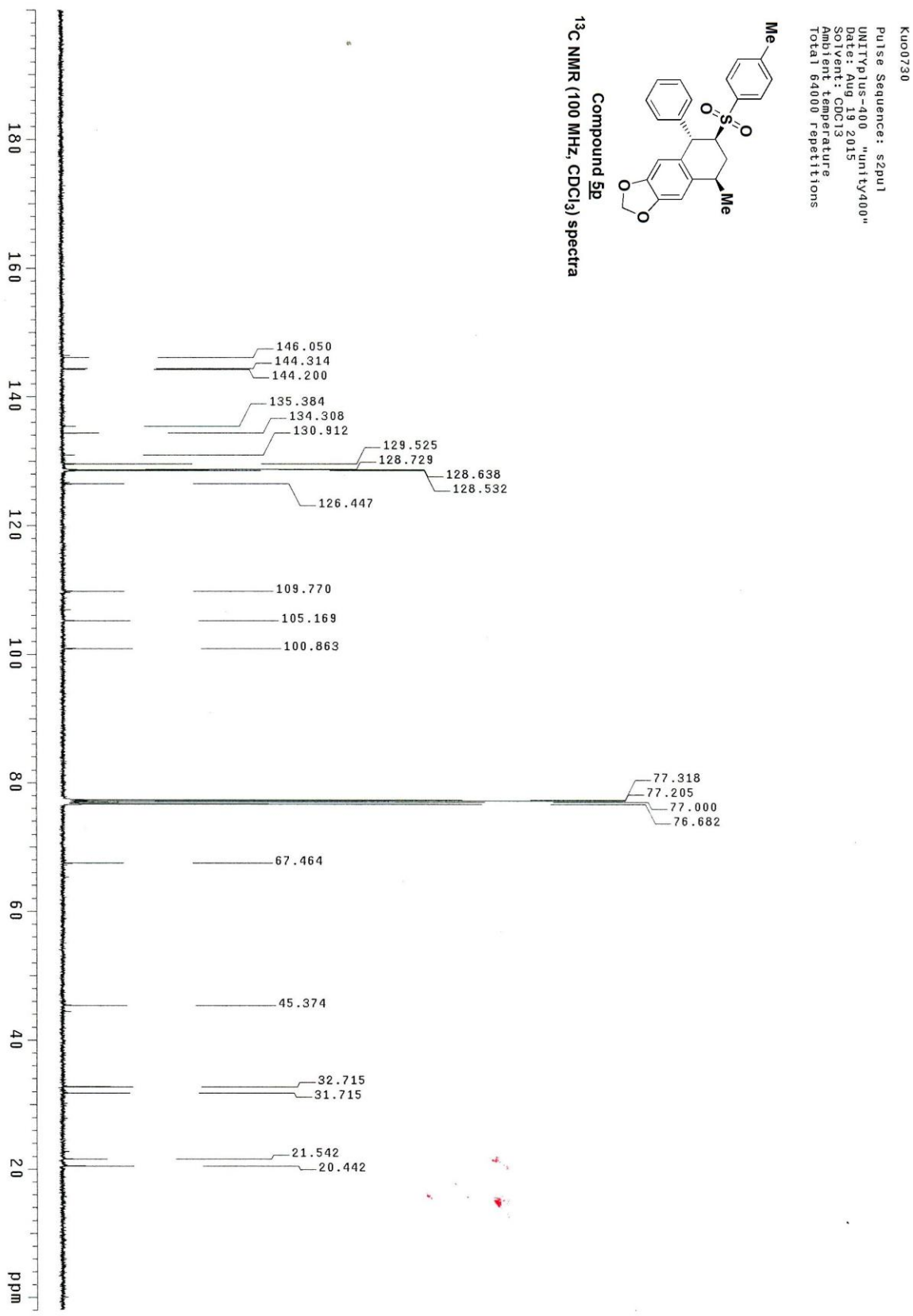
^{1}H NMR (400 MHz, $CDCl_3$) spectra

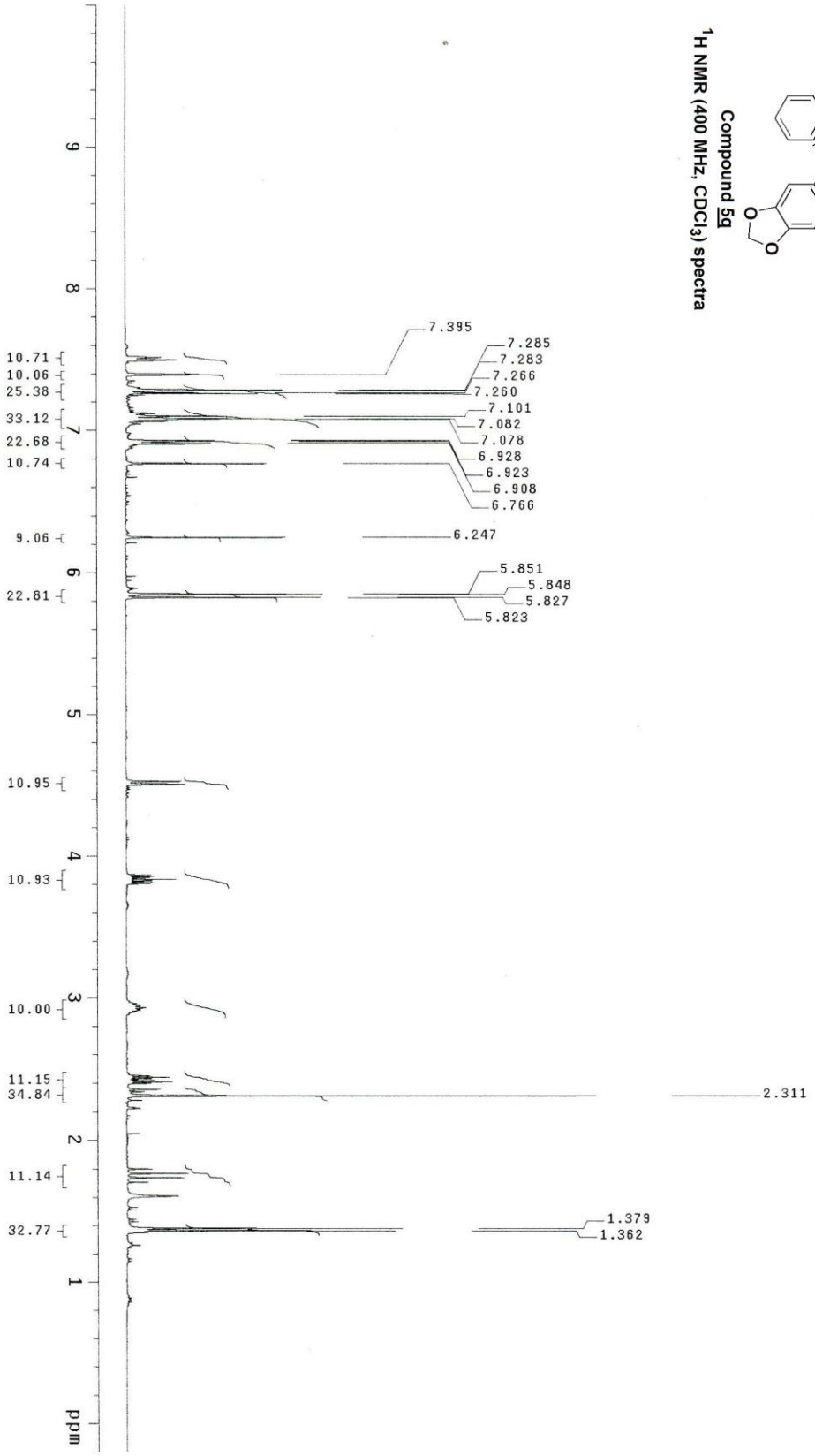

Kuo0713
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 15 2015
Solvent: CDCl3
Ambient temperature
Total 1472 repetitions
Me
O
S
O
Me
OMe
OMe
Compound 5o
13C NMR (100 MHz, CDCl3) spectra
148.908
147.528
147.430
144.193
135.695
132.921
129.836
128.812
128.577
128.532
128.388
126.432
112.719
108.133
77.318
77.000
76.682
67.388
55.835
55.608
45.223
35.474
33.071
32.480
31.510
22.194
20.405
13.794
180
160
140
120
100
80
60
40
20
ppm

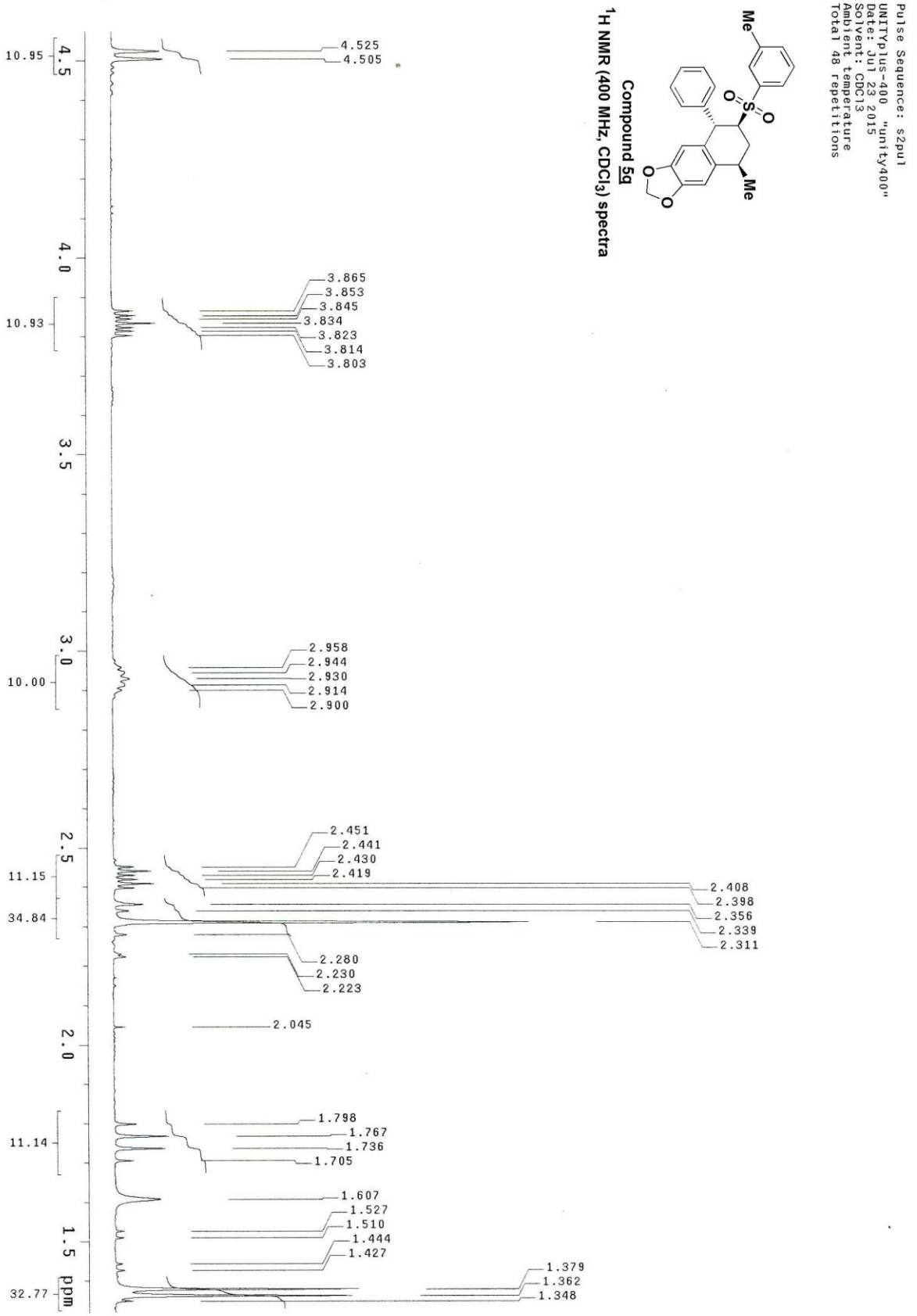

Kuo0730
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 19 2015
Solvent: CDCl3
Ambient temperature
Total 272 repetitions
Me
Me
Compound 5p
1H NMR (400 MHz, CDCl3) spectra
17.69
21.43
29.10
19.94
9.16
8.32
21.03
10.00
10.13
9.80
43.30
11.21
31.67
7.581
7.561
7.260
7.191
7.102
6.763
6.268
5.854
5.851
5.833
5.829
2.388
1.558
1.364
1.347
-0.002
ppm

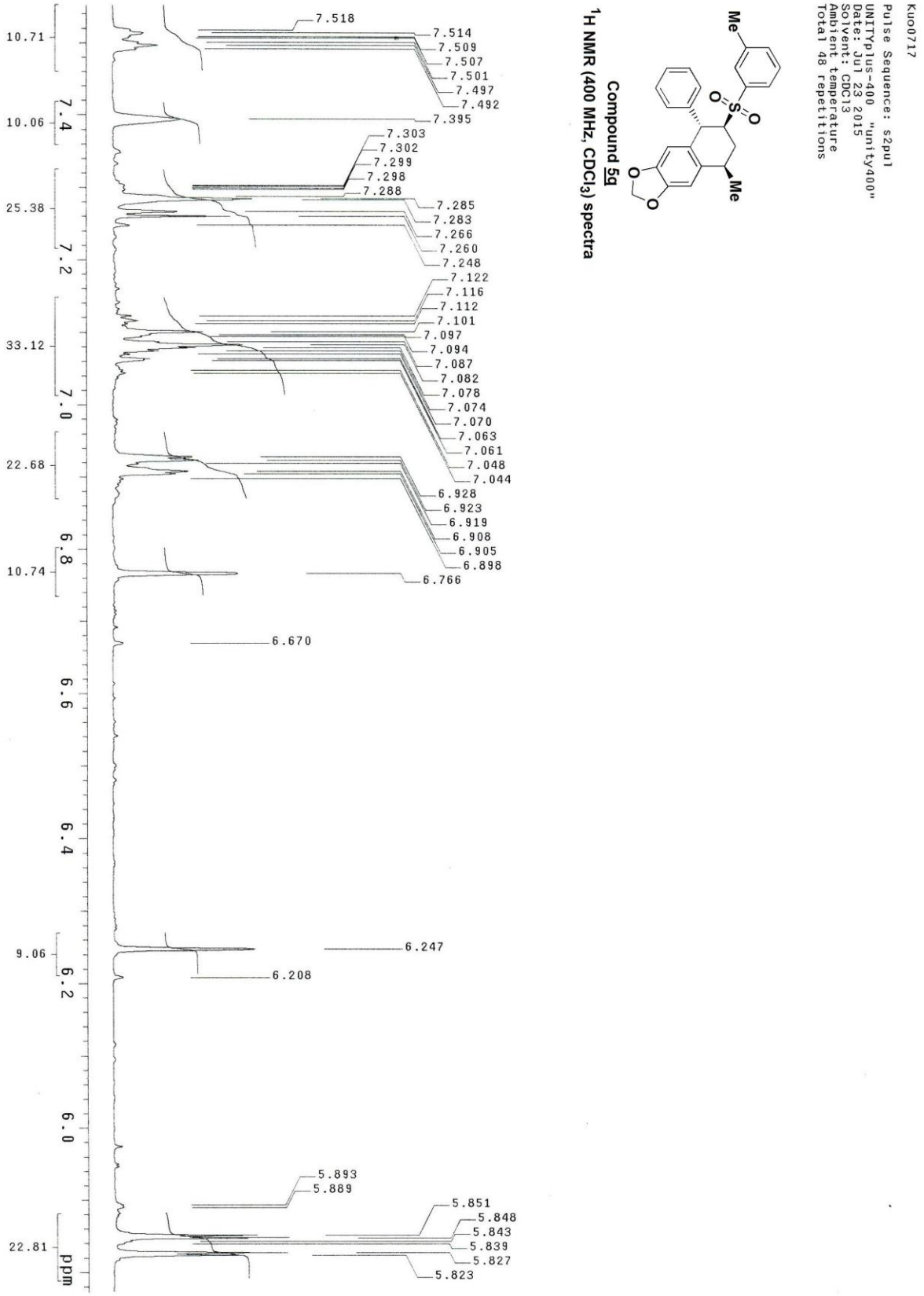

Kuo0730
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 19 2015
Solvent: CDCl3
Ambient temperature
Total 272 repetitions
Me
Me
Compound 5p
1H NMR (400 MHz, CDCl3) spectra
4.516
4.497
4.462
4.450
3.834
3.822
3.814
3.803
3.792
3.784
3.772
2.924
2.907
2.897
2.884
2.881
2.867
2.423
2.388
2.382
2.372
2.361
2.350
2.340
2.329
2.172
2.045
1.763
1.732
1.701
1.670
1.607
1.558
1.521
1.513
1.364
1.357
1.347
1.340
10.00
10.13
9.80
43.30
11.21
31.67
ppm

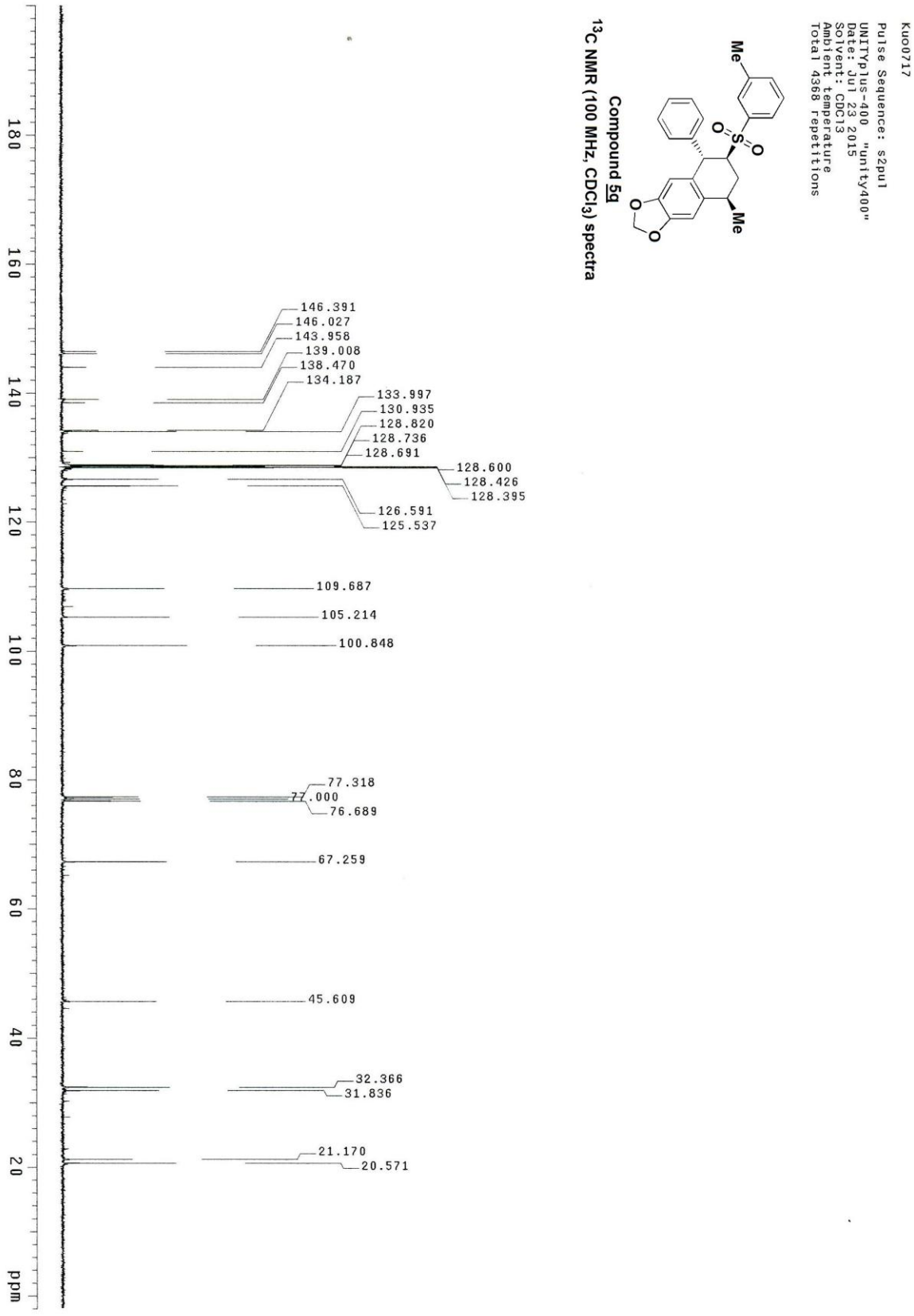

Kuo0730
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 19 2015
Solvent: CDCl3
Ambient temperature
Total 272 repetitions
Me
Me
Compound 5p
1H NMR (400 MHz, CDCl3) spectra
7.662
7.641
7.586
7.581
7.577
7.565
7.561
7.556
7.265
7.264
7.260
7.256
7.255
7.253
7.238
7.191
7.172
7.151
7.147
7.142
7.137
7.134
7.129
7.125
7.120
7.115
7.110
7.107
7.102
7.098
7.095
7.089
7.085
6.937
6.932
6.927
6.922
6.917
6.914
6.763
6.683
6.268
6.212
5.854
5.851
5.833
5.829
17.69
21.43
29.10
19.94
9.16
8.32
21.03
ppm

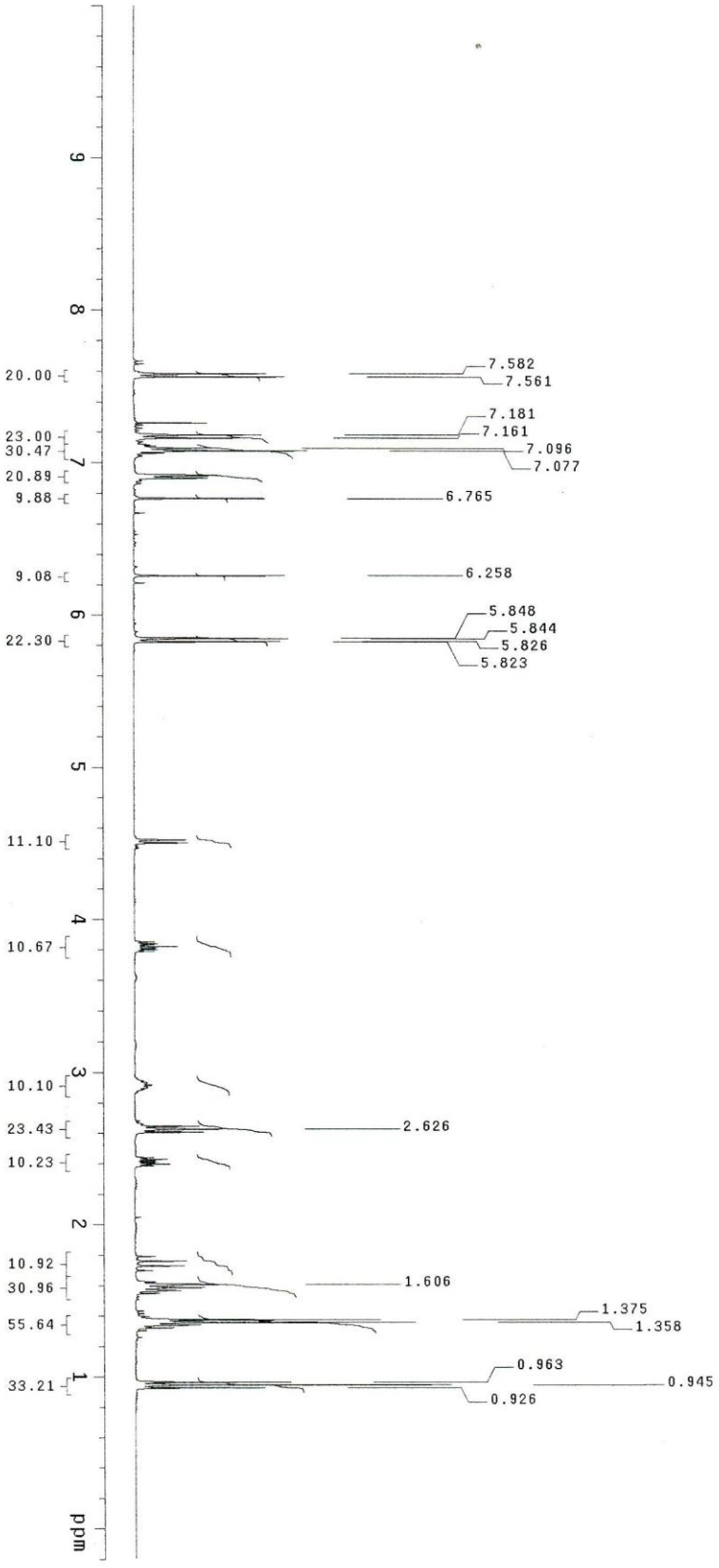

Kuo0730
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 19 2015
Solvent: CDCl3
Ambient temperature
Total 64000 repetitions
Me
Me
Compound 5p
13C NMR (100 MHz, CDCl3) spectra
146.050
144.314
144.200
135.384
134.308
130.912
129.525
128.729
128.638
128.532
126.447
109.770
105.169
100.863
77.318
77.205
77.000
76.682
67.464
45.374
32.715
31.715
21.542
20.442
180
160
140
120
100
80
60
40
20
ppm

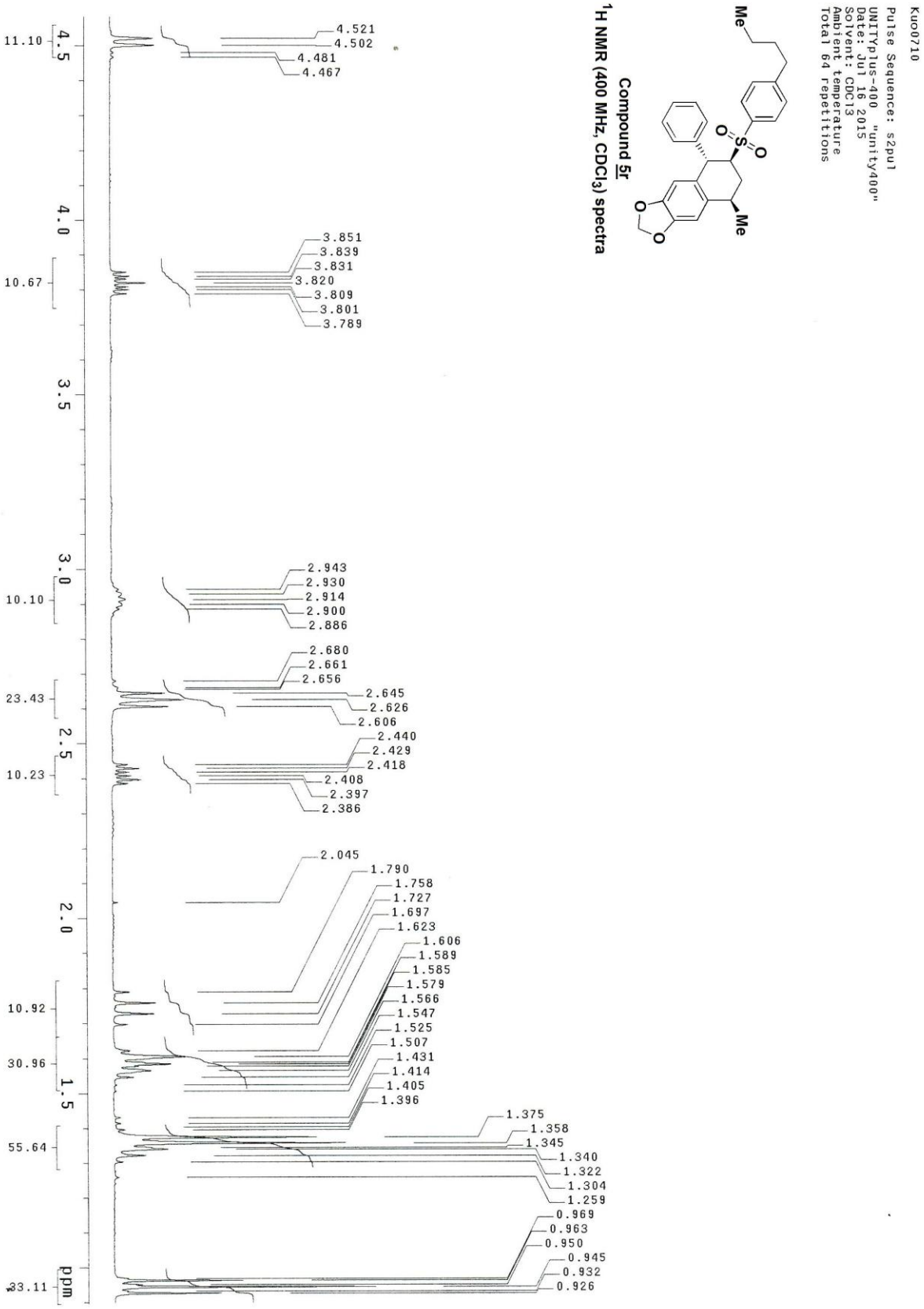

Kuo0717
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 23 2015
Solvent: CDCl3
Ambient temperature
Total 48 repetitions
Me
Me
O
O
S
O
O
O
Compound 5g
1H NMR (400 MHz, CDCl3) spectra
7.395
7.285
7.283
7.266
7.260
7.101
7.082
7.078
6.928
6.923
6.908
6.766
6.247
5.851
5.848
5.827
5.823
2.311
1.379
1.362
10.71
10.06
25.38
33.12
22.68
10.74
9.06
22.81
10.95
10.93
10.00
11.15
34.84
11.14
32.77
ppm

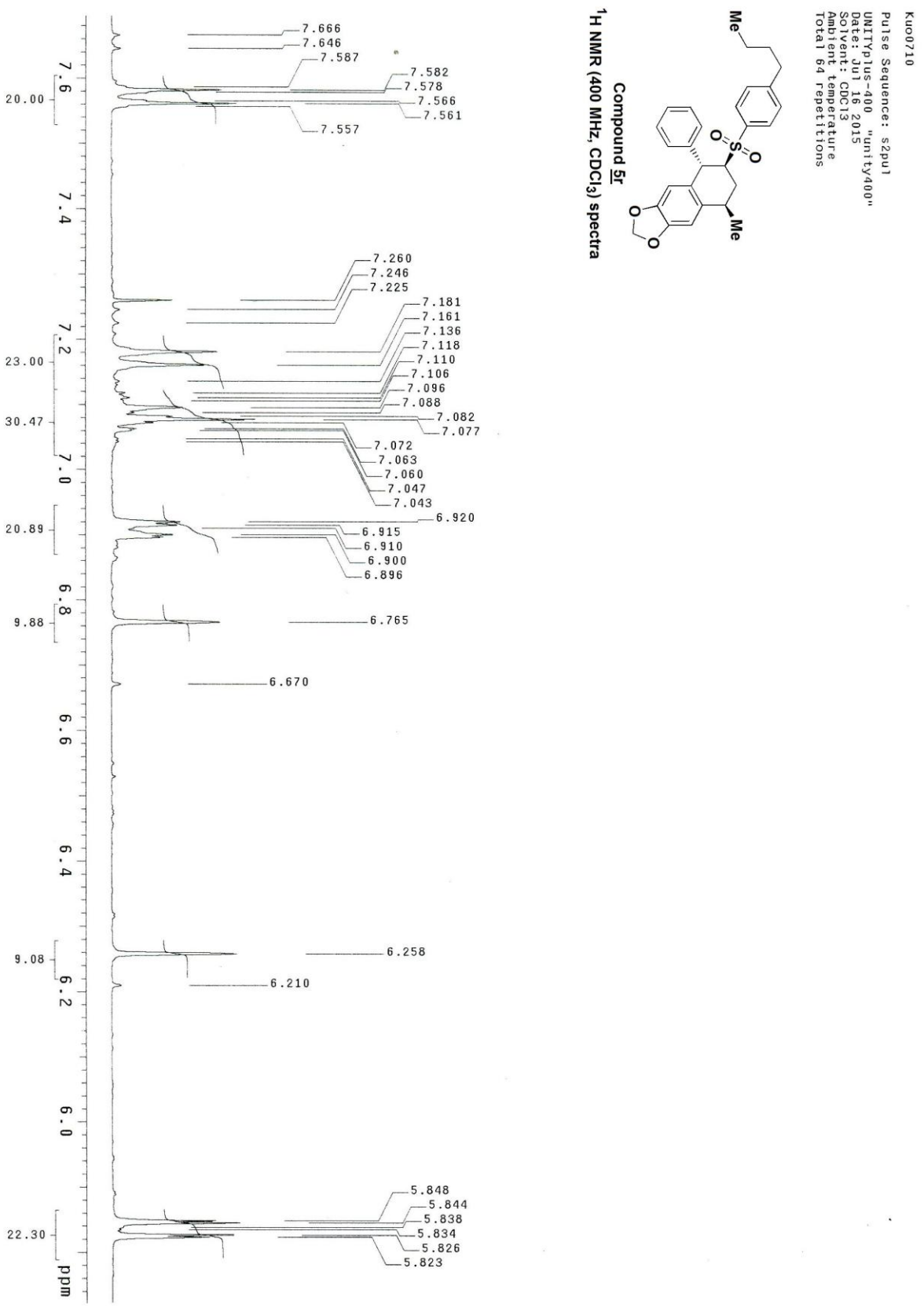

Kuo0717
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 23 2015
Solvent: CDCl3
Ambient temperature
Total 48 repetitions
Me
Me
Compound 5g
1H NMR (400 MHz, CDCl3) spectra
4.525
4.505
3.865
3.853
3.845
3.834
3.823
3.814
3.803
2.958
2.944
2.930
2.914
2.900
2.451
2.441
2.430
2.419
2.408
2.398
2.356
2.339
2.311
2.280
2.230
2.223
2.045
1.798
1.767
1.736
1.705
1.607
1.527
1.510
1.444
1.427
1.379
1.362
1.348
10.95
10.93
10.00
11.15
34.84
11.14
32.77
ppm

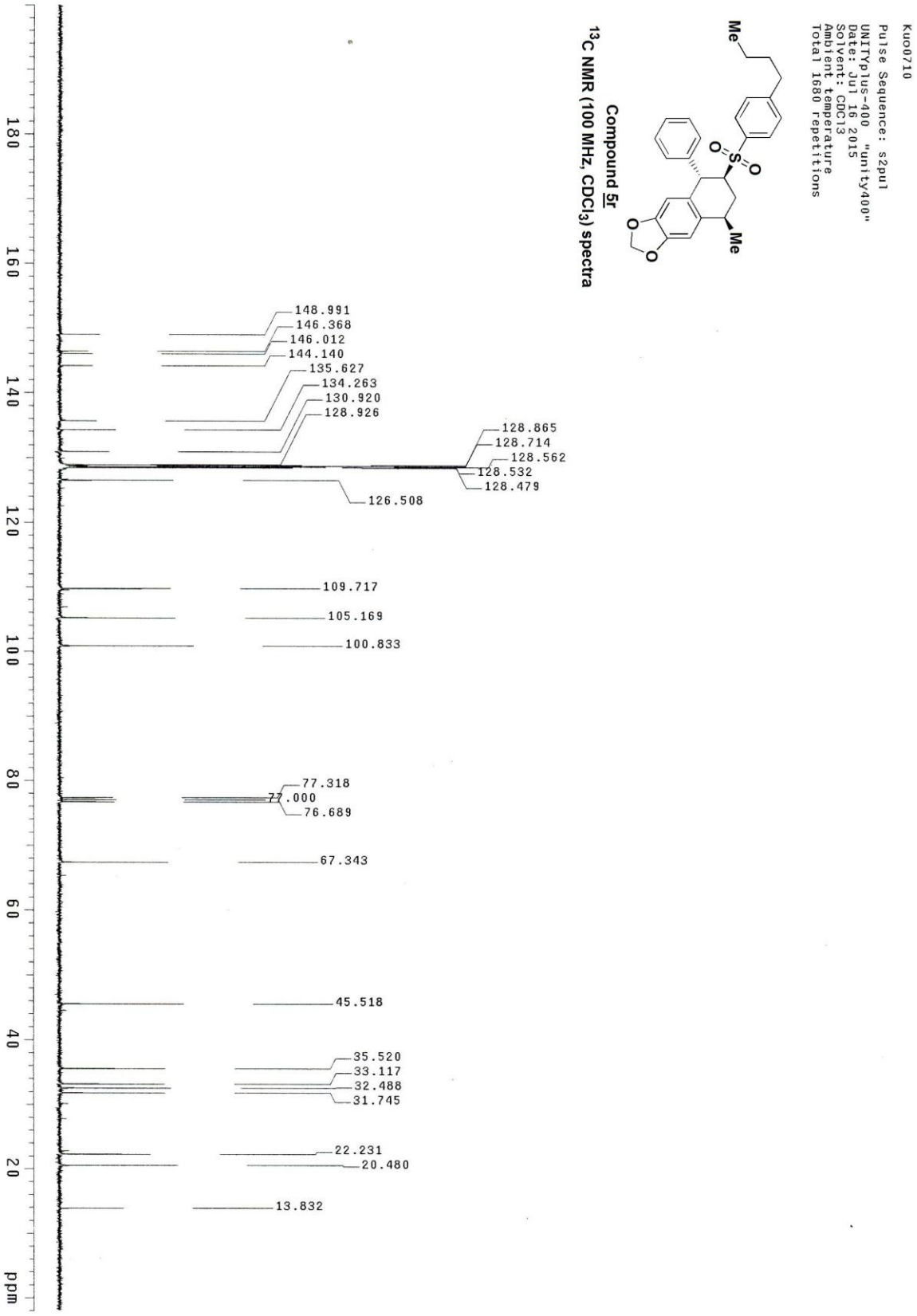

Kuo0717
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 23 2015
Solvent: CDCl3
Ambient temperature
Total 48 repetitions
Me
Me
O
O
S
O
O
O
Compound 5g
1H NMR (400 MHz, CDCl3) spectra
7.518
7.514
7.509
7.507
7.501
7.497
7.492
7.395
7.303
7.302
7.299
7.298
7.288
7.285
7.283
7.266
7.260
7.248
7.122
7.116
7.112
7.101
7.097
7.094
7.087
7.082
7.078
7.074
7.070
7.063
7.061
7.048
7.044
6.928
6.923
6.919
6.908
6.905
6.898
6.766
6.670
6.247
6.208
5.893
5.889
5.851
5.848
5.843
5.839
5.827
5.823
10.71
10.06
25.38
33.12
22.68
10.74
9.06
22.81
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
ppm

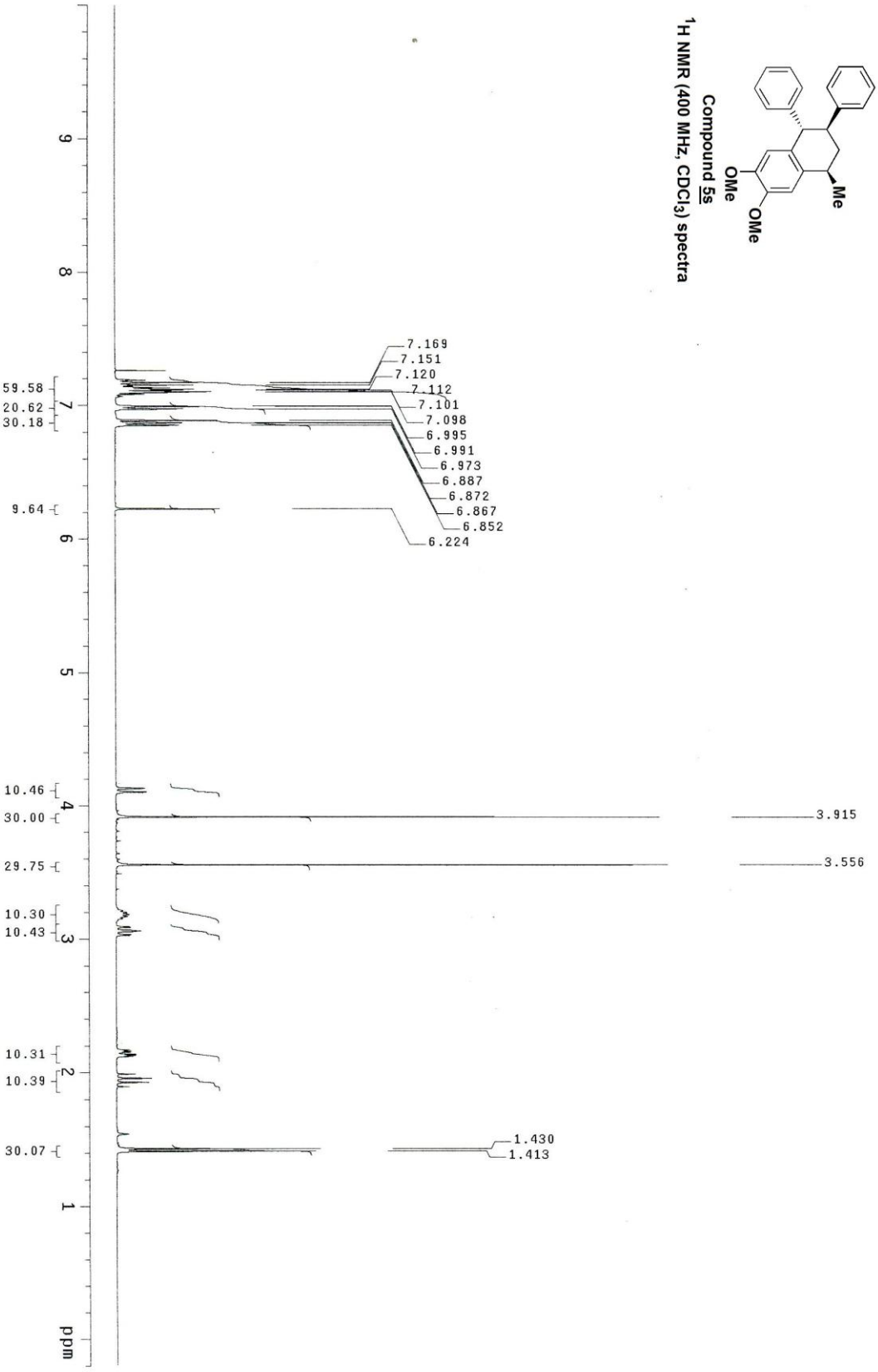

Kuo0717
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 23 2015
Solvent: CDCl3
Ambient temperature
Total 4368 repetitions
Me
Me
Compound 5g
13C NMR (100 MHz, CDCl3) spectra
146.391
146.027
143.958
139.008
138.470
134.187
133.997
130.935
128.820
128.736
128.691
128.600
128.426
128.395
126.591
125.537
109.687
105.214
100.848
77.318
77.000
76.689
67.259
45.609
32.366
31.836
21.170
20.571
180
160
140
120
100
80
60
40
20
ppm

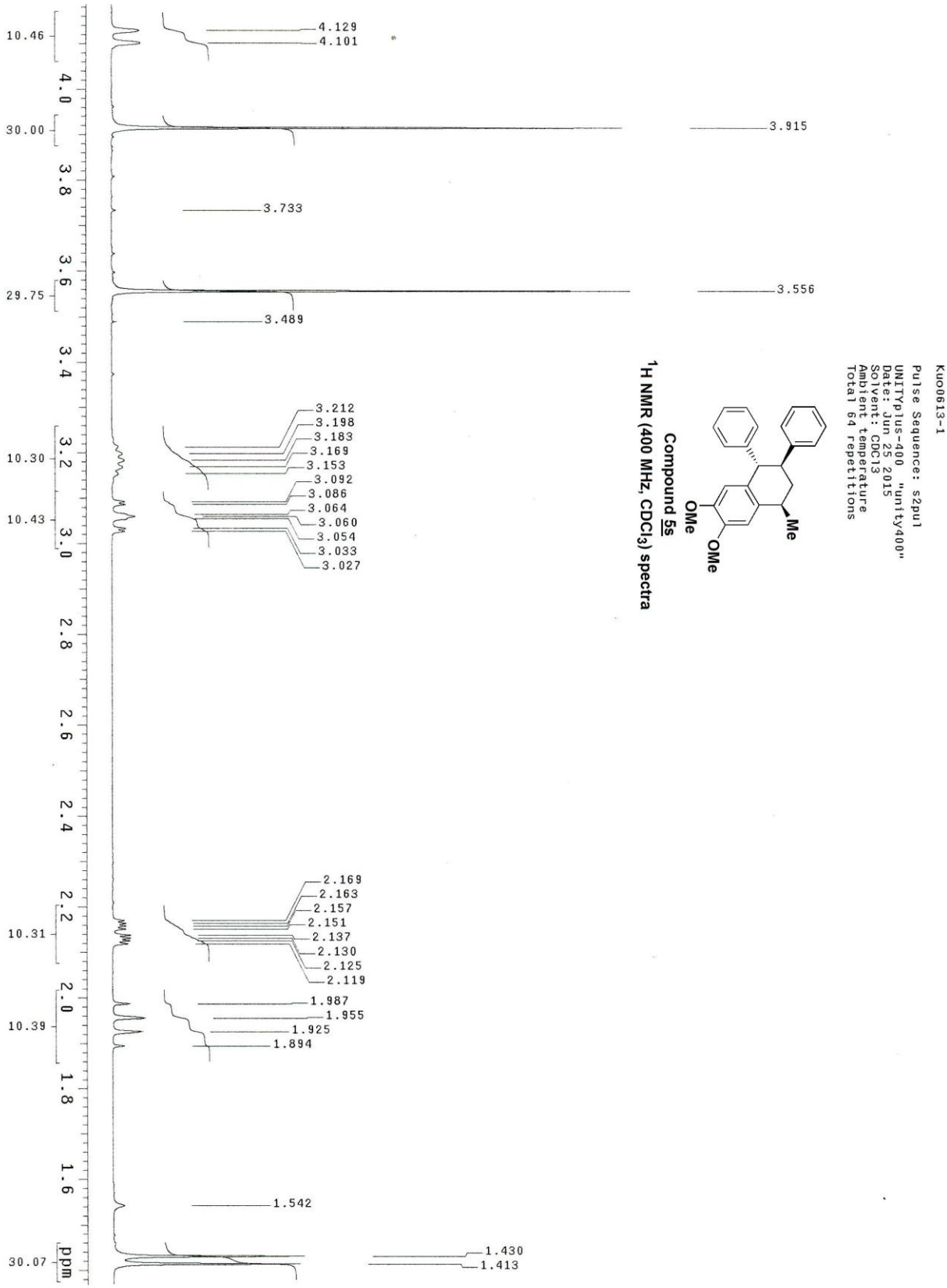

Kuo0710
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
Compound 5r
1H NMR (400 MHz, CDCl3) spectra
7.582
7.561
7.181
7.161
7.096
7.077
6.765
6.258
5.848
5.844
5.826
5.823
2.626
1.606
1.375
1.358
0.963
0.945
0.926
20.00
23.00
30.47
20.89
9.88
9.08
22.30
11.10
10.67
10.10
23.43
10.23
10.92
30.96
55.64
33.21
ppm

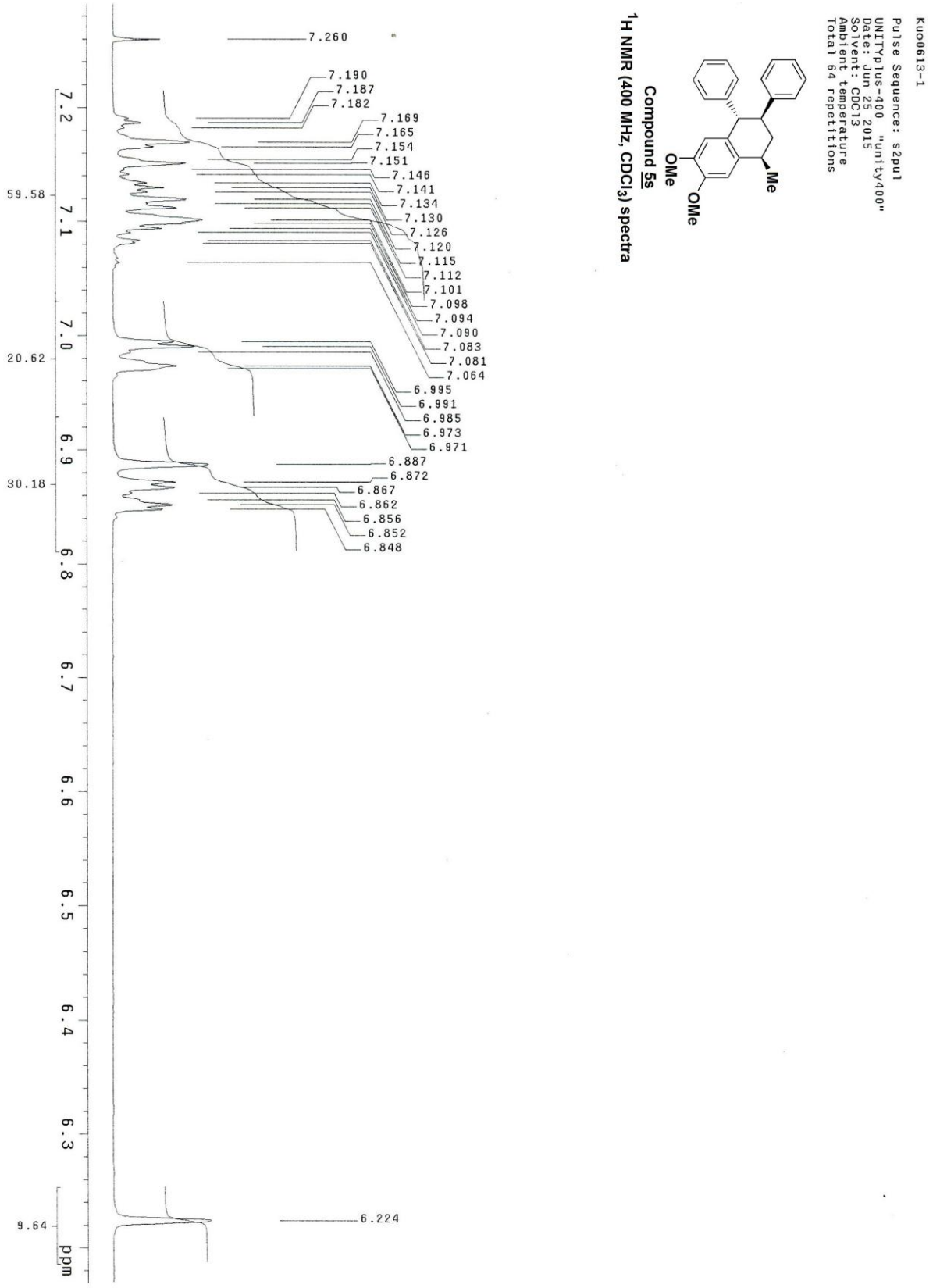

Kuo0710
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
Compound 5r
^{1}H NMR (400 MHz, CDCl$_3$) spectra
11.10
10.67
10.10
23.43
10.23
10.92
30.96
55.64
33.11
4.521
4.502
4.481
4.467
3.851
3.839
3.831
3.820
3.809
3.801
3.789
2.943
2.930
2.914
2.900
2.886
2.680
2.661
2.656
2.645
2.626
2.606
2.440
2.429
2.418
2.408
2.397
2.386
2.045
1.790
1.758
1.727
1.697
1.623
1.606
1.589
1.585
1.579
1.566
1.547
1.525
1.507
1.431
1.414
1.405
1.396
1.375
1.358
1.345
1.340
1.322
1.304
1.259
0.969
0.963
0.950
0.945
0.932
0.926
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm


Kuo0710
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
Compound 5r
1H NMR (400 MHz, CDCl3) spectra
7.666
7.646
7.587
7.582
7.578
7.566
7.561
7.557
7.260
7.246
7.225
7.181
7.161
7.136
7.118
7.110
7.106
7.096
7.088
7.082
7.077
7.072
7.063
7.060
7.047
7.043
6.920
6.915
6.910
6.900
6.896
6.765
6.670
6.258
6.210
5.848
5.844
5.838
5.834
5.826
5.823
20.00
23.00
30.47
20.89
9.88
9.08
22.30
ppm


Kuo0710
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 16 2015
Solvent: CDCl3
Ambient temperature
Total 1680 repetitions
Me
Me
Compound 5r
13C NMR (100 MHz, CDCl3) spectra
148.991
146.368
146.012
144.140
135.627
134.263
130.920
128.926
128.865
128.714
128.562
128.532
128.479
126.508
109.717
105.169
100.833
77.318
77.000
76.689
67.343
45.518
35.520
33.117
32.488
31.745
22.231
20.480
13.832
180
160
140
120
100
80
60
40
20
ppm


Kuo0613-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OMe
OMe
Me
Compound 5s
1H NMR (400 MHz, CDCl3) spectra
7.169
7.151
7.120
7.112
7.101
7.098
6.995
6.991
6.973
6.887
6.872
6.867
6.852
6.224
3.915
3.556
1.430
1.413
59.58
20.62
30.18
9.64
10.46
30.00
29.75
10.30
10.43
10.31
10.39
30.07
ppm

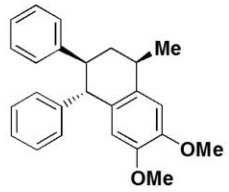

Kuo0613-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 5s
^{1}H NMR (400 MHz, CDCl$_3$) spectra
OMe
OMe
Me
4.129
4.101
3.915
3.733
3.556
3.489
3.212
3.198
3.183
3.169
3.153
3.092
3.086
3.064
3.060
3.054
3.033
3.027
2.169
2.163
2.157
2.151
2.137
2.130
2.125
2.119
1.987
1.955
1.925
1.894
1.542
1.430
1.413
10.46
30.00
29.75
10.30
10.43
10.31
10.39
30.07
ppm


Kuo0613-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
OMe
OMe
Me
Compound 5s
1H NMR (400 MHz, CDCl3) spectra
7.260
7.190
7.187
7.182
7.169
7.165
7.154
7.151
7.146
7.141
7.134
7.130
7.126
7.120
7.115
7.112
7.101
7.098
7.094
7.090
7.083
7.081
7.064
6.995
6.991
6.985
6.973
6.971
6.887
6.872
6.867
6.862
6.856
6.852
6.848
6.224
59.58
20.62
30.18
9.64
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
ppm

Kuo0613-1

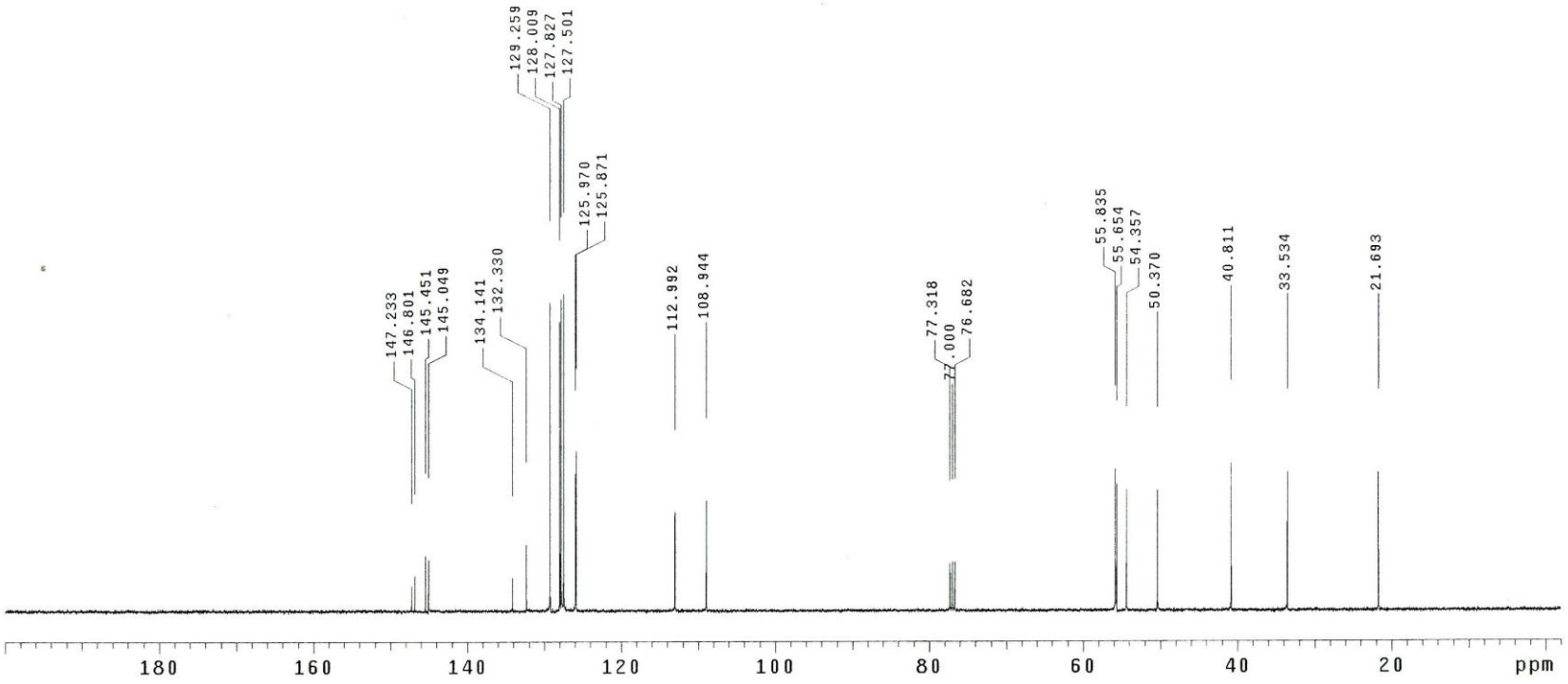
Pulse Sequence: s2pul

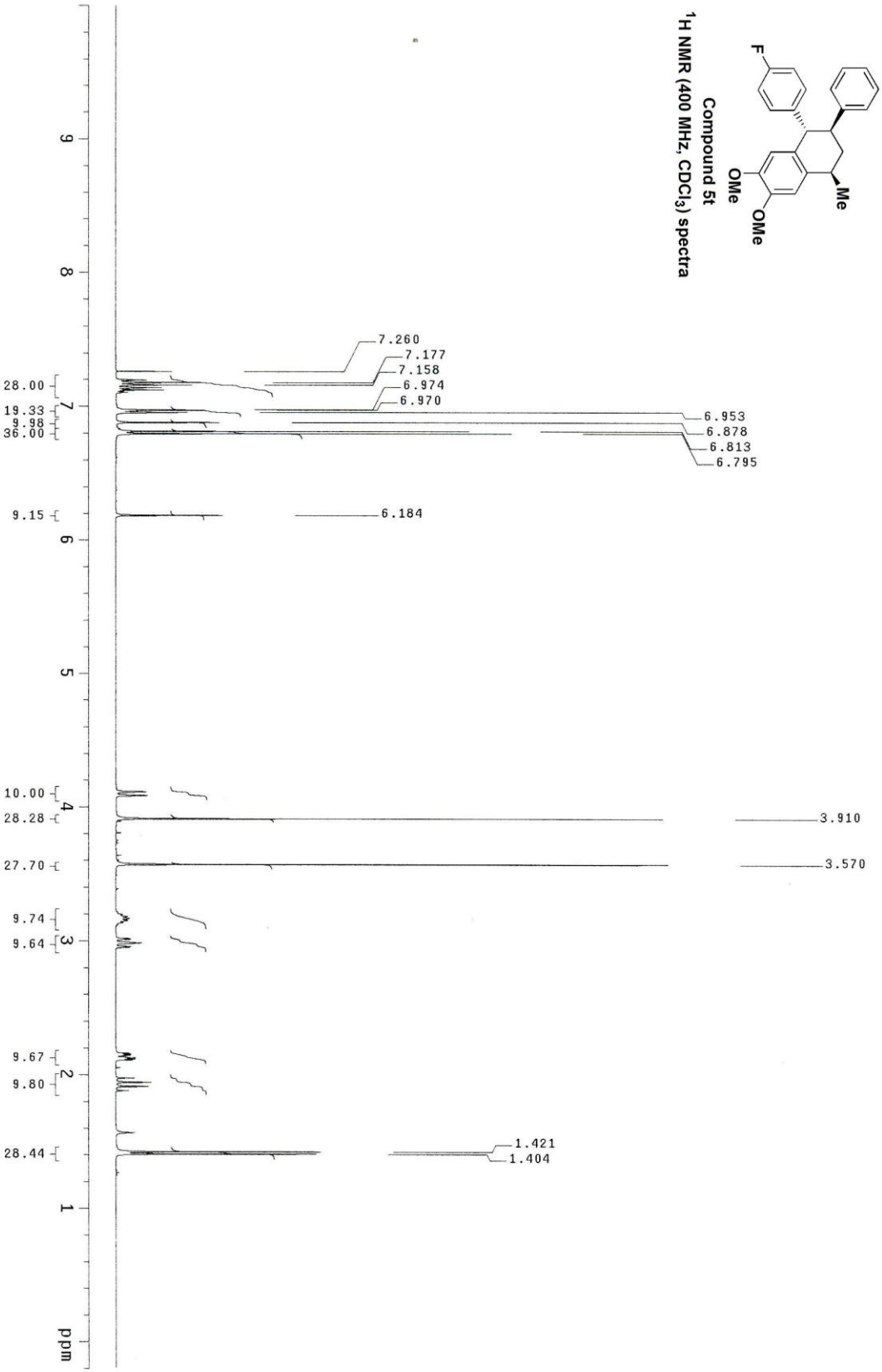
UNITYplus-400 "unity400"
Date: Jun 25 2015
Solvent: CDCl3
Ambient temperature
Total 1552 repetitions

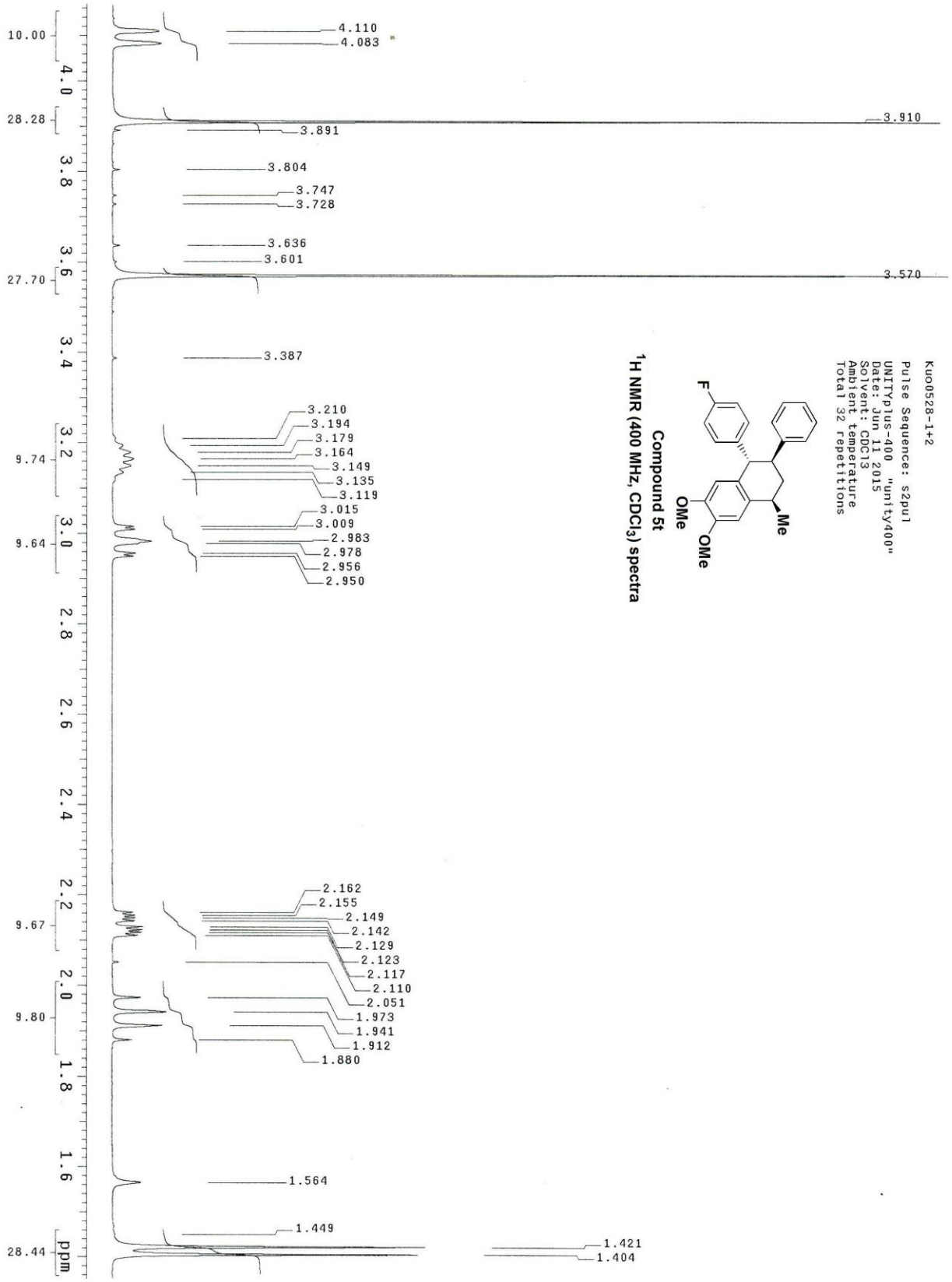


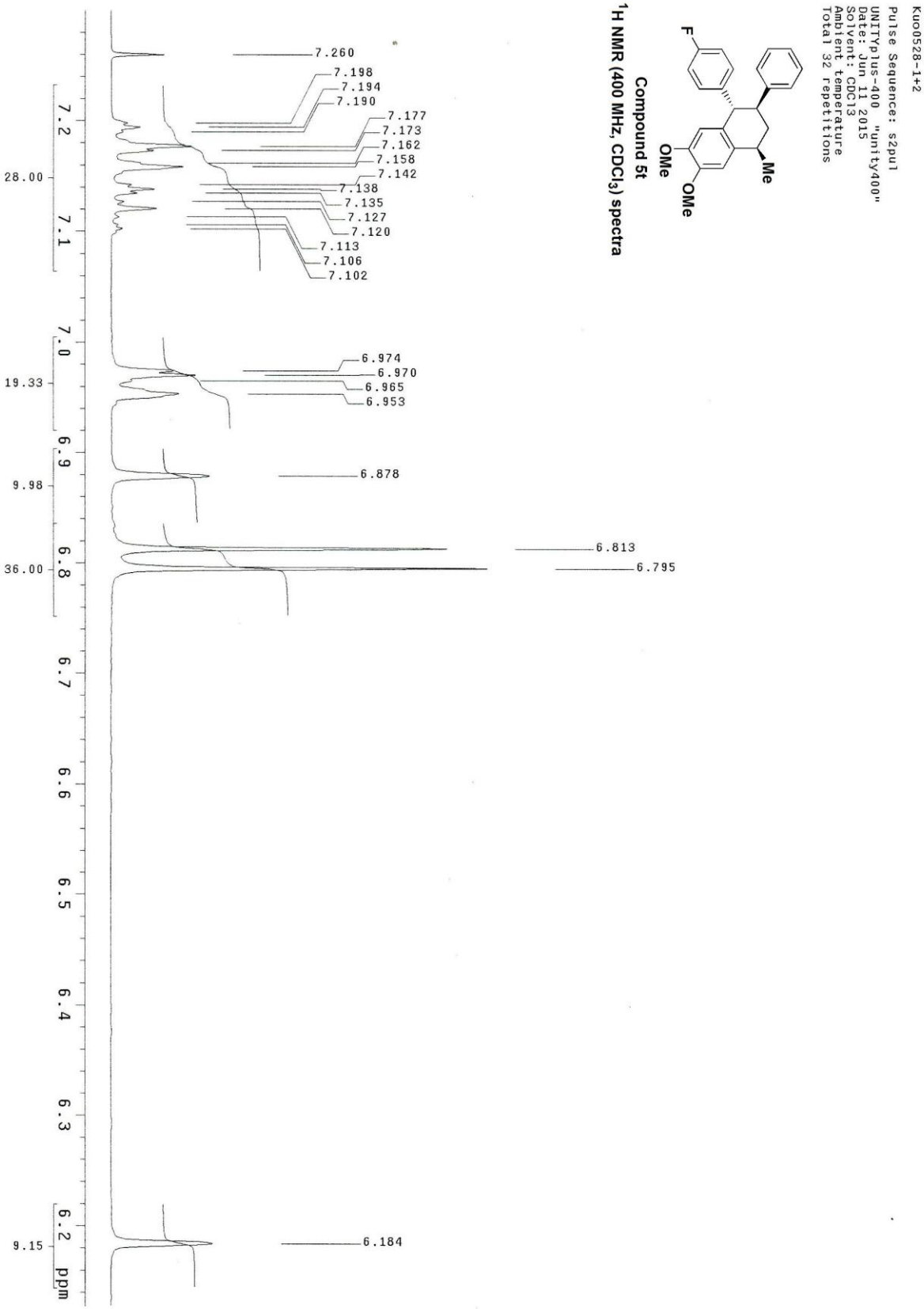
Compound 5s

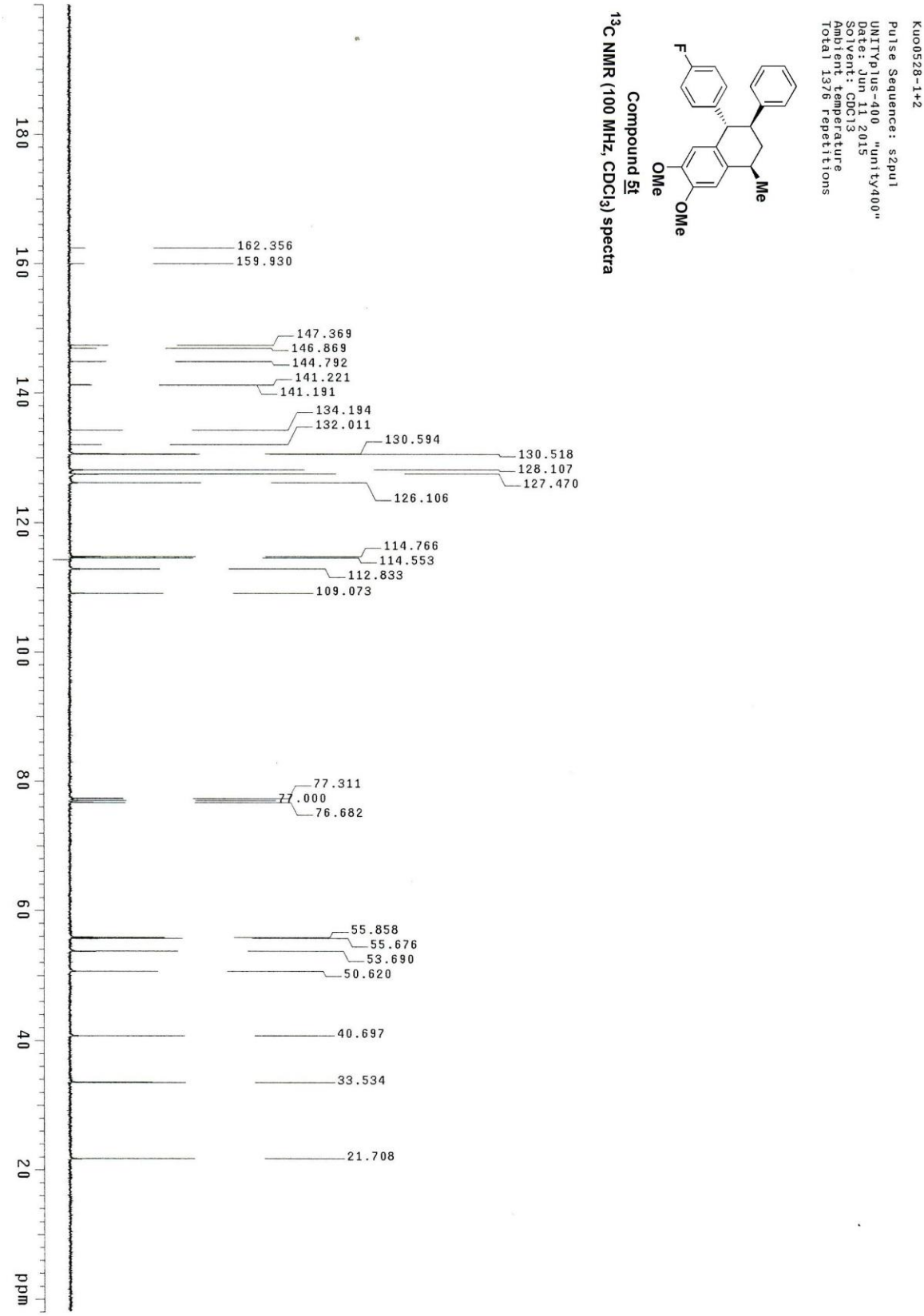
^{13}C NMR (100 MHz, $CDCl_3$) spectra

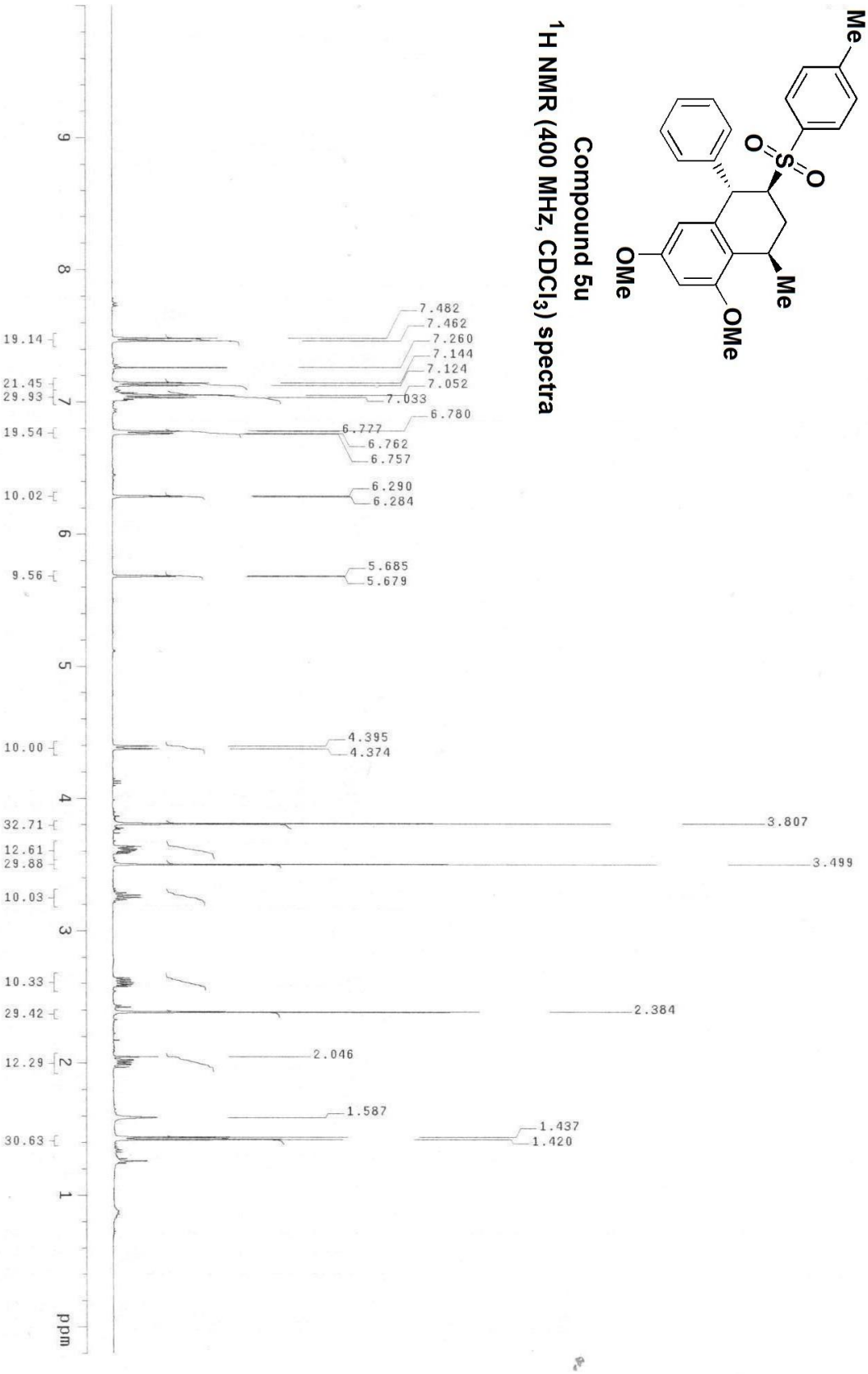


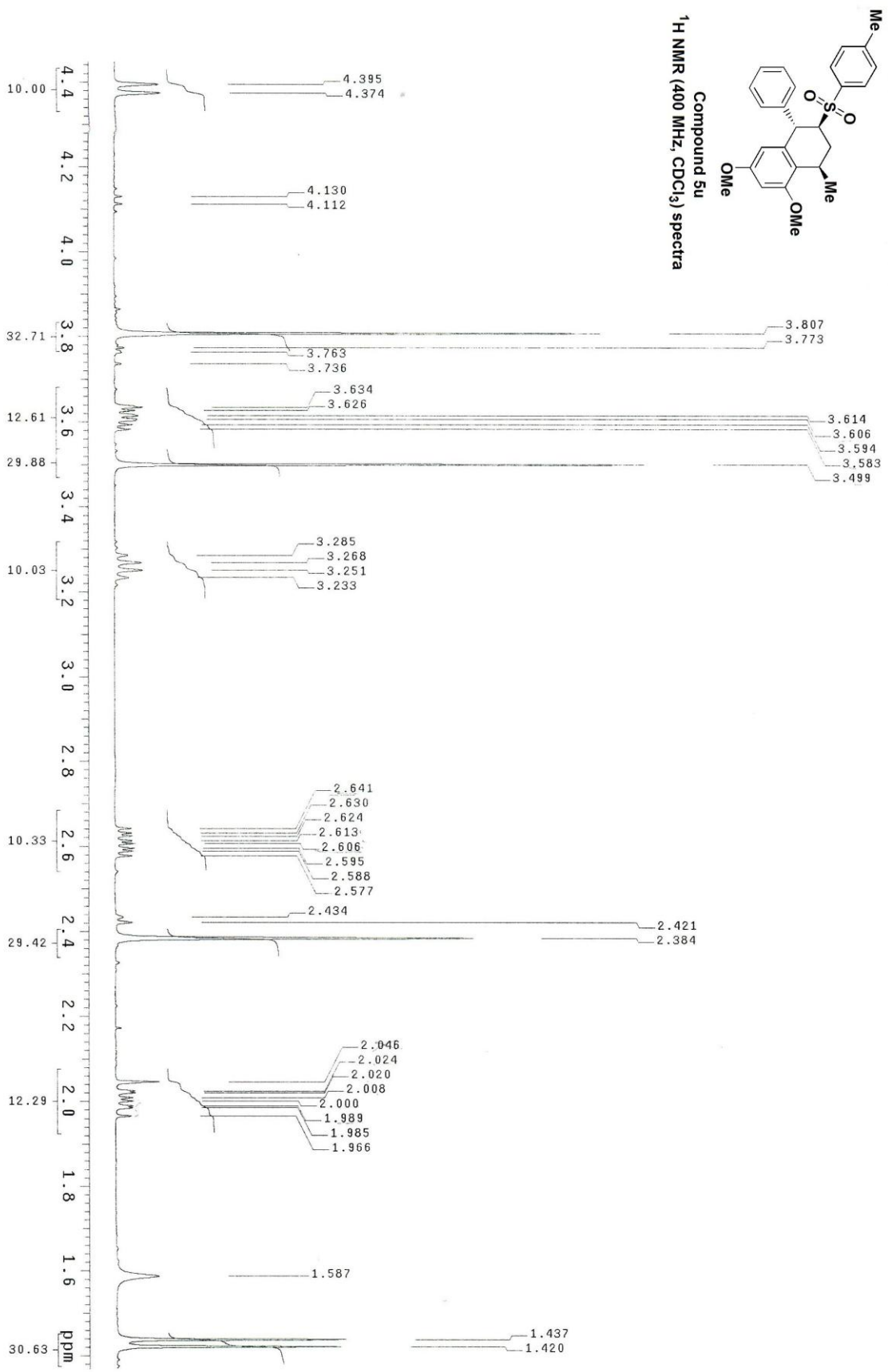

Kuo0528-1+2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 11 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
F
OMe
OMe
Me
Compound 5t
1H NMR (400 MHz, CDCl3) spectra
7.260
7.177
7.158
6.974
6.970
6.953
6.878
6.813
6.795
6.184
3.910
3.570
1.421
1.404
28.00
19.33
9.98
36.00
9.15
10.00
28.28
27.70
9.74
9.64
9.67
9.80
28.44
ppm

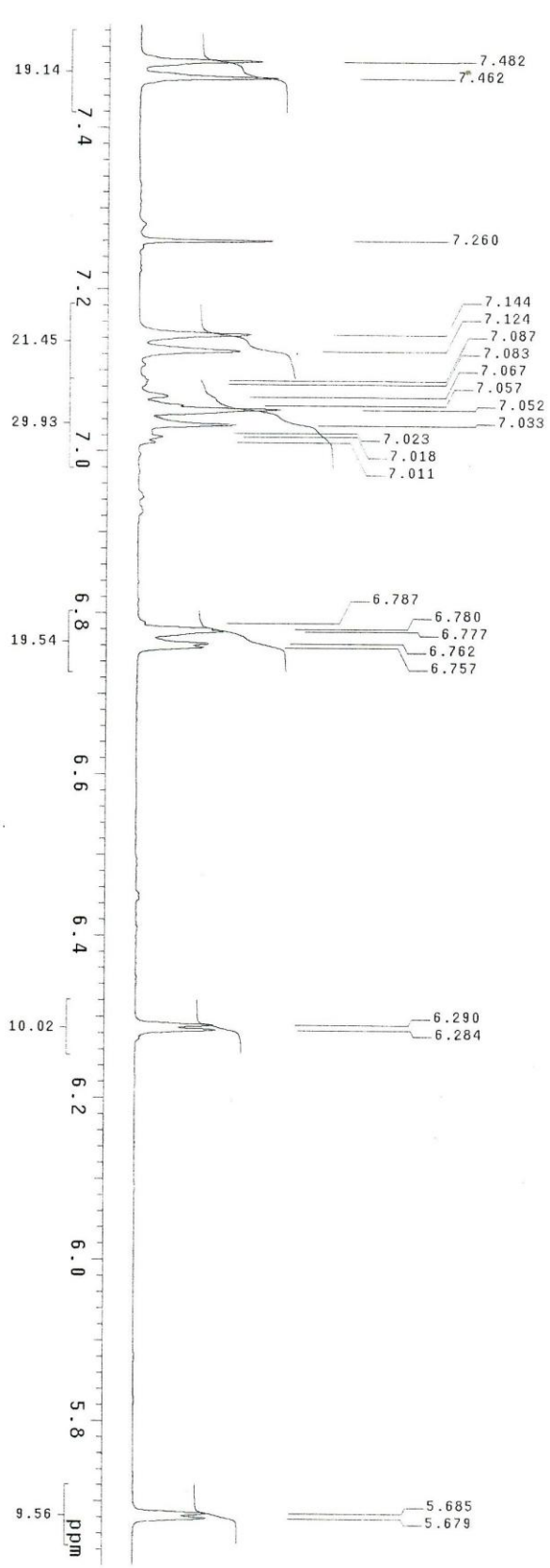

Kuo0528-1+2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 11 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
F
OMe
OMe
Me
Compound 5t
^{1}H NMR (400 MHz, CDCl$_3$) spectra
4.110
4.083
3.910
3.891
3.804
3.747
3.728
3.636
3.601
3.570
3.387
3.210
3.194
3.179
3.164
3.149
3.135
3.119
3.015
3.009
2.983
2.978
2.956
2.950
2.162
2.155
2.149
2.142
2.129
2.123
2.117
2.110
2.051
1.973
1.941
1.912
1.880
1.564
1.449
1.421
1.404
10.00
28.28
27.70
9.74
9.64
9.67
9.80
28.44
ppm


Kuo0528-1+2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 11 2015
Solvent: CDCl3
Ambient temperature
Total 32 repetitions
F
OMe
OMe
Me
Compound 5t
1H NMR (400 MHz, CDCl3) spectra
7.260
7.198
7.194
7.190
7.177
7.173
7.162
7.158
7.142
7.138
7.135
7.127
7.120
7.113
7.106
7.102
6.974
6.970
6.965
6.953
6.878
6.813
6.795
6.184
28.00
19.33
9.98
36.00
9.15
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
ppm


Kuo0528-1+2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 11 2015
Solvent: CDCl3
Ambient temperature
Total 1376 repetitions
F
OMe
OMe
Me
Compound 5t
13C NMR (100 MHz, CDCl3) spectra
162.356
159.930
147.369
146.869
144.792
141.221
141.191
134.194
132.011
130.594
130.518
128.107
127.470
126.106
114.766
114.553
112.833
109.073
77.311
77.000
76.682
55.858
55.676
53.690
50.620
40.697
33.534
21.708
180
160
140
120
100
80
60
40
20
ppm

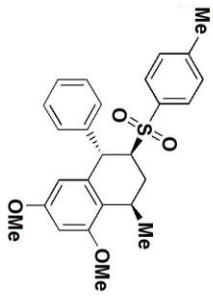

Kuo0204
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Feb 6 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
OMe
Me
OMe
Compound 5u
1H NMR (400 MHz, CDCl3) spectra
7.482
7.462
7.260
7.144
7.124
7.052
7.033
6.780
6.777
6.762
6.757
6.290
6.284
5.685
5.679
4.395
4.374
3.807
3.499
2.384
2.046
1.587
1.437
1.420
19.14
21.45
29.93
19.54
10.02
9.56
10.00
32.71
12.61
29.88
10.03
10.33
29.42
12.29
30.63
ppm

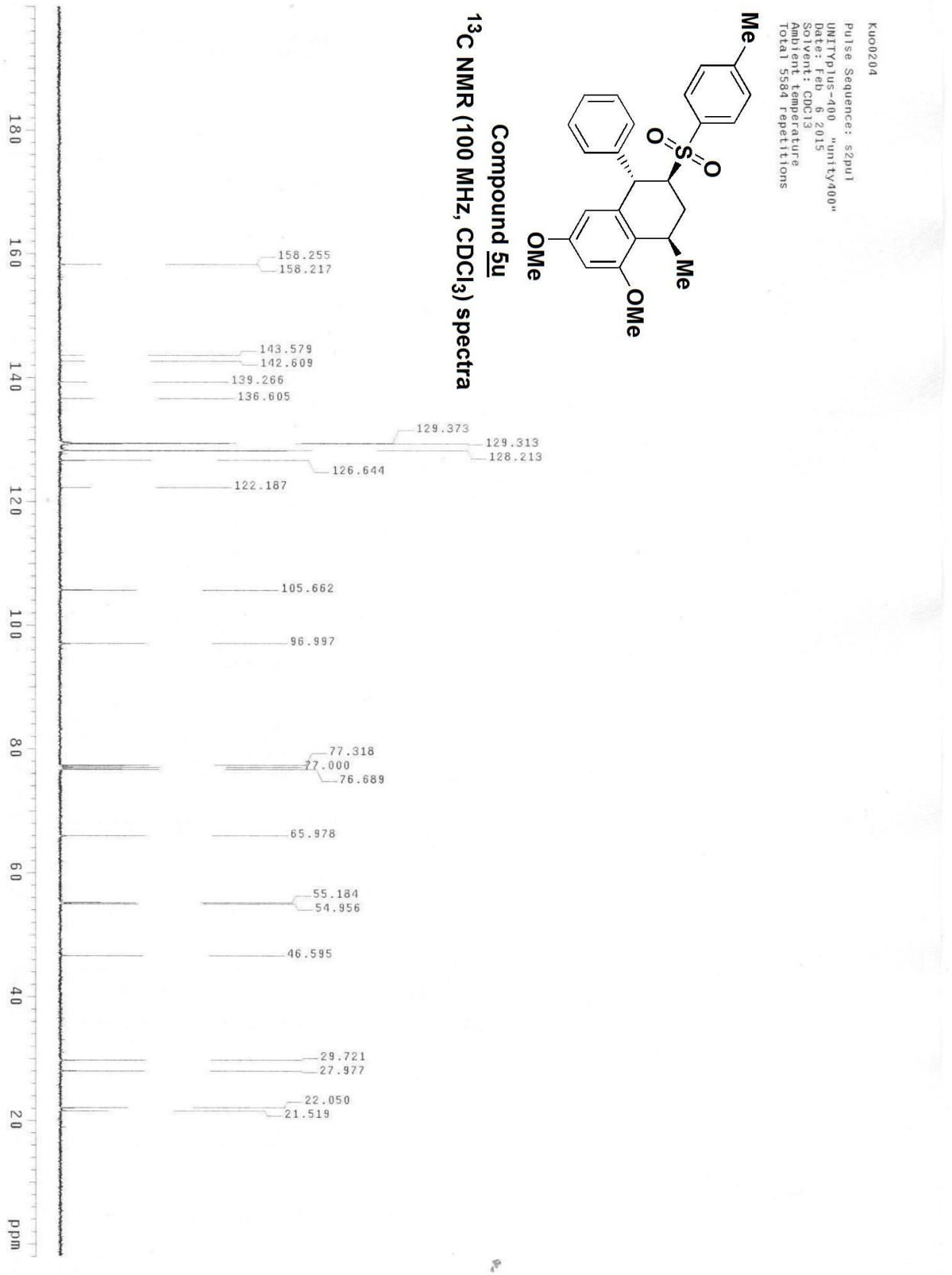

Compound 5u
^{1}H NMR (400 MHz, $CDCl_3$) spectra
Me
OMe
OMe
Me
4.395
4.374
4.130
4.112
3.807
3.773
3.763
3.736
3.634
3.626
3.614
3.606
3.594
3.583
3.499
3.285
3.268
3.251
3.233
2.641
2.630
2.624
2.613
2.606
2.595
2.588
2.577
2.434
2.421
2.384
2.046
2.024
2.020
2.008
2.000
1.989
1.985
1.966
1.587
1.437
1.420
10.00
32.71
12.61
29.88
10.03
10.33
29.42
12.29
30.63
ppm

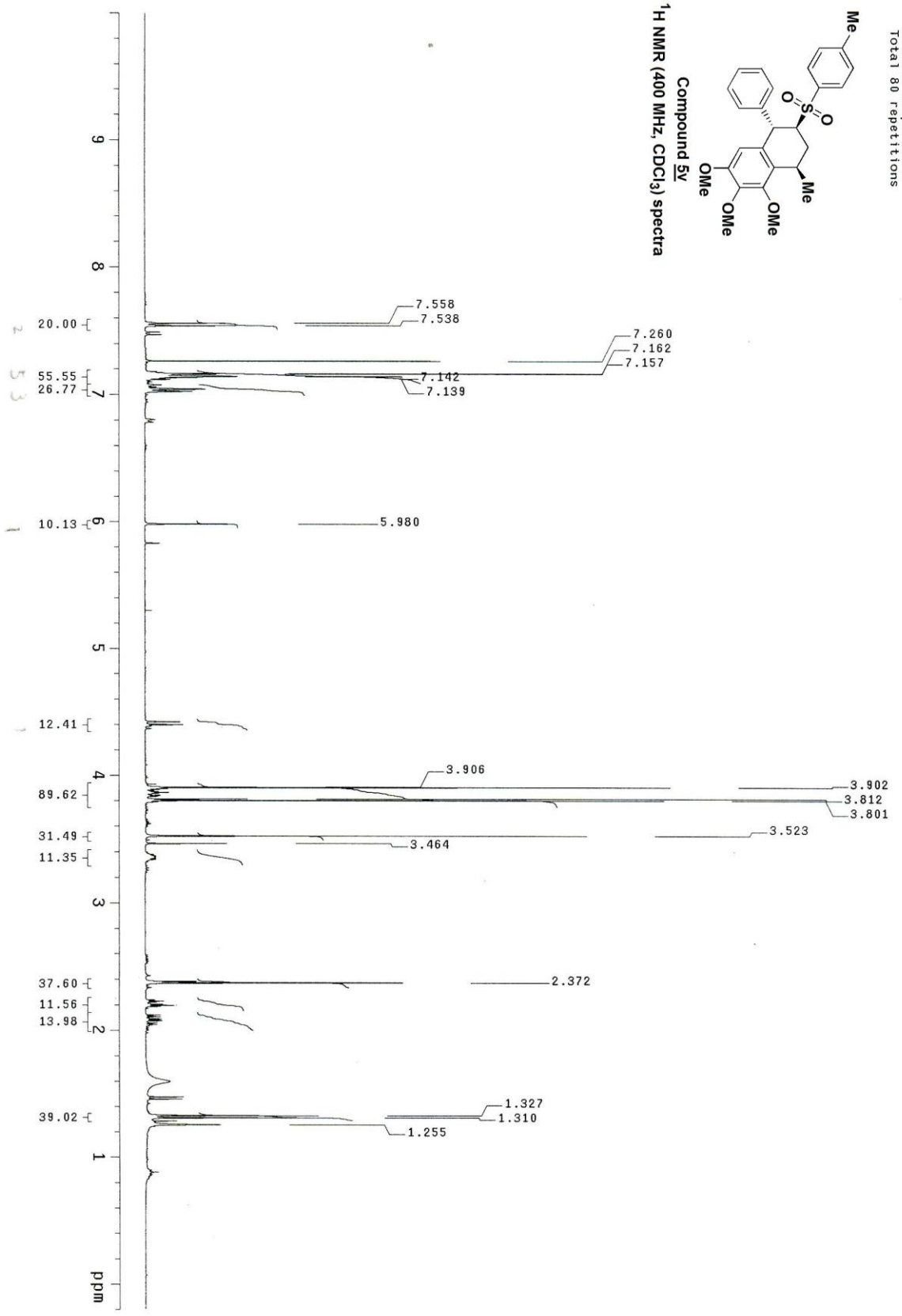


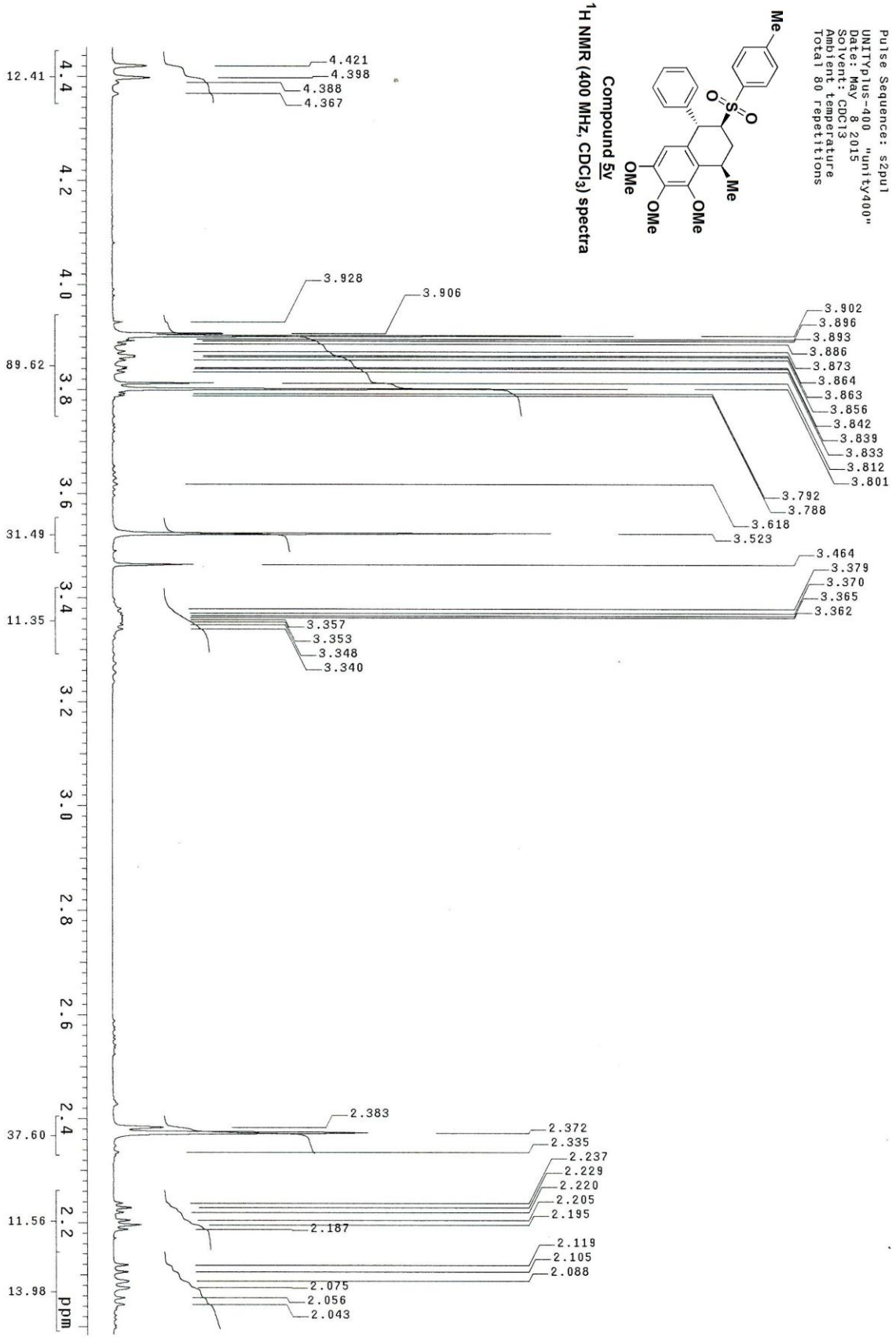
Compound 5u

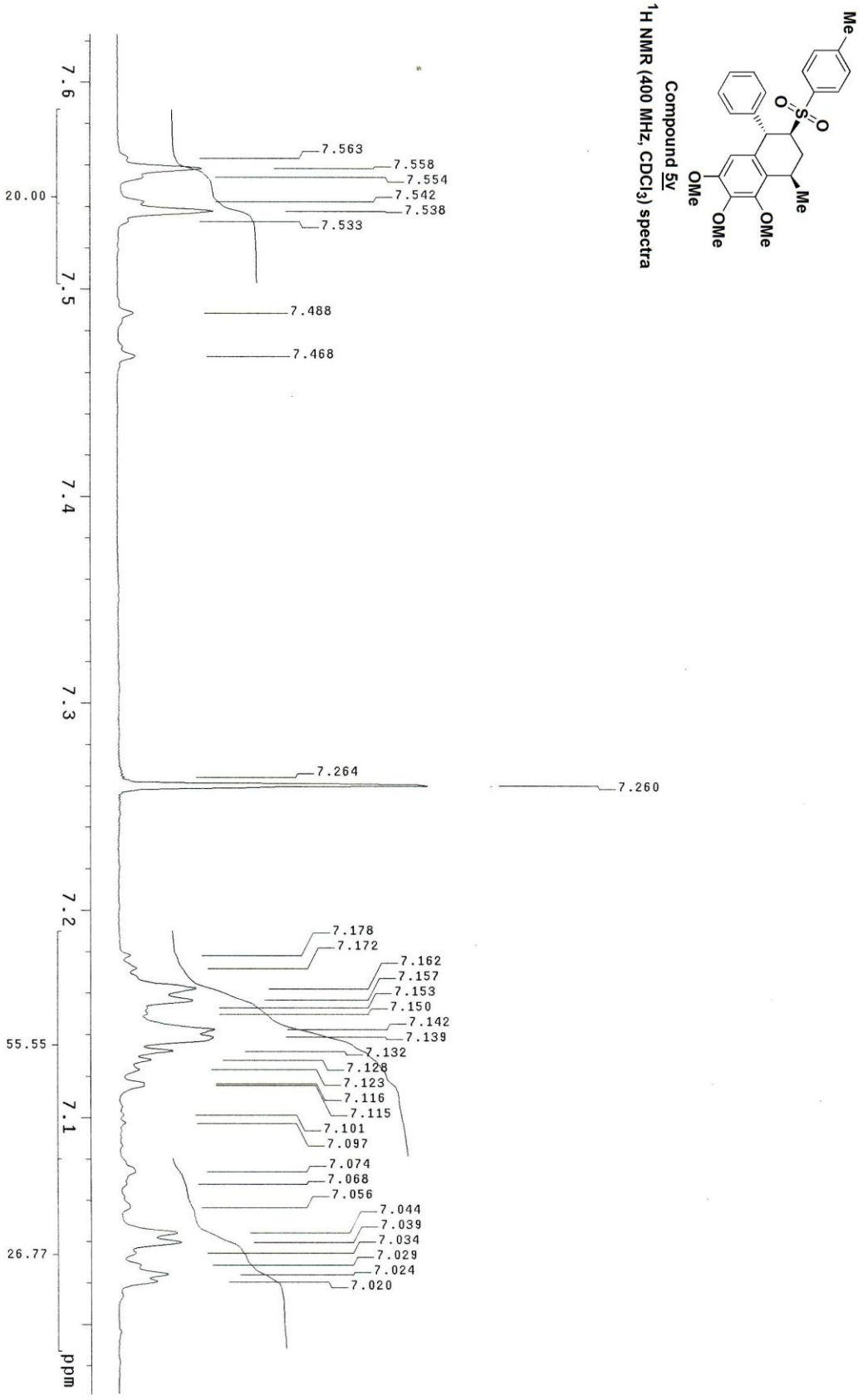
^{1}H NMR (400 MHz, $CDCl_3$) spectra

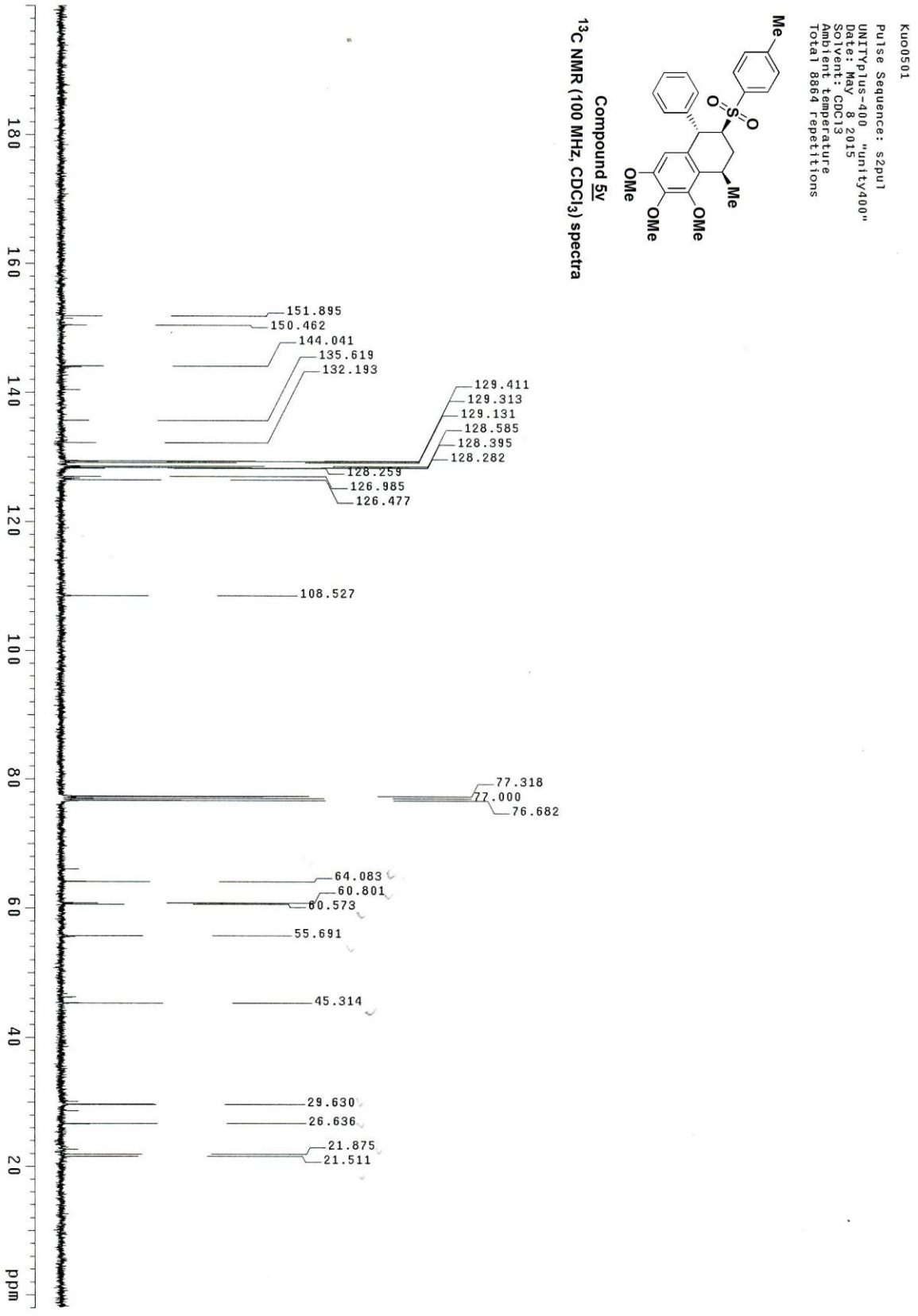


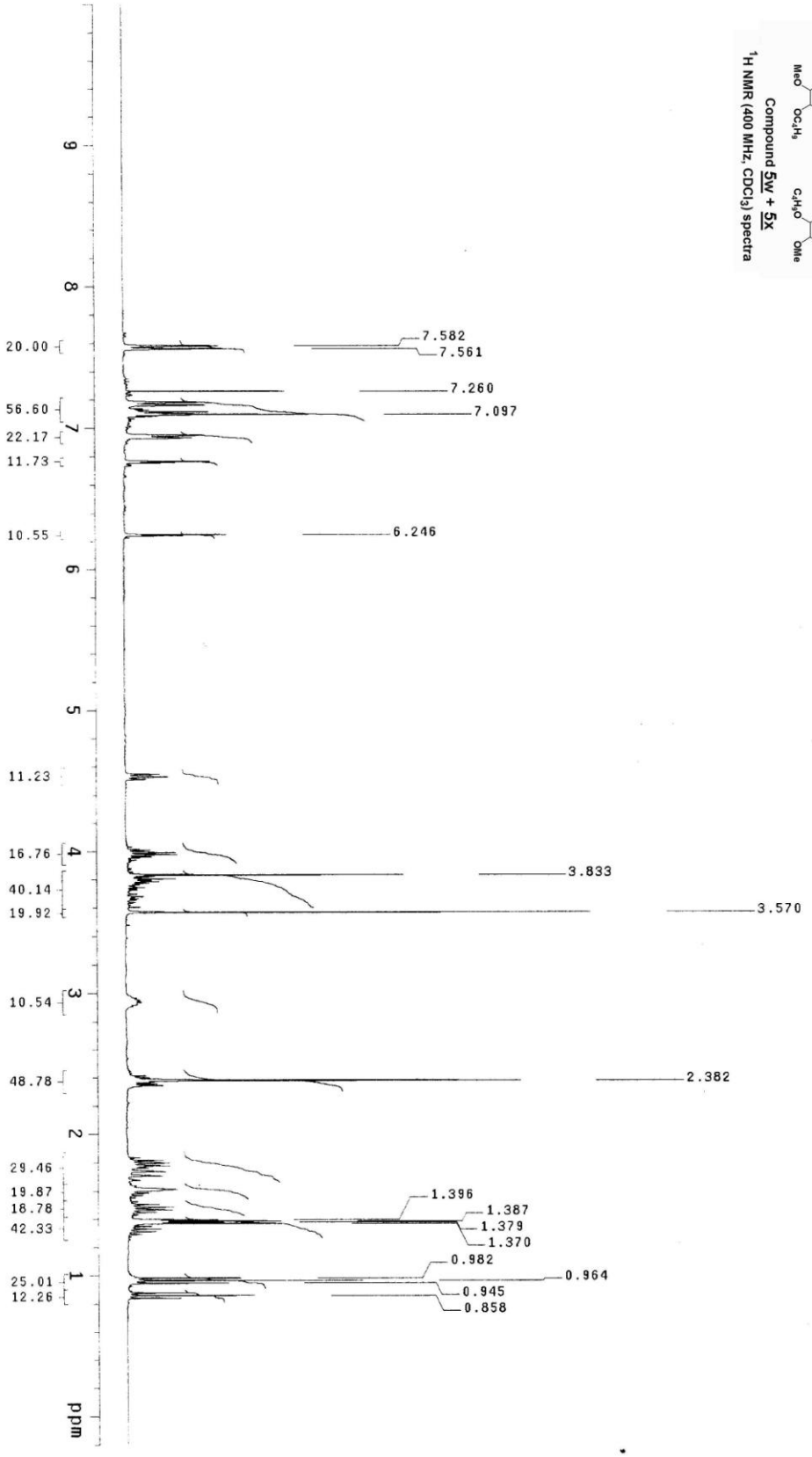

Kuo0204
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Feb 6 2015
Solvent: CDCl3
Ambient temperature
Total 5584 repetitions
Me
O
S
O
Me
OMe
OMe
Compound 5u
13C NMR (100 MHz, CDCl3) spectra
158.255
158.217
143.579
142.609
139.266
136.605
129.373
129.313
128.213
126.644
122.187
105.662
96.997
77.318
77.000
76.689
65.978
55.184
54.956
46.595
29.721
27.977
22.050
21.519
180
160
140
120
100
80
60
40
20
ppm

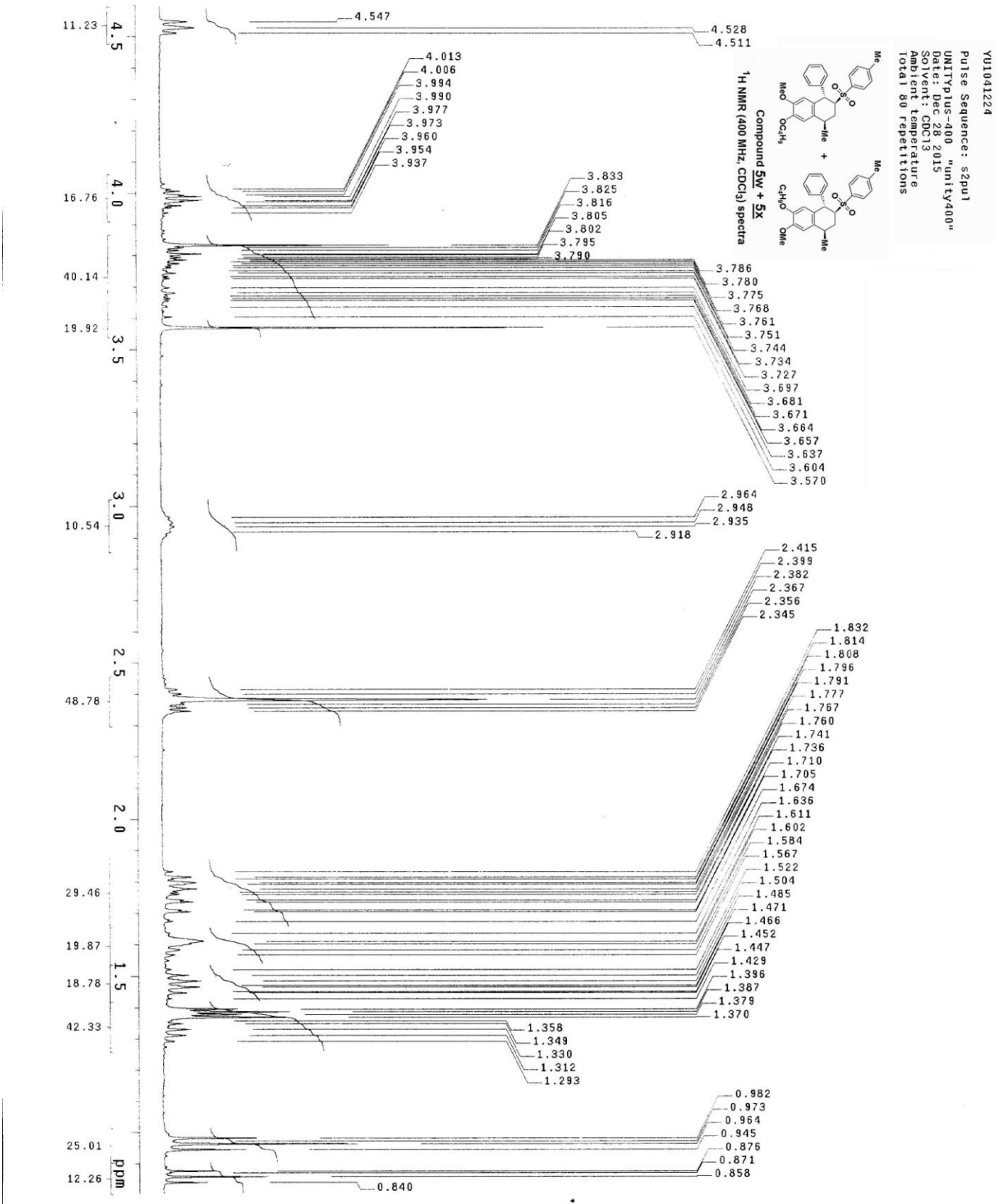

Kuo0501
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 8 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Compound 5y
1H NMR (400 MHz, CDCl3) spectra
Me
OMe
OMe
OMe
Me
20.00
55.55
26.77
10.13
12.41
89.62
31.49
11.35
37.60
11.56
13.98
39.02
7.558
7.538
7.260
7.162
7.157
7.142
7.139
5.980
3.906
3.902
3.812
3.801
3.523
3.464
2.372
1.327
1.310
1.255
ppm

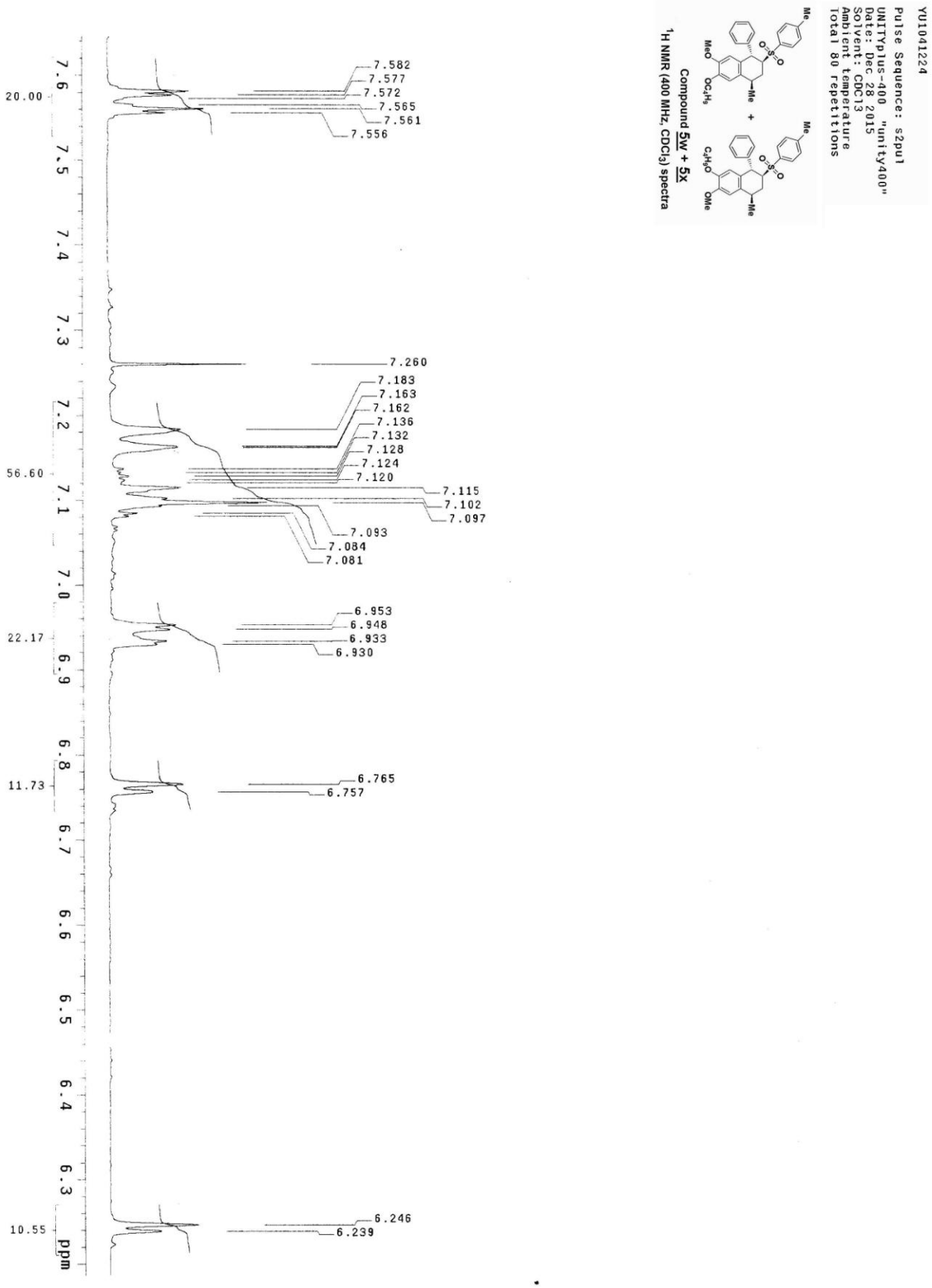

Kuo0501
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 8 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Compound 5v
1H NMR (400 MHz, CDCl3) spectra
Me
OMe
OMe
OMe
Me
4.421
4.398
4.388
4.367
3.928
3.906
3.902
3.896
3.893
3.886
3.873
3.864
3.863
3.856
3.842
3.839
3.833
3.812
3.801
3.792
3.788
3.618
3.523
3.464
3.379
3.370
3.365
3.362
3.357
3.353
3.348
3.340
2.383
2.372
2.335
2.237
2.229
2.220
2.205
2.195
2.187
2.119
2.105
2.088
2.075
2.056
2.043
12.41
89.62
31.49
11.35
37.60
11.56
13.98
ppm


Kuo0501
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 8 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Me
O
S
O
Me
OMe
OMe
OMe
Compound 5v
1H NMR (400 MHz, CDCl3) spectra
7.6
7.5
7.4
7.3
7.2
7.1
ppm
20.00
55.55
26.77
7.563
7.558
7.554
7.542
7.538
7.533
7.488
7.468
7.264
7.260
7.178
7.172
7.162
7.157
7.153
7.150
7.142
7.139
7.132
7.128
7.123
7.116
7.115
7.101
7.097
7.074
7.068
7.056
7.044
7.039
7.034
7.029
7.024
7.020


Kuo0501
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: May 8 2015
Solvent: CDCl3
Ambient temperature
Total 8864 repetitions
Me
OMe
OMe
OMe
Me
Compound 5v
13C NMR (100 MHz, CDCl3) spectra
151.895
150.462
144.041
135.619
132.193
129.411
129.313
129.131
128.585
128.395
128.282
128.259
126.985
126.477
108.527
77.318
77.000
76.682
64.083
60.801
60.573
55.691
45.314
29.630
26.636
21.875
21.511
180
160
140
120
100
80
60
40
20
ppm


YU1041224
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Dec 28 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Compound 5w + 5x
1H NMR (400 MHz, CDCl3) spectra
20.00
56.60
22.17
11.73
10.55
11.23
16.76
40.14
19.92
10.54
48.78
29.46
19.87
18.78
42.33
25.01
12.26
7.582
7.561
7.260
7.097
6.246
3.833
3.570
2.382
1.396
1.387
1.379
1.370
0.982
0.964
0.945
0.858
ppm

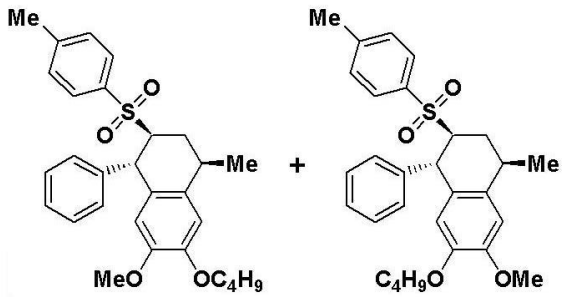

YU1041224
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Dec 28 2015
Solvent: CDCl3
Ambient temperature
total 80 repetitions
Compound 5w + 5x
1H NMR (400 MHz, CDCl3) spectra
4.547
4.528
4.511
4.013
4.006
3.994
3.990
3.977
3.973
3.960
3.954
3.937
3.833
3.825
3.816
3.805
3.802
3.795
3.790
3.786
3.780
3.775
3.768
3.761
3.751
3.744
3.734
3.727
3.697
3.681
3.671
3.664
3.657
3.637
3.604
3.570
2.964
2.948
2.935
2.918
2.415
2.399
2.382
2.367
2.356
2.345
1.832
1.814
1.808
1.796
1.791
1.777
1.767
1.760
1.741
1.736
1.710
1.705
1.674
1.636
1.611
1.602
1.584
1.567
1.522
1.504
1.485
1.471
1.466
1.452
1.447
1.429
1.396
1.387
1.379
1.370
1.358
1.349
1.330
1.312
1.293
0.982
0.973
0.964
0.945
0.876
0.871
0.858
0.840
11.23
16.76
40.14
19.92
10.54
48.78
29.46
19.87
18.78
42.33
25.01
12.26
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm


YU1041224
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Dec 28 2015
Solvent: CDCl3
Ambient temperature
Total 80 repetitions
Compound 5w + 5x
1H NMR (400 MHz, CDCl3) spectra
7.582
7.577
7.572
7.565
7.561
7.556
7.260
7.183
7.163
7.162
7.136
7.132
7.128
7.124
7.120
7.115
7.102
7.097
7.093
7.084
7.081
6.953
6.948
6.933
6.930
6.765
6.757
6.246
6.239
20.00
56.60
22.17
11.73
10.55
ppm

YU1041224

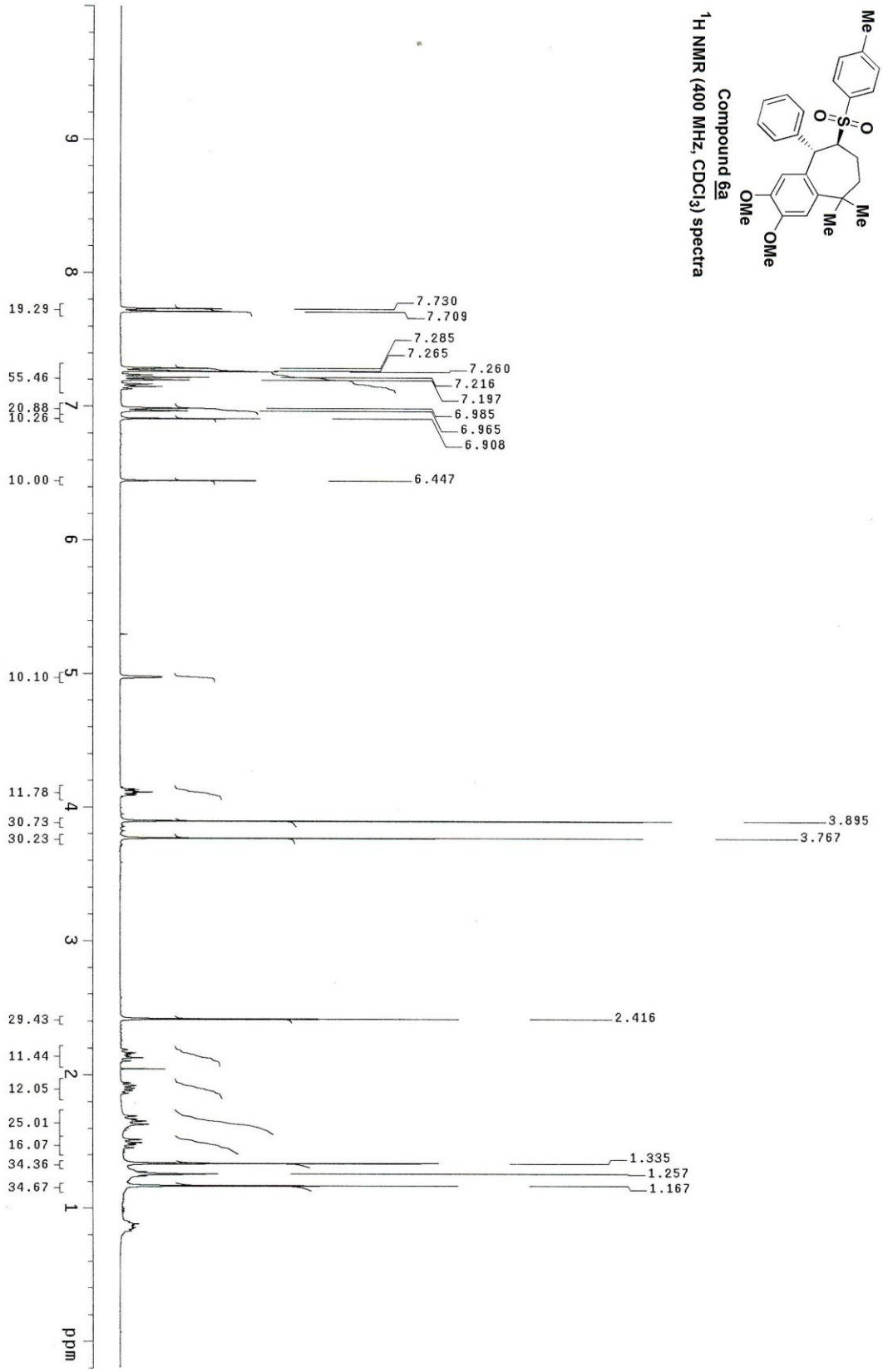
Pulse Sequence: s2pul

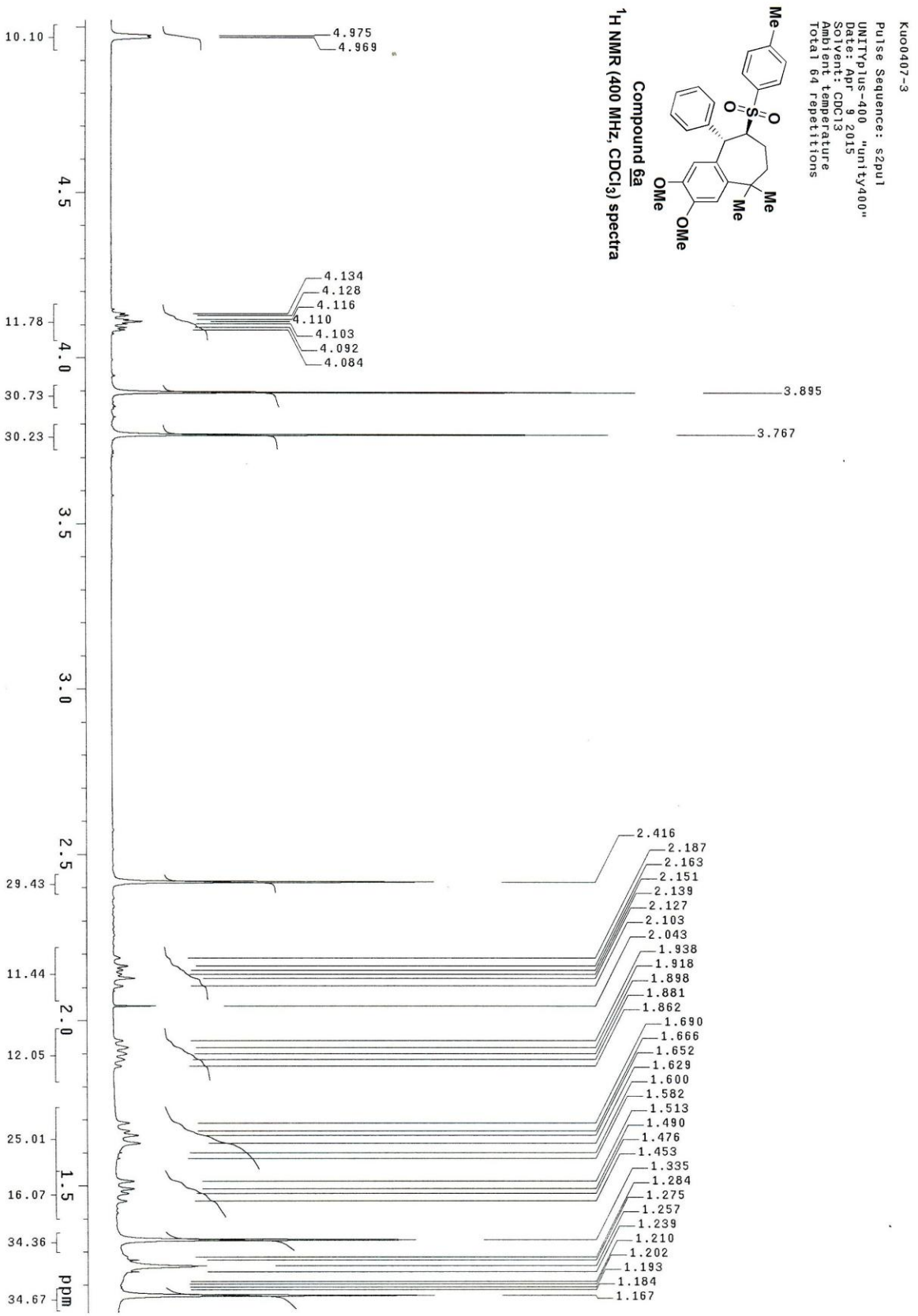
UNITYplus-400 "unity400"
Date: Dec 28 2015
Solvent: CDCl3
Ambient temperature
Total 25968 repetitions

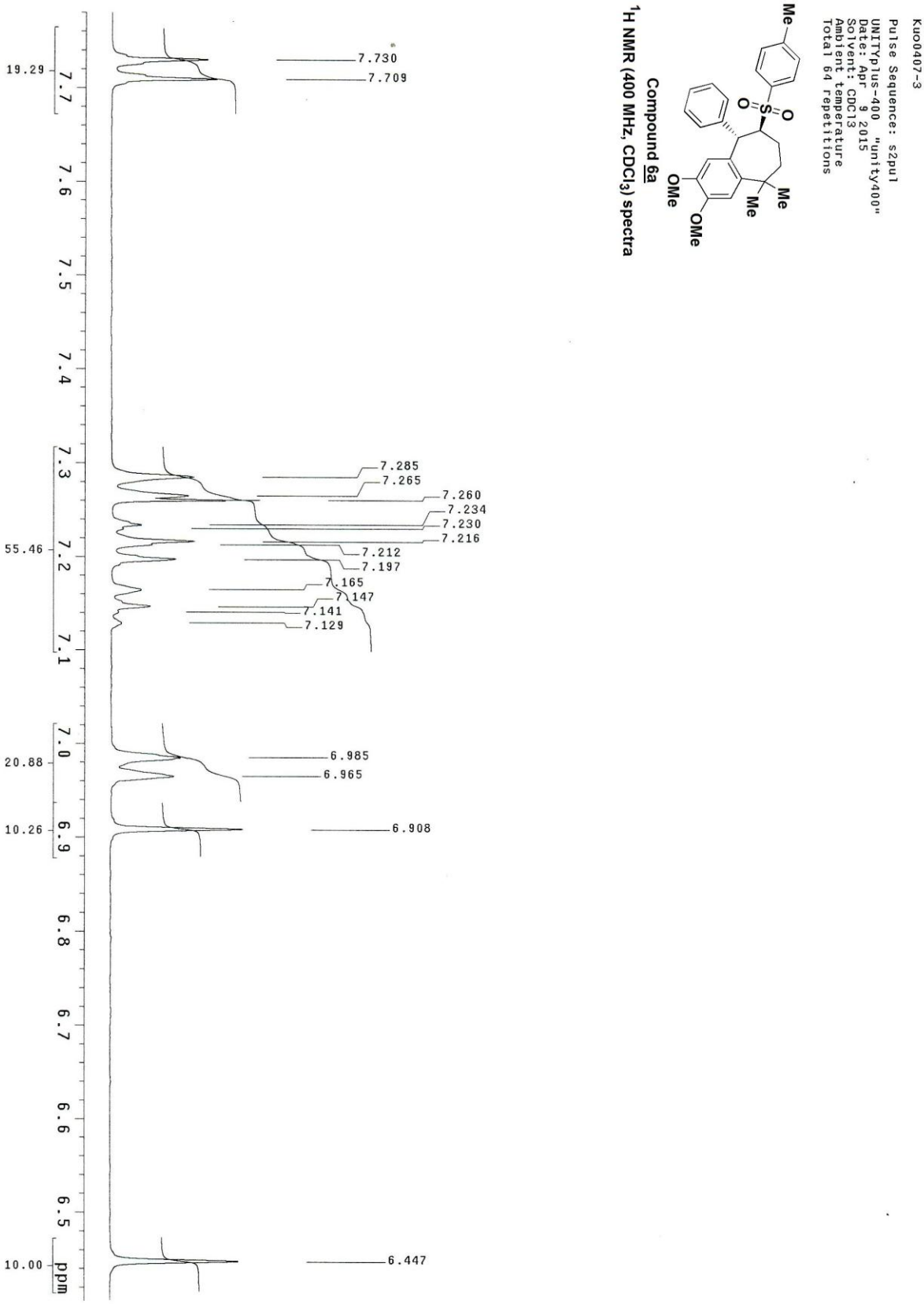


Compound 5w + 5x

^{13}C NMR (100 MHz, $CDCl_3$) spectra

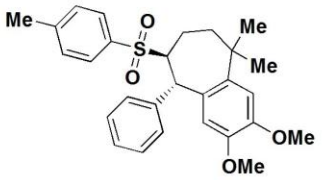

Kuo0407-3
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
Me
Me
OMe
OMe
Compound 6a
1H NMR (400 MHz, CDCl3) spectra
19.29
55.46
20.88
10.26
10.00
10.10
11.78
30.73
30.23
29.43
11.44
12.05
25.01
16.07
34.36
34.67
7.730
7.709
7.285
7.265
7.260
7.216
7.197
6.985
6.965
6.908
6.447
3.895
3.767
2.416
1.335
1.257
1.167
ppm


Kuo0407-3
Pulse Sequence: s2pul
UNITyplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 6a
1H NMR (400 MHz, CDCl3) spectra
Me
O
S
O
Me
Me
OMe
OMe
10.10
4.975
4.969
4.5
11.78
4.134
4.128
4.116
4.110
4.103
4.092
4.084
4.0
30.73
3.895
30.23
3.767
3.5
3.0
2.5
29.43
2.416
2.187
2.163
2.151
2.139
2.127
2.103
2.043
11.44
1.938
1.918
1.898
1.881
1.862
2.0
12.05
1.690
1.666
1.652
1.629
1.600
1.582
1.513
25.01
1.490
1.476
1.453
1.335
1.284
1.5
16.07
1.275
1.257
1.239
34.36
1.210
1.202
1.193
1.184
34.67
1.167
ppm


Kuo0407-3
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
O
S
Me
Me
OMe
OMe
Compound 6a
1H NMR (400 MHz, CDCl3) spectra
19.29
55.46
20.88
10.26
10.00
7.730
7.709
7.285
7.265
7.260
7.234
7.230
7.216
7.212
7.197
7.165
7.147
7.141
7.129
6.985
6.965
6.908
6.447
ppm

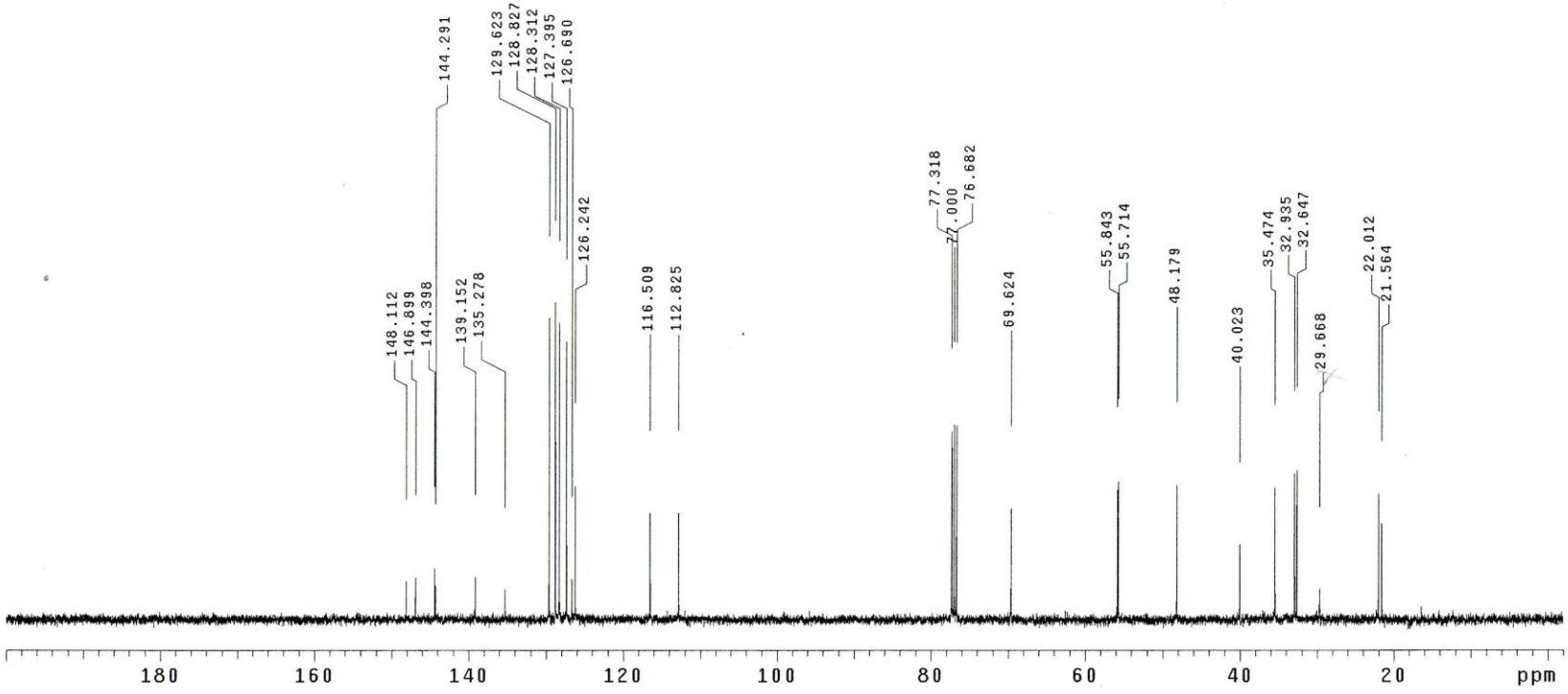
Kuo0407-3

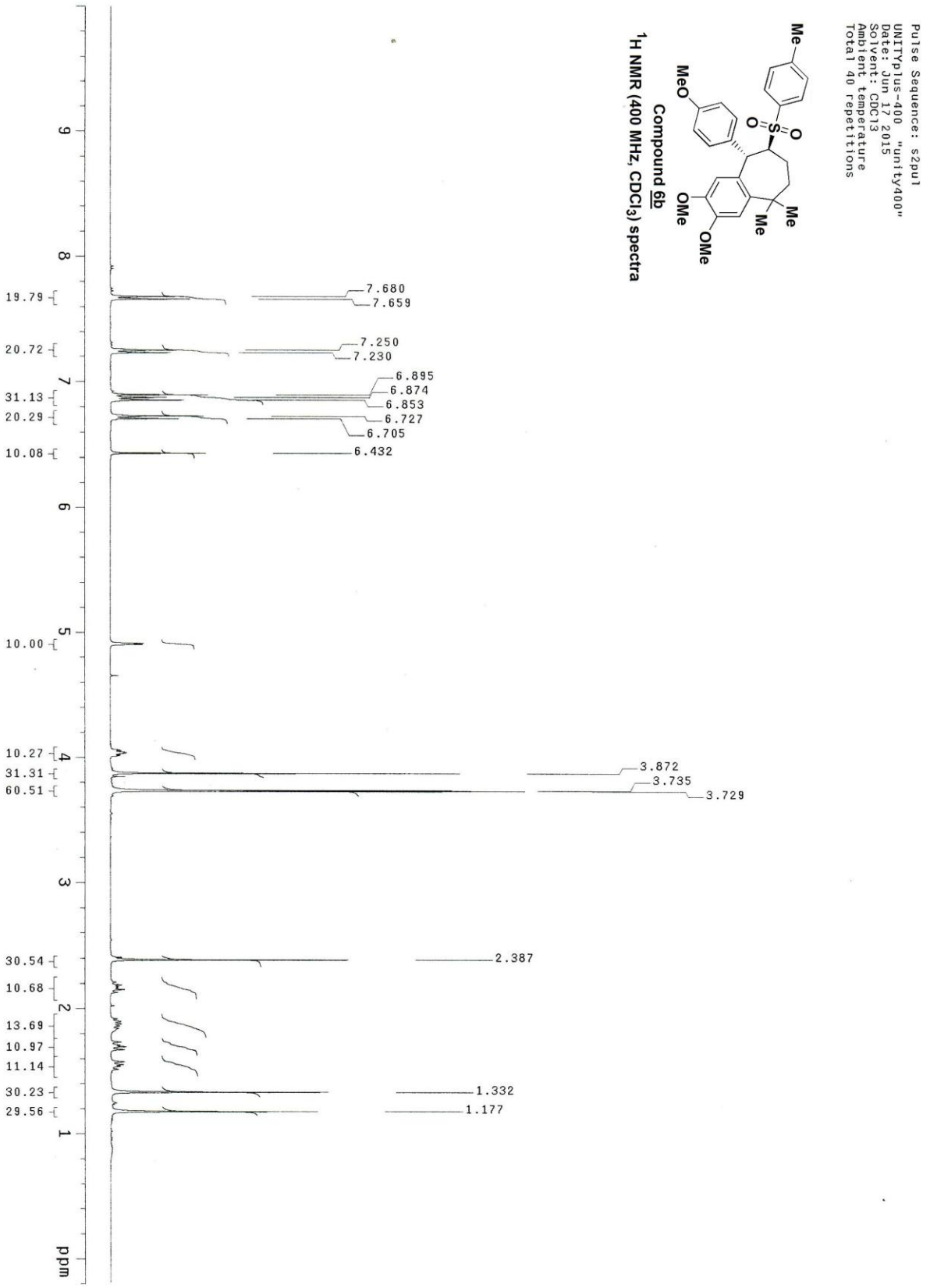
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 12800 repetitions

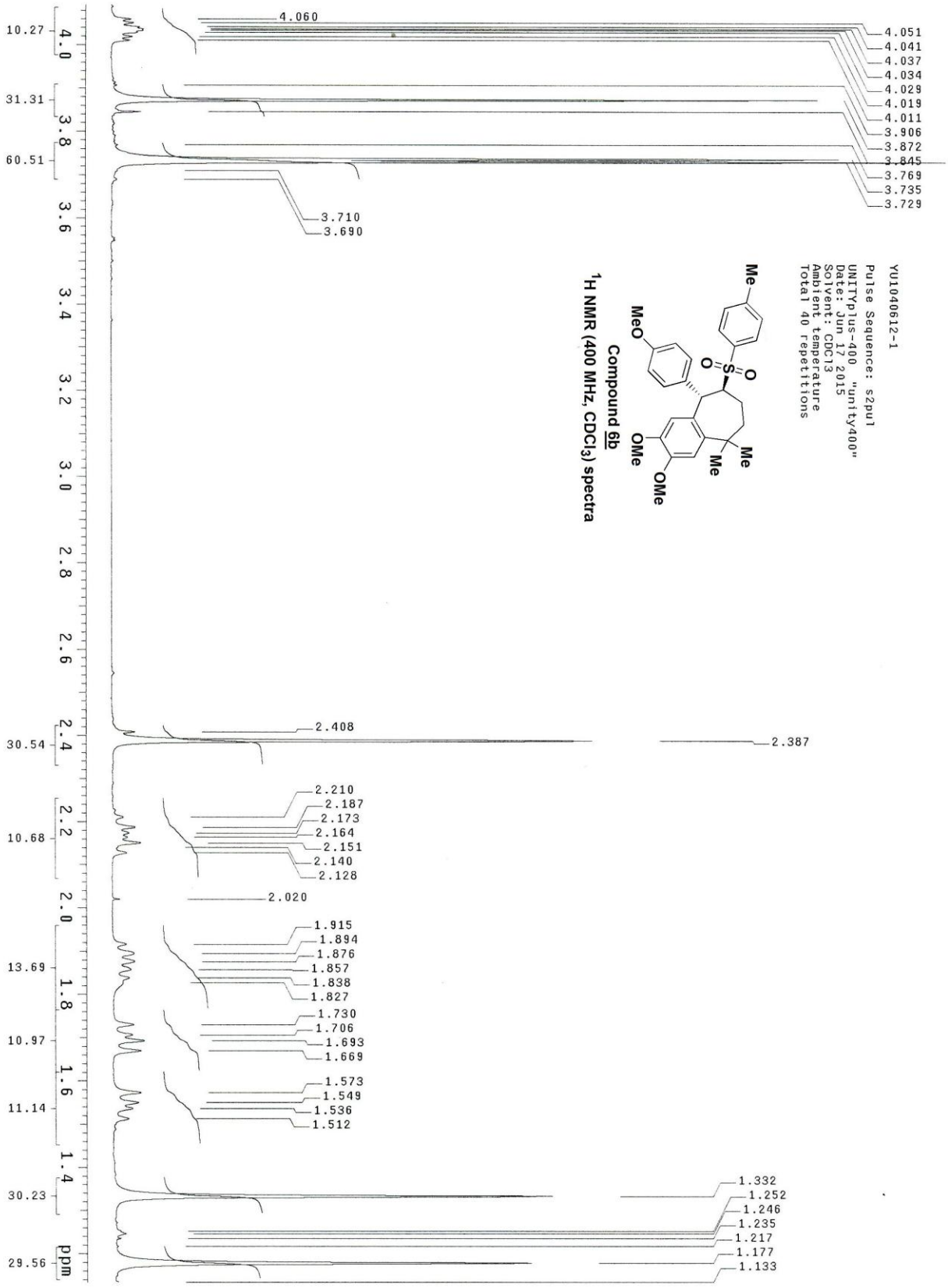


Compound 6a

^{13}C NMR (100 MHz, $CDCl_3$) spectra

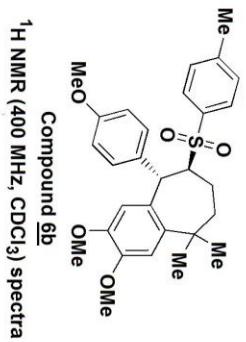



YU1040612-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 40 repetitions
Me
MeO
OMe
OMe
Me
Me
Compound 6b
1H NMR (400 MHz, CDCl3) spectra
19.79
20.72
31.13
20.29
10.08
10.00
10.27
31.31
60.51
30.54
10.68
13.69
10.97
11.14
30.23
29.56
7.680
7.659
7.250
7.230
6.895
6.874
6.853
6.727
6.705
6.432
3.872
3.735
3.729
2.387
1.332
1.177
ppm


4.060
4.051
4.041
4.037
4.034
4.029
4.019
4.011
3.906
3.872
3.845
3.769
3.735
3.729
3.710
3.690
2.408
2.387
2.210
2.187
2.173
2.164
2.151
2.140
2.128
2.020
1.915
1.894
1.876
1.857
1.838
1.827
1.730
1.706
1.693
1.669
1.573
1.549
1.536
1.512
1.332
1.252
1.246
1.235
1.217
1.177
1.133
10.27
31.31
60.51
30.54
10.68
13.69
10.97
11.14
30.23
29.56
ppm
YU1040612-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 40 repetitions
Compound 6b
1H NMR (400 MHz, CDCl3) spectra
Me
MeO
OMe
OMe
Me
Me
S
O
O

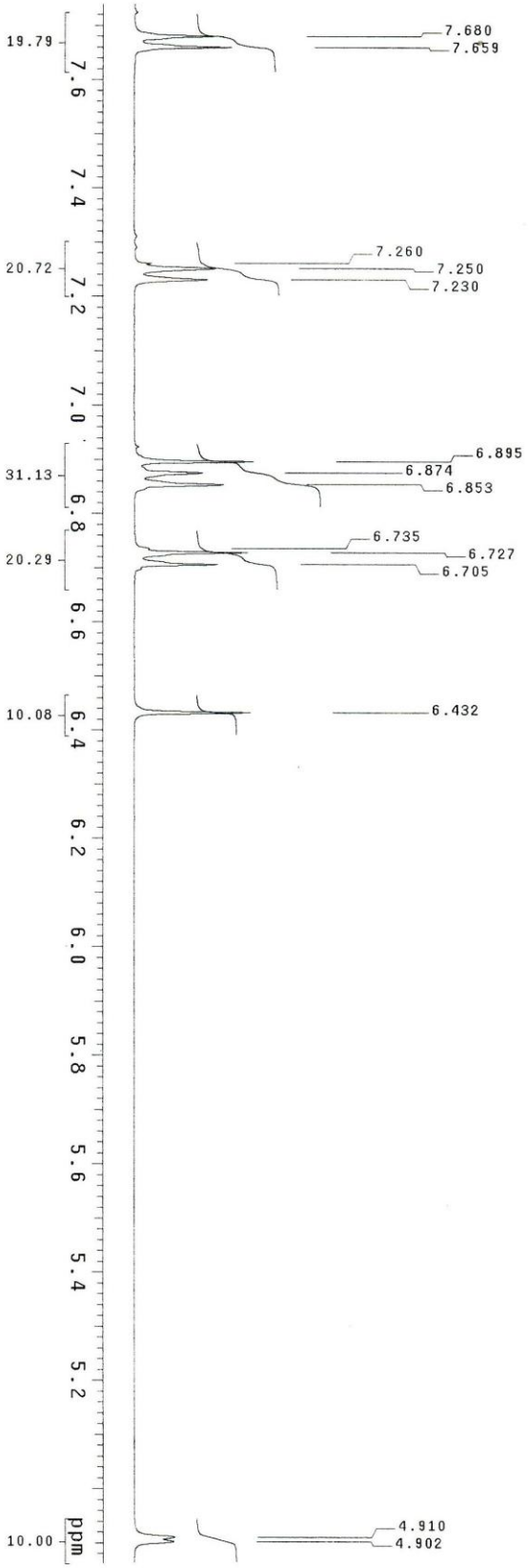
YU1040612-1

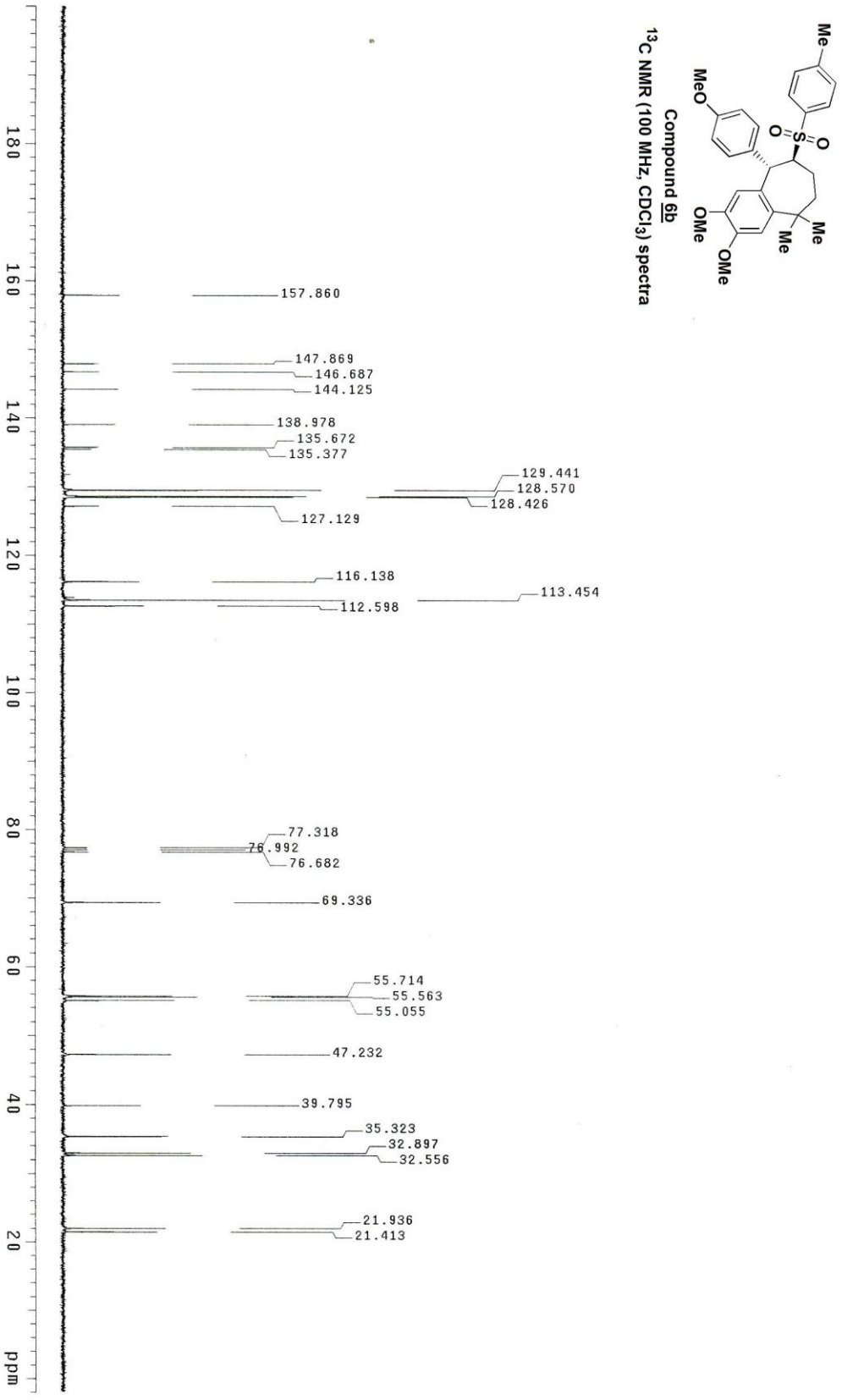
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 40 repetitions

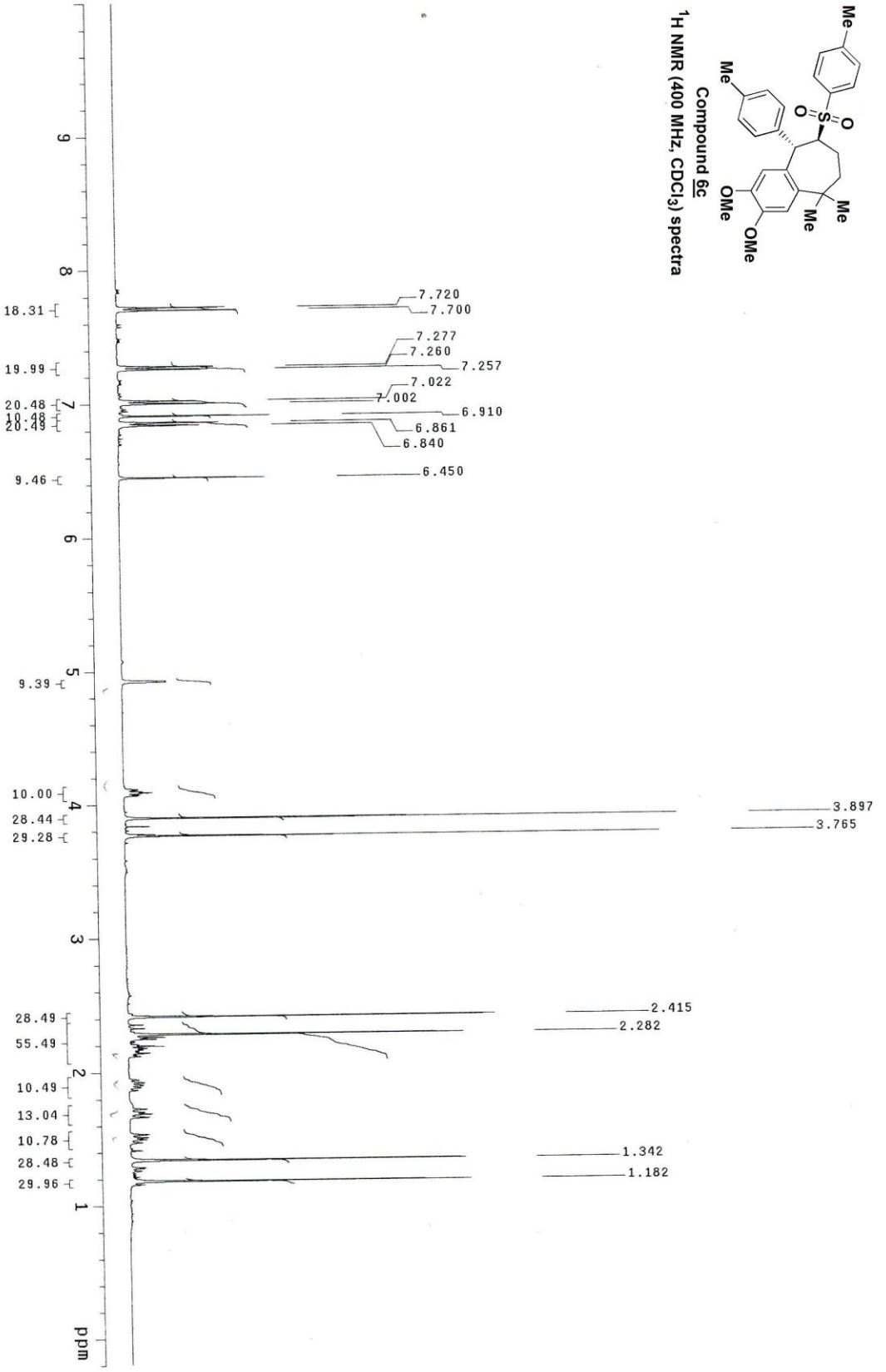


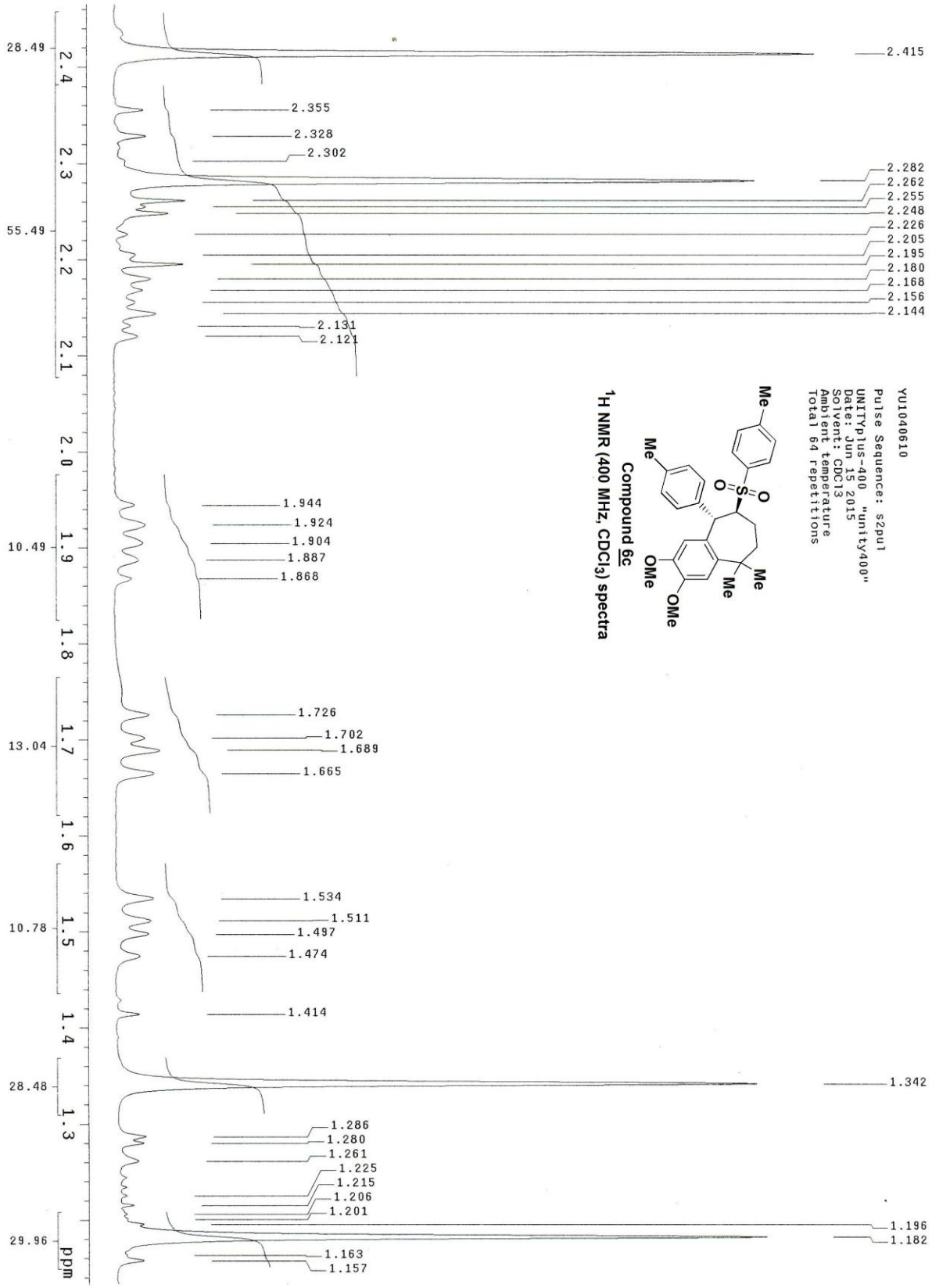
Compound 6b

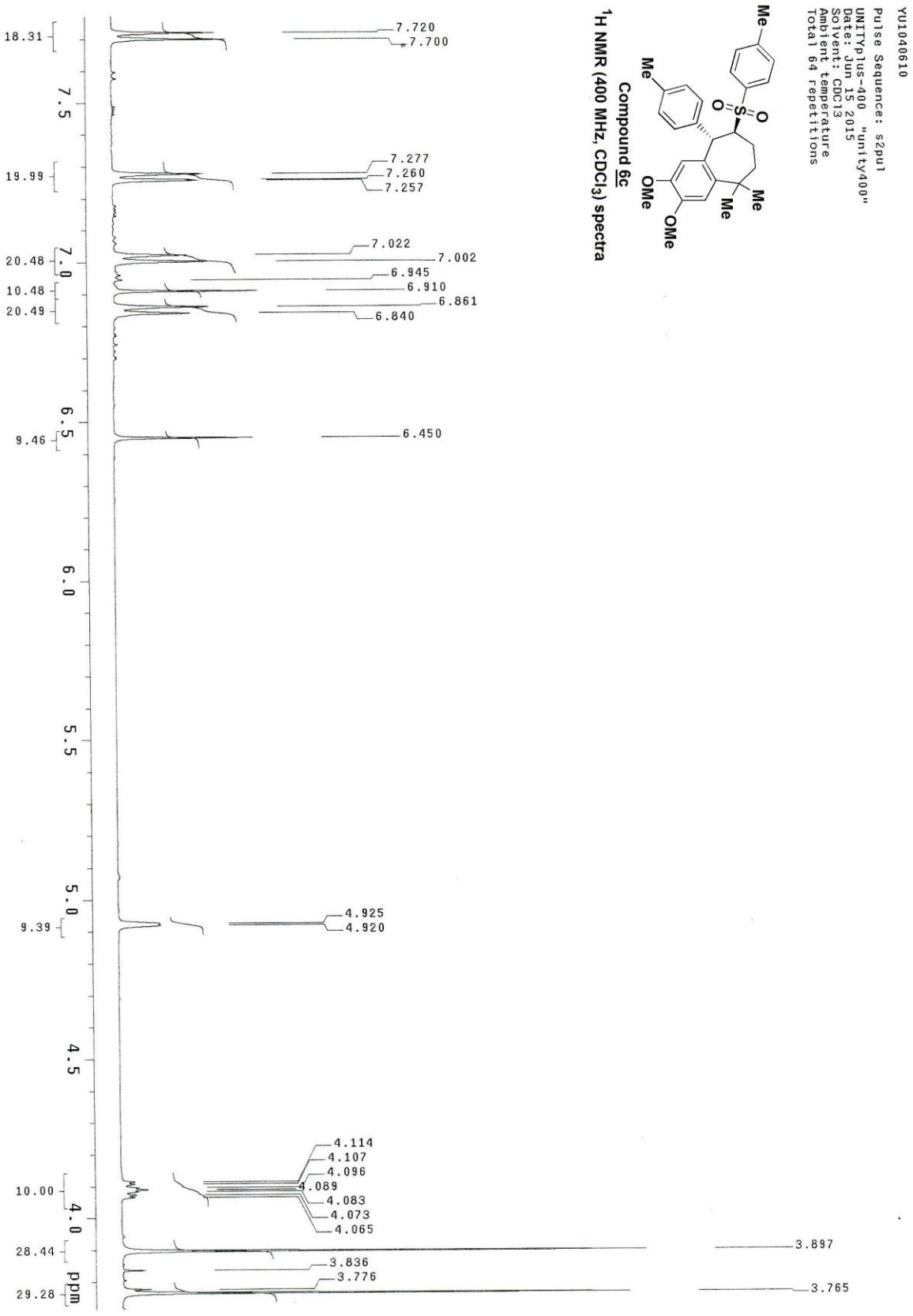
^{1}H NMR (400 MHz, $CDCl_3$) spectra

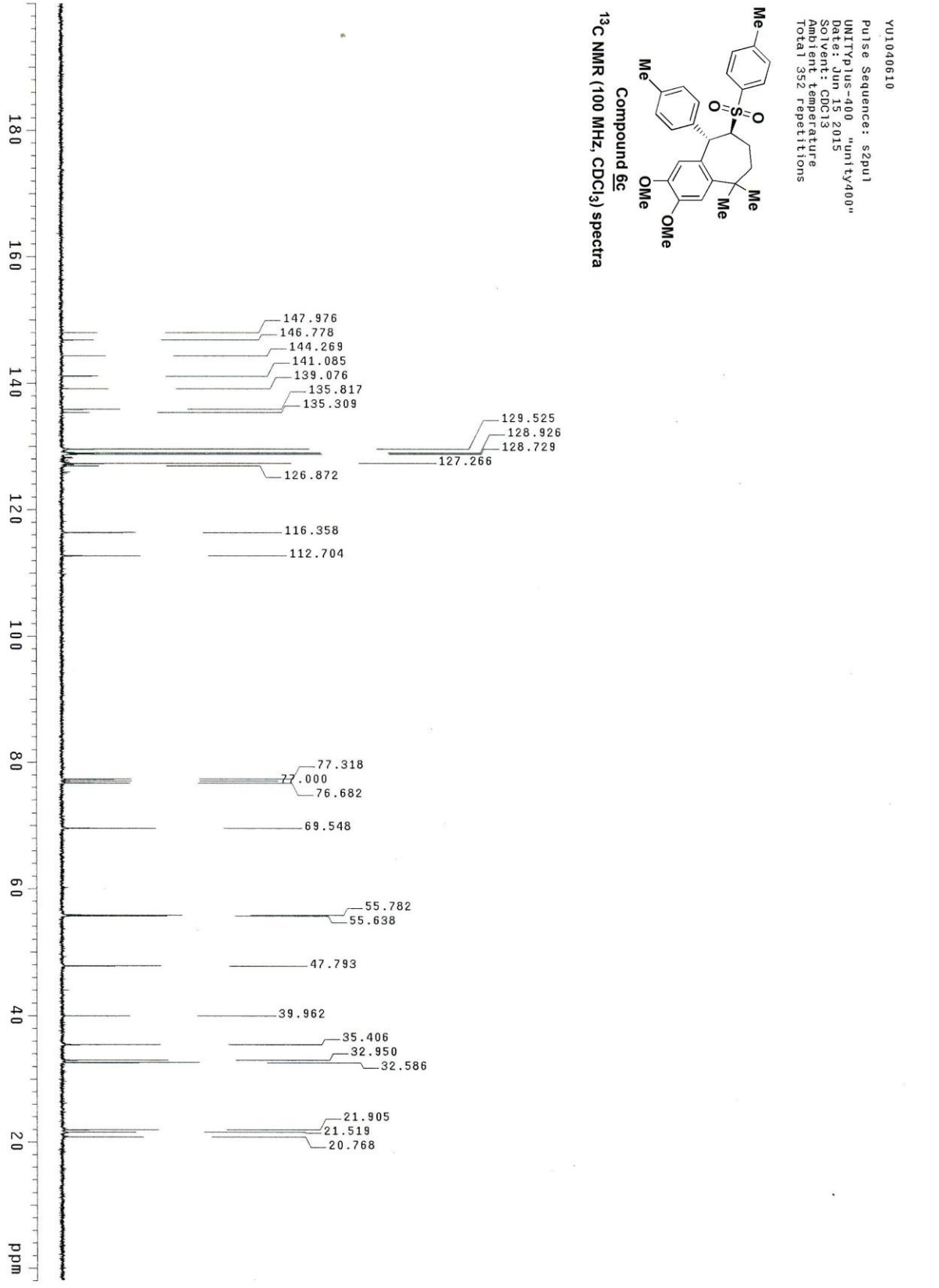


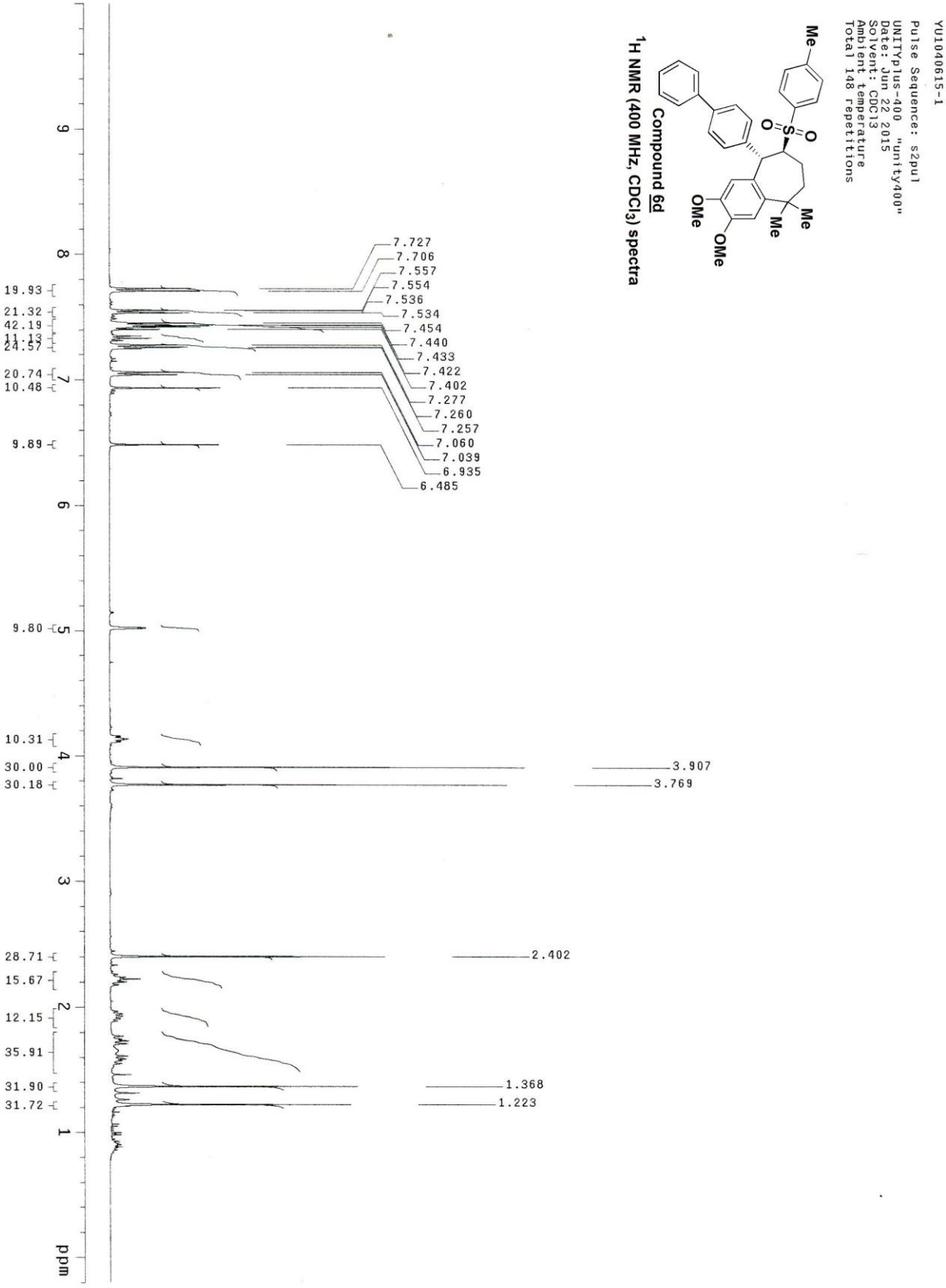

YU1040612-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 17 2015
Solvent: CDCl3
Ambient temperature
Total 144 repetitions
Me
MeO
OMe
OMe
Me
Me
Compound 6b
13C NMR (100 MHz, CDCl3) spectra
157.860
147.869
146.687
144.125
138.978
135.672
135.377
129.441
128.570
128.426
127.129
116.138
113.454
112.598
77.318
76.992
76.682
69.336
55.714
55.563
55.055
47.232
39.795
35.323
32.897
32.556
21.936
21.413
180
160
140
120
100
80
60
40
20
ppm

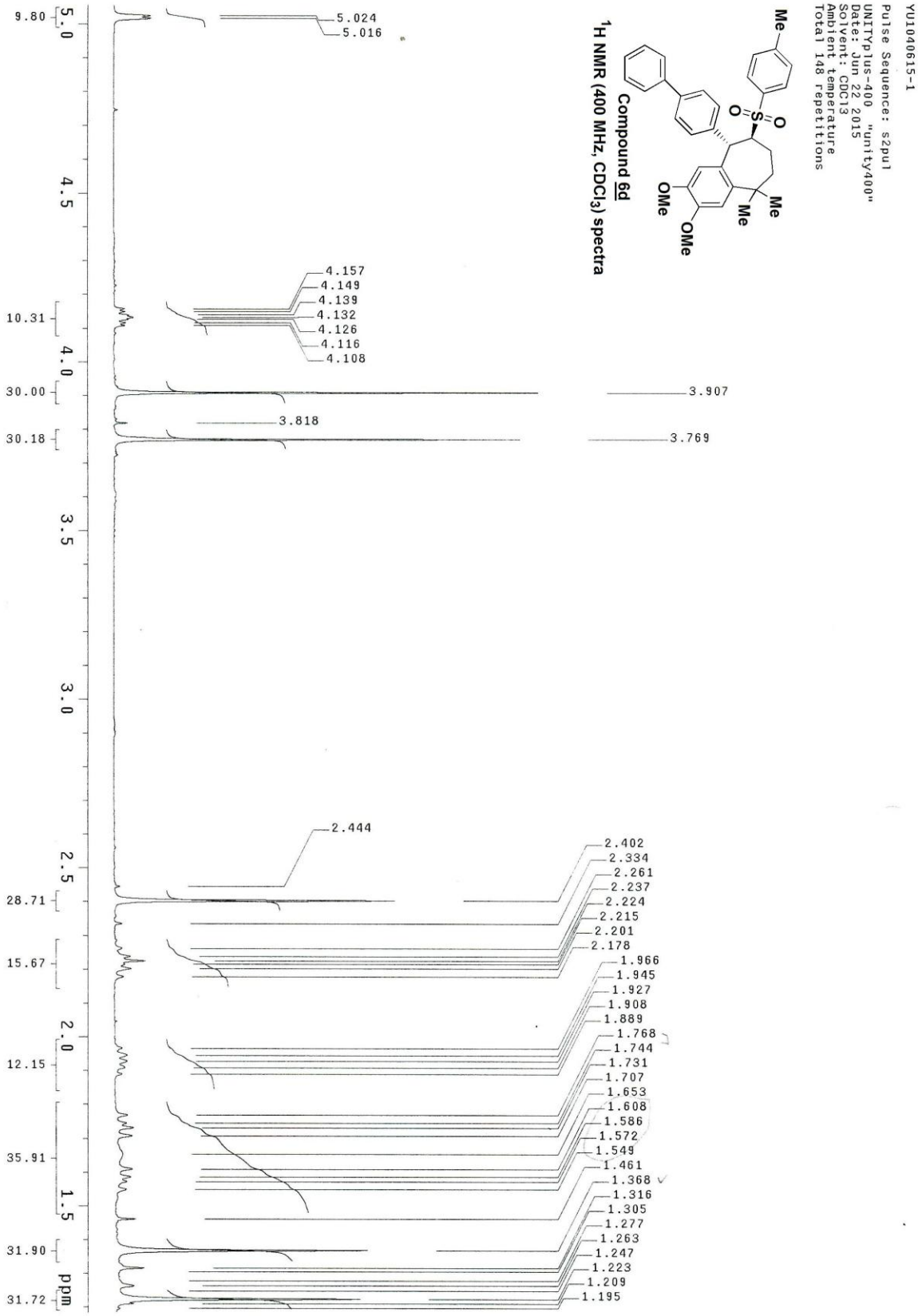

YU1040610
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
O
O
S
Me
OMe
OMe
Me
Compound 6c
1H NMR (400 MHz, CDCl3) spectra
18.31
19.99
20.48
10.48
20.49
9.46
9.39
10.00
28.44
29.28
28.49
55.49
10.49
13.04
10.78
28.48
29.96
7.720
7.700
7.277
7.260
7.257
7.022
7.002
6.910
6.861
6.840
6.450
3.897
3.765
2.415
2.282
1.342
1.182
ppm

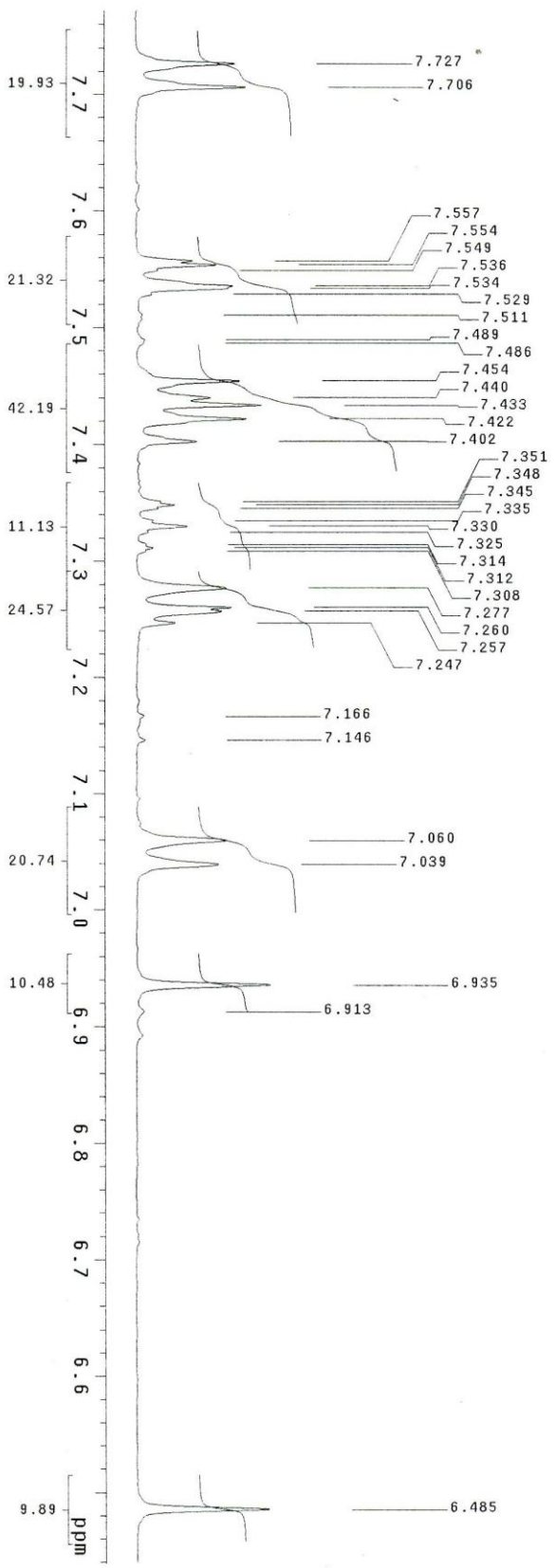

YU1040610
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 6c
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
Me
OMe
OMe
Me
Me
O
O
S
28.49
55.49
10.49
13.04
10.78
28.48
29.96
2.4
2.3
2.2
2.1
2.0
1.9
1.8
1.7
1.6
1.5
1.4
1.3
ppm
2.415
2.355
2.328
2.302
2.282
2.262
2.255
2.248
2.226
2.205
2.195
2.180
2.168
2.156
2.144
2.131
2.121
1.944
1.924
1.904
1.887
1.868
1.726
1.702
1.689
1.665
1.534
1.511
1.497
1.474
1.414
1.342
1.286
1.280
1.261
1.225
1.215
1.206
1.201
1.196
1.182
1.163
1.157


YU1040610
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
Me
O
S
O
OMe
OMe
Me
Me
Compound 6c
1H NMR (400 MHz, CDCl3) spectra
18.31
19.99
20.48
10.48
20.49
9.46
9.39
10.00
28.44
29.28
7.720
7.700
7.277
7.260
7.257
7.022
7.002
6.945
6.910
6.861
6.840
6.450
4.925
4.920
4.114
4.107
4.096
4.089
4.083
4.073
4.065
3.897
3.836
3.776
3.765
ppm


YU1040610
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 15 2015
Solvent: CDCl3
Ambient temperature
Total 352 repetitions
Me
Me
O
S
O
Me
Me
OMe
OMe
Compound 6c
13C NMR (100 MHz, CDCl3) spectra
147.976
146.778
144.269
141.085
139.076
135.817
135.309
129.525
128.926
128.729
127.266
126.872
116.358
112.704
77.318
77.000
76.682
69.548
55.782
55.638
47.793
39.962
35.406
32.950
32.586
21.905
21.519
20.768
180
160
140
120
100
80
60
40
20
ppm


YU1040615-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 148 repetitions
Me
O
S
O
Me
Me
OMe
OMe
Compound 6d
1H NMR (400 MHz, CDCl3) spectra
7.727
7.706
7.557
7.554
7.536
7.534
7.454
7.440
7.433
7.422
7.402
7.277
7.260
7.257
7.060
7.039
6.935
6.485
3.907
3.769
2.402
1.368
1.223
19.93
21.32
42.19
11.13
24.57
20.74
10.48
9.89
9.80
10.31
30.00
30.18
28.71
15.67
12.15
35.91
31.90
31.72
ppm


YU1040615-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 148 repetitions
Compound 6d
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
O
S
O
Me
Me
OMe
OMe
9.80
10.31
30.00
30.18
28.71
15.67
12.15
35.91
31.90
31.72
5.024
5.016
4.157
4.149
4.139
4.132
4.126
4.116
4.108
3.907
3.818
3.769
2.444
2.402
2.334
2.261
2.237
2.224
2.215
2.201
2.178
1.966
1.945
1.927
1.908
1.889
1.768
1.744
1.731
1.707
1.653
1.608
1.586
1.572
1.549
1.461
1.368
1.316
1.305
1.277
1.263
1.247
1.223
1.209
1.195
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm



YU1040615-1

Pulse Sequence: s2pul

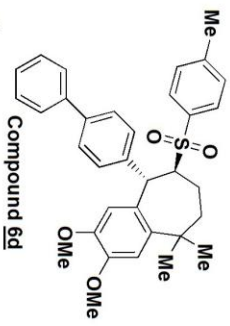
UNITYplus-400 "unity400"

Date: Jun 22 2015

Solvent: CDCl3

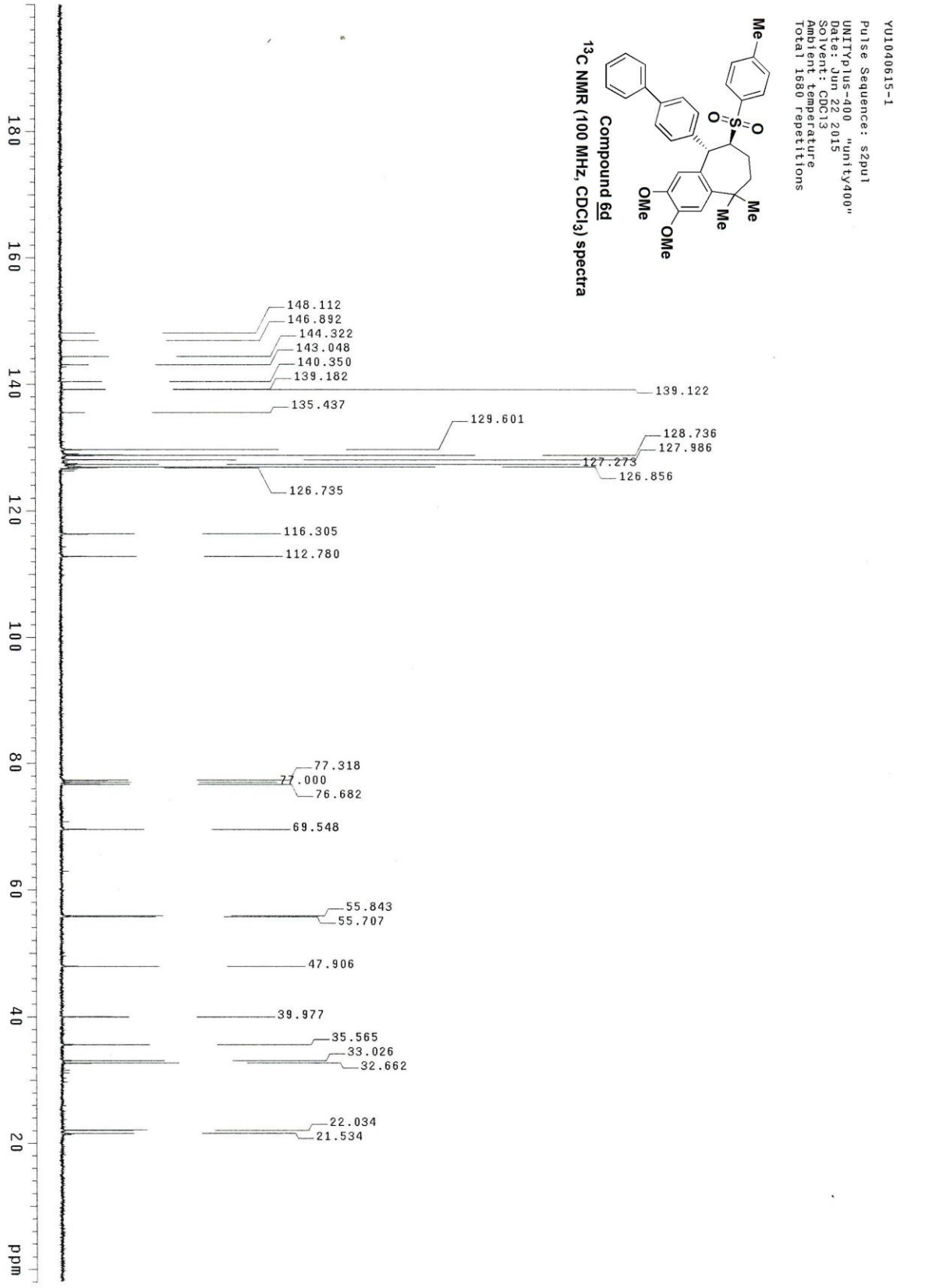
Ambient temperature

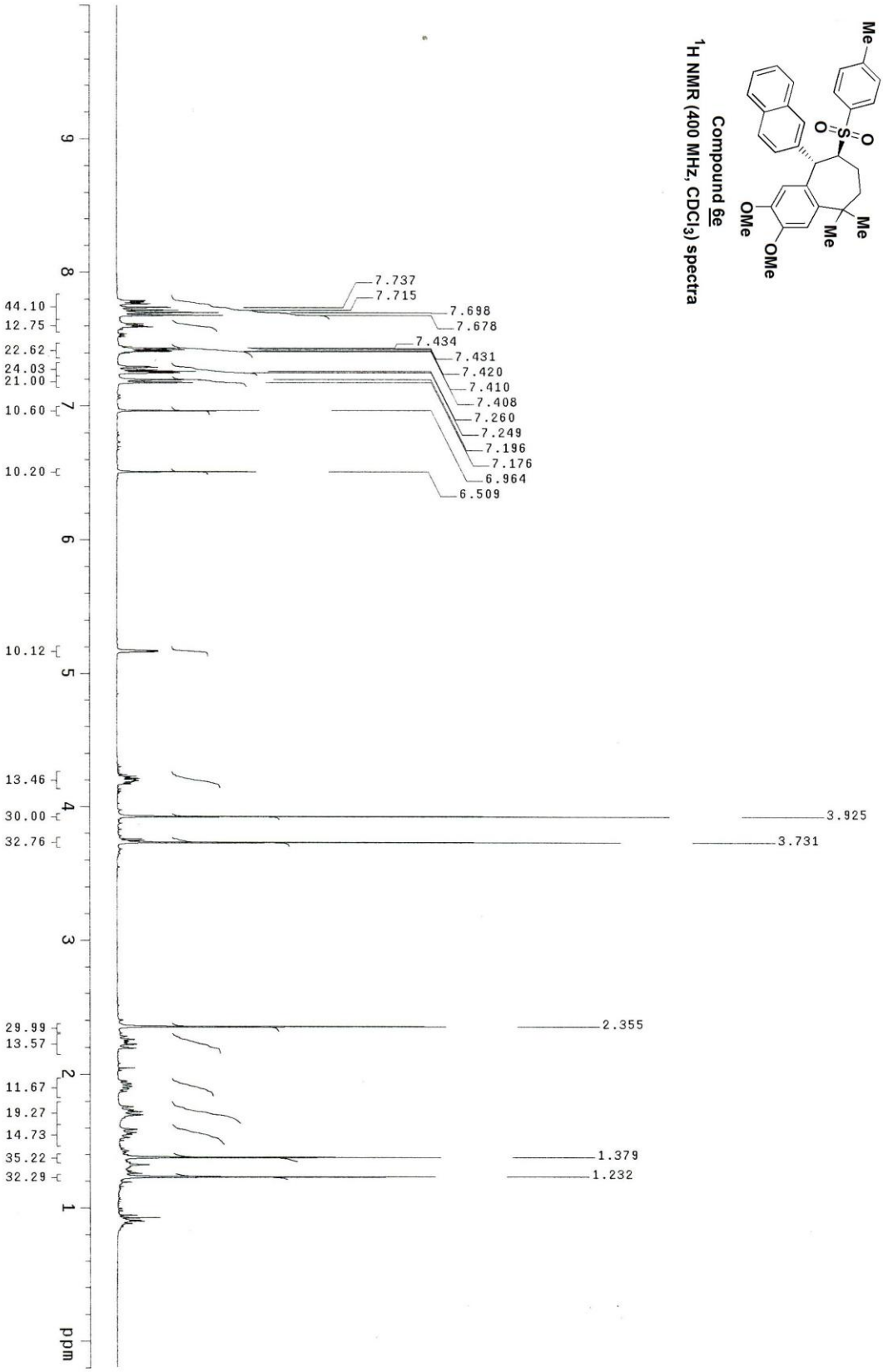
Total 148 repetitions

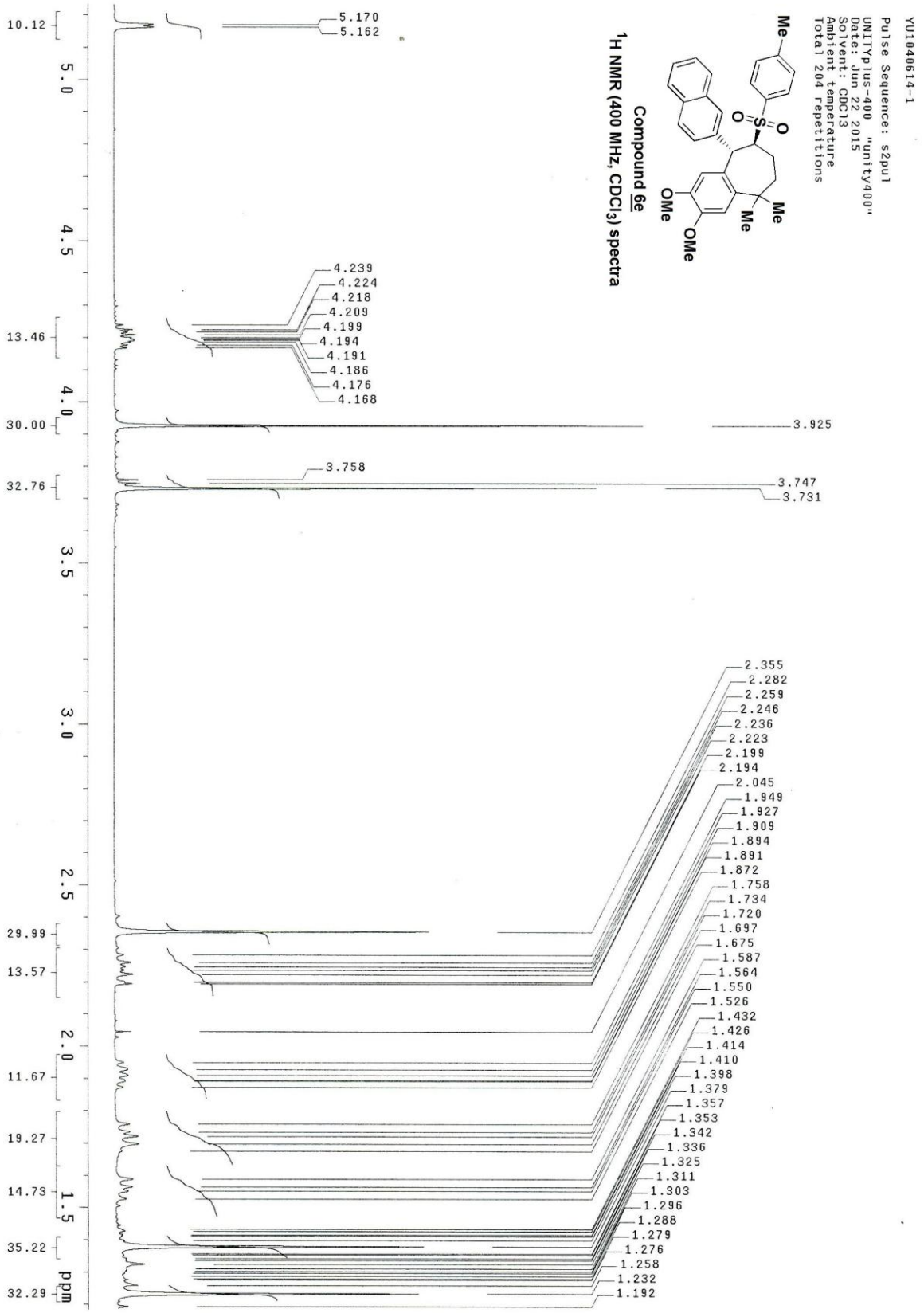


Compound 6d

^{1}H NMR (400 MHz, $CDCl_3$) spectra

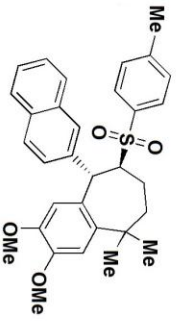

YU1040615-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 1680 repetitions
Me
O
S
O
OMe
OMe
Me
Me
Compound 6d
13C NMR (100 MHz, CDCl3) spectra
148.112
146.892
144.322
143.048
140.350
139.182
139.122
135.437
129.601
128.736
127.986
127.273
126.856
126.735
116.305
112.780
77.318
77.000
76.682
69.548
55.843
55.707
47.906
39.977
35.565
33.026
32.662
22.034
21.534
180
160
140
120
100
80
60
40
20
ppm


YU1040614-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 204 repetitions
Me
O
S
O
Me
Me
OMe
OMe
Compound 6e
1H NMR (400 MHz, CDCl3) spectra
7.737
7.715
7.698
7.678
7.434
7.431
7.420
7.410
7.408
7.260
7.249
7.196
7.176
6.964
6.509
3.925
3.731
2.355
1.379
1.232
44.10
12.75
22.62
24.03
21.00
10.60
10.20
10.12
13.46
30.00
32.76
29.99
13.57
11.67
19.27
14.73
35.22
32.29
ppm


YU1040614-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 204 repetitions
Compound 6e
^{1}H NMR (400 MHz, CDCl$_3$) spectra
Me
OMe
OMe
Me
Me
5.170
5.162
4.239
4.224
4.218
4.209
4.199
4.194
4.191
4.186
4.176
4.168
3.925
3.758
3.747
3.731
2.355
2.282
2.259
2.246
2.236
2.223
2.199
2.194
2.045
1.949
1.927
1.909
1.894
1.891
1.872
1.758
1.734
1.720
1.697
1.675
1.587
1.564
1.550
1.526
1.432
1.426
1.414
1.410
1.398
1.379
1.357
1.353
1.342
1.336
1.325
1.311
1.303
1.296
1.288
1.279
1.276
1.258
1.232
1.192
10.12
13.46
30.00
32.76
29.99
13.57
11.67
19.27
14.73
35.22
32.29
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm

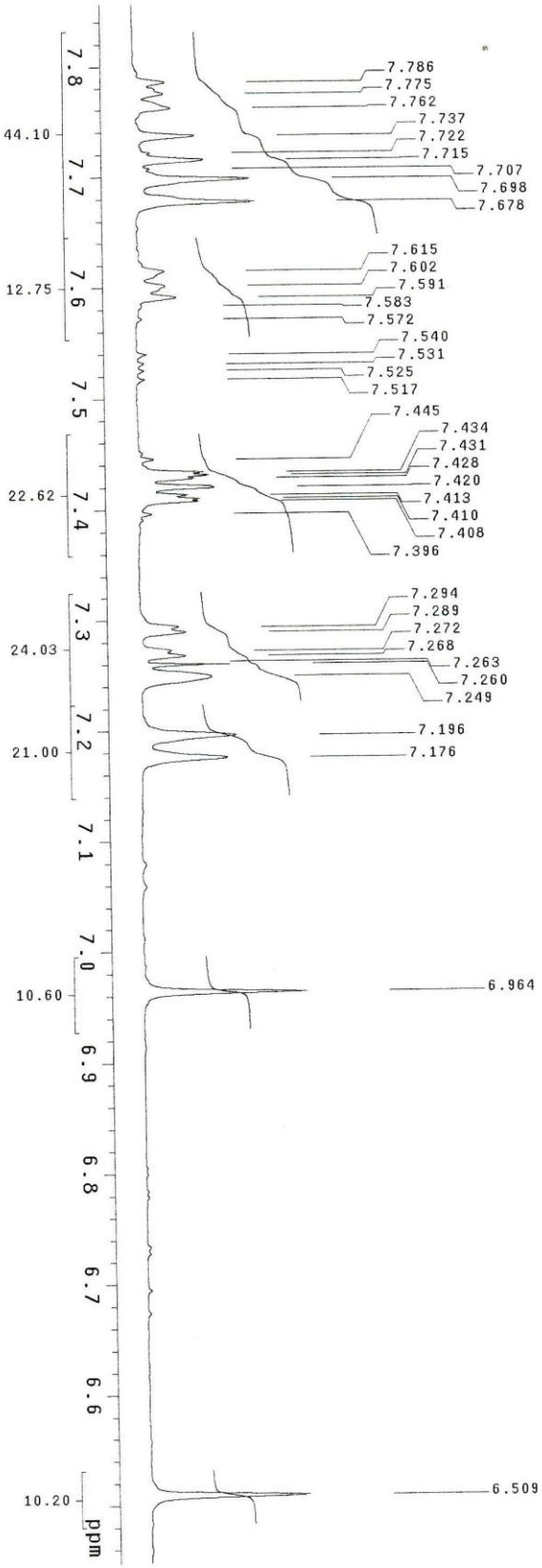
YU1040614-1

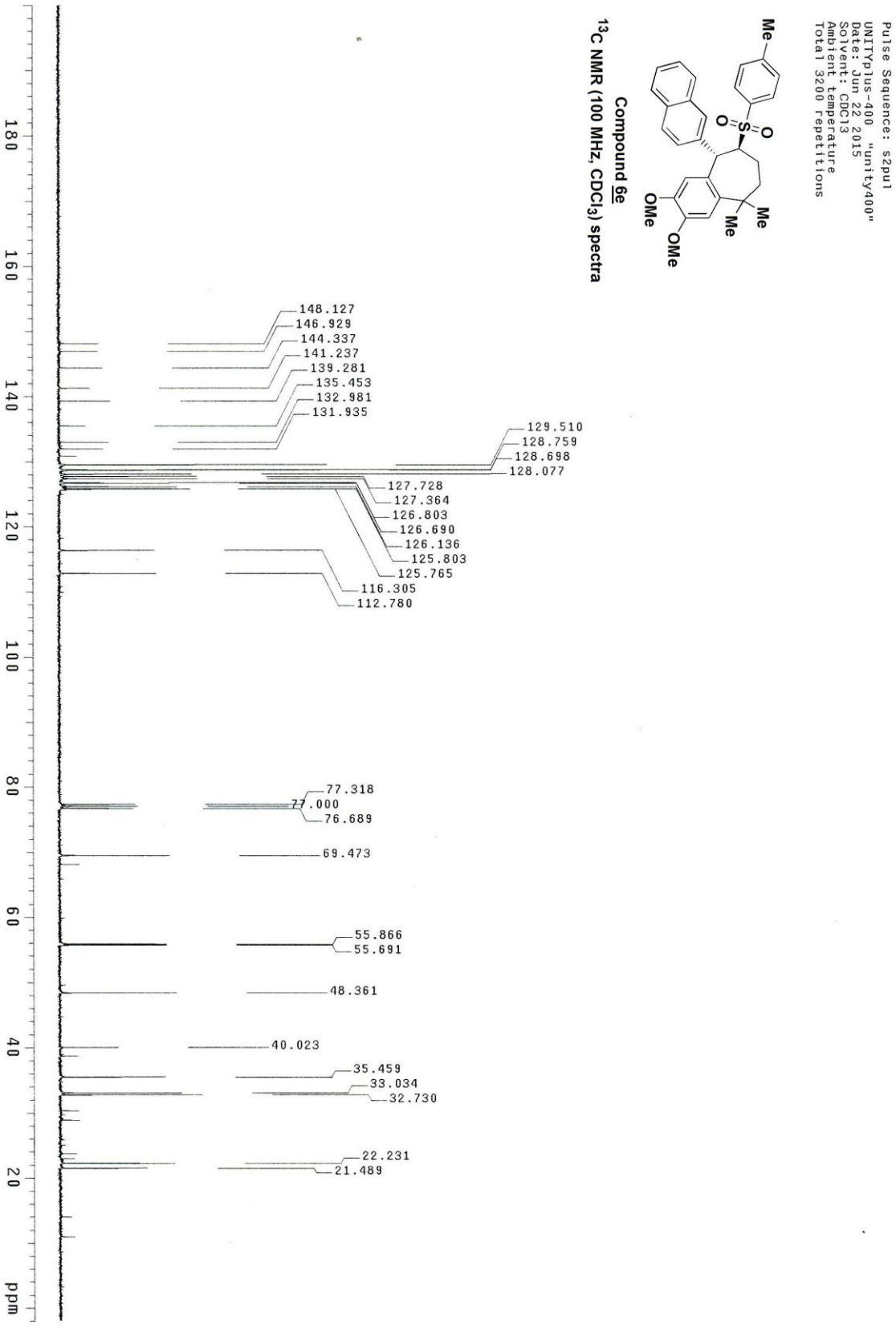
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 204 repetitions

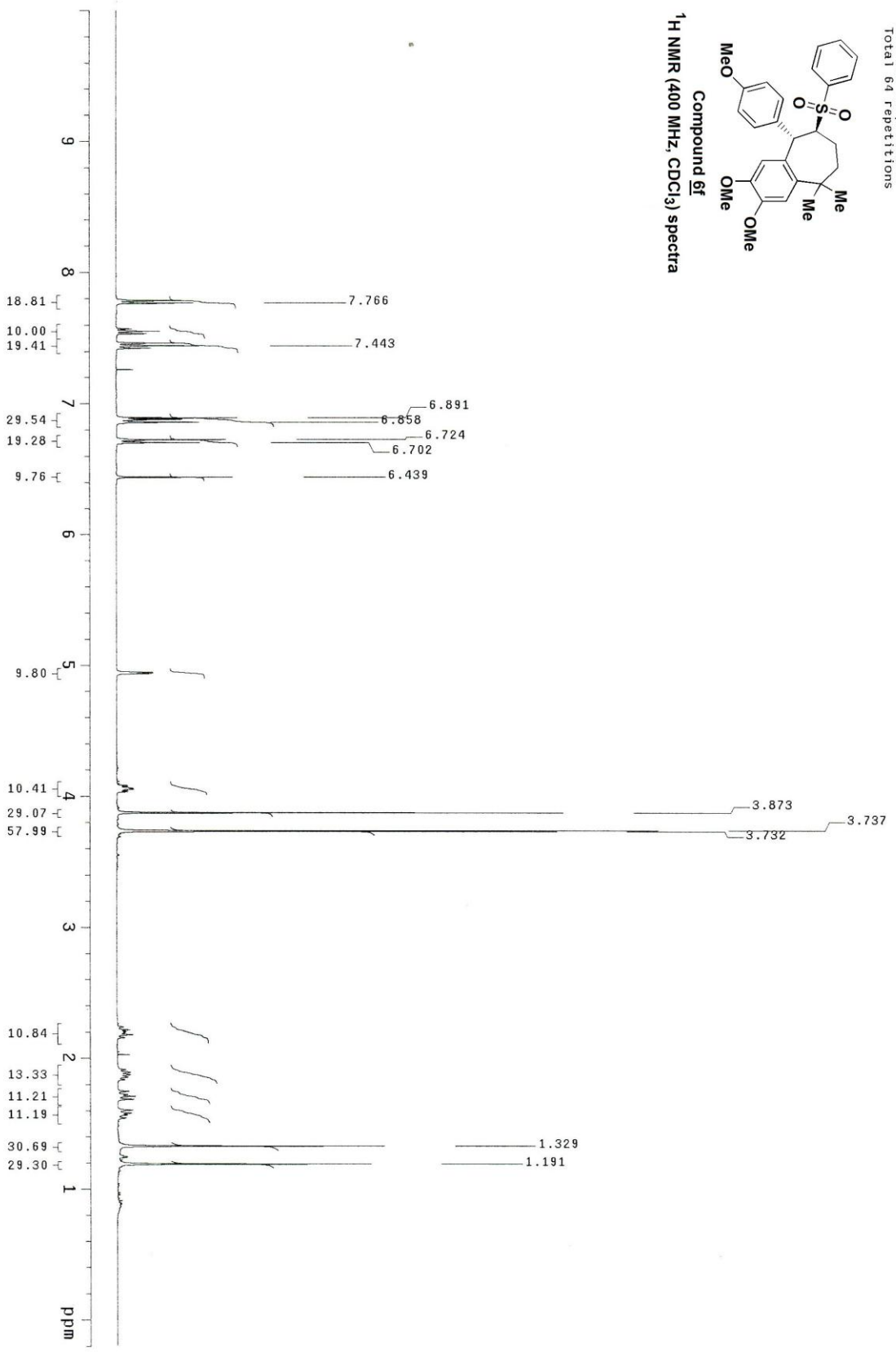


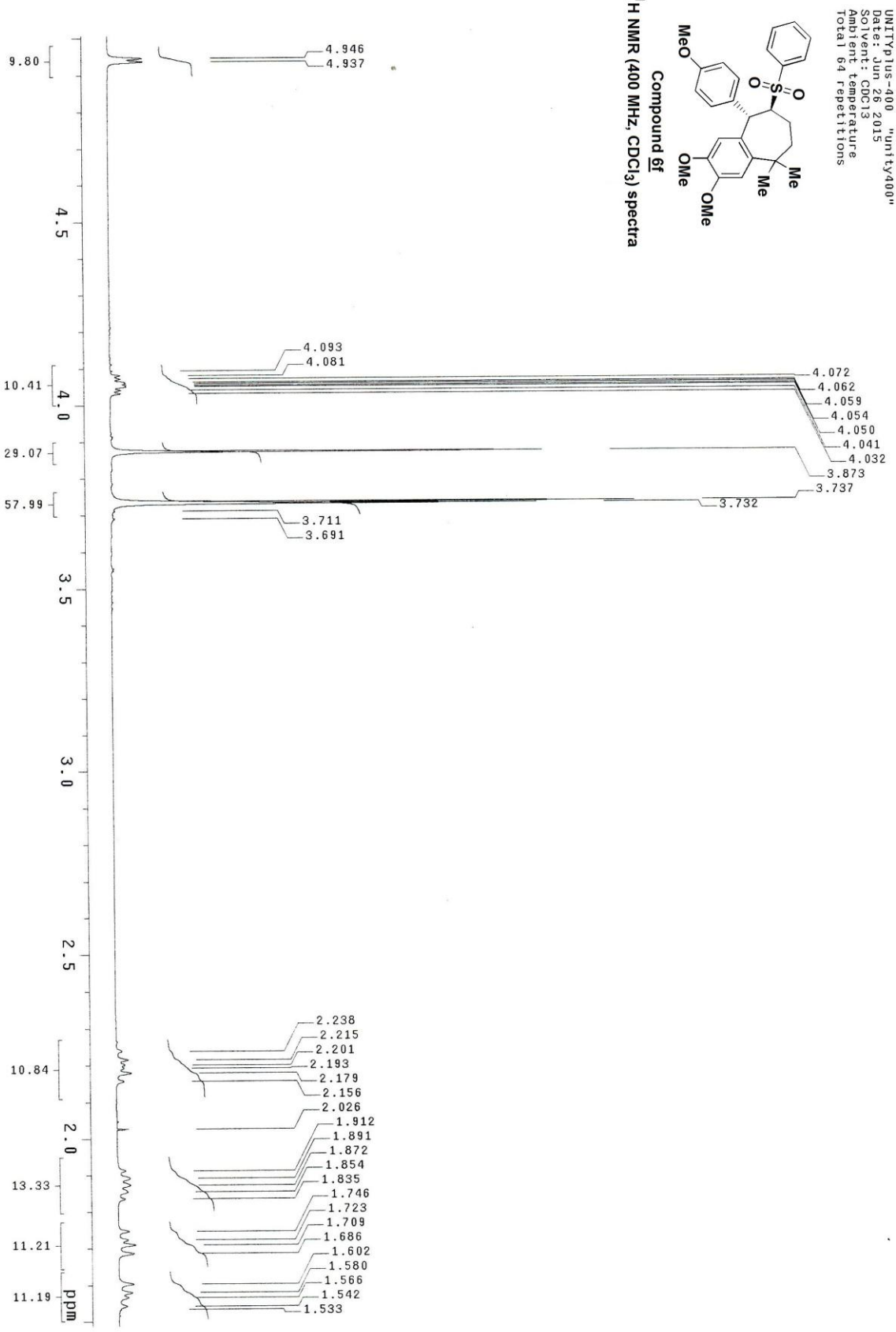
Compound 6e

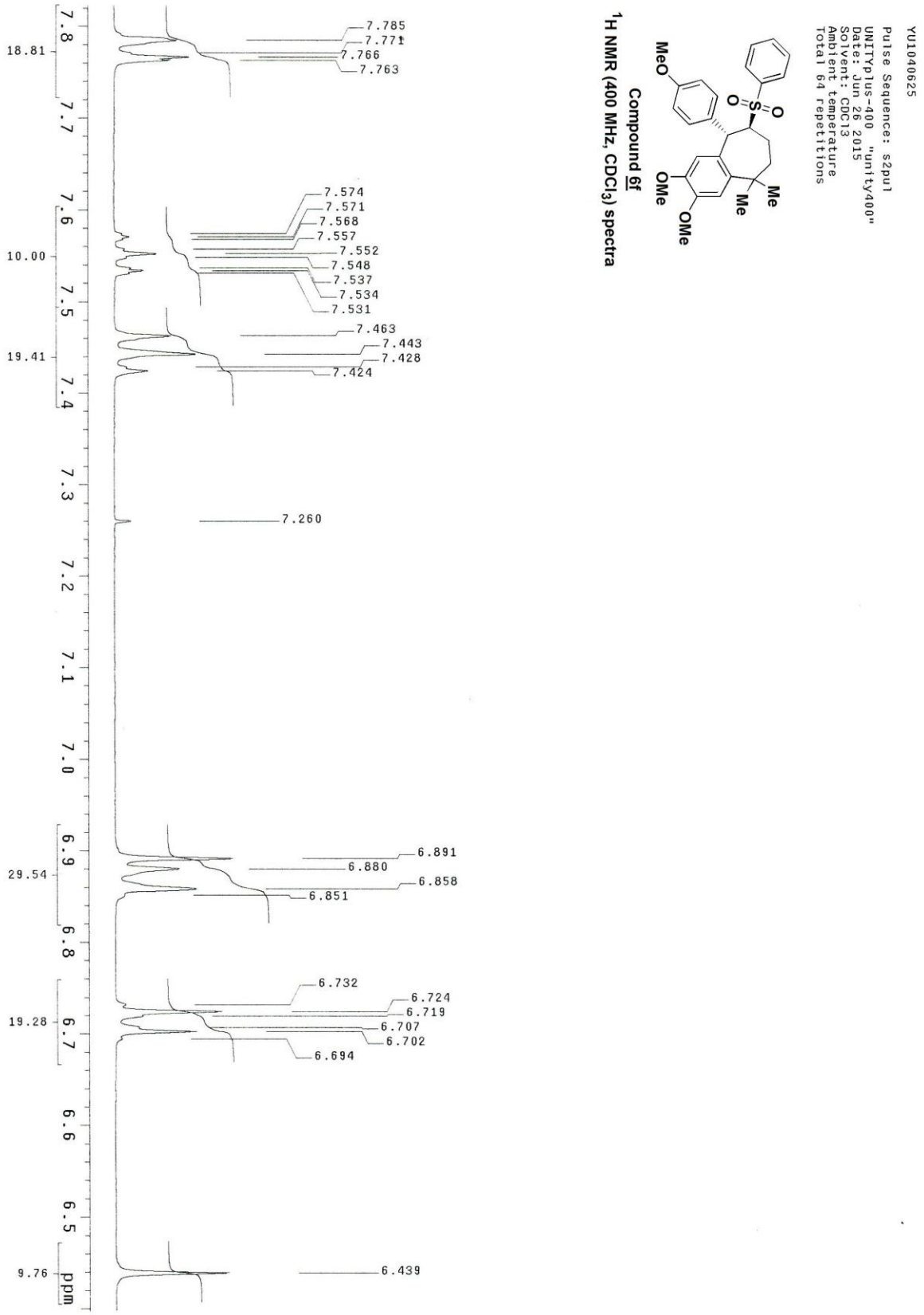
^{1}H NMR (400 MHz, $CDCl_3$) spectra

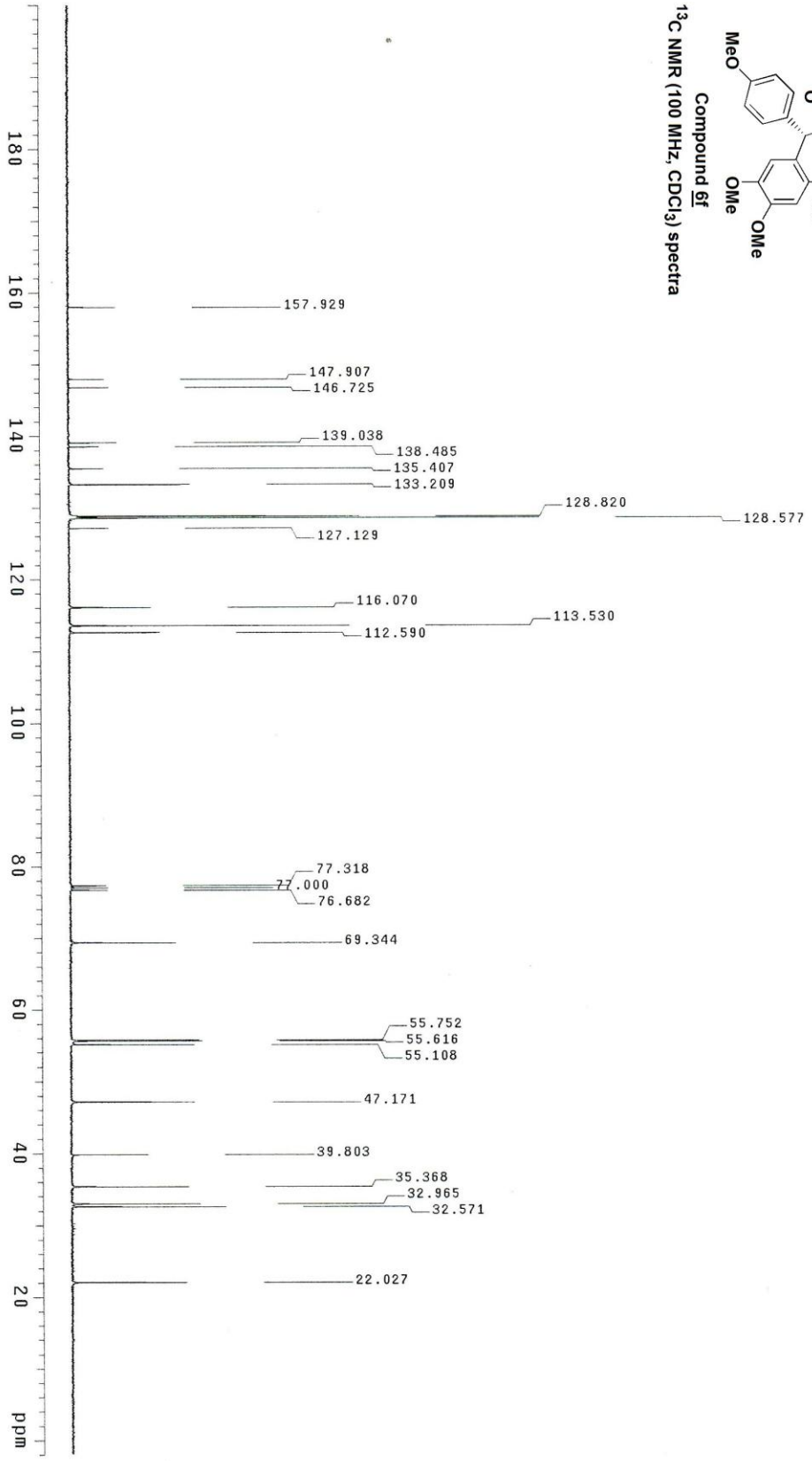


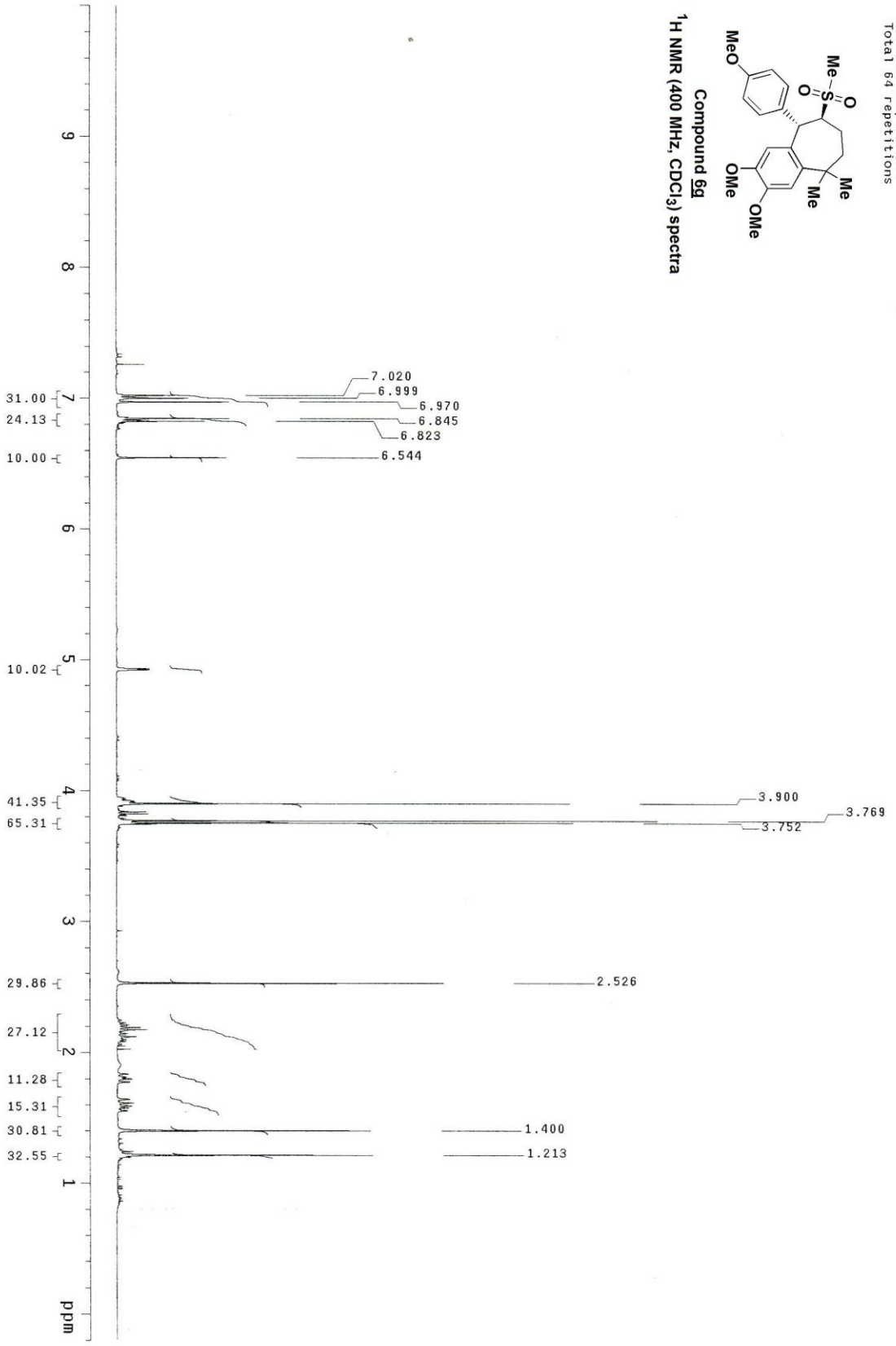

YU1040614-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 3200 repetitions
Me
O
S
O
Me
Me
OMe
OMe
Compound 6e
13C NMR (100 MHz, CDCl3) spectra
148.127
146.929
144.337
141.237
139.281
135.453
132.981
131.935
129.510
128.759
128.698
128.077
127.728
127.364
126.803
126.690
126.136
125.803
125.765
116.305
112.780
77.318
77.000
76.689
69.473
55.866
55.691
48.361
40.023
35.459
33.034
32.730
22.231
21.489
180
160
140
120
100
80
60
40
20
ppm

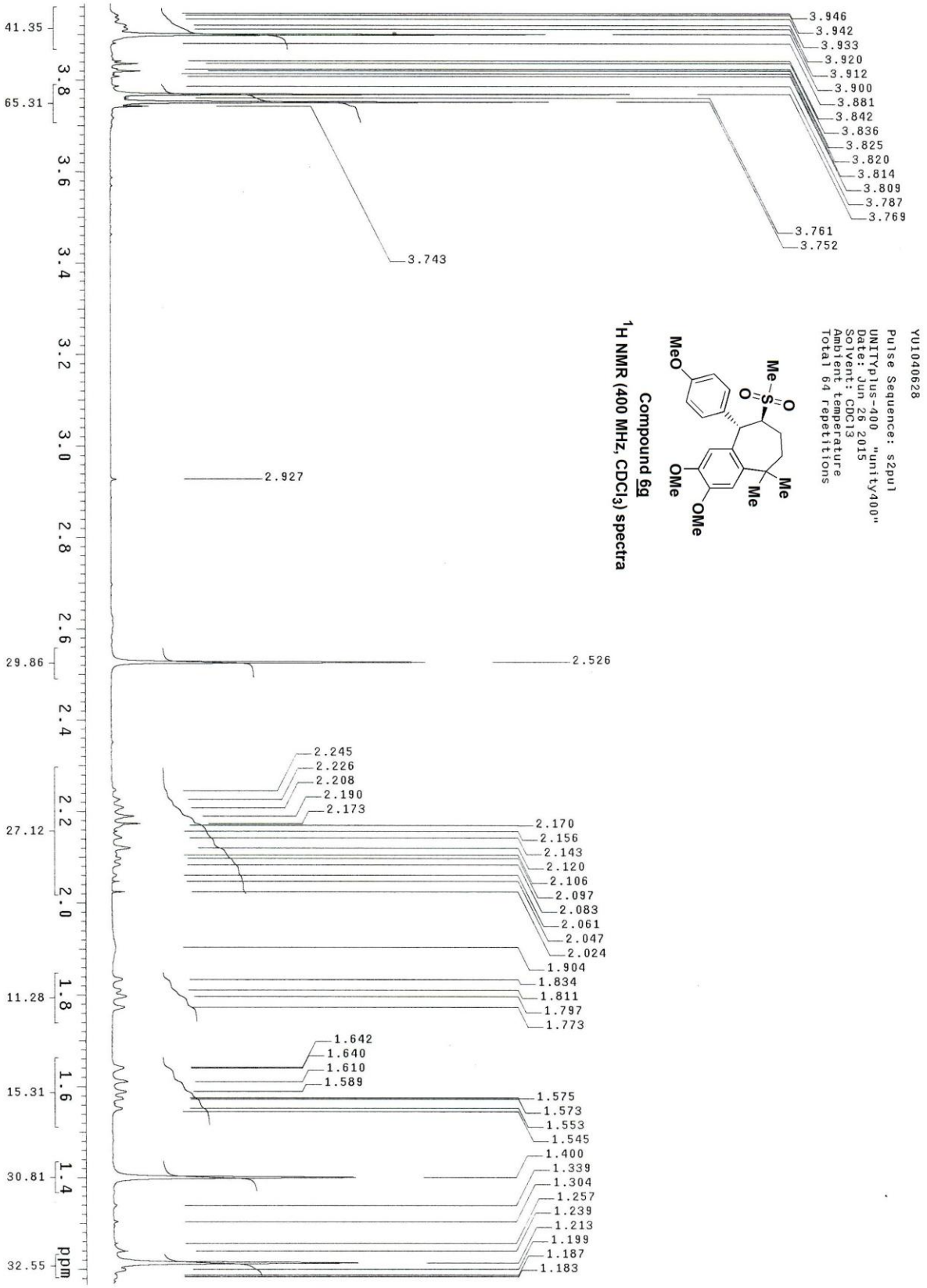

YU1040625
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OMe
OMe
Me
Me
O
O
S
Compound 6f
1H NMR (400 MHz, CDCl3) spectra
18.81
10.00
19.41
29.54
19.28
9.76
9.80
10.41
29.07
57.99
10.84
13.33
11.21
11.19
30.69
29.30
7.766
7.443
6.891
6.858
6.724
6.702
6.439
3.873
3.737
3.732
1.329
1.191
ppm

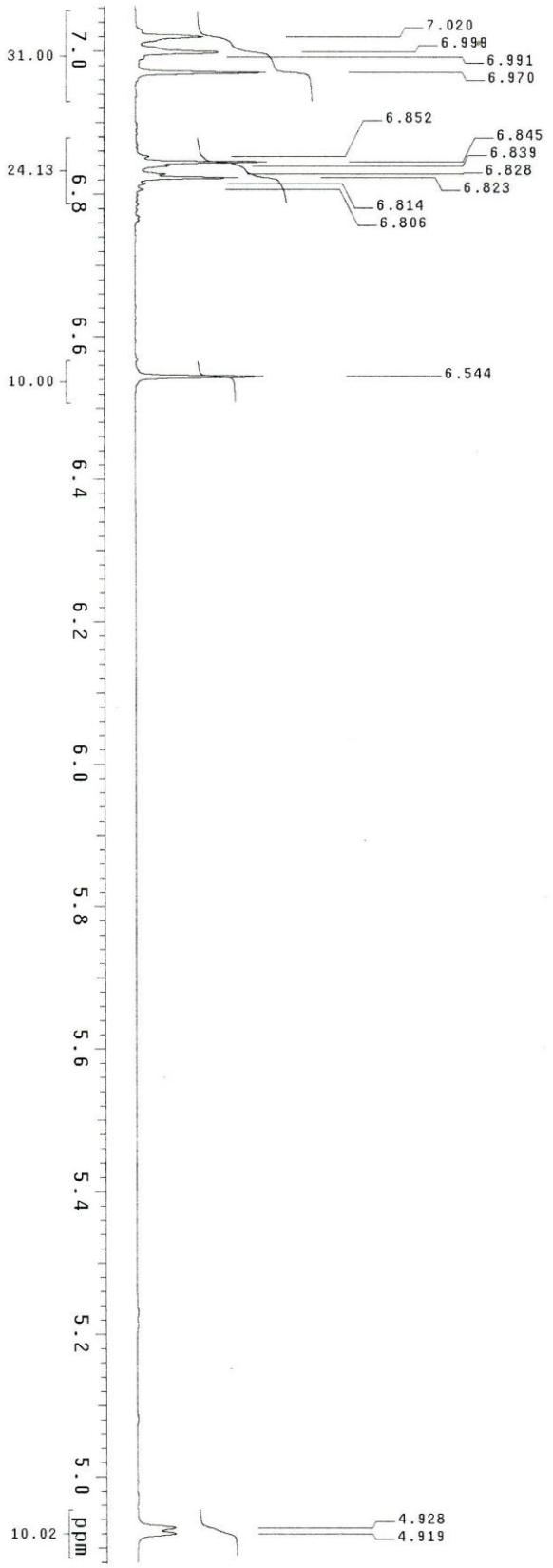

YU1040625
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OMe
OMe
Me
Me
Compound 6f
1H NMR (400 MHz, CDCl3) spectra
9.80
10.41
29.07
57.99
10.84
13.33
11.21
11.19
4.946
4.937
4.093
4.081
4.072
4.062
4.059
4.054
4.050
4.041
4.032
3.873
3.737
3.732
3.711
3.691
2.238
2.215
2.201
2.193
2.179
2.156
2.026
1.912
1.891
1.872
1.854
1.835
1.746
1.723
1.709
1.686
1.602
1.580
1.566
1.542
1.533
4.5
4.0
3.5
3.0
2.5
2.0
ppm


YU1040625
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OMe
OMe
Me
Me
O
O
S
Compound 6f
1H NMR (400 MHz, CDCl3) spectra
7.785
7.771
7.766
7.763
7.574
7.571
7.568
7.557
7.552
7.548
7.537
7.534
7.531
7.463
7.443
7.428
7.424
7.260
6.891
6.880
6.858
6.851
6.732
6.724
6.719
6.707
6.702
6.694
6.439
18.81
10.00
19.41
29.54
19.28
9.76
ppm


YU1040625
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 1472 repetitions
MeO
OMe
OMe
Me
Me
Compound 6f
13C NMR (100 MHz, CDCl3) spectra
157.929
147.907
146.725
139.038
138.485
135.407
133.209
128.820
128.577
127.129
116.070
113.530
112.590
77.318
77.000
76.682
69.344
55.752
55.616
55.108
47.171
39.803
35.368
32.965
32.571
22.027
ppm

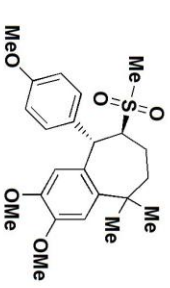

YU1040628
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 6g
1H NMR (400 MHz, CDCl3) spectra
MeO
Me
Me
OMe
OMe
OMe
7.020
6.999
6.970
6.845
6.823
6.544
3.900
3.769
3.752
2.526
1.400
1.213
31.00
24.13
10.00
10.02
41.35
65.31
29.86
27.12
11.28
15.31
30.81
32.55
ppm


Compound 6g
^{1}H NMR (400 MHz, $CDCl_3$) spectra
YU1040628
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
OMe
OMe
Me
Me
Me
O
O
S
3.946
3.942
3.933
3.920
3.912
3.900
3.881
3.842
3.836
3.825
3.820
3.814
3.809
3.787
3.769
3.761
3.752
3.743
2.927
2.526
2.245
2.226
2.208
2.190
2.173
2.170
2.156
2.143
2.120
2.106
2.097
2.083
2.061
2.047
2.024
1.904
1.834
1.811
1.797
1.773
1.642
1.640
1.610
1.589
1.575
1.573
1.553
1.545
1.400
1.339
1.304
1.257
1.239
1.213
1.199
1.187
1.183
41.35
65.31
29.86
27.12
11.28
15.31
30.81
32.55
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
ppm



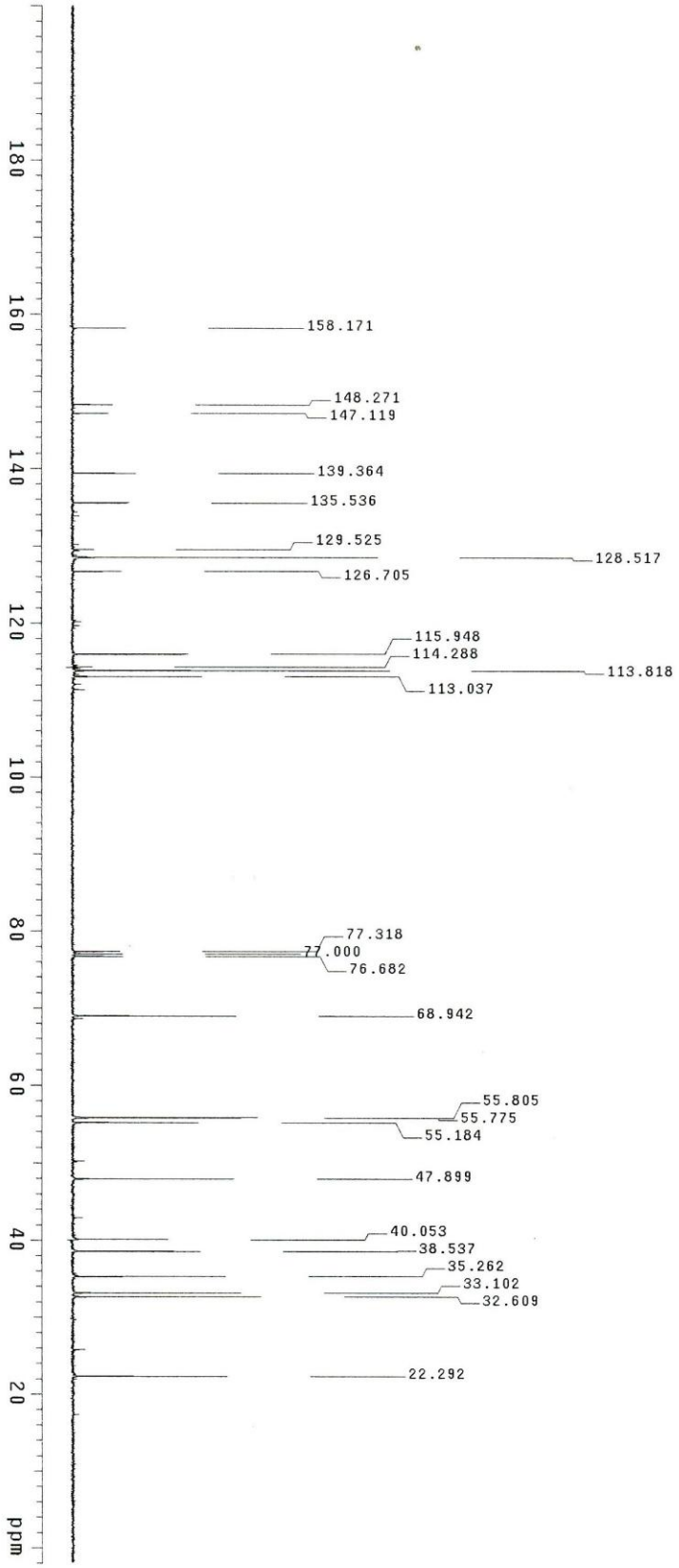
YU1040628

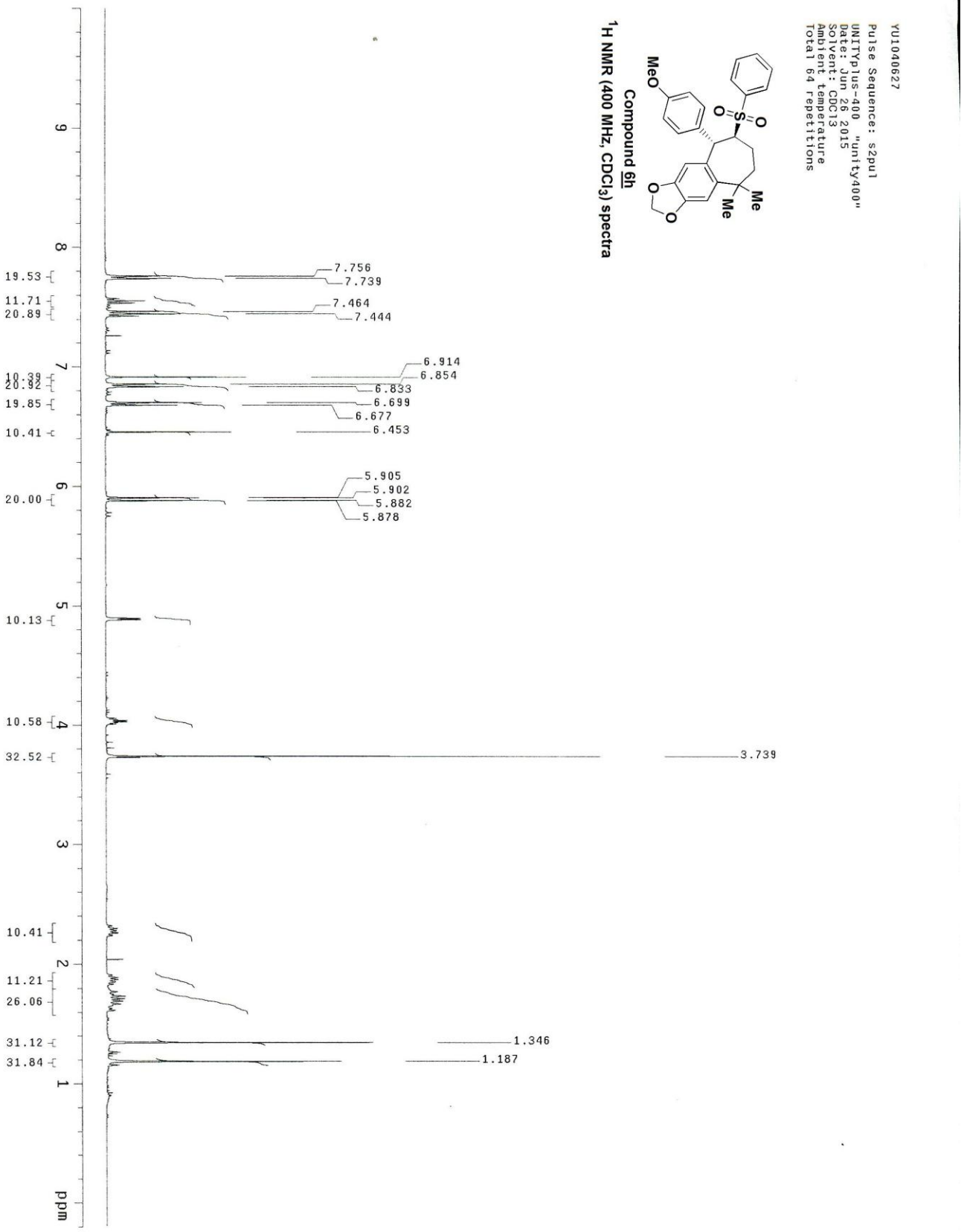
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

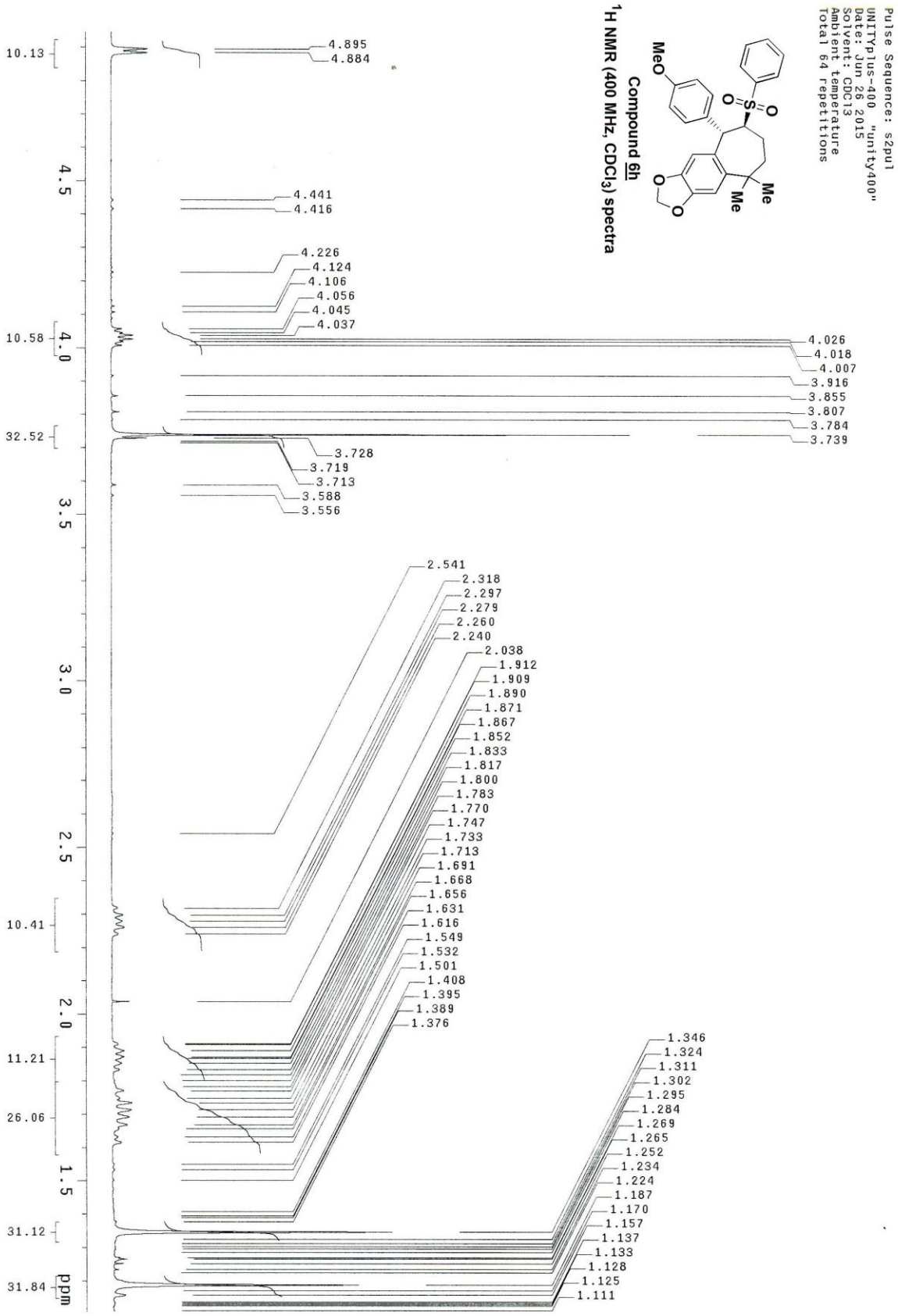


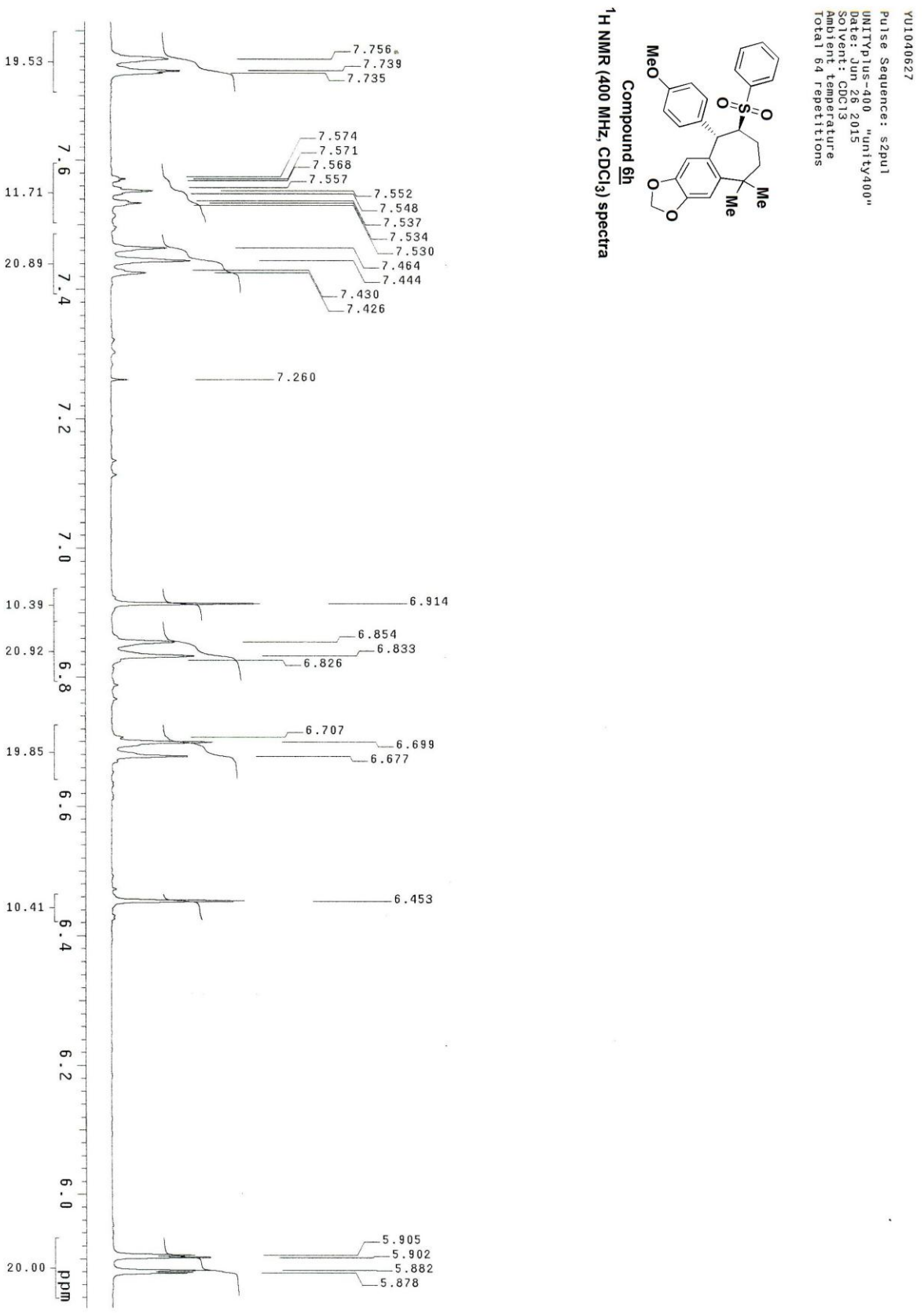
Compound 6g

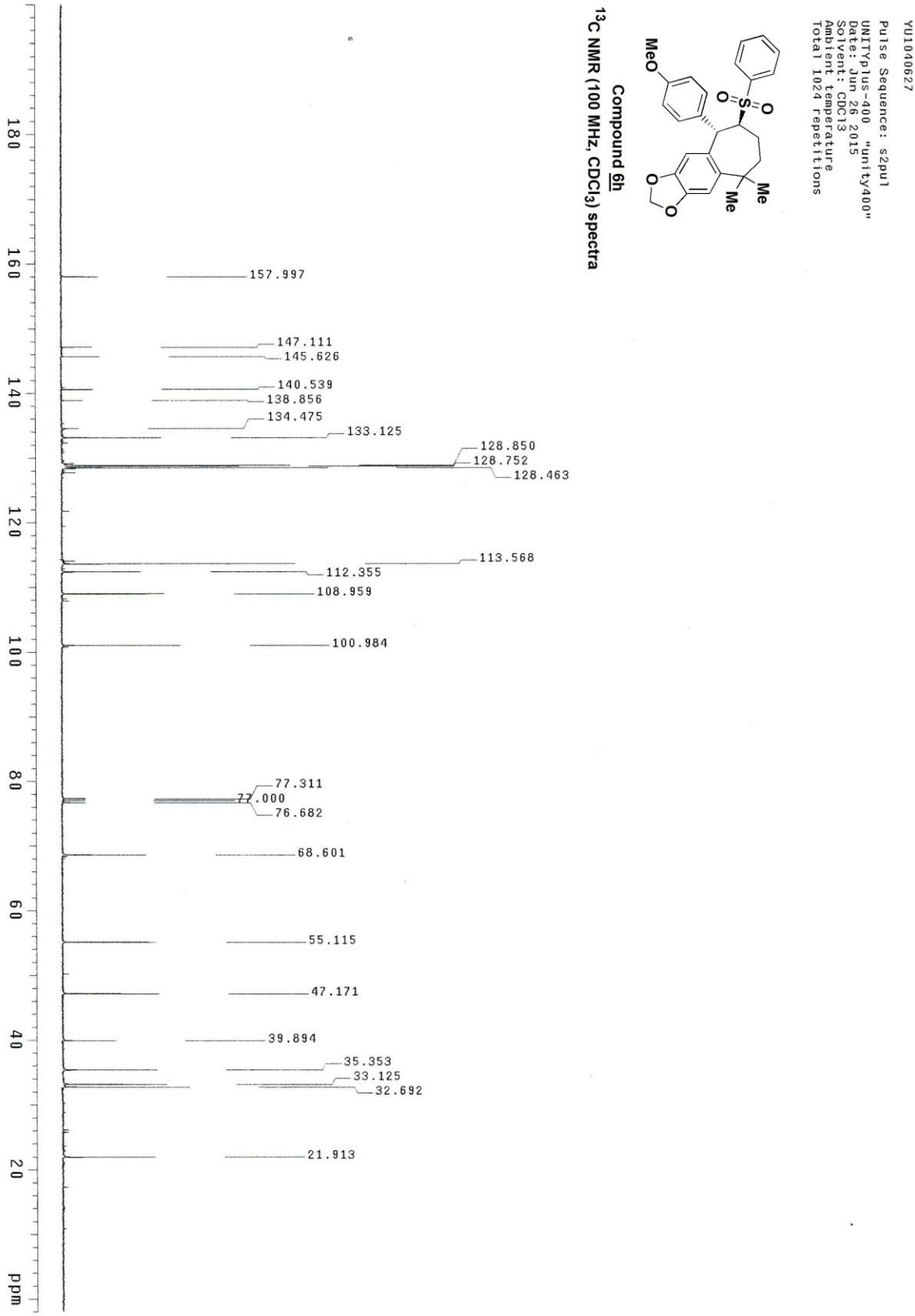
^{1}H NMR (400 MHz, $CDCl_3$) spectra

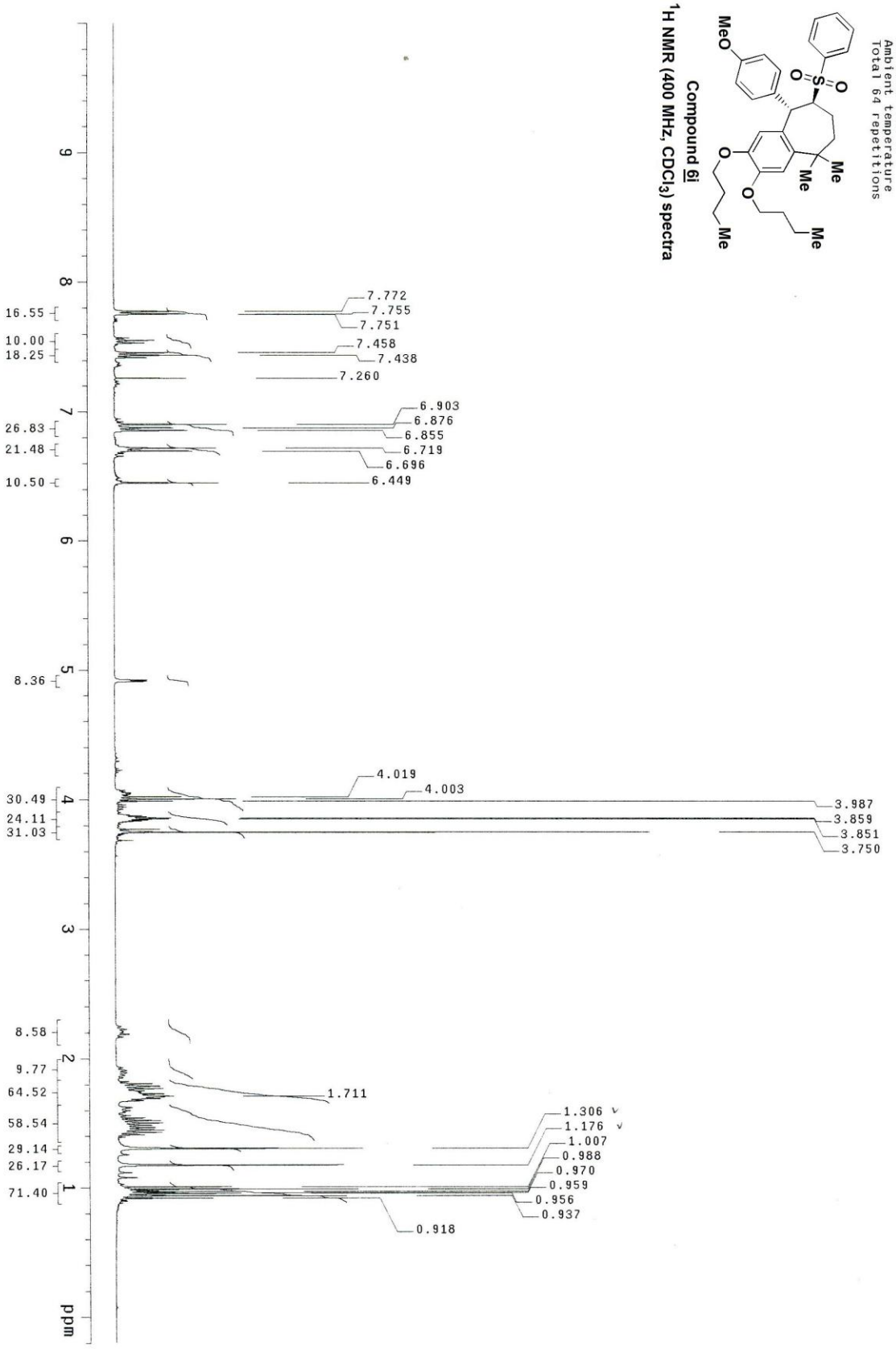

YU1040628
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 1184 repetitions
MeO
Me
Me
OMe
OMe
Me
Compound 6g
13C NMR (100 MHz, CDCl3) spectra
158.171
148.271
147.119
139.364
135.536
129.525
128.517
126.705
115.948
114.288
113.818
113.037
77.318
77.000
76.682
68.942
55.805
55.775
55.184
47.899
40.053
38.537
35.262
33.102
32.609
22.292
180
160
140
120
100
80
60
40
20
ppm

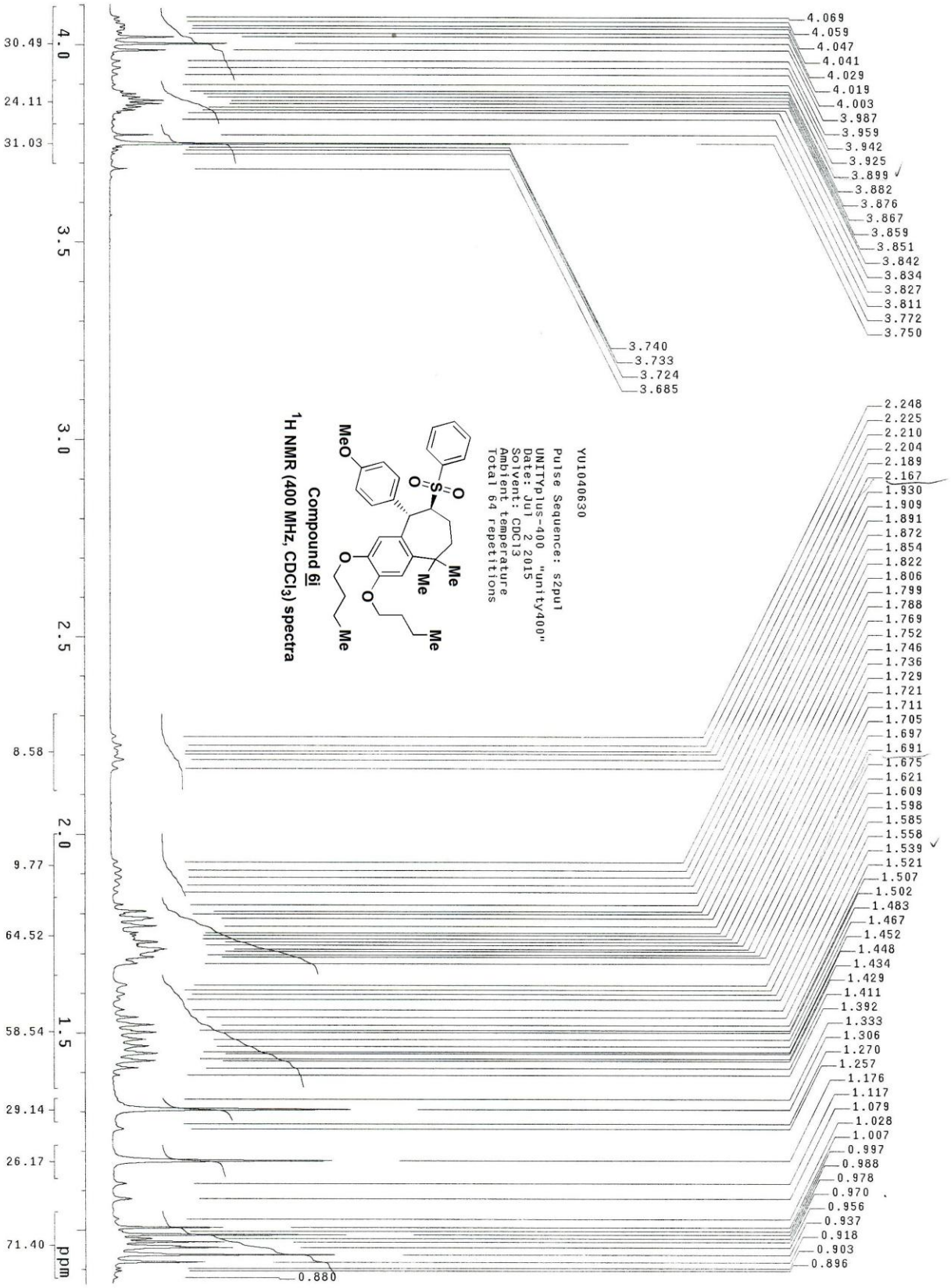

YU1040627
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
Me
Me
Compound 6h
1H NMR (400 MHz, CDCl3) spectra
19.53
11.71
20.89
10.39
20.92
19.85
10.41
20.00
10.13
10.58
32.52
10.41
11.21
26.06
31.12
31.84
7.756
7.739
7.464
7.444
6.914
6.854
6.833
6.699
6.677
6.453
5.905
5.902
5.882
5.878
3.739
1.346
1.187
ppm

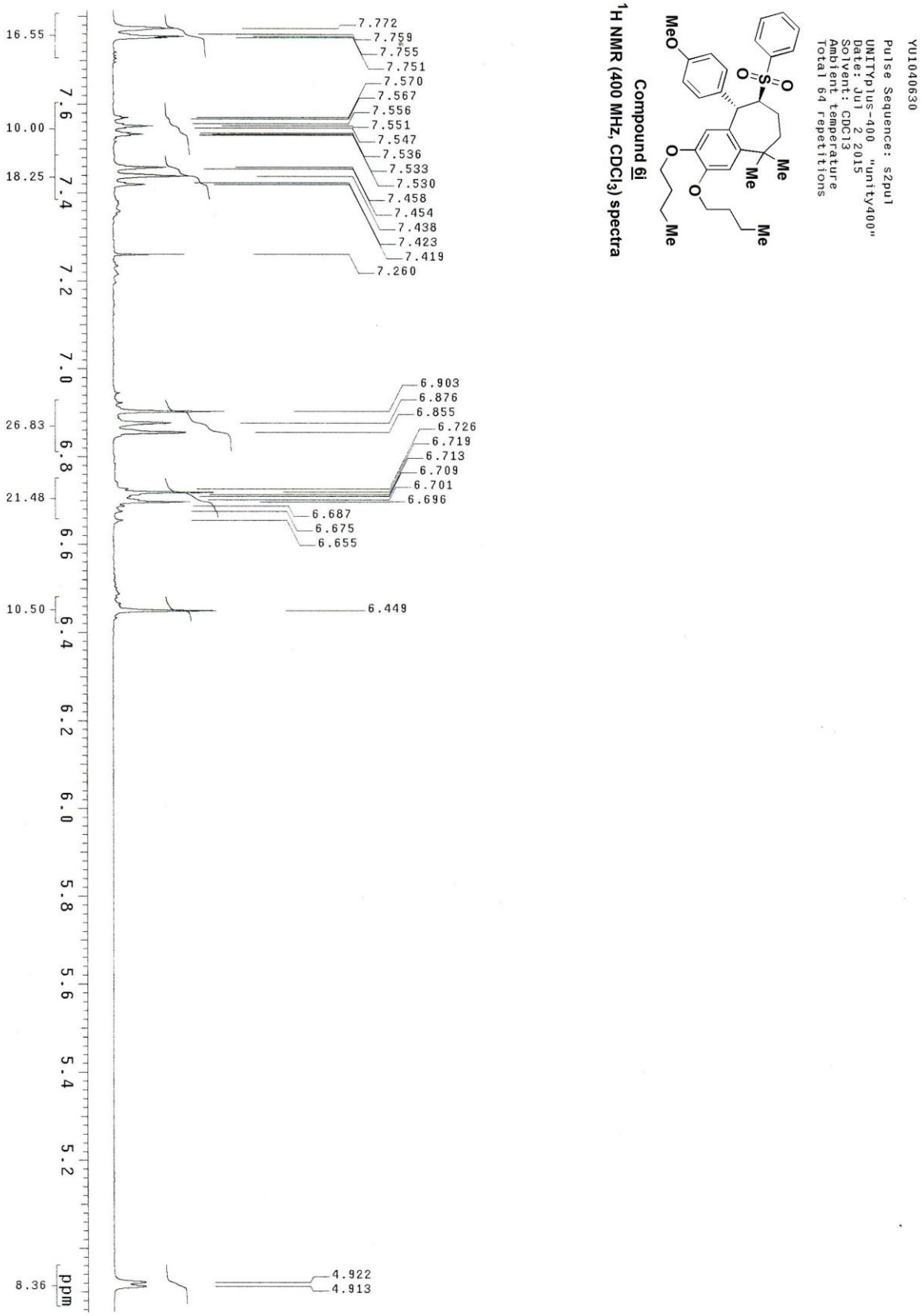

YU1040627
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
Me
Me
Compound 6h
1H NMR (400 MHz, CDCl3) spectra
4.895
4.884
4.441
4.416
4.226
4.124
4.106
4.056
4.045
4.037
4.026
4.018
4.007
3.916
3.855
3.807
3.784
3.739
3.728
3.719
3.713
3.588
3.556
2.541
2.318
2.297
2.279
2.260
2.240
2.038
1.912
1.909
1.890
1.871
1.867
1.852
1.833
1.817
1.800
1.783
1.770
1.747
1.733
1.713
1.691
1.668
1.656
1.631
1.616
1.549
1.532
1.501
1.408
1.395
1.389
1.376
1.346
1.324
1.311
1.302
1.295
1.284
1.269
1.265
1.252
1.234
1.224
1.187
1.170
1.157
1.137
1.133
1.128
1.125
1.111
10.13
10.58
32.52
10.41
11.21
26.06
31.12
31.84
ppm

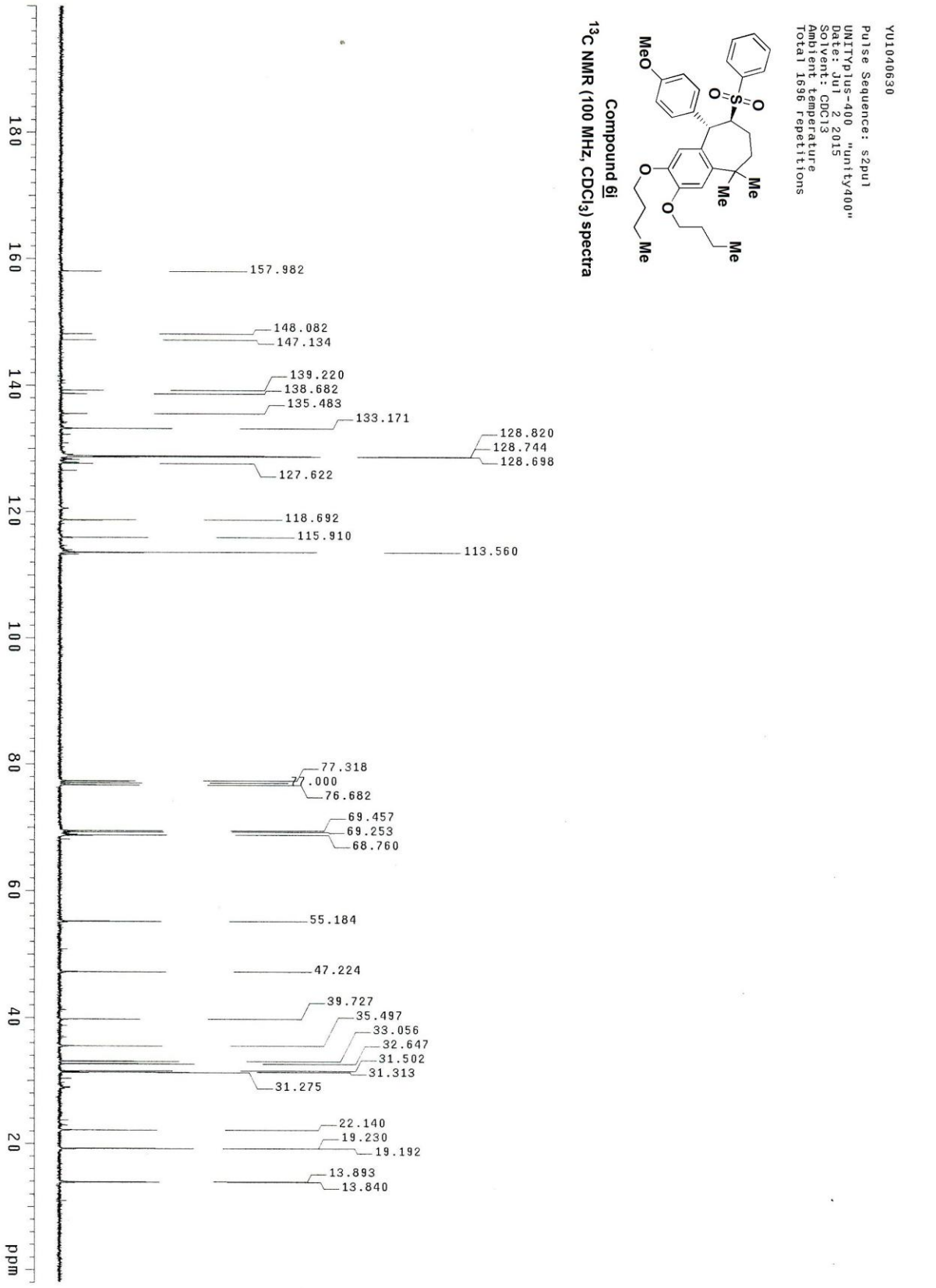

YU1040627
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
O
S
O
O
Me
Me
O
O
Compound 6h
1H NMR (400 MHz, CDCl3) spectra
19.53
11.71
20.89
10.39
20.92
19.85
10.41
20.00
7.756
7.739
7.735
7.574
7.571
7.568
7.557
7.552
7.548
7.537
7.534
7.530
7.464
7.444
7.430
7.426
7.260
6.914
6.854
6.833
6.826
6.707
6.699
6.677
6.453
5.905
5.902
5.882
5.878
7.6
7.4
7.2
7.0
6.8
6.6
6.4
6.2
6.0
ppm

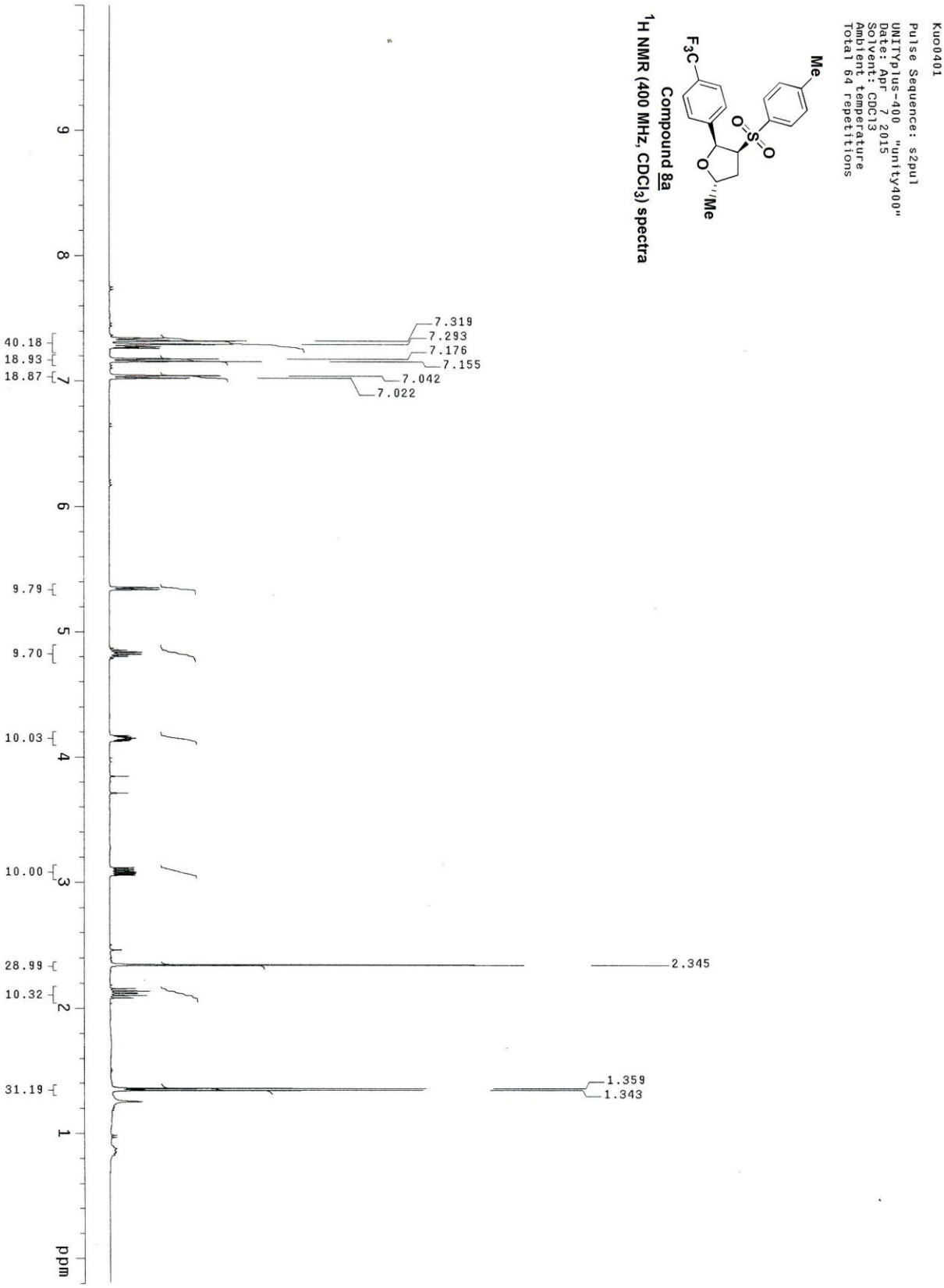

YU1040627
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 1024 repetitions
MeO
O
S
O
Me
Me
O
O
Compound 6h
13C NMR (100 MHz, CDCl3) spectra
157.997
147.111
145.626
140.539
138.856
134.475
133.125
128.850
128.752
128.463
113.568
112.355
108.959
100.984
77.311
77.000
76.682
68.601
55.115
47.171
39.894
35.353
33.125
32.692
21.913
180
160
140
120
100
80
60
40
20
ppm

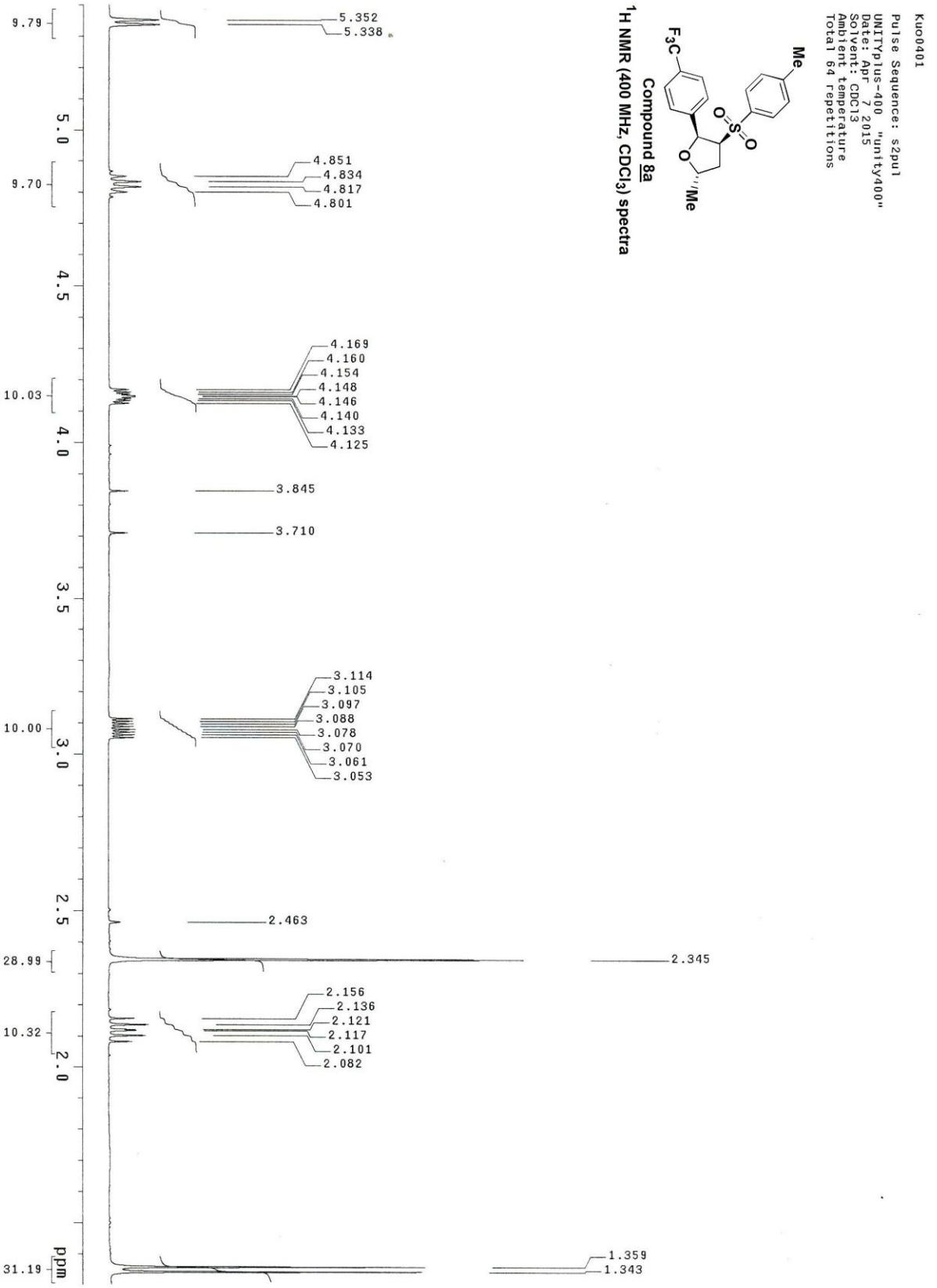

YU1040630
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
Me
Me
Me
Me
Compound 6i
1H NMR (400 MHz, CDCl3) spectra
7.772
7.755
7.751
7.458
7.438
7.260
6.903
6.876
6.855
6.719
6.696
6.449
4.019
4.003
3.987
3.859
3.851
3.750
1.711
1.306
1.176
1.007
0.988
0.970
0.959
0.956
0.937
0.918
16.55
10.00
18.25
26.83
21.48
10.50
8.36
30.49
24.11
31.03
8.58
9.77
64.52
58.54
29.14
26.17
71.40
ppm

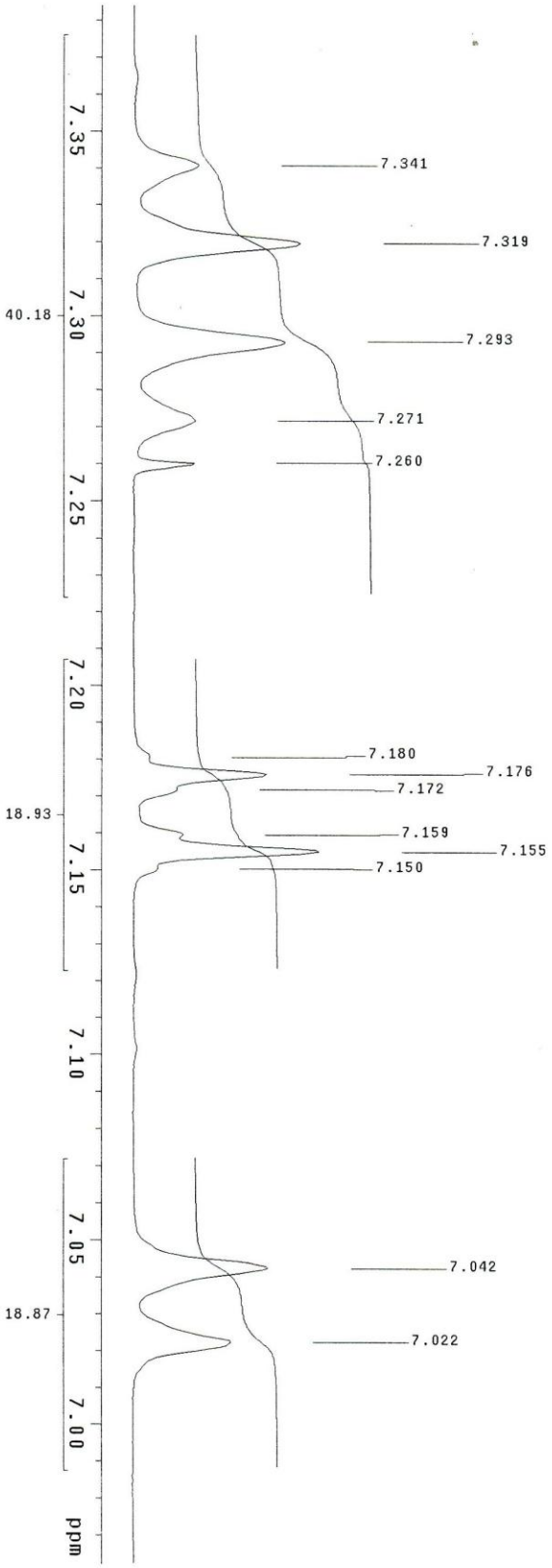

4.069
4.059
4.047
4.041
4.029
4.019
4.003
3.987
3.959
3.942
3.925
3.899
3.882
3.876
3.867
3.859
3.851
3.842
3.834
3.827
3.811
3.772
3.750
3.740
3.733
3.724
3.685
2.248
2.225
2.210
2.204
2.189
2.167
1.930
1.909
1.891
1.872
1.854
1.822
1.806
1.799
1.788
1.769
1.752
1.746
1.736
1.729
1.721
1.711
1.705
1.697
1.691
1.675
1.621
1.609
1.598
1.585
1.558
1.539
1.521
1.507
1.502
1.483
1.467
1.452
1.448
1.434
1.429
1.411
1.392
1.333
1.306
1.270
1.257
1.176
1.117
1.079
1.028
1.007
0.997
0.988
0.978
0.970
0.956
0.937
0.918
0.903
0.896
0.880
30.49
24.11
31.03
8.58
9.77
64.52
58.54
29.14
26.17
71.40
4.0
3.5
3.0
2.5
2.0
1.5
ppm
YU1040630
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
Me
Me
Me
Me
Compound 6i
1H NMR (400 MHz, CDCl3) spectra


YU1040630
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
MeO
Me
Me
Me
Me
Compound 6i
1H NMR (400 MHz, CDCl3) spectra
16.55
10.00
18.25
26.83
21.48
10.50
8.36
ppm
7.772
7.759
7.755
7.751
7.570
7.567
7.556
7.551
7.547
7.536
7.533
7.530
7.458
7.454
7.438
7.423
7.419
7.260
6.903
6.876
6.855
6.726
6.719
6.713
6.709
6.701
6.696
6.687
6.675
6.655
6.449
4.922
4.913


YU1040630
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 1696 repetitions
MeO
Me
Me
Me
Me
Compound 6i
13C NMR (100 MHz, CDCl3) spectra
157.982
148.082
147.134
139.220
138.682
135.483
133.171
128.820
128.744
128.698
127.622
118.692
115.910
113.560
77.318
77.000
76.682
69.457
69.253
68.760
55.184
47.224
39.727
35.497
33.056
32.647
31.502
31.313
31.275
22.140
19.230
19.192
13.893
13.840
180
160
140
120
100
80
60
40
20
ppm

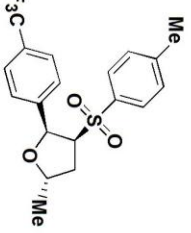

Kuo0401
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 7 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
F3C
Me
O
S
O
O
Me
Compound 8a
1H NMR (400 MHz, CDCl3) spectra
7.319
7.293
7.176
7.155
7.042
7.022
2.345
1.359
1.343
40.18
18.93
18.87
9.79
9.70
10.03
10.00
28.99
10.32
31.19
ppm


Kuo0401
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 7 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
F3C
O
S
O
O
Me
Compound 8a
1H NMR (400 MHz, CDCl3) spectra
9.79
5.352
5.338
5.0
9.70
4.851
4.834
4.817
4.801
4.5
10.03
4.169
4.160
4.154
4.148
4.146
4.140
4.133
4.125
4.0
3.845
3.710
3.5
10.00
3.114
3.105
3.097
3.088
3.078
3.070
3.061
3.053
3.0
2.463
2.5
28.99
2.345
10.32
2.156
2.136
2.121
2.117
2.101
2.082
2.0
31.19
1.359
1.343
ppm



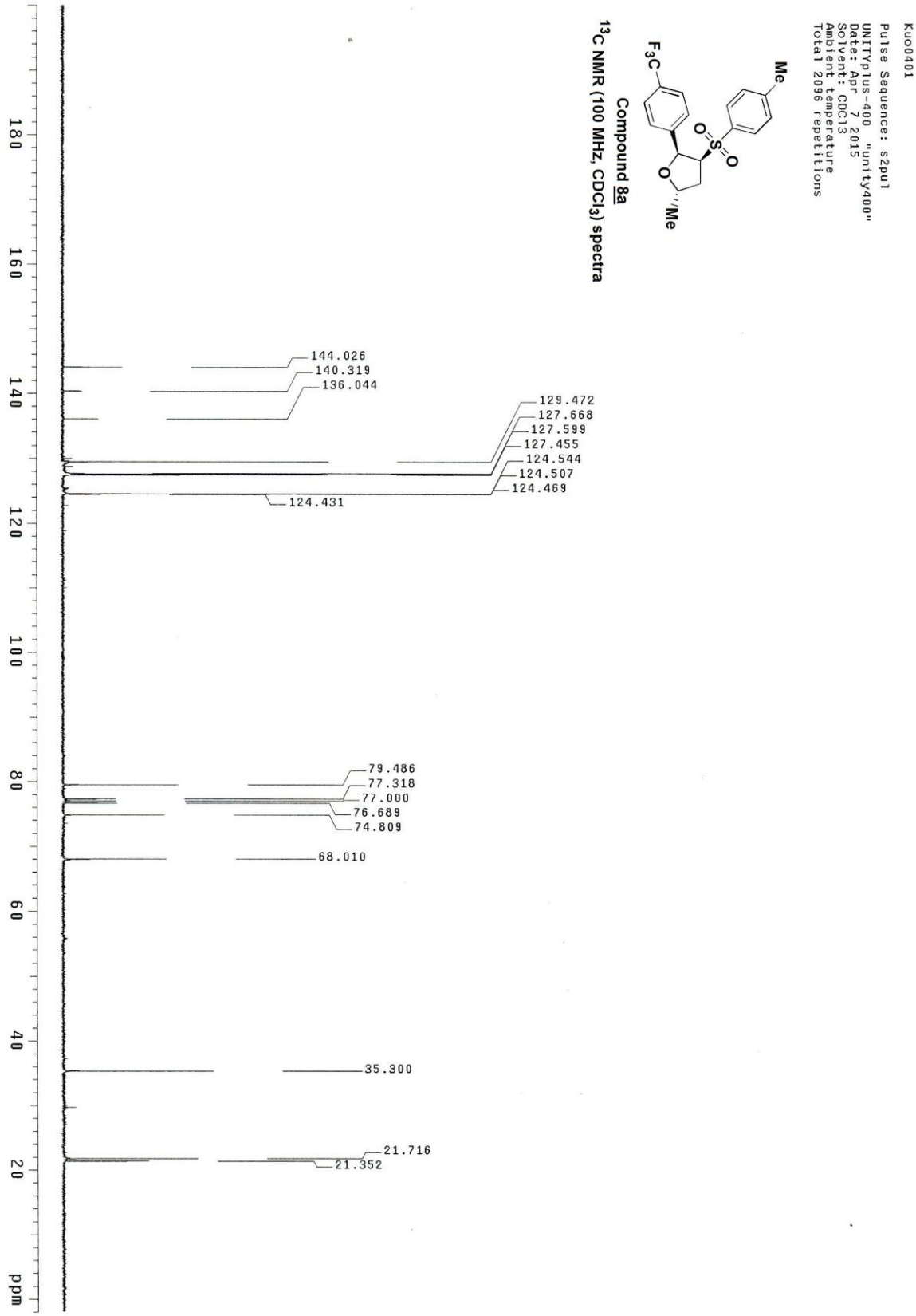
Kuo0401

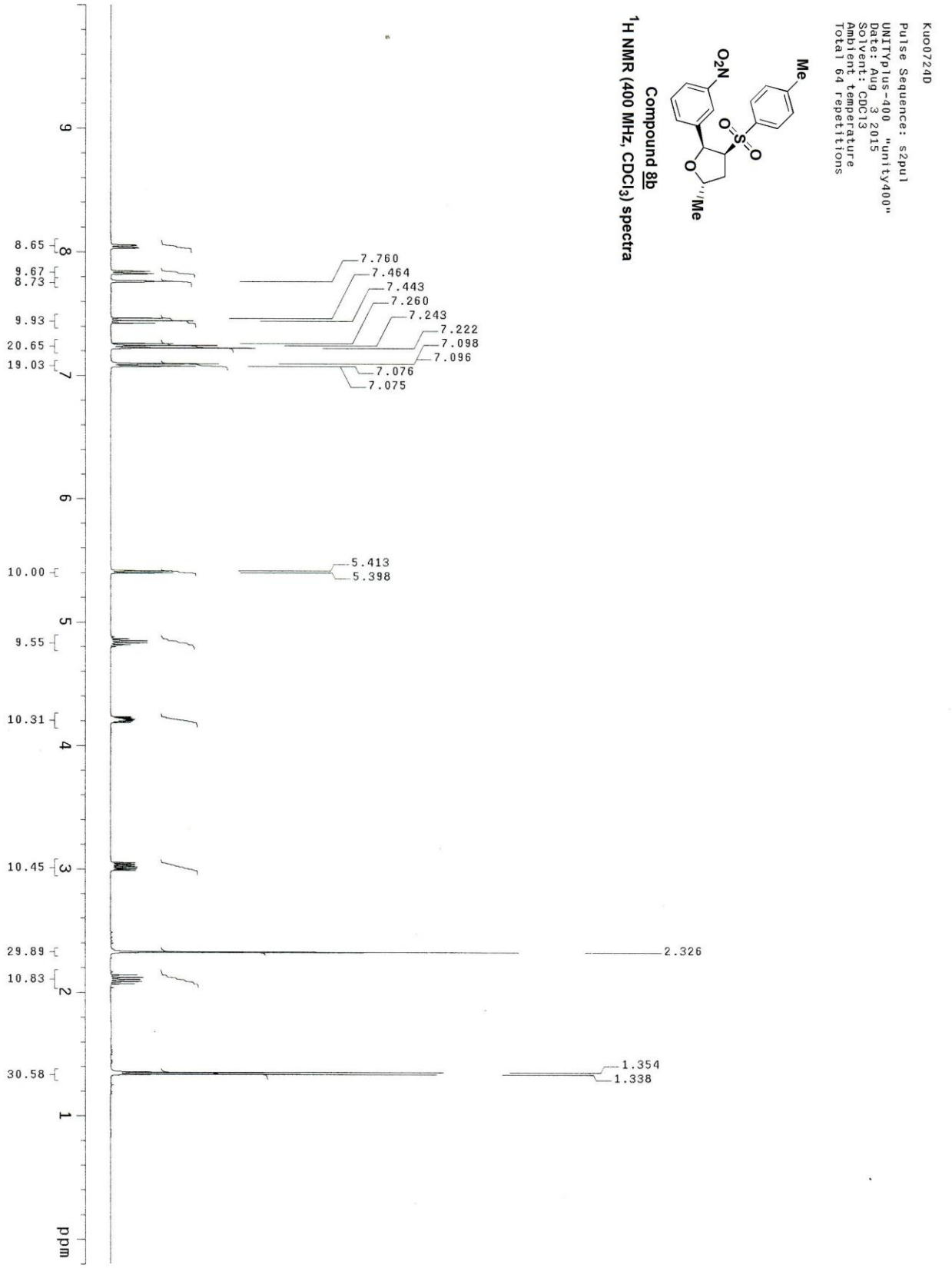
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 7 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

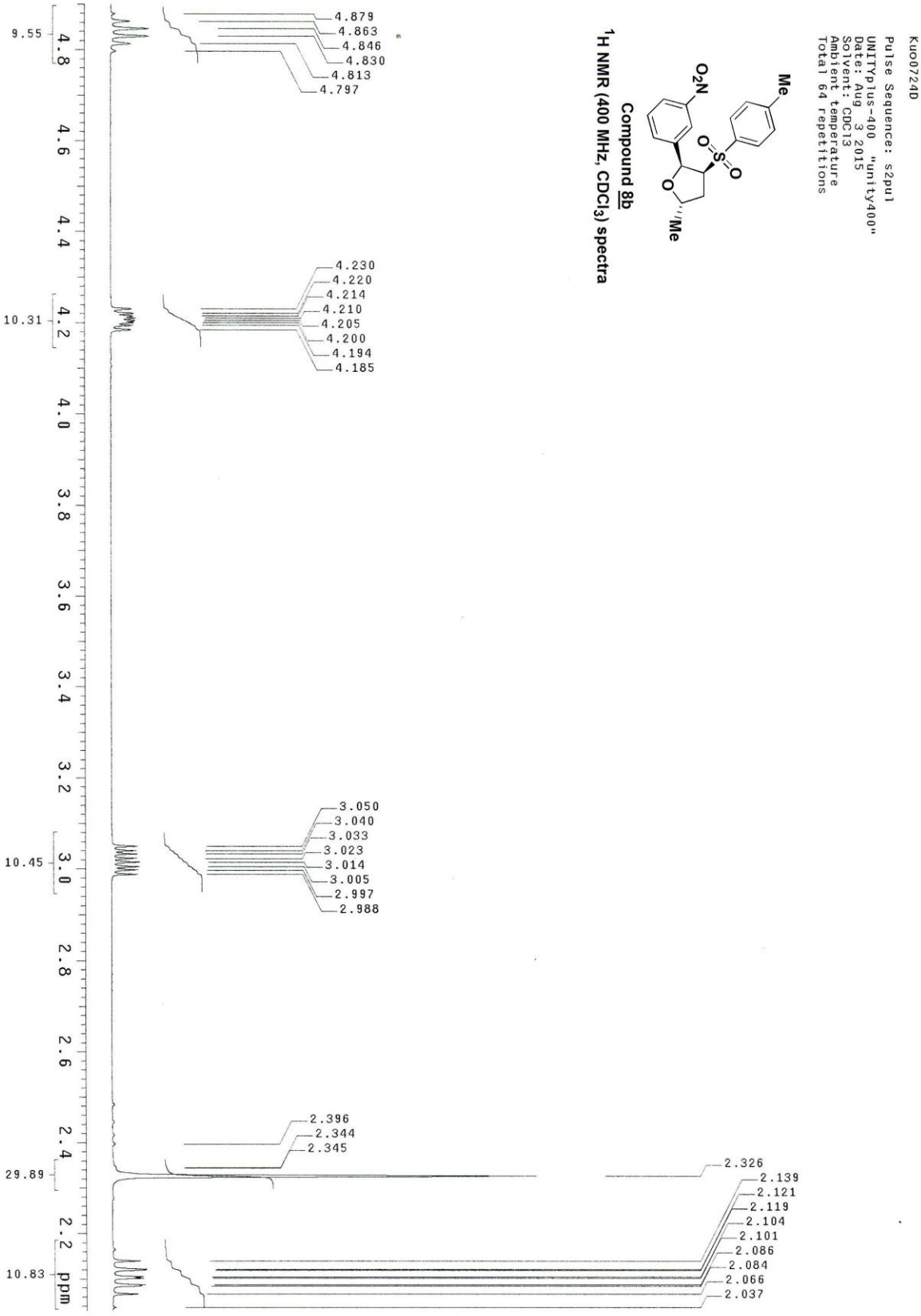


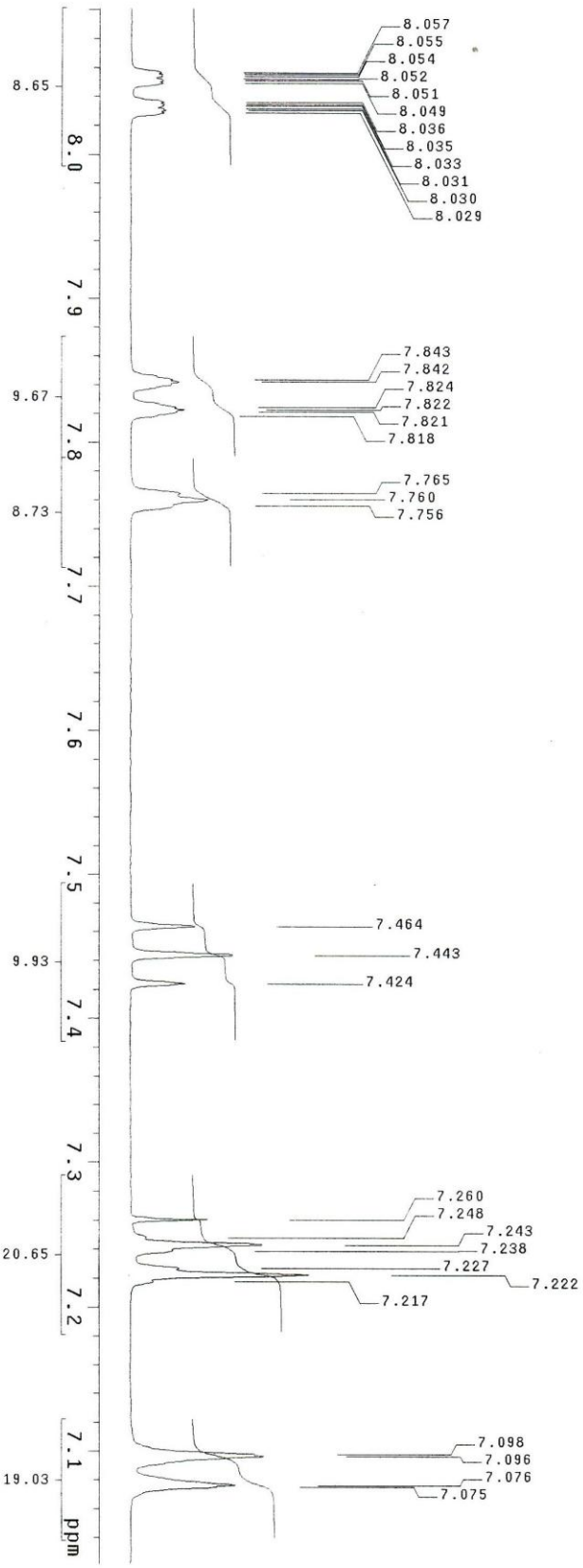
Compound 8a

^{1}H NMR (400 MHz, $CDCl_3$) spectra


Kuo0401
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 7 2015
Solvent: CDCl3
Ambient temperature
Total 2096 repetitions
Me
F3C
O
S
O
O
Me
Compound 8a
13C NMR (100 MHz, CDCl3) spectra
144.026
140.319
136.044
129.472
127.668
127.599
127.455
124.544
124.507
124.469
124.431
79.486
77.318
77.000
76.689
74.809
68.010
35.300
21.716
21.352
180
160
140
120
100
80
60
40
20
ppm

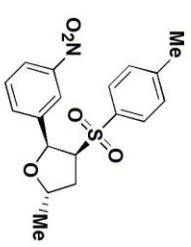

Kuo0724D
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 3 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
O2N
Me
O
S
O
O
Me
Compound 8b
1H NMR (400 MHz, CDCl3) spectra
8.65
9.67
8.73
9.93
20.65
19.03
10.00
9.55
10.31
10.45
29.89
10.83
30.58
7.760
7.464
7.443
7.260
7.243
7.222
7.098
7.096
7.076
7.075
5.413
5.398
2.326
1.354
1.338
ppm


Kuo0724D
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 3 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O2N
O
S
O
O
Me
Compound 8b
1H NMR (400 MHz, CDCl3) spectra
4.879
4.863
4.846
4.830
4.813
4.797
4.230
4.220
4.214
4.210
4.205
4.200
4.194
4.185
3.050
3.040
3.033
3.023
3.014
3.005
2.997
2.988
2.396
2.344
2.345
2.326
2.139
2.121
2.119
2.104
2.101
2.086
2.084
2.066
2.037
9.55
10.31
10.45
29.89
10.83
ppm



Compound 8b

^{1}H NMR (400 MHz, $CDCl_3$) spectra

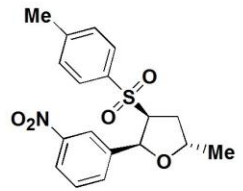


Kuo0724D

Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 3 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

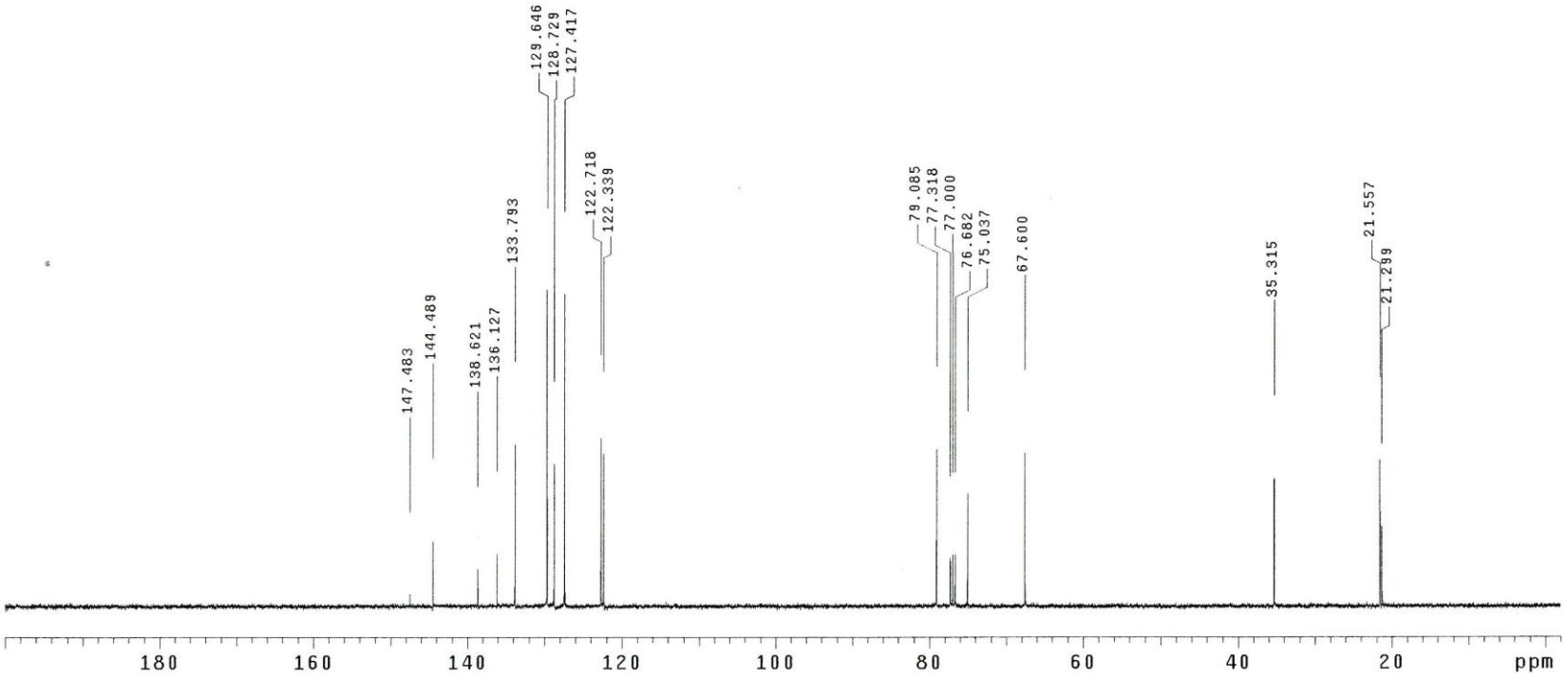
Kuo0724D

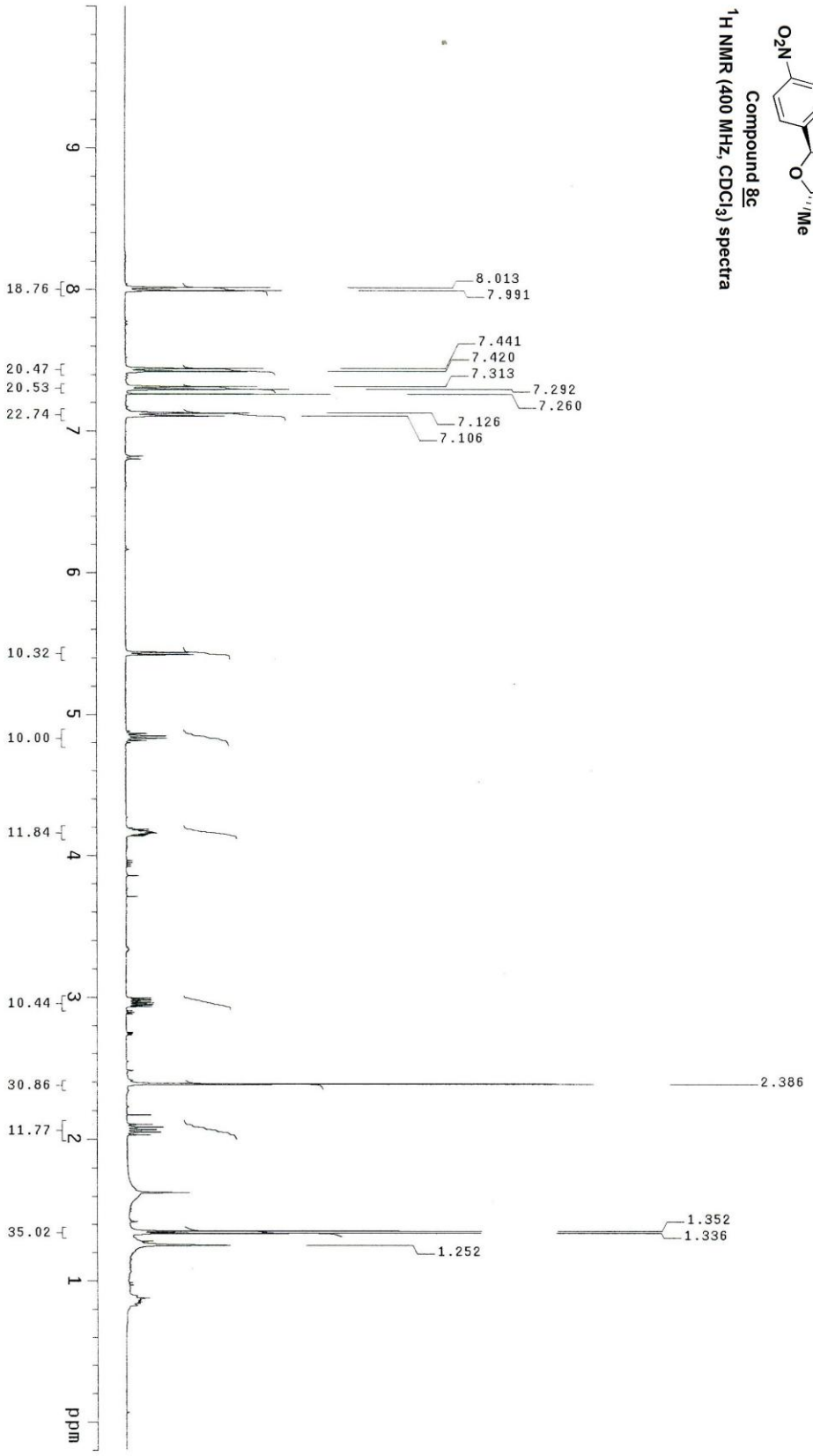
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 3 2015
Solvent: CDCl3
Ambient temperature
Total 1408 repetitions

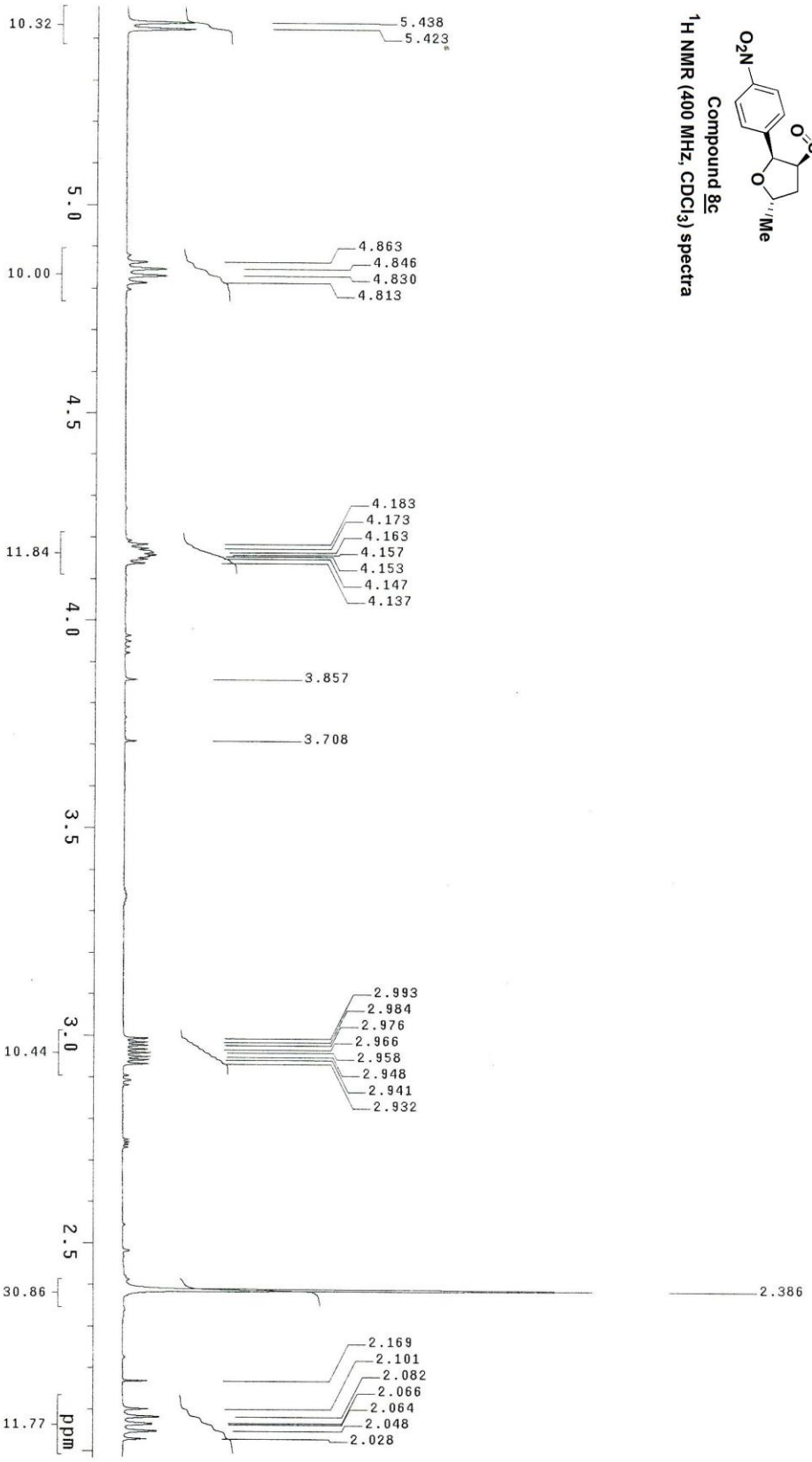


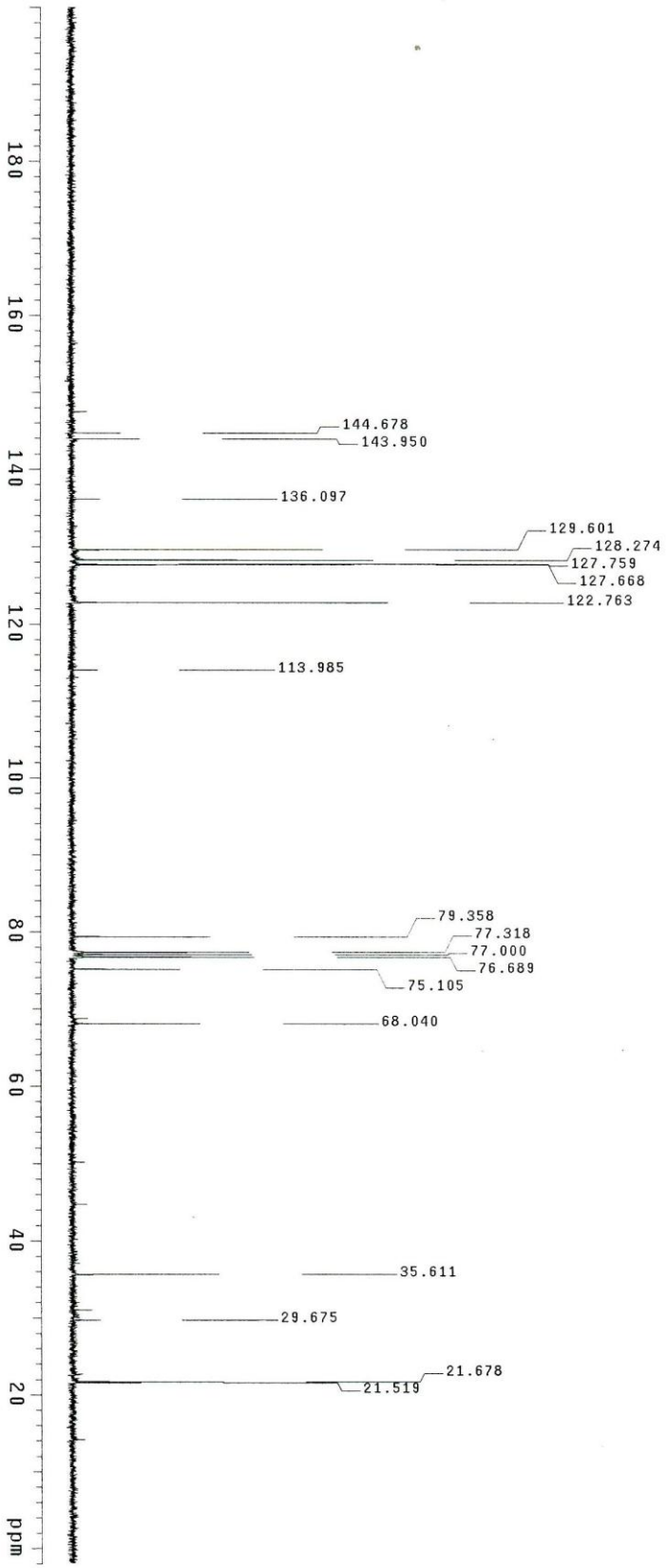
Compound 8b

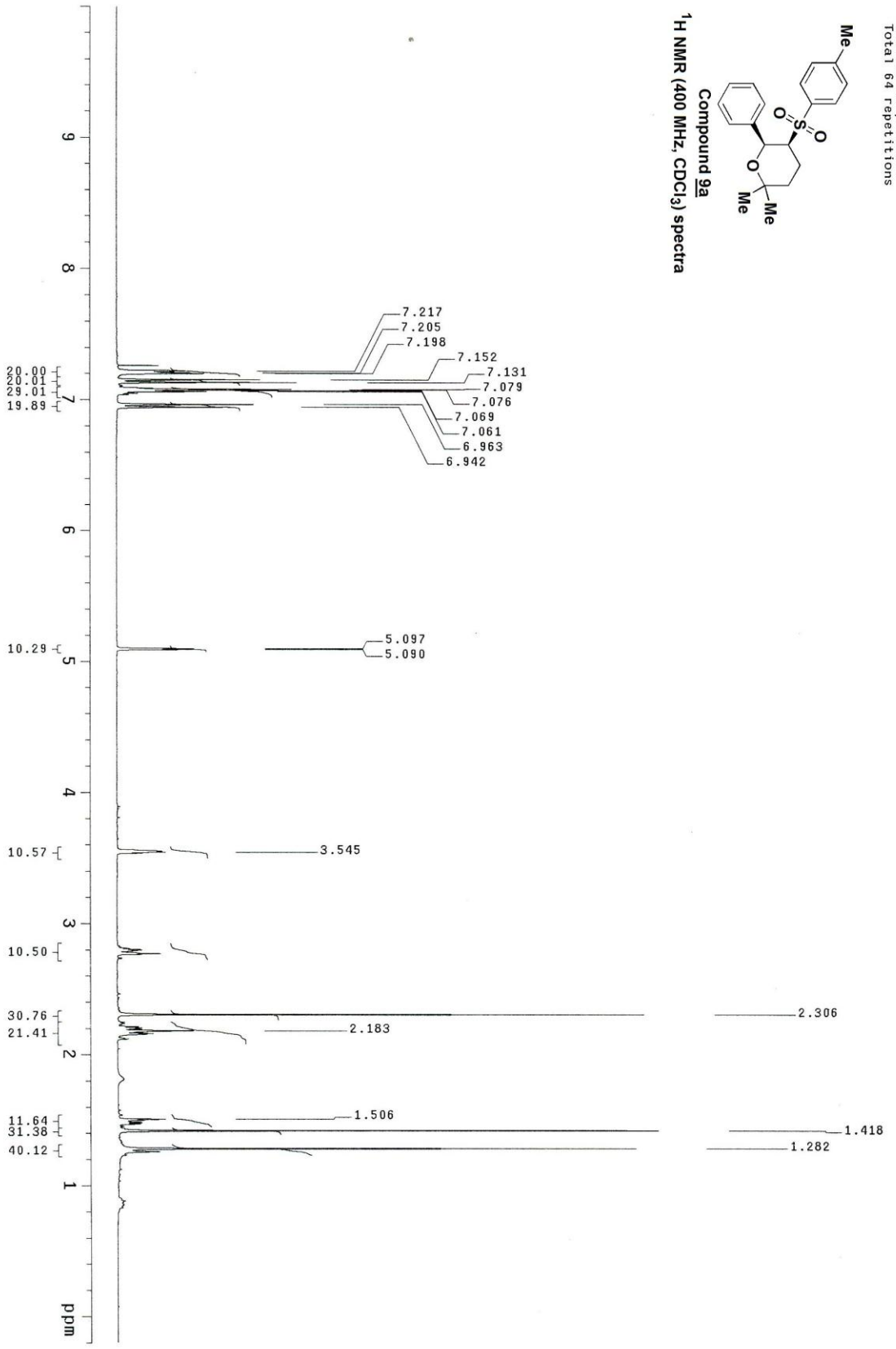
^{13}C NMR (100 MHz, $CDCl_3$) spectra

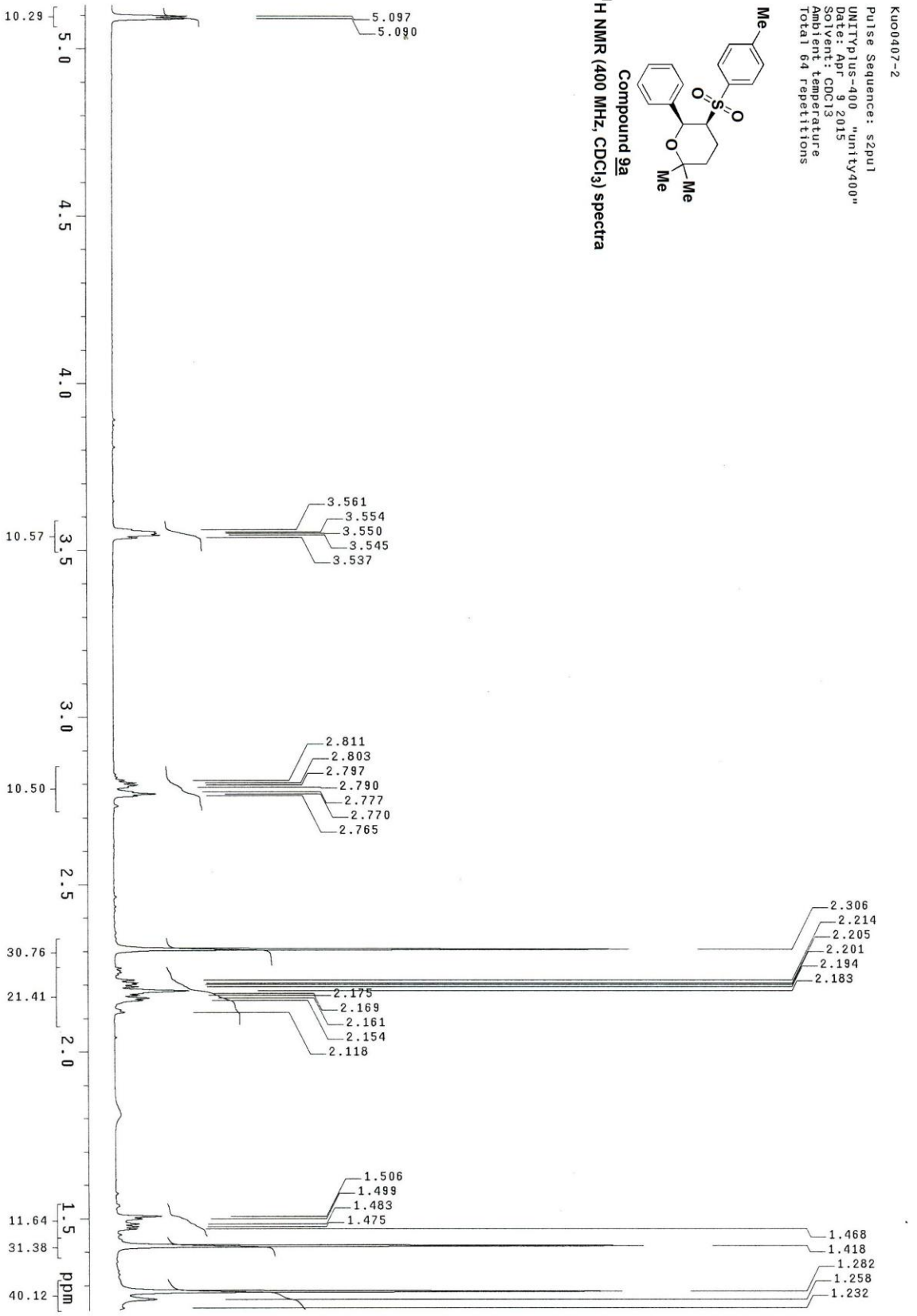



Kuo0804D
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O2N
O
S
O
O
Me
Compound 8c
1H NMR (400 MHz, CDCl3) spectra
8.013
7.991
7.441
7.420
7.313
7.292
7.260
7.126
7.106
2.386
1.352
1.336
1.252
18.76
20.47
20.53
22.74
10.32
10.00
11.84
10.44
30.86
11.77
35.02
ppm


Kuo0804D
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 17 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O2N
O
S
O
O
Me
Compound 8c
1H NMR (400 MHz, CDCl3) spectra
10.32
10.00
11.84
10.44
30.86
11.77
5.438
5.423
4.863
4.846
4.830
4.813
4.183
4.173
4.163
4.157
4.153
4.147
4.137
3.857
3.708
2.993
2.984
2.976
2.966
2.958
2.948
2.941
2.932
2.386
2.169
2.101
2.082
2.066
2.064
2.048
2.028
5.0
4.5
4.0
3.5
3.0
2.5
ppm

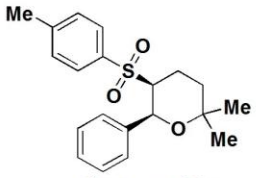

Kuo0804D
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Aug 17 2015
Solvent: CDCl3
Ambient temperature
Total 5216 repetitions
Me
O2N
O
S
O
O
Me
Compound 8c
13C NMR (100 MHz, CDCl3) spectra
144.678
143.950
136.097
129.601
128.274
127.759
127.668
122.763
113.985
79.358
77.318
77.000
76.689
75.105
68.040
35.611
29.675
21.678
21.519
180
160
140
120
100
80
60
40
20
ppm


Kuo0407-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
O
Me
Me
Compound 9a
1H NMR (400 MHz, CDCl3) spectra
7.217
7.205
7.198
7.152
7.131
7.079
7.076
7.069
7.061
6.963
6.942
5.097
5.090
3.545
2.306
2.183
1.506
1.418
1.282
20.00
20.01
29.01
19.89
10.29
10.57
10.50
30.76
21.41
11.64
31.38
40.12
ppm


Kuo0407-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
O
Me
Me
Compound 9a
1H NMR (400 MHz, CDCl3) spectra
10.29
10.57
10.50
30.76
21.41
11.64
31.38
40.12
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm
5.097
5.090
3.561
3.554
3.550
3.545
3.537
2.811
2.803
2.797
2.790
2.777
2.770
2.765
2.306
2.214
2.205
2.201
2.194
2.183
2.175
2.169
2.161
2.154
2.118
1.506
1.499
1.483
1.475
1.468
1.418
1.282
1.258
1.232

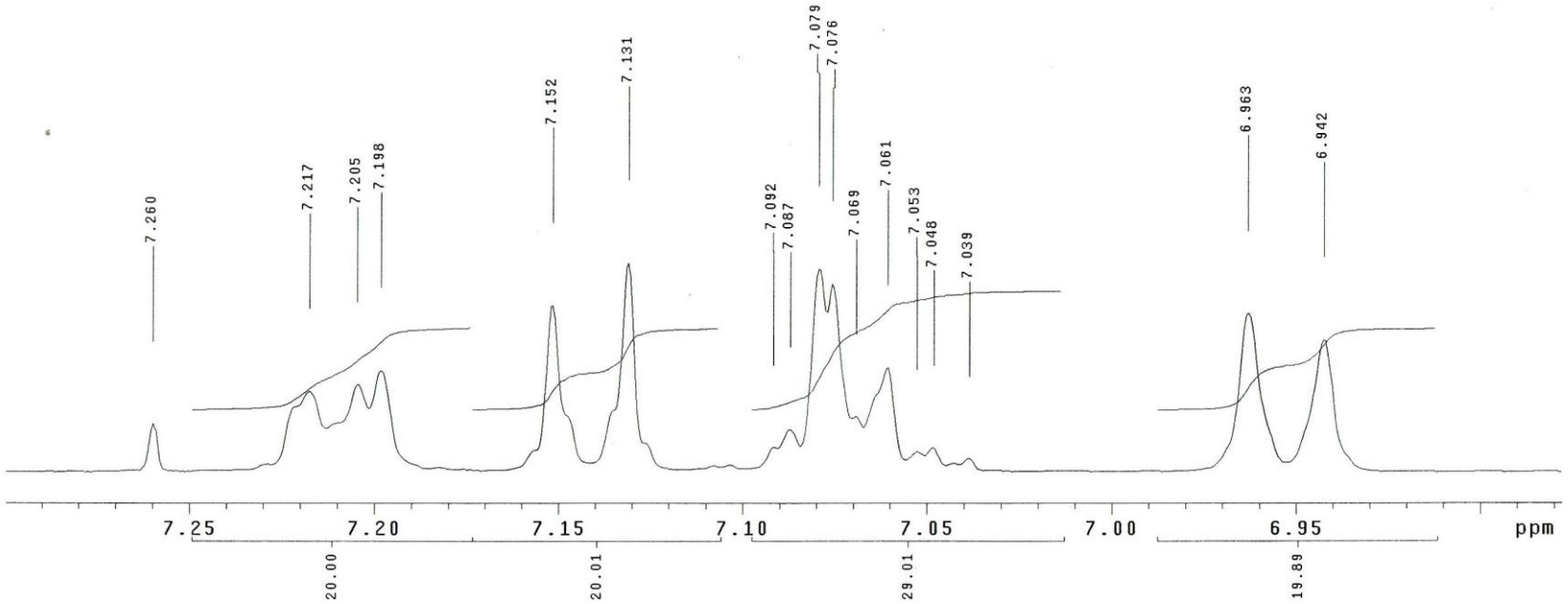
Kuo0407-2

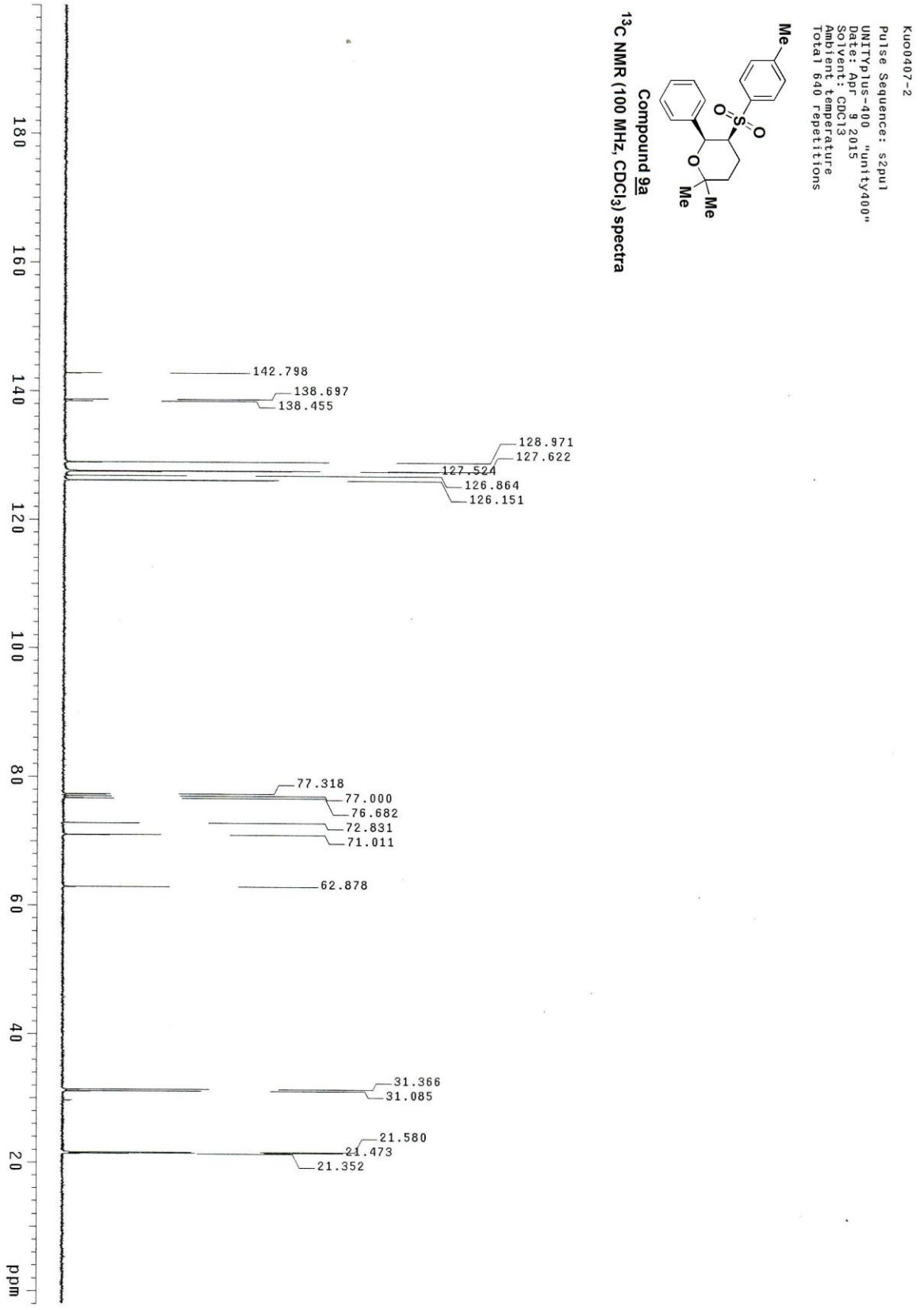
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

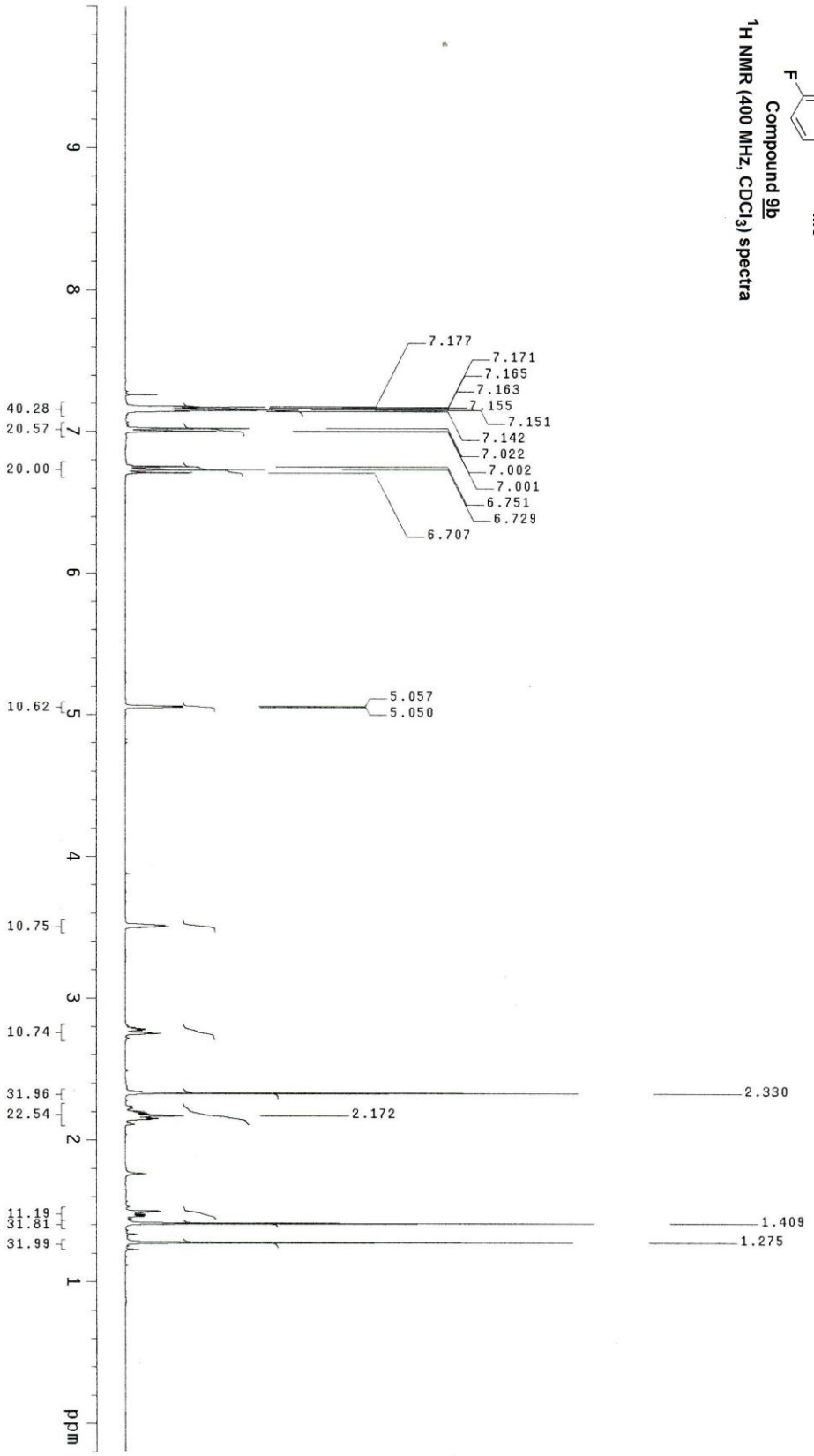


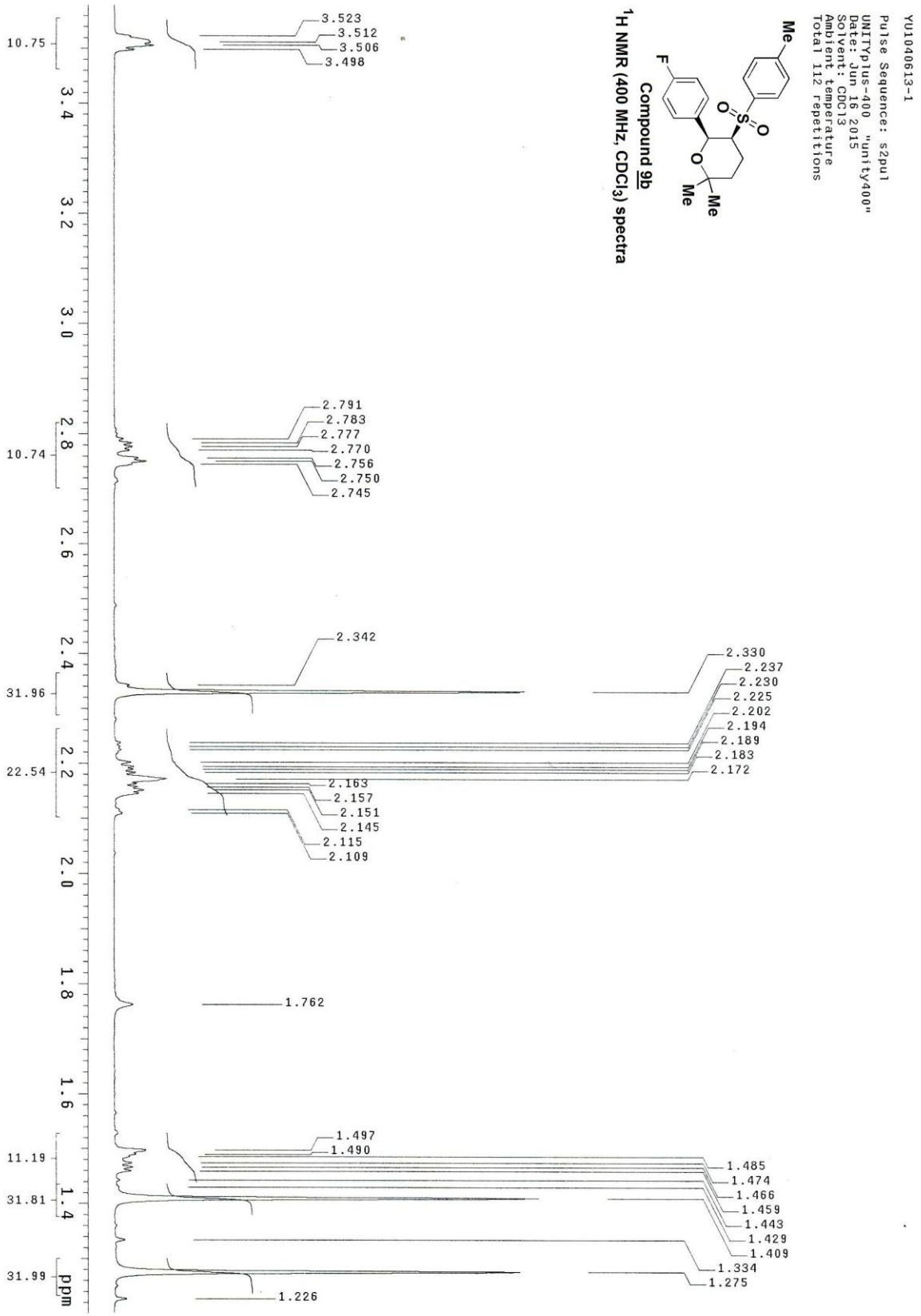
Compound 9a

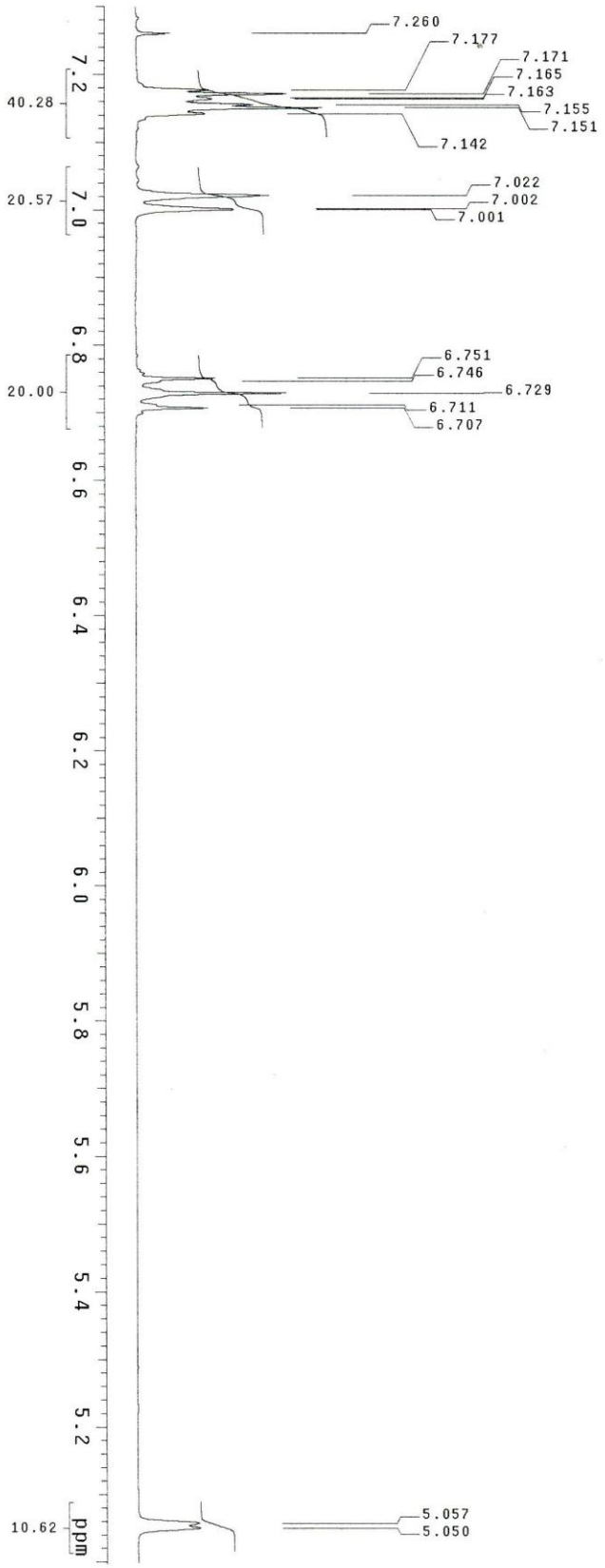
^{1}H NMR (400 MHz, $CDCl_3$) spectra




Kuo0407-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Apr 9 2015
Solvent: CDCl3
Ambient temperature
Total 640 repetitions
Me
O
S
O
O
Me
Me
Compound 9a
13C NMR (100 MHz, CDCl3) spectra
142.798
138.697
138.455
128.971
127.622
127.524
126.864
126.151
77.318
77.000
76.682
72.831
71.011
62.878
31.366
31.085
21.580
21.473
21.352
180
160
140
120
100
80
60
40
20
ppm

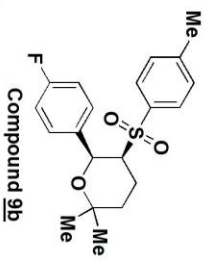

YU1040613-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 112 repetitions
Me
F
O
S
O
O
Me
Me
Compound 9b
1H NMR (400 MHz, CDCl3) spectra
7.177
7.171
7.165
7.163
7.155
7.151
7.142
7.022
7.002
7.001
6.751
6.729
6.707
5.057
5.050
2.330
2.172
1.409
1.275
40.28
20.57
20.00
10.62
10.75
10.74
31.96
22.54
11.19
31.81
31.99
ppm


YU1040613-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 112 repetitions
Me
F
O
S
O
O
Me
Me
Compound 9b
1H NMR (400 MHz, CDCl3) spectra
3.523
3.512
3.506
3.498
2.791
2.783
2.777
2.770
2.756
2.750
2.745
2.342
2.330
2.237
2.230
2.225
2.202
2.194
2.189
2.183
2.172
2.163
2.157
2.151
2.145
2.115
2.109
1.762
1.497
1.490
1.485
1.474
1.466
1.459
1.443
1.429
1.409
1.334
1.275
1.226
10.75
10.74
31.96
22.54
11.19
31.81
31.99
ppm



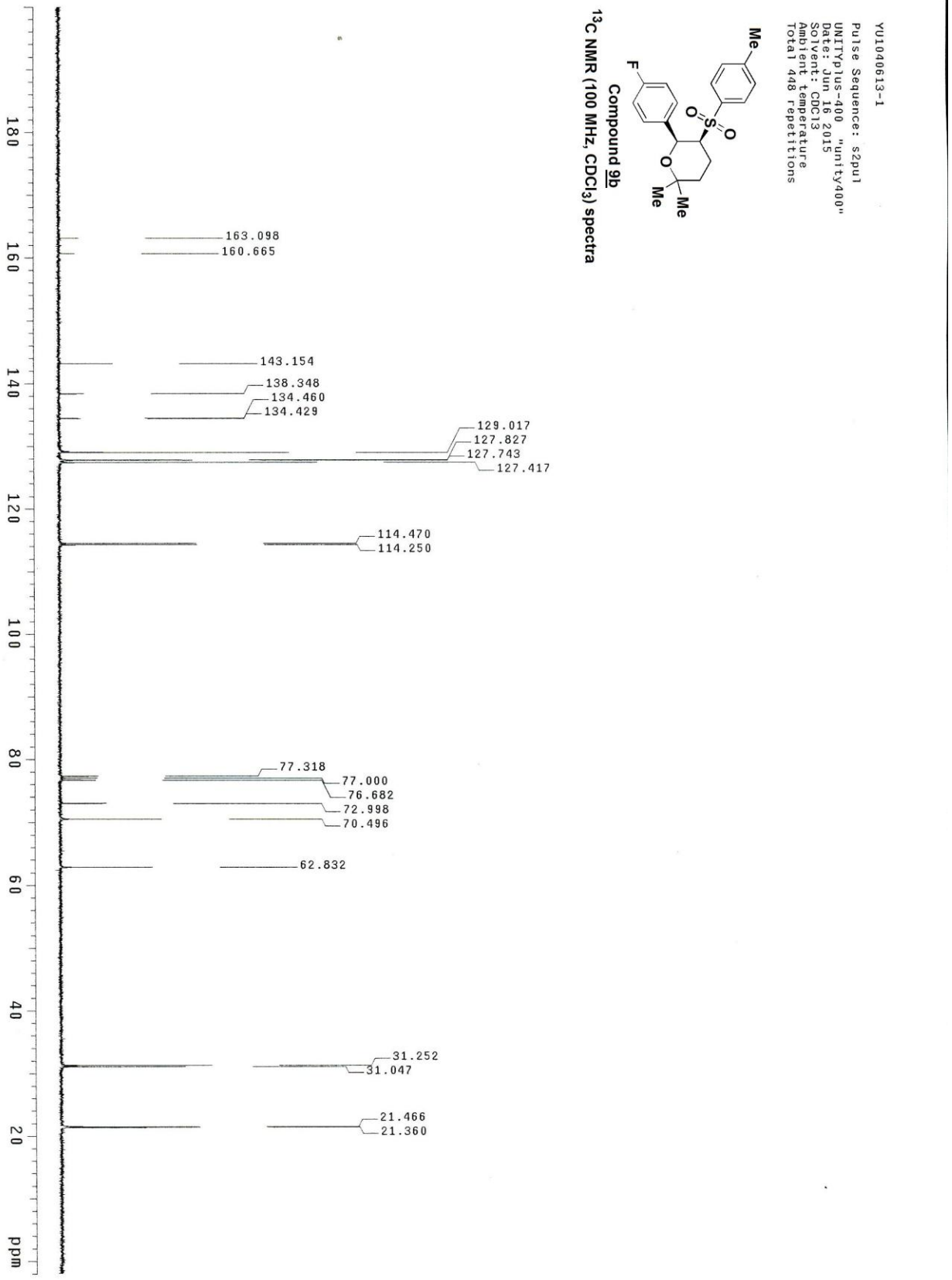
YU1040613-1

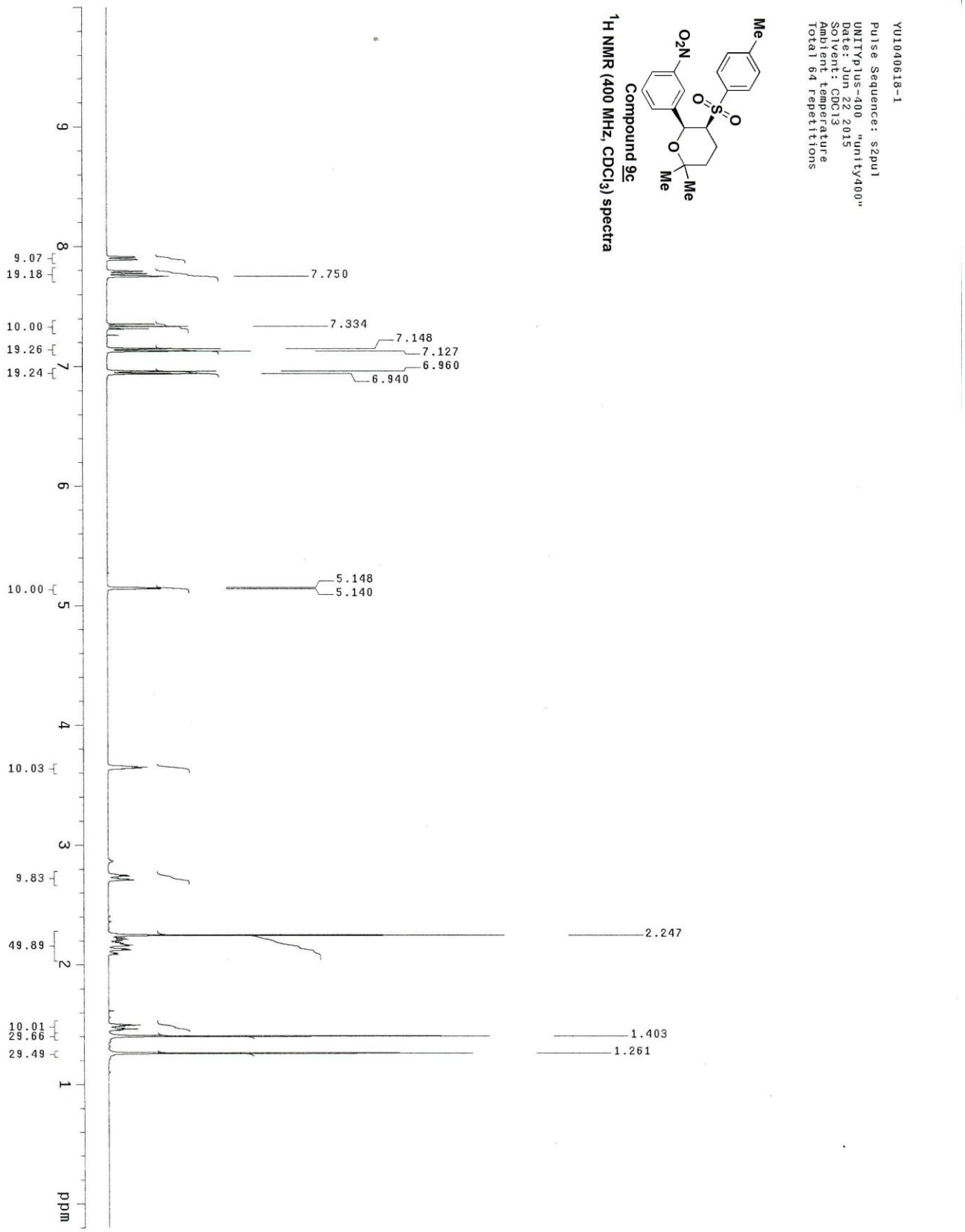
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 112 repetitions

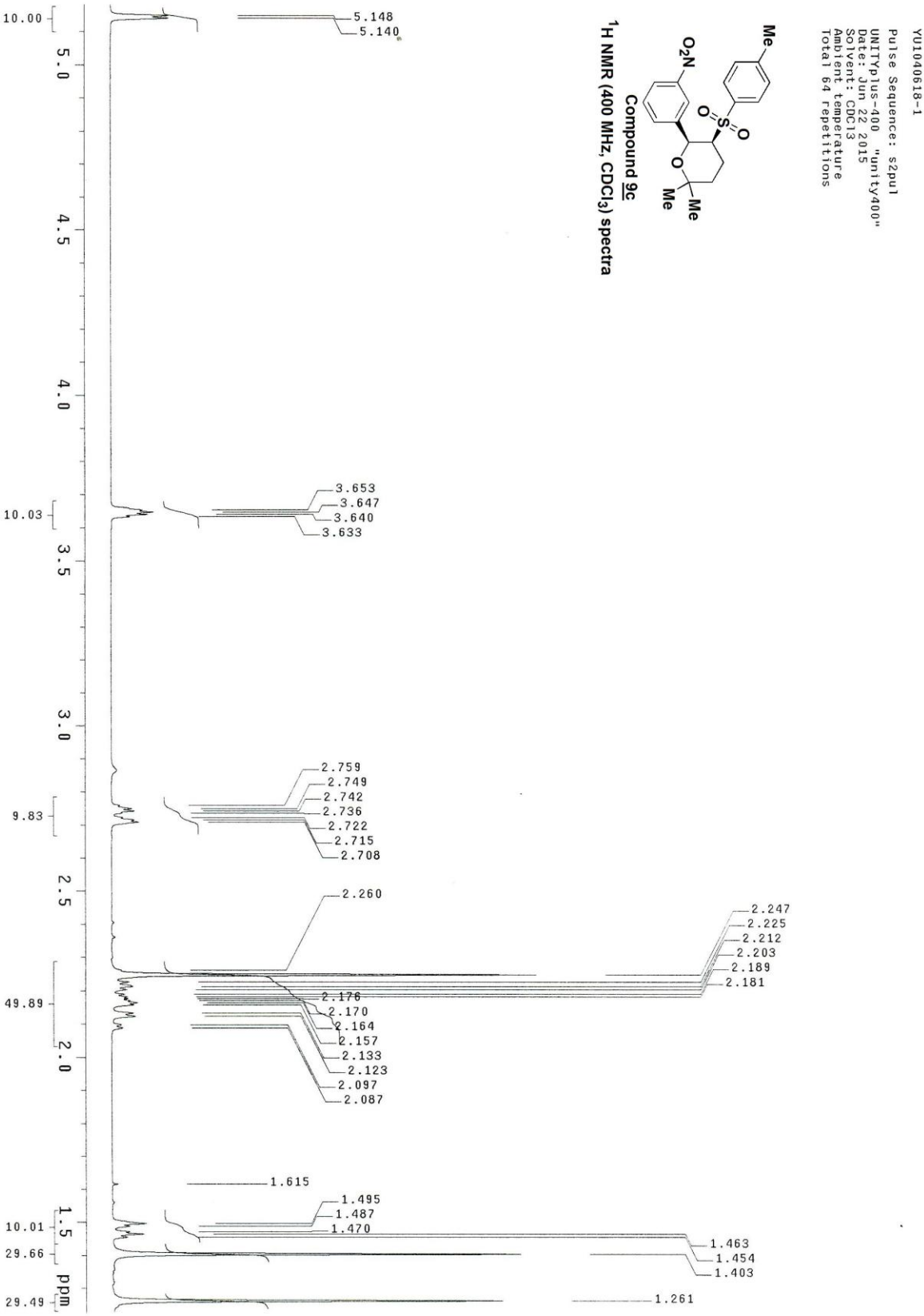


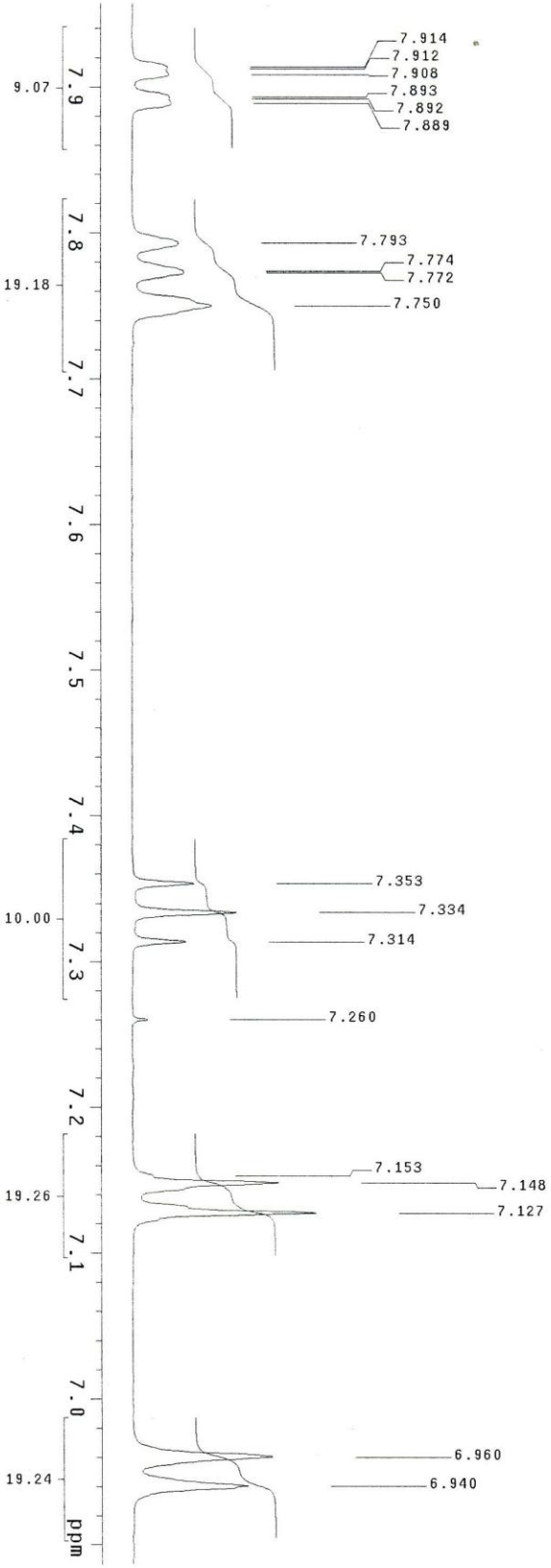
Compound 9b

^{1}H NMR (400 MHz, $CDCl_3$) spectra


YU1040613-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 16 2015
Solvent: CDCl3
Ambient temperature
Total 448 repetitions
Me
F
O
S
O
O
Me
Me
Compound 9b
13C NMR (100 MHz, CDCl3) spectra
163.098
160.665
143.154
138.348
134.460
134.429
129.017
127.827
127.743
127.417
114.470
114.250
77.318
77.000
76.682
72.998
70.496
62.832
31.252
31.047
21.466
21.360
180
160
140
120
100
80
60
40
20
ppm

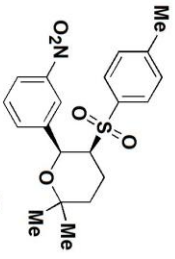

YU1040618-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O2N
O
S
O
O
Me
Me
Compound 9c
1H NMR (400 MHz, CDCl3) spectra
9.07
19.18
7.750
10.00
7.334
7.148
19.26
7.127
6.960
19.24
6.940
10.00
5.148
5.140
10.03
9.83
49.89
2.247
10.01
29.66
1.403
29.49
1.261
ppm


YU1040618-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 9c
1H NMR (400 MHz, CDCl3) spectra
Me
O2N
O
S
O
O
Me
Me
10.00
5.148
5.140
5.0
4.5
4.0
10.03
3.653
3.647
3.640
3.633
3.5
3.0
9.83
2.759
2.749
2.742
2.736
2.722
2.715
2.708
2.5
2.260
2.247
2.225
2.212
2.203
2.189
2.181
49.89
2.176
2.170
2.164
2.157
2.133
2.123
2.097
2.087
2.0
1.615
1.495
1.487
1.470
10.01
1.5
1.463
29.66
1.454
1.403
29.49
1.261
ppm



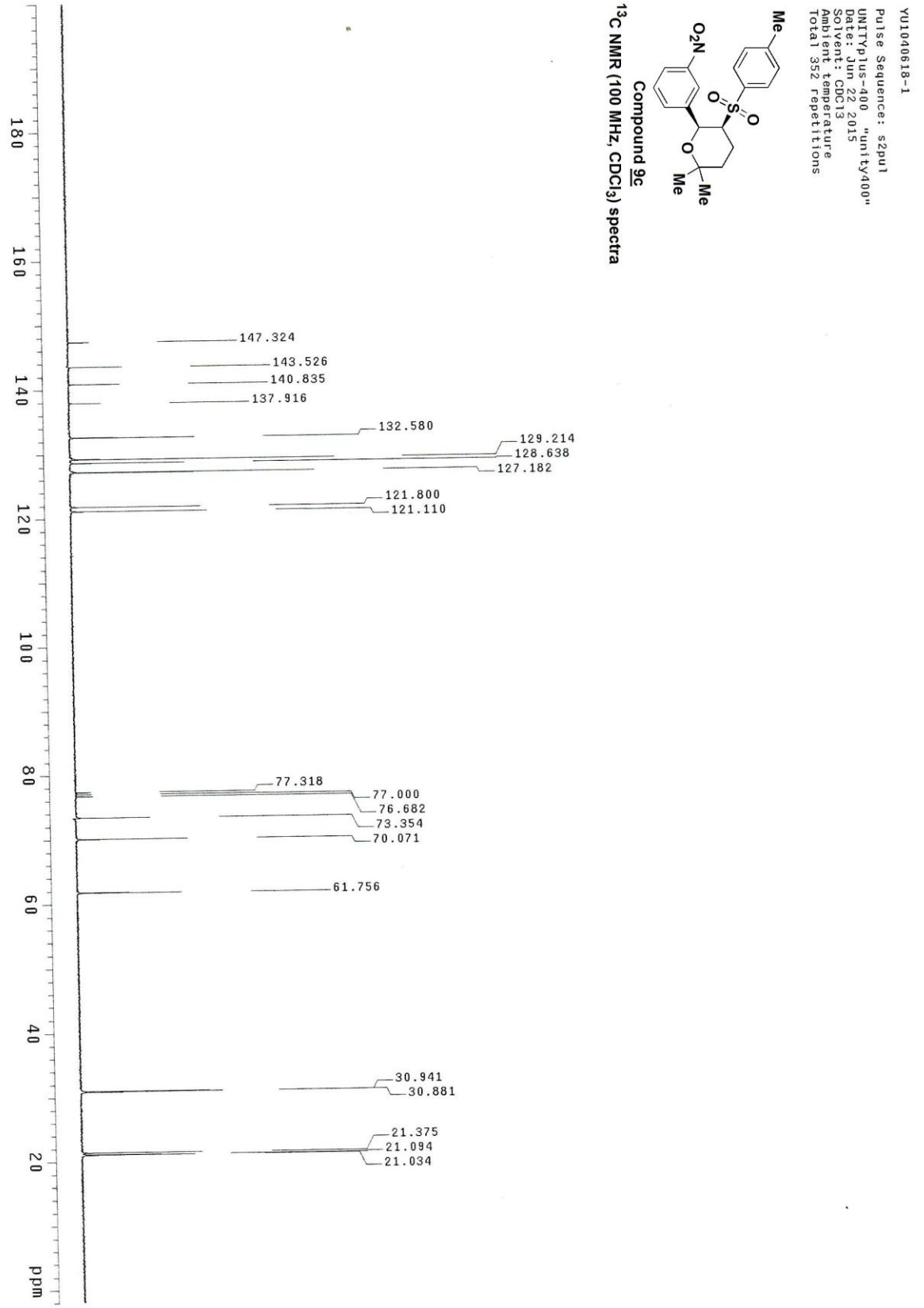
YU1040618-1

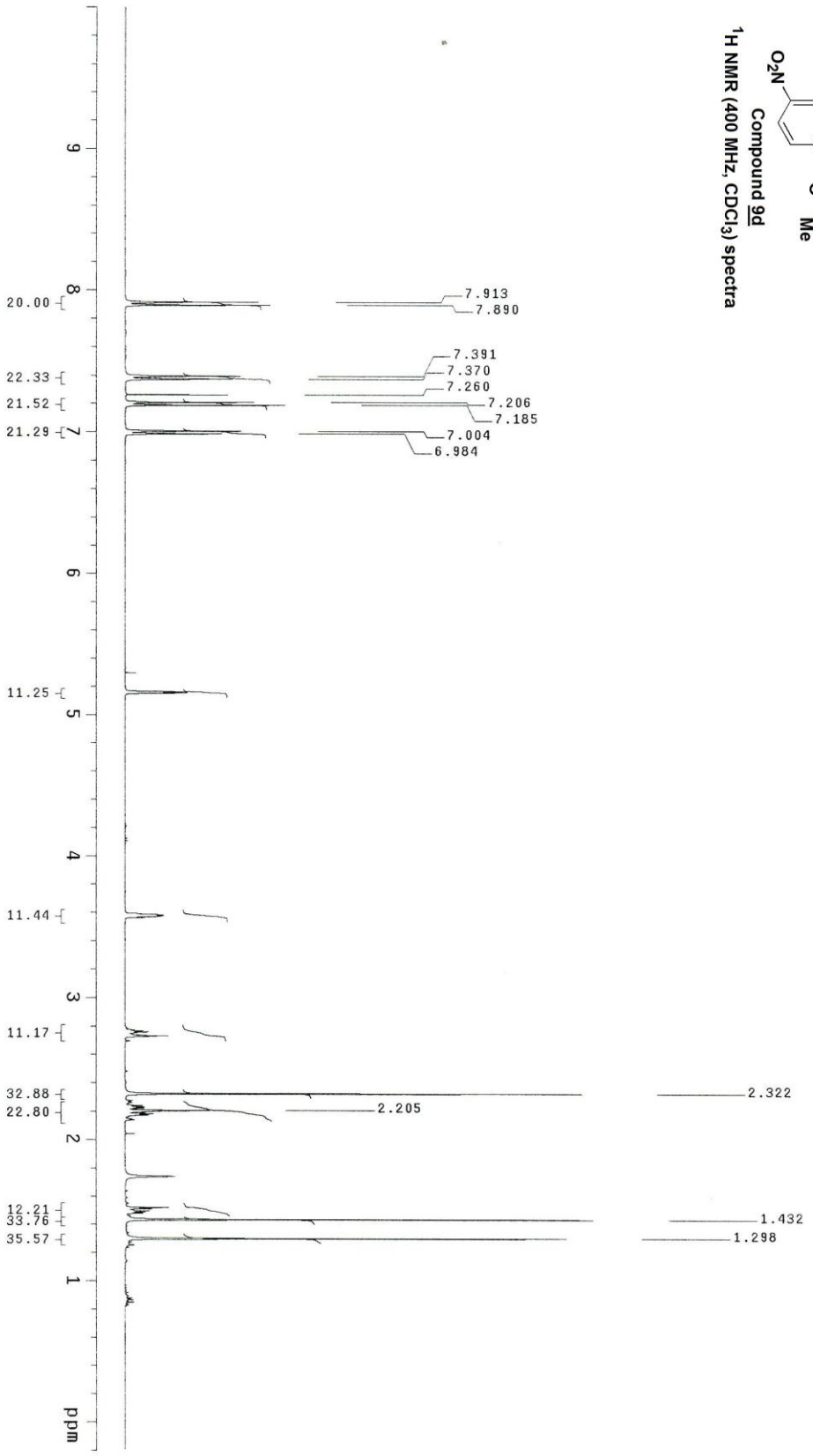
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions

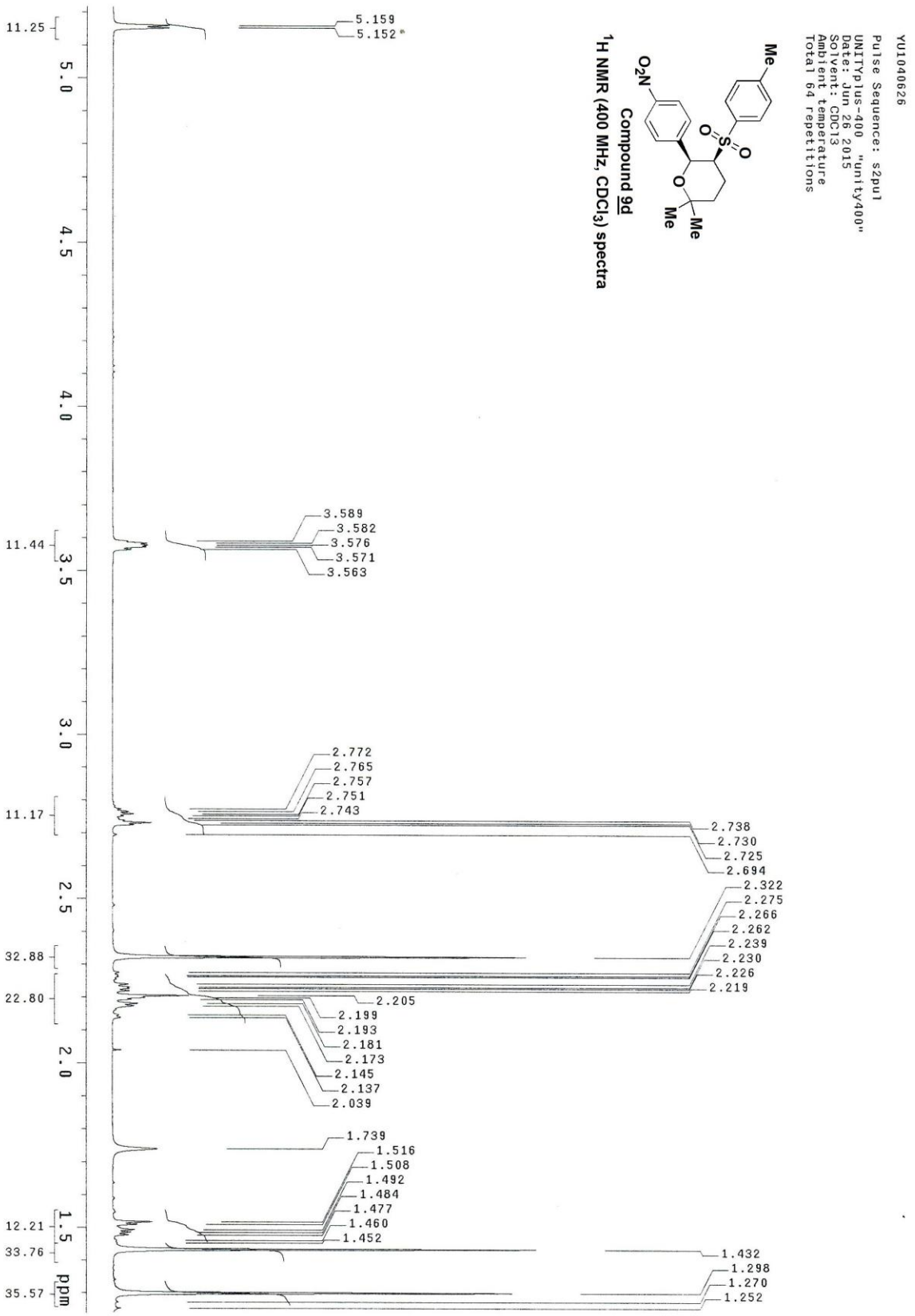


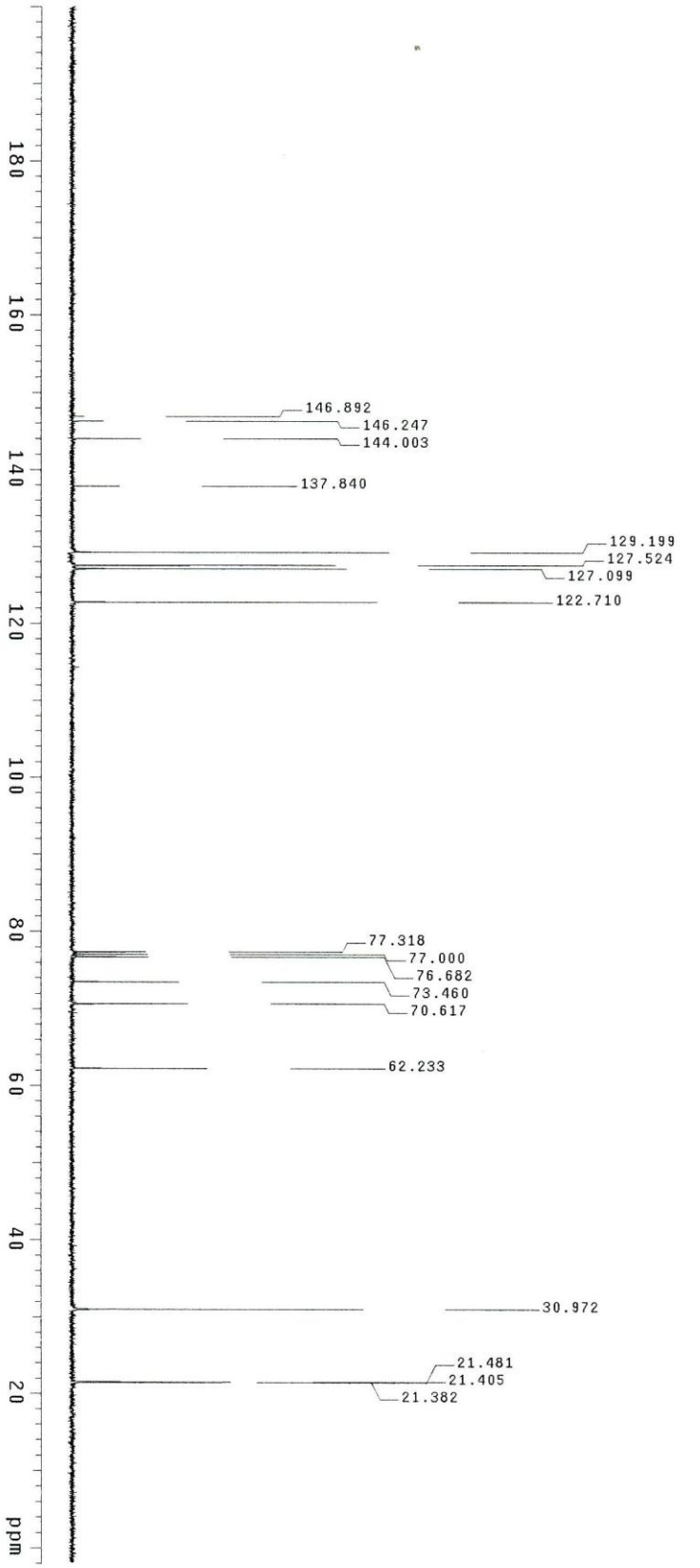
Compound 9c

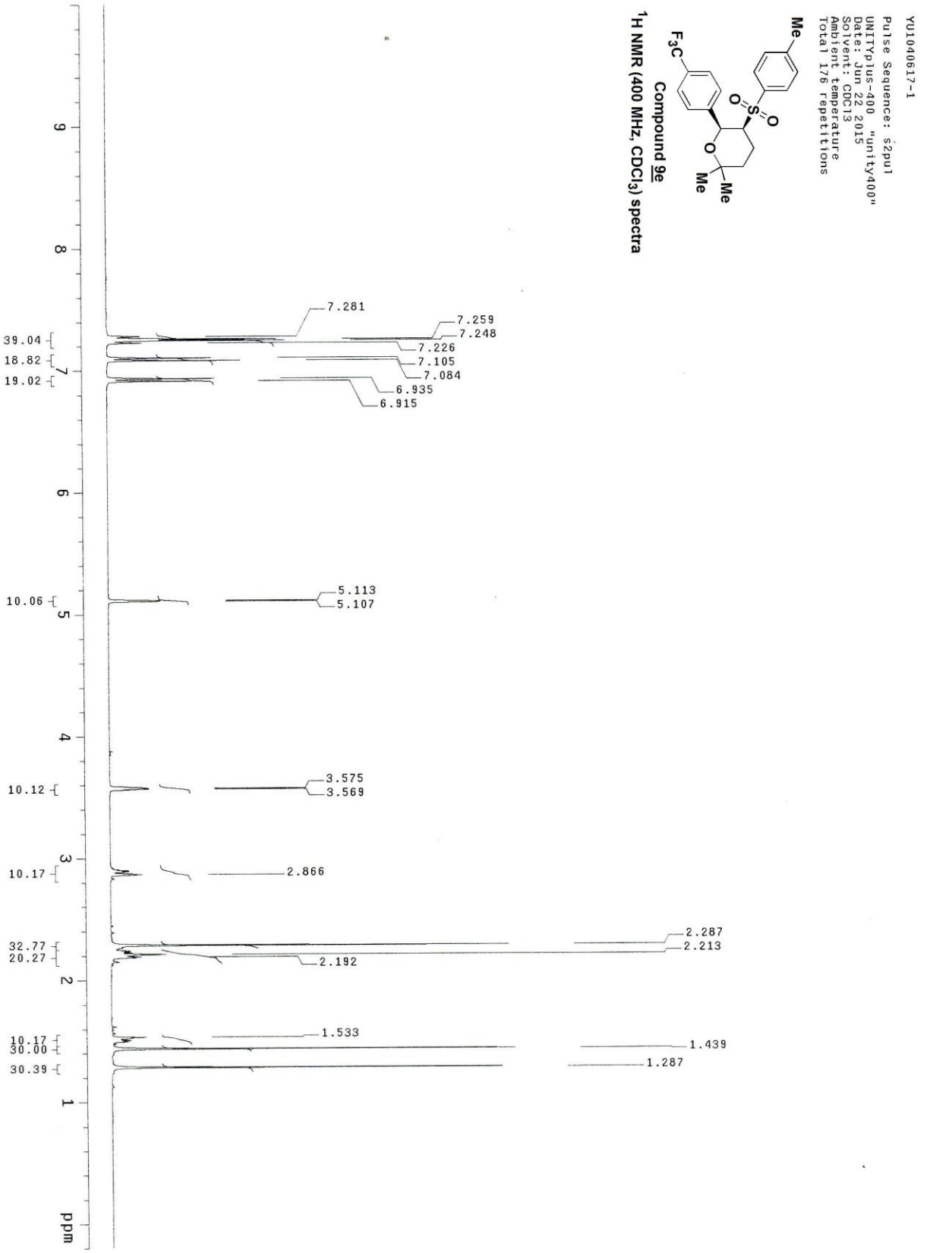
^{1}H NMR (400 MHz, $CDCl_3$) spectra

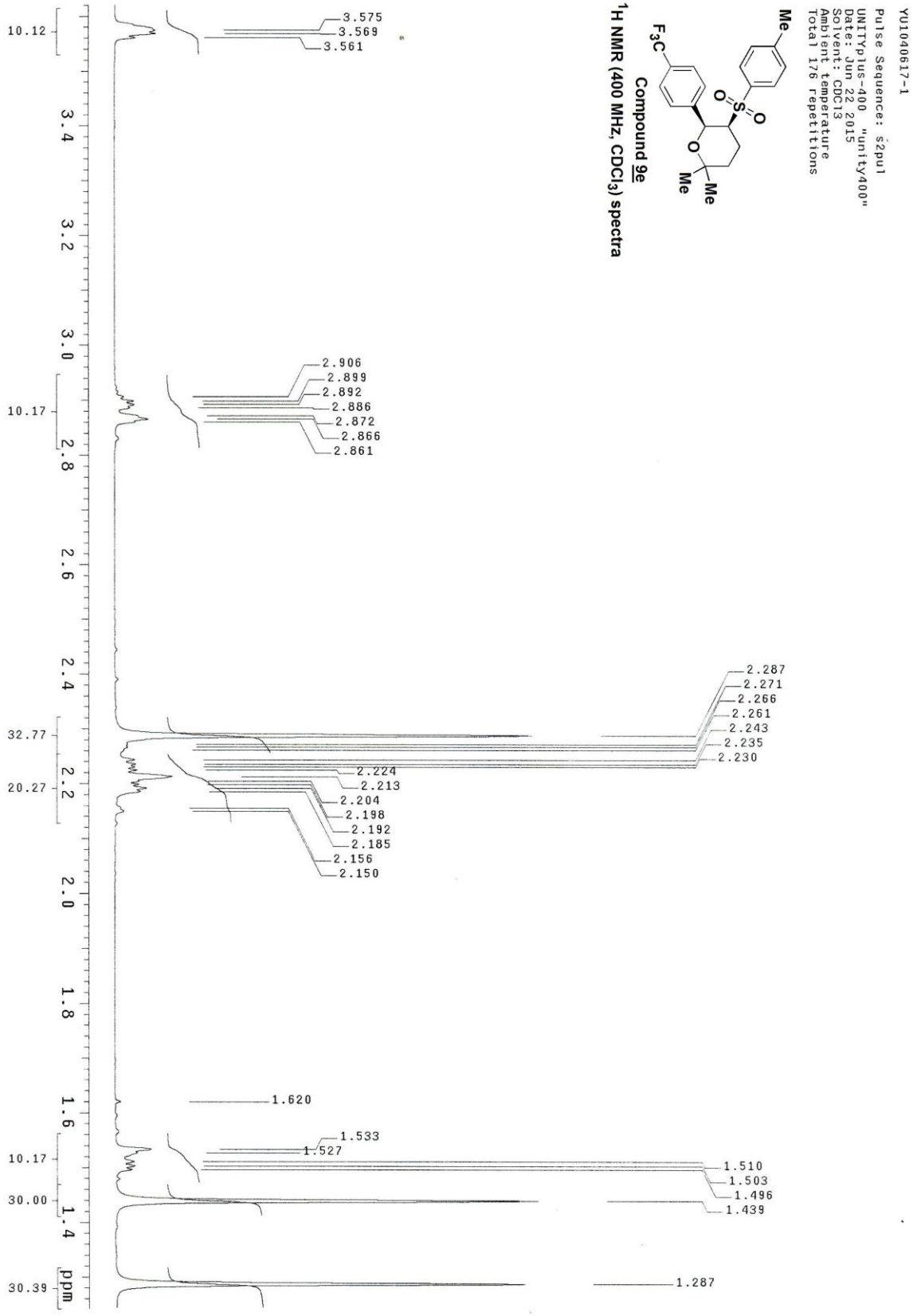

YU1040618-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 352 repetitions
Me
O2N
O
S
O
O
Me
Me
Compound 9c
13C NMR (100 MHz, CDCl3) spectra
147.324
143.526
140.835
137.916
132.580
129.214
128.638
127.182
121.800
121.110
77.318
77.000
76.682
73.354
70.071
61.756
30.941
30.881
21.375
21.094
21.034
180
160
140
120
100
80
60
40
20
ppm

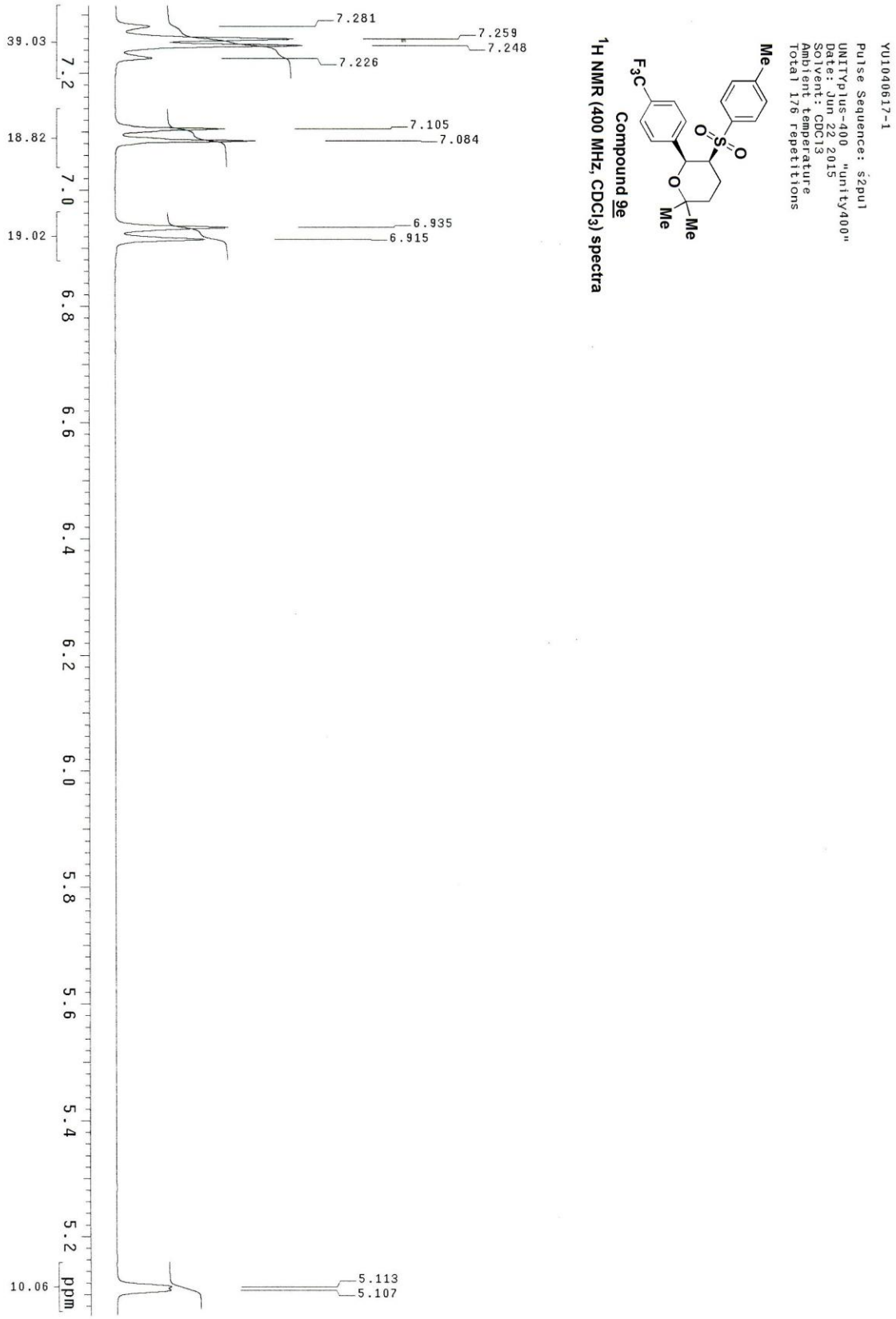

YU1040626
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O2N
S
O
O
O
Me
Me
Compound 9d
1H NMR (400 MHz, CDCl3) spectra
20.00
22.33
21.52
21.29
11.25
11.44
11.17
32.88
22.80
12.21
33.76
35.57
7.913
7.890
7.391
7.370
7.260
7.206
7.185
7.004
6.984
2.322
2.205
1.432
1.298
ppm

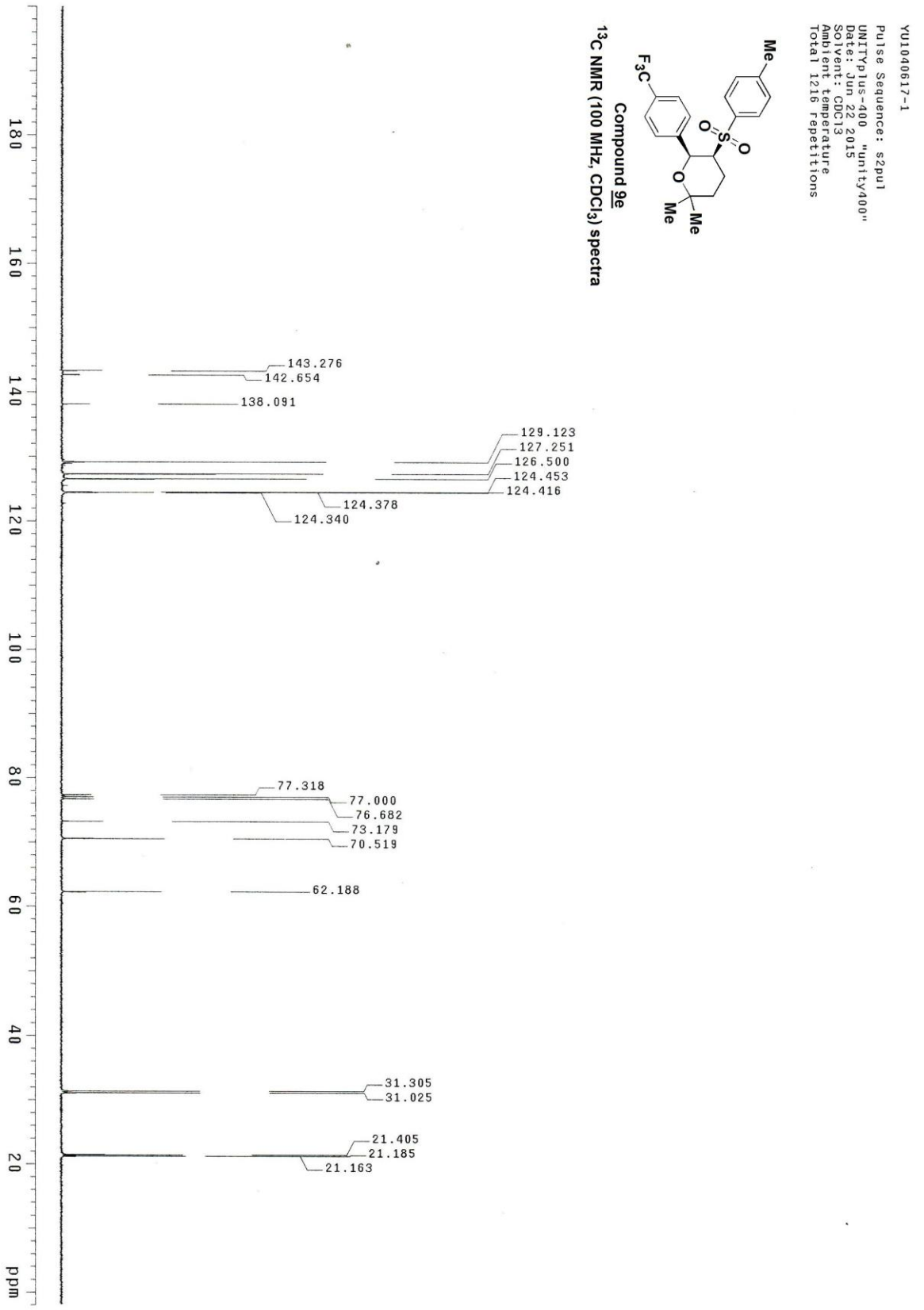

YU1040626
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 9d
1H NMR (400 MHz, CDCl3) spectra
O2N
Me
Me
Me
11.25
11.44
11.17
32.88
22.80
12.21
33.76
35.57
5.159
5.152
3.589
3.582
3.576
3.571
3.563
2.772
2.765
2.757
2.751
2.743
2.738
2.730
2.725
2.694
2.322
2.275
2.266
2.262
2.239
2.230
2.226
2.219
2.205
2.199
2.193
2.181
2.173
2.145
2.137
2.039
1.739
1.516
1.508
1.492
1.484
1.477
1.460
1.452
1.432
1.298
1.270
1.252
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
ppm

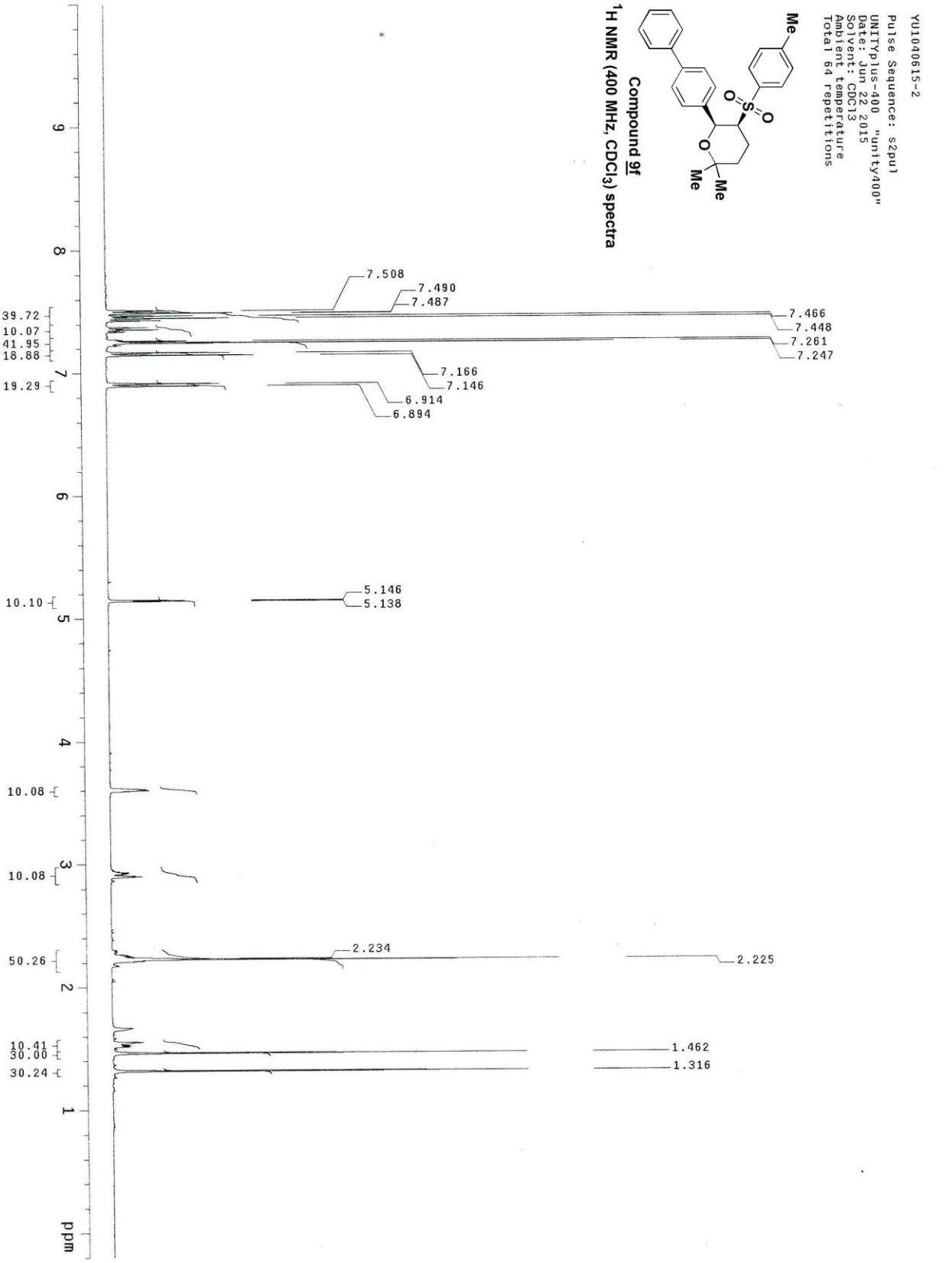

YU1040626
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 26 2015
Solvent: CDCl3
Ambient temperature
Total 1664 repetitions
Me
O2N
O
S
O
O
Me
Me
Compound 9d
13C NMR (100 MHz, CDCl3) spectra
146.892
146.247
144.003
137.840
129.199
127.524
127.099
122.710
77.318
77.000
76.682
73.460
70.617
62.233
30.972
21.481
21.405
21.382
180
160
140
120
100
80
60
40
20
ppm

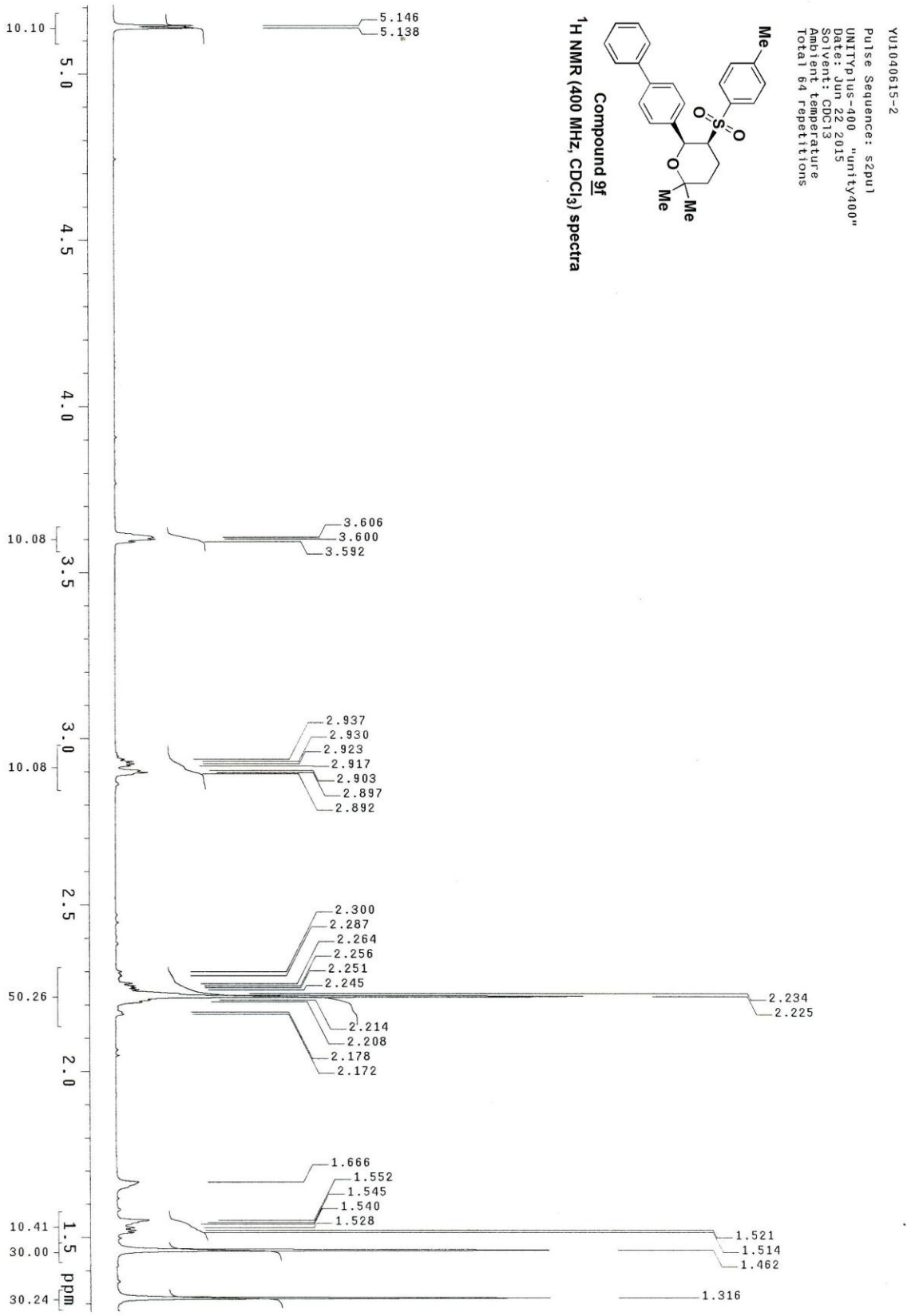

YU1040617-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 176 repetitions
Me
F3C
O
S
O
O
Me
Me
Compound 9e
1H NMR (400 MHz, CDCl3) spectra
7.281
7.259
7.248
7.226
7.105
7.084
6.935
6.915
5.113
5.107
3.575
3.569
2.866
2.287
2.213
2.192
1.533
1.439
1.287
39.04
18.82
19.02
10.06
10.12
10.17
32.77
20.27
10.17
30.00
30.39
ppm

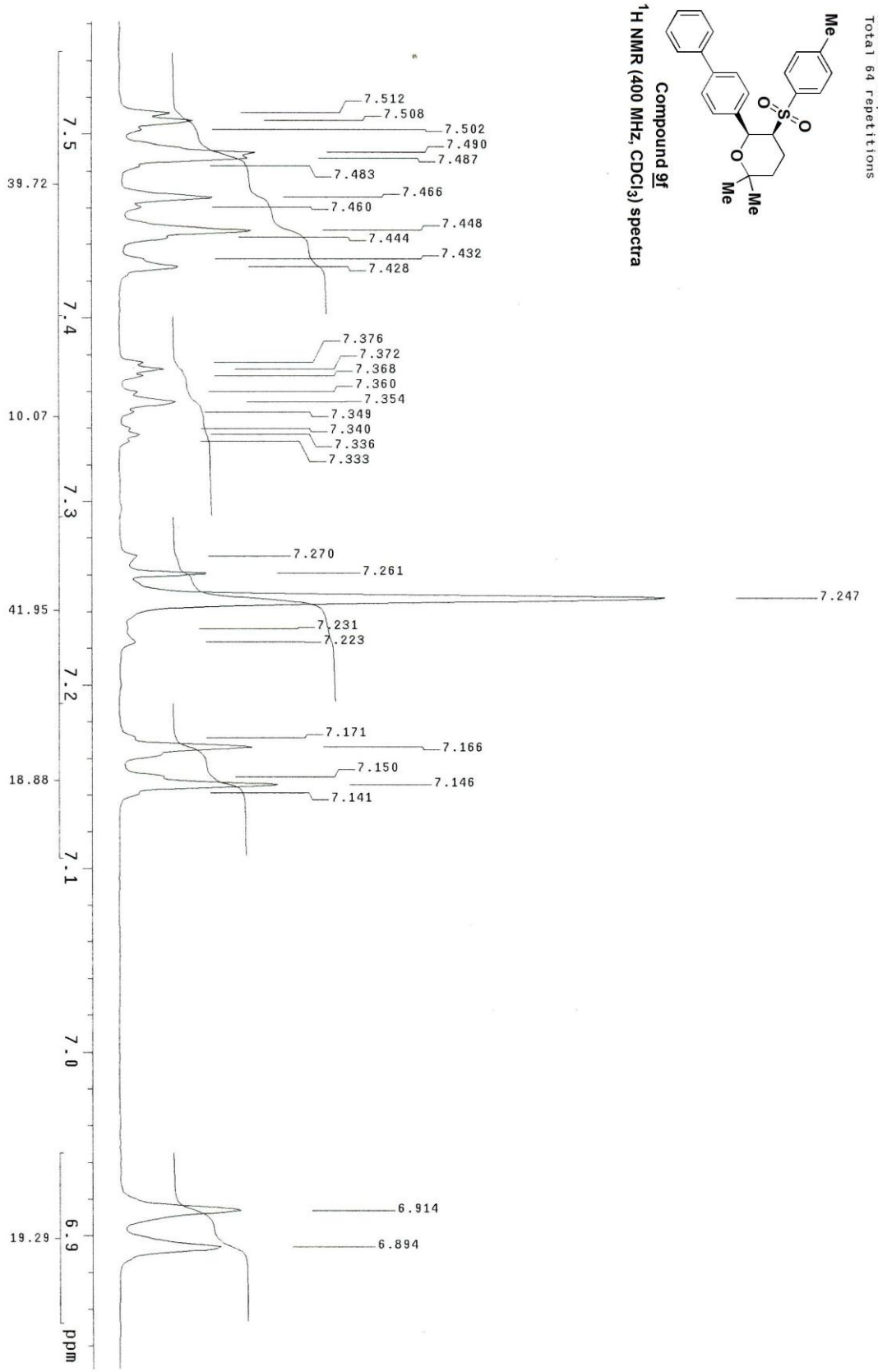

YU1040617-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 176 repetitions
Me
F3C
O
S
O
O
Me
Me
Compound 9e
1H NMR (400 MHz, CDCl3) spectra
3.575
3.569
3.561
2.906
2.899
2.892
2.886
2.872
2.866
2.861
2.287
2.271
2.266
2.261
2.243
2.235
2.230
2.224
2.213
2.204
2.198
2.192
2.185
2.156
2.150
1.620
1.533
1.527
1.510
1.503
1.496
1.439
1.287
10.12
10.17
32.77
20.27
10.17
30.00
30.39
ppm

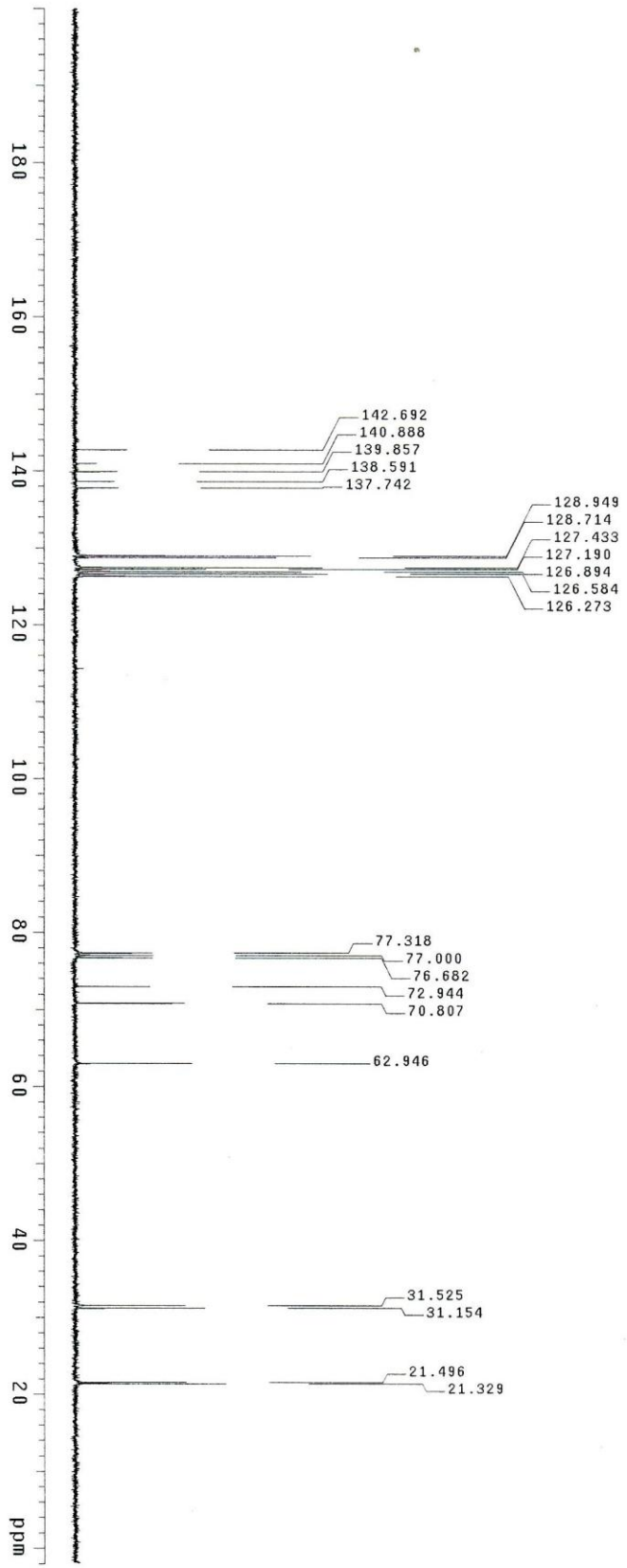

YU1040617-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 176 repetitions
Me
F3C
O
S
O
O
Me
Me
Compound 9e
1H NMR (400 MHz, CDCl3) spectra
7.281
7.259
7.248
7.226
7.105
7.084
6.935
6.915
5.113
5.107
39.03
18.82
19.02
10.06
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
ppm

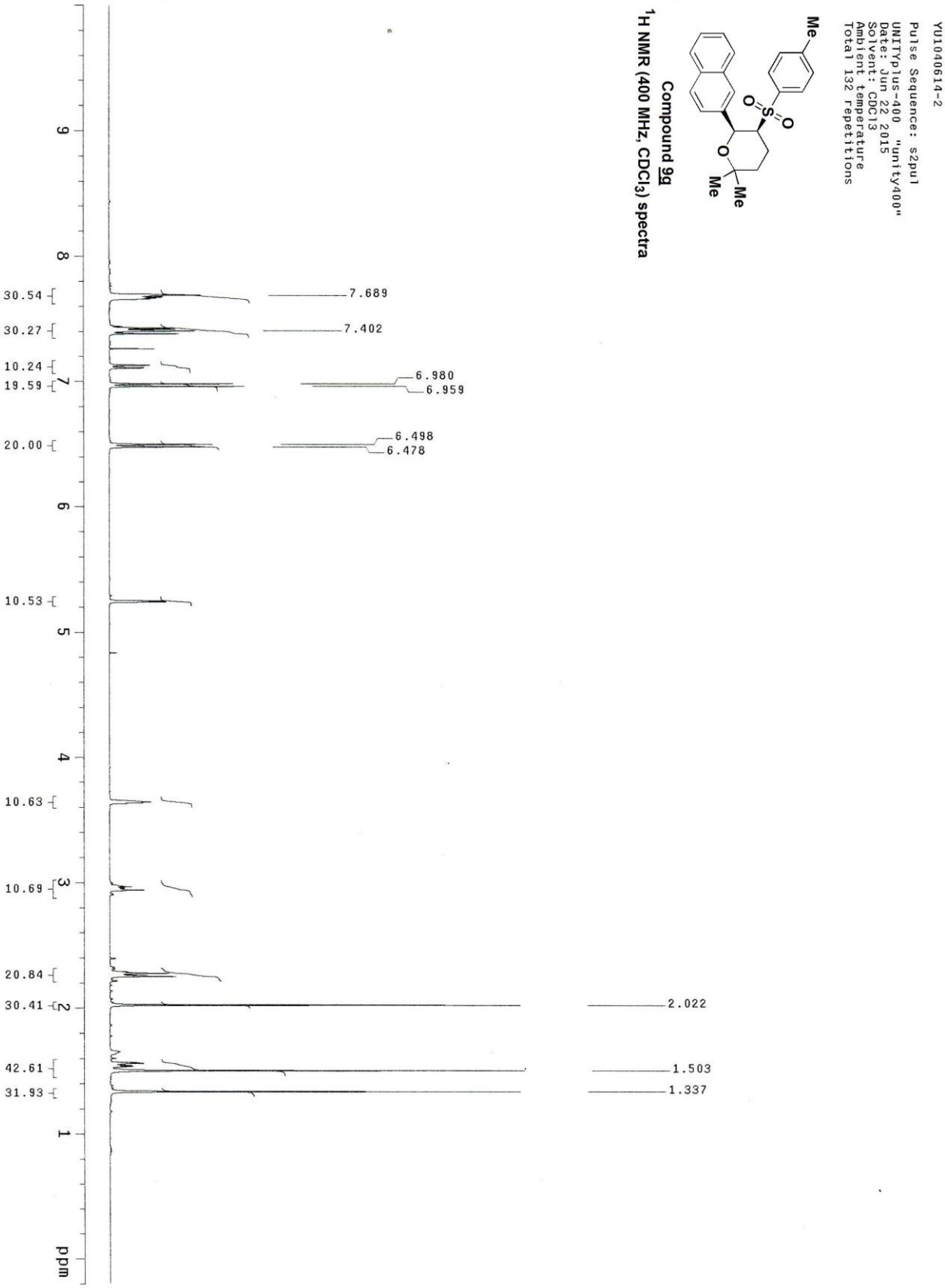

YU1040617-1
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 1216 repetitions
Me
F3C
O
S
O
O
Me
Me
Compound 9e
13C NMR (100 MHz, CDCl3) spectra
143.276
142.654
138.091
129.123
127.251
126.500
124.453
124.416
124.378
124.340
77.318
77.000
76.682
73.179
70.519
62.188
31.305
31.025
21.405
21.185
21.163
180
160
140
120
100
80
60
40
20
ppm

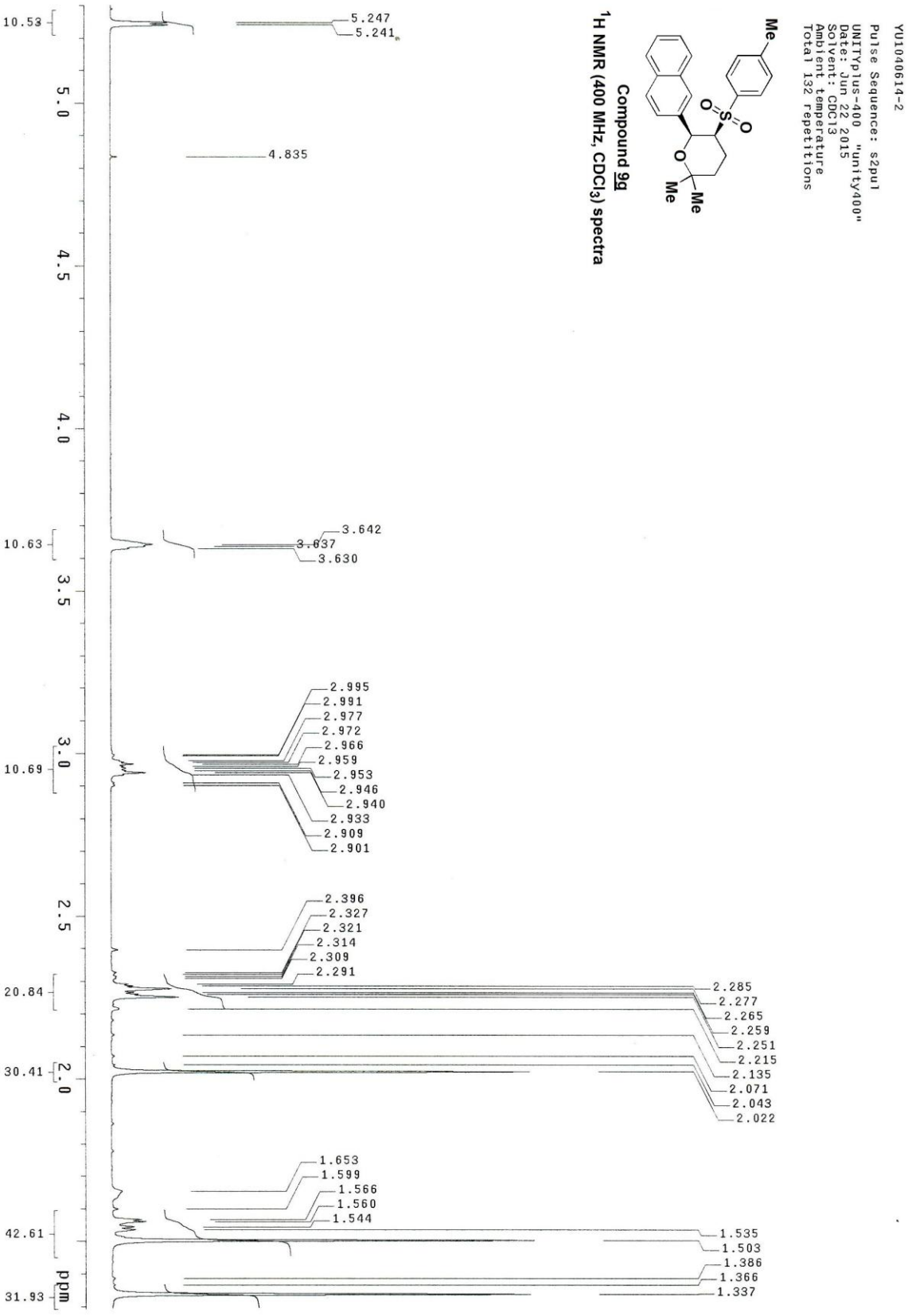

YU1040615-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
O
Me
Me
Compound 9f
1H NMR (400 MHz, CDCl3) spectra
7.508
7.490
7.487
7.466
7.448
7.261
7.247
7.166
7.146
6.914
6.894
5.146
5.138
2.234
2.225
1.462
1.316
39.72
10.07
41.95
18.88
19.29
10.10
10.08
10.08
50.26
10.41
30.00
30.24
ppm

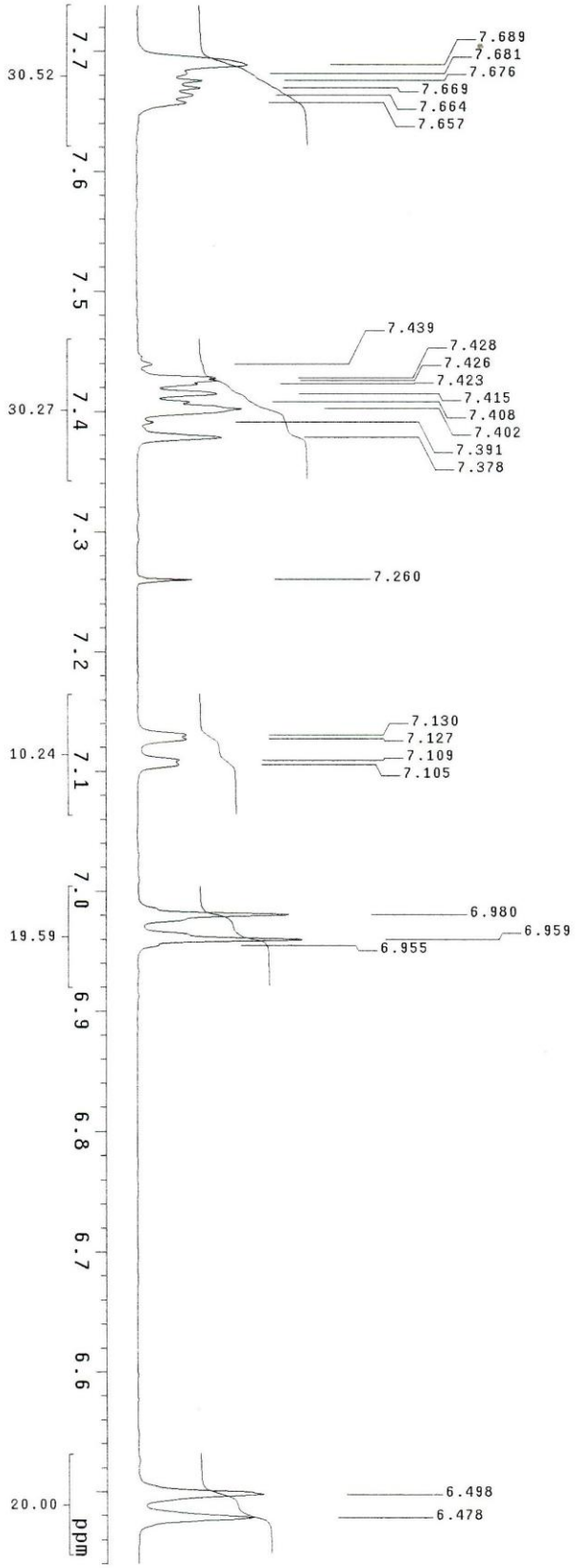

YU1040615-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
O
Me
Me
Compound 9f
1H NMR (400 MHz, CDCl3) spectra
10.10
5.146
5.138
5.0
4.5
4.0
10.08
3.606
3.600
3.592
3.5
3.0
10.08
2.937
2.930
2.923
2.917
2.903
2.897
2.892
2.5
50.26
2.300
2.287
2.264
2.256
2.251
2.245
2.234
2.225
2.214
2.208
2.178
2.172
2.0
1.666
1.552
1.545
1.540
1.528
10.41
1.5
30.00
1.521
1.514
1.462
30.24
1.316
ppm


YU140615-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
O
Me
Me
Compound 9f
1H NMR (400 MHz, CDCl3) spectra
7.512
7.508
7.502
7.490
7.487
7.483
7.466
7.460
7.448
7.444
7.432
7.428
7.376
7.372
7.368
7.360
7.354
7.349
7.340
7.336
7.333
7.270
7.261
7.247
7.231
7.223
7.171
7.166
7.150
7.146
7.141
6.914
6.894
39.72
10.07
41.95
18.88
19.29
7.5
7.4
7.3
7.2
7.1
7.0
6.9
ppm


YU1040615-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 912 repetitions
Me
O
S
O
O
Me
Me
Compound 9f
13C NMR (100 MHz, CDCl3) spectra
142.692
140.888
139.857
138.591
137.742
128.949
128.714
127.433
127.190
126.894
126.584
126.273
77.318
77.000
76.682
72.944
70.807
62.946
31.525
31.154
21.496
21.329
180
160
140
120
100
80
60
40
20
ppm

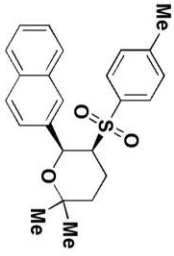

YU1040614-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 132 repetitions
Me
O
S
O
O
Me
Me
Compound 9g
1H NMR (400 MHz, CDCl3) spectra
30.54
30.27
10.24
19.59
20.00
10.53
10.63
10.69
20.84
30.41
42.61
31.93
7.689
7.402
6.980
6.959
6.498
6.478
2.022
1.503
1.337
ppm


YU1040614-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 132 repetitions
Me
O
S
O
O
Me
Me
Compound 9g
1H NMR (400 MHz, CDCl3) spectra
10.53
5.247
5.241
4.835
5.0
4.5
4.0
10.63
3.642
3.637
3.630
3.5
10.69
2.995
2.991
2.977
2.972
2.966
2.959
2.953
2.946
2.940
2.933
2.909
2.901
3.0
2.5
20.84
2.396
2.327
2.321
2.314
2.309
2.291
2.285
2.277
2.265
2.259
2.251
2.215
2.135
2.071
2.043
2.022
30.41
2.0
1.653
1.599
1.566
1.560
1.544
42.61
1.535
1.503
1.386
1.366
1.337
31.93
ppm



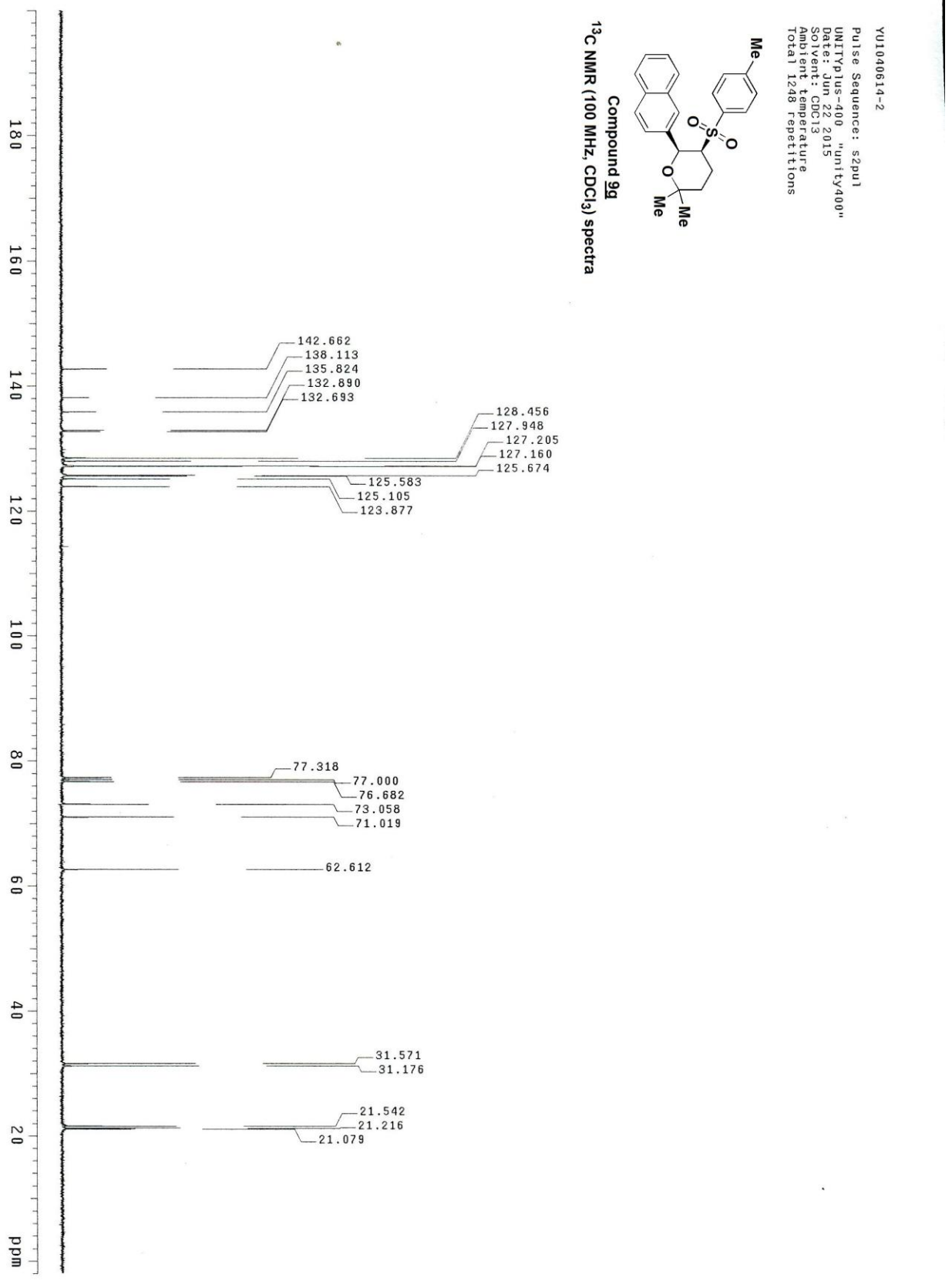
YU1040614-2

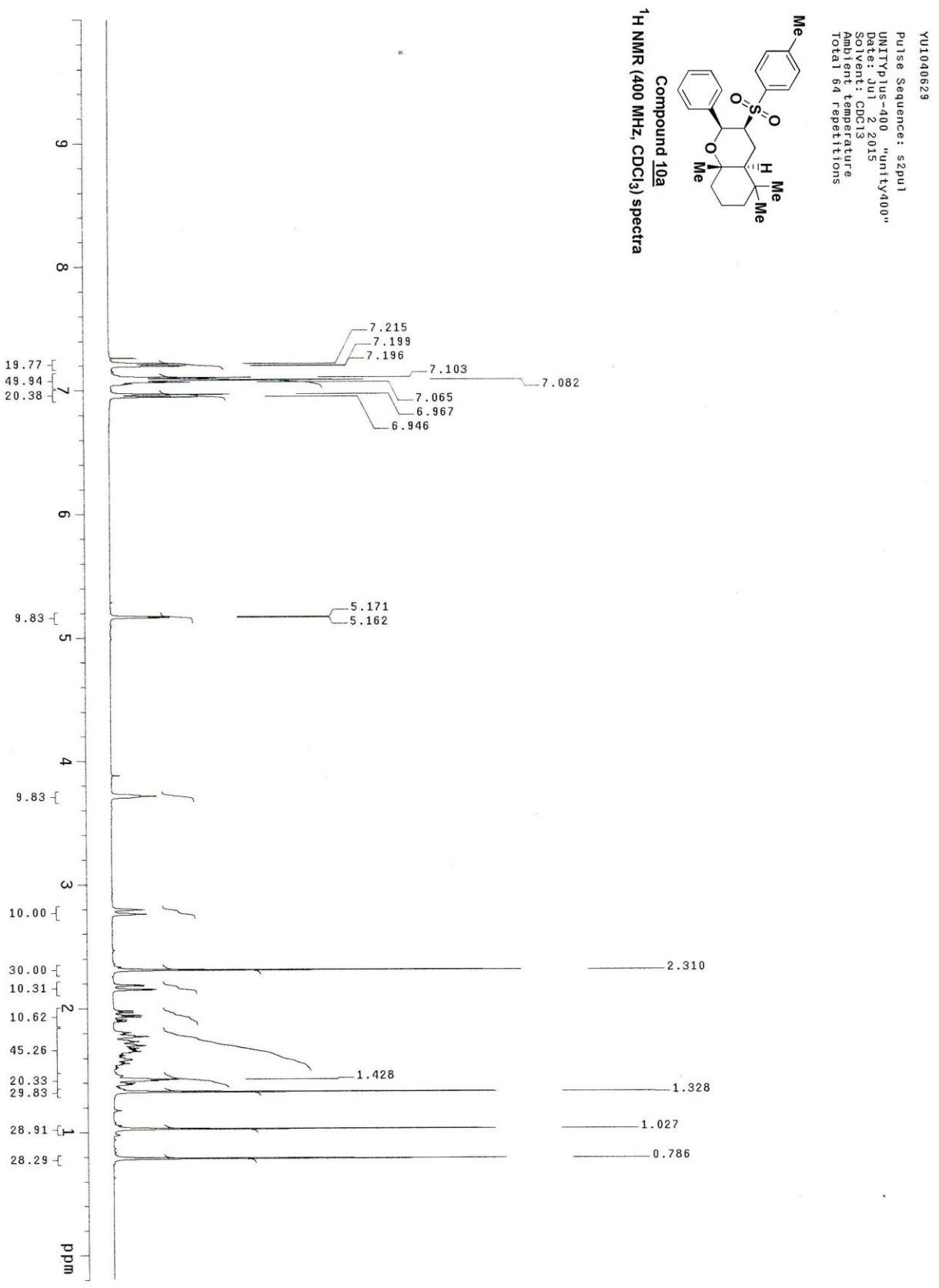
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 132 repetitions

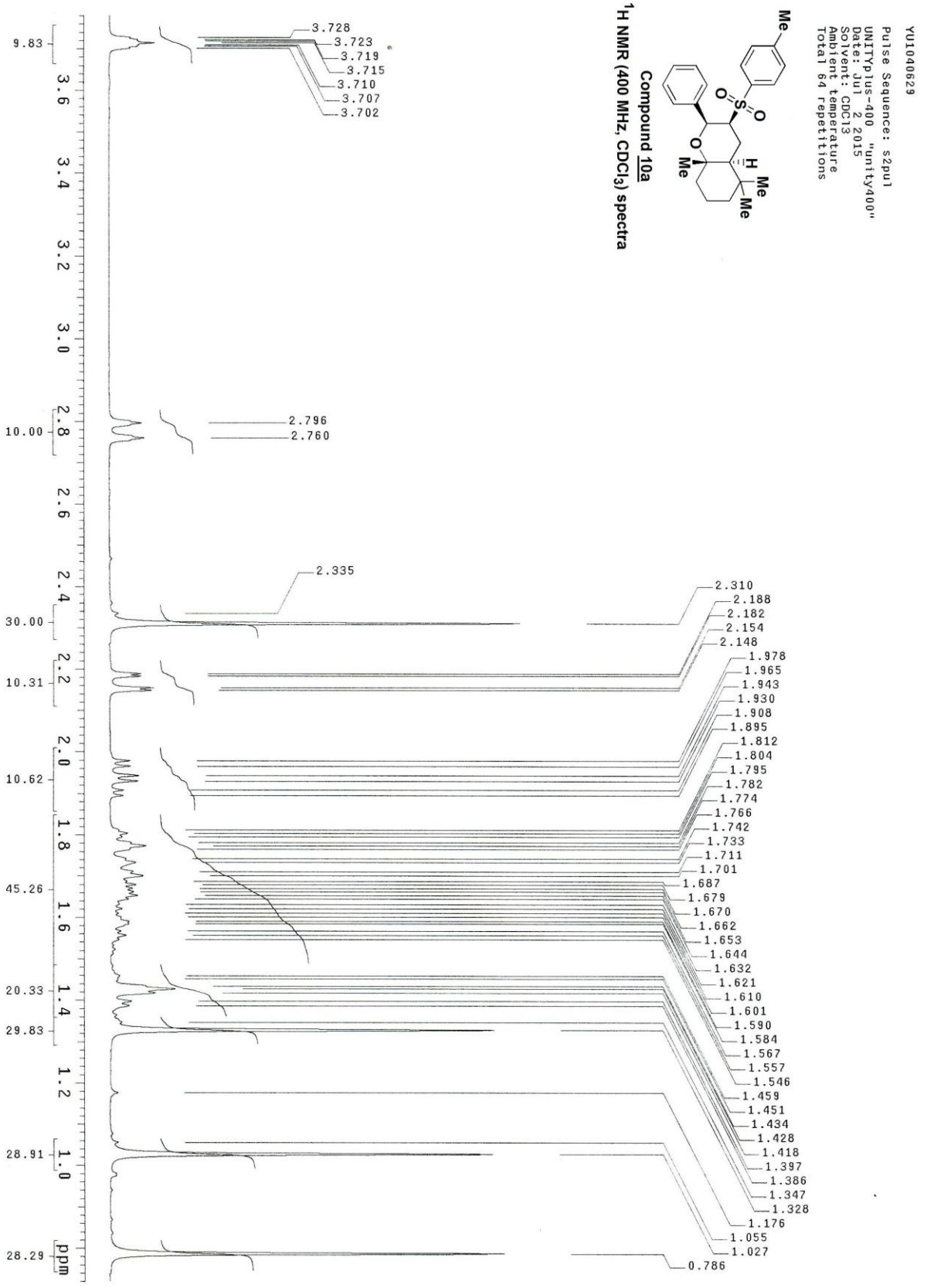


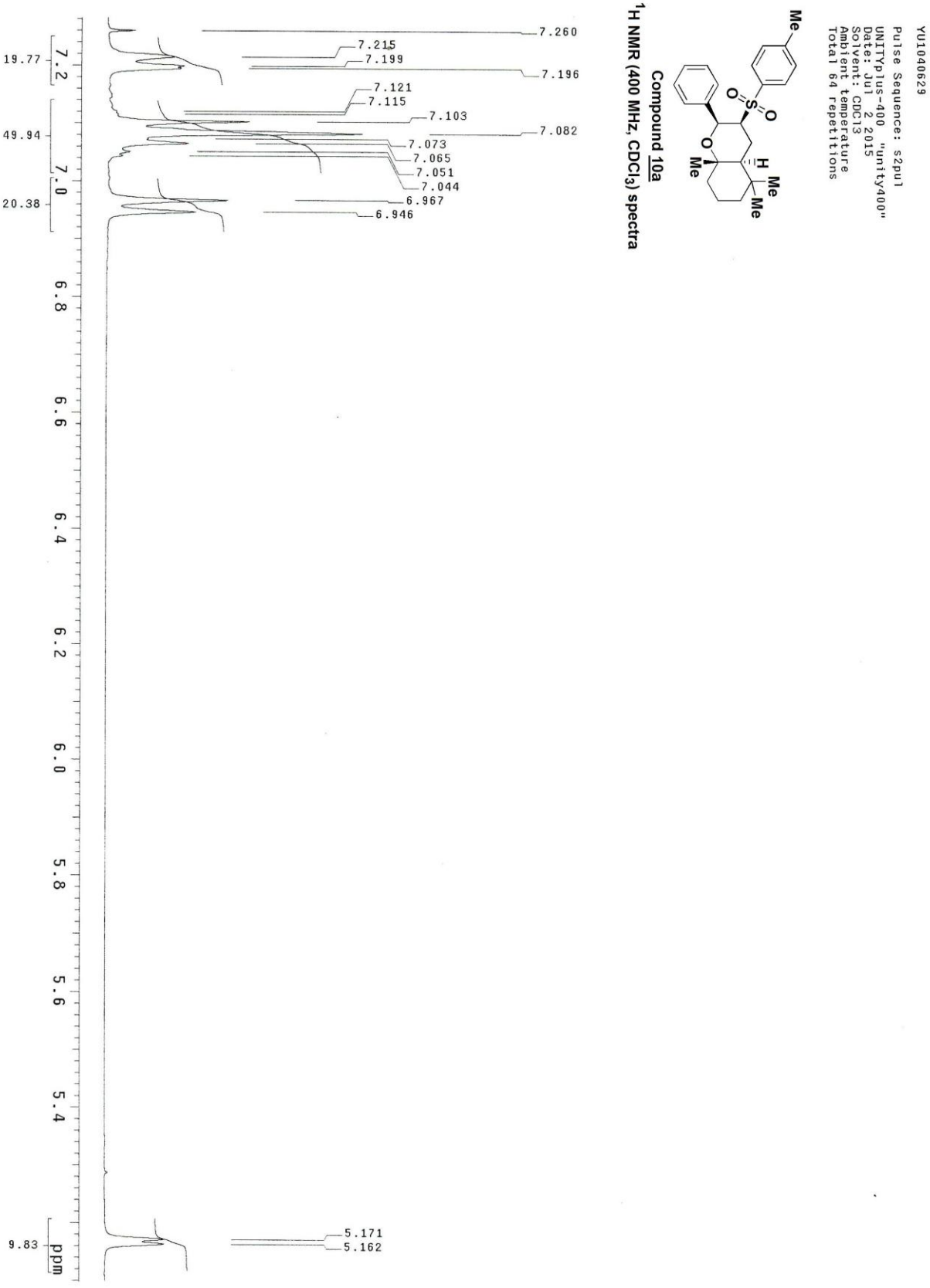
Compound 9g

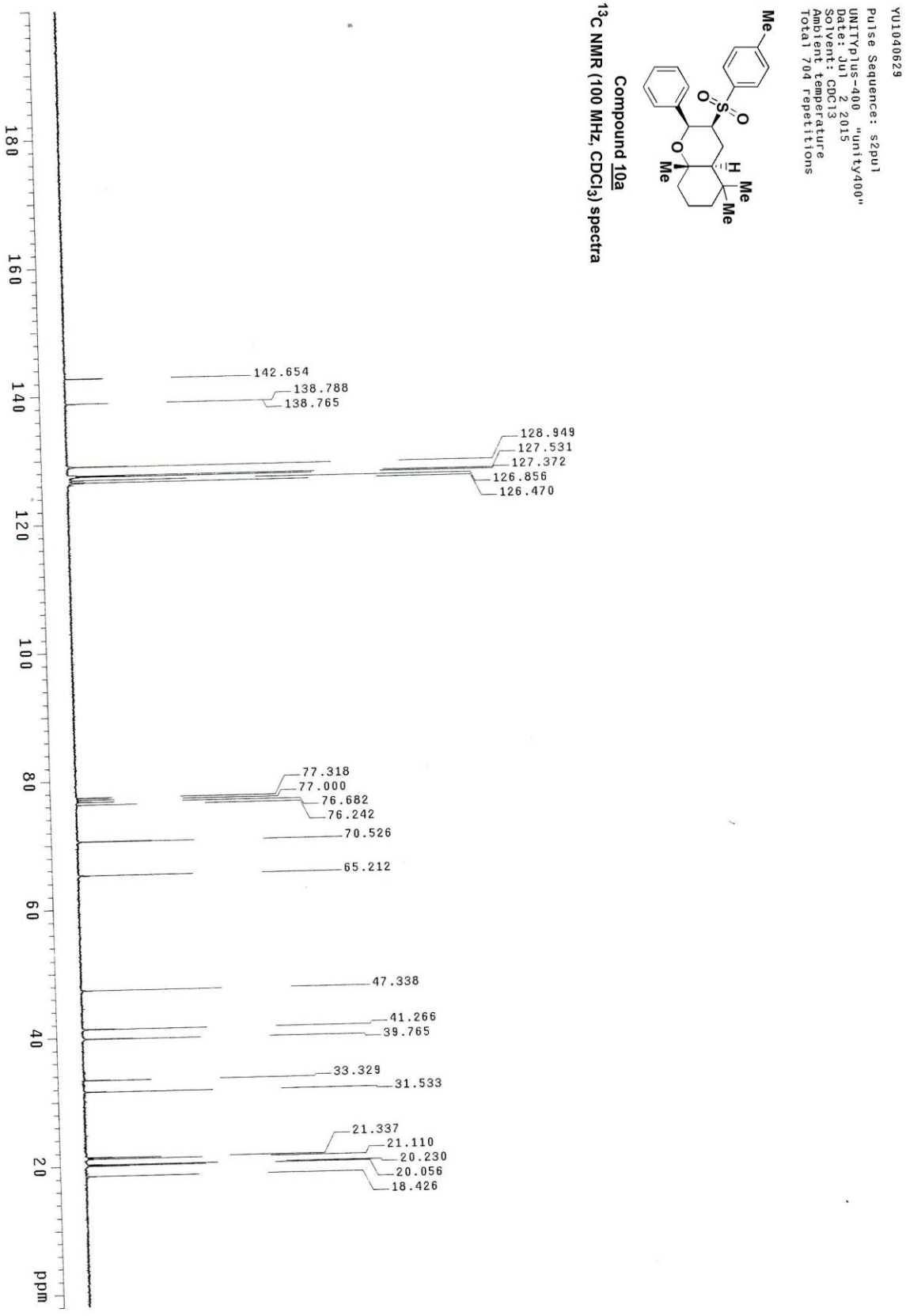
^{1}H NMR (400 MHz, $CDCl_3$) spectra

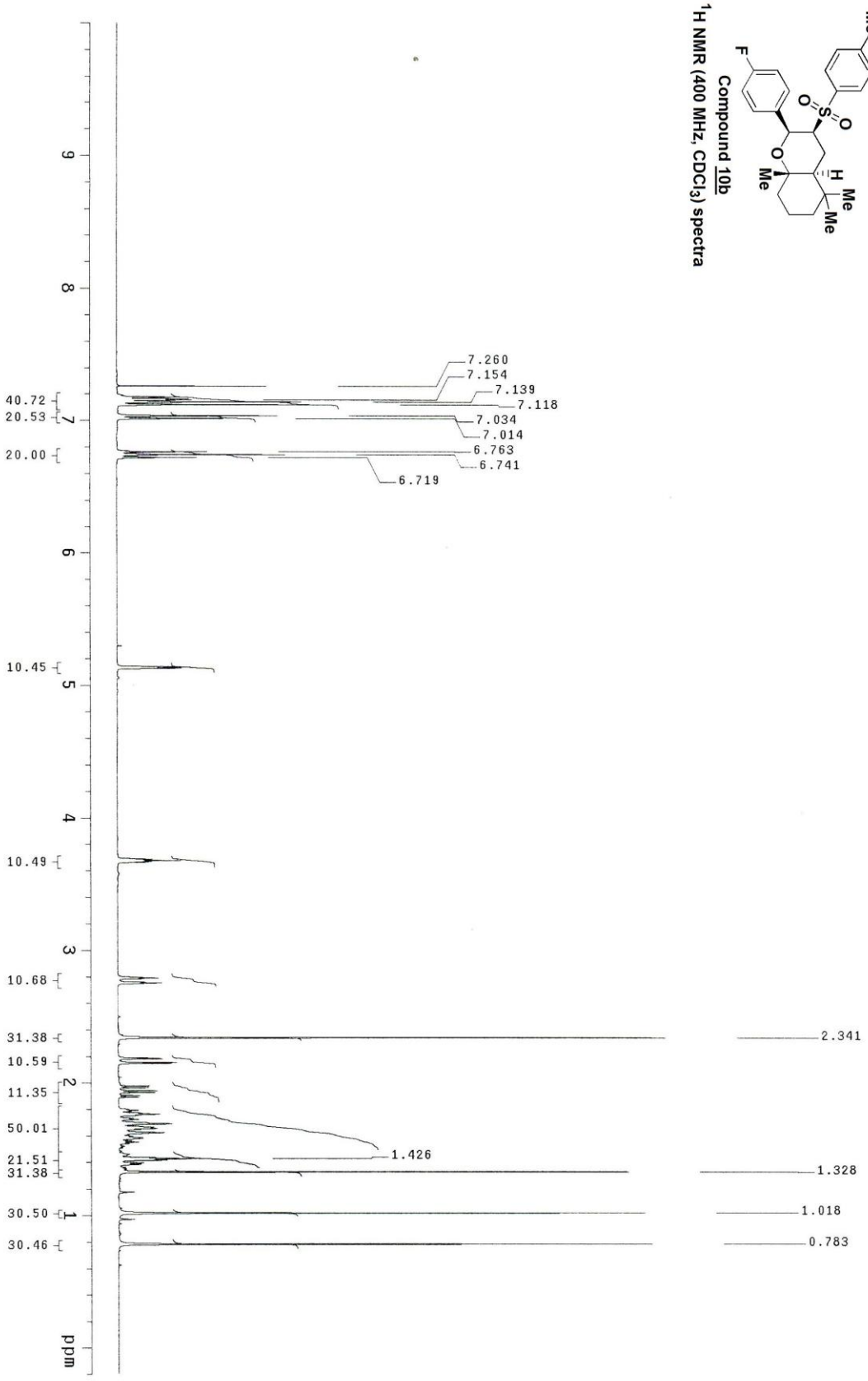

YU1040614-2
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jun 22 2015
Solvent: CDCl3
Ambient temperature
Total 1248 repetitions
Me
O
S
O
O
Me
Me
Compound 9g
13C NMR (100 MHz, CDCl3) spectra
142.662
138.113
135.824
132.890
132.693
128.456
127.948
127.205
127.160
125.674
125.583
125.105
123.877
77.318
77.000
76.682
73.058
71.019
62.612
31.571
31.176
21.542
21.216
21.079
180
160
140
120
100
80
60
40
20
ppm

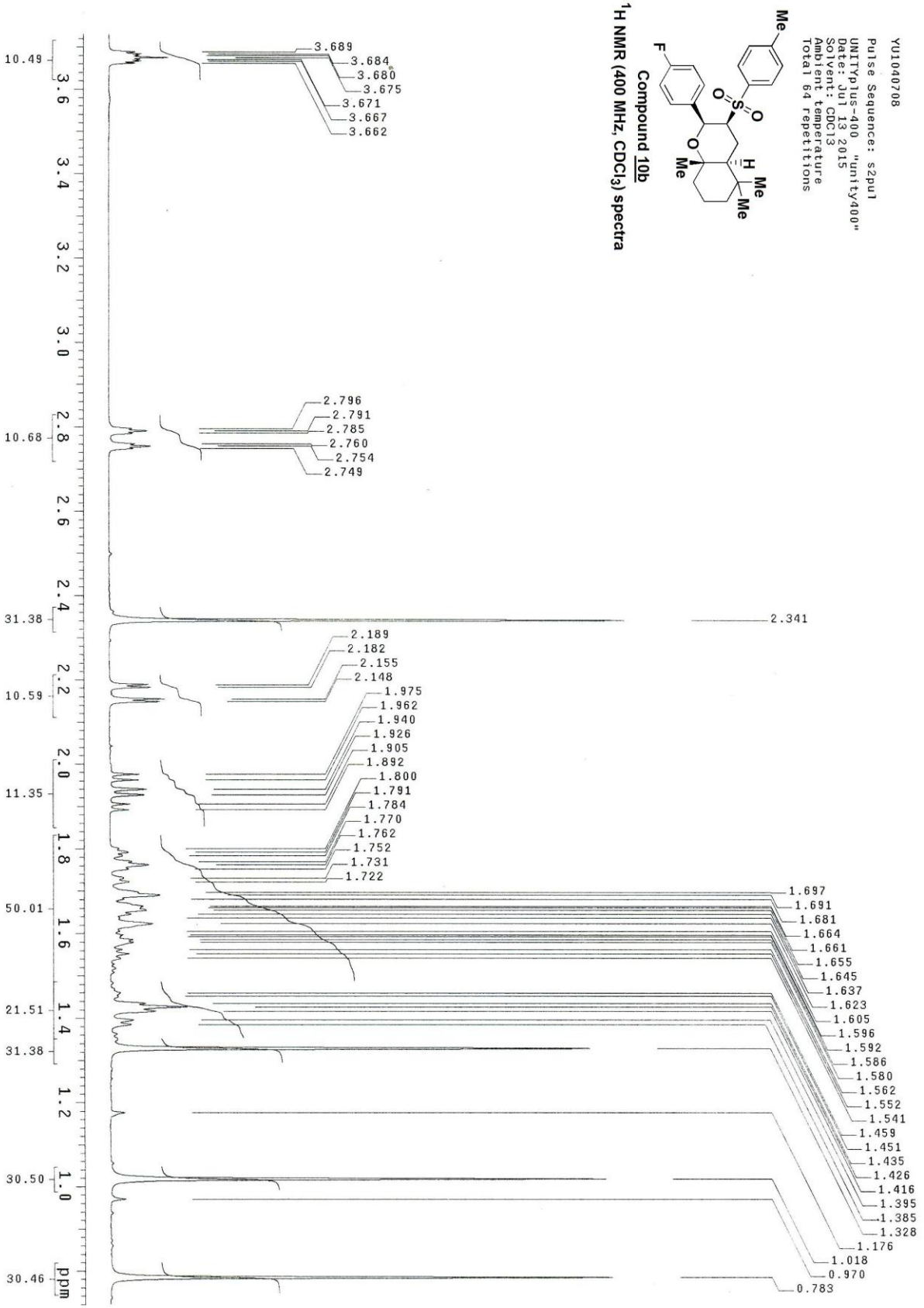

YU1040629
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
O
Me
H
Me
Me
Compound 10a
1H NMR (400 MHz, CDCl3) spectra
7.215
7.199
7.196
7.103
7.082
7.065
6.967
6.946
5.171
5.162
2.310
1.428
1.328
1.027
0.786
19.77
49.94
20.38
9.83
9.83
10.00
30.00
10.31
10.62
45.26
20.33
29.83
28.91
28.29
ppm

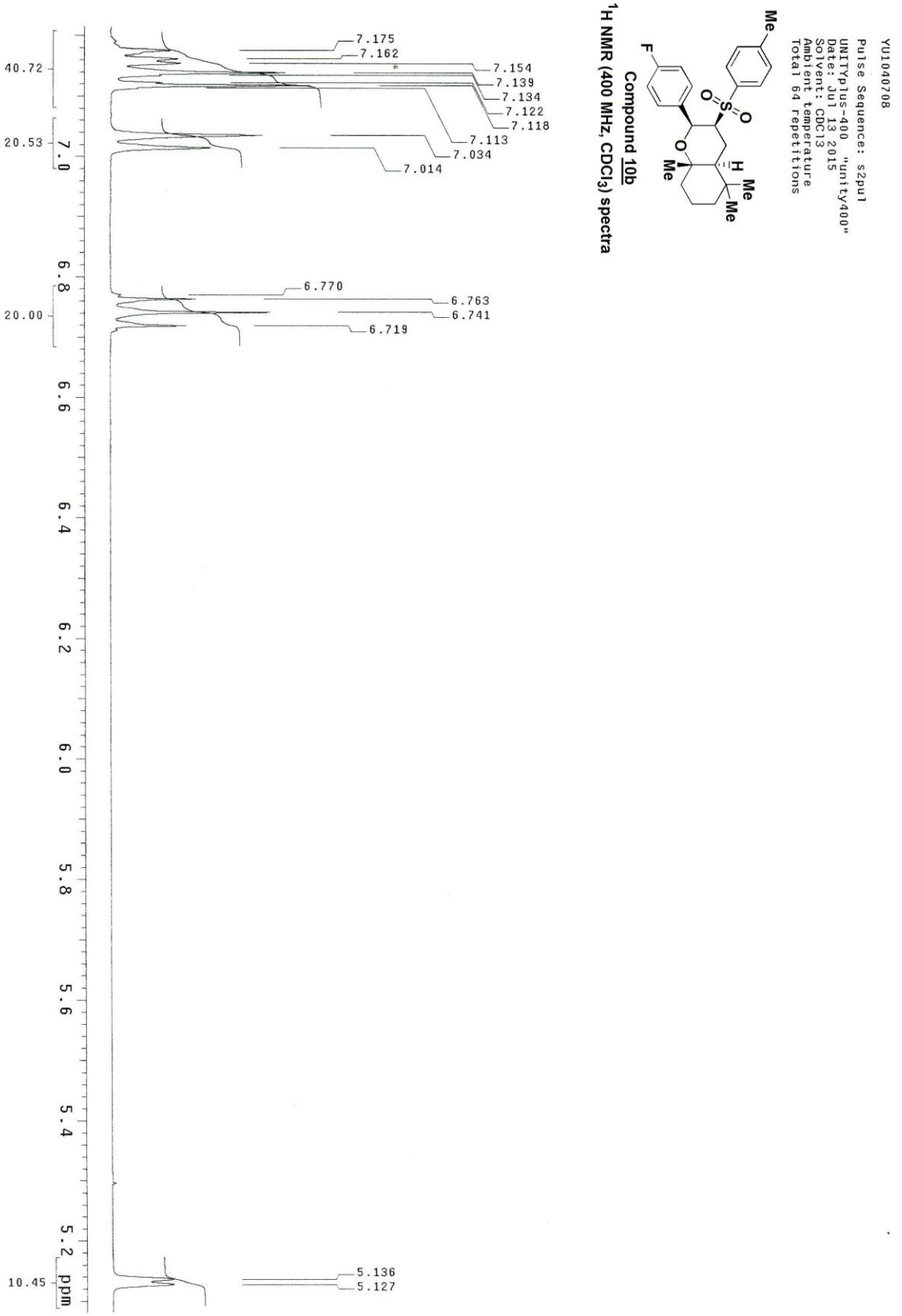

YU1040629
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
O
H
Me
Me
Me
Compound 10a
1H NMR (400 MHz, CDCl3) spectra
9.83
10.00
30.00
10.31
10.62
45.26
20.33
29.83
28.91
28.29
3.728
3.723
3.719
3.715
3.710
3.707
3.702
2.796
2.760
2.335
2.310
2.188
2.182
2.154
2.148
1.978
1.965
1.943
1.930
1.908
1.895
1.812
1.804
1.795
1.782
1.774
1.766
1.742
1.733
1.711
1.701
1.687
1.679
1.670
1.662
1.653
1.644
1.632
1.621
1.610
1.601
1.590
1.584
1.567
1.557
1.546
1.459
1.451
1.434
1.428
1.418
1.397
1.386
1.347
1.328
1.176
1.055
1.027
0.786
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
ppm

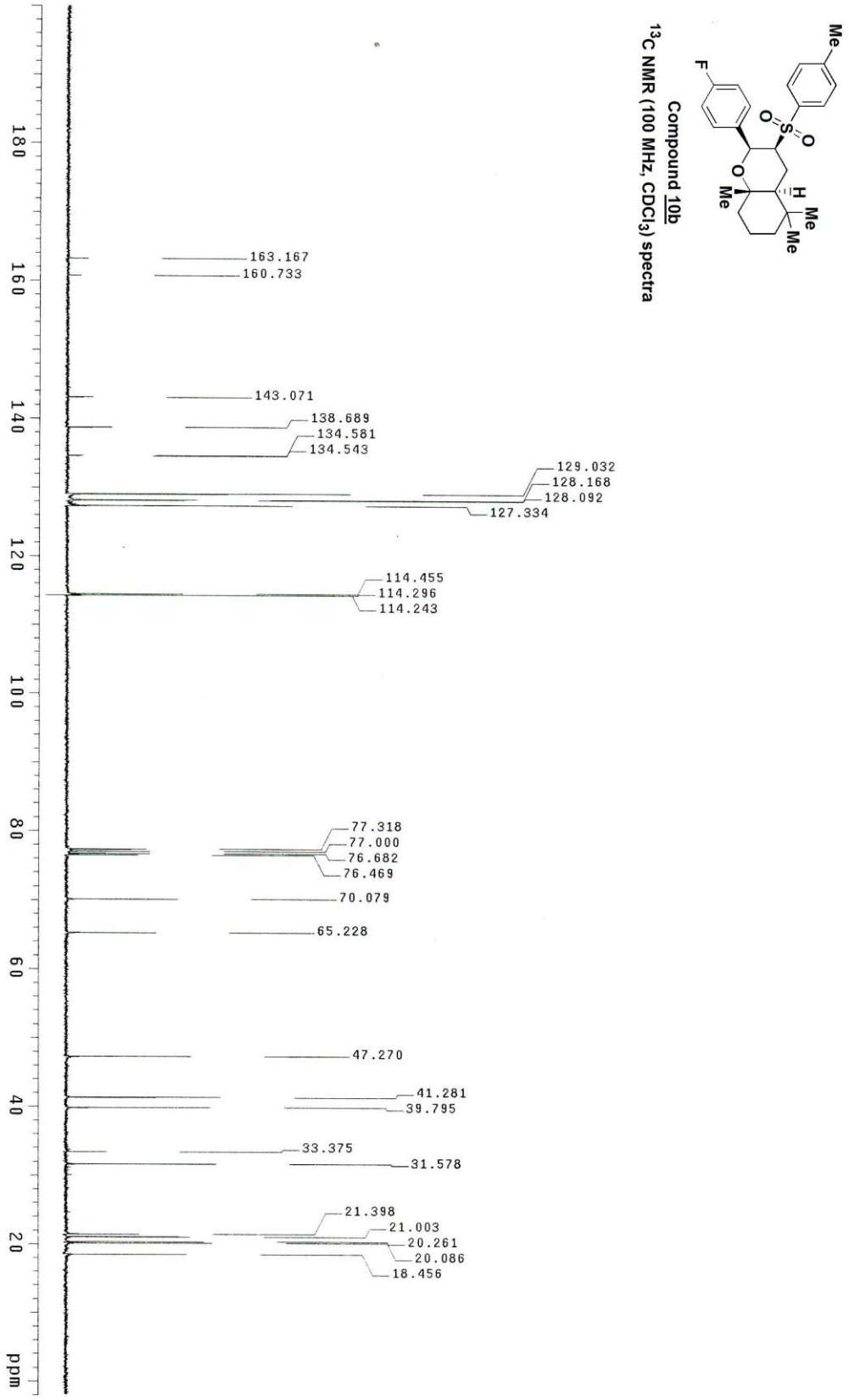

YU1040629
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
O
S
O
O
Me
H
Me
Me
Compound 10a
1H NMR (400 MHz, CDCl3) spectra
7.260
7.215
7.199
7.196
7.121
7.115
7.103
7.082
7.073
7.065
7.051
7.044
6.967
6.946
5.171
5.162
19.77
49.94
20.38
9.83
7.2
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
ppm


YU1040629
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 2 2015
Solvent: CDCl3
Ambient temperature
Total 704 repetitions
Me
O
S
O
O
H
Me
Me
Me
Compound 10a
13C NMR (100 MHz, CDCl3) spectra
142.654
138.788
138.765
128.949
127.531
127.372
126.856
126.470
77.318
77.000
76.682
76.242
70.526
65.212
47.338
41.266
39.765
33.329
31.533
21.337
21.110
20.230
20.056
18.426
180
160
140
120
100
80
60
40
20
ppm


YU1040708
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 10b
1H NMR (400 MHz, CDCl3) spectra
7.260
7.154
7.139
7.118
7.034
7.014
6.763
6.741
6.719
2.341
1.426
1.328
1.018
0.783
40.72
20.53
20.00
10.45
10.49
10.68
31.38
10.59
11.35
50.01
21.51
31.38
30.50
30.46
ppm


YU1040708
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Compound 10b
^{1}H NMR (400 MHz, $CDCl_3$) spectra
Me
F
O
S
O
O
H
Me
Me
Me
3.689
3.684
3.680
3.675
3.671
3.667
3.662
2.796
2.791
2.785
2.760
2.754
2.749
2.341
2.189
2.182
2.155
2.148
1.975
1.962
1.940
1.926
1.905
1.892
1.800
1.791
1.784
1.770
1.762
1.752
1.731
1.722
1.697
1.691
1.681
1.664
1.661
1.655
1.645
1.637
1.623
1.605
1.596
1.592
1.586
1.580
1.562
1.552
1.541
1.459
1.451
1.435
1.426
1.416
1.395
1.385
1.328
1.176
1.018
0.970
0.783
10.49
10.68
31.38
10.59
11.35
50.01
21.51
31.38
30.50
30.46
ppm


YU1040708
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 64 repetitions
Me
F
O
S
O
O
H
Me
Me
Me
Compound 10b
1H NMR (400 MHz, CDCl3) spectra
7.175
7.162
7.154
7.139
7.134
7.122
7.118
7.113
7.034
7.014
6.770
6.763
6.741
6.719
5.136
5.127
40.72
20.53
20.00
10.45
7.0
6.8
6.6
6.4
6.2
6.0
5.8
5.6
5.4
5.2
ppm


YU1040708
Pulse Sequence: s2pul
UNITYplus-400 "unity400"
Date: Jul 13 2015
Solvent: CDCl3
Ambient temperature
Total 3840 repetitions
Me
F
O
S
O
O
H
Me
Me
Compound 10b
13C NMR (100 MHz, CDCl3) spectra
163.167
160.733
143.071
138.689
134.581
134.543
129.032
128.168
128.092
127.334
114.455
114.296
114.243
77.318
77.000
76.682
76.469
70.079
65.228
47.270
41.281
39.795
33.375
31.578
21.398
21.003
20.261
20.086
18.456
180
160
140
120
100
80
60
40
20
ppm