Angewandte
Eine Zeitschrift der Gesellschaft Deutscher Chemiker
Chemie

Supporting Information

69451 Weinheim, Germany

Catalysis-Based Total Synthesis of Putative Mandelalide A**

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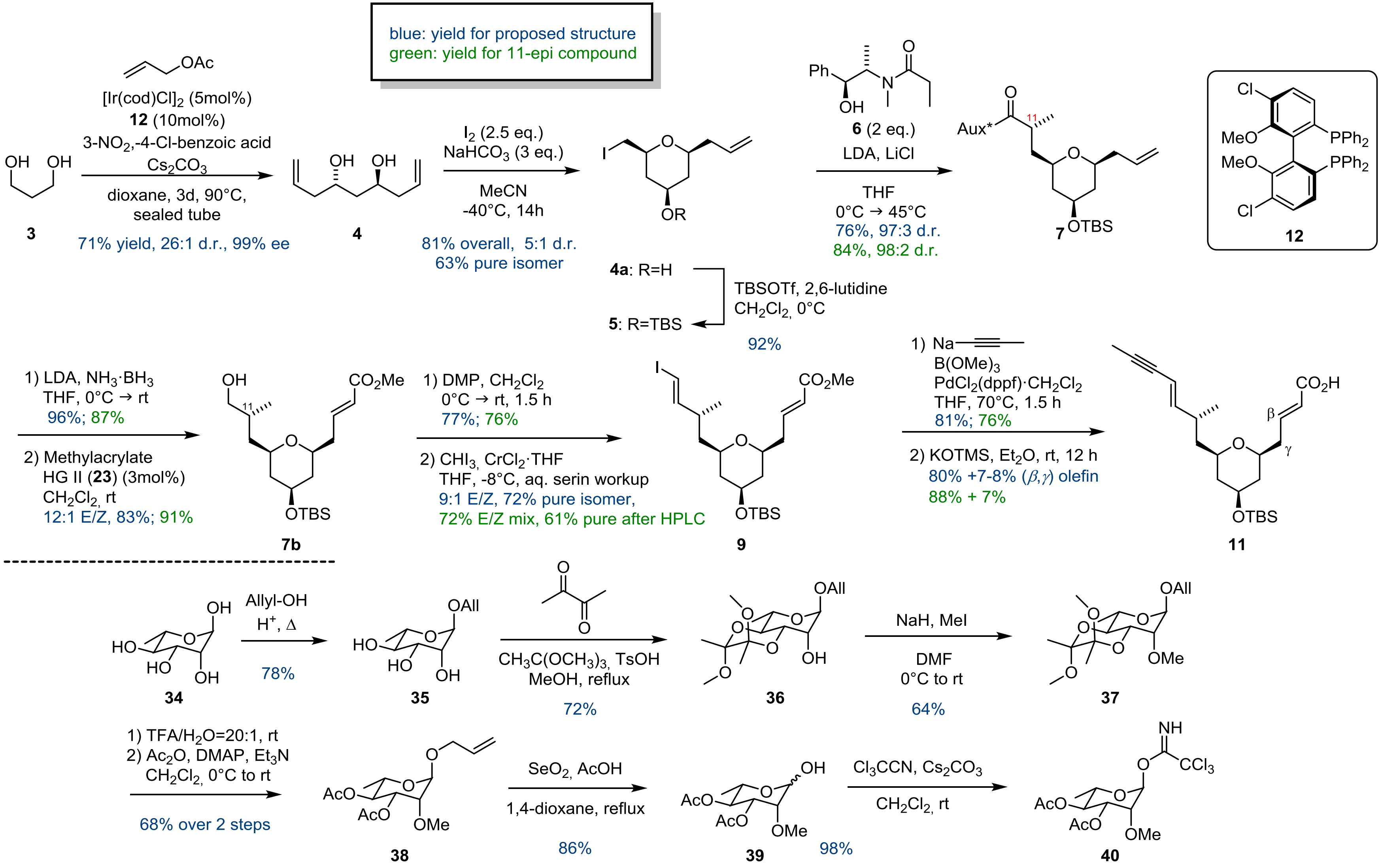
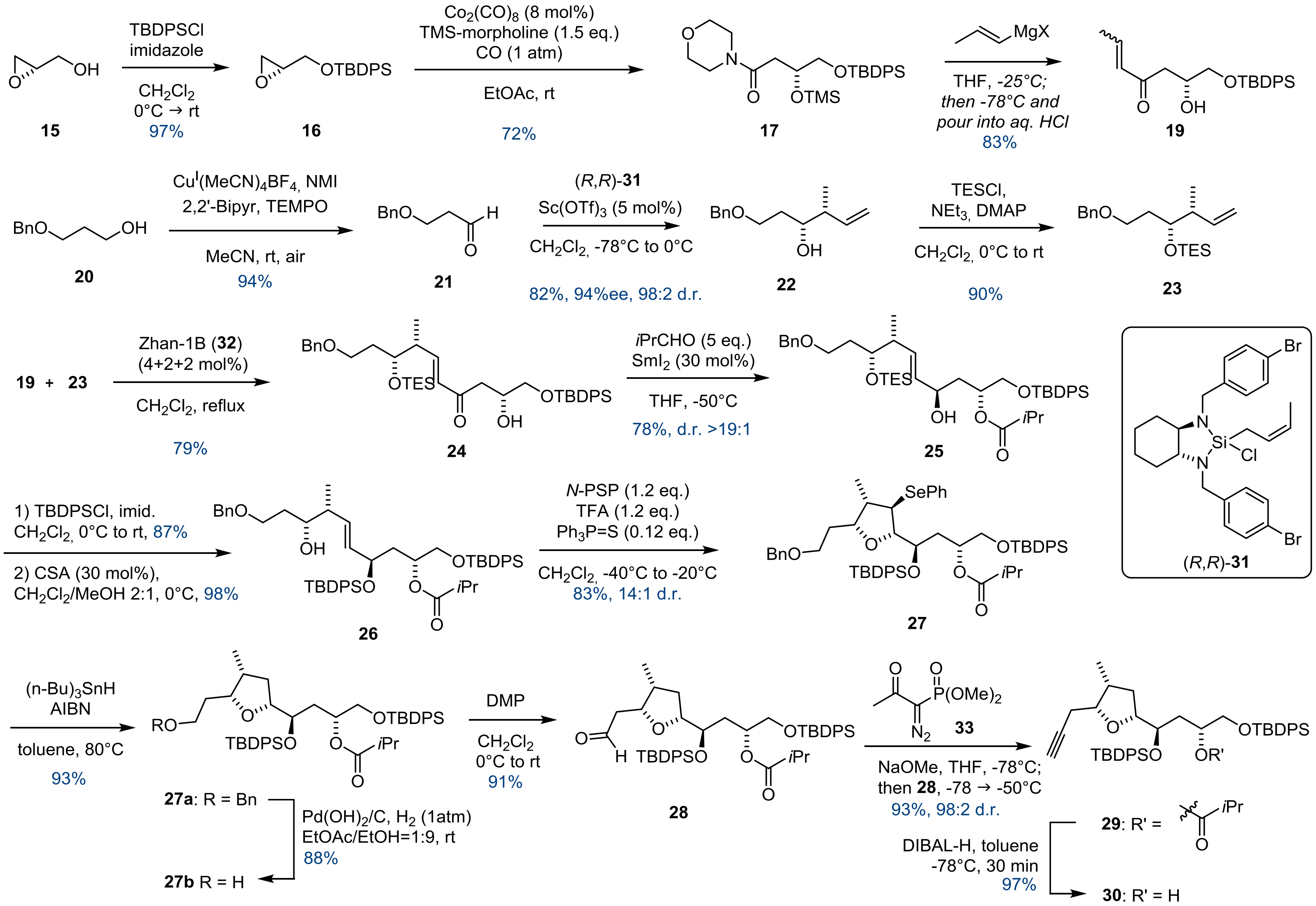
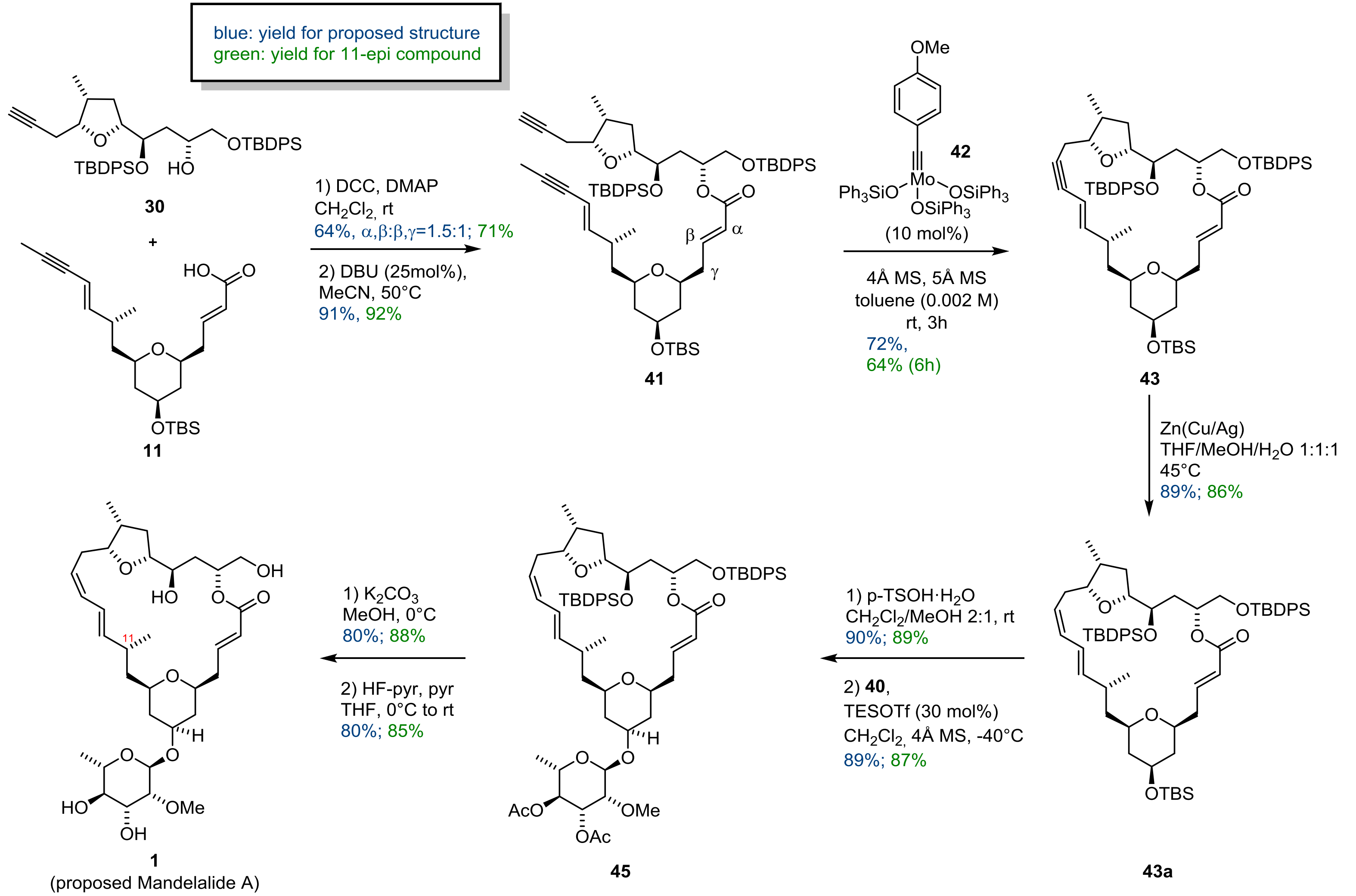


Scheme 1: Synthesis overview of the southern fragment **11** and rhamnosyl donor **40**.



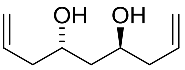
Scheme 2: Synthesis Overview of the northern Fragment **30**



Scheme 3: Synthesis overview of the assembly stage and endgame.

General. All reactions were carried out under Ar in flame-dried glassware unless H_2O was used as a solvent. The solvents were purified by distillation over the drying agents indicated and were transferred under Ar: THF, Et_2O (Mg/anthracene), CH_2Cl_2, hexane, toluene (Na/K), MeOH (Mg, stored over MS 3Å), EtOH (MS 3Å), EtOAc (P_2O_5, filter through dry Al_2O_3, store over 4Å MS); dioxane, DMF, MeCN , NEt_3 and pyridine were dried by an adsorbtion solvent purification system based on molecular sieves. Thin layer chromatography (TLC): Macherey-Nagel precoated plates (POLYGRAM® SIL/UV254); Flash chromatography: Merck silica gel 60 (40–63 µm) with predistilled or HPLC grade solvents. NMR: Spectra were recorded on Bruker DPX 300, AV 400, AV 500 or AVIII 600 spectrometer in the solvents indicated; chemical shifts (δ) are given in ppm relative to TMS, coupling constants (J) in Hz. The solvent signals were used as references and the chemical shifts converted to the TMS scale ($CDCl_3$: $\delta_C \equiv 77.0$ ppm; residual $CHCl_3$ in $CDCl_3$: $\delta_H \equiv 7.24$ ppm; C_6D_6: $\delta_C \equiv 128.0$ ppm; residual C_6D_5H: $\delta_H \equiv 7.16$ ppm, pyr-d^5: $\delta_C \equiv 150.35$ ppm; residual $CHCl_3$ in $CDCl_3$: $\delta_H \equiv 7.24$ ppm). IR: Spectrum One (Perkin-Elmer) spectrometer, wavenumbers ($\tilde{\nu}$) in cm^{-1}. MS (EI): Finnigan MAT 8200 (70 eV), ESI-MS: ESQ3000 (Bruker), accurate mass determinations: Bruker APEX III FT-MS (7 T magnet) or Mat 95 (Finnigan). Optical rotations ($[\propto]^{D}_{20}$) were measured with a Perkin-Elmer Model 343 polarimeter. Unless stated otherwise, all commercially available compounds (Alfa Aesar, Aldrich, Fluka, Lancaster) were used as received.

(4*S*,6*S*)-Nona-1,8-diene-4,6-diol (4). According to the procedure from Krische et. al.,[1] a flame-dried Young tube was charged with $[Ir(cod)Cl]_2$ (974 mg, 1.45 mmol), (*S*)-Cl,MeO-BIPHEP (1.89 g, 2.90 mmol), Cs_2CO_3 (3.78 g, 11.6 mmol) and 4-chloro-3-nitrobenzoic acid (1.17 g, 5.80 mmol). 1,4-Dioxane (65 mL) and distilled allyl acetate (31.3 mL, 290 mmol) were added, the flask was sealed, and the suspension heated to 90°C for 30 min and cooled back to room temperature. A solution of 1,3-propanediol (**3**) (2.10 mL, 29.0 mmol) in 1,4-dioxane (65 mL) was introduced, the flask sealed and stirring continued at 90°C for 72 h. After cooling to ambient temperature, the mixture was filtered through a pad of Celite (eluent: EtOAc) and the filtrate was concentrated. The brown residue was purified by flash chromatography (hexanes/EtOAc 3:1) to give the desired diol as a pale yellow oil (3.22 g, 71% yield, >99% ee, >29:1 d.r.). $[\propto]^{D}_{20} = +24.5$ (c = 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ = 5.85 – 5.72 (m, 2H), 5.13 – 5.09 (m, 2H), 5.09 – 5.07 (m, 2H), 4.01 – 3.91 (br s, 2H), 2.72 – 2.57 (br s, 2H), 2.27 – 2.21 (m, 4H), 1.60 (tr, J = 5.8 Hz, 2H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 134.6, 118.0, 68.1, 42.0, 41.5 ppm. IR (film): $\tilde{\nu}$ = 3340, 3077, 2979, 2936, 1723, 1641, 1434, 1327, 1232, 1133, 1047, 994, 912, 871, 830 cm^{-1}. MS (EI) m/z (%) = 115 (10), 97 (74), 79 (38), 73 (19), 71 (89), 69 (52), 67 (49), 55 (19), 45 (39), 41 (100), 39 (29), 29 (13), 27 (28). HRMS (ESIpos): calcd for $C_9H_{16}O_2H$: 157.1228; found: 157.1229. The enantiomeric excess was determined by HPLC analysis of the bis-(4-nitrobenzoate) derivative (5 eq. 4-nitro-



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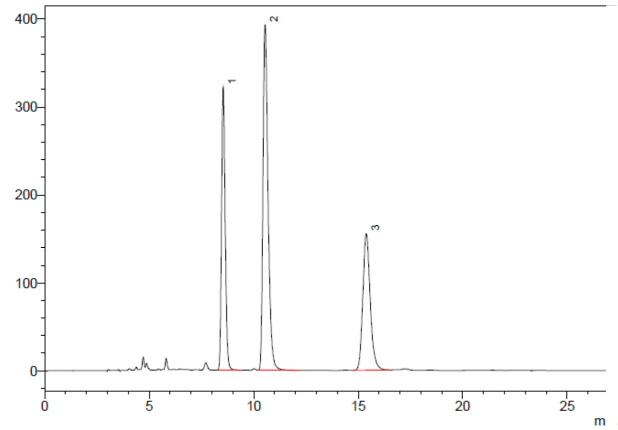
[1] Y. Lu, I. S. Kim, A. Hassan, D. J. Del Valle, M. J. Krische, *Angew. Chem. Int. Ed.* **2009**, *48*, 5018-5021.

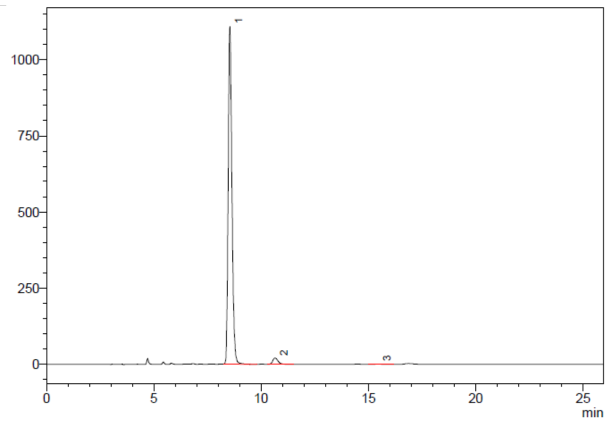
benzoic acid anhydride, 10 eq. pyridine, 0.2 eq. DMAP, 0°C, 3h, CH_2Cl_2). HPLC: 250 mm Chiralpak IB (Ø 4.6 mm), n-heptane/2-propanol 85:15, 1.0 mL/min, 298 K, 4.4 MPa: R_t = 8.54 min (major), 10.64 min (meso), 15.44 min (minor).



256nm,4nm

PDA Ch1 256nm

Peak #	Ret. Time	Area %	Name
1	8,54	27,09	1. Enantiomer
2	10,54	46,28	meso
3	15,38	26,63	2, Enantiomer
Total		100,00	

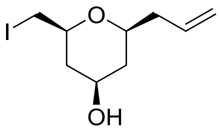


256nm,4nm

PDA Ch1 256nm

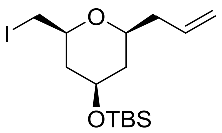
Peak #	Ret. Time	Area %	Name
1	8,54	97,18	1. Enantiomer
2	10,64	2,63	meso
3	15,44	0,19	2. Enantiomer
Total		100,00	

The analytic and spectroscopic data matched those reported in the literature.[1]

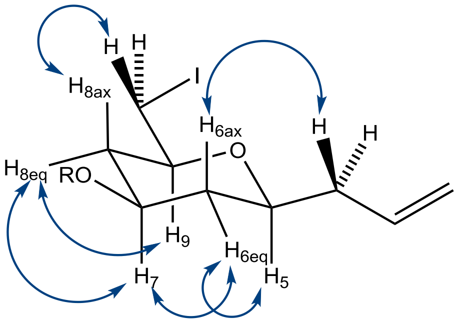


(2*S*,4*R*,6*S*)-2-Allyl-6-(iodomethyl)tetrahydro-2*H*-pyran-4-ol (4a). $NaHCO_3$ (4.18 g, 49.8 mmol) was added at –40°C to a solution of diol **4** (3.11 g, 19.9 mmol) in MeCN (360 mL) and the resulting suspension was vigorously stirred for 10 min. I_2 (15.2 g, 59.7 mmol) was carefully added in three portions and the resulting brown mixture stirred for 15 h at –40°C. The mixture was poured into sat. $Na_2S_2O_3$-solution (200 mL) and rinsed with EtOAc (2 x 50 mL). After extraction with EtOAc (2 x 150 mL), the combined organic layers were dried over Na_2SO_4 and concentrated. The brown residue was purified by flash chromatography (hexanes/EtOAc 3:1) to yield a 5:1 mixture of diastereoisomers (based on ^{1}H-NMR integration, solvent: C_6D_6) as a colorless oil (4.55 g, 81%). This mixture was purified by flash chromatography (SiO_2 60 (15 x 40 µm), CH_2Cl_2/Et_2O 5:1) to give the desired all-*cis* diastereomer as a colorless oil (3.54 g, 63%), which solidified upon prolonged storage at –20°C. $[\propto]_{20}^{D}$ = +25.7 (c = 0.37, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.84 (dddd, *J* = 16.8, 10.2, 7.5, 6.5 Hz, 1H), 5.11 – 5.02 (m, 2H), 3.80 (m, 1H), 3.36 (m, 2H), 3.19 (dd, *J* = 5.8, 3.8 Hz, 2H), 2.42 – 2.30 (m, 1H), 2.26 – 2.12 (m, 2H), 1.90 (ddt, *J* = 12.5, 4.3, 2.0 Hz, 1H), 1.63 (s, 1H), 1.14 (m, 2H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 134.3, 117.1, 75.4, 75.0, 67.8, 40.7, 40.2, 40.1, 8.7 ppm. IR (film): $\tilde{\nu}$ = 3346, 2942, 2917, 2850, 1641, 1446, 1430, 1414, 1368, 1325, 1270, 1185, 1136, 1080, 1038, 998, 916, 854 cm^{-1}. MS (EI) m/z (%) = 282 (0.3), 241 (100), 223 (23), 197 (38), 73 (14), 67 (17), 45 (15), 43 (10). HRMS (ESIpos): calcd for $C_9H_{15}O_2INa$: 305.0009; found: 305.0009.

(((2*S*,4*R*,6*S*)-2-allyl-6-(iodomethyl)tetrahydro-2*H*-pyran-4-yl)oxy)(*tert*-butyl)-dimethylsilane (5).



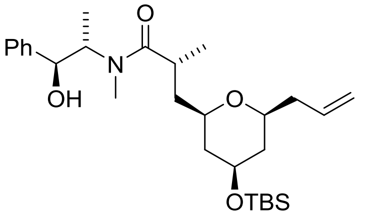
A solution of alcohol **4a** (3.10 g, 11.0 mmol) in CH_2Cl_2 (38 mL) was cooled to 0°C before 2,6-lutidine (1.79 mL, 15.4 mmol) and TBSOTf (3.03 mL, 13.2 mmol) were added dropwise via syringe. The mixture was stirred for 1 h at 0°C before the reaction was quenched with sat. NH_4Cl-solution (40 mL). After phase separation, the aqueous layer was extracted with EtOAc (2 x 25 mL), the combined organic layers were washed with brine (50 mL), dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 29:1) to yield the desired silyl ether as a colorless oil (4.18 g, 96%). $[\propto]_{20}^{D}$ = +15.8 (c = 1.21, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ = 5.90 – 5.77 (m, 1H), 5.12 – 4.97 (m, 2H), 3.74 (dddd, *J* = 10.8, 10.7, 4.8, 4.7 Hz, 1H), 3.35 – 3.24 (m, 2H), 3.16 (dd, *J* = 5.9, 1.5 Hz, 2H), 2.33 (dtt, *J* = 13.3, 6.6, 1.5 Hz, 1H), 2.18 (dddd, *J* = 14.4, 7.1, 5.7, 1.3 Hz, 1H), 2.00 (dddd, *J* = 12.4, 4.1, 1.9, 1.8 Hz, 1H), 1.79 – 1.68 (m, 1H), 1.23 – 1.11 (m, 2H), 0.85 (s, 9H), 0.03 (s, 6H) ppm. ^1H NMR (400 MHz, C_6D_6): δ = 5.92 (dddd, *J* = 16.7, 10.9, 8.3, 6.3 Hz, 1H), 5.09 – 4.98 (m, 2H), 3.54 (dddd, *J* = 10.8, 10.7, 4.9, 4.7 Hz, 1H), 3.07 (dddd, *J* = 11.5, 6.7, 5.1, 1.8 Hz, 1H), 2.93 (dddd, *J* = 11.2, 6.6, 4.6, 2.0 Hz, 1H), 2.85 (dd, *J* = 10.1, 6.7 Hz, 1H), 2.76 (dd, *J* = 10.1, 4.6 Hz, 1H), 2.29 (dtt, *J* = 13.2, 8.1, 6.6, 5.1 Hz, 1H), 2.08 (dddt, *J* = 14.0, 7.5, 5.2, 1.1 Hz, 1H), 1.74 (ddt, *J* = 12.3, 47, 2.0, 1H), 1.63 (dddd, *J* = 12.6, 4.6, 2.0, 2.0 Hz, 1H), 1.21 (ddd, *J* = 12.6, 11.1, 11.1 Hz, 1H), 1.11 (ddd, *J* = 12.2, 11.1, 11.0 Hz, 1H), 0.97 (s, 9H), 0.05 (s, 6H). ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 134.5, 116.8, 75.4, 75.1, 68.3, 41.1, 40.7, 40.2, 25.8, 18.0, 8.9, –4.6 ppm. IR (film): $\tilde{\nu}$ = 2950, 2928, 2856, 1642, 1471, 1462, 1383, 1251, 1126, 1087, 1068, 1005, 916, 833, 773, 669 cm^{-1}. MS (EI) m/z (%) = 340 (14), 339 (81), 271 (27), 269 (10), 172 (14), 171 (100), 141 (14), 129 (42), 101 (38), 79 (21), 75 (37), 73 (23), 67 (11), 59 (14), 43 (25), 41 (18). HRMS (ESIpos): calcd for $C_{15}H_{29}O_2SiINa$: 419.0872; found: 419.0874.



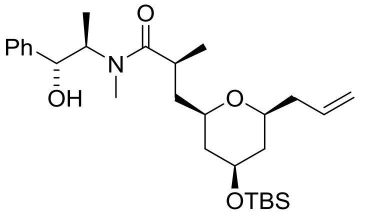
At this stage, the relative stereochemistry of the tetrahydropyran ring was confirmed by NOESY experiments in C_6D_6 (which showed the best signal separation). Although no direct NOESY contacts between H**5**, H**7** and H**9** of the six-membered ring were observed (which was the case on later intermediates, see for example the analysis of the final compounds **1** and 11-*epi*-**1**), the structure was assigned to an all-*cis* configured THP ring. Further evidence was obtained from the coupling constants in C_6D_6 for H**6ax** (1.21 ppm, ddd, *J* = 12.5, 11.3, 11.3 Hz) and H**8ax** (1.10 ppm, ddd, *J* = 12.2, 11.1, 11.0 Hz), suggesting one geminal and two axial vicinal couplings; for H**6eq** (1.63 ppm, dddd, *J* = 12.6, 4.6, 2.0, 2.0 Hz) and H**8eq** (1.74 ppm, dddd, *J* = 12.3, 4.4, 2.3, 2.3 Hz) one geminal and two equatorial vicinal coupling constants were observed. The coupling constants of H**9** (2.93 ppm, dddd, *J* = 11.2, 6.6, 4.6, 2.0 Hz) can be assigned to H**8ax** (11.2 Hz), H**10a** (6.6 Hz), H**10b** (4.6 Hz) and H**8eq**

(2.0 Hz), which is consistent with the assignment. The pseudosymmetric nature of the signals around the THP ring gives additional evidence for an all-*cis* substitution.

(*R*)-3-((2*R*,4*R*,6*S*)-6-Allyl-4-((*tert*-butyldimethylsilyl)oxy)tetrahydro-2*H*-pyran-2-yl)-*N*-((1*S*,2*S*)-1-Hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (7). A flame-dried 3-necked round-bottom flask equipped with a stirbar, a reflux condenser and a dropping funnel was charged with dry LiCl (5.13 g, 121 mmol), diisopropylamine (6.24 mL, 44.4 mmol) and THF (75 mL). After cooling to −78°C, a solution of n-BuLi (1.50 M in hexanes, 29.0 mL, 43.5 mmol) was added dropwise over 20 min and the mixture was stirred for 10 min before it was warmed to 0°C. After 10 min, the mixture was cooled to −78°C and a solution of (1*S*,2*S*)-*N*-(2-hydroxy-1-methyl-2-phenylethyl)-*N*-methylpropionic amide[2] (**6**) (4.69 g, 21.2 mmol) in THF (115 mL) was added over 45 min via the dropping funnel. The resulting yellow suspension was stirred for 1 h at −78°C, for 30 min at 0°C and for 20 min at RT before it was cooled to 0°C. A solution of alkyl iodide **5** (4.01 g, 10.1 mmol) in THF (6 mL + 2 x 2 mL rinse) was then added dropwise over 5 min via syringe. The mixture was warmed to 45°C and stirred at this temperature for 48 h. After cooling to RT, the reaction was quenched with sat. NH_4Cl solution (300 mL) and the aqueous layer was extracted with EtOAc (4 x 200 mL). The combined extracts were dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 2:1) to give the alkylated compound as a white foam that collapsed to a colorless syrup upon storage (3.83 g, 76%). $[\propto]_{20}^{D}$ = +50.7 (c = 0.96, CH_2Cl_2). ^{1}H and ^{13}C NMR spectra were complex and broadened due to the presence of amide bond rotamers. IR (film): $\tilde{\nu}$ = 3387, 2933, 2930, 2856, 1619, 1462, 1409, 1374, 1252, 1115, 1072, 913, 835, 774, 700, 673 cm^{-1}. MS (EI) m/z (%) = 433 (31), 432 (97), 383 (16), 382 (31), 325 (19), 258 (20), 257 (100), 216 (31), 193 (16), 171 (10), 148 (21), 129 (10), 119 (11), 101 (12), 99 (19), 79 (11), 75 (22), 73 (25), 58 (39). HRMS (ESIpos): calcd for $C_{28}H_{47}NO_4SiNa$: 512.3167; found: 512.3166.



(*S*)-3-((2*R*,4*R*,6*S*)-6-Allyl-4-((*tert*-butyldimethylsilyl)oxy)tetrahydro-2*H*-pyran-2-yl)-*N*-((1*R*,2*R*)-1-hydroxy-1-phenylpropan-2-yl)-*N*,2-dimethylpropanamide (11-*epi*-7). Prepared analogously from (1*R*,2*R*)-*N*-(2-hydroxy-1-methyl-2-phenylethyl)-*N*-methylpropionic amide[2] (*ent*-**6**) and alkyl iodide **5** (3.08 g, 7.77 mmol) as a sticky syrup (3.20 g, 84%). $[\propto]_{20}^{D}$ = −24.3 (c = 0.77, CH_2Cl_2). ^{1}H and ^{13}C NMR spectra were complex and partially broadened due to the presence of amide bond rotamers. IR (film): $\tilde{\nu}$ = 3376, 2934, 2930, 2856, 1619, 1472, 1463, 1374, 1328, 1306, 1254, 1120, 1073, 1006, 915, 857, 836, 775, 702, 671 cm^{-}



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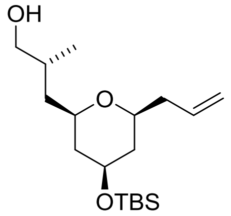
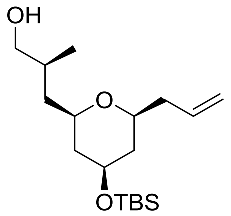
[2] A. G. Myers, B. H. Yang, H. Chen, L. McKinstry, D. J. Kopecky, J. L. Gleason, *J. Am. Chem. Soc.* **1997**, *119*, 6496-6511.

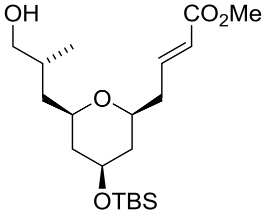
^{1}. MS (EI) m/z (%) = 474 (5), 433 (28), 432 (89), 383 (15), 382 (26), 325 (22), 258 (20), 257 (100), 222 (17), 193 (13), 148 (18), 119 (10), 99 (19), 75 (15), 73 (17), 58 (23). HRMS (ESIpos): calcd for $C_{28}H_{47}NO_4SiNa$: 512.3167; found: 512.3169.



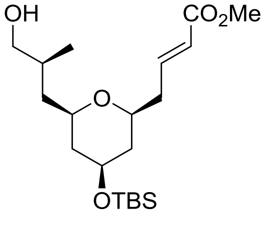
(*R*)-3-((2*R*,4*R*,6*S*)-6-allyl-4-((*tert*-Butyldimethylsilyl)oxy)tetrahydro-2*H*-pyran-2-yl)-2-methylpropan-1-ol (7a). A solution of n-BuLi (1.60 M in hexanes, 23.1 mL, 37.0 mmol) was added over 15 min at –78°C to a solution of diisopropylamine (5.57 mL, 39.6 mmol) in THF (34 mL) and the resulting mixture was stirred at this temperature for 15 min and for 45 min at 0°C. Solid $NH_3 \cdot BH_3$ (90%, 1.31 g, 38.1 mmol) was then added in one portion and the resulting mixture stirred for 40 min at 0°C and for 45 min at ambient temperature. After cooling to 0°C, a solution of amide **7** (3.80 g, 7.62 mmol) in THF (34 mL) was slowly added over 10 min. After stirring for 3 h at 0°C, the mixture was warmed to RT and stirring continued for 1 h before the reaction was quenched with sat. NH_4Cl (200 mL) solution. The mixture was vigorously stirred for 45 min before the phases were separated, the aqueous phase was extracted with EtOAc (3 x 120 mL), the combined organic extracts were dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 5:1) to give the desired alcohol as a colorless oil (2.42 g, 96%). $[\propto]_{20}^{D}$ = +17.8 (c = 0.83, CH_2Cl_2). ^{1}H NMR (400 MHz, C_6D_6): δ = 5.85 (dddd, *J* = 16.0, 9.2, 6.6, 6.6 Hz, 1H), 5.07 – 5.00 (m, 2H), 3.63 (dddd, *J* = 10.7, 10.4, 5.1, 5.1 Hz, 1H), 3.46 (ddd, *J* = 10.5, 5.2, 5.1 Hz, 1H), 3.36 (ddd, *J* = 10.4, 5.1, 5.1 Hz, 1H), 3.19 – 3.04 (m, 2H), 2.26 (dddt, J = 14.1, 7.0, 7.0, 1.2 Hz, 1H), 2.22 – 2.15 (br t, 1H), 2.12 – 2.04 (m, 1H), 1.78 (dddd, *J* = 12.4, 6.2, 6.2, 6.2 Hz, 1H), 1.75 – 1.61 (m, 2H), 1.55 (ddd, *J* = 14.4, 9.6, 7.3 Hz, 1H), 1.34 – 1.21 (m, 2H), 1.09 (ddd, *J* = 14.4, 6.4, 2.3 Hz, 1H), 1.00 (s, 9H), 0.87 (d, *J* = 6.8 Hz, 3H), 0.09 (s, 3H), 0.08 (s, 3H) ppm. ^{13}C NMR (100 MHz, C_6D_6): δ = 134.9, 117.2, 75.3, 74.8, 69.1, 68.2, 43.0, 41.4, 41.2, 40.8, 34.5, 26.0, 18.2, 18.0, –4.3 ppm. IR (film): $\tilde{\nu}$ = 3395, 2926, 2929, 2856, 1643, 1472, 1462, 1375, 1253, 1152, 1123, 1070, 975, 914, 835, 774, 671 cm^{-1}. MS (EI) m/z (%) = 271 (33), 201 (20), 179 (37); 171 (47), 161 (16), 159 (47), 145 (46), 131 (12), 129 (69), 127 (12), 125 (15), 119 (15), 111 (12), 109 (65), 107 (12), 105 (22), 101 (44), 93 (18), 85 (93), 81 (28), 79 (26), 75 (100), 73 (49), 67 (43), 59 (22), 57 (14), 55 (24), 43 (17), 41 (32). HRMS (ESIpos): calcd for $C_{18}H_{36}O_3SiNa$: 351.2326; found: 351.2326.



(*S*)-3-((2*R*,4*R*,6*S*)-6-allyl-4-((*tert*-Butyldimethylsilyl)oxy)tetrahydro-2*H*-pyran-2-yl)-2-methylpropan-1-ol (11-*epi*-7a). Prepared analogously from amide 11-*epi*-**7** (3.20 g, 6.53 mmol) as a colorless oil (1.86 g, 87%). $[\propto]_{20}^{D}$ = +1.8 (c = 1.03, CH_2Cl_2). ^{1}H NMR (400 MHz, C_6D_6): δ = 5.85 (dddd, *J* = 17.7, 9.6, 7.0, 7.0 Hz, 1H), 5.08 – 4.99 (m, 2H), 3.65 (dddd, *J* = 10.7, 10.7, 5.0, 4.8 Hz, 1H), 3.50 – 3.40 (m, 1H), 3.36 (dd, *J* = 10.7, 6.6 Hz, 1H), 3.28 (dddd, *J* = 11.5, 8.3, 3.5, 1.9 Hz, 1H), 3.11 (dddd, *J* = 11.4, 7.1, 5.3, 1.9 Hz, 1H), 2.25 (dtt, *J* = 14.0, 7.0, 1.4 Hz, 1H), 2.08 (dddd, *J* = 14.1, 8.6, 4.0, 2.6 Hz, 1H), 2.01 (br s, 1H), 1.86 (qt, *J* = 6.8, 5.3 Hz, 1H), 1.77 – 1.64 (m, 2H), 1.52 (ddd, *J* = 13.9, 8.3, 5.4 Hz, 1H), 1.43 – 1.20 (m, 3H), 0.99 (s, 9H), 0.86 (d, *J* = 6.9 Hz, 3H), 0.08 (s, 6H) ppm. ^{13}C NMR (100 MHz, C_6D_6): δ = 135.0, 117.0, 75.3, 73.5, 69.2, 67.5, 42.3, 41.6, 40.8, 40.0, 32.9, 26.0, 18.2, 17.6, –4.3 ppm. IR (film): $\tilde{\nu}$ = 3394, 2950, 2929, 2857, 1375, 1254, 1151, 1123, 1072, 1005, 914, 836, 775, 672 cm^{-1}. MS (EI) m/z (%) = 271 (33), 201 (20), 179 (37); 171 (47), 161 (16), 159 (47), 145 (46), 131 (12), 129 (69), 127 (12), 125 (15), 119 (15), 111 (12), 109 (65), 107 (12), 105 (22), 101 (44), 95 (41), 93 (18), 85 (93), 81 (28), 79 (26), 75 (100), 73 (49), 67 (43), 59 (22), 57 (14), 55 (24), 43 (17), 41 (32). HRMS (ESIpos): calcd for $C_{18}H_{36}O_3SiNa$: 351.2326; found: 351.2327.

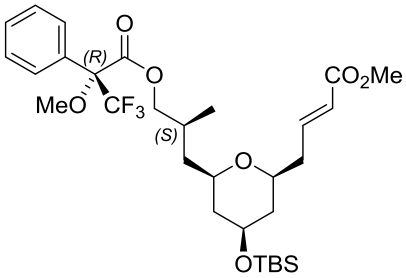


Methyl (*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*R*)-3-hydroxy-2-methylpropyl)-tetrahydro-2*H*-pyran-2-yl)but-2-enoate (7b). Hoveyda-Grubbs 2nd gen. catalyst **13** (137 mg, 0.219 mmol) was added to a solution of the terminal alkene **7a** (2.40 g, 7.30 mmol) and methylacrylate (3.27 mmol, 36.5 mmol) in CH_2Cl_2 (70 mL). The mixture was stirred under Ar for 7.5 h at ambient temperature. After concentration, the residue (*E/Z* = 12:1 based on ^{1}H NMR integration of a crude sample) was purified by flash chromatography (hexanes/EtOAc 5:1 to 4:1) to give the title compound as a pale brown oil (2.33 g, single isomer, 83%). $[\propto]_{20}^{D}$ = +9.0 (c = 1.0, CH_2Cl_2). ^{1}H NMR (400 MHz, C_6D_6): δ = 7.09 (dt, *J* = 15.6, 7.2 Hz, 1H), 5.90 (dt, *J* = 15.6, 1.5 Hz, 1H), 3.57 (dddd, *J* = 10.8, 10.6, 4.9 4.8 Hz, 1H), 3.40 (s, 3H) 3.39 – 3.29 (m, 2H), 3.09 (dddd, *J* = 11.7, 9.7, 2.3, 2.3 Hz, 1H), 2.96 (dddd, *J* = 11.7, 7.0, 4.7, 1.9 Hz, 1H), 2.09 (dddd, *J* = 14.8, 7.4, 7.3, 1.5 Hz, 1H), 1.94 (dddd, *J* = 8.6, 8.6, 5.1, 2.0 Hz, 1H), 1.81 – 1.70 (m, 2H), 1.67 – 1.56 (m, 2H), 1.51 (ddd, *J* = 14.4, 9.6, 6.9 Hz, 1H), 1.29 – 1.12 (m, 2H), 1.07 – 1.01 (m, 1H), 0.99 (s, 9H), 0.87 (d, *J* = 6.8 Hz, 3H), 0.08 (s, 3H), 0.07 (s, 3H) ppm. ^{13}C NMR (100 MHz, C_6D_6): δ = 166.4, 145.1, 123.5, 74.6, 74.2, 68.9, 68.1, 51.0, 42.7, 41.5, 40.7, 38.7, 34.0, 26.0, 18.2, 17.7, –4.3, –4.3 ppm. IR (film): $\tilde{\nu}$ = 3436, 2933, 2929, 2856, 1725, 1659, 1462, 1436, 1376, 1324, 1255, 1175, 1122, 1069, 985, 855, 836, 775, 669 cm^{-1}. MS (EI) m/z (%) = 329 (14), 237 (54), 229 (17), 203 (11), 159 (26), 137 (11), 131 (12), 129 (20), 109 (30), 101 (23), 97 (20), 93 (21), 89 (11), 85 (100), 81 (15), 75 (46), 73 (32), 67 (18), 59 (13), 55 (12), 41 (15). HRMS (ESIpos): calcd for $C_{20}H_{38}O_5SiNa$: 409.2381; found: 409.2381.



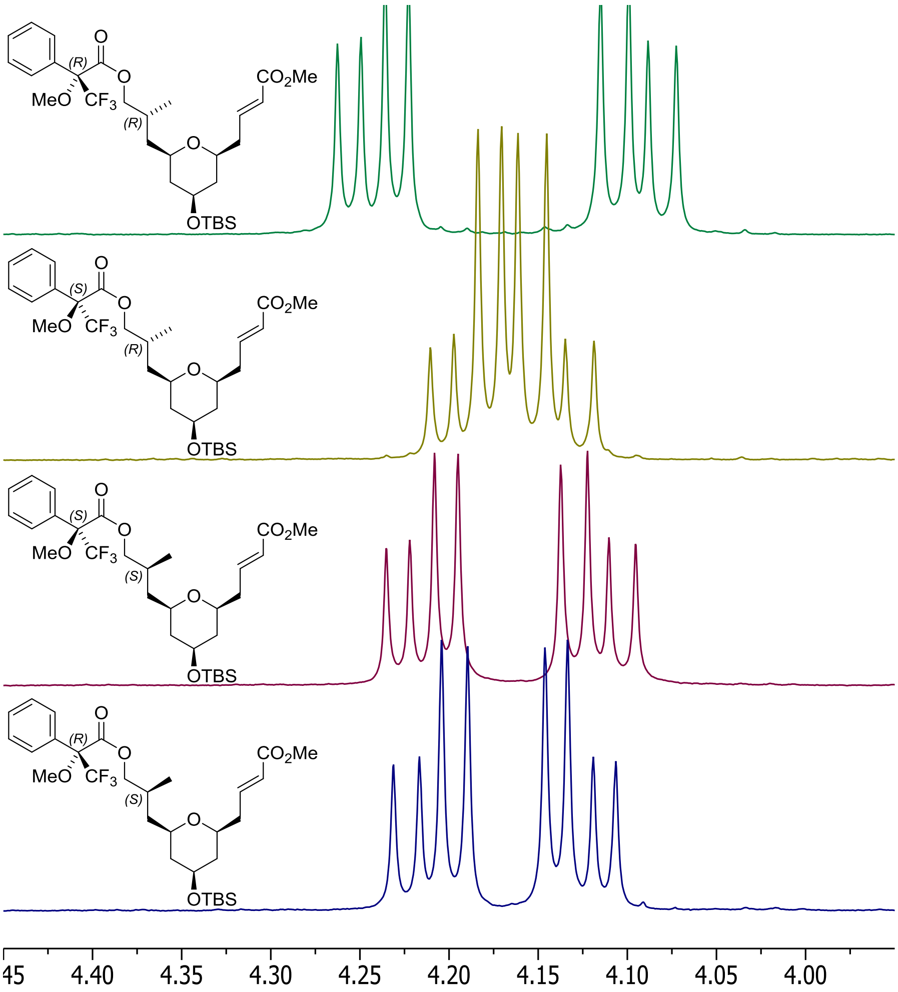
Methyl (*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*S*)-3-hydroxy-2-methylpropyl)-tetrahydro-2*H*-pyran-2-yl)but-2-enoate (11-*epi*-7b). Prepared analogously from the terminal alkene 11-*epi*-**7a** (1.82 g, 5.63 mmol) as a colorless oil (1.99 g, 91%). $[\propto]_{20}^{D}$ = –0.4 (c = 1.09, CH_2Cl_2). ^{1}H NMR (400 MHz, C_6D_6): δ = 7.09 (dt, *J* = 15.7, 7.1 Hz, 1H), 5.90 (dt, *J* = 15.7, 1.5 Hz, 1H), 3.59 (tt, *J* = 10.5, 4.7 Hz, 1H), 3.40 (m, 5H), 3.27 – 3.15 (dddd, *J* = 11.6, 8.6, 3.4, 1.8 Hz, 1H), 3.04 – 2.94 (dddd, *J* = 11.7, 7.4, 4.4, 2.1 Hz, 1H), 2.16 – 2.04 (m, 1H), 2.04 – 1.97 (br s, 1H), 1.97 – 1.89 (dddd, *J* = 14.9, 7.1, 4.5, 1.5 Hz, 1H), 1.84 (tdd, *J* = 12.8, 7.3, 1.3 Hz, 1H), 1.67 (ddt, *J* =

12.6, 4.8, 1.9 Hz, 1H), 1.59 (ddt, *J* = 12.4, 4.8, 1.9 Hz, 1H), 1.43 (ddd, *J* = 14.1, 8.3, 5.7 Hz, 1H), 1.35 (ddd, *J* = 14.2, 7.2, 3.9 Hz, 1H), 1.26 (ddd, *J* = 11.8, 11.6, 11.1 Hz, 1H), 1.19 (ddd, *J* = 11.7, 11.6, 11.2 Hz, 1H), 0.98 (s, 9H), 0.87 (d, *J* = 6.9 Hz, 3H), 0.06 (s, 6H) ppm. ^{13}C NMR (100 MHz, C_6D_6): δ = 166.6, 145.5, 123.3, 74.2, 73.8, 69.0, 67.5, 51.0, 42.2, 41.7, 40.0, 38.7, 32.9, 26.0, 18.2, 17.7, –4.3, –4.3 ppm. IR (film): $\tilde{\nu}$ = 3436, 2951, 2930, 2857, 1726, 1660, 1463, 1436, 1376, 1330, 1256, 1175, 1154, 1122, 1072, 987, 854, 837, 776 cm^{-1}. MS (EI) m/z (%) = 329 (14), 237 (54), 229 (17), 203 (11), 159 (26), 137 (11), 131 (12), 129 (20), 109 (30), 101 (23), 97 (20), 93 (21), 89 (11), 85 (100), 81 (15), 75 (46), 73 (32), 67 (18), 59 (13), 55 (12), 41 (15). HRMS (ESIpos): calcd for $C_{20}H_{38}O_5SiNa$: 409.2381; found: 409.2382.



(*R*)-Mosher Ester of (11-*epi*)-7b (*all 4 possible Mosher Esters were prepared analogously):* Pyridine (10.5 µL, 129 µmol) and (*S*)-(+)-α-methoxy-α-trifluoromethylphenylacetyl chloride (9.77 µL, 51.8 µmol) were successively added to a solution of the primary alcohol 11-*epi*-**7b** (10.0 mg, 25.9 µmol) in CH_2Cl_2 (300 µL). The mixture was stirred for 90 min before the reaction was quenched by addition of NH_4Cl-solution (3 mL). The aqueous phase was extracted with EtOAc (2 x 3 mL), the combined extracts were washed with $NaHCO_3$-solution, dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 15:1) to give the desired (*R*)-mosher ester as a colorless oil (14.5 mg, 93%). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.54 – 7.46 (m, 2H), 7.43 – 7.34 (m, 3H), 6.93 (dt, *J* = 15.6, 7.2 Hz, 1H), 5.84 (dt, *J* = 15.8, 1.4 Hz, 1H), 4.21 (dd, *J* = 10.8, 5.8 Hz, 1H), 4.13 (dd, *J* = 10.8, 5.0 Hz, 1H), 3.70 (m, 4H), 3.52 (q, *J* = 1.2 Hz, 3H), 3.33 (dddd, *J* = 11.6, 7.0, 5.0, 1.9 Hz, 1H), 3.25 (tdd, *J* = 9.2, 4.1, 2.0 Hz, 1H), 2.45 – 2.25 (m, 2H), 2.12 – 1.99 (m, 1H), 1.75 (ddt, *J* = 12.5, 4.1, 1.8 Hz, 1H), 1.68 – 1.59 (m, 1H), 1.43 (ddd, *J* = 14.7, 8.8, 6.0 Hz, 1H), 1.34 (ddd, *J* = 14.2, 7.5, 4.0 Hz, 1H), 1.14 (m, 2H), 0.94 (d, *J* = 6.8 Hz, 3H), 0.86 (s, 9H), 0.04 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.8, 166.6, 145.4, 132.4, 129.6, 128.4, 127.4, 122.9, 74.1, 73.4, 70.5, 68.5, 55.4, 51.4, 41.8, 41.2, 39.0, 38.7, 29.4, 25.8, 18.1, 17.6, –4.5, –4.5 ppm. ^{19}F NMR (282 MHz, $CDCl_3$): δ = –71.6 ppm. MS (ESIpos) m/z (%) = 625.4 (100 (M+Na$^+$)). HRMS (ESIpos): calcd for $C_{30}H_{45}F_3O_7SiNa$: 625.2779; found: 625.2774.

For a comparison of the full range ^{1}H NMR spectra of all four diastereomers, see page 112; shown below is the characteristic region between 4.45 and 3.95 ppm, displaying the two proton signals of C12:



As expected from literature data,[3,4] the distance between the two inner lines of the dd of the protons at C12 is bigger for the (*R*)-Mosher Ester of the (11*R*)-isomer, whereas it is bigger in case of the (*S*)-Mosher Ester for the (11*S*)-isomer. Therefore the configuration of the stereogenic center at C11 corresponds to the prediction for the auxiliary-controlled asymmetric alkylation.[2]

Mosher Ester	**C11**	**H12a /ppm**	**H12b /ppm**	**Δ(ppm) between two inner lines**
R	**R**	4.24 (dd, J= 10.7, 5.2 Hz)	4.09 (dd, J= 10.7, 6.3 Hz)	0.108
S	**R**	4.19 (dd, J= 10.7, 5.3 Hz)	4.14 (dd, J= 10.7, 6.4 Hz)	0.009
S	**S**	4.21 (dd, J= 10.8, 5.3 Hz)	4.11 (dd, J= 10.8, 6.0 Hz)	0.058
R	**S**	4.21 (dd, J=10.8, 5.8 Hz)	4.13 (dd, J= 10.8, 5.0 Hz)	0.043

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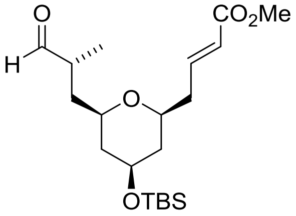
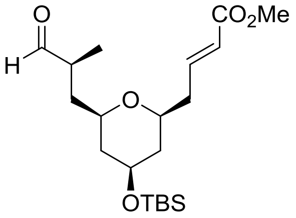
[3] E. Finamore, L. Minale, R. Riccio, G. Rinaldo, F. Zollo, *J. Org. Chem.* **1991**, *56*, 1146.

[4] J. M. Seco, E. Quiñoá, R. Riguera, *Chem. Rev.* **2004**, *104*, 17 and references cited therein.

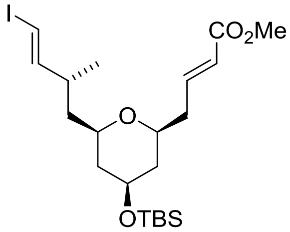


Methyl (*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*R*)-2-methyl-3-oxopropyl)tetrahydro-2*H*-pyran-2-yl)but-2-enoate (8). A solution of Dess-Martin periodinane (524 mg, 1.24 mmol) in CH_2Cl_2 (2 mL) was cooled to 0°C before a solution of alcohol **7b** (398 mg, 1.03 mmol) in CH_2Cl_2 (2 mL + 1 mL rinse) was added dropwise via syringe. After 5 min, the mixture was allowed to warm to ambient temperature and stirring was continued for 3 h. The reaction was quenched by addition of aq. sat. $Na_2S_2O_3$ and $NaHCO_3$-solution (1:1, 15 mL) and the aqueous phase was extracted with CH_2Cl_2 (3x 10 mL). The combined organic layers were dried over Na_2SO_4 and concentrated, and the residue purified by flash chromatography (hexanes/EtOAc 12:1 to 9:1) to yield the desired aldehyde as a colorless oil (305 mg, 77%). $[\propto]_{20}^{D}$ = +3.4 (c = 0.81, hexane). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.55 (d, *J* = 2.3 Hz, 1H), 6.91 (dd, *J* = 15.7, 7.3, 7.2 Hz, 1H), 5.83 (ddd, *J* = 15.7, 1.5, 1.5 Hz, 1H), 3.77 – 3.68 (m, 1H), 3.71 (s, 3H), 3.39 – 3.25 (m, 2H), 2.52 (dqd, *J* = 7.1, 7.0, 2.4 Hz, 1H), 2.43 – 2.24 (m, 2H), 1.93 (ddd, *J* = 14.3, 9.9, 7.0 Hz, 1H), 1.80 – 1.71 (m, 2H), 1.38 (ddd, *J* = 14.3, 7.1, 3.0 Hz, 1H), 1.26 – 1.14 (m, 2H), 1.06 (d, *J* = 7.0 Hz, 3H), 0.85 (s, 9H), 0.03 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 204.8, 166.8, 145.2, 123.0, 74.2, 73.4, 68.4, 51.5, 43.8, 41.8, 41.1, 38.6, 37.3, 25.8, 18.1, 13.8, –4.5 ppm. MS (EI) m/z (%) = 328 (15), 327 (60), 309 (27), 235 (20), 229 (49), 227 (16), 203 (51), 201 (22), 199 (22), 185 (15), 183 (36), 175 (16), 157 (33), 145 (30), 129 (33), 109 (15), 107 (23), 101 (48), 97 (29), 93 (29), 89 (22), 85 (31), 83 (25), 81 (36), 79 (15), 75 (100), 73 (54), 59 (27), 41 (25). HRMS (ESIpos): calcd for $C_{20}H_{36}O_5SiNa$: 407.2228; found: 407.2224.

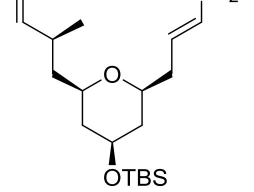


Methyl (*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*S*)-2-methyl-3-oxopropyl)tetrahydro-2*H*-pyran-2-yl)but-2-enoate (11-*epi*-8). A slightly modified procedure had to be used: A solution of Dess-Martin periodinane (783 mg, 1.85 mmol) in CH_2Cl_2 (2 mL) was cooled to 0°C and $NaHCO_3$ (358 mg, 4.27 mmol) was added as a solid, followed by addition of a solution of alcohol 11-*epi*-**7b** (550 mg, 1.42 mmol) in CH_2Cl_2 (2 mL + 1 mL rinse). After 5 min, the mixture was allowed to reach ambient temperature and stirring was continued for 3 h. The mixture was filtered and the filtrate loaded onto SiO_2. Purification by flash chromatography (hexanes/EtOAc 12:1 to 9:1) gave the desired aldehyde as a colorless oil (414 mg, 76%). $[\propto]_{20}^{D}$ = +17.7 (c = 1.105, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.59 (d, *J* = 1.4 Hz, 1H), 6.90 (dt, *J* = 15.7, 7.2 Hz, 1H), 5.82 (dt, *J* = 15.7, 1.5 Hz, 1H), 3.71 (m, 4H), 3.39 – 3.26 (m, 2H), 2.61 – 2.48 (m, 1H), 2.41 – 2.23 (m, 2H), 1.79 (ddd, *J* = 14.4, 8.1, 3.4 Hz, 1H), 1.77 – 1.70 (m, 2H), 1.65 (ddd, *J* = 14.0, 9.2, 4.4 Hz, 1H), 1.24 – 1.12 (m, 2H), 1.08 (d, *J* = 7.2 Hz, 3H), 0.84 (s, 9H), 0.02 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 204.5, 166.8, 145.2, 122.9, 74.1, 72.8, 68.4, 51.4, 42.8, 41.6, 41.1, 38.6, 36.9, 25.8, 18.0, 13.8, –4.5, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2951, 2939, 2856, 1725, 1660, 1462, 1436, 1376, 1330, 1255, 1175, 1122, 1072, 853, 776 cm^{-1}. MS (EI) m/z (%) = 328 (14), 327 (60), 309 (29), 235 (20), 229 (49), 227 (16), 203 (51), 201 (22), 199 (22), 185 (15), 183 (36), 175 (16), 157 (33), 155

(13), 153 (15), 151 (17), 145 (30), 143 (10), 129 (33), 109 (15), 107 (23), 101 (48), 97 (29), 93 (29), 89 (22), 85 (31), 83 (25), 81 (36), 79 (15), 75 (100), 73 (54), 67 (17), 59 (27), 43 (17), 41 (25). HRMS (ESIpos): calcd for $C_{20}H_{36}O_5SiNa$: 407.2224; found: 407.2224.



Methyl (*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*R*,*E*)-4-iodo-2-methylbut-3-en-1-yl)-tetrahydro-2*H*-pyran-2-yl)but-2-enoate (9). A flame-dried Schlenk tube was charged with $CrCl_2\cdot 1.7$ THF (1.21 g, 4.94 mmol) which was suspended in degassed THF (11.5 mL) and cooled to –8°C. Solid CHI_3 (642 mg, 1.63 mmol) was then added under vigorous stirring, causing a color change from green-grey to brown. After 5 min, a solution of aldehyde **8** (190 mg, 0.494 mmol) in degassed THF (1 mL + 2 x 0.5 mL rinse) was added dropwise. After 3 h at –8°C, the reaction was quenched by addition of aq. serine/$KHCO_3$ solution (1 M, pH = 8, 25 mL)[5] and hexanes/EtOAc (1:1, 40 mL). The mixture was allowed to warm to room temperature and vigorously stirred for 30 min. After phase separation, the deep violet aqueous phase was extracted with hexanes/EtOAc (1:1, 3 x 40 mL) and the combined extracts were dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc, 100:0 (until all CHI_3 was removed) to 99:1 to 49:1 to 39:1 to 29:1) to yield the desired (*E*)-vinyl iodide as a colorless oil (181 mg, 72%) and the isomeric (*Z*)-vinyl-iodide (18.8 mg, 8%). $[\propto]_{20}^{D}$ = –29.6 (c = 1.20, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.94 (dt, *J* = 15.7, 7.2 Hz, 1H), 6.43 (dd, *J* = 14.4, 8.0 Hz, 1H), 5.95 (dd, *J* = 14.4, 1.0 Hz, 1H), 5.86 (dt, *J* = 15.7, 1.5 Hz, 1H), 3.76 – 3.66 (m, 1H), 3.71 (s, 3H), 3.41 – 3.30 (m, 1H), 3.25 (dddd, *J* = 10.0, 8.4, 4.8, 1.8 Hz, 1H), 2.47 – 2.25 (m, 3H), 1.75 (m, 2H), 1.62 (ddd, *J* = 13.8, 8.4, 6.5 Hz, 1H), 1.28 (ddd, J = 13.9, 7.0, 4.9 Hz, 1H), 1.25 – 1.09 (m, 2H), 0.97 (d, *J* = 6.7 Hz, 3H), 0.86 (s, 9H), 0.03 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.9, 152.0, 145.4, 122.8, 74.1, 73.3, 73.2, 68.6, 51.4, 41.9, 41.6, 41.3, 38.7, 37.1, 25.8, 19.1, 18.1, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2949, 2929, 2856, 1725, 1660, 1435, 1376, 1329, 1269, 1255, 1174, 1069, 950, 836, 775, 670 cm^{-1}. MS (EI) m/z (%) = 452 (23), 451 (100), 229 (47), 197 (11), 181 (37), 169 (10), 157 (11), 131 (34), 129 (31), 101 (19), 93 (12), 89 (13), 75 (28), 73 (21), 59 (11). HRMS (ESIpos): calcd for $C_{21}H_{37}O_4SiINa$: 531.1398; found: 531.1402.



Methyl (*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*S*,*E*)-4-iodo-2-methylbut-3-en-1-yl)-tetrahydro-2*H*-pyran-2-yl)but-2-enoate (11-*epi*-9). Prepared analogously from aldehyde 11-*epi*-**8** (404 mg, 1.05 mmol) as a mixture of olefin isomers (*E*/*Z* = 10:1). An aliquot (340 mg, 0.669 mmol) was purified by preparative HPLC (2 runs with 170 mg each, Nucleodur C18 HTec 10 µm, length: 250 mm, Ø: 40 mm, MeOH/H_2O =93:7, 75 mL/min) to give the desired (*E*)-isomer as a colorless syrup (286 mg, 84%). $[\propto]_{20}^{D}$ = +92.8 (c = 1. 01, CH_2Cl_2). ^{1}H NMR (400 MHz,

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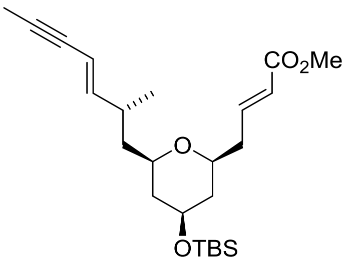
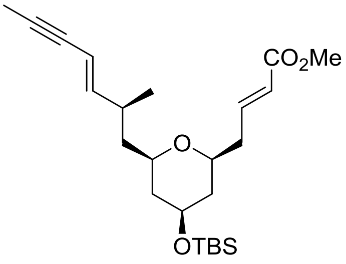
[5] D. P. Stamos, X. C. Sheng, S. S. Chen, Y. Kishi, *Tetrahedron Lett.* **1997**, *38*, 6355.

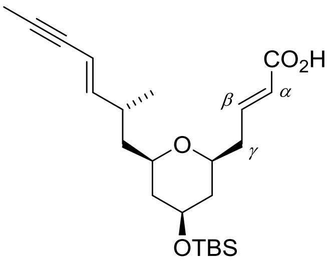
$CDCl_3$): δ = 6.95 (dt, *J* = 15.7, 7.1 Hz, 1H), 6.27 (dd, *J* = 14.3, 9.2 Hz, 1H), 6.00 (dd, *J* = 14.3, 0.7 Hz, 1H), 5.86 (dt, *J* = 15.7, 1.5 Hz, 1H), 3.73 (m, 4H), 3.30 (dddd, *J* = 11.5, 8.2, 4.3, 1.9 Hz, 1H), 3.18 (dddd, *J* = 12.0, 10.4, 3.1, 1.5 Hz, 1H), 2.49 (tdd, *J* = 9.2, 6.8, 3.9 Hz, 1H), 2.38 (dddd, *J* = 15.3, 8.4, 7.1, 1.5 Hz, 1H), 2.29 (dddd, *J* = 9.1, 7.1, 3.6, 1.4 Hz, 1H), 1.80 – 1.64 (m, 2H), 1.50 (ddd, *J* = 14.2, 10.2, 4.2 Hz, 1H), 1.29 – 1.11 (m, 3H), 0.97 (d, *J* = 6.8 Hz, 3H), 0.85 (s, 9H), 0.03 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.8, 151.2, 145.9, 122.6, 74.4, 74.3, 73.2, 68.5, 51.5, 42.4, 41.9, 41.5, 38.6, 37.4, 25.8, 20.6, 18.1, –4.5, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2950, 2928, 2855, 1724, 1660, 1435, 1375, 3129, 1253, 1219, 1175, 1156, 1126, 1067, 987, 955, 869, 834, 774, 669 cm^{-1}. MS (EI) m/z (%) = 452 (24), 451 (100), 229 (41), 181 (22), 131 (26), 129 (20), 101 (11), 75 (14), 73 (10). HRMS (ESIpos): calcd for $C_{21}H_{37}O_4SiINa$: 531.1398; found: 531.1393.



Methyl (*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*R*,*E*)-2-methylhept-3-en-5-yn-1-yl)-tetrahydro-2*H*-pyran-2-yl)but-2-enoate (10). A flame-dried two-necked round-bottom flask equipped with a reflux condenser was charged with 1-propynylsodium (42.1 mg, 0.677 mmol), which was suspended in degassed THF (4 mL). Trimethyl borate (76.9 µL, 0.677 mmol) was added dropwise via syringe at RT. After stirring for 20 min, $[Pd(dppf)Cl_2]\cdot CH_2Cl_2$ (42.5 mg, 0.0521 mmol) was added, causing the reaction mixture to turn dark red. Next, a solution of (*E*)-vinyl iodide **9** (265 mg, 0.521 mmol) in degassed THF (3 mL + 1 mL rinse) was added and the mixture stirred at 65°C. After 2 h, the pale orange mixture was allowed to cool to ambient temperature, the reaction was quenched with sat. NH_4Cl/H_2O (1:1 v/v, 15 mL), the organic phase was extracted with EtOAc (3x 20 mL) and the combined extracts were dried over Na_2SO_4 and concentrated. The crude product was purified by flash chromatography (hexanes/EtOAc 49:1 to 39:1 to 29:1) to give the title compound as a pale yellow oil (177 mg, 81%). $[\propto]_{20}^{D}$ = –30.0 (c = 0.92, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.94 (dt, *J* = 15.7, 7.2 Hz, 1H), 5.93 (ddd, *J* = 15.9, 7.9, 0.8 Hz, 1H), 5.85 (dt, *J* = 15.7, 1.5 Hz, 1H), 5.37 (dqd, *J* = 15.9, 2.2, 1.1 Hz, 1H), 3.76 – 3.66 (m, 1H), 3.71 (s, 3H), 3.39 – 3.30 (m, 1H), 3.25 (dddd, *J* = 11.2, 7.4, 5.5, 1.7 Hz, 1H), 2.47 – 2.25 (m, 3H), 1.90 (d, *J* = 2.2 Hz, 3H), 1.75 (dt, *J* = 4.8, 1.5 Hz, 1H), 1.75 (dt, *J* = 4.8, 1.5 Hz, 1H), 1.61 (dddd, *J* = 7.1, 7.1, 7.0, 6.9 Hz, 1H), 1.28 (ddd, J = 13.6, 7.7, 5.7 Hz, 1H), 1.24 – 1.09 (m, 2H), 0.96 (d, *J* = 6.7 Hz, 3H), 0.86 (s, 9H), 0.03 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.9, 148.5, 145.5, 122.8, 108.2, 84.4, 78.3, 74.1, 73.2, 68.6, 51.4, 42.3, 41.5, 41.3, 38.7, 33.4, 25.8, 19.6, 18.1, 4.2, –4.5, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2951, 2928, 2856, 1725, 1660, 1435, 1376, 1328, 1255, 1174, 1068, 985, 962, 836, 775, 670 cm^{-1}. MS (EI) m/z (%) = 420 (19), 364 (11), 363 (40), 313 (13), 288 (11), 229 (53), 189 (17), 181 (37), 171 (12), 169 (13), 159 (16), 157 (14), 145 (32), 131 (24), 129 (37), 123 (10), 121 (10), 120 (13), 119 (37), 108 (13), 105 (23), 101 (33), 97 (18), 93 (100), 91 (45), 89 (21), 81 (19), 79 (13), 77 (41), 75(48), 73 (46), 59 (17), 41 (14). HRMS (ESIpos): calcd for $C_{24}H_{40}O_4SiNa$: 443.2588; found: 443.2592.

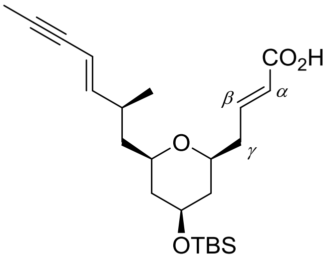


Methyl (*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*S*,*E*)-2-methylhept-3-en-5-yn-1-yl)-tetrahydro-2*H*-pyran-2-yl)but-2-enoate (11-*epi*-10). Prepared analogously from vinyl iodide 11-*epi*-**9** (185 mg, 1.05 mmol) as a pale yellow oil (117 mg, 76%). $[\propto]^{D}_{20}$ = +93.8 (c = 0.99, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 6.96 (dt, *J* = 15.7, 7.1 Hz, 1H), 5.86 (dt, *J* = 15.8, 1.5 Hz, 1H), 5.79 (ddd, *J* = 15.8, 9.0, 0.8 Hz, 1H), 5.41 (dqd, *J* = 15.9, 2.3, 0.8 Hz, 1H), 3.72 (m, 4H), 3.38 – 3.25 (m, 1H), 3.20 (dddd, *J* = 11.8, 10.2, 3.0, 1.9 Hz, 1H), 2.53 – 2.34 (m, 2H), 2.30 (tdd, *J* = 7.7, 4.6, 1.6 Hz, 1H), 1.91 (d, *J* = 2.3 Hz, 3H), 1.79 – 1.70 (m, 1H), 1.71 – 1.63 (m, 1H), 1.53 (ddd, *J* = 14.0, 10.1, 4.0 Hz, 1H), 1.28 – 1.10 (m, 3H), 0.96 (d, *J* = 6.8 Hz, 3H), 0.85 (s, 9H), 0.02 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.8, 148.0, 145.8, 122.7, 109.2, 84.2, 78.4, 74.1, 73.3, 68.6, 51.4, 42.9, 42.0, 41.4, 38.6, 33.9, 25.8, 21.1, 18.1, 4.2, –4.5, –4.6 ppm. IR (film): $\tilde{\nu}$ = 2951, 2929, 2856, 1727, 1660, 1435, 1375, 1329, 1257, 1218, 1155, 1118, 1072, 962, 852, 837, 776 cm^{-1}. MS (EI) m/z (%) = 420 (19), 364 (11), 363 (40), 313 (13), 288 (11), 229 (53), 189 (17), 181 (37), 171 (12), 169 (13), 159 (16), 157 (14), 145 (32), 131 (24), 129 (37), 123 (10), 121 (10), 120 (13), 119 (37), 107 (13), 105 (23), 101 (33), 97 (18), 93 (100), 91 (45), 89 (21), 81 (19), 79 (14), 77 (41), 75(48), 73 (46), 59 (17), 41 (14). HRMS (ESIpos): calcd for $C_{24}H_{40}O_4SiNa$: 443.2588; found: 443.2586.

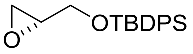


(*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-Butyldimethylsilyl)oxy)-6-((*R*,*E*)-2-methylhept-3-en-5-yn-1-yl)tetrahydro-2*H*-pyran-2-yl)but-2-enoic acid (11). KOTMS (90%, 246 mg, 1.73 mmol) was added to a solution of methyl ester **10** (145 mg, 0.345 mmol) in Et_2O (7.0 mL). After stirring for 1h, additional KOTMS (90%, 246 mg, 1.73 mmol) was introduced and stirring of the yellow suspension continued for 5 h. Excess base was quenched with aq. HCl (0.5 M, 10 mL) and the aqueous layer was extracted with EtOAc (5 x 15 mL). The combined organic phases were dried over Na_2SO_4 and concentrated, and the residue purified by flash chromatography (hexanes/EtOAc 6:1 with 0.1% AcOH) to give the desired acid as a colorless oil (112 mg, 80%). As a by-product, the β,γ-olefin was isolated as a colorless oil (9.8 mg, 7%). $[\propto]^{D}_{20}$ = –28.2 (c = 1.37, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 13.0 – 10.4 (br s, 1H), 7.06 (dt, *J* = 15.7, 7.1 Hz, 1H), 5.93 (dd, *J* = 15.9, 7.8 Hz, 1H), 5.84 (dt, *J* = 15.7, 1.2 Hz, 1H), 5.37 (ddd, *J* = 15.9, 2.1, 1.1 Hz, 1H), 3.72 (m, 1H), 3.43 – 3.31 (m, 1H), 3.31 – 3.19 (m, 1H), 2.51 – 2.28 (m, 3H), 1.90 (d, *J* = 2.3 Hz, 3H), 1.80 – 1.73 (m, 2H), 1.61 (dddd, *J* = 7.1, 7.0, 7.0, 6.9 Hz, 1H), 1.29 (ddd, J = 13.6, 7.7, 5.7 Hz, 1H), 1.25 – 1.08 (m, 2H), 0.97 (d, *J* = 6.7 Hz, 3H), 0.86 (s, 9H), 0.04 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 171.4, 148.5, 148.2, 122.4, 108.2, 84.4, 78.3, 73.9, 73.3, 68.6, 42.3, 41.5, 41.4, 38.8, 33.4, 25.8, 19.6, 18.1, 4.2, –4.5, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2928, 2926, 2855, 1698, 1654, 1462, 1443, 1376, 1282, 1255, 1152, 1068, 960, 852, 835, 815, 774, 699, 669 cm^{-1}. MS (EI) m/z

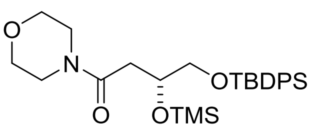
(%) = 418 (5), 349 (8), 257 (13), 237 (24), 169 (23), 160 (12), 145 (27), 131 (33), 129 (11), 121 (10), 119 (28), 107 (12), 105 (12), 101 (24), 93 (100), 91 (37), 79 (13), 77 (37), 75 (47), 73 (32), 59 (11), 41 (11). HRMS (ESIpos): calcd for $C_{23}H_{38}O_4SiNa$: 429.2427; found: 429.2431.



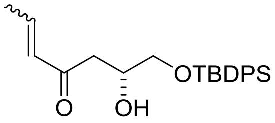
(*E*)-4-((2*S*,4*R*,6*R*)-4-((*tert*-butyldimethylsilyl)oxy)-6-((*S*,*E*)-2-methylhept-3-en-5-yn-1-yl)tetrahydro-2*H*-pyran-2-yl)but-2-enoic acid (11-*epi*-11). Prepared analogously from methyl ester 11-*epi*-**10** (116 mg, 0.276 mmol) as a colorless oil (101 mg, 88%), along with the corresponding β,γ-olefin as a colorless oil (8.2 mg, 7%). $[\propto]_{20}^{D}$ = +84.0 (c = 1.02, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 13.6 – 9.40 (br s, 1H), 7.08 (dt, *J* = 15.8, 7.0 Hz, 1H), 5.87 (d, *J* = 15.7 Hz, 1H), 5.79 (ddd, *J* = 15.9, 8.9, 0.9 Hz, 1H), 5.41 (ddt, *J* = 16.0, 2.7, 1.9 Hz, 1H), 3.79 – 3.63 (m, 1H), 3.34 (dddd, *J* = 12.6, 6.1, 4.0, 1.7 Hz, 1H), 3.22 (dddd, *J* = 10.9, 10.4, 2.1, 1.8 Hz, 1H), 2.53 – 2.37 (m, 2H), 2.34 (m, 1H), 1.90 (dd, *J* = 2.3, 0.7 Hz, 3H), 1.81 – 1.63 (m, 2H), 1.53 (ddd, *J* = 14.1, 10.0, 4.1 Hz, 1H), 1.30 – 1.10 (m, 3H), 0.96 (d, *J* = 6.8 Hz, 3H), 0.85 (s, 9H), 0.02 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 171.5, 148.3, 148.0, 122.4, 109.2, 84.3, 78.4, 74.0, 73.4, 68.5, 42.9, 41.9, 41.5, 38.7, 33.9, 25.8, 21.1, 18.1, 4.2, –4.5, –4.6 ppm. IR (film): $\tilde{\nu}$ = 2952, 2928, 2856, 1696, 1653, 1421, 1375, 1304, 1283, 1254, 1154, 1117, 976, 960, 924, 852, 834, 774, 739, 669 cm^{-1}. MS (EI) m/z (%) = 418 (6), 349 (8), 257 (13), 237 (25), 169 (23), 160 (12), 145 (27), 131 (33), 129 (11), 121 (10), 119 (28), 107 (12), 105 (11), 101 (24), 93 (100), 91 (39), 79 (13), 77 (37), 75 (49), 73 (32), 59 (12). HRMS (ESIneg): calcd for $C_{23}H_{37}O_4Si$: 405.2467; found: 405.2468.



(*R*)-*tert*-Butyl(oxiran-2-ylmethoxy)diphenylsilane (16). A solution of TBDPSCl (18.1 mL, 69.4 mmol) in CH_2Cl_2 (50 mL) was added over 15 min via a dropping funnel to a solution of (*S*)-glycidol (**15**) (4.41 mL, 66.1 mmol) and imidazole (5.99 g, 87.9 mmol) in CH_2Cl_2 (200 mL) at 0°C. A white solid started to precipitate after 5 min and the reaction mixture was allowed to warm to RT. After 2 h, H_2O (250 mL) was added and the aqueous phase extracted with CH_2Cl_2 (2 x 100 mL). The combined organic layers were washed with brine, dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 19:1 to 9:1) to give the desired silyl ether as a colorless oil (19.5 g, 94%). $[\propto]_{20}^{D}$ = +0.9 (c = 1.41, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.75 – 7.61 (m, 4H), 7.47 – 7.32 (m, 6H), 3.84 (dd, *J* = 11.8, 3.2 Hz, 1H), 3.70 (dd, *J* = 11.8, 4.7 Hz, 1H), 3.14 – 3.09 (m, 1H), 2.73 (dd, *J* = 5.2, 4.0 Hz, 1H), 2.60 (dd, *J* = 5.2, 2.7 Hz, 1H), 1.05 (s, 9H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 135.6, 135.5, 132.3, 129.7, 127.0, 64.3, 52.3, 44.4, 26.8, 19.2 ppm. IR (film): $\tilde{\nu}$ = 3071, 3049, 2998, 2930, 2894, 2857, 1472, 1427, 1390, 1361, 1254, 1159, 1136, 1111, 1091, 1030, 980, 917, 823, 739, 700, 690 cm^{-1}. MS (EI) m/z (%) = 256 (11), 255 (53), 226 (20), 225 (100), 211 (22), 184 (16), 183 (87), 181 (20), 177 (46), 117 (38), 105 (13), 77 (99). HRMS (ESIpos): calcd for $C_{19}H_{24}O_2SiNa$: 335.1438; found: 335.1435.



(*R*)-4-((*tert*-Butyldiphenylsilyl)oxy)-1-morpholino-3-((trimethylsilyl)oxy)butan-1-one (17). According to a modified protocol from Jacobsen et. al.,[6] a flame-dried two-necked round-bottom flask was charged with $Co_2(CO)_8$ (274 mg, 0.8 mmol). The flask was evacuated (1 x 10^{-1} mbar)[7] and backfilled with CO (1 atm, from a balloon, 3 cycles). Dry EtOAc (15 mL) was introduced and the suspension stirred for 10 min, at which point freshly distilled *N*-trimethylsilyl morpholine (2.66 mL, 15.0 mmol) and silylated epoxide **16** (3.12 g, 10.0 mmol) were added via syringe. The brown mixture was vigorously stirred under CO atmosphere (balloon) for 15 h, before it was concentrated. The residue was quickly purified by flash chromatography (hexanes/EtOAc 5:1 to 4:1) to yield the desired morpholine amide as a colorless oil (3.70 g, 74%). $[\propto]_{20}^{D}$ = +21.1 (c = 0.915, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.65 (m, 4H), 7.43 – 7.34 (m, 6H), 4.25 (ddt, *J* = 8.5, 5.9, 4.3 Hz, 1H), 3.63 (m, 7H), 3.56 – 3.44 (m, 3H), 2.62 (dd, *J* = 14.4, 4.0 Hz, 1H), 2.53 (dd, *J* = 14.4, 8.3 Hz, 1H), 1.04 (s, 9H), 0.02 (s, 9H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.1, 135.6, 135.6, 133.4, 129.7, 129.7, 127.7, 127.7, 70.7, 67.8, 66.9, 66.7, 46.5, 41.9, 37.5, 26.8, 26.8, 19.2, 0.1 ppm. IR (film): $\tilde{\nu}$ = 2958, 2930, 2857, 1644, 1460, 1428, 1249, 1186, 1111, 1070, 1033, 959, 840, 824, 741, 701, 612 cm^{-1}. MS (EI) m/z (%) = 484 (11), 444 (13), 443 (36), 442 (100), 364 (23), 271 (13), 230 (6), 193 (14), 135 (5), 114 (7), 73 (4). HRMS (ESIpos): calcd for $C_{27}H_{41}NO_4Si_2Na$: 522.2466; found: 522.2465.



(*R*)-7-((*tert*-Butyldiphenylsilyl)oxy)-6-hydroxyhept-2-en-4-one (19). A solution of propenylmagnesium bromide (**18**) (0.5 M in THF, 8.6 mL, 4.30 mmol) was added dropwise over 10 min at 0°C to a solution of amide **17** (565 mg, 1.131 mmol) in THF (9 mL) and the resulting mixture was stirred at 0°C for 2 h. The mixture was cooled to −78°C and slowly transferred via canula into a vigorously stirred aq. solution of HCl (0.75 M, 130 mL). The reaction flask was rinsed with EtOAc (2 x 10 mL), which was also transferred to the aqueous acid layer. After stirring for 15 min at ambient temperature, EtOAc (20 mL) was added, the phases were separated and the aqueous phase extracted with EtOAc (3 x 40 mL). The combined organic layers were washed with brine (50 mL), dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 9:1 to 7.5:1 to 6:1) to give the desired enone as an inconsequential mixture of olefin isomers (*E*/*Z* = 2:1, 360 mg, 83%). ^{1}H NMR (300 MHz, $CDCl_3$, only the peaks assigned to the major isomer are given): δ = 7.70 – 7.57 (m, 4H), 7.47 – 7.31 (m, 6H), 6.84 (dq, *J* = 15.7, 6.8 Hz, 1H), 6.11 (dq, *J* = 15.8, 1.6 Hz, 1H), 4.25 – 4.14 (m, 1H), 3.65 (d, *J* = 5.5 Hz, 2H), 3.02 (d, *J* = 4.1 Hz, 1H), 2.72 (d, *J* = 5.9 Hz, 2H), 1.89 (dd, *J* =

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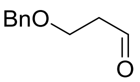
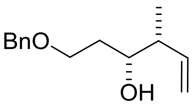
[6] S. N. Goodman, E. N. Jacobsen, *Angew. Chem. Int. Ed.* **2002**, *41*, 4703-4705.

[7] Due to the volatility of the catalyst, a higher vacuum should be avoided.

6.9, 1.7 Hz, 3H), 1.05 (s, 9H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$ only the peaks assigned to the major isomer are given): δ = 199.6, 143.7, 135.5, 135.5, 133.2, 133.1, 132.3, 129.8, 127.7, 68.5, 67.0, 42.8, 26.8, 19.2, 18.3 ppm. IR (film): $\tilde{\nu}$ = 3462, 3071, 2930, 2587, 1680, 1663, 1628, 1472, 1428, 1362, 1188, 1112, 969, 823, 741, 702 cm^{-1}. MS (ESIpos) m/z (%) = 405.2 (100 (M+Na$^+$)), 787.3 (85 ((2M+Na$^+$). HRMS (ESIpos): calcd for $C_{23}H_{30}O_3SiNa$: 405.1856; found: 405.1856.



3-(Benzyloxy)propanal (21). According to the procedure of Stahl et. al.,[8] a 1 L-round-bottom flask was charged with 3-(benzyloxy)propanol (**20**) (7.20 g, 43.3 mmol) and MeCN (HPLC grade, 210 mL). [Cu(MeCN)$_4$]BF$_4$ (683 mg, 2.17 mmol) and 2,2'-bipyridine (339 mg, 2.17 mmol) were added as solids, followed by *N*-methyl imidazole (346 µL, 4.34 mmol) and TEMPO (339 mg, 2.17 mmol). The resulting red/brown mixture was vigorously stirred open to air for 3 h until the reaction mixture turned dark green. After concentration at reduced pressure, the residue was purified by flash chromatography (hexanes/EtOAc 6:1 to 5:1 to 4:1) to give the desired aldehyde as a colorless oil with an unpleasant smell (6.69 g, 94%). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.78 (t, *J* = 1.8 Hz, 1H), 7.41 – 7.22 (m, 5H), 4.52 (s, 2H), 3.80 (td, *J* = 6.1, 1.2 Hz, 2H), 2.68 (tt, *J* = 6.1, 1.6 Hz, 2H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 201.1, 137.8, 128.4, 127.7, 127.7, 73.2, 63.8, 43.9 ppm. IR (film): $\tilde{\nu}$ = 3031, 2860, 2733, 1721, 1496, 1454, 1394, 1362, 1205, 1091, 1027, 899, 885, 736, 697 cm^{-1}. MS (EI) m/z (%) = 108 (79), 107 (85), 92 (17), 91 (66), 79 (100), 78 (14), 77 (56), 65 (14), 56 (29), 55 (22), 51 (18), 39 (10), 28 (11), 27 (22), 26 (11). HRMS (ESIpos): calcd for $C_{10}H_{12}O_2H$: 165.0916; found: 165.0914.



(3*R*,4*R*)-1-(Benzyloxy)-4-methylhex-5-en-3-ol (22). A solution of crotylsilane (*R*,*R*)-**31**[9] (1.0 M in CH_2Cl_2, 6.62 mmol, 6.62 mL) was added dropwise at –78°C[10] via syringe to a solution of aldehyde **21** (906 mg, 5.52 mmol) in CH_2Cl_2 (56 mL). Next, solid Sc(OTf)$_3$ (136 mg, 0.276 mmol) was added and the mixture stirred for 15 min at –78°C before it was allowed to reach 0°C. Stirring was continued for 2 h. At this point, NMR analysis of an aliquot (50 µL) confirmed full consumption of the aldehyde. The mixture was concentrated and treated with HCl (1 M, 70 mL) and Et_2O (70 mL) under vigorous stirring for 1 h. The white precipitate was filtered off and washed with Et_2O (2 x 10 mL) (treatment of this solid with NaOH allowed the diamine ligand to be recovered after chromatographic purification in > 90%). The phases of the filtrate were separated and the aqueous layer extracted with Et_2O (3 x 50 mL). The combined extracts were washed with $NaHCO_3$ (70 mL), dried over Na_2SO_4, and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 5:1) to give the crotylated alcohol as a colorless oil (995 mg, 82% yield, 94% ee, 98:2 d.r.). $[\propto]_{20}^{D}$ = +16.5 (c = 1.18, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.40

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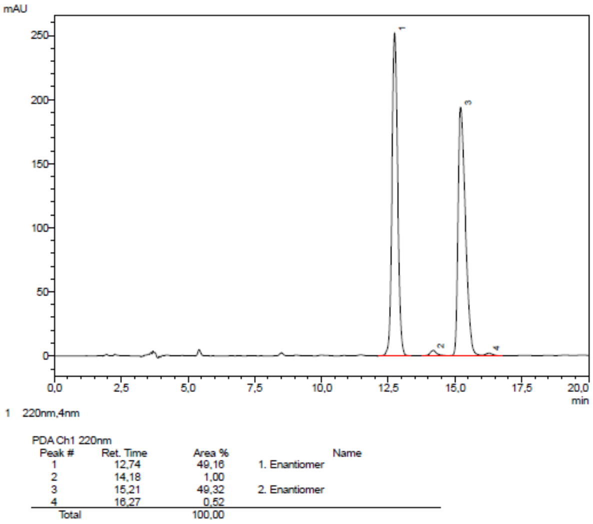
[8] J. M. Hoover, S. S. Stahl, *J. Am. Chem. Soc.* **2011**, *133*, 16901-16910.

[9] B. Hackman, P. J. Lombardi, J. L. Leighton, *Org. Lett.* **2004**, *6*, 4375.

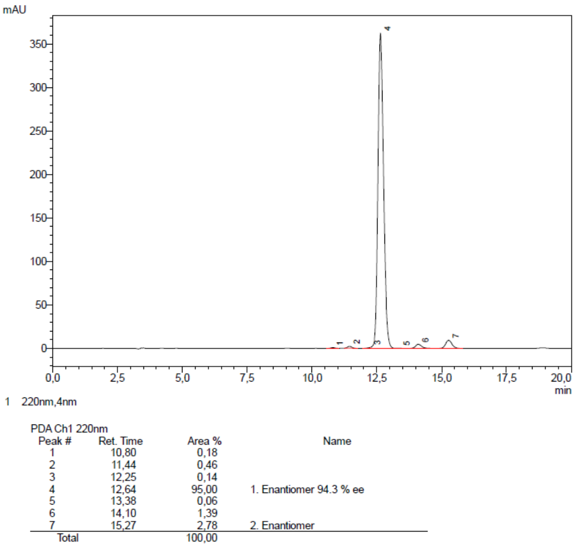
[10] If the addition of Sc(OTf)$_3$ was performed at 0°C as described in the literature, lower ee values were obtained.

– 7.25 (m, 5H), 5.77 (ddd, *J* = 17.7, 10.4, 7.6 Hz, 1H), 5.09 – 4.98 (m, 2H), 4.50 (s, 2H), 3.75 – 3.59 (m, 3H), 2.80 (br s, 1H), 2.25 (m, 1H), 1.82 – 1.62 (m, 2H), 1.03 (d, *J* = 6.8 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 141.0, 137.9, 128.4, 127.7, 127.7, 114.9, 74.5, 73.3, 69.4, 43.9, 33.5, 15.0 ppm. IR (film): $\tilde{\nu}$ = 3471, 3031, 2943, 2865, 1638, 1496, 1454, 1418, 1363, 1206, 1092, 1071, 1028, 997, 949, 913, 736, 697 cm^{-1}. MS (EI) m/z (%) = 220 (0.1), 165 (2.6), 107 (14), 92 (13), 91 (100), 79 (7), 65 (8), 55 (7). HRMS (ESIpos): calcd for $C_{14}H_{20}O_2Na$: 243.1355; found: 243.1356. The enantiomeric excess was determined by HPLC of the TBS ether (prepared from the alcohol with TBSOTf (1.2 eq.) and 2,6-lutidine (1.4 eq.) in CH_2Cl_2): HPLC: 150 mm Chiralcel OJ-3R (Ø 4.6 mm), MeCN/water 70:30, 0.5 mL/min, 308 K, 9.2 MPa: R_t = 12.64 min (major *syn*), 14.10 min (*anti*), 15.27 min (minor *syn*).



PDA Ch1 220nm

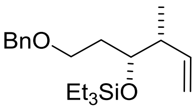
Peak #	Ret. Time	Area %	Name
1	12,74	49,16	1. Enantiomer
2	14,18	1,00	
3	15,21	49,32	2. Enantiomer
4	16,27	0,52	
Total		100,00	



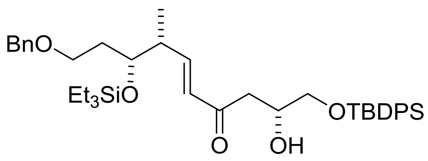
PDA Ch1 220nm

Peak #	Ret. Time	Area %	Name
1	10,80	0,18	
2	11,44	0,46	
3	12,25	0,14	
4	12,64	95,00	1. Enantiomer 94.3 % ee
5	13,38	0,06	
6	14,10	1,39	
7	15,27	2,78	2. Enantiomer
Total		100,00	

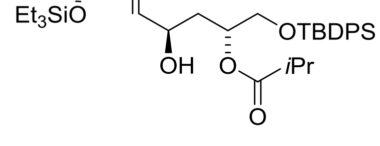
(((3*R*,4*R*)-1-(Benzyloxy)-4-methylhex-5-en-3-yl)oxy)triethylsilane (23). NEt_3 (0.951 mL, 6.86 mmol) and TESCl (1.05 mL, 6.29 mmol) were added via syringe at 0°C to a solution of alcohol **22** (1.26 g, 5.72 mmol) in CH_2Cl_2 (28.6 mL). DMAP (34.9 mg, 0.286 mmol) was then introduced and the mixture stirred for 90 min at 0°C and for another 30 min at RT before the reaction was quenched with sat. NH_4Cl-solution. The aqueous phase was extracted with CH_2Cl_2 (3 x 30 mL), the combined extracts were washed with brine, dried over Na_2SO_4 and concentrated. Purification of the residue by flash chromatography (hexanes/EtOAc 35:1) yielded the target silyl ether as a colorless oil (1.72 g, 90%). $[\propto]_{20}^{D}$ = +38.6 (c = 1.13, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.39 – 7.24 (m, 5H), 5.86 (ddd, *J* = 17.3, 10.5, 6.6 Hz, 1H), 5.03 – 4.95 (m, 2H), 4.50 (d, *J* = 11.6 Hz, 1H), 4.45 (d, J = 11.8 Hz, 1H), 3.74 (dt, *J* = 8.2, 4.3, 4.2 Hz, 1H), 3.53 (t, *J* = 6.7 Hz, 2H), 2.35 – 2.22 (m, 1H), 1.83 – 1.70 (m, 1H), 1.70 – 1.59 (m, 1H), 0.97 (d, *J* = 6.8 Hz, 3H), 0.94 (dd, *J* = 7.7 Hz, 9H), 0.58 (q, *J* = 8.0 Hz, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 140.8, 138.6, 128.3, 127.7, 127.5, 114.3, 73.2, 73.0, 67.2, 43.4, 33.7, 15.0, 7.0, 5.2 ppm. IR (film): $\tilde{\nu}$ = 2954, 2911, 2876, 1455, 1414, 1363, 1238, 1091, 1004, 911, 840, 725, 695 cm^{-1}. MS (EI) m/z (%) = 305 (8),



279 (17), 173 (33), 159 (6), 117 (9), 115 (10), 91 (100), 87 (9), 59 (5). HRMS (ESIpos): calcd for $C_{20}H_{34}O_2SiNa$: 357.2220; found: 357.2222.



(6*R*,11*R*,12*R*,*E*)-12-(2-(Benzyloxy)ethyl)-14,14-diethyl-6-hydroxy-2,2,11-trimethyl-3,3-diphenyl-4,13-dioxa-3,14-disilahexadec-9-en-8-one (24). A flame-dried two necked round-bottom flask equipped with a reflux condenser and a septum was charged with a solution of olefin **23** (495 mg, 1.48 mmol) in CH_2Cl_2 (15 mL). The Zhan-catalyst 1B **32** (39.4 mg, 53.7 µmol) was added and the resulting mixture was heated to 45°C while a solution of enone **19** (514 mg, 1.34 mmol) in CH_2Cl_2 (2 mL) was added dropwise through the septum over the course of 1 h via syringe pump. After 16 h, the mixture was cooled to RT, another batch of Zhan-catalyst 1B **32** (19.7 mg, 26.9 µmol) was added and stirring continued at 45°C. This procedure was repeated once again after additonal 12 h. After an overall reaction time of 48 h, the mixture was concentrated and the residue purified by flash chromatography (hexanes/EtOAc 14:1 to 12:1 to 9:1) to yield the title compound as a pale orange oil (716 mg, 79%). $[\propto]_{20}^{D}$ = +41.2 (c = 0.96, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.67 – 7.60 (ddd, *J* = 7.9, 3.8, 1.7 Hz, 4H), 7.44 – 7.34 (m, 6H), 7.34 – 7.25 (m, 5H), 6.92 (dd, *J* = 16.2, 6.8 Hz, 1H), 6.06 (dd, *J* = 16.2, 1.5 Hz, 1H), 4.48 (d, *J* = 11.9 Hz, 1H), 4.43 (d, *J* = 11.9 Hz, 1H), 4.25 – 4.16 (m, 1H), 3.85 (dt, *J* = 8.3, 4.2 Hz, 1H), 3.64 (dd, *J* = 5.5, 1.5 Hz, 2H), 3.55 – 3.43 (m, 2H), 3.04 (d, *J* = 3.9 Hz, 1H), 2.82 – 2.66 (m, 2H), 2.53 – 2.41 (m, 1H), 1.79 – 1.69 (m, 1H), 1.62 – 1.52 (m, 1H), 1.05 (s, 9H), 1.01 (d, *J* = 6.9 Hz, 3H), 0.92 (t, *J* = 7.9 Hz, 9H), 0.57 (q, *J* = 8.0 Hz, 6H). ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 199.8, 150.5, 138.4, 135.5, 135.5, 133.2, 133.2, 130.4, 129.8, 128.3, 127.7, 127.7, 127.6, 73.0, 72.4, 68.5, 67.1, 66.8, 42.6, 42.6, 33.9, 26.9, 19.3, 14.2, 7.0, 5.1 ppm. IR (film): $\tilde{\nu}$ = 3512, 3071, 2955, 2932, 2875, 1664, 1624, 1456, 1427, 1362, 1238, 1186, 1112, 1007, 823, 739, 701 cm^{-1}. MS (ESIpos) m/z (%) = 697.5 (100 (M+Na$^+$)). HRMS (ESIpos): calcd for $C_{40}H_{58}O_5Si_2Na$: 697.3715; found: 697.3720.



(6*R*,8*R*,11*R*,12*R*,*E*)-12-(2-(Benzyloxy)ethyl)-14,14-diethyl-8-hydroxy-2,2,11-trimethyl-3,3-diphenyl-4,13-dioxa-3,14-disilahexadec-9-en-6-yl isobutyrate (25). A freshly prepared solution of SmI$_2$[11] (0.096 M in THF, 3.80 mL, 0.363 mmol) was slowly added at –50°C alongside the cold wall of the flask to a solution of enone **24** (700 mg, 1.04 mmol) and freshly distilled isobutyraldehyde (473 µL, 5.19 mmol) in degassed THF (9.4 mL). The mixture was stirred for 1 h at –50°C before it was poured into sat. aq. $NaHCO_3$ (65 mL). The mixture was diluted with EtOAc (40 mL overall) and vigorously stirred until ambient temperature was reached. The phases were separated, the aqueous layer was extracted with EtOAc (3 x 40 mL), and the combined extracts were washed with brine

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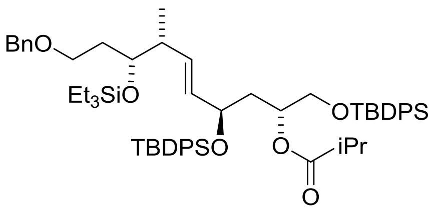
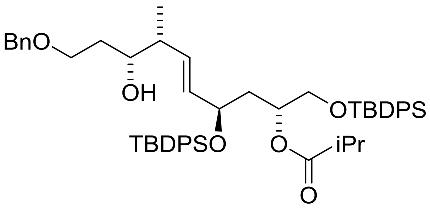
[11] For the preparation of SmI$_2$, see: M. Szostak, M. Spain, D. J. Procter, *Nature Protocols* **2012**, *7*, 970-977.

(60 mL), dried over Na_2SO_4 and concentrated. During concentration, a small amount of SiO_2 was added and the crude product loaded on a silica gel column, from which the title compound was eluted with hexanes/EtOAc (12:1 to 9:1); colorless oil (598 mg, 78%). $[\propto]^{D}_{20}$ = +27.2 (c = 1.32, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.67 – 7.61 (m, 4H), 7.44 – 7.27 (m, 11H), 5.69 (ddd, J = 15.8, 6.9, 1.2 Hz, 1H), 5.43 (ddd, J = 15.6, 6.2, 1.3 Hz, 1H), 5.16 (ddt, J = 9.4, 5.5, 4.1 Hz, 1H), 4.47 (d, J = 11.9 Hz, 1H), 4.43 (d, J = 11.9 Hz, 1H), 3.99 (ddd, J = 9.8, 6.3, 3.5 Hz, 1H), 3.71 (m, 3H), 3.50 (dd, J = 7.4, 5.9 Hz, 2H), 2.73 (br s, 1H), 2.56 (hep, J = 7.0 Hz, 1H), 2.33 – 2.21 (m, 1H), 1.77 – 1.53 (m, 4H), 1.18 (d, J = 7.2 Hz, 3H), 1.16 (d, J = 7.2 Hz, 3H), 1.02 (s, 9H), 0.95 – 0.89 (m, 12H), 0.56 (q, J = 8.1 Hz, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 178.0, 138.5, 135.6, 135.5, 133.3, 133.3, 133.2, 131.8, 129.8, 129.7, 128.3, 127.7, 127.7, 127.5, 73.2, 73.0, 71.9, 68.3, 67.2, 65.7, 42.0, 39.0, 34.2, 33.7, 26.7, 19.2, 19.2, 19.0, 15.3, 7.0, 5.2 ppm. IR (film): $\tilde{\nu}$ = 3502, 2956, 2932, 2875, 1732, 1457, 1428, 1388, 1362, 1239, 1196, 1160, 1111, 1007, 975, 823, 738, 701, 612 cm^{-1}. MS (ESIpos) m/z (%) = 769.5 (100 (M+Na$^+$)). HRMS (ESIpos): calcd for $C_{44}H_{66}O_6Si_2Na$: 769.4290; found: 769.4291.

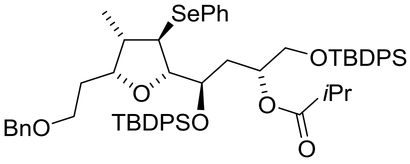


(6*R*,8*R*,11*R*,12*R*,*E*)-12-(2-(Benzyloxy)ethyl)-8-((*tert*-butyldiphenylsilyl)oxy)-14,14-diethyl-2,2,11-trimethyl-3,3-diphenyl-4,13-dioxa-3,14-disilahexadec-9-en-6-yl isobutyrate (25a). TBDPSCl (284 µL, 1.09 mmol) was added at 0°C to a solution of the homoallylic alcohol **25** (584 mg, 0.782 mmol) and imidazole (90.5 mg, 1.33 mmol) in CH_2Cl_2 (5.2 mL). After 5 min, the mixture was allowed to reach ambient temperature and stirring was continued for 17 h before the reaction was quenched with sat. NH_4Cl solution (25 mL) and extracted with CH_2Cl_2 (4 x 20 mL). The combined extracts were dried over Na_2SO_4 and concentrated, and the residue purified by flash chromatography (hexanes/EtOAc 39:1) to yield the title compound as a colorless syrup (671 mg, 87%). $[\propto]^{D}_{20}$ = +36.7 (c = 1.00, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.67 – 7.60 (m, 8H), 7.44 – 7.25 (m, 17H), 5.34 (dd, J = 15.9, 6.8 Hz, 1H), 5.27 (dd, J = 15.8, 5.5 Hz, 1H), 5.20 – 5.10 (m, 1H), 4.51 – 4.46 (d, J = 11.9 Hz, 1H), 4.42 (d, J = 11.9 Hz, 1H), 4.14 (td, J = 7.5, 5.3 Hz, 1H), 3.67 – 3.53 (m, 3H), 3.49 – 3.36 (m, 2H), 2.43 (hep, J = 7.0 Hz, 1H), 2.05 – 1.96 (m, 1H), 1.89 (ddd, J = 14.0, 7.7, 4.9 Hz, 1H), 1.77 (ddd, J = 14.1, 7.9, 5.3 Hz, 1H), 1.62 – 1.52 (m, 1H), 1.45 – 1.34 (m, 1H), 1.10 (d, J = 6.9 Hz, 6H), 1.02 (s, 18H), 0.89 (t, J = 7.9 Hz, 9H), 0.73 (d, J = 6.9 Hz, 3H), 0.52 (q, J = 7.9 Hz, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 176.1, 138.7, 136.0, 135.9, 135.6, 135.5, 134.7, 134.0, 133.5, 133.5, 133.3, 129.6, 129.6, 129.4, 129.2, 128.3, 127.6, 127.6, 127.4, 127.2, 73.0, 72.9, 72.0, 71.4, 67.2, 65.2, 41.7, 39.8, 34.1, 33.5, 27.0, 26.8, 19.2, 19.0, 18.9, 15.0, 7.0, 5.1 ppm. IR (film): $\tilde{\nu}$ = 2956, 2932, 2875, 2858, 1734, 1471, 1427, 1387, 1361, 1259, 1191, 1157, 1105, 1007, 977, 822, 736, 698 cm^{-1}. MS (EI) m/z (%) = 927 (2), 820 (2), 561 (2), 509 (6), 493 (7), 469 (4), 467 (4), 377 (5), 322 (3), 319 (3), 280 (22), 279 (97), 269 (26), 199 (16), 174 (15), 173 (100), 171 (14), 135 (22), 131 (44), 91 (57), 73 (16). HRMS (ESIpos): calcdfor $C_{60}H_{84}O_6Si_3Na$: 1007.5468; found: 1007.5473.

(6*R*,8*R*)-8-((3*R*,4*R*,*E*)-6-(Benzyloxy)-4-hydroxy-3-methylhex-1-en-1-yl)-2,2,11,11-tetramethyl-3,3,10,10-tetraphenyl-4,9-dioxa-3,10-disiladodecan-6-yl isobutyrate (26). Camphorsulfonic acid (47.7 mg, 0.205 mmol) was added at 0°C to a solution of compound **25a** (675 mg, 0.685 mmol) in CH_2Cl_2/MeOH (2:1, 12.6 mL). The resulting mixture was stirred for 90 min before the reaction was carefully quenched with sat. $NaHCO_3$ (40 mL) solution. After extraction with CH_2Cl_2 (3 x 40 mL), the combined organic phases were washed with brine, dried over Na_2SO_4 and concentrated to give a colorless oil, which was purified by flash chromatography (hexanes/EtOAc 8:1) to give the title compound as a colorless oil (576 mg, 97%). $[\propto]_{20}^{D}$ = +22.9 (c = 1.32, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.64 – 7.57 (m, 8H), 7.43 – 7.25 (m, 18H), 5.35 (dd, *J* = 15.5, 7.9 Hz, 1H), 5.14 – 5.06 (m, 1H), 4.98 (dd, *J* = 15.5, 7.9 Hz, 1H), 4.45 (s, 2H), 4.08 (q, *J* = 7.0 Hz, 1H), 3.57 (d, *J* = 4.8 Hz, 2H), 3.51 – 3.37 (m, 2H), 3.30 (br t, 1H), 2.51 – 2.37 (m, 2H), 1.91 (ddd, *J* = 11.5, 7.4, 4.6 Hz, 2H), 1.73 (dt, *J* = 13.6, 6.5 Hz, 1H), 1.44 – 1.29 (m, 3H), 1.09 (d, *J* = 6.9 Hz, 6H), 0.99 (d, *J* = 7.7 Hz, 18H), 0.79 (d, *J* = 6.8 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): 176.2, 138.0, 135.9, 135.9, 135.6, 135.5, 134.6, 134.2, 133.6, 133.4, 133.4, 132.8, 129.6, 129.6, 129.6, 129.3, 128.4, 127.7, 127.6, 127.5, 127.3, 74.0, 73.3, 72.0, 69.3, 65.2, 42.3, 39.7, 34.1, 33.5, 26.9, 26.7, 19.2, 19.0, 19.0, 15.0 ppm. IR (film): $\tilde{\nu}$ = 3511, 2960, 2931, 2858, 1734, 1472, 1427, 1389, 1361, 1260, 1193, 1158, 1111, 1082, 976, 822, 739, 701 cm^{-1}. MS (EI) m/z (%) = 527 (5), 467 (8), 393 (28), 363 (27), 319 (11), 271 (12), 270 (18), 269 (81), 209 (11), 200 (13), 199 (71), 197 (19), 135 (48), 108 (21), 91 (100), 81 (11), 43 (15). HRMS (ESIpos): calcd for $C_{54}H_{70}O_6Si_2Na$: 870.4711; found: 870.4715.



(6*R*,8*R*)-8-((2*S*,3*R*,4*S*,5*R*)-5-(2-(Benzyloxy)ethyl)-4-methyl-3-(phenylselanyl) tetrahydrofuran-2-yl)-2,2,11,11-tetramethyl-3,3,10,10-tetraphenyl-4,9-dioxa-3,10-disiladodecan-6-yl isobutyrate (27). According to a modified protocol from Denmark et. al.,[12] a solution of alcohol **26** (574 mg, 0.659 mmol) in CH_2Cl_2 (10 mL) was prepared and cooled to –40°C. *N*-(Phenylseleno)phthalimide (239 mg, 0.791 mmol) followed by a solution of triphenylphosphine sulfide (23.3 mg, 79.1 µmol) and trifluoroacetic acid (56.7 µL, 0.791 mmol) in CH_2Cl_2 (1 mL) were added via syringe over 5 min. After complete addition, the mixture was allowed to warm to –20°C and stirring was continued for 3 h before the mixture was poured into a stirred emulsion of sat. aq. $NaHCO_3$ and CH_2Cl_2 (1:1, 40 mL). The aqueous phase was extracted with CH_2Cl_2 (3 x 15 mL), the combined organic extracts were dried over Na_2SO_4 and concentrated. ^{1}H NMR and HPLC analysis of the crude mixture revealed a d.r. of 14:1. The residue was purified by flash chromatography (hexanes/EtOAc 100:0 to 49:1 to 29:1 to 24:1) to give the cyclized product as a colorless oil (560 mg, 83% yield, 14:1 d.r.). An analytically pure sample was obtained by preparative



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[12] S. E. Denmark, D. Kalyani, W. R. Collins, *J. Am. Chem. Soc.* **2010**, *132*, 15752.

HPLC (Triart C18 5 µm, 12 nm, 150x30 mm, 100% MeCN, 35°C, 35bar, 35mL/min). $[\propto]_{20}^{D}$ = +1.1 (c = 0.93, CH_2Cl_2). ^{1}H NMR (600 MHz, $CDCl_3$): see Table 1. ^{13}C NMR (150 MHz, $CDCl_3$): δ = 176.0, 138.7, 136.1, 135.8, 135.6, 135.6, 134.4, 134.4, 133.6, 133.4, 133.3, 129.6, 129.6, 129.3, 129.2, 129.1, 128.3, 127.7, 127.7, 127.6, 127.4, 127.3, 127.1, 85.8, 72.9, 72.7, 71.6, 67.9, 65.3, 49.6, 44.6, 36.1, 34.1, 30.6, 29.7, 27.1, 26.7, 19.7, 19.2, 19.0, 18.8, 14.9 ppm. IR (film): $\tilde{\nu}$ = 2961, 2929, 2855, 1733, 1472, 1427, 1361, 1260, 1192, 1111, 1021, 821, 802, 738, 701 cm^{-1}. MS (EI) m/z (%) = 970 (6), 969 (9), 883 (9), 882 (13), 881 (22), 880 (8), 879 (11), 805 (11), 724 (11), 723 (11), 563 (11), 467 (10), 361 (25), 349 (11), 319 (13), 296 (11), 295 (45), 270 (23), 269 (100), 241 (14), 239 (34), 200 (13), 199 (73), 197 (30), 136 (12), 135 (93), 91 (84), 43 (13). HRMS (ESIpos): calcd for $C_{60}H_{74}O_6Si_2SeNa$: 1049.4081; found: 1049.4072.

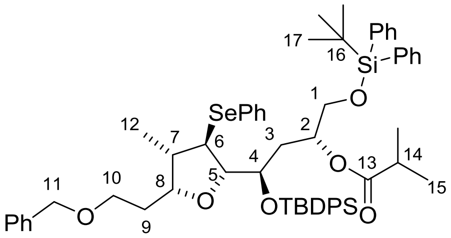

Table 1: Assignment & NOESY relations for the aliphatic signals of major cyclization isomer **27**;[13] numbering scheme as shown in the Insert.

atom n°	^{1}H /ppm	multiplet	J / Hz	^{13}C /ppm	COSY	NOESY
1	3.52	dd	10.9, 4.1	65.3	1a, 2	1a,2,(3a)
1a	3.45	dd	10.9, 5.4	-	1, 2	1,2,(3a)
2	5.12	m	-	71.6	1, 1a, 3, (3a)	1, 1a(3),3a,(4)
3	2.16	ddd	14.6, 9.8, 3.9	36.1	2, 3a, 4	3a, (4),(5),6
3a	1.73	ddd	14.7, 7.1, 2.8	-	2, 3, 4	3, (4), (5)
4	3.68	ddd	6.9, 6.9, 3.8	72.7	3, 3a, 5	2,3a,6
5	3.63	dd	6.5, 6.5	85.8	4, 6	(6),7,8,(3a)
6	2.93	dd	6.3, 3.5	49.6	5, 7	4,(8),12
7	2.07	ddq	12.4, 7.1, 3.6	44.6	6, 8, 12	(5),6,8,12
8	3.85	ddd	8.2, 5.5, 5.0	77.1	7, 9	5,7,9,9a,10,10a
9	1.46	m	-	30.6	8, 10, 10a	8,10,10a,12
9a	1.46	m	-	-	8, 10, 10a	8,10,10a,12
10	3.11	m	-	67.9	9, 9a	8,9,9a,11,11a
10a	3.11	m	-	-	9, 9a	8,9,9a,11,11a
11	4.32	s	-	72.9	-	10,10a
11a	4.32	s	-	-	-	10,10a
12	0.49	d	7.14	14.9	7	(4),6,7,9,9a
13	-	-	-	176.0	-	-
14	2.40	hept	7.0	30.6	15, 15a	15,15a
15	1.07	d	7.0	18.8	14	14, 15a
15a	1.05	d	7.0	19.0	14	14, 15
16	-	-	-	19.7	-	1, 1, 17
16a	-	-	-	19.2	-	4, 17a
17	0.98	s	-	27.1	-	1, 1a, 16
17a	1.01	s	-	26.7	-	4, 16a

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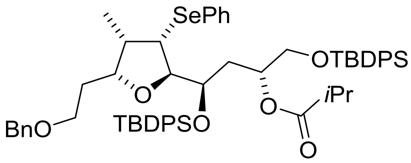
[13] The aromatic signals were not assigned, they were found at: δ = 7.69 – 7.66 (m, 2H), 7.64 – 7.60 (m, 6H), 7.44 – 7.24 (m, 19H), 7.23 – 7.16 (m, 3H) ppm.

(6*R*,8*R*)-8-((2*R*,3*S*,4*S*,5*R*)-5-(2-(Benzyloxy)ethyl)-4-methyl-3-(phenylselanyl) tetrahydrofuran-2-yl)-2,2,11,11-tetramethyl-3,3,10,10-tetraphenyl-4,9-dioxa-3,10-disiladodecan-6-yl isobutyrate.[14]



Obtained as the minor isomer by preparative HPLC (conditions see above) as a colorless oil. ^{1}H NMR (600 MHz, CDCl$_3$): see Table 2. ^{13}C NMR (150 MHz, CDCl$_3$): δ = 176.1, 138.5, 136.1, 136.0, 135.6, 135.5, 134.2, 133.5, 133.4, 133.4, 133.1, 132.5, 130.9, 130.6, 129.6, 129.6, 129.4, 129.0, 128.8, 128.4, 127.7, 127.6, 127.6, 127.5, 127.3, 127.0, 83.3, 78.7, 73.0, 71.9, 71.6, 68.0, 65.3, 48.1, 40.2, 34.0, 33.6, 31.9, 27.1, 26.7, 19.4, 19.2, 19.0, 18.9, 11.6 ppm. IR (film): $\tilde{\nu}$ = 2962, 2930, 2854, 1732, 1472, 1427, 1360, 1260, 1192, 1110, 1021, 823, 799, 738, 701 cm^{-1}. MS (EI) m/z (%) = 970 (6), 969 (9), 883 (10), 882 (14), 881 (22), 880 (8), 879 (11), 805 (11), 724 (11), 723 (11), 563 (11), 467 (11), 361 (25), 349 (11), 319 (13), 296 (12), 295 (47), 270 (23), 269 (100), 241 (14), 239 (34), 200 (13), 199 (73), 197 (30), 135 (93), 91 (84). HRMS (ESIpos): calcd for $C_{60}H_{74}O_6Si_2SeNa$: 1049.4081; found: 1049.4075.

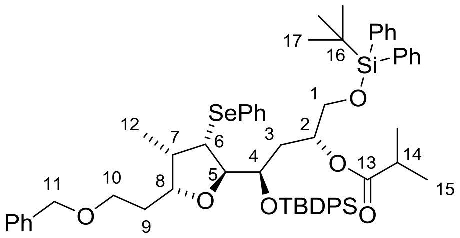


Table 2: Assignment & NOESY relations for the aliphatic signals of minor cyclization isomer;[15] numbering scheme as shown in the Insert.

atom n°	^{1}H /ppm	multiplet	J /Hz	^{13}C /ppm	COSY	NOESY
1	3.53	dd	11.0, 3.9	-	2, 1	1a, 2 (15)
1a	3.41	dd	10.9, 5.2	65.3	2, 1a	1, 2, (15)
2	5.02	m	-	71.6	1, 3, 3a	1, 1a, 3a, 4
3	1.99	ddd	14.5, 9.9, 4.3	33.6	2, 3a, 4	3a, 4, 6
3a	1.80	m	-	-	2, 3, 4	2, 3, 4
4	4.04	ddd	7.9, 4.1, 1.4	71.9	3, 3a, (5)	2, 3, 5, 6
5	3.92	dd	9.9, 1.3	83.3	(4), 6	4, 6, 12
6	3.67	dd	9.9, 6.2	48.1	5, 7	4, 5, 8, 3, 7
7	2.20	m	-	40.2	6, (8), 12	6, 8
8	3.98	ddd	8.8, 4.5, 4.5	78.7	(7), 9, (9a)	6, 7, 9, 9a, 10
9	1.82	m	-	31.9	8, 10, 10a	(8), 9a, (10a), 10, 12
9a	1.73	ddd	13.7, 7.3, 5.0	-	(8), 10, 10a	(8), 9, 10, 10a, 12
10	3.59	ddd	9.1, 7.7, 5.4	68.0	9, 9a, 10a	9, (9a), 10a, 11, 11a
10a	3.50	dd	9.2, 7.2	-	9, 9a, 10	9, (9a), 10, 11, 11a
11	4.48	d	13.8	73.0	-	10, 10a, 11a
11a	4.48	d	13.8	-	-	10, 10a, 11a
12	0.86	d	7.1	11.6	7	5, 7, 9
13	-	-	-	176.1	-	-
14	2.27	hept	-	34.0	15, 15a	15, 15a
15	1.00	d	7.0	19.0	14, 15a	14, 15a
15a	0.99	d	7.0	18.9	14, 15	14, 15
16	-	-	-	19.2	-	-
16a	-	-	-	19.4	-	-
17	0.97	s	-	26.7	-	1, (1a)
17a	1.01	s	-	27.1	-	4

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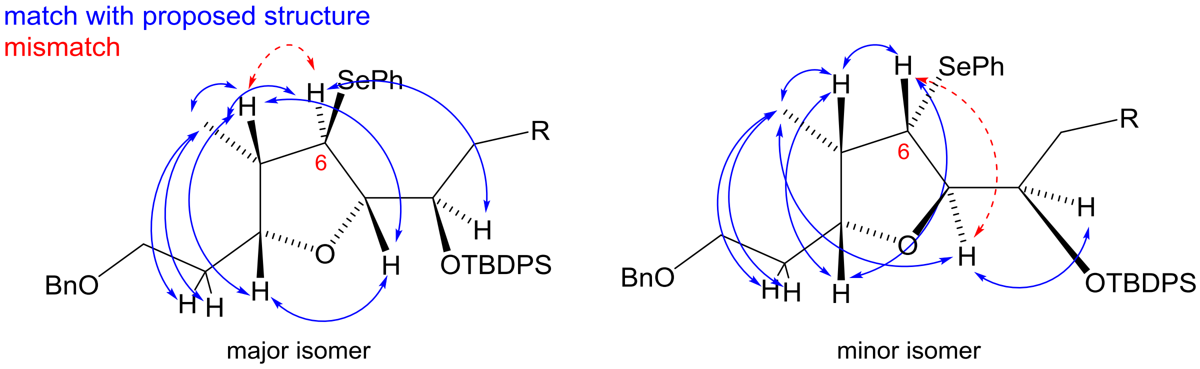
[14] This compound was isolated after the reaction of alcohol **26** with PhSeBr in MeCN, which gave a 2.6:1 ratio of **27**:undesired isomer.

[15] The aromatic signals were not assigned, they were found at: δ = 7.70 – 7.67 (m, 3H), 7.63 – 7.60 (m, 2H), 7.60 – 7.56 (m, 4H), 7.53 – 7.49 (m, 1H), 7.40 – 7.24 (m, 17H), 7.23 – 7.14 (m, 3H) ppm.

NOESY signals important for the assignment of the relative stereochemistry of the THF ring of the two isomers:



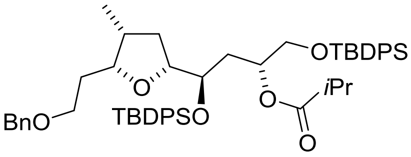
major isomer

minor isomer

Additional support for this assignment was obtained by comparison of the chemical shift of H**6** of the two isomers. As reported in the literature,[12,13] the chemical shift is strongly dependent on the number of *syn*-alkyl groups, which cause an up-field shift.

Compound	# of *syn*-alkyl groups	δ (H6) /ppm	δ (Lit.)[16,17] /ppm
27 (major isomer)	2	2.93	2.80
minor isomer	1	3.67	3.50
-	0	-	3.90

(6*R*,8*R*)-8-((2*R*,4*R*,5*R*)-5-(2-(Benzyloxy)ethyl)-4-methyltetrahydrofuran-2-yl)-2,2,11,11-tetramethyl-3,3,10,10-tetraphenyl-4,9-dioxa-3,10-disiladodecan-6-yl isobutyrate (27a). A flame-dried two-necked round-bottom flask equipped with a reflux condenser was charged with a solution of selenoether **27** (560 mg, 0.546 mmol) in degassed toluene (22 mL). (nBu)$_3$SnH (177 µL, 0.655 mmol) was added via syringe, followed by solid AIBN (0.9 mg, 5.5 µmol). The resulting mixture was stirred at 80°C for 90 min under Argon, allowing the generated N$_2$ to evaporate. After cooling to room-temperature, the mixture was concentrated and the residue purified by flash chromatography (hexanes/EtOAc 100:0 to 49:1 to 39:1 to 29:1) to yield the title compound as a sticky colorless syrup (440 mg, 93% yield, single d.r.). $[\propto]_{20}^{D}$ = +34.1 (c = 0.95, CH$_2$Cl$_2$). ^{1}H NMR (400 MHz, CDCl$_3$): δ = 7.71 – 7.61 (m, 8H), 7.42 – 7.25 (m, 17H), 5.24 – 5.17 (m, 1H), 4.30 (s, 2H), 3.72 – 3.63 (m, 2H), 3.61 – 3.54 (m, 3H), 3.15 – 3.03 (m, 2H), 2.36 (hep, J =



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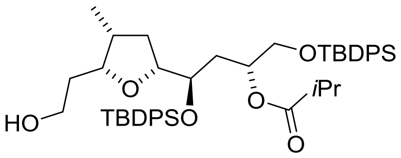
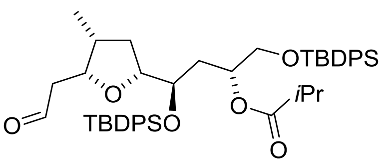
[16] E. D. Mihelich, G. A. Hite, *J. Am. Chem. Soc.* **1992**, *114*, 7318.
[17] D. R. Williams, Y. Harigaya, J. L. Moore, A. D'sa, *J. Am. Chem. Soc.* **1984**, *106*, 2641.

7.0 Hz, 1H), 2.05 (dddd, J = 13.3, 11.7, 6.7, 5.4 Hz, 1H), 1.94 (ddd, *J* = 12.3, 7.3, 7.2 Hz, 1H), 1.83 (ddd, *J* = 14.1, 9.1, 0.2 Hz, 1H), 1.72 (ddd, *J* = 14.4, 7.6, 2.9 Hz, 1H), 1.51 – 1.37 (m, 2H), 1.06 – 0.99 (m, 25H), 0.61 (d, *J* = 6.9 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 176.1, 138.8, 136.2, 135.9, 135.6, 135.5, 135.0, 133.8, 133.5, 133.4, 129.6, 129.3, 129.0, 128.3, 127.7, 127.6, 127.6, 127.6, 127.4, 127.3, 127.0, 80.8, 78.3, 73.2, 72.8, 71.3, 68.2, 63.4, 36.1, 35.6, 35.2, 34.0, 31.0, 27.2, 26.7, 19.6, 19.3, 19.0, 18.8, 15.6 ppm. IR (film): $\tilde{\nu}$ = 2959, 2930, 2856, 1734, 1471, 1427, 1388, 1361, 1258, 1192, 1157, 1110, 998, 937, 822, 738, 700 cm^{-1}. MS (EI) m/z (%) = 814 (16), 813 (25), 726 (18), 725 (29), 563 (14), 558 (17), 557 (37), 469 (12), 319 (12), 301 (13), 296 (13), 295 (47), 271 (11), 270 (23), 269 (100), 241 (24), 239 (29), 200 (14), 199 (77), 197 (25), 163 (13), 136 (10), 135 (80), 91 (96). HRMS (ESIpos): calcd for $C_{54}H_{70}O_6Si_2Na$: 893.4603; found: 893.4594.

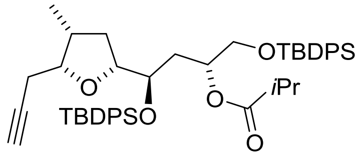
(6*R*,8*R*)-8-((2*R*,4*R*,5*R*)-5-(2-Hydroxyethyl)-4-methyltetrahydrofuran-2-yl)-2,2,11,11-tetramethyl-3,3,10,10-tetraphenyl-4,9-dioxa-3,10-disiladodecan-6-yl isobutyrate (27b). A flame-dried Schlenk tube was charged with $Pd(OH)_2$/C (20 wt. %, 35.5 mg, 50.5 µmol). The flask was evacuated (5 x 10^{-1} mbar) and backfilled with H_2 from a balloon (two cycles). EtOH (27 mL) was added and the suspension vigorously stirred for 10 min before a solution of benzyl ether **27a** (440 mg, 0.505 mmol) in EtOAc (3 mL) was introduced. After stirring for 7.5 h under a H_2 atmosphere (balloon), the mixture was filtered through a short pad of Celite that was carefully rinsed with EtOAc (3 x 20 mL). The combined filtrates were concentrated and the residue was purified by flash chromatography (hexanes/EtOAc 4:1) to yield the desired product as a white foam (345 mg, 88%). $[\propto]_{20}^{D}$ = +24.2 (c = 0.88, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.71 – 7.60 (m, 8H), 7.44 – 7.28 (m, 12H), 5.12 (ddd, *J* = 9.6, 4.8, 4.9, 3.1 Hz, 1H), 3.75 – 3.66 (m, 3H), 3.58 – 3.51 (m, 2H), 3.49 – 3.35 (m, 2H), 2.36 (hep, *J* = 7.0 Hz, 1H), 2.14 (dddd, *J* = 14.1, 14.1, 7.1, 6.9 Hz, 1H), 2.00 – 1.89 (m, 3H), 1.88 (dd, J = 9.6, 3.0 Hz, 1H), 1.73 (ddd, *J* = 14.3, 7.4, 3.1 Hz, 1H), 1.50 – 1.37 (m, 1H), 1.24 – 1.16 (m, 1H), 1.06 – 1.00 (m, 24H), 0.74 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 176.1, 136.1, 135.8, 135.6, 135.5, 134.7, 133.5, 133.4, 133.3, 129.6, 129.6, 129.5, 129.2, 127.6, 127.6, 127.4, 127.2, 80.9, 80.3, 72.2, 71.2, 65.3, 61.4, 35.5, 35.3, 35.2, 34.0, 32.9, 27.1, 26.7, 19.5, 19.2, 19.0, 18.8, 15.5 ppm. IR (film): $\tilde{\nu}$ = 3487, 2960, 2930, 2857, 1735, 1472, 1428, 1388, 1259, 1193, 1158, 1112, 998, 823, 740, 702, 610 cm^{-1}. MS (EI) m/z (%) = 723 (12), 646 (10), 645 (18), 636 (13), 635 (23), 563 (12), 558 (20), 557 (41), 437 (16), 379 (31), 319 (13), 301 (18), 295 (34), 270 (18), 269 (82), 241 (32), 239 (32), 200 (18), 199 (97), 197 (38), 183 (12), 181 (14), 163 (14), 145 (11), 139 (12), 137 (12), 136 (14), 135 (100), 85 (29), 71 (14), 43 (26). HRMS (ESIpos): calcd for $C_{47}H_{64}O_6Si_2Na$: 803.4134; found: 803.4135.



(6*R*,8*R*)-2,2,11,11-Tetramethyl-8-((2*R*,4*R*,5*R*)-4-methyl-5-(2-oxoethyl)tetrahydrofuran-2-yl)-3,3,10,10-tetraphenyl-4,9-dioxa-3,10-disiladodecan-6-yl isobutyrate (28). A solution of the primary alcohol **27b** (341 mg, 0.437 mmol) in CH_2Cl_2 (1 mL + 2 x 0.5 mL rinse) was added dropwise at 0°C to a solution of Dess-Martin periodinane (463 mg, 1.09 mmol) in CH_2Cl_2 (2.6 mL). After complete addition, the ice bath was removed and stirring continued at RT for 4.5 h before the reaction was quenched with sat. $Na_2S_2O_3$ and sat. $NaHCO_3$ solution (1:1, 20 mL). The aqueous phase was extracted with CH_2Cl_2 (3 x 15 mL), and the combined extracts were dried over Na_2SO_4 and concentrated. The residue was purified flash chromatography (short column, hexanes/EtOAc 19:1) to give the desired aldehyde as a colorless sticky syrup (310 mg, 91%). $[\propto]_{20}^{D}$ = +35.2 (c = 0.57, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.13 (t, *J* = 2.2 Hz, 1H), 7.70 – 7.59 (m, 8H), 7.46 – 7.25 (m, 12H), 5.18 (dddd, *J* = 9.5, 4.8, 4.7, 3.0 Hz, 1H), 3.93 (ddd, *J* = 8.8, 6.5, 4.7 Hz, 1H), 3.75 – 3.63 (m, 2H), 3.58 (d, *J* = 4.7 Hz, 2H), 2.37 (hep, *J* = 7.0 Hz, 1H), 2.25 – 2.19 (m, 1H), 2.16 (dd, *J* = 8.6, 1.8 Hz, 1H), 2.10 (ddd, *J* = 16.2, 4.9, 2.5 Hz, 1H), 2.02 – 1.92 (m, 1H), 1.83 (ddd, *J* = 14.2, 9.5, 2.5 Hz, 1H), 1.73 (ddd, *J* = 14.4, 7.6, 3.1 Hz, 1H), 1.14 – 1.09 (m, 1H), 1.05 (d, *J* = 7.0 Hz, 3H), 1.04 (d, *J* = 7.1 Hz, 3H), 1.02 (s, 9H), 0.99 (s, 9H), 0.63 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 202.1, 176.1, 136.1, 135.7, 135.6, 135.5, 134.8, 133.7, 133.4, 133.4, 129.7, 129.4, 129.1, 127.7, 127.7, 127.3, 127.0, 81.3, 76.3, 72.9, 71.2, 65.3, 44.8, 35.8, 35.5, 35.2, 34.0, 27.1, 26.7, 19.6, 19.3, 19.0, 18.8, 15.6 ppm. IR (film): $\tilde{\nu}$ = 2959, 2929, 2856, 1729, 1472, 1427, 1388, 1240, 1192, 1158, 1111, 998, 822, 740, 701 cm^{-1}. MS (EI) m/z (%) = 721 (7), 635 (16), 634 (42), 633 (80), 563 (7), 377 (15), 319 (11), 295 (31), 270 (22), 269 (100), 241 (14), 239 (21), 225 (10), 200 (12), 199 (66), 197 (29), 183 (13), 179 (15), 163 (12), 136 (10), 136 (78), 43 (19). HRMS (ESIpos): calcd for $C_{47}H_{62}O_6Si_2Na$: 801.3977; found: 801.3977.



(6*R*,8*R*)-2,2,11,11-Tetramethyl-8-((2*R*,4*R*,5*R*)-4-methyl-5-(prop-2-yn-1-yl)tetrahydrofuran-2-yl)-3,3,10,10-tetraphenyl-4,9-dioxa-3,10-disiladodecan-6-yl isobutyrate (29). A flame-dried Schlenk tube was charged with dimethyl-1-diazo-2-oxopropylphosphonate (**33**) (306 mg, 1.592 mmol) and THF (8 mL). The resulting solution was cooled to −78°C before a freshly prepared solution of NaOMe (0.5 M, 3.18 mL, 1.592 mmol)[18]was added over the course of 10 min via syringe, causing the mixture to turn intensively yellow. After stirring for 15 min at −78°C, a precooled (−78°C) solution of aldehyde **28** (310 mg, 0.398 mmol) in THF (5 mL + 2 x 1 mL rinse) was added slowly via canula. The reaction flask was then equipped with an Argon bubbler to allow the generated N_2 to evaporate. The mixture was slowly warmed to −50°C, causing a heavy gas evolution. After stirring for 90 min at −50°C, the reaction was quenched by addition of sat. NH_4Cl solution



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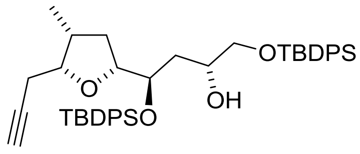
[18] A solution of NaOMe was prepared by adding an equimolar amount of MeOH to a suspension of NaH in THF at 0°C, which was allowed to stir at room-temperature until gas evolution had ceased (~1 h).

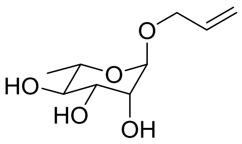
(20 mL) and H_2O (4 mL) and the aqueous layer was extracted with EtOAc (4 x 30 mL). The combined extracts were washed with brine (35 mL), dried over Na_2SO_4 and concentrated. The orange residue was purified by flash chromatography (hexanes/EtOAc 39:1) to yield the desired alkyne as a white foam that collapsed upon storage (287 mg, 93%). $[\propto]_{20}^{D}$ = +19.4 (c = 1.10, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.72 – 7.57 (m, 8H), 7.48 – 7.25 (m, 12H), 5.13 (dddd, *J* = 9.5, 4.7, 4.6, 2.9 Hz, 1H), 3.78 – 3.64 (m, 3H), 3.57 (d, *J* = 4.7 Hz, 2H), 2.35 (hep, *J* = 7.0 Hz, 1H), 2.24 (ddd, *J* = 14.0, 7.0, 7.0 Hz, 1H), 2.05 – 2.00 (m, 2H), 1.97 – 1.84 (m, 2H), 1.83 (t, *J* = 2.7 Hz, 1H), 1.71 (ddd, *J* = 14.5, 7.8, 3.0 Hz, 1H), 1.27 – 1.15 (m, 1H), 1.06 – 0.98 (m, 24H), 0.81 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 176.1, 136.1, 135.9, 135.6, 135.5, 134.7, 134.0, 133.5, 133.4, 129.6, 129.6, 129.3, 129.1, 127.7, 127.6, 127.3, 127.0, 81.6, 81.0, 79.3, 72.7, 71.2, 69.1, 65.3, 35.2, 35.1, 34.0, 27.2, 26.7, 20.6, 19.6, 19.2, 19.0, 18.8, 14.8 ppm. IR (film): $\tilde{\nu}$ = 2960, 2930, 2857, 1735, 1472, 1428, 1388, 1260, 1192, 1158, 1112, 1006, 822, 740, 702 cm^{-1}. MS (ESIpos) m/z (%) = 797.5 (100 (M+Na$^+$)). HRMS (ESIpos): calcd for $C_{48}H_{62}O_5Si_2Na$: 797.4028; found: 797.4028.

(6*R*,8*R*)-2,2,11,11-Tetramethyl-8-((2*R*,4*R*,5*R*)-4-methyl-5-(prop-2-yn-1-yl)tetrahydrofuran-2-yl)-3,3,10,10-tetraphenyl-4,9-dioxa-3,10-disiladodecan-6-ol (30). A solution of DIBAL-H in toluene (1.0 M, 1.10 mL, 1.10 mmol) was added dropwise at −78°C to a solution of ester **29** (285 mg, 0.368 mmol) in toluene (24 mL) and the resulting mixture was stirred for 30 min at this temperature. The mixture was then poured via canula into a stirred sat. solution of Rochelle salt (150 mL), the flask was rinsed with EtOAc (2 x 20 mL) and the emulsion was vigorously stirred at ambient temperature for 4 h. The layers were separated, the aqueous phase was extracted with EtOAc (3 x 40 mL), and the combined organic extracts were dried over Na_2SO_4 and concentrated. The crude residue was purified by flash chromatography (hexanes/EtOAc 24:1 to 19:1) to give the title compound as a sticky colorless syrup (252 mg, 97%). $[\propto]_{20}^{D}$ = +18.2 (c = 1.07, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.75 – 7.68 (m, 4H), 7.64 – 7.59 (m, 4H), 7.45 – 7.28 (m, 12H), 4.06 (ddd, *J* = 6.7, 6.6, 4.1 Hz, 1H), 3.90 – 3.74 (m, 3H), 3.43 (d, *J* = 5.6 Hz, 2H), 2.60 (d, *J* = 3.4 Hz, 1H), 2.30 (hep, *J* = 7.1 Hz, 1H), 2.13 (ddd, *J* = 16.7, 6.0, 2.5 Hz, 1H), 2.07 (ddd, *J* = 16.6, 7.6, 2.6 Hz, 1H), 1.95 (ddd, *J* = 12.5, 7.8, 6.9 Hz, 1H), 1.86 (t, *J* = 2.7 Hz, 1H), 1.62 (ddd, *J* = 14.3, 9.3, 4.2 Hz, 1H), 1.56 (ddd, *J* = 14.4, 6.9, 3.1 Hz, 1H), 1.30 (ddd, *J* =12.5, 9.0, 7.4 Hz, 1H), 1.06 (s, 9H), 1.03 (s, 9H), 0.87 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 136.1, 136.0, 135.5, 135.5, 134.2, 134.1, 133.4, 133.4, 129.7, 129.4, 129.4, 127.7, 127.4, 127.2, 81.6, 81.0, 79.5, 73.2, 69.3, 68.8, 68.3, 36.6, 35.2, 35.1, 27.1, 26.8, 20.8, 19.6, 19.2, 14.8 ppm. IR (film): $\tilde{\nu}$ = 3311, 2957, 2928, 2856, 1472, 1469, 1427, 1390, 1362, 1269, 1189, 1111, 999, 822, 739, 701 cm^{-1}. MS (EI) m/z (%) = 570 (22), 569 (48), 491 (8), 417 (7), 319 (18), 299 (10), 259 (12), 257 (14), 241 (35), 239 (19), 223 (11), 221 (35), 200 (19), 199 (100), 197 (40), 183 (17), 181 (14), 175 (16), 163 (22), 149 (34), 139 (13), 136 (12), 135

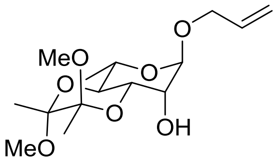


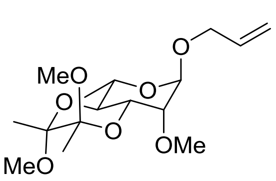
(88), 117 (17), 93 (12), 91 (22), 79 (12). HRMS (ESIpos): calcd for $C_{44}H_{56}O_4Si_2Na$: 727.3609; found: 727.3610.

Allyl α-L-rhamnopyranoside (35). *L*-Rhamnose (**34**) (4.0 g, 22 mmol) was dissolved in allyl alcohol (30 mL) and conc. H_2SO_4 (0.4 mL) was added. The mixture was stirred at 100°C for 1 h while its color changed to brown. After cooling to ambient temperature, solid K_2CO_3 (60 mg) was added and excess allyl alcohol was removed under reduced pressure. The residue was purified by flash chromatography (EtOAc) to yield the targeted compound as highly viscous colorless oil (3.5 g, 78%). $[\propto]_{20}^{D}$ = –83.0 (c = 1.29, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.85 (dddd, *J* = 17.2, 10.3, 6.1, 5.2 Hz, 1H), 5.25 (dq, *J* = 17.3, 1.6 Hz, 1H), 5.16 (dq, *J* = 10.4, 1.3 Hz, 1H), 4.77 (d, *J* = 1.5 Hz, 1H), 4.74 – 4.56 (s, 1H), 4.39 – 4.23 (br s, 1H), 4.30 – 4.17 –(br s, 1H), 4.12 (ddt, *J* = 13.0, 5.3, 1.5 Hz, 1H), 4.03 – 3.86 (m, 2H), 3.75 (dd, *J* = 9.5, 3.3 Hz, 1H), 3.61 (dq, *J* = 9.4, 6.2 Hz, 1H), 3.44 (t, *J* = 9.5 Hz, 1H), 1.27 (d, *J* = 6.2 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 133.7, 117.5, 98.9, 72.8, 71.7, 710, 68.2, 68.0, 17.5 ppm. IR (film): $\tilde{\nu}$ = 3371, 2977, 2915, 1450, 1422, 1383, 1265, 1128, 1046, 980, 880, 835, 808, 734, 685 cm^{-1}. MS (EI) m/z (%) = 131 (5), 100 (46), 87 (21), 85 (11), 83 (5), 74 (7), 73 (18), 72 (5), 71 (63), 61 (13), 60 (96), 59 (11), 58 (46), 57 (26), 56 (6), 55 (10), 45 (18), 43 (41), 42 (15), 41 (100), 39 (21), 31 (18), 29 (25), 27 (11). HRMS (ESIpos): calcd for $C_9H_{16}O_5Na$: 227.0889; found: 227.0891.

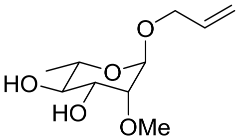


Compound 36. Trimethylorthoacetate (44.8 mL 350 mmol) and 2,3-butadione (7.7 mL, 88 mmol) were dissolved in MeOH (200 mL) and treated with *p*-TsOH·H_2O (1.25 g, 6.57 mmol) before the mixture was stirred at 75°C for 24 h. After cooling to ambient temperature, a solution of rhamnoside **35** (3.02 g, 14.8 mmol) in MeOH (7 mL+7 mL rinse) was added and the mixture stirred at 75°C overnight. After cooling to ambient temperature, NEt_3 (1.2 mL) was added to neutralize the medium prior to evaporation of the solvents under reduced pressure. The residue was purified by flash chromatography (hexanes/EtOAc 4:1) to give the desired bis-acetal as a highly viscous colorless syrup (3.21 g, 72%). $[\propto]_{20}^{D}$ = –182.6 (c = 0.99, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.86 (dddd, *J* = 16.8, 10.3, 6.3, 5.2 Hz, 1H), 5.24 (dq, *J* = 17.2, 1.7 Hz, 1H), 5.15 (dq, *J* = 10.4, 1.4 Hz, 1H), 4.79 (d, *J* = 1.5 Hz, 1H), 4.13 (ddt, *J* = 12.9, 5.2, 1.5 Hz, 1H), 4.00 – 3.87 (m, 3H), 3.78 (dq, *J* = 9.7, 6.0 Hz, 1H), 3.68 (t, *J* = 9.9 Hz, 1H), 3.22 (s, 3H), 3.19 (s, 3H), 2.46 (d, *J* = 2.3 Hz, 1H), 1.27 (s, 3H), 1.24 (s, 3H), 1.22 (d, *J* = 6.1 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 133.8, 117.4, 100.2, 99.8, 98.9, 69.9, 68.4, 68.2, 67.9, 66.5, 48.0, 47.6, 17.8, 17.6, 16.5 ppm. IR (film): $\tilde{\nu}$ = 3464, 2932, 2834, 1454, 1376, 1138, 1111, 1076, 1034, 984, 929, 915, 882, 848, 734, 701, 672 cm^{-1}. MS (EI) m/z (%) = 116 (7), 113 (7), 101 (33), 85 (7), 84 (100), 83 (23), 75 (16), 73 (11), 57 (5), 55 (11), 43 (34), 41 (21), 29 (7). HRMS (ESIpos): calcd for $C_{15}H_{27}O_7Na$: 341.1571; found: 341.1571.

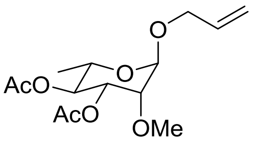




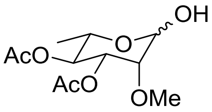
Compound 37. A solution of bisacetal **36** (3.17 g, 10.4 mmol) in DMF (10 mL) was slowly added at 0°C to a suspension of NaH (748 mg, 31.2 mmol) in DMF (60 mL). The resulting mixture was stirred for about 30 min at 0°C until gas evolution had ceased. MeI (1.95 mL, 31.2 mmol) was then added dropwise, causing a color change to yellow. The mixture was warmed to room temperature overnight before the reaction was quenched with aq. sat. NH_4Cl (300 mL). The aqueous phase was extracted with EtOAc (3 x 150 mL), the combined organic extracts were washed with brine (200 mL), dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 3:2) to give the methylated product as pale yellow oil (2.21 g, 64%). $[\propto]_{20}^{D}$ = –214.0 (c = 0.88, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.91 (m, 1H), 5.24 (dd, *J* = 17.3, 1.3 Hz, 1H), 5.15 (dd, *J* = 10.4, 1.3 Hz, 1H), 4.82 (d, 1H, *J* = 1.5 Hz), 4.13 (m, 1H), 3.99 (dd, *J* = 9.9, 3.0 Hz, 1H), 3.93 (m, 1H), 3.75 (dq, *J* = 9.8, 6.0 Hz, 1H), 3.68 (dd, *J* = 9.9, 9.8 Hz, 1H), 3.44 (dd, *J* = 3.0, 1.5 Hz, 1H), 3.47 (s, 3H), 3.24 (s, 3H), 3.22 (s, 3H), 1.29 (s, 3H), 1.26 (s, 3H), 1.23 (d, *J* = 6.0 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 133.9, 117.3, 99.8, 99.5, 97.1, 78.8, 68.7, 68.4, 67.9, 66.9, 59.2, 47.9, 47.6, 17.8, 17.8, 16.6 ppm. IR (film): $\tilde{\nu}$ = 2932, 2832, 1453, 1375, 1197, 1138, 1114, 1083, 1037, 994, 932, 882, 848, 815 cm^{-1}. MS (EI) m/z (%) = 116 (9), 115 (11), 101 (25), 99 (11), 98 (100), 97 (17), 83 (16), 75 (5), 73 (16), 71 (5), 67 (9), 55 (7), 45 (10), 43 (30), 41 (29), 39 (6), 29 (7). HRMS (ESIpos): calcd for $C_{16}H_{28}O7Na$: 355.1727; found: 355.1725.



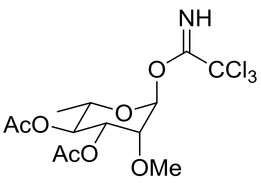
Allyl 2-O-methyl-α-L-rhamnopyranoside 37a. Trifluoroacetic acid (19 mL) was added to an emulsion of compound **37** (2.05 g, 6.17 mmol) in H_2O (1 mL) at 0°C. The mixture turned slightly yellow and was allowed to stir for 7 min at this temperature. The mixture was diluted with CH_2Cl_2 (300 mL), the organic phase was dried over Na_2SO_4 and concentrated to give the diol as a pale orange oil that was used in the next step without further purification (1.32 g, 98%, 95% purity). An analytically pure sample was obtained by flash chromatography (Hex/EtOAc = 1:1 to 1:2). $[\propto]_{20}^{D}$ = –46.3 (c = 1.00, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.84 (dddd, *J* = 17.2, 10.4, 6.1, 5.0 Hz, 1H), 5.23 (dq, *J* = 17.2, 1.7 Hz, 1H), 5.14 (dq, *J* = 10.4, 1.4 Hz, 1H), 4.84 (d, *J* = 1.6 Hz, 1H), 4.13 (ddt, *J* = 13.0, 5.1, 1.6 Hz, 1H), 3.92 (ddt, *J* = 13.0, 6.1, 1.4 Hz, 1H), 3.75 –3.66 (br s, 1H), 3.56 (dq, *J* = 9.2, 6.2 Hz, 1H), 3.50 – 3.42 (br s, 1H), 3.43 (dd, *J* = 3.8, 1.5 Hz, 1H), 3.41 (s, 3H), 3.33 (t, *J* = 9.5 Hz, 1H), 3.24 – 3.11 (m, 1H), 1.24 (d, *J* = 6.2 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 133.7, 117.2, 95.4, 80.4, 73.5, 71.4, 67.9, 67.8, 58.8, 17.5 ppm. IR (film): $\tilde{\nu}$ = 3416, 2976, 2932, 2907, 2832, 1453, 1382, 1192, 1133, 1103, 1075, 1038, 990, 975, 926, 912, 874, 836, 807 cm^{-1}. MS (EI) m/z (%) = 157 (8), 156 (16), 129 (18), 125 (7), 116 (28), 115 (8), 114 (17), 113 (15), 103 (5), 96 (13), 87 (22), 85 (13), 83 (12), 74 (50), 45 (9), 43 (100), 41 (20).



Allyl 3,4-bis-O-acetyl-2-O-methyl-α-L-rhamnopyranoside (38). NEt_3 (2.8 mL, 21 mmol) and Ac_2O (1.4 mL, 21 mmol) were subsequently added via syringe at 0°C to a solution of DMAP (152 mg, 1.2 mmol) and the crude diol **37a** (1.4 g, 6.2 mmol) in CH_2Cl_2 (40 mL). The ice bath was removed and stirring continued for 2 h at ambient temperature. Aq. sat. NH_4Cl (20 mL) was added and the aqueous phase extracted with EtOAc (3 x 7 mL). The combined extracts were dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 3:2) to give the desired bisacetate as a white crystalline solid (1.28 g, 68%). $[\propto]^{D}_{20}$ = –72.3 (c = 0.98, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 5.86 (dddd, *J* = 17.3, 10.4, 6.1, 5.1 Hz, 1H), 5.27 (dq, *J* = 17.2, 1.6 Hz, 1H), 5.22 – 5.15 (m, 2H), 5.07 (t, *J* = 9.9 Hz, 1H), 4.82 (d, *J* = 1.8 Hz, 1H), 4.15 (ddt, *J* = 12.9, 5.1, 1.5 Hz, 1H), 3.96 (ddt, *J* = 12.9, 6.1, 1.3 Hz, 1H), 3.78 (dq, J = 9.6, 5.2 Hz, 1H), 3.59 (dd, *J* = 3.3, 1.9 Hz, 1H), 3.43 (s, 3H), 2.03 (s, 3H), 1.99 (s, 3H), 1.16 (d, *J* = 6.3 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.3, 169.8, 133.5, 117.5, 96.4, 78.4, 71.6, 71.5, 68.1, 66.4, 59.5, 20.9, 20.7, 17.4 ppm. IR (film): $\tilde{\nu}$ = 2924, 1740, 1455, 1370, 1239, 1219, 1107, 1074, 1036, 1000, 976, 915, 835, 798 cm^{-1}. MS (EI) m/z (%) = 157 (8), 156 (16), 129 (18), 125 (7), 116 (28), 115 (8), 114 (17), 113 (15), 103 (5), 96 (13), 87 (22), 85 (13), 83 (12), 74 (50), 45 (9), 43 (100), 41 (20). HRMS (ESIpos): calcd for $C_{14}H_{22}O_7Na$: 325.1258; found: 325.1255.

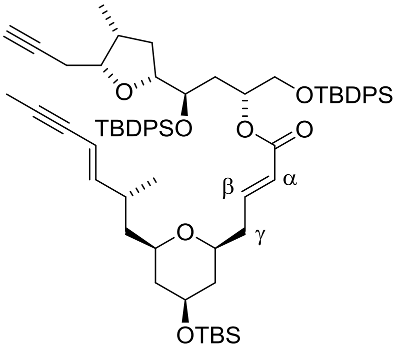


3,4-Bis-O-acetyl-2-O-methyl-α-L-rhamnopyranose (39). SeO_2 (488 mg, 4.40 mmol) was added to a solution of compound **38** (1.20 g, 3.97 mmol) and AcOH (183 µL, 3.20 mmol) in 1,4-dioxane (10 mL) and the resulting suspension was stirred at reflux temperature for 2 h. After cooling to room temperature, the mixture was neutralized with Et_3N (0.44 mL) and concentrated under reduced pressure. The residue was purified by flash chromatography (hexanes/EtOAc 3:2) to give the desired hemiacetal as a white solid (0.891 g, 86%). $[\propto]^{D}_{20}$ = –42.3 (c = 0.94, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$, *data of the major anomer only*): δ = 5.26 – 5.17 (m, 2H), 5.05 (t, *J* = 9.9 Hz, 1H), 4.04 (dq, *J* = 9.8, 6.2 Hz, 1H), 3.66 (d, *J* = 3.8 Hz, 1H), 3.61 (dd, *J* = 3.3, 1.8 Hz, 1H), 3.43 (s, 3H), 2.02 (s, 3H), 1.98 (s, 3H), 1.13 (d, *J* = 6.2 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$, *data of the major anomer only*): δ = 170.4, 170.0, 92.0, 78.6, 71.5, 71.3, 66.3, 59.5, 20.9, 20.7, 17.4 ppm. IR (film): $\tilde{\nu}$ = 3453, 2923, 2854, 1741, 1456, 1373, 1243, 1225, 1108, 1074, 1050, 916, 797 cm^{-1}. MS (EI) m/z (%) = 156 (14), 129 (34), 116 (12), 115 (5), 114 (14), 113 (7), 87 (54), 85 (6), 83 (7), 74 (56), 45 (7), 43 (100), 29 (6). HRMS (ESIpos): calcd for $C_{11}H_{18}O_7Na$: 285.0945; found: 285.0947.



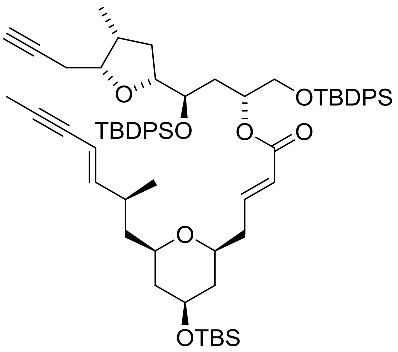
Trichloroacetimidate 40. Cl_3CCN (0.934 mL, 9.31 mmol) was added dropwise to a suspension of hemiacetal **39** (348 mg, 0.19 mmol) and Cs_2CO_3 (86.7 mg, 0.039 mmol) in CH_2Cl_2 (7.0 mL). After stirring for 3 h at room temperature, the mixture was filtered and the filtrate was evaporated. The residue was purified by flash chromatography (hexanes/EtOAc 4:1) to give the desired trichloroacetimidate as a white solid (532 mg, 98%). $[\propto]^{D}_{20}$ = –59.9 (c = 1.06, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 8.62 (s, 1H), 6.25 (d, *J* = 2.0 Hz, 1H), 5.28 – 5.10 (m, 2H), 3.98 (dq, *J* = 9.0, 6.3 Hz, 1H), 3.80 (dd, *J* = 3.0, 2.0 Hz, 1H), 3.48 (s, 3H), 2.04 (s, 3H), 2.01 (s, 3H), 1.20 (d, *J* = 6.3 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.9, 169.3, 160.0, 94.6, 90.5, 76.1, 70.7, 70.2, 69.0, 59.2, 20.5, 20.4, 17.2 ppm. IR (film): $\tilde{\nu}$ = 3332, 2988, 2922, 2851, 1741, 1673, 1448, 1368, 1279, 1236, 1219, 1156, 1107, 1056, 1039, 968, 943, 926, 842, 831, 793, 734 cm^{-1}. MS (EI) m/z (%) = 245 (28), 184 (19), 143 (14), 142 (24), 129 (16), 125 (28), 116 (18), 113 (13), 87 (22), 74 (34), 43 (100). HMRS (ESIpos): calcd for $C_{13}H_{18}O_7NCl_3Na$: 428.0041; found: 428.0042.

Diyne 41. A flame-dried Schlenk tube was charged with a solution of alcohol **30** (224 mg, 0.318 mmol) in CH_2Cl_2 (1.8 mL) and a solution of acid **11** (142 mg, 0.350 mmol) in CH_2Cl_2 (0.3 mL). DMAP (194 mg, 1.59 mmol) and DCC (138 mg, 0.668 mmol) were introduced as solids and the resulting mixture was stirred at ambient temperature for 18 h. The white precipitate was filtered off through a short pad of Celite that was rinsed with CH_2Cl_2. The combined filtrates were concentrated and the residue purified by flash chromatography (hexanes/EtOAc 24:1) to give the diyne as a mixture of α,β- and β,γ-olefins (1.5:1, 222 mg, 64%) as a white foam, along with recovered alcohol **30** (63.1 mg, 28%) as a colorless oil.

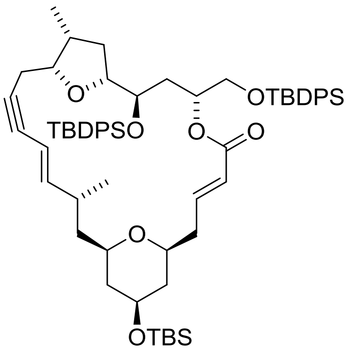


A solution of DBU (0.5 M in MeCN, 102 µL, 0.051 mmol) was added to a solution of this mixture of diynes (222 mg, 0.203 mmol) in MeCN (25 mL) and the resulting solution was stirred at 50°C for 70 h. After cooling to ambient temperature, sat. NH_4Cl solution (30 mL) containing 10 drops of 1 M HCl was added, the aqueous phase was extracted with EtOAc (4 x 30 mL), and the combined organic extracts were dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 24:1) to yield the desired α,β-olefin as a white foam (202 mg, 91%). $[\propto]^{D}_{20}$ = –10.5 (c = 1.03, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.66 – 7.57 (m, 8H), 7.47 – 7.25 (m, 12H), 6.85 (dt, *J* = 15.5, 7.2 Hz, 1H), 5.90 (dd, *J* = 15.9, 7.9 Hz, 1H), 5.72 (dt, *J* = 15.6, 1.5 Hz, 1H), 5.36 (ddd, *J* = 15.9, 2.0, 0.1 Hz, 1H), 5.22 – 5.11 (m, 1H), 3.79 (ddd, *J* = 7.9, 6.4, 3.3 Hz, 1H), 3.76 – 3.67 (m, 3H), 3.61 (dd, *J* = 10.6, 4.5 Hz, 1H), 3.57 (dd, *J* = 10.5, 4.2 Hz, 1H), 3.33 (ddd, *J* = 11.4, 5.8, 5.8 Hz, 1H), 3.26 (dd, J = 11.6, 6.2, 6.1 Hz, 1H), 2.45 – 2.19 (m, 4H), 2.11 – 2.01 (m, 2H), 1.96 – 1.87 (m, 2H), 1.90 (d, *J* = 2.1 Hz, 3H), 1.83 (t, *J* = 2.6 Hz, 1H), 1.80 – 1.73 (dd, *J* = 11.7, 3.7 Hz, 3H), 1.61 (ddd, *J* = 13.8, 7.4, 7.2 Hz, 1H), 1.37 – 1.27 (m, 1H), 1.23 – 1.07 (m, 3H), 1.01 (s, 9H), 1.00 (s, 9H), 0.95 (d, *J* = 6.6 Hz, 3H), 0.86 (s, 9H), 0.83 (d, *J* = 7.0 Hz, 3H), 0.04 (s, 3H), 0.03 (s, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.6, 148.4, 144.7, 136.0, 136.0, 135.9, 135.6, 135.6, 134.6, 134.0, 133.5, 133.4, 129.6, 129.3, 129.1, 127.6, 127.6, 127.3, 127.1, 123.4, 108.3, 84.4, 81.7, 80.9, 79.3, 78.3, 74.1, 73.2, 72.3, 69.2, 68.6, 65.2, 42.3, 41.4, 41.3, 38.8, 35.1, 35.0, 34.6, 33.3, 27.2, 26.8, 25.8, 20.7, 19.8, 19.6, 19.2, 18.1, 3.2, –4.5, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2956, 2930, 2856, 1720, 1656, 1472, 1462, 1427, 1376, 1361, 1257, 1175, 1111, 1071, 1006, 836, 823, 776, 740, 701 cm^{-1}. MS (ESIpos) m/z (%) = 1115.7 (100 (M+Na). HRMS (ESIpos): calcd for $C_{67}H_{92}O_7Si_3Na$: 1115.6043; found:1115.6049.

Diyne (11-*epi*)-41. Prepared analogously from acid 11-*epi*-**11** (34.9 mg, 85.8 µmol) and alcohol **30** (55 mg, 78.0 µmol) as a white foam (1st step: 61 mg, 71% yield, 2nd step: 56 mg, 92%). $[\propto]_{20}^{D}$ = +32.5 (c = 0.72, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.67 – 7.58 (m, 8H), 7.44 – 7.25 (m, 12H), 6.86 (dt, *J* = 15.6, 7.0 Hz, 1H), 5.81 (dd, *J* = 15.8, 8.7 Hz, 1H), 5.73 (dt, *J* = 15.6, 1.5 Hz, 1H), 5.42 (dd, *J* = 15.7, 2.2 Hz, 1H), 5.22 – 5.14 (m, 1H), 3.81 (ddd, *J* = 7.8, 6.6, 3.1 Hz, 1H), 3.77 – 3.67 (m, 3H), 3.64 (dd, *J* = 10.7, 4.8 Hz, 1H), 3.58 (dd, *J* = 10.7, 4.8 Hz, 1H), 3.37 – 3.28 (m, 1H), 3.27 – 3.18 (m, 1H), 2.51 – 2.34 (m, 2H), 2.34 – 2.19 (m, 2H), 2.07 – 2.02 (m, 2H), 1.96 – 1.88 (m, 2H), 1.86 (d, *J* = 2.2 Hz, 3H), 1.83 (t, *J* = 2.6 Hz, 1H), 1.81 – 1.67 (m, 3H), 1.54 (ddd, *J* = 14.0, 9.7, 4.2 Hz, 1H), 1.26 – 1.12 (m, 4H), 1.02 (s, 9H), 1.01 (s, 9H), 0.94 (d, *J* = 6.7 Hz, 3H), 0.86 (s, 9H), 0.83 (d, *J* = 7.1 Hz, 3H), 0.04 (s, 3H), 0.03 (s, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.5, 148.0, 144.7, 136.0, 135.9, 135.9, 135.6, 135.5, 134.6, 133.9, 133.5, 133.4, 129.6, 129.3, 129.1, 127.6, 127.6, 127.3, 127.1, 123.3, 109.2, 84.3, 81.6, 81.0, 79.3, 78.4, 74.0, 73.3, 72.3, 71.4, 69.2, 68.6, 65.2, 42.9, 41.9, 41.3, 38.8, 35.1, 35.0, 34.7, 33.9, 27.2, 26.8, 25.8, 21.0, 20.7, 19.5, 19.2, 18.1, 14.8, 4.2, –4.5, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2956, 2930, 2856, 1721, 1472, 1462, 1428, 1361, 1258, 1112, 1075, 1006, 836, 776, 740, 702, 612 cm^{-1}. MS (ESIpos) m/z (%) = 1115.7 (100 (M+Na). HRMS (ESIpos): calcd for $C_{67}H_{92}O_7Si_3Na$: 1115.6043; found:1115.6053.

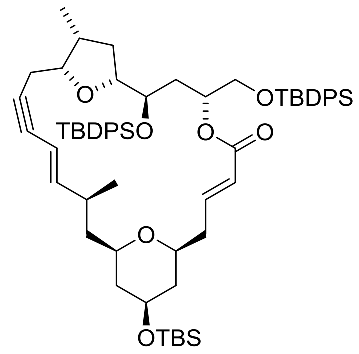


Macrocyclic Enyne 43. A flame-dried Schlenk tube was charged with powdered 4Å molecular sieves (~1.2 g) and 5Å molecular sieves (~1.5 g). The flask was then evacuated and the molecular sieves were flame-dried. After reaching ambient temperature, a solution of diyne **41** (191 mg, 0.175 mmol) in toluene (85 mL) was added and the resulting suspension was stirred for 45 min. In a separate flame-dried Schlenk tube, a stock solution of the molybdenum alkylidyne complex **42** (18.2 mg, 17.5 µmol) in toluene (2 mL) was prepared. This solution was added dropwise to the flask containing the diyne via syringe and the resulting mixture was stirred at ambient temperature for 3 h. The mixture was filtered through a short pad of Celite that was carefully rinsed with Et_2O (100 mL). The combined filtrates were evaporated and the brown residue was purified by flash chromatography (hexanes/EtOAc 29:1 to 24:1 to 19:1) to yield the targeted

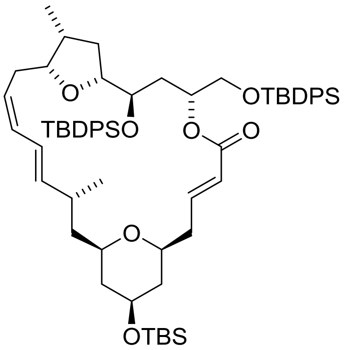


macrocyclic as a white foam (133 mg, 72%). $[\propto]_{20}^{D}$ = –7.4 (c = 0.87, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.68 – 7.60 (m, 8H), 7.45 – 7.24 (m, 12H), 6.87 (ddd, *J* = 15.7, 8.2, 5.7 Hz, 1H), 5.97 (dd, *J* = 16.0, 7.3 Hz, 1H), 5.73 (dt, *J* = 15.6, 1.3 Hz, 1H), 5.32 (dq, *J* = 15.9, 1.7 Hz, 1H), 5.22 – 5.15 (m, 1H), 4.09 (ddd, *J* = 9.6, 5.7, 2.6 Hz, 1H), 3.82 – 3.74 (m, 2H), 3.74 – 3.69 (m, 1H), 3.67 (dd, *J* = 10.3, 4.9 Hz, 1H), 3.62 (dd, J = 10.4, 5.0 Hz, 1H), 3.27 (dddd, *J* = 11.2, 9.2, 2.1, 1.8 Hz, 1H), 3.22 – 3.14 (m, 1H), 2.31 (tdd, *J* = 9.1, 4.6, 1.5 Hz, 1H), 2.26 – 2.12 (m, 5H), 2.10 (dd, *J* = 14.2, 9.3, 2.5 Hz, 1H), 1.86 – 1.67 (m, 4H), 1.61 – 1.50 (m, 1H), 1.35 – 1.30 (m, 2H), 1.22 – 1.11 (m, 2H), 1.03 (s, 9H), 1.01 (s, 9H), 1.00 (d, *J* = 6.6 Hz, 3H), 0.92 (d, *J* = 6.9 Hz, 3H), 0.87 (s, 9H), 0.04 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.8, 148.5, 144.9, 135.9, 135.8, 135.6, 135.2, 135.0, 134.9, 133.9, 133.6, 133.0, 129.5, 129.3, 129.2, 127.9, 127.6, 127.6, 127.4, 127.2, 123.6, 107.8, 86.8, 81.3, 81.2, 78.5, 75.6, 74.5, 71.9, 71.7, 68.6, 65.5, 43.2, 42.2, 41.8, 38.4, 36.5, 35.1, 34.0, 33.8, 29.7, 27.2, 26.8, 25.8, 21.6, 19.6, 19.3, 18.1, 13.8, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2955, 2929, 2856, 1718, 1472, 1462, 1428, 1361, 1328, 1256, 1174, 1112, 1071, 986, 836, 823, 775, 737, 700 cm^{-1}. MS (ESIpos) m/z (%) = 1075.7 (100 (M+Na). HRMS (ESIpos): calcd for $C_{64}H_{88}O_7Si_3Na$: 1075.5730; found:1075.5725.

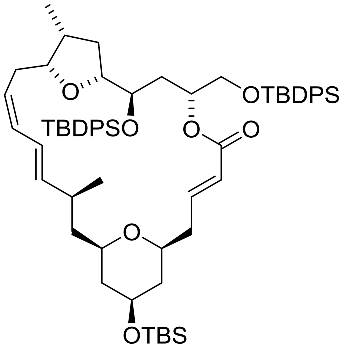
Macrocyclic Enyne (11-*epi*)-43. Prepared analogously from diyne 11-*epi*-**41** (52 mg, 47.5 µmol) as a white foam (32 mg, 64%). $[\propto]_{20}^{D}$ = +54.6 (c = 1.04, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.69 (ddd, *J* = 7.7, 3.3, 1.7 Hz, 4H), 7.63 – 7.56 (m, 4H), 7.44 – 7.25 (m, 12H), 6.97 (ddd, *J* = 15.4, 8.2, 7.0 Hz, 1H), 5.73 (dt, *J* = 15.5, 1.1 Hz, 1H), 5.60 (dd, *J* = 15.7, 9.6 Hz, 1H), 5.30 (dt, *J* = 15.7, 1.8 Hz, 1H), 5.09 – 5.02 (m, 1H), 4.16 (ddd, *J* = 8.8, 6.8, 1.8 Hz, 1H), 3.85 (ddd, *J* = 8.2, 5.8, 3.9 Hz, 1H), 3.80 – 3.68 (m, 2H), 3.65 (dd, *J* = 11.0, 3.4 Hz, 1H), 3.47 (dd, *J* = 11.0, 5.4 Hz, 1H), 3.20 – 3.08 (m, 2H), 2.63 – 2.50 (m, 1H), 2.39 – 2.17 (m, 3H), 2.13 (dd, *J* = 12.9, 7.9, 1H), 2.07 (ddd, *J* = 16.9, 5.7, 0.1 Hz, 1H), 1.90 (ddd, *J* = 14.5, 7.1, 2.1 Hz, 1H), 1.80 – 1.64 (m, 4H), 1.59 – 1.51 (m, 1H), 1.51 – 1.41 (m, 1H), 1.30 – 1.14 (m, 3H), 1.02 (s, 9H), 1.01 (m, 3H), 1.00 (s, 9H), 0.97 (d, *J* = 6.3 Hz, 3H), 0.86 (s, 9H), 0.03 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.3, 146.2, 146.0, 135.9, 135.9, 135.6, 134.8, 134.6, 133.6, 133.6, 129.5, 129.2, 129.1, 127.6, 127.5, 127.3, 127.2, 123.3, 110.4, 86.6, 81.6, 81.0, 78.8, 75.5, 74.1, 72.9, 72.9, 68.7, 65.8, 42.6, 42.2, 41.9, 38.6, 36.6, 35.8, 35.3, 33.8, 27.3, 26.8, 25.8, 23.1, 21.3, 19.7, 19.3, 18.1, 13.7, –4.5, –4.6 ppm. IR (film): $\tilde{\nu}$ = 2955, 2930, 2857, 1722, 1472, 1462, 1428, 1361, 1327, 1257, 1176, 1112, 1067, 854, 836, 823, 776, 739, 701, 608 cm^{-1}. MS (ESIpos) m/z (%) = 1075.6 (100 (M+Na). HRMS (ESIpos): calcd for $C_{64}H_{88}O_7Si_3Na$: 1075.5730; found:1075.5722.



Macrocyclic Diene 43a. *In order to obtain reproducible results, all solvents used for the preparation of the activated Zn/Cu/Ag and the reaction were degassed by bubbling Ar through the solvent for at least 20 min.*



A Young tube was evacuated, backfilled with Argon and charged with a mixture of MeOH/H_2O (1:1, 1.8 mL). Freshly prepared Zn/Cu/Ag[19] (1.6 g) was added, followed by a solution of enyne **43** (130 mg, 0.123 mmol) in THF (0.5 mL + 2 x 0.2 mL rinse). The Young tube was sealed and placed in a preheated (45°C) oil bath. The suspension was vigorously stirred at this temperature for 70 h before it was allowed to reach ambient temperature. The mixture was filtered through a short pad of Celite that was rinsed with EtOAc/EtOH (9:1, 75 mL). The combined filtrates were concentrated to ≈1/10 of the original volume before brine (10 mL) was added. The aqueous phase was extracted with EtOAc (3 x 10 mL) and the combined organic extracts were dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 29:1 to 24:1 to 19:1) to give the desired diene as a white foam (115 mg, 89%). $[\propto]_{20}^{D}$ = –47.9 (c = 0.70, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ = 7.64 – 7.54 (m, 8H), 7.40 – 7.22 (m, 12H), 6.84 (ddd, *J* = 15.7, 8.0, 5.5 Hz, 1H), 6.19 (dd, *J* = 15.4, 10.8 Hz, 1H), 5.88 (t, *J* = 10.8 Hz, 1H), 5.76 (dt, *J* = 15.7, 1.4 Hz, 1H), 5.55 (dd, *J* = 15.4, 6.8 Hz, 1H), 5.18 – 5.08 (m, 2H), 3.99 (ddd, *J* = 8.8, 6.0, 2.3 Hz, 1H), 3.73 (td, *J* = 7.9, 6.3 Hz, 1H), 3.66 (dt, *J* = 10.0, 4.8 Hz, 1H), 3.64 – 3.59 (m, 2H), 3.56 (dt, *J* = 7.0, 5.7 Hz, 1H), 3.28 – 3.14 (m, 2H), 2.43 – 2.33 (m, 1H), 2.32 – 2.24 (m, 1H), 2.20 (ddd, *J* = 16.0, 8.2, 2.7 Hz, 1H), 2.14 – 1.95 (m, 3H), 1.90 (dt, *J* = 15.7, 7.5 Hz, 1H), 1.85 – 1.77 (m, 2H), 1.75 – 1.64 (m, 3H), 1.34 (ddd, *J* = 12.7, 7.3, 5.2 Hz, 1H), 1.29 – 1.25 (m, 1H), 1.23 – 1.17 (m, 2H), 1.17 – 1.07 (m, 1H), 0.99 (s, 9H), 0.97 (s, 9H), 0.94 (d, *J* = 6. 7 Hz, 3H), 0.83 (s, 9H), 0.76 (d, *J* = 7.1 Hz, 3H), 0.00 (s, 6H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.8, 145.0, 140.2, 136.0, 136.0, 135.6, 135.6, 134.7, 133.9, 133.5, 133.5, 129.6, 129.5, 129.4, 127.6, 127.6, 127.4, 127.2, 126.4, 124.3, 123.3, 81.4, 80.1, 74.2, 73.4, 72.0, 71.6, 68.7, 65.4, 43.1, 41.9, 41.9, 38.5, 35.4, 34.4, 34.3, 32.1, 30.0, 27.2, 26.8, 25.8, 20.7, 19.5, 19.3, 18.1, 15.4, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2956, 2930, 2857, 1721, 1654, 1472, 1462, 1428, 1375, 1257, 1175, 1112, 1073, 1006, 836, 823, 775, 739, 702 cm^{-1}. MS (ESIpos) m/z (%) = 1077.6 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{64}H_{90}O_7Si_3Na$: 1077.5887; found:1075.5884.



Macrocyclic Diene (11-*epi*)-43a. Prepared analogously from enyne 11-*epi*-**43** (31.0 mg, 29.4 μmol) as a white foam (26.8 mg, 86%). $[\propto]_{20}^{D}$ = +15.2 (c = 1.22, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ = 7.66 – 7.53 (m, 8H), 7.42 – 7.20 (m, 12H), 7.09 (ddd, *J* = 15.1, 10.3, 4.3 Hz, 1H), 6.21 (dd, *J* = 14.9, 11.1 Hz, 1H), 5.89 (tt, *J* = 10.9, 1.9 Hz, 1H), 5.74 (dd, *J* = 15.6, 1.6 Hz, 1H), 5.25 (dd, *J* = 14.9, 9.7 Hz, 1H), 5.12 –

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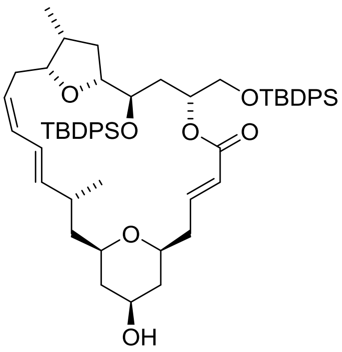
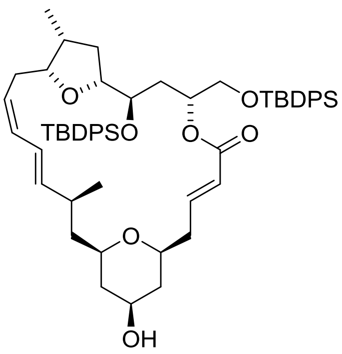
[19] W. Boland, N. Schroer, C. Sieler, M. Feigel, *Helv. Chim. Acta* **1987**, *70*, 1025.

5.02 (m, 2H), 3.92 – 3.82 (m, 2H), 3.77 – 3.65 (m, 2H), 3.41 (dd, *J* = 11.2, 3.3 Hz, 1H), 3.34 (dd, *J* = 11.2, 5.3 Hz, 1H), 3.18 – 3.04 (m, 2H), 2.71 – 2.59 (m, 1H), 2.40 (tdd, *J* = 9.6, 4.6, 1.9 Hz, 1H), 2.26 – 2.11 (m, 4H), 2.03 (dt, *J* = 15.1, 7.4 Hz, 1H), 1.93 (dt, *J* = 14.6, 5.9 Hz, 1H), 1.85 – 1.72 (m, 2H), 1.66 (dd, *J* = 12.5, 4.7 Hz, 1H), 1.56 (ddd, *J* = 14.0, 10.6, 2.9 Hz, 2H), 1.49 – 1.38 (m, 1H), 1.25 – 1.12 (m, 4H), 1.01 (s, 9H), 0.99 (d, *J* = 6.8 Hz, 3H), 0.97 (s, 9H), 0.85 (s, 9H), 0.79 (d, *J* = 7.0 Hz, 3H), 0.02 (s, 3H), 0.02 (s, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.2, 145.7, 139.8, 135.9, 135.8, 135.7, 135.6, 134.1, 133.9, 133.7, 133.4, 129.6, 129.5, 127.6, 127.5, 127.5, 127.4, 125.9, 125.6, 122.8, 81.3, 80.7, 75.1, 73.0, 72.3, 72.0, 68.5, 65.1, 43.5, 42.3, 42.1, 39.3, 35.6, 34.6, 34.6, 33.9, 29.4, 27.1, 26.7, 25.8, 22.1, 19.4, 19.2, 18.1, 15.1, –4.5, –4.5 ppm. IR (film): $\tilde{\nu}$ = 2957, 2928, 2856, 1724, 1427, 1257, 1157, 1113, 1076, 833, 822, 778, 741, 703, 557 cm^{-1}. MS (ESIpos) m/z (%) = 1077.6 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{64}H_{90}O_7Si_3Na$: 1077.5887; found: 1077.5884.

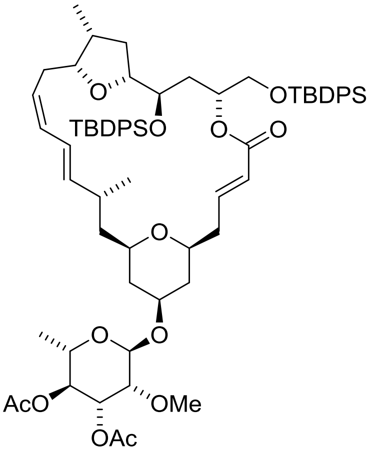


Alcohol 44. *p*-TsOH·H_2O (6.2 mg, 32.6 µmol) was added to a solution of silyl ether **43a** (114 mg, 0.109 mmol) in CH_2Cl_2/MeOH (2:1, 12 mL) and the mixture was stirred for 5 h. The reaction was quenched by addition of sat. $NaHCO_3$ solution (12 mL) and the aqueous layer was extracted with CH_2Cl_2 (3 x 8 mL). The combined extracts were dried over Na_2SO_4 and concentrated, and the residue was purified by flash chromatography (hexanes/EtOAc 2:1) to yield the desired alcohol as a white foam (92 mg, 90%). $[\propto]_{20}^{D}$ = –42.5 (c = 0.89, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.70 – 7.58 (m, 8H), 7.43 – 7.25 (m, 12H), 6.87 (ddd, *J* = 15.8, 7.9, 5.7 Hz, 1H), 6.23 (ddt, *J* = 15.6, 10.8, 1.2 Hz, 1H), 5.92 (t, *J* = 10.8 Hz, 1H), 5.80 (dt, *J* = 15.8, 1.4 Hz, 1H), 5.59 (dd, *J* = 15.4, 6.9 Hz, 1H), 5.23 – 5.12 (m, 2H), 4.03 (ddd, *J* = 8.8, 6.0, 2.3 Hz, 1H), 3.83 – 3.71 (m, 2H), 3.71 – 3.56 (m, 3H), 3.35 – 3.21 (m, 2H), 2.46 – 2.30 (m, 2H), 2.27 (tdd, *J* = 7.5, 3.0, 1.3 Hz, 1H), 2.18 – 2.05 (m, 2H), 2.03 (ddd, J = 14.5, 10.1, 0.1 Hz, 1H), 1.99 – 1.81 (m, 5H), 1.76 (ddd, *J* = 14.0, 8.2, 6.0 Hz, 1H), 1.52 – 1.44 (br s, 1H), 1.38 (ddd, *J* = 12.8, 7.3, 5.4 Hz, 1H), 1.33 (ddd, *J* = 13.5, 8.1, 4.8 Hz, 1H), 1.22 (ddd, *J* = 11.5, 10.9, 10.6 Hz, 1H), 1.13 (ddd, *J* = 11.6, 11.3, 1.09 Hz, 1H), 1.03 (s, 9H), 1.01 (s, 9H), 0.98 (d, *J* = 6.7 Hz, 3H), 0.80 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.7, 143.7, 140.0, 136.0, 136.0, 135.6, 135.6, 134.6, 133.9, 133.5, 130.0, 129.6, 129.6, 129.4, 129.2, 127.6, 127.6, 127.4, 127.2, 126.4, 124.4, 123.3, 81.4, 80.1, 74.2, 73.4, 72.1, 71.6, 68.1, 65.4, 42.9, 41.4, 41.3, 38.4, 35.4, 34.5, 34.3, 32.1, 30.0, 27.2, 26.8, 20.9, 19.5, 15.4 ppm. IR (film): $\tilde{\nu}$ = 3454, 2957, 2930, 2857, 1720, 1654, 1472, 1427, 1361, 1265, 1176, 1112, 1006, 822, 739, 702 cm^{-1}. MS (ESIpos) m/z (%) = 963.6 (100 (M+Na). HRMS (ESIpos): calcd for $C_{58}H_{76}O_7Si_2Na$: 963.5022; found: 963.5028.

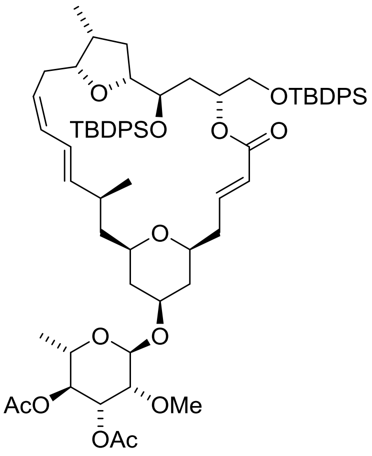
Alcohol (11-*epi*)-44. Prepared analogously from silyl ether 11-*epi*-**43a** (24.2 mg, 22.9 µmol) as a white foam (19.3 mg, 89%). $[\propto]_{20}^{D}$ = +28.4 (c = 0.96, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.66 – 7.53 (m, 8H), 7.42 – 7.20 (m, 12H), 7.07 (ddd, *J* = 15.1, 10.2, 4.4 Hz, 1H), 6.20 (dd, *J* = 14.9, 11.0 Hz, 1H), 5.87 (tt, *J* = 10.9, 1.9 Hz, 1H), 5.75 (dd, *J* = 15.6, 1.7 Hz, 1H), 5.24 (dd, *J* = 14.9, 9.7 Hz, 1H), 5.11 – 5.01 (m, 2H), 3.93 – 3.83 (m, 2H), 3.79 – 3.68 (m, 2H), 3.41 (dd, *J* = 11.1, 3.5 Hz, 1H), 3.35 (dd, *J* = 11.2, 5.3 Hz, 1H), 3.21 – 3.07 (m, 2H), 2.64 (tt, *J* = 9.5, 3.4 Hz, 1H), 2.42 (tdd, *J* = 9.6, 4.7, 1.9 Hz, 1H), 2.27 – 2.10 (m, 4H), 2.02 (dd, *J* = 8.0, 7.7, 7.4 Hz, 1H), 1.96 – 1.86 (m, 2H), 1.84 – 1.75 (m, 2H), 1.63 – 1.52 (m, 2H), 1.42 (ddd, *J* = 13.6, 7.2, 3.5 Hz, 1H), 1.23 – 1.11 (m, 3H), 1.01 (s, 9H), 0.99 (d, *J* = 6.8 Hz, 3H), 0.97 (s, 9H), 0.78 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.2, 145.4, 139.6, 135.9, 135.8, 135.7, 135.6, 134.1, 133.9, 133.6, 133.5, 129.6, 129.5, 127.6, 127.5, 127.5, 127.4, 126.0, 125.7, 122.9, 81.3, 80.8, 75.0, 73.1, 72.4, 72.1, 68.0, 65.2, 43.4, 41.7, 41.6, 39.2, 35.6, 34.6, 34.6, 34.0, 29.5, 27.1, 26.7, 20.1, 19.4, 19.2, 15.1 ppm. IR (film): $\tilde{\nu}$ = 3414, 2957, 2930, 2857, 1722, 1655, 1472, 1428, 1361, 1326, 1262, 1177, 1111, 990, 822, 739, 702, 610 cm^{-1}. MS (ESIpos) m/z (%) = 963.6 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{58}H_{76}O_7Si_2Na$: 963.5022; found: 963.5017.



Glycoside 45. A Schlenk tube was charged with powdered 4Å MS (400 mg) that was flame-dried in vacuo. After reaching RT, the molecular sieves were suspended in CH_2Cl_2 (10 mL) and a solution of alcohol **44** (87.0 mg, 92.4 µmol) in CH_2Cl_2 (1.6 mL) was introduced. Rhamnosyl donor **40** (56.3 mg, 139 µmol) was added as a solid and the resulting suspension was stirred for 45 min at ambient temperature before it was cooled to −50°C. A solution of TESOTf (0.1 M, 277 µL, 27.7 µmol) was added dropwise via syringe over 1 min. After stirring for 30 min at −50°C, the reaction was quenched with NEt_3 (0.1 mL), the mixture was filtered through a pad of Celite and the filtrate was evaporated. The crude residue was purified by flash chromatography (hexanes/EtOAc 3:1) to yield the desired glycoside as a white foam (97.0 mg, 88% yield, 16:1 d.r.). $[\propto]_{20}^{D}$ = –61.5 (c = 0.82, $CHCl_3$). ^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.70 – 7.55 (m, 8H), 7.43 – 7.24 (m, 12H), 6.85 (ddd, *J* = 15.8, 8.1, 5.5 Hz, 1H), 6.23 (dd, *J* = 15.4, 10.8 Hz, 1H), 5.91 (t, *J* = 10.8 Hz, 1H), 5.80 (dt, *J* = 15.7, 1.1 Hz, 1H), 5.58 (dd, *J* = 15.4, 6.8 Hz, 1H), 5.23 – 5.14 (m, 3H), 5.08 (t, *J* = 9.9 Hz, 1H), 4.95 (d, *J* = 1.9 Hz, 1H), 4.02 (ddd, *J* = 8.8, 6.1, 2.4 Hz, 1H), 3.82 (dq, *J* = 9.7, 6.3 Hz, 1H), 3.79 – 3.70 (m, 2H), 3.65 (dd, *J* = 10.7, 4.5 Hz, 2H), 3.60 (q, *J* = 6.4 Hz, 1H), 3.54 (dd, *J* = 3.3, 1.8 Hz, 1H), 3.45 (s, 3H), 3.32 – 3.23 (m, 2H), 2.44 – 2.37 (m, 1H), 2.37 – 2.31 (m, 1H), 2.25 (ddd, *J* = 15.3, 8.1, 2.6 Hz, 1H), 2.14 – 2.06 (m, 2H), 2.05 (s, 3H), 2.03 – 1.99 (m, 1H), 2.00 (s, 3H), 1.98 – 1.90 (m, 2H), 1.90 –

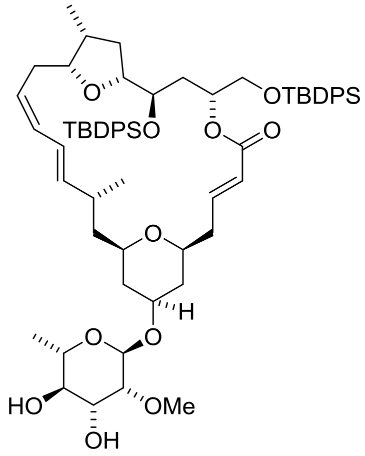


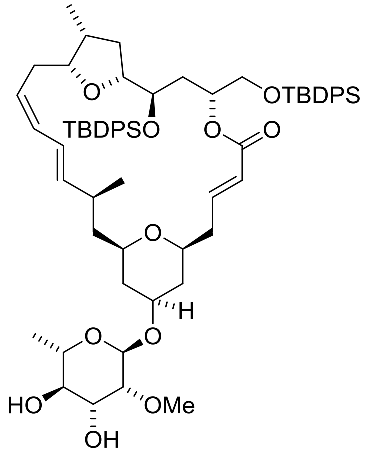
1.81 (m, 3H), 1.75 (ddd, *J* = 14.1, 8.5, 6.0 Hz, 1H), 1.37 (ddd, *J* = 12.7, 7.3, 5.1 Hz, 1H), 1.34 – 1.28 (m, 2H), 1.27 – 1.26 (m, 1H), 1.17 (d, *J* = 6.3 Hz, 3H), 1.02 (s, 9H), 1.00 (s, 9H), 0.98 (d, *J* = 6.7 Hz, 3H), 0.79 (d, *J* = 7.1 Hz, 3H) ppm. ^{13}C NMR (150 MHz, $CDCl_3$): δ = 170.3, 169.9, 165.7, 144.5, 140.0, 136.0, 136.0, 135.6, 135.6, 135.6, 134.6, 133.9, 133.5, 130.0, 129.6, 129.6, 129.4, 129.2, 127.6, 127.6, 127.4, 127.2, 126.5, 124.4, 123.5, 95.4, 81.4, 80.1, 78.8, 74.1, 73.4, 73.2, 72.1, 71.7, 71.6, 71.6, 66.7, 65.4, 59.6, 43.0, 39.1, 38.5, 37.6, 35.4, 34.5, 34.3, 32.1, 29.9, 29.7, 27.2, 26.8, 21.0, 20.8, 19.5, 19.3, 17.5, 15.3 ppm. IR (film): $\tilde{\nu}$ = 2958, 2929, 2857, 1745, 1720, 1654, 1472, 1361, 1427, 1365, 1241, 1223, 1177, 1107, 1074, 1040, 998, 822, 803, 755, 702 cm^{-1}. MS (ESIpos) m/z (%) = 1207.6 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{69}H_{92}O_{13}Si_2Na$: 1207.5969; found: 107.5976.



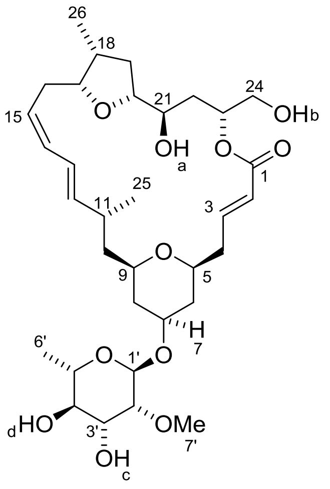
Glycoside (11-*epi*)-45. Prepared analogously from 11-*epi*-**44** (24.2 mg, 22.9 µmol) as a white foam (20.6 mg, 87% yield, single dr). $[\propto]_{20}^{D}$ = –17.4 (c = 0.87, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 7.67 – 7.52 (m, 8H), 7.43 – 7.24 (m, 11H), 7.23 – 7.20 (m, 1H), 7.05 (ddd, *J* = 15.2, 10.3, 4.4 Hz, 1H), 6.19 (dd, *J* = 14.9, 11.0 Hz, 1H), 5.87 (t, *J* = 11.0 Hz, 1H), 5.74 (dd, *J* = 15.6, 1.1 Hz, 1H), 5.24 (dd, J = 15.0 Hz, 9.7 Hz, 1H), 5.18 (dd, *J* = 10.1, 3.2 Hz, 1H), 5.12 – 5.00 (m, 3H), 4.91 (d, *J* = 1.9 Hz, 1H), 3.92 – 3.83 (m, 2H), 3.80 (dq, *J* = 9.5, 6.2 Hz, 1H), 3.77 – 3.66 (m, 2H), 3.52 (dd, *J* = 3.18, 1.98 Hz, 1H), 3.43 (s, 3H), 3.40 (dd, *J* = 11.1, 3.5 Hz, 1H), 3.35 (dd, J = 11.2, 5.1 Hz, 1H), 3.21 – 3.06 (m, 2H), 2.69 – 2.56 (m, 1H), 2.43 (dddd, J = 14.1, 9.3, 4.3, 1.5 Hz, 1H), 2.25 – 2.17 (m, 2H), 2.17 – 2.10 (m, 2H), 2.04 (s, 3H), 2.01 (s, 3H), 1.96 – 1.87 (m, 2H), 1.83 – 1.74 (m, 2H), 1.56 (dd, *J* = 14.0, 2.8 Hz, 1H), 1.45 – 1.37 (m, 1H), 1.31 (q, *J* = 11.7 Hz, 2H), 1.23 – 1.16 (m, 2H), 1.15 (d, *J* = 6.2 Hz, 3H), 1.00 (s, 9H), 0.98 (d, J = 6.6 Hz, 3H), 0.96 (s, 9H), 0.78 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 170.3, 169.9, 165.2, 145.3, 139.5, 135.9, 135.8, 135.6, 135.6, 134.1, 133.9, 133.6, 133.4, 129.6, 129.5, 129.5, 127.6, 127.5, 127.5, 127.4, 126.0, 125.7, 123.0, 95.4, 81.3, 80.8, 78.8, 75.0, 73.1, 73.1, 72.4, 72.1, 71.6, 71.6, 66.6, 65.1, 59.6, 43.4, 39.3, 39.3, 37.9, 35.6, 34.6, 33.9, 29.4, 27.0, 26.7, 22.0, 21.0, 20.8, 19.4, 19.2, 17.4, 15.1 ppm. IR (film): $\tilde{\nu}$ = 2956, 2930, 2857, 1725, 1428, 1365, 1327, 1243, 1223, 1178, 1110, 1042, 912, 824, 736, 703, 611 cm^{-1}. MS (ESIpos) m/z (%) = 1207.6 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{69}H_{92}O_{13}Si_2Na$: 1207.5969; found: 1207.5966.

Diol 45a. Dry K_2CO_3 (28.3 mg, 205 µmol) was added to a solution of compound **45** (96.9 mg, 81.8 µmol) in MeOH (11 mL) at 0°C. The mixture was stirred at this temperature for 2 h before a second portion of K_2CO_3 (22.6 mg, 164 µmol) was introduced. After an additonal 2 h at 0°C, the reaction was quenched with NH_4Cl solution (15 mL) and the mixture allowed to reach ambient temperature. The aqueous phase was extracted with EtOAc (4 x 15 mL) and the combined organic extracts were dried over Na_2SO_4 and concentrated. The residue was purified by flash chromatography (hexanes/EtOAc 2:3) to give the desired product as a white foam (72.3 mg, 80%). $[\propto]^{D}_{20}$ = –53.1 (c = 0.57, $CHCl_3$). ^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.66 – 7.59 (m, 8H), 7.41 – 7.25 (m, 12H), 6.86 (ddd, *J* = 15.8, 8.2, 5.6 Hz, 1H), 6.22 (ddt, *J* = 15.5, 10.8, 1.2 Hz, 1H), 5.91 (t, *J* = 10.8 Hz, 1H), 5.80 (dt, *J* = 15.7, 1.4 Hz, 1H), 5.59 (dd, *J* = 15.4, 6.8 Hz, 1H), 5.21 – 5.09 (m, 2H), 5.02 (d, *J* = 1.5 Hz, 1H), 4.02 (ddd, *J* = 8.9, 6.2, 2.3 Hz, 1H), 3.80 – 3.72 (m, 2H), 3.69 (td, *J* = 9.6, 3.7 Hz, 1H), 3.69 – 3.65 (m, 2H), 3.64 – 3.58 (m, 2H), 3.45 (s, 3H), 3.40 (dd, *J* = 3.8, 1.5 Hz, 1H), 3.36 (dd, *J* = 9.6, 9.4 Hz, 1H), 3.35 – 3.25 (m, 2H), 2.45 – 2.39 (m, 1H), 2.38 – 2.31 (m, 2H), 2.31 – 2.23 (m, 2H), 2.13 – 2.06 (m, 2H), 2.02 (ddd, *J* = 14.9, 10.1, 2.5 Hz, 1H), 1.97 – 1.90 (m, 2H), 1.90 – 1.82 (m, 3H), 1.75 (ddd, *J* = 14.0, 8.4, 5.9 Hz, 1H), 1.37 (ddd, *J* = 12.8, 7.4, 5.3 Hz, 1H), 1.32 (ddd, *J* = 13.7, 8.0, 4.2 Hz, 1H), 1.28 (d, *J* = 6.2 Hz, 3H), 1.24 – 1.17 (m, 2H), 1.03 (s, 9H), 1.00 (s, 9H), 0.98 (d, *J* = 6.7 Hz, 3H), 0.79 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (150 MHz, $CDCl_3$): δ = 165.7, 144.5, 140.0, 136.0, 136.0, 135.6, 135.6, 135.5, 134.6, 134.0, 133.5, 130.0, 129.6, 129.6, 129.3, 129.2, 127.6, 127.6, 127.4, 127.2, 126.5, 124.4, 123.5, 93.9, 81.4, 80.6, 80.1, 74.0, 74.0, 73.5, 72.7, 72.1, 71.7, 71.4, 67.9, 65.4, 58.9, 43.0, 39.1, 38.5, 37.5, 35.4, 34.5, 34.4, 29.9, 27.2, 26.8, 20.8, 19.5, 19.3, 17.5, 15.4 ppm. IR (film): $\tilde{\nu}$ = 3411, 2958, 2930, 2857, 1719, 1656, 1462, 1428, 1360, 1327, 1263, 1176, 1111, 1076, 1045, 823, 740, 702 cm^{-1}. MS (ESIpos) m/z (%) = 1123.7 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{65}H_{88}O_{11}Si_2Na$: 1123.5757; found: 1123.5748.

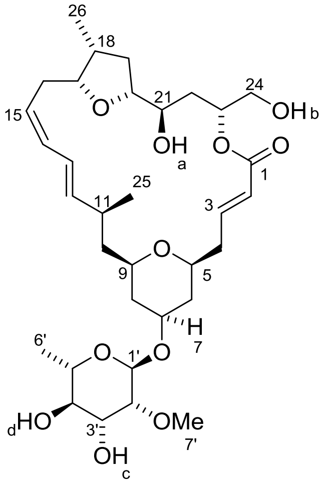




Diol (11-*epi*)-45a. Prepared analogously from alcohol 11-*epi*-**45** (20.0 mg, 16.9 µmol) as a white foam (16.4 mg, 88%). $[\propto]^{D}_{20}$ = –5.9 (c = 0.67, CH_2Cl_2). ^{1}H NMR (600 MHz, $CDCl_3$): δ = 7.65 – 7.53 (m, 8H), 7.42 – 7.24 (m, 10H), 7.24 – 7.19 (m, 2H), 7.05 (ddd, *J* = 15.5, 10.3, 4.3 Hz, 1H), 6.20 (dd, *J* = 15.0, 11.0 Hz, 1H), 5.88 (tt, *J* = 11.0, 1.9 Hz, 1H), 5.77 – 5.71 (m, 1H), 5.25 (dd, *J* = 14.9, 9.7 Hz, 1H), 5.11 – 5.00 (m, 2H), 4.97 (d, *J* = 1.4 Hz, 1H), 3.91 – 3.83 (m, 2H), 3.76 – 3.69 (m, 2H), 3.67 (dd, *J* = 9.4, 3.8 Hz, 1H), 3.61 (dq, *J* = 9.4, 6.2 Hz, 1H), 3.42 (s, 3H), 3.40 – 3.33 (m, 3H), 3.32 (dd, *J* = 9.3, 9.3 Hz, 1H), 3.17 (tt, *J* = 11.3, 1.9 Hz, 1H), 3.11 (tdd, *J* = 11.2, 3.3, 1.8 Hz, 1H) 2.70 – 2.57 (m, 1H), 2.43 (dddd, *J* = 14.4, 9.2, 4.3, 1.9 Hz, 1H), 2.36 – 2.28 (br s, 1H), 2.23 – 2.17 (m, 2H), 2.18 – 2.11 (m, 2H), 2.03 (dt, *J* = 13.1, 7.6 Hz, 1H), 1.97 – 1.88 (m, 2H), 1.83 – 1.75 (m, 2H), 1.56 (ddd, *J* = 14.1, 11.1, 3.1 Hz, 1H), 1.41 (ddd, *J* = 13.6, 7.7, 5.9 Hz, 1H), 1.31 – 1.22 (m, 2H), 1.26 (d, *J* = 6.1 Hz, 3H), 1.22 – 1.10 (m, 2H), 1.00 (s, 9H), 0.99 (d, J = 6.5 Hz, 3H), 0.97 (s, 9H), 0.78 (d, *J* = 7.0 Hz, 3H) ppm. ^{13}C NMR (150 MHz, CDCl$_3$): δ = 165.2, 145.3, 139.6, 135.9, 135.8, 135.7, 135.6, 134.1, 133.9, 133.6, 133.4, 129.6, 129.5, 129.5, 129.5, 127.6, 127.5, 127.5, 127.4, 126.0, 125.7, 123.0, 93.9, 81.3, 80.7, 80.6, 74.9, 74.0, 73.1, 72.6, 72.4, 72.1, 71.4, 67.8, 65.1, 58.8, 43.4, 39.3, 37.9, 35.6, 34.6, 34.6, 33.9, 29.4, 27.0, 26.7, 22.0, 19.4, 19.2, 17.5, 15.2 ppm. IR (film): $\tilde{\nu}$ = 3426, 2956, 2929, 2857, 1722, 1461, 1428, 1390, 1361, 1326, 1261, 1178, 1108, 1077, 1043, 909, 822, 734, 702, 611 cm^{-1}. MS (ESIpos) m/z (%) = 1123.6 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{65}H_{88}O_{11}Si_2Na$: 1123.5757; found: 1123.5754.

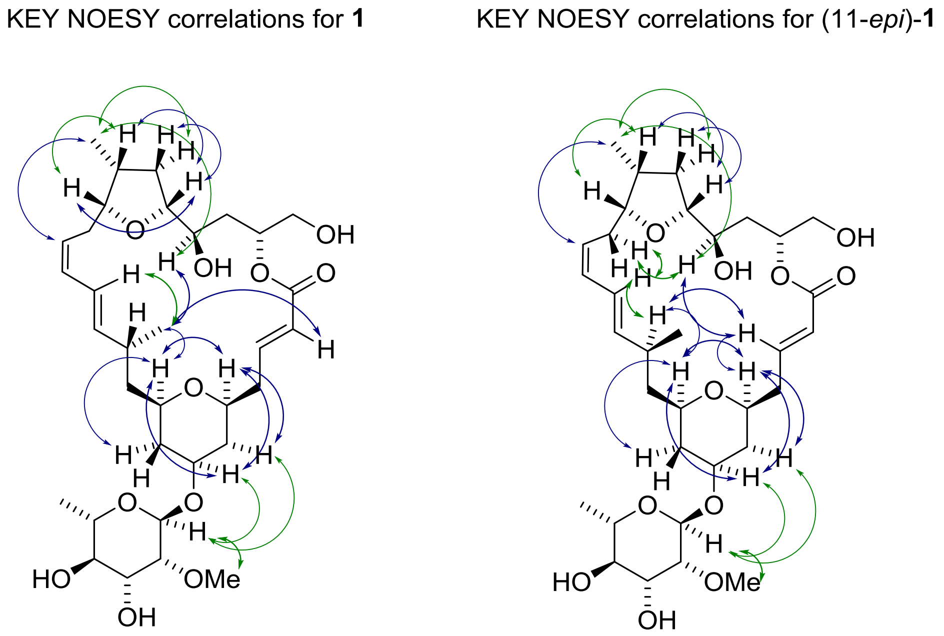


Putative Mandelalide A (1). A Teflon vial was charged with diol **45a** (42.0 mg, 38.1 µmol) and THF (2.5 mL). The solution was cooled to 0°C before pyridine (2.5 mL) and HF·pyridine (2.5 mL) were slowly added via an Eppendorf pipette. After stirring for 5 min at 0°C, the ice bath was removed and stirring continued at ambient temperature for 46 h. The mixture was diluted with EtOAc (10 mL) and carefully poured into NaHCO$_3$ solution (30 mL). The aqueous phase was extracted with EtOAc/EtOH (9:1, 4 x 15 mL). The combined organic extracts were washed with NH$_4$Cl solution (20 mL), dried over Na$_2$SO$_4$ and concentrated. The residue was purified by flash chromatography (CH$_2$Cl$_2$/MeOH 97:3 to 96:4 to 95:5 to 96:4) to give the desired compound as a white amorphous solid (19.1 mg, 80%). $[\propto]_{23}^{D}$ = –29 (c = 0.25, MeOH). ^{1}H NMR (600 MHz, CDCl$_3$): see Table 3. ^{13}C NMR (150 MHz, CDCl$_3$): see Table 3. IR (film): $\tilde{\nu}$ = 3427, 2924, 1714, 1653, 1454, 1373, 1323, 1275, 1179, 1106, 1043, 988, 734 cm^{-1}. MS (ESIpos) m/z (%) = 647.4 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{33}H_{52}O_{11}Na$: 647.3402; found: 647.3406.



(11-*epi*)-Isomer of putative Mandelalide A (11-*epi*-1). Prepared analogously from diol 11-*epi*-**45a** (10.0 mg, 9.08 µmol) as a white amorphous solid (4.8 mg, 85%). $[\propto]_{23}^{D}$ = –25.8 (c = 0.41, MeOH). ^{1}H NMR (600 MHz, CDCl$_3$): see Table 4. ^{13}C NMR (150 MHz, CDCl$_3$): see Table 4. IR (film): $\tilde{\nu}$ = 3411, 2924, 2854, 1716, 1654, 1457, 1373, 1246, 1178, 1107, 1045, 992, 812, 733 cm^{-1}. MS (ESIpos) m/z (%) = 647.4 (100 (M+Na)). HRMS (ESIpos): calcd for $C_{65}H_{88}O_{11}Si_2Na$: 647.3402; found: 647.3402.

The following Scheme shows key NOESY contacts observed for **1** and 11-*epi*-**1**. The structural assignments made above for the different building blocks were confirmed by the observed NOE contacts between H**5**, H**7** and H**9** for the southern THP unit. Furthermore, the NOE contacts between H**17**, H**18** and H**19** indicates once again an all-*cis* configured THF ring. Interesting to note are the different NOE contacts across the macrocycle for the two isomers.


KEY NOESY correlations for **1**

KEY NOESY correlations for (11-*epi*)-**1**

different colors were used only for better overview

For comparison with the natural product, the ^{13}C NMR spectra of synthetic **1** and 11-*epi*-**1** were referenced to $CDCl_3$ = 77.23 ppm as in the isolation paper (in other spectra reported above, the solvent signal was set to 77.00 ppm).

Table 3: ^{1}H & ^{13}C NMR data of putative Mandelalide A (**1**) (^{1}H NMR: 600 MHz, ^{13}C NMR: 150 MHz, 4.2 mg in 0.45 mL $CDCl_3$).[20]

atom n°	^{1}H /ppm	^{13}C /ppm	m	*J*/Hz	COSY	HMBC	NOESY
1	--	167.3	-	-	-	-	-
2	5.92	123.1	dt	15.6, 1.5	3, (4ab)	1, (3), 4	3, 4(a)b, (25)
3	7.02	146.3	ddd	15.5, 8.6, 5.5	2, 4a(b)	1, 2, 4, 5	2, 4a(b), (6a)
4a	2.34	38.5	ddd	15.2, 6.5, 5.6, 1.8	(3), 4b, 5	2, 3, 5, 6	(2), 3, 4b, 5
4b	2.46	--	dddd	15.2, 8.6, 3.7, 1.2	3, 4a, (5)	2, 3, 5, (6)	2, 3, 4a, 5, 25
5	3.42	73.4	m	-	4a(b), 6a	3, (4), 7, 9	(3), 4ab, 6b, 7, 9
6a	1.26	36.7	m	-	5, 6b, 7	5, 7, 8	-
6b	1.94	--	ddt	12.0, 4.6, 1.9	6a, 7	6, 8	(5), 6a, 7, 1'
7	3.77	72.8	m	-	6ab, 8ab	6, 8, (1')	5, 6b, 8b, 9, 1'
8a	1.22	39.3	m	-	7, 8b, 9	-	-
8b	1.84	--	dddd	12.5, 4.2, 1.9, 1.9	7, 8a, (9)	6, 7, 9	7, 8a, 9
9	3.33	73.1	m	-	8a(b), 10ab	(5), (7), 8, 10	5, 7, 8b, 10b, 25
10a	1.27	42.9	m	-	9, 10b, 11	-	-
10b	1.69	--	ddd	14.1, 9.1, 5.1	9, 10a, (11)	8, 9, 11, 12, 25	9, 10a
11	2.44	32.8	m	-	10a(b), 12, 25	9, 10, 12, 13, 25	9, 10a, 12, 13, 25
12	5.61	140.9	dd	15.2, 7.6	11, 13	10, 11, 14, (15), 25	(10ab), 11, 13, 14, 25
13	6.22	123.8	ddt	15.2, 10.8, 1.0	12, 14	11, 14, 15	11, 12, 14, 16ab, 25
14	6.01	130.5	tt	10.8, 1.8	13, 15	12, 13, 16	12, 13, 15
15	5.27	126.5	ddd	10.8, 8.3, 7.5	14, 16ab	13, 16, 17	14, 16ab, 17, (26)
16a	2.14	31.2	Dddd	14.8, 6.8, 5.1, 1.9	15, 16b, 17	14, 15, 17, 18	13, (15), 16a, (17), (26)
16b	2.29	--	dtd	14.8, 8.5, 1.6	15, 16a, 17	(13), 14, 15, 17, 18	13, 15, 16b, 17, 26
17	4.03	81.3	ddd	8.6, 7.2, 4.9	16ab, 18	15, 19, 20, 26	15, 16a(b), 18, (20), (26)
18	2.43	37.1	m	-	17, 19a(b), 26	16, 17, 19, (20), 26	17, 19ab, 20, 26
19a	1.28	36.0	m	-	18, 19b, 20	-	(18), 19b, 21, 26
19b	2.04	--	dt	12.3, 6.7	(18), 19a, 20	17, 18, (20), 21, 26	18, 19a, 20, (26)
20	3.71	82.7	ddd	8.4, 8.2, 6.7	19ab, 21	(17), (18), 19, 21, 22	17, 18, 19b, 21, 22a(b)
21	3.45	73.4	m	-	20, 22(a)b	(19), 20, 22, 23	(16a), 19a, 20, 22b, 23, 25, 26
22a	1.54	34.1	ddd	14.4, 10.5, 2.5	21, 22b, (23)	20, 23, 24	20, 21, 22b, 23, 24ab
22b	1.77	--	ddd	14.4, 10.8, 2.0	(21), 22a, 23	(20), 23, 24	(19b), 21, 22a, 23, (24a)
23	5.24	72.5	m	-	22(a)b, 24ab	(22), (1)	21, 22a(b), 24ab
24a	3.65	65.7	m	-	23, 24b	22, 23	(22ab), 23, 24b
24b	3.78	--	dd	12.1, 3.3	23, 24a	22, (23)	21, 23, 24a
25	1.00	20.1	d	6.7	11	10, 11, 12	9, (10b), 11, 12, 13, ,21 ,2
26	0.98	14.7	d	7.0	18	17, 18, 19	16a(b), (17), 18, (21)
1'	5.02	94.0	d	1.5	2'	7, 2', 3', 5'	6b, 7, 2', 7'
2'	3.40	80.9	dd	3.8, 1.5	1', 3'	3', 4', 7'	1', 7', 3'
3'	3.69	71.7	m	-	2', 4'	(2'), 4'	(2'), 5'
4'	3.34	74.2	t	9.4	3', 5'	3', 5'	6', 7'
5'	3.63	68.2	dd	9.4, 6.1	4', 6'	(1'), 3', 4', (6')	(2'), 3', 6'
6'	1.28	17.7	d	6.3	5'	(1'), 4', 5'	4', 5', 7'
7'	3.46	59.2	s	-	-	2'	1', 6'
OHa	2.56-2.33	-	-	-	21	21,22	
OHb	2.56-2.33	-	-	-			
OHc	2.44-2.34	-	-	-	3'	3'	
OHd	2.78-2.64	-	br s	-	4'	4'	

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[20] The assignment of multiple protons on a single carbon (e.g. 4a and 4b) is in analogy to the ones reported in the isolation paper (Ref. 24)

Table 4: ^{1}H & ^{13}C NMR data of 11-*epi*-Isomer of putative Mandelalide A (11-*epi*-**1**) (^{1}H-NMR: 600 MHz, ^{13}C-NMR: 150 MHz, 4.1 mg in 0.25 mL $CDCl_3$).[22]

atom n°	**^{1}H /ppm**	**^{13}C /ppm**	**m**	***J*/Hz**	**COSY**	**HMBC**	**NOESY**
1	--	166.8	-	-	-	-	-
2	5.92	123.6	dt	15.6, 1.1	3, (4a)	1, 3, 4, (5)	3, 4b
3	7.09	146.1	ddd	15.6, 8.2, 6.7	2, 4ab	1, 2, 4, 5	2, 4ab, 5, 11, 13, (21)
4a	2.31	39.5	dddd	14.3, 8.2, 2.7, 0.8	3, 4b, (5)	2, 3, 5, (6)	2, 3, 4b, 5, (6a)
4b	2.39	-	m	-	3, 4a, 5	2, 3, 5, 6	2, 3, 4b, 6a
5	3.26	74.0	dddd	11.2, 10.5, 3.0, 2.1	4a, 4b, 6a(b)	(3), (4), (9)	4a, 6b, 7, 9
6a	1.15	38.2	ddd	11.8, 11.7, 11.6	5, 6b, 7	5, 7, 8	4b, 6b, 8a
6b	1.98	-	ddt	12.2, 4.7, 1.9	5, 6a, 7	(5), 7, 8	4a, 5, 6a, 7, 1'
7	3.76	72.7	m	-	6a(b), 8a(b)	8, (9), 1'	5, 6b, 8b, 9, 1'
8a	1.27	39.2	m	-	7, 8b, 9	6, 7, 9, 10	6a, 8b
8b	1.75	-	ddt	12.4, 4.7, 1.9, 1.7	7, 8a, (9)	6, 7, 9	7, 8a, 9, 10a
9	3.16	73.2	tt	11.1, 1.5	8a, 10(a)b	5, 7, 10, 11	5, 7, 8b, 10a
10a	1.14	43.5	m	-	(9), 10b, 11	(5), 7, 8, 11, 12, 25	8b, 9, 10b, (12), (25)
10b	1.52	-	ddd	13.9, 11.0, 2.8	9, (11), 10a	9, 11, 12, 25	(8a), 10a, 11, 25
11	2.48	34.1	m	-	10a, 12, 25	9, 10, 12, 13, (25)	9, 10b, (12), 13, 25
12	5.32	141.3	dd	14.9, 9.7	11, 13	10, 11, 14, 25	(9), 10a, (11), 13, 14, 25
13	6.10	124.9	dd	14.9, 11.0	12, 14	11, 14, 15	(3), 11, 12, 16(a)b, (21)
14	6.00	130.6	ddt	11.0, 10.9, 1.5	(10ab), 13, 15	12, 13, 16	12, 15, 16b
15	5.20	126.2	m	-	14, 16ab	13, 16, 17	13, 14, 16ab, 17, 26
16a	2.08	31.0	ddd	14.6, 5.9, 1.9	15, 16b, 17	(13), 14, 15, 17, 18	13, 15, 16b, 17, 21, 26
16b	2.25	-	dddd	14.7, 9.0, 7.5, 1.4	(14), 15, 16a, 17	14, 15, 17, 18	13, (14), 15, 16a, 17, 19a, 26
17	3.99	81.8	dt	7.3, 6.2	18, 16ab	15, 19, 20, 26	16ab, 18, 20, (26)
18	2.46	36.9	m	-	17, 19ab, 26	16, 17, 20, 26	(15), 17, 19(a)b, 20, 26
19a	1.26	36.4	m	-	18, 19b, 20	18, (20), 21, 26	(18), 19b, 26
19b	2.09	-	ddd	12.3, 7.1, 7.1	(18), 19a, 20	18, 20, 21, 26	18, 19a, 20, 21
20	3.74	82.1	m	-	19ab, 21	17, 19, 21, 22	17, 18, 19(a)b, 21, (22b)
21	3.46	73.3	dddd	9.1, 7.6, 2.8, 1.6	20, 22ab, OH1	20, 22, 23	(3), 19a, 20, 22ab, 23, (26), OH1
22a	1.55	34.7	ddd	14.7, 9.2, 2.1	21, 22b, (23)	20, 21, 24	21, 22b, 24ab
22b	1.88	-	dddt	14.4, 11.5, 1.4	21, 22a, 23	20, 23, 24	19a(b), 21, 22a, 24ab
23	5.23	73.9	dddd	11.2, 5.3, 2.8, 2.7	22(a)b, 24ab	(1), 22	21, 22ab, 24ab
24a	3.65	65.7	m	-	23, 24b	22, 23	22ab, 23, 24b
24b	3.79	-	m	-	23, 24a	22, 23	22a(b), 23, 24a
25	0.98	22.0	d	6.8	11	10, 11, 12	10ab, 11, 12
26	0.98	14.9	d	7.0	18	17, 18, 19	16a(b), (15), (17), 18
1'	4.99	94.1	d	1.2	2'	2', 3', 5', 7	2', 7', 6b, 7
2'	3.38	80.9	dd	3.8, 1.5	1', 3'	3', 4', 7'	1', 3', 7'
3'	3.68	71.6	td	9.7, 3.8	2', 4', OH3	1', 4'	2', 5', OH3, OH4
4'	3.33	74.2	td	9.5, 1.9	3', 5', OH4	3', 5', 6', 7'	5', 6', OH3, OH4
5'	3.61	68.2	dq	9.4, 6.2	4', 6'	1', 3', 4', 6'	3', 4', 6'
6'	1.26	17.7	d	6.2	5'	4', 5'	4', 5', 7'
7'	3.44	59.1	s	-		2'	2', 6', OH3
OHa	2.74-2.72	-	br s	-	21	21,22	
OHb	2.40-2.36	-	m	-			
OHc	2.42-2.35	-	m	-	3'	3'	
OHd	2.48-2.44	-	m	-	4'	4'	

Table 5: Comparison of the ^{1}H and ^{13}C NMR data of **1** and 11-*epi*-**1** with the data of the natural sample.[20,21]

	putative Mandelalide A (**1**)		Natural Product		11-*epi*-**1**	
atom n°	**^{1}H/ppm**	**^{13}C/ppm**	**^{1}H/ppm**	**^{13}C/ppm**	**^{1}H/ppm**	**^{13}C/ppm**
1	--	167.3	-	167.5[22]	--	166.8
2	5.92	123.1	6.01	123.1	5.92	123.6
3	7.02	146.3	6.97	147.1	7.09	146.1
4a	2.34	38.5	2.36	38.8	2.31	39.5
4b	2.46	--	2.39	-	2.39	-
5	3.42	73.4	3.36	73.9	3.26	73.9
6a	1.26	36.7	1.20	37.6	1.15	38.2
6b	1.94	--	2.02	--	1.98	-
7	3.77	72.8	3.82	73.1	3.76	72.7
8a	1.22	39.3	1.22	39.7	1.27	39.2
8b	1.84	--	1.87	--	1.75	-
9	3.33	73.1	3.32	72.5	3.16	73.2
10a	1.27	42.9	1.21	43.1	1.14	43.5
10b	1.69	--	1.51	-	1.52	-
11	2.44	32.8	2.37	34.2	2.48	34.1
12	5.61	140.9	5.45	141.5	5.32	141.3
13	6.22	123.8	6.28	123.9	6.10	124.9
14	6.01	130.5	6.05	131.3	6.00	130.6
15	5.27	126.5	5.28	126.9	5.20	126.2
16a	2.14	31.2	1.88	31.1	2.08	31.0
16b	2.29	--	2.28	-	2.25	-
17	4.03	81.3	3.98	81.0	3.99	81.8
18	2.43	37.1	2.52	37.4[22]	2.46	36.9
19a	1.28	36.0	1.17	36.8	1.26	36.4
19b	2.04	--	2.01	-	2.09	-
20	3.71	82.7	3.63	83.2	3.74	82.1
21	3.45	73.4	3.42	73.0	3.46	73.3
22a	1.54	34.1	1.46	34.1	1.55	34.7
22b	1.77	--	1.76	-	1.88	-
23	5.24	72.5	5.23	72.3	5.23	74.0
24a	3.65	65.7	3.61	66.1	3.65	65.7
24b	3.78	--	3.81	-	3.79	-
25	1.00	20.1	0.85	18.3	0.98	22.0
26	0.98	14.7	1.03	14.5	0.98	14.9
1'	5.02	94.0	5.02	94.2	4.99	94.1
2'	3.40	80.9	3.40	80.8	3.38	80.9
3'	3.69	71.7	3.68	71.7	3.68	71.6
4'	3.34	74.2	3.34	74.3	3.33	74.2
5'	3.63	68.2	3.62	68.1	3.61	68.2
6'	1.28	17.7	1.27	17.7	1.26	17.7
7'	3.46	59.2	3.45	59.1	3.44	59.1
OH1	2.56-2.33				2.74-2.72	-
OH2	2.56-2.33				2.40-2.36	-
OH3	2.44-2.34		2.24		2.42-2.35	-
OH4	2.78-2.64		1.54		2.48-2.44	-

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[21] J. Sikorska, Andrew M. Hau, C. Anklin, S. Parker-Nance, M. T. Davies-Coleman, J. E. Ishmael, K. L. McPhail, *J. Org. Chem.* **2012**, *77*, 6066-6075.

[22] The indicated value was taken from the spectra contained in the SI of Ref. 21 rather than from Table 1 in the printed communication, since an error of ≈0.1 ppm was noticed (for example for C1: 167.47 in the spectra, 167.4 in the table)

Table 5: Comparison of the ^{1}H NMR data of **1** and 11-*epi*-**1** with the data of the natural product (NP); Δ = chemical shift differences (in ppm), as indicated.[20,21]

atom n°	**1**	**natural product**	11-*epi*-**1**	**Δ (1–NP)**	**Δ (11-*epi*-1 – NP)**
1	--	-	--	--	--
2	5.92	6.01	5.92	-0.09	-0.09
3	7.02	6.97	7.09	0.05	0.12
4a	2.34	2.36	2.31	-0.02	-0.05
4b	2.46	2.39	2.39	0.07	0.00
5	3.42	3.36	3.26	0.06	-0.10
6a	1.26	1.20	1.15	0.06	-0.05
6b	1.94	2.02	1.98	-0.08	-0.04
7	3.77	3.82	3.76	-0.05	-0.06
8a	1.22	1.22	1.27	0.00	0.05
8b	1.84	1.87	1.75	-0.03	-0.12
9	3.33	3.32	3.16	0.01	-0.16
10a	1.27	1.21	1.14	0.06	-0.07
10b	1.69	1.51	1.52	0.18	0.01
11	2.44	2.37	2.48	0.07	0.11
12	5.61	5.45	5.32	0.16	-0.13
13	6.22	6.28	6.10	-0.06	-0.18
14	6.01	6.05	6.00	-0.04	-0.05
15	5.27	5.28	5.20	-0.01	-0.08
16a	2.14	1.88	2.08	0.26	0.20
16b	2.29	2.28	2.25	0.01	-0.03
17	4.03	3.98	3.99	0.05	0.01
18	2.43	2.52	2.46	-0.09	-0.06
19a	1.28	1.17	1.26	0.11	0.09
19b	2.04	2.01	2.09	0.03	0.08
20	3.71	3.63	3.74	0.08	0.11
21	3.45	3.42	3.46	0.03	0.04
22a	1.54	1.46	1.55	0.08	0.09
22b	1.77	1.76	1.88	0.01	0.12
23	5.24	5.23	5.23	0.01	0.00
24a	3.65	3.61	3.65	0.04	0.04
24b	3.78	3.81	3.79	-0.03	-0.02
25	1.00	0.85	0.98	0.15	0.13
26	0.98	1.03	0.98	-0.05	-0.05
1'	5.02	5.02	4.99	0.00	-0.03
2'	3.40	3.40	3.38	0.00	-0.02
3'	3.69	3.68	3.68	0.01	0.00
4'	3.34	3.34	3.33	0.00	-0.01
5'	3.63	3.62	3.61	0.01	-0.01
6'	1.28	1.27	1.26	0.01	-0.01
7'	3.46	3.45	3.44	0.01	-0.01

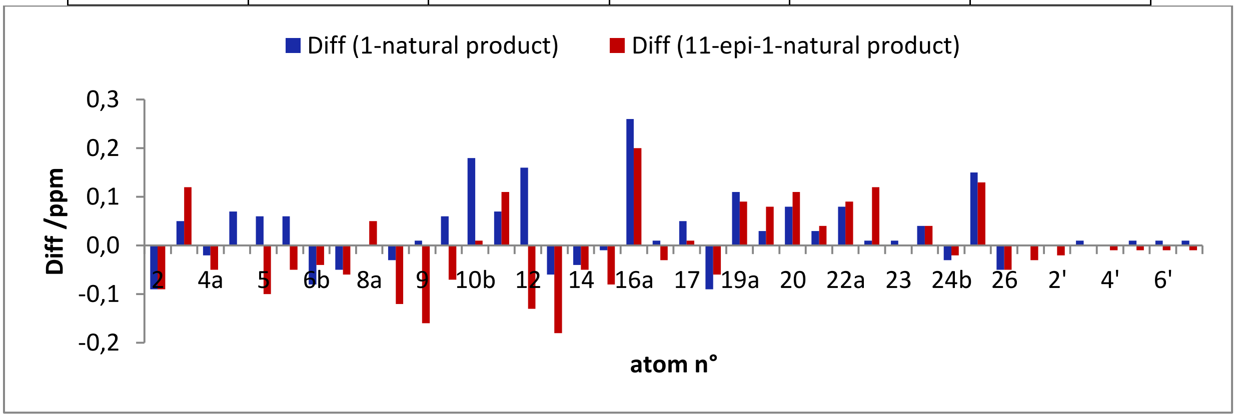
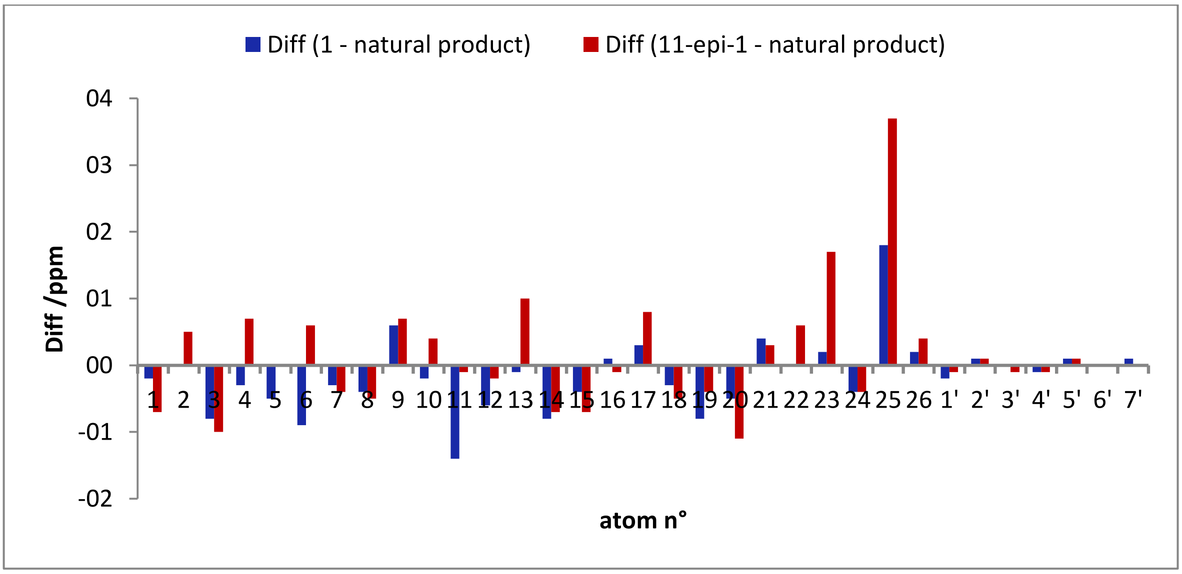
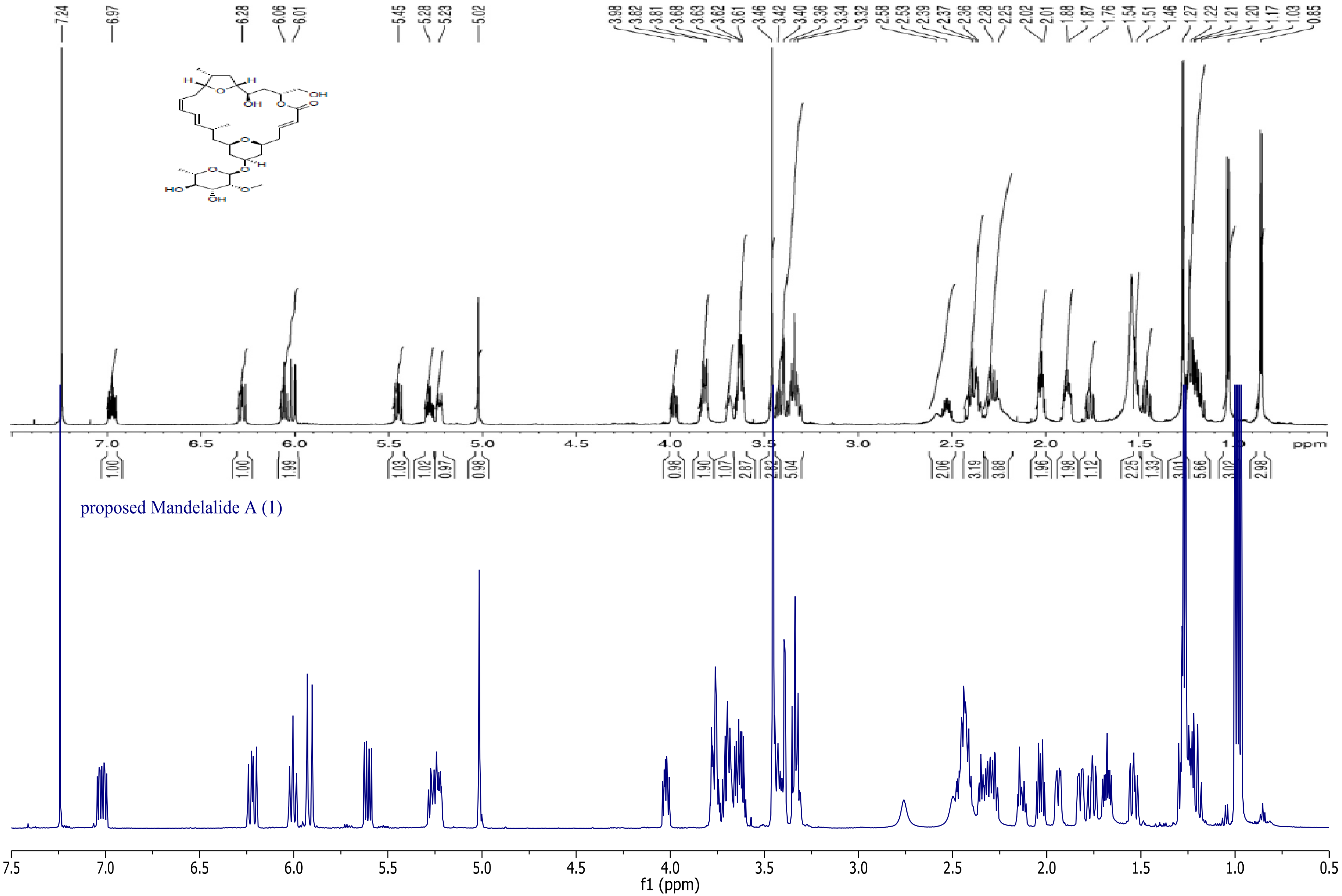


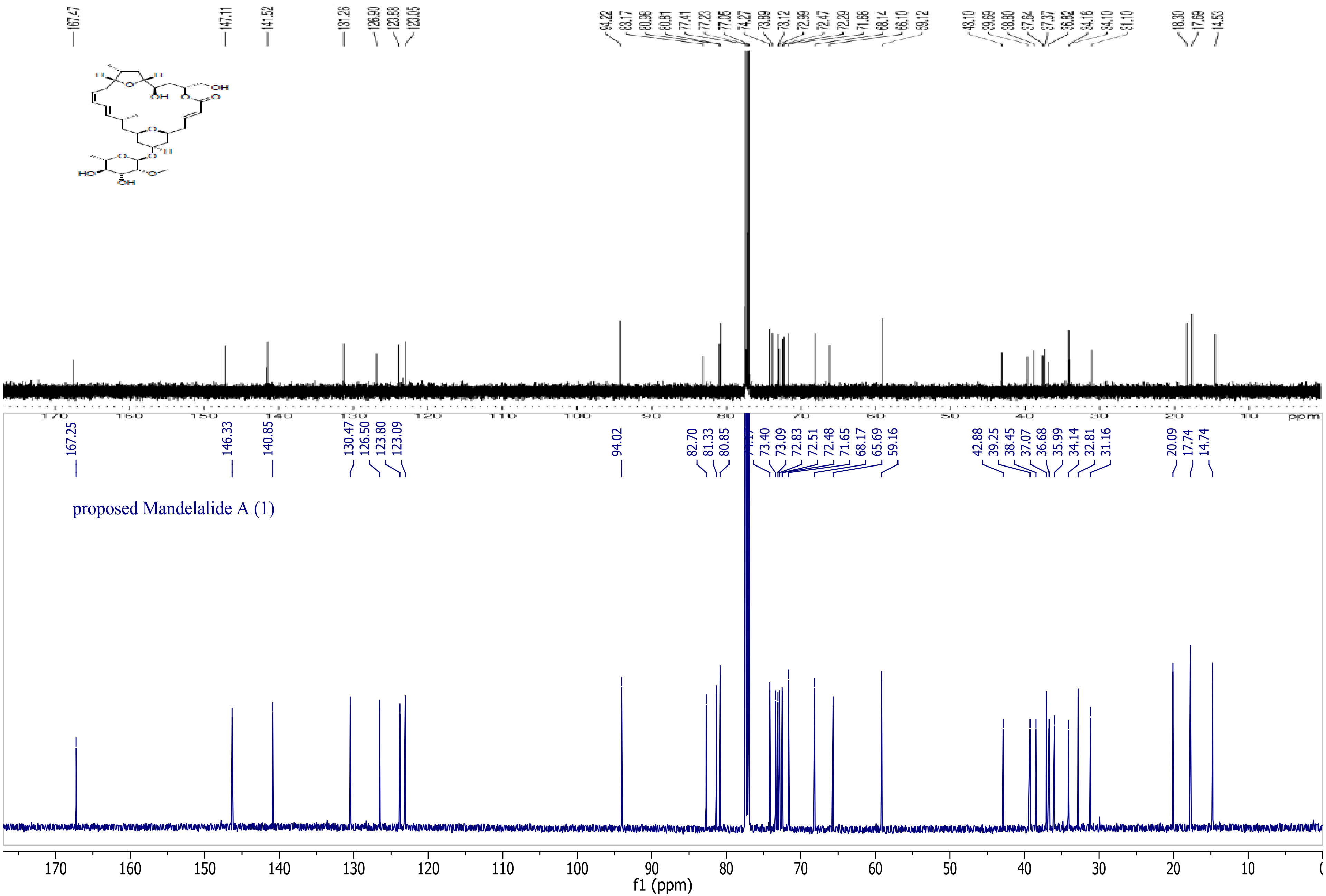
Table 6: Comparison of the ^{13}C data of **1** and 11-*epi*-**1** with the data of the natural product (NP); Δ = chemical shift differences (in ppm), as indicated.[20,21]

atom n°	**1**	**natural product**	11-*epi*-**1**	**Δ (1 – NP)**	**Δ (11-*epi*-1 – NP)**
1	167.3	167.5	166.8	-0.2	-0.7
2	123.1	123.1	123.6	0.0	0.5
3	146.3	147.1	146.1	-0.8	-1.0
4	38.5	38.8	39.5	-0.3	0.7
5	73.4	73.9	73.9	-0.5	0.0
6	36.7	37.6	38.2	-0.9	0.6
7	72.8	73.1	72.7	-0.3	-0.4
8	39.3	39.7	39.2	-0.4	-0.5
9	73.1	72.5	73.2	0.6	0.7
10	42.9	43.1	43.5	-0.2	0.4
11	32.8	34.2	34.1	**-1.4**	-0.1
12	140.9	141.5	141.3	-0.6	-0.2
13	123.8	123.9	124.9	-0.1	1.0
14	130.5	131.3	130.6	-0.8	-0.7
15	126.5	126.9	126.2	-0.4	-0.7
16	31.2	31.1	31.0	0.1	-0.1
17	81.3	81.0	81.8	0.3	0.8
18	37.1	37.4	36.9	-0.3	-0.5
19	36.0	36.8	36.4	-0.8	-0.4
20	82.7	83.2	82.1	-0.5	-1.1
21	73.4	73.0	73.3	0.4	0.3
22	34.1	34.1	34.7	0.0	0.6
23	72.5	72.3	74.0	0.2	1.7
24	65.7	66.1	65.7	-0.4	-0.4
25	20.1	18.3	22.0	**1.8**	3.7
26	14.7	14.5	14.9	0.2	0.4
1'	94.0	94.2	94.1	-0.2	-0.1
2'	80.9	80.8	80.9	0.1	0.1
3'	71.7	71.7	71.6	0.0	-0.1
4'	74.2	74.3	74.2	-0.1	-0.1
5'	68.2	68.1	68.2	0.1	0.1
6'	17.7	17.7	17.7	0.0	0.0
7'	59.2	59.1	59.1	0.1	0.0

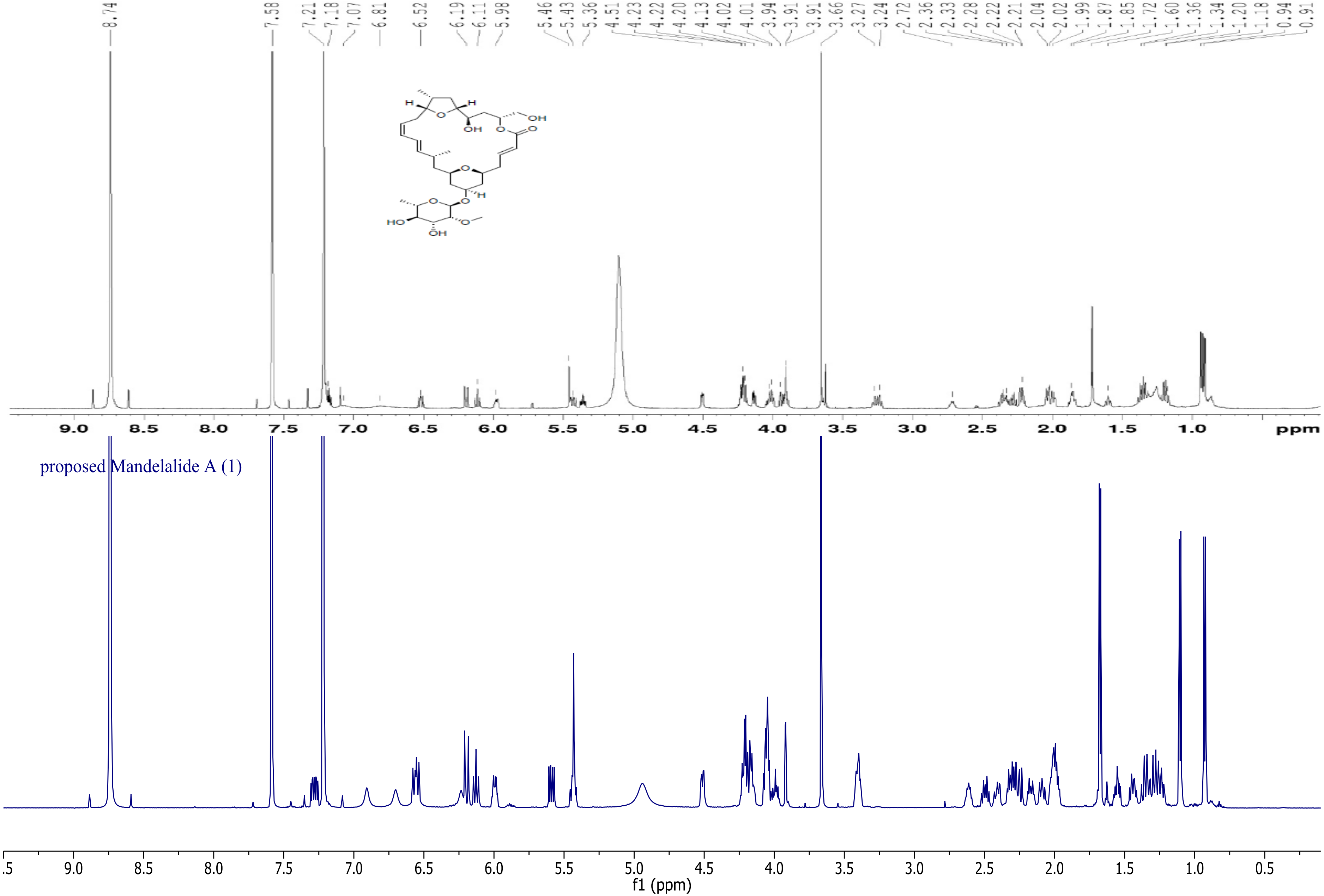


Comparison of the NMR spectra ($CDCl_3$) of putative Mandelalide A (1, 600 MHz, bottom) with those of the natural product (top, 700 MHz)

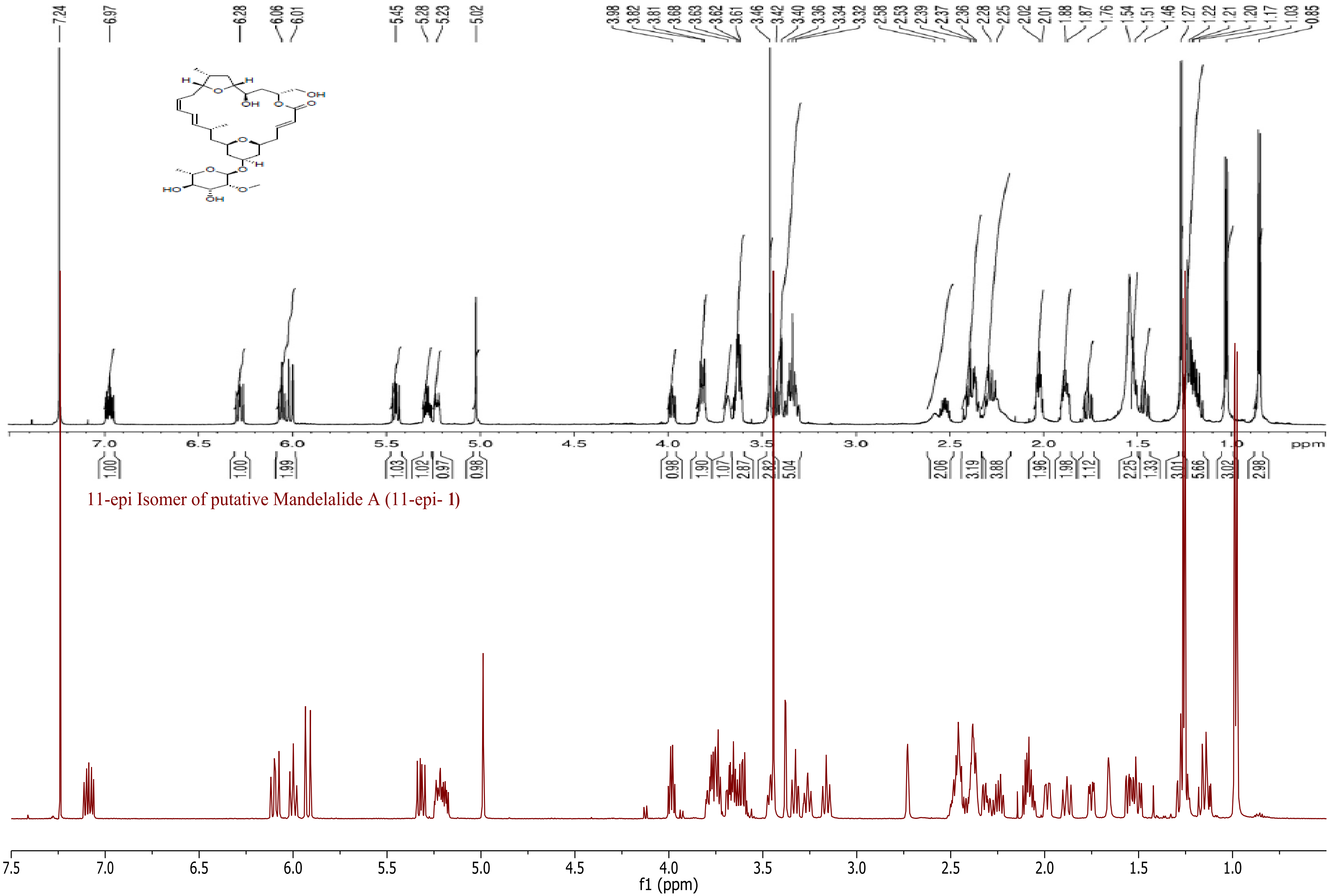


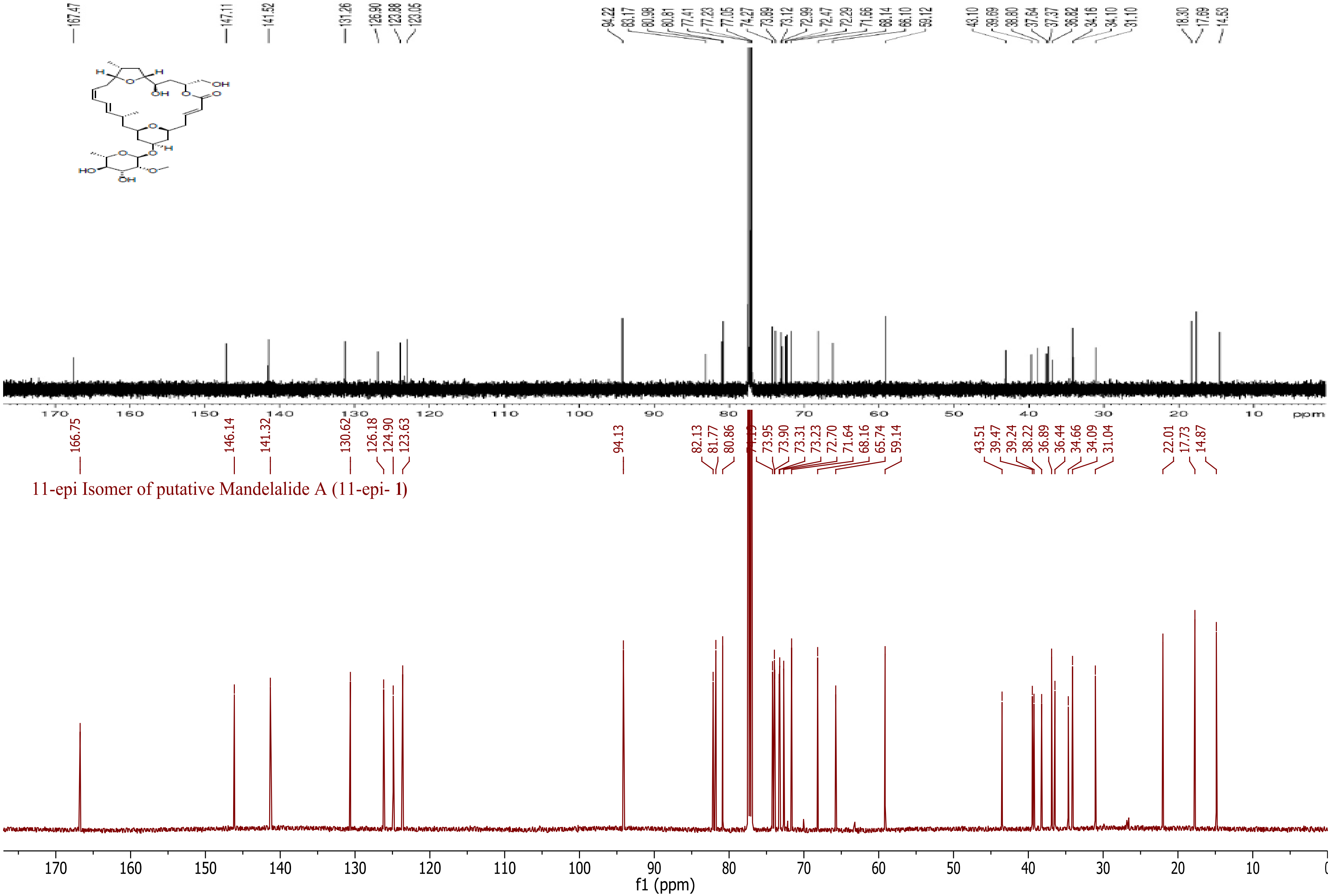

167.47
147.11
141.52
131.26
126.90
123.88
123.05
94.22
83.17
80.98
80.81
77.41
77.23
77.05
74.27
73.89
73.12
72.99
72.47
72.29
71.66
68.14
66.10
59.12
43.10
39.69
38.80
37.64
37.37
36.82
34.16
34.10
31.10
18.30
17.69
14.53
OH
O
H
O
O
H
HO
OH
O
ppm
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
167.25
146.33
140.85
130.47
126.50
123.80
123.09
94.02
82.70
81.33
80.85
73.40
73.09
72.83
72.51
72.48
71.65
68.17
65.69
59.16
42.88
39.25
38.45
37.07
36.68
35.99
34.14
32.81
31.16
20.09
17.74
14.74
proposed Mandelalide A (1)
f1 (ppm)

Comparison of the NMR spectra ([D_5]-pyridine) of putative Mandelalide A (1, 600 MHz, bottom) with that of the natural product (700 MHz, top)



Comparison of the NMR spectra ($CDCl_3$) of 11-*epi*-1 (600 MHz, , bottom) with those of natural product (top, 700 MHz)




167.47
147.11
141.52
131.26
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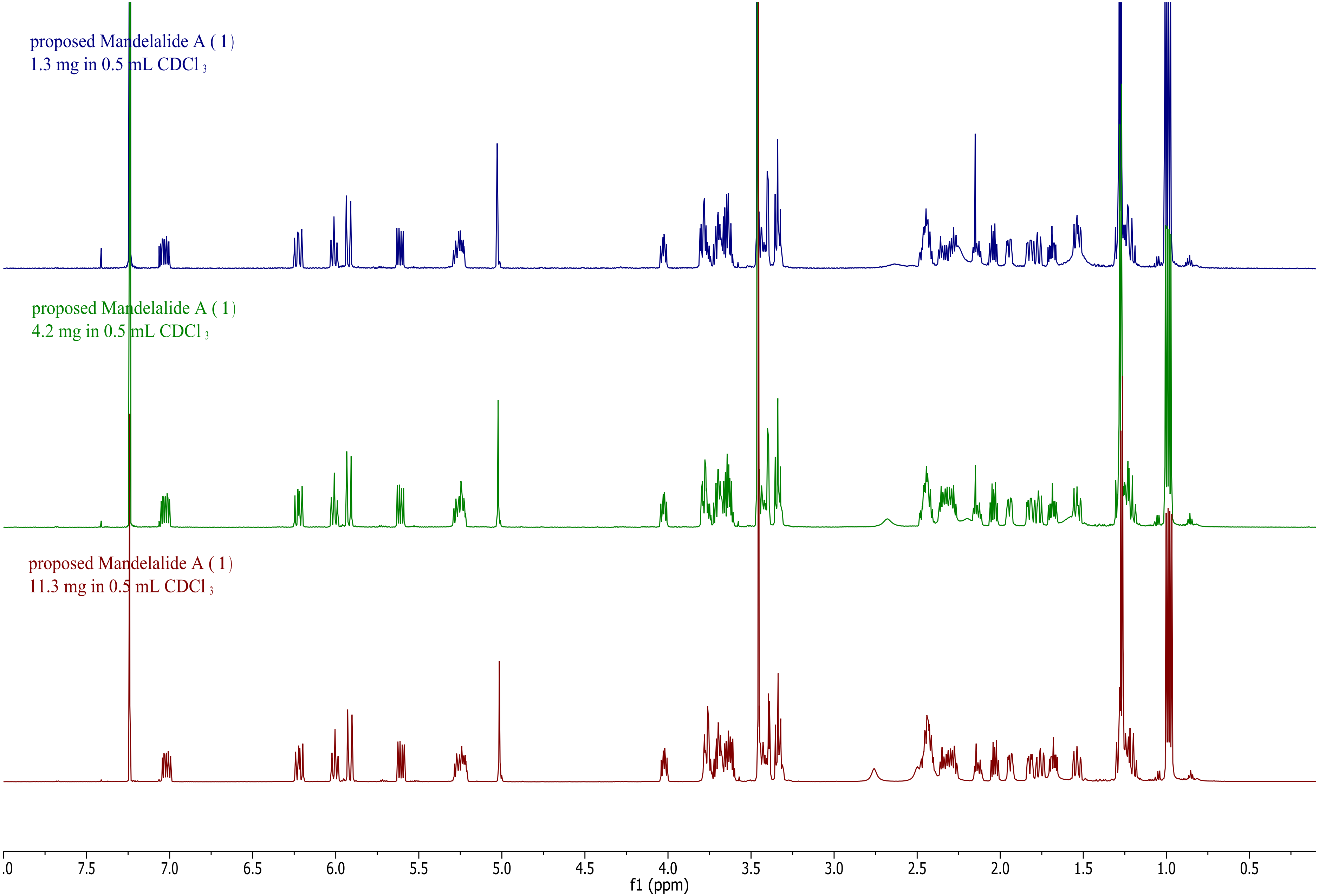
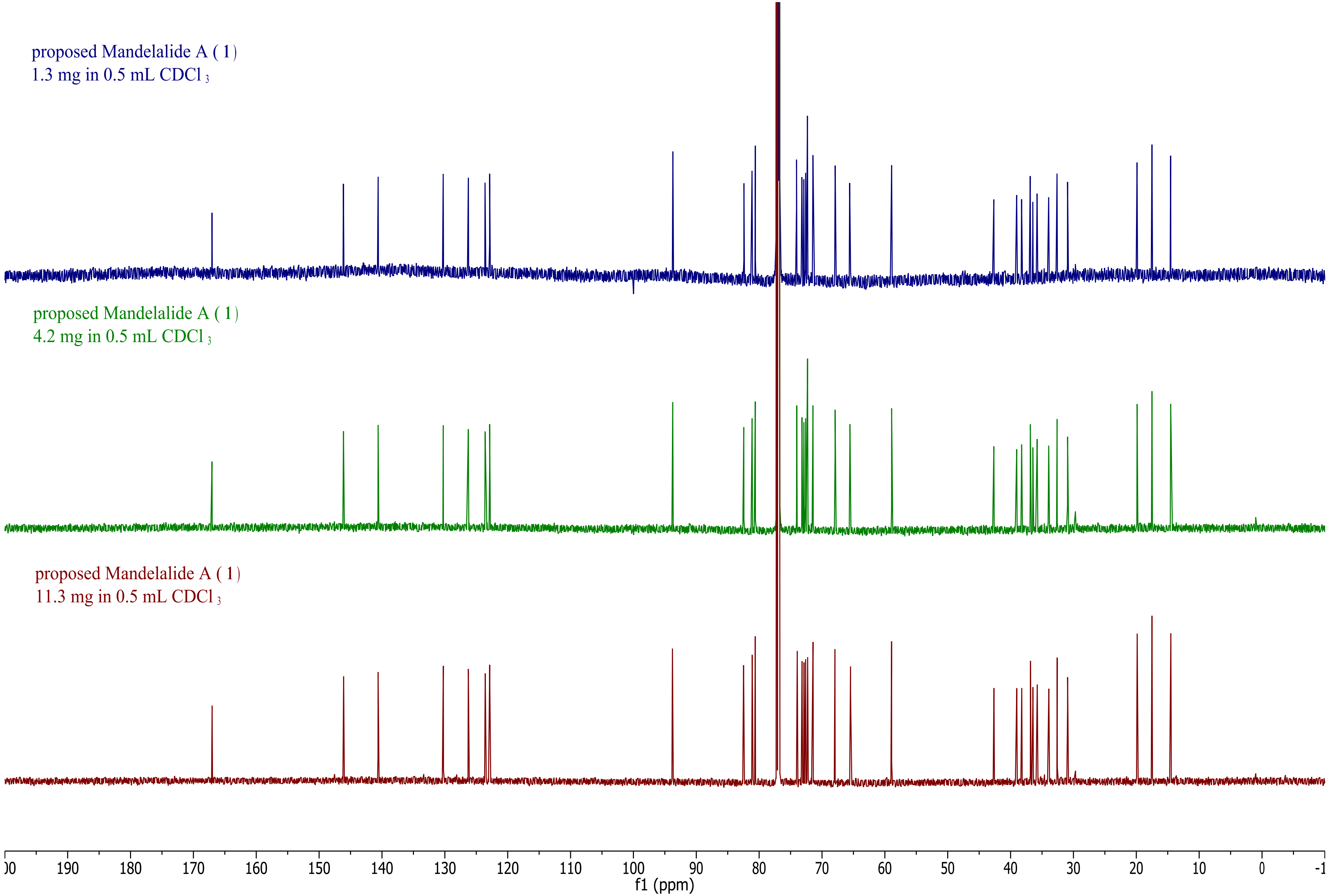
123.88
123.05
94.22
83.17
80.98
80.81
77.41
77.23
77.05
74.27
73.89
73.12
72.99
72.47
72.29
71.66
68.14
66.10
59.12
43.10
39.69
38.80
37.64
37.37
36.82
34.16
34.10
31.10
18.30
17.69
14.53
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm
166.75
146.14
141.32
130.62
126.18
124.90
123.63
94.13
82.13
81.77
80.86
73.95
73.90
73.31
73.23
72.70
71.64
68.16
65.74
59.14
43.51
39.47
39.24
38.22
36.89
36.44
34.66
34.09
31.04
22.01
17.73
14.87
11-epi Isomer of putative Mandelalide A (11-epi- 1)
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)
H
O
H
OH
O
O
OH
O
H
HO
OH
O

The spectra of putative Mandelalide A (1) in CDCl$_3$ (600 MHz) are not strongly concentration dependent:

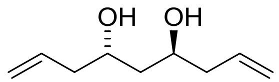




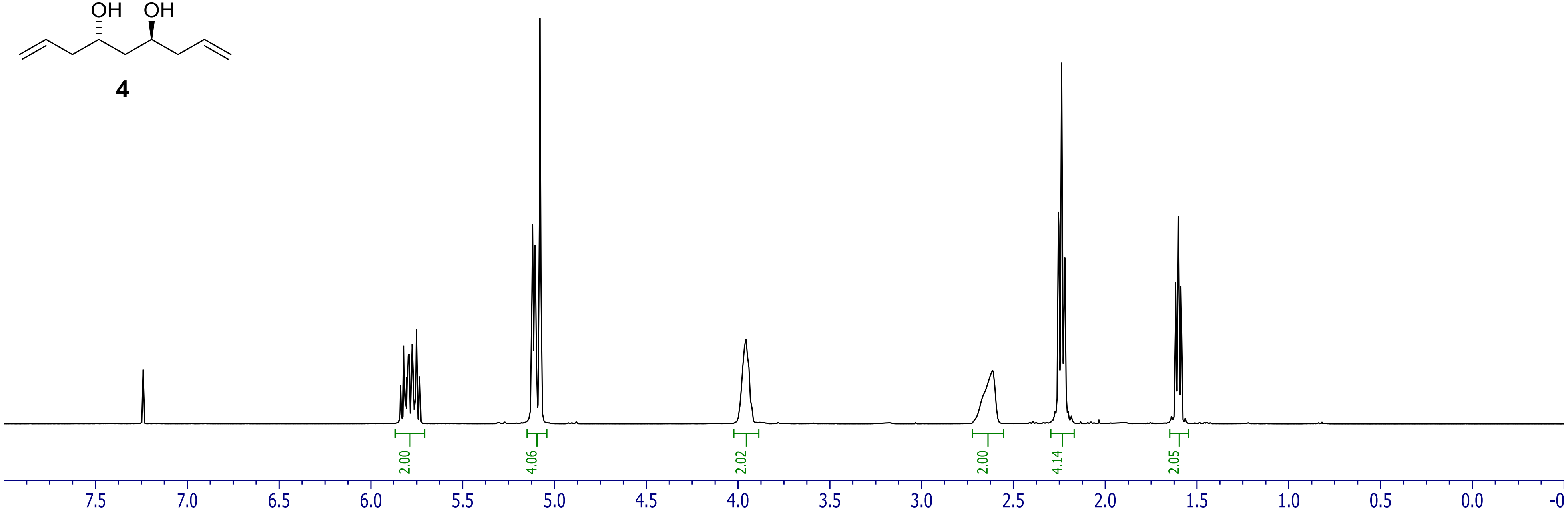
proposed Mandelalide A (1)
1.3 mg in 0.5 mL $CDCl_3$

proposed Mandelalide A (1)
4.2 mg in 0.5 mL $CDCl_3$

proposed Mandelalide A (1)
11.3 mg in 0.5 mL $CDCl_3$


OH
OH

4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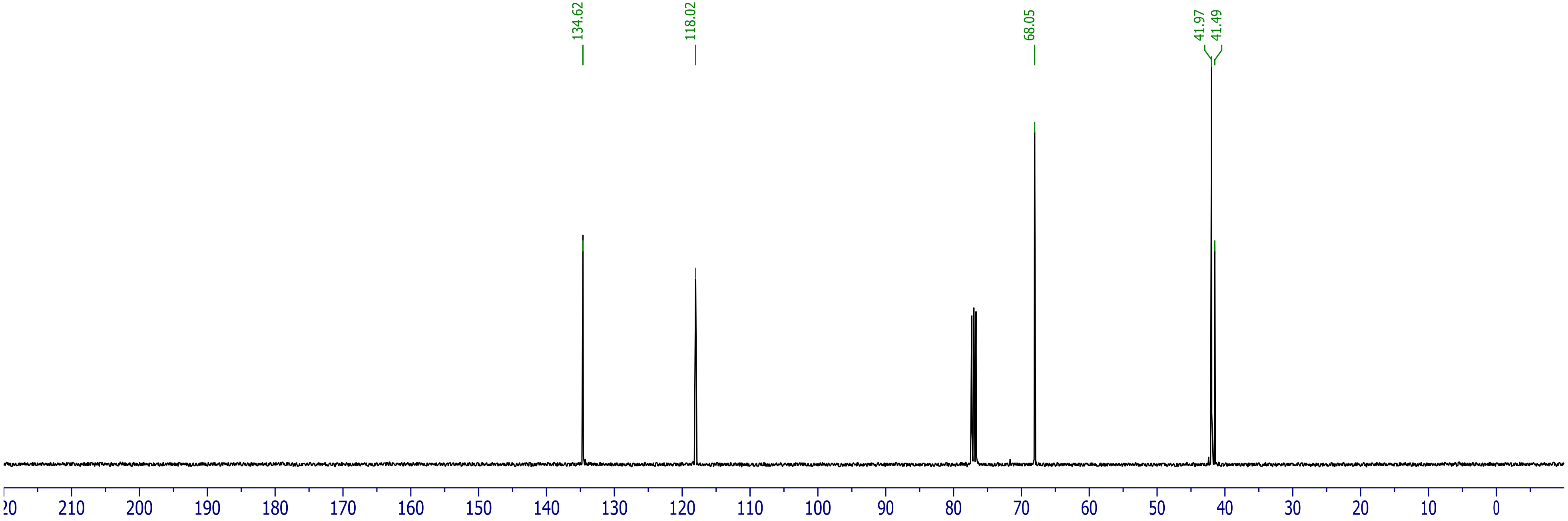
4.06
2.02
2.00
4.14
2.05
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0


134.62
118.02
68.05
41.97
41.49
20
210
200
190
180
170
160
150
140
130
120
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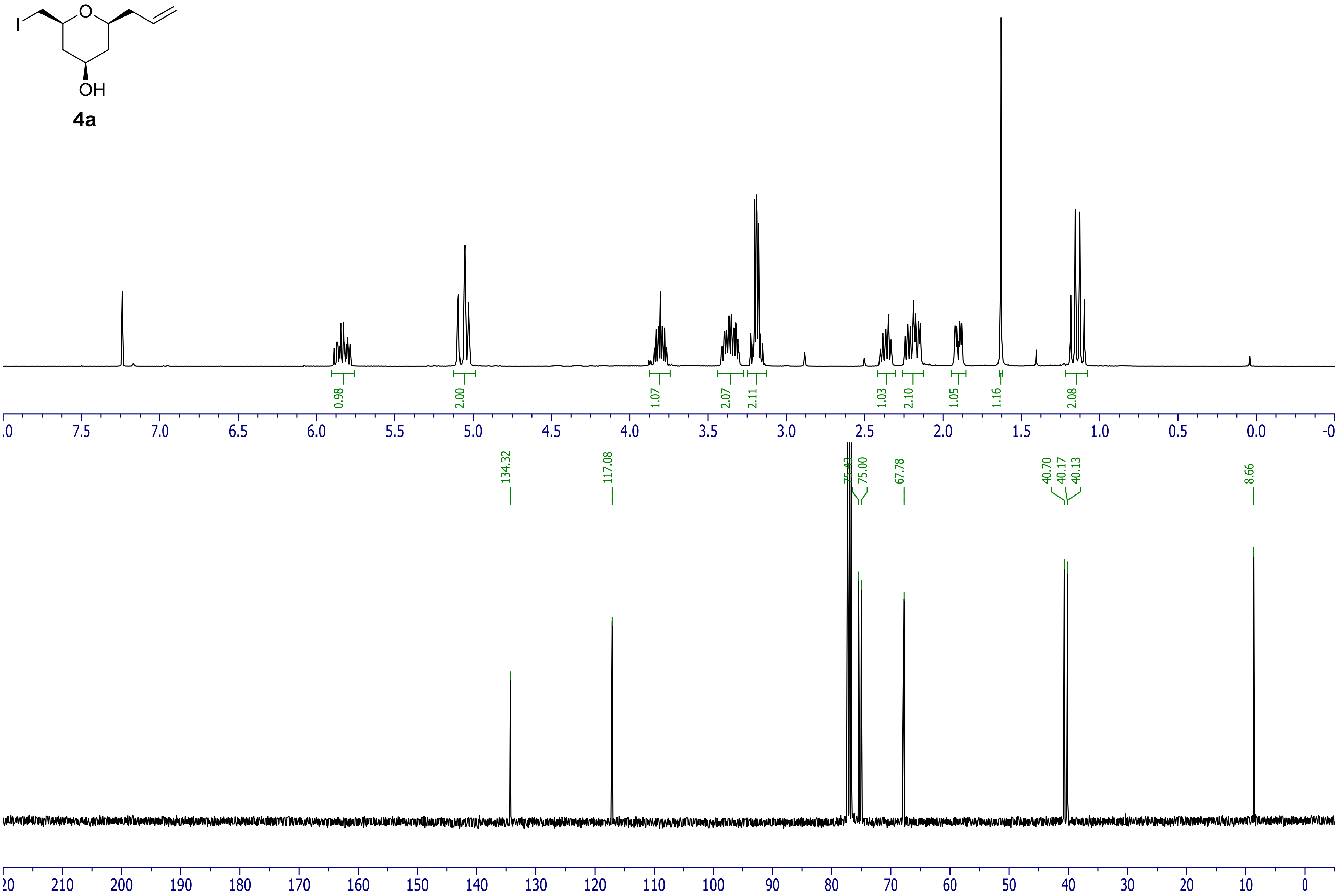
40
30
20
10
0



4a

I
O
OH
0.98
2.00
1.07
2.07
2.11
1.03
2.10
1.05
1.16
2.08
.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
134.32
117.08
75.43
75.00
67.78
40.70
40.17
40.13
8.66
20
210
200
190
180
170
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150
140
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100
90
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70
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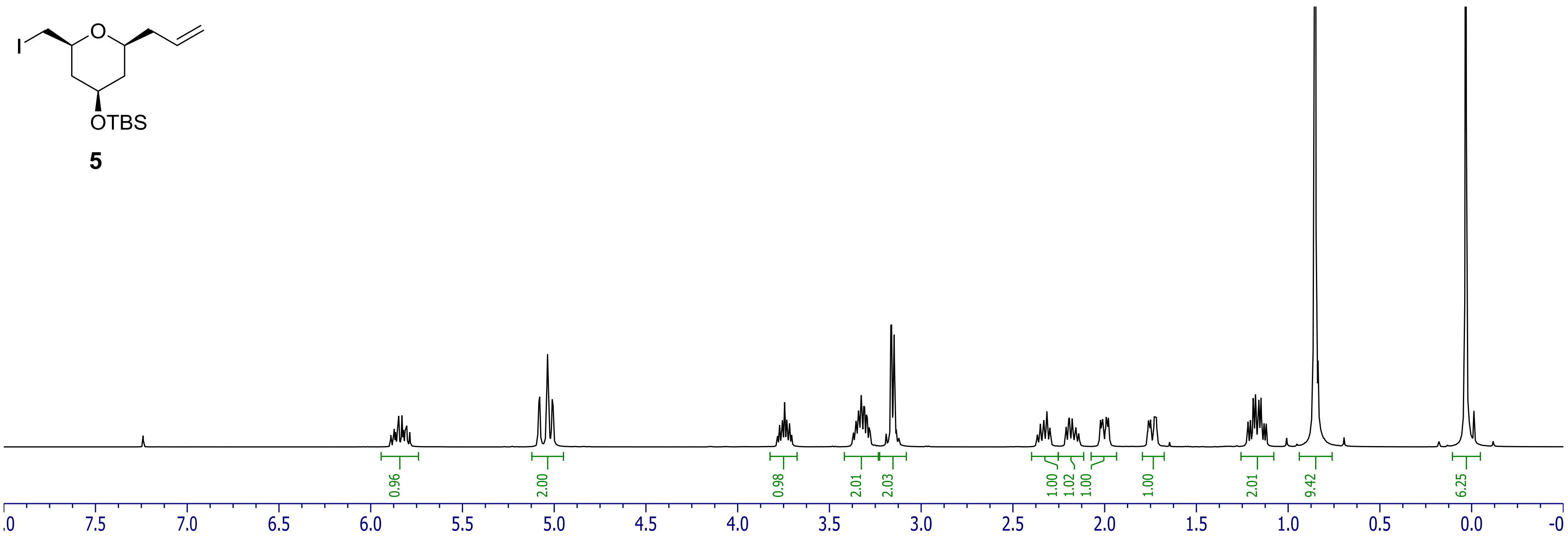
50
40
30
20
10
0


I
O
OTBS

5

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2.00
0.98
2.01
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1.02
1.00
1.00
2.01
9.42
6.25
.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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3.0
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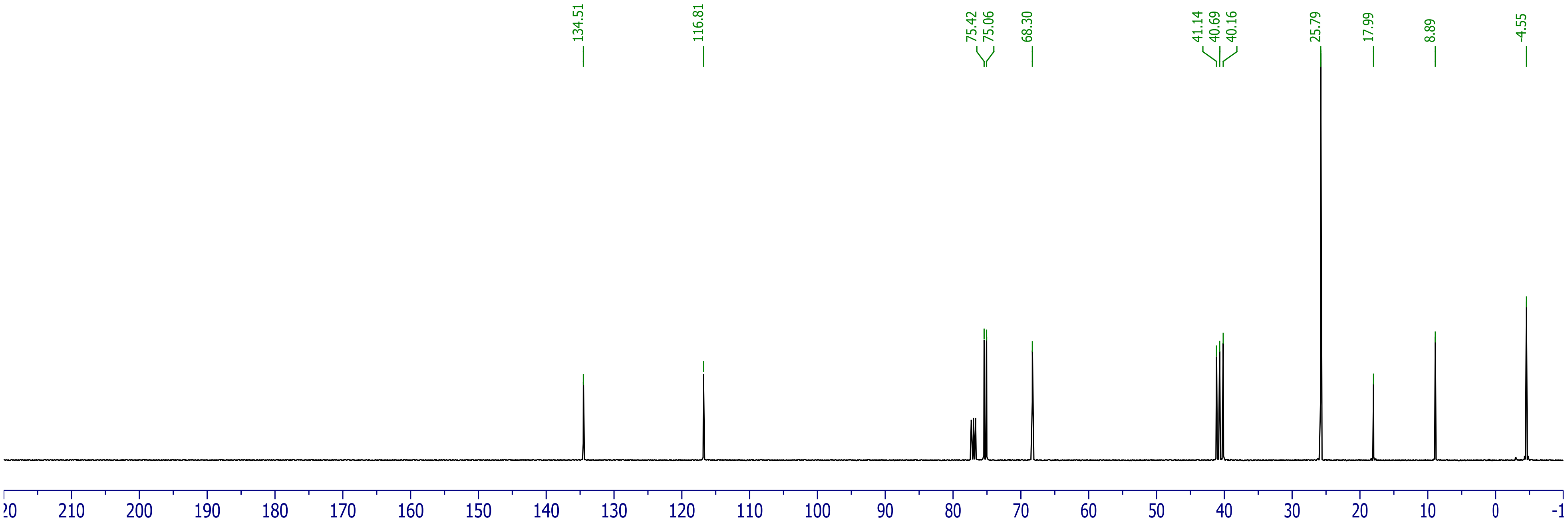
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-4.55
20
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200
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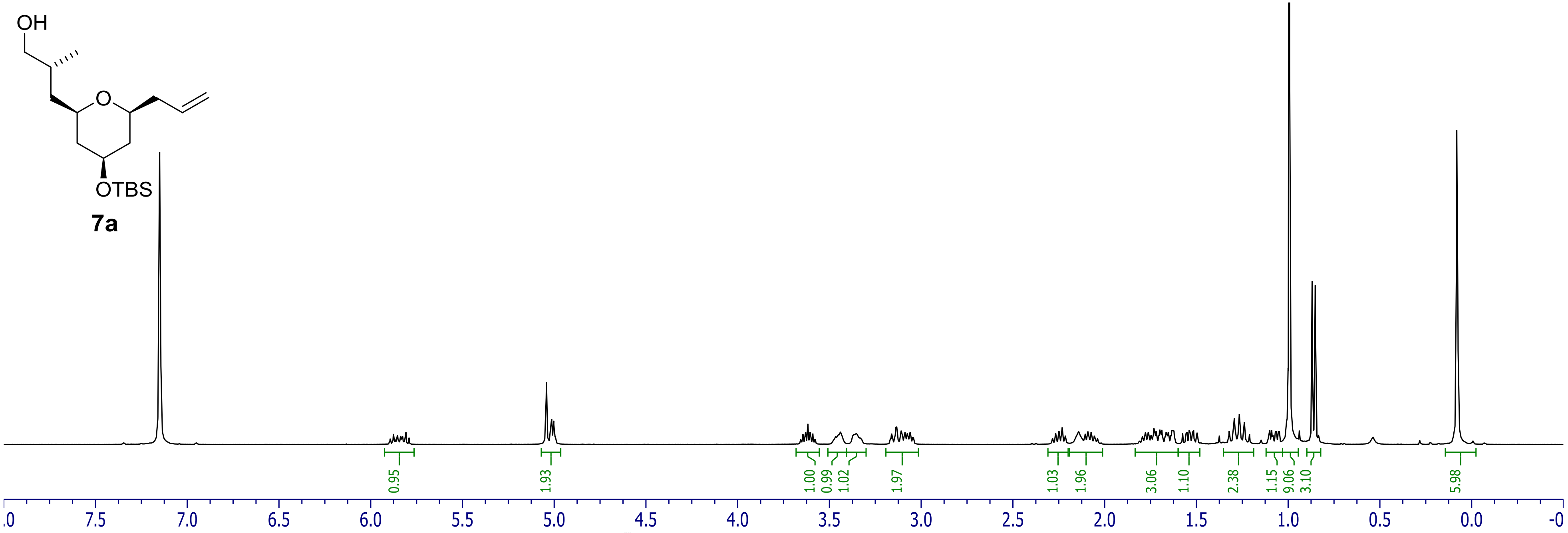

OH
O
OTBS
7a
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1.02
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1.03
1.96
3.06
1.10
2.38
1.15
9.06
3.10
5.98
.0
7.5
7.0
6.5
6.0
5.5
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3.5
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1.5
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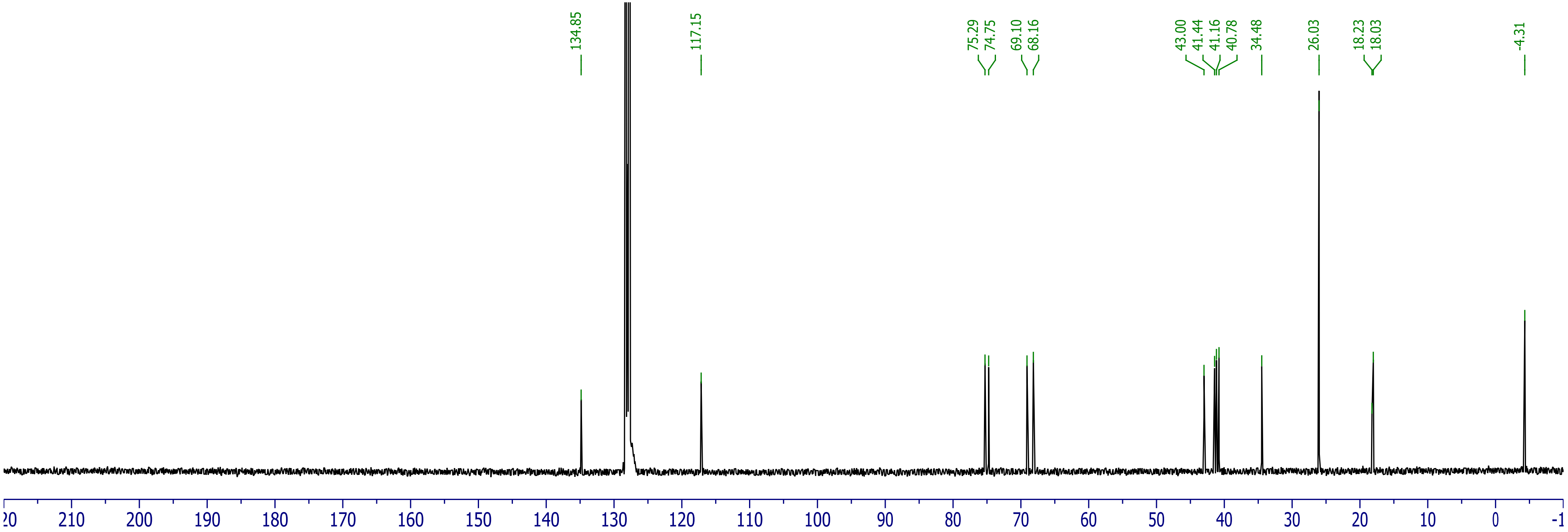
-0



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117.15
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74.75
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68.16
43.00
41.44
41.16
40.78
34.48
26.03
18.23
18.03
-4.31
20
210
200
190
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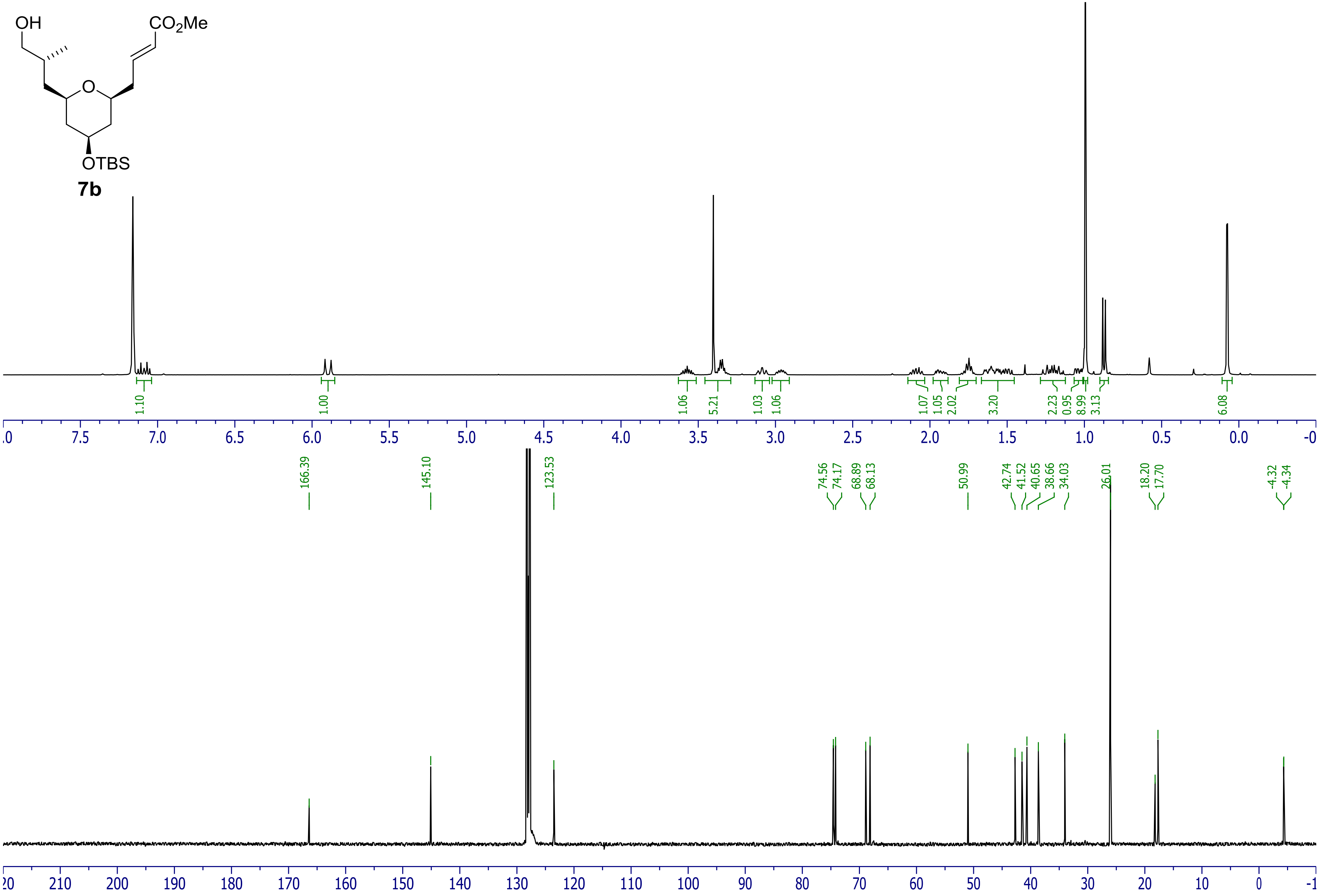
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CO2Me
O
OTBS
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1.07
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2.02
3.20
2.23
0.95
8.99
3.13
6.08
.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
166.39
145.10
123.53
74.56
74.17
68.89
68.13
50.99
42.74
41.52
40.65
38.66
34.03
26.01
18.20
17.70
-4.32
-4.34
20
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200
190
180
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120
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100
90
80
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40
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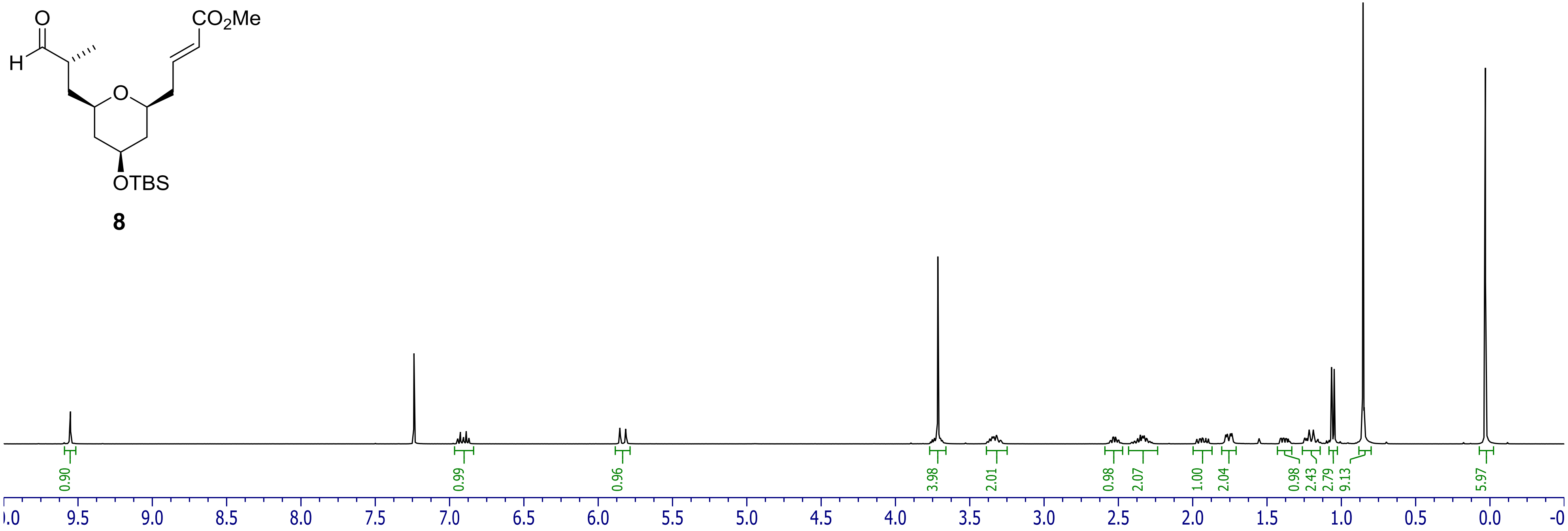
20
10
0
-1

7b


CO2Me
O
H
O
OTBS
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0.98
2.07
1.00
2.04
0.98
2.43
2.79
9.13
5.97
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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3.5
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2.5
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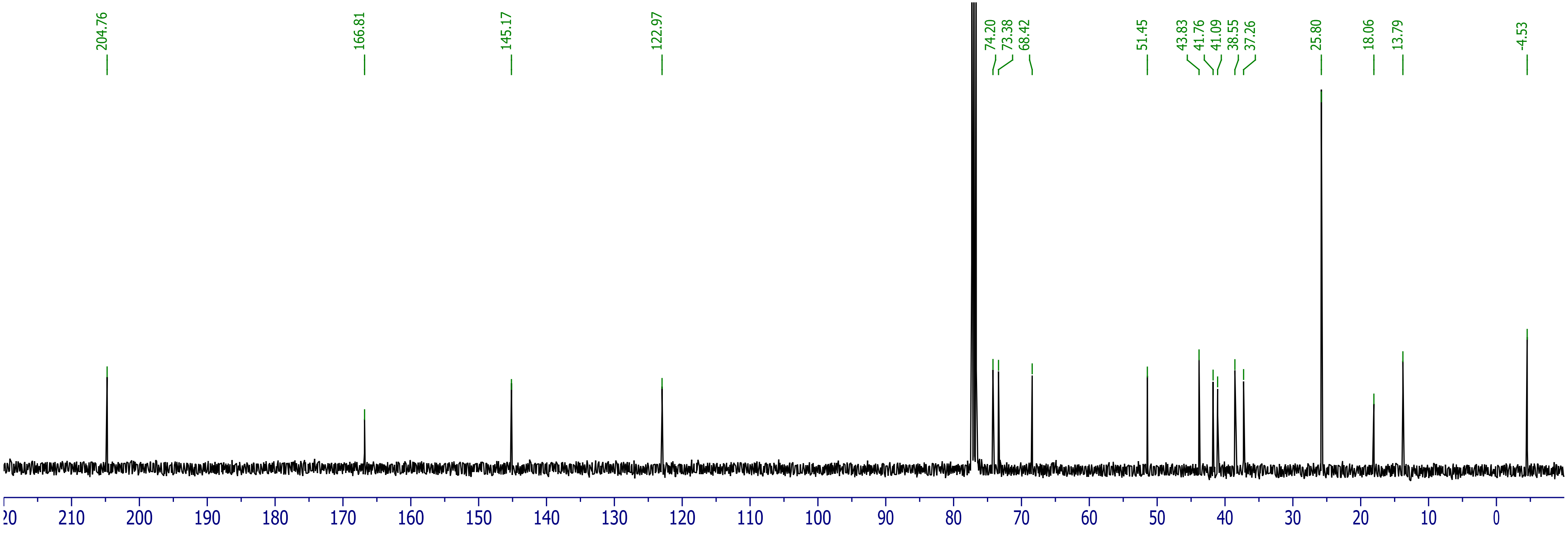
1.0
0.5
0.0
-0

8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73.38
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51.45
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41.76
41.09
38.55
37.26
25.80
18.06
13.79
-4.53
220
210
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150
140
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110
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90
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70
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30
20
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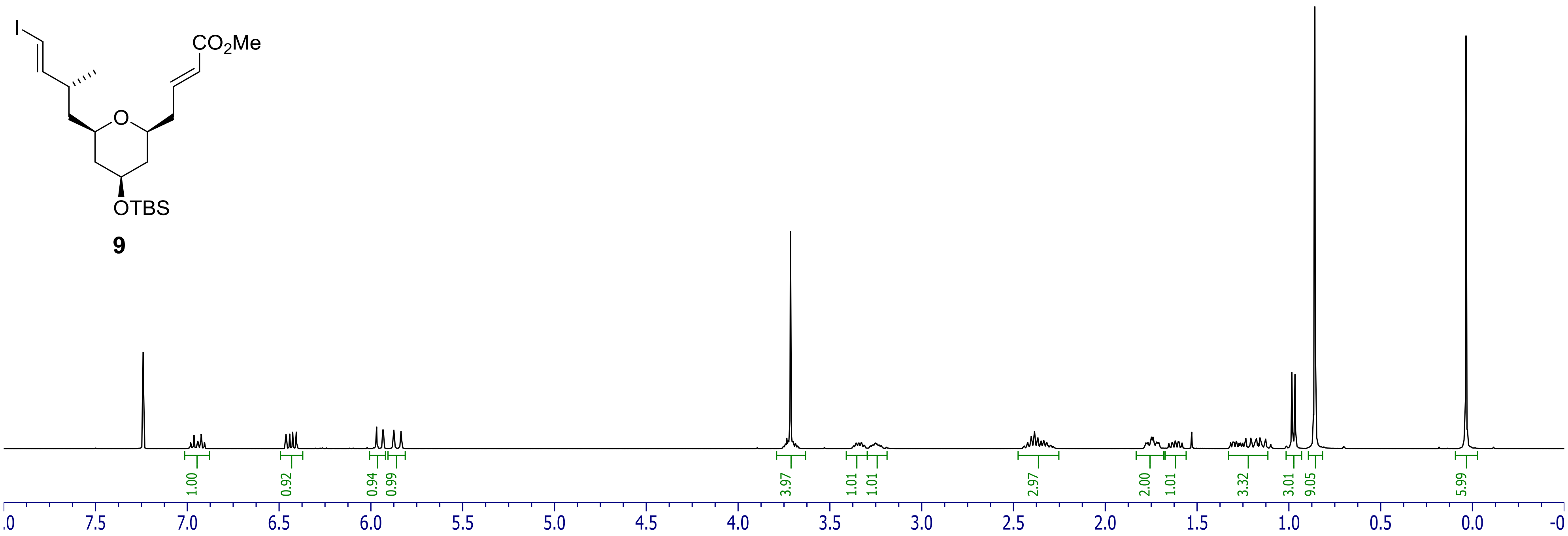
0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CO2Me
O
OTBS
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0.94
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3.97
1.01
1.01
2.97
2.00
1.01
3.32
3.01
9.05
5.99
7.5
7.0
6.5
6.0
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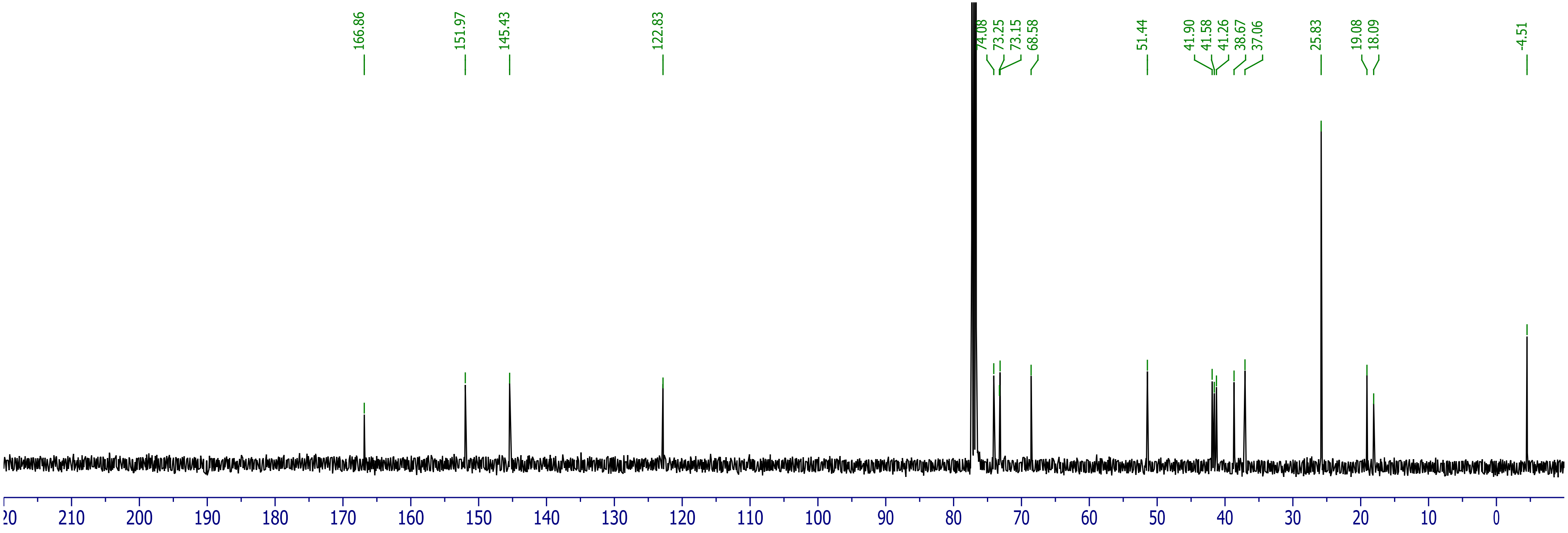
1.5
1.0
0.5
0.0

9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73.25
73.15
68.58
51.44
41.90
41.58
41.26
38.67
37.06
25.83
19.08
18.09
-4.51
210
200
190
180
170
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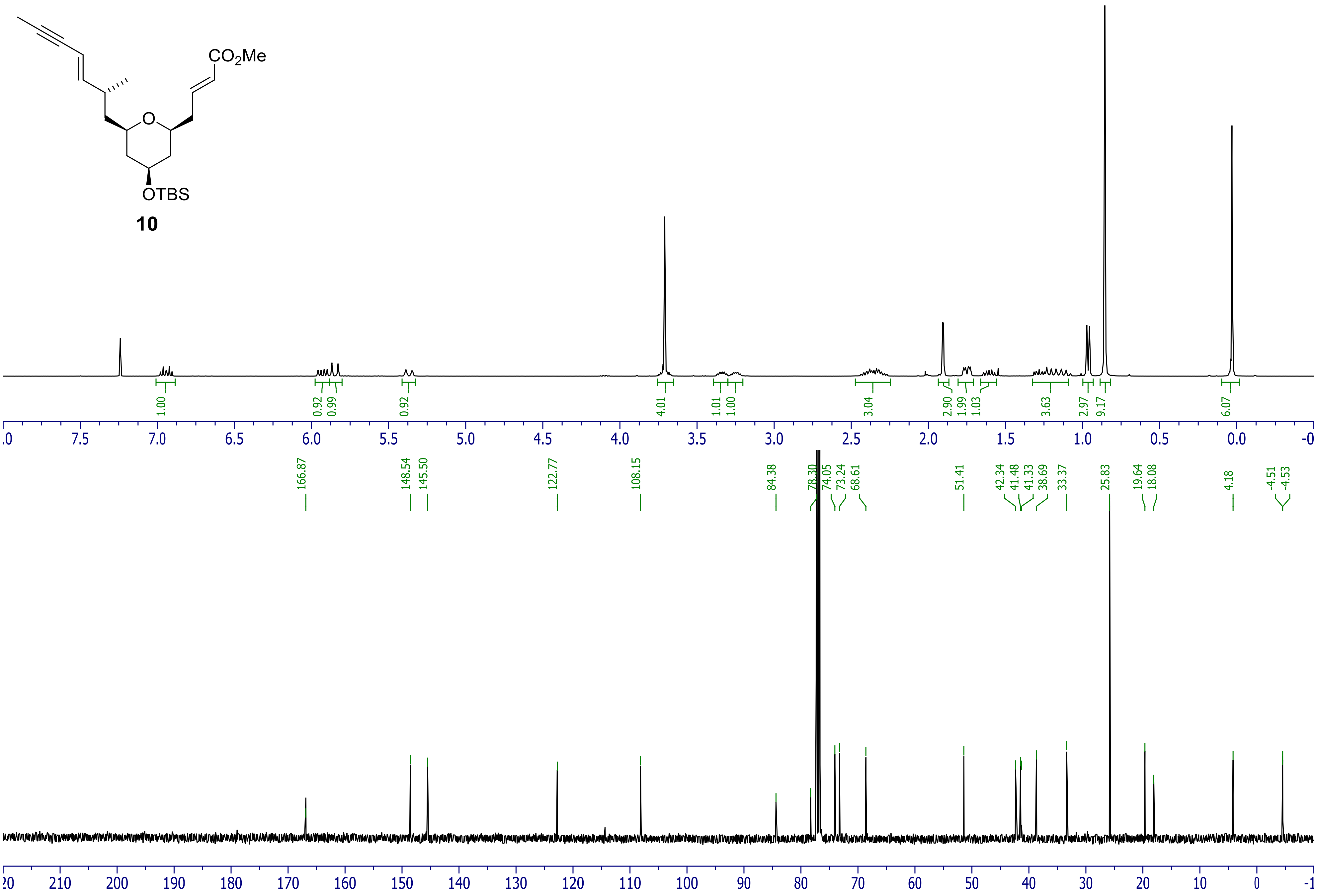
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0


CO2Me
O
OTBS
1.00
0.92
0.99
0.92
4.01
1.01
1.00
3.04
2.90
1.99
1.03
3.63
2.97
9.17
6.07
.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
166.87
148.54
145.50
122.77
108.15
84.38
78.30
74.05
73.24
68.61
51.41
42.34
41.48
41.33
38.69
33.37
25.83
19.64
18.08
4.18
-4.51
-4.53
20
210
200
190
180
170
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130
120
110
100
90
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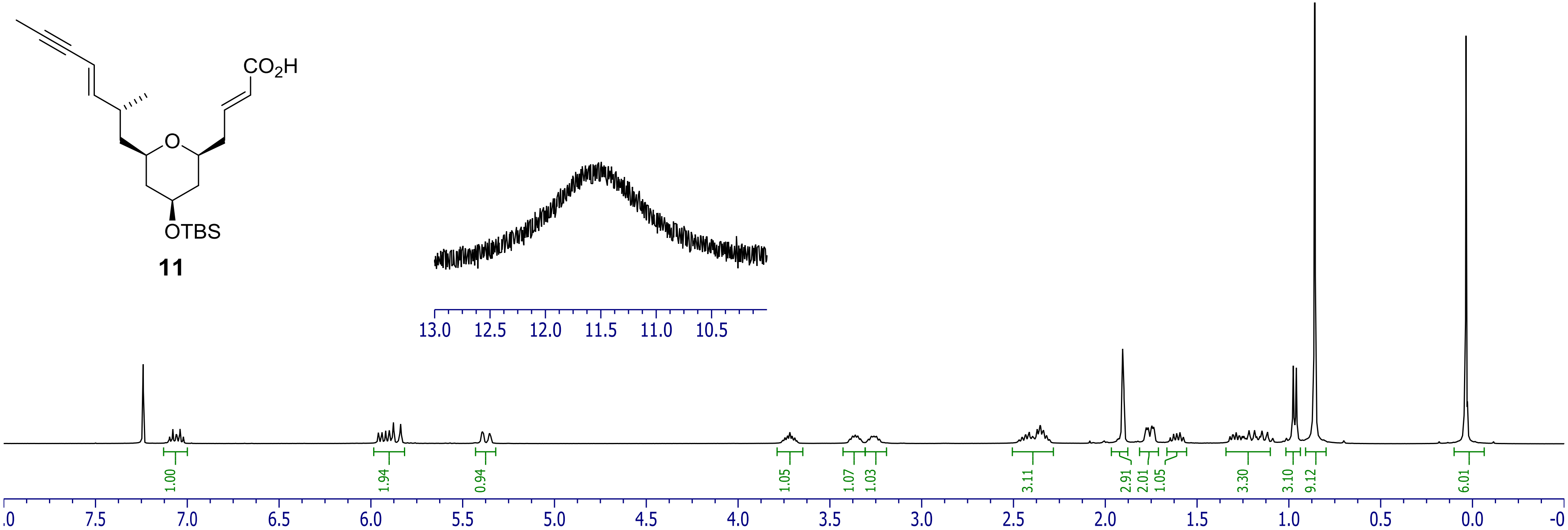
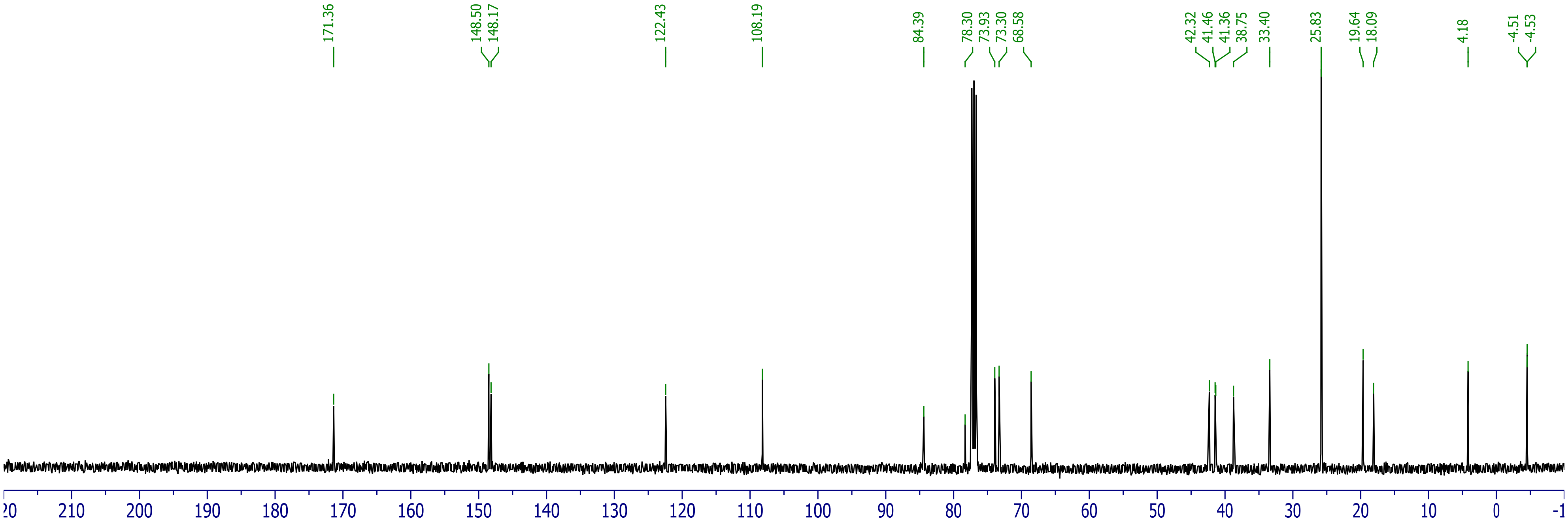
50
40
30
20
10
0
-1

10



11

CO2H
OTBS
13.0
12.5
12.0
11.5
11.0
10.5
1.00
1.94
0.94
1.05
1.07
1.03
3.11
2.91
2.01
1.05
3.30
3.10
9.12
6.01
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0



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148.17
122.43
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84.39
78.30
73.93
73.30
68.58
42.32
41.46
41.36
38.75
33.40
25.83
19.64
18.09
4.18
-4.51
-4.53
210
200
190
180
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150
140
130
120
110
100
90
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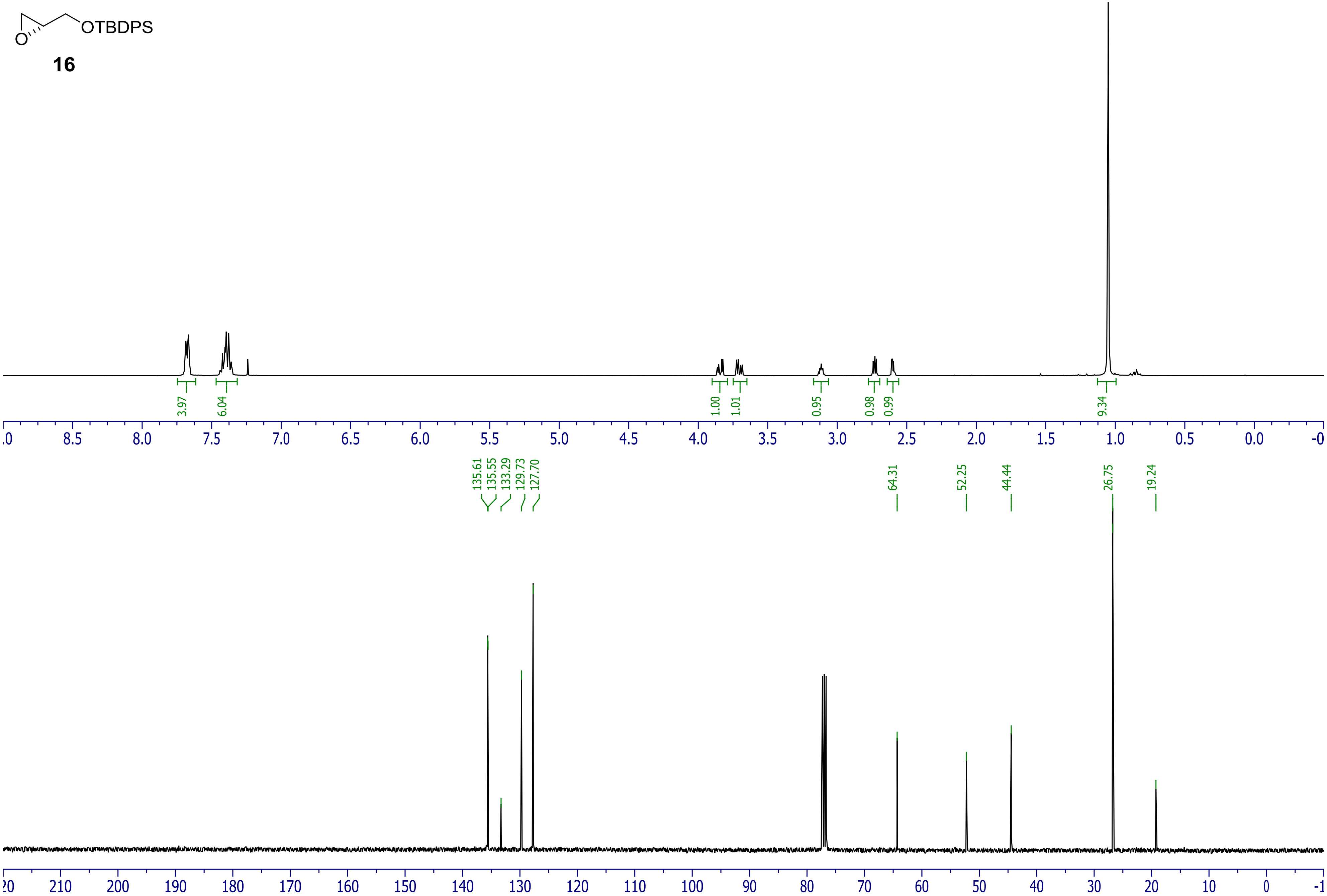
50
40
30
20
10
0



16

OTBDPS
O
3.97
6.04
1.00
1.01
0.95
0.98
0.99
9.34
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
135.61
135.55
133.29
129.73
127.70
64.31
52.25
44.44
26.75
19.24
210
200
190
180
170
160
150
140
130
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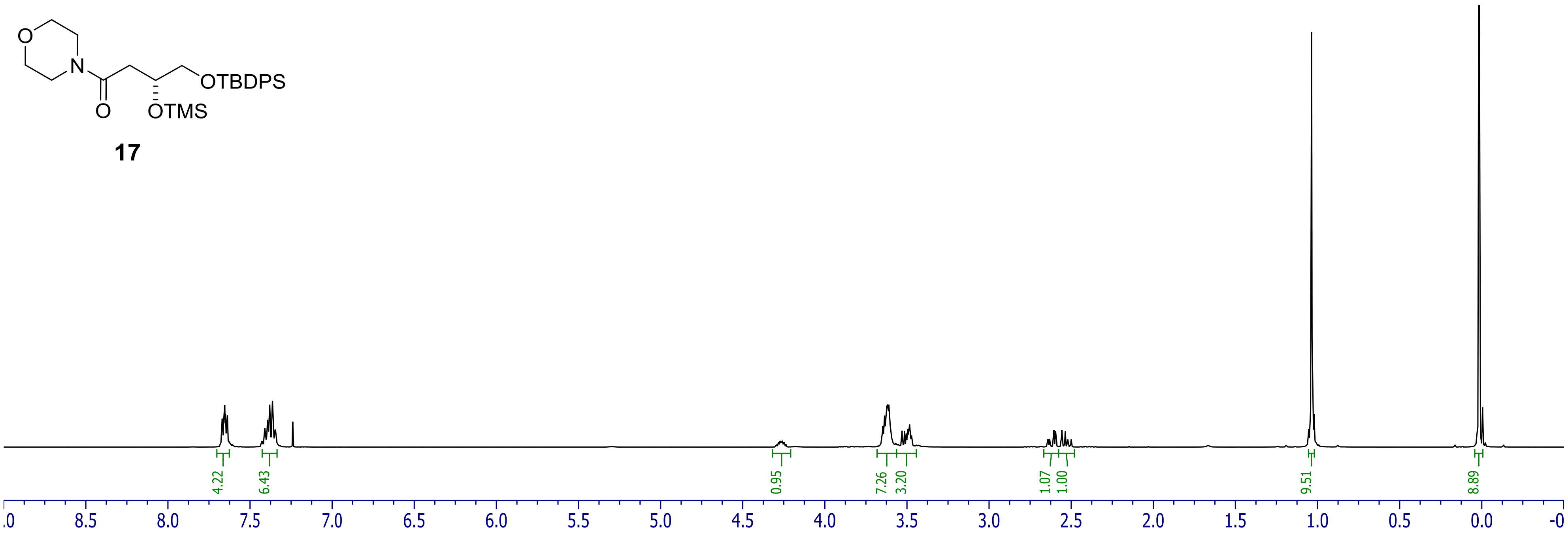
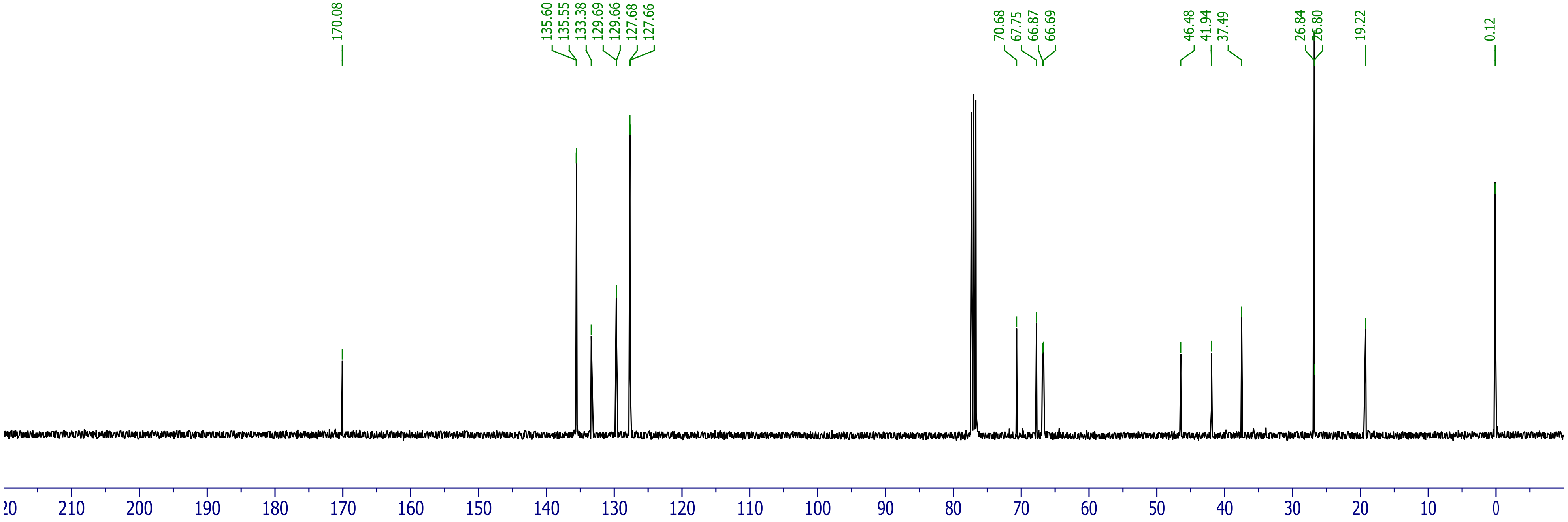
110
100
90
80
70
60
50
40
30
20
10
0


O
N
O
OTBDPS
OTMS

17

4.22
6.43
0.95
7.26
3.20
1.07
1.00
9.51
8.89
.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0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129.66
127.68
127.66
70.68
67.75
66.87
66.69
46.48
41.94
37.49
26.84
26.80
19.22
0.12
20
210
200
190
180
170
160
150
140
130
120
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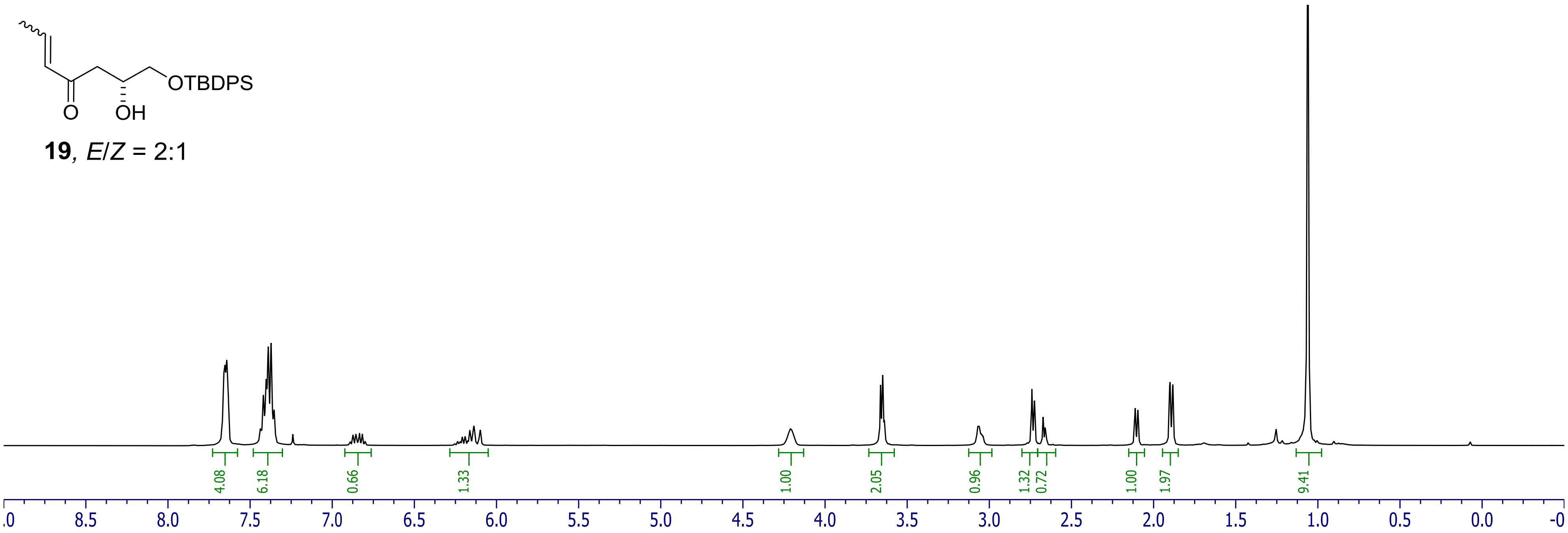
70
60
50
40
30
20
10
0

OTBDPS
O
OH

19, *E*/*Z* = 2:1


4.08
6.18
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1.33
1.00
2.05
0.96
1.32
0.72
1.00
1.97
9.41
.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
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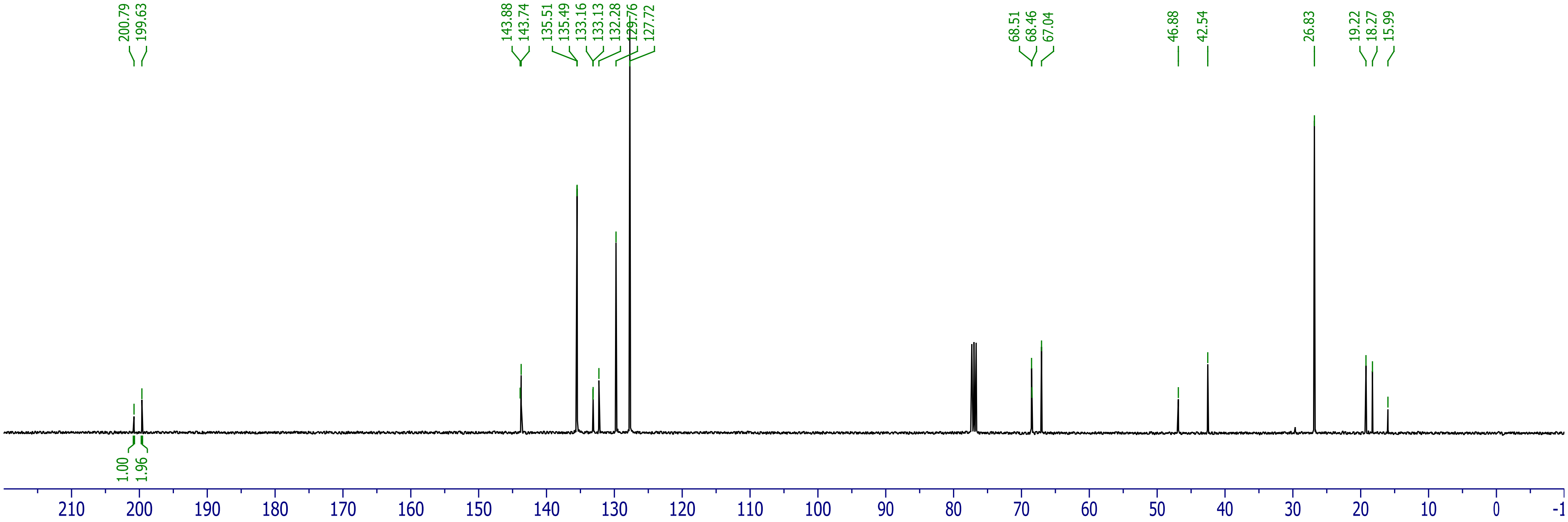
-0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199.63
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143.74
135.51
135.49
133.16
133.13
132.28
129.76
127.72
68.51
68.46
67.04
46.88
42.54
26.83
19.22
18.27
15.99
1.00
1.96
210
200
190
180
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130
120
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100
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80
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60
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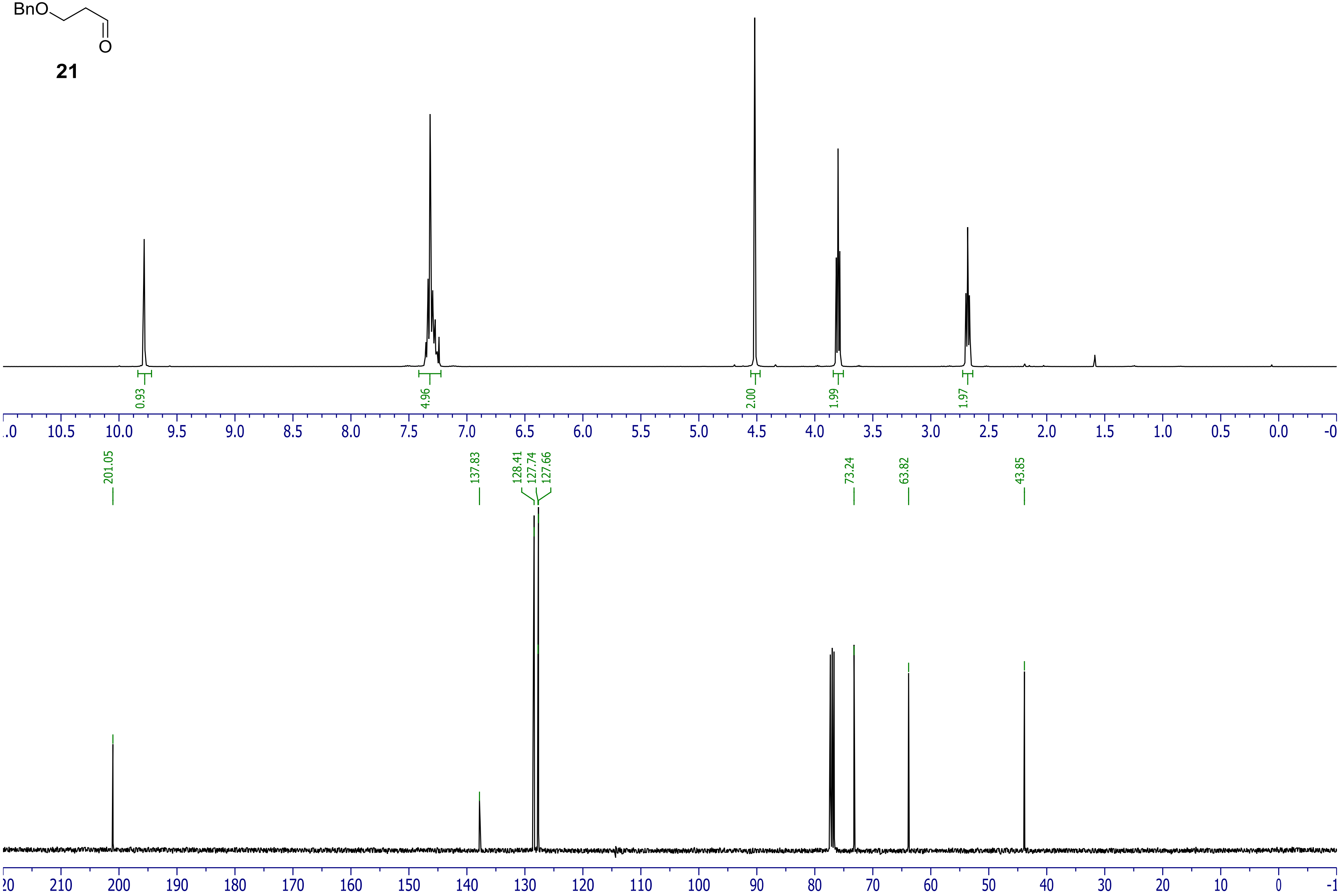
0
-1



21

BnO
O
0.93
4.96
2.00
1.99
1.97
.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
201.05
137.83
128.41
127.74
127.66
73.24
63.82
43.85
20
210
200
190
180
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160
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140
130
120
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100
90
80
70
60
50
40
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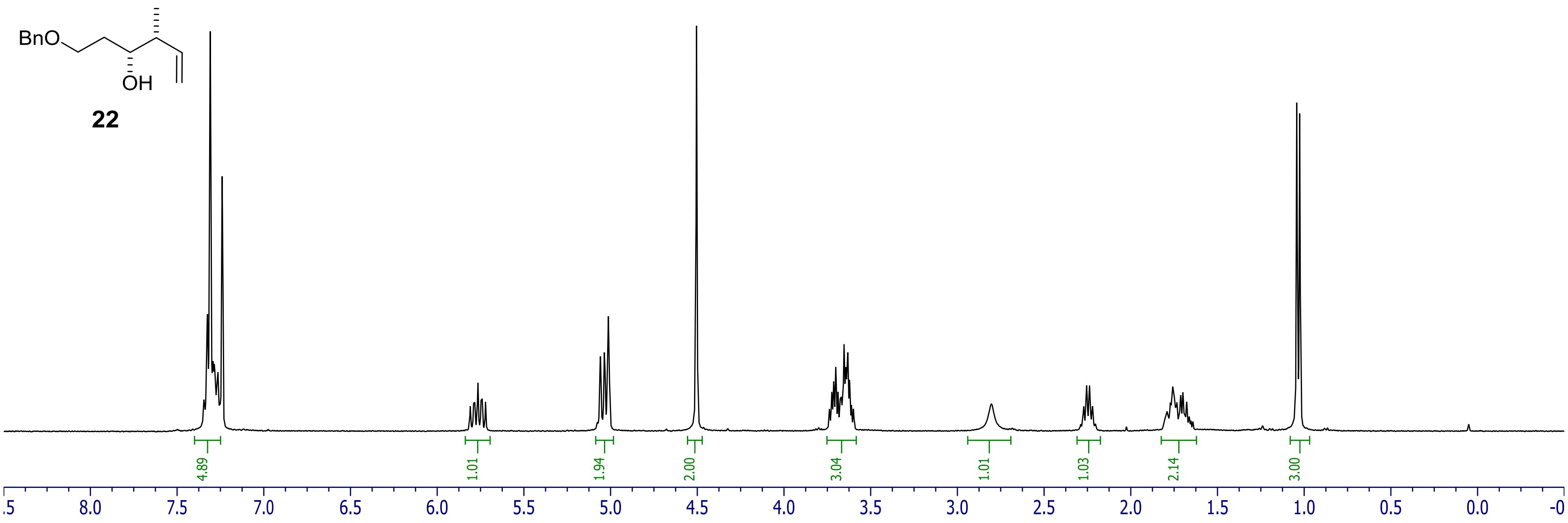
20
10
0
-1


BnO
OH

22

4.89
1.01
1.94
2.00
3.04
1.01
1.03
2.14
3.00
.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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4.0
3.5
3.0
2.5
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1.5
1.0
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0.0
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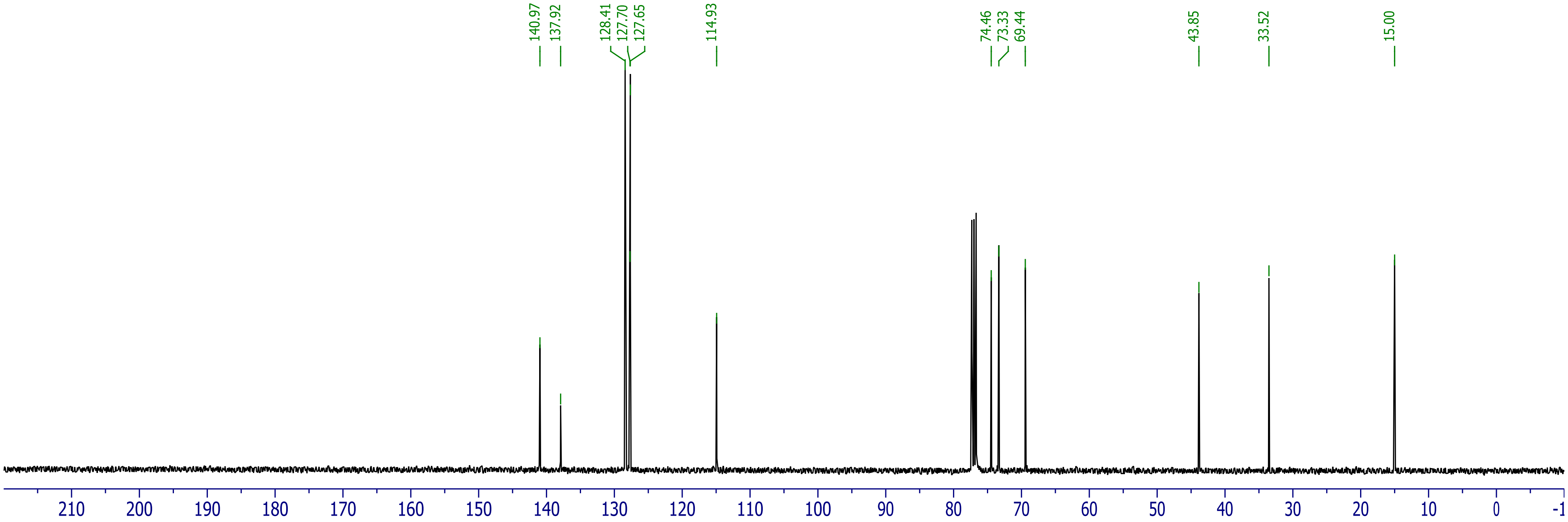
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128.41
127.70
127.65
114.93
74.46
73.33
69.44
43.85
33.52
15.00
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
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20
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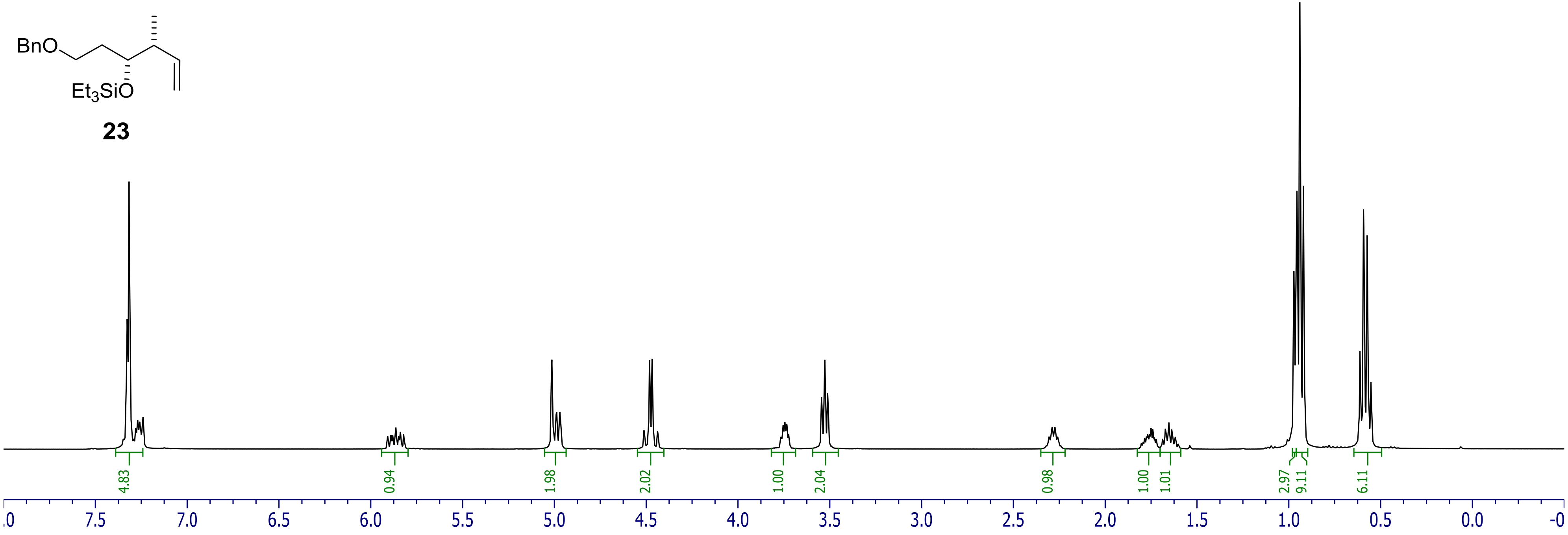
0
-1


BnO
Et3SiO
4.83
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2.02
1.00
2.04
0.98
1.00
1.01
2.97
9.11
6.11
.0
7.5
7.0
6.5
6.0
5.5
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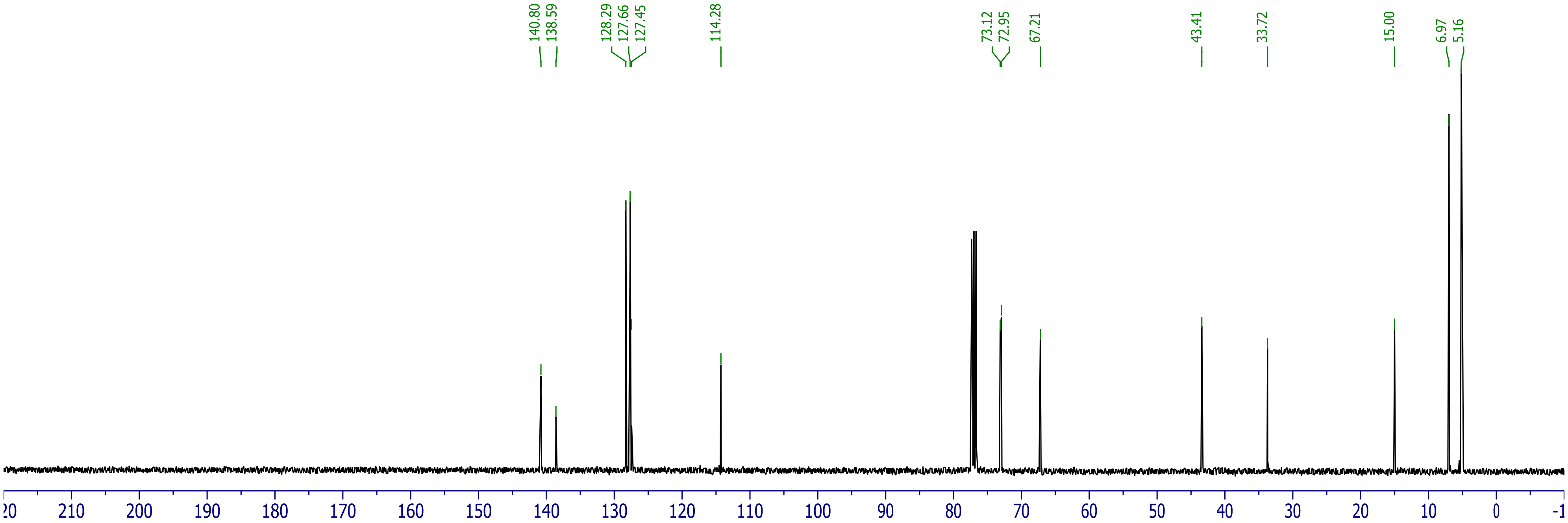
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0

23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114.28
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67.21
43.41
33.72
15.00
6.97
5.16
20
210
200
190
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120
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100
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80
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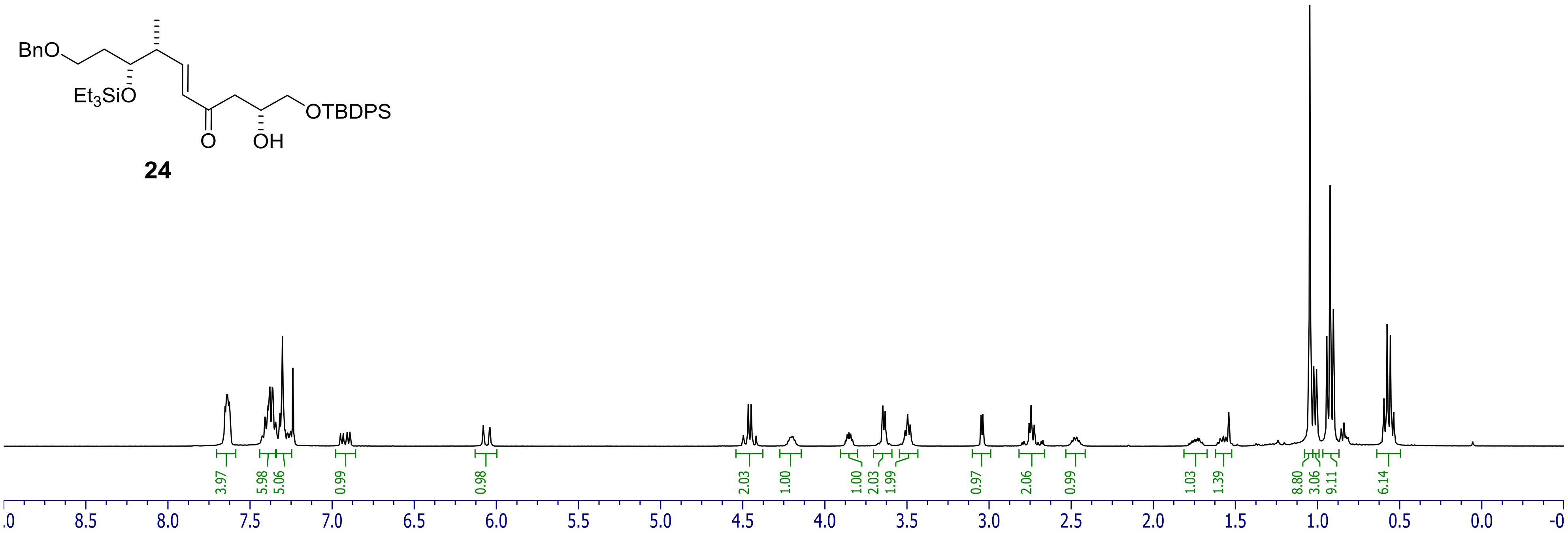
0
-1


BnO
Et3SiO
O
OH
OTBDPS

24

3.97
5.98
5.06
0.99
0.98
2.03
1.00
1.00
2.03
1.99
0.97
2.06
0.99
1.03
1.39
8.80
3.06
9.11
6.14
8.5
8.0
7.5
7.0
6.5
6.0
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2.0
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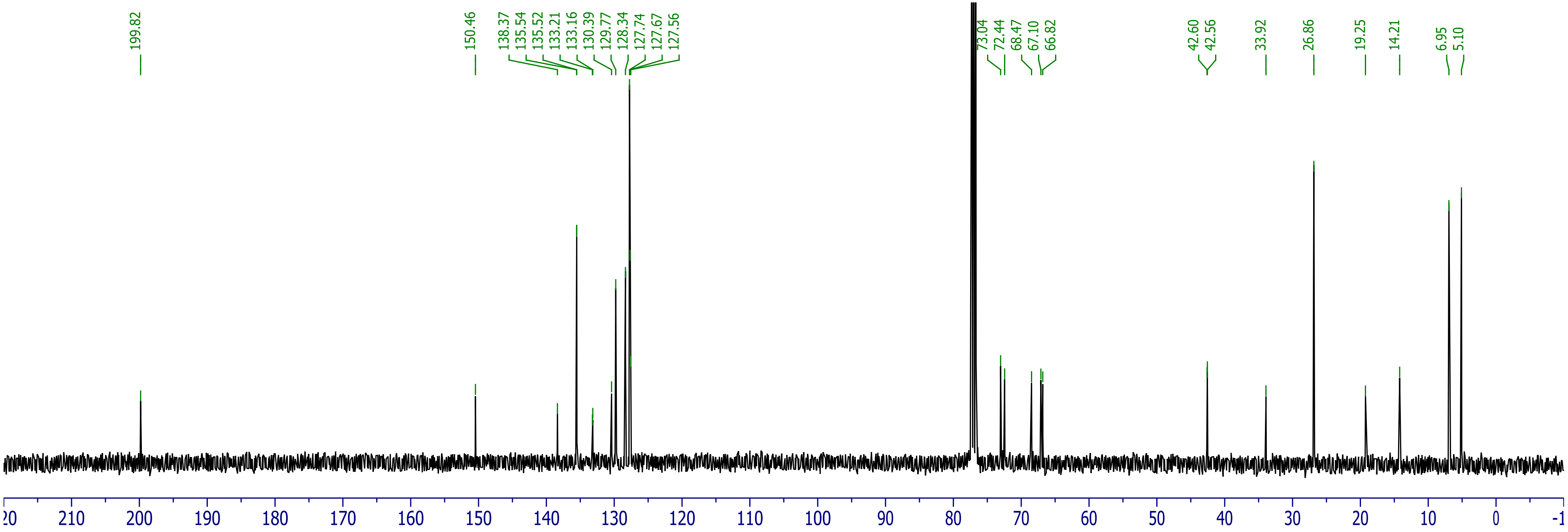
0.0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127.74
127.67
127.56
73.04
72.44
68.47
67.10
66.82
42.60
42.56
33.92
26.86
19.25
14.21
6.95
5.10
210
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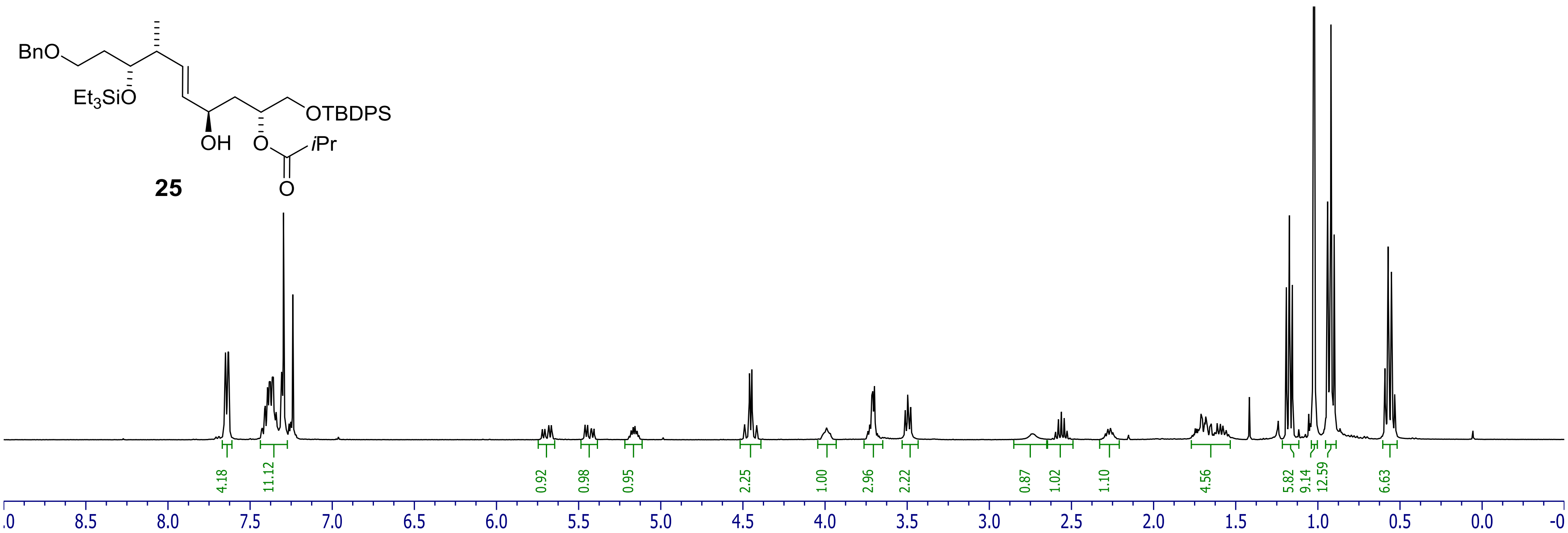
BnO
Et3SiO
OTBDPS
OH
O
iPr
O
25
4.18
11.12
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0.98
0.95
2.25
1.00
2.96
2.22
0.87
1.02
1.10
4.56
5.82
9.14
12.59
6.63
.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
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4.0
3.5
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1.5
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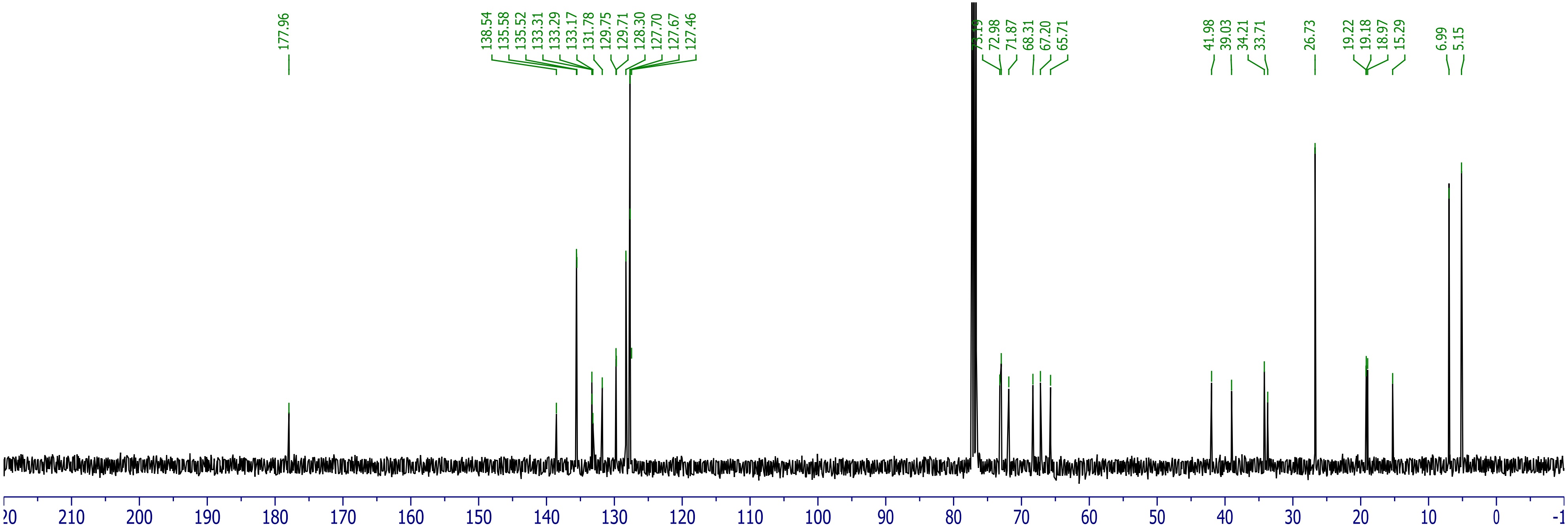
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127.67
127.46
73.19
72.98
71.87
68.31
67.20
65.71
41.98
39.03
34.21
33.71
26.73
19.22
19.18
18.97
15.29
6.99
5.15
20
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200
190
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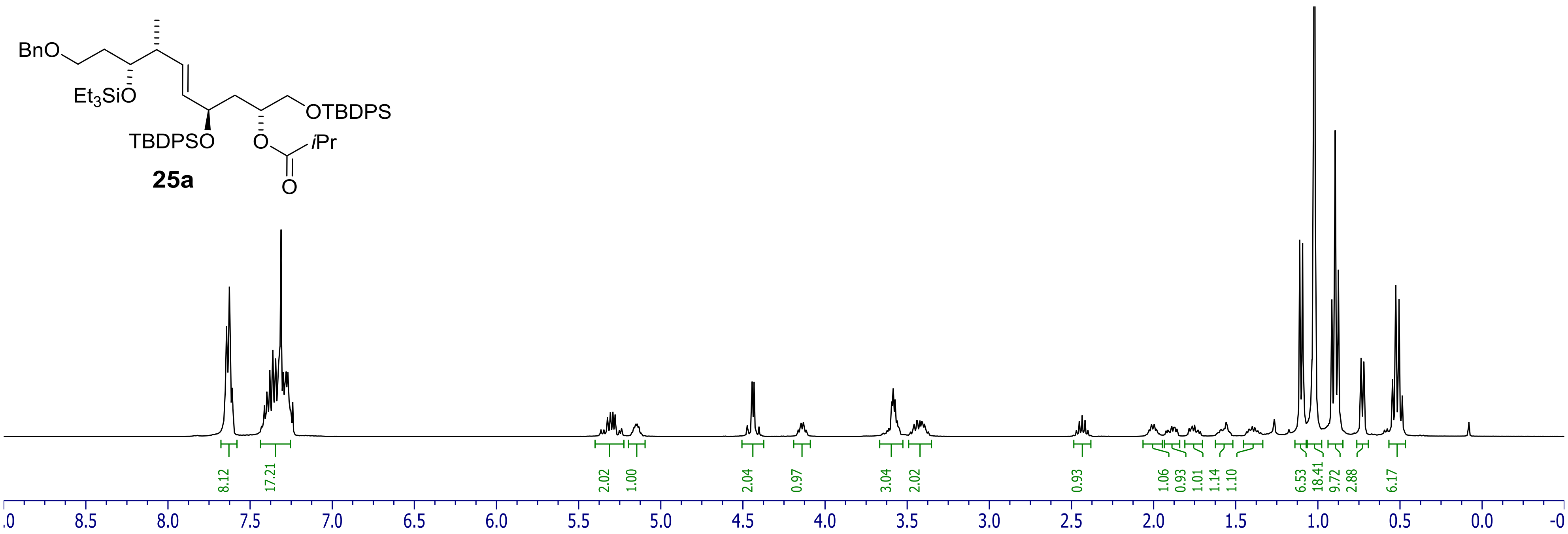
BnO
Et3SiO
TBDPSO
O
iPr
O
OTBDPS
25a
8.12
17.21
2.02
1.00
2.04
0.97
3.04
2.02
0.93
1.06
0.93
1.01
1.14
1.10
6.53
18.41
9.72
2.88
6.17
9.0
8.5
8.0
7.5
7.0
6.5
6.0
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1.5
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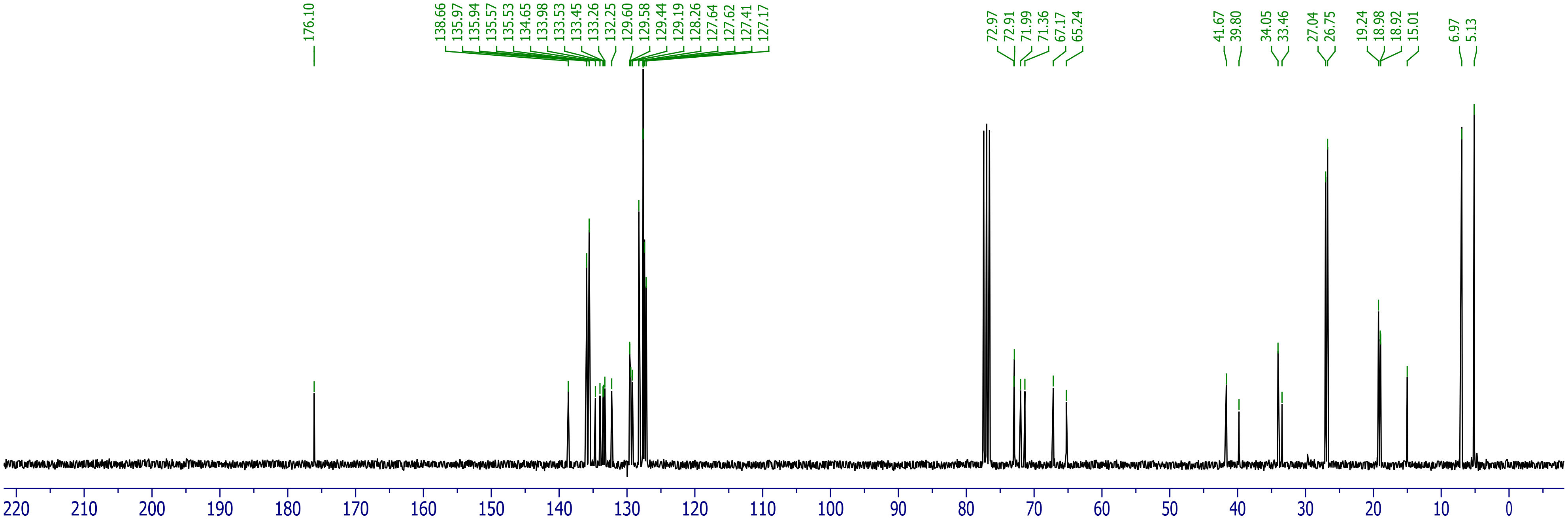
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129.60
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129.44
129.19
128.26
127.64
127.62
127.41
127.17
72.97
72.91
71.99
71.36
67.17
65.24
41.67
39.80
34.05
33.46
27.04
26.75
19.24
18.98
18.92
15.01
6.97
5.13
220
210
200
190
180
170
160
150
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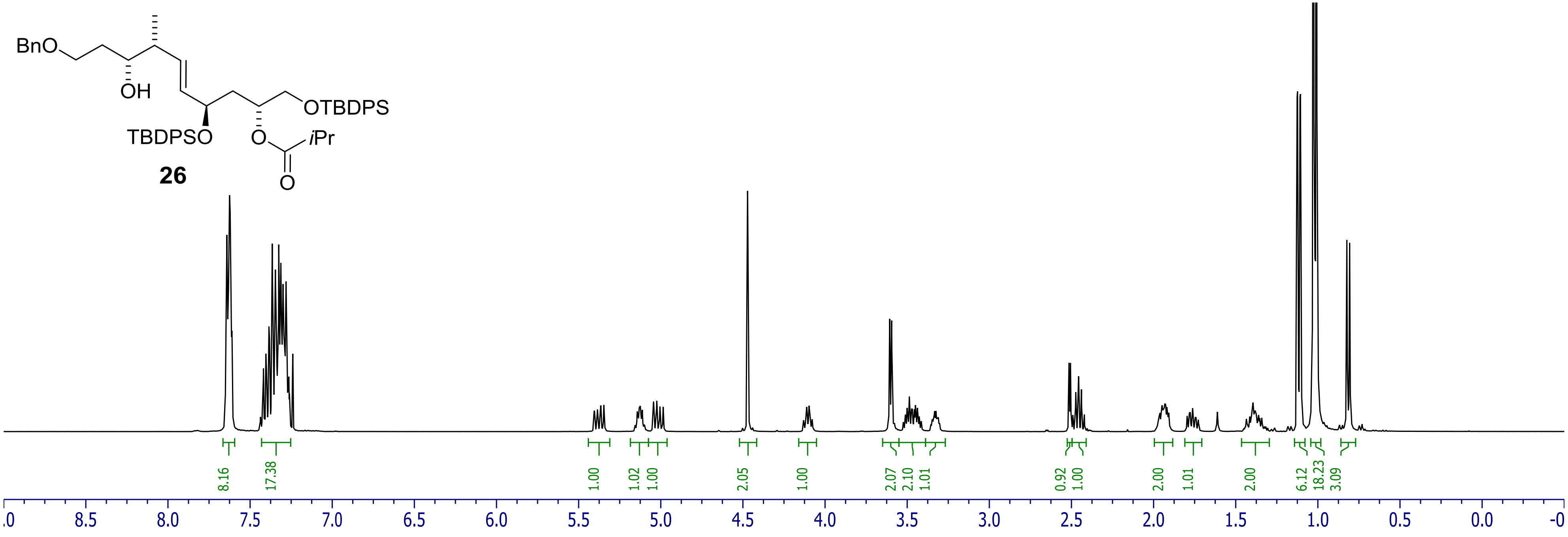
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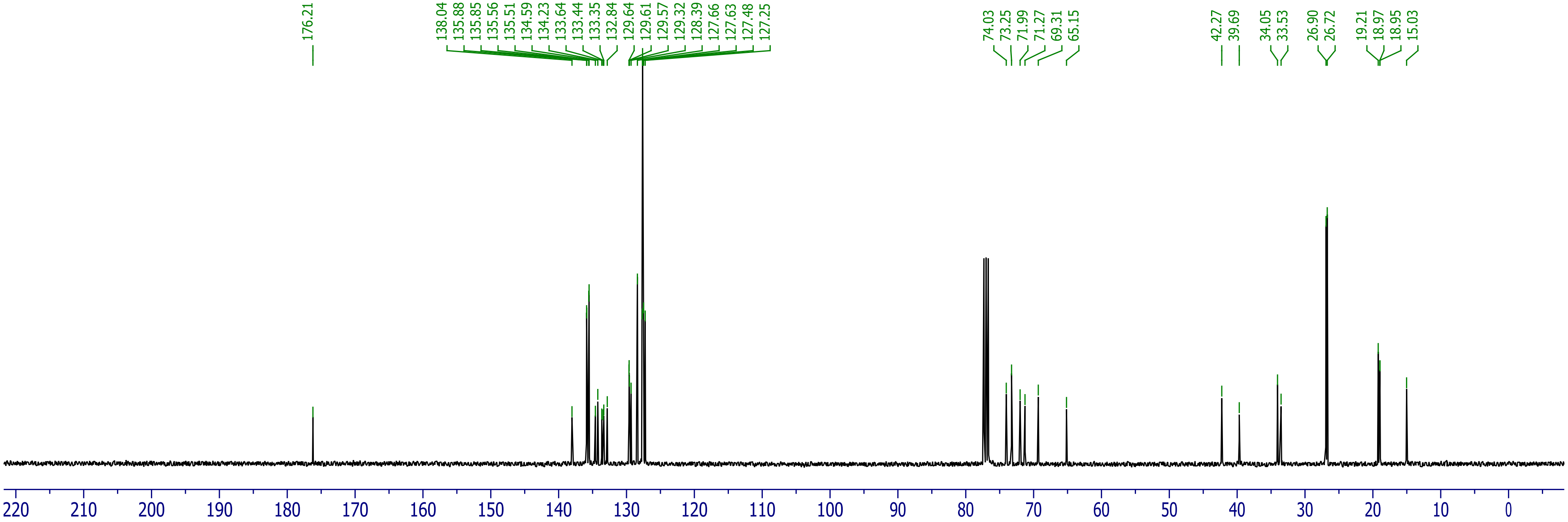
26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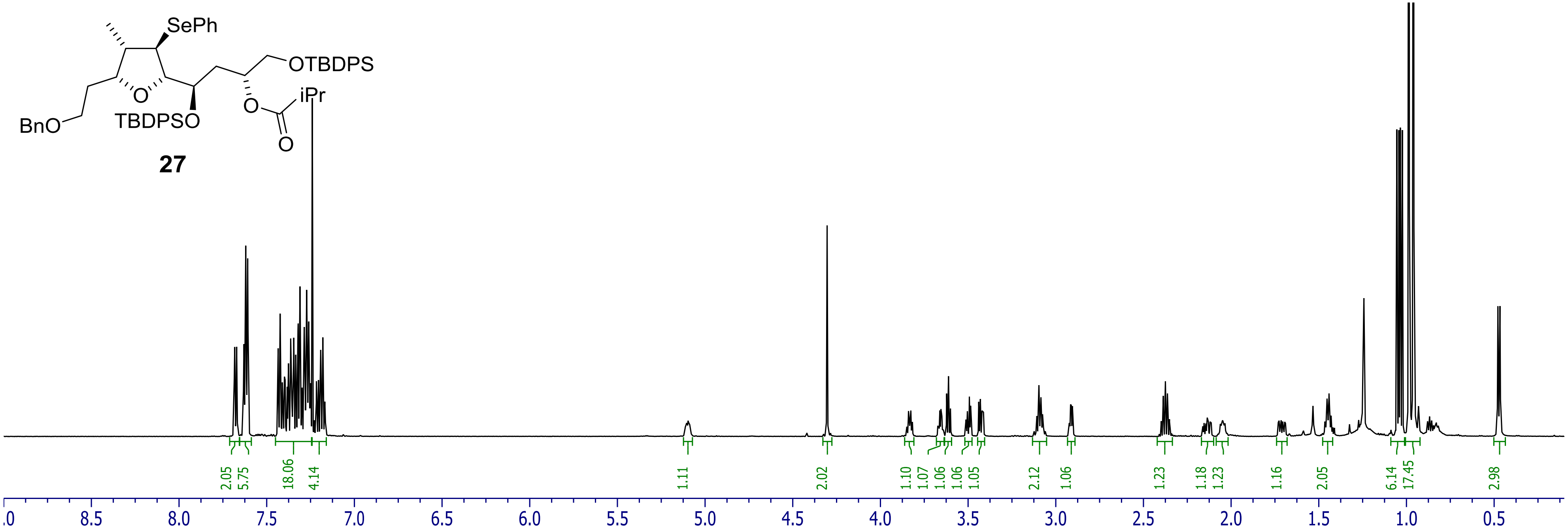
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1.10
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1.06
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1.18
1.23
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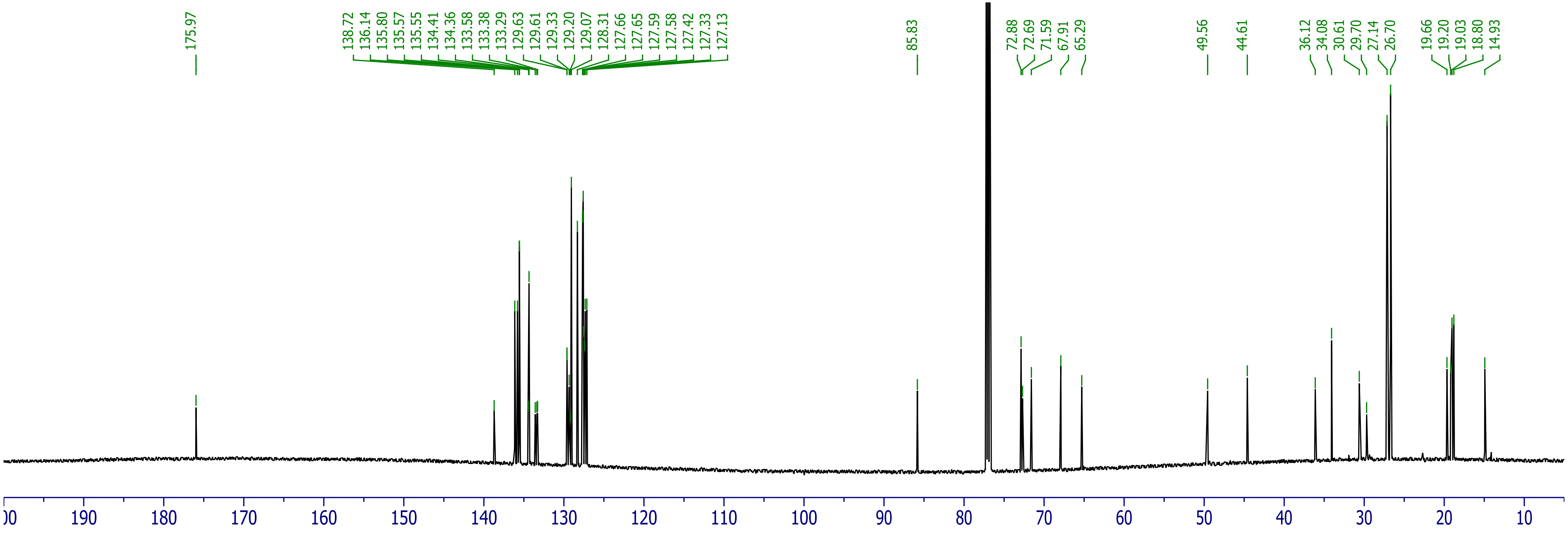
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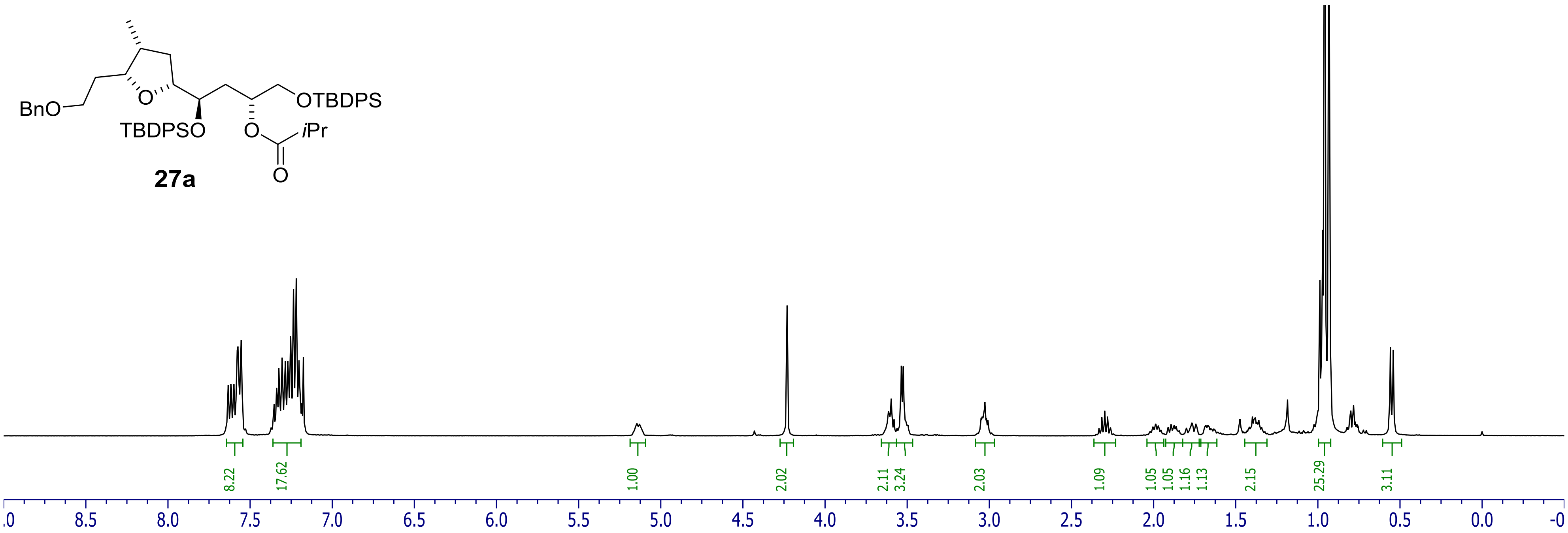
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O
iPr
O
OTBDPS

27a

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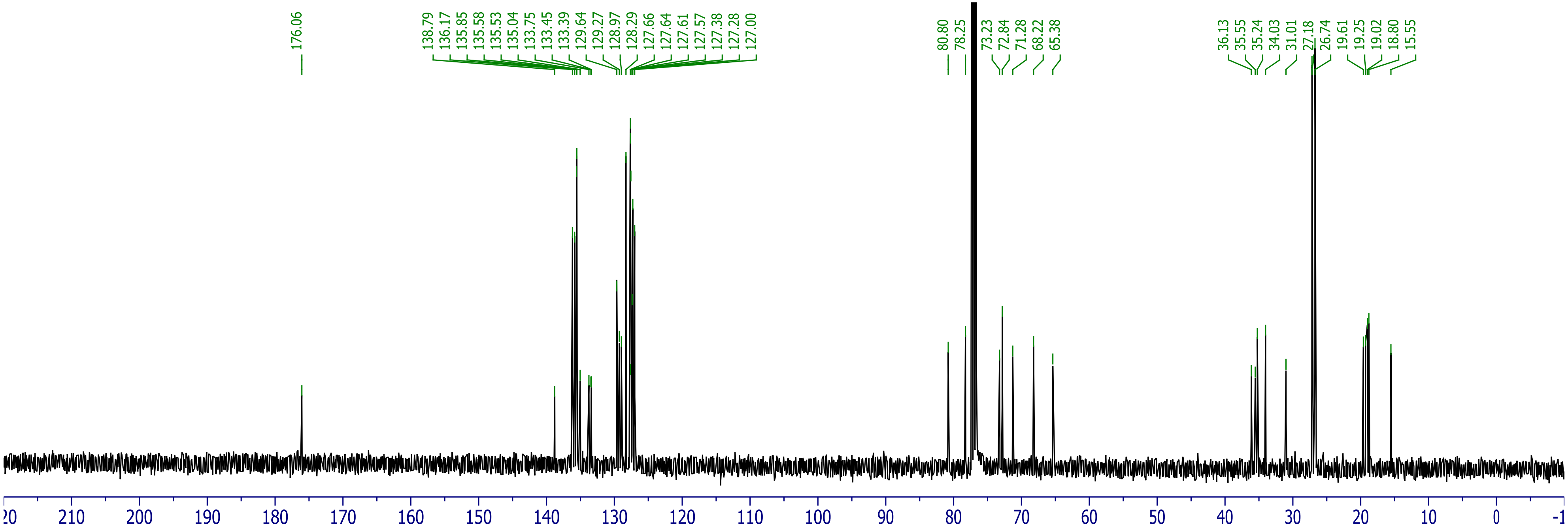
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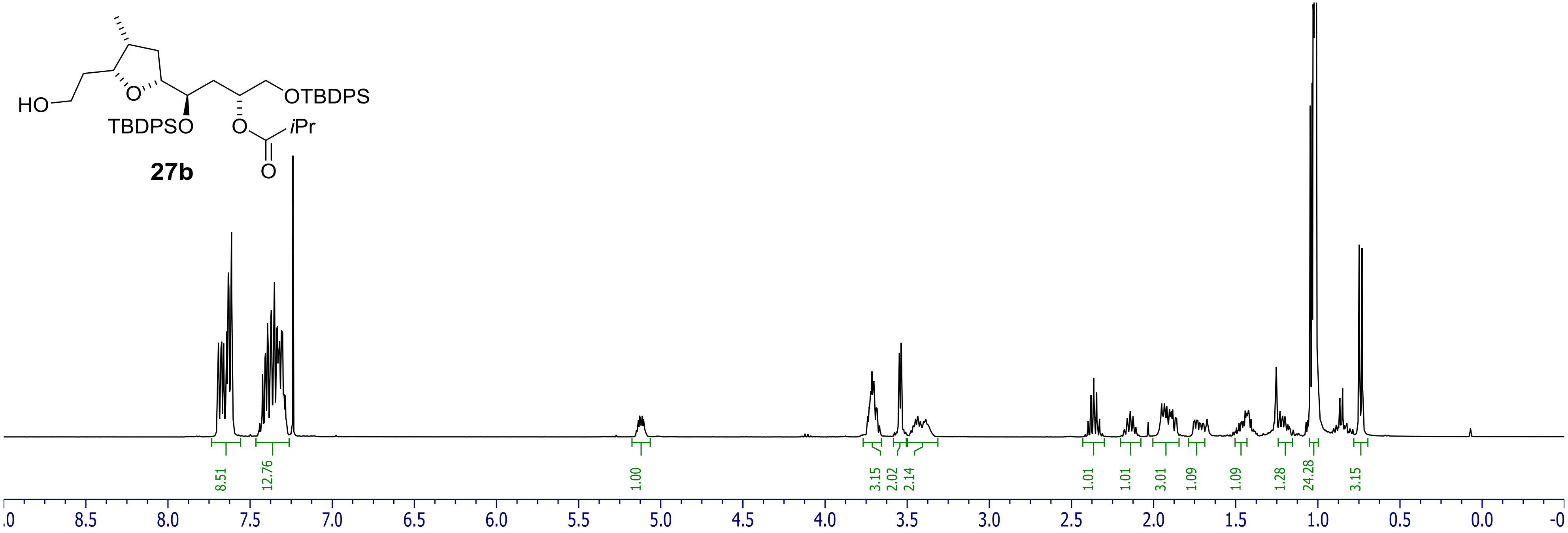
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1.01
3.01
1.09
1.09
1.28
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3.15
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8.5
8.0
7.5
7.0
6.5
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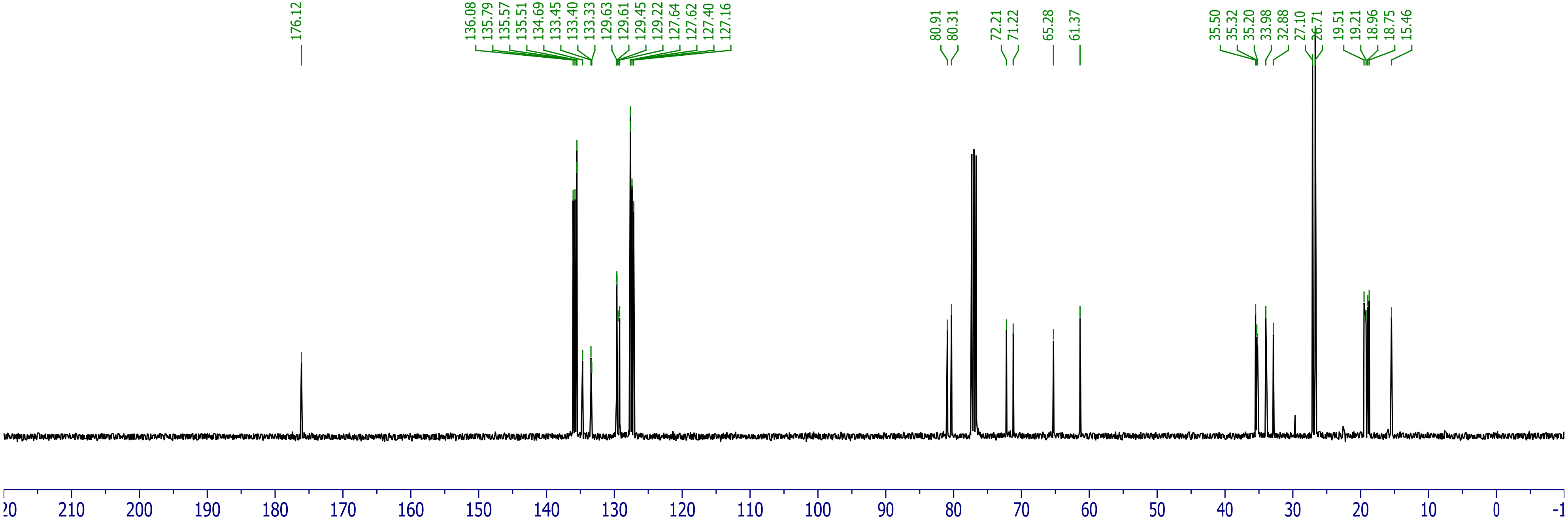
27b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71.22
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32.88
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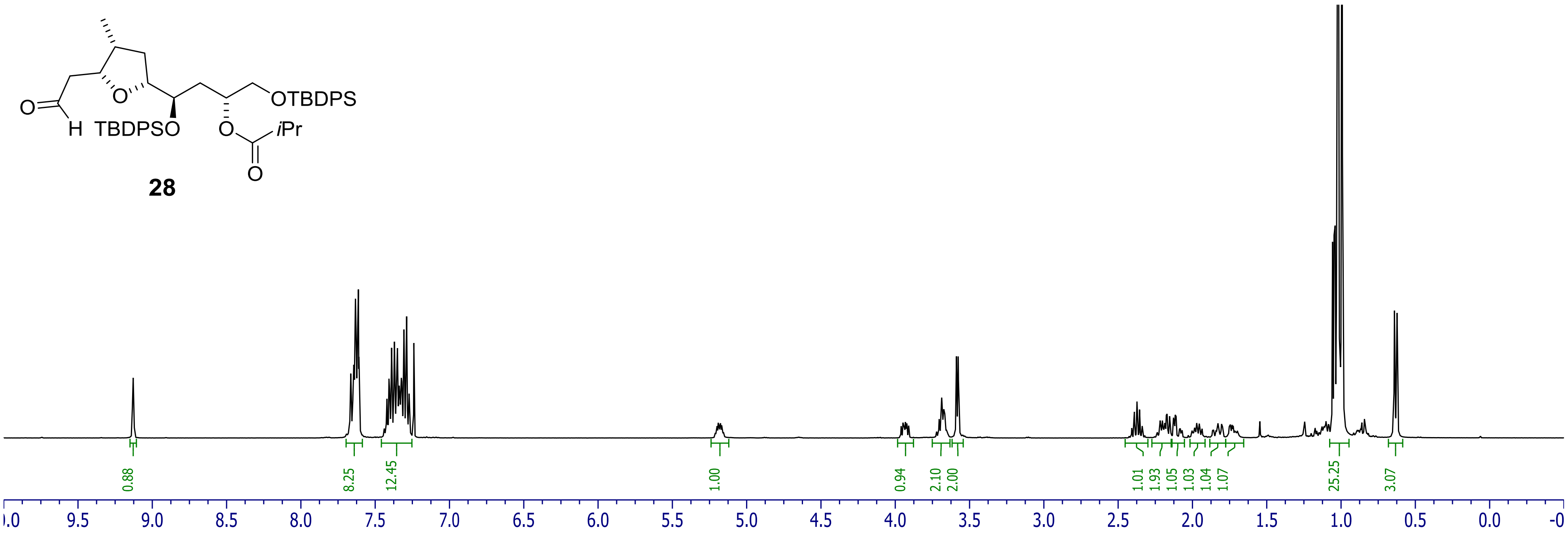
TBDPSO
OTBDPS
O
iPr
O

28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3.07
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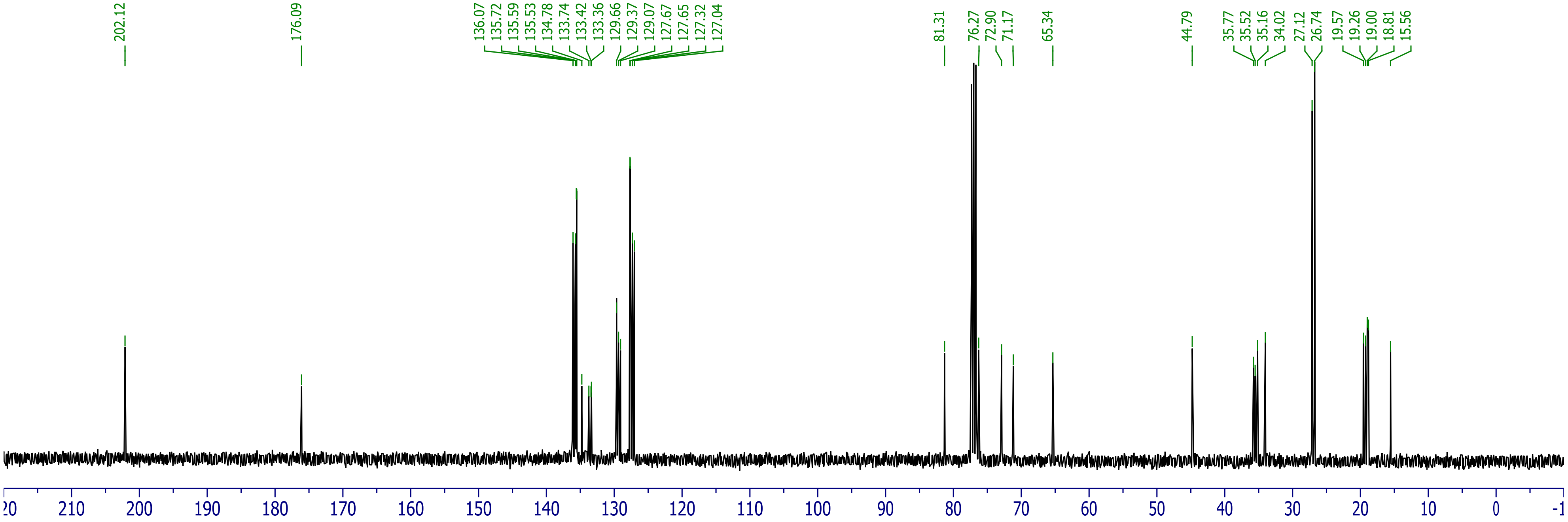
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127.32
127.04
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35.16
34.02
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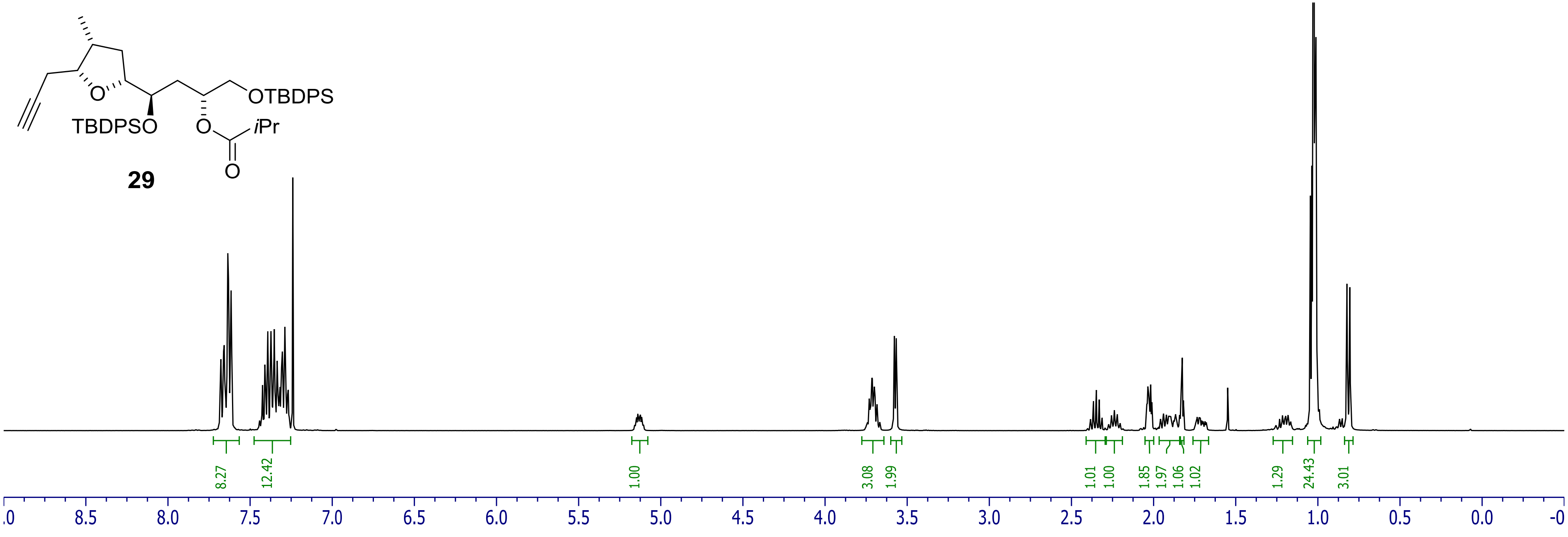
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1.06
1.02
1.29
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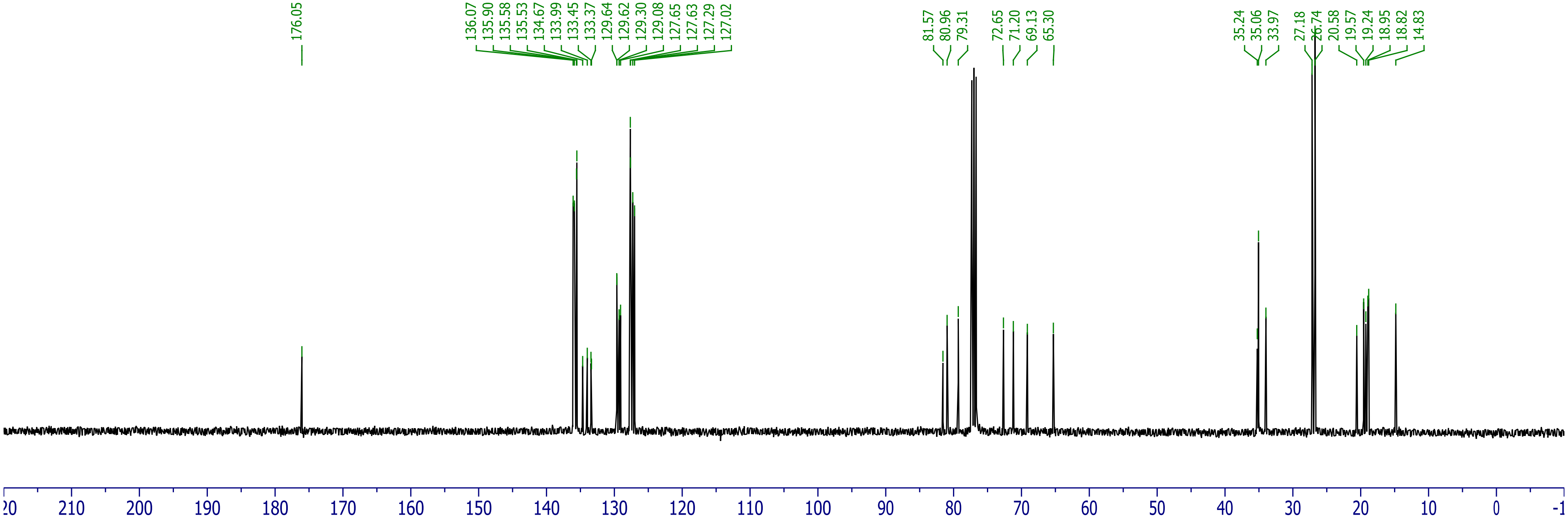
29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127.02
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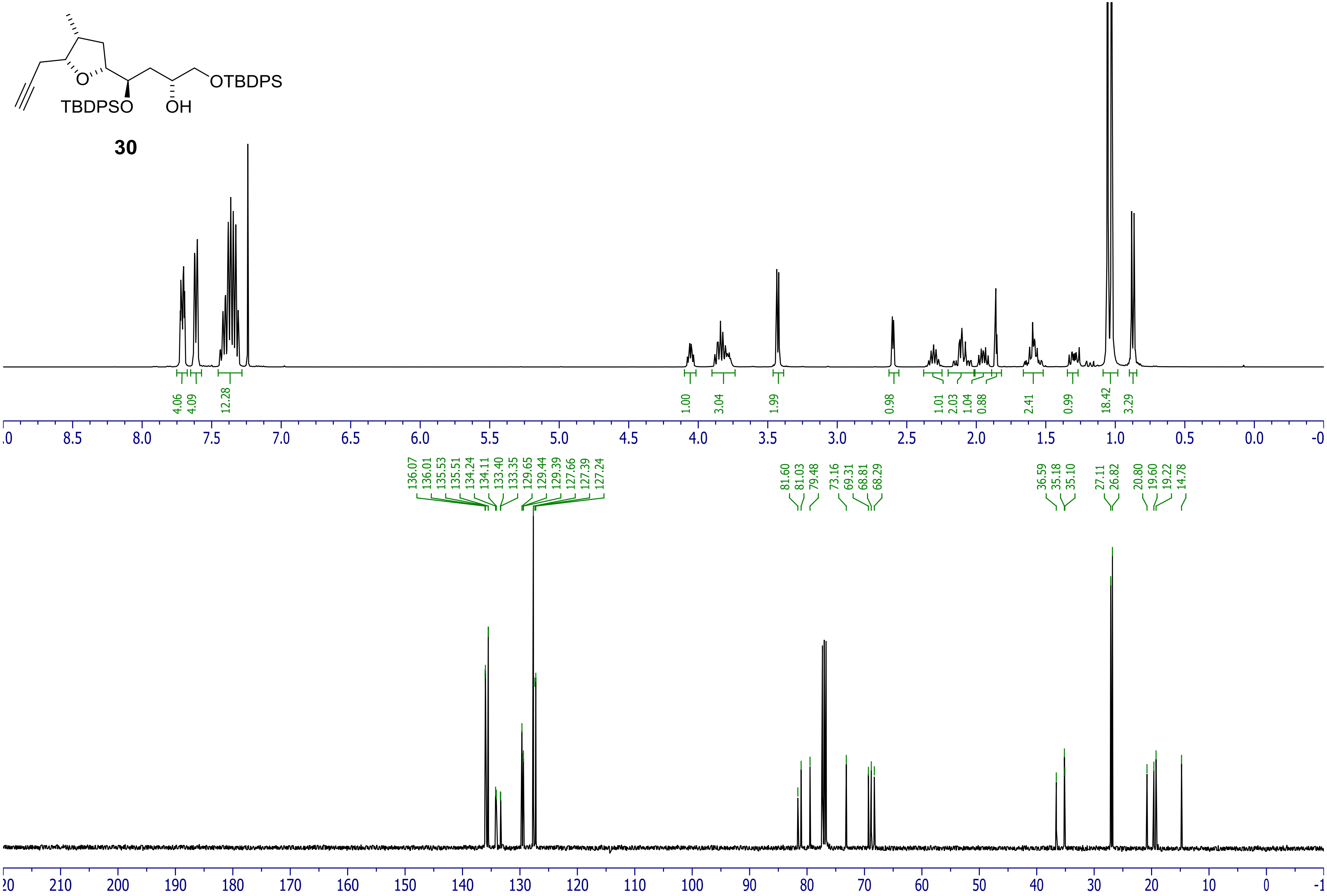
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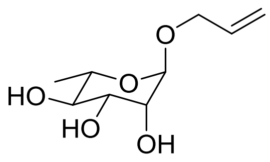
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HO
OH

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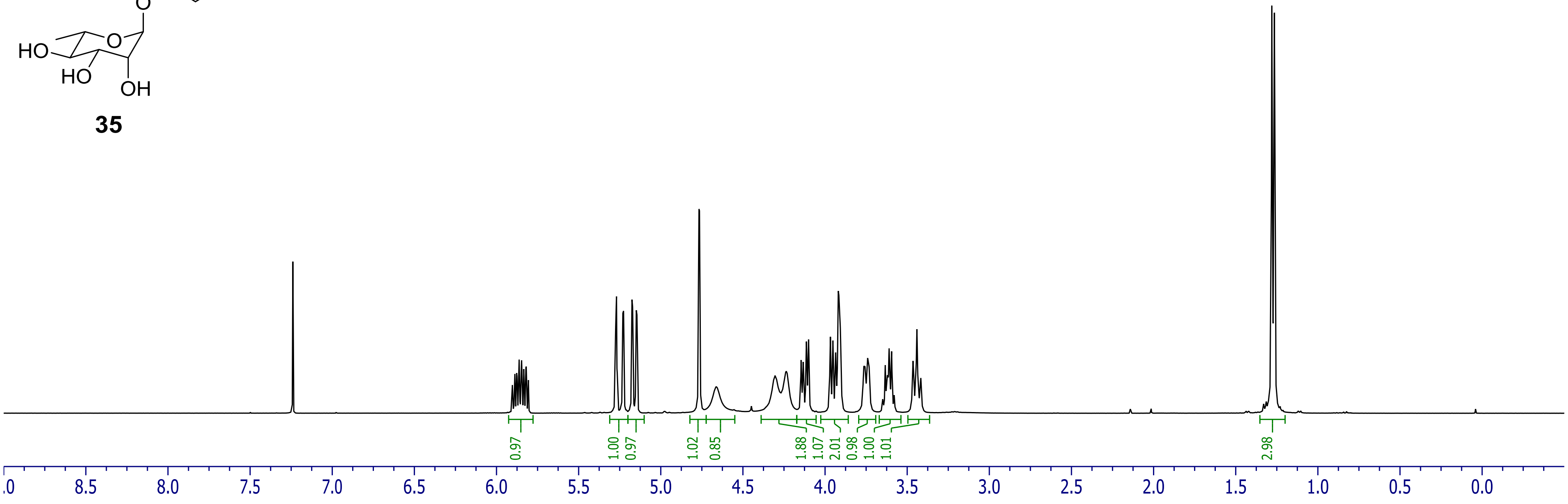
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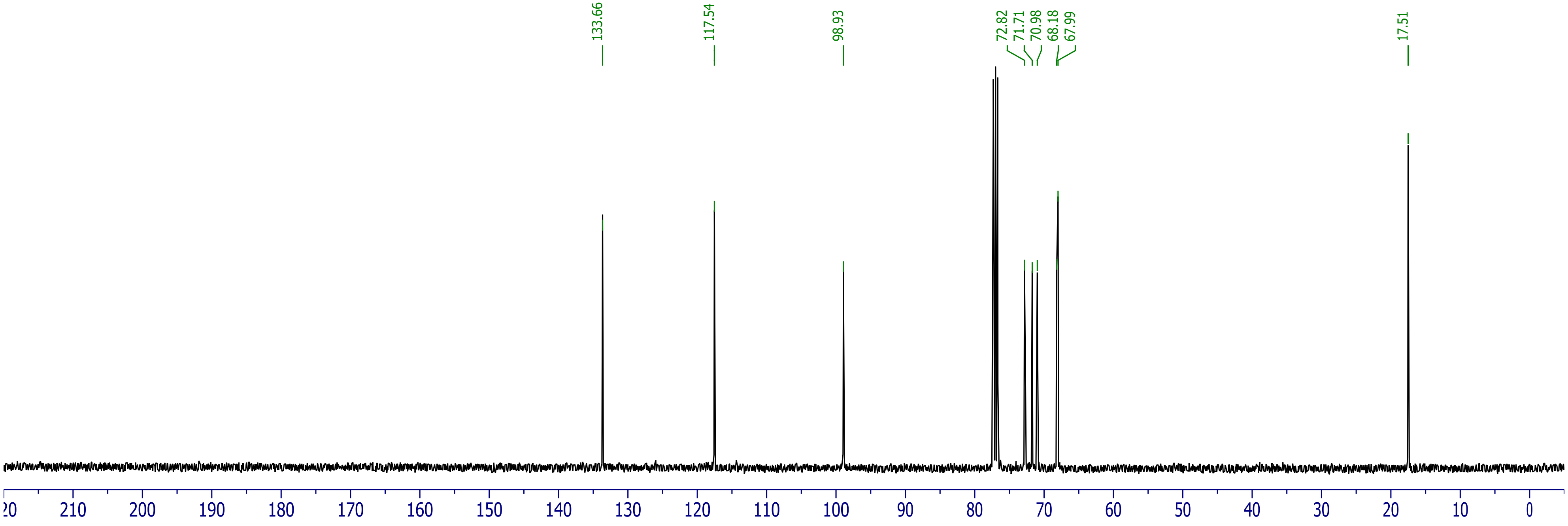
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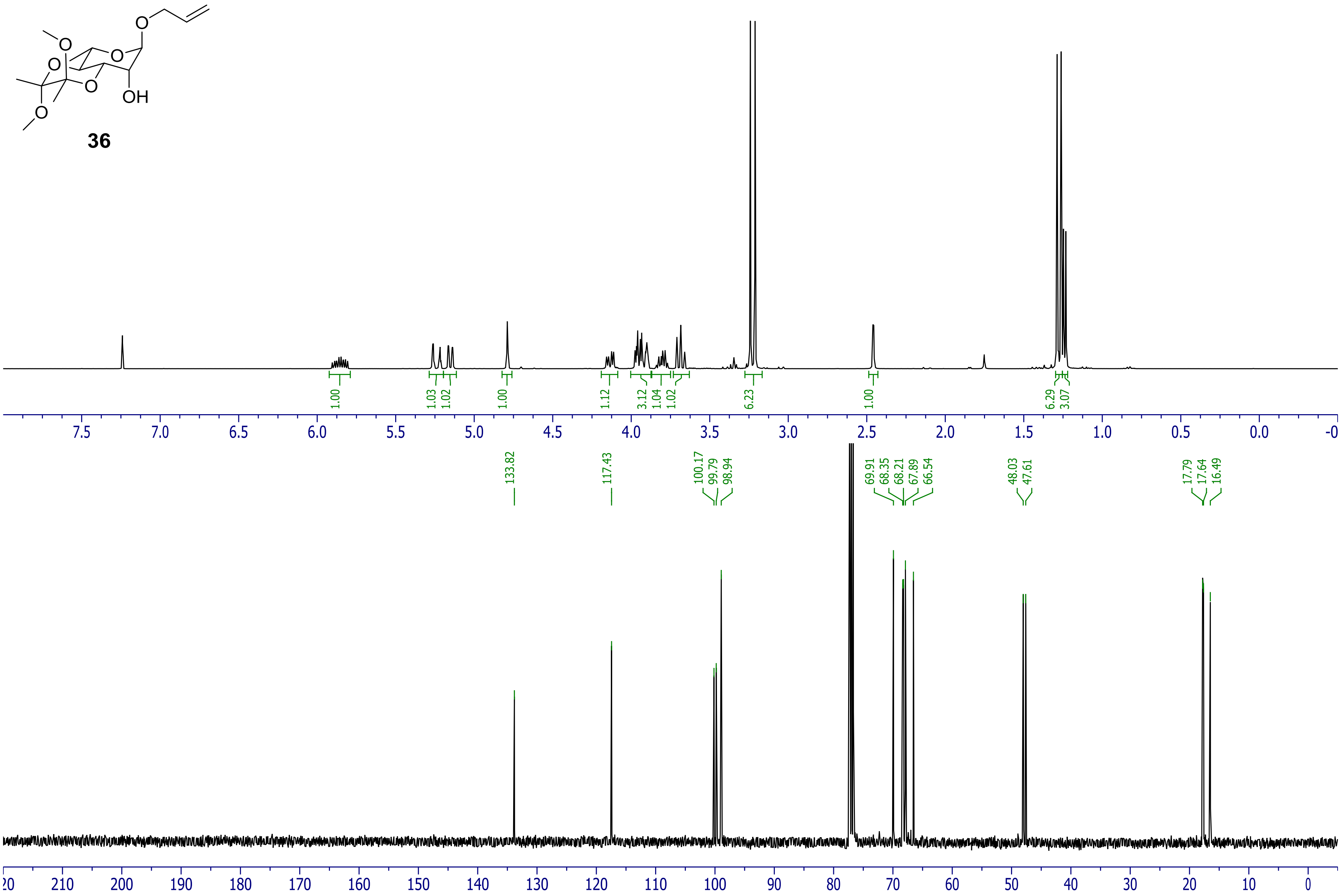

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3.12
1.04
1.02
6.23
1.00
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6.0
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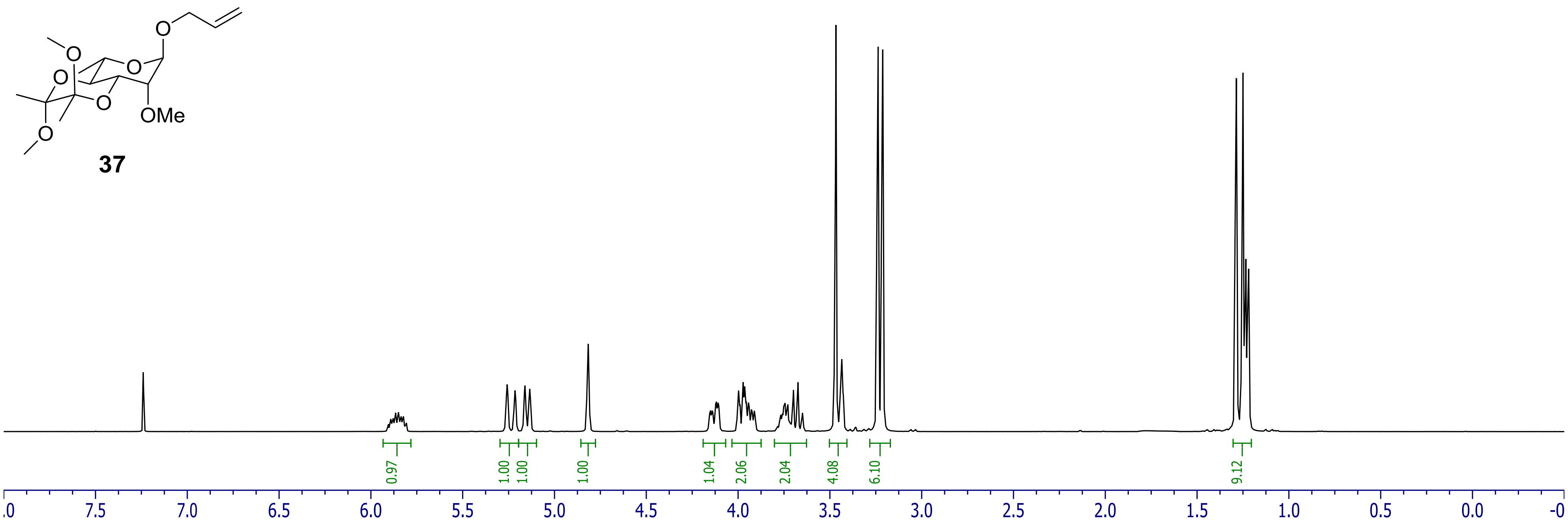
0

36



37

OMe
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6.10
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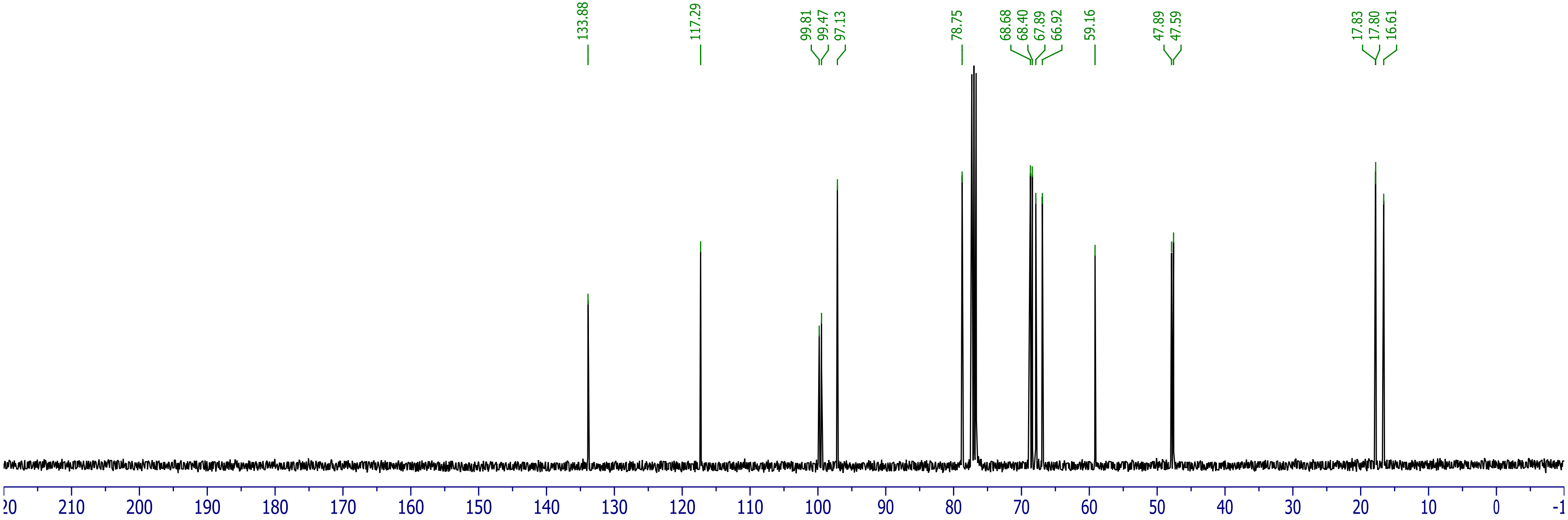

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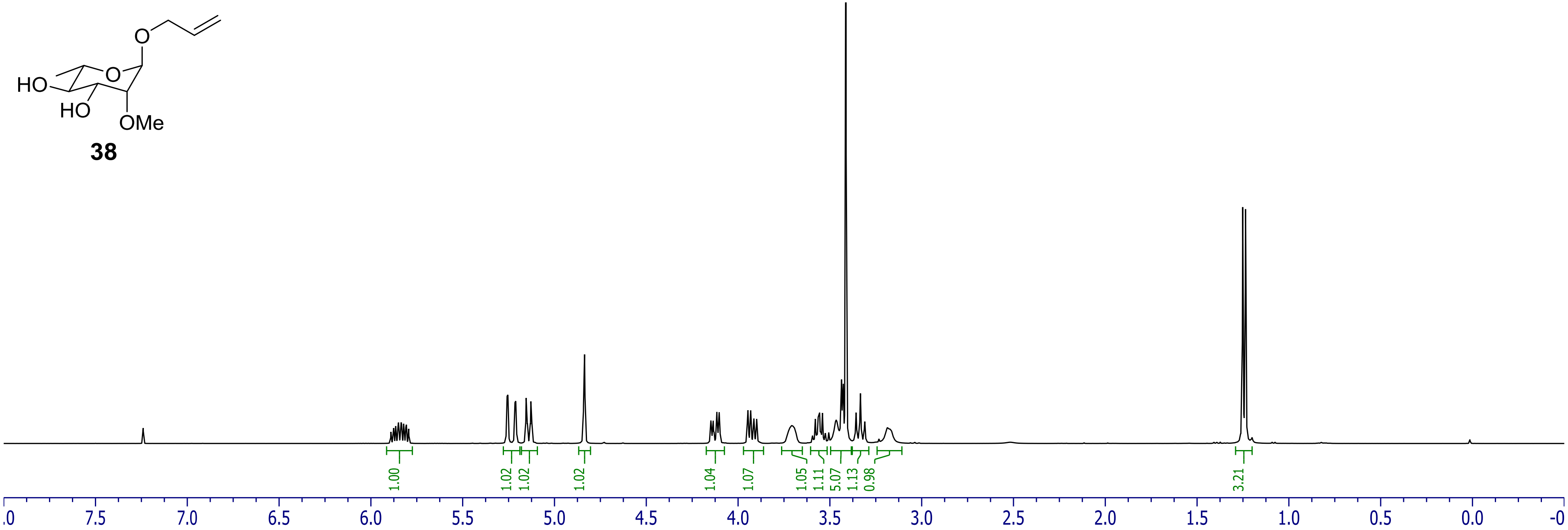
38

O
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HO
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1.02
1.02
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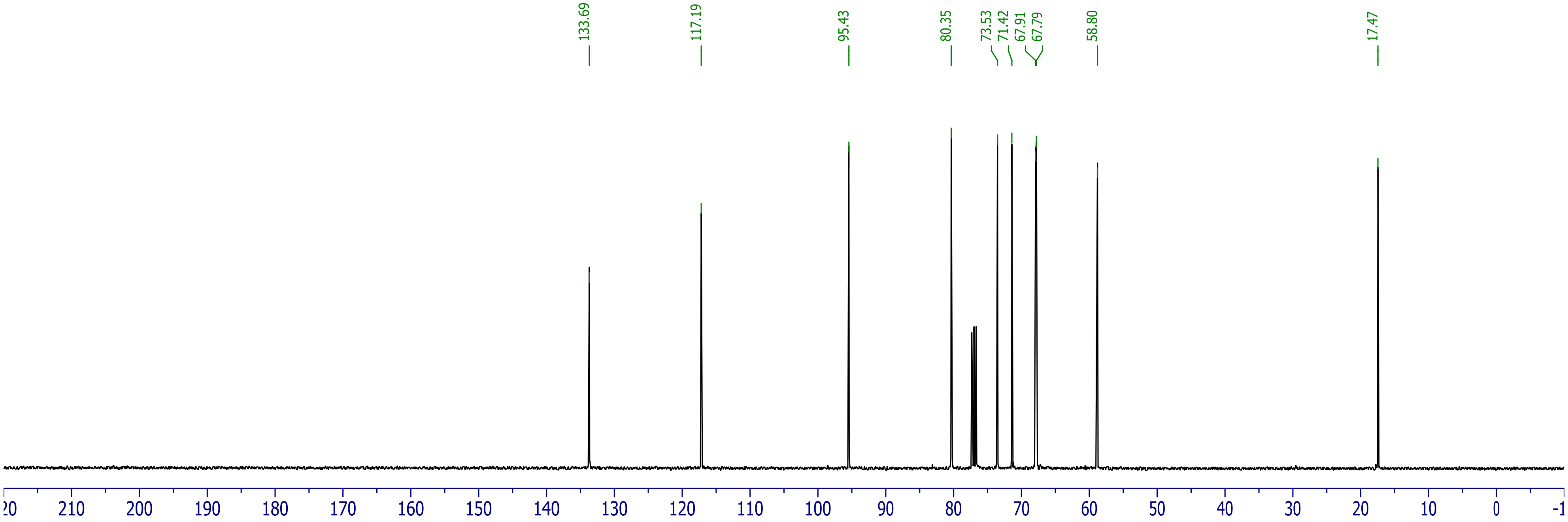
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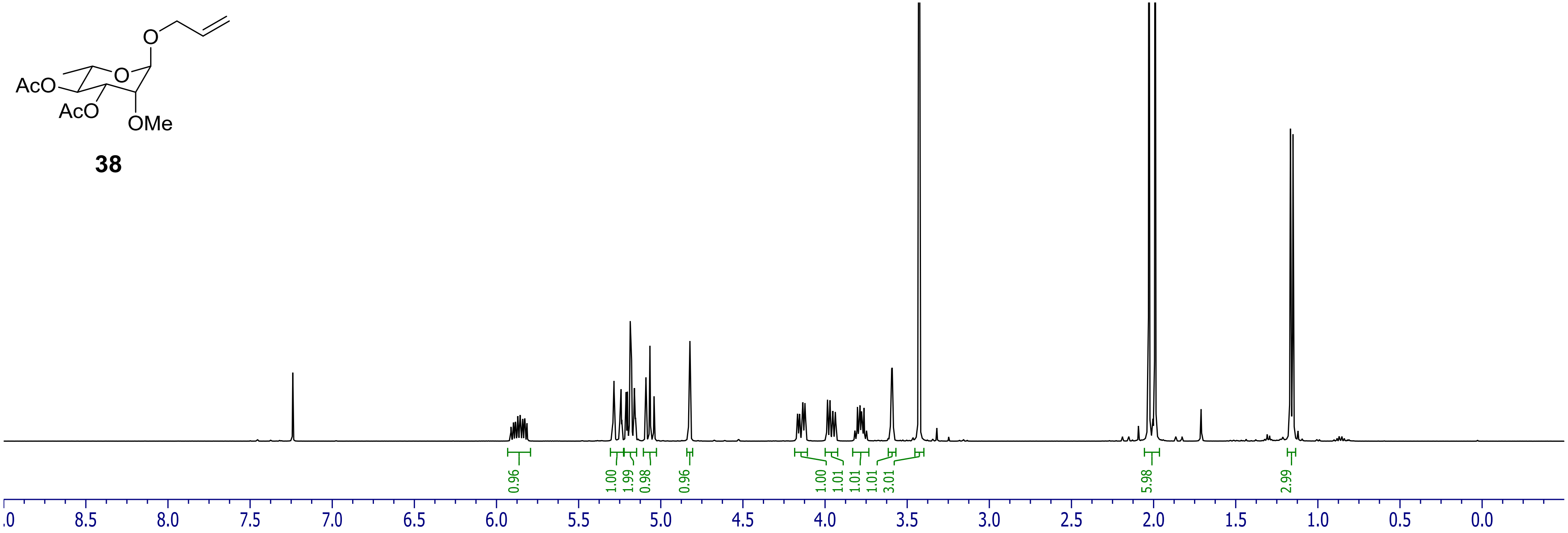
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AcO
AcO
OMe

38

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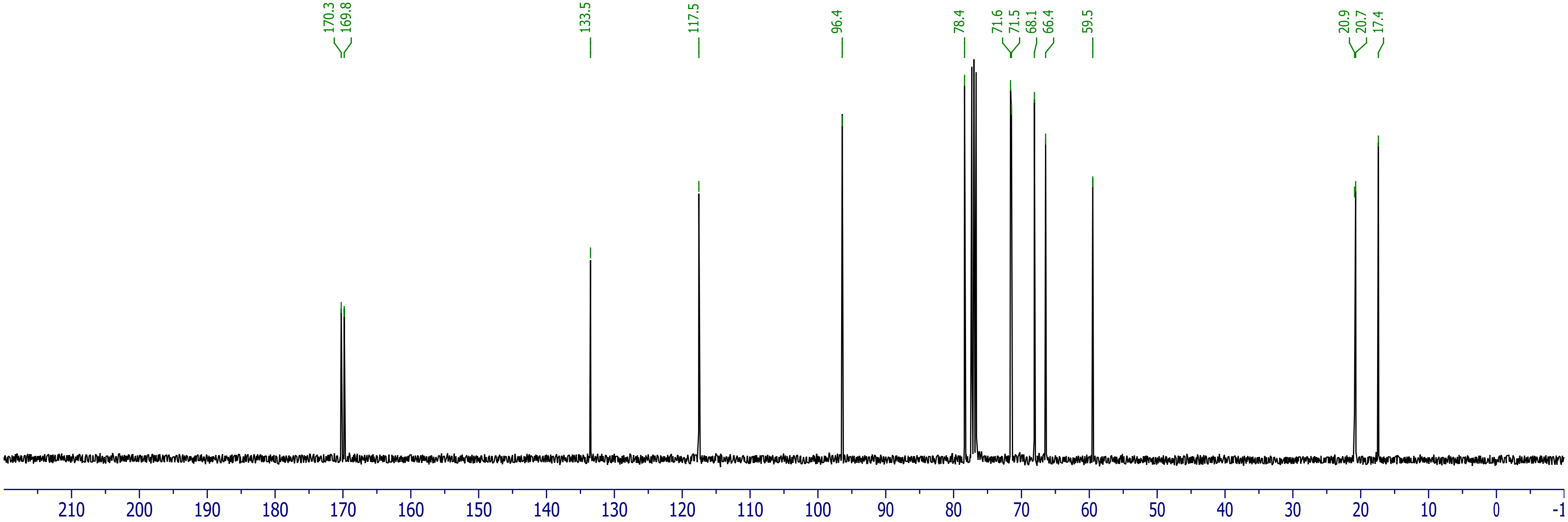
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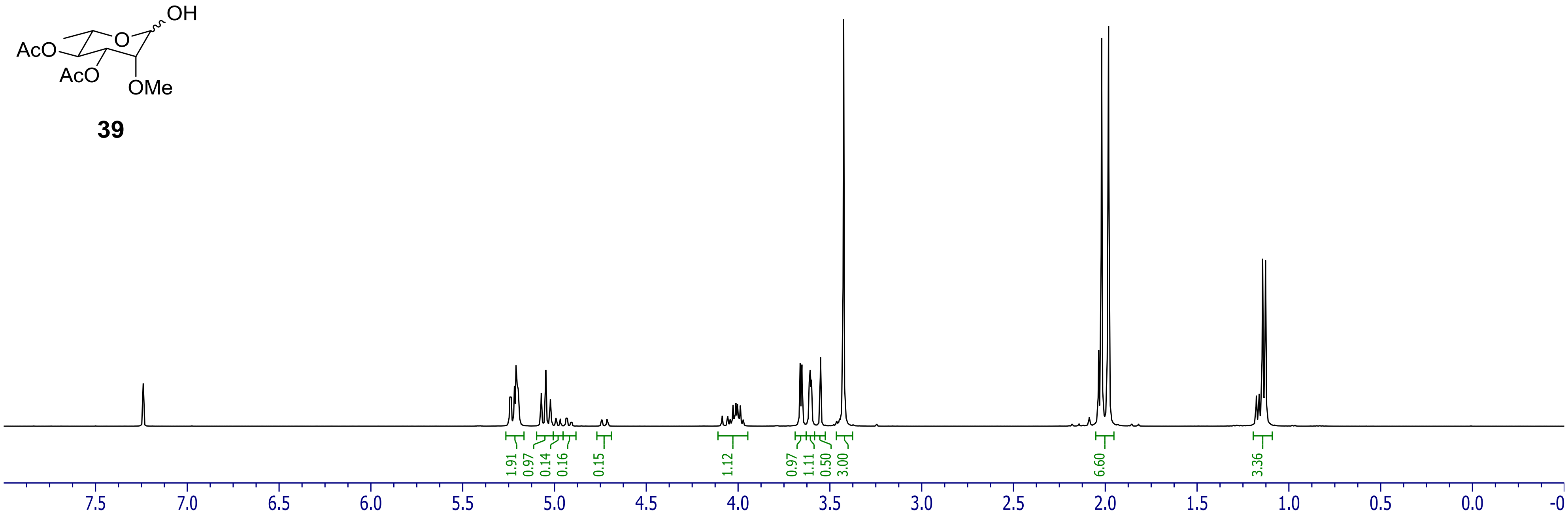
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AcO
OMe
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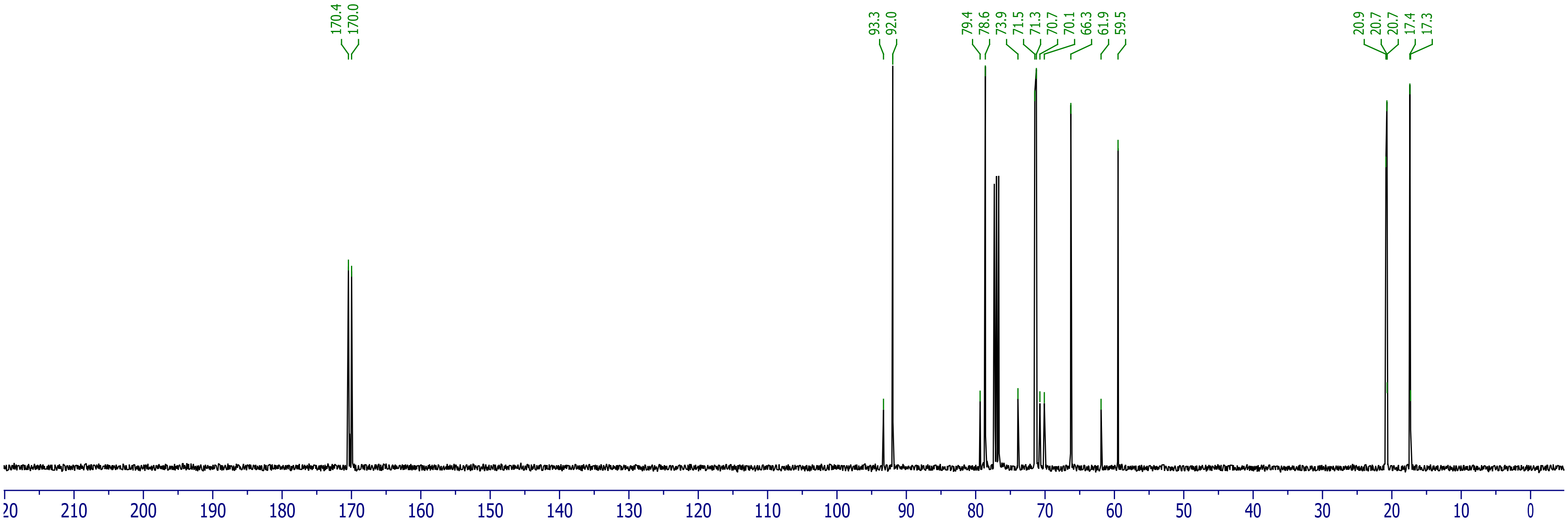
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0

NH
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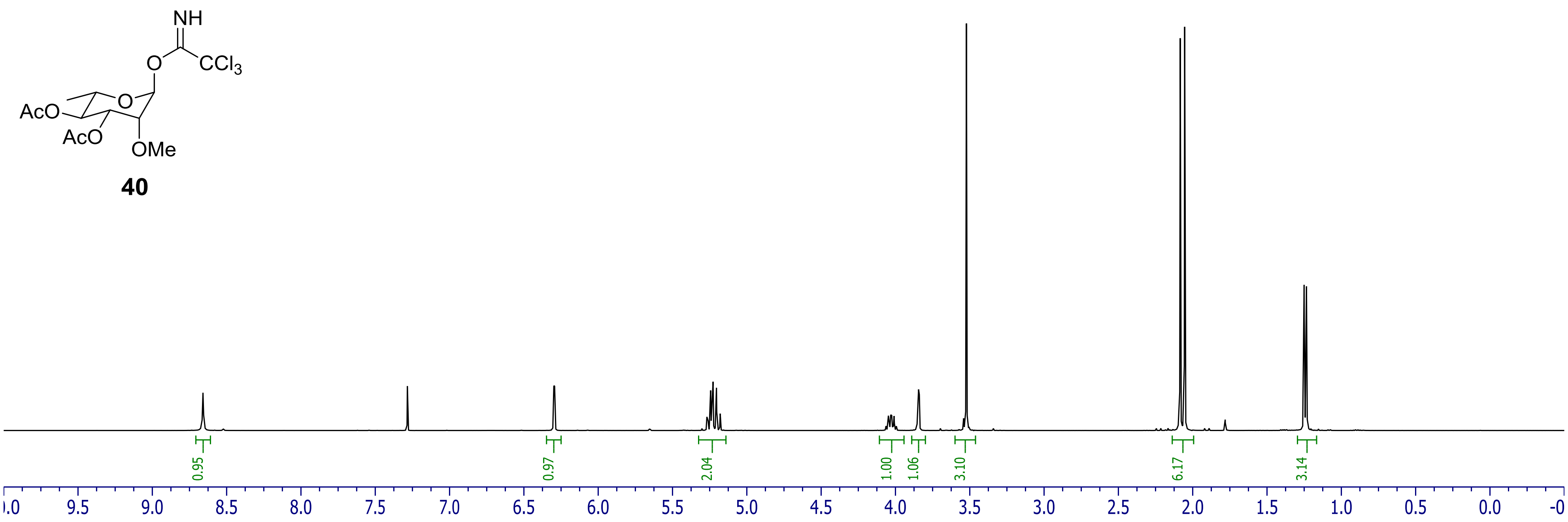
CCl3
AcO
O
AcO
OMe

40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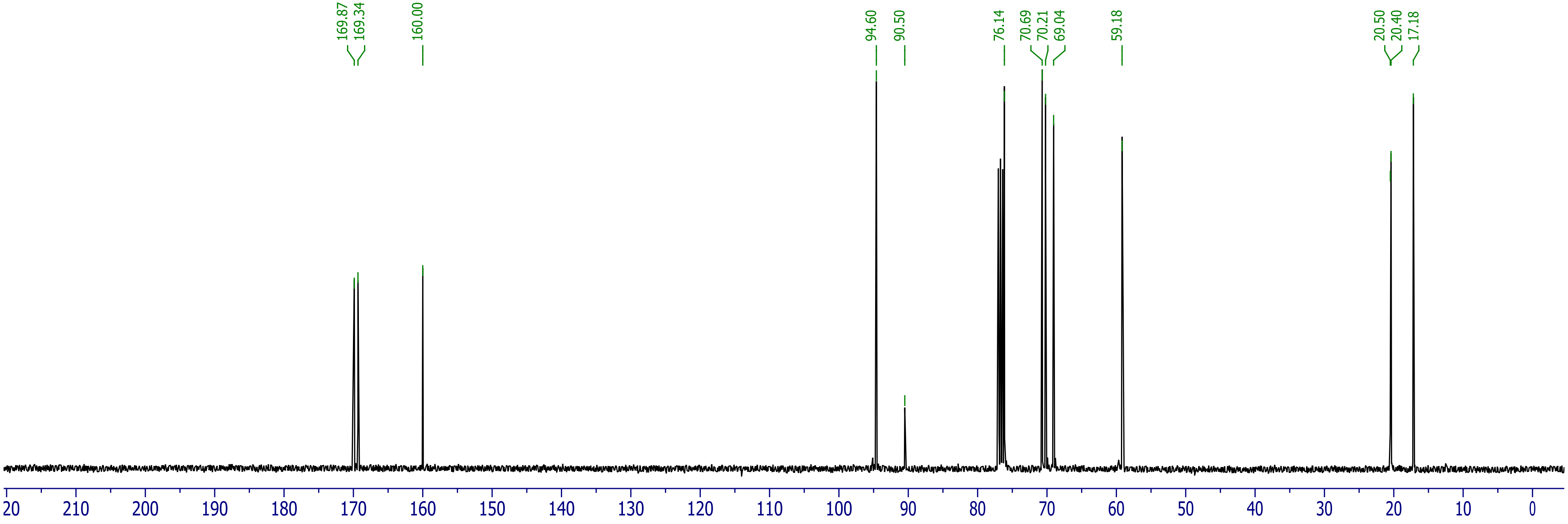
0.0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200
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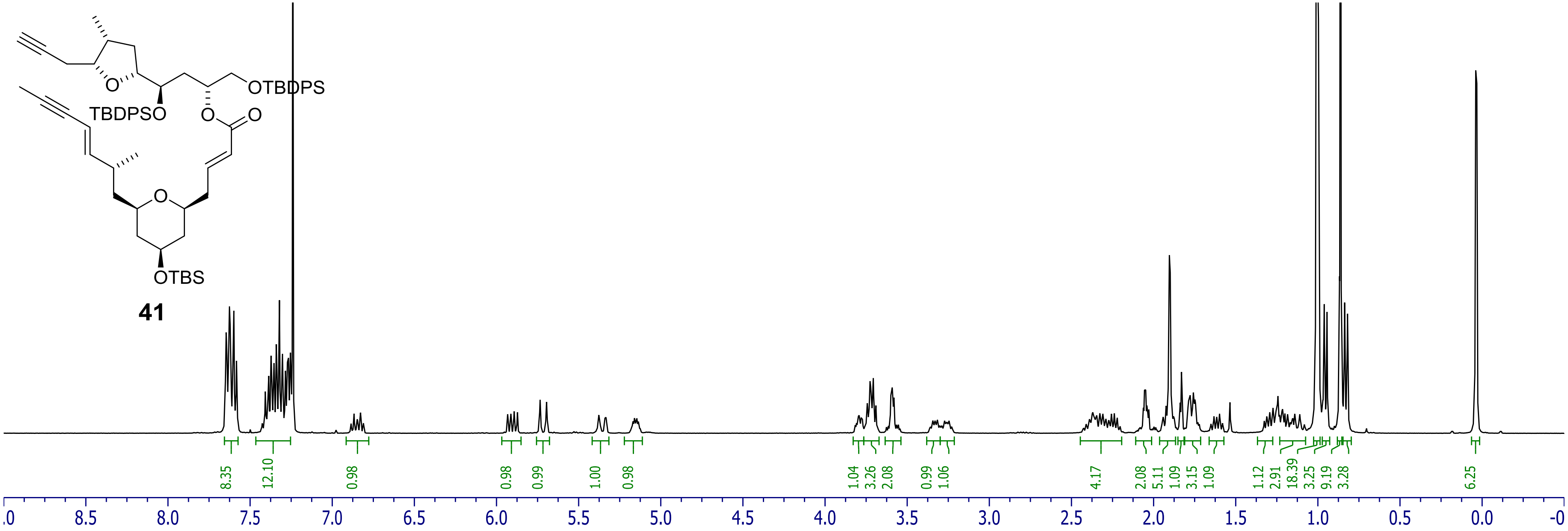
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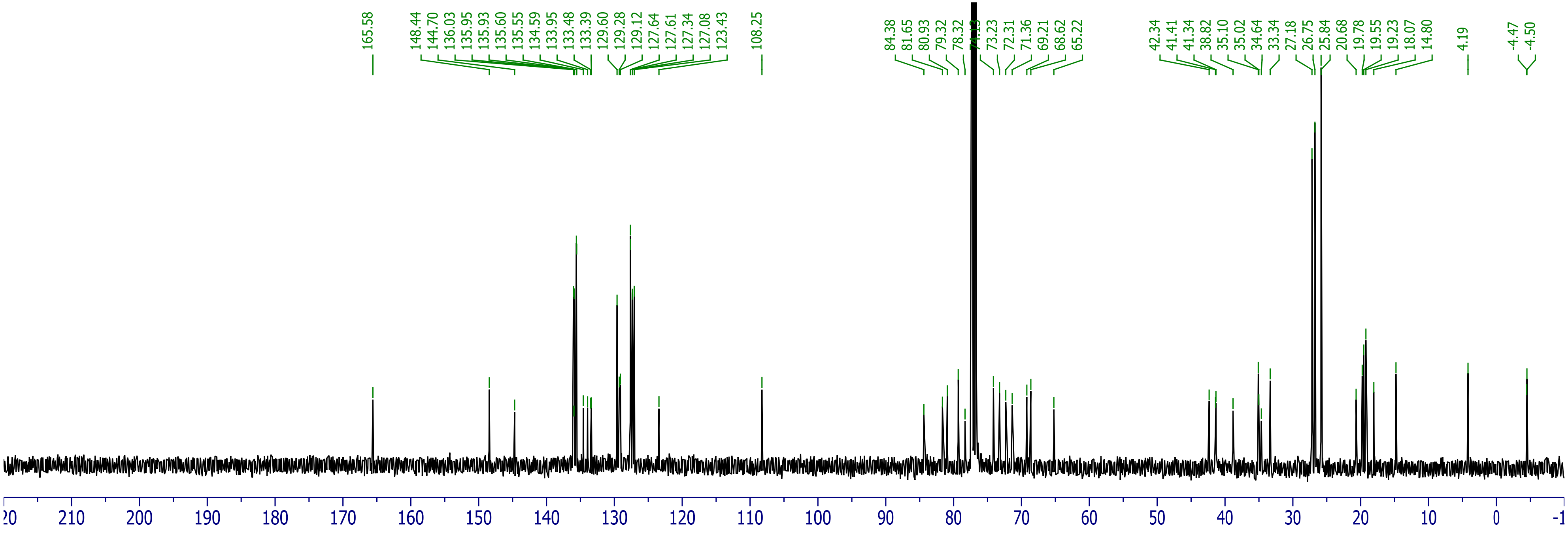
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127.08
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4.19
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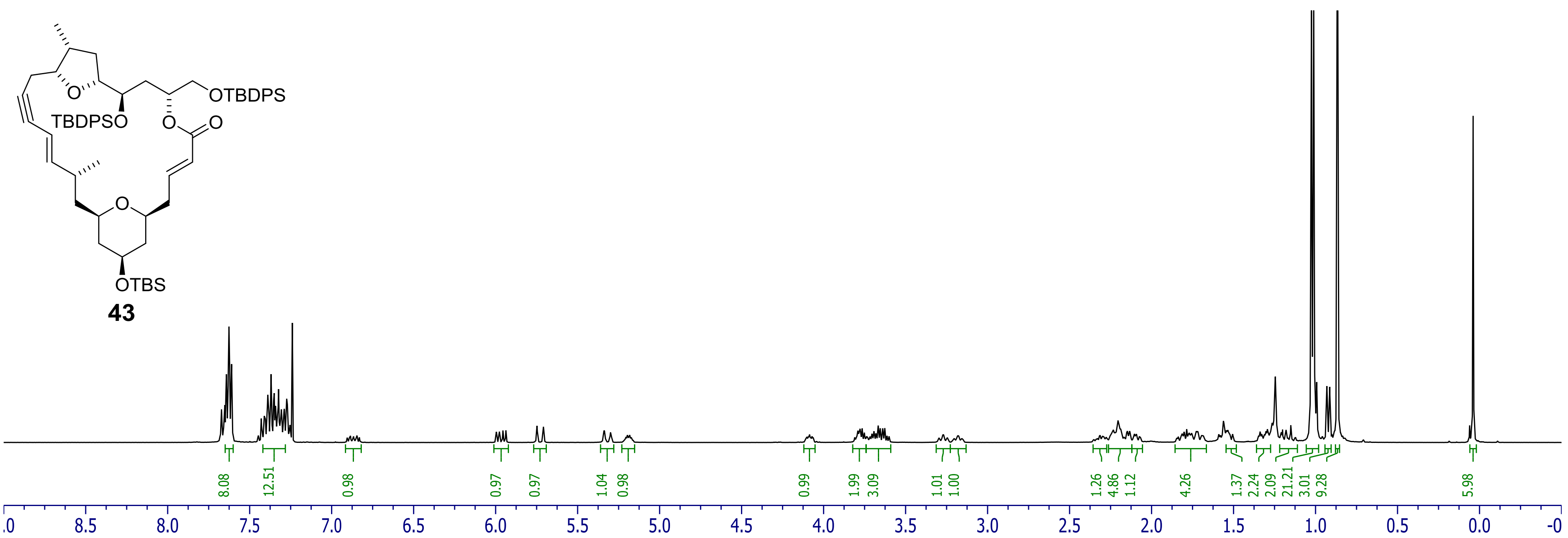

43

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2.09
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3.01
9.28
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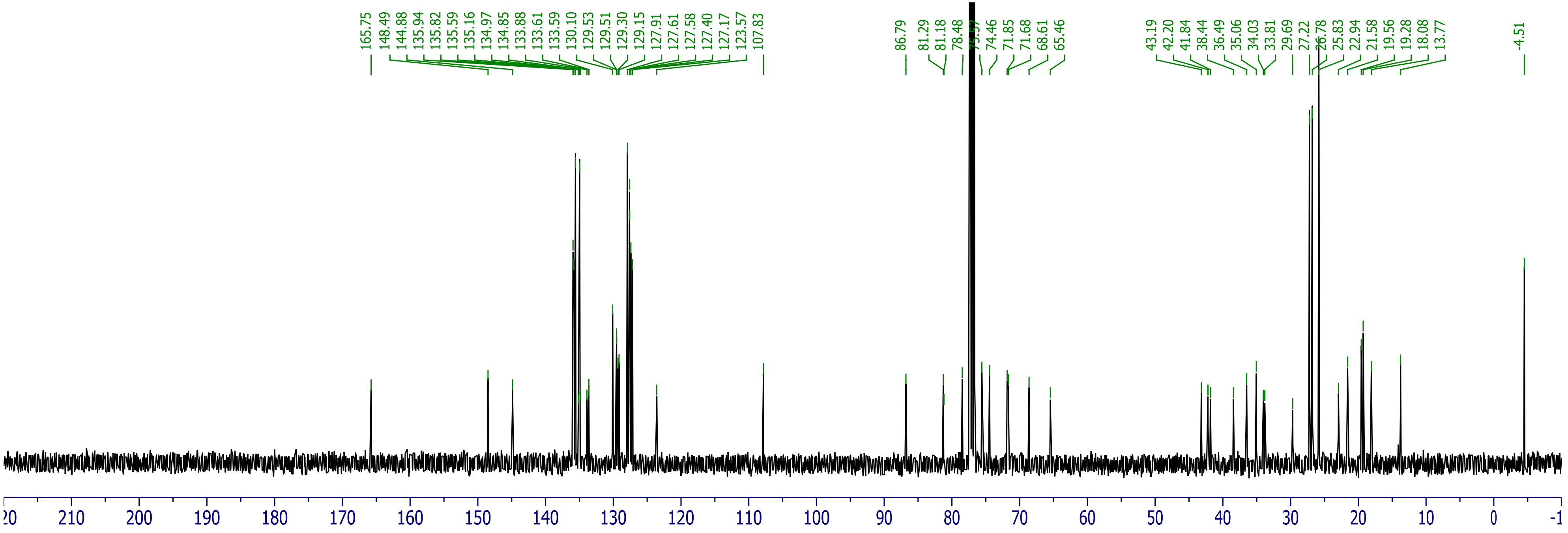

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71.68
68.61
65.46
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42.20
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38.44
36.49
35.06
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29.69
27.22
26.78
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22.94
21.58
19.56
19.28
18.08
13.77
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20
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200
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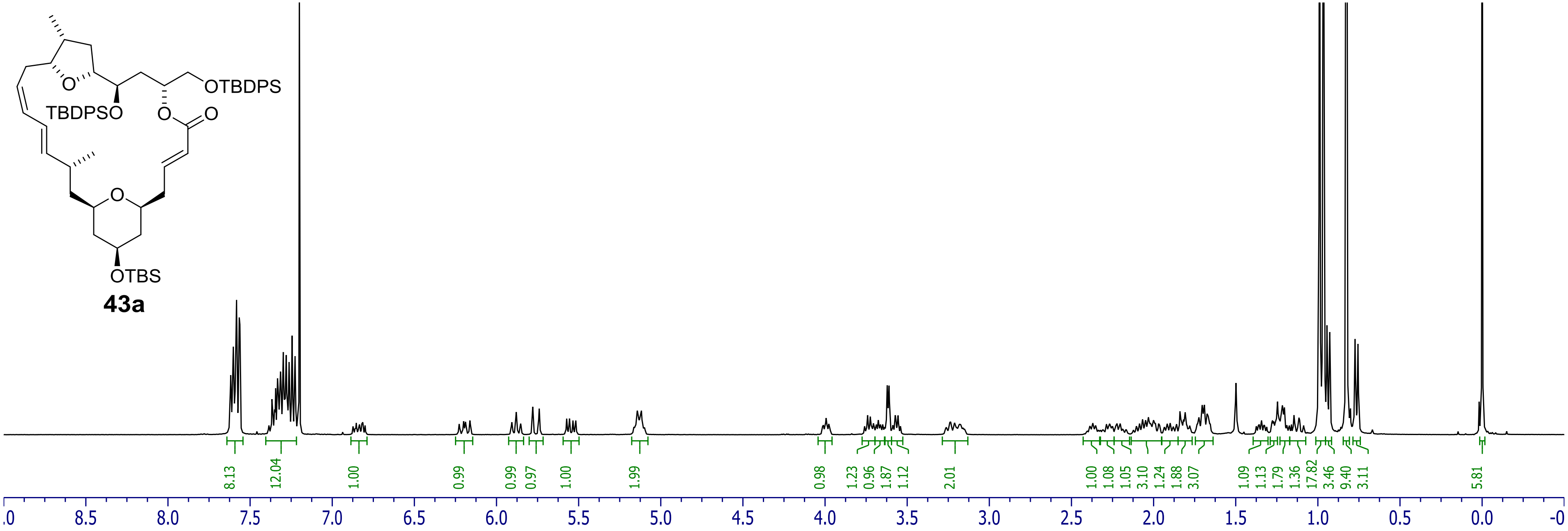
43a
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1.05
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1.13
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3.46
9.40
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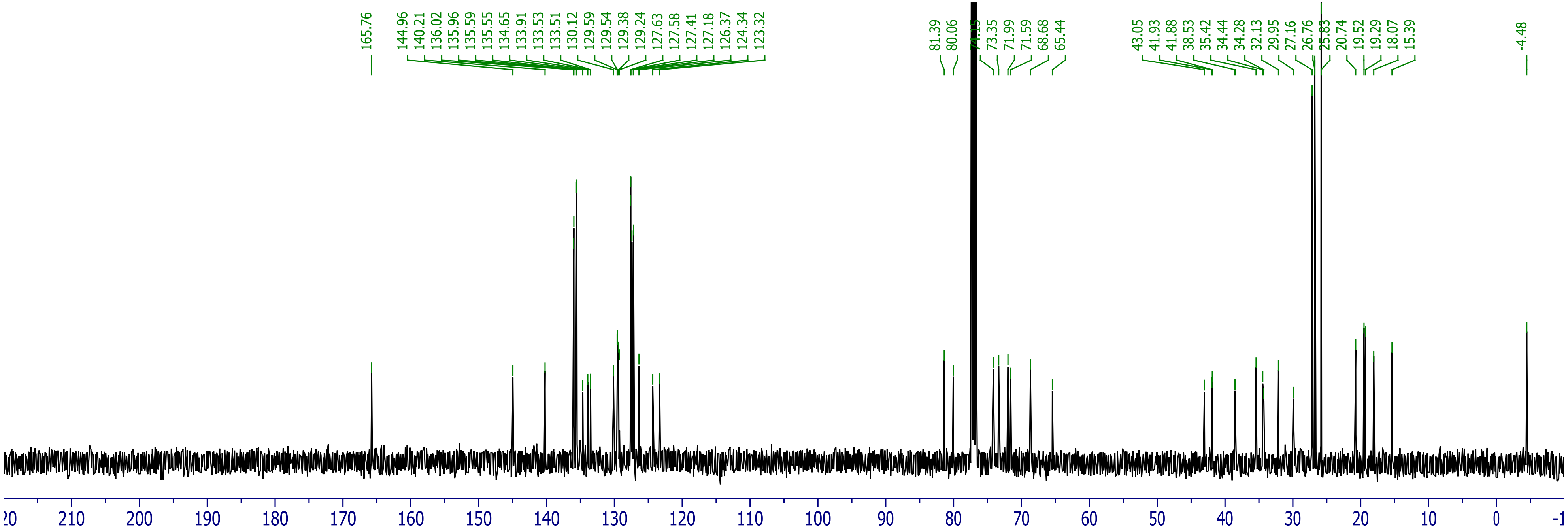
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80.06
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65.44
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34.44
34.28
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20.74
19.52
19.29
18.07
15.39
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200
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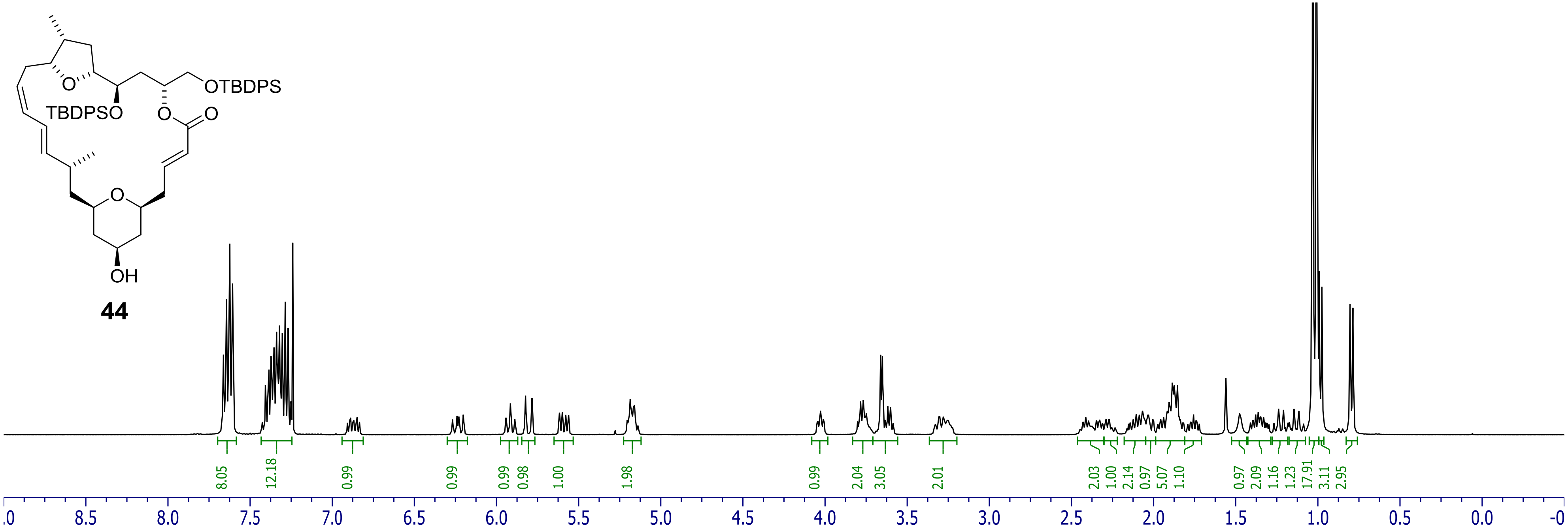
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1.98
0.99
2.04
3.05
2.01
2.03
1.00
2.14
0.97
5.07
1.10
0.97
2.09
1.16
1.23
17.91
3.11
2.95
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8.5
8.0
7.5
7.0
6.5
6.0
5.5
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1.0
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0.0
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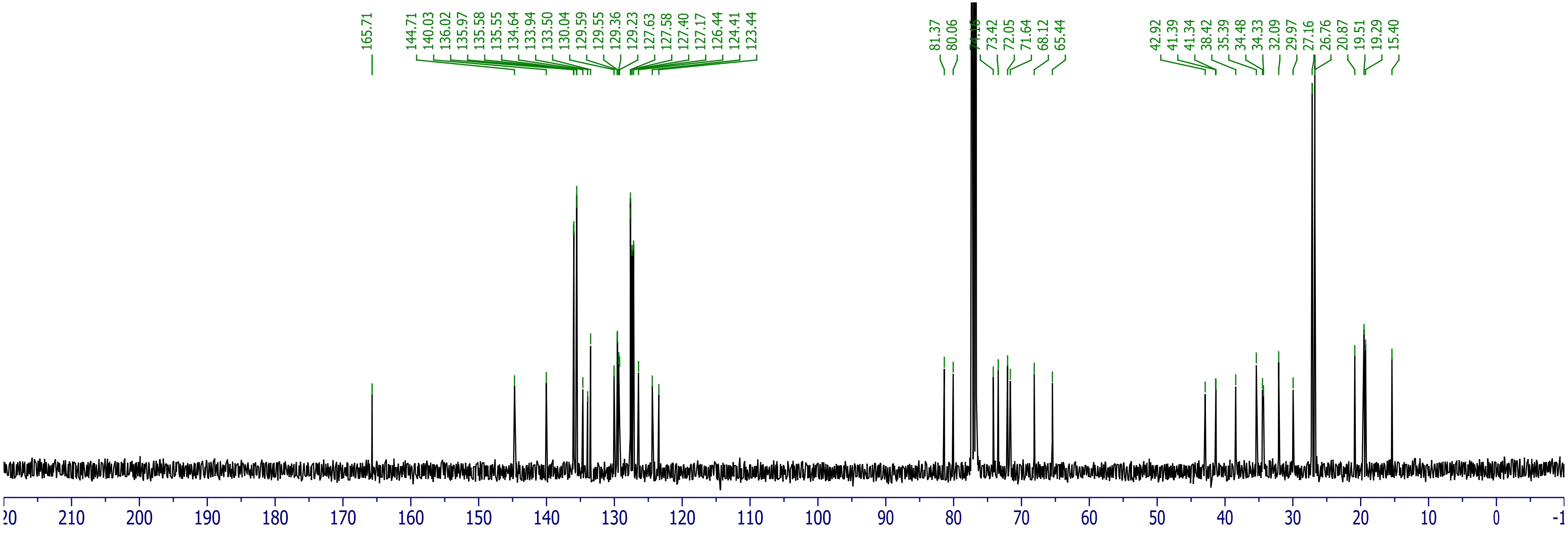
44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129.23
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127.58
127.40
127.17
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124.41
123.44
81.37
80.06
74.16
73.42
72.05
71.64
68.12
65.44
42.92
41.39
41.34
38.42
35.39
34.48
34.33
32.09
29.97
27.16
26.76
20.87
19.51
19.29
15.40
0
210
200
190
180
170
160
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140
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120
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100
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80
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60
50
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20
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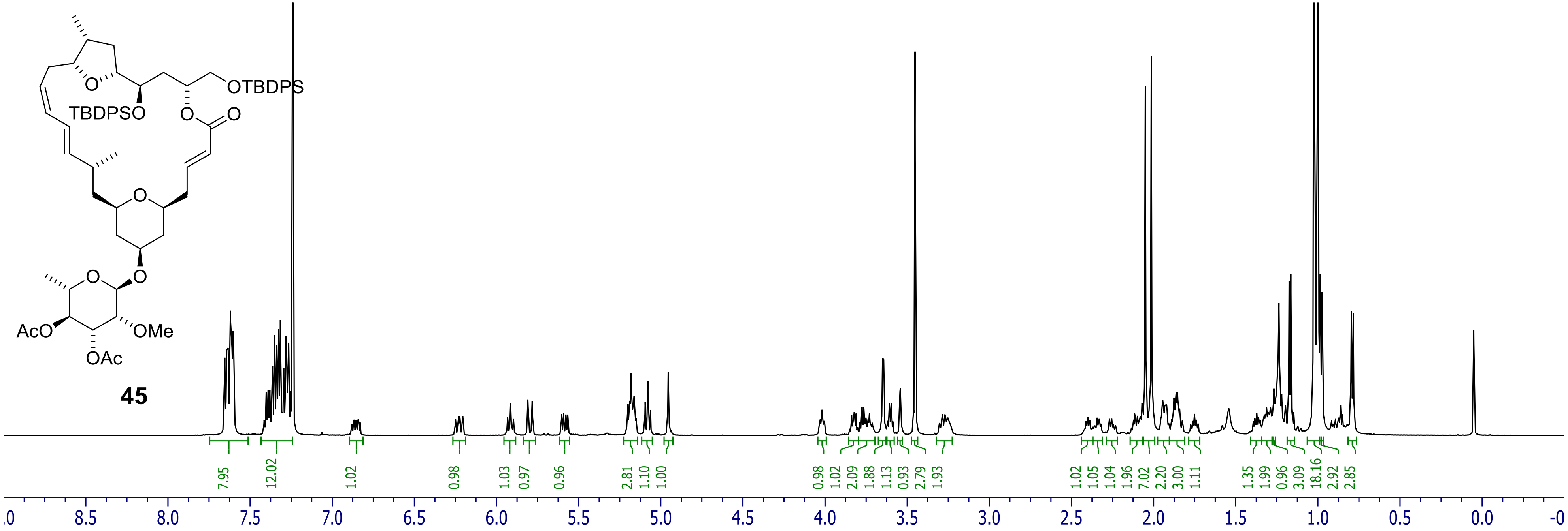
0
-1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TBDPSO
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O
O
O
AcO
OMe
OAc
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1.03
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0.96
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1.00
0.98
1.02
2.09
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1.13
0.93
2.79
1.93
1.02
1.05
1.04
1.96
7.02
2.20
3.00
1.11
1.35
1.99
0.96
3.09
18.16
2.92
2.85
8.5
8.0
7.5
7.0
6.5
6.0
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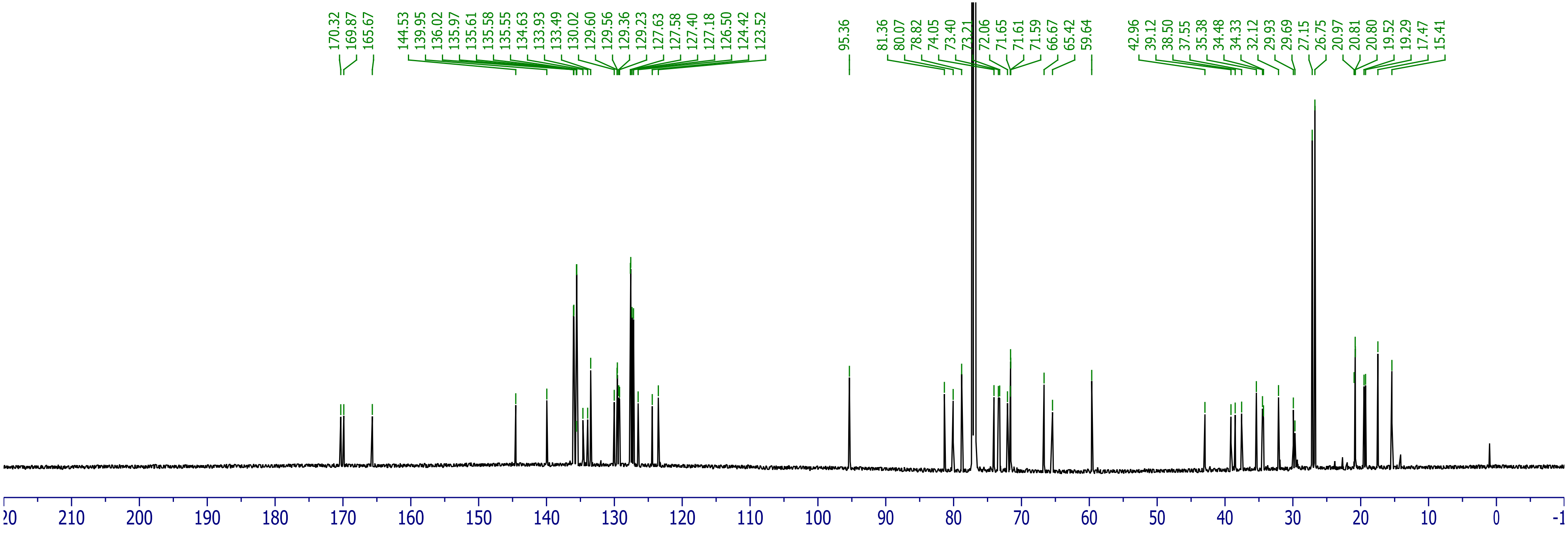
45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130.02
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129.23
127.63
127.58
127.40
127.18
126.50
124.42
123.52
95.36
81.36
80.07
78.82
74.05
73.40
73.21
72.06
71.65
71.61
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66.67
65.42
59.64
42.96
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38.50
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35.38
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32.12
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29.69
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26.75
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20.81
20.80
19.52
19.29
17.47
15.41
210
200
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120
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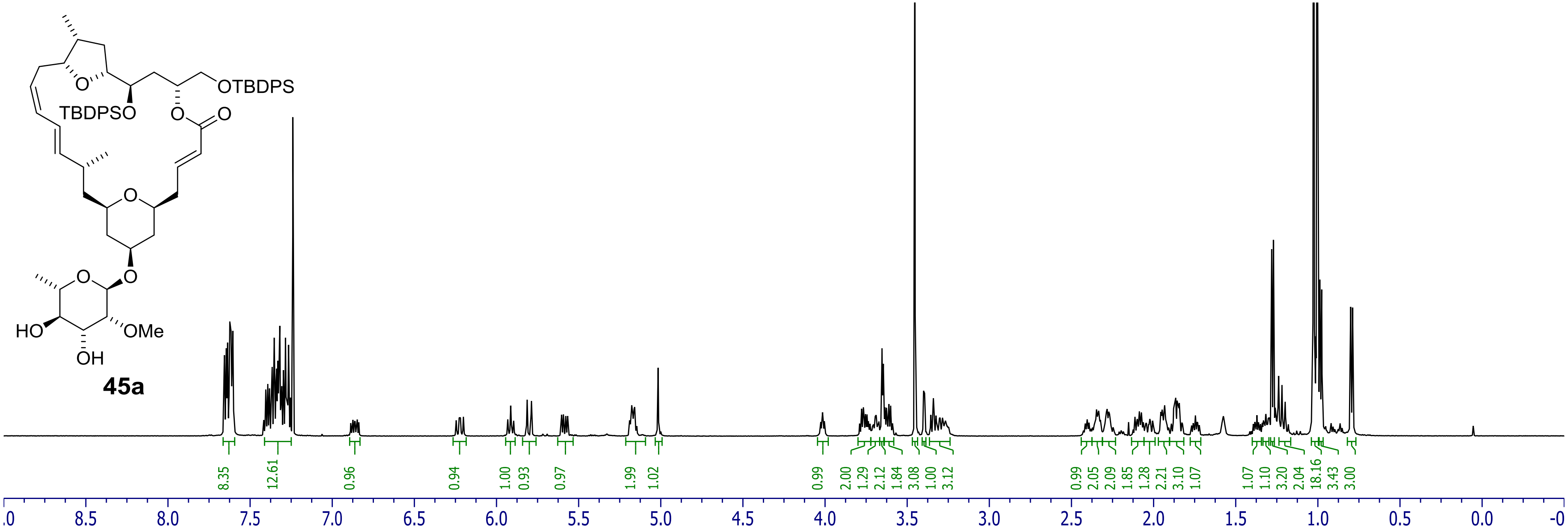
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TBDPSO
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O
O
O
HO
OH
OMe
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1.00
0.93
0.97
1.99
1.02
0.99
2.00
1.29
2.12
1.84
3.08
1.00
3.12
0.99
2.05
2.09
1.85
1.28
2.21
3.10
1.07
1.07
1.10
3.20
2.04
18.16
3.43
3.00
.0
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8.0
7.5
7.0
6.5
6.0
5.5
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1.0
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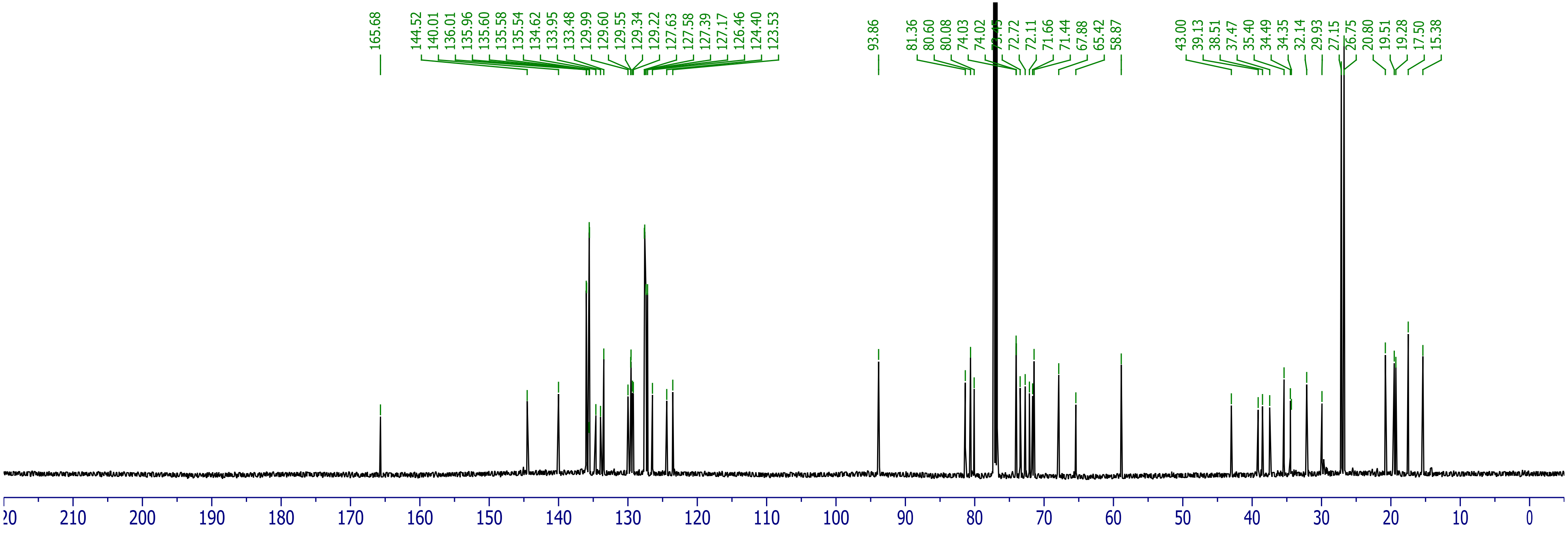
0.0
-0

45a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129.55
129.34
129.22
127.63
127.58
127.39
127.17
126.46
124.40
123.53
93.86
81.36
80.60
80.08
74.03
74.02
73.45
72.72
72.11
71.66
71.44
67.88
65.42
58.87
43.00
39.13
38.51
37.47
35.40
34.49
34.35
32.14
29.93
27.15
26.75
20.80
19.51
19.28
17.50
15.38
210
200
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20
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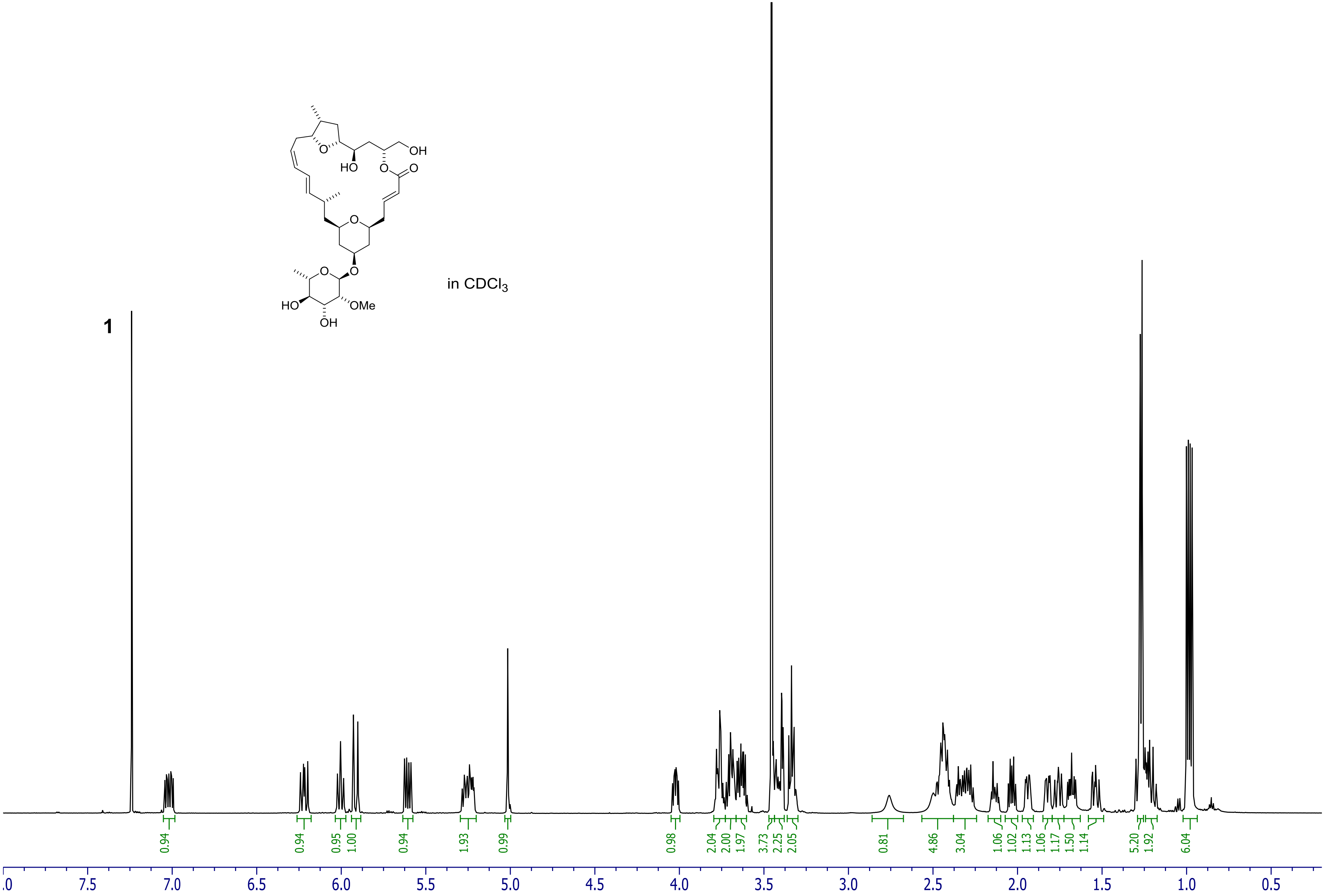
1



in CDCl3
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HO
O
O
O
OMe
HO
OH
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0.94
0.95
1.00
0.94
1.93
0.99
0.98
2.04
2.00
1.97
3.73
2.25
2.05
0.81
4.86
3.04
1.06
1.02
1.13
1.06
1.17
1.50
1.14
5.20
1.92
6.04
.0
7.5
7.0
6.5
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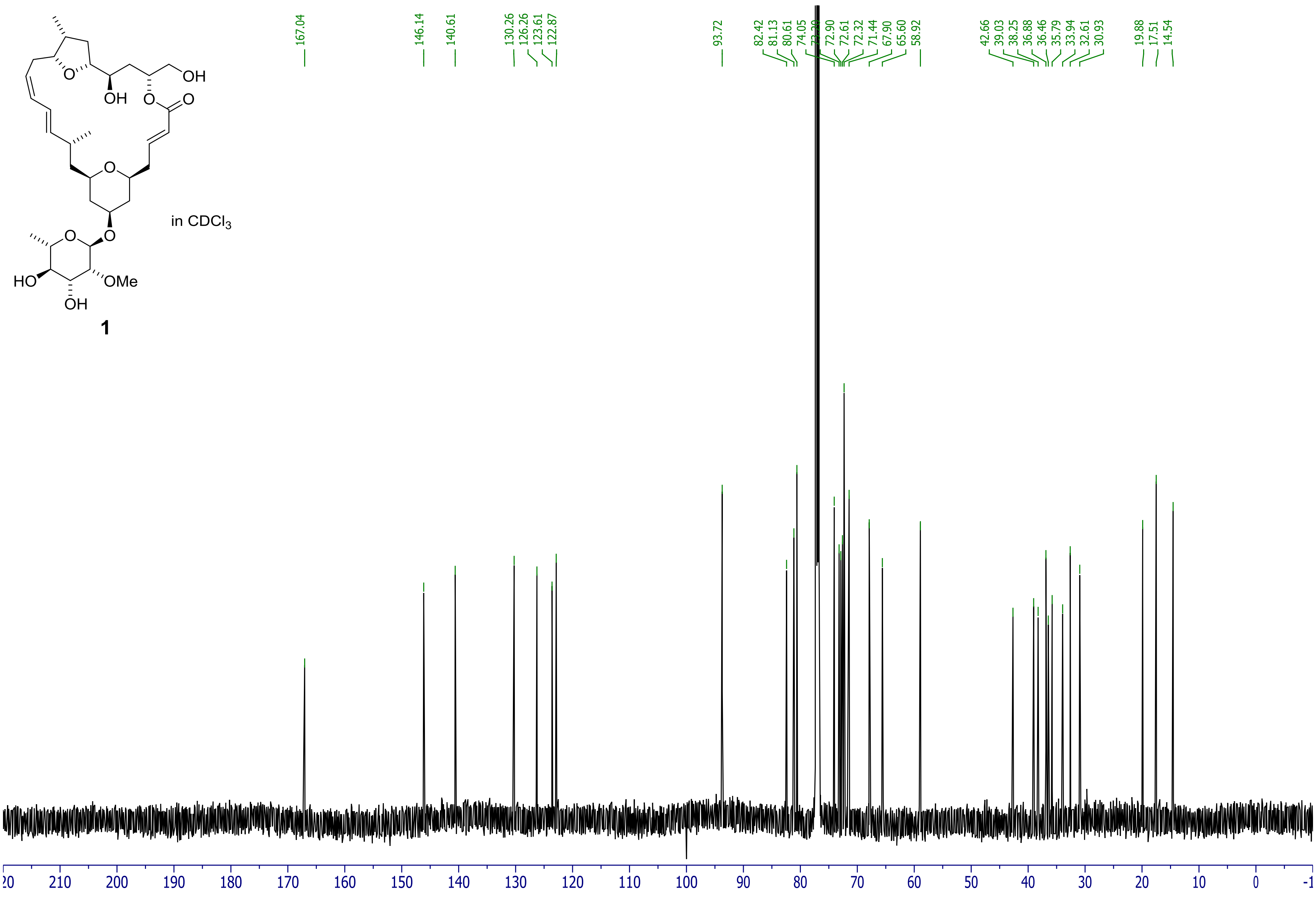
OH
OH
O
O
O
OMe
HO
OH
in CDCl$_3$

1

167.04
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123.61
122.87
93.72
82.42
81.13
80.61
74.05
73.20
72.90
72.61
72.32
71.44
67.90
65.60
58.92
42.66
39.03
38.25
36.88
36.46
35.79
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20
210
200
190
180
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100
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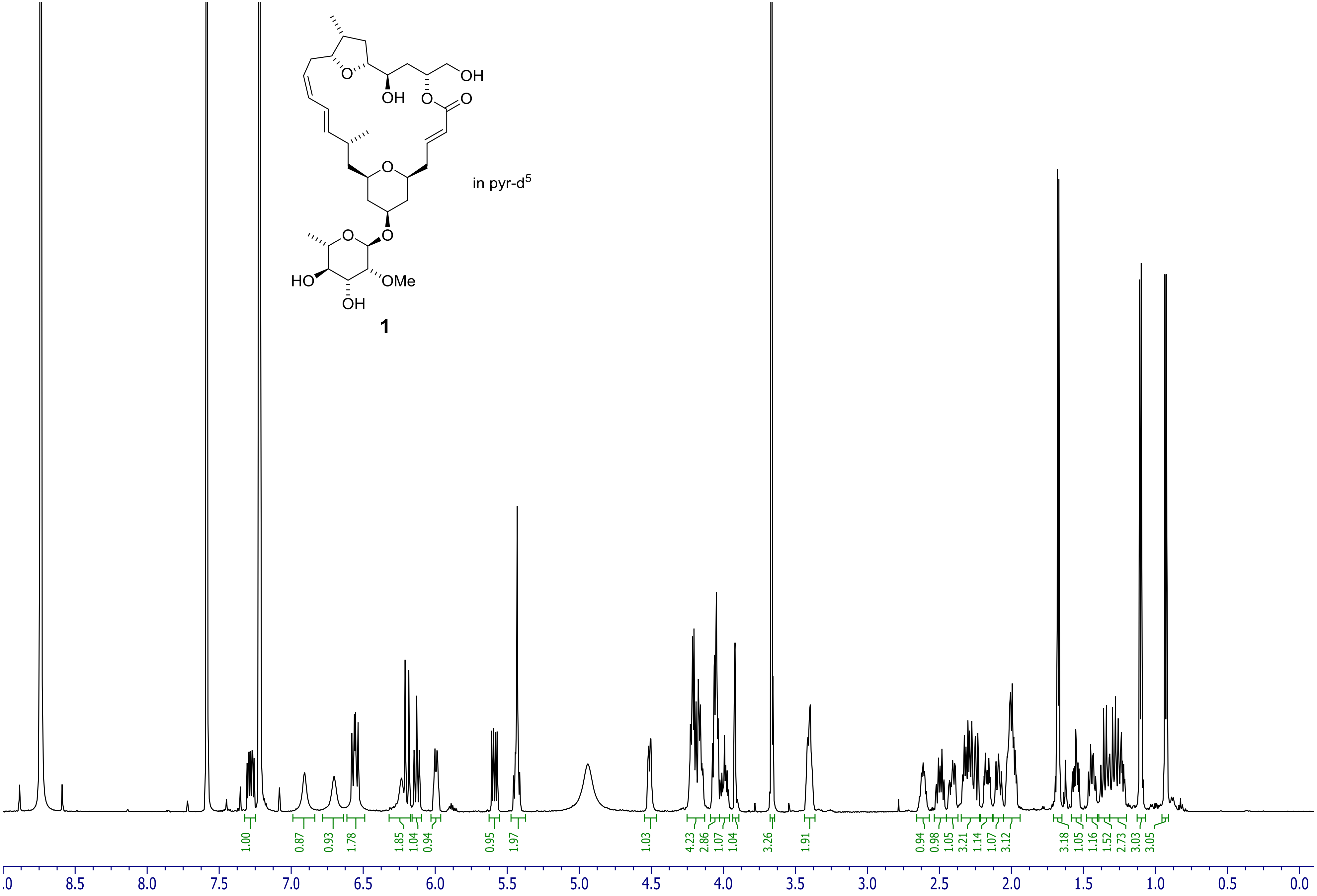
0
-1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O
O
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O
O
HO
OMe
OH
1
in pyr-d5
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1.85
1.04
0.94
0.95
1.97
1.03
4.23
2.86
1.07
1.04
3.26
1.91
0.94
0.98
1.05
3.21
1.14
1.07
3.12
3.18
1.05
1.16
1.52
2.73
3.03
3.05
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8.5
8.0
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7.0
6.5
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2.0
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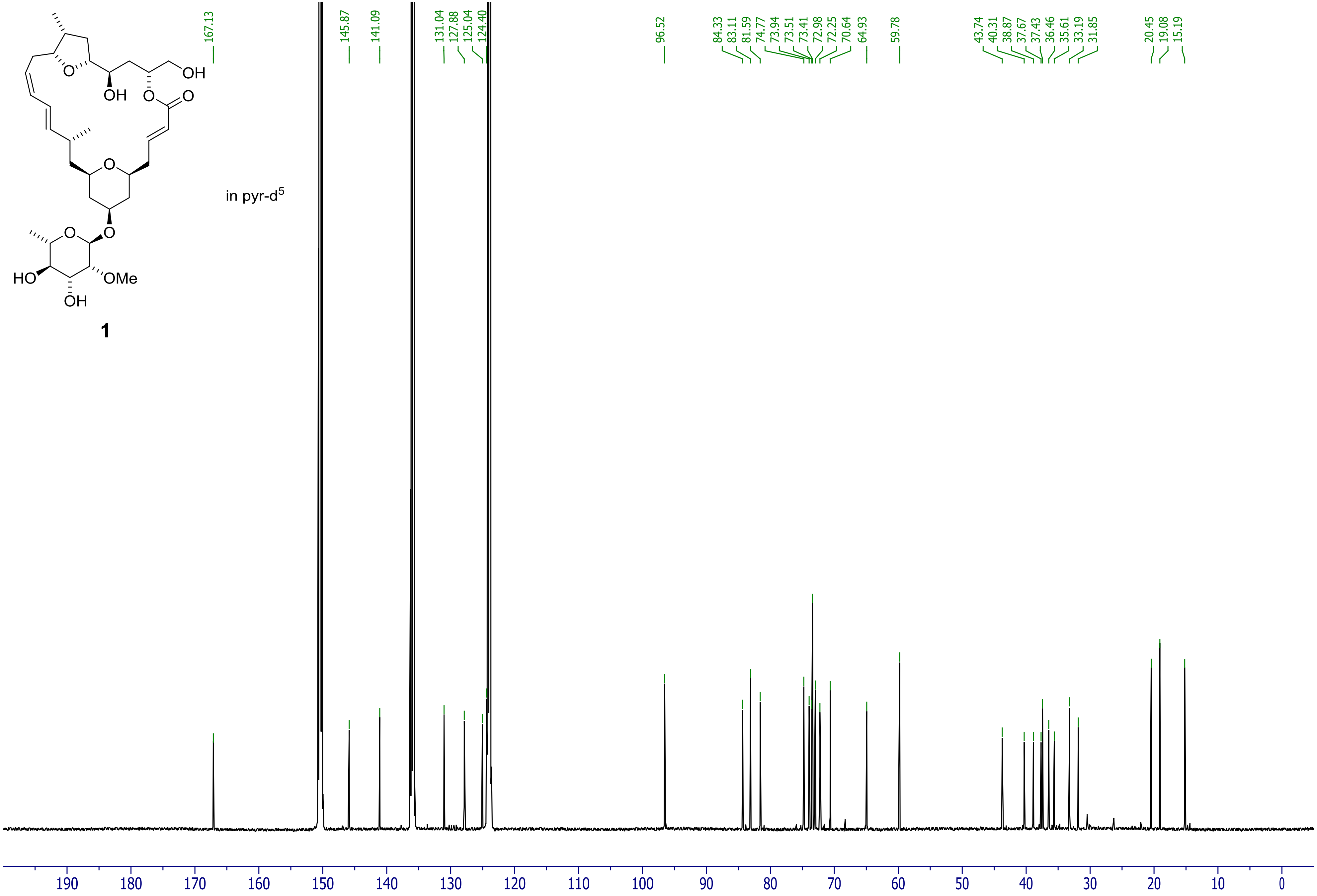
0.0


OH
O
OH
O
O
O
HO
OH
OMe
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145.87
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127.88
125.04
124.40
96.52
84.33
83.11
81.59
74.77
73.94
73.51
73.41
72.98
72.25
70.64
64.93
59.78
43.74
40.31
38.87
37.67
37.43
36.46
35.61
33.19
31.85
20.45
19.08
15.19
190
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170
160
150
140
130
120
110
100
90
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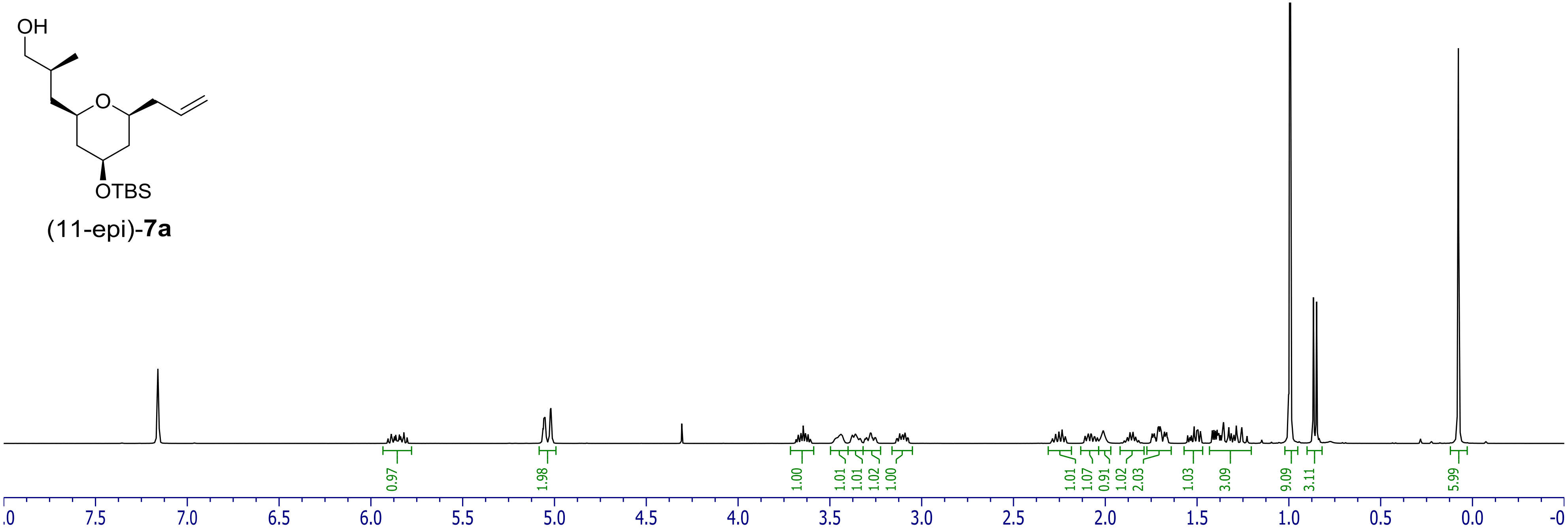
50
40
30
20
10
0

1

in pyr-d^5

OH
O
OTBS

(11-epi)-**7a**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1.01
1.07
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1.02
2.03
1.03
3.09
9.09
3.11
5.99
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7.5
7.0
6.5
6.0
5.5
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4.0
3.5
3.0
2.5
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1.5
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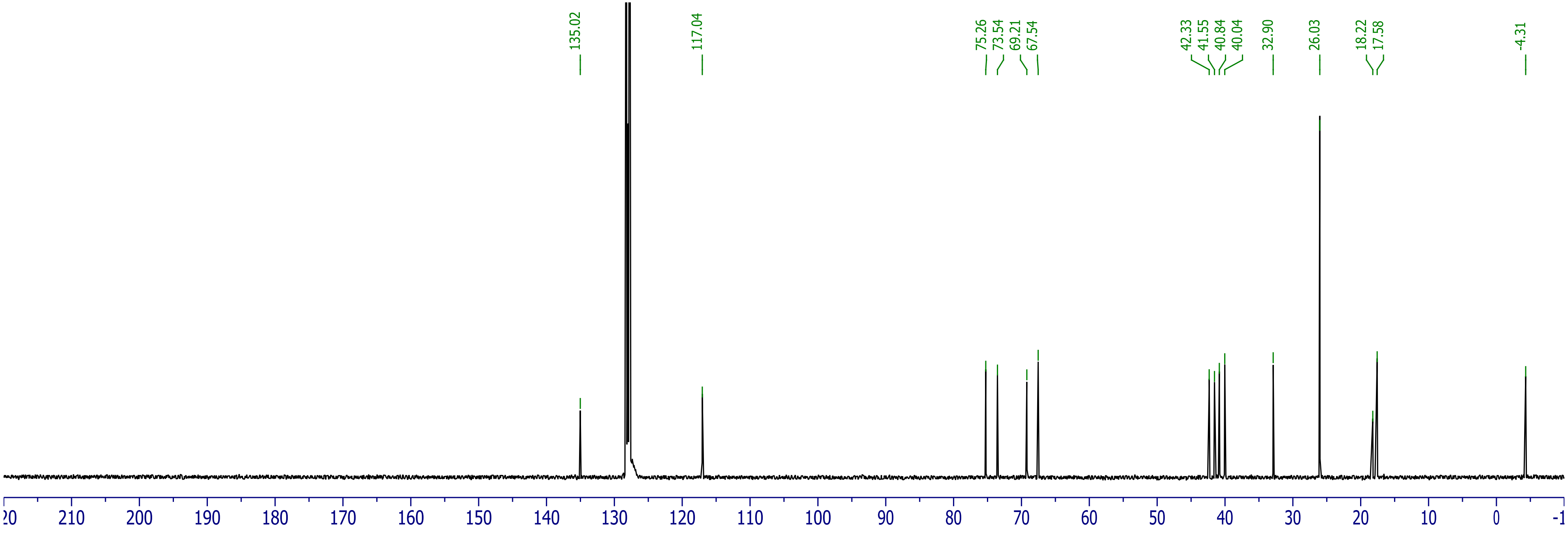
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200
190
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100
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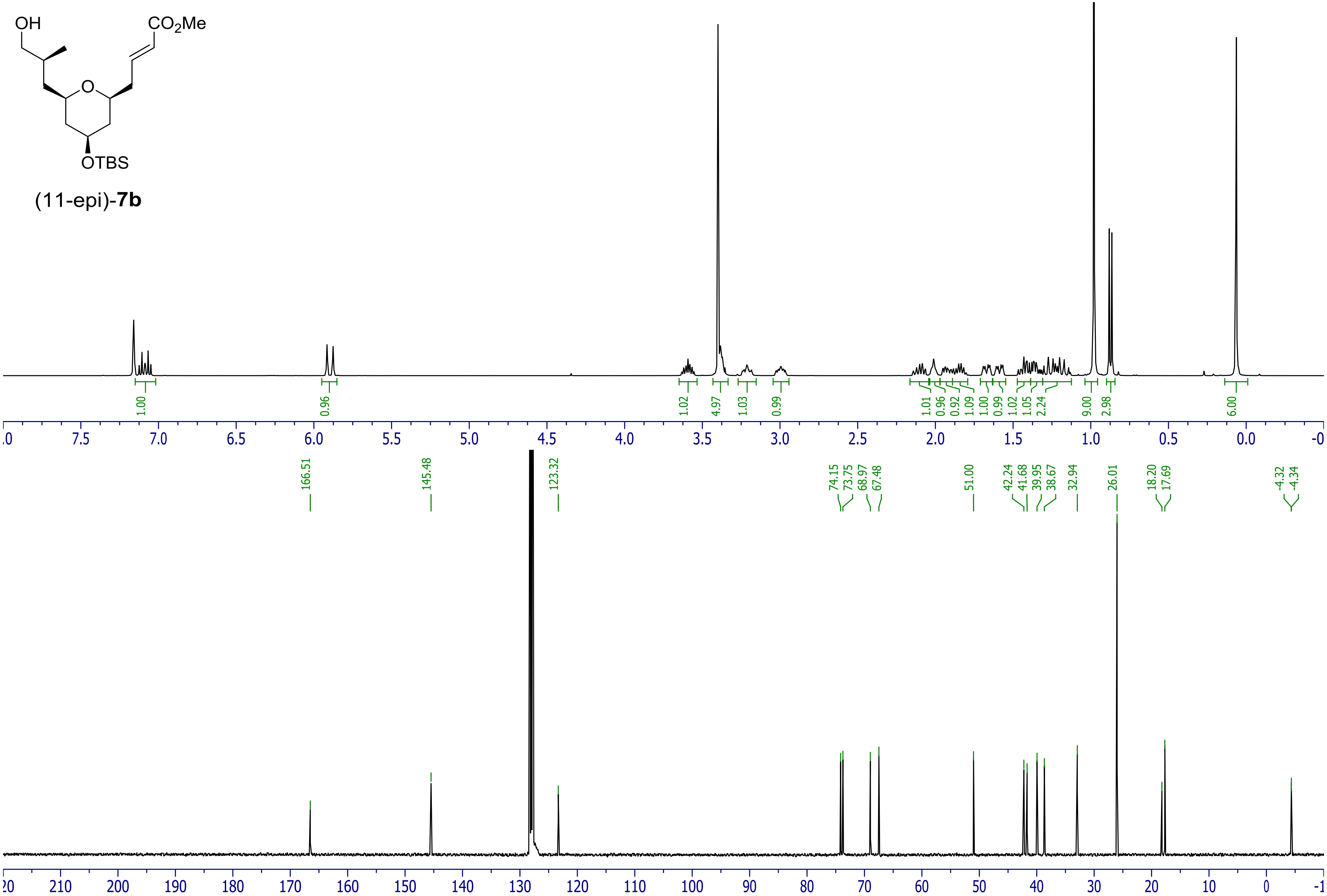
-1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CO2Me
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OTBS
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0.96
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1.09
1.00
0.99
1.02
1.05
2.24
9.00
2.98
6.00
.0
7.5
7.0
6.5
6.0
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5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
166.51
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74.15
73.75
68.97
67.48
51.00
42.24
41.68
39.95
38.67
32.94
26.01
18.20
17.69
-4.32
-4.34
20
210
200
190
180
170
160
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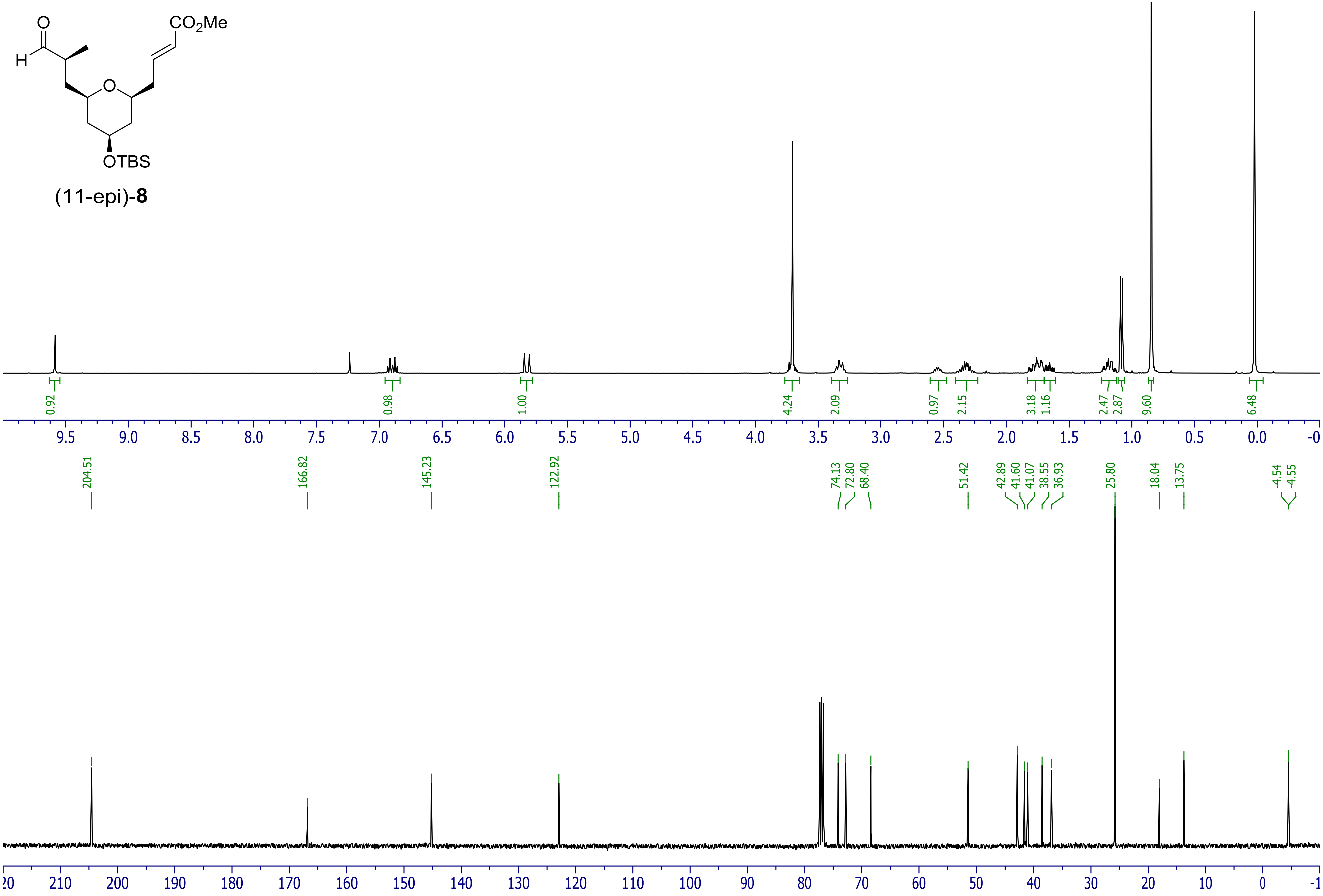
(11-epi)-**7b**



O
H
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1.16
2.47
2.87
9.60
6.48
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
204.51
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145.23
122.92
74.13
72.80
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51.42
42.89
41.60
41.07
38.55
36.93
25.80
18.04
13.75
-4.54
-4.55
20
210
200
190
180
170
160
150
140
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120
110
100
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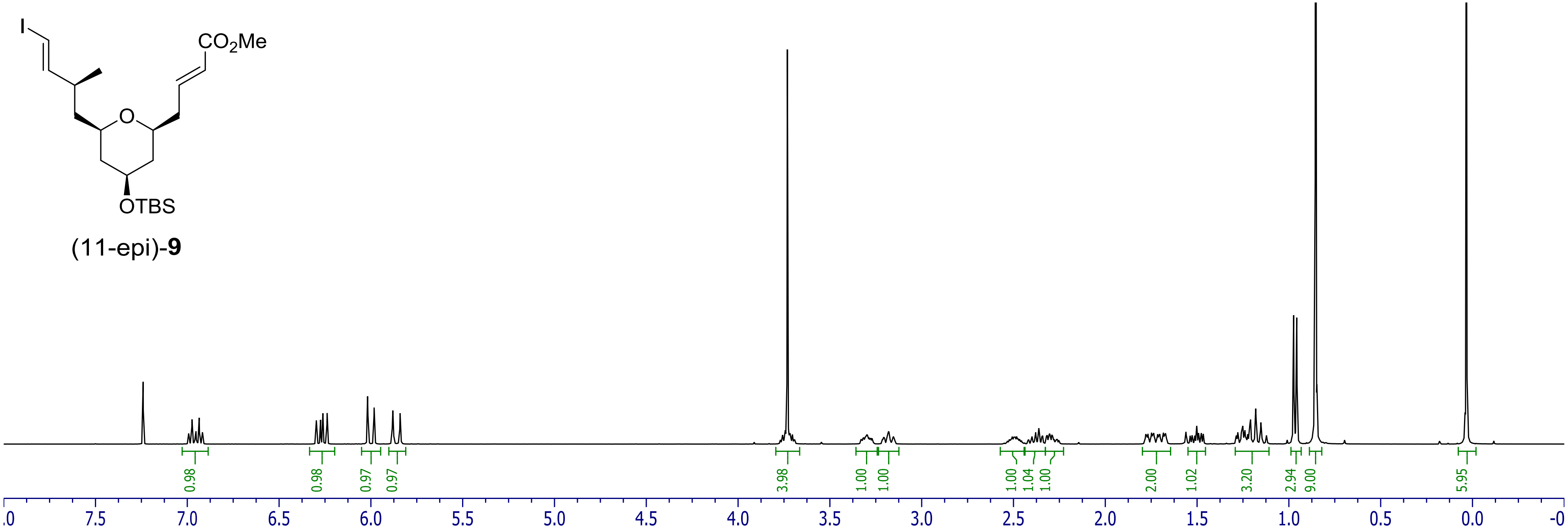
10
0
-1

(11-epi)-**8**

I
CO2Me
O
OTBS



(11-epi)-**9**
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0.97
3.98
1.00
1.00
1.00
1.04
1.00
2.00
1.02
3.20
2.94
9.00
5.95
.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
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1.5
1.0
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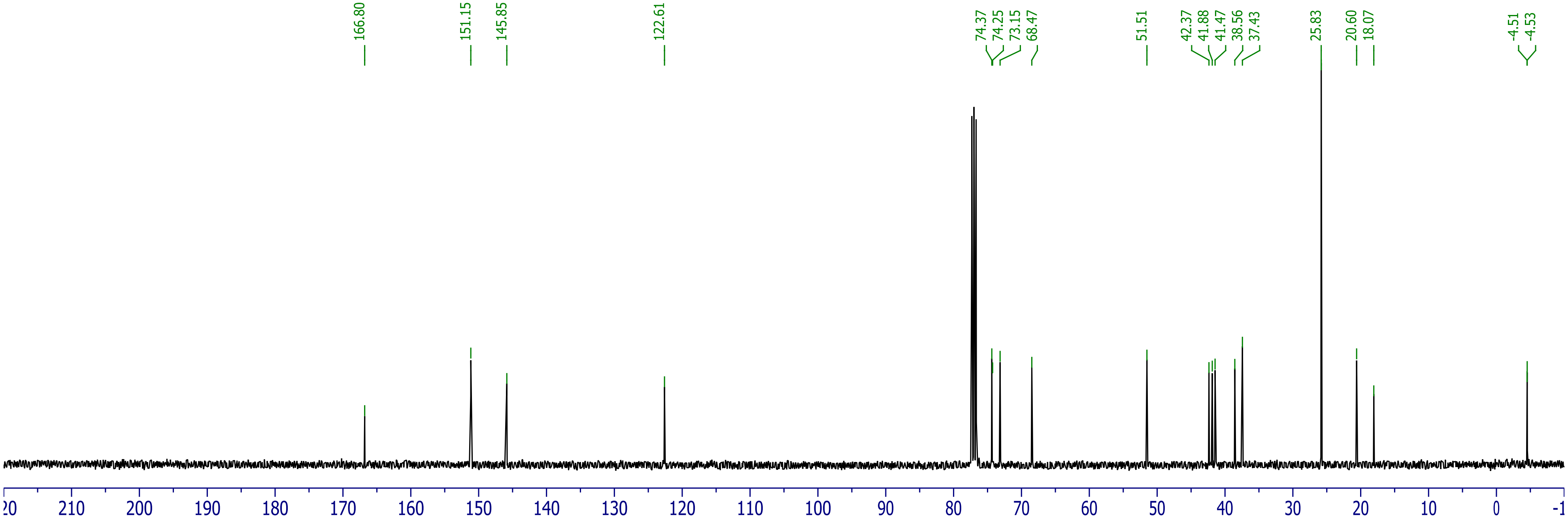
-0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151.15
145.85
122.61
74.37
74.25
73.15
68.47
51.51
42.37
41.88
41.47
38.56
37.43
25.83
20.60
18.07
-4.51
-4.53
20
210
200
190
180
170
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140
130
120
110
100
90
80
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50
40
30
20
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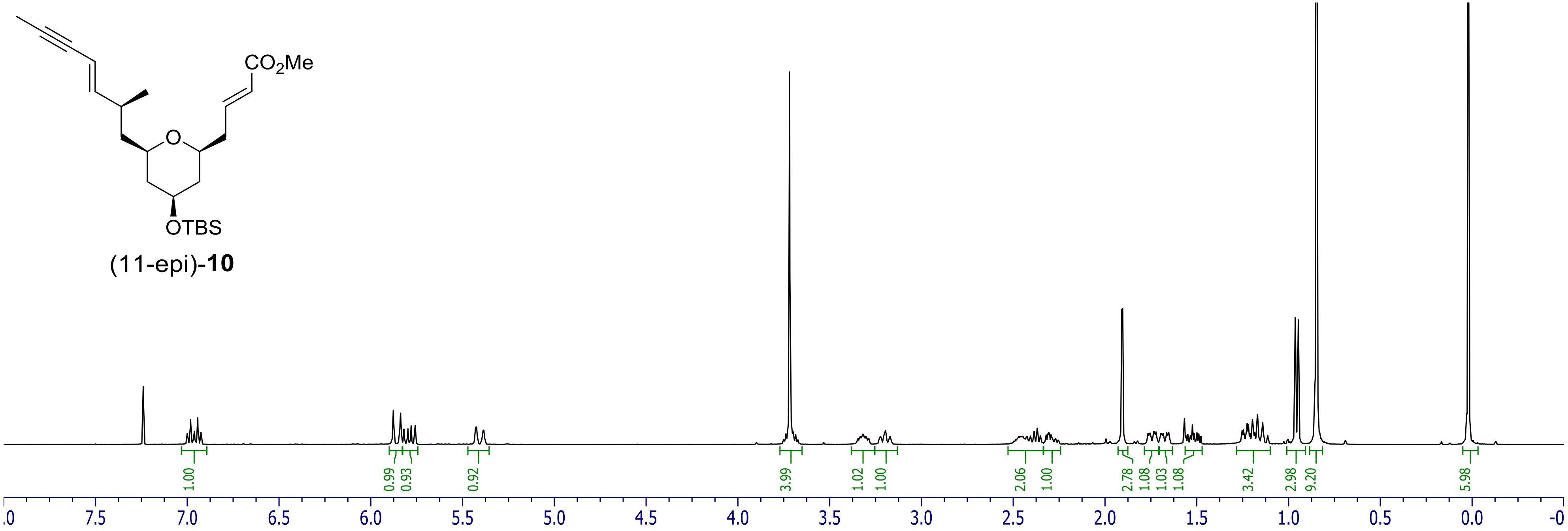
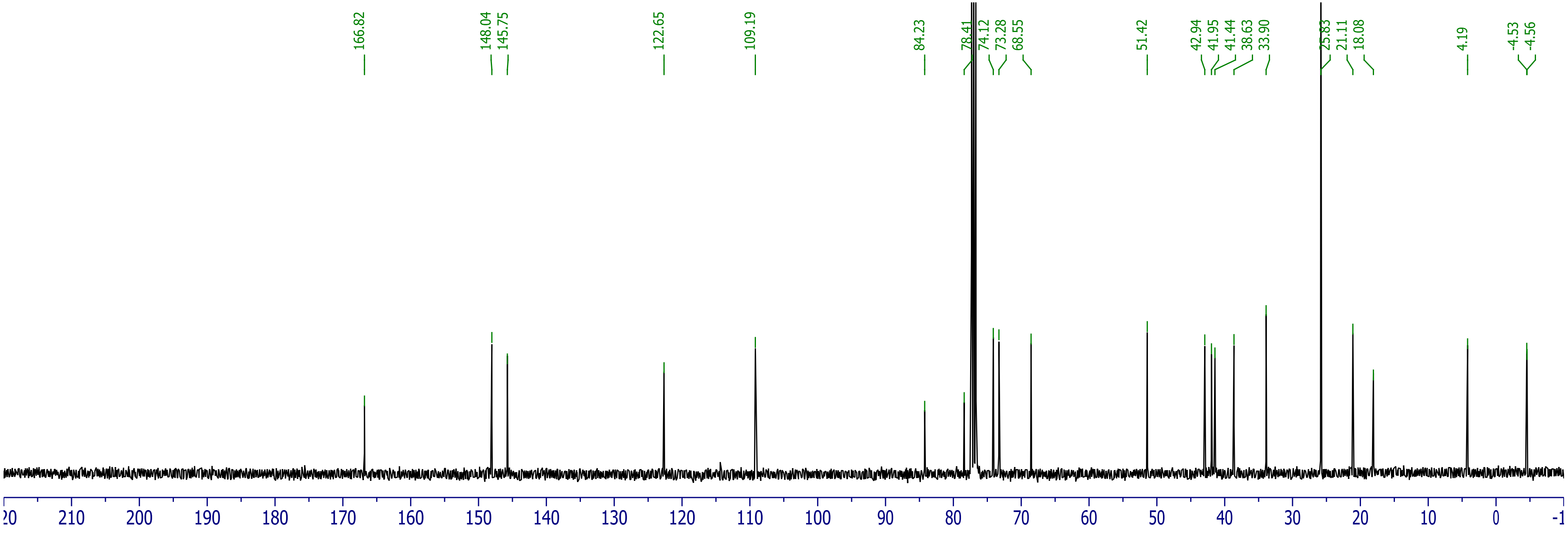
-1


CO$_2$Me
O
OTBS

(11-epi)-**10**

1.00
0.99
0.93
0.92
3.99
1.02
1.00
2.06
1.00
2.78
1.08
1.03
1.08
3.42
2.98
9.20
5.98
.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0


166.82
148.04
145.75
122.65
109.19
84.23
78.41
74.12
73.28
68.55
51.42
42.94
41.95
41.44
38.63
33.90
25.83
21.11
18.08
4.19
-4.53
-4.56
20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
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30
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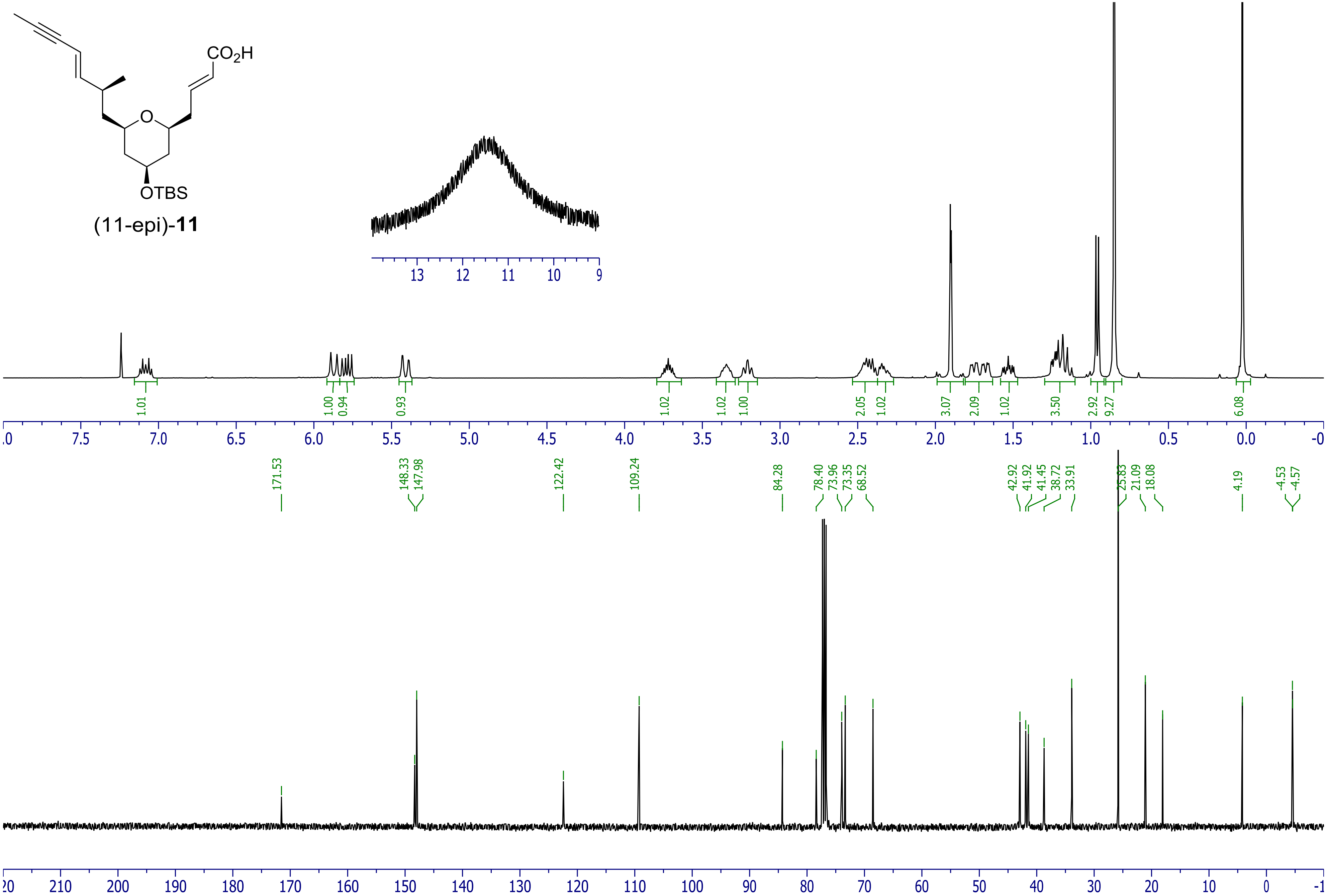
0
-1


CO$_2$H
O
OTBS
13
12
11
10
9
1.01
1.00
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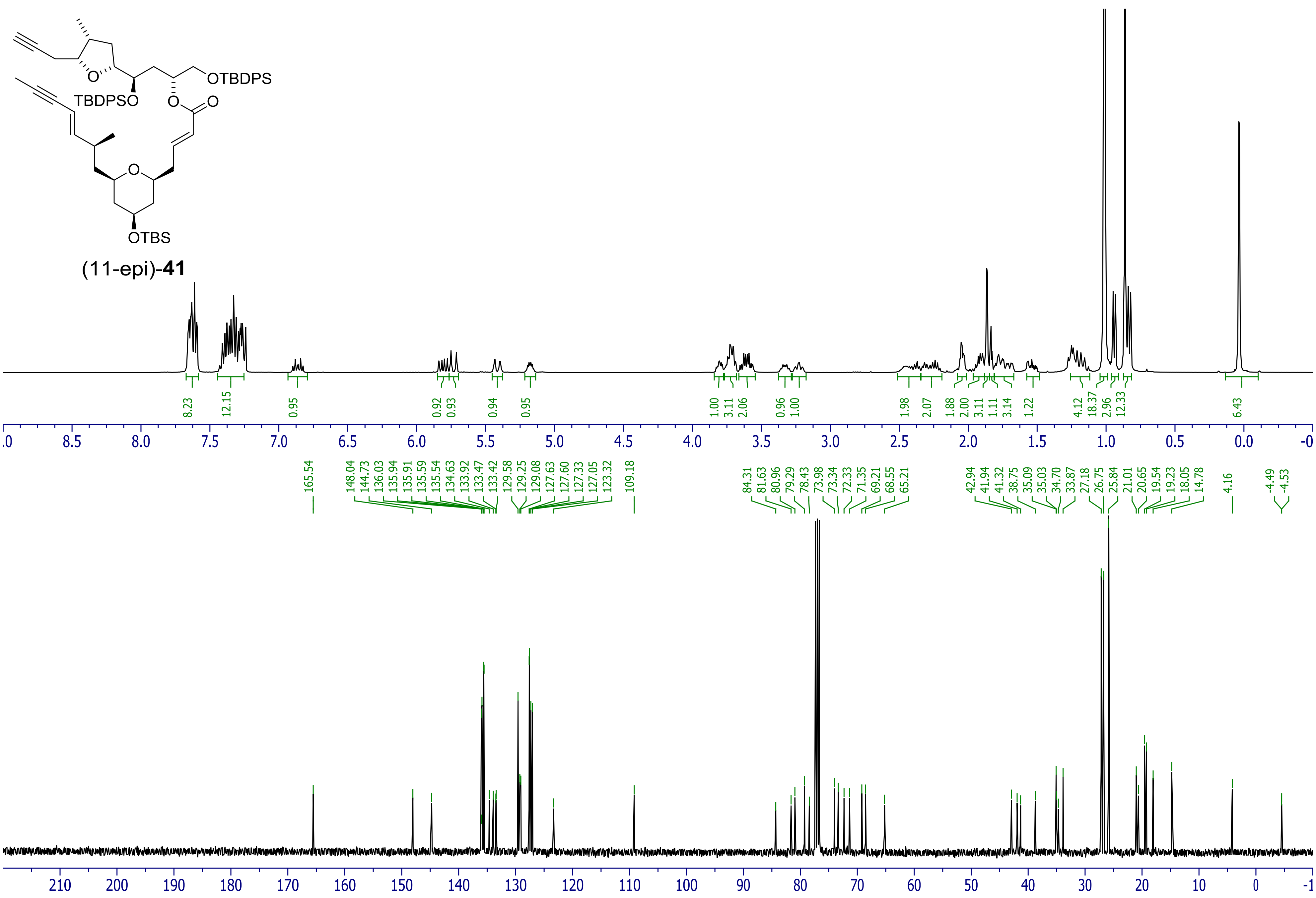
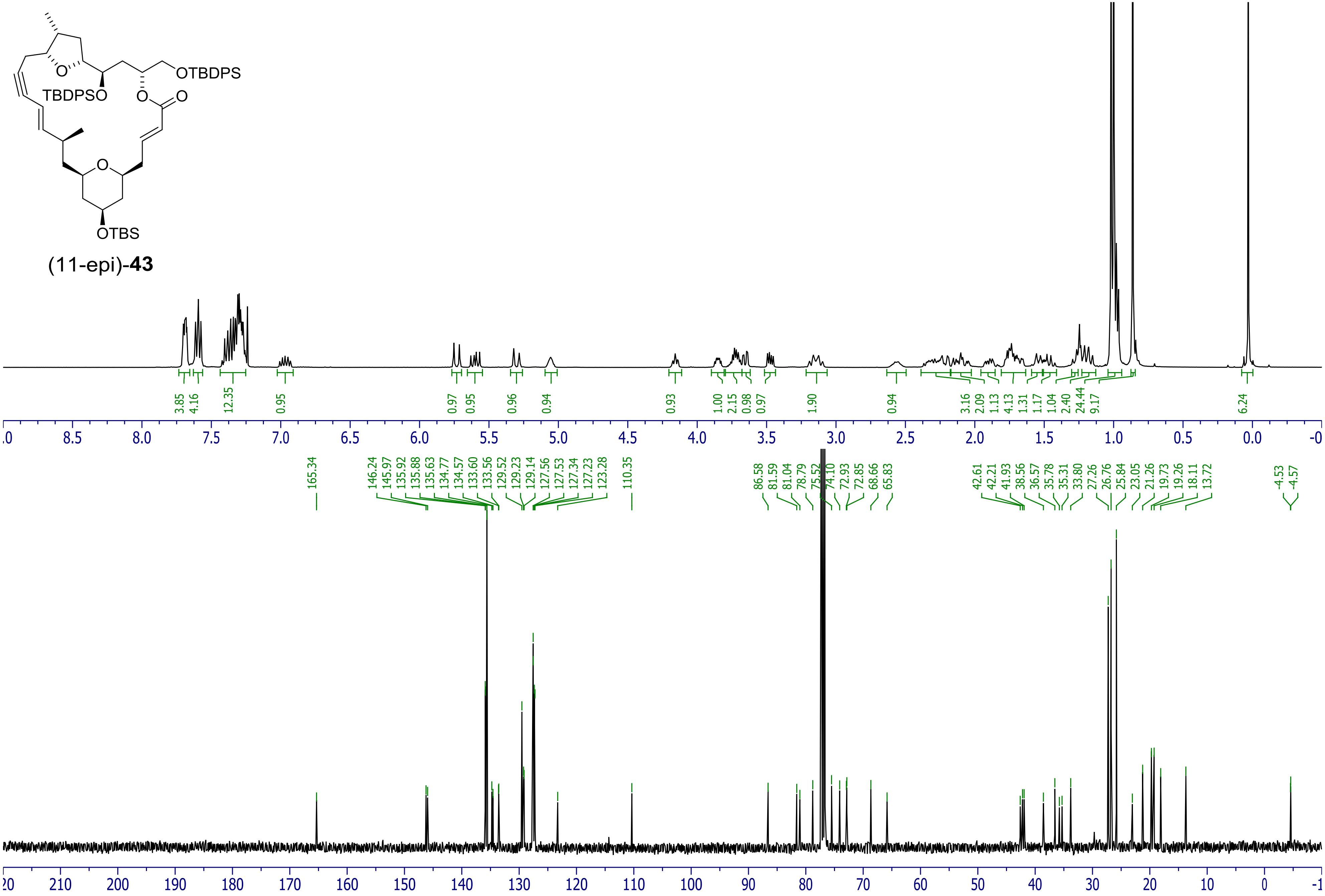
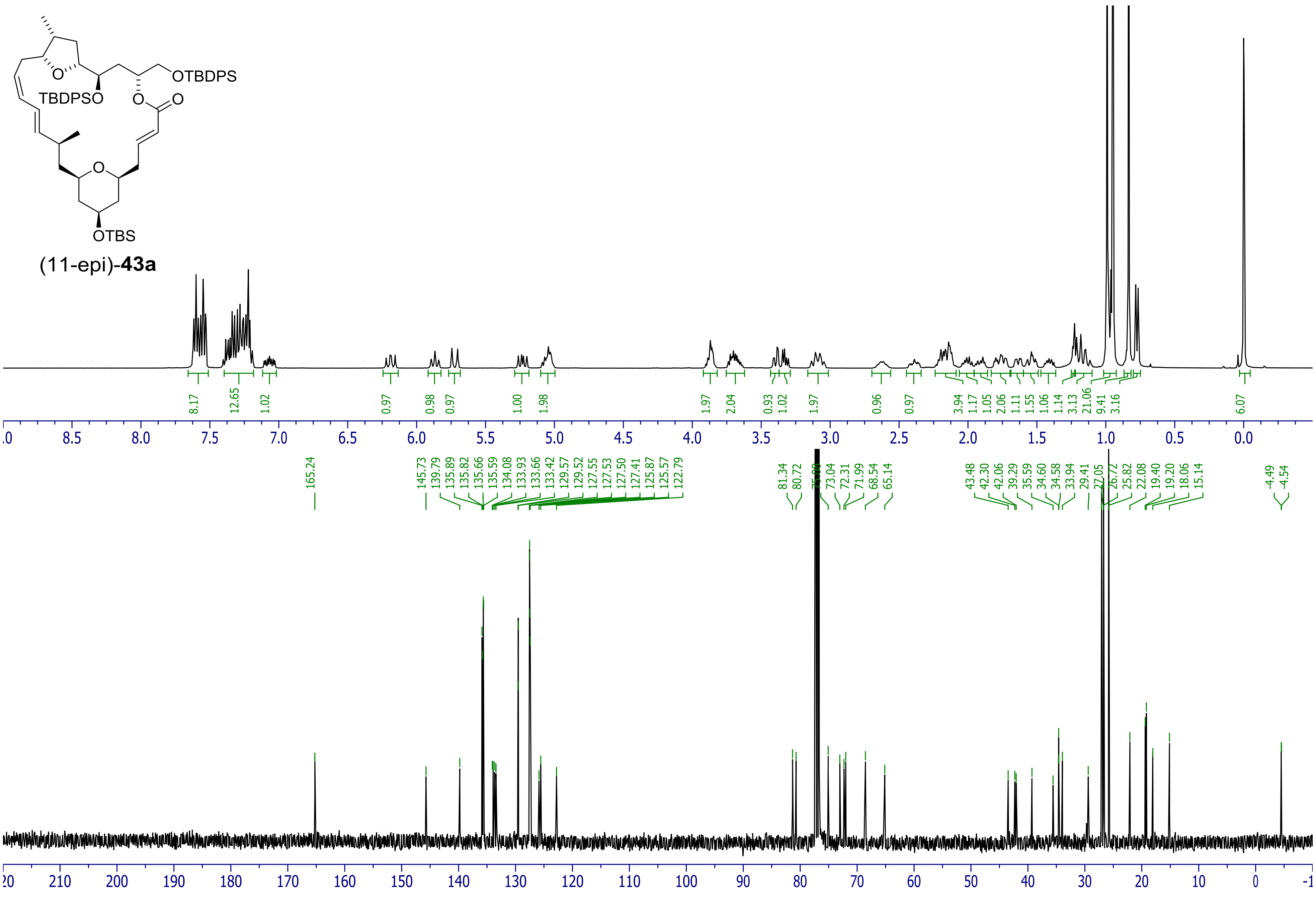
0.93
1.02
1.02
1.00
2.05
1.02
3.07
2.09
1.02
3.50
2.92
9.27
6.08
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
171.53
148.33
147.98
122.42
109.24
84.28
78.40
73.96
73.35
68.52
42.92
41.92
41.45
38.72
33.91
25.83
21.09
18.08
4.19
-4.53
-4.57
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

(11-epi)-**11**


OTBDPS
TBDPSO
O
O
O
O
OTBS
8.23
12.15
0.95
0.92
0.93
0.94
0.95
1.00
3.11
2.06
0.96
1.00
1.98
2.07
1.88
2.00
3.11
1.11
3.14
1.22
4.12
18.37
2.96
12.33
6.43
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
165.54
148.04
144.73
136.03
135.94
135.91
135.59
135.54
134.63
133.92
133.47
133.42
129.58
129.25
129.08
127.63
127.60
127.33
127.05
123.32
109.18
84.31
81.63
80.96
79.29
78.43
73.98
73.34
72.33
71.35
69.21
68.55
65.21
42.94
41.94
41.32
38.75
35.09
35.03
34.70
33.87
27.18
26.75
25.84
21.01
20.65
19.54
19.23
18.05
14.78
4.16
-4.49
-4.53
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

(11-epi)-**41**


OTBDPS
TBDPSO
O
O
O
O
OTBS
(11-epi)-43
3.85
4.16
12.35
0.95
0.97
0.95
0.96
0.94
0.93
1.00
2.15
0.98
0.97
1.90
0.94
3.16
2.09
1.13
4.13
1.31
1.17
1.04
2.40
24.44
9.17
6.24
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
165.34
146.24
145.97
135.92
135.88
135.63
134.77
134.57
133.60
133.56
129.52
129.23
129.14
127.56
127.53
127.34
127.23
123.28
110.35
86.58
81.59
81.04
78.79
75.52
74.10
72.93
72.85
68.66
65.83
42.61
42.21
41.93
38.56
36.57
35.78
35.31
33.80
27.26
26.76
25.84
23.05
21.26
19.73
19.26
18.11
13.72
-4.53
-4.57
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0


OTBDPS
TBDPSO
O
O
O
OTBS
8.17
12.65
1.02
0.97
0.98
0.97
1.00
1.98
1.97
2.04
0.93
1.02
1.97
0.96
0.97
3.94
1.17
1.05
2.06
1.11
1.55
1.06
1.14
3.13
21.06
9.41
3.16
6.07
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
165.24
145.73
139.79
135.89
135.82
135.66
135.59
134.08
133.93
133.66
133.42
129.57
129.52
127.55
127.53
127.50
127.41
125.87
125.57
122.79
81.34
80.72
73.04
72.31
71.99
68.54
65.14
43.48
42.30
42.06
39.29
35.59
34.60
34.58
33.94
29.41
27.05
26.72
25.82
22.08
19.40
19.20
18.06
15.14
-4.49
-4.54
210
200
190
180
170
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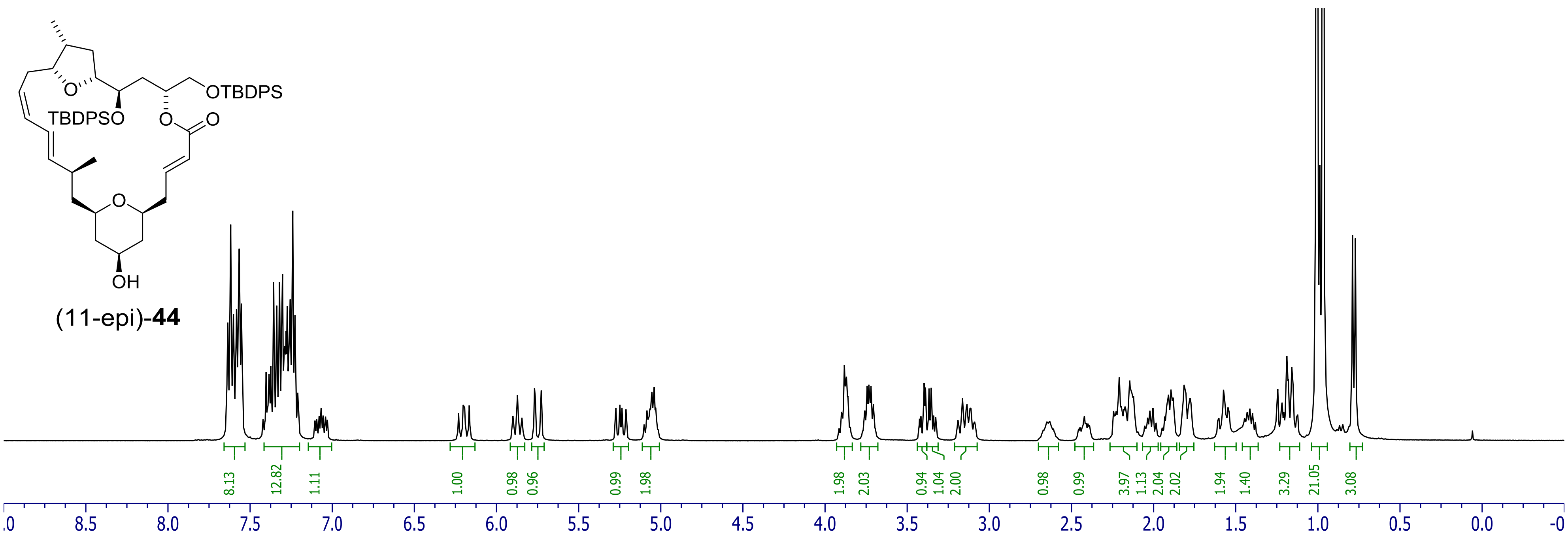
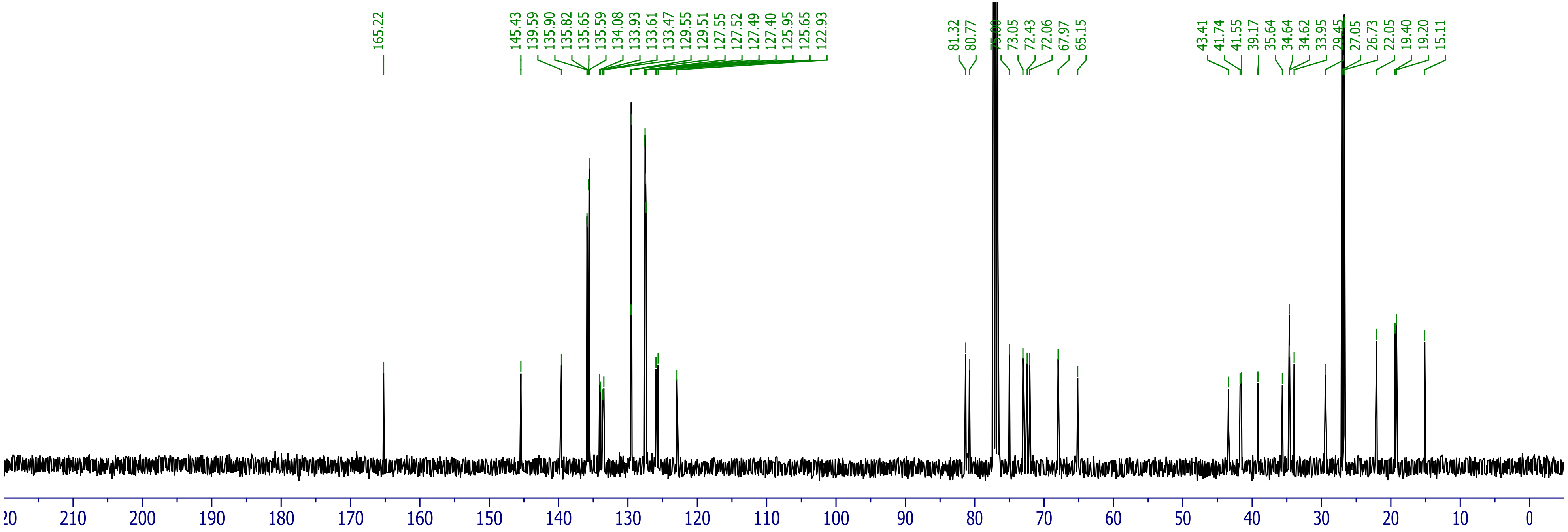
120
110
100
90
80
70
60
50
40
30
20
10
0

(11-epi)-**43a**

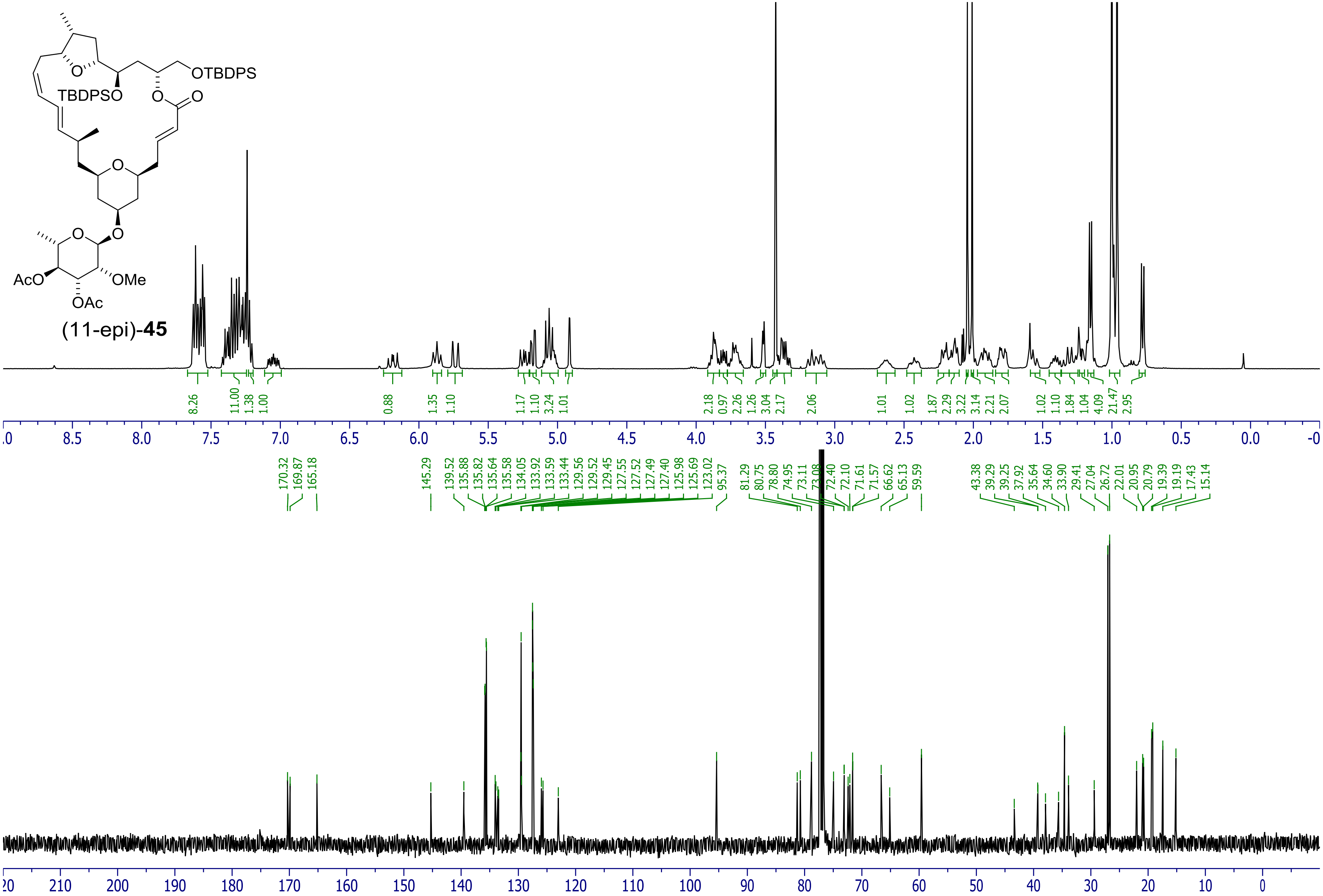


(11-epi)-**44**

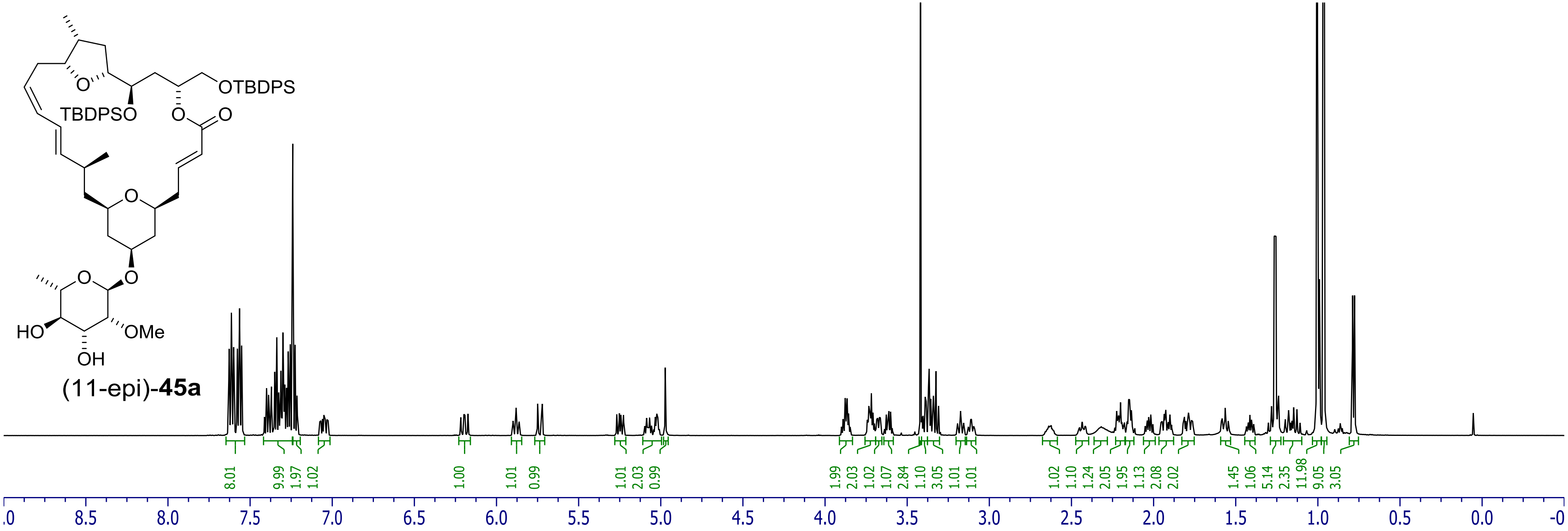
OTBDPS
TBDPSO
O
O
OH
8.13
12.82
1.11
1.00
0.98
0.96
0.99
1.98
1.98
2.03
0.94
1.04
2.00
0.98
0.99
3.97
1.13
2.04
2.02
1.94
1.40
3.29
21.05
3.08
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0



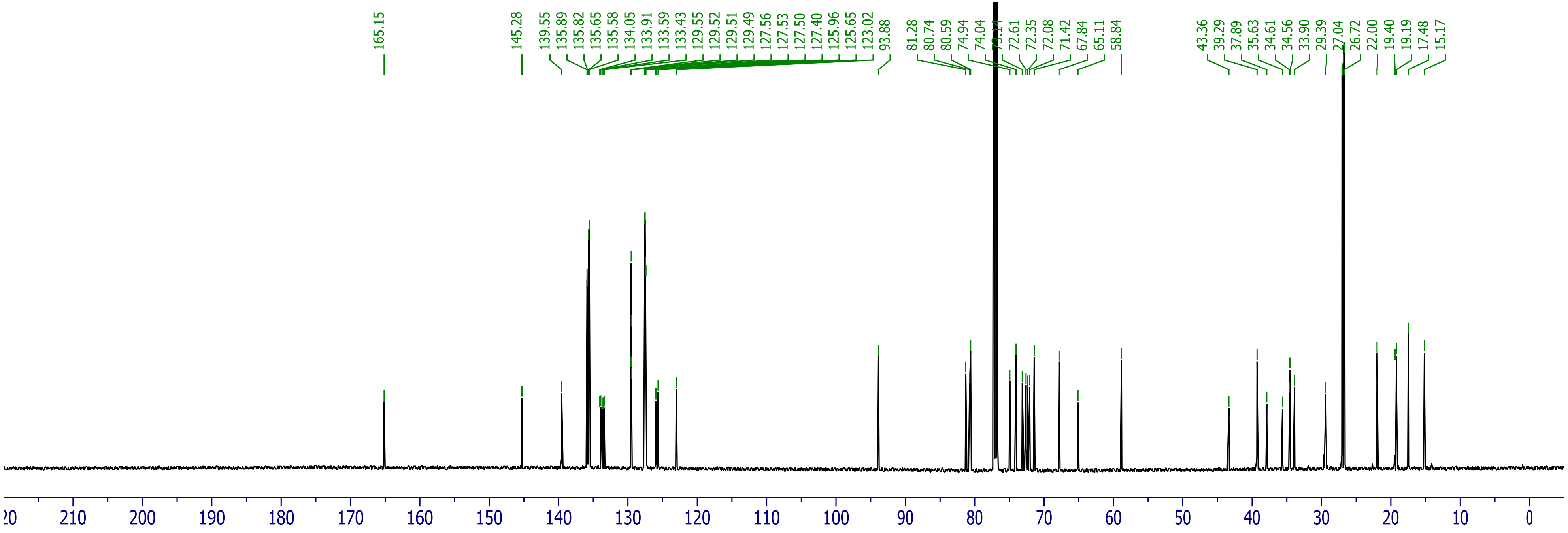
165.22
145.43
139.59
135.90
135.82
135.65
135.59
134.08
133.93
133.61
133.47
129.55
129.51
127.55
127.52
127.49
127.40
125.95
125.65
122.93
81.32
80.77
75.00
73.05
72.43
72.06
67.97
65.15
43.41
41.74
41.55
39.17
35.64
34.64
34.62
33.95
29.45
27.05
26.73
22.05
19.40
19.20
15.11
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0


OTBDPS
TBDPSO
O
OMe
AcO
OAc
8.26
11.00
1.38
1.00
0.88
1.35
1.10
1.17
1.10
3.24
1.01
2.18
0.97
2.26
1.26
3.04
2.17
2.06
1.01
1.02
1.87
2.29
3.22
3.14
2.21
2.07
1.02
1.10
1.84
1.04
4.09
21.47
2.95
.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0
170.32
169.87
165.18
145.29
139.52
135.88
135.82
135.64
135.58
134.05
133.92
133.59
133.44
129.56
129.52
129.45
127.55
127.52
127.49
127.40
125.98
125.69
123.02
95.37
81.29
80.75
78.80
74.95
73.11
73.08
72.40
72.10
71.61
71.57
66.62
65.13
59.59
43.38
39.29
39.25
37.92
35.64
34.60
33.90
29.41
27.04
26.72
22.01
20.95
20.79
19.39
19.19
17.43
15.14
20
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

(11-epi)-**45**


(11-epi)-**45a**

OTBDPS
TBDPSO
O
O
O
O
HO
OH
OMe
O
O
8.01
9.99
1.97
1.02
1.00
1.01
0.99
1.01
2.03
0.99
1.99
2.03
1.02
1.07
2.84
1.10
3.05
1.01
1.01
1.02
1.10
1.24
2.05
1.95
1.13
2.08
2.02
1.45
1.06
5.14
2.35
11.98
9.05
3.05
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0



165.15
145.28
139.55
135.89
135.82
135.65
135.58
134.05
133.91
133.59
133.43
129.55
129.52
129.51
129.49
127.56
127.53
127.50
127.40
125.96
125.65
123.02
93.88
81.28
80.74
80.59
74.94
74.04
72.61
72.35
72.08
71.42
67.84
65.11
58.84
43.36
39.29
37.89
35.63
34.61
34.56
33.90
29.39
27.04
26.72
22.00
19.40
19.19
17.48
15.17
210
200
190
180
170
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150
140
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120
110
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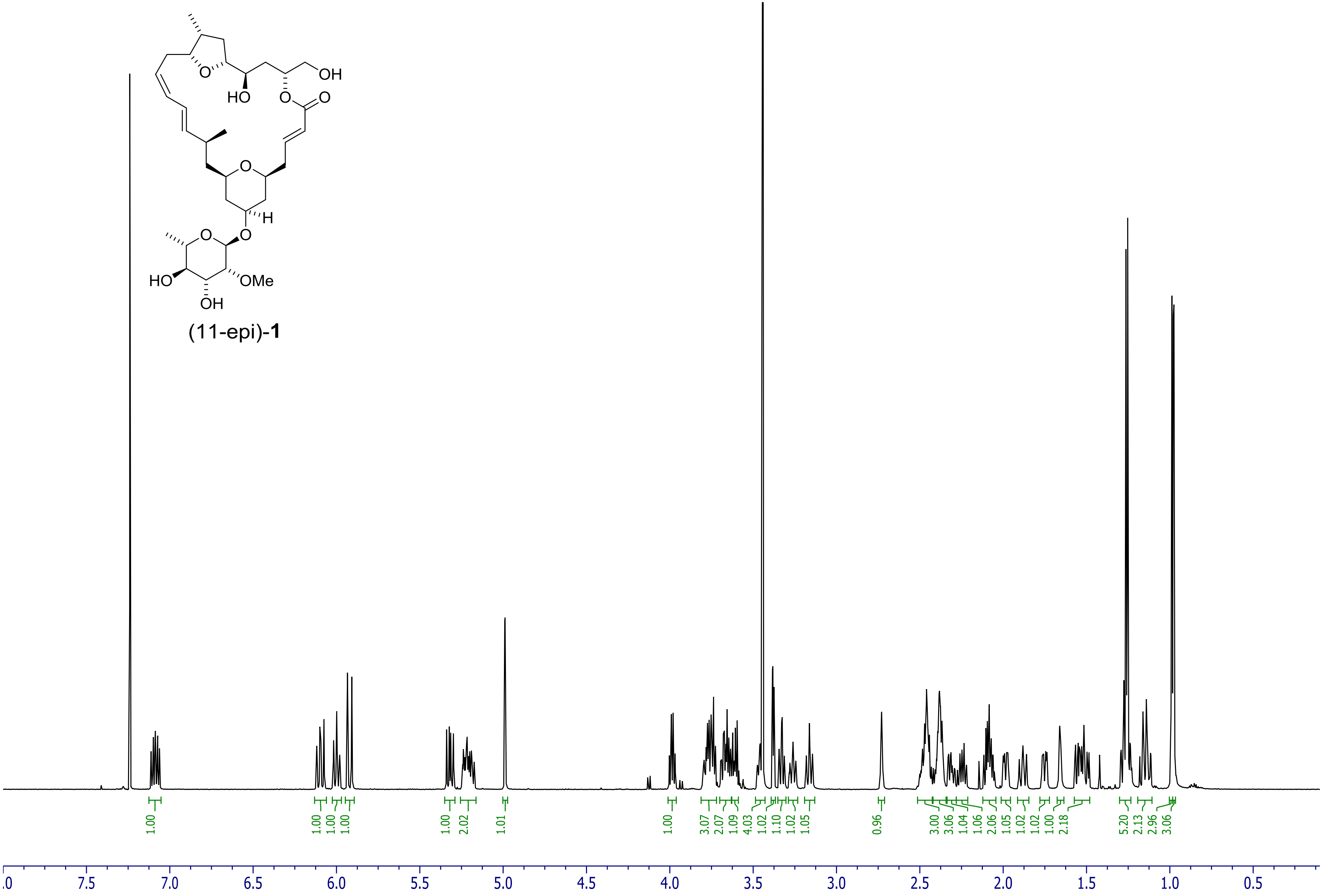
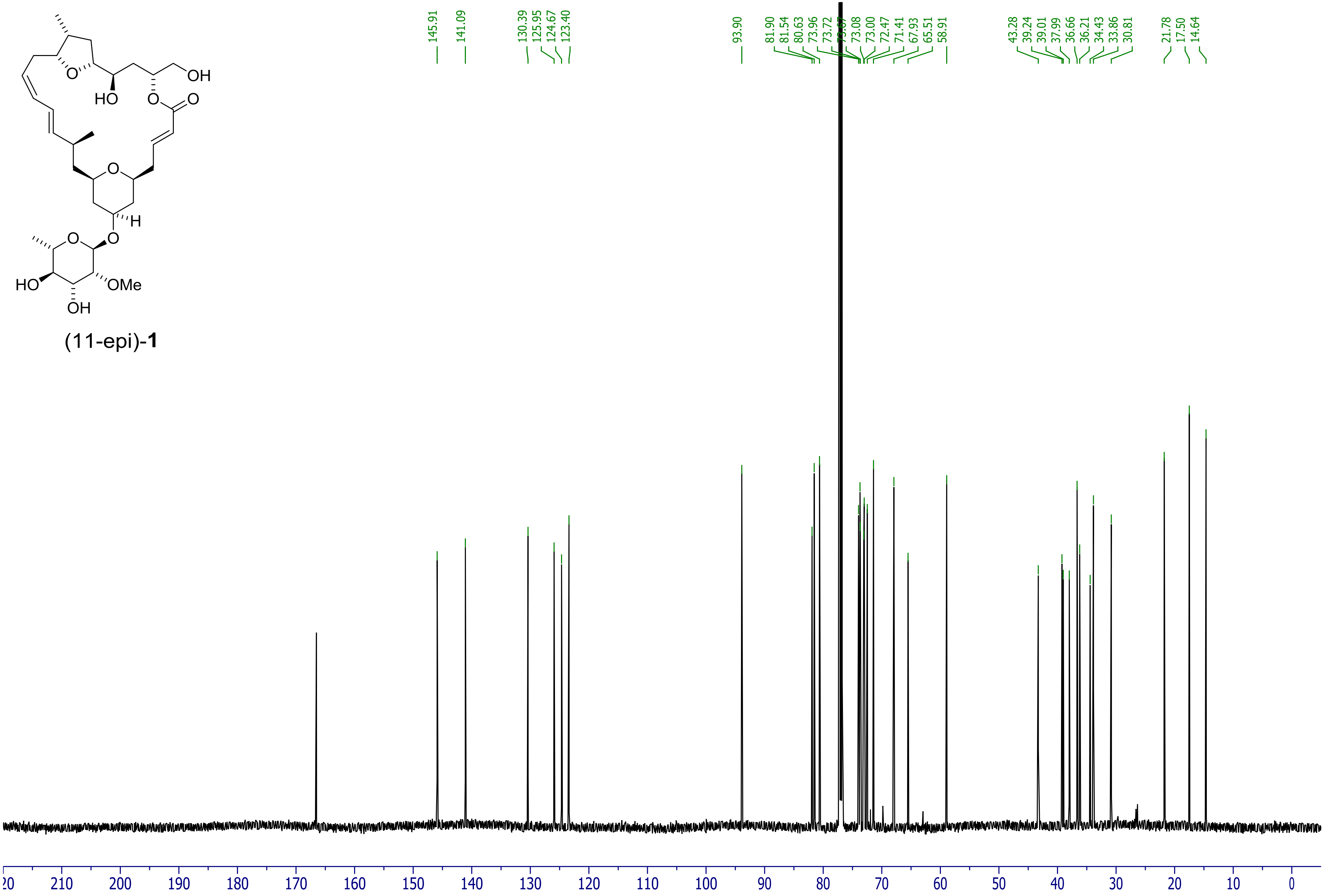

OH
HO
O
O
O
O
O
H
O
HO
OMe
OH
1.00
1.00
1.00
1.00
1.00
2.02
1.01
1.00
3.07
2.07
1.09
4.03
1.02
1.10
1.02
1.05
0.96
3.00
3.06
1.04
1.06
2.06
1.05
1.02
1.02
1.00
2.18
5.20
2.13
2.96
3.06
.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

(11-epi)-**1**

OH
HO
O
O
O
O
H
O
O
HO
OH
OMe

(11-epi)-**1**



145.91
141.09
130.39
125.95
124.67
123.40
93.90
81.90
81.54
80.63
73.96
73.72
73.67
73.08
73.00
72.47
71.41
67.93
65.51
58.91
43.28
39.24
39.01
37.99
36.66
36.21
34.43
33.86
30.81
21.78
17.50
14.64
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
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50
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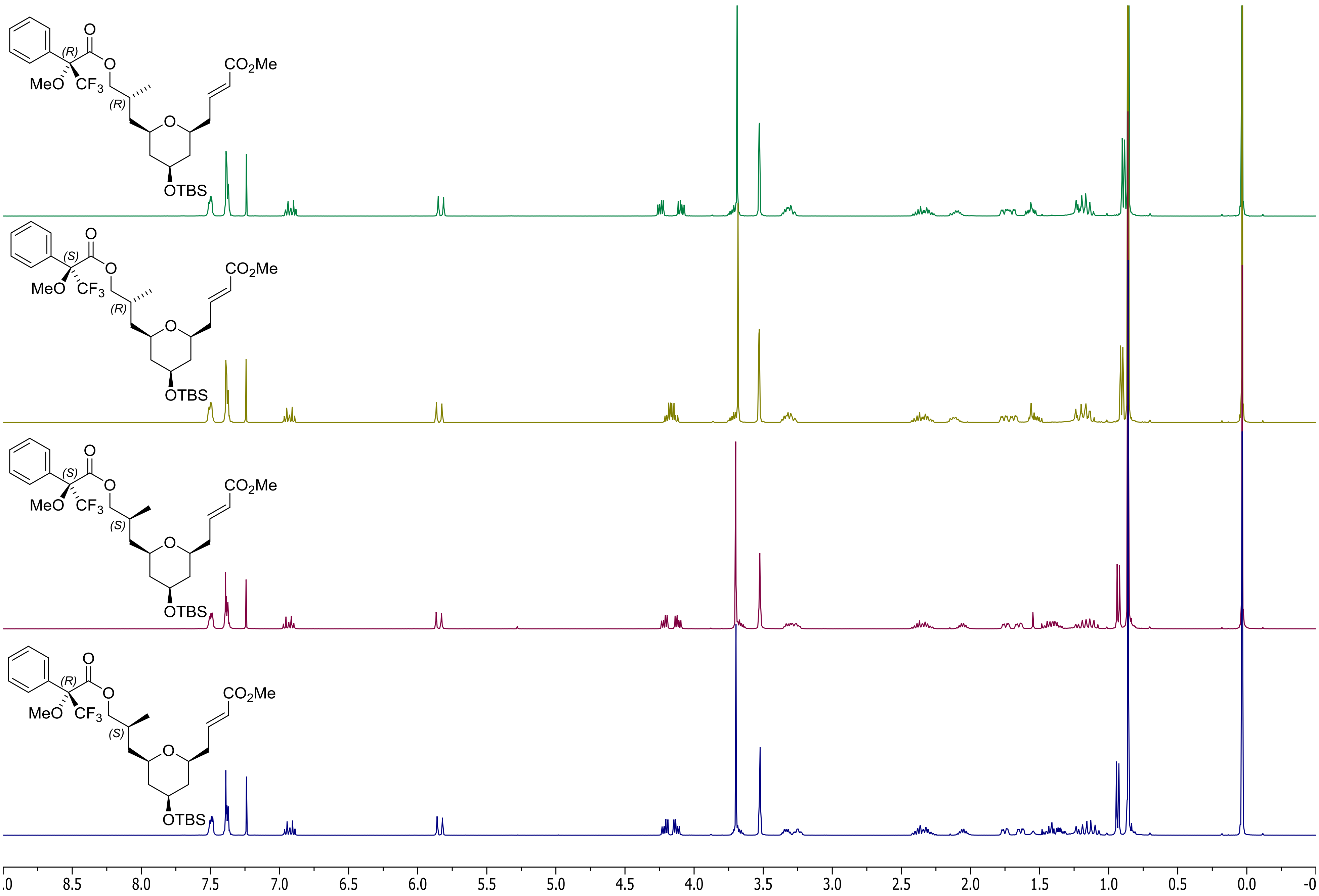
30
20
10
0


O
(R)
O
MeO
CF3
CO2Me
(R)
O
OTBS
O
(S)
O
MeO
CF3
CO2Me
(R)
O
OTBS
O
(S)
O
MeO
CF3
CO2Me
(S)
O
OTBS
O
(R)
O
MeO
CF3
CO2Me
(S)
O
OTBS
.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
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