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Supporting Information

Structure Revision of Halisphingosine A via Total Synthesis and Bioactivity Studies

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1 General information

NMR spectroscopy: NMR measurements were performed on a Bruker AVANCE II 300 MHz, a Bruker AVANCE III 500 MHz and a Bruker AVANCE III 600 MHz spectrometer, equipped with a Bruker Cryoplatform. The chemical shifts are reported in parts per million (ppm) relative to the solvent residual peak of C_6D_6 (^{1}H: 7.16 ppm, singlet; ^{13}C: 128.06 ppm, triplet), DMSO-d6 (^{1}H: 2.50 ppm, quintet; ^{13}C: 39.52 ppm, septet), $CDCl_3$ (^{1}H: 7.26 ppm, singlet; ^{13}C: 77.16 ppm, triplet) and CD_3OD (^{1}H: 3.30 ppm, quintet; ^{13}C: 49.00 ppm, septet).

High Resolution Mass Spectrometry: LC-ESI-HRMS measurements were carried out on an Accela UPLC system (Thermo Scientific) coupled with a Kinetex Phenyl-Hexyl column (50 x 2.1 mm, particle size 1.7 µm), Kinetex C18 column (150 x 2.1 mm, particle size 2.6 µm) or a Kinetex C8 column (50 x 2.1 mm, particle size 1.7 µm) combined with a Q-Exactive mass spectrometer (Thermo Scientific) equipped with an electrospray ion (ESI) source.

Chiral HPLC was performed on a Shimadzu HPLC system using a Lux® 5 µm cellulose-1 (250 x 4.6 mm) column or a Lux® 5 µm amylose-1 (250 x 4.6 mm) (UV detection at 210 nm).

Column chromatography: Flash chromatography was performed on a Biotage Isolera Prime. Normal phase purifications were run on Biotage cartridges packed with Normasil 60 silica gel (particle size 40 – 63 µm).

TLC: Thin layer chromatography was performed using 0.25 mm Macherey-Nagel silica plates with fluorescent indicator UV254, using short-wave UV light as the visualizing agent, $KMnO_4$ and heat as developing agents.

IR Spectroscopy: IR spectra were recorded on an FT/IR-4100 ATR spectrometer (JASCO).

Polarimetry: Optical rotations were recorded on a P-1020 polarimeter (JASCO) at 589 nm using a 50 mm cell and the solvent and concentration (g/100 mL) indicated.

Chemicals: All reagents and solvents for the synthesis were purchased from ABCR, Acros Organics, Alfa Aesar, Carbolution Chemicals, Carl Roth, Fluorochem, Sigma Aldrich, TCI, Th. Geyer and used without further purification. All anhydrous solvents were purchased from Acros Organics. Unless otherwise stated all reactions of air/water sensitive substances were carried out using standard Schlenk techniques under a positive pressure of argon.

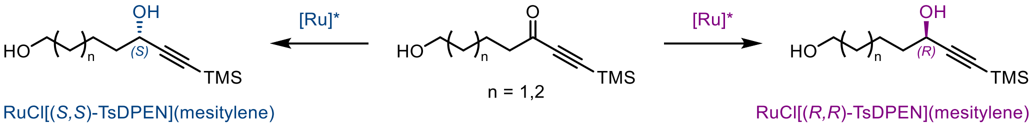
Data deposition: Analytical datasets have been uploaded to Zendo under the DOI: 10.5281/zenodo.13841907

2 Experimental procedures and characterization data

2.1 General procedures

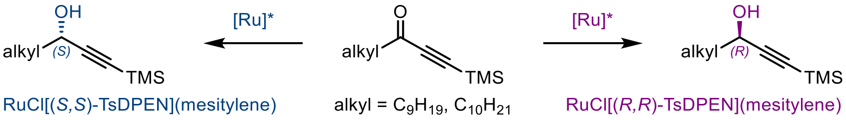
GP1: Stereoselective [Ru] reduction of ynones

Variation A:



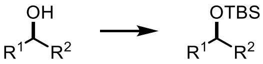
To a solution of ynone (1.0 equiv.) in *i*-PrOH (0.3 M) was added RuCl[(*R,R*)-TsDPEN](mesitylene) or RuCl[(*S,S*)-TsDPEN](mesitylene) (2.5 mol%) followed by a cold solution of NEt_3 (6.0 equiv.) and HCOOH (5.0 equiv.) in *i*-PrOH (3.8 M/ based on NEt_3). The reaction mixture was stirred at 30 °C for 2 h and then the solvent was evaporated. The residue was taken up in H_2O/CH_2Cl_2 and the aqueous layer was extracted with CH_2Cl_2. The combined organic layers were washed with brine, dried over $MgSO_4$, filtrated and evaporated. The residue was purified by column chromatography (0 to 80% EtOAc in cyclohexane) to yield the ynol as oil.

Variation B:



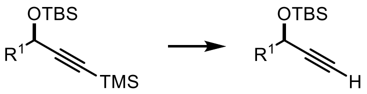
To a solution of ynone (1.0 equiv.) in *i*-PrOH (0.14 M) was added RuCl[(*R,R*)-TsDPEN](mesitylene) or RuCl[(*S,S*)-TsDPEN](mesitylene) (2.5 mol%) followed by a cold solution of NEt_3 (6.0 equiv.) and HCOOH (5.0 equiv.) in *i*-PrOH (3M /based on NEt_3). The reaction mixture was stirred at 30 °C for 1.5 h and then the solvent was evaporated. The residue was taken up in H_2O/EtOAc and the aqueous layer was extracted with EtOAc. The combined organic layers were washed with brine, dried over $MgSO_4$, filtrated and evaporated. The resulting residue was purified by column chromatography (0 to 20% EtOAc in cyclohexane) to yield the ynol as slightly yellow oil.

GP2: TBS protection



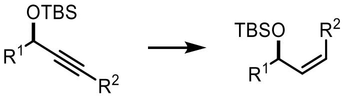
To a solution of the alcohol (1.0 equiv.) in CH_2Cl_2 (0.3-0.5 M) at 0 °C was added imidazole (1.3-6.0 equiv.) followed by TBSCl (1.3-3.0 equiv.). The cooling bath was removed and the reaction mixture was stirred for 1-1.5 h. The reaction was quenched by the addition of H_2O and extracted with CH_2Cl_2. The combined organic layers were washed with brine, dried over $MgSO_4$, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (0%, 0 to 5% or 0 to 25% EtOAc in cyclohexane) to yield the silyl ether as oil.

GP3: TMS deprotection



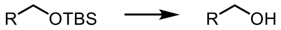
K_2CO_3 (1.1 equiv.) was added to a solution of silyl ether (1.0 equiv.) in MeOH (0.2 M). The reaction mixture was stirred at r.t. for 2 h and then concentrated *in vacuo*. The resulting residue was taken up in H_2O/EtOAc and the aqueous layer was extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and evaporated. The residue was purified by column chromatography (100% cyclohexane or 0 to 10% EtOAc in cyclohexane) to yield the terminal alkyne as oil.

GP4: Hydrogenation of triple to double bond



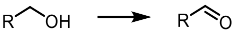
To a solution of $Ni(OAc)_2 \cdot 4\ H_2O$ (1.1 equiv.) in EtOH (0.2M) was added $NaBH_4$ (1.1 equiv.) and the argon atmosphere was replaced by H_2. After stirring for 10 min, a solution of alkyne (1.0 equiv.) and ethylenediamine (1.1 equiv.) in EtOH (0.3M based on alkyne) was added. The reaction mixture was stirred under an H_2-atmosphere at r.t. for 2 h. The reaction mixture was diluted with diethyl ether and subsequent filtrated over celite. The organic layer was washed with H_2O and brine, dried over Na_2SO_4, filtrated and evaporated to obtain the (*Z*)-allylic alcohol as oil. The crude product was either used without further purification or it was purified by column chromatography (0 to 10% EtOAc in cyclohexane).

GP5: TBS deprotection of primary alcohol



TBAF (1.0 equiv., 1 M in THF) was added to solution of TBS-alcohol (1.0 equiv.) in THF (0.1-0.2 M). The reaction mixture was stirred at r.t. for 1.5-4 h, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and evaporated. The residue was purified by column chromatography (0 to 30% EtOAc in cyclohexane) to yield alcohol as oil.

GP6: Dess-Martin oxidation of primary alcohol



To a solution of alcohol (1.0 equiv.) in CH_2Cl_2 (0.1 M) at 0 °C was added $NaHCO_3$ (5.0 equiv.) followed by DMP (1.5 equiv.). The cooling bath was removed and the reaction mixture was stirred for 1 h. The reaction was quenched by the addition of H_2O and aq. sat. $Na_2S_2O_3$-solution. The layers were separated and the aqueous layer was extracted with CH_2Cl_2. The combined organic layers were washed with brine, dried over $MgSO_4$, filtrated and evaporated. The residue was purified by column chromatography (0 to 20% EtOAc in cyclohexane) to obtain the aldehyde as slightly yellow oil.

2.2 Synthesis of aldehydes and precursors

2.2.1 Synthesis of (*R,Z*)-4-((*tert*-butyldimethylsilyl)oxy)hexadec-5-enal (*R*)-7 and (*S,Z*)-4-((*tert*-butyldimethylsilyl)oxy)hexadec-5-enal (*S*)-7

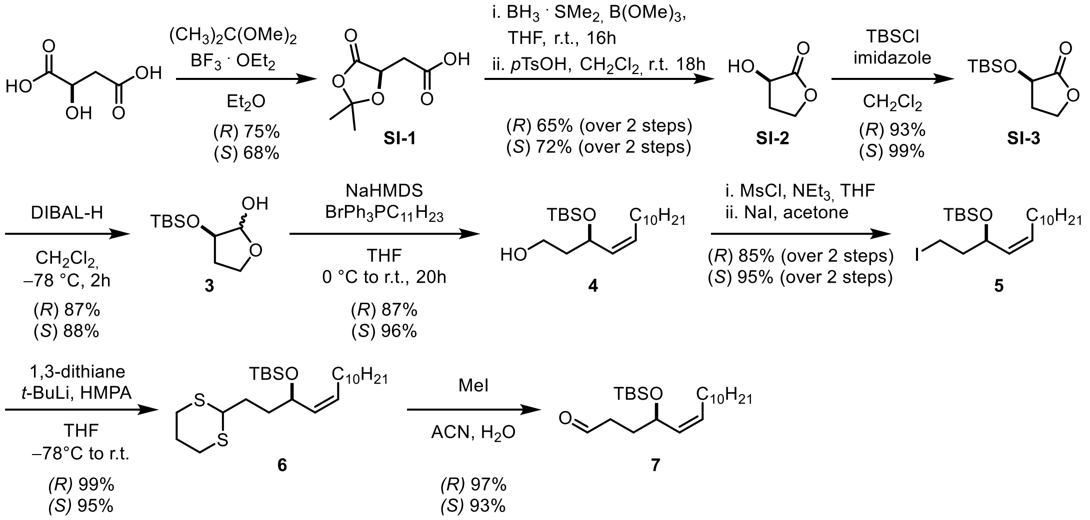
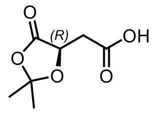


Figure S1. Reaction overview for the synthesis of (*R,Z*)- and (*S,Z*)-4-((*tert*-butyldimethyl-silyl)oxy)hexadec-5-enal **7**.

(*R*)- and (S)-2-(2,2-Dimethyl-5-oxo-1,3-dioxolan-4-yl)acetic acid SI-1

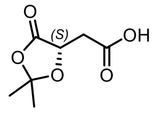


(***R***)**-SI-1:** Following a modified procedure;[1] To a mixture of (*R*)-malic acid (10.0 g, 74.6 mmol, 1.0 equiv.) in 2,2-dimethoxypropane (75 mL) was added *p*-TsOH · H_2O (142 mg, 0.75 mmol, 0.01 equiv.). The reaction mixture was stirred at r.t. for 2 h, quenched by the addition of $NaHCO_3$-solution (62.0 mg $NaHCO_3$ in 50 mL H_2O) and extracted with CH_2Cl_2. The combined organic layers were dried over $MgSO_4$, filtrated and evaporated *in vacuo*. The residue was dissolved in diethyl ether (30 mL), diluted with cyclohexane (300 mL) and concentrated to half amount. The precipitate was filtered and washed with cold cyclohexane to yield the acetal (***R***)**-SI-1** (9.23 g, 71%) as white solid.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 10.53 (s, br, 1H), 4.71 (dd, *J* = 6.5, 3.9 Hz, 1H), 3.00 (dd, *J* = 17.3, 3.9 Hz, 1H), 2.85 (dd, *J* = 17.3, 6.5 Hz, 1H), 1.62 (s, 3H), 1.57 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 175.3, 172.0, 111.5, 70.5, 36.1, 26.9, 26.0 ppm.

The analytical data are in accordance with literature data.[1, 2]



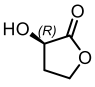
(***S***)**-SI-1:** Following the same procedure, (*S*)-malic acid (10.0 g, 74.6 mmol, 1.0 equiv.), 2,2-dimethoxy-propane (75 mL) and *p*-TsOH · H_2O (142 mg, 0.75 mmol, 0.01 equiv.) were used to yield acetal (*S*)-**SI-1** (9.64 g, 74%) as white solid.

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 10.95 (s, br, 1H), 4.70 (dd, *J* = 6.4, 3.8 Hz, 1H), 2.99 (dd, *J* = 17.3, 3.8 Hz, 1H), 2.85 (dd, *J* = 17.3, 6.5 Hz, 1H), 1.61 (s, 3H), 1.56 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 175.4, 172.0, 111.5, 70.5, 36.1, 26.8, 25.9 ppm.

The analytical data are in accordance with literature data.[1, 3]

(*R*)- and (*S*)-3-Hydroxydihydrofuran-2(*3H*)-one SI-2

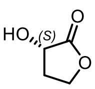


(*R*)-SI-2: Following a modified procedure;[1] To a solution of $BH_3 \cdot SMe_2$ (61.0 mL, 122 mmol, 2.85 equiv., 2 M in THF) and $B(OMe)_3$ (13.7 mL, 122 mmol, 2.85 equiv.) in THF (120 mL) was added at 0 °C a solution of (*R*)-acid **SI-1** (7.46 g, 42.9 mmol, 1.0 equiv.) in THF (43 mL). The reaction mixture was stirred at 0 °C to r.t. for 16 h, cooled to 0 °C, quenched by the addition of MeOH (43 mL), and stirred for 1h. The mixture was evaporated *in vacuo,* dissolved in MeOH (2 x 60 mL) and evaporated to obtain the alcohol as colorless oil. The residue was dissolved in CH_2Cl_2 (104 mL) and *p*-TsOH · H_2O (813 mg, 4.3 mmol, 0.1 equiv.) was added. The reaction mixture was stirred at r.t. for 18 h, quenched by the addition of NEt_3 (0.90 mL) and concentrated *in vacuo*. The residue was purified by column chromatography (100% Et_2O) to yield the lactone **(*R*)-SI-2** (2.83 g, 65%) as colorless oil.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 4.57 – 4.38 (m, 3H), 4.23 (ddd, *J* = 10.4, 9.2, 6.0 Hz, 1H), 3.42 (s, 1H), 2.61 (dddd, *J* = 12.5, 8.1, 6.0, 2.0 Hz, 1H), 2.39 – 2.18 (m, 1H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 178.2, 67.6, 65.3, 31.0 ppm.

The analytical data are in accordance with literature data.[1, 4]



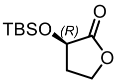
(*S*)-SI-2: Following the same procedure; $BH_3 \cdot SMe_2$ (45.0 mL, 90.0 mmol, 2.85 equiv., 2 M in THF), $B(OMe)_3$ (10.2 mL, 90.0 mmol, 2.85 equiv.) in THF (90 mL) and (*S*)-acid **SI-1** (5.50 g, 31.6 mmol, 1 equiv.) in THF (40 mL) were used to yield alcohol as colorless oil. Residue and *p*-TsOH·H_2O (599 mg, 3.16 mmol, 0.1 equiv.) in CH_2Cl_2 (76 mL) were used to yield lactone **(*S*)-SI-2** (2.36 g, 73%) as colorless oil.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 4.59 – 4.37 (m, 2H), 4.24 (ddd, *J* = 10.5, 9.3, 6.0 Hz, 1H), 3.08 (s, br, 1H), 2.62 (dddd, *J* = 12.6, 8.1, 6.0, 1.9 Hz, 1H), 2.41 – 2.18 (m, 1H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 178.0, 67.6, 65.3, 31.0 ppm.

The analytical data are in accordance with literature data.[1, 4]

(*R*)- and (*S*)-3-((*tert*-Butyldimethylsilyl)oxy)dihydrofuran-2(3*H*)-one SI-3

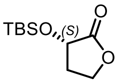


(*R*)-SI-3: Following GP2, (*R*)-Lactone **SI-2** (2.68 g, 26.3 mmol, 1.0 equiv.), imidazole (2.32 g, 34.1 mmol, 1.3 equiv.) and TBSCl (5.14 g, 34.1 mmol, 1.3 equiv.) in CH_2Cl_2 (52 mL) were stirred for 1 h to yield after column chromatography (0 to 25% EtOAc in cyclohexane, linear gradient) the silyl ether **SI-3** (5.30 g, 93%) as colorless oil.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 4.46 – 4.33 (m, 2H), 4.19 (td, *J* = 9.2, 6.4 Hz, 1H), 2.46 (dddd, *J* = 12.6, 7.8, 6.4, 3.3 Hz, 1H), 2.31 – 2.13 (m, 1H), 0.91 (s, 9H), 0.17 (s, 3H), 0.15 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 176.0, 68.4, 64.9, 32.5, 25.8, 18.4, -4.5, -5.1 ppm.

The analytical data are in accordance with literature data.[5]



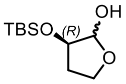
(*S*)-SI-3: Following GP2, (*S*)-Lactone **SI-2** (2.34 g, 22.9 mmol, 1.0 equiv.), imidazole (2.03 g, 29.8 mmol, 1.3 equiv.) and TBSCl (4.49 g, 29.8 mmol, 1.3 equiv.) in CH_2Cl_2 (35mL) were stirred for 1 h to yield after column chromatography (0 to 25% EtOAc in cyclohexane, linear gradient) the lactone **SI-3** (4.90 g, 99%) as colorless oil.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 4.48 – 4.33 (m, 2H), 4.19 (td, *J* = 9.2, 6.4 Hz, 1H), 2.46 (dddd, *J* = 12.7, 7.8, 6.4, 3.3 Hz, 1H), 2.22 (dtd, *J* = 12.7, 9.1, 8.4 Hz, 1H), 0.91 (s, 9H), 0.17 (s, 3H), 0.15 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 176.0, 68.4, 64.9, 32.5, 25.8, 18.4, -4.5, -5.1 ppm.

The analytical data are in accordance with literature data.[6]

(*R*)- and (*S*)-3-((*tert*-Butyldimethylsilyl)oxy)tetrahydrofuran-2-ol 3

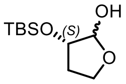


(*R*)-3: Following a modified procedure,[7] To a solution of lactone **SI-3** (5.1 g, 23.6 mmol, 1.0 equiv.) in CH_2Cl_2 (80 mL) at –78 °C was added DIBAL-H (31 mL, 30.7 mmol, 1.3 equiv., 1M in hexane). The reaction mixture was stirred for 2 h, quenched by the addition of saturated K-Na-tartrate solution and extracted with CH_2Cl_2. The combined organic layers were washed with brine, dried over $MgSO_4$, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (0 to 35% EtOAc in cyclohexane, linear gradient) to yield the hemiacetal **(*R*)-3** (4.50 g, 87%, 1:3.7 inseparable anomeric mixture) as slightly yellow oil.

^{1}H-NMR (300 MHz, $CDCl_3$)* δ = 5.20 (d, *J* = 2.9 Hz, 1H), 4.20 (dd, *J* = 5.0, 1.7 Hz, 1H), 4.08 (dd, *J* = 8.8, 5.4 Hz, 2H), 2.77 – 2.53 (m, 1H), 2.31 – 2.15 (m, 1H), 1.78 (dtd, *J* = 12.7, 5.4, 1.7 Hz, 1H), 0.89 (s, 9H), 0.09 (s, 3H), 0.08 (s, 4H) ppm. *main anomer

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 103.4, 97.4, 77.0, 72.3, 67.4, 64.9, 33.9, 32.9, 25.9, 25.9, 18.2, -4.6, -4.6, -4.7, -5.0 ppm.

The analytical data are in accordance with literature data.[7]



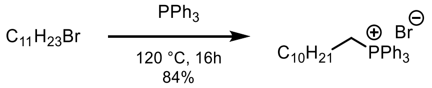
(*S*)-3: Following the same procedure; lactone **SI-3** (4.50 g, 20.8 mmol, 1.0 equiv.) and DIBAL-H (27.0 mL, 27.0 mmol, 1.3 equiv., 1M in hexane) in CH_2Cl_2 (70 mL) were used to yield the hemiacetal (***S***)**-3** (3.98 g, 88%, 1:1.6 inseparable anomeric mixture) as colorless oil.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.23 (dd, *J* = 8.6, 4.1 Hz, 1H), 5.20 (d, *J* = 3.0 Hz, 1H), 4.28 – 4.22 (m, 1H), 4.20 (dd, *J* = 5.1, 1.7 Hz, 1H), 4.07 (dd, *J* = 8.7, 5.4 Hz, 2H), 4.01 (dd, *J* = 8.5, 6.6 Hz, 1H), 3.96 (d, *J* = 8.6 Hz, 1H), 3.81 (td, *J* = 8.1, 3.9 Hz, 1H), 2.61 (s, br, 1H), 2.20 (dtd, *J* = 12.8, 8.7, 5.0 Hz, 1H), 2.12 – 1.98 (m, 1H), 1.86 (ddt, *J* = 12.8, 6.7, 3.5 Hz, 1H), 1.65 (s, br, 1H), 0.92 (s, 9H), 0.88 (s, 9H), 0.13 (s, 6H), 0.08 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 103.4, 97.4, 77.0, 72.3, 67.4, 64.9, 33.9, 32.9, 25.9, 25.8, 18.2, 18.2, -4.6, -4.6, -4.7, -5.0 ppm.

The analytical data are in accordance with literature data.[7]

Triphenyl(undecyl)phosphonium bromide SI-4



A mixture of 1-bromoundecane (9.4 mL, 10.00 g, 42.6 mmol, 1.0 equiv.) and PPh_3 (11.2 g, 42.6 mmol, 1.0 equiv.) were stirred at 120 °C for 16 h, cooled to r.t. and treated with diethyl ether. The mixture was stored at 4 °C for 10 days, where a white solid was formed, which was filtered and washed with diethyl ether. The filter cake was dried *in vacuo* to yield triphenyl(undecyl)phosphonium bromide **SI-4** (19.8 g, 93%) as white solid.

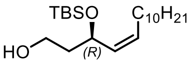
^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.85 – 7.73 (m, 9H), 7.73 – 7.63 (m, 6H), 3.80 – 3.59 (m, 2H), 1.72 – 1.51 (m, 4H), 1.31 – 1.07 (m, 14H), 0.82 (t, *J* = 6.7 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 135.1, 133.7, 133.6, 130.6, 130.5, 118.9, 117.8, 31.9, 30.6, 30.4, 29.5, 29.3, 29.2, 23.2, 22.7, 22.5, 14.1 ppm.

^{31}P-NMR (203 MHz, $CDCl_3$) δ = 24.3 ppm.

The analytical data are in accordance with literature data.[8]

(*R,Z*) and (*S,Z*) -3-((*tert*-Butyldimethylsilyl)oxy)pentadec-4-en-1-ol 4



(*R*)-4: Following a modified procedure;[9] To a solution of Triphenyl(undecyl)phosphonium bromide **SI-4** (38.3 g, 77.2 mmol, 4.0 equiv.) in THF (250 mL) at 0 °C was added NaHMDS (38.0 mL, 75.3 mmol, 3.9 equiv., 2M in THF). After stirring at 0 °C for 30 min, a solution of hemiacetal **3** (4.21 g, 19.3 mmol, 1.0 equiv.) in THF (40 mL) was added. The reaction mixture was stirred at 0 °C for 1 h and then at r.t. for 16 h, quenched by the addition of sat. NH_4Cl solution and extracted with diethyl ether. The combined organic layers were washed with H_2O and brine, dried over $MgSO_4$, filtrated and evaporated. The residue was purified by column chromatography (0 to 15% EtOAc in cyclohexane) to yield the allylic alcohol **(*R*)-4** (5.97 g, 87%) as colorless oil.

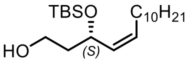
$[\alpha]_D^{22}$ = -5.1 (c = 1.70 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.50 – 5.28 (m, 2H), 4.71 (dt, *J* = 8.2, 5.9 Hz, 1H), 3.77 (ddt, *J* = 23.5, 10.9, 5.6 Hz, 2H), 2.59 (t, *J* = 5.3 Hz, 1H), 2.12 – 1.89 (m, 2H), 1.77 – 1.62 (m, 2H), 1.45 – 1.18 (m, 16H), 0.94 – 0.79 (m, 12H), 0.08 (s, 3H), 0.05 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 133.1, 129.9, 69.1, 60.9, 40.0, 32.1, 29.7, 29.7, 29.7, 29.5, 29.5, 27.9, 26.0, 22.8, 18.2, 14.3, -4.0, -4.8 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3360 (br, w), 2924 (s), 2853 (s), 1463 (w), 1252 (m), 1081 (m), 1017 (m), 835 (s), 775 (s), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{21}H_{45}O_2Si$ $[M+H]^+$ 357.3183, found 357.3175.



(*S*)-4: Following the same procedure; Triphenyl(undecyl)phosphonium bromide **SI-4** (17.5 g, 35.2 mmol, 4.0 equiv.), NaHMDS (17.2 mL, 34.4 mmol, 3.9 equiv., 2M in THF) in THF (117 mL) and (*S*)-hemiacetal **3** (1.92 g, 8.81 mmol, 1 equiv.) in THF (17.0 mL) were used to yield the allylic alcohol **(*S*)-4** (3.02 g, 96%) as slightly yellow oil

$[\alpha]_D^{22}$ = 4.4 (c = 2.08 $CHCl_3$)

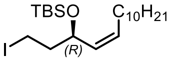
^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.52 – 5.26 (m, 2H), 4.71 (dt, *J* = 8.1, 5.9 Hz, 1H), 3.91 – 3.65 (m, 2H), 2.22 (s, br, 1H), 2.15 – 1.94 (m, 2H), 1.82 – 1.64 (m, 2H), 1.43 – 1.17 (m, 16H), 0.95 – 0.84 (m, 12H), 0.08 (s, 3H), 0.05 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.1, 129.9, 69.1, 60.9, 40.0, 32.1, 29.7, 29.7, 29.7, 29.5, 29.5, 27.9, 26.0, 22.8, 18.2, 14.3, -4.0, -4.8 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3353 (br, w), 2924 (s), 2854 (s), 1463 (w), 1361 (w), 1252 (m), 1081 (m), 1018 (m), 835 (s), 775 (s), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{21}H_{45}O_2Si$ $[M+H]^+$ 357.3183, found 357.3172.

(*R,Z*) and (*S,Z*)-*tert*-Butyl((1-iodopentadec-4-en-3-yl)oxy)dimethylsilane 5



(*R*)-5: A solution of (*R*)-alcohol **4** (978 mg, 2.74 mmol, 1.0 equiv.) in THF (27 mL) was cooled to 0 °C and NEt_3 (0.68 mL, 4.94 mmol, 1.8 equiv.) was added followed by MsCl (0.32 mL, 4.11 mmol, 1.5 equiv.). The cooling bath was removed and the reaction mixture was stirred for 30 min. After quenching with H_2O, the aqueous layer was extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and concentrated *in vacuo.* The residue was dissolved in acetone (27 mL) and NaI (4.11 g, 27.4 mmol, 10 equiv.) was added. The reaction mixture was stirred at r.t. for 20 h, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with sat. $Na_2S_2O_4$ solution, H_2O and brine, dried over Na_2SO_4, filtrated and evaporated to obtain the alkyl iodide **(*R*)-5** (1.08 g, 85%) as slightly yellow oil.

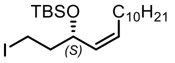
$[\alpha]_D^{22}$ = 6.1 (c = 2.08 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.42 – 5.29 (m, 2H), 4.53 (td, *J* = 7.8, 4.3 Hz, 1H), 3.29 – 3.17 (m, 2H), 2.10 – 2.03 (m, 2H), 2.03 – 1.80 (m, 2H), 1.38 – 1.21 (m, 16H), 0.88 (s, 12H), 0.09 (s, 3H), 0.05 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 132.8, 130.7, 68.7, 42.1, 32.1, 29.8, 29.7, 29.5, 29.5, 28.1, 26.0, 22.9, 18.3, 14.3, 3.8, -4.0, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 2924 (s), 2853 (m), 1462 (w), 1252 (m), 1083 (s), 934 (m), 834 (s), 775 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{21}H_{44}IOSi$ $[M+H]^+$ 467.2201, found 467.2255.



(*S*)-5: Following the same procedure; (*S*)-alcohol **3** (2.85 g, 7.99 mmol, 1.0 equiv.), NEt_3 (2.0 mL, 14.4 mmol, 1.8 equiv.) and MsCl (0.93 mL, 12.0 mmol, 1.5 equiv.) in THF (80 mL) were used. The residue and NaI (12.0 g, 79.9 mmol, 10 equiv.) in acetone (80 mL) were used to obtain the alkyl iodide **(*S*)-5** (3.54 g, 95%) as slightly yellow oil.

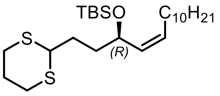
$[\alpha]_D^{22}$ = -5.7 (c = 1.31 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.44 – 5.27 (m, 2H), 4.60 – 4.47 (m, 1H), 3.30 – 3.12 (m, 2H), 2.12 – 1.78 (m, 4H), 1.41 – 1.20 (m, 16H), 0.92 – 0.84 (m, 12H), 0.09 (s, 3H), 0.05 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 132.8, 130.7, 68.8, 42.1, 32.1, 29.8, 29.7, 29.6, 29.5, 28.1, 26.0, 22.9, 18.3, 14.3, 3.7, -4.0, -4.5 ppm.

IR (ATR) $\tilde{\nu}$ = 2924 (s), 2853 (s), 1463 (w), 1361 (w), 1252 (m), 1084 (m), 935 (w), 834 (s), 775 (s), 721 (w), 541 (w) cm^{-1}.

(***R*,*Z***)- and (***S*,*Z***)-((1-(1,3-Dithian-2-yl)pentadec-4-en-3-yl)oxy)(***tert***-butyl)dimethylsilane 6



(***R***)**-6:** To a stirred solution of 1,3-dithiane (634 mg, 5.27 mmol, 1.1 equiv.) in THF (53 mL) at –78 °C was added HMPA (5.3 mL), followed by *t*-BuLi (2.8 mL, 5.27 mmol, 1.1 equiv., 1.9 M in pentane). After 30 min a solution of the alkyl iodide (*R*)-**5** (2.24 g, 4.79 mmol, 1.0 equiv.) in THF (16 mL) was added and the reaction mixture was stirred at –78 °C for 1 h. After removal of the cooling bath the mixture was stirred additional 30 min, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over $MgSO_4$, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (0 to 5% EtOAc in cyclohexane) to yield the thioketal **(*R*)-6** (2.17 g, 99%) as colorless oil.

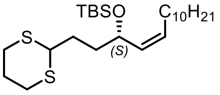
$[\alpha]_D^{22}$ = 13.8 (c = 1.12 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.37 – 5.24 (m, 2H), 4.48 – 4.34 (m, 1H), 4.03 (t, *J* = 6.6 Hz, 1H), 2.95 – 2.75 (m, 4H), 2.17 – 1.53 (m, 6H), 1.45 – 1.20 (m, 18H), 0.93 – 0.83 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 133.5, 129.8, 68.5, 47.8, 35.5, 32.1, 31.5, 30.6, 30.6, 29.8, 29.8, 29.7, 29.6, 29.5, 28.0, 26.2, 26.1, 26.0, 22.8, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2924 (s), 2853 (s), 1462 (w), 1251 (m), 1080 (s), 834 (s), 773 (s), 721 (w), 667 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{25}H_{51}OS_2Si$ $[M+H]^+$ 459.3145, found 459.3080.



(***S***)**-6:** Following the same procedure; 1,3-dithiane (70.9 mg, 0.59 mmol, 1.1 equiv.), HMPA (0.59 mL), *t*-BuLi (0.31 mL, 0.59 mmol, 1.1 equiv., 1.9 M in pentane) in THF (5.9 mL) and alkyl iodide (*S*)-**5** (254 mg, 0.54 mmol, 1.0 equiv.) in THF (2.7 mL) were used to yield the thioketal **(*S*)-6** (235 mg, 95%) as slightly yellow oil.

$[\alpha]_D^{22}$ = -12.9 (c = 1.93 $CHCl_3$)

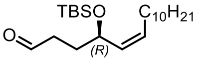
^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.40 – 5.23 (m, 2H), 4.50 – 4.35 (m, 1H), 4.03 (t, *J* = 6.6 Hz, 1H), 2.95 – 2.71 (m, 4H), 2.16 – 1.53 (m, 6H), 1.42 – 1.14 (m, 18H), 0.94 – 0.81 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 133.5, 129.8, 68.5, 47.8, 35.5, 32.1, 31.4, 30.6, 30.6, 29.8, 29.8, 29.7, 29.6, 29.5, 28.0, 26.2, 26.0, 22.8, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2924 (s), 2853 (s), 1462 (m), 1251 (m), 1080 (s), 834 (s), 773 (s), 722 (w), 666 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{25}H_{51}OS_2Si$ $[M+H]^+$ 459.3145, found 459.3080.

(*R,Z*)- and (*S,Z*)-4-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-enal 7



(*R*)-7: To a solution of thioketal (*R*)-**6** (2.10 g, 4.58 mmol, 1.0 equiv.) in ACN (46 mL) and H_2O (11 mL) were added $NaHCO_3$ (1.15 g, 13.7 mmol, 3.0 equiv.) and MeI (14.2 mL, 229 mmol, 50 equiv.). The reaction mixture was stirred at r.t. for 20 h, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over $MgSO_4$, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (0 to 10% EtOAc in cyclohexane) to yield the aldehyde **(*R*)-7** (1.64 g, 97%) as slightly yellow oil.

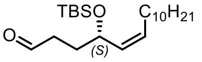
$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 0.6 (c = 1.59 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 9.77 (t, *J* = 1.7 Hz, 1H), 5.44 – 5.24 (m, 2H), 4.54 – 4.40 (m, 1H), 2.48 (td, *J* = 7.3, 1.7 Hz, 2H), 2.12 – 1.92 (m, 2H), 1.88 – 1.68 (m, 2H), 1.42 – 1.19 (m, 16H), 0.93 – 0.83 (m, 12H), 0.03 (s, 3H), 0.01 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 202.8, 133.1, 130.2, 68.0, 40.1, 32.1, 31.0, 29.8, 29.7, 29.6, 29.5, 28.0, 26.0, 22.8, 18.3, 14.3, -4.1, -4.7 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2925 (s), 2854 (s), 2711 (w), 1728 (s), 1463 (m), 1252 (s), 1086 (s), 834 (s), 775 (s), 722 (w), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{45}O_2Si$ $[M+H]^+$ 369.3183, found 369.3175.



(*S*)-7: Following the same procedure; thioketal (*S*)-**6** (209 mg, 0.46 mmol, 1.0 equiv.), $NaHCO_3$ (115 mg, 1.37 mmol, 3.0 equiv.) and MeI (1.4 mL, 22. mmol, 50 equiv.) in ACN (4.6 mL) and H_2O (1.1 mL) were used to yield the aldehyde **(*S*)-7** (156 mg, 93%) as slightly yellow oil.

$[\alpha]_D^{22}$ = -0.8 (c = 1.64 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 9.77 (t, *J* = 1.7 Hz, 1H), 5.45 – 5.20 (m, 2H), 4.61 – 4.31 (m, 1H), 2.48 (td, *J* = 7.3, 1.7 Hz, 2H), 2.17 – 1.91 (m, 2H), 1.87 – 1.71 (m, 2H), 1.42 – 1.16 (m, 16H), 0.94 – 0.81 (m, 12H), 0.03 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 202.8, 133.1, 130.3, 68.0, 40.1, 32.1, 31.0, 29.7, 29.7, 29.6, 29.5, 28.0, 26.0, 22.8, 18.3, 14.3, -4.1, -4.7 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2925 (s), 2854 (s), 2711 (w), 1728 (s), 1463 (m), 1252 (s), 1085 (s), 834 (s), 775 (s), 722 (w), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{45}O_2Si$ $[M+H]^+$ 369.3183, found 369.3185.

2.2.2 Synthesis of (*R,Z*)-6-((*tert*-butyldimethylsilyl)oxy)hexadec-4-enal 23 and (*S,Z*)-6-((*tert*-butyldimethylsilyl)oxy)hexadec-4-enal 23

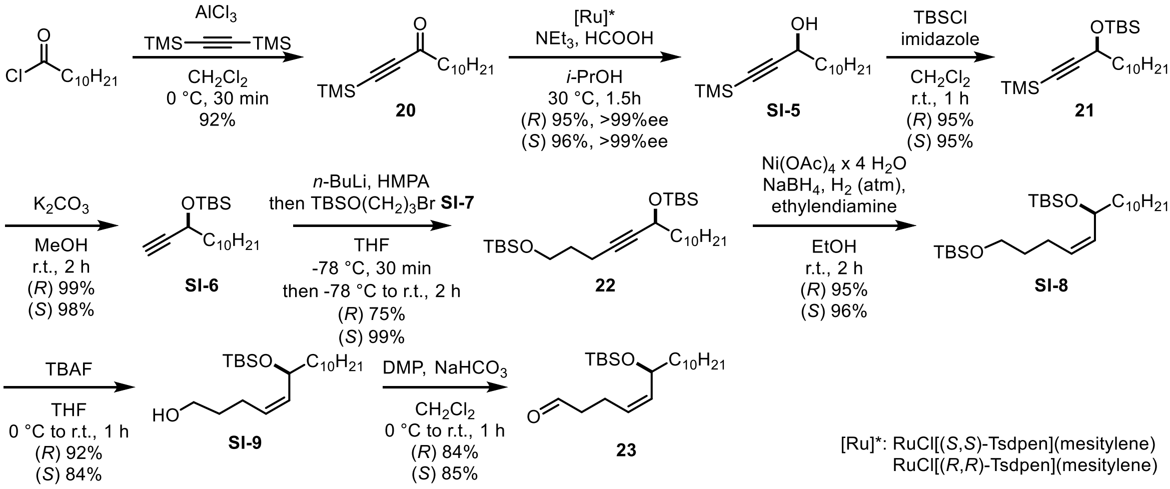
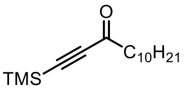


Figure S2. Reaction overview for the synthesis of (*R,Z*)- and (*S,Z*)-6-((*tert*-butyldimethylsilyl)-oxy)hexadec-4-enal **23**.

1-(Trimethylsilyl)tridec-1-yn-3-one 20



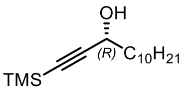
A suspension of $AlCl_3$ (7.61 g, 57.1 mmol, 1.3 equiv.) in CH_2Cl_2 (200 mL) was cooled to 0 °C and treated slowly with undecanoyl chloride (9.7 mL, 43.96 mmol, 1.0 equiv.) followed by *bis*(trimethylsilyl)acetylene (8.24 g, 48.4 mmol, 1.1 equiv.) over a period of 10 min. The reaction mixture was stirred at 0 °C for 30 min, quenched by the slowly addition of cold H_2O and extracted with CH_2Cl_2. The combined organic layers were washed with brine, dried over $MgSO_4$, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (0 to 5% EtOAc in cyclohexane) to yield ynone **20** (10.8 g, 92%) as slightly yellow oil.

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 2.54 (t, *J* = 7.4 Hz, 2H), 1.65 (p, *J* = 7.3 Hz, 2H), 1.32 – 1.21 (m, 14H), 0.87 (t, *J* = 6.8 Hz, 3H), 0.24 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 188.3, 102.2, 97.7, 45.5, 32.0, 29.7, 29.6, 29.5, 29.1, 24.1, 22.8, 14.3, -0.6 ppm.

The analytical data are in accordance with published data.[10]

(*R*) and (*S*)-1-(Trimethylsilyl)tridec-1-yn-3-ol SI-5



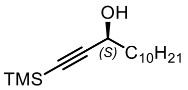
(*R*)-SI-5: Following GP1_B, Ynone **20** (2.00 g, 7.5 mmol, 1.0 equiv.), RuCl[(*R*,*R*)-TsDPEN](mesitylene) (117 mg, 0.188 mmol, 0.025 equiv.) in *i*-PrOH (55 mL) and NEt_3 (6.2 mL, 45.0 mmol, 6.0 equiv.) and HCOOH (1.4 mL, 37.5 mmol, 5.0 equiv.) in *i*-PrOH (15 mL) were used to yield the (*R*)-ynol **SI-5** (1.92 g, 95%, >99% ee (0.5% *i*-PrOH in heptane, Phenomenex Lux® 5µm Amylose 1)) as slightly yellow oil.

$[\alpha]_D^{22}$ = -0.8 (c = 2.42 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 4.34 (t, *J* = 6.6 Hz, 1H), 1.89 – 1.76 (m, 1H), 1.75 – 1.61 (m, 2H), 1.51 – 1.37 (m, 2H), 1.35 – 1.19 (m, 14H), 0.87 (t, *J* = 6.9 Hz, 3H), 0.16 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 107.1, 89.4, 63.1, 37.8, 32.0, 29.7, 29.7, 29.6, 29.5, 29.4, 25.2, 22.8, 14.3, 0.0 ppm.

The analytical data are in accordance with published data.[11]



(*S*)-SI-5: Following GP1_B, Ynone **20** (1.00 g, 3.75 mmol, 1.0 equiv.), RuCl[(*S*,*S*)-TsDPEN](mesitylene) (58.4 mg, 0.094 mmol, 0.025 equiv.) in *i*-PrOH (28 mL) and NEt_3 (3.1 mL, 22.5 mmol, 6.0 equiv.) and HCOOH (0.7 mL, 18.8 mmol, 5.0 equiv.) in *i*-PrOH (8 mL) were used to yield the ynol (*S*)-**SI-5** (966 mg, 96%, >99% ee (0.5% *i*-PrOH in heptane, Phenomenex Lux® 5µm Amylose 1)) as slightly yellow oil.

$[\alpha]_{D}^{22}$ = 0.7 (c = 2.18 $CHCl_3$)

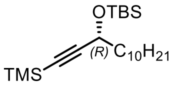
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.34 (q, *J* = 6.3 Hz, 1H), 1.86 – 1.76 (m, 1H), 1.74 – 1.58 (m, 2H), 1.51 – 1.38 (m, 2H), 1.34 – 1.19 (m, 14H), 0.87 (t, *J* = 6.9 Hz, 3H), 0.17 (s, 9H) ppm.

$^{13}C\{^1H\}$-NMR (126 MHz, $CDCl_3$) δ = 107.0, 89.4, 63.1, 37.8, 32.0, 29.7, 29.7, 29.6, 29.5, 29.4, 25.2, 22.8, 14.3, 0.0 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3310 (br, w), 2923 (s), 2853 (s), 1457 (w), 1249 (s), 1020 (m), 840 (s), 759 (m), 698 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{16}H_{33}OSi$ $[M+H]^+$ 269.2295, found 269.2296.

(*R*)- and (S)-*tert*-Butyldimethyl((1-(trimethylsilyl)tridec-1-yn-3-yl)oxy)silane 21



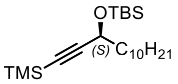
(*R*)-21: Following GP2, ynol (*R*)-**SI-5** (1.76 g, 6.57 mmol, 1.0 equiv.), imidazole (1.34 g, 19.7 mmol, 3.0 equiv.) and TBSCl (1.48 g, 9.86 mmol, 1.5 equiv.) in CH_2Cl_2 (17 mL) were stirred for 1 h to yield after column chromatography (100% cyclohexane) the TBS-ynol (*R*)-**21** (2.38 g, 95%) as colorless oil.

$[\alpha]_{D}^{22}$ = 35.9 (c = 0.99 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) *δ* = 4.31 (t, *J* = 6.6 Hz, 1H), 1.72 – 1.59 (m, 2H), 1.51 – 1.36 (m, 2H), 1.26 (s, 14H), 0.96 – 0.83 (m, 12H), 0.15 (s, 9H), 0.13 (s, 3H), 0.11 (s, 3H) ppm.

$^{13}C\{^1H\}$-NMR (75 MHz, $CDCl_3$) *δ* = 108.20, 88.39, 63.57, 38.64, 32.08, 29.78, 29.73, 29.69, 29.51, 29.35, 25.99, 25.42, 22.86, 18.46, 14.28, 0.01, -4.30, -4.76 ppm.

The analytical data are in accordance with published data.[11]



(*S*)-21: Following GP2, Ynol (*S*)-**SI-5** (593 mg, 2.21 mmol, 1.0 equiv.), imidazole (451 mg, 6.63 mmol, 3.0 equiv.) and TBSCl (497 mg, 3.32 mmol, 1.5 equiv.) in CH_2Cl_2 (5.6 mL) were stirred for 1 h to yield after column chromatography (100% cyclohexane) the TBS-ynol (*S*)-**21** (800 mg, 95%) as colorless oil.

$[\alpha]_{D}^{22}$ = -37.7 (c = 0.61 $CHCl_3$)

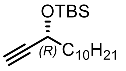
^{1}H-NMR (300 MHz, $CDCl_3$) *δ* = 4.31 (t, *J* = 6.6 Hz, 1H), 1.74 – 1.35 (m, 4H), 1.27 (d, *J* = 4.4 Hz, 14H), 0.90 (m, 12H), 0.15 (s, 9H), 0.13 (s, 3H), 0.11 (s, 3H) ppm.

$^{13}C\{^1H\}$-NMR (75 MHz, $CDCl_3$) *δ* = 108.2, 88.4, 63.6, 38.6, 32.1, 29.8, 29.7, 29.7, 29.5, 29.4, 26.0, 25.4, 22.9, 18.5, 14.3, 0.0, -4.3, -4.7 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2925 (m), 2855 (m), 2171 (w), 1464 (w), 1250 (m), 1093 (m), 835 (s), 776 (m), 759 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{47}OSi_2$ $[M+H]^+$ 383.3160, found 383.3129.

(*R*)- and (S)-*tert*-Butyldimethyl(tridec-1-yn-3-yloxy)silane SI-6



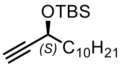
(*R*)-SI-6: Following GP3, Silyl ether **21** (2.20 g, 5.28 mmol, 1.0 equiv.) and K_2CO_3 (803 mg, 5.81 mmol, 1.1 equiv.) in MeOH (26 mL) were used. The residue was purified by column chromatography (100% cyclohexane) to yield the terminal alkyne (*R*)-**SI-6** (1.77 g, 99%) as colorless oil.

$[\alpha]_D^{22}$ = 31.5 (c = 0.67 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 4.33 (td, J = 6.5, 2.1 Hz, 1H), 2.37 (d, J = 2.1 Hz, 1H), 1.73 – 1.61 (m, 2H), 1.47 – 1.37 (m, 2H), 1.27 (s, 14H), 0.97 – 0.81 (m, 12H), 0.13 (s, 3H), 0.11 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 86.0, 72.0, 62.9, 38.7, 32.1, 29.8, 29.7, 29.7, 29.5, 29.4, 25.9, 25.3, 22.8, 18.4, 14.3, -4.4, -4.9 ppm.

The analytical data are in accordance with published data.[11]



(*S*)-SI-6: Following GP3, Silyl ether **21** (207.5 mg, 0.542 mmol, 1.0 equiv.) and K_2CO_3 (82.4 mg, 0.596 mmol, 1.1 equiv.) in MeOH (2.7 mL) were used. The residue was purified by column chromatography (100% cyclohexane) to yield the terminal alkyne (*S*)-**SI-6** (166 mg, 98%) as colorless oil.

$[\alpha]_D^{22}$ = -30.6 (c = 0.71 $CHCl_3$)

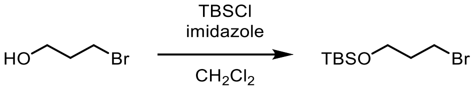
^{1}H-NMR (300 MHz, $CDCl_3$) δ = 4.33 (td, J = 6.5, 2.1 Hz, 1H), 2.37 (d, J = 2.1 Hz, 1H), 1.73 – 1.61 (m, 2H), 1.51 – 1.34 (m, 1H), 1.26 (s, 10H), 0.97 – 0.80 (m, 12H), 0.13 (s, 3H), 0.11 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 85.97, 71.97, 62.93, 38.74, 32.07, 29.76, 29.73, 29.70, 29.49, 29.39, 25.94, 25.27, 22.85, 18.39, 14.28, -4.41, -4.91 ppm.

IR (ATR) $\tilde{\nu}$ = 3312 (w), 2925 (s), 2854 (s), 1464 (m), 1251 (m), 1093 (s), 835 (s), 776 (s), 653 (m), 626 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{19}H_{39}OSi$ $[M+H]^+$ 311.2765, found 311.2763.

(3-Bromopropoxy)(*tert*-butyl)dimethylsilane SI-7



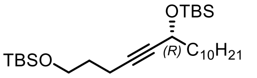
Following GP2: 3-Bromopropan-1-ol (0.95 mL, 10.5 mmol, 1.0 equiv.), imidazole (930 mg, 13.7 mmol, 1.3 equiv.) and TBSCl (2.06 g, 13.7 mmol, 1.3 equiv.) in CH_2Cl_2 (35 mL) were used. The residue was purified by column chromatography (0 to 5% EtOAc in cyclohexane) to yield the protected alcohol **SI-7** (2.31 g, 87%) as colorless oil.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 3.73 (t, J = 5.7 Hz, 2H), 3.51 (t, J = 6.5 Hz, 2H), 2.13 – 1.96 (m, 2H), 0.89 (s, 9H), 0.07 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 60.6, 35.7, 30.8, 26.1, 18.5, -5.2 ppm.

The analytical data are in accordance with published data.[12]

(*R*)- and (*S*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-yne 22



(*R*)-22: To a solution of terminal (*R*)-alkyne **SI-6** (990 mg, 3.19 mmol, 1.0 equiv.) in THF (16 mL) was added at –78 °C *n*-BuLi (1.4 mL, 3.19 mmol, 1.0 equiv., 2.3 M in cyclohexane/hexane) and the reaction mixture was stirred at –78 °C for 30 min. Then HMPA (3.6 mL) was added followed by a solution of TBSO(CH$_2$)$_3$Br **SI-7** (889 mg, 3.51 mmol, 1.1 equiv.) in THF (5.9 mL). The cooling bath was removed and the reaction mixture was stirred for 2 h, quenched by the addition of water and extracted with EtOAc. The combined organic layers were washed with brine, dried over MgSO$_4$, filtrated and concentrated. The residue was purified by column chromatography (0 to 10% EtOAc in cyclohexane) to yield the alkyne (*R*)-**22** (1.15 g, 75%) as slightly yellow oil.

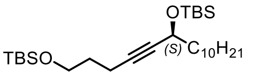
$[\alpha]_D^{22}$ = 21.9 (c = 0.34 CHCl$_3$)

^{1}H-NMR (300 MHz, CDCl$_3$) δ = 4.30 (tt, *J* = 6.6, 2.0 Hz, 1H), 3.68 (t, *J* = 6.1 Hz, 2H), 2.27 (td, *J* = 7.1, 2.0 Hz, 2H), 1.76 – 1.66 (m, 2H), 1.66 – 1.53 (m, 2H), 1.26 (s, 16H), 0.89 (d, *J* = 2.4 Hz, 21H), 0.11 (s, 3H), 0.09 (s, 3H), 0.05 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 84.0, 82.3, 63.4, 61.8, 39.2, 32.1, 31.9, 29.8, 29.8, 29.7, 29.5, 29.5, 26.1, 26.0, 25.5, 22.9, 18.5, 18.4, 15.3, 14.3, -4.3, -4.8, -5.2 ppm.

IR (ATR) $\tilde{\nu}$ = 2925 (m), 2855 (m), 1463 (w), 1252 (m), 1098 (m), 833 (s), 774 (s), 663 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{59}O_2Si_2$ [M+H]$^+$ 483.4048, found 483.4088.



(*S*)-22: Terminal (*S*)-alkyne **SI-6** (245.0 mg, 0.79 mmol, 1.0 equiv.), *n*-BuLi (0.3 mL, 0.79 mmol, 1.0 equiv., 2.3 M in cyclohexane/hexane), HMPA (0.9 mL) in THF (4.0 mL) and TBSO(CH$_2$)$_3$Br **SI-7** (240 mg, 0.95 mmol, 1.2 equiv.) in THF (1.5 mL) were used to yield the alkyne (*S*)-**22** (379 mg, 99%) as slightly yellow oil.

$[\alpha]_D^{22}$ = -24.7 (c = 0.21 CHCl$_3$)

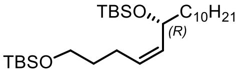
^{1}H-NMR (300 MHz, CDCl$_3$) δ = 4.30 (t, *J* = 6.5 Hz, 1H), 3.68 (t, *J* = 6.1 Hz, 2H), 2.27 (td, *J* = 7.1, 1.9 Hz, 2H), 1.74 – 1.66 (m, 2H), 1.67 – 1.53 (m, 2H), 1.47 – 1.19 (m, 16H), 0.96 – 0.83 (m, 21H), 0.11 (s, 3H), 0.09 (s, 3H), 0.05 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 84.0, 82.3, 63.4, 61.8, 39.2, 32.1, 31.9, 29.8, 29.8, 29.7, 29.5, 29.5, 26.1, 26.0, 25.5, 22.9, 18.5, 18.5, 15.3, 14.3, -4.3, -4.8, -5.2 ppm.

IR (ATR) $\tilde{\nu}$ = 2925 (m), 2854 (m), 1463 (w), 1252 (m), 1101 (m), 836 (s), 776 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{59}O_2Si_2$ [M+H]$^+$ 483.4048, found 483.4083.

(***R,Z***)- and (***S,Z***)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-ene SI-8



(*R*)-SI-8: Following GP4, $Ni(OAc)_2 \cdot 4\ H_2O$ (620 mg, 2.49 mmol, 1.1 equiv.), $NaBH_4$ (94.2 mg, 2.49 mmol, 1.1 equiv.) in EtOH (12.5 mL) and (*R*)-alkyne **22** (1.09 g, 2.26 mmol, 1.0 equiv.), ethylenediamine (0.17 mL, 2.49 mmol, 1.1 equiv.) in EtOH (9.0 mL) were used. The residue was purified by column chromatography (0 to 10% EtOAc in cyclohexane) to obtain the allylic alcohol **(*R,Z*)-SI-8** (1.04 g, 95%) as slightly yellow oil.

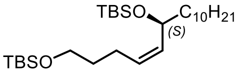
$[\alpha]_D^{22}$ = -2.3 (c = 0.19 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.39 – 5.22 (m, 2H), 4.38 (dt, *J* = 7.3, 4.2 Hz, 1H), 3.62 (t, *J* = 6.4 Hz, 2H), 2.14 – 2.01 (m, 2H), 1.64 – 1.45 (m, 4H), 1.39 – 1.19 (m, 16H), 0.93 – 0.83 (m, 21H), 0.05 (s, 6H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 134.7, 128.4, 68.9, 62.9, 38.7, 33.0, 32.1, 29.8, 29.8, 29.5, 26.1, 26.1, 25.6, 24.5, 22.9, 18.5, 18.4, 14.3, -4.1, -4.6, -5.1 ppm.

IR (ATR) $\tilde{\nu}$ = 2925 (m), 2854 (m), 1463 (w), 1253 (m), 1093 (m), 833 (s), 772 (s), 665 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{61}O_2Si_2$ $[M+H]^+$ 485.4205, found 485.4147.



(*S*)-SI-8: Following GP4, $Ni(OAc)_2 \cdot 4\ H_2O$ (454 mg, 1.82 mmol, 1.1 equiv.), $NaBH_4$ (68.9 mg, 1.82 mmol, 1.1 equiv.) in EtOH (9.0 mL) and (*S*)-alkyne **22** (801 mg, 1.66 mmol, 1.0 equiv.), ethylenediamine (0.12 mL, 1.82 mmol, 1.1 equiv.) in EtOH (6.6 mL) were used. The residue was purified by column chromatography (0 to 10% EtOAc in cyclohexane) to obtain the allylic alcohol **(*S,Z*)-SI-8** (775 mg, 96%) as slightly yellow oil.

$[\alpha]_D^{22}$ = 0.9 (c = 1.05 $CHCl_3$)

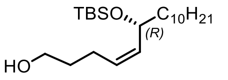
^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.42 – 5.23 (m, 2H), 4.46 – 4.32 (m, 1H), 3.61 (t, *J* = 6.4 Hz, 2H), 2.16 – 2.00 (m, 2H), 1.66 – 1.44 (m, 4H), 1.40 – 1.16 (m, 16H), 0.94 – 0.81 (m, 21H), 0.05 (s, 6H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 134.7, 128.4, 68.9, 62.9, 38.7, 33.0, 32.1, 29.8, 29.8, 29.5, 26.1, 26.0, 25.6, 24.5, 22.9, 18.5, 18.4, 14.3, -4.1, -4.6, -5.1 ppm.

IR (ATR) $\tilde{\nu}$ = 2925 (m), 2854 (m), 1463 (w), 1253 (m), 1093 (m), 833 (s), 772 (s), 665 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{61}O_2Si_2$ $[M+H]^+$ 485.4205, found 485.4208.

(*R,Z*)- and (S,Z)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-en-1-ol SI-9



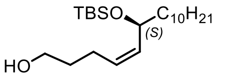
(*R*)-SI-9: Following GP5, Alcohol (*R*)-**SI-8** (996 mg, 2.05 mmol, 1.0 equiv.) and TBAF (2.1 mL, 2.05 mmol, 1.0 equiv., 1 M in THF) in THF (20 mL) were stirred for 1 h to obtain the alcohol (*R*)-**SI-9** (698 mg, 92%) as slightly yellow oil.

$[\alpha]_D^{22}$ = 4.6 (c = 0.13 $CHCl_3$)

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.44 – 5.24 (m, 2H), 4.47 – 4.32 (m, 1H), 3.66 (t, *J* = 6.5 Hz, 2H), 2.26 – 2.05 (m, 2H), 1.71 – 1.59 (m, 2H), 1.46 (s, 1H), 1.41 – 1.17 (m, 18H), 0.91 – 0.84 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

IR (ATR) $\tilde{\nu}$ = 3315 (w, br), 2924 (s), 2853 (s), 1464 (w), 1252 (m), 1042 (m), 871 (m), 834 (s), 774 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{47}O_2Si$ $[M+H]^+$ 371.3340, found 371.3342.



(*S*)-SI-9: Following GP5, Alcohol (*S*)-**SI-8** (753 mg, 1.55 mmol, 1.0 equiv.) and TBAF (1.6 mL, 1.55 mmol, 1.0 equiv., 1 M in THF) in THF (16 mL) were stirred for 1 h to obtain the alcohol (*S*)-**SI-9** (484 mg, 84%) as slightly yellow oil.

$[\alpha]_D^{20}$ = -10.1 (c = 0.83 $CHCl_3$)

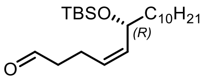
^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.44 – 5.25 (m, 2H), 4.39 (td, *J* = 7.5, 4.6 Hz, 1H), 3.66 (t, *J* = 6.5 Hz, 2H), 2.24 – 2.06 (m, 2H), 1.69 – 1.59 (m, 2H), 1.41 (s, 1H), 1.25 (m, 18H), 0.90 – 0.84 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 135.1, 128.0, 69.0, 62.7, 38.7, 32.8, 32.1, 29.8, 29.8, 29.5, 26.0, 25.8, 25.5, 24.3, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 3328 (w, br), 2924 (s), 2853 (s), 1463 (w), 1253 (m), 1057 (m), 870 (m), 834 (s), 773 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{47}O_2Si$ $[M+H]^+$ 371.3340, found 371.3338.

(*R,Z*)- and (*S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-enal 23



(*R*)-23: Following GP6, (*R*)-Alcohol **SI-9** (594 mg, 1.60 mmol, 1.0 equiv.), $NaHCO_3$ (673 mg, 8.01 mmol, 5.0 equiv.) and DMP (1.02 g, 2.40 mmol, 1.5 equiv.) in CH_2Cl_2 (16 mL) were used. The residue was purified by column chromatography (0 to 20% EtOAc in cyclohexane) to yield the aldehyde (*R*)-**23** (495 mg, 84%) as slightly yellow oil.

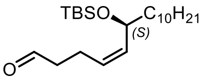
$[\alpha]_D^{22}$ = -0.5 (c = 1.90 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 9.79 (t, *J* = 1.5 Hz, 1H), 5.40 (ddt, *J* = 10.3, 8.4, 1.7 Hz, 1H), 5.26 (dtd, *J* = 11.1, 7.3, 1.1 Hz, 1H), 4.44 – 4.34 (m, 1H), 2.51 (td, *J* = 7.1, 1.5 Hz, 2H), 2.44 – 2.29 (m, 2H), 1.55 – 1.45 (m, 1H), 1.39 – 1.18 (m, 17H), 0.93 – 0.82 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 201.8, 136.0, 126.1, 68.8, 43.9, 38.6, 32.1, 29.8, 29.8, 29.5, 26.0, 25.5, 22.8, 20.6, 18.4, 14.3, -4.2, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 2925 (m), 2854 (m), 1730 (m), 1463 (w), 1252 (m), 1081 (m), 834 (s), 773 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{45}O_2Si$ $[M+H]^+$ 369.3183, found 369.3185.



(*S*)-23: Following GP6, (*S*)-Alcohol **SI-9** (472 mg, 1.27 mmol, 1.0 equiv.), $NaHCO_3$ (535 mg, 6.37 mmol, 5.0 equiv.) and DMP (810 mg, 1.91 mmol, 1.5 equiv.) in CH_2Cl_2 (13 mL) were used. The residue was purified by column chromatography (0 to 20% EtOAc in cyclohexane) to yield the aldehyde (*S*)-**23** (400 mg, 85%) as slightly yellow oil.

$[\alpha]_D^{22}$ = 0.2 (c = 2.43 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 9.79 (t, J = 1.4 Hz, 1H), 5.40 (ddt, J = 10.4, 8.5, 1.6 Hz, 1H), 5.26 (dtd, J = 11.1, 7.3, 1.1 Hz, 1H), 4.44 – 4.33 (m, 1H), 2.51 (td, J = 7.1, 1.4 Hz, 2H), 2.44 – 2.30 (m, 2H), 1.59 – 1.46 (m, 1H), 1.25 (s, 17H), 0.91 – 0.84 (m, 12H), 0.04 (s, 3H), 0.01 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 201.8, 136.0, 126.1, 68.8, 43.9, 38.6, 32.1, 29.8, 29.8, 29.5, 26.0, 25.5, 22.8, 20.6, 18.4, 14.3, -4.2, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 2925 (m), 2854 (m), 1730 (m), 1463 (w), 1251 (m), 1082 (m), 834 (s), 773 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{45}O_2Si$ [M+H]$^+$ 369.3183, found 369.3183.

2.2.3 Synthesis of (*R,Z*)-7-((*tert*-butyldimethylsilyl)oxy)hexadec-5-enal 32

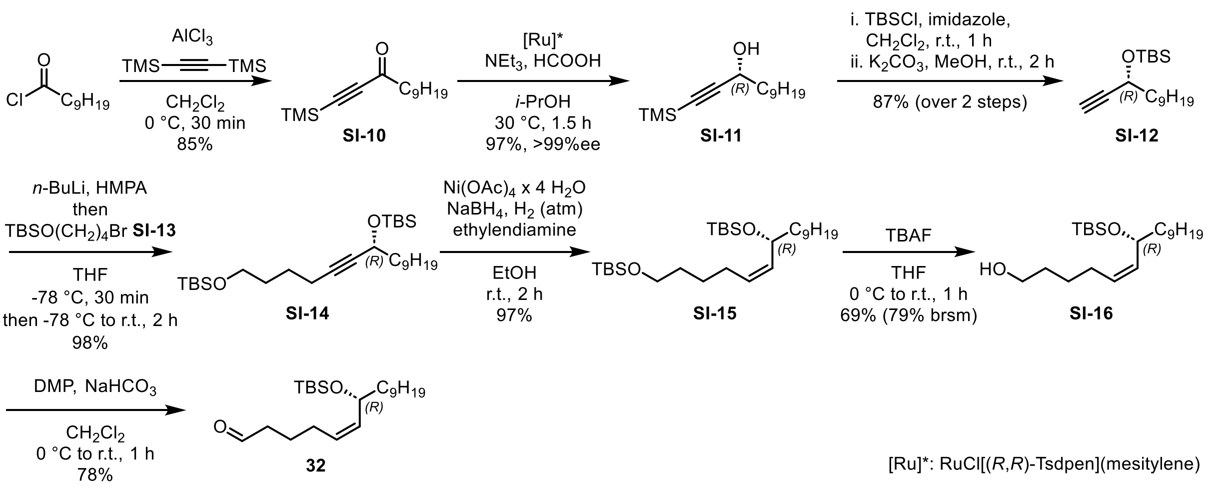
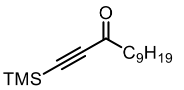


Figure S3. Reaction overview for the synthesis of (*R,Z*)-7-((tert-butyldimethylsilyl)oxy)hexadec-5-enal **32**.

1-(Trimethylsilyl)dodec-1-yn-3-one SI-10



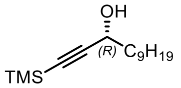
A suspension of $AlCl_3$ (9.09 g, 68.2 mmol, 1.3 equiv.) in CH_2Cl_2 (230 mL) was cooled to 0 °C, and treated slowly with decanoyl chloride (10.9 mL, 52.4 mmol, 1.0 equiv.) followed by *bis*(trimethylsilyl)acetylene (9.83 g, 57.7 mmol, 1.1 equiv.) over a period of 10 min. The reaction mixture was stirred at 0 °C for 30 min, quenched by the slowly addition of cold H_2O and extracted with CH_2Cl_2. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (0 to 7% EtOAc in cyclohexane) to yield the ynone **SI-10** (11.3 g, 85%) as yellow oil.

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 2.53 (dt, J = 7.4 Hz, 2H), 1.65 (h, J = 7.9, 7.2 Hz, 2H), 1.35 – 1.18 (m, 12H), 0.86 (t, J = 6.8 Hz, 3H), 0.22 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 188.2, 102.1, 97.6, 45.4, 32.0, 29.5, 29.4, 29.4, 29.0, 24.0, 22.8, 14.2, -0.6 ppm.

The analytical data are in accordance with published data.[13]

(*R*)-1-(Trimethylsilyl)dodec-1-yn-3-ol SI-11



Following GP1_B: Ynone **SI-10** (500 mg, 1.98 mmol, 1.0 equiv.), RuCl[(*R*,*R*)-TsDPEN](mesitylene) (30.8 mg, 0.05 mmol, 0.025 equiv.) in *i*-PrOH (15 mL) and NEt$_3$ (1.6 mL, 11.9 mmol, 6.0 equiv.) and HCOOH (0.37 mL, 9.9 mmol, 5.0 equiv.) in *i*-PrOH (4 mL) were used to yield the ynol (*R*)-**SI-11** (488 mg, 97%, >99%ee (0.5% *i*-PrOH in heptane, Phenomenex Lux® 5µm Amylose 1)) as slightly yellow oil.

$[\alpha]_D^{22}$ = 2.3 (c = 2.00 CHCl$_3$)

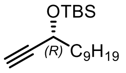
^{1}H-NMR (500 MHz, CDCl$_3$) δ = 4.34 (t, *J* = 6.6 Hz, 1H), 1.84 (s, 1H), 1.68 (dq, *J* = 9.3, 6.3 Hz, 2H), 1.51 – 1.38 (m, 2H), 1.35 – 1.20 (m, 12H), 0.87 (t, *J* = 6.9 Hz, 3H), 0.16 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CDCl$_3$) δ = 107.1, 89.4, 63.0, 37.8, 32.0, 29.6, 29.4, 29.3, 25.2, 22.8, 14.3, 0.0 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3327 (br, w), 2923 (m), 2854 (m), 2173 (w), 1458 (w), 1249 (m), 1015 (m), 839 (s), 759 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{15}H_{31}OSi$ [M+H]$^+$ 255.2139, found 255.2139.

(*R*)-*tert*-Butyl(dodec-1-yn-3-yloxy)dimethylsilane SI-12



To a solution of ynole **SI-11** (1.29 g, 5.05 mmol, 1.0 equiv.) in CH$_2$Cl$_2$ (15 mL) was added at 0 °C imidazole (1.03 g, 15.2 mmol, 3.0 equiv.) followed by TBSCl (1.14 g, 7.58 mmol, 1.5 equiv.). The cooling bath was removed and the reaction mixture was stirred for 1 h, quenched by the addition of H$_2$O and extracted with CH$_2$Cl$_2$. The combined organic layers were washed with brine, dried over Na$_2$SO$_4$, filtrated and evaporated. The residue was dissolved in MeOH (25 mL) and K$_2$CO$_3$ (768 mg, 5.6 mmol, 1.1 equiv.) was added. The reaction mixture was stirred at r.t. for 2 h and concentrated in *vacuo*. The residue was taken up in H$_2$O/EtOAc and the aqueous layer was extracted with EtOAc. The combined organic layers were washed with brine, dried over Na$_2$SO$_4$, filtrated and evaporated. The residue was purified by column chromatography (0 to 10% EtOAc in cyclohexane) to yield the alkyne (*R*)-**SI-12** (1.31 g, 87%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 30.7 (c = 0.64 CHCl$_3$)

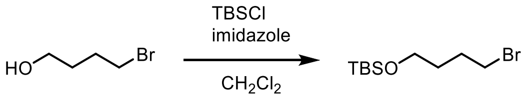
^{1}H-NMR (500 MHz, CDCl$_3$) δ = 4.33 (td, *J* = 6.5, 2.1 Hz, 1H), 2.37 (d, *J* = 2.1 Hz, 1H), 1.72 – 1.62 (m, 2H), 1.48 – 1.35 (m, 2H), 1.34 – 1.21 (m, 12H), 0.95 – 0.85 (m, 12H), 0.13 (s, 3H), 0.11 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CDCl$_3$) δ = 85.9, 72.0, 62.9, 38.7, 32.0, 29.7, 29.5, 29.4, 25.9, 25.3, 22.8, 18.4, 14.3, -4.4, -4.9 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3312 (w), 2925 (m), 2855 (m), 1464(w), 1251 (m), 1092 (m), 835 (s), 776 (s), 653 (m), 626 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{37}OSi$ [M+H]$^+$ 297.2608, found 297.2609.

(4-Bromobutoxy)(*tert*-butyl)dimethylsilane SI-13



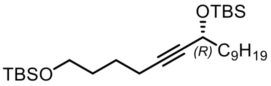
Following GP2: 4-Bromobutan-1-ol (1.10 mL, 10.5 mmol, 1.0 equiv.), imidazole (930 mg, 13.7 mmol, 1.3 equiv.) and TBSCl (2.06 g, 13.7 mmol, 1.3 equiv.) in CH_2Cl_2 (35 mL) were used. The residue was purified by column chromatography (0 to 5% EtOAc in cyclohexane) to yield the protected alcohol **SI-13** (2.45 g, 87%) as colorless oil.

^{1}H-NMR (500 MHz, CDCl$_3$) δ = 3.64 (t, *J* = 6.1 Hz, 2H), 3.45 (t, *J* = 6.8 Hz, 2H), 1.94 (p, *J* = 6.9 Hz, 2H), 1.75 – 1.58 (m, 2H), 0.89 (s, 9H), 0.05 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CDCl$_3$) δ = 62.3, 34.1, 31.4, 29.6, 26.1, 18.4, -5.2 ppm.

The analytical data are in accordance with published data.[14]

(*R*)-2,3,13,14-Octamethyl-5-nonyl-4,12-dioxa-3,13-disilapentadec-6-yne SI-14



To a solution of terminal alkyne **SI-12** (1.28 g, 4.32 mmol, 1.0 equiv.) in THF (15 mL) was added at –78 °C *n*-BuLi (2.7 mL, 4.32 mmol, 1.0 equiv., 1.6 M) and the reaction mixture was stirred at –78 °C for 30 min. HMPA (4.3 mL) was added followed by a solution (4-bromobutoxy)(*tert*-butyl)-dimethylsilane **SI-13** (1.39 g, 5.18 mmol, 1.2 equiv.) in THF (10 mL). The cooling bath was removed and the reaction mixture was stirred for 2 h, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and evaporated *in vacuo*. The residue was purified by column chromatography (0 to 7% EtOAc in cyclohexane) to obtain the alkyne (*R*)-**SI-14** (2.04 g, 98%) as slightly yellow oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 17.6 (c = 0.63 $CHCl_3$)

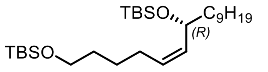
^{1}H-NMR (500 MHz, CDCl$_3$) δ = 4.30 (tt, *J* = 6.6, 1.9 Hz, 1H), 3.69 – 3.58 (m, 2H), 2.21 (td, *J* = 6.9, 2.0 Hz, 2H), 1.72 – 1.51 (m, 4H), 1.46 – 1.35 (m, 2H), 1.30 – 1.14 (m, 14H), 0.94 – 0.82 (m, 21H), 0.11 (s, 3H), 0.09 (s, 3H), 0.04 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CDCl$_3$) δ = 84.3, 82.4, 63.4, 62.8, 39.2, 32.1, 32.1, 29.7, 29.7, 29.5, 29.4, 26.1, 26.0, 25.5, 25.3, 22.8, 18.7, 18.5, 14.3, -4.3, -4.8, -5.2 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2926 (m), 2855 (m), 1471 (w), 1252 (m), 1091 (s), 833 (s), 773 (s), 661 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{59}O_2Si_2$ $[M+H]^+$ 483.4048, found 483.4048.

(*R,Z*)-2,3,13,14-Octamethyl-5-nonyl-4,12-dioxa-3,13-disilapentadec-6-ene SI-15



Following GP4: $Ni(OAc)_2 \cdot 4\ H_2O$ (1.12g, 4.51 mmol, 1.1 equiv.), $NaBH_4$ (171 mg, 4.51 mmol, 1.1 equiv.) in EtOH (23 mL) and alkyne (*R*)-**SI-14** (1.98 g, 4.10 mmol, 1.0 equiv.), ethylenediamine (0.30 mL, 4.51 mmol, 1.1 equiv.) in EtOH (14 mL) were used to obtain (*R,Z*)-**SI-15** (1.93 g, 97%) as slightly yellow oil, which was used without further purification.

$[\alpha]_D^{22}$ = -2.8 (c = 0.72 $CHCl_3$)

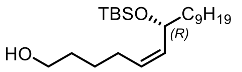
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.38 – 5.24 (m, 2H), 4.37 (td, *J* = 7.2, 4.5 Hz, 1H), 3.66 – 3.56 (m, 2H), 2.11 – 1.98 (m, 2H), 1.58 – 1.46 (m, 3H), 1.44 – 1.18 (m, 17H), 0.91 – 0.85 (m, 21H), 0.05 (s, 6H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 134.5, 128.8, 69.0, 63.2, 38.7, 32.8, 32.1, 29.8, 29.8, 29.5, 27.8, 26.1, 26.0, 25.6, 22.8, 18.5, 18.4, 14.3, -4.1, -4.6, -5.1 ppm.

IR (ATR) $\tilde{\nu}$ = 2926 (m), 2855 (m), 1462 (w), 1252 (m), 1099 (m), 833 (s), 772 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{61}O_2Si_2$ $[M+H]^+$ 485.4205, found 485.4143.

(*R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-en-1-ol SI-16



Following GP5: (*R*)-Alcohol **SI-15** (1.89 g, 3.89 mmol, 1.0 equiv.) and TBAF (3.9 mL, 3.99 mmol, 1.0 equiv., 1 M in THF) in THF (20 mL) were stirred for 4 h to obtain the alcohol (*R*)-**SI-16** (1.00 g, 69%, 79% brsm) as slightly yellow oil.

$[\alpha]_D^{22}$ = 5.8 (c = 0.86 $CHCl_3$)

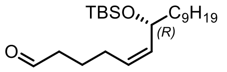
^{1}H-NMR (600 MHz, $CDCl_3$) δ = 5.38 – 5.25 (m, 2H), 4.37 (ddt, *J* = 8.3, 5.5, 2.6 Hz, 1H), 3.65 (t, *J* = 6.6 Hz, 2H), 2.15 – 1.99 (m, 2H), 1.64 – 1.55 (m, 2H), 1.55 – 1.37 (m, 3H), 1.37 – 1.18 (m, 16H), 0.89 – 0.86 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (151 MHz, $CDCl_3$) δ = 134.8, 128.5, 69.0, 63.0, 38.7, 32.6, 32.0, 29.8, 29.7, 29.5, 27.7, 26.0, 25.8, 25.5, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 3326 (br, w), 2925 (s), 2854 (s), 1462 (m), 1252 (m), 1069 (m), 834 (s), 773 (s), 666 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{47}O_2Si$ $[M+H]^+$ 371.3340, found 371.3336.

(*R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-enal 32



Following GP6: (*R*)-Alcohol **SI-16** (912 mg, 2.48 mmol, 1.0 equiv.), $NaHCO_3$ (1.04 g, 12.4 mmol, 5.0 equiv.) and DMP (1.58 g, 3.72 mmol, 1.5 equiv.) in CH_2Cl_2 (25 mL) were used to yield the aldehyde (*R*)-**32** (715 mg, 78%) as slightly yellow oil.

$[\alpha]_D^{22}$ = -1.1 (c = 3.11 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 9.78 (t, *J* = 1.6 Hz, 1H), 5.42 – 5.34 (m, 1H), 5.26 (dtd, *J* = 11.1, 7.2, 1.0 Hz, 1H), 4.34 (ddt, *J* = 8.5, 5.3, 2.5 Hz, 1H), 2.51 – 2.39 (m, 2H), 2.16 – 2.01 (m, 2H), 1.75 – 1.65 (m, 2H), 1.54 – 1.45 (m, 1H), 1.38 – 1.18 (m, 17H), 0.91 – 0.85 (m, 12H), 0.03 (s, 3H), 0.01 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 202.4, 135.6, 127.4, 68.9, 43.5, 38.7, 32.0, 29.8, 29.7, 29.5, 27.2, 26.0, 25.5, 22.8, 22.1, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 2925 (m), 2854 (m), 2715 (w), 1729 (m), 1462 (w), 1252 (m), 1081 (m), 834 (s), 773 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{45}O_2Si$ $[M+H]^+$ 369.3183, found 369.3180.

2.2.4 Synthesis (*R,Z*)-5-((*tert*-butyldimethylsilyl)oxy)hexadec-6-enal 37

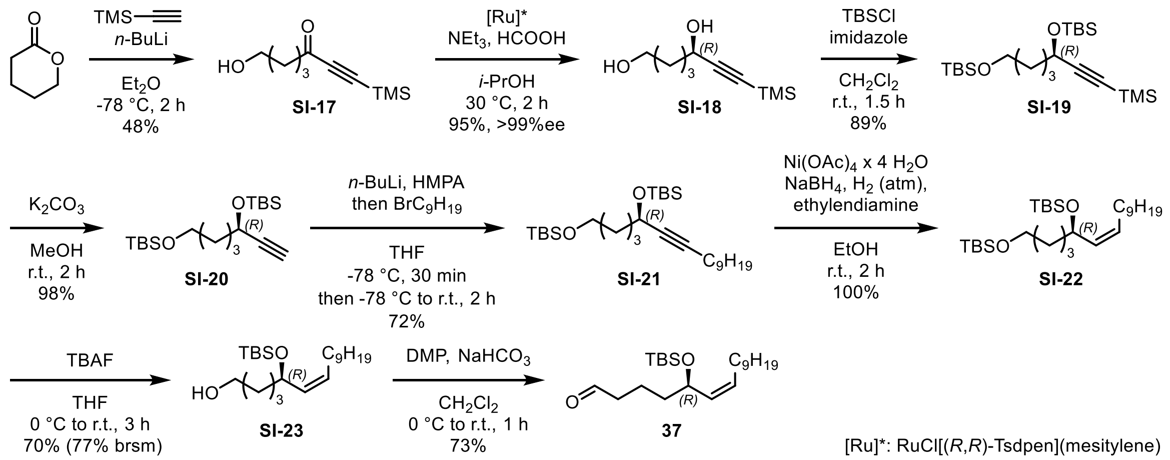
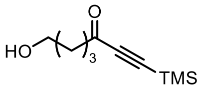


Figure S4. Reaction overview for the synthesis of (*R,Z*)-5-((*tert*-butyldimethylsilyl)oxy)hexadec-6-enal **37**.

7-Hydroxy-1-(trimethylsilyl)hept-1-yn-3-one SI-17



To a solution of TMS-acetylene (6.9 mL, 4.90 g, 49.9 mmol, 1.0 equiv.) in diethyl ether (100 mL) at –78 °C was added *n*-BuLi (31.2 mL, 49.9 mmol, 1.0 equiv., 1.6 M in hexane) and the reaction mixture was stirred for 30 min. Then, a solution of δ-valerolactone (4.6 mL, 5.00 g, 49.9 mmol, 1.0 equiv.) in diethyl ether (30 mL) was added. After stirring at –78 °C for 1 h, the reaction mixture was quenched by the addition of sat. NH_4Cl solution and extracted with diethyl ether. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (20 to 70% EtOAc in cyclohexane, linear gradient) to yield the ynone **SI-17** (4.71 g, 48%) as slightly yellow oil.

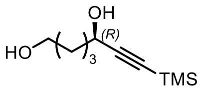
^{1}H-NMR (500 MHz, C_6D_6) δ = 3.24 (q, *J* = 6.2, 5.6 Hz, 2H), 2.28 (dt, *J* = 7.4, 3.6 Hz, 2H), 1.66 – 1.49 (m, 2H), 1.31 – 1.17 (m, 2H), 0.06 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, C_6D_6) δ = 186.7, 103.2, 96.1, 62.0, 45.1, 32.0, 20.3, -0.9 ppm.

IR (ATR) $\tilde{\nu}$ = 3353 (br, w), 2957 (w), 2874 (w), 1672 (m), 1405 (w), 1252 (m), 1118 (m), 1057 (m), 844 (s), 762 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{10}H_{19}O_2Si$ $[M+H]^+$ 199.1149, found 199.1144.

(*R*)-7-(Trimethylsilyl)hept-6-yne-1,5-diol SI-18



Following GP1_A: Ynone **SI-17** (3.50 g, 17.6 mmol, 1.0 equiv.), RuCl[(*R,R*)-TsDPEN](mesitylene) (274 mg, 0.44 mmol, 0.025 equiv.) in *i*-PrOH (60 mL) and NEt_3 (14.6 mL, 105.6 mmol, 6.0 equiv.) and HCOOH (3.3 mL, 88.0 mmol, 5.0 equiv.) in *i*-PrOH (30 mL) were used to yield the ynol (*R*)-**SI-18** (3.36 g, 95%, >99%ee (2% *i*-PrOH in heptane, Phenomenex Lux® 5µm Cellulose 1)) as brown oil.

$[\alpha]_D^{22}$ = 7.4 (c = 1.15 $CHCl_3$)

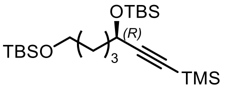
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.36 (t, *J* = 6.5 Hz, 1H), 3.65 (td, *J* = 6.3, 1.7 Hz, 2H), 2.59 (s, br, 2H), 1.79 – 1.65 (m, 2H), 1.64 – 1.44 (m, 4H), 0.15 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 106.9, 89.4, 62.6, 37.3, 32.1, 21.4, -0.0 ppm.

IR (ATR) $\tilde{\nu}$ = 3311 (br, m), 2942 (m), 2863 (m), 2171 (w), 1716 (w), 1409 (w), 1249 (m), 1018 (m), 839 (s), 759 (m), 698 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{10}H_{21}O_2Si$ $[M+H]^+$ 201.1305, found 201.1304.

(*R*)-2,3,11,12-Octamethyl-5-((trimethylsilyl)ethynyl)-4,10-dioxa-3,11-disila-tridecane SI-19



Following GP2: (*R*)-Ynole **SI-18** (3.00 g, 15.0 mmol, 1.0 equiv.), imidazole (6.11 g, 89.8 mmol, 6.0 equiv.) and TBSCl (6.77 g, 44.9 mmol, 3.0 equiv.) in CH_2Cl_2 (50 mL), were stirred for 1.5 h to yield after column chromatography (0 to 5% EtOAc in cyclohexane) the silyl ether (*R*)-**SI-19** (5.69g, 89%) as colorless oil.

$[\alpha]_D^{22}$ = 33.0 (c = 0.50 MeOH)

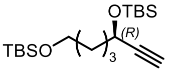
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.32 (dd, *J* = 7.2, 6.0 Hz, 1H), 3.61 (t, *J* = 6.3 Hz, 2H), 1.78 – 1.61 (m, 2H), 1.56 – 1.38 (m, 4H), 0.90 (s, 9H), 0.89 (s, 9H), 0.15 (s, 9H), 0.13 (s, 3H), 0.10 (s, 3H), 0.04 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 108.0, 88.5, 63.5, 63.3, 38.5, 32.6, 26.1, 26.0, 21.9, 18.5, 18.4, -0.0, -4.3, -4.8, -5.1 ppm.

IR (ATR) $\tilde{\nu}$ = 2954 (m), 2928 (m), 2857 (m), 2171 (w), 1472 (w), 1250 (m), 1099 (m), 833 (s), 774 (s), 661 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{49}O_2Si_3$ $[M+H]^+$ 429.3035, found 429.3025.

(*R*)-5-Ethynyl-2,3,11,12-octamethyl-4,10-dioxa-3,11-disilatridecane SI-20



Following GP3: (*R*)-silyl ether **SI-19** (5.65 g, 13.2 mmol, 1.0 equiv.), K_2CO_3 (2.00 g, 14.5 mmol, 1.1 equiv.) in MeOH (66 mL) were used. The residue was purified by column chromatography (0 to 10% EtOAc in cyclohexane) to yield the terminal (*R*)-alkyne **SI-20** (4.62 g, 98%) as slightly yellow oil.

$[\alpha]_D^{22}$ = 27.0 (c = 1.00 MeOH)

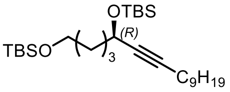
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.33 (td, *J* = 6.5, 2.1 Hz, 1H), 3.61 (t, *J* = 6.2 Hz, 2H), 2.37 (d, *J* = 2.1 Hz, 1H), 1.69 (dq, *J* = 8.6, 6.3 Hz, 2H), 1.60 – 1.39 (m, 4H), 0.90 (s, 9H), 0.89 (s, 9H), 0.13 (s, 3H), 0.11 (s, 3H), 0.04 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 85.8, 72.1, 63.2, 62.9, 38.5, 32.6, 26.1, 25.9, 21.7, 18.5, 18.4, -4.4, -4.9, -5.1 ppm.

IR (ATR) $\tilde{\nu}$ = 3312 (w), 2954 (m), 2928 (m), 2857 (m), 1472 (w), 1252 (m), 1097 (m), 832 (s), 773 (s), 654 (m), 627 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{19}H_{41}O_2Si_2$ $[M+H]^+$ 357.2640, found 357.2635.

(*R*)-2,3,11,12-Octamethyl-5-(undec-1-yn-1-yl)-4,10-dioxa-3,11-disilatridecane SI-21



To a solution of terminal alkyne (*R*)-**SI-20** (2.00 g, 5.61 mmol, 1.0 equiv.) in THF (20 mL) was added at –78 °C *n*-BuLi (3.5 mL, 5.61 mmol, 1.0 equiv., 1.6 M) and the reaction mixture was stirred at –78 °C for 30 min. Then HMPA (5.6 mL) was added followed by a solution of 1-bromononane (1.07 mL, 1.16 g, 5.61 mmol, 1.0 equiv.) in THF (10 mL). The cooling bath was removed and the reaction mixture was stirred for 2 h, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and concentrated in *vacuo*. The residue was purified by column chromatography (0 to 5% EtOAc in cyclohexane) to afford the alkyne (*R*)-**SI-21** (1.95 g, 72%) as colorless oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 23.8 (c = 1.71 $CHCl_3$)

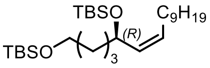
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.32 (tt, *J* = 6.7, 1.9 Hz, 1H), 3.60 (t, *J* = 6.4 Hz, 2H), 2.17 (td, *J* = 7.0, 2.0 Hz, 2H), 1.64 (tt, *J* = 8.8, 6.2 Hz, 2H), 1.58 – 1.33 (m, 6H), 1.33 – 1.17 (m, 12H), 0.90 (s, 9H), 0.89 – 0.86 (m, 12H), 0.11 (s, 3H), 0.10 (s, 3H), 0.04 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 84.6, 82.0, 63.3, 63.3, 39.0, 32.7, 32.0, 29.7, 29.5, 29.3, 29.0, 28.8, 26.1, 26.0, 22.8, 21.9, 18.8, 18.5, 18.4, 14.3, -4.3, -4.8, -5.1 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2954 (m), 2926 (m), 2855 (m), 1462 (w), 1252 (m), 1098 (m), 833 (s), 773 (s), 663 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{59}O_2Si_2$ $[M+H]^+$ 483.4048, found 483.4082.

(*R,Z*)-2,3,11,12-Octamethyl-5-(undec-1-en-1-yl)-4,10-dioxa-3,11-disilatridecane SI-22



Following GP4: $Ni(OAc)_2 \cdot 4\ H_2O$ (878 mg, 3.53 mmol, 1.1 equiv.), $NaBH_4$ (134 mg, 3.53 mmol, 1.1 equiv.) in EtOH (20 mL) and alkyne (*R*)-**SI-21** (1.55 g, 3.21 mmol, 1.0 equiv.), ethylenediamine (0.24 mL, 3.53 mmol, 1.1 equiv.) in EtOH (10 mL) were used to obtain the allylic alcohol (*R,Z*)-**SI-22** (1.56 g, 100%) as colorless oil, which was used without further purification.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 0.2 (c = 2.60 $CHCl_3$)

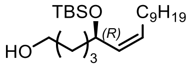
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.36 – 5.24 (m, 2H), 4.38 (q, *J* = 6.9 Hz, 1H), 3.59 (t, *J* = 6.5 Hz, 2H), 2.10 – 1.92 (m, 2H), 1.51 (tdd, *J* = 8.7, 6.6, 2.9 Hz, 3H), 1.38 – 1.20 (m, 17H), 0.90 – 0.87 (m, 21H), 0.04 (d, *J* = 2.5 Hz, 9H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 134.2, 129.2, 69.0, 63.4, 38.5, 33.0, 32.1, 29.8, 29.7, 29.7, 29.6, 29.5, 28.0, 26.1, 26.0, 22.8, 21.9, 18.5, 18.4, 14.3, -4.1, -4.6, -5.1 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2925 (m), 2855 (m), 1462 (w), 1252 (m), 1097 (m), 833 (s), 772 (s), 664 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{61}O_2Si_2$ $[M+H]^+$ 485.4205, found 485.4208.

(*R,Z*)-5-((*tert*-Butyldimethylsilyl)oxy)hexadec-6-en-1-ol SI-23



Following GP5: Alcohol (*R*)-**SI-22** (1.50 g, 3.09 mmol, 1.0 equiv.) and TBAF (3.1 mL, 3.09 mmol, 1.0 equiv., 1 M in THF) in THF (20 mL) were stirred for 3 h to obtain the alcohol (*R*)-**SI-23** (801 mg, 70%, 77% brsm) as slightly yellow oil.

$[\alpha]_D^{22}$ = 3.3 (c = 0.68 $CHCl_3$)

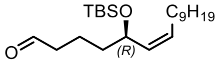
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.36 – 5.25 (m, 2H), 4.46 – 4.33 (m, 1H), 3.63 (t, *J* = 6.6 Hz, 2H), 2.10 – 1.93 (m, 2H), 1.65 – 1.50 (m, 3H), 1.47 (s, 1H), 1.45 – 1.20 (m, 17H), 0.90 – 0.85 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 134.0, 129.4, 68.8, 63.1, 38.4, 32.9, 32.1, 29.8, 29.7, 29.7, 29.6, 29.5, 28.0, 26.0, 22.8, 21.6, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 3330 (br, w), 2925 (s), 2854 (m), 1741 (w), 1462 (w), 1252 (m), 1056 (m), 834 (s), 773 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{47}O_2Si$ $[M+H]^+$ 371.3340, found 371.3340.

(*R,Z*)-5-((*tert*-Butyldimethylsilyl)oxy)hexadec-6-enal 37



Following GP6: Alcohol (*R*)-**SI-23** (757 mg, 2.04 mmol, 1.0 equiv.), $NaHCO_3$ (858 mg, 10.2 mmol, 5.0 equiv.) and DMP (1.30 g, 3.06 mmol, 1.5 equiv.) in CH_2Cl_2 (20 mL) were used to yield the aldehyde (*R*)-**37** (547 mg, 73%) as slightly yellow oil.

$[\alpha]_D^{22}$ = 0.7 (c = 2.86 $CHCl_3$)

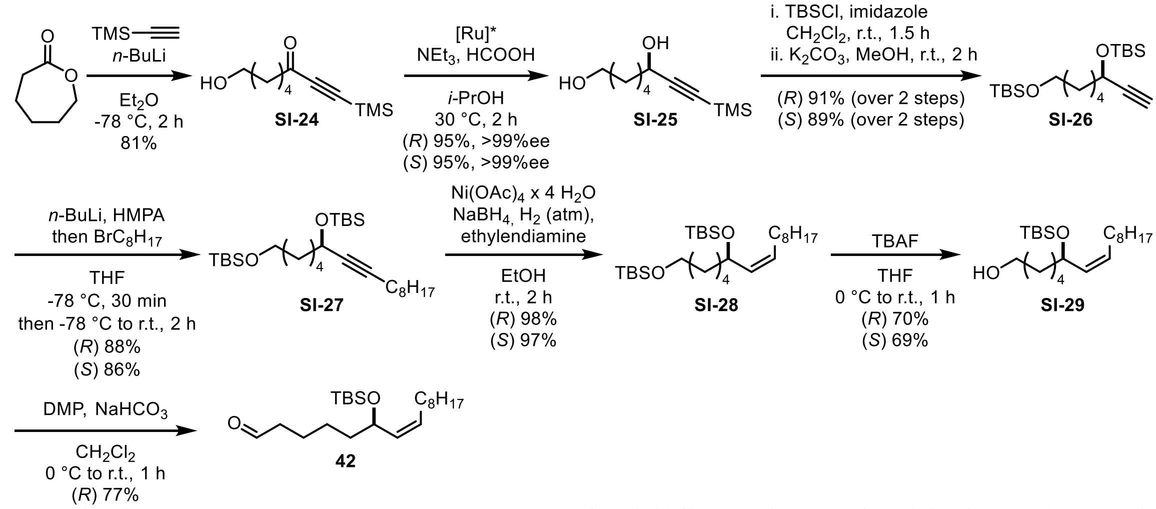
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 9.75 (t, *J* = 1.9 Hz, 1H), 5.40 – 5.25 (m, 2H), 4.41 (td, *J* = 7.2, 5.3 Hz, 1H), 2.43 (td, *J* = 7.3, 1.9 Hz, 2H), 2.09 – 1.92 (m, 2H), 1.76 – 1.47 (m, 3H), 1.43 – 1.37 (m, 1H), 1.36 – 1.19 (m, 14H), 0.90 – 0.82 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 202.9, 133.6, 129.7, 68.6, 44.0, 38.0, 32.0, 29.8, 29.7, 29.7, 29.6, 29.5, 28.0, 26.0, 22.8, 18.3, 18.2, 14.3, -4.1, -4.7 ppm.

IR (ATR) $\tilde{\nu}$ = 2925 (m), 2854 (m), 2711 (w), 1729 (m), 1462 (w), 1252 (m), 1092 (m), 834 (s), 774 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{45}O_2Si$ $[M+H]^+$ 369.3183, found 369.3182.

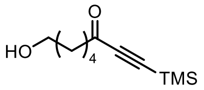
2.2.5 Synthesis of (*R,Z*)- and (*S,Z*)-6-((*tert*-butyldimethylsilyl)oxy)hexadec-7-enal 42



[Ru]*: RuCl[(*S*,*S*)-Tsdpen](mesitylene), RuCl[(*R*,*R*)-Tsdpen](mesitylene)

Figure S5. Reaction overview for the synthesis of (*R,Z*)- and (*S,Z*)-6-((*tert*-butyldimethylsilyl)-oxy)hexadec-7-enal **42**.

8-Hydroxy-1-(trimethylsilyl)oct-1-yn-3-one SI-24



Following a modified procedure:[15] To a solution of TMS-acetylene (6.1 mL, 4.30 g, 43.8 mmol, 1.0 equiv.) in diethyl ether (150 mL) at –78°C was added *n*-BuLi (27.4 mL, 43.8 mmol, 1.0 equiv., 1.6 M in hexane) and the reaction mixture was stirred for 30 min. Then ε-caprolactone (4.9 mL, 5.00 g, 43.8 mmol, 1.0 equiv.) was added. After stirring at –78 °C for 1.5 h, the reaction mixture was quenched by the addition of 10% aqueous HCl solution and extracted with diethyl ether. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (0 to 70% EtOAc in cyclohexane, linear gradient) to yield the ynone **SI-24** (7.51 g, 81%) as slightly yellow oil.

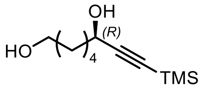
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 3.67 – 3.62 (m, 2H), 2.58 (t, *J* = 7.2 Hz, 2H), 1.74 – 1.65 (m, 2H), 1.62 – 1.54 (m, 2H), 1.46 (s, br, 1H), 1.39 (ddd, *J* = 15.3, 8.7, 6.1 Hz, 2H), 0.23 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 188.0, 102.1, 97.9, 62.7, 45.3, 32.5, 25.2, 23.7, -0.6 ppm.

IR (ATR) $\tilde{\nu}$ = 3333 (br, w), 2936 (w), 2863 (w), 1672 (m), 1405 (w), 1252 (m), 1119 (m), 1057 (m), 842 (s), 761 (m), 621 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{11}H_{21}O_2Si$ $[M+H]^+$ 213.1305, found 213.1305.

(*R*)- and (*S*)-8-(Trimethylsilyl)oct-7-yne-1,6-diol SI-25



(*R*)-SI-25: Following GP1_A, Ynone **SI-24** (4.00 g, 18.8 mmol, 1.0 equiv.), RuCl[(*R*,*R*)-TsDPEN](mesitylene) (293 mg, 0.47 mmol, 0.025 equiv.) in *i*-PrOH (60 mL) and NEt_3 (15.6 mL, 112.8 mmol, 6.0 equiv.) and HCOOH (3.5 mL, 94.0 mmol, 5.0 equiv.) in *i*-PrOH (30 mL) were used to yield the ynol (*R*)-**SI-25** (3.82 g, 95%, >99% ee (2% i-PrOH in heptan, Phenomenex Lux® 5µm Cellulose 1)) as brown oil.

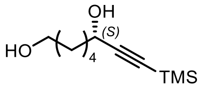
$[\alpha]_D^{22}$ = 3.2 (c = 1.53 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.35 (t, *J* = 6.6 Hz, 1H), 3.64 (t, *J* = 6.6 Hz, 2H), 2.08 (s, br, 2H), 1.76 – 1.63 (m, 2H), 1.63 – 1.55 (m, 2H), 1.53 – 1.43 (m, 2H), 1.43 – 1.35 (m, 2H), 0.16 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 106.9, 89.4, 62.9, 62.8, 37.7, 32.6, 25.5, 25.0, 0.0 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3244 (br, m), 2939 (m), 2865 (m), 2175 (w), 1475 (w), 1319 (w), 1247 (m), 1055 (m), 1030 (m), 837 (s), 757 (m), 697 (w) 667 (w), 531 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{11}H_{23}O_2Si$ $[M+H]^+$ 215.1462, found 215.1458.



(*S*)-SI-25: Following GP1_A, Ynone **SI-24** (3.00 g, 14,1 mmol, 1.0 equiv.), RuCl[(*S,S*)-TsDPEN](mesitylene) (220 mg, 0.35 mmol, 0.025 equiv.) in *i*-PrOH (50 mL) and NEt_3 (11.7 mL, 84.6 mmol, 6.0 equiv.) and HCOOH (2.7 mL, 70.5 mmol, 5.0 equiv.) in *i*-PrOH (24 mL) were used to yield the ynol (*S*)-**SI-25** (2.86 g, 95%, >99% ee (2% *i*-PrOH in heptan, Phenomenex Lux® 5µm Cellulose 1)) as brown oil.

$[\alpha]_D^{22}$ = -3.6 (c = 1.47 $CHCl_3$)

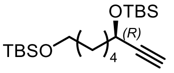
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.34 (t, *J* = 6.6 Hz, 1H), 3.64 (t, *J* = 6.6 Hz, 2H), 2.15 (s, br, 2H), 1.78 – 1.62 (m, 2H), 1.63 – 1.54 (m, 2H), 1.52 – 1.43 (m, 2H), 1.43 – 1.35 (m, 2H), 0.15 (s, 9H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 107.0, 89.4, 62.9, 62.8, 37.7, 32.6, 25.4, 25.0, 0.0 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3252 (br, m), 2945 (m), 2865 (m), 2174 (w), 1458 (w), 1333 (w), 1248 (m), 1053 (m), 1030 (m), 834 (s), 758 (m), 697 (w) 666 (w), 531 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{11}H_{23}O_2Si$ $[M+H]^+$ 215.1462, found 215.1460.

(*R*)- and (*S*)-5-Ethynyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradecane SI-26



(*R*)-SI-26: To a solution of ynole (*R*)-**SI-25** (3.78 g, 17.6 mmol, 1.0 equiv.) in CH_2Cl_2 (60 mL) was added at 0 °C imidazole (7.20 g, 105.8 mmol, 6.0 equiv.) followed by TBSCl (7.92 g, 52.8 mmol, 3.0 equiv.). The cooling bath was removed and the reaction mixture was stirred for 1.5 h, quenched by the addition of H_2O and extracted with CH_2Cl_2. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and evaporated.

The residue was dissolved in MeOH (88 mL) and K_2CO_3 (2.68 g, 19.4 mmol, 1.1 equiv.) was added. The reaction mixture was stirred at r.t. for 2 h and concentrated in *vacuo*. The residue was taken up in H_2O/EtOAc and the aqueous layer was extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and evaporated. The residue was purified by column chromatography (0 to 10% EtOAc in cyclohexane) to yield the terminal alkyne **SI-26** (5.96 g, 91%, over 2 steps) as slightly yellow oil.

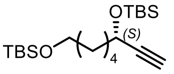
$[\alpha]_D^{22}$ = 28.9 (c = 0.57 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.33 (td, *J* = 6.5, 2.1 Hz, 1H), 3.60 (t, *J* = 6.6 Hz, 2H), 2.37 (d, *J* = 2.1 Hz, 1H), 1.73 – 1.62 (m, 2H), 1.57 – 1.49 (m, 2H), 1.48 – 1.38 (m, 2H), 1.38 – 1.30 (m, 2H), 0.90 (s, 9H), 0.89 (s, 9H), 0.13 (s, 3H), 0.11 (s, 3H), 0.04 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 85.9, 72.0, 63.3, 62.8, 38.7, 32.9, 26.1, 25.9, 25.6, 25.1, 18.5, 18.4, -4.4, -4.9, -5.1 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3312 (w), 2928 (m), 2857 (m), 1472 (w), 1252 (m), 1095 (s), 833 (s), 773 (s), 626 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{20}H_{43}O_2Si_2$ $[M+H]^+$ 371.2796, found 317.2792.



(*S*)-SI-26: Following the same procedure, ynole **SI-25** (2.82 g, 13.2 mmol, 1.0 equiv.), imidazole (5.37 g, 78.9 mmol, 6.0 equiv.) and TBSCl (5.97 g, 39.6 mmol, 3.0 equiv.) in CH_2Cl_2 were used for protection. The residue and K_2CO_3 (2.00 g, 14.5 mmol, 1.1 equiv.) in MeOH (66 mL) were used to yield the terminal alkyne **SI-26** (4.36 g, 89%, over 2 steps) as slightly yellow oil.

$[\alpha]_D^{22}$ = -26.9 (c = 0.95 $CHCl_3$)

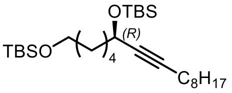
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 4.40 – 4.28 (m, 1H), 3.60 (t, *J* = 6.6 Hz, 2H), 2.37 (d, *J* = 2.1 Hz, 1H), 1.73 – 1.62 (m, 2H), 1.57 – 1.49 (m, 2H), 1.48 – 1.39 (m, 2H), 1.38 – 1.30 (m, 2H), 0.90 (s, 9H), 0.89 (s, 9H), 0.13 (s, 3H), 0.11 (s, 3H), 0.04 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 85.9, 72.0, 63.3, 62.8, 38.7, 32.9, 26.1, 25.9, 25.6, 25.1, 18.5, 18.4, -4.4, -4.9, -5.1 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3312 (w), 2929 (m), 2857 (m), 1472 (w), 1252 (m), 1094 (s), 833 (s), 773 (s), 626 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{20}H_{43}O_2Si_2$ $[M+H]^+$ 371.2796, found 317.2793.

(*R*)- and (*S*)-5-(Dec-1-yn-1-yl)-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetra-decane SI-27



(*R*)-27: To a solution of terminal (*R*)-alkyne **SI-26** (3.50 g, 9.44 mmol, 1.0 equiv.) in THF (35 mL) was added at –78 °C *n*-BuLi (5.9 mL, 9.44 mmol, 1.0 equiv., 1.6 M in hexane) and the reaction mixture was stirred at -78 °C for 30 min. Then HMPA (9.4 mL) was added followed by a solution of 1-bromooctane (1.8 mL, 2.01 g, 10.4 mmol, 1.1 equiv.) in THF (15 mL). The cooling bath was removed and the reaction mixture was stirred for 2 h, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and concentrated in *vacuo*. The residue was purified by column chromatography (0 to 5% EtOAc in cyclohexane) to yield (*R*)-**SI-27** (4.05 g, 88%) as colorless oil.

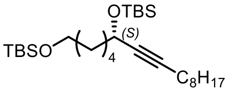
$[\alpha]_D^{22}$ = 29.0 (c = 1.00 MeOH)

^{1}H-NMR (500 MHz, CDCl$_3$) δ = 4.35 – 4.28 (m, 1H), 3.60 (t, *J* = 6.6 Hz, 2H), 2.17 (td, *J* = 7.1, 2.0 Hz, 2H), 1.70 – 1.57 (m, 2H), 1.57 – 1.44 (m, 4H), 1.44 – 1.29 (m, 2H), 1.29 – 1.21 (m, 12H), 0.90 (s, 9H), 0.89 – 0.86 (m, 12H), 0.11 (s, 3H), 0.10 (s, 3H), 0.04 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CDCl$_3$) δ = 84.6, 82.1, 63.3, 63.3, 39.2, 33.0, 32.0, 29.4, 29.3, 29.0, 28.8, 26.1, 26.1, 26.0, 25.6, 25.3, 22.8, 18.8, 18.5, 18.5, 14.3, -4.3, -4.8, -5.1 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2927 (m), 2855 (m), 1463 (w), 1252 (m), 1096 (m), 833 (s), 773 (s), 663 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{28}H_{59}O_2Si_2$ $[M+H]^+$ 483.4048, found 483.4082.



(*S*)-SI-27: Following same procedure, terminal (*S*)-alkyne **SI-26** (3.50 g, 9.44 mmol, 1.0 equiv.), *n*-BuLi (5.9 mL, 9.44 mmol, 1.0 equiv., 1.6 M in hexane), HMPA (9.4 mL) in THF (35 mL) and 1-bromooctane (1.8 mL, 2.01 g, 10.4 mmol, 1.1 equiv.) in THF (15 mL) were used to yield (*S*)-alkyne **SI-27** (3.91 g, 86%) as colorless oil.

$[\alpha]_D^{22}$ = -29.5 (c = 1.00 MeOH)

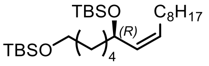
^{1}H-NMR (500 MHz, CDCl$_3$) δ = 4.37 – 4.27 (m, 1H), 3.60 (t, *J* = 6.6 Hz, 2H), 2.17 (td, *J* = 7.0, 2.0 Hz, 2H), 1.69 – 1.56 (m, 2H), 1.57 – 1.44 (m, 4H), 1.42 – 1.22 (m, 14H), 0.90 (s, 9H), 0.89 – 0.84 (m, 12H), 0.11 (s, 3H), 0.09 (s, 3H), 0.04 (s, 6H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CDCl$_3$) δ = 84.6, 82.1, 63.3, 63.3, 39.2, 33.0, 32.0, 29.4, 29.3, 29.0, 28.8, 26.1, 26.0, 25.6, 25.3, 22.8, 18.8, 18.5, 18.5, 14.3, -4.3, -4.8, -5.1 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2927 (m), 2855 (m), 1463 (w), 1251 (m), 1096 (s), 833 (s), 774 (s), 663 (w) cm^{-1}.

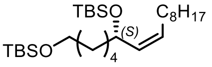
HRMS (ESI) calcd for $C_{28}H_{59}O_2Si_2$ $[M+H]^+$ 483.4048, found 483.4082.

(***R,Z***)- and (***S,Z***)-5-(Dec-1-en-1-yl)-2,3,12,13-Octamethyl-4,11-dioxa-3,12-disila-tetradecane SI-28



(*R*)-SI-28: Following GP4, $Ni(OAc)_2 \cdot 4\ H_2O$ (1.70 g, 6.83 mmol, 1.1 equiv.), $NaBH_4$ (258 mg, 6.83 mmol, 1.1 equiv.) in EtOH (30 mL) and alkyne (*R*)-**SI-27** (3.00 g, 6.21 mmol, 1.0 equiv.), ethylenediamine (0.46 mL, 411 mg, 6.83 mmol, 1.1 equiv.) in EtOH (20 mL) were used to obtain (*R,Z*)-**SI-28** (2.95 g, 98%) as slightly yellow oil, which was used without further purification.

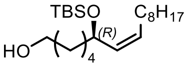
HRMS (ESI) calcd for $C_{28}H_{61}O_2Si_2$ $[M+H]^+$ 485.4205, found 485.4136.



(*S*)-SI-28: Following GP4, $Ni(OAc)_2 \cdot 4\ H_2O$ (1.70 g, 6.83 mmol, 1.1 equiv.), $NaBH_4$ (258 mg, 6.83 mmol, 1.1 equiv.) in EtOH (30 mL) and alkyne (*S*)-**SI-27** (3.00 g, 6.21 mmol, 1.0 equiv.), ethylenediamine (0.46 mL, 411 mg, 6.83 mmol, 1.1 equiv.) in EtOH (20 mL) were used to obtain allylic alcohol (*S,Z*)-**SI-28** (2.92 g, 97%) as slightly yellow oil, which was used without further purification.

HRMS (ESI) calcd for $C_{28}H_{61}O_2Si_2$ $[M+H]^+$ 485.4205, found 485.4139.

(***R,Z***)- and (***S,Z***)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-en-1-ol SI-29



(*R*)-SI-29: Following GP5, TBS-protected alcohol (*R*)-**SI-28** (2.92 g, 6.02 mmol, 1.0 equiv.) and TBAF (6.0 mL, 6.02 mmol, 1.0 equiv., 1M in THF) in THF (30 mL) were stirred for 3 h to yield the alcohol (*R*)-**SI-29** (1.56 g, 70%) as slightly yellow oil.

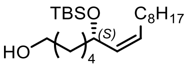
$[\alpha]_D^{22}$ = 1.2 (c = 1.07 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.38 – 5.22 (m, 1H), 4.44 – 4.32 (m, 1H), 3.64 (td, *J* = 6.6, 2.8 Hz, 2H), 2.13 – 1.91 (m, 2H), 1.70 – 1.44 (m, 2H), 1.41 – 1.22 (m, 20H), 0.88 (d, *J* = 4.6 Hz, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 134.1, 129.2, 68.9, 63.1, 38.6, 33.0, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 26.0, 25.8, 25.3, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 3309 (br, w), 2923 (s), 2854 (s), 1462 (w), 1252 (m), 1055 (m), 834 (s), 774 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{47}O_2Si$ $[M+H]^+$ 371.3340, found 371.3337.



(*S*)-SI-29: Following GP5, (*S*)-alcohol **SI-28** (2.85 g, 5.88 mmol, 1.0 equiv.) and TBAF (5.9 mL, 5.88 mmol, 1.0 equiv., 1M in THF) in THF (30 mL) were stirred for 3 h to yield the (*S*)-**SI-29** (1.50 g, 69%) as slightly yellow oil.

$[\alpha]_D^{22}$ = -5.5 (c = 0.09 $CHCl_3$)

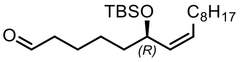
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.37 – 5.21 (m, 2H), 4.43 – 4.34 (m, 1H), 3.64 (td, *J* = 6.6, 2.8 Hz, 2H), 2.08 – 1.90 (m, 2H), 1.60 – 1.18 (m, 21H), 0.89 – 0.84 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 134.1, 129.2, 68.9, 63.1, 38.6, 33.0, 32.0, 29.9, 29.8, 29.6, 29.6, 29.4, 28.0, 26.1, 26.0, 26.0, 25.8, 25.3, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 3334 (br, w), 2925 (s), 2854 (s), 1460 (w), 1251 (m), 1060 (m), 834 (s), 773 (s), 666 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{47}O_2Si$ $[M+H]^+$ 371.3340, found 371.3337.

(*R,Z*)- and (*S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-enal 42



(*R*)-42: Following GP3, alcohol (*R*)-**SI-29** (796 mg, 2.15 mmol, 1.0 equiv.), $NaHCO_3$ (901 mg, 10.7 mmol, 5.0 equiv.) and DMP (1.37 g, 3.22 mmol, 1.5 equiv.) in CH_2Cl_2 (20 mL) were used to yield the aldehyde (*R*)-**42** (609 mg, 77%) as slightly yellow oil.

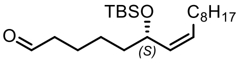
$[\alpha]_D^{22}$ = 0.7 (c = 0.21 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 9.76 (d, *J* = 1.8 Hz, 1H), 5.50 – 5.16 (m, 2H), 4.46 – 4.27 (m, 1H), 2.42 (td, *J* = 7.4, 1.9 Hz, 2H), 2.11 – 1.88 (m, 2H), 1.70 – 1.40 (m, 4H), 1.41 – 1.21 (m, 14H), 0.91 – 0.83 (m, 12H), 0.03 (s, 3H), 0.01 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 202.9, 133.9, 129.4, 68.6, 44.1, 38.4, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 26.0, 25.1, 22.8, 22.2, 18.3, 14.3, -4.1, -4.7 ppm.

IR (ATR) $\tilde{\upsilon}$ = 2925 (s), 2854 (s), 2708 (w), 1728 (s), 1462 (m), 1251 (m), 1070 (m), 834 (s), 774 (s), 666 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{45}O_2Si$ $[M+H]^+$ 369.3183, found 369.3178.



(*S*)-42: Following GP3, alcohol (*S*)-**SI-29** (909 mg, 2.45 mmol, 1.0 equiv.), $NaHCO_3$ (1.03 g, 12.3 mmol, 5.0 equiv.) and DMP (1.56 g, 3.68 mmol, 1.5 equiv.) in CH_2Cl_2 (25 mL) were used to yield the aldehyde (*S*)-**42** (678 mg, 75%) as slightly yellow oil.

$[\alpha]_D^{22}$ = -4.0 (c = 1.95 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 9.76 (d, *J* = 1.8 Hz, 1H), 5.45 – 5.14 (m, 2H), 4.38 (td, *J* = 7.1, 4.1 Hz, 1H), 2.42 (td, *J* = 7.4, 1.9 Hz, 2H), 2.07 – 1.93 (m, 2H), 1.70 – 1.51 (m, 4H), 1.49 – 1.21 (m, 14H), 0.91 – 0.84 (m, 12H), 0.03 (s, 3H), 0.01 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 202.9, 133.9, 129.4, 68.6, 44.1, 38.4, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.1, 26.0, 26.0, 25.9, 25.1, 22.8, 22.2, 18.3, 14.3, -4.1, -4.7 ppm.

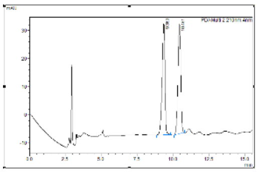
IR (ATR) $\tilde{\upsilon}$ = 2925 (s), 2854 (s), 2715 (w), 1728 (s), 1462 (m), 1250 (m), 1069 (m), 834 (s), 774 (s), 666 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{22}H_{45}O_2Si$ $[M+H]^+$ 369.3183, found 369.3178.

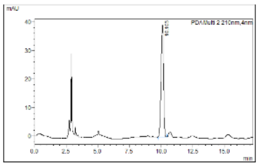
2.3 Determination of the enantiomeric excess of ynols

Method B: 0.5% *i*-PrOH in heptane; 1.0 mL/min; column: Phenomenex Lux® 5µm Amylose 1

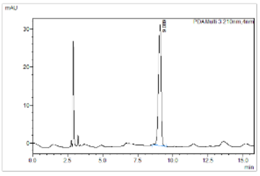
(*R* + *S*)-SI-5



(*R*)-SI-5

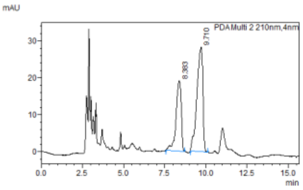


(*S*)-SI-5

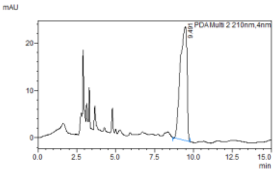


	(*R* + *S*)-SI-5	(*R*)-SI-5	(*S*)-SI-5
P1	9.4 min (50.1%)	-	9.1 min (100%)
P2	10.5 min (49.9%)	10.1 min (100%)	-

(*R* + *S*)-SI-11



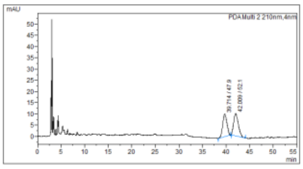
(*R*)-SI-11



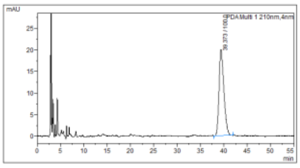
	(*R* + *S*)-SI-11	(*R*)-SI-11
P1	8.4 min	-
P2	9.7 min	9.5 min (100%)

Method A: 2% *i*-PrOH in heptane; 1.0 mL/min; column: Phenomenex Lux® 5µm Cellulose 1

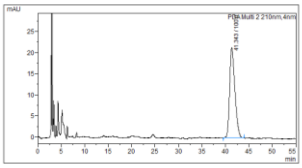
(*R* + *S*)-SI-18



(*R*)-SI-18

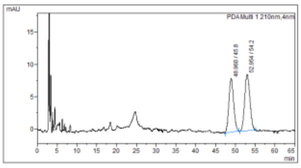


(*S*)-SI-18

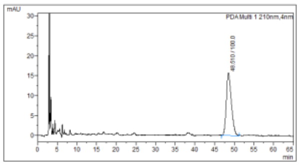


	(*R* + *S*)-SI-18	(*R*)-SI-18	(*S*)-SI-18
P1	39.7 min (47.9%)	39.4 min (100%)	-
P2	42.0 min (52.1%)	-	41.3 min (100%)

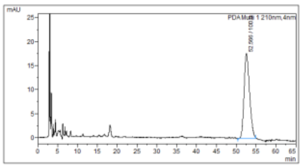
(*R* + *S*)-SI-25



(*R*)-SI-25



(*S*)-SI-25



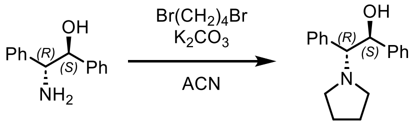
	(*R* + *S*)-SI-25	(*R*)-SI-25	(*S*)-SI-25
P1	49.0 min (45.8%)	48.5 min (100%)	-
P2	53.0 min (54.2%)	-	52.6 min (100%)

Figure S6. Determination of the enantiomeric excess of ynols.

2.4 Stereoselective Henry reaction

2.4.1 Synthesis of Ligands

(1*S*,2*R*)-1,2-Diphenyl-2-(pyrrolidin-1-yl)ethan-1-ol L1



L1

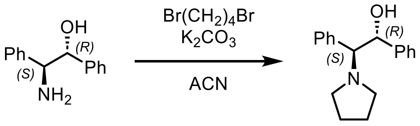
Following a literature procedure:[16] To a solution of (1*S*,2*R*)-2-amino-1,2-diphenylethanol (928 mg, 4.35 mmol, 1.0 equiv.) in ACN (13 mL) were added potassium carbonate (1.20 g, 8.70 mmol, 2.0 equiv.) followed by 1,4-dibromobutane (0.56 mL, 4.79 mmol, 1.1 equiv.) and the reaction mixture was stirred under reflux for 18 h. After cooling to ambient temperature, the mixture was filtered and washed with ACN (10 mL). The combined filtrate was evaporated *in vacuo*. The crude product was purified by recrystallization from hexane (15 mL) to obtain **L1** (814 mg, 70%) as white needles.

^{1}H-NMR (300 MHz, CDCl$_3$) δ = 7.19 – 7.02 (m, 6H), 7.01 – 6.84 (m, 4H), 5.23 (d, *J* = 3.5 Hz, 1H), 3.65 (s, 1H), 3.29 (d, *J* = 3.5 Hz, 1H), 2.73 (m, 2H), 2.59 (m, 2H), 1.89 – 1.76 (m, 4H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 140.8, 137.7, 129.4, 127.6, 127.4, 127.2, 126.9, 126.2, 77.0, 74.2, 53.1, 23.7 ppm.

The analytical data are in comparison with literature data.[16]

(1*R*,2*S*)-1,2-Diphenyl-2-(pyrrolidin-1-yl)ethan-1-ol L2



L2

Following literature procedure:[16] To a solution of (1*R*,2*S*)-2-amino-1,2-diphenylethanol (2.13 g, 10.0 mmol, 1.0 equiv.) in ACN (30 mL) were added potassium carbonate (2.76 g, 20.0 mmol, 2.0 equiv.) followed by 1,4-dibromobutane (1.3 mL, 11.0 mmol, 1.1 equiv.) and the reaction mixture was stirred under reflux for 18 h. After cooling to ambient temperature, the mixture was filtered and washed with ACN (20 mL). The combined filtrate was evaporated *in vacuo*. The crude product was purified by recrystallization from hexane (30 mL) to obtain **L2** (1.94 g, 73%) as white needles.

^{1}H-NMR (300 MHz, CDCl$_3$) δ = 7.17 – 7.03 (m, 6H), 6.99 – 6.86 (m, 4H), 5.24 (d, *J* = 3.5 Hz, 1H), 3.67 (s, 1H), 3.29 (d, *J* = 3.5 Hz, 1H), 2.81 – 2.69 (m, 2H), 2.62 – 2.51 (m, 2H), 1.95 – 1.76 (m, 4H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 140.8, 137.6, 129.4, 127.6, 127.4, 127.2, 126.9, 126.2, 77.0, 74.2, 53.1, 23.7 ppm.

The analytical data are in comparison with literature data.[17]

(*R*)- and (*S*)-2-((2-(Hydroxydiphenylmethyl)pyrrolidin-1-yl)methyl)-6-(trifluoromethyl)-phenol

Following modified procedures[18-21]

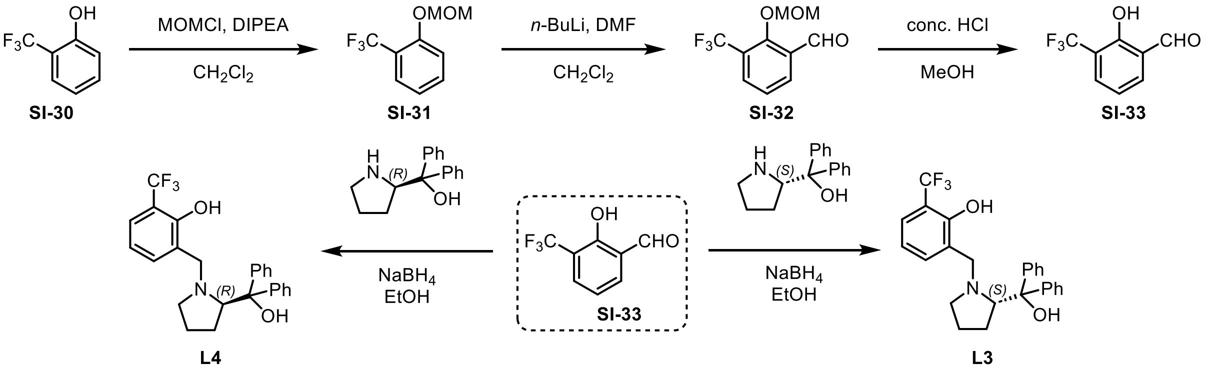
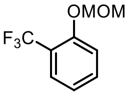


Figure S7. Reaction overview for the synthesis of ligands **L3** and **L4** for the *anti*-selective Henry reaction.

1-(Methoxymethoxy)-2-(trifluoromethyl)benzene SI-31



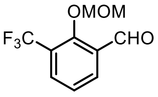
To a solution of 2-(trifluoromethyl)phenol **SI-30** (6.00 g, 37.0 mmol, 1.0 equiv.) in CH_2Cl_2 (25 mL) at 0 °C was added *N*,*N*-diisopropylethylamine (13.0 mL, 74.0 mmol, 2.0 equiv.) followed by methoxymethyl chloride (4.2 mL, 55.5 mmol, 1.5 equiv.). The reaction mixture was stirred for 30 min diluted with MTBE (125 mL) and washed with 1N HCl (2 x 25 mL), 1N NaOH (2 x 15 mL) and brine (15 mL). The organic layer was dried over Na_2SO_4 and concentrated *in vacuo* to yield **SI-31** (7.0 g, 92%) as colorless oil, which was used without further purification.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 7.58 (d, *J* = 7.5 Hz, 1H), 7.51 – 7.43 (m, 1H), 7.27 – 7.19 (m, 1H), 7.12 – 7.00 (m, 1H), 5.27 (s, 2H), 3.50 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 155.1, 133.3, 127.2 (q), 123.8 (d, *J* = 272.4 Hz), 121.3, 119.7 (d, *J* = 30.7 Hz), 115.4, 94.3, 56.4 ppm.

The analytical data are in comparison with literature data.[20]

2-(Methoxymethoxy)-3-(trifluoromethyl)benzaldehyde SI-32



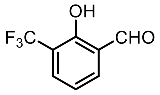
To a stirred solution of 2-(methoxymethoxy)-1-(trifluoromethyl)benzene **SI-31** (6.72 g, 32.6 mmol, 1 equiv.) in THF (42 mL) at −78 °C was added dropwise *n*-BuLi (15.6 mL, 35.9 mmol, 1.1 equiv., 2.3M in cyclohexane/hexane). After stirring at −78 °C for 1 h, a solution of DMF (2.8 mL, 35.9 mmol, 1.1 equiv.) in THF (2 mL) was added dropwise. The reaction mixture was stirred at −78 °C to r.t. for 16 h, quenched by the addition of H_2O and extracted with Et_2O. The combined organic layers were washed with 1M HCl (20 mL) and brine, dried over $MgSO_4$, filtrated and concentrated *in vacuo*. The crude material was purified by distillation (20 mbar, ~190°C) to yield the aldehyde **SI-32** (5.3 g, 69%) as yellow oil.

^{1}H-NMR (300 MHz, $CDCl_3$) δ = 10.31 (d, *J* = 0.8 Hz, 1H), 8.07 (dd, *J* = 7.9, 1.8 Hz, 1H), 7.96 – 7.83 (m, 1H), 7.44 – 7.30 (m, 1H), 5.13 (s, 2H), 3.63 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $CDCl_3$) δ = 189.5, 158.7, 132.7 (q), 131.7, 124.9, 118.5 (q), 102.7, 94.3, 58.2 ppm.

The analytical data are in comparison with literature data.[20]

2-Hydroxy-3-(trifluoromethyl)benzaldehyde SI-33



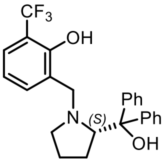
A mixture of aldehyde **SI-32** (4.7 g, 20.1 mmol) and conc. HCl (16 mL) in MeOH (40 mL) was stirred at r.t. for 1 h. Then heated to reflux and stirred additional 48 h. After cooling the precipitate was filtered and dried to yield the unprotected aldehyde **SI-33** (1.82 g, 48%) as yellow solid, which was used without further purification.

^{1}H-NMR (300 MHz, CDCl$_3$) δ = 11.74 (s, 1H), 9.96 (s, 1H), 7.88-7.73 (m, 2H), 7.12 (t, *J* = 7.7 Hz, 1H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 196.4, 159.9, 137.5, 134.2 (q), 121.4, 121.2, 119.3 ppm.

The analytical data are in comparison with literature data.[20]

(*S*)-2-((2-(Hydroxydiphenylmethyl)pyrrolidin-1-yl)methyl)-6-(trifluoromethyl)phenol L3



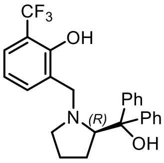
A mixture of (*S*)-diphenyl(pyrrolidin-2-yl)methanol (999 mg, 3.94 mmol) and aldehyde **SI-33** (750 mg, 3.94 mmol, 1.0 equiv.) in EtOH (7.9 mL) was stirred at r.t. for 48 h. Then NaBH$_4$ (149 mg, 3.95 mmol, 1.0 equiv.) was added and stirring was continued for 16 h. The reaction mixture was quenched with 10% aqueous HCl solution, neutralized by the addition of sat. NaHCO$_3$ solution and extracted with EtOAc. The combined organic layers were washed with water and brine, dried over Na$_2$SO$_4$, filtrated and evaporated. The residue was purified by column chromatography (0 to 50% EtOAc in cyclohexane) to yield **L3** (654 mg, 39%) as slightly yellow solid.

^{1}H-NMR (300 MHz, CDCl$_3$) δ = 7.65 – 7.47 (m, 4H), 7.40 – 7.16 (m, 6H), 7.17 – 7.08 (m, 1H), 6.97 – 6.90 (m, 1H), 6.75 – 6.65 (m, 1H), 3.93 (dd, *J* = 9.5, 4.7 Hz, 1H), 3.49 (d, *J* = 13.6 Hz, 1H), 3.32 (d, *J* = 13.7 Hz, 1H), 2.98 (dq, *J* = 9.9, 5.4, 4.6 Hz, 1H), 2.47 – 2.28 (m, 1H), 2.23 – 2.07 (m, 1H), 1.90 (ddt, *J* = 12.6, 8.1, 4.4 Hz, 1H), 1.78 – 1.59 (m, 2H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 154.7, 146.0, 145.5, 131.7, 128.6, 128.5, 127.2, 127.1, 126.3, 126.1, 125.9, 125.8, 124.2, 122.7, 118.0, 79.9, 72.4, 60.6, 55.7, 29.5, 24.3 ppm.

The analytical data are in comparison with literature data.[22]

(*R*)-2-((2-(Hydroxydiphenylmethyl)pyrrolidin-1-yl)methyl)-6-(trifluoromethyl)phenol L4



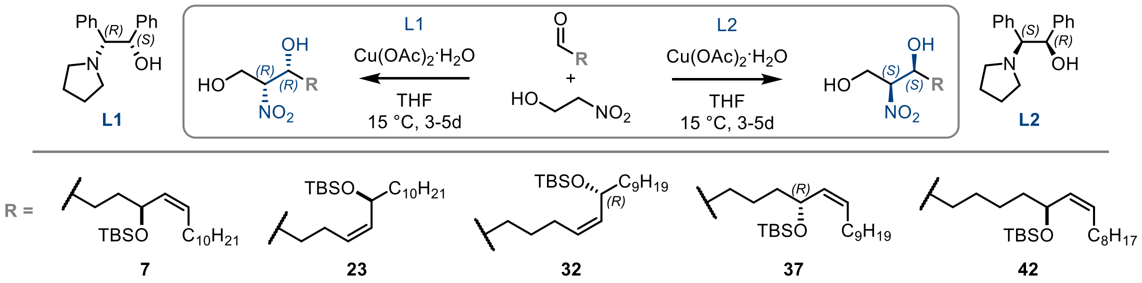
A mixture of (*R*)-diphenyl(pyrrolidin-2-yl)methanol (999 mg, 3.94 mmol) and aldehyde **SI-33** (750 mg, 3.94 mmol, 1.0 equiv.) in EtOH (7.9 mL) was stirred at r.t. for 48 h. Then NaBH$_4$ (149 mg, 3.95 mmol, 1.0 equiv.) was added and stirring was continued for 16 h. The reaction mixture was quenched with 10% aqueous HCl solution, neutralized by the addition of sat. NaHCO$_3$ solution and extracted with EtOAc. The combined organic layers were washed with water and brine, dried over Na$_2$SO$_4$, filtrated and evaporated. The residue was purified by column chromatography (0 to 50% EtOAc in cyclohexane) to yield **L4** (620 mg, 37%) as slightly yellow solid.

^{1}H-NMR (300 MHz, CDCl$_3$) δ =7.61 – 7.47 (m, 4H), 7.38 – 7.19 (m, 6H), 7.17 – 7.08 (m, 1H), 6.99 – 6.88 (m, 1H), 6.76 – 6.63 (m, 1H), 3.93 (dd, *J* = 9.5, 4.7 Hz, 1H), 3.49 (d, *J* = 13.7 Hz, 1H), 3.32 (d, *J* = 13.7 Hz, 1H), 3.03 – 2.91 (m, 1H), 2.42 – 2.28 (m, 1H), 2.19 – 2.01 (m, 1H), 1.97 – 1.82 (m, 1H), 1.79 – 1.59 (m, 2H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ =154.2, 146.0, 145.5, 131.7, 128.6, 128.5, 127.2, 127.1, 126.1, 125.9, 125.8, 125.8, 124.2, 122.6, 118.0, 79.9, 72.4, 60.6, 55.8, 29.5, 24.3 ppm.

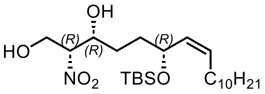
The analytical data are in comparison with literature data.[22]

2.4.2 Synthesis of 1,2-*syn* nitro alcohols



Following a modified procedure:[16] To a solution of $Cu(OAc)_2 \cdot H_2O$ (0.1 equiv./ 0.2 equiv.) and ligand **L1** or **L2** (0.1 equiv./ 0.2 equiv.) in THF (0.05M) was added 2-nitroethanol (3.0 equiv.) and a solution of aldehyde **7, 23, 32, 37, 42** (1 equiv.) in THF (0.5 M). The reaction mixture was stirred at 15 °C for 3-5 d, quenched by the addition of H_2O, and extracted with EtOAc. The combined organic layers were washed with H_2O and brine, dried over Na_2SO_4, filtrated and concentrated *in vacuo*. The residue was purified by column chromatography (0 to 40% EtOAc in cyclohexane) to yield the nitro alcohol predominately in a highly enriched Fraction (*syn*) and a mix fraction (*syn* + *anti*) fraction with R_f *syn* > R_f *anti*. The ratio of *syn/anti* was also determined by HPLC (See Figure S8). For NMR analysis, only the *syn*-fraction was taken into consideration.

(2*R*,3*R*,6*R*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol 8



To $Cu(OAc)_2 \cdot H_2O$ (21.3 mg, 0.08 mmol, 0.1 equiv.), **L1** (21.6 mg, 0.08 mmol, 0.1 equiv.) and 2-nitroethanol (0.18 mL, 2.43 mmol, 3.0 equiv.) in THF (2 mL) were added aldehyde **(*R*)-7** (300 mg, 0.81 mmol, 1.0 equiv.) in THF (1.5 mL) and stirred for 3 d to yield the nitro alcohol *R,R*-**8** (290 mg, 78%) as slightly yellow oil and a mixture of diastereomers (46.4 mg, 15%). $[\alpha]_D^{22}$ = 8.9 (c = 0.18 $CHCl_3$)

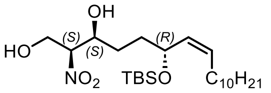
^{1}H-NMR (300 MHz, $CDCl_3$) δ = 5.41 – 5.28 (m, 2H), 4.59 (ddd, *J* = 7.1, 6.0, 3.5 Hz, 1H), 4.50 (td, *J* = 6.6, 3.8 Hz, 1H), 4.25 – 3.99 (m, 3H), 3.25 (s, br, 1H), 2.27 (s, br, 1H), 1.99 (td, *J* = 9.5, 8.1, 4.6 Hz, 2H), 1.80 – 1.53 (m, 4H), 1.26 (s, 16H), 0.93 – 0.80 (m, 12H), 0.06 (s, 3H), 0.04 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 132.7, 130.3, 92.4, 70.1, 68.9, 61.7, 33.7, 32.1, 29.8, 29.7, 29.6, 29.5, 29.0, 28.0, 26.0, 22.8, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3361 (br, m), 2921 (m), 2851 (m), 1734 (w), 1558 (s), 1468 (w), 1390 (w), 1249 (m), 1079 (s), 916 (w), 835 (s), 776 (s), 687 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3316.

(2*S*,3*S*,6*R*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol 9



To $\mathrm{Cu(OAc)_2{\cdot}H_2O}$ (10.7 mg, 0.04 mmol, 0.1 equiv.), **L2** (10.8 mg, 0.04 mmol, 0.1 equiv.) and 2-nitroethanol (0.09 mL, 1.23 mmol, 3.0 equiv.) in THF (1 mL) were added aldehyde **(*R*)-7** (150 mg, 0.41 mmol, 1.0 equiv.) in THF (0.7 mL) and stirred for 3 d to yield the nitro alcohol *S,S*-**9** (129 mg, 69%) as slightly yellow oil and a mixture of diastereomers (27.7 mg, 15%).

$[\alpha]_D^{20}$ = 3.8 (c = 1.39 $\mathrm{CHCl_3}$)

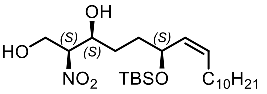
^{1}H-NMR (300 MHz, $\mathrm{CDCl_3}$) δ = 5.44 – 5.28 (m, 2H), 4.64 – 4.51 (m, 2H), 4.26 – 4.02 (m, 3H), 3.72 – 3.63 (m, 1H), 2.24 (t, *J* = 6.3 Hz, 1H), 2.05 – 1.90 (m, 2H), 1.76 – 1.54 (m, 4H), 1.41 – 1.21 (m, 16H), 0.94 – 0.78 (m, 12H), 0.07 (s, 3H), 0.04 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, $\mathrm{CDCl_3}$) δ = 132.4, 130.3, 92.4, 70.7, 68.8, 61.6, 34.9, 32.1, 29.7, 29.7, 29.6, 29.5, 29.1, 28.0, 25.9, 22.8, 18.3, 14.3, -4.2, -4.8 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3386 (br, w), 2925 (m), 2854 (m), 1734 (w), 1551 (m), 1461 (w), 1362 (w), 1252 (m), 1070 (s), 835 (s), 775 (s), 669 (w) cm^{-1}.

HRMS (ESI) calcd for $\mathrm{C_{24}H_{48}NO_5Si}$ $[\mathrm{M-H}]^-$ 458.3307, found 458.3306.

(2*S*,3*S*,6*S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol SI-34



To $\mathrm{Cu(OAc)_2{\cdot}H_2O}$ (3.25 mg, 0.016 mmol, 0.1 equiv.), **L2** (4.35 mg, 0.016 mmol, 0.1 equiv.) and 2-nitroethanol (0.04 mL, 0.49 mmol, 3.0 equiv.) in THF (1 mL) were added aldehyde **(*S*)-7** (60 mg, 0.16 mmol, 1.0 equiv.) in THF (0.3 mL) and stirred for 3 d to yield the nitro alcohol S,S- **SI-34** (47.5 mg, 63%) as slightly yellow oil and a mixture of diastereomers (4.6 mg, 6%).

$[\alpha]_D^{22}$ = -12.0 (c = 0.18 $\mathrm{CHCl_3}$)

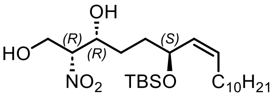
^{1}H-NMR (500 MHz, $\mathrm{CDCl_3}$) δ = 5.40 – 5.31 (m, 2H), 4.59 (ddd, *J* = 7.1, 5.9, 3.4 Hz, 1H), 4.54 – 4.46 (m, 1H), 4.20 – 4.02 (m, 3H), 3.25 (d, *J* = 6.5 Hz, 1H), 2.19 (t, *J* = 6.3 Hz, 1H), 2.04 – 1.91 (m, 2H), 1.79 – 1.60 (m, 4H), 1.31 – 1.20 (m, 16H), 0.90 – 0.85 (m, 12H), 0.06 (s, 3H), 0.04 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $\mathrm{CDCl_3}$) δ = 132.7, 130.3, 92.5, 70.1, 68.9, 61.7, 33.7, 32.1, 29.8, 29.7, 29.6, 29.5, 29.0, 28.0, 26.0, 22.8, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3362 (br, m), 2921 (m), 2851 (m), 1558 (s), 1463 (w), 1390 (w), 1251 (m), 1079 (s), 986 (w), 835 (s), 776 (s), 688 (w) cm^{-1}.

HRMS (ESI) calcd for $\mathrm{C_{24}H_{48}NO_5Si}$ $[\mathrm{M-H}]^-$ 458.3307, found 458.3317.

(2*R*,3*R*,6*S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol SI-35



To Cu(OAc)$_2$·H$_2$O (4.2 mg, 0.02 mmol, 0.1 equiv.), **L1** (5.6 mg, 0.016 mmol, 0.1 equiv.) and 2-nitroethanol (45 µL, 0.63 mmol, 3.0 equiv.) in THF (0.5 mL) were added aldehyde **(*S*)-7** (77.8 mg, 0.21 mmol, 1.0 equiv.) in THF (0.5 mL) and stirred for 3 d to yield the nitro alcohol R,R- **SI-35** (71.0 mg, 74%) as slightly yellow oil and a mixture of diastereomers (6.4 mg, 6%).

$[\alpha]_D^{22}$ = -3.5 (c = 1.10 CHCl$_3$)

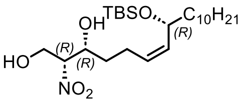
^{1}H-NMR (300 MHz, CDCl$_3$) δ = 5.50 – 5.26 (m, 2H), 4.68 – 4.47 (m, 2H), 4.12 (td, *J* = 11.3, 4.1 Hz, 3H), 3.71 – 3.61 (m, 1H), 2.44 – 2.24 (m, 1H), 2.02 – 1.91 (m, 2H), 1.76 – 1.55 (m, 4H), 1.38 – 1.18 (m, 16H), 0.92 – 0.83 (m, 12H), 0.06 (s, 3H), 0.04 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 132.5, 130.2, 92.5, 70.6, 68.8, 61.6, 34.8, 32.0, 29.7, 29.7, 29.5, 29.5, 29.1, 28.0, 25.9, 22.8, 18.3, 14.3, -4.3, -4.8 ppm.

IR (ATR) $\tilde{\nu}$ = 3352 (br, w), 2925 (s), 2854 (m), 1726 (w), 1551 (s), 1462 (w), 1361 (w), 1252 (m), 835 (s), 775 (s), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ [M−H]$^-$ 458.3307, found 458.3310.

(*2R,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol SI-36



To Cu(OAc)$_2$·H$_2$O (10.8 mg, 0.05 mmol, 0.2 equiv.), **L1** (14.5 mg, 0.05 mmol, 0.2 equiv.) and 2-nitroethanol (0.06 mL, 0.81 mmol, 3.0 equiv.) in THF (0.7 mL) were added aldehyde **(*R*)-23** (100 mg, 0.27 mmol, 1.0 equiv.) in THF (0.7 mL) and stirred for 5 d to the yield nitro alcohol R,R- **SI-36** (94.2 mg, 76%) as slightly yellow oil and a mixture of diastereomers (13.0 mg, 10%).

$[\alpha]_D^{22}$ = -1.9 (c = 0.18 CHCl$_3$)

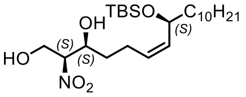
^{1}H-NMR (500 MHz, CDCl$_3$) δ = 5.47 – 5.38 (m, 1H), 5.27 (dt, *J* = 11.1, 7.3 Hz, 1H), 4.57 (ddd, *J* = 6.6, 5.4, 3.6 Hz, 1H), 4.41 – 4.33 (m, 1H), 4.21 – 4.04 (m, 3H), 2.47 (s, br, 1H), 2.38 – 2.13 (m, 3H), 1.68 – 1.57 (m, 2H), 1.52 (q, *J* = 9.6, 8.0 Hz, 1H), 1.41 – 1.18 (m, 17H), 0.95 – 0.82 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CDCl$_3$) δ = 136.0, 126.8, 92.1, 69.9, 68.9, 62.0, 38.6, 33.5, 32.1, 29.8, 29.8, 29.5, 26.0, 25.5, 23.8, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 3404 (br, w), 2925 (s), 2854 (s), 1551 (s), 1462 (m), 1361 (w), 1252 (m), 1082 (s), 834 (s), 774 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ [M−H]$^-$ 458.3307, found 458.3318.

(2*S*,3*S*,8*S*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol SI-37



To $Cu(OAc)_2 \cdot H_2O$ (5.4 mg, 0.03 mmol, 0.2 equiv.), **L2** (7.2 mg, 0.03 mmol, 0.2 equiv.) and 2-nitroethanol (29.3 µL, 0.41 mmol, 3.0 equiv.) in THF (0.34 mL) were added aldehyde **(*S*)-23** (50.0 mg, 0.14 mmol, 1.0 equiv.) in THF (0.34 mL) and stirred for 5 d to yield the nitro alcohol *S,S*-**SI-37** (47.2 mg, 76%) as slightly yellow oil and a mixture of diastereomers (11.5 mg, 18%).

$[\alpha]_D^{22}$ = 1.0 (c = 0.19 $CHCl_3$)

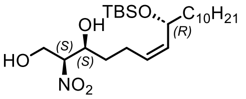
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.47 – 5.39 (m, 1H), 5.27 (dt, *J* = 10.8, 7.3 Hz, 1H), 4.62 – 4.55 (m, 1H), 4.44 – 4.29 (m, 1H), 4.23 – 4.04 (m, 3H), 2.46 (s, br, 1H), 2.38 – 2.13 (m, 3H), 1.75 – 1.57 (m, 2H), 1.54 – 1.42 (m, 1H), 1.39 – 1.15 (m, 17H), 0.89 – 0.81 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 136.0, 126.8, 92.1, 69.9, 68.9, 62.0, 38.6, 33.5, 32.1, 29.8, 29.5, 26.0, 25.5, 23.8, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3393 (br, w), 2925 (s), 2854 (s), 1551 (s), 1462 (w), 1361 (w), 1252 (m), 1082 (s), 834 (s), 774 (s), 666 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M{-}H]^-$ 458.3307, found 458.3317.

(*2S,3S,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol SI-38



To $Cu(OAc)_2 \cdot H_2O$ (7.6 mg, 0.04 mmol, 0.2 equiv.), **L2** (10.2 mg, 0.04 mmol, 0.2 equiv.) and 2-nitroethanol (0.04 mL, 0.57 mmol, 3.0 equiv.) in THF (0.5 mL) were added aldehyde **(*R*)-23** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.5 mL) and stirred for 5 d to yield the nitro alcohol *S,S*-**SI-38** (66.3 mg, 76%) as slightly yellow oil and a mixture of diastereomers (18.3 mg, 21%).

$[\alpha]_D^{22}$ = -4.7 (c = 0.39 $CHCl_3$)

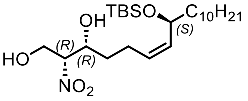
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.43 (ddt, *J* = 11.5, 8.3, 1.6 Hz, 1H), 5.27 (dt, *J* = 11.2, 7.3 Hz, 1H), 4.57 (ddd, *J* = 6.8, 5.4, 3.5 Hz, 1H), 4.46 – 4.34 (m, 1H), 4.21 – 4.06 (m, 3H), 2.51 (d, *J* = 7.1 Hz, 1H), 2.33 – 2.15 (m, 3H), 1.62 (tdd, *J* = 8.3, 5.6, 2.4 Hz, 2H), 1.56 – 1.44 (m, 1H), 1.40 – 1.18 (m, 17H), 0.93 – 0.82 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 136.1, 126.7, 92.2, 69.8, 69.1, 62.0, 38.6, 33.5, 32.0, 29.8, 29.5, 26.0, 25.5, 23.7, 22.8, 18.4, 14.3, -4.1, -4.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3318 (br, m), 2924 (s), 2853 (s), 1552 (s), 1469 (w), 1360 (w), 1250 (m), 1084 (s), 835 (s), 776 (s), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M{-}H]^-$ 458.3307, found 458.3314.

(2*R*,3*R*,8*S*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol SI-39



To $Cu(OAc)_2 \cdot H_2O$ (5.4 mg, 0.03 mmol, 0.2 equiv.), **L1** (7.2 mg, 0.03 mmol, 0.2 equiv.) and 2-nitroethanol (29.3 µL, 0.41 mmol, 3.0 equiv.) in THF (0.34 mL) were added aldehyde **(*S*)-23** (50.0 mg, 0.14 mmol, 1.0 equiv.) in THF (0.34 mL) and stirred for 5 d to yield the nitro alcohol *R,R*-**SI-39** (40.6 mg, 65%) as slightly yellow oil and a mixture of diastereomers (8.9 mg, 14%).

$[\alpha]_D^{22}$ = 6.5 (c = 0.04 $CHCl_3$)

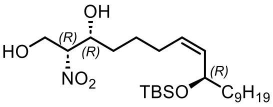
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.46 – 5.37 (m, 1H), 5.27 (dt, *J* = 11.4, 7.3 Hz, 1H), 4.57 (tt, *J* = 6.4, 3.1 Hz, 1H), 4.38 (dq, *J* = 8.5, 4.7, 3.0 Hz, 1H), 4.22 – 4.04 (m, 3H), 2.50 (d, *J* = 7.1 Hz, 1H), 2.36 – 2.13 (m, 3H), 1.62 (dtd, *J* = 8.2, 6.3, 5.7, 3.5 Hz, 2H), 1.55 – 1.44 (m, 1H), 1.39 – 1.19 (m, 17H), 0.93 – 0.82 (m, 12H), 0.04 (s, 2H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 136.1, 126.7, 92.1, 69.8, 69.1, 62.0, 38.6, 33.5, 32.1, 29.8, 29.8, 29.5, 26.0, 25.5, 23.8, 22.8, 18.4, 14.3, -4.1, -4.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3302 (br, w), 2924 (s), 2852 (s), 1552 (s), 1469 (w), 1360 (w), 1250 (m), 1084 (s), 835 (s), 776 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ [M−H]$^-$ 458.3307, found 458.3318.

(2*R*,3*R*,9*R*,*Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol SI-40



To $Cu(OAc)_2 \cdot H_2O$ (10.8 mg, 0.05 mmol, 0.2 equiv.), **L1** (14.5 mg, 0.05 mmol, 0.2 equiv.) and 2-nitroethanol (0.06 mL, 0.81 mmol, 3.0 equiv.) in THF (0.7 mL) were added aldehyde **(*R*)-34** (100 mg, 0.27 mmol, 1.0 equiv.) in THF (0.7 mL) and stirred for 5 d to yield the nitro alcohol *R,R*-**SI-40** (97.1 mg, 78%) as slightly yellow oil and a mixture of diastereomers (23.6 mg, 19%).

$[\alpha]_D^{22}$ = 19.0 (c = 0.10 $CHCl_3$)

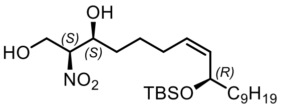
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.37 (td, *J* = 9.5, 8.6, 1.5 Hz, 1H), 5.26 (dt, *J* = 11.1, 7.1 Hz, 1H), 4.58 (ddd, *J* = 6.7, 5.3, 3.6 Hz, 1H), 4.35 (td, *J* = 7.9, 4.6 Hz, 1H), 4.22 – 4.03 (m, 3H), 2.40 (s, br, 1H), 2.28 (s, br, 1H), 2.17 – 2.00 (m, 2H), 1.68 – 1.43 (m, 5H), 1.38 – 1.18 (m, 15H), 0.92 – 0.78 (m, 12H), 0.03 (s, 3H), 0.01 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 135.3, 127.7, 92.1, 70.4, 68.9, 62.0, 38.7, 33.4, 32.0, 29.8, 29.8, 29.5, 27.5, 26.0, 25.6, 25.5, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3337 (br, m), 2925 (s), 2854 (m), 1553 (s), 1463 (w), 1362 (w), 1253 (m), 1006 (m), 835 (s), 774 (s), 669 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ [M−H]$^-$ 458.3307, found 458.3318.

(2*S*,3*S*,9*R*,*Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol SI-41



To $Cu(OAc)_2{\cdot}H_2O$ (10.8 mg, 0.05 mmol, 0.2 equiv.), **L2** (14.5 mg, 0.05 mmol, 0.2 equiv.) and 2-nitroethanol (0.06 mL, 0.81 mmol, 3.0 equiv.) in THF (0.7 mL) were added aldehyde **(*R*)-34** (100 mg, 0.27 mmol, 1.0 equiv.) in THF (0.7 mL) and stirred for 5 d to yield the nitro alcohol *S,S*-**SI-41** (92.6 mg, 74%) as slightly yellow oil and a mixture of diastereomers (28.7 mg, 23%).

$[\alpha]_D^{22}$ = 4.1 (c = 0.39 $CHCl_3$)

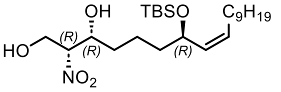
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.43 – 5.33 (m, 1H), 5.27 (dt, *J* = 11.2, 7.1 Hz, 1H), 4.58 (ddd, *J* = 7.0, 5.4, 3.5 Hz, 1H), 4.35 (td, *J* = 7.9, 4.4 Hz, 1H), 4.22 – 4.15 (m, 1H), 4.11 (ddd, *J* = 9.8, 7.1, 3.6 Hz, 2H), 2.40 (d, *J* = 7.3 Hz, 1H), 2.28 (d, *J* = 6.0 Hz, 1H), 2.10 – 2.05 (m, 2H), 1.71 – 1.44 (m, 5H), 1.36 – 1.17 (m, 15H), 0.91 – 0.78 (m, 12H), 0.03 (d, *J* = 2.9 Hz, 3H), 0.01 (d, *J* = 3.0 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 135.3, 127.7, 92.1, 70.4, 68.9, 62.0, 38.6, 33.4, 32.0, 29.8, 29.7, 29.5, 27.5, 26.0, 25.6, 25.5, 22.8, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3396 (br, w), 2925 (s), 2854 (m), 1716 (w), 1552 (s), 1461 (w), 1361 (w), 1252 (m), 1081 (s), 834 (s), 773 (s), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3315.

(2*R*,3*R*,7*R*,*Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol SI-42



To $Cu(OAc)_2{\cdot}H_2O$ (5.4 mg, 0.03 mmol, 0.1 equiv.), **L1** (7.2 mg, 0.03 mmol, 0.1 equiv.) and 2-nitroethanol (0.06 mL, 0.81 mmol, 3.0 equiv.) in THF (0.7 mL) were added aldehyde **(*R*)-37** (100 mg, 0.27 mmol, 1.0 equiv.) in THF (0.7 mL) and stirred for 5 d to yield the nitro alcohol *R,R*-**SI-42** (92.7 mg, 74%) as slightly yellow oil and a mixture of diastereomers (9.4 mg, 7.5%).

$[\alpha]_D^{22}$ = 9.7 (c = 0.34 $CHCl_3$)

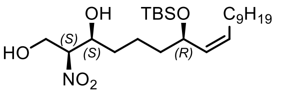
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.35 – 5.26 (m, 2H), 4.61 – 4.53 (m, 1H), 4.45 – 4.34 (m, 1H), 4.21 – 4.14 (m, 1H), 4.13 – 4.06 (m, 2H), 2.40 (s, 1H), 2.20 (s, 1H), 2.04 – 1.90 (m, 2H), 1.64 – 1.45 (m, 5H), 1.41 – 1.21 (m, 15H), 0.92 – 0.81 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.7, 129.6, 92.2, 70.4, 68.7, 62.0, 38.1, 33.7, 32.0, 29.8, 29.7, 29.7, 29.6, 29.5, 28.0, 26.0, 22.8, 21.4, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3390 (br, w), 2925 (m), 2853 (m), 1552 (s), 1462 (m), 1361 (w), 1252 (m), 1076 (s), 835 (s), 775 (s), 505 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3316.

(2*S*,3*S*,7*R*,*Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol SI-43



To $Cu(OAc)_2·H_2O$ (5.4 mg, 0.03 mmol, 0.1 equiv.), **L2** (7.2 mg, 0.03 mmol, 0.1 equiv.) and 2-nitroethanol (0.06 mL, 0.81 mmol, 3.0 equiv.) in THF (0.7 mL) were added aldehyde **(*R*)-37** (100 mg, 0.27 mmol, 1.0 equiv.) in THF (0.7 mL) and stirred for 5 d to yield the nitro alcohol *S,S*-**SI-43** (85.7 mg, 69%) as slightly yellow oil and a mixture of diastereomers (10.7 mg, 8.6%).

$[\alpha]_D^{22}$ = 3.0 (c = 0.29 $CHCl_3$)

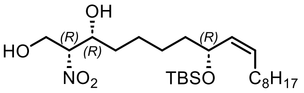
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.39 – 5.26 (m, 2H), 4.57 (tdd, *J* = 6.9, 6.4, 4.9, 3.2 Hz, 1H), 4.41 (td, *J* = 7.1, 3.6 Hz, 1H), 4.23 – 4.14 (m, 1H), 4.12 – 4.04 (m, 2H), 2.43 (s, 1H), 2.24 (s, 1H), 2.07 – 1.91 (m, 2H), 1.67 – 1.48 (m, 5H), 1.45 – 1.37 (m, 1H), 1.35 – 1.20 (m, 14H), 0.94 – 0.82 (m, 12H), 0.04 (d, *J* = 1.4 Hz, 3H), 0.02 (d, *J* = 1.4 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.6, 129.7, 92.2, 70.5, 68.7, 62.0, 38.1, 33.7, 32.1, 29.8, 29.7, 29.7, 29.6, 29.5, 28.0, 26.0, 22.8, 21.2, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3392 (br, w), 2925 (m), 2854 (m), 1551 (s), 1462 (m), 1361 (w), 1252 (m), 1076 (s), 834 (s), 774 (s), 505 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3317.

(2*R*,3*R*,8*R*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol SI-44



To $Cu(OAc)_2·H_2O$ (10.8 mg, 0.05 mmol, 0.1 equiv.), **L1** (14.4 mg, 0.05 mmol, 0.1 equiv.) and 2-nitroethanol (0.12 mL, 1.63 mmol, 3.0 equiv.) in THF (0.7 mL) were added aldehyde **(*R*)-42** (200 mg, 0.54 mmol, 1.0 equiv.) in THF (1.4 mL) and stirred for 5 d to yield the nitro alcohol *R,R*-**SI-44** (151 mg, 61%) as slightly yellow oil and a mixture of diastereomers (24.6 mg, 9%).

$[\alpha]_D^{22}$ = 9.8 (c = 0.19 $CHCl_3$)

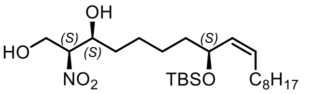
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.37 – 5.24 (m, 2H), 4.58 (ddd, *J* = 6.9, 5.4, 3.5 Hz, 1H), 4.38 (td, *J* = 7.3, 4.0 Hz, 1H), 4.17 (t, *J* = 5.4 Hz, 1H), 4.13 – 4.02 (m, 2H), 2.34 (d, *J* = 33.3 Hz, 2H), 2.05 – 1.89 (m, 2H), 1.66 – 1.43 (m, 3H), 1.40 – 1.22 (m, 17H), 0.92 – 0.83 (m, 12H), 0.03 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.9, 129.4, 92.2, 70.5, 68.8, 62.0, 38.5, 33.7, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 25.5, 25.2, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3328 (br, w), 2925 (s), 2854 (m), 1551 (s), 1463 (m), 1362 (w), 1252 (m), 1070 (m), 834 (s), 776 (s), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3315.

(2*S*,3*S*,8*S*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol SI-45



To $Cu(OAc)_2 \cdot H_2O$ (3.2 mg, 0.02 mmol, 0.1 equiv.), **L2** (7.2 mg, 0.02 mmol, 0.1 equiv.) and 2-nitroethanol (35 µL, 0.49 mmol, 3.0 equiv.) in THF (0.4 mL) were added aldehyde **(*S*)-42** (60.0 mg, 0.16 mmol, 1.0 equiv.) in THF (0.4 mL) and stirred for 5 d to yield the nitro alcohol *S,S*-**SI-45** (40.1 mg, 54%) as slightly yellow oil and a mixture of diastereomers (14.6 mg, 20%).

$[\alpha]_D^{22}$ = -17.4 (c = 0.24 $CHCl_3$)

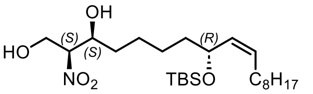
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.37 – 5.25 (m, 2H), 4.58 (ddd, *J* = 7.1, 5.5, 3.6 Hz, 1H), 4.38 (dt, *J* = 7.6, 3.9 Hz, 1H), 4.18 (dt, *J* = 12.7, 6.3 Hz, 1H), 4.14 – 4.01 (m, 2H), 2.33 (d, *J* = 7.4 Hz, 1H), 2.22 (s, 1H), 2.07 – 1.92 (m, 2H), 1.55 (m, 3H), 1.43 – 1.18 (m, 17H), 0.87 (d, *J* = 6.0 Hz, 12H), 0.03 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.9, 129.4, 92.1, 70.5, 68.8, 62.0, 38.5, 33.8, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 25.5, 25.2, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3322 (br, w), 3198 (br, w), 2924 (s), 2853 (m), 1734 (w), 1558 (s), 1464 (m), 1362 (w), 1251 (m), 1065 (m), 1041 (m), 1012 (m), 835 (s), 774 (m), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3327.

(2*S*,3*S*,8*R*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol SI-46



To $Cu(OAc)_2 \cdot H_2O$ (5.4 mg, 0.03 mmol, 0.1 equiv.), **L2** (7.2 mg, 0.03 mmol, 0.1 equiv.) and 2-nitroethanol (0.06 mL, 0.081 mmol, 3.0 equiv.) in THF (0.7 mL) were added aldehyde **(*R*)-42** (100 mg, 0.27 mmol, 1.0 equiv.) in THF (0.7 mL) and stirred for 5 d to yield the nitro alcohol *S,S*-**SI-46** (66.3 mg, 53%) as slightly yellow oil and a mixture of diastereomers (15.1 mg, 12%).

$[\alpha]_D^{22}$ = 4.6 (c = 0.26 $CHCl_3$)

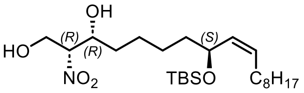
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.36 – 5.26 (m, 2H), 4.58 (ddd, *J* = 6.9, 5.5, 3.6 Hz, 1H), 4.42 – 4.34 (m, 1H), 4.18 (dd, *J* = 12.5, 7.0 Hz, 1H), 4.14 – 4.03 (m, 2H), 2.35 (d, *J* = 7.2 Hz, 1H), 2.25 (s, 1H), 2.08 – 1.92 (m, 2H), 1.67 – 1.47 (m, 4H), 1.43 – 1.22 (m, 16H), 0.93 – 0.82 (m, 12H), 0.03 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.9, 129.4, 92.2, 70.5, 68.8, 62.0, 38.4, 33.8, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 25.5, 25.2, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3305 (br, w), 2925 (s), 2854 (m), 1552 (s), 1463 (m), 1362 (w), 1252 (m), 1038 (m), 835 (s), 774 (m), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3316.

(2*R*,3*R*,8*S*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol SI-47



To $Cu(OAc)_2{\cdot}H_2O$ (5.4 mg, 0.03 mmol, 0.1 equiv.), **L1** (7.2 mg, 0.03 mmol, 0.1 equiv.) and 2-nitroethanol (0.06 mL, 0.81 mmol, 3.0 equiv.) in THF (0.7 mL) were added aldehyde **(*S*)-42** (100 mg, 0.27 mmol, 1.0 equiv.) in THF (0.7 mL) and stirred for 5 d to yield the *R,R*-**SI-47** (78.7 mg, 63%) as slightly yellow oil and a mixture of diastereomers (16.1 mg, 13%).

$[\alpha]_D^{22}$ = -6.7 (c = 0.21 $CHCl_3$)

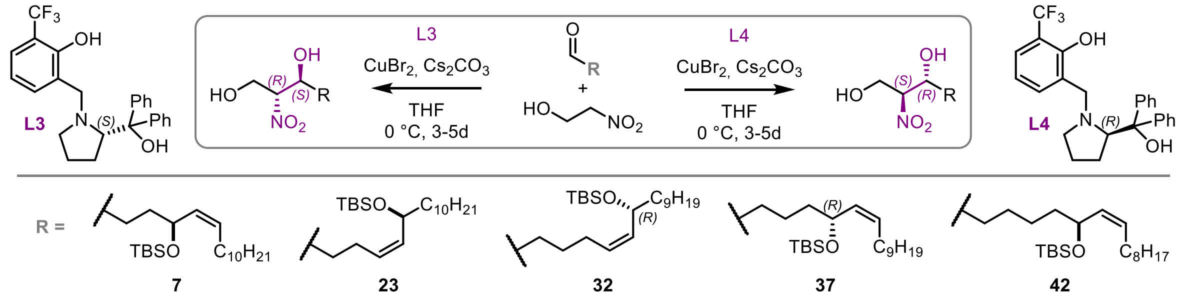
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.37 – 5.24 (m, 2H), 4.58 (ddd, *J* = 6.8, 5.4, 3.5 Hz, 1H), 4.38 (q, *J* = 4.6, 2.6 Hz, 1H), 4.18 (dt, *J* = 12.8, 6.4 Hz, 1H), 4.14 – 4.03 (m, 2H), 2.38 (d, *J* = 7.4 Hz, 1H), 2.31 (t, *J* = 6.2 Hz, 1H), 2.03 – 1.92 (m, 2H), 1.61 – 1.48 (m, 3H), 1.45 – 1.21 (m, 17H), 0.93 – 0.83 (m, 12H), 0.03 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.8, 129.3, 92.0, 70.4, 68.6, 61.9, 38.3, 33.6, 31.9, 29.7, 29.5, 29.5, 29.3, 27.9, 25.9, 25.4, 25.1, 22.7, 18.2, 14.2, -4.2, -4.8 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3306 (br, w), 2925 (s), 2854 (m), 1552 (s), 1463 (m), 1362 (w), 1253 (m), 1038 (m), 835 (s), 775 (m), 668 (w) cm^{-1}.

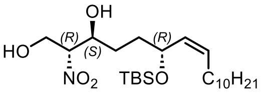
HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3315.

2.4.3 Synthesis of 1,2-*anti* nitro alcohols



Following a modified procedure:[22] To a mixture of ligand **L3** or **L4** (0.1/0.2 equiv.), $CuBr_2$ (0.1/0.2 equiv.) and Cs_2CO_3 (0.15/0.3 equiv.) in THF (0.04 M based on ligand) was added 2-nitroethanol (10 equiv.) and the reaction mixture was stirred at r.t. for 1 h where a white precipitate appeared. The resulting suspension was moved to an Eppendorf tube and centrifuged (5 min, 13x1000 rpm). The supernatant was transferred to a reaction flask, cooled to 0 °C and subsequently treated with a solution of aldehyde **7, 23, 32, 37, 42** (1.0 equiv.) in THF (0.4 M). The reaction mixture was stirred at 0 °C for 3-5 d, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and evaporated *in vacuo*. The residue was purified by column chromatography (0 to 40% EtOAc in cyclohexane) to obtain the *anti*-nitro-alcohol as highly enriched fraction and a mix (*syn* + *anti*) fraction with R_f *syn* > R_f *anti*. The ratio of syn/anti was also determined by HPLC (See Figure S8). For NMR analysis, only the *anti*-fraction was taken into consideration.

(*2R*,3*S*,6*R*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol 10



A mixture of **L3** (9.3 mg, 0.02 mmol, 0.1 equiv.), CuBr$_2$ (4.9 mg, 0.02 mmol, 0.1 equiv.), Cs$_2$CO$_3$ (10.6 mg, 0.03 mmol, 0.15 equiv.) and 2-nitroethanol (0.16 mL, 2.17 mmol, 10 equiv.) in THF (0.5 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-7** (80.0 mg, 0.22 mmol, 1.0 equiv.) in THF (0.5 mL) was added and stirred for 3 d to yield the nitro alcohol *R,S*-**10** (67.8 mg, 68%) as slightly yellow oil and a mixture of diastereomers (21.7 mg, 22%).

$[\alpha]_D^{22}$ = 6.5 (c = 0.27 CHCl$_3$)

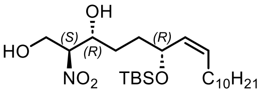
^{1}H-NMR (300 MHz, CDCl$_3$) δ = 5.48 – 5.29 (m, 2H), 4.65 – 4.52 (m, 1H), 4.47 (td, *J* = 5.9, 3.9 Hz, 1H), 4.29 – 4.04 (m, 3H), 2.65 – 2.47 (m, 2H), 2.07 – 1.88 (m, 2H), 1.78 – 1.52 (m, 3H), 1.26 (d, *J* = 1.6 Hz, 17H), 0.93 – 0.79 (m, 12H), 0.08 (s, 3H), 0.05 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 132.2, 130.4, 91.4, 71.9, 68.9, 61.3, 35.0, 32.1, 29.7, 29.7, 29.7, 29.5, 29.5, 28.0, 25.9, 22.8, 18.3, 14.3, -4.3, -4.8 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3386 (br, w), 2925 (s), 2854 (m), 1551 (s), 1462 (m), 1361 (w), 1253 (m), 1067 (s), 835 (s), 775 (s), 665 (w) cm^{-1}.

HRMS (ESI) calcd for C$_{24}$H$_{48}$NO$_5$Si [M−H]$^-$ 458.3307, found 458.3306.

(*2S,3R,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol 11



A mixture of **L4** (9.5 mg, 0.02 mmol, 0.1 equiv.), CuBr$_2$ (5.0 mg, 0.02 mmol, 0.1 equiv.), Cs$_2$CO$_3$ (10.8 mg, 0.03 mmol, 0.15 equiv.) and 2-nitroethanol (0.16 mL, 2.22 mmol, 10 equiv.) in THF (0.5 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-7** (81.9 mg, 0.22 mmol, 1.0 equiv.) in THF (0.5 mL) was added and stirred for 3 d to yield the nitro alcohol *S,R*-**11** (57.4 mg, 56%) as slightly yellow oil and a mixture of diastereomers (23.6 mg, 23%).

$[\alpha]_D^{22}$ = 10.8 (c = 0.20 CHCl$_3$)

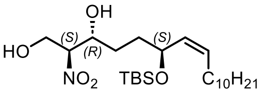
^{1}H-NMR (300 MHz, CDCl$_3$) δ = 5.45 – 5.28 (m, 2H), 4.60 – 4.44 (m, 2H), 4.34 – 4.20 (m, 2H), 4.19 – 4.03 (m, 1H), 3.66 (s, 1H), 2.40 (s, 1H), 2.09 – 1.88 (m, 2H), 1.81 – 1.51 (m, 3H), 1.41 – 1.17 (m, 17H), 0.96 – 0.77 (m, 12H), 0.07 (s, 3H), 0.05 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (75 MHz, CDCl$_3$) δ = 132.5, 130.5, 91.2, 71.2, 69.0, 61.3, 33.8, 32.1, 29.7, 29.7, 29.6, 29.5, 29.3, 28.0, 26.0, 22.8, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3386 (br, w), 2925 (s), 2854 (m), 1719 (w), 1551 (s), 1463 (m), 1361 (w), 1252 (m), 1070 (s), 834 (s), 775 (s), 669 (w) cm^{-1}.

HRMS (ESI) calcd for C$_{24}$H$_{48}$NO$_5$Si [M−H]$^-$ 458.3307, found 458.3308.

(2*S*,3*R*,6*S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol SI-48



A mixture of **L4** (5.8 mg, 0.01 mmol, 0.1 equiv.), $CuBr_2$ (3.0 mg, 0.01 mmol, 0.1 equiv.), Cs_2CO_3 (6.6 mg, 0.02 mmol, 0.15 equiv.) and 2-nitroethanol (0.10 mL, 1.36 mmol, 10 equiv.) in THF (0.5 mL) were used to obtain the active catalyst. A solution of aldehyde **(*S*)-7** (50.0 mg, 0.14 mmol, 1.0 equiv.) in THF (0.5 mL) was added and stirred for 3 d to yield the nitro alcohol *S,R*-**SI-48** (45.8 mg, 73%) as slightly yellow oil and a mixture of diastereomers (14.2 mg, 23%).

$[\alpha]_D^{22}$ = -7.3 (c = 0.14 $CHCl_3$)

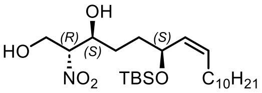
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.45 – 5.31 (m, 2H), 4.58 (dt, *J* = 7.9, 4.4 Hz, 1H), 4.51 – 4.38 (m, 1H), 4.30 – 4.15 (m, 3H), 2.81 – 2.41 (m, 1H), 2.06 – 1.92 (m, 3H), 1.78 – 1.54 (m, 3H), 1.42 – 1.17 (m, 17H), 0.91 – 0.85 (m, 12H), 0.08 (s, 3H), 0.05 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 132.2, 130.4, 91.4, 71.9, 68.8, 61.2, 60.6, 35.0, 32.0, 29.7, 29.6, 29.5, 29.5, 28.0, 25.9, 22.8, 21.2, 18.3, 14.3, -4.3, -4.8 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3364 (br, w), 2924 (s), 2853 (m), 1551 (s), 1463 (m), 1361 (w), 1253 (m), 1066 (s), 835 (s), 775 (s), 669 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3317.

(*2R,3S,6S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol SI-49



A mixture of **L3** (5.8 mg, 0.01 mmol, 0.1 equiv.), $CuBr_2$ (3.0 mg, 0.01 mmol, 0.1 equiv.), Cs_2CO_3 (6.6 mg, 0.02 mmol, 0.15 equiv.) and 2-nitroethanol (0.10 mL, 1.36 mmol, 10 equiv.) in THF (0.5 mL) were used to obtain the active catalyst. A solution of aldehyde **(*S*)-7** (50.0 mg, 0.14 mmol, 1.0 equiv.) in THF (0.5 mL) was added and stirred for 3 d to yield the nitro alcohol *R,S*-**SI-49** (47.1 mg, 76%) as slightly yellow oil and a mixture of diastereomers (11.4 mg, 18%).

$[\alpha]_D^{22}$ = -6,1 (c = 0.21 $CHCl_3$)

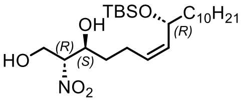
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.43 – 5.29 (m, 2H), 4.57 – 4.43 (m, 2H), 4.29 – 4.15 (m, 3H), 3.72 (s, 1H), 2.57 (s, br, 1H), 2.03 – 1.89 (m, 2H), 1.79 – 1.55 (m, 3H), 1.45 – 1.19 (m, 17H), 0.91 – 0.81 (m, 12H), 0.07 (s, 3H), 0.05 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 132.5, 130.5, 91.2, 71.2, 69.0, 61.3, 60.6, 33.7, 32.0, 29.7, 29.7, 29.6, 29.5, 29.3, 28.0, 26.0, 22.8, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3391 (br, w), 2924 (s), 2853 (m), 1551 (s), 1463 (m), 1361 (w), 1252 (m), 1069 (s), 835 (s), 775 (s), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3317.

(*2R,3S,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol SI-50



A mixture of **L3** (13.9 mg, 0.03 mmol, 0.2 equiv.), CuBr$_2$ (7.3 mg, 0.03 mmol, 0.2 equiv.), Cs$_2$CO$_3$ (15.9 mg, 0.05 mmol, 0.3 equiv.) and 2-nitroethanol (0.12 mL, 1.63 mmol, 10 equiv.) in THF (0.5 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-23** (60.0 mg, 0.16 mmol, 1.0 equiv.) in THF (0.5 mL) was added and stirred for 5 d to yield the nitro alcohol *R,S*-**SI-50** (51.6 mg, 69%) as slightly yellow oil and a mixture of diastereomers (19.7 mg, 26%).

$[\alpha]_D^{22}$ = -1.8 (c = 0.10 CHCl$_3$)

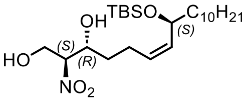
^{1}H-NMR (500 MHz, C$_6$D$_6$) δ = 5.60 – 5.51 (m, 1H), 5.16 – 5.04 (m, 1H), 4.58 – 4.49 (m, 1H), 3.88 – 3.79 (m, 2H), 3.69 (dd, *J* = 12.7, 6.0 Hz, 1H), 3.59 (dd, *J* = 12.7, 2.8 Hz, 1H), 2.21 – 1.89 (m, 3H), 1.81 – 1.67 (m, 1H), 1.58 – 1.40 (m, 2H), 1.38 – 1.18 (m, 16H), 1.05 (s, 9H), 0.95 – 0.88 (m, 3H), 0.18 (s, 3H), 0.17 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, C$_6$D$_6$) δ = 136.0, 127.4, 91.2, 70.7, 69.3, 60.5, 39.1, 33.8, 32.3, 30.2, 30.1, 30.1, 29.8, 26.2, 25.9, 24.1, 23.1, 18.5, 14.4, -3.9, -4.4 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3384 (br, w), 2925 (s), 2854 (m), 1551 (s), 1462 (m), 1361 (w), 1252 (m), 1079 (s), 834 (s), 774 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for C$_{24}$H$_{48}$NO$_5$Si [M−H]$^-$ 458.3307, found 458.3316.

(*2S,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol SI-51



A mixture of **L4** (11.6 mg, 0.03 mmol, 0.2 equiv.), CuBr$_2$ (6.0 mg, 0.03 mmol, 0.2 equiv.), Cs$_2$CO$_3$ (13.3 mg, 0.04 mmol, 0.3 equiv.) and 2-nitroethanol (0.10 mL, 1.36 mmol, 10 equiv.) in THF (0.34 mL) were used to obtain the active catalyst. A solution of aldehyde **(*S*)-23** (50.0 mg, 0.14 mmol, 1.0 equiv.) in THF (0.34 mL) was added and stirred for 5 d to yield the nitro alcohol *S,R*-**SI-51** (37.8 mg, 61%) as slightly yellow oil and a mixture of diastereomers (18.8 mg, 30%).

$[\alpha]_D^{22}$ = 2.7 (c = 0.07 CHCl$_3$)

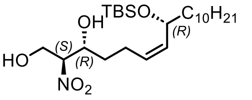
^{1}H-NMR (500 MHz, C$_6$D$_6$) δ = 5.55 (ddt, *J* = 10.3, 8.4, 1.6 Hz, 1H), 5.16 – 5.05 (m, 1H), 4.58 – 4.49 (m, 1H), 3.88 – 3.79 (m, 2H), 3.76 – 3.65 (m, 1H), 3.63 – 3.55 (m, 1H), 2.20 – 1.90 (m, 3H), 1.79 – 1.67 (m, 1H), 1.58 – 1.42 (m, 2H), 1.40 – 1.21 (m, 16H), 1.05 (s, 9H), 0.92 (t, *J* = 7.1, 3H), 0.18 (s, 3H), 0.17 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, C$_6$D$_6$) δ = 136.0, 127.4, 91.2, 70.7, 69.3, 60.5, 39.1, 33.8, 32.3, 30.2, 30.1, 30.1, 29.8, 26.2, 25.9, 24.1, 23.1, 18.5, 14.4, -3.9, -4.4 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3420 (br, w), 2925 (s), 2853 (m), 1551 (s), 1462 (m), 1361 (w), 1252 (m), 1078 (s), 834 (s), 774 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for C$_{24}$H$_{48}$NO$_5$Si [M−H]$^-$ 458.3307, found 458.3317.

(*2S,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol SI-52



A mixture of **L4** (13.9 mg, 0.03 mmol, 0.2 equiv.), $CuBr_2$ (7.3 mg, 0.03 mmol, 0.2 equiv.), Cs_2CO_3 (15.9 mg, 0.05 mmol, 0.3 equiv.) and 2-nitroethanol (0.12 mL, 1.63 mmol, 10 equiv.) in THF (0.5 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-23** (60.0 mg, 0.16 mmol, 1.0 equiv.) in THF (0.5 mL) was added and stirred for 5 d to yield the nitro alcohol *S,R*-**SI-52** (50.2 mg, 67%) as slightly yellow oil and a mixture of diastereomers (24.4 mg, 33%).

$[\alpha]_D^{22}$ = -4.9 (c = 0.11 $CHCl_3$)z

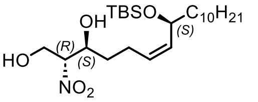
^{1}H-NMR (500 MHz, C_6D_6) δ = 5.61 – 5.51 (m, 1H), 5.16 – 5.05 (m, 1H), 4.60 – 4.48 (m, 1H), 3.88 – 3.78 (m, 2H), 3.69 (dd, *J* = 12.6, 5.8 Hz, 1H), 3.59 (dd, *J* = 12.6, 3.0 Hz, 1H), 2.20 – 1.89 (m, 3H), 1.78 – 1.68 (m, 1H), 1.57 – 1.46 (m, 2H), 1.42 – 1.18 (m, 16H), 1.05 (s, 9H), 0.91 (t, *J* = 6.9 Hz, 3H), 0.18 (s, 3H), 0.17 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 135.9, 127.4, 91.1, 70.7, 69.1, 60.4, 39.1, 33.7, 32.3, 30.2, 30.2, 30.1, 29.8, 26.2, 25.9, 24.2, 23.1, 18.5, 14.4, -3.9, -4.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3384 (br, w), 2925 (s), 2854 (m), 1551 (s), 1462 (m), 1361 (w), 1252 (m), 1079 (s), 834 (s), 774 (s), 666 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3317.

(*2R,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol SI-53



A mixture of **L3** (11.6 mg, 0.03 mmol, 0.2 equiv.), $CuBr_2$ (6.0 mg, 0.03 mmol, 0.2 equiv.), Cs_2CO_3 (13.3 mg, 0.04 mmol, 0.3 equiv.) and 2-nitroethanol (0.10 mL, 1.36 mmol, 10 equiv.) in THF (0.34 mL) were used to obtain the active catalyst. A solution of aldehyde **(*S*)-23** (50.0 mg, 0.14 mmol, 1.0 equiv.) in THF (0.34 mL) was added and stirred for 5 d to yield the nitro alcohol *R,S*-**SI-53** (40.1 mg, 64%) as slightly yellow oil and a mixture of diastereomers (20.9 mg, 34%).

$[\alpha]_D^{22}$ = 3.8 (c = 0.15 $CHCl_3$)

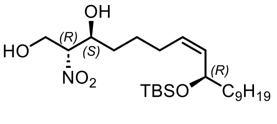
^{1}H-NMR (500 MHz, C_6D_6) δ = 5.55 (ddt, *J* = 10.4, 8.6, 1.6 Hz, 1H), 5.16 – 5.05 (m, 1H), 4.62 – 4.48 (m, 1H), 3.89 – 3.78 (m, 2H), 3.68 (dd, *J* = 12.8, 5.9 Hz, 1H), 3.58 (dd, *J* = 12.8, 2.9 Hz, 1H), 2.19 – 2.10 (m, 1H), 2.09 – 1.87 (m, 2H), 1.78 – 1.68 (m, 1H), 1.58 – 1.44 (m, 2H), 1.31 (m, 16H), 1.05 (s, 9H), 0.92 (t, *J* = 7.1 Hz, 3H), 0.18 (s, 3H), 0.17 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, C_6D_6) δ = 135.9, 127.4, 91.1, 70.7, 69.1, 60.4, 39.1, 33.7, 32.3, 30.2, 30.2, 30.2, 30.1, 29.8, 26.2, 25.9, 24.2, 23.1, 18.5, 14.4, -3.9, -4.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3394 (br, w), 2925 (s), 2853 (m), 1551 (s), 1462 (m), 1361 (w), 1252 (m), 1080 (s), 834 (s), 774 (s), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3315.

(2*R*,3*S*,9*R*,*Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol SI-54



A mixture of **L3** (16.2 mg, 0.04 mmol, 0.2 equiv.), $CuBr_2$ (8.4 mg, 0.04 mmol, 0.2 equiv.), Cs_2CO_3 (18.6 mg, 0.06 mmol, 0.3 equiv.) and 2-nitroethanol (0.14 mL, 1.90 mmol, 10 equiv.) in THF (0.6 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-34** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.6 mL) was added and stirred for 5 d to yield the nitro alcohol *R,S*-**SI-54** (44.2 mg, 51%) as slightly yellow oil and a mixture of diastereomers (38.3 mg, 44%).

$[\alpha]_D^{22}$ = 8.5 (c = 0.11 $CHCl_3$)

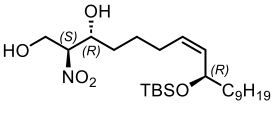
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.43 – 5.33 (m, 1H), 5.27 (dt, *J* = 11.1, 7.1 Hz, 1H), 4.45 (dq, *J* = 5.4, 3.3 Hz, 1H), 4.40 – 4.31 (m, 2H), 4.29 – 4.17 (m, 2H), 2.65 (s, br, *J* = 6.0 Hz, 1H), 2.58 (s, br, 1H), 2.13 – 2.05 (m, 2H), 1.75 – 1.38 (m, 5H), 1.38 – 1.16 (m, 15H), 0.93 – 0.78 (m, 12H), 0.03 (s, 3H), 0.01 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 135.4, 127.7, 90.8, 71.6, 68.9, 60.5, 38.6, 33.7, 32.0, 29.8, 29.7, 29.5, 27.5, 26.0, 25.9, 25.5, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3329 (br, w), 2925 (s), 2854 (m), 1551 (s), 1462 (w), 1362 (w), 1253 (m), 1005 (m), 835 (s), 775 (m), 668 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3316.

(2*S*,3*R*,9*R*,*Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol SI-55



A mixture of **L4** (16.2 mg, 0.04 mmol, 0.2 equiv.), $CuBr_2$ (8.4 mg, 0.04 mmol, 0.2 equiv.), Cs_2CO_3 (18.6 mg, 0.06 mmol, 0.3 equiv.) and 2-nitroethanol (0.14 mL, 1.90 mmol, 10 equiv.) in THF (0.6 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-34** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.6 mL) was added and stirred for 5 d to yield the nitro alcohol *S,R*-**SI-55** (58.1 mg, 67%) as slightly yellow oil and a mixture of diastereomers (26.6 mg, 30%).

$[\alpha]_D^{22}$ = 10.9 (c = 0.28 $CHCl_3$)

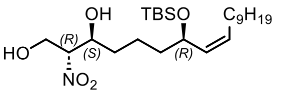
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.37 (ddt, *J* = 10.4, 8.5, 1.7 Hz, 1H), 5.26 (dt, *J* = 11.1, 7.1 Hz, 1H), 4.48 – 4.43 (m, 1H), 4.40 – 4.29 (m, 1H), 4.28 – 4.16 (m, 2H), 2.63 (s, br, 1H), 2.55 (s, br, 1H), 2.14 – 2.00 (m, 2H), 1.72 – 1.40 (m, 5H), 1.38 – 1.14 (m, 15H), 0.96 – 0.78 (m, 12H), 0.03 (s, 3H), 0.01 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 135.4, 127.7, 90.7, 71.6, 68.9, 60.5, 38.7, 33.7, 32.0, 29.8, 29.8, 29.5, 27.5, 26.0, 25.9, 25.5, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3330 (br, w), 2923 (s), 2853 (m), 1551 (s), 1457 (w), 1362 (w), 1253 (w), 1005 (m), 836 (m), 776 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3315.

(*2R,3S,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol SI-56



A mixture of **L3** (8.1 mg, 0.02 mmol, 0.1 equiv.), $\mathrm{CuBr_2}$ (4.2 mg, 0.02 mmol, 0.1 equiv.), $\mathrm{Cs_2CO_3}$ (9.1 mg, 0.03 mmol, 0.15 equiv.) and 2-nitroethanol (0.14 mL, 1.90 mmol, 10 equiv.) in THF (0.6 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-39** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.6 mL) was added and stirred for 5 d to yield the nitro alcohol *R,S*-**SI-56** (63.4 mg, 73%) as slightly yellow oil and a mixture of diastereomers (14.2 mg, 16%).

$[\alpha]_D^{22}$ = 8.7 (c = 0.08 $\mathrm{CHCl_3}$)

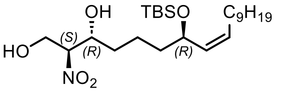
^{1}H-NMR (500 MHz, $\mathrm{CDCl_3}$) δ = 5.40 – 5.28 (m, 2H), 4.47 – 4.36 (m, 2H), 4.35 – 4.09 (m, 3H), 2.69 (s, br, 1H), 2.56 (s, br, J = 16.4 Hz, 1H), 2.04 – 1.92 (m, 2H), 1.70 – 1.48 (m, 3H), 1.45 – 1.19 (m, 17H), 0.91 – 0.81 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $\mathrm{CDCl_3}$) δ = 133.6, 129.7, 90.9, 71.7, 68.7, 60.6, 38.0, 34.0, 32.0, 29.8, 29.7, 29.7, 29.6, 29.5, 28.0, 26.0, 22.8, 21.5, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) 3306 (br, w), 2924 (s), 2854 (m), 1551 (s), 1463 (m), 1362 (m), 1253 (m), 1037 (m), 835 (s), 776 (m), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $\mathrm{C_{24}H_{48}NO_5Si}$ [M−H]$^-$ 458.3307, found 458.3314.

(*2S,3R,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol SI-57



A mixture of **L4** (8.1 mg, 0.02 mmol, 0.1 equiv.), $\mathrm{CuBr_2}$ (4.2 mg, 0.02 mmol, 0.1 equiv.), $\mathrm{Cs_2CO_3}$ (9.1 mg, 0.03 mmol, 0.15 equiv.) and 2-nitroethanol (0.14 mL, 1.90 mmol, 10 equiv.) in THF (0.6 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-39** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.6 mL) was added and stirred for 5d to yield the nitro alcohol *S,R*-**SI-57** (54.1 mg, 62%) as slightly yellow oil and a mixture of diastereomers (32.5 mg, 37%).

$[\alpha]_D^{22}$ = 8.2 (c = 0.10 $\mathrm{CHCl_3}$)

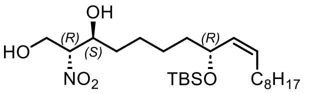
^{1}H-NMR (500 MHz, $\mathrm{CDCl_3}$) δ = 5.38 – 5.26 (m, 2H), 4.49 – 4.36 (m, 2H), 4.36 – 4.15 (m, 3H), 2.65 (d, J = 5.9 Hz, 1H), 2.52 (s, 1H), 2.04 – 1.92 (m, 2H), 1.72 – 1.43 (m, 5H), 1.39 – 1.19 (m, 15H), 0.92 – 0.82 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $\mathrm{CDCl_3}$) δ = 133.7, 129.7, 90.9, 71.6, 68.8, 60.6, 38.1, 33.9, 32.0, 29.8, 29.7, 29.7, 29.6, 29.5, 28.0, 26.0, 22.8, 21.7, 18.3, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\nu}$ = 3306 (br, w), 2924 (m), 2854 (m), 1551 (s), 1463 (w), 1362 (w), 1253 (w), 1037 (w), 836 (m), 776 (m), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $\mathrm{C_{24}H_{48}NO_5Si}$ [M−H]$^-$ 458.3307, found 458.3317.

(2*R*,3*S*,8*R*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol SI-58



A mixture of **L3** (8.1 mg, 0.02 mmol, 0.1 equiv.), $CuBr_2$ (4.2 mg, 0.02 mmol, 0.1 equiv.), Cs_2CO_3 (9.1 mg, 0.03 mmol, 0.15 equiv.) and 2-nitroethanol (0.14 mL, 1.90 mmol, 10 equiv.) in THF (0.6 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-44** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.6 mL) was added and stirred for 5 d to yield the nitro alcohol *R,S*-**SI-58** (63.4 mg, 73%) as slightly yellow oil and a mixture of diastereomers (14.2 mg, 16%).

$[\alpha]_D^{22}$ = 6.1 (c = 0.11 $CHCl_3$)

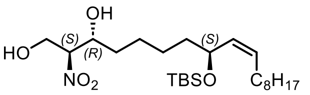
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.40 – 5.23 (m, 2H), 4.47 – 4.42 (m, 1H), 4.38 (td, *J* = 7.1, 4.7 Hz, 1H), 4.36 – 4.23 (m, 2H), 4.23 – 4.16 (m, 1H), 2.58 (s, br, 2H), 2.05 – 1.89 (m, 2H), 1.70 – 1.46 (m, 4H), 1.44 – 1.17 (m, 16H), 0.94 – 0.80 (m, 12H), 0.03 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.9, 129.4, 90.8, 71.7, 68.8, 60.5, 38.4, 34.0, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 25.8, 25.2, 22.8, 18.3, 14.3, -4.1, -4.7 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3333 (br, w), 2925 (s), 2854 (m), 1551 (s), 1463 (w), 1362 (w), 1253 (m), 1045 (m), 835 (s), 775 (m), 669 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3314.

(2*S*,3*R*,8*S*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol SI-59



A mixture of **L4** (8.1 mg, 0.02 mmol, 0.1 equiv.), $CuBr_2$ (4.2 mg, 0.02 mmol, 0.1 equiv.), Cs_2CO_3 (9.1 mg, 0.03 mmol, 0.15 equiv.) and 2-nitroethanol (0.14 mL, 1.90 mmol, 10 equiv.) in THF (0.6 mL) were used to obtain the active catalyst. A solution of aldehyde **(*S*)-44** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.6 mL) was added and stirred for 5 d to yield the nitro alcohol *S,R*-**SI-59** (52.0 mg, 60%) as slightly yellow oil and a mixture of diastereomers (12.6 mg, 14%).

$[\alpha]_D^{22}$ = -11.0 (c = 0.15 $CHCl_3$)

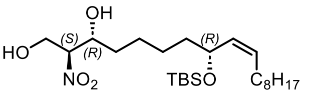
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.36 – 5.23 (m, 2H), 4.51 – 4.15 (m, 5H), 2.52 (d, *J* = 29.8 Hz, 2H), 2.09 – 1.91 (m, 2H), 1.68 – 1.46 (m, 4H), 1.45 – 1.17 (m, 16H), 0.92 – 0.84 (m, 12H), 0.04 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.9, 129.4, 90.7, 71.7, 68.8, 60.5, 38.4, 34.0, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 25.8, 25.2, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3362 (br, w), 2925 (s), 2854 (m), 1551 (s), 1462 (w), 1362 (w), 1252 (m), 1067 (m), 834 (s), 774 (m), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ $[M-H]^-$ 458.3307, found 458.3316.

(*2S,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol SI-60



A mixture of **L4** (8.1 mg, 0.02 mmol, 0.1 equiv.), $CuBr_2$ (4.2 mg, 0.02 mmol, 0.1 equiv.), Cs_2CO_3 (9.1 mg, 0.03 mmol, 0.15 equiv.) and 2-nitroethanol (0.14 mL, 1.90 mmol, 10 equiv.) in THF (0.6 mL) were used to obtain the active catalyst. A solution of aldehyde **(*R*)-44** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.6 mL) was added and stirred for 5 d to yield the nitro alcohol *S,R*-**SI-60** (53.3 mg, 61%) as slightly yellow oil and a mixture of diastereomers (9.5 mg, 11%).

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 7.1 (c = 0.16 $CHCl_3$)

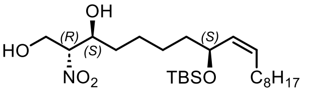
^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.36 – 5.23 (m, 2H), 4.47 – 4.42 (m, 1H), 4.41 – 4.35 (m, 1H), 4.35 – 4.30 (m, 1H), 4.27 (dd, *J* = 13.0, 5.7 Hz, 1H), 4.19 (dd, *J* = 13.0, 3.0 Hz, 1H), 2.64 – 2.41 (m, 2H), 2.09 – 1.91 (m, 2H), 1.69 – 1.44 (m, 4H), 1.42 – 1.16 (m, 16H), 0.93 – 0.84 (m, 12H), 0.03 (s, 3H), 0.02 (s, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.9, 129.4, 90.7, 71.7, 68.7, 60.5, 38.4, 34.0, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 25.8, 25.2, 22.8, 18.4, 14.3, -4.1, -4.6 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3355 (br, w), 2925 (s), 2854 (m), 1551 (s), 1462 (w), 1362 (w), 1252 (m), 1065 (m), 835 (s), 775 (m), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ [M−H]$^-$ 458.3307, found 458.3315.

(*2R,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol SI-61



A mixture of **L3** (8.1 mg, 0.02 mmol, 0.1 equiv.), $CuBr_2$ (4.2 mg, 0.02 mmol, 0.1 equiv.), Cs_2CO_3 (9.1 mg, 0.03 mmol, 0.15 equiv.) and 2-nitroethanol (0.14 mL, 1.90 mmol, 10 equiv.) in THF (0.6 mL) were used to obtain the active catalyst. A solution of aldehyde **(*S*)-44** (70.0 mg, 0.19 mmol, 1.0 equiv.) in THF (0.6 mL) was added and stirred for 5 d to yield the nitro alcohol *R,S*-**SI-61** (62.6 mg, 72%) as slightly yellow oil and a mixture of diastereomers (8.1 mg, 9%).

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = -8.4 (c = 0.18 $CHCl_3$)

^{1}H-NMR (500 MHz, $CDCl_3$) δ = 5.37 – 5.25 (m, 2H), 4.49 – 4.42 (m, 1H), 4.38 (dt, *J* = 7.8, 3.8 Hz, 1H), 4.33 – 4.22 (m, 2H), 4.22 – 4.15 (m, 1H), 2.70 – 2.51 (m, 2H), 2.04 – 1.93 (m, 2H), 1.72 – 1.44 (m, 4H), 1.44 – 1.19 (m, 16H), 0.91 – 0.82 (m, 12H), 0.03 (s, 3H), 0.02 (s, 3H) ppm.

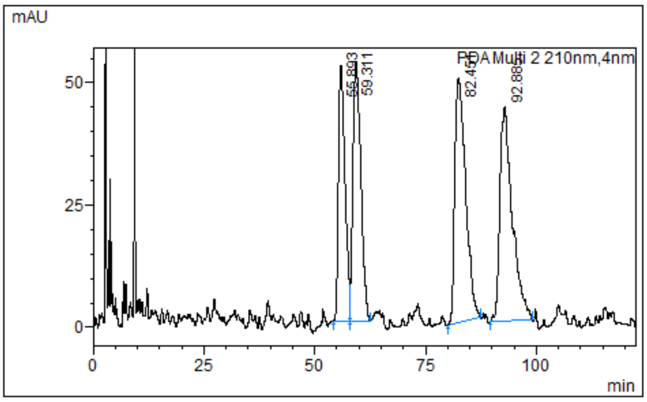
^{13}C{^{1}H}-NMR (126 MHz, $CDCl_3$) δ = 133.9, 129.4, 90.8, 71.7, 68.8, 60.5, 38.4, 34.0, 32.0, 29.8, 29.6, 29.6, 29.4, 28.0, 26.0, 25.8, 25.2, 22.8, 18.3, 14.3, -4.1, -4.7 ppm.

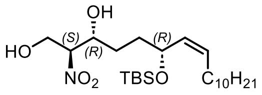
IR (ATR) $\tilde{\upsilon}$ = 3333 (br, w), 2925 (s), 2854 (m), 1551 (s), 1463 (w), 1362 (w), 1253 (m), 1006 (m), 835 (s), 775 (m), 667 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{24}H_{48}NO_5Si$ [M−H]$^-$ 458.3307, found 458.3315.

Mixture analysis of nitro alcohols 8-11 obtained from Henry reaction

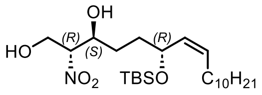
Methode: 0.6% *i*-PrOH in heptane; 1.0 mL/min; column: Phenomenex Lux® 5µm Amylose 1





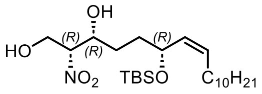
P1: 55.9 min

11



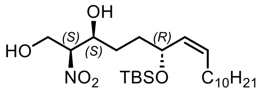
P2: 59.3 min

10



P3: 82.5 min

8

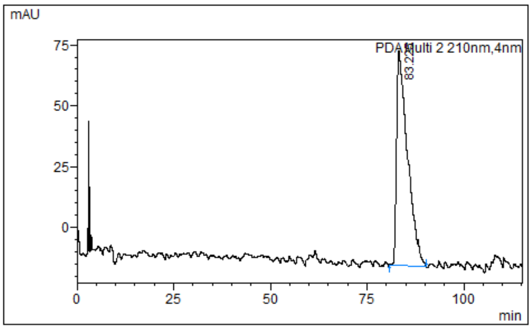


P4: 92.9 min

9

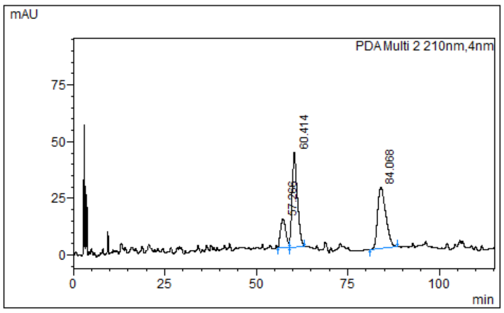
Peak	Ret. Time	Peak	Ret. Time
1 (11)	55.9 min	3 (8)	82.5 min
2 (10)	59.3 min	4 (9)	92.9 min

Diastereomeric enriched fraction **8**



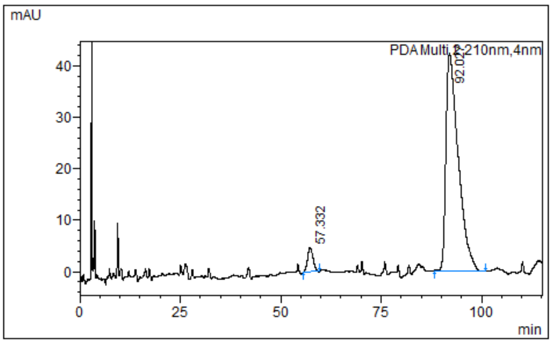
Peak	Ret. Time	Area %
1	83.2 min	100

Mix fraction **8**



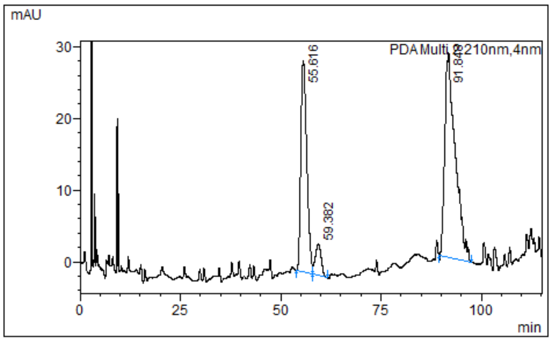
Peak	Ret. Time	Area %
1	57.3 min	13.3
2	60.4 min	42.7
3	84.1 min	44.0

Diastereomeric enriched fraction **9**



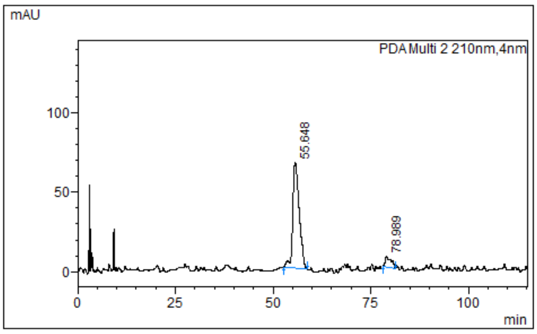
Peak	Ret. Time	Area %
1	57.3 min	4.7
2	92.0 min	95.3

Mix fraction **9**



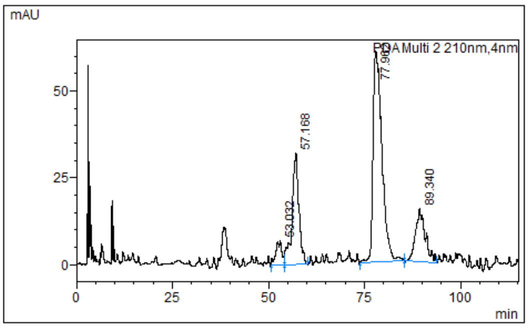
Peak	Ret. Time	Area %
1	55.6 min	35.3
2	59.4 min	5.0
3	91.8 min	59.7

Diastereomeric enriched fraction **11**



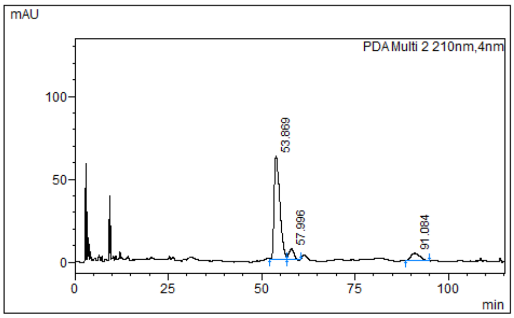
Peak	Ret. Time	Area %
1	55.6 min	92.0
2	79.0 min	8.0

Mix fraction **11**



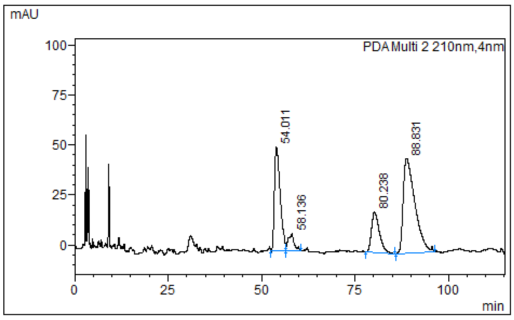
Peak	Ret. Time	Area %
1	53.0 min	4.3
2	57.2 min	23.1
3	78.0 min	56.9
4	89.3 min	15.6

Diastereomeric enriched fraction **10**



Peak	Ret. Time	Area %
1	53.9 min	83.5
2	58.0 min	6.9
3	91.0 min	9.6

Mix fraction **10**



Peak	Ret. Time	Area %
1	54.0 min	28.0
2	58.1 min	4.7
3	80.2 min	15.1
4	88.8 min	52.2

Figure S8. Analysis of the diastereomeric enrich fraction and the mix fraction obtained during Henry reaction by chiral HPLC.

2.5 Synthesis of halisphingosine A and isomers

GP 7: Reduction of the nitro group

To a solution of nitro alcohol (1.0 equiv.) in EtOAc (0.04 M) was added Zn (40 equiv.) followed by acetic acid (40 equiv.). The reaction mixture was stirred at r.t. for 30 min. Then the suspension was filtrated over a syringe filter (0.2 µm, PTFE) and rinsed with EtOAc. The combined organic layers were washed with sat. $NaHCO_3$ solution (2x) and brine, dried over Na_2SO_4, filtrated and evaporated to obtain the crude amino alcohol as colorless oil, which was used directly in the next step.

GP 8: TBS-deprotection

Variation A: The residue was dissolved in THF (0.04 M / based on nitro alcohol) and TBAF (2-5 equiv. / based on nitro alcohol, 1 M in THF) was added. The reaction mixture was stirred at r.t. for 3 to 40 h, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and concentrated. The crude residue was purified by column chromatography (0 to 20% then isocratic 20% MeOH in CH_2Cl_2) to yield the amino alcohol as oil [also referred to as conformer 1].

Variation B: The residue was dissolved in THF (0.04 M / based on nitro alcohol) and 4 Å molecular sieve (MS) followed by TBAF (2-5 equiv. / based on nitro alcohol, 1 M in THF) were added. The reaction mixture was stirred for 3 to 40 h, quenched by the addition of H_2O and extracted with EtOAc. The combined organic layers were washed with brine, dried over Na_2SO_4, filtrated and concentrated. The crude residue was purified by column chromatography (0 to 20% then isocratic 20% MeOH in CH_2Cl_2) to yield the amino alcohol as oil [also referred to as conformer 2].

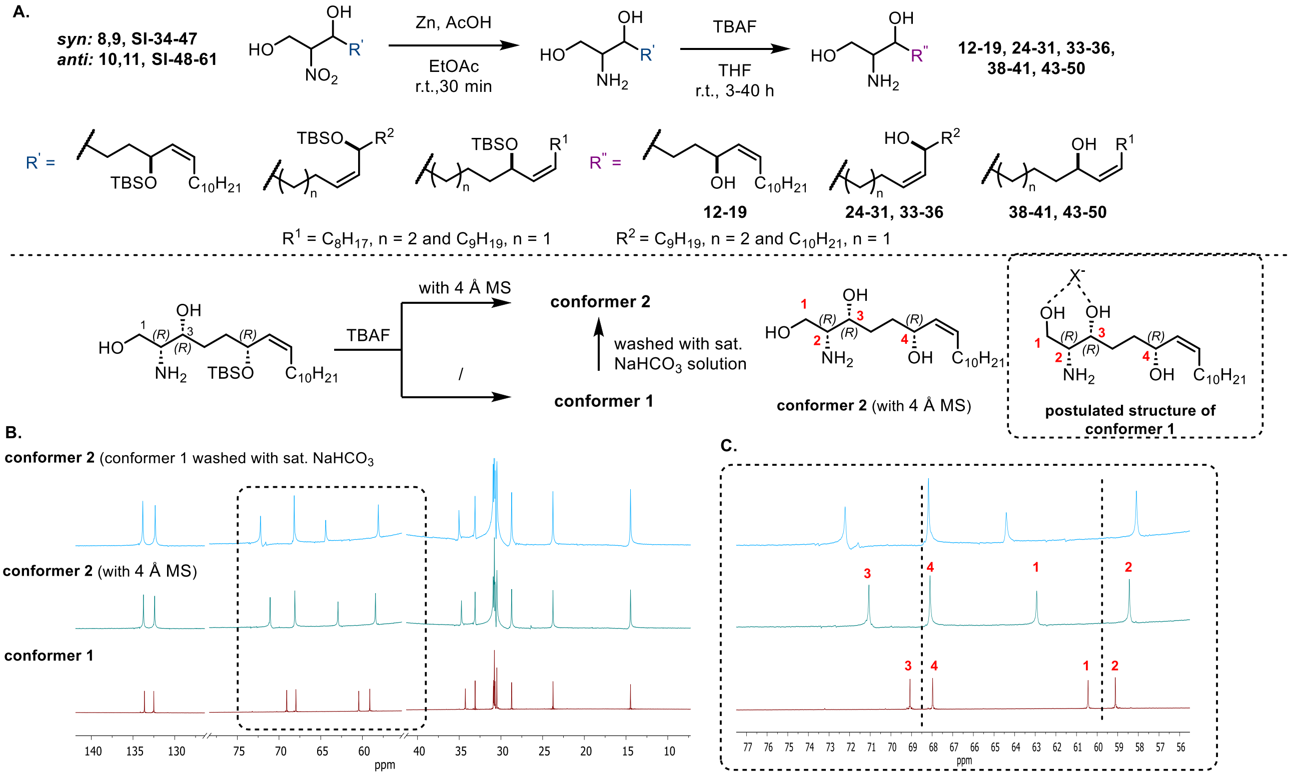
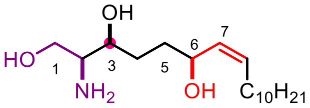
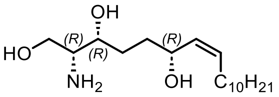


Figure S9. A) Overview of the reaction sequence of reduction and TBS deprotection. B-C) Representative ^{13}C-NMR spectra with zoom-ins (B) from 0 to 160 ppm and C) 55 to 75 ppm of stable conformer **1** and **2** obtained after TBS cleavage. Stable conformer 1 is presumable formed due to the formation of stable ammonium salt and intramolecular hydrogen bridges (variation A). Conformer 1 was transformable into stable conformer 2 by washing the product with sat. $NaHCO_3$ solution, which likely causes the release of the amine.

Total synthesis of Δ^7-C(6)-OH isomers 12-19



(2*R*,3*R*,6*R*,*Z*)-2-Aminooctadec-7-ene-1,3,6-triol 12



Nitro alcohol **8** (32.3 mg, 0.07 mmol, 1.0 equiv.), Zn (184 mg, 2.80 mmol, 40 equiv.) and AcOH (0.16 mL, 2.80 mmol, 40 equiv.) in EtOAc (1.8 mL) were used to obtain the crude protected amino alcohol (30.1 mg, 100%), as colorless oil. The residue was dissolved in THF (1.8 mL) and TBAF (0.14 mL, 0.14 mmol, 2.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 3 h to yield the amino alcohol **12** (12.7 mg, 57%, over 2 steps) as oil.

$[\alpha]_D^{22}$ = 11.4 (c = 0.02 MeOH) [Lit.: 11.6 (c = 0.1 MeOH)][23]

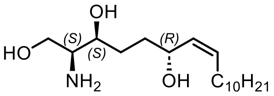
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.46 (dt, *J* = 11.1, 7.3 Hz, 1H), 5.37 (dd, *J* = 11.0, 8.8 Hz, 1H), 4.42 (td, *J* = 7.9, 4.7 Hz, 1H), 3.76 (dd, *J* = 11.7, 3.9 Hz, 1H), 3.69 (dt, *J* = 7.9, 3.8 Hz, 1H), 3.64 (dd, *J* = 11.8, 6.8 Hz, 1H), 3.04 (td, *J* = 6.8, 3.9 Hz, 1H), 2.18 – 2.00 (m, 2H), 1.78 – 1.68 (m, 1H), 1.67 – 1.56 (m, 1H), 1.56 – 1.46 (m, 2H), 1.42 – 1.21 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.6, 132.5, 69.1, 68.0, 60.4, 59.1, 34.3, 33.1, 30.9, 30.8, 30.8, 30.7, 30.5, 28.7, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3275 (br, w), 2921 (s), 2851 (m), 1459 (br, m), 1046 (br, s), 721 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2845.

(2*S*,3*S*,6*R*,*Z*)-2-Aminooctadec-7-ene-1,3,6-triol 13



Nitro alcohol **9** (92.4 mg, 0.20 mmol, 1.0 equiv.), Zn (526 mg, 8.04 mmol, 40 equiv.) and AcOH (0.46 mL, 8.04 mmol, 40 equiv.) in EtOAc (6.0 mL) were used to obtain the crude protected amino alcohol (83.4 mg, 97%), as colorless oil. The residue was dissolved in THF (6.0 mL) and TBAF (0.20 mL, 0.40 mmol, 2.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 3 h to yield the amino alcohol **13** (48.4 mg, 77%, over 2 steps) as oil.

$[\alpha]_D^{22}$ = 9.2 (c = 0.1 MeOH)

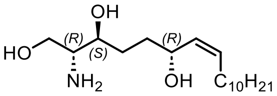
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.45 (dt, *J* = 11.1, 7.4 Hz, 1H), 5.34 (dd, *J* = 10.9, 8.8 Hz, 1H), 4.46 – 4.33 (m, 1H), 3.61 (dd, *J* = 10.9, 4.9 Hz, 1H), 3.56 – 3.51 (m, 1H), 3.47 (dd, *J* = 10.9, 6.7 Hz, 1H), 2.67 (dt, *J* = 6.7, 4.9 Hz, 1H), 2.19 – 2.01 (m, 2H), 1.69 – 1.53 (m, 3H), 1.50 – 1.42 (m, 1H), 1.41 – 1.22 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.8, 132.4, 72.4, 68.4, 64.5, 58.0, 35.1, 33.1, 31.0, 30.9, 30.8, 30.7, 30.5, 28.7, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3244 (br, m), 2917 (s), 2849 (m), 1666 (m), 1581 (m), 1465 (m), 1059 (s), 1029 (m), 1009 (m), 988 (m), 963 (m), 851 (m), 717 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2841.

(*2R*,3*S*,6*R*,*Z*)-2-Aminooctadec-7-ene-1,3,6-triol 14



Nitro alcohol **10** (29.5 mg, 0.06 mmol, 1.0 equiv.), Zn (167 mg, 2.56 mmol, 40 equiv.) and AcOH (0.15 mL, 2.56 mmol, 40 equiv.) in EtOAc (2.0 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. To a solution of residue in THF (2.0 mL) were added 4 Å powdered MS (125 mg) and TBAF (0.13 mL, 0.13 mmol, 2.0 equiv., 1 M in THF). The reaction mixture was stirred for 3 h to yield the amino alcohol **14** (14.9 mg, 74%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 22.1 (c = 0.1 MeOH)

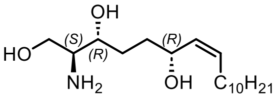
^{1}H-NMR (500 MHz, CD$_3$OD) δ = 5.46 (dt, *J* = 11.0, 7.3 Hz, 1H), 5.40 – 5.31 (m, 1H), 4.40 (dt, *J* = 8.9, 6.2 Hz, 1H), 3.78 (dd, *J* = 11.3, 4.0 Hz, 1H), 3.67 (dt, *J* = 9.2, 3.7 Hz, 1H), 3.61 (dd, *J* = 11.3, 8.3 Hz, 1H), 3.02 (dt, *J* = 8.4, 4.2 Hz, 1H), 2.17 – 2.00 (m, 2H), 1.72 – 1.60 (m, 2H), 1.60 – 1.49 (m, 1H), 1.49 – 1.41 (m, 1H), 1.41 – 1.22 (m, 16H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD$_3$OD) δ = 133.7, 132.5, 71.9, 68.3, 60.9, 58.3, 35.2, 33.1, 30.9, 30.8, 30.7, 30.5, 30.3, 28.7, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3312 (br, m), 2920 (s), 2851 (m), 1618 (w), 1465 (m), 1379 (w), 1046 (m, br), 720 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2845.

(*2S,3R,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol 15



Nitro alcohol **11** (21.8 mg, 0.05 mmol, 1.0 equiv.), Zn (123 mg, 1.88 mmol, 40 equiv.) and AcOH (0.11 mL, 1.88 mmol, 40 equiv.) in EtOAc (2.0 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. To a solution of residue in THF (2.0 mL) were added 4 Å powdered MS (93 mg) and TBAF (0.09 mL, 0.09 mmol, 2.0 equiv., 1 M in THF). The reaction mixture was stirred for 3 h to yield the amino alcohol **15** (12.0 mg, 81%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 14.8 (c = 0.1 MeOH)

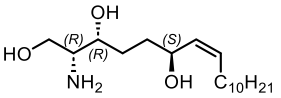
^{1}H-NMR (500 MHz, CD$_3$OD) δ = 5.45 (dt, *J* = 11.0, 7.3 Hz, 1H), 5.40 – 5.32 (m, 1H), 4.45 – 4.37 (m, 1H), 3.76 (dd, *J* = 11.1, 4.1 Hz, 1H), 3.62 (dt, *J* = 8.8, 4.1 Hz, 1H), 3.55 (dd, *J* = 11.1, 8.0 Hz, 1H), 2.90 (dt, *J* = 8.5, 4.5 Hz, 1H), 2.18 – 2.00 (m, 2H), 1.79 – 1.70 (m, 1H), 1.62 – 1.43 (m, 3H), 1.40 – 1.23 (m, 16H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD$_3$OD) δ = 133.8, 132.4, 72.5, 68.1, 62.2, 58.2, 35.0, 33.1, 30.9, 30.8, 30.7, 30.5, 30.2, 28.7, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3300 (br, m), 2919 (s), 2850 (m), 1620 (w), 1557 (w), 1464 (m), 1320 (w), 1053 (m), 999 (m), 720 (w), 586 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2844.

(2*R*,3*R*,6*S*,*Z*)-2-Aminooctadec-7-ene-1,3,6-triol 16



Nitro alcohol **SI-35** (20.0 mg, 0.04 mmol, 1.0 equiv.), Zn (115 mg, 1.76 mmol, 40 equiv.) and AcOH (0.10 mL, 1.76 mmol, 40 equiv.) in EtOAc (1.0 mL) were used to obtain the crude protected amino alcohol (17.2 mg, 91%), as colorless oil. To a solution of amino alcohol (16.8 mg, 0.0.39 mmol, 1.0 equiv.) in THF (1.0 mL) were added 4 Å powdered MS (73 mg) and TBAF (0.08 mL, 0.08 mmol, 2.0 equiv., 1 M in THF). The reaction mixture was stirred for 1 h to yield the amino alcohol **16** (10.5 mg, 85%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = -10.6 (c = 0.1 MeOH)

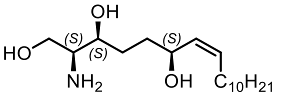
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.53 – 5.44 (m, 1H), 5.37 (ddt, *J* = 10.5, 8.7, 1.5 Hz, 1H), 4.48 – 4.37 (m, 1H), 3.64 (dd, *J* = 10.9, 4.9 Hz, 1H), 3.59 – 3.53 (m, 1H), 3.50 (dd, *J* = 10.9, 6.6 Hz, 1H), 2.70 (dt, *J* = 6.6, 4.9 Hz, 1H), 2.23 – 2.02 (m, 2H), 1.68 – 1.56 (m, 3H), 1.48 – 1.26 (m, 17H), 0.98 – 0.89 (m, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.8, 132.4, 72.5, 68.4, 64.7, 64.6, 58.0, 35.1, 33.1, 31.0, 30.9, 30.8, 30.7, 30.5, 28.7, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3248 (br, m), 2919 (s), 2850 (s), 1570 (m), 1465 (m), 1059 (m), 1031 (m), 989 (w), 718 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ [M+H]$^+$ 316.2846, found 316.2845.

(2*S*,3*S*,6*S*,*Z*)-2-Aminooctadec-7-ene-1,3,6-triol 17



Nitro alcohol **SI-34** (30.4 mg, 0.07 mmol, 1.0 equiv.), Zn (173 mg, 2.64 mmol, 40 equiv.) and AcOH (0.15 mL, 2.64 mmol, 40 equiv.) in EtOAc (2.8 mL) were used to obtain the crude protected amino alcohol (27.7 mg, 98%), as colorless oil. To a solution of residue in THF (2.8 mL) were added 4 Å powdered MS (129 mg) and TBAF (0.13 mL, 0.13 mmol, 2.0 equiv., 1 M in THF). The reaction mixture was stirred for 3 h to yield the amino alcohol **17** (16.4 mg, 79%, over 2 steps) as oil.

$[\alpha]_D^{22}$ = -17,2 (c = 0.1 MeOH)

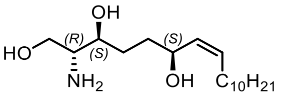
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.48 (dt, *J* = 11.1, 7.3 Hz, 1H), 5.43 – 5.33 (m, 1H), 4.49 – 4.38 (m, 1H), 3.69 (dd, *J* = 11.2, 4.5 Hz, 1H), 3.65 – 3.58 (m, 1H), 3.56 (dd, *J* = 11.2, 6.7 Hz, 1H), 2.86 – 2.78 (m, 1H), 2.21 – 2.04 (m, 2H), 1.81 – 1.69 (m, 1H), 1.66 – 1.47 (m, 3H), 1.46 – 1.24 (m, 16H), 0.92 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.8, 132.4, 71.2, 68.1, 63.2, 58.4, 34.8, 33.1, 30.9, 30.8, 30.8, 30.7, 30.5, 30.5, 28.7, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3350 (br, w), 2918 (s), 2850 (m), 1468 (m), 1052 (m), 718 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ [M+H]$^+$ 316.2846, found 316.2844.

(2*R*,3*S*,6*S*,*Z*)-2-Aminooctadec-7-ene-1,3,6-triol 18



Nitro alcohol **SI-49** (24.9 mg, 0.05 mmol, 1.0 equiv.), Zn (142 mg, 2.17 mmol, 40 equiv.) and AcOH (0.12 mL, 2.17 mmol, 40 equiv.) in EtOAc (1.4 mL) were used to obtain the crude protected amino alcohol (22.8 mg, 98%), as colorless oil. The residue was dissolved in THF (1.4 mL) and TBAF (0.11 mL, 0.11 mmol, 2.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 3 h to yield the amino alcohol **18** (10.4 mg, 61%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = -13.6 (c = 0.02 MeOH)

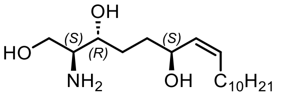
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.46 (dt, *J* = 10.8, 7.4 Hz, 1H), 5.36 (dd, *J* = 11.0, 8.6 Hz, 1H), 4.49 – 4.36 (m, 1H), 3.86 – 3.75 (m, 2H), 3.70 (dd, *J* = 11.5, 8.5 Hz, 1H), 3.20 (dt, *J* = 8.2, 4.0 Hz, 1H), 2.19 – 2.00 (m, 2H), 1.81 – 1.69 (m, 1H), 1.59 – 1.51 (m, 1H), 1.51 – 1.43 (m, 1H), 1.42 – 1.22 (m, 17H), 0.89 (t, *J* = 6.7 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.6, 132.6, 70.2, 67.9, 58.9, 58.4, 35.0, 33.1, 30.9, 30.8, 30.7, 30.5, 30.1, 28.7, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3304 (br, m), 2918 (s), 2849 (s), 1620 (w), 1557 (w), 1464 (m), 1379 (m), 1321 (w), 1055 (m), 999 (m), 820 (w), 633 (m), 589 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2842.

(2*S*,3*R*,6*S*,*Z*)-2-Aminooctadec-7-ene-1,3,6-triol 19



Nitro alcohol **SI-48** (29.8 mg, 0.07 mmol, 1.0 equiv.), Zn (170 mg, 2.59 mmol, 40 equiv.) and AcOH (0.15 mL, 2.59 mmol, 40 equiv.) in EtOAc (1.6 mL) were used to obtain the crude protected amino alcohol (27.9 mg, 100%), as colorless oil. The residue was dissolved in THF (1.6 mL) and TBAF (0.13 mL, 0.13 mmol, 2.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 3 h to yield the amino alcohol **19** (14.2 mg, 69%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = -15.5 (c = 0.1 MeOH)

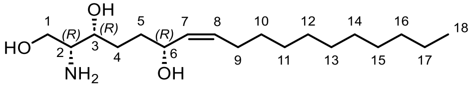
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.46 (dt, *J* = 11.8, 7.3 Hz, 1H), 5.40 – 5.30 (m, 1H), 4.41 (dt, *J* = 9.0, 5.9 Hz, 1H), 3.83 (dd, *J* = 11.5, 4.1 Hz, 1H), 3.80 – 3.74 (m, 1H), 3.70 (dd, *J* = 11.6, 8.8 Hz, 1H), 3.21 (dt, *J* = 8.3, 3.9 Hz, 1H), 2.19 – 1.99 (m, 2H), 1.74 – 1.57 (m, 2H), 1.57 – 1.50 (m, 1H), 1.49 – 1.42 (m, 1H), 1.41 – 1.21 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}c-NMR (126 MHz, CD_3OD) δ = 133.6, 132.6, 70.5, 68.2, 58.8, 58.4, 35.2, 33.1, 30.9, 30.8, 30.7, 30.5, 30.3, 28.7, 23.7, 14.5 ppm.

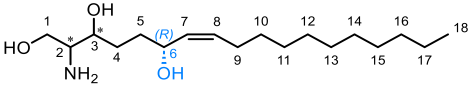
IR (ATR) $\tilde{\upsilon}$ = 3306 (br, w), 2919 (s), 2850 (m), 1620 (w), 1557 (w), 1465 (m), 1385 (w), 1037 (m), 644 (m) cm-^{1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2843.

Table S1. NMR comparison of isolated and synthesized halisphingosine A (Δ^7-*R*-C(6)-OH) (500 MHz, 126 MHz, CD_3OD).



proposed structure of isolated product



synthesized

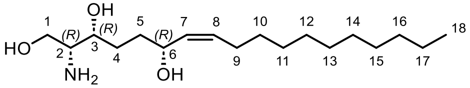
N°	isolated[a]		2*R*,3*R*,6*R*,*Z*-12[b]		2*S*,3*S*,6*R*,*Z*-13[c]		2*R*,3*S*,6*R*,*Z*-14[c]		2*S*,3*R*,6*R*,*Z*-15[c]	
	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]
1	60.9	3.74 (dd, 11.4, 4.5 Hz)	60.4	3.76 (dd, 11.7, 7.3 Hz)	64.5	3.61 (dd, 10.9, 4.9 Hz)	60.9	3.78 (dd, 11.3, 4.0 Hz)	62.2	3.76 (dd, 11.1, 4.1 Hz)
		3.62 (dd, 11.5, 7.0 Hz)		3.64 (dd, 11.8. 6.8 Hz)		3.47 (dd, 10.9, 6.7 Hz)		3.61 (dd, 11.3, 8.3 Hz)		3.55 (dd, 11.1, 8.0 Hz)
2	59.0	2.99 (dt, 7.0, 4.5 Hz)	59.1	3.04 (td, 6.8, 3.9 Hz)	58.0	2.67 (td, 6.7, 4.9 Hz)	58.2	3.02 (dt, 8.4, 4.2 Hz)	58.2	2.90 (dt, 8.5, 4.5 Hz)
3	69.3	3.64 (m)	69.0	3.69 (dt, 7.9, 3.8 Hz)	72.4	3.52 (m)	71.9	3.67 (dt, 9.2, 3.7 Hz)	72.5	3.62 (dt, 8.8, 4.1 Hz)
4	35.0	1.52 (m)	30.7	1.62 (m)	30.7	1.60 (m)	30.3	1.64 (m)	30.2	1.52 (m)
		1.42 (m)		1.53 (m)		1.45 (m)		1.45 (m)		
5	38.7	1.55 (m)	34.3	1.73 (m)	35.1	1.60 (m)	35.2	1.64 (m)	35.0	1.74 (m)
		1.35 (m)		1.53 (m)				1.54 (m)		1.52 (m)
6	68.2	4.35 (m)	68.0	4.42 (td, 7.9, 4.7 Hz)	68.4	4.39 (m)	68.3	4.40 (td, 8.9, 6.2 Hz)	68.1	4.41 (m)
7	134.0	5.31 (dd, 11.0, 9.0 Hz)	133.6	5.37 (dd, 11.0, 8.8 Hz)	133.8	5.34 (dd, 10.9, 8.8 Hz)	133.7	5.36 (m)	133.8	5.36 (m)
8	132.2	5.44 (dt, 11.0, 7.5 Hz)	132.5	5.46 (dt, 11.1, 7.3 Hz)	132.4	5.45 (dt, 11.1, 7.4 Hz)	132.5	5.46 (dt, 11.0, 7.3 Hz)	132.4	5.45 (dt, 11.0, 7.3 Hz)
9	28.7	2.08 (m)	28.7	2.10 (m)	28.7	2.09 (m)	28.7	2.09 (m)	28.7	2.09 (m)
10-16	26.3–32.9	1.28–1.37 (m)	30.5–33.1	1.23–1.41 (m)	30.5–33.1	1.24–1.39 (m)	30.5–33.1	1.22–1.41 (m)	30.5–33.1	1.23–1.40
17	23.7	1.28–1.37 (m)	23.8	1.23–1.41 (m)	23.8	1.24–1.39 (m)	23.8	1.22–1.41 (m)	23.8	1.23–1.40
18	14.1	0.90 (t, 7.0 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.9 Hz)	14.5	0.89 (t, 6.9 Hz)

[a] Mansoor, T. A.; Park, T.; Luo, X.; Hong, J.; Lee, C. O.; Jung, J. H. A new sphingosine from a marine sponge *Haliclona* (*Reniera*) sp. *Natural Product Sciences* **2007**, *13* (3), 247–250.

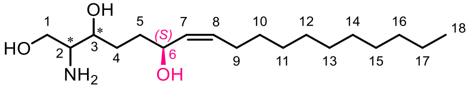
[b] NMR data of conformer 1 (Figure S9)

[c] NMR data of conformer 2 (Figure S9)

Table S2. NMR comparison of isolated and synthesized halisphingosine A (Δ^7-*S*-C(6)-OH) (500 MHz, 126 MHz, CD$_3$OD).



proposed structure of isolated product

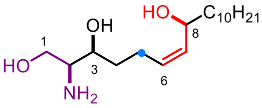


synthesized

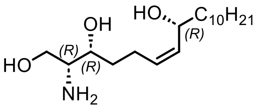
N°	isolated[a]		2*R*,3*R*,6*S*,*Z*-16[c]		2*S*,3*S*,6*S*,*Z*-17[c]		2*R*,3*S*,6*S*,*Z*-18[b]		2*S*,3*R*,6*S*,*Z*-19[b]	
	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]
1	60.9	3.74 (dd, 11.4, 4.5 Hz)	64.6	3.60 (dd, 10.9, 4.9 Hz)	63.2	3.66 (dd, 11.2, 4.5 Hz)	58.9	3.81 (m)	58.8	3.83 (dd, 11.5, 4.1 Hz)
		3.62 (dd, 11.5, 7.0 Hz)		3.47 (dd, 10.8, 6.7 Hz)		3.53 (dd, 11.2, 6.7 Hz)		3.70 (dd, 11.5, 8.5 Hz)		3.70 (dd, 11.6, 8.8 Hz)
2	59.0	2.99 (dt, 7.0, 4.5 Hz)	58.0	2.66 (m)	58.4	2.79 (m)	58.4	3.20 (dt, 8.2, 4,0 Hz)	58.4	3.21 (dt, 8.3, 3,9 Hz)
3	69.3	3.64 (m)	72.5	3.52 (m)	71.2	3.58 (m)	70.2	3.81 (m)	70.5	3.78 (m)
4	35.0	1.52 (m)	30.7	1.60 (m)	30.5	1.53 (m)	30.1	1.54 (m)	30.3	1.64 (m)
		1.42 (m)		1.45 (m)				1.22-1.42 (m)		1.46 (m)
5	38.7	1.55 (m)	35.1	1.60 (m)	34.8	1.72 (m)	35.0	1.73 (m)	35.2	1.64 (m)
		1.35 (m)				1.53 (m)		1.47 (m)		1.53 (m)
6	68.2	4.35 (m)	68.4	4.39 (m)	68.1	4.41 (m)	67.9	4.42 (m)	68.2	4.41 (dt, 9.0, 5.9 Hz)
7	134.0	5.31 (dd, 11.0, 9.0 Hz)	133.8	5.34 (dd, 11.0, 8.9 Hz)	133.8	5.36 (m)	133.6	5.36 (dd, 11.0, 8.6 Hz)	133.6	5.36 (m)
8	132.2	5.44 (dt, 11.0, 7.5 Hz)	132.4	5.45 (dt, 11.2, 7.4 Hz)	132.4	5.45 (dt, 11.1, 7.3 Hz)	132.6	5.46 (dt, 10.8, 7.4 Hz)	132.6	5.46 (dt, 11.8, 7.3 Hz)
9	28.7	2.08 (m)	28.7	2.08 (m)	28.7	2.13 (m)	28.7	2.09 (m)	28.7	2.08 (m)
10-16	26.3–32.9	1.28–1.37 (m)	30.5–33.1	1.23–1.48 (m)	30.5–33.1	1.21–1.43 (m)	30.5–33.1	1.22-1.42 (m)	30.5–33.1	1.21–1.41 (m)
17	23.7	1.28–1.37 (m)	23.8	1.23–1.48 (m)	23.8	1.21–1.43 (m)	23.8	1.22-1.42 (m)	23.7	1.21–1.41 (m)
18	14.1	0.90 (t, 7.0 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.9 Hz)	14.5	0.89 (t, 6.7 Hz)	14.5	0.89 (t, 6.8 Hz)

[a] Mansoor, T. A.; Park, T.; Luo, X.; Hong, J.; Lee, C. O.; Jung, J. H. A new sphingosine from a marine sponge *Haliclona* (*Reniera*) sp. *Natural Product Sciences* **2007**, *13* (3), 247–250.
[b] NMR data of conformer 1 (Figure S9)
[c] NMR data of conformer 2 (Figure S9)

Total synthesis of Δ^6-C(8)-OH Isomers 24-31



(*2R,3R,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol 24



Nitro alcohol **SI-36** (33.8 mg, 0.07 mmol, 1.0 equiv.), Zn (192 mg, 2.94 mmol, 40 equiv.) and AcOH (0.17 mL, 2.94 mmol, 40 equiv.) in EtOAc (1.8 mL) were used to obtain the crude protected amino alcohol (31.8 mg, quant.), as colorless oil. The residue was dissolved in THF (1.8 mL) and TBAF (0.37 mL, 0.37 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 18 h to yield the amino alcohol **24** (20.1 mg, 87%, over 2 steps) as oil.

$[\alpha]_D^{22}$ = 20.3 (c = 0.07 MeOH)

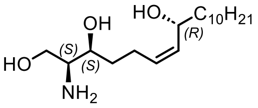
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.49 (dt, *J* = 10.6, 7.3 Hz, 1H), 5.42 – 5.33 (m, 1H), 4.45 – 4.32 (m, 1H), 3.77 (dd, *J* = 11.8, 4.1 Hz, 1H), 3.74 – 3.67 (m, 1H), 3.65 (dd, *J* = 11.7, 6.7 Hz, 1H), 3.06 (dt, *J* = 6.7, 3.9 Hz, 1H), 2.43 – 2.31 (m, 1H), 2.19 – 2.08 (m, 1H), 1.70 – 1.59 (m, 1H), 1.59 – 1.49 (m, 2H), 1.44 – 1.35 (m, 1H), 1.36 – 1.21 (m, 16H), 0.89 (t, *J* = 6.7 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 134.7, 131.2, 68.7, 68.2, 60.5, 59.0, 38.8, 34.9, 33.1, 30.8, 30.8, 30.8, 30.5, 26.5, 24.6, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3290 (br, m), 2922 (s), 2852 (s), 2454 (br, w), 1457 (m), 1010 (br, m), 721 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2846.

(*2S,3S,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol 25



Nitro alcohol **SI-38** (40.5 mg, 0.09 mmol, 1.0 equiv.), Zn (230 mg, 3.52 mmol, 40 equiv.) and AcOH (0.20 mL, 3.52 mmol, 40 equiv.) in EtOAc (2.2 mL) were used to obtain the crude protected amino alcohol (38.0 mg, quant.), as colorless oil. To a solution of the residue in THF (2.2 mL) were added 4 Å powdered MS (165 mg) and TBAF (0.44 mL, 0.44 mmol, 5.0 equiv., 1 M in THF). The reaction mixture was stirred for 20 h to yield the amino alcohol **25** (19.8 mg, 71%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 18.4 (c = 0.1 MeOH)

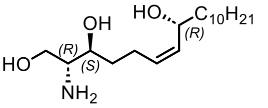
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.53 – 5.42 (m, 1H), 5.36 (dd, *J* = 10.9, 8.8 Hz, 1H), 4.47 – 4.34 (m, 1H), 3.62 (dd, *J* = 10.9, 4.9 Hz, 1H), 3.57 (dt, *J* = 9.0, 4.6 Hz, 1H), 3.49 (dd, *J* = 10.9, 6.6 Hz, 1H), 2.69 (dt, *J* = 6.5, 4.9 Hz, 1H), 2.34 – 2.24 (m, 1H), 2.24 – 2.14 (m, 1H), 1.63 – 1.49 (m, 3H), 1.43 – 1.36 (m, 1H), 1.34 – 1.21 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 134.6, 131.7, 71.3, 68.1, 64.3, 58.1, 38.6, 34.7, 33.1, 30.8, 30.8, 30.5, 26.6, 25.0, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3496 (w), 3394 (w), 3310 (w), 2915 (s), 2848 (s), 1578 (w), 1467 (w), 1318 (w), 1069 (m), 1026 (s), 989 (m), 876 (s), 750 (s), 594 (w), 528 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2847.

(*2R,3S,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol 26



Nitro alcohol **SI-50** (33.3 mg, 0.07 mmol, 1.0 equiv.), Zn (174 mg, 2.90 mmol, 40 equiv.) and AcOH (0.17 mL, 2.90 mmol, 40 equiv.) in EtOAc (1.8 mL) were used to obtain the crude protected amino alcohol (30.5 mg, 98%), as colorless oil. To a solution of the residue in THF (1.8 mL) were added 4 Å powdered MS (135 mg) and TBAF (0.36 mL, 0.36 mmol, 5.0 equiv., 1 M in THF). The reaction mixture was stirred for 20 h to yield the amino alcohol **26** (15.2 mg, 67%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 21.6 (c = 0.1 MeOH)

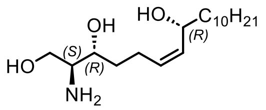
^{1}H-NMR (500 MHz, CD$_3$OD) δ = 5.52 – 5.41 (m, 1H), 5.41 – 5.31 (m, 1H), 4.39 (dt, *J* = 9.2, 6.3 Hz, 1H), 3.76 (dd, *J* = 11.1, 4.1 Hz, 1H), 3.64 – 3.57 (m, 1H), 3.54 (dd, *J* = 11.1, 7.8 Hz, 1H), 2.87 (dt, *J* = 8.6, 4.6 Hz, 1H), 2.35 – 2.16 (m, 2H), 1.65 – 1.45 (m, 3H), 1.44 – 1.35 (m, 1H), 1.34 – 1.21 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD$_3$OD) δ = 134.8, 131.5, 71.8, 68.1, 62.6, 58.4, 38.7, 34.0, 33.1, 30.8, 30.8, 30.5, 26.5, 25.0, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\nu}$ = 3295 (br, m), 2921 (s), 2852 (s), 1558 (w), 1457 (m), 1050 (br, m), 720 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2846.

(2*S*,3*R*,8*R*,*Z*)-2-Aminooctadec-6-ene-1,3,8-triol 27



Nitro alcohol **SI-52** (31.9 mg, 0.07 mmol, 1.0 equiv.), Zn (182 mg, 2.78 mmol, 40 equiv.) and AcOH (0.16 mL, 2.78 mmol, 40 equiv.) in EtOAc (1.7 mL) were used to obtain the crude protected amino alcohol (30.6 mg, quant.), as colorless oil. To a solution of the residue in THF (1.7 mL) were added 4 Å powdered MS (130 mg) and TBAF (0.35 mL, 0.35 mmol, 5.0 equiv., 1 M in THF). The reaction mixture was stirred for 20 h to yield the amino alcohol **27** (15.0 mg, 69%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 24.4 (c = 0.1 MeOH)

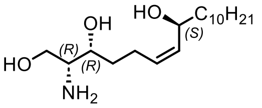
^{1}H-NMR (500 MHz, CD$_3$OD) δ = 5.54 – 5.43 (m, 1H), 5.41 – 5.29 (m, 1H), 4.45 – 4.32 (m, 1H), 3.75 (dd, *J* = 11.0, 4.1 Hz, 1H), 3.59 (dt, *J* = 9.0, 4.3 Hz, 1H), 3.52 (dd, *J* = 11.0, 7.8 Hz, 1H), 2.84 (dt, *J* = 8.4, 4.6 Hz, 1H), 2.39 – 2.30 (m, 1H), 2.16 – 2.03 (m, 1H), 1.68 – 1.46 (m, 3H), 1.43 – 1.34 (m, 1H), 1.35 – 1.20 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD$_3$OD) δ = 134.5, 131.5, 72.6, 68.2, 62.9, 58.1, 38.7, 34.3, 33.1, 30.8, 30.8, 30.5, 26.5, 25.2, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\nu}$ = 3288 (br, m), 2921 (s), 2852 (s), 1457 (w), 1047 (br, m), 721 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2846.

(2*R*,3*R*,8*S*,*Z*)-2-Aminooctadec-6-ene-1,3,8-triol 28



Nitro alcohol **SI-39** (25.2 mg, 0.05 mmol, 1.0 equiv.), Zn (143 mg, 2.19 mmol, 40 equiv.) and AcOH (0.13 mL, 2.19 mmol, 40 equiv.) in EtOAc (1.8 mL) were used to obtain the crude protected amino alcohol (quant.), as oil. The residue was dissolved in THF (1.8 mL) and TBAF (0.27 mL, 0.27 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 20 h to yield the amino alcohol **28** (12.5 mg, 72%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = -18.4 (c = 0.09 MeOH)

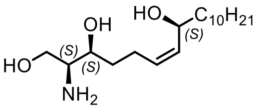
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.53 – 5.43 (m, 1H), 5.39 (dd, *J* = 10.9, 8.9 Hz, 1H), 4.39 (dt, *J* = 8.8, 6.4 Hz, 1H), 3.77 (dd, *J* = 11.7, 4.0 Hz, 1H), 3.74 – 3.66 (m, 1H), 3.65 (dd, *J* = 11.7, 6.7 Hz, 1H), 3.05 (dt, *J* = 6.8, 3.9 Hz, 1H), 2.40 – 2.27 (m, 1H), 2.27 – 2.15 (m, 1H), 1.69 – 1.47 (m, 3H), 1.44 – 1.36 (m, 1H), 1.35 – 1.21 (m, 16H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}72-NMR (126 MHz, CD_3OD) δ = 135.0, 131.4, 68.3, 68.1, 60.4, 59.2, 38.7, 34.6, 33.1, 30.8, 30.5, 26.5, 24.5, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3499 (w), 3400 (w), 3364 (w), 2915 (s), 2849 (s), 1577 (w), 1467 (w), 1318 (w), 1069 (m), 1024 (m), 991 (w), 876 (m), 750 (m), 530 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2841.

(2*S*,3*S*,8*S*,*Z*)-2-Aminooctadec-6-ene-1,3,8-triol 29



Nitro alcohol **SI-37** (22.6 mg, 0.05 mmol, 1.0 equiv.), Zn (129 mg, 1.97 mmol, 40 equiv.) and AcOH (0.11 mL, 1.97 mmol, 40 equiv.) in EtOAc (1.3 mL) were used to obtain the crude protected amino alcohol (21.4 mg, quant.), as colorless oil. To a solution of the residue in THF (1.3 mL) were added 4 Å powdered MS (104 mg) and TBAF (0.25 mL, 0.25 mmol, 5.0 equiv., 1 M in THF). The reaction mixture was stirred for 20 h to yield the amino alcohol **29** (10.0 mg, 65%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = -32.5 (c = 0.1 MeOH)

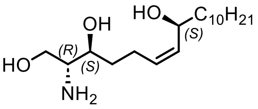
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.48 (dt, *J* = 10.8, 7.5 Hz, 1H), 5.39 – 5.29 (m, 1H), 4.44 – 4.35 (m, 1H), 3.62 (dd, *J* = 10.9, 5.0 Hz, 1H), 3.57 (dt, *J* = 8.9, 4.5 Hz, 1H), 3.49 (dd, *J* = 10.9, 6.5 Hz, 1H), 2.73 – 2.66 (m, 1H), 2.39 – 2.27 (m, 1H), 2.17 – 2.06 (m, 1H), 1.65 – 1.48 (m, 3H), 1.44 – 1.35 (m, 1H), 1.35 – 1.20 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 134.4, 131.6, 71.6, 68.2, 64.3, 57.9, 38.7, 34.9, 33.1, 30.8, 30.8, 30.5, 26.5, 25.2, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3276 (br, m), 2921 (s), 2852 (s), 1558 (w), 1457 (w), 1049 (br, m), 720 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2842.

(*2R,3S,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol 30



Nitro alcohol **SI-53** (23.0 mg, 0.05 mmol, 1.0 equiv.), Zn (131 mg, 2.00 mmol, 40 equiv.) and AcOH (0.11 mL, 2.00 mmol, 40 equiv.) in EtOAc (1.7 mL) were used to obtain the crude protected amino alcohol (21.9 mg, quant.), as oil. The residue was dissolved in THF (1.7 mL) and TBAF (0.25 mL, 0.25 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 20 h to yield the amino alcohol **30** (12.2 mg, 77%, over 2 steps) as oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{20}}$ = -21.4 (c = 0.1 MeOH)

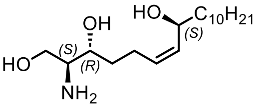
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.49 (dt, *J* = 10.7, 7.4 Hz, 1H), 5.43 – 5.32 (m, 1H), 4.44 – 4.34 (m, 1H), 3.83 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.81 – 3.75 (m, 1H), 3.70 (dd, *J* = 11.5, 8.5 Hz, 1H), 3.22 (dt, *J* = 8.5, 4.1 Hz, 1H), 2.44 – 2.32 (m, 1H), 2.19 – 2.07 (m, 1H), 1.61 – 1.49 (m, 3H), 1.45 – 1.36 (m, 1H), 1.36 – 1.20 (m, 16H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 134.8, 131.0, 69.8, 68.2, 58.9, 58.3, 38.8, 34.1, 33.1, 30.8, 30.5, 26.5, 25.2, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3289 (br, m), 2921 (s), 2851 (s), 1559 (w), 1457 (m), 1051 (br, m), 721 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2844.

(2*S*,3*R*,8*S*,*Z*)-2-Aminooctadec-6-ene-1,3,8-triol 31



Nitro alcohol **SI-51** (29.7 mg, 0.07 mmol, 1.0 equiv.), Zn (170 mg, 2.60 mmol, 40 equiv.) and AcOH (0.15 mL, 2.60 mmol, 40 equiv.) in EtOAc (2.2 mL) were used to obtain the crude protected amino alcohol (quant.), as oil. The residue was dissolved in THF (2.2 mL) and TBAF (0.33 mL, 0.33 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 20 h to yield the amino alcohol **31** (14.7 mg, 72%, over 2 steps) as oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = -20.2 (c = 0.1 MeOH)

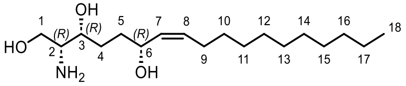
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.53 – 5.42 (m, 1H), 5.39 (dd, *J* = 10.8, 8.7 Hz, 1H), 4.39 (dt, *J* = 8.7, 6.3 Hz, 1H), 3.88 – 3.80 (m, 2H), 3.70 (dd, *J* = 11.6, 8.5 Hz, 1H), 3.21 (dt, *J* = 8.3, 4.0 Hz, 1H), 2.42 – 2.19 (m, 2H), 1.66 – 1.48 (m, 3H), 1.45 – 1.35 (m, 1H), 1.35 – 1.21 (m, 16H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 135.1, 131.1, 69.3, 68.1, 59.0, 58.6, 38.7, 33.8, 33.1, 30.8, 30.7, 30.5, 26.5, 25.0, 23.7, 14.5 ppm.

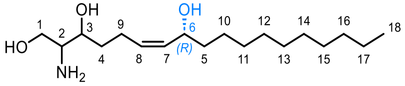
IR (ATR) $\tilde{\upsilon}$ = 3340 (br, m), 2916 (s), 2849 (s), 1570 (w), 1458 (m), 1053 (br, m), 745 (w), 720 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2842.

Table S3. NMR comparison of isolated halisphingosine A and regioisomers Δ^6-*R*-C(8)-OH (500 MHz, 126 MHz, CD_3OD).



proposed structure of isolated product



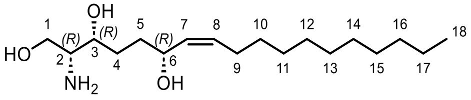
N°	**isolated**[a]		**2*R*,3*R*,8*R*,*Z*-24**[b]		**2*S*,3*S*,8*R*,*Z*-25**[c]		**2*R*,3*S*,8*R*,*Z*-26**[c]		**2*S*,3*R*,8*R*,*Z*-27**[c]	
	δ C [ppm]	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**
1	60.9	3.74 (dd, 11.4, 4.5 Hz)	60.5	3.77 (dd, 11.8, 4.1 Hz)	64.3	3.62 (dd, 10.9, 4.9 Hz)	62.6	3.76 (dd, 11.1, 4.1 Hz)	62.9	3.75 (dd, 11.0, 4.1 Hz)
		3.62 (dd, 11.5, 7.0 Hz)		3.65 (dd, 11.7, 6.7 Hz)		3.49 (dd, 10.9, 6.6 Hz)		3.54 (dd, 11.1, 7.8 Hz)		3.52 (dd, 11.0, 7.8 Hz)
2	59.0	2.99 (dt, 7.0, 4.5 Hz)	59.0	3.06 (dt, 6.7, 3.9 Hz)	58.1	2.69 (dt, 6.5, 4.9 Hz)	58.4	2.87 (dt, 8.6, 4.6 Hz)	58.1	2.84 (dt, 8.4, 4.6 Hz)
3	69.3	3.64 (m)	68.7	3.70 (m)	71.3	3.57 (dt, 9.0, 4.6 Hz)	71.8	3.61 (m)	72.6	3.59 (dt, 9.0, 4.3 Hz)
4	35.0	1.52 (m)	34.9	1.62 (m)	34.7	1.52 (m)	34.0	1.58 (m)	34.3	1.59(m)
		1.42 (m)		1.54 (m)				1.52 (m)		1.53 (m)
5	38.7	1.55 (m)	38.8	1.55 (m)	38.6	1.52 (m)	38.7	1.56 (m)	38.7	1.55 (m)
		1.35 (m)		1.39 (m)		1.35 (m)		1.39 (m)		1.38 (m)
6	68.2	4.35 (m)	68.2	4.38 (m)	68.1	4.39 (m)	68.1	4.39 (dt, 9.2, 6.3 Hz)	68.2	4.38 (m)
7	134.0	5.31 (dd, 11.0, 9.0 Hz)	134.7	5.37 (m)	134.6	5.36 (dd, 10.9, 8.8 Hz)	134.8	5.36 (m)	134.5	5.36 (m)
8	132.2	5.44 (dt, 11.0, 7.5 Hz)	131.2	5.49 (dt, 10.6, 7.3 Hz)	131.7	5.47 (m)	131.5	5.47 (m)	131.5	5.48 (m)
9	28.7	2.08 (m)	24.6	2.37 (m)	25.0	2.27 (m)	25.0	2.24 (m)	25.2	2.34 (m)
				2.14 (m)		2.19 (m)				2.11 (m)
10-16	26.3–32.9	1.28–1.37 (m)	26.5–33.1	1.21–1.36 (m)	26.6–33.1	1.21–1.34 (m)	26.5–33.1	1.21–1.34 (m)	26.5–33.1	1.20–1.35 (m)
17	23.7	1.28–1.37 (m)	23.8	1.21–1.36 (m)	23.8	1.21–1.34 (m)	23.8	1.21–1.34 (m)	23.8	1.20–1.35 (m)
18	14.1	0.90 (t, 7.0 Hz)	14.5	0.89 (t, 6.7 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.8 Hz)

[a] Mansoor, T. A.; Park, T.; Luo, X.; Hong, J.; Lee, C. O.; Jung, J. H. A new sphingosine from a marine sponge *Haliclona* (*Reniera*) sp. *Natural Product Sciences* **2007**, *13* (3), 247–250.

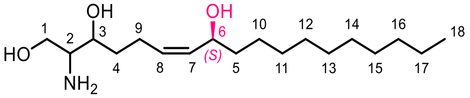
[b] NMR data of conformer 1 (Figure S9)

[c] NMR data of conformer 2 (Figure S9)

Table S4. NMR comparison of isolated halisphingosine A and regioisomers Δ^6-*S*-C(8)-OH (500 MHz, 126 MHz, CD_3OD).



proposed structure of isolated product



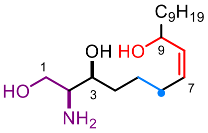
N°	isolated[a]		2*R*,3*R*,8*S*,*Z*-28[b]		2*S*,3*S*,8*S*,*Z*-29[c]		2*R*,3*S*,8*S*,*Z*-30[c]		2*S*,3*R*,8*S*,*Z*-31[b]	
	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]
1	60.9	3.74 (dd, 11.4, 4.5 Hz)	60.4	3.77 (dd, 11.7, 4.0 Hz)	64.3	3.62 (dd, 10.9, 5.5 Hz)	58.9	3.83 (dd, 11.6, 4.0 Hz)	59.0	3.83 (m)
		3.62 (dd, 11.5, 7.0 Hz)		3.65 (dd, 11.7, 6.7 Hz)		3.49 (dd, 10.9, 6.5 Hz)		3.70 (dd, 11.5, 8.5 Hz)		3.70 (dd, 11.6, 8.5 Hz)
2	59.0	2.99 (dt, 7.0, 4.5 Hz)	59.2	3.05 (dt, 6.8, 3.9 Hz)	57.9	2.70 (m)	58.3	3.22 (dt, 8.5, 4.1 Hz)	58.6	3.21 (dt, 8.3, 4.0 Hz)
3	69.3	3.64 (m)	68.3	3.70 (m)	71.6	3.57 (dt, 8.9, 4.5 Hz)	69.8	3.77 (m)	69.3	3.83 (m)
4	35.0	1.52 (m)	34.6	1.62 (m)	34.9	1.55 (m)	34.1	1.58 (m)	33.8	1.58 (m)
		1.42 (m)		1.53 (m)						
5	38.7	1.55 (m)	38.7	1.57 (m)	38.7	1.55 (m)	38.8	1.58 (m)	38.7	1.59 (m)
		1.35 (m)		1.40 (m)		1.39 (m)		1.42 (m)		1.42 (m)
6	68.2	4.35 (m)	68.1	4.39 (dt, 8.8, 6.4 Hz)	68.2	4.38 (m)	68.2	4.38 (m)	68.1	4.39 (dt, 8.7, 6.3 Hz)
7	134.0	5.31 (dd, 11.0, 9.0 Hz)	135.0	5.39 (dd, 10.9, 8.9 Hz)	134.4	5.34 (m)	134.8	5.38 (m)	135.1	5.39 (dd, 10.8, 8.7 Hz)
8	132.2	5.44 (dt, 11.0, 7.5 Hz)	131.4	5.47 (m)	131.6	5.48 (dt, 10.8, 7.5 Hz)	131.0	5.49 (dt, 10.7, 7.4 Hz)	131.1	5.47 (m)
9	28.7	2.08 (m)	24.5	2.31 (m)	25.2	2.33 (m)	25.2	2.35 (m)	25.0	2.26 (m)
				2.22 (m)		2.11 (m)		2.13 (m)		
10-16	26.3–32.9	1.28–1.37 (m)	26.5–33.1	1.24–1.34 (m)	26.5–33.1	1.20–1.35 (m)	26.5–33.1	1.20–1.36 (m)	26.5–33.1	1.21–1.35 (m)
17	23.7	1.28–1.37 (m)	23.7	1.24–1.34 (m)	23.8	1.20–1.35 (m)	23.7	1.20–1.36 (m)	23.7	1.21–1.35 (m)
18	14.1	0.90 (t, 7.0 Hz)	14.5	0.89 (t, 6.9 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.9 Hz)	14.5	0.89 (t, 6.9 Hz)

[a] Mansoor, T. A.; Park, T.; Luo, X.; Hong, J.; Lee, C. O.; Jung, J. H. A new sphingosine from a marine sponge *Haliclona* (*Reniera*) sp. *Natural Product Sciences* **2007**, *13* (3), 247–250.

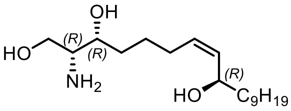
[b] NMR data of conformer 1 (Figure S9)

[c] NMR data of conformer 2 (Figure S9)

Total synthesis of Δ^7-C(9)-OH isomers 33-36



(2*R*,3*R*,9*R*,*Z*)-2-Aminooctadec-7-ene-1,3,9-triol 33



Nitro alcohol **SI-40** (35.1 mg, 0.08 mmol, 1.0 equiv.), Zn (199 mg, 3.05 mmol, 40 equiv.) and AcOH (0.17 mL, 2.19 mmol, 40 equiv.) in EtOAc (2.0 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (2.0 mL) and TBAF (0.38 mL, 0.38 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 20 h to yield the amino alcohol **33** (9.0 mg, 37%, over 2 steps, 75% brsm) as colorless oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 17.6 (c = 0.18 MeOH)

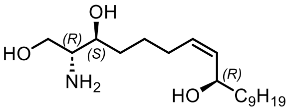
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.51 – 5.42 (m, 1H), 5.35 (dd, *J* = 10.9, 8.8 Hz, 1H), 4.43 – 4.31 (m, 1H), 3.75 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.72 – 3.66 (m, 1H), 3.64 (dd, *J* = 11.7, 6.7 Hz, 1H), 3.02 (dt, *J* = 6.7, 4.0 Hz, 1H), 2.26 – 2.15 (m, 1H), 2.14 – 2.03 (m, 1H), 1.66 – 1.52 (m, 3H), 1.52 – 1.42 (m, 2H), 1.41 – 1.21 (m, 15H), 0.89 (t, *J* = 6.6 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 134.4, 131.8, 69.2, 68.2, 60.7, 59.1, 38.8, 34.5, 33.1, 30.8, 30.7, 30.5, 28.5, 26.5, 26.5, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3265 (br, m), 2921 (s), 2850 (s), 1661 (m), 1466 (m), 1363 (w), 1063 (m), 1002 (m), 750 (w), 574 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2844.

(2*R*,3*S*,9*R*,*Z*)-2-Aminooctadec-7-ene-1,3,9-triol 34



Nitro alcohol **SI-54** (30.2 mg, 0.07 mmol, 1.0 equiv.), Zn (172 mg, 2.63 mmol, 40 equiv.) and AcOH (0.15 mL, 2.63 mmol, 40 equiv.) in EtOAc (1.6 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (1.6 mL) and TBAF (0.33 mL, 0.33 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 20 h to yield the amino alcohol **34** (9.1 mg, 44%, over 2 steps, 71% brsm) as oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 12.7 (c = 0.2 MeOH)

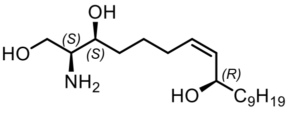
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.49 – 5.41 (m, 1H), 5.35 (dd, *J* = 11.2, 8.9 Hz, 1H), 4.40 – 4.31 (m, 1H), 3.82 (dd, *J* = 11.5, 4.0 Hz, 1H), 3.78 (dt, *J* = 8.2, 4.2 Hz, 1H), 3.69 (dd, *J* = 11.5, 8.6 Hz, 1H), 3.19 (dt, *J* = 8.4, 4.1 Hz, 1H), 2.23 – 2.15 (m, 1H), 2.17 – 2.06 (m, 1H), 1.65 – 1.53 (m, 2H), 1.51 – 1.42 (m, 3H), 1.42 – 1.20 (m, 15H), 0.89 (t, *J* = 6.3 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 134.5, 131.6, 70.0, 68.2, 58.9, 58.5, 38.8, 33.5, 33.1, 30.8, 30.7, 30.5, 28.2, 26.9, 26.5, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3386 (br, m), 2922 (s), 2851 (s), 1504 (w), 1458 (w), 1049 (m), 996 (m), 836 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2841.

(2*S*,3*S*,9*R*,*Z*)-2-Aminooctadec-7-ene-1,3,9-triol 35



Nitro alcohol **SI-41** (39.6 mg, 0.09 mmol, 1.0 equiv.), Zn (225 mg, 3.45 mmol, 40 equiv.) and AcOH (0.20 mL, 3.45 mmol, 40 equiv.) in EtOAc (2.2 mL) were used to obtain the crude protected amino alcohol (35.3 mg, 96%), as colorless oil. The residue was dissolved in THF (2.2 mL) and TBAF (0.43 mL, 0.43 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 20 h to yield the amino alcohol **35** (12.6 mg, 46%, over 2 steps, 67% brsm) as colorless oil.

$[\alpha]_D^{22}$ = 7.1 (c = 0.20 MeOH)

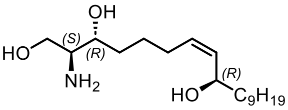
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.49 – 5.41 (m, 1H), 5.39 – 5.28 (m, 1H), 4.35 (dt, *J* = 9.2, 6.3 Hz, 1H), 3.76 (dd, *J* = 11.8, 4.0 Hz, 1H), 3.72 – 3.67 (m, 1H), 3.65 (dd, *J* = 11.7, 6.7 Hz, 1H), 3.04 (dt, *J* = 6.8, 3.9 Hz, 1H), 2.23 – 2.15 (m, 1H), 2.15 – 2.05 (m, 1H), 1.65 – 1.52 (m, 3H), 1.53 – 1.43 (m, 2H), 1.42 – 1.22 (m, 15H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 134.5, 131.7, 68.8, 68.2, 60.4, 59.1, 38.8, 34.3, 33.1, 30.8, 30.7, 30.5, 28.3, 26.5, 26.2, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3329 (br, m), 2921 (s), 2852 (s), 1655 (w), 1045 (m), 1008 (m), 721 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2844.

(*2S,3R,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol 36



Nitro alcohol **SI-55** (47.1 mg, 0.10 mmol, 1.0 equiv.), Zn (268 mg, 4.10 mmol, 40 equiv.) and AcOH (0.23 mL, 4.10 mmol, 40 equiv.) in EtOAc (2.6 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (2.6 mL) and TBAF (0.51 mL, 0.51 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 20 h to yield the amino alcohol **36** (15.6 mg, 48%, over 2 steps, 62% brsm) as colorless oil.

$[\alpha]_D^{22}$ = 5.3 (c = 0.23 MeOH)

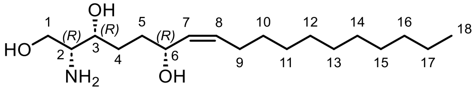
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.46 (dt, *J* = 10.9, 7.3 Hz, 1H), 5.35 (dd, *J* = 11.0, 8.9 Hz, 1H), 4.41 – 4.31 (m, 1H), 3.83 (dd, *J* = 11.5, 4.0 Hz, 1H), 3.79 (dt, *J* = 8.3, 3.9 Hz, 1H), 3.70 (dd, *J* = 11.5, 8.7 Hz, 1H), 3.20 (dt, *J* = 8.3, 4.0 Hz, 1H), 2.26 – 2.15 (m, 1H), 2.14 – 2.04 (m, 1H), 1.68 – 1.35 (m, 6H), 1.34 – 1.21 (m, 14H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 134.5, 131.7, 70.2, 68.2, 58.9, 58.4, 38.8, 33.8, 33.1, 30.8, 30.7, 30.5, 28.5, 27.2, 26.5, 23.7, 14.5 ppm.

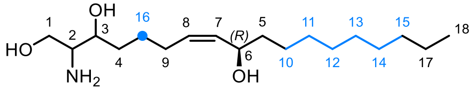
IR (ATR) $\tilde{\upsilon}$ = 3330 (br, m), 2922 (s), 2852 (s), 1654 (w), 1457 (w), 1048 (m), 1004 (m), 721 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2841.

Table S5. NMR comparison of isolated halisphingosine A and regioisomers Δ^7-*R*-C(9)-OH (500 MHz, 126 MHz, CD$_3$OD).



proposed structure of isolated product



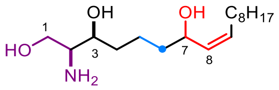
C10-16

N°	isolated[a]		2*R*,3*R*,9*R*,*Z*-33[b]		2*S*,3*S*,9*R*,*Z*-35[b]		2*R*,3*S*,9*R*,*Z*-34[b]		2*S*,3*R*,9*R*,*Z*-36[b]	
	δ C [ppm]	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**
1	60.9	3.74 (dd, 11.4, 4.5 Hz)	60.7	3.75 (dd, 11.6, 4.0 Hz)	60.4	3.76 (dd, 11.8, 4.0 Hz)	58.9	3.82 (dd, 11.5, 4.0 Hz)	58.9	3.83 (dd, 11.5, 4.0 Hz)
		3.62 (dd, 11.5, 7.0 Hz)		3.64 (dd, 11.7, 6.7 Hz)		3.65 (dd, 11.7, 6.7 Hz)		3.69 (dd, 11.5, 8.6 Hz)		3.70 (dd, 11.5, 8.7 Hz)
2	59.0	2.99 (dt, 7.0, 4.5 Hz)	59.1	3.02 (dt, 6.7, 4.0 Hz)	59.1	3.04 (dt, 6.8, 3.9 Hz)	58.5	3.19 (dt, 8.4, 4.1 Hz)	58.4	3.20 (dt, 8.3, 4.0 Hz)
3	69.3	3.64 (m)	69.2	3.67 (m)	68.8	3.69 (m)	70.0	3.78 (dt, 8.2, 4.2 Hz)	70.2	3.79 (dt, 8.3, 3.9 Hz)
4	35.0	1.52 (m)	34.5	1.59 (m)	34.3	1.58 (m)	33.5	1.49 (m)	33.8	1.50 (m)
		1.42 (m)		1.46 (m)		1.48 (m)				
5	38.7	1.55 (m)	38.8	1.56 (m)	38.8	1.55 (m)	38.8	1.56 (m)	38.8	1.56 (m)
		1.35 (m)		1.38 (m)		1.37 (m)		1.38 (m)		1.37 (m)
6	68.2	4.35 (m)	68.2	4.36 (m)	68.2	4.35 (dt, 9.2, 6.3 Hz)	68.2	4.34 (m)	68.2	4.35 (m)
7	134.0	5.31 (dd, 11.0, 9.0 Hz)	134.4	5.35 (dd, 10.9, 8.8 Hz)	134.5	5.35 (m)	134.5	5.35 (dd, 11.2, 8.9 Hz)	134.5	5.35 (dd, 11.0, 8.9 Hz)
8	132.2	5.44 (dt, 11.0, 7.5 Hz)	131.8	5.47 (m)	131.7	5.46 (m)	131.6	5.45 (m)	131.7	5.46 (dt, 10.9, 7.3 Hz)
9	28.7	2.08 (m)	28.5	2.20 (m)	28.3	2.18 (m)	28.2	2.19 (m)	28.5	2.20 (m)
				2.08 (m)		2.12 (m)		2.12 (m)		2.09 (m)
10-15	26.3–32.9	1.28–1.37 (m)	26.5–33.1	1.21–1.41 (m)	26.5–33.1	1.22–1.42 (m)	26.5–33.1	1.20–1.42 (m)	26.5–33.1	1.21–1.34 (m)
16			26.5	1.59 (m)	26.2	1.58 (m)	26.9	1.62 (m)	27.2	1.62 (m)
				1.46 (m)		1.48 (m)		1.46 (m)		1.41 (m)
17	23.7	1.28–1.37 (m)	23.7	1.21–1.41 (m)	23.7	1.22–1.42 (m)	23.8	1.20–1.42 (m)	23.7	1.21–1.34 (m)
18	14.1	0.90 (t, 7.0 Hz)	14.5	0.89 (t, 6.6 Hz)	14.5	0.89 (t, 6.9 Hz)	14.5	0.89 (t, 6.3 Hz)	14.5	0.89 (t, 6.8 Hz)

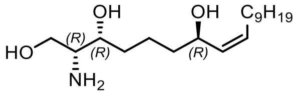
[a] Mansoor, T. A.; Park, T.; Luo, X.; Hong, J.; Lee, C. O.; Jung, J. H. A new sphingosine from a marine sponge *Haliclona* (*Reniera*) sp. *Natural Product Sciences* **2007**, *13* (3), 247–250.

[b] NMR data of conformer 1 (Figure S9)

Total synthesis of Δ^8-(C7)-OH isomers 38-41



(2*R*,3*R*,7*R*,*Z*)-2-Aminooctadec-8-ene-1,3,7-triol 38



Nitro alcohol **SI-42** (38.3 mg, 0.08 mmol, 1.0 equiv.), Zn (218 mg, 3.33 mmol, 40 equiv.) and AcOH (0.19 mL, 3.33 mmol, 40 equiv.) in EtOAc (3.5 mL) were used to obtain the crude protected amino alcohol (35.2 mg, 98%), as colorless oil. The residue was dissolved in THF (3.5 mL) and TBAF (0.17 mL, 0.17 mmol, 2.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 16 h to yield the amino alcohol **38** (16.8 mg, 64%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 11.7 (c = 0.1 MeOH)

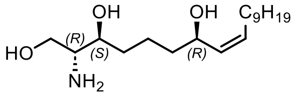
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.44 (dt, *J* = 11.3, 7.4 Hz, 1H), 5.37 – 5.28 (m, 1H), 4.38 (dt, *J* = 12.4, 6.2 Hz, 1H), 3.63 (dd, *J* = 11.0, 4.8 Hz, 1H), 3.59 – 3.53 (m, 1H), 3.50 (dd, *J* = 11.0, 6.7 Hz, 1H), 2.71 (dt, *J* = 6.9, 4.9 Hz, 1H), 2.18 – 2.00 (m, 2H), 1.66 – 1.57 (m, 1H), 1.55 – 1.46 (m, 3H), 1.46 – 1.32 (m, 2H), 1.36 – 1.21 (m, 14H), 0.89 (t, *J* = 6.7 Hz, 3H) ppm.

$^{13}C\{^1H\}$-NMR (126 MHz, CD_3OD) δ = 133.9, 132.3, 71.7, 68.2, 64.0, 58.1, 38.7, 34.9, 33.1, 30.9, 30.7, 30.7, 30.5, 30.5, 28.7, 23.8, 22.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3282 (br, m), 2920 (s), 2852 (s), 1559 (w), 1458 (w), 1044 (m, br), 720 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2843.

(2*R*,3*S*,7*R*,*Z*)-2-Aminooctadec-8-ene-1,3,7-triol 39



Nitro alcohol **SI-56** (48.6 mg, 0.11 mmol, 1.0 equiv.), Zn (277 mg, 4.23 mmol, 40 equiv.) and AcOH (0.24 mL, 4.23 mmol, 40 equiv.) in EtOAc (2.6 mL) were used to obtain the crude protected amino alcohol (45.9 mg, quant.), as colorless oil. The residue was dissolved in THF (2.6 mL) and TBAF (0.21 mL, 0.21 mmol, 2.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 16 h to yield the amino alcohol **39** (14.1 mg, 42%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 7.7 (c = 0.1 MeOH)

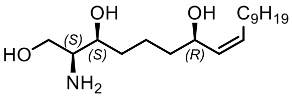
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.45 (dt, *J* = 11.1, 7.3 Hz, 1H), 5.38 – 5.29 (m, 1H), 4.39 (dt, *J* = 8.8, 6.4 Hz, 1H), 3.83 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.81 – 3.74 (m, 1H), 3.69 (dd, *J* = 11.6, 8.7 Hz, 1H), 3.19 (dt, *J* = 8.3, 3.9 Hz, 1H), 2.18 – 2.01 (m, 2H), 1.66 – 1.53 (m, 2H), 1.51 – 1.42 (m, 3H), 1.41 – 1.22 (m, 15H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

$^{13}C\{^1H\}$-NMR (126 MHz, CD_3OD) δ = 133.8, 132.4, 70.2, 68.1, 58.9, 58.4, 38.4, 34.1, 33.1, 30.9, 30.7, 30.7, 30.5, 30.5, 28.7, 23.7, 22.9, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3322 (br, m), 2921 (s), 2852 (m), 1615 (w), 1507 (w), 1458 (w), 1051 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2843.

(2*S*,3*S*,7*R*,*Z*)-2-Aminooctadec-8-ene-1,3,7-triol 40



Nitro alcohol **SI-43** (36.9 mg, 0.08 mmol, 1.0 equiv.), Zn (210 mg, 3.21 mmol, 40 equiv.) and AcOH (0.18 mL, 3.21 mmol, 40 equiv.) in EtOAc (3.5 mL) were used to obtain the crude protected amino alcohol (33.8 mg, 98%), as colorless oil. The residue was dissolved in THF (3.5 mL) and TBAF (0.16 mL, 0.16 mmol, 2.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 16 h to yield the amino alcohol **40** (13.6 mg, 54%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 5.8 (c = 0.1 MeOH)

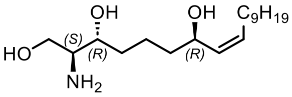
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.44 (dt, *J* = 11.2, 7.3 Hz, 1H), 5.33 (dd, *J* = 10.9, 9.0 Hz, 1H), 4.39 (dt, *J* = 9.1, 6.3 Hz, 1H), 3.66 (dd, *J* = 11.2, 4.6 Hz, 1H), 3.62 – 3.57 (m, 1H), 3.54 (dd, *J* = 11.2, 6.7 Hz, 1H), 2.81 (dt, *J* = 6.7, 4.9 Hz, 1H), 2.19 – 1.99 (m, 2H), 1.63 – 1.51 (m, 3H), 1.49 – 1.41 (m, 2H), 1.41 – 1.34 (m, 1H), 1.33 – 1.22 (m, 14H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.9, 132.3, 71.0, 68.1, 63.1, 58.3, 38.6, 34.9, 33.1, 30.9, 30.7, 30.7, 30.5, 30.5, 28.7, 23.8, 22.6, 14.5 ppm.

IR (ATR) $\tilde{\nu}$ = 3327 (br, m), 2921 (s), 2852 (s), 1662 (m), 1456 (w), 1047 (m, br), 569 (br, m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2844.

(2*S*,3*R*,7*R*,*Z*)-2-Aminooctadec-8-ene-1,3,7-triol 41



Nitro alcohol **SI-57** (41.6 mg, 0.09 mmol, 1.0 equiv.), Zn (237 mg, 3.62 mmol, 40 equiv.) and AcOH (0.21 mL, 3.62 mmol, 40 equiv.) in EtOAc (2.3 mL) were used to obtain the crude protected amino alcohol (39.2 mg, quant.), as colorless oil. The residue was dissolved in THF (2.3 mL) and TBAF (0.18 mL, 0.18 mmol, 2.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 16 h to yield the amino alcohol **41** (11.5 mg, 40%, over 2 steps) as colorless oil.

$[\alpha]_D^{22}$ = 7.3 (c = 0.1 MeOH)

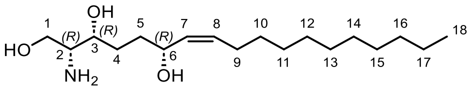
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.45 (dt, *J* = 11.3, 7.3 Hz, 1H), 5.34 (dd, *J* = 10.9, 8.9 Hz, 1H), 4.39 (dt, *J* = 8.5, 5.9 Hz, 1H), 3.83 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.82 – 3.76 (m, 1H), 3.69 (dd, *J* = 11.5, 8.7 Hz, 1H), 3.19 (dt, *J* = 8.3, 3.9 Hz, 1H), 2.18 – 2.01 (m, 2H), 1.65 – 1.57 (m, 1H), 1.57 – 1.52 (m, 1H), 1.52 – 1.46 (m, 2H), 1.44 – 1.35 (m, 2H), 1.34 – 1.23 (m, 14H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.8, 132.4, 70.2, 68.1, 58.9, 58.4, 38.4, 34.1, 33.1, 30.9, 30.7, 30.7, 30.5, 30.5, 28.7, 23.7, 23.0, 14.5 ppm.

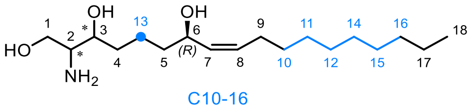
IR (ATR) $\tilde{\nu}$ = 3310 (br, w), 2921 (s), 2851 (m), 1654 (w), 1466 (m), 1035 (m), 705 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2843.

Table S6. NMR comparison of isolated halisphingosine A and regioisomers Δ^8-*R*-C(7)-OH (500 MHz, 126 MHz, CD_3OD).



proposed structure of isolated product

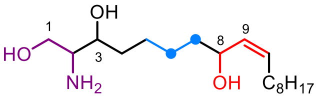


N°	isolated[a]		2*R*,3*R*,7*R*,*Z*-38[b]		2*S*,3*S*,7*R*,*Z*-40[b]		2*R*,3*S*,7*R*,*Z*-39[b]		2*S*,3*R*,7*R*,*Z*-41[b]	
	δ C [ppm]	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**
1	60.9	3.74 (dd, 11.4, 4.5 Hz)	64.0	3.63 (dd, 11.0, 4.8 Hz)	63.1	3.66 (dd, 11.2, 4.6 Hz)	58.9	3.83 (dd, 11.6, 4.0 Hz)	58.9	3.83 (dd, 11.6, 4.0 Hz)
		3.62 (dd, 11.5, 7.0 Hz)		3.50 (dd, 11.0, 6.7 Hz)		3.54 (dd, 11.2, 6.7 Hz)		3.69 (dd, 11.6, 8.7 Hz)		3.69 (dd, 11.5, 8.7 Hz)
2	59.0	2.99 (dt, 7.0, 4.5 Hz)	58.1	2.71 (dt, 6.9, 4.9 Hz)	58.3	2.81 (dt, 6.7, 4.9 Hz)	58.4	3.19 (dt, 8.3, 3.9 Hz)	58.4	3.19 (dt, 8.7, 3.9 Hz)
3	69.3	3.64 (m)	71.7	3.56 (m)	71.0	3.59 (m)	70.2	3.77 (m)	70.2	3.79 (m)
4	35.0	1.52 (m)	34.9	1.50 (m)	34.9	1.55 (m)	34.1	1.46 (m)	34.1	1.49 (m)
		1.42 (m)				1.45 (m)				
5	38.7	1.55 (m)	38.7	1.60 (m)	38.6	1.55 (m)	38.4	1.58 (m)	38.4	1.61 (m)
		1.35 (m)		1.38 (m)		1.45 (m)		1.46 (m)		1.39 (m)
6	68.2	4.35 (m)	68.2	4.38 (dt, 12.4, 6.2 Hz)	68.1	4.39 (dt, 9.1, 6.3 Hz)	68.1	4.39 (dt, 8.8, 6.4 Hz)	68.1	4.39 (dt, 8.5, 5.9 Hz)
7	134.0	5.31 (dd, 11.0, 9.0 Hz)	133.9	5.33 (m)	133.9	5.33 (dd, 10.9, 9.0 Hz)	133.8	5.34 (m)	133.8	5.34 (dd, 10.9, 8.9 Hz)
8	132.2	5.44 (dt, 11.0, 7.5 Hz)	132.3	5.44 (dt, 11.3, 7.4 Hz)	132.3	5.44 (dt, 11.2, 7.3 Hz)	132.4	5.45 (dt, 11.1, 7.3 Hz)	132.4	5.45 (dt, 11.3, 7.3 Hz)
9	28.7	2.08 (m)	28.7	2.09 (m)	28.7	2.09 (m)	28.7	2.09 (m)	28.7	2.09 (m)
10-16	26.3–32.9	1.28–1.37 (m)	30.5–33.1	1.21–1.36	30.5–33.1	1.22–1.33 (m)	30.5–33.1	1.22–1.41 (m)	30.5–33.1	1.23–1.34 (m)
13			22.8	1.50 (m)	22.6	1.55 (m)	22.9	1.58 (m)	23.0	1.54 (m)
				1.38 (m)		1.37 (m)		1.22–1.41 (m)		1.39 (m)
17	23.7	1.28–1.37 (m)	23.8	1.21–1.36 (m)	23.8	1.22–1.33 (m)	23.7	1.22–1.41 (m)	23.7	1.23–1.34 (m)
18	14.1	0.90 (t, 7.0 Hz)	14.5	0.89 (t, 6.7 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.9 Hz)

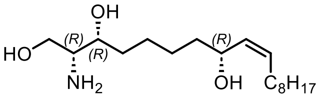
[a] Mansoor, T. A.; Park, T.; Luo, X.; Hong, J.; Lee, C. O.; Jung, J. H. A new sphingosine from a marine sponge *Haliclona* (*Reniera*) sp. *Natural Product Sciences* **2007**, *13* (3), 247–250.

[b] NMR data of conformer 1 (Figure S9)

Total synthesis of Δ^9-C(8)-OH Isomers 43 - 50



(2*R*,3*R*,8*R*,*Z*)-2-Aminooctadec-9-ene-1,3,8-triol 43



Nitro alcohol **SI-44** (110 mg, 0.24 mmol, 1.0 equiv.), Zn (628 mg, 9.60 mmol, 40 equiv.) and AcOH (0.55 mL, 9.60 mmol, 40 equiv.) in EtOAc (6.0 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (6.0 mL) and TBAF (1.2 mL, 1.20 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 40 h to yield the amino alcohol **43** (69.8 mg, 92%, over 2 steps) as oil.

$[\alpha]_D^{22}$ = 10.2 (c = 0.1 MeOH)

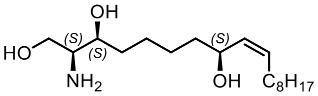
^{1}H-NMR (500 MHz, CD$_3$OD) δ = 5.44 (dt, *J* = 11.0, 7.4 Hz, 1H), 5.32 (dd, *J* = 10.9, 9.0 Hz, 1H), 4.42 – 4.33 (m, 1H), 3.76 (dd, *J* = 11.7, 4.0 Hz, 1H), 3.70 – 3.67 (m, 1H), 3.64 (dd, *J* = 11.8, 6.9 Hz, 1H), 3.04 (dt, *J* = 6.8, 4.0 Hz, 1H), 2.15 – 2.01 (m, 2H), 1.63 – 1.50 (m, 3H), 1.49 – 1.35 (m, 5H), 1.34 – 1.20 (m, 12H), 0.89 (t, *J* = 7.0 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD$_3$OD) δ = 133.9, 132.3, 69.0, 68.1, 60.5, 59.1, 38.7, 34.9, 33.1, 30.9, 30.6, 30.4, 28.7, 26.4, 26.3, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\nu}$ = 3321 (br, m), 2923 (s), 2853 (m), 1742 (m), 1661 (m), 1606 (w), 1458 (m), 1373 (w), 1237 (m), 1044 (s), 848 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2841.

(2*S*,3*S*,8*S*,*Z*)-2-Aminooctadec-9-ene-1,3,8-triol 44



Nitro alcohol **SI-45** (32.3 mg, 0.07 mmol, 1.0 equiv.), Zn (184 mg, 2.81 mmol, 40 equiv.) and AcOH (0.16 mL, 2.81 mmol, 40 equiv.) in EtOAc (1.8 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (1.8 mL) and TBAF (0.35 mL, 0.35 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 40 h to yield the amino alcohol **44** (18.9 mg, 85%, over 2 steps) as oil.

$[\alpha]_D^{22}$ = -10.7 (c = 0.1 MeOH)

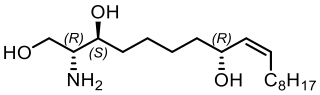
^{1}H-NMR (500 MHz, CD$_3$OD) δ = 5.44 (dt, *J* = 11.1, 7.4 Hz, 1H), 5.32 (dd, *J* = 10.9, 8.9 Hz, 1H), 4.41 – 4.34 (m, 1H), 3.77 (dd, *J* = 11.7, 4.0 Hz, 1H), 3.73 – 3.67 (m, 1H), 3.65 (dd, *J* = 12.0, 7.0 Hz, 1H), 3.05 (dt, *J* = 6.8, 4.0 Hz, 1H), 2.15 – 2.00 (m, 2H), 1.64 – 1.50 (m, 3H), 1.48 – 1.34 (m, 5H), 1.34 – 1.21 (m, 12H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD$_3$OD) δ = 133.9, 132.3, 69.0, 68.1, 60.5, 59.1, 38.7, 34.9, 33.1, 30.9, 30.6, 30.4, 28.7, 26.4, 26.3, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\nu}$ = 3334 (br, m), 2922 (s), 2853 (m), 1657 (w), 1459 (w), 1032 (br, m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2842.

(*2R,3S,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol 45



Nitro alcohol **SI-58** (43.6 mg, 0.09 mmol, 1.0 equiv.), Zn (248 mg, 3.79 mmol, 40 equiv.) and AcOH (0.22 mL, 9.60 mmol, 40 equiv.) in EtOAc (2.4 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (2.4 mL) and TBAF (0.47 mL, 0.47 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 40 h to yield the amino alcohol **45** (27.3 mg, 91%, over 2 steps) as oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 10.9 (c = 0.1 MeOH)

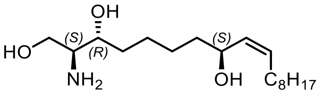
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.44 (dt, *J* = 10.6, 7.2 Hz, 1H), 5.32 (dd, *J* = 10.8, 9.0 Hz, 1H), 4.37 (dt, *J* = 8.9, 6.1 Hz, 1H), 3.83 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.78 (dt, *J* = 8.4, 4.2 Hz, 1H), 3.69 (dd, *J* = 11.6, 8.7 Hz, 1H), 3.20 (dt, *J* = 8.3, 3.9 Hz, 1H), 2.16 – 1.99 (m, 2H), 1.63 – 1.52 (m, 2H), 1.52 – 1.45 (m, 2H), 1.44 – 1.23 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.9, 132.3, 70.2, 68.1, 58.9, 58.4, 38.6, 34.2, 33.1, 30.9, 30.6, 30.4, 28.7, 27.1, 26.4, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3231 (br, m), 2922 (s), 2851 (m), 2319 (br, m), 1655 (br, m), 1423 (br, m), 1038 (s), 974 (w), 857 (w), 706 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2842.

(*2S,3R,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol 46



Nitro alcohol **SI-59** (44.6 mg, 0.10 mmol, 1.0 equiv.), Zn (254 mg, 3.88 mmol, 40 equiv.) and AcOH (0.22 mL, 3.88 mmol, 40 equiv.) in EtOAc (2.4 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (2.4 mL) and TBAF (0.49 mL, 0.49 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 40 h to yield the amino alcohol **46** (25.8 mg, 84%, over 2 steps) as oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = -10.8 (c = 0.1 MeOH)

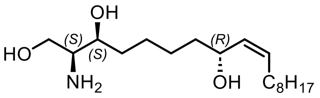
^{1}H-NMR (500 MHz, CD_3OD) δ =5.44 (dt, *J* = 11.1, 7.4 Hz, 1H), 5.32 (dd, *J* = 11.0, 8.9 Hz, 1H), 4.37 (dt, *J* = 8.8, 6.0 Hz, 1H), 3.83 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.83 – 3.75 (m, 1H), 3.70 (dd, *J* = 11.6, 8.7 Hz, 1H), 3.20 (dt, *J* = 8.3, 3.9 Hz, 1H), 2.15 – 1.99 (m, 2H), 1.62 – 1.53 (m, 2H), 1.52 – 1.45 (m, 2H), 1.44 – 1.25 (m, 16H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.9, 132.3, 70.2, 68.1, 58.9, 58.4, 38.6, 34.2, 33.1, 30.9, 30.6, 30.4, 28.7, 27.1, 26.4, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3231 (br, m), 2922 (s), 2851 (m), 2376 (br, m), 1656 (br, m), 1424 (br, m), 1038 (s), 936 (w), 857 (w), 706 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2841.

(2*S*,3*S*,8*R*,*Z*)-2-Aminooctadec-9-ene-1,3,8-triol 47



Nitro alcohol **SI-46** (44.6 mg, 0.10 mmol, 1.0 equiv.), Zn (254 mg, 3.88 mmol, 40 equiv.) and AcOH (0.22 mL, 3.88 mmol, 40 equiv.) in EtOAc (2.4 mL) were used to obtain the crude protected amino alcohol (41.8 mg, 100%), as colorless oil. The residue was dissolved in THF (2.4 mL) and TBAF (0.49 mL, 0.49 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 40 h to yield the amino alcohol **47** (25.5 mg, 87%, over 2 steps) as oil.

$[\alpha]_D^{22}$ = -3.8 (c = 0.1 MeOH)

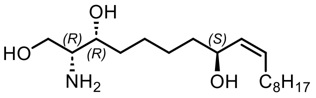
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.44 (dt, *J* = 11.2, 7.4 Hz, 1H), 5.32 (dd, *J* = 10.9, 9.0 Hz, 1H), 4.37 (dt, *J* = 9.1, 6.1 Hz, 1H), 3.77 (dd, *J* = 11.7, 4.0 Hz, 1H), 3.70 – 3.67 (m, 1H), 3.65 (dd, *J* = 11.8, 6.9 Hz, 1H), 3.05 (dt, *J* = 6.8, 4.0 Hz, 1H), 2.16 – 2.00 (m, 2H), 1.63 – 1.50 (m, 3H), 1.50 – 1.35 (m, 5H), 1.35 – 1.22 (m, 12H), 0.89 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.9, 132.3, 69.0, 68.2, 60.5, 59.1, 38.7, 34.9, 33.1, 30.9, 30.6, 30.4, 28.7, 26.5, 26.4, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3245 (br, m), 2921 (s), 2851 (s), 1577 (m), 1461 (m), 1319 (w), 1067 (s), 1008 (s), 957 (s), 849 (m), 720 (m, br), 546 (m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2845.

(*2R,3R,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol 48



Nitro alcohol **SI-47** (61.0 mg, 0.13 mmol, 1.0 equiv.), Zn (347 mg, 5.31 mmol, 40 equiv.) and AcOH (0.30 mL, 5.31 mmol, 40 equiv.) in EtOAc (3.3 mL) were used to obtain the crude protected amino alcohol (56.1 mg, 98%), as colorless oil. The residue was dissolved in THF (3.3 mL) and TBAF (0.66 mL, 0.66 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 40 h to yield the amino alcohol **48** (37.2 mg, 89%, over 2 steps) as oil.

$[\alpha]_D^{22}$ = 3.1 (c = 0.1 MeOH)

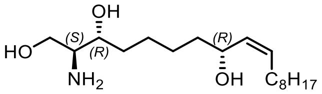
^{1}H-NMR (500 MHz, CD_3OD) δ = 5.44 (dt, *J* = 10.6, 7.3 Hz, 1H), 5.32 (dd, *J* = 11.6, 9.8 Hz, 1H), 4.37 (dt, *J* = 8.4, 5.9 Hz, 1H), 3.76 (dd, *J* = 11.7, 4.1 Hz, 1H), 3.73 – 3.60 (m, 2H), 3.03 (dt, *J* = 6.7, 3.7 Hz, 1H), 2.17 – 1.99 (m, 2H), 1.64 – 1.50 (m, 3H), 1.48 – 1.23 (m, 17H), 0.89 (t, *J* = 6.7 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 133.9, 132.3, 69.0, 68.2, 60.5, 59.1, 38.7, 34.9, 33.1, 30.9, 30.6, 30.4, 28.7, 26.5, 26.4, 23.8, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3049 (br, m), 2922 (s), 2852 (m), 1604 (w), 1406 (m), 1255 (w), 1038 (br, m), 548 (br, m) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2842.

(*2S,3R,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol 49



Nitro alcohol **SI-60** (41.6 mg, 0.09 mmol, 1.0 equiv.), Zn (237 mg, 3.62 mmol, 40 equiv.) and AcOH (0.21 mL, 3.62 mmol, 40 equiv.) in EtOAc (2.3 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (2.3 mL) and TBAF (0.45 mL, 0.45 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 40 h to yield the amino alcohol **49** (24.9 mg, 87%, over 2 steps) as oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = 11.9 (c = 0.1 MeOH)

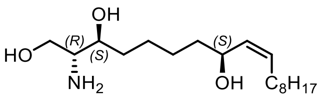
^{1}H-NMR (500 MHz, CD$_3$OD) δ = 5.44 (dt, *J* = 11.2, 7.4 Hz, 1H), 5.36 – 5.28 (m, 1H), 4.44 – 4.32 (m, 1H), 3.83 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.81 – 3.77 (m, 1H), 3.70 (dd, *J* = 11.6, 8.6 Hz, 1H), 3.20 (dt, *J* = 8.2, 3.9 Hz, 1H), 2.16 – 2.01 (m, 2H), 1.65 – 1.45 (m, 4H), 1.44 – 1.35 (m, 5H), 1.34 – 1.23 (m, 11H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD$_3$OD) δ = 133.9, 132.3, 70.2, 68.1, 58.9, 58.4, 38.6, 34.2, 33.1, 30.9, 30.6, 30.4, 28.7, 27.0, 26.4, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3127 (br, m), 2923 (m), 2853 (m), 2313 (br, m), 2126 (br, w), 1404 (m), 1057 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2839.

(*2R,3S,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol 50



Nitro alcohol **SI-61** (46.1 mg, 0.10 mmol, 1.0 equiv.), Zn (184 mg, 2.81 mmol, 40 equiv.) and AcOH (0.16 mL, 2.81 mmol, 40 equiv.) in EtOAc (2.5 mL) were used to obtain the crude protected amino alcohol (quant.), as colorless oil. The residue was dissolved in THF (2.5 mL) and TBAF (0.50 mL, 0.50 mmol, 5.0 equiv., 1 M in THF) was added. The reaction mixture was stirred for 40 h to yield the amino alcohol **50** (27.1 mg, 86%, over 2 steps) as oil.

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = -11.5 (c = 0.1 MeOH)

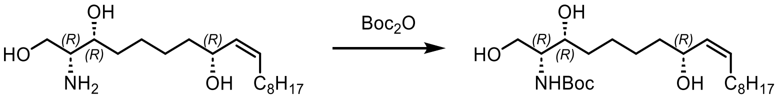
^{1}H-NMR (500 MHz, CD$_3$OD) δ = 5.44 (dt, *J* = 11.1, 7.4 Hz, 1H), 4.89 (s, 17H), 4.45 – 4.32 (m, 1H), 3.83 (dd, *J* = 11.6, 4.0 Hz, 1H), 3.78 (dt, *J* = 8.3, 4.2 Hz, 1H), 3.69 (dd, *J* = 11.6, 8.7 Hz, 1H), 3.19 (dt, *J* = 8.3, 3.9 Hz, 1H), 2.15 – 2.00 (m, 2H), 1.68 – 1.53 (m, 2H), 1.51 – 1.45 (m, 2H), 1.44 – 1.34 (m, 4H), 1.34 – 1.20 (m, 12H), 0.89 (t, *J* = 6.8 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD$_3$OD) δ = 133.9, 132.3, 70.2, 68.1, 58.9, 58.5, 38.6, 34.2, 33.1, 30.9, 30.6, 30.4, 28.7, 27.0, 26.4, 23.7, 14.5 ppm.

IR (ATR) $\tilde{\upsilon}$ = 3348 (br, m), 2923 (s), 2853 (m), 2306 (br, m), 2126 (br, w), 1656 (br, m), 1407 (m), 1054 (s) cm^{-1}.

HRMS (ESI) calcd for $C_{18}H_{38}NO_3$ $[M+H]^+$ 316.2846, found 316.2840.

tert-Butyl ((*2R,3R,8R,Z*)-1,3,8-trihydroxyoctadec-9-en-2-yl)carbamate 51



To a stirred solution of amine **43** (6.4 mg, 0.02 mmol, 1.0 equiv.) in THF (0.5 mL) was added NEt_3 (3.4 µL, 0.024 mmol, 1.2 equiv.) followed by Boc_2O (4.6 mg, 0.021 mmol, 1.05 equiv.). The reaction mixture was stirred at r.t. for 24 h and concentrated *in vacuo*. The residue was purified by column chromatography (20 to 100% EtOAc in cyclohexane) to yield the Boc-protected amine **51** (5.3 mg, 63%).

$[\boldsymbol{\alpha}]_{\mathbf{D}}^{\mathbf{22}}$ = + 11.1 (c = 0.2 $CHCl_3$), Lit: $[\boldsymbol{\alpha}]_{\boldsymbol{D}}$ = + 12.7 (c = 0.20 $CHCl_3$)[24]

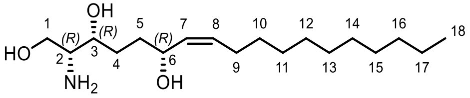
^{1}H-NMR (500 MHz, CD_3OD) δ = 6.04 – 5.92 (m, 1H), 5.44 (dt, *J* = 11.0, 7.4 Hz, 1H), 5.32 (dd, *J* = 10.9, 9.0 Hz, 1H), 4.41 – 4.33 (m, 1H), 3.76 (d, *J* = 6.1 Hz, 1H), 3.63 – 3.51 (m, 3H), 2.15 – 2.00 (m, 2H), 1.65 – 1.52 (m, 1H), 1.38 (m, 28H), 0.90 (t, *J* = 6.9 Hz, 3H) ppm.

^{13}C{^{1}H}-NMR (126 MHz, CD_3OD) δ = 158.4, 134.0, 132.2, 80.2, 71.0, 68.2, 63.1, 56.9, 38.7, 35.1, 33.1, 30.9, 30.6, 30.4, 28.8, 28.7, 26.9, 26.6, 23.8, 14.5 ppm.

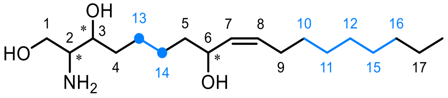
IR (ATR) $\tilde{\upsilon}$ = 3382 (br, m), 2923 (s), 2854 (m), 1687 (s), 1502 (w), 1456 (w), 1365 (m), 1168 (s), 1055 (m), 996 (m), 858 (w) cm^{-1}.

HRMS (ESI) calcd for $C_{23}H_{46}NO_5$ $[M+H]^+$ 416.3371 found 416.3366.

Table S7. NMR comparison of isolated halisphingosine A and regioisomers Δ^9-*R*-C(8)-OH (500 MHz, 126 MHz, CD_3OD).



proposed structure of isolated product



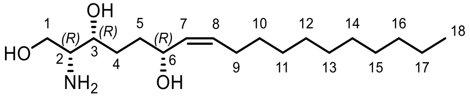
C10-16

N°	Isolated[a] $[\alpha]_D^{22}$ = + 10 (c = 0.1 MeOH δ C [ppm]	 δ H [ppm]	2*R*,3*R*,8*R*,*Z*-43[b] + 10.2 (c = 0.1 MeOH) δ C [ppm]	 δ H [ppm]	2*S*,3*S*,8*S*,*Z*-44[b] -10.7 (c = 0.1 MeOH) δ C [ppm]	 δ H [ppm]	2*R*,3*R*,8*S*,*Z*-48[b] + 3.1 (c = 0.1 MeOH) δ C [ppm]	 δ H [ppm]	2*S*,3*S*,8*R*,*Z*-47[b] -3.8 (c = 0.1 MeOH) δ C [ppm]	 δ H [ppm]
1	60.9	3.74 (dd, 11.4, 4.5 Hz)	60.5	3.76 (dd, 11.7, 4.0 Hz)	60.5	3.77 (dd, 11.7, 4.0 Hz)	60.5	3.76 (dd, 11.7, 4.1 Hz)	60.5	3.77 (dd, 11.7, 4.0 Hz)
		3.62 (dd, 11.5, 7.0 Hz)		3.64 (dd, 11.8, 6.9 Hz)		3.65 (dd, 10.0, 7.0 Hz)		3.65 (m)		3.65 (dd, 11.8, 6.9 Hz)
2	59.0	2.99 (dt, 7.0, 4.5 Hz)	59.1	3.04 (dt, 6.8, 4.0 Hz)	59.1	3.05 (dt, 6.8, 4.0 Hz)	59.1	3.03 (dt, 6.7, 3.7 Hz)	59.1	3.05 (dt, 6.8, 4.0 Hz)
3	69.3	3.64 (m)	69.0	3.68 (m)	69.0	3.69 (m)	69.0	3.65 (m)	69.0	3.69 (m)
4	35.0	1.52 (m)	34.9	1.55 (m)	34.9	1.55 (m)	34.9	1.55 (m)	34.9	1.55 (m)
		1.42 (m)		1.45 (m)		1.45 (m)		1.46 (m)		1.46 (m)
5	38.7	1.55 (m)	38.7	1.58 (m)	38.7	1.58 (m)	38.7	1.57 (m)	38.7	1.58 (m)
		1.35 (m)		1.40 (m)		1.40 (m)		1.42 (m)		1.42 (m)
6	68.2	4.35 (m)	68.1	4.37 (m)	68.1	4.37 (m)	68.2	4.37 (dt, 8.4. 5.9 Hz)	68.2	4.37 (dt, 9.1, 6.1 Hz)
7	134.0	5.31 (dd, 11.0, 9.0 Hz)	133.9	5.32 (dd, 10.9, 9.0 Hz)	133.9	5.32 (dd, 10.9, 8.9 Hz)	133.9	5.32 (dd, 11.6, 9.8 Hz)	133.9	5.32 (dd, 10.9, 9.0 Hz)
8	132.2	5.44 (dt, 11.0, 7.5 Hz)	132.3	5.44 (dt, 11.0, 7.4 Hz)	132.3	5.44 (dt, 11.1, 7.4 Hz)	132.3	5.44 (dt, 10.6, 7.3 Hz)	132.3	5.44 (dt, 11.2, 7.4 Hz)
9	28.7	2.08 (m)	28.7	2.08 (m)	28.7	2.07 (m)	28.7	2.07 (m)	28.7	2.07 (m)
10-16	26.3–32.9	1.28–1.37 (m)	26.3–33.1	1.23–1.40 (m)	26.3–33.1	1.21–1.48 (m)	26.4–33.1	1.23–1.48 (m)	26.4–33.1	1.23–1.42 (m)
17	23.7	1.28–1.37 (m)	23.8	1.23–1.40 (m)	23.7	1.21–1.48 (m)	23.8	1.23–1.48 (m)	23.7	1.23–1.42 (m)
18	14.1	0.90 (t, 7.0 Hz)	14.5	0.89 (t, 7.0 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.7 Hz)	14.5	0.89 (t, 6.9 Hz)

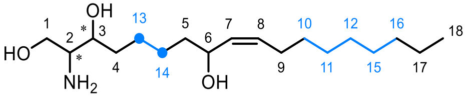
[a] Mansoor, T. A.; Park, T.; Luo, X.; Hong, J.; Lee, C. O.; Jung, J. H. A new sphingosine from a marine sponge *Haliclona (Reniera)* sp. *Natural Product Sciences* **2007**, *13* (3), 247–250.

[b] NMR data of conformer 1 (Figure S9)

Table S8. NMR comparison of isolated halisphingosine A and regioisomers Δ^9-*R*-C(8)-OH (500 MHz, 126 MHz, CD$_3$OD).



proposed structure of isolated product



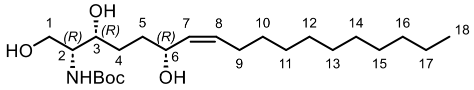
C10-16

N°	Isolated[a] $[\alpha]_D^{22}$ = + 10 (c = 0.1 MeOH)		2*R*,3*S*,8*R*,*Z*-45[b] 10.9 (c = 0.1 MeOH)		2*S*,3*R*,8*S*,*Z*-46[b] -10.8 (c = 0.1 MeOH)		2*R*,3*S*,8*S*,*Z*-50[b] -11.5 (c = 0.1 MeOH)		2*S*,3*R*,8*R*,*Z*-49[b] 11.9 (c = 0.1 MeOH)	
	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]	δ C [ppm]	δ H [ppm]
1	60.9	3.74 (dd, 11.4, 4.5 Hz)	**58.9**	3.83 (dd, 11.6, 4.0 Hz)	58.9	3.83 (dd, 11.6, 4.0 Hz)	58.9	3.83 (dd, 11.6, 4.0 Hz)	58.9	3.83 (dd, 11.6, 4.0 Hz)
		3.62 (dd, 11.5, 7.0 Hz)		3.69 (dd, 11.6, 8.7 Hz)		3.70 (dd, 11.6, 8.7 Hz)		3.69 (dd, 11.6, 8.7 Hz)		3.70 (dd, 11.6, 8.6 Hz)
2	59.0	2.99 (dt, 7.0, 4.5 Hz)	**58.4**	3.20 (dt, 8.3, 3.9 Hz)	58.4	3.20 (dt, 8.3, 3.9 Hz)	58.5	3.19 (dt, 8.3, 3.9 Hz)	58.4	3.20 (dt, 8.2, 3.9 Hz)
3	69.3	3.64 (m)	**70.2**	3.78 (dt, 8.4, 4.2 Hz)	70.2	3.79 (m)	70.2	3.78 (dt, 8.3, 4.2 Hz)	70.2	3.79 (m)
4	35.0	1.52 (m)	**34.2**	1.48 (m)	34.2	1.48 (m)	34.2	1.48 (m)	34.2	1.48 (m)
		1.42 (m)								
5	38.7	1.55 (m)	38.6	1.57 (m)	38.6	1.58 (m)	38.6	1.58 (m)	38.6	1.58 (m)
		1.35 (m)		1.41 (m)		1.41 (m)		1.40 (m)		1.39 (m)
6	68.2	4.35 (m)	68.1	4.37 (dt, 8.9, 6.1 Hz)	68.1	4.37 (dt, 8.4. 5.9 Hz)	68.1	4.37 (m)	68.1	4.37 (m)
7	134.0	5.31 (dd, 11.0, 9.0 Hz)	133.9	5.32 (dd, 10.8, 9.0 Hz)	133.9	5.32 (dd, 11.0, 8.9 Hz)	133.9	5.33 (m)	133.9	5.32 (m)
8	132.2	5.44 (dt, 11.0, 7.5 Hz)	132.3	5.44 (dt, 10.6, 7.2 Hz)	132.3	5.44 (dt, 11.1, 7.4 Hz)	132.3	5.44 (dt, 11.1, 7.4 Hz)	132.3	5.44 (dt, 11.2, 7.4 Hz)
9	28.7	2.08 (m)	28.7	2.07 (m)	28.7	2.08 (m)	28.7	2.09 (m)	28.7	2.08 (m)
10-16	26.3–32.9	1.28–1.37 (m)	26.4–33.1	1.23–1.42 (m)	26.4–33.1		26.4–33.1	1.20–1.44 (m)	26.4–33.1	1.23–1.43 (m)
17	23.7	1.28–1.37 (m)	23.7	1.23–1.42 (m)	23.7		23.7	1.20–1.34 (m)	23.7	1.23–1.43 (m)
18	14.1	0.90 (t, 7.0 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.8 Hz)	14.5	0.89 (t, 6.8 Hz)

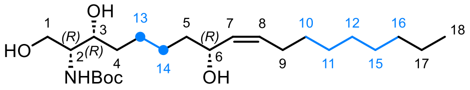
[a] Mansoor, T. A.; Park, T.; Luo, X.; Hong, J.; Lee, C. O.; Jung, J. H. A new sphingosine from a marine sponge *Haliclona (Reniera)* sp. *Natural Product Sciences* **2007**, *13* (3), 247–250.

[b] NMR data of conformer 1 (Figure S9)

Table S9. NMR comparison of isolated Boc-halisphingosine A and Boc-protected regio isomer **51** Δ^9-*R*-C(8)-OH (500 MHz, 126 MHz, CD_3OD).



proposed structure of Boc protected isolated product

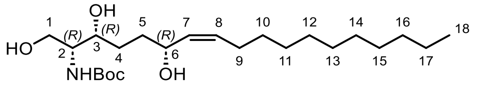


C10-16

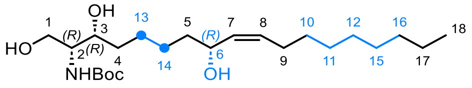
	Literature[a]		*synthesized Boc-2R,3R,8R,Z 51*		$|\Delta\delta|$ *[ppm]*	
	$[\alpha]_D$ = + 12.7 (c = 0.2 $CHCl_3$)		$[\alpha]_D^{22}$ = + 11.1 (c = 0.2 $CHCl_3$)			
N°	**δ C [ppm]**	**δ H [ppm]**	**δ C [ppm]**	**δ H [ppm]**	**C**	**H**
1	62.8	3.55 (m)	63.1	3.52 (m)	0.3	0.03
		3.6 (m)		3.57 (m)		0.03
2	56.5	3.54 (m)	56.9	3.53 (m)	0.4	0.01
3	70.7	3.75 (m)	71.0	3.76 (m)	0.3	0.01
4	34.7	1.45 (m)	35.1	1.44 (m)	0.4	0.01
5	38.5	1.38 (m)	38.7	1.37 (m)	0.2	0.01
		1.56 (m)		1.56 (m)		0
6	67.9	4.37 (dt, 9.0, 5.7)	68.2	4.36 (m)	0.3	0.01
7	133.7	5.31 (dddd 9.3, 7.8, 1.5, 1.5)	134.0	5.32 (dd, 10.9, 9.0)	0.3	0.01
8	131.8	5.45 (dt, 9.3, 6.4)	132.2	5.44 (dt, 11.0, 7.4)	0.4	0.01
9	28.4	2.09 (m)	28.7	2.08 (m)	0.3	0.01
10-17	23.5-32.5	1.29-1.41 (m)	23.5-33.1	1.28-1.42 (m)		
18	14.1	0.91 (t, 6.7)	14.5	0.9 (t, 6,7)	0.4	0.01
N-Boc (CH3)	28.5	1.45 (s)	28.8	1.45 (s)	0.3	0

[a] Molinski, T. F.; Biegelmeyer, R.; Stout, E. P.; Wang, X.; Frota, M. L. C.; Henriques, A. T. Halisphingosines A and B, modified sphingoid bases from Haliclona tubifera. Assignment of configuration by circular dichroism and van't Hoff's principle of optical superposition. *Journal of natural products* **2013**, *76* (3), 374–381.

Table S10. NMR comparison of ^{13}C-signals from the DEPT spectra of isolated Boc-halisphingosine A and Boc-protected regio isomer **51** Δ^9-*R*-C(8)-OH (126 MHz, CD$_3$OD) ([a] Molinski, T. F.; Biegelmeyer, R.; Stout, E. P.; Wang, X.; Frota, M. L. C.; Henriques, A. T. Halisphingosines A and B, modified sphingoid bases from Haliclona tubifera. Assignment of configuration by circular dichroism and van't Hoff's principle of optical superposition. *Journal of natural products* **2013**, *76* (3), 374–381.



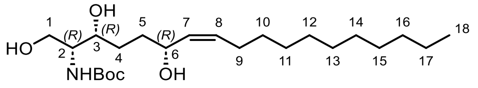
proposed structure of Boc protected isolated product



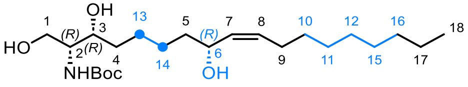
C10-16

isolated[a] δ C (DEPT) [ppm]	synthesized *Boc-2R,3R,8R,Z-51* δ C (DEPT) [ppm]	|Δ*δ*| *[ppm]*
133.74	133.67	0.04
131.93	131.95	0.02
70.81	70.73	0.08
67.92	67.92	0.00
62.85	62.84	0.01
56.58	56.59	0.00
38.48	38.46	0.02
34.74	34.79	0.05
32.63	32.79	0.16
30.55	30.60	0.06
30.51	30.35	0.16
30.41	30.16	0.25
29.81	30.15	0.34
28.46	28.47	0.01
28.42	28.42	0.00
26.56	26.62	0.07
26.24	26.34	0.10
23.43	23.48	0.05
14.17	14.21	0.04

Table S11. NMR comparison of the ^{13}C-signals of isolated Boc-halisphingosine A and Boc-protected regio isomer **51** Δ^9-*R*-C(8)-OH (126 MHz, $CDCl_3$). [a] Molinski, T. F.; Biegelmeyer, R.; Stout, E. P.; Wang, X.; Frota, M. L. C.; Henriques, A. T. Halisphingosines A and B, modified sphingoid bases from Haliclona tubifera. Assignment of configuration by circular dichroism and van't Hoff's principle of optical superposition. *Journal of natural products* **2013**, *76* (3), 374–381.



proposed structure of Boc protected isolated product



C10-16

isolated[a] δ C [ppm]	synthesized *Boc-2R,3R,8S,Z-51*	
	δ C [ppm]	|Δ*δ*| *[ppm]*
156.4	156.6	0.2
132.5	132.6	0.1
132.4	132.5	0.1
79.6	79.8	0.2
73.2	73.0	0.2
67.7	67.7	0.0
65.6	65.6	0.0
54.2	54.3	0.1
37.4	37.4	0.0
34.2	34.2	0.0
31.7	32.0	0.3
29.7	29.9	0.2
29.4	29.6	0.2
29.4	29.4	0.0
28.9	29.4	0.5
28.4	28.5	0.1
27.7	27.9	0.2
25.4	25.5	0.1
25.2	25.3	0.1
22.6	22.8	0.2
14.1	14.3	0.2

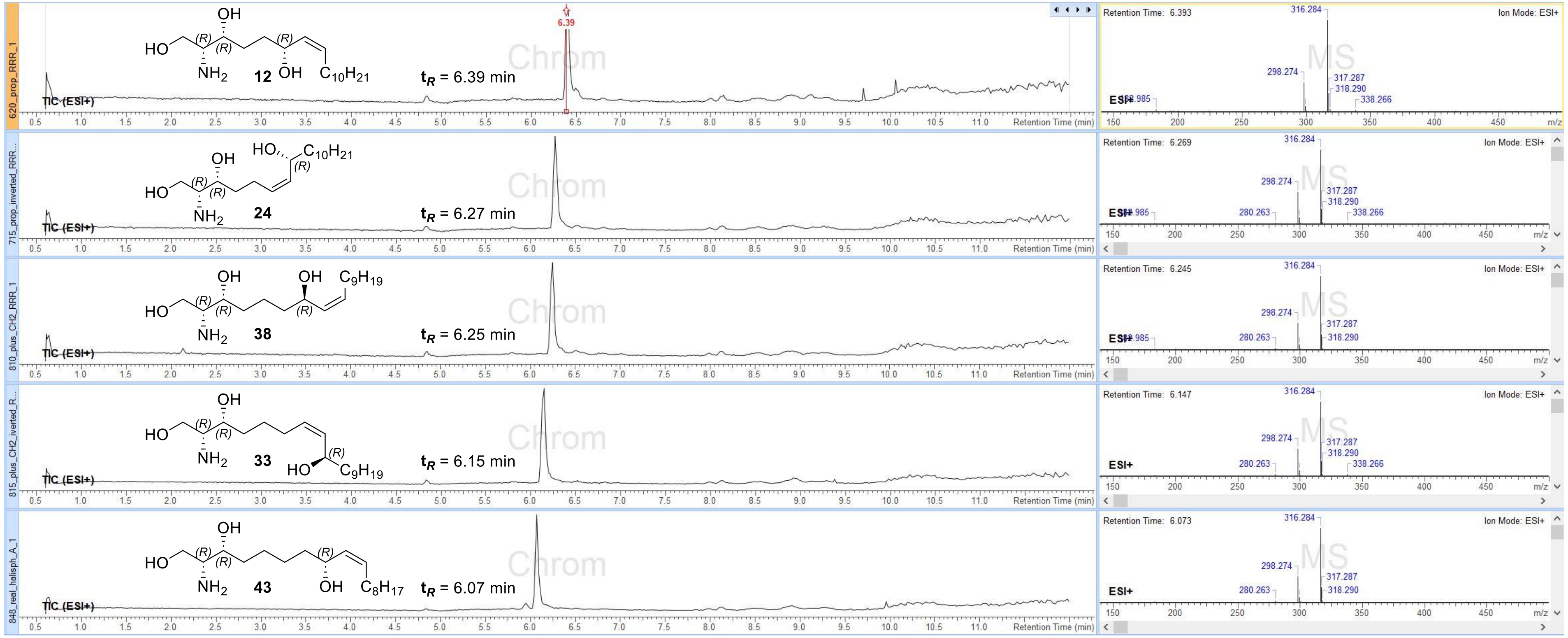


Figure S10. Comparison of the chromatograms (total ion count – TIC) and MS-spectra of different sphingoid bases. The anaylsis was performed on an Exactive Orbitrap High Performance Benchtop LCMS (Thermo Fisher Scientific, Germany) with an ESI and a Betasil C18 column (150 × 2.1 mm, Thermo Fisher Schíentific, Germany). Distilled water was used as solvent A and acetonitrile as solvent B. Both solvents were mixed with 0.1 % formic acid. With a flow rate of 0.2 mL min^{-1} the concentration of acetonitrile was hold at 5% for 1 min and then increased from 5% to 98% within 13 min. MS spectra were recorded at the indicated retention times. Analytical datasets have been uploaded to Zendo under the **DOI: 10.5281/zenodo.13841907**.

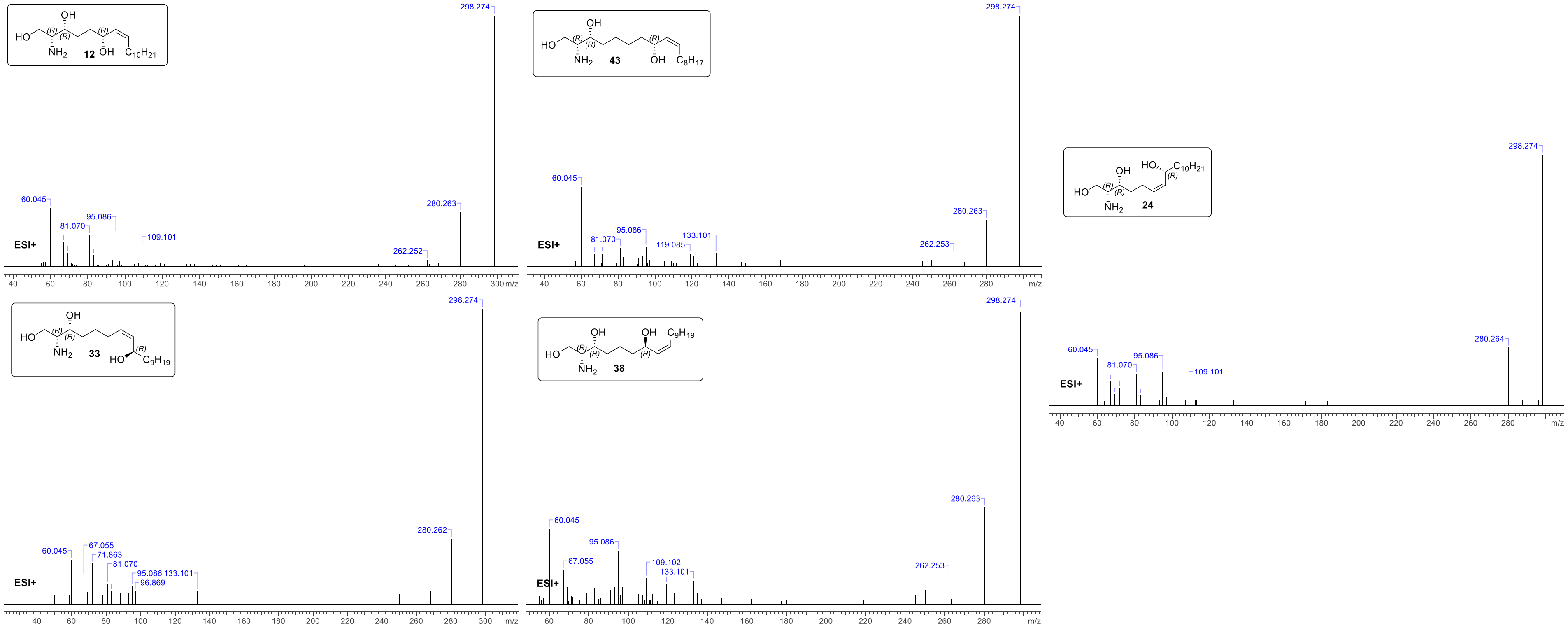
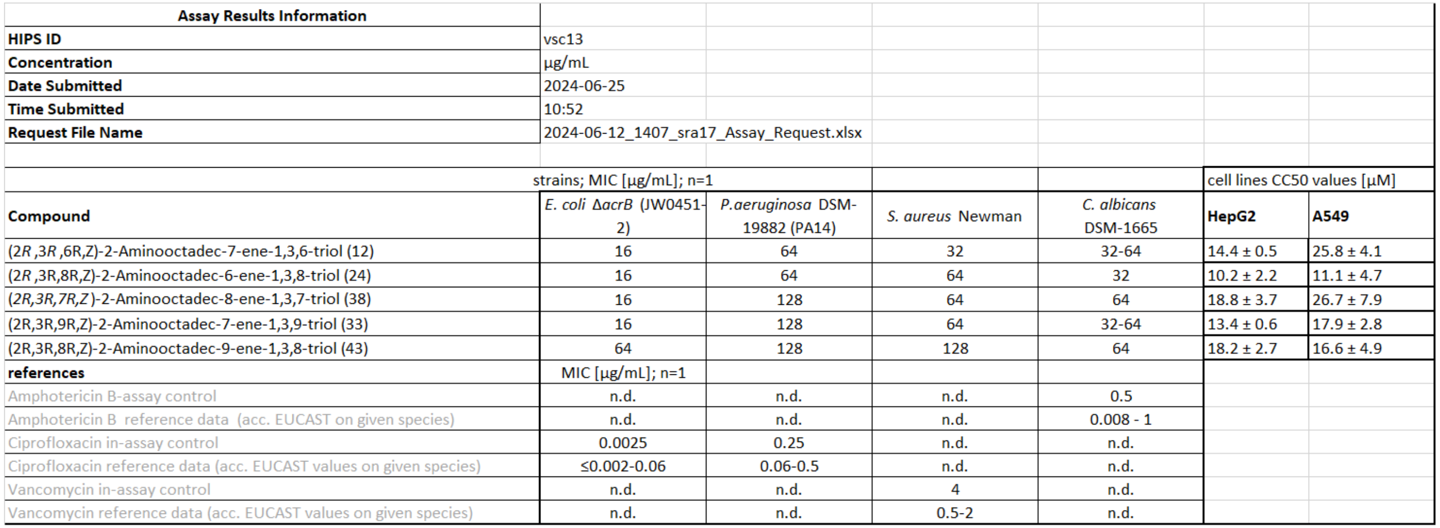


Figure S11. MS^2-spectra of different sphingoid bases using the exact same set up as indicated in Figure S10. 316.28 was chosen as a parent ion mass and CID was set to 30 keV. Analytical datasets have been uploaded to Zendo under the **DOI: 10.5281/zenodo.13841907**.

Determination of cytotoxicity

HepG2 or A549 cells (2x10^4 cells per well) were seeded in 96-well, flat-bottomed culture plates in 100 µL culture medium (DMEM containing 10% fetal calve serum, 1% penicillin-streptomycin). Twenty-four hours after seeding the cells, medium was removed and replaced by medium containing test compounds in a final DMSO concentration of 1%. For CC_{50} determination, compounds were tested at 8 concentrations that were prepared *via* 2-fold serial dilutions in 1% DMSO/medium. Epirubicin and doxorubicin were used as positive controls in serial dilutions starting from 10 µM, and rifampicin was used as a negative control (at 100 µM). The living cell mass was determined 48 h after treatment with compounds by adding 0.1 volumes of 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) solution (5 mg/mL sterile PBS) (Sigma, St. Louis, MO) to the wells. After incubating the cells for 30 min at 37 °C (atmosphere containing 5% CO_2), medium was removed and MTT crystals were dissolved in 75 µL of a solution containing 10% SDS and 0.5% acetic acid in DMSO. The optical density (OD) of the samples was determined photometrically at 570 nm in a PHERAstar Omega plate reader (BMG labtech, Ortenberg, Germany). To obtain percent viability for each sample, their ODs were related to those of DMSO controls. At least two independent measurements were performed for each compound. The calculation of CC_{50} was performed using the nonlinear regression function of GraphPad Prism 10 (GraphPad Software, San Diego, CA, USA).

Table S12. Antimicrobial activity using broth dilution assay and cytotoxicity against HepG2 and A549 cell lines.



Assay Results Information						
HIPS ID	vsc13					
Concentration	µg/mL					
Date Submitted	2024-06-25					
Time Submitted	10:52					
Request File Name	2024-06-12_1407_sra17_Assay_Request.xlsx					
	strains; MIC [µg/mL]; n=1				cell lines CC50 values [µM]	
Compound	*E. coli ΔacrB* (JW0451-2)	*P.aeruginosa* DSM-19882 (PA14)	*S. aureus* Newman	*C. albicans* DSM-1665	**HepG2**	**A549**
(2*R* ,3*R* ,6R,Z)-2-Aminooctadec-7-ene-1,3,6-triol (12)	16	64	32	32-64	14.4 ± 0.5	25.8 ± 4.1
(2*R* ,3R,8R,Z)-2-Aminooctadec-6-ene-1,3,8-triol (24)	16	64	64	32	10.2 ± 2.2	11.1 ± 4.7
(*2R,3R,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol (38)	16	128	64	64	18.8 ± 3.7	26.7 ± 7.9
(2R,3R,9R,Z)-2-Aminooctadec-7-ene-1,3,9-triol (33)	16	128	64	32-64	13.4 ± 0.6	17.9 ± 2.8
(2R,3R,8R,Z)-2-Aminooctadec-9-ene-1,3,8-triol (43)	64	128	128	64	18.2 ± 2.7	16.6 ± 4.9
references	MIC [µg/mL]; n=1					
Amphotericin B-assay control	n.d.	n.d.	n.d.	0.5		
Amphotericin B reference data (acc. EUCAST on given species)	n.d.	n.d.	n.d.	0.008 - 1		
Ciprofloxacin in-assay control	0.0025	0.25	n.d.	n.d.		
Ciprofloxacin reference data (acc. EUCAST values on given species)	≤0.002-0.06	0.06-0.5	n.d.	n.d.		
Vancomycin in-assay control	n.d.	n.d.	4	n.d.		
Vancomycin reference data (acc. EUCAST values on given species)	n.d.	n.d.	0.5-2	n.d.		

3 NMR-spectra - Analytical datasets have been uploaded to Zendo under the DOI: 10.5281/zenodo.13841907

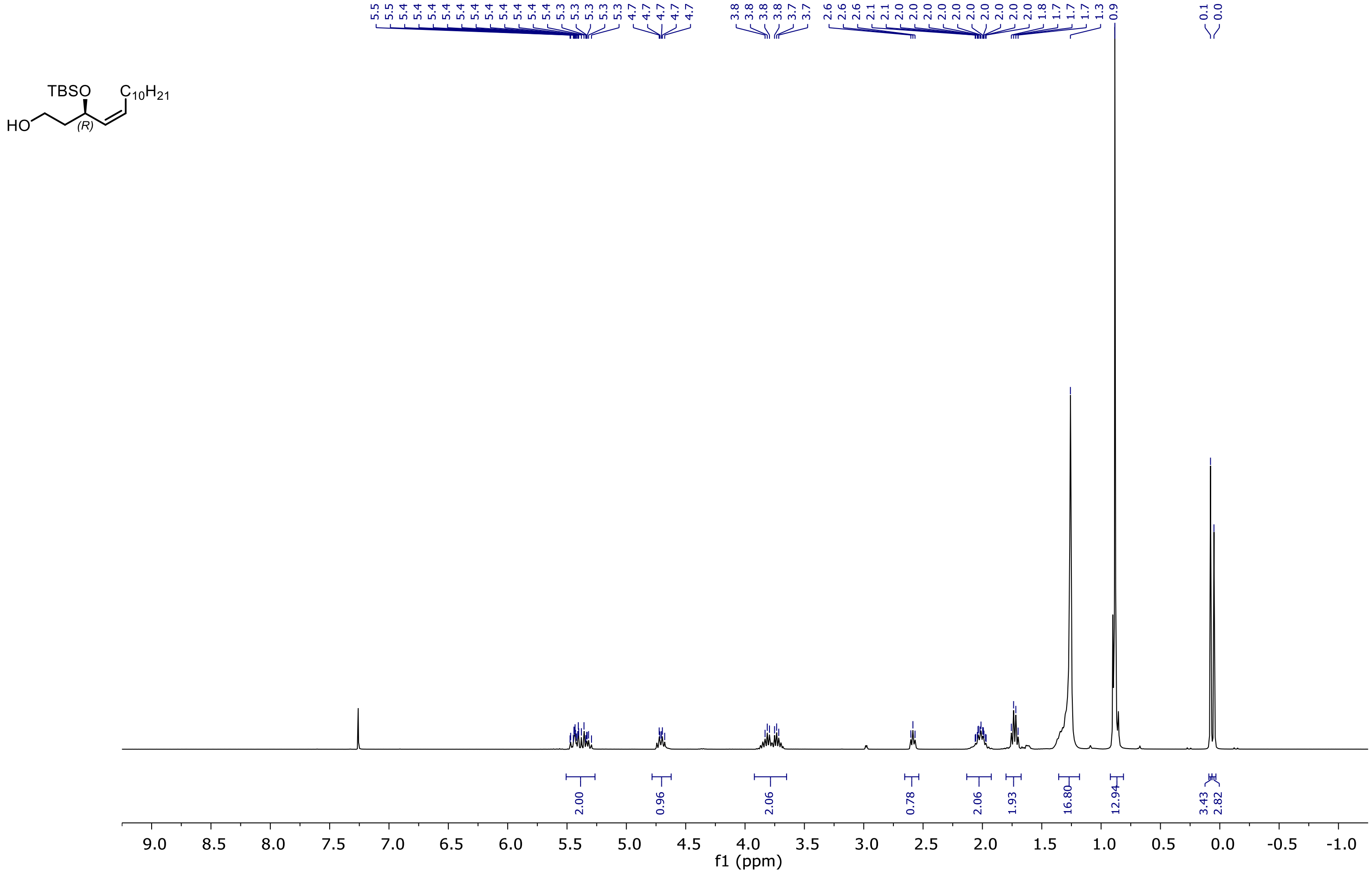


Figure S12. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*R,Z*)-3-((*tert*-butyldimethylsilyl)oxy)pentadec-4-en-1-ol **4**.

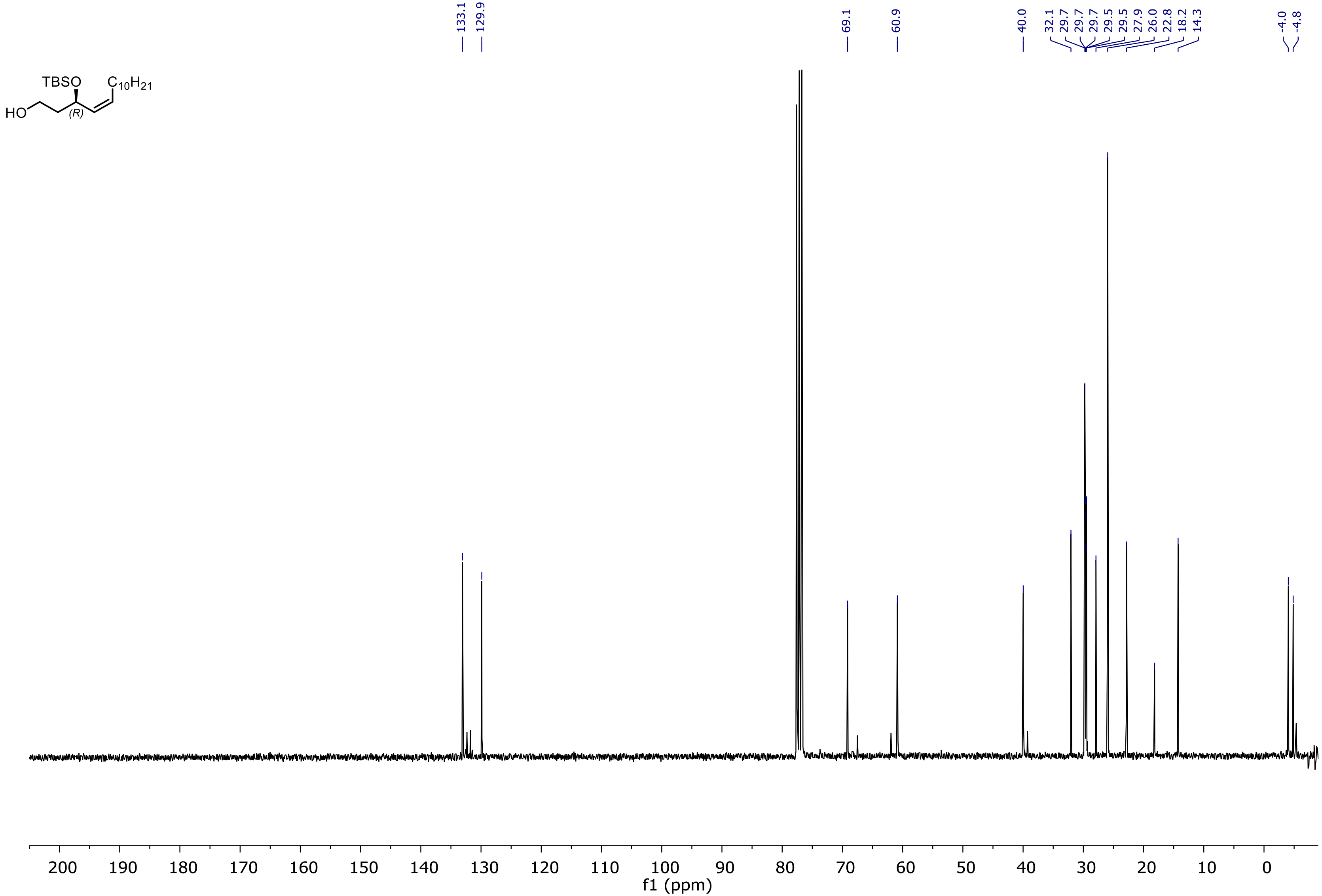


Figure S13. $^{13}C\{^1H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*R,Z*)-3-((*tert*-butyldimethylsilyl)oxy)pentadec-4-en-1-ol **4**.

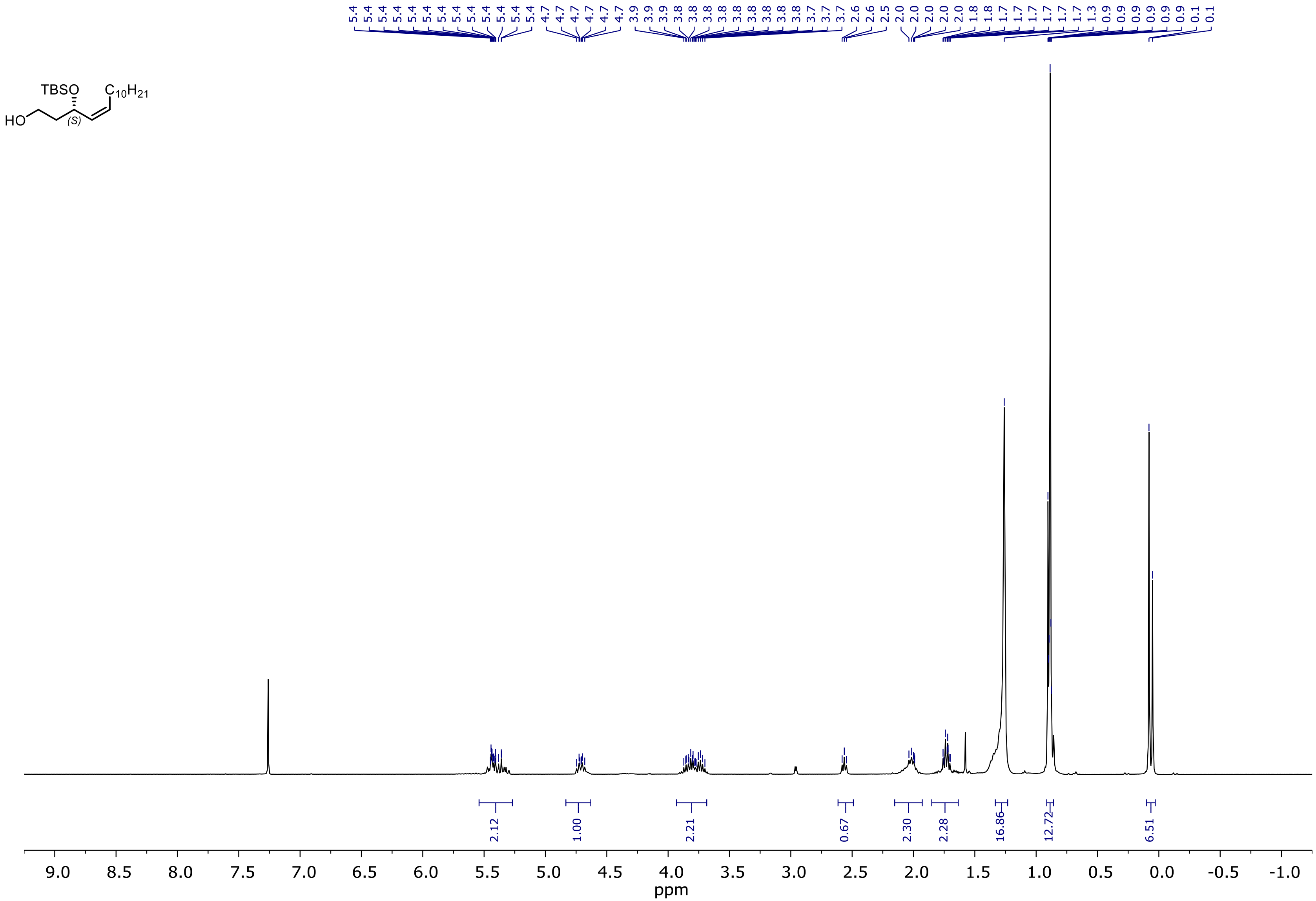


Figure S14. ^{1}H-NMR spectrum (300 MHz, CDCl$_3$) of (*S,Z*)-3-((*tert*-butyldimethylsilyl)oxy)pentadec-4-en-1-ol **4**.

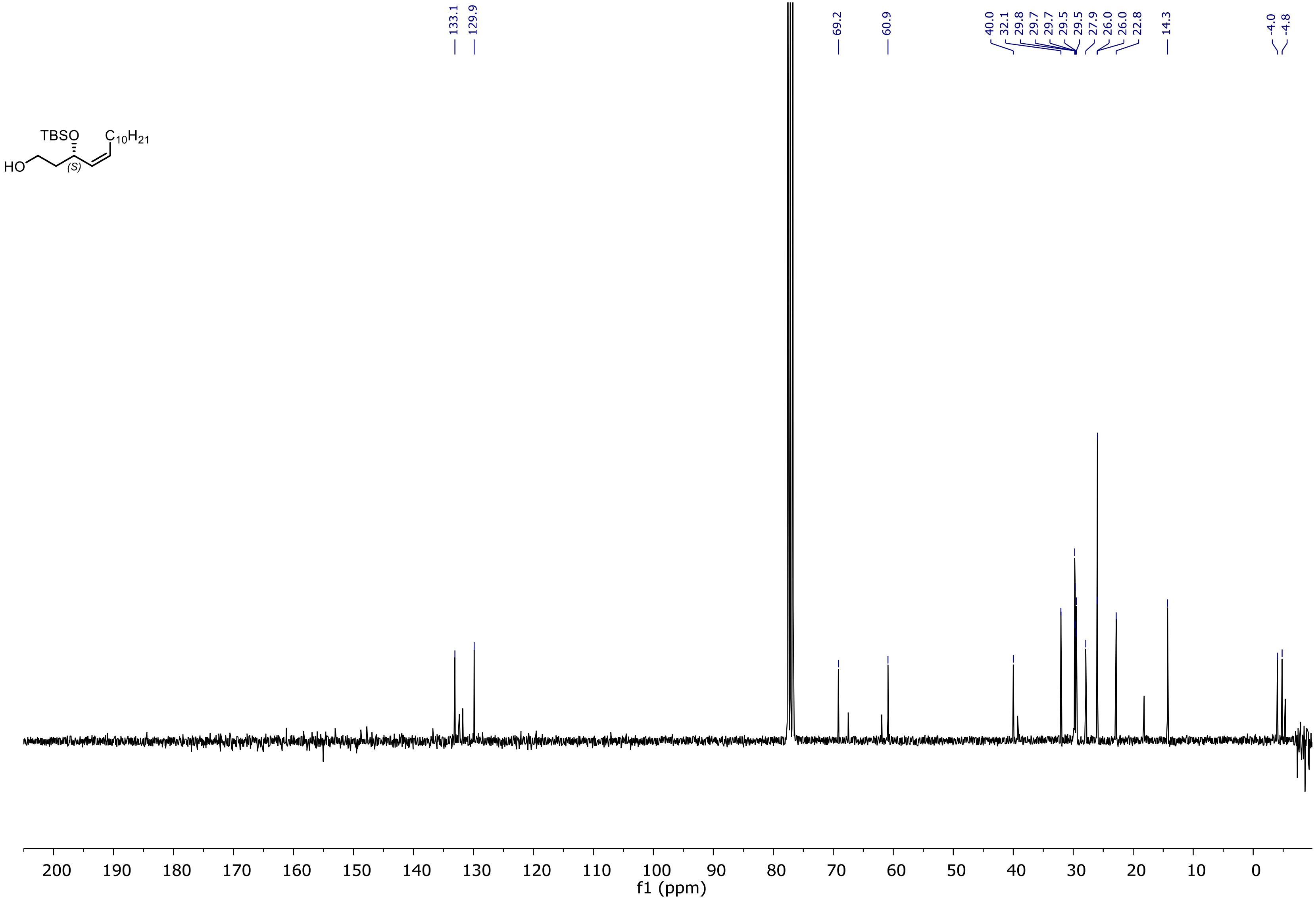


Figure S15. $^{13}C\{^{1}H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*S*,*Z*)-3-((*tert*-butyldimethylsilyl)oxy)pentadec-4-en-1-ol **4**.

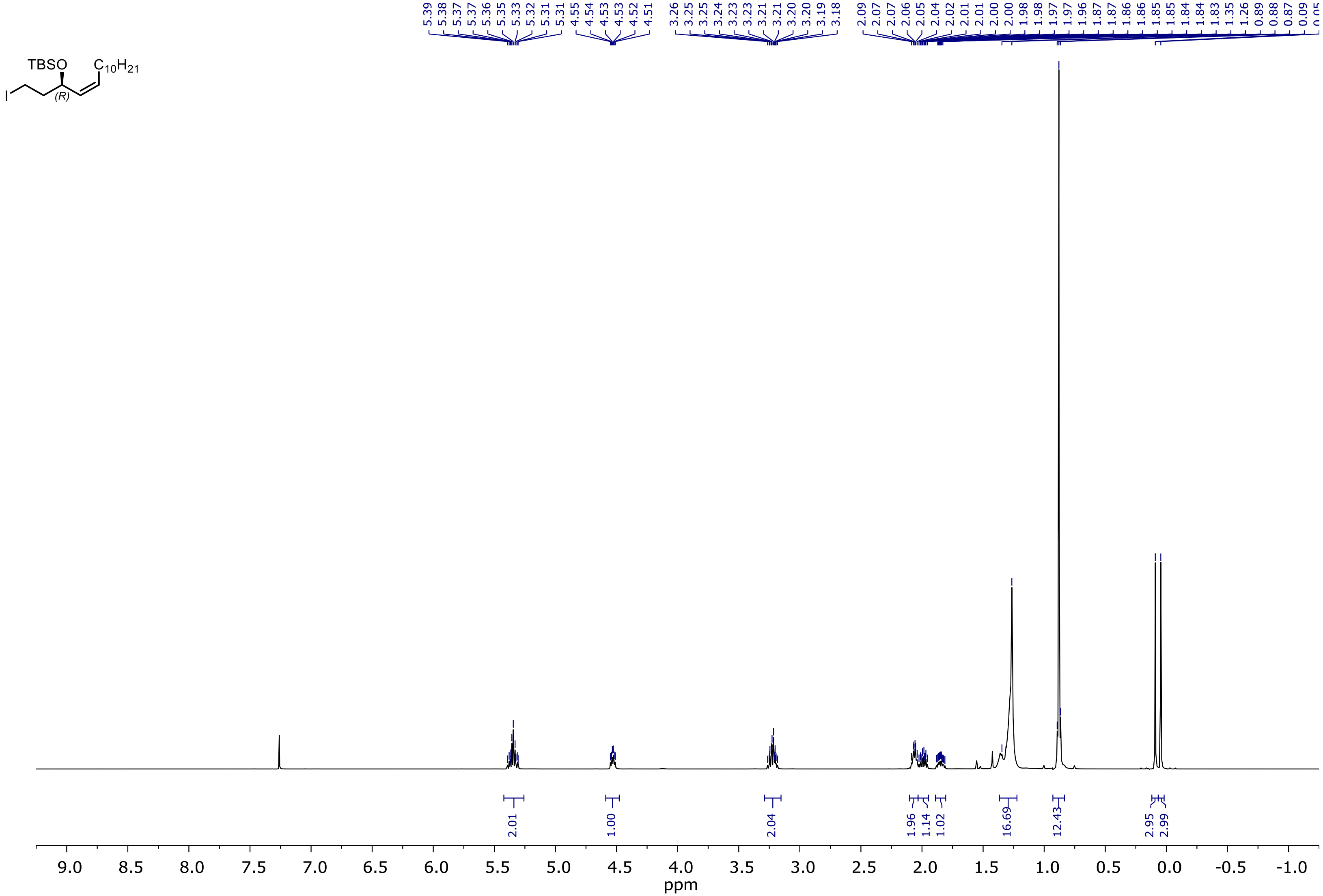


Figure S16. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R,Z*)-3-*tert*-Butyl((1-iodopentadec-4-en-3-yl)oxy)dimethylsilane **5.**

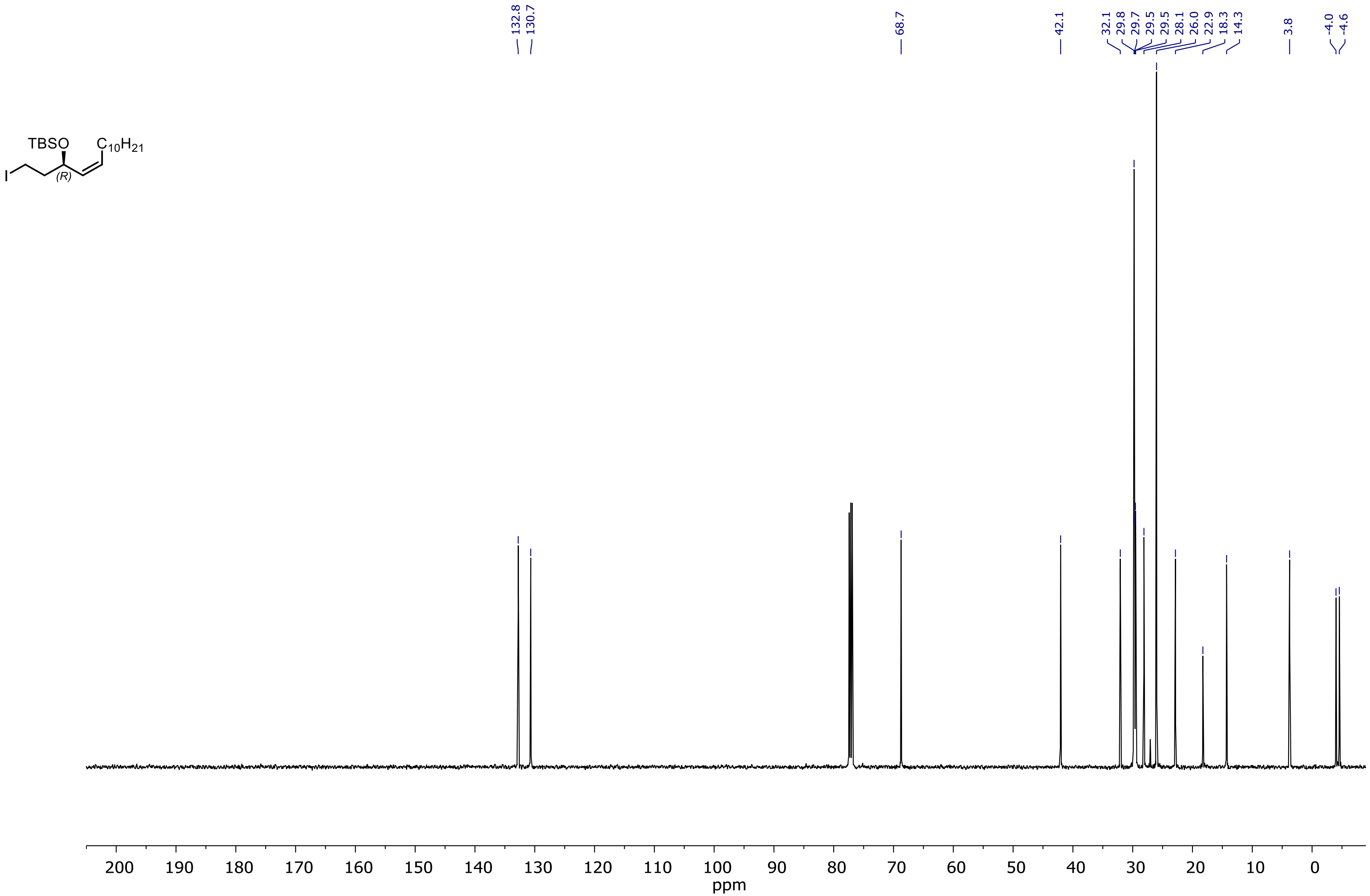


Figure S17. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R,Z*)-3-*tert*-Butyl((1-iodopentadec-4-en-3-yl)oxy)dimethylsilane **5**.

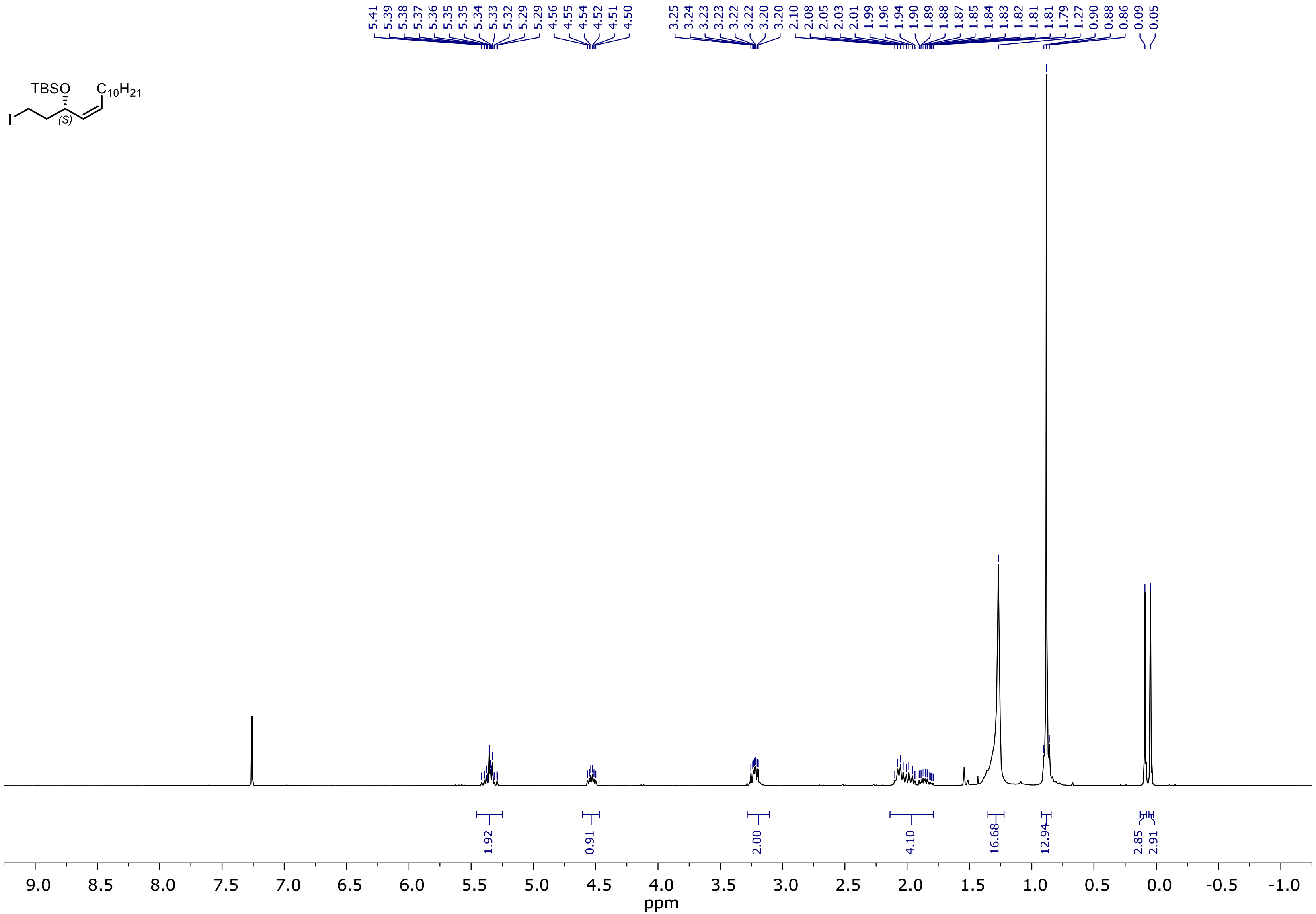


Figure S18. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*S,Z*)-3-*tert*-Butyl((1-iodopentadec-4-en-3-yl)oxy)dimethylsilane **5**.

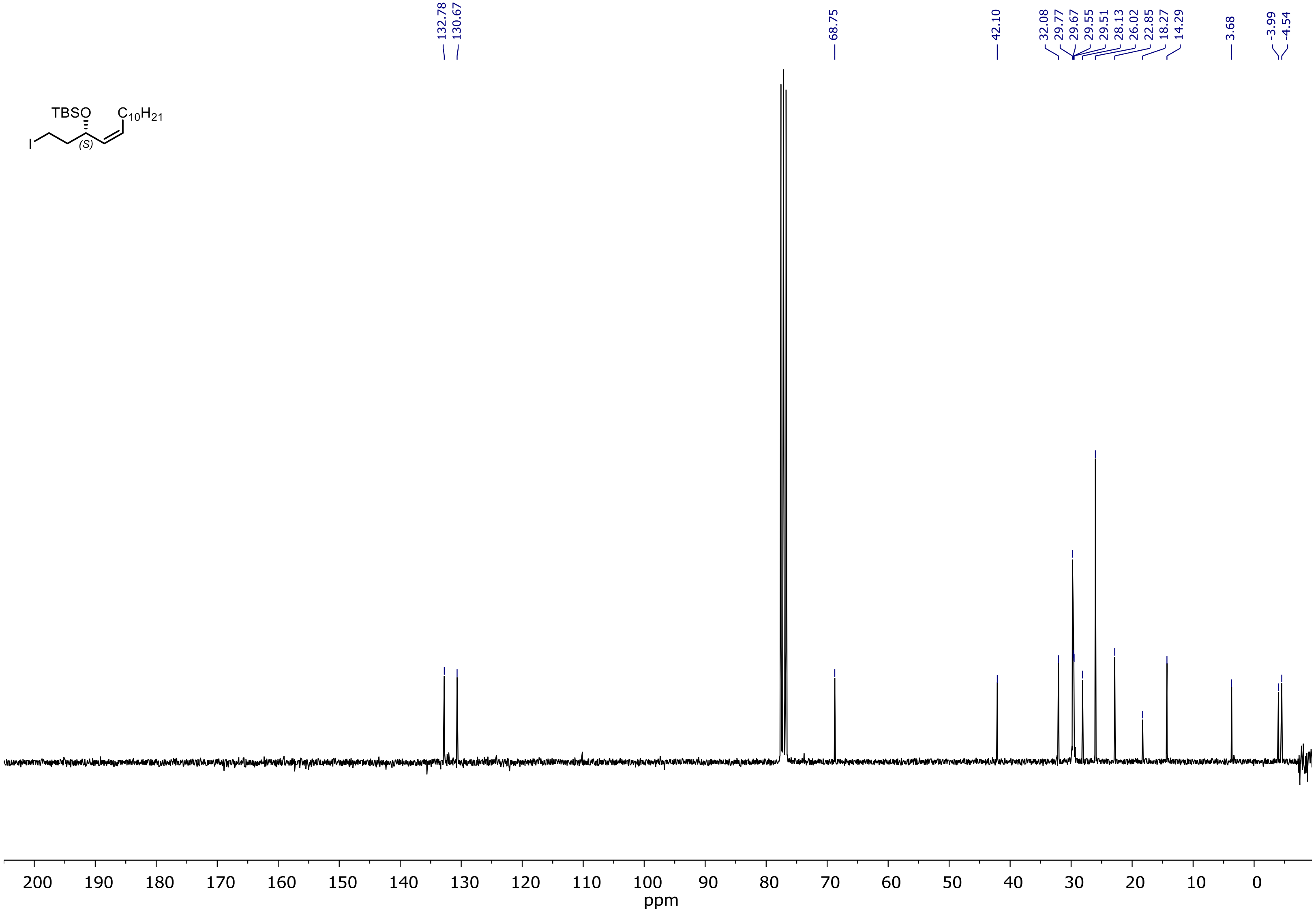


Figure S19. $^{13}C\{^{1}H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*S,Z*)-3-*tert*-Butyl((1-iodopentadec-4-en-3-yl)oxy)dimethylsilane **5**.

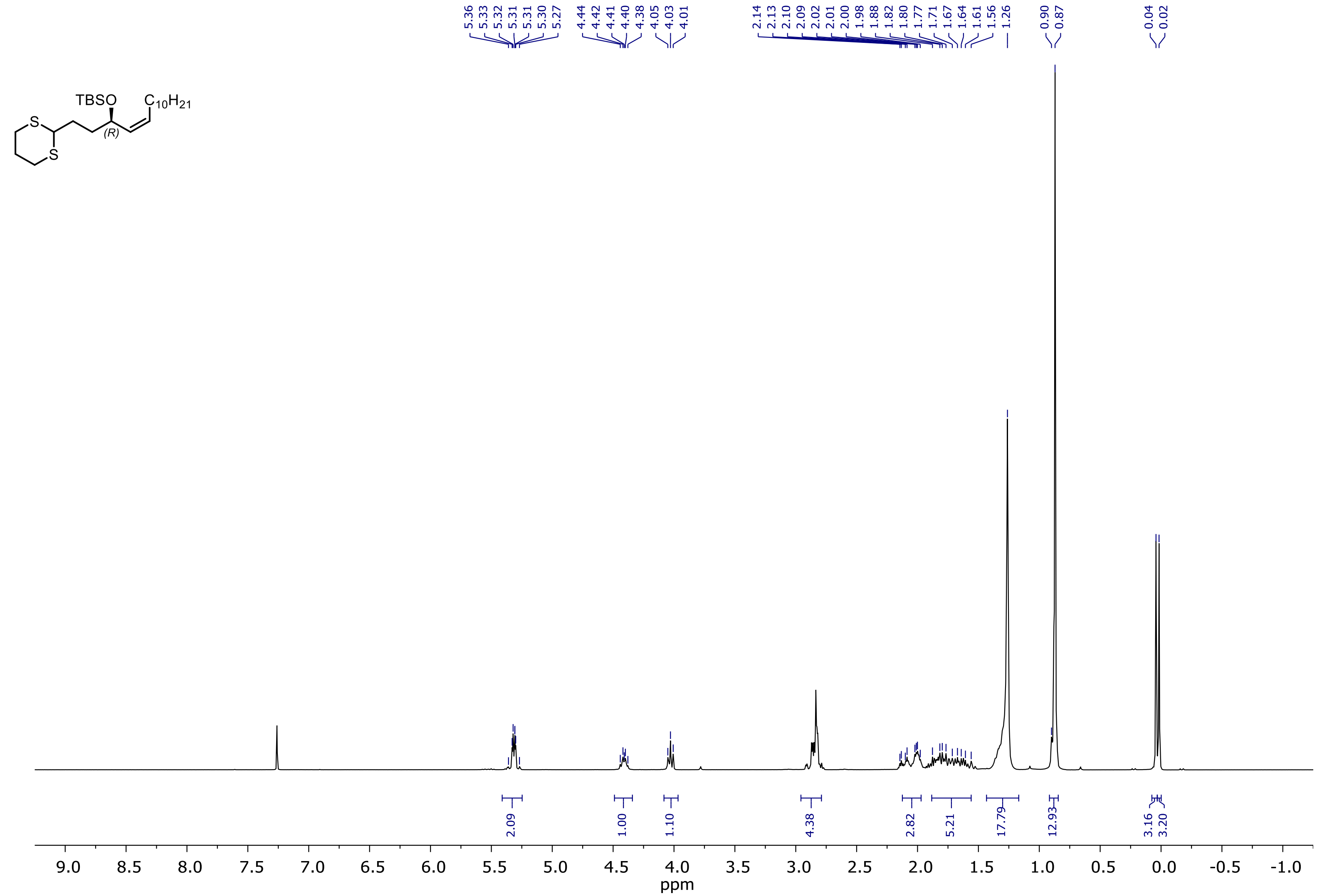


Figure S20. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*R,Z*)-((1-(1,3-Dithian-2-yl)pentadec-4-en-3-yl)oxy)(*tert*-butyl)dimethylsilane **6**.

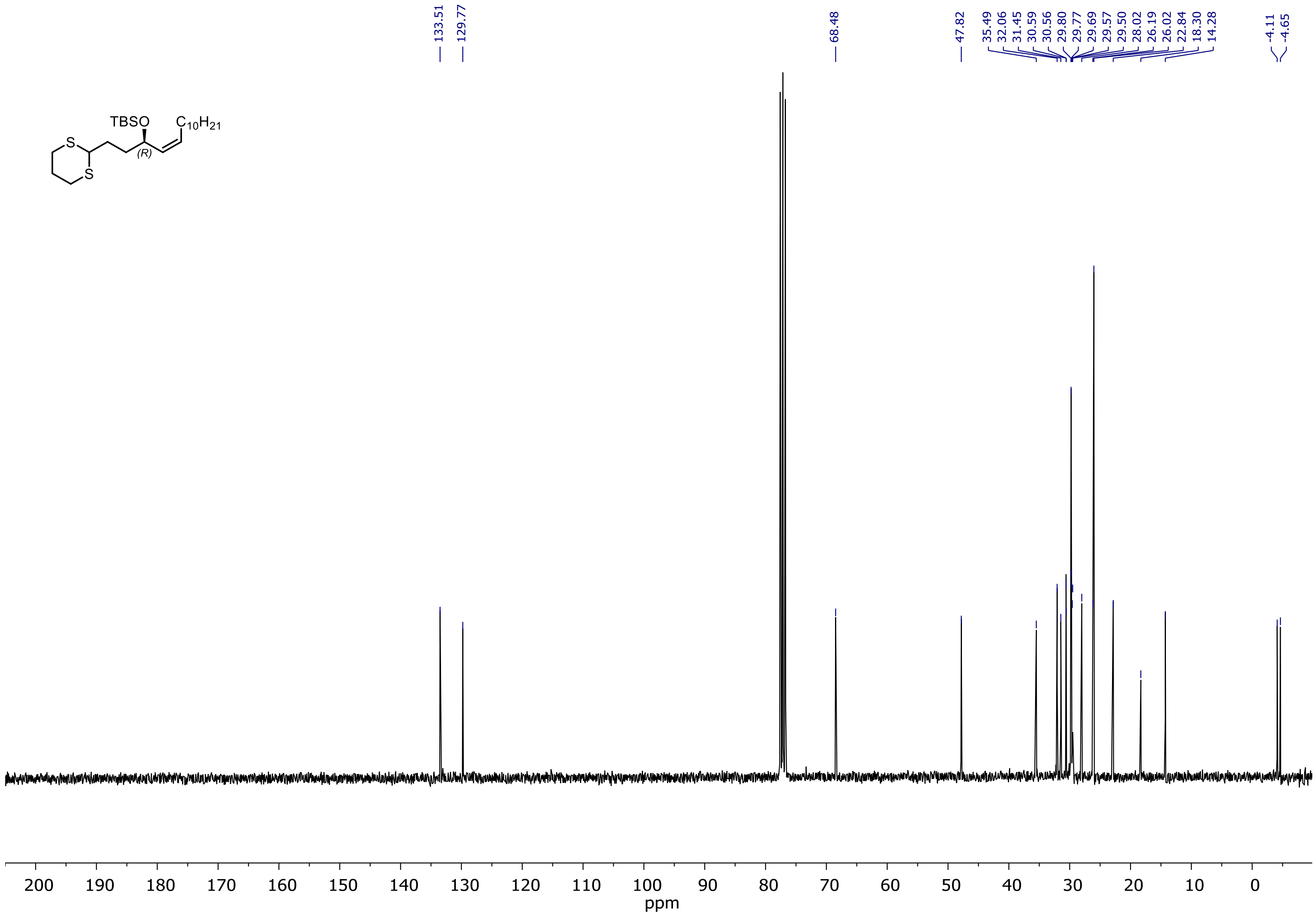


Figure S21. ^{13}C{^{1}H}-NMR spectrum (75 MHz, CDCl$_3$) of (*R,Z*)-((1-(1,3-Dithian-2-yl)pentadec-4-en-3-yl)oxy)(*tert*-butyl)dimethylsilane **6**.

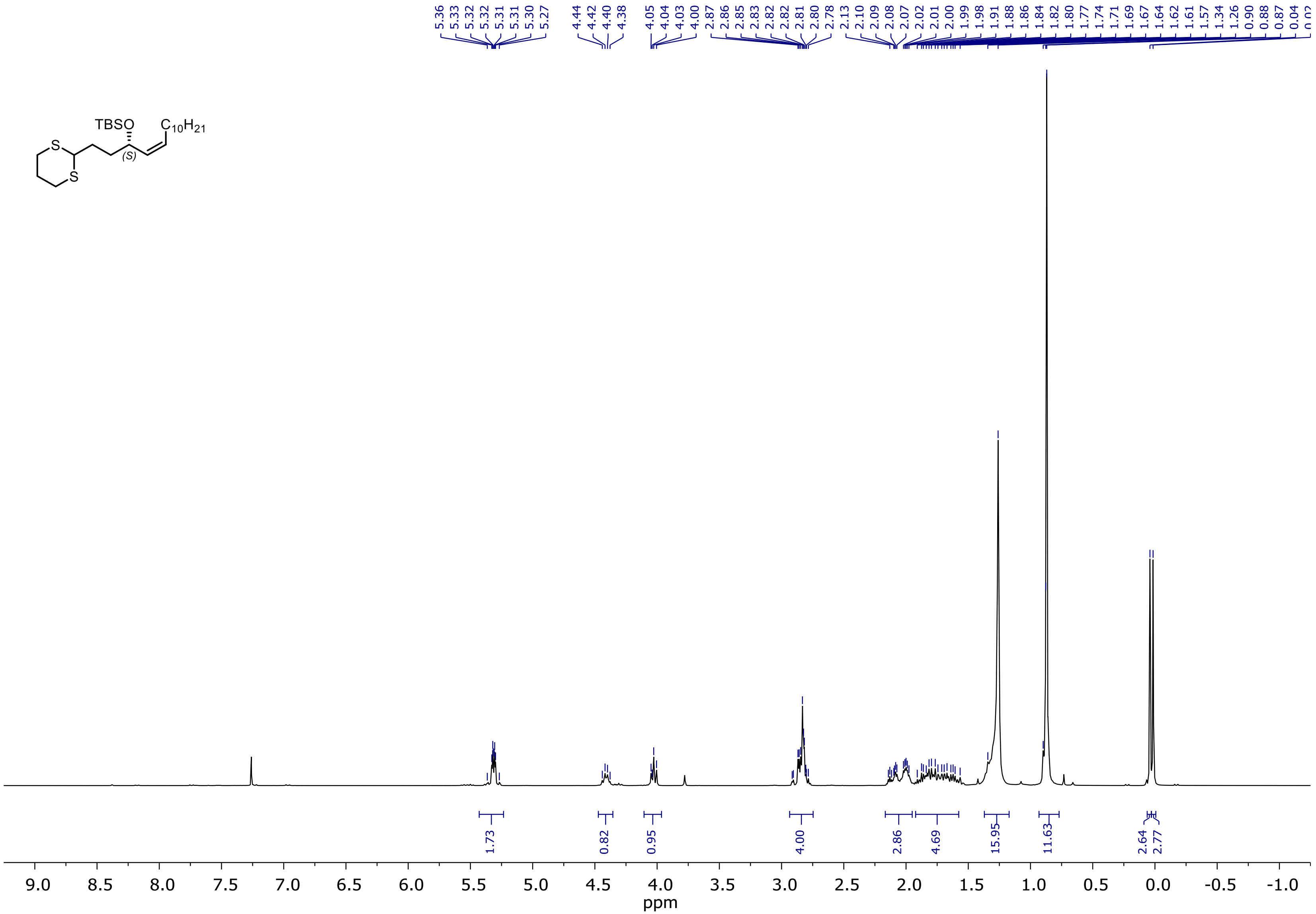


Figure S22. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*S,Z*)-((1-(1,3-Dithian-2-yl)pentadec-4-en-3-yl)oxy)(*tert*-butyl)dimethylsilane **6**.

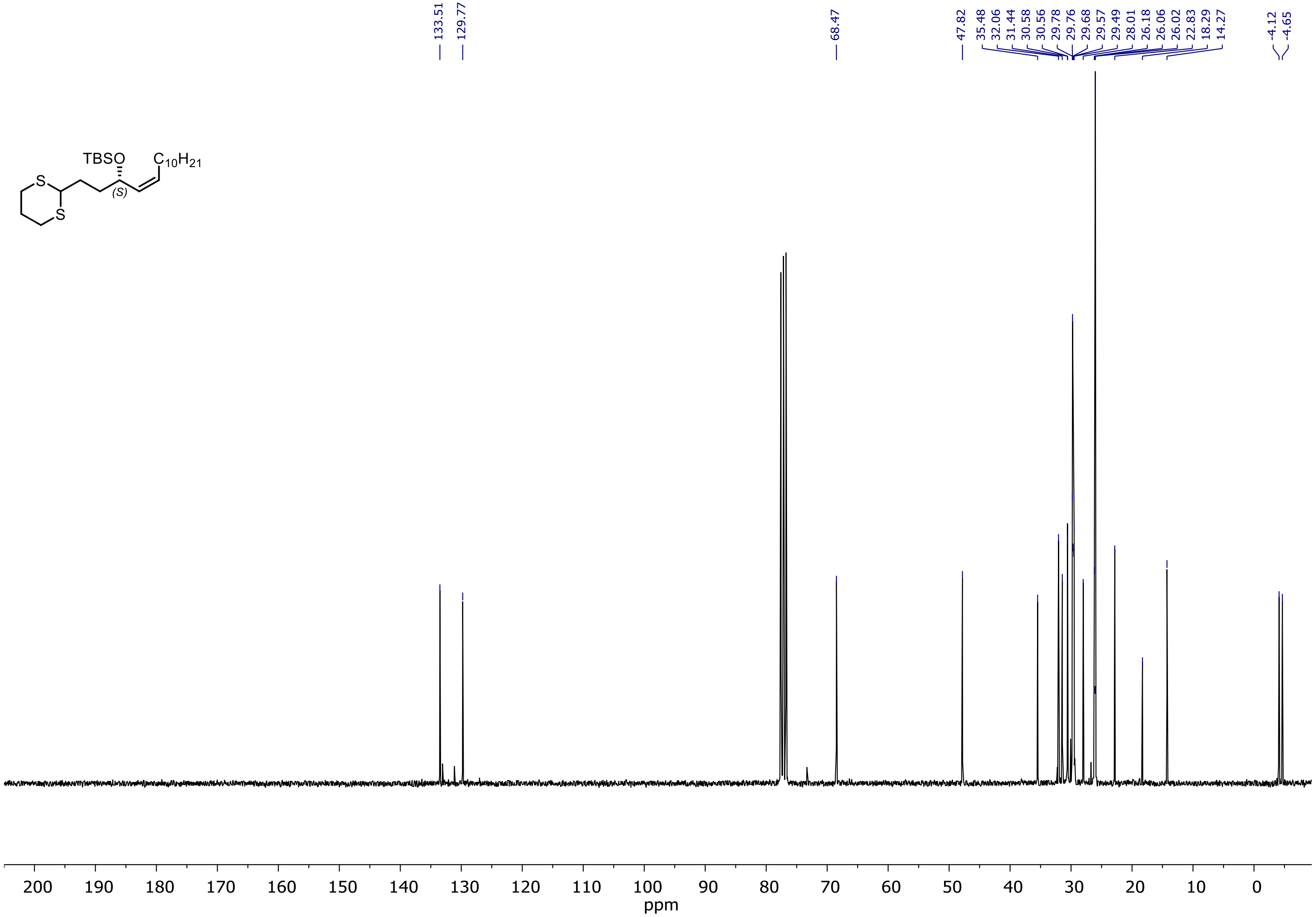


Figure S23. ^{13}C{^{1}H}-NMR spectrum (75 MHz, CDCl$_3$) of (*S,Z*)-((1-(1,3-Dithian-2-yl)pentadec-4-en-3-yl)oxy)(*tert*-butyl)dimethylsilane **6**.

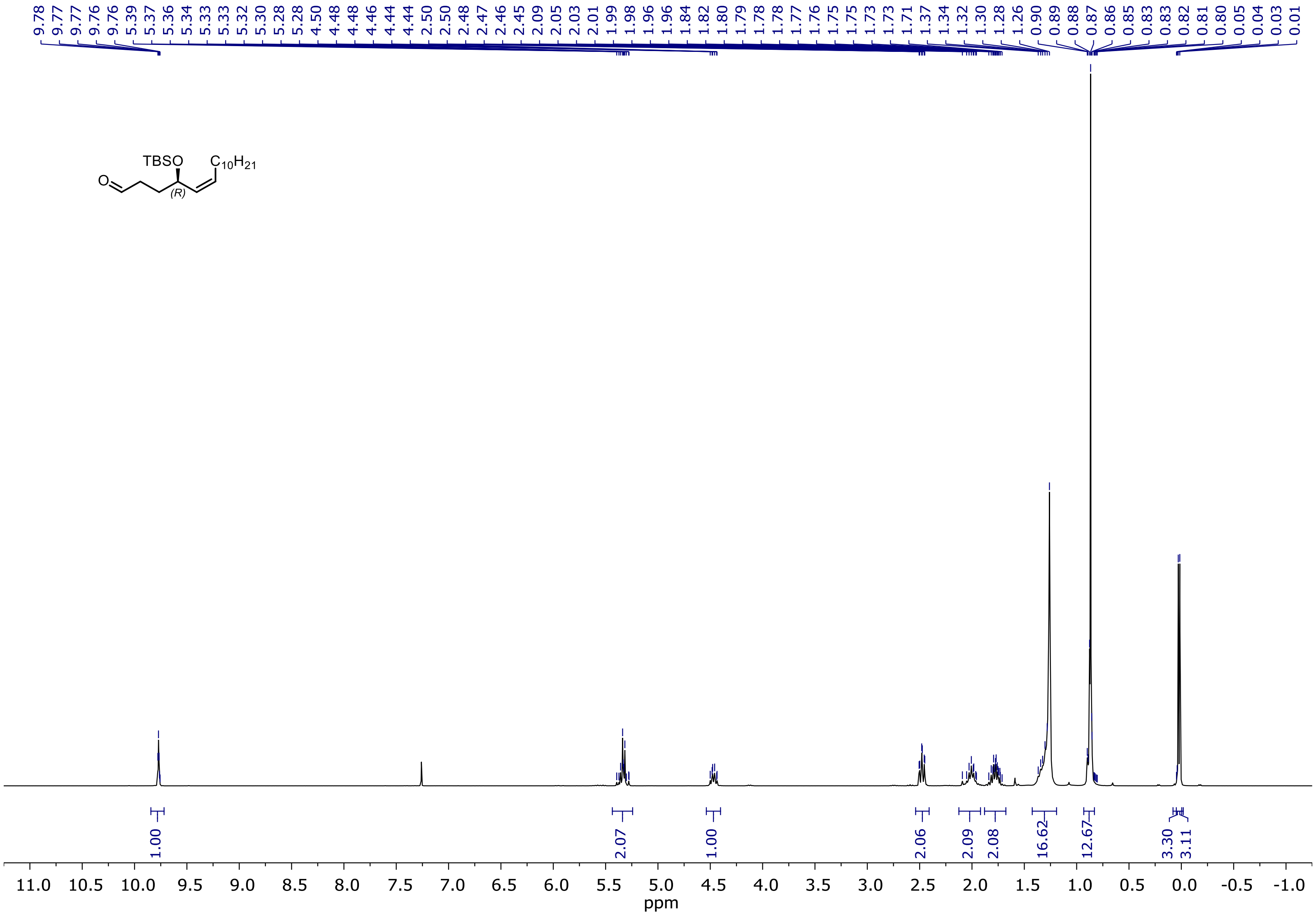


Figure S24. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*R,Z*)-4-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-enal **7**.

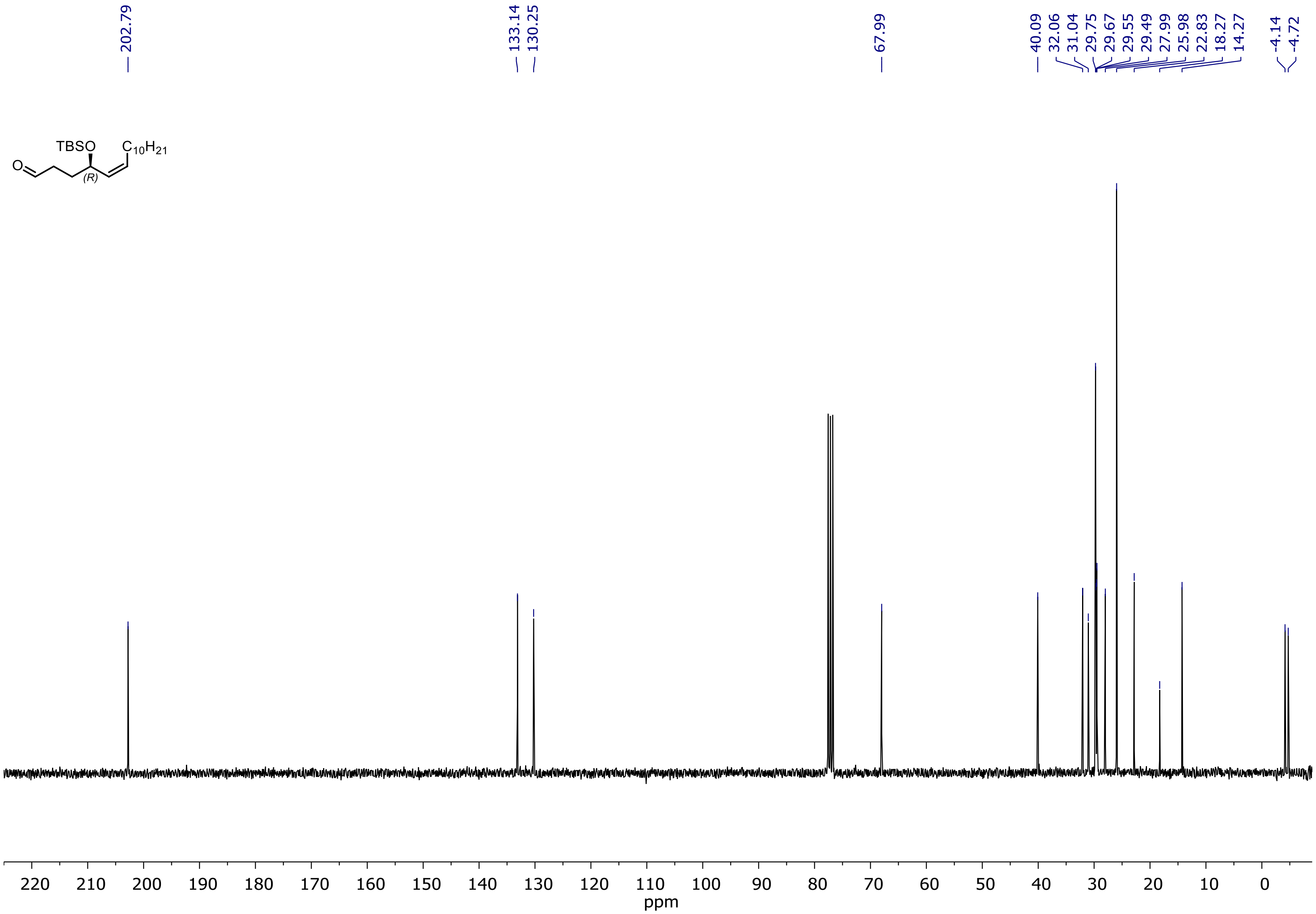


Figure S25. ^{13}C{^{1}H}-NMR spectrum (75 MHz, CDCl$_3$) of (*R,Z*)-4-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-enal **7**.

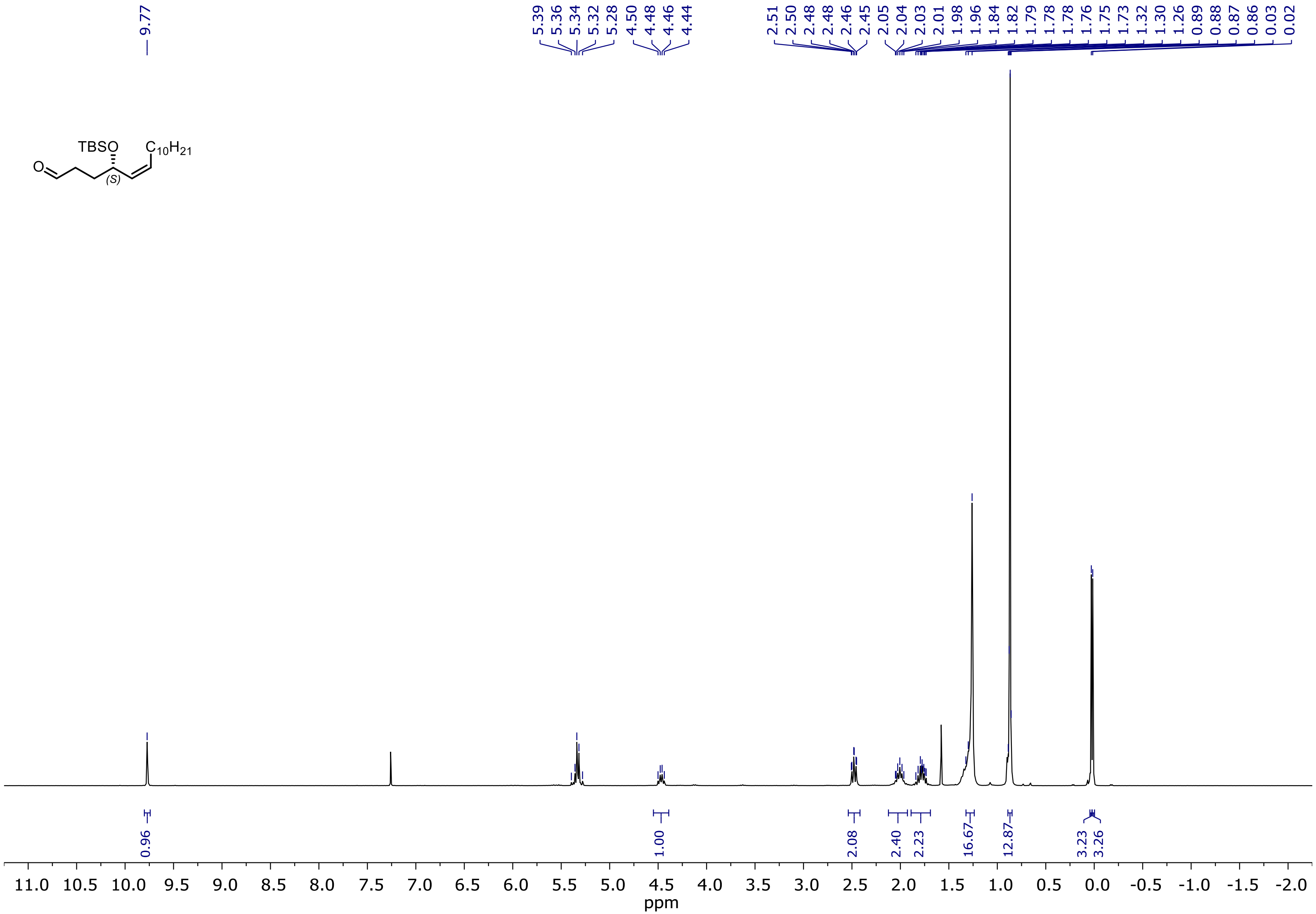


Figure S26. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*S,Z*)-4-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-enal **7**.

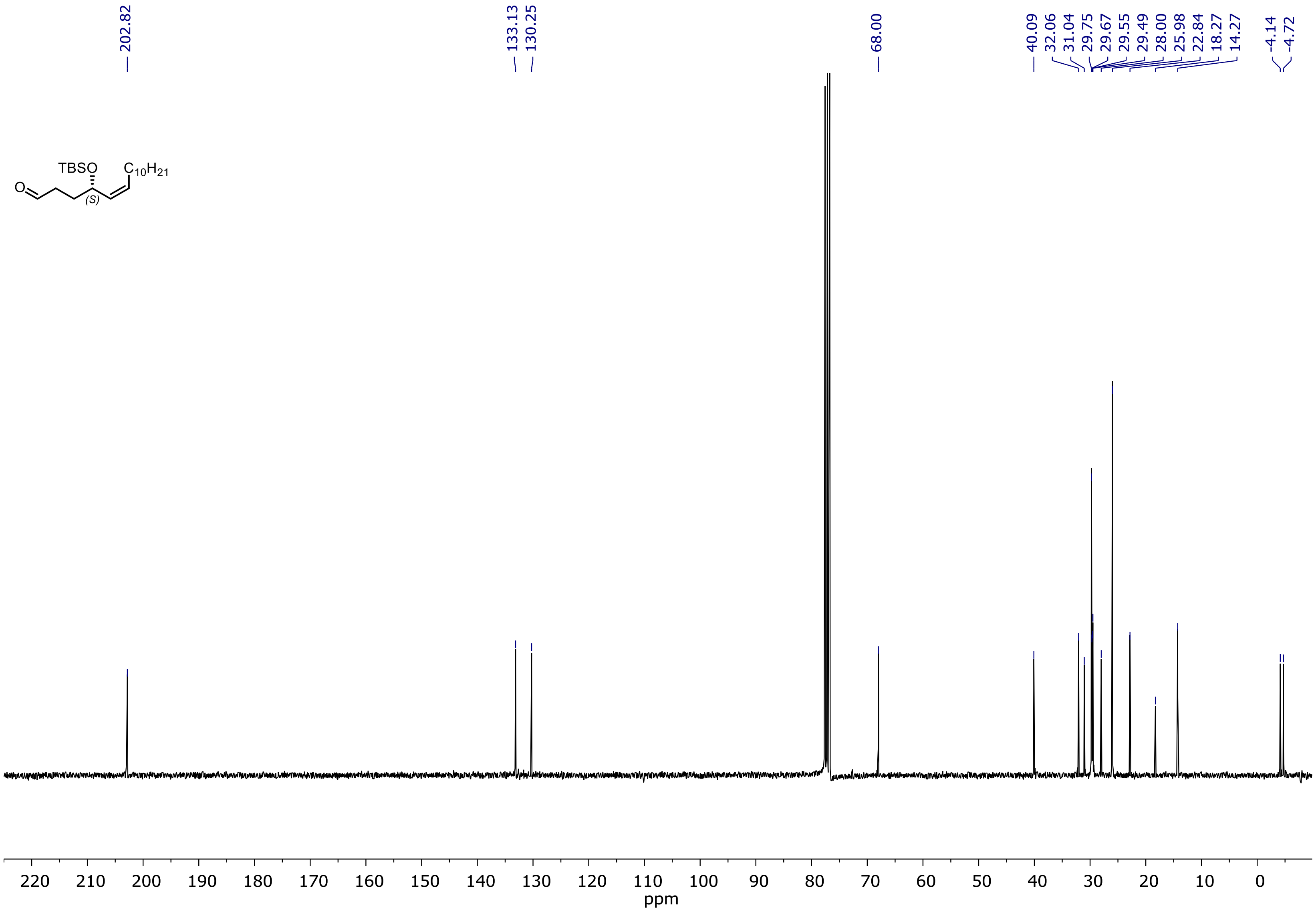


Figure S27. $^{13}C\{^1H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*S,Z*)-4-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-enal **7**.

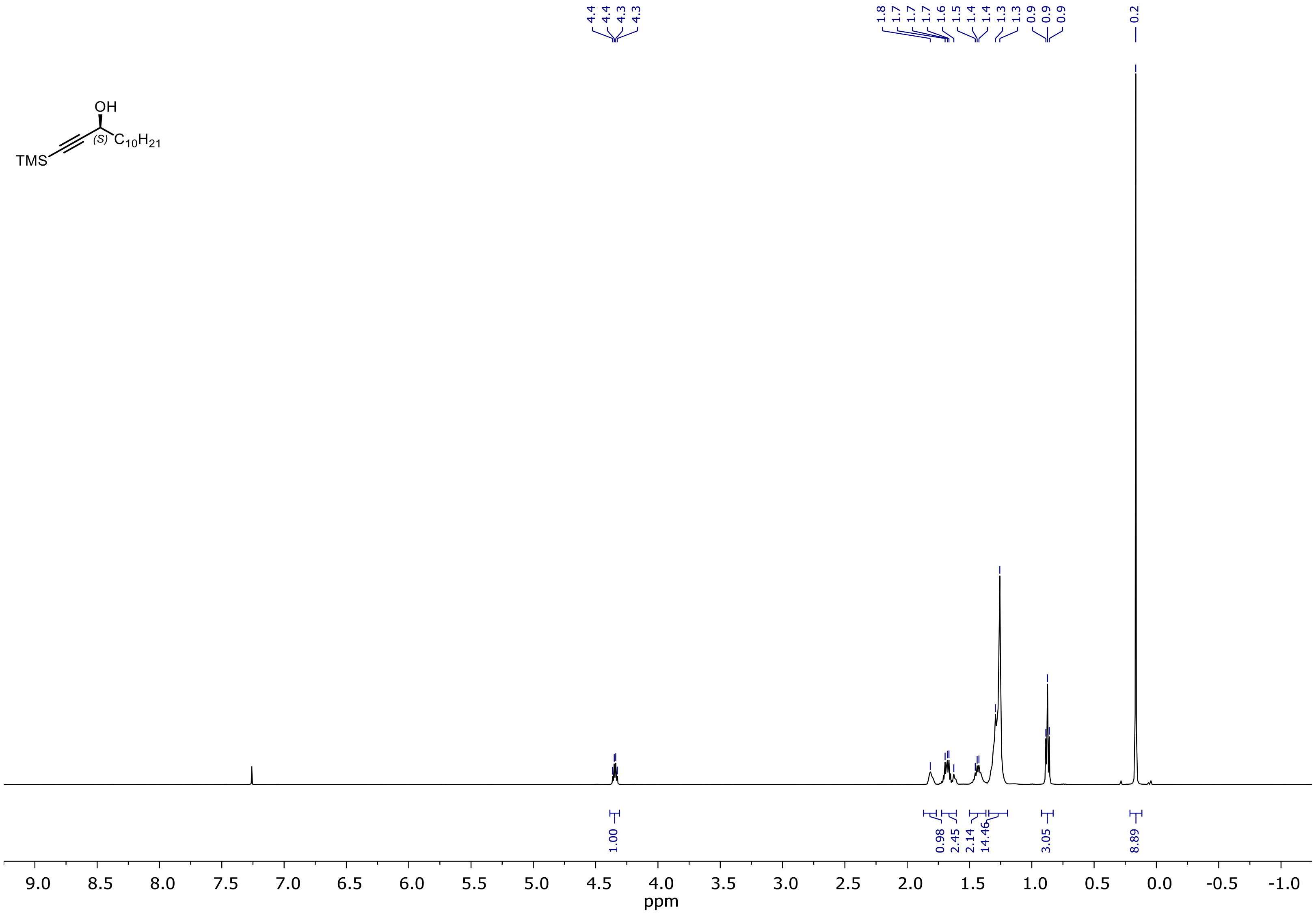


Figure S28. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*S*)-1-(Trimethylsilyl)tridec-1-yn-3-ol **SI-5**.

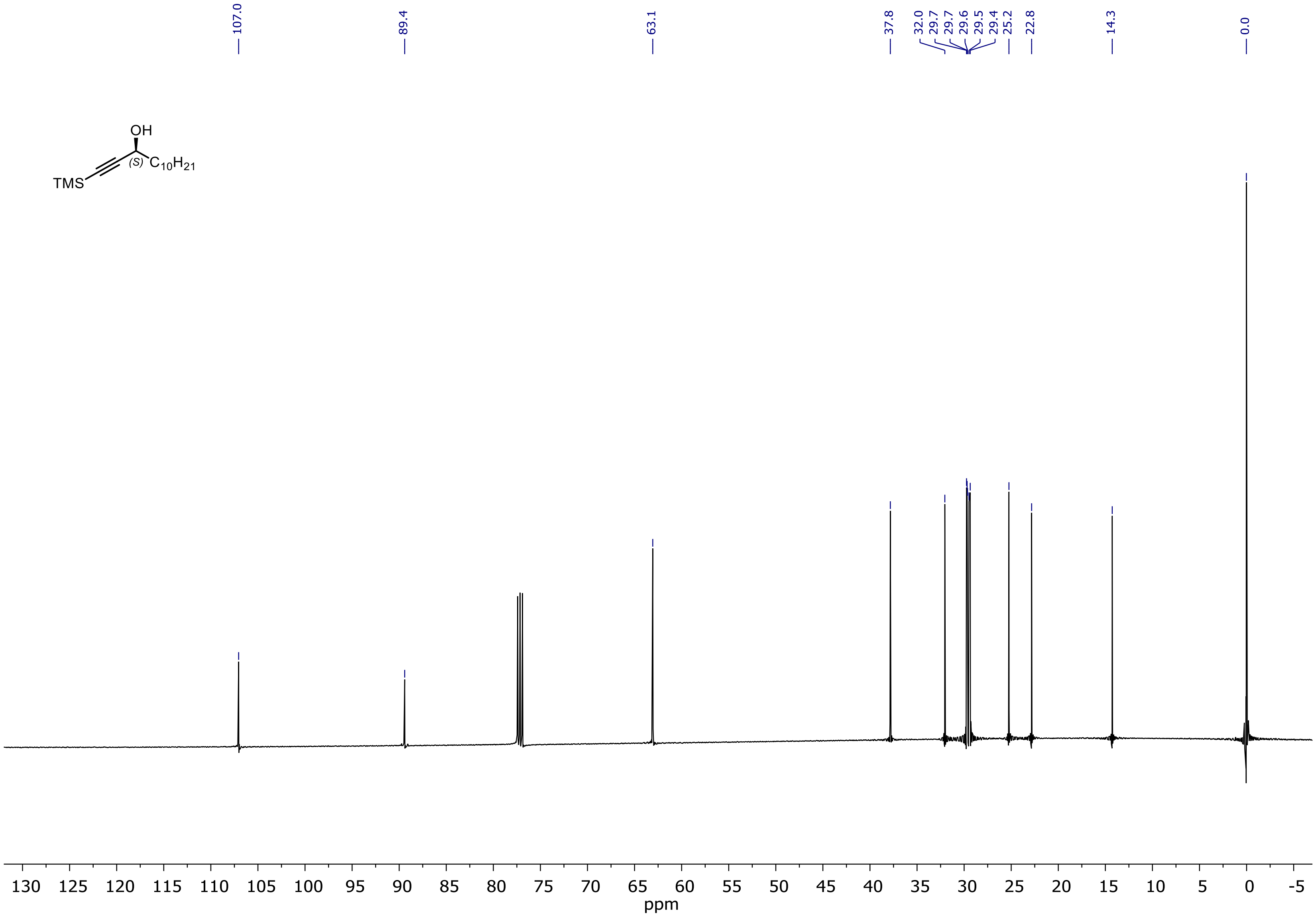


Figure S29. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*S*)-1-(Trimethylsilyl)tridec-1-yn-3-ol **SI-5**.

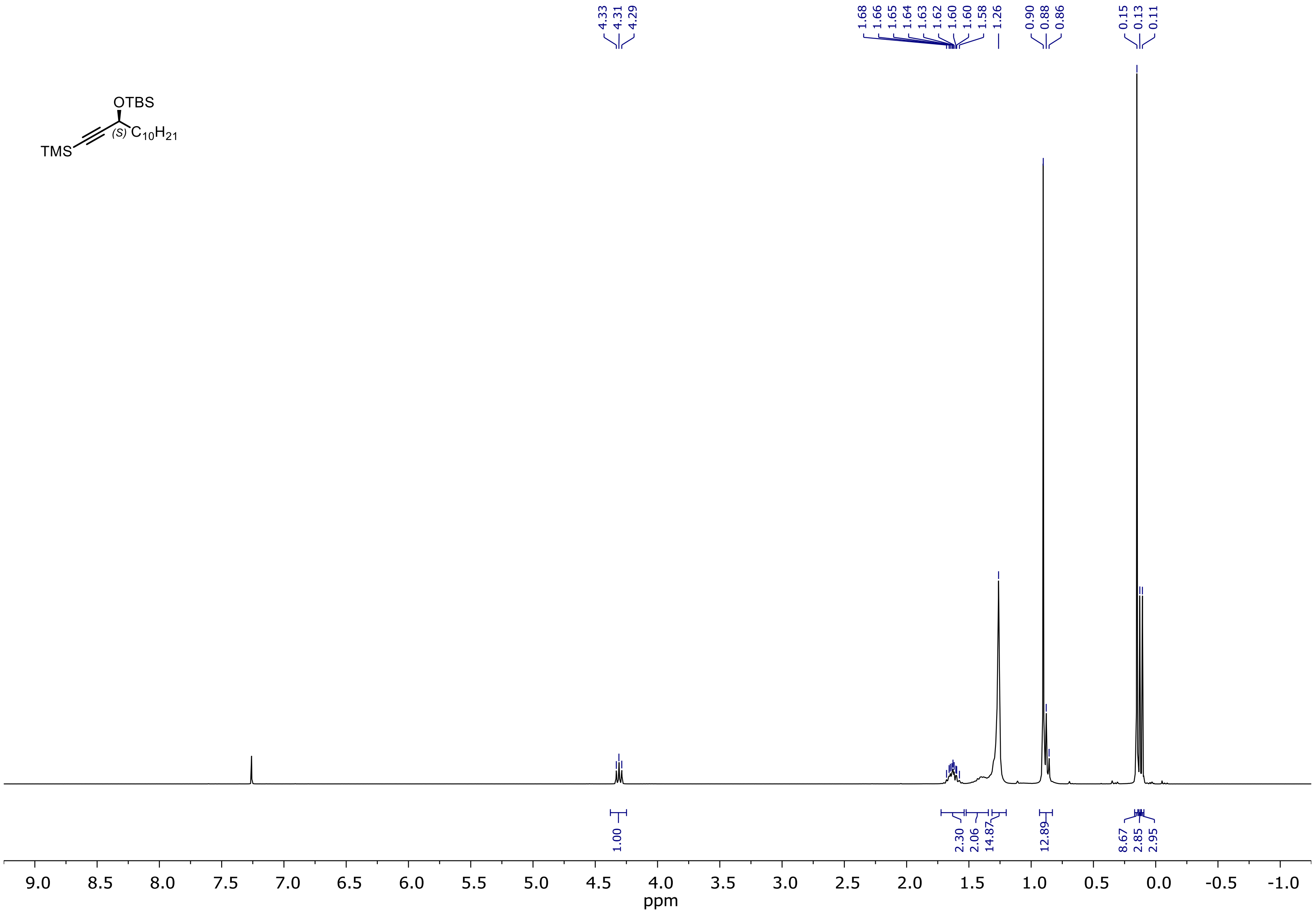


Figure S30. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*S*)-*tert*-Butyldimethyl((1-(trimethylsilyl)tridec-1-yn-3-yl)oxy)silane **21**.

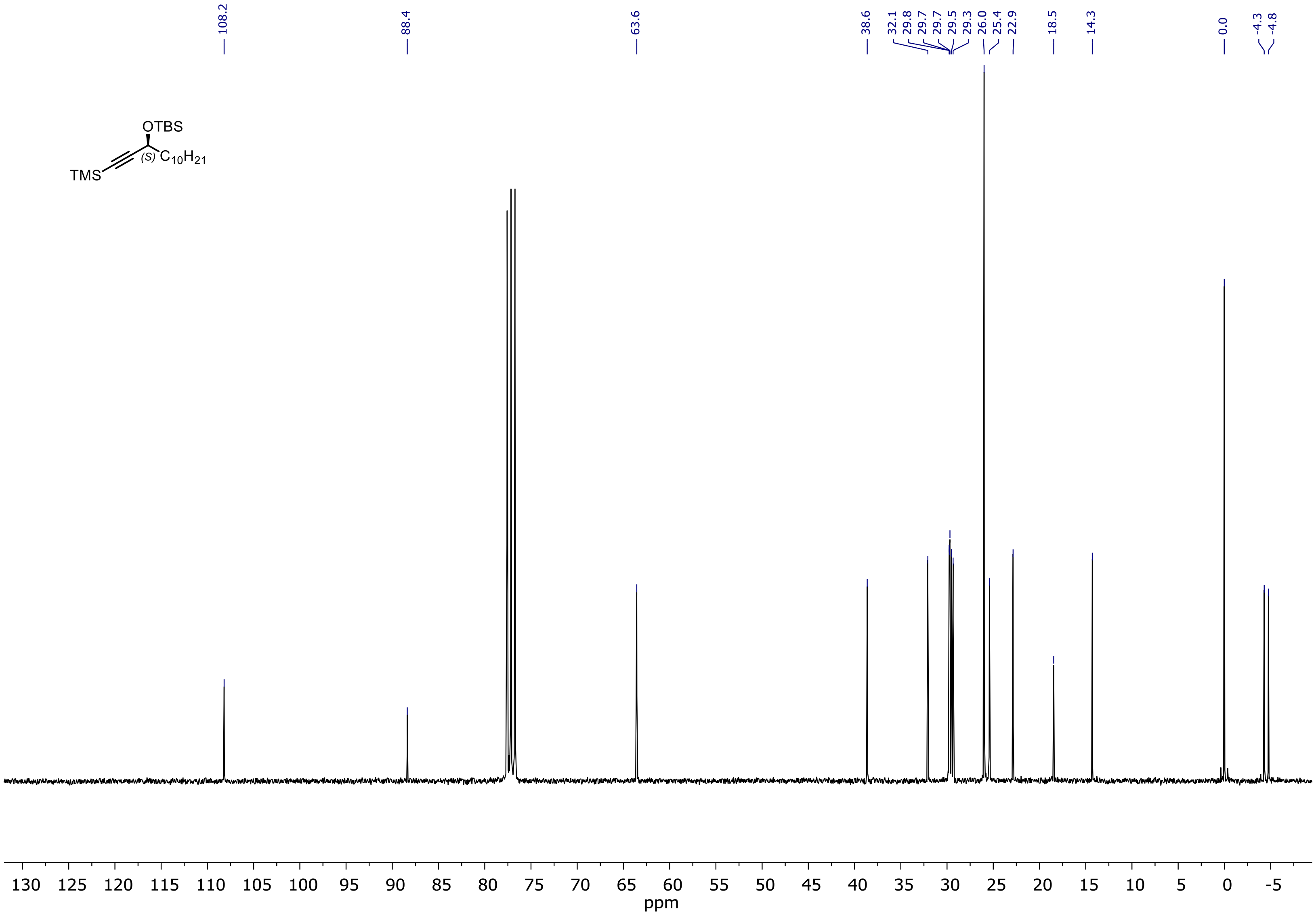


Figure S31. ^{13}C{^{1}H}-NMR spectrum (75 MHz, $CDCl_3$) of (*S*)-*tert*-Butyldimethyl((1-(trimethylsilyl)tridec-1-yn-3-yl)oxy)silane **21**.

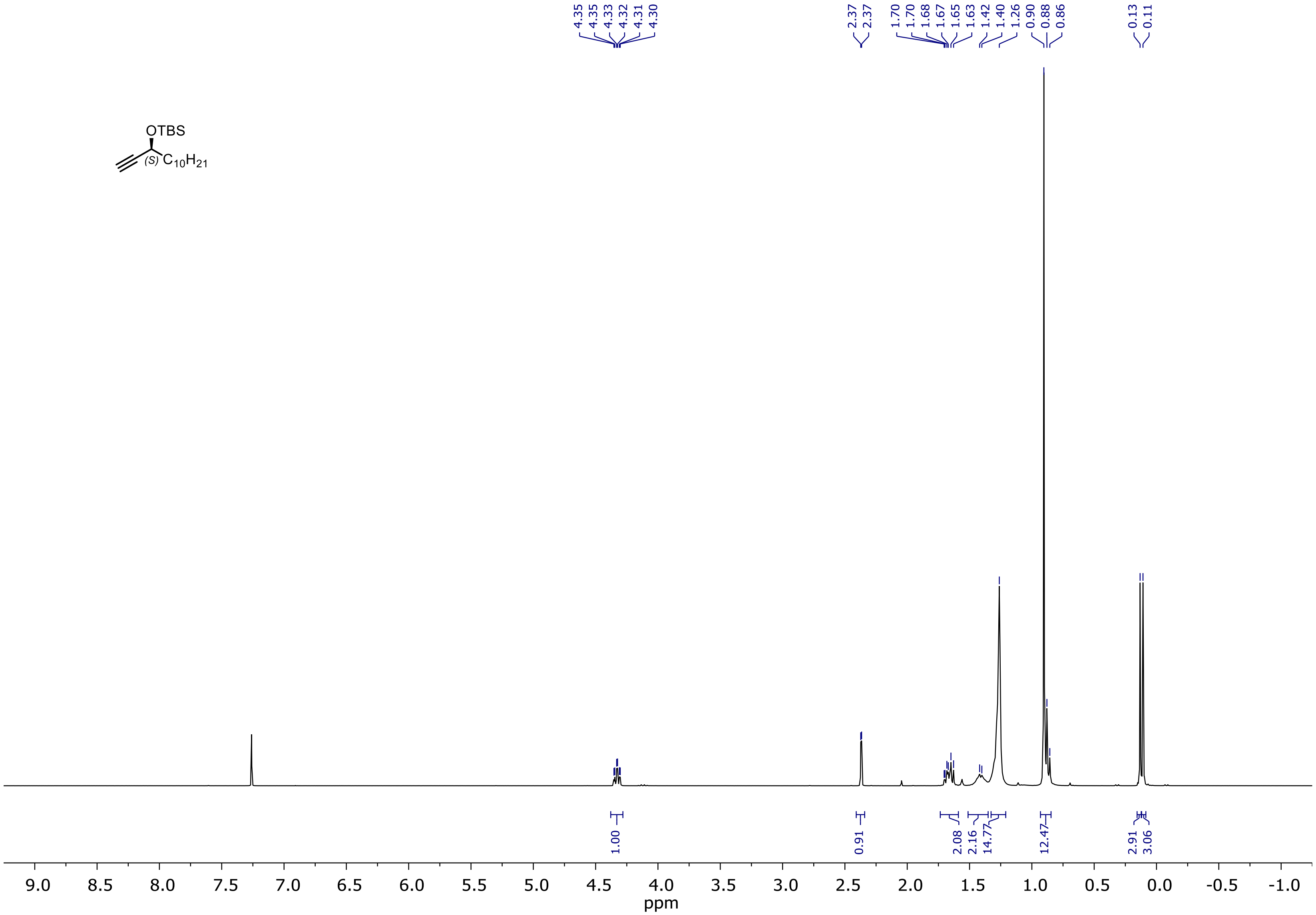


Figure S32. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*S*)-*tert*-Butyldimethyl(tridec-1-yn-3-yloxy)silane **SI-6**.

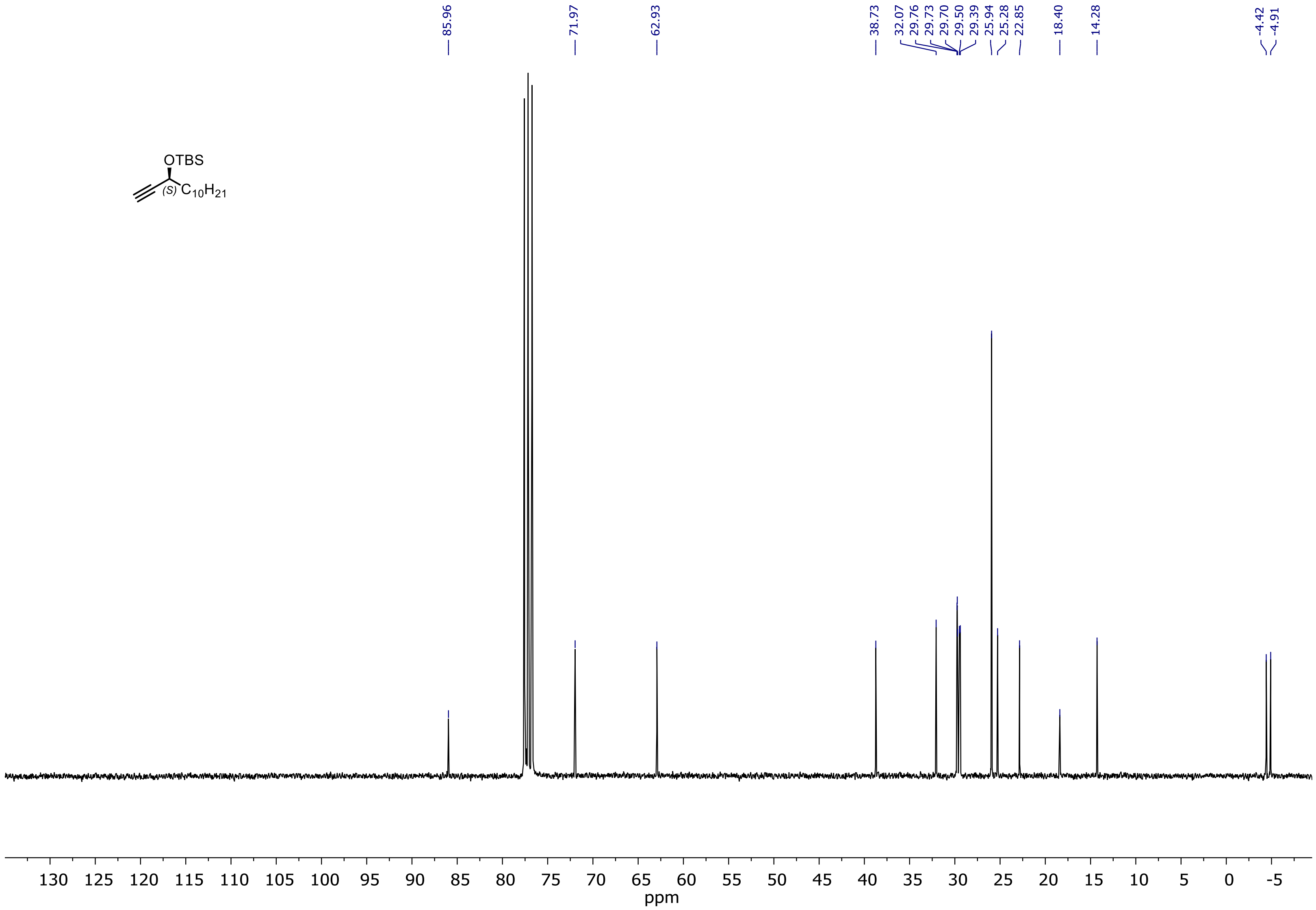


Figure S33. ^{13}C{^{1}H}-NMR spectrum (75 MHz, CDCl$_3$) of (*S*)-*tert*-Butyldimethyl(tridec-1-yn-3-yloxy)silane **SI-6**.

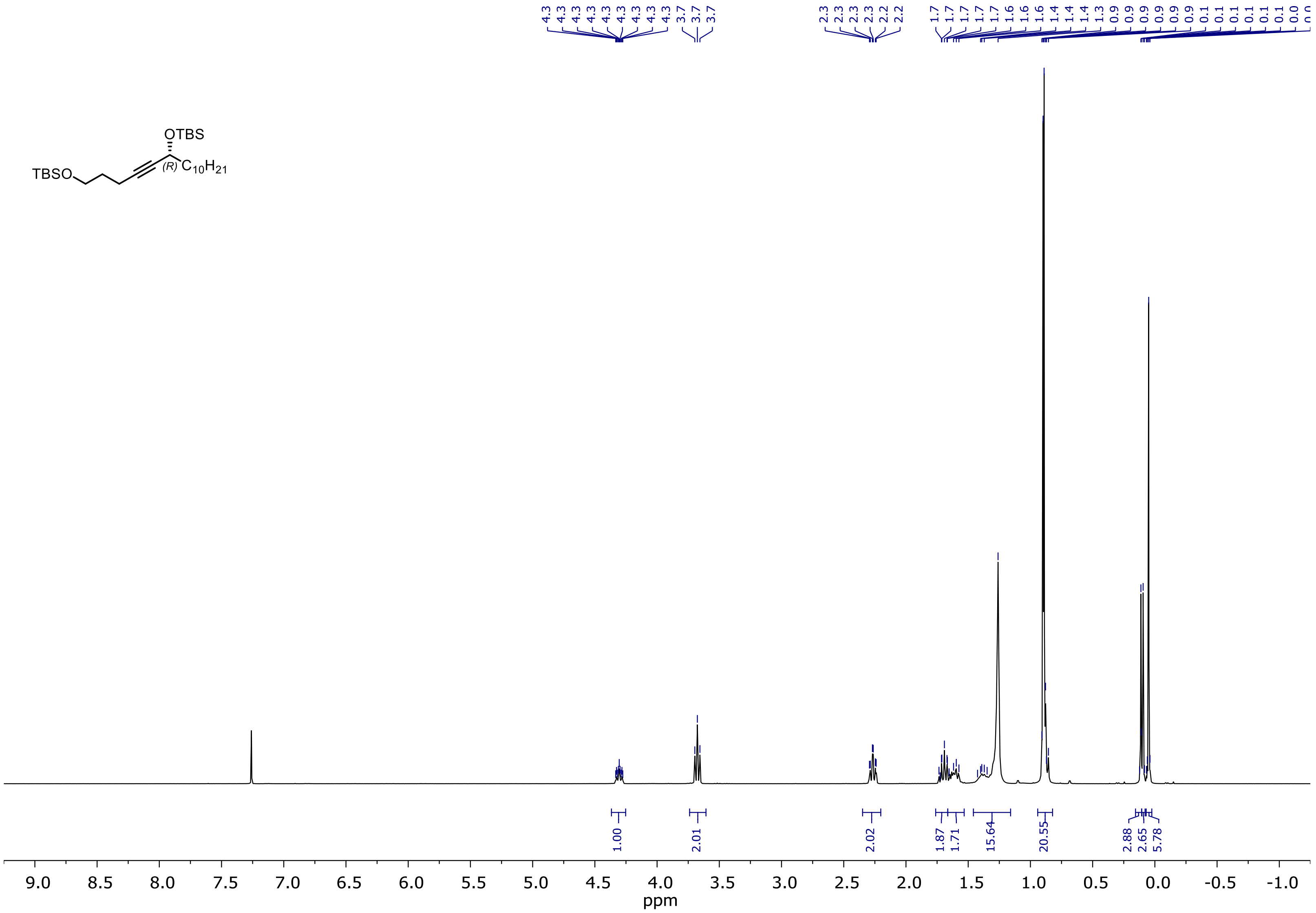


Figure S34. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*R*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-yne **22**.

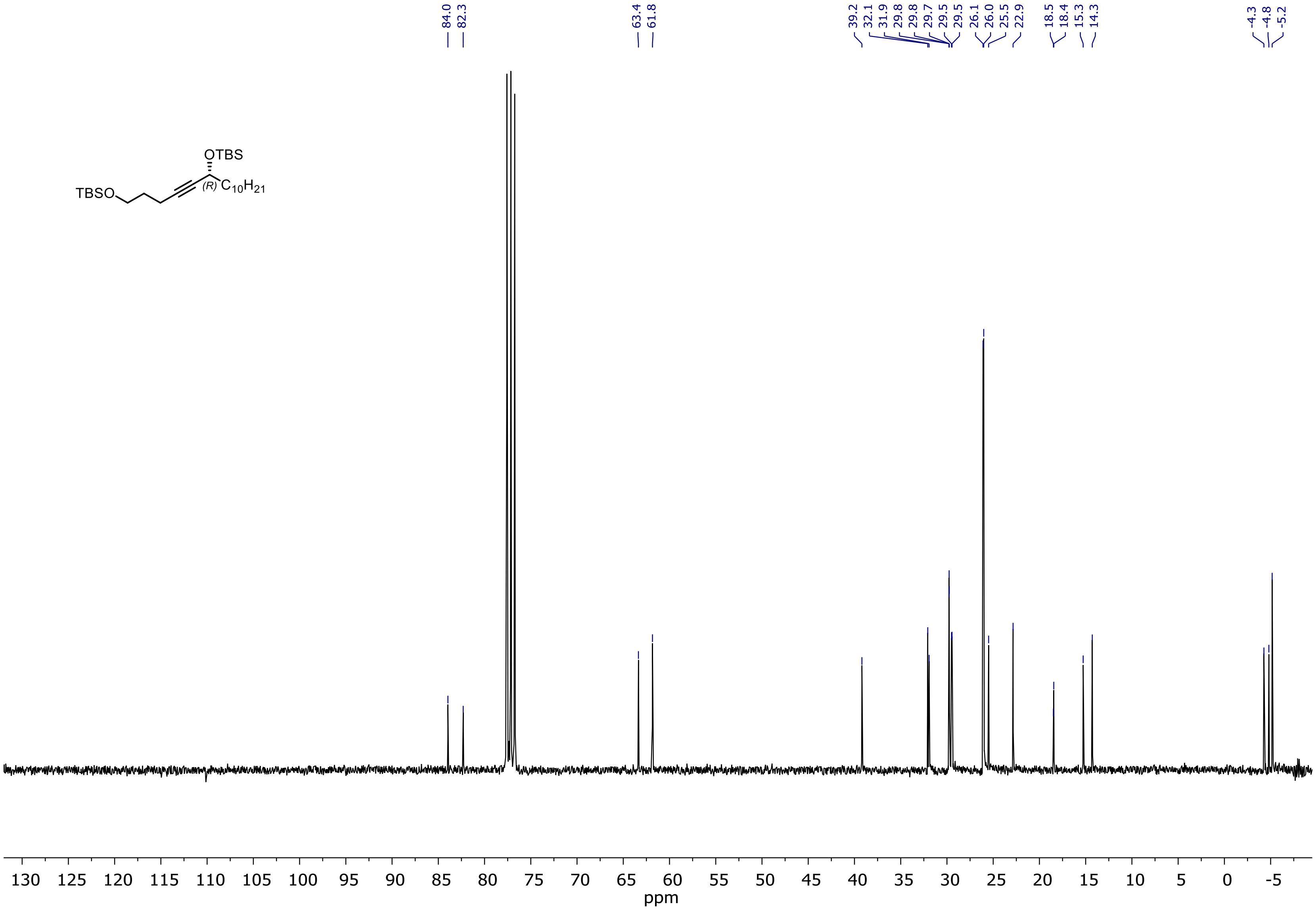


Figure S35. $^{13}C\{^{1}H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*R*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-yne **22**.

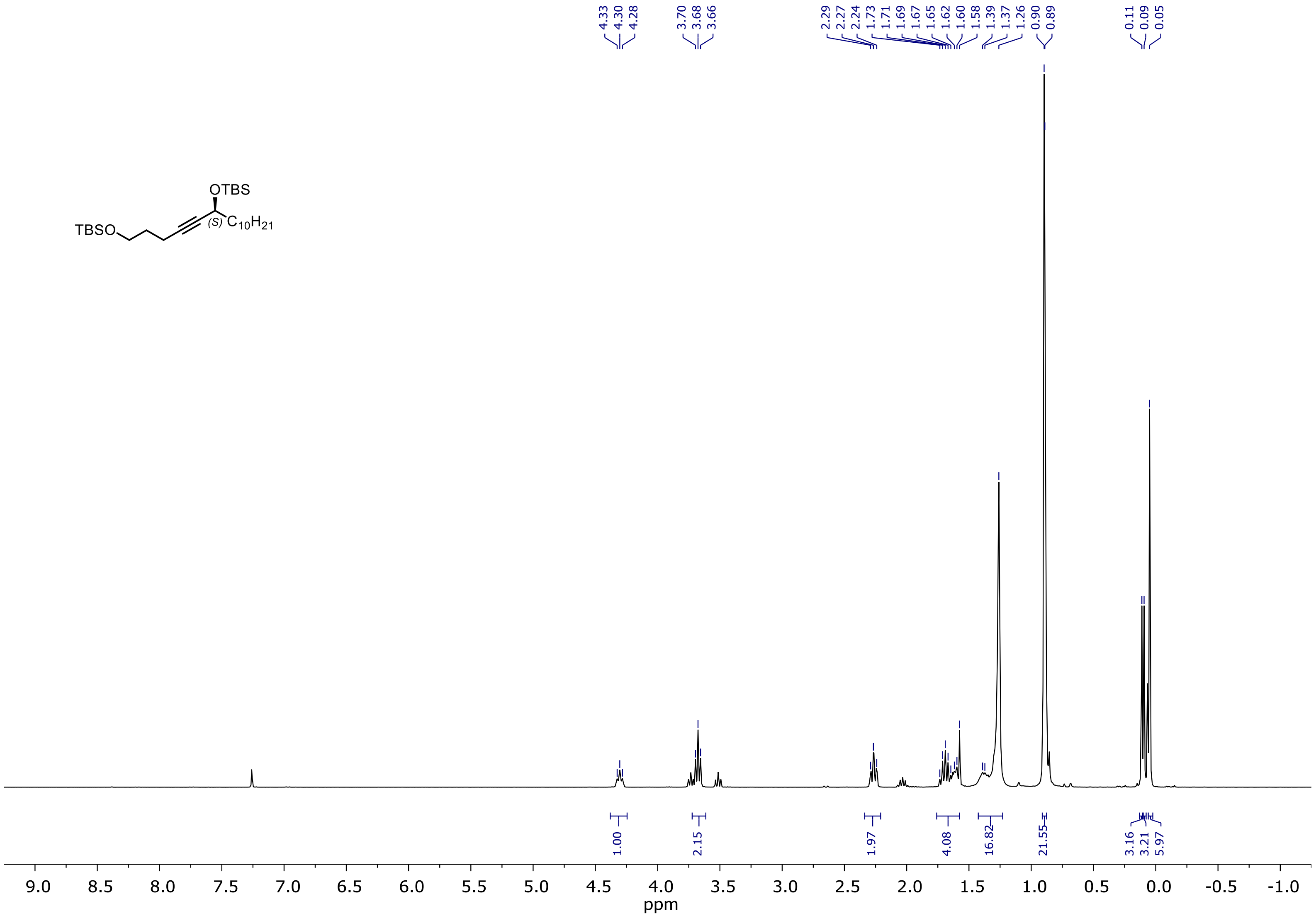


Figure S36. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*S*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-yne **22**.

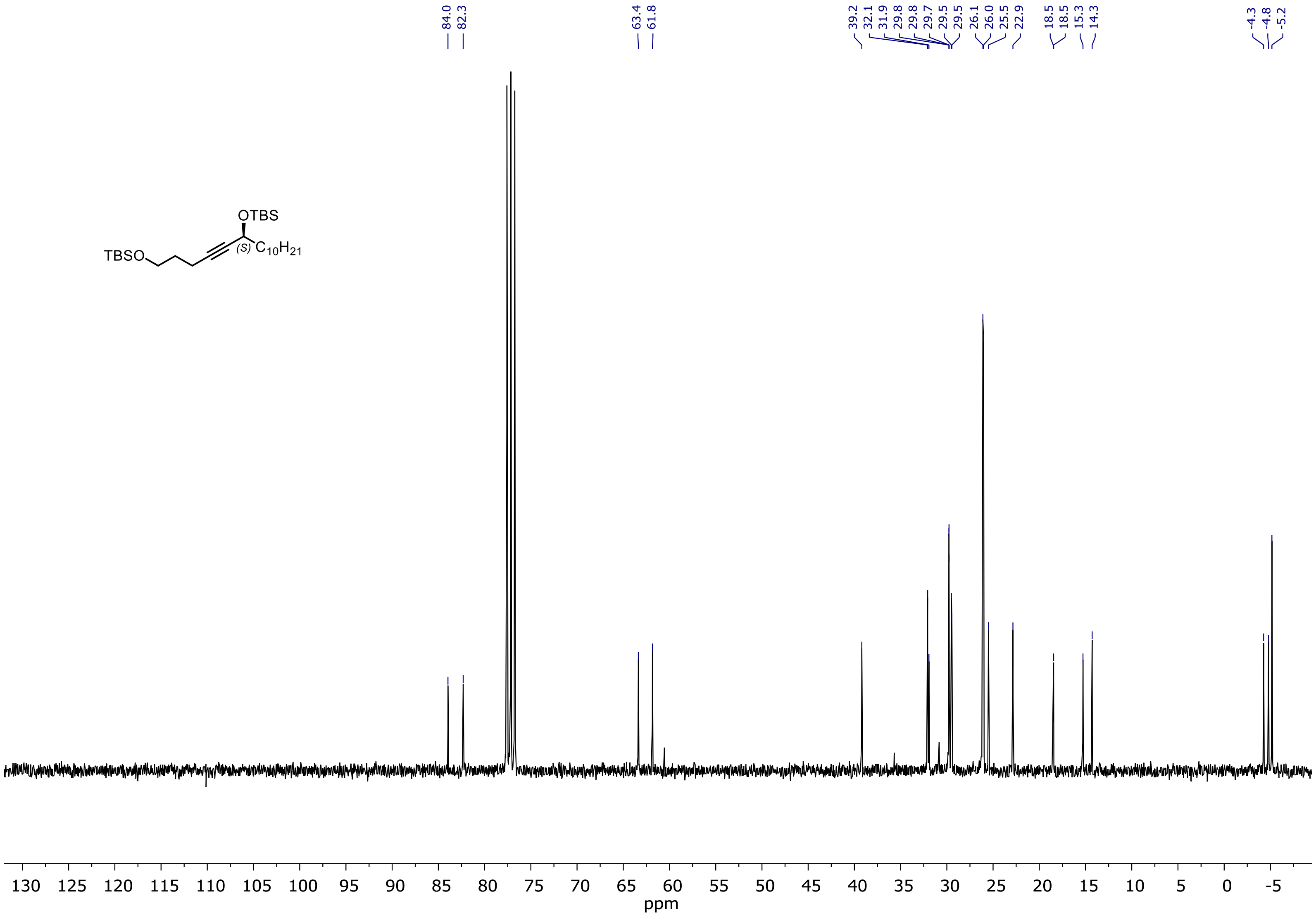


Figure S37. $^{13}C\{^{1}H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*S*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-yne **22**.

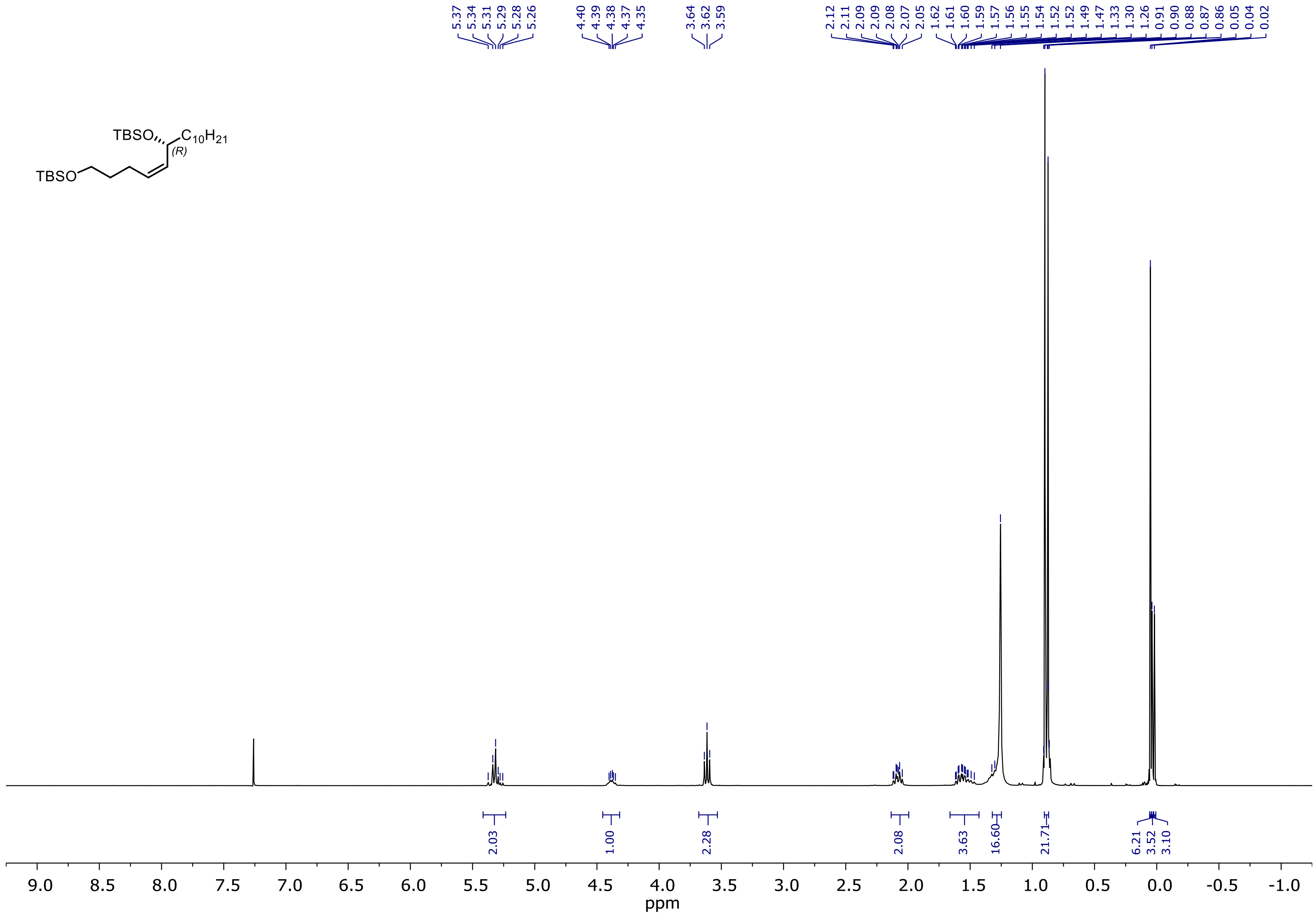


Figure S38. ^{1}H-NMR spectrum (300 MHz, CDCl$_3$) of (*R*,*Z*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-ene **SI-8**.

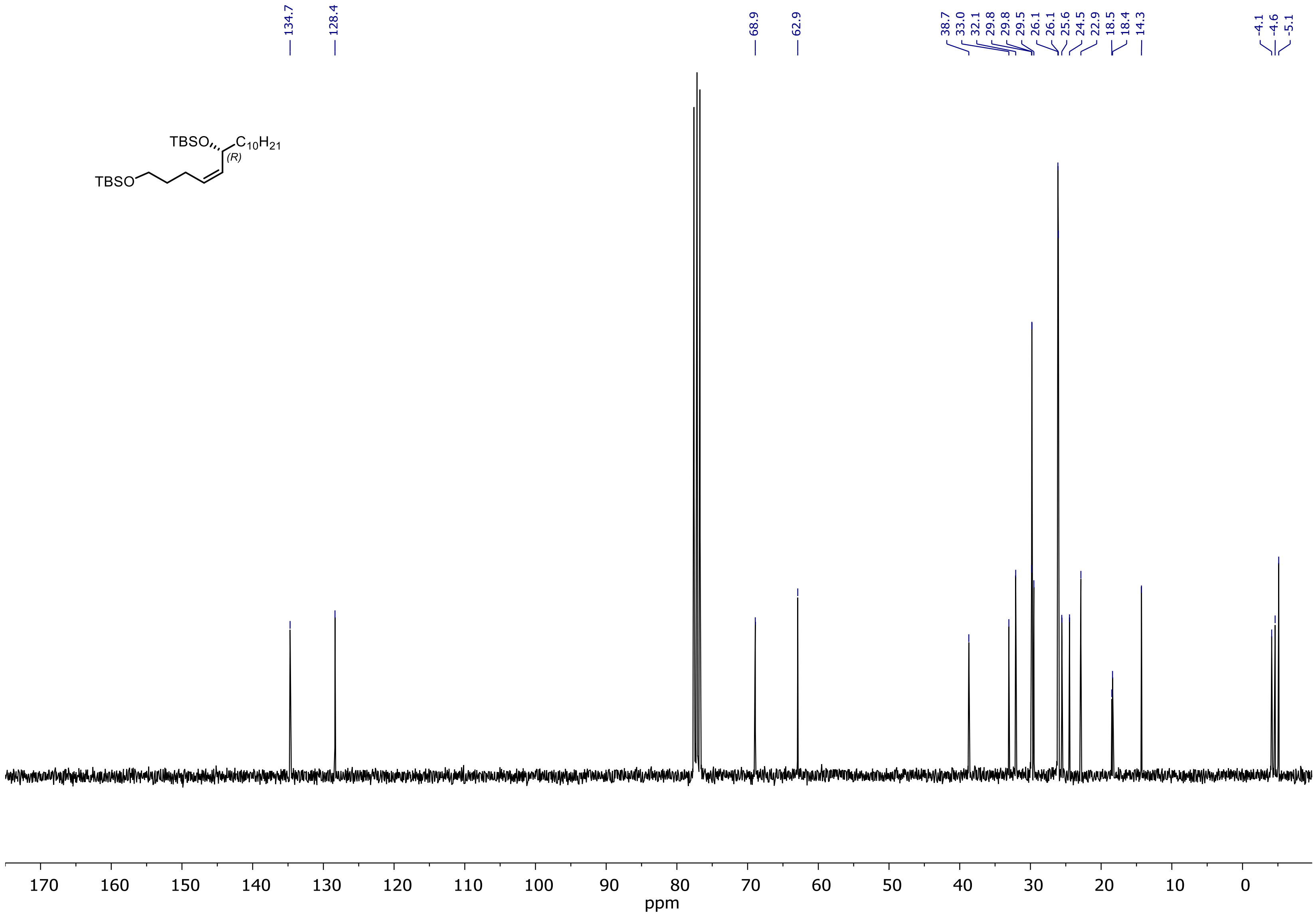


Figure S39. ^{13}C{^{1}H}-NMR spectrum (75 MHz, $CDCl_3$) of (*R*,*Z*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-ene **SI-8**.

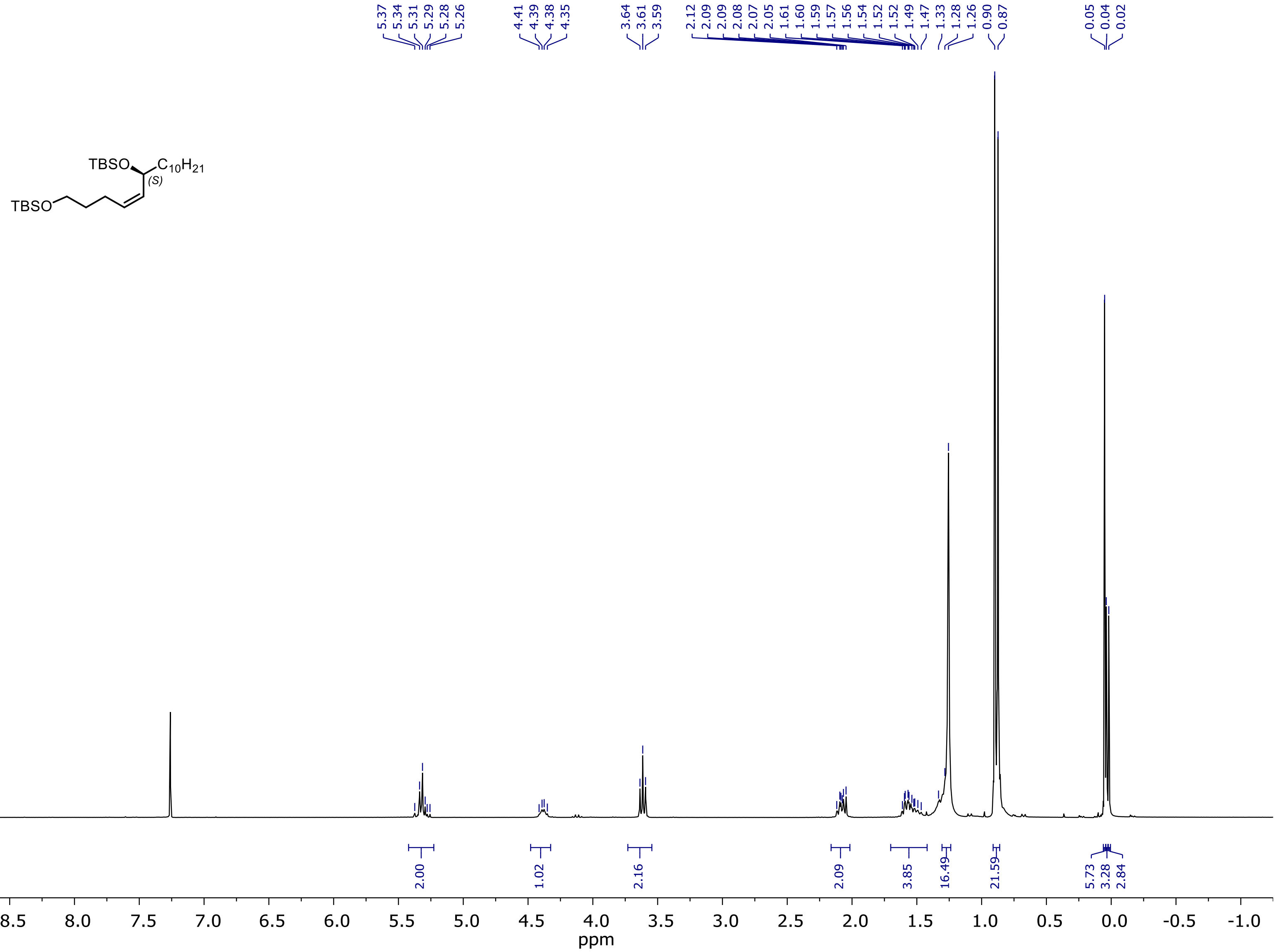


Figure S40. ^{1}H-NMR spectrum (300 MHz, CDCl$_3$) of (*S*,*Z*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-ene **SI-8**.

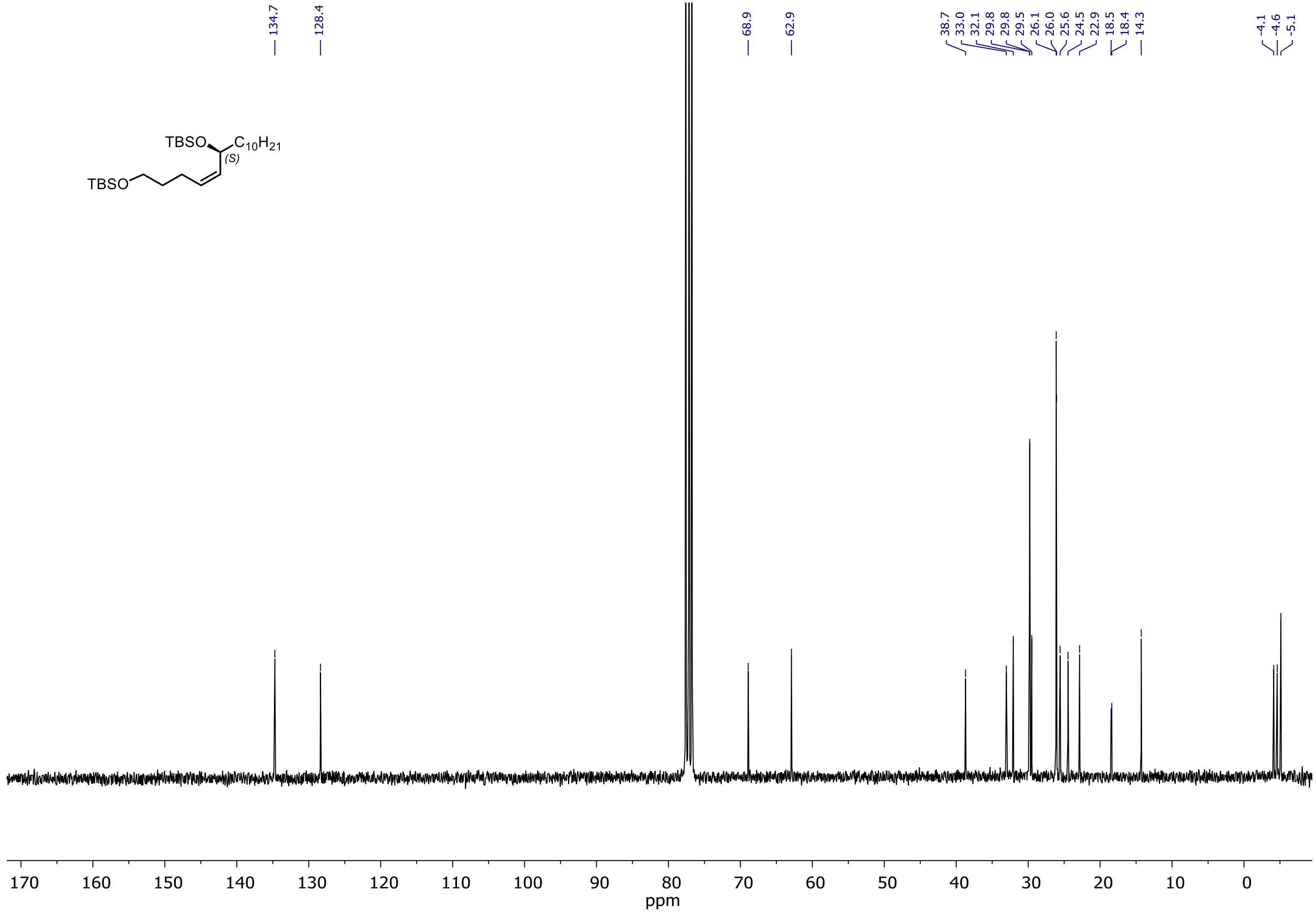


Figure S41. ^{13}C{^{1}H}-NMR spectrum (75 MHz, CDCl$_3$) of (*S*,*Z*)-5-Decyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradec-6-ene **SI-8**.

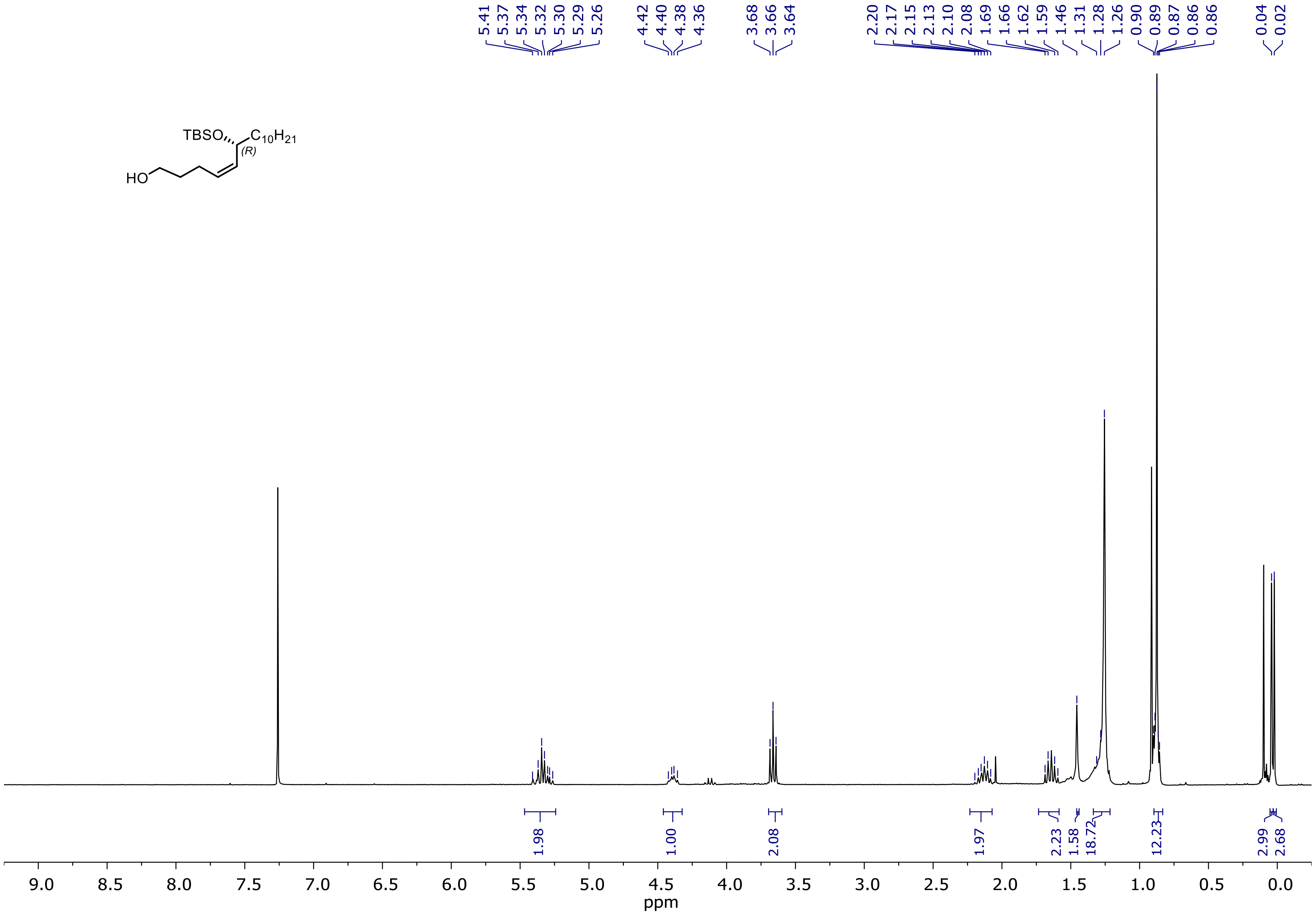


Figure S42. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*R*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-en-1-ol **SI-9**.

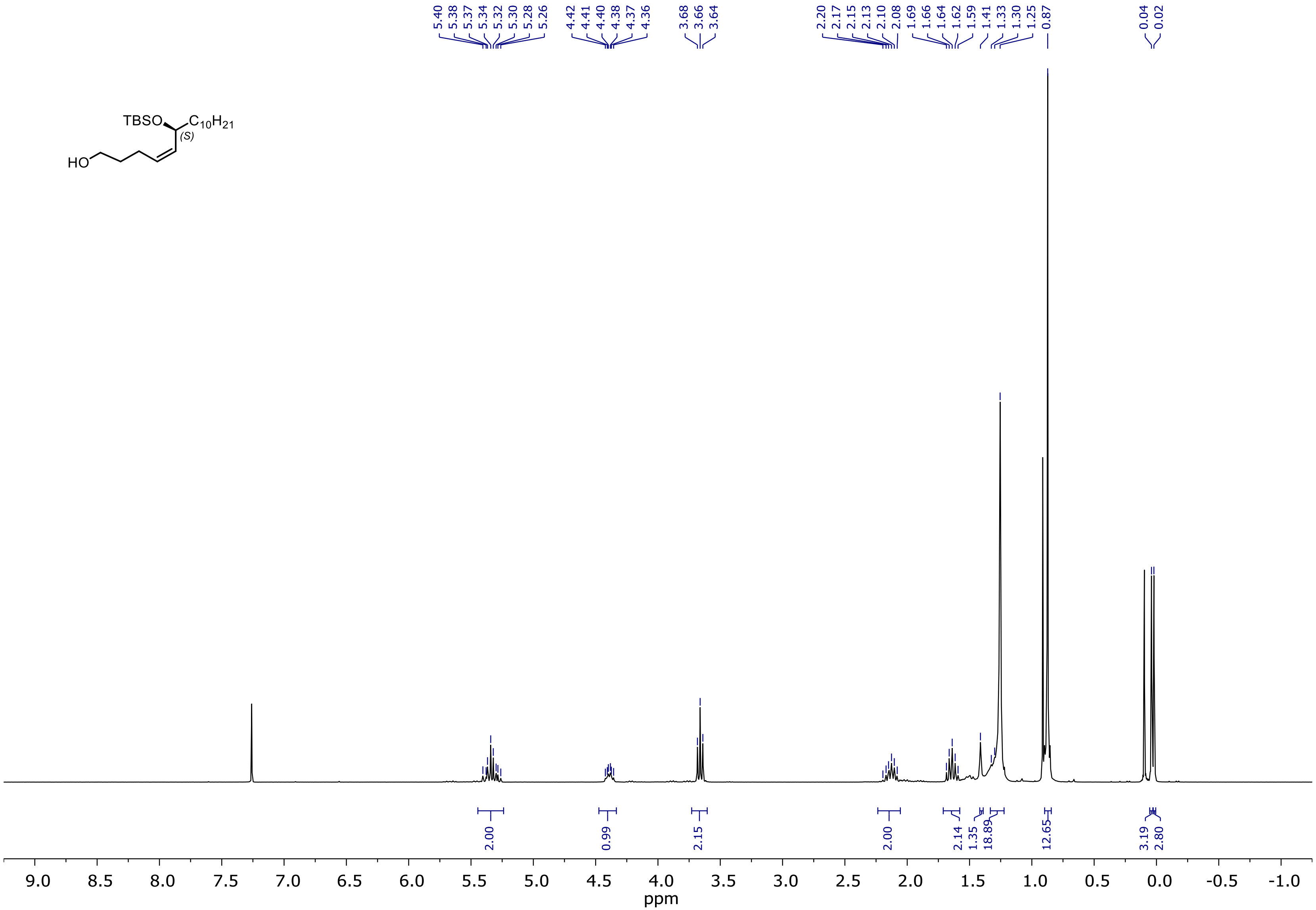


Figure S43. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-en-1-ol **SI-9**.

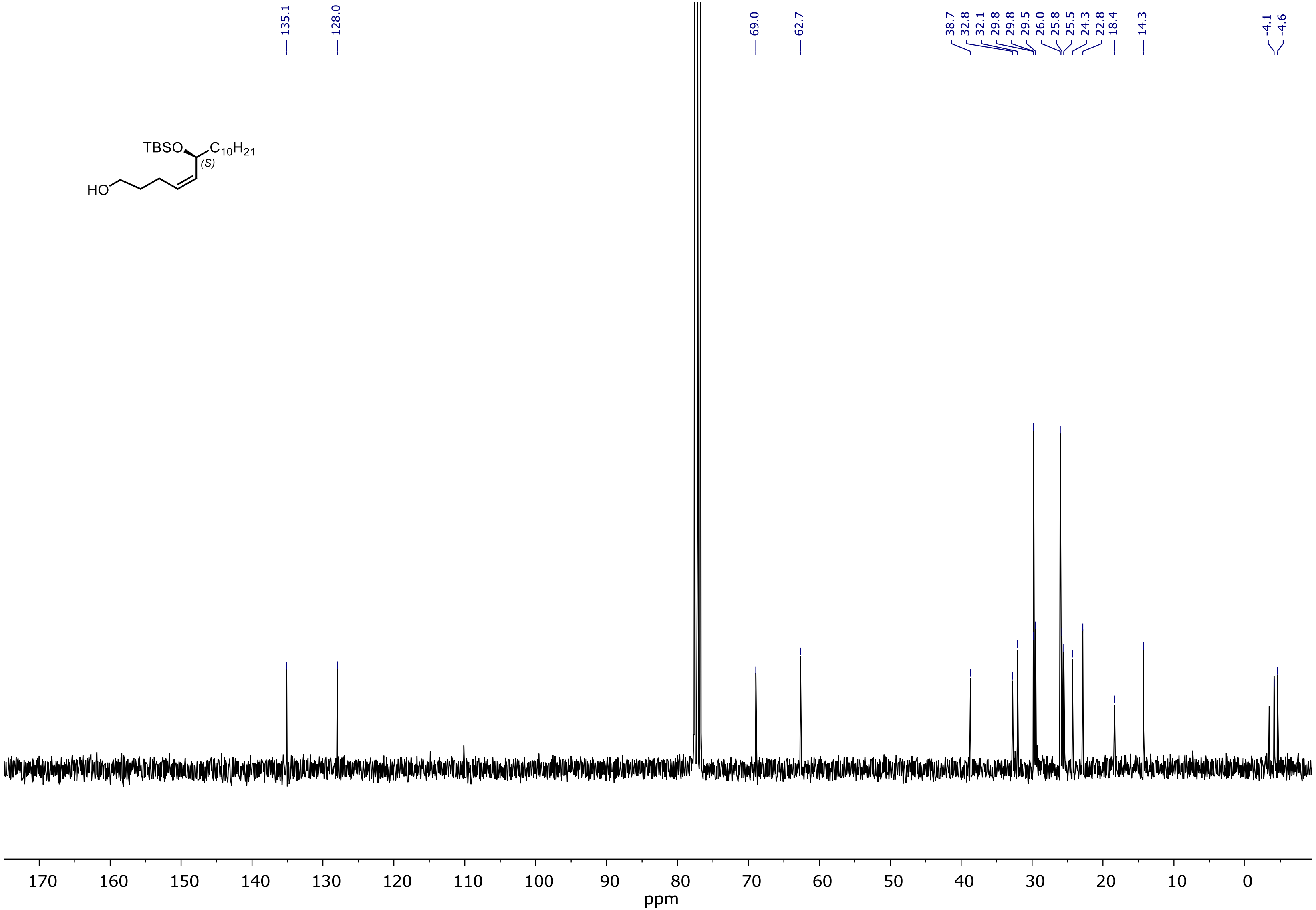


Figure S44. ^{13}C{^{1}H}-NMR spectrum (75 MHz, CDCl$_3$) of (*S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-en-1-ol **SI-9**.

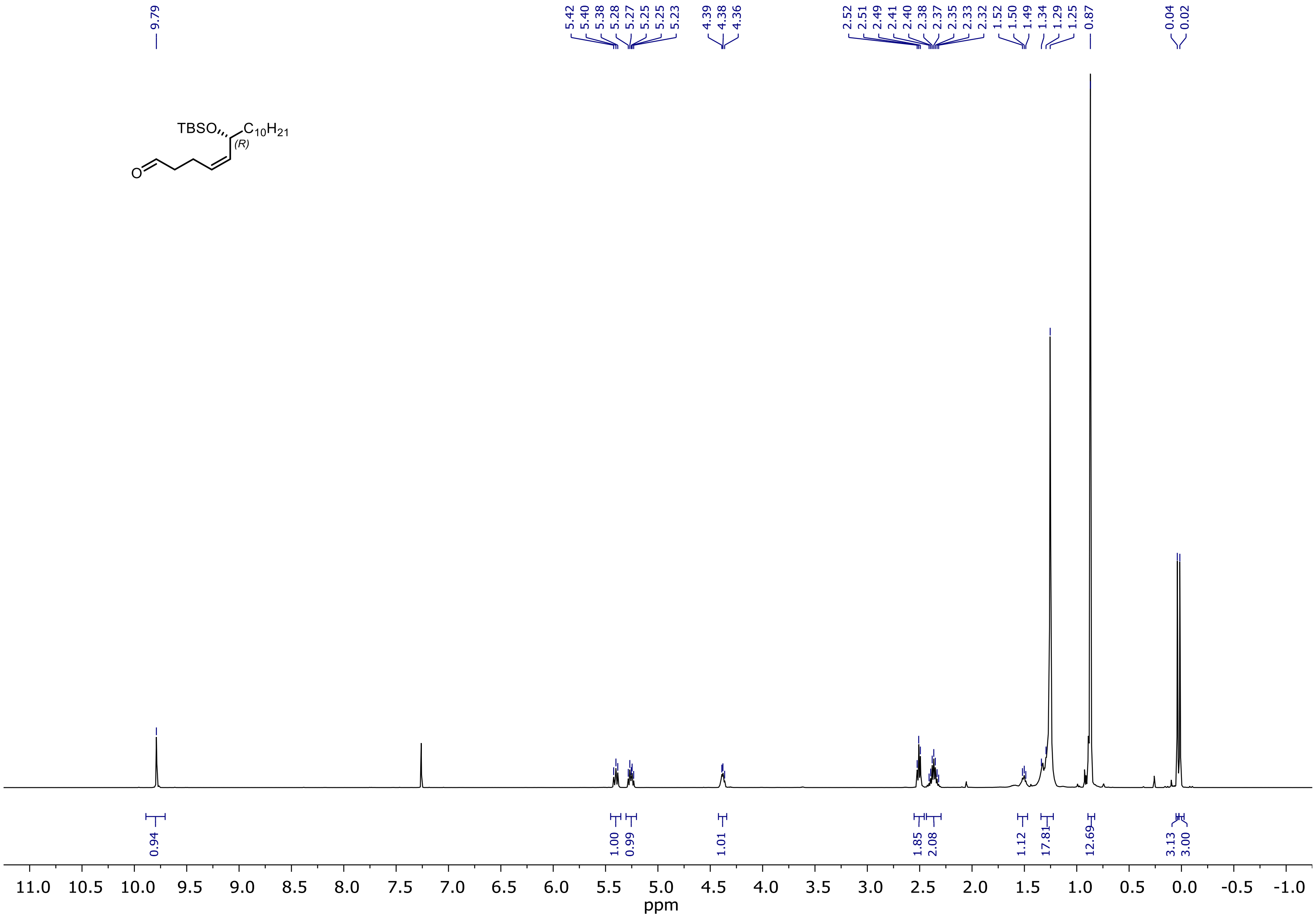


Figure S45. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*R*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-enal **23**.

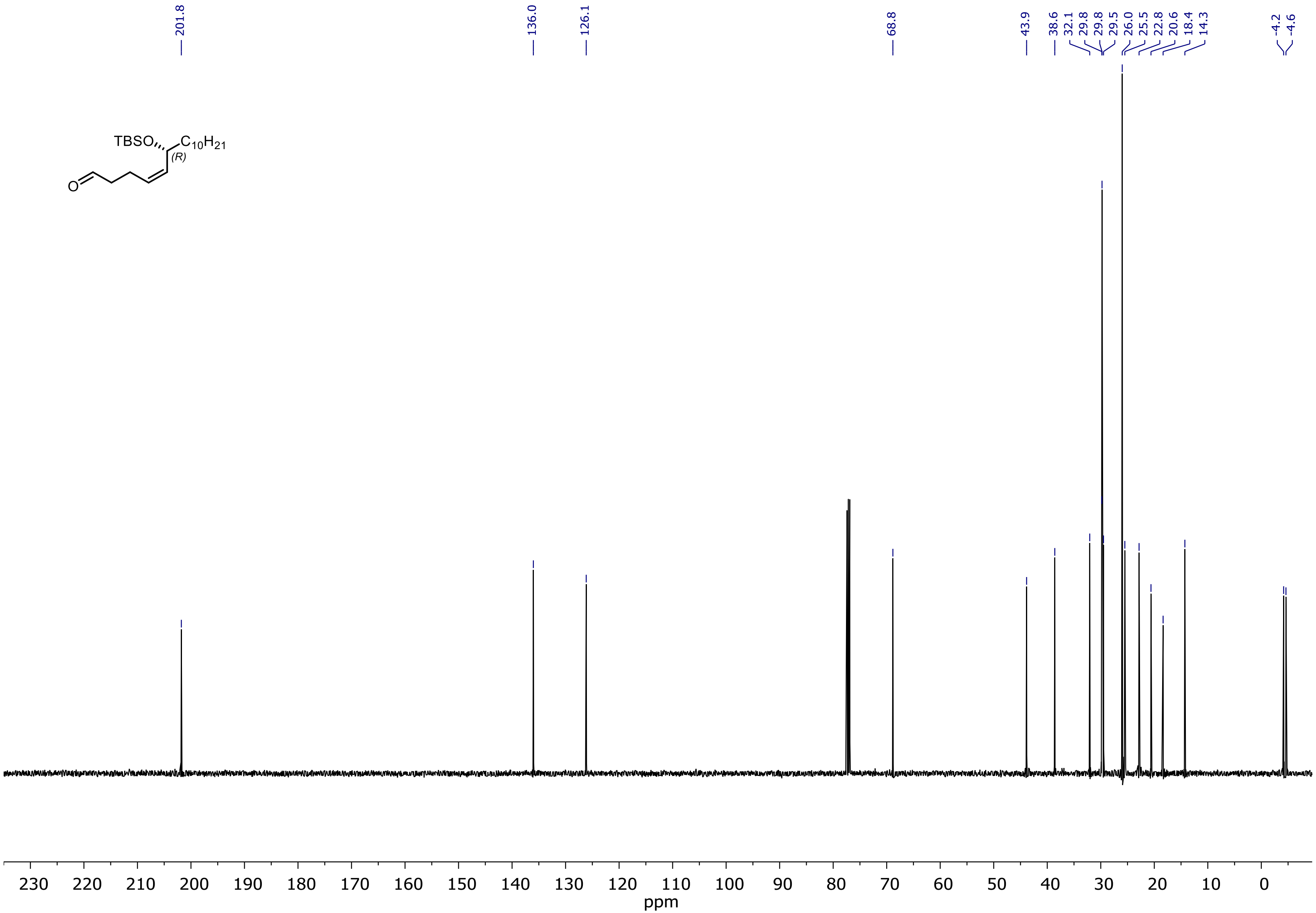


Figure S46. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-enal **23**.

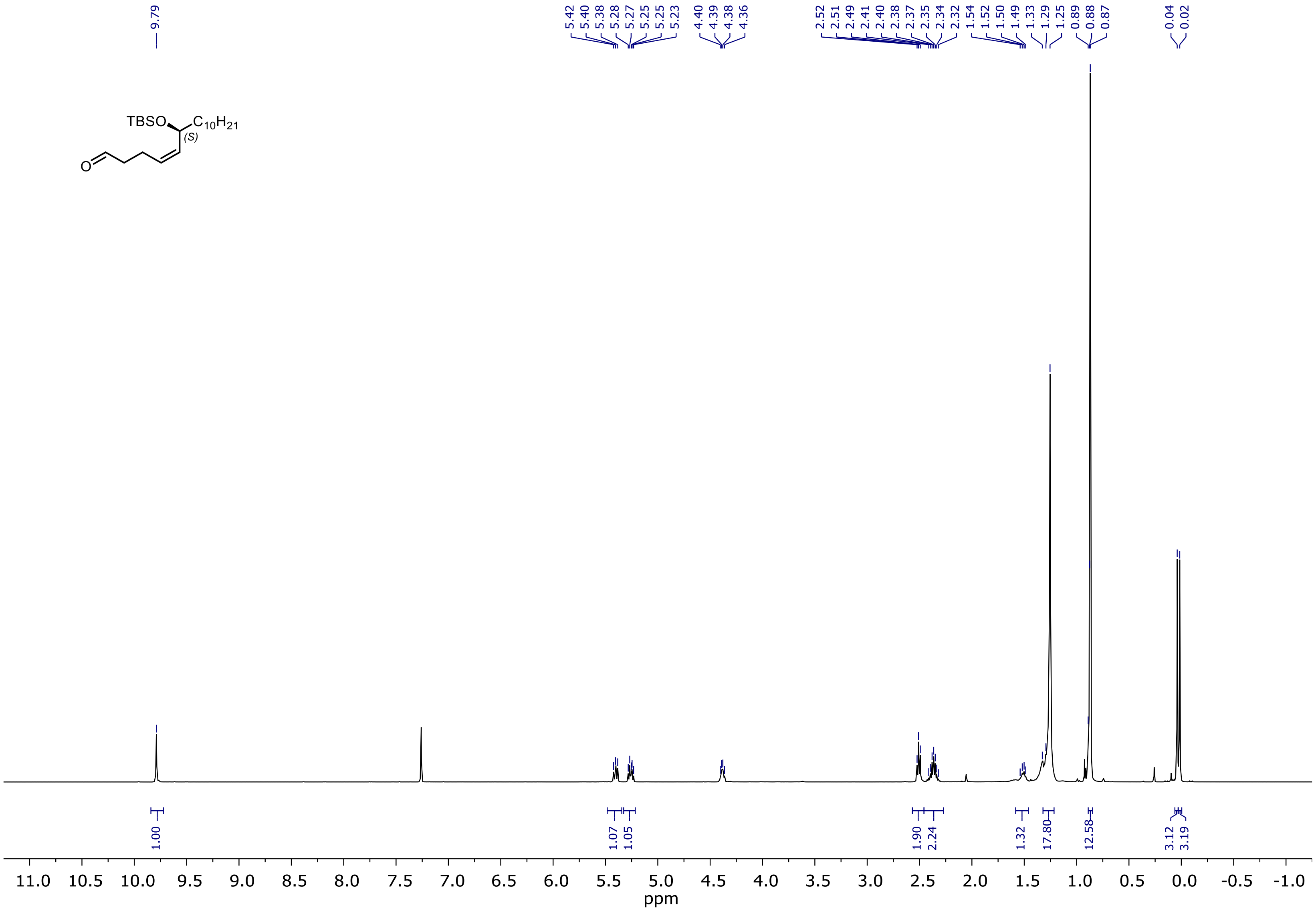


Figure S47. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-enal **23**.

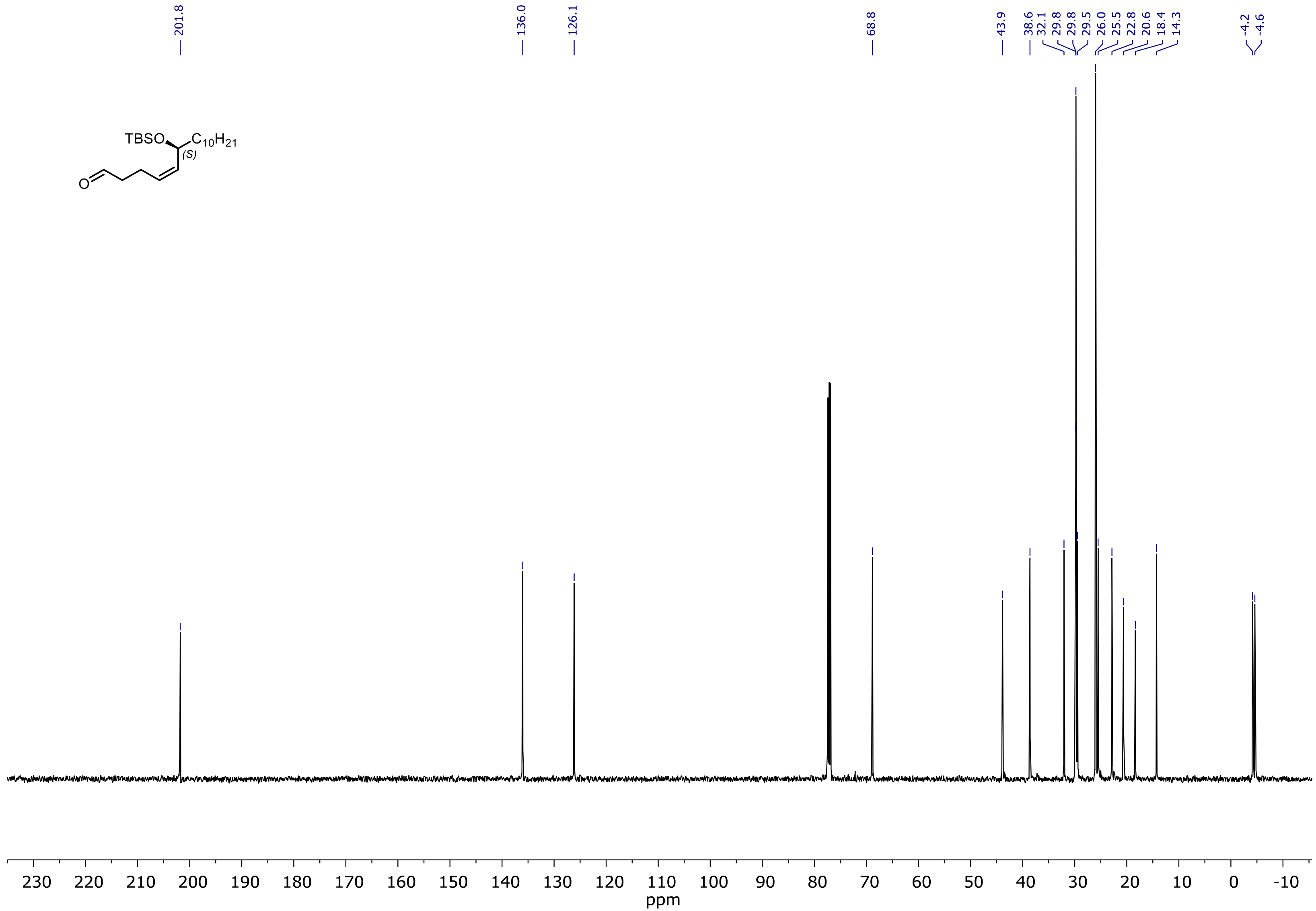


Figure S48. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-4-enal **23**.

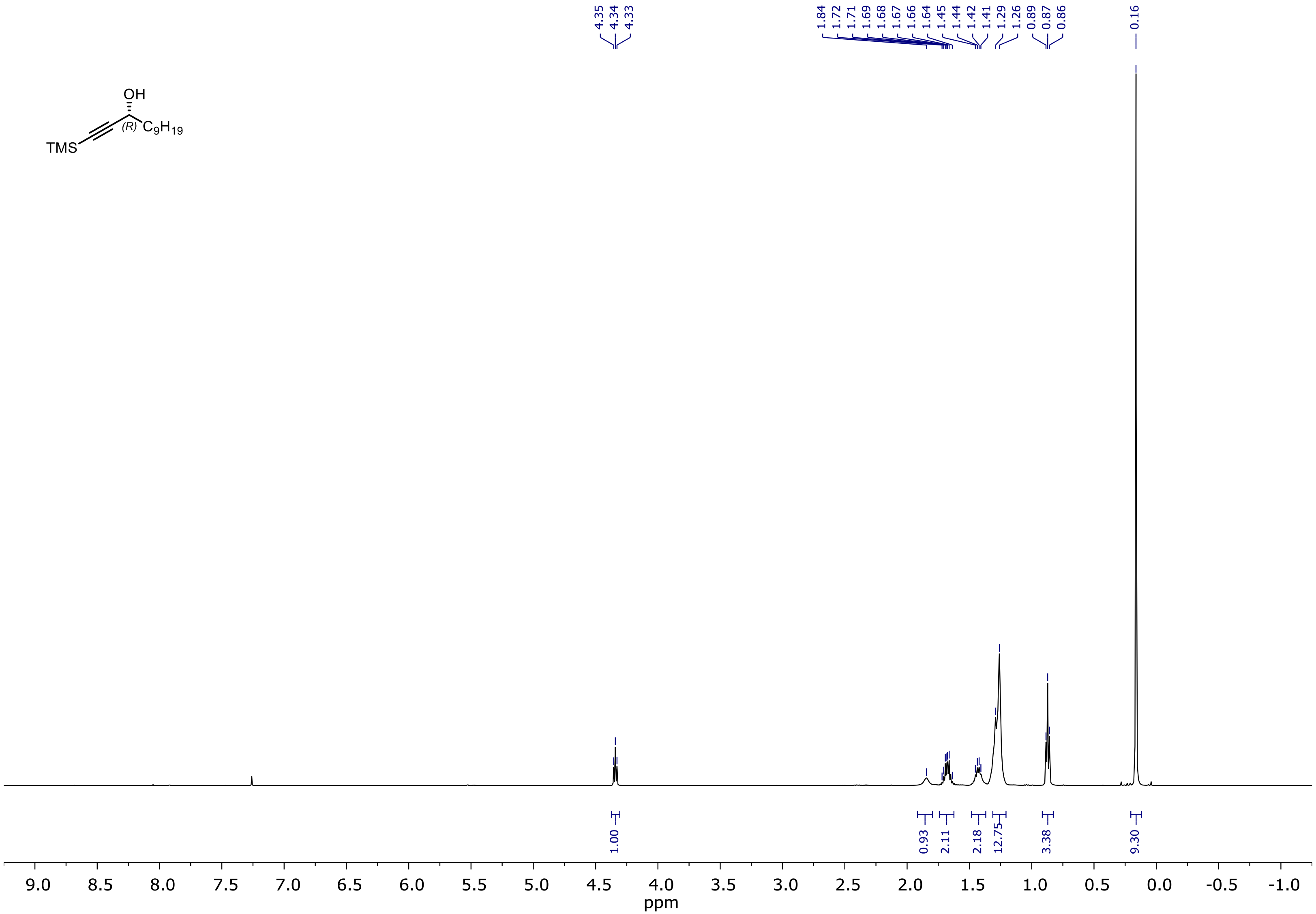


Figure S49. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*)-1-(Trimethylsilyl)dodec-1-yn-3-ol **SI-11**.

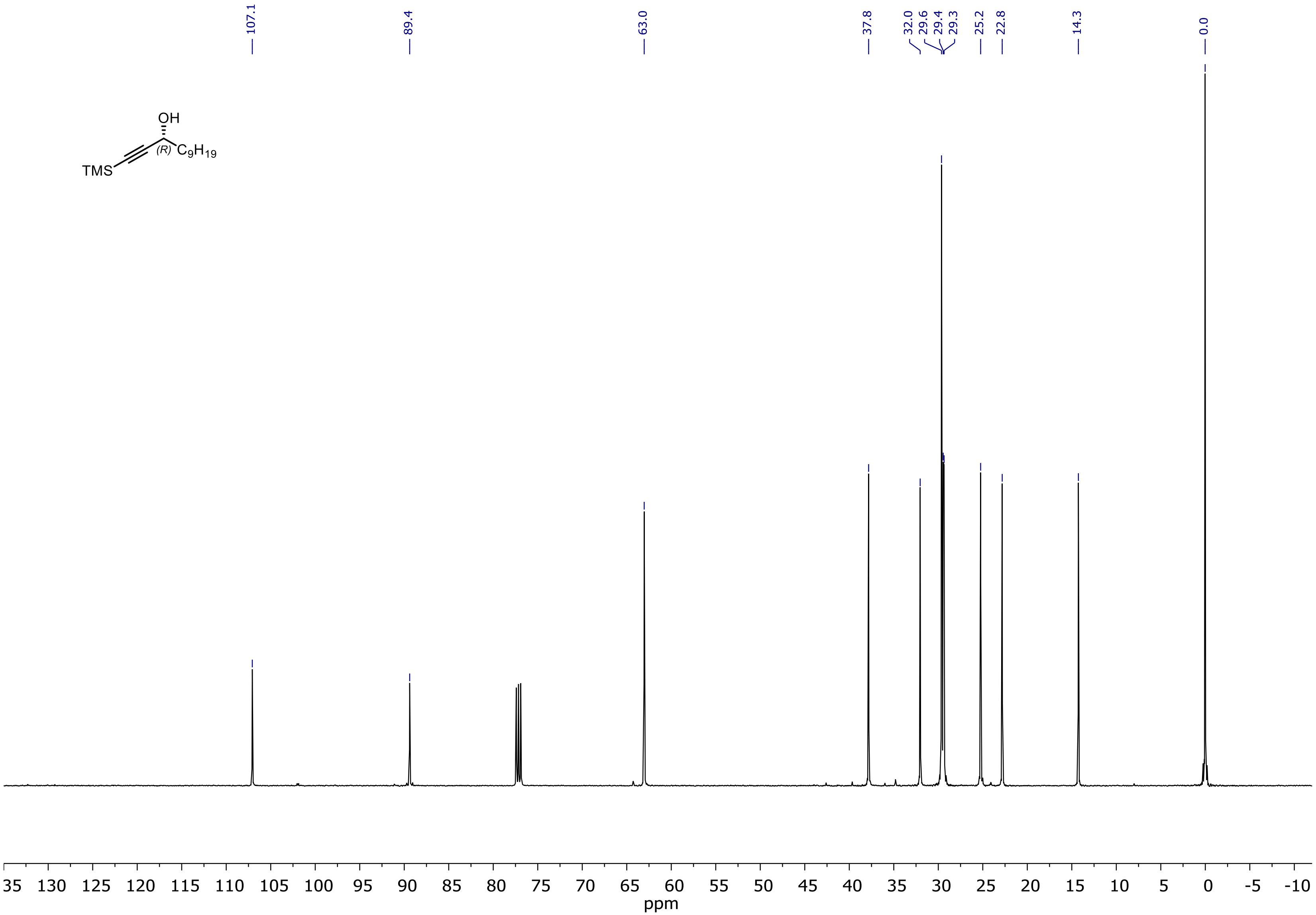


Figure S50. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-1-(Trimethylsilyl)dodec-1-yn-3-ol **SI-11**.

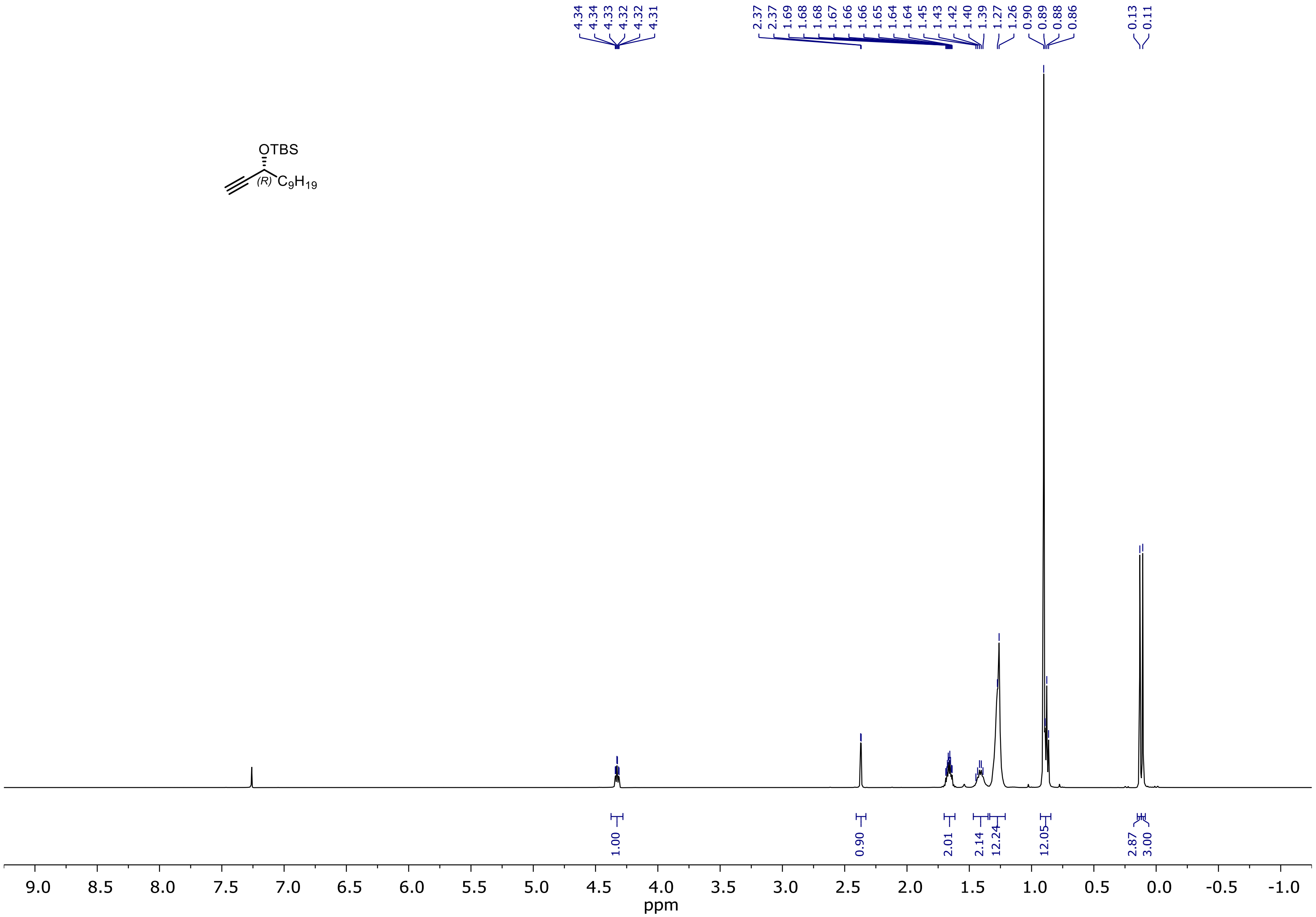


Figure S51. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*R*)-*tert*-Butyl(dodec-1-yn-3-yloxy)dimethylsilane **SI-12**.

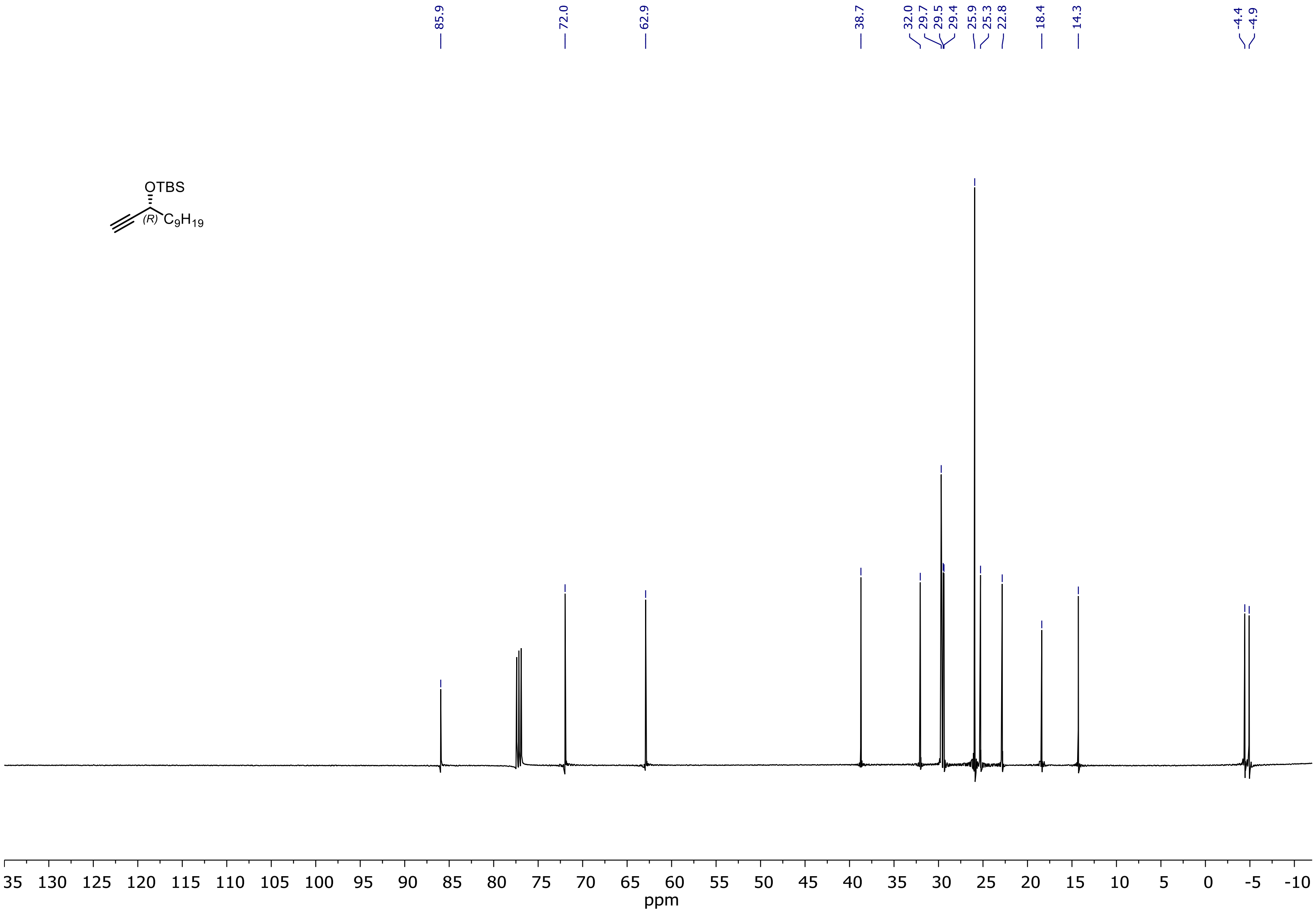


Figure S52. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-*tert*-Butyl(dodec-1-yn-3-yloxy)dimethylsilane **SI-12**.

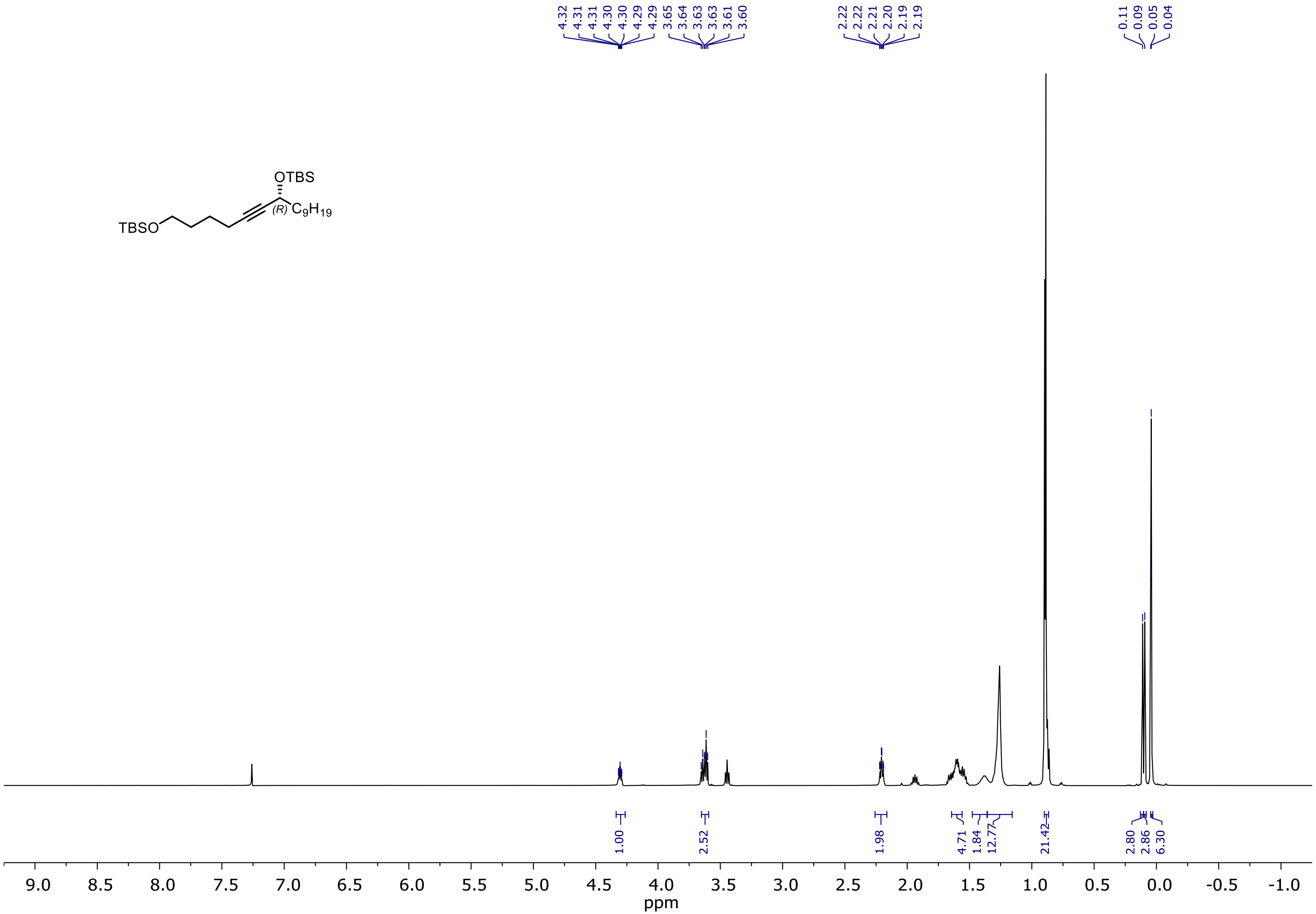


Figure S53. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*)-2,2,3,3,13,13,14,14-Octamethyl-5-nonyl-4,12-dioxa-3,13-disilapentadec-6-yne **SI-14**.

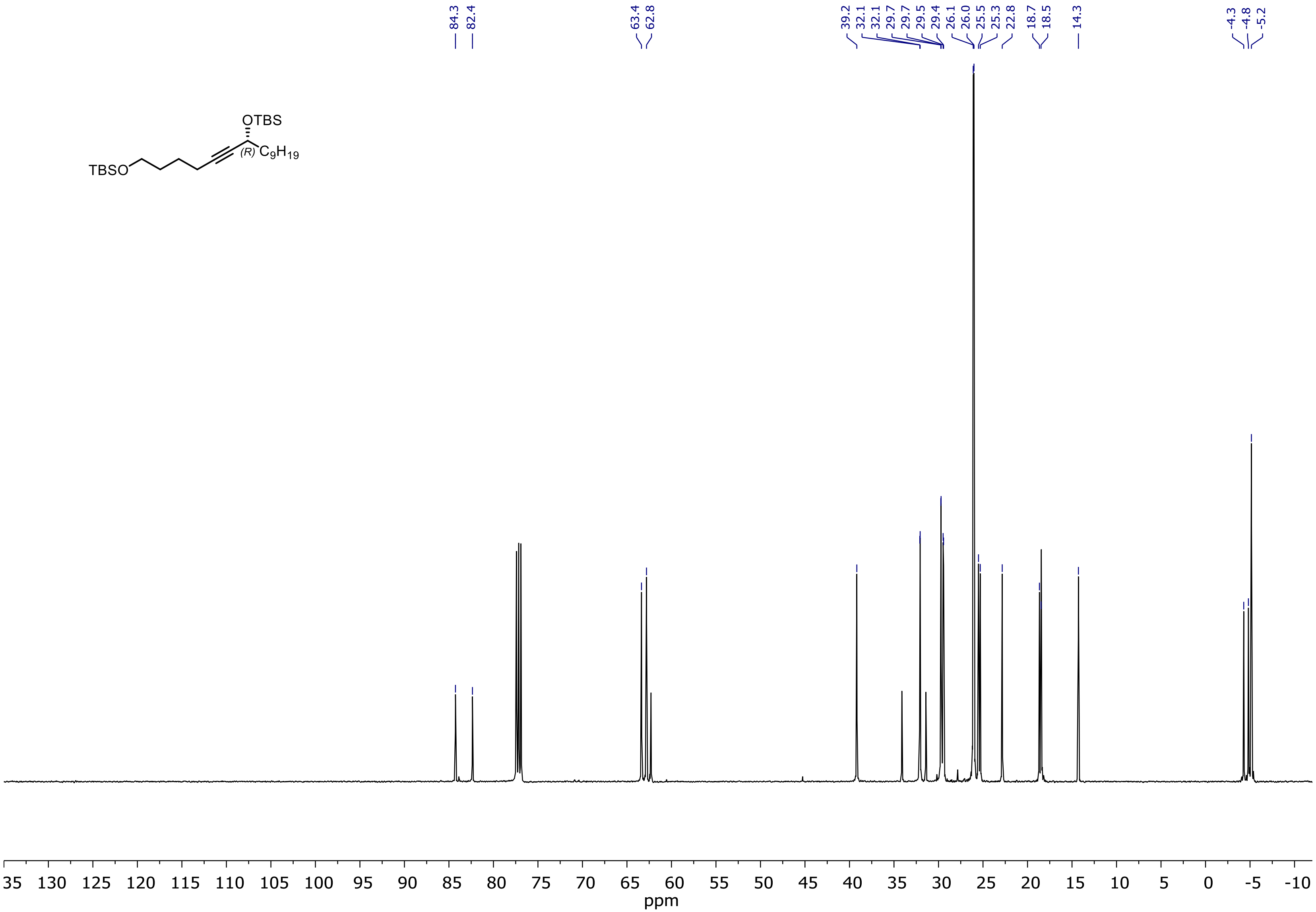


Figure S54. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-2,2,3,3,13,13,14,14-Octamethyl-5-nonyl-4,12-dioxa-3,13-disilapentadec-6-yne **SI-14**.

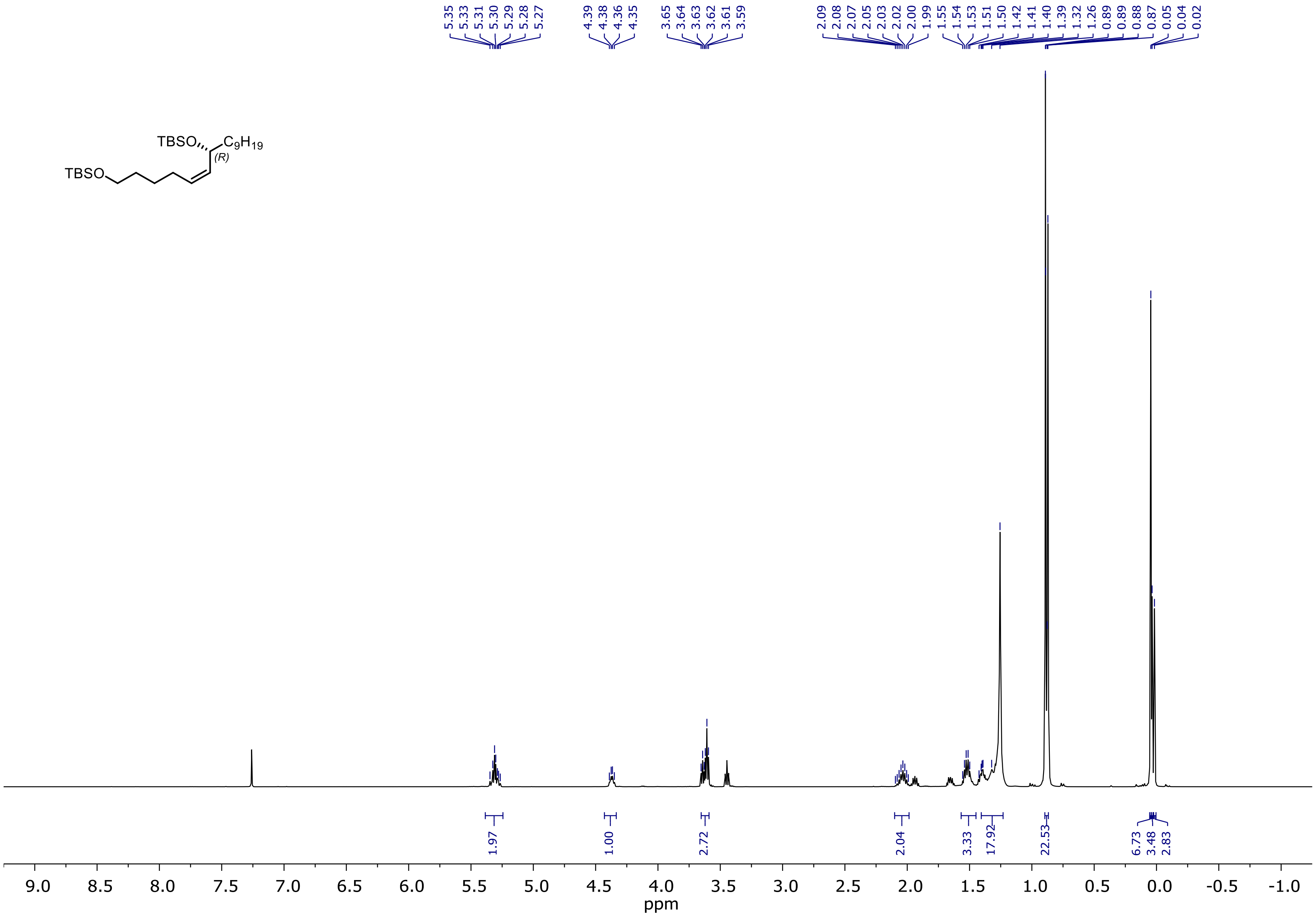


Figure S55. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*R*,*Z*)-2,2,3,3,13,13,14,14-Octamethyl-5-nonyl-4,12-dioxa-3,13-disilapentadec-6-ene **SI-15**.

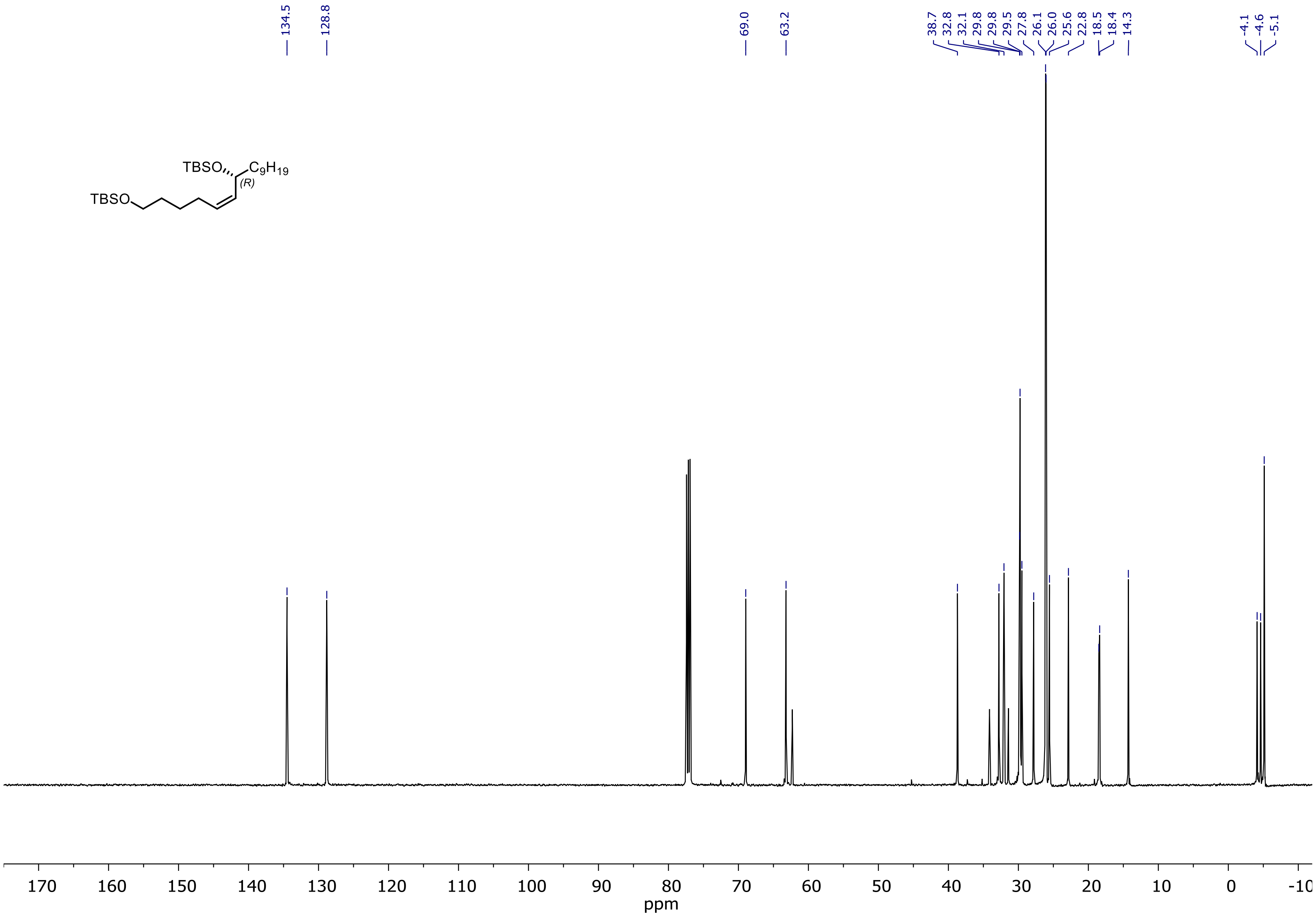


Figure S56. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*,*Z*)-2,2,3,3,13,13,14,14-Octamethyl-5-nonyl-4,12-dioxa-3,13-disilapentadec-6-ene **SI-15**.

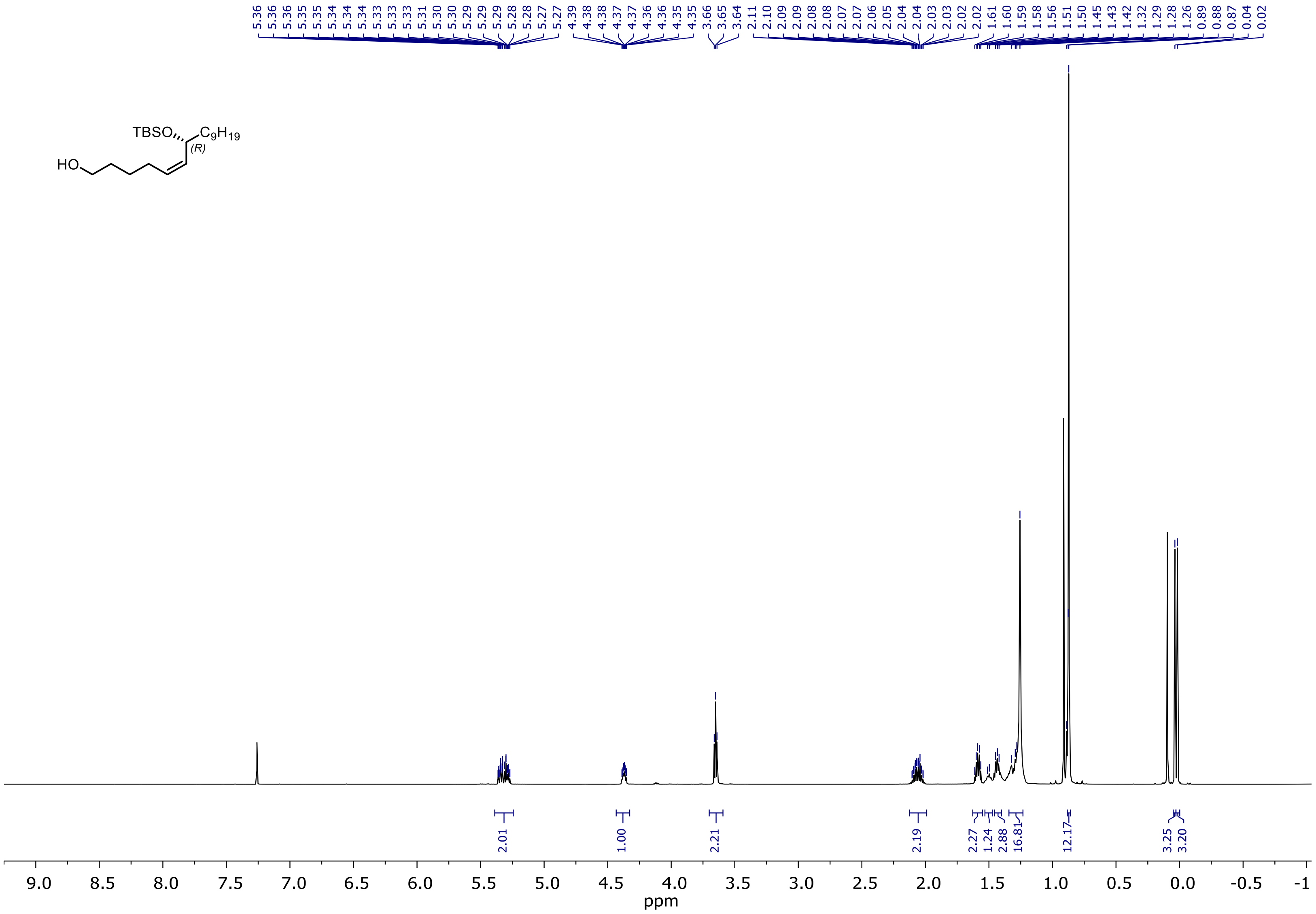


Figure S57. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*,*Z*)-7-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-en-1-ol **SI-16**.

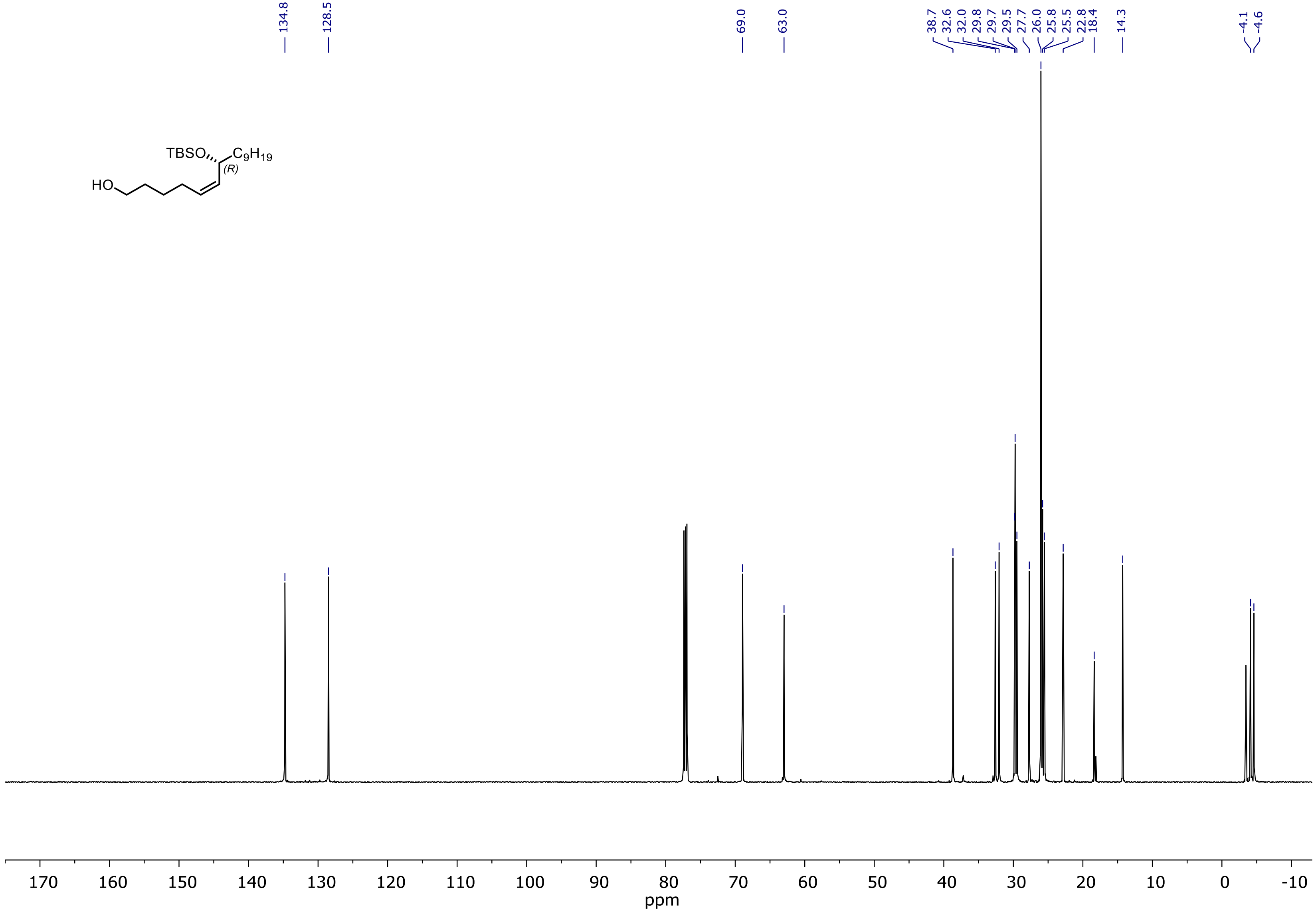


Figure S58. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*R*,*Z*)-7-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-en-1-ol **SI-16**.

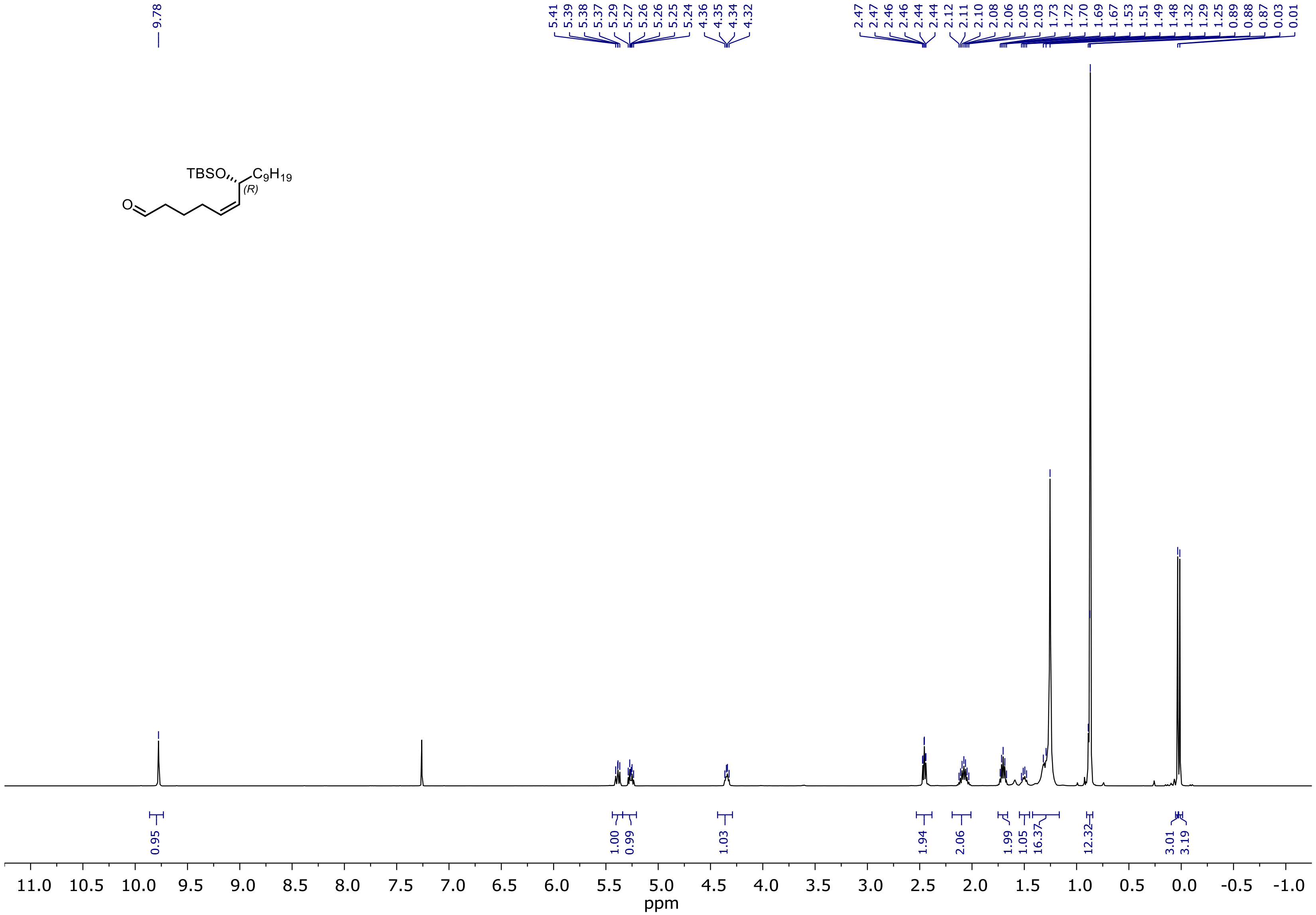


Figure S59. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*,*Z*)-7-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-enal **32**.

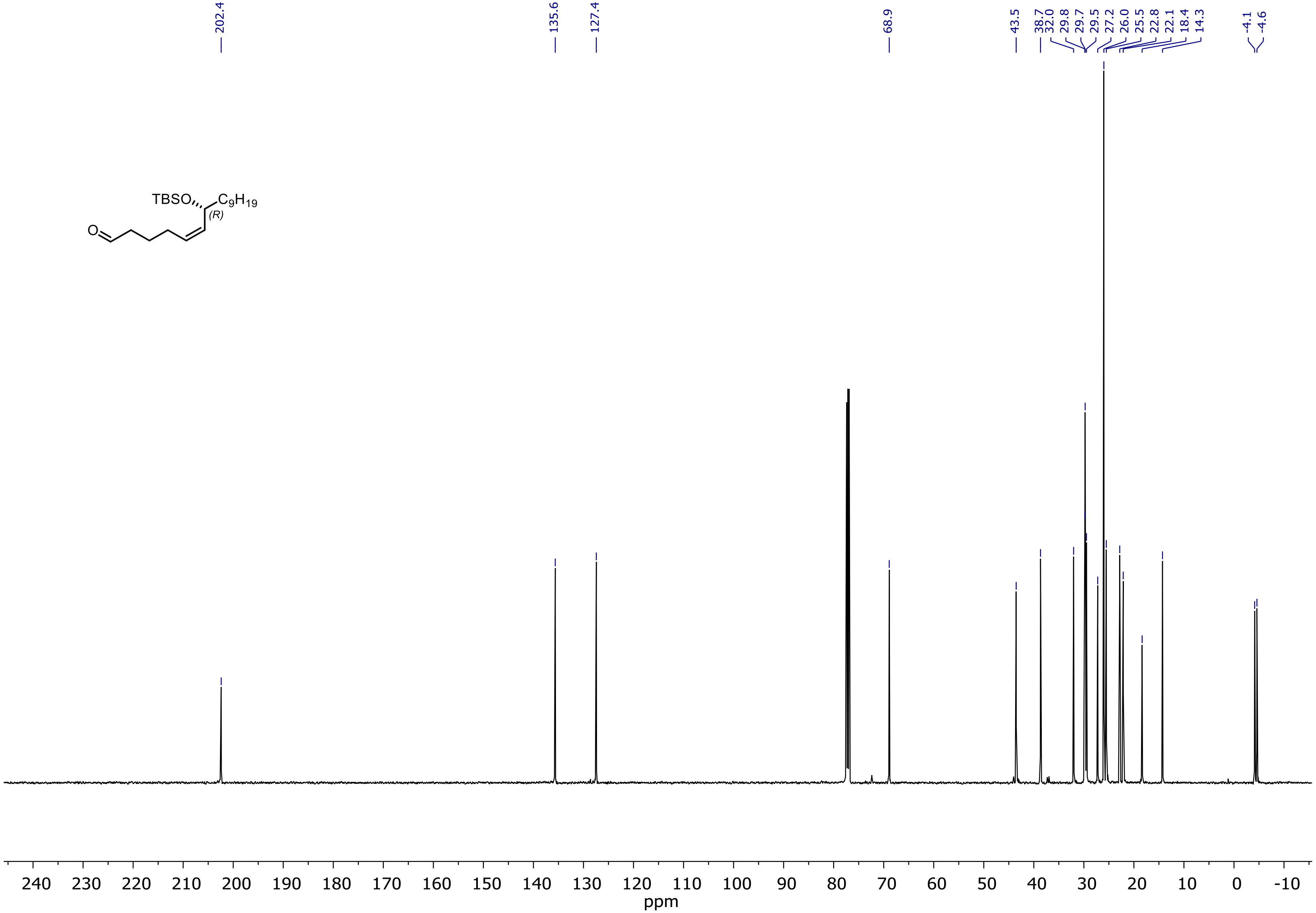


Figure S60. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*,*Z*)-7-((*tert*-Butyldimethylsilyl)oxy)hexadec-5-enal **32**.

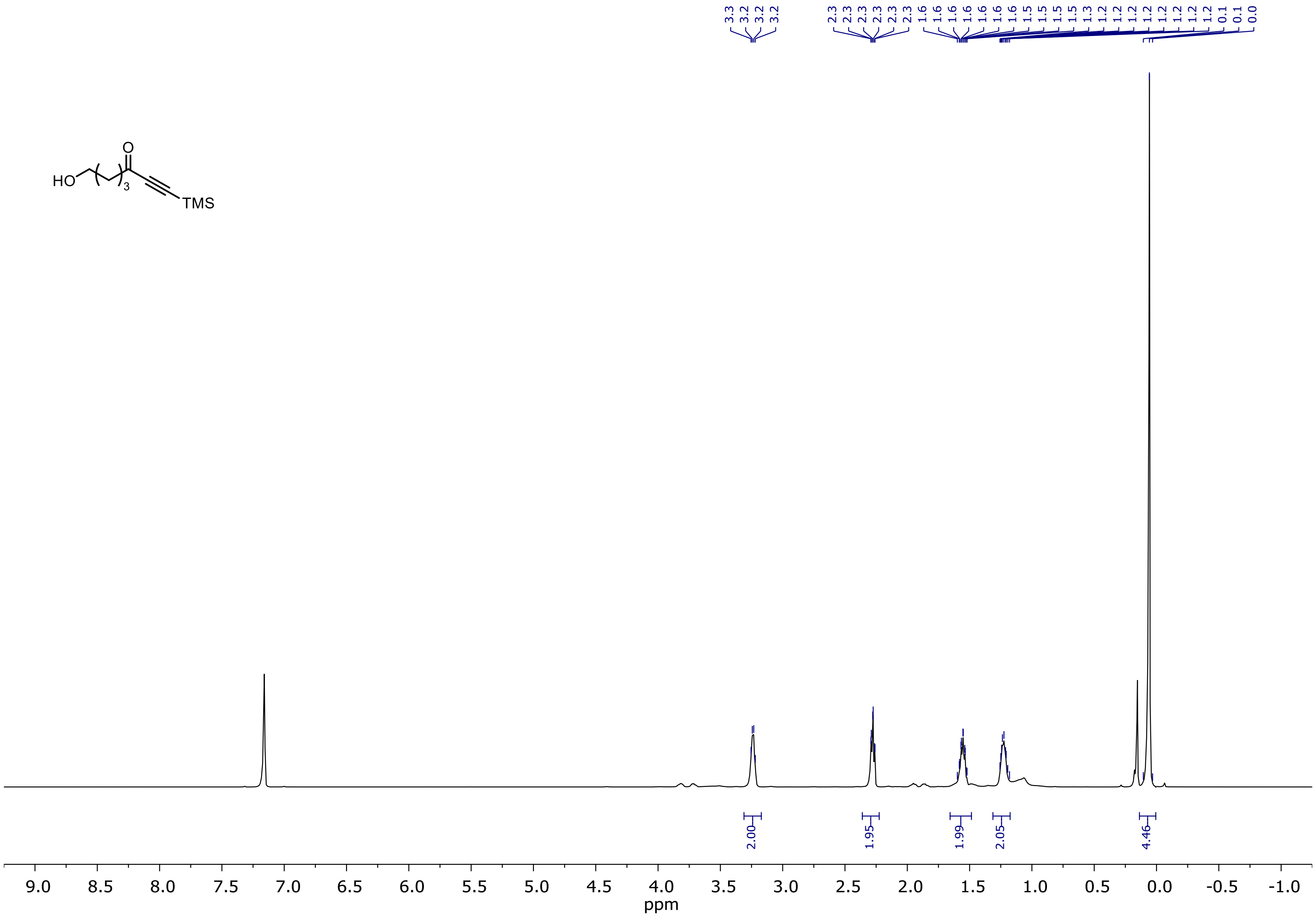


Figure S61. ^{1}H-NMR spectrum (500 MHz, C_6D_6) of 7-Hydroxy-1-(trimethylsilyl)hept-1-yn-3-one **SI-17**.

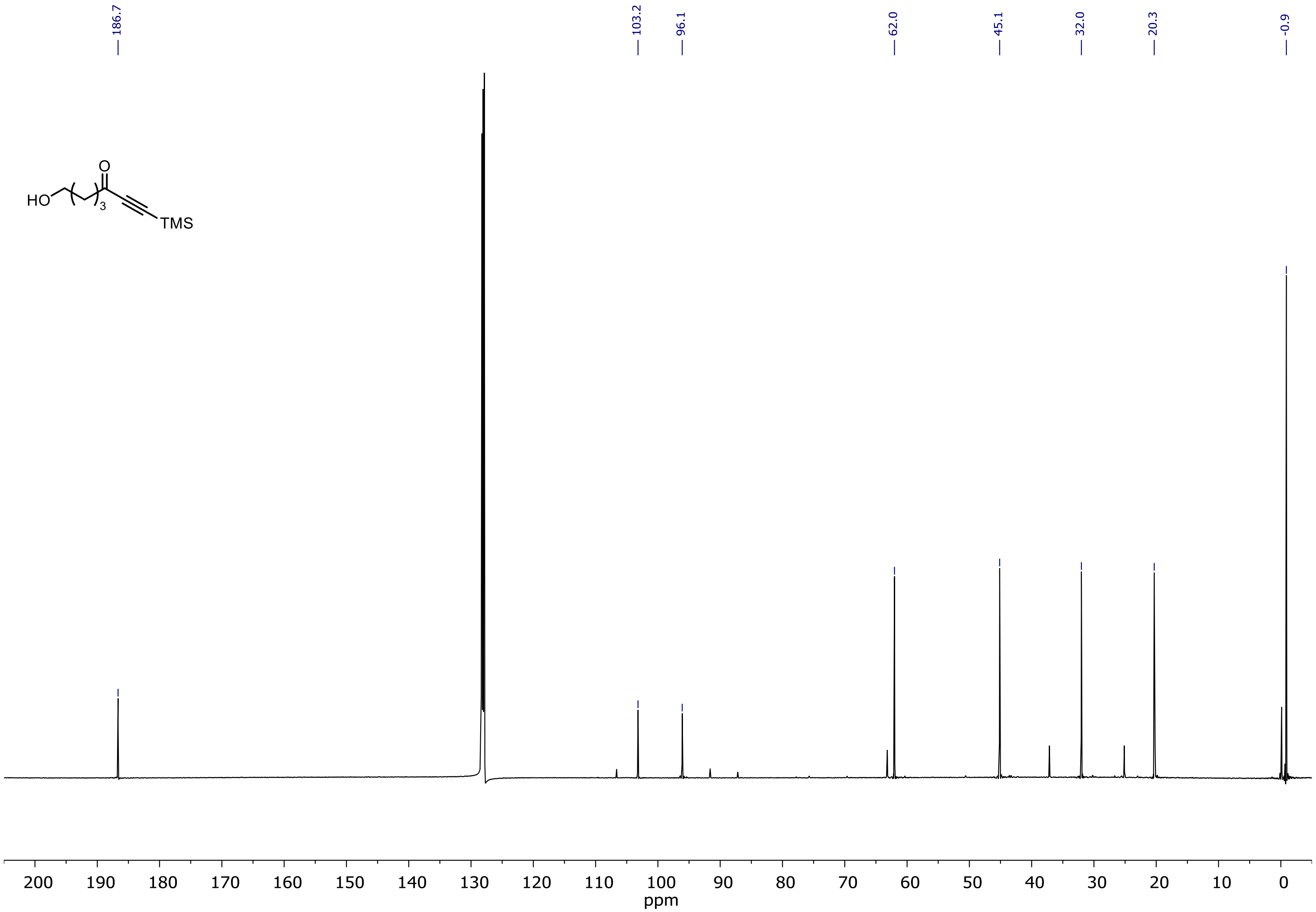


Figure S62. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, C_6D_6) of 7-Hydroxy-1-(trimethylsilyl)hept-1-yn-3-one **SI-17**.

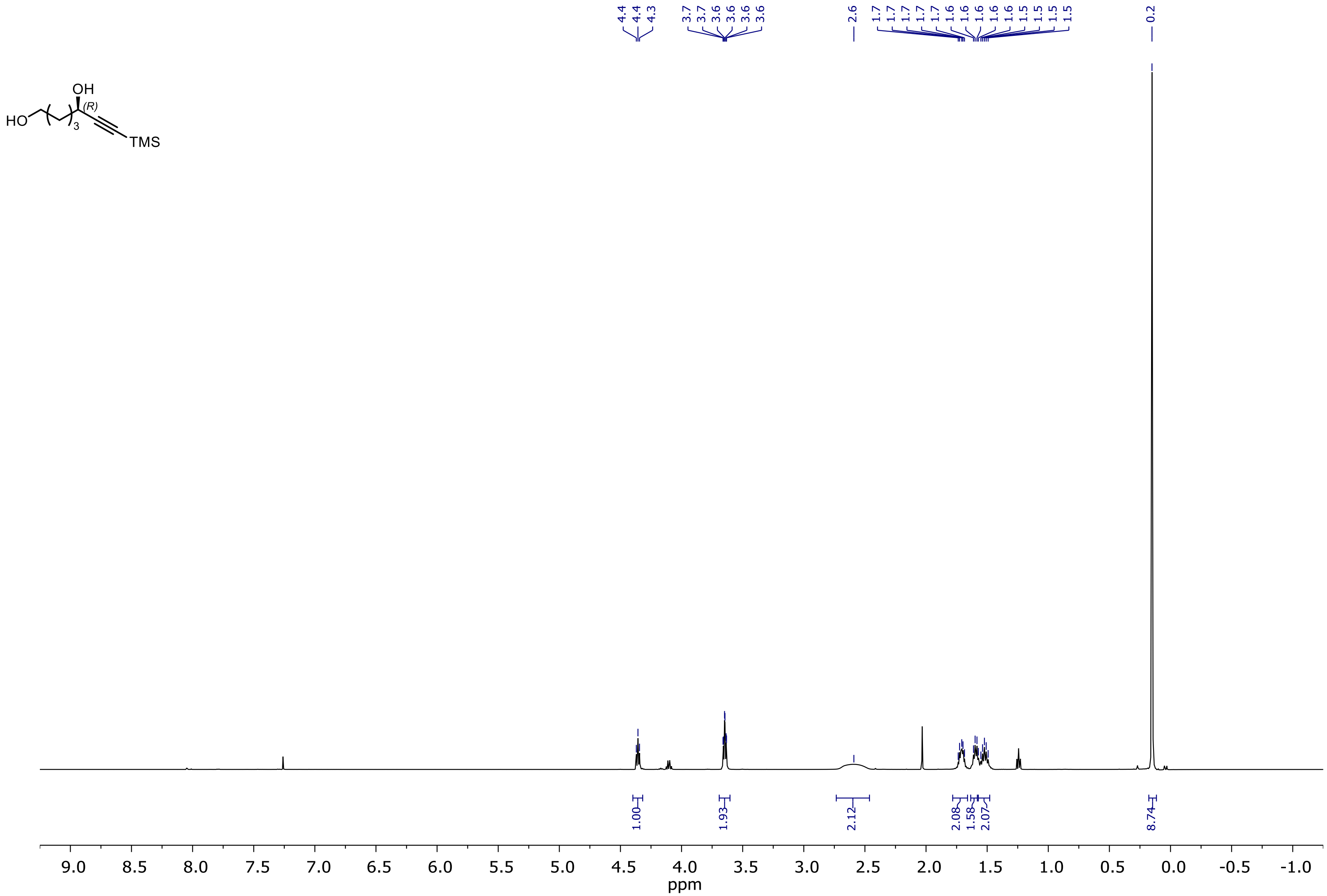


Figure S63. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*R*)-7-(Trimethylsilyl)hept-6-yne-1,5-diol-tridec-1-yn **SI-18.**

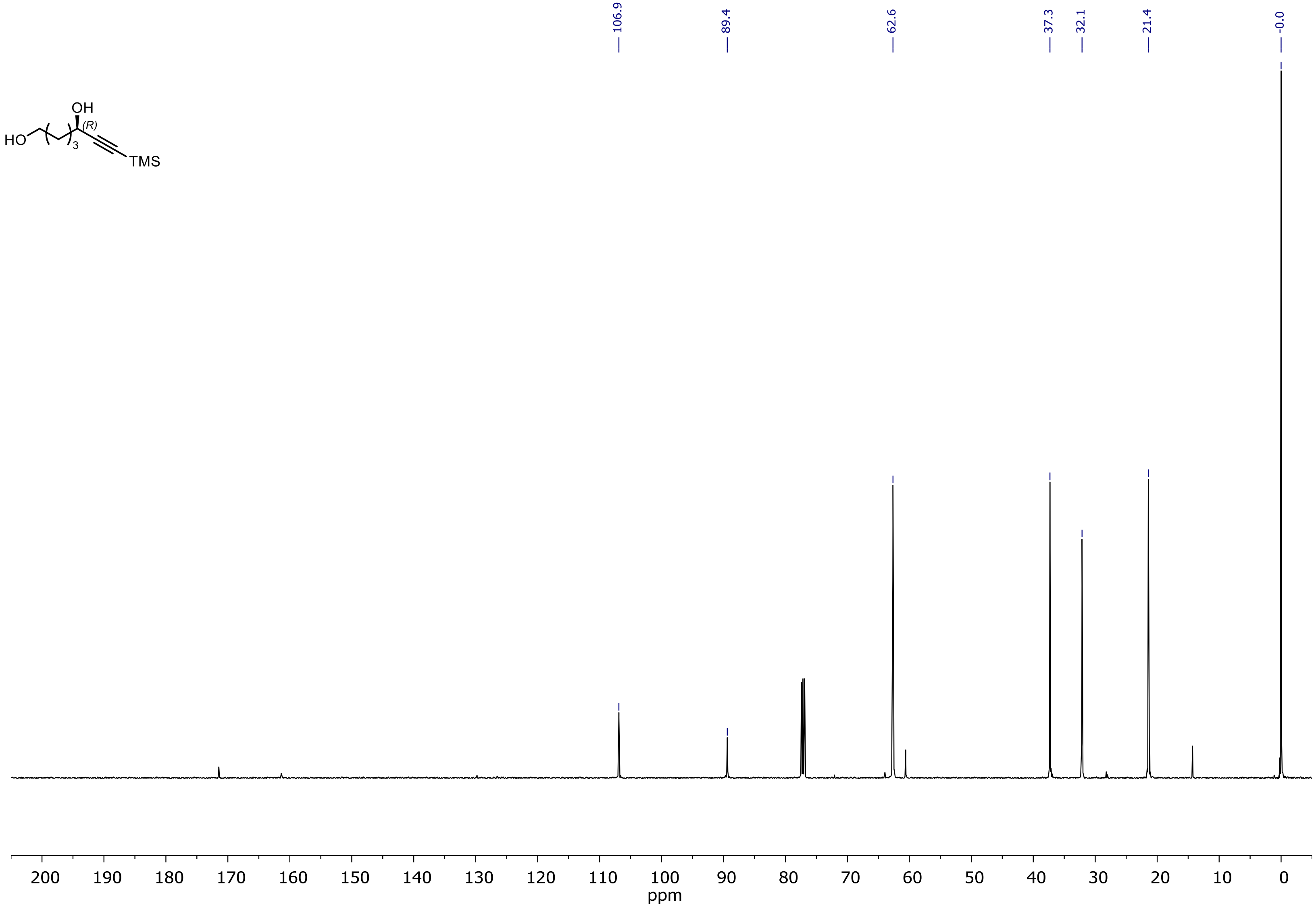


Figure S64. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-7-(Trimethylsilyl)hept-6-yne-1,5-diol **SI-18**.

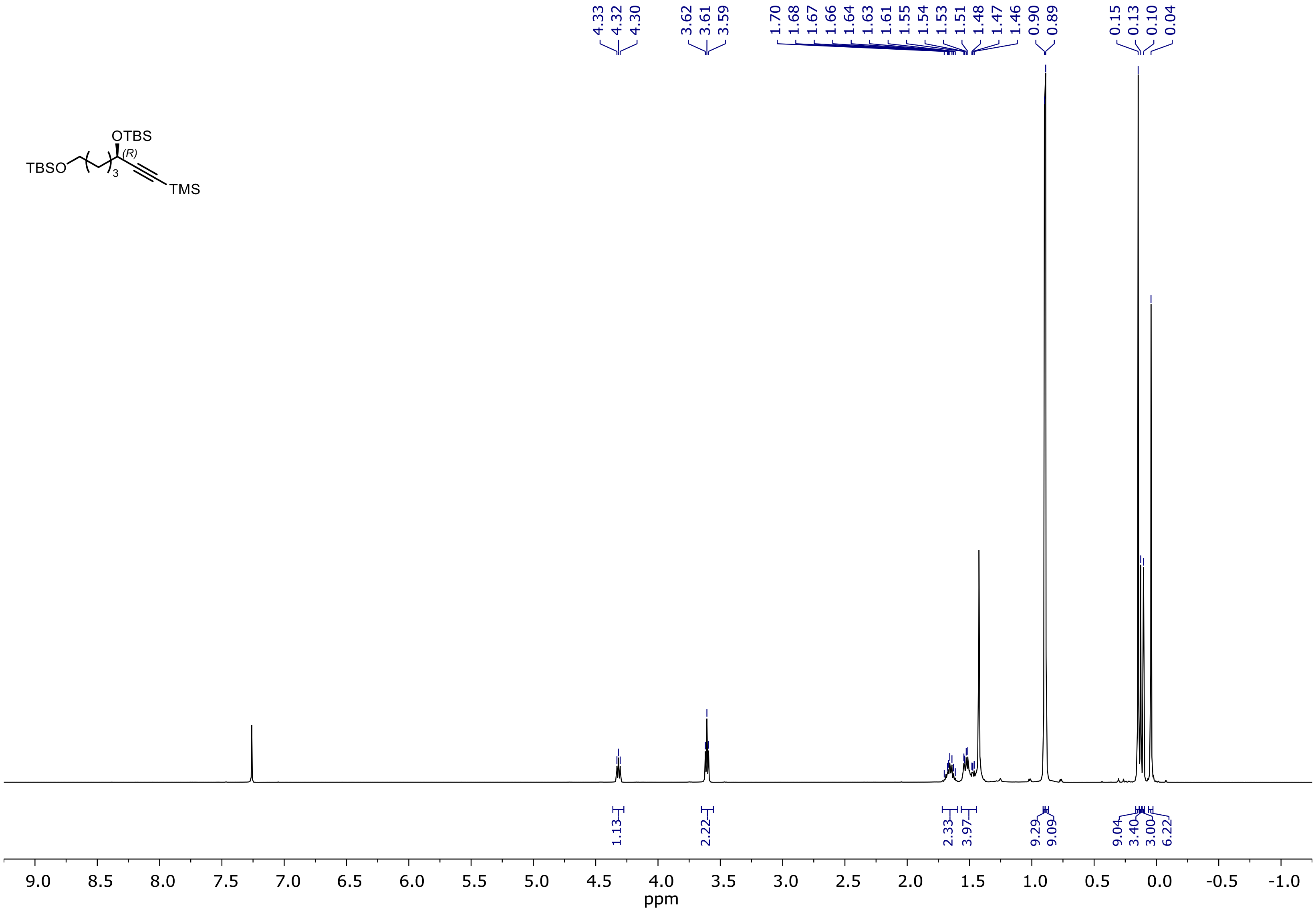


Figure S65. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*)-2,3,11,12-Octamethyl-5-((trimethylsilyl)ethynyl)-4,10-dioxa-3,11-disila-tridecane **SI-19**.

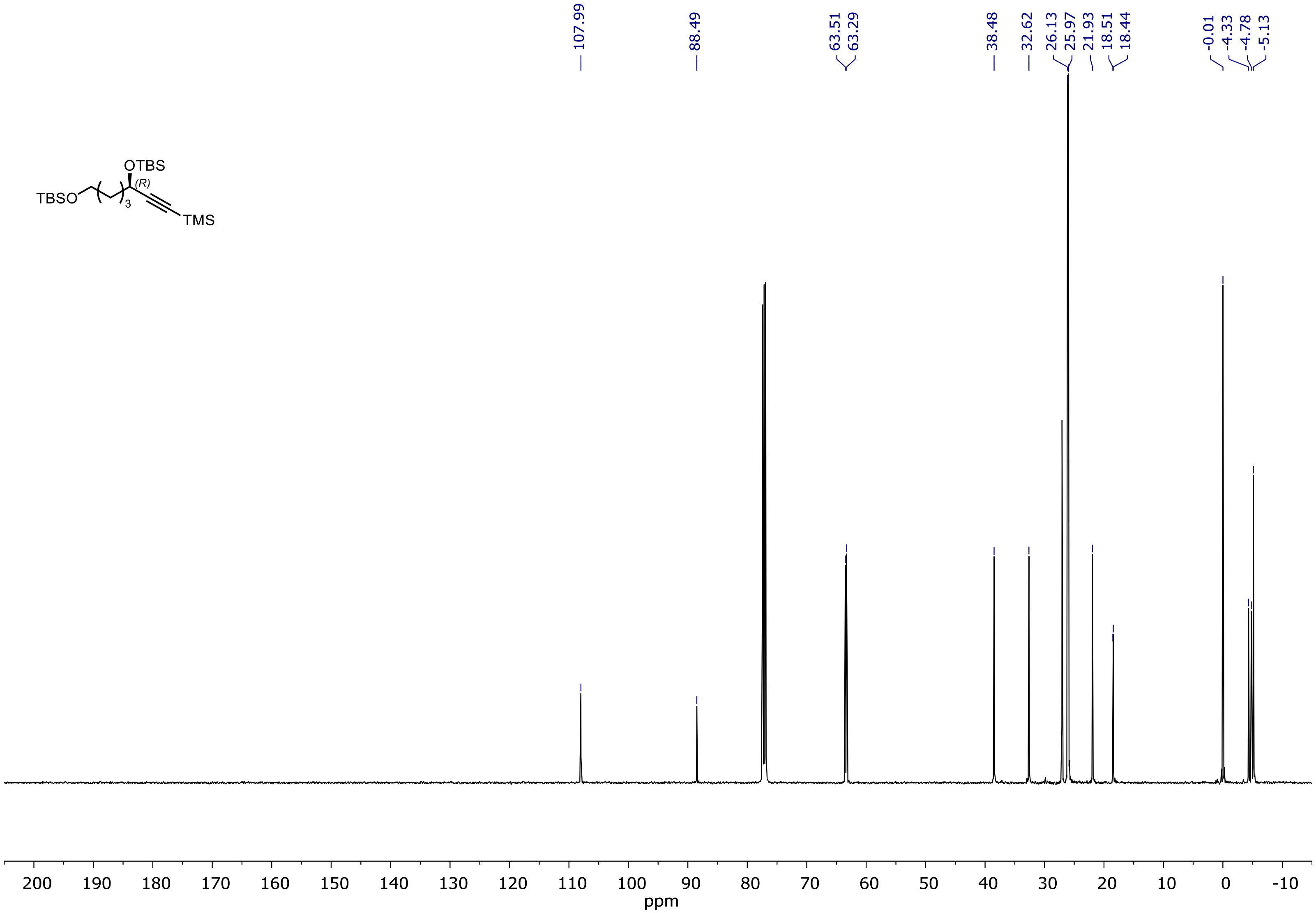


Figure S66. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-2,3,11,12-Octamethyl-5-((trimethylsilyl)ethynyl)-4,10-dioxa-3,11-disila-tridecane **SI-19**.

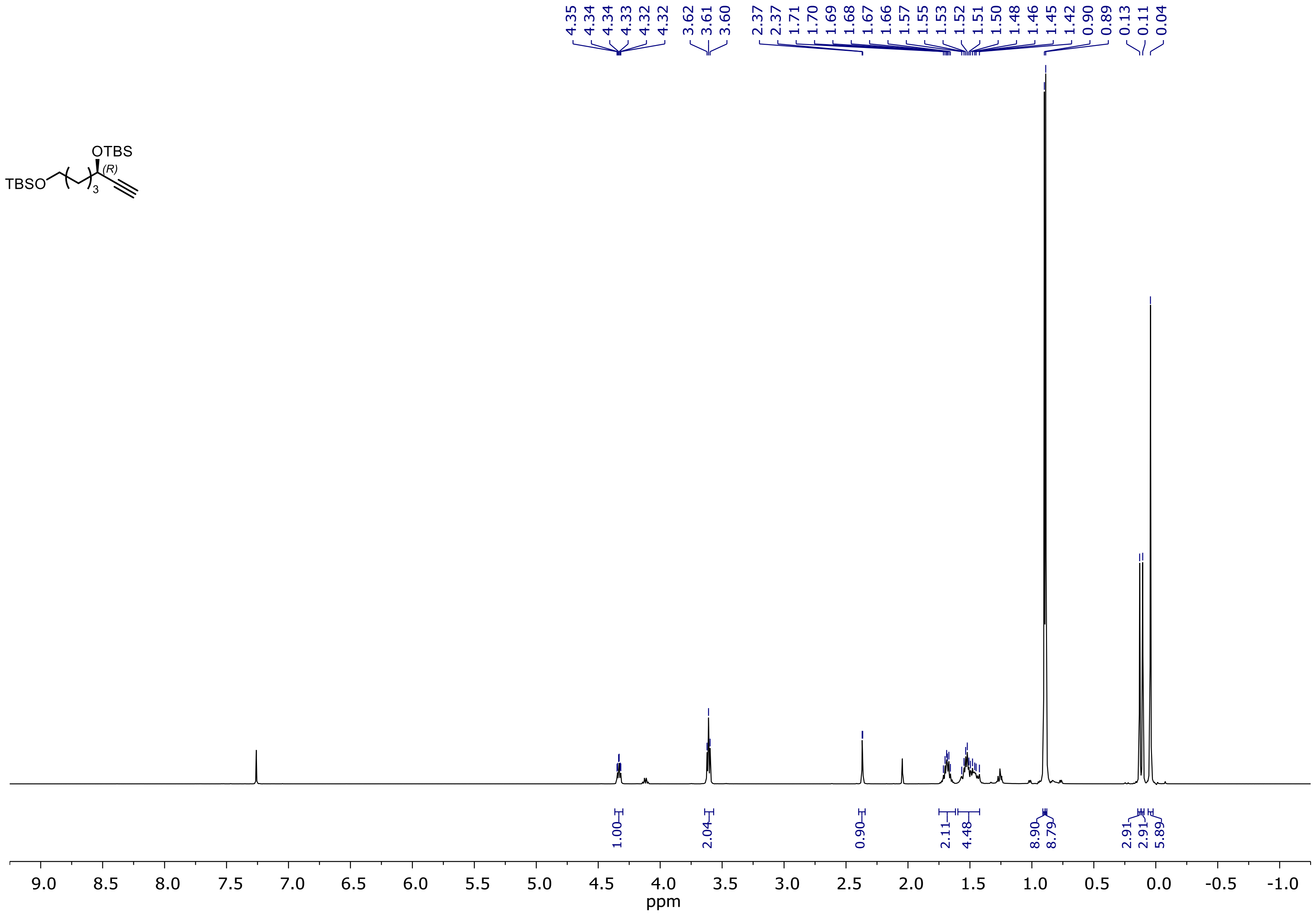


Figure S67. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*R*)-5-Ethynyl-2,3,11,12-octamethyl-4,10-dioxa-3,11-disilatridecane **SI-20**.

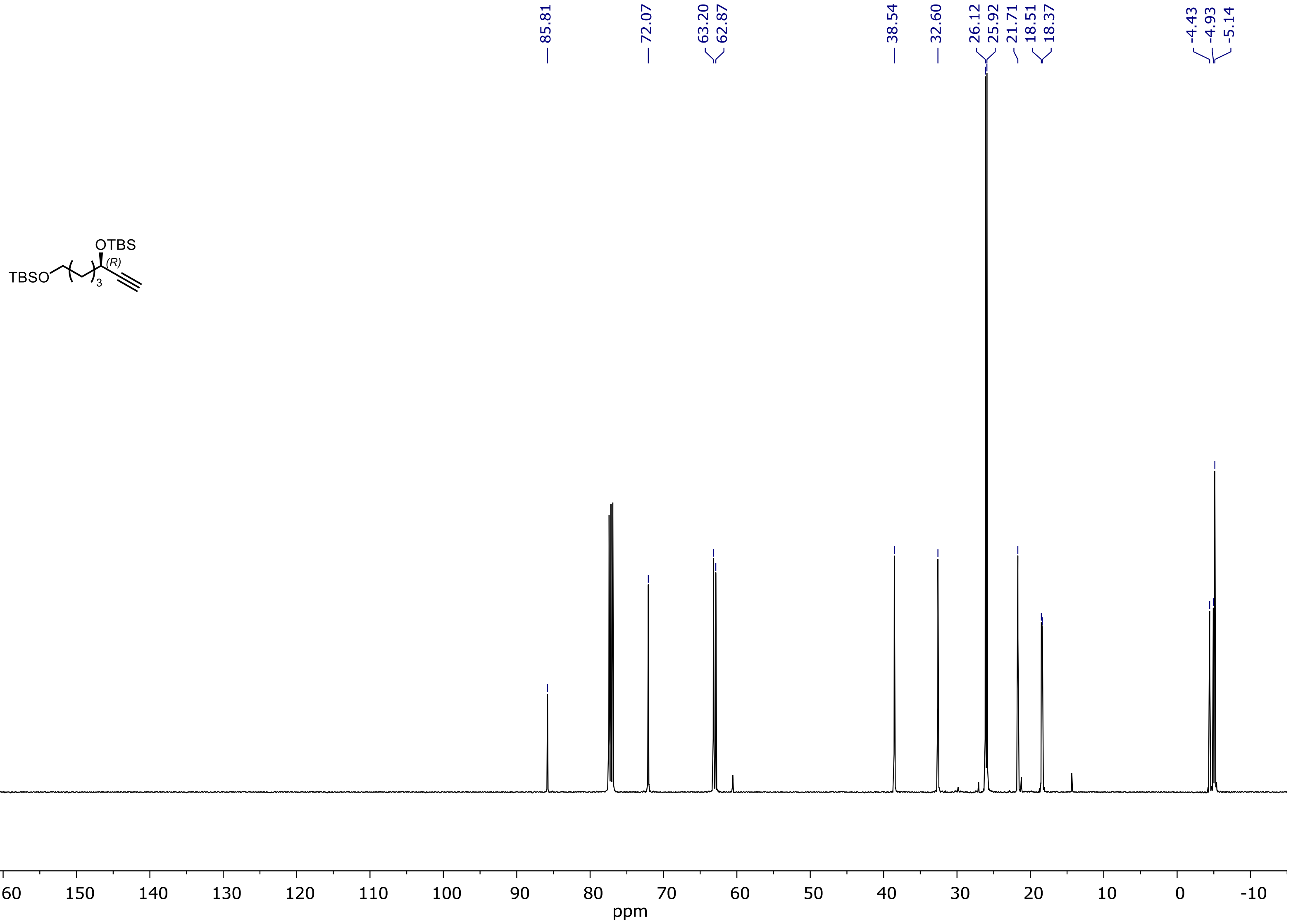


Figure S68. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*R*)-5-Ethynyl-2,3,11,12-octamethyl-4,10-dioxa-3,11-disilatridecane **SI-20**.

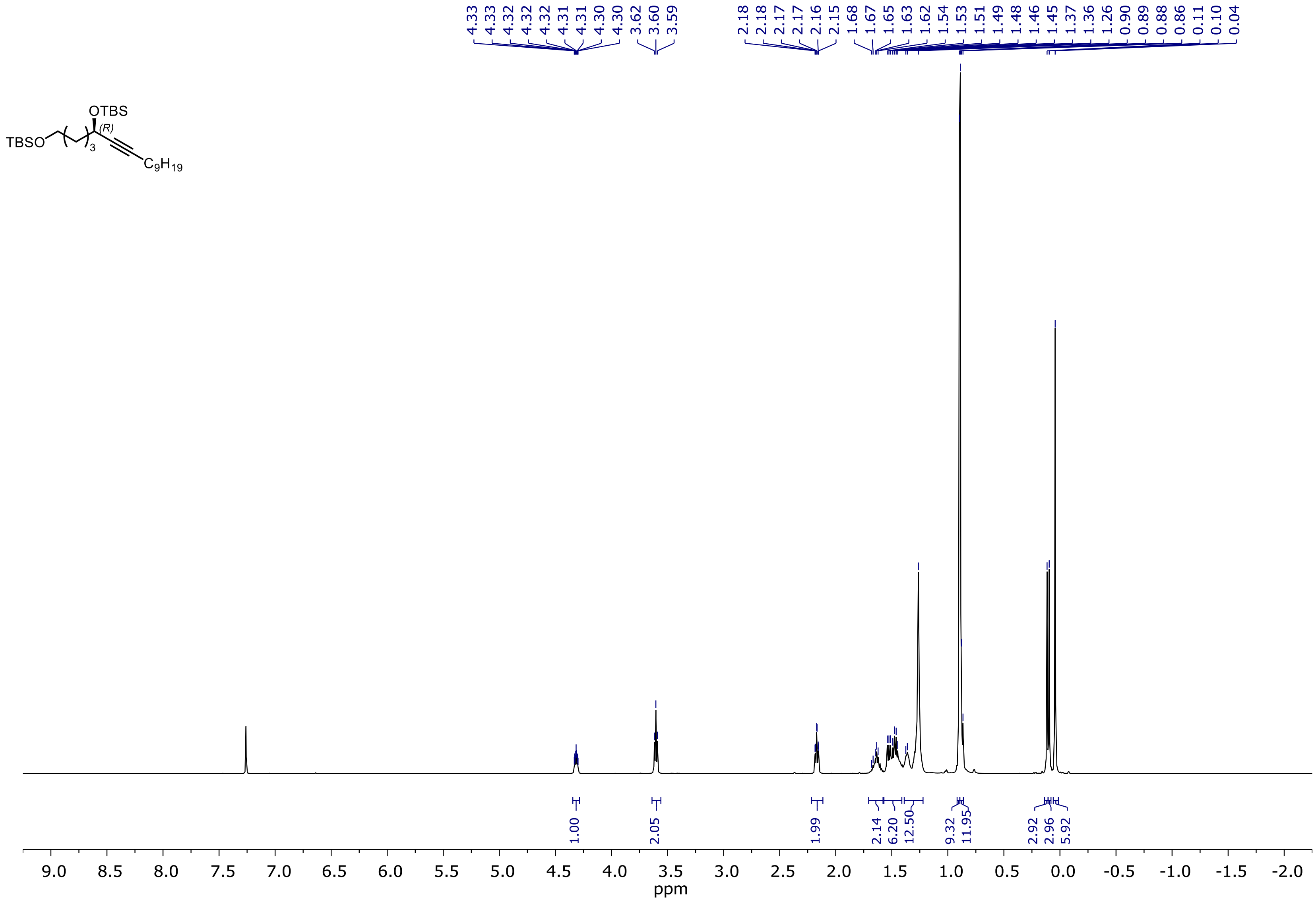


Figure S69. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*)-2,3,11,12-Octamethyl-5-(undec-1-yn-1-yl)-4,10-dioxa-3,11-disilatridecane **SI-21**.

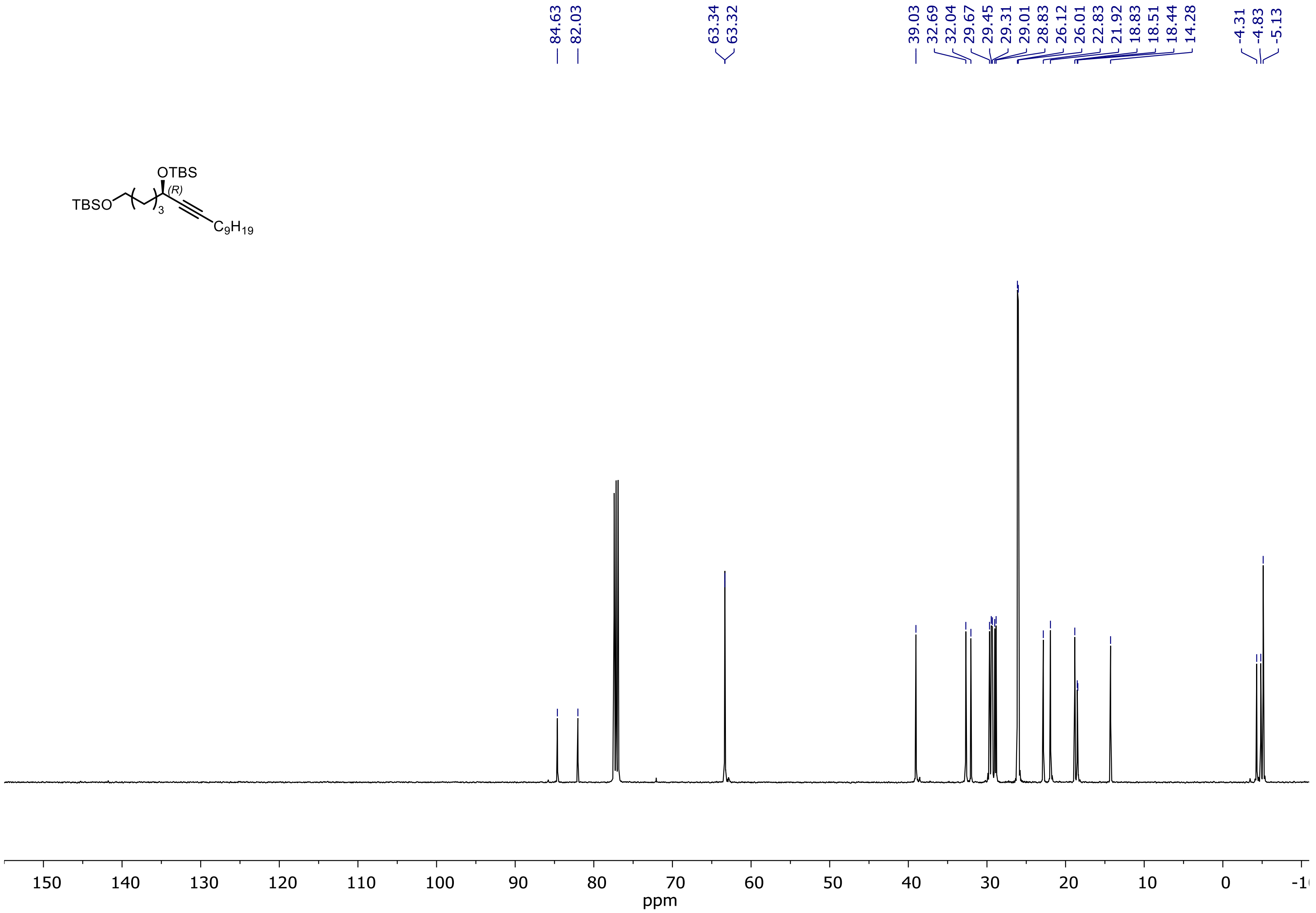


Figure S70. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-2,3,11,12-Octamethyl-5-(undec-1-yn-1-yl)-4,10-dioxa-3,11-disilatridecane **SI-21**.

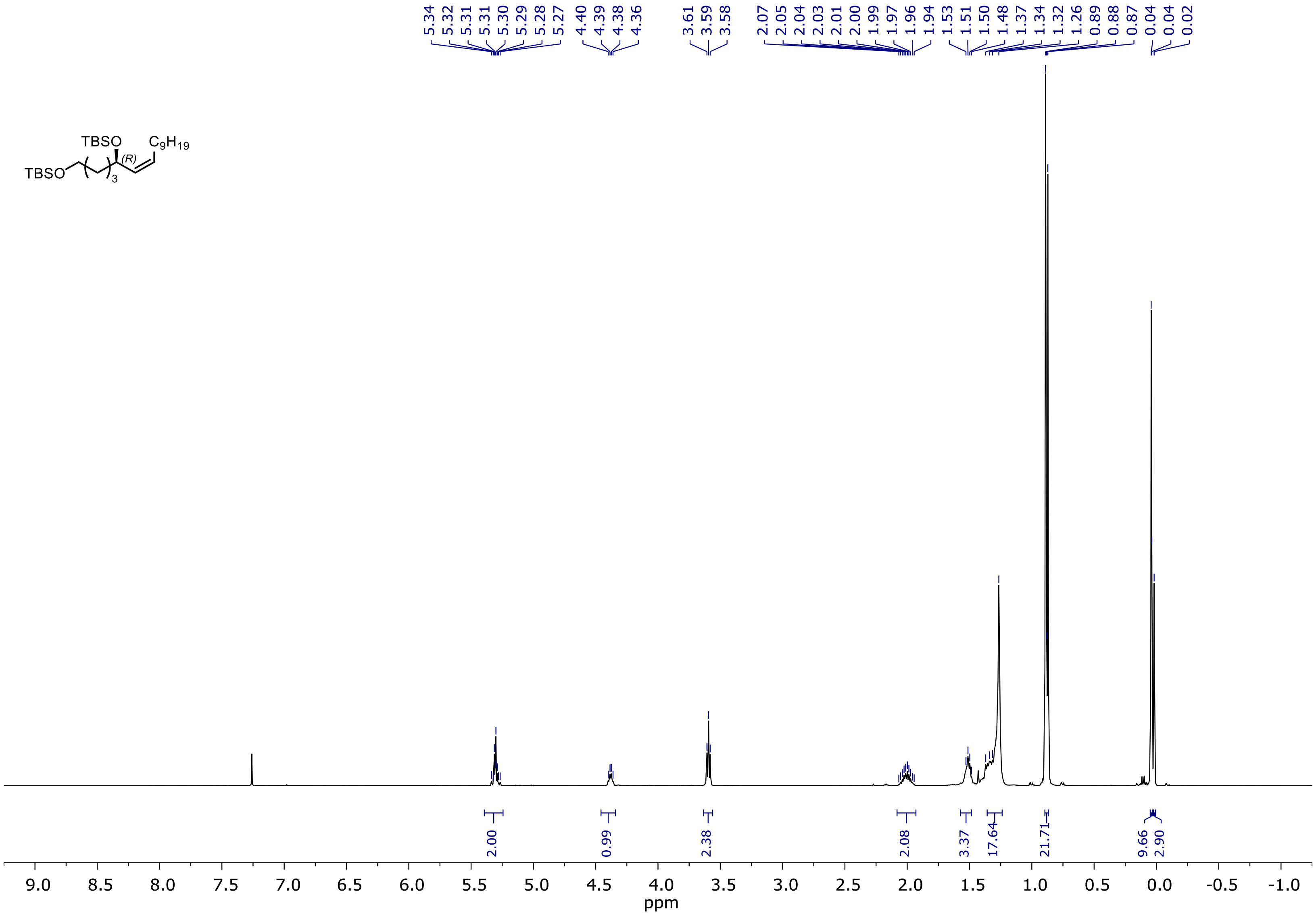


Figure S71. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*R,Z*)-2,3,11,12-Octamethyl-5-(undec-1-en-1-yl)-4,10-dioxa-3,11-disilatridecane **SI-22**.

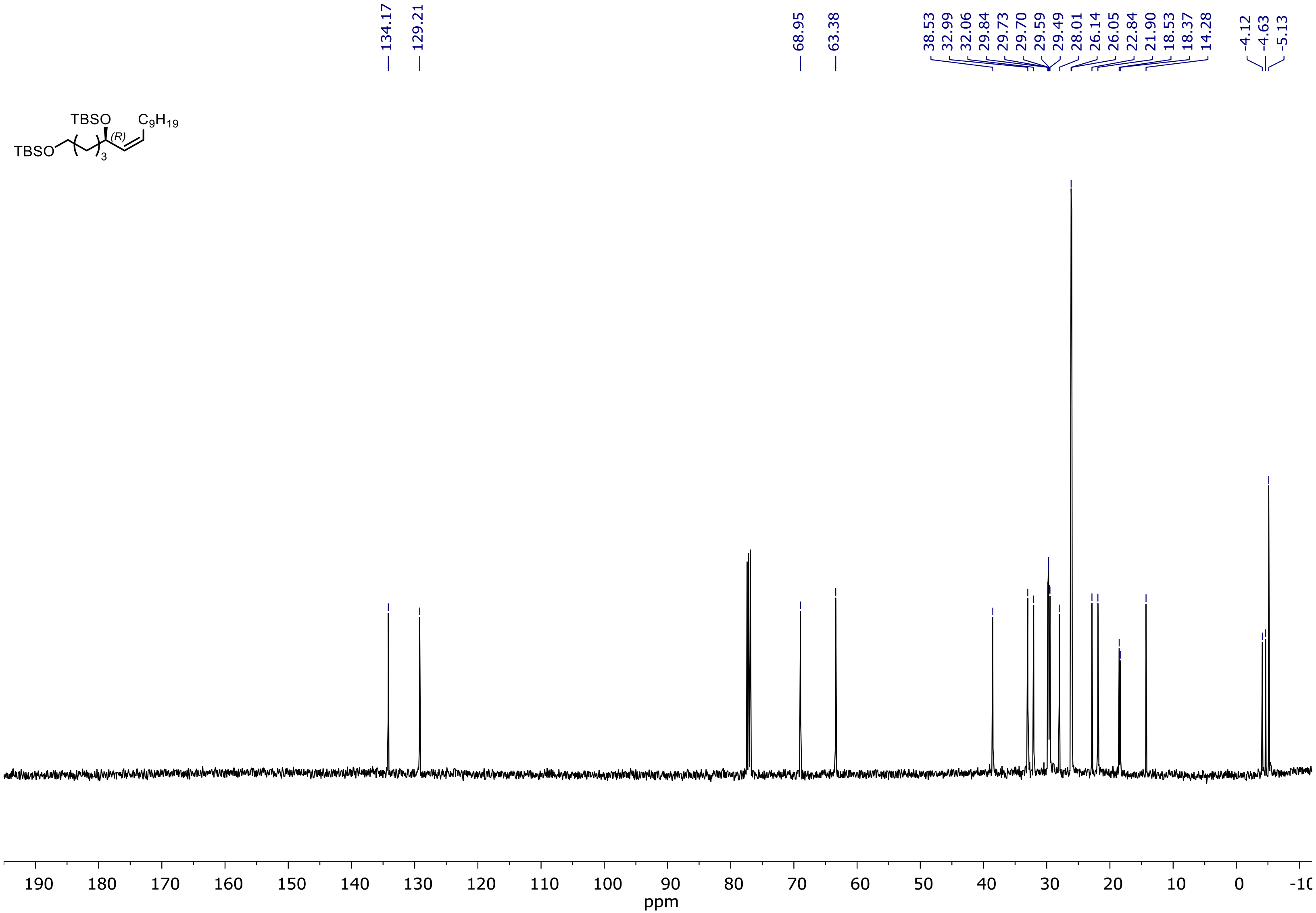


Figure S72. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R,Z*)-2,3,11,12-Octamethyl-5-(undec-1-en-1-yl)-4,10-dioxa-3,11-disilatridecane **SI-22**.

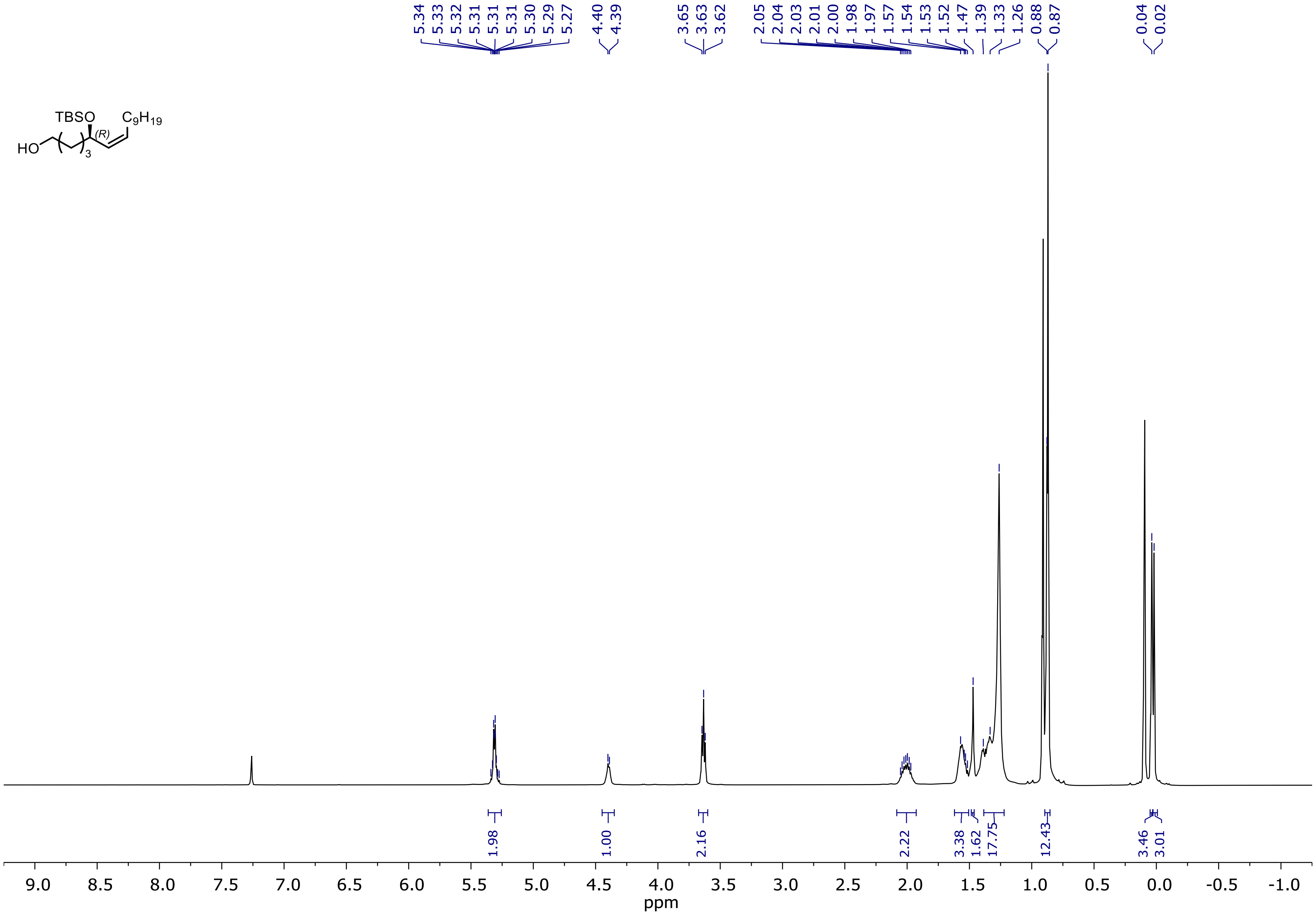


Figure S73. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*R,Z*)-5-((*tert*-Butyldimethylsilyl)oxy)hexadec-6-en-1-ol **SI-23**.

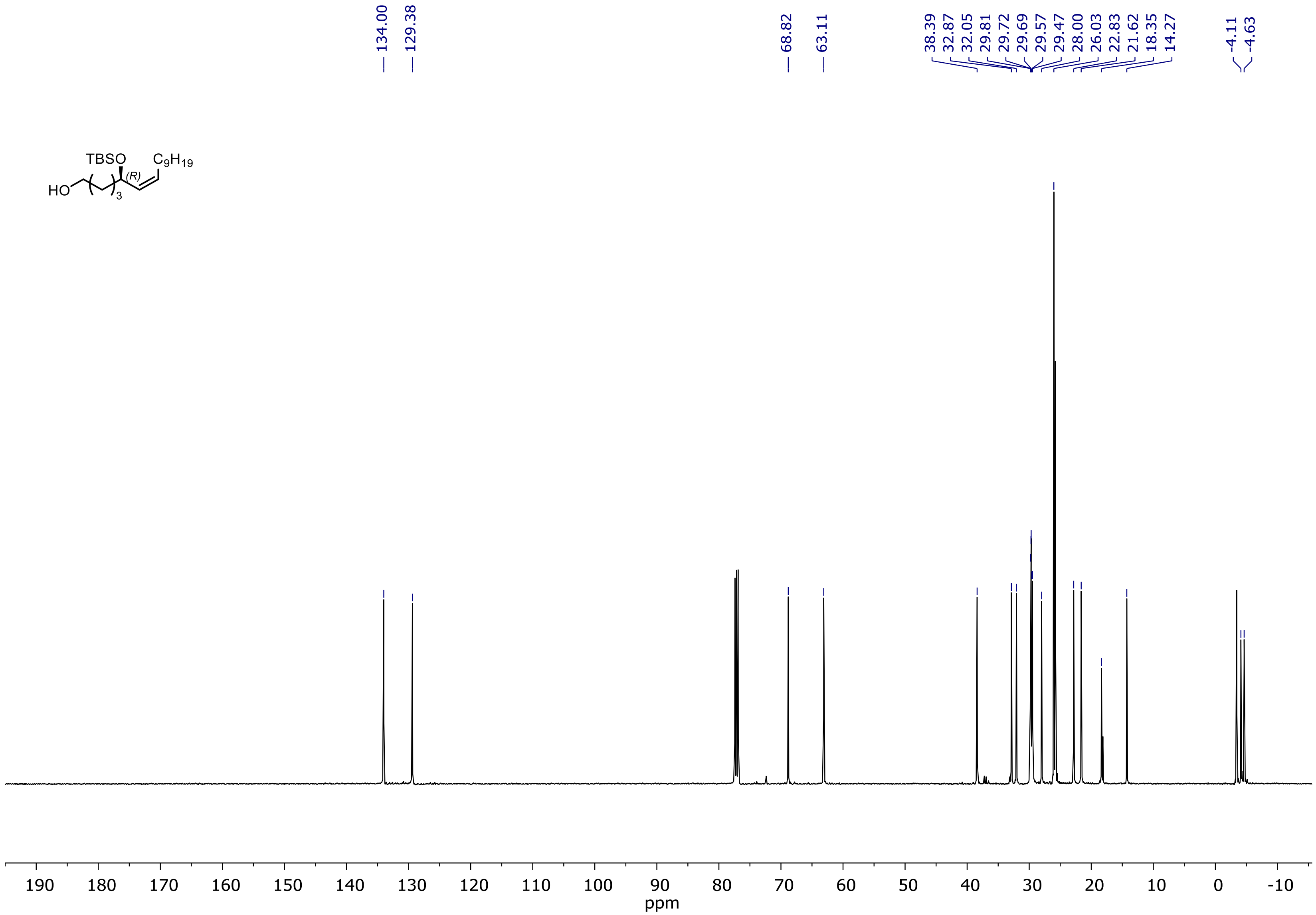


Figure S74. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*R,Z*)-5-((*tert*-Butyldimethylsilyl)oxy)hexadec-6-en-1-ol **SI-23**.

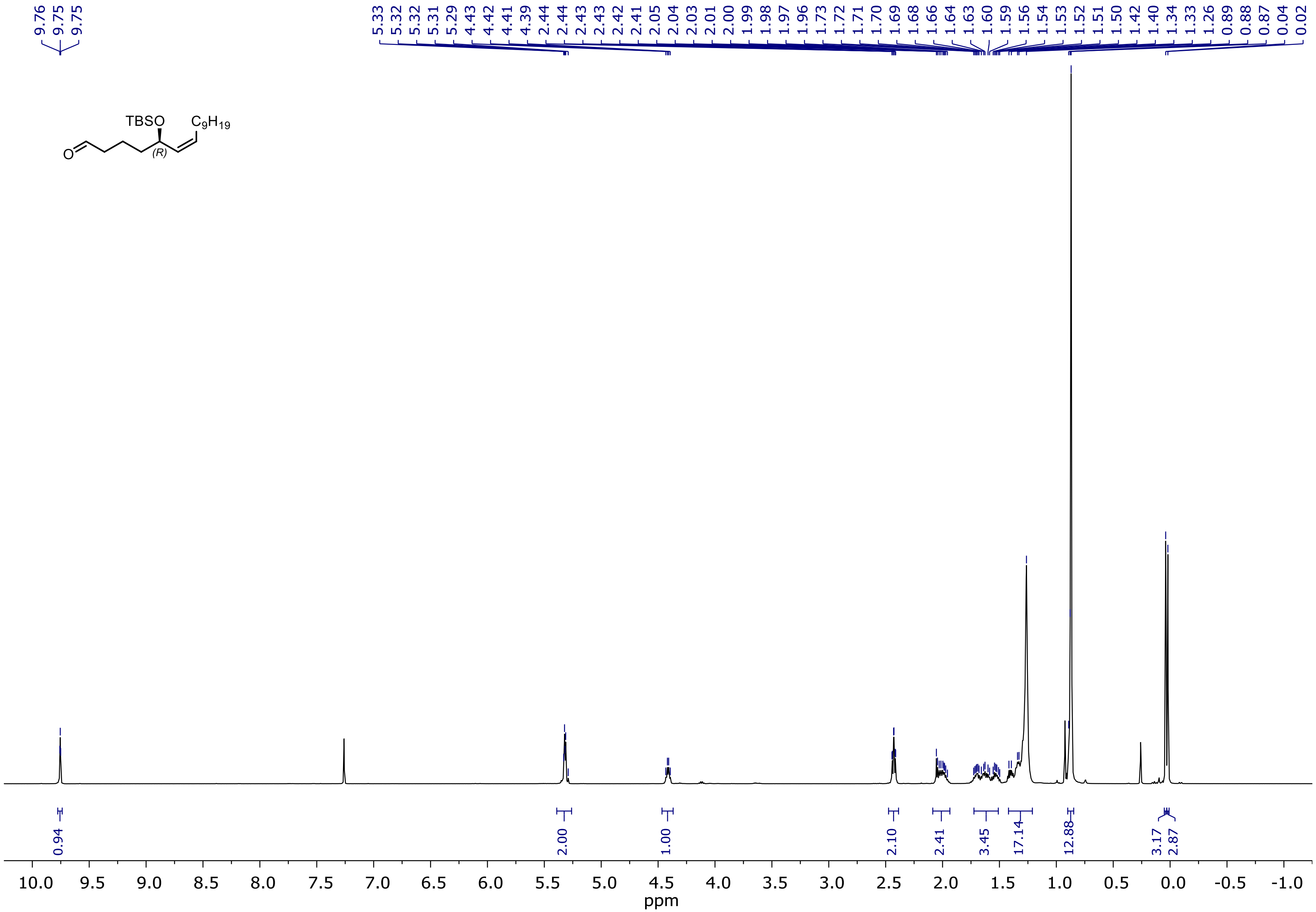


Figure S75. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R,Z*)-5-((*tert*-Butyldimethylsilyl)oxy)hexadec-6-enal **37**.

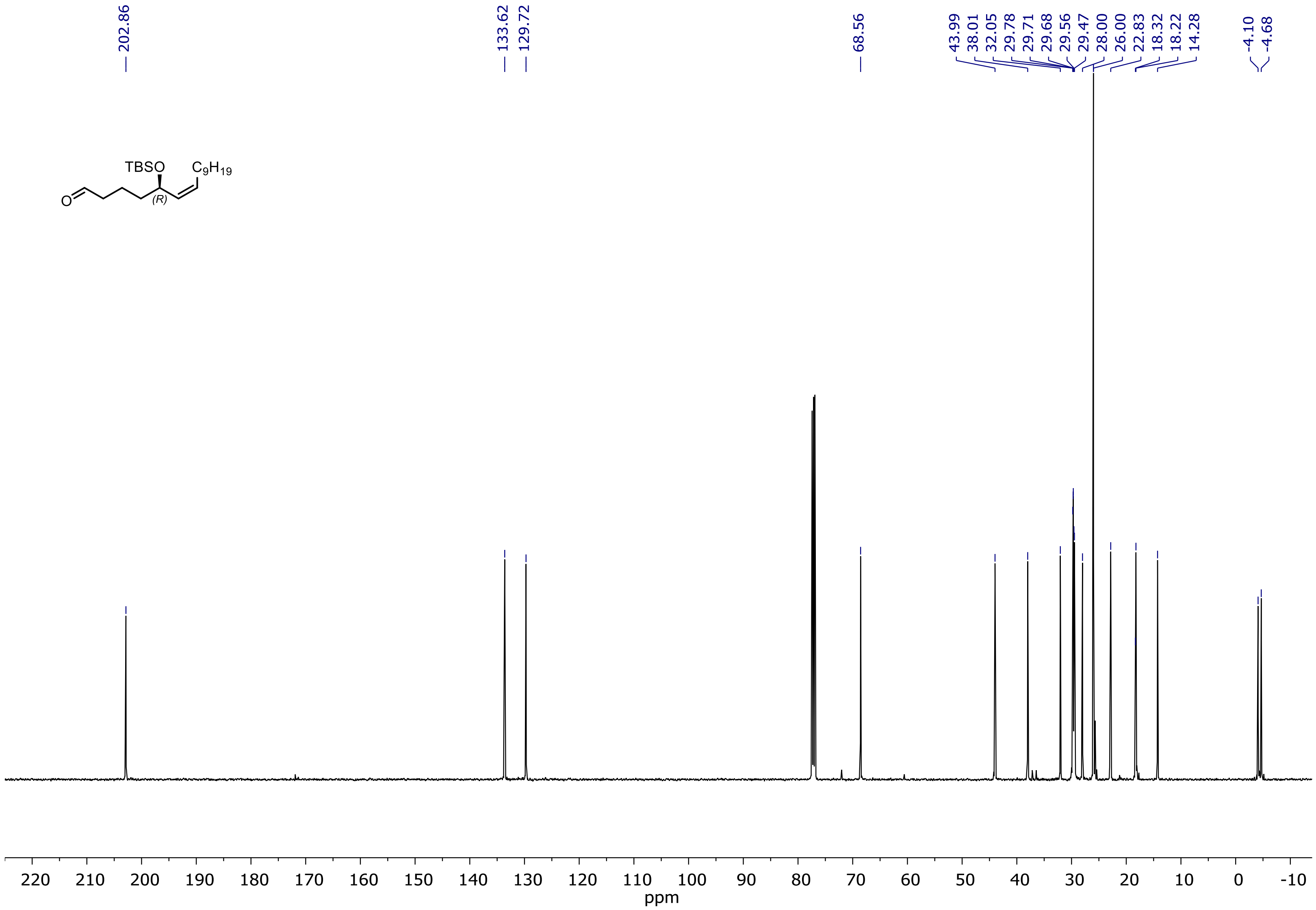


Figure S76. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R,Z*)-5-((*tert*-Butyldimethylsilyl)oxy)hexadec-6-enal **37**.

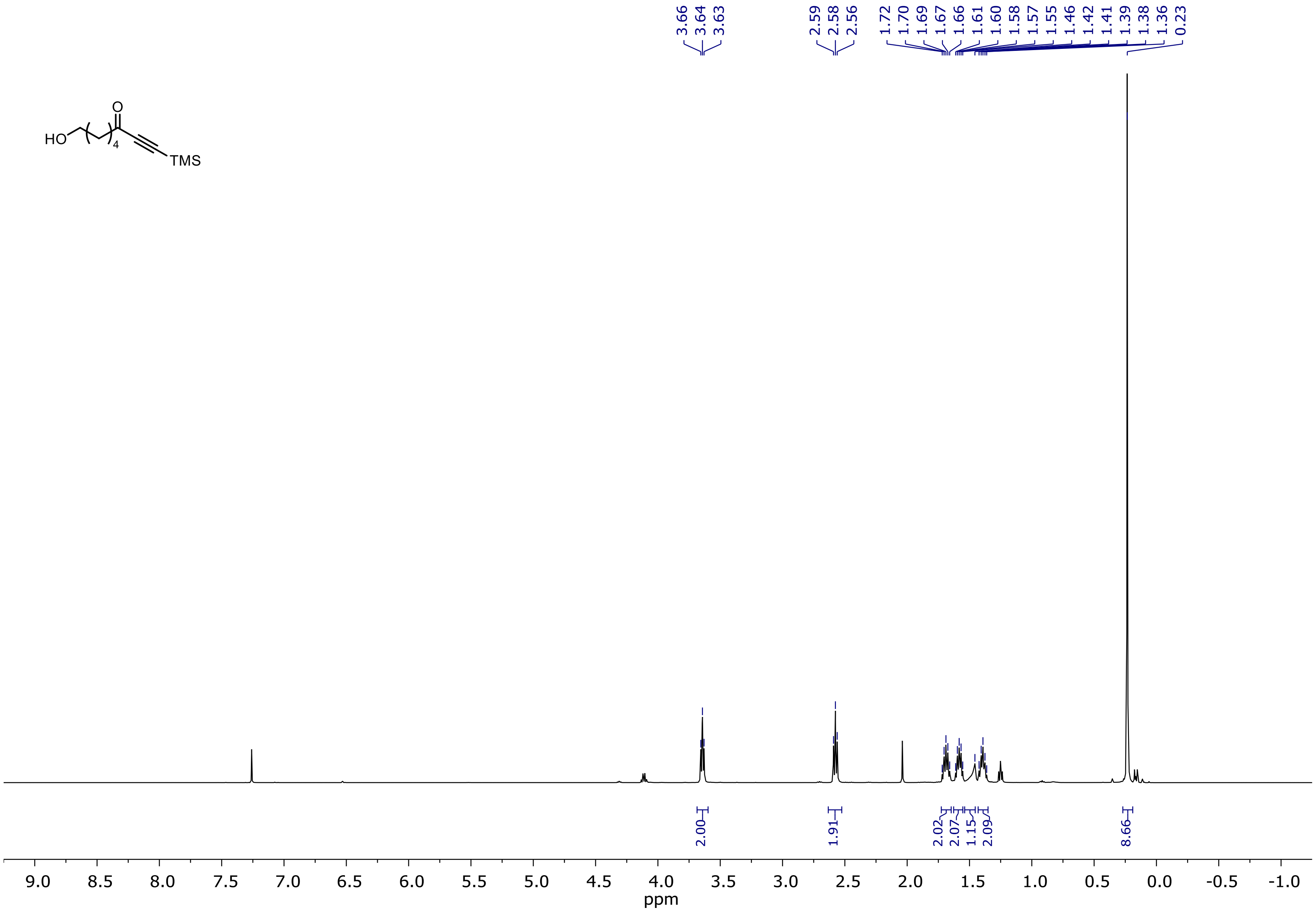


Figure S77. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of 8-Hydroxy-1-(trimethylsilyl)oct-1-yn-3-one **SI-24**.

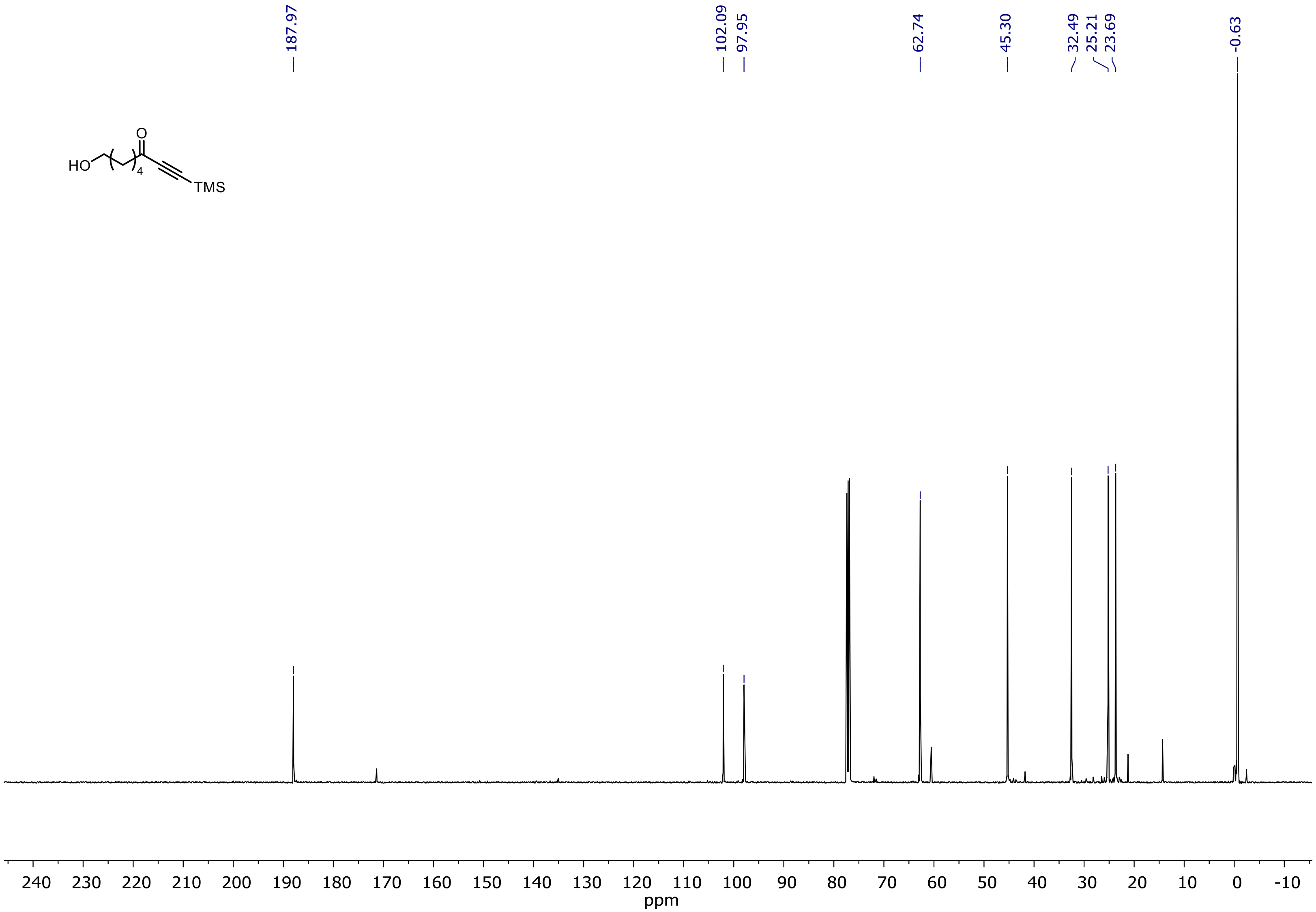


Figure S78. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of 8-Hydroxy-1-(trimethylsilyl)oct-1-yn-3-one **SI-24**.

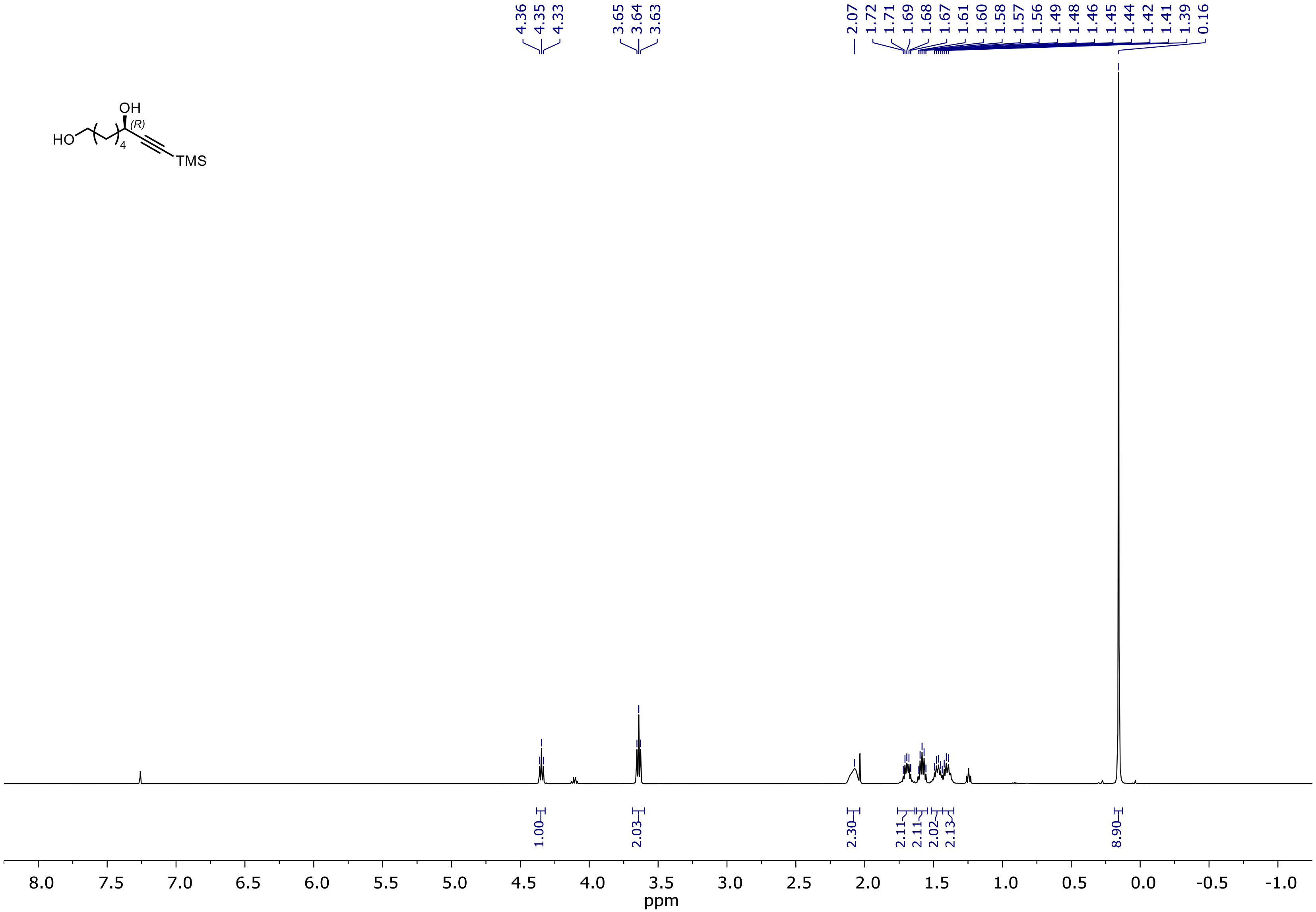


Figure S79. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*)-8-(Trimethylsilyl)oct-7-yne-1,6-diol **SI-25**.

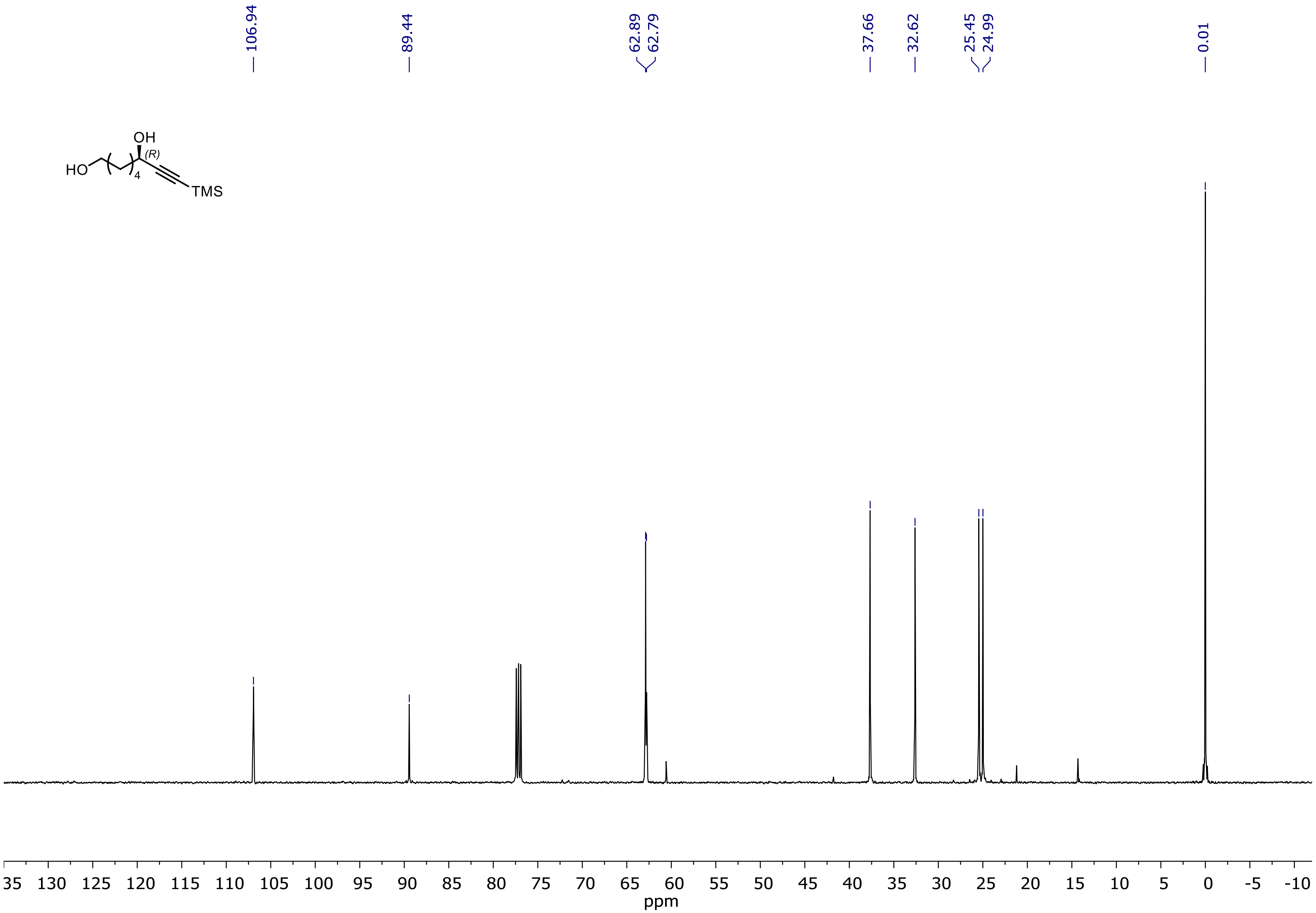


Figure S80. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-8-(Trimethylsilyl)oct-7-yne-1,6-diol **SI-25**.

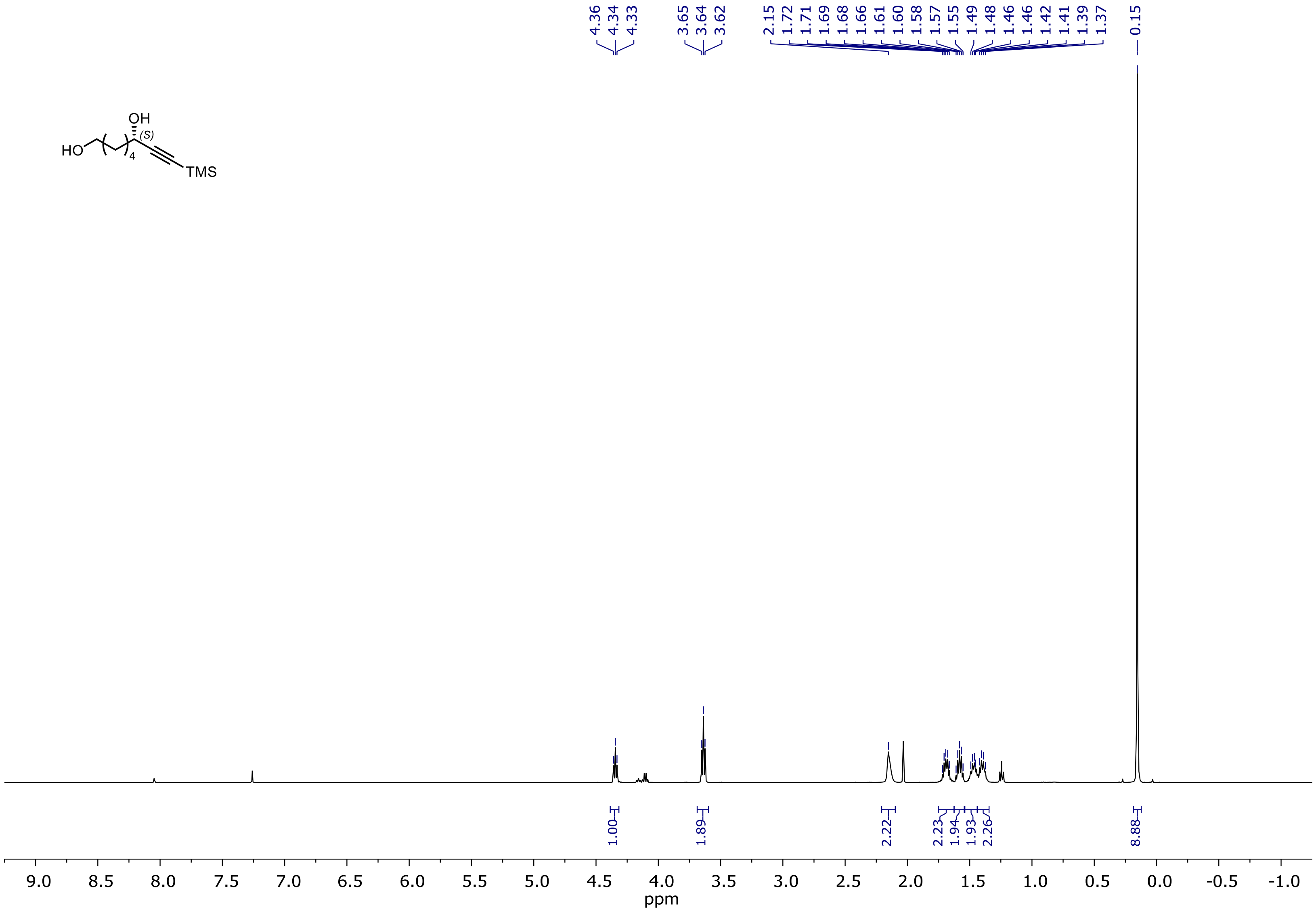


Figure S81. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*S*)-8-(Trimethylsilyl)oct-7-yne-1,6-diol **SI-25**.

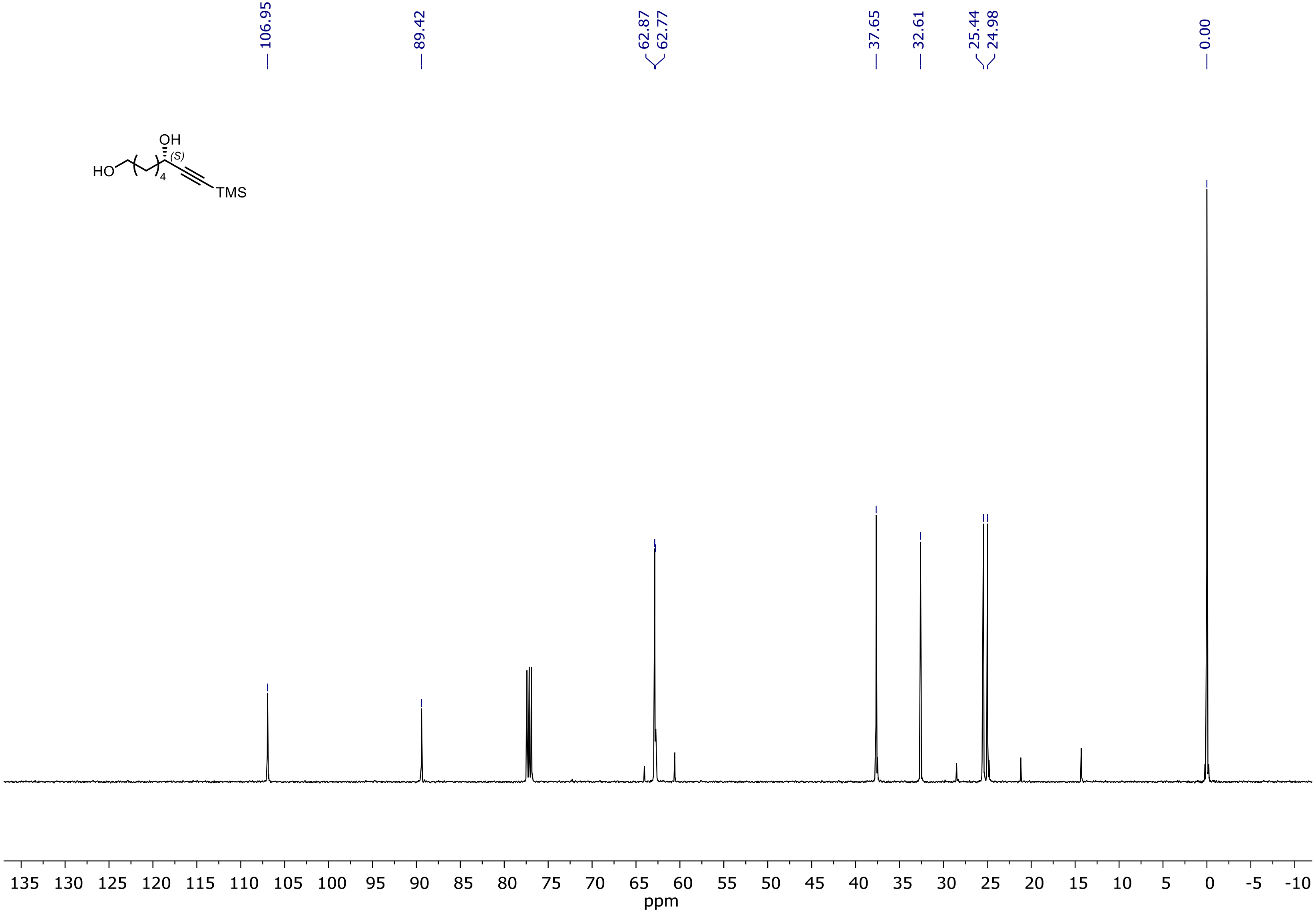


Figure S82. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*S*)-8-(Trimethylsilyl)oct-7-yne-1,6-diol **SI-25**.

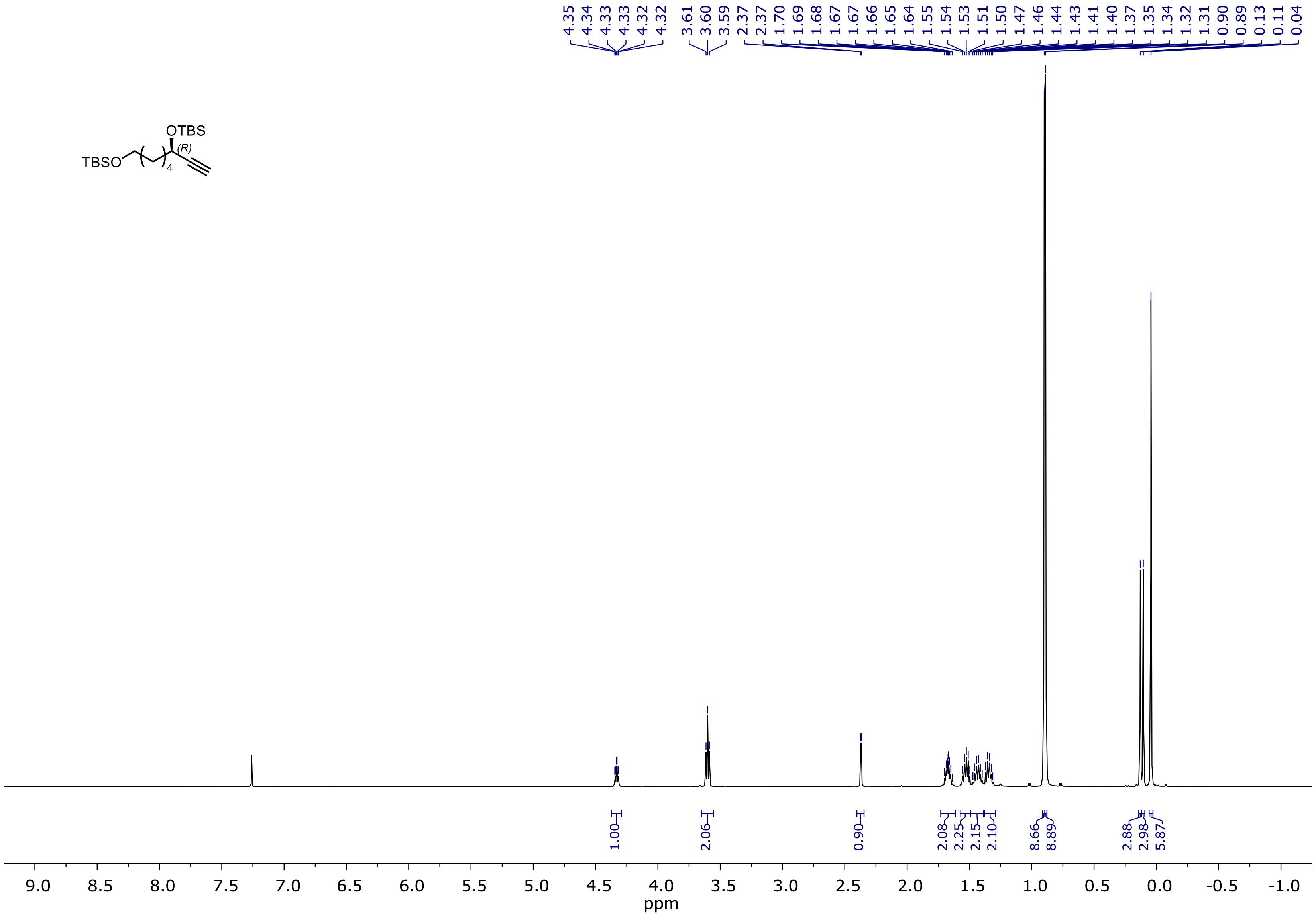


Figure S83. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*)-5-Ethynyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradecane **SI-26**.

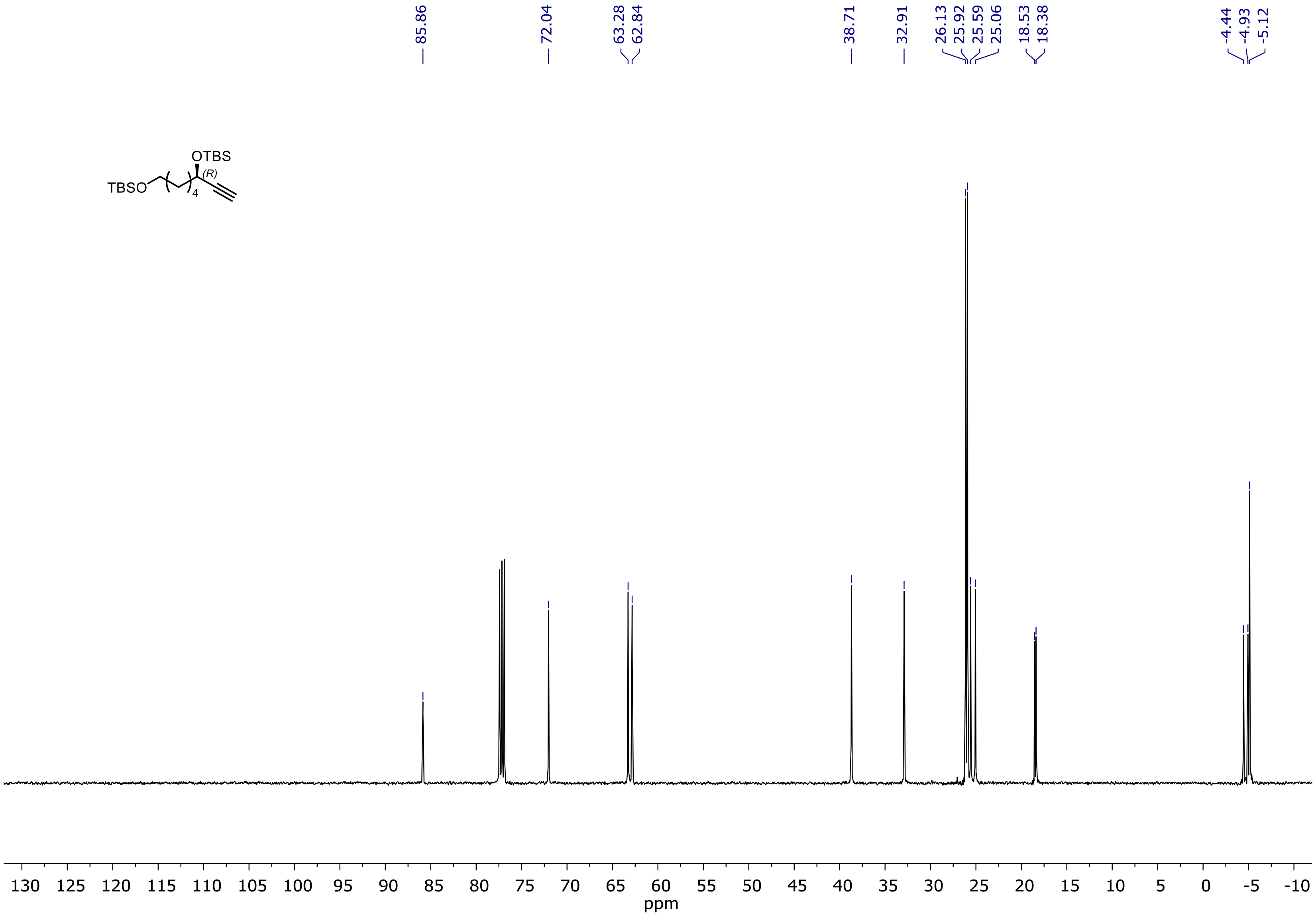


Figure S84. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-5-Ethynyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradecane **SI-26**.

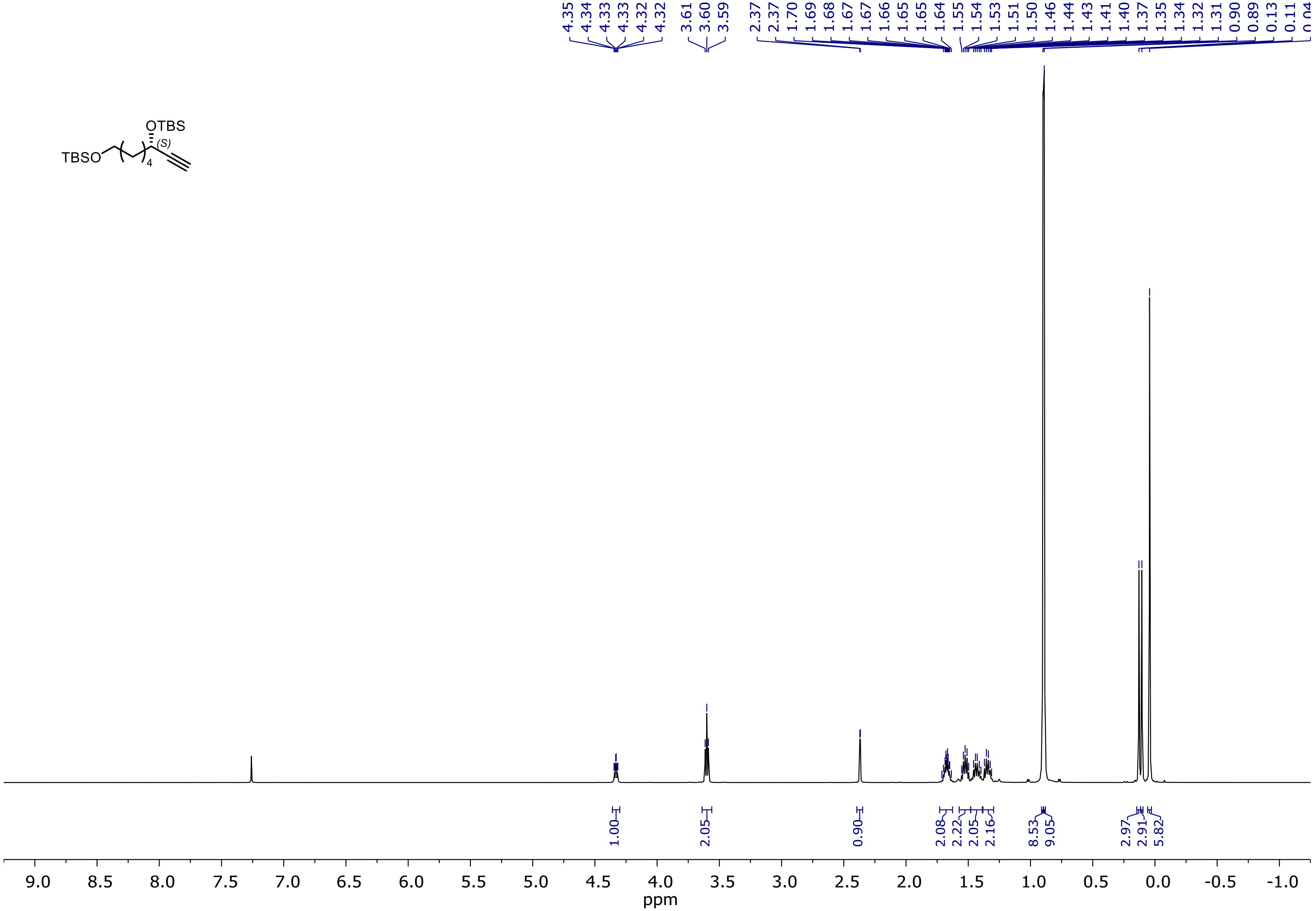


Figure S85. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*S*)-5-Ethynyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradecane **SI-26**.

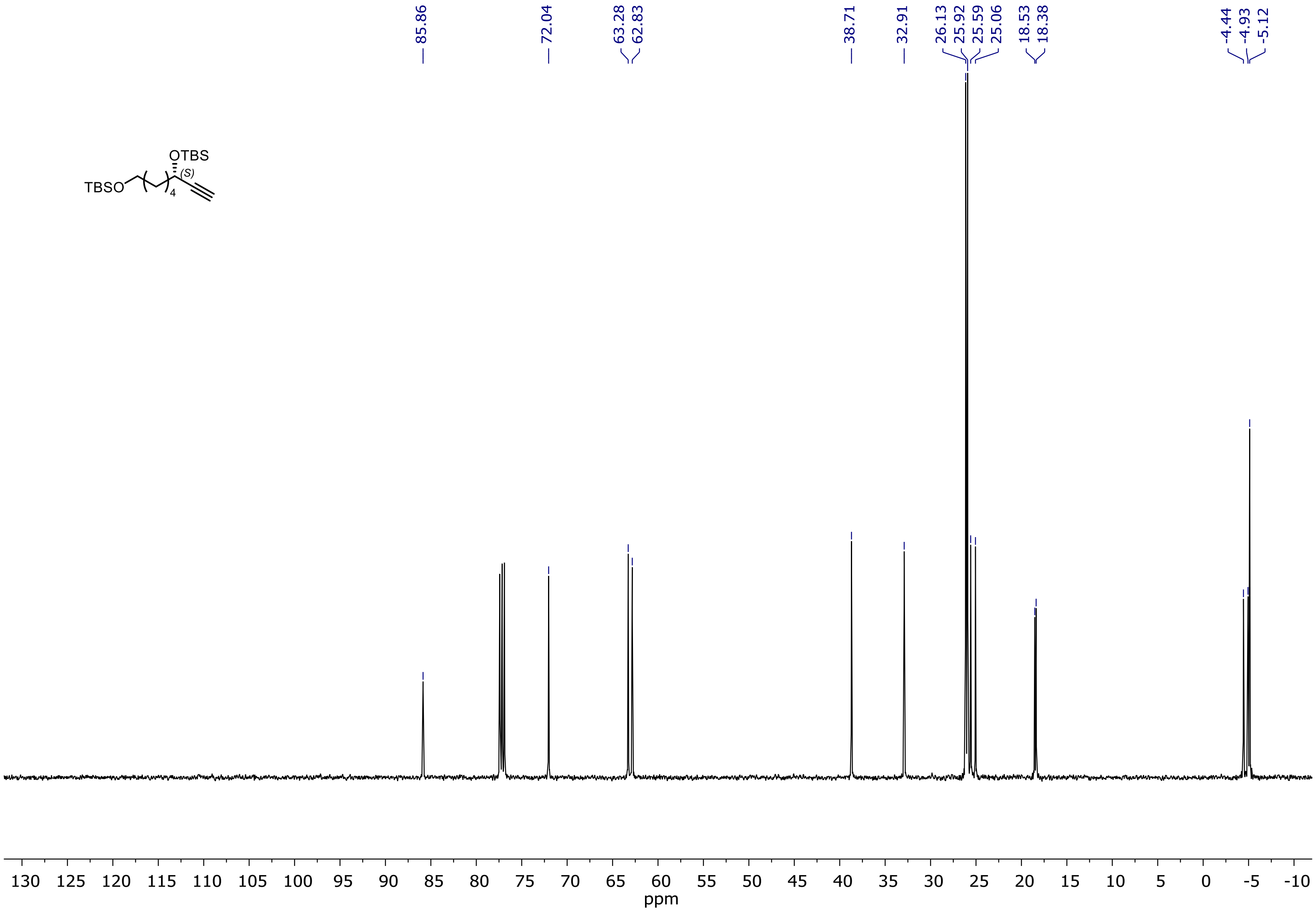


Figure S86. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*S*)-5-Ethynyl-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetradecane **SI-26**.

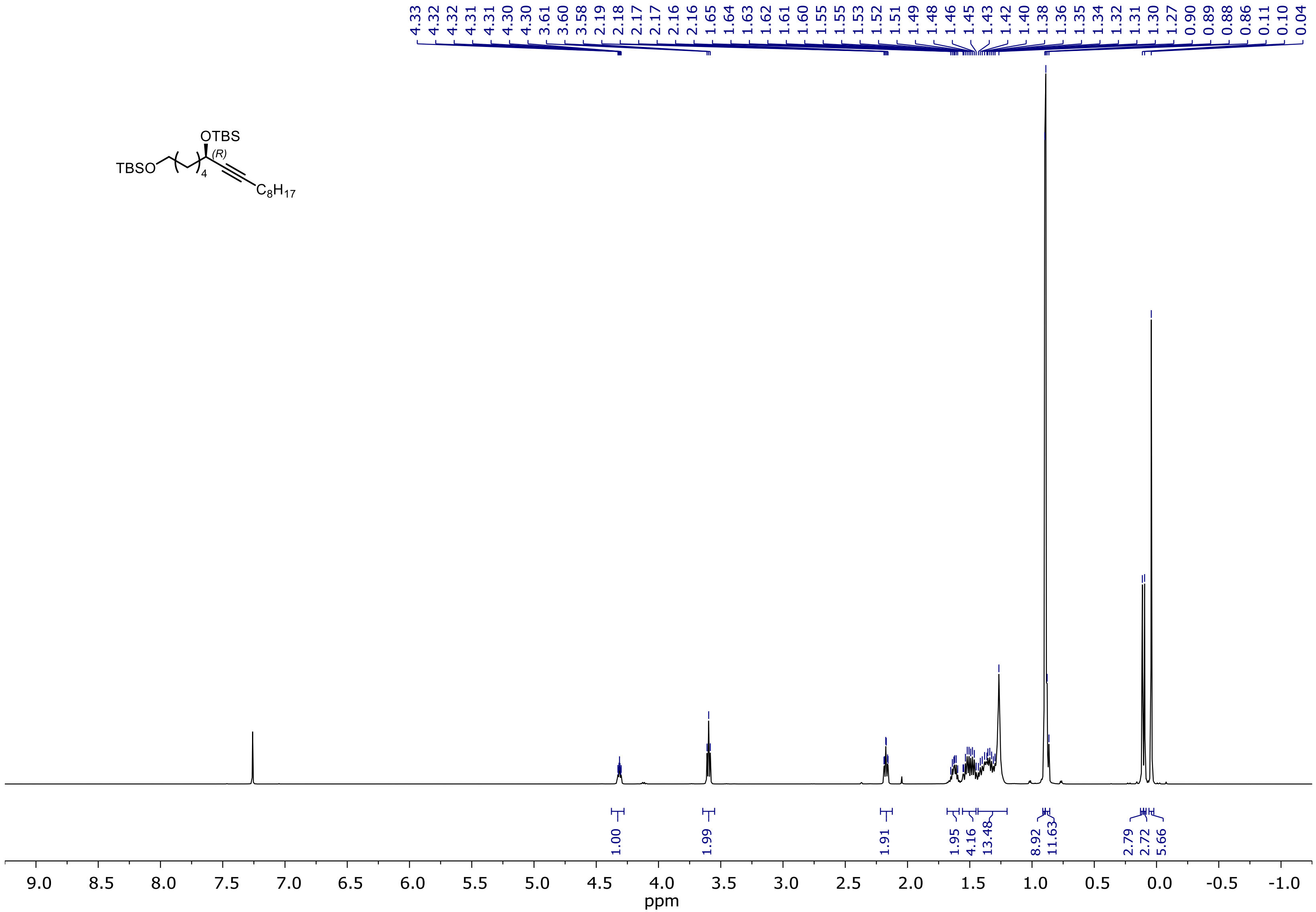


Figure S87. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R*)-5-(Dec-1-yn-1-yl)-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetra-decane **SI-27**.

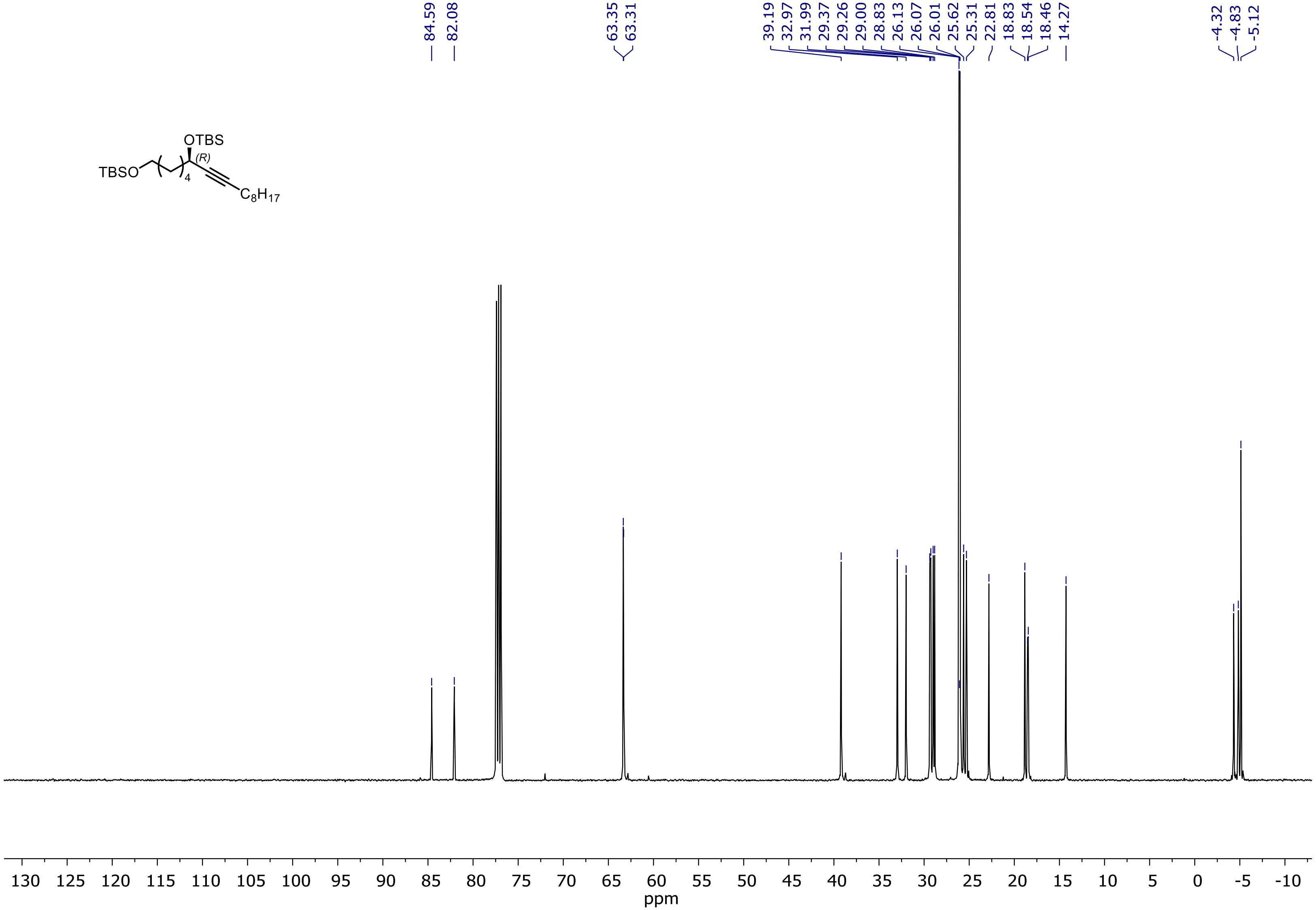


Figure S88. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R*)-5-(Dec-1-yn-1-yl)-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetra-decane **SI-27**.

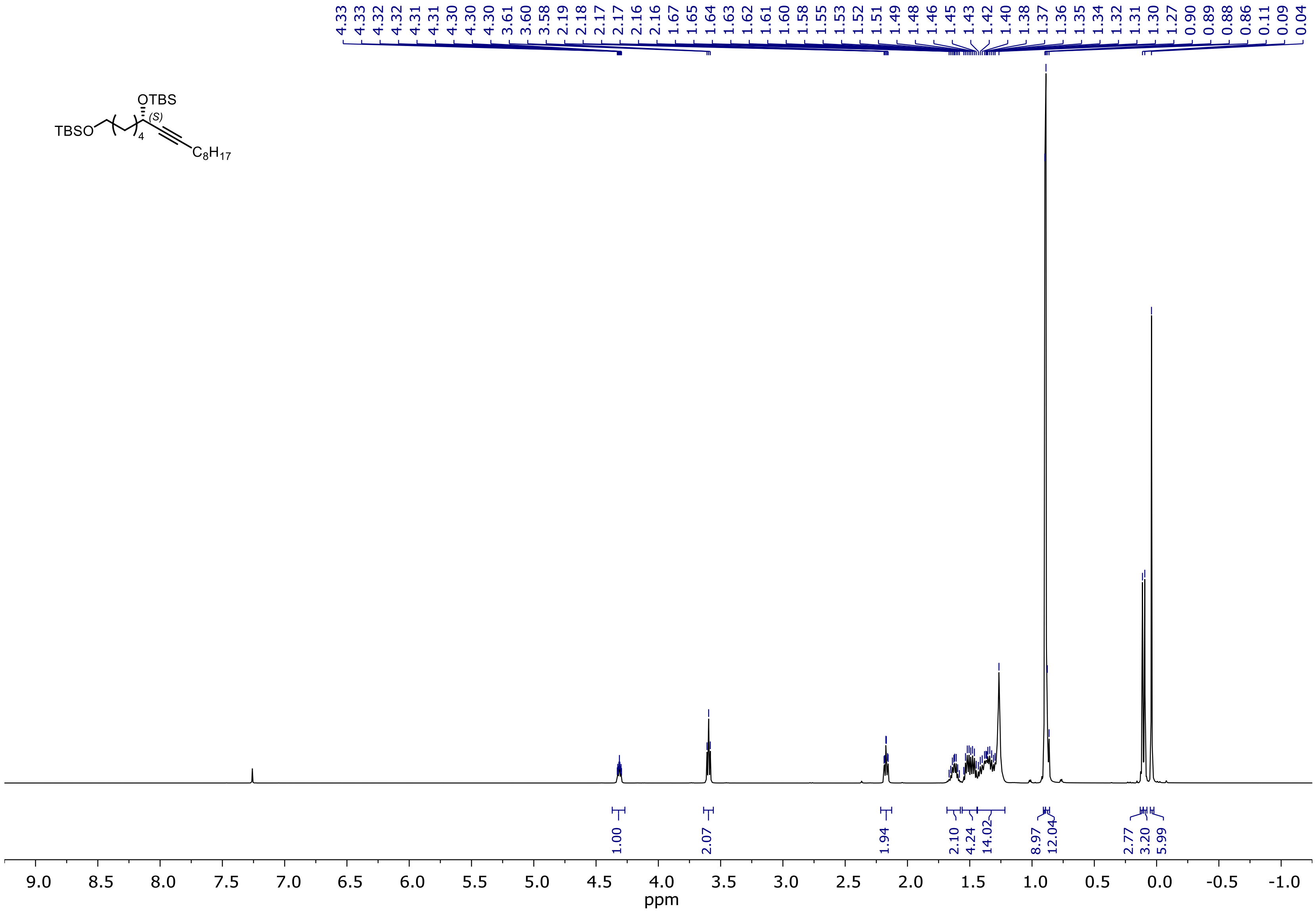


Figure S89. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*S*)-5-(Dec-1-yn-1-yl)-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetra-decane **SI-27**.

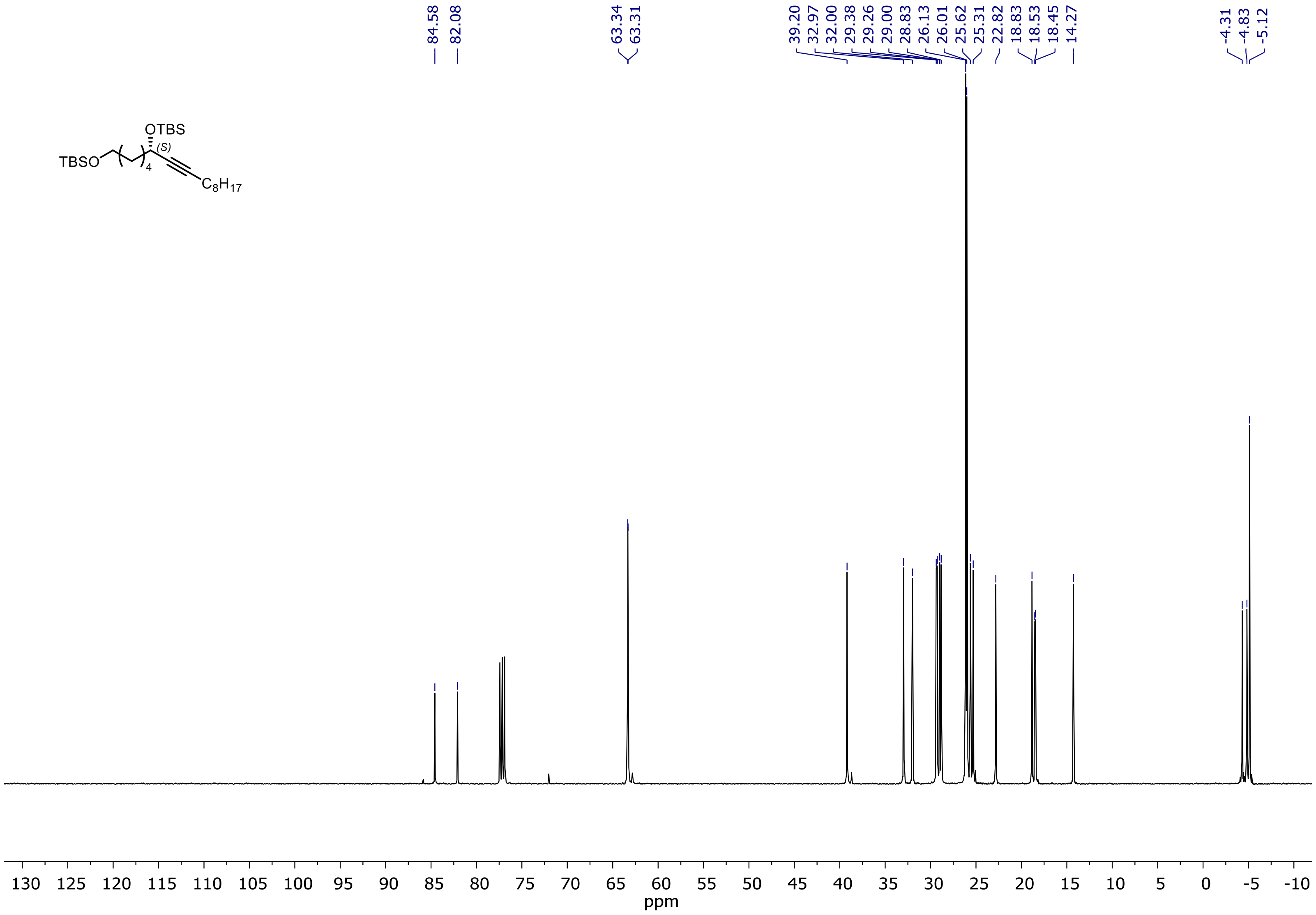


Figure S90. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*S*)-5-(Dec-1-yn-1-yl)-2,3,12,13-octamethyl-4,11-dioxa-3,12-disilatetra-decane **SI-27**.

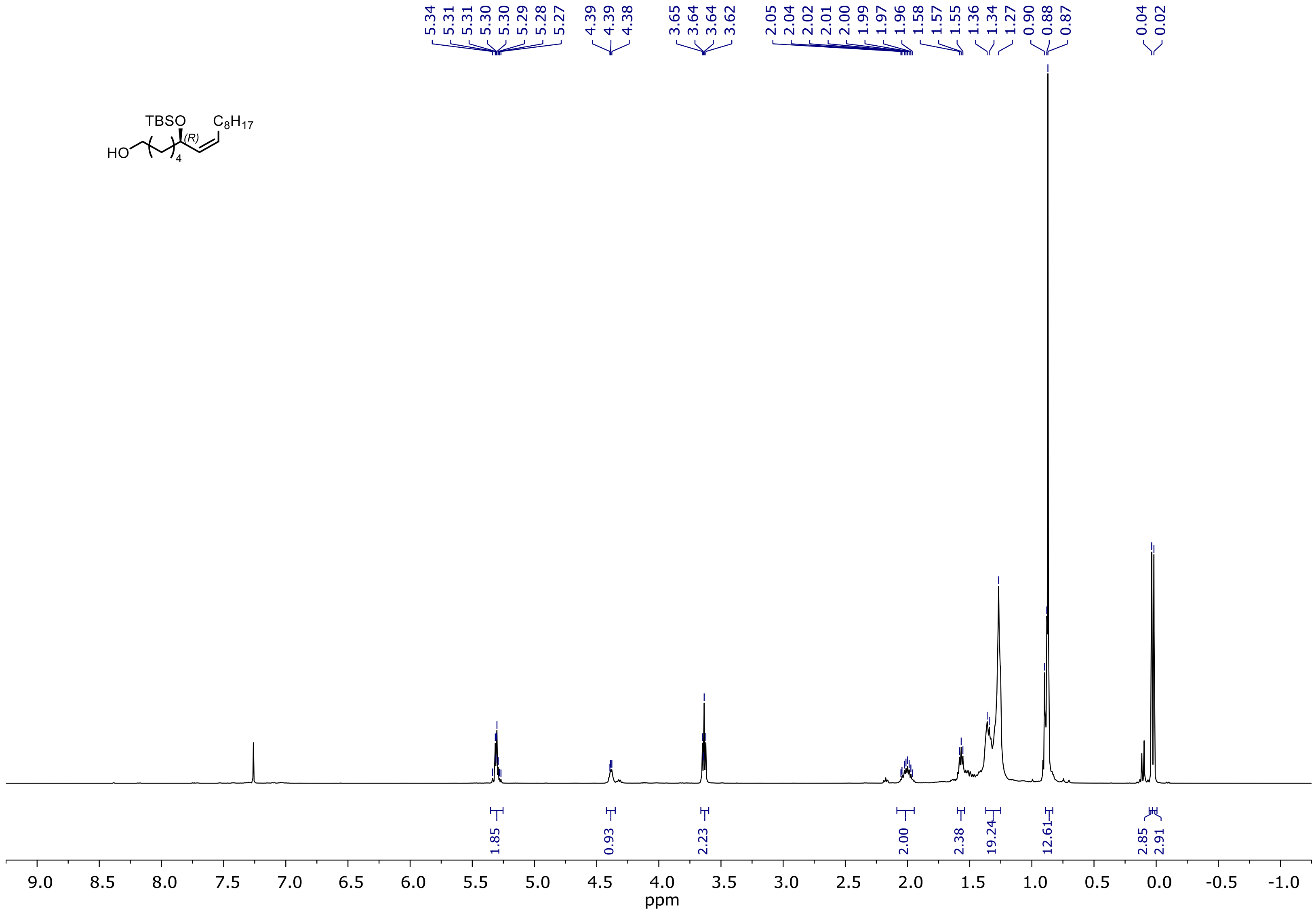


Figure S91. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-en-1-ol **SI-29**.

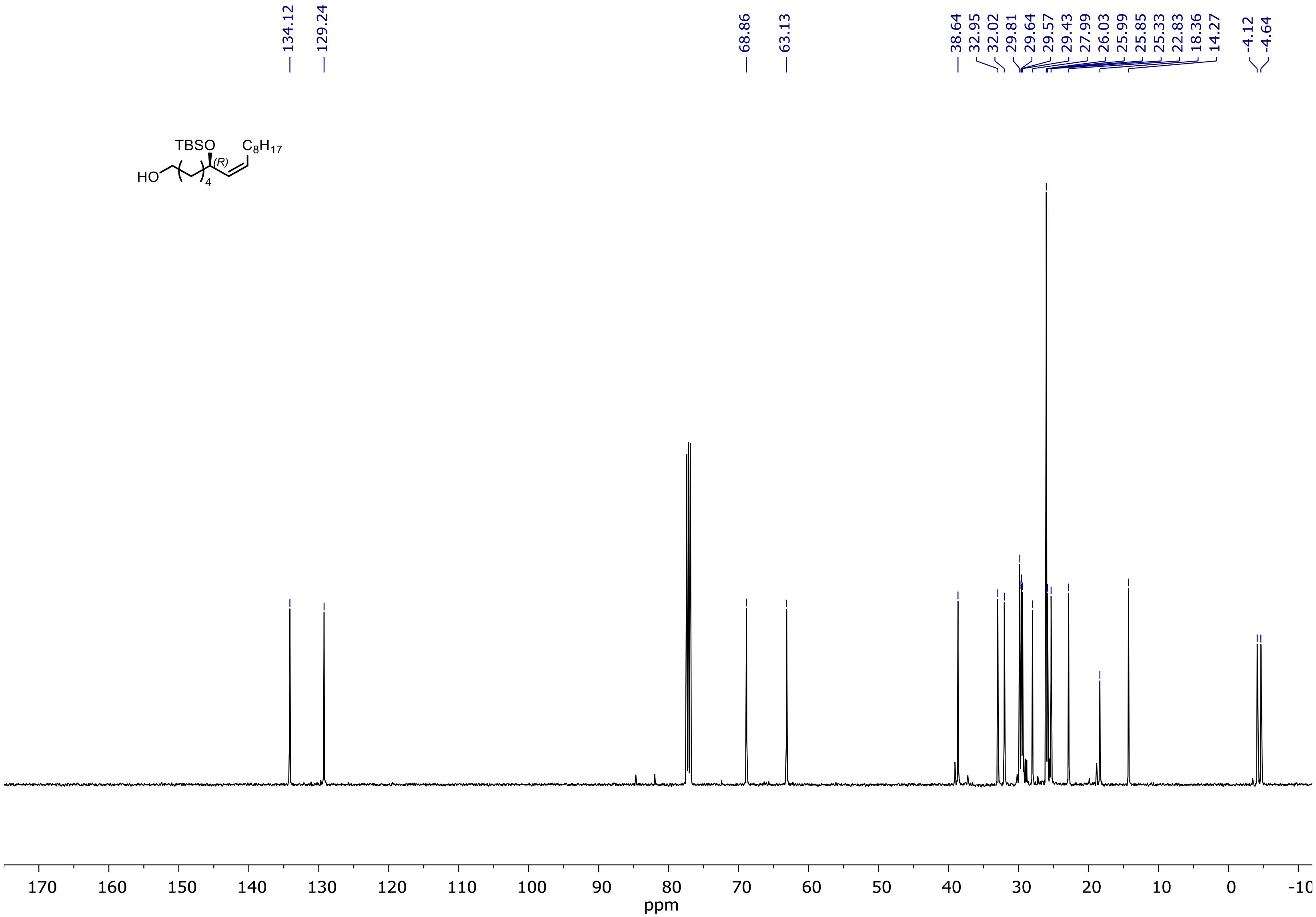


Figure S92. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-en-1-ol **SI-29**.

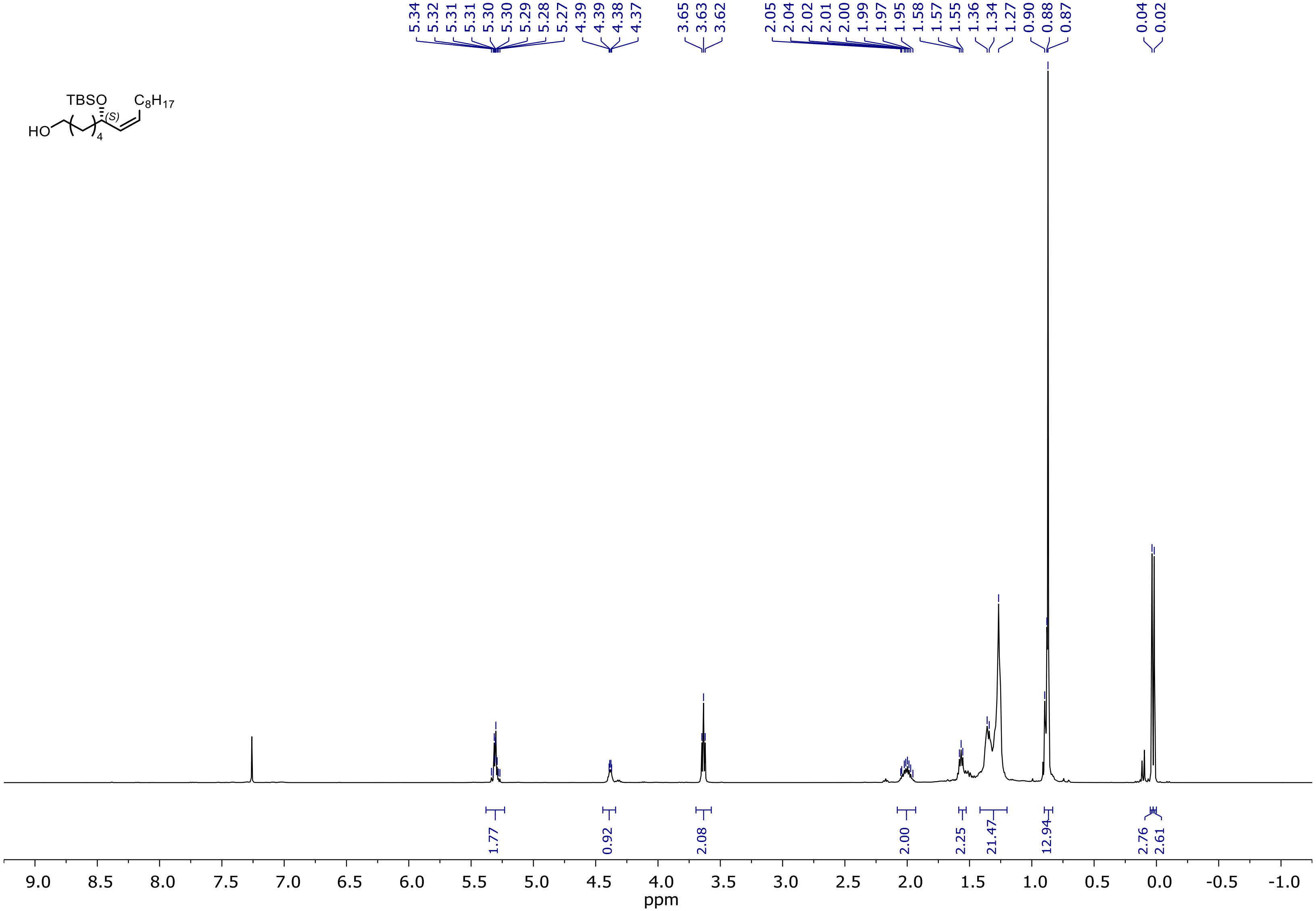


Figure S93. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-en-1-ol **SI-29**.

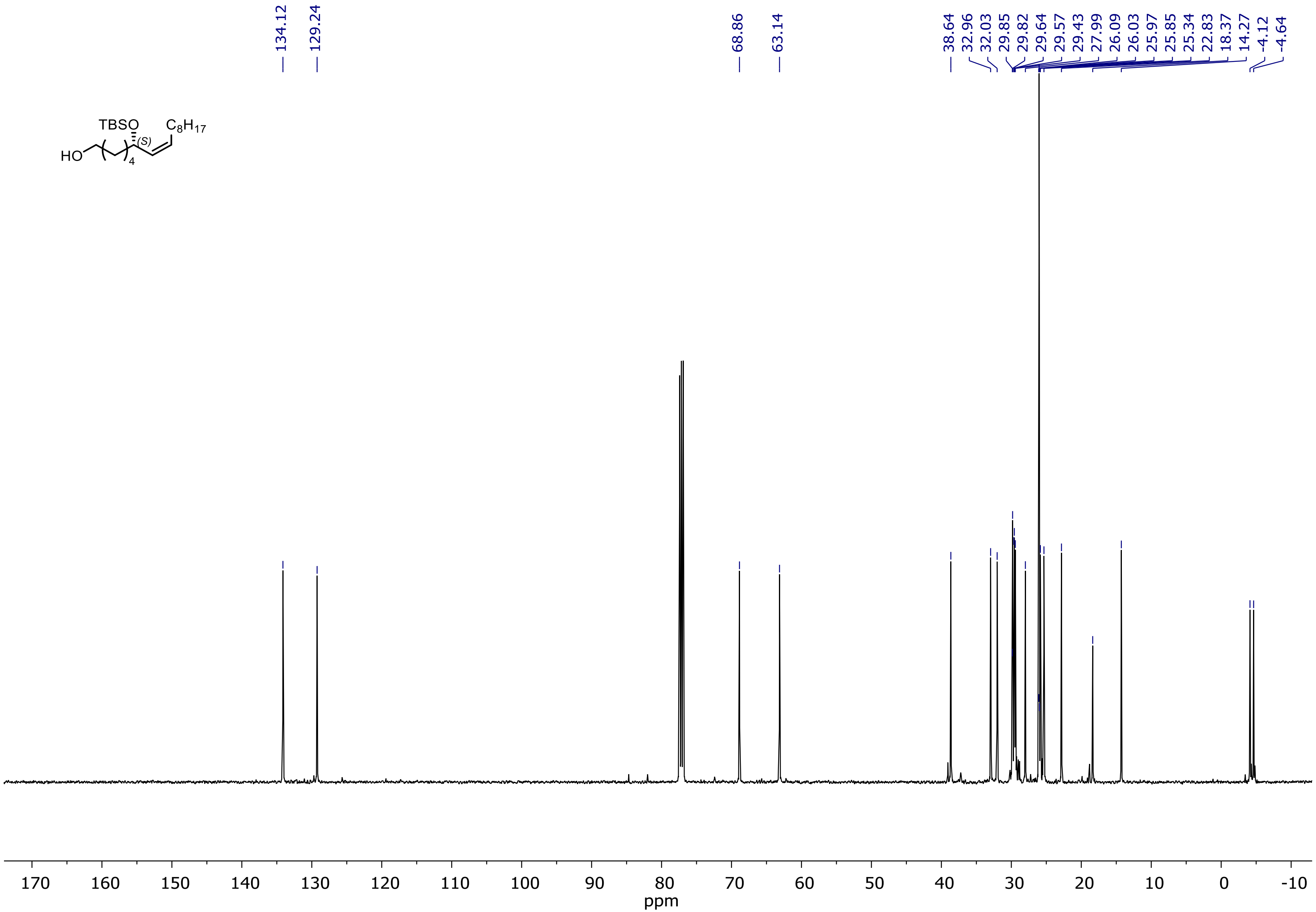


Figure S94. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-en-1-ol **SI-29**.

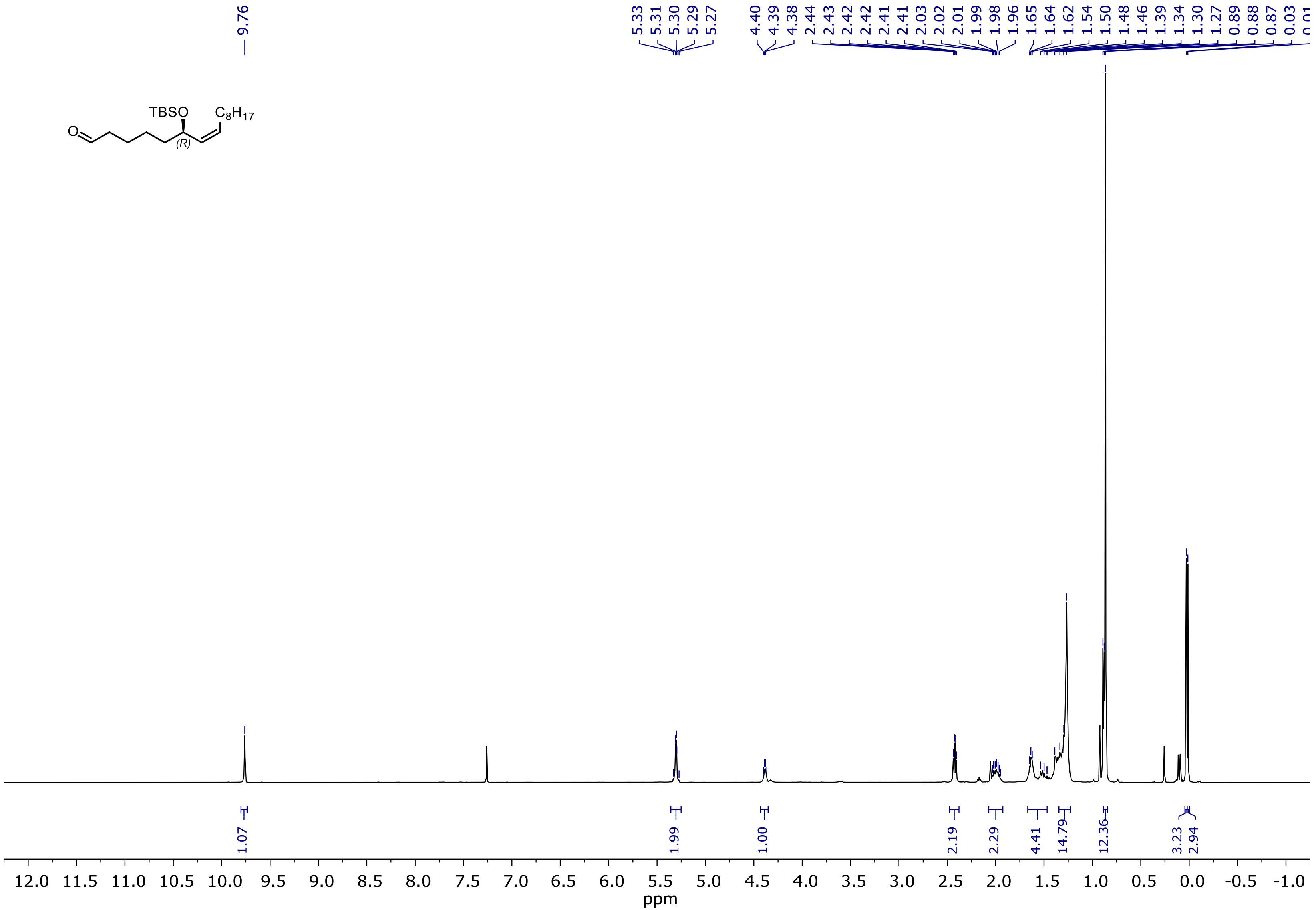


Figure S95. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-enal **42**.

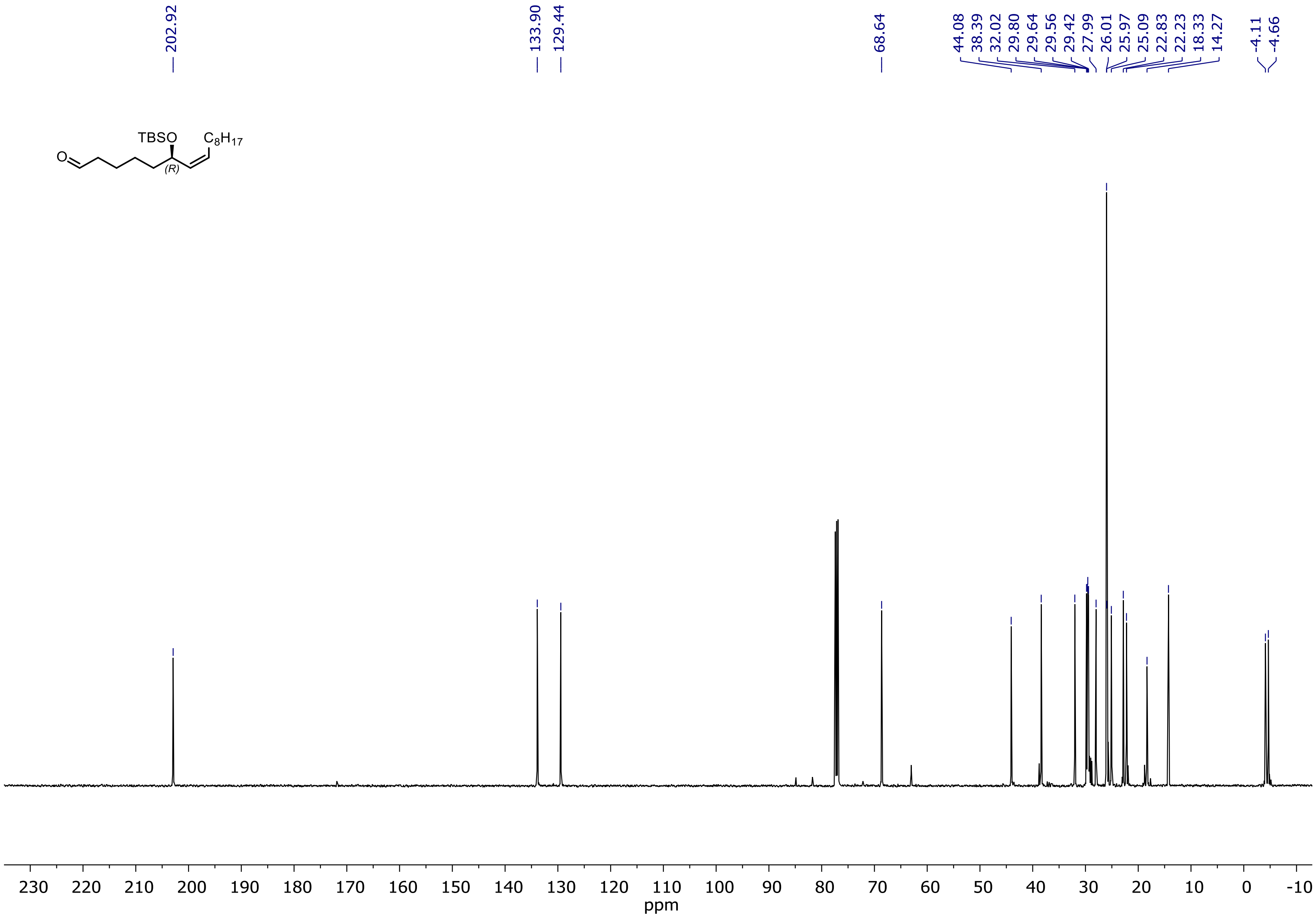


Figure S96. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-enal **42**.

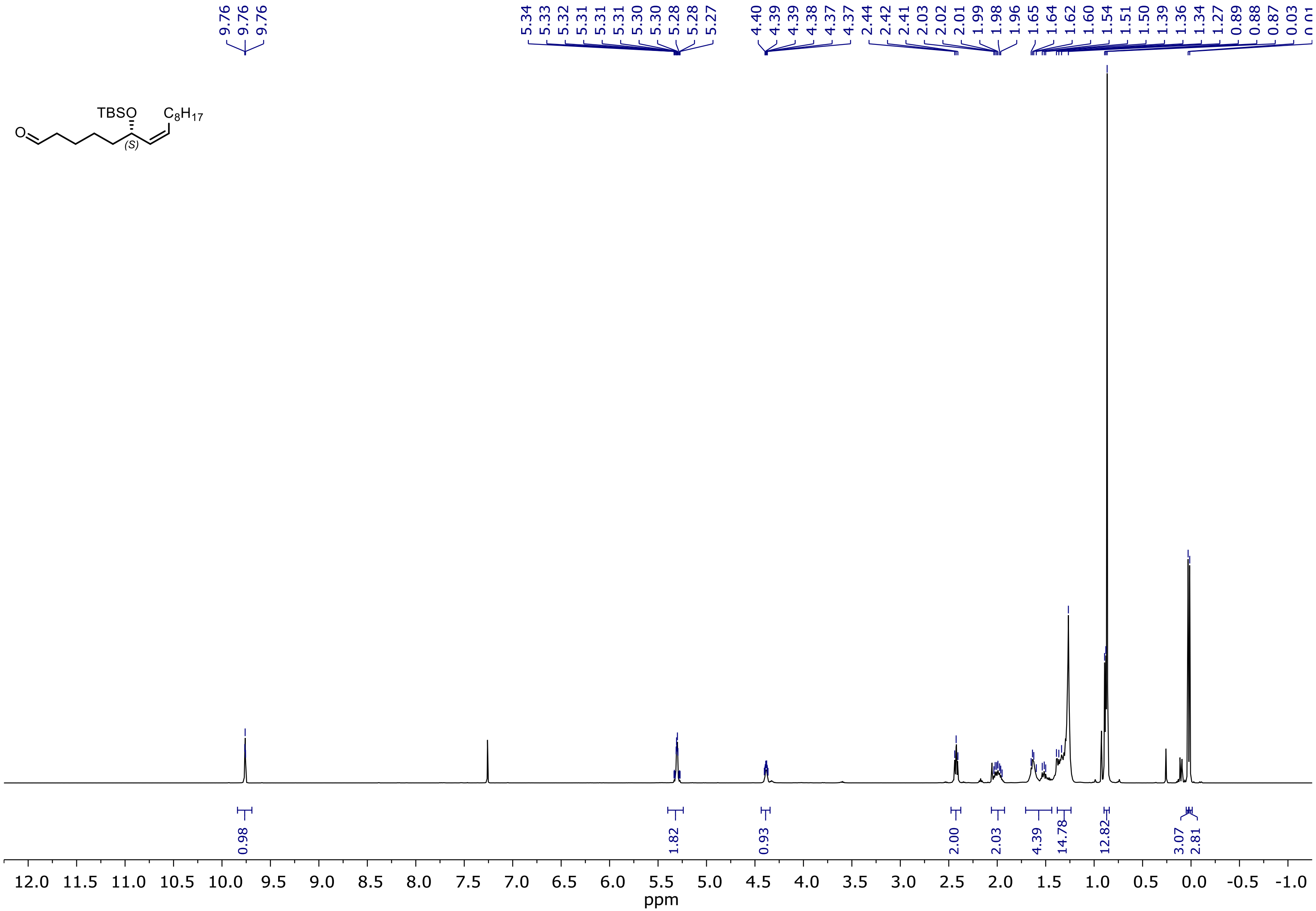


Figure S97. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-enal **42**.

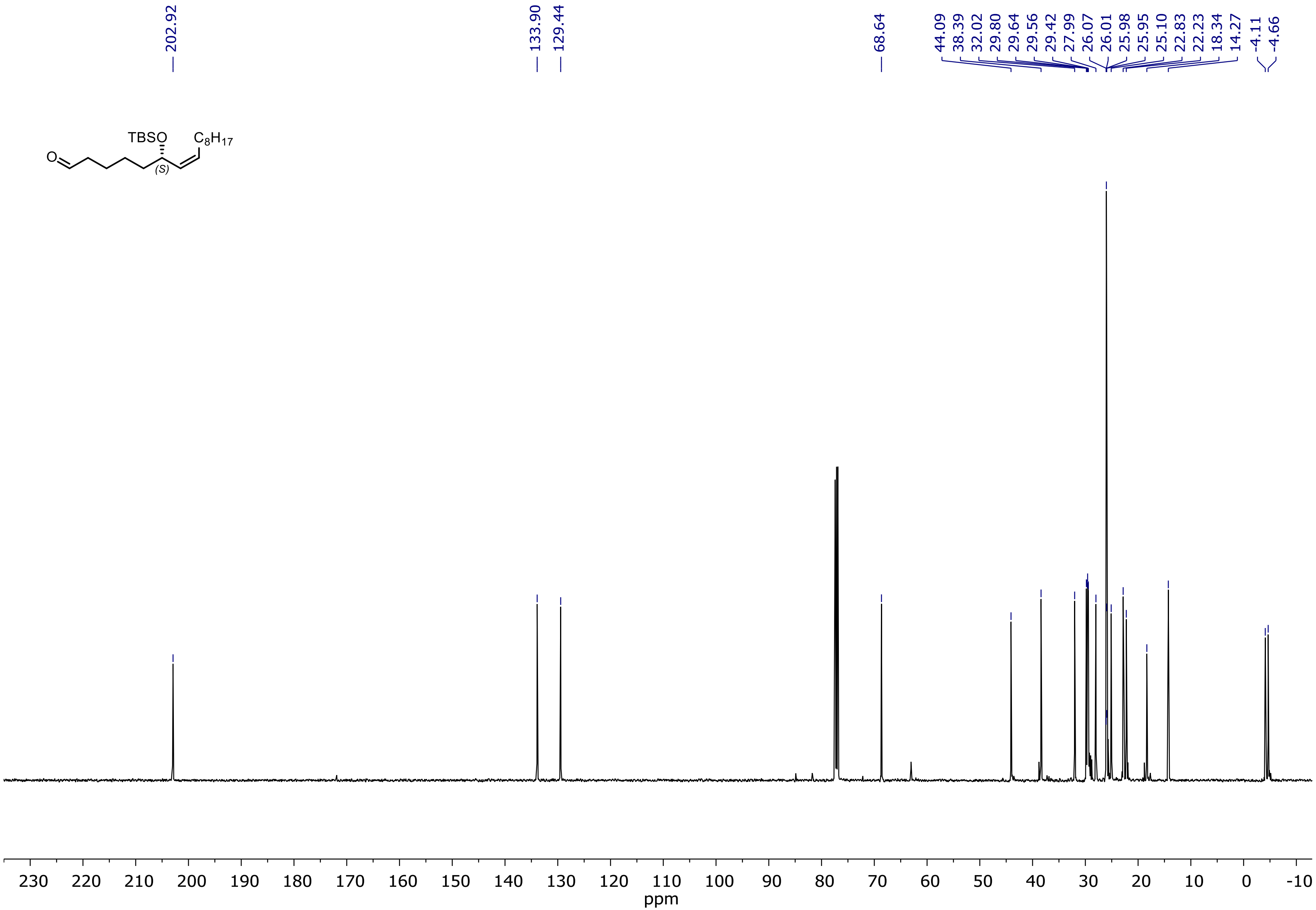


Figure S98. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)hexadec-7-enal **42**.

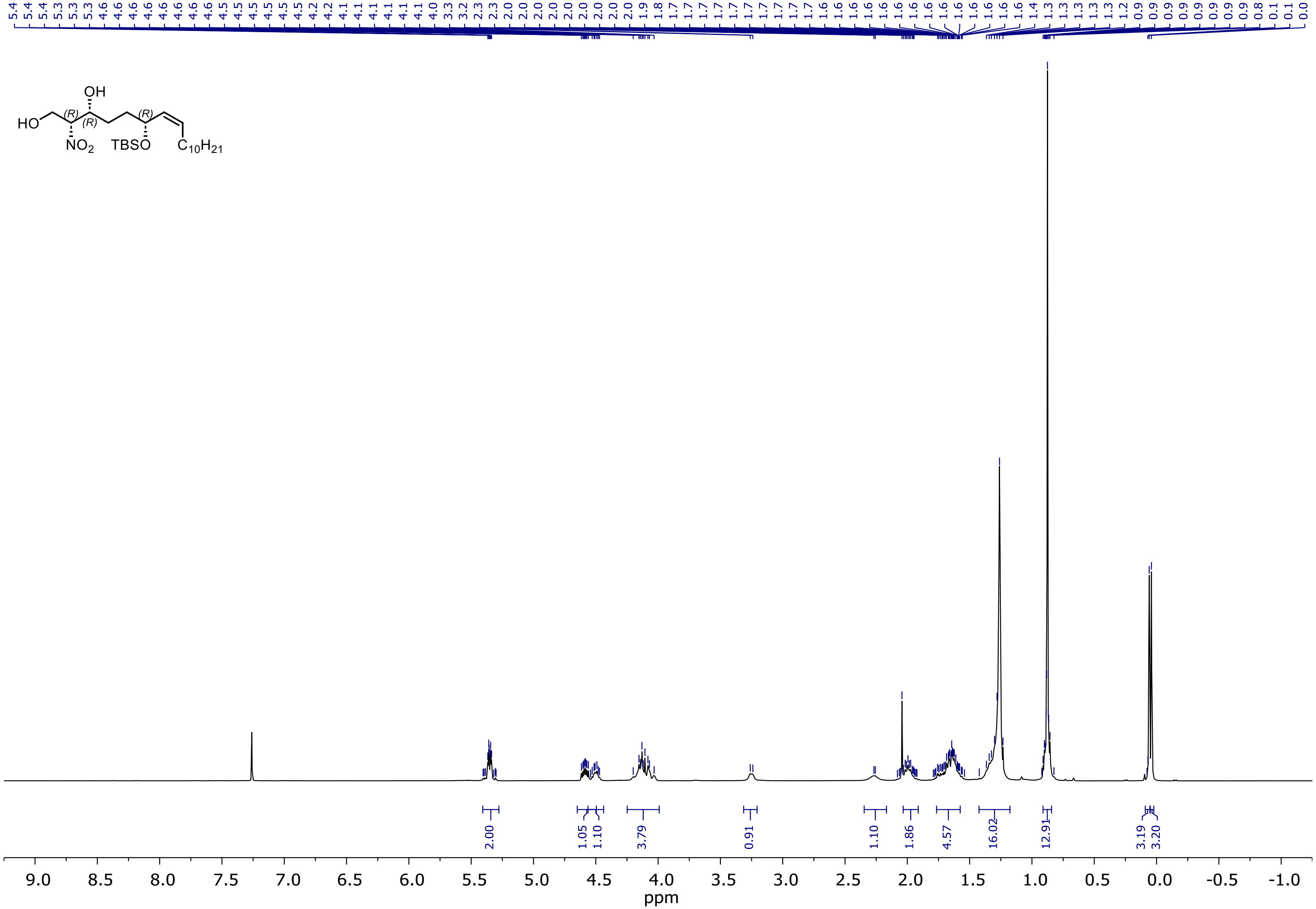


Figure S99. ^{1}H-NMR spectrum (300 MHz, CDCl$_3$) of (*2R,3R,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **8**.

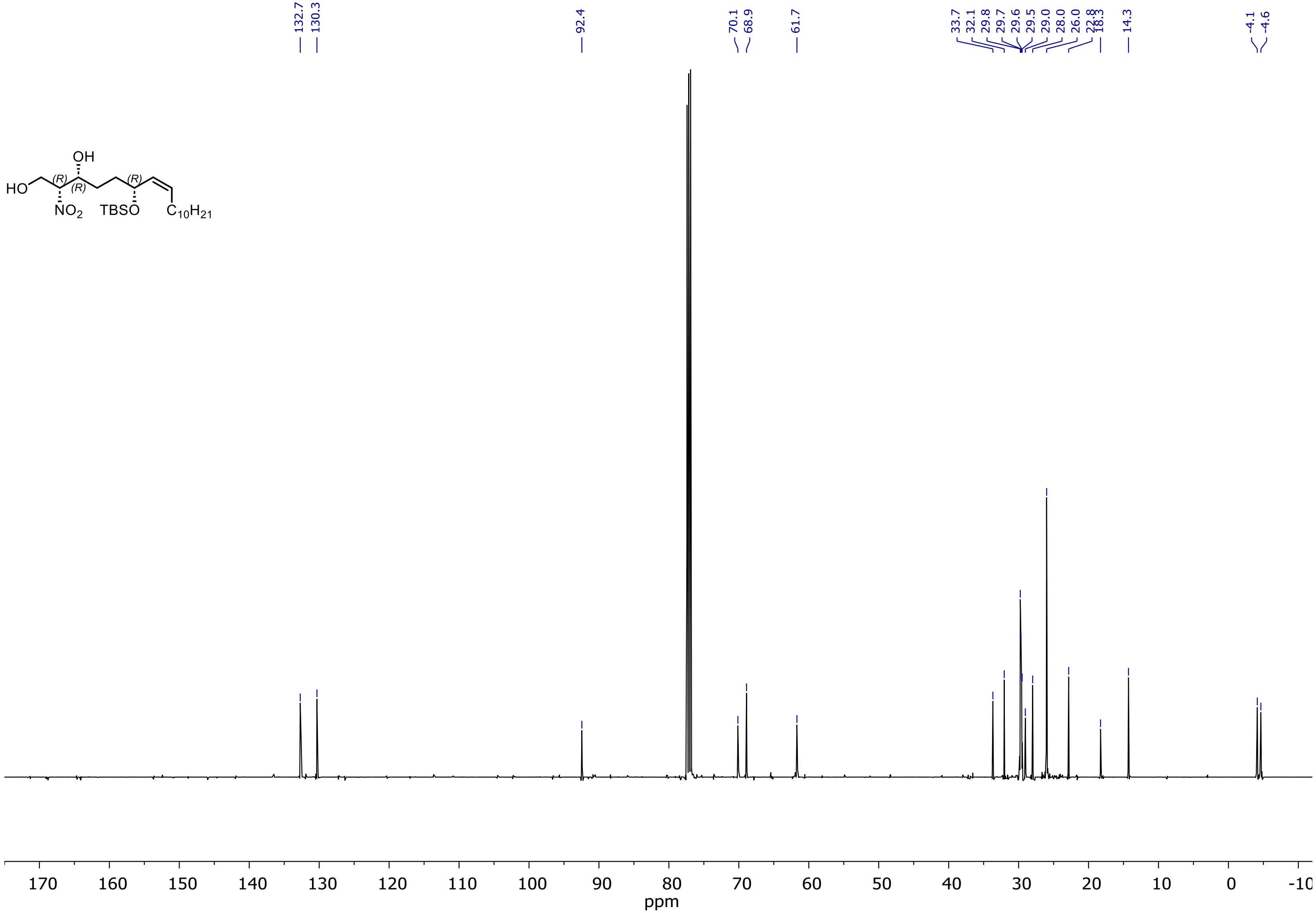


Figure S100. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2R,3R,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **8**.

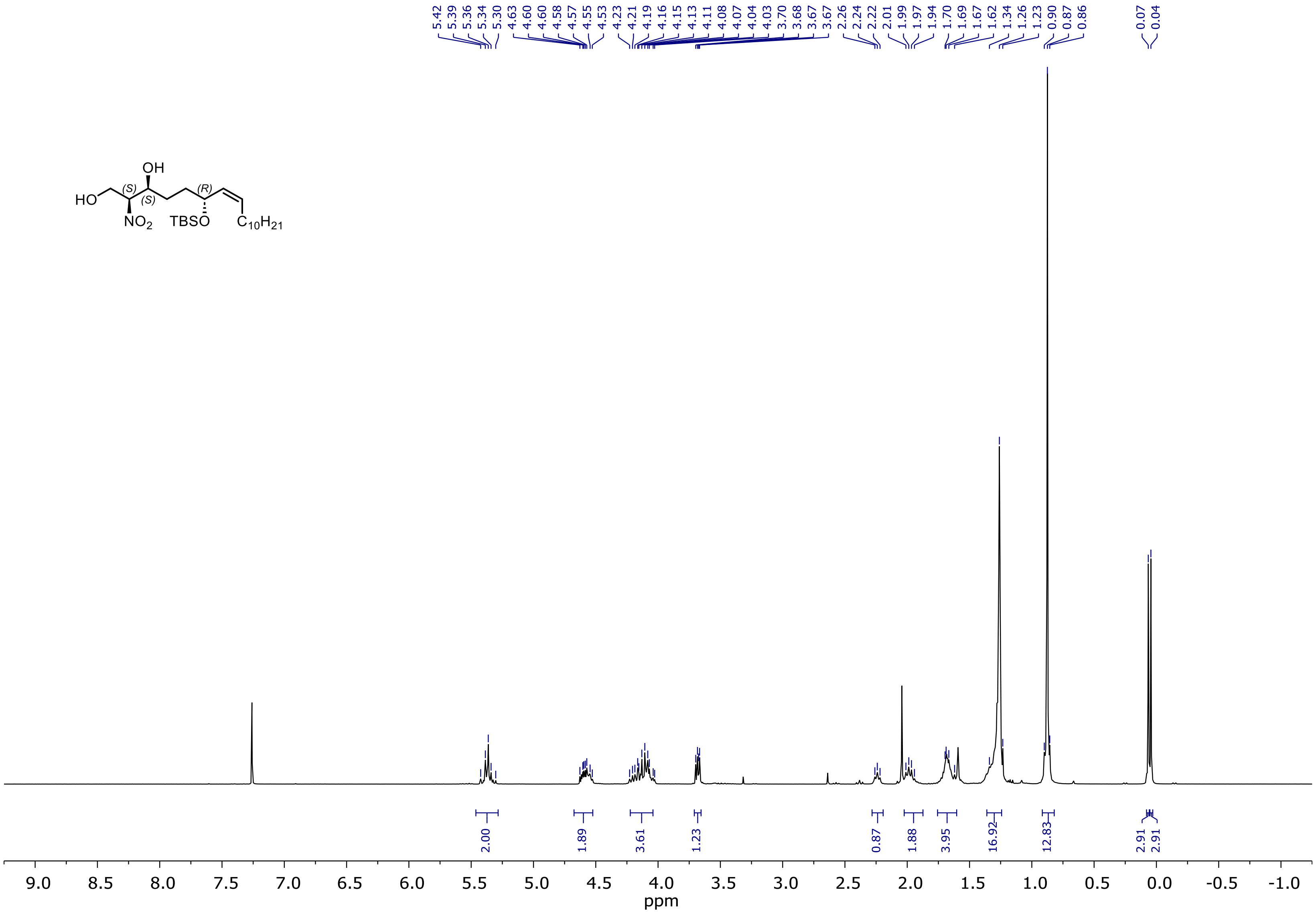


Figure S101. ^{1}H-NMR spectrum (300 MHz, CDCl$_3$) of (2*S*,3*S*,6*R*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **9**.

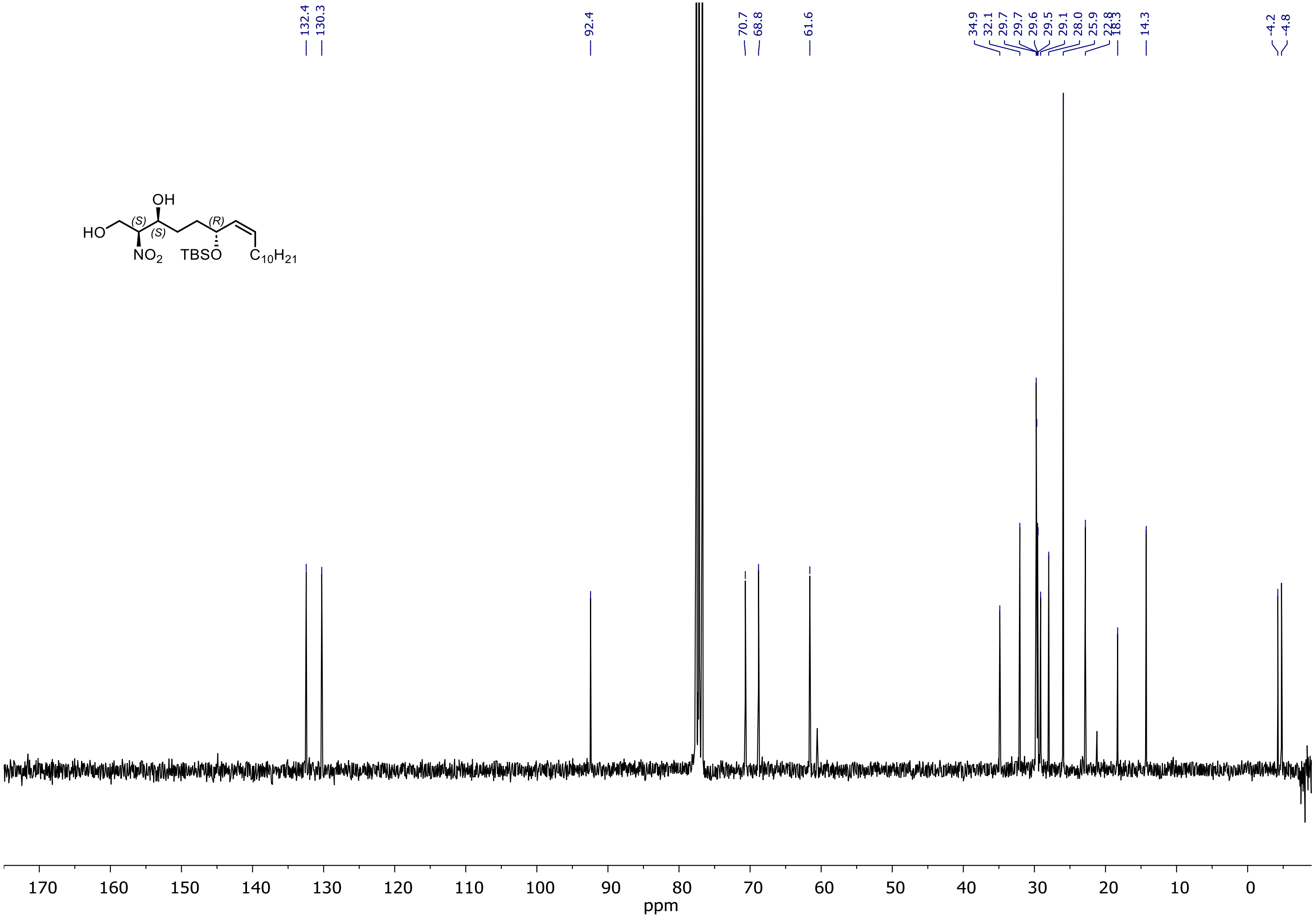


Figure S102. $^{13}C\{^1H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*2S,3S,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **9**.

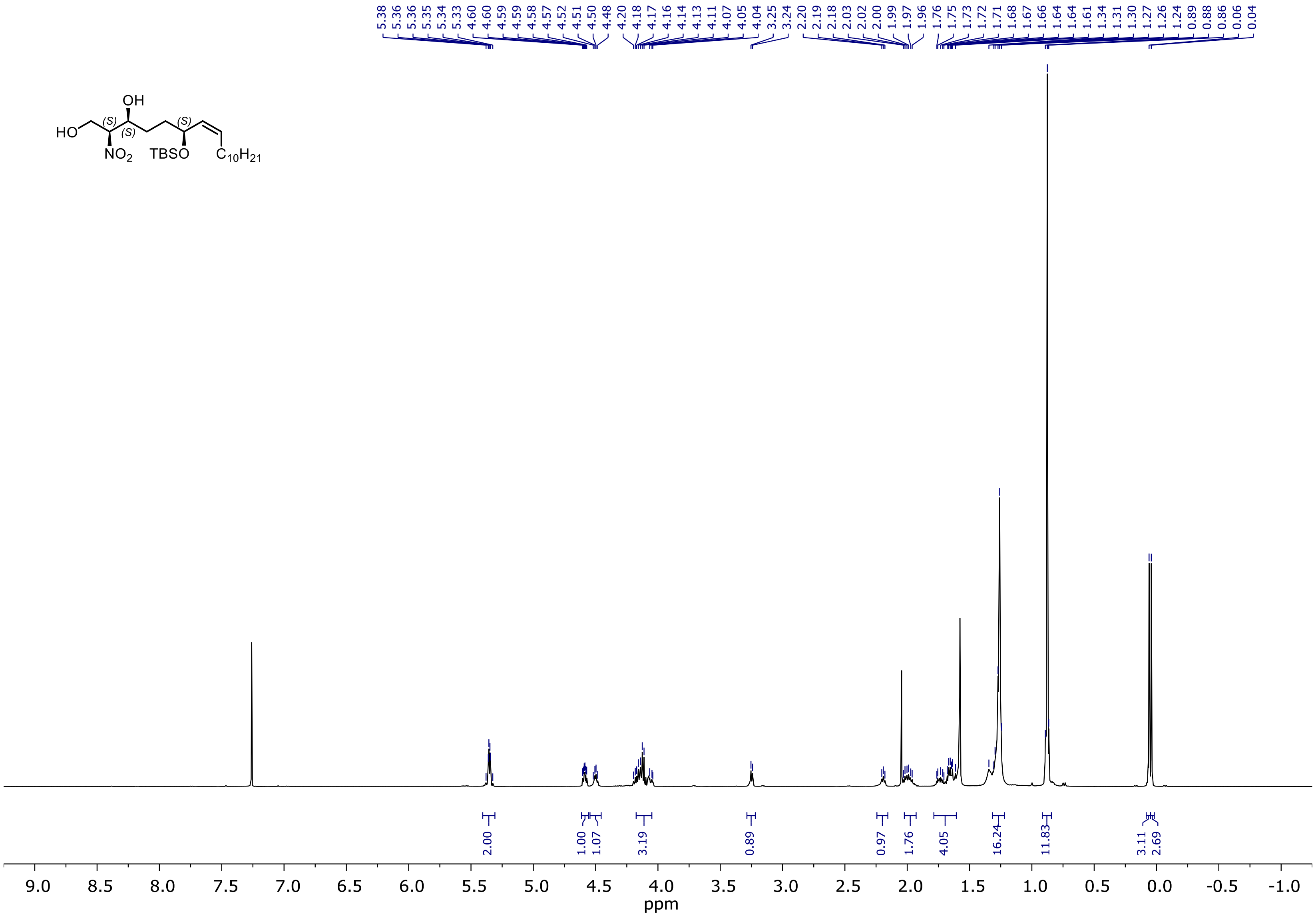


Figure S103. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (2*S*,3*S*,6*S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-34**.

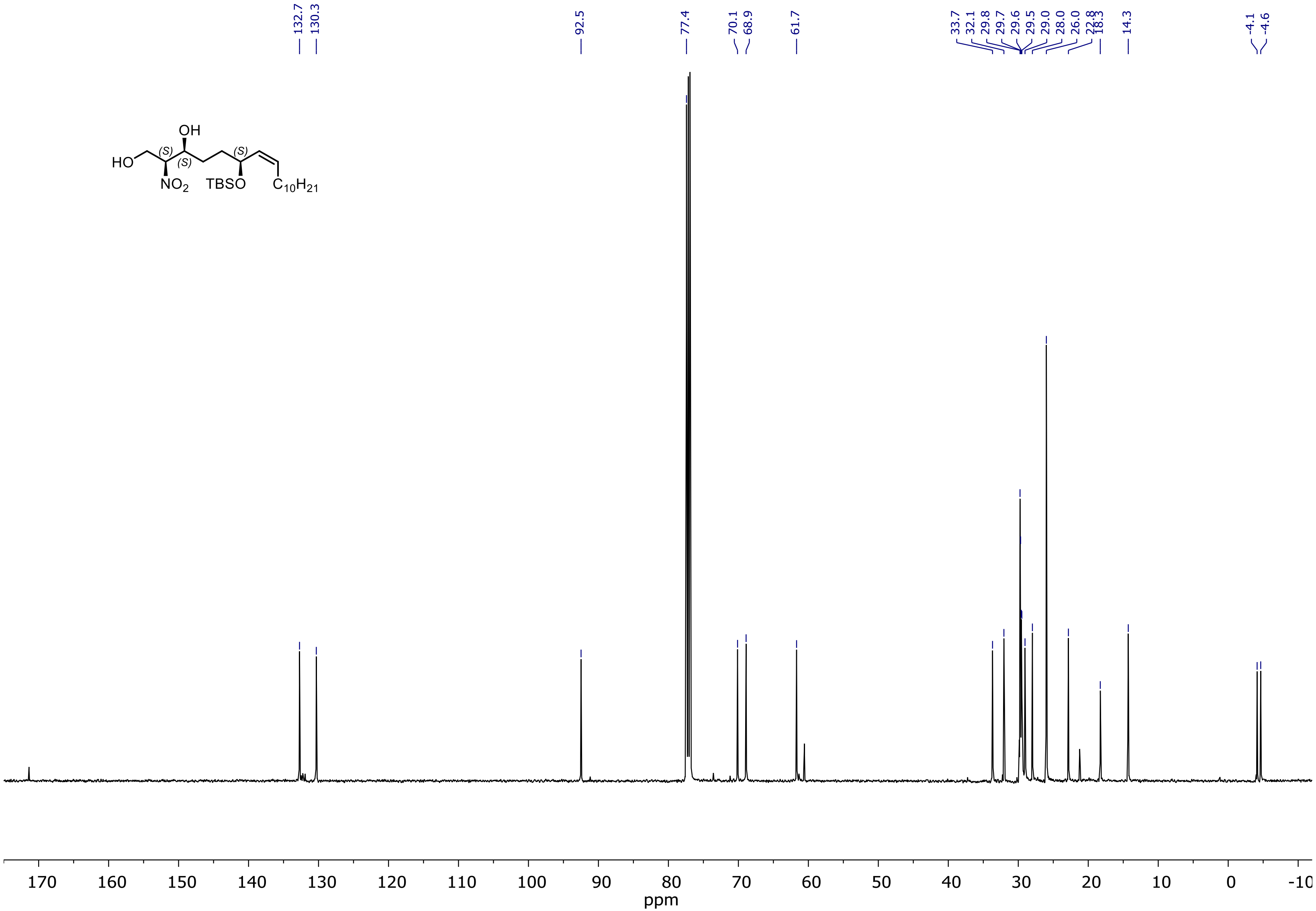


Figure S104. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S*,*3S*,*6S*,*Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-34**.

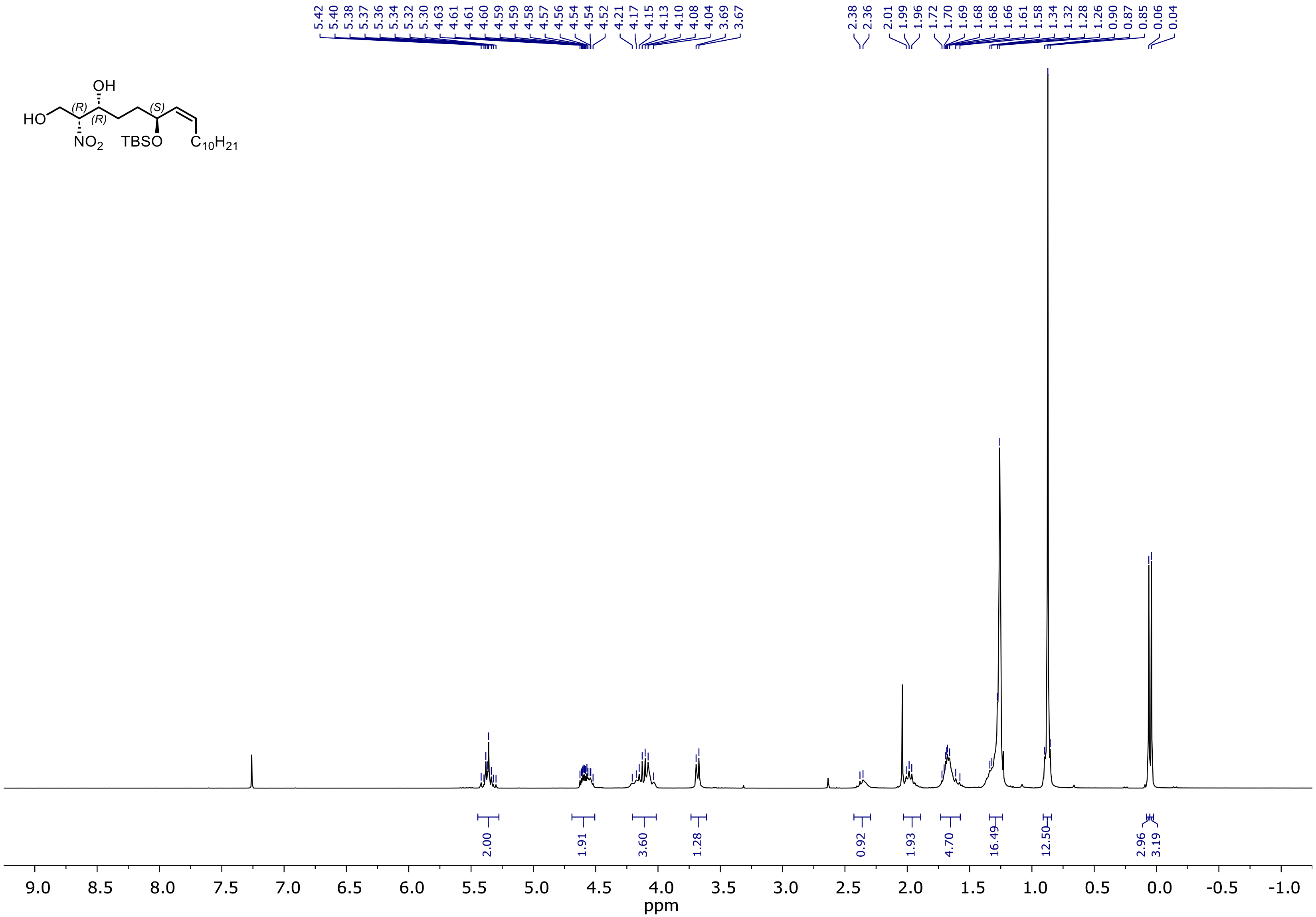


Figure S105. ^{1}H-NMR spectrum (300 MHz, CDCl$_3$) of (*2R,3R,6S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-35**.

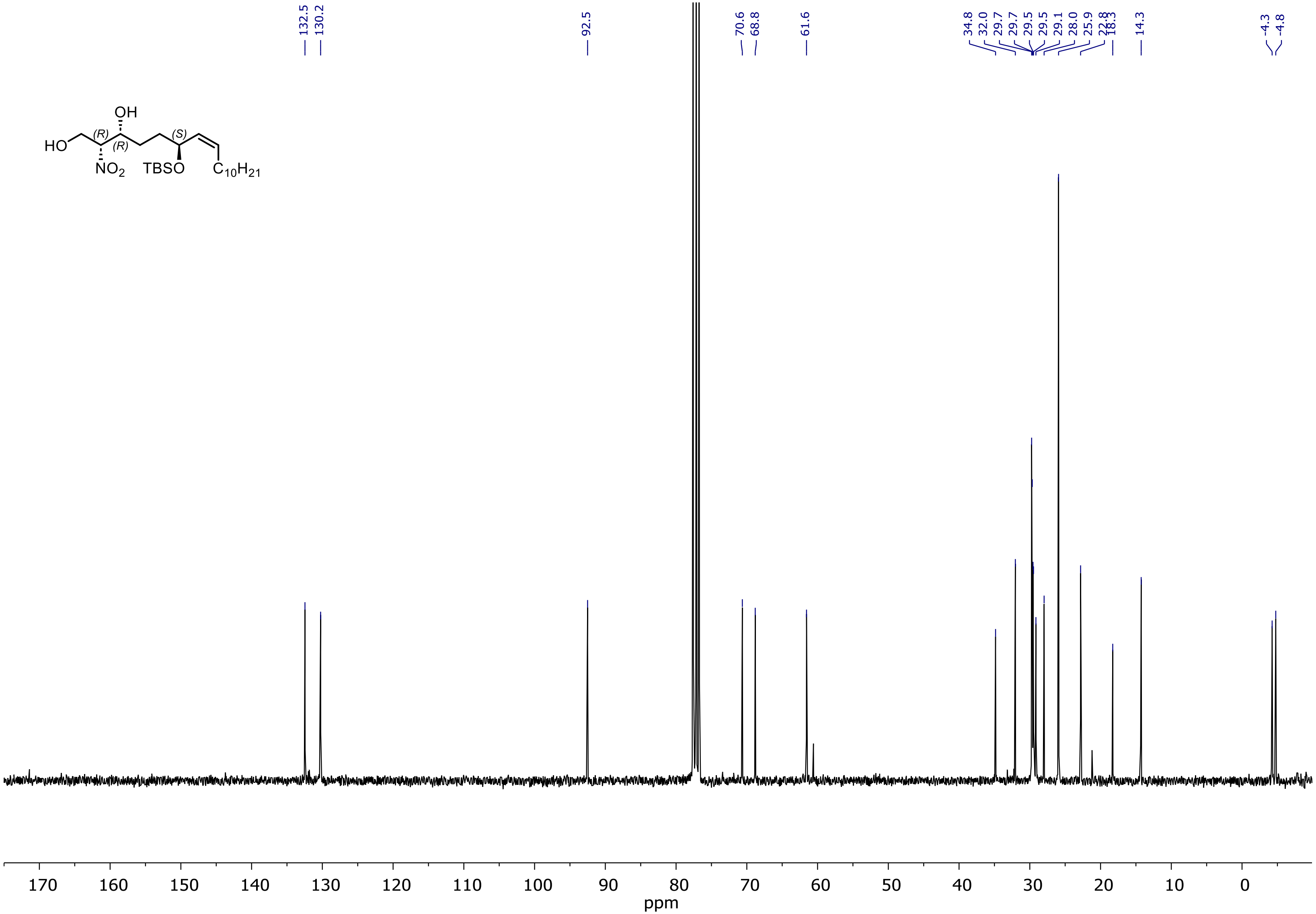


Figure S106. $^{13}C\{^{1}H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*2R,3R,6S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-35**.

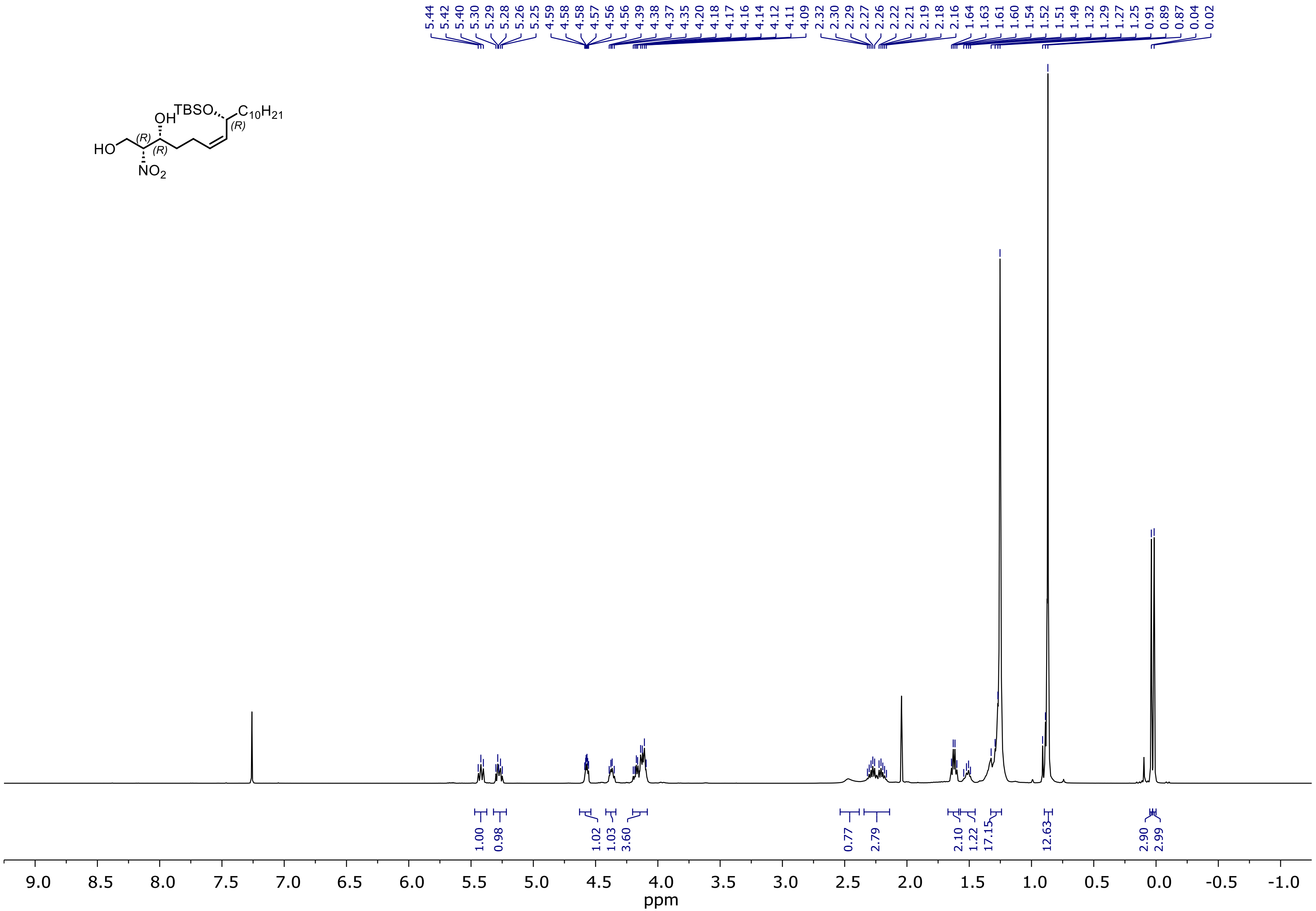


Figure S107. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*2R*,*3R*,*8R*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-36**.

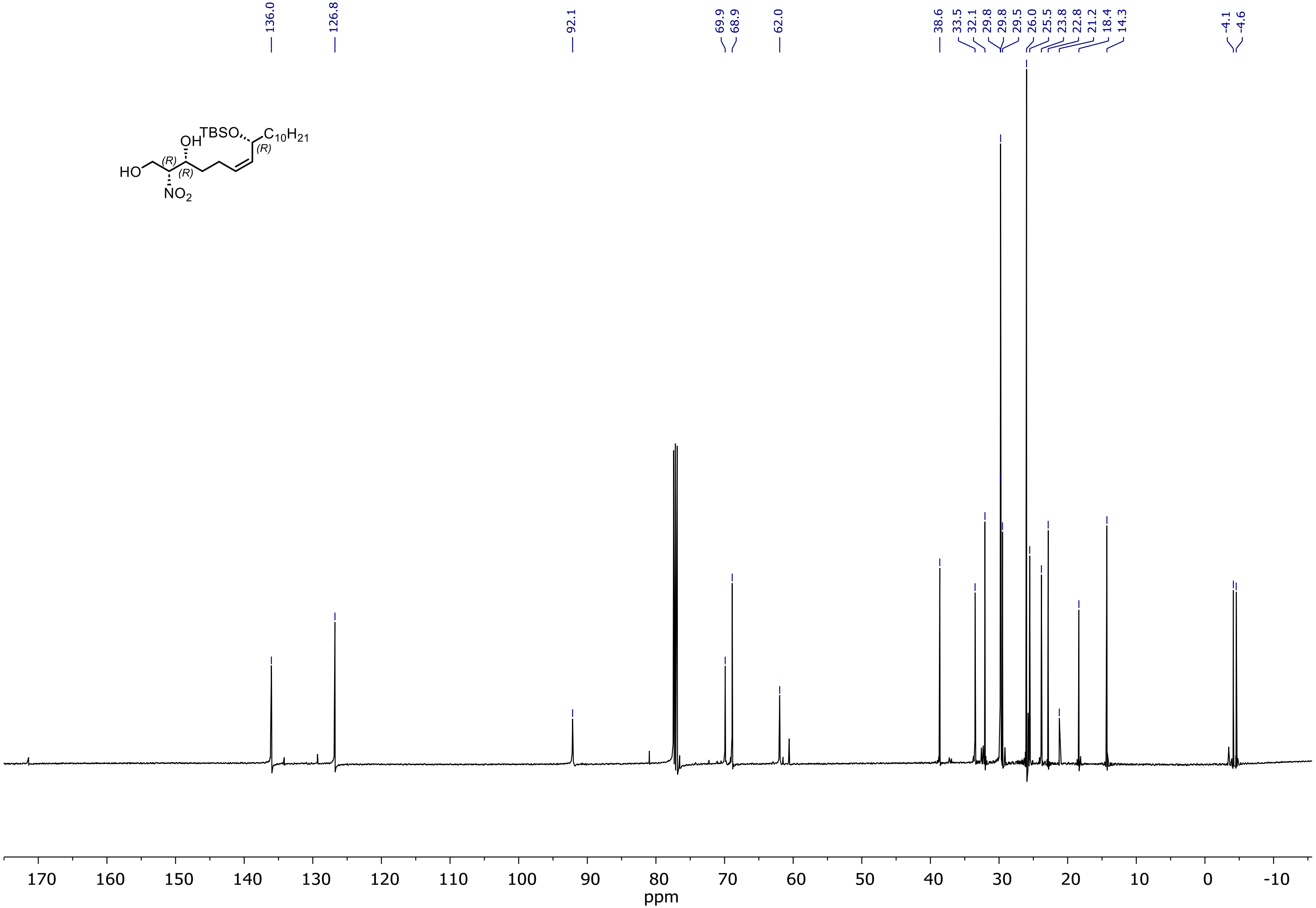


Figure S108. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2R,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-36**.

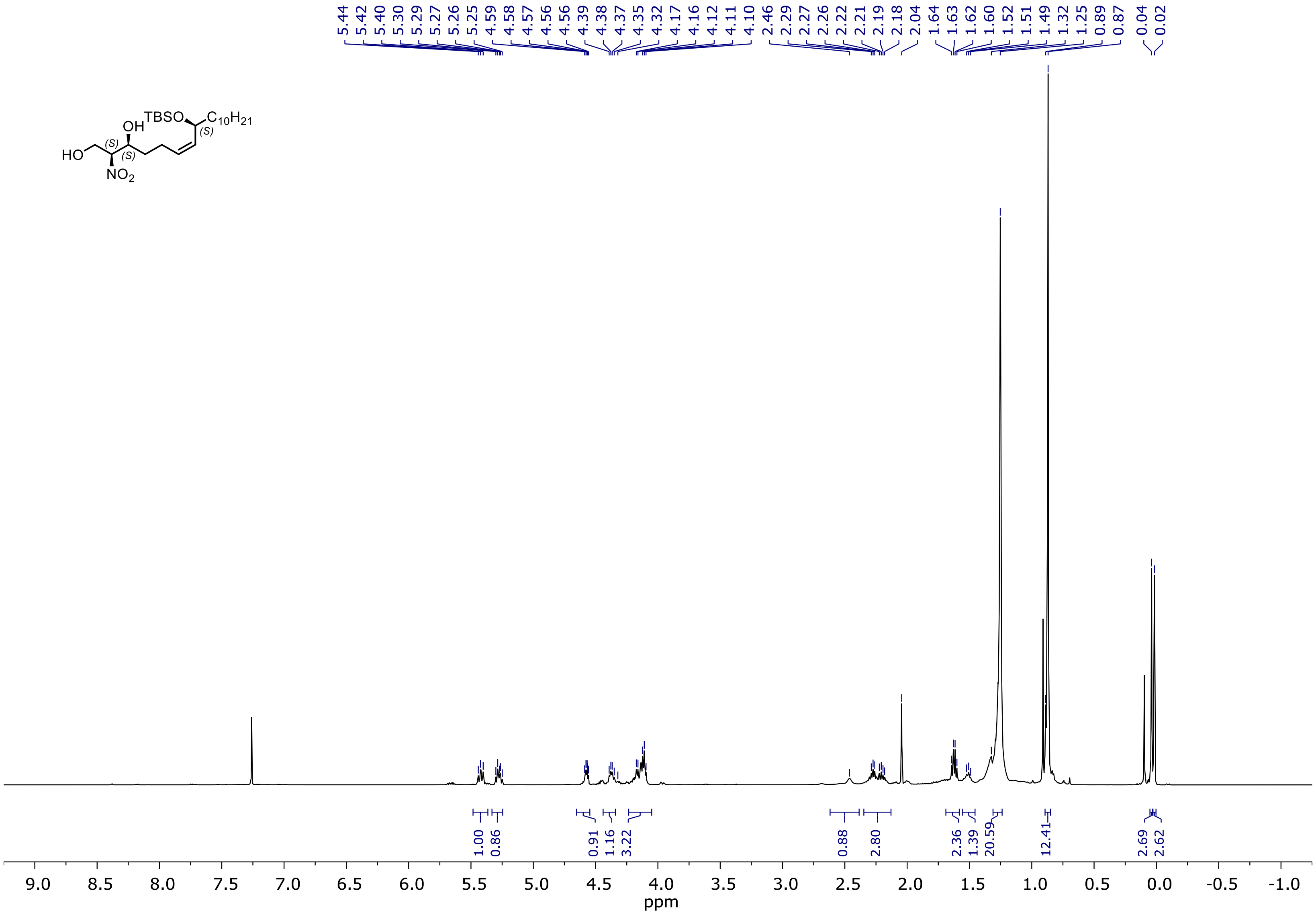


Figure S109. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2S,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-37**.

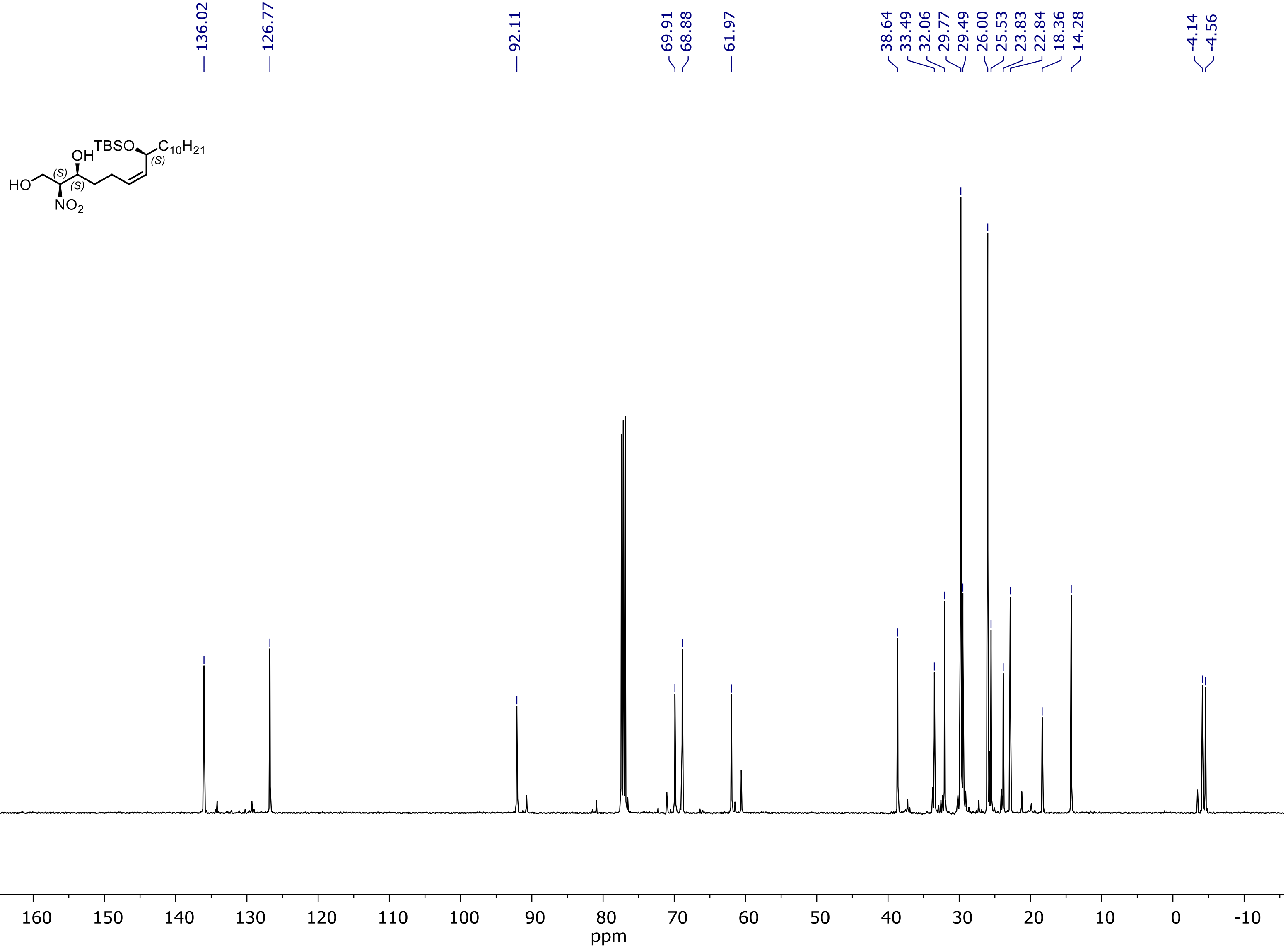


Figure S110. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-37**.

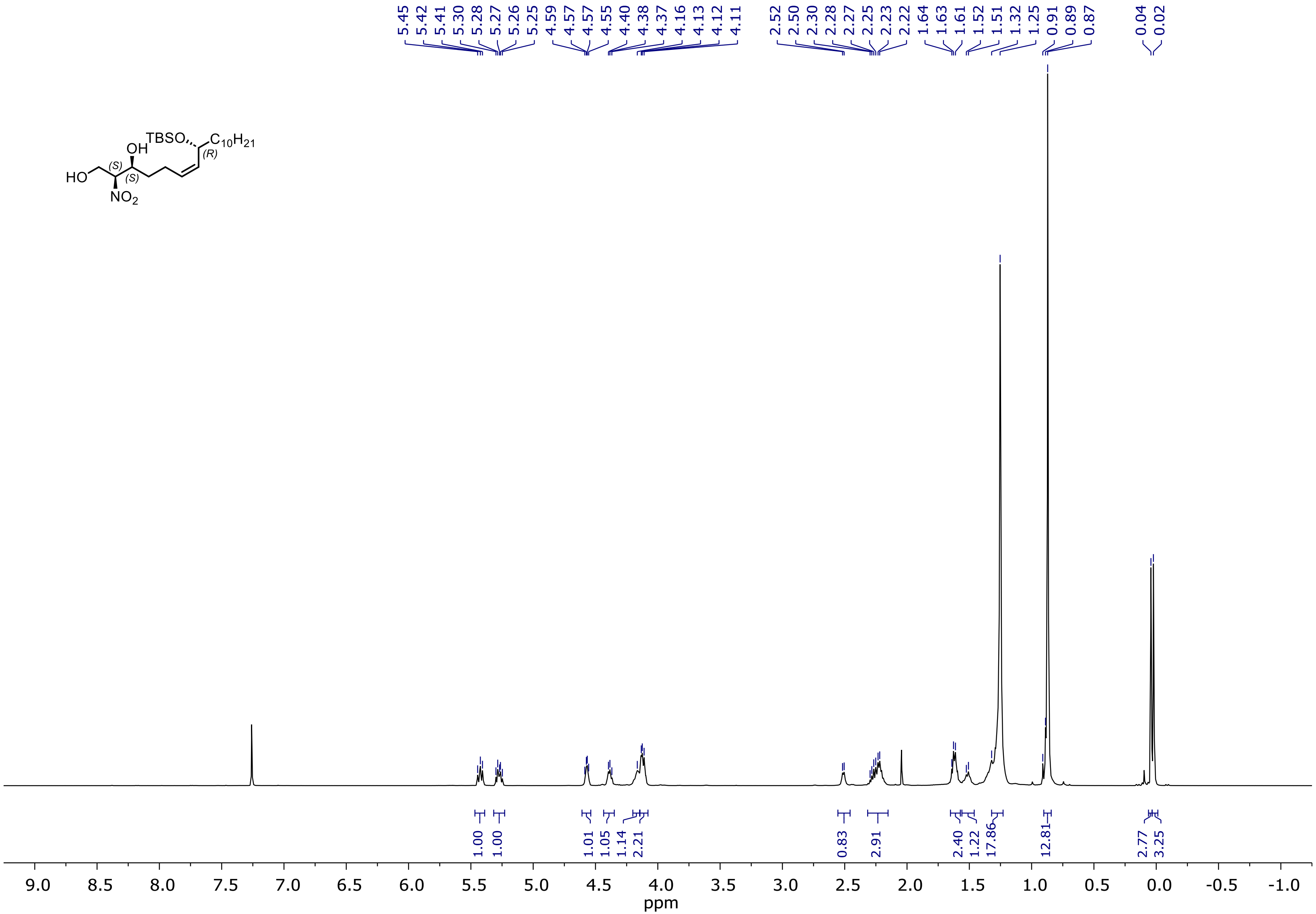


Figure S111. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (2*S*,3*S*,8*R*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-38**.

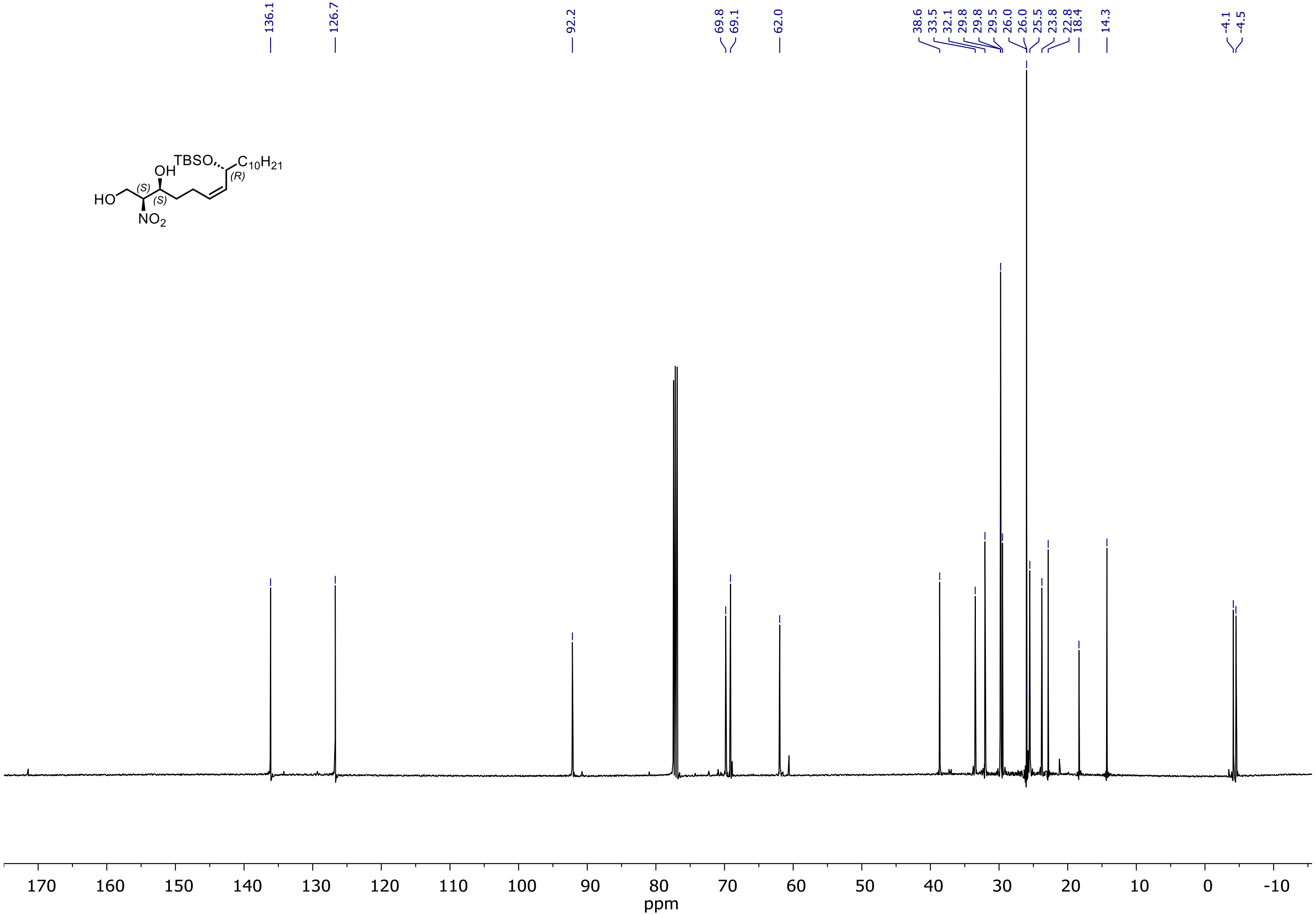


Figure S112. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (2*S*,3*S*,8*R*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-38**.

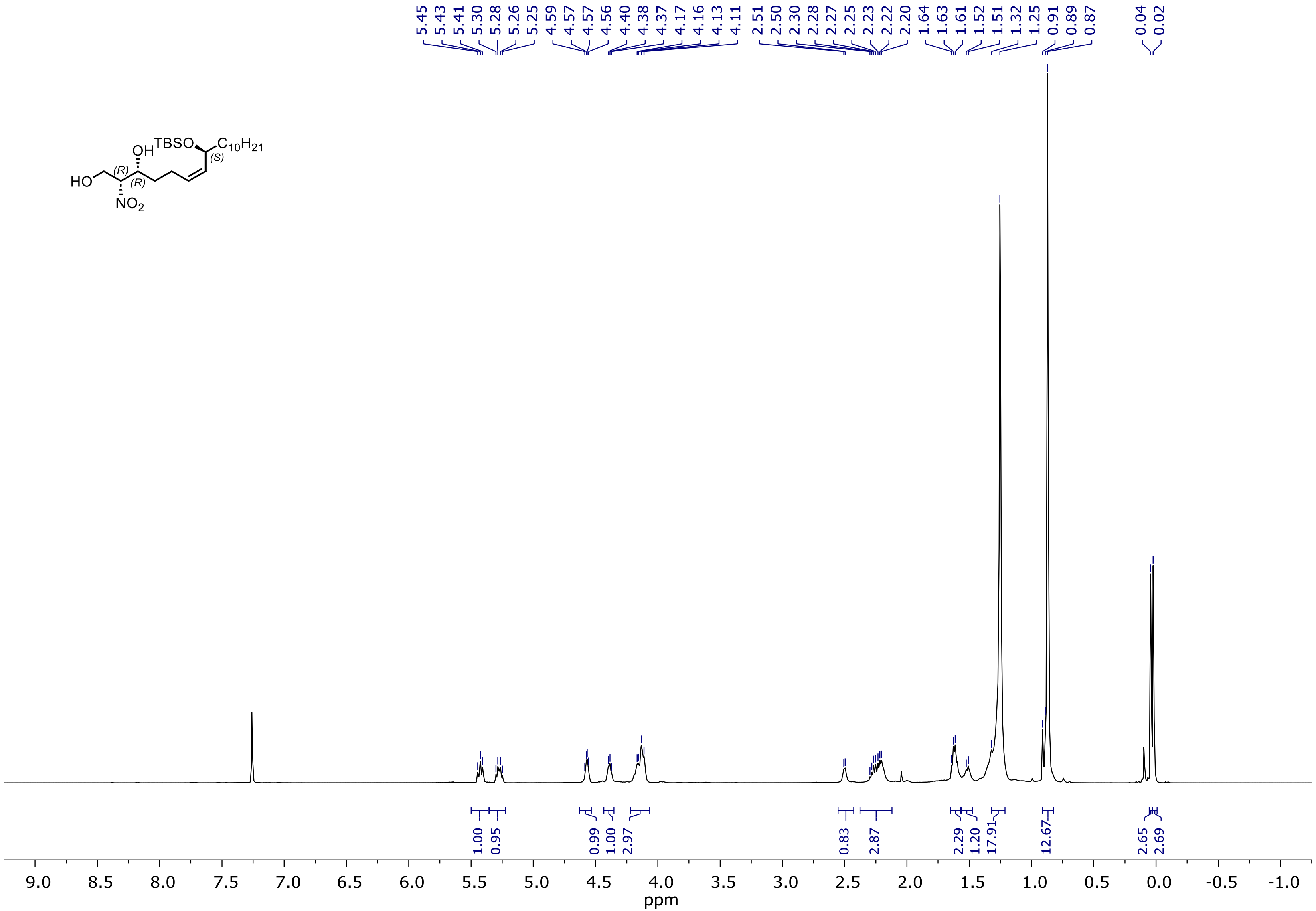


Figure S113. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2R,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-39**.

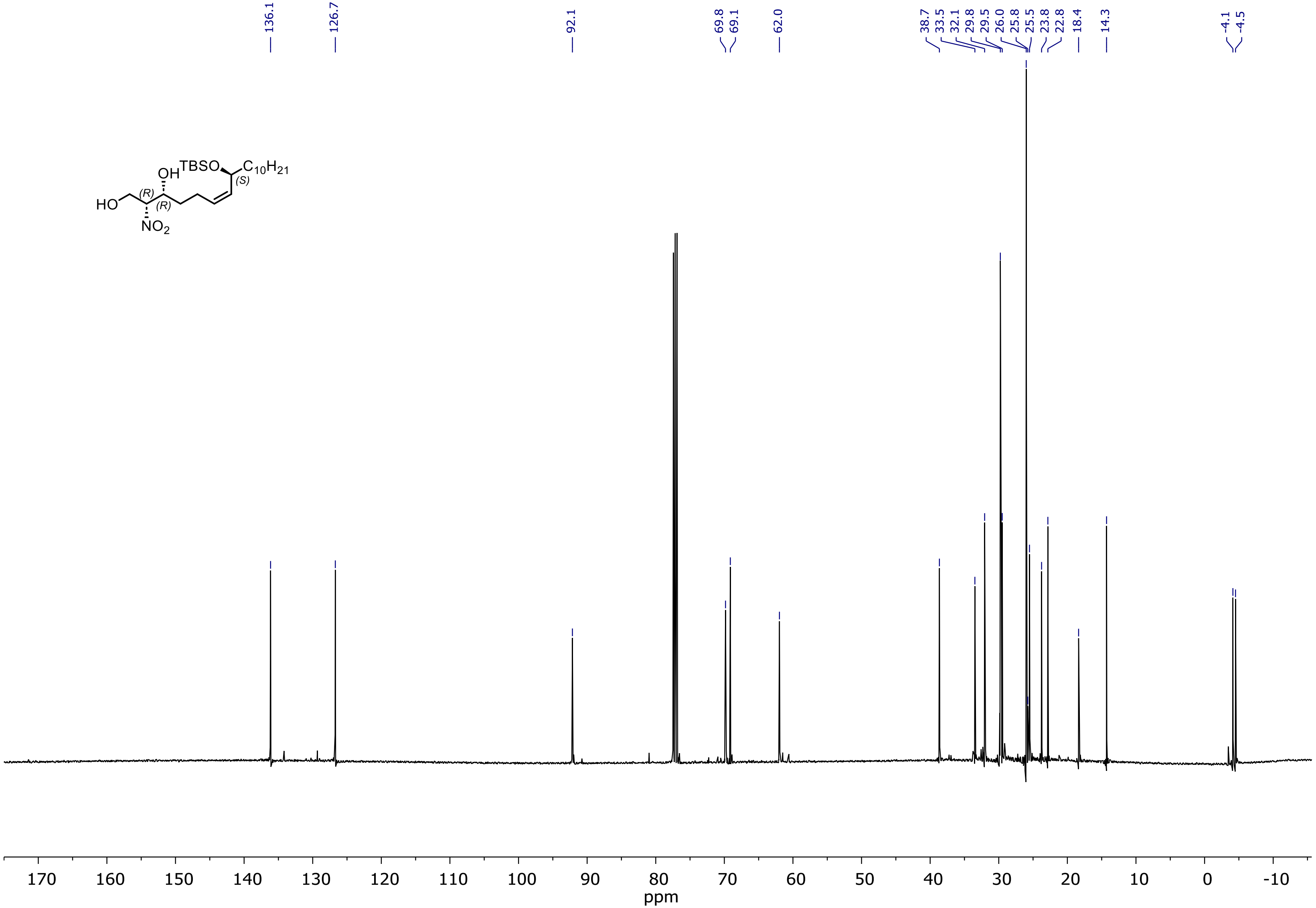


Figure S114. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2R,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-39**.

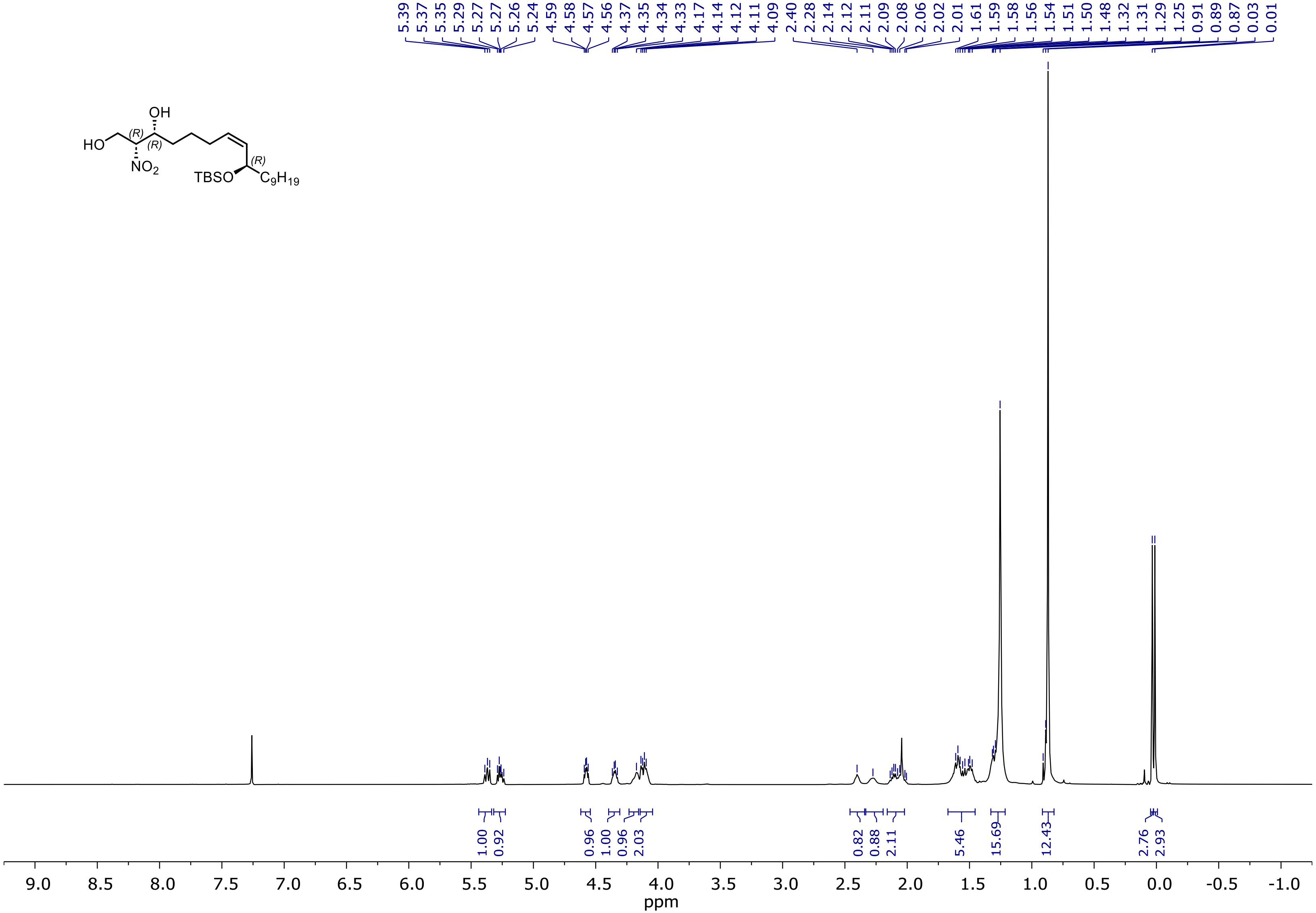


Figure S115. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2R,3R,9R,Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-40**.

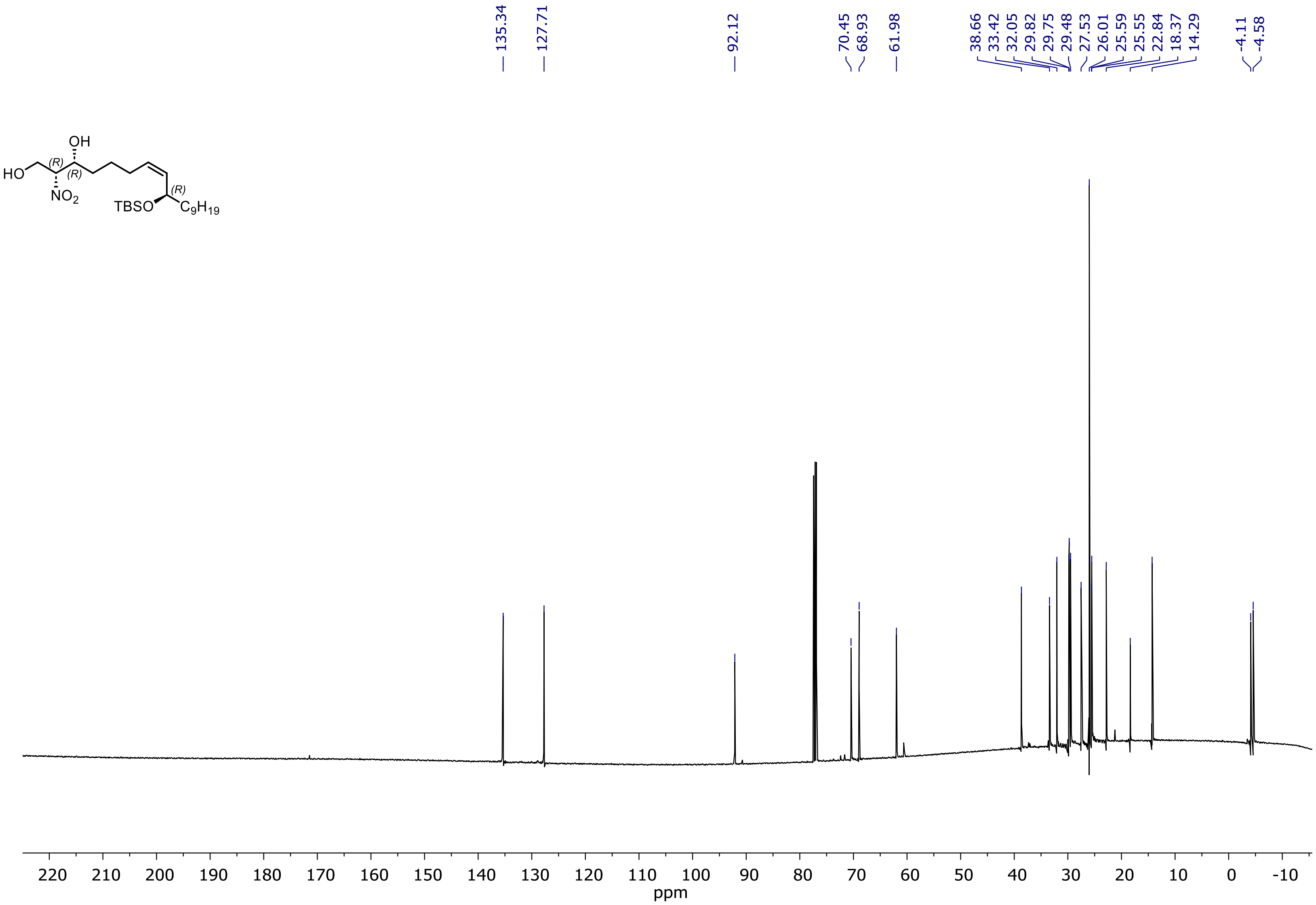


Figure S116. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2R,3R,9R,Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-40**.

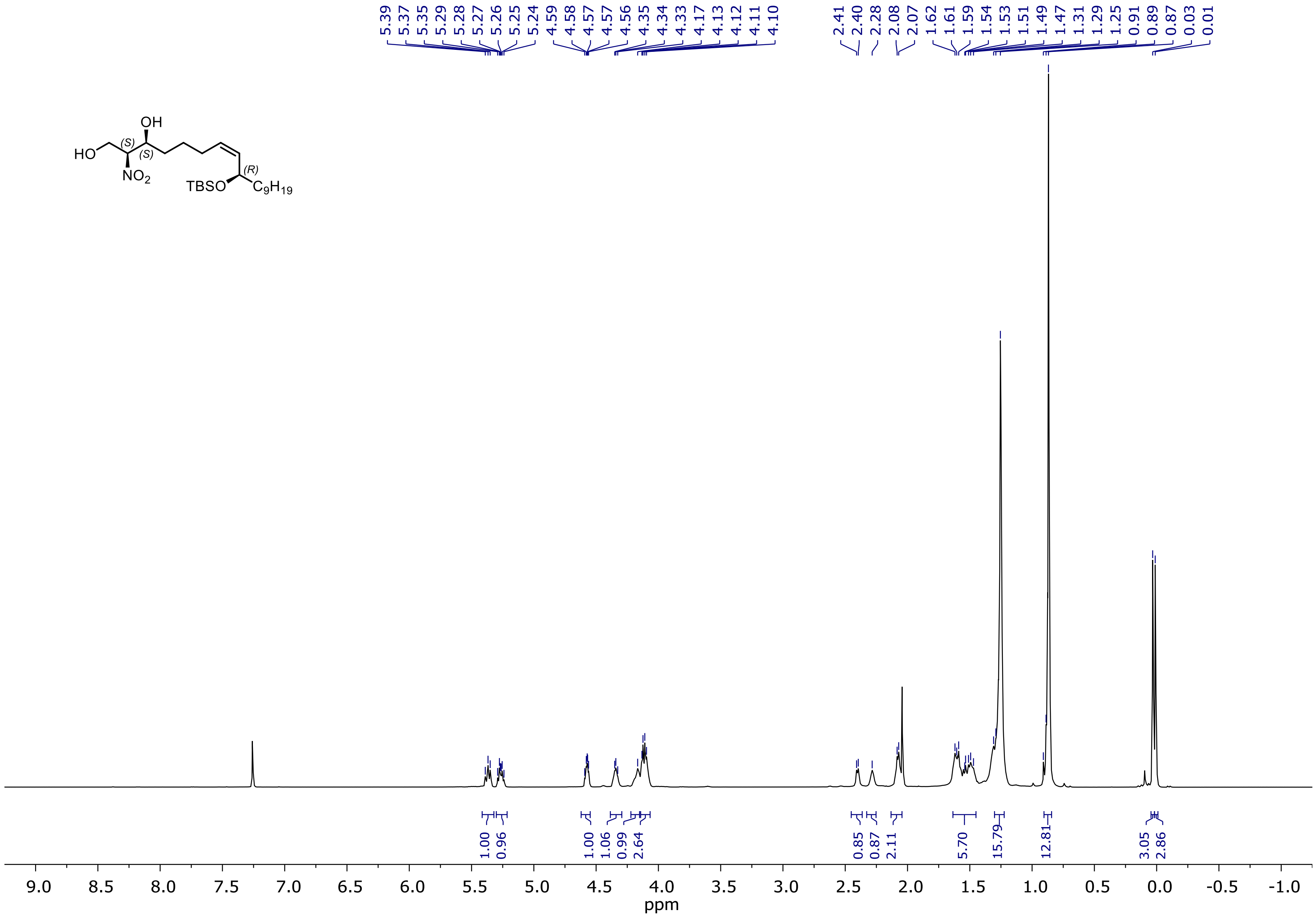


Figure S117. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*2S,3S,9R,Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-41**.

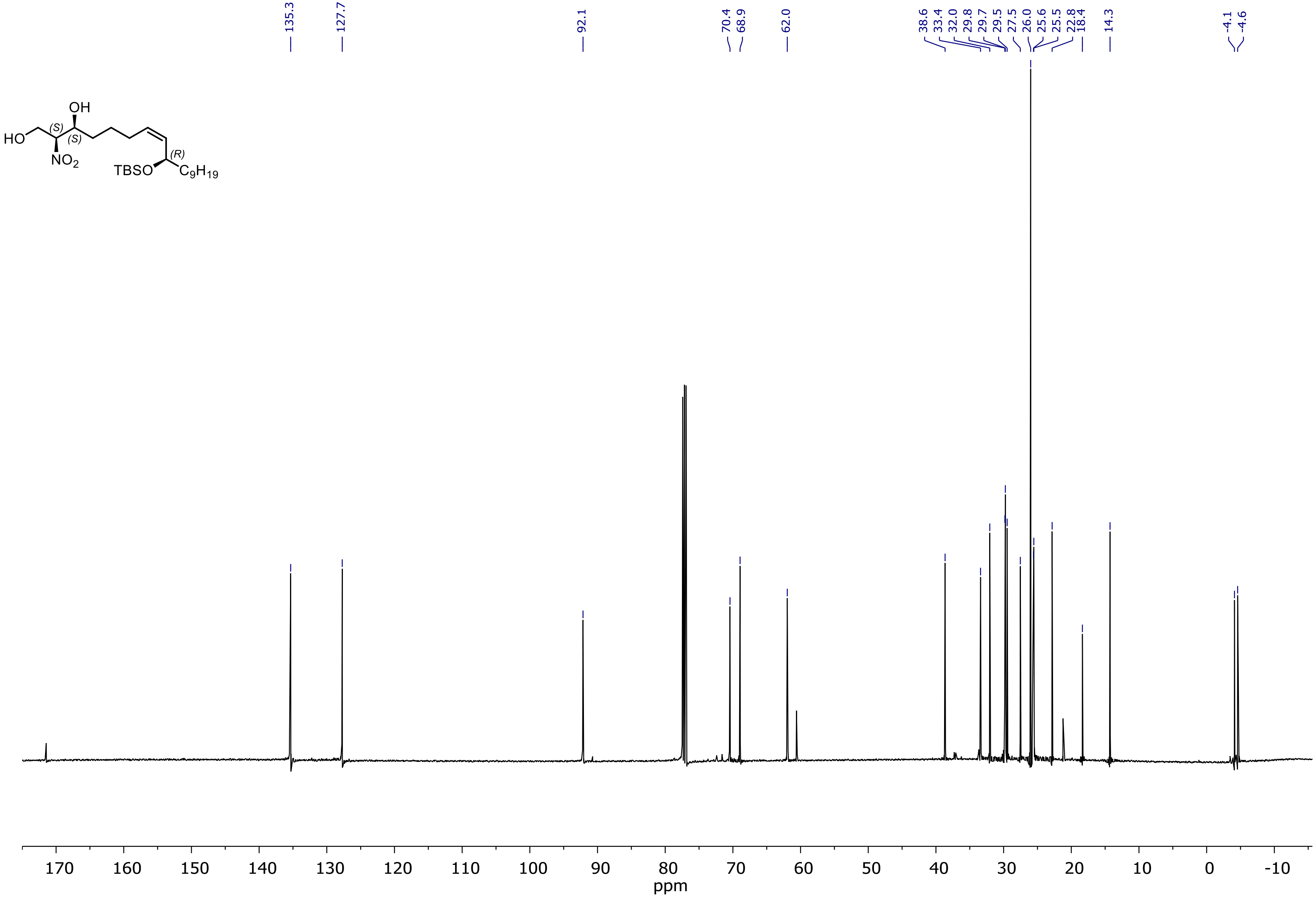


Figure S118. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S,3S,9R,Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-41**.

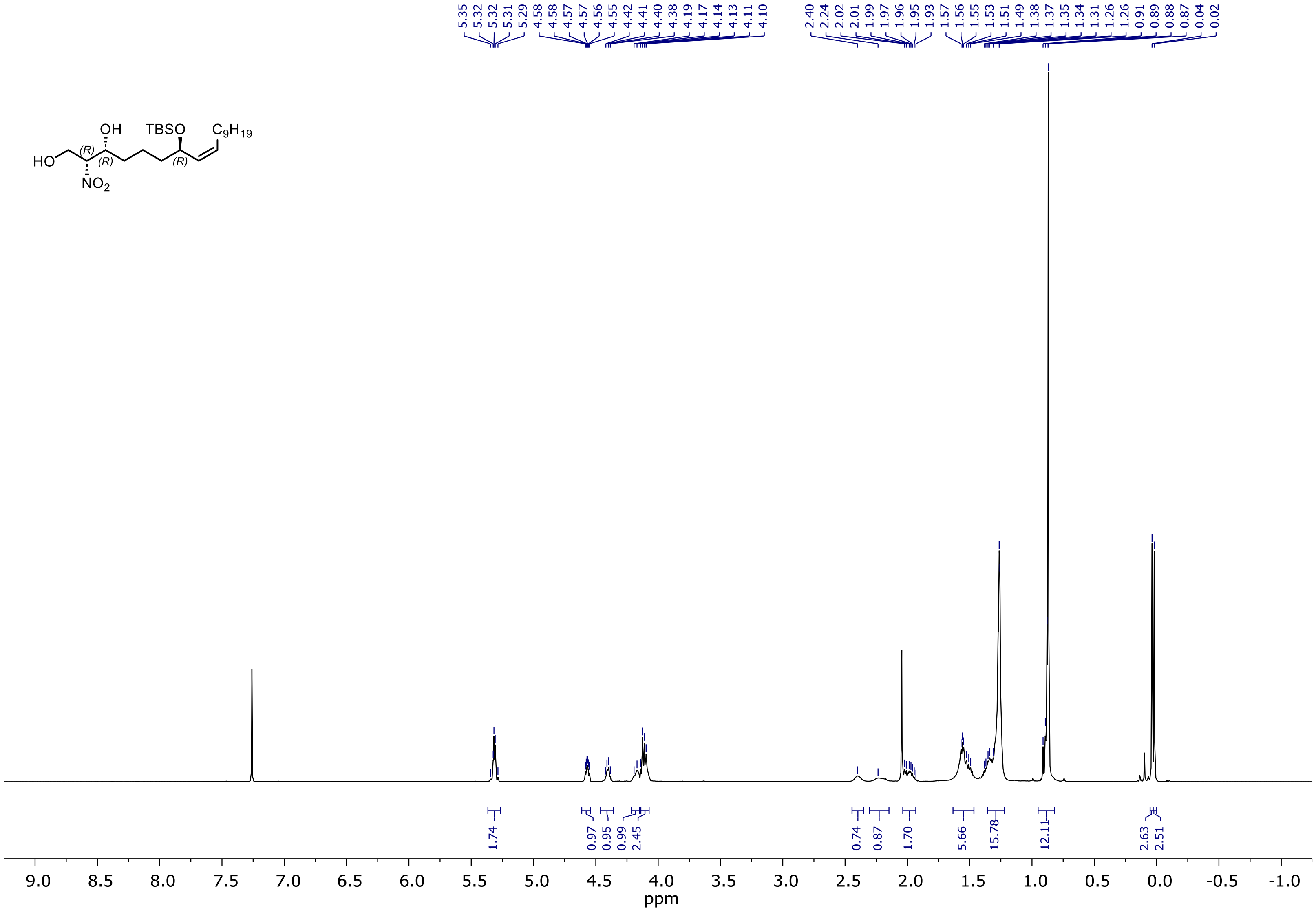


Figure S119. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2R*,*3R*,*7R*,*Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol **SI-42**.

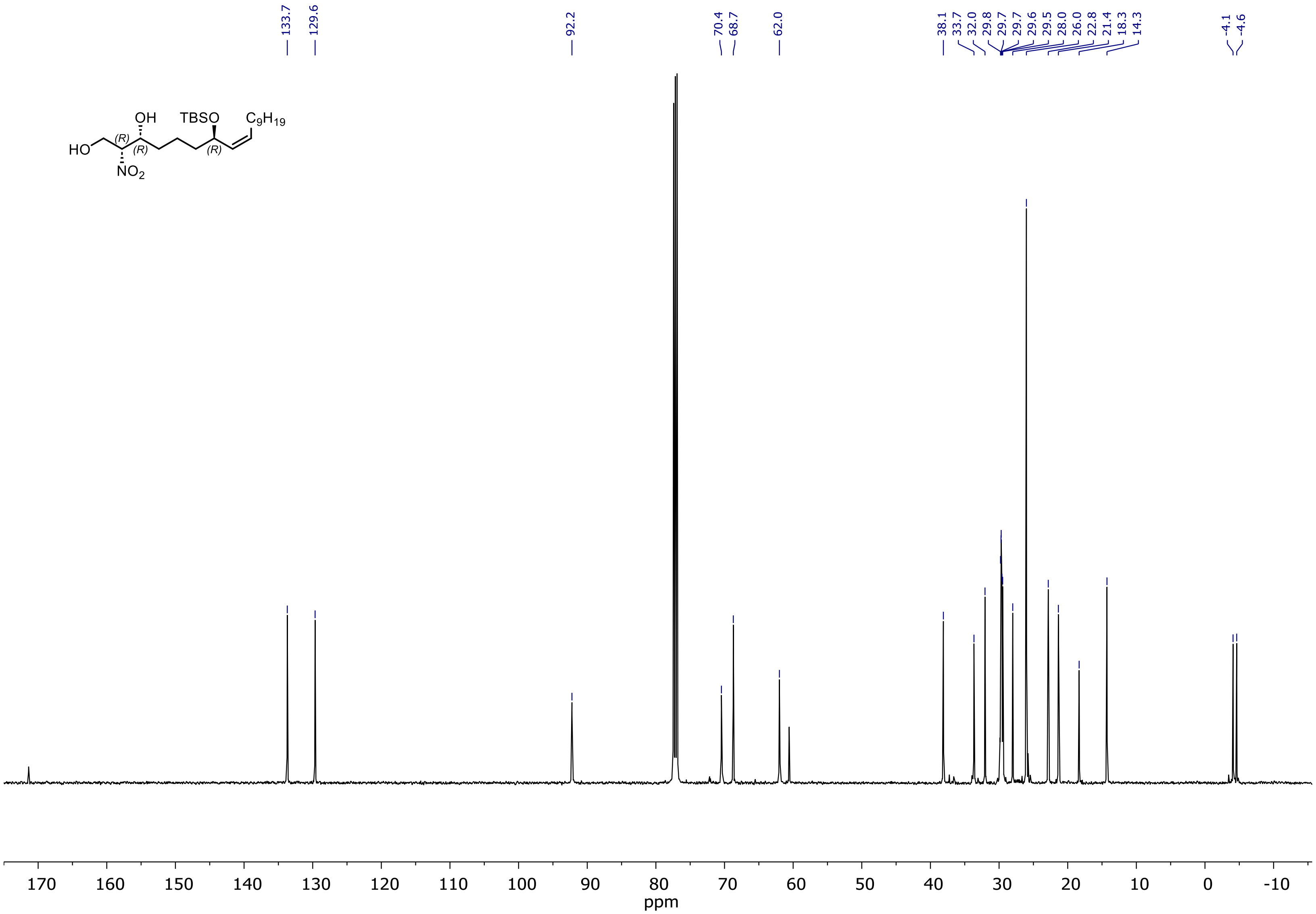


Figure S120. ${}^{13}C\{{}^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2R,3R,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol **SI-42**.

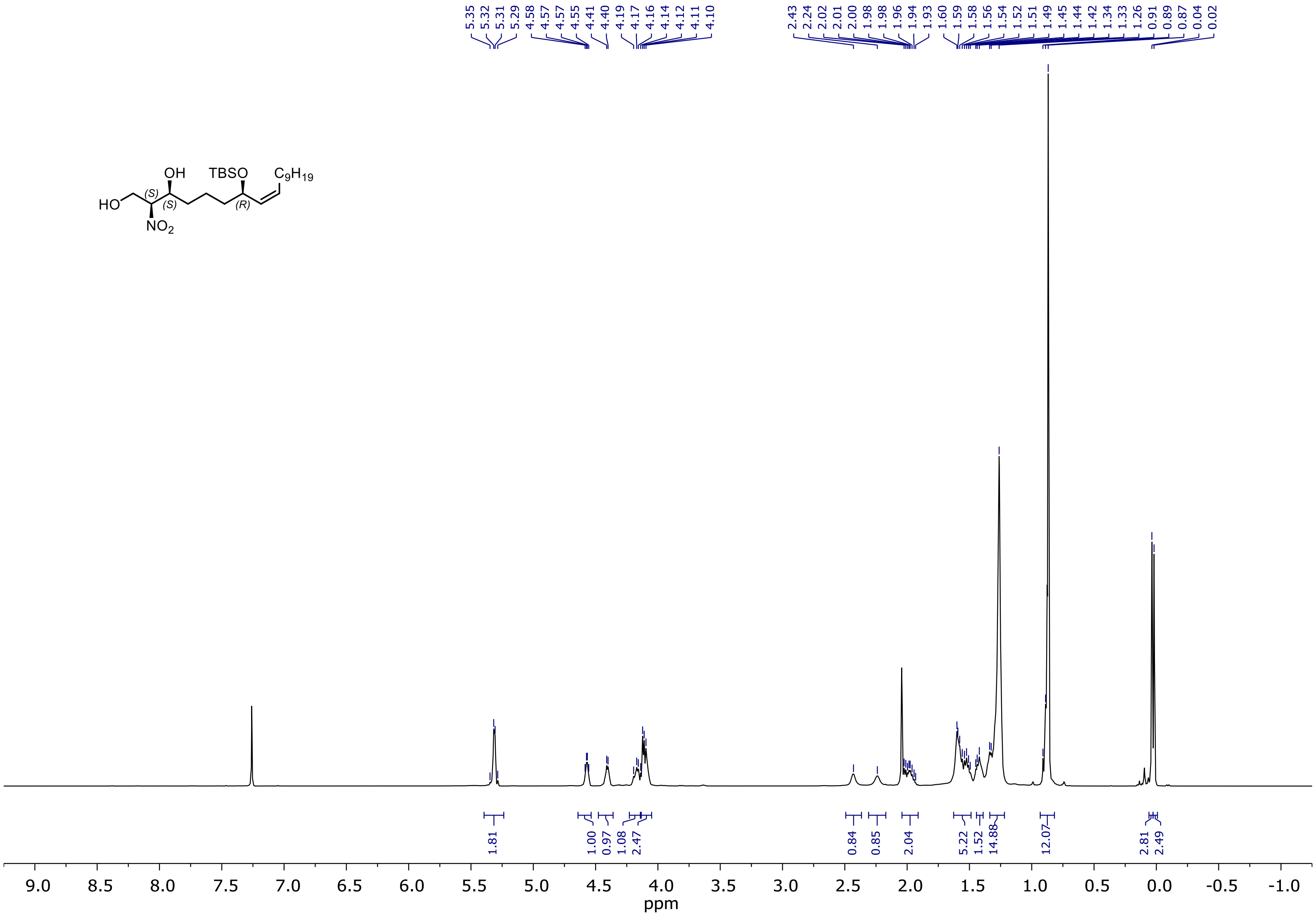


Figure S121. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*2S,3S ,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol **SI-43**.

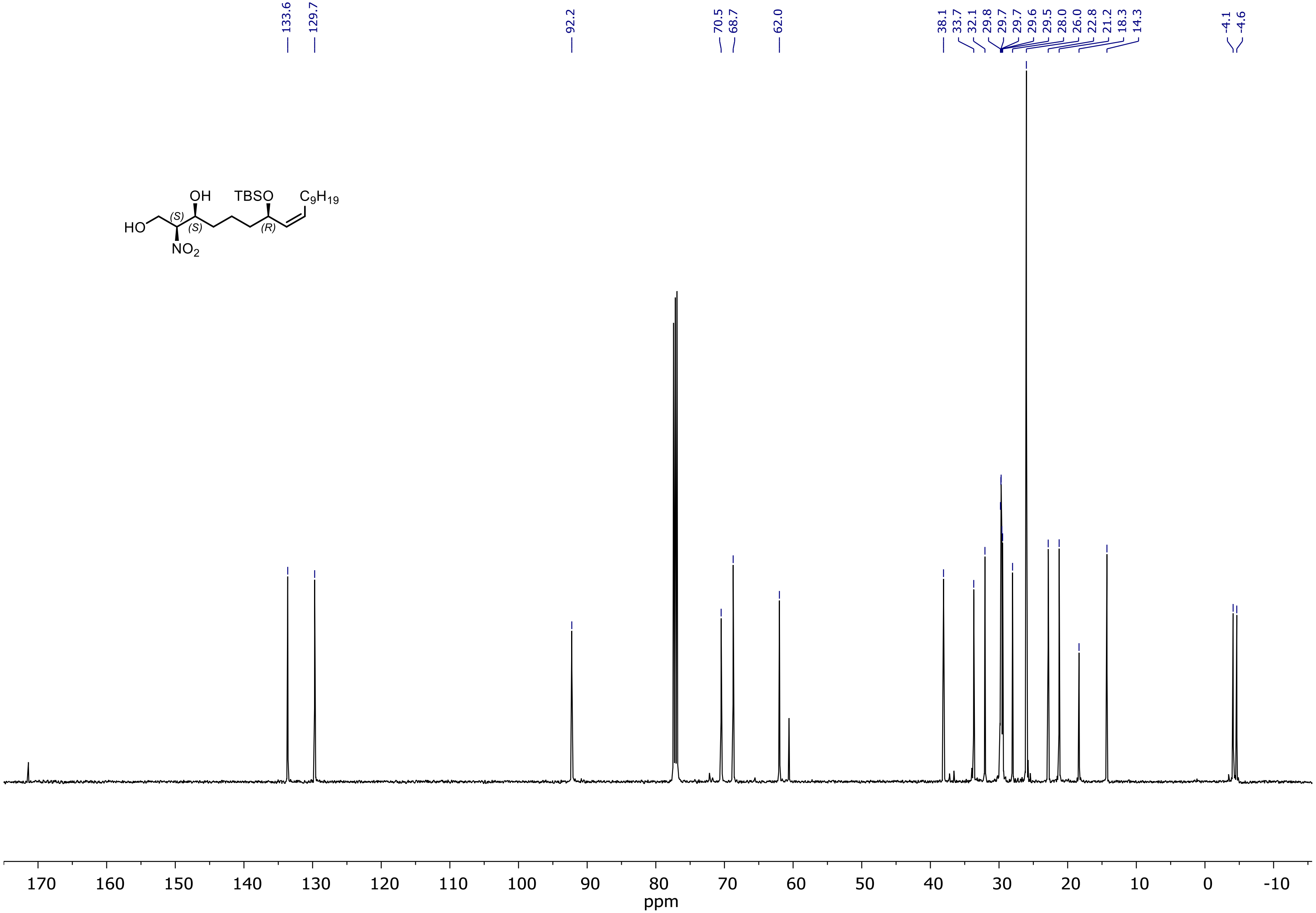


Figure S122. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*2S,3S,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol **SI-43**.

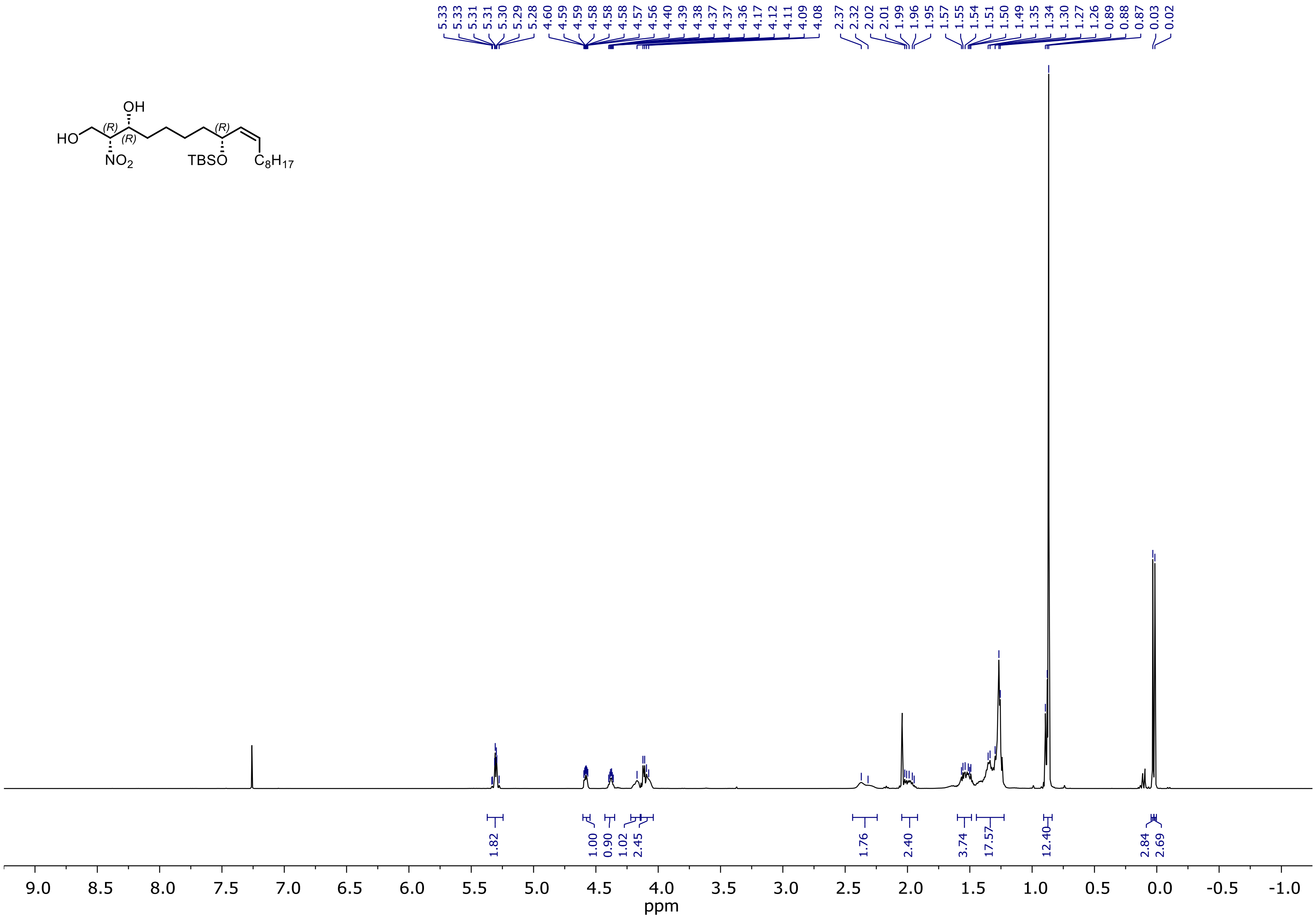


Figure S123. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2R,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-44**.

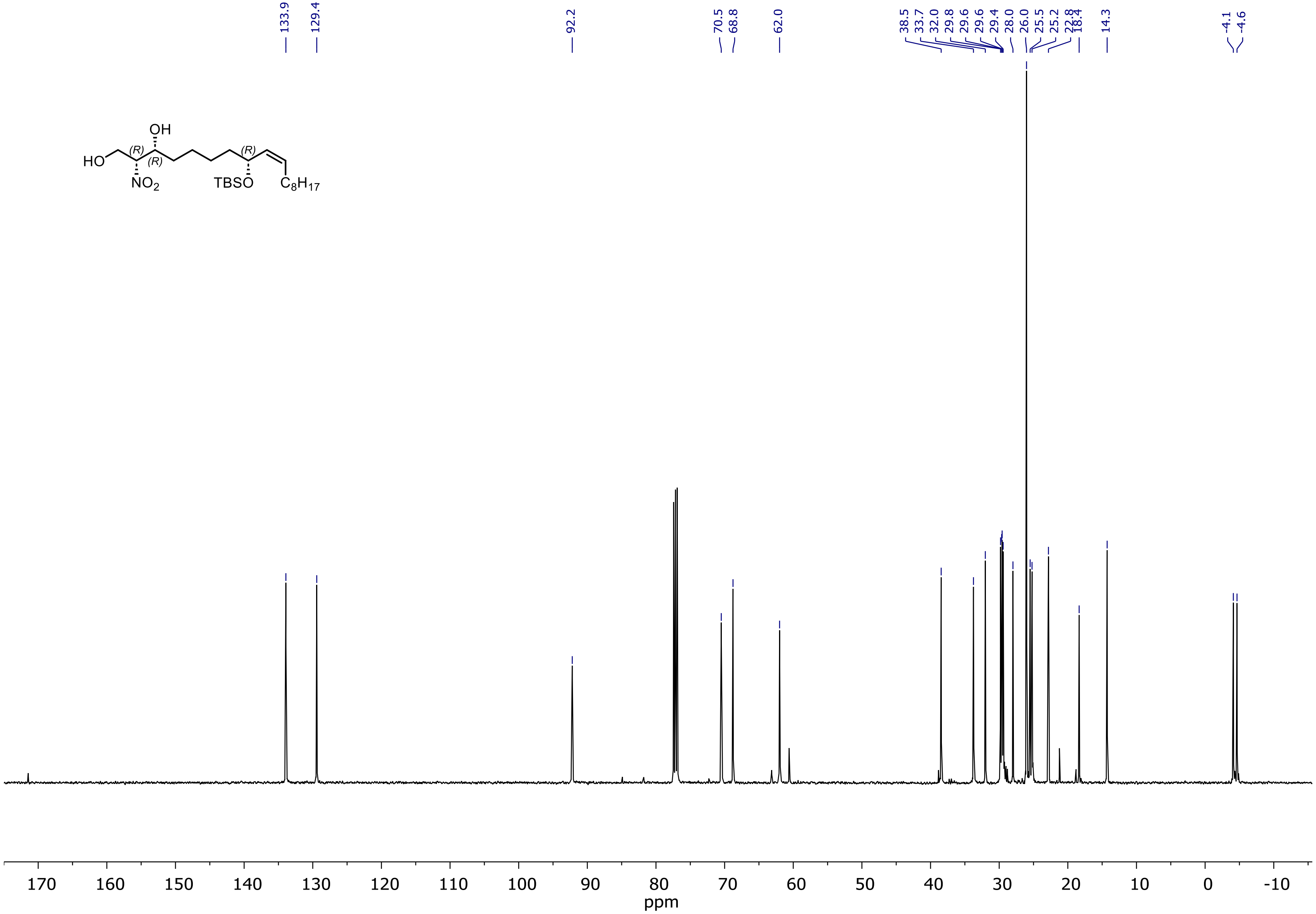


Figure S124. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*2R,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-44**.

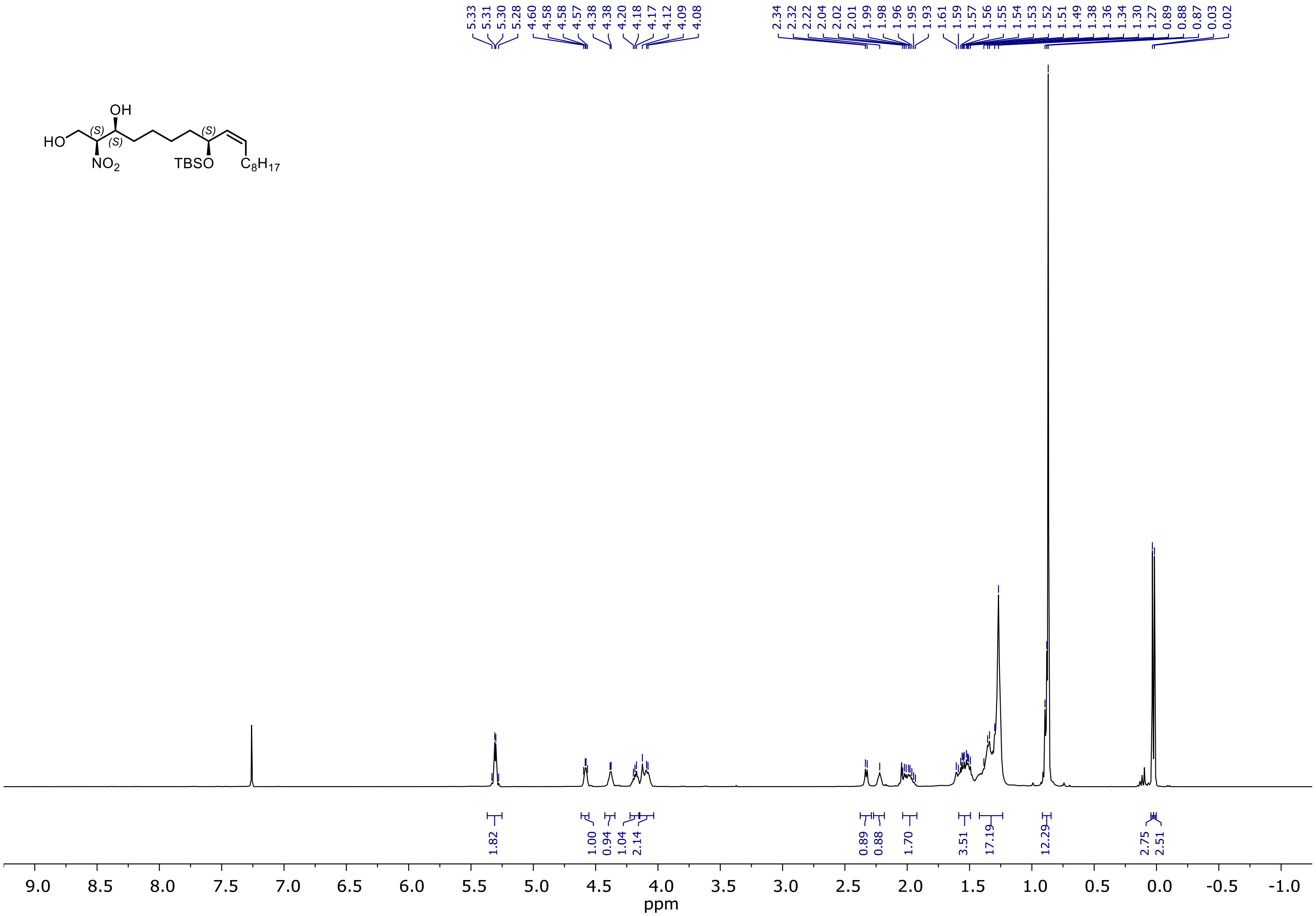


Figure S125. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2S,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-45**.

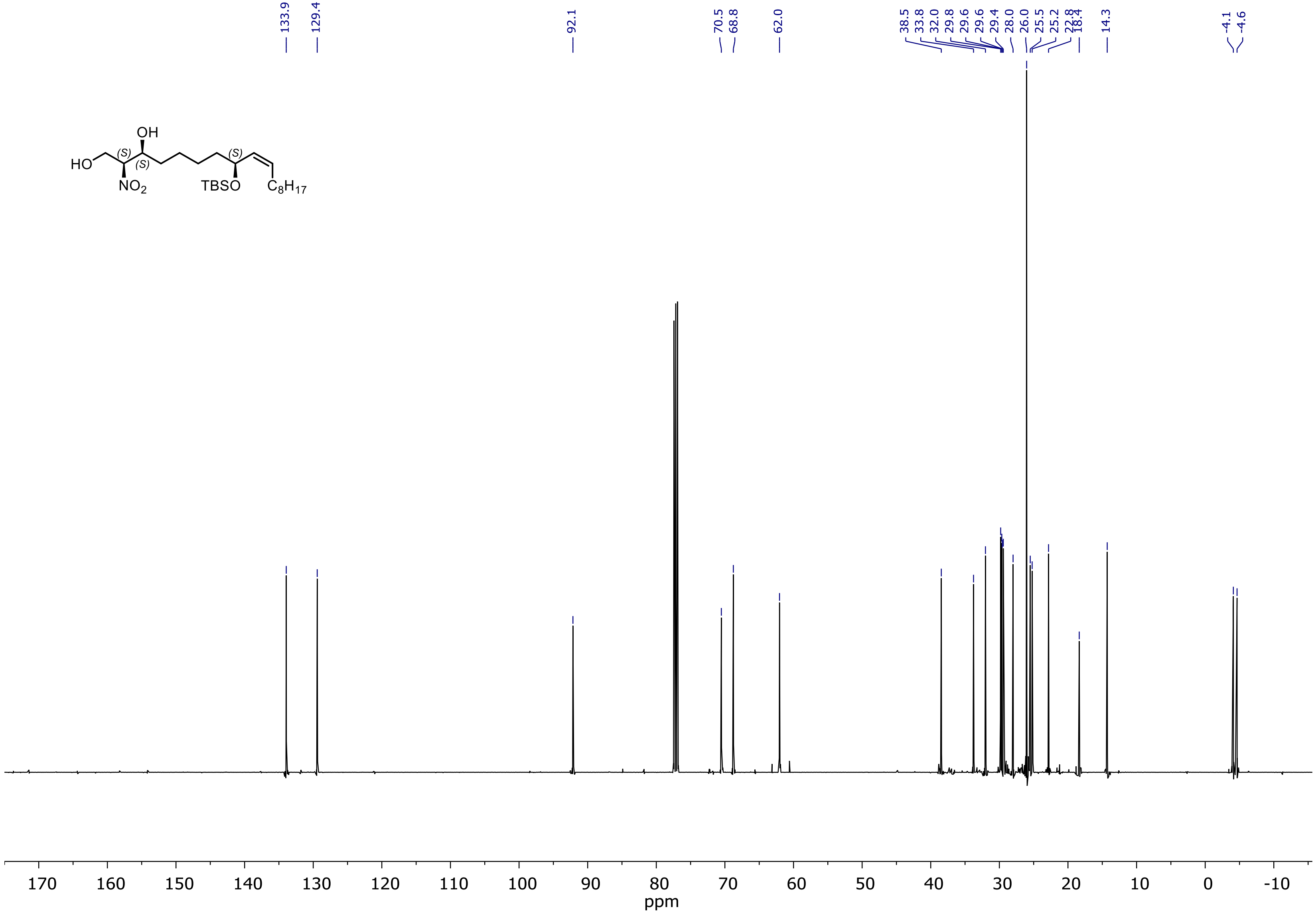


Figure S126. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*2S*,*3S*,*8S*,*Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-45**.

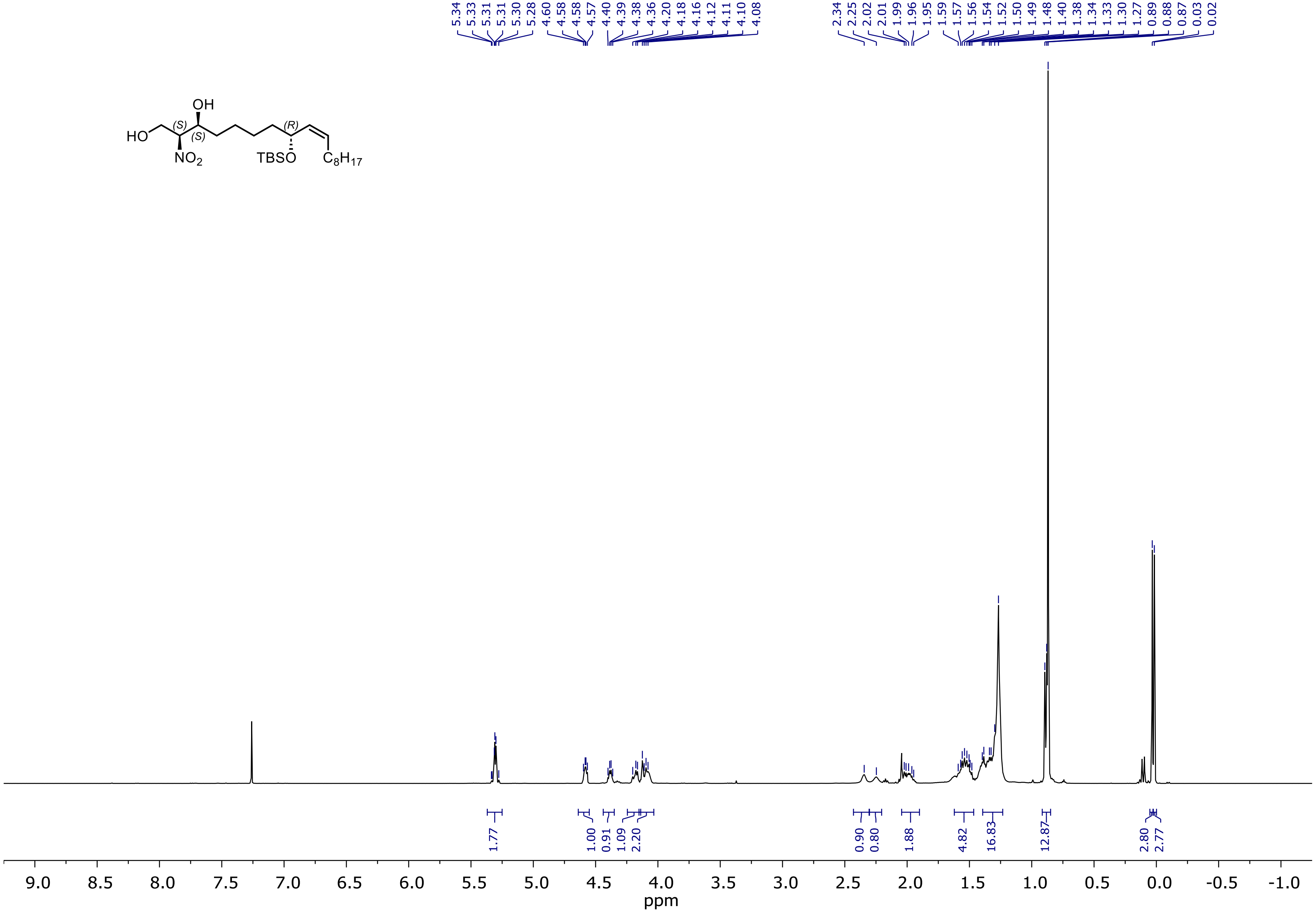


Figure S127. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*2S,3S,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-46**.

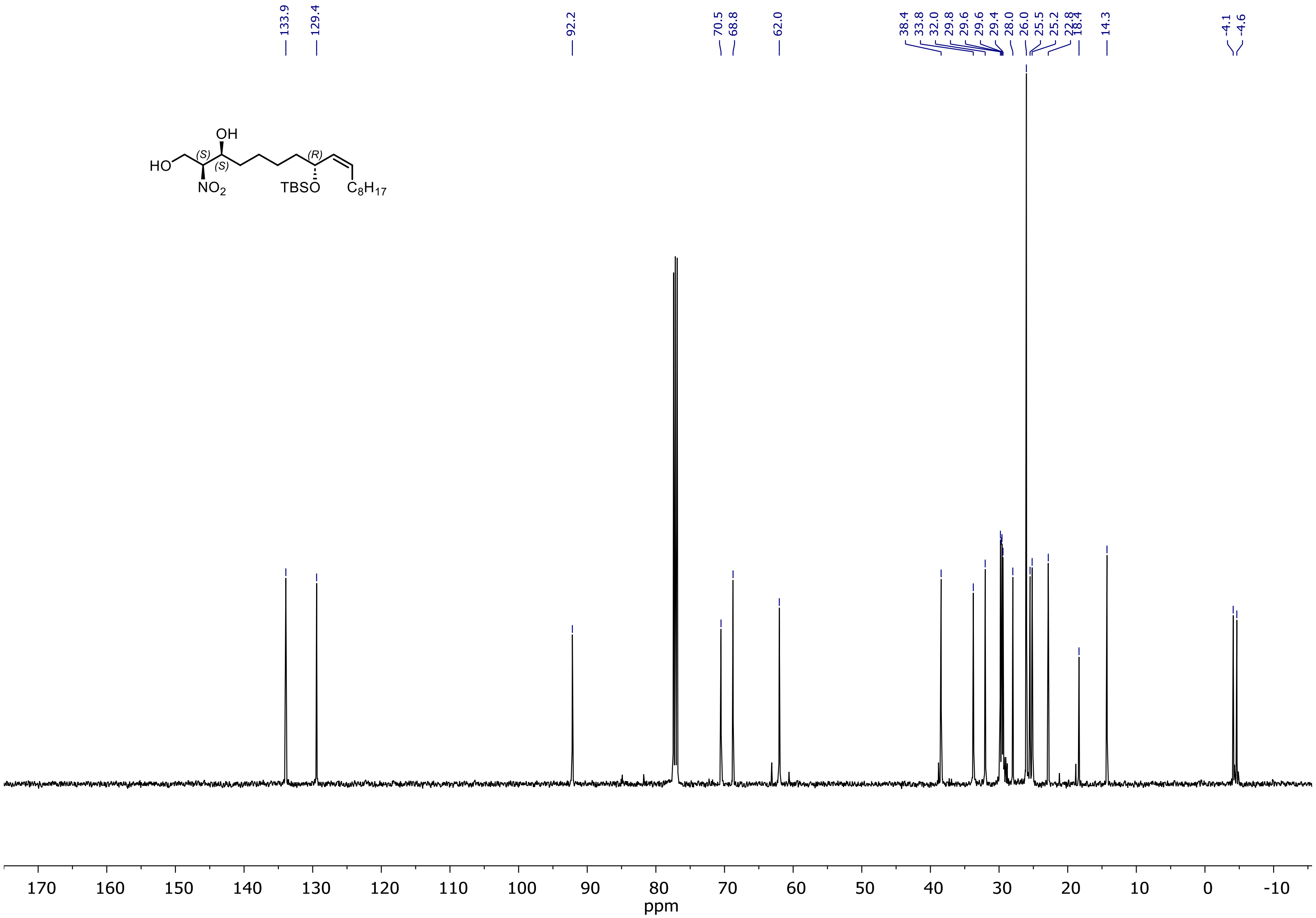


Figure S128. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S,3S,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-46**.

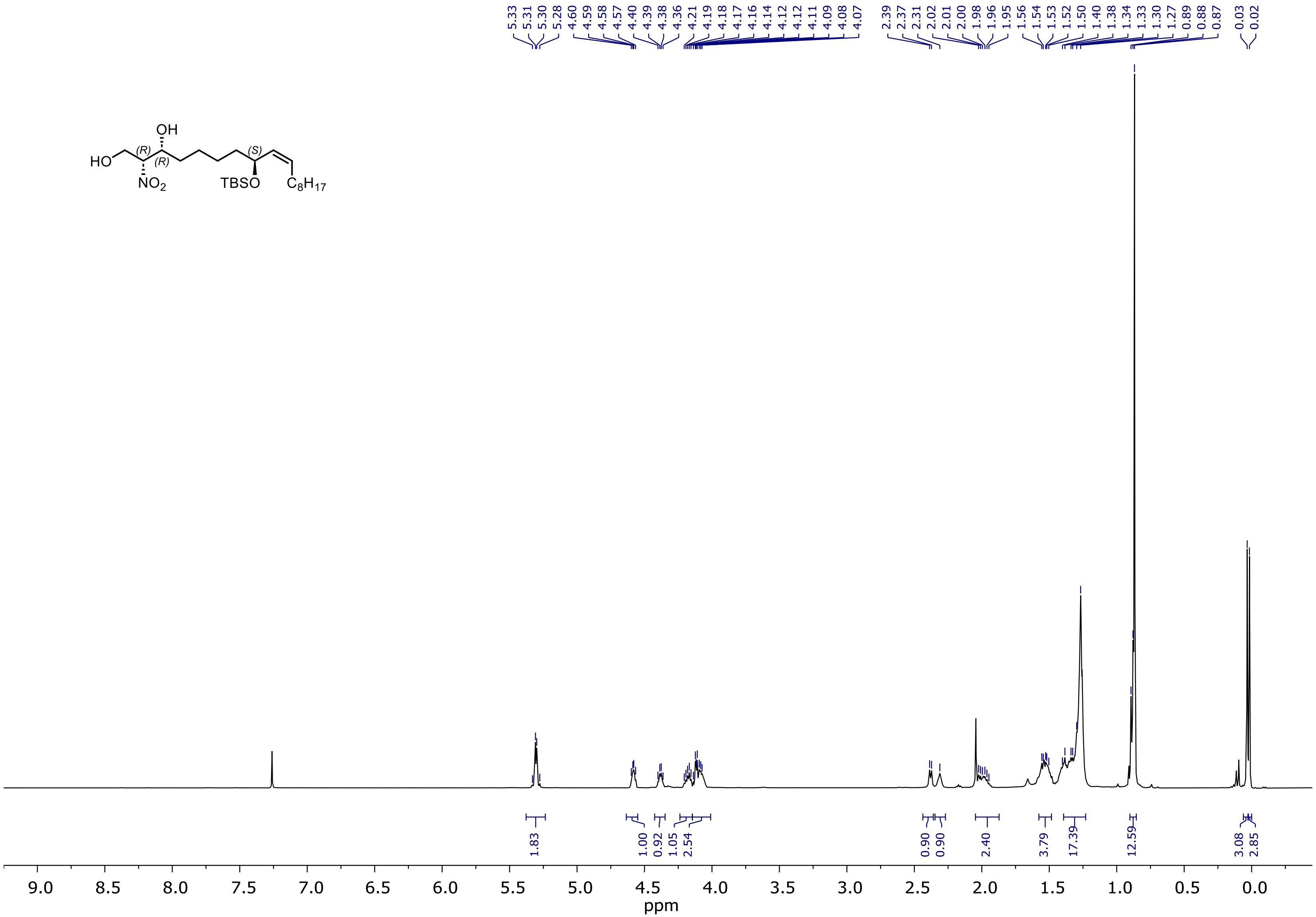


Figure S129 . ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*2R,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-47**.

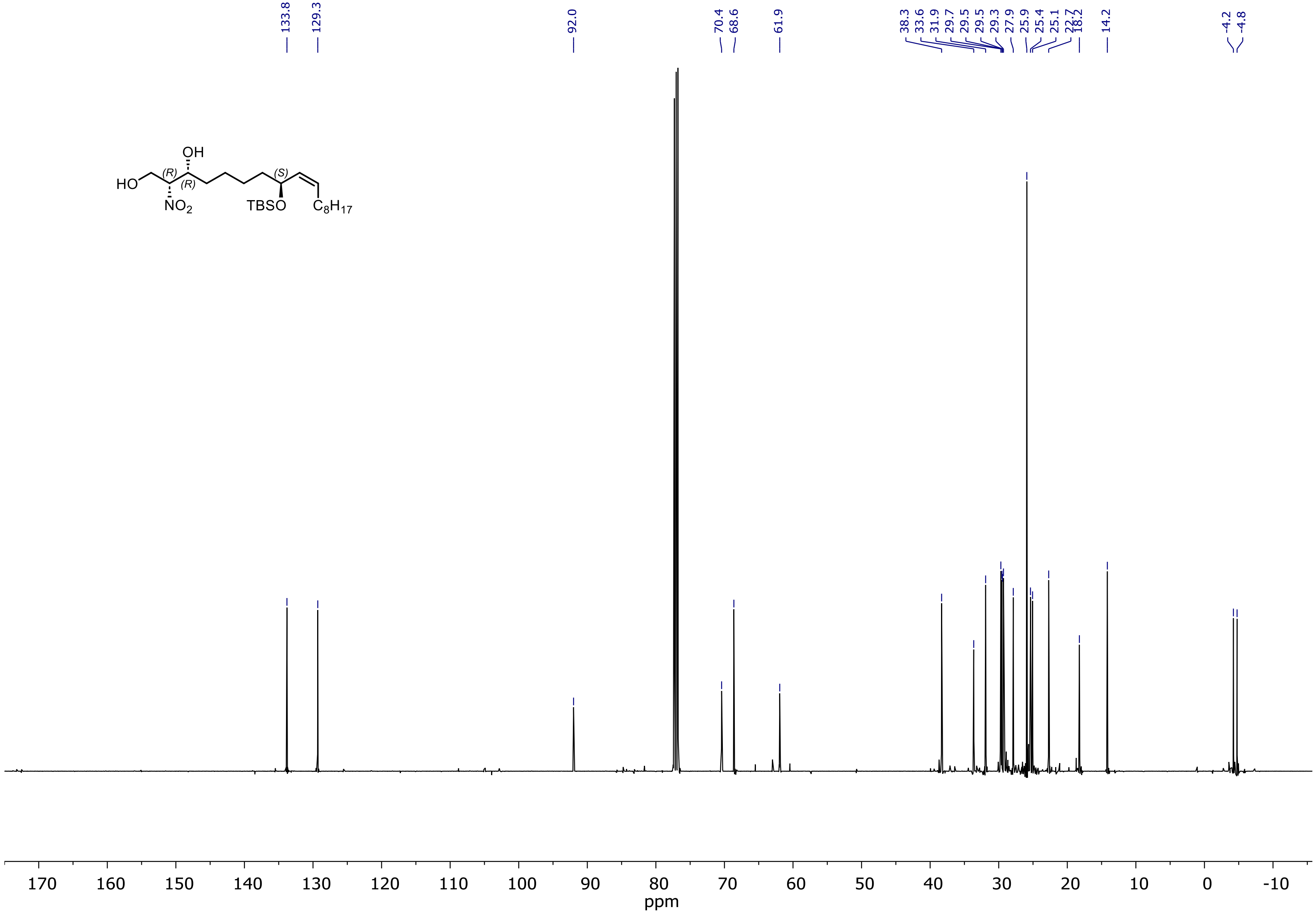


Figure S130. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*2R,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-47**.

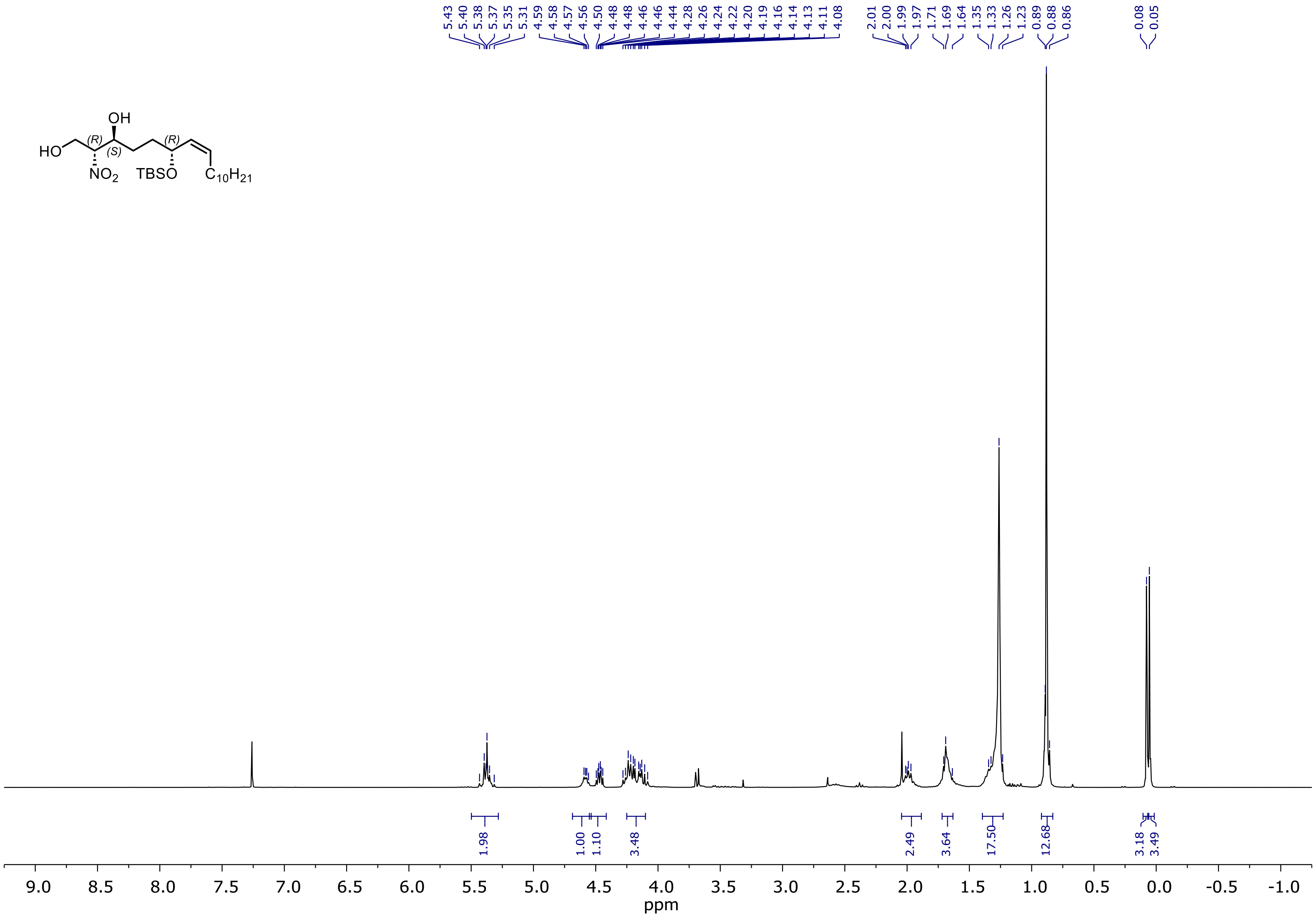


Figure S131. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*2R,3S,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **10**.

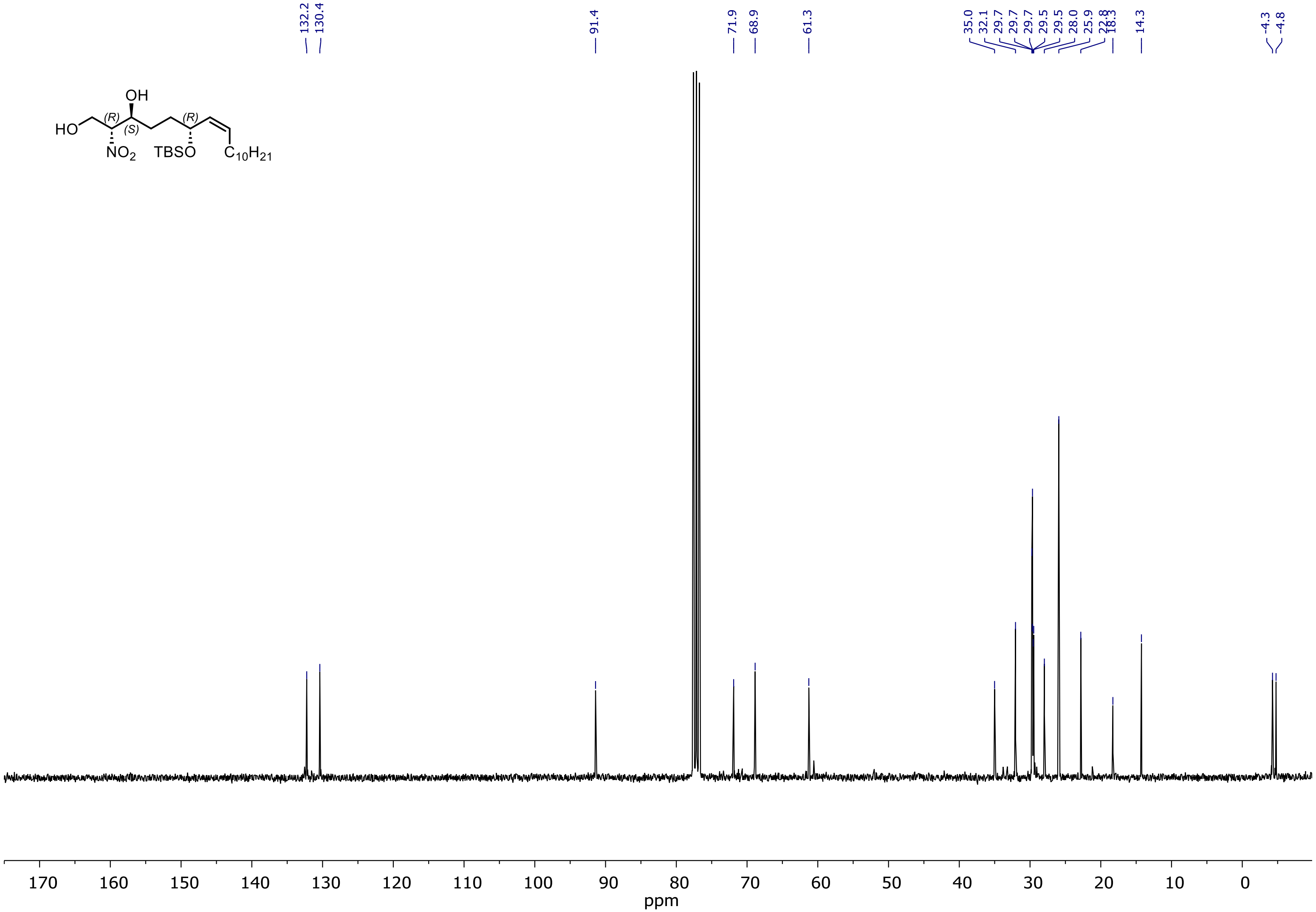


Figure S132. ${}^{13}C\{{}^{1}H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*2R,3S,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **10**.

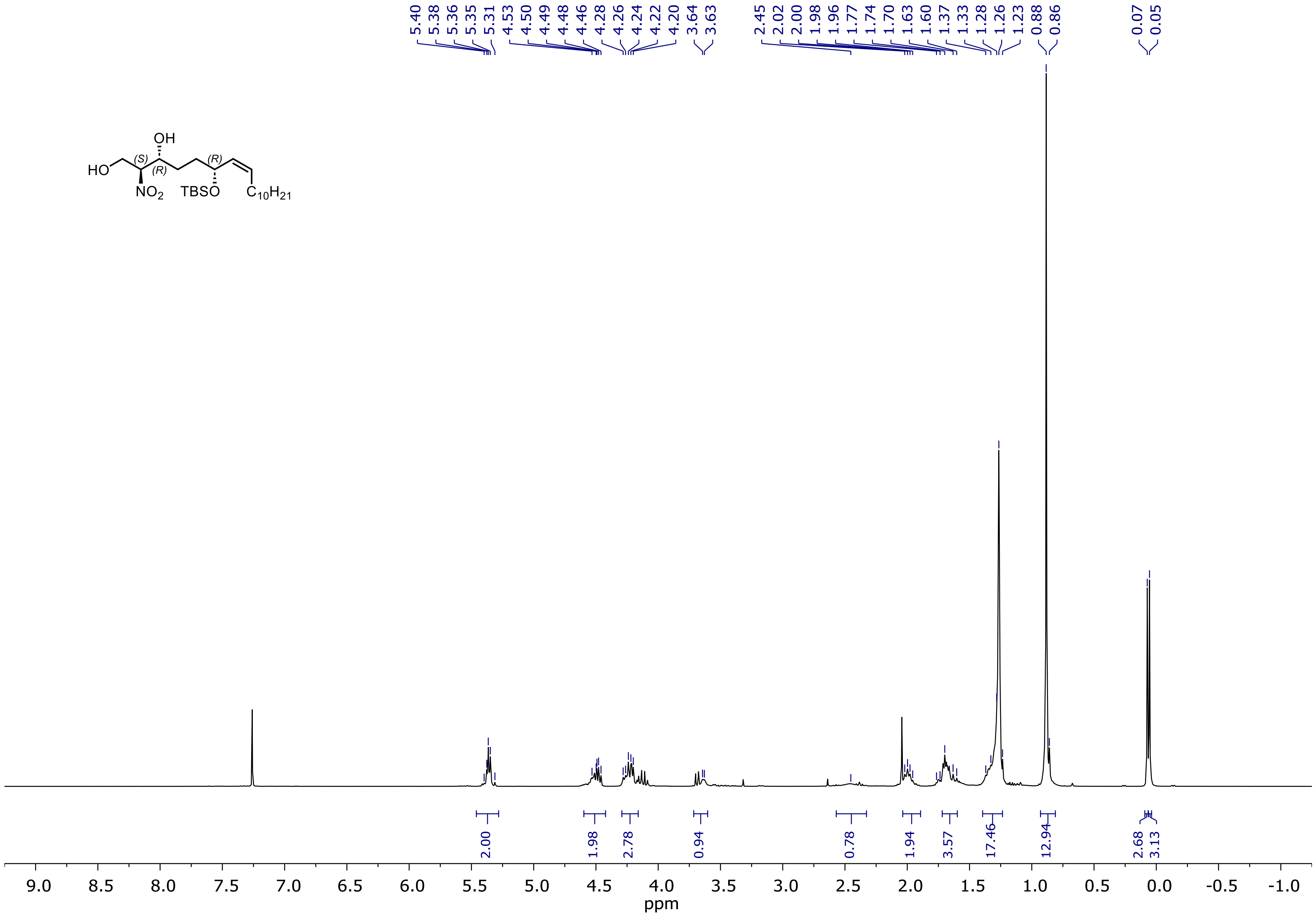

5.40
5.38
5.36
5.35
5.31
4.53
4.50
4.49
4.48
4.46
4.28
4.26
4.24
4.22
4.20
3.64
3.63
2.45
2.02
2.00
1.98
1.96
1.77
1.74
1.70
1.63
1.60
1.37
1.33
1.28
1.26
1.23
0.88
0.86
0.07
0.05
OH
HO
(S)
(R)
(R)
NO2
TBSO
C10H21
2.00
1.98
2.78
0.94
0.78
1.94
3.57
17.46
12.94
2.68
3.13
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
ppm

Figure S133. ^{1}H-NMR spectrum (300 MHz, $CDCl_3$) of (*2S,3R,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **11**.

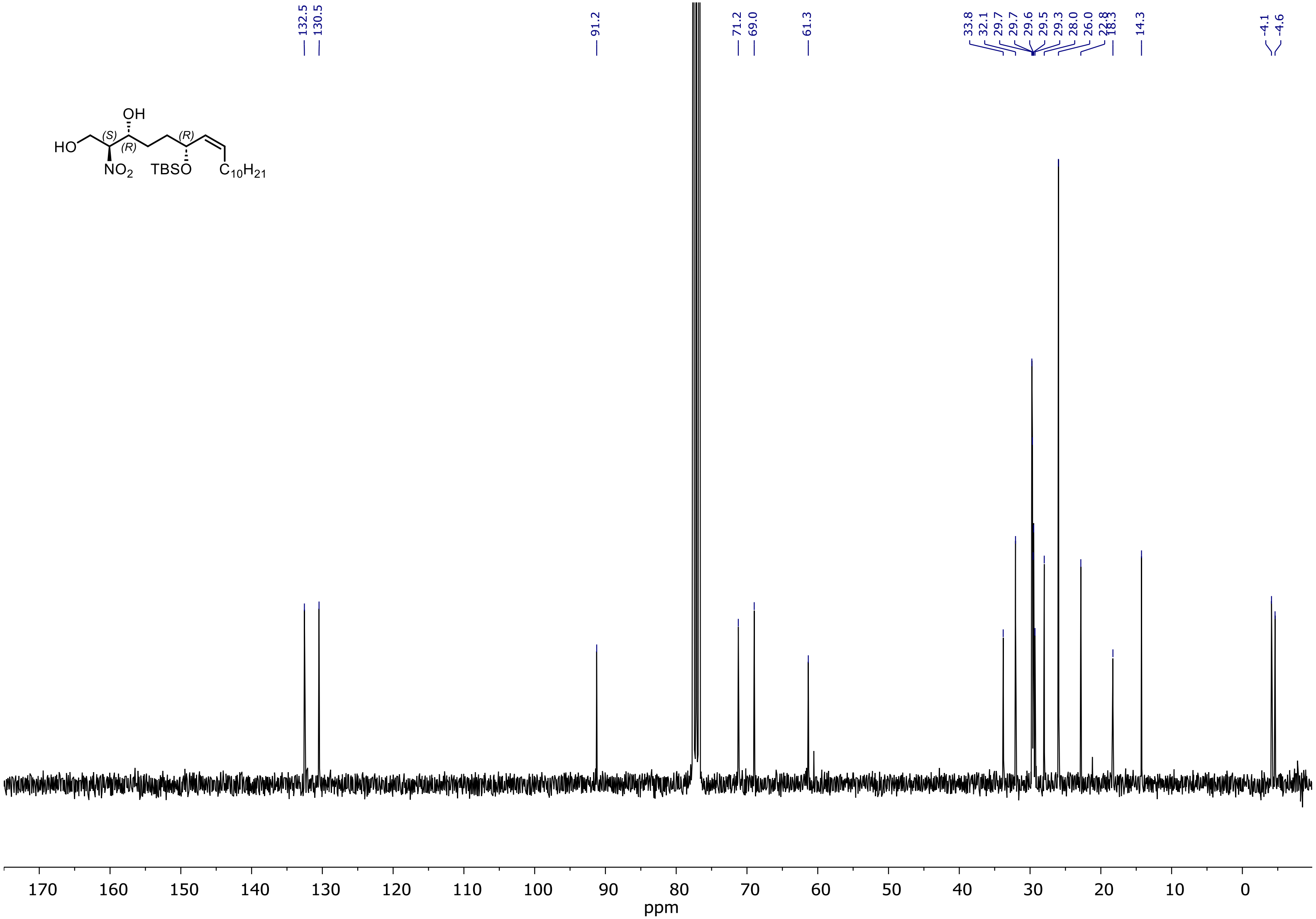


Figure S134. $^{13}C\{^1H\}$-NMR spectrum (75 MHz, $CDCl_3$) of (*2S,3R,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **11**.

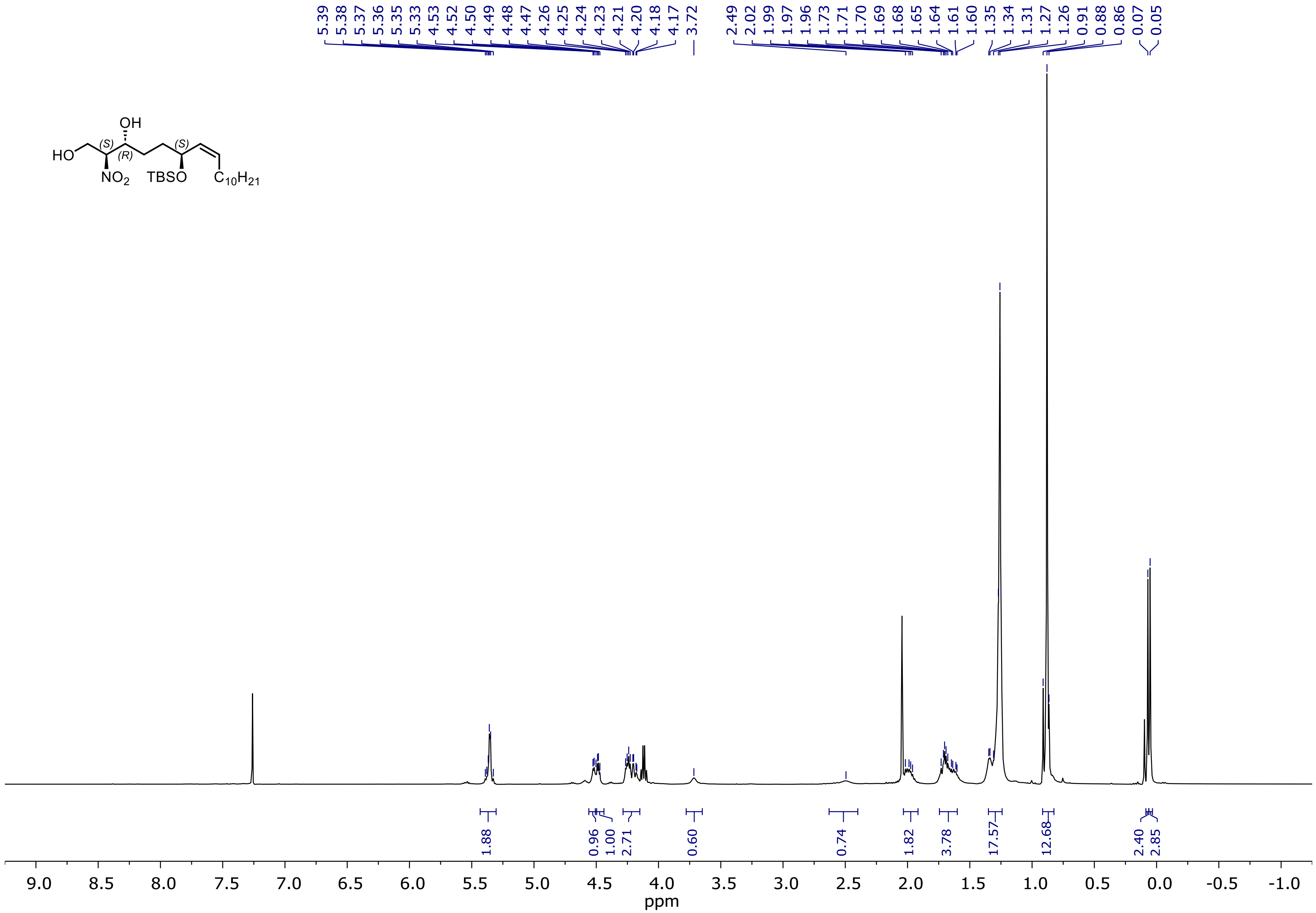


Figure S135. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2S,3R,6S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-48**.

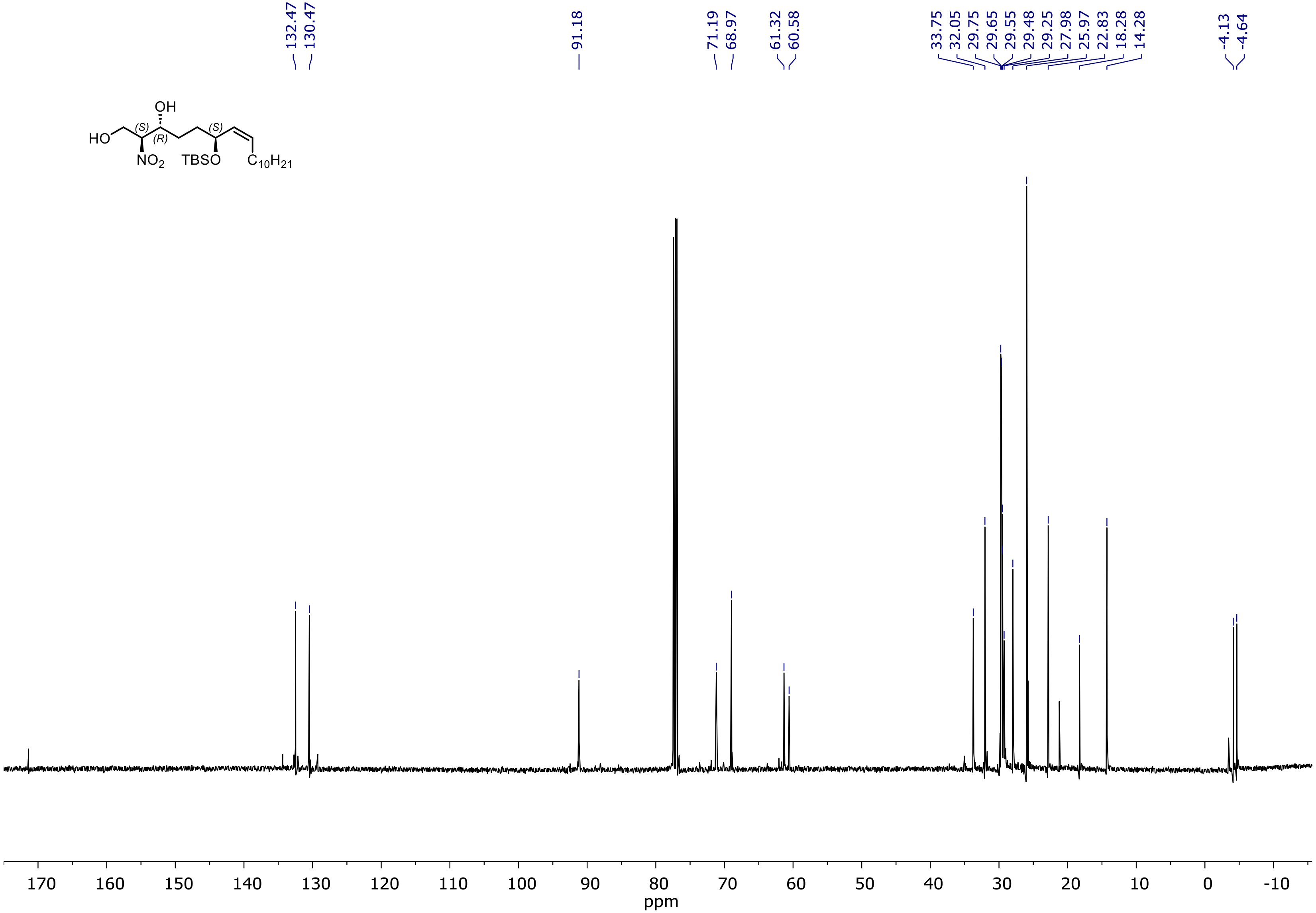


Figure S136. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S,3R,6S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-48**.

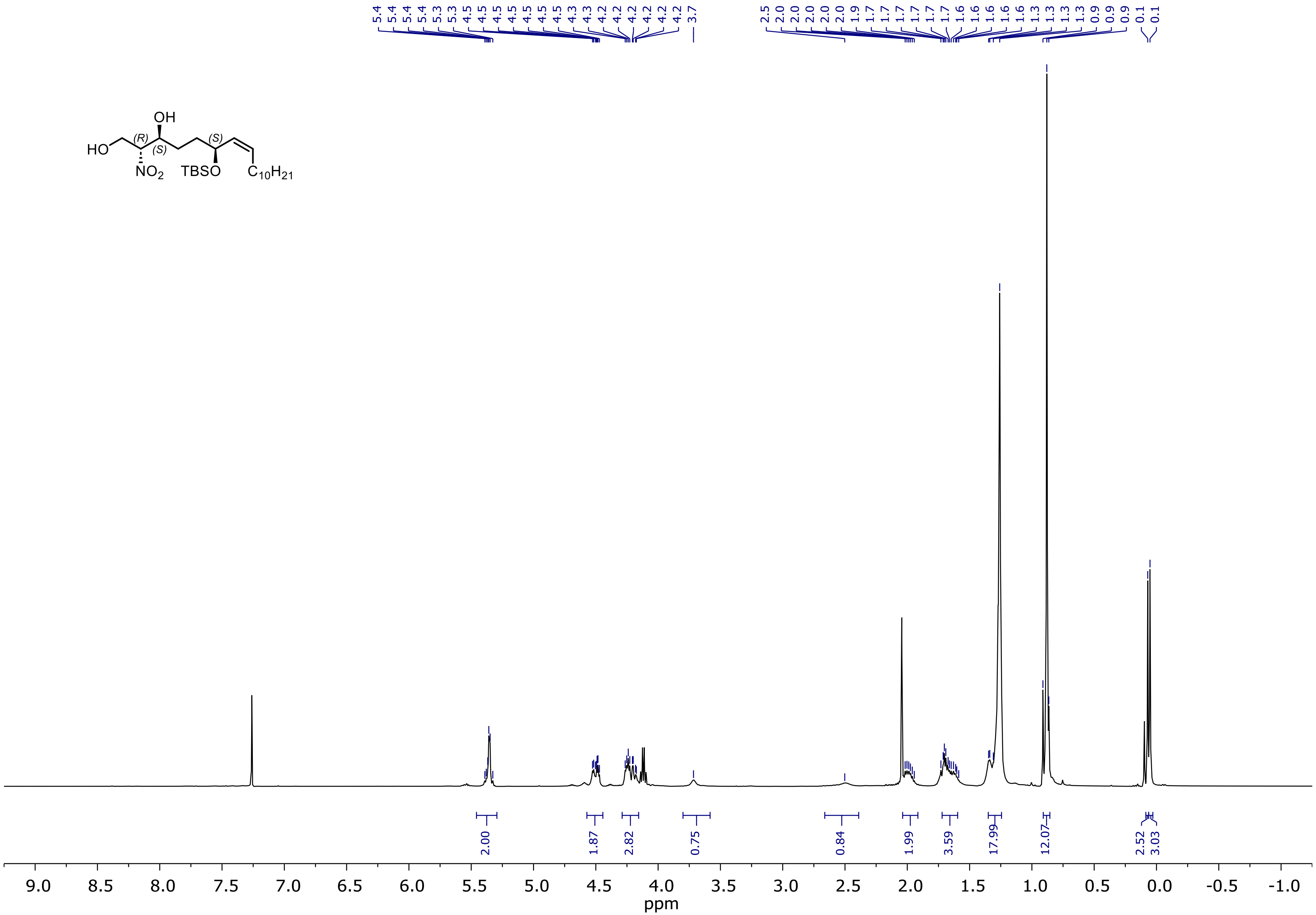


Figure S137. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2R,3S,6S,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-49**.

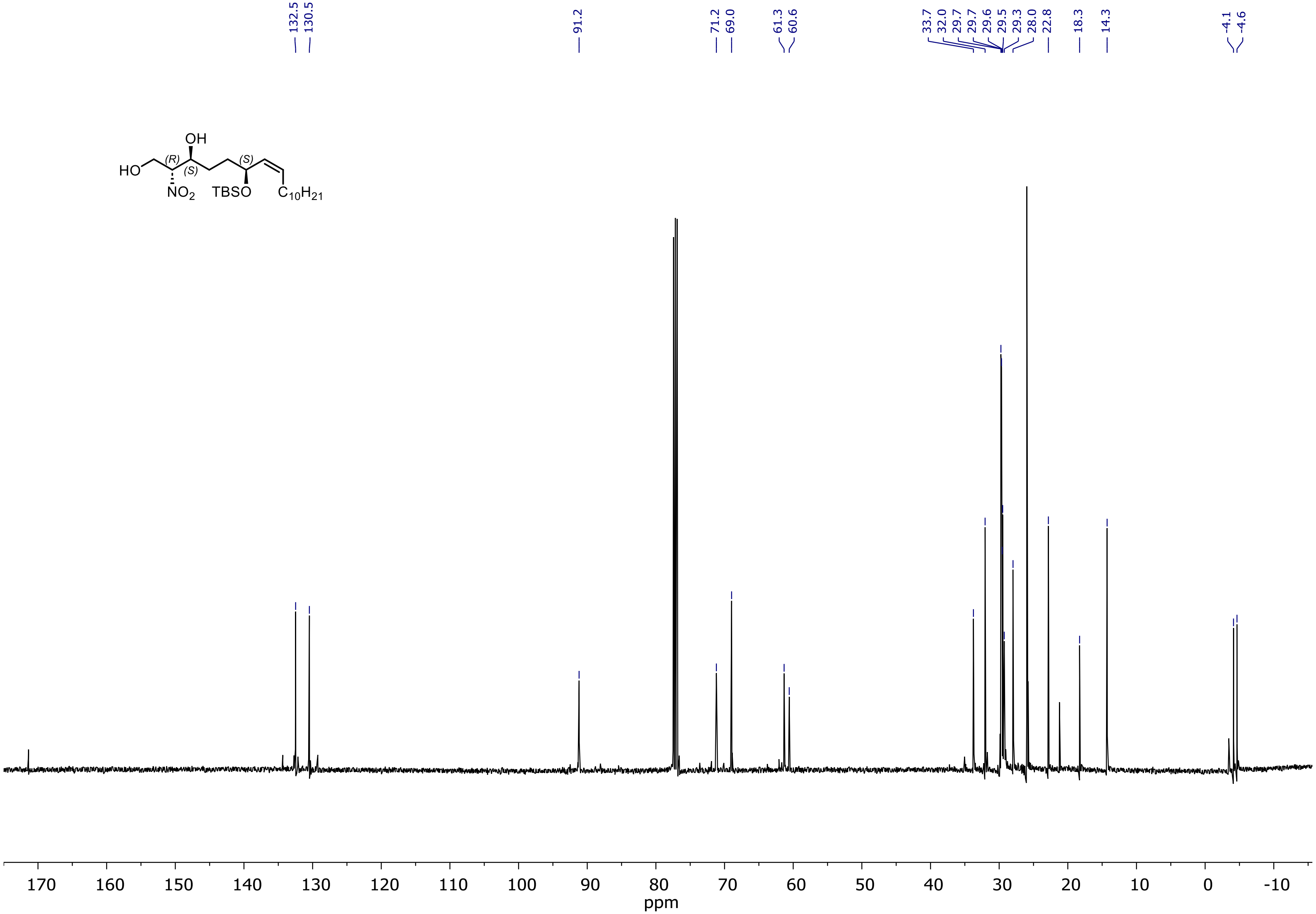


Figure S138. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S,3R,6R,Z*)-6-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-49**.

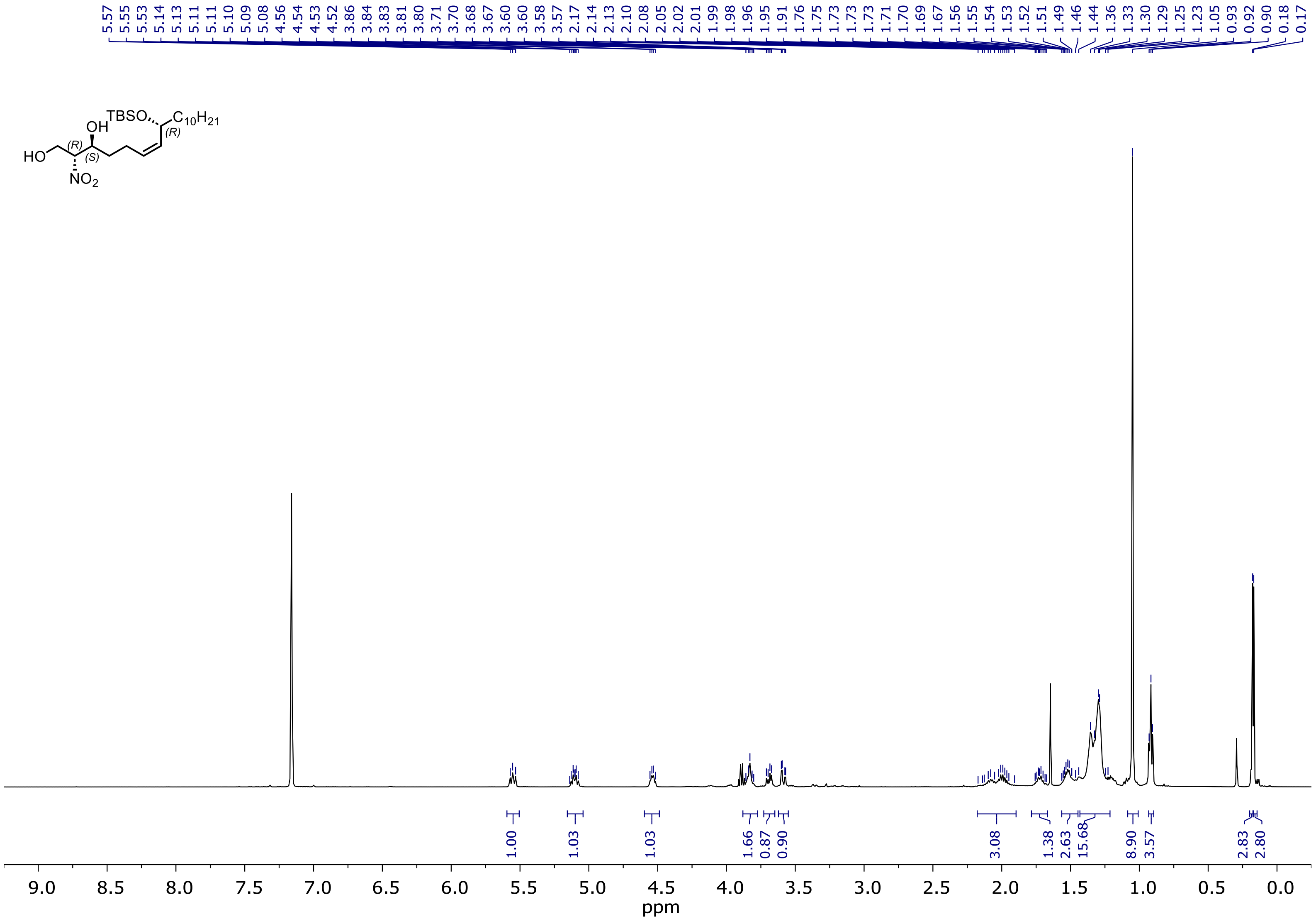


Figure S139. ^{1}H-NMR spectrum (500 MHz, C_6D_6) of (*2R,3S,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-50**.

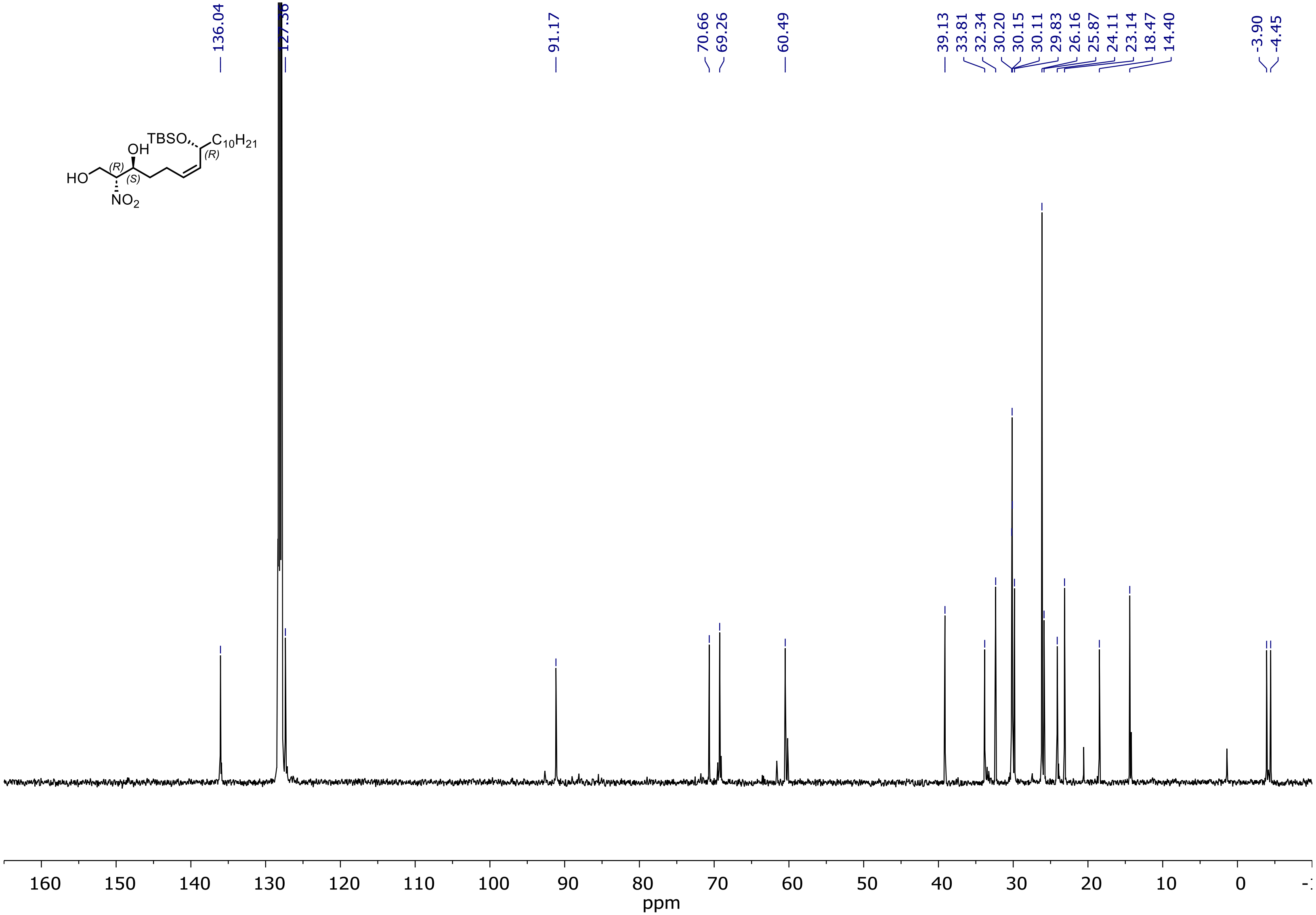


Figure S140. ^{13}C{^{1}H}-NMR spectrum (126 MHz, C_6D_6) of (*2R,3S,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-50**.

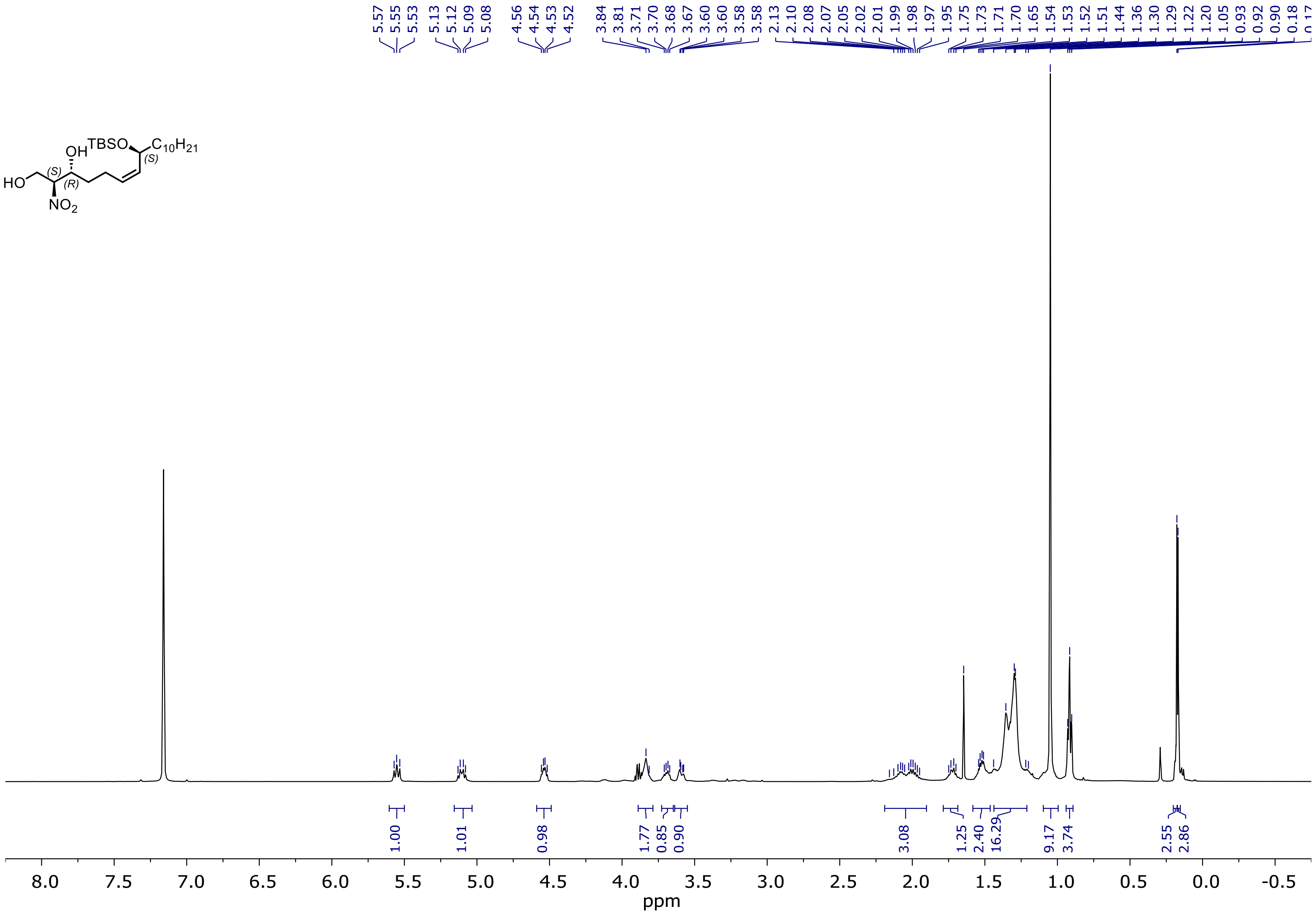


Figure S141. ^{1}H-NMR spectrum (500 MHz, C_6D_6) of (*2S,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-51**.

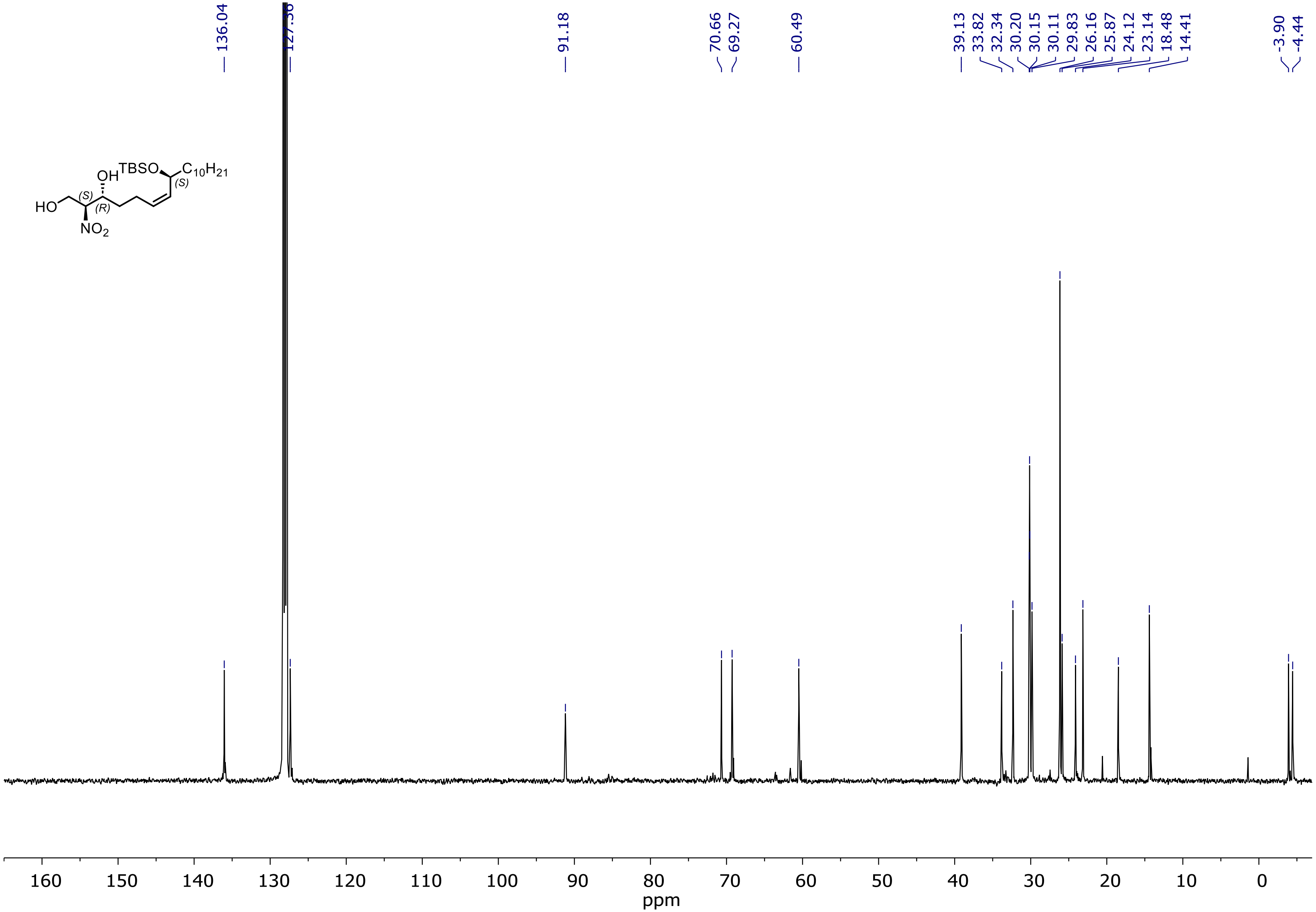


Figure S142. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, C_6D_6) of (*2S,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-51**.

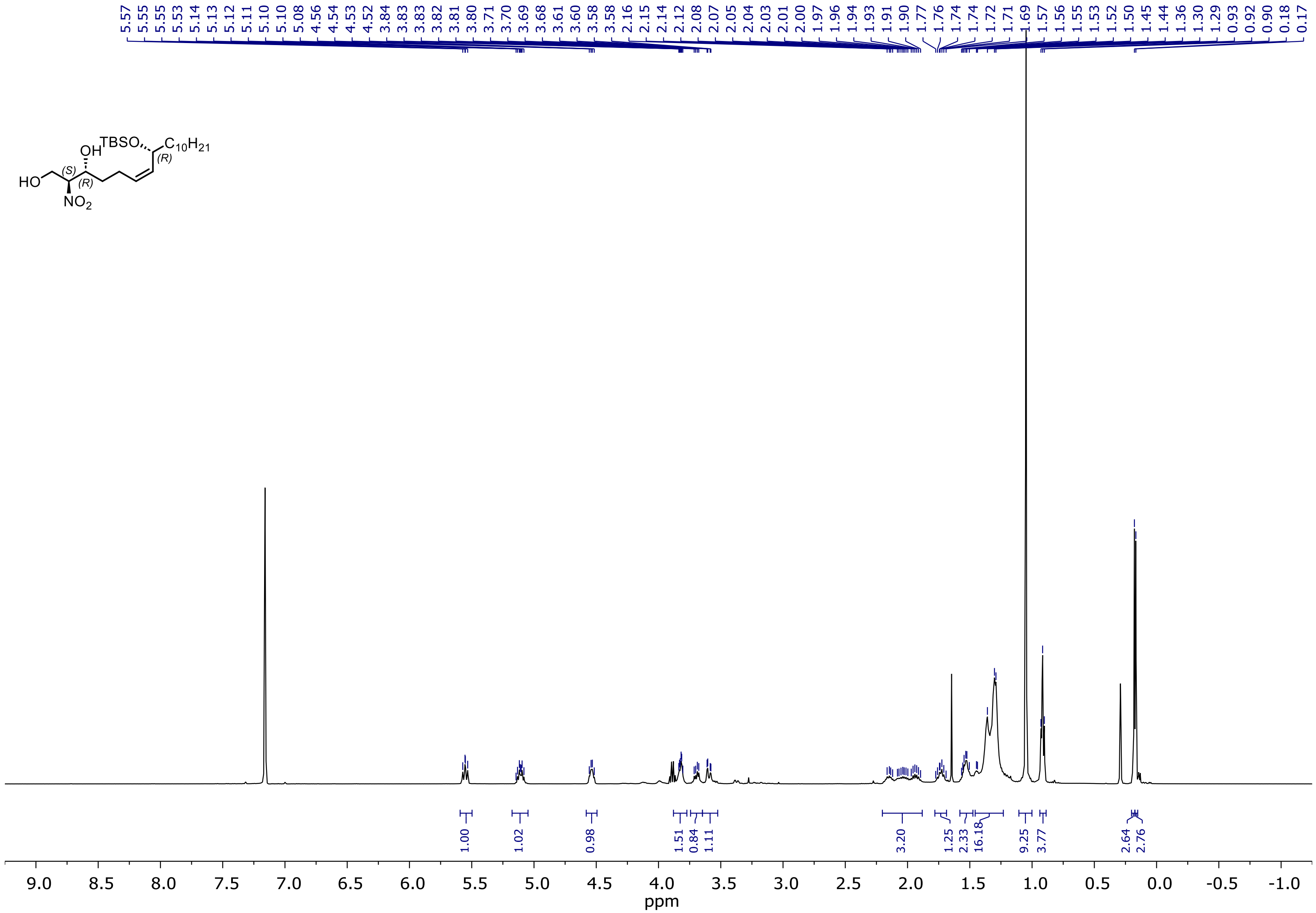


Figure S143. ^{1}H-NMR spectrum (500 MHz, C$_6$D$_6$) of (*2S,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-52**.

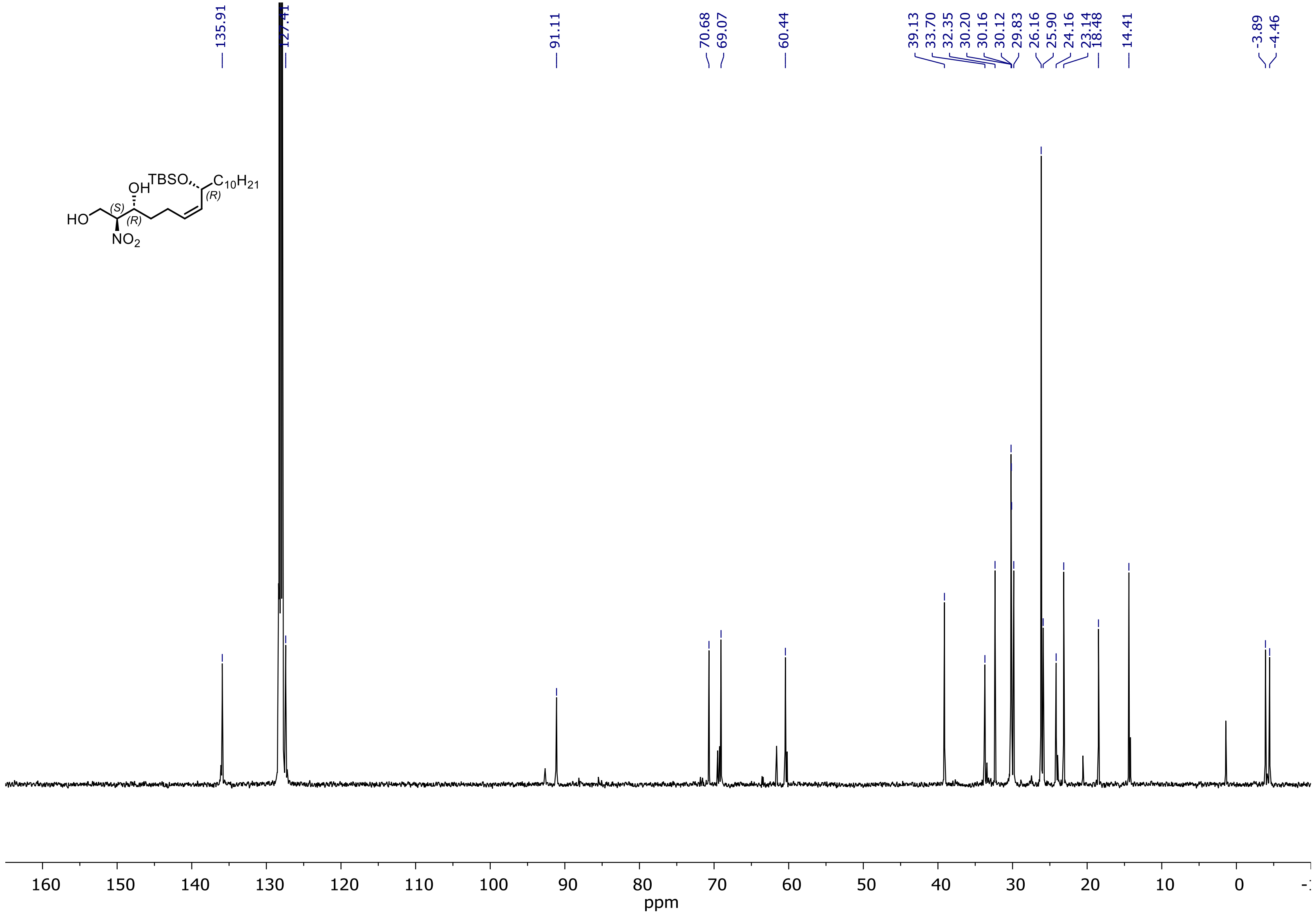


Figure S144. ^{13}C{^{1}H}-NMR spectrum (126 MHz, C_6D_6) of (*2S,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-52**.

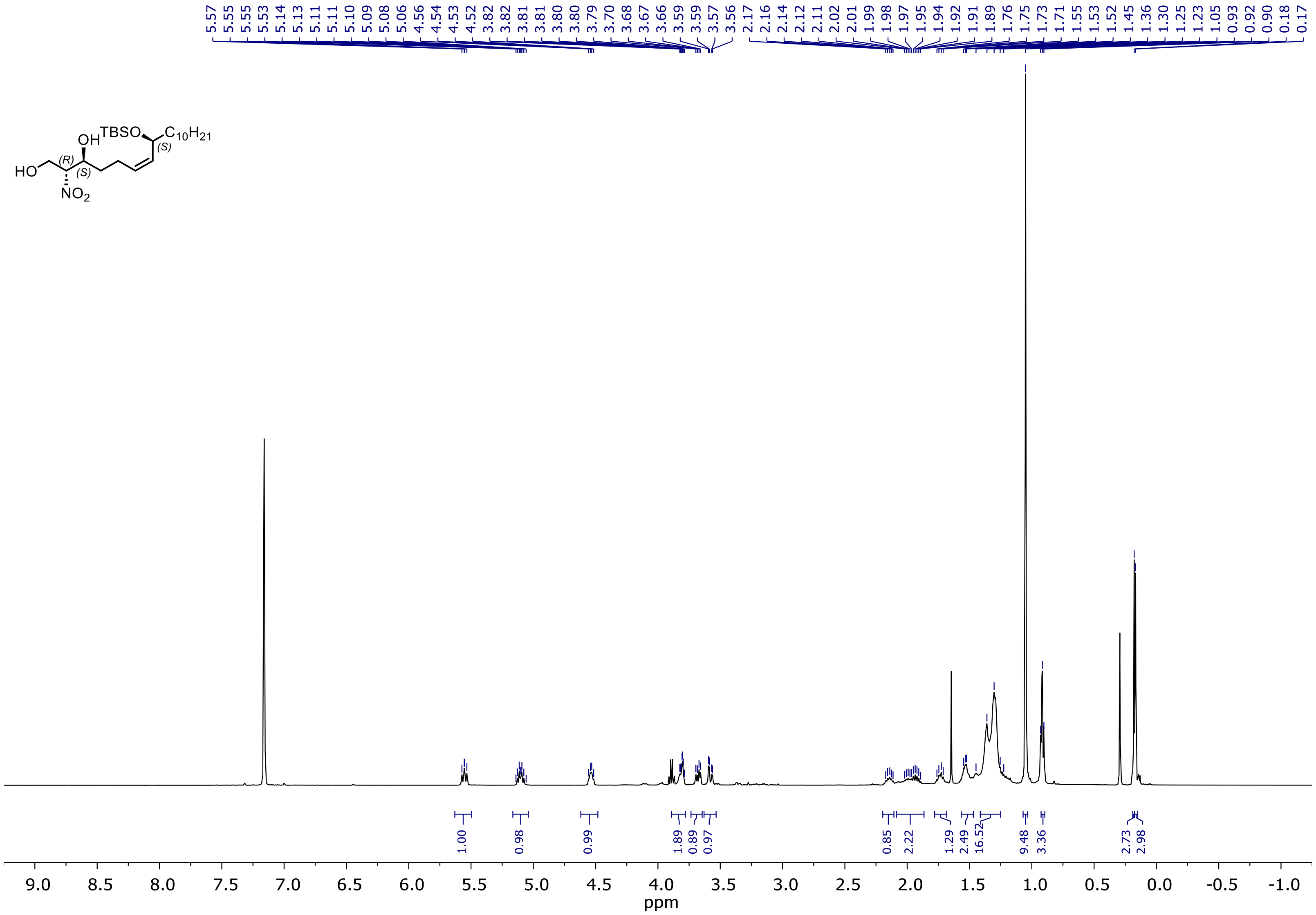


Figure S145. ^{1}H-NMR spectrum (500 MHz, C_6D_6) of (*2R,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-53**.

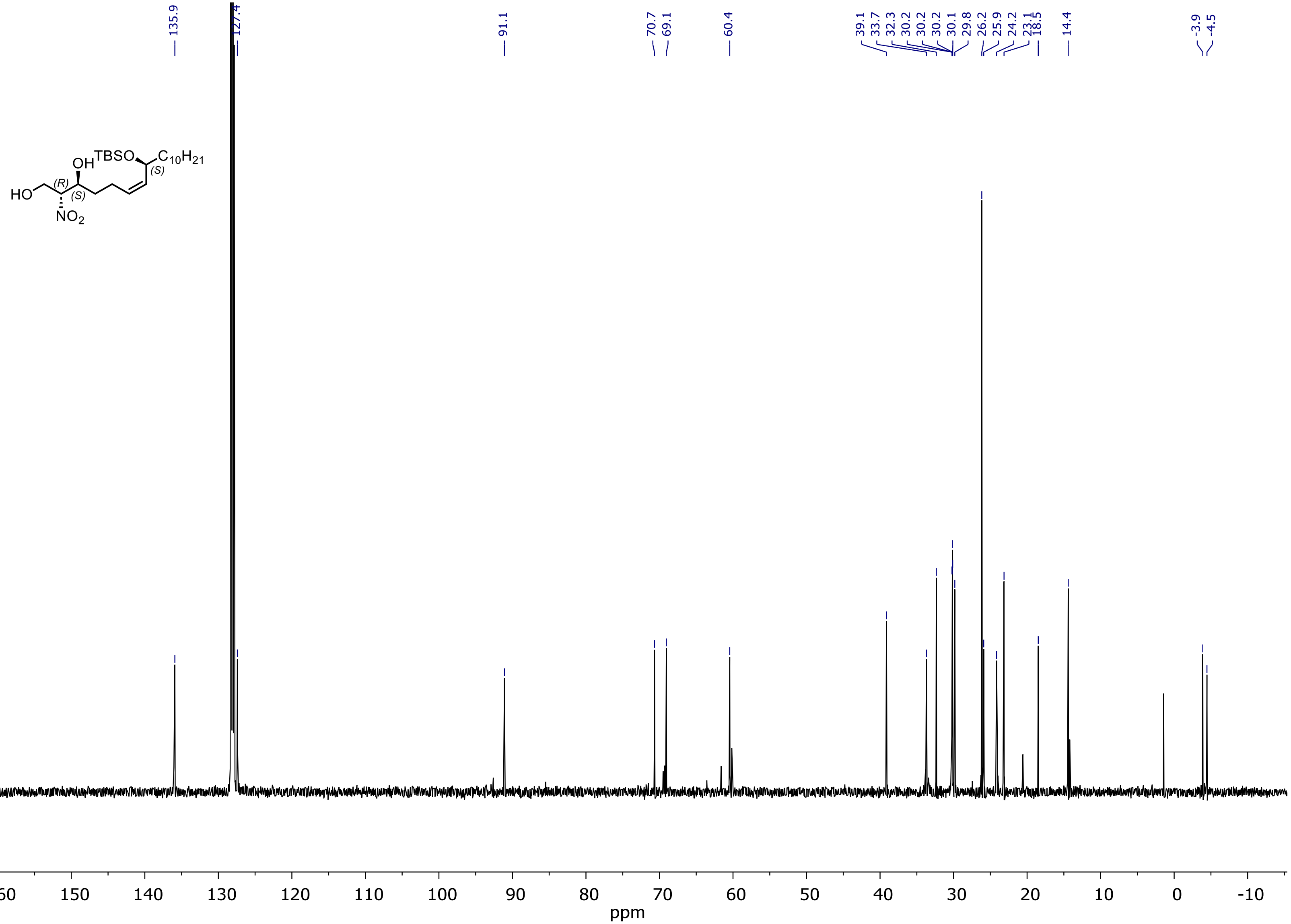


Figure S146. ^{13}C{^{1}H}-NMR spectrum (126 MHz, C_6D_6) of (*2R,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-6-ene-1,3-diol **SI-53**.

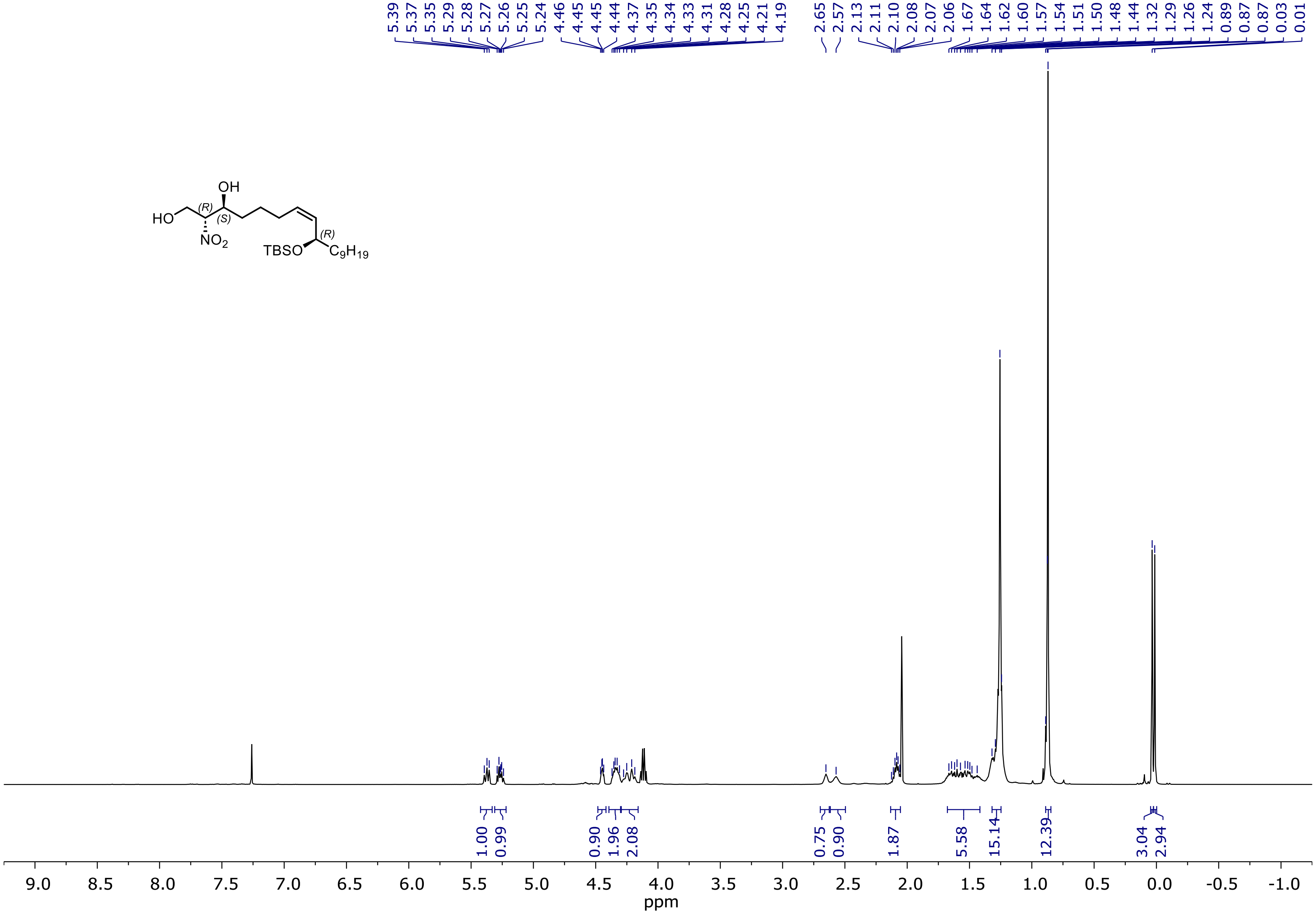


Figure S147. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*2R,3S,9R,Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-54**.

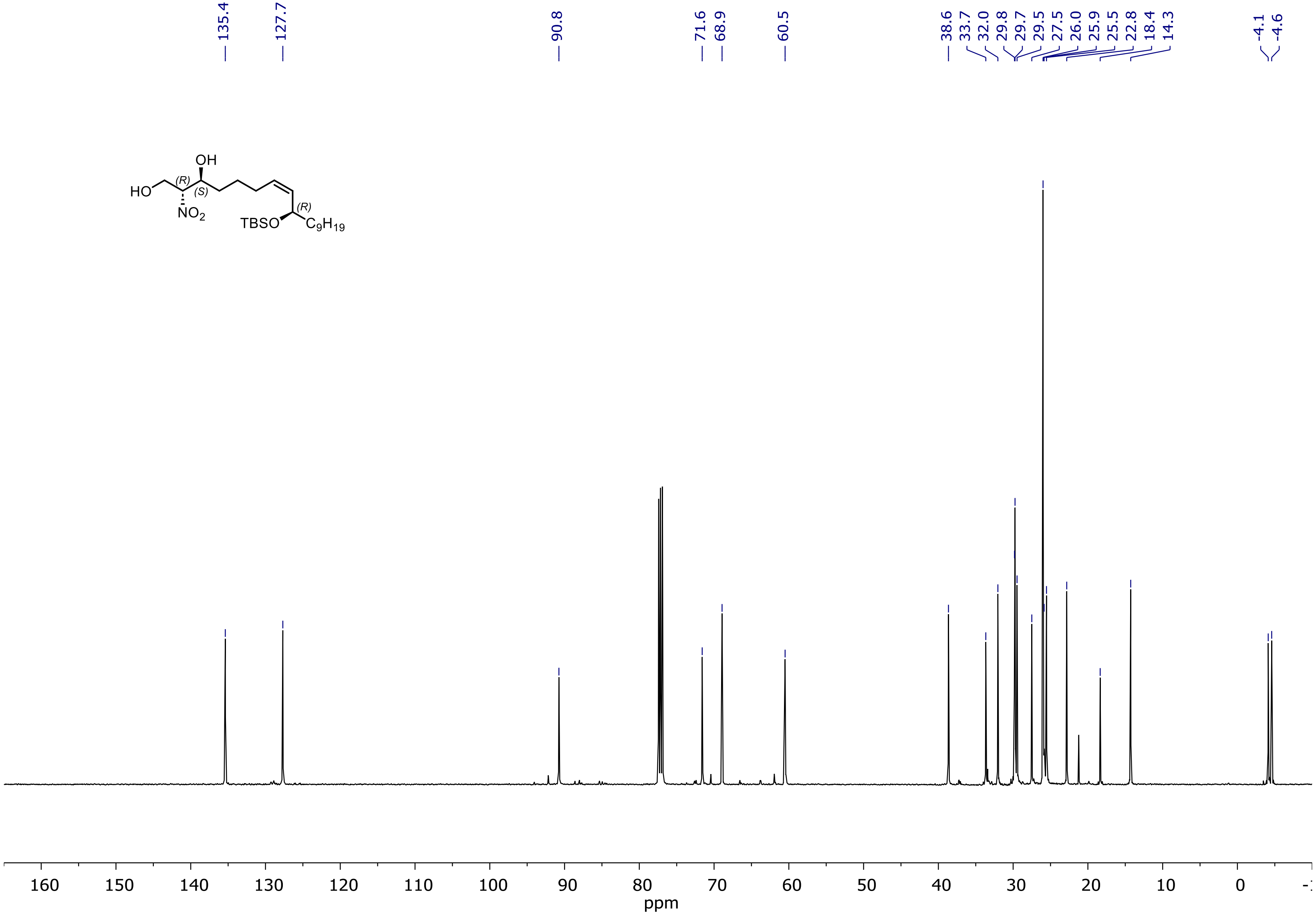


Figure S148. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*2R,3S,9R,Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-54**.

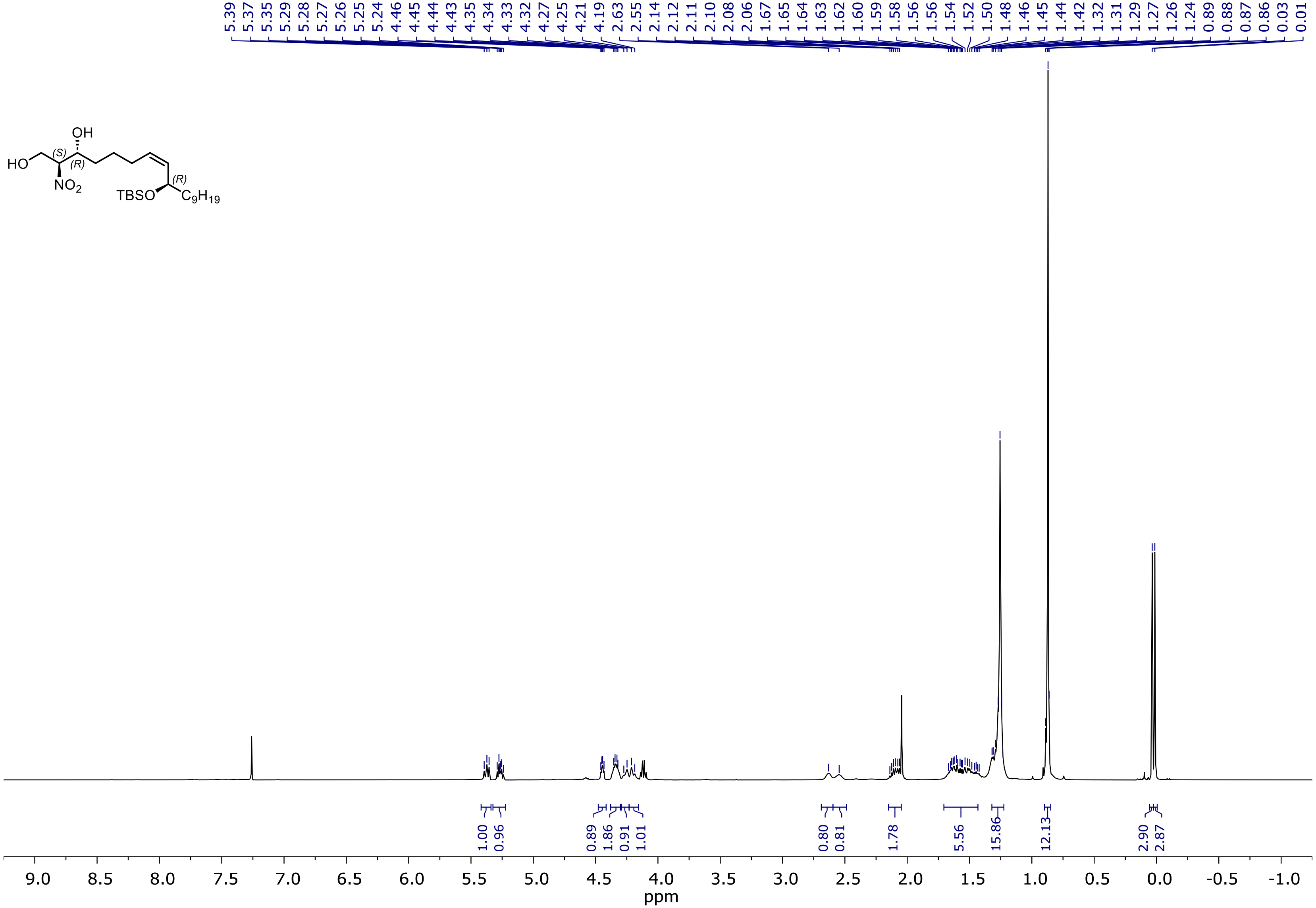


Figure S149. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2S,3R,9R,Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-55**.

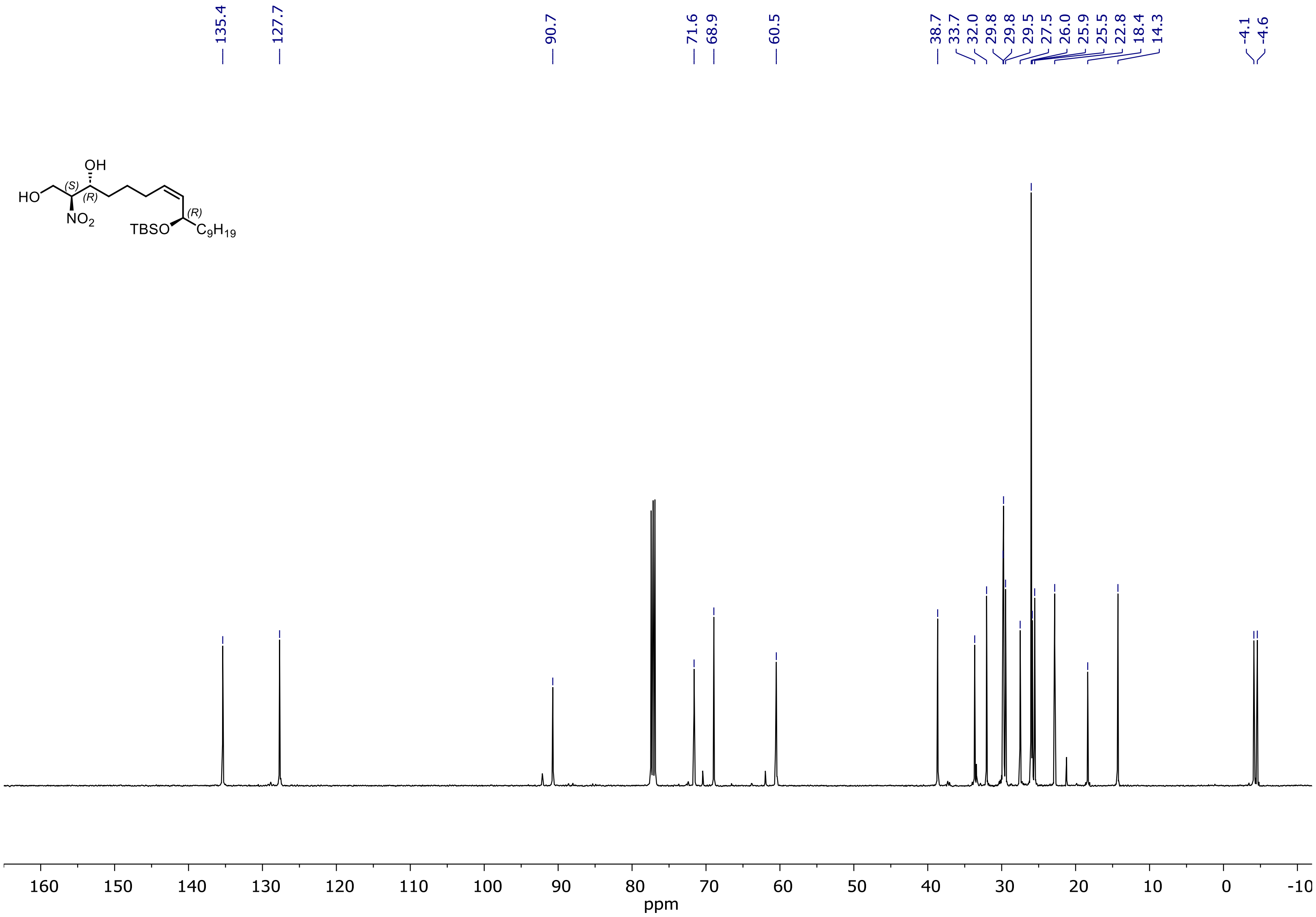


Figure S150. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S,3R,9R,Z*)-9-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-7-ene-1,3-diol **SI-55**.

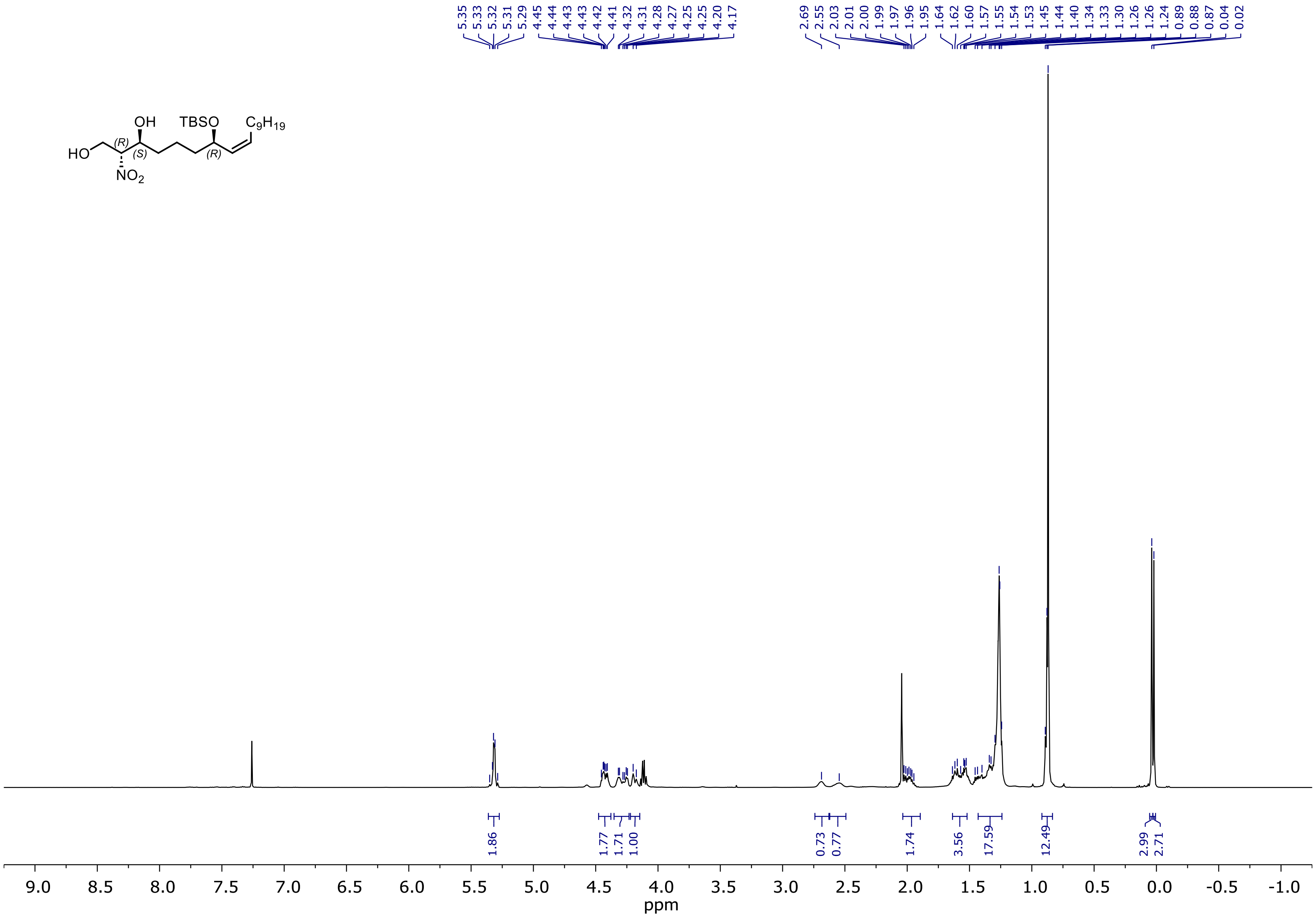


Figure S151. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2R,3S,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol **SI-56**.

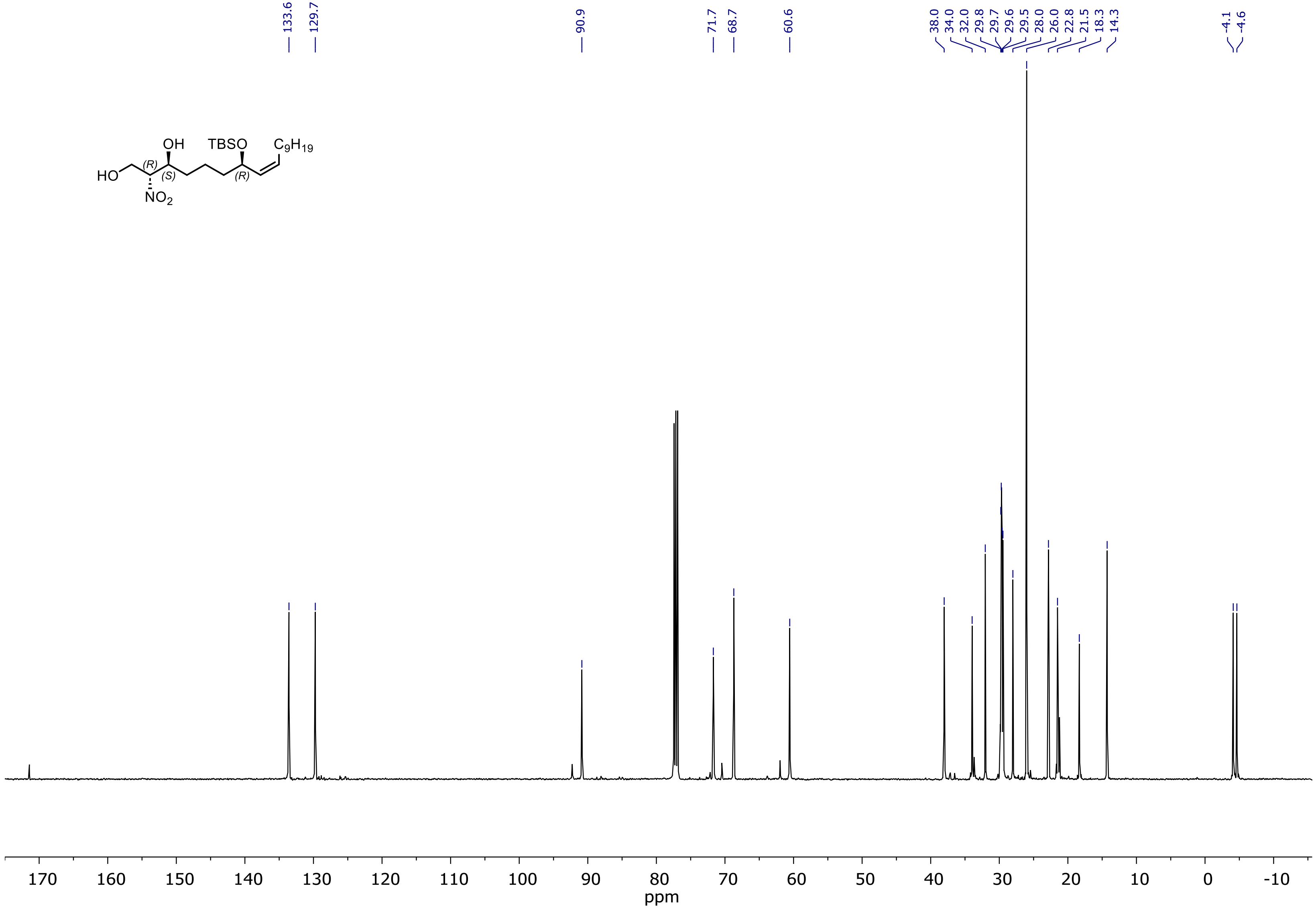


Figure S152. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2R,3S,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol **SI-56**.

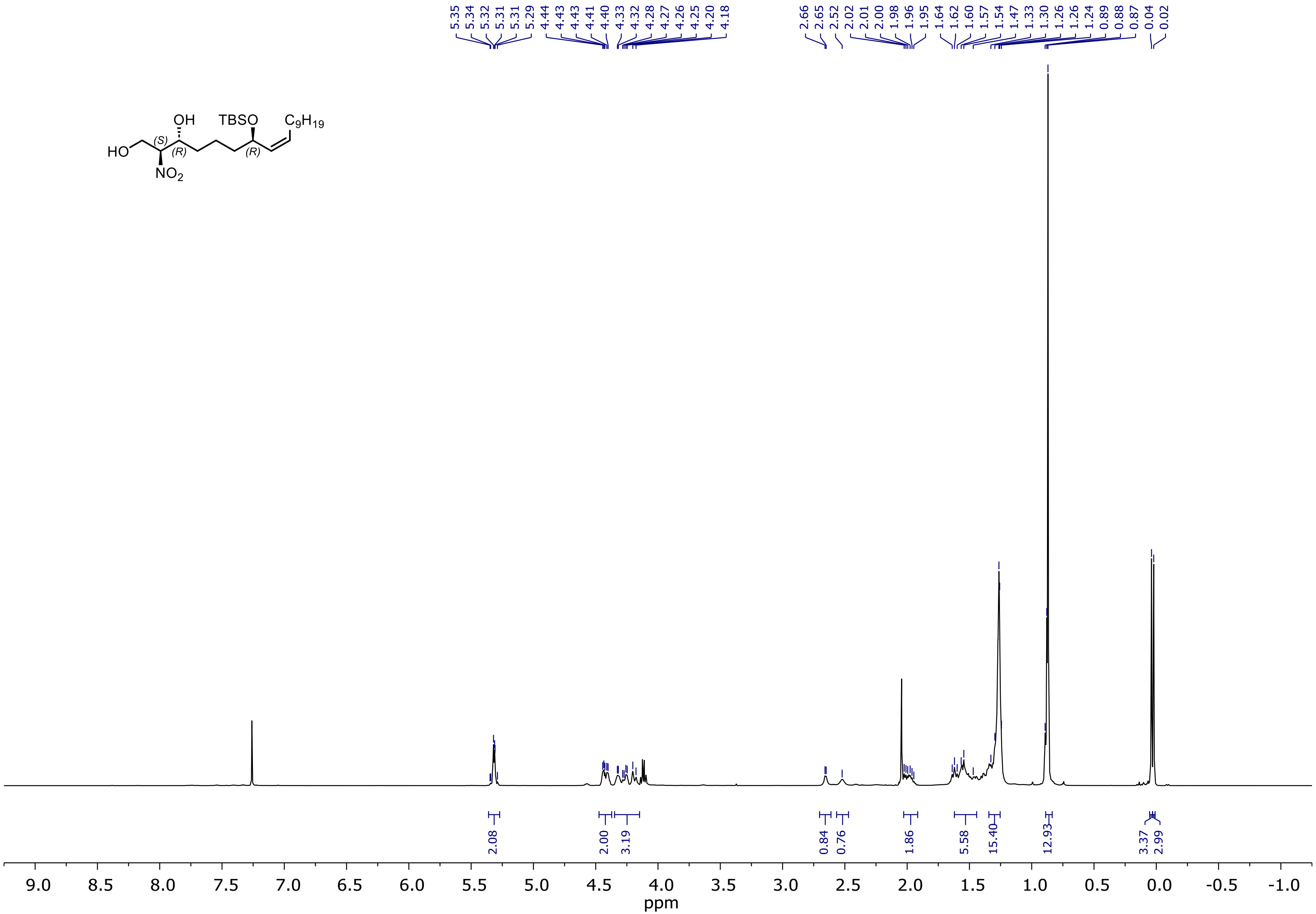


Figure S153. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2S,3R,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol **SI-57**.

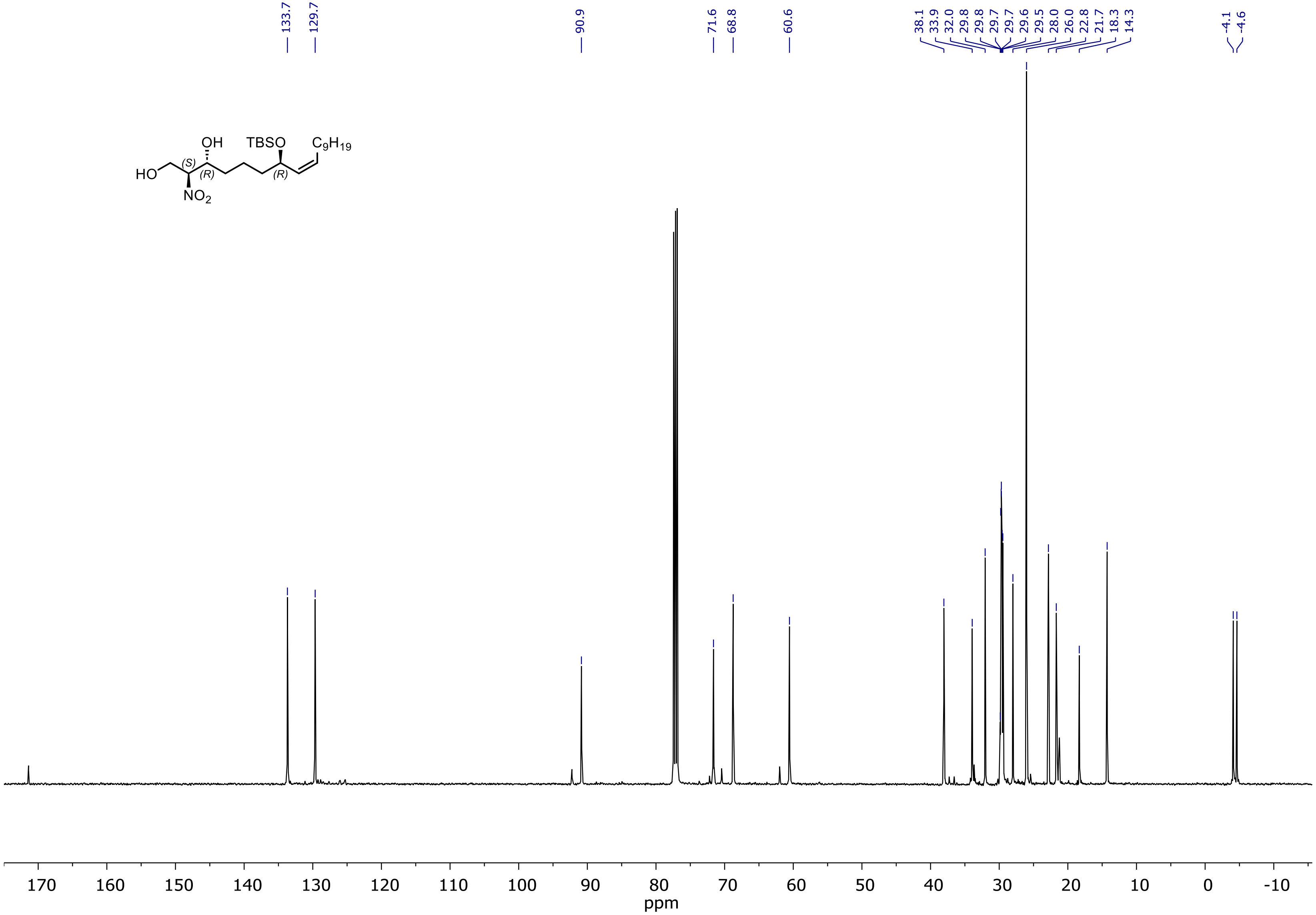


Figure S154. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S,3R,7R,Z*)-7-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-8-ene-1,3-diol **SI-57**.

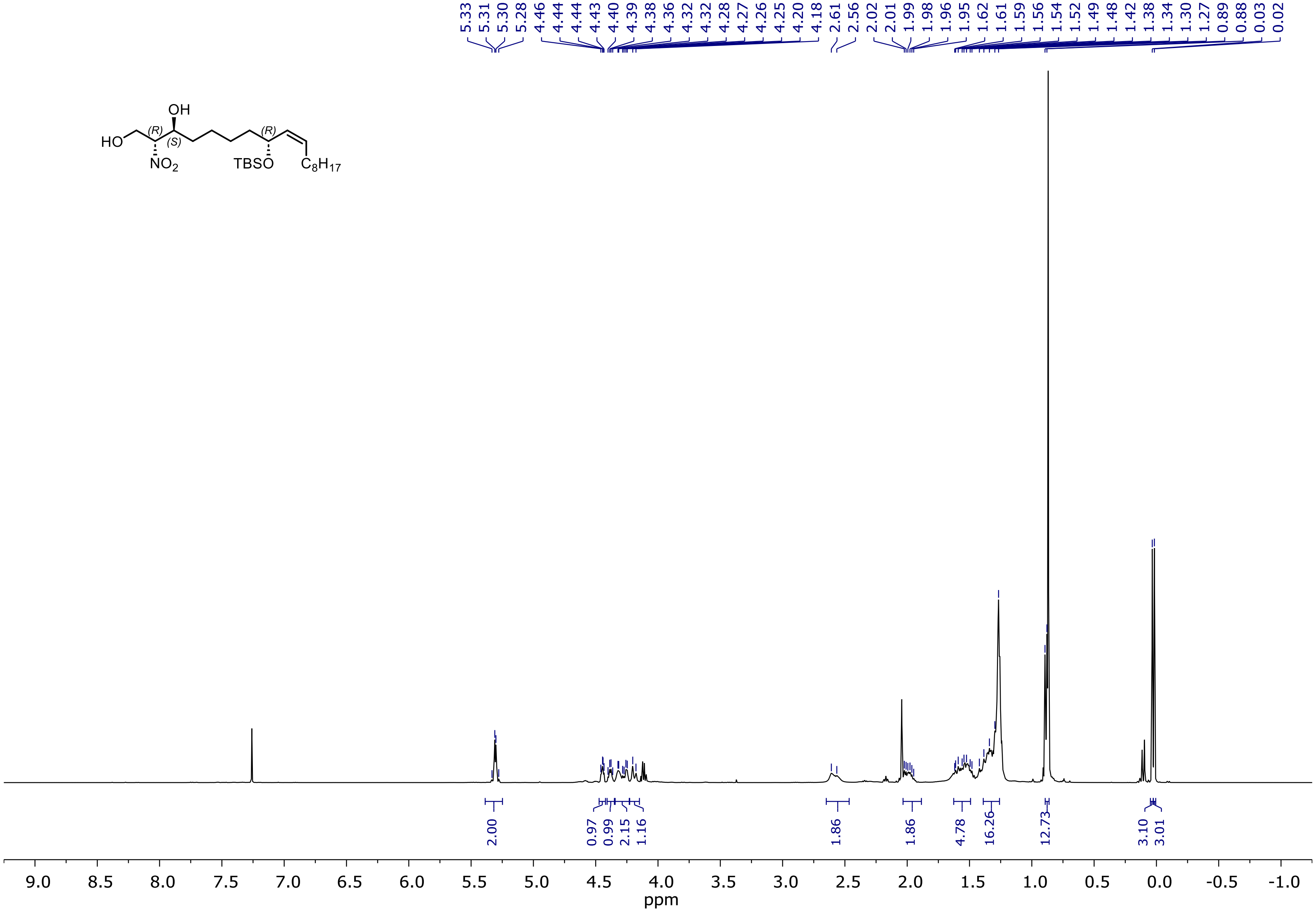


Figure S155. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2R,3S,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-58**.

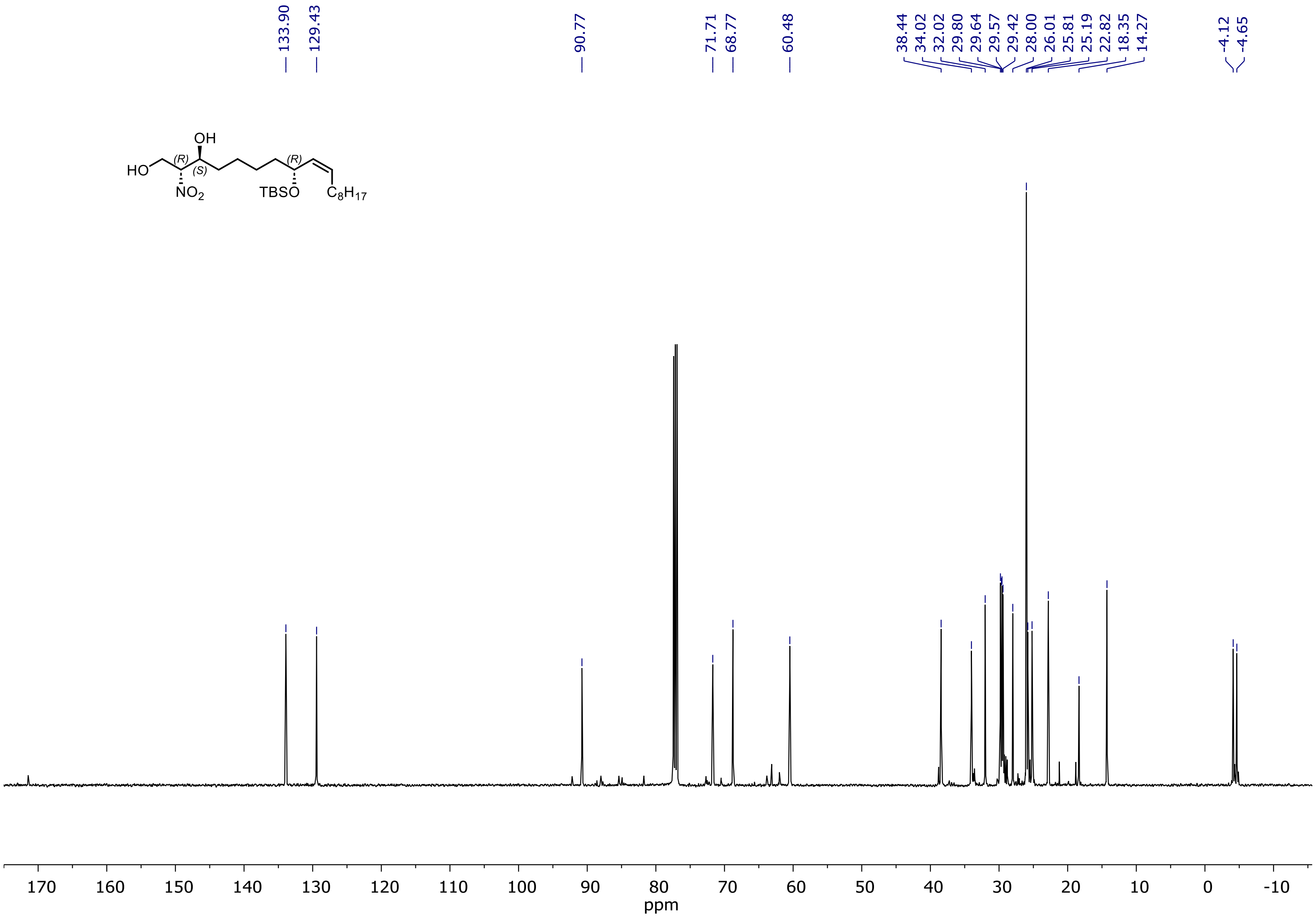


Figure S156. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2R,3S,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-58**.

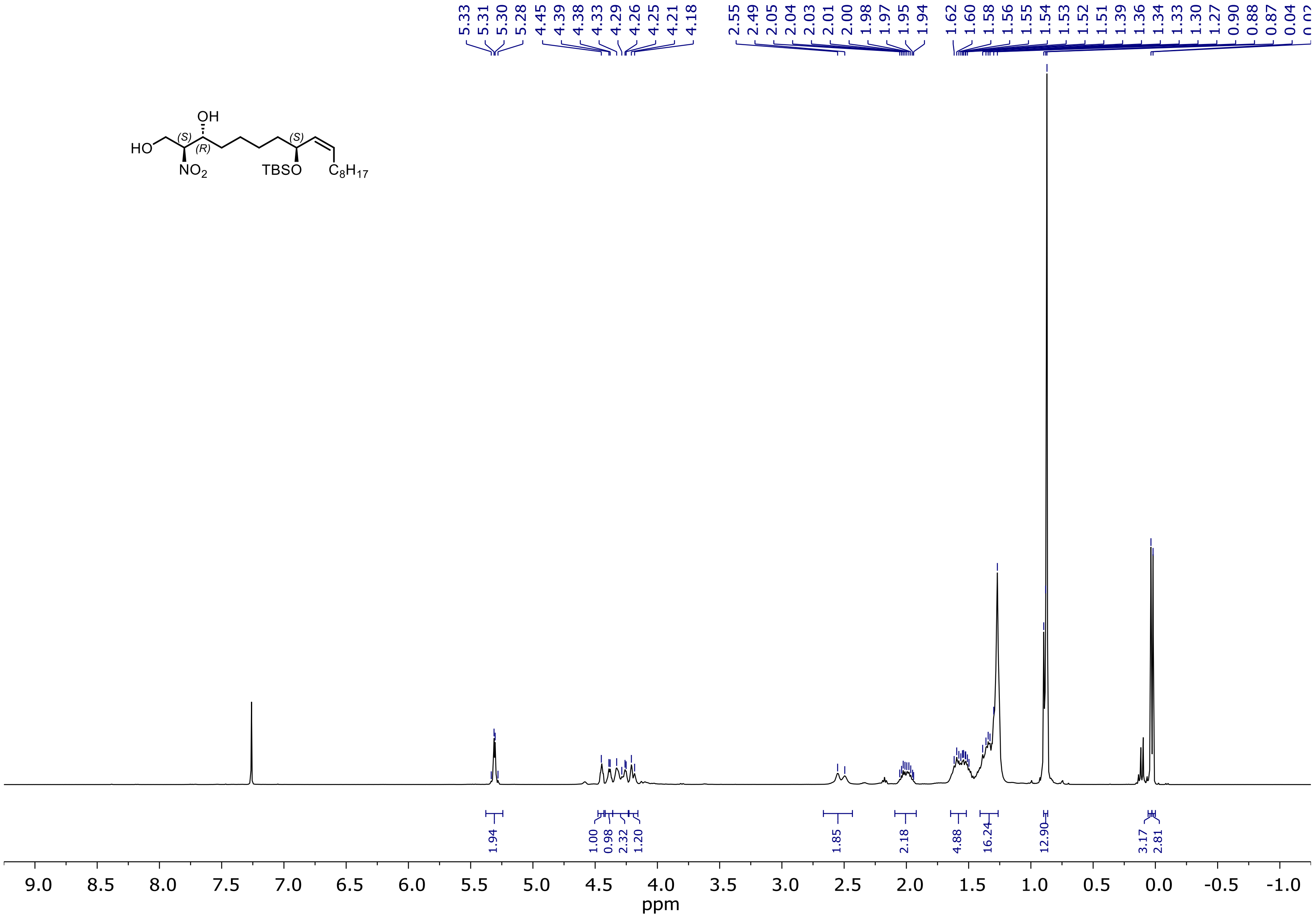


Figure S157. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2S,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-59**.

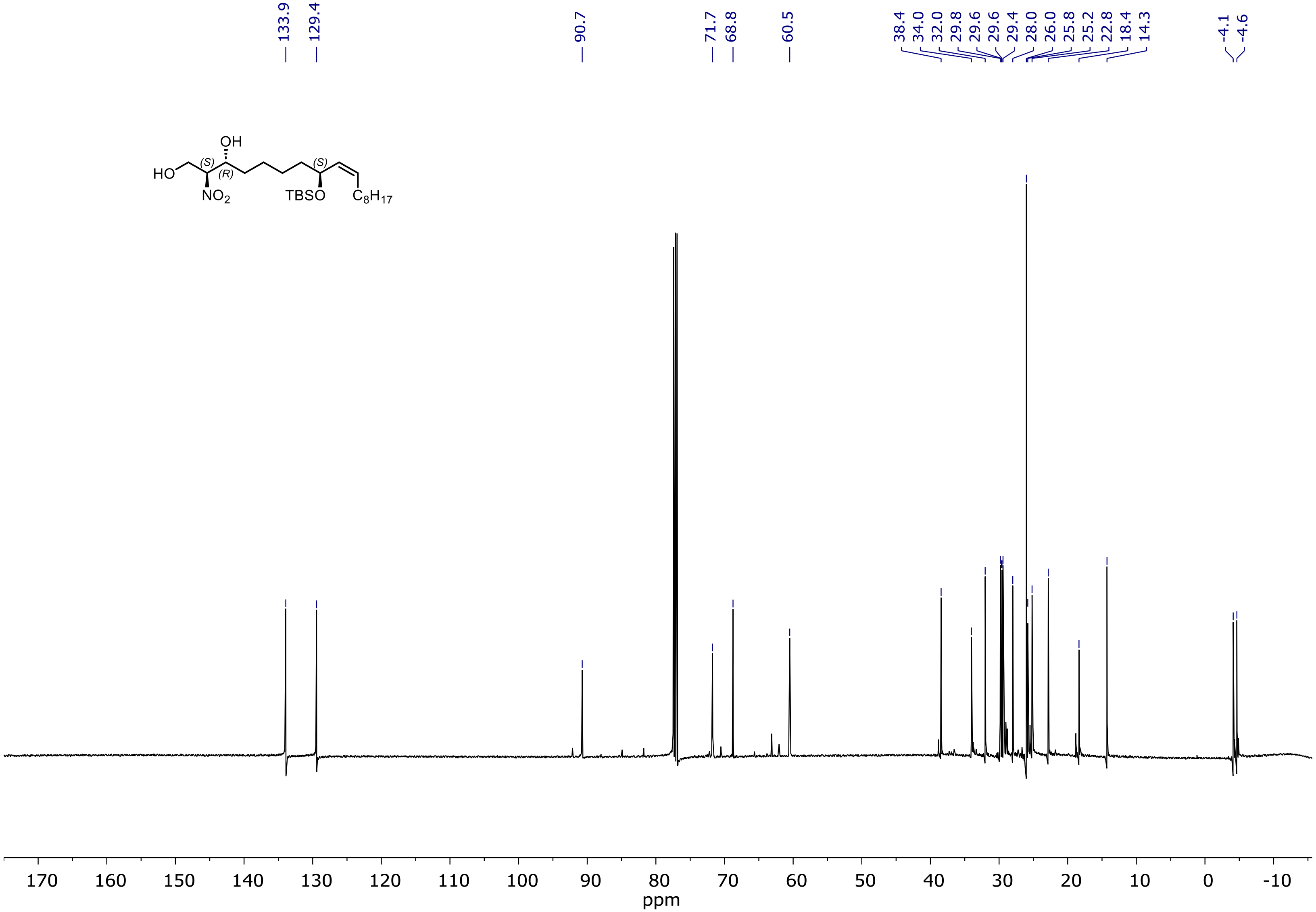


Figure S158. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CDCl$_3$) of (*2S,3R,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-59**.

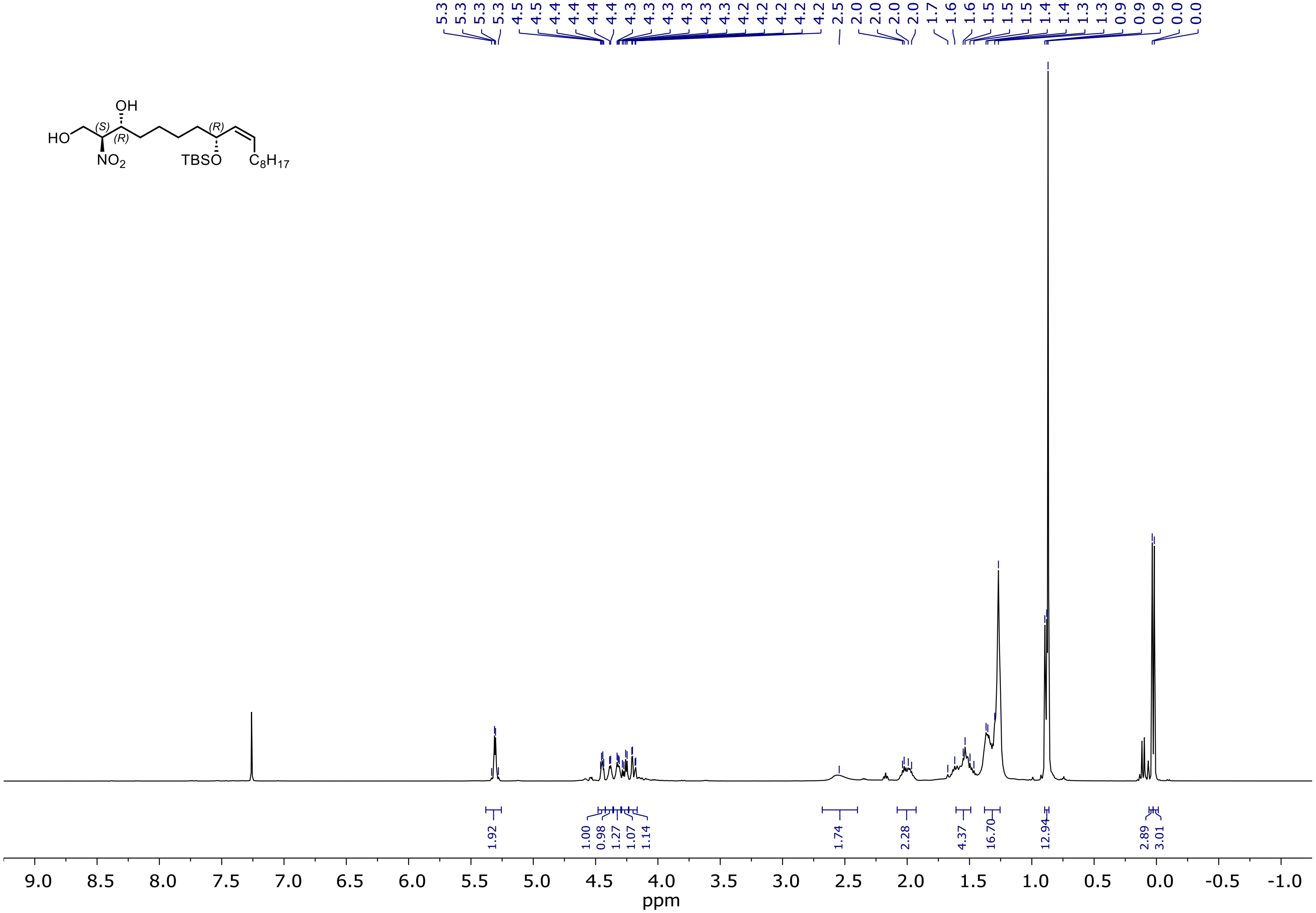


Figure S159. ^{1}H-NMR spectrum (500 MHz, CDCl$_3$) of (*2S,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-60**.

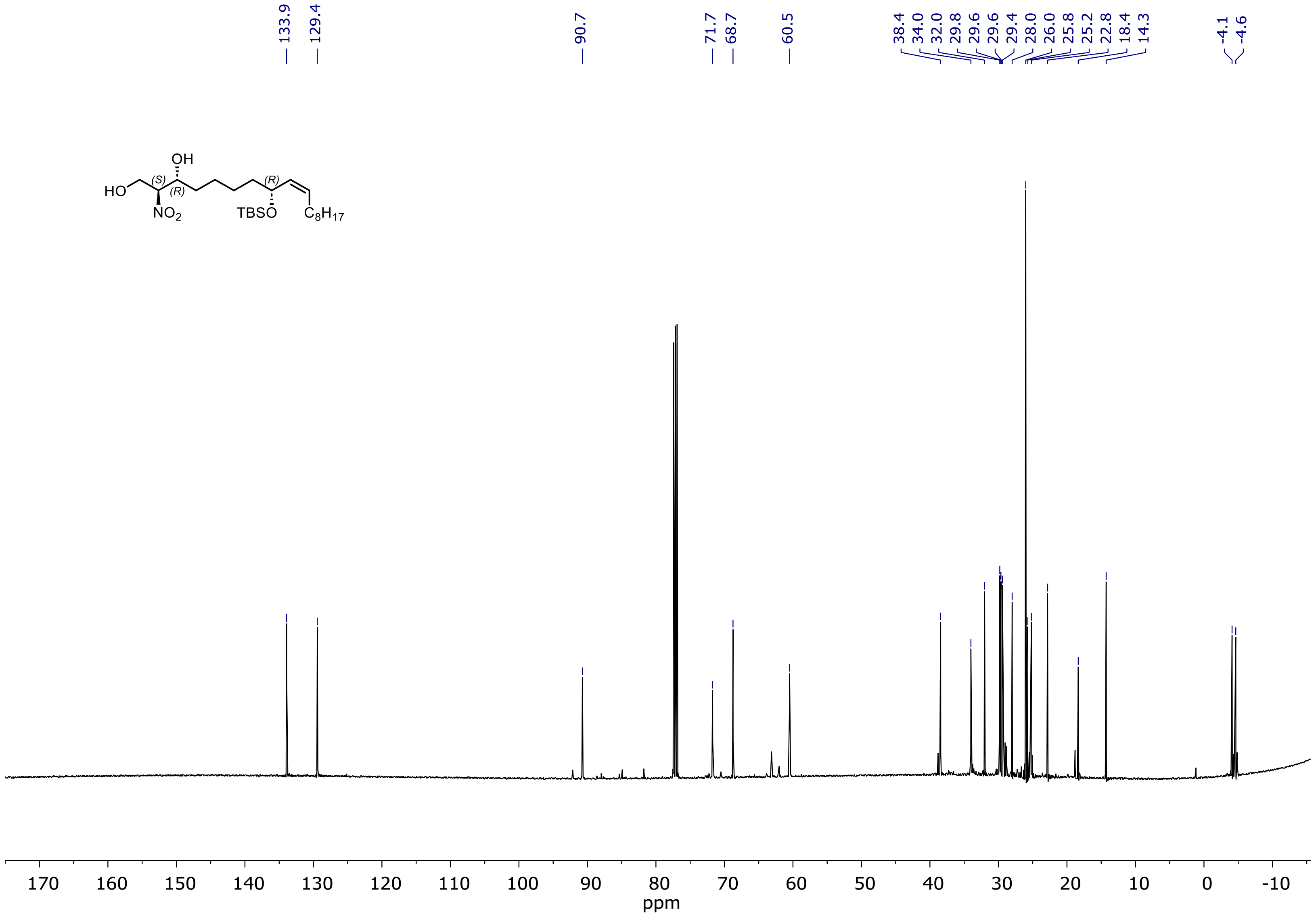


Figure S160. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2S,3R,8R,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-60**.

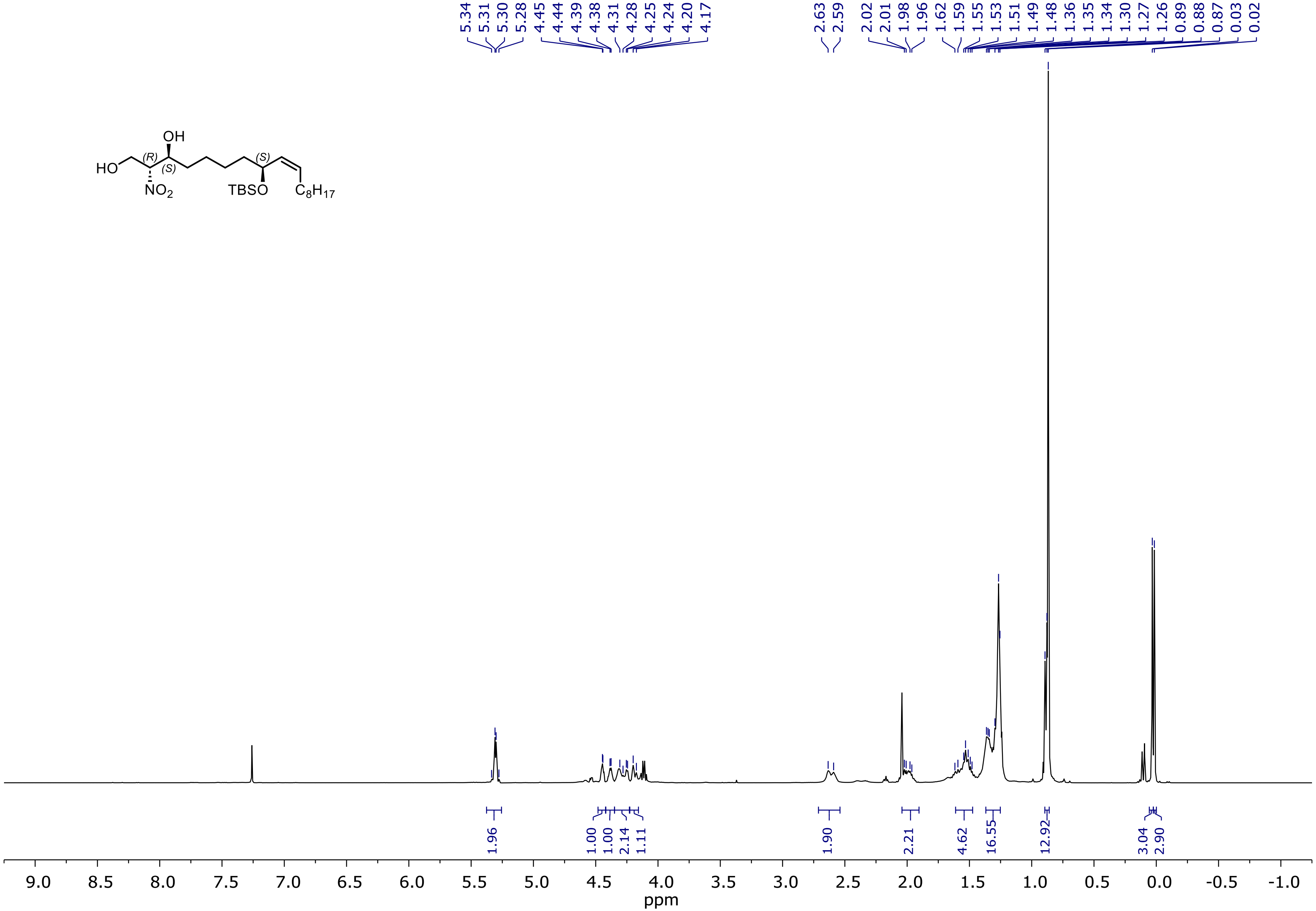


Figure S161. ^{1}H-NMR spectrum (500 MHz, $CDCl_3$) of (*2R,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-61**.

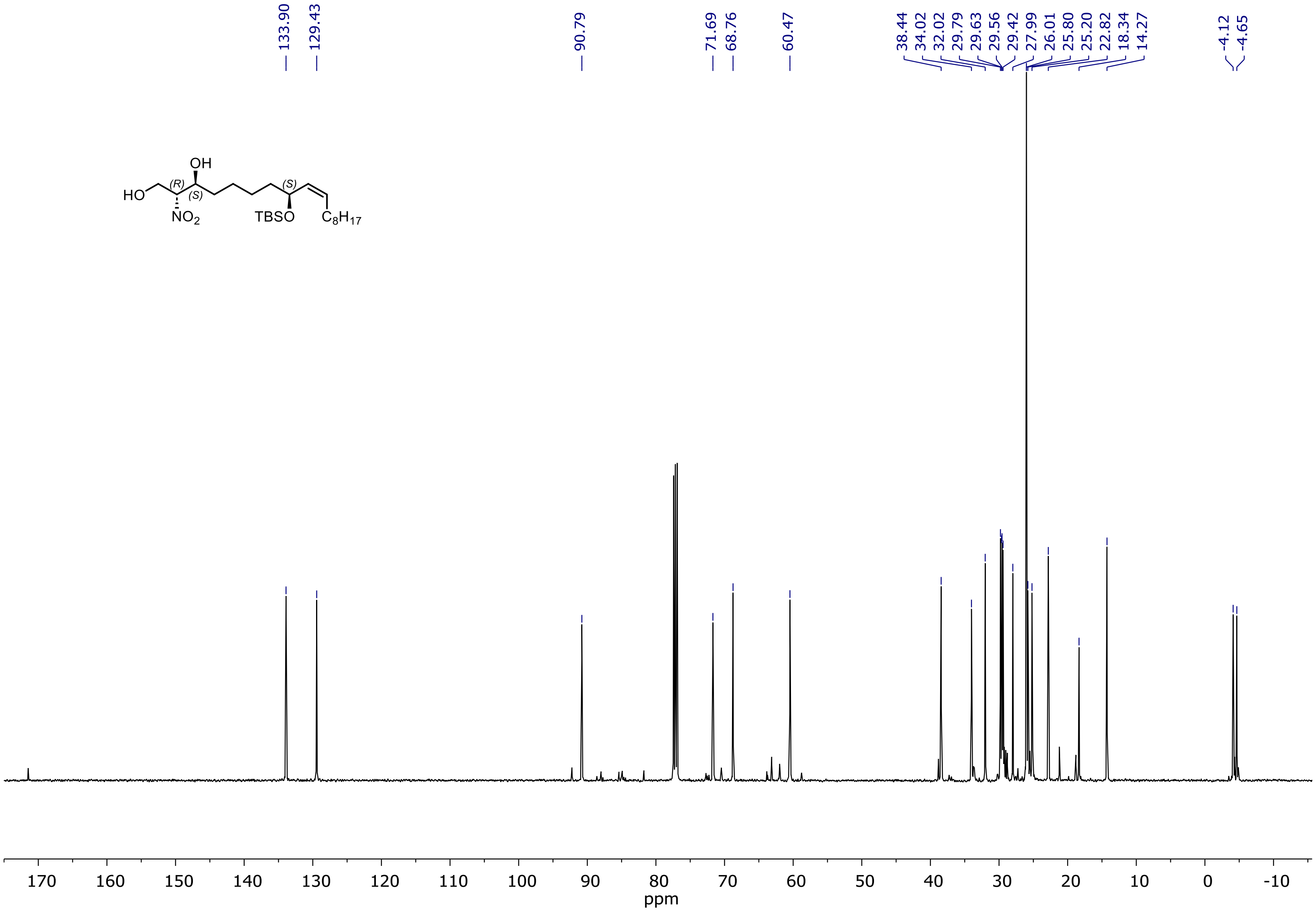


Figure S162. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, $CDCl_3$) of (*2R,3S,8S,Z*)-8-((*tert*-Butyldimethylsilyl)oxy)-2-nitrooctadec-9-ene-1,3-diol **SI-61**.

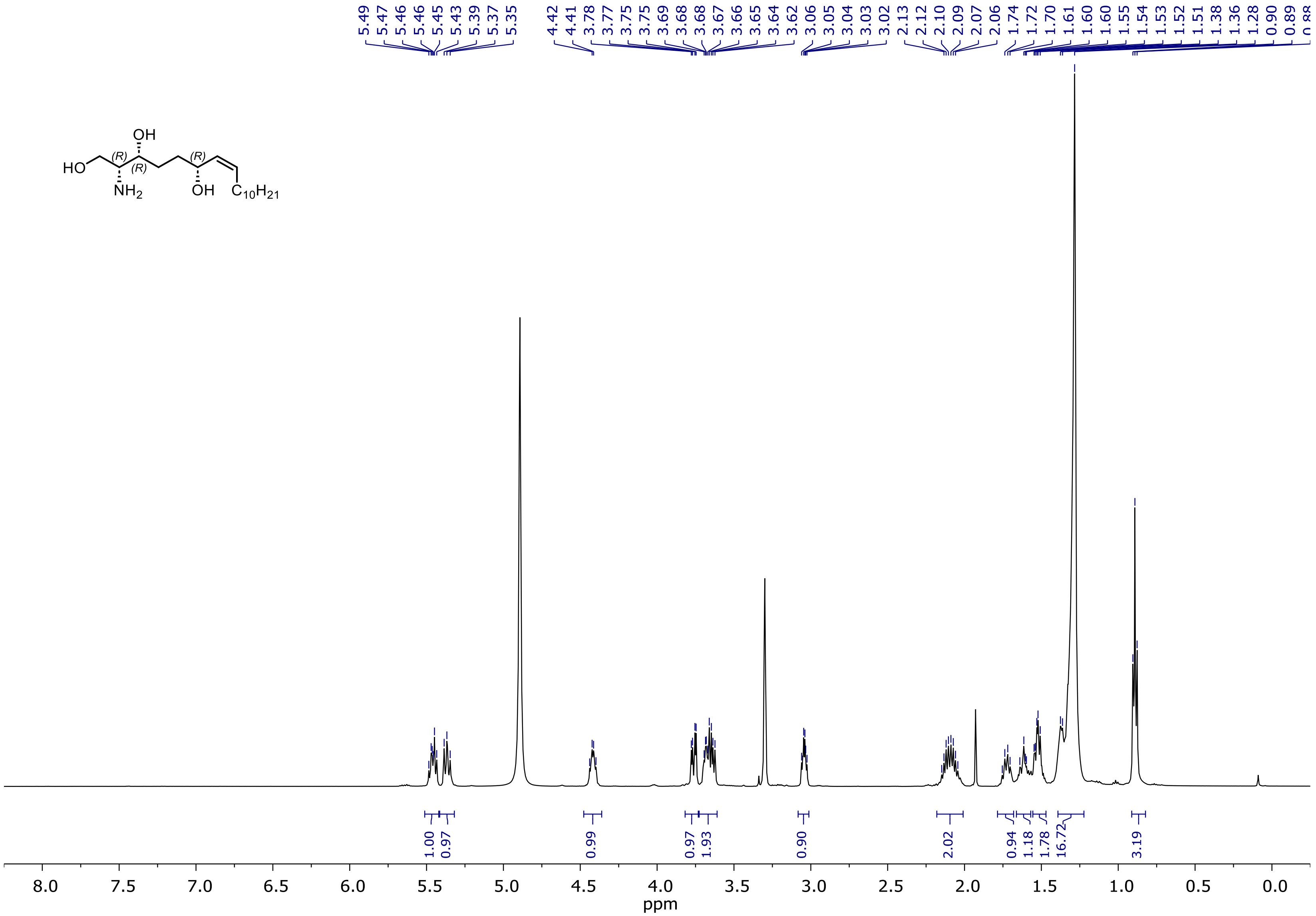


Figure S163. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3R,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **12**.

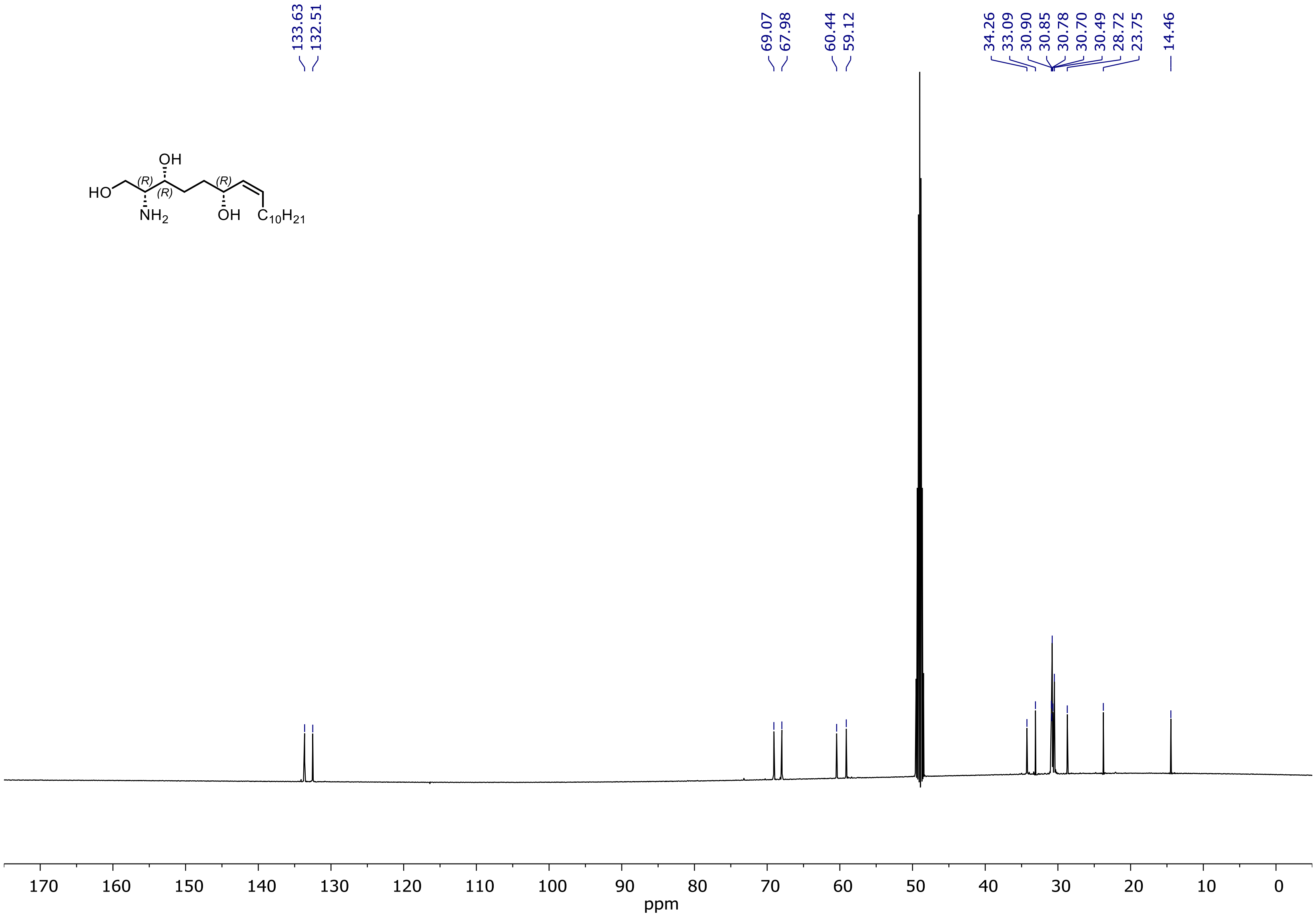


Figure S164. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3R,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **12**.

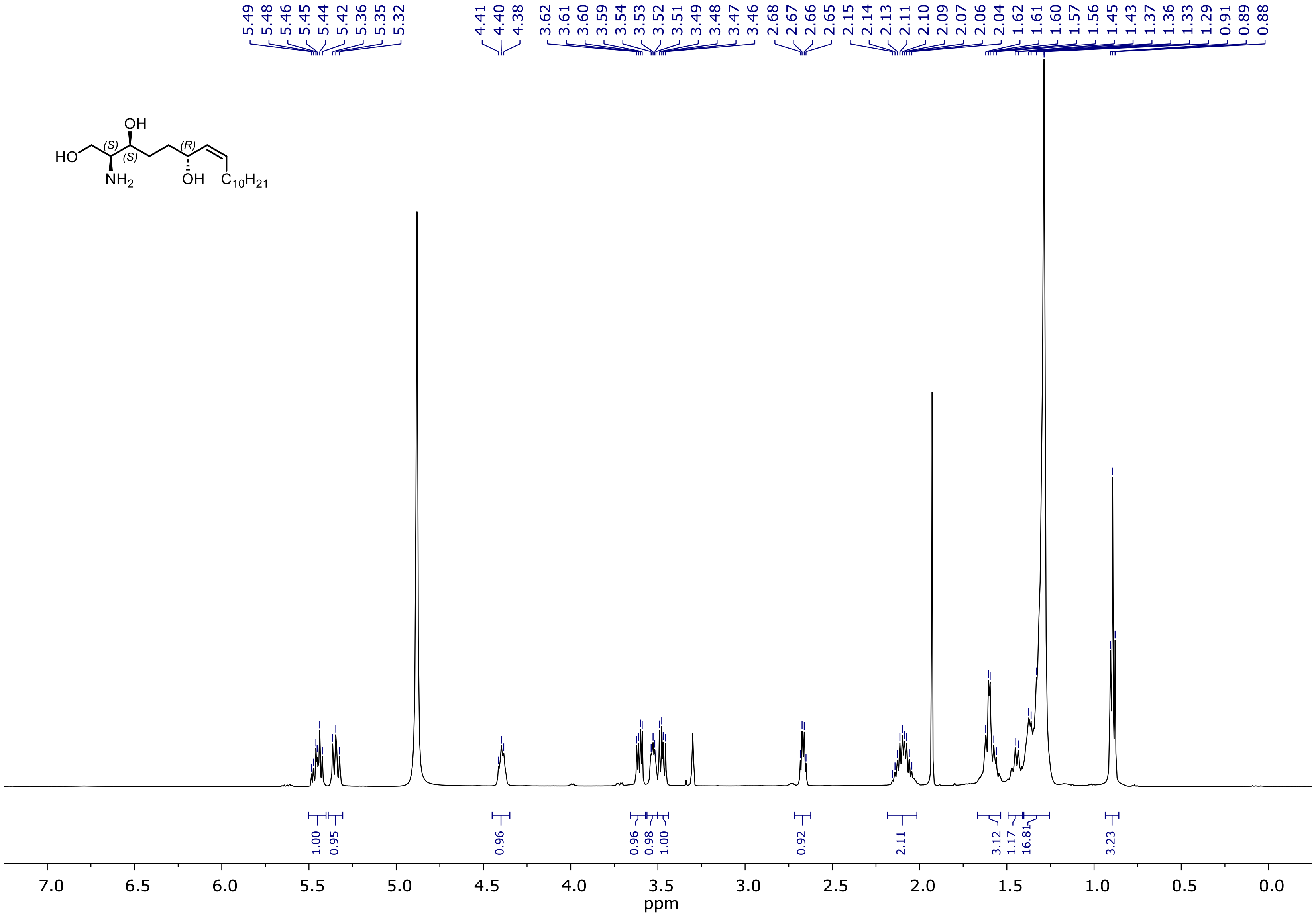


Figure S165. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3S,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **13**.

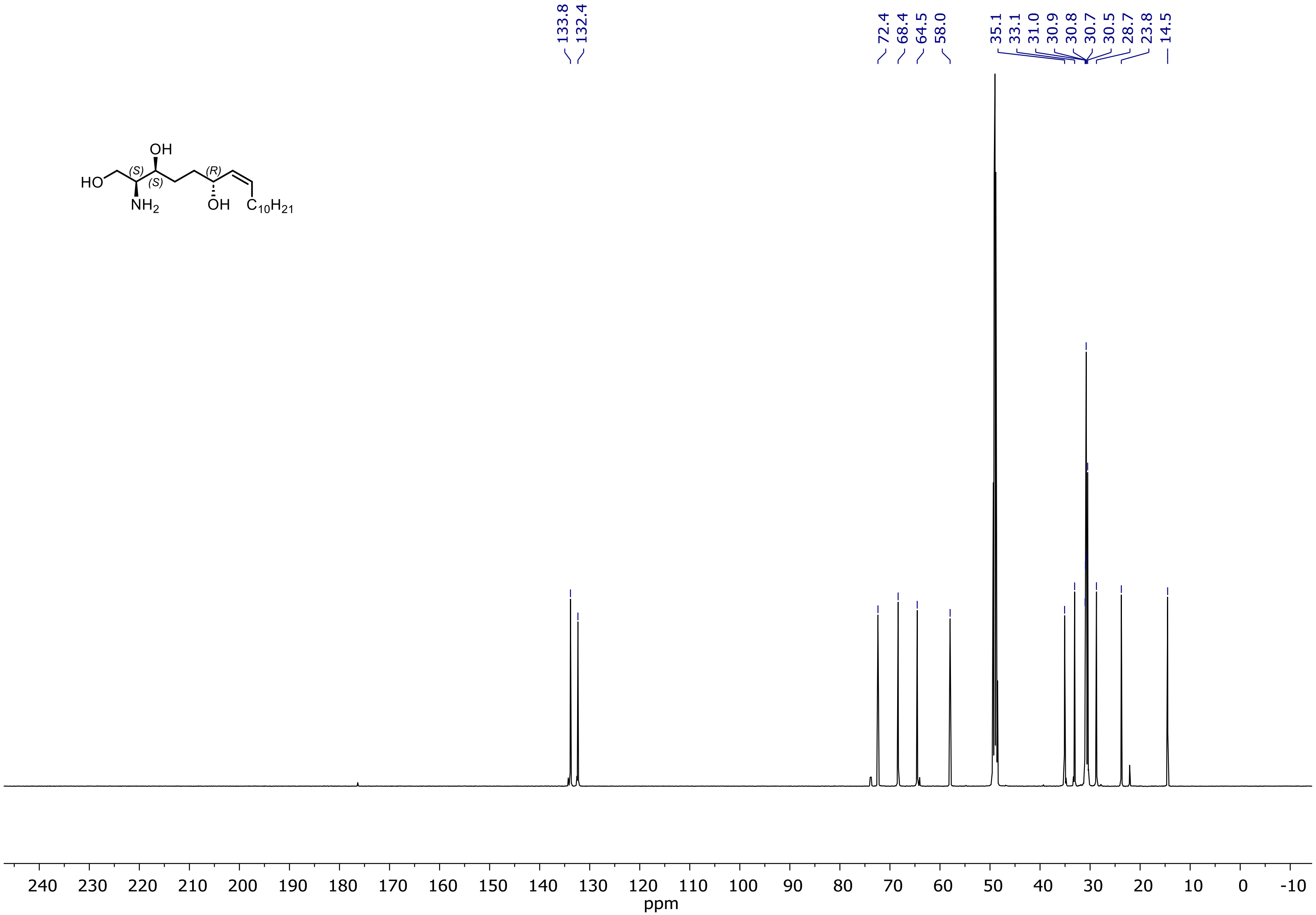


Figure S166. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3S,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **13**.

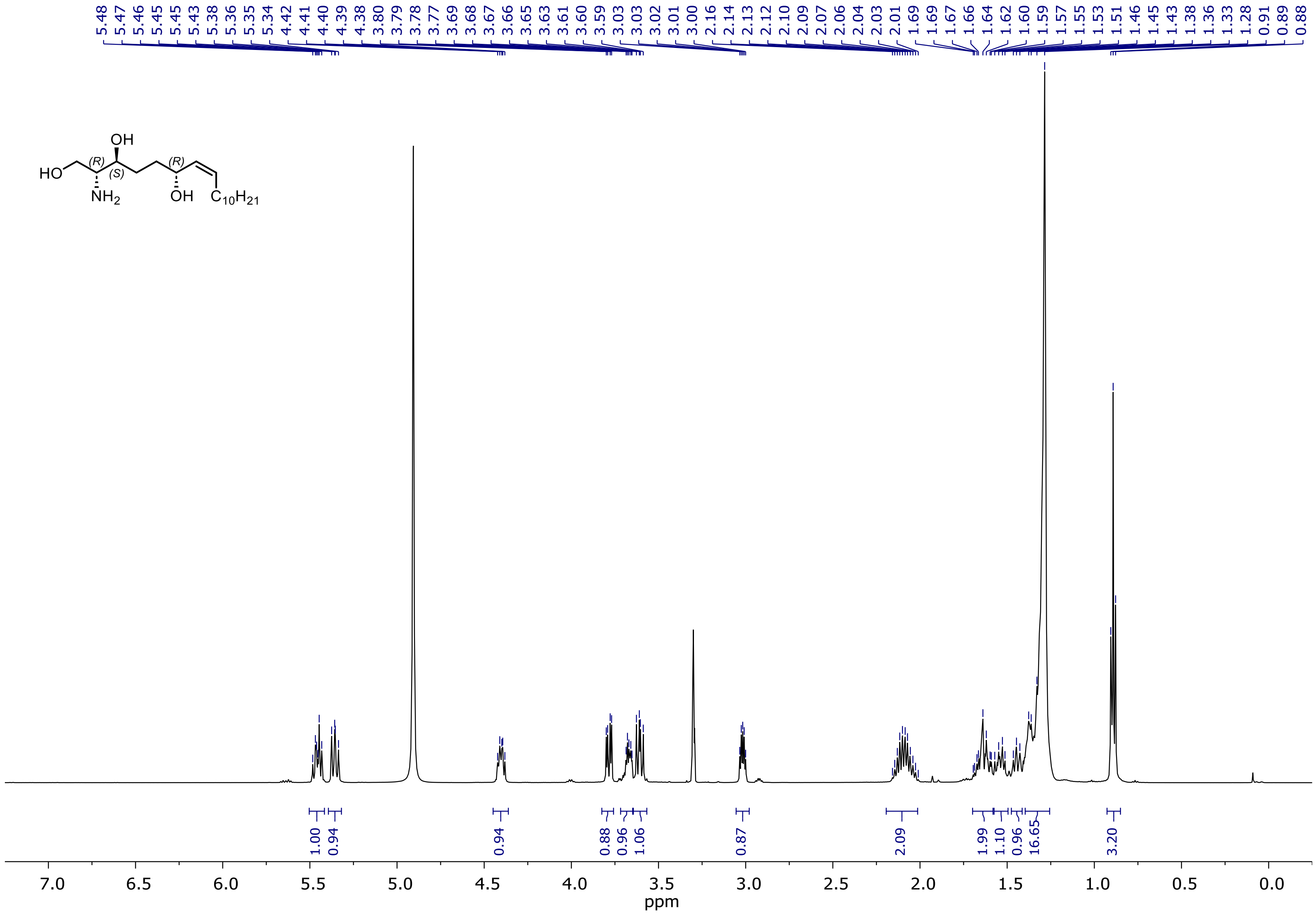


Figure S167. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3S,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **14**.

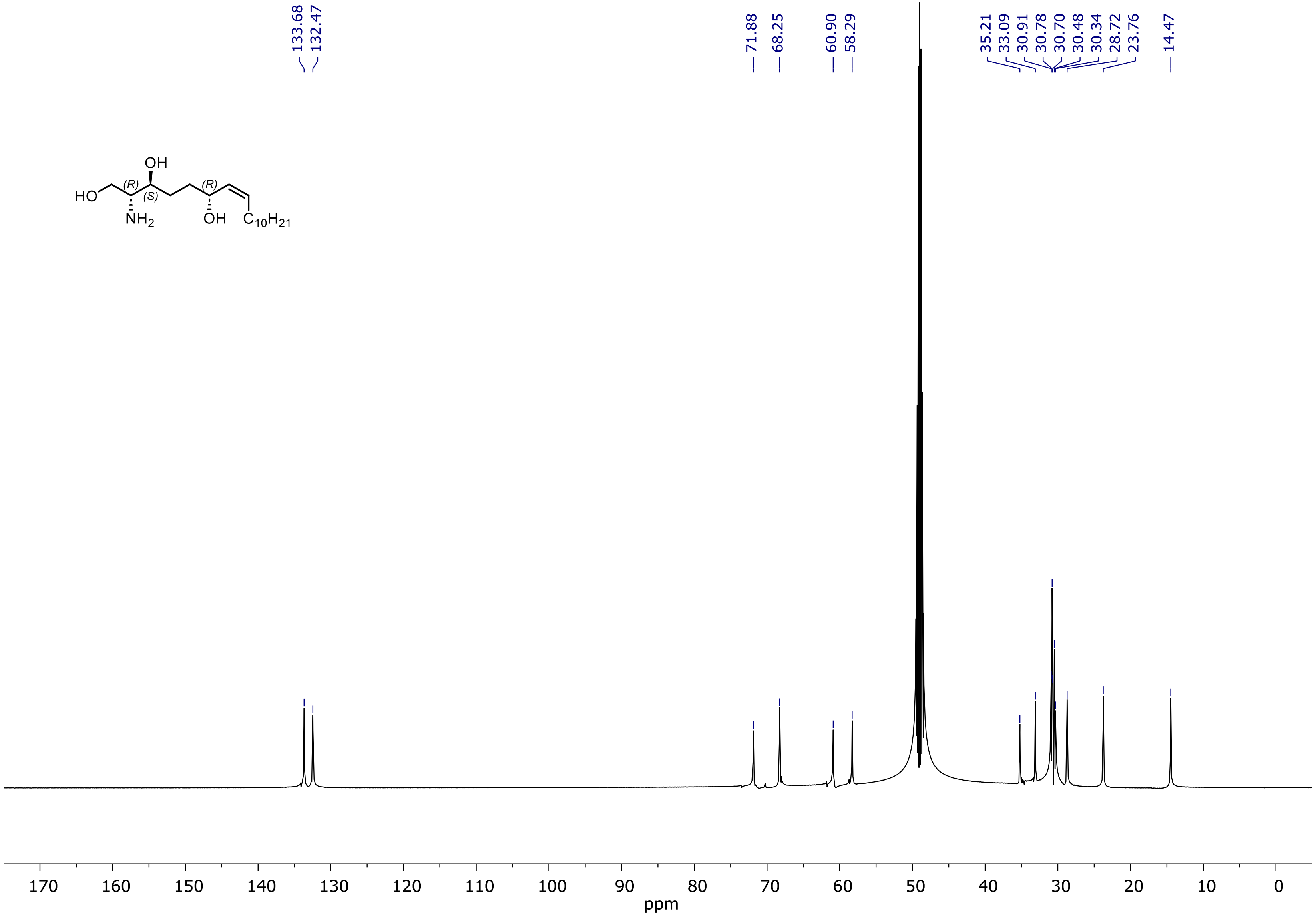


Figure S168. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3S,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **14**.

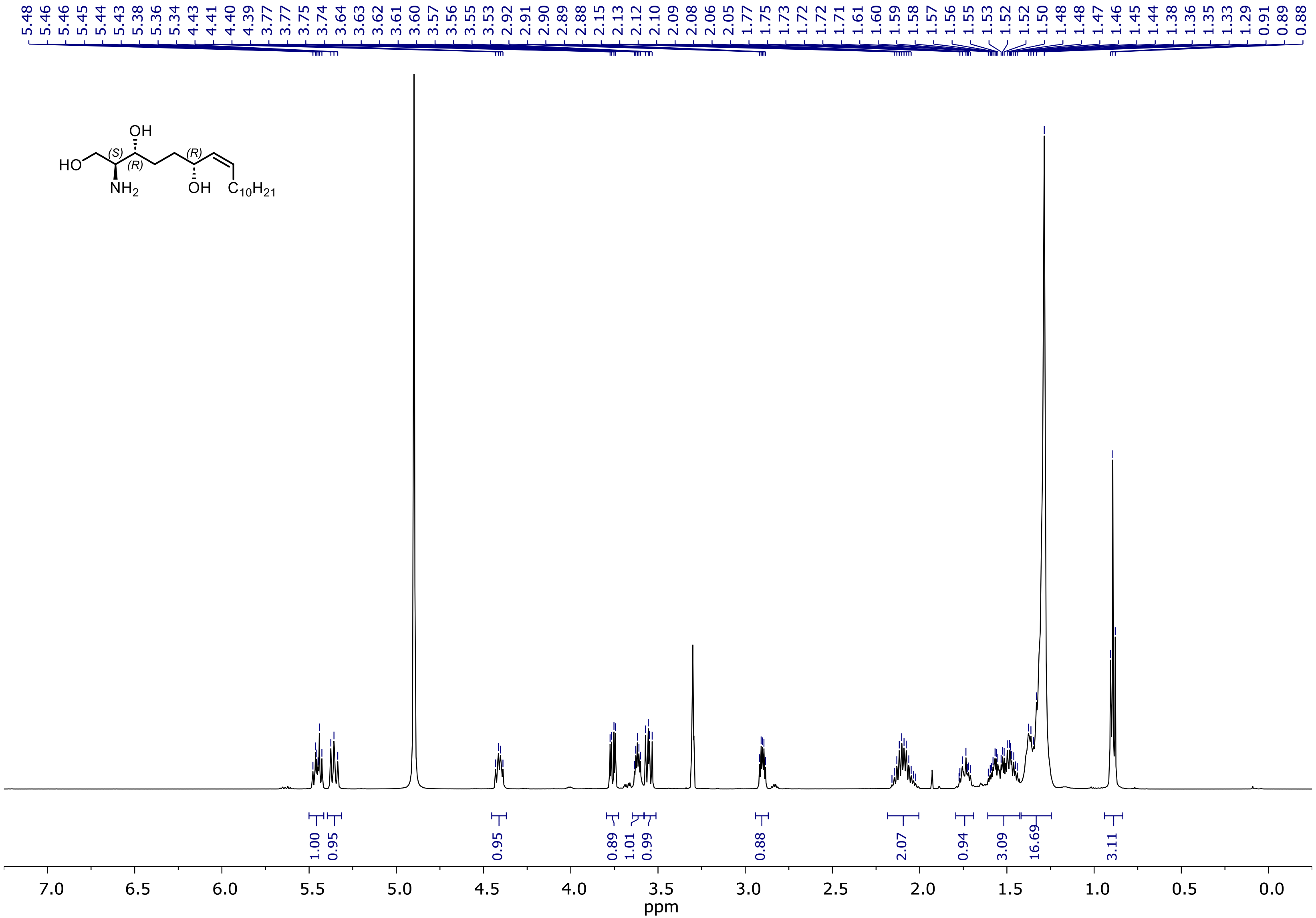


Figure S169. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3R,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **15**.

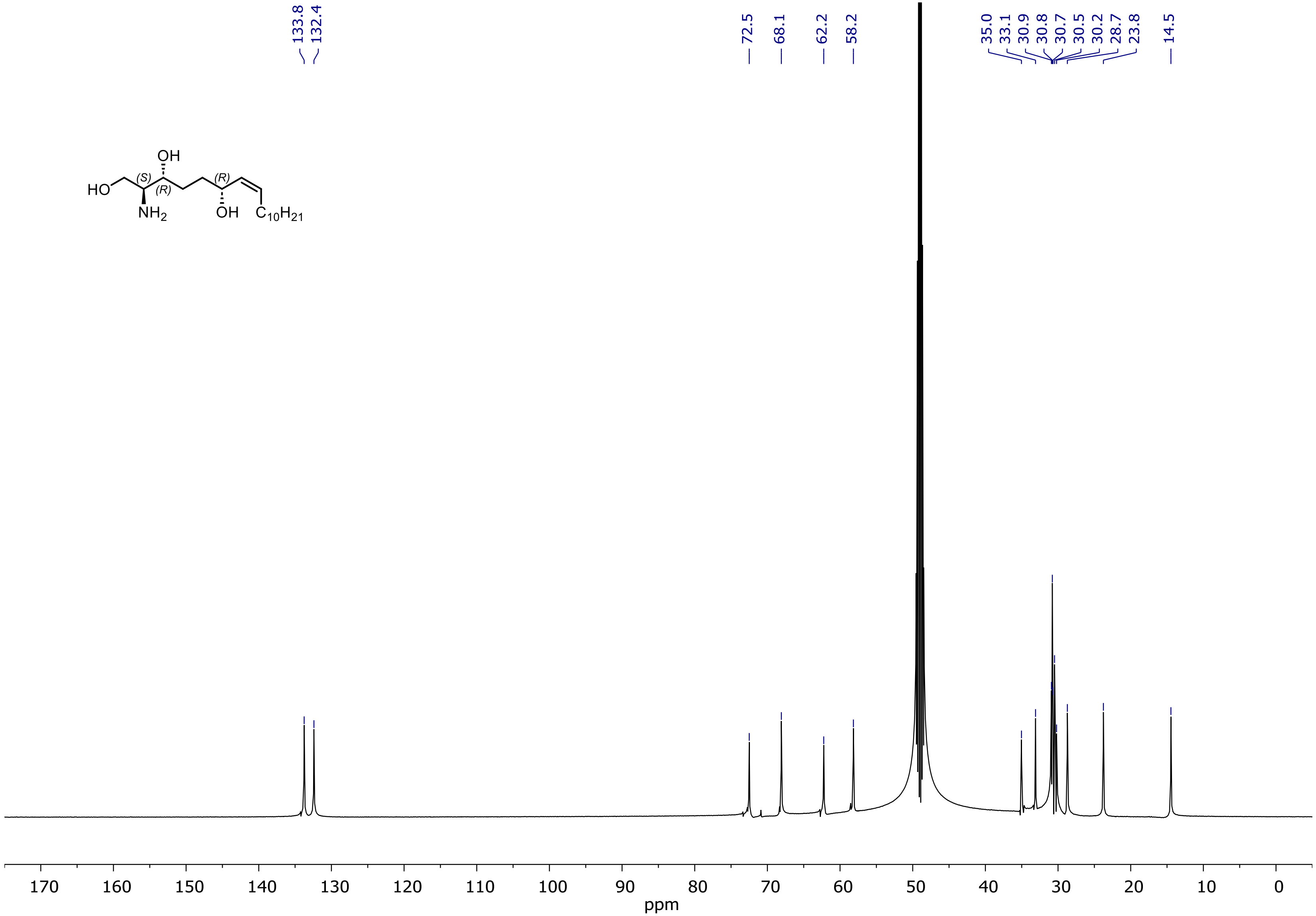


Figure S170. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3R,6R,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **15**.

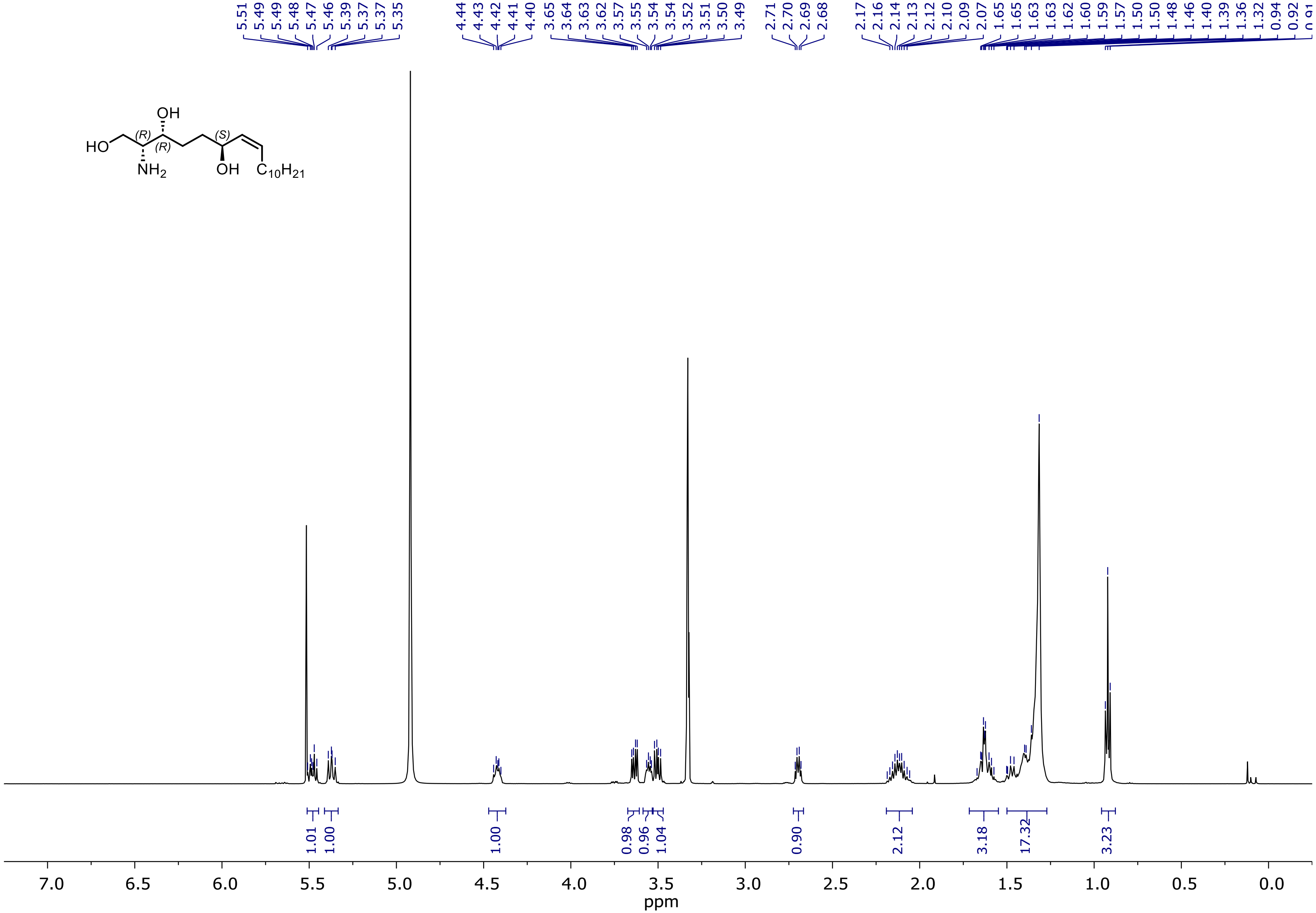


Figure S171. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3R,6S,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **16**.

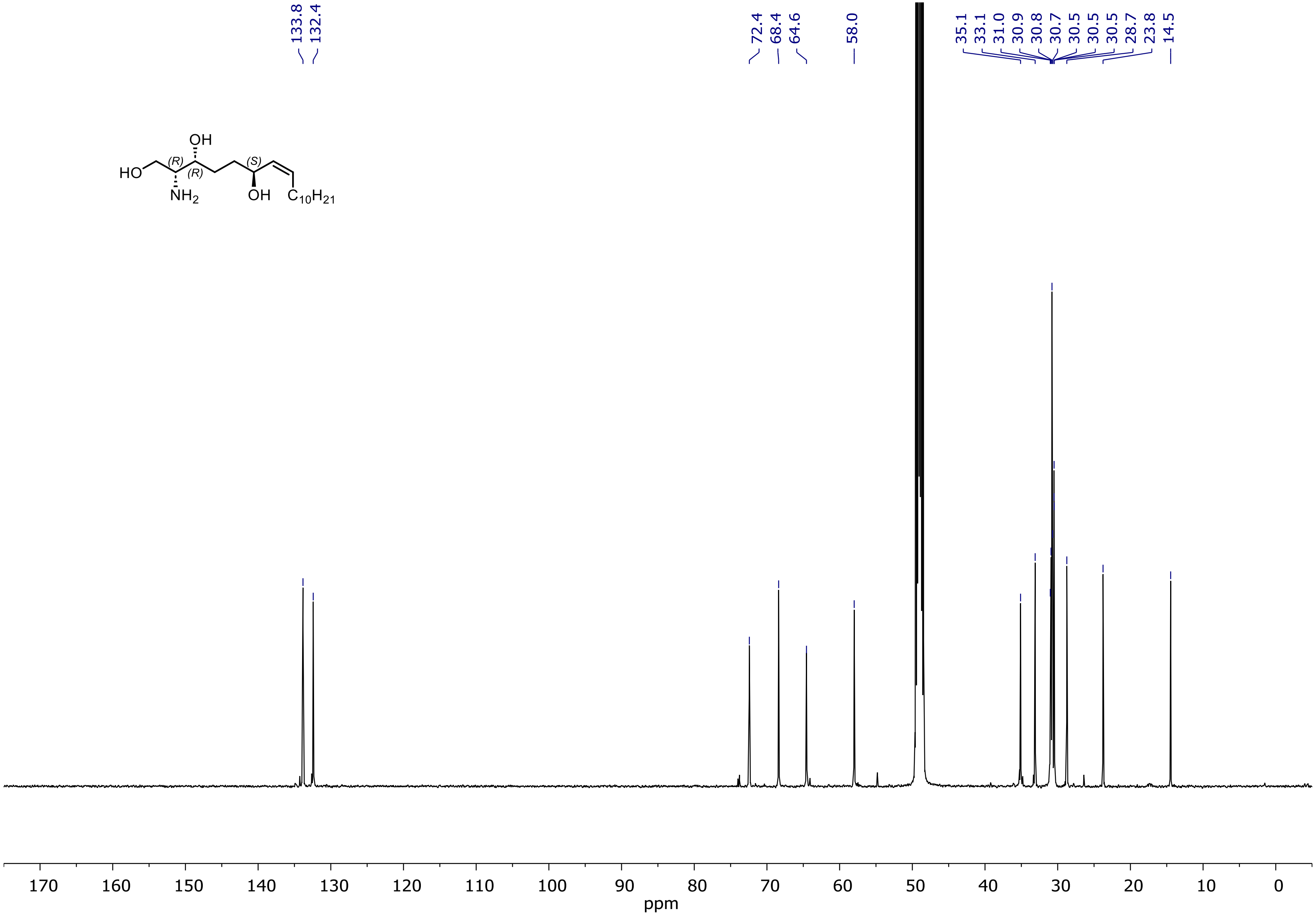


Figure S172. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3R,6S,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **16**.

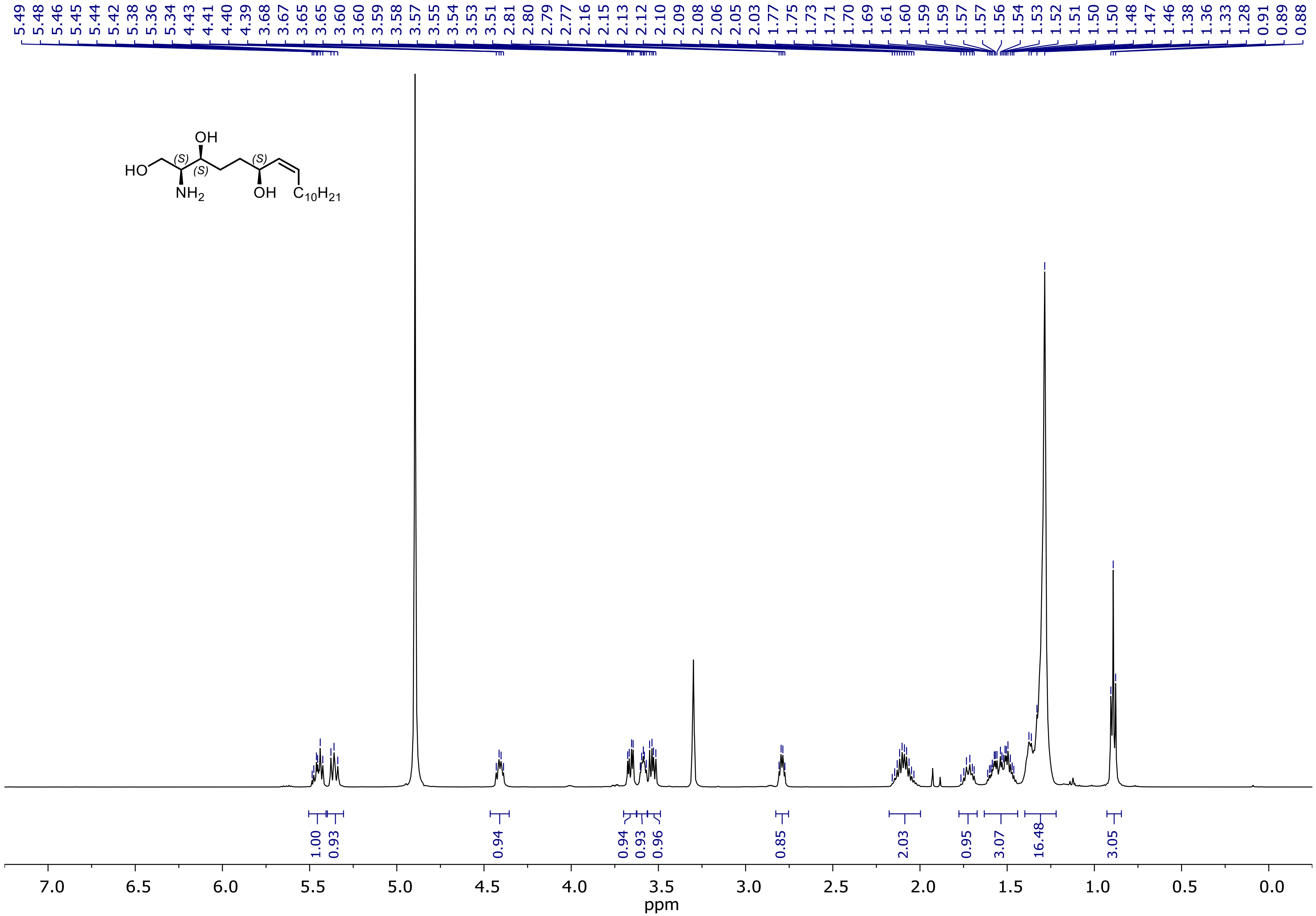


Figure S173. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3S,6S,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **17**.

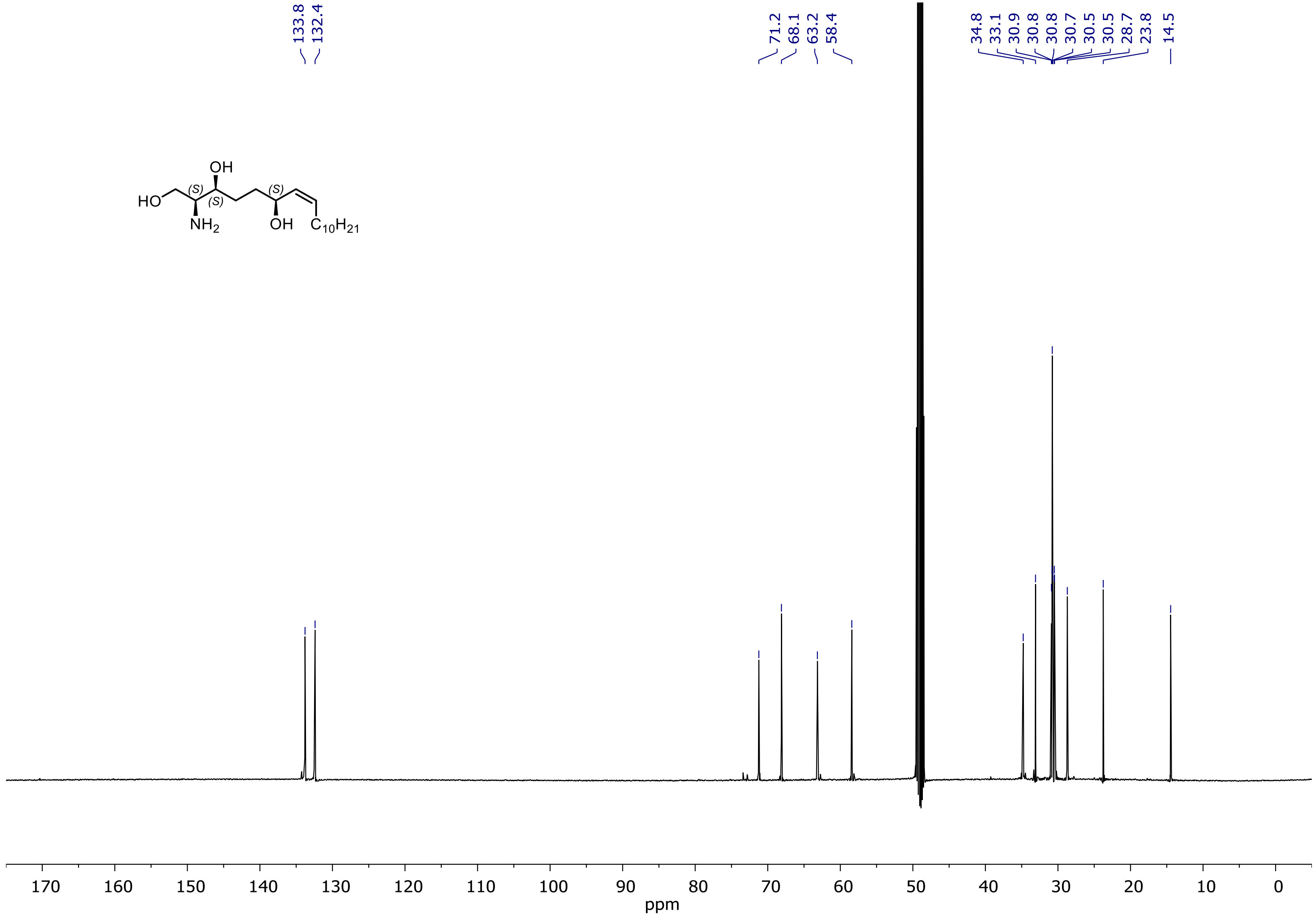


Figure S174. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3S,6S,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **17**.

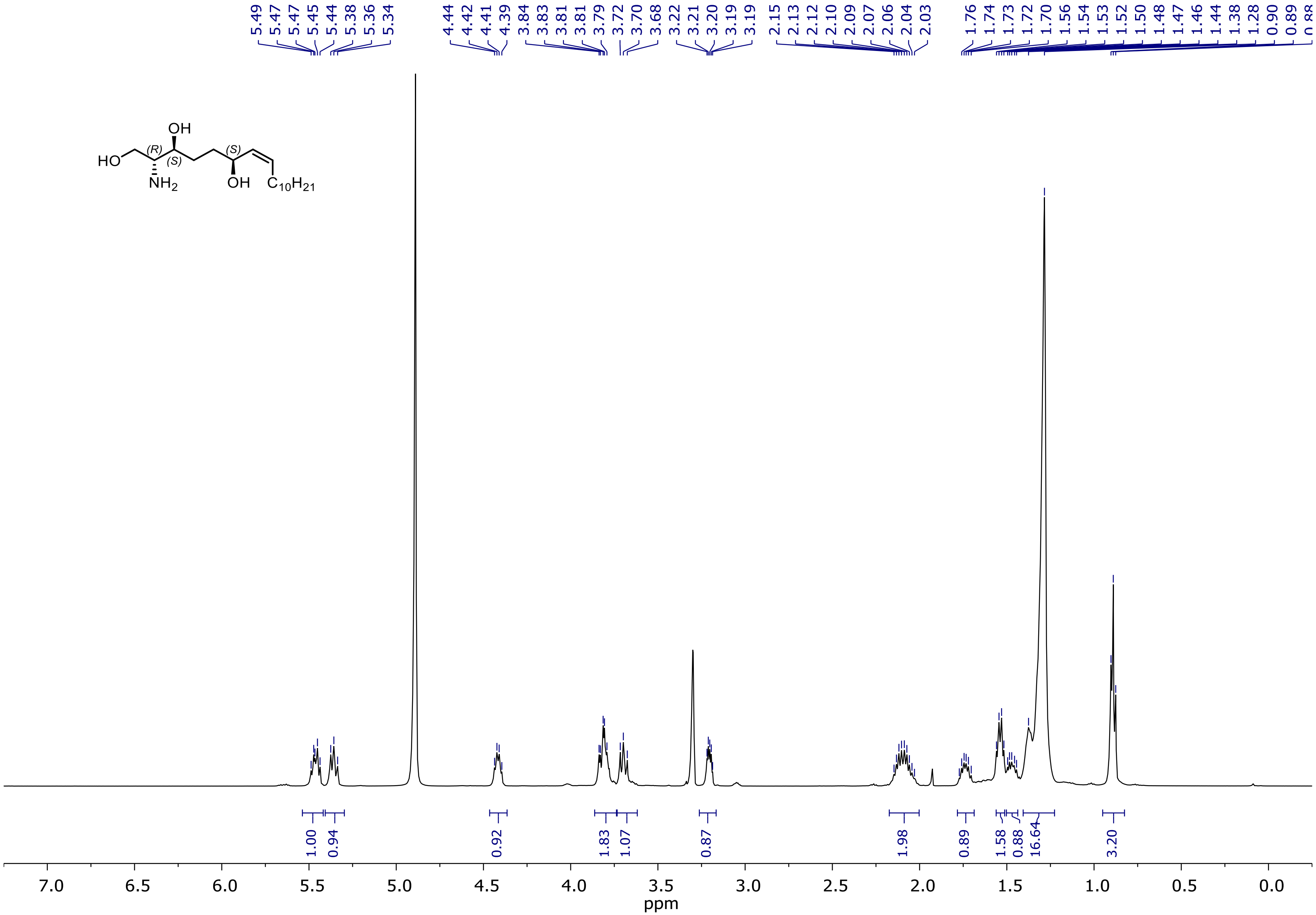


Figure S175. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3S,6S,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **18**.

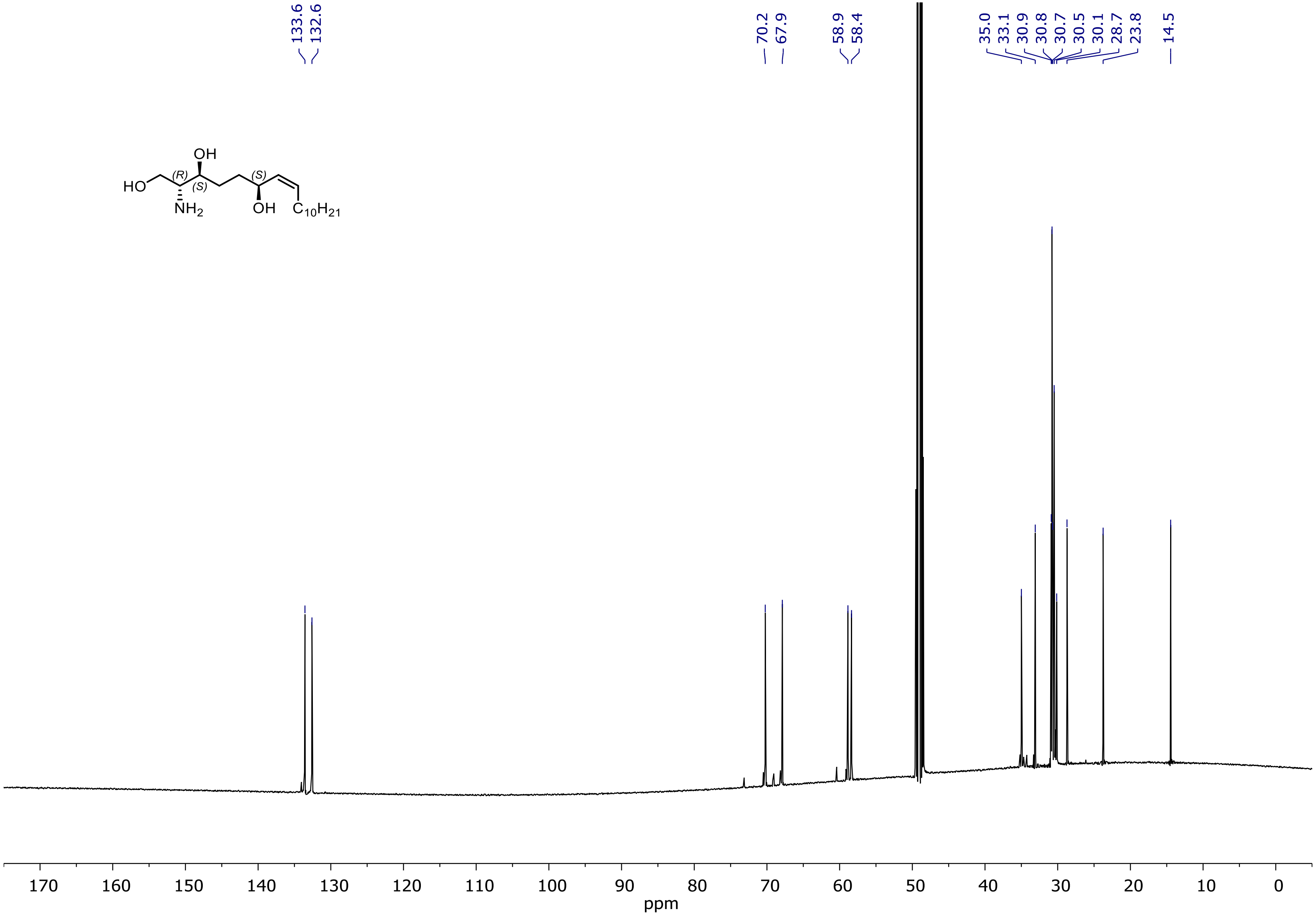


Figure S176. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3S,6S,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **18**.

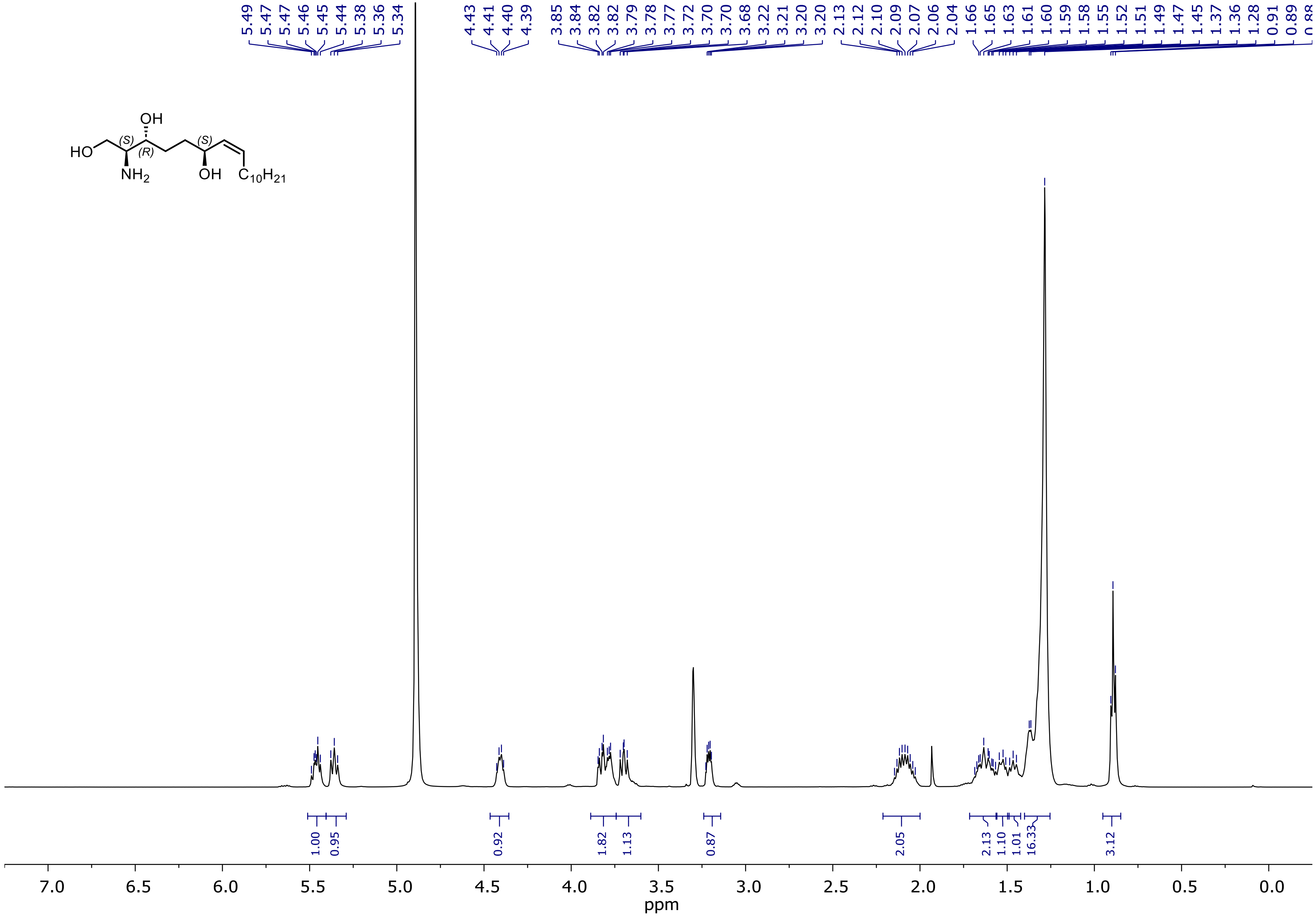


Figure S177. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3R,6S,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **19**.

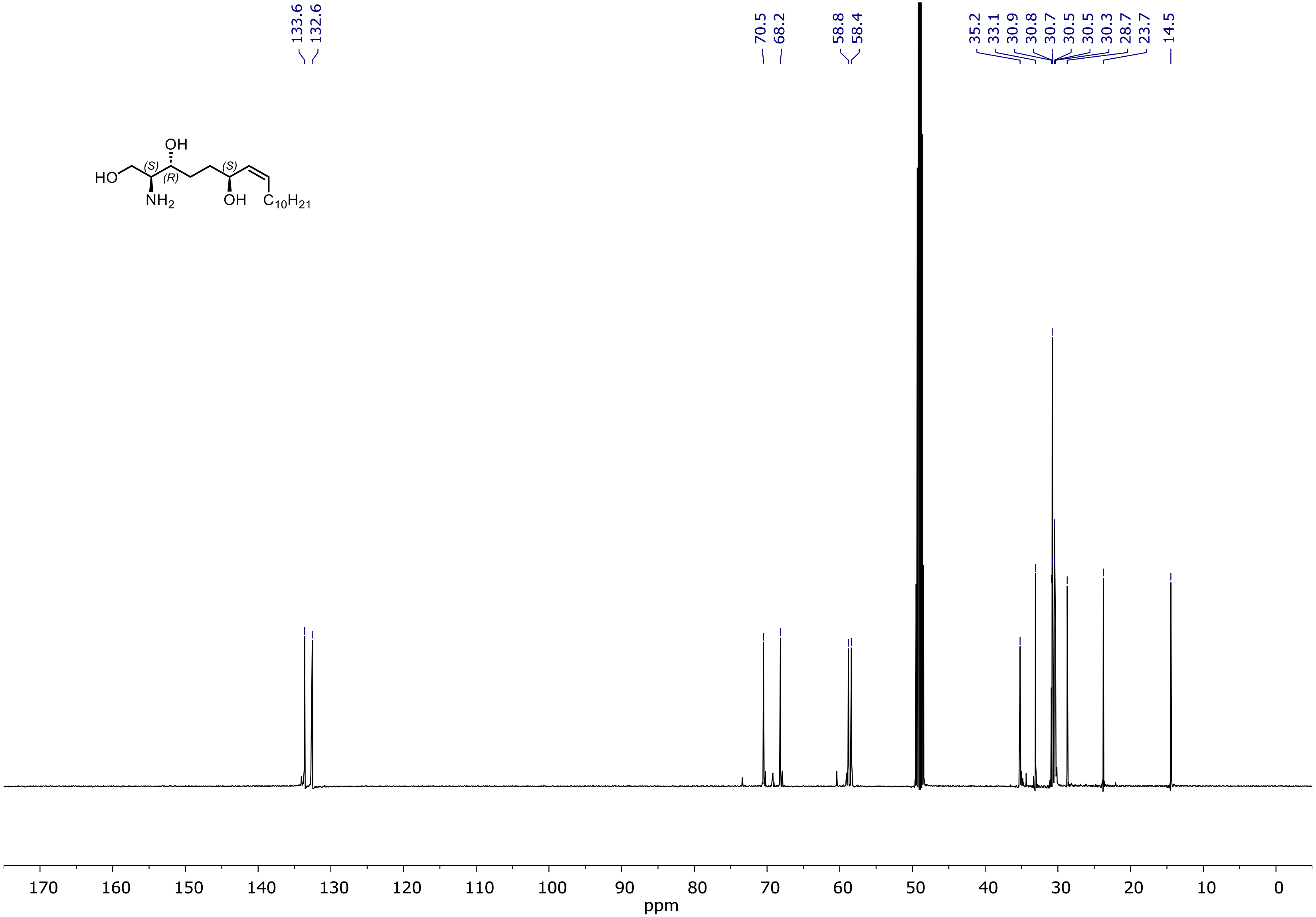


Figure S178. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3R,6S,Z*)-2-Aminooctadec-7-ene-1,3,6-triol **19**.

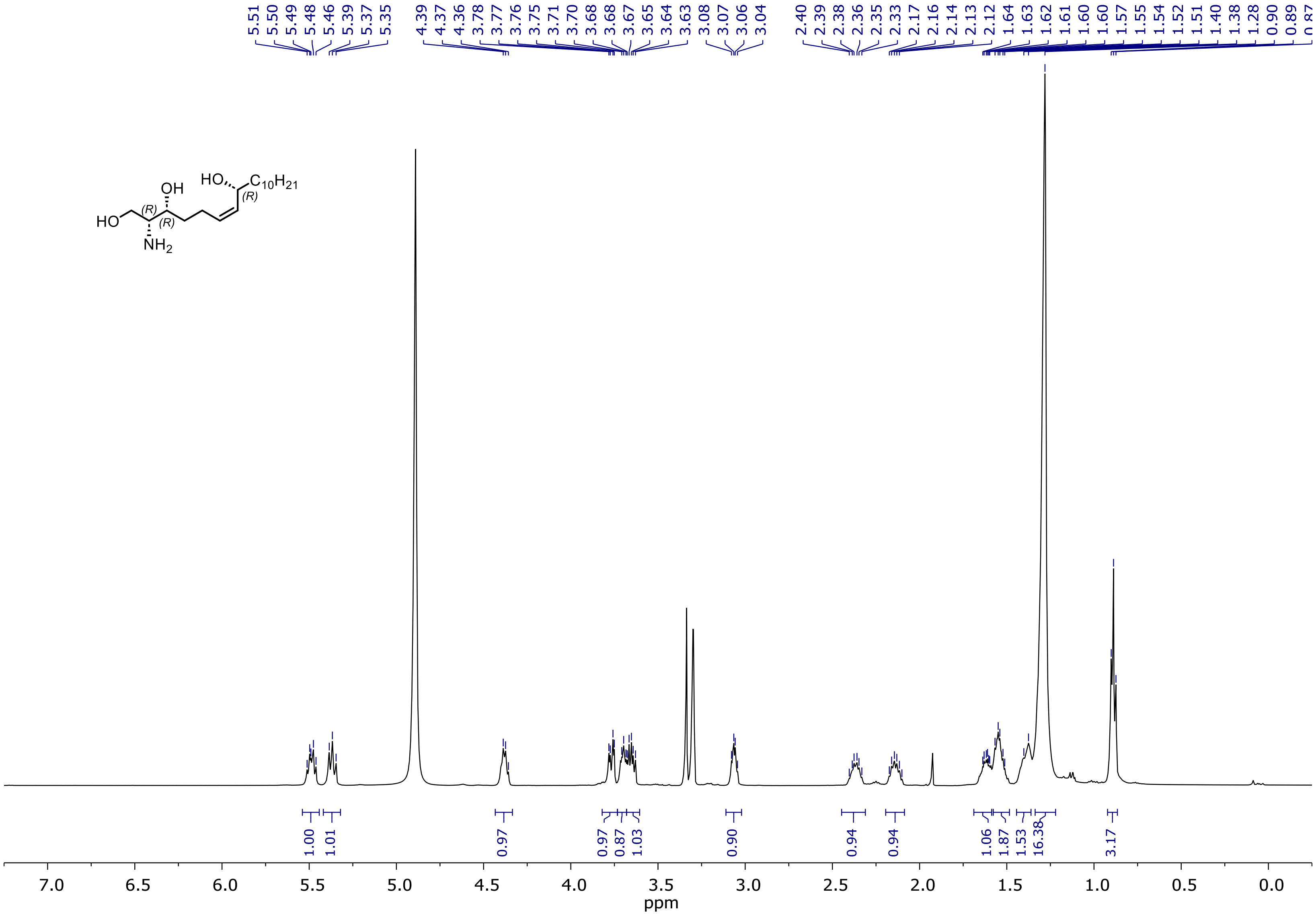


Figure S179. ^{1}H-NMR spectrum (500 MHz, CD$_3$OD) of (*2R,3R,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **24**.

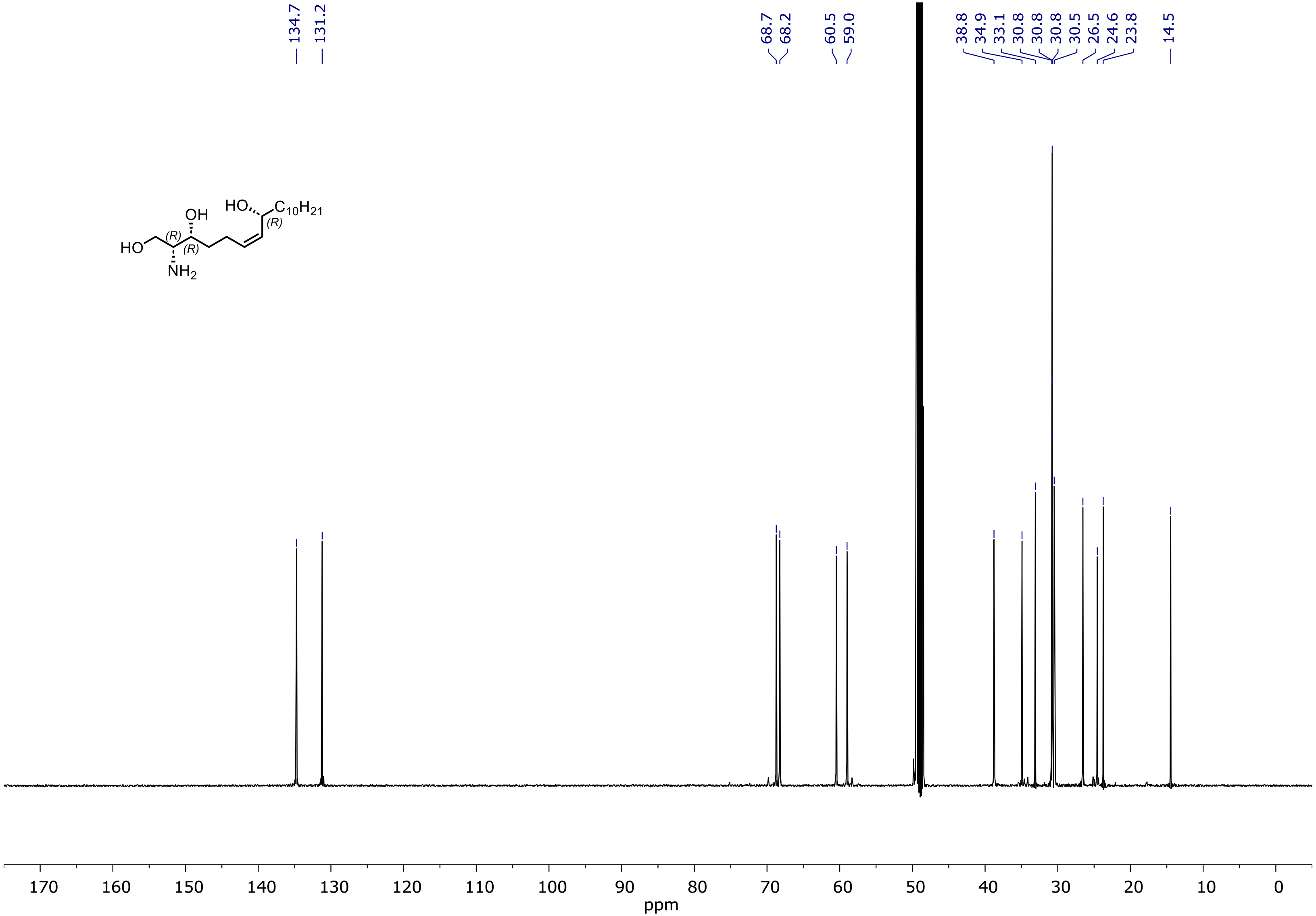


Figure S180. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CD$_3$OD) of (*2R,3R,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **24**.

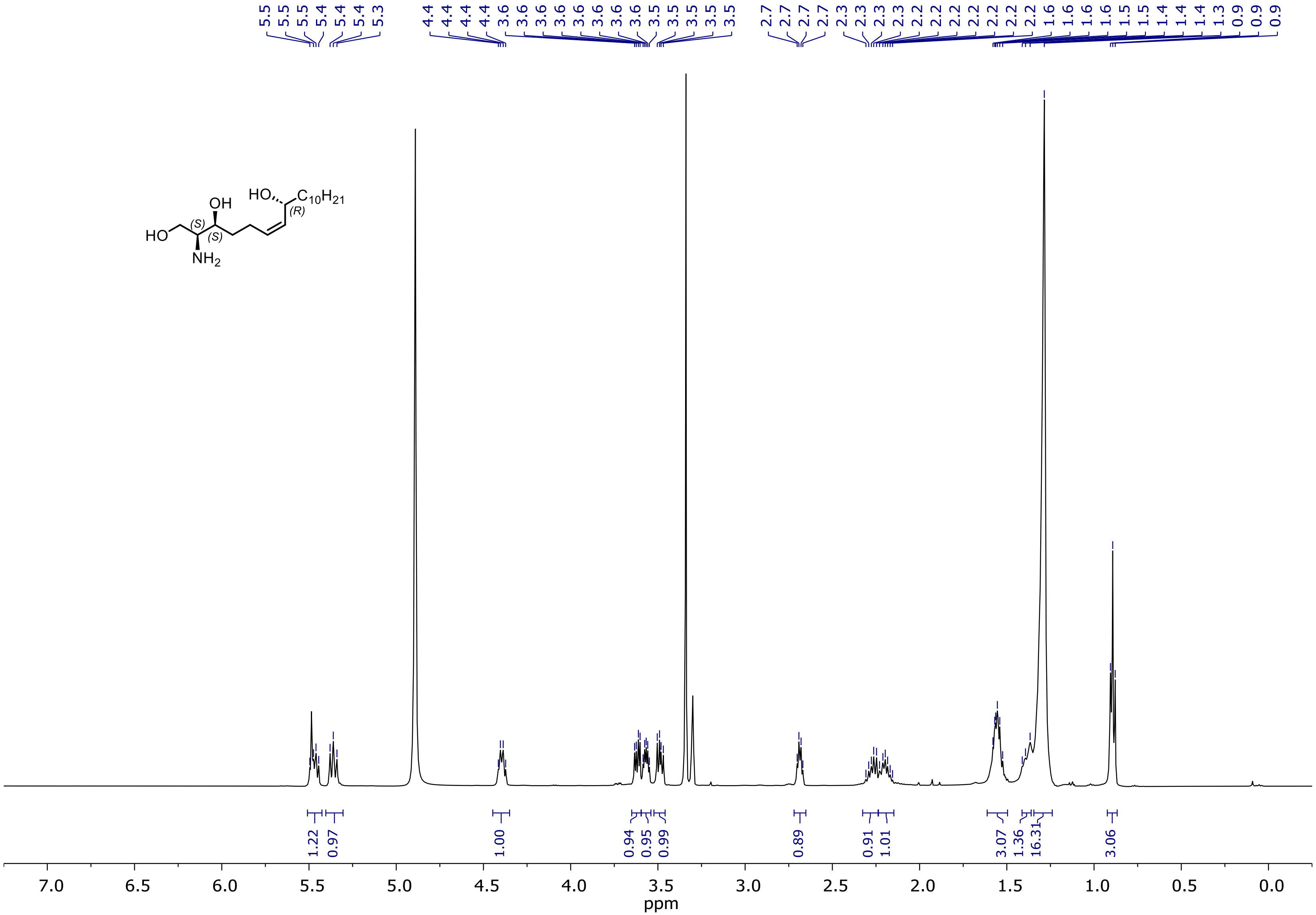


Figure S181. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3S,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **25**.

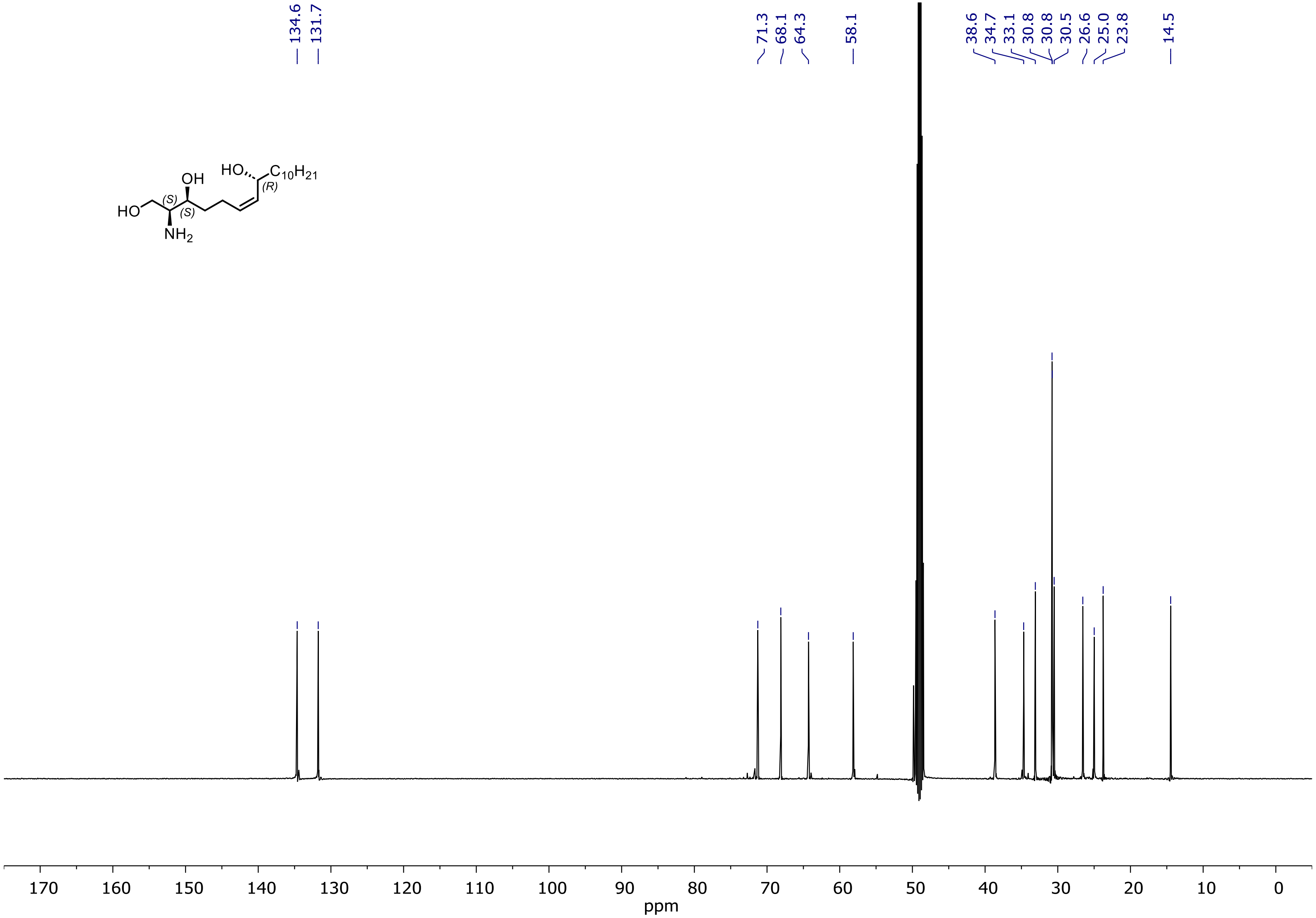


Figure S182. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3S,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **25**.

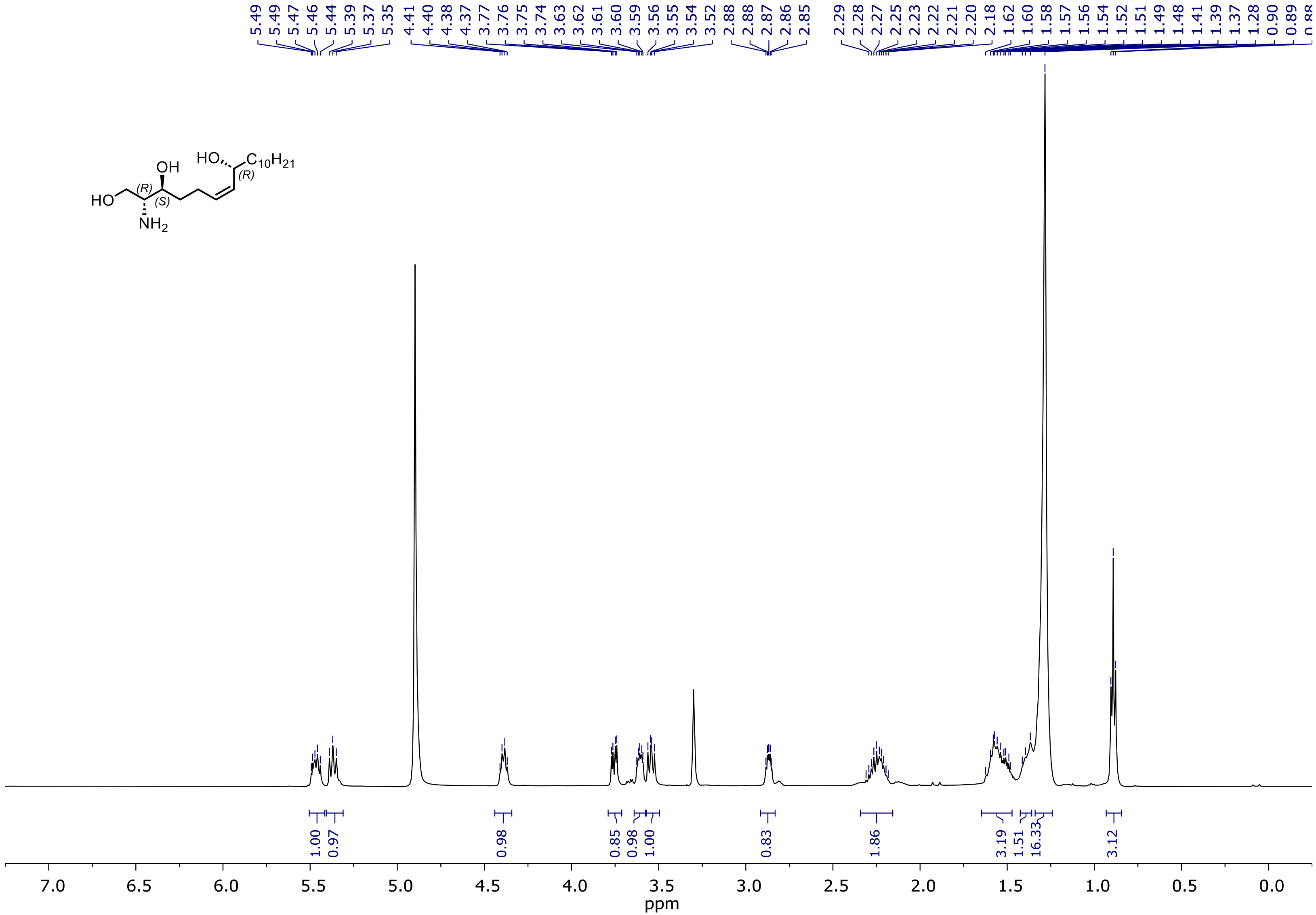


Figure S183. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3S,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **26**.

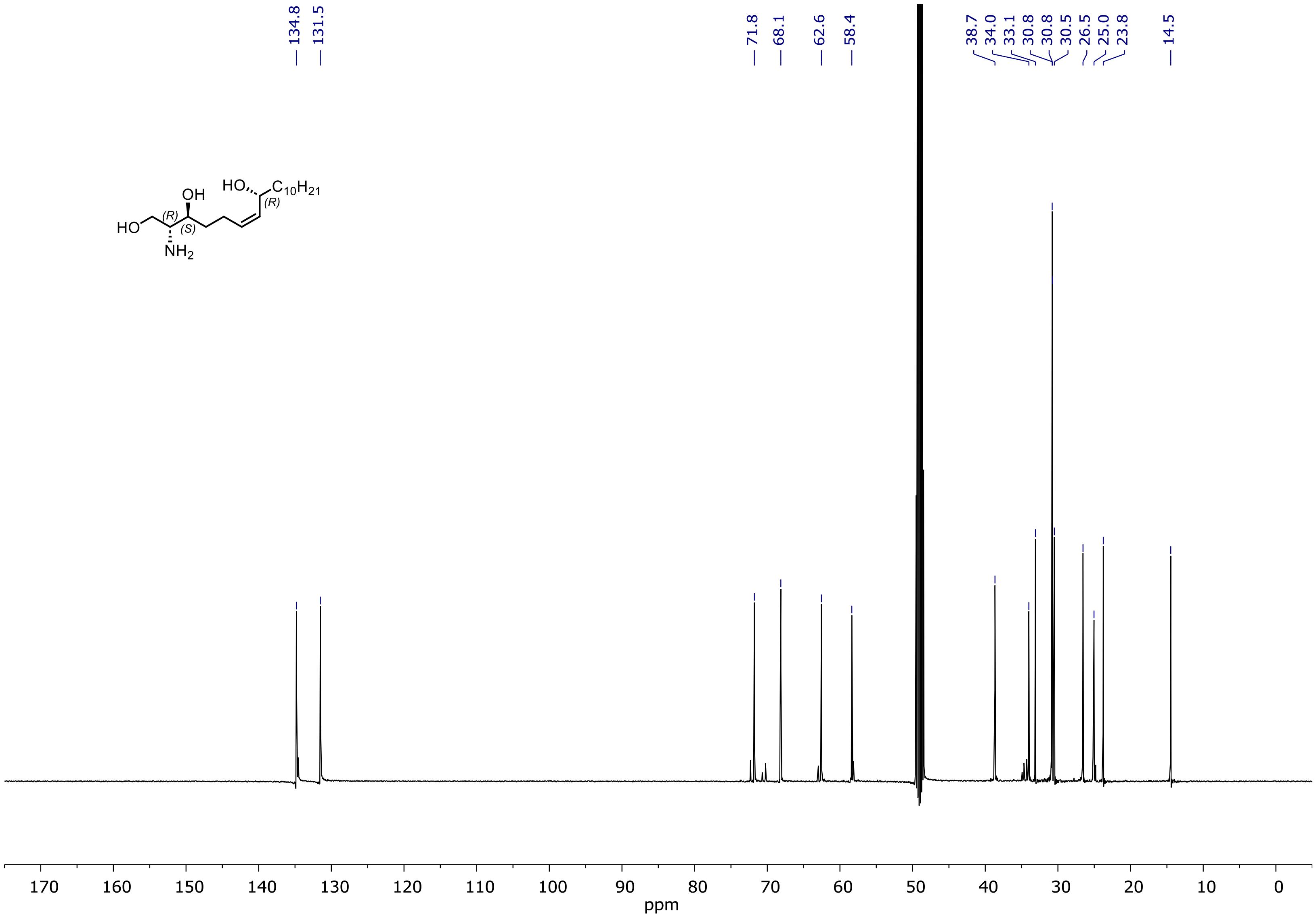


Figure S184. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CD$_3$OD) of (*2R,3S,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **26**.

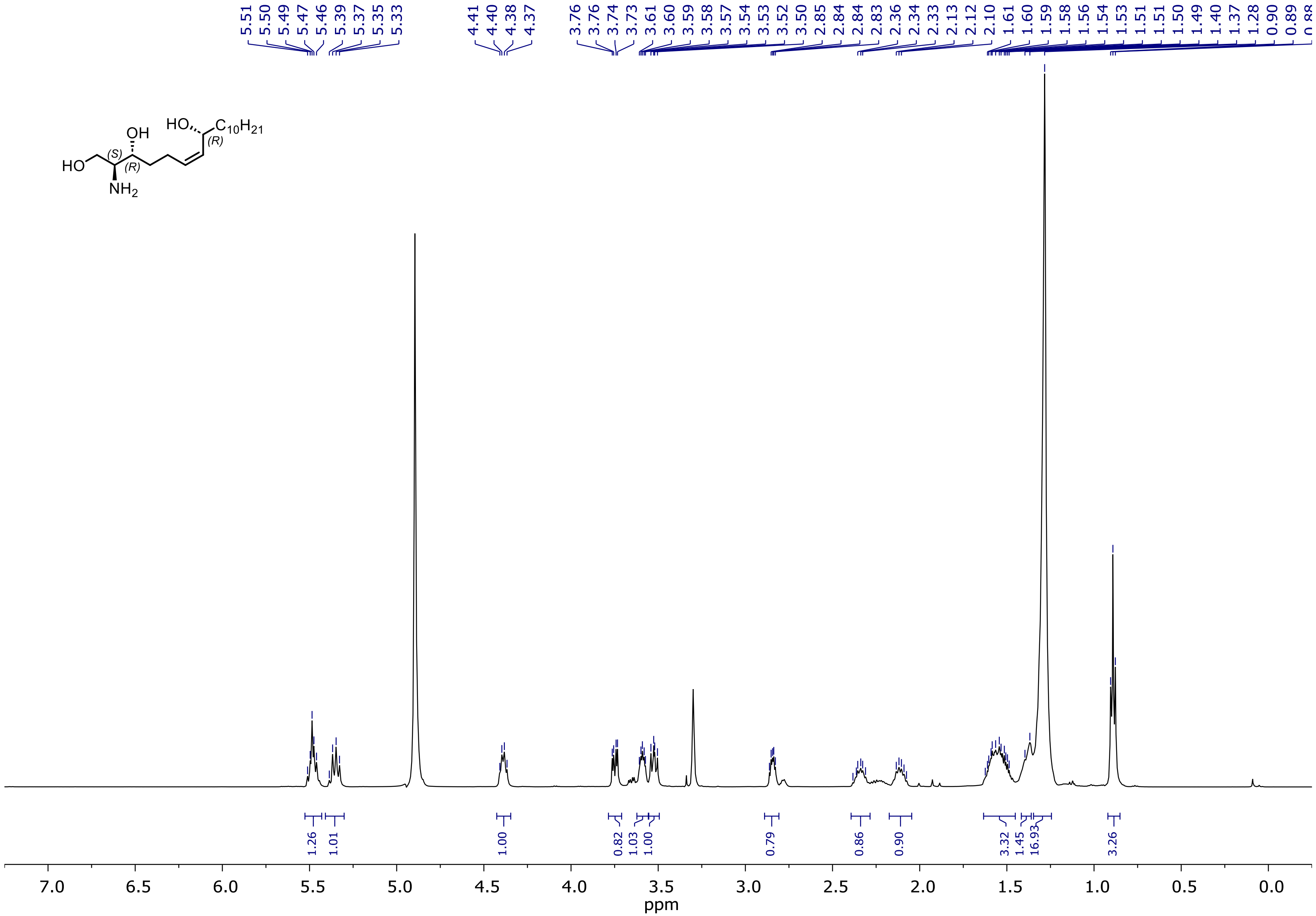


Figure S185. ^{1}H-NMR spectrum (500 MHz, CD$_3$OD) of (*2S,3R,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **27**.

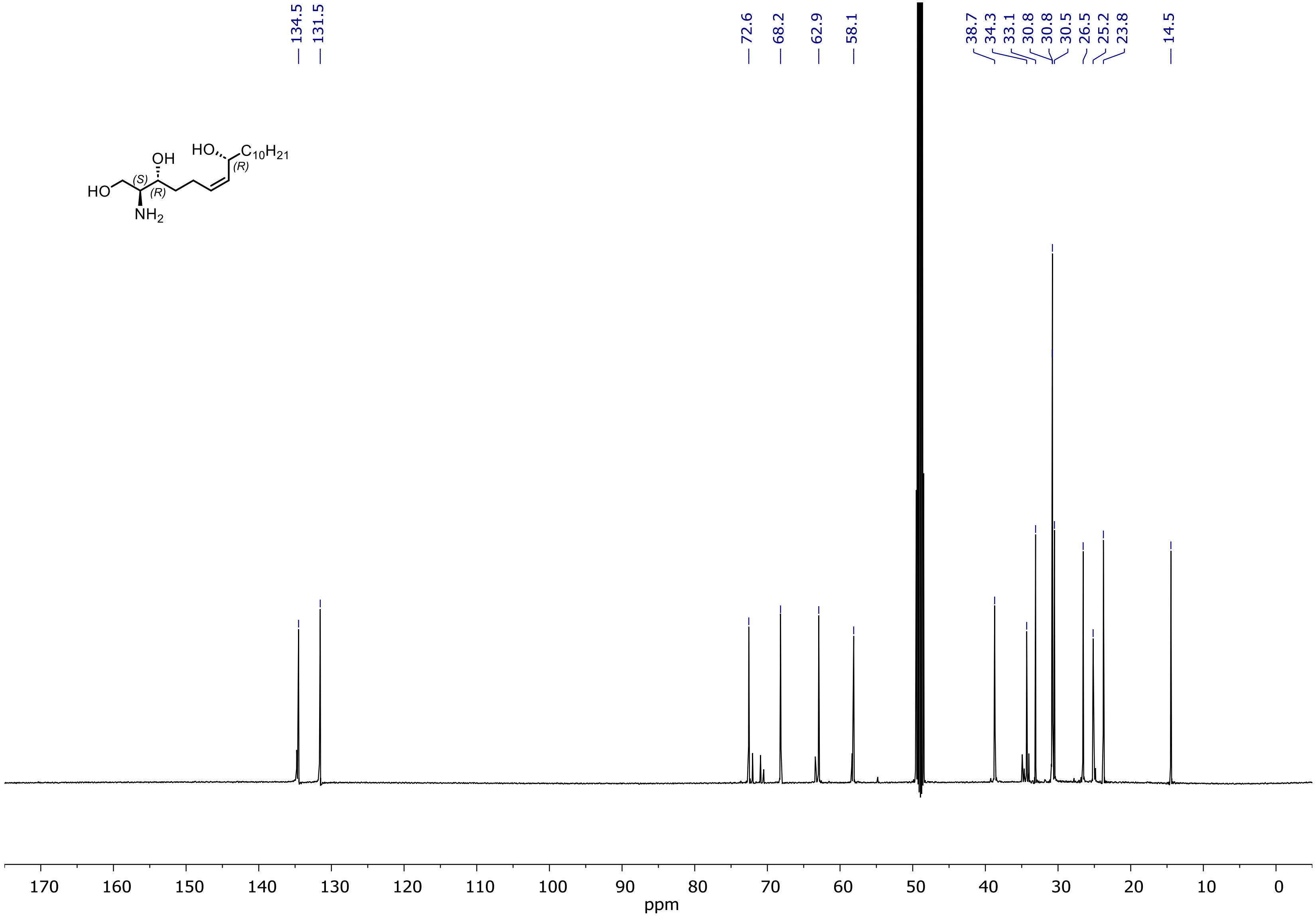


Figure S186. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3R,8R,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **27**.

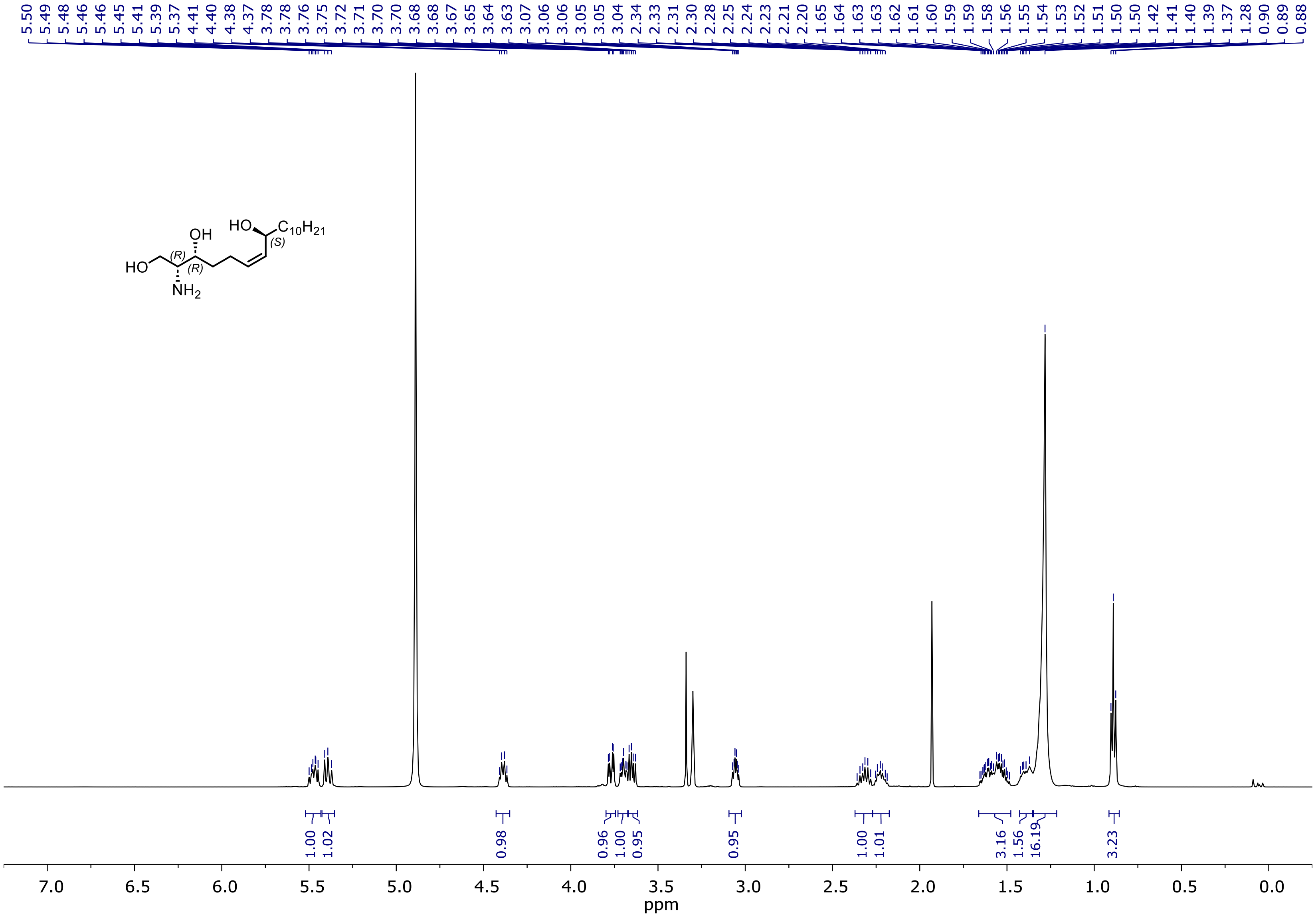


Figure S187. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3R,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **28**.

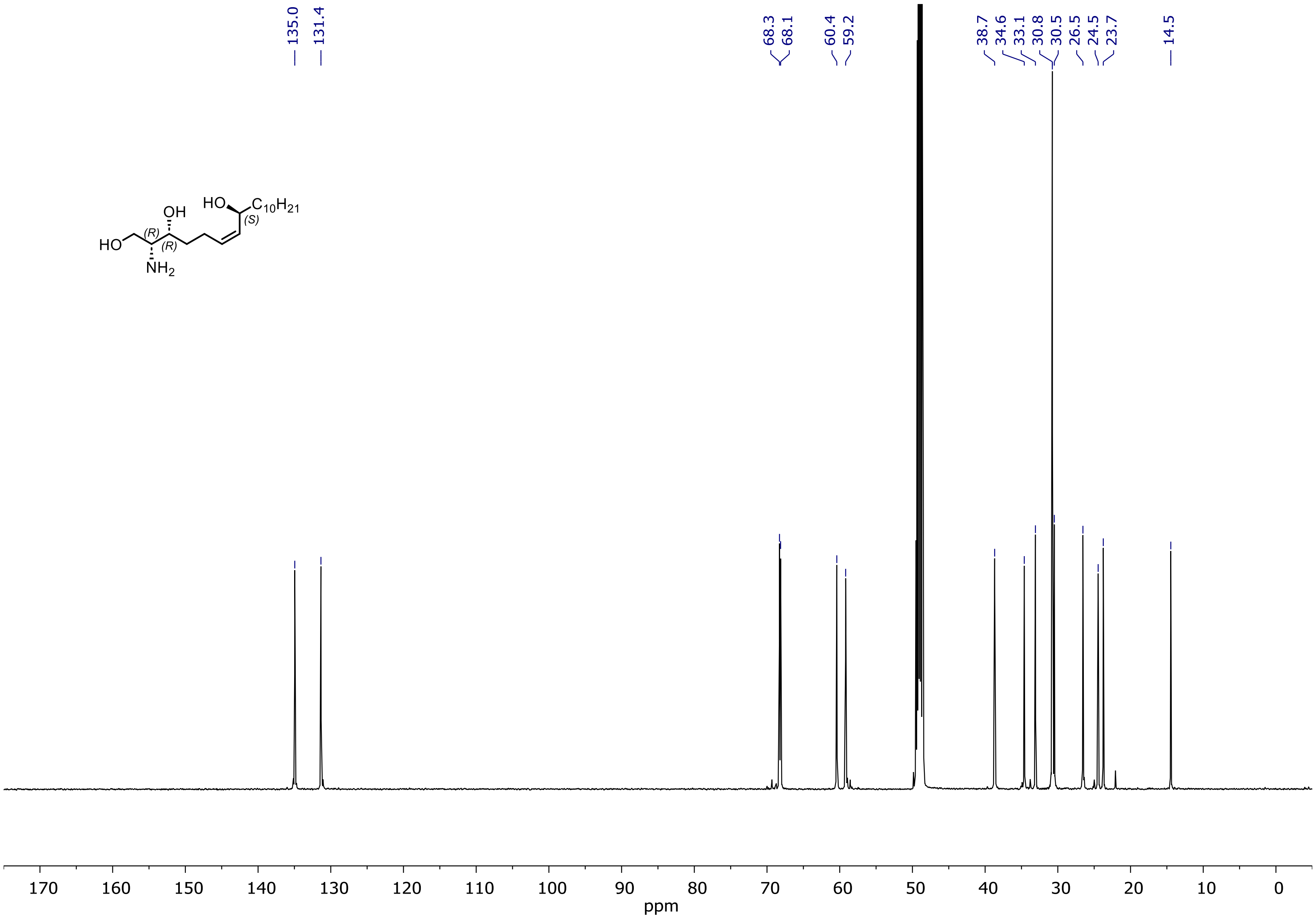


Figure S188. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3R,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **28**.

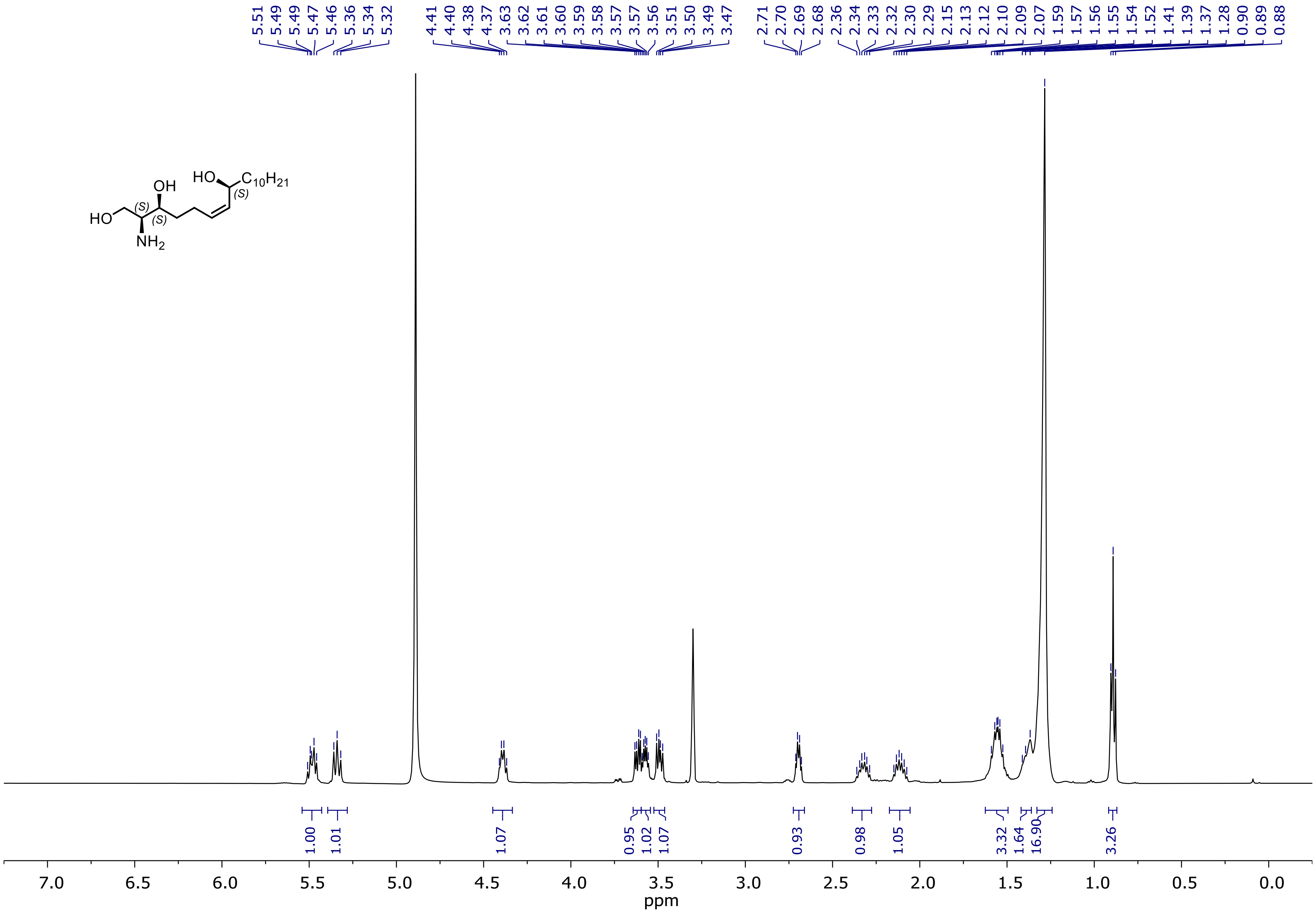


Figure S189. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3S,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **29**.

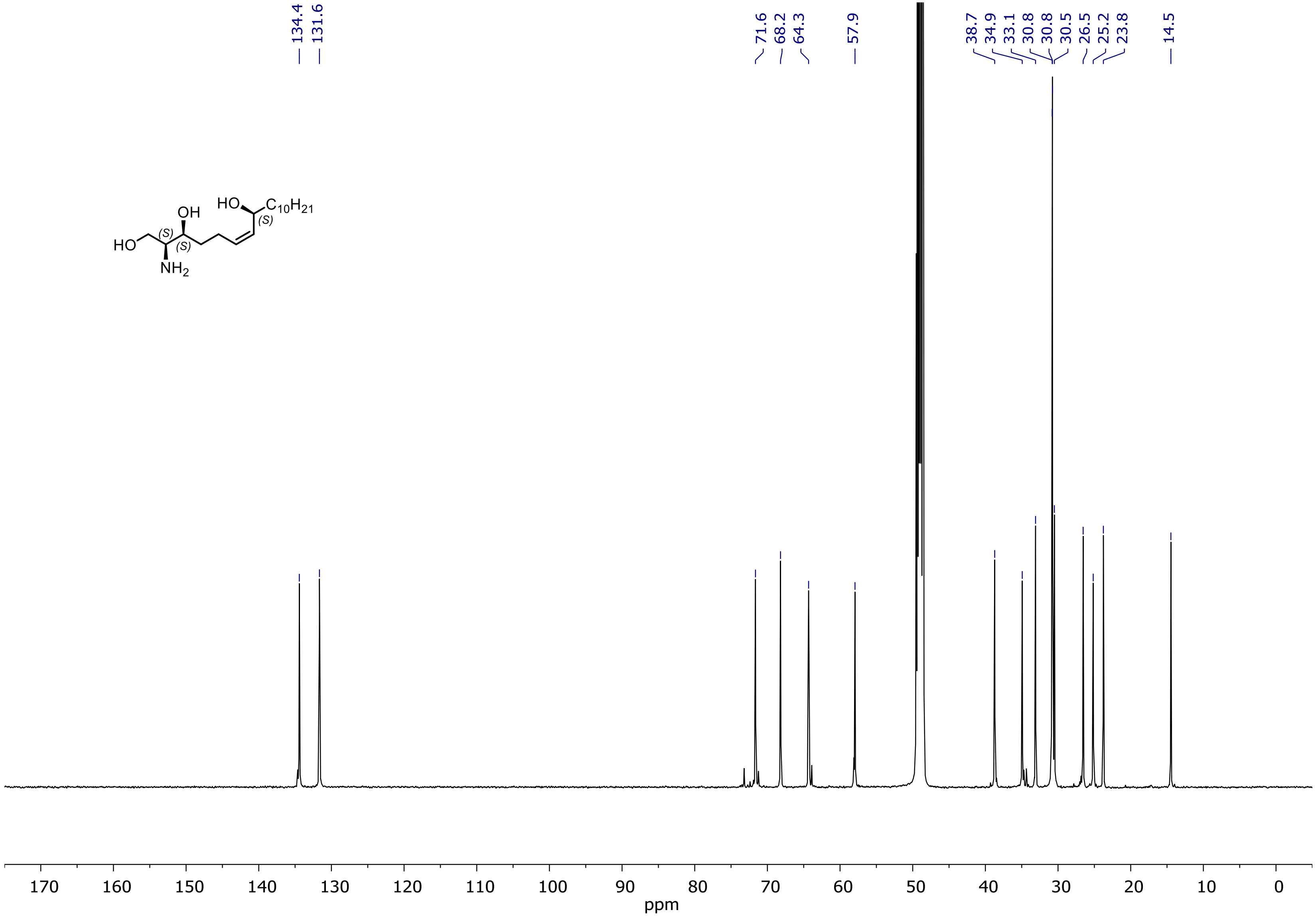


Figure S190. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3S,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **29**.

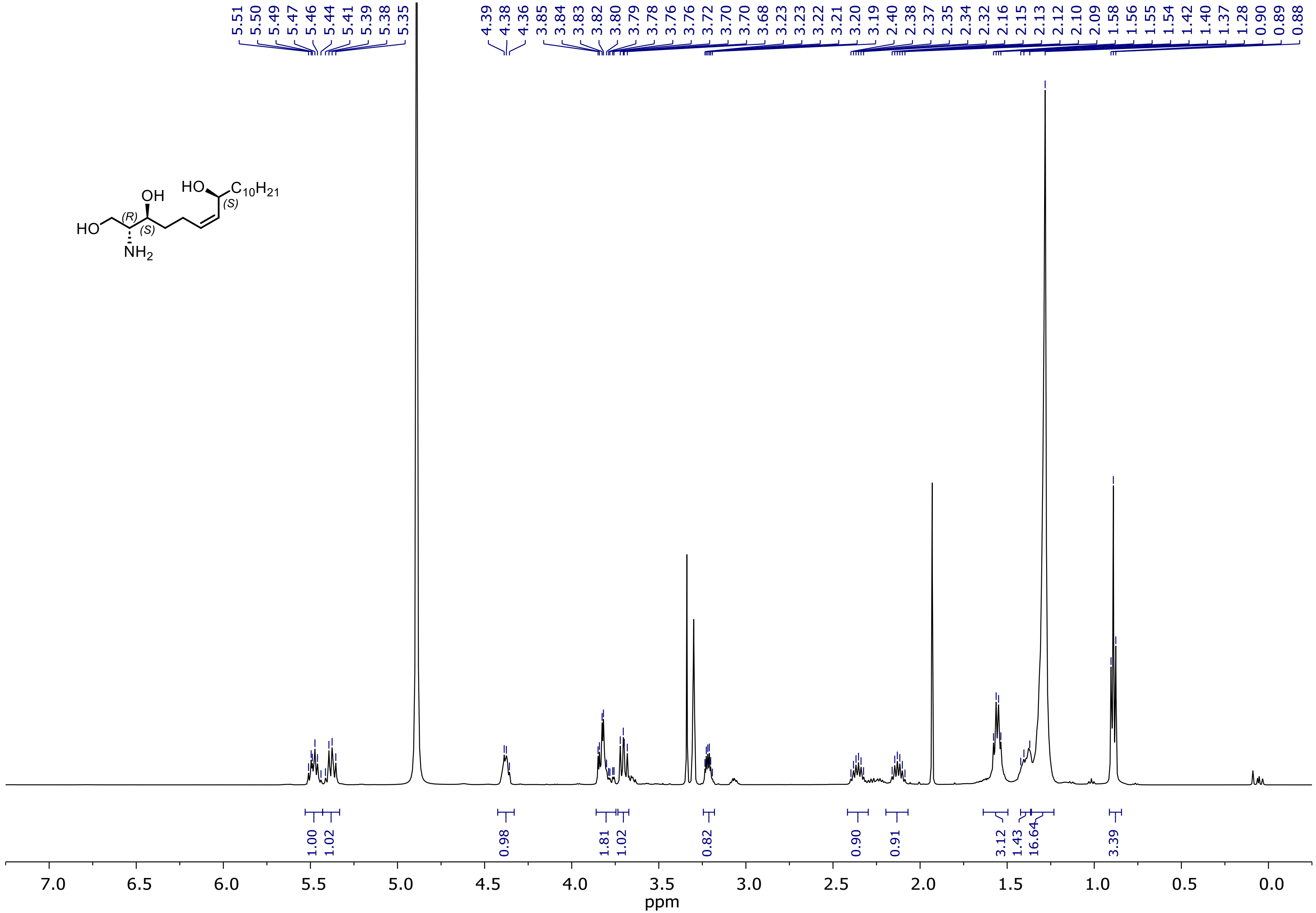


Figure S191. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3S,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **30**.

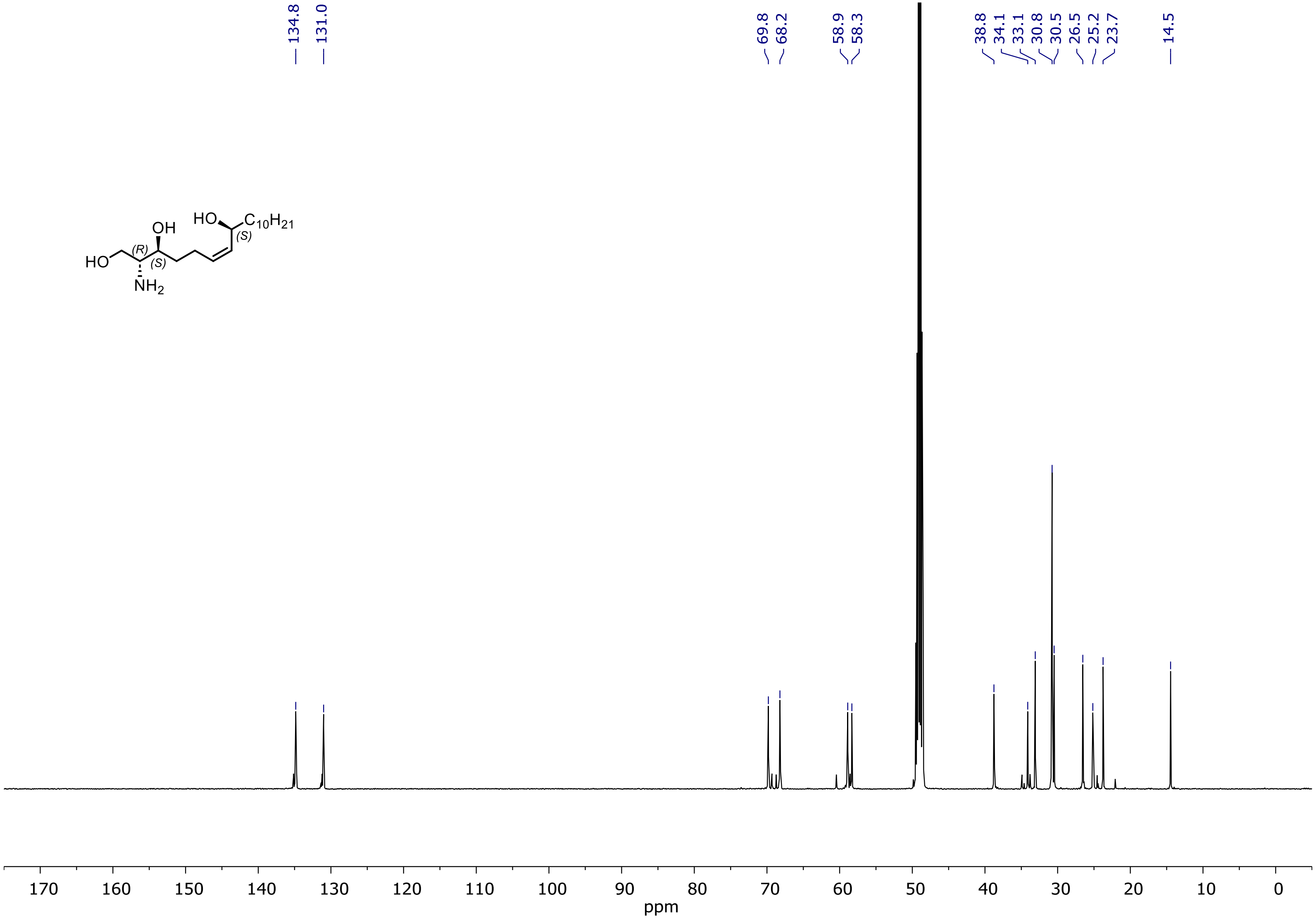


Figure S192. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3S,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **30**.

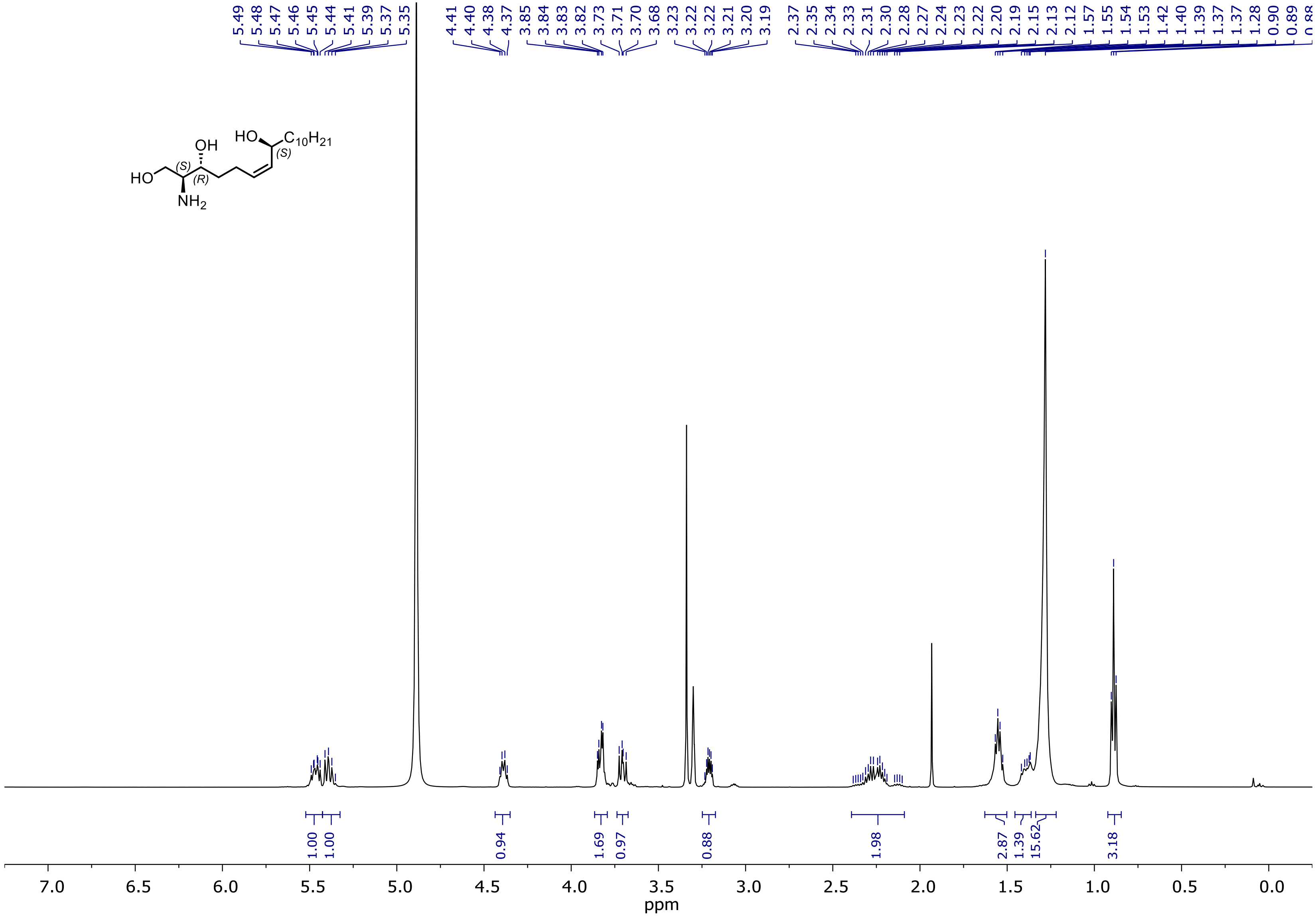


Figure S193. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3R,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **31**.

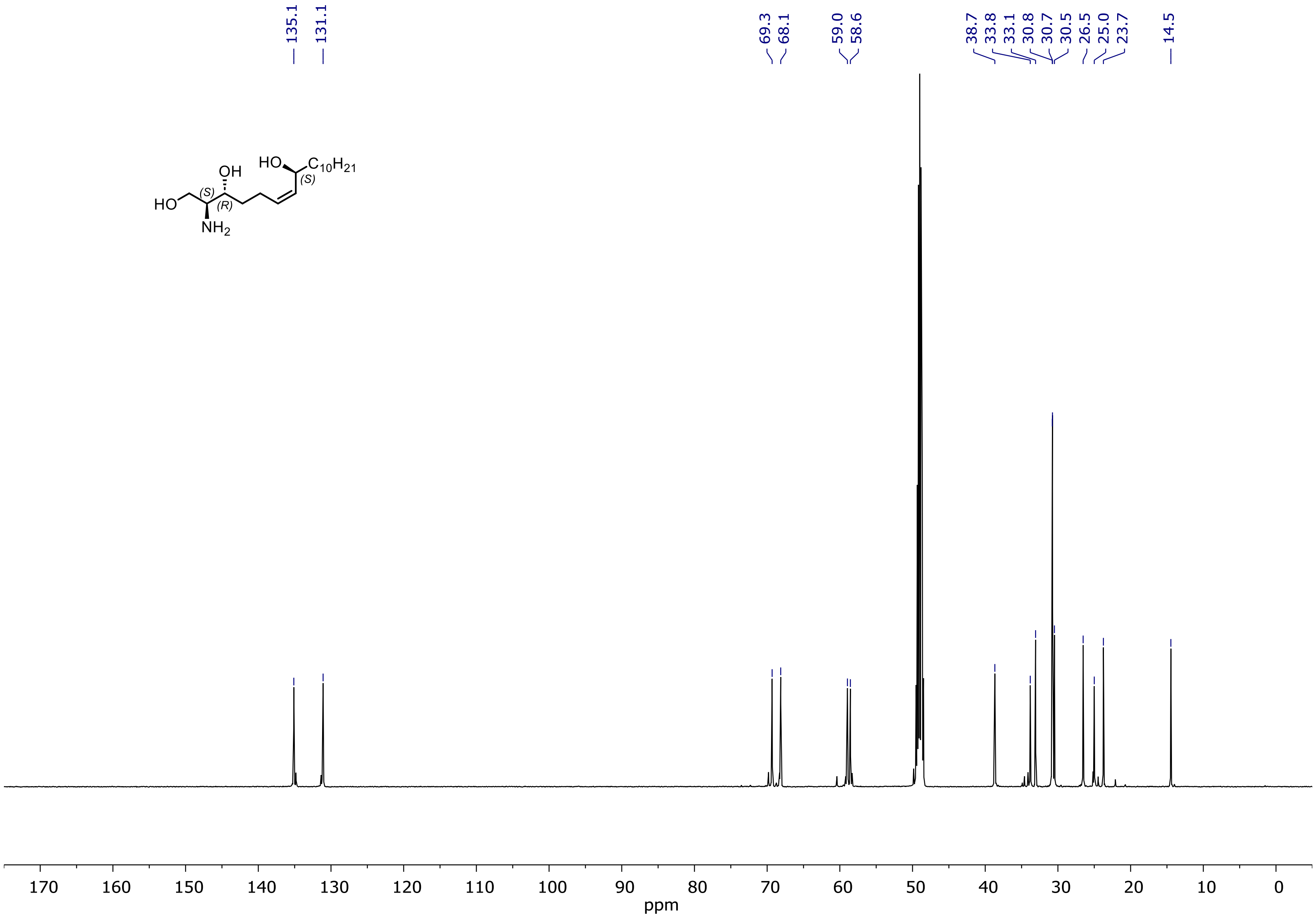


Figure S194. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3R,8S,Z*)-2-Aminooctadec-6-ene-1,3,8-triol **31**.

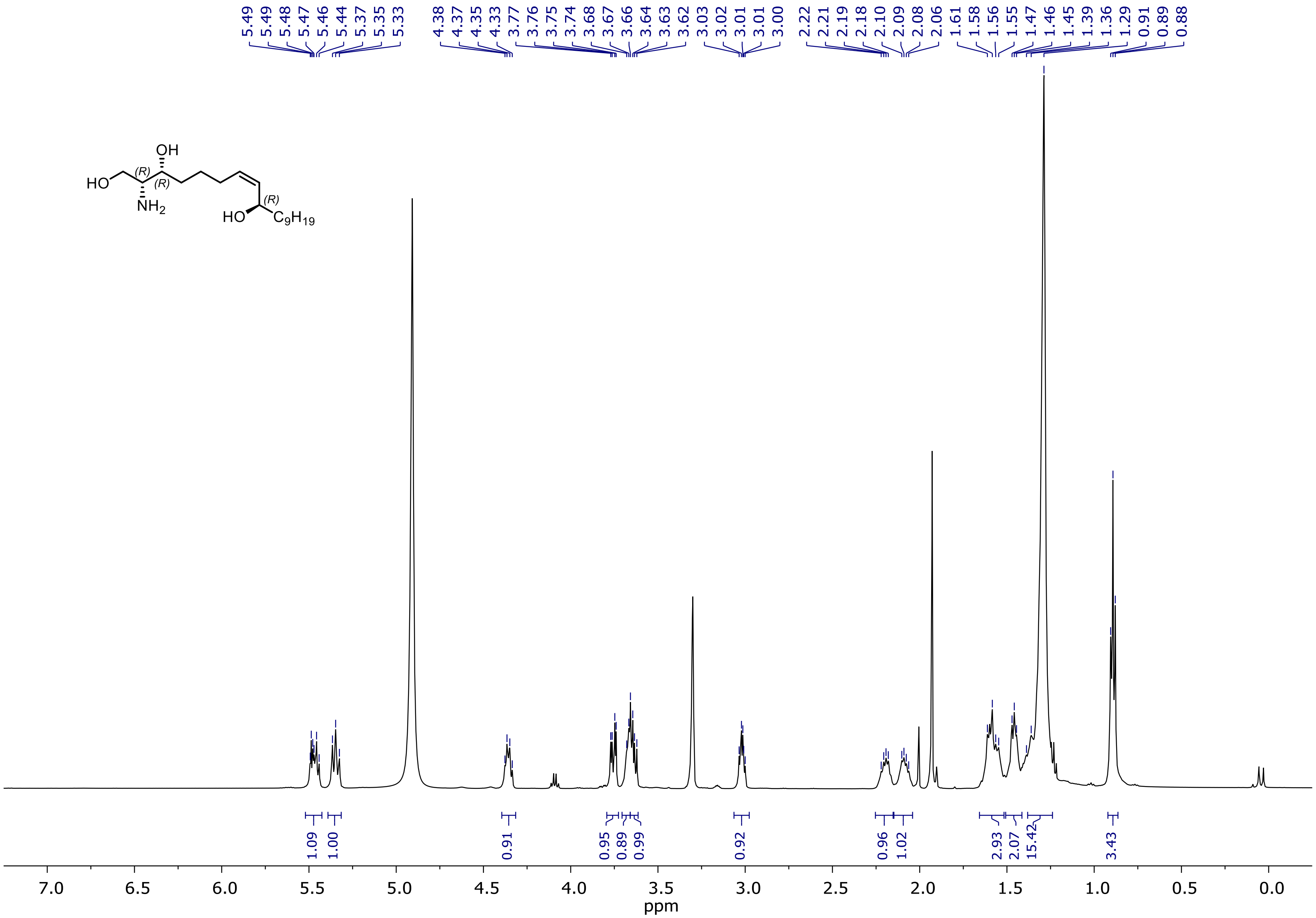


Figure S195. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3R,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol **33**.

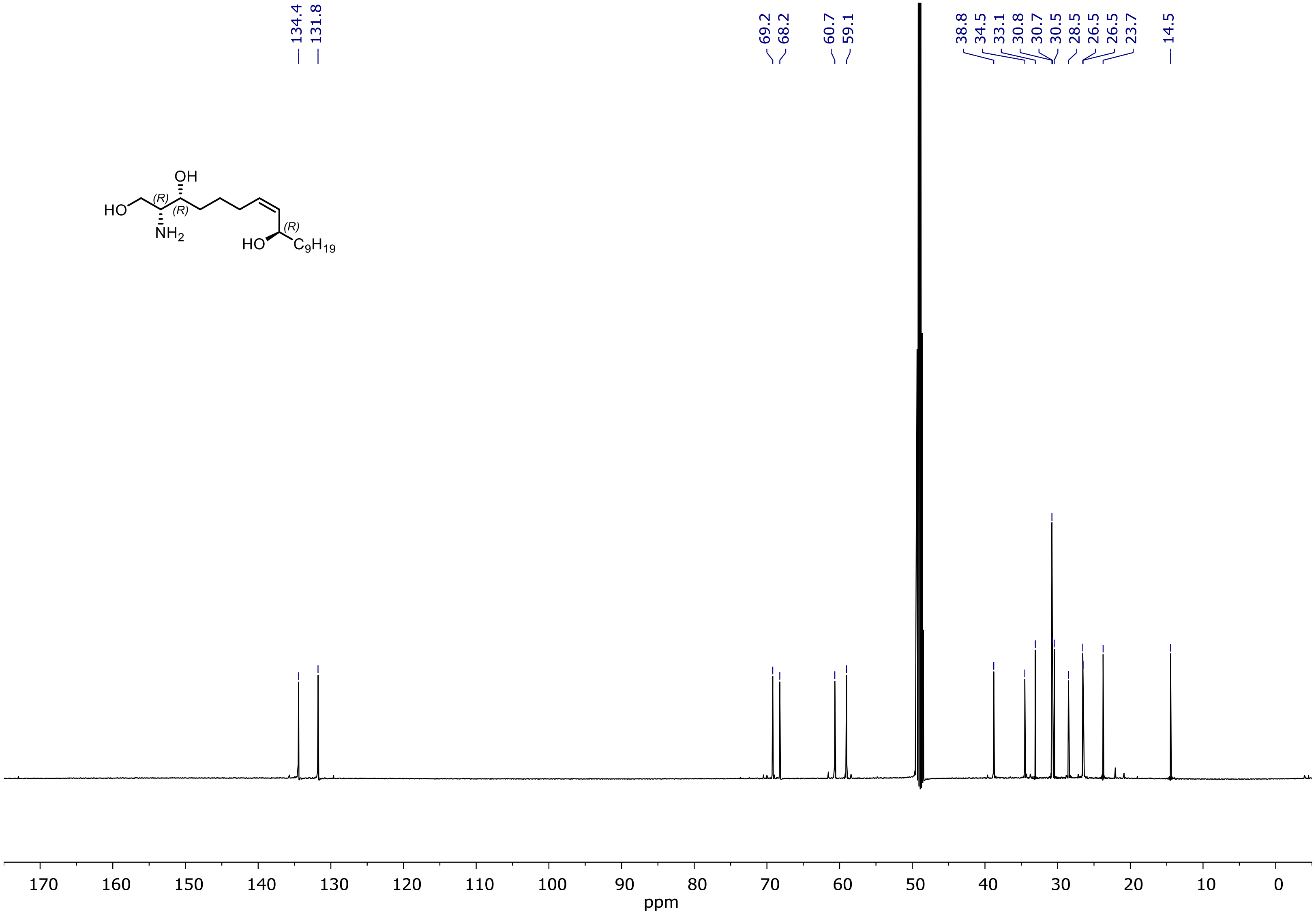


Figure S196. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3R,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol **33**.

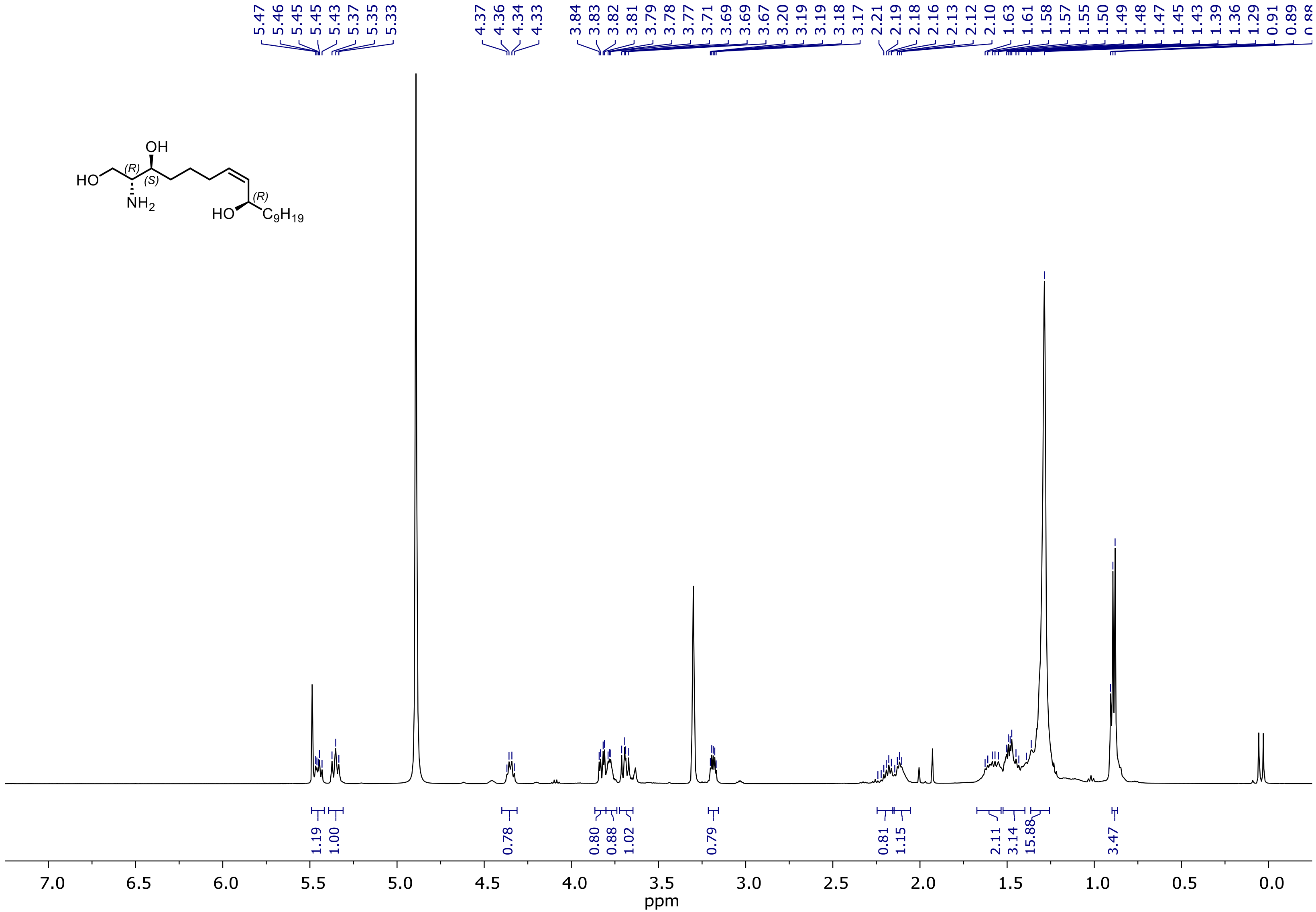


Figure S197. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3S,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol **34**.

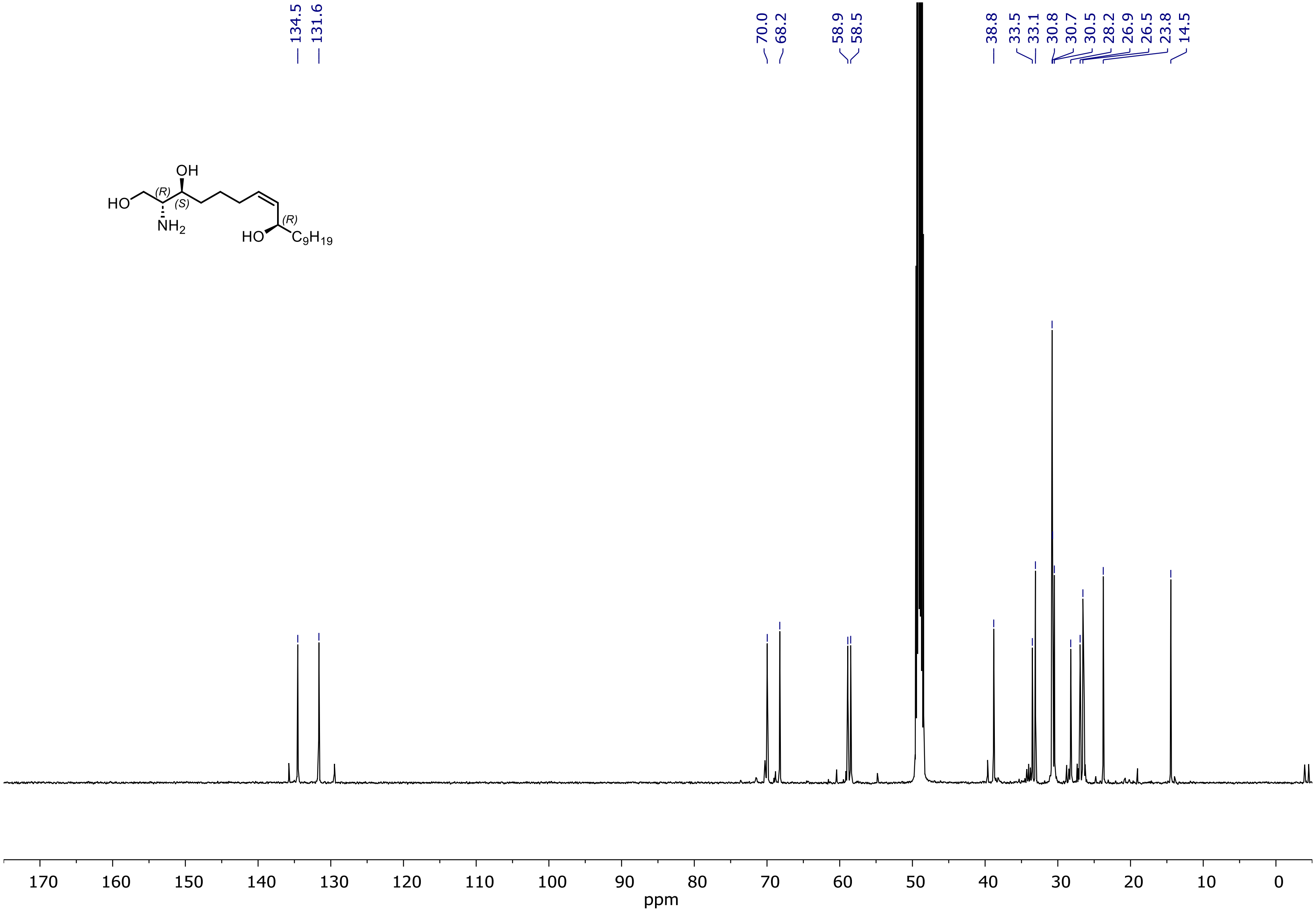


Figure S198. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3S,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol **34**.

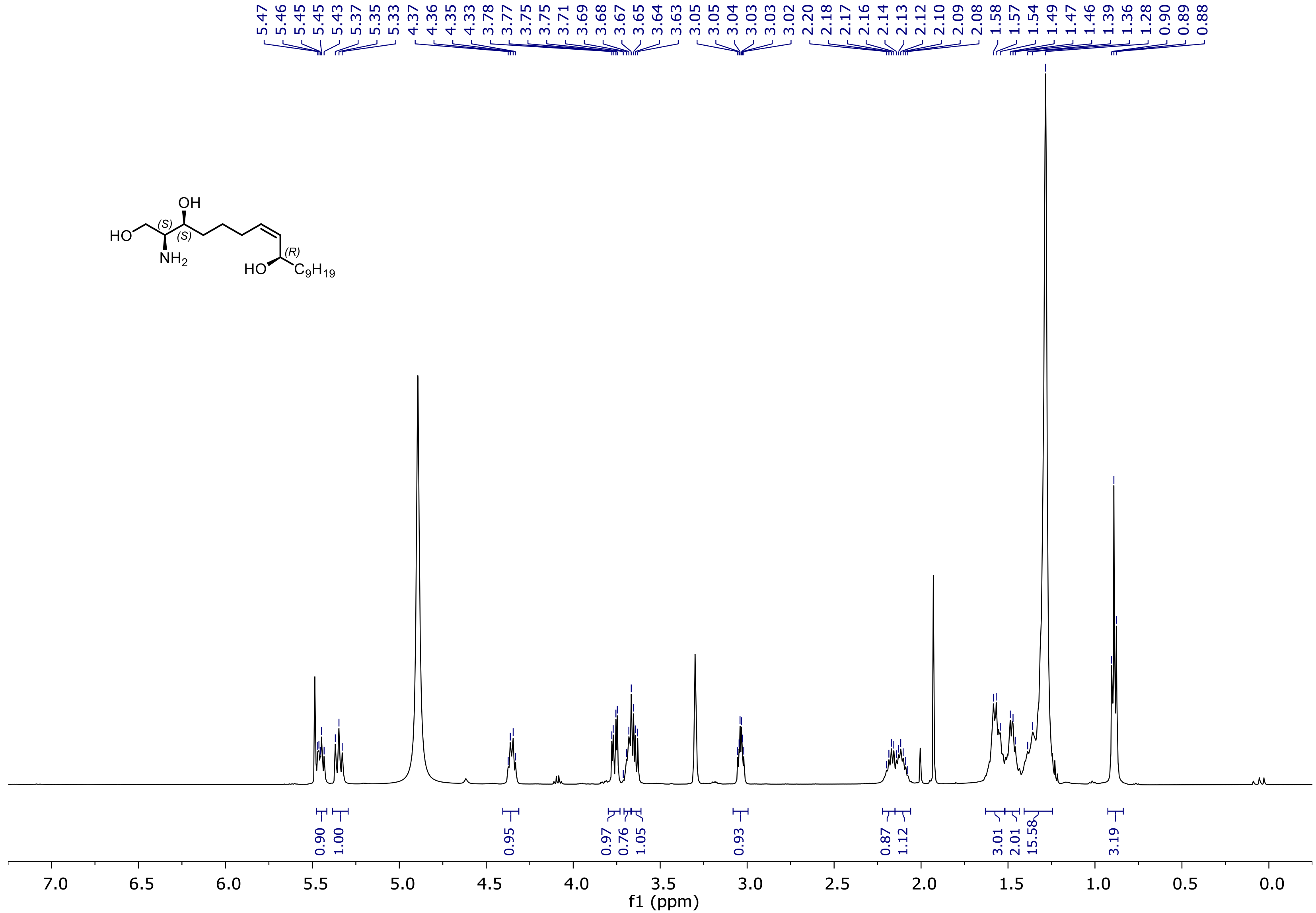


Figure S199. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3S,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol **35**.

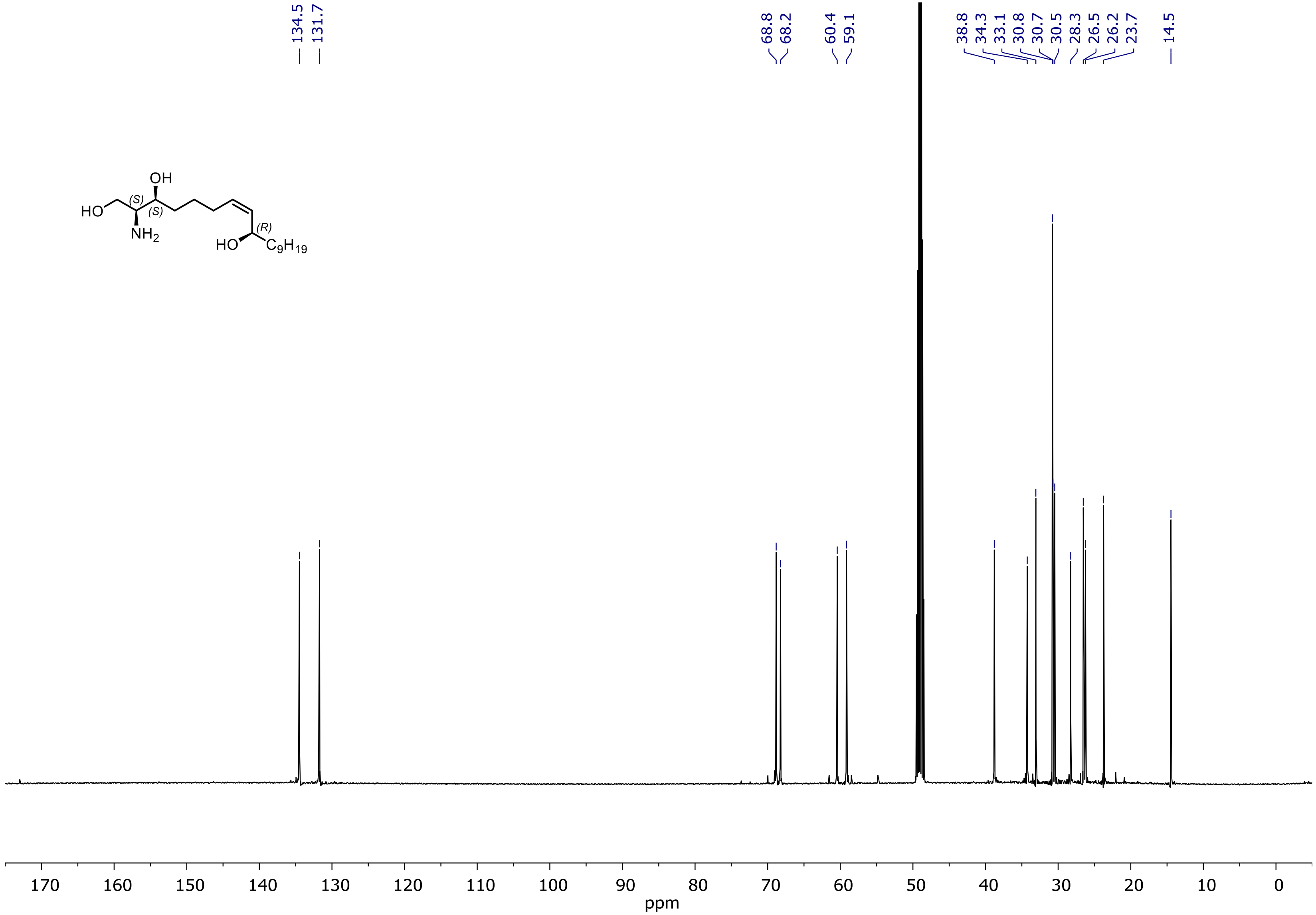


Figure S200. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3S,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol **35**.

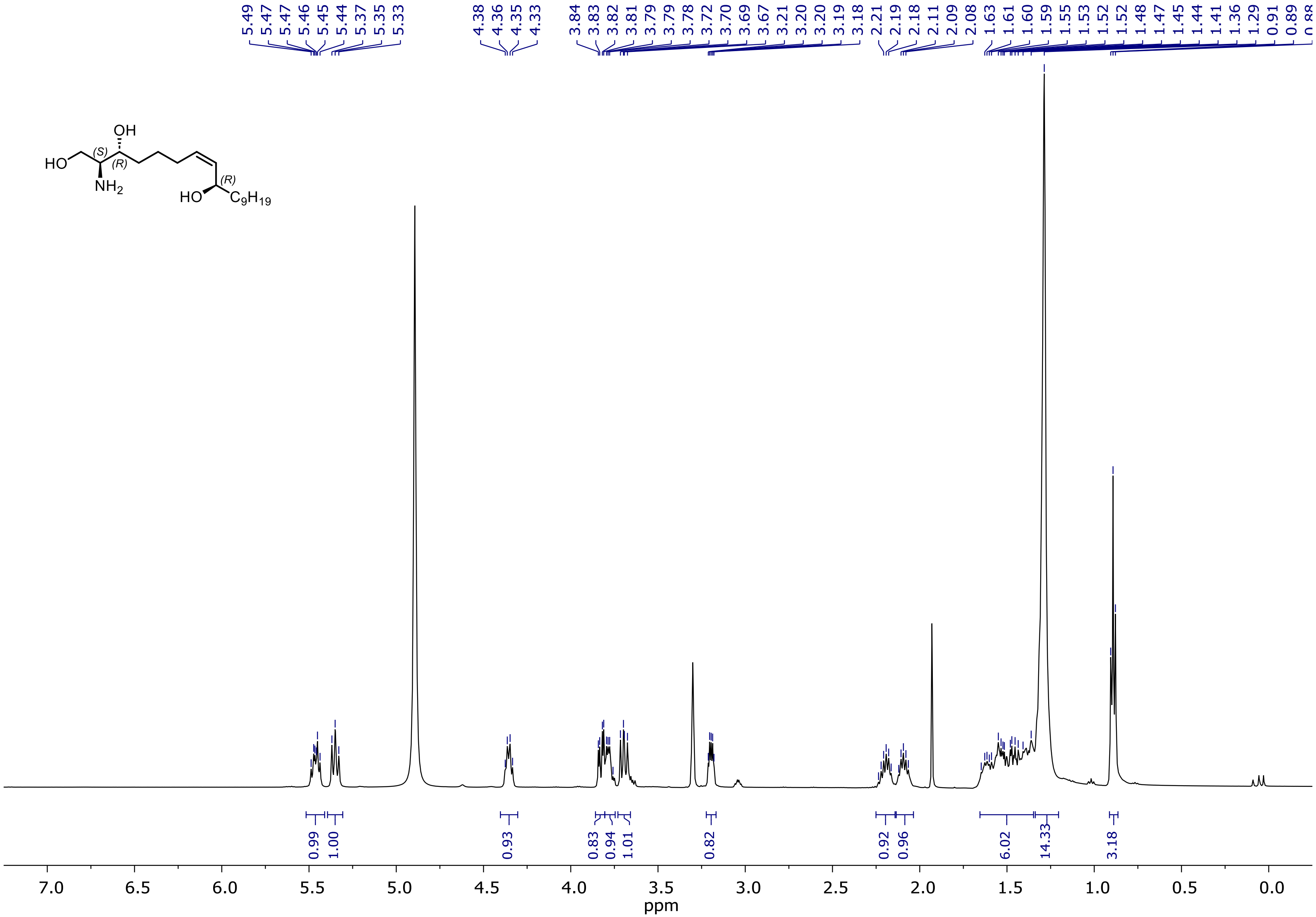


Figure S201. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3R,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol **36**.

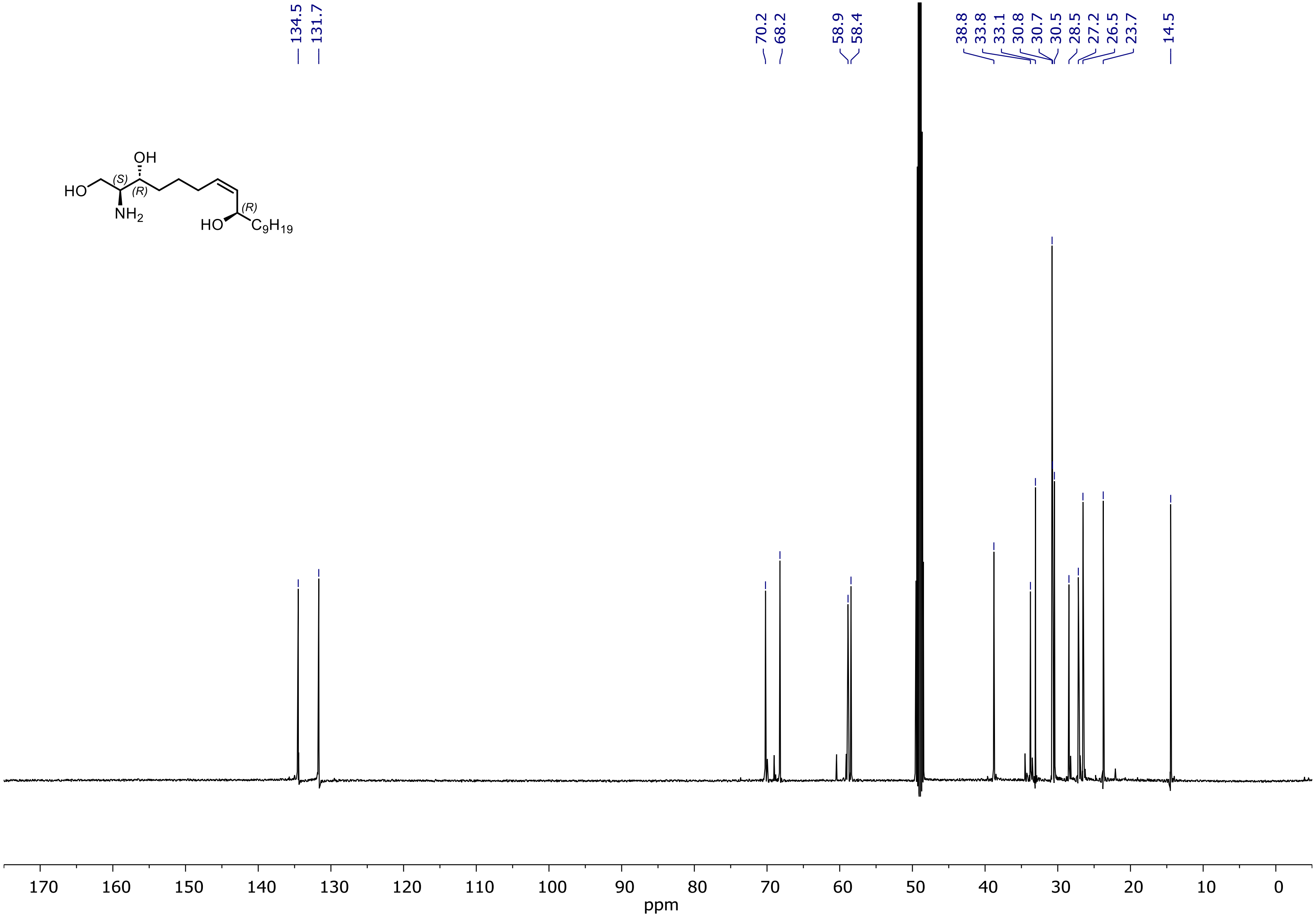


Figure S202. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3R,9R,Z*)-2-Aminooctadec-7-ene-1,3,9-triol **36**.

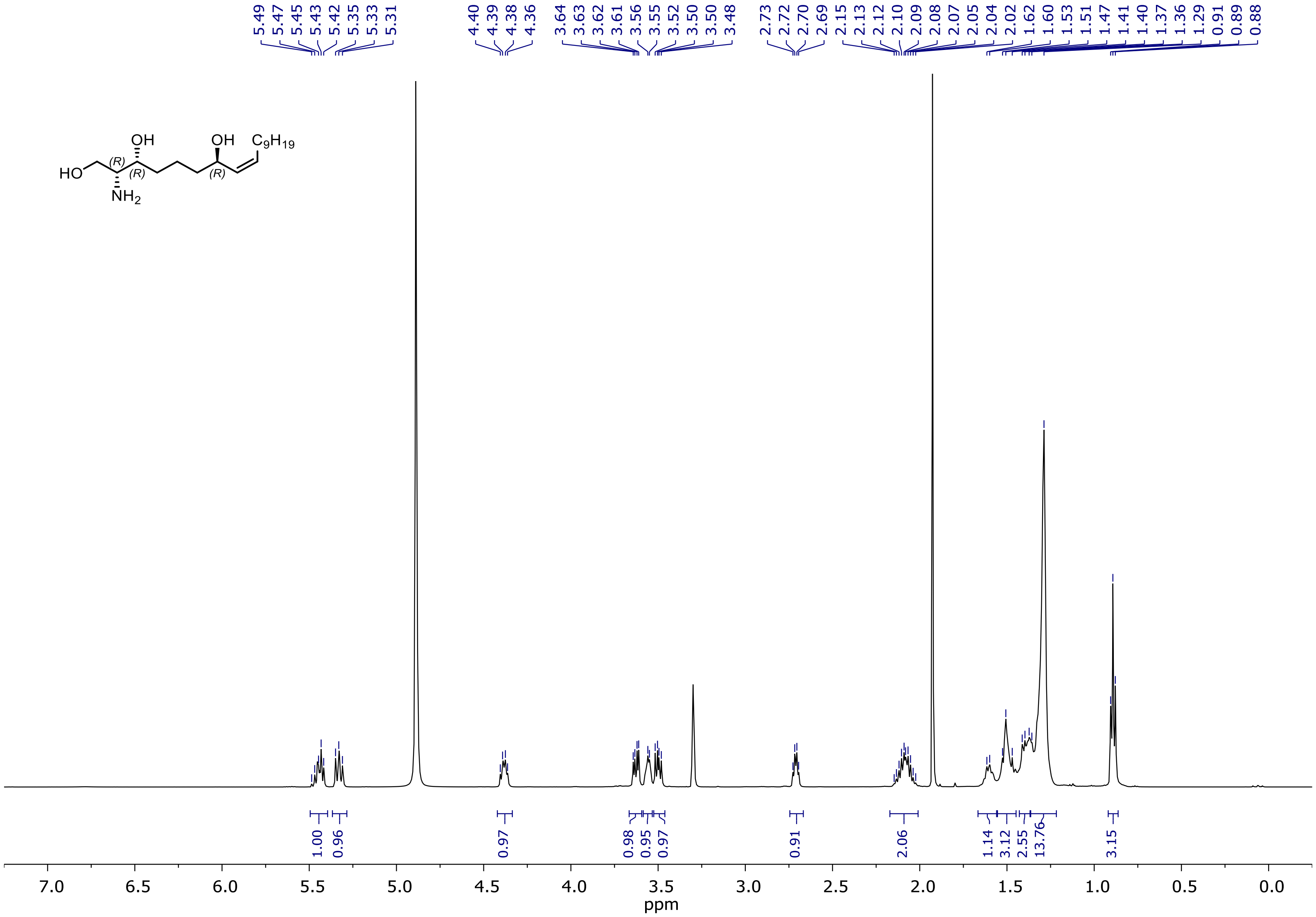


Figure S203. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3R,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol **38**.

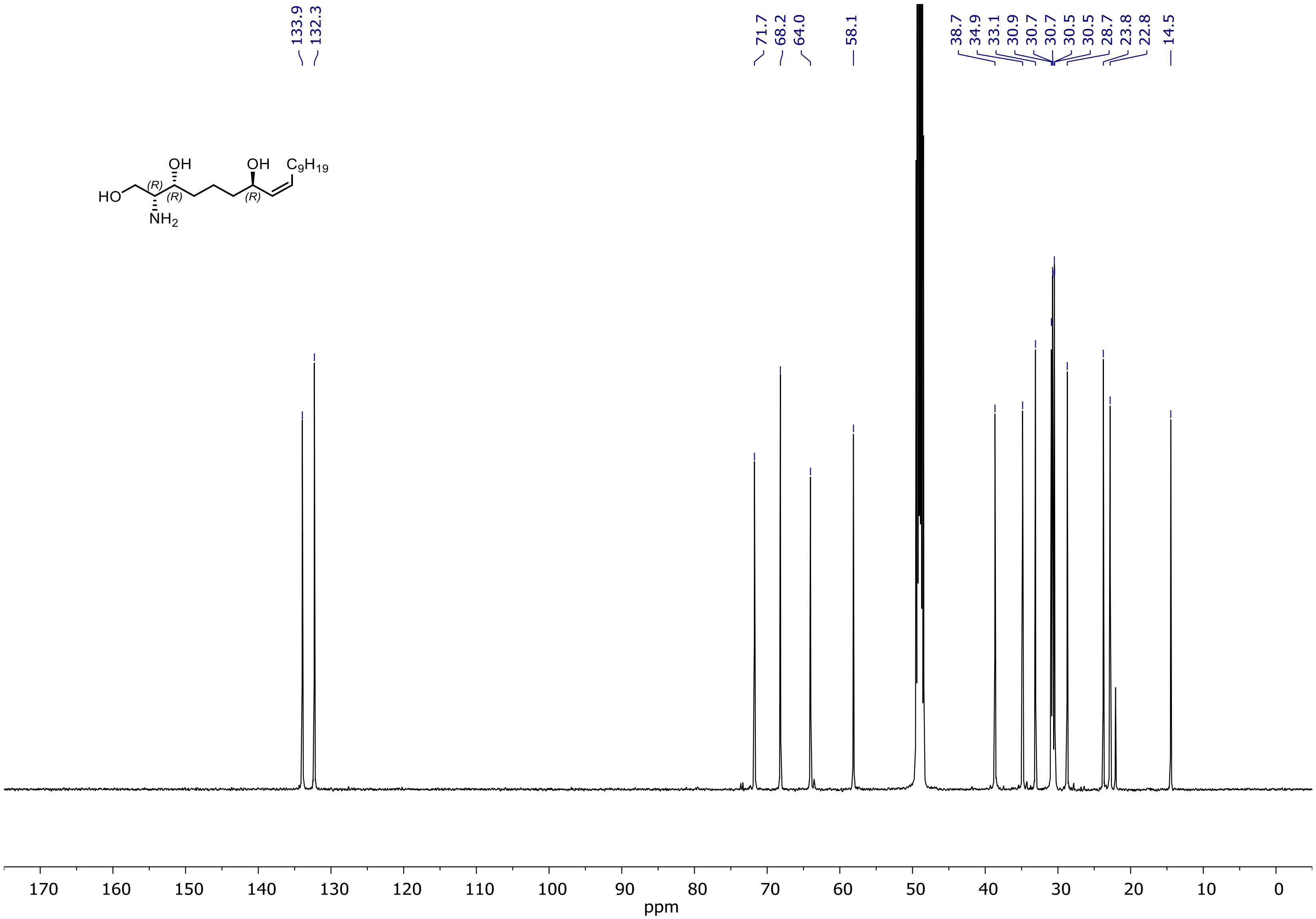


Figure S204. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3R,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol **38**.

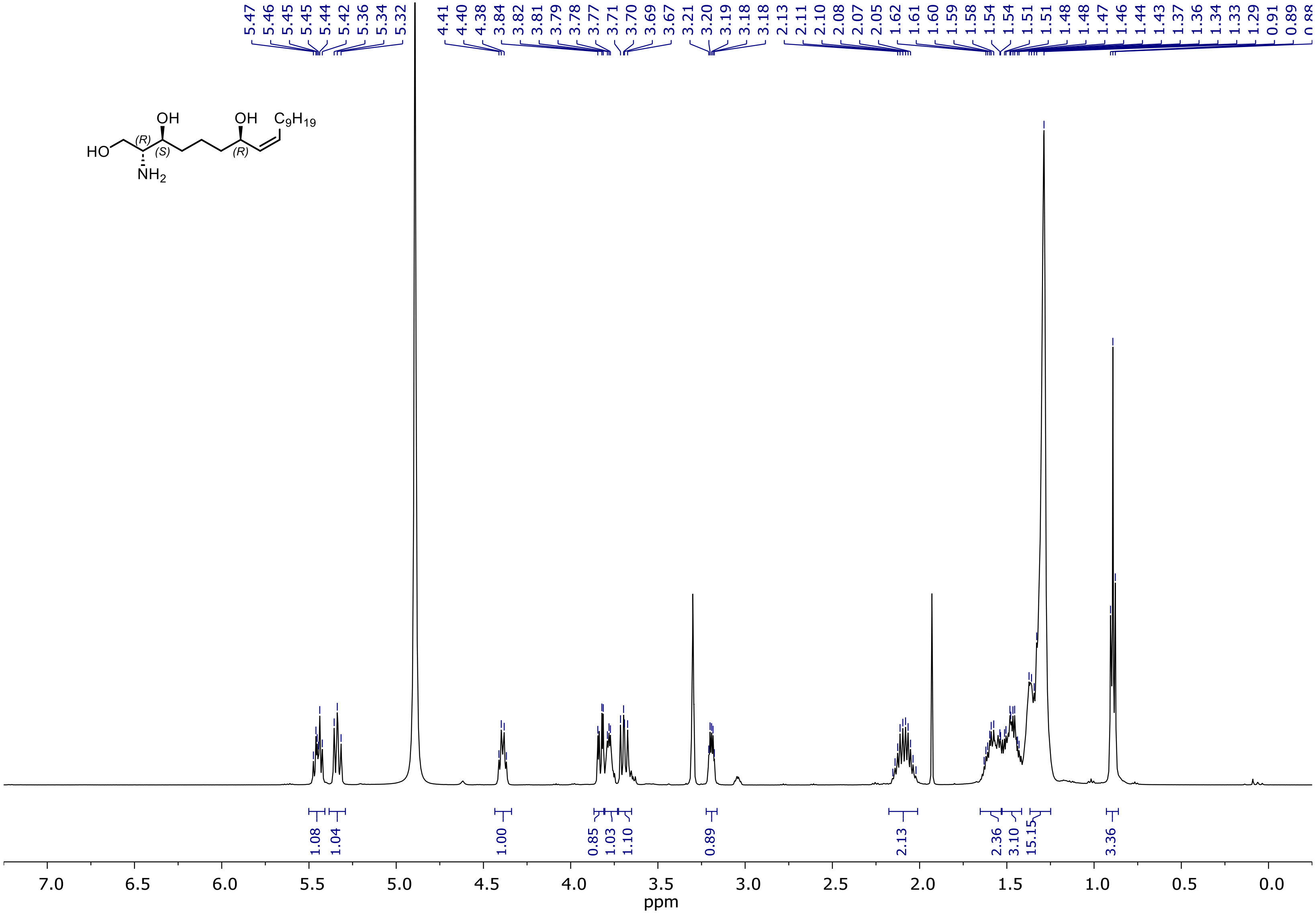


Figure S205. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3S,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol **39**.

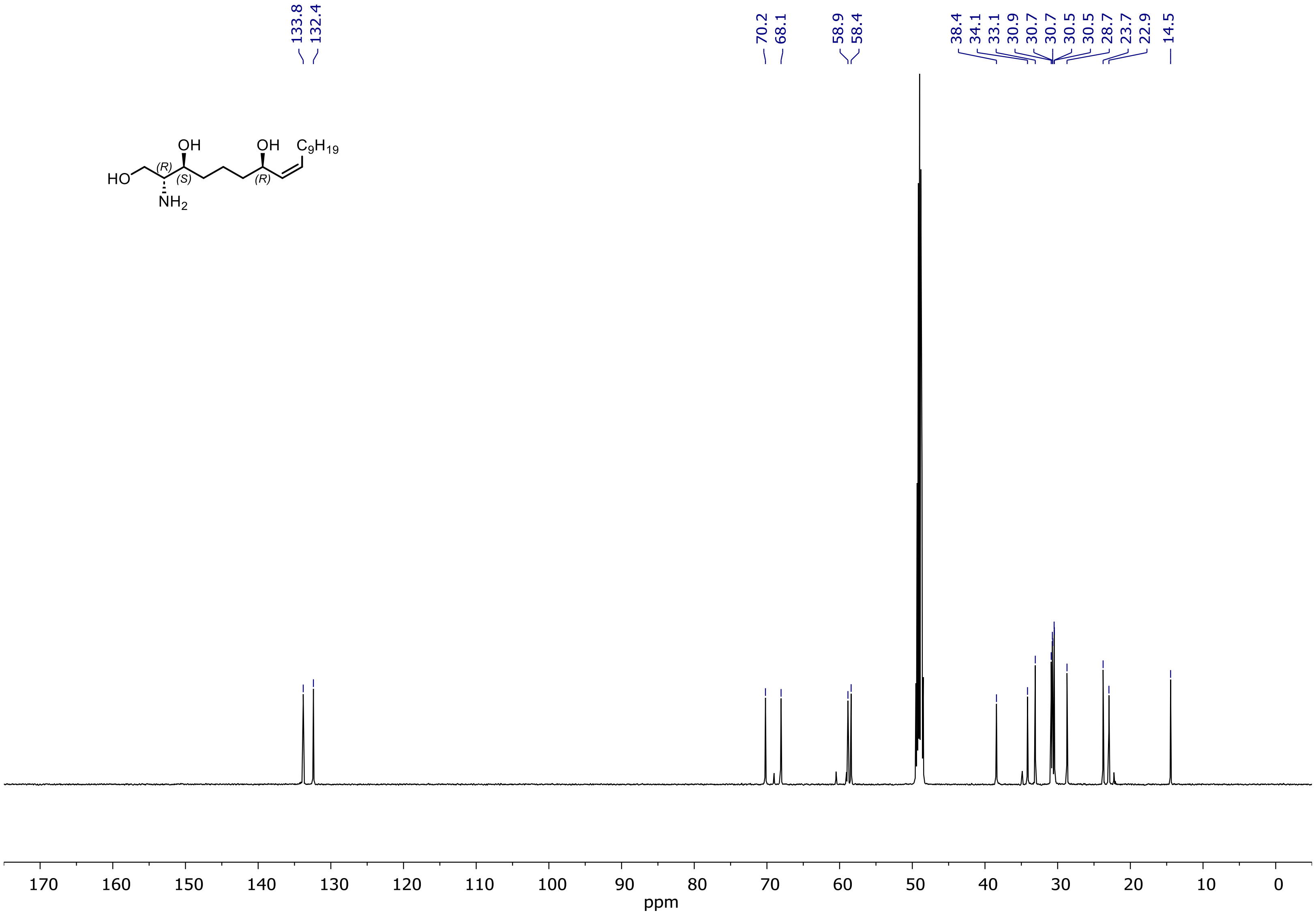


Figure S206. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3S,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol **39**.

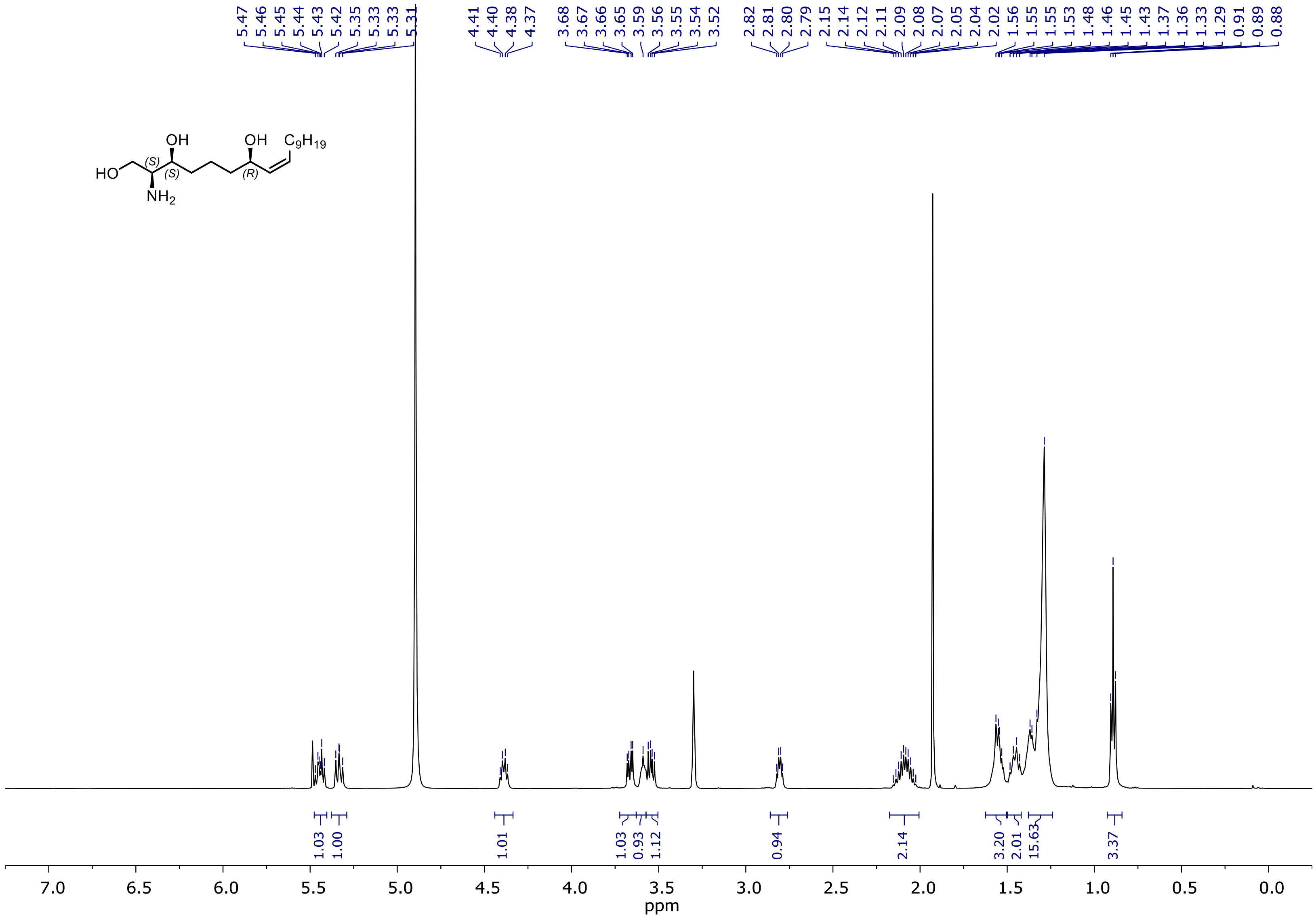


Figure S207. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3S,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol **40**.

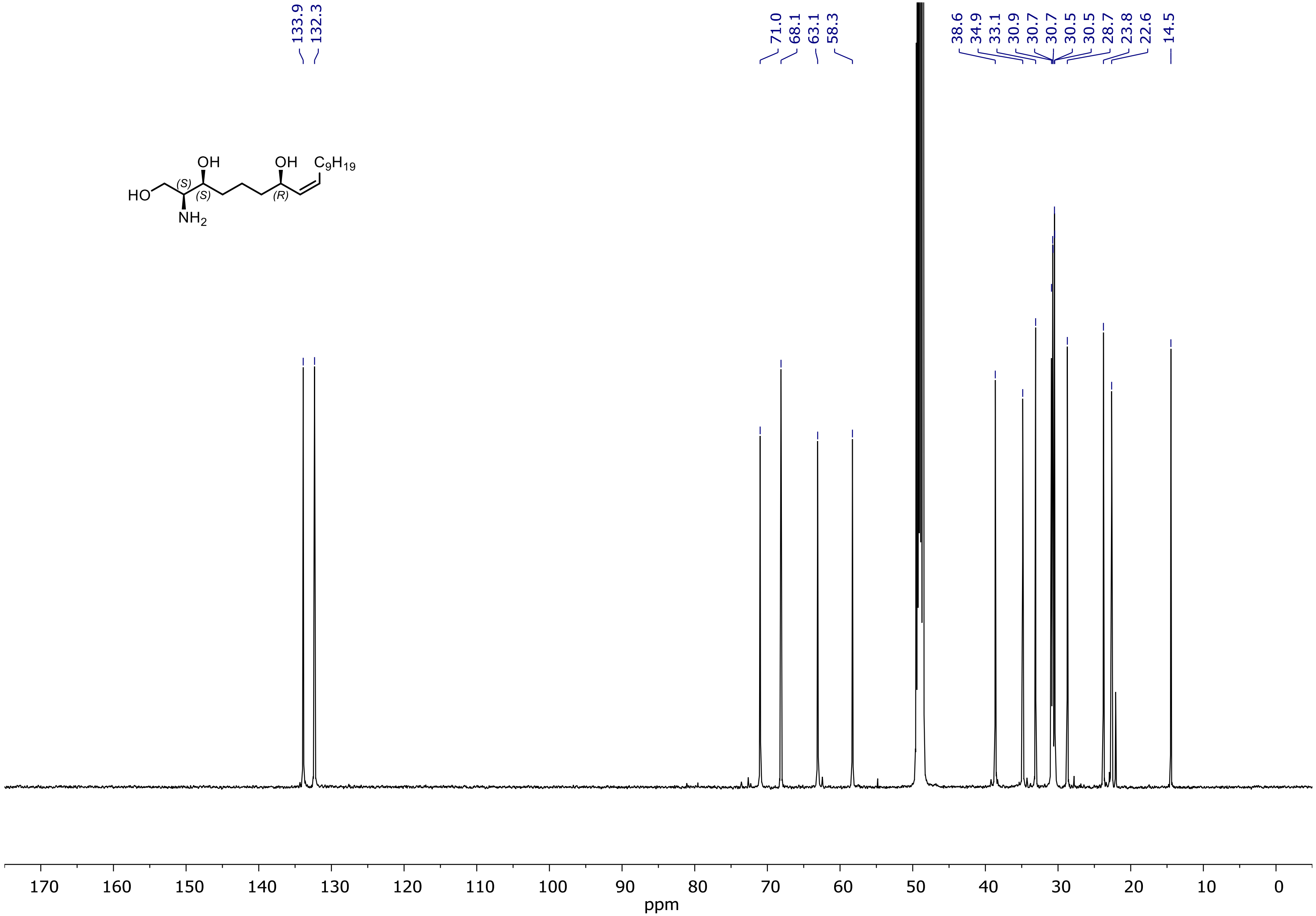


Figure S208. $^{13}C\{^1H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3S,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol **40.**

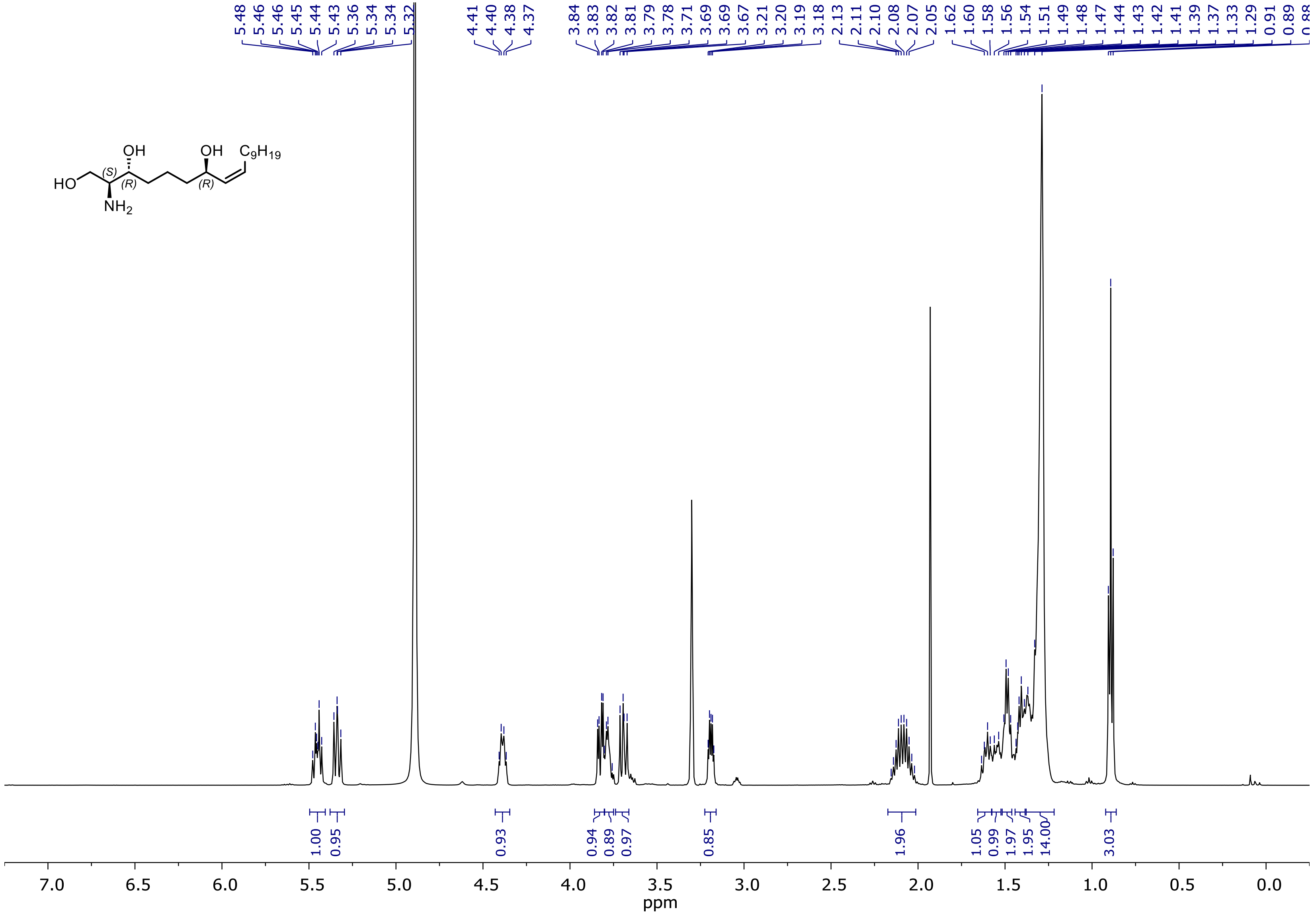


Figure S209. ^{1}H-NMR spectrum (500 MHz, CD$_3$OD) of (*2S,3R,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol **41**.

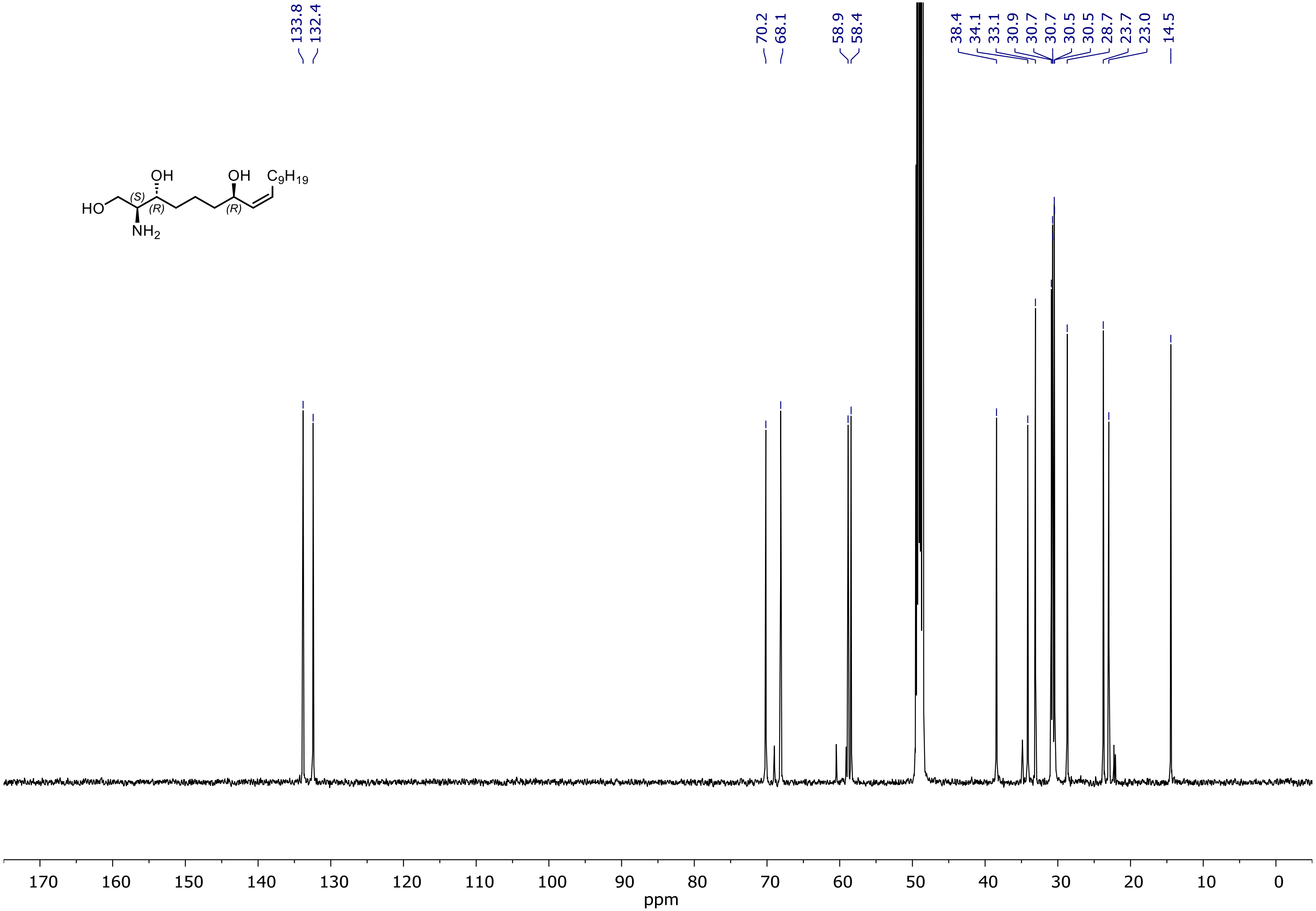


Figure S210. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3R,7R,Z*)-2-Aminooctadec-8-ene-1,3,7-triol **41**.

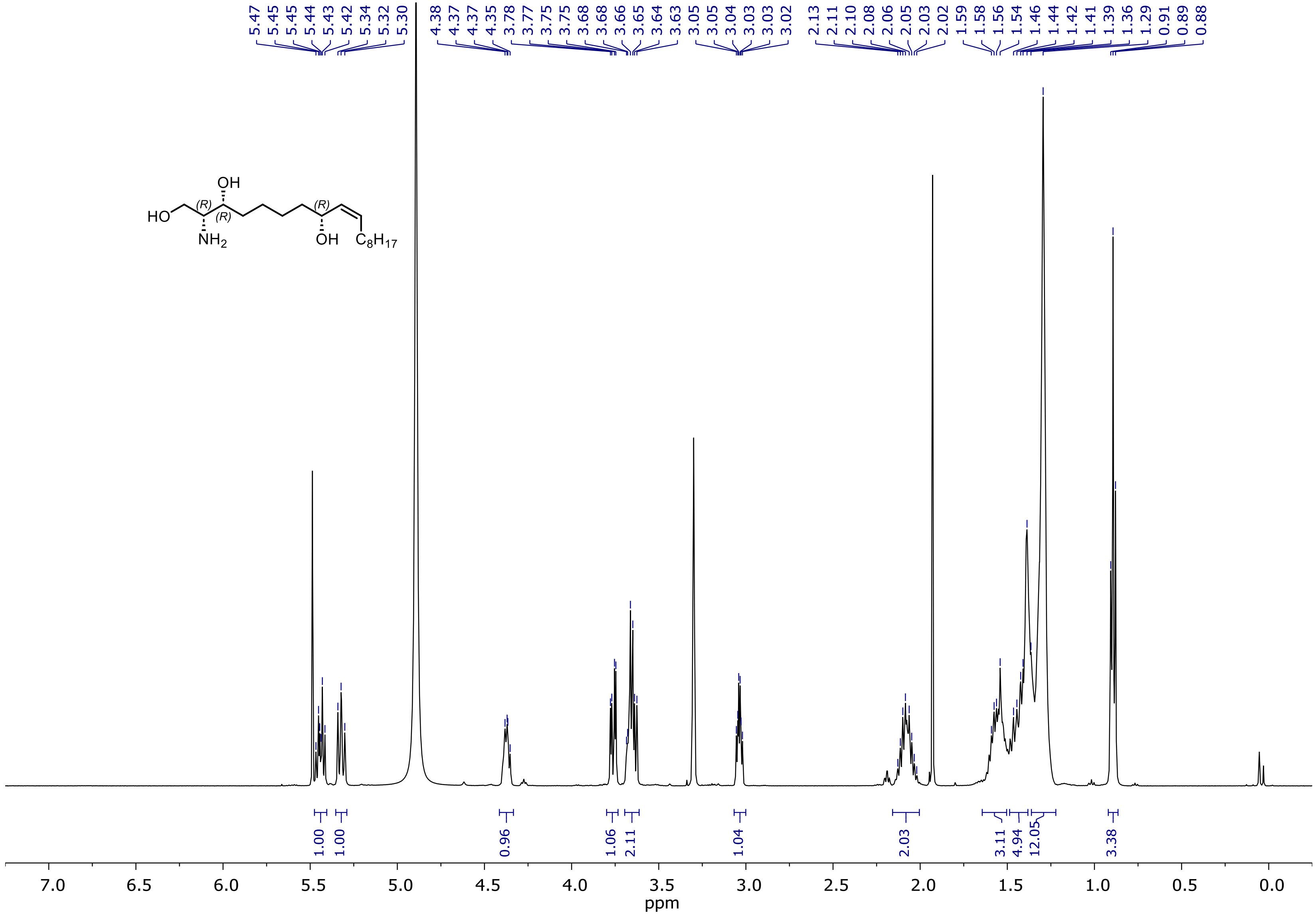


Figure S211. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3R,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **43**.

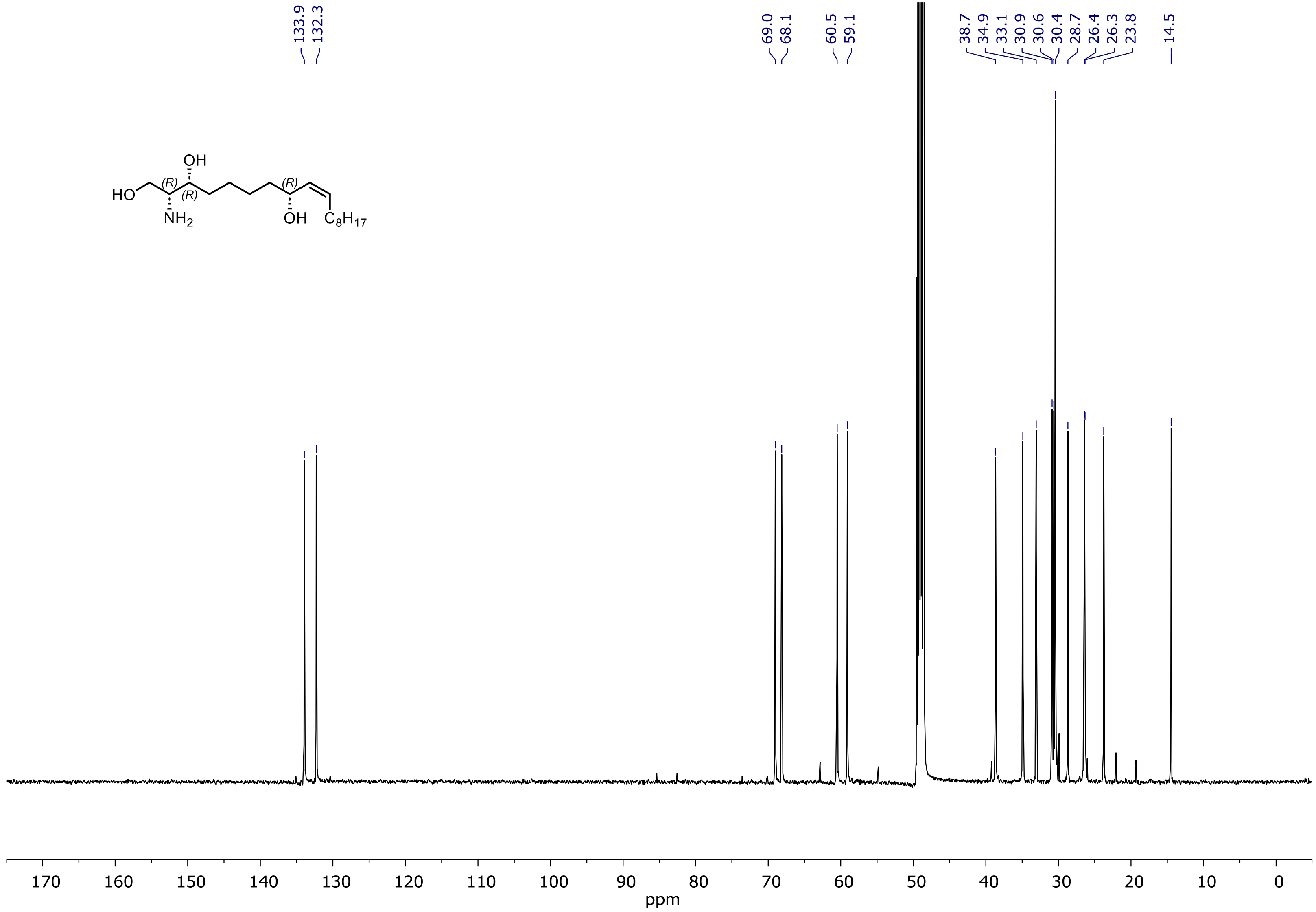


Figure S212. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3R,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **43**.

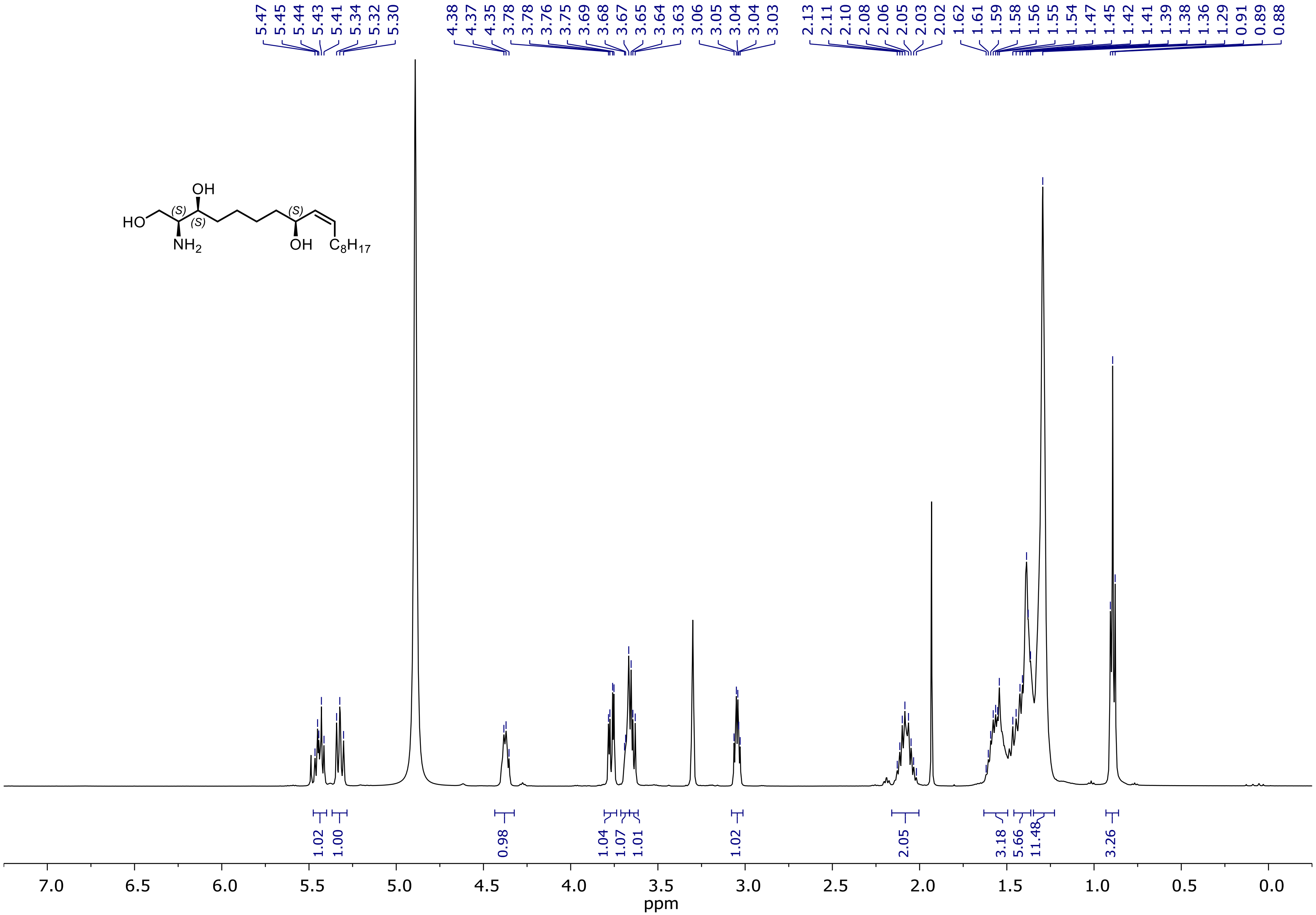


Figure S213. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3S,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **44**.

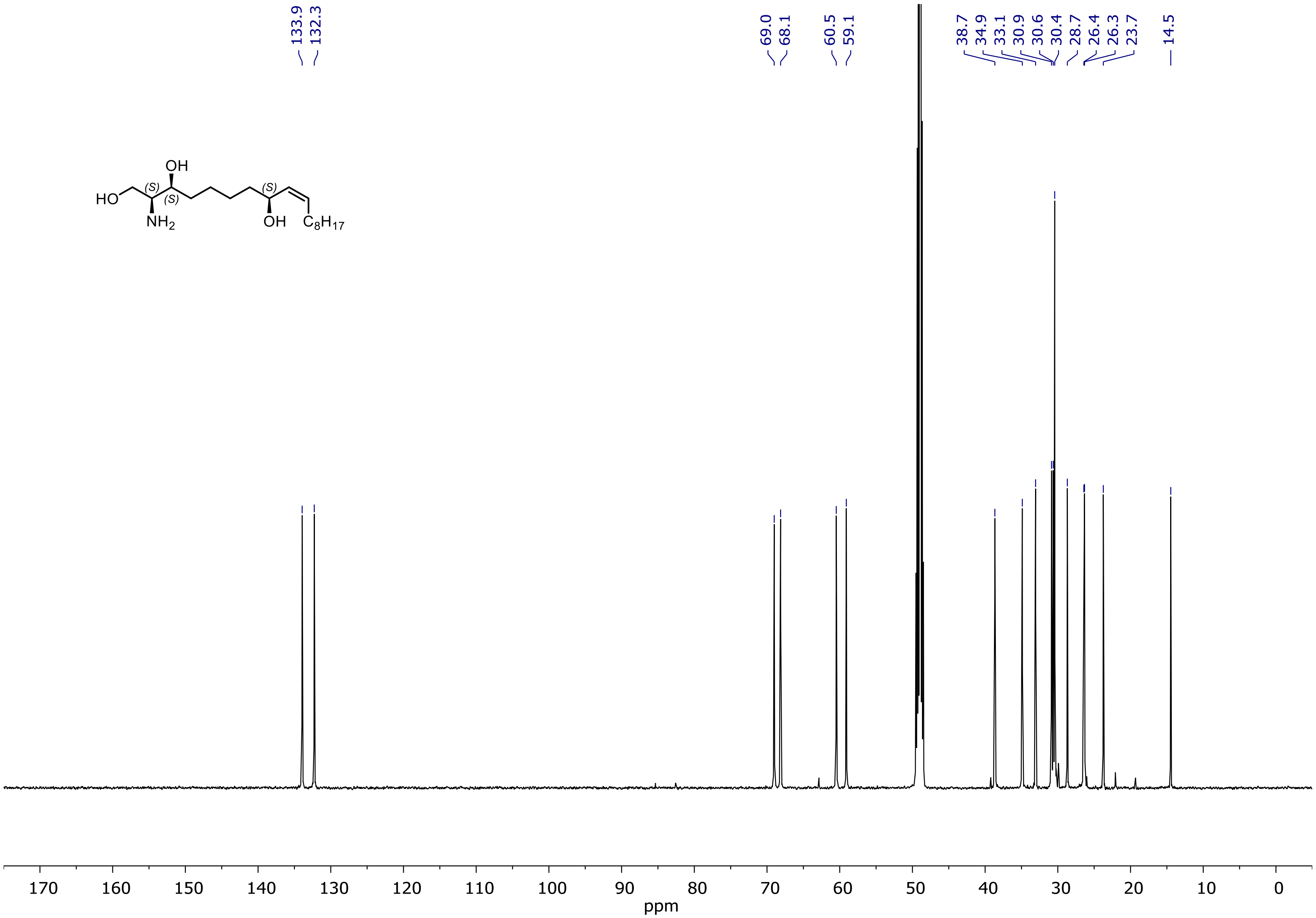


Figure S214. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3S,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **44**.

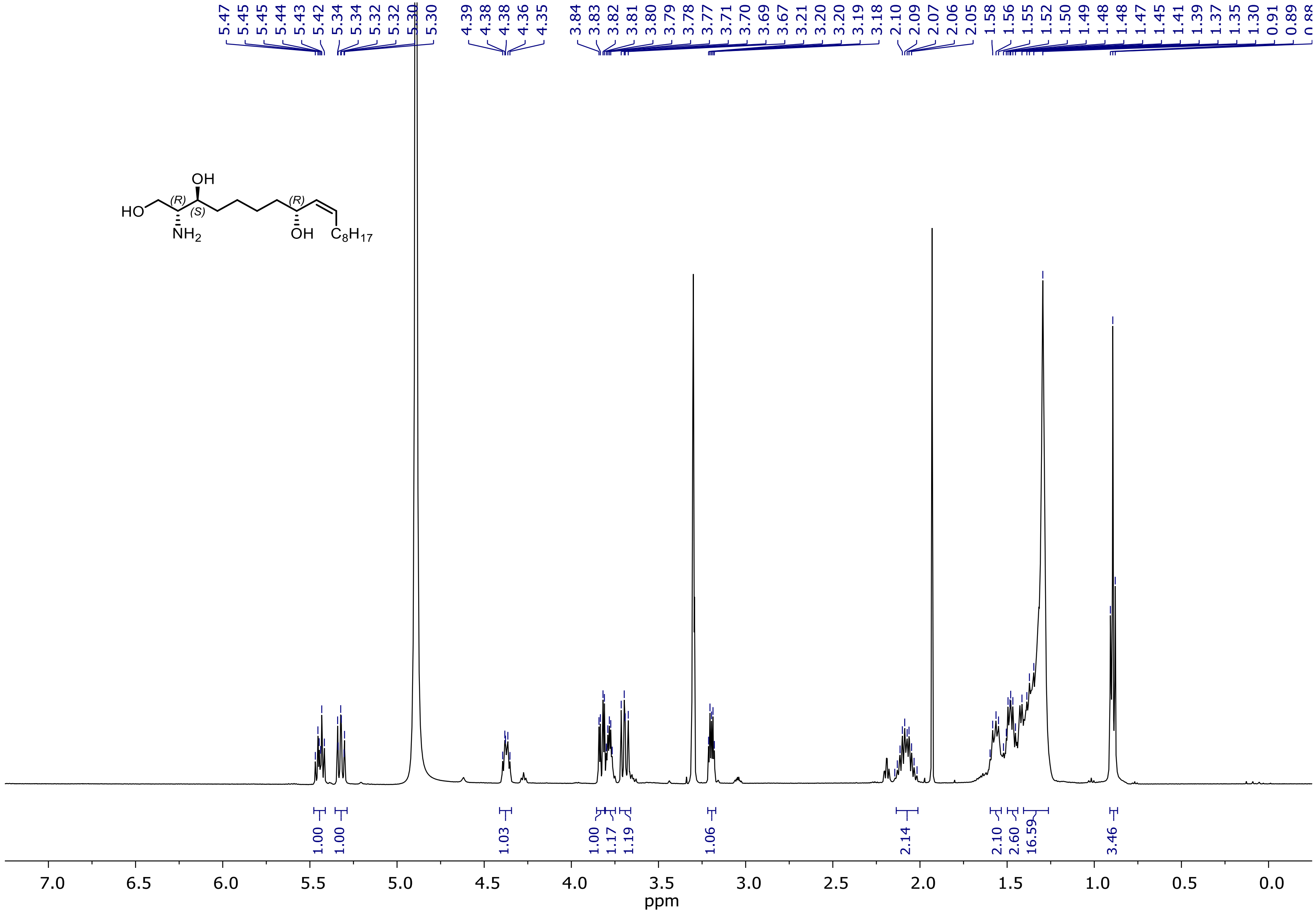


Figure S215. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3S,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **45**.

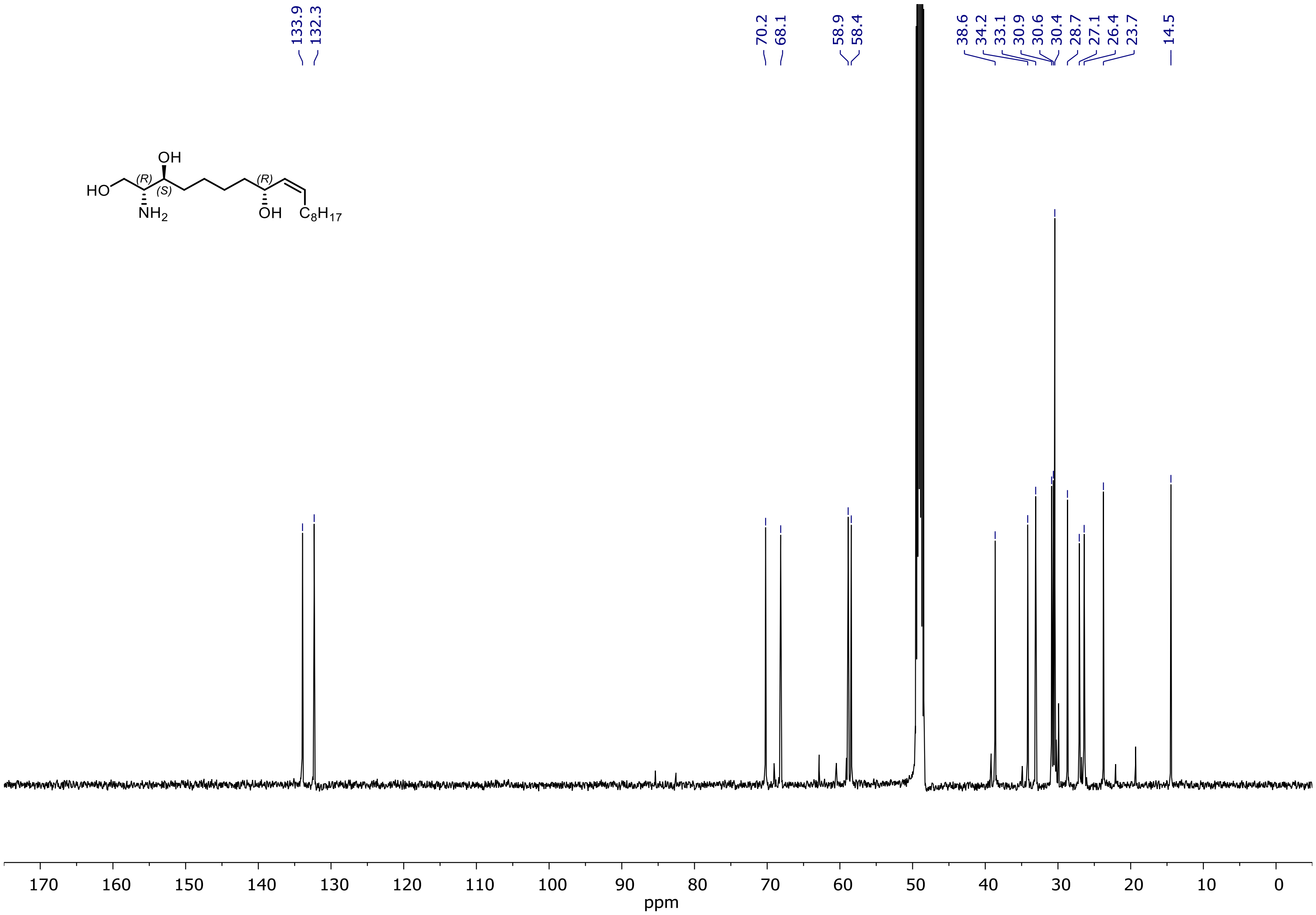


Figure S216. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3S,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **45**.

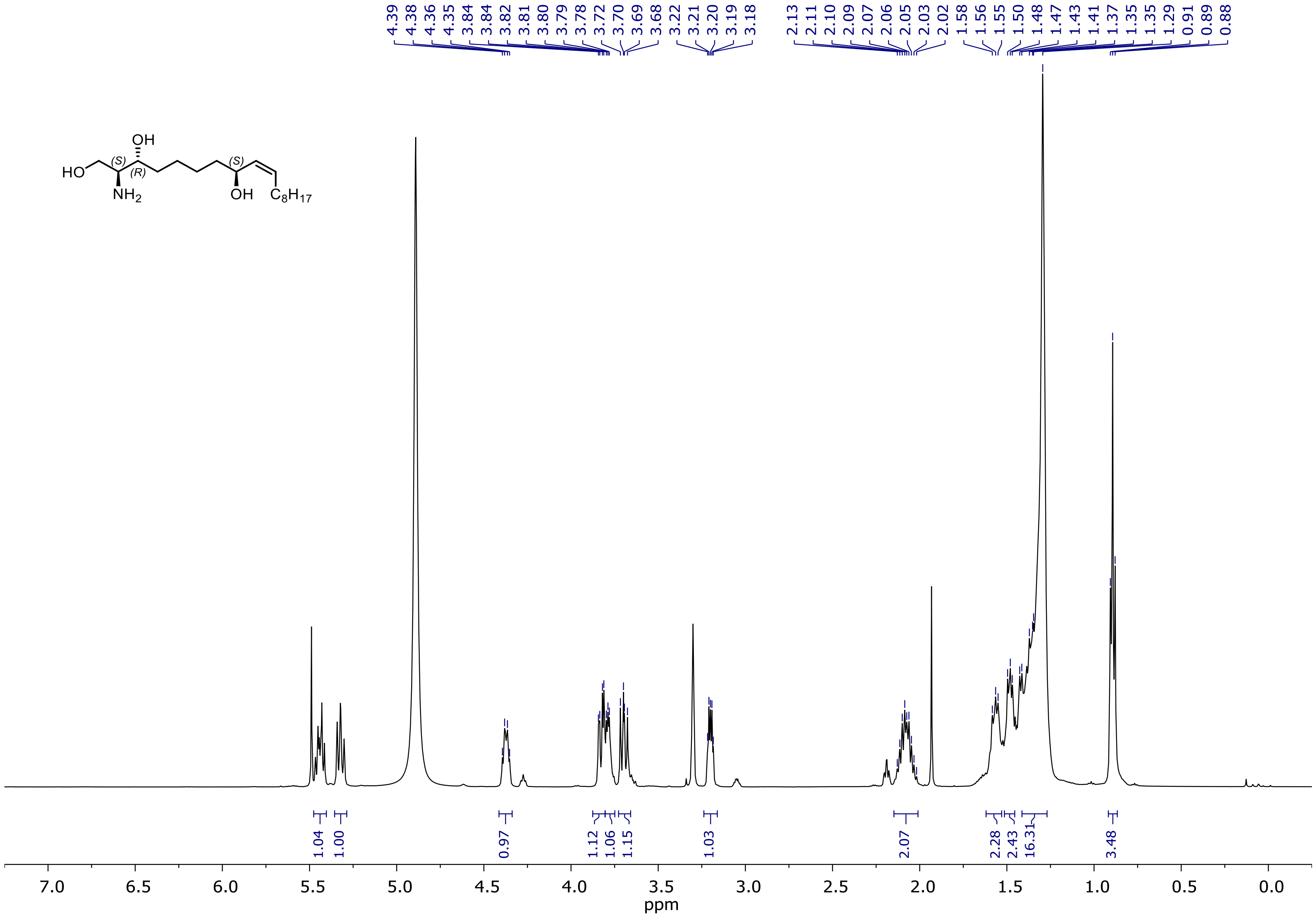


Figure S217. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3R,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **46**.

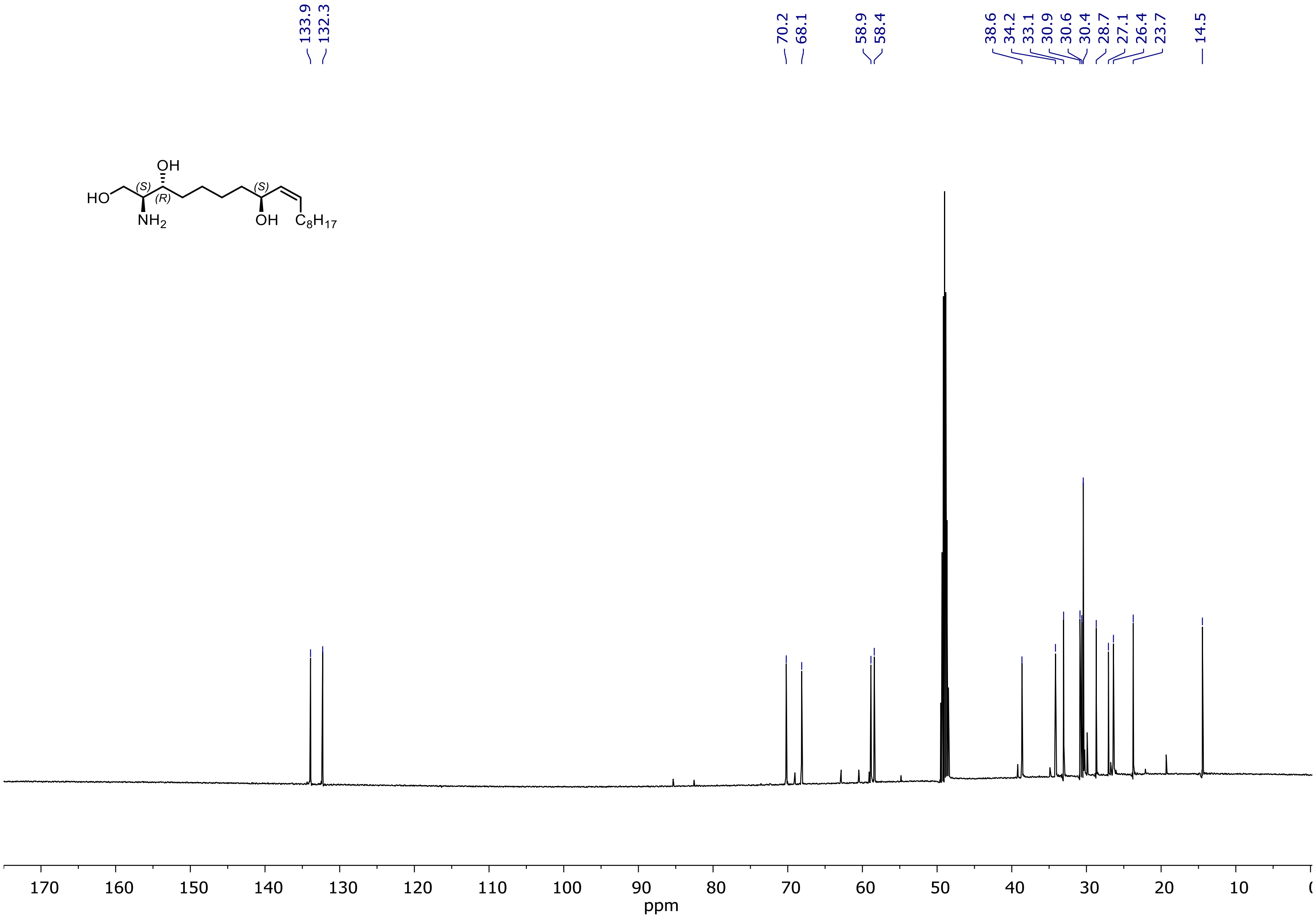


Figure S218. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3R,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **46**.

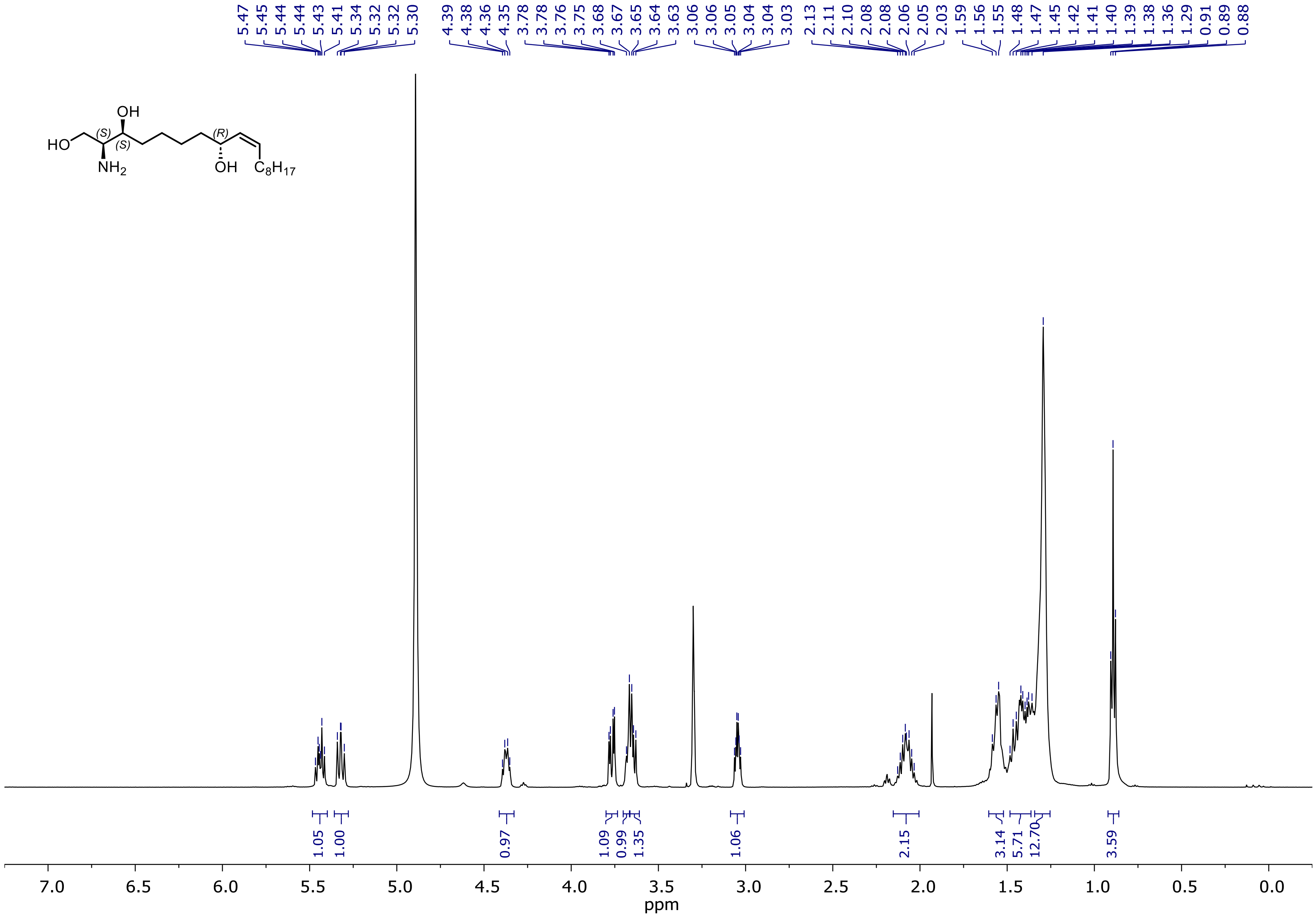


Figure S219. ^{1}H-NMR spectrum (500 MHz, CD$_3$OD) of (*2S,3S,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **47**.

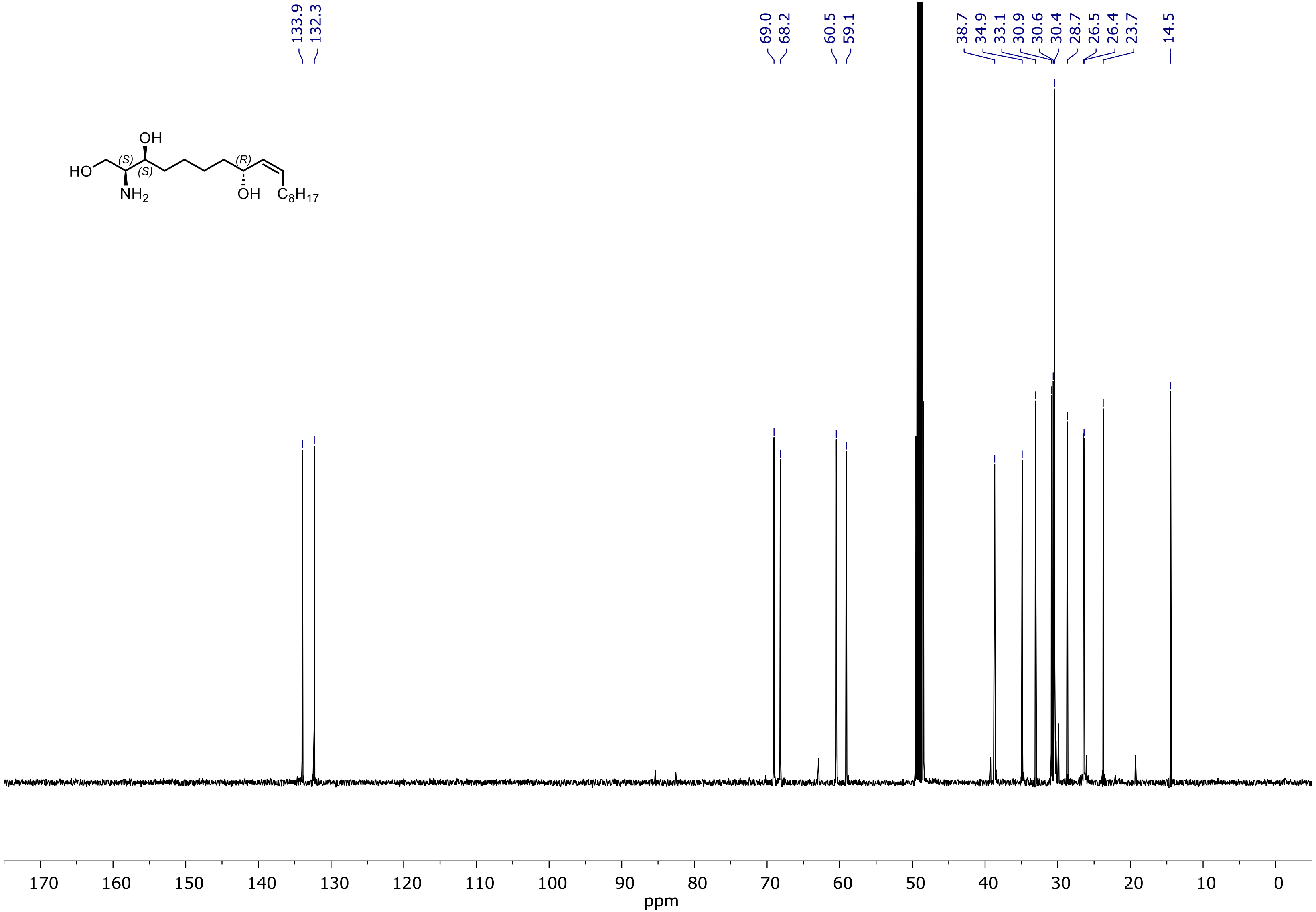


Figure S220. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3S,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **47**.

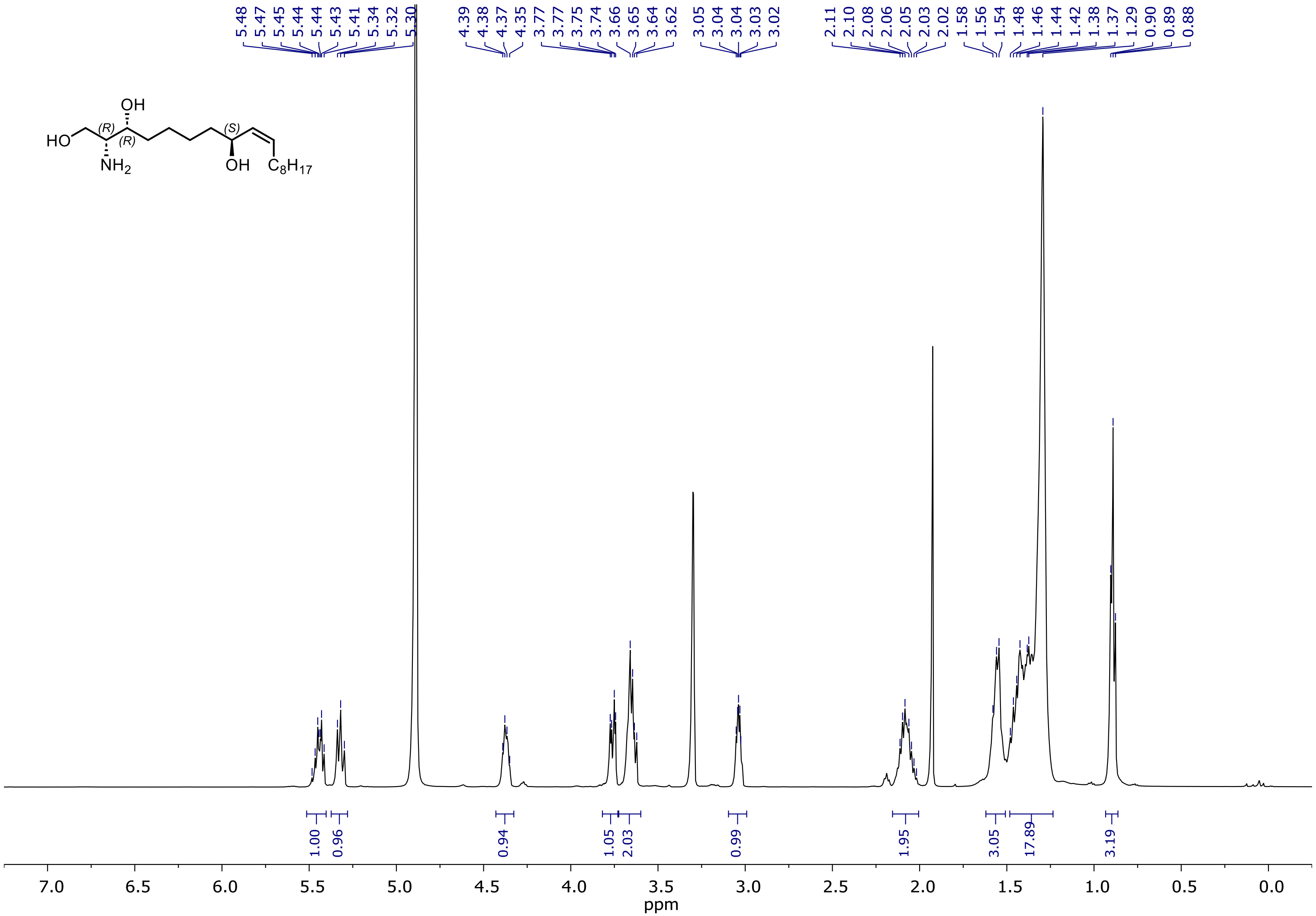


Figure S221. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3R,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **48**.

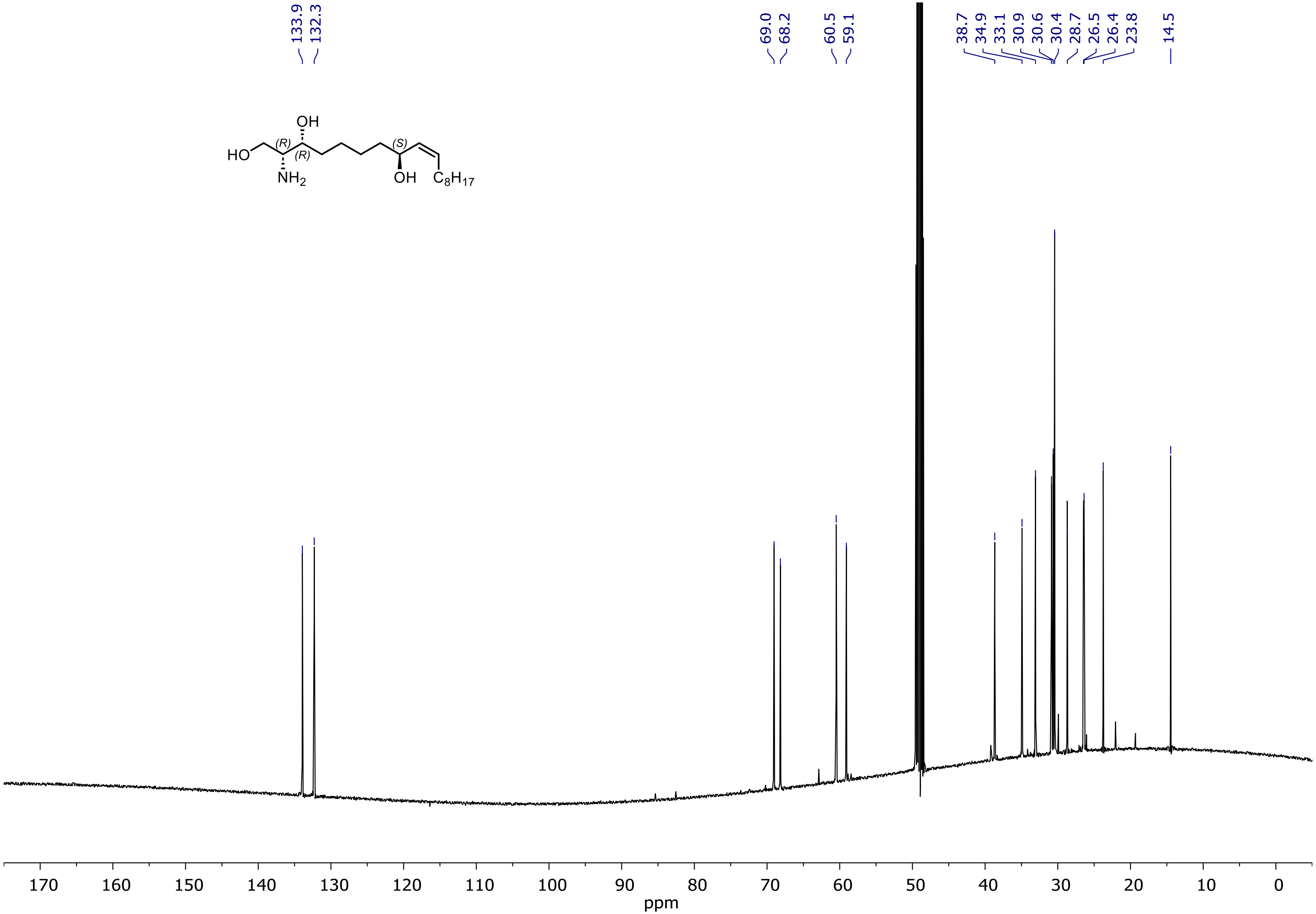


Figure S222. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3R,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **48**.

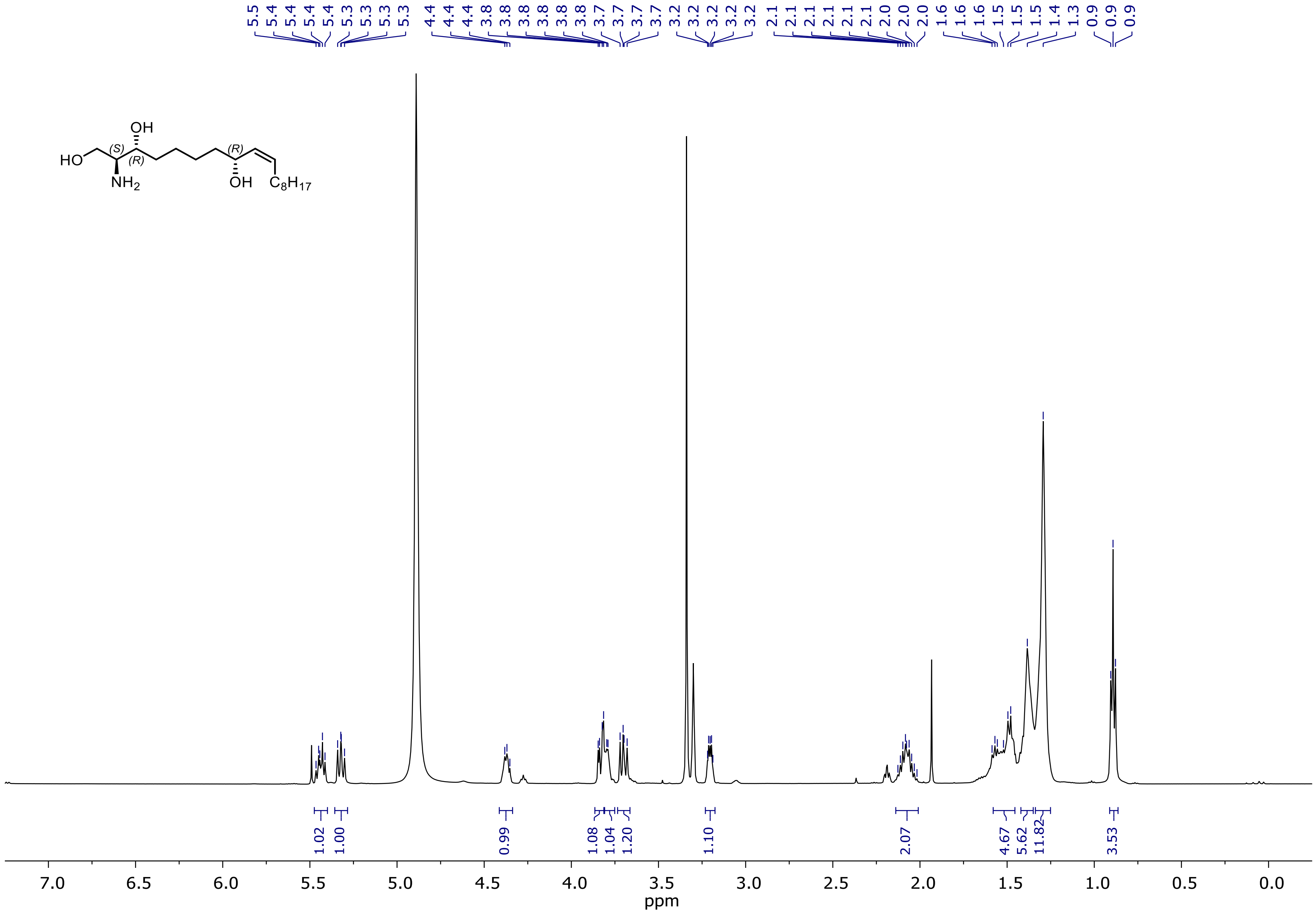


Figure S223. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2S,3R,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **49**.

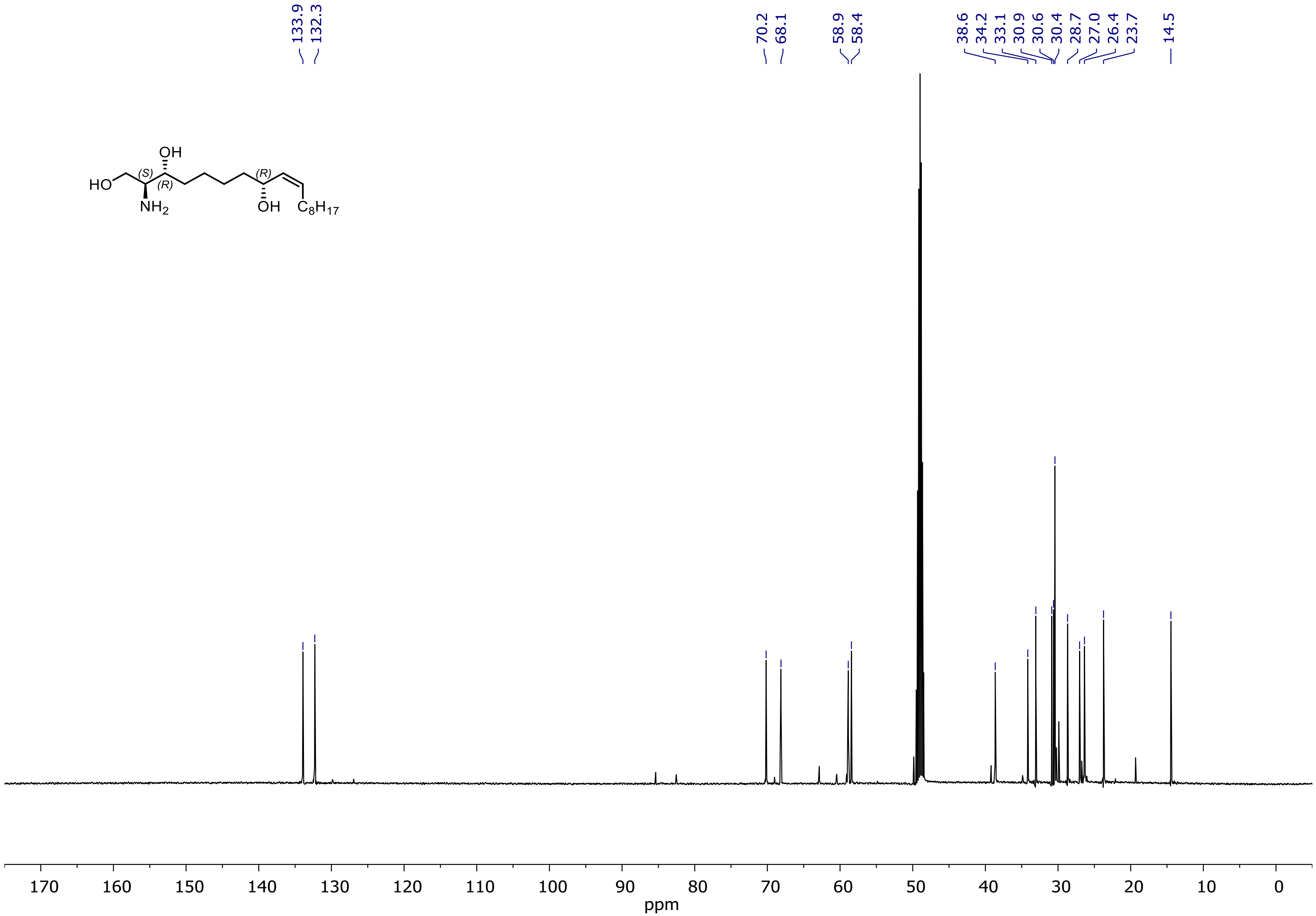


Figure S224. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2S,3R,8R,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **49**.

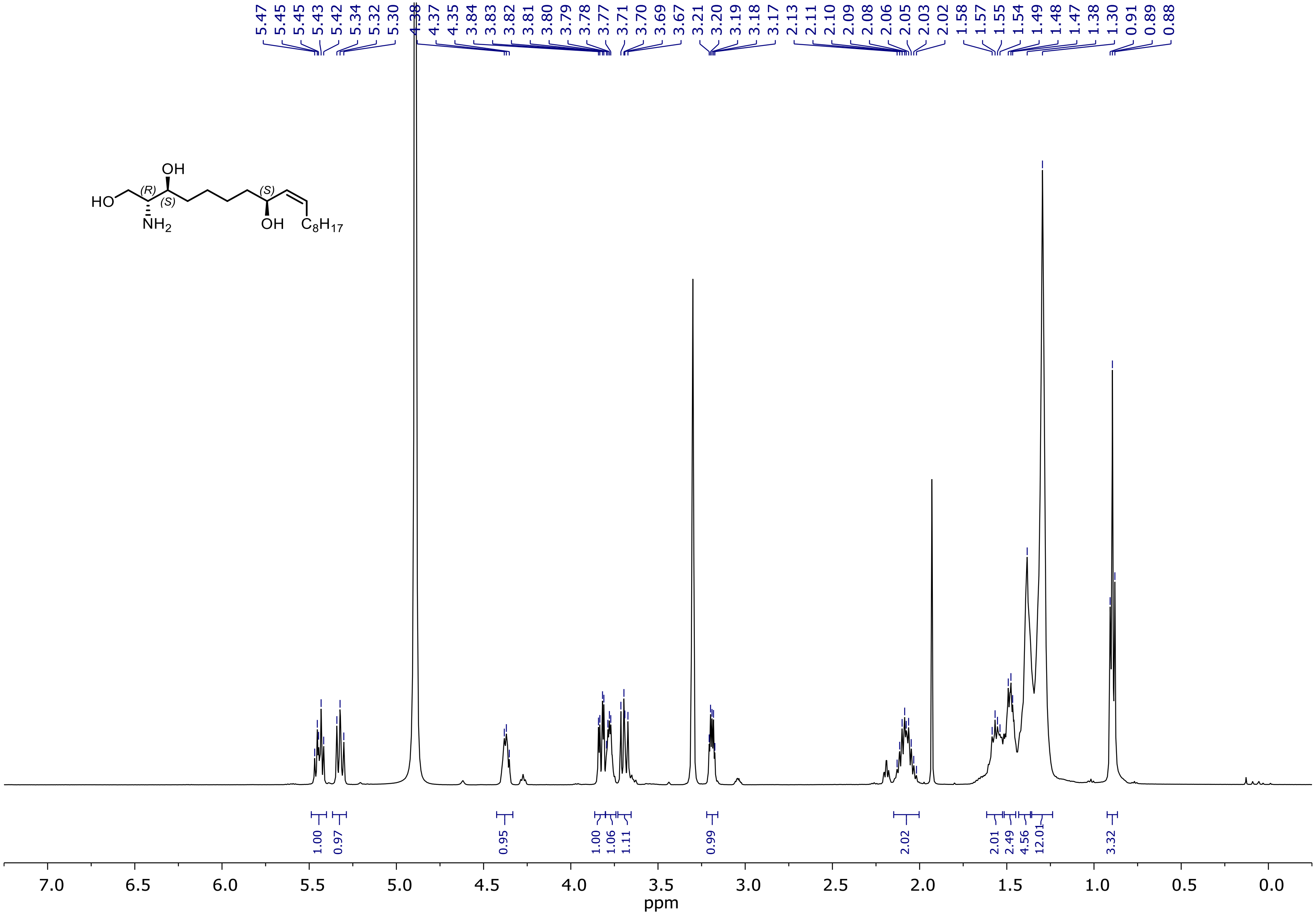


Figure S225. ^{1}H-NMR spectrum (500 MHz, CD_3OD) of (*2R,3S,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **50**.

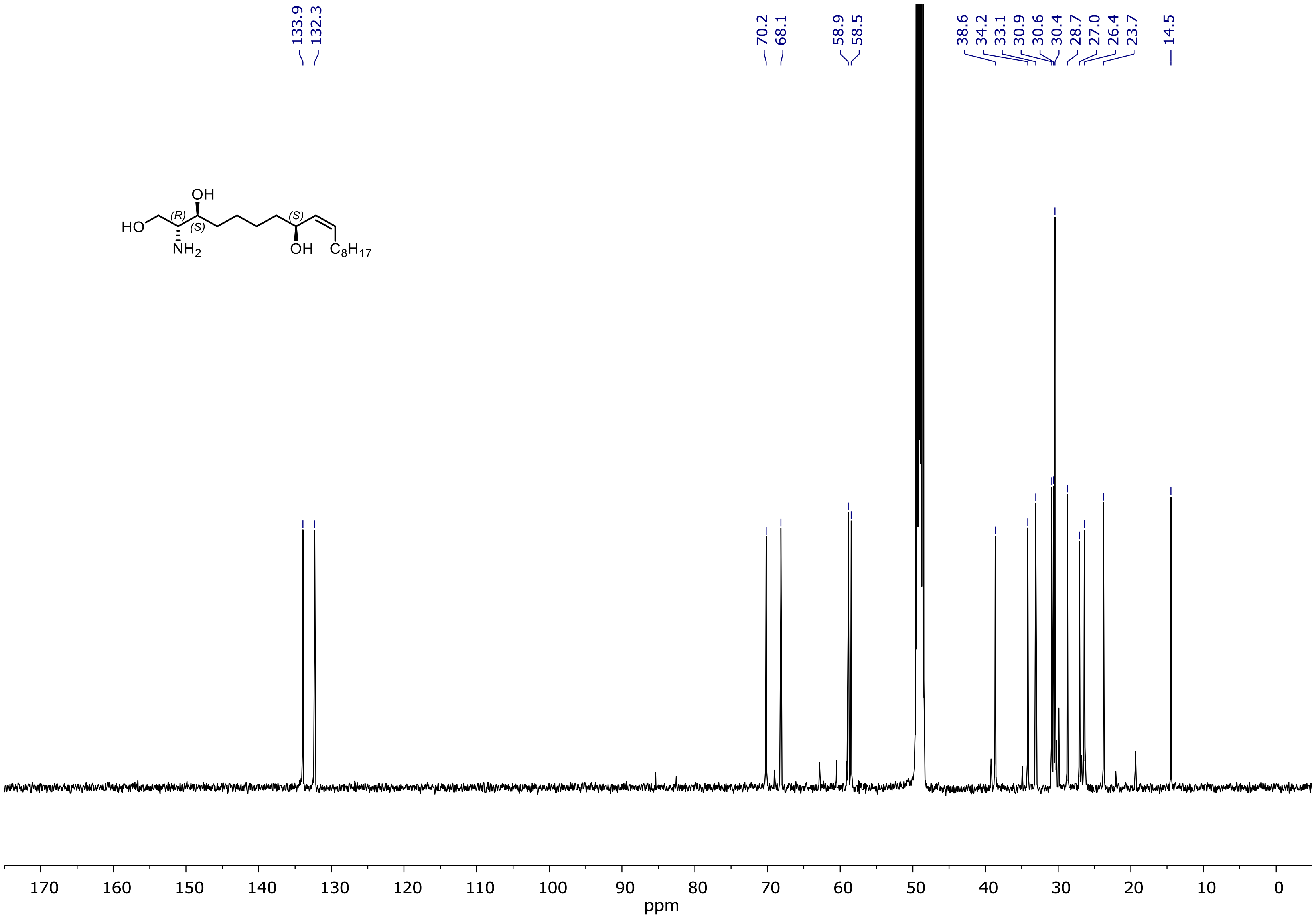


Figure S226. $^{13}C\{^{1}H\}$-NMR spectrum (126 MHz, CD_3OD) of (*2R,3S,8S,Z*)-2-Aminooctadec-9-ene-1,3,8-triol **50**.

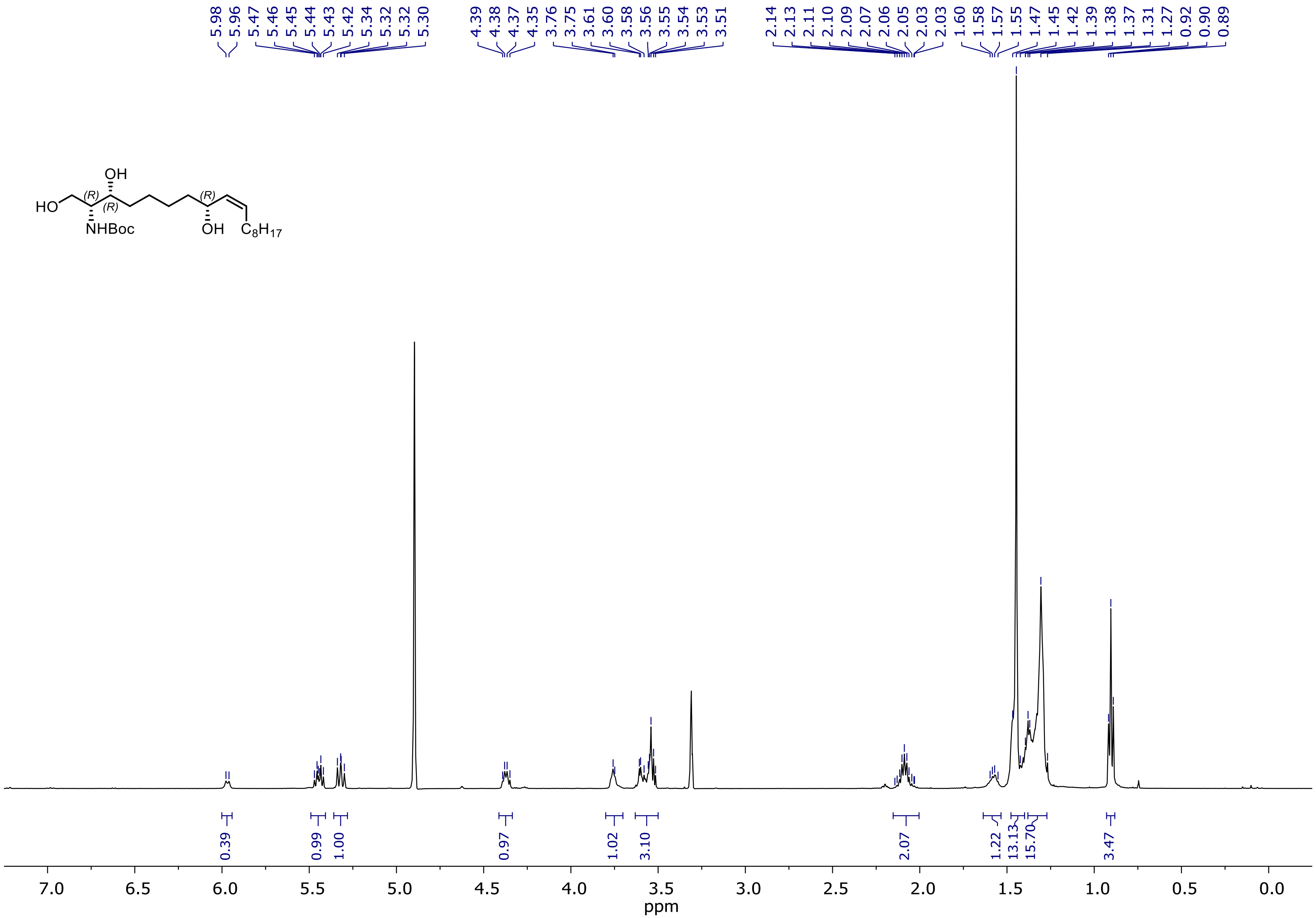


Figure S227. ^{1}H-NMR spectrum (500 MHz, CD$_3$OD) of *tert*-Butyl ((*2R,3R,8R,Z*)-1,3,8-trihydroxyoctadec-9-en-2-yl)carbamate **51**.

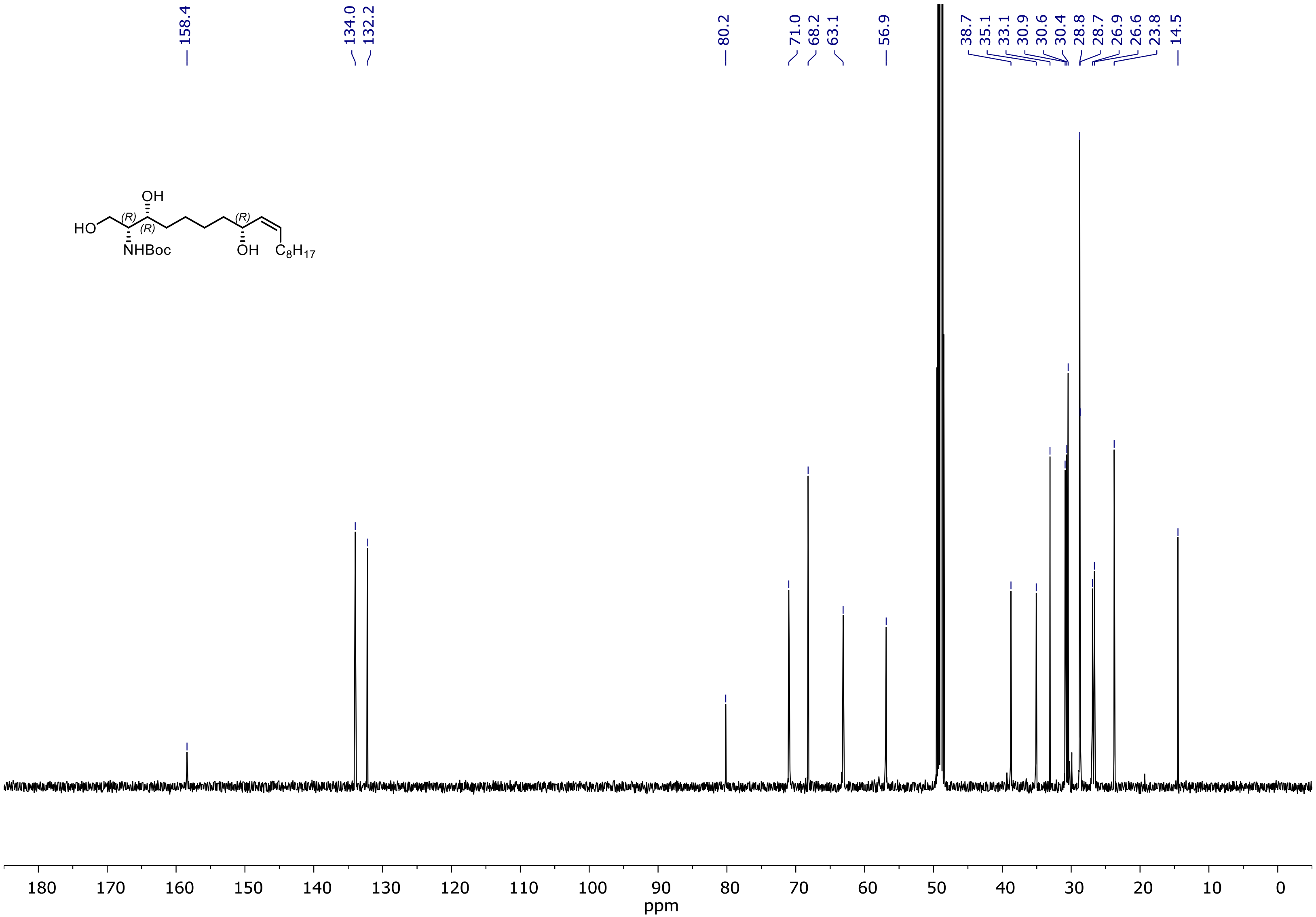


Figure S228. ^{13}C{^{1}H}-NMR spectrum (126 MHz, CD$_3$OD) of *tert*-Butyl ((*2R,3R,8R,Z*)-1,3,8-trihydroxyoctadec-9-en-2-yl)carbamate **51**.

4 Bibliography

[1] S. E. Denmark, S.-M. Yang, *J. Am. Chem. Soc.* **2004**, *126*, 12432-12440.
[2] F. E. Dutton, B. H. Lee, S. S. Johnson, E. M. Coscarelli, P. H. Lee, *J. Med. Chem.* **2003**, *46*, 2057-2073.
[3] N. Palyam, M. Majewski, *J. Org. Chem.* **2009**, *74*, 4390-4392.
[4] H. Liu, M. El-Salfiti, D. I. Chai, J. Auffret, M. Lautens, *Org. Lett.* **2012**, *14*, 3648-3651.
[5] D. K. Mohapatra, G. Umamaheshwar, M. M. Rao, D. Umadevi, J. S. Yadav, *RSC Adv.* **2014**, *4*, 8335-8340.
[6] J. Mulzer, A. Mantoulidis, E. Öhler, *J. Org. Chem.* **2000**, *65*, 7456-7467.
[7] M. Prévost, O. St-Jean, Y. Guindon, *J. Am. Chem. Soc.* **2010**, *132*, 12433-12439.
[8] S. N. Mostyn, J. E. Carland, S. Shimmon, R. M. Ryan, T. Rawling, R. J. Vandenberg, *ACS Chem. Neurosci.* **2017**, *8*, 1949-1959.
[9] K. Nishikawa, S. Kikuchi, S. Ezaki, T. Koyama, H. Nokubo, T. Kodama, Y. Tachi, Y. Morimoto, *Org. Lett.* **2015**, *17*, 5772-5775.
[10] H. E. Burks, S. Liu, J. P. Morken, *J. Am. Chem. Soc.* **2007**, *129*, 8766-8773.
[11] L. R. Chowhan, S. Raghavan, *Tetrahedron Lett.* **2019**, *60*, 151132.
[12] B. J. Moritz, D. J. Mack, L. Tong, R. J. Thomson, *Angew. Chem. Int. Ed.* **2014**, *53*, 2988-2991.
[13] S. Saito, T. Tanaka, T. Koizumi, N. Tsuboya, H. Itagaki, T. Kawasaki, S. Endo, Y. Yamamoto, *J. Am. Chem. Soc.* **2000**, *122*, 1810-1811.
[14] P. Tauh, A. G. Fallis, *J. Org. Chem.* **1999**, *64*, 6960-6968.
[15] Y. Wang, M. Zarca, L.-Z. Gong, L. Zhang, *J. Am. Chem. Soc.* **2016**, *138*, 7516-7519.
[16] D.-D. Qin, W.-H. Lai, D. Hu, Z. Chen, A. A. Wu, Y. P. Ruan, Z. H. Zhou, H. B. Chen, *Chem. Eur. J.* **2012**, *18*, 10515-10518.
[17] Y.-N. Li, S.-Y. Zhang, Y. Ma, Y.-J. Ding, Z.-H. Chen, Q.-L. Che, L. Qin, X.-L. Sun, X. Liu, X. Feng, *ACS Catalysis* **2022**, *12*, 11606-11614.
[18] V. Banphavichit, W. Mansawat, W. Bhanthumnavin, T. Vilaivan, *Tetrahedron* **2004**, *60*, 10559-10568.
[19] M. Murata, M. Takizawa, H. Sasaki, Y. Kohari, H. Sakagami, T. Namikoshi, S. Watanabe, *Chem. Lett.* **2016**, *45*, 857-859.
[20] A. M. Daly, M. F. Renehan, D. G. Gilheany, *Org. Lett.* **2001**, *3*, 663-666.
[21] A. M. Daly, D. G. Gilheany, *Tetrahedron: Asymmetry* **2003**, *14*, 127-137.
[22] K. Xu, G. Lai, Z. Zha, S. Pan, H. Chen, Z. Wang, *Chem. Eur. J.* **2012**, *18*, 12357-12362.
[23] A. Bär, S. I. Bär, R. Schobert, *Org. Biomol. Chem.* **2020**, *18*, 7565-7570.
[24] T. F. Molinski, R. Biegelmeyer, E. P. Stout, X. Wang, M. L. Frota Jr, A. T. Henriques, *J. Nat. Prod.* **2013**, *76*, 374-381.