

Supporting Information

Total Synthesis of Muricadienin, the Putative Key Precursor in the Solamin Biosynthesis

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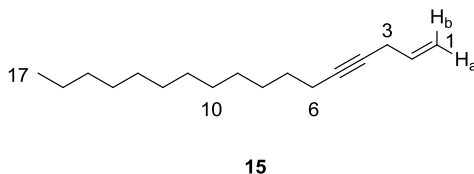
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I. Materials and Methods

All reagents were used as purchased from commercial suppliers. Solvents were purified by conventional methods prior to use. Reactions were monitored by **thin layer chromatography** using Machery-Nagel pre-coated TLC-sheets ALUGRAM[®] Xtra SIL G/UV₂₅₄ and visualized with potassium permanganate [(2.4 g KMnO₄, 16 g K₂CO₃, 4 mL NaOH (5 %), 196 mL H₂O)] or ceric ammonium molybdate [(phosphomolybdic acid (5 g), Ce(SO₄)₂·2 H₂O (2 g), H₂SO_{4 conc} (12 mL), H₂O (188 mL)]. **Chromatographic purification** was performed as flash chromatography on Fluka silica gel 60 (particle size 0.040-0.063 mm). Yields refer to chromatographically purified and spectroscopically pure compounds. **NMR spectra** were recorded on a Bruker F-300 (operating at 300 MHz for ¹H and 75 MHz for ¹³C acquisitions), a Bruker AV-400 (operating at 400 MHz for ¹H and 100 MHz for ¹³C acquisitions), a Bruker DRX-500 (operating at 500 MHz for ¹H and 125 MHz for ¹³C acquisitions) or a Bruker AV-600 (operating at 600 MHz for ¹H and 150 MHz for ¹³C acquisitions). Chemical shifts δ are reported in ppm with the solvent resonance as the internal standard: chloroform-d₁: 7.26 (¹H-NMR), 77.16 (¹³C-NMR). Coupling constants J are given in Hertz (Hz). Multiplicities are classified as follows: s = singlet, d = doublet, t = triplet, q = quartet and combinations thereof, or m = multiplet or br = broad signal. Two-dimensional NMR (H-COSY, HSQC, HMBC) were used for the assignment of all compounds. Assignment of every single carbon atom of long alkyl chains was not always possible due to overlap of signals in ¹³C NMR spectra (compounds **4**, **17**, **18**, **21**, **22**, **23**). **High resolution mass spectra** were obtained on an Agilent 6224 ESI-TOF. **EI mass spectra** were obtained on a Thermo Fisher ISQ mass spectrometer EI LT Large Turbo (low resolution). **IR spectra** were recorded on a Bruker ALPHA FT-IR Platinum ATR. Absorbance frequencies $\tilde{\nu}$ are reported in reciprocal centimeters (cm⁻¹). **Optical rotation data** were measured with a Krüss Optronic P8000 at 598 nm using a 100 mm path-length cell in the solvent, at the concentration and temperature indicated. **Melting Points** were measured with a Büchi Melting Point M-565 and are uncorrected. All compounds were named according to IUPAC rules. For simplicity, the numbering of the carbon atoms of a given structure does not follow IUPAC rules.

II. Characterization Data of all Compounds

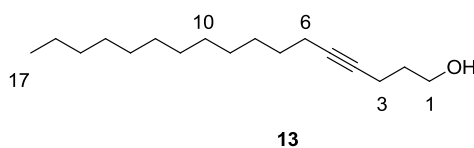
Heptadec-1-en-4-yne (15)



1-Tetradecyne (**16**) (1.94 g, 2.46 mL, 10.0 mmol, 1.00 equiv.) in THF_{abs} (20 mL) was cooled to 0 °C. *n*-Butyl-lithium (1.6 M in hexane, 9.40 mL, 15.0 mmol, 1.50 equiv.) was added slowly and the yellowish solution stirred for 1 h with warming to rt. 3-Bromopropene (3.63 g, 2.60 mL, 30.0 mmol, 3.00 equiv.) and TBAI (369 mg, 1.00 mmol, 0.10 equiv.) were added and the reaction mixture was heated to 80 °C. After complete conversion brine (15 mL) was added and the solution extracted with ethyl acetate (3 x 10 mL). The combined organic phases were dried over MgSO₄, filtrated and the solvents were removed under reduced pressure. The crude product was co-distilled with toluene to remove excess of 3-bromopropene. Flash chromatography (100 % hexanes) of the residue gave the title compound **15** (2.11 g, 90 %) as a colourless liquid.

¹H NMR (500 MHz, CDCl₃): δ = 5.83 (ddt, J = 16.8, 10.4, 5.2 Hz, 1H, H-2), 5.34 – 5.29 (m, 1H, H-1a), 5.11 – 5.08 (m, 1H, H-1b), 2.95 – 2.93 (m, 2H, H-3), 2.18 (tt, J = 7.1, 2.3 Hz, 2H, H-6), 1.53 – 1.47 (m, 2H, H-7), 1.39 – 1.35 (m, 2H, H-8), 1.31 – 1.26 (m, 16H, H-9 – H-16), 0.88 (t, J = 6.9 Hz, 3H, H-17) ppm; **¹³C NMR** (75 MHz, CDCl₃): δ = 133.6 (C-2), 115.7 (C-1), 83.1 (C-5), 76.6 (C-4), 32.1, 29.8, 29.8, 29.8, 29.7, 29.5, 29.3, 29.2, 29.1, 23.3 (C-3), 22.9, 18.9 (C-6), 14.3 (C-17) ppm; **IR** (ATR): $\tilde{\nu}$ = 3086, 2922, 2853, 1642, 1465, 1421, 1401, 1378, 1331, 1284, 1110, 989, 913, 721, 558 cm⁻¹; **MS** (EI) m/z = 234 [M]⁺, 219 [M – CH₃]⁺, 205 [M – C₂H₅]⁺, 163 [M – C₅H₁₁]⁺, 149 [M – C₆H₁₃]⁺, 135 [M – C₇H₁₅]⁺, 121 [M – C₈H₁₇]⁺, 107 [M – C₉H₁₉]⁺, 93 [M – C₁₀H₂₁]⁺, 79 [M – C₁₁H₂₃]⁺.

Heptadec-4-yn-1-ol (**13**)

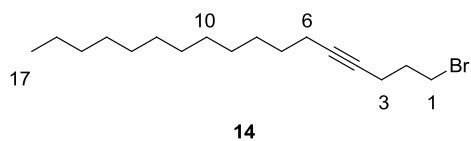


9-BBN-dimer¹ (2.99 g, 12.3 mmol, 0.49 equiv.) was added under N₂-atmosphere to enyne **15** (5.86 g, 25.0 mmol, 1.00 equiv.). The reaction mixture was warmed to 50 °C for 10 min (until all solids had been dissolved) and subsequently stirred at rt for 4 hours, before adding THF (50 mL), 2 N NaOH (75 mL, 150 mmol, 6.00 equiv.) and H₂O₂ (30%, 12.8 mL, 125 mmol, 5.00 equiv.) at 0 °C. The reaction mixture was slowly warmed to rt overnight under vigorous stirring. The phases were separated and the aqueous phase was extracted with ethyl acetate (3 x 50 mL). The combined organic phases were washed with brine (75 mL), dried over MgSO₄, filtrated and concentrated under reduced pressure. Flash chromatography (100 % hexanes to 10 % ethyl acetate in hexanes) of the residue gave alcohol **13** (4.80 g, 78 %, borsm 91 %) as a colourless solid (17 % starting material reisolated).

¹H NMR (300 MHz, CDCl₃): δ = 3.76 (t, J = 6.1 Hz, 2H, H-1), 2.28 (tt, J = 6.8, 2.4 Hz, 2H, H-3), 2.13 (tt, J = 7.1, 2.4 Hz, 2H, H-6), 1.78 – 1.68 (m, 2H, H-2), 1.63 (br s, 1H, OH), 1.52 – 1.40 (m, 2H, H-7), 1.39 – 1.32 (m, 2H, H-8), 1.31 – 1.24 (m, 16H, H-9 – H-16), 0.87 (t, J = 6.7 Hz, 3H, H-17) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 81.3 (C-5), 79.4 (C-4), 62.3 (C-1), 32.1 (C-2), 31.8 (C-15), 29.8, 29.8, 29.8, 29.7, 29.5, 29.3, 29.2, 29.0, 22.8 (C-16), 18.9 (C-6), 15.6 (C-3), 14.2 (C-17) ppm; IR (ATR): $\tilde{\nu}$ = 3252, 2954, 2918, 2849, 1729, 1460, 1335, 1284, 1177, 1052, 999, 912, 724 cm⁻¹; HRMS (ESI) m/z : calculated for [C₁₇H₃₃O]⁺: 253.2526, found: 253.2528; m.p.: 31–33 °C.

¹ 9-BBN-dimer was freshly prepared. For a detailed procedure, see: Soderquist, J. A.; Negron, A. *Org. Synth.*, **1992**, 70, 169; Soderquist, J. A.; Negron, A. *Org. Synth.*, **1998**, 9, 95.

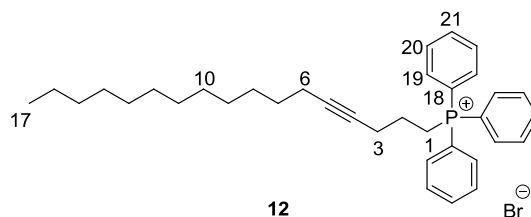
1-Bromoheptadec-4-yne (**14**)



PPh_3 (973 mg, 3.71 mmol, 1.30 equiv.) was added to a solution of alcohol **13** (780 mg, 3.10 mmol, 1.00 equiv.) in THF_{abs} (7 mL) at $-20\text{ }^\circ\text{C}$. NBS (605 mg, 3.40 mmol, 1.20 equiv.) was added and the clear light yellow solution was stirred for 4 h with warming to rt. The reaction was quenched with $\text{NH}_4\text{Cl}_{\text{aq}}$ (5 mL) and extracted with ethyl acetate (3 x 5 mL). The combined organic phases were dried over MgSO_4 , filtrated and concentrated under reduced pressure. Filtration over a short plug of silica gel (100 % hexanes) gave bromide **14** (961 mg, 98 %) as a colourless oil.

$^1\text{H NMR}$ (600 MHz, CDCl_3): δ = 3.52 (t, J = 6.5 Hz, 2H, H-1), 2.34 (tt, J = 6.7, 2.3 Hz, 2H, H-3), 2.13 (tt, J = 7.1, 2.3 Hz, 2H, H-6), 2.04 – 1.98 (m, 2H, H-2), 1.49 – 1.45 (m, 2H, H-7), 1.37 – 1.35 (m, 2H, H-8), 1.31 – 1.24 (m, 16H, H-9 – H-16), 0.88 (t, J = 7.0 Hz, 3H, H-17) ppm; $^{13}\text{C NMR}$ (150 MHz, CDCl_3): δ = 81.8 (C-5), 78.0 (C-4), 32.7 (C-1), 32.1 (C-2), 32.1 (C-15), 29.8, 29.8, 29.8, 29.7, 29.5, 29.3, 29.2, 29.0, 22.8 (C-16), 18.9 (C-6), 17.7 (C-3), 14.3 (C-17) ppm; **IR** (ATR): $\tilde{\nu}$ = 2922, 2852, 1465, 1433, 1377, 1350, 1331, 1272, 1247, 1205, 1169, 982, 961, 854, 721, 652, 566, 511 cm^{-1} ; **MS** (EI) m/z = 314 $[\text{M}]^+$, 271 $[\text{M} - \text{C}_3\text{H}_7]^+$, 235 $[\text{M} - \text{Br}]^+$, 215 $[\text{M} - \text{C}_7\text{H}_{15}]^+$, 207 $[\text{M} - \text{C}_2\text{H}_4\text{Br}]^+$, 201 $[\text{M} - \text{C}_8\text{H}_{17}]^+$, 187 $[\text{M} - \text{C}_9\text{H}_{19}]^+$.

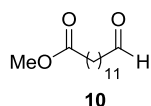
Heptadec-4-yn-1-yltriphenylphosphonium bromide (**12**)



PPh₃ (3.70 g, 14.1 mmol, 1.20 equiv.) was added to bromide **14** (3.70 g, 11.7 mmol, 1.00 equiv.) under N₂-atmosphere in the absence of any solvent. The mixture was heated to 140 °C and stirred at this temperature overnight. After cooling to rt the crude reaction mixture was diluted with small amounts of chloroform and added dropwise to diethyl ether. The colourless precipitate was filtered off and the purification procedure was repeated. The title compound **12** (6.76 g, quant.) was isolated as a colourless foam after drying at 80 °C in vacuo overnight.

¹H NMR (400 MHz, CDCl₃): δ = 7.88 – 7.74 (m, 9H, Ar), 7.73 – 7.63 (m, 6H, Ar), 3.97 – 3.83 (m, 2H, H-1), 2.61 – 2.49 (m, 2H, H-3), 2.09 (tt, *J* = 7.0, 2.1 Hz, 2H, H-6), 1.89 – 1.77 (m, 2H, H-2), 1.46 – 1.35 (m, 2H, H-7), 1.35 – 1.25 (m, 4H), 1.24 – 1.19 (m, 14H), 0.86 (t, *J* = 6.9 Hz, 3H, H-17) ppm; ¹³C NMR (150 MHz, CDCl₃): δ = 135.2 (d, *J* = 2.9 Hz, C-21), 133.8 (d, *J* = 10.0 Hz, C-19), 130.6 (d, *J* = 12.6 Hz, C-20), 118.3 (d, *J*_{C-P} = 86.1 Hz, C-18), 82.5 (C-5), 78.2 (C-4), 32.0 (C-15), 29.7, 29.7, 29.7, 29.6, 29.4, 29.2, 29.1, 29.1, 22.7 (C-16), 22.6 (d, *J* = 3.3 Hz, C-2), 21.7 (d, *J* = 51.9 Hz, C-1), 19.7 (d, *J* = 18.3 Hz, C-3), 18.8 (C-6), 14.2 (C-17) ppm; ³¹P NMR (162 MHz, CDCl₃): δ = 24.2 ppm; IR (ATR): $\tilde{\nu}$ = 3409, 3054, 3008, 2922, 2852, 1621, 1587, 1485, 1465, 1437, 1339, 1190, 1162, 1111, 996, 924, 815, 723, 690, 639, 616, 537, 508, 490 cm⁻¹; HRMS (ESI) *m/z*: calculated for [C₃₅H₄₆P]⁺: 497.3332, found: 497.3330.

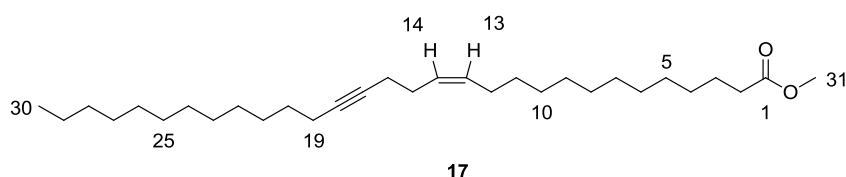
Methyl 13-Oxotridecanoate (**10**)



Methyl 13-Oxotridecanoate (**10**) was synthesized according to a literature procedure².

The analytical data were identical to those reported by Ducho and coworkers².

(Z)-Methyl triacont-13-en-17-ynoate (**17**)



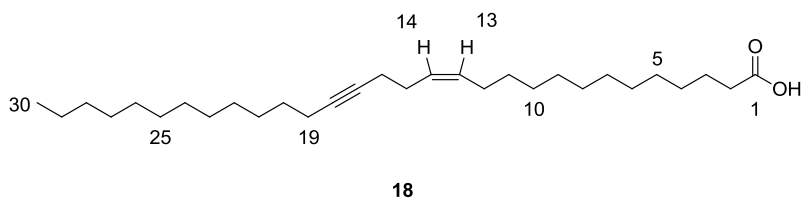
Phosphonium salt **12** (4.28 g, 7.41 mmol, 1.00 equiv.) was added to a solution of NaHMDS (2 M in THF, 4.08 mL, 8.15 mmol, 1.10 equiv.) in THF_{abs} (30 mL). The reaction mixture was stirred at rt for 30 min and aldehyde **10** (1.98 g, 8.15 mmol, 1.10 equiv.), dissolved in THF_{abs} (10 mL), was added slowly to the orange solution at -20 °C. The reaction mixture was stirred 1 h at -20 °C before warming to rt. After complete conversion (4 h) the reaction was quenched with water (25 mL) and extracted with diethyl ether (3 x 15 mL). The combined organic phases were dried over MgSO₄, filtrated and the solvents were removed under reduced pressure. Flash chromatography (2 % ethyl acetate in hexanes) of the residue gave methyl ester **17**³ (2.42 g, 71 %) as a slightly yellow oil.

¹H NMR (500 MHz, CDCl₃): δ = 5.47 – 5.35 (m, 2H, H-13, H-14), 3.66 (s, 3H, H-31), 2.30 (t, *J* = 7.6 Hz, 2H, H-2), 2.24 – 2.19 (m, 4.7 Hz, 2H, H-15), 2.19 – 2.15 (m, 2H, H-16), 2.15 – 2.10 (m, 2H, H-19), 2.06 – 1.99 (m, 2H, H-12), 1.64 – 1.59 (m, 2H, H-3), 1.50 – 1.43 (m, 2H, H-20), 1.40 – 1.29 (m, 4H), 1.32 – 1.25 (m, 30H), 0.88 (t, *J* = 6.8 Hz, 3H, H-30) ppm; ¹³C NMR (125 MHz, CDCl₃): δ = 174.5 (C-1), 131.3 (C-13), 128.2 (C-14), 80.6 (C-18), 79.9 (C-17), 51.6 (C-31), 34.3 (C-2), 32.1 (C-28), 29.9, 29.8, 29.8, 29.8, 29.8, 29.7, 29.7, 29.6, 29.5, 29.5, 29.4, 29.3, 29.3, 29.3, 29.0, 27.5, 27.2, 25.1 (C-3), 22.8 (C-29), 19.4 (C-16), 18.9 (C-19), 14.3 (C-30) ppm; IR (ATR): $\tilde{\nu}$ = 3006, 2922, 2852, 1742, 1464, 1435, 1361, 1333, 1246, 1195, 1169, 1107, 1010, 879, 721 cm⁻¹; HRMS (ESI) *m/z*: calculated for [C₃₁H₅₇O₂]⁺: 461.4353, found: 461.4361, calculated for [C₃₁H₅₆NaO₂]⁺: 483.4173, found: 483.4178, calculated for [C₃₁H₆₀NO₂]⁺: 478.4619, found: 478.4626.

² Ries, O.; Ochmann, A.; Ducho, C. *Synthesis* **2011**, 2357–2368.

³ Z/E ratio of >95:5, determined by ¹³C NMR.

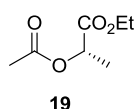
(Z)-Triacont-13-en-17-ynoic acid (18)



KOH_{aq} (sat., 5 mL) was added to a stirred solution of **17** (1.38 g, 3.00 mmol, 1.00 equiv.) in MeOH/THF (2:1, 15 mL). The reaction mixture was stirred at rt for 2 h. After complete conversion of the starting material the reaction was acidified with a solution of 1 M KHSO₄. After extraction with diethyl ether (3 x 10 mL) the combined organic phases were dried over MgSO₄, filtrated and concentrated under reduced pressure. Fatty acid **18** was obtained as a pale yellow solid (1.37 g, quant.).

¹H NMR (300 MHz, CDCl₃): δ = 5.49 – 5.31 (m, 2H, H-13, H-14), 2.35 (t, *J* = 7.5 Hz, 2H, H-2), 2.29 – 2.08 (m, 6H, H-15, H-16, H-19), 2.06 – 1.99 (m, 2H, H-12), 1.69 – 1.57 (m, 2H, H-3), 1.53 – 1.41 (m, 2H, H-20), 1.41 – 1.33 (m, 4H), 1.33 – 1.23 (m, 30H), 0.88 (t, *J* = 6.7 Hz, 3H, H-30) ppm; ¹³C NMR (100 MHz, CDCl₃): δ = 179.4 (C-1), 131.3 (C-13), 128.2 (C-14), 80.7 (C-18), 79.9 (C-17), 34.1 (C-2), 32.1 (C-28), 29.9, 29.8, 29.8, 29.8, 29.8, 29.7, 29.7, 29.6, 29.5, 29.5, 29.4, 29.3, 29.3, 29.2, 29.1, 27.5, 27.3, 24.8 (C-3), 22.8 (C-29), 19.4 (C-16), 18.9 (C-19), 14.3 (C-30) ppm; IR (ATR): $\tilde{\nu}$ = 3011, 2953, 2916, 2848, 1708, 1460, 1433, 1332, 1309, 1286, 1261, 1233, 1209, 1188, 1108, 912, 723, 707, 630, 591 cm⁻¹. HRMS (ESI) *m/z*: calculated for [C₃₀H₅₅O₂]⁺: 447.4197, found: 447.4195, calculated for [C₃₀H₅₄NaO₂]⁺: 469.4016, found: 469.3986; mp: 50 – 53 °C.

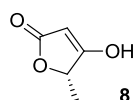
(S)-Ethyl 2-acetoxypropanoate (**19**)



Acetyl chloride (10.7 mL, 150 mmol, 1.50 equiv.) was slowly added to a solution of (*S*)-ethyl lactate (**9**) (11.8 g, 11.5 mL, 100 mmol, 1.00 equiv.) in DCM_{abs} (50 mL) at 0 °C. The reaction was stirred overnight with slow warming to rt. After complete conversion the reaction was quenched with MeOH (5 mL) and stirred for 10 min. Brine (30 mL) was added and the phases were separated. The aqueous phase was extracted with ethyl acetate (3 x 20 mL). The combined organic phases were dried over MgSO₄, filtrated and concentrated under reduced pressure. Vacuum distillation (13 mbar, 68 – 72 °C) gave the title compound **19** (12.2 g, 76 %) as a colourless liquid.

The analytical data were identical to those reported in reference 4.

(S)-4-Hydroxy-5-methylfuran-2(5*H*)-one (**8**)



Butenolide **8** was synthesized according to a literature procedure.⁴

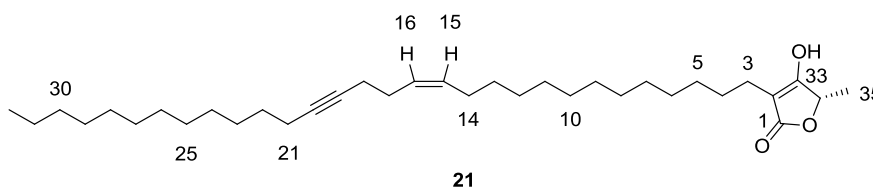
The analytical data were identical to those reported in reference 4.

⁴ Brandänge, S.; Flodman, L.; Norberg, A. *J. Org. Chem.* **1984**, 49, 928-931.

See also: Spence, J. T. J.; George, J. H. *Org. Lett.* **2013**, 15, 3891-3893 and Ghobril, C.; Kister, J.; Baati, R. *Eur. J. Org. Chem.* **2011**, 3416-3419.

For the analytical data of (*S*)-ethyl 2-acetoxypropanoate (**19**), see: Fryzuk, M. D.; Bosnich, B. *J. Am. Chem. Soc.* **1978**, 100, 5491- 5494.

(S,Z)-4-Hydroxy-5-methyl-3-(triacont-13-en-17-yn-1-yl)furan-2(5H)-one⁵ (21)

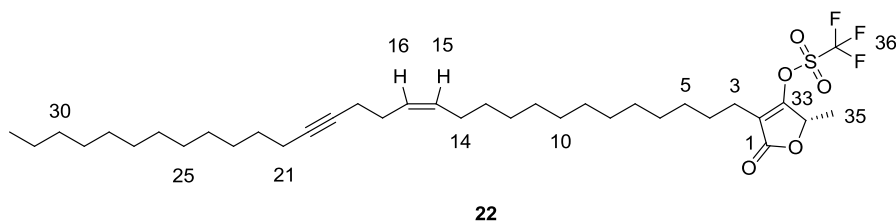


DIPEA (2.01 mL, 11.8 mmol, 1.10 equiv.) was added to a suspension of butenolide **8** (1.35 g, 11.8 mmol, 1.10 equiv.), fatty acid **18** (4.80 g, 10.7 mmol, 1.00 equiv.), 4-DMAP (394 mg, 3.22 mmol, 0.30 equiv.), and DCC (2.66 g, 12.9 mmol, 1.20 equiv.) in DCM (50 mL) at 0 °C. The reaction mixture was stirred overnight with warming to rt. The yellow solution was filtered and the solid was washed with diethyl ether. The filtrate was concentrated and the residue was dissolved in ethyl acetate. The organic phase was washed with a solution of 1 N HCl (30 mL) and brine (30 mL), dried over MgSO₄, filtrated and concentrated under reduced pressure. In order to remove residual urea derivative, the mixture was dissolved in diethyl ether, filtrated and concentrated in vacuo to yield a brownish solid that was directly used in the subsequent reduction step. To this end, the crude product was dissolved in acetic acid (30 mL) and NaBH₃CN (1.35 g, 21.4 mmol, 2.00 equiv.) was slowly added at 10 °C. The reaction mixture was stirred overnight with warming to rt and then poured into a solution of 1 N HCl (10 mL). The aqueous layer was extracted with ethyl acetate (3 x 15 mL). The combined organic phases were washed with H₂O (15 mL) and brine (15 mL), dried over MgSO₄, filtrated and concentrated in vacuo (3 x co-distillation with toluene to remove acetic acid). The title compound **21** (5.56 g, 98 %) was obtained in analytically pure form as a colourless solid.

$[\alpha]_D^{22} = -1.70$ (0.30, CHCl₃); ¹H NMR (300 MHz, CDCl₃): δ = 5.50 – 5.25 (m, 2H, H-15, H-16), 4.81 (q, J = 6.5 Hz, 1H, H-34), 2.23 – 1.98 (m, 10H, H-3, H-14, H-17, H-18, H-21), 1.52 – 1.42 (m, 7H, H-22, H-35), 1.40 – 1.32 (m, 4H), 1.32 – 1.24 (m, 32H), 0.88 (t, J = 6.7 Hz, 3H, H-32) ppm; ¹³C NMR (150 MHz, CDCl₃): δ = 175.9 (C-33), 175.6 (C-1), 131.3 (C-15), 128.2 (C-16), 101.7 (C-2), 80.7 (C-20), 79.9 (C-19), 74.7 (C-34), 32.1 (C-30), 29.9, 29.8, 29.8, 29.8, 29.8, 29.8, 29.7, 29.6, 29.6, 29.5, 29.3, 29.3, 29.1, 28.1, 27.5, 27.3, 22.8 (C-31), 21.4 (C-3), 19.4 (C-18), 18.9 (C-21), 18.0 (C-35), 14.3 (C-32) ppm; IR (ATR): $\tilde{\nu}$ = 3011, 2953, 2915, 2847, 1707, 1624, 1466, 1403, 1368, 1345, 1312, 1296, 1280, 1261, 1245, 1224, 1110, 1082, 1054, 974, 824, 779, 722, 693, 666, 641, 613, 599 cm⁻¹; HRMS (ESI) m/z : calculated for [C₃₅H₆₀O₃]⁺: 529.4615, found: 529.4617, calculated for [C₃₅H₆₀NaO₃]⁺: 551.4435, found: 551.4435; mp: 65–68 °C.

⁵ For the DMAP-mediated Fries-rearrangement, see: Ghobril, C.; Kister, J.; Baati, R. *Eur. J. Org. Chem.* **2011**, 3416–3419.

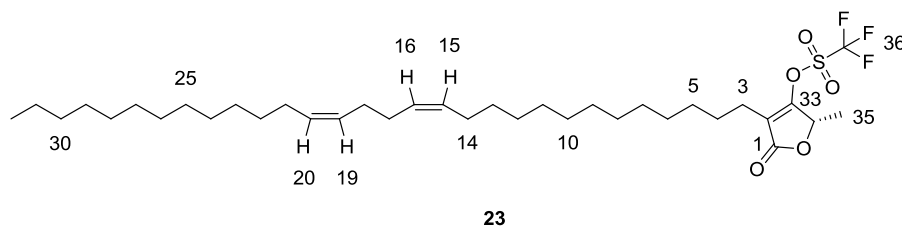
(*S,Z*)-2-Methyl-5-oxo-4-(triacont-13-en-17-yn-1-yl)-2,5-dihydrofuran-3-yl trifluoromethanesulfonate (22**)**



DIPEA (3.00 mL, 17.0 mmol, 1.50 equiv.) was added to a stirred solution of **21** (6.00 g, 11.4 mmol, 1.00 equiv.) in DCM_{abs} (100 mL) at rt. The solution was cooled to -78 °C and Tf₂O (3.84 g, 2.30 mL, 13.6 mmol, 1.20 equiv.) was slowly added. The mixture was stirred at -78 °C for 2 h. After complete conversion DCM (20 mL) was added and the reaction mixture was extracted with a solution of 1 N HCl (100 mL). The combined organic phases were washed with H₂O (100 mL), brine (100 mL), dried over MgSO₄ and filtrated. The solvents were removed under reduced pressure. Flash chromatography (5 % ethyl acetate in hexanes) of the residue gave triflate **22** (7.59 g, quant.) as a pale yellow oil.

[α]_D²² = + 32.4 (1.0, CHCl₃); ¹H NMR (600 MHz, CDCl₃): δ = 5.47 – 5.35 (m, 2H, H-15, H-16), 5.11 (q, *J* = 6.7 Hz, 1H, H-34), 2.36 – 2.28 (m, 2H), 2.24 – 2.11 (m, 6H), 2.05 – 2.01 (m, 2H), 1.57 – 1.53 (m, 5H), 1.50 – 1.44 (m, 2H), 1.39 – 1.33 (m, 4H), 1.33 – 1.28 (m, 8H), 1.28 – 1.25 (m, 24H), 0.88 (t, *J* = 7.0 Hz, 3H, H-32) ppm; ¹³C NMR (150 MHz, CDCl₃): δ = 169.3 (C-1), 163.5 (C-33), 131.3 (C-15), 128.2 (C-16), 122.1 (C-2), 118.6 (q, *J*_{C-F} = 321.0 Hz, C-36), 80.6 (C-20), 79.9 (C-19), 74.6 (C-34), 32.1 (C-30), 29.9, 29.9, 29.8, 29.8, 29.8, 29.7, 29.7, 29.6, 29.5, 29.3, 29.3, 29.3, 29.0, 27.5, 27.3, 26.8, 22.8 (C-31), 19.4 (C-18), 18.9 (C-21), 17.9 (C-35), 14.3 (C-32) ppm; ¹⁹F NMR (188 MHz, CDCl₃): δ = -72.9 ppm; IR (ATR): $\tilde{\nu}$ = 2923, 2853, 1780, 1735, 1699, 1434, 1379, 1339, 1218, 1136, 1105, 1066, 936, 891, 806, 764, 722, 603, 534, 509 cm⁻¹; HRMS (ESI) *m/z*: calculated for [C₃₆H₆₀F₃O₅S]⁺: 661.4108, found: 661.4112.

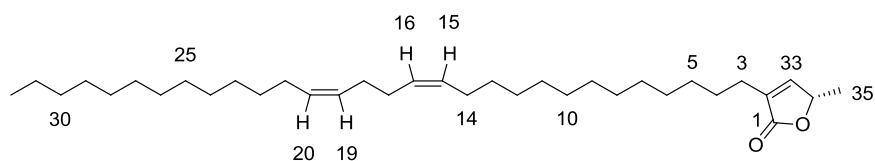
(S)-2-Methyl-5-oxo-4-((13Z,17Z)-triaconta-13,17-dien-1-yl)-2,5-dihydrofuran-3-yl trifluoromethanesulfonate (23)



Lindlar catalyst (195 mg, 0.09 mmol, 5 mol%, 0.05 equiv.) and quinoline (0.22 mL, 1.83 mmol, 1.00 equiv.) were added to a stirred solution of alkyne **22** (1.21 g, 1.83 mmol, 1.00 equiv.) in MeOH_{abs}. The reaction mixture was stirred at rt for 2 h under H₂-atmosphere (1 atm). After complete conversion of the starting material the mixture was filtrated over a short plug of Celite and silica gel, washed with ethyl acetate and concentrated under reduced pressure. Flash chromatography (5 % ethyl acetate in hexanes) of the residue gave Z,Z-diene **23** (1.18 g, 98 %) as a colourless oil.

$[\alpha]_D^{22} = +25.2$ (1.0, CHCl₃); ¹H NMR (600 MHz, CDCl₃): δ = 5.42 – 5.32 (m, 4H, H-15, H-16, H-19, H-20), 5.11 (q, J = 6.7 Hz, 1H, H-34), 2.36 – 2.29 (m, 2H), 2.11 – 1.97 (m, 8H), 1.58 – 1.52 (m, 5H), 1.35 – 1.28 (m, 12H), 1.28 – 1.24 (m, 26H), 0.88 (t, J = 7.0 Hz, 3H, H-32) ppm; ¹³C NMR (150 MHz, CDCl₃): δ = 169.2 (C-1), 163.5 (C-33), 130.5 (C_{sp2}H), 130.5 (C_{sp2}H), 129.3 (C_{sp2}H), 129.3 (C_{sp2}H), 122.1 (C-2), 118.6 (q, J_{C-F} = 321.0 Hz, C-36), 74.6 (C-34), 32.1 (C-30), 29.9, 29.9, 29.9, 29.8, 29.8, 29.8, 29.8, 29.7, 29.6, 29.5, 29.5, 29.5, 29.5, 29.3, 27.6, 27.4, 27.4, 26.8, 22.8, 22.8 (C-31), 17.9 (C-35), 14.3 (C-32) ppm; ¹⁹F NMR (188 MHz, CDCl₃): δ = -72.9 ppm; IR (ATR): $\tilde{\nu}$ = 3007, 2923, 2853, 1781, 1737, 1699, 1434, 1378, 1340, 1322, 1218, 1137, 1104, 1066, 936, 806, 764, 722, 603, 535, 509 cm⁻¹; HRMS (ESI) m/z: calculated for [C₃₆H₆₁F₃NaO₅S]⁺: 685.4084, found: 685.4093; calculated for [C₃₆H₆₅F₃NO₅S]⁺: 680.4530, found: 680.4529.

(S)-5-Methyl-3-((13Z,17Z)-triaconta-13,17-dien-1-yl)furan-2(5H)-one (4)

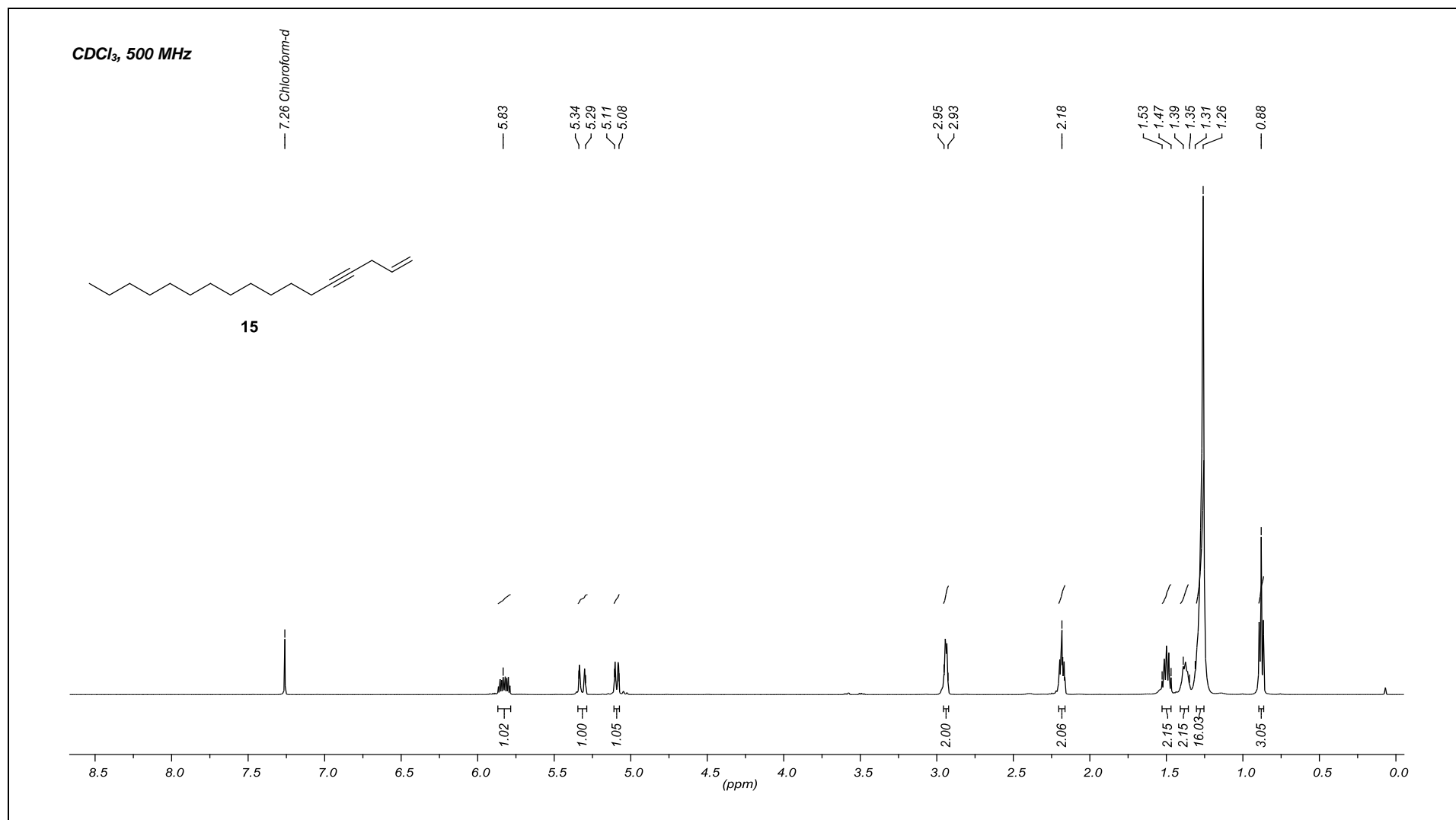


(+)-Muricadienin (**4**)

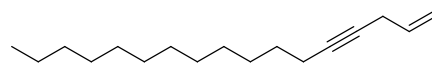
$\text{Pd}_2(\text{dba})_3$ (4.12 mg, 0.0045 mmol, 1.5 mol%, 0.015 equiv.) and PPh_3 (11.8 mg, 0.045 mmol, 15.0 mol%, 0.15 equiv.) were dissolved in THF_{abs} (5 mL). After stirring for 5 min at rt triflate **23** (199 mg, 0.30 mmol, 1.00 equiv.) and Bu_3SnH (243 μL , 0.90 mmol, 3.00 equiv.) were added to the orange solution. The mixture was heated to 50 °C and stirred at this temperature for 5 hours. After complete conversion of the starting material the reaction was cooled to rt, diluted with H_2O (3 mL) and extracted with diethyl ether (3 x 5 mL). The combined organic phases were dried over MgSO_4 , filtrated and the solvents were removed under reduced pressure. Flash chromatography (2 % ethyl acetate in hexanes to 5 % ethyl acetate in hexanes) of the residue gave (+)-muricadienin (**4**) (140 mg, 91 %) as a colourless waxy solid.

$[\alpha]_{\text{D}}^{22} = +13.5$ (1.0, CHCl_3); $^1\text{H NMR}$ (400 MHz, CDCl_3): δ = 6.98 (d, J = 1.5 Hz, 1H, H-33), 5.46 – 5.27 (m, 4H, H-15, H-16, H-19, H-20), 4.99 (qd, J = 6.8, 1.7 Hz, 1H, H-34), 2.29 – 2.22 (m, 2H), 2.14 – 1.92 (m, 8H), 1.56 – 1.50 (m, 2H), 1.40 (d, J = 6.8 Hz, 3H, H-35), 1.38 – 1.29 (m, 10H), 1.26 (s, 28H), 0.88 (t, J = 6.8 Hz, 3H, H-32) ppm; $^{13}\text{C NMR}$ (100 MHz, CDCl_3): δ = 174.0 (C-1), 148.9 (C-33), 134.5 (C-2), 130.5 ($\text{C}_{\text{sp}^2}\text{H}$), 130.5 ($\text{C}_{\text{sp}^2}\text{H}$), 129.3 ($\text{C}_{\text{sp}^2}\text{H}$), 129.3 ($\text{C}_{\text{sp}^2}\text{H}$), 77.5 (C-34), 32.1 (C-30), 29.9, 29.9, 29.8, 29.8, 29.7, 29.7, 29.5, 29.5, 29.4, 27.6, 27.4, 25.3, 22.8 (C-31), 19.4 (C-35), 14.3 (C-32) ppm; **IR** (ATR): $\tilde{\nu}$ = 3005, 2921, 2852, 1757, 1655, 1463, 1373, 1317, 1197, 1119, 1075, 1026, 966, 857, 782, 721, 639, 611, 504 cm^{-1} ; **HRMS** (ESI) m/z : calculated for $[\text{C}_{35}\text{H}_{63}\text{O}_2]^+$: 515.4823, found: 515.4824; calculated for $[\text{C}_{35}\text{H}_{62}\text{NaO}_2]^+$: 537.4642, found: 537.4642, calculated for $[\text{C}_{35}\text{H}_{66}\text{NO}_2]^+$: 532.5088, found: 532.5089.

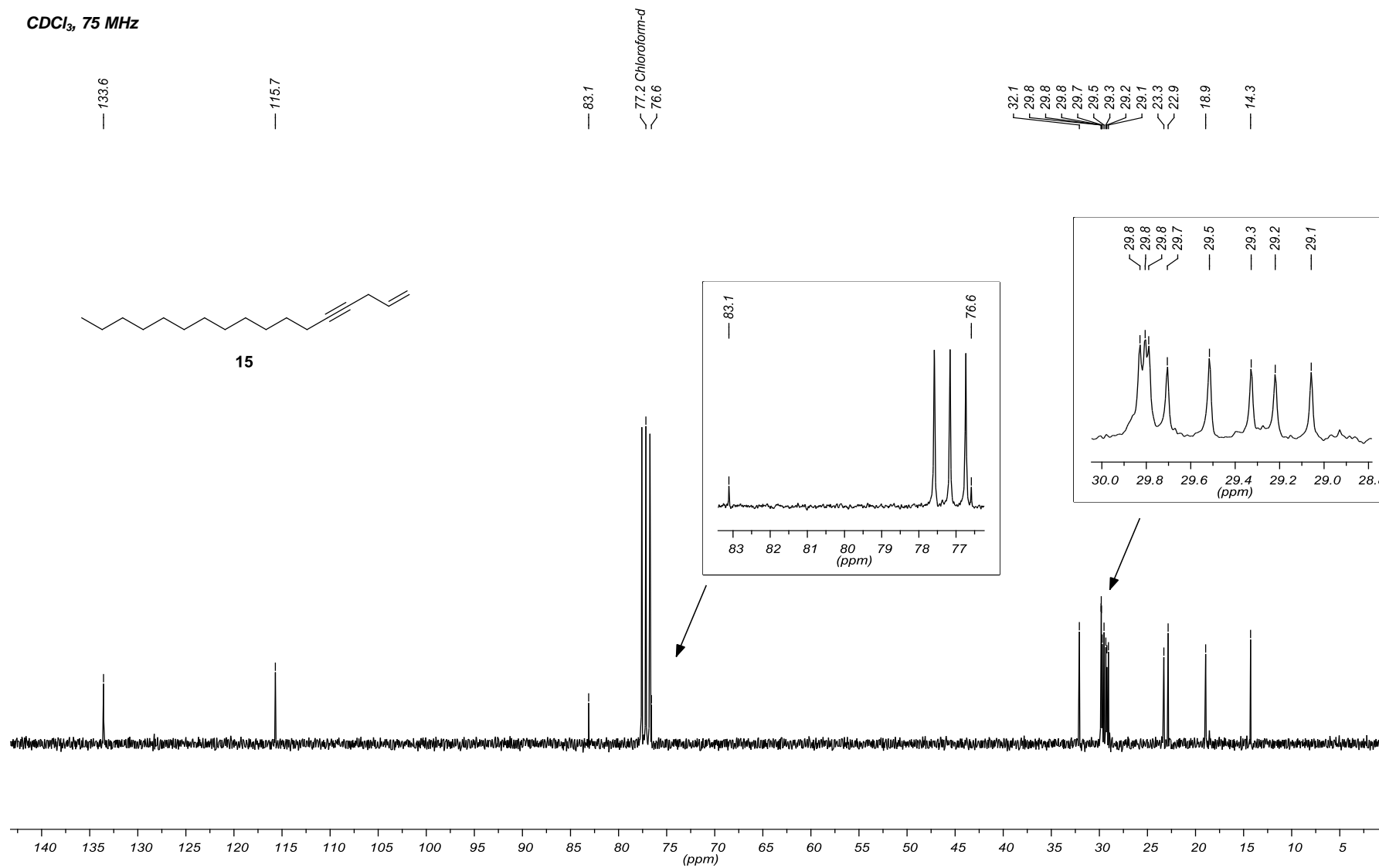
III. ^1H and ^{13}C NMR Spectra of all Compounds



CDCl₃, 75 MHz

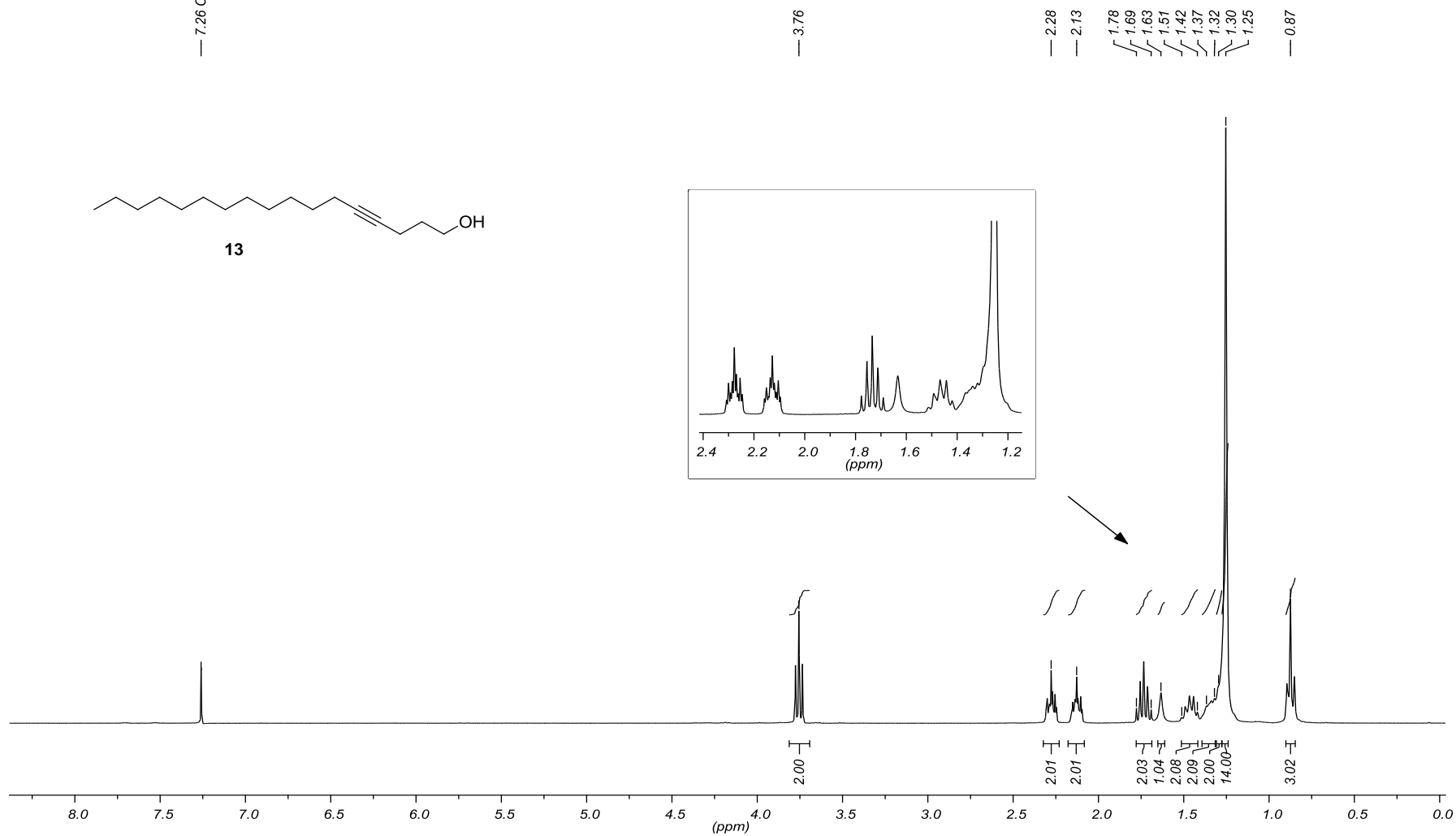
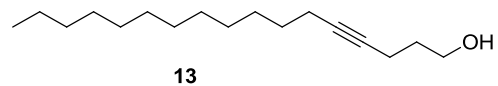


15

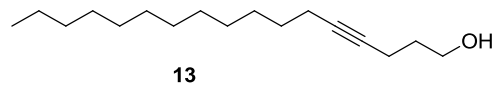


CDCl₃, 300 MHz

7.26 Chloroform-d



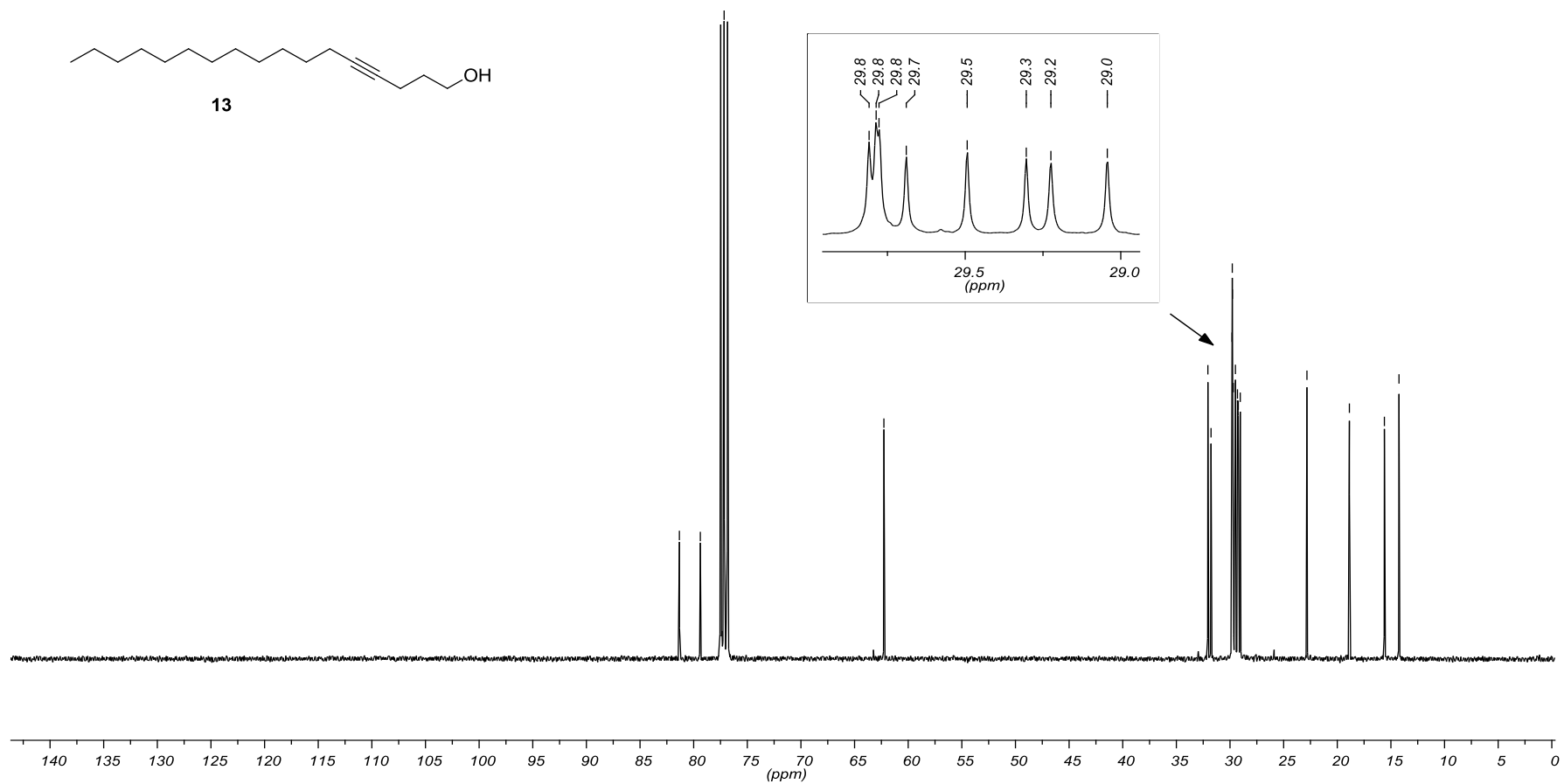
CDCl_3 , 100 MHz



81.3
79.4
77.2 Chloroform-d

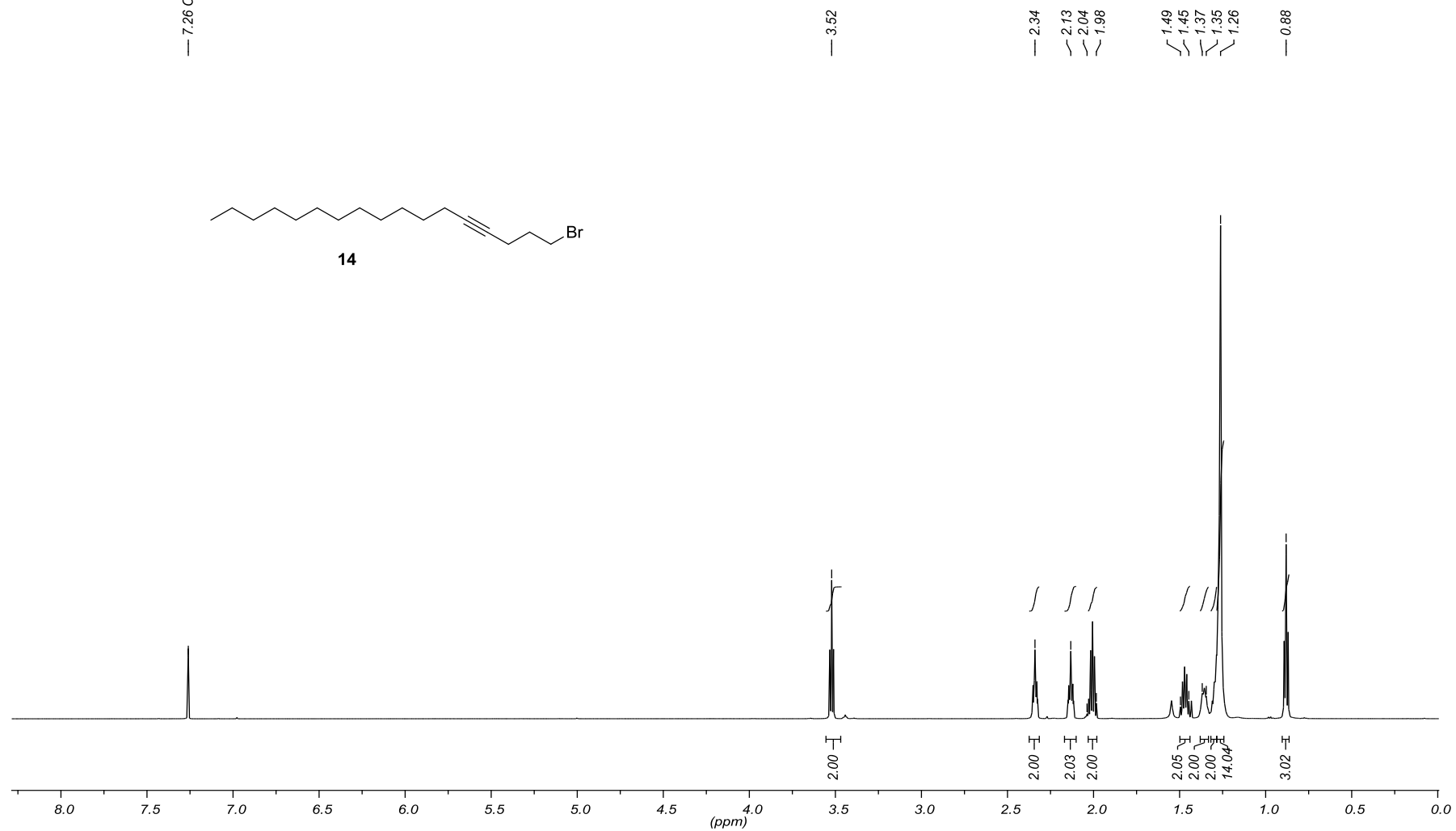
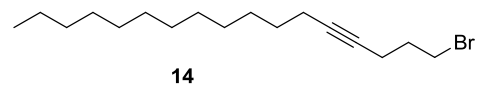
62.3

32.1
31.8
29.8
29.8
29.7
29.5
29.3
29.2
29.0
22.8
18.9
15.6
14.2



CDCl₃, 600 MHz

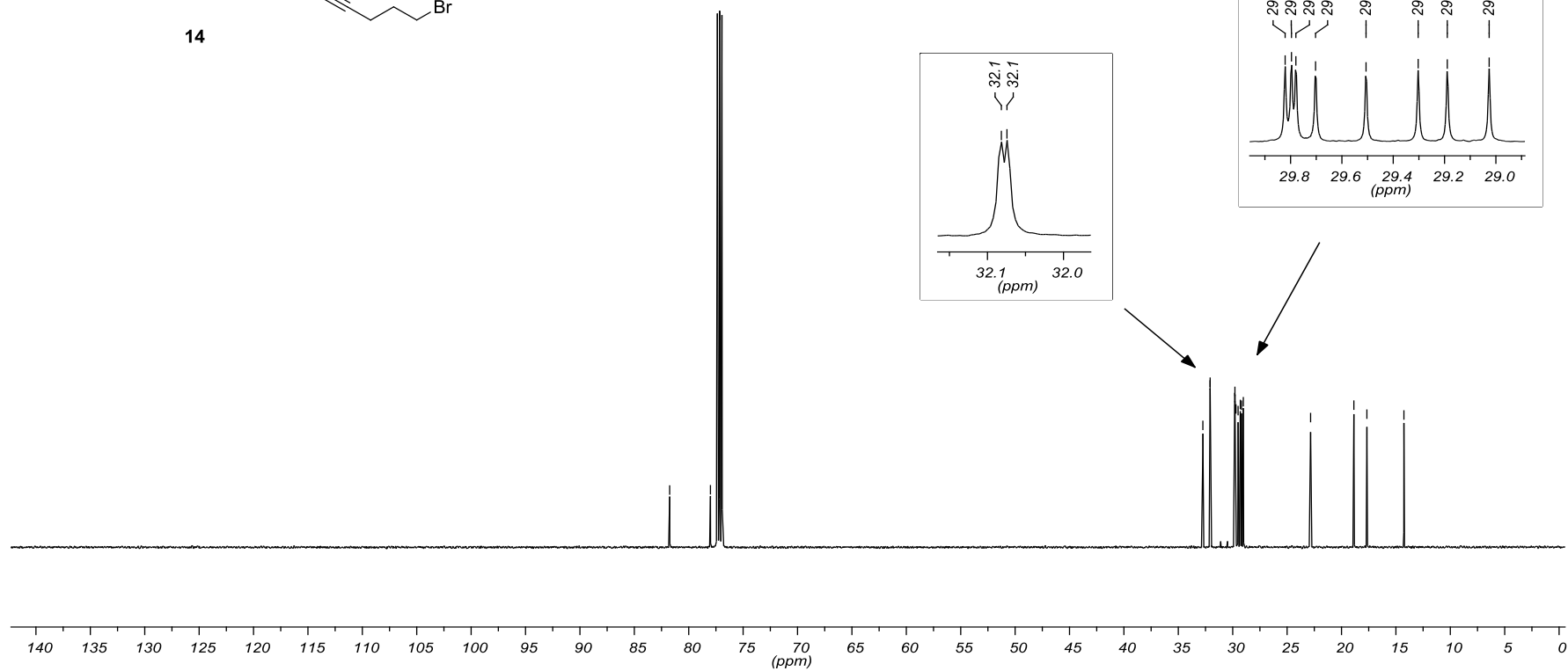
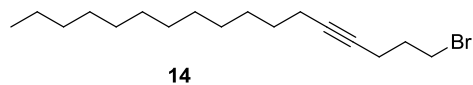
— 7.26 Chloroform-d



CDCl₃, 150 MHz

— 81.8
— 78.0
— 77.2 Chloroform-d

32.7
32.1
32.1
29.8
29.8
29.8
29.7
29.5
29.3
29.2
29.0
22.8
18.9
17.7
14.3



CDCl_3 , 400 MHz

— 7.26 Chloroform-d

7.85
7.76
7.71
7.66

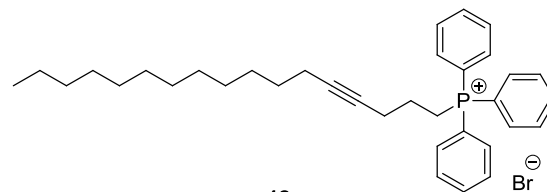
3.95
3.87

2.57
2.54

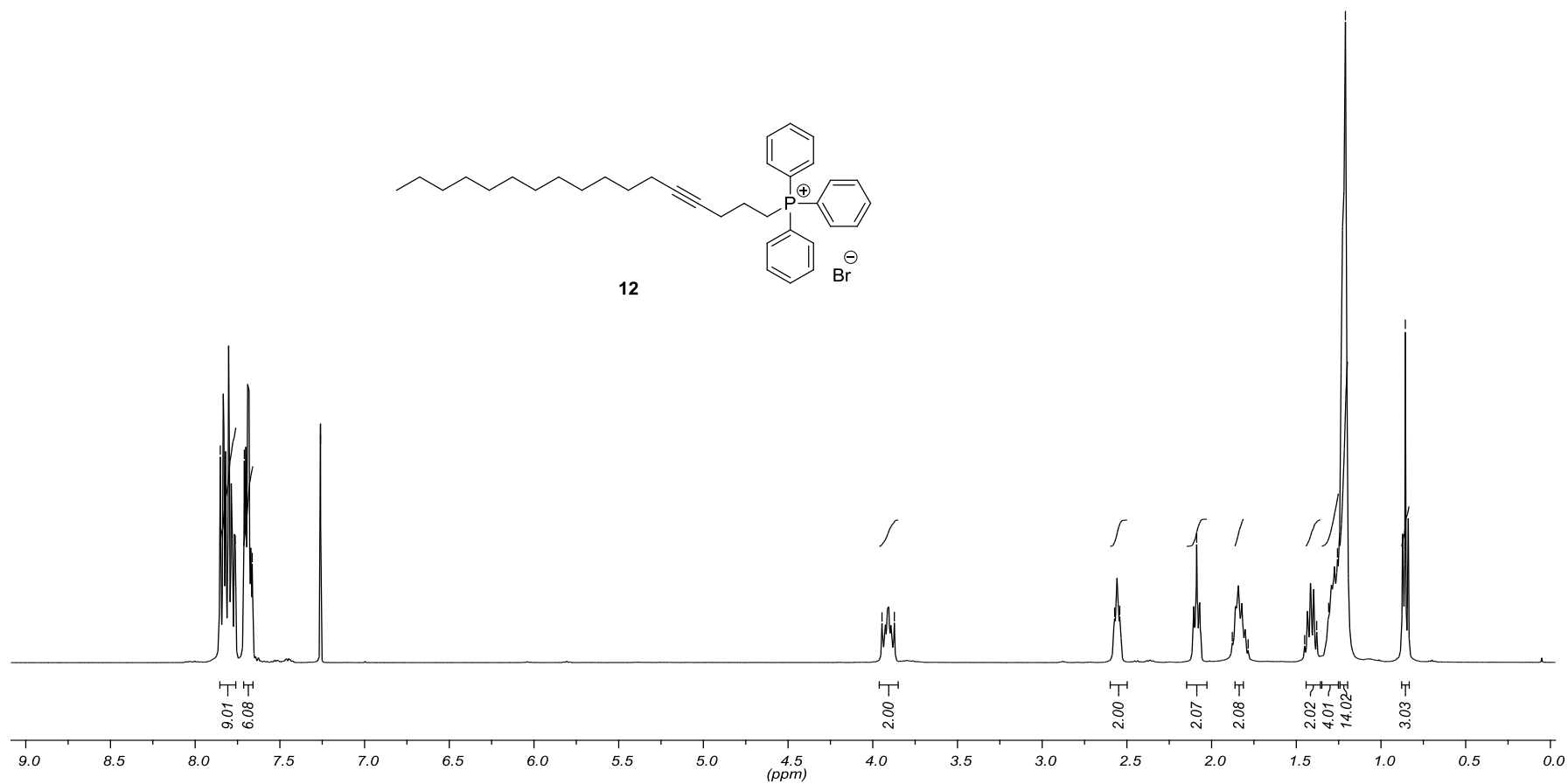
2.09
1.88
1.78

1.45
1.38
1.31
1.26
1.21

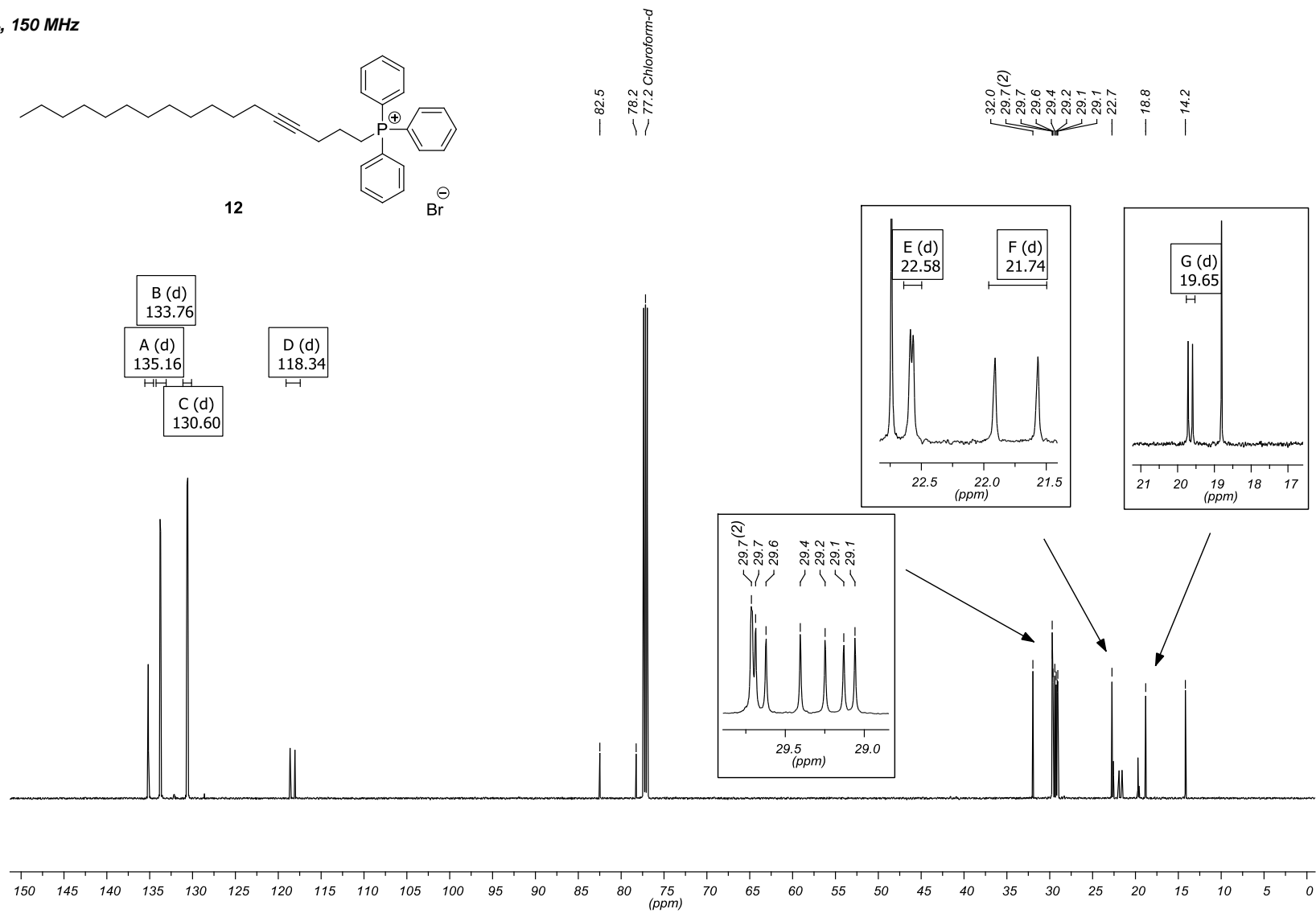
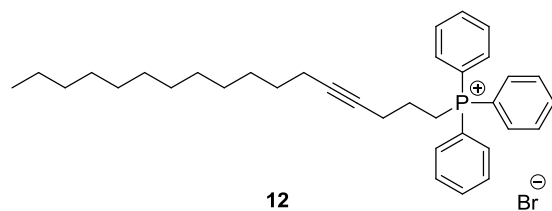
— 0.86

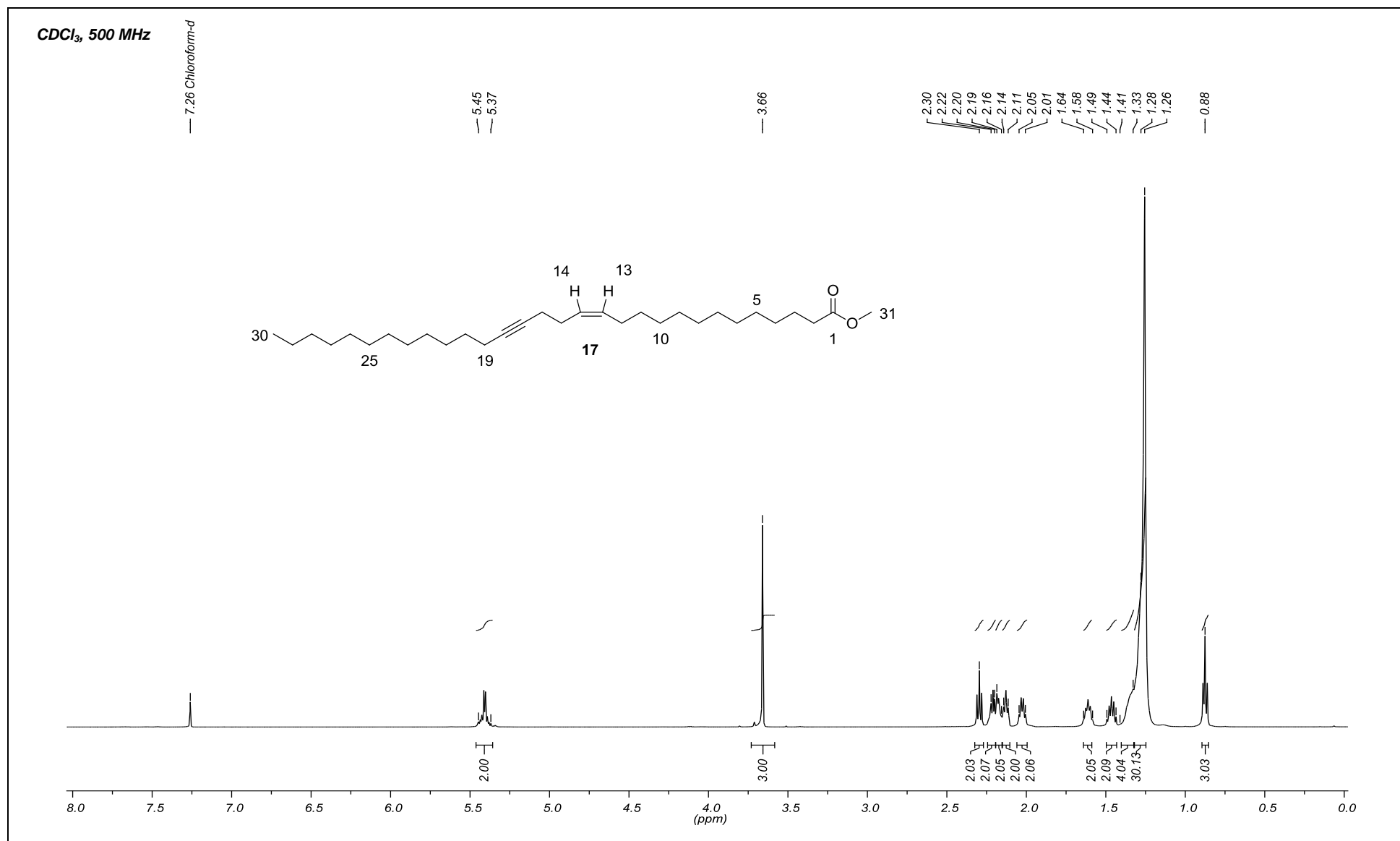


12

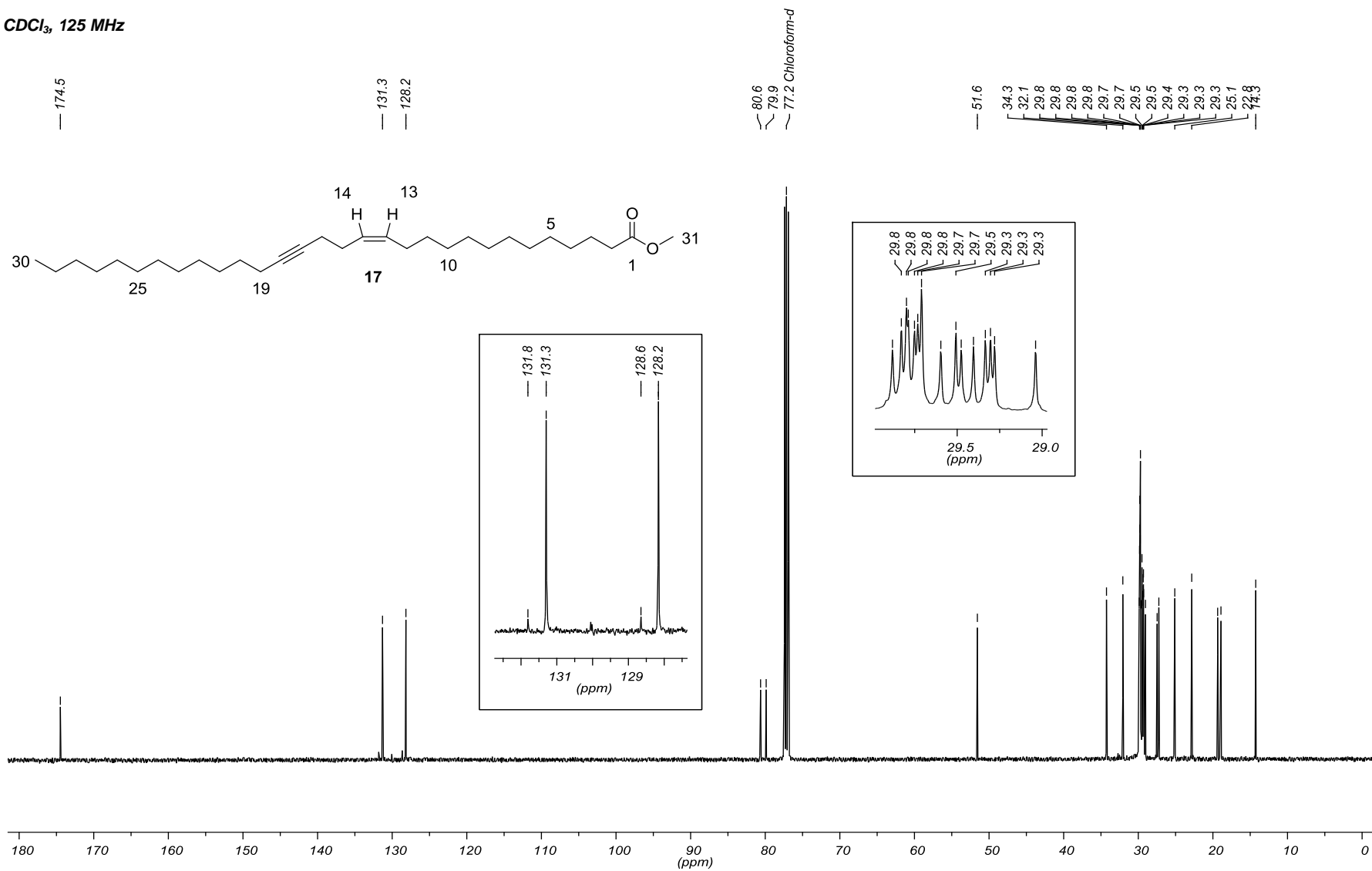


CDCl₃, 150 MHz





CDCl_3 , 125 MHz

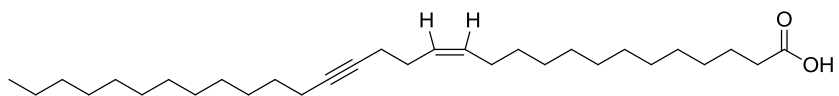


CDCl₃, 300 MHz

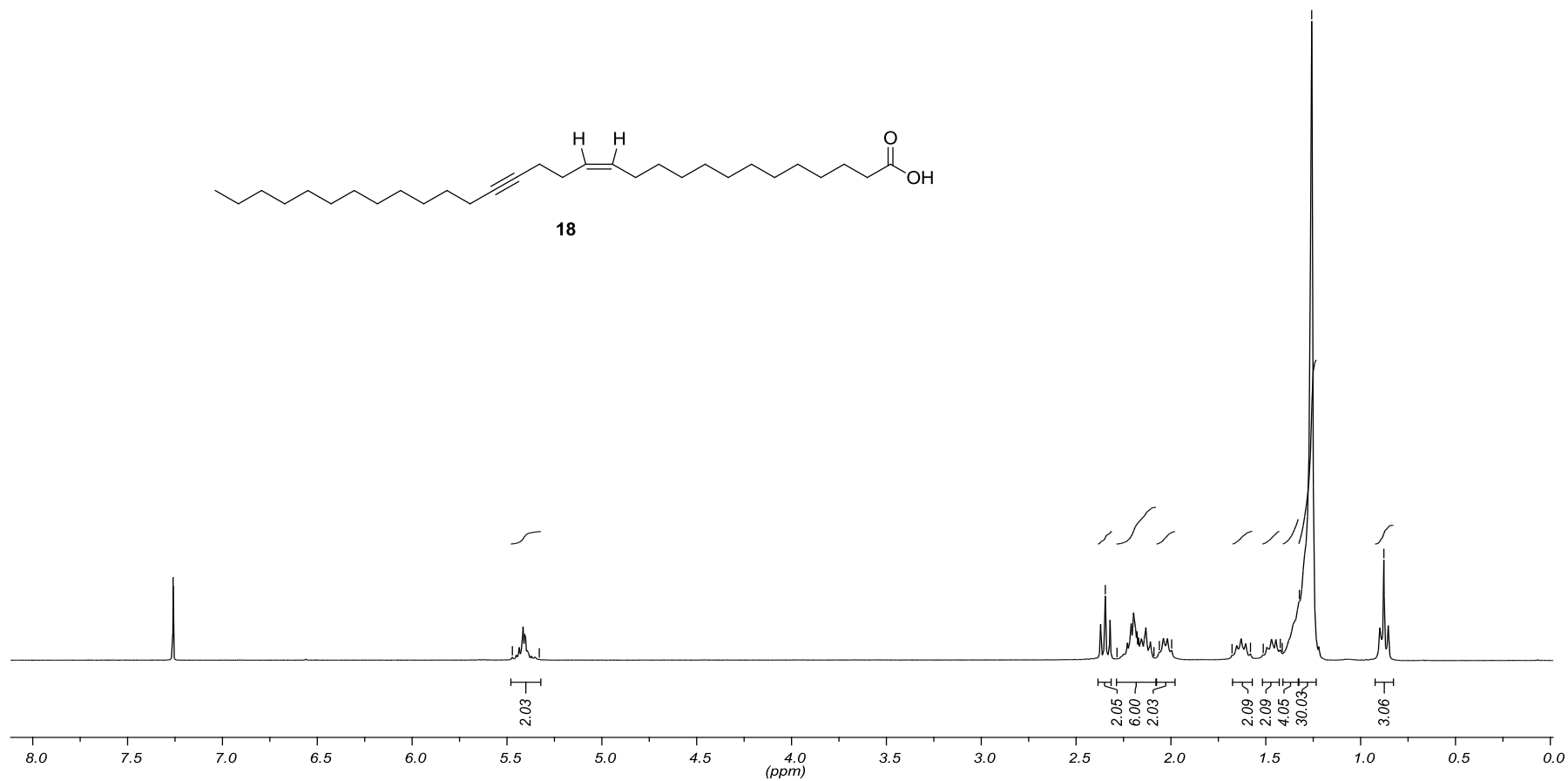
— 7.26 Chloroform-d

— 5.47
— 5.33

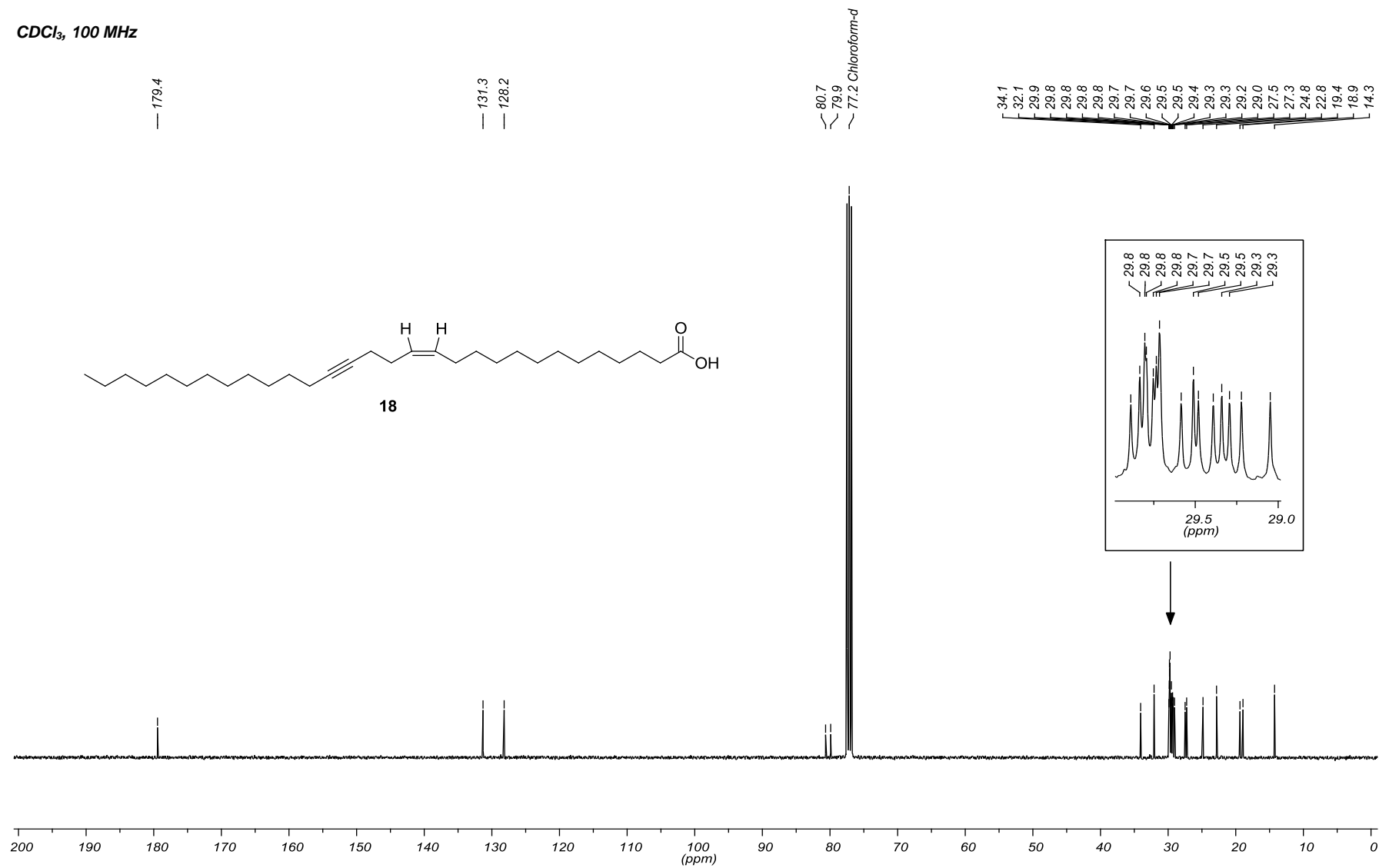
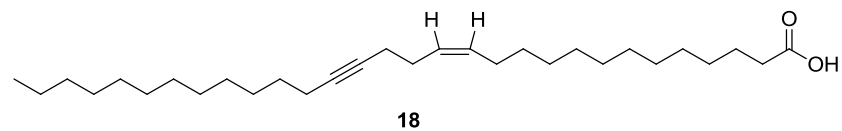
— 2.35
— 2.28
— 2.09
— 2.06
— 1.68
— 1.58
— 1.51
— 1.42
— 1.41
— 1.32
— 1.26
— 0.88

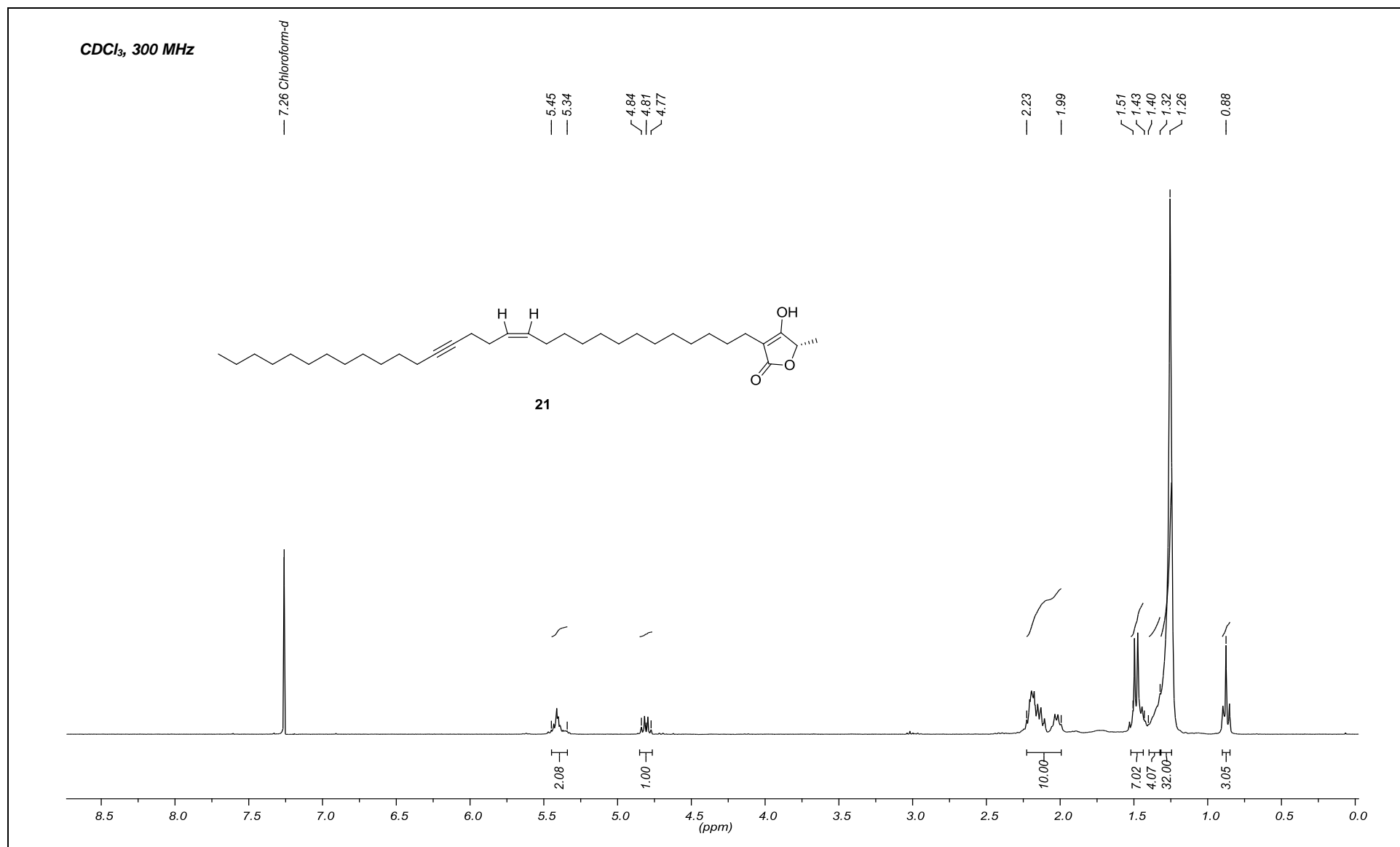


18

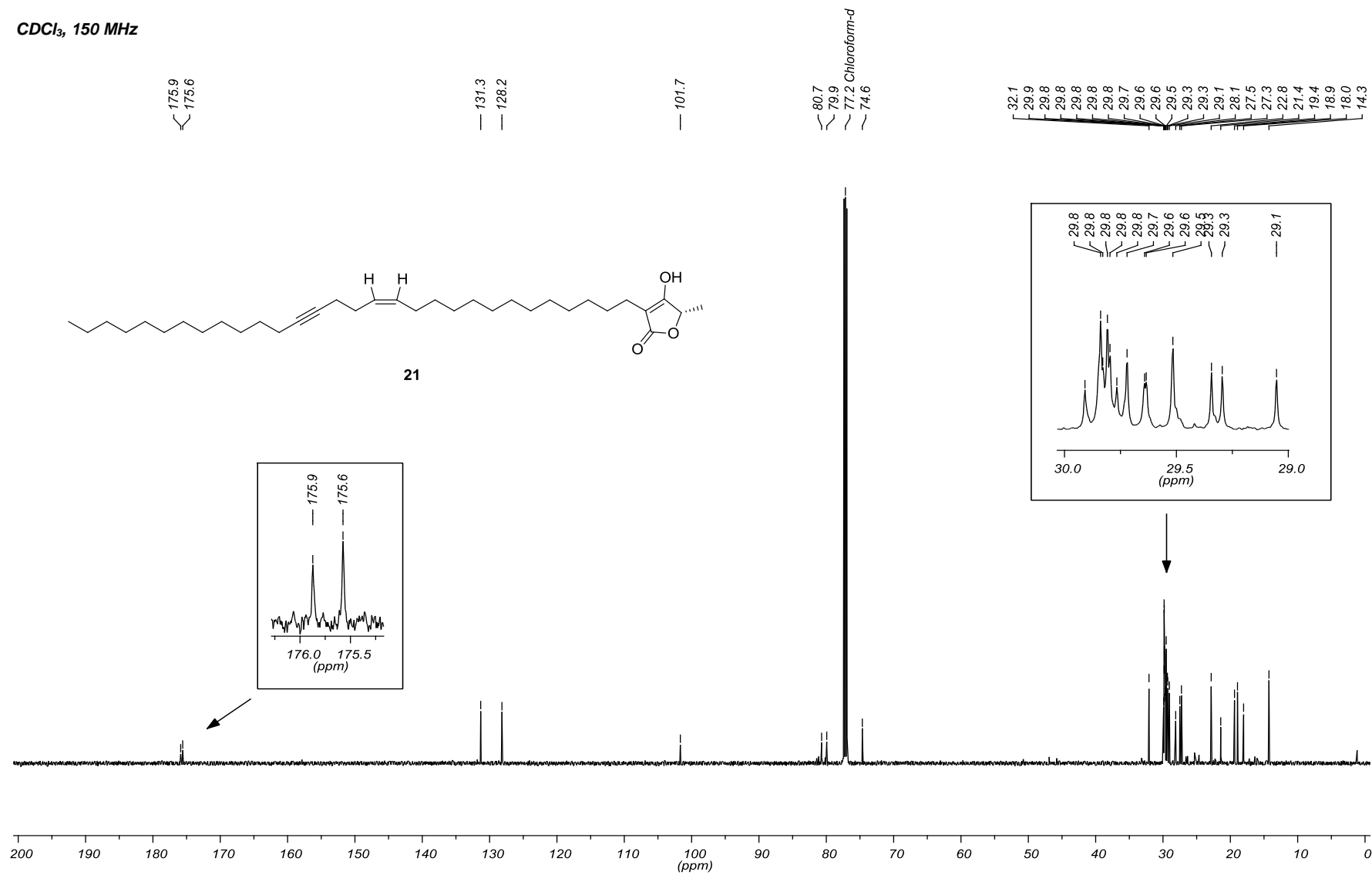


CDCl₃, 100 MHz





CDCl_3 , 150 MHz

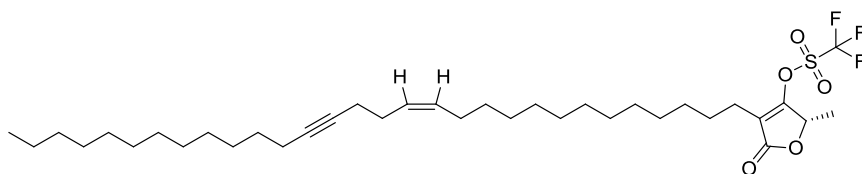


CDCl₃, 600 MHz

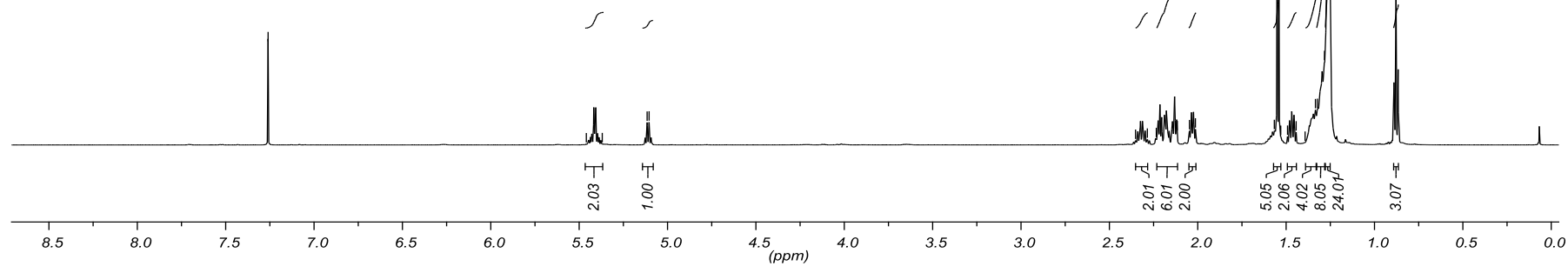
— 7.26 Chloroform-d

5.46
5.37
5.12
5.10

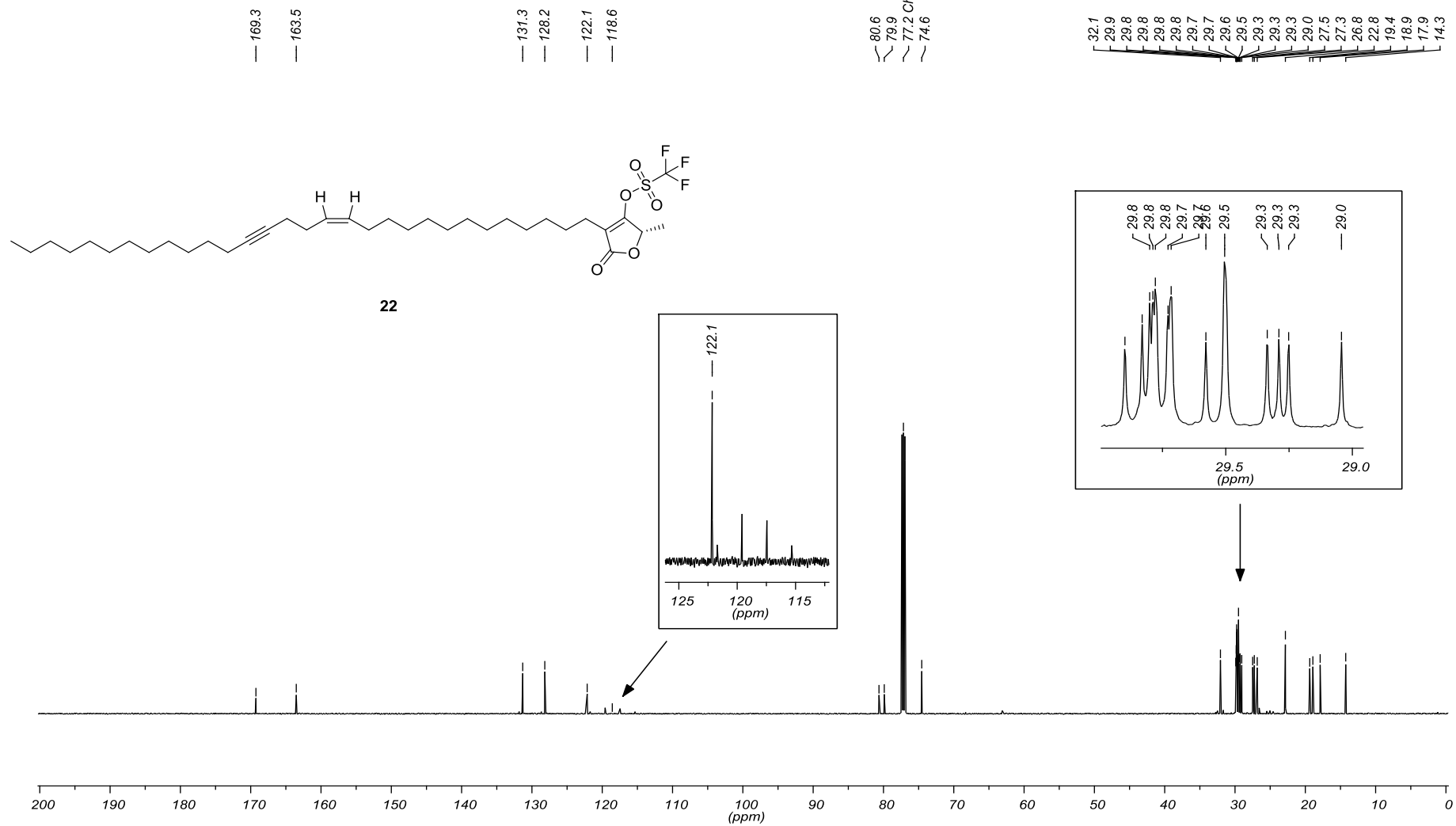
2.35
2.29
2.23
2.12
2.05
2.01
1.57
1.53
1.49
1.44
1.39
1.33
1.32
1.28
1.26
0.88



22



CDCl₃, 150 MHz



CDCl₃, 600 MHz

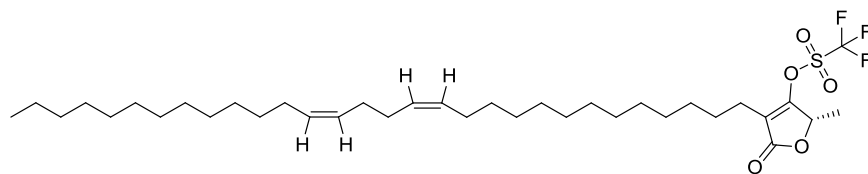
— 7.26 Chloroform-d

— 5.42
— 5.32
— 5.13
— 5.09

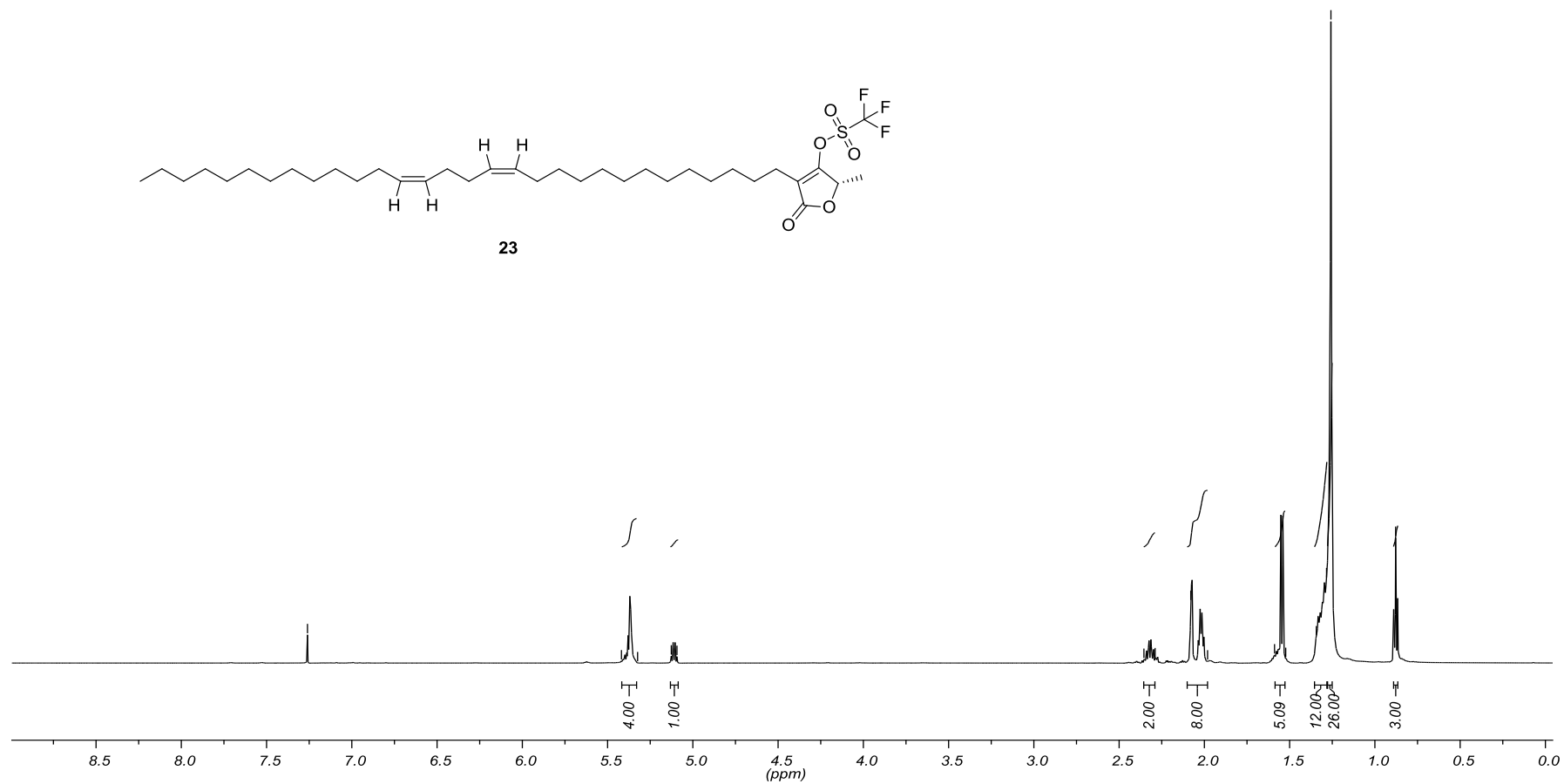
— 2.35
— 2.29
— 2.08
— 1.98

— 1.59
— 1.52
— 1.34
— 1.28
— 1.26

— 0.88



23



CDCl_3 , 150 MHz

— 169.2

— 163.5

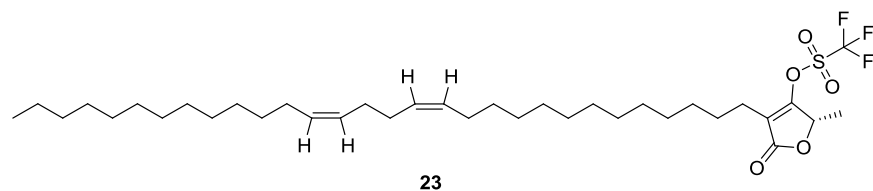
— 130.5
— 130.5 (2)
— 129.3

— 122.1

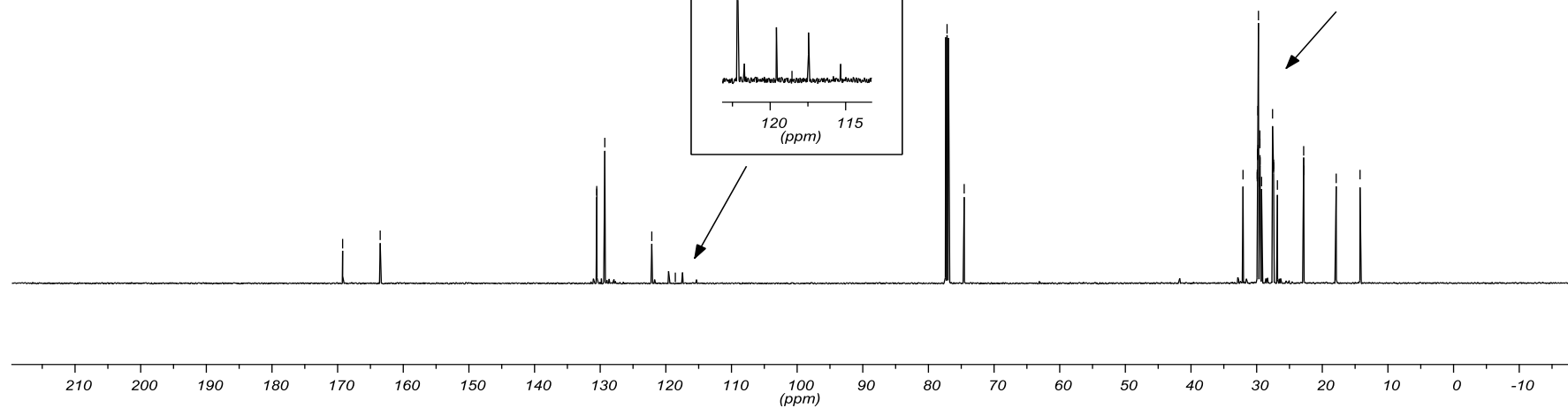
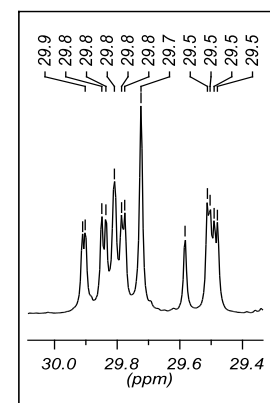
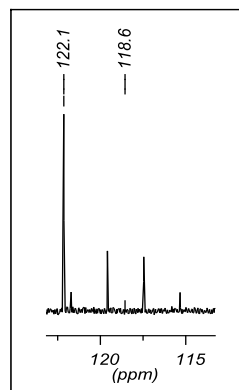
— 118.6

— 77.2 Chloroform-d
— 74.6

32.1
29.9
29.9
29.8
29.8
29.8
29.8
29.8
29.7
29.6
29.5
29.5
29.5
29.5
29.3
27.6
27.4
27.4
26.8
22.8
17.9
14.2



23



CDCl₃, 400 MHz

— 7.26 Chloroform-d

$$\begin{array}{r} 6.98 \\ 6.97 \\ \hline \end{array}$$

— 5.45

— 5.29

5.01
4.96

— 5.01

2.29

2.24

2.13

— 1.94

- 156

1.56
1.53

1.53

1.41

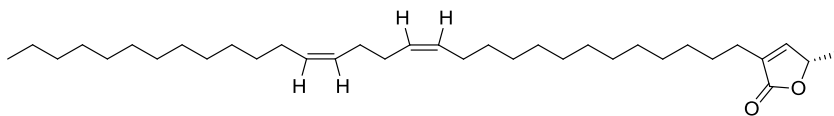
1.39

 ≥ 1.30

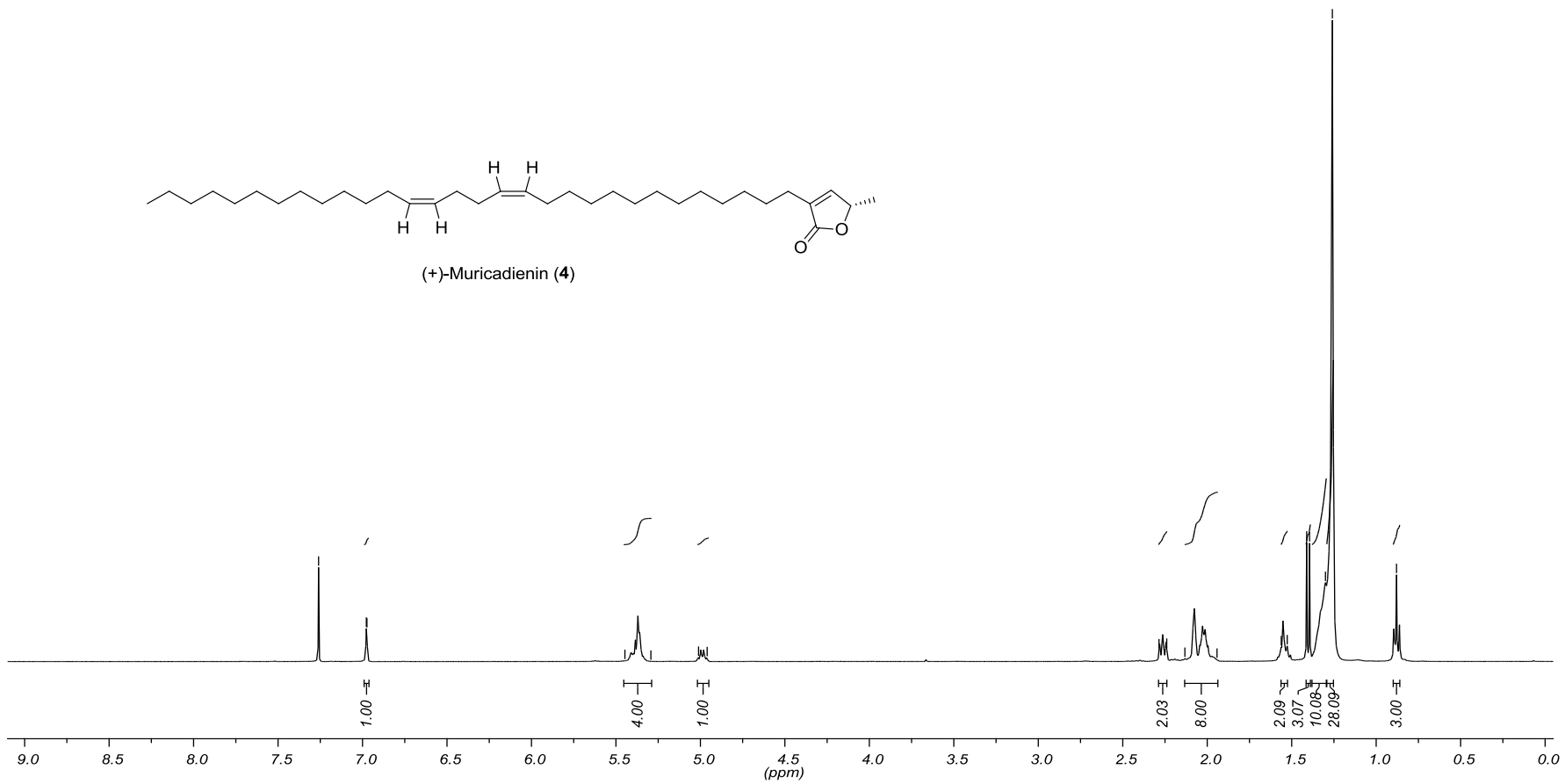
1.30
1.26

1.26

— 088 —



(+)-Muricadienin (**4**)



CDCl_3 , 100 MHz

