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SUPPORTING INFORMATION

Nitronate-aryne cycloaddition as a concise route to stereochemically complex fused benzisoxazolines and amino alcohols

Alexander A. Lukoyanov,[a] Andrey A. Tabolin,[a,*] Yulia V. Nelyubina,[b] Svetlana A. Aksenova,[b,c] Alexey Yu. Sukhorukov[a,*]

[a] N. D. Zelinsky Institute of Organic Chemistry, Russian Academy of Sciences, 119991, Leninsky prospect, 47, Moscow, Russian Federation

[b] A. N. Nesmeyanov Institute of Organoelement Compounds, 119991, Vavilov str. 28, Moscow, Russian Federation

[c] Moscow Institute of Physics and Technology (National Research University), 141700, Institutskiy per. 9, Dolgoprudny, Moscow Region, Russian Federation

* Corresponding authors: tabolin87@mail.ru (A.A.T), atabolin@ioc.ac.ru (A.A.T), sukhorukov@ioc.ac.ru (A.Y.S)

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General experimental

All reactions were performed in oven-dried (150 °C) glassware. Most of the chemicals were acquired from commercial sources and used as received. Petroleum ether (PE), ethyl acetate, and *tert*-butyl methyl ether (MTBE) were distilled. CH_3CN and CH_2Cl_2 were distilled from CaH_2 prior to use. Triethylamine, DBU and DMF were distilled from CaH_2. Brine refers to saturated aqueous solution of NaCl. TLC were performed on silica coated on aluminium with UV254 indicator. Visualization was accomplished with UV and/or anisaldehyde/H_2SO_4/EtOH stain and/or ninhydrin/EtOH stain. Column chromatography was performed on silica (0.04–0.063 mm, 60 Å). NMR spectra were recorded at 300K on Bruker AM300, Fourier 300HD and Avance NEO spectrometers at the following spectrometer frequencies: 300 MHz (^{1}H NMR), 75 MHz (^{13}C NMR), 282 MHz (^{19}F NMR). Multiplicities are assigned as s (singlet), d (doublet), t (triplet), q (quartet), quint (quintet), m (multiplet), br (broad), app (apparent). Assignment was made using 2D NMR spectra for selected products. For other products signals were assigned by analogy. High resolution mass spectra were acquired on Bruker micrOTOF spectrometer using electrospray ionization (ESI). GC-MS was performed on a Chromatec 5000 with Agilent DB-1MS column 122-0132. Melting points were determined on a Koffler melting point apparatus and are uncorrected.

Structures, synthesis and characterization data of cyclic nitronates 1, 2, nitroalkenes 3, and aryne precursors 9

Model cyclic nitronates **1** and **2** were synthesized starting from readily available α-substituted nitroalkenes **3** by known methods (Scheme S1). Six-membered cyclic nitronates **1a**–**m** were assembled using a $SnCl_4$-promoted inverse-electron demand [4+2]-cycloaddition of nitroalkenes **3** with electron-rich olefins (Scheme S1, a). The synthesis of isoxazoline *N*-oxide 5,5-dicarboxylates **2a**–**e** was accomplished by condensation of nitroalkenes **3** with diethyl bromomalonate (Scheme S1, b). Isoxazoline *N*-oxides **2f**–**i** were prepared by [4+1]-annulation of nitroalkenes **3** with sulfur ylides **11** (Corey-Chaykovsky reagent **11a**, ester- and benzyl-stabilized ylides **11b** and **11c**, Scheme S1, c). All products are racemates.

5,6-Dihydro-4*H*-1,2-oxazine *N*-oxides **1a**,[1] **1b**,[2] **1e**,[3] **1f**,[2] and **1m**[4] were prepared from corresponding nitroalkenes **3a**, **3b**, **3e**, **3f**, and **3i** following the previously described procedures.

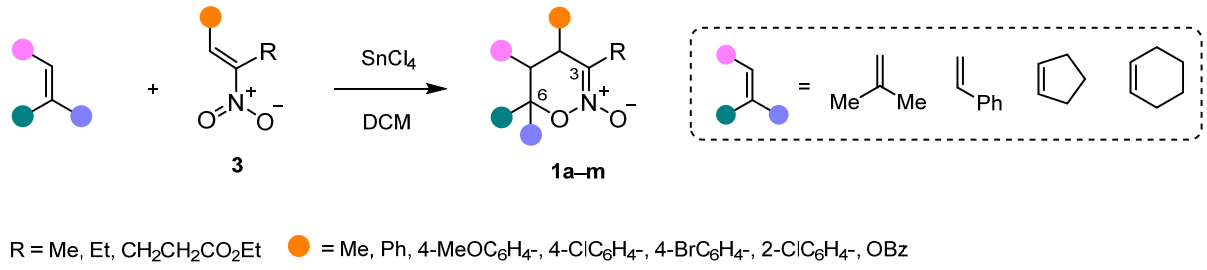
Isoxazoline *N*-oxides **2b**,[2] **2g**,[2] **2h**,[2] and **2i**[5] were prepared from corresponding nitroalkenes **3j**, **3a**, **3d**, and **3a** following the previously described procedures.

NItroalkenes **3a**,[6] **3b**,[7] **3c**,[8] **3d**,[9] **3e**,[3] **3f**,[10] **3h**,[3] **3i**,[11] **3j**,[5] **3k**,[12] **3l**[13a] were prepared following the previously described procedures.

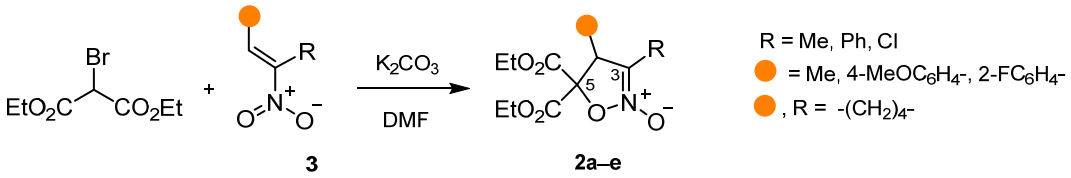
Aryne precursors **9a**–**f** were commercial grade and used as received. Aryne precursor **9g** was synthesized according to a literature method.[13b]

Exact structures of compounds **1**, **2**, **3** and **9** are given in Figures S1–S4.

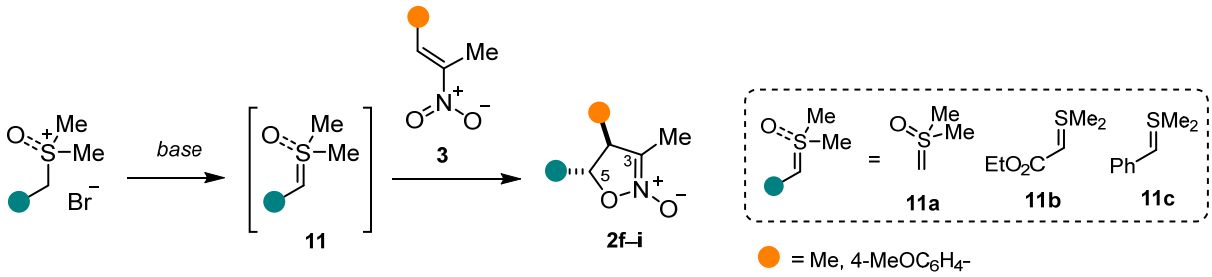
a. Synthesis of 5,6-dihydro-4H-1,2-oxazine N-oxides ***1a–m***



b. Synthesis of isoxazoline N-oxides **2a–e**



c. Synthesis of isoxazoline N-oxides **2f–i**



Scheme S1. General scheme for the synthesis of cyclic nitronates **1** and **2**

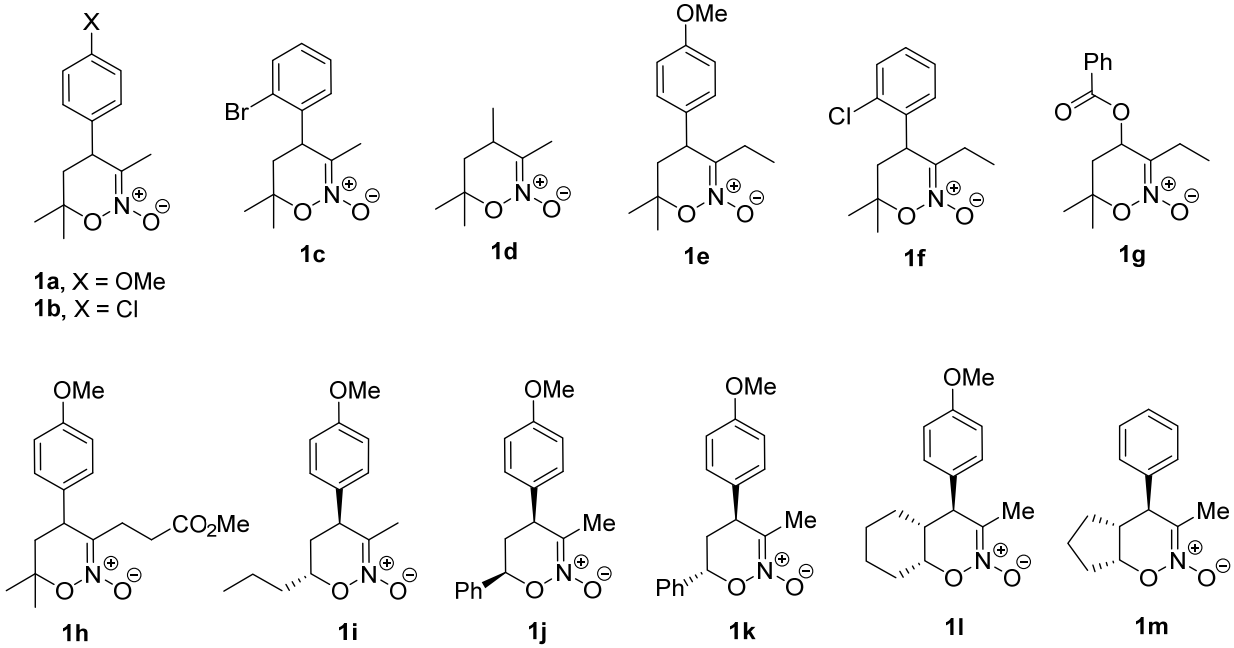


Fig. S1. Structures of 5,6-dihydro-4*H*-1,2-oxazine *N*-oxides **1a–m**

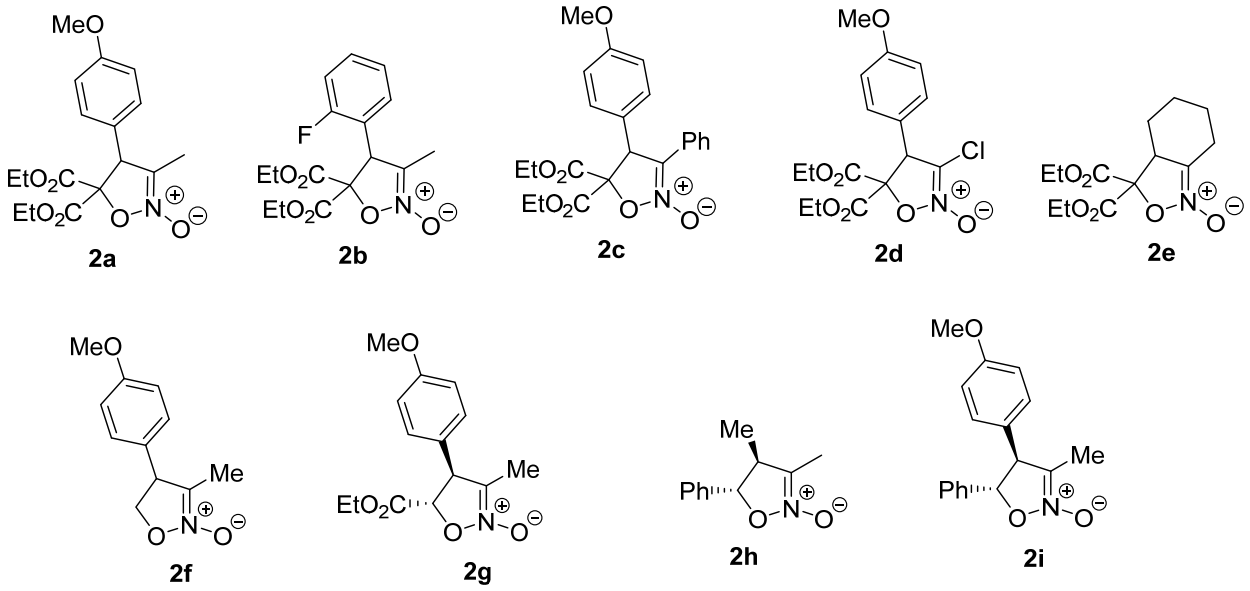


Fig. S2. Structures of isoxazoline *N*-oxides **2a–i**

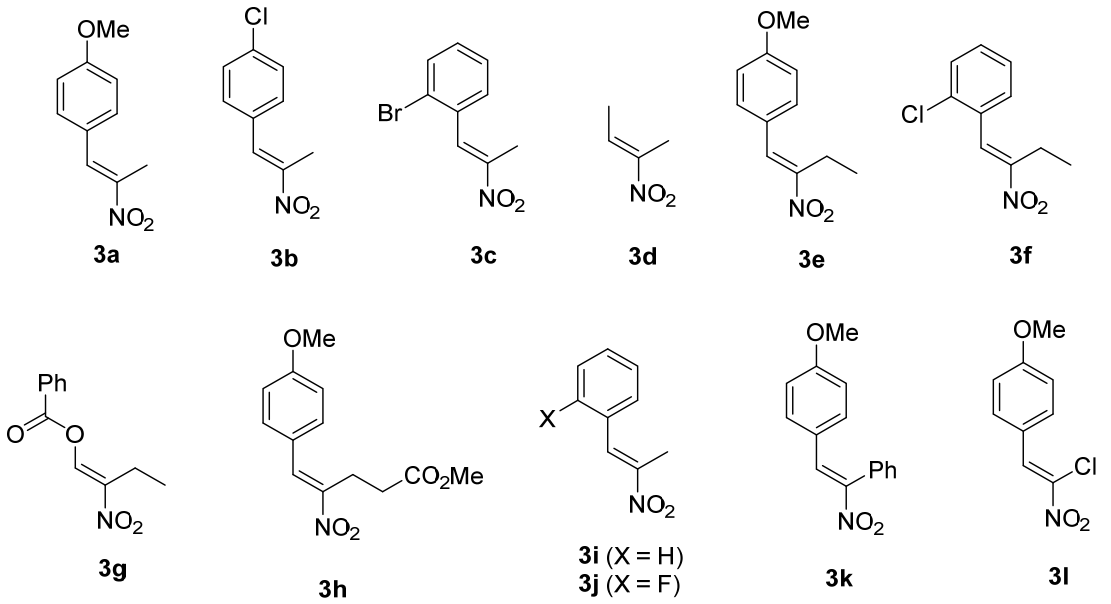


Fig. S3. Structures of nitroalkenes **3a–m**

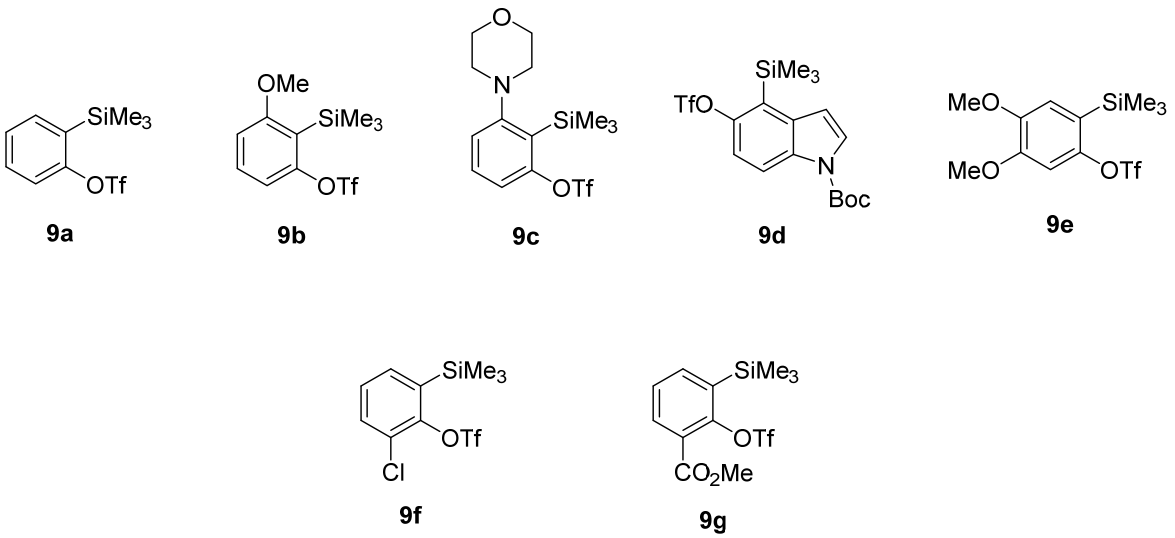
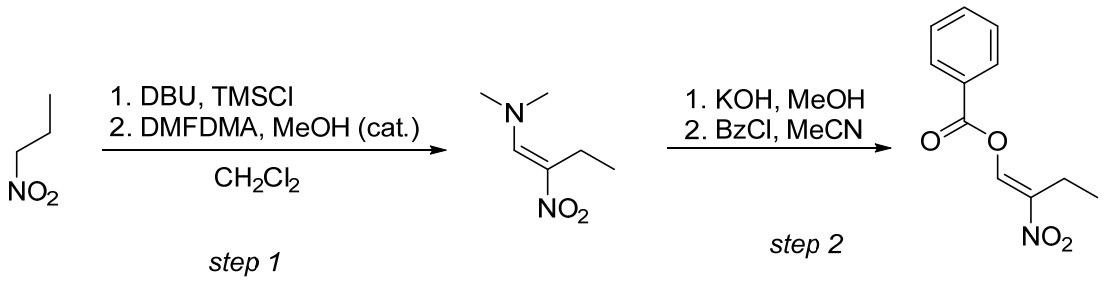


Fig. S4. Structures of aryne precursors **9a–g**

(*E*)-2-Nitrobut-1-en-1-yl benzoate (3g)



Step 1:[14] To the solution of 1-nitropropane (2.2 mL, 2.3 g, 30 mmol) in CH_2Cl_2 (30 mL) DBU (4.4 mL, 4.5 g, 32 mmol, 1.05 equiv.) was added dropwise at -15 °C with stirring. After 20 min TMSCl (4.2 mL, 3.6 g, 33 mmol, 1.1 equiv.) was added. The reaction mixture was stirred for 10 min, cooling bath was removed. After 40 min, the reaction mixture was cooled to -78 °C, dimethylformamide dimethylacetal (DMFDMA) (4.4 mL, 3.9 g, 33 mmol, 1.1 equiv.) was added dropwise, then MeOH (60 µL, 48 mg, 1.5 mmol, 0.05 equiv.) was added. The reaction mixture was allowed to warm to room temperature, maintained overnight and evaporated. Et_2O (100 mL) was added to the residue resulting in the formation of precipitate. The mixture was vigorously stirred for 0.5 h, and the organic layer was decanted. Such process was repeated 5 times with fresh portions of Et_2O (100 mL). Combined ethereal extract was evaporated to give 3.4 g (79%) of target *N*,*N*-dimethyl-2-nitrobut-1-en-1-amine as dark orange oil that solidifies upon storage in a freezer. NMR matches previously reported data.[14]

Step 2: To a solution of KOH (108 mg, 1.93 mmol, 1.1 equiv.) in MeOH (1.41 mL) at 0°C was added *N*,*N*-dimethyl-2-nitrobut-1-en-1-amine from the previous stage (252 mg, 1.75 mmol, 1 equiv.). The reaction mixture was stirred for 3 hours at 0°C and then concentrated under reduced pressure. To the red-orange precipitate MeCN (0.5 mL) was added. The resulting suspension was concentrated under reduced pressure and the precipitate was dried in vacuo. Then MeCN (1.75 mL) was added. The resulting suspension was cooled to 0°C and benzoyl chloride (271 mg, 223 µL, 1.93 mmol, 1.1 equiv.) was added dropwise with stirring. The reaction mixture was kept at 0 °C upon vigorous stirring for 8 hours and then kept in the refrigerator overnight. The resulting mixture was poured into mixture of

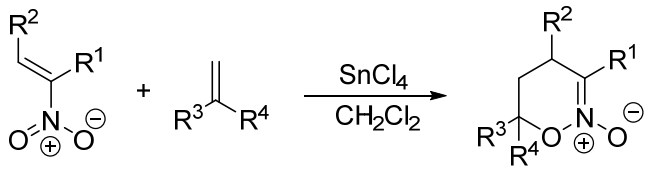
CH_2Cl_2 (10 ml) and sat. aq solution of $NaHCO_3$ (10 mL). The aqueous phase was extracted with CH_2Cl_2 (3 × 5 mL); the combined organic layers were washed with H_2O (10 mL), brine (10 mL), dried (Na_2SO_4) and concentrated under reduced pressure. The residue was subjected to silica gel column chromatography (eluent: PE/EtOAc, 100:0, then 40:1, then 30:1) to give 287 mg (74%) of title compound as white solid. R_f = 0.80 (PE/ EtOAc, 10:1, ninhydrin). mp = 79-81 °C (PE/EtOAc, 5 : 1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.26 (t, *J* = 7.4 Hz, 3H, $CH_2C\underline{H}_3$), 2.84 (q, *J* = 7.4 Hz, 2H, $C\underline{H}_2CH_3$), 7.57 (app t, *J* = 7.7 Hz, 2H, CH_{Bz}), 7.72 (tt, *J* = 7.4, 1.3 Hz, 1H, CH_{Bz}), 8.14 (app d, *J* = 7.1 Hz, 2H, CH_{Bz}).

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 12.1 ($CH_2\underline{C}H_3$), 19.1 ($\underline{C}H_2CH_3$), 127.2 (C_{Bz}), 129.0 (CH_{Bz}), 130.4 (CH_{Bz}), 135.0 (CH_{Bz}), 142.8 (=CH–O), 143.3 (C–NO_2), 161.8 (C=O).

Anal. Calcd for $C_{11}H_{11}NO_4$: C, 59.73; H, 5.01; N, 6.33. Found: C, 59.84; H, 5.00; N, 6.33.

General procedure for the preparation of 5,6-dihydro-4*H*-1,2-oxazine *N*-oxides 1c,d,g-l (GP-1)

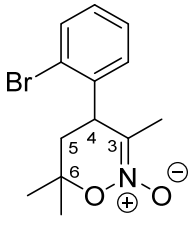


3 **1**

$SnCl_4$ (1.1-1.2 equiv) was added to the stirred solution of the corresponding nitroalkene in CH_2Cl_2 (5 mL / 1 mmol of nitroalkene) at -78 °C under argon atmosphere. Then the corresponding alkene (either neat or soln in CH_2Cl_2 (1.5-5 equiv.) was added. The reaction mixture was stirred for 15-60 min and then poured into a mixture of EtOAc (150 mL) and $NaHCO_3$ (sat. aq. soln, 100 mL). The organic layer was washed with saturated aqueous solution of $NaHCO_3$ (sat. aq. soln, 50 mL), H_2O (100 mL), brine (50 mL), dried over Na_2SO_4, and evaporated under vacuum. Title compounds were isolated either by crystallization or column chromatography.

4-(2-Bromophenyl)-3,6,6-trimethyl-5,6-dihydro-4H-1,2-oxazine 2-oxide (1c). Prepared according to GP-1 from (*E*)-1-bromo-2-(2-nitroprop-1-en-1-yl)benzene **3c** (500 mg, 2.1 mmol) and 2-methylpropene (1.9 mL of 5.5 M soln in CH_2Cl_2, 0.58 g, 10.5 mmol) using 1.1 equiv of $SnCl_4$. Reaction time – 15 min. Column chromatography (eluent: PE/EtOAc, 2:1, then 1:1, then EtOAc) afforded an oil, which was triturated with PE to give 345 mg (56%) of target compound as white solid. R_f = 0.26 (PE/EtOAc, 1:2, UV, anisaldehyde). mp = 99-101 °C.

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.42 (s, 3H, Me(6)), 1.49 (s, 3H, Me(6)), 1.84 (dd, overlapped, *J* = 13.7, 11.1 Hz, 1H, CH_{2a}(5)), 1.89 (d, *J* = 1.5 Hz, 3H, Me(3)), 2.22 (dd, *J* = 13.7, 7.9 Hz, 1H, CH_{2b}(5)), 4.26 (ddq, *J* = 11.1, 7.9, 1.3 Hz, 1H, CH(4)), 7.13-7.18 (m, 2H, CH_{Ar}), 7.33 (app td, *J* = 7.5, 1.3 Hz, 1H, CH_{Ar}), 7.56-7.59 (d, *J* = 7.3 Hz, 2H, CH_{Bz}).

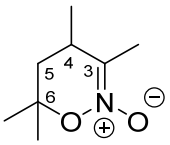


1c

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 17.3 (Me(3)), 22.0 (Me(6)), 27.8 (Me(6)), 39.4 (CH_2(5)), 42.6 (CH(4)), 81.4 (C(6)), 121.2 (C(3)=N), 123.7 (C_{Ar}–Br), 128.6 (CH_{Ar}), 129.2 (CH_{Ar}), 129.3 (CH_{Ar}), 133.4 (CH_{Ar}), 139.4 (C_{Ar}).

HRMS (ESI): *m/z* calcd. for [$C_{13}H_{16}BrNO_2$+H^+]: 298.0437, found: 298.0445.

3,4,6,6-Tetramethyl-5,6-dihydro-4H-1,2-oxazine 2-oxide (1d). Prepared according to GP-1 from (*E*)-2-nitrobut-2-ene **3d** (500 mg, 5 mmol) and 2-methylpropene (1.4 g, 25 mmol) using 1.2 equiv of $SnCl_4$. Reaction time – 60 min. Column chromatography (eluent: PE/EtOAc, 2:1, then 1:1) afforded 405 mg (52%) of target compound as white solid. R_f = 0.18 (PE/EtOAc, 1:1, UV, anisaldehyde). mp = 61-63 °C. NMR matches previously reported data.[4]

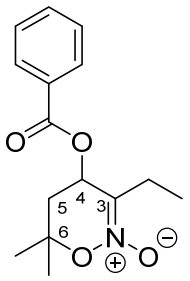


1d

4-(Benzoyloxy)-3-ethyl-6,6-dimethyl-5,6-dihydro-4H-1,2-oxazine 2-oxide (1g). Prepared according to GP-1 from (*E*)-2-nitrobut-1-en-1-yl benzoate **3g** (622 mg, 3 mmol) and 2-methylpropene (0.84 g, 15 mmol) using 1.1 equiv of $SnCl_4$. Reaction time – 30 min. Column chromatography (eluent: PE/EtOAc, 5:1, then 3:1, then 2:1) afforded 462 mg (56%) of target compound as white solid. R_f = 0.33 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 86-88 °C (PE/EtOAc, 10:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.18 (t, *J* = 7.5 Hz, 3H, $CH_2C\underline{H}_3$), 1.44 (s, 3H, Me(6)), 1.54 (s, 3H, Me(6)), 2.08 (dd, *J* = 14.7, 4.0 Hz, 1H, CH_{2a}(5)), 2.34 (dd, *J* = 14.7, 6.7 Hz, 1H, CH_{2b}(5)), 2.50 (q, *J* = 7.5 Hz, 2H, $C\underline{H}_2CH_3$), 5.87 (dd, *J* = 6.7, 4.0 Hz, 1H, CH(4)), 7.48 (app t, *J* = 7.6 Hz, 2H, CH_{Bz}), 7.61 (t, *J* = 7.5 Hz, 1H, CH_{Bz}), 8.02 (d, *J* = 7.3 Hz, 2H, CH_{Bz}).

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 8.9 ($CH_2\underline{C}H_3$), 23.2 ($\underline{C}H_2CH_3$), 24.6 (Me(6)), 26.1 (Me(6)), 37.5 (CH_2(5)), 65.6 (CH(4)), 80.7 (C(6)), 121.8 (C(3)=N), 128.7 (CH_{Bz}), 129.1 (C_{Bz}), 129.7 (CH_{Bz}), 133.7 (CH_{Bz}), 165.5 (C=O).



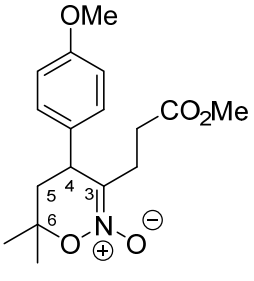
1g

HRMS (ESI): *m/z* calcd. for [$C_{15}H_{19}NO_4$+H^+]: 278.1387, found: 278.1389.

3-(3-Methoxy-3-oxopropyl)-4-(4-methoxyphenyl)-6,6-dimethyl-5,6-dihydro-4*H*-1,2-oxazine 2-oxide (1h). Prepared according to GP-1 from methyl (*E*)-5-(4-methoxyphenyl)-4-nitropent-4-enoate **3h** (1.33 g, 5 mmol) and 2-methylpropene (1.4 g, 25 mmol) using 1.1 equiv of $SnCl_4$. Reaction time – 30 min. Column chromatography (eluent: PE/EtOAc, 3:1, then 1:1) afforded 1.46 g (91%) of title compound as a pale yellow oil. R_f = 0.28 (PE/EtOAc, 1:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.39 (s, 3H, Me(6)), 1.42 (s, 3H, Me(6)), 1.94 (dd, *J* = 14.0, 11.2 Hz, 1H, CH_{2a}(5)), 2.10 (dd, *J* = 14.0, 7.8 Hz, 1H, CH_{2b}(5)), 2.21-2.38 (m, 2H), 2.48-2.58 (m, 1H), and 2.94-3.06 (m, 1H) (2 × CH_2), 3.63 (s, 3H, CO_2Me), 3.79 (s, 3H, OMe), 3.91 (dd, *J* = 11.2, 7.8 Hz, 1H, CH(4)), 6.87 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.13 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 21.8 (Me(6)), 26.1 (CH_2), 27.7 (CH_2), 27.8 (Me(6)), 41.6 (CH_2), 41.9 (CH(4)), 51.7 (CO_2Me), 55.3 (OMe), 81.5 (C(6)), 114.6 (CH_{Ar}), 124.4 (C(3)=N), 129.2 (CH_{Ar}), 131.9 (C_{Ar}), 159.1 ($\underline{C}_{Ar}$–OMe), 173.5 (C=O).

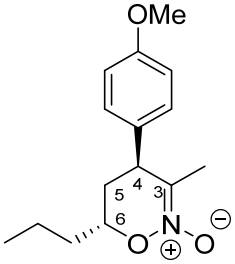


1h

HRMS (ESI): *m/z* calcd. for [$C_{17}H_{23}NO_5$+H^+]: 322.1649, found: 322.1653.

(4*S,6*R**)-4-(4-Methoxyphenyl)-3-methyl-6-propyl-5,6-dihydro-4H-1,2-oxazine 2-oxide (1i).** Prepared according to GP-1 from (*E*)-1-methoxy-4-(2-nitroprop-1-en-1-yl)benzene **3a** (580 mg, 3 mmol) and 1-pentene (0.42 mL, 0.27 g, 4.5 mmol) using 1.2 equiv of $SnCl_4$. Reaction time – 30 min. Column chromatography (eluent: PE/EtOAc, 3:1, then 2:1, then 1:1) afforded 626 mg (74%) of title compound as white solid. R_f = 0.55 (PE/EtOAc, 1:1, UV, anisaldehyde). mp = 75-76 °C (PE/EtOAc, 5:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 0.87 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.31-1.54 (m, 3H) and 1.61-1.75 (m, 1H) ($C\underline{H}_2C\underline{H}_2CH_3$), 1.84 (app dt, *J* = 13.7, 2.2 Hz, 1H, CH_{2a}(5)), 1.96 (s, 3H, Me(3)), 2.10 (ddd, *J* = 13.7, 10.7, 7.0 Hz, 1H, CH_{2b}(5)), 3.74 (app d, *J* = 6.6 Hz, 1H, CH(4)), 3.81 (s, 3H, OMe), 4.35-4.44 (m, 1H, CH(6)–O), 6.89 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.09 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).

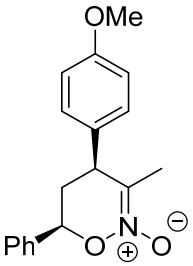


1i

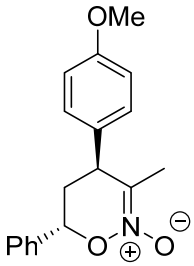
^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 13.9 ($CH_2\underline{C}H_3$), 18.1 (CH_2), 18.6 (Me(3)), 33.9 (CH_2), 35.3 (CH_2), 42.1 (CH(4)), 55.3 (OMe), 77.2 (CH(6)), 114.5 (CH_{Ar}), 121.2 (C(3)=N), 128.9 (CH_{Ar}), 133.7 (C_{Ar}), 158.9 (C_{Ar}–O).

HRMS (ESI): *m/z* calcd. for [$C_{15}H_{21}NO_3$+H^+]: 264.1594, found: 264.1596.

4-(4-Methoxyphenyl)-3-methyl-6-phenyl-5,6-dihydro-4H-1,2-oxazine 2-oxides (4*S,6*R**)-1j (4,6-*cis*-isomer) and (4*S**,6*S**)-1k (*trans*-isomer).** Prepared according to GP-1 from (*E*)-1-methoxy-4-(2-nitroprop-1-en-1-yl)benzene **3a** (1.8 g, 9.3 mmol) and styrene (2.1 mL, 1.9 g, 19 mmol) using 1.2 equiv of $SnCl_4$ with an exception that styrene was added at -94°C and then the temperature was raised to -78°C and the mixture was stirred for 30 min. Column chromatography (eluent: PE/EtOAc, 2:1, then 1:1, then 1:2) afforded 1.20 g (43%) of *trans*-isomer **1k** as pale yellow solid, 507 g (18%) of **1j**/**1k** mixture (ratio 1:1) as pale yellow solid, and 356 mg (13 %) of *cis*-isomer **1j** as white solid. NMR matches previously reported data.[15]



1j



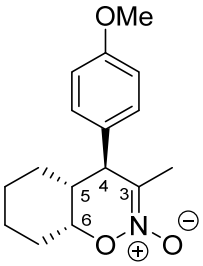
1k

(4*S,6*R**)-1j** R_f = 0.38 (PE/EtOAc, 1:1, UV, anisaldehyde).

(4*S,6*S**)-1k** R_f = 0.48 (PE/EtOAc, 1:1, UV, anisaldehyde).

(4*S,4a*R**,8a*R**)-4-(4-Methoxyphenyl)-3-methyl-4a,5,6,7,8,8a-hexahydro-4H-benzo[e][1,2]oxazine 2-oxide (1l).** Prepared according to GP-1 from (*E*)-1-methoxy-4-(2-nitroprop-1-en-1-yl)benzene **3a** (4.0 g, 21 mmol) and cyclohexene (10.5 mL, 8.5 g, 0.1 mol) using 1.2 equiv. of $SnCl_4$. Reaction time – 30 min. Crystallization from PE/MTBE, 1:2, afforded 3.0 g (53%) of title compound as pale yellow solid. R_f = 0.26 (PE/EtOAc, 1:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.26-1.49 (m, 3H) and 1.61-1.82 (m, 5H) (4×CH_2), 1.97 (s, 3H, Me), 2.02-2.08 (m, 1H, CH), 3.34 (br s, 1H, CH–Ar), 3.80 (s, 3H, OMe), 4.59 (br s, 1H, CH–O), 6.89 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.07 (d, *J* = 8.6 Hz, 2H, CH_{Ar}).

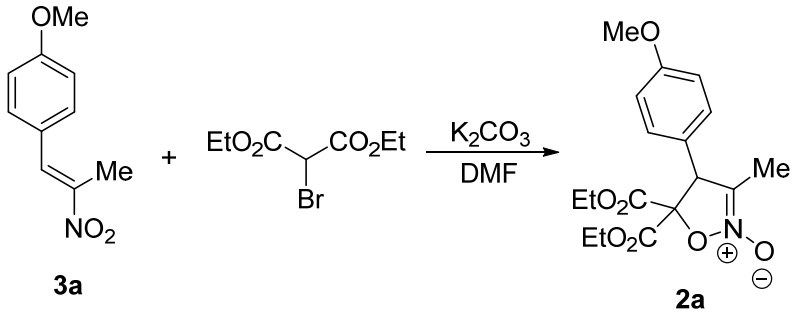


1l

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 18.8 (Me), 19.9 (CH_2), 24.6 (CH_2), 27.5 (CH_2), 28.7 (CH_2), 40.0 (CH), 49.4 (C<u>H</u>–Ar), 55.3 (OMe), 75.4 (CH–O), 114.4 (CH_{Ar}), 120.1 (C(3)=N), 128.8 (CH_{Ar}), 133.5 (C_{Ar}), 158.9 (C_{Ar}–O).

NMR matches previously reported data.[16]

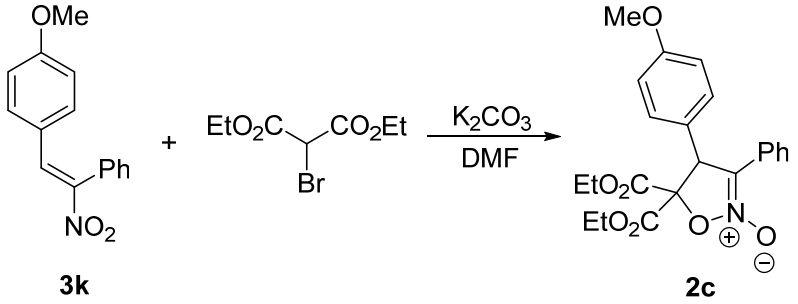
5,5-Bis(ethoxycarbonyl)-4-(4-methoxyphenyl)-3-methyl-4,5-dihydroisoxazole 2-oxide (2a)



3a **2a**

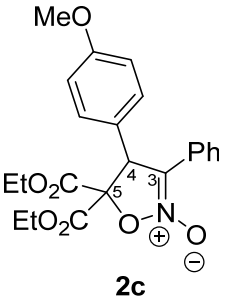
To a solution of (*E*)-1-methoxy-4-(2-nitroprop-1-en-1-yl)benzene **3a** (965 mg, 5 mmol) in DMF (10 mL) diethyl bromomalonate (0.94 mL, 1.32 g, 5.5 mmol, 1.1 equiv.) and potassium carbonate (1.03 g, 7.5 mmol, 1.5 equiv.) were added. The mixture was stirred for 6 h at r.t. and then kept in the fridge overnight. Then the reaction was transferred into a separating funnel containing EtOAc (100 mL) and water (100 mL). The organic phase was separated, and the aqueous phase was extracted with EtOAc (3 × 50 mL). The combined organic layer was washed with brine (50 mL), dried over Na_2SO_4, and concentrated under reduced pressure. The residue was subjected to column chromatography on silica gel (eluent: PE/EtOAc, 3:1, then 2:1, then 1:1) to give target isoxazoline *N*-oxide **2a** (1.21 g, 69%) as white solid. R_f = 0.25 (PE/EtOAc, 1:1, UV, anisaldehyde). NMR matches previously reported data.[8]

5,5-Bis(ethoxycarbonyl)-4-(4-methoxyphenyl)-3-phenyl-4,5-dihydroisoxazole 2-oxide (2c)



3k **2c**

To a stirring solution of nitroalkene **3k** (255 mg, 1 mmol) in DMF (2 mL) diethyl bromomalonate (188 µL, 264 mg, 1.1 mmol) and K_2CO_3 (201 mg, 1.46 mmol) were consecutively added. The mixture was stirred for 3 h at r.t., and then concentrated on a rotary evaporator. The residue was subjected to column chromatography on silica gel (eluent: PE/EtOAc, 10:1, then 5:1, then 3:1) to give target isoxazoline *N*-oxide **2c** (413 mg, 99%) as colorless oil. Solid sample was obtained by crystallization from Et_2O/PE, 6:1. R_f = 0.33 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 90-93 °C (Et_2O/PE, 6:1).



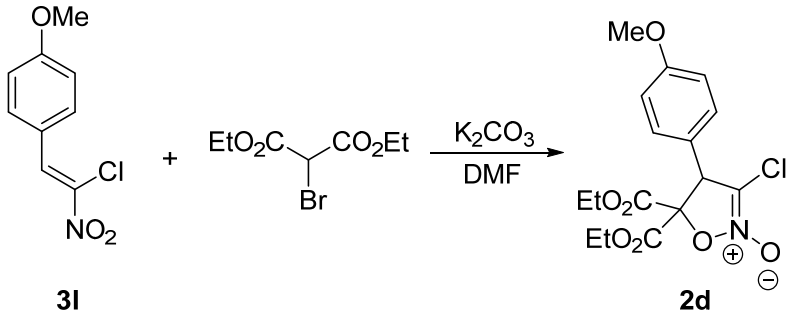
2c

^{1}H NMR (300 MHz, $CDCl_3$): δ 0.97 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.34 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 3.76 (s, 3H, OMe), 3.76-3.92 (m, 2H, $OC\underline{H}_2CH_3$), 4.26-4.46 (m, 2H, $OC\underline{H}_2CH_3$), 5.72 (s, 1H, CH(4)), 6.84 (d, *J* = 8.7 Hz, 1H, CH_{Ar}), 7.26 (d, *J* = 8.7 Hz, 1H, CH_{Ar}), 7.30-7.38 (m, 3H, Ph), 7.82-7.86 (m, 2H, Ph).

^{13}C NMR (75 MHz, $CDCl_3$): δ 13.6 ($CH_2\underline{C}H_3$), 13.9 ($CH_2\underline{C}H_3$), 54.9 (CH(4)), 55.3 (OMe), 62.5 ($OC\underline{H}_2CH_3$), 63.5 ($OC\underline{H}_2CH_3$), 85.0 (C(5)), 114.2 (CH_{Ar}), 115.5 (C(3)=N), 125.2 and 125.7 (C_{Ar} and C_{Ph}), 127.0, 128.7, 129.7, and 130.3 (3×CH_{Ph} and CH_{Ar}), 160.0 (C_{Ar}–O), 163.6 (C=O), 166.6 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{22}H_{23}NO_7$+H^+]: 414.1547, found: 414.1559.

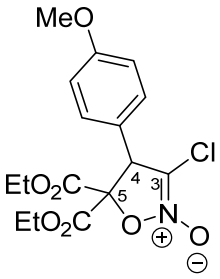
3-Chloro-5,5-bis(ethoxycarbonyl)-4-(4-methoxyphenyl)-4,5-dihydroisoxazole 2-oxide (2d)



3l **2d**

To a solution of (*Z*)-1-(2-chloro-2-nitrovinyl)-4-methoxybenzene **3l** (230 mg, 1.1 mmol) in DMF (5 mL) diethyl bromomalonate (0.20 mL, 0.28 g, 1.2 mmol, 1.1 equiv.) and potassium carbonate (0.22 g, 1.6 mmol, 1.5 equiv.) were added. The mixture was stirred for 2.5 h, transferred into a separating funnel containing MTBE (50 mL) and water (30 mL). The organic phase was separated, and the aqueous phase was extracted with MTBE (20 mL). The combined organic layer was washed with brine (30 mL), dried over Na_2SO_4, and concentrated under reduced pressure. The residue was recrystallized from PE/EtOAc, 3:1 to give target isoxazoline *N*-oxide (252 mg) as white solid. The mother liquor was evaporated and crystallized to give additional target isoxazoline *N*-oxide **2d** (89 mg). Total yield: 341 mg (85%). R_f = 0.53 (PE/EtOAc, 1:1, UV, anisaldehyde). mp = 109-111 °C (PE/EtOAc, 10:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 0.93 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.34 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 3.69-3.92 (m, 2H, $OC\underline{H}_2CH_3$), 3.82 (s, overlapped, 3H, OMe), 4.28-4.46 (m, 2H, $OC\underline{H}_2CH_3$), 5.39 (s, 1H, CH(4)), 6.91 (d, *J* = 8.5 Hz, 1H, CH_{Ar}), 7.20 (d, *J* = 8.5 Hz, 1H, CH_{Ar}).

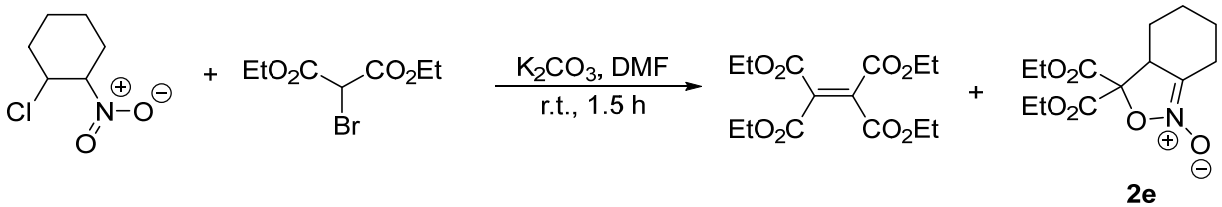


2d

^{13}C NMR (75 MHz, DEPT, HMBC, $CDCl_3$): δ 13.5 ($CH_2\underline{C}H_3$), 13.9 ($CH_2\underline{C}H_3$), 54.6 (CH(4)), 55.4 (OMe), 62.8 ($OC\underline{H}_2CH_3$), 63.8 ($OC\underline{H}_2CH_3$), 84.7 (C(5)), 109.5 (C(3)=N), 114.4 (CH_{Ar}), 123.2 (C_{Ar}), 130.5 (CH_{Ar}), 160.5 (C_{Ar}–O), 163.1 (C=O), 165.5 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{16}H_{18}ClNO_7$+NH_4^+]: 389.1110, found: 389.1114.

3,3-Bis(ethoxycarbonyl)-3,3a,4,5,6,7-hexahydrobenzo[c]isoxazole 1-oxide (2e)

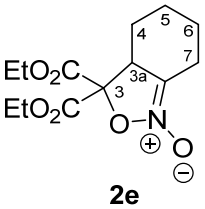


2e

To the solution of 1-chloro-2-nitrocyclohexane[17] (0.350 mg, 2.1 mmol) and diethyl bromomalonate (0.39 mL, 0.55 g, 2.3 mmol, 1.1 equiv.) in DMF (6.3 mL) K_2CO_3 (0.725 g, 5.3 mmol, 2.5 equiv.) was added. The mixture was stirred for 1.5 h, and transferred into EtOAc/H_2O (60/20 mL). Organic layer was washed with H_2O (20 mL), brine (20 mL), dried over Na_2SO_4, and evaporated. The residue was subjected to column chromatography on silica gel (eluent: PE/EtOAc, 5:1, then 4:1, then 1:1) to give tetraethyl

ethylenetetracarboxylate (0.183 g) and target isoxazoline *N*-oxide **2e** (0.200 g, 33%) as colorless oil. R_f = 0.17 (PE/EtOAc, 3:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.14-1.46 (m, overlapped, 3H, CH_2), 1.30 (t, overlapped, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.32 (t, overlapped, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.93-1.97 (m, 2H, CH_2), 2.03-2.09 (m, 1H, CH_2), 2.15-2.25 (m, 1H, CH_2), 2.75-2.80 (m, 1H, CH_2), 4.02 (ddd, *J* = 12.2, 5.7, 2.8 Hz, 1H, CH(3a)), 4.21-4.41 (m, 4H, OCH_2).

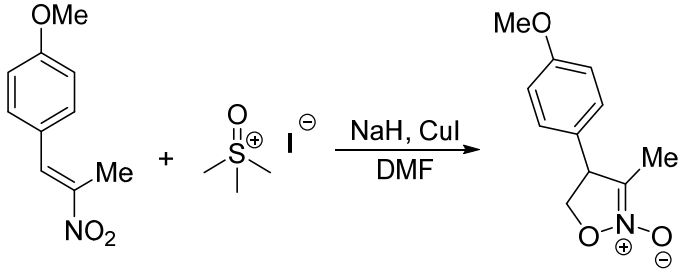


2e

^{13}C NMR (75 MHz, DEPT, HSQC, $CDCl_3$): δ 13.9 ($CH_2\underline{C}H_3$), 14.2 ($CH_2\underline{C}H_3$), 23.8 , 23.9 and 24.3 (CH_2(5), CH_2(6) and CH_2(7)), 28.1 (CH_2(4)), 48.2 (CH(3a)), 62.6 (OCH_2), 63.2 (OCH_2), 83.2 (C(3)), 114.0 (C=N), 165.4 (C=O), 165.9 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{13}H_{19}NO_6$+NH_4^+]: 303.1551, found: 303.1548.

4-(4-Methoxyphenyl)-3-methyl-4,5-dihydroisoxazole 2-oxide (2f).



3a **2f**

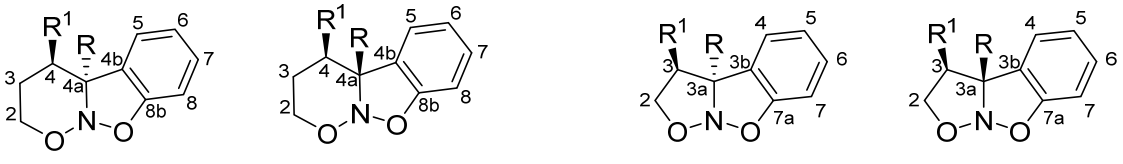
Prepared similar to a literature procedure.[18] To a suspension of trimethylsulfoxonium iodide (3.30 g, 15 mmol, 1.2 equiv.) in DMF (65 mL) sodium hydride (575 mg, 14.4 mmol, ~60% in mineral oil, 1.15 equiv.) was added. After vigorous stirring for 1 hour copper(I) iodide (952 mg, 5 mmol, 0.4 equiv.) was added. Upon stirring for 30 min color changed from gray to dark-orange. Then the solution was cooled 0°C with an ice bath and solution of (*E*)-1-methoxy-4-(2-nitroprop-1-en-1-yl)benzene **3a** (2.42 g, 12.5 mmol, 1 equiv.) in DMF (15 mL) was added dropwise over the course of 20 min. After addition was complete, the ice bath was removed. After stirring for 2 hours at room temperature the reaction mixture was poured into 100 mL of ice cold water and then 150 mL of CH_2Cl_2 was added. The resulting mixture was filtered through Celite, water layer was washed with CH_2Cl_2 (3×50 mL). The aqueous layer was extracted with CH_2Cl_2 (3×50 mL); the combined organic layers were washed with H_2O (100 mL), brine (100 mL), dried (Na_2SO_4), and concentrated under reduced pressure. Most of DMF was then removed in vacuum at 35°C on water bath. The residue was subjected to silica gel column chromatography (eluent: PE/EtOAc, 3:1, then 1:1) to give 1.96 g (76%) of target nitronate as white solid. R_f = 0.31 (PE/EtOAc, 1:1, UV, anisaldehyde). mp = 92-93 °C. NMR matches previously reported data.[19]

Synthesis and characterization data of nitroso acetals 5 and 6

General procedure for the synthesis of nitroso acetals 5 and 6 (GP-2):

Commercial CsF (152 mg, 1.0 mmol, 2.0 equiv) was placed in a Schlenk tube and dried at ~250 °C (heat gun) in a vacuum (~1-2 mmHg) for ~1 min. After the mixture had cooled, nitronate **1** or **2** (0.5 mmol, 1.0 equiv) and anhydrous acetonitrile (4.0 mL) were added under an argon atmosphere. After dissolution of the nitronate, aryne precursor **9** (0.5 mmol, 1.0 equiv) was added and the reaction mixture was stirred until full consumption of the nitronate (TLC control, 18−24 h). Then, EtOAc (~2 mL) and water (~4 mL) were added with vigorous stirring. After ~1 min, the mixture was transferred into a separating funnel containing EtOAc (15 mL) and water (15 mL). The organic phase was separated, and the aqueous phase was extracted with EtOAc (3 × 15 mL). The combined organic extracts were washed with brine (30 mL), dried with anhydrous Na_2SO_4, and concentrated under reduced pressure. The resulting crude product was subjected to column chromatography on silica gel (PE/EtOAc gradient).

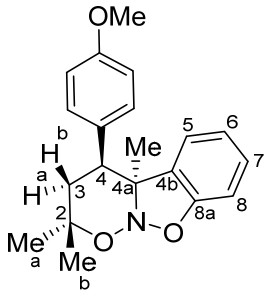
Isomers of products 5/6 and numeration of atoms



trans-**5** *cis*-**5** *trans*-**6** *cis*-**6**

(4*S,4a*S**)-4-(4-Methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5aa).** Nitroso acetal **5aa** was obtained from nitronate **1a** (100 mg, 0.40 mmol) and aryltriflate **9a** (98 µL, 120 mg, 0.40 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 30:1, then 20:1) afforded 113 mg (87%) of the target nitroso acetal as pale yellow solid. Single diastereomer (*trans*-**5aa**). R_f = 0.62 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 93-95 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.43 (s, 3H, Me_a(2)), 1.53 (s, 3H, Me_b(2)), 1.60 (s, 3H, Me(4a)), 1.69 (dd, *J* = 13.5, 2.1 Hz, 1H, CH_{2a}(3)), 2.11 (app t, *J* = 13.5 Hz, 1H, CH_{2b}(3)), 3.19 (dd, *J* = 13.5, 2.1 Hz, 1H, CH(4)), 3.86 (s, 3H, OMe), 6.15 (d, *J* = 7.5 Hz, 1H, CH_{Ar}(5)), 6.70 (app t, *J* = 7.5 Hz, 1H, CH_{Ar}(6)), 6.81 (d, *J* = 8.0 Hz, 1H, CH_{Ar}(8)), 6.88 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.03 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.17 (app t, *J* = 7.7 Hz, 1H, CH_{Ar}(7)).



trans-**5aa**

Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH(4) / Me(4a); CH_{2b}(3) / CH_{Ar}; CH_{Ar}(5) / CH_{Ar}; CH(4) / CH_{2a}(3); CH_{2b}(3) / Me_b(2); CH(4) / Me_a(2).

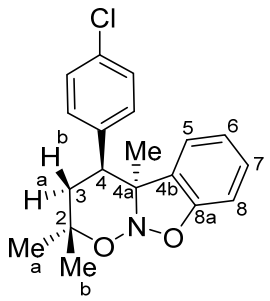
^{13}C NMR (75 MHz, DEPT, HMBC, $CDCl_3$): δ 26.2 (Me_a(2)), 27.1 (Me(4a)), 31.2 (Me_b(2)), 36.1 (CH_2(3)), 42.4 (CH(4)), 55.3 (OMe), 74.3 (C(4a)), 79.9 (C(2)), 107.5 (CH_{Ar}(8)), 113.2 (CH_{Ar}), 120.2 (CH_{Ar}(6)), 125.7 (CH_{Ar}(5)), 127.8 (C_{Ar}(4b)), 128.7 (CH_{Ar}(7)), 130.6 (C_{Ar}), 130.8 (CH_{Ar}), 155.7 (C_{Ar}(8a)–O), 158.9 ($\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{20}H_{23}NO_3$+H^+]: 326.1751, found: 326.1756.

Anal. Calcd for $C_{20}H_{23}NO_3$: C, 73.82; H, 7.12; N, 4.30. Found: C, 73.84; H, 7.25; N, 4.17.

(4*S,4a*S**)-4-(4-Chlorophenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5ba).** Nitroso acetal **5ba** was obtained from nitronate **1b** (127 mg, 0.50 mmol) and aryltriflate **9a** (121 µL, 149 mg, 0.50 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 20:1) afforded 100 mg (61%) of the target nitroso acetal as pale yellow solid. Single diastereomer (*trans*-**5ba**). R_f = 0.77 (PE/EtOAc, 1:1, UV, anisaldehyde). mp = 100-103 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.43 (s, 3H, Me_a(2)), 1.55 (s, 3H, Me_b(2)), 1.60 (s, 3H, Me(4a)), 1.68 (dd, *J* = 13.5, 2.5 Hz, 1H, CH_{2a}(3)), 2.12 (app t, *J* = 13.5 Hz, 1H, CH_{2b}(3)), 3.18 (dd, *J* = 13.5, 2.5 Hz, 1H, CH(4)), 6.09 (d, *J* = 7.5 Hz, 1H, CH_{Ar}(5)), 6.70 (app t, *J* = 7.5 Hz, 1H, CH_{Ar}(6)), 6.80 (d, *J* = 8.0 Hz, 1H, CH_{Ar}(8)), 7.02 (d, *J* = 8.4 Hz, 2H, CH_{Ar}), 7.18 (app t, *J* = 7.7 Hz, 1H, CH_{Ar}(7)), 7.31 (d, *J* = 8.4 Hz, 2H, CH_{Ar}).



trans-**5ba**

Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH(4) / Me(4a); CH_{2b}(3) / CH_{Ar}; CH_{Ar}(5) / CH_{Ar}; CH(4) / CH_{2a}(3); CH_{2b}(3) / Me_b(2); CH(4) / Me_a(2).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 26.4 (Me_a(2)), 26.9 (Me(4a)), 31.3 (Me_b(2)), 35.8 (CH_2(3)), 42.8 (CH(4)), 73.8 (C(4a)), 80.1 (C(2)), 107.6 (CH_{Ar}(8)), 120.3 (CH_{Ar}(6)), 125.5 (CH_{Ar}(5)), 127.2 (C_{Ar}(4b)), 128.0 (CH_{Ar}), 129.0 (CH_{Ar}(7)), 131.1 (CH_{Ar}), 133.3 (C_{Ar}–Cl), 137.2 (C_{Ar}), 155.4 (C_{Ar}(8a)–O).

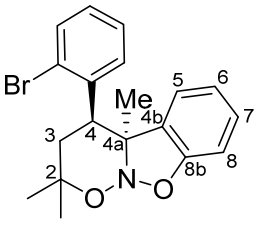
HRMS (ESI): *m/z* calcd. for [$C_{19}H_{20}ClNO_2$+H^+]: 330.1255, found: 330.1256.

Anal. Calcd for $C_{19}H_{20}ClNO_2$: C, 69.19; H, 6.11; N, 4.25. Found: C, 68.93; H, 5.90; N, 4.25.

Crystals for X-ray diffraction analysis were obtained by crystallization from hexane – methyl *tert*-butyl ether 1:1 mixture at ca. 0°C. The crystallographic information for compound **5ba** was deposited in the Cambridge Crystallographic Data Centre (CCDC 2237935).

(4*S,4a*S**)-4-(2-Bromophenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5ca).** Nitroso acetal **5ca** was obtained from nitronate **1c** (100 mg, 0.34 mmol) and aryltriflate **9a** (81 µL, 100 mg, 0.34 mmol) according to GP-2 with the following change: work up was performed with MTBE/water. Column chromatography with precooled (-30 °C) eluent (eluent: PE/EtOAc/NEt_3, 10:1:0.1) afforded 102 mg (81%) of the target nitroso acetal as white solid. Single diastereomer (*trans*-**5ca**). R_f = 0.79 (PE/EtOAc, 20:1, UV, anisaldehyde). mp = 139-140 °C (dec.) (hexane/MTBE, 1:1). Stereochemistry was assigned by analogy with other products.

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.47 (s, 3H, Me_a(2)), 1.59 (s, 3H, Me_b(2)), 1.67 (Me(4a)), 1.59-1.67 (m, overlapped, 1H, CH_{2a}(3)), 2.19 (app t, *J* = 13.4 Hz, 1H, CH_{2b}(3)), 3.90 (dd, *J* = 13.3, 2.5 Hz, 1H, CH(4)), 6.22 (app d, *J* = 8.1 Hz, 1H, CH_{Ar}(5)), 6.57-6.60 (m, 1H, CH_{Ar}), 6.72 (app t, *J* = 7.8 Hz, 1H, CH_{Ar}(6)), 6.81 (app d, *J* = 8.0 Hz, 1H, CH_{Ar}(8)), 7.11-7.16 (m, 2H, CH_{Ar}), 7.21 (app td, *J* = 7.8, 1.4 Hz, 1H, CH_{Ar}(7)), 7.63-7.69 (m, 1H, CH_{Ar}).



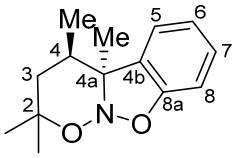
trans-**5ca**

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 26.9 (Me_a(2)), 27.3 (Me(4a)), 31.3 (Me_b(2)), 36.9 (CH_2(3)), 40.9 (CH(4)), 74.6 (C(4a)), 81.2 (C(2)), 107.5 (CH_{Ar}(8)), 119.8 (CH_{Ar}(6)), 126.1 (C_{Ar}–Br), 126.4 and 126.5 (CH_{Ar}(5) and CH_{Ar}), 127.4 (C_{Ar}(4b)), 128.7 (CH_{Ar}), 129.1 (CH_{Ar}(7)), 131.9 (CH_{Ar}), 133.0 (CH_{Ar}), 138.3 (C_{Ar}), 154.9 (C_{Ar}(8a)–O).

HRMS (ESI): *m/z* calcd. for [$C_{19}H_{20}BrNO_2$+H^+]: 374.0750, found: 374.0758.

(4*R,4a*S**)-2,2,4,4a-Tetramethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5da).** Nitroso acetal **5da** was obtained from nitronate **1d** (100 mg, 0.64 mmol) and aryltriflate **9a** (154 µL, 189 mg, 0.64 mmol) according to GP-2 with the following change: work up was performed with MTBE/water. Column chromatography with precooled (-30 °C) eluent (eluent: PE/EtOAc/NEt_3, 10:1:0.1) afforded 120 mg (81%) of the target nitroso acetal as pale white solid. Single diastereomer (*trans*-**5da**). R_f = 0.35 (PE/EtOAc, 10:1, UV, anisaldehyde). mp = 67-69 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.27-1.29 (m, 6H, Me(4) and Me(2)), 1.39 (s, overlapped, 3H, Me(2)), 1.36-1.49 (m, 2H, CH_2(3)), 1.51 (s, 3H, Me(4a)), 2.19-2.32 (m, 1H, CH(4)), 6.90 (d, *J* = 8.1 Hz, 1H, CH_{Ar}(8)), 6.96 (app t, *J* = 7.4 Hz, 1H, CH_{Ar}(6)), 7.21-7.25 (m, 2H, CH_{Ar}(5) and CH_{Ar}(7)).



trans-**5da**

Characteristic NOESY-interactions: [CH_{Ar}(5) and CH_{Ar}(7)] / [Me(4) and Me(2)]; CH(4) / Me(4a).

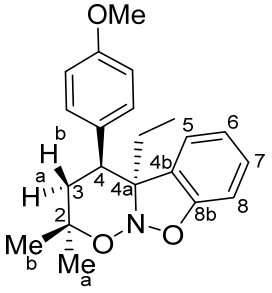
^{13}C NMR (75 MHz, DEPT, HMBC, $CDCl_3$): δ 16.6 (Me(4) or Me(2)), 24.9 (Me(2)), 26.1 (Me(4a)), 30.3 (Me(2) or Me(4)), 32.8 (CH(4)), 39.5 (CH_2(3)), 75.0 (C(4a)), 77.6 (C(2)), 108.8 (CH_{Ar}(8)), 121.4 (CH_{Ar}(6)), 124.3 (CH_{Ar}(5)), 128.5 (CH_{Ar}(7)), 129.5 (C_{Ar}(4b)), 157.3 (C_{Ar}(8a)–O).

HRMS (ESI): *m/z* calcd. for [$C_{14}H_{19}NO_2$+H^+]: 234.1489, found: 234.1498.

Crystals for X-ray diffraction analysis were obtained by evaporation of the compound solution in PE-EtOAc mixture (5:1). The crystallographic information for compound **5da** was deposited in the Cambridge Crystallographic Data Centre (CCDC 2240874).

(4*S,4a*S**)-4a-Ethyl-4-(4-methoxyphenyl)-2,2-dimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5ea).** Nitroso acetal **5ea** was obtained from nitronate **1e** (100 mg, 0.38 mmol) and aryltriflate **9a** (92 µL, 113 mg, 0.38 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 20:1) afforded 109 mg (85%) of the target nitroso acetal as colorless oil. Single diastereomer (*trans*-**5ea**). R_f = 0.56 (PE/EtOAc, 20:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.92 (t, *J* = 7.3 Hz, 3H, $CH_2C\underline{H}_3$), 1.38 (s, 3H, Me_a(2)), 1.61 (s, 3H, Me_b(2)), 1.70 (dd, *J* = 13.5, 2.4 Hz, 1H, CH_{2a}(3)), 1.91-2.05 (m, 2H, $C\underline{H}_2CH_3$), 2.12 (app t, *J* = 13.6 Hz, 1H, CH_{2b}(3)), 3.14 (dd, *J* = 13.6, 2.4 Hz, 1H, CH(4)), 3.85 (s, 3H, OMe), 5.90 (dd, *J* = 7.5, 1.0 Hz, 1H, CH_{Ar}(5)), 6.64 (app td, *J* = 7.5, 1.0 Hz, 1H, CH_{Ar}(6)), 6.75 (app d, *J* = 8.0 Hz, 1H, CH_{Ar}(8)), 6.84 (d, *J* = 8.9 Hz, 2H, CH_{Ar}), 6.90 (d, *J* = 8.9 Hz, 2H, CH_{Ar}), 7.17 (app td, *J* = 7.8, 1.3 Hz, 1H, CH_{Ar}(7)).



trans-**5ea**

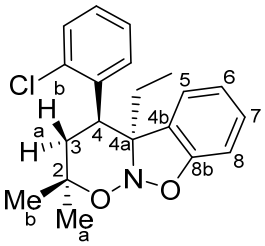
Characteristic NOESY-interactions: CH(4) / $C\underline{H}_2CH_3$; CH(4) / $CH_2C\underline{H}_3$; CH(4) / Me_a(2); CH_{2a}(3) / Me_a(2); CH(4) / CH_{2a}(3), CH_{Ar} / CH_{Ar}(5); CH_{Ar} / $C\underline{H}_2CH_3$.

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 7.9 ($CH_2\underline{C}H_3$), 27.4 (Me_a(2)), 31.1 ($\underline{C}H_2CH_3$), 31.7 (Me_b(2)), 35.7 (CH_2(3)), 39.8 (CH(4)), 55.3 (OMe), 76.9 (C(4a)), 81.1 (C(2)), 106.8 (CH_{Ar}(8)), 113.0 (CH_{Ar}), 119.4 (CH_{Ar}(6)), 125.7 (C_{Ar}(4b)), 126.3 (CH_{Ar}(5)), 128.8 (CH_{Ar}(7)), 130.9 (CH_{Ar} and C_{Ar}), 155.1 (C_{Ar}(8a)–O), 158.8 ($\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{21}H_{25}NO_3$+H^+]: 340.1907, found: 340.1895.

(4*S,4a*S**)-4-(2-Chlorophenyl)-4a-ethyl-2,2-dimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5fa).** Nitroso acetal **5fa** was obtained from nitronate **1f** (100 mg, 0.37 mmol) and aryltriflate **9a** (91 µL, 111 mg, 0.37 mmol) according to GP-2. Column chromatography (eluent: PE, then PE/EtOAc, 10:1) afforded 98 mg (76%) of the target nitroso acetal as white solid. Single diastereomer (*trans*-**5fa**). R_f = 0.75 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 140-142 °C (dec.) (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 0.86 (t, *J* = 7.3 Hz, 3H, $CH_2C\underline{H}_3$), 1.43 (s, 3H, Me_a(2)), 1.62 (s, 3H, Me_b(2)), 1.60-1.65 (m, 1H, CH_{2a}(3)), 1.94 (dq, *J* = 14.5, 7.3 Hz, 1H, $C\underline{H}_{2a}CH_3$), 2.09 (dq, *J* = 14.5, 7.3 Hz, 1H, $C\underline{H}_{2b}CH_3$), 2.22 (app t, *J* = 13.4 Hz, 1H, CH_{2b}(3)), 3.86 (dd, *J* = 13.3, 2.1 Hz, 1H, CH(4)), 6.05 (dd, *J* = 7.5, 0.8 Hz, 1H, CH_{Ar}(5)), 6.48 (dd, *J* = 7.8, 1.2 Hz, 1H, $CH_{m\text{-Cl}}$), 6.68 (app td, *J* = 7.5, 0.8 Hz, 1H, CH_{Ar}(6)), 6.78 (app d, *J* = 8.0 Hz, 1H, CH_{Ar}(8)), 7.05 (td, *J* = 7.7, 1.1 Hz, 1H, $CH_{p\text{-Cl}}$), 7.17-7.24 (m, 2H, CH_{Ar}(7) and $CH_{m\text{-Cl}}$), 7.44 (dd, *J* = 8.0, 1.2 Hz, 1H, $CH_{o\text{-Cl}}$).



trans-**5fa**

Characteristic NOESY-interactions: CH(4) / $C\underline{H}_2CH_3$; CH(4) / $CH_2C\underline{H}_3$; CH(4) / Me_a(2); $CH_{m\text{-ClAr}}$ / CH_{2b}(3).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 8.1 ($CH_2\underline{C}H_3$), 27.4 (Me_a(2)), 31.2 ($\underline{C}H_2CH_3$), 31.5 (Me_b(2)), 36.5 (CH_2(3)), 37.1 (CH(4)), 77.5 (C(4a)), 81.6 (C(2)), 107.1 (CH_{Ar}(8)), 119.3 (CH_{Ar}(6)), 125.1 (C_{Ar}(4b)), 125.7 ($CH_{p\text{-Cl}}$), 126.8 (CH_{Ar}(5)), 128.2 ($CH_{m\text{-Cl}}$), 129.1 (CH_{Ar}(7)), 129.4 ($CH_{o\text{-Cl}}$), 132.0 ($CH_{m\text{-Cl}}$), 135.0 (C–Cl), 136.8 ($C_{o\text{-Cl}}$), 155.0 (C_{Ar}(8a)–O).

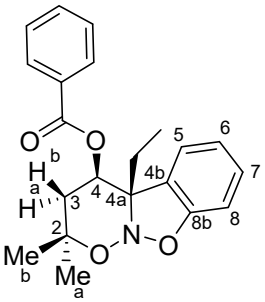
HRMS (ESI): *m/z* calcd. for [$C_{20}H_{22}ClNO_2$+H^+]: 344.1412, found: 344.1408.

Anal. Calcd for $C_{20}H_{22}ClNO_2$: C, 69.86; H, 6.45; N, 4.07. Found: C, 69.55; H, 6.50; N, 3.94.

4a-Ethyl-2,2-dimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazin-4-yl benzoate (*cis*-5ga and *trans*-5ga). Nitroso acetal **5ga** was obtained from nitronate **1g** (150 mg, 0.54 mmol) and aryltriflate **9a** (131 µL, 161 mg, 0.54 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 100:1) afforded 28 mg (*cis*-**5ga**/*trans*-**5ga** = 90:10), 128 mg (*cis*-**5ga**/*trans*-**5ga** = 73:27), and 26 mg (*cis*-**5ga**/*trans*-**5ga** = 53:47) of target nitroso acetal mixture as colorless oils. Total yield: 182 mg (95%, *cis*-**5ga**/*trans*-**5ga** = 2.6:1). R_f = 0.30 (PE/EtOAc, 20:1, UV, anisaldehyde).

Major isomer (4*R**,4a*S**)-**5ga** (*cis*-**5ga**):

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.86 (t, *J* = 7.5 Hz, 3H, $CH_2C\underline{H}_3$), 1.28 (s, 3H, Me_a(2)), 1.56 (s, 3H, Me_b(2)), 1.98 (dd, *J* = 13.4, 4.1 Hz, 1H, CH_{2a}(3)), 2.07 (app q, overlapped, *J* = 7.5 Hz, 2H, $C\underline{H}_2CH_3$), 2.06-2.13 (m, overlapped, 1H, CH_{2b}(3)), 5.74 (dd, *J* = 8.9, 4.1 Hz, 1H, CH(4)), 6.99 (app d, *J* = 8.0 Hz, 1H, CH_{Ar}(8)), 7.05 (app td, *J* = 7.4, 0.8 Hz, 1H, CH_{Ar}(6)), 7.21 (app td, *J* = 7.4, 0.8 Hz, 1H, CH_{Ar}(5)), 7.30 (app td, *J* = 8.0, 1.3 Hz, 1H, CH_{Ar}(7)), 7.54 (t, *J* = 7.5 Hz, 2H, CH_{Bz}), 7.65 (app tt, *J* = 7.4, 1.3 Hz, 1H, CH_{Bz}), 8.16 (app d, *J* = 7.1 Hz, 2H, CH_{Bz}).

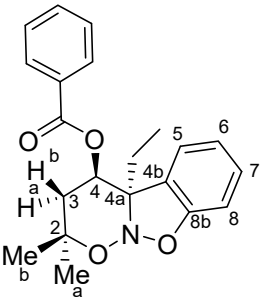


cis-**5ga**

Characteristic NOESY-interactions: CH(4) / CH_{Ar}(5); CH_{Bz} / $C\underline{H}_2CH_3$; CH_{Bz} / Me_b(2); CH(4) / Me_a(2); CH_{2a}(3) / Me_a(2); CH_{2b}(3) / Me_a(2); CH(4) / $CH_2C\underline{H}_3$.

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 7.9 ($CH_2\underline{C}H_3$), 26.6 ($\underline{C}H_2CH_3$), 26.9 (Me_b(2)), 28.2 (Me_a(2)), 36.6 (CH_2(3)), 71.1 (CH(4)), 75.2 (C(2)), 78.5 (C(4a)), 108.9 (CH_{Ar}(8)), 122.7 (CH_{Ar}(6)), 123.1 (CH_{Ar}(5)), 128.7 (CH_{Bz}), 128.8 (C_{Ar}(4b)), 129.2 (CH_{Ar}(7)), 129.7 (CH_{Bz}), 129.8 (C_{Bz}), 133.5 (CH_{Bz}), 157.9 (C_{Ar}(8a)–O), 165.5 (C=O).

Minor isomer (4*R**,4a*R**)-**5ga** (*trans*-**5ga**):



trans-**5ga**

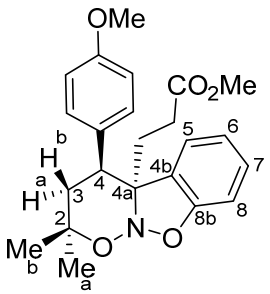
^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.96 (t, *J* = 7.5 Hz, 3H, $CH_2C\underline{H}_3$), 1.27 (s, 3H, Me_a(2)), 1.55 (s, 3H, Me_b(2)), 1.83-1.91 (m, 2H, $C\underline{H}_2CH_3$), 1.94-2.06 (m, 2H, CH_2(3)), 5.83 (dd, *J* = 6.7, 3.8 Hz, 1H, CH(4)), 6.93-7.06 (m, 2H, CH_{Ar}(6,8)), 7.20-7.32 (m, 2H, CH_{Ar}(5,7)), 7.43 (t, *J* = 7.6 Hz, 2H, CH_{Bz}), 7.54-7.61 (m, 1H, CH_{Bz}), 7.94 (app d, *J* = 7.1 Hz, 2H, CH_{Bz}).

Characteristic NOESY-interactions: CH_{Bz} / Me_a(2); CH(4) / Me_b(2); CH(4) / $C\underline{H}_2CH_3$;

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 8.1 ($CH_2\underline{C}H_3$), 26.6 (Me_b(2)), 29.3 (Me_a(2)), 29.8 ($\underline{C}H_2CH_3$), 36.0 (CH_2(3)), 69.9 (CH(4)), 76.6 (C(2)), 79.4 (C(4a)), 108.8 (CH_{Ar}(8)), 122.1 (CH_{Ar}(6)), 124.9 (CH_{Ar}(5)), 126.7 (C_{Ar}(4b)), 128.5 (CH_{Bz}), 128.9 (CH_{Ar}(7)), 129.7 (CH_{Bz}), 129.8 (C_{Bz}), 133.3 (CH_{Bz}), 158.2 (C_{Ar}(8a)–O), 166.0 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{21}H_{23}NO_4$+H^+]: 354.1700, found: 354.1709.

Methyl 3-((4*S,4a*S**)-4-(4-methoxyphenyl)-2,2-dimethyl-3,4-dihydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazin-4a(2H)-yl)propanoate (*trans*-5ha).** Nitroso acetal **5ha** was obtained from nitronate **1h** (100 mg, 0.31 mmol) and aryltriflate **9a** (76 µL, 93 mg, 0.31 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 10:1) afforded 120 mg (97%) of the target nitroso acetal as white solid. Single diastereomer (*trans*-**5ha**). R_f = 0.75 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 90-92 °C (MeOH).



trans-**5ha**

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.37 (s, 3H, Me_a(2)), 1.60 (s, 3H, Me_b(2)), 1.70 (dd, *J* = 13.5, 2.4 Hz, 1H, CH_{2a}(3)), 1.98-2.09 (m, 1H, $C\underline{H}_{2a}CO_2Me$), 2.10 (app t, *J* = 13.5 Hz, 1H, CH_{2b}(3)), 2.20-2.30 (m, 1H, C(4a)–$C\underline{H}_{2a}$), 2.33-2.43 (m, 1H, C(4a)–$C\underline{H}_{2b}$), 2.62 (ddd, *J* = 16.0, 10.7, 5.1 Hz, 1H, $C\underline{H}_{2b}CO_2Me$), 3.06 (dd, *J* = 13.7, 2.4 Hz, 1H, CH(4)), 3.60 (s, 3H, CO_2Me), 3.84 (s, 3H, OMe), 5.89 (d, *J* = 7.3 Hz, 1H, CH_{Ar}(5)), 6.63 (app t, *J* = 7.5 Hz, 1H, CH_{Ar}(6)), 6.74 (d, *J* = 8.0 Hz, 1H, CH_{Ar}(8)), 6.83 (d, *J* = 8.9 Hz, 2H, CH_{Ar}), 6.89 (d, *J* = 8.9 Hz, 2H, CH_{Ar}), 7.17 (app td, *J* = 7.7, 1.0 Hz, 1H, CH_{Ar}(7)).

Characteristic NOESY-interactions: CH(4) / $C\underline{H}_{2b}CO_2Me$; CH(4) / C(4a)–$C\underline{H}_{2b}$; CH(4) / Me_a(2); CH_{2a}(3) / Me_a(2); CH_{2b}(3) / Me_b(2); CH(4) / CH_{2a}(3); CH_{Ar}(5) / CH_{Ar}.

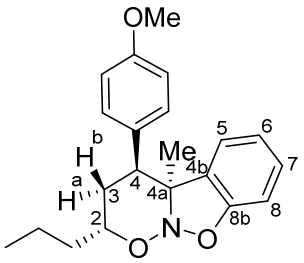
^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 27.4 (Me_a(2)), 28.7 ($\underline{C}H_2CO_2Me$), 31.7 (Me_b(2)), 33.1 (C(4a)–$\underline{C}H_2$), 35.5 (CH_2(3)), 41.0 (CH(4)), 51.6 ($CO_2\underline{Me}$), 55.3 (OMe), 76.0 (C(4a)), 81.5 (C(2)), 106.9 (CH_{Ar}(8)), 113.2 (CH_{Ar}), 119.7 (CH_{Ar}(6)), 124.3 (C_{Ar}(4b)), 126.3 (CH_{Ar}(5)), 129.3 (CH_{Ar}(7)), 130.2 (C_{Ar}), 130.8 (CH_{Ar}), 155.0 (C_{Ar}(8a)–O), 158.9 ($\underline{C}_{Ar}$–OMe), 174.0 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{23}H_{27}NO_5$+H^+]: 398.1962, found: 398.1955.

4-(4-Methoxyphenyl)-4a-methyl-2-propyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ia (*trans*-5ia and *cis*-5ia). Nitroso acetal **5ia** was obtained from nitronate **1i** (100 mg, 0.38 mmol) and aryltriflate **9a** (92 µL, 113 mg, 0.38 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 20:1, then 15:1) afforded 80 mg (62%) of the target nitroso acetal as yellow oil. Ratio *trans*-**5ia**/*cis*-**5ia** = 4:1 (^{1}H NMR). R_f = 0.78 (PE/EtOAc, 3:1, UV, anisaldehyde).

Major isomer (2*R**,4*S**,4a*S**)-**5ia** (*trans*-**5ia**):

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.94 (t, *J* = 7.1 Hz, 3H, $CH_2\underline{Me}$), 1.35-1.51 (m, 3H, CH(2)–$C\underline{H}_{2a}$ and $C\underline{H}_2Me$), 1.51 (s, 3H, Me(4a)), 1.58-1.76 (m, 2H, CH(2)–$C\underline{H}_{2b}$ and CH_{2a}(3)), 2.06 (td, *J* = 13.4, 8.2 Hz, 1H, CH_{2b}(3)), 3.23 (dd, *J* = 13.6, 4.6 Hz, 1H, CH(4)), 3.87 (s, 3H, OMe), 4.26-4.34 (m, 1H, CH(2)), 6.51 (d, *J* = 7.4 Hz, 1H, CH_{Ar}(5)), 6.79 (app t, *J* = 7.5 Hz, 1H, CH_{Ar}(6)), 6.82 (d, *J* = 8.0 Hz, 1H, CH_{Ar}(8)), 6.93 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.15 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.23 (app td, *J* = 7.8, 1.3 Hz, 1H, CH_{Ar}(7)).



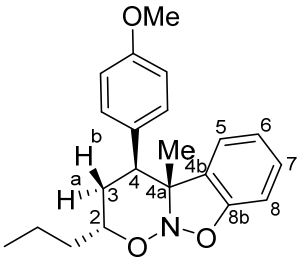
trans-**5ia**

Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH_{2b}(3) / CH_{Ar}; CH_{2b}(3) / CH(2); CH(4) / Me(4a); CH_{Ar}(5) / CH_{Ar}.

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 14.0 ($CH_2\underline{Me}$), 18.3 ($\underline{C}H_2Me$), 28.3 (Me(4a)), 29.9 (CH_2(3)), 37.1 (CH(2)–$\underline{C}H_2$), 40.1 (CH(4)), 55.3 (OMe), 70.8 (CH(2)), 73.8 (C(4a)), 106.4 (CH_{Ar}(8)), 113.3 (CH_{Ar}), 120.5 (CH_{Ar}(6)), 125.1 (CH_{Ar}(5)), 127.6 (C_{Ar}(4b)), 128.9 (CH_{Ar}(7)), 129.9 (C_{Ar}), 131.1 (CH_{Ar}), 156.9 (C_{Ar}(8a)–O), 159.0 ($\underline{C}_{Ar}$–OMe).

Minor isomer (2*R**,4*S**,4a*R**)-**5ia** (*cis*-**5ia**):

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.89 (t, *J* = 7.2 Hz, 3H, $CH_2\underline{Me}$), 1.24 (s, 3H, Me(4a)), 1.31-1.49 (m, 3H, CH(2)–$C\underline{H}_{2a}$ and $C\underline{H}_2Me$), 1.58-1.66 (m, 2H, CH(2)–$C\underline{H}_{2b}$ and CH_{2a}(3)), 2.25-2.33 (m, 1H, CH_{2b}(3)), 3.62 (dd, *J* = 11.4, 3.7 Hz, 1H, CH(4)), 3.87 (s, 3H, OMe), 4.36-4.44 (m, 1H, CH(2)), 6.95-7.06 (m, 4H, CH_{Ar}), 7.17-7.28 (m, 2H, CH_{Ar}), 7.41 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).



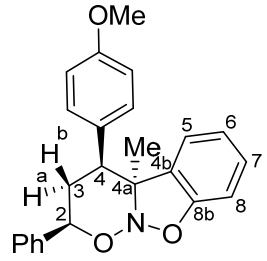
cis-**5ia**

Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH_{2b}(3) / CH_{Ar}; CH_{2b}(3) / CH(2); CH(4) / CH(2)–$C\underline{H}_{2b}$ and CH_{2a}(3); CH(2) / CH_{Ar}; Me(4a) / CH_{2b}(3).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 14.0 ($CH_2\underline{Me}$), 18.4 ($\underline{C}H_2Me$), 22.0 (Me(4a)), 32.0 (CH_2(3)), 36.2 (CH(2)–$\underline{C}H_2$), 42.4 (CH(4)), 55.3 (OMe), 73.2 (CH(2)), 76.2 (C(4a)), 109.0 (CH_{Ar}(8)), 113.8 (CH_{Ar}), 122.6, 122.7, and 128.5 (CH_{Ar}(5-7)), 130.9 (CH_{Ar}), 131.9 (C_{Ar}), 133.0 (C_{Ar}(4b)), 157.4 (C_{Ar}(8a)–O), 158.9 ($\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{21}H_{25}NO_3$+H^+]: 340.1907, found: 340.1899.

(2*R,4*S**,4a*S**)-4-(4-Methoxyphenyl)-4a-methyl-2-phenyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5ja).** Nitroso acetal **5ja** was obtained from nitronate **1j** (100 mg, 0.34 mmol) and aryltriflate **9a** (82 µL, 100 mg, 0.34 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 15:1, then 10:1) afforded 85 mg (68%) of the target nitroso acetal as pale yellow solid. Single diastereomer (*trans*-**5ja**). R_f = 0.75 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 118-120 °C (PE/MTBE, 1:1).



^{1}H NMR (300 MHz, $CDCl_3$): δ 1.56 (s, 3H, Me(4a)), 2.06 (app dt, *J* = 13.1, 2.6 Hz, 1H, CH_{2a}(3)), 2.36 (app td, *J* = 13.1, 11.4 Hz, 1H, $CH_{2b}(3)_{ax}$), 3.64 (dd, *J* = 13.1, 3.4 Hz, 1H, $CH(4)_{ax}$), 3.90 (s, 3H, OMe), 5.09 (dd, *J* = 11.2, 2.0 Hz, 1H, $CH(2)_{ax}$), 6.76 (d, *J* = 7.1 Hz, 1H, CH_{Ar}(5)), 6.88 (app t, *J* = 7.3 Hz, 1H, CH_{Ar}(6)), 6.98-7.01 (m, 3H, CH_{Ar}(8) and CH_{Ar}), 7.23 (app td, *J* = 7.6, 1.1 Hz, 1H, CH_{Ar}(7)), 7.27-7.37 (m, 5H, Ph), 7.40 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).

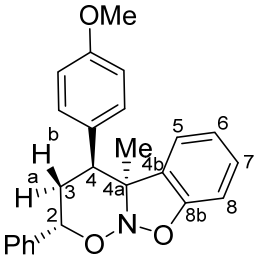
Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH(4) / Me(4a); CH_{2b}(3) / CH_{Ar}; CH_{2a}(3) / CH(2); CH(2) / CH(4); CH_{Ar}(5) / CH_{Ar}.

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 27.2 (Me(4a)), 33.6 (CH_2(3)), 46.7 (CH(4)), 55.3 (OMe), 76.2 (C(4a)), 78.4 (CH(2)), 109.4 (CH_{Ar}(8)), 113.5 (CH_{Ar}), 122.1 (CH_{Ar}(6)), 124.7 (CH_{Ar}(5)), 126.5 (CH_{Ph}), 128.0 (CH_{Ph}), 128.39 (CH_{Ph}), 128.42 (CH_{Ar}(7)), 129.4 (C_{Ar}(4b)), 130.1 (C_{Ar}), 131.0 (CH_{Ar}), 139.6 (C_{Ph}), 159.06 and 159.14 (C_{Ar}(8a)–O and $\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{24}H_{23}NO_3$+H^+]: 374.1751, found: 374.1745.

4-(4-Methoxyphenyl)-4a-methyl-2-phenyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ka (*trans*-5ka and *cis*-5ka). Nitroso acetal **5ka** was obtained from nitronate **1k** (100 mg, 0.34 mmol) and aryltriflate **9a** (82 µL, 100 mg, 0.34 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 10:1, then 5:1, then 3:1) afforded 82 mg (65%) of the target nitroso acetal as yellow oil. Ratio *trans*-**5ka**/*cis*-**5ka** = 2.2:1 (^{1}H NMR). R_f = 0.75 (PE/EtOAc, 3:1, UV, anisaldehyde).

Major isomer (2*S**,4*S**,4a*S**)-**5ka** (*trans*-**5ka**):



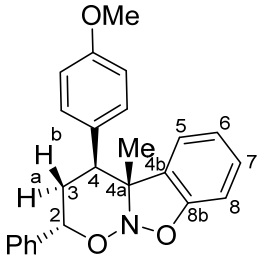
trans-**5ka**

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.63 (s, 3H, Me(4a)), 2.12 (app dt, *J* = 13.5, 4.7 Hz, 1H, CH_{2a}(3)), 2.46 (app td, *J* = 13.5, 9.2 Hz, 1H, $CH_{2b}(3)_{ax}$), 3.47 (dd, *J* = 13.5, 4.5 Hz, 1H, $CH(4)_{ax}$), 3.88 (s, 3H, OMe), 5.39 (dd, *J* = 8.6, 5.2 Hz, 1H, $CH(2)_{eq}$), 6.56 (d, *J* = 7.4 Hz, 1H, CH_{Ar}(5)), 6.86 (app t, *J* = 7.5 Hz, 1H, CH_{Ar}(6)), 6.90-6.93 (m, 1H, CH_{Ar}(8)), 6.94 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.18 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.24-7.31 (m, 1H, CH_{Ar}(7)), 7.34-7.47 (m, 5H, CH_{Ph}).

Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH(4) / Me(4a); CH_{2b}(3) / CH_{Ar}; CH_{2b}(3) / CH(2); CH_{Ar}(5) / CH_{Ar}; Ph / CH_{2a}(3).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 28.3 (Me(4a)), 31.4 (CH_2(3)), 40.1 (CH(4)), 55.3 (OMe), 72.9 (CH(2)), 73.9 (C(4a)), 106.7 (CH_{Ar}(8)), 113.4 (CH_{Ar}), 120.8 (CH_{Ar}(6)), 125.3 (CH_{Ar}(5)), 126.5 (CH_{Ph}), 127.4 (C_{Ar}(4b)), 128.0 (CH_{Ph}), 128.6 (CH_{Ph}), 129.2 (CH_{Ar}(7)), 129.5 (C_{Ar}), 131.1 (CH_{Ar}), 140.8 (C_{Ph}), 156.8 (C_{Ar}(8a)–O), 159.1 ($\underline{C}_{Ar}$–OMe).

Minor isomer (2*S**,4*S**,4a*R**)-**5ka** (*cis*-**5ka**):



cis-**5ka**

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.33 (s, 3H, Me(4a)), 2.07-2.16 (m, 1H, CH_{2a}(3)), 2.50-2.69 (m, 1H, CH_{2b}(3)), 3.85-3.90 (m, 1H, CH(4)), 3.88 (s, overlapped, 3H, OMe), 5.47 (app t, *J* = 6.0, 1H, CH(2)), 7.00 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.05-7.12 (m, 2H, CH_{Ar}(6) and CH_{Ar}(8)), 7.25-7.37 (m, 7H, CH_{Ph}, CH_{Ar}(5), and CH_{Ar}(7)), 7.51 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).

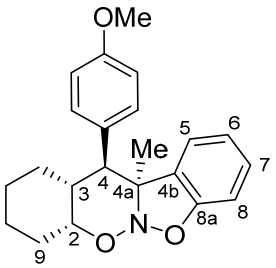
Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH_{2b}(3) / CH_{Ar}; CH_{2b}(3) / CH(2); CH(2) / CH_{Ar}; Me(4a) / CH_{2b}(3).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 22.8 (Me(4a)), 33.9 (CH_2(3)), 42.8 (CH(4)), 55.3 (OMe), 74.6 (CH(2)), 76.4 (C(4a)), 109.3 (CH_{Ar}(8)), 113.9 (CH_{Ar}), 122.5 (CH_{Ar}(5)), 122.9 (CH_{Ar}(6)), 126.4 (CH_{Ph}), 127.9 (CH_{Ar}(7)), 128.4 (CH_{Ph}), 130.9 (CH_{Ar}), 131.7 (C_{Ar}), 133.0 (C_{Ar}(4b)), 140.2 (C_{Ph}), 157.7 (C_{Ar}(8a)–O), 158.9 ($\underline{C}_{Ar}$–OMe). One of the CH_{Ph} cannot be unambiguously assigned due to overlapping.

HRMS (ESI): *m/z* calcd. for [$C_{24}H_{23}NO_3$+H^+]: 374.1751, found: 374.1746.

(4a*R*,11b*S***,12*S***,12a*R***)-12-(4-Methoxyphenyl)-11b-methyl-1,2,3,4,4a,11b,12,12a-octahydrobenzo[e]benzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5la).** Nitroso acetal **5la** was obtained from nitronate **1l** (69 mg, 0.25 mmol) and aryltriflate **9a** (60 µL, 75 mg, 0.25 mmol) according to GP-2 with the following change: after overnight exposure additional silane **9a** (30 µL, 38 mg, 0.125 mmol, 0.5 equiv.) was added. After that the reaction mixture was stirred for 4 h and then worked up as described. Column chromatography (eluent: PE/EtOAc, 10:1, then 5:1) afforded 53 mg (60%) of the target nitroso acetal as pale yellow solid. Single diastereomer (*trans*-**5la**). R_f = 0.69 (PE/EtOAc, 1:1, UV, anisaldehyde). mp = 109-112 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.15-1.41 (m, 5H, CH_2), 1.42 (s, 3H, Me(4a)), 1.56-1.68 (m, 1H, CH_2), 1.74-1.97 (m, 2H, $C\underline{H}_2$–CH(2)), 2.25-2.35 (m, 1H, CH(3)), 3.13 (d, *J* = 11.7 Hz, 1H, CH(4)), 3.88 (s, 3H, OMe), 4.31 (app q, *J* = 6.3 Hz, 1H, CH(2)–O), 6.70 (d, *J* = 7.5 Hz, 1H, CH_{Ar}(5)), 6.79-6.86 (m, 2H, CH_{Ar}(6) and CH_{Ar}(8)), 6.94 (d, *J* = 8.5 Hz, 2H, CH_{Ar}), 7.17-7.22 (m, 3H, CH_{Ar} and CH_{Ar}(7)).



trans-**5la**

Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH(4) / Me(4a); CH(3) / CH_{Ar}; CH(2) / CH(3); CH(4) / $C\underline{H}_2$–CH(2); Me(4a) / CH_{Ar}(5).

^{13}C NMR (75 MHz, DEPT, HSQC, $CDCl_3$): δ 20.9 (CH_2), 21.0 (CH_2), 26.0 (CH_2), 26.4 (CH_2), 28.8 (Me(4a)), 33.9 (CH(3)), 47.5 (CH(4)), 55.3 (OMe), 72.6 (CH(2)), 74.2 (C(4a)), 107.0 (CH_{Ar}(8)), 113.4 (CH_{Ar}), 120.8 (CH_{Ar}(6)), 125.0 (CH_{Ar}(5)), 128.4 (C_{Ar}(4b) or C_{Ar}), 128.6 (CH_{Ar}(7)), 129.0 (C_{Ar} or C_{Ar}(4b)), 131.9 (CH_{Ar}), 157.7 (C_{Ar}(8a)–O), 159.0 ($\underline{C}_{Ar}$–OMe).

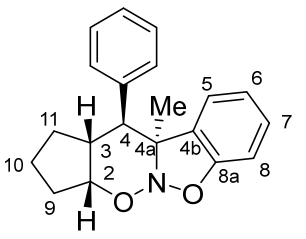
HRMS (ESI): *m/z* calcd. for [$C_{22}H_{25}NO_3$+H^+]: 352.1907, found: 352.1909.

10b-Methyl-11-phenyl-2,3,3a,10b,11,11a-hexahydro-1H-benzo[4,5]isoxazolo[2,3-b]cyclopenta[e][1,2]oxazine 5ma (*trans*-5ma and *cis*-5ma). Nitroso acetal **5ma** was obtained from nitronate **1m** (200 mg, 0.86 mmol) and aryltriflate **9a** (210 µL, 258 mg, 0.86 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 40:1, then 30:1, then 25:1, then 20:1) afforded 68 mg (major isomer) and 197 mg (*trans*-**5ma**/*cis*-**5ma** = 1.9:1) of target nitroso acetal as pale yellow oils. Total yield: 265 mg (99%, *trans*-**5ma**/*cis*-**5ma** = 2.9:1). Enriched minor isomer was obtained after recrystallization of second fraction from PE/MTBE, 1:1.

Major isomer (3a*R***,10b*S***,11*S***,11a*R***)-**5ma** (*trans*-**5ma**):

R_f = 0.65 (PE/EtOAc, 10:1, UV, anisaldehyde). mp = 75-78 °C (PE/Et_2O, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.18-1.29 (m, 1H, CH_{2a}(11)), 1.33-1.41 (m, 1H, CH_{2a}(10)), 1.42 (s, 3H, Me(4a)), 1.58-1.72 (m, 2H, CH_{2b}(10) and CH_{2b}(11)), 1.78-1.83 (m, 1H, CH_{2a}(9)), 1.90-2.02 (m, 1H CH_{2b}(9)), 2.33-2.44 (m, 1H, CH(3)), 3.05 (d, *J* = 12.5 Hz, 1H, CH(4)), 4.52 (td, *J* = 7.2, 3.6 Hz, 1H, CH(2)), 6.83-6.89 (m, 3H, CH_{Ar}(5,6,8)), 7.20-7.25 (m, 1H, CH_{Ar}(7)), 7.36-7.46 (m, 5H, Ph).

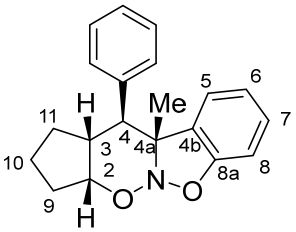


trans-**5ma**

Characteristic NOESY-interactions: Me(4a) / Ph; CH(4) / Me(4a); Ph / CH(3); CH(2) / CH(3).

^{13}C NMR (75 MHz, DEPT, HSQC, $CDCl_3$): δ 23.5 (CH_2(10)), 28.9 (Me(4a)), 31.8 (CH_2(11)), 33.2 (CH_2(9)), 39.4 (CH(3)), 47.5 (CH(4)), 73.2 (C(4a)), 75.1 (CH(2)), 106.3 (CH_{Ar}(8)), 120.8 (CH_{Ar}(6)), 124.6 (CH_{Ar}(5)), 127.6 (CH_{Ph}), 128.1 (CH_{Ph}), 128.3 (C_{Ar}(4b)), 128.9 (CH_{Ar}(7)), 130.8 (CH_{Ph}), 137.2 (C_{Ph}), 157.6 (C_{Ar}(8a)–O).

Minor isomer (3a*R**,10b*R**,11*S**,11a*R**)-**5ma** (*cis*-**5ma**):



cis-**5ma**

R_f = 0.60 (PE/EtOAc, 10:1, UV, anisaldehyde). mp = 122-125 °C (PE/Et_2O, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.04-1.15 (m, 1H, CH_{2a}(11)), 1.34 (s, 3H, Me(4a)), 1.35-1.44 (m, 1H, CH_{2a}(10)), 1.53-1.75 (m, 3H, CH_{2a}(9), CH_{2b}(10), and CH_{2b}(11)), 1.97-2.10 (m, 1H CH_{2b}(9)), 2.72 (app dtd, *J* = 12.6, 7.7, 4.9 Hz, 1H, CH(3)), 3.33 (d, *J* = 12.8 Hz, 1H, CH(4)), 4.77 (app q, *J* = 7.7 Hz, 1H, CH(2)), 6.94-7.04 (m, 3H, CH_{Ar}(5,6,8)), 7.24 (app td, *J* = 7.6, 1.3 Hz, 1H, CH_{Ar}(7)), 7.36-7.46 (m, 5H, Ph).

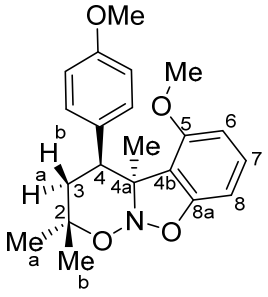
Characteristic NOESY-interactions: Me(4a) / Ph; Me(4a) / CH(3); Ph / CH(3); CH(2) / CH(3).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 22.2 (Me(4a)), 22.9 (CH_2(10)), 31.2 and 31.4 (CH_2(9) and CH_2(11)), 39.2 (CH(3)), 49.4 (CH(4)), 75.1 (C(4a)), 79.5 (CH(2)), 108.4 (CH_{Ar}(8)), 122.6 and 123.5 (CH_{Ar}(5) and CH_{Ar}(6)), 127.5, 128.1, 128.3, and 128.6 (3×CH_{Ph} and CH_{Ar}(7)), 132.5 (C_{Ar}(4b)), 138.0 (C_{Ph}), 157.0 (C_{Ar}(8a)–O).

HRMS (ESI): *m/z* calcd. for [$C_{20}H_{21}NO_2$+H^+]: 308.1645, found: 308.1636.

5-Methoxy-4-(4-methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5ab and *cis*-5ab). Nitroso acetal **5ab** was obtained from nitronate **1a** (150 mg, 0.60 mmol) and aryltriflate **9b** (198 mg, 0.60 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 40:1, then 20:1, then 15:1, then 10:1) afforded 76 mg (*trans*-**5ab**/*cis*-**5ab** = 14:1; ^{1}H NMR) of white solid and 110 mg (*trans*-**5ab**/*cis*-**5ab** = 1.2:1; ^{1}H NMR) of colorless oil of the target nitroso acetal. Total yield: 186 mg (87%, *trans*-**5ab**/*cis*-**5ab** = 2.5:1). Enriched major isomer was obtained by the recrystallization from PE/MTBE, 1:1.

Major isomer (4*S**,4a*S**)-**5ab** (*trans*-**5ab**):



trans-**5ab**

R_f = 0.74 (PE/EtOAc, 10:1, UV, anisaldehyde). mp = 139-143 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.39 (s, 3H, Me_a(2)), 1.62 (s, 3H, Me_b(2)), 1.70 (dd, *J* = 13.6, 2.5 Hz, 1H, CH_{2a}(3)), 1.77 (s, 3H, Me(4a)), 2.33 (app t, *J* = 13.5 Hz, 1H, CH_{2b}(3)), 2.96 (dd, *J* = 13.3, 2.5 Hz, 1H, CH(4)), 3.04 (s, 3H, OMe(5)), 3.81 (s, 3H, OMe), 6.13 (d, *J* = 8.3 Hz, 1H, CH_{Ar}(6)), 6.39 (d, *J* = 7.9 Hz, 1H, CH_{Ar}(8)), 6.77 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 6.89 (d, *J* = 8.5 Hz, 2H, CH_{Ar}), 7.11 (app t, *J* = 8.2 Hz, 1H, CH_{Ar}(7)).

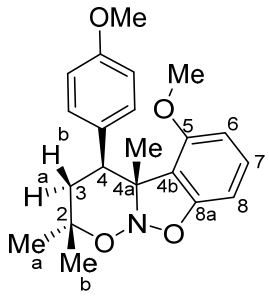
Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH(4) / Me(4a); CH_{2b}(3) / CH_{Ar}; CH_{2b}(3) / Me_b(2); CH(4) / Me_a(2); OMe(5) / CH_{Ar}(6).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 24.8 (Me(4a)), 27.3 (Me_a(2)), 31.7 (Me_b(2)), 35.3 (CH_2(3)), 43.4 (CH(4)), 54.5 (OMe(5)), 55.3 (OMe), 74.8 (C(4a)), 81.5 (C(2)), 100.3 (CH_{Ar}(8)), 102.8 (CH_{Ar}(6)), 112.9 (CH_{Ar}), 113.7 (C_{Ar}(4b)), 130.0 (CH_{Ar}), 130.3 (CH_{Ar}(7)), 133.2 (C_{Ar}), 155.2 (C_{Ar}(8a)–O) , 157.0 ($\underline{C}(5)_{Ar}$–OMe), 158.4 ($\underline{C}_{Ar}$–OMe).

Minor isomer (4*S**,4a*R**)-**5ab** (*cis*-**5ab**):

R_f = 0.64 (PE/EtOAc, 10:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.28 (s, 3H, Me_a(2)), 1.35 (s, 3H, Me(4a)), 1.55 (s, 3H, Me_b(2)), 1.55-1.62 (m, 1H, CH_{2a}(3)), 2.32 (app t, *J* = 13.6 Hz, 1H, CH_{2b}(3)), 3.55 (dd, *J* = 13.9, 2.7 Hz, 1H, CH(4)), 3.59 (s, 3H, OMe(5)), 3.86 (s, 3H, OMe), 6.50 (d, *J* = 8.2 Hz, 1H, CH_{Ar}(6)), 6.60 (d, *J* = 7.9 Hz, 1H, CH_{Ar}(8)), 6.89 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.19 (app t, *J* = 8.1 Hz, 1H, CH_{Ar}(7)) , 7.26 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).



cis-**5ab**

Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; Me(4a) / CH_{2b}(3); CH_{2b}(3) / CH_{Ar}; CH_{2b}(3) / Me_b(2); CH(4) / Me_a(2); OMe(5) / CH_{Ar}(6).

^{13}C NMR (75 MHz, HSQC, HMBC, $CDCl_3$): δ 18.7 (Me(4a)), 26.0 (Me_a(2)), 27.4 (Me_b(2)), 39.4 (CH_2(3)), 42.3 (CH(4)), 54.2 (OMe(5)), 55.3 (OMe), 76.5 (C(2)), 77.7 (C(4a)), 101.9 (CH_{Ar}(8)), 104.9 (CH_{Ar}(6)), 112.6 (CH_{Ar}), 119.6 (C_{Ar}(4b)), 130.3 (overlapped, CH_{Ar}(7)), 131.4 (CH_{Ar}), 132.9 (C_{Ar}), 156.0 ($\underline{C}(5)_{Ar}$–OMe), 158.4 and 158.6 (C_{Ar}(8a)–O and $\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{21}H_{25}NO_4$+H^+]: 356.1856, found: 356.1857.

Anal. Calcd for $C_{21}H_{25}NO_4$: C, 70.96; H, 7.09; N, 3.94. Found: C, 71.00; H, 7.28; N, 3.77.

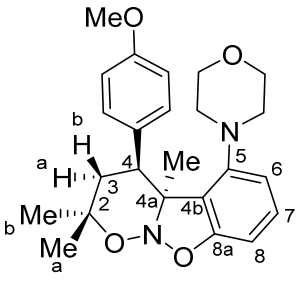
Crystals of *cis*-**5ab** for X-ray diffraction analysis were obtained by crystallization from PE – ethyl acetate 5:1 mixture at ca. 0°C. The crystallographic information for compound *cis*-**5ab** was deposited in the Cambridge Crystallographic Data Centre (CCDC 2250122).

4-(4-Methoxyphenyl)-2,2,4a-trimethyl-5-morpholino-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5ac and *cis*-5ac). Nitroso acetal **5ac** was obtained from nitronate **1a** (100 mg, 0.40 mmol) and morpholine-derived aryltriflate **9c** (154 mg, 0.40 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 15:1, then 10:1, then 7:1) afforded 76 mg (46%) of the target nitroso acetal (major isomer *trans*-**5ga**) as white solid and 89 mg (53%) of nitroso acetal (ratio *trans*-**5ac**/*cis*-**5ac** = 1.3:1) as colorless oil. Total: 165 mg (99%, *trans*-**5ac**/*cis*-**5ac** = 3.2:1). Enriched minor isomer was obtained by column chromatography of the second fraction (eluent: PE/EtOAc, 20:1).

Major isomer (4*S**,4a*S**)-**5ac** (*trans*-**5ac**):

R_f = 0.55 (PE/EtOAc, 3:1, UV, anisaldehyde). Mp = 159-161 °C (dec.) (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$, 323K): δ 1.37 (br s, 3H, Me_a(2)), 1.42 (s, 3H, Me_b(2)), 1.71-1.83 (m, 3H, CH_{2ab}–N and CH_{2a}(3)), 1.86 (s, 3H, Me(4a)), 2.27 (app t, *J* = 12.1 Hz, 1H, CH_{2b}(3)), 2.58-2.64 (m, 2H, CH_{2cd}–N), 3.18 (app br d, *J* = 8.8 Hz, 1H, CH(4)), 3.37-3.52 (m, 4H, CH_2–O), 3.79 (s, 3H, OMe), 6.63 (d, *J* = 8.1 Hz, 1H, CH_{Ar}(6)), 6.65-6.71 (m, 3H, CH_{Ar} and CH_{Ar}(8)), 6.83 (br d, *J* = 8.1 Hz, 2H, CH_{Ar}), 7.20 (app t, *J* = 8.0 Hz, 1H, CH_{Ar}(7)).



trans-**5ac**

Characteristic NOESY-interactions: CH(4) / Me(4a); CH_{2b}(3) / CH_{Ar}; CH_{2b}(3) / Me_a(2); CH(4) / Me_b(2); CH_2–N / CH_{Ar}(6).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$, 323K): δ 26.2 (Me(4a)), 27.3 (Me_b(2)), 30.6 (br, Me_a(2)), 37.3 (br, CH_2(3)), 45.8 (br, CH(4)), 54.0 (CH_2–N), 55.3 (OMe), 67.2 (CH_2–O), 75.4 (br, C(4a)), 80.1 (br,

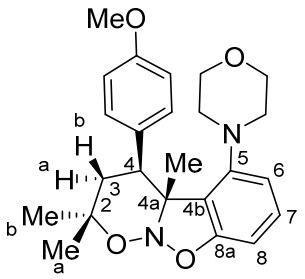
C(2)), 105.2 (CH_{Ar}(8)), 113.1 (CH_{Ar}), 115.8 (br, CH_{Ar}(6)), 123.4 (C_{Ar}(4b)), 130.1 (CH_{Ar}(7)), 130.7 (CH_{Ar}), 134.3 (br, C_{Ar}), 151.7 (C_{Ar}(5)–N), 156.3 (C_{Ar}(8a)–O), 158.2 ($\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{24}H_{30}N_2O_4$+H^+]: 411.2278, found: 411.2287.

Minor isomer (4*S**,4a*R**)-**5ac** (*cis*-**5ac**):

R_f (minor) = 0.50 (PE/EtOAc, 3:1, UV, anisaldehyde). Mp (minor) = 137-139 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.44 (br s, 3H, Me_a(2)), 1.61 (s, 3H, Me_b(2)), 1.68 (dd, *J* = 13.7, 3.2 Hz, 1H, CH_{2a}(3)), 1.81 (s, 3H, Me(4a)), 2.26-2.37 (m, 3H, CH_{2ab}–N and CH_{2b}(3)), 2.71-2.76 (m, 2H, CH_{2cd}–N), 3.16-3.26 (m, 2H, CH_{2ab}–O), 3.34-3.42 (m, 3H, CH_{2cd}–O and CH(4)), 3.79 (s, 3H, OMe), 6.70 (d, *J* = 7.8 Hz, 1H) and 6.71 (d, *J* = 8.1 Hz, 1H) (CH_{Ar}(6) and CH_{Ar}(8)), 6.81 (d, *J* = 8.6 Hz, 1H, CH_{Ar}), 6.95 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.19 (app t, *J* = 8.0 Hz, 1H, CH_{Ar}(7)).



cis-**5ac**

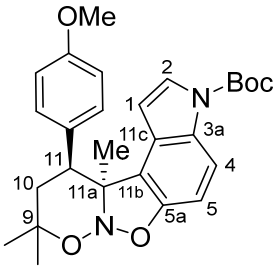
Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH_2–N / Me(4a); Me(4a) / [CH_2O+CH(4)]; Me(4a) / [CH_2–N+CH_{2b}(3)].

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 16.4 (Me(4a)), 27.4 (Me_b(2)), 30.3 (Me_a(2)), 36.6 (CH_2(3)), 40.2 (CH(4)), 54.3 (br, CH_2–N), 55.3 (OMe), 66.8 (CH_2–O), 71.7 (C(4a)), 79.8 (C(2)), 106.0 (CH_{Ar}(8)), 113.5 (CH_{Ar}), 115.0 (CH_{Ar}(6)), 127.6 (C_{Ar}(4b)), 129.5 (CH_{Ar}(7)), 130.6 (CH_{Ar}), 133.3 (C_{Ar}), 151.0 (C_{Ar}(5)–N), 155.2 (C_{Ar}(8a)–O), 158.6 ($\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{24}H_{30}N_2O_4$+H^+]: 411.2278, found: 411.2268.

***tert*-Butyl (11*R**,11a*R**)-11-(4-methoxyphenyl)-9,9,11a-trimethyl-9,10,11,11a-tetrahydro-3H-[1,2]oxazino[2',3':2,3]isoxazolo[4,5-e]indole-3-carboxylate (*trans*-5ad).** Nitroso acetal **5ad** was obtained from nitronate **1a** (20 mg, 0.08 mmol) and indol-derived aryltriflate **9d** (35 mg, 0.08 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 20:1, then 15:1, then 10:1) afforded 21 mg (66%) of the target nitroso acetal as white solid. Single diastereomer (*trans*-**5ad**). R_f = 0.78 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 106-108 °C (dec.) (hexane/MTBE, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.41 (s, 3H, Me_a(9)), 1.65 (s, 9H, Boc), 1.68 (s, 3H, Me_b(9)), 1.79 (s, 3H, Me(11a)), 1.71-1.76 (m, overlapped, 1H, CH_{2a}(10)), 2.33 (app t, *J* = 13.5 Hz, 1H, CH_{2b}(10)), 3.06 (dd, *J* = 13.1, 1.4 Hz, 1H, CH(4)), 3.81 (s, 3H, OMe), 4.74 (d, *J* = 3.8 Hz, 1H, CH(1)), 6.67-6.79 (m, 3H, CH_{Ar} and CH(5)), 6.82 (br m, 2H, CH_{Ar}), 7.19 (d, *J* = 3.8 Hz, 1H, CH(2)), 8.00 (br d, *J* = 8.5 Hz, 1H, CH(4)).



trans-**5ad**

Characteristic NOESY-interactions: Me(11a) / CH_{Ar}; CH(11) / Me(11a); Me(11a) / CH(1); Boc / CH(2); Boc / CH(4).

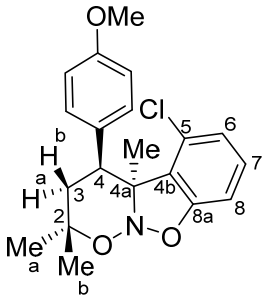
^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 26.1 (Me(11a)), 27.6 (Me(9)), 28.2 (Me_{Boc}), 31.9 (Me(9)), 35.4 (CH_2(10)), 42.6 (CH(11)), 55.5 (OMe), 75.0 (C(11a)), 81.8 (C(9)), 83.5 (C_{Boc}), 104.3 (CH(1) and CH(5)), 113.7 (CH_{Ar}), 115.6 (CH(4)), 117.2 (C(11b)), 126.5 (CH(2)), 128.2 (C(11c)), 130.5 (br, CH_{Ar} and C(3a)), 131.8 (C_{Ar}), 149.6 (C=O), 150.2 (C(5a)–O), 159.0 (C_{Ar}–O).

HRMS (ESI): *m/z* calcd. for [$C_{27}H_{32}N_2O_5$+H^+]: 465.2384, found: 465.2372.

5-Methoxy-4-(4-methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5af and *cis*-5af). Nitroso acetal **5af** was obtained from nitronate **1a** (62 mg, 0.25 mmol) and aryltriflate **9f** (83 mg, 0.25 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 20:1) afforded 47 mg (52 %) of the target nitroso acetal (*trans*-**5af**/*cis*-**5af** = 2.1:1; ^{1}H NMR) as colorless oil. Further eluation (PE/EtOAc, 1:1; and then 1:4) afforded 23 mg (37%) of starting nitronate **1a**. Yield of **5af** based on reacted starting material – 83%. Enriched major isomer (*trans*-**5af**) was obtained from isomeric mixture by crystallization from PE/EtOAc, 10:1.

Major isomer (4*S**,4a*S**)-**5af** (*trans*-**5af**):

R_f = 0.50 (PE/EtOAc, 10:1, UV, anisaldehyde). Mp = 126-128 °C (PE/EtOAc, 10:1).



trans-**5af**

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.42 (s, 3H, Me_a(2)), 1.57 (s, 3H, Me_b(2)), 1.72-1.82 (m, 1H, CH_{2a}(3)), 1.81 (s, 3H, Me(4a)), 2.31 (app t, *J* = 13.2 Hz, 1H, CH_{2b}(3)), 3.03 (dd, *J* = 12.6, 2.6 Hz, 1H, CH(4)), 3.81 (s, 3H, OMe), 6.63 (dd, *J* = 8.0, 0.7 Hz, 1H, CH_{Ar}(6)), 6.70 (dd, *J* = 8.0, 0.7 Hz, 1H, CH_{Ar}(8)), 6.75-6.87 (m, 4H, CH_{Ar}), 7.10 (app t, *J* = 8.0 Hz, 1H, CH_{Ar}(7)).

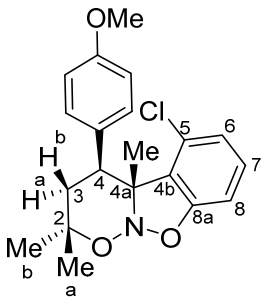
Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH(4) / Me(4a); CH_{2b}(3) / Me_b(2); CH(4) / Me_a(2).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 24.6 (Me(4a)), 27.3 (Me_a(2)), 31.3 (Me_b(2)), 35.9 (CH_2(3)), 44.1 (CH(4)), 55.3 (OMe), 75.0 (C(4a)), 81.6 (C(2)), 106.1 (CH_{Ar}(8)), 113.5 (CH_{Ar}), 122.2 (CH_{Ar}(6)), 124.5 (C_{Ar}(4b)), 130.2 (CH_{Ar}(7)), 130.4 (br, CH_{Ar}), 131.5 (C_{Ar}), 132.8 (C_{Ar}(5)), 155.7 (C(8a)$_{Ar}$–O), 159.0 ($\underline{C}_{Ar}$–OMe).

Minor isomer (4*S**,4a*R**)-**5af** (*cis*-**5af**):

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.49 (s, 3H, Me_a(2)), 1.53 (s, 3H, Me_b(2)), 1.62 (s, 3H, Me(4a)), 1.68-1.73 (m, 1H, CH_{2a}(3)), 2.33 (app t, *J* = 13.1 Hz, 1H, CH_{2b}(3)), 3.50 (dd, *J* = 13.6, 3.0 Hz, 1H, CH(4)), 3.83 (s, 3H, OMe), 6.77-6.87 (CH_{Ar}(6), CH_{Ar}(8), and CH_{Ar}), 7.06 (d, *J* = 7.7 Hz, 2H, CH_{Ar}), 7.13 (app t, *J* = 8.0 Hz, 1H, CH_{Ar}(7)).

Characteristic NOESY-interactions: Me(4a) / CH_{Ar}; CH_{2b}(3) / CH_{Ar}; CH_{2b}(3) / Me_a(2); CH(4) / Me_b(2).



cis-**5af**

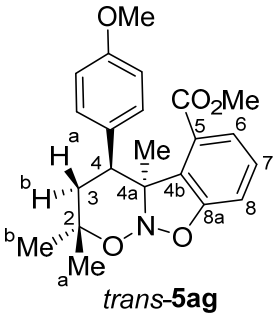
^{13}C NMR (75 MHz, HSQC, HMBC, $CDCl_3$, characteristic signals): δ 16.4 (Me(4a)), 26.8 (Me_b(2)), 29.3 (Me_a(2)), 37.1 (CH_2(3)), 40.3 (CH(4)), 55.3 (OMe), 73.9 (C(4a)), 79.2 (C(2)), 107.4 (CH_{Ar}(8)), 113.6 (CH_{Ar}), 122.8 (CH_{Ar}(6)), 156.3 (C_{Ar}(8a)–O), 158.8 ($\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{20}H_{22}ClNO_3$+H^+]: 360.1361, found: 360.1355.

5-Methoxy-4-(4-methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5ag and *cis*-5ag). Nitroso acetal **5ag** was obtained from nitronate **1a** (14.7 mg, 0.059 mmol) and aryltriflate **1g** (21 mg, 0.059 mmol) according to GP-2. Column chromatography (eluent: PE, then PE/EtOAc, 10:1) afforded 9.5 mg (42 %) of *trans*-**5ag** and 4 mg (18%) of a mixture of *trans*-**5ag** and *cis*-**5ag** (d.r. 1 : 1). Further eluation (PE/EtOAc, 1:1; and then 1:4) afforded 5.5 mg (37%) of starting nitronate **1a**. Overall yield of **5ag**: 60%, d.r. 5.8 : 1. Yield of **5ag** based on reacted starting material – 95%.

Major isomer (4*S**,4a*S**)-**5ag** (*trans*-**5ag**):

White solid. R_f = 0.36 (PE/EtOAc, 10:1, UV, anisaldehyde). mp = 160-162 °C.



trans-**5ag**

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.91 (s, 3H, Me_a(2)), 1.50 (s, 3H, Me_b(2)), 1.84 (dd, ovedrlapped, *J* = 13.7, 4.2 Hz, 1H, CH_{2a}(3)), 1.84 (s, 3H, Me(4a)), 2.22 (dd, *J* = 13.7, 4.7 Hz, 1H, CH_{2b}(3)), 3.48 (s, 3H, CO_2Me), 3.61 (app t, *J* = 4.3 Hz, 1H, CH(4)), 3.73 (s, 3H, OMe), 6.58 (br m, 2H, CH_{Ar}), 6.86 (br m, 2H, CH_{Ar}), 7.17 (dd, *J* = 7.2, 1.8 Hz, 1H, CH_{Ar}(8)), 7.25-7.33 (m, 2H, CH_{Ar}(6) and CH_{Ar}(7)).

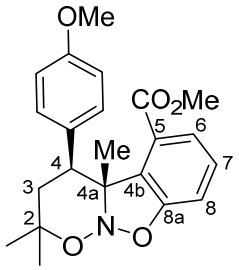
^{1}H NMR (300 MHz, COSY, HSQC, HMBC, benzene-d_6) δ 0.88 (s, 3H, Me_a(2)), 1.49 (s, 3H, Me_b(2)), 1.61 (dd, *J* = 13.8, 3.7 Hz, 1H, CH_{2a}(3)), 1.93 (s, 3H, Me(4a)), 2.06 (dd, *J* = 13.8, 4.9 Hz, 1H, CH_{2b}(3)), 3.16 (s, 3H, CO_2Me), 3.19 (s, 3H, OMe), 3.63 (t, *J* = 4.2 Hz, 1H, CH(4)), 6.63 – 6.38 (br m, 2H, CH_{Ar}), 6.85 – 6.79 (dd, *J* = 8.0, 7.5 Hz, 1H, CH_{Ar}(7)), 6.89 (dd, *J* = 8.0, 1.2 Hz, 1H, CH_{Ar}), 6.94 (d, *J* = 8.2 Hz, 2H, CH_{Ar}(8)), 7.31 (dd, *J* = 7.5, 1.3 Hz, 1H, CH_{Ar}(6)).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 24.9 (Me(4a)), 28.0 (Me_a(2) and Me_b(2)), 38.3 (CH_2(3)), 47.2 (CH(4)), 51.6 ($CO_2\underline{Me}$), 55.2 (OMe), 77.8 (C(2)), 78.5 (C(4a)), 112.3 (br, CH_{Ar}), 112.5 (CH_{Ar}(8)), 123.6 and 128.6 (CH_{Ar}(6) and CH_{Ar}(7)), 129.0 (C_{Ar}(5)), 130.5 (br, C_{Ar}(4b)), 132.0 (br, CH_{Ar}), 133.6 (C_{Ar}), 157.6 ($\underline{C}_{Ar}$–OMe), 158.3 (C(8a)$_{Ar}$–O), 165.9 ($\underline{C}O_2Me$).

Characteristic NOESY-interactions (benzene-d_6): Me_a(2) / CH_{Ar}; CH_{2a}(3) / CH_{Ar}; CH(4) / Me(4a); Me_a(2) / CH_{2a}(3); CH_{2b}(3) / Me_b(2).

Minor isomer (4*S**,4a*R**)-**5ag** (*cis*-**5ag**):

Characterized in a mixture with *trans*-**5ag**.



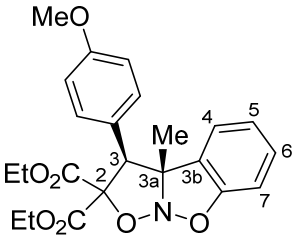
cis-**5ag**

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.36 (s, 3H, Me), 1.58 (s, 3H, Me), 1.55 (dd, *J* = 13.0, 2.9 Hz, 1H, CH_2(3)), 1.78 (s, 3H, Me), 2.29 (dd, *J* = 13.0, 13.0 Hz, 1H, CH_2(3)), 3.25 (s, 3H, OMe), 3.34 (dd, *J* = 13.0, 2.9 Hz, 1H, CH(4)), 3.83 (s, 3H, OMe), 6.87 (d, *J* = 8.8 Hz, 2H, CH_{Ar}), 7.05 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.10 (dd, *J* = 7.4, 1.6 Hz, 1H, CH_{Ar}), 7.37 – 7.24 (m, 2H, CH_{Ar}).

HRMS (ESI): *m/z* calcd. for [$C_{22}H_{25}NO_5$+H^+]: 384.1805, found: 384.1813.

Diethyl (3*S,3a*R**)-3-(4-methoxyphenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate (*cis*-6aa).** Nitroso acetal **6aa** was obtained from nitronate **2a** (100 mg, 0.28 mmol) and aryltriflate **9a** (69 µL, 85 mg, 0.28 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 20:1) afforded 85 mg (70%) of the target nitroso acetal **6aa** as white solid. Single diastereomer (*cis*-**6aa**). R_f = 0.35 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 108-109 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 0.85 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.04 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.25 (s, 3H, Me(3a)), 3.64-3.90 (m, 4H, 2×$C\underline{H}_2CH_3$), 3.83 (s, overlapped, 3H, OMe), 4.86 (s, 1H, CH(3)), 6.89-6.94 (m, 3H, CH_{Ar} and CH_{Ar}(7)), 7.08 (app t, *J* = 7.4 Hz, 1H, CH_{Ar}(5)), 7.26-7.31 (CH_{Ar}(4) and CH_{Ar}(6)), 7.40 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).



cis-**6aa**

Characteristic NOESY-interactions: Me(3a) / CH_{Ar}; Me(3a) / CH(3); Me(3a) / CH_{Ar}(4); CH(3) / [CH_{Ar}(4) and CH_{Ar}(6)].

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 13.5 ($CH_2\underline{C}H_3$), 13.7 ($CH_2\underline{C}H_3$), 22.1 (Me(3a)), 55.3 (OMe), 62.0 (CH(3)), 62.2 ($O\underline{C}H_2CH_3$), 62.6 ($O\underline{C}H_2CH_3$), 83.8 (C(3a)), 93.3 (C(2)), 108.6 (CH_{Ar}(7)), 113.8 (CH_{Ar}), 122.9 and 123.4 (CH_{Ar}(4) and CH_{Ar}(5)), 126.5 (C(3b)), 129.75 (C_{Ar}), 129.78 (CH_{Ar}(6)), 131.2 (CH_{Ar}), 156.3 (C(7a)–O), 159.5 ($\underline{C}_{Ar}$–OMe), 164.6 (C=O), 167.0 (C=O).

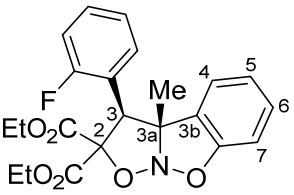
HRMS (ESI): *m/z* calcd. for [$C_{23}H_{25}NO_7$+H^+]: 428.1704, found: 428.1697.

Anal. Calcd for $C_{23}H_{25}NO_7$: C, 64.63; H, 5.90; N, 3.28. Found: C, 64.50; H, 5.98; N, 3.27.

Crystals for X-ray diffraction analysis were obtained by crystallization from hexane – methyl *tert*-butyl ether 1:1 mixture at ca. 0°C. The crystallographic information for compound **6aa** was deposited in the Cambridge Crystallographic Data Centre (CCDC 2237936).

Diethyl (3*S,3a*R**)-3-(2-fluorophenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate (*cis*-6ba).** Nitroso acetal **6ba** was obtained from nitronate **2b** (100 mg, 0.29 mmol) and aryltriflate **9a** (72 µL, 88 mg, 0.29 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 10:1, then 8:1, then 6:1) afforded 93 mg (76%) of the target nitroso acetal as pale yellow solid. Single diastereomer (*cis*-**6ba**). R_f = 0.45 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 105-107 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.81 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.04 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.25 (s, 3H, Me(3a)), 3.65-3.91 (m, 4H, 2×$C\underline{H}_2CH_3$), 5.47 (s, 1H, CH(3)), 6.92 (d, *J* = 8.0 Hz, 1H, CH_{Ar}(7)), 7.07-7.21 (m, 3H, CH_{Ar}(5), $CH_{o\text{-}F}$, $CH_{p\text{-}F}$), 7.26-7.36 (m, CH_{Ar}(4), CH_{Ar}(6), and $CH_{m\text{-}F}$), 7.60 (app td, *J* = 7.7, 1.6 Hz, 1H, $CH_{m\text{-}F}$).



cis-**6ba**

Characteristic NOESY-interactions: Me(3a) / $CH_{m\text{-}F}$; Me(3a) – CH(3); Me(3a) / [CH_{Ar}(4) + CH_{Ar}(6) + $CH_{m\text{-}F}$]; CH(3) / [CH_{Ar}(4) + CH_{Ar}(6) + $CH_{m\text{-}F}$].

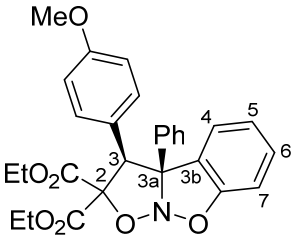
^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 13.3 ($CH_2\underline{C}H_3$), 13.7 ($CH_2\underline{C}H_3$), 21.9 (Me(3a)), 53.0 (d, $^3J_{CF}$ = 5.7 Hz, CH(3)), 62.3 ($O\underline{C}H_2CH_3$), 62.8 ($O\underline{C}H_2CH_3$), 83.6 (C(3a)), 93.0 (C(2)), 108.5 (CH_{Ar}(7)), 115.4 (d, $^2J_{CF}$ = 22.9 Hz, $CH_{o\text{-}F}$), 122.1 (d, $^2J_{CF}$ = 13.1 Hz, $C_{o\text{-}F}$), 123.0 (CH_{Ar}(5)), 123.5 (CH_{Ar}(4)), 124.4 (d, $^4J_{CF}$ = 3.8 Hz, $CH_{p\text{-}F}$), 129.2 (C(3b)), 130.0 (CH_{Ar}(6)), 130.1 (d, $^3J_{CF}$ = 8.5 Hz, $CH_{m\text{-}F}$), 130.6 (d, $^3J_{CF}$ = 2.2 Hz, $CH_{m\text{-}F}$), 156.4 (C(7a)–O), 161.0 (d, $^1J_{CF}$ = 247.3 Hz, C–F), 164.3 (C=O), 166.5 (C=O).

^{19}F NMR (282 MHz, $CDCl_3$): δ -117.7-118.0 (m).

HRMS (ESI): *m/z* calcd. for [$C_{22}H_{22}FNO_6$+H^+]: 416.1504, found: 416.1506.

Anal. Calcd for $C_{22}H_{22}FNO_6$: C, 63.61; H, 5.34; N, 3.37. Found: C, 63.53; H, 5.43; N, 3.46.

Diethyl (3*S,3a*S**)-3-(4-methoxyphenyl)-3a-phenyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate (*cis*-6ca).** Nitroso acetal **6ca** was obtained from nitronate **2c** (100 mg, 0.24 mmol) and aryltriflate **9a** (59 µL, 72 mg, 0.24 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 10:1, then 7:1, then 5:1) afforded 105 mg (89%) of the target nitroso acetal **6ca** as white solid and 6 mg (6%) of starting nitronate. Single diastereomer (*cis*-**6ca**). R_f = 0.26 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 142-144 °C ($MeOH/CH_2Cl_2$, 1:1).



cis-**6ca**

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.86 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.06 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 3.67 (s, 3H, OMe), 3.67-3.79 (m, 4H, 2×$C\underline{H}_2CH_3$), 5.44 (s, 1H, CH(3)), 6.64 (d, *J* = 8.8 Hz, 2H, CH_{Ar}), 6.93 (d, *J* = 8.0 Hz, 1H, CH_{Ar}(7)), 6.98-7.07 (m, 2H, CH_{Ar}(5) and CH_{Ph}), 7.09 (app t, *J* = 7.4 Hz, 2H, CH_{Ph}), 7.21-7.27 (m, 3H, CH_{Ar}(6) and CH_{Ar}), 7.36 (app d, *J* = 7.3 Hz, 2H, CH_{Ph}), 7.50 (d, *J* = 7.3 Hz, 1H, CH_{Ar}(4)).

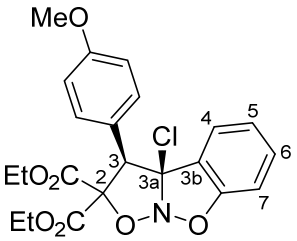
Characteristic NOESY-interactions: Ph(3a) / CH(3); CH_{Ar}(4) / CH(3).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 13.5 ($CH_2\underline{C}H_3$), 13.7 ($CH_2\underline{C}H_3$), 55.0 (OMe), 62.3 ($O\underline{C}H_2CH_3$), 62.6 (CH(3) and $O\underline{C}H_2CH_3$), 88.5 (C(3a)), 93.6 (C(2)), 109.0 (CH_{Ar}(7)), 113.2 (CH_{Ar}), 123.1 (CH_{Ar}(5)), 124.4 (CH_{Ar}(4)), 125.8 (CH_{Ph}), 126.0 (C_{Ar}), 127.1 (CH_{Ph}), 128.3 (CH_{Ph}), 128.8 (C(3b)), 130.0 (CH_{Ar}(6)), 131.8 (CH_{Ar}), 138.2 (C_{Ph}), 156.1 (C(7a)–O), 158.9 ($\underline{C}_{Ar}$–OMe), 164.6 (C=O), 167.1 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{28}H_{27}NO_7$+H^+]: 490.1860, found: 490.1856.

Crystals for X-ray diffraction analysis were obtained by crystallization from hexane – methyl *tert*-butyl ether 1:1 mixture at ca. 0°C. The crystallographic information for compound **6ca** was deposited in the Cambridge Crystallographic Data Centre (CCDC 2237937).

Diethyl (3*R,3a*S**)-3a-chloro-3-(4-methoxyphenyl)-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate (*cis*-6da).** Nitroso acetal **6da** was obtained from nitronate **2d** (100 mg, 0.27 mmol) and aryltriflate **9a** (65 µL, 80 mg, 0.27 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 8:1, then 7:1, then 5:1) afforded 72 mg (60%) of the target nitroso acetal **6da** as yellowish oil. Single diastereomer (*cis*-**6da**). R_f = 0.29 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 127-129 °C (PE/MTBE, 1:1).



cis-**6da**

^{1}H NMR (300 MHz, $CDCl_3$): δ 0.87 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.06 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 3.72-3.89 (m, 4H, 2×$C\underline{H}_2CH_3$), 3.84 (s, overlapped, 3H, OMe), 5.16 (s, 1H, CH(3)), 6.91-6.97 (m, 3H, CH_{Ar} and CH_{Ar}(7)), 7.17 (app t, *J* = 7.4 Hz, 1H, CH_{Ar}(5)), 7.36-7.49 (m, 4H, CH_{Ar}(4), CH_{Ar}(6) and CH_{Ar}).

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 13.4 ($CH_2\underline{C}H_3$), 13.7 ($CH_2\underline{C}H_3$), 55.3 (OMe), 62.6 ($O\underline{C}H_2CH_3$), 62.96 (CH(3)), 63.02 ($O\underline{C}H_2CH_3$), 93.7 (C(2)), 101.1 (C(3a)–Cl), 108.9 (CH_{Ar}(7)), 113.6 (CH_{Ar}), 123.8 and 124.4 (CH_{Ar}(4) and CH_{Ar}(5)), 125.7 and 126.0 (C(3b) and C_{Ar}), 131.7 (CH_{Ar}), 131.9 (CH_{Ar}(6)), 157.1 (C(7a)–O), 159.9 ($\underline{C}_{Ar}$–OMe), 163.5 (C=O), 166.2 (C=O).

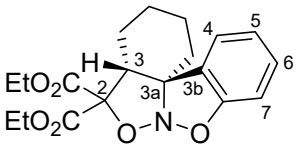
HRMS (ESI): *m/z* calcd. for [$C_{22}H_{22}ClNO_7$+NH_4^+]: 465.1423, found: 465.1408.

Anal. Calcd for $C_{22}H_{22}ClNO_7$: C, 59.00; H, 4.95; N, 3.13. Found: C, 58.84; H, 4.91; N, 3.15.

Crystals for X-ray diffraction analysis were obtained by crystallization from hexane – methyl *tert*-butyl ether 1:1 mixture at ca. 0°C. The crystallographic information for compound **6da** was deposited in the Cambridge Crystallographic Data Centre (CCDC 2237938).

Diethyl (4a*R,12b*S**)-2,3,4,4a-tetrahydrobenzo[c]benzo[4,5]isoxazolo[2,3-b]isoxazole-5,5(1H)-dicarboxylate (6ea).** Nitroso acetal **6ea** was obtained from nitronate **2e** (156 mg, 0.55 mmol) and aryltriflate **9a** (133 µL, 163 mg, 0.55 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 15:1, then 10:1, then 7:1) afforded 134 mg (68%) of target nitroso acetal as pale yellow solid. Single diastereomer. R_f = 0.50 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 120-123 °C (PE/MTBE, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.96 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.27 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.35-1.48 (m, 1H, CH_{2a}), 1.51-1.62 (m, 1H, CH_{2b}), 1.64-1.75 (m, 3H, CH_{2cde}), 1.85-2.01 (m, 3H, CH_{2fgh}), 3.54 (dq, *J* = 10.7, 7.2 Hz, 1H, $C\underline{H}_{2a}CH_3$), 3.63 (dq, *J* = 10.7, 7.2 Hz, 1H, $C\underline{H}_{2b}CH_3$), 3.76 (dd, *J* = 12.3, 5.8 Hz, 1H, CH(3)), 4.14-4.42 (m, 2H, $C\underline{H}_{2cd}CH_3$), 6.91 (app d, *J* = 8.0 Hz, 1H, CH_{Ar}(7)), 7.02 (app td, *J* = 7.5, 0.8 Hz, 1H, CH_{Ar}(5)), 7.16 (app d, *J* = 7.5, 0.8 Hz, 1H, CH_{Ar}(4)), 7.24 (app td, *J* = 7.7, 1.3 Hz, 1H, CH_{Ar}(6)).



6ea

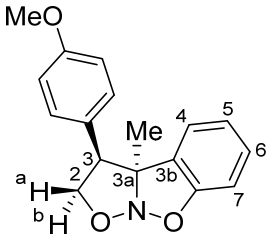
Characteristic NOESY-interactions: CH(3) / CH_{Ar}(4).

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 13.7 ($CH_2\underline{C}H_3$), 14.1 ($CH_2\underline{C}H_3$), 21.8 (CH_2), 23.5 (CH_2), 24.7 (CH_2), 33.0 (CH_2), 49.8 (CH(3)), 62.2 ($O\underline{C}H_2CH_3$), 62.5 ($O\underline{C}H_2CH_3$), 81.3 (C(3a)), 92.0 (C(2)), 109.0 (CH_{Ar}(7)), 122.7 (CH_{Ar}(5)), 124.0 (CH_{Ar}(4)), 129.0 (C(3b)), 129.8 (CH_{Ar}(6)), 157.1 (C_{Ar}(7a)–O), 165.6 (C=O), 167.2 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{19}H_{23}NO_6$+H^+]: 362.1598, found: 362.1606.

(3*S,3a*S**)-3-(4-Methoxyphenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole (*trans*-6fa).** Nitroso acetal **6fa** was obtained from nitronate **2f** (100 mg, 0.48 mmol) and aryltriflate **9a** (117 µL, 144 mg, 0.48 mmol) according to GP-2. Column chromatography (eluent: PE, then PE/EtOAc, 20:1) afforded 77 mg (57%) of the target nitroso acetal **6fa** as pale yellow oil. Single diastereomer (*trans*-**6fa**). R_f = 0.50 (PE/EtOAc, 3:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.76 (s, 3H, Me(3a)), 3.71 (dd, *J* = 12.1, 7.0 Hz, 1H, CH(3)), 3.81 (s, 3H, OMe), 4.33 (dd, *J* = 12.1, 8.8 Hz, 1H, CH_{2a}(2)–O), 4.47 (dd, *J* = 8.8, 7.0 Hz, 1H, CH_{2b}(2)–O), 5.96 (dd, *J* = 7.6, 0.8 Hz, 1H, CH_{Ar}(4)), 6.62 (app td, *J* = 7.5, 0.8 Hz, 1H, CH_{Ar}(5)), 6.77-6.80 (m, 5H, CH_{Ar} and CH_{Ar}(7)), 7.15 (ddd, *J* = 8.2, 7.4, 1.3 Hz, 1H, CH_{Ar}(6)).



trans-**6fa**

Characteristic NOESY-interactions: Me(3a) / CH_{Ar}; Me(3a) / CH(3); CH_{2a}(2) / CH_{Ar}.

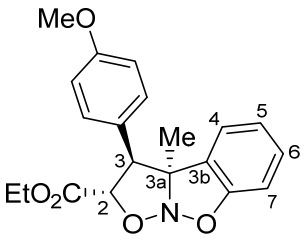
^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 25.4 (Me(3a)), 55.3 (OMe), 58.1 (CH(3)), 73.6 (CH_2(2)–O), 83.3 (C(3a)), 106.3 (CH_{Ar}(7)), 113.6 (CH_{Ar}), 120.5 (CH_{Ar}(5)), 124.7 (CH_{Ar}(4)), 125.1 (C_{Ar}), 126.1 (C(3b)), 129.0 (CH_{Ar}(6)), 129.8 (CH_{Ar}), 156.6 (C(7a)–O), 159.2 ($\underline{C}_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{17}H_{17}NO_3$+H^+]: 284.1281, found: 284.1275.

Ethyl (2*S,3*S**,3a*S**)-3-(4-methoxyphenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2-carboxylate (*trans*-6ga).** Nitroso acetal **6ga** was obtained from nitronate **1g** (100 mg, 0.36 mmol) and aryltriflate **9a** (87 µL, 107 mg, 0.36 mmol) according to GP-2. Column chromatography

(eluent: PE/EtOAc, 15:1, then 10:1, then 8:1) afforded 42 mg (33%) of the target nitroso acetal as yellow oil. Single diastereomer (*trans*-**6ga**). R_f = 0.46 (PE/EtOAc, 3:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.15 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.77 (s, 3H, Me(3a)), 3.80 (s, 3H, OMe), 3.88 (d, *J* = 11.4 Hz, 1H, CH(3)), 4.14 (q, *J* = 7.1 Hz, 2H, $OC\underline{H}_2CH_3$), 4.98 (d, *J* = 11.4 Hz, 1H, CH(2)), 5.97 (d, *J* = 8.2 Hz, 1H, CH_{Ar}(4)), 6.65 (app t, *J* = 7.5 Hz, 1H, CH_{Ar}(5)), 6.76-6.85 (m, 5H, CH_{Ar}(7) and CH_{Ar}), 7.17 (app td, *J* = 7.8, 1.2 Hz, 1H, CH_{Ar}(6)).



trans-**6ga**

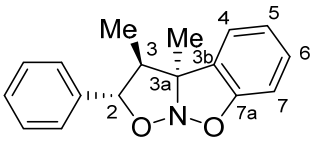
Characteristic NOESY-interactions: Me(3a) / CH_{Ar}; Me(3a) – CH(3); CH(2) / CH_{Ar}.

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 14.0 ($CH_2\underline{C}H_3$), 25.0 (Me(3a)), 55.2 (OMe), 61.6 (CH(3)), 61.8 ($O\underline{C}H_2CH_3$), 82.3 (CH(2)), 84.2 (C(3a)), 106.8 (CH_{Ar}(7)), 113.7 (CH_{Ar}), 121.0 (CH_{Ar}(5)), 123.8 (C_{Ar}), 124.7 (CH_{Ar}(4)), 125.7 (C(3b)), 129.4 (CH_{Ar}(6)), 130.1 (CH_{Ar}), 156.3 (C(7a)–O), 159.4 ($\underline{C}_{Ar}$–OMe), 167.7 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{20}H_{21}NO_5$+Na^+]: 378.1312, found: 378.1308.

(2*R,3*R**,3a*R**)-3,3a-Dimethyl-2-phenyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole (*trans*-6ha).** Nitroso acetal **6ha** was obtained from nitronate **2h** (64 mg, 0.33 mmol) and aryltriflate **9a** (100 mg, 0.33 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 20:1, then 15:1) afforded 56 mg (62%) of the nitroso acetal **6ha** as yellow oil. Single diastereomer (*trans*-**6ha**). R_f = 0.68 (PE/EtOAc, 3:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.94 (d, *J* = 6.9 Hz, 3H, Me(3)), 1.78 (s, 3H, Me(3a)), 2.48 (dq, *J* = 10.9, 6.9 Hz, 1H, CH(3)), 4.76 (d, *J* = 10.9 Hz, 1H, CH(2)), 6.86 (d, *J* = 8.1 Hz, 1H, CH_{Ar}(7)), 6.99 (td, *J* = 7.5, 0.9 Hz, 1H, CH_{Ar}(5)), 7.13 (d, *J* = 7.5, 0.9 Hz, 1H, CH_{Ar}(4)), 7.27 (app td, *J* = 7.7, 1.3 Hz, 1H, CH_{Ar}(6)), 7.35-7.39 (m, 5H, Ph).



trans-**6ha**

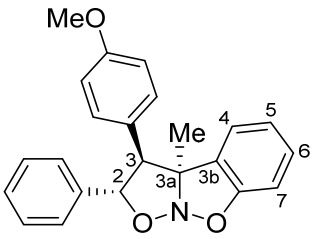
Characteristic NOESY-interactions: Me(3a) / CH(3); Me(3) / CH(2); Me(3) / CH_{Ar}(4); CH(3) / Ph; Me(3) / Ph.

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 10.7 (Me(3)), 25.4 (Me(3a)), 54.7 (CH(3)), 83.7 (C(3a)), 89.5 (CH(2)), 107.1 (CH_{Ar}(7)), 121.0 (CH_{Ar}(5)), 124.0 (CH_{Ar}(4)), 126.5 (C(3b)), 127.1 (CH_{Ph}), 128.7 (CH_{Ph}), 128.9 (CH_{Ph})), 129.2 (CH_{Ar}(6)), 135.6 (C_{Ph}), 157.1 (C(7a)–O).

HRMS (ESI): *m/z* calcd. for [$C_{17}H_{17}NO_2$+H^+]: 268.1332, found: 268.1327.

(2*S,3*S**,3a*S**)-3-(4-Methoxyphenyl)-3a-methyl-2-phenyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole (*trans*-6ia).** Nitroso acetal **6ia** was obtained from nitronate **2i** (87 mg, 0.31 mmol) and aryltriflate **9a** (75 µL, 92 mg, 0.31 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 10:1, then 8:1) afforded 66 mg (60%) of the target nitroso acetal **6ia** as pale yellow solid. Single diastereomer (*trans*-**6ia**). R_f = 0.52 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 143-145 °C (hexane/MTBE, 1:1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.85 (s, 3H, Me(3a)), 3.68 (d, *J* = 11.4 Hz, 1H, CH(3)), 3.78 (s, 3H, OMe), 5.57 (d, *J* = 11.4 Hz, 1H, CH(2)–O), 6.00 (d, *J* = 7.3 Hz, 1H, CH_{Ar}(4)), 6.67 (t, *J* = 7.5 Hz, 1H, CH_{Ar}(5)), 6.75 (d, *J* = 8.9 Hz, 2H, CH_{Ar}), 6.81 (d, *J* = 8.9 Hz, 2H, CH_{Ar}), 6.85 (app t, *J* = 8.1 Hz, 1H, CH_{Ar}(7)), 7.20 (app t, *J* = 7.7 Hz, 1H, CH_{Ar}(6)), 7.28-7.37 (m, 5H, Ph).



trans-**6ia**

Characteristic NOESY-interactions: Me(3a) / CH_{Ar}; Me(3a) / CH(3); CH(3) / Ph; CH(2) / CH_{Ar}; CH_{Ar}(4) / CH_{Ar}.

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 25.9 (Me(3a)), 55.2 (OMe), 65.6 (CH(3)), 84.6 (C(3a)), 86.5 (CH(2)–O), 106.5 (CH_{Ar}(7)), 113.7 (CH_{Ar}), 120.6 (CH_{Ar}(5)), 124.8 (CH_{Ar}(4)), 124.9 (C_{Ar}), 126.5 (C(3b)), 127.0 (CH_{Ph}), 128.5 (CH_{Ph}), 128.7 (CH_{Ph})), 129.2 (CH_{Ar}(6)), 130.2 (CH_{Ar}), 135.2 (C_{Ph}), 156.5 (C(7a)–O), 159.2 ($\underline{C}_{Ar}$–OMe).

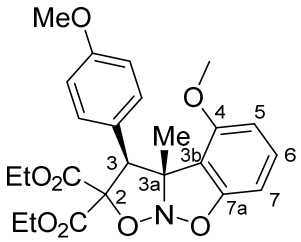
HRMS (ESI): *m/z* calcd. for [$C_{23}H_{21}NO_3$+H^+]: 360.1594, found: 360.1604.

Anal. Calcd for $C_{23}H_{21}NO_3$: C, 76.62; H, 5.59; N, 3.90. Found: C, 76.61; H, 5.83; N, 3.97.

Crystals for X-ray diffraction analysis were obtained by crystallization from PE – ethyl acetate 5:1 mixture at ca. 0°C. The crystallographic information for compound *trans*-**6ia** was deposited in the Cambridge Crystallographic Data Centre (CCDC 2250118).

Diethyl (3*S,3a*R**)-4-methoxy-3-(4-methoxyphenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate (*cis*-6ab).** Nitroso acetal **6ab** was obtained from nitronate **2a** (100 mg, 0.28 mmol) and methoxy-substituted aryltriflate **9b** (93 mg, 0.28 mmol) according to GP-2. Column chromatography (eluent: PE/EtOAc, 10:1, then 5:1, then 3:1) afforded 106 mg (81%) of the target nitroso acetal **6ab** as white solid. Single diastereomer (*cis*-**6ab**). R_f = 0.35 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 101-102°C (hexane/MTBE, 1:1).

^{1}H NMR (300 MHz, $CDCl_3$): δ 0.82 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.04 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.25 (s, 3H, Me(3a)), 3.56-3.90 (m, 4H, 2×$C\underline{H}_2CH_3$), 3.81 (s, overlapped, 3H, OMe), 3.98 (m, 3H, C_{Ar}(4)–OMe), 5.21 (s, 1H, CH(3)), 6.52-6.56 (m, 2H, CH_{Ar}(5) and CH_{Ar}(7)), 6.88 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.22 (t, *J* = 8.1 Hz, 1H, CH_{Ar}(6)), 7.39 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).



cis-**6ab**

Characteristic NOESY-interactions: Me(3a) / CH_{Ar}.

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 13.5 ($CH_2\underline{C}H_3$), 13.7 ($CH_2\underline{C}H_3$), 19.7 (Me(3a)), 55.3 (OMe), 55.9 (OMe(4)), 59.7 (CH(3)), 62.1 ($O\underline{C}H_2CH_3$), 62.5 ($O\underline{C}H_2CH_3$), 83.7 (C(3a)), 93.4 (C(2)), 101.5 and 105.0 (CH_{Ar}(5) and CH_{Ar}(7)), 113.7 (CH_{Ar}), 116.1 (C_{Ar}(3b)), 126.9 (C_{Ar}), 131.3 and 131.4 (CH_{Ar}(6) and CH_{Ar}), 155.9 ($\underline{C}_{Ar}$(4)–OMe), 157.7 ($\underline{C}_{Ar}$(7a)–O), 159.3 ($\underline{C}_{Ar}$–OMe), 164.8 (C=O), 167.1 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{24}H_{27}NO_8$+H^+]: 458.1809, found: 458.1802.

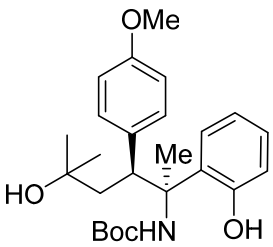
Hydrogenation of nitroso acetals 5 and 6

General procedure for the preparation of synthesis of aminoalcohols 7 and 8 (GP-3):

A suspension of Raney nickel (ca. 25–80 mg) in water was placed in a glass vial and washed with MeOH (3 × 2 mL). Then MeOH (0.5–1.0 mL) was added and the resulting suspension was transferred into another vial containing the solution of the corresponding nitroso acetal **5** or **6** (0.06–0.23 mmol) and Boc_2O (1.5 equiv) in MeOH (the resulting concentration of nitroso acetal was ca. 0.013–0.13 M, see Supporting information). The vial was equipped with a magnetic stir bar and placed in a steel autoclave that was then flushed and filled with hydrogen to a pressure of 30 atm. The hydrogenation was conducted at the indicated temperature for 2–6 h with intense stirring. Then, the autoclave was cooled to rt and slowly depressurized. The reaction mixture was filtered through Celite and then evaporated. The residue was subjected to column chromatography on silica gel to give the target protected aminoalcohols **7** or **8**.

***tert*-Butyl ((2*S**,3*S**)-5-hydroxy-2-(2-hydroxyphenyl)-3-(4-methoxyphenyl)-5-methylhexan-2-yl)carbamate (7aa).** Aminoalcohol **7aa** was obtained from nitroso acetal **5aa** (50 mg, 0.15 mmol) according to GP-3. Hydrogenation was performed over Raney nickel (~50 mg) in MeOH (1.5 mL) at 50 °C for 2 h. Column chromatography (eluent: PE/EtOAc, 3:1, then 2:1) afforded 55 mg (83%) of the target protected aminoalcohol **7aa** as white solid. R_f = 0.18 (PE/EtOAc, 2:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, $CDCl_3$): δ 0.78 (s, 3H, Me), 0.79 (s, 3H, Me), 1.05-1.44 (br, 1H, CH–OH), 1.18 (s, 9H, *t*-Bu), 1.59 (app d, *J* = 13.9 Hz, 1H, CH_{2a}), 1.68 (s, 3H, N–C–Me), 1.98 (dd, *J* = 13.9, 9.8 Hz, 1H, CH_{2b}), 3.42 (app d, *J* = 9.6 Hz, 1H, CH–Ar), 3.85 (s, 3H, OMe), 4.68 (br s, 1H, NH), 6.87-6.92 (m, 2H, CH_{Ar}), 6.97 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.16-7.21 (m, 2H, CH_{Ar}), 7.32 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.97 (br s, 1H, C_{Ar}–OH).



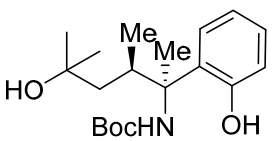
7aa

^{13}C NMR (75 MHz, DEPT, $CDCl_3$): δ 19.5 (N–C–Me), 27.8 (Me_{Boc}), 29.0 (Me), 29.2 (Me), 43.8 (CH_2), 47.0 (CH–Ar), 55.3 (OMe), 61.4 (C–N), 71.0 (Me_2C–O), 80.8 (C_{Boc}), 114.6 (CH_{Ar}), 117.3 (CH_{Ar}), 119.8 (CH_{Ar}), 128.2 (CH_{Ar}), 128.5 (CH_{Ar}), 129.2 (C_{Ar}), 131.4 (br, CH_{Ar}), 131.7 (C_{Ar}), 154.6 and 155.2 (C=O and C_{Ar}–O), 159.2 (C_{Ar}–O).

HRMS (ESI): *m/z* calcd. for [$C_{25}H_{35}NO_5$+H^+]: 430.2588, found: 430.2579.

***tert*-Butyl ((2*S**,3*R**)-5-hydroxy-2-(2-hydroxyphenyl)-3,5-dimethylhexan-2-yl)carbamate (7da).** Aminoalcohol **7da** was obtained from nitroso acetal **5da** (30 mg, 0.13 mmol) according to GP-3. Hydrogenation was performed over Raney nickel (~30 mg) in MeOH (1.0 mL) at r.t. for 2 h. Column chromatography (eluent: PE/EtOAc, 3:1, then 2:1, then 1:1) afforded 38 mg (88%) of the target protected amino alcohol **7da** as white foam. R_f = 0.28 (PE/ EtOAc, 2:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.95 (s, 3H, O–C–Me), 1.02 (s, 3H, O–C–Me), 1.17 (d, overlapped, *J* = 6.7 Hz, 3H, CH–Me), 1.13-1.20 (m, 1H, CH_{2a}), 1.29 (s, 9H, *t*-Bu), 1.43 (app d, *J* = 13.9 Hz, 1H, CH_{2b}), 1.67 (s, 3H, N–C–Me), 2.51 (app quint, *J* = 6.8 Hz, 1H, CH–Me), 5.46 (br s, 1H, NH), 6.78 (d, *J* = 8.0 Hz, 1H, CH_{Ar}), 6.83 (app t, *J* = 7.6 Hz, 1H, CH_{Ar}), 7.09 (app td, *J* = 7.7, 1.4 Hz, 1H, CH_{Ar}), 7.17 (dd, *J* = 7.8, 1.3 Hz, 1H, CH_{Ar}), 8.05 (br s, 1H, C_{Ar}–OH). CH–OH cannot unambiguously assigned due to broadening.



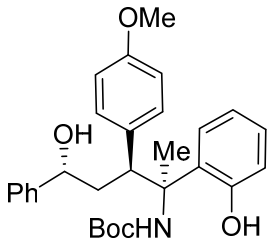
7da

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 17.7 (CH–Me), 19.6 (N–C–Me), 28.1 (Me_{Boc}), 29.3 (O–C–Me), 29.5 (O–C–Me), 35.3 (CH–Me), 45.6 (CH_2), 61.8 (C–N), 71.3 (Me_2C–O), 80.1 (C_{Boc}), 117.1 (CH_{Ar}), 119.3 (CH_{Ar}), 128.1 (CH_{Ar}), 128.6 (CH_{Ar}), 129.8 (C_{Ar}), 154.6 (C_{Ar}–O), 156.3 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{19}H_{31}NO_4$+H^+]: 338.2326, found: 338.2321.

***tert*-Butyl (2*S**,3*S**,5*R**)-5-hydroxy-2-(2-hydroxyphenyl)-3-(4-methoxyphenyl)-5-phenylpentan-2-ylcarbamate (7ja).** Aminoalcohol **7ja** was obtained from nitroso acetal **5ja** (25.0 mg, 0.067 mmol) according to GP-3. Hydrogenation was performed over Raney nickel (~25 mg) in MeOH (5 mL) at 50 °C for 2 h. Column chromatography (eluent: PE/EtOAc, 1:1, then 1:2, then EtOAc) afforded 18.5 mg (58%) of target protected aminoalcohol **7ja** as colorless oil. R_f = 0.58 (PE/EtOAc, 1:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.23 (s, 9H, *t*-Bu), 1.70 (s, 3H, Me), 1.72-1.84 (m, 1H, CH_{2a}), 1.95-2.07 (m, 1H, CH_{2b}), 3.75 (dd, *J* = 11.7, 2.1 Hz, 1H, CH–Ar), 3.87 (s, 3H, OMe), 4.09-4.17 (m, 1H, CH–OH), 4.74 (br s, 1H, NH), 6.84-6.93 (m, 2H, CH_{Ar}), 6.98 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.03-7.08 (m, 2H, CH_{Ar}), 7.11 (app d, *J* = 7.7 Hz, 1H, CH_{Ar}), 7.17-7.27 (m, 6H, CH_{Ar}), 7.93 (br s, 1H, C_{Ar}–OH). CH–OH cannot unambiguously assigned due to broadening.



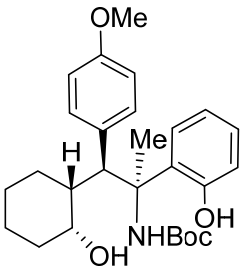
7ja

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 20.3 (N–C–Me), 27.9 (Me_{Boc}), 40.1 (CH_2), 48.4 (CH–Ar), 55.3 (OMe), 61.2 (C–N), 71.7 (CH–O), 80.8 (C_{Boc}), 114.5 (CH_{Ar}), 117.5 (CH_{Ar}), 119.8 (CH_{Ar}), 125.4 (CH_{Ar}), 127.3 (CH_{Ar}), 128.1 (CH_{Ar}), 128.4 (CH_{Ar}), 128.6 (CH_{Ar}), 129.0 (N–C–C_{Ar}), 130.1 (CH–C_{Ar}), 131.5 (br, CH_{Ar}), 144.9 (C_{Ar}), 154.6 (C_{Ar}–OH), 155.3 (C=O), 159.2 (C_{Ar}–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{29}H_{35}NO_5$+Na^+]: 500.2407, found: 500.2406.

***tert*-Butyl ((1*S**,2*S**)-1-((1*R**,2*R**)-2-hydroxycyclohexyl)-2-(2-hydroxyphenyl)-1-(4-methoxyphenyl)propan-2-yl)carbamate (7la).** Aminoalcohol **7la** was obtained from nitroso acetal **5la** (42 mg, 0.12 mmol) according to GP-3. Hydrogenation was performed over Raney nickel (~40 mg) in MeOH (1.5 mL) at 50 °C for 2 h. Column chromatography (eluent: PE, then PE/EtOAc, 10:1, then 5:1, then 3:1) afforded 33 mg (60%) of target protected aminoalcohol **7la** as colorless oil. R_f = 0.29 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 127-128 °C (dec.) (PE/MeCN/$CHCl_3$, 1:1:0.1).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.59 (d, *J* = 4.5 Hz, 1H, CHOH), 1.05-1.44 (m, 6H, CH_2), 1.18 (s, overlapped, 9H, *t*-Bu), 1.51-1.64 (m, 2H, CH_2), 1.77-1.86 (m, 1H, CH), 1.93 (s, 3H, Me), 3.60-3.62 (m, 2H, CHOH and CH–Ar), 3.85 (s, 3H, OMe), 4.64 (br s, 1H, NH), 6.89-6.96 (m, 4H, CH_{Ar}), 7.22 (app t, *J* = 7.6 Hz, 1H, CH_{Ar}), 7.30 (d, *J* = 8.0 Hz, 2H, CH_{Ar}), 7.36 (app d, *J* = 7.8 Hz, 1H, CH_{Ar}), 7.87 (br s, 1H, C_{Ar}–OH).



7la

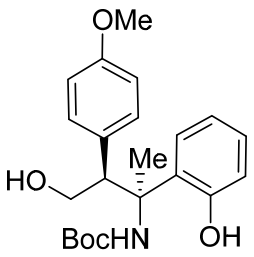
^{13}C NMR (75 MHz, DEPT, HSQC, $CDCl_3$): δ 19.6 (CH_2), 20.1 (N–C–Me), 26.4 (CH_2), 26.6 (CH_2), 28.0 (Me_{Boc}), 33.5 (CH_2–CHOH), 43.3 (CH), 53.6 (CH–Ar), 55.4 (OMe), 60.9 (C–N), 69.0 (CH–O), 80.6 (C_{Boc}), 114.5 (br, CH_{Ar}), 117.5 (CH_{Ar}), 120.1 (CH_{Ar}), 128.2 (CH_{Ar}), 128.9 (CH_{Ar}), 130.7 (C_{Ar}), 131.2 (C_{Ar}), 132.2 (br, CH_{Ar}), 154.9 and 155.1 (C=O and C_{Ar}–O), 159.1 (C_{Ar}–O). Note: signal at 132.2 (br, CH_{Ar}) was better observed at 323K.

HRMS (ESI): *m/z* calcd. for [$C_{27}H_{37}NO_5$+Na^+]: 478.2564, found: 478.2558.

***tert*-Butyl ((2*S**,3*S**)-4-hydroxy-2-(2-hydroxyphenyl)-3-(4-methoxyphenyl)butan-2-yl)carbamate (8fa).** Aminoalcohol **8fa** was obtained from nitroso acetal **6fa** (30 mg, 0.11 mmol) according to GP-3.

Hydrogenation was performed over Raney nickel (~30 mg) in MeOH (1.2 mL) at r.t. for 2 h. Column chromatography (eluent: PE/EtOAc, 2:1, then 1:1, then EtOAc) afforded 24 mg (59%) of the target protected amino alcohol **8fa** as colorless oil. R_f = 0.64 (PE/EtOAc, 1:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.24 (s, 9H, *t*-Bu), 1.71 (s, 3H, N–C–Me), 2.09 (br s, 1H, OH), 3.50 (app t, *J* = 6.9 Hz, 1H, CH–Ar), 3/76-3.89 (m, overlapped, 2H, CH_2OH), 3.83 (s, 3H, OMe), 5.42 (br s, 1H, NH), 6.80-6.92 (m, 4H, CH_{Ar}), 6.98 (d, *J* = 6.8 Hz, 1H, CH_{Ar}), 7.07 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.19 (app t, *J* = 7.6 Hz, 1H, CH_{Ar}), 8.19 (br s, 1H, C_{Ar}–OH).



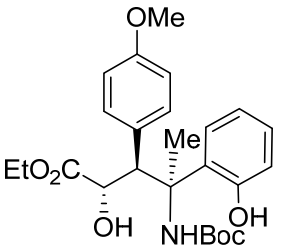
8fa

^{13}C NMR (75 MHz, DEPT, HSQC, $CDCl_3$): δ 22.9 (N–C–Me), 28.0 (Me_{Boc}), 54.8 (CH–Ar), 55.3 (OMe), 60.6 (C–N), 63.5 (CH_2–O), 80.7 (C_{Boc}), 114.2 (CH_{Ar}), 117.3 (CH_{Ar}), 119.7 (CH_{Ar}), 128.1 (C_{Ar}), 128.3 (CH_{Ar}), 128.7 (CH_{Ar}), 129.0 (C_{Ar}), 131.2 (CH_{Ar}), 155.0 (C_{Ar}–OH), 155.5 (C=O), 159.2 (C_{Ar}–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{22}H_{29}NO_5$+H^+]: 388.2118, found: 388.2122.

(2*S,3*S**,4*S**)-Ethyl 4-(*tert*-butoxycarbonylamino)-2-hydroxy-4-(2-hydroxyphenyl)-3-(4-methoxyphenyl)pentanoate (8ga).** Aminoalcohol **8ga** was obtained from nitroso acetal **6ga** (80 mg, 0.23 mmol) according to GP-3. Hydrogenation was performed over Raney nickel (~80 mg) in MeOH (2.5 mL) at 50 °C for 2 h. Column chromatography (eluent: PE, then PE/EtOAc, 10:1) afforded 59 mg (57%) of the target protected aminoalcohol **8ga** as white foam. R_f = 0.80 (PE/EtOAc, 1:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.01 (t, *J* = 7.1 Hz, 3H, CH_2CH_3), 1.26 (s, 9H, *t*-Bu), 1.77 (s, 3H, Me), 3.68 (br d, *J* = 6.6 Hz, 1H, CH–Ar), 3.79 (s, 3H, OMe), 3.79-3.95 (m, 2H, CH_2CH_3), 4.11 (br s, 1H, CH–OH), 4.59 (br s, 1H, CH–OH), 6.21 (br s, 1H, NH), 6.75 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 6.79-6.93 (m, 3H, CH_{ArOH}), 6.94 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.18 (app t, *J* = 7.0 Hz, 1H, CH_{ArOH}), 8.20 (br s, 1H, C_{Ar}–OH).



8ga

^{13}C NMR (75 MHz, DEPT, HSQC, $CDCl_3$): δ 13.7 (CH_2CH_3), 25.9 (N–C–Me), 28.0 (Me_{Boc}), 55.2 (OMe), 55.9 (CH–Ar), 61.5 (CH_2CH_3), 61.8 (C–N), 74.6 (CH–O), 80.6 (C_{Boc}), 113.3 (CH_{Ar}), 117.0 (CH_{ArOH}), 119.5 (CH_{ArOH}), 126.9 (C_{Ar}), 128.9 (CH_{ArOH}), 129.1 (C_{Ar}), 129.2 (CH_{ArOH}), 131.8 (CH_{Ar}), 155.6 (C_{Ar}–OH), 155.9 (N–C=O), 159.1 (C_{Ar}–OMe), .172.8 (O–C=O).

HRMS (ESI): *m/z* calcd. for [$C_{25}H_{33}NO_7$+Na^+]: 482.2149, found: 482.2140.

***tert*-Butyl ((2*S**,3*S**)-5-hydroxy-2-(2-hydroxy-6-methoxyphenyl)-3-(4-methoxyphenyl)-5-methylhexan-2-ylcarbamate (7ab).**

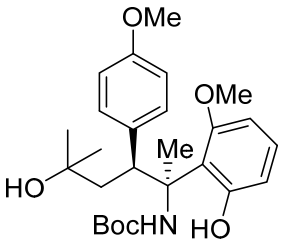
1) *Synthesis from nitroso acetal **5ab***: Aminoalcohol **7ab** was obtained from nitroso acetal **5ab** (32 mg, 0.09 mmol) according to GP-3 with the following change: 3 equiv. of Boc_2O were used. Hydrogenation was performed over Raney nickel (~30 mg) in MeOH (1.1 mL) at 50 °C for 6 h. Column chromatography (eluent: PE/EtOAc, 3:1, then 2:1, then 1:1) afforded 30 mg (72%) of the target protected aminoalcohol as colorless oil.

2) *Synthesis from tetrahydrooxazine **12ab***: A suspension of Raney nickel (~30 mg) in water was placed in a glass vial and washed with MeOH (3 × 2 mL). Then MeOH (0.6 mL) was added and resulting suspension was transferred into another vial containing the solution of tetrahydrooxazine **12ab** (32 mg, 0.09 mmol)

and Boc_2O (29 mg, 0.13 mmol, 1.5 equiv) in MeOH (0.5 mL). The vial was equipped with magnetic stir bar and placed in a steel autoclave that was then flushed and filled with hydrogen to a pressure of 30 bar. The hydrogenation was conducted at 50 °C for 2 h with intensive stirring. Then, the autoclave was cooled to rt, slowly depressurised, and the reaction mixture was filtered through Celite, and then evaporated. The residue was subjected to column chromatography on silica gel (eluent: PE/EtOAc, 5:1, then 2:1, then 1:1, then EtOAc) to give 8 mg (25% recovery of starting tetrahydrooxazine **12ab**) and 17 mg (42%) of the target protected aminoalcohol as colorless oil.

R_f = 0.70 (PE/EtOAc, 1:1, anisaldehyde).

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 0.79 (s, 3H, Me), 0.81 (s, 3H, Me), 1.23 (s, 9H, *t*-Bu), 1.62 (br s, 1H, OH), 1.76 (app d, *J* = 13.6 Hz, 1H, CH_{2a}), 1.83 (s, 3H, N–C–Me), 2.11 (dd, *J* = 14.2, 9.7 Hz, 1H, CH_{2b}), 3.41 (app d, *J* = 9.3 Hz, 1H, CH–Ar), 3.82 (s, 3H, OMe), 3.85 (s, 3H, OMe), 4.43 (br s, 1H, NH), 6.50 (dd, *J* = 8.3, 1.0 Hz, 1H, CH_{ArOH}), 6.56 (dd, *J* = 8.1, 1.1 Hz, 1H, CH_{ArOH}), 6.96 (d, *J* = 8.5 Hz, 2H, CH_{Ar}), 7.11 (t, *J* = 8.2 Hz, 1H, CH_{ArOH}), 7.32 (d, *J* = 8.5 Hz, 2H, CH_{Ar}), 8.78 (br s, 1H, C_{Ar}–OH).

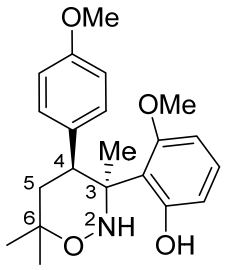


7ab

^{13}C NMR (75 MHz, HSQC, HMBC, $CDCl_3$): δ 23.2 (N–C–Me), 27.8 (Me_{Boc}), 29.0 (Me), 29.2 (Me), 44.2 (CH_2), 48.4 (CH–Ar), 55.3 (OMe), 55.9 (OMe), 63.1 (C–N), 71.2 (Me_2C–O), 80.9 (C_{Boc}), 104.4 (CH_{ArOH}), 111.2 (CH_{ArOH}), 114.5 (CH_{Ar}), 117.9 (C_{ArOH}), 128.2 (CH_{ArOH}), 131.5 (CH_{Ar}), 131.6 (C_{Ar}), 155.3 (C=O), 156.4 (C_{Ar}–OH), 159.06 and 159.10 (2×C_{Ar}–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{26}H_{37}NO_6$+Na^+]: 482.2513, found: 482.2520.

3-Methoxy-2-((3*S,4*S**)-4-(4-methoxyphenyl)-3,6,6-trimethyl-1,2-oxazinan-3-yl)phenol (12ab).** Nitroso acetal **5ab** (50 mg, 0.14 mmol) was subjected to hydrogenation (30 atm H_2) over Raney nickel (~50 mg) in MeOH (1.5 mL) at r.t. for 2 h as described in GP-3. Column chromatography (eluent: PE, then PE/EtOAc, 5:1, then 2:1, then 1:1, then 1:2, then EtOAc) gave two fractions: 32 mg (64%) of target tetrahydrooxazine **12ab** as white solid and 9 mg (14%) of aminoalcohol **7ab** as colorless oil, which solidified upon standing. R_f = 0.88 (PE/EtOAc, 3:1, UV, anisaldehyde). mp = 118-121 °C.



12ab

^{1}H NMR (300 MHz, COSY, $CDCl_3$): δ 1.28 (s, 3H, Me_a(6)), 1.45 (s, 3H, Me_b(6)), 1.47-1.58 (m, 1H, CH_{2a}(5)), 1.98 (s, 3H, Me(3)), 2.49 (app t, *J* = 13.4 Hz, 1H, CH_{2b}(5)), 3.00 (s, 3H, OMe), 3.18 (br d, *J* = 12.8 Hz, 1H, CH(4)), 3.73 (s, 3H, OMe), 5.02 (br s, 1H, NH), 5.90 (d, *J* = 8.2 Hz, 1H, CH_{ArOH}), 6.46 (dd, *J* = 8.1, 1.1 Hz, 1H, CH_{ArOH}), 6.61 (d, *J* = 8.5 Hz, 2H, CH_{Ar}), 6.84 (d, *J* = 8.5 Hz, 2H, CH_{Ar}), 6.98 (app t, *J* = 8.2 Hz, 1H, CH_{ArOH}(7)), 13.62 (br s, 1H, OH).

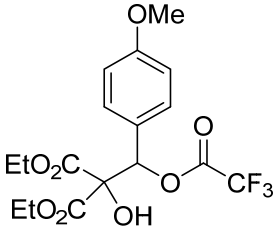
^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 25.6 (Me_a(6)), 26.9 (Me_b(6)), 28.0 (Me(3)), 39.1 (CH_2(5)), 48.7 (br, CH(4)), 54.4 (OMe), 55.3 (OMe), 68.9 (br, C(3)), 78.5 (C(6)), 101.9 (CH_{ArOH}), 110.5 (CH_{ArOH}), 112.4 (CH_{Ar}), 112.6 (C_{ArOH}), 129.0 (CH_{ArOH}), 129.9 (CH_{Ar}), 133.6 (C_{Ar}), 157.9 (C_{Ar}–OMe), 159.3 (C_{ArOH}–O), 159.4 (C_{ArOH}–O).

HRMS (ESI): *m/z* calcd. for [$C_{21}H_{27}NO_4$+H^+]: 358.2013, found: 358.2007.

Acid-mediated transformations of nitroso acetals 5 and 6

Diethyl 2-hydroxy-2-((4-methoxyphenyl)(2,2,2-trifluoroacetoxy)methyl)malonate (13). To a solution of nitrosoacetal **6aa** (40 mg, 0.094 mmol) in dichloromethane (0.75 mL) was added trifluoroacetic acid (7 µL, 11 mg, 0.094 mmol, 1 equiv.) and the reaction mixture was stirred overnight. Then, $NaHCO_3$ (~10 mg) was added, the reaction mixture was stirred for 1 min, diluted with EtOAc, filtered through a cotton wool and concentrated under reduced pressure to give 38 mg (99%) of target ester as pale yellow oil.

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.25 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.33 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 3.81 (s, 3H, OMe), 4.08 (br s, 1H, OH), 4.21 (q, *J* = 7.1 Hz, 2H, $C\underline{H}_2CH_3$), 4.29-4.40 (m, 2H, $C\underline{H}_2CH_3$), 6.65 (s, 1H, CH–O), 6.88 (d, *J* = 8.8 Hz, 2H, CH_{Ar}), 7.47 (d, *J* = 8.8 Hz, 2H, CH_{Ar}).



13

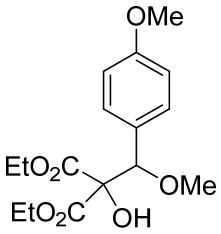
^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 13.87 ($CH_2\underline{C}H_3$), 13.90 ($CH_2\underline{C}H_3$), 55.2 (OMe), 63.4 ($O\underline{C}H_2CH_3$), 63.6 ($O\underline{C}H_2CH_3$), 78.9 (CH–O), 80.8 (C–OH), 113.8 (CH_{Ar}), 114.4 (d, *J* = 285.8 Hz, CF_3), 124.1 (C_{Ar}), 130.3 (CH_{Ar}), 156.0 (q, *J* = 43.1 Hz, $\underline{C}(O)CF_3$), 160.6 ($\underline{C}_{Ar}$–OMe), 166.9 (C=O), 167.7 (C=O).

^{19}F NMR (282 MHz, $CDCl_3$): δ -75.1.

HRMS (ESI): *m/z* calcd. for [$C_{17}H_{19}F_3O_8$+NH_4^+]: 426.1370, found: 426.1371.

Diethyl 2-hydroxy-2-(methoxy(4-methoxyphenyl)methyl)malonate (14). To a solution of nitrosoacetal **6aa** (50 mg, 0.12 mmol, 1 equiv.) in MeOH (0.94 mL) was added trifluoroacetic acid (9 µL, 13 mg, 0.12 mmol, 1 equiv.) and the reaction mixture was stirred overnight. Then, $NaHCO_3$ (~10 mg) was added, the reaction mixture was stirred for 1 min, diluted with EtOAc, filtered through a cotton wool and concentrated under reduced pressure. The residue was subjected to column chromatography on silica gel (eluent: PE/EtOAc, 4:1, then 2:1) to give 38 mg (99%) of target ether as pale yellow oil. R_f = 0.31 (PE/EtOAc, 3:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.21 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 1.36 (t, *J* = 7.1 Hz, 3H, $CH_2C\underline{H}_3$), 3.23 (s, 3H, CH–O$\underline{Me}$), 3.80 (s, 3H, C_{Ar}–O$\underline{Me}$), 3.83 (s, 1H, OH), 4.14 (q, *J* = 7.1 Hz, 2H, $C\underline{H}_2CH_3$), 4.33 (dq, *J* = 10.8, 7.1 Hz, 1H, $C\underline{H}_{2a}CH_3$), 4.42 (dq, *J* = 10.8, 7.1 Hz, 1H, $C\underline{H}_{2b}CH_3$), 5.02 (s, 1H, CH–O), 6.87 (d, *J* = 8.7 Hz, 2H, CH_{Ar}), 7.40 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).



14

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 13.9 ($CH_2\underline{C}H_3$), 14.1 ($CH_2\underline{C}H_3$), 55.2 (C_{Ar}–O$\underline{Me}$), 57.1 (CH–O$\underline{Me}$), 62.5 ($O\underline{C}H_2CH_3$), 62.9 ($O\underline{C}H_2CH_3$), 82.4 (C–OH), 83.6 (CH–O), 113.4 (CH_{Ar}), 126.7 (C_{Ar}), 130.3 (CH_{Ar}), 159.8 ($\underline{C}_{Ar}$–OMe), 167.7 (C=O), 169.1 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{16}H_{22}O_7$+NH_4^+]: 344.1704, found: 344.1712.

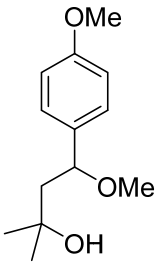
3-Methylbenzo[d]isoxazole (15a). To a solution of nitrosoacetal **6aa** (50 mg, 0.117 mmol) in $CDCl_3$ (1 mL) was added trifluoroacetic acid (9 µL, 13.3 mg, 0.117 mmol, 1 equiv.) and the reaction mixture was stirred overnight. Then, trichloroethylene (10.5 µL, 15.4 mg, 0.117 mmol, 1 equiv.) was added and the reaction mixture was analyzed by NMR, which showed the presence of trifluoroacetate **13** (ca. 80%) and volatile 3-methylbenzo[d]isoxazole **15a** (ca. 70%). ^{1}H and ^{13}C NMR signals of **15a** are in agreement with

literature data.[20] Also, the presence of 3-methylbenzo[d]isoxazole **15a** was confirmed by GC-MS analysis of the reaction mixture.

4-Methoxy-4-(4-methoxyphenyl)-2-methylbutan-2-ol (16).

Synthesis of 16 from 5aa: To a solution of nitrosoacetal **5aa** (50 mg, 0.15 mmol, 1 equiv.) in MeOH (1.23 mL) was added trifluoroacetic acid (12 µL, 18 mg, 0.15 mmol, 1 equiv.) and the reaction mixture was stirred overnight at rt. Then, $NaHCO_3$ (~10 mg) was added, the reaction mixture was stirred for 1 min, diluted with EtOAc, filtered through a cotton wool and concentrated under reduced pressure. The residue was subjected to column chromatography on silica gel (eluent: PE/EtOAc, 7:1, then 4:1) to give 34 mg (99%) of target ether **16** as pale yellow oil. R_f = 0.88 (PE/EtOAc, 3:1, UV, anisaldehyde). R_f = 0.33 (PE/EtOAc, 3:1, UV, anisaldehyde).

^{1}H NMR (300 MHz, $CDCl_3$): δ 1.22 (s, 3H, Me), 1.37 (s, 3H, Me), 1.62 (dd, *J* = 14.9, 2.7 Hz, 1H, CH_{2a}), 2.05 (dd, *J* = 14.9, 11.3 Hz, 1H, CH_{2b}), 3.20 (s, 3H, CH–O<u>Me</u>), 3.82 (s, 3H, C_{Ar}–O<u>Me</u>), 4.13 (br s, 1H, OH), 4.47 (dd, *J* = 11.3, 2.7 Hz, 1H, C<u>H</u>–OMe), 6.91 (d, *J* = 8.6 Hz, 2H, CH_{Ar}), 7.24 (d, *J* = 8.7 Hz, 2H, CH_{Ar}).



16

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$): δ 28.1 (Me), 30.9 (Me), 50.3 (CH_2), 55.3 (C_{Ar}–O<u>Me</u>), 56.0 (CH–O<u>Me</u>), 70.3 (C–OH), 81.9 (CH–O), 113.9 (CH_{Ar}), 127.7 (CH_{Ar}), 133.6 (C_{Ar}), 159.3 (<u>C</u>$_{Ar}$–OMe).

HRMS (ESI): *m/z* calcd. for [$C_{13}H_{20}O_3$+Na^+]: 247.1305, found: 247.1310.

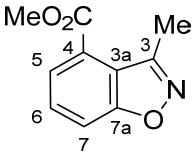
Synthesis of 16 from 5af: To a solution of nitrosoacetal **5af** (20 mg, 0.056 mmol, 1 equiv.) in MeOH (0.44 mL) was added trifluoroacetic acid (4.5 µL, 6.3 mg, 0.056 mmol, 1 equiv.) and the reaction mixture was stirred overnight at rt. Then, $NaHCO_3$ (~2 mg) was added, the reaction mixture was stirred for 1 min, diluted with EtOAc, filtered through a cotton wool and concentrated under reduced pressure. The residue was subjected to column chromatography on silica gel (eluent: PE/EtOAc, 30:1, then 5:1, then 2:1) to give 10 mg (80%) of target ether **16**. The second product, 4-chloro-3-methylbenzo[d]isoxazole **15f** (CAS RN 1784549-24-1) was detected by ^{1}H NMR and HRMS, however, its isolation was problematic due to its volatile character (R_f = 0.86 (PE/EtOAc, 10:1, UV). ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.47 – 7.32 (m, 2H, 2 CH_{Ar}), 7.27 – 7.11 (m, 1H, CH_{Ar}), 2.69 (s, 3H, CH_3). HRMS (ESI): *m/z* calcd. for [C_8H_6ClNO+H^+]: 168.0211 and 170.0181, found 168.0215 and 170.0187.).

Synthesis of 16 from 5ag: To a solution of nitrosoacetal **5ag** (8 mg, 0.021 mmol, 1 equiv.) in MeOH (0.84 mL) and CH_2Cl_2 (60 µL) was added trifluoroacetic acid (8 µL, 12 mg, 0.105 mmol, 5 equiv.) and the reaction mixture was stirred for 7 h at rt. Then, additional portion of trifluoroacetic acid (8 µL, 12 mg, 0.105 mmol, 5 equiv.) was added and the reaction mixture was stirred overnight. Then, $NaHCO_3$ (~10 mg) was added, the reaction mixture was stirred for 1 min, diluted with CH_2Cl_2, filtered through a cotton wool and concentrated under reduced pressure. The residue was subjected to column chromatography on silica gel (eluent: PE/EtOAc, 10:1, then 4:1) to give 2.5 mg (63%) of benzisoxazole **15g** and 3.2 mg (68%) of ether **16**.

Methyl 3-methylbenzo[d]isoxazole-4-carboxylate (15g). White solid. mp = 64–66 °C. R_f = 0.25 (PE/EtOAc, 10:1, UV).

^{1}H NMR (300 MHz, $CDCl_3$): δ 2.78 (s, 3H, Me(3)), 4.01 (s, 3H, CO_2Me), 7.60 (dd, *J* = 8.4, 7.4 Hz, 1H, CH_{Ar}(6)), 7.78 (dd, *J* = 8.4, 0.8 Hz, 1H, CH_{Ar}(7)), 7.96 (dd, *J* = 7.4, 0.8 Hz, 1H, CH_{Ar}(5)).

^{13}C NMR (75 MHz, HMBC, $CDCl_3$): δ 13.8 (Me(3)), 52.3 ($CO_2\underline{Me}$), 114.4 (CH_{Ar}(7)), 120.1 (C_{Ar}(3a)), 126.0 (C_{Ar}(4)), 126.3 (CH_{Ar}(5)), 129.1 (CH_{Ar}(6)), 155.3 (C(3)=N), 164.0 (C(7a)$_{Ar}$–O), 165.8 ($\underline{C}O_2Me$).

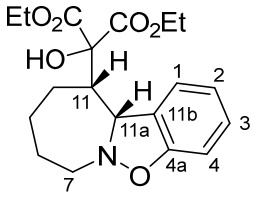


15g

HRMS (ESI): *m/z* calcd. for [$C_{10}H_9NO_3$+H^+]: 192.0655, found 192.0650.

Diethyl 2-((11*S,11a*R**)-7,8,9,10,11,11a-hexahydrobenzo[4,5]isoxazolo[2,3-a]azepin-11-yl)-2-hydroxymalonate (17).** To the stirring solution of nitroso acetal **6ea** (30 mg, 0.083 mmol) in $CHCl_3$ (0.66 mL) was added CF_3COOH (13 µL, 19 mg, 0.166 mmol, 2 equiv.) at r.t. The reaction mixture was maintained overnight. Then, $NaBH_3CN$ (16 mg, 0.25 mmol, 3 equiv.) was added. After stirring for 15 min, second portion of $NaBH_3CN$ (16 mg, 0.25 mmol, 3 equiv.) and MeOH (0.30 mL) was consecutively added. The reaction mixture was maintained overnight and transferred into EtOAc (20 mL) /$NaHCO_3$ (20 mL, sat. aq. soln). Water layer was extracted with EtOAc (3×20 mL). Combined organic layer was washed with brine (20 mL), dried (Na_2SO_4), and evaporated. The residue was subjected to column chromatography on silica gel to give 25 mg (83%) of target azepine as colorless oil that solidifies upon storage in a fridge. R_f = 0.32 (PE/EtOAc, 3:1, UV, ninhydrin).

^{1}H NMR (300 MHz, COSY, $CDCl_3$, 323 K): δ 1.07 (t, *J* = 7.0 Hz, 3H, $CH_2C\underline{H}_3$), 1.29 (t, *J* = 7.0 Hz, 3H, $CH_2C\underline{H}_3$), 1.49-2.00 (br m, 5H, $CHC\underline{H}_{2a}C\underline{H}_2C\underline{H}_2$), 2.13-2.30 (br m, 1H, $CHC\underline{H}_{2b}$), 2.96 (app t, *J* = 9.6 Hz, 1H, CH_{2a}(7)–N), 3.37-3.53 (br m, 2H, C$\underline{H}$(11)CH–N and $C\underline{H}_{2a}CH_3$), 3.59-3.70 (br m, 1H, $C\underline{H}_{2b}CH_3$), 3.73-3.79 (m, 1H, CH_{2b}(7)–N), 4.18-4.36 (m, 2H, $C\underline{H}_{2cd}CH_3$), 4.93 (app s, 1H, CH(11a)–N), 6.18 (br s, 1H, OH), 6.68 (d, *J* = 8.1 Hz, 1H, CH_{Ar}(4)), 6.86 (app t, *J* = 7.4, 1H, CH_{Ar}(2)), 7.11-7.16 (m, 2H, CH_{Ar}(1) and CH_{Ar}(3)).



Characteristic NOESY-interactions: C$\underline{H}$(11)CH–N / CH_{Ar}(1); C$\underline{H}$(11)CH–N / CH(11a)–N; CH(11a)–N / CH_{Ar}(1); CH(11a)–N / $C\underline{H}_{2a}$(7)–N.

^{13}C NMR (75 MHz, DEPT, HSQC, HMBC, $CDCl_3$, 323 K): δ 13.5 ($CH_2\underline{C}H_3$), 13.9 ($CH_2\underline{C}H_3$), 24.9 (br, CH_2), 25.6 (br, CH_2), 28.3 (br, CH_2), 39.2 (br, $\underline{C}$H(11)CH–N), 59.0 (br, CH_2(7)–N), 61.7 (br, $O\underline{C}H_2CH_3$), 62.0 ($O\underline{C}H_2CH_3$), 72.1 (br, CH(11a)–N), 83.4 (C–OH), 106.6 (CH_{Ar}(4)), 120.3 (CH_{Ar}(2)), 124.7 (br, CH_{Ar}(1) and C_{Ar}(11b)), 128.9 (CH_{Ar}(3)), 156.5 (br, C_{Ar}(4a)–O), 169.0 (C=O), 170.0 (C=O).

HRMS (ESI): *m/z* calcd. for [$C_{19}H_{25}NO_6$+H^+]: 364.1755, found: 364.1769.

Crystals for X-ray diffraction analysis were obtained by crystallization from PE – ethyl acetate 5:1 mixture at ca. 0°C. The crystallographic information for compound **17** was deposited in the Cambridge Crystallographic Data Centre (CCDC 2250121).

Elucidation of structure and relative stereochemistry of products 5 and 6

The relative configuration of cycloadducts **5** and **6** was elucidated on the basis of 2D NOESY spectra and X-ray diffraction analysis for products *trans*-**5ba**, *trans*-**5da**, *cis*-**6aa**, *cis*-**6ca**, *cis*-**6da**, *cis*-**6ia**, and for the minor isomer *cis*-**5ab** (see X-ray crystallography section). In the crystal structure of 6,5-bicyclic products *trans*-**5ba** and *trans*-**5da**, the 1,2-oxazine ring adopts a boat-like conformation (closer to a twist-boat one in **5da**) with the aryl group at C(4) and the methyl at C(4a) occupying pseudo-equatorial positions (*trans*-arrangement of substituents at C(4) and C(4a)). According to DFT calculations of possible conformations of *trans*-**5ba**, the conformer observed in the crystal structure is the most stable. The structure with a chair-like conformation of the 1,2-oxazine ring is less stable by ca. 2 kcal/mol. Calculations of hypothetic *cis*-**5ba** show the twist boat conformation of the 1,2-oxazine ring to be the most stable, yet it is separated from the chair conformation by less than 1 kcal/mol (see DFT calculations section).

The X-ray structures are consistent with the characteristic correlations observed in the ^{1}H-^{1}H NOESY spectra of *trans*-**5ba** and *trans*-**5da** and the major isomers of the majority of other 5,6-annulated products **5** (Figure S5). Here, the bridgehead substituent R showed a cross-peak to both H(4) and the substituent at the C(4) (shown in orange color) that is indicative of a (pseudo)equatorial position of R. Also, small cross-peaks between the C(4) substituent (usually, an aryl group) and the aromatic H(5) atom were observed supporting their relative *cis*-disposition. As for 4,4a-*cis*-isomers (*cis*-**5**), the bridgehead substituent R showed a cross-peak with the substituent at C(4), while the cross-peak with the H(4) hydrogen was negligible. Importantly, the substituent R showed a cross-peak with one of the H(3) hydrogens suggesting their pseudo-axial positions.

Figure S5. Characteristic 2D NOESY correlations in *trans*-**5** and *cis*-**5**

While ^{1}H-^{1}H coupling constants and ^{1}H-^{1}H NOESY spectra allowed us to establish the relative stereochemistry of carbon centers, we cannot be sure in the relative configuration of nitrogen due to

the absence of any characteristic interactions. However, DFT calculations (performed for *trans*-**5ba** and *cis*-**5ba**) predict that invertomers having *trans*-arrangement of the nitrogen lone electron pair and substituent R are less stable by ca. 6–12 kcal/mol (compared to the most stable conformations of *trans*-**5ba** and *cis*-**5ba**, see DFT calculations section). This arrangement is also confirmed by X-ray data in the crystal state. No isomerization attributed to the nitrogen inversion was observed upon moderate heating.

In the ^{1}H NMR spectra of 4-aryl-substituted 6,5-bicyclic adducts **5**, the chemical shift of the aromatic H(5) hydrogen (in the former aryne moiety) is indicative of the relative C(4)/C(4a) configuration (Figure S6). In the 4,4a-*trans*-isomers (*trans*-**5**), a strong upfield shift to 5.9–6.8 ppm due to the anisotropic effect of the aryl group at C(4) is observed. In 4,4a-*cis*-isomers (*cis*-**5**) as well as in products lacking the aryl-group at C(4) (e.g. **5da** and **5ga**), the H(5) hydrogen resonates at 7.2–7.4 ppm and is often overlapped with other aromatic protons. The same trend occurs in 5,5-annulated nitroso acetals 3,3a-*trans*-**6** bearing an aryl group at the C(3) carbon.

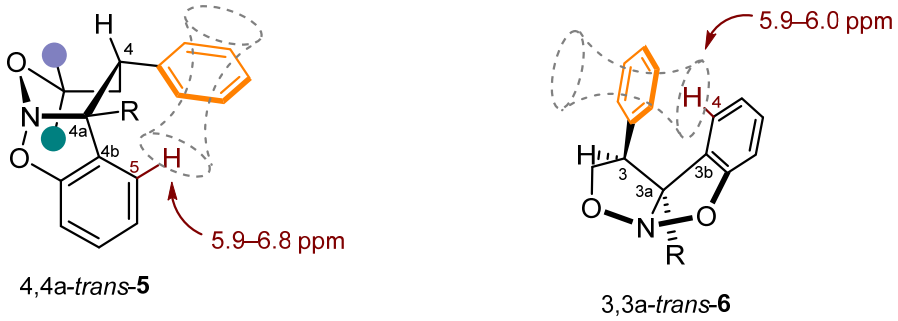


Figure S6. Anisotropic effect of the aryl group in *trans*-**5** and *trans*-**6**

X-ray crystallography

X-ray diffraction data for *trans*-**5ba** were collected at 120 K with a Bruker APEXII DUO CCD diffractometer, and those for others (*trans*-**5da**, *cis*-**6aa**, *cis*-**6ca**, *cis*-**6da**, *trans*-**6ia**, *cis*-**5ab**, and **17**), at 100 K with a Bruker Quest D8 CMOS diffractometer, using graphite monochromated Mo-Kα radiation (λ = 0.71073 Å, ω-scans). Structures were solved using Intrinsic Phasing with the ShelXT[21] structure solution program in Olex2[22] and then refined with the XL[23] refinement package using Least-Squares minimization against F^2 in the anisotropic approximation for non-hydrogen atoms. Positions of other hydrogen atoms were calculated, and they were refined in the isotropic approximation within the riding model.

General view of compounds *trans*-**5ba**, *trans*-**5da**, *cis*-**6aa**, *cis*-**6ca** and *cis*-**6da** is shown in Fig. S7. General view of compounds *trans*-**6ia**, *cis*-**5ab**, and **17** is shown in Fig. S8.

Crystal data and structure refinement parameters are given in Tables S1 and S2.

Supplementary crystallographic data is available from the CCDC with the following deposit numbers:

CCDC 2237935 *trans*-**5ba**
CCDC 2237936 *cis*-**6aa**
CCDC 2237937 *cis*-**6ca**
CCDC 2237938 *cis*-**6da**
CCDC 2240874 *trans*-**5da**
CCDC 2250118 *trans*-**6ia**
CCDC 2250122 *cis*-**5ab**
CCDC 2250121 **17**

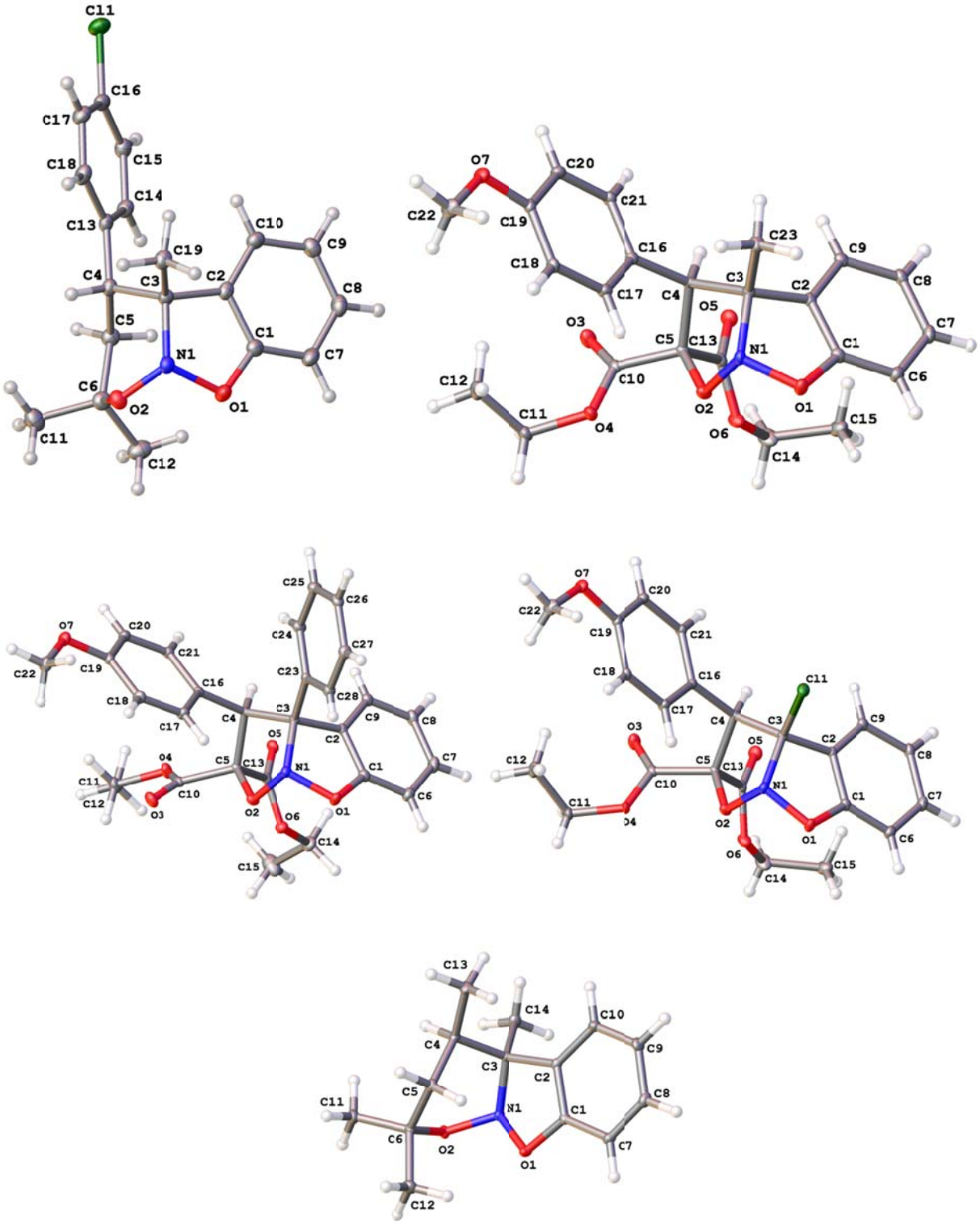


Fig. S7. General view of *trans*-**5ba** (top left), *cis*-**6aa** (top right), *cis*-**6ca** (middle left) and *cis*-**6da** (middle right) and *trans*-**5da** (bottom) in representation of atoms *via* thermal ellipsoids at 30% probability level.

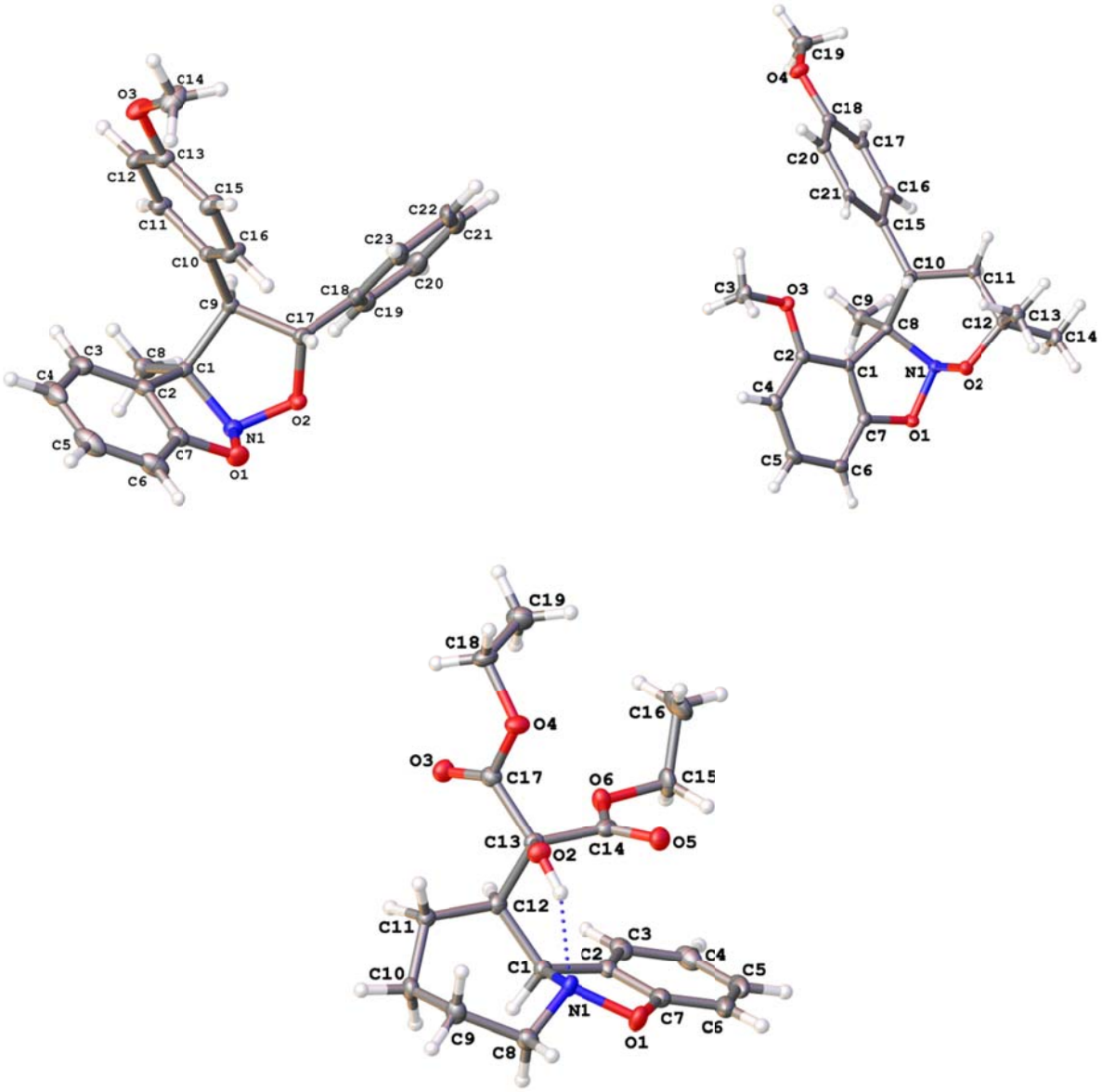


Fig. S8. General view of *trans*-**6ia** (top **l**eft), *cis*-**5ab** (top right) and **17** (bottom) in representation of atoms *via* thermal ellipsoids at 50% probability level.

Table S1. Crystal data and structure refinement parameters for *trans*-**5ba**, *trans*-**5da**, *cis*-**6aa**, *cis*-**6ca** and *cis*-**6da**.

	trans-**5ba**	*cis*-**6aa**	*cis*-**6ca**	*cis*-**6da**	*trans*-**5da**
Empirical formula	$C_{19}H_{20}ClNO_2$	$C_{23}H_{25}NO_7$	$C_{28}H_{27}NO_7$	$C_{22}H_{22}ClNO_7$	$C_{14}H_{19}NO_2$
Formula weight	329.81	427.44	489.50	447.85	233.30
T, K	120	100	100	100	100
Crystal system	Monoclinic	Triclinic	Monoclinic	Triclinic	Monoclinic
Space group	$P2_1/c$	P-1	C2/c	P-1	$P2_1/n$
Z	4	2	8	2	4
a, Å	9.4108(6)	8.2690(2)	18.0942(6)	8.2903(2)	8.3557(2)
b, Å	7.4249(5)	11.3776(3)	12.8516(4)	11.3338(3)	12.0543(3)
c, Å	23.5740(16)	12.6210(3)	20.5407(7)	12.6044(3)	12.7272(3)
α, °	90	65.3470(10)	90	65.4040(10)	90
β, °	98.9610(10)	81.305(2)	93.074(2)	81.0380(10)	98.3530(10)
γ, °	90	82.114(2)	90	82.3700(10)	90
V, $Å^3$	1627.11(19)	1063.13(5)	4769.6(3)	1060.66(5)	1268.31(5)
D_{calc} (g cm^{-1})	1.346	1.335	1.363	1.402	1.222
Linear absorption, μ (cm^{-1})	2.44	0.99	0.98	2.25	0.91
F(000)	696	452	2064	468	504
$2\theta_{max}$, °	54	54	58	58	54
Reflections measured	16452	10765	31219	13623	14324
Independent reflections	3551	4440	6335	5625	2769
Observed reflections [$I > 2\sigma(I)$]	3111	3809	4584	4899	2324
Parameters	211	284	339	283	158
R1	0.0333	0.0384	0.0491	0.0346	0.0401
wR2	0.0802	0.0981	0.1239	0.0878	0.0978
GOF	1.058	1.094	1.027	1.031	1.045
$\Delta\rho_{max}$/ $\Delta\rho_{min}$ (e $Å^{-3}$)	0.308/-0.224	0.403/-0.229	0.445/-0.273	0.462/-0.322	0.331/-0.225

Table S2. Crystal data and structure refinement parameters for *trans*-**6ia**, *cis*-**5ab** and **17**.

	trans-**6ia**	*cis*-**5ab**	**17**
Empirical formula	$C_{23}H_{21}NO_3$	$C_{21}H_{25}NO_4$	$C_{19}H_{25}NO_6$
Formula weight	359.41	355.42	363.40
T, K	100	100	100
Crystal system	Monoclinic	Monoclinic	Monoclinic
Space group	$P2_1/c$	C2/c	$P2_1/c$
Z	4	8	4
a, Å	9.3222(2)	16.0364(3)	7.6481(4)
b, Å	9.7350(2)	7.7955(2)	14.5397(9)
c, Å	20.5787(4)	29.9446(5)	16.0367(8)
α, °	90	90	90
β, °	100.0680(10)	104.0650(10)	97.315(2)
γ, °	90	90	90
V, $Å^3$	1838.79(7)	3631.20(13)	1768.78(17)
D_{calc} (g cm^{-1})	1.298	1.300	1.365
Linear absorption, μ (cm^{-1})	0.86	0.9	1.01
F(000)	760	1520	776
$2\theta_{max}$, °	58	58	58
Reflections measured	23650	17677	11391
Independent reflections	4893	4806	4500
Observed reflections [$I > 2\sigma(I)$]	4459	4044	3145
Parameters	246	240	237
R1	0.0403	0.0408	0.0511
wR2	0.1066	0.1050	0.1129
GOF	1.046	1.019	1.033
$\Delta\rho_{max}$/ $\Delta\rho_{min}$ (e $Å^{-3}$)	0.348/-0.222	0. 386/-0. 221	0.338/-0.239

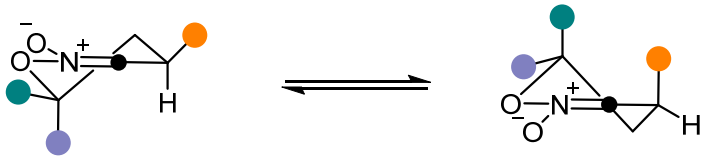
DFT calculations

DFT calculations were performed with the Gaussian 16 Rev C.01.[24] M11 DFT functional with Def2TZVP basis set was used for geometry optimization and calculations of thermodynamics. Calculations were performed in acetonitrile (SMD model), the approach of Martin and co-workers was followed.[25] Cartesian coordinates are given in angstroms; absolute energies for all substances are given in hartrees. Analysis of vibrational frequencies was performed for all optimized structures. All compounds were characterized by only real vibrational frequencies. Wavefunction stability, using stable keyword, was also checked for each molecule.

For calculations of optimized geometries, frequencies and thermodynamics following keywords were used:

 # opt freq scrf=(smd,solvent=acetonitrile) nosymm def2tzvp m11 pressure=469 scf=xqc temperature=298.15 test

Table S3. Relative thermodynamic stability of conformations **1-A** and **1-B** in nitronates **1a** and **1g**



1-A **1-B**

Nitronate	Conformation	ΔE_0 Kcal/mol	$\Delta G°_{298,15K}$ Kcal/mol
1a	**1a-A**	0	0
1a	**1a-B**	+1.43	+2.73
1g	**1g-A**	+0.65	+0.80
1g	**1g-B**	0	0

Table S4. Relative thermodynamic stability of conformations in nitroso acetal *trans*-**5ba**

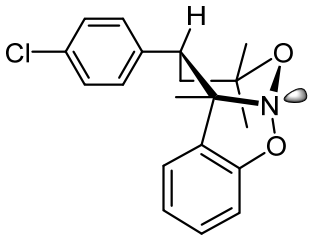
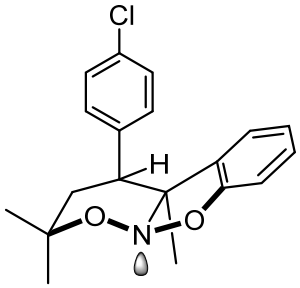
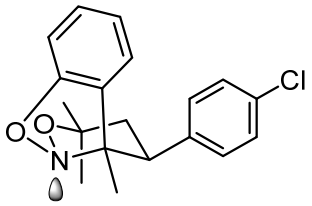
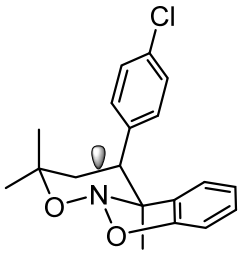
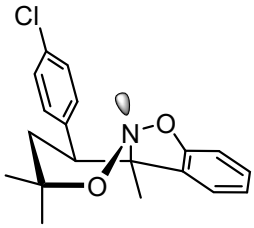
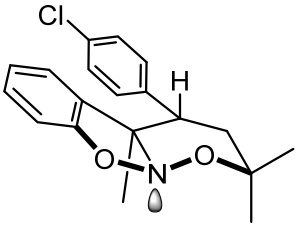
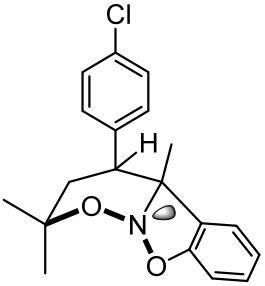
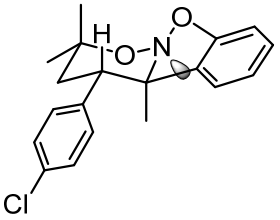
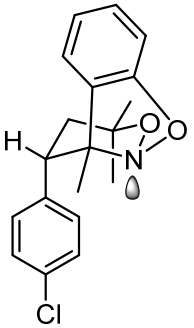
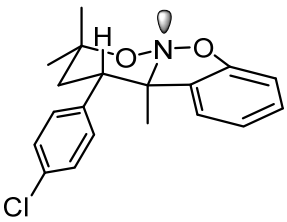
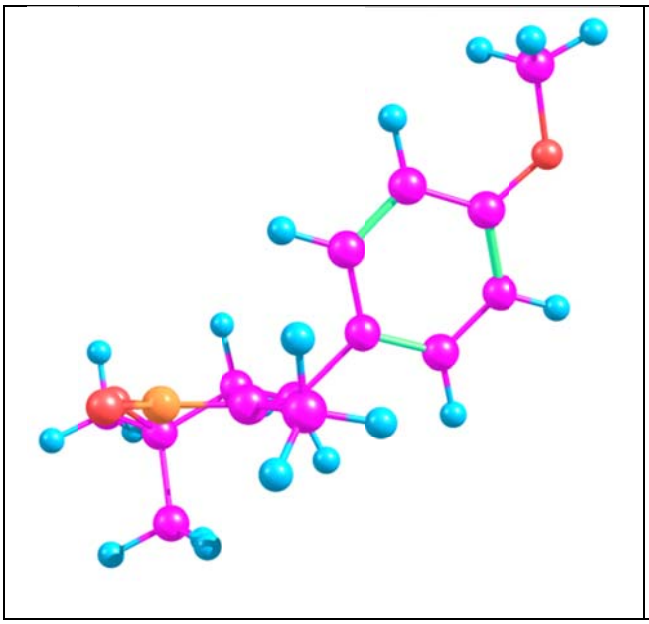
Conformation	**Structure**	**ΔE_0 Kcal/mol**	**$\Delta G^\circ_{298,15K}$ Kcal/mol**
trans-**5ba-A**		0	0
trans-**5ba-B**		+3.07	+3.33
trans-**5ba-C**		+1.73	+2.07
trans-**5ba-D**		+9.75	+9.87
trans-**5ba-E**		+12.73	+12.66

Table S5. Relative thermodynamic stability of conformations in nitroso acetal *cis*-**5ba**

Conformation	**Structure**	**ΔE_0 Kcal/mol**	**$\Delta G°_{298,15K}$ Kcal/mol**
cis-**5ba-A**		0	0
cis-**5ba-B**		+3.82	+3.23
cis-**5ba-C**		+1.33	+0.71
cis-**5ba-D**		+6.75	+6.28
cis-**5ba-E**		+7.14	+6.68

1a (conformation 1a-A)



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H	-4.62402700	-4.24203300	-3.15427300
H	-3.33517300	-4.27660400	-1.90806200
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H	-9.84620600	2.04465600	1.70534600
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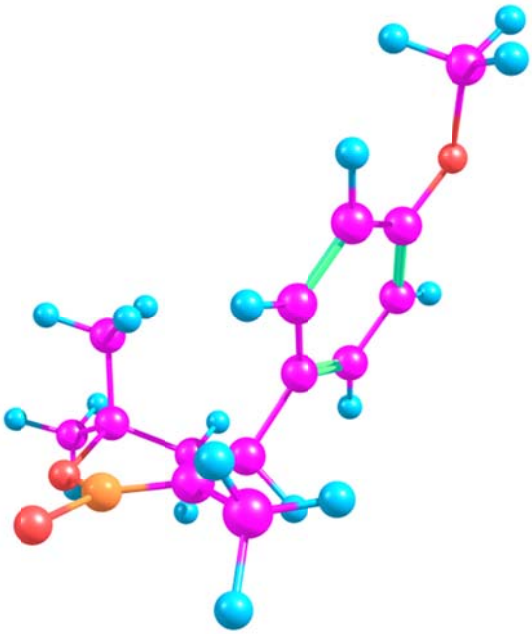
H	-9.10375800	4.14093800	-0.55595800
H	-8.63257300	2.93374200	-1.78254900
H	-9.08463300	0.35412900	-0.13507900

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-825.152297 E_0
Sum of electronic and zero-point Energies=	-824.841752 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-824.824302 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-824.823358 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-824.881205 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.310546
Number of imaginary vibrational frequencies = 0	

1a (conformation 1a-B)



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C	-6.17197100	1.16338400	1.24184000
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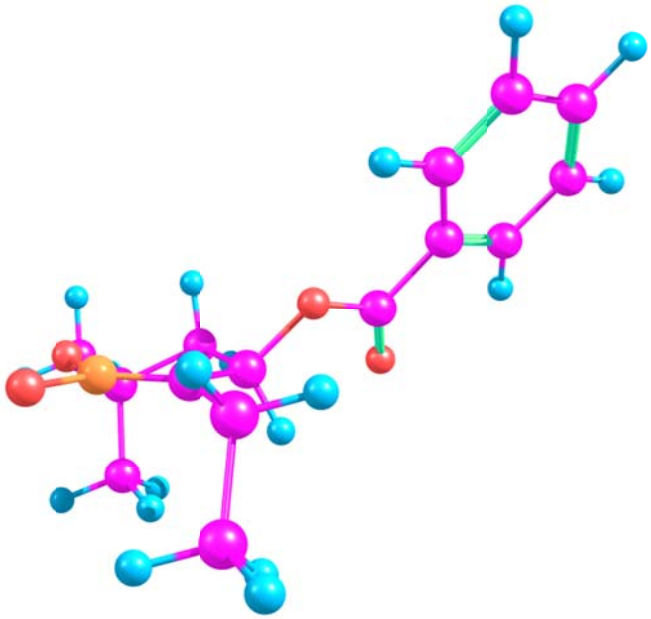
C	-5.41809300	-1.23744600	-0.22355200
O	-5.43994900	-4.72869000	-1.36399000
C	-4.15431700	-4.83649800	-1.96255200
H	-9.86877700	1.74917800	-1.85230200
H	-8.96711100	3.28039600	-1.92380800
H	-9.02499100	-0.09887100	-0.17732500
H	-7.53926400	-0.19464100	2.02415000
H	-5.01407100	1.55329200	2.98825200
H	-5.00617500	-0.14998900	2.44639800
H	-4.05671000	1.09271500	1.58141400
H	-8.47077300	-2.24410800	0.79387500
H	-7.68723000	-4.34789500	-0.24672100
H	-3.97624800	-2.44495700	-1.25513400

H	-4.75761600	-0.37221100	-0.23406300
H	-4.07268200	-5.85974900	-2.33433400
H	-4.05158300	-4.13372600	-2.79889700
H	-3.36246700	-4.65015900	-1.22617800
H	-9.10075300	1.18284100	1.04280200
H	-9.88603500	2.85354100	-0.45466000
C	-7.17440100	1.21134600	-1.84628900
H	-6.18216000	0.92658800	-1.48798600
H	-7.64182300	0.33015500	-2.29893700
H	-7.05672200	1.98248100	-2.61432700

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-825.150020 E_0
Sum of electronic and zero-point Energies=	-824.838781 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-824.821707 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-824.820763 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-824.876853 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.311239
Number of imaginary vibrational frequencies = 0	

1g (conformation 1g-A)



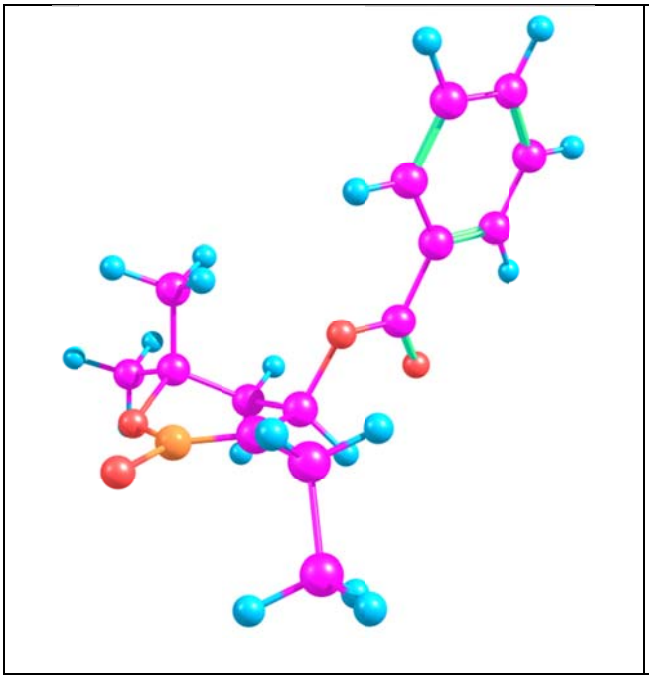
Charge 0; multiplicity 1

H	-8.69816900	3.74317800	1.85813800
H	-7.82819000	2.32656900	2.48986000
C	-8.46189700	2.17631600	0.39841900
C	-8.37900400	0.66482800	0.26585400
O	-7.21192200	2.71344400	-0.13644000
N	-6.05758100	2.25507400	0.49218100
C	-6.00218800	1.07585200	1.01646800
C	-7.18464800	0.15540300	1.04999400
C	-8.64465300	2.65038800	1.83462600
H	-8.24460400	0.41509300	-0.79269000
H	-7.44867600	-0.01166000	2.10282600
O	-5.13558000	3.09533500	0.47065500
H	-9.58106800	2.24402800	2.23039000
C	-9.52576000	2.75486200	-0.51345000
H	-10.50837400	2.39686000	-0.19051100
H	-9.51517400	3.84810800	-0.46204700
H	-9.35613000	2.44051100	-1.54791800
H	-9.29824100	0.19598000	0.62566500
C	-4.75736800	0.71330500	1.76113600
C	-4.74100100	1.39890100	3.13263700
H	-3.88489400	1.01797300	1.17557800
H	-4.73044100	-0.37382400	1.87691500
H	-3.82932900	1.14209500	3.68060300
H	-4.77915500	2.48662800	3.01392600
H	-5.60156100	1.08196100	3.73261800
O	-6.72548000	-1.10756200	0.51614600
C	-7.43016000	-2.19362900	0.85646900

O	-8.39871100	-2.14856300	1.57465500
C	-6.88808000	-3.44582400	0.25740600
C	-7.54964400	-4.63770500	0.53142200
C	-5.75682700	-3.43886700	-0.55168800
C	-7.07969200	-5.82522500	-0.00409300
H	-8.43188800	-4.61961400	1.16591500
C	-5.28944500	-4.62962600	-1.08528400
H	-5.24588400	-2.50384900	-0.76155900
C	-5.94972300	-5.82043500	-0.81235200
H	-7.59517100	-6.75830700	0.20831000
H	-4.40556700	-4.62875500	-1.71790000
H	-5.58059400	-6.75281400	-1.23298200

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-938.516370 E_0
Sum of electronic and zero-point Energies=	-938.194702 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-938.175728 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-938.174784 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-938.237178 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.321668
Number of imaginary vibrational frequencies = 0	

1g (conformation 1g-B)



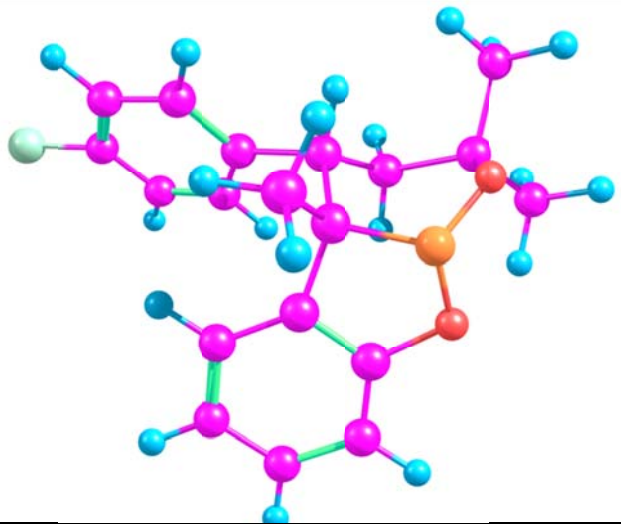
Charge 0; multiplicity 1

C	-8.80264400	2.40722000	-1.53289800
C	-7.75475100	1.63844200	-0.75076400
C	-8.39683900	0.76186100	0.31387900
O	-7.01270500	2.68017100	-0.04532700
N	-6.07212800	2.23509300	0.87617500
C	-6.17642000	1.08360400	1.45508700
C	-7.33993200	0.17205100	1.22392400
O	-5.17453000	3.07709500	1.07852000
H	-9.40950400	1.70030000	-2.10772500
H	-8.32245100	3.10316900	-2.22777800
H	-8.98258000	-0.03772700	-0.14870700
H	-7.76844800	-0.09270500	2.19681500
H	-9.07505900	1.37974900	0.91235500
H	-9.45582200	2.96594100	-0.85549900
C	-6.80956500	0.89287800	-1.68487100
H	-5.94748200	0.47566900	-1.15688200
H	-7.34670600	0.06676400	-2.16281000
H	-6.45101600	1.57614700	-2.46102900
C	-5.12515300	0.71350300	2.45146600
C	-5.36167000	1.41017900	3.79587100
H	-4.14470100	0.99278800	2.05272700
H	-5.14726100	-0.37359500	2.57756100
H	-4.58018500	1.13604100	4.51112700
H	-5.34889400	2.49709300	3.66823900
H	-6.32947900	1.11902700	4.21838500
O	-6.78325000	-1.04308300	0.65605100
C	-7.49970700	-2.16224200	0.81125700

O	-8.54118600	-2.19834700	1.42021700
C	-6.87279200	-3.34312800	0.15248000
C	-7.48871500	-4.57979600	0.30865100
C	-5.71166200	-3.22528100	-0.60413000
C	-6.94069200	-5.70249400	-0.28888300
H	-8.39661900	-4.64719500	0.90233100
C	-5.16799400	-4.35100100	-1.20289600
H	-5.23828200	-2.25480200	-0.72352700
C	-5.78053200	-5.58724800	-1.04450300
H	-7.41873100	-6.67094800	-0.16639000
H	-4.26137300	-4.26389400	-1.79604900
H	-5.35029100	-6.46853800	-1.51437600

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-938.517407 E_0
Sum of electronic and zero-point Energies=	-938.195781 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-938.176841 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-938.175897 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-938.238453 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.321627
Number of imaginary vibrational frequencies = 0	

***trans*-5ba-A**



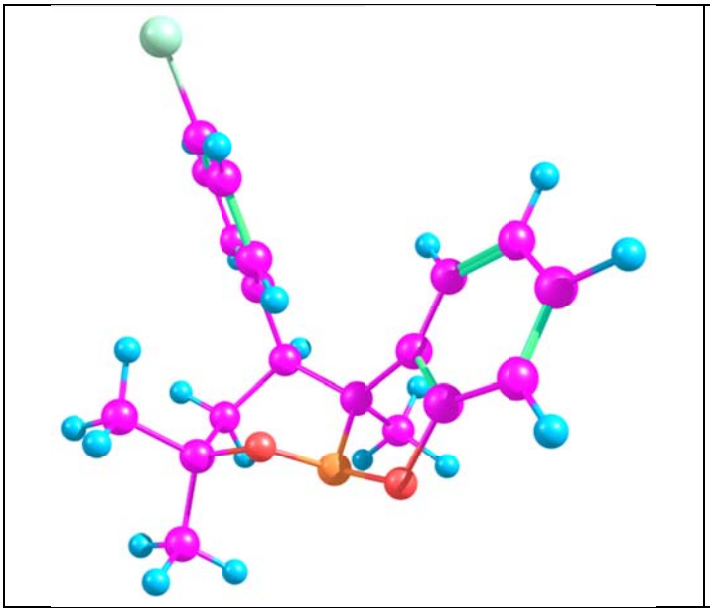
Charge 0; multiplicity 1

O	2.93581700	-0.94189500	0.00986600
O	3.03713400	1.25312800	0.62758900
C	1.04010900	-0.00880200	1.14308400
N	2.55069600	0.04687900	1.02918300
C	0.68794000	0.13004100	2.61564800
H	1.20103100	-0.63898500	3.20009300
H	0.98301100	1.11920500	2.98367400
H	-0.39206800	0.01164600	2.75311400
C	0.39708500	1.12090700	0.28939300
H	0.50500400	2.03937900	0.87873100
C	2.59640800	1.79671900	-0.67199100
C	1.20173200	1.26796300	-0.99837600
H	1.27466900	0.30350400	-1.51555400
H	0.71191100	1.96895600	-1.68292900
C	-1.08135100	0.89719500	0.07151400
C	-1.99898000	1.36283900	1.00957300
C	-1.56169700	0.21430800	-1.04281700
C	-3.35935000	1.14198800	0.85858100
H	-1.64238900	1.91576400	1.87688500
C	-2.91869500	-0.01340200	-1.21383500
H	-0.87027900	-0.16018000	-1.79418200
C	-3.80275000	0.44961100	-0.25488600
H	-4.06875300	1.50941100	1.59486500
H	-3.28635900	-0.54855000	-2.08498200
C	3.61637800	1.43219600	-1.74111400
H	4.61046100	1.78766000	-1.44882800
H	3.65410800	0.35309600	-1.90247400
H	3.33806400	1.92167300	-2.68166100
C	2.59415200	3.30212800	-0.44837400
H	1.84077200	3.59813800	0.28830600

H	3.57746600	3.62527900	-0.09071000
H	2.38299700	3.81183500	-1.39393500
Cl	-5.51200500	0.16350700	-0.45856000
C	1.91178200	-1.82839800	-0.05696700
C	0.77725300	-1.38520900	0.59811100
C	1.96938300	-3.05274200	-0.69698700
C	-0.34713600	-2.18501400	0.65497600
C	0.82642600	-3.84450400	-0.64777300
H	2.87174700	-3.37889000	-1.20587700
C	-0.31710300	-3.42671200	0.02515500
H	-1.23865700	-1.84619500	1.18073100
H	0.83586600	-4.81543200	-1.13732900
H	-1.19003400	-4.07276300	0.05992200

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.229769 E_0
Sum of electronic and zero-point Energies=	-1400.879028 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.859471 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.858526 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.920543 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.350741
Number of imaginary vibrational frequencies = 0	

***trans*-5ba-B**



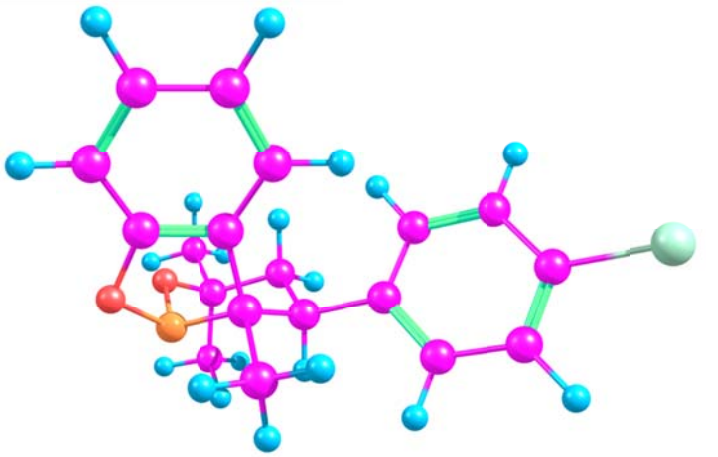
Charge 0; multiplicity 1

O	-2.89637000	0.89934200	-0.80633200
O	-1.69862700	-0.96034300	-1.03341200
C	-1.58582400	0.22963100	1.00299400
N	-2.49865400	-0.25109900	-0.09731000
C	-2.47276700	0.44922700	2.22937300
H	-2.85725700	-0.50959000	2.59393500
H	-1.88768600	0.92609300	3.02211900
H	-3.31812300	1.09817100	1.97658000
C	-0.52765300	-0.86546900	1.30022200
H	-0.41051600	-0.86649200	2.38888600
C	-1.55775500	-2.31986600	-0.54603200
C	-1.13570300	-2.23700200	0.93569800
H	-0.42114000	-3.03353000	1.16854800
H	-2.01764900	-2.38931300	1.56943800
C	0.87714800	-0.67378200	0.74754400
C	1.93673700	-1.07520700	1.55850500
C	1.17875500	-0.15770100	-0.51147500
C	3.25582200	-0.97427100	1.14197600
H	1.72688600	-1.47751400	2.54835500
C	2.49086100	-0.04220500	-0.94420600
H	0.37854400	0.14565400	-1.17861000
C	3.51747800	-0.45274000	-0.11129300
H	4.06977800	-1.29165500	1.78778900
H	2.71390700	0.36218600	-1.92773100
C	-0.49252000	-2.95253800	-1.42749500
H	-0.77634900	-2.85804400	-2.48140600
H	0.48593400	-2.49041400	-1.27860600
H	-0.41550100	-4.01720300	-1.18337200
C	-2.87771000	-3.06309400	-0.70472700

H	-3.67672100	-2.55247300	-0.15938800
H	-3.14910800	-3.13071300	-1.76389700
H	-2.77549400	-4.07790800	-0.30437200
Cl	5.17002400	-0.30773600	-0.65374500
C	-1.95610900	1.88086900	-0.58466400
C	-1.12201500	1.55884000	0.46544700
C	-1.87088800	3.06721900	-1.28143100
C	-0.14805700	2.44966900	0.86794200
C	-0.87863500	3.95664700	-0.87629900
H	-2.54383200	3.29163800	-2.10391100
C	-0.02806600	3.65701400	0.18250300
H	0.51478700	2.21155300	1.69754400
H	-0.76986000	4.90249800	-1.40129800
H	0.73615000	4.37096800	0.47763600

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.224873 E_0
Sum of electronic and zero-point Energies=	-1400.873827 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.854406 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.853462 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.915230 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.351046
Number of imaginary vibrational frequencies = 0	

***trans*-5ba-C**



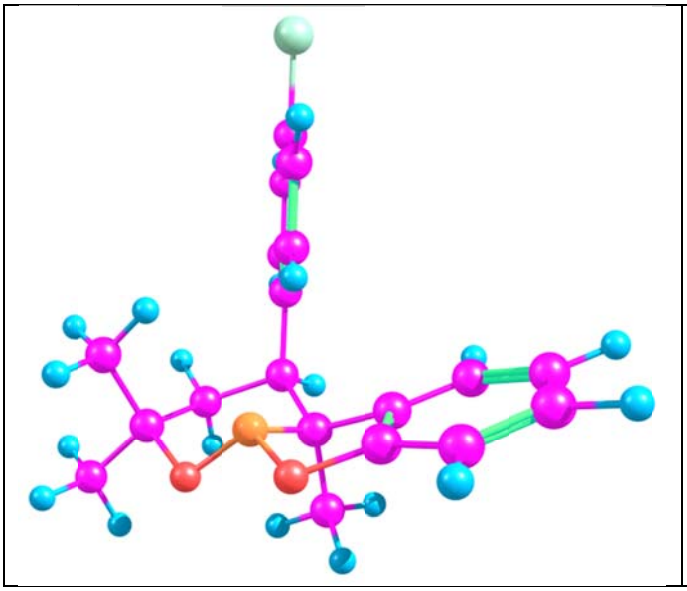
Charge 0; multiplicity 1

O	3.13885500	-0.68195700	1.14293300
O	2.84250200	0.96289500	-0.25371600
C	0.96421500	0.02317300	0.91932900
N	2.38882800	0.50854300	1.02369900
C	0.53758700	-0.31217900	2.35189800
H	0.47288400	0.60156600	2.95235600
H	-0.43811200	-0.80553100	2.34078700
H	1.25990300	-0.99218900	2.81310100
C	0.09109600	1.15697600	0.33481000
H	0.10649800	1.93882600	1.10409500
C	2.15037500	2.14515800	-0.70490900
C	0.70018200	1.73285400	-0.93776300
H	0.70187300	0.98024300	-1.73591300
H	0.10990500	2.59136500	-1.27802700
C	-1.36701500	0.76113900	0.17316100
C	-2.23693800	0.88177300	1.25559300
C	-1.88668500	0.31982800	-1.04028900
C	-3.57739900	0.54847000	1.14812600
H	-1.85896600	1.25478600	2.20546400
C	-3.22612900	-0.01849200	-1.16896300
H	-1.24491000	0.22817200	-1.91247400
C	-4.05660300	0.09572300	-0.06904600
H	-4.24565700	0.64740800	1.99894300
H	-3.62059200	-0.36425800	-2.12028500
C	2.82667500	2.49174900	-2.02074500
H	3.88038100	2.73804700	-1.85379600
H	2.76299800	1.64772800	-2.71535600
H	2.32993300	3.35742100	-2.47117500
C	2.31466400	3.28706800	0.29253200
H	1.89443000	3.05250500	1.27377400
H	3.37963400	3.50855800	0.42007200
H	1.81646500	4.18212400	-0.09518900
Cl	-5.74314900	-0.32335500	-0.22209500

C	2.48018600	-1.63868400	0.39631400
C	1.16335600	-1.27484100	0.15892700
C	3.03133600	-2.82655800	-0.02136700
C	0.33746600	-2.14731200	-0.52001800
C	2.19277500	-3.68899700	-0.72750300
H	4.06797900	-3.07410300	0.18816800
C	0.86912700	-3.35651600	-0.97507200
H	-0.70998100	-1.91768700	-0.68888700
H	2.58695700	-4.63655500	-1.08639200
H	0.23318800	-4.04805300	-1.52137100

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.227013 E_0
Sum of electronic and zero-point Energies=	-1400.875862 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.856366 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.855422 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.917250 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.351151
Number of imaginary vibrational frequencies = 0	

***trans*-5ba-D**



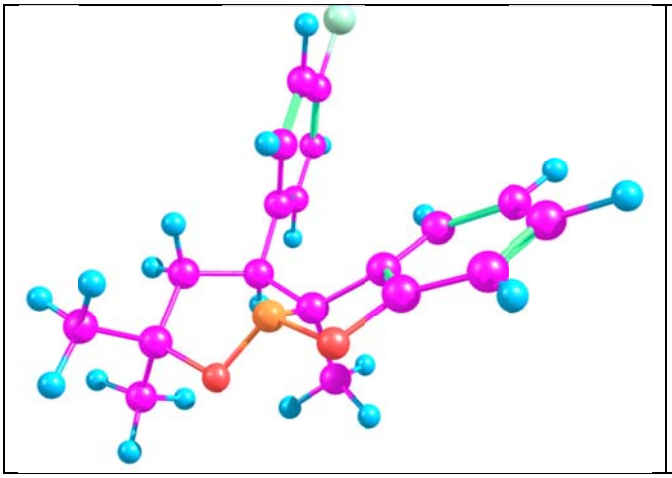
Charge 0; multiplicity 1

O	-2.56808000	0.71925000	-1.21017700
O	-2.48335700	-1.48317700	-0.64534800
C	-1.46893800	0.11307900	0.74291100
N	-1.73250400	-0.31528300	-0.65606100
C	-2.70105300	-0.01487500	1.65140000
H	-3.55753200	0.49348900	1.19693800
H	-2.97432400	-1.05549000	1.83560400
H	-2.47552400	0.46986000	2.60676200
C	-0.34106600	-0.81039700	1.21584000
H	-0.26482300	-0.69287200	2.30307100
C	-1.53531100	-2.56198700	-0.36220600
C	-0.81401600	-2.27630000	0.97532600
H	0.04839400	-2.94798700	1.04488200
H	-1.49384600	-2.55083900	1.78760300
C	1.05330600	-0.54533800	0.66899700
C	2.12366300	-1.04678100	1.41042400
C	1.33997300	0.14310900	-0.50642200
C	3.43642300	-0.87549100	1.00519100
H	1.92135100	-1.58503200	2.33547200
C	2.65025900	0.32901100	-0.92759900
H	0.53706800	0.53500700	-1.12213000
C	3.68497700	-0.18267900	-0.16738500
H	4.25823100	-1.27039400	1.59595400
H	2.86185600	0.86841600	-1.84678300
C	-0.57127200	-2.72333800	-1.53122200
H	-1.13752900	-2.87165300	-2.45719700
H	0.07847600	-1.85408800	-1.64890800
H	0.05416800	-3.60617800	-1.36010900
C	-2.41328800	-3.79258600	-0.22189000
H	-3.16588900	-3.63662200	0.55833300

H	-2.91815800	-4.00931700	-1.16927900
H	-1.79584900	-4.65435800	0.05190800
Cl	5.33288800	0.04938600	-0.69320800
C	-2.01363400	1.85528500	-0.67295700
C	-1.26129300	1.58129800	0.46469300
C	-2.16709100	3.12868600	-1.17438400
C	-0.63048400	2.60219200	1.13949600
C	-1.52244600	4.15575300	-0.48541800
H	-2.75665400	3.31881600	-2.06668200
C	-0.76057200	3.90200700	0.64789700
H	-0.04379900	2.39901700	2.03332900
H	-1.61441500	5.17509600	-0.85236300
H	-0.26301600	4.72325400	1.15668600

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.214236 E_0
Sum of electronic and zero-point Energies=	-1400.863358 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.843787 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.842842 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.904812 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.350878
Number of imaginary vibrational frequencies = 0	

***trans*-5ba-E**



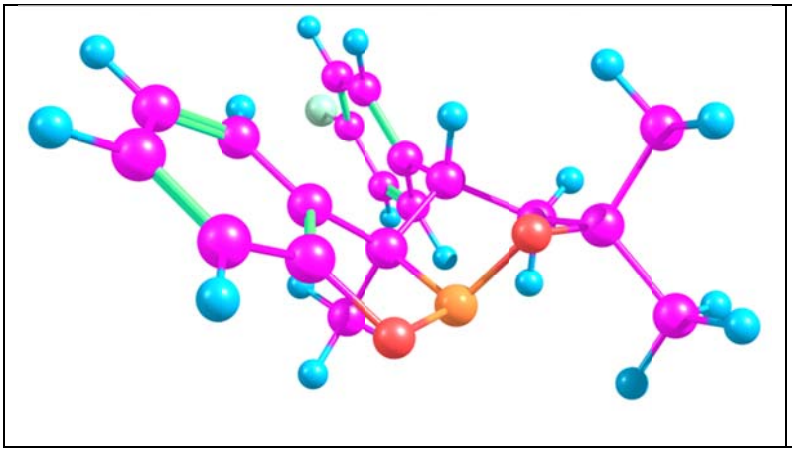
Charge 0; multiplicity 1

O	-2.57007700	1.61816000	-0.61957400
O	-3.20850200	-0.52579300	-0.18018000
C	-1.20506100	0.27373800	0.68899300
N	-2.10968500	0.26399800	-0.49301300
C	-1.95634400	0.46379900	2.01331100
H	-2.59741100	1.35055500	1.97531500
H	-2.56793400	-0.40863000	2.25228900
H	-1.21287800	0.60200900	2.80582200
C	-0.51573600	-1.12289100	0.65710300
H	-0.63200000	-1.55067000	1.65775700
C	-2.78573100	-1.92029000	-0.39627200
C	-1.24537800	-2.03391200	-0.36147100
H	-0.86476100	-1.81288500	-1.36255200
H	-0.99541100	-3.07821200	-0.14391800
C	0.96467400	-1.06538900	0.35562300
C	1.89729500	-1.44325000	1.31337900
C	1.42272800	-0.59993000	-0.87562900
C	3.26047500	-1.35948800	1.06126300
H	1.55556300	-1.80681000	2.28054600
C	2.77720700	-0.50733000	-1.14578600
H	0.70729500	-0.28458700	-1.63391800
C	3.68294800	-0.88947300	-0.16807100
H	3.98501700	-1.65638700	1.81431400
H	3.13068200	-0.13844800	-2.10459100
C	-3.30173400	-2.35005900	-1.75979300
H	-2.96195300	-3.36635000	-1.98891000
H	-4.39668900	-2.33200500	-1.77612200
H	-2.92027700	-1.67103300	-2.53049700
C	-3.43607900	-2.71419800	0.72408300
H	-4.50446700	-2.48048100	0.78138100
H	-3.32430900	-3.78486900	0.52333100
H	-2.97068200	-2.49128400	1.68976900
Cl	5.39263000	-0.77524500	-0.49917300

C	-1.43008100	2.33039200	-0.33843900
C	-0.50346000	1.57587900	0.37589400
C	-1.21205000	3.64258300	-0.69665200
C	0.68906900	2.14922300	0.76573100
C	0.00015200	4.20654000	-0.30453200
H	-1.95216000	4.20473200	-1.25880300
C	0.93972200	3.47457300	0.41084000
H	1.42063200	1.58008800	1.33591600
H	0.21316300	5.23899700	-0.57054600
H	1.87869200	3.93998300	0.69838600

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.209477 E_0
Sum of electronic and zero-point Energies=	-1400.858557 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.839018 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.838074 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.900375 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.350920
Number of imaginary vibrational frequencies = 0	

cis-**5ba-A**



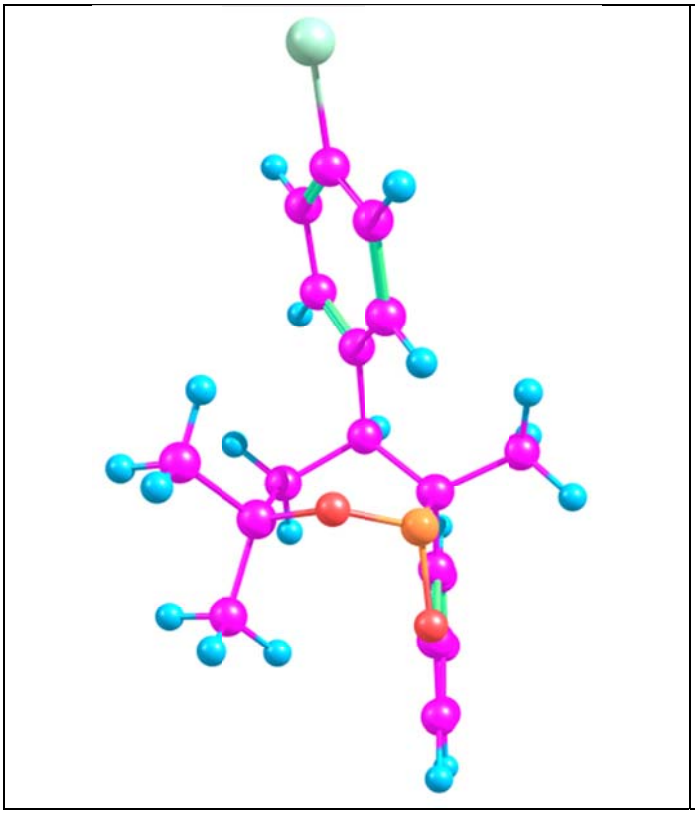
Charge 0; multiplicity 1

O	3.21860100	-0.38725800	-1.01224800
O	2.58690000	1.19921400	0.40211500
C	0.93288400	-0.09385500	-0.67774500
N	2.25234300	0.62435200	-0.85320300
C	0.35235700	-0.25812600	-2.07864000
H	1.09737600	-0.72955700	-2.72869700
H	-0.53593800	-0.89584700	-2.04870900
H	0.08396600	0.71542600	-2.50220900
C	0.06557700	0.76785500	0.28160300
H	0.36076800	0.49831900	1.30135300
C	1.88744500	2.46650000	0.51313400
C	0.43486700	2.23795400	0.05293600
H	0.33510000	2.48602500	-1.01102700
H	-0.23814400	2.89525700	0.61329500
C	-1.41932600	0.49842600	0.16358900
C	-2.04544400	-0.34353800	1.07772300
C	-2.19883100	1.09866800	-0.82348800
C	-3.40553500	-0.60669000	1.00446800
H	-1.45872800	-0.79762800	1.87398200
C	-3.55895000	0.84893000	-0.91333100
H	-1.74337600	1.77951100	-1.53863900
C	-4.14658600	-0.00823700	0.00194700
H	-3.88510800	-1.26473900	1.72368000
H	-4.15988000	1.32036200	-1.68604300
C	2.58846100	3.51937000	-0.32987600
H	3.60467400	3.69102100	0.04089400
H	2.63624400	3.19847200	-1.37527700
H	2.03262300	4.46239300	-0.28002000
C	1.95576000	2.80066700	1.99330200
H	1.40695200	2.06052900	2.58572300
H	2.99842200	2.81711200	2.32769700
H	1.51619100	3.78809100	2.16686500
Cl	-5.85857900	-0.32749200	-0.10375200
C	2.74281500	-1.52024600	-0.38872300

C	1.38789800	-1.42706500	-0.13470400
C	3.49482600	-2.63523300	-0.09366100
C	0.72647600	-2.49321100	0.43955500
C	2.82066000	-3.70257200	0.49683000
H	4.55844900	-2.67540400	-0.31006500
C	1.45878700	-3.63624500	0.76188700
H	-0.34369700	-2.45279000	0.62541500
H	3.37522200	-4.60192900	0.75325800
H	0.95748100	-4.48501100	1.21928700

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.229975 E_0
Sum of electronic and zero-point Energies=	-1400.878451 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.859134 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.858190 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.919460 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.351525
Number of imaginary vibrational frequencies = 0	

cis-**5ba-B**



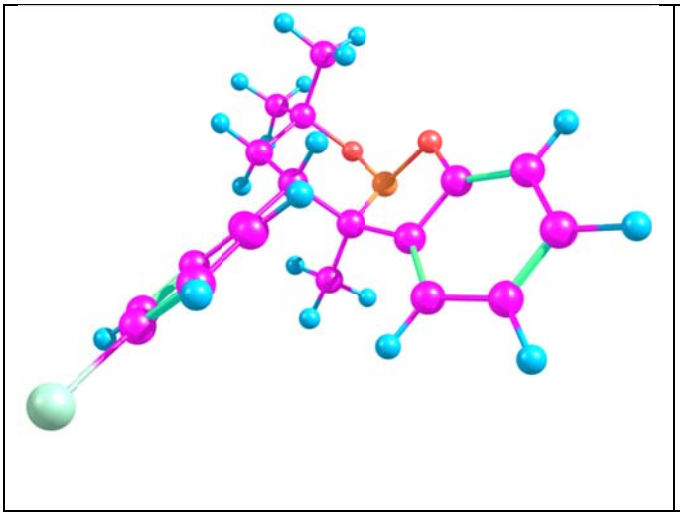
Charge 0; multiplicity 1

O	2.46450100	0.73227000	-1.58036600
O	0.46645600	1.56635200	-0.84647600
C	0.95746100	-0.78983000	-0.53845900
N	1.04968100	0.45193600	-1.39900800
C	0.56994500	-1.96822000	-1.42983900
H	0.58469200	-2.88519300	-0.82953200
H	-0.42421700	-1.84570700	-1.86393600
H	1.29817200	-2.07327200	-2.24072600
C	0.00615700	-0.56560300	0.64470200
H	0.12825900	-1.45159400	1.28030900
C	0.63761300	1.90157700	0.57205000
C	0.50549300	0.64329500	1.44908800
H	-0.18353400	0.84720500	2.27492500
H	1.47615900	0.39267600	1.88827500
C	-1.47880600	-0.46398700	0.33083900
C	-2.36458800	-0.74840400	1.36893800
C	-2.00856100	-0.06532600	-0.89279600
C	-3.73576700	-0.63976700	1.20597600
H	-1.96895100	-1.06159000	2.33415400
C	-3.37983900	0.04329300	-1.07803400
H	-1.35235700	0.17806100	-1.72303500
C	-4.22923200	-0.24323500	-0.02489600
H	-4.41393400	-0.86399600	2.02452000
H	-3.78367000	0.35341100	-2.03783000
C	-0.52411700	2.85840700	0.80797700

H	-0.46093200	3.70781600	0.11936300
H	-1.47985700	2.34524200	0.65610600
H	-0.48356400	3.23356000	1.83561100
C	1.96039400	2.62288700	0.79742400
H	2.81882000	1.95591600	0.68581300
H	2.05852000	3.45853200	0.09630800
H	1.97447300	3.02036100	1.81887300
Cl	-5.95409600	-0.10729600	-0.25263900
C	3.17699200	-0.07196500	-0.74391300
C	2.38104000	-0.97306500	-0.07031500
C	4.54768300	-0.01714200	-0.57383000
C	2.94039000	-1.86653200	0.82029700
C	5.10654800	-0.92135900	0.32425700
H	5.15426800	0.70243800	-1.11622200
C	4.31885000	-1.83528400	1.01695900
H	2.31553200	-2.58104000	1.35387400
H	6.18159400	-0.90825100	0.48668100
H	4.78238900	-2.53001400	1.71203200

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.223887 E_0
Sum of electronic and zero-point Energies=	-1400.873075 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.853623 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.852679 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.914306 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.350812
Number of imaginary vibrational frequencies = 0	

cis-**5ba-C**



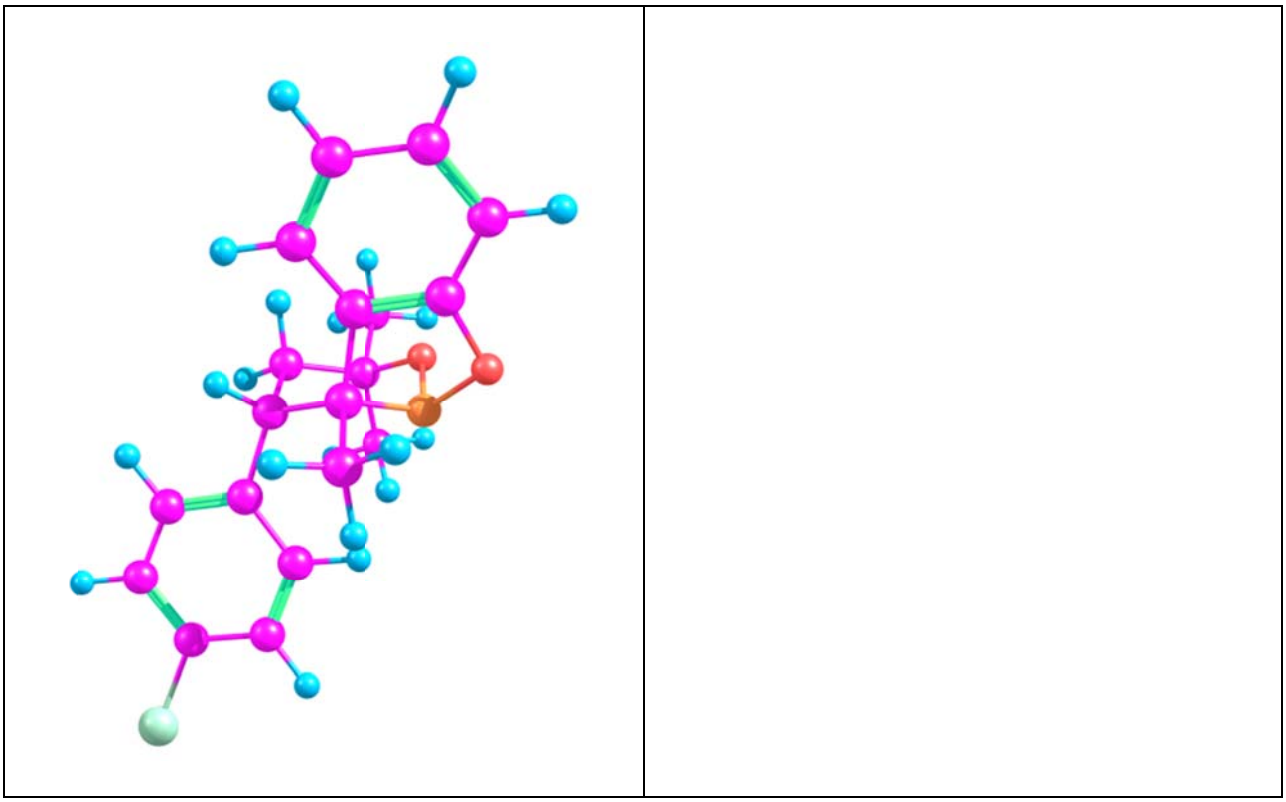
Charge 0; multiplicity 1

O	2.93506000	0.83123500	-0.26319800
O	3.01249200	-1.29065100	0.63716800
C	1.02252200	0.08322600	0.87970500
N	2.51636500	-0.05046700	0.85591800
C	0.53499100	-0.30528400	2.26320500
H	1.12162800	0.22439900	3.01912700
H	-0.51670100	-0.02758300	2.38008700
H	0.63130400	-1.38278700	2.43271500
C	0.37784500	-0.72415200	-0.28361900
H	0.70076300	-0.23356700	-1.20913900
C	2.44274500	-2.14641900	-0.41475500
C	0.92530400	-2.14792100	-0.28084000
H	0.65835500	-2.66883000	0.64568300
H	0.49739700	-2.71435900	-1.11608100
C	-1.13167000	-0.64582000	-0.25527500
C	-1.78381900	0.31903700	-1.01879100
C	-1.90209000	-1.50850900	0.52116100
C	-3.16569100	0.43300800	-1.01028100
H	-1.19648300	0.99454000	-1.63851400
C	-3.28489200	-1.41069700	0.54231700
H	-1.42266100	-2.27268800	1.12854600
C	-3.90097900	-0.43697400	-0.22503100
H	-3.66663900	1.18665500	-1.61134900
H	-3.88034500	-2.08680500	1.14952600
C	3.01521100	-3.51278900	-0.07648600
H	4.10758500	-3.49782800	-0.15311900
H	2.73232900	-3.80362200	0.94024100
H	2.62464300	-4.25584600	-0.77937300
C	2.92695300	-1.70848300	-1.79272000
H	2.48032400	-0.77023800	-2.12574700
H	4.01500300	-1.58696300	-1.77706600

H	2.67564500	-2.49270900	-2.51564300
C	2.08033600	1.88365700	-0.15428700
C	2.28096200	3.14266100	-0.68207200
C	0.94056100	1.55407500	0.56750700
C	1.28142600	4.08757700	-0.45521700
H	3.18000700	3.38345900	-1.24212500
C	-0.03695700	2.49660500	0.79805300
C	0.14304700	3.77951700	0.27944500
H	1.40547400	5.09149500	-0.85431400
H	-0.93034200	2.24139900	1.36533800
H	-0.61178700	4.54243600	0.44962600
Cl	-5.64110800	-0.30937100	-0.20758200

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.227854 E_0
Sum of electronic and zero-point Energies=	-1400.876989 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.857426 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.856482 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.918335 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.350865
Number of imaginary vibrational frequencies = 0	

cis-**5ba-D**



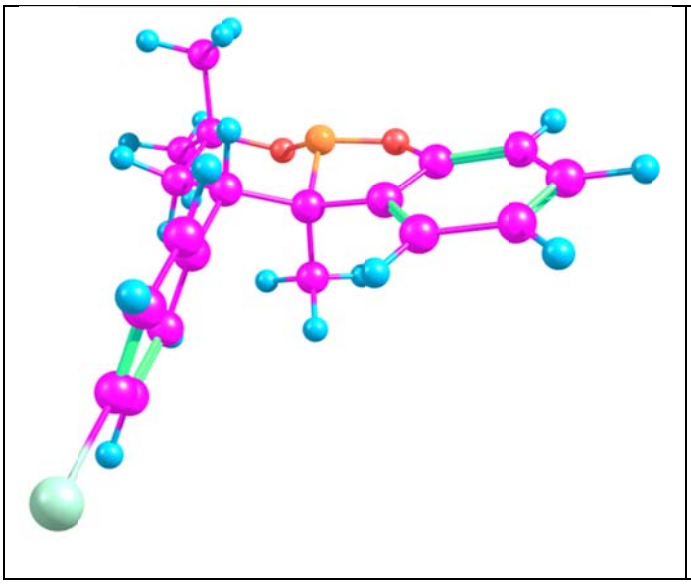
Charge 0; multiplicity 1

O	2.45641700	0.08855900	-1.87321600
O	1.64189700	1.64173900	-0.58291000
C	0.96856500	-0.63849600	-0.29867600
N	1.21947700	0.46356900	-1.28884400
C	0.53786700	-1.89310900	-1.07147700
H	1.35790300	-2.25413000	-1.69815700
H	0.29020900	-2.67454900	-0.34470300
H	-0.32976300	-1.71919500	-1.70728800
C	-0.03103000	-0.22923300	0.79028800
H	0.12861000	-0.96437100	1.58933700
C	0.65869100	2.19792300	0.31480000
C	0.34418100	1.14086900	1.37380400
H	-0.45282300	1.50032800	2.03330900
H	1.24920500	1.01467700	1.98043200
C	-1.51317700	-0.32738700	0.45114000
C	-2.38636000	-0.56330700	1.51243800
C	-2.06072800	-0.16519900	-0.81750100
C	-3.75701300	-0.63616200	1.32730200
H	-1.98036900	-0.69552200	2.51430800
C	-3.43052500	-0.23805500	-1.02666900
H	-1.41837200	0.02827700	-1.67185300
C	-4.26532600	-0.47318300	0.05033900
H	-4.42310400	-0.82316900	2.16486200
H	-3.84355200	-0.11095600	-2.02344100
C	-0.54410800	2.71842900	-0.46747200

H	-0.25793600	3.62620700	-1.00952200
H	-0.90228400	1.99275400	-1.19627200
H	-1.36451800	2.96352800	0.21601100
C	1.38742700	3.36360700	0.96887600
H	2.27596600	3.01118200	1.50243300
H	1.68957300	4.09340500	0.21092800
H	0.71738200	3.85588000	1.68210700
Cl	-5.98853100	-0.57021600	-0.20511500
C	3.20219000	-0.48494200	-0.85770000
C	2.38520800	-0.89085800	0.18337600
C	4.56368600	-0.66517200	-0.85970400
C	2.92794600	-1.49309300	1.29372100
C	5.11095200	-1.27721800	0.27121300
H	5.18126200	-0.33971000	-1.69190000
C	4.31356800	-1.67784000	1.33338700
H	2.29715400	-1.82161300	2.11786700
H	6.18594500	-1.43289400	0.31867800
H	4.76987400	-2.14346700	2.20288300

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.219223 E_0
Sum of electronic and zero-point Energies=	-1400.868005 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.848491 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.847547 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.909448 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.351218
Number of imaginary vibrational frequencies = 0	

cis-**5ba-E**



Charge 0; multiplicity 1

O	3.25912800	0.79630100	0.34238500
O	2.81871100	-1.43439200	0.46872500
C	1.04227000	0.09701300	0.34340500
N	2.40651100	-0.25634700	-0.13936700
C	0.87684300	-0.07928800	1.85615500
H	1.70201900	0.42103700	2.37390300
H	-0.05965400	0.39242300	2.16899900
H	0.86813900	-1.12928400	2.15669700
C	0.16680400	-0.84242400	-0.50711500
H	0.40343900	-0.60934100	-1.55134100
C	2.14334300	-2.51232400	-0.25790000
C	0.61526300	-2.29015300	-0.20836700
H	0.25466200	-2.59362900	0.77962600
H	0.15346000	-2.96513800	-0.93777500
C	-1.31990400	-0.63010600	-0.32105200
C	-2.03981100	0.04528400	-1.30346600
C	-2.00292000	-1.07926000	0.80726100
C	-3.40029300	0.27741900	-1.17235000
H	-1.52307600	0.39995100	-2.19362000
C	-3.36335900	-0.85615900	0.95692400
H	-1.47417000	-1.61345300	1.59272400
C	-4.04716000	-0.17828000	-0.03735000
H	-3.95260100	0.80416800	-1.94549200
H	-3.88927500	-1.20896000	1.83963000
C	2.52041800	-3.76468200	0.51097900
H	3.60074800	-3.93551000	0.45524500
H	2.22642500	-3.66815400	1.56158300
H	2.00548500	-4.62897100	0.07921200
C	2.65999600	-2.57651700	-1.69026600
H	2.32160400	-1.72458100	-2.28532800
H	3.75510400	-2.59532600	-1.68892300

H	2.29602700	-3.49663100	-2.15963800
C	2.47250200	1.90404300	0.14733700
C	2.93546800	3.19839600	0.06862100
C	1.12189100	1.57649600	0.04985400
C	1.97981500	4.19638100	-0.11690000
H	3.99487600	3.42550000	0.14512700
C	0.18537700	2.57400100	-0.11975100
C	0.62816500	3.89416500	-0.21546500
H	2.30509900	5.23135900	-0.18896100
H	-0.87562600	2.34110500	-0.16923800
H	-0.09291400	4.69391000	-0.36173100
Cl	-5.75999800	0.10194200	0.14145700

DFT M11/Def2TZVP, solvent acetonitrile, SMD model	
Total electronic energy=	-1401.218603 E_0
Sum of electronic and zero-point Energies=	-1400.867477 $E_0 + E_{ZPE}$
Sum of electronic and thermal Energies=	-1400.847957 $E_0 + E_{tot}$
Sum of electronic and thermal Enthalpies=	-1400.847013 $E_0 + H_{corr}$
Sum of electronic and thermal Free Energies=	-1400.908807 $E_0 + G_{corr}$
Zero-point correction *(unscaled)* =	0.351127
Number of imaginary vibrational frequencies = 0	

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Copies of NMR spectra

_N_,_N_-Dimethyl-2-nitrobut-1-en-1-amine

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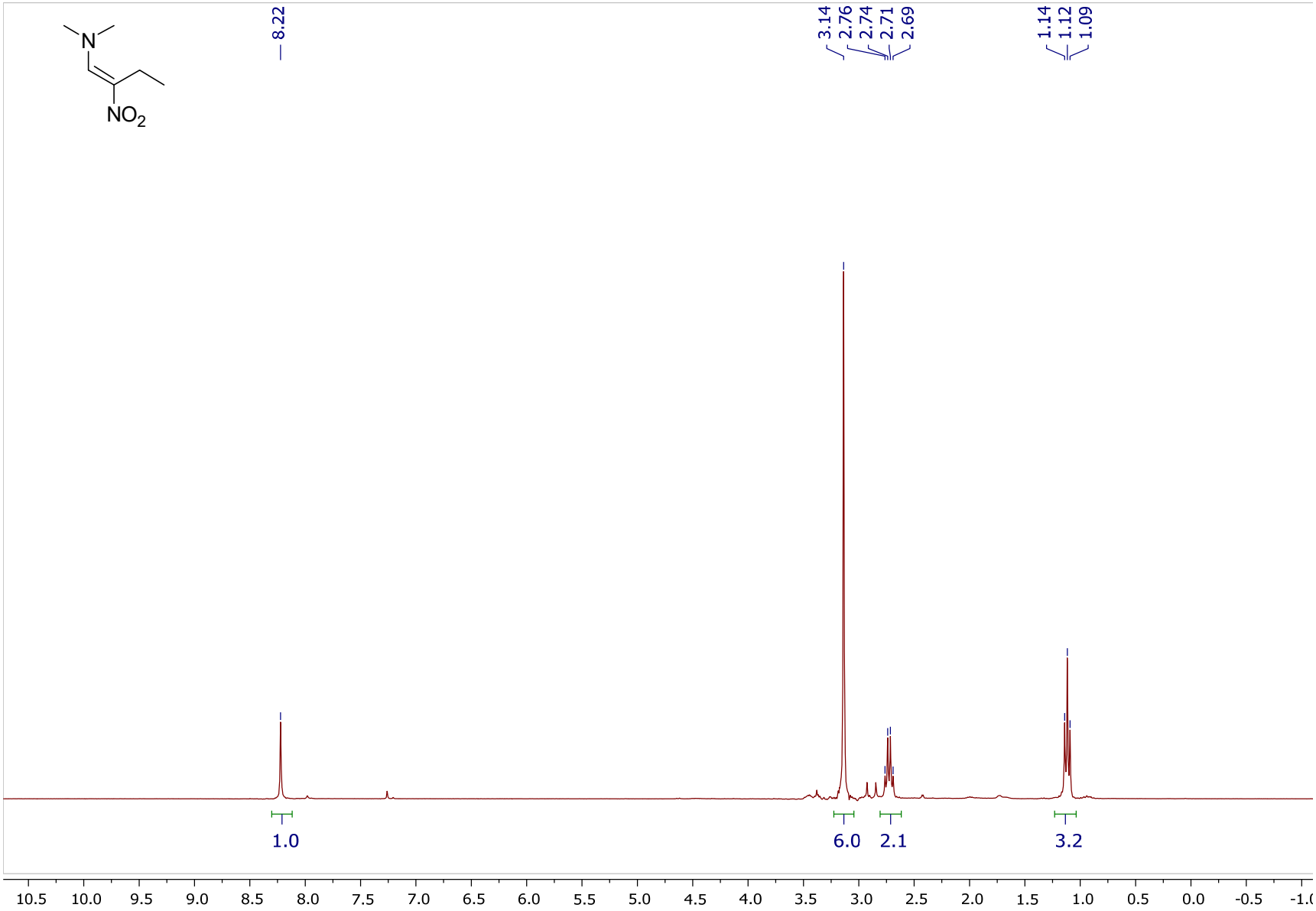

(*E*)-2-Nitrobut-1-en-1-yl benzoate 3g

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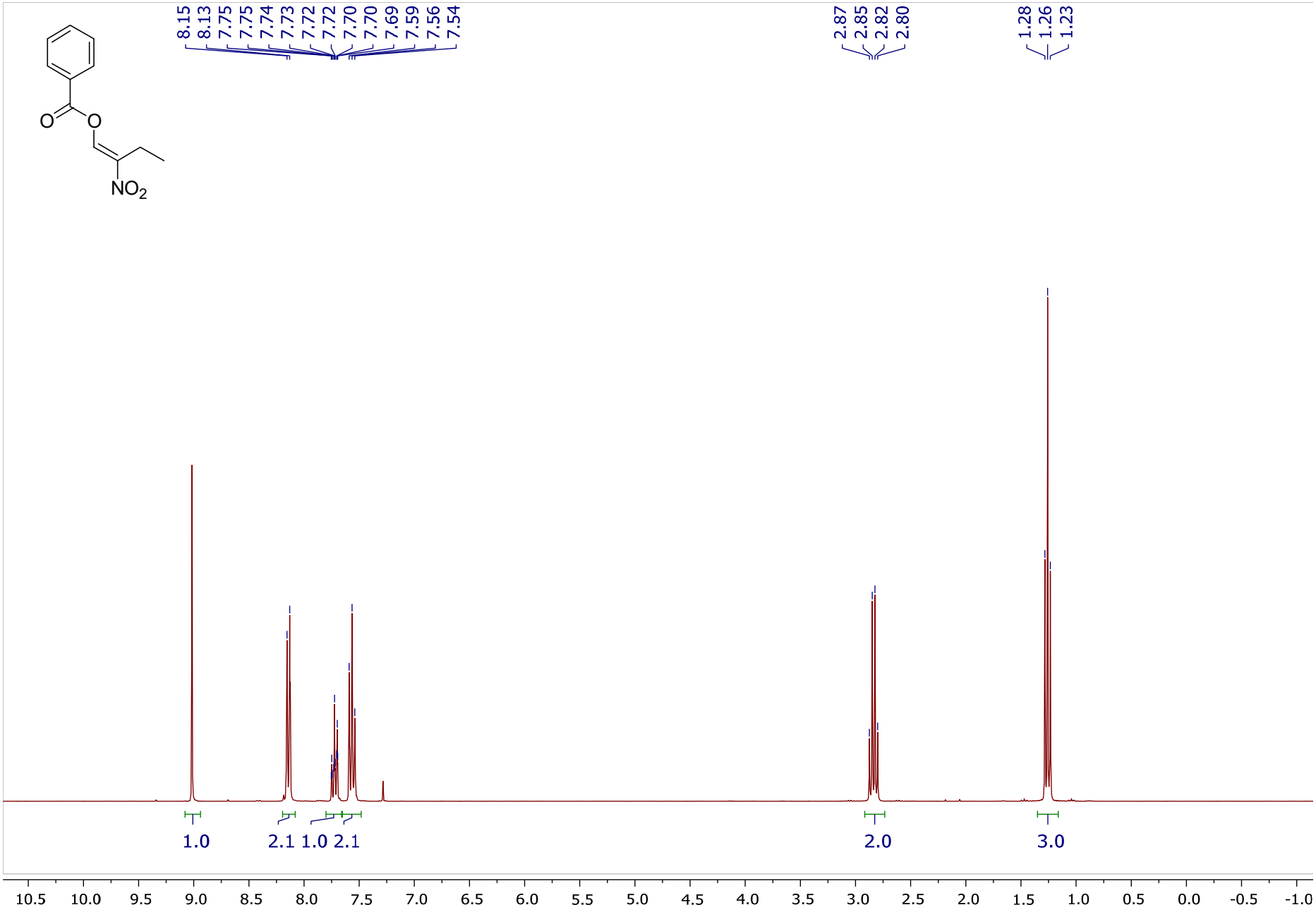

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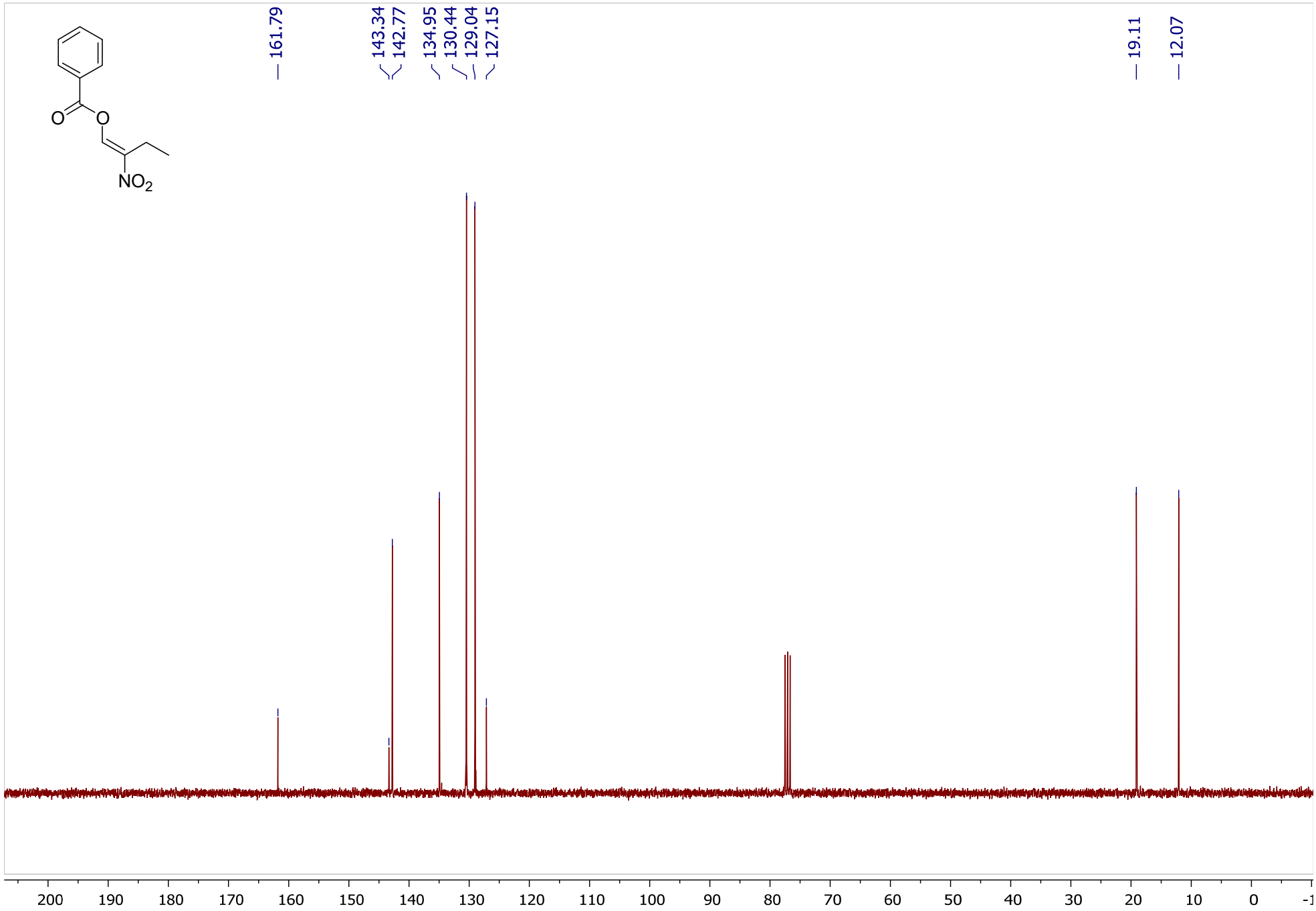

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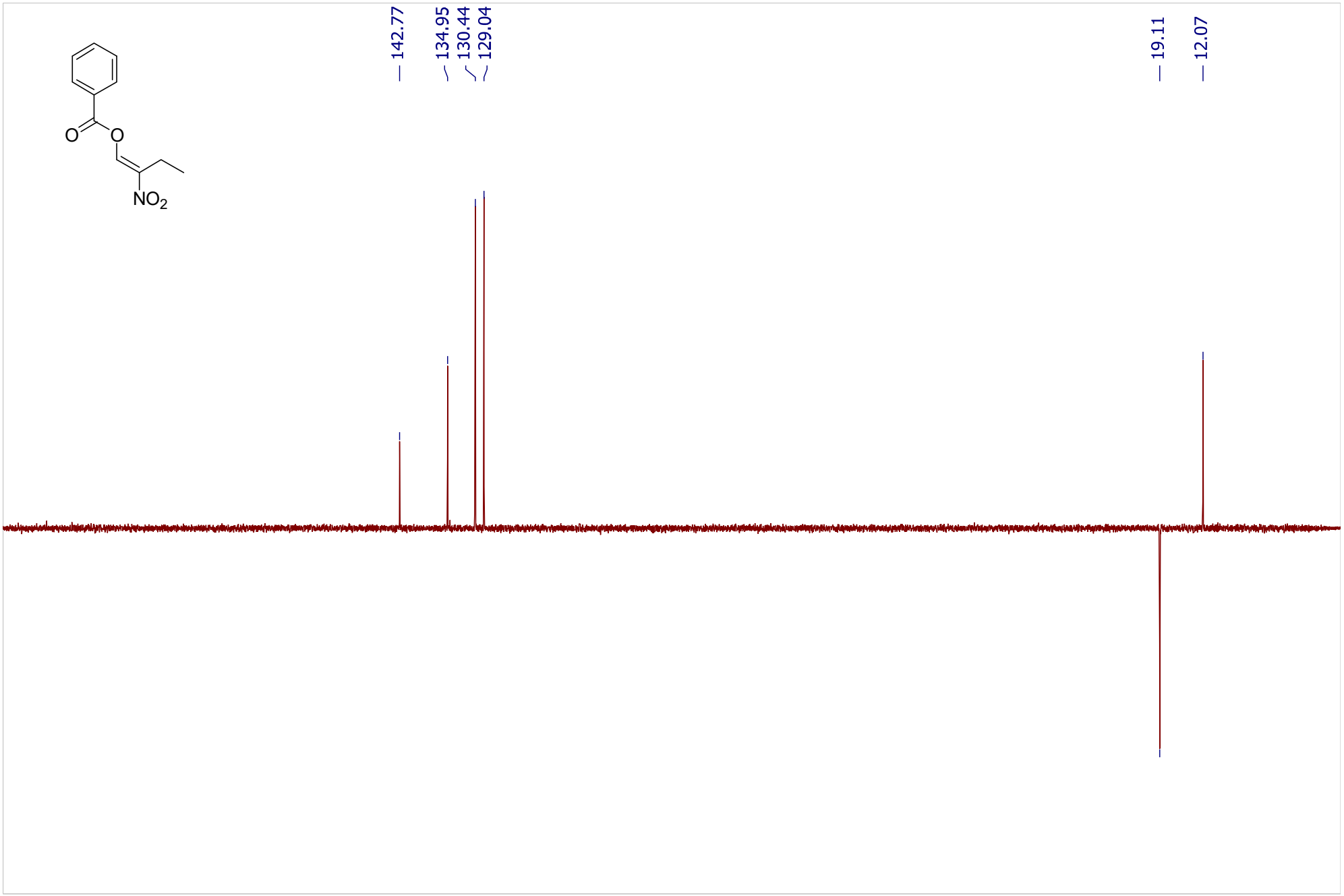

4-(2-Bromophenyl)-3,6,6-trimethyl-5,6-dihydro-4H-1,2-oxazine 2-oxide 1c

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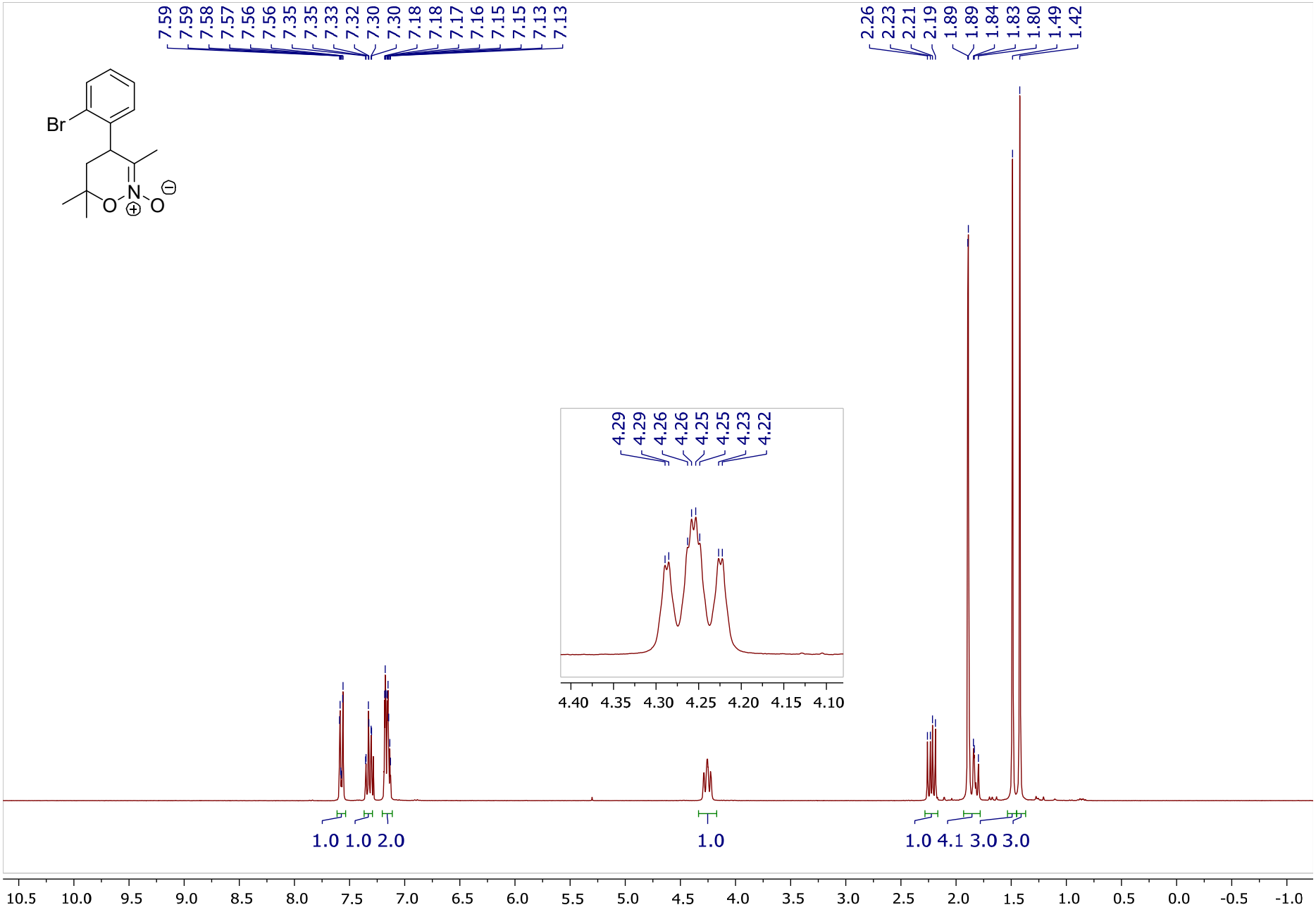

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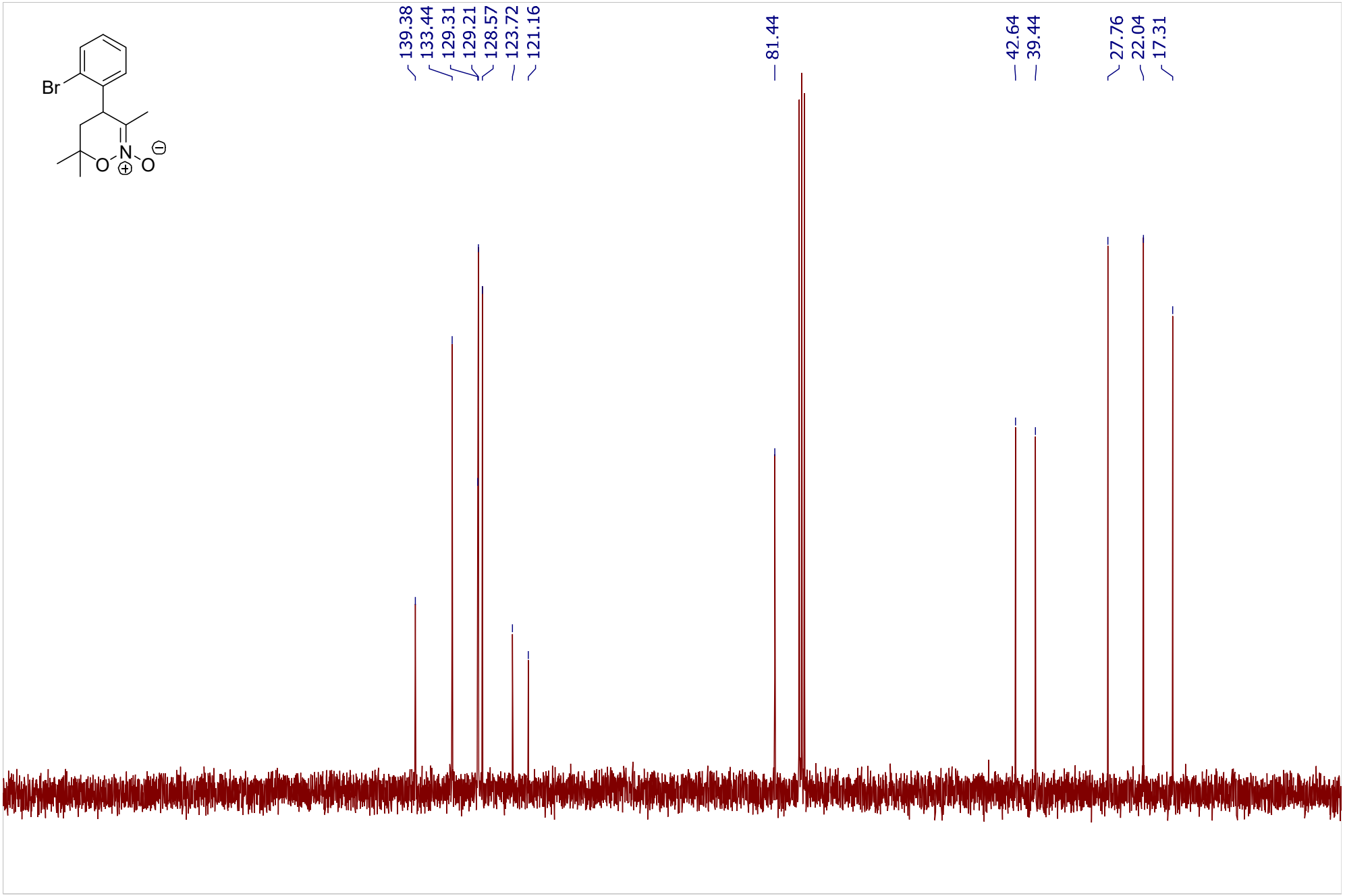

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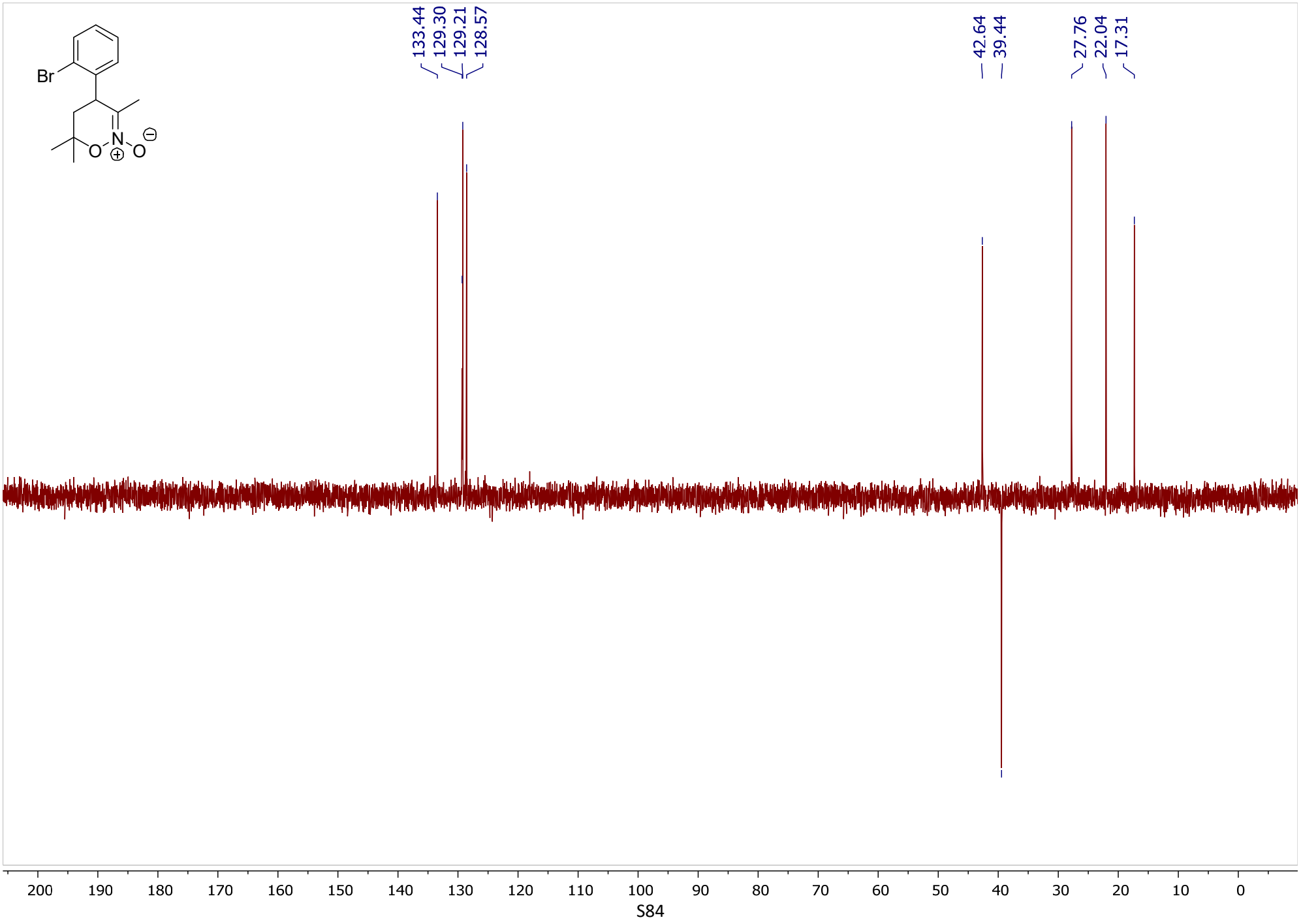

3,4,6,6-Tetramethyl-5,6-dihydro-4H-1,2-oxazine 2-oxide 1d

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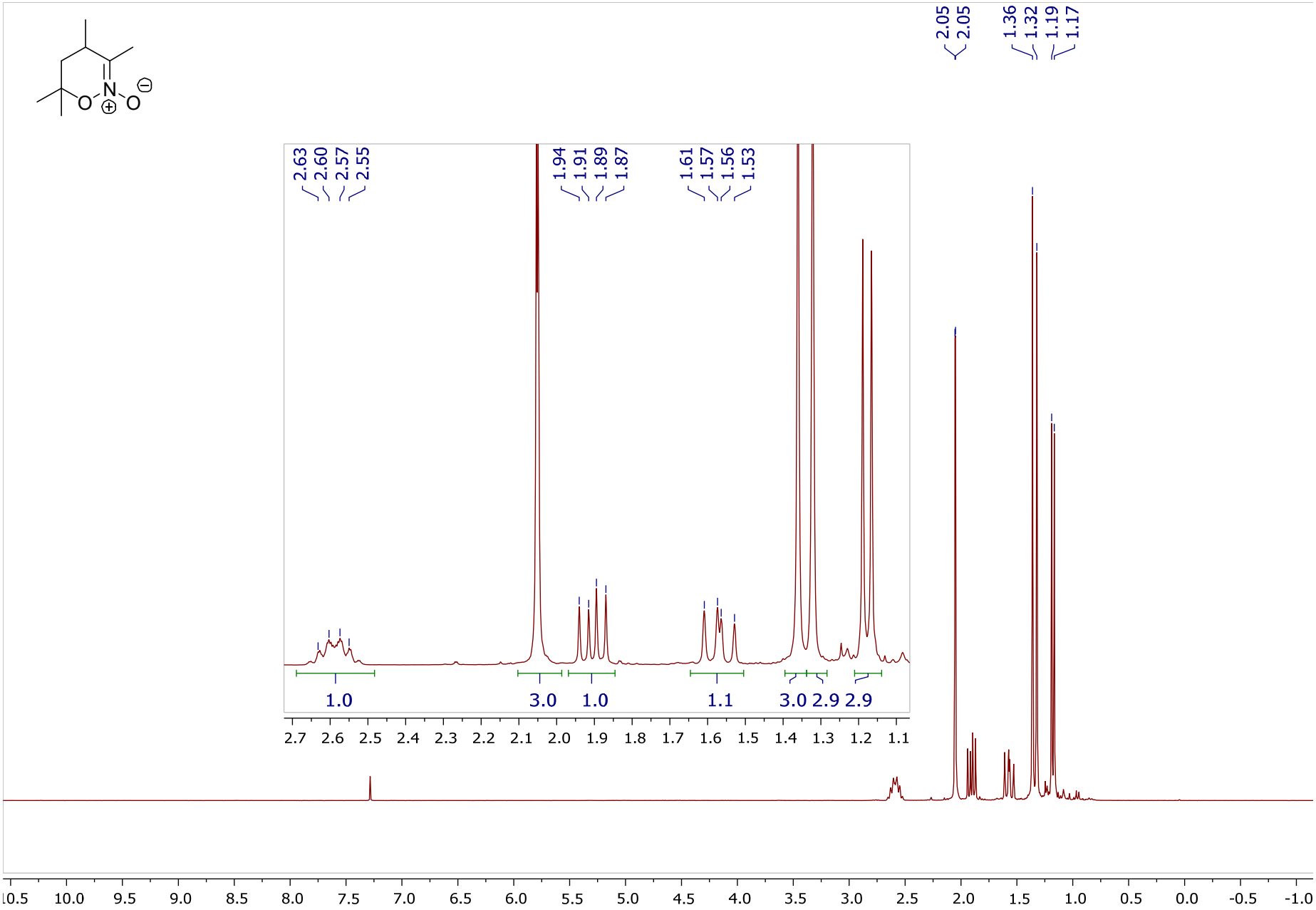

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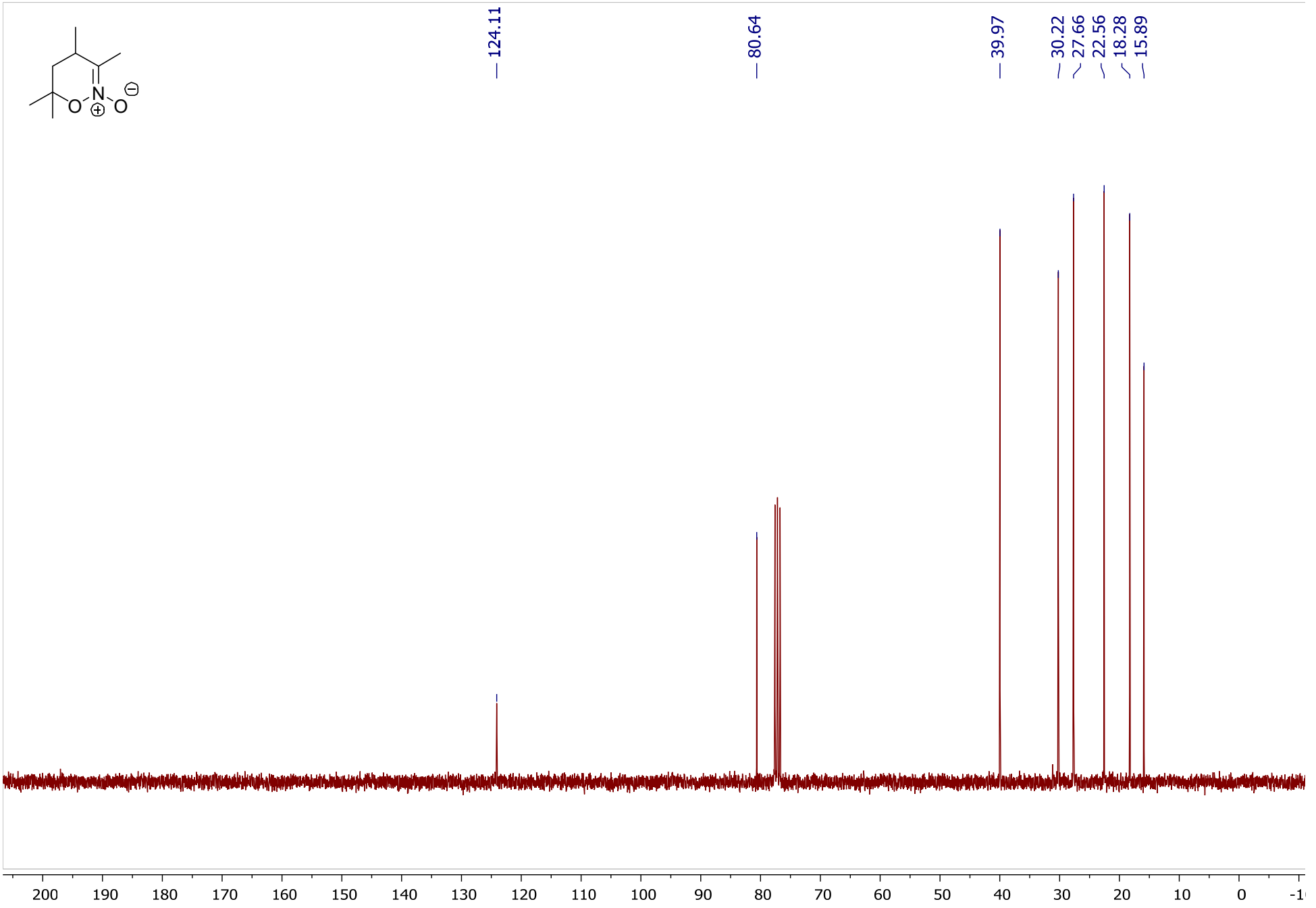

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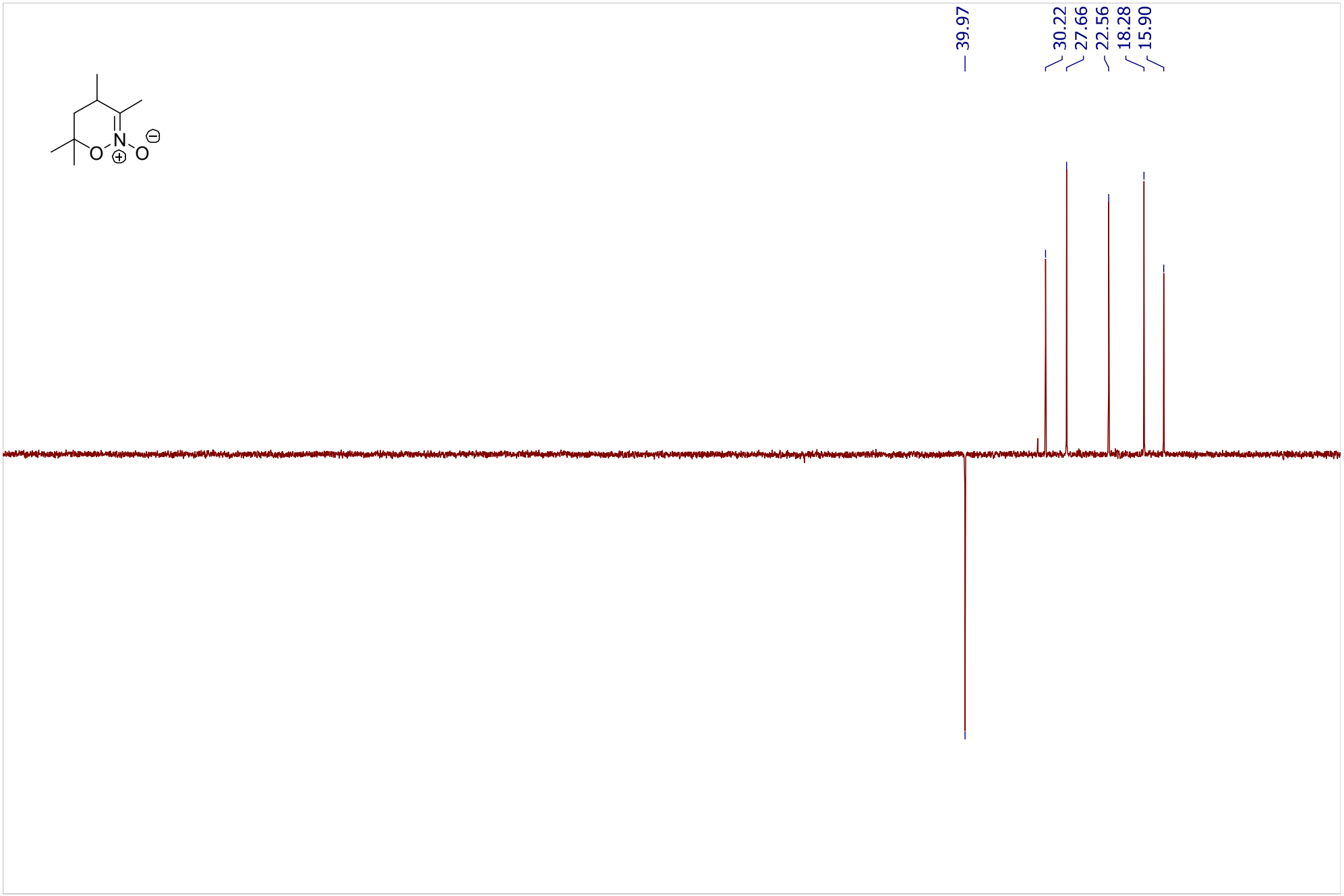

4-(Benzoyloxy)-3-ethyl-6,6-dimethyl-5,6-dihydro-4H-1,2-oxazine 2-oxide 1g

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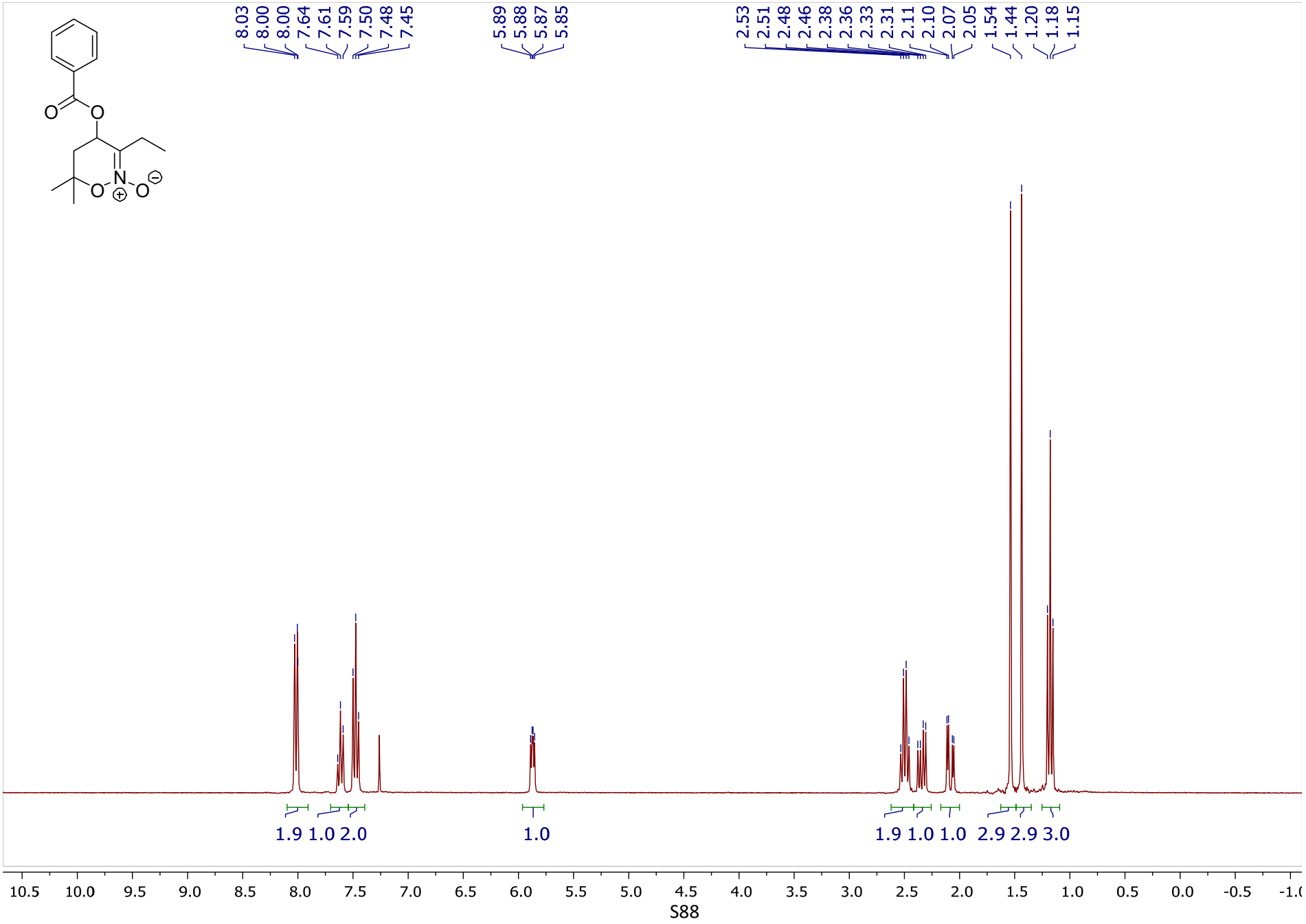

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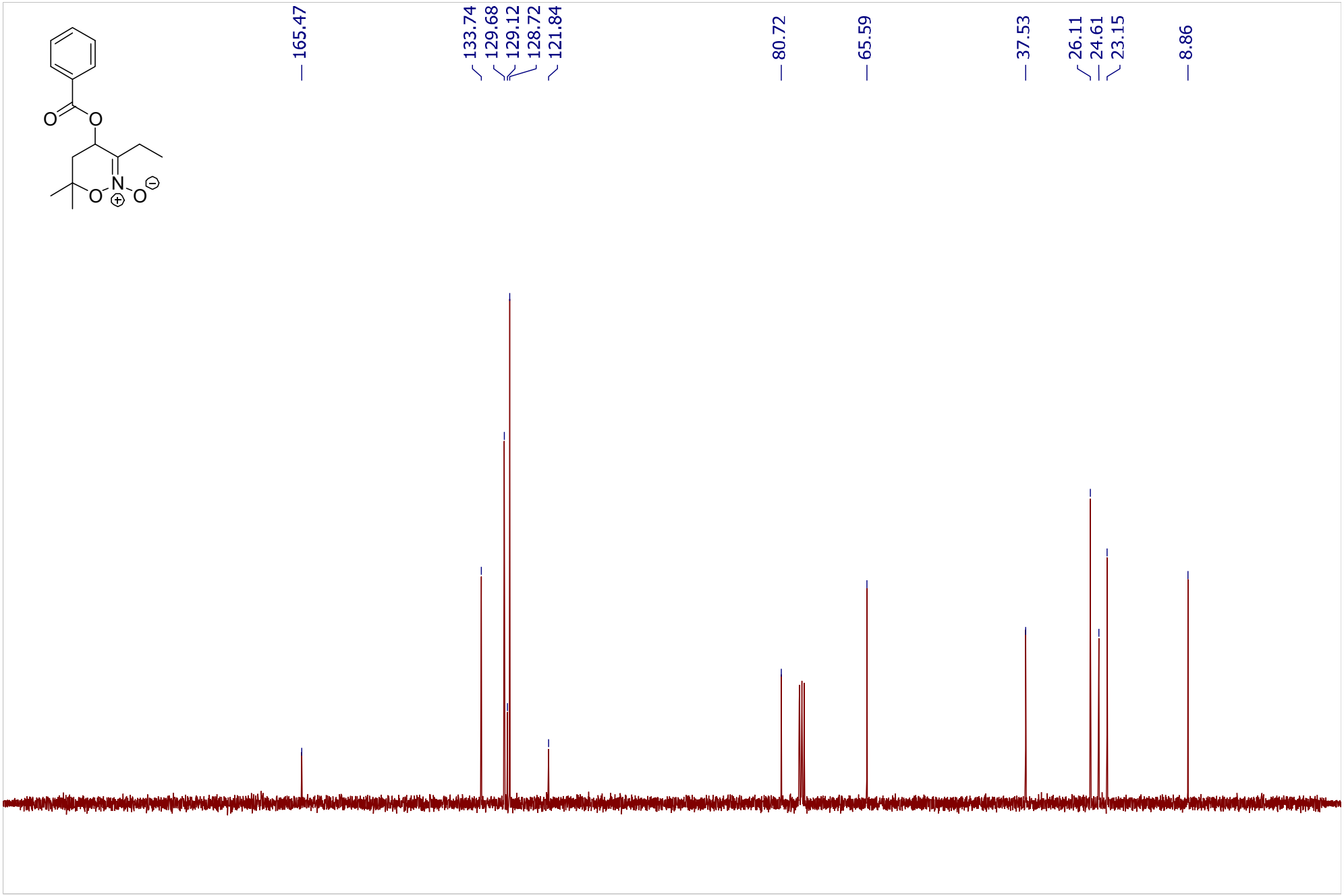
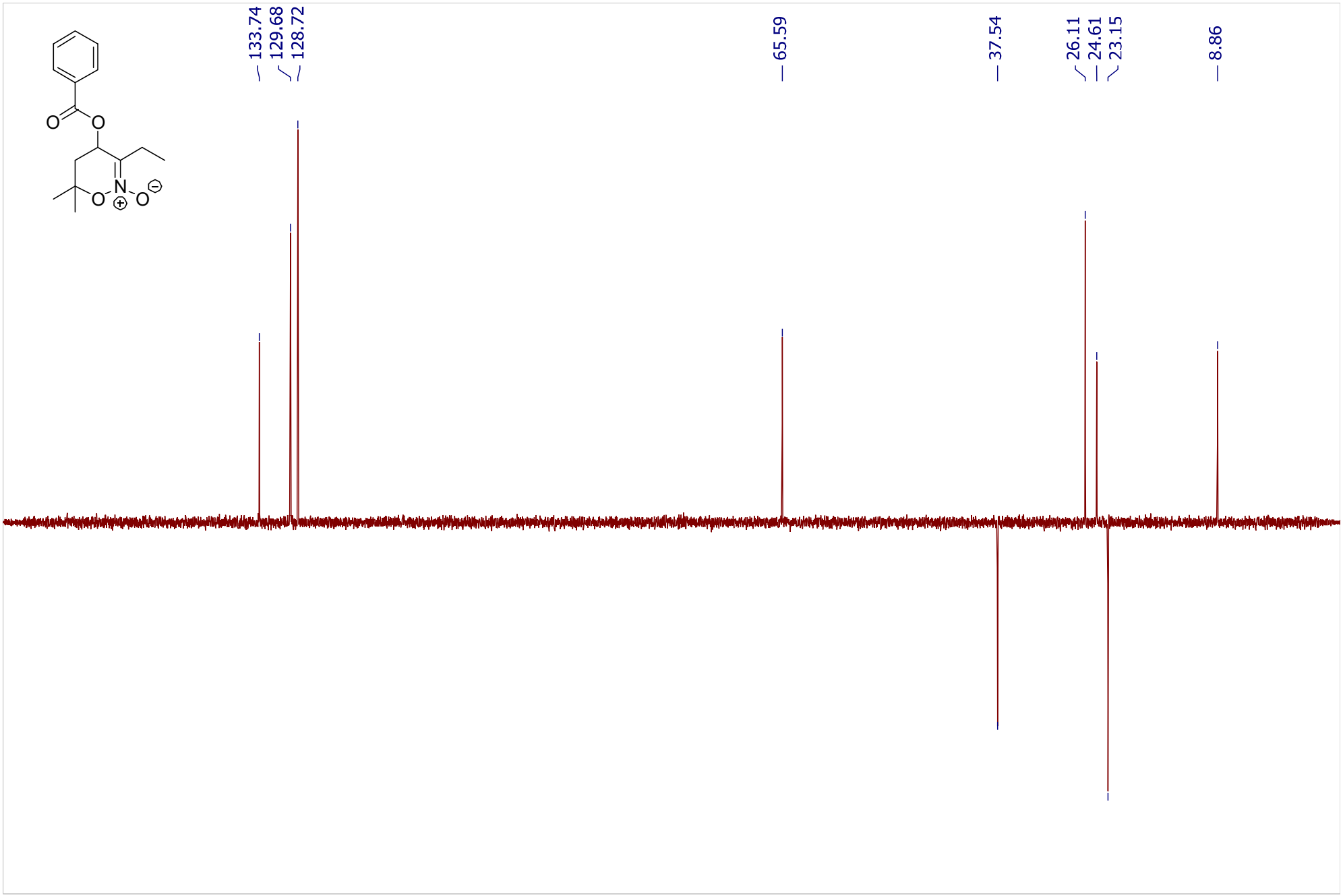
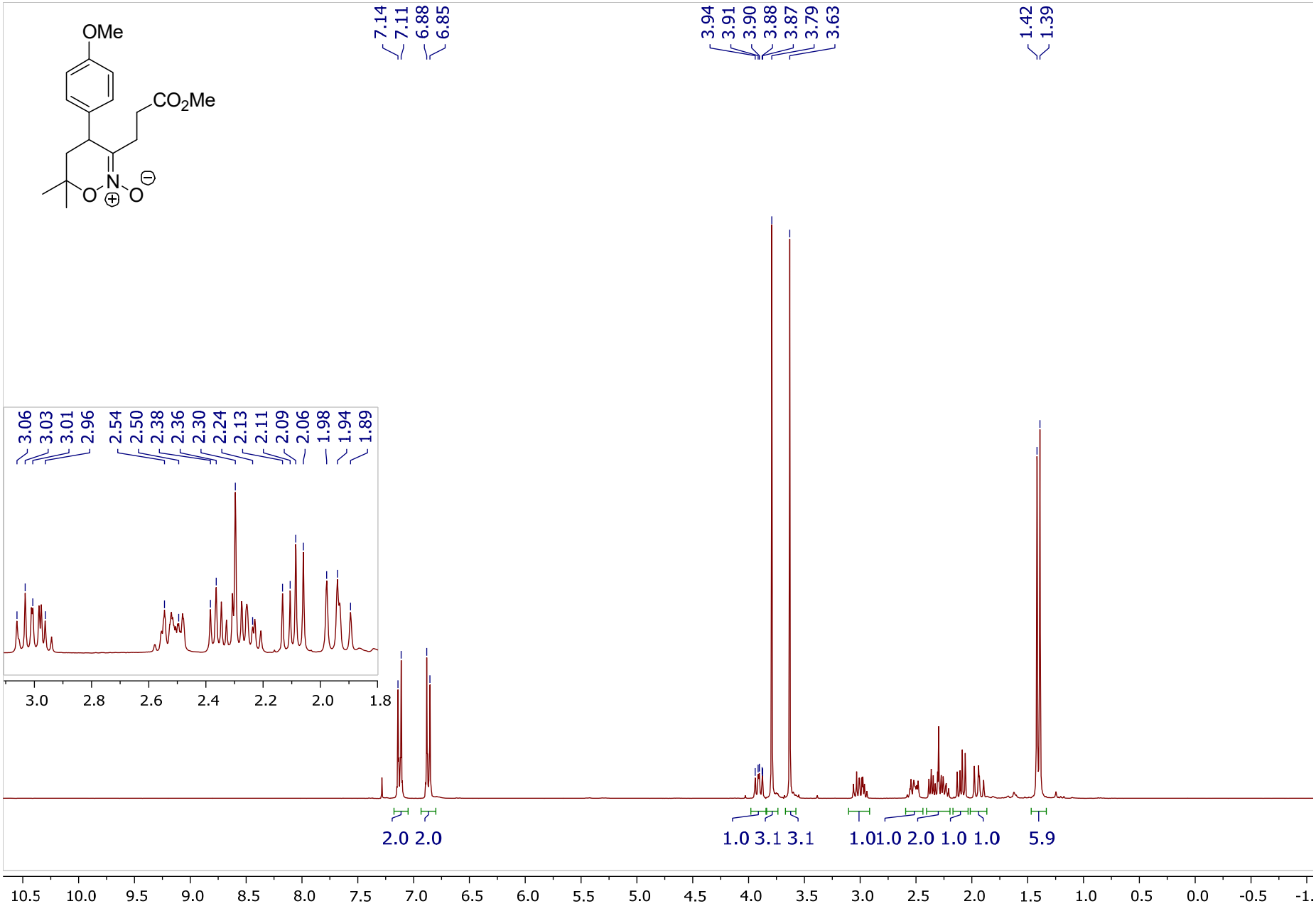


^{13}C DEPT 135 (75 MHz, $CDCl_3$)



3-(3-Methoxy-3-oxopropyl)-4-(4-methoxyphenyl)-6,6-dimethyl-5,6-dihydro-4H-1,2-oxazine 2-oxide 1h

^{1}H NMR (300 MHz, $CDCl_3$)



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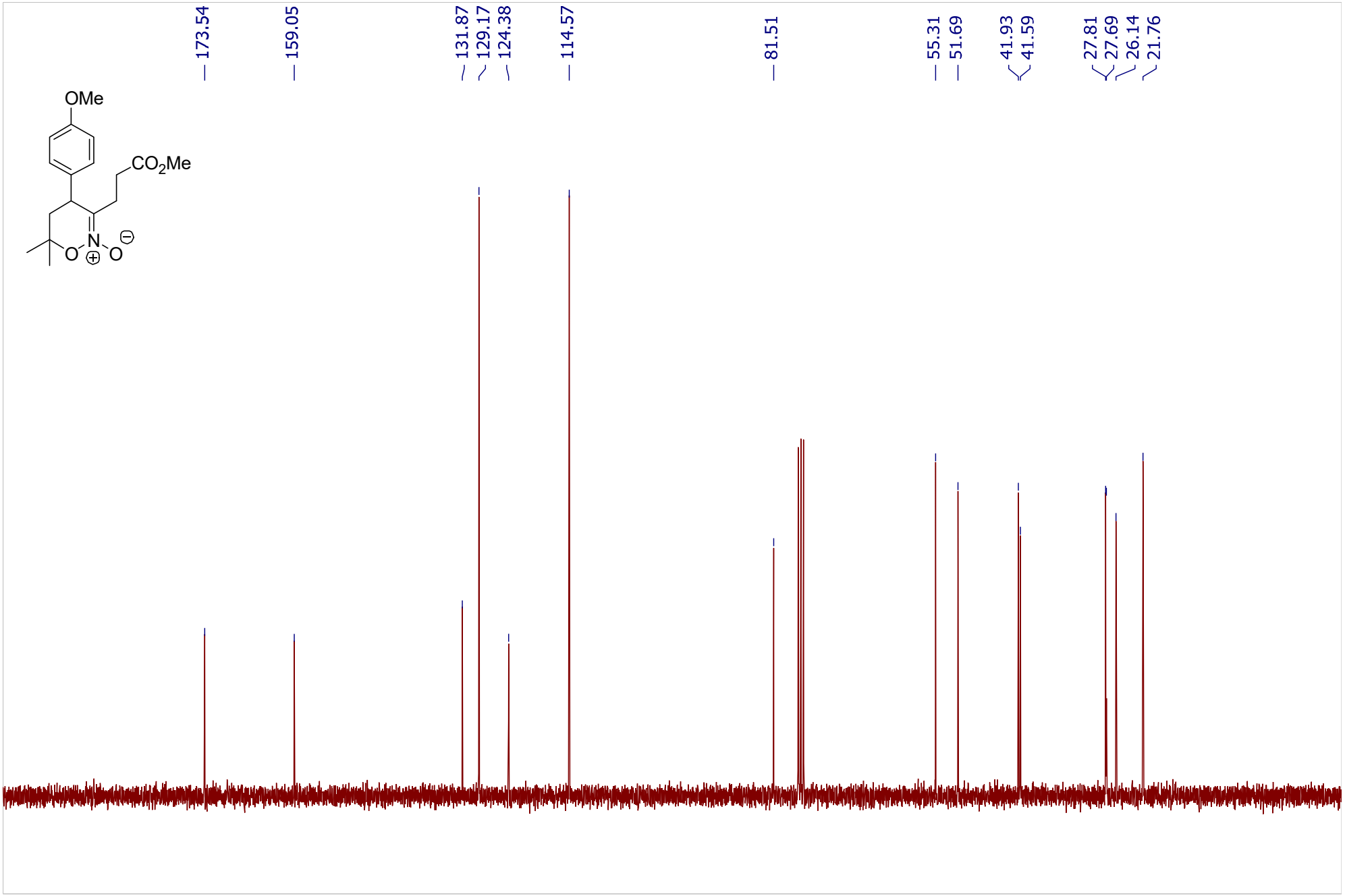

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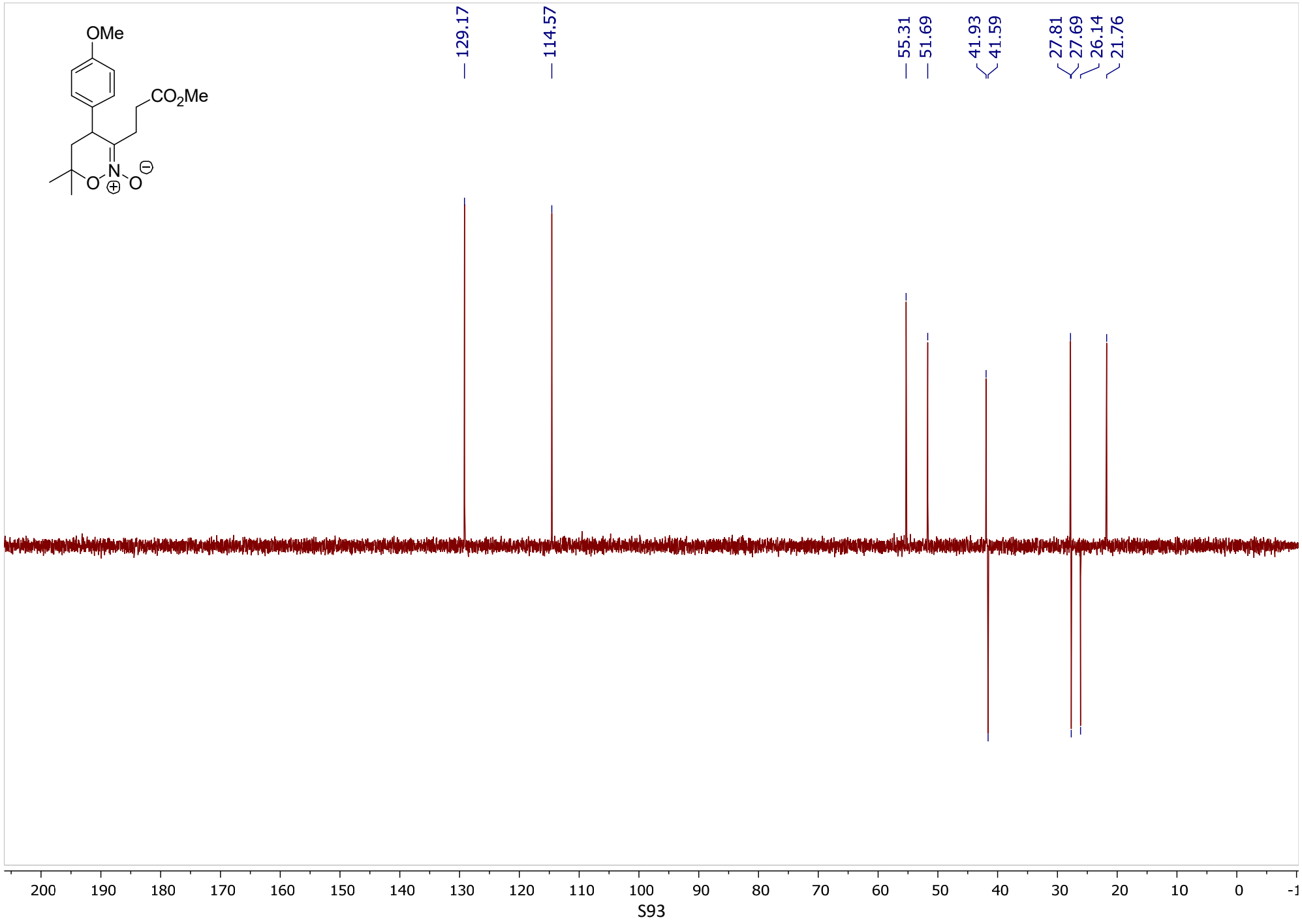
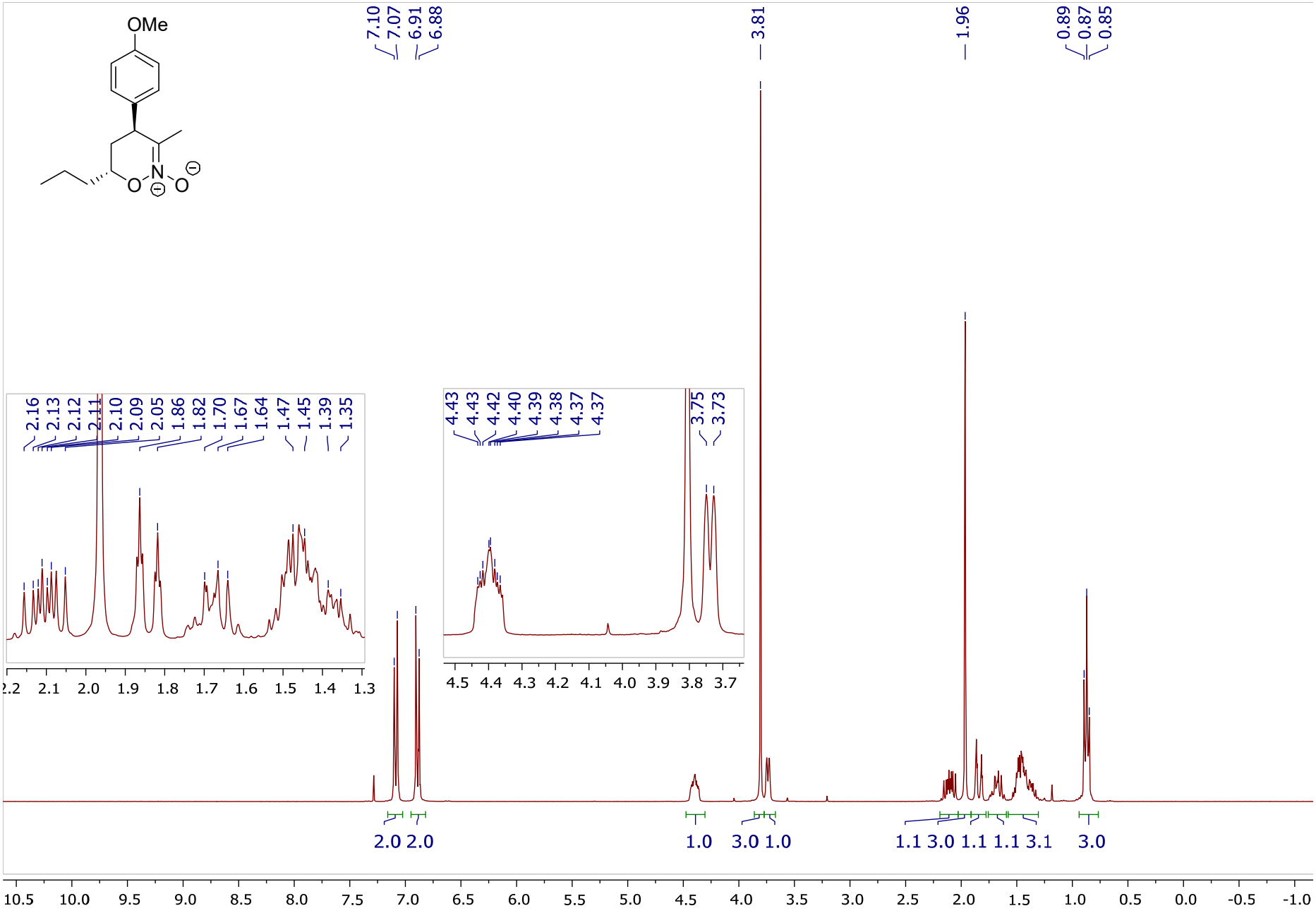


(4*S,6*R**)-4-(4-Methoxyphenyl)-3-methyl-6-propyl-5,6-dihydro-4H-1,2-oxazine 2-oxide 1i**

^{1}H NMR (300 MHz, $CDCl_3$)



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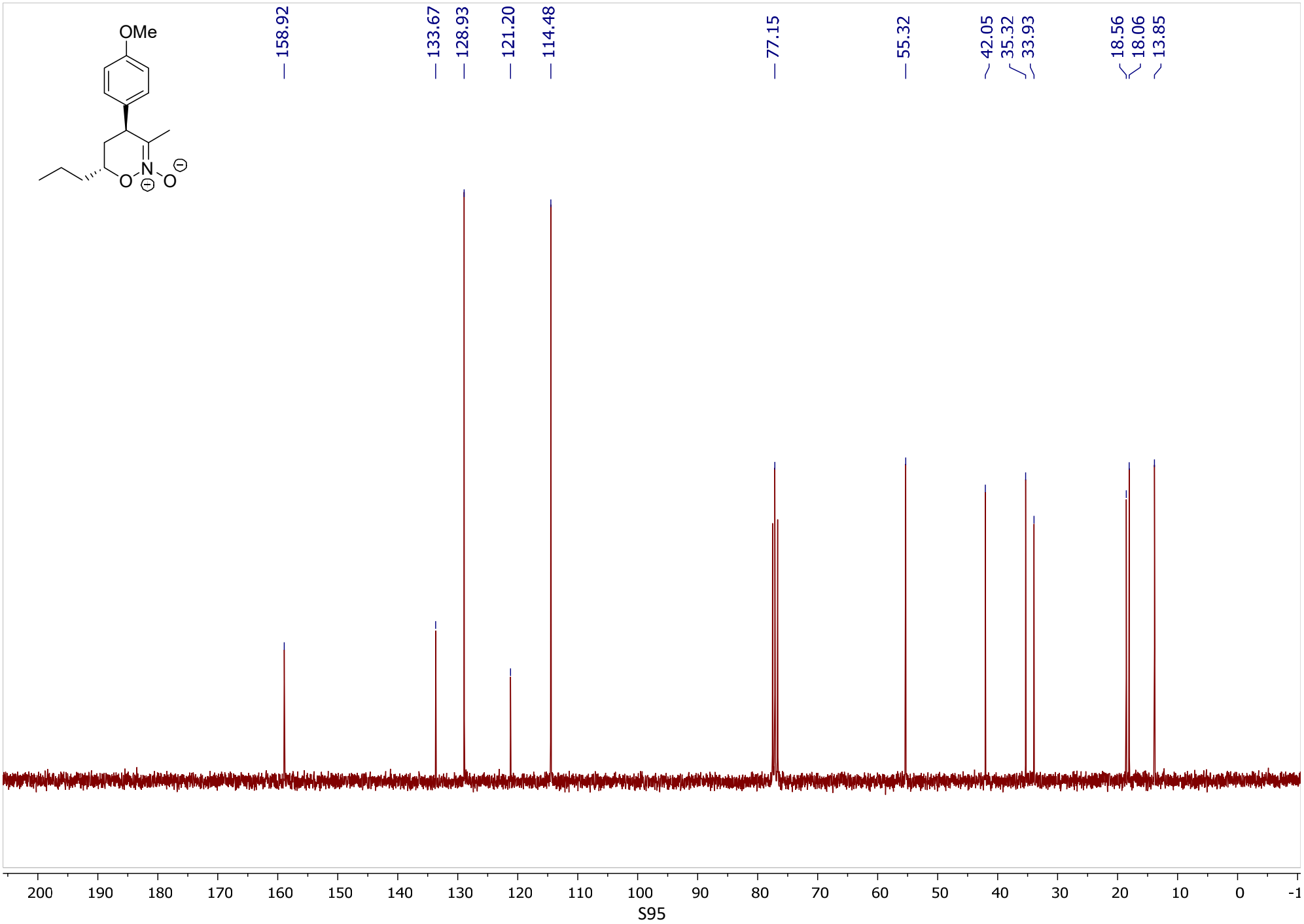

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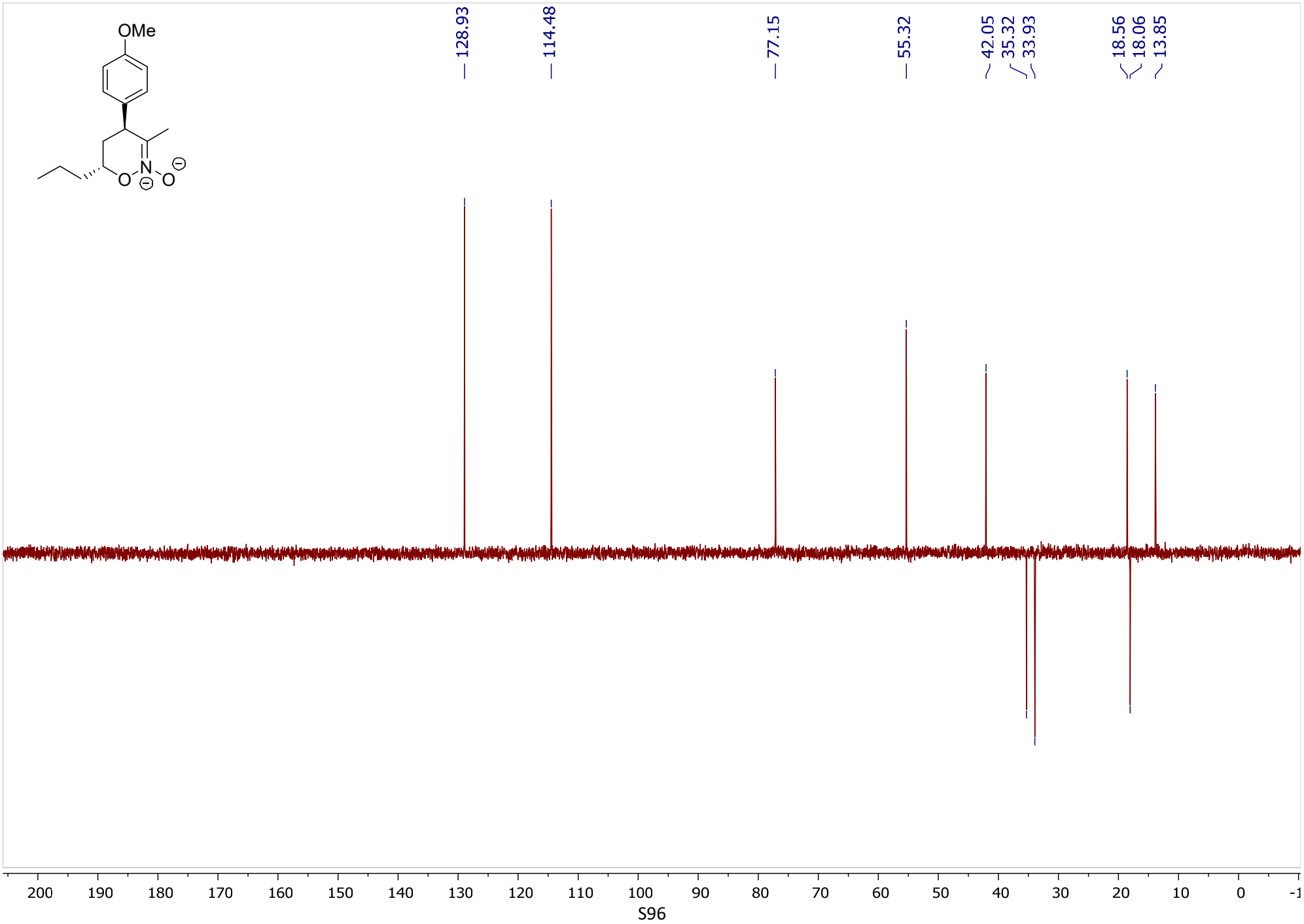

(4*S,6*R**)-4-(4-Methoxyphenyl)-3-methyl-6-phenyl-5,6-dihydro-4H-1,2-oxazine 2-oxide 1j**

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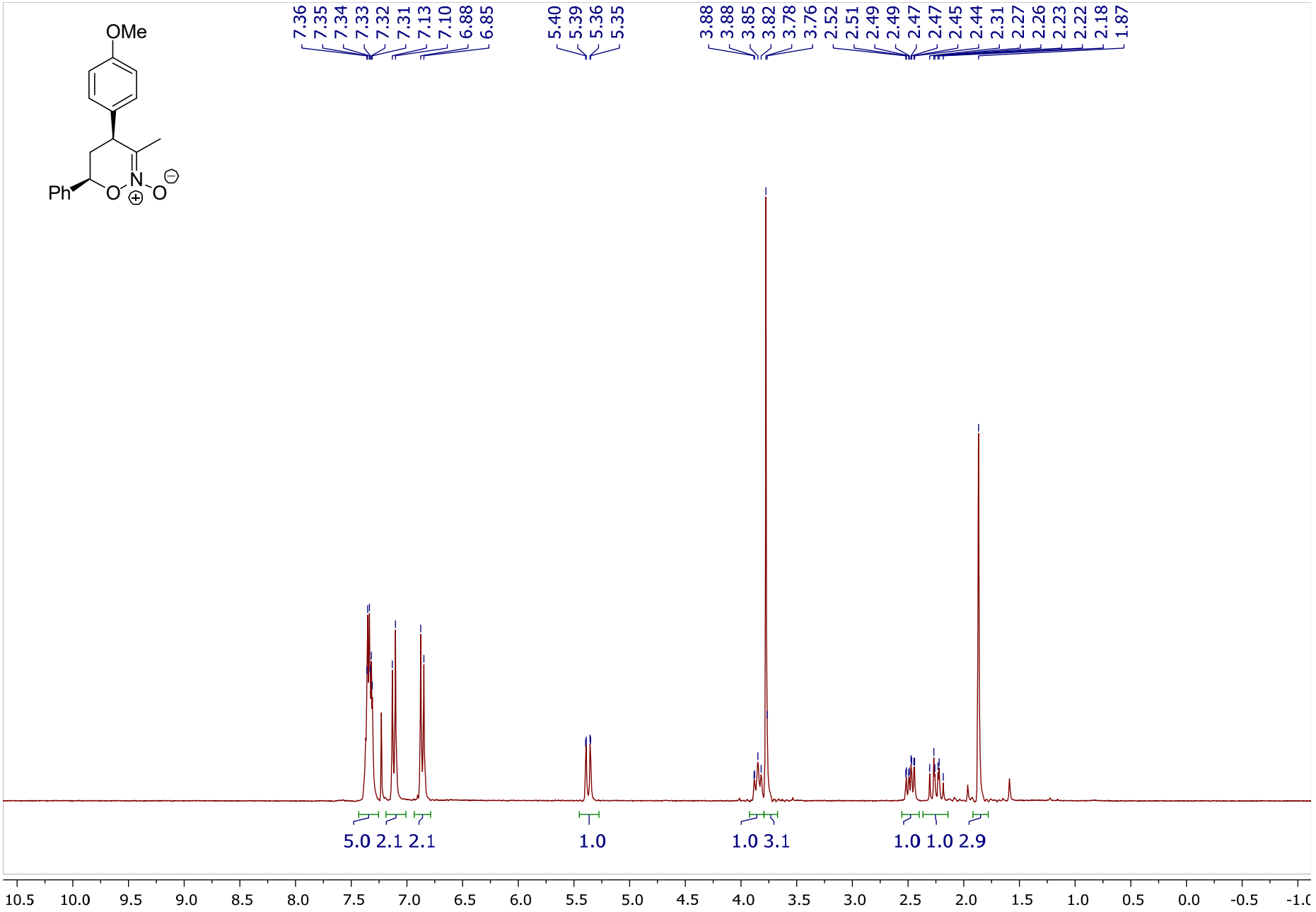

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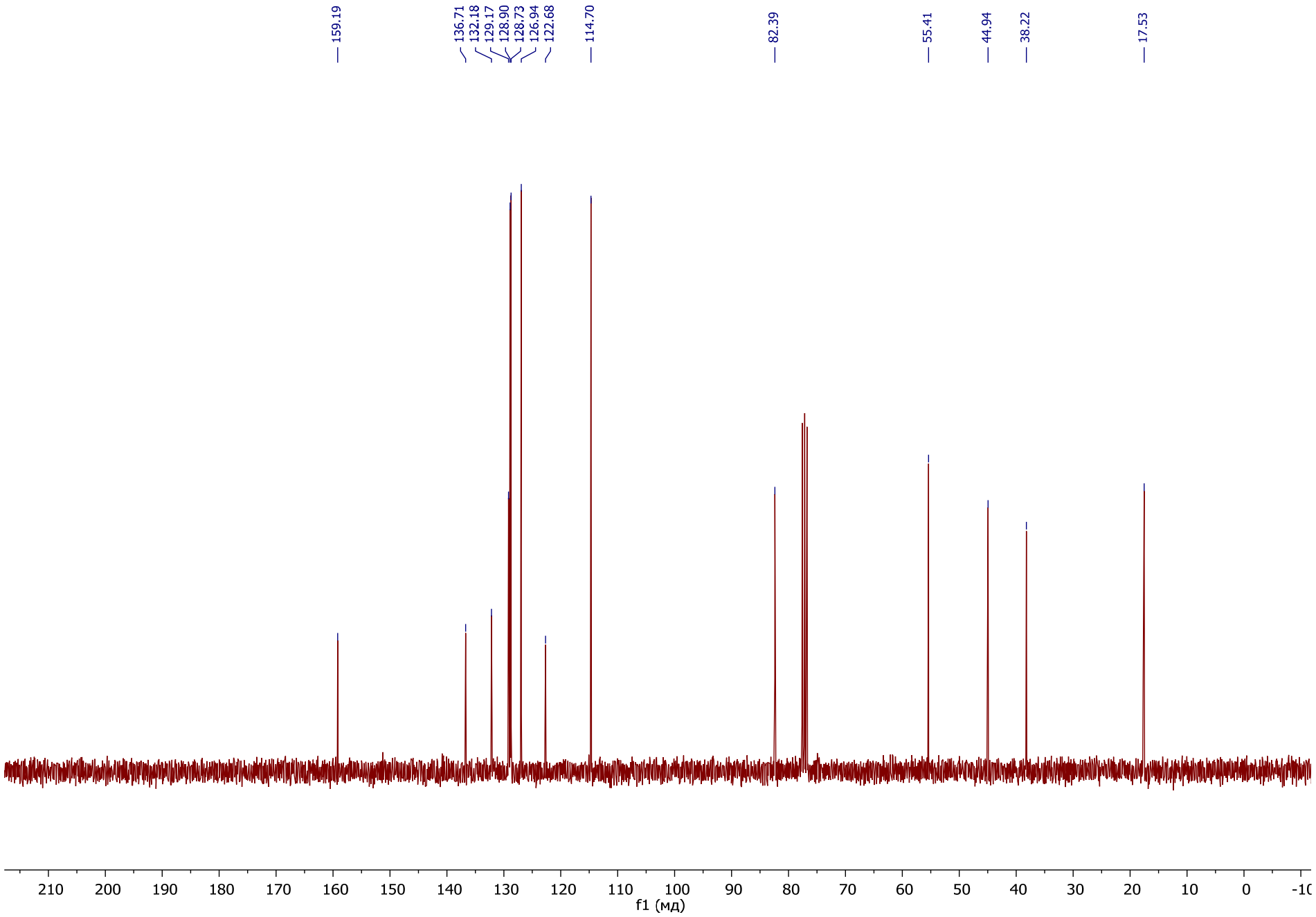

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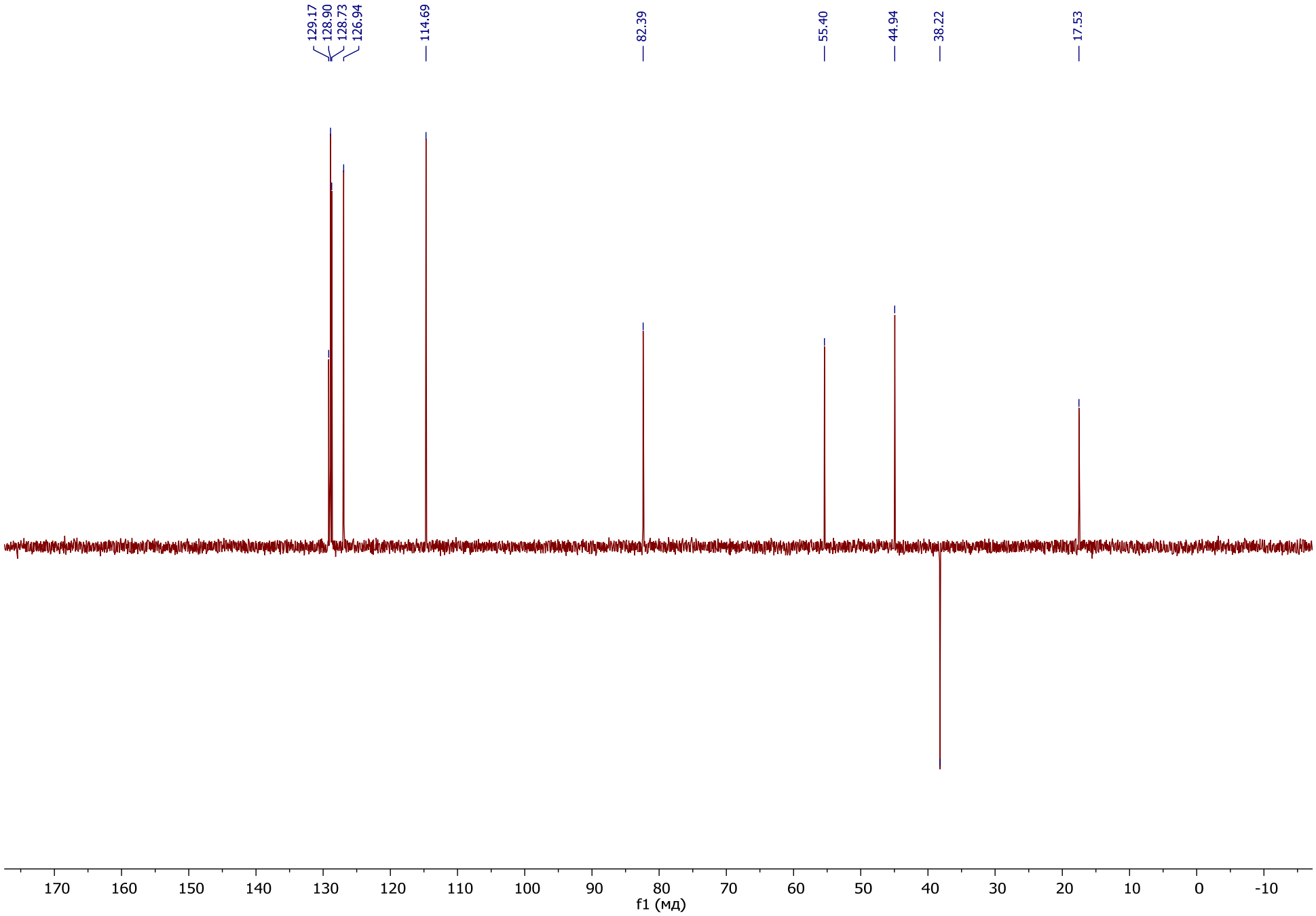

(4*S,6*S**)-4-(4-Methoxyphenyl)-3-methyl-6-phenyl-5,6-dihydro-4H-1,2-oxazine 2-oxide 1k**

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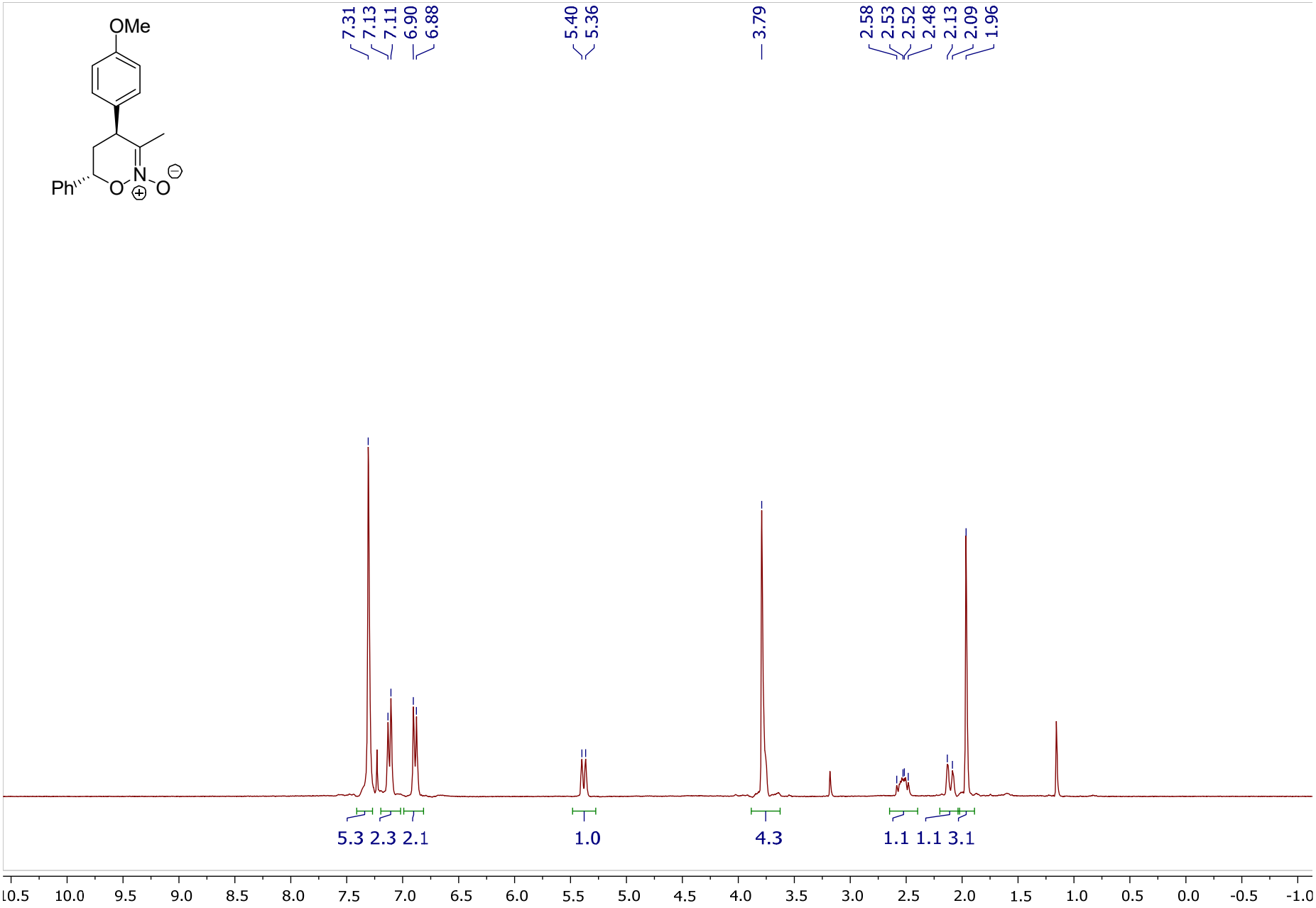

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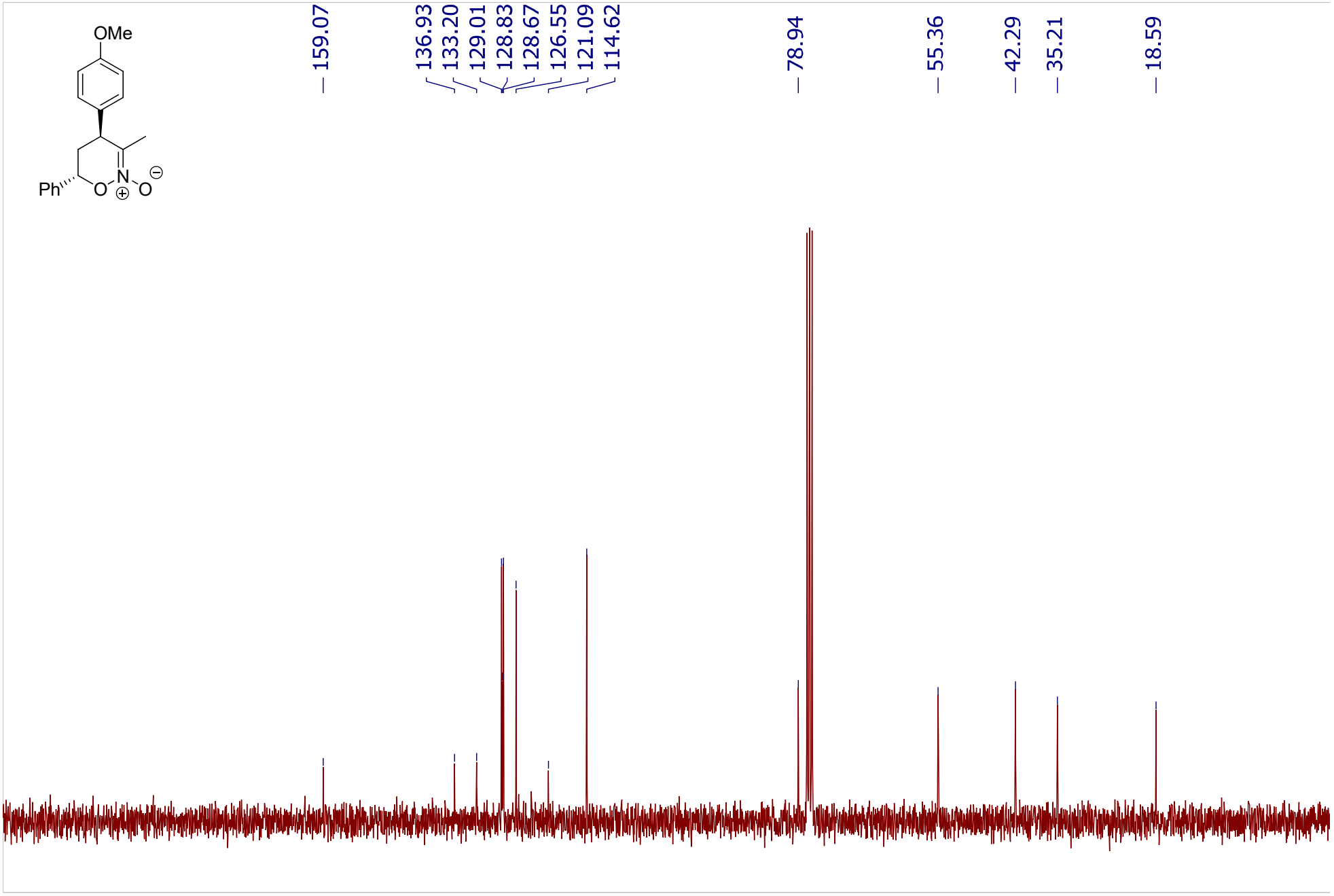

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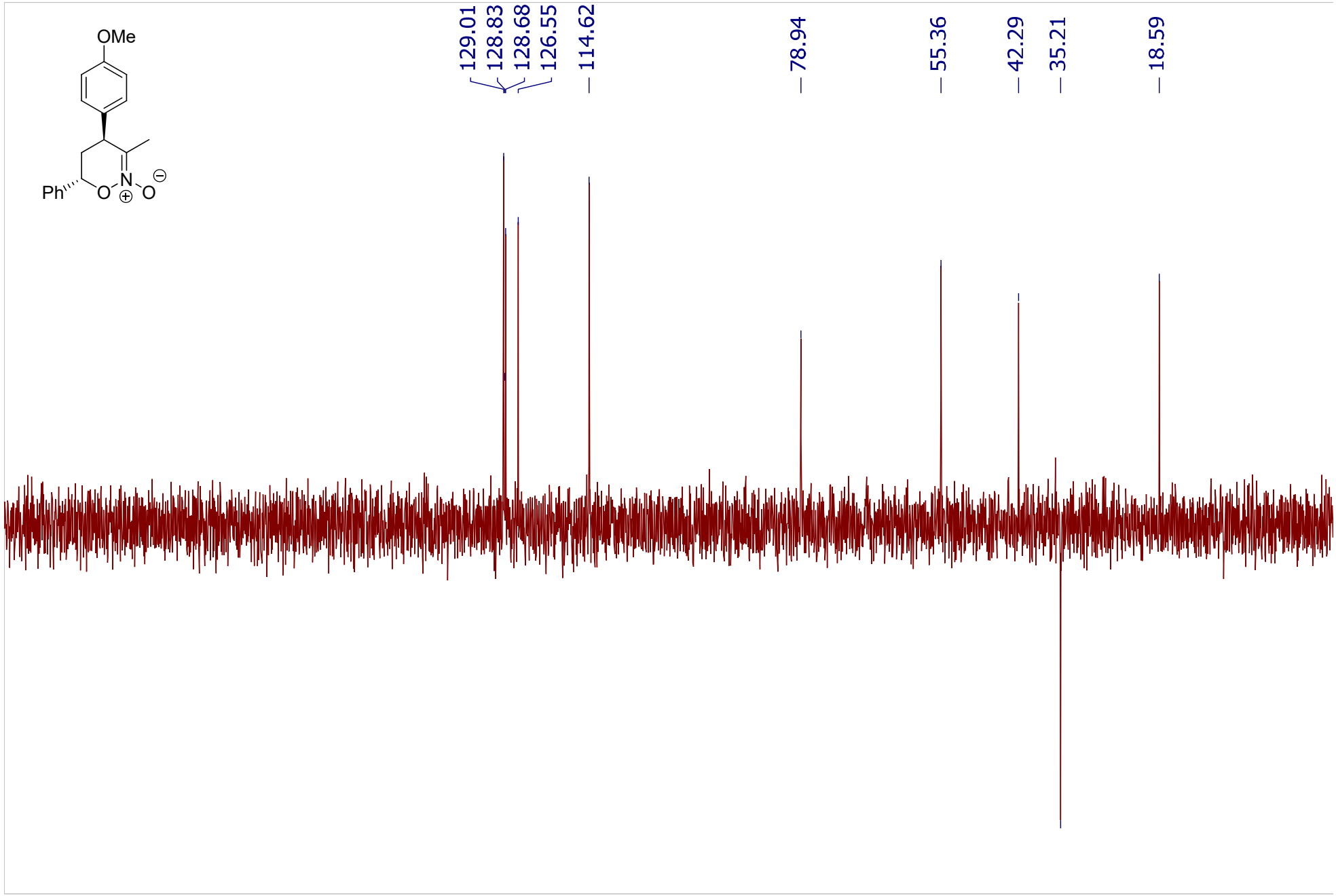
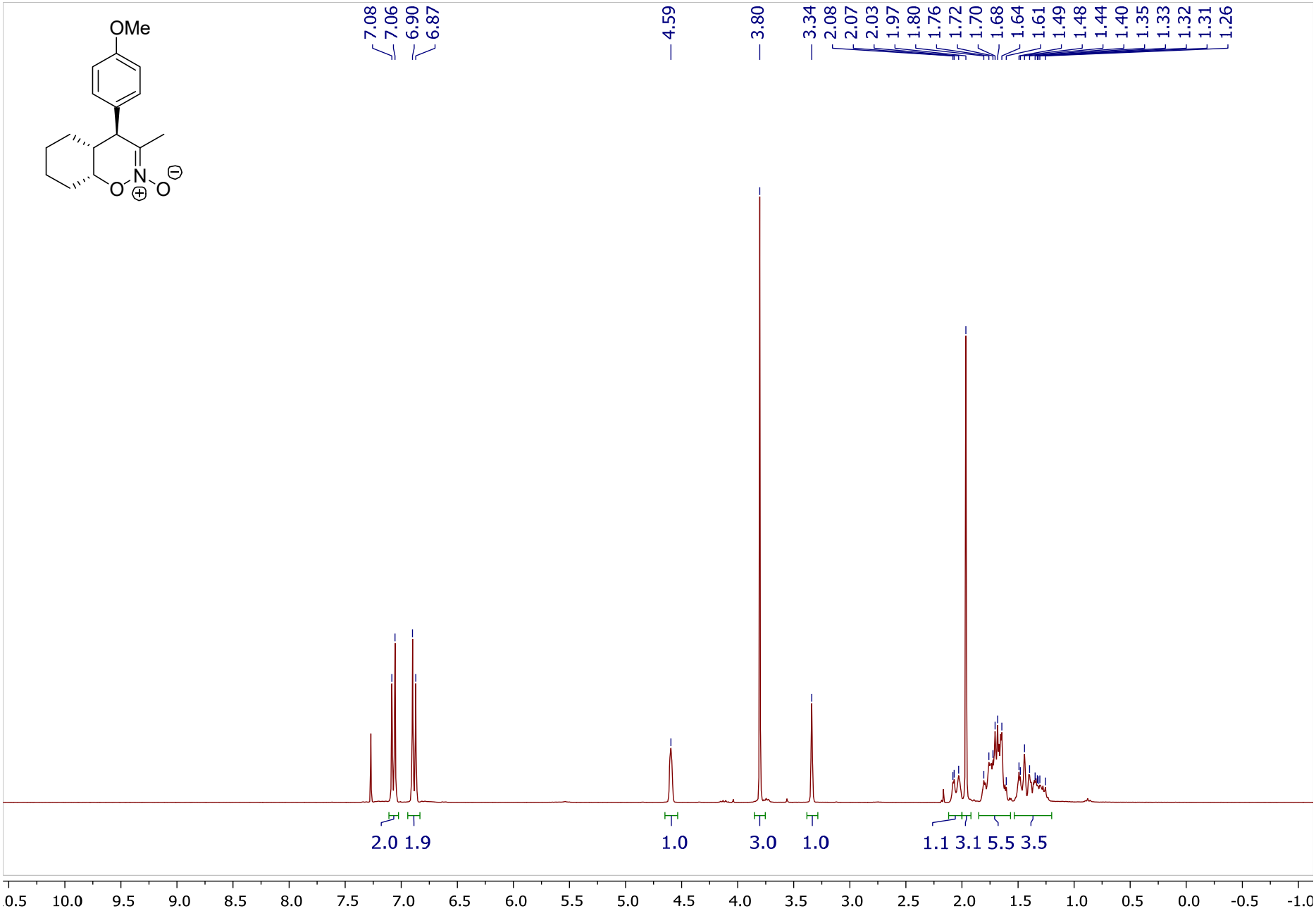
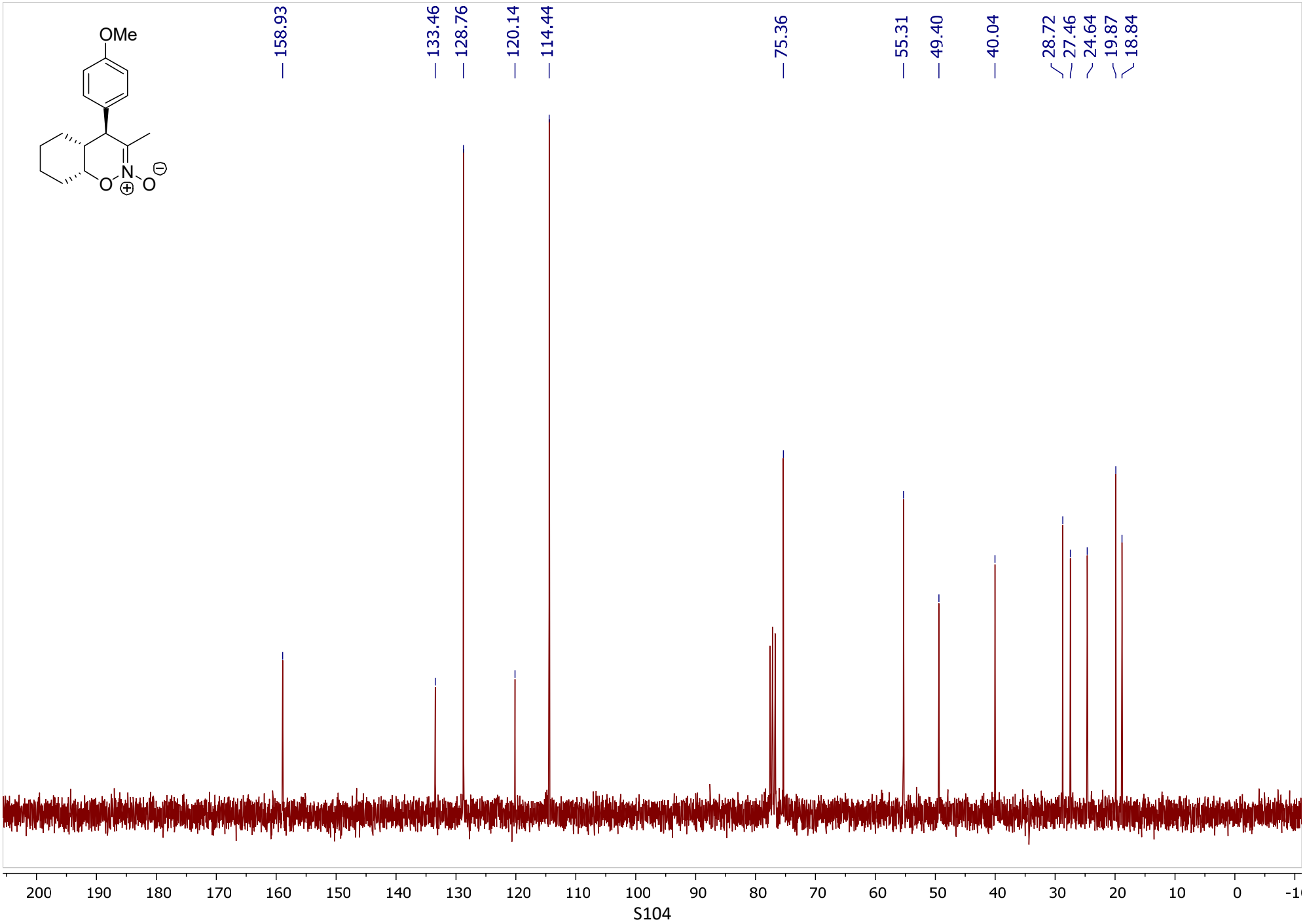


(4*S,4a*R**,8a*R**)-4-(4-Methoxyphenyl)-3-methyl-4a,5,6,7,8,8a-hexahydro-4H-benzo[e][1,2]oxazine 2-oxide 1l**

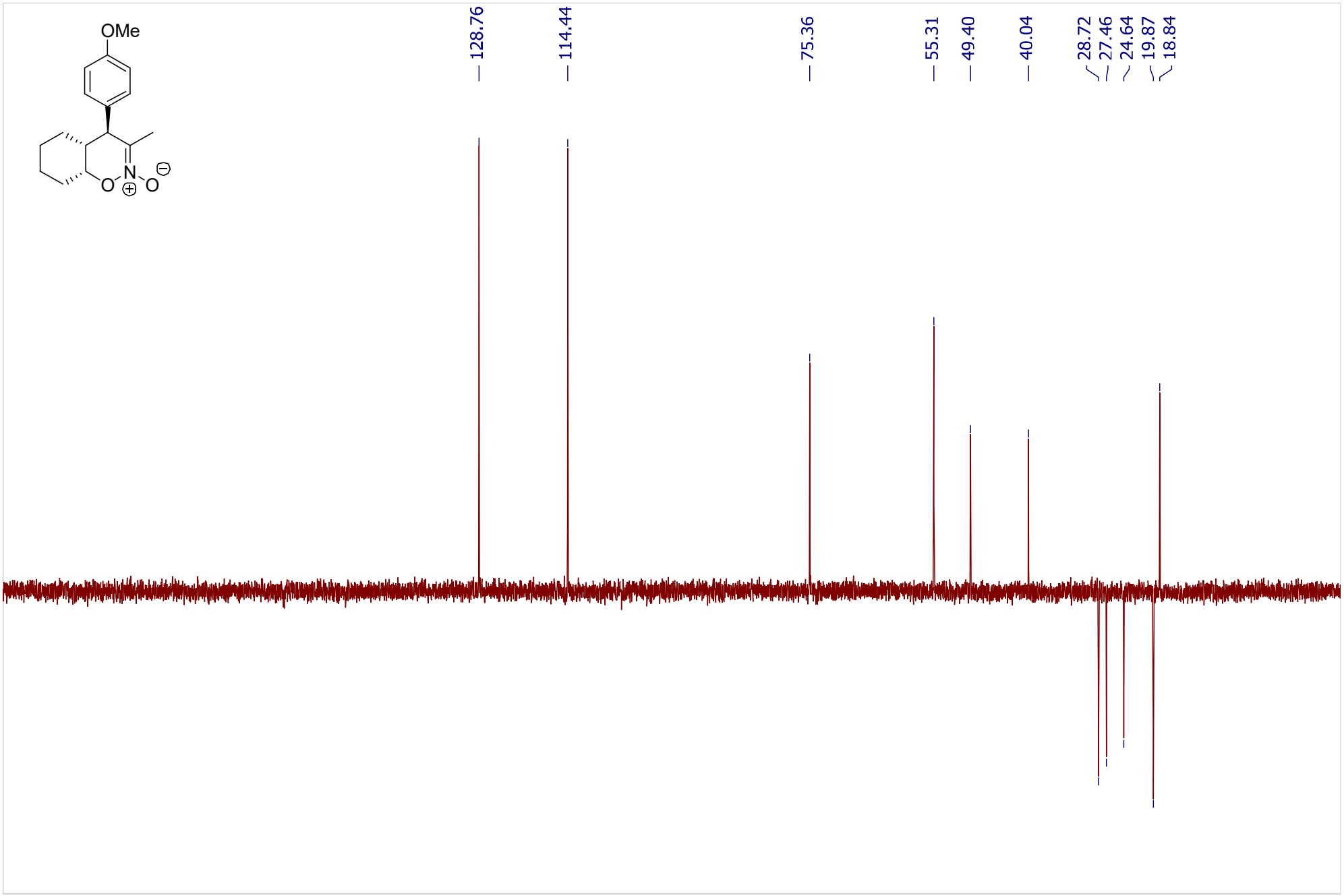
^{1}H NMR (300 MHz, $CDCl_3$)



^{13}C NMR (75 MHz, $CDCl_3$)

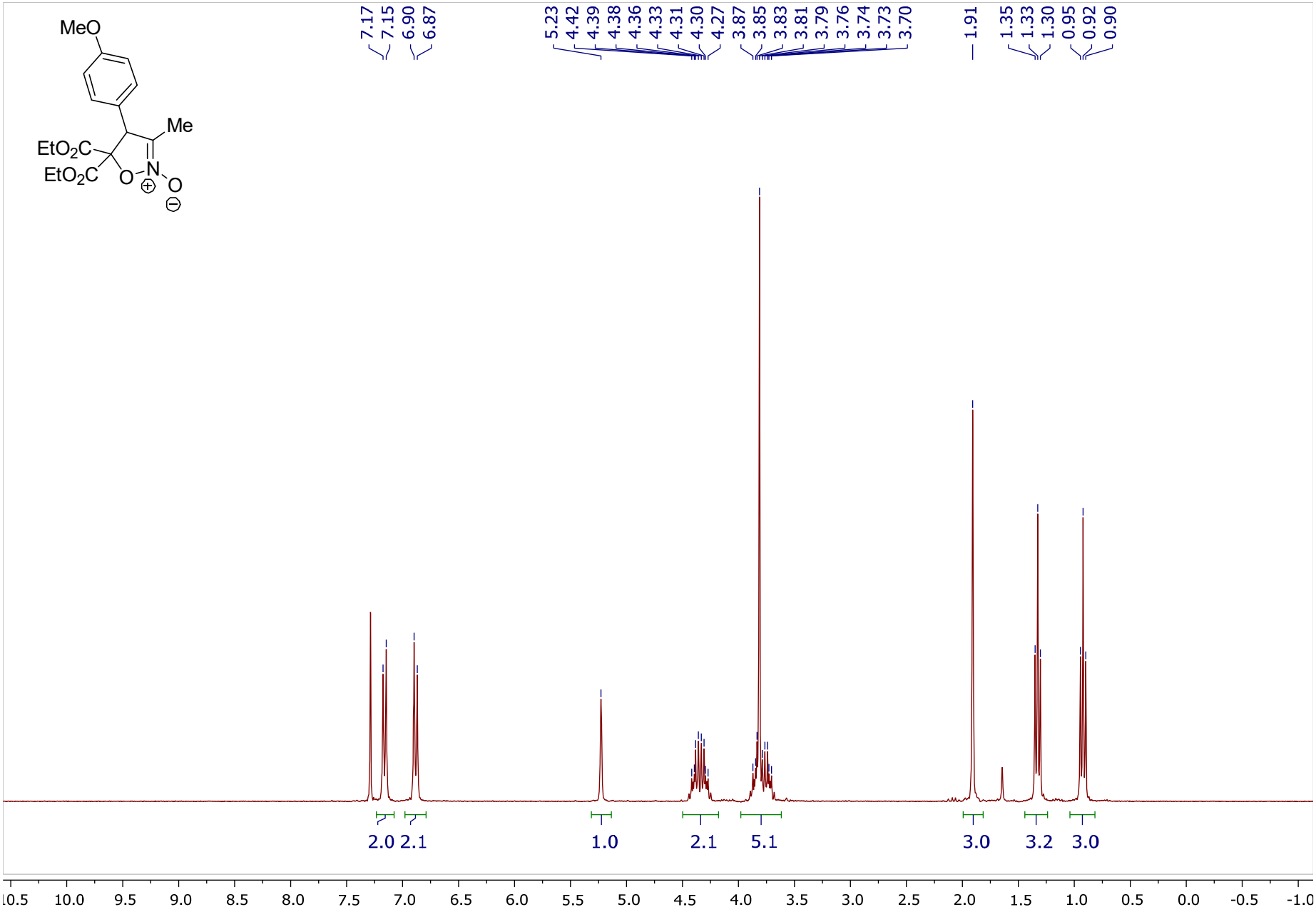


^{13}C DEPT 135 (75 MHz, $CDCl_3$)

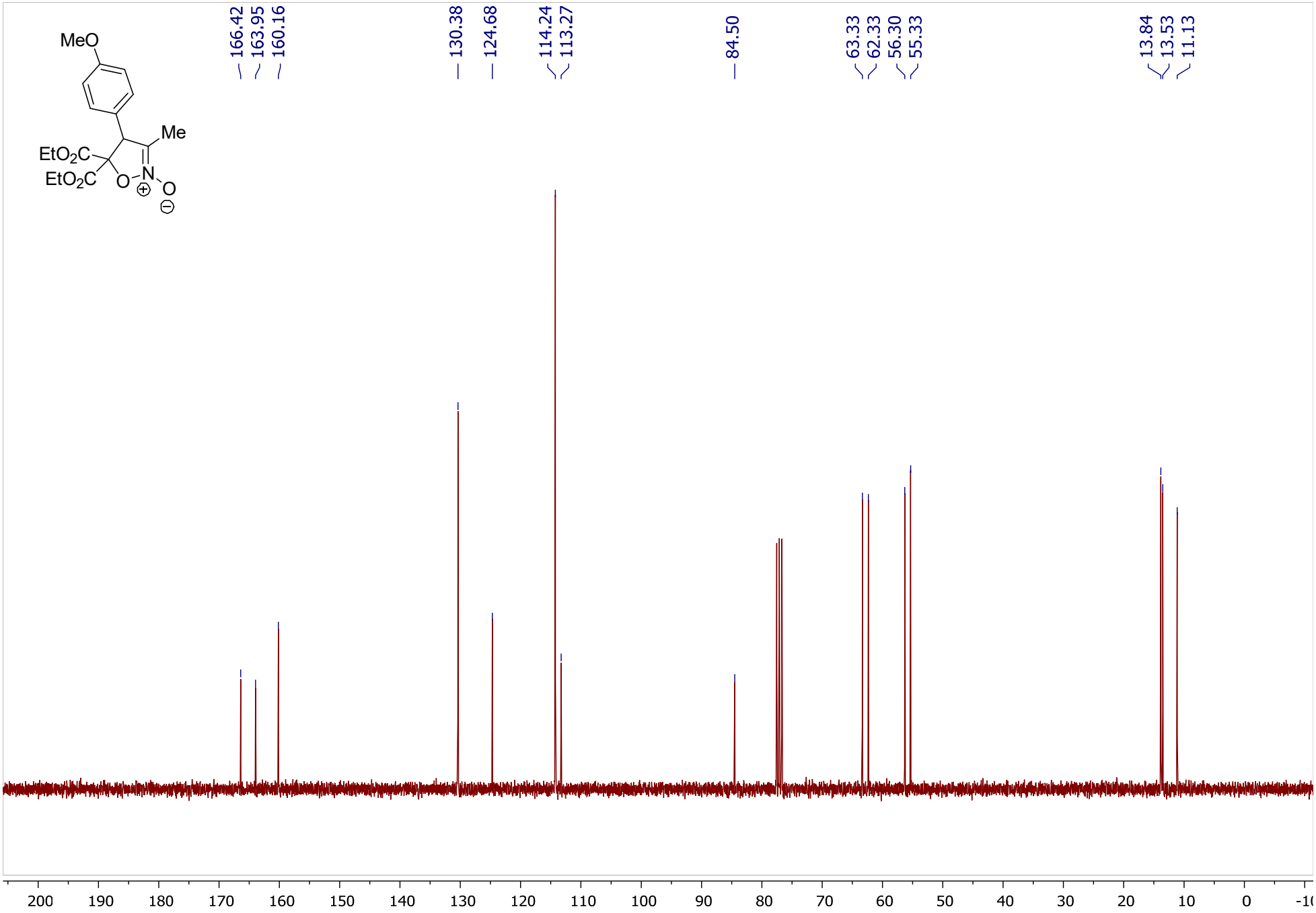


5,5-Bis(ethoxycarbonyl)-4-(4-methoxyphenyl)-3-methyl-4,5-dihydroisoxazole 2-oxide 2a

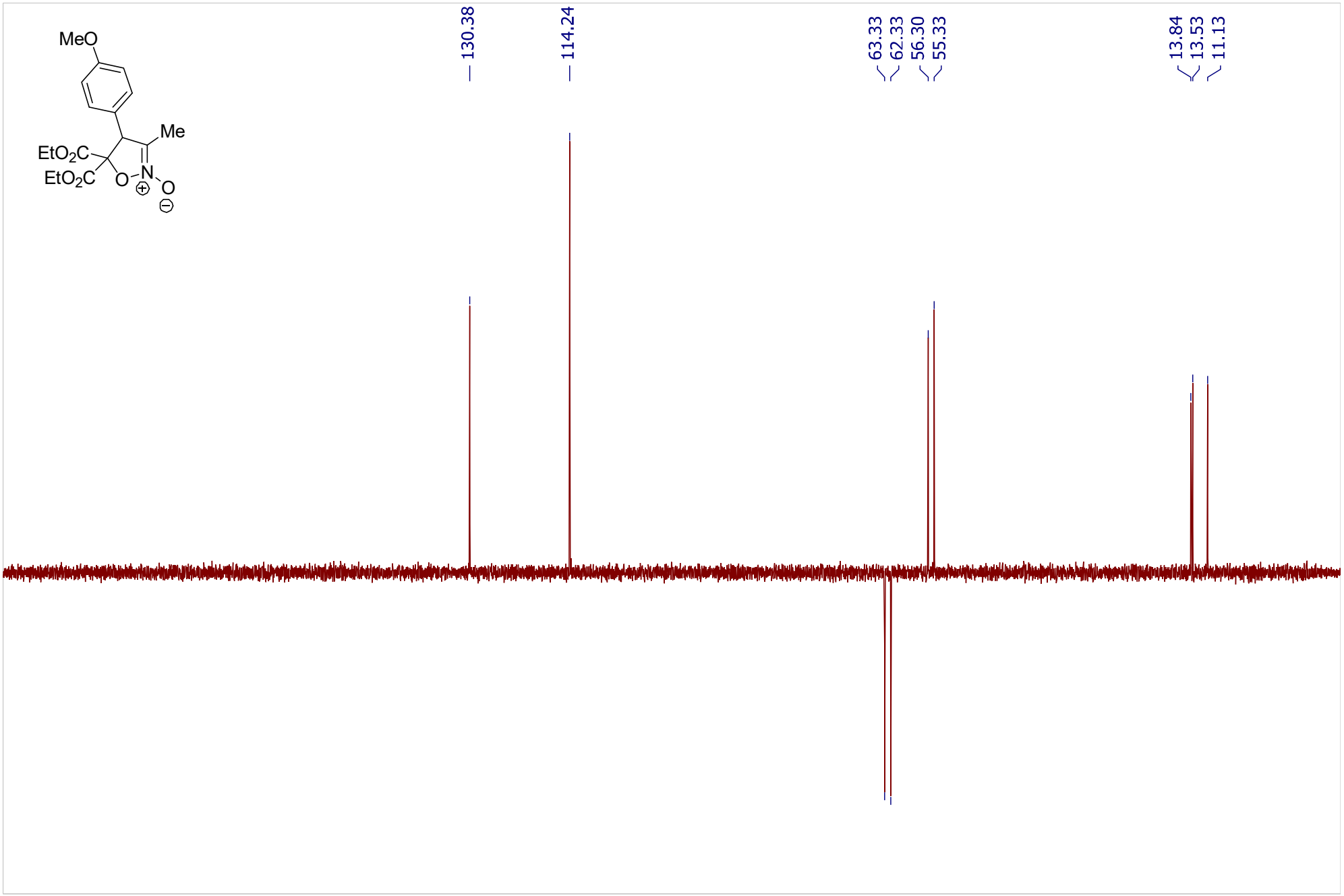
^{1}H NMR (300 MHz, $CDCl_3$)



^{13}C NMR (75 MHz, $CDCl_3$)

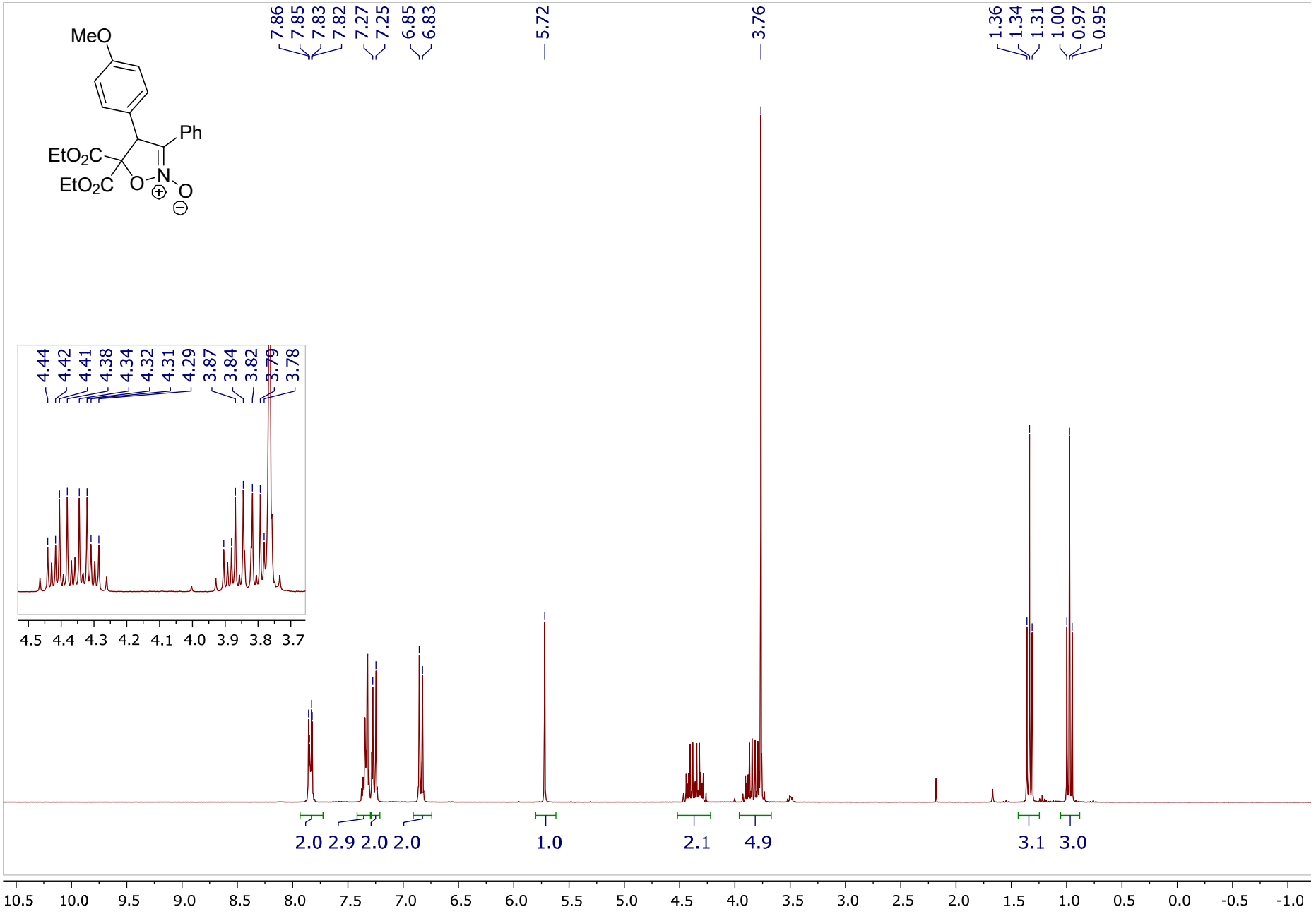


^{13}C DEPT 135 (75 MHz, $CDCl_3$)

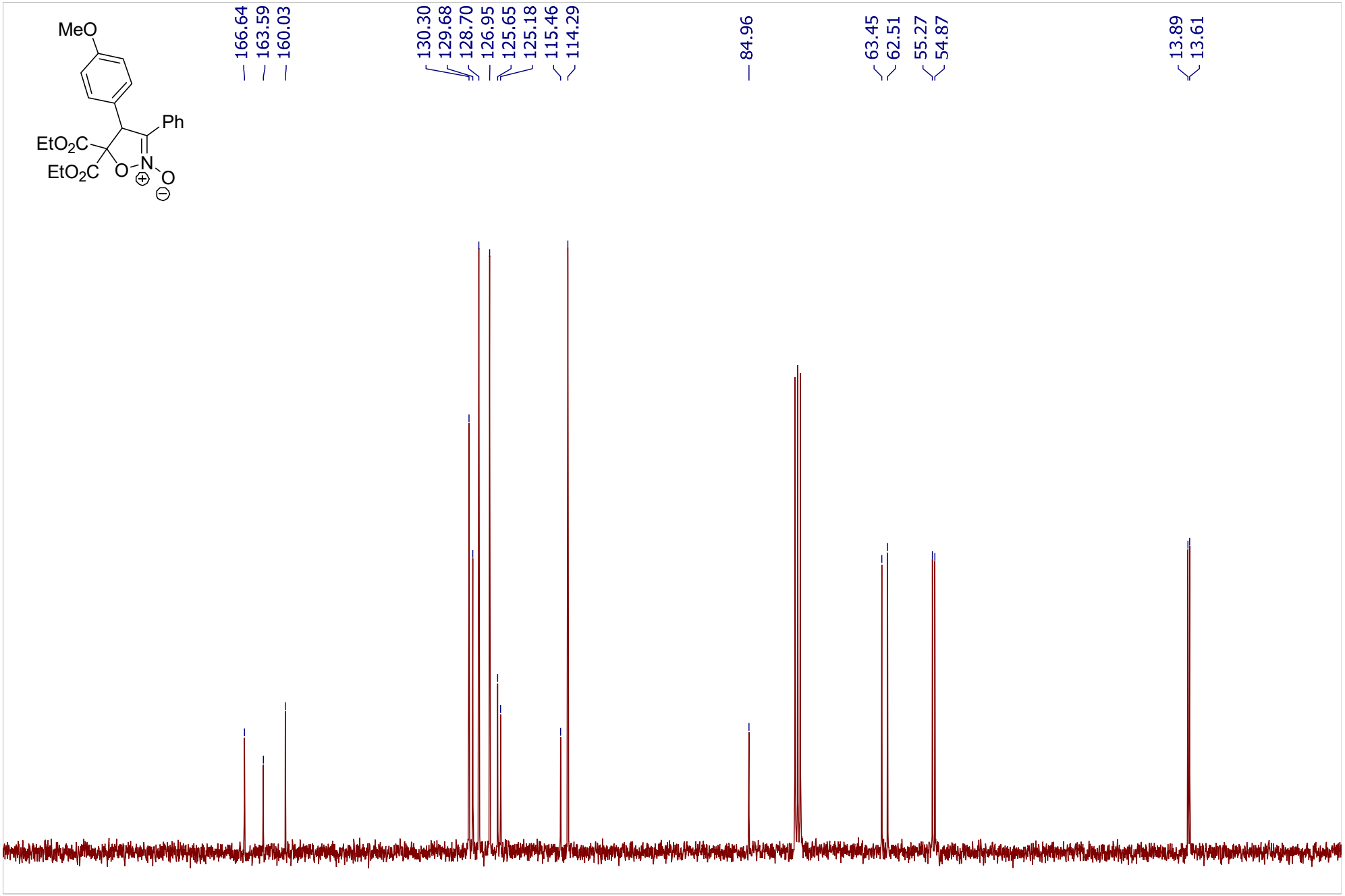


5,5-Bis(ethoxycarbonyl)-4-(4-methoxyphenyl)-3-phenyl-4,5-dihydroisoxazole 2-oxide 2c

^{1}H NMR (300 MHz, $CDCl_3$)

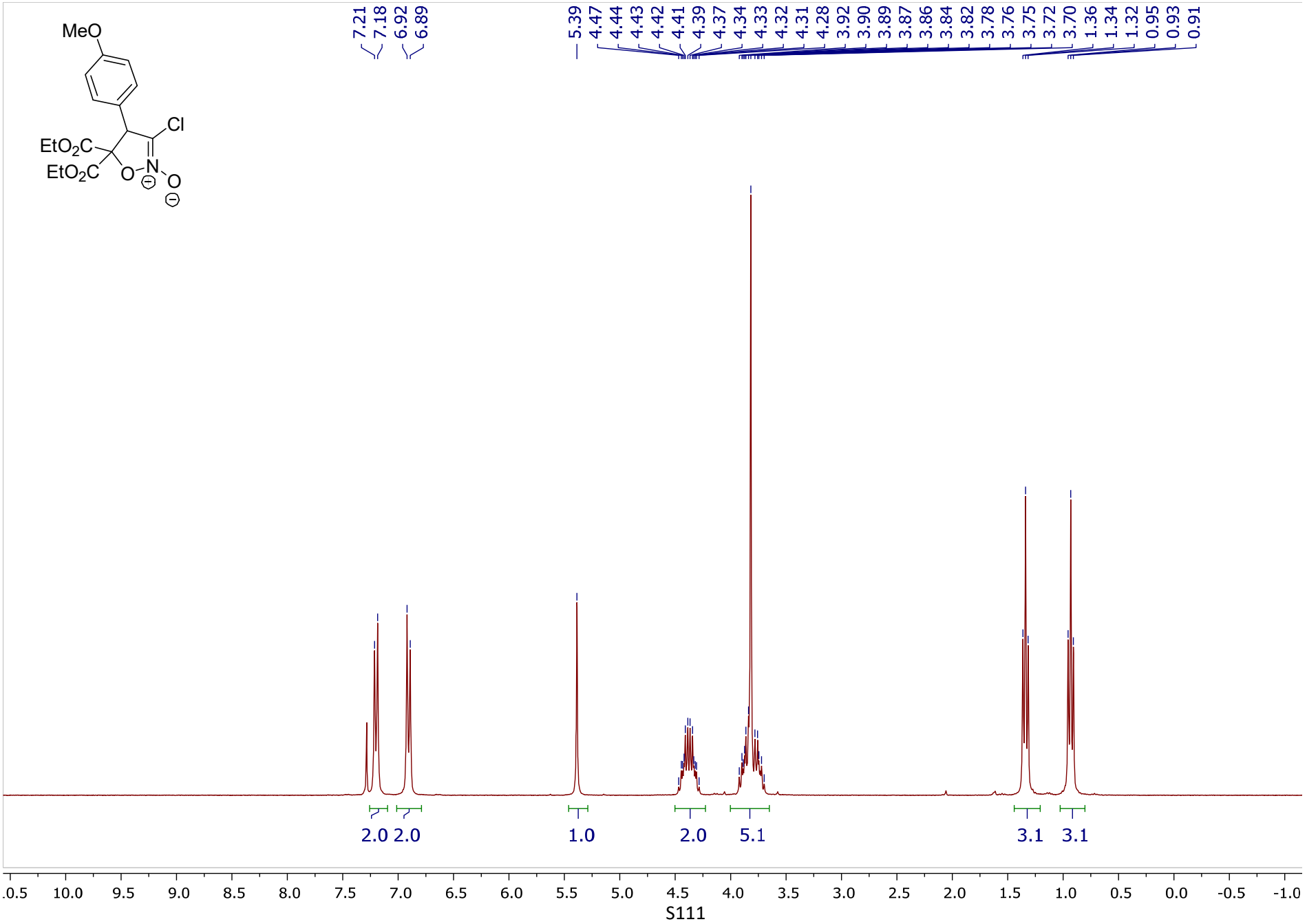


^{13}C NMR (75 MHz, $CDCl_3$)

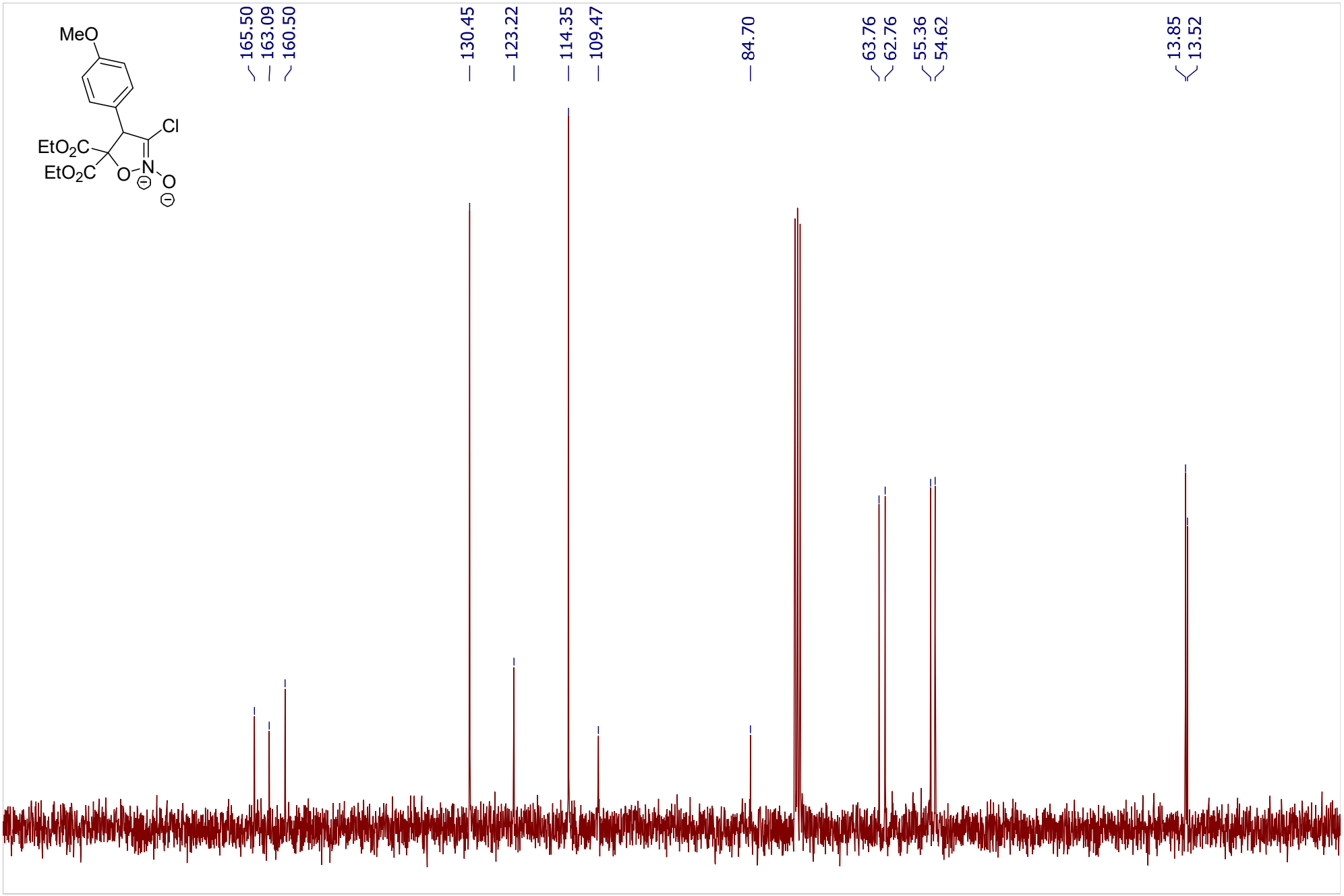


3-Chloro-5,5-bis(ethoxycarbonyl)-4-(4-methoxyphenyl)-4,5-dihydroisoxazole 2-oxide 2d

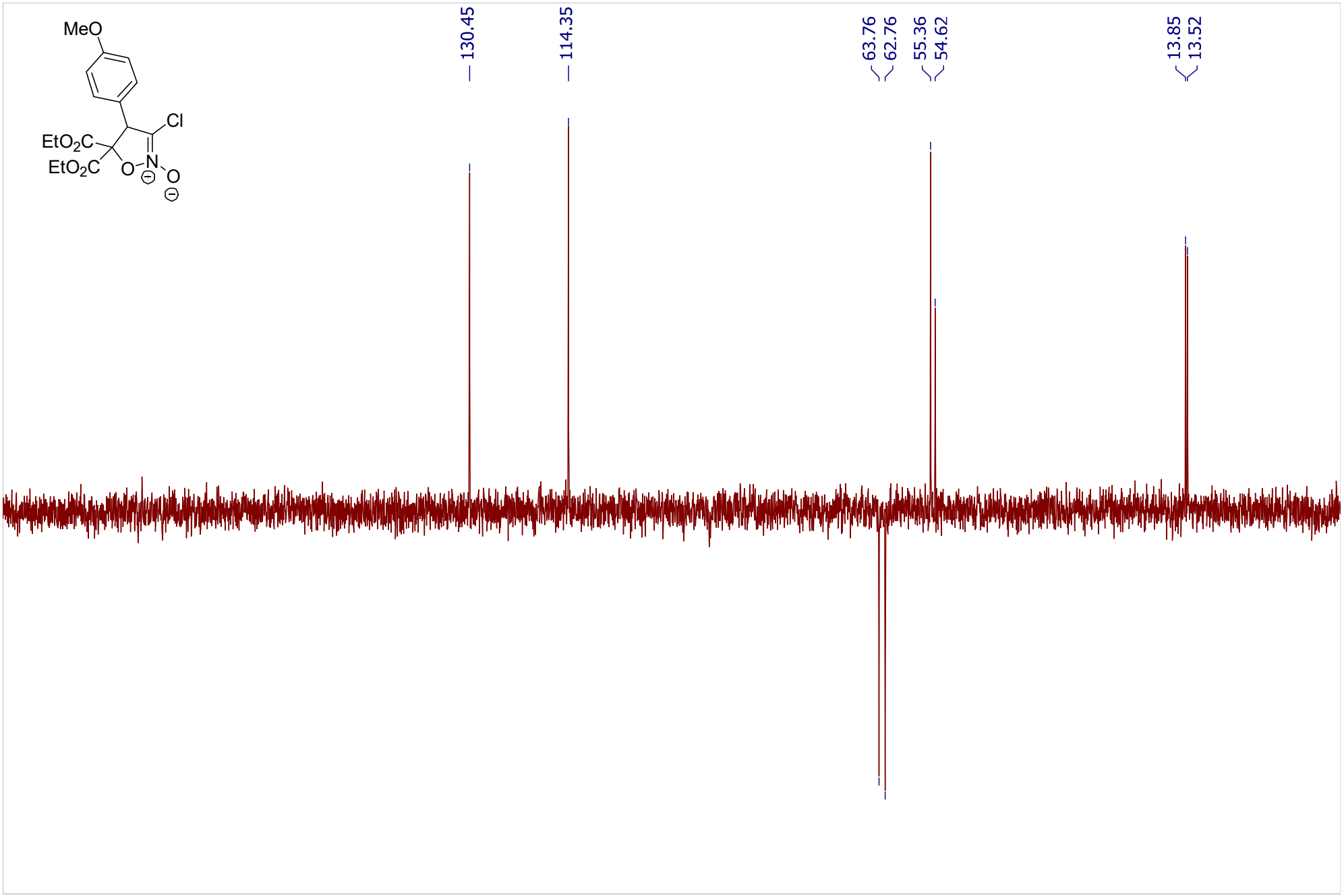
^{1}H NMR (300 MHz, $CDCl_3$)



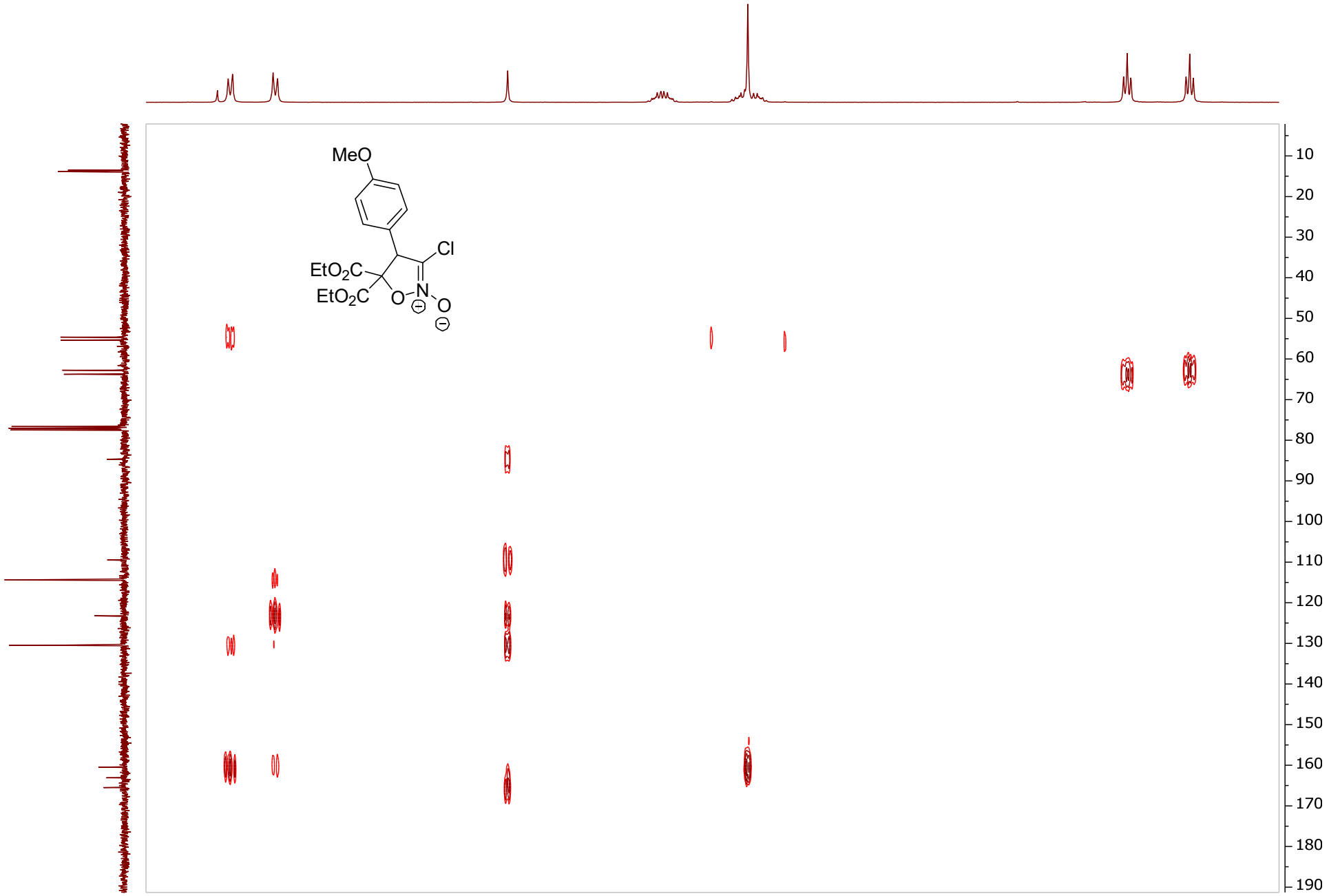
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{13}C HMBC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Cl
EtO2C
EtO2C
O
N
O
10
20
30
40
50
60
70
80
90
100
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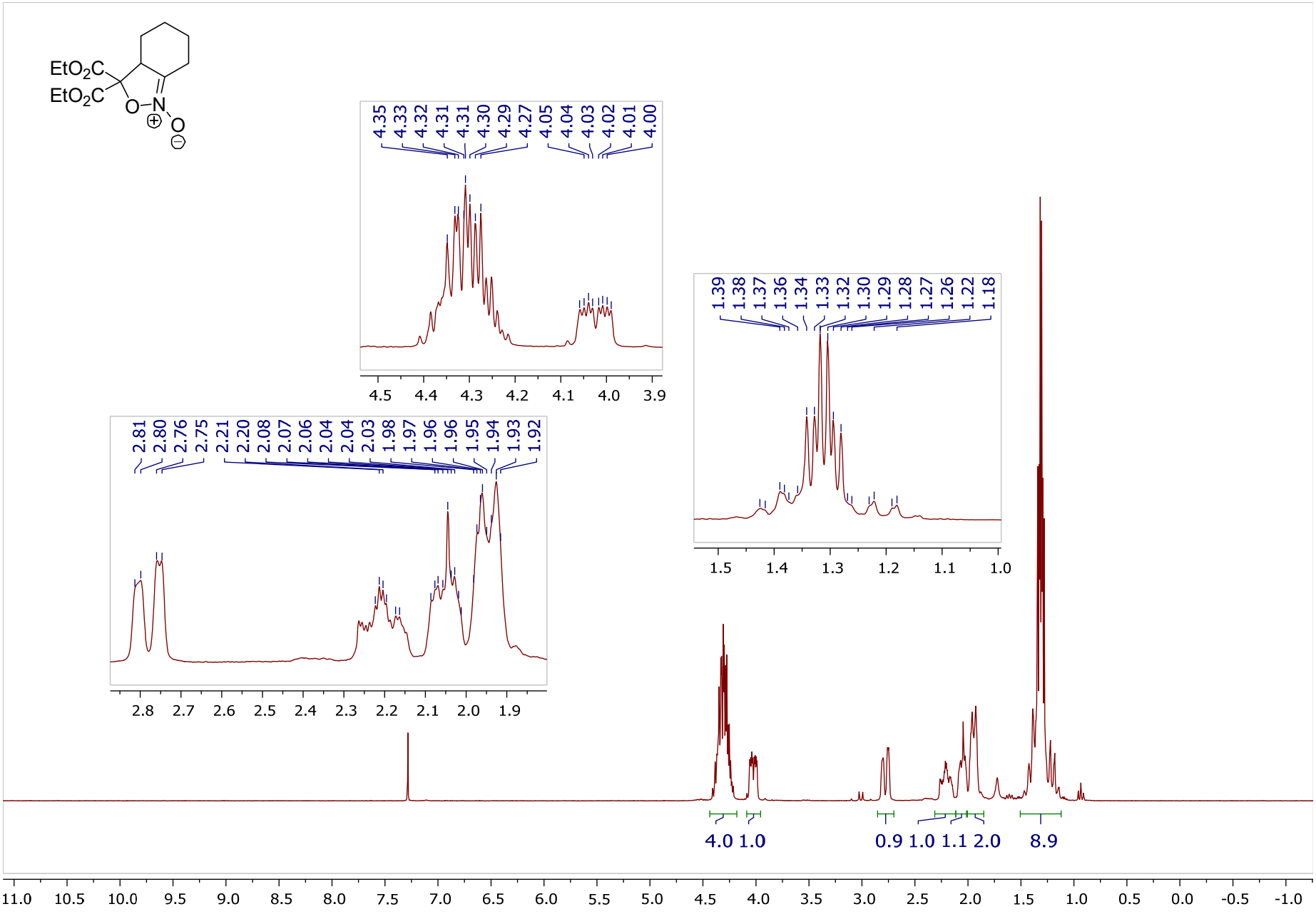
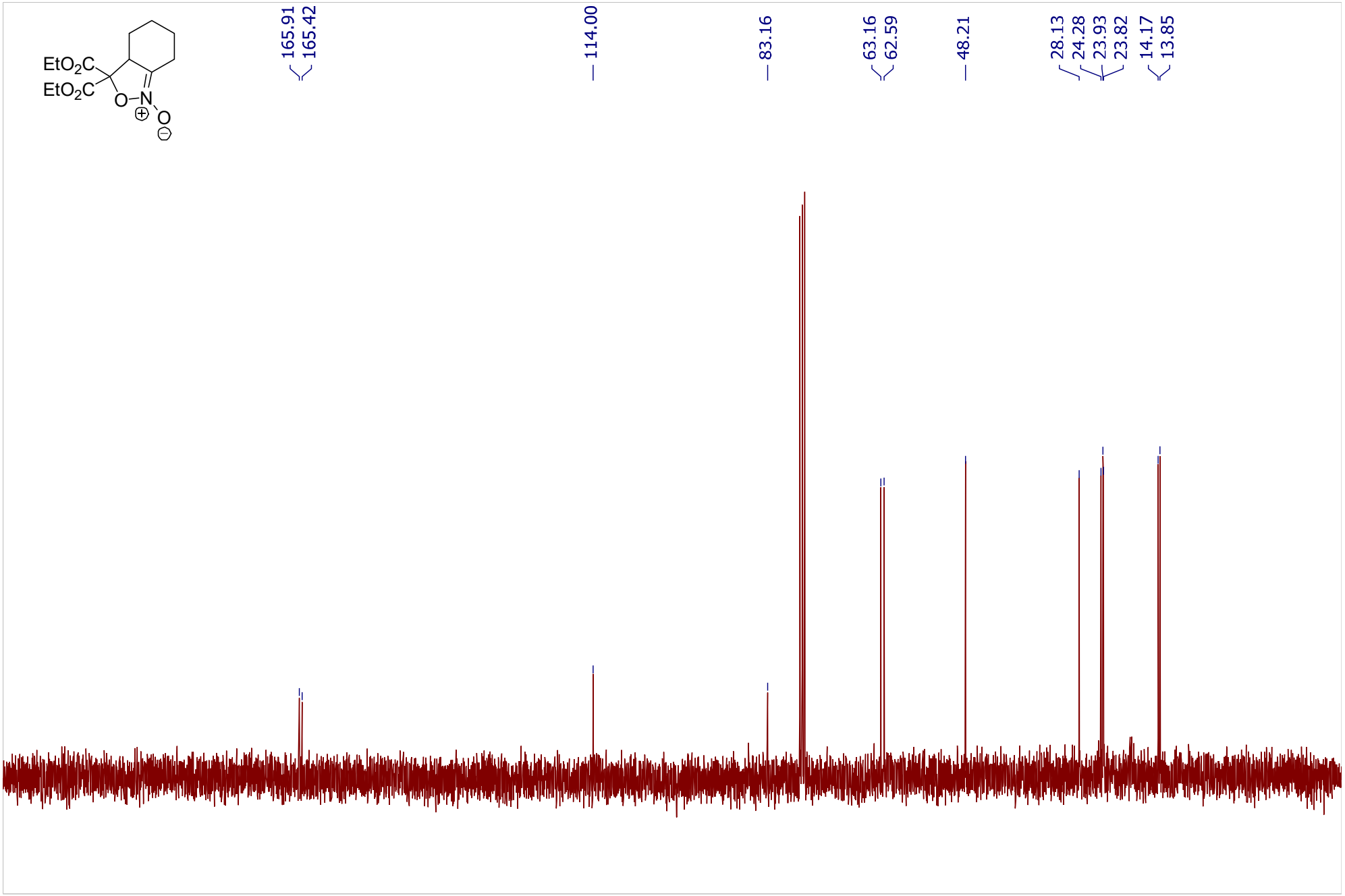
120
130
140
150
160
170
180
190
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

3,3-Bis(ethoxycarbonyl)-3,3a,4,5,6,7-hexahydrobenzo[c]isoxazole 1-oxide 2e

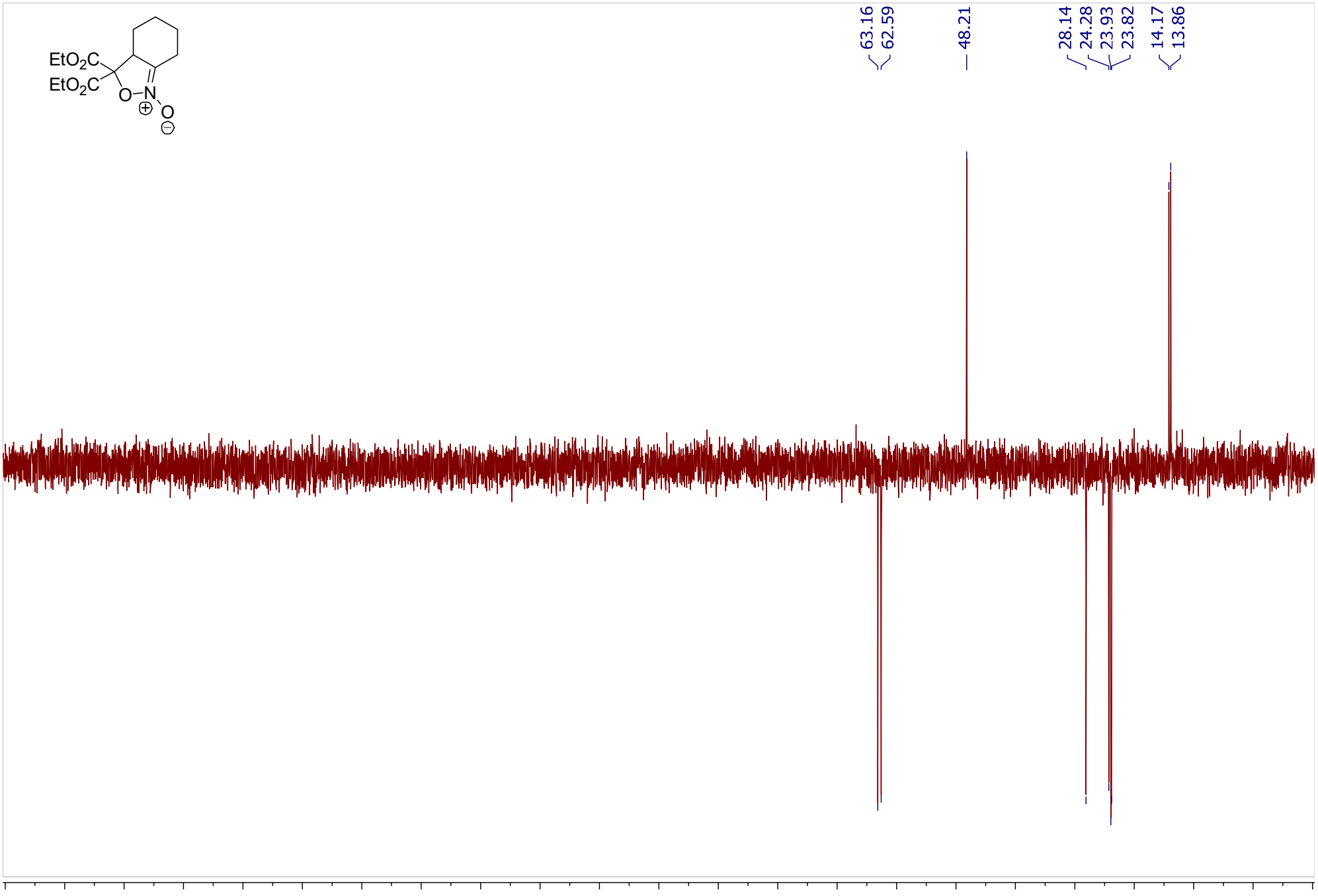
^{1}H NMR (300 MHz, $CDCl_3$)



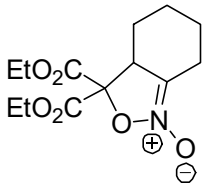
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)

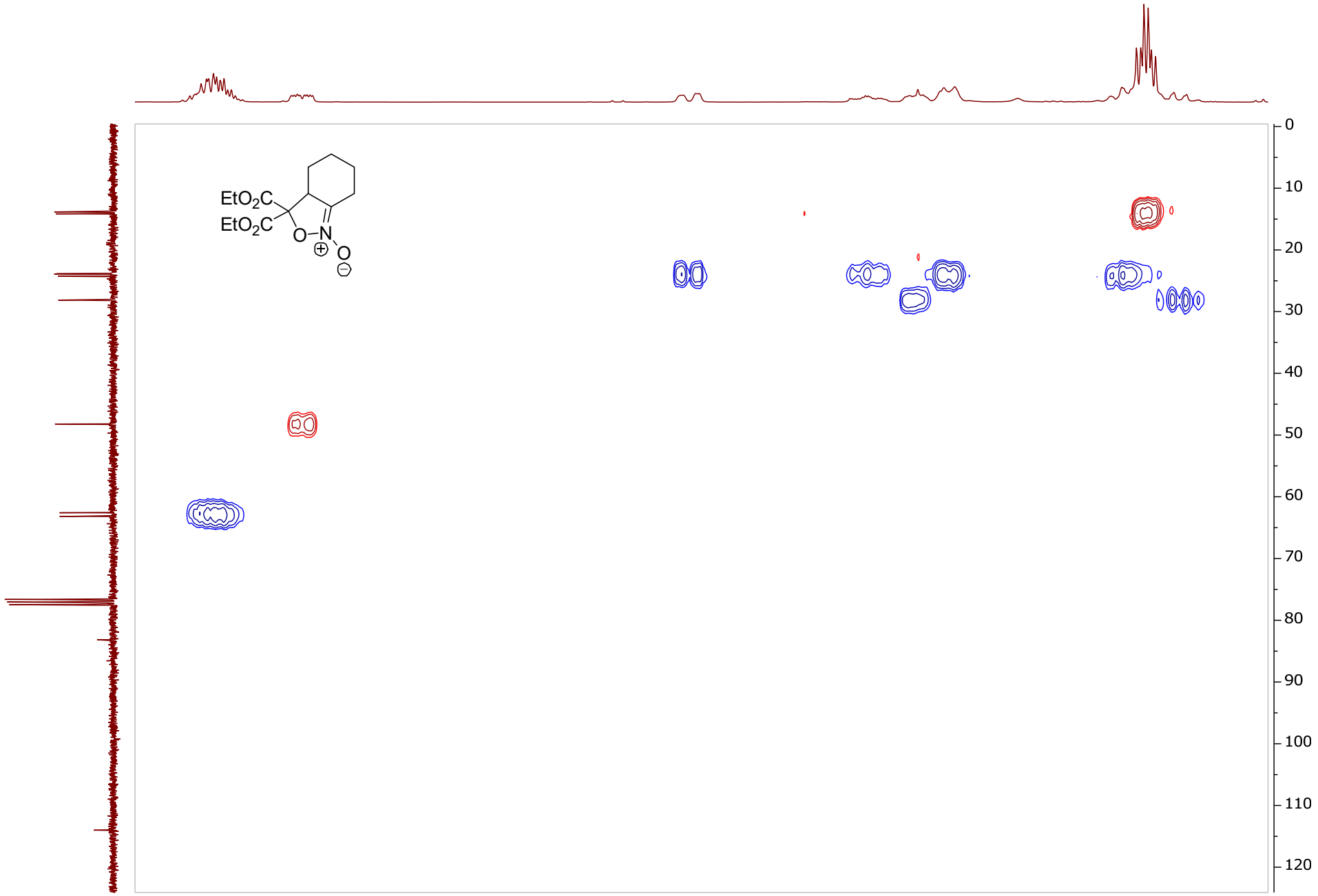


^{1}H-^{1}H COSY


EtO2C
EtO2C
O
N
O

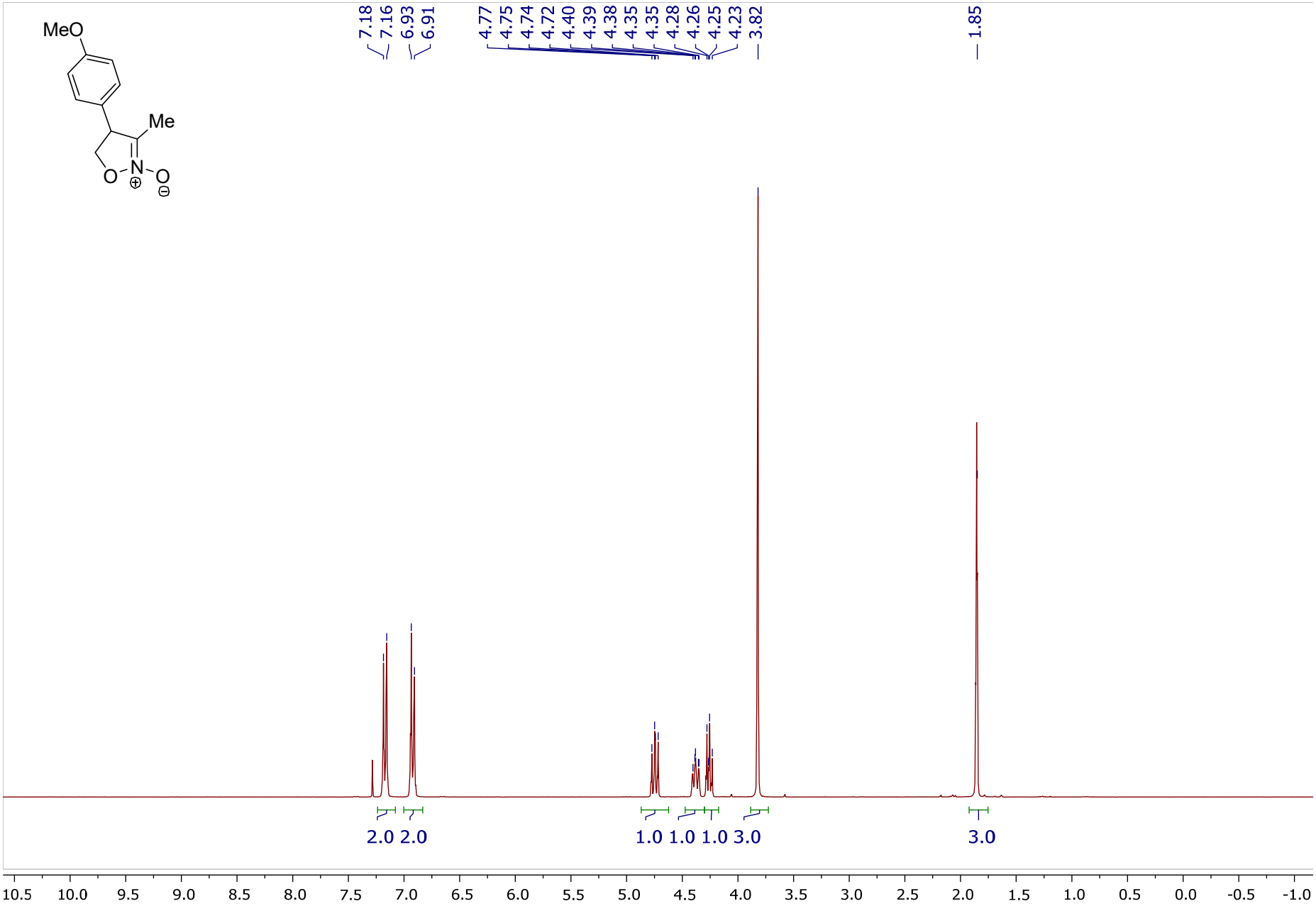
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6

^{1}H-^{13}C HSQC


EtO2C
EtO2C
O–N
O
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0
10
20
30
40
50
60
70
80
90
100
110
120

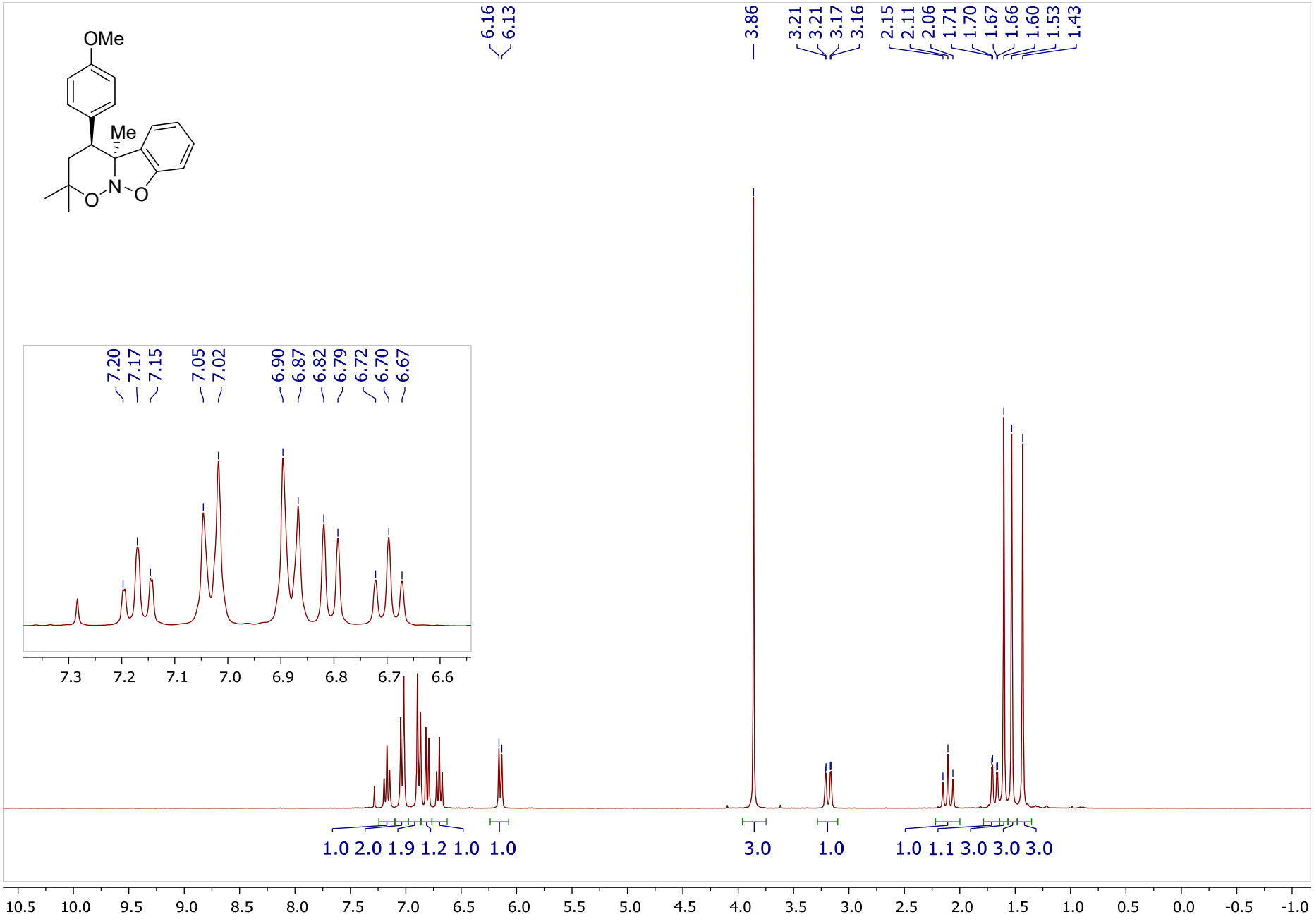
4-(4-Methoxyphenyl)-3-methyl-4,5-dihydroisoxazole 2-oxide 2f

^{1}H NMR (300 MHz, $CDCl_3$)

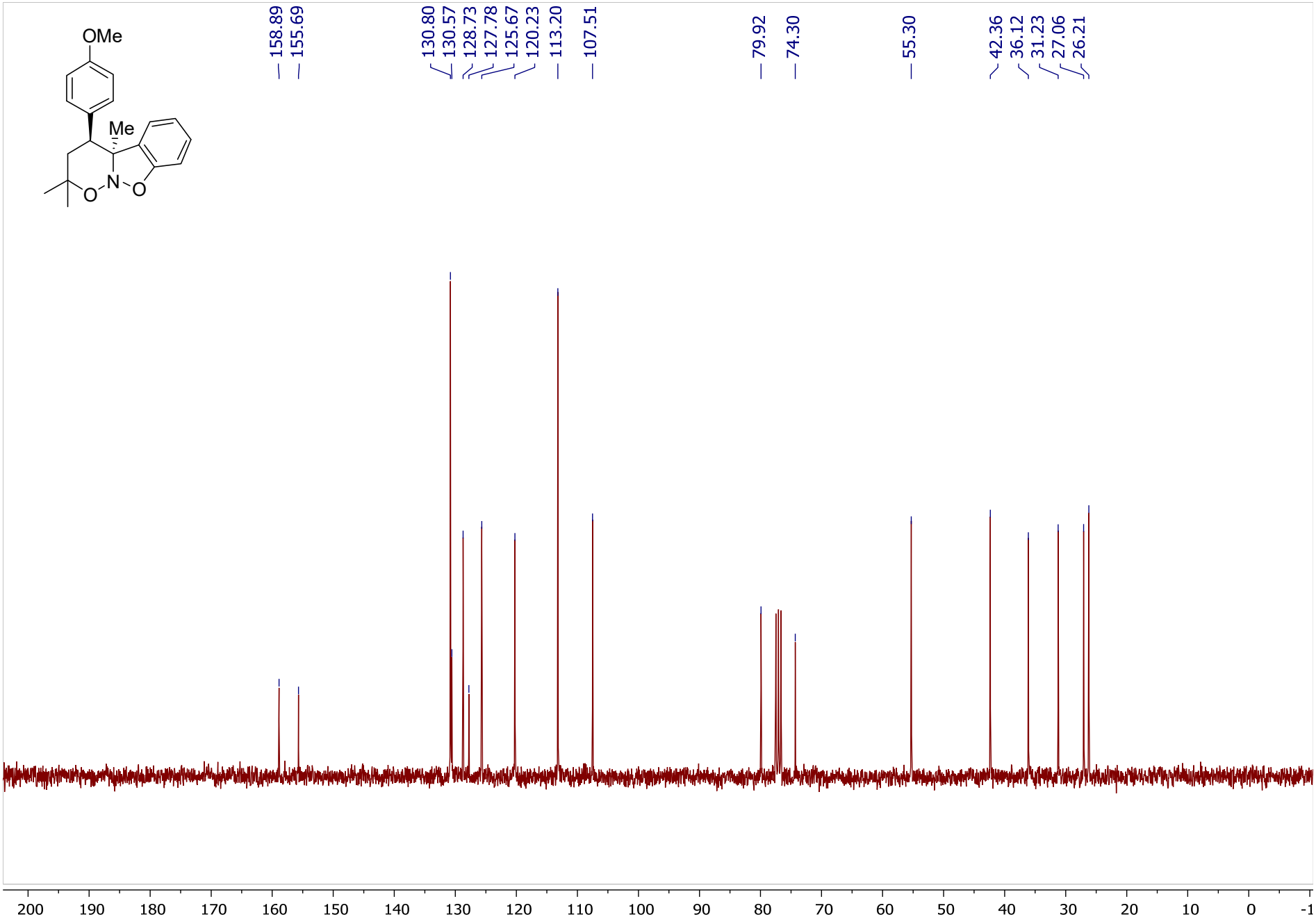


(4*S,4a*S**)-4-(4-Methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5aa**

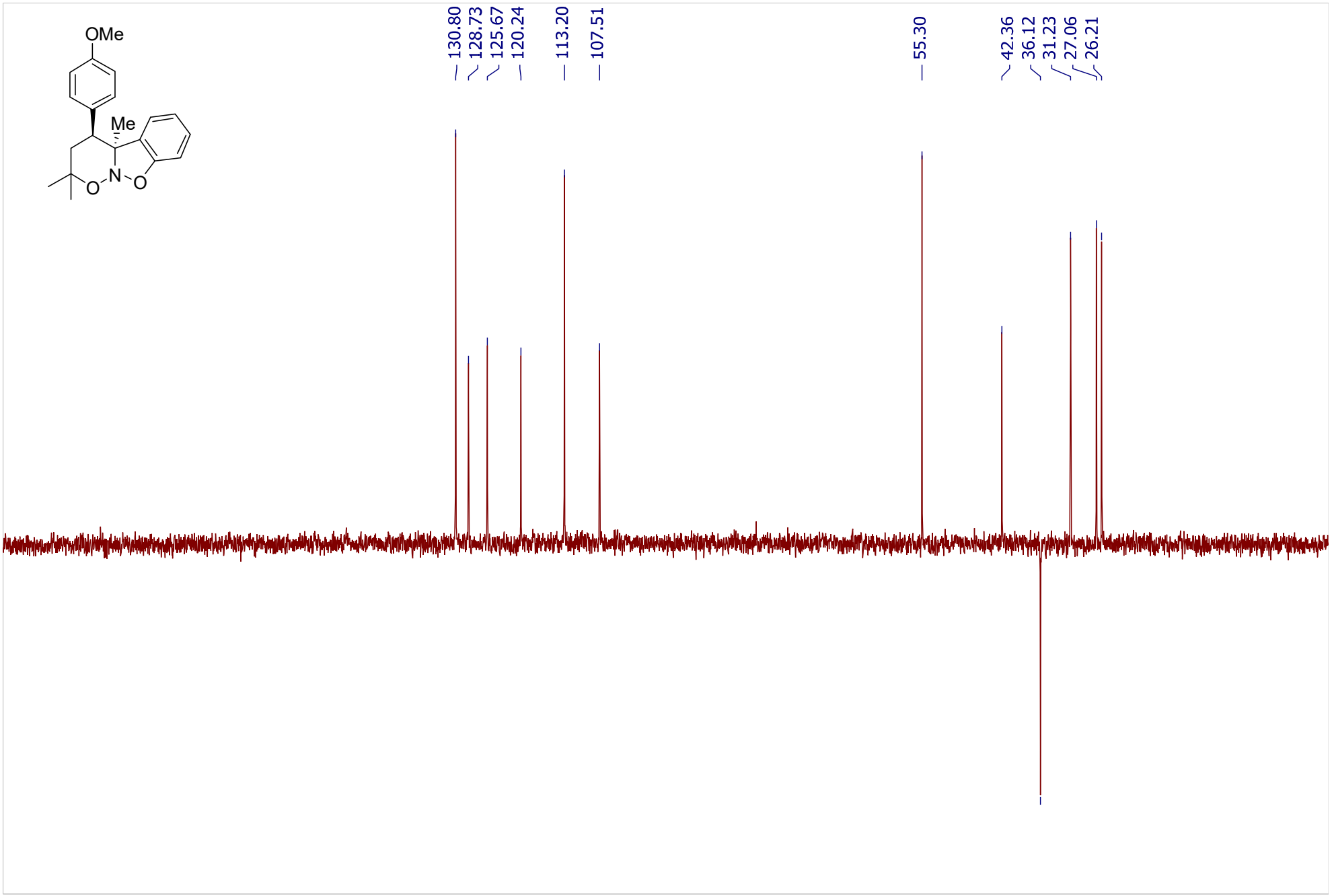
^{1}H NMR (300 MHz, $CDCl_3$)



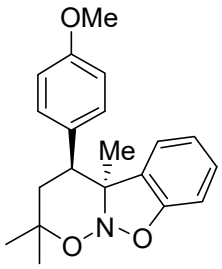
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{13}C HMBC


OMe
Me
N
O
O

20
30
40
50
60
70
80
90
100
110
120
130
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150
160
170
7.0
6.5
6.0
5.5
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4.0
3.5
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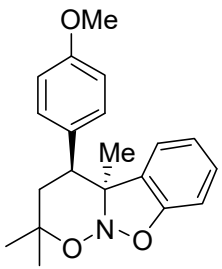
1.5
1.0

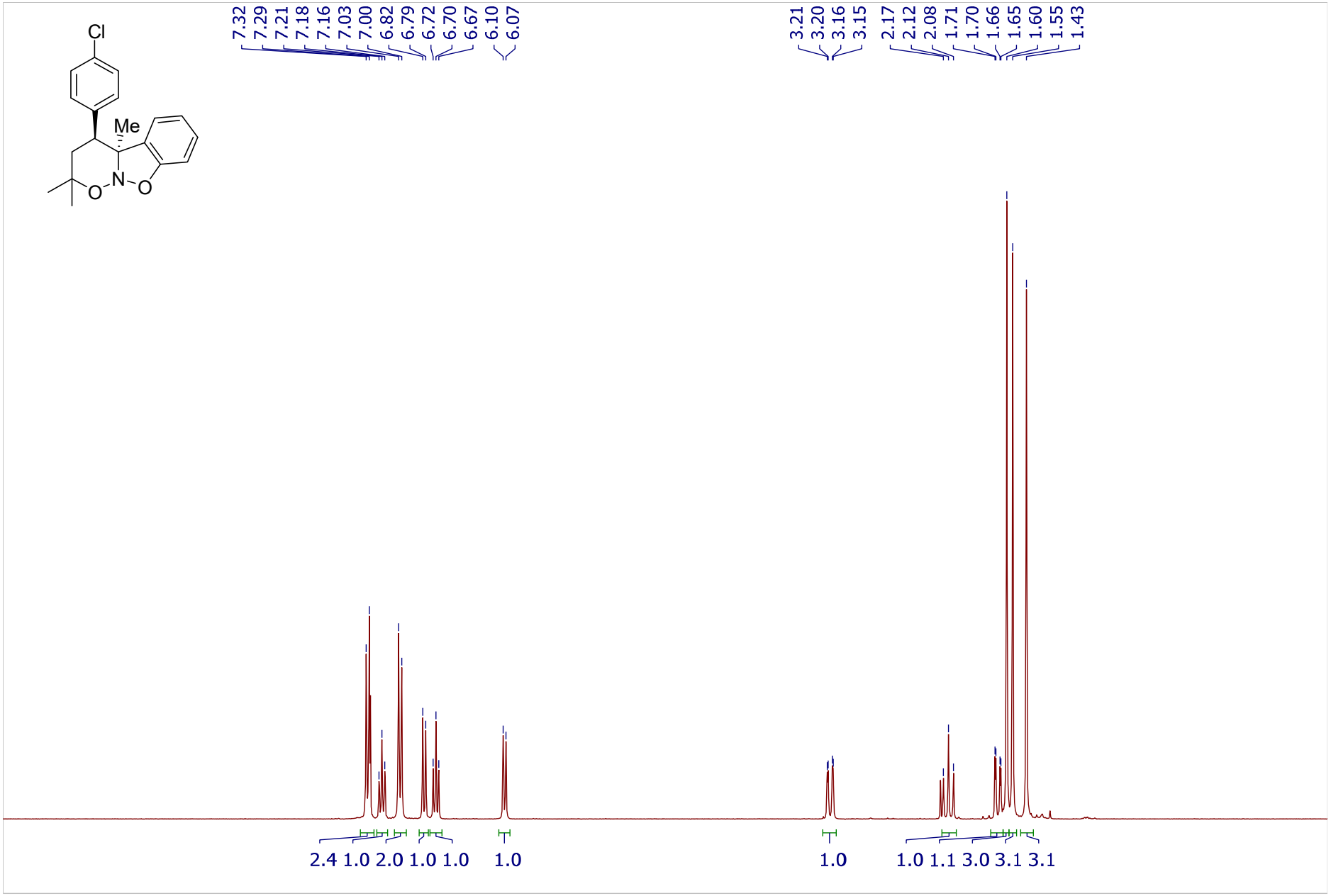
^{1}H-^{1}H NOESY


OMe
Me
N
O
O

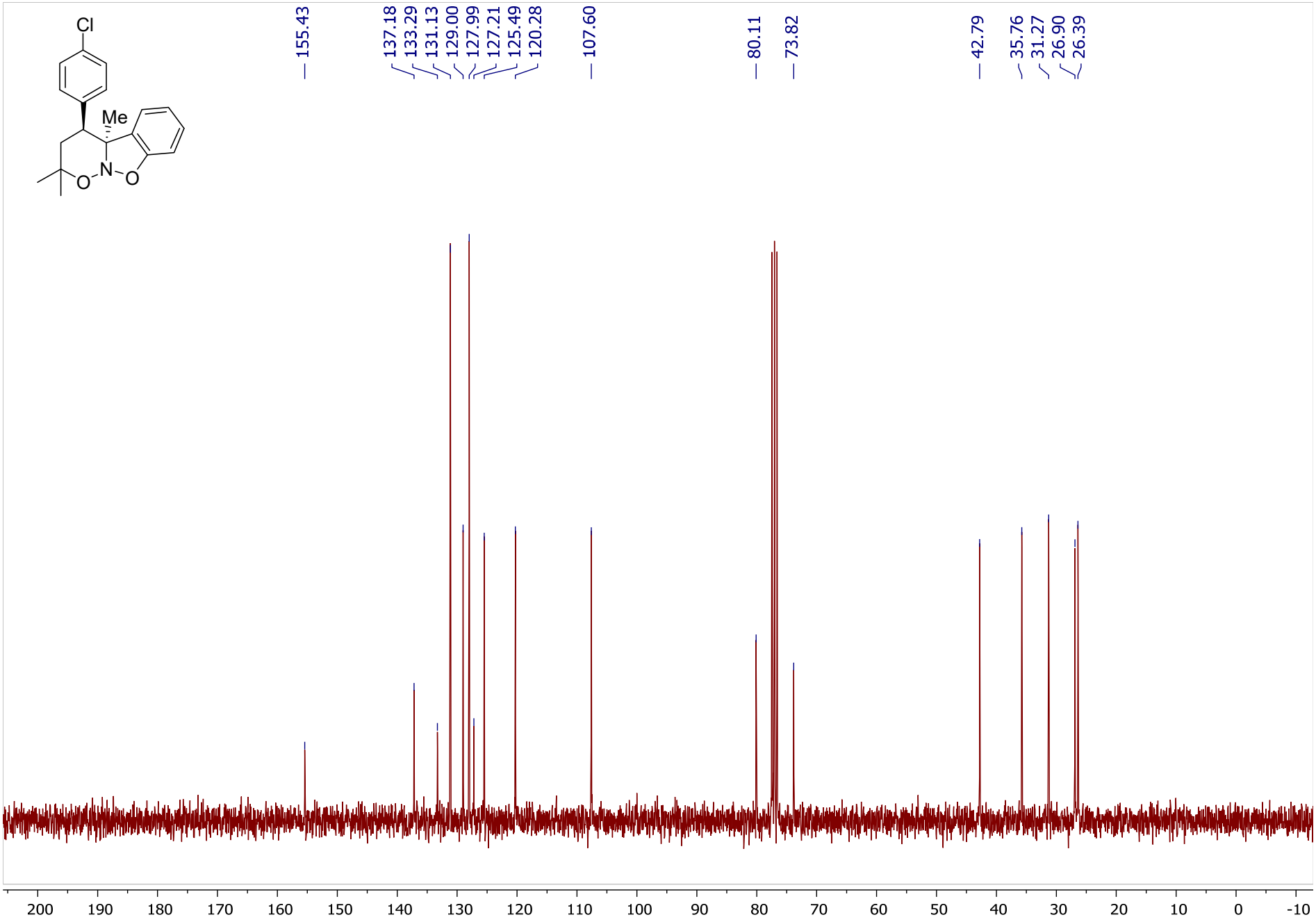
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

(4*S,4a*S**)-4-(4-Chlorophenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ba**

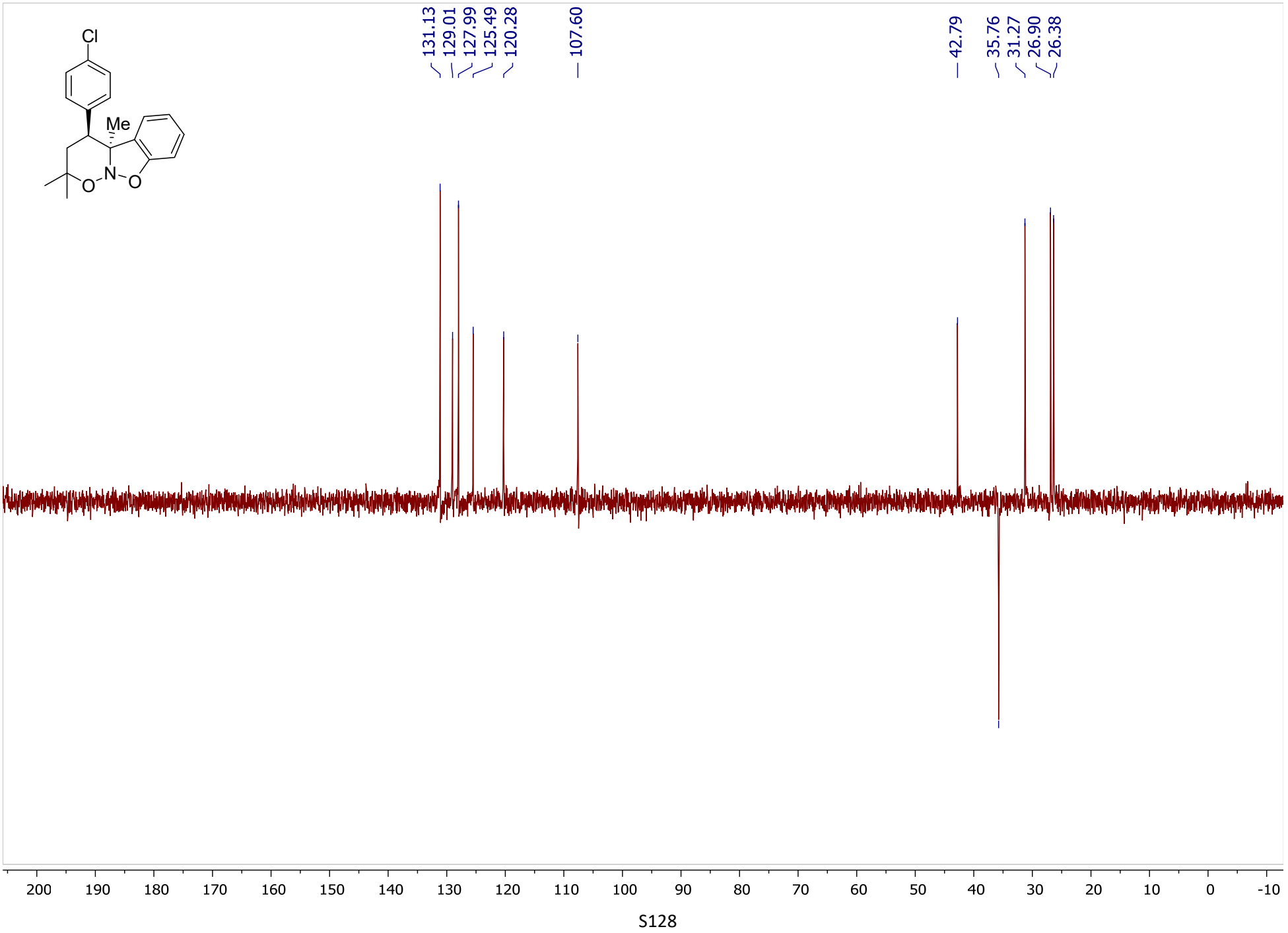
^{1}H NMR (300 MHz, $CDCl_3$)



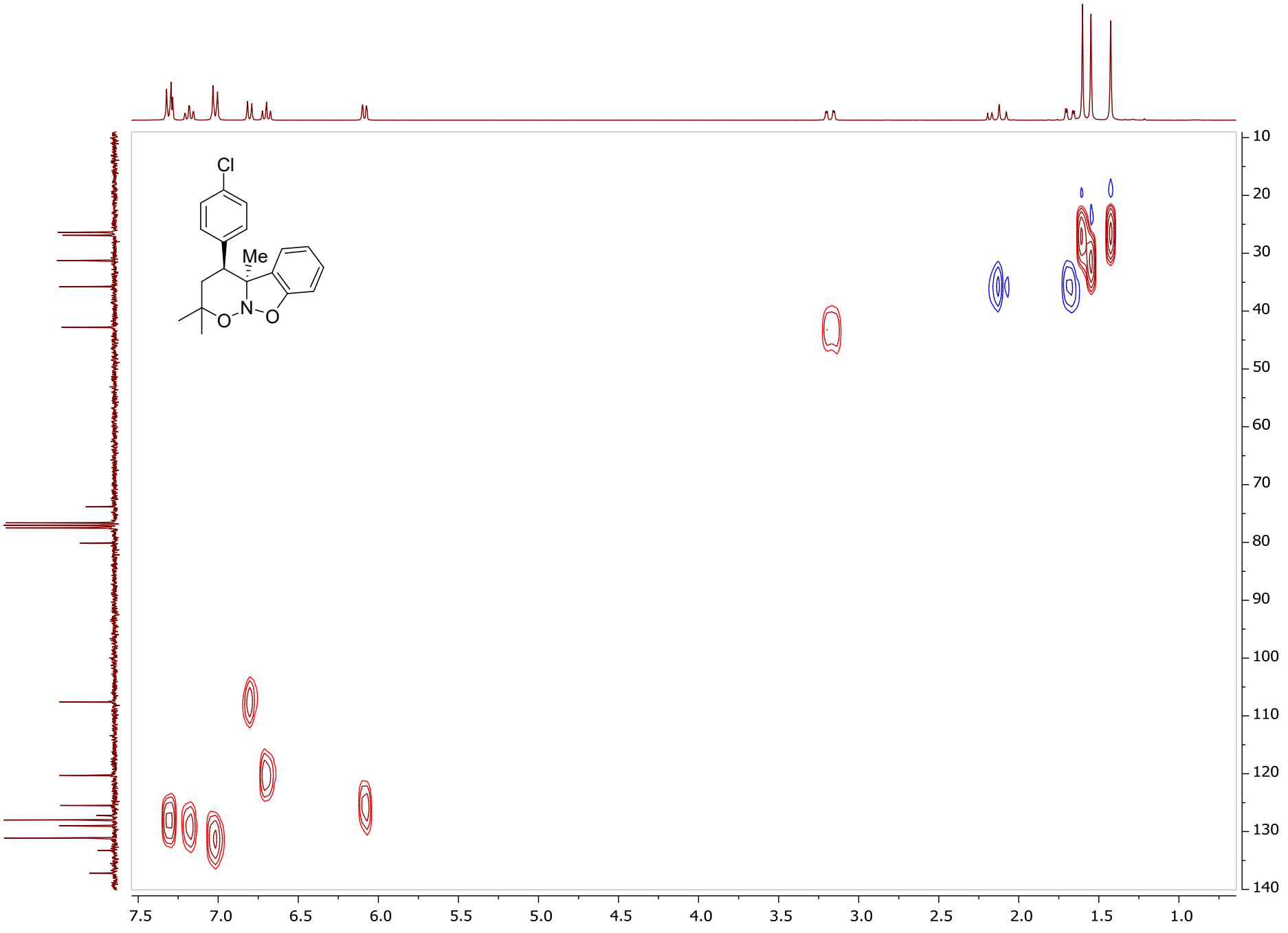
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{13}C HSQC


Cl
Me
N
O
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
7.5
7.0
6.5
6.0
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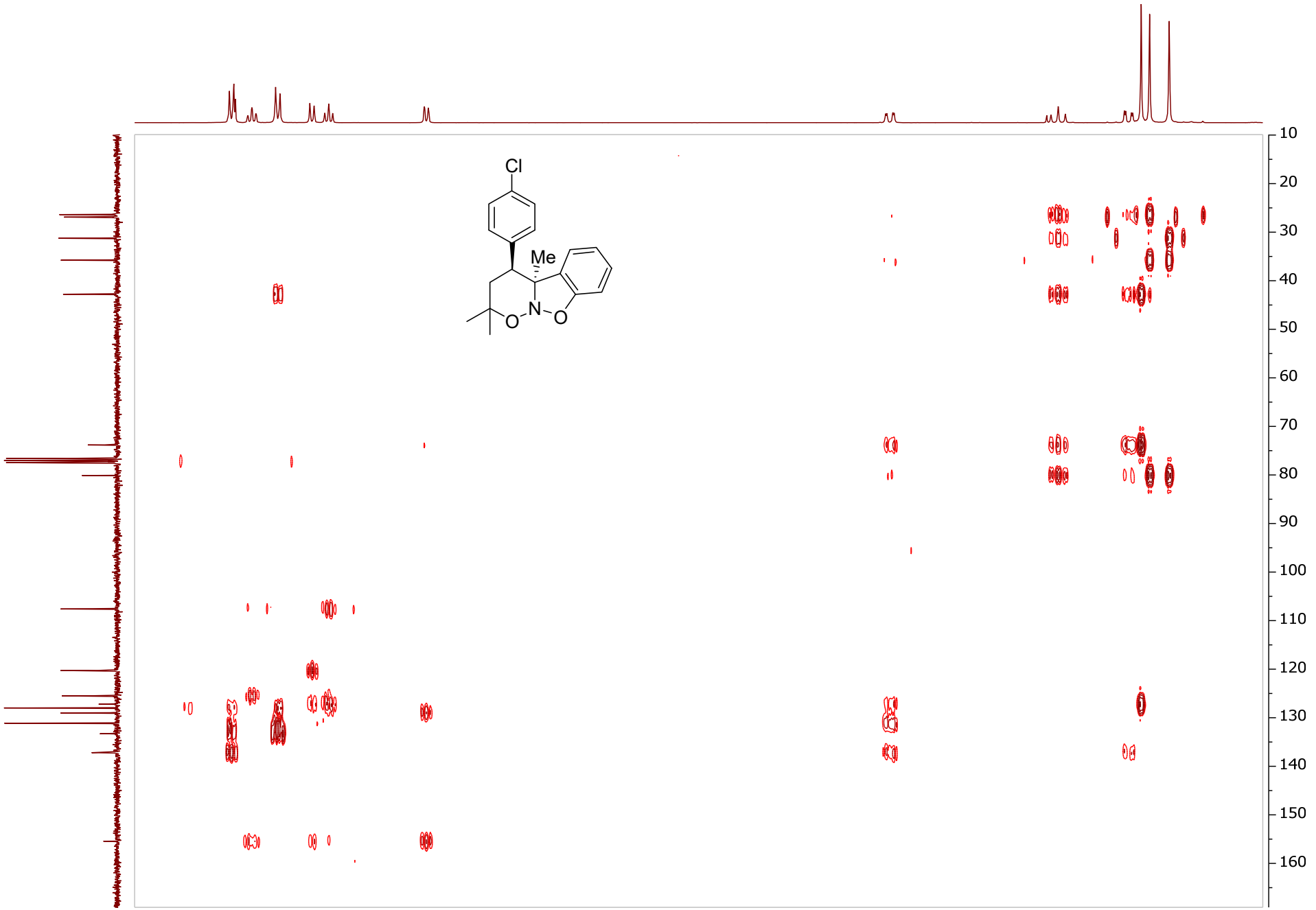
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{13}C HMBC


Cl
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O
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40
50
60
70
80
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110
120
130
140
150
160
7.5
7.0
6.5
6.0
5.5
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3.5
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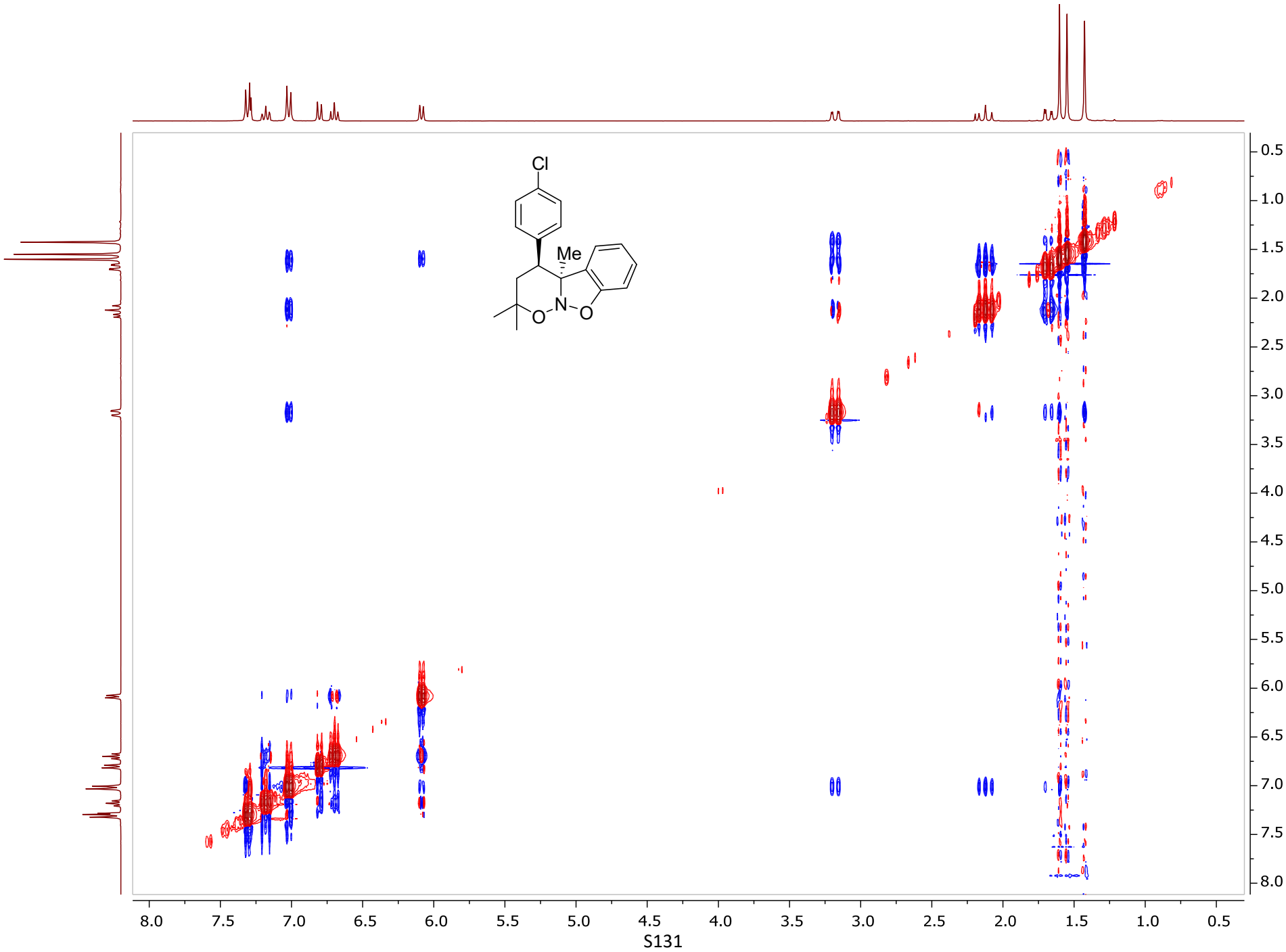
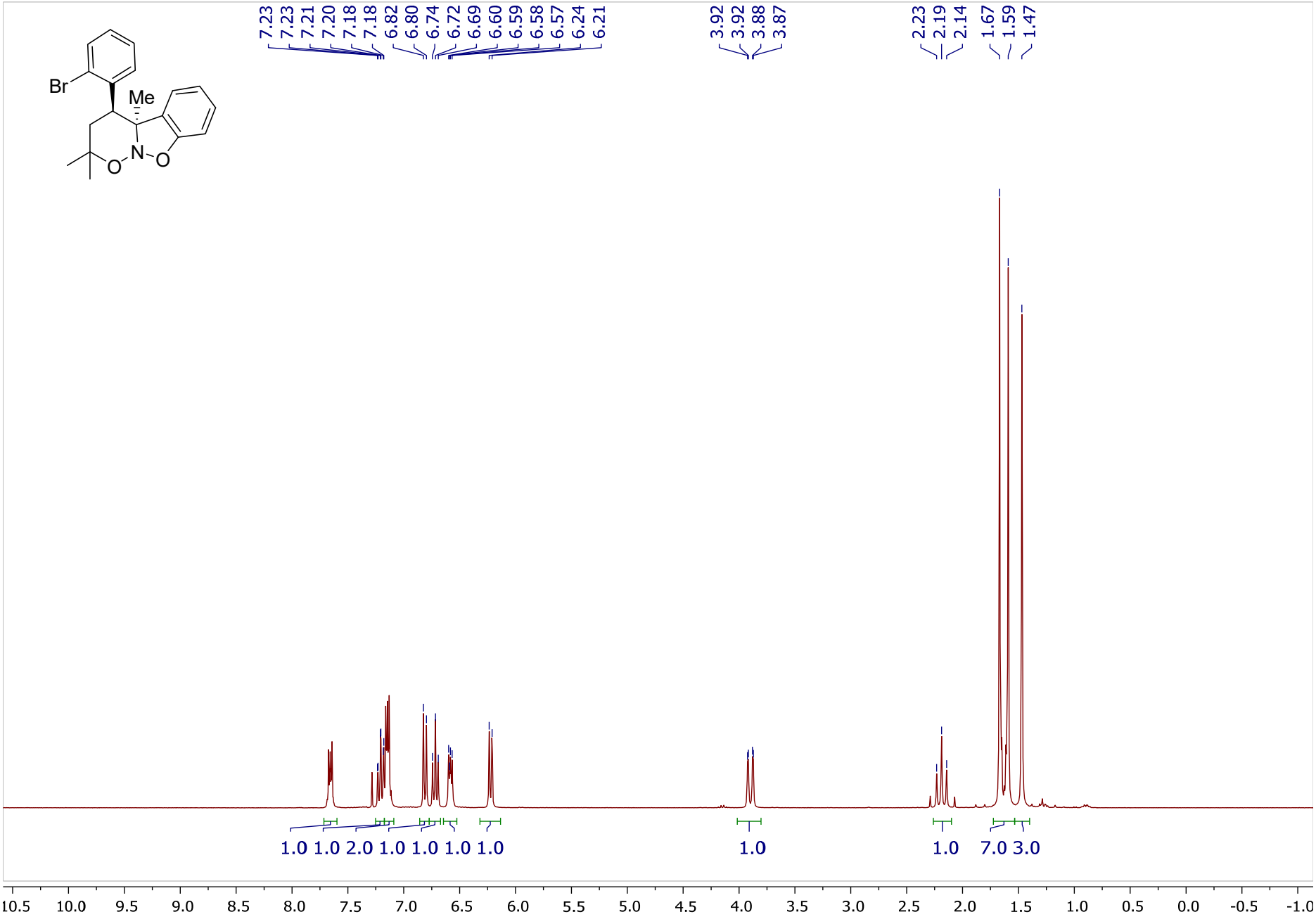
1.0

^{1}H-^{1}H NOESY

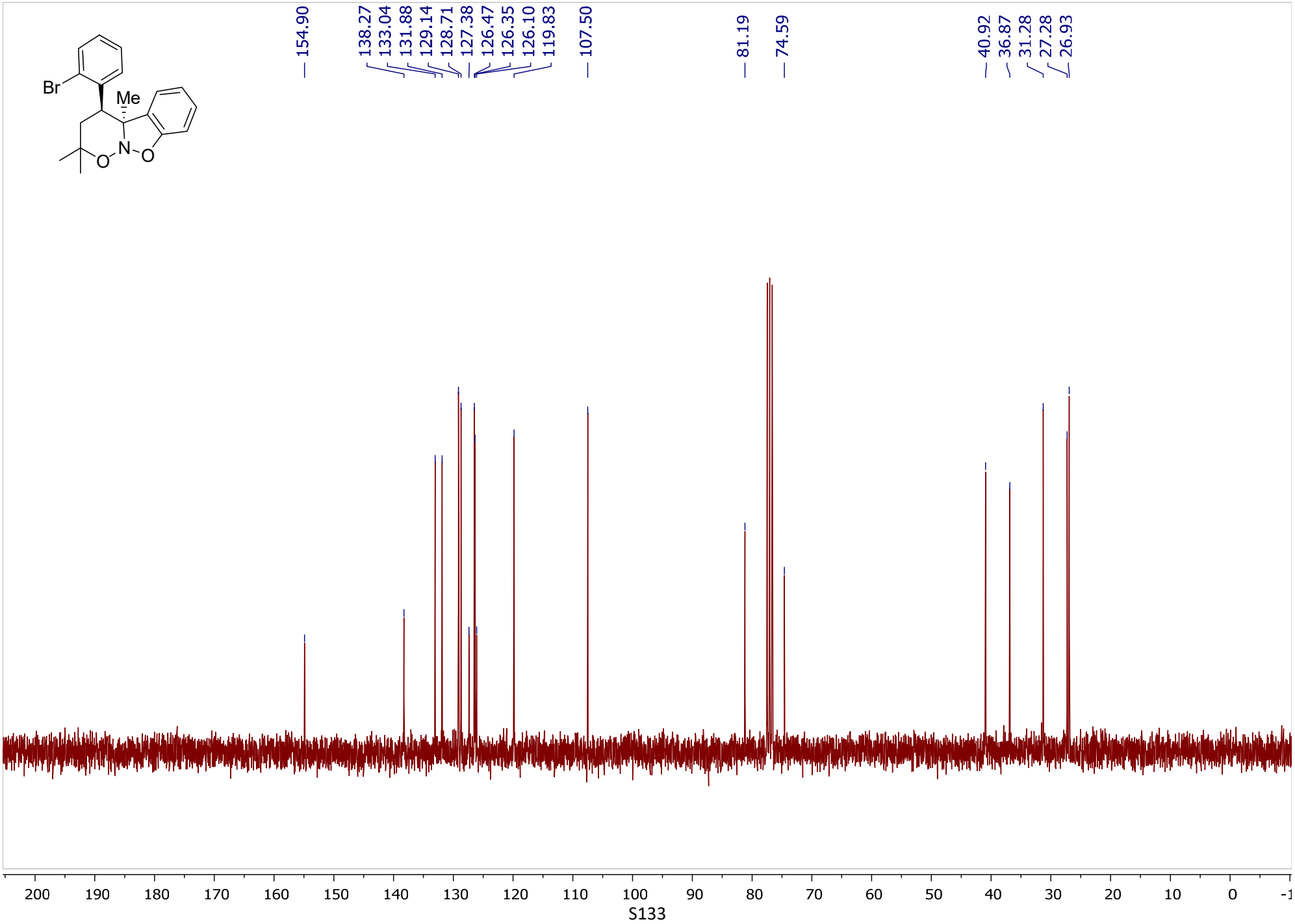


(4*S,4a*S**)-4-(2-Bromophenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ca**

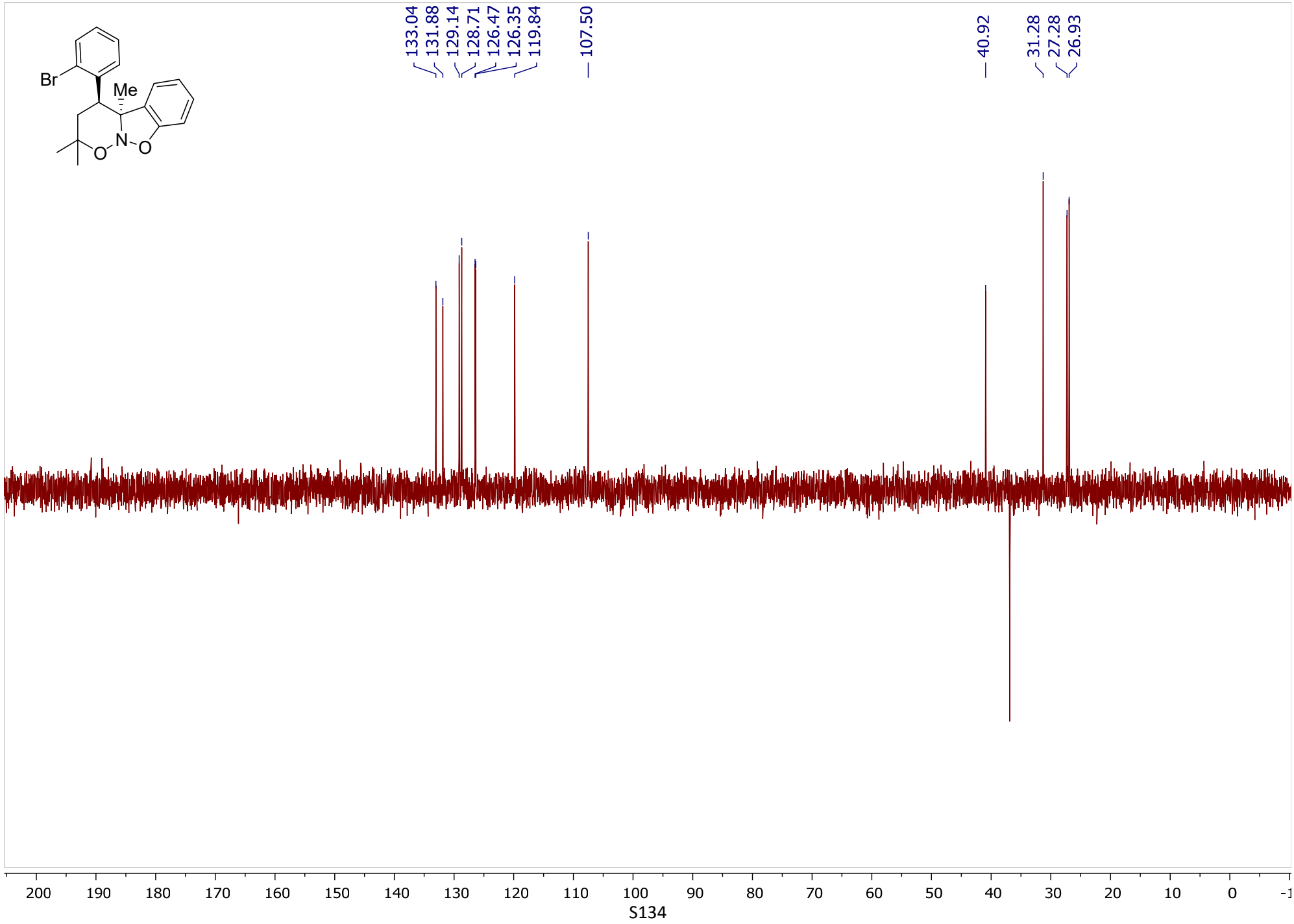
^{1}H NMR (300 MHz, $CDCl_3$)



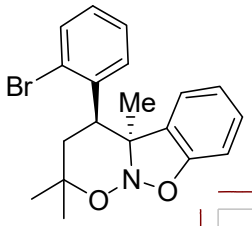
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


Br
Me
N
O
O

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1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
7.5
7.0
6.5
6.0
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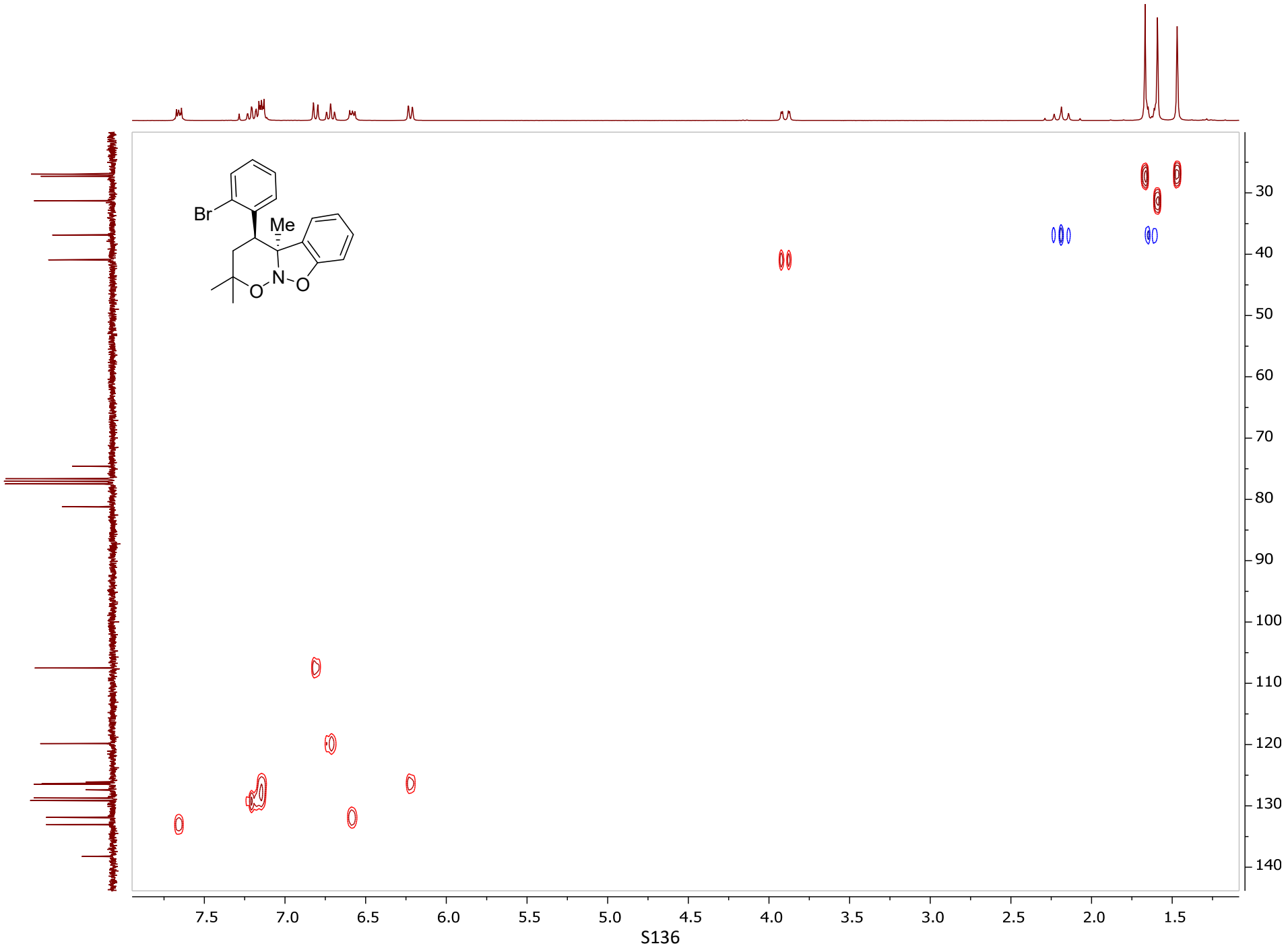
1.0

^{1}H-^{13}C HSQC


Br
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6.5
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3.5
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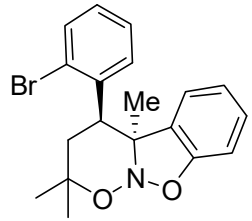
2.0
1.5

^{1}H-^{13}C HMBC


Br
Me
N
O
O

20
30
40
50
60
70
80
90
100
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120
130
140
150
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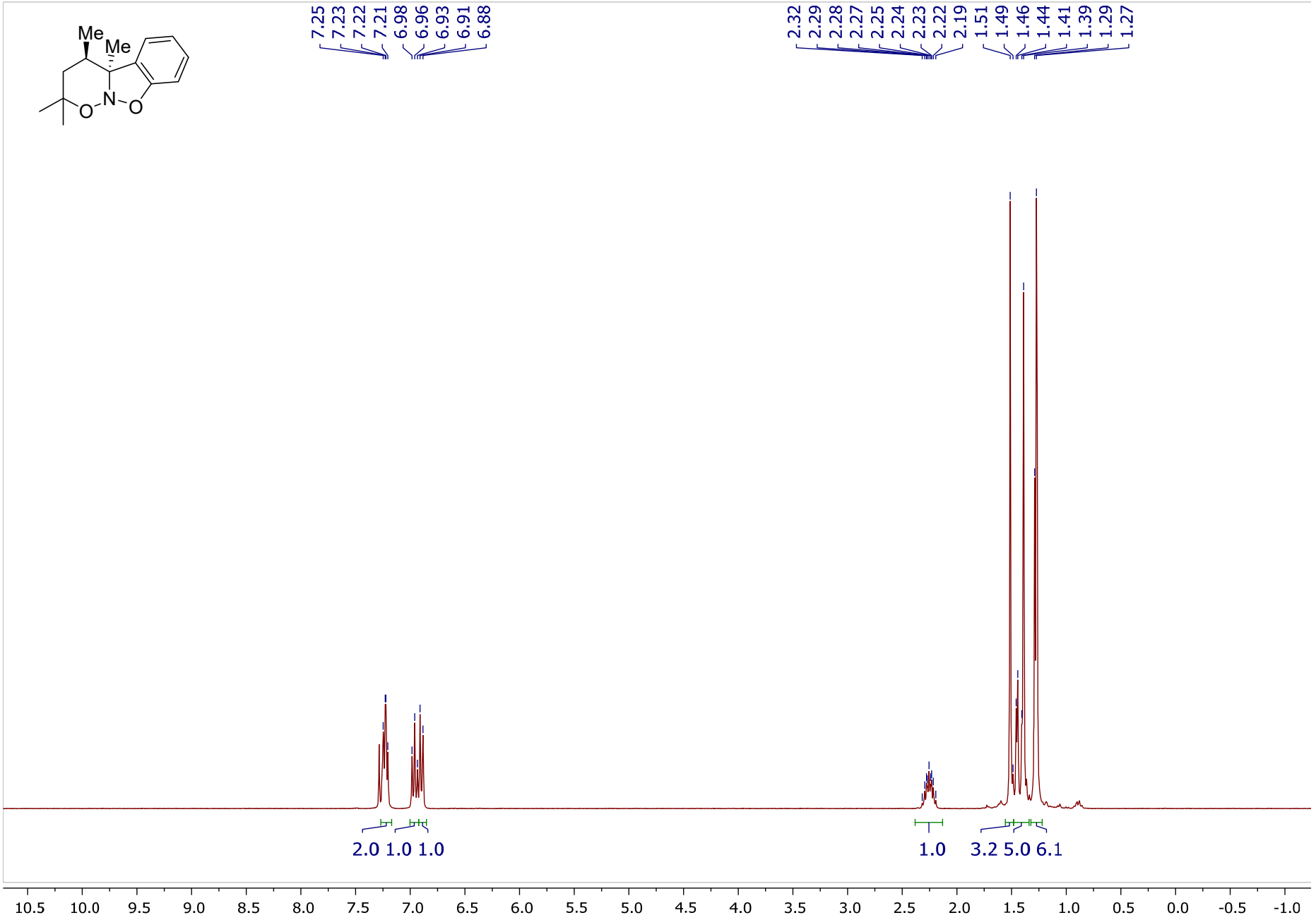
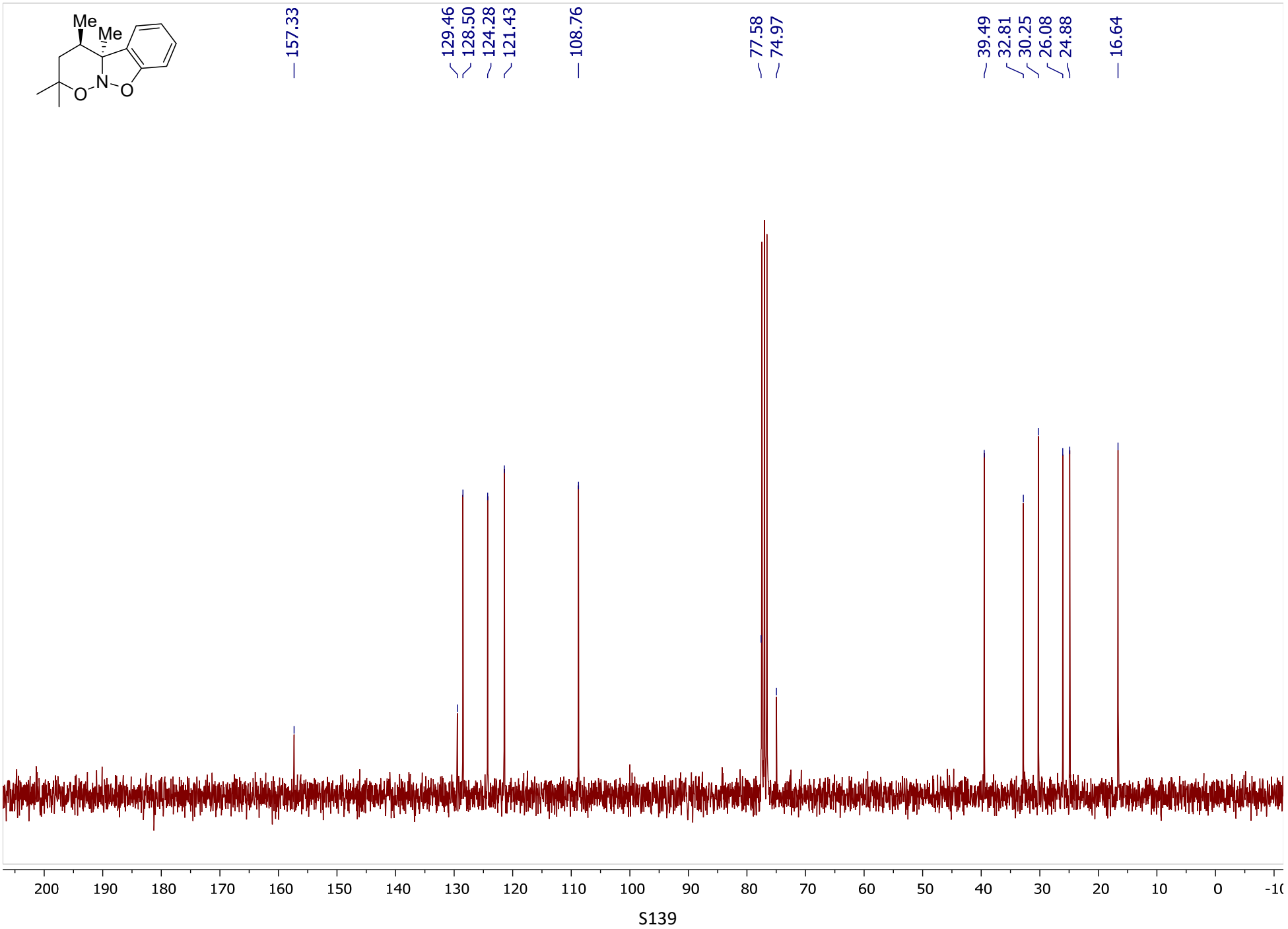
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

(4*R,4a*S**)-2,2,4,4a-Tetramethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5da**

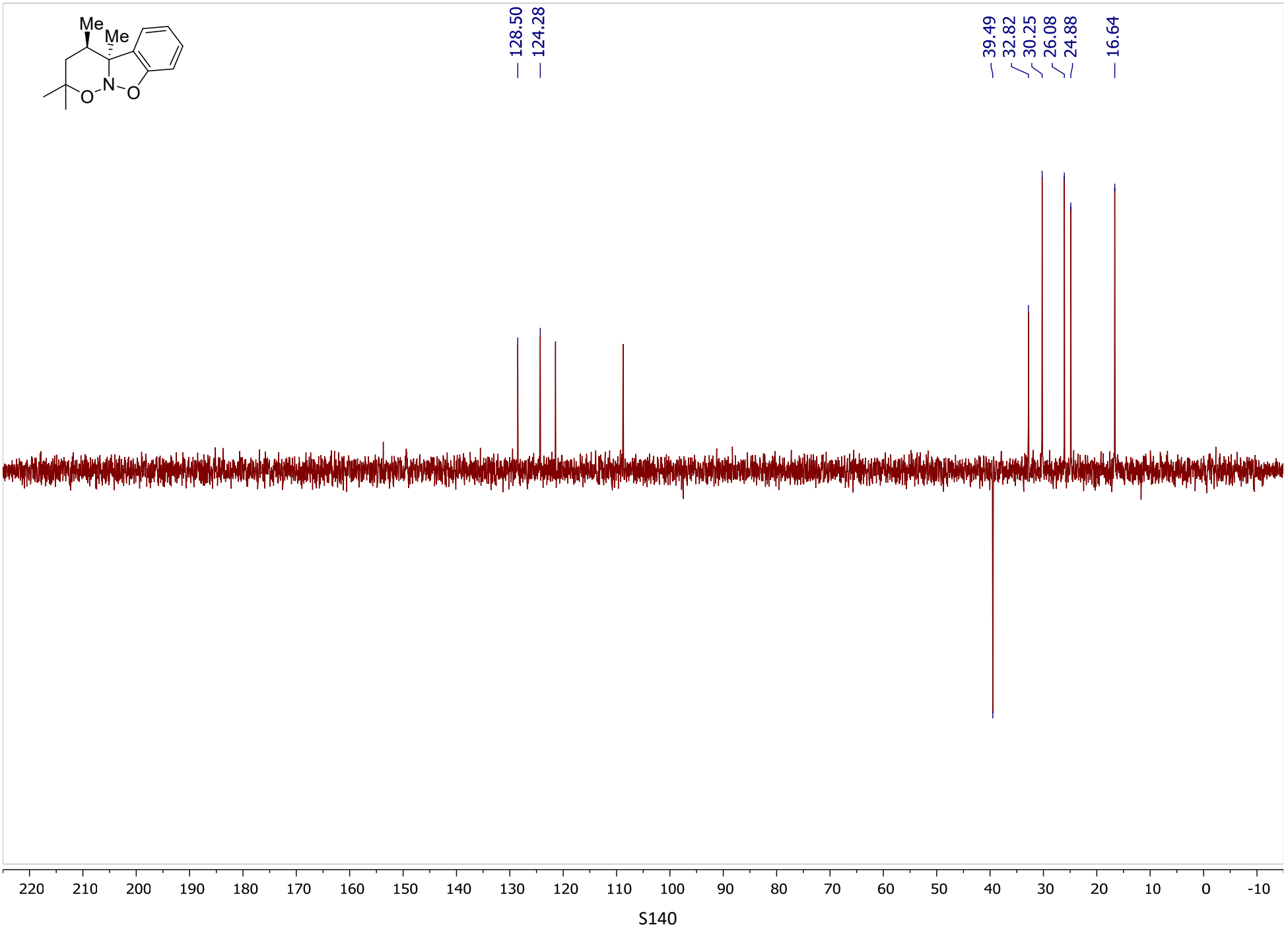
^{1}H NMR (300 MHz, $CDCl_3$)



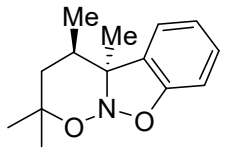
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


Me
Me
N
O
O

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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3.5
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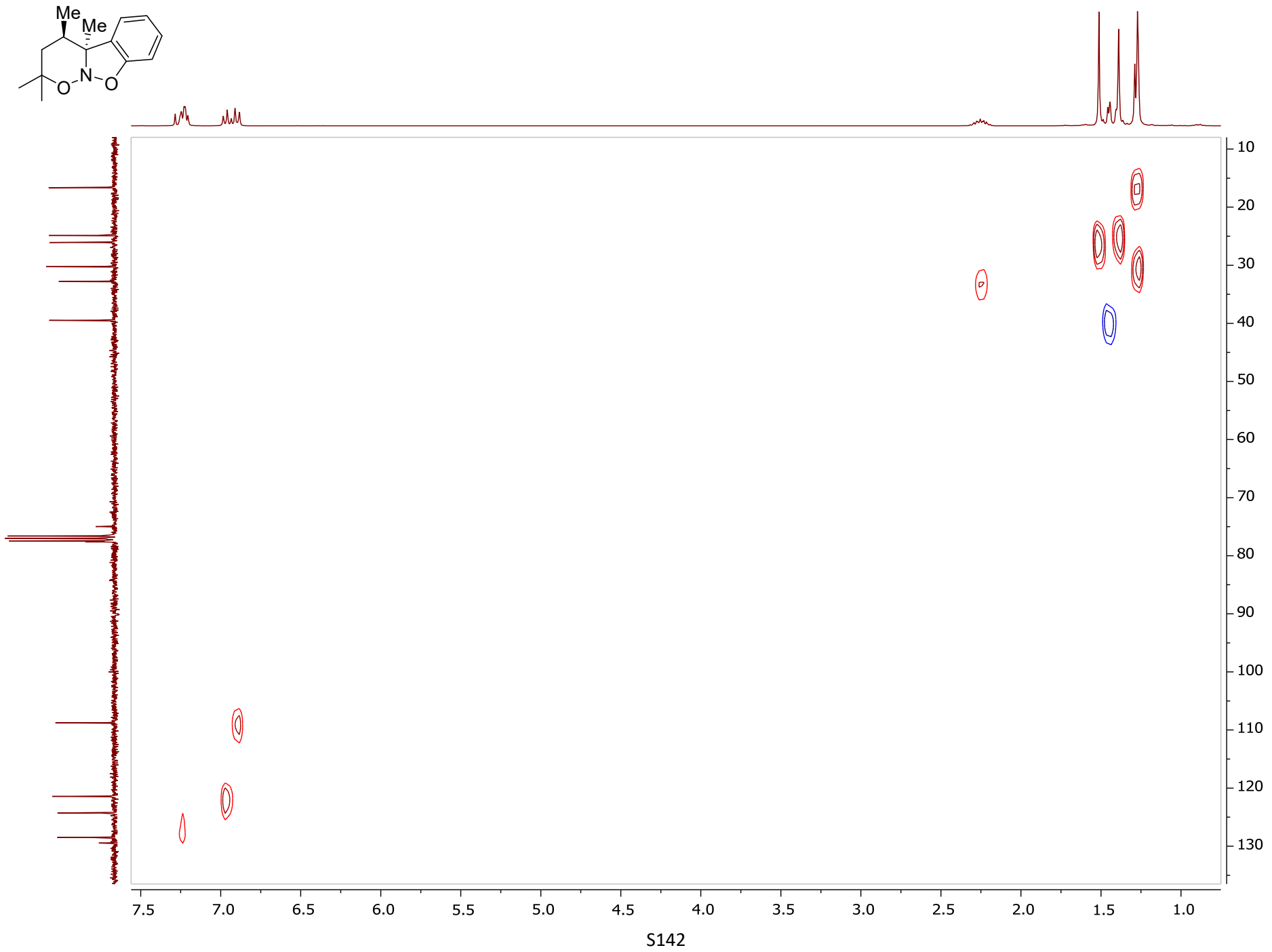
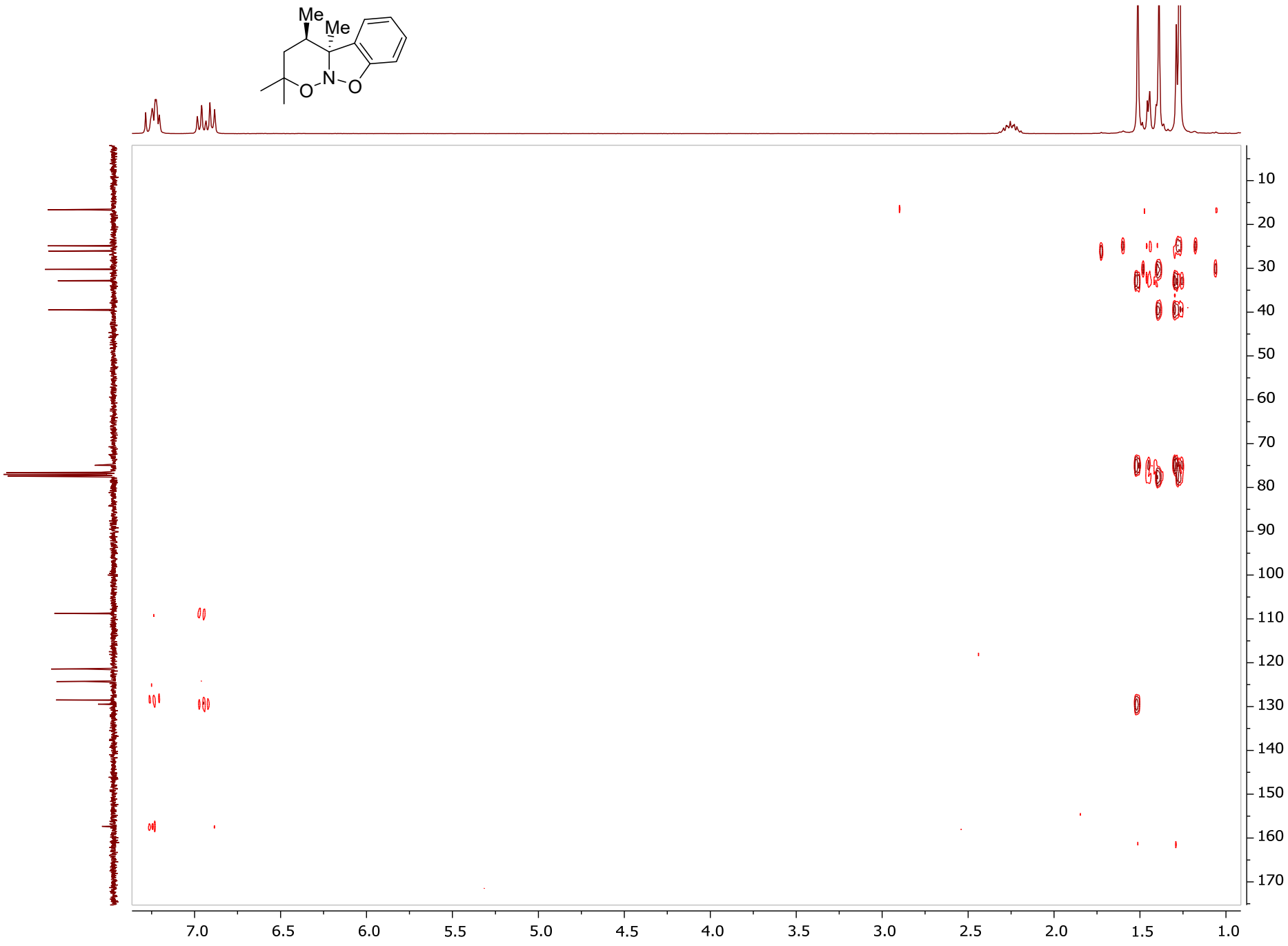
2.5
2.0
1.5
1.0
0.5

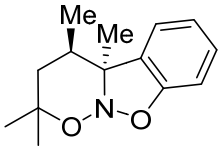
^{1}H-^{13}C HSQC

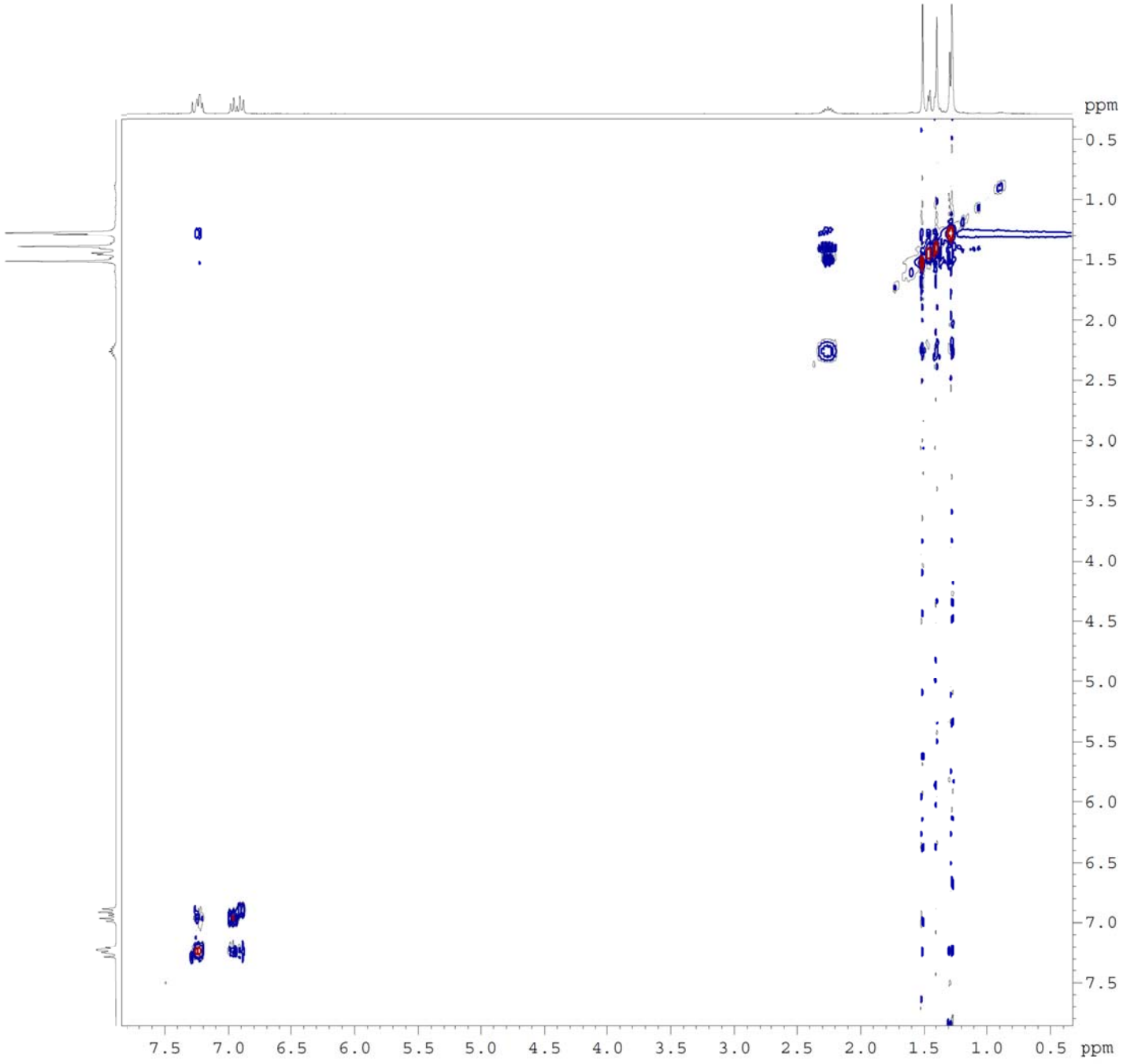

Me
Me
N
O
O
10
20
30
40
50
60
70
80
90
100
110
120
130
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{13}C HMBC


Me
Me
N
O
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
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

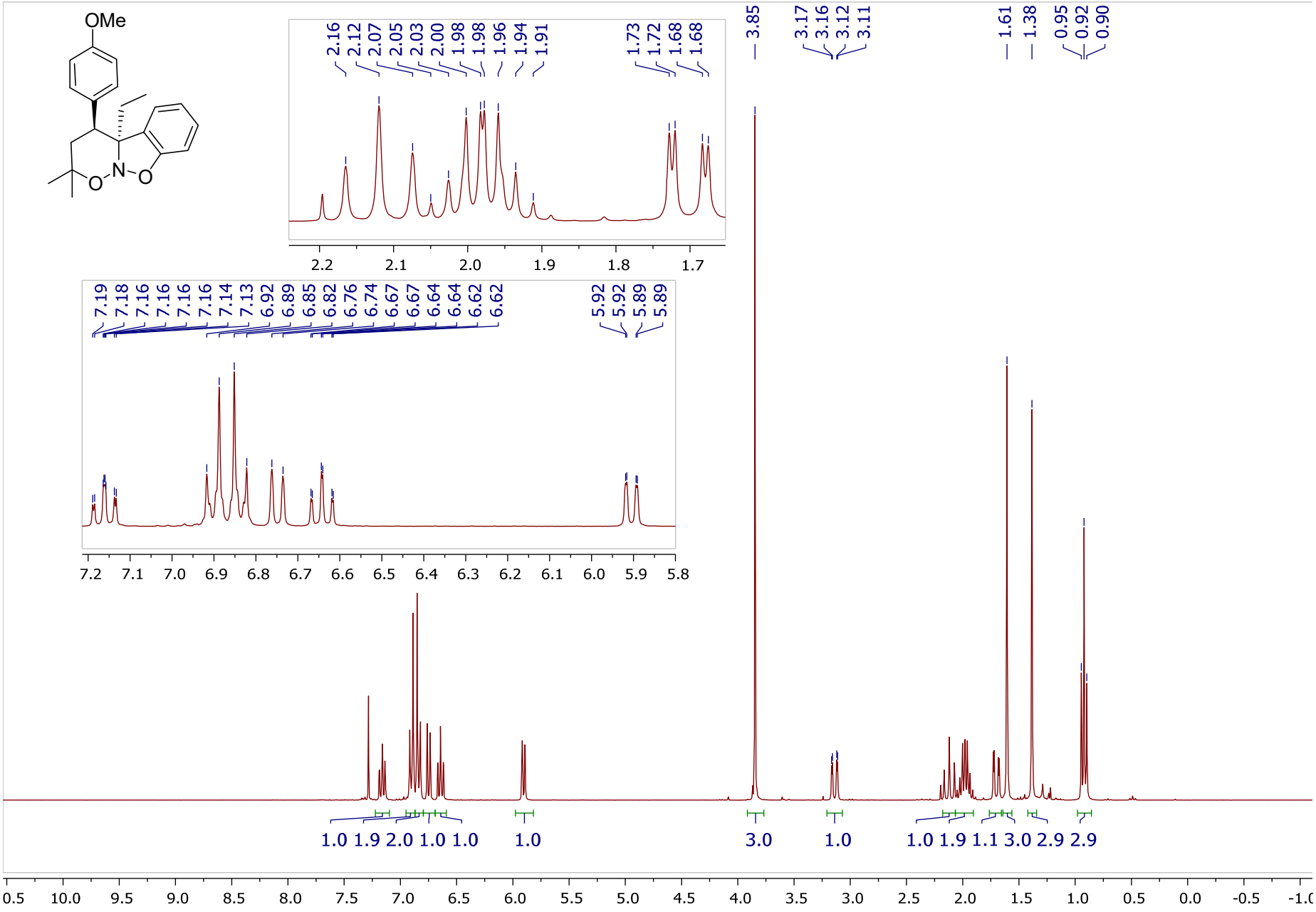
^{1}H-^{1}H NOESY


Me
Me
N
O
O

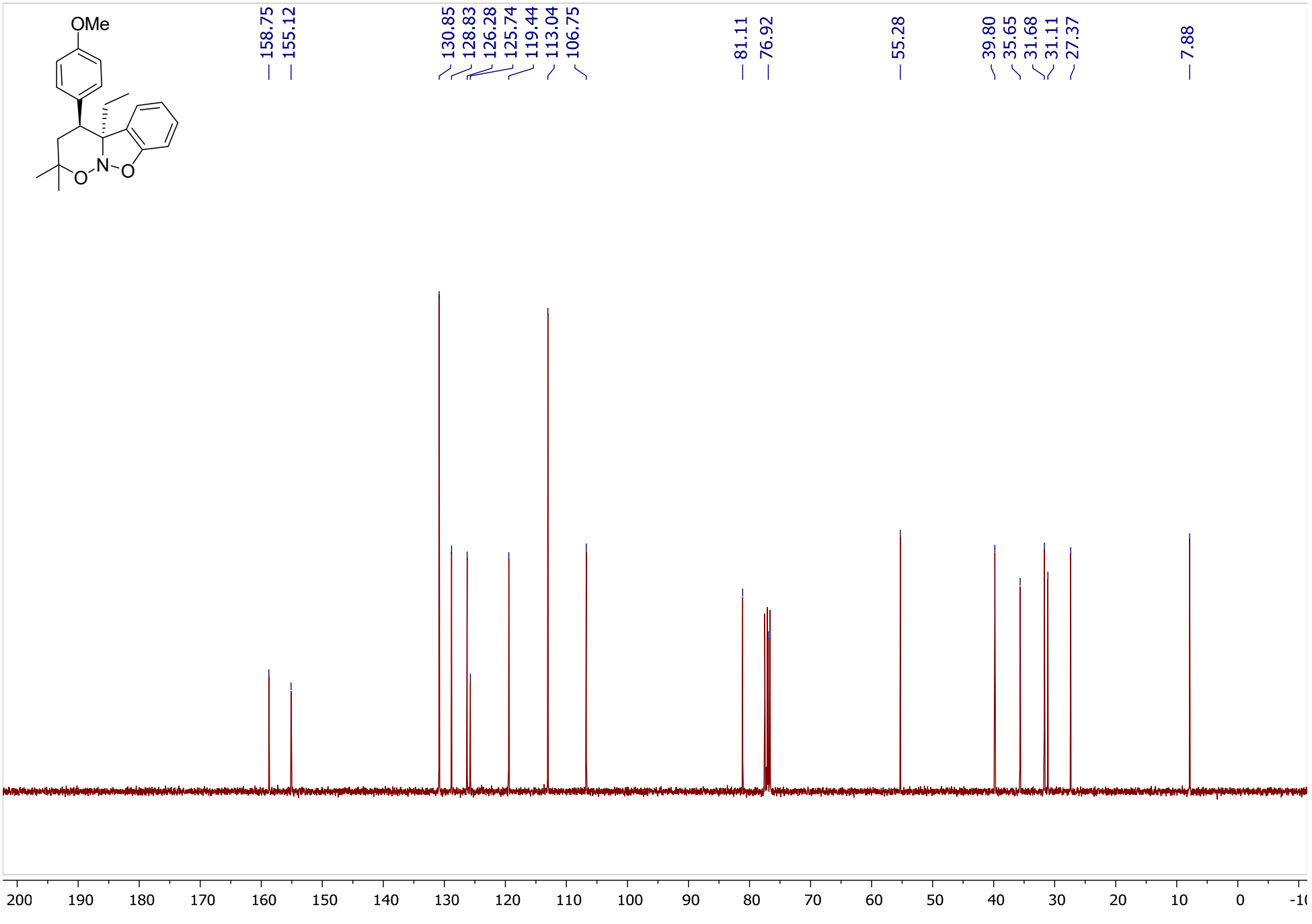

ppm
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm

(4*S,4a*S**)-4a-Ethyl-4-(4-methoxyphenyl)-2,2-dimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ea**

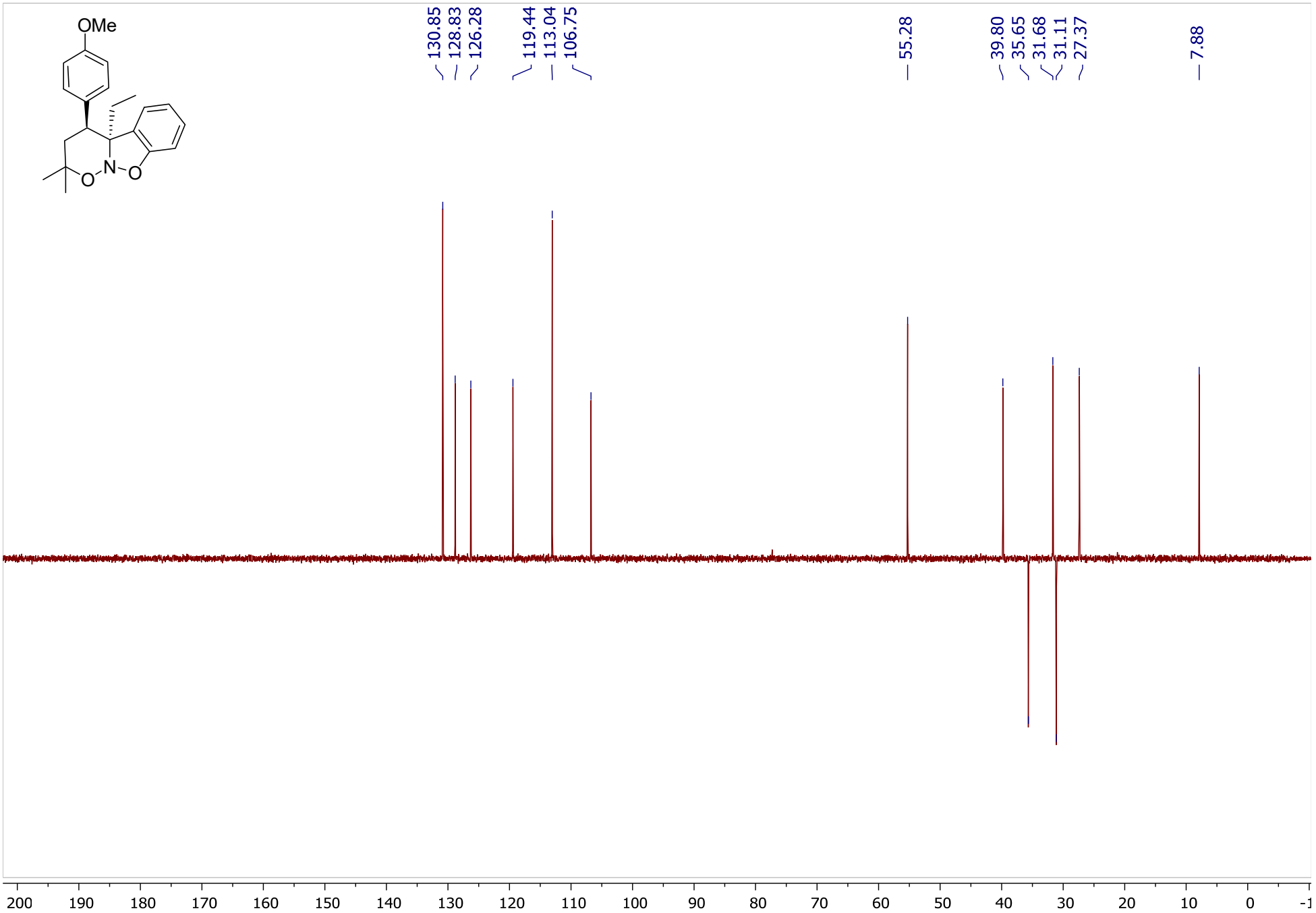
^{1}H NMR (300 MHz, $CDCl_3$)



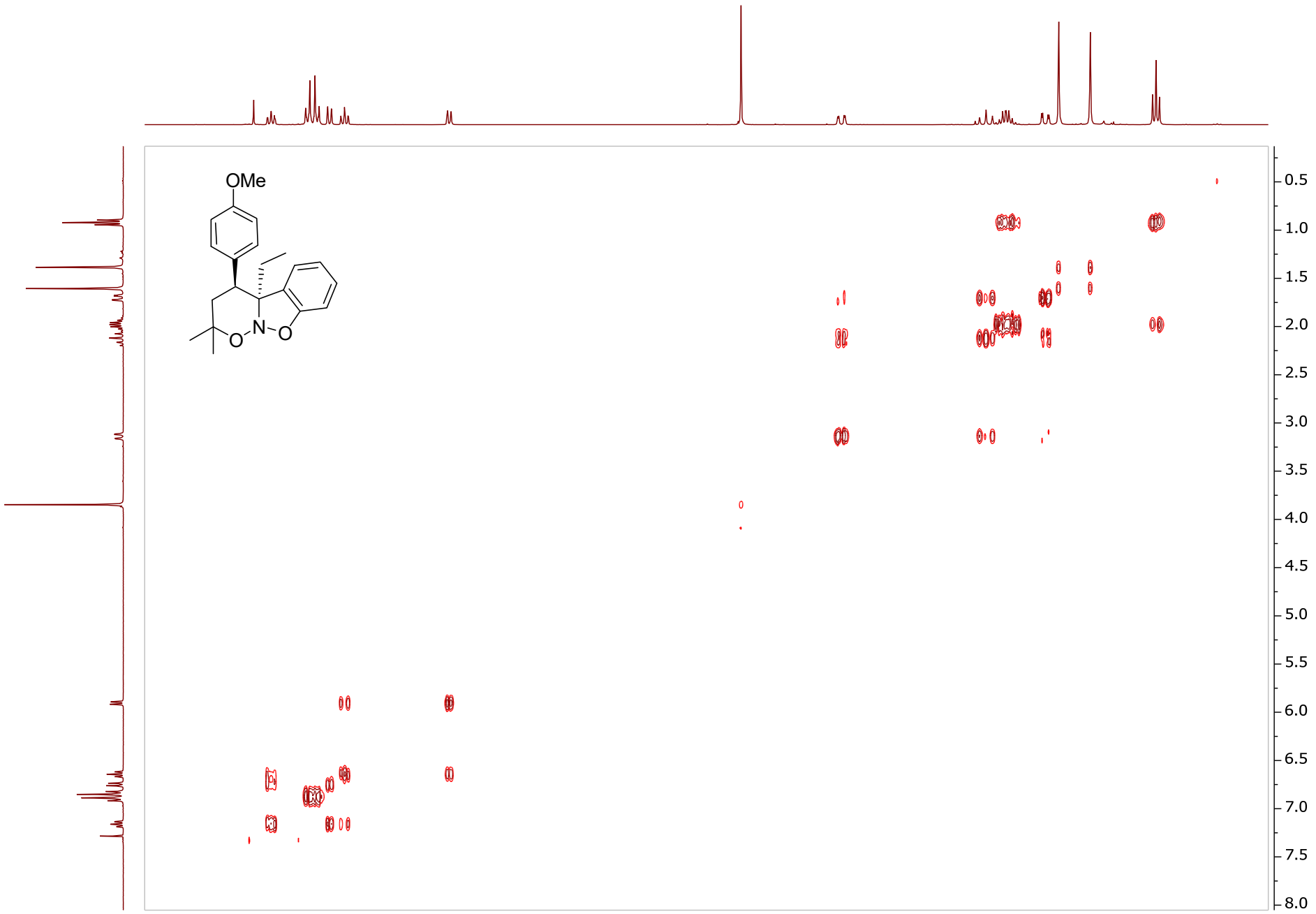
^{13}C NMR (75 MHz, $CDCl_3$)



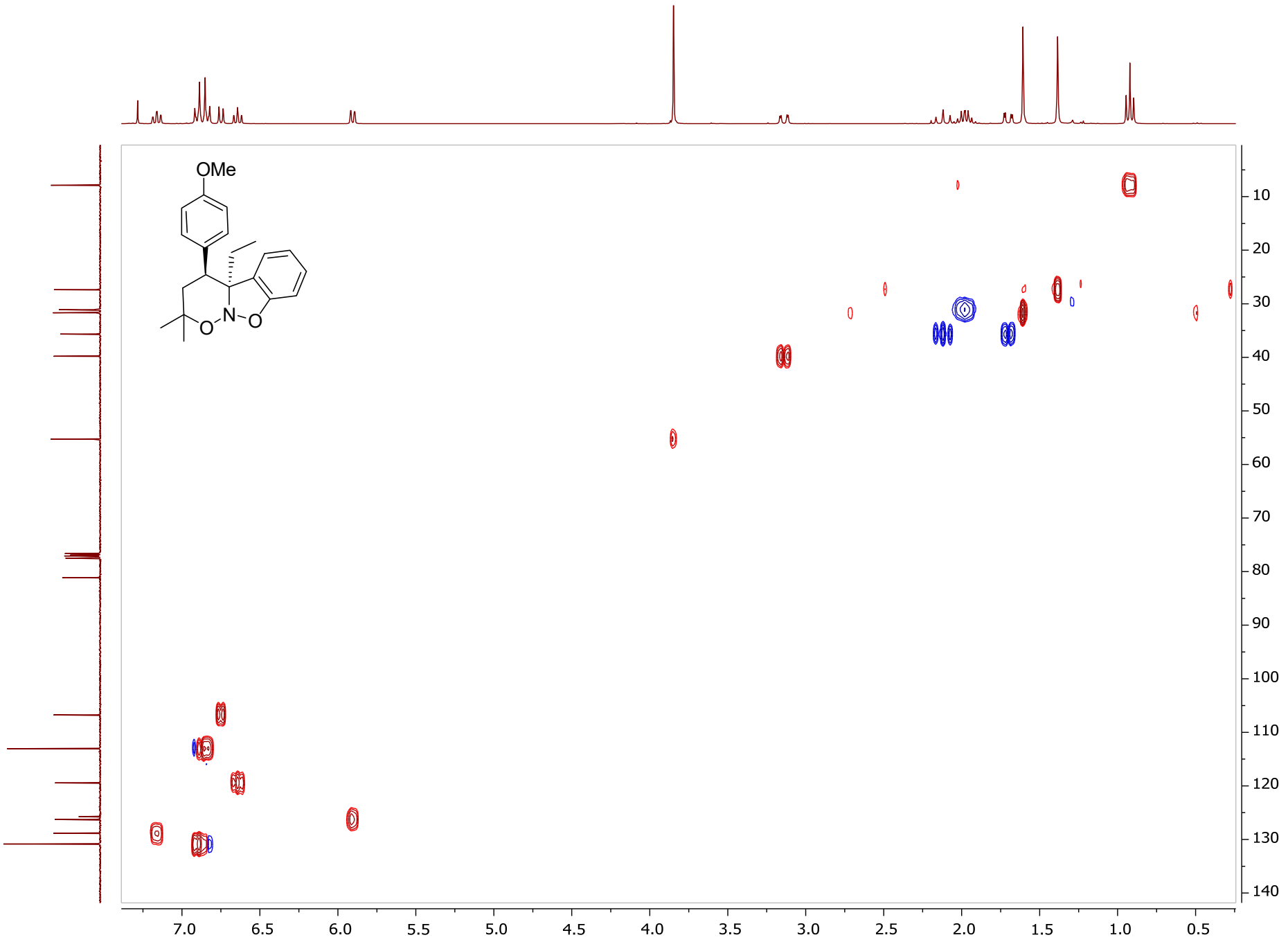
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



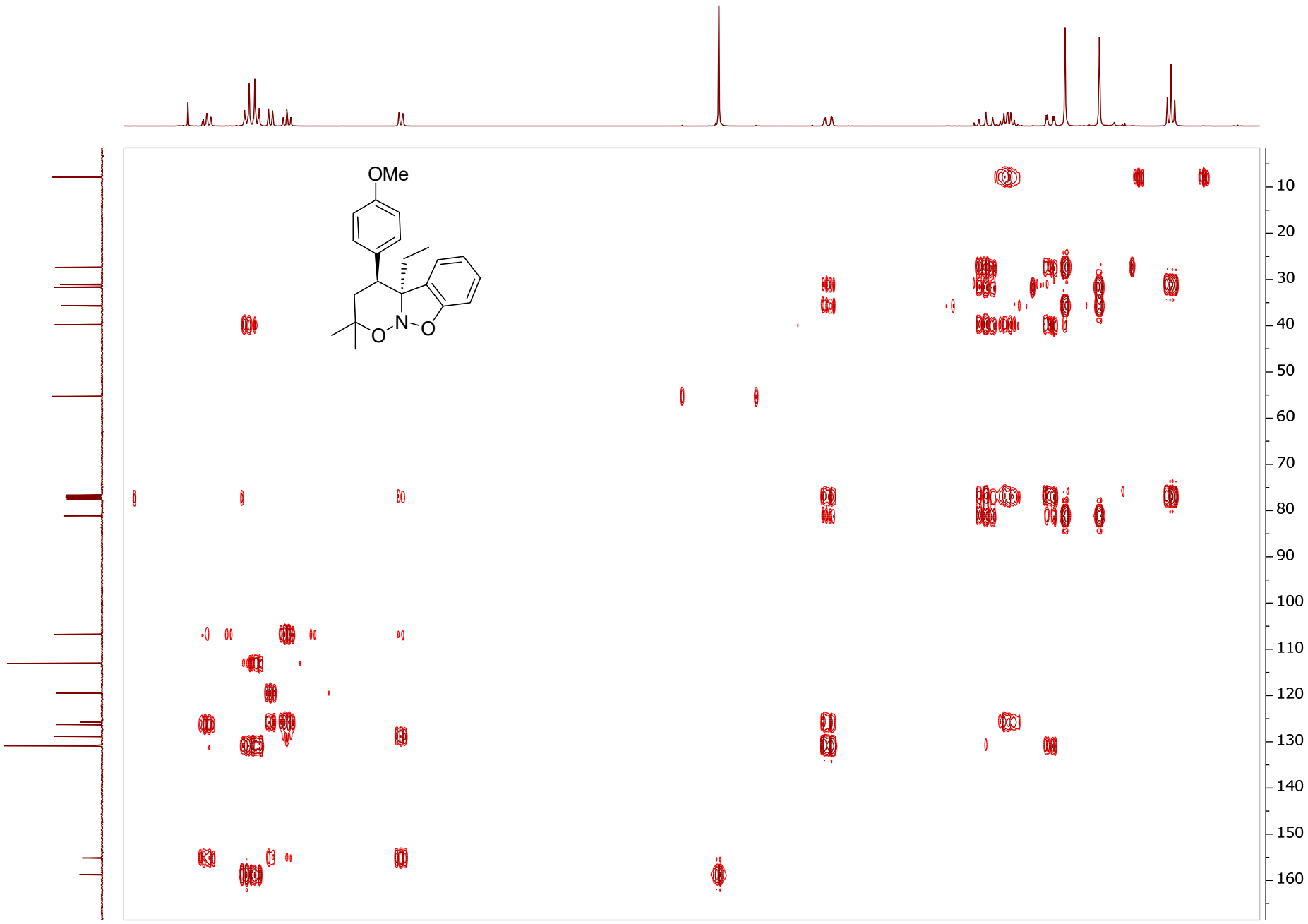
^{1}H-^{1}H COSY

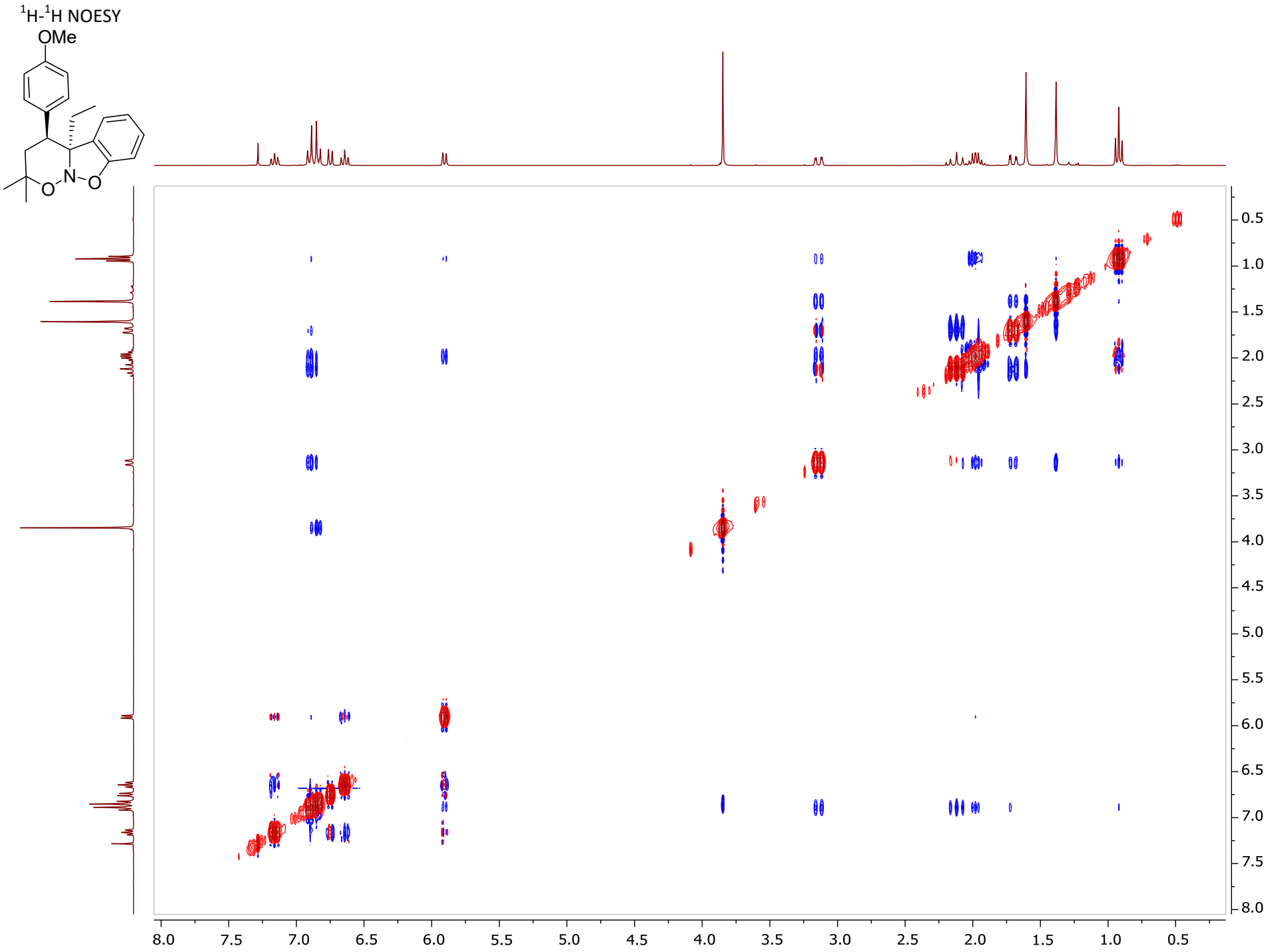


^{1}H-^{13}C HSQC


OMe
O
N
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
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

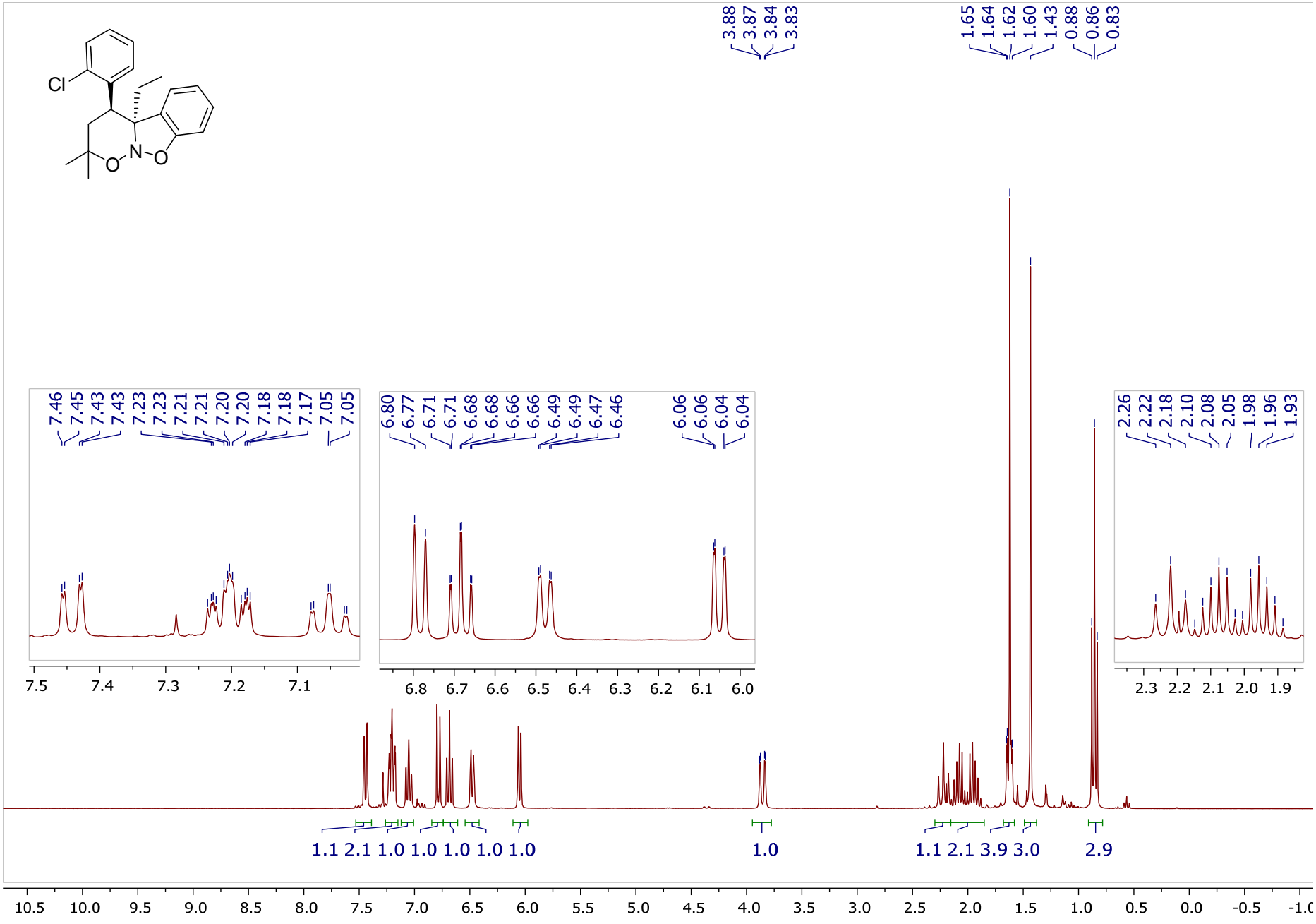
^{1}H-^{13}C HMBC


OMe
O
N
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
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

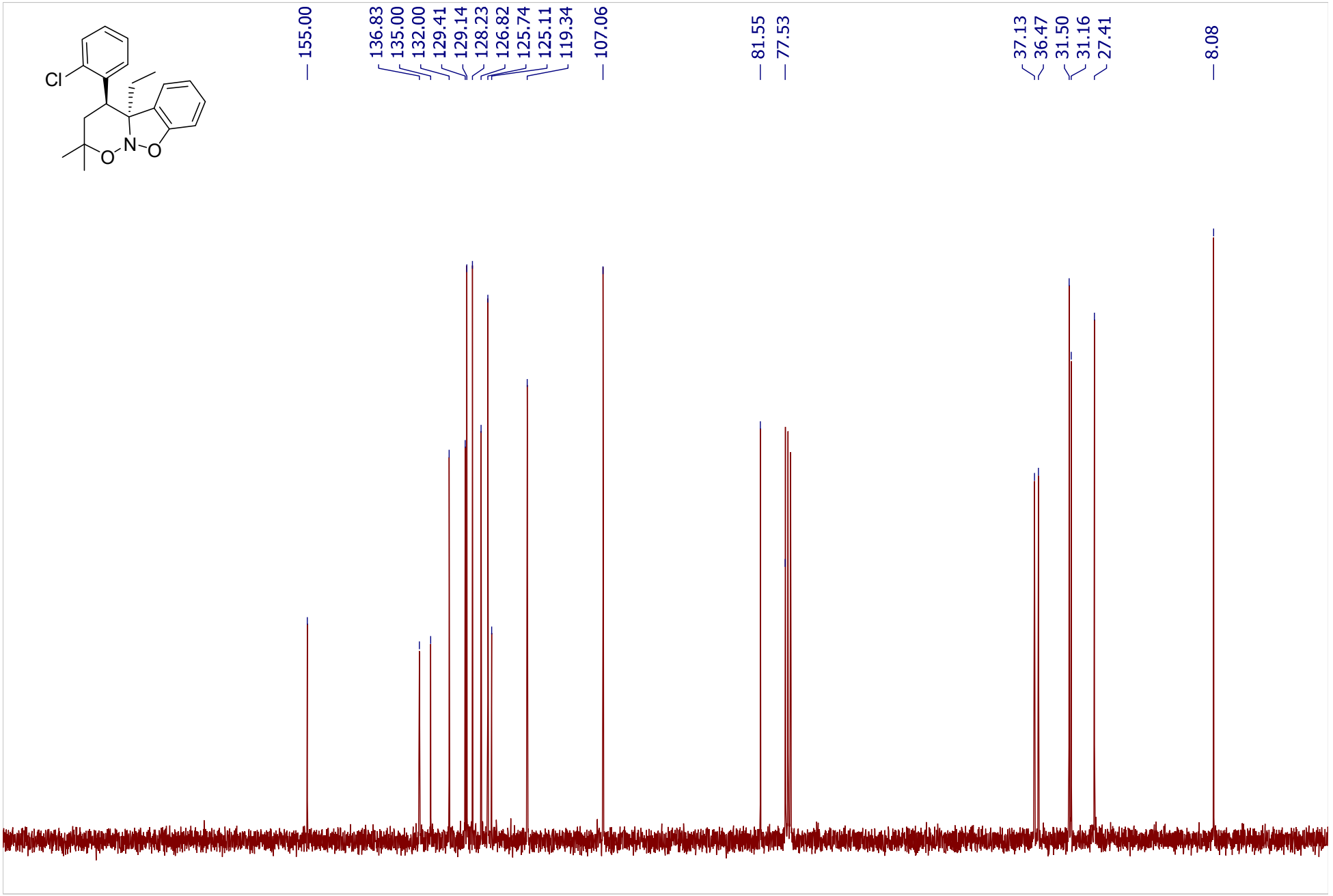

^{1}H-^{1}H NOESY
OMe
O
N
O
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

(4*S,4a*S**)-4-(2-Chlorophenyl)-4a-ethyl-2,2-dimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5fa**

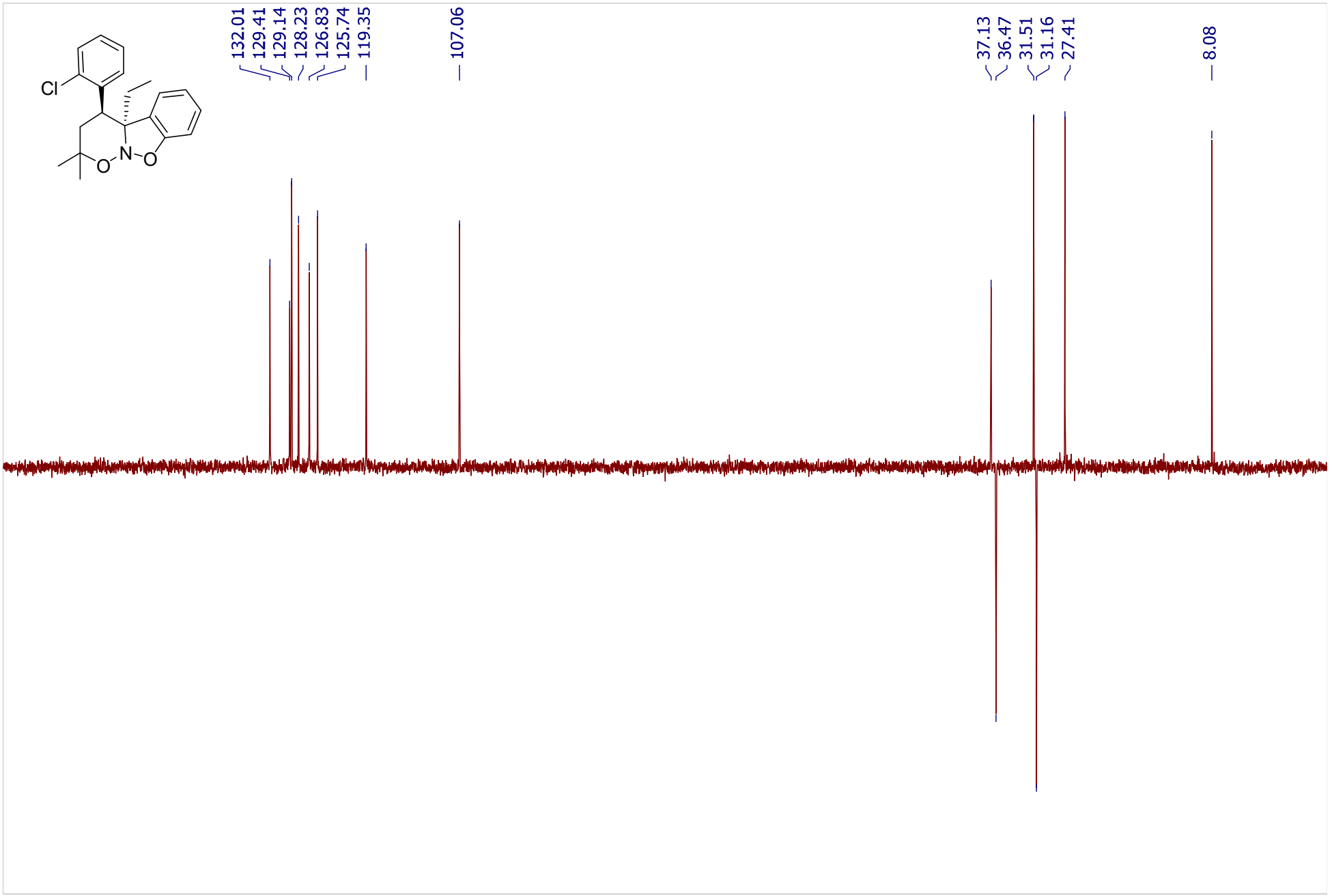
^{1}H NMR (300 MHz, $CDCl_3$)



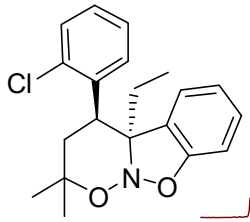
^{13}C NMR (75 MHz, $CDCl_3$)

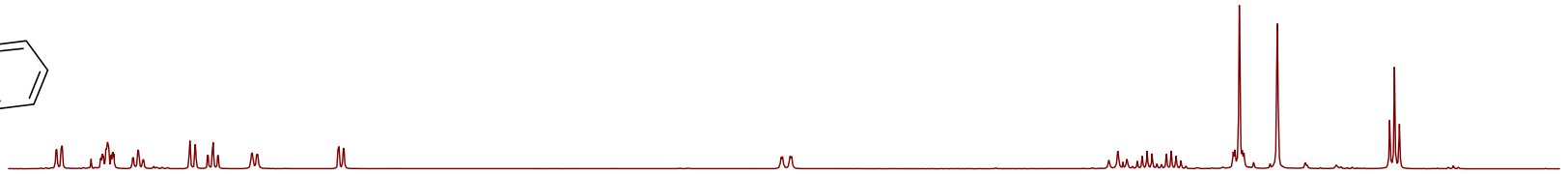


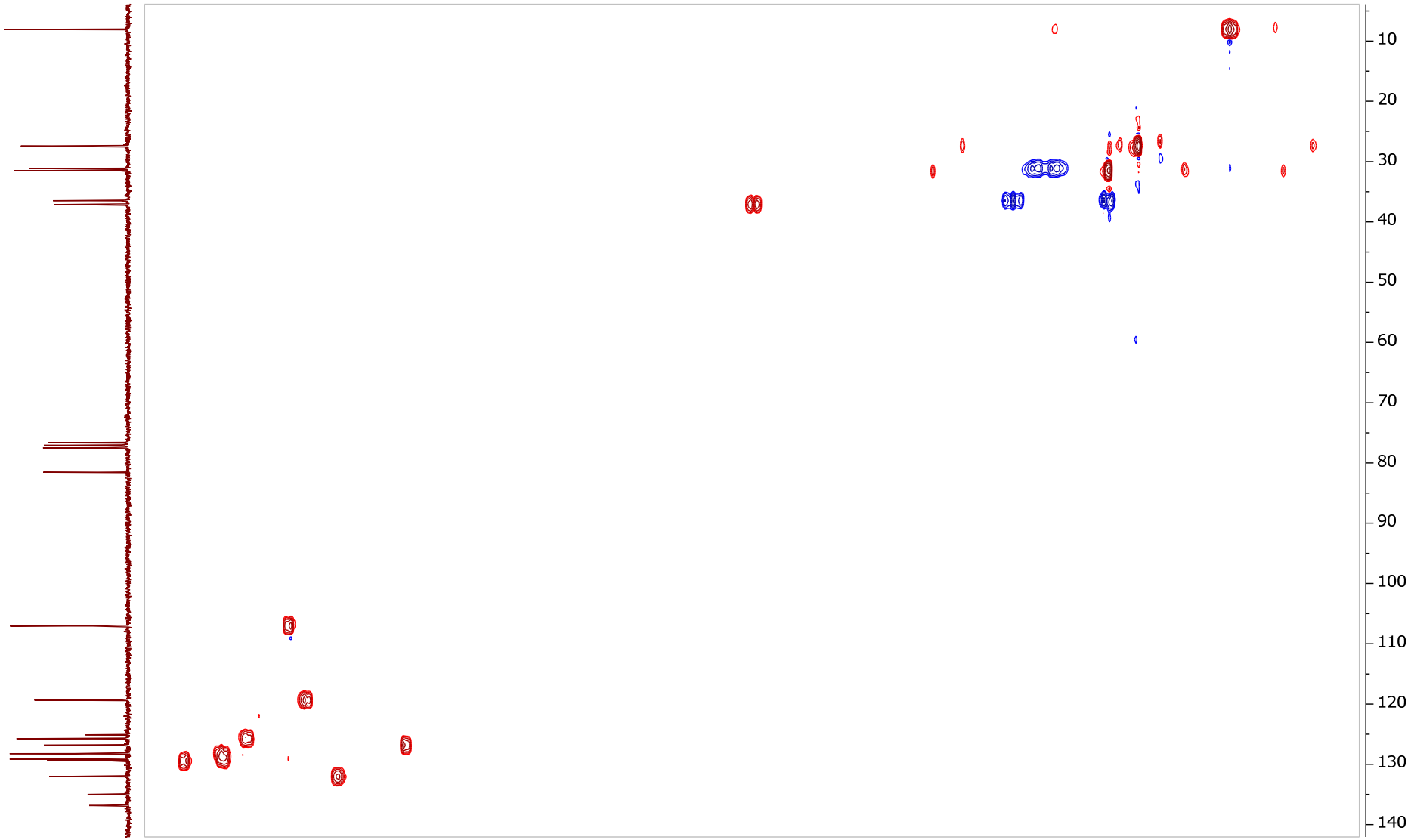
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



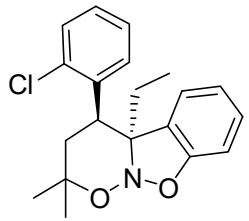
^{1}H-^{13}C HSQC


Cl
N
O
O



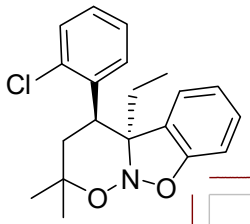

10
20
30
40
50
60
70
80
90
100
110
120
130
140
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{13}C HMBC


Cl
N
O
O

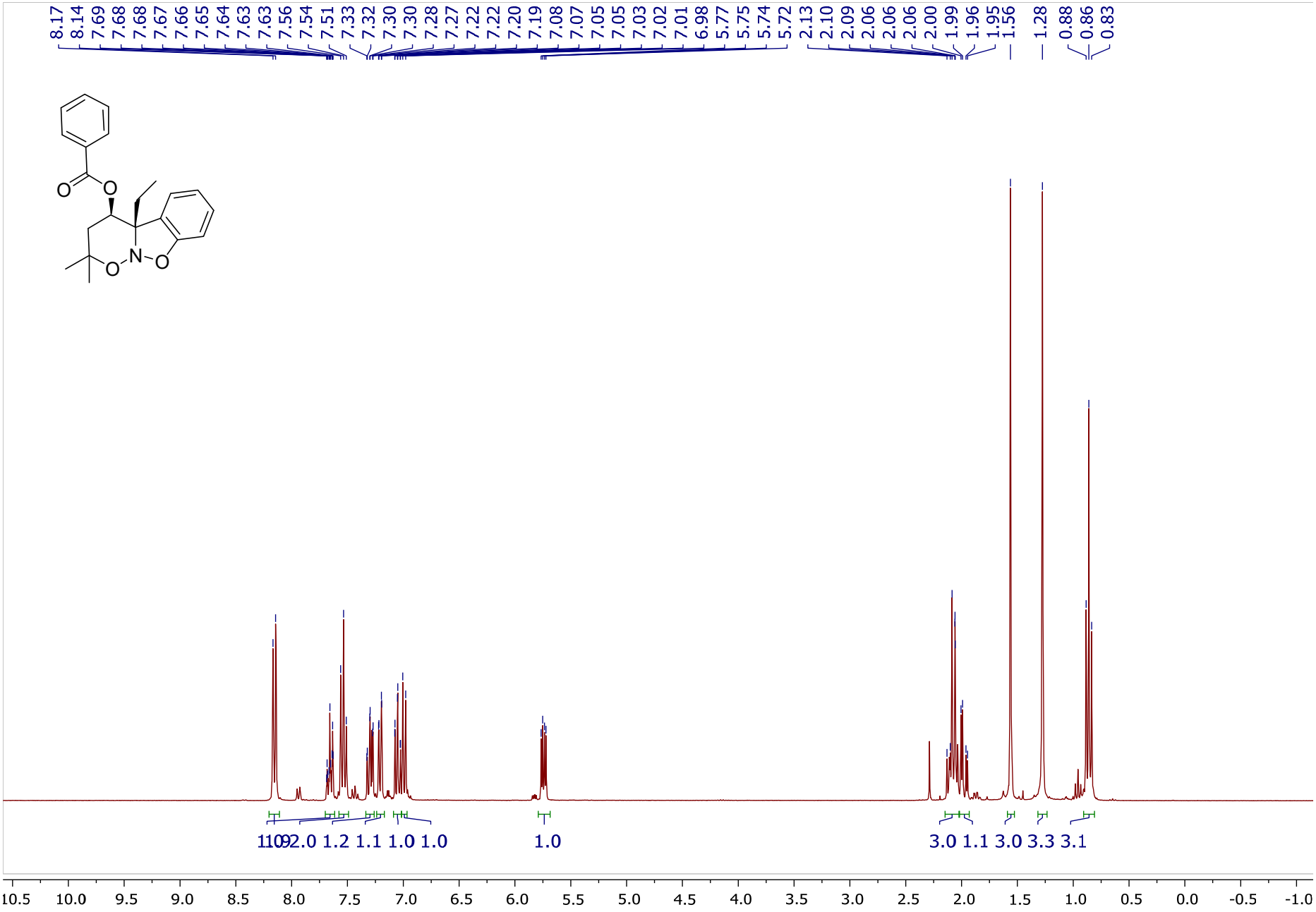
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{1}H NOESY

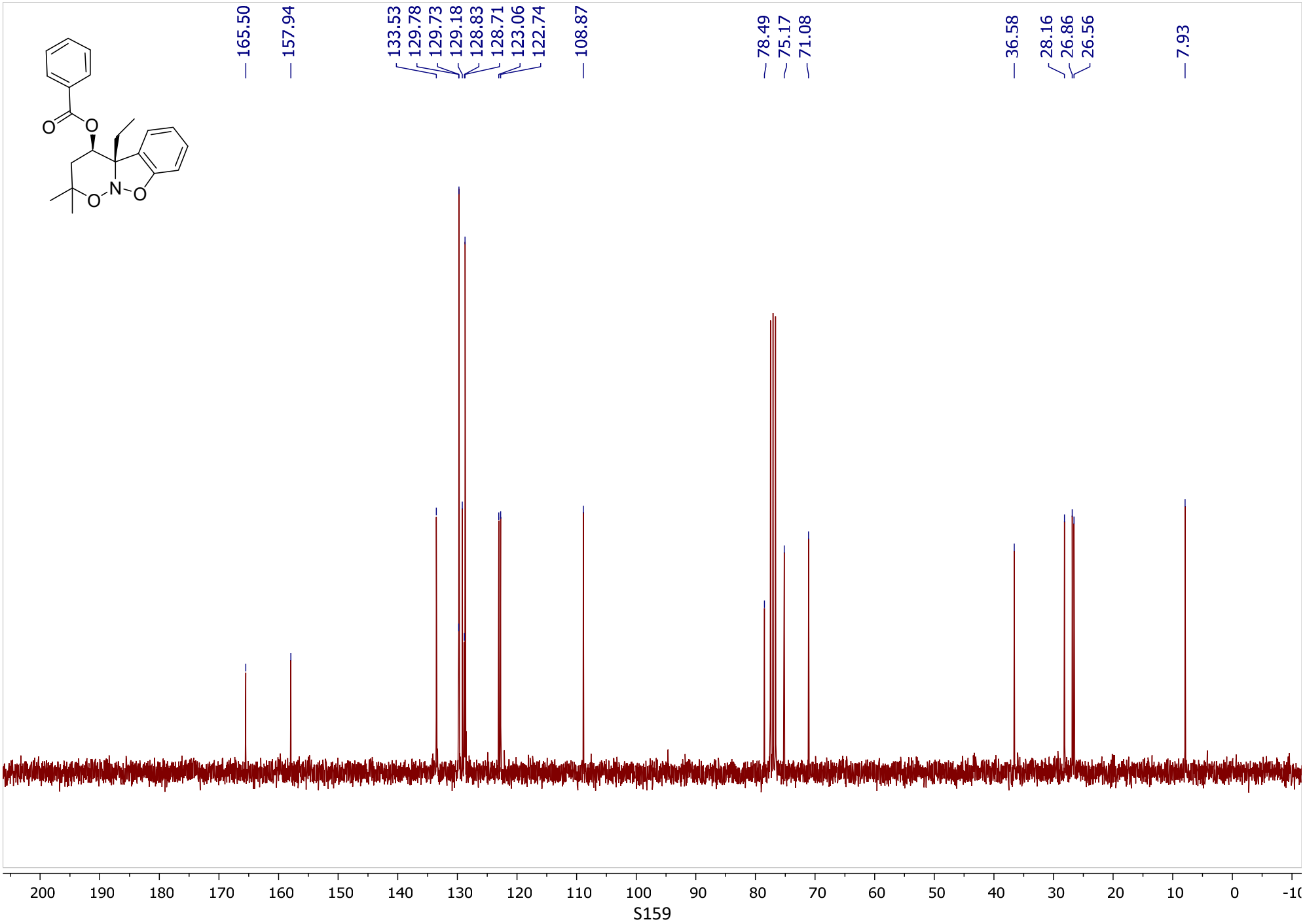


(4*R,4a*S**)-4a-Ethyl-2,2-dimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazin-4-yl benzoate 5ga,** major / minor = 9:1

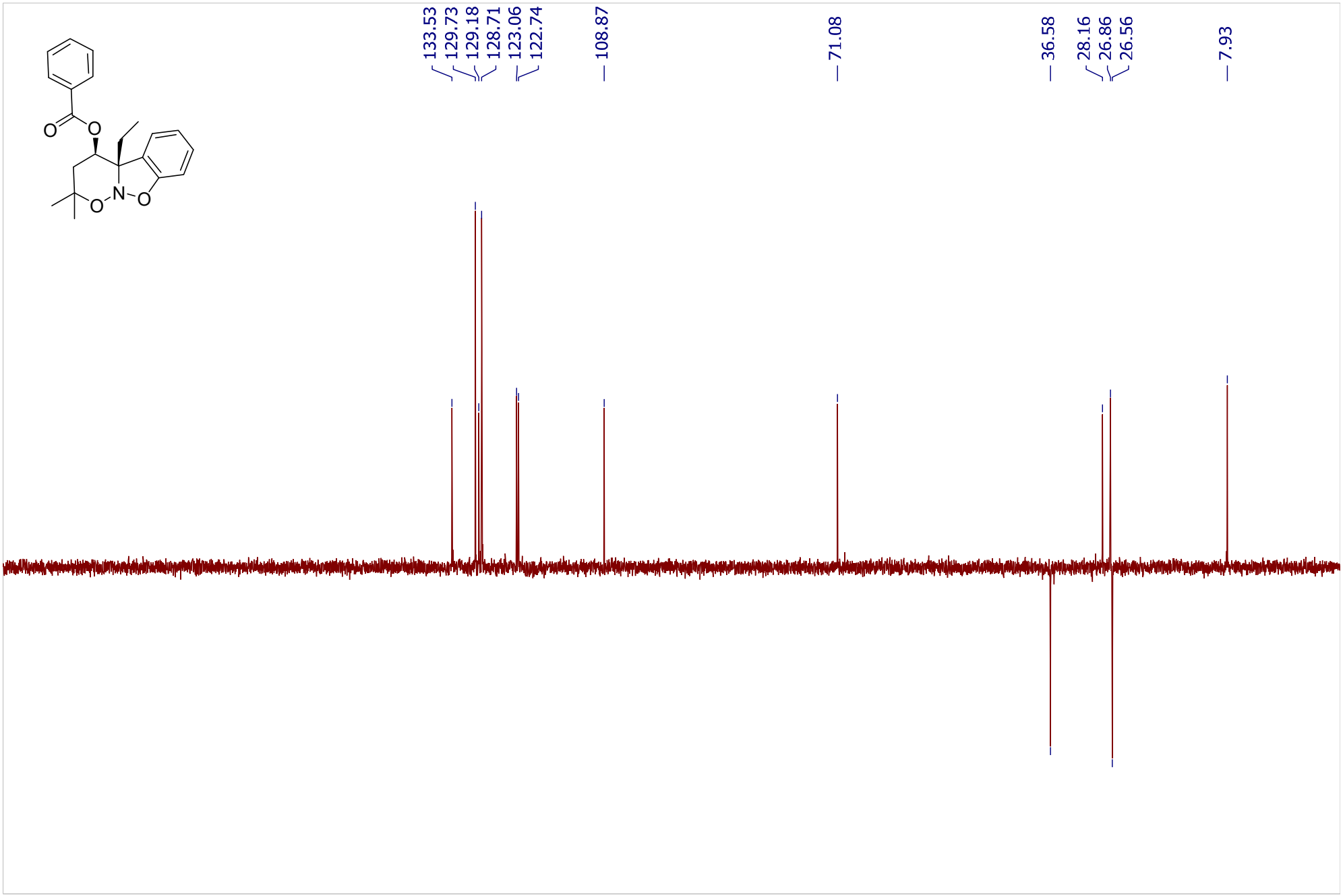
^{1}H NMR (300 MHz, $CDCl_3$)



^{13}C NMR (75 MHz, $CDCl_3$)

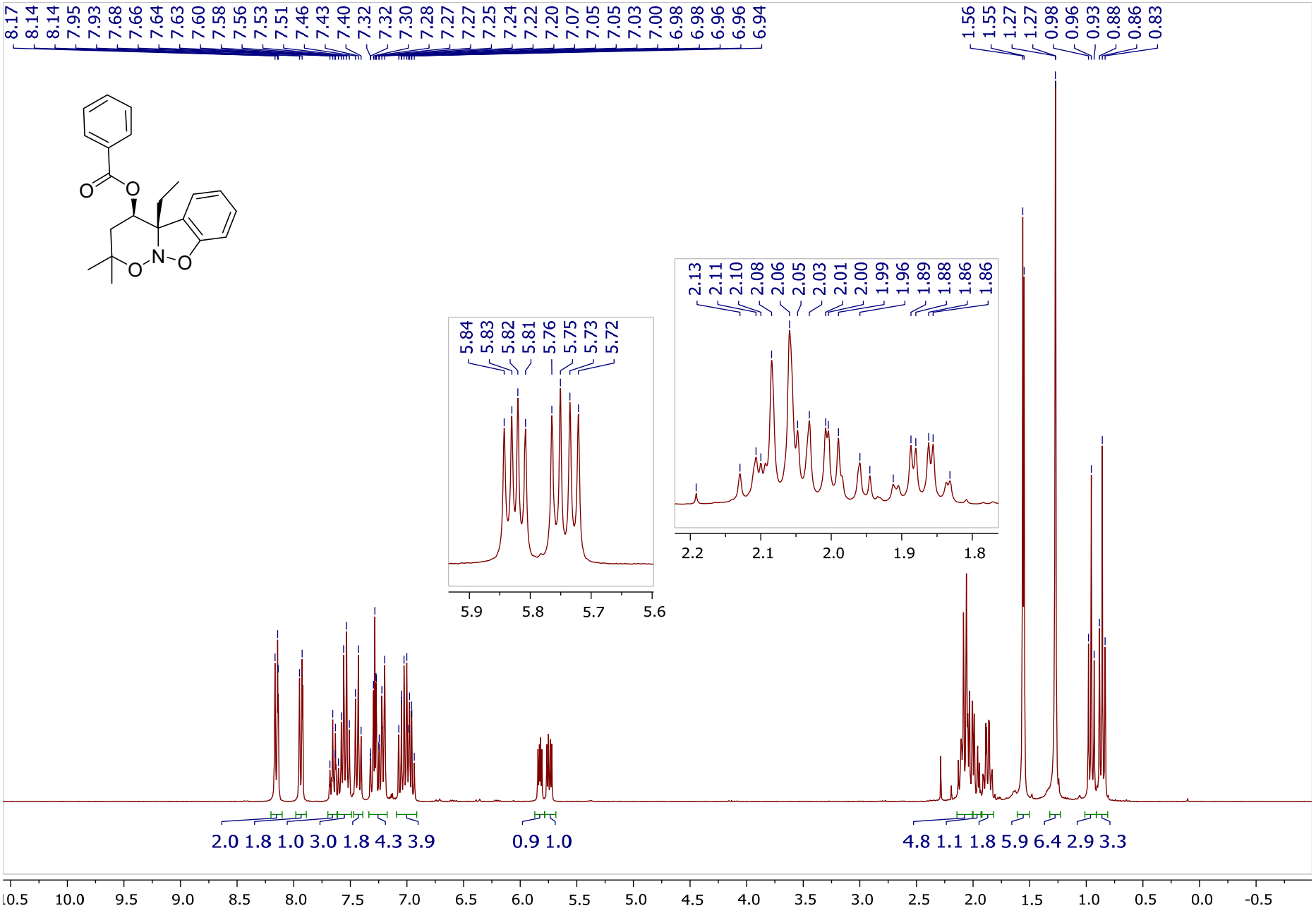


^{13}C DEPT 135 (75 MHz, $CDCl_3$)

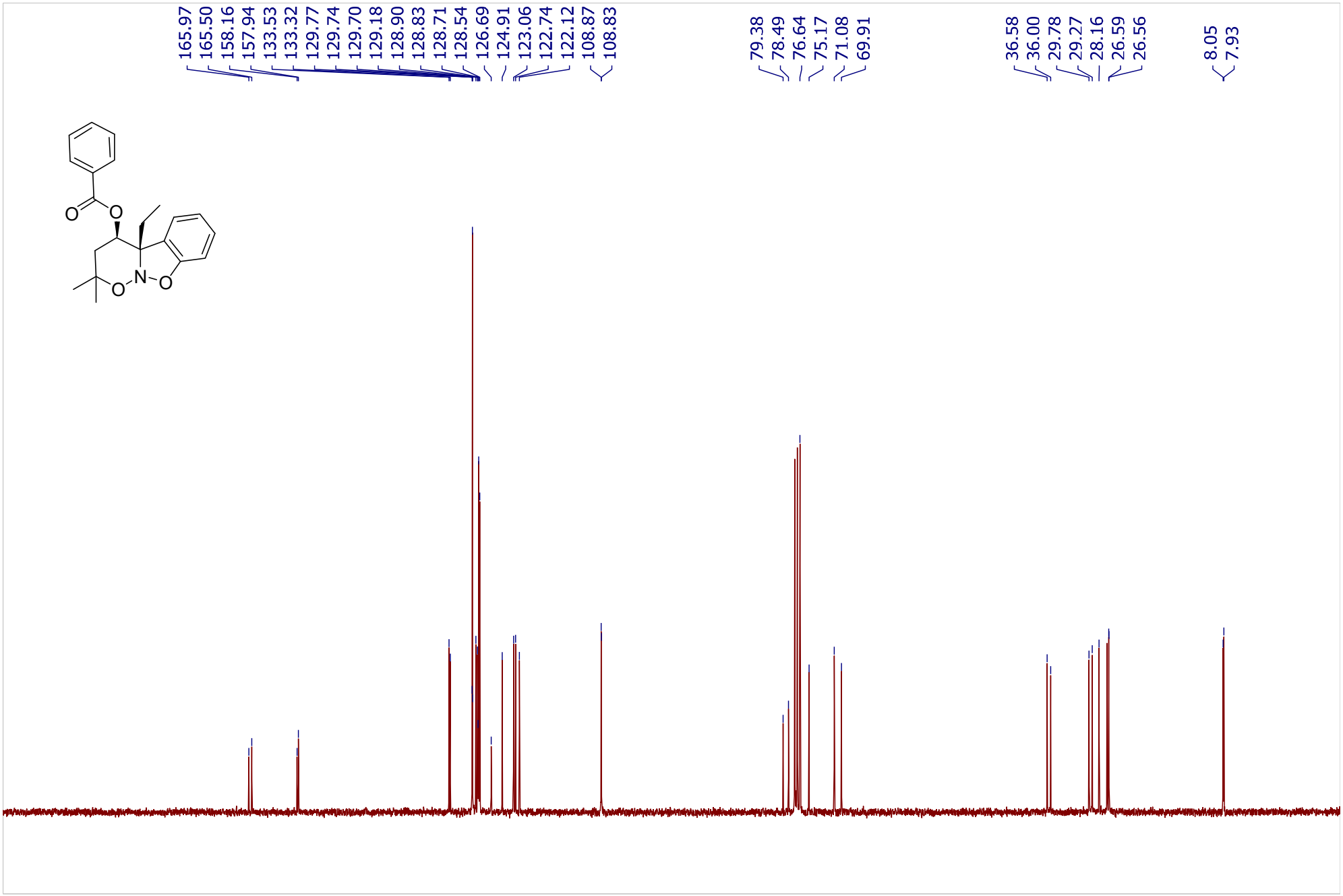


(4*R,4a*S**)-4a-Ethyl-2,2-dimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazin-4-yl benzoate 5ga,** major / minor = 1:1

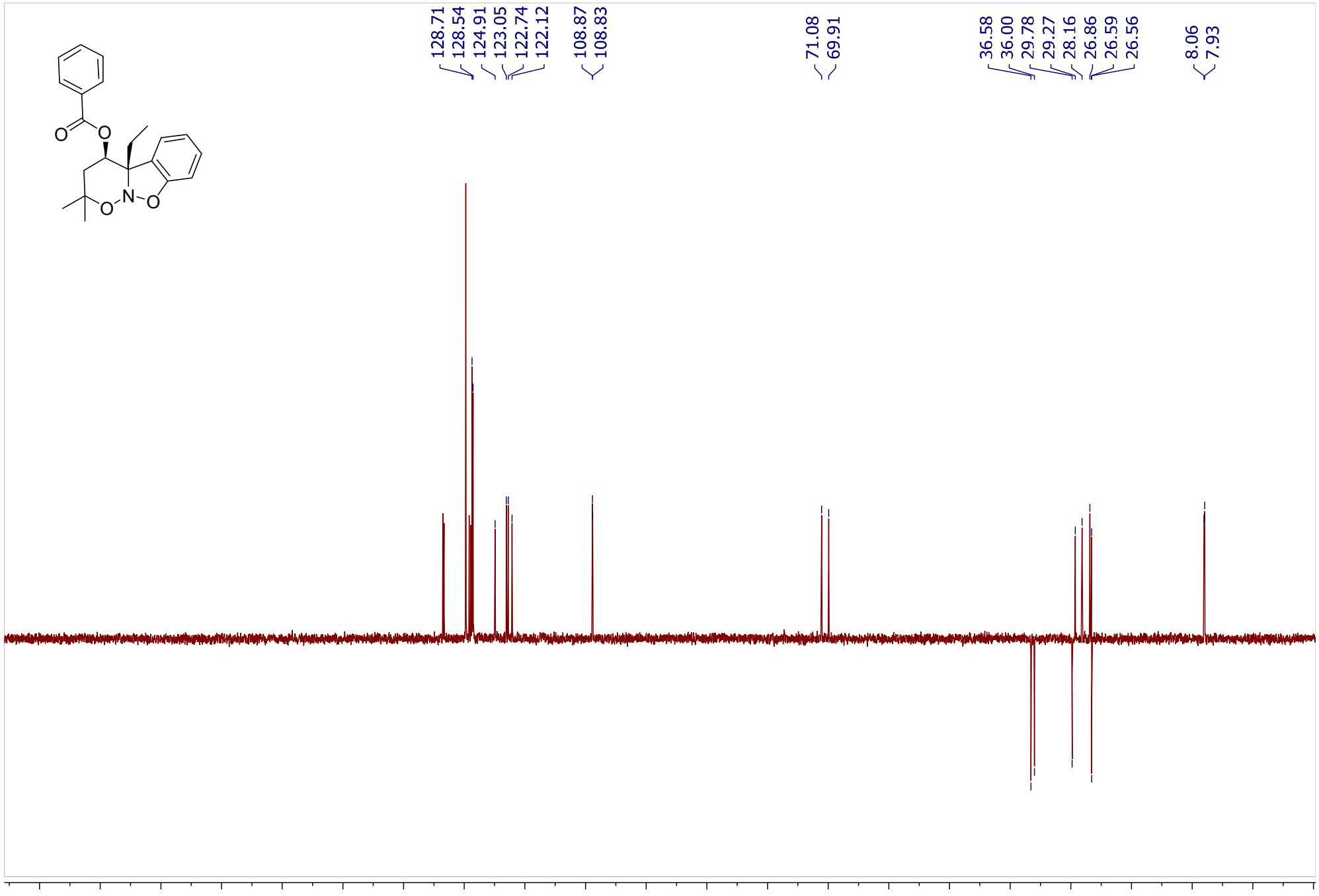
^{1}H NMR (300 MHz, $CDCl_3$)



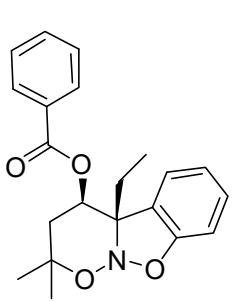
^{13}C NMR (75 MHz, $CDCl_3$)

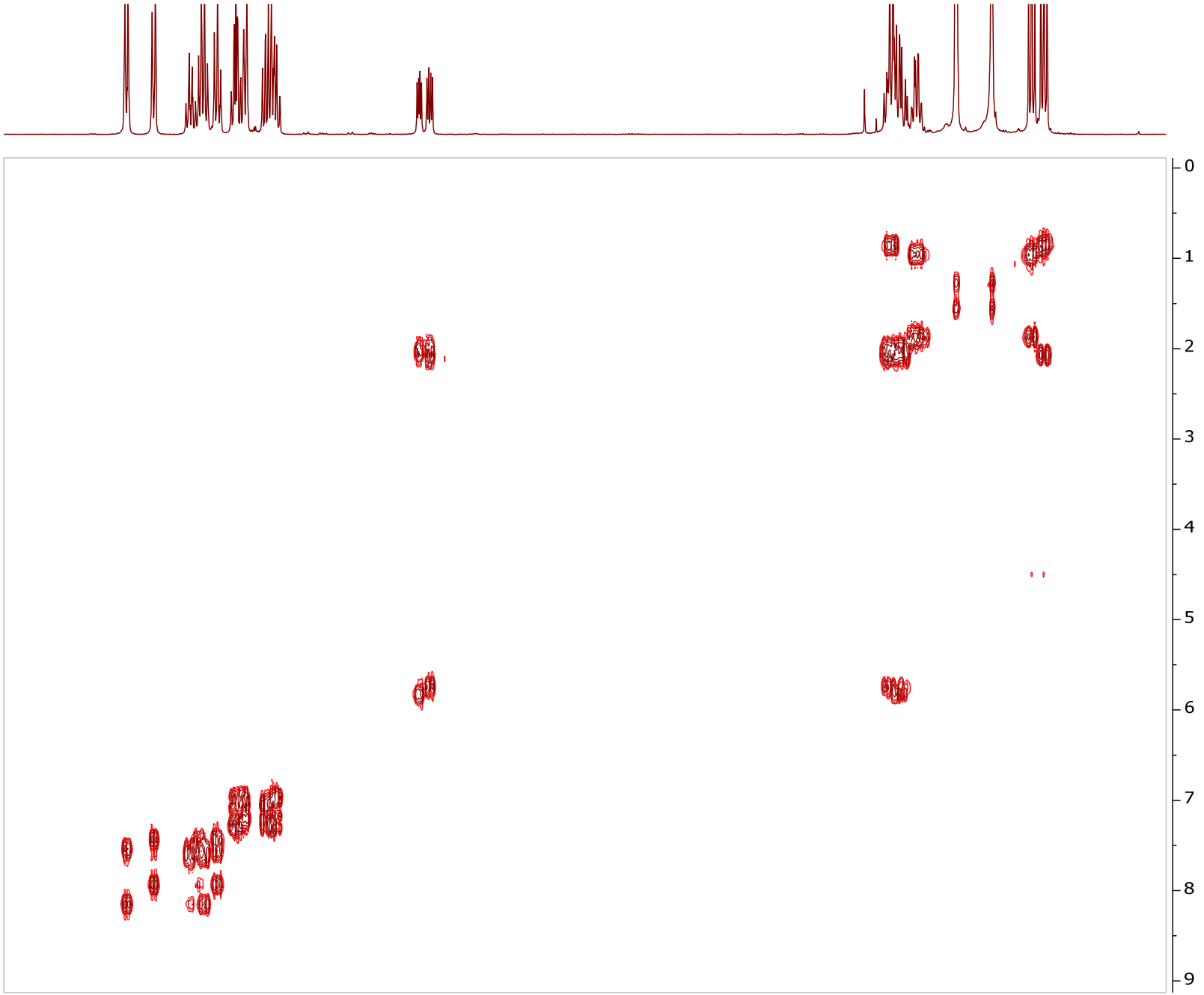


^{13}C DEPT 135 (75 MHz, $CDCl_3$)

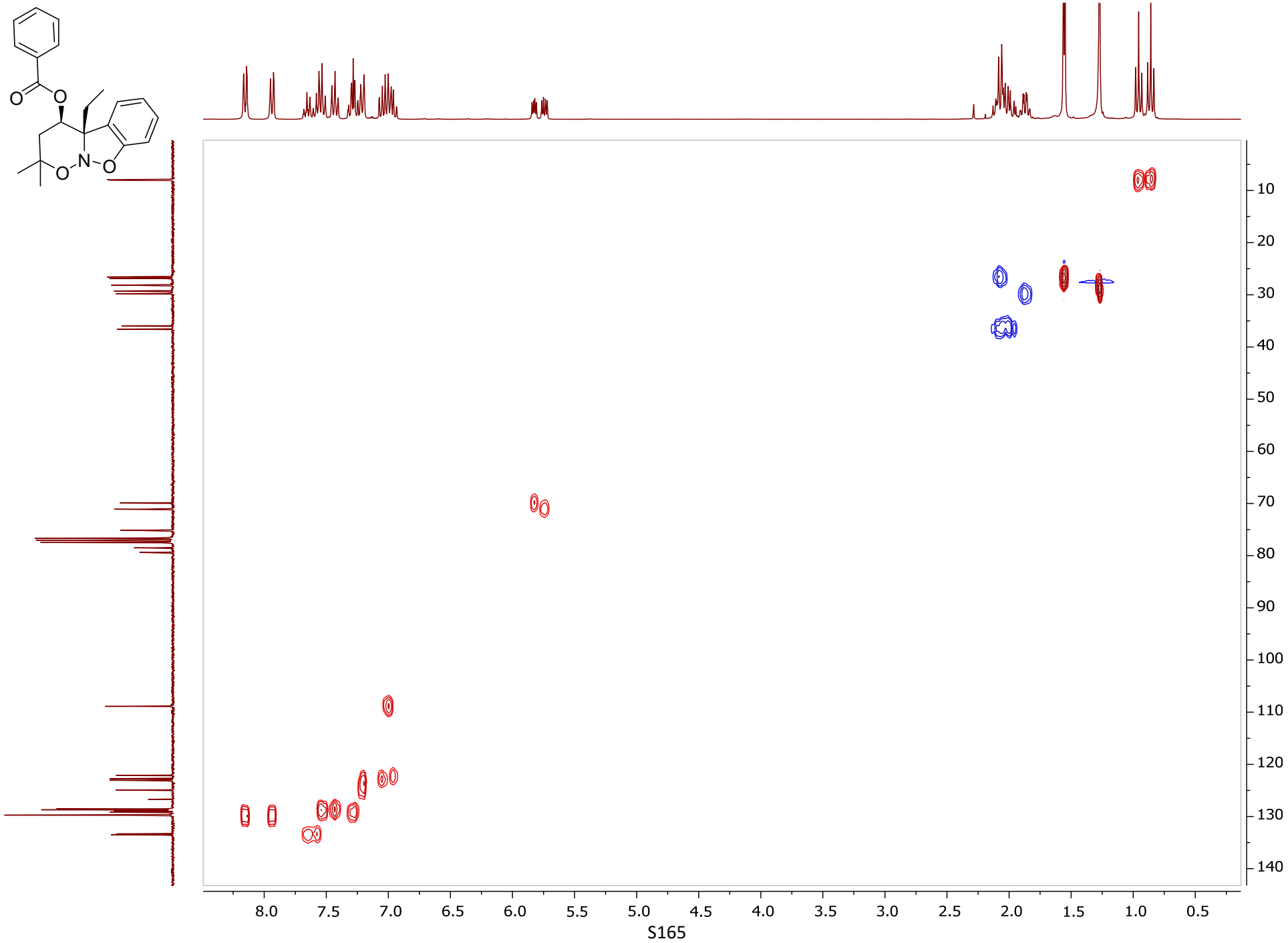


^{1}H-^{1}H COSY

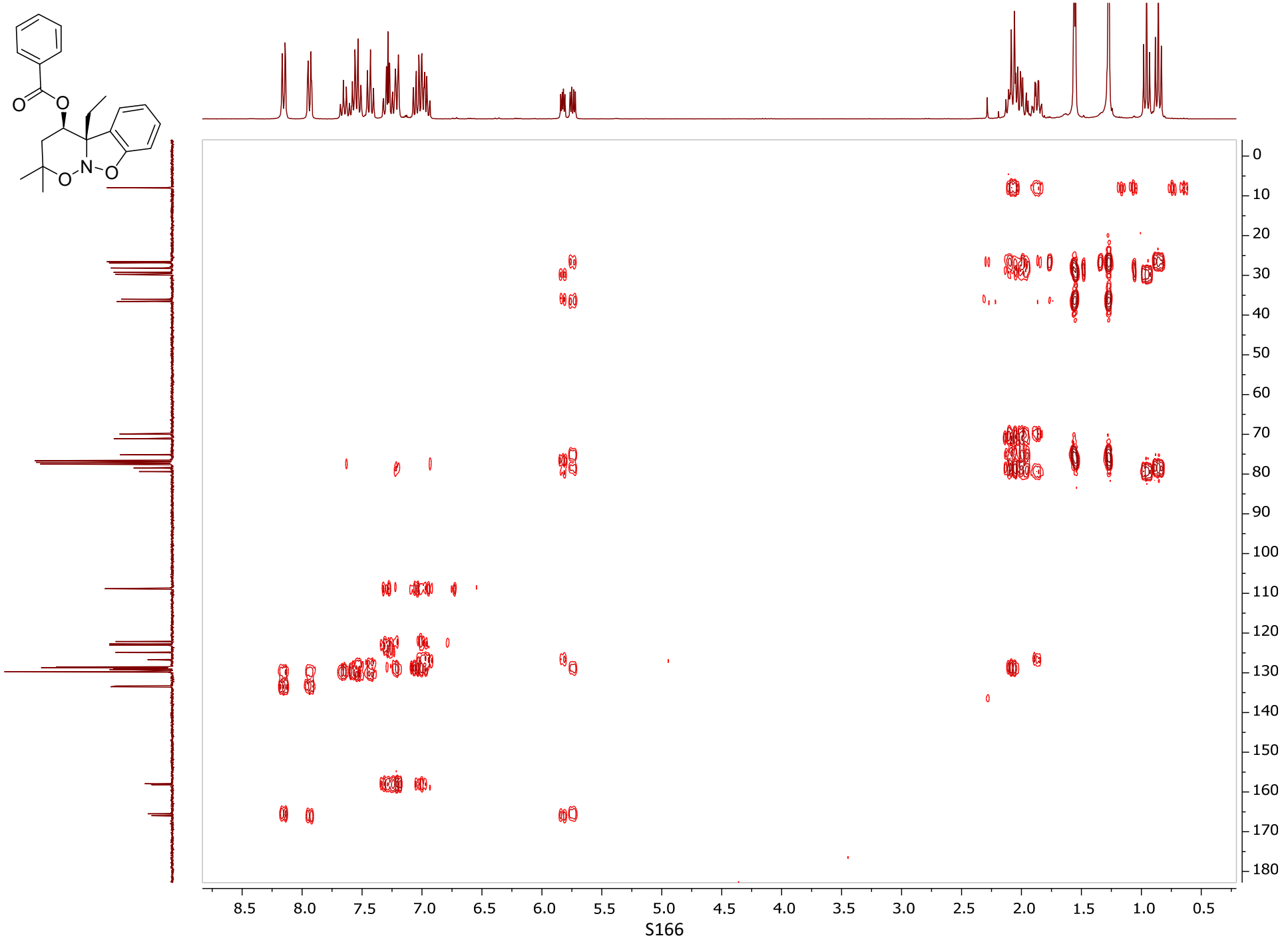




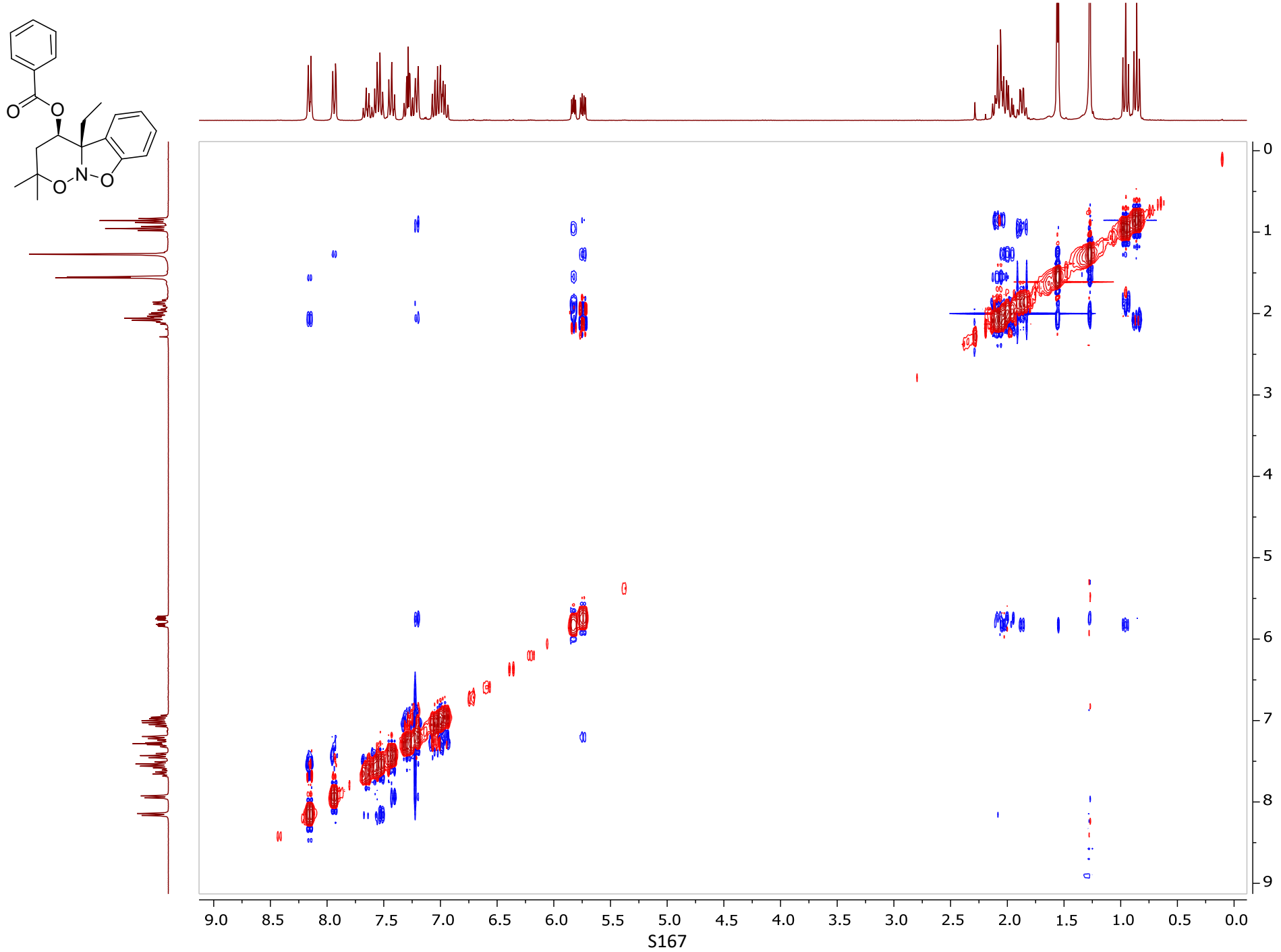
^{1}H-^{13}C HSQC


O
O
N
O
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
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

^{1}H-^{13}C HMBC

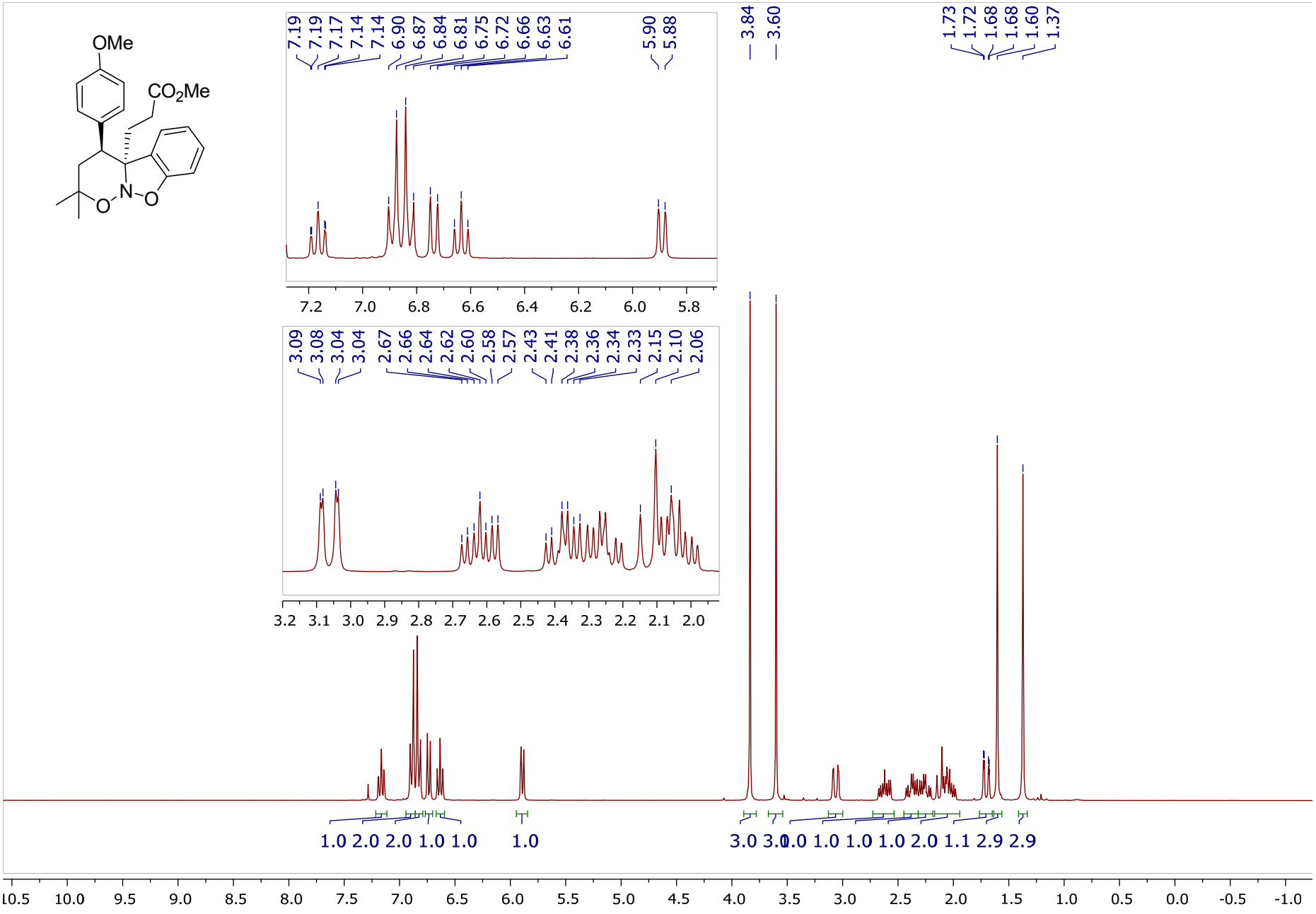

O
O
O
N
O
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

^{1}H-^{1}H NOESY

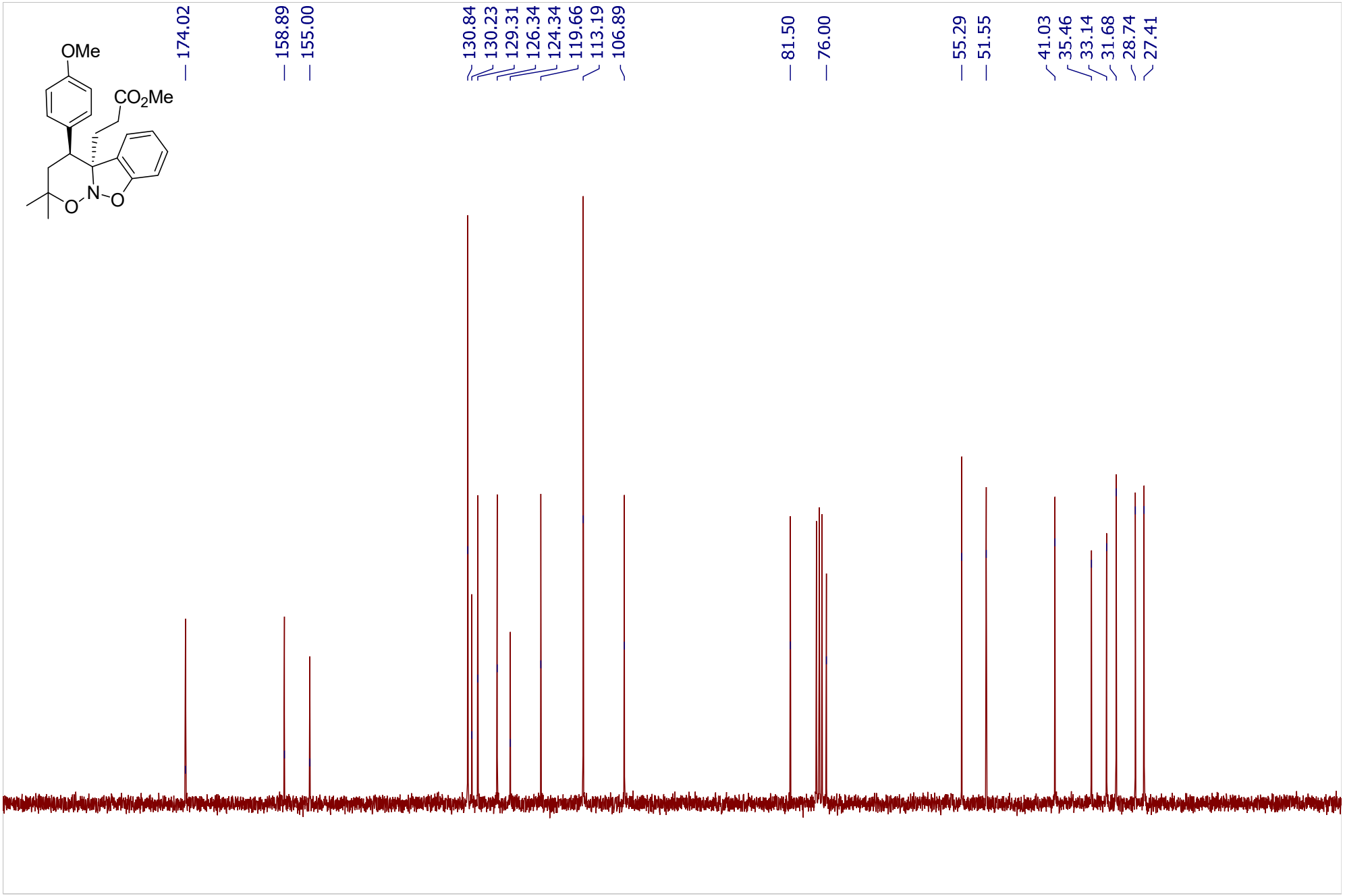

O
O
O
N
O
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
7
8
9

Methyl 3-((4*S,4a*S**)-4-(4-methoxyphenyl)-2,2-dimethyl-3,4-dihydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazin-4a(2H)-yl)propanoate 5ha**

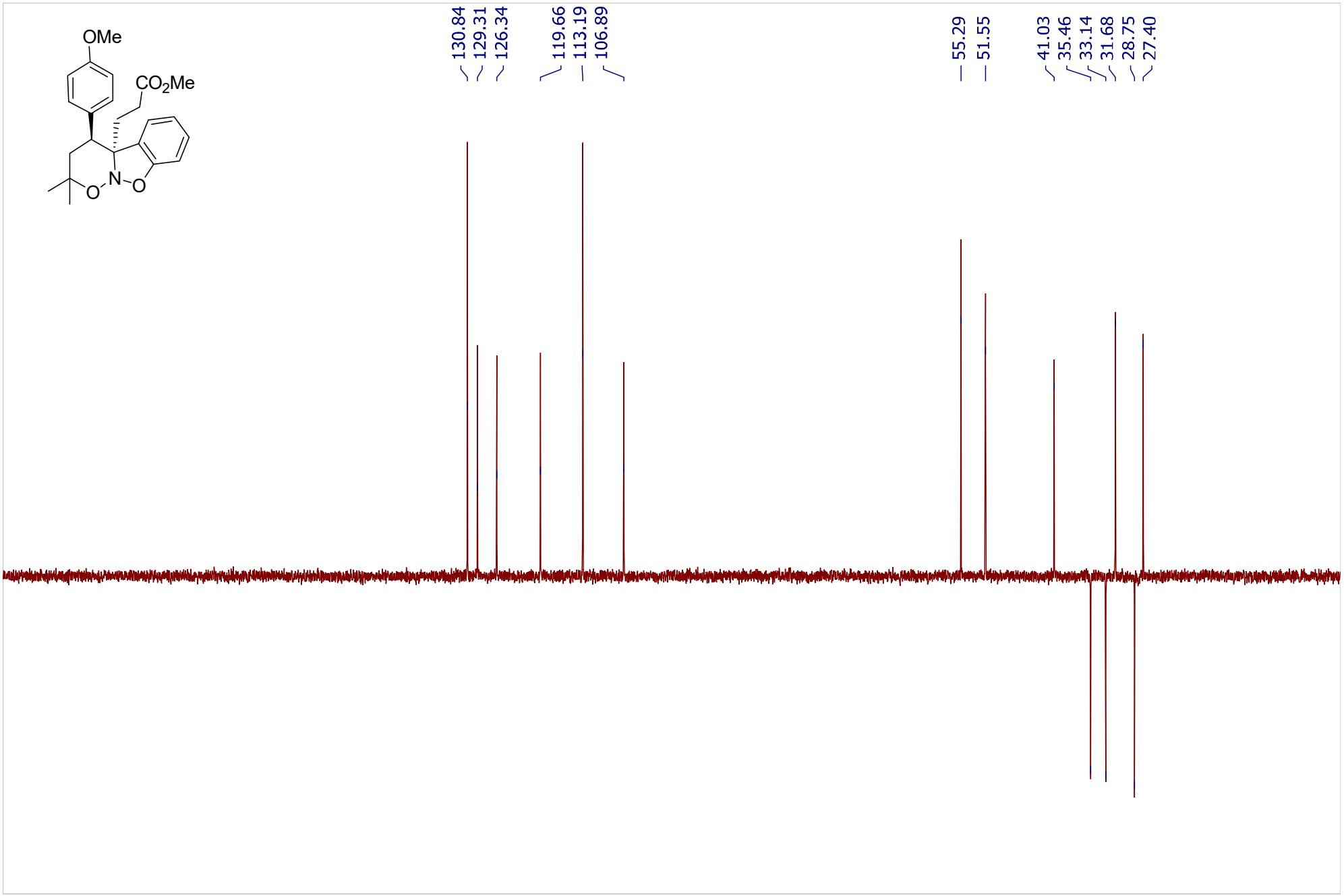
^{1}H NMR (300 MHz, $CDCl_3$)



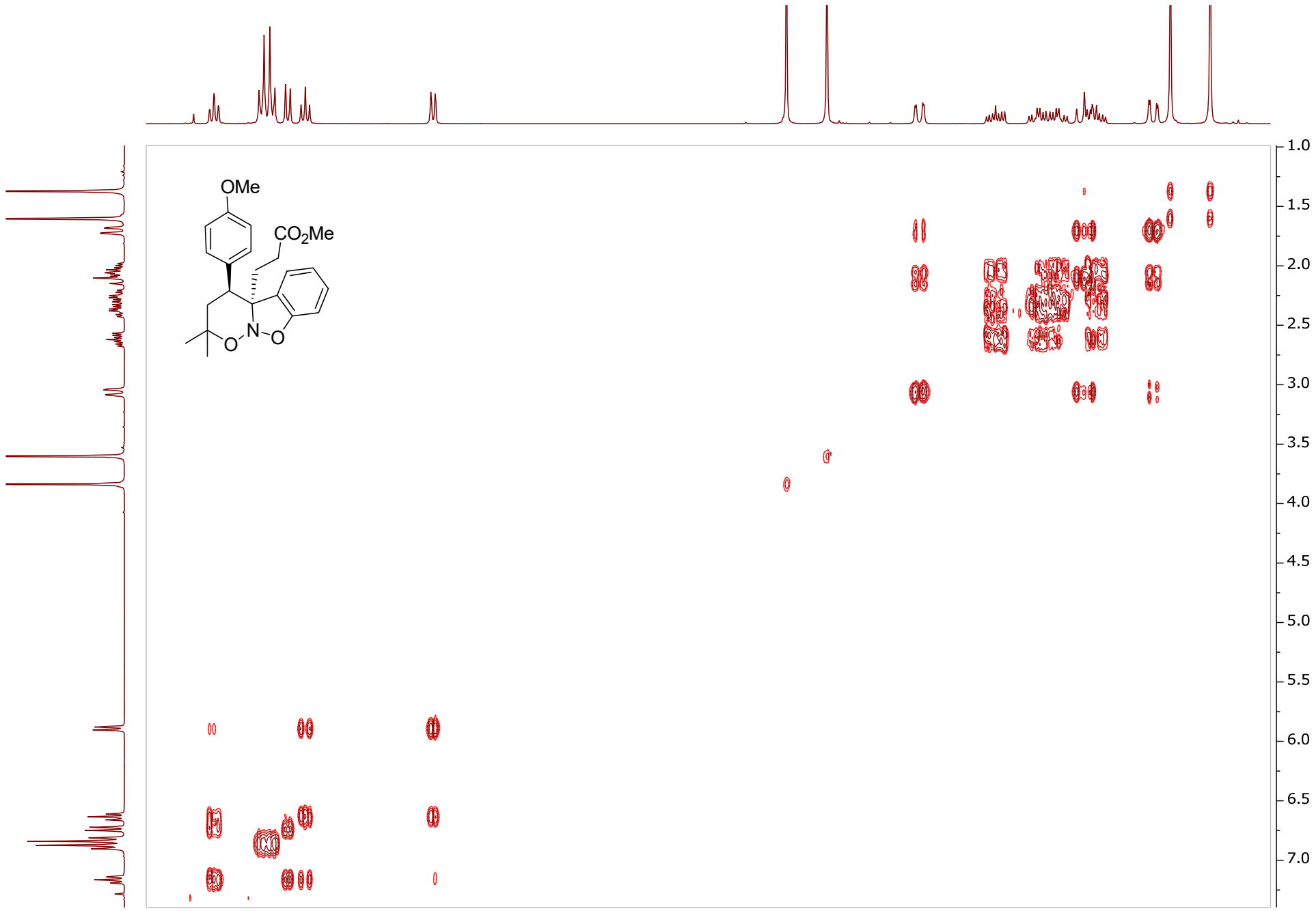
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


OMe
CO2Me
N
O
O
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1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.0
6.5
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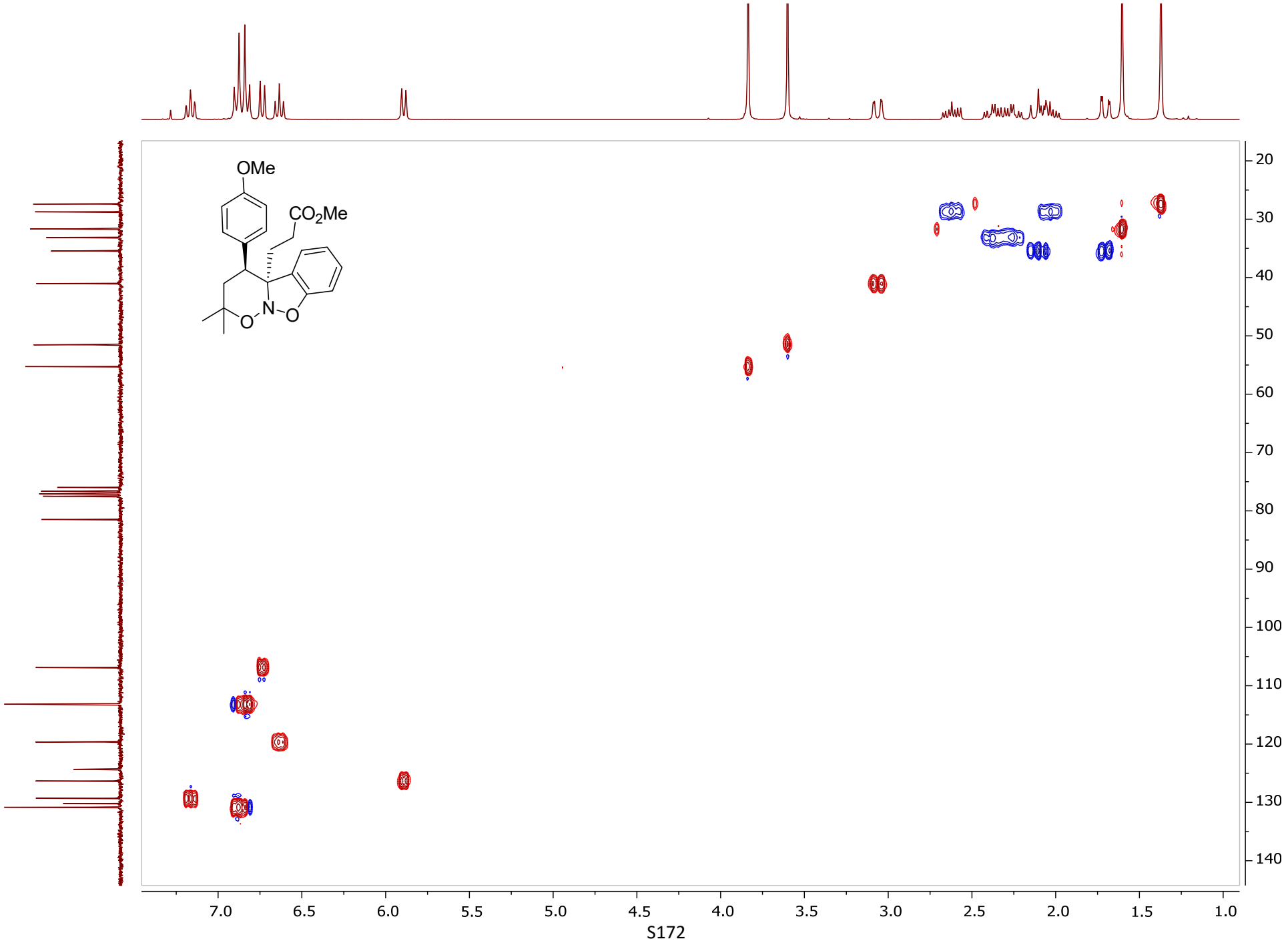
4.0
3.5
3.0
2.5
2.0
1.5

^{1}H-^{13}C HSQC


OMe
CO2Me
N
O
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20
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80
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120
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140
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6.5
6.0
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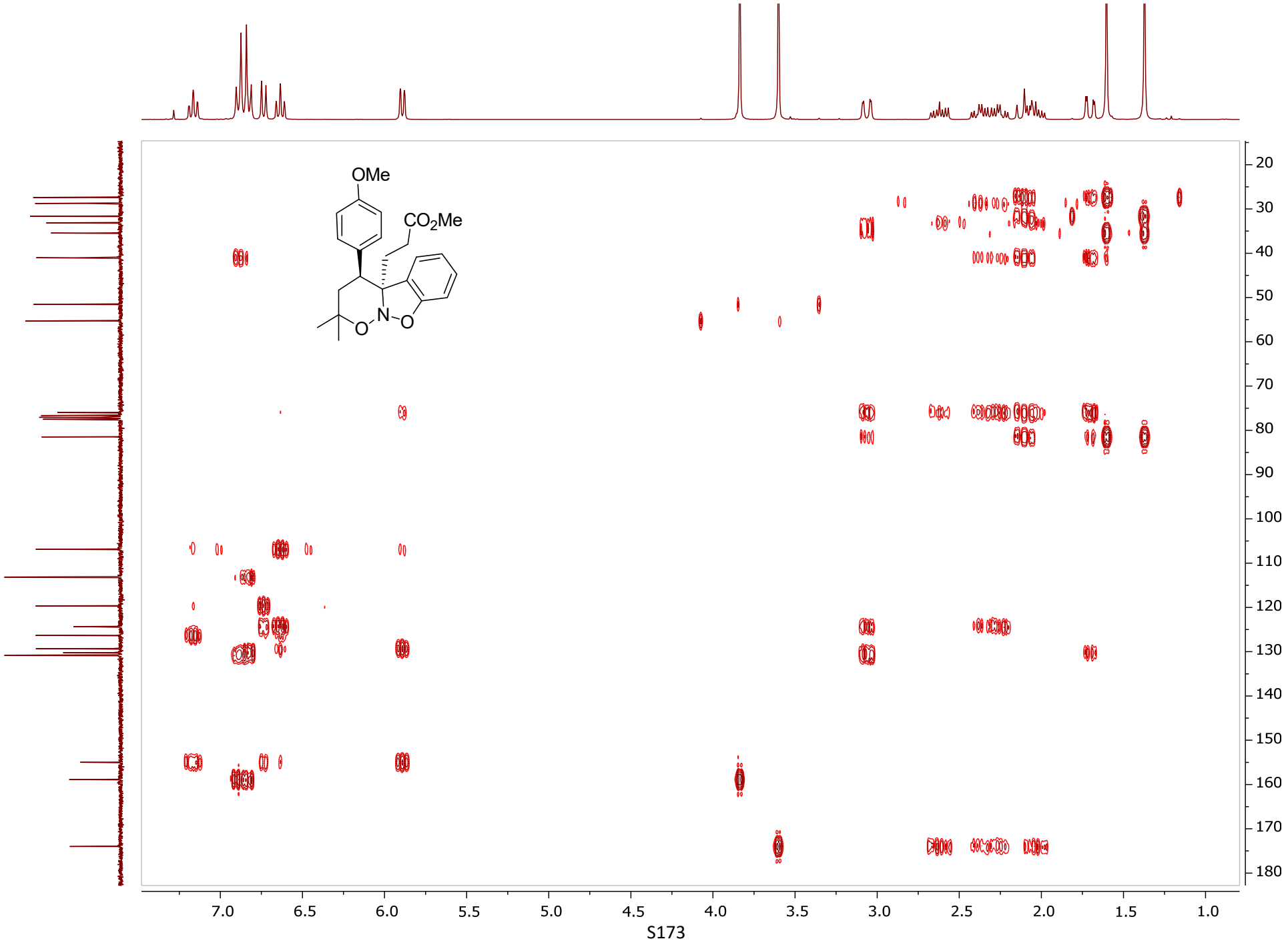
1.5
1.0

^{1}H-^{13}C HMBC


OMe
CO2Me
N
O
O
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6.0
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2.5
2.0
1.5
1.0
20
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120
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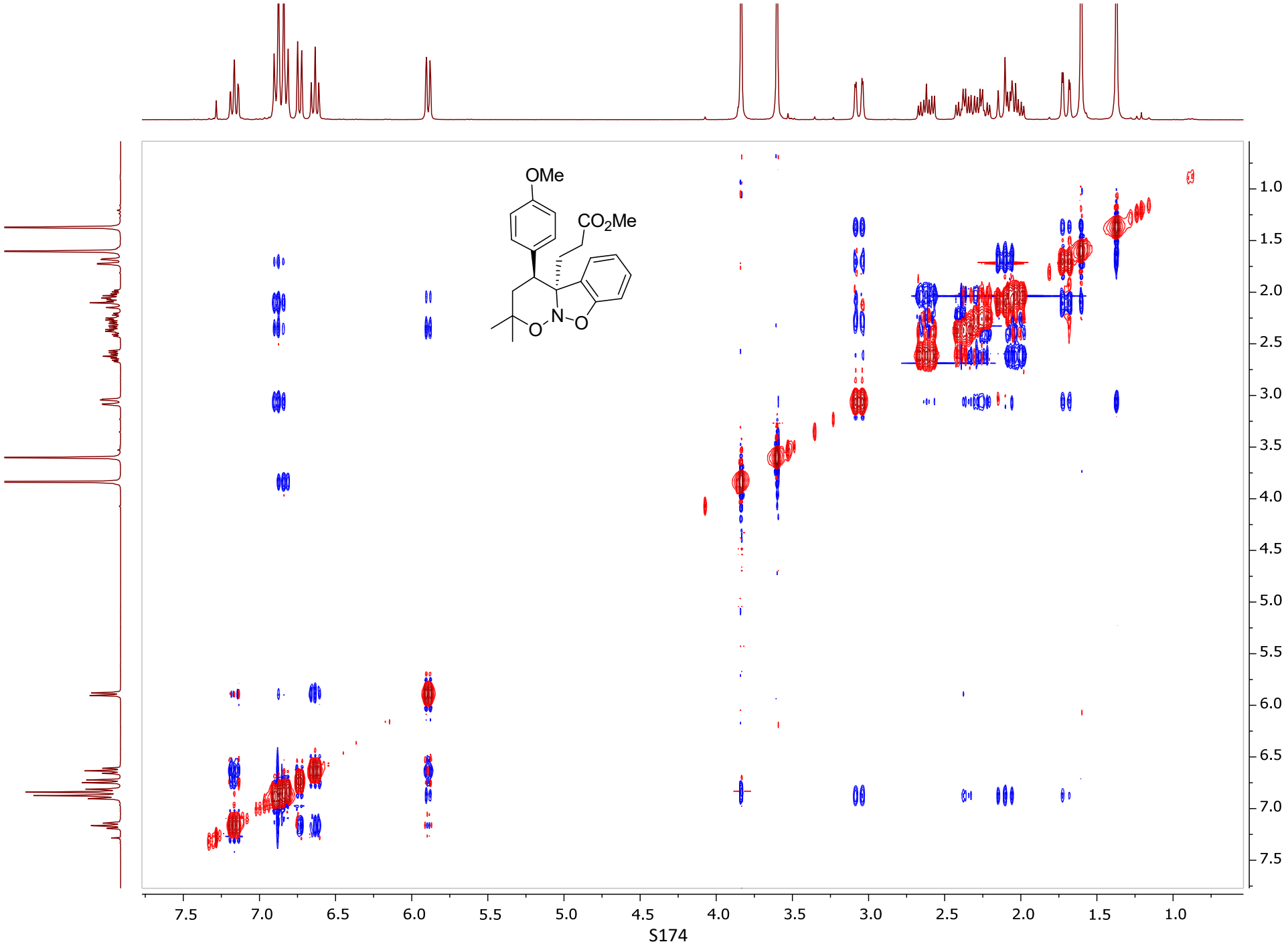
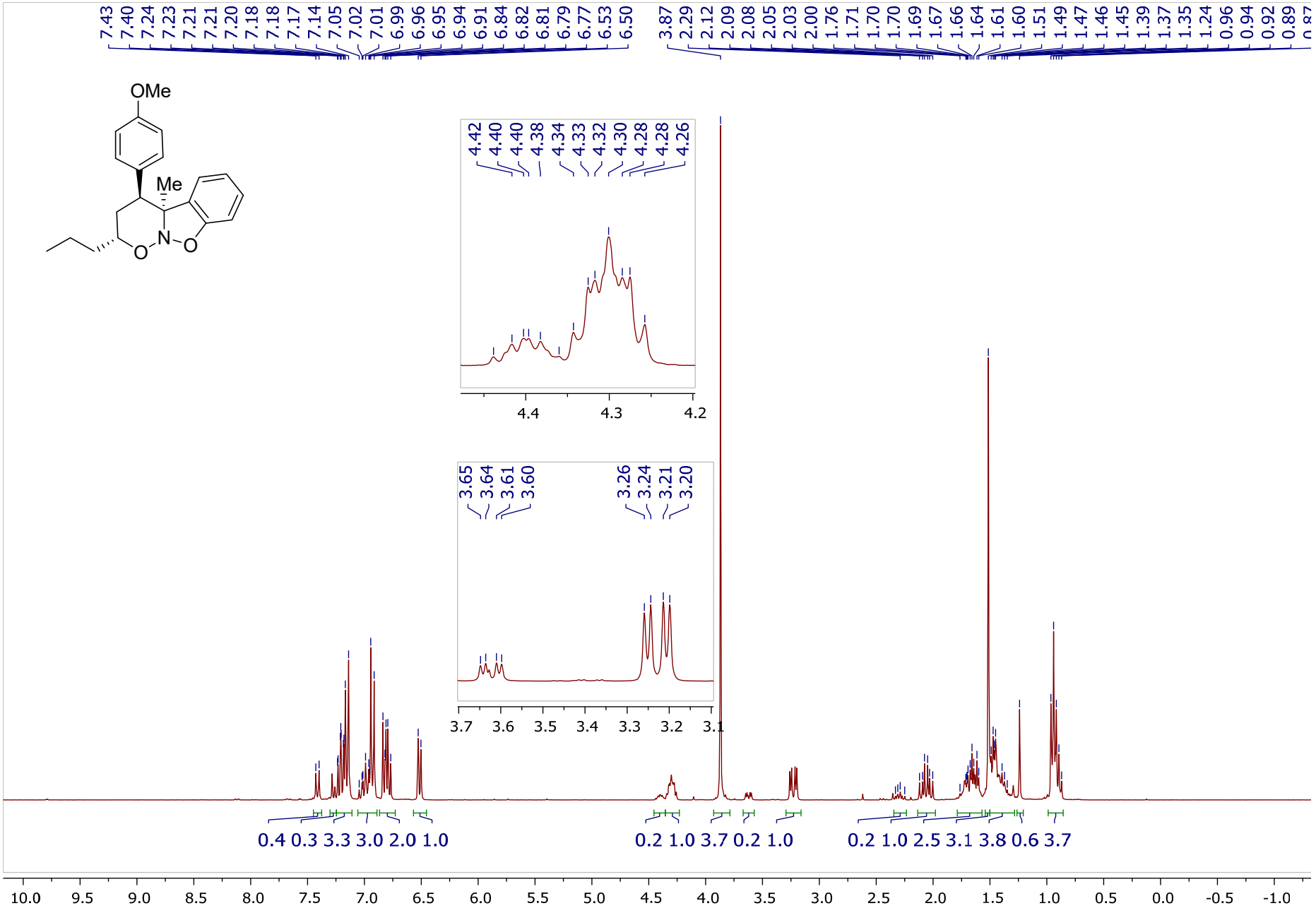
140
150
160
170
180

^{1}H-^{1}H NOESY

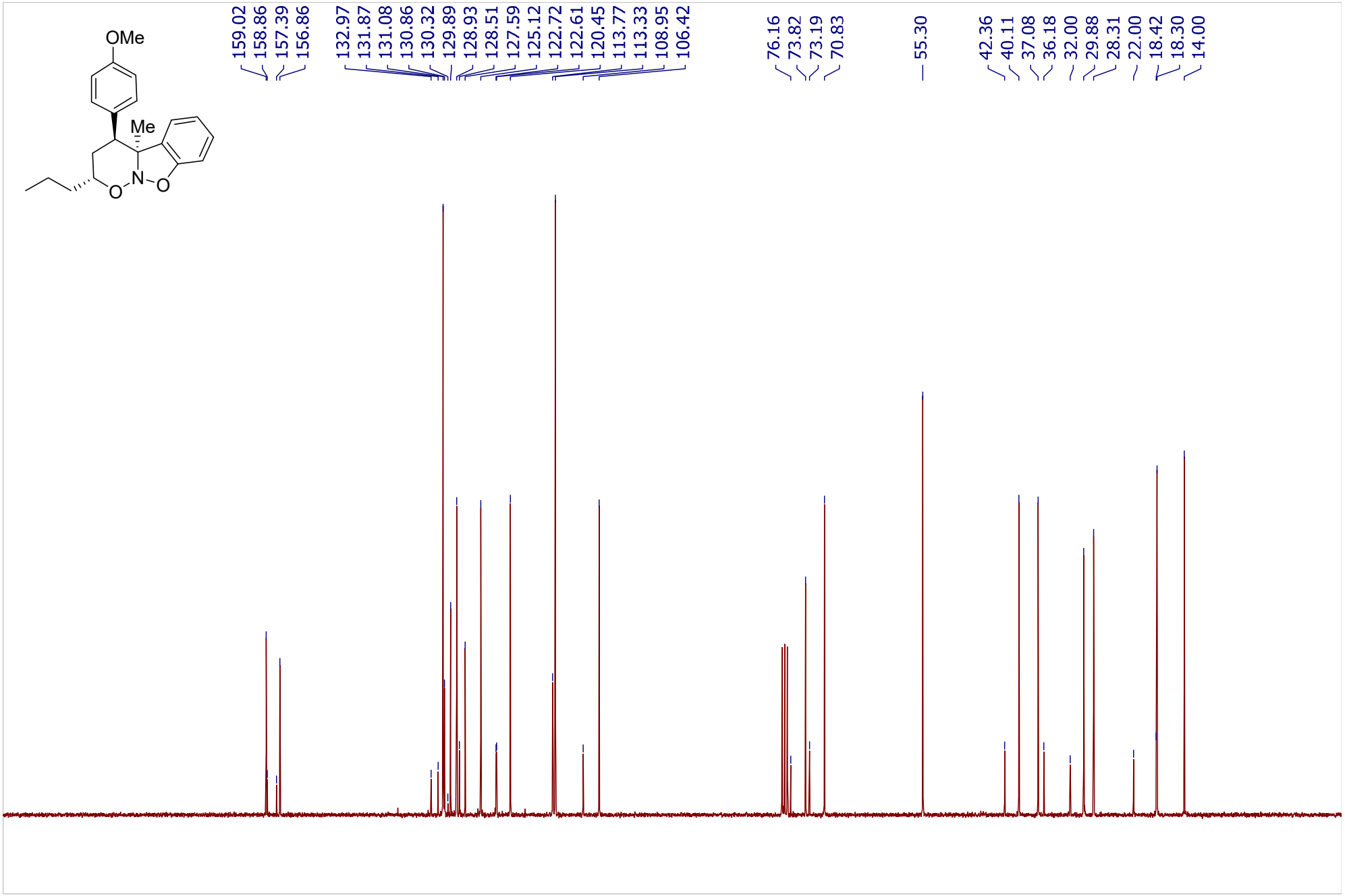


(2*R,4*S**,4a*S**)-4-(4-Methoxyphenyl)-4a-methyl-2-propyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ia**, major / minor = 4:1

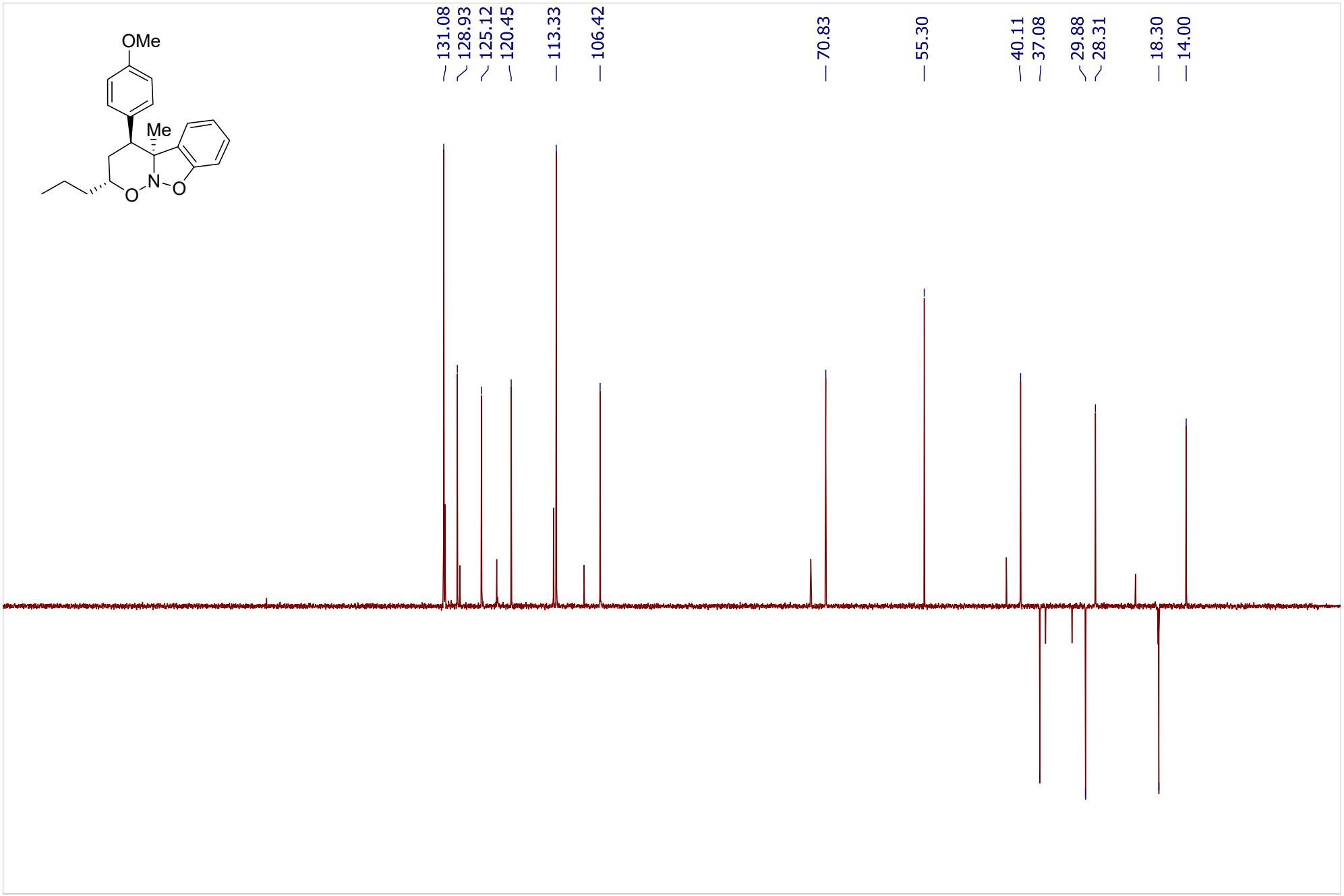
^{1}H NMR (300 MHz, $CDCl_3$)



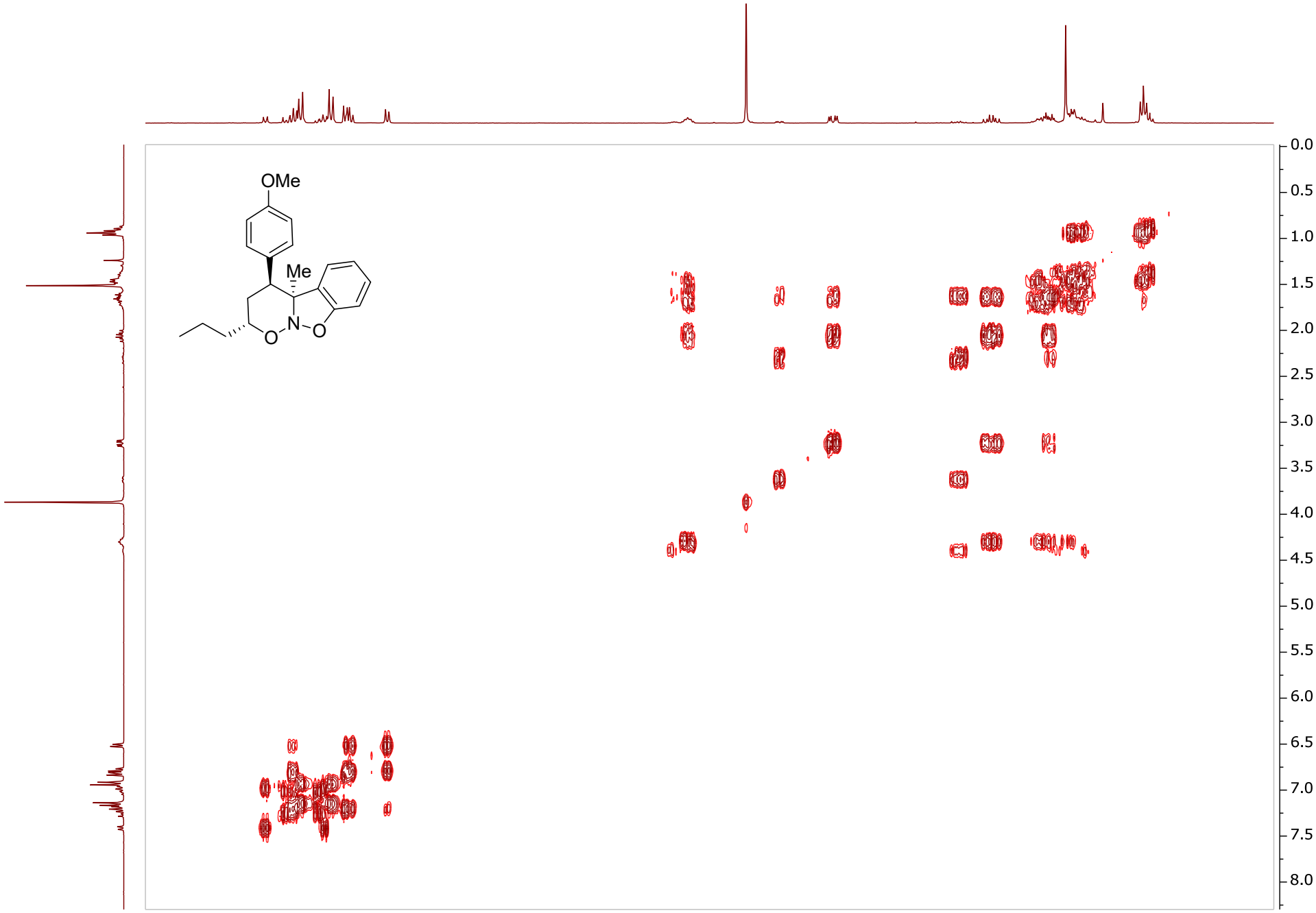
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


OMe
Me
N
O
O
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2.0
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4.5
5.0
5.5
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8.0
7.5
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6.5
6.0
5.5
5.0
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1.5
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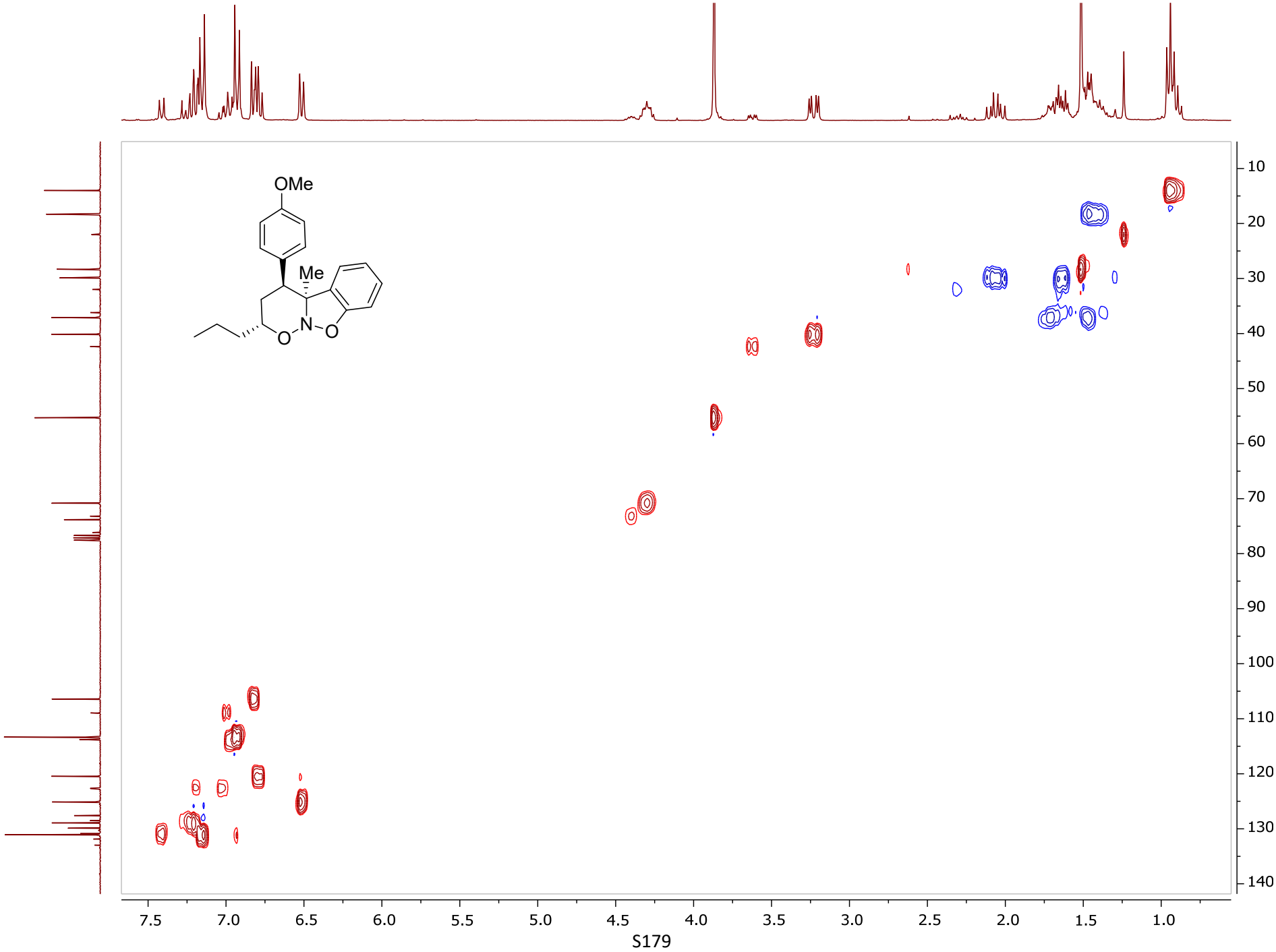
0.5
0.0

^{1}H-^{13}C HSQC


OMe
Me
N
O
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
7.5
7.0
6.5
6.0
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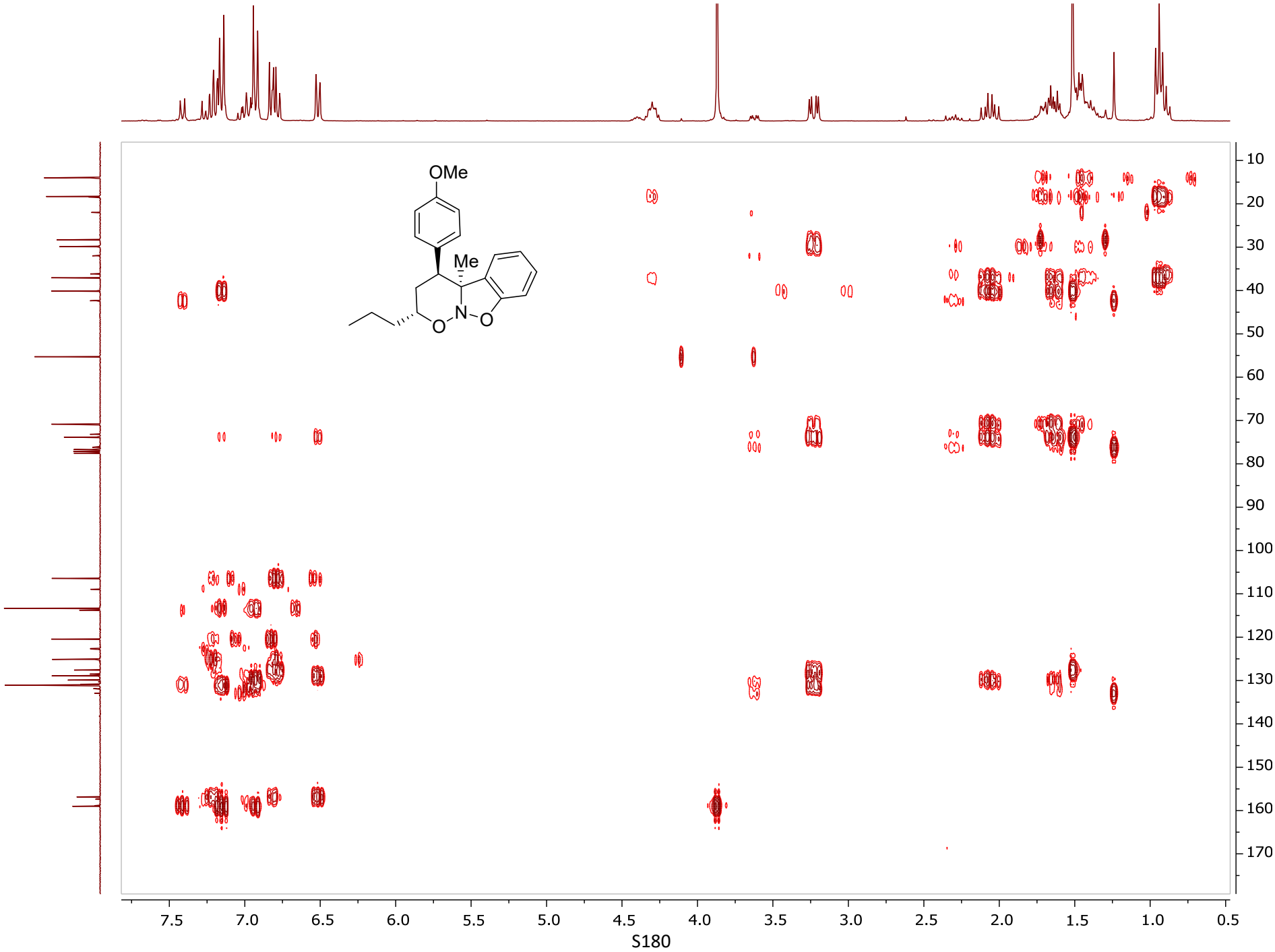
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{13}C HMBC


OMe
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120
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140
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170
7.5
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6.5
6.0
5.5
5.0
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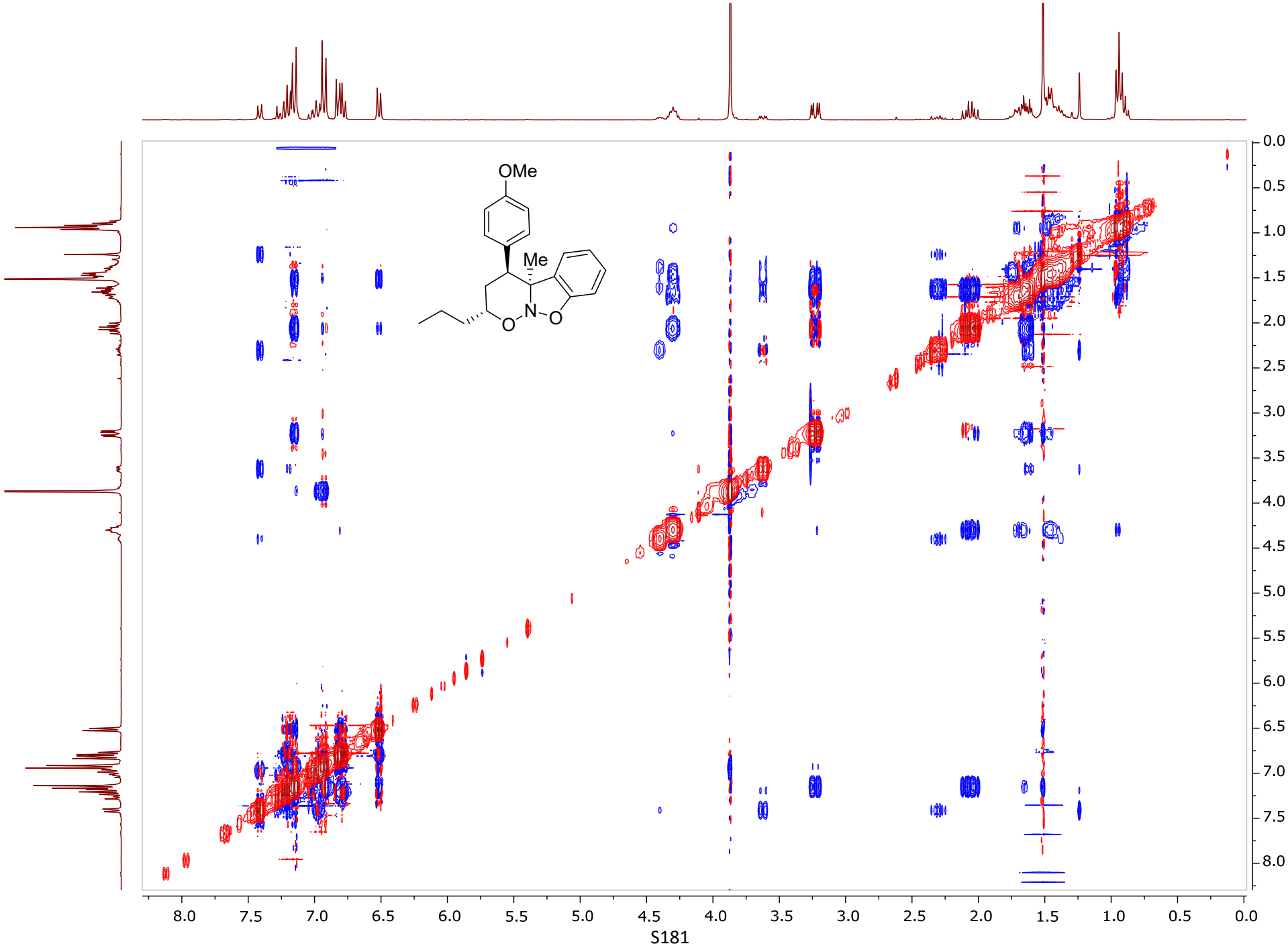
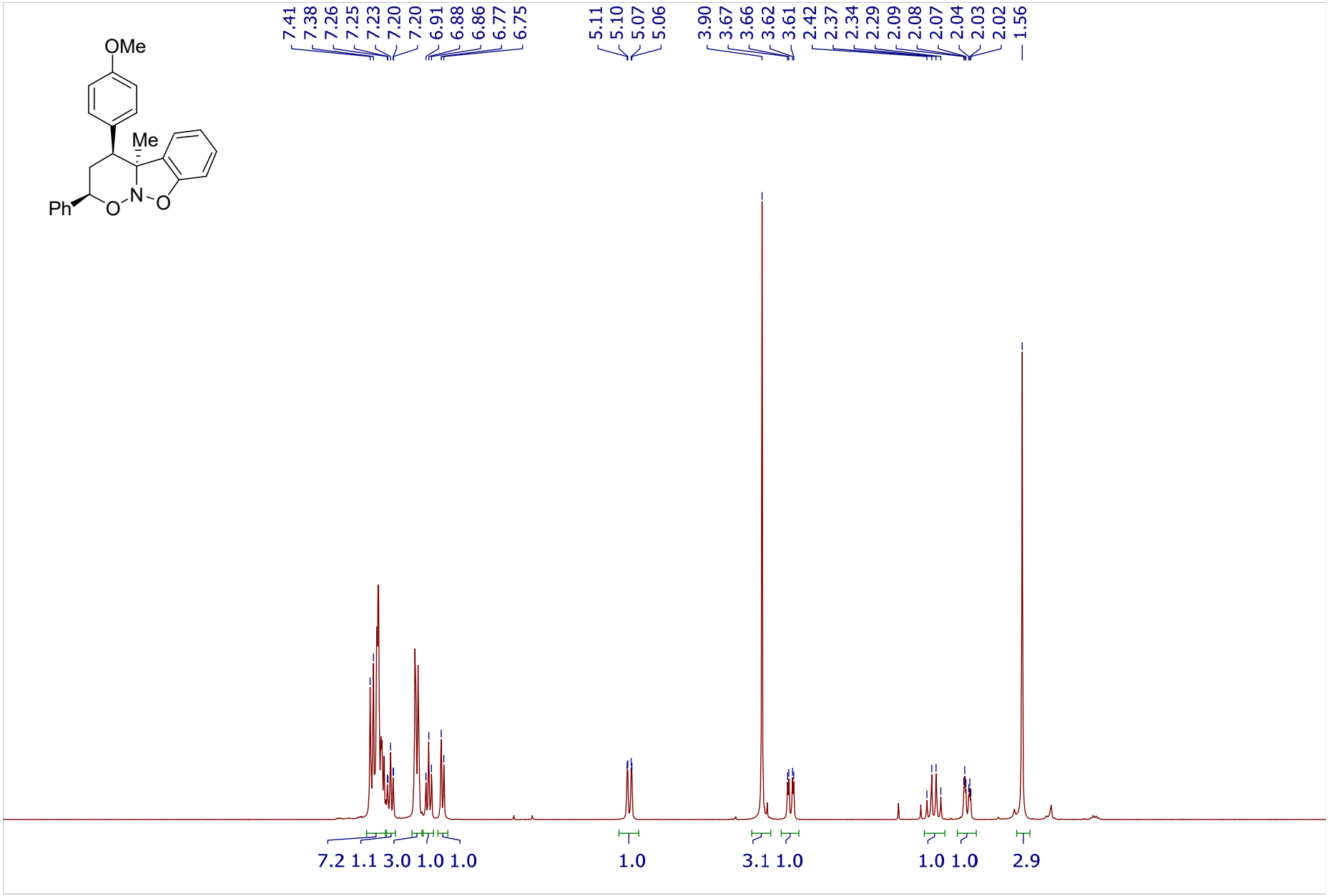
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{1}H NOESY

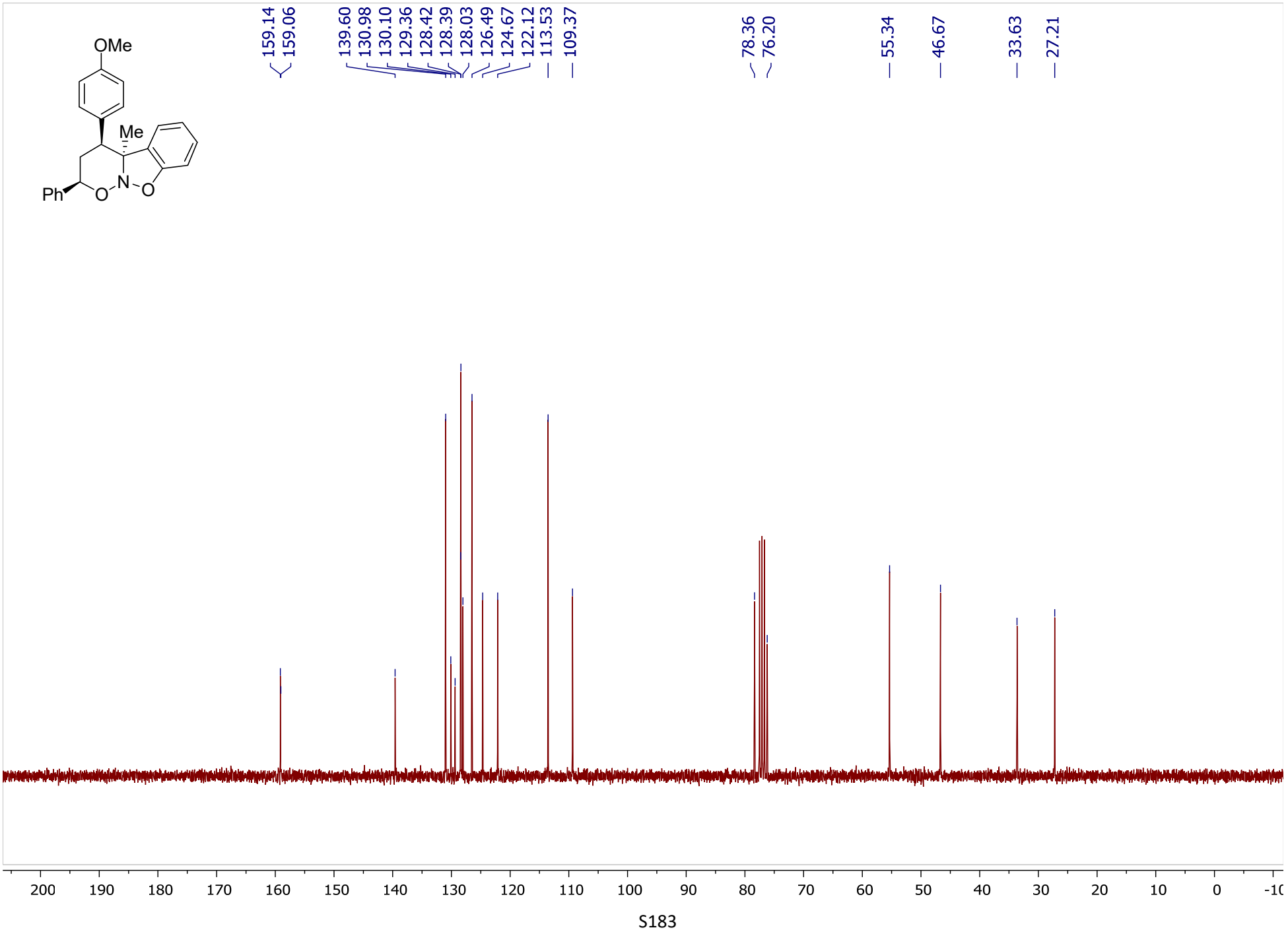


(2*R,4*S**,4a*S**)-4-(4-Methoxyphenyl)-4a-methyl-2-phenyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ja**

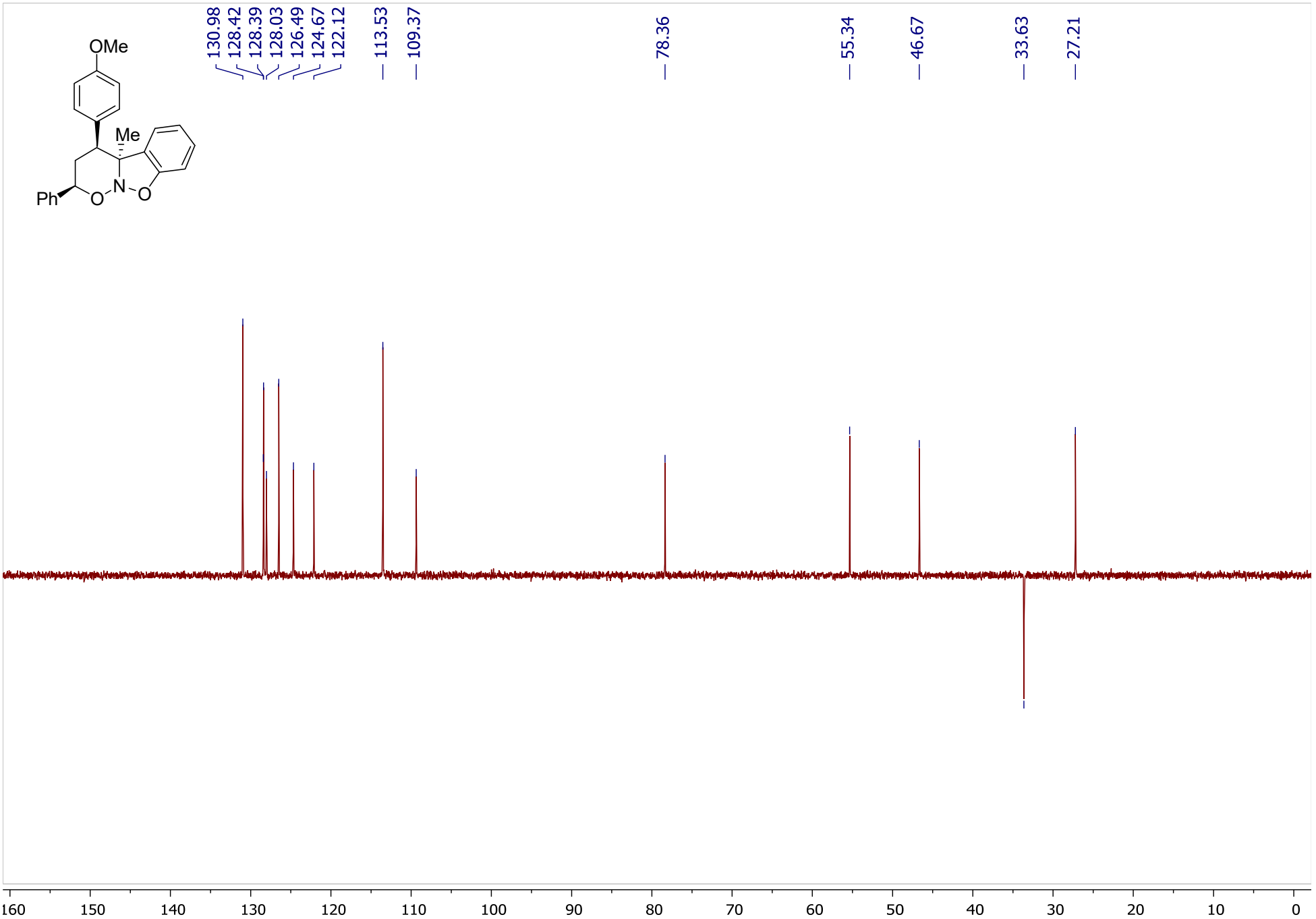
^{1}H NMR (300 MHz, $CDCl_3$)

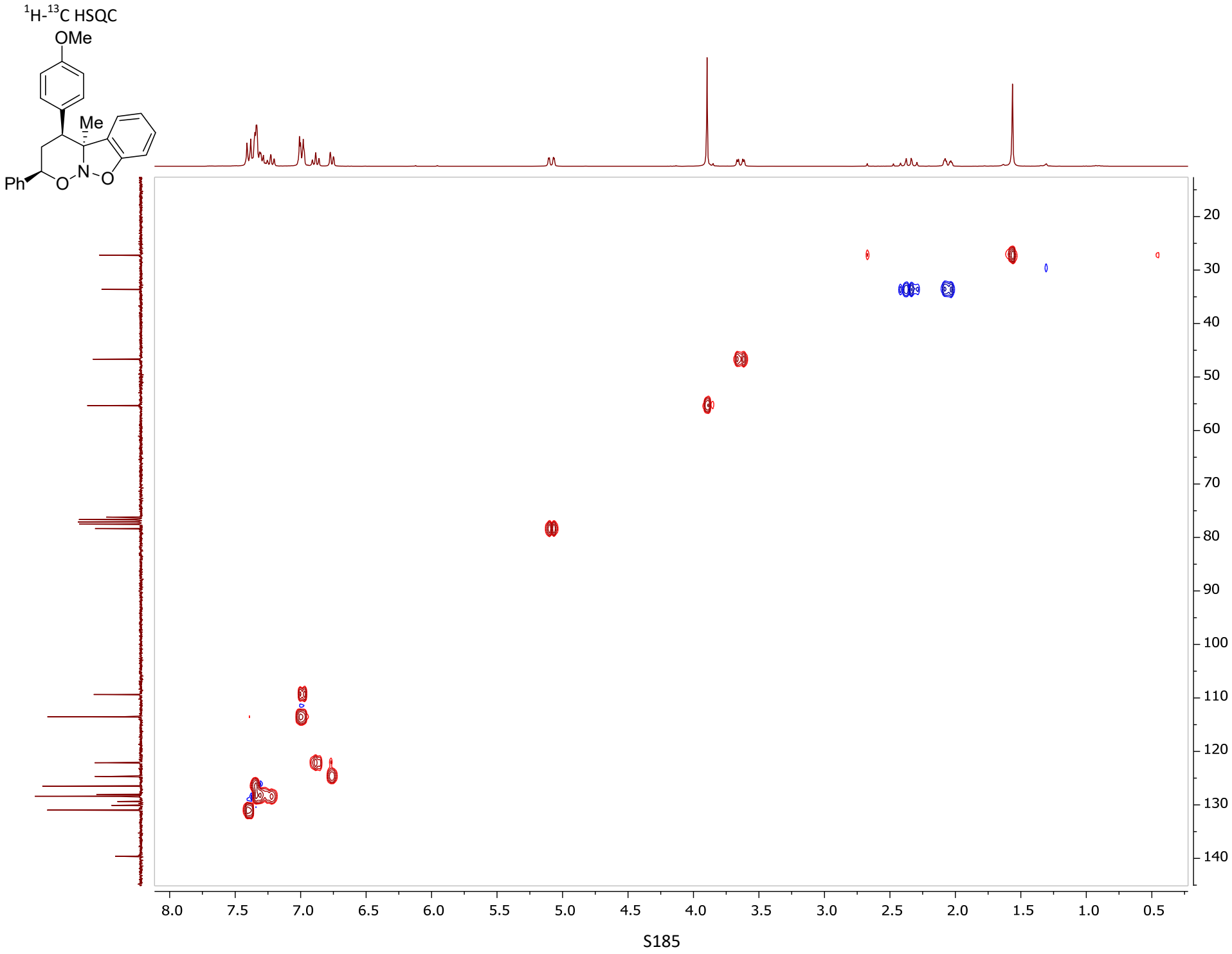


^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)




^{1}H-^{13}C HSQC
OMe
Me
Ph
O
N
O
20
30
40
50
60
70
80
90
100
110
120
130
140
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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3.5
3.0
2.5
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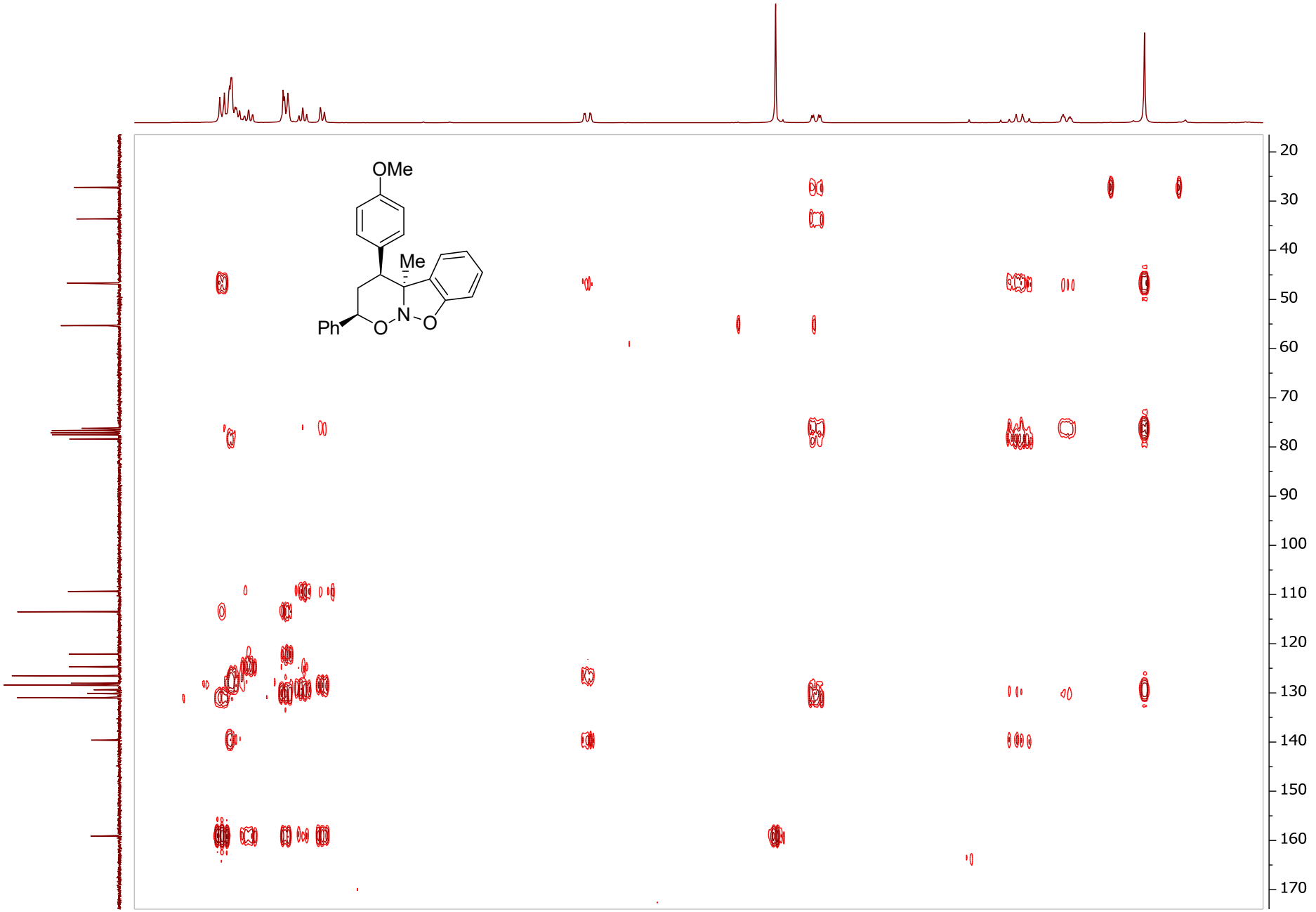
1.5
1.0
0.5

^{1}H-^{13}C HMBC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Me
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N
O
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80
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110
120
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140
150
160
170
7.5
7.0
6.5
6.0
5.5
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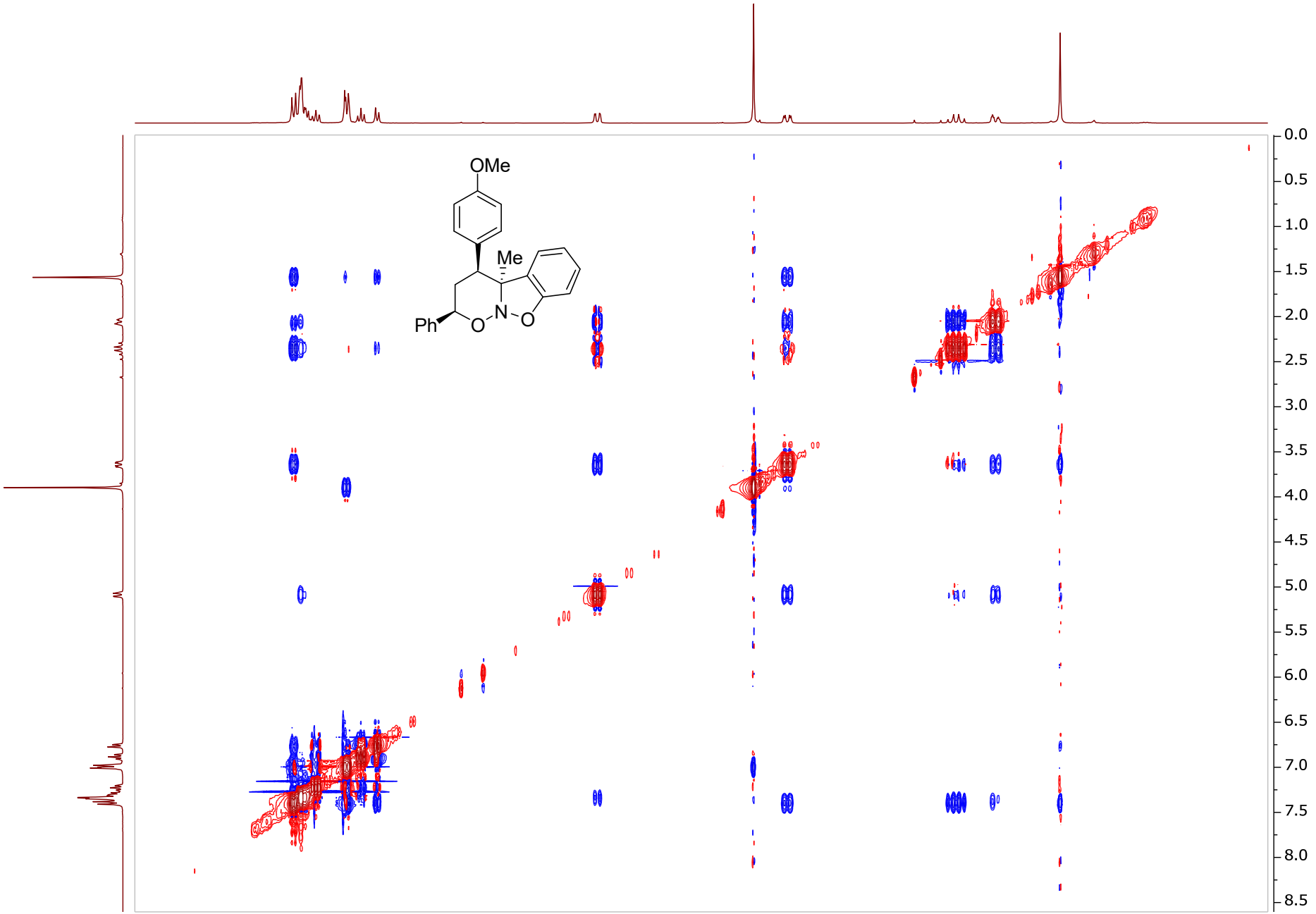
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{1}H NOESY


OMe
Me
Ph
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N
O
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0.5
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1.5
2.0
2.5
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4.0
4.5
5.0
5.5
6.0
6.5
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7.5
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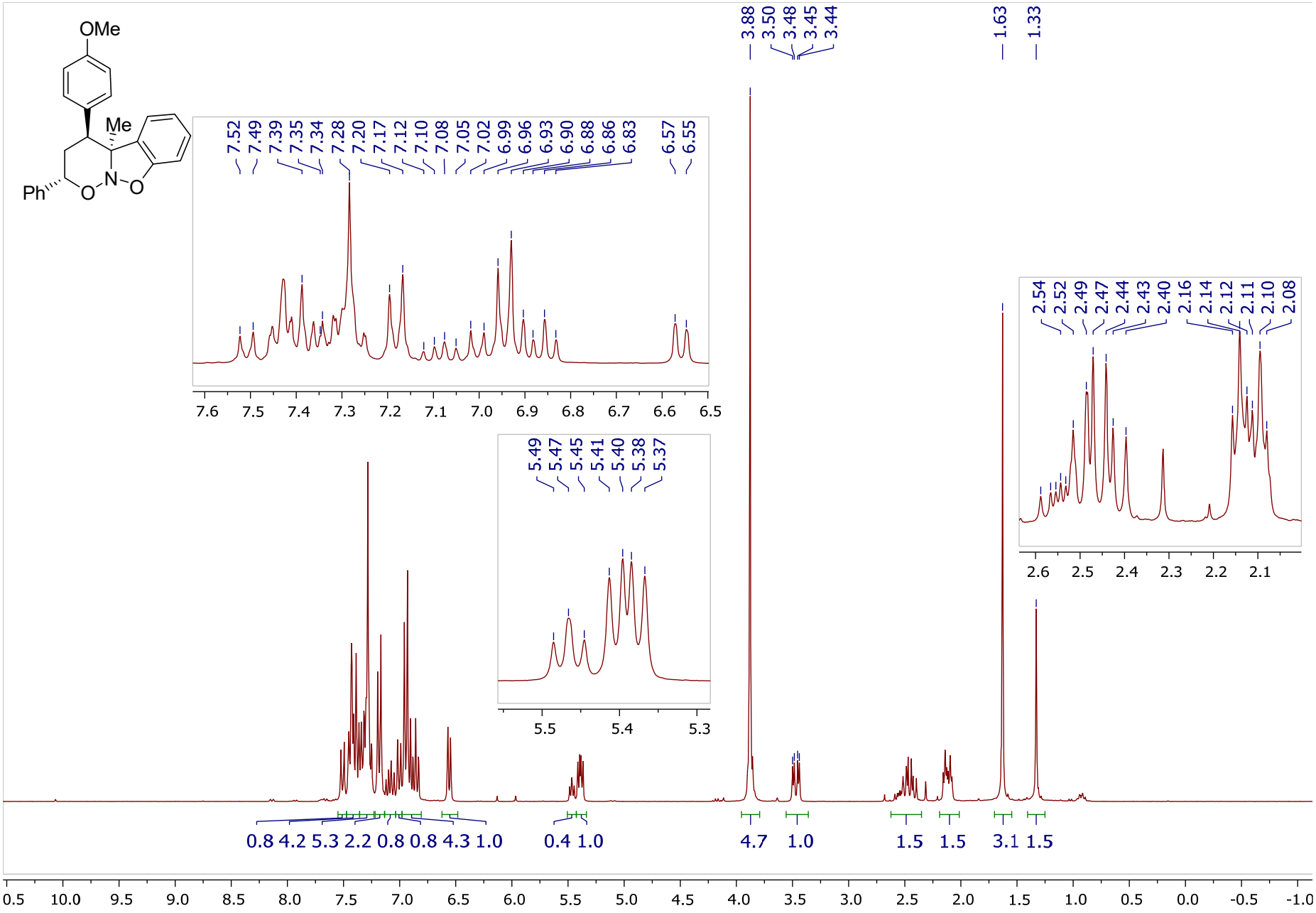
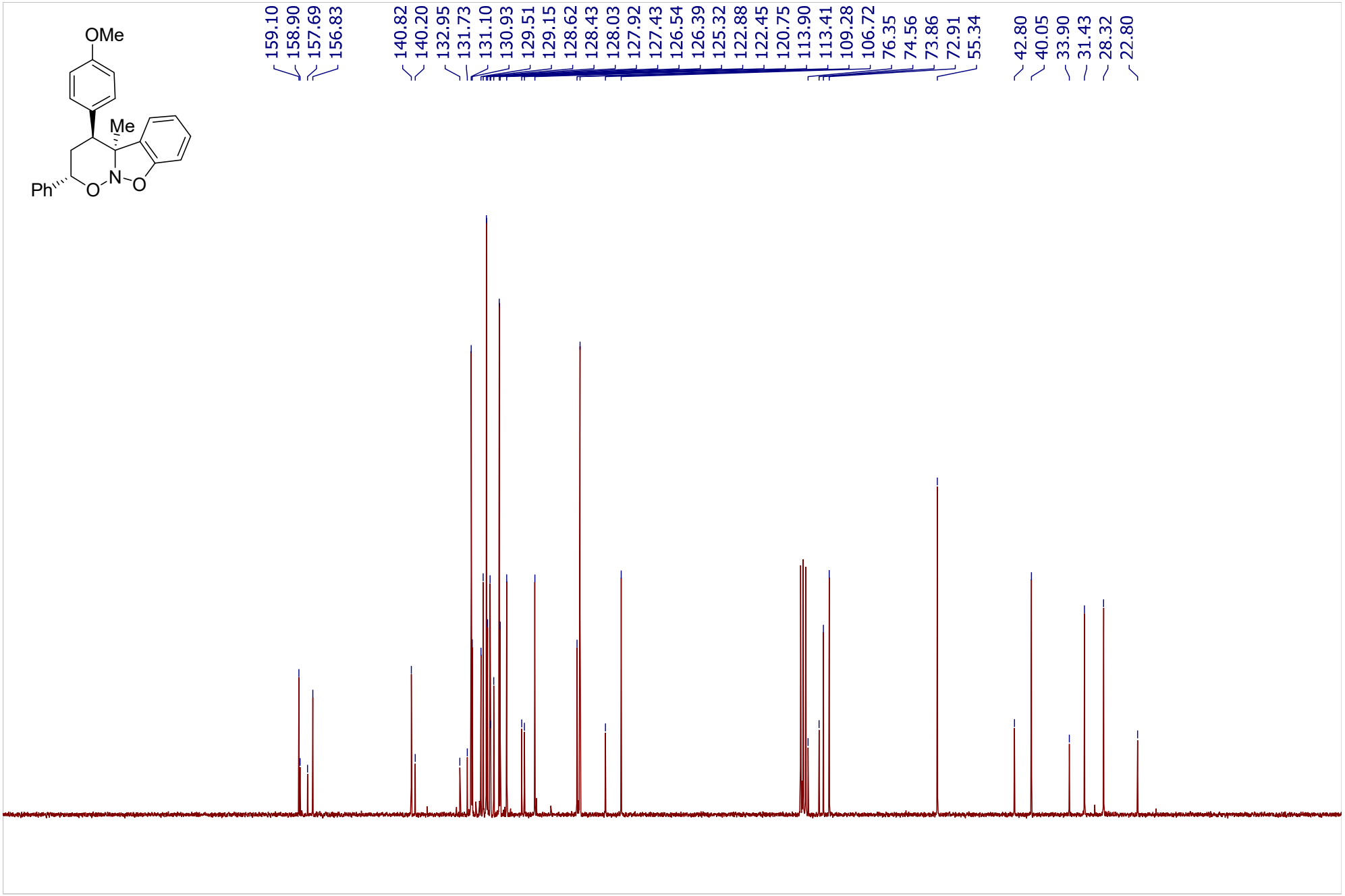
8.5
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

(2*S,4*S**,4a*S**)-4-(4-Methoxyphenyl)-4a-methyl-2-phenyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ka**, major / mnor = 2.2:1

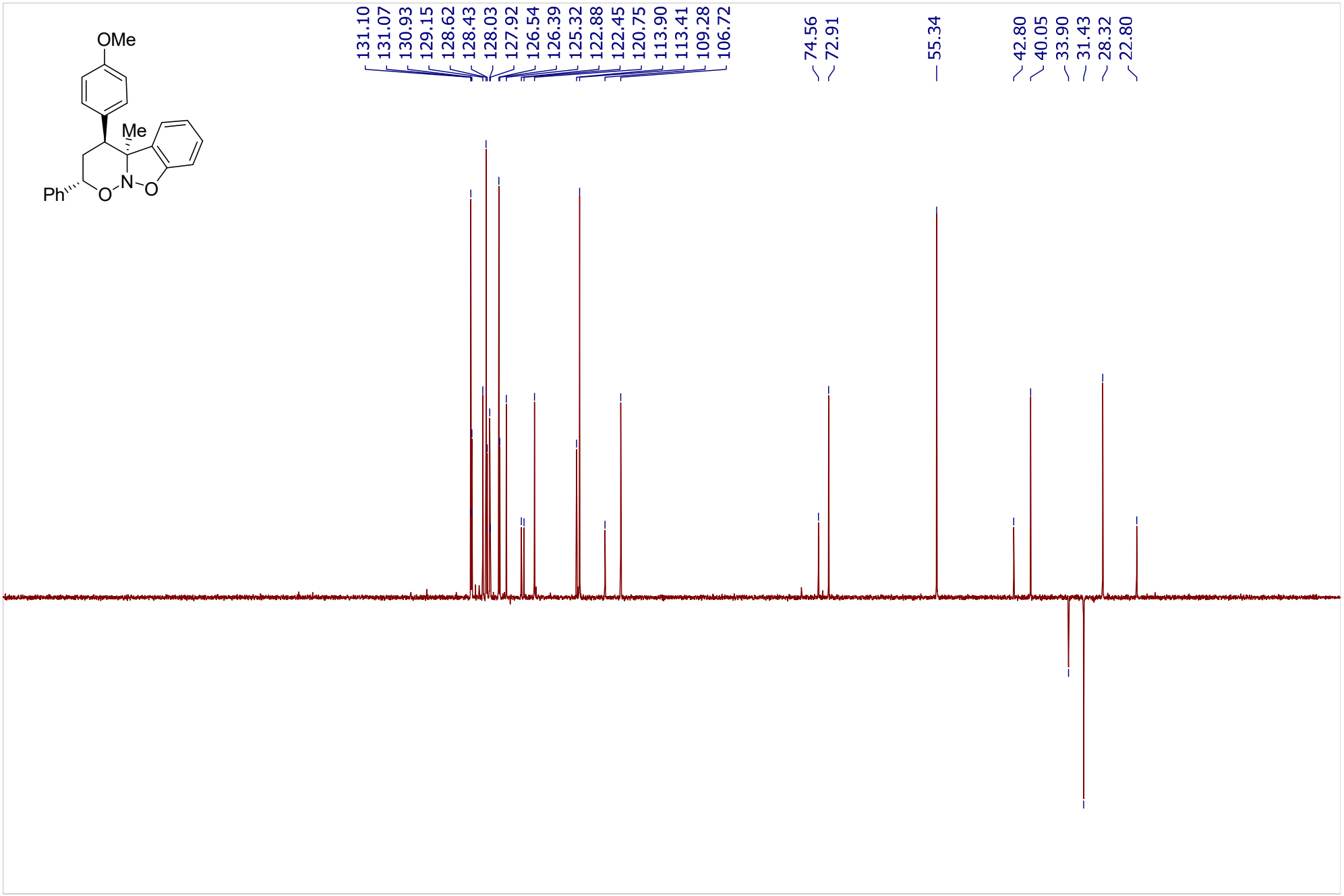
^{1}H NMR (300 MHz, $CDCl_3$)



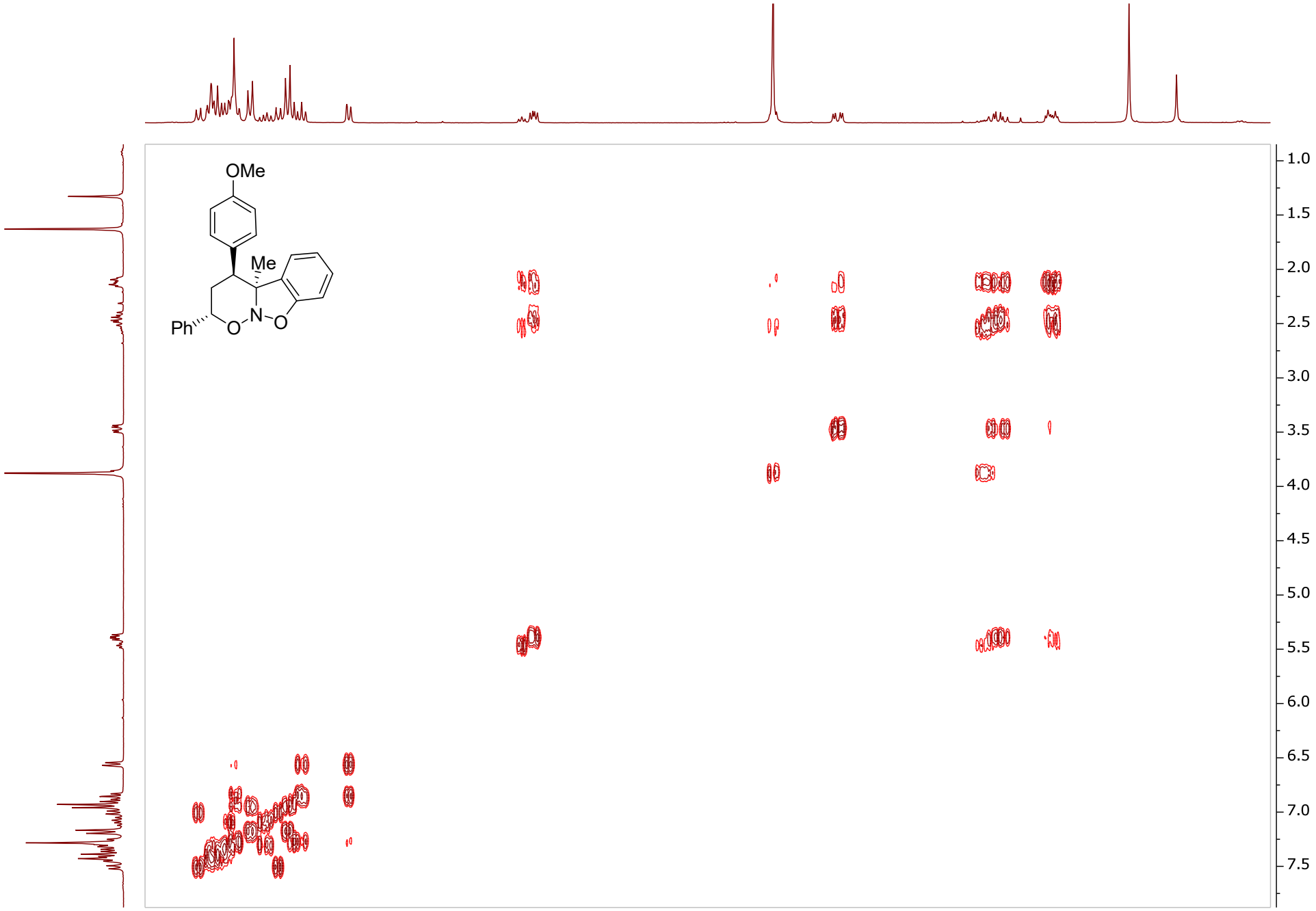
^{13}C NMR (75 MHz, $CDCl_3$)



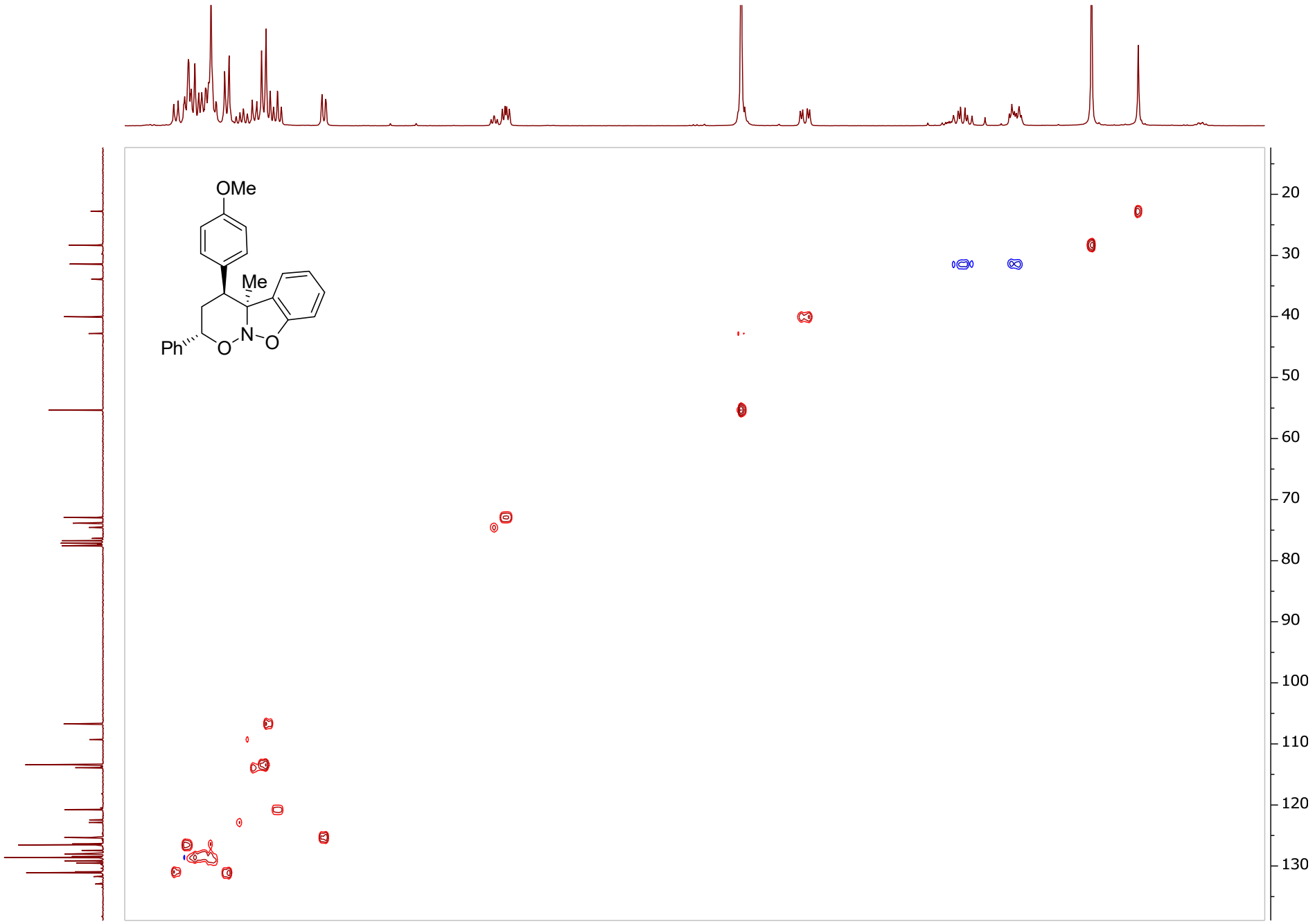
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY



^{1}H-^{13}C HSQC


OMe
Me
Ph
O
N
O
20
30
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50
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70
80
90
100
110
120
130
7.5
7.0
6.5
6.0
5.5
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3.0
2.5
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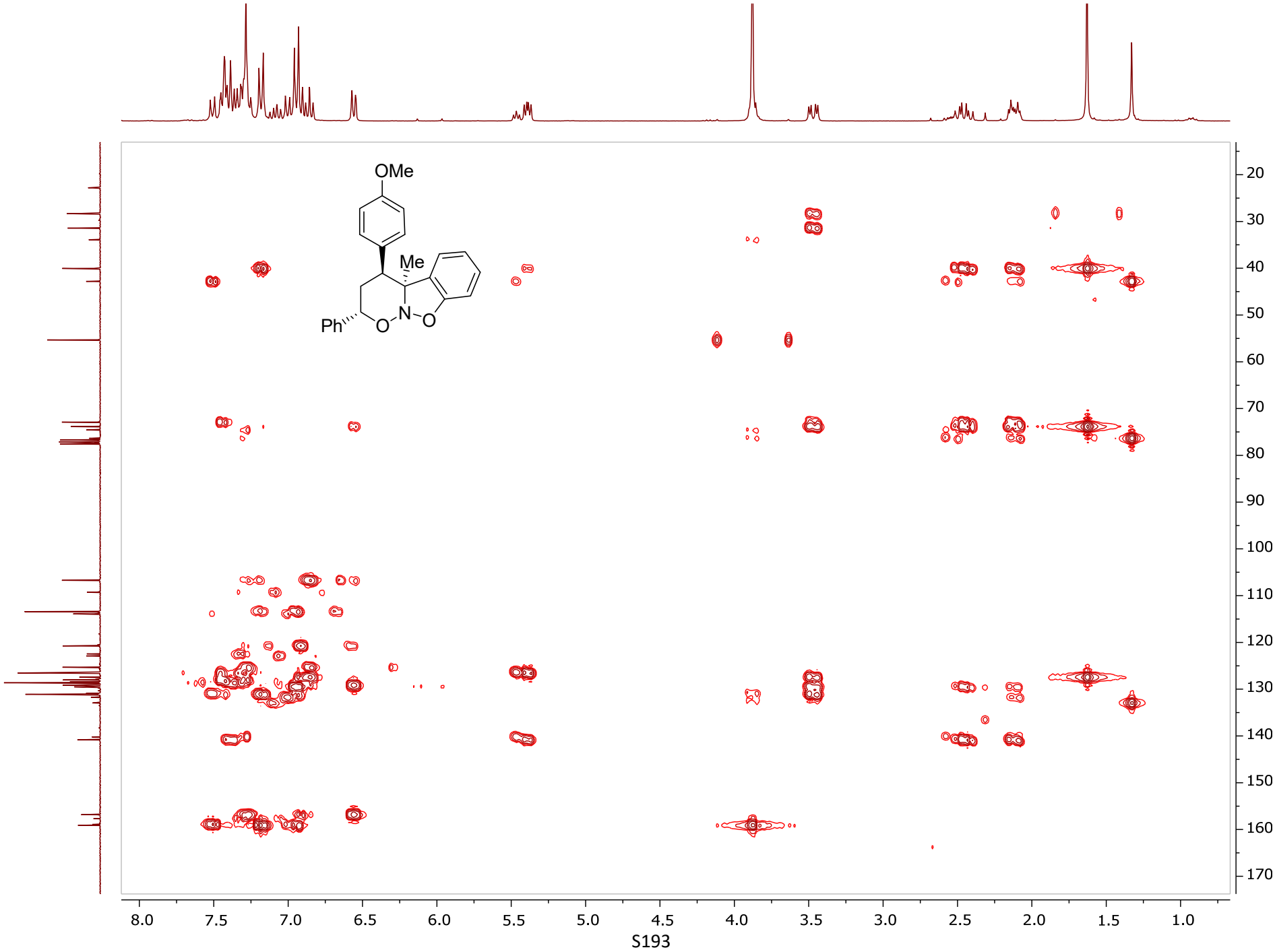
1.5
1.0

^{1}H-^{13}C HMBC


OMe
Me
Ph
O
N
O
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40
50
60
70
80
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100
110
120
130
140
150
160
170
8.0
7.5
7.0
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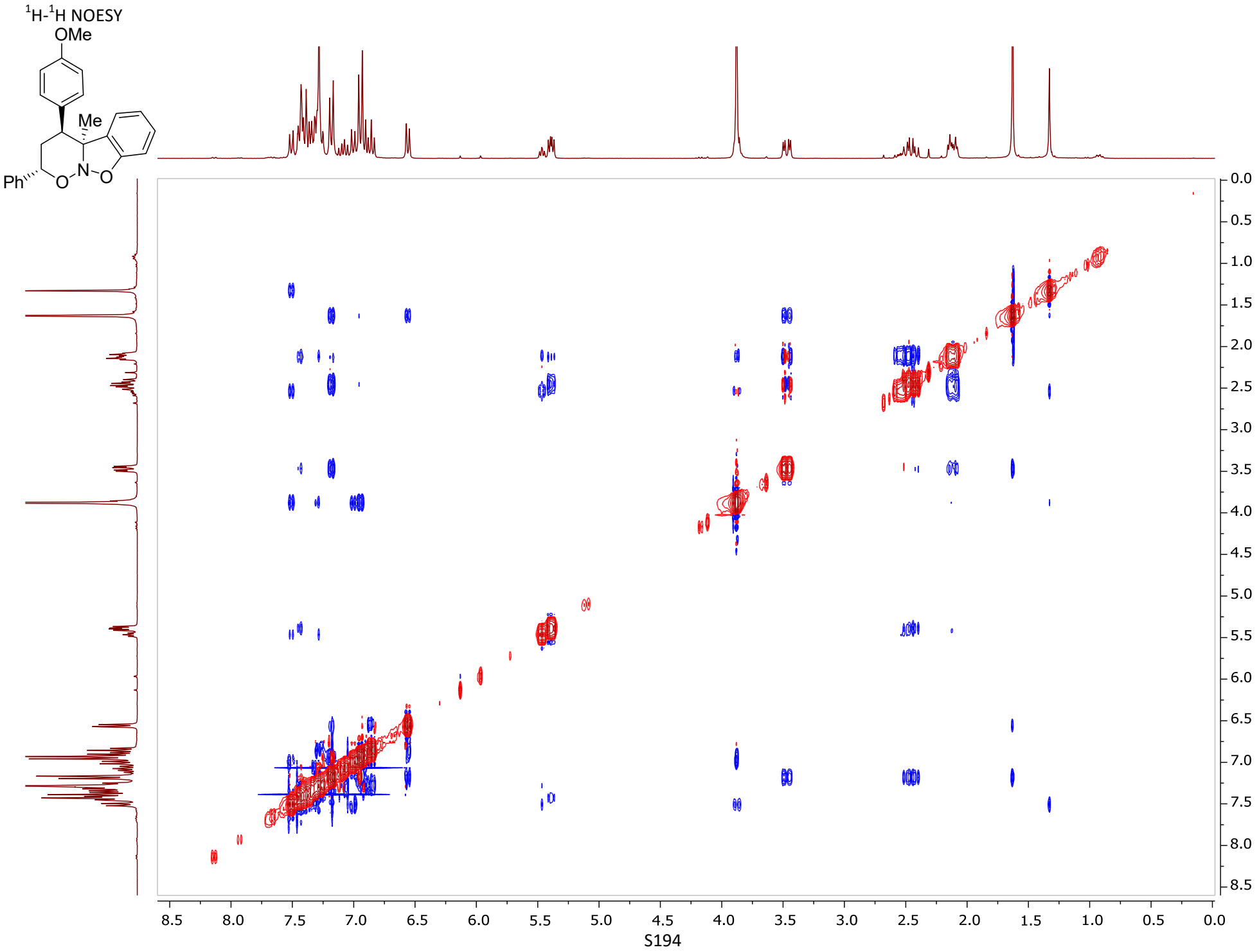
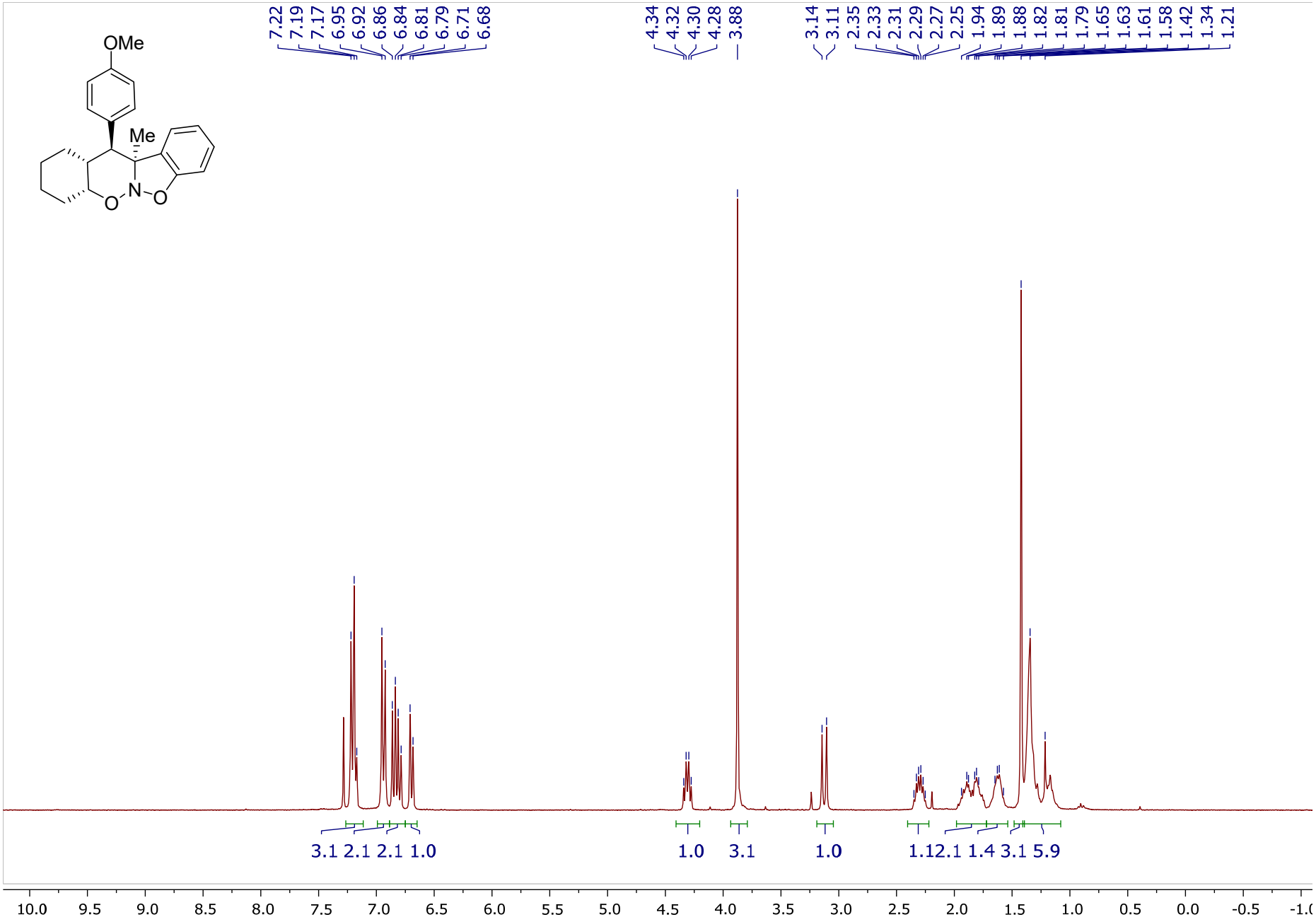
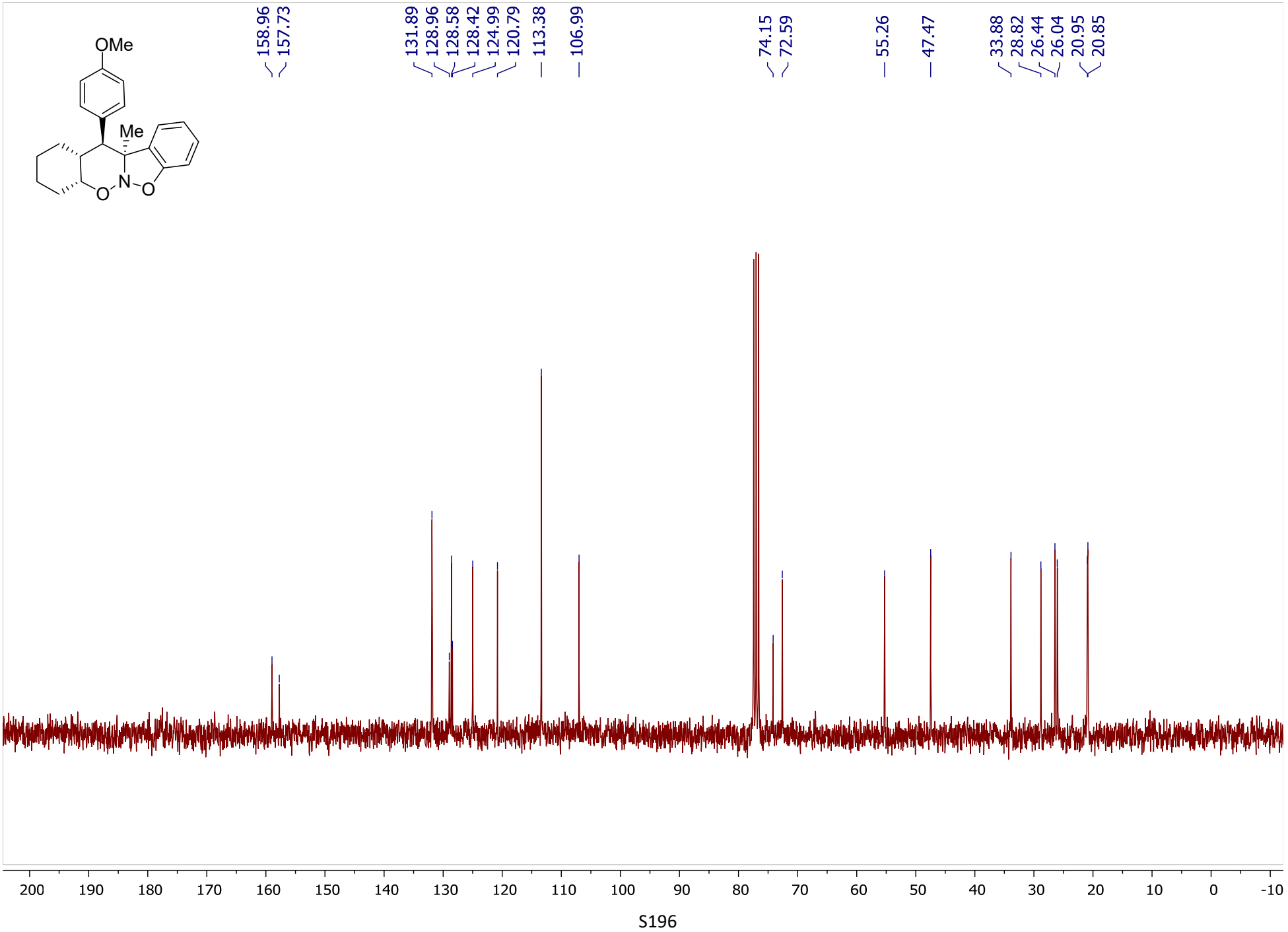

^{1}H-^{1}H NOESY
OMe
Me
Ph
O
N
O
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

(4a*R,11b*S**,12*S**,12a*R**)-12-(4-Methoxyphenyl)-11b-methyl-1,2,3,4,4a,11b,12,12a-octahydrobenzo[e]benzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5la**

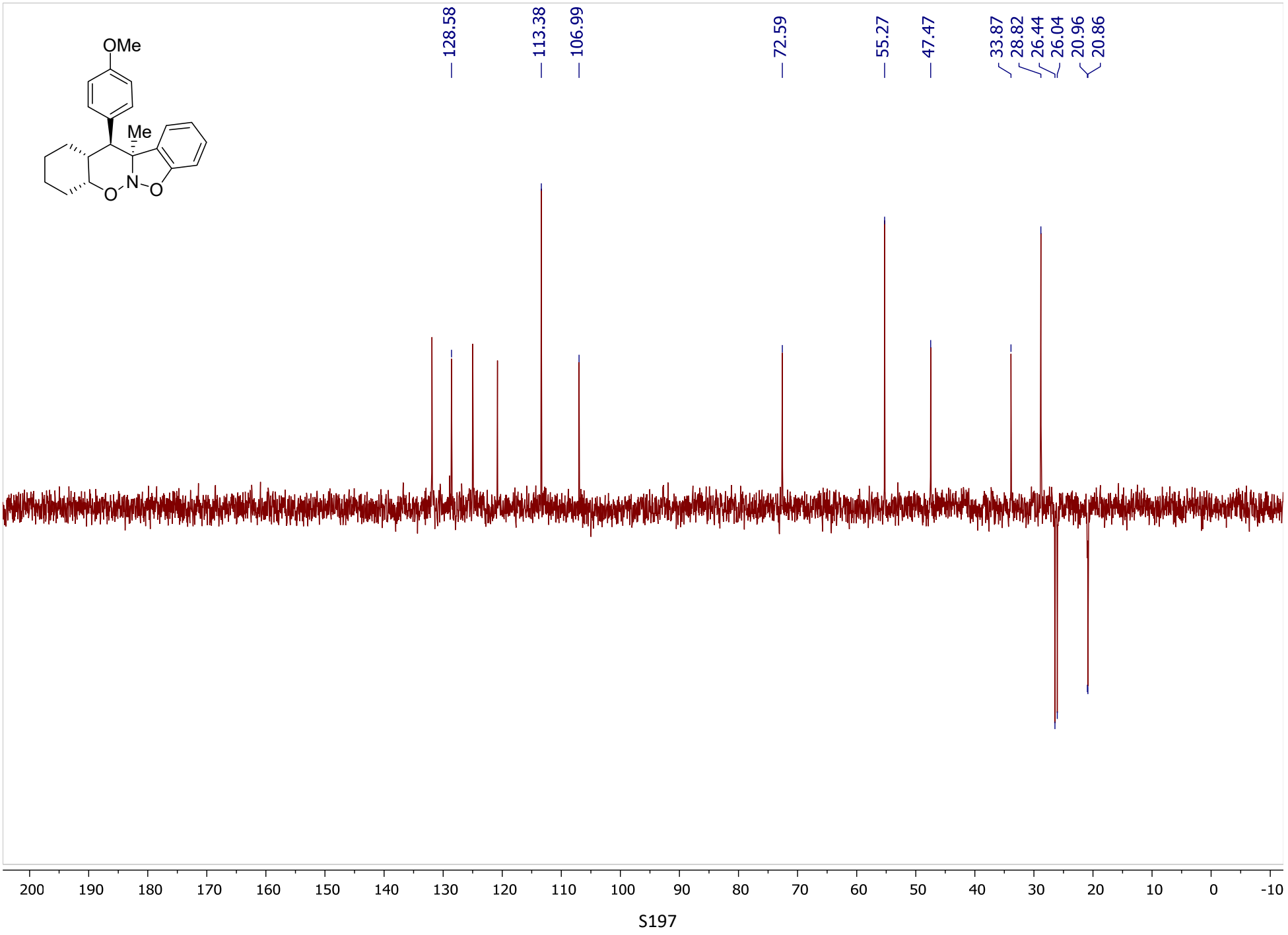
^{1}H NMR (300 MHz, $CDCl_3$)

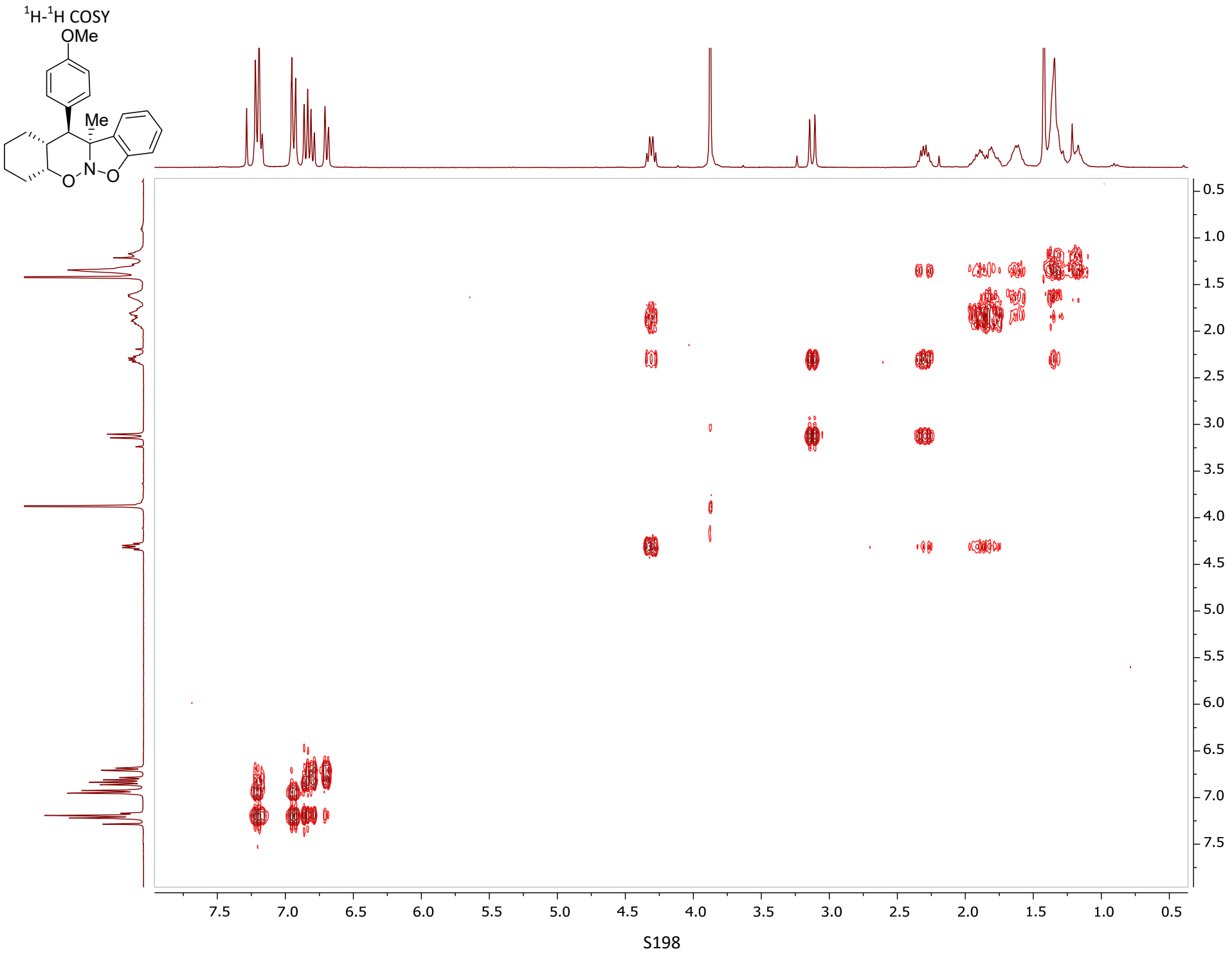


^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)




^{1}H-^{1}H COSY
OMe
Me
O
N
O
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
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6.5
6.0
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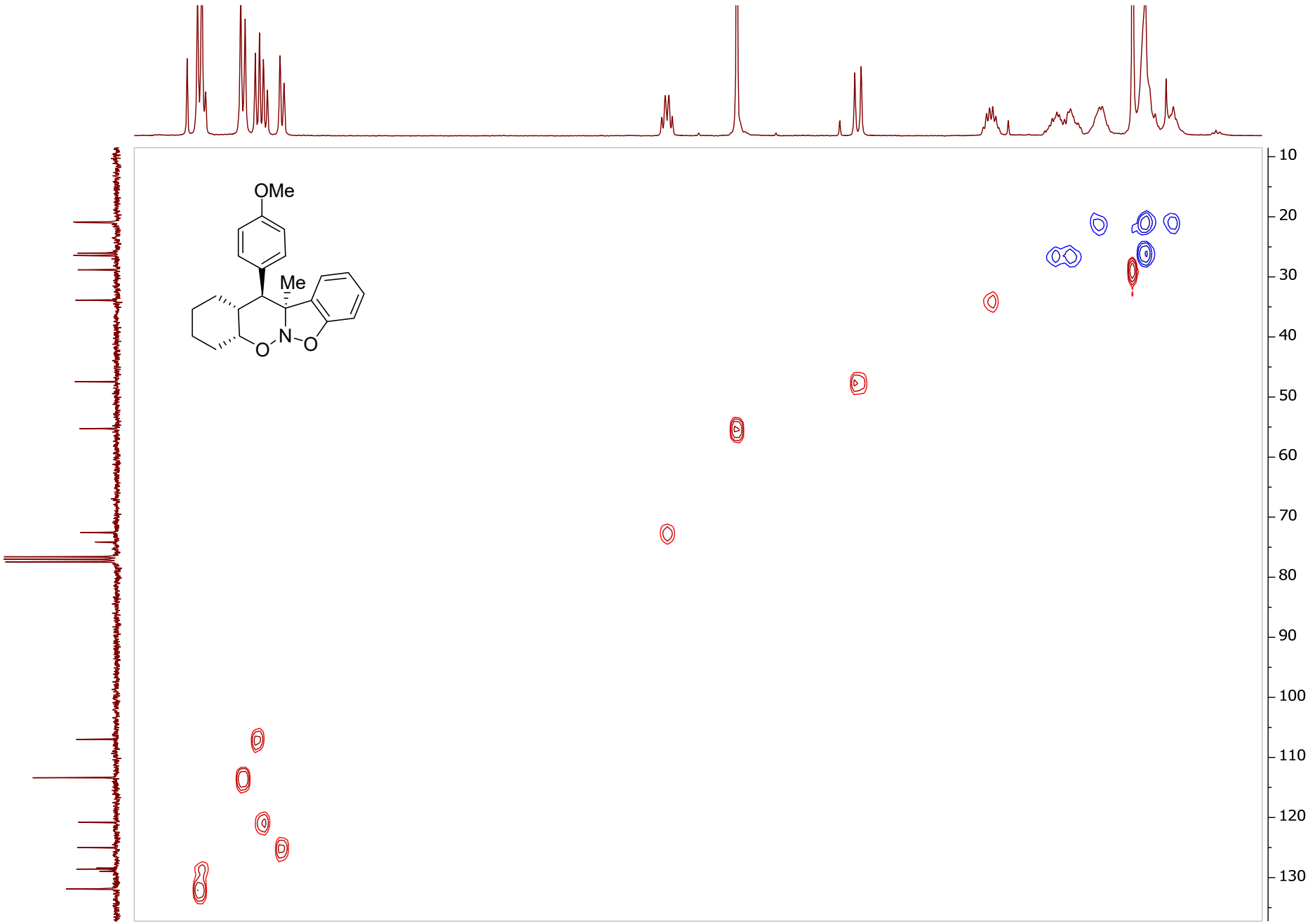
^{1}H-^{13}C HSQC


OMe
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4.5
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3.0
2.5
2.0
1.5
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40
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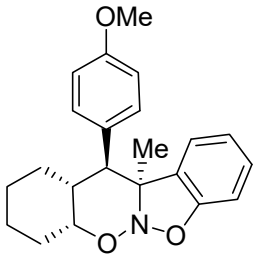
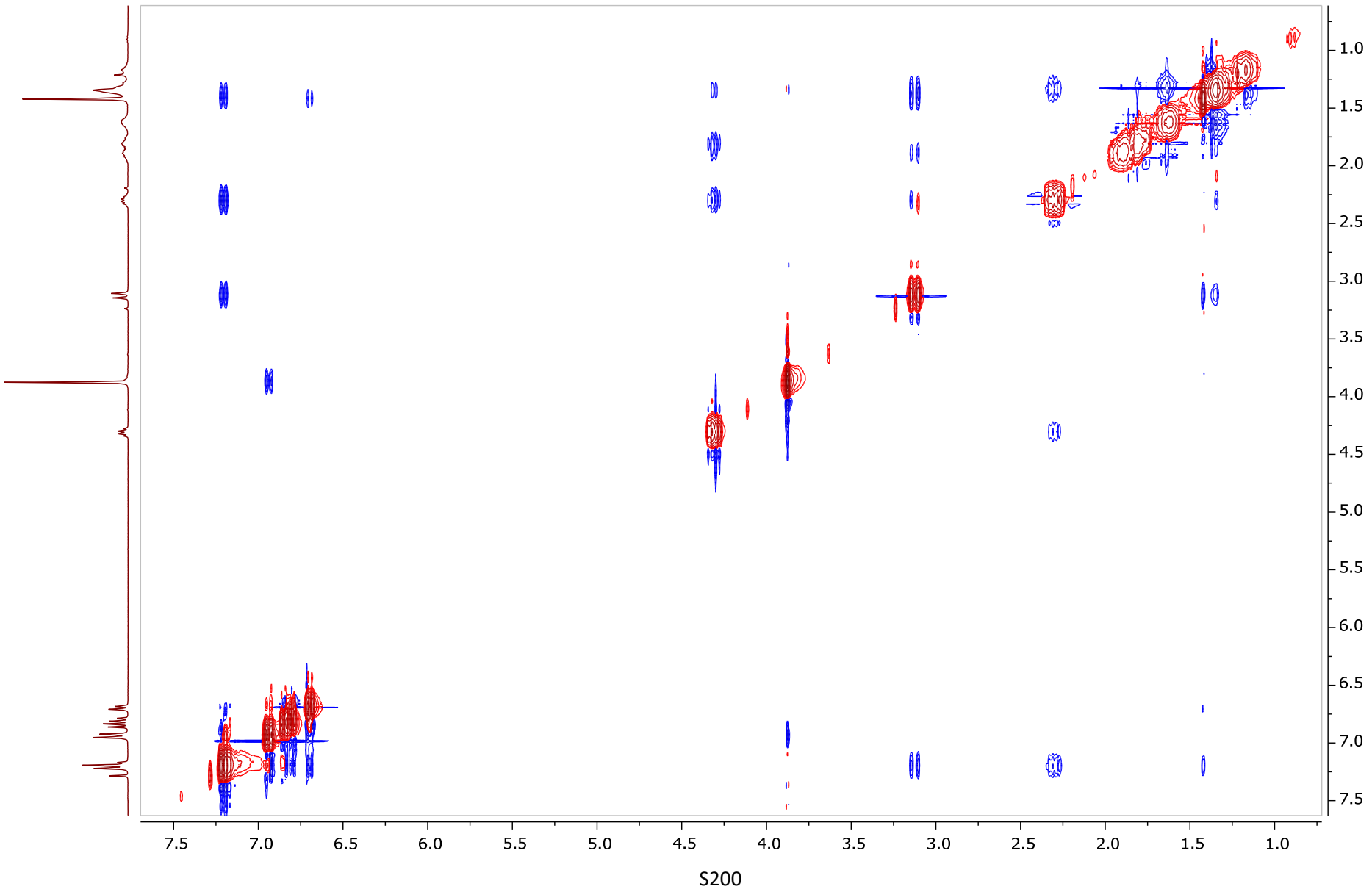
60
70
80
90
100
110
120
130

^{1}H-^{1}H NOESY


OMe
Me
N
O
O


1.0
1.5
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2.5
3.0
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4.0
4.5
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6.0
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6.5
6.0
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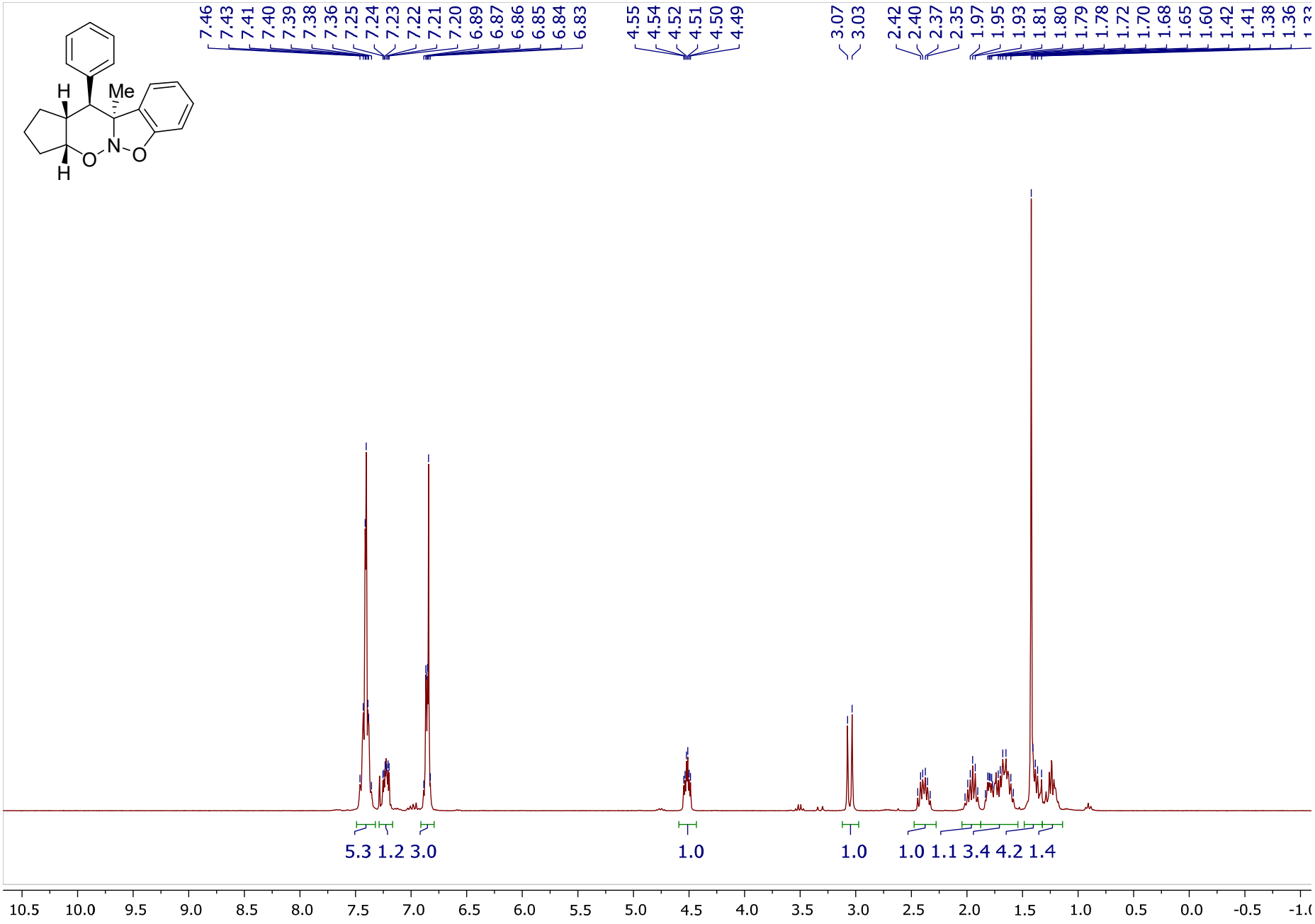
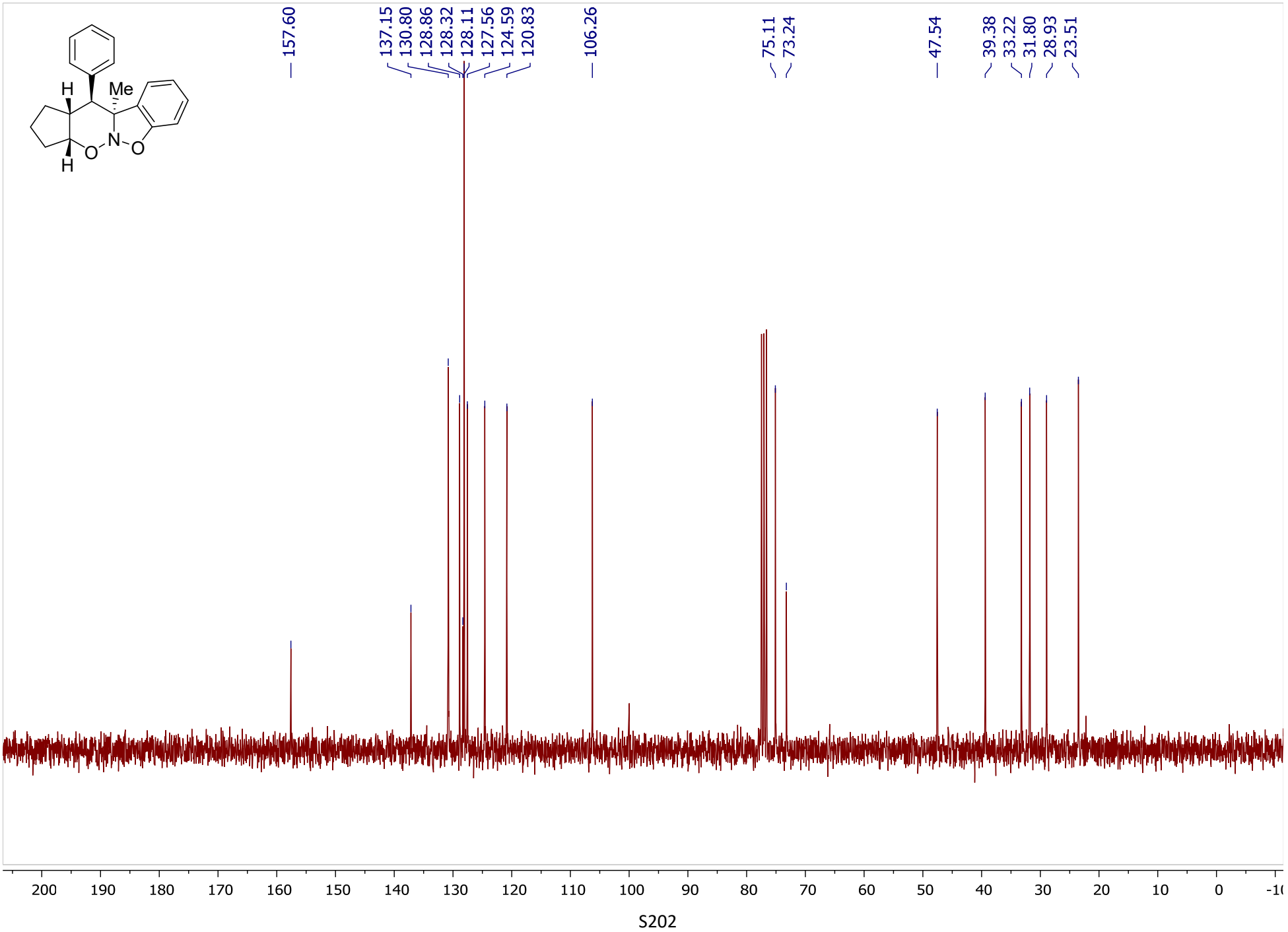
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

(3a*R,10b*S**,11*S**,11a*R**)-10b-Methyl-11-phenyl-2,3,3a,10b,11,11a-hexahydro-1H-benzo[4,5]isoxazolo[2,3-b]cyclopenta[e][1,2]oxazine 5ma**

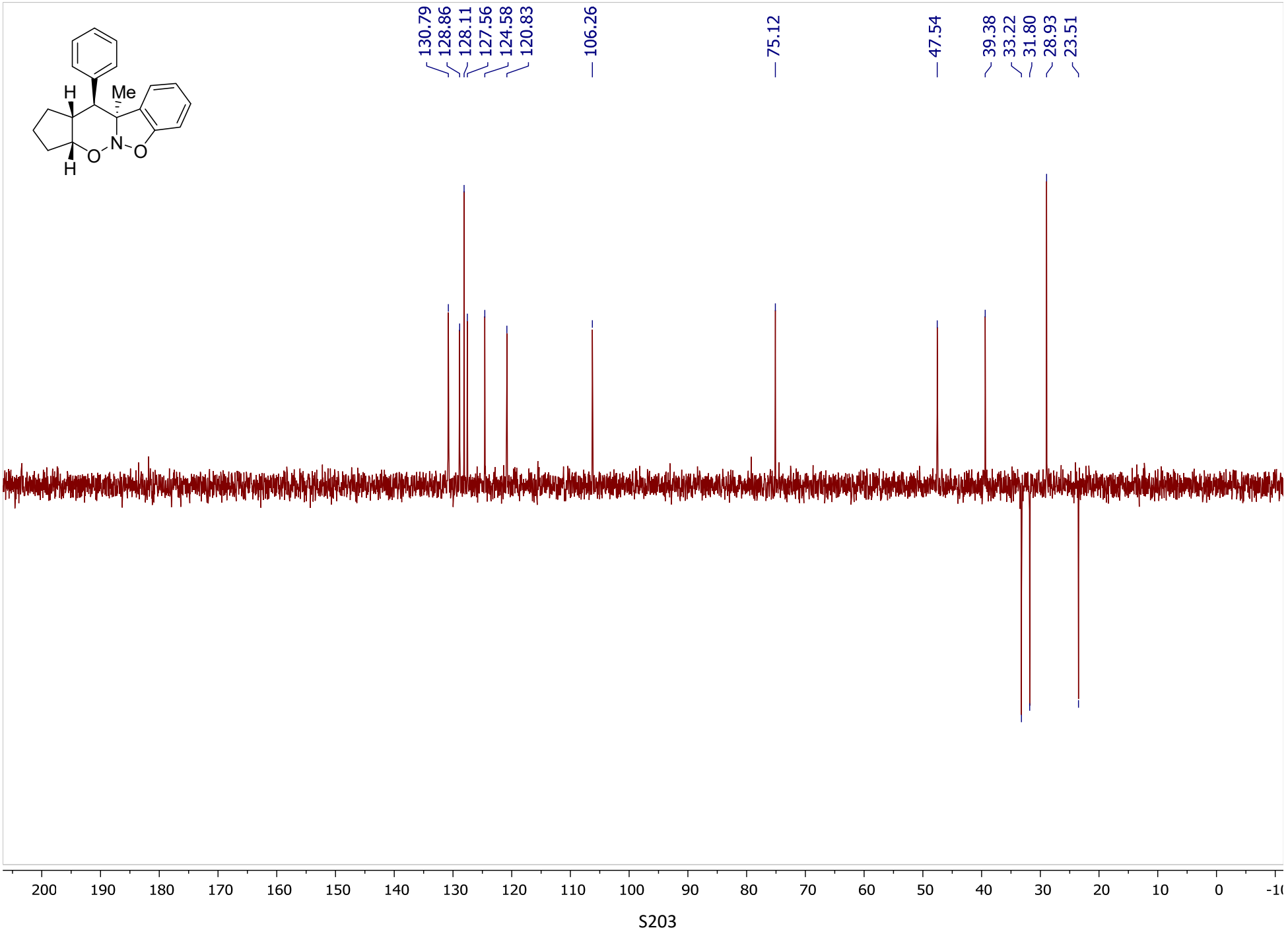
^{1}H NMR (300 MHz, $CDCl_3$), major/minor = 24:1



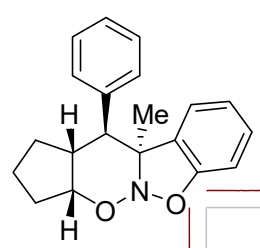
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


H
Me
N
O
O
H

0.5
1.0
1.5
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4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.0
7.5
7.0
6.5
6.0
5.5
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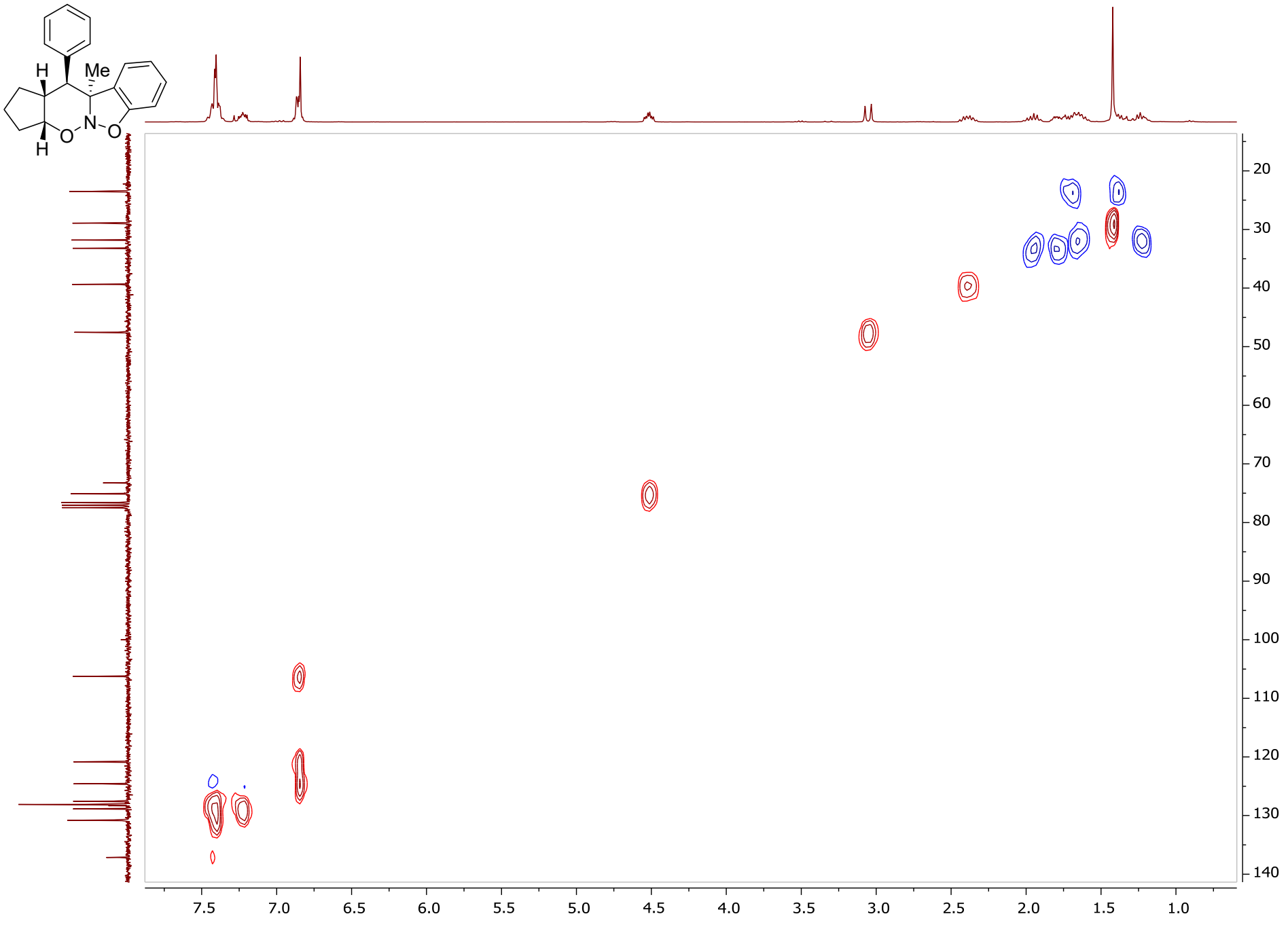
1.5
1.0
0.5

^{1}H-^{13}C HSQC


H
Me
N
O
O
H
20
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80
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120
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6.5
6.0
5.5
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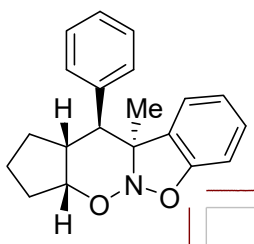
1.5
1.0

^{1}H-^{1}H NOESY


H
Me
N
O
O
H

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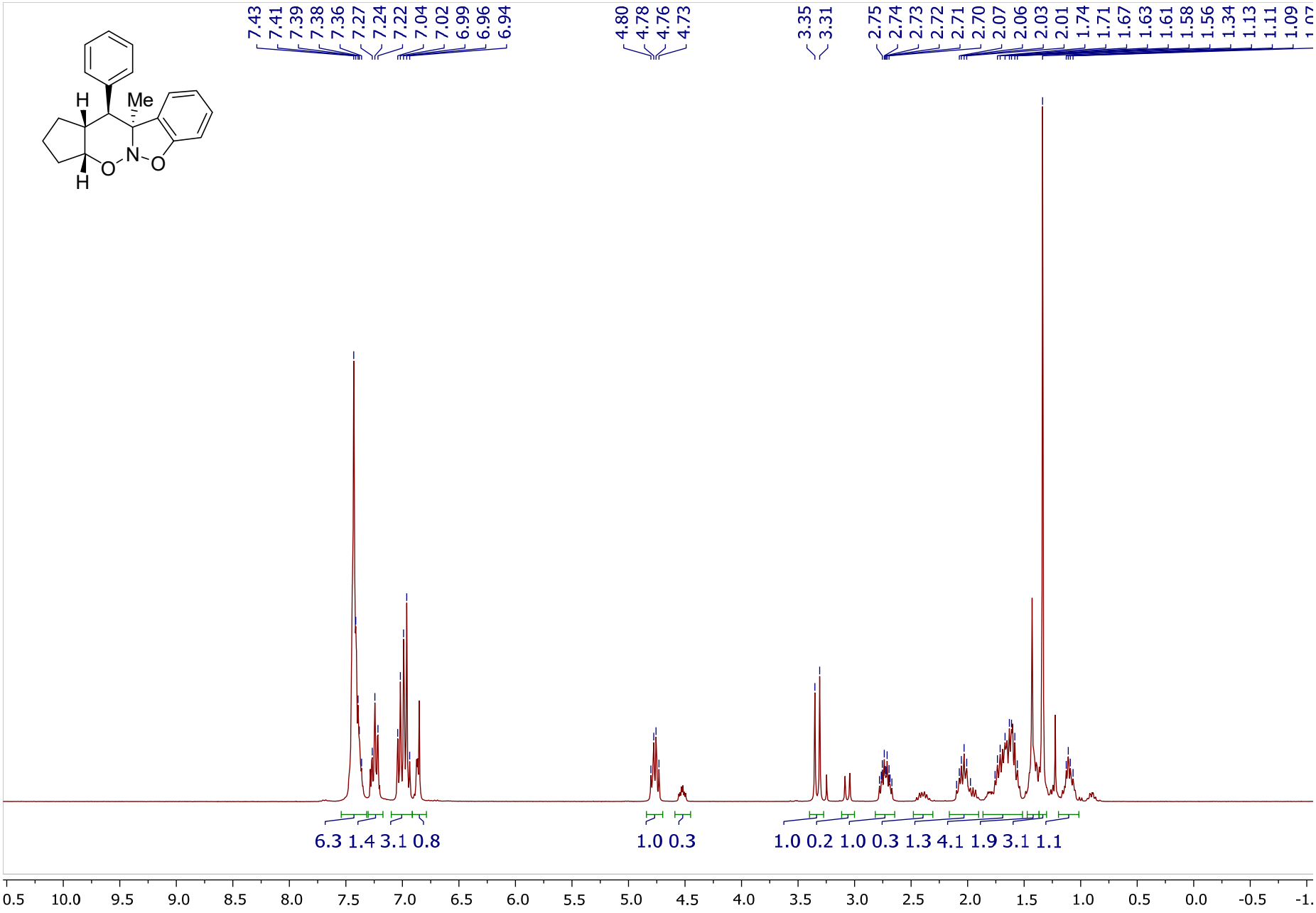
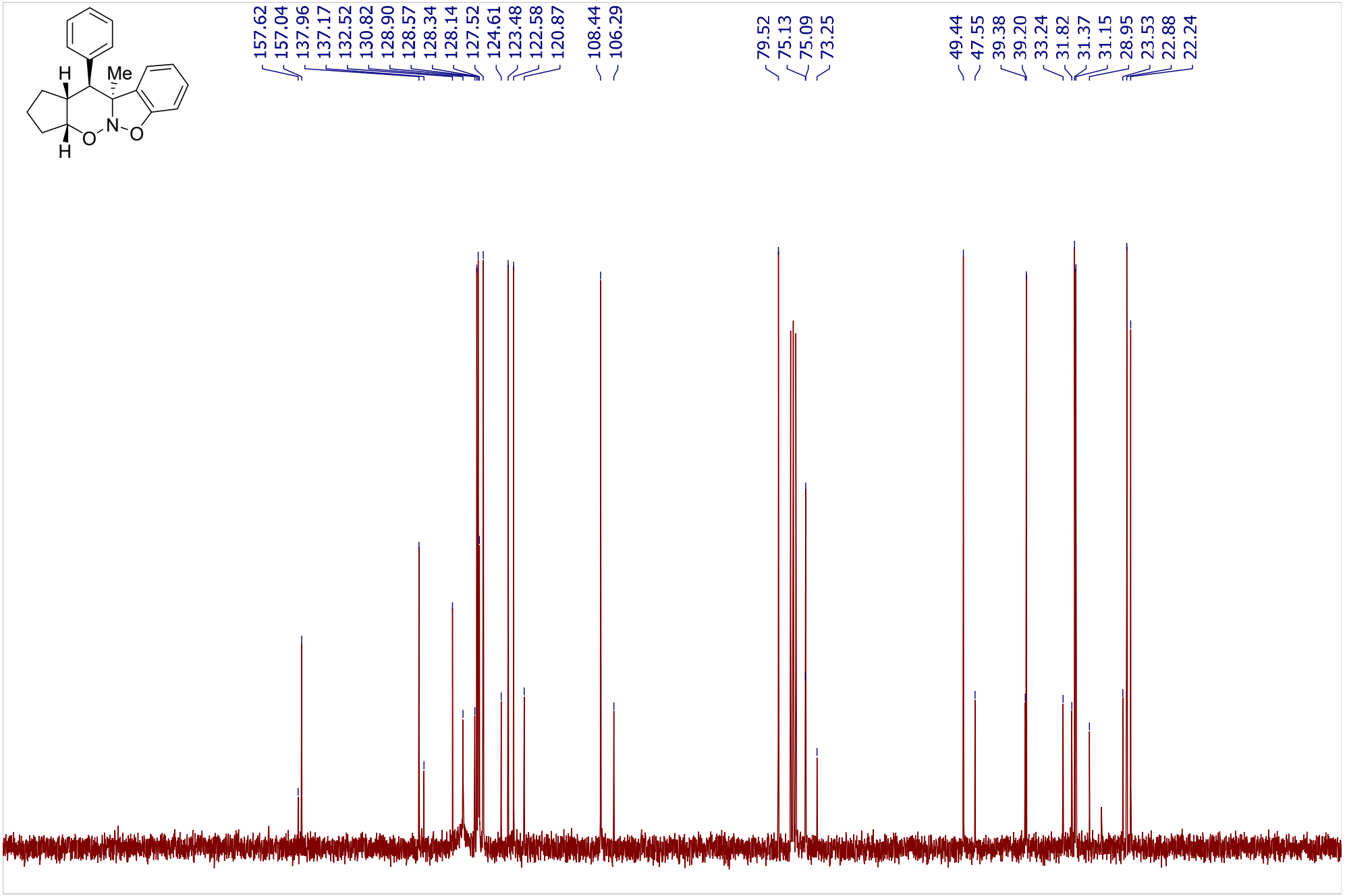
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0

(3a*R,10b*S**,11*S**,11a*R**)-10b-Methyl-11-phenyl-2,3,3a,10b,11,11a-hexahydro-1H-benzo[4,5]isoxazolo[2,3-b]cyclopenta[e][1,2]oxazine 5ma**

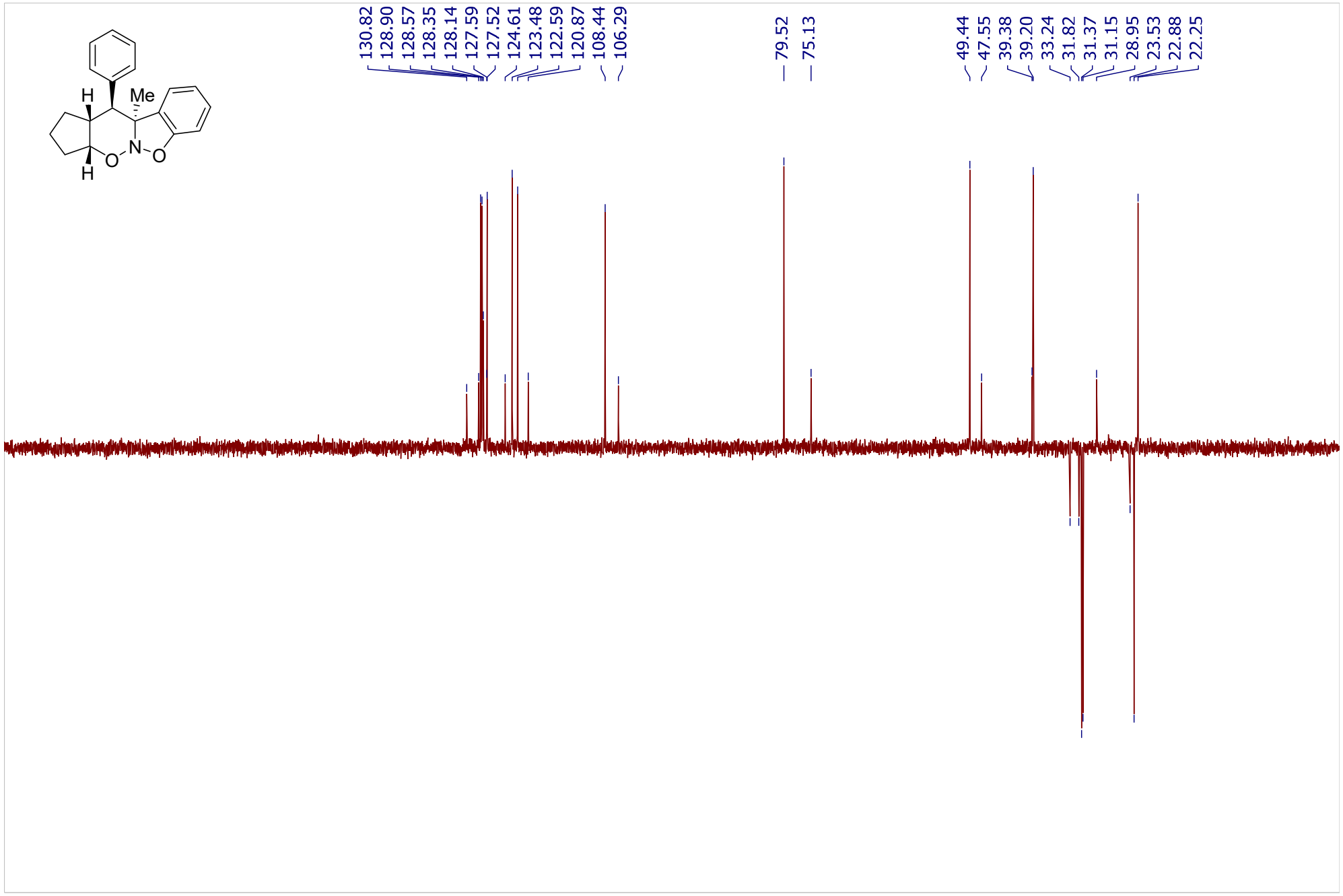
^{1}H NMR (300 MHz, $CDCl_3$), major/minor = 1:4



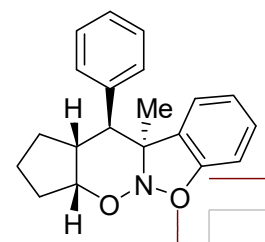
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


H
Me
N
O
O
H

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
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8.0
8.0
7.5
7.0
6.5
6.0
5.5
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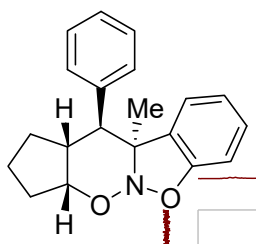
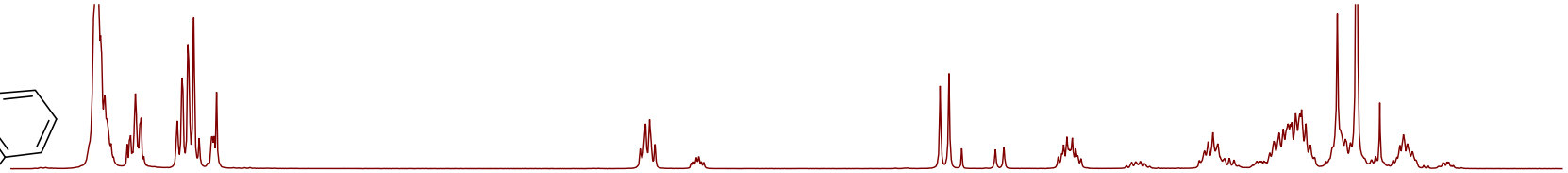
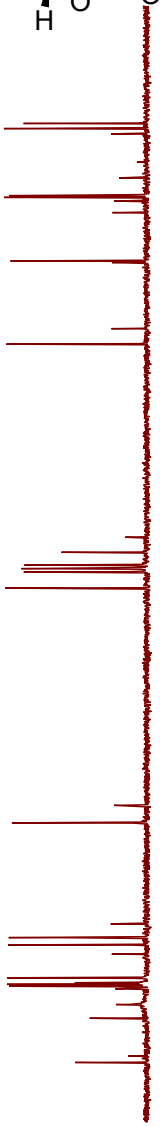
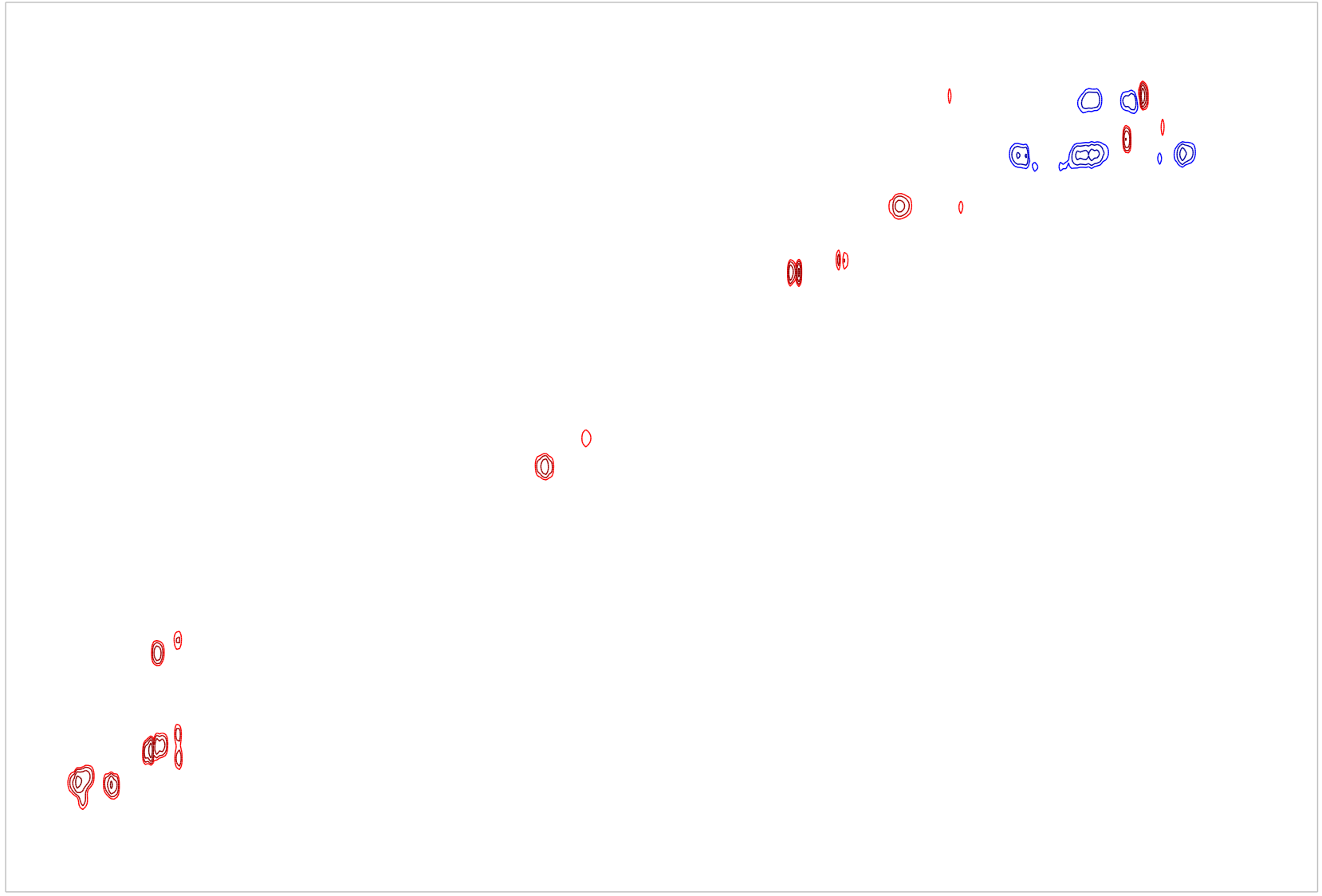
0.5

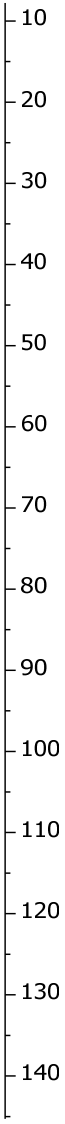
^{1}H-^{13}C HSQC

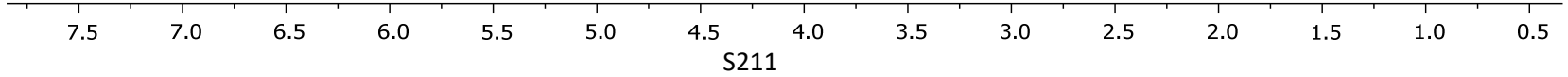






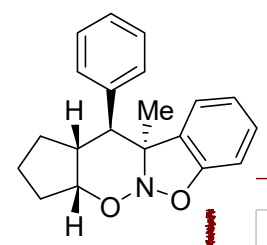


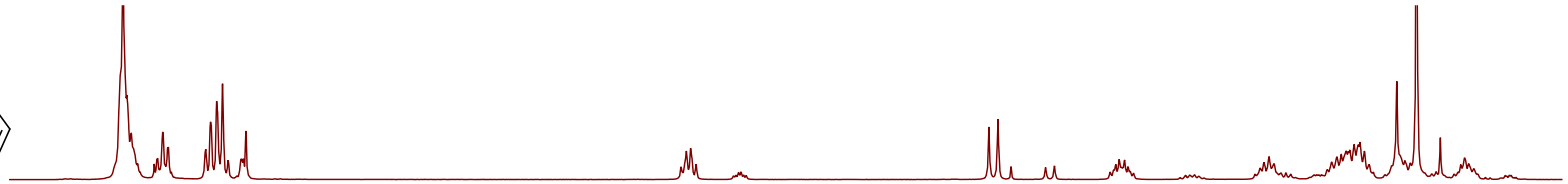


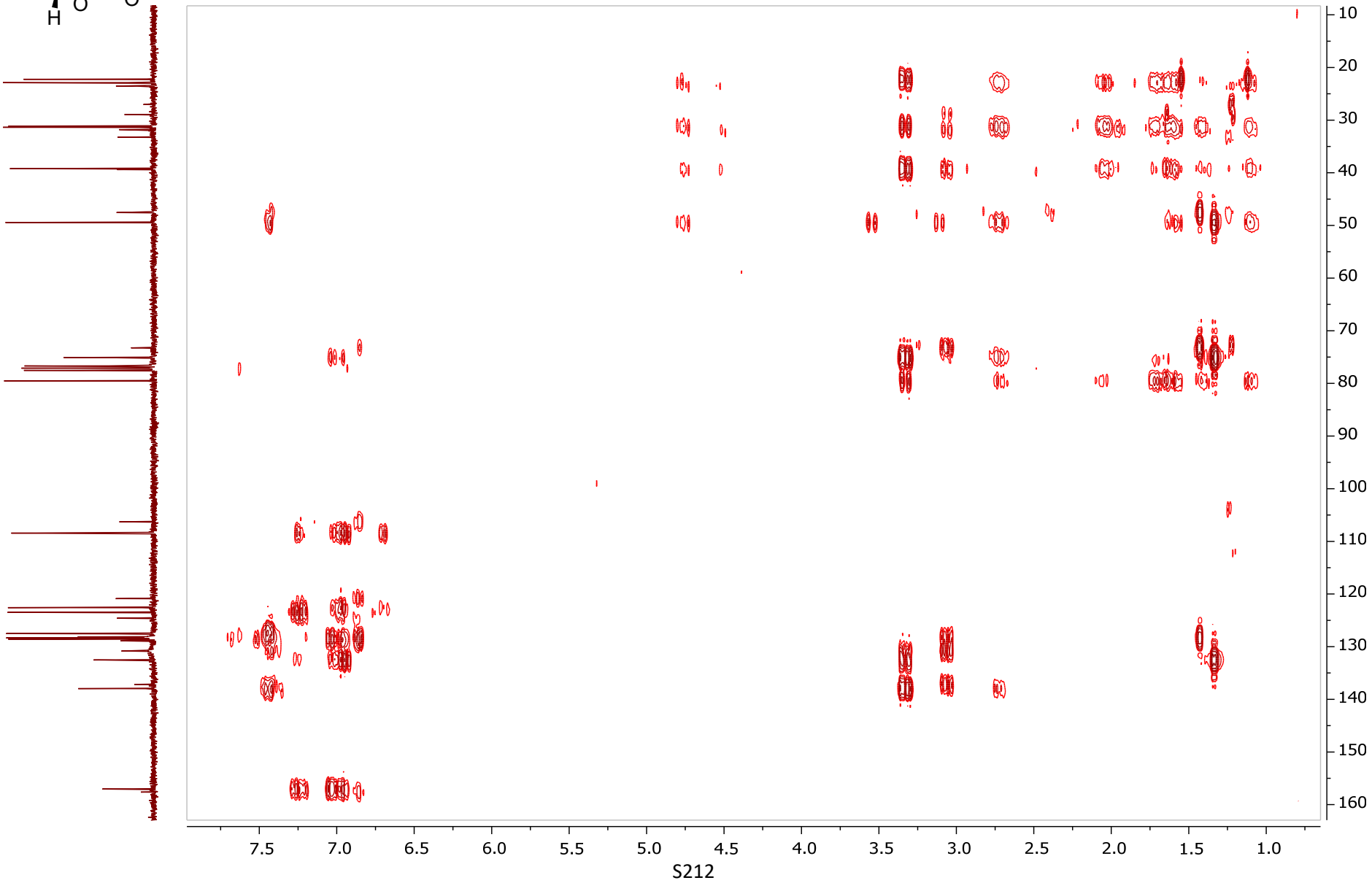


S211

^{1}H-^{13}C HMBC


H
Me
N
O
O
H

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130
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6.0
5.5
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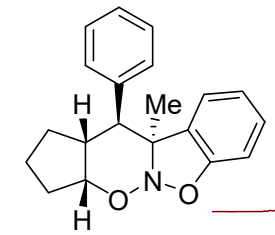
1.5
1.0

^{1}H-^{1}H NOESY


H
Me
N
O
O
H

0.5
1.0
1.5
2.0
2.5
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4.5
5.0
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6.5
7.0
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8.0
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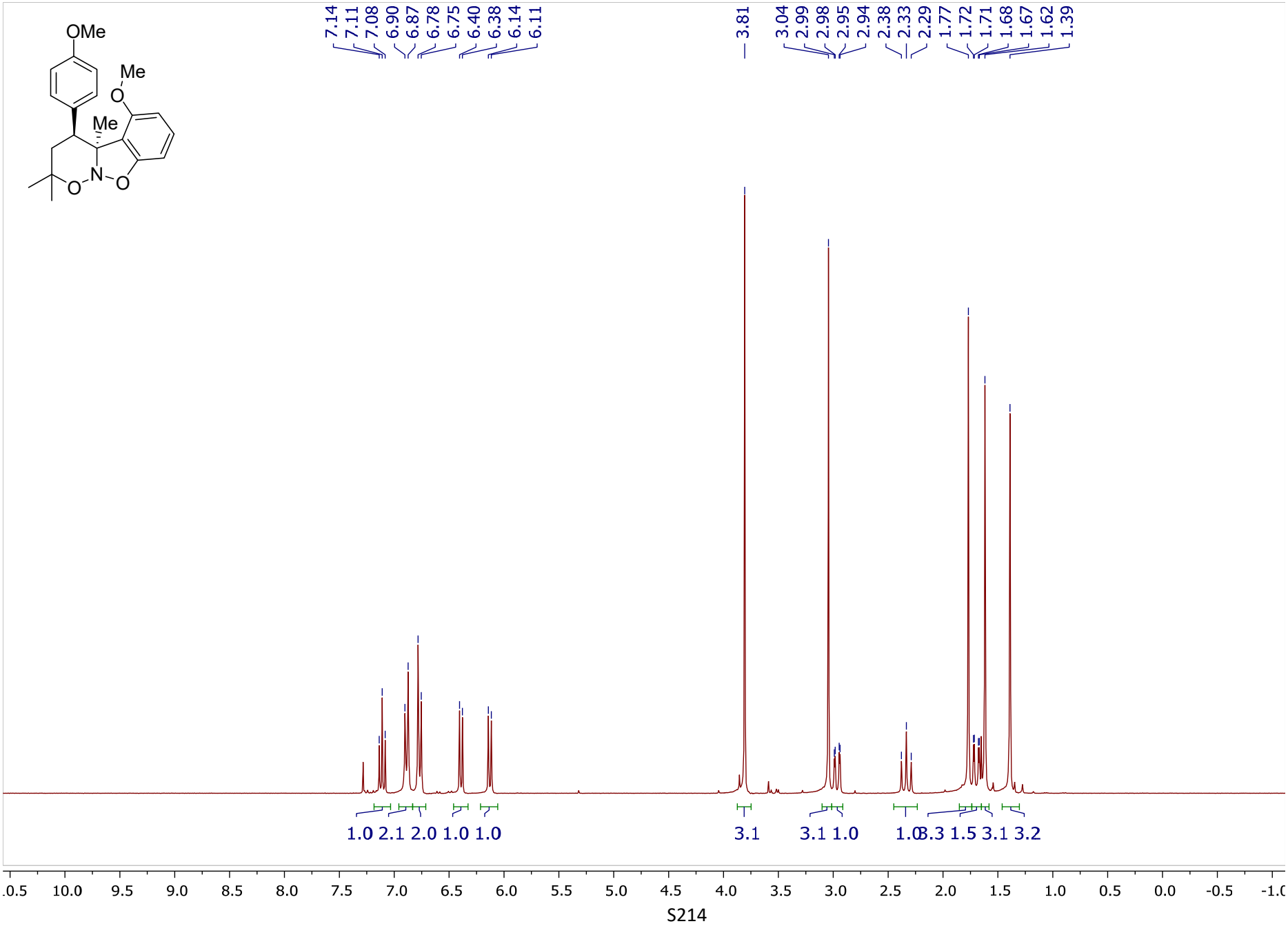
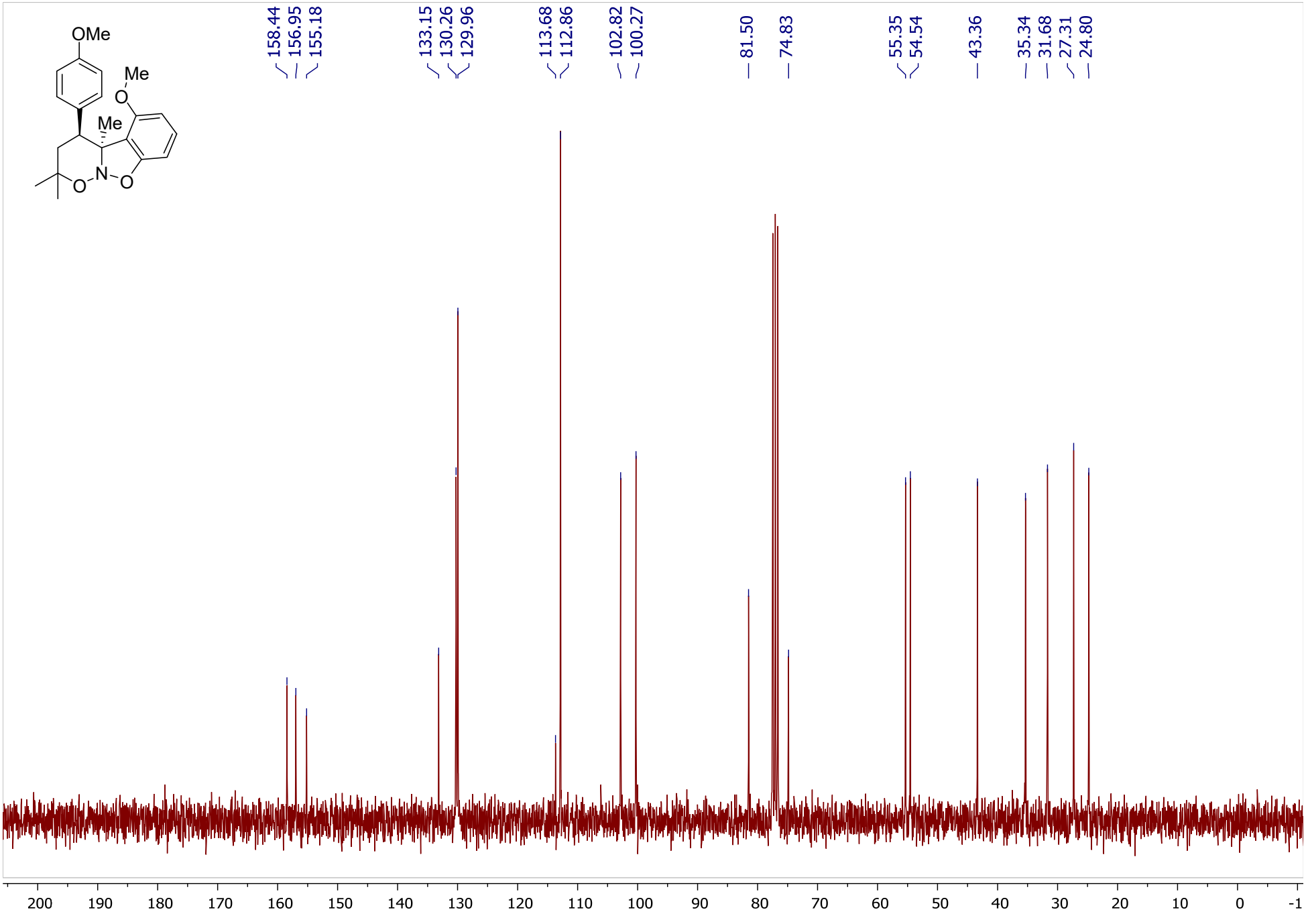
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

(4*S,4a*S**)-5-Methoxy-4-(4-methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ab,** major isomer

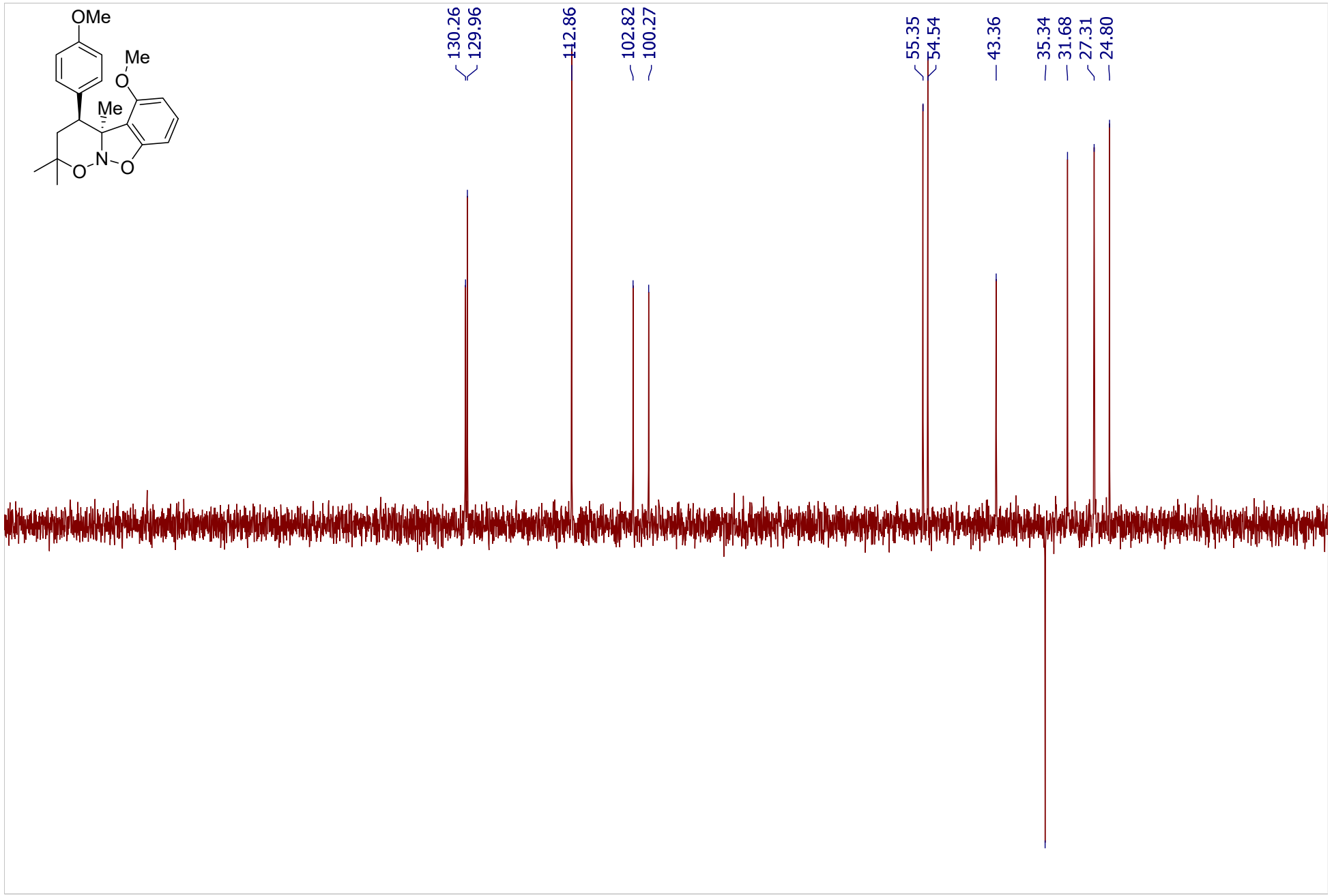
^{1}H NMR (300 MHz, $CDCl_3$)



^{13}C NMR (75 MHz, $CDCl_3$)

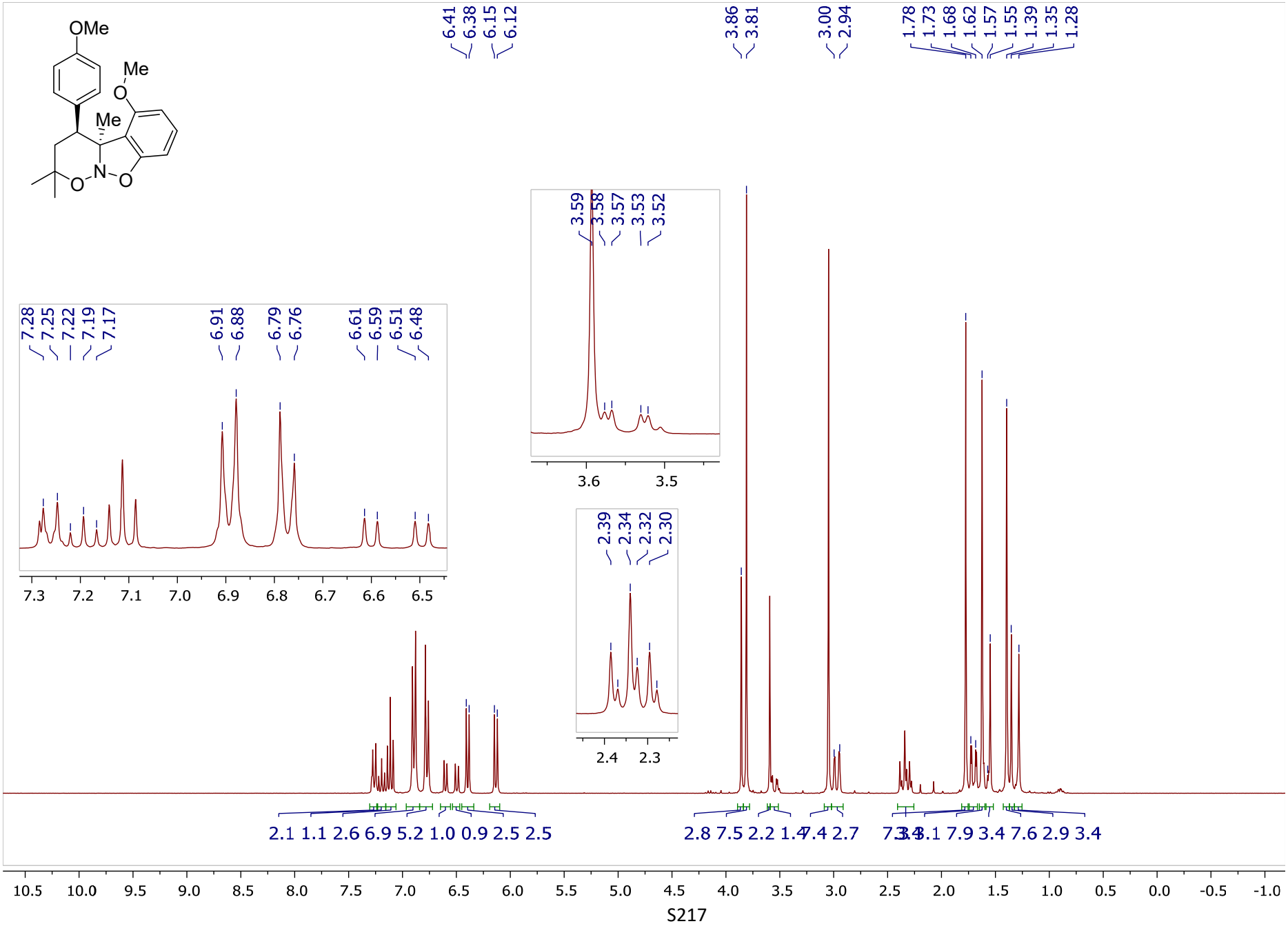


^{13}C DEPT 135 (75 MHz, $CDCl_3$)

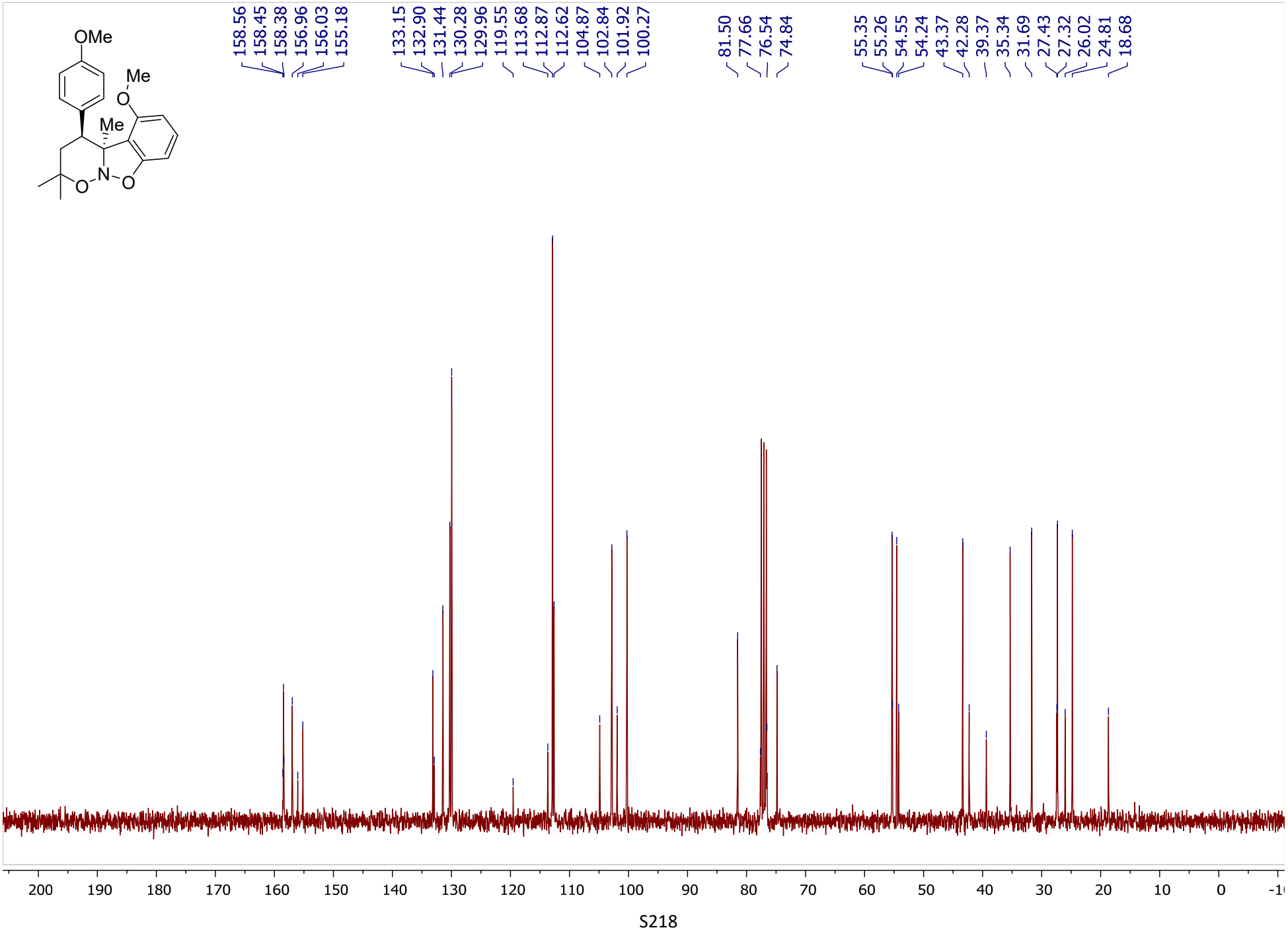


(4*S,4a*S**)-5-Methoxy-4-(4-methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ab,** major / minor = 2.5:1

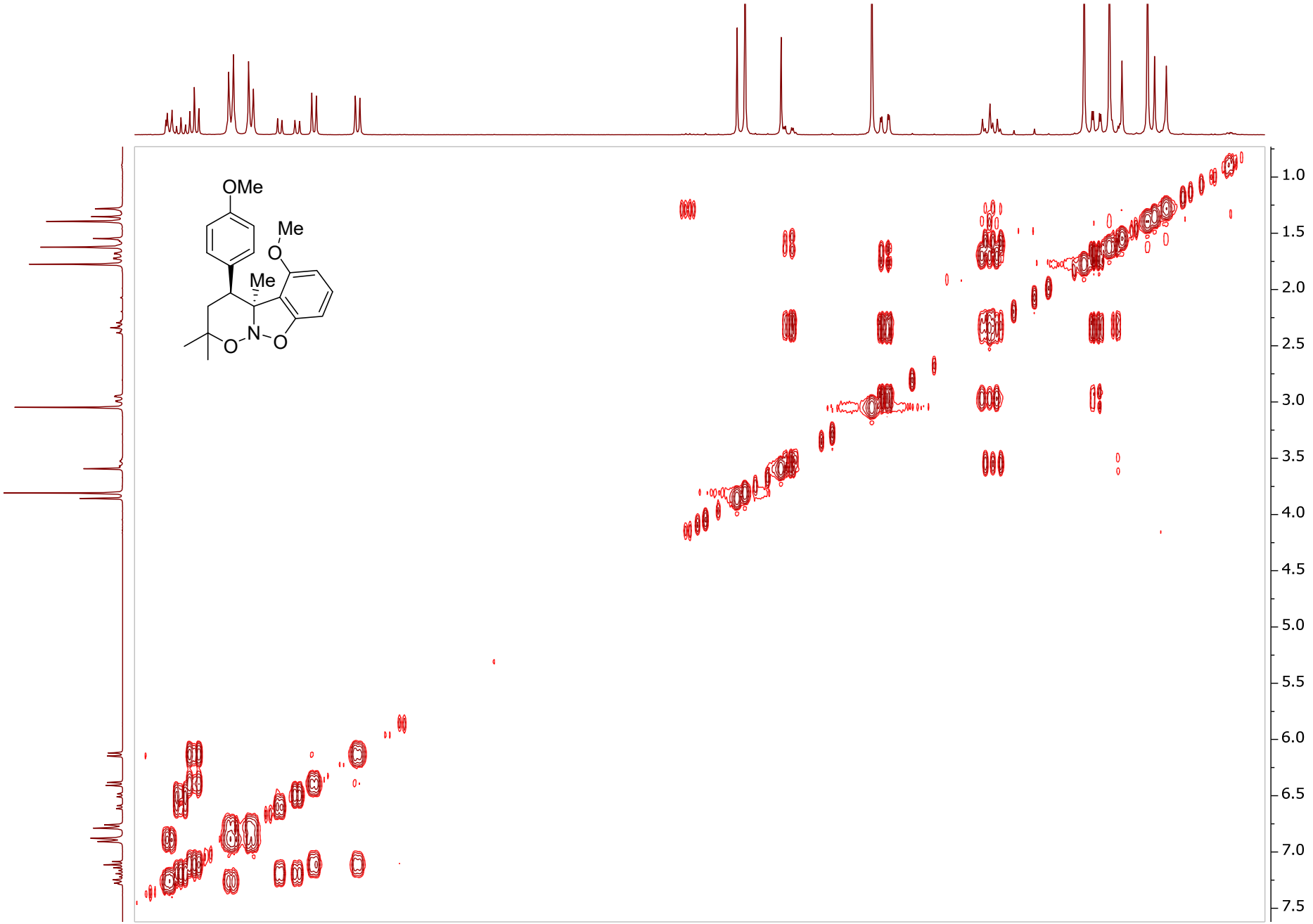
^{1}H NMR (300 MHz, $CDCl_3$)



^{13}C NMR (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


OMe
Me
O
Me
N
O
O
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2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.0
6.5
6.0
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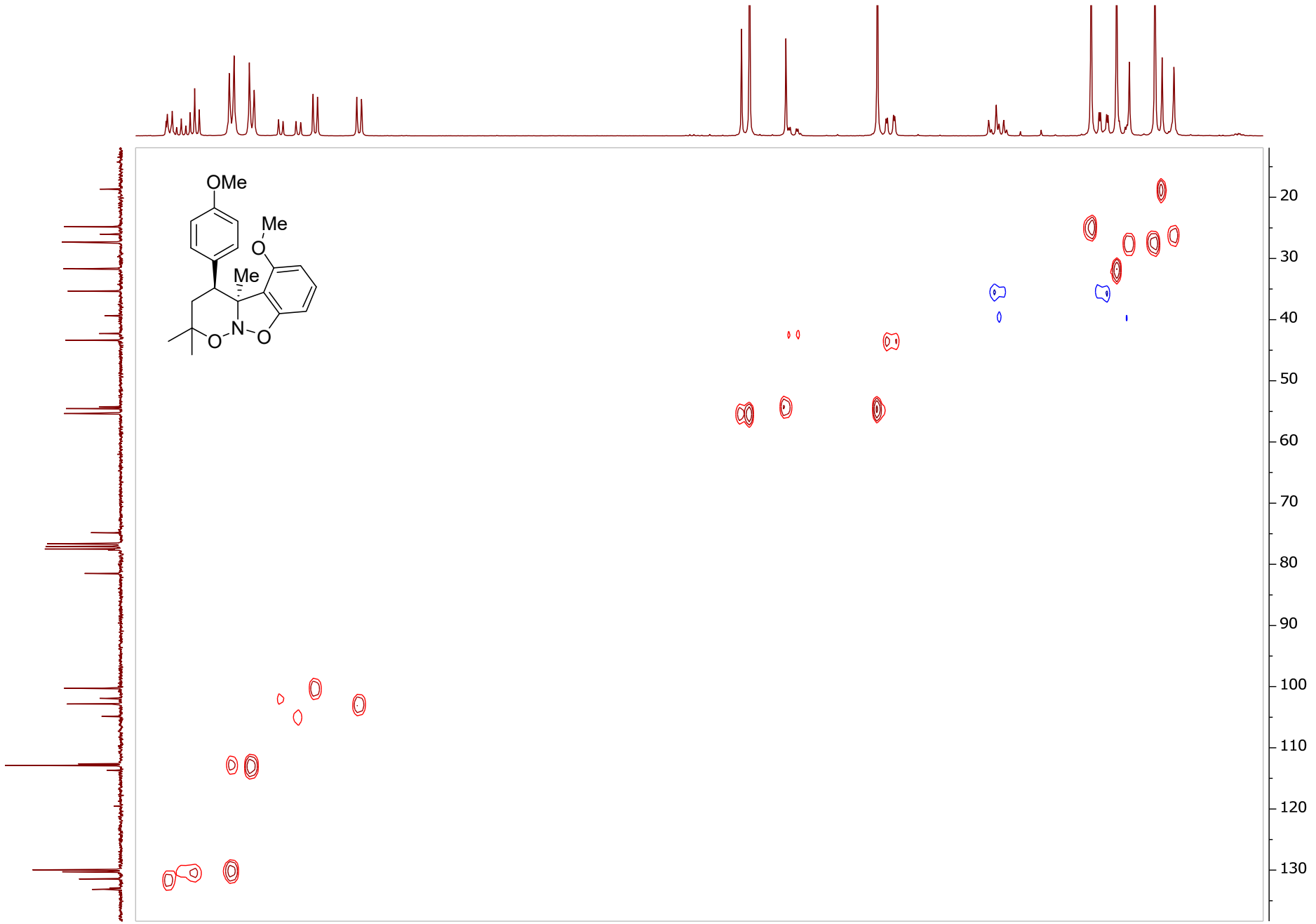
1.5
1.0

^{1}H-^{13}C HSQC


OMe
Me
O
Me
N
O
O
20
30
40
50
60
70
80
90
100
110
120
130
7.0
6.5
6.0
5.5
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4.0
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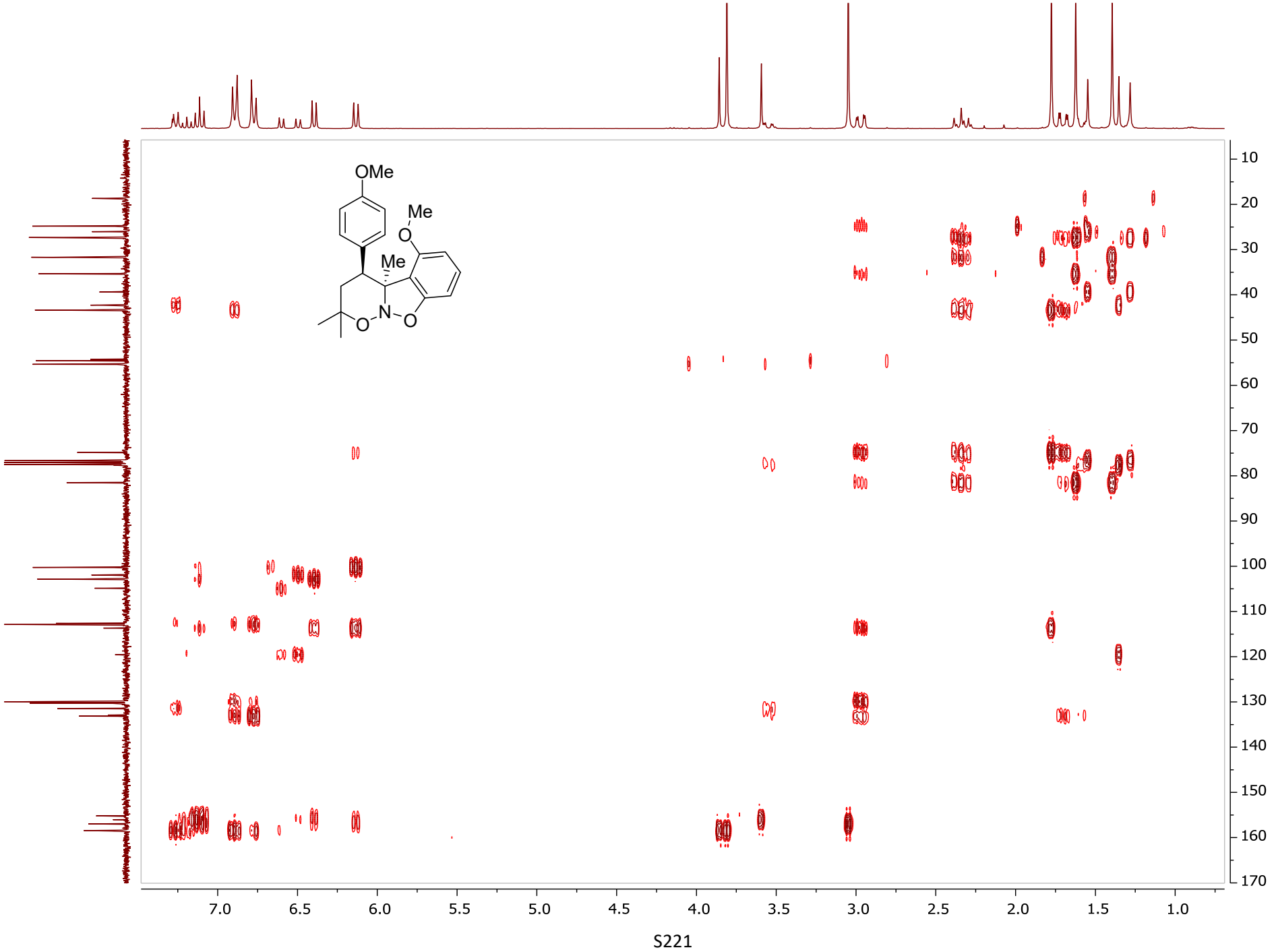
1.5
1.0

^{1}H-^{13}C HMBC


OMe
Me
O
Me
N
O
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
7.0
6.5
6.0
5.5
5.0
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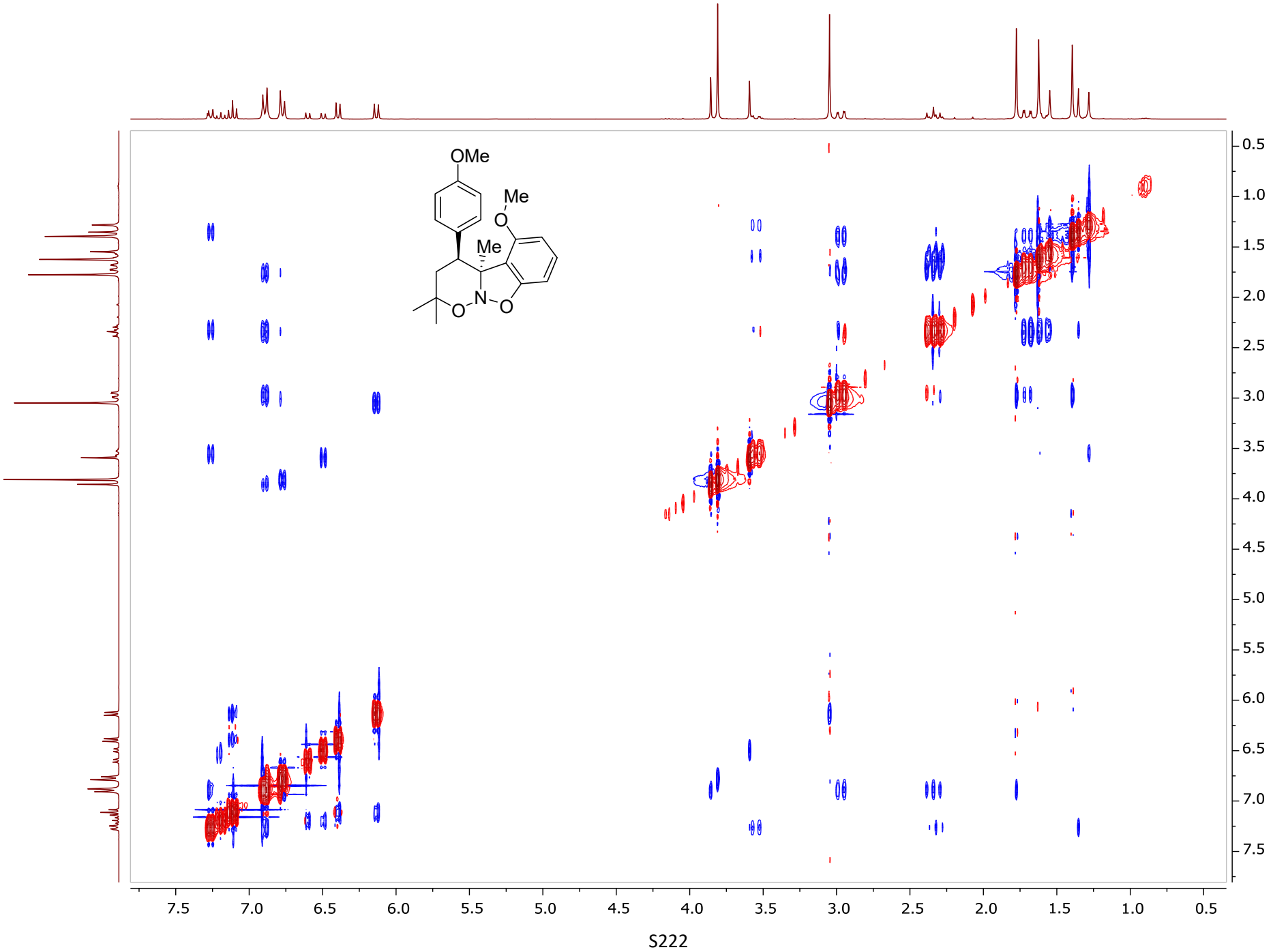
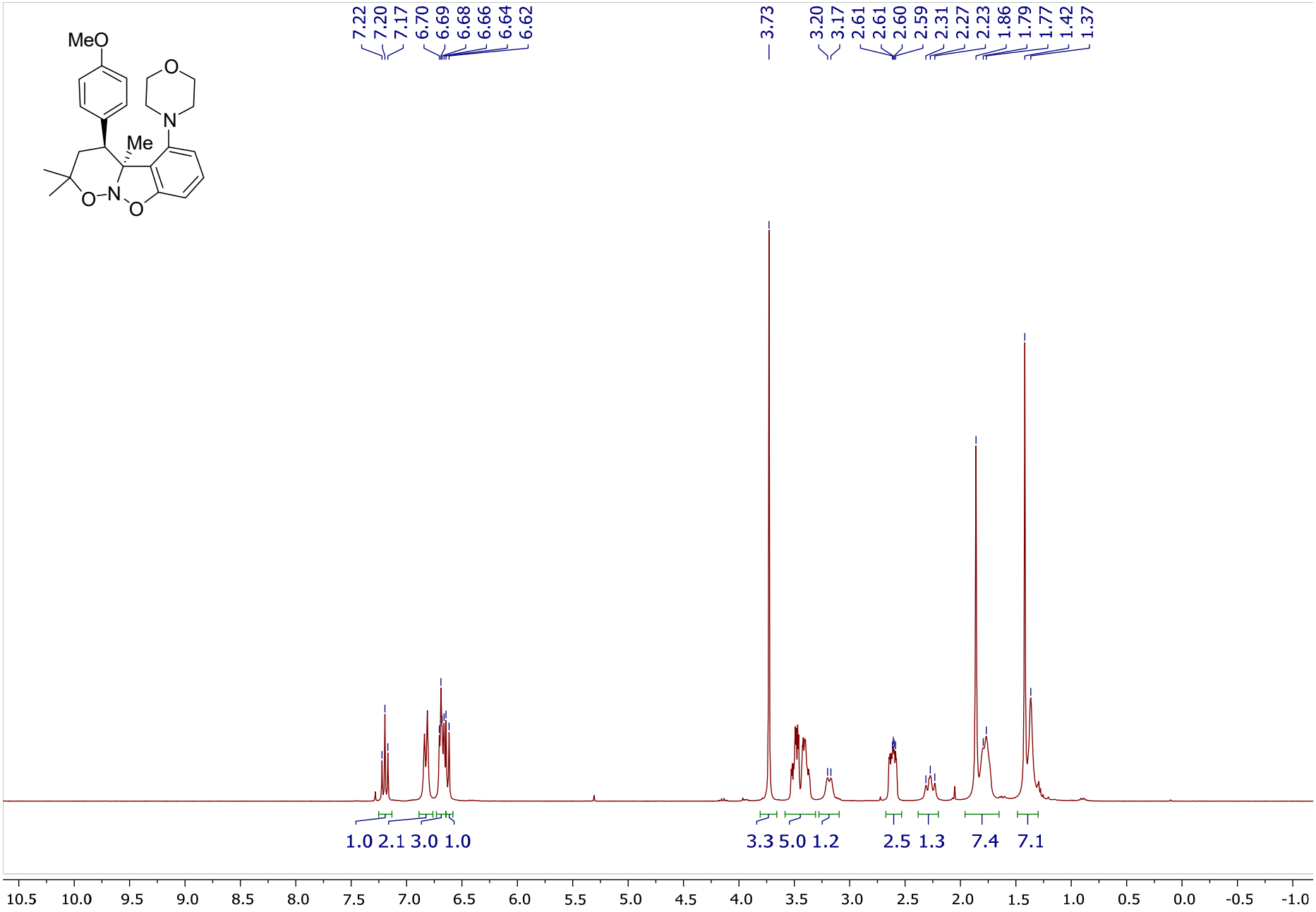
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{1}H NOESY

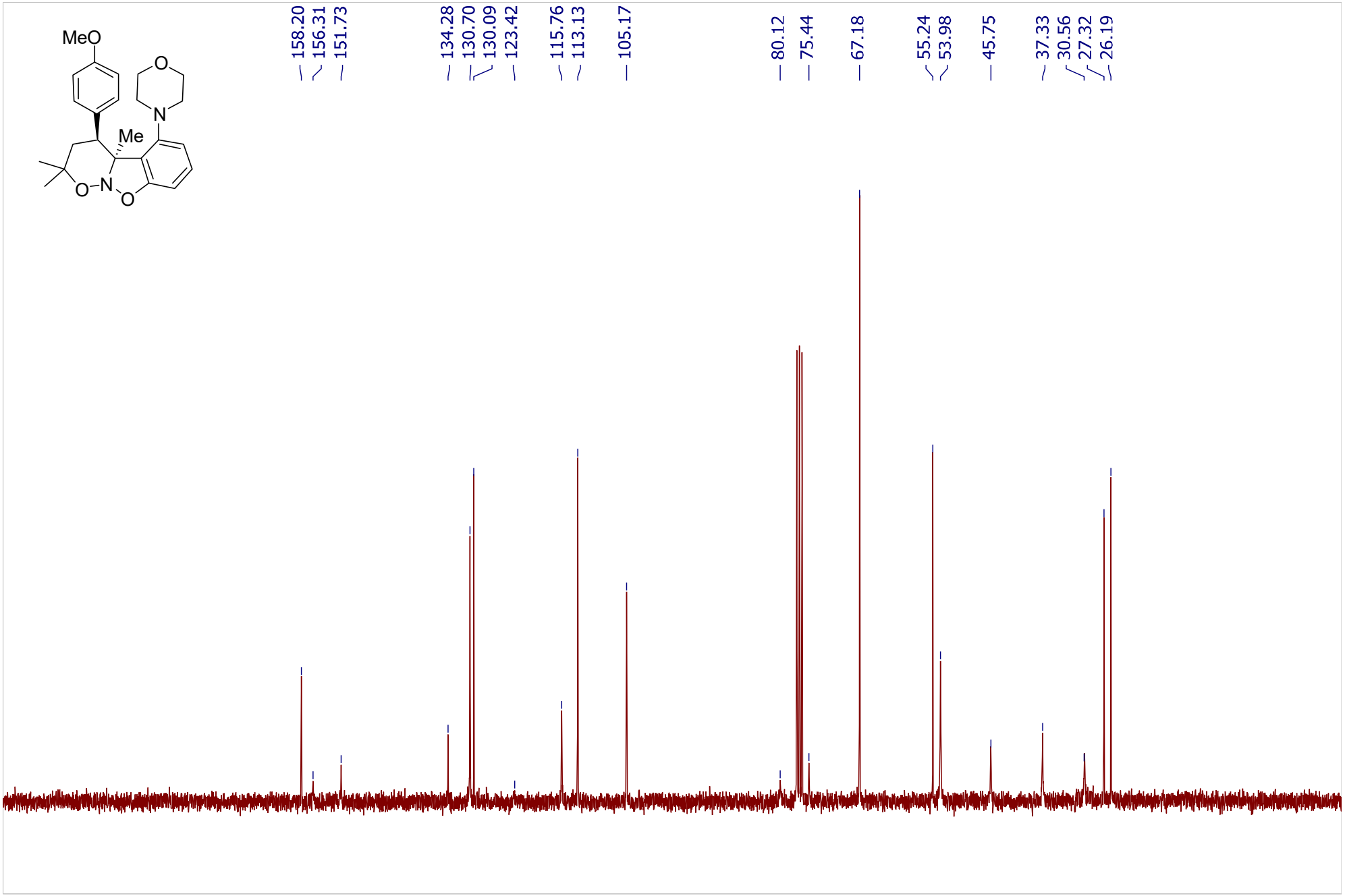

OMe
Me
O
Me
N
O
O
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

(4*S,4a*S**)- 4-(4-Methoxyphenyl)-2,2,4a-trimethyl-5-morpholino-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ac**, major isomer

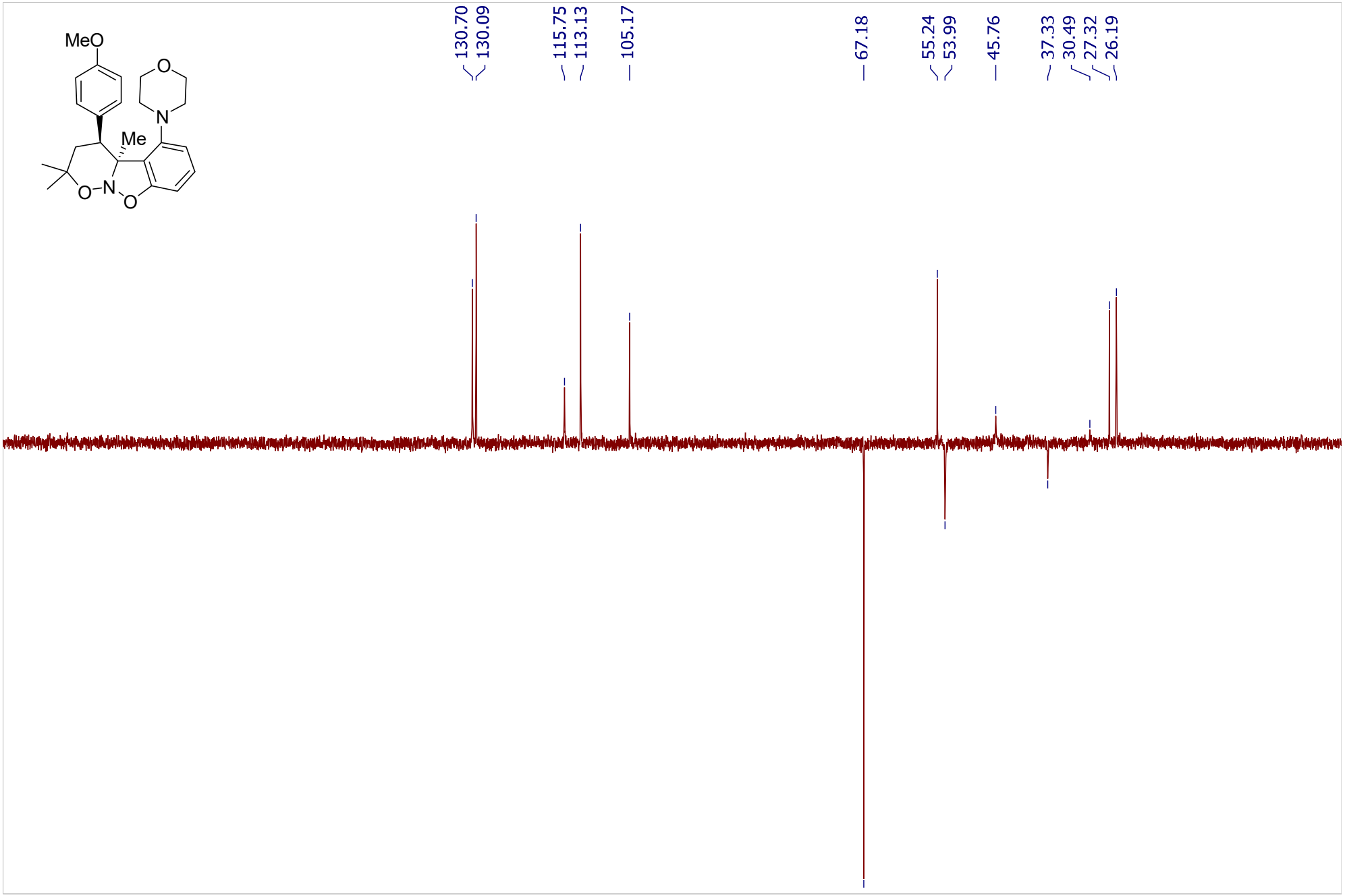
^{1}H NMR (300 MHz, 323K, $CDCl_3$)



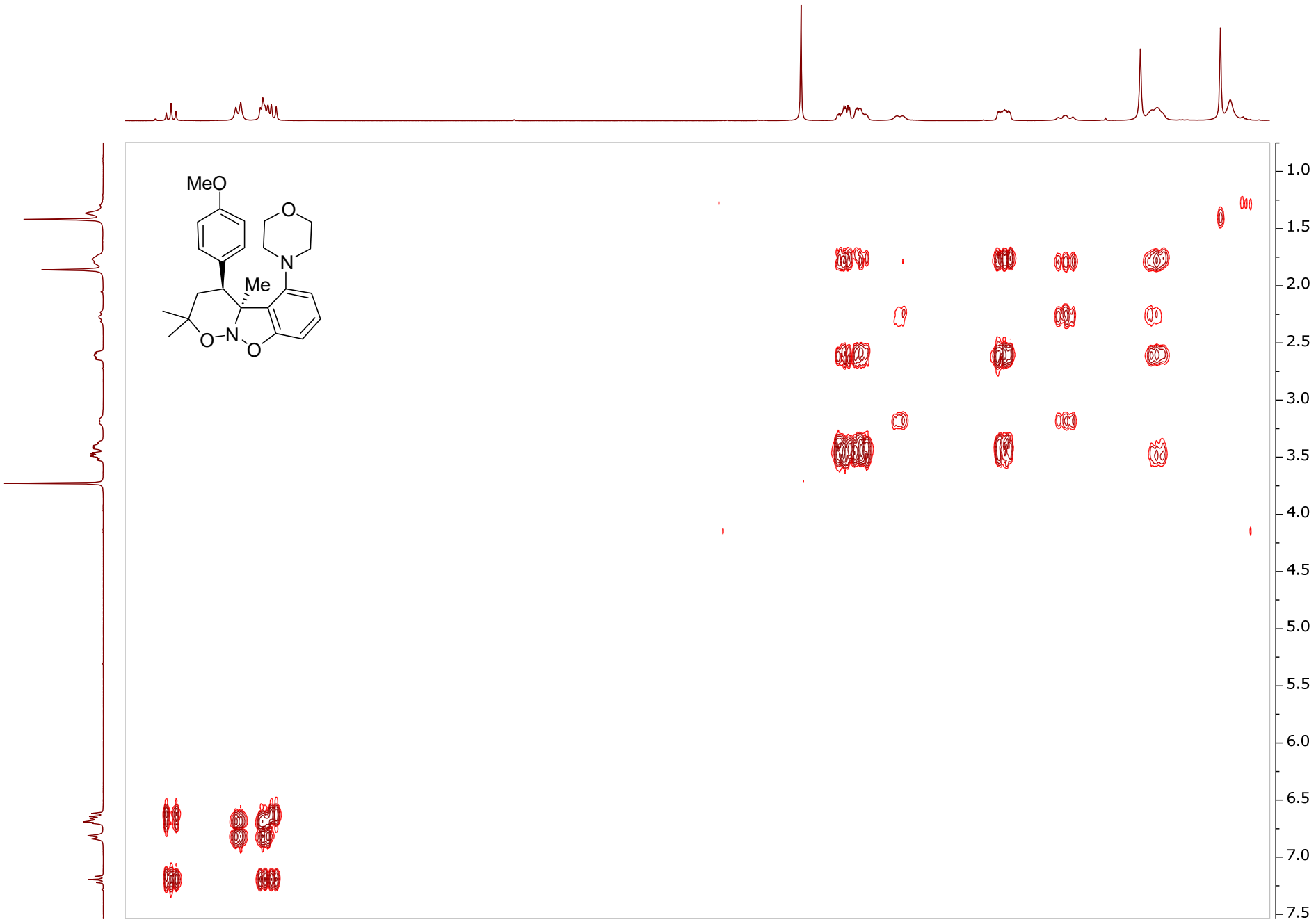
^{13}C NMR (75 MHz, 323K, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, 323K, $CDCl_3$)



^{1}H-^{1}H COSY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O
N
Me
O
N
O
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1.5
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4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.0
6.5
6.0
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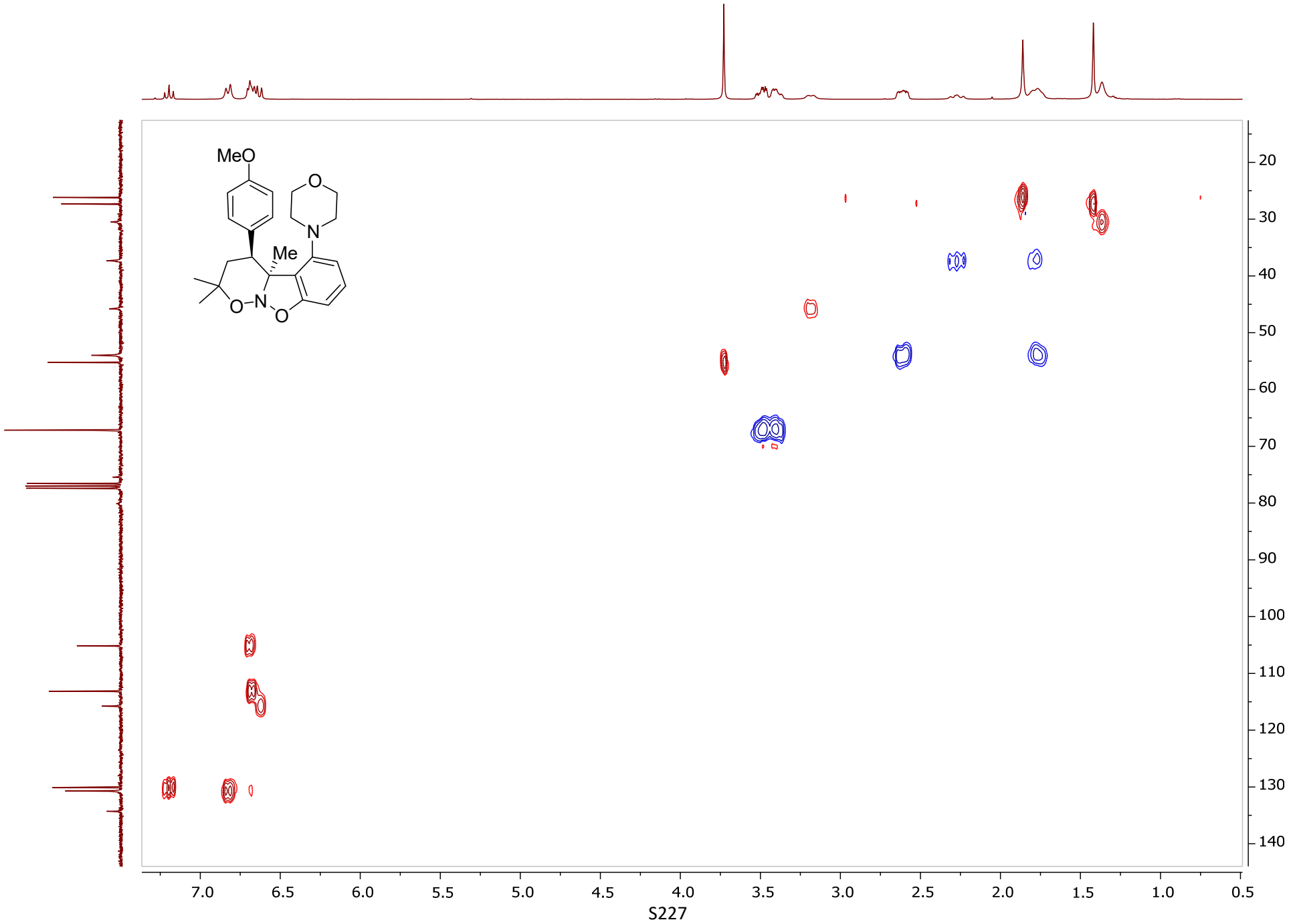
2.0
1.5

^{1}H-^{13}C HSQC


MeO
O
N
Me
O
N
O
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60
70
80
90
100
110
120
130
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6.5
6.0
5.5
5.0
4.5
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3.5
3.0
2.5
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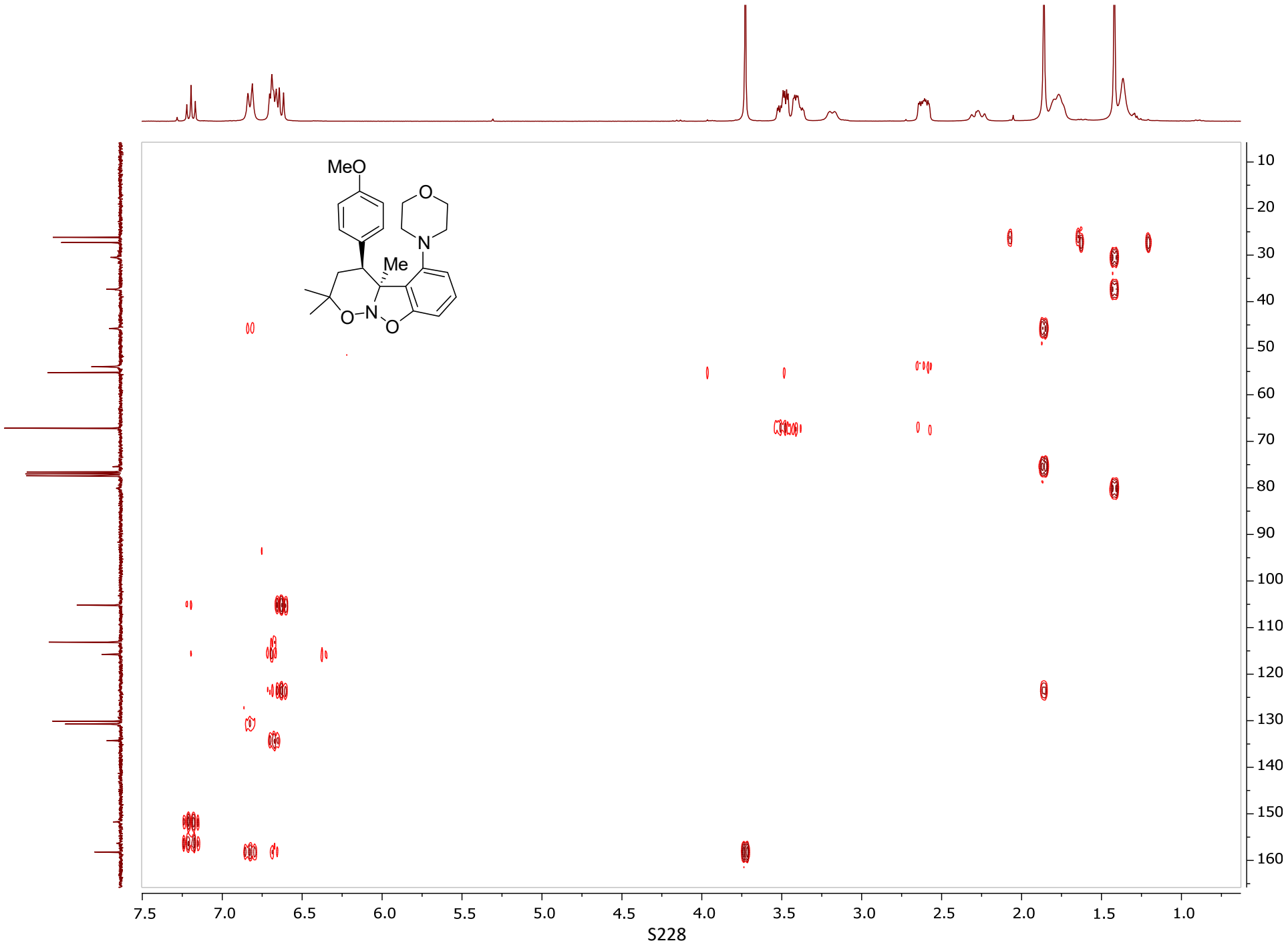
1.5
1.0
0.5

^{1}H-^{13}C HMBC


MeO
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Me
O
N
O
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30
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50
60
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80
90
100
110
120
130
140
150
160
7.5
7.0
6.5
6.0
5.5
5.0
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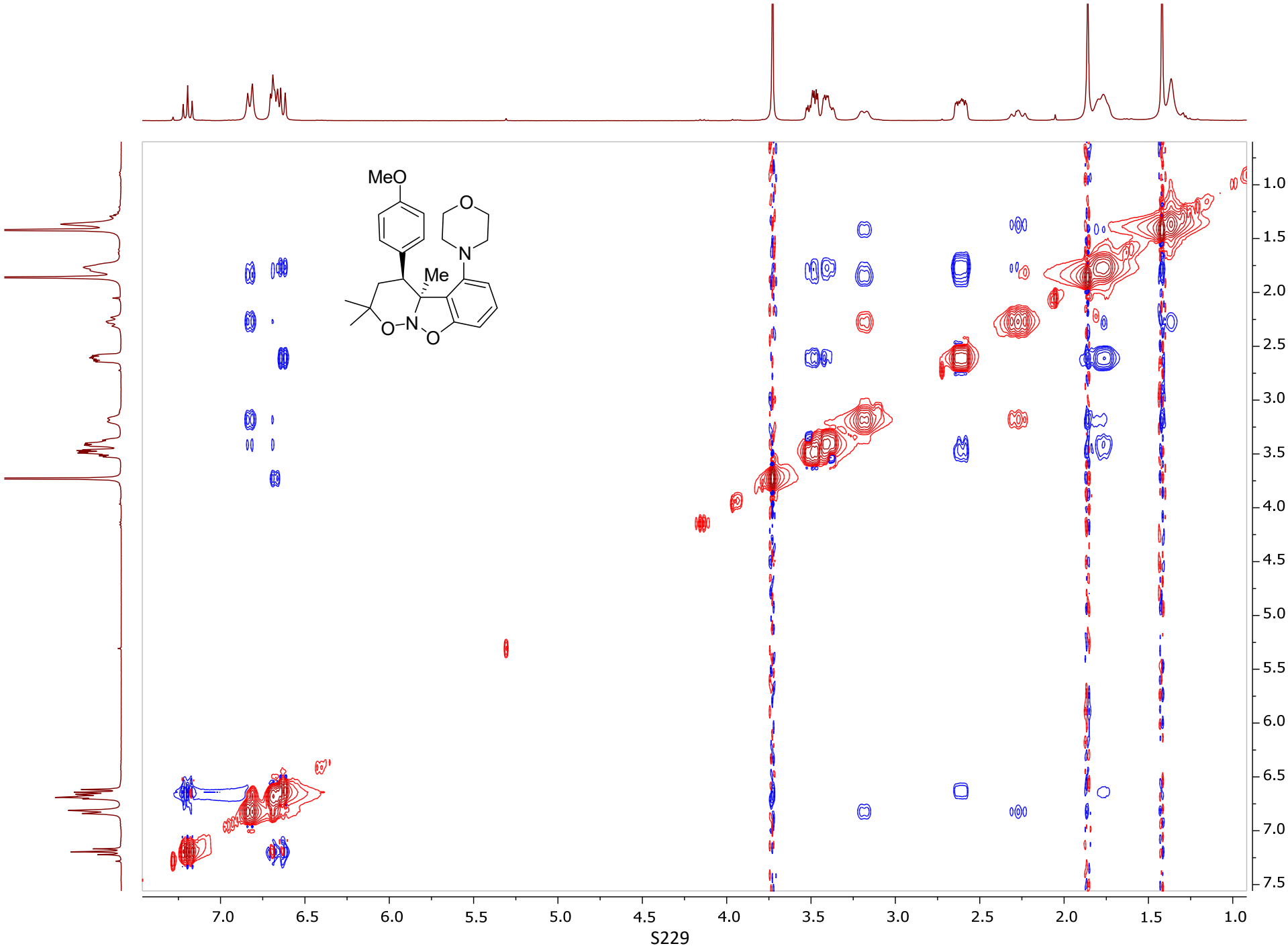
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{1}H NOESY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N
Me
O
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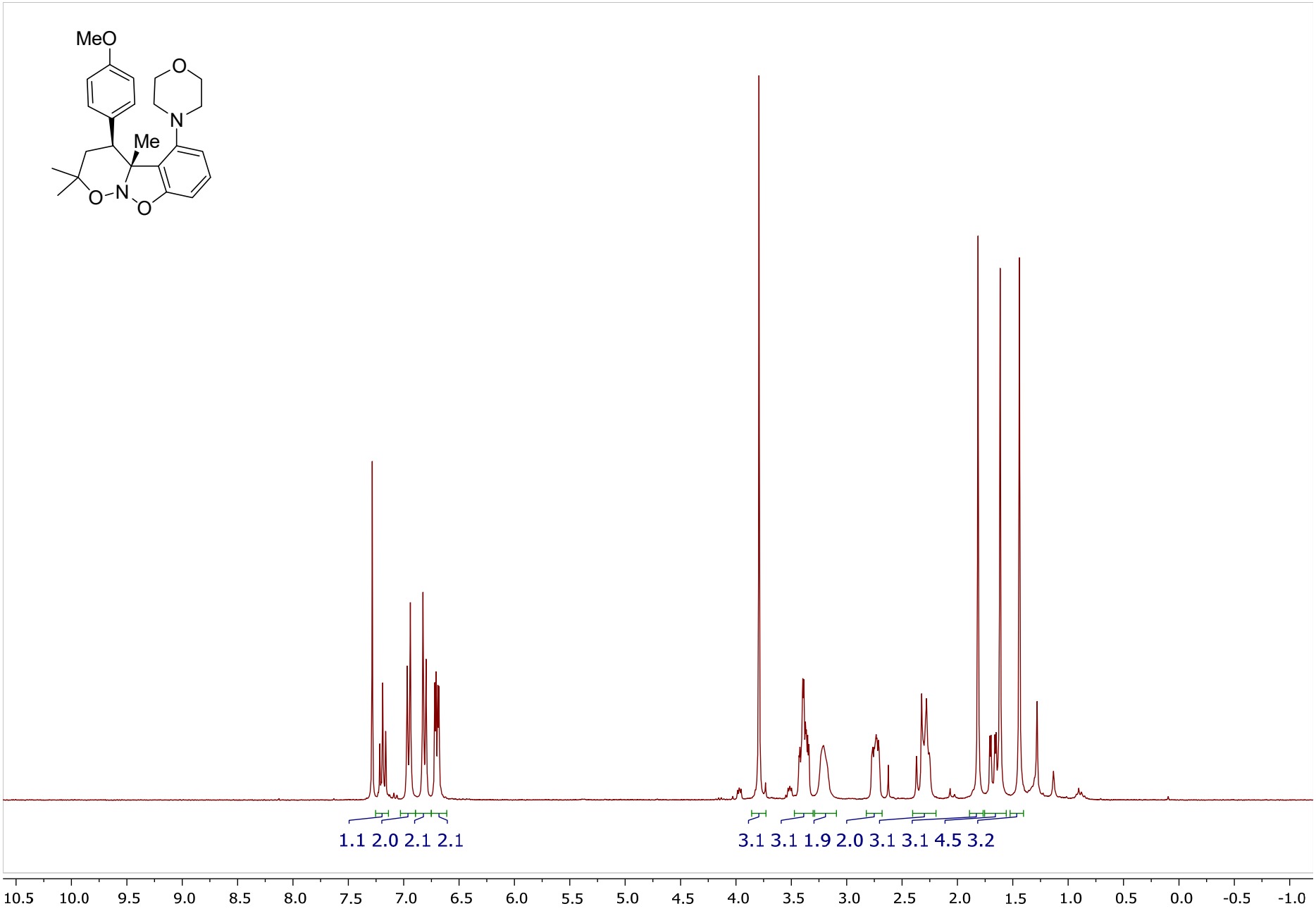
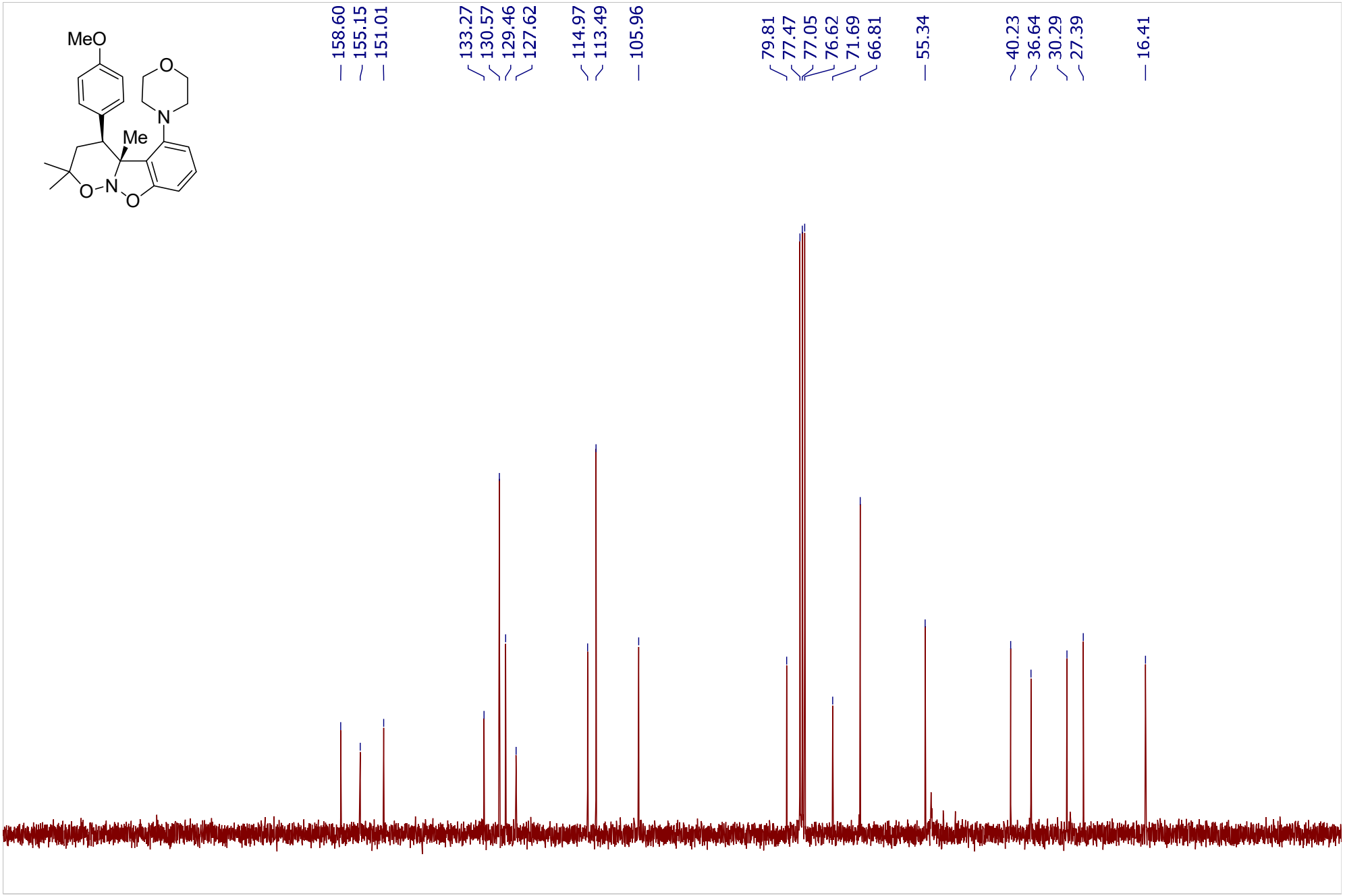
2.5
2.0
1.5
1.0
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5

4-(4-Methoxyphenyl)-2,2,4a-trimethyl-5-morpholino-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine 5ac, minor ((4*S**,4a*R**)-isomer)

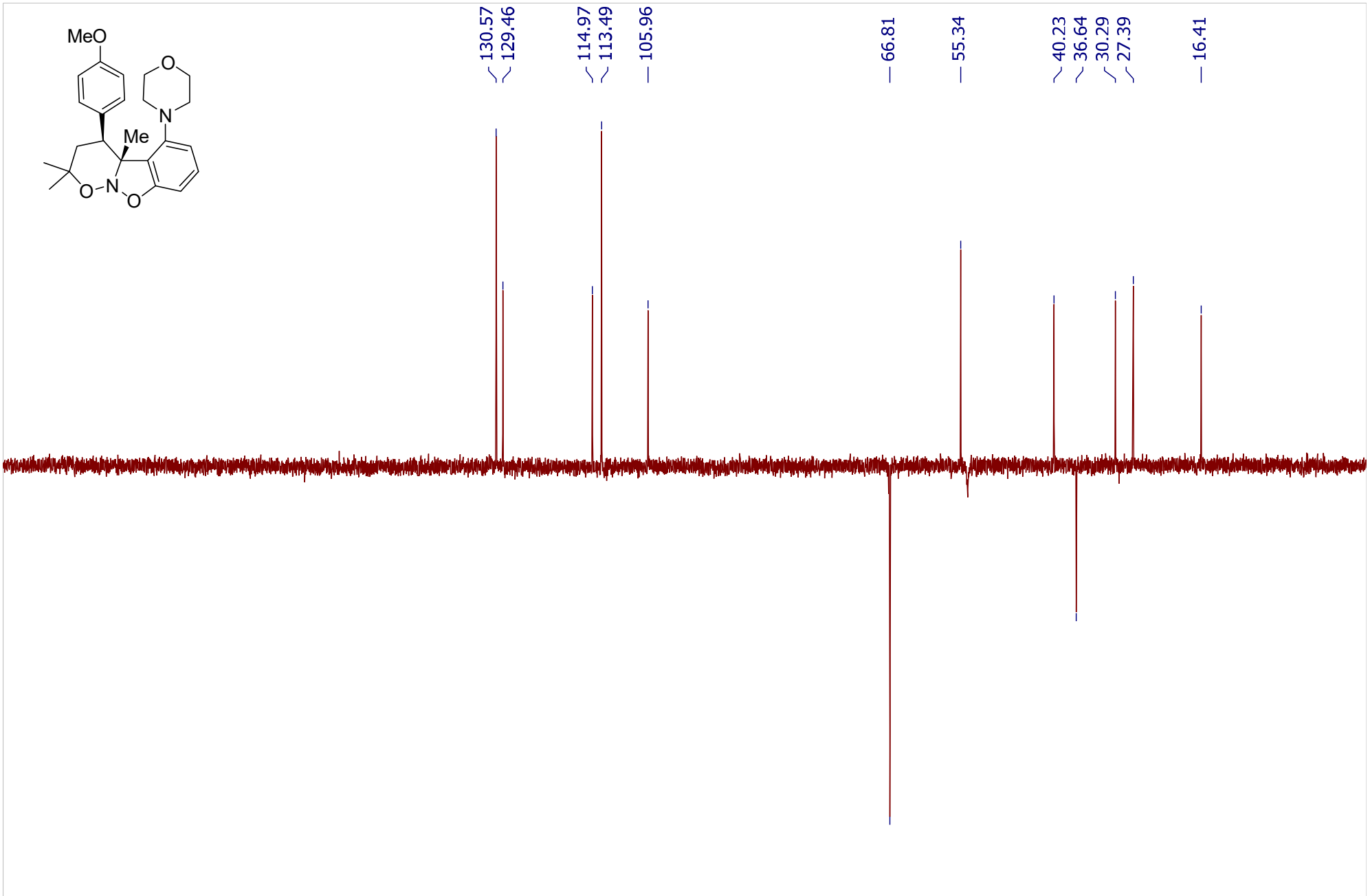
^{1}H NMR (300 MHz, $CDCl_3$)



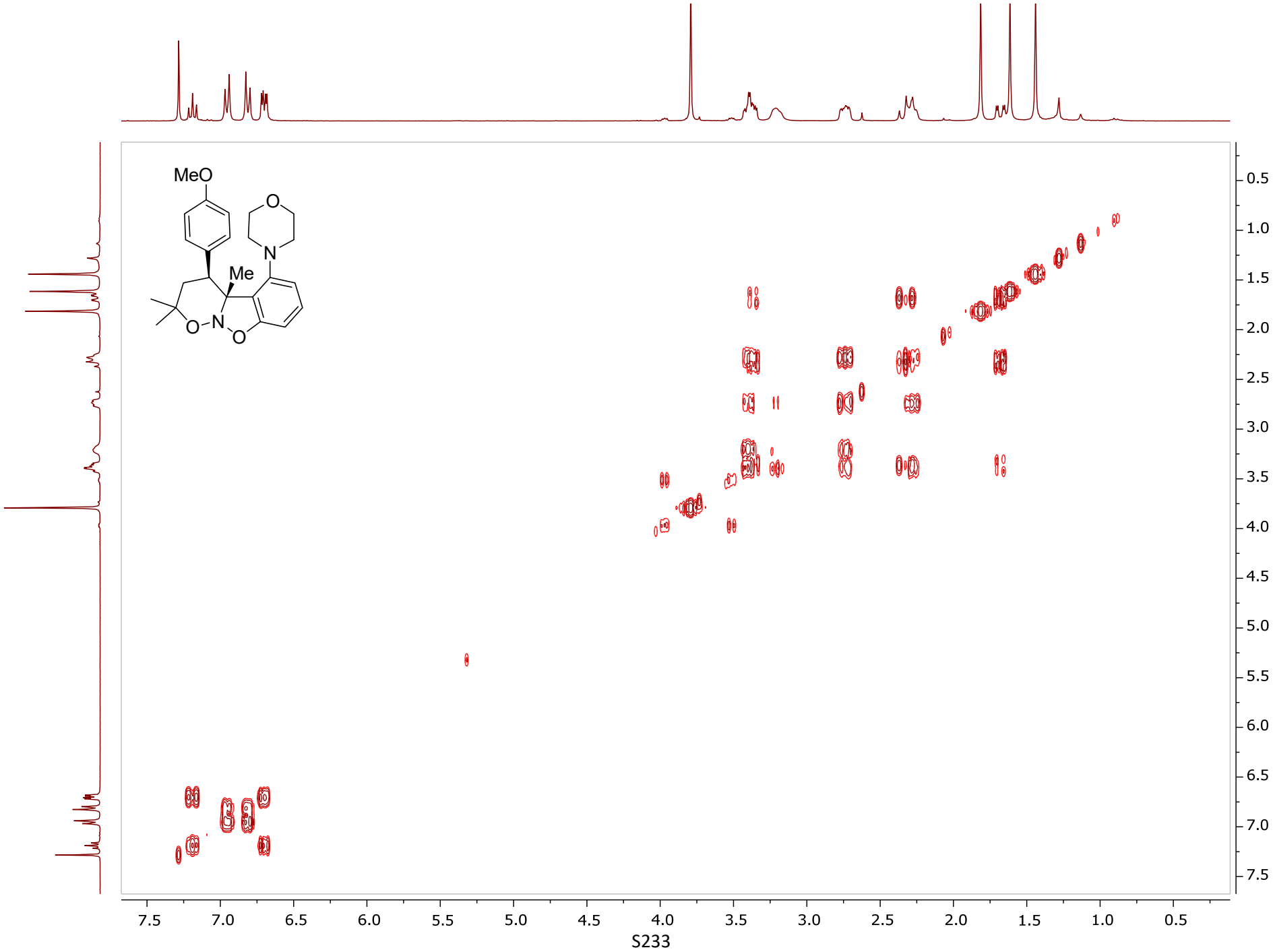
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY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N
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6.0
6.5
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7.5
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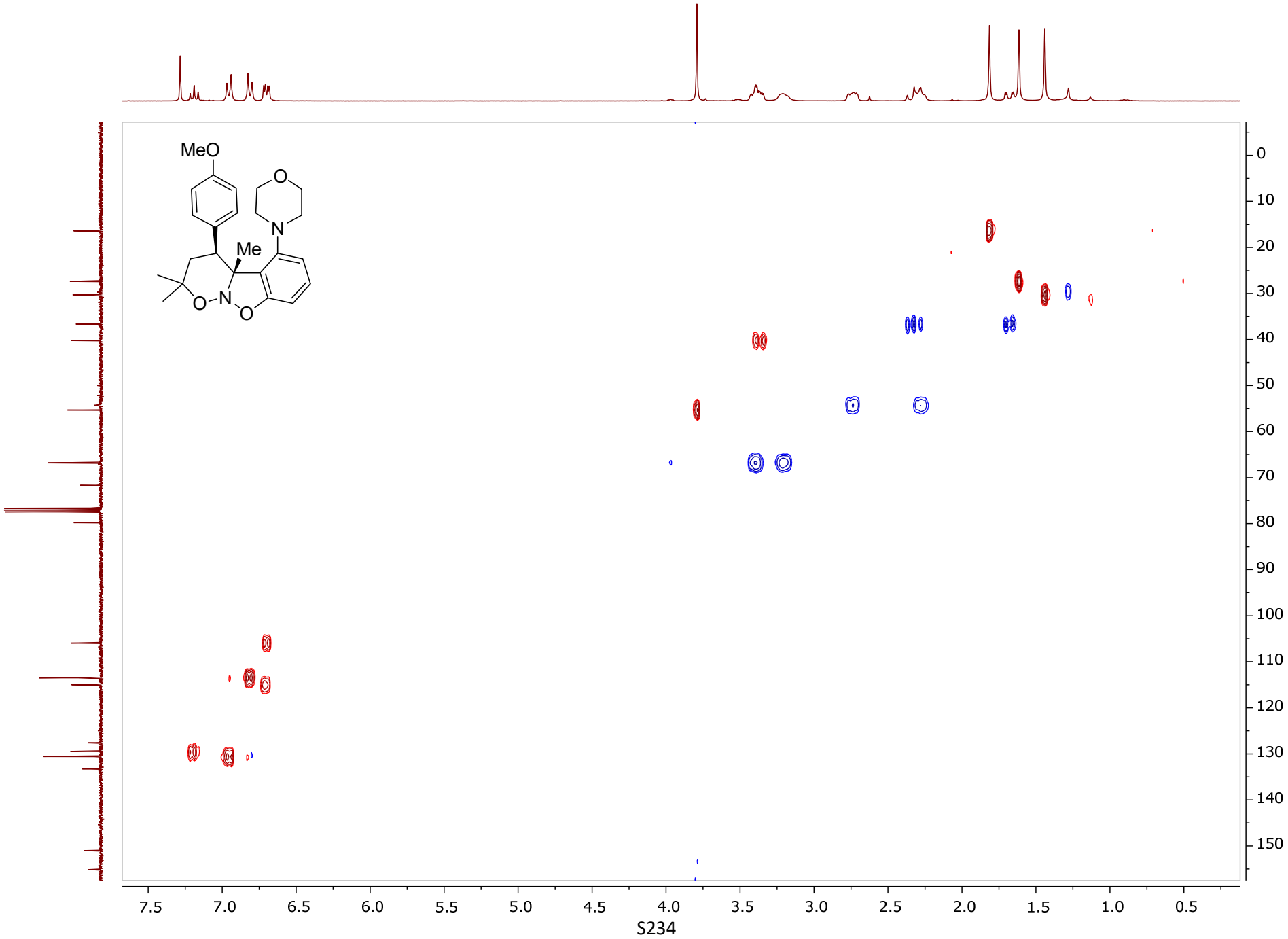
0.5
S233

^{1}H-^{13}C HSQC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6.5
6.0
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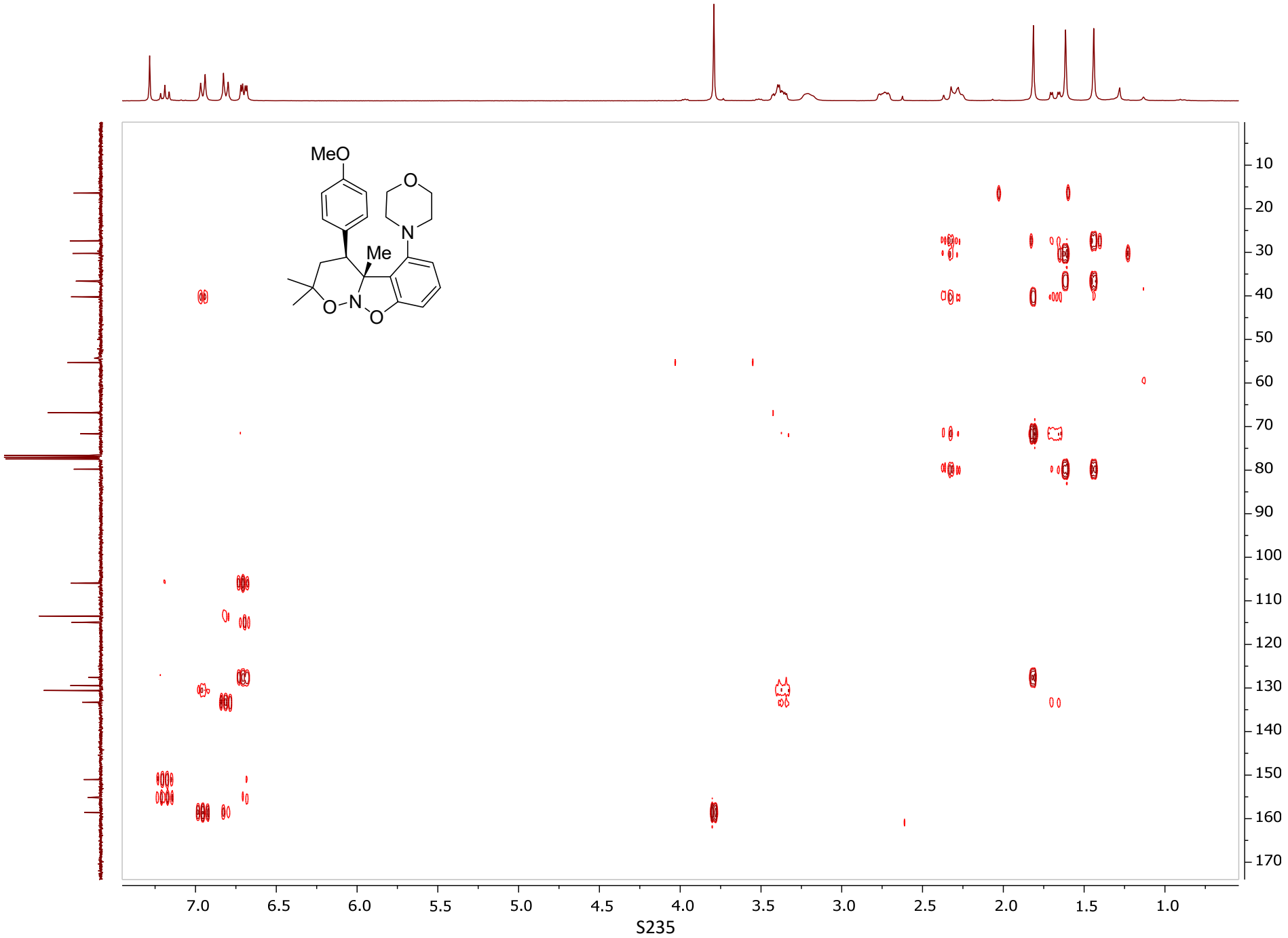
1.0
0.5

^{1}H-^{13}C HMBC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80
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100
110
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150
160
170
7.0
6.5
6.0
5.5
5.0
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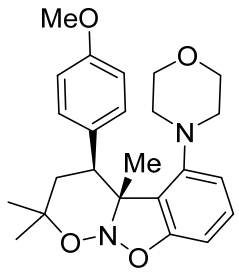
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{1}H NOESY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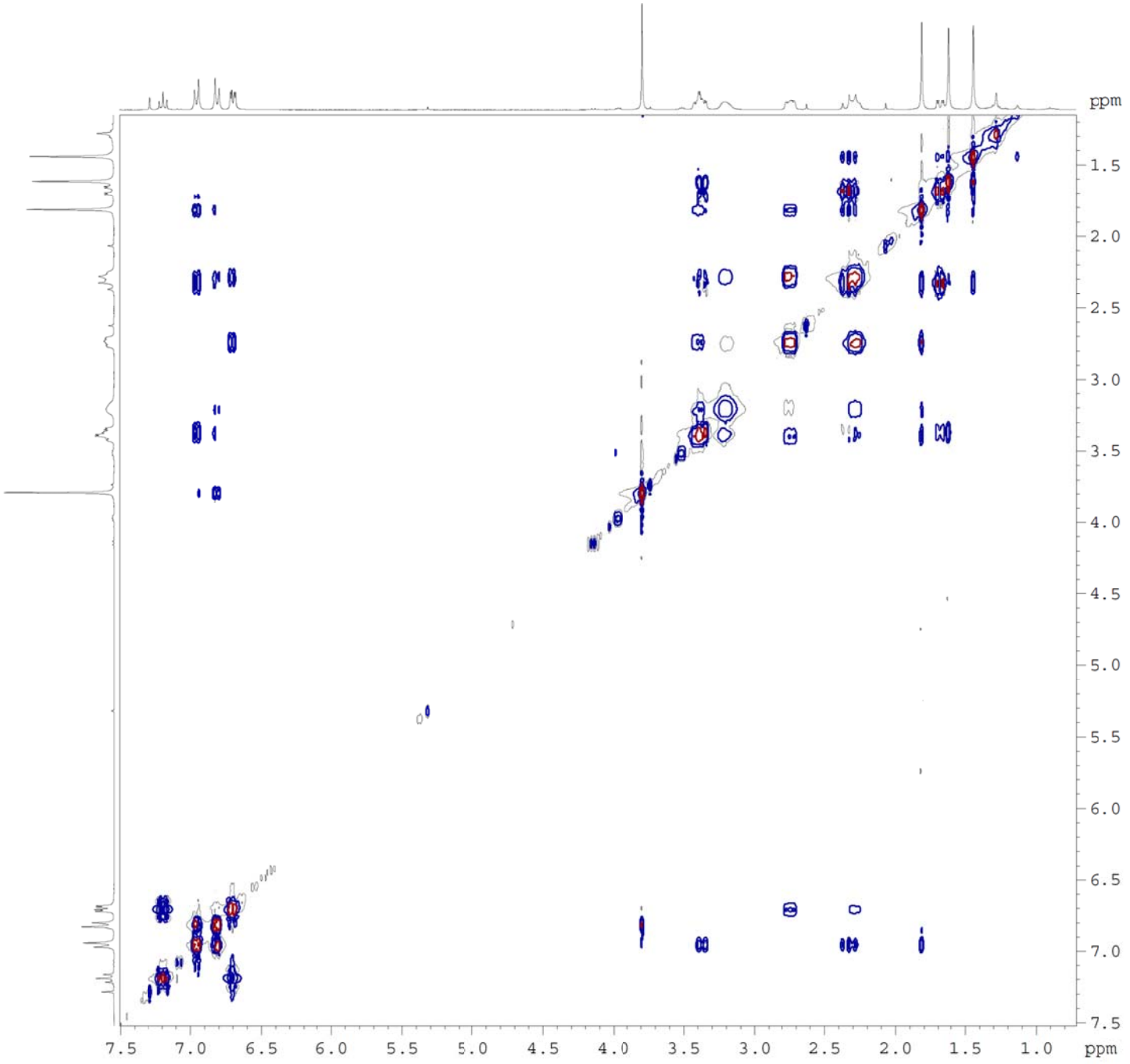
Me
O
N
O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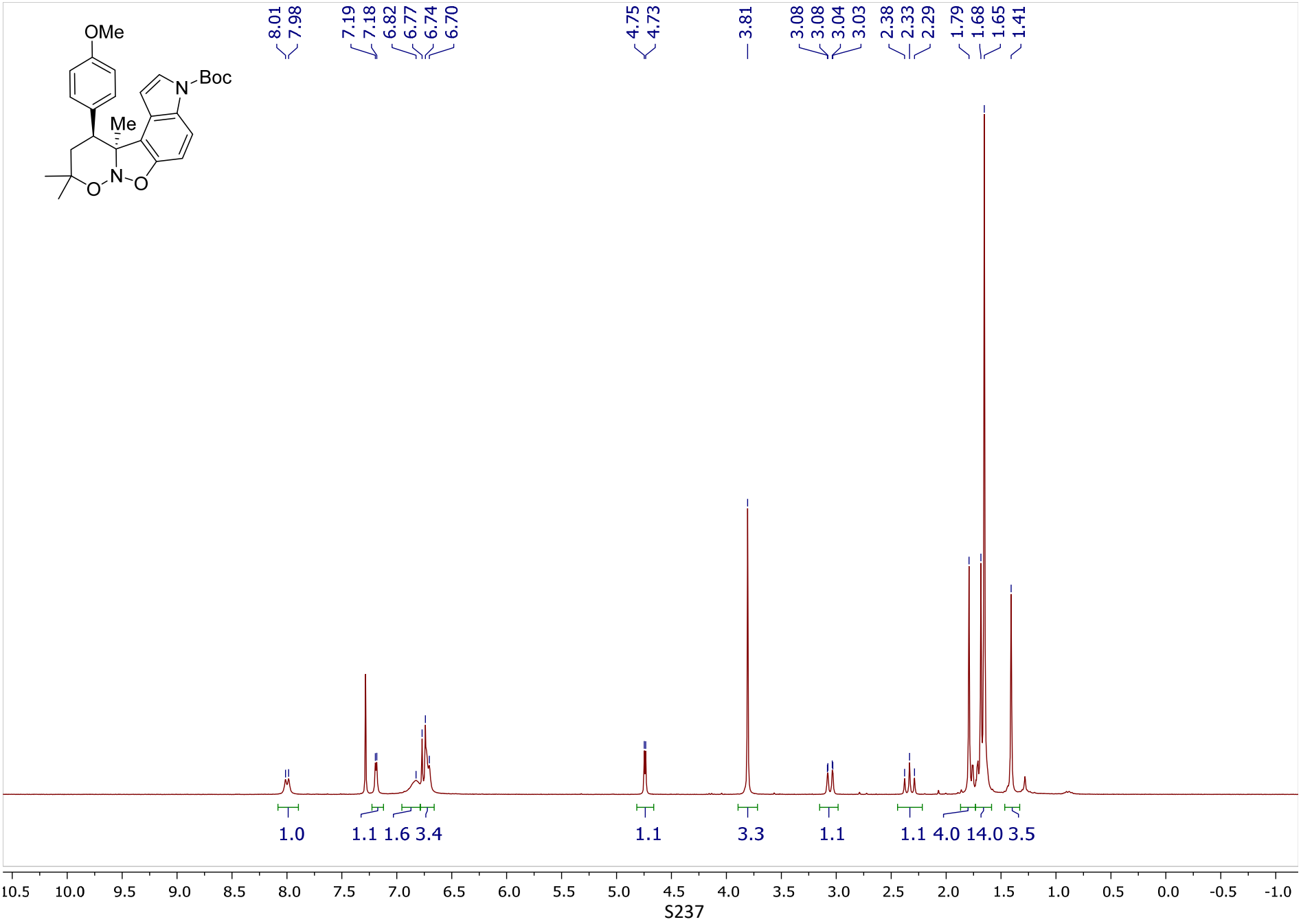
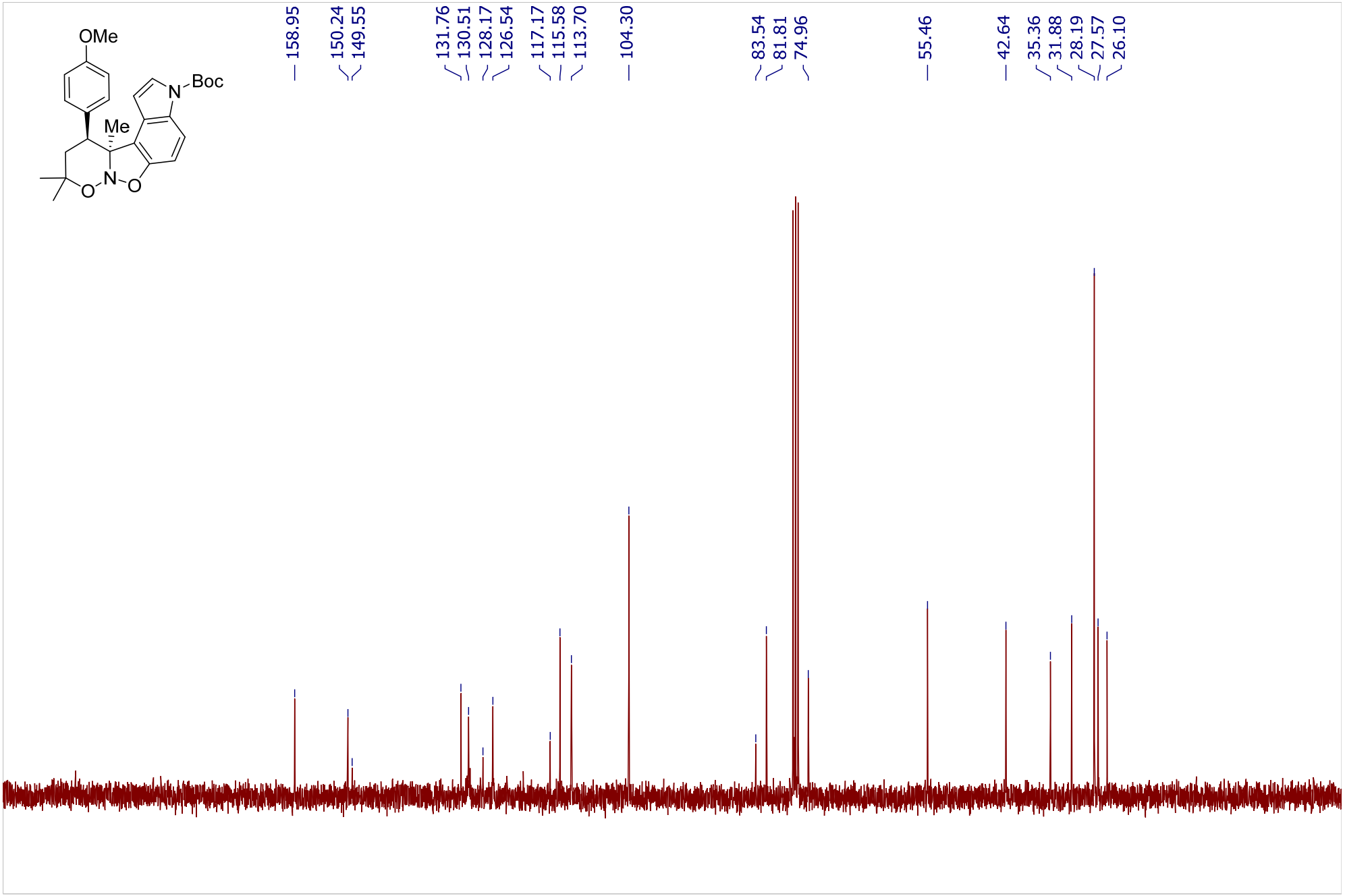
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
ppm

***tert*-Butyl (11*R**,11a*R**)-11-(4-methoxyphenyl)-9,9,11a-trimethyl-9,10,11,11a-tetrahydro-3H-[1,2]oxazino[2',3':2,3]isoxazolo[4,5-e]indole-3-carboxylate 5ad**

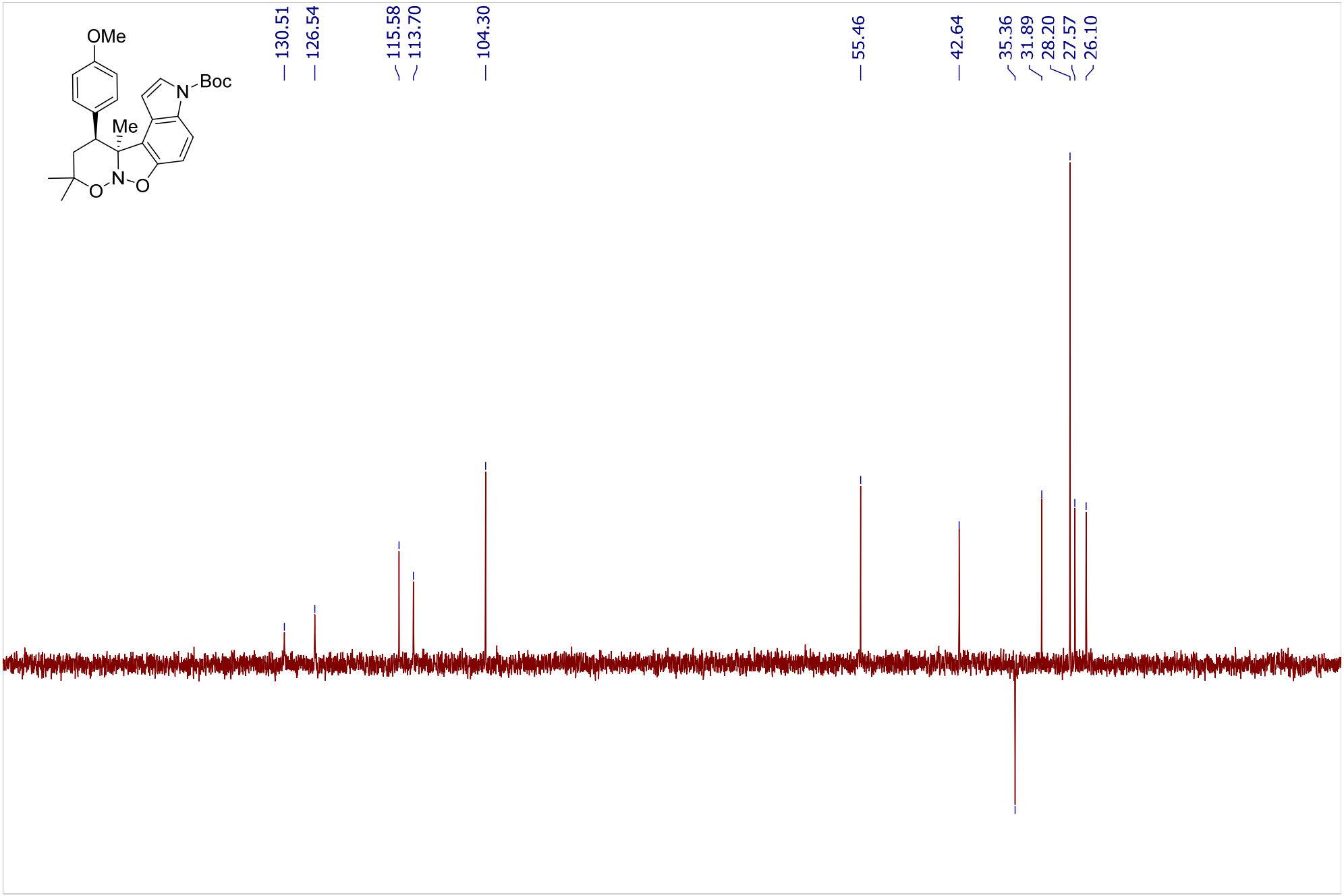
^{1}H NMR (300 MHz, $CDCl_3$)



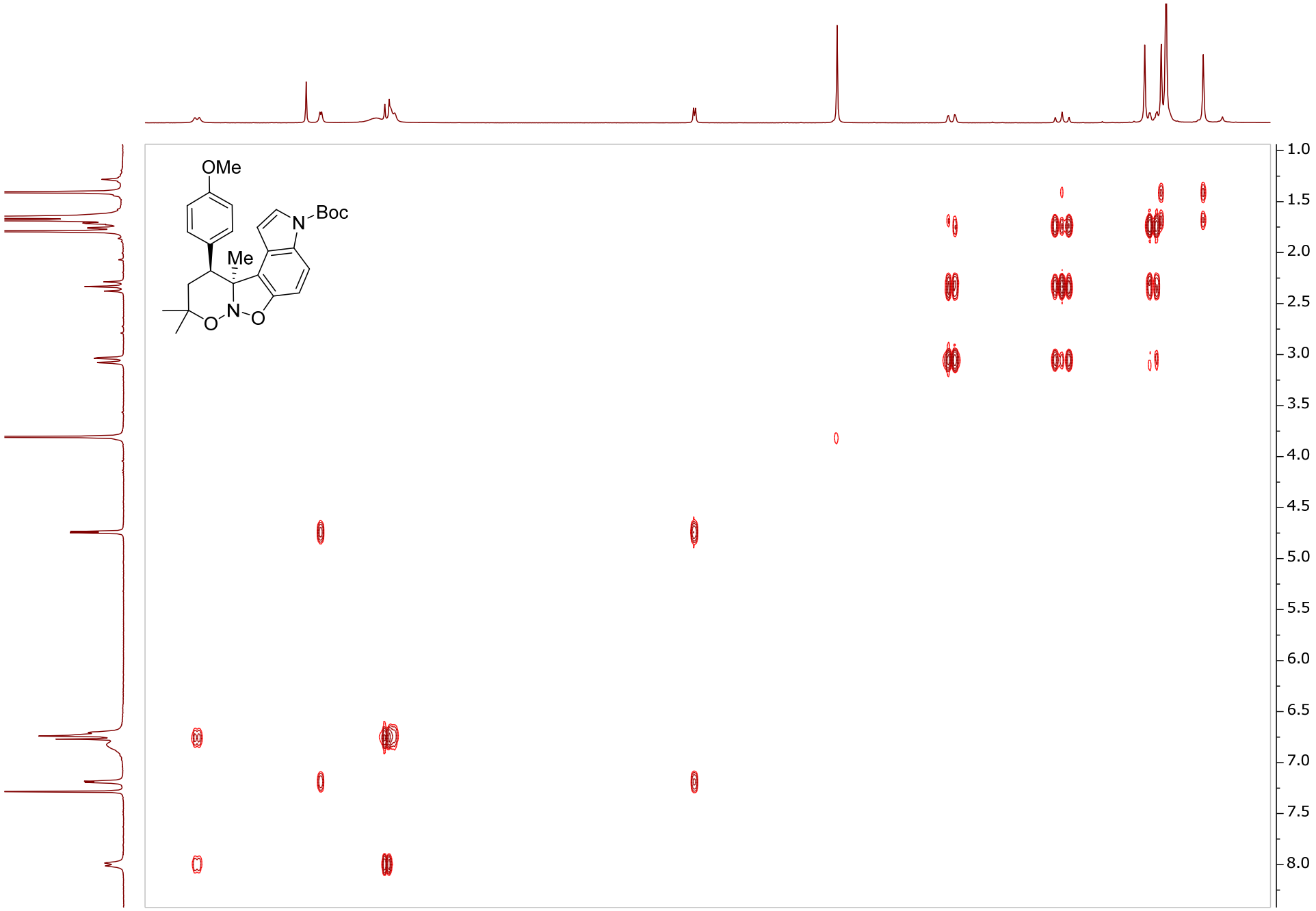
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY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Me
N
Boc
O
N
O
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.0
7.5
7.0
6.5
6.0
5.5
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4.0
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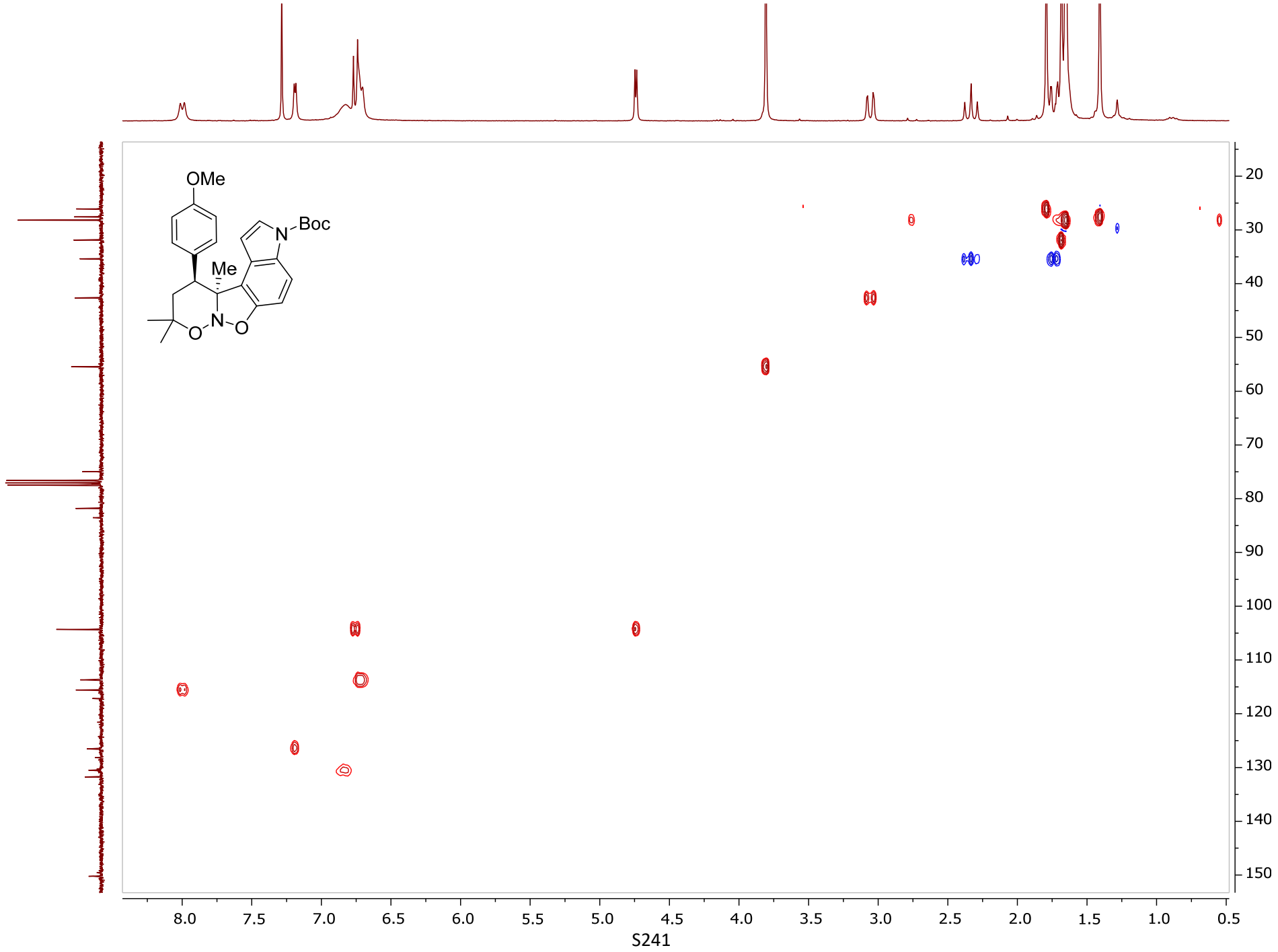
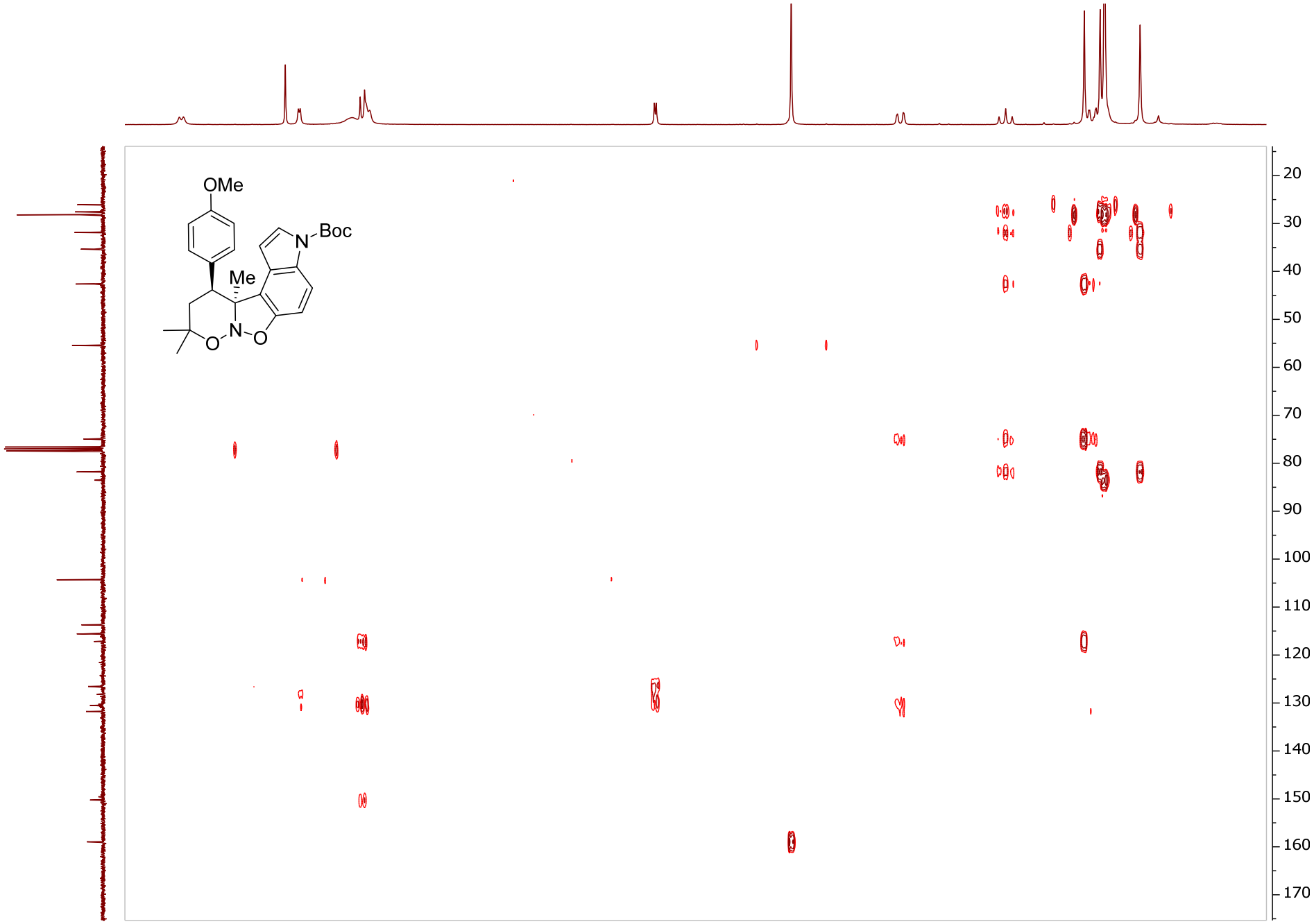
2.5
2.0
1.5
1.0

^{1}H-^{13}C HSQC


OMe
Boc
N
Me
N
O
O
20
30
40
50
60
70
80
90
100
110
120
130
140
150
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

^{1}H-^{13}C HMBC


OMe
Boc
N
Me
N
O
O
20
30
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50
60
70
80
90
100
110
120
130
140
150
160
170
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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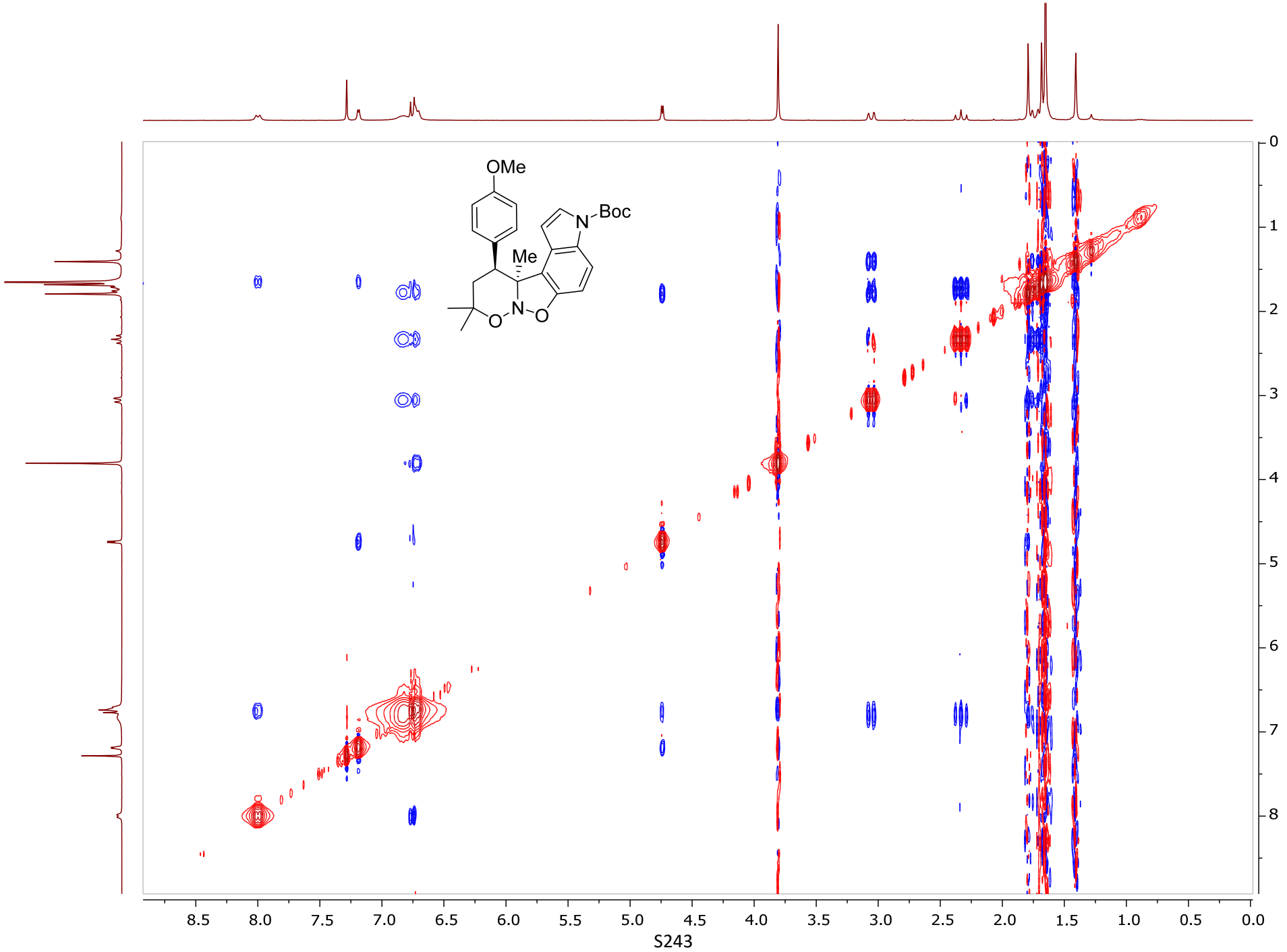
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{1}H NOESY


OMe
Me
N
Boc
N
O
O
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7.5
7.0
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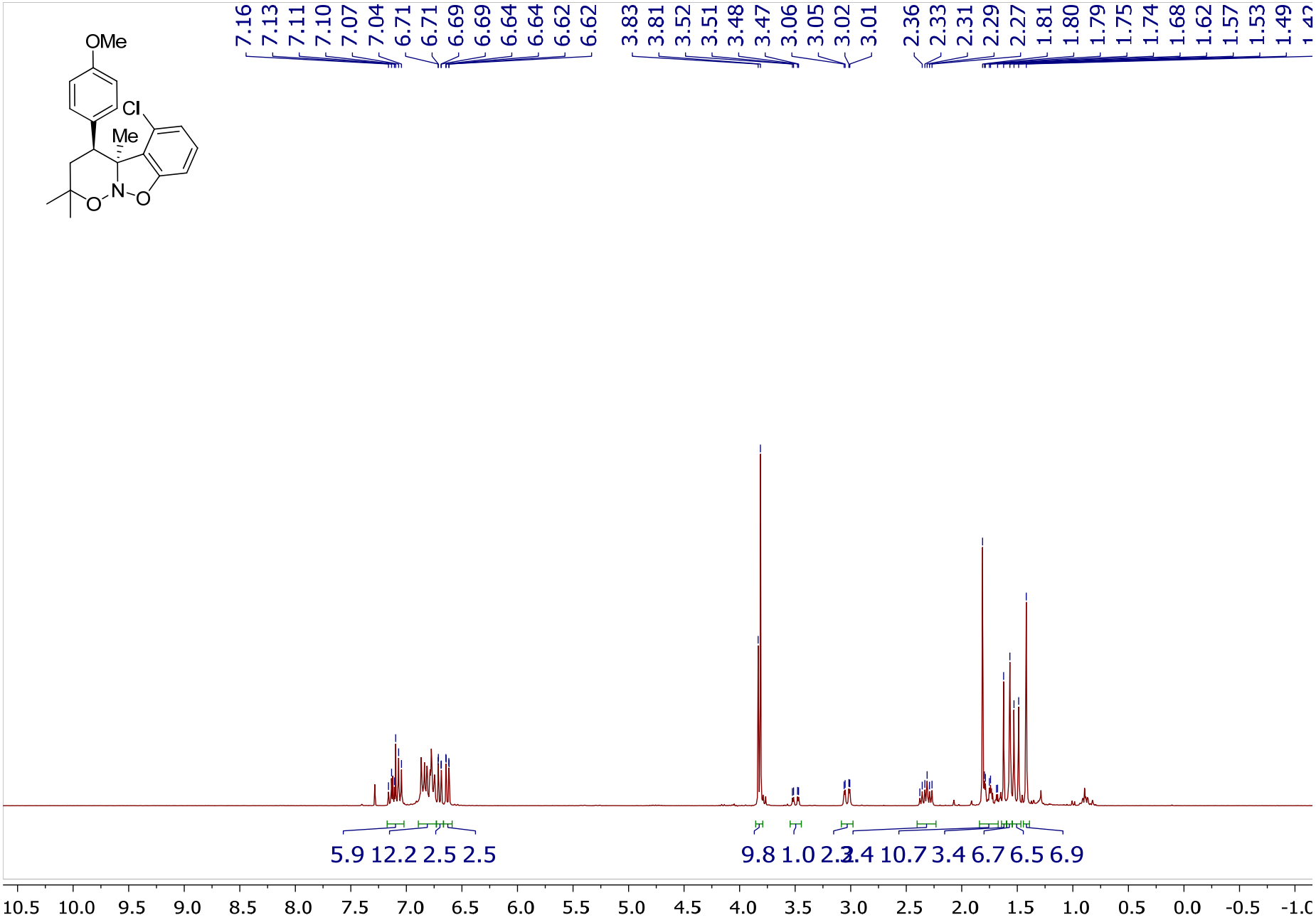
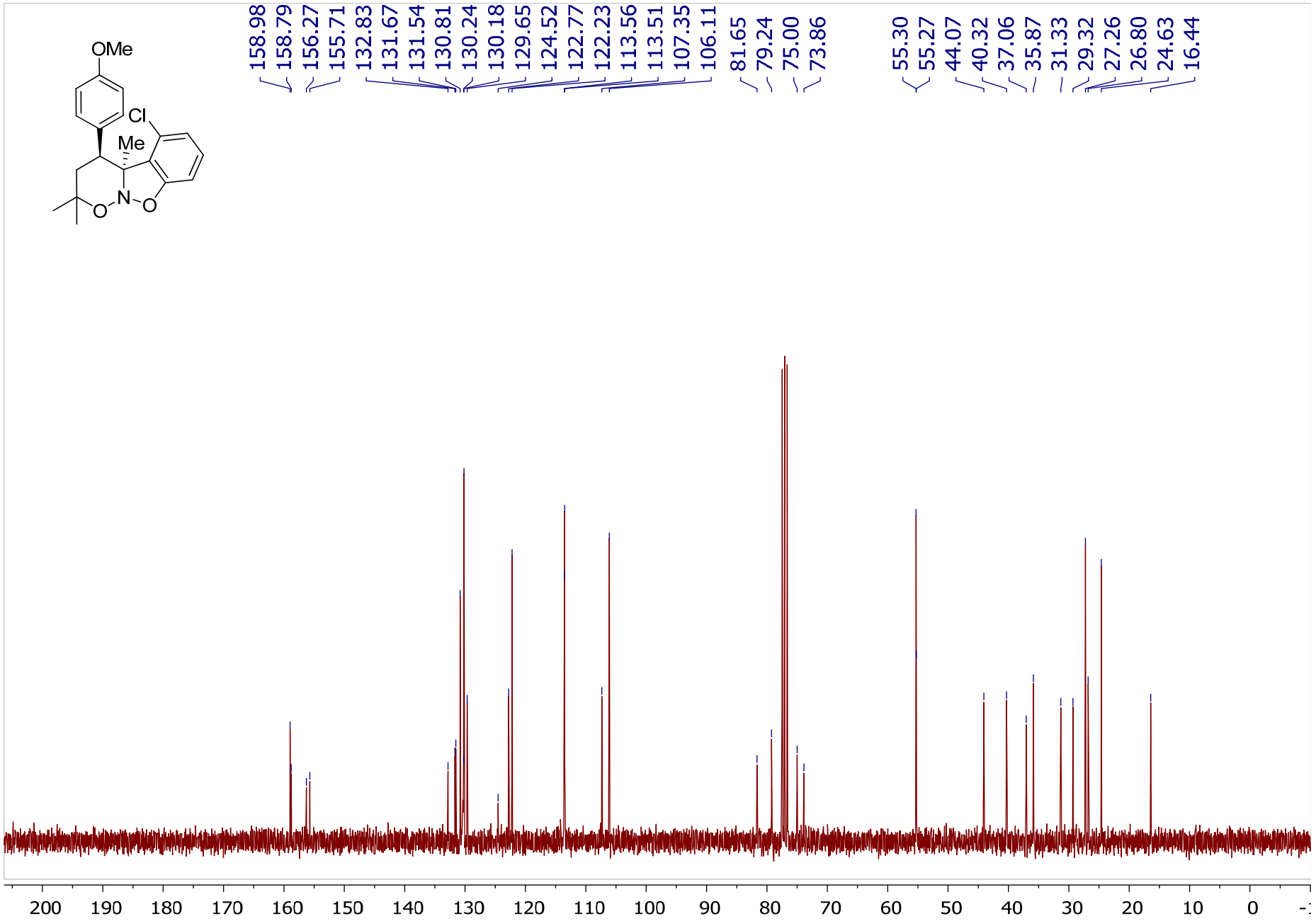
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
5
6
7
8

5-Methoxy-4-(4-methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-**5af**/*cis*-**5af** = 2.1:1)

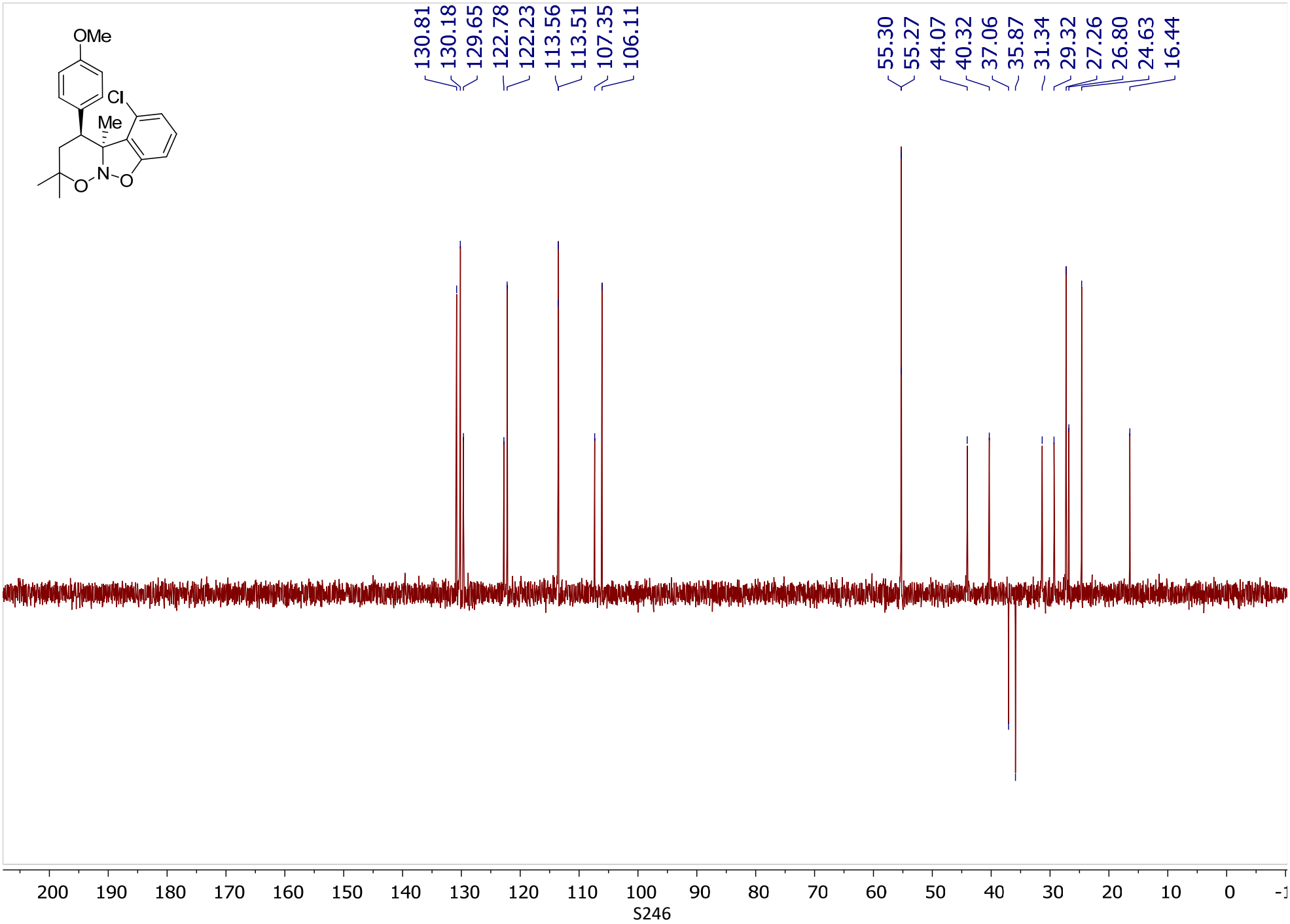
^{1}H NMR (300 MHz, $CDCl_3$)



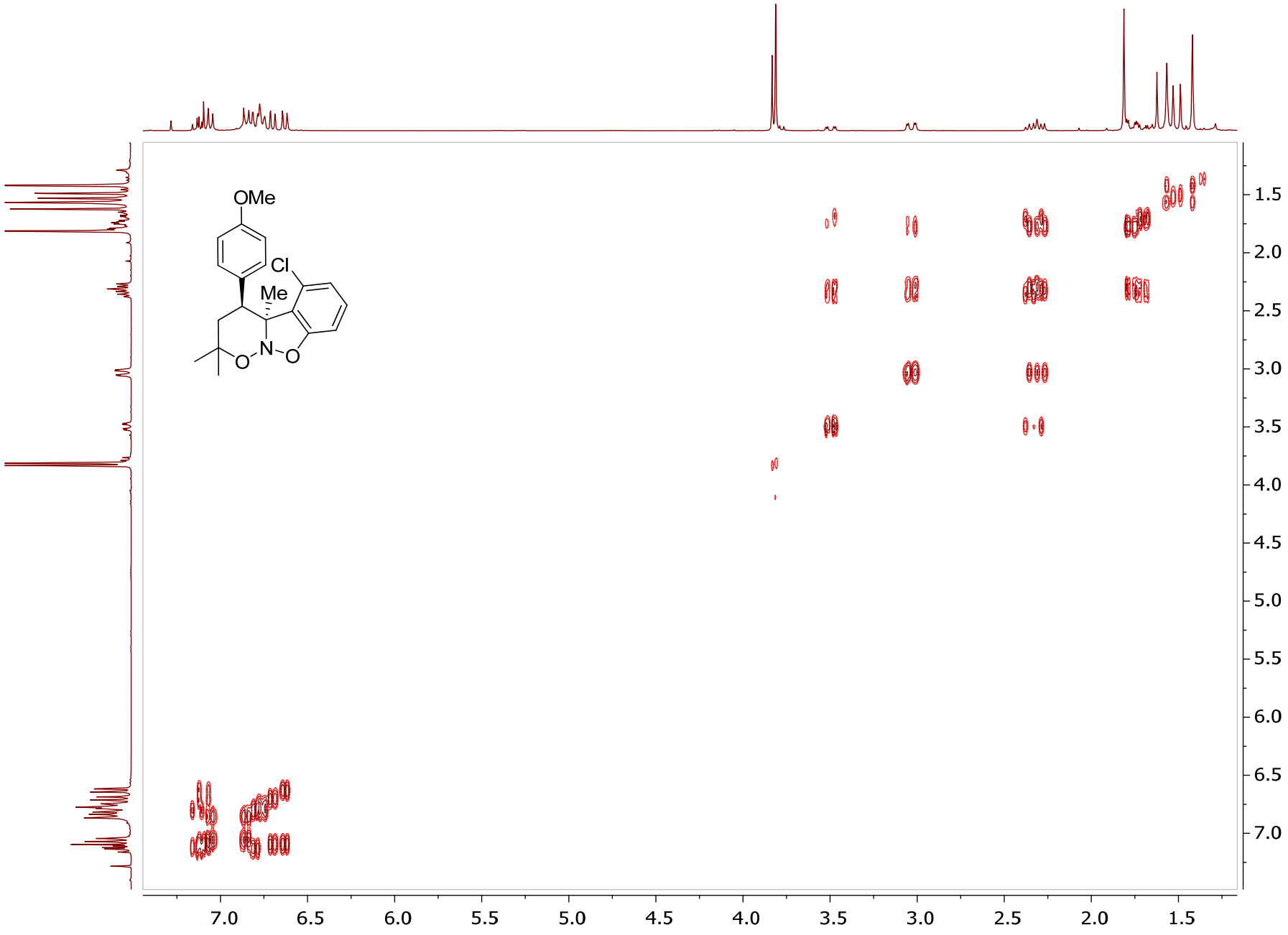
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


OMe
Cl
Me
N
O
O
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6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.5
2.0
2.5
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4.0
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5.0
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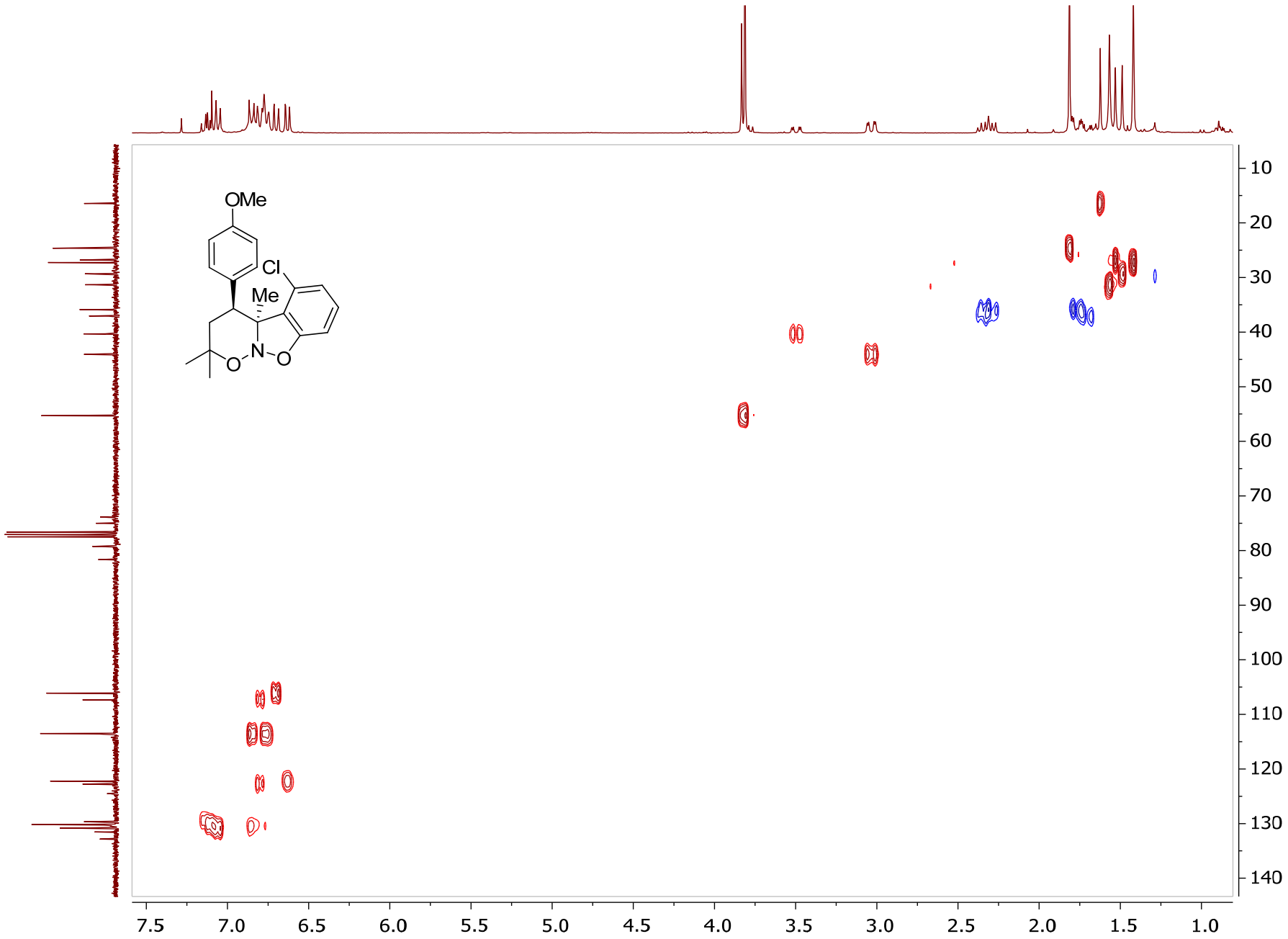
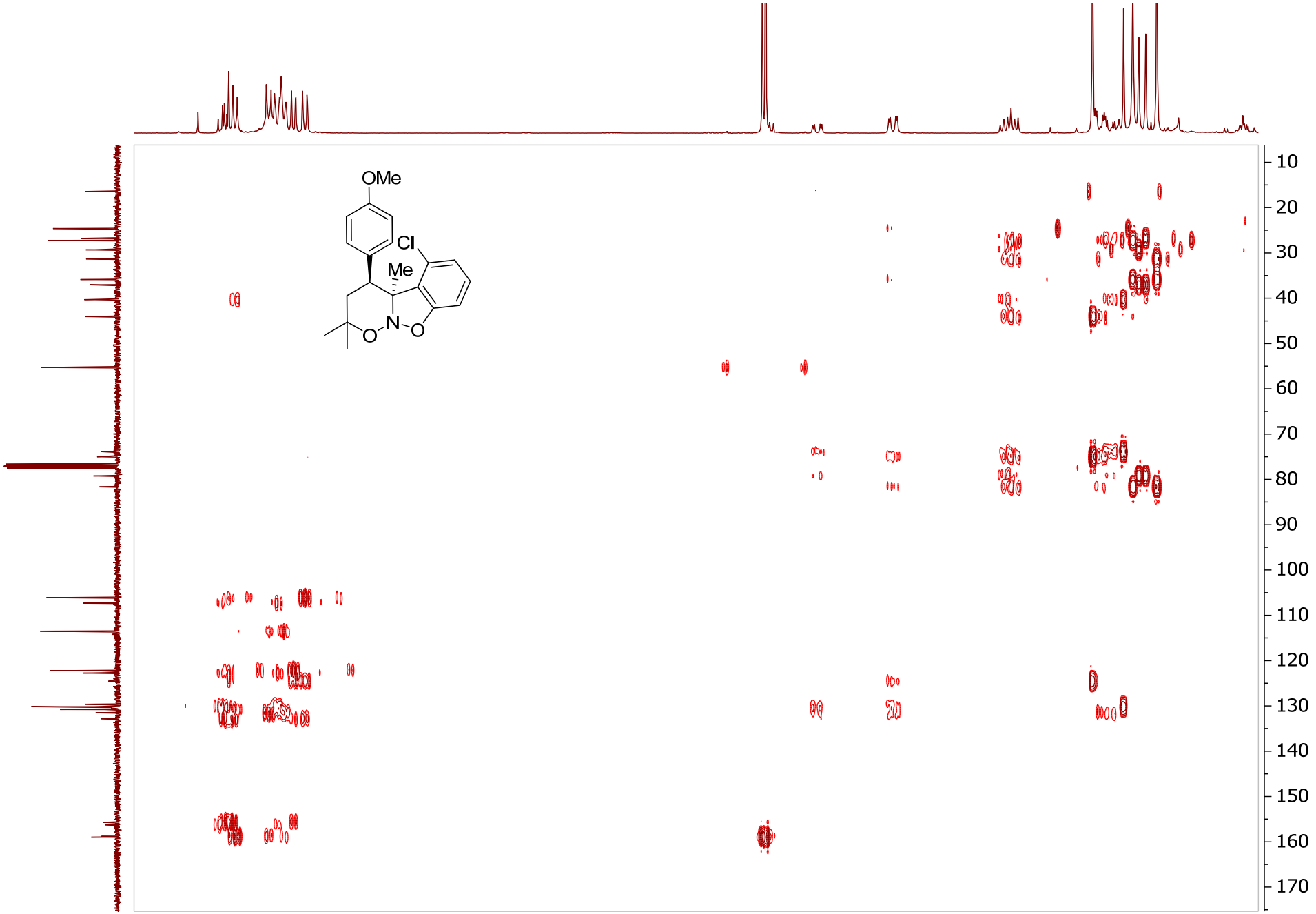
6.5
7.0

^{1}H-^{13}C HSQC



^{1}H-^{13}C HMBC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Cl
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100
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140
150
160
170
7.5
7.0
6.5
6.0
5.5
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4.0
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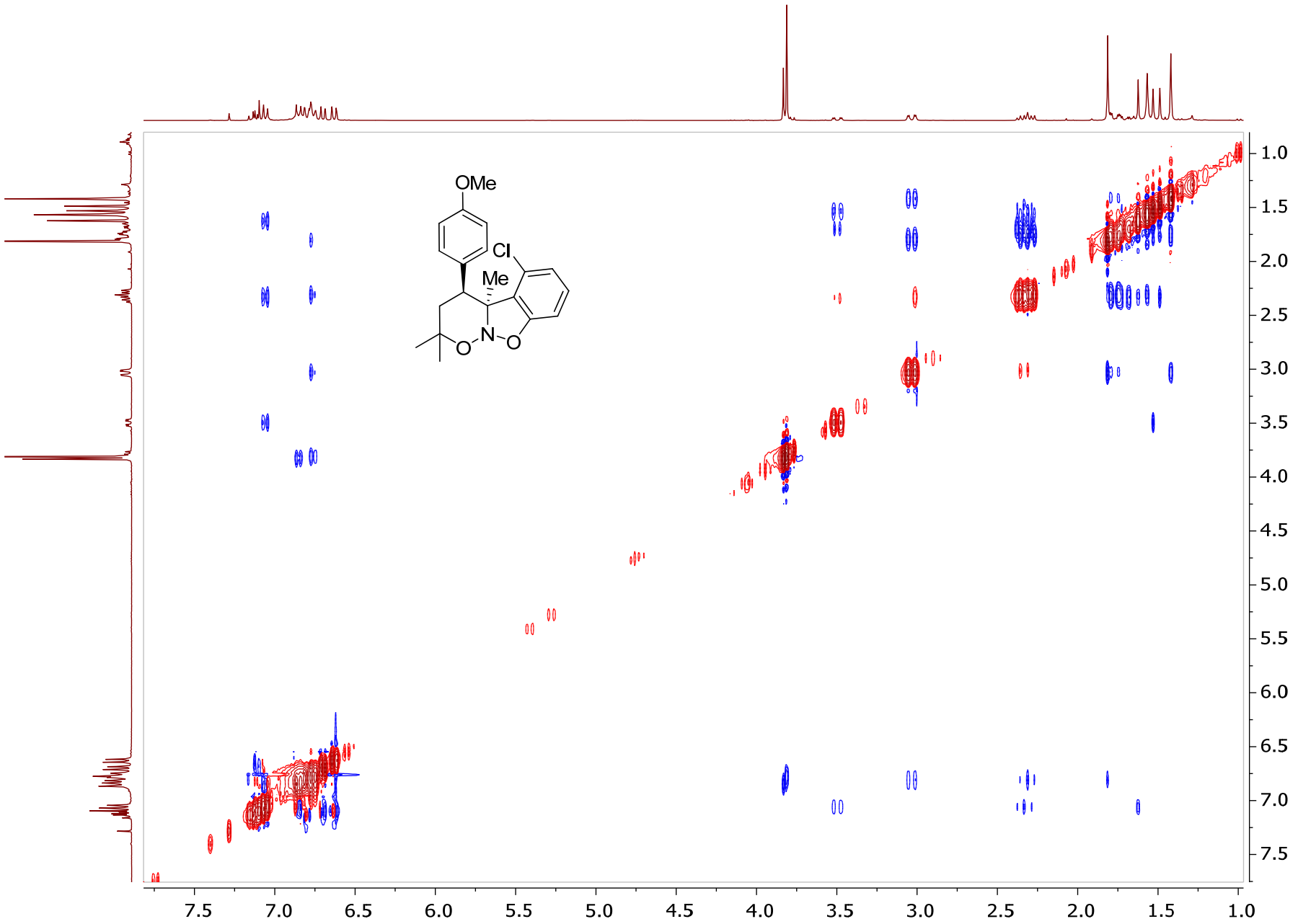
1.5
1.0

^{1}H-^{1}H NOESY


OMe
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O
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6.5
6.0
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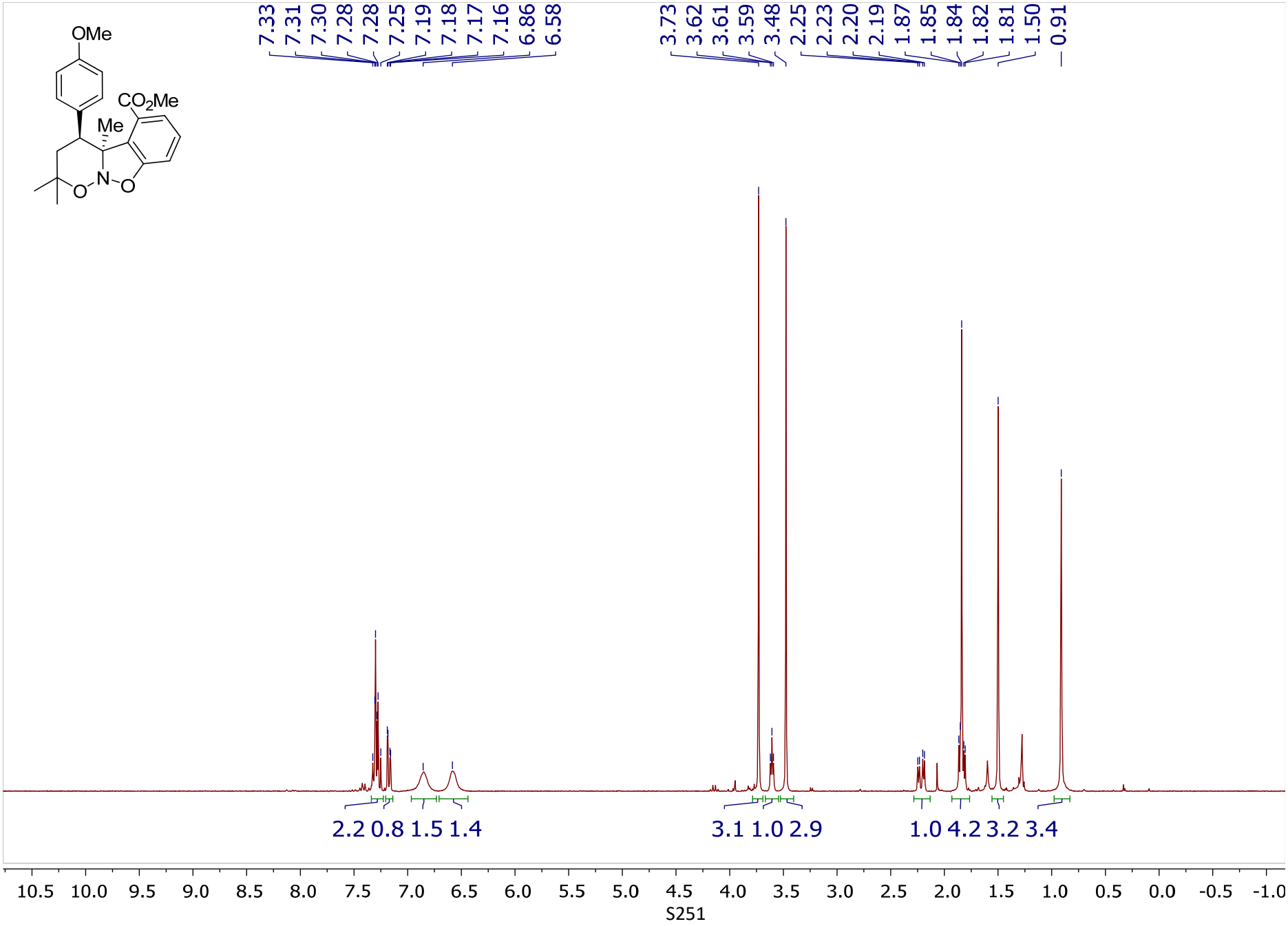
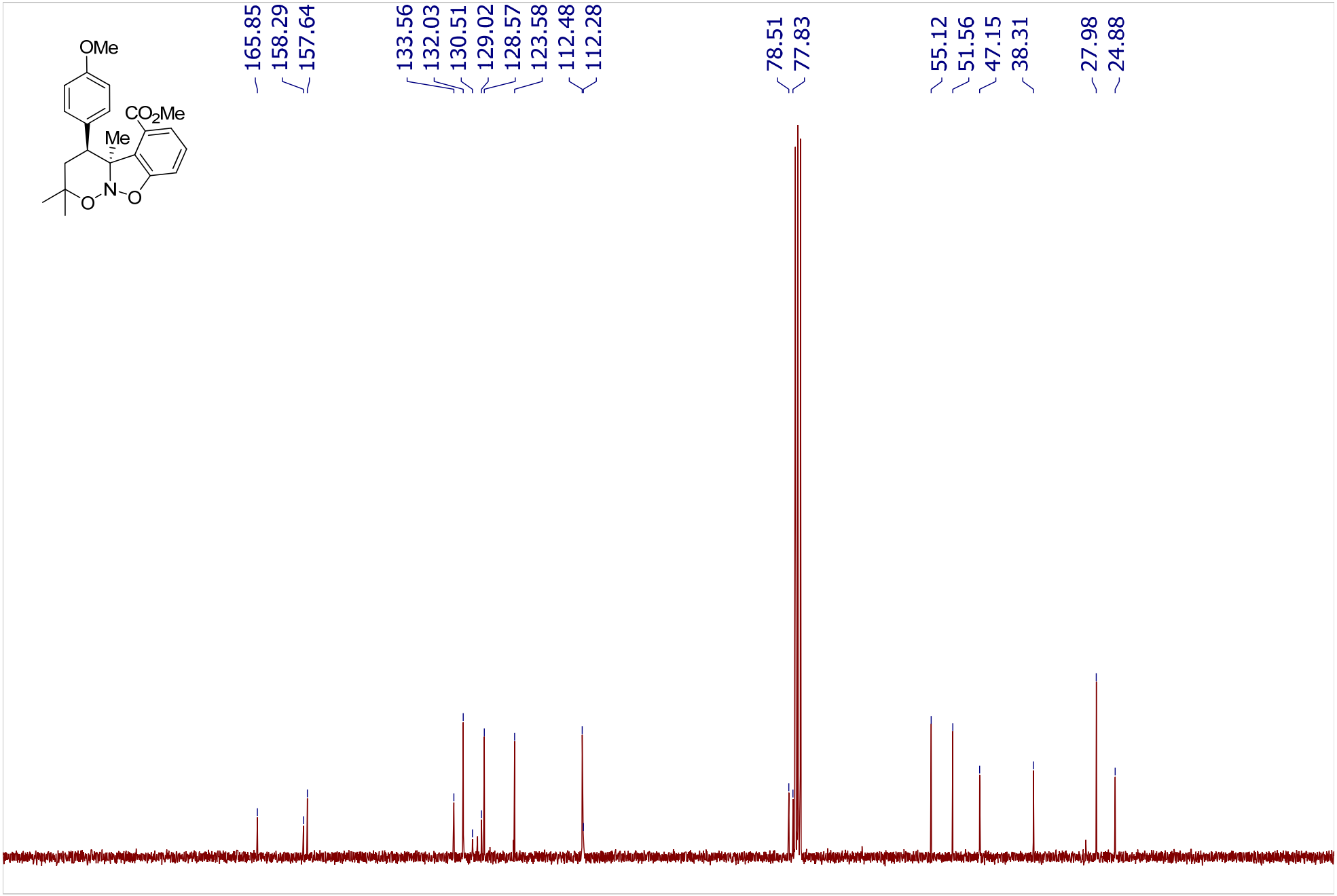
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

(4*S,4a*S**)-5-Methoxy-4-(4-methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine** (*trans*-**5ag**)

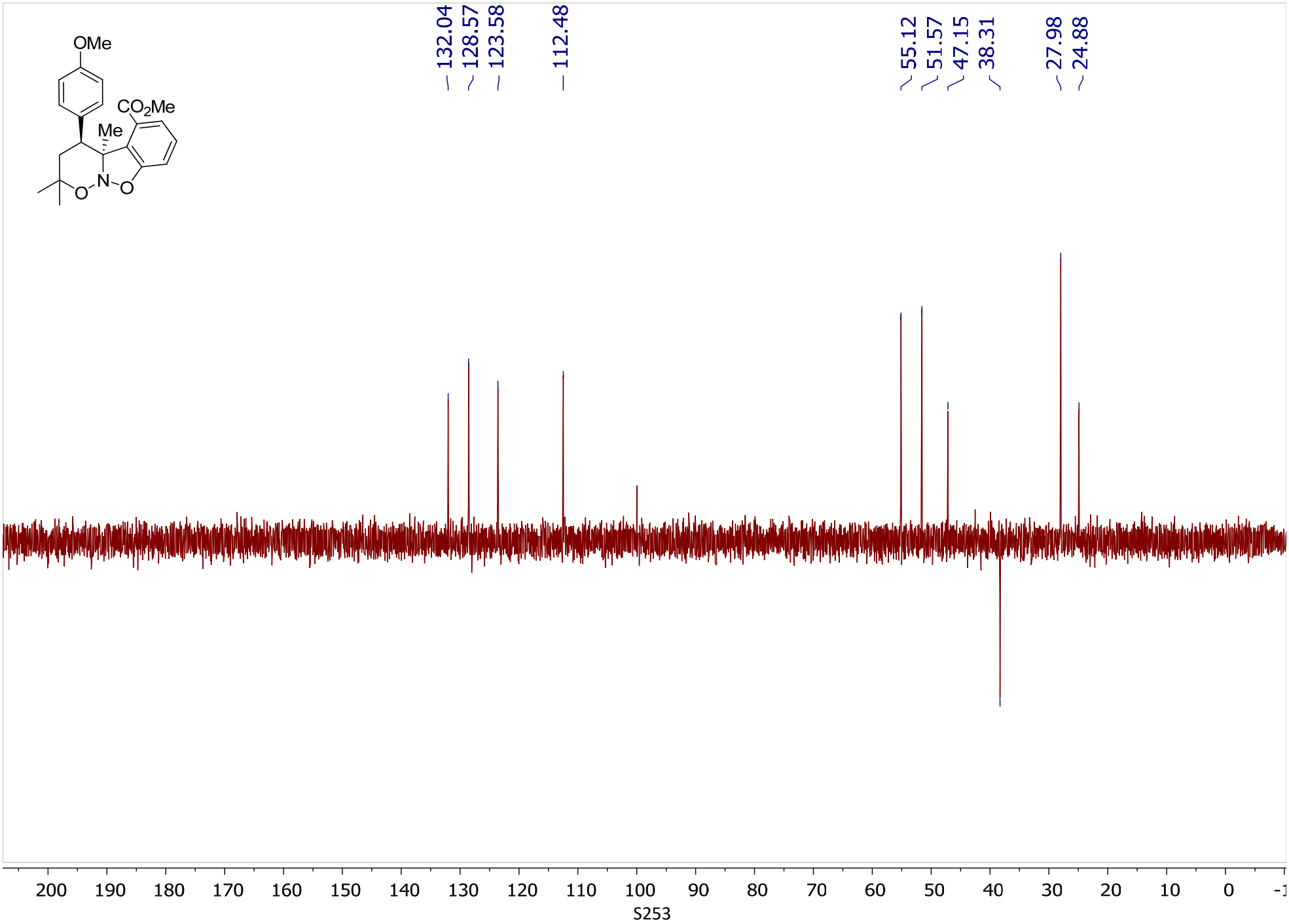
^{1}H NMR (300 MHz, $CDCl_3$)



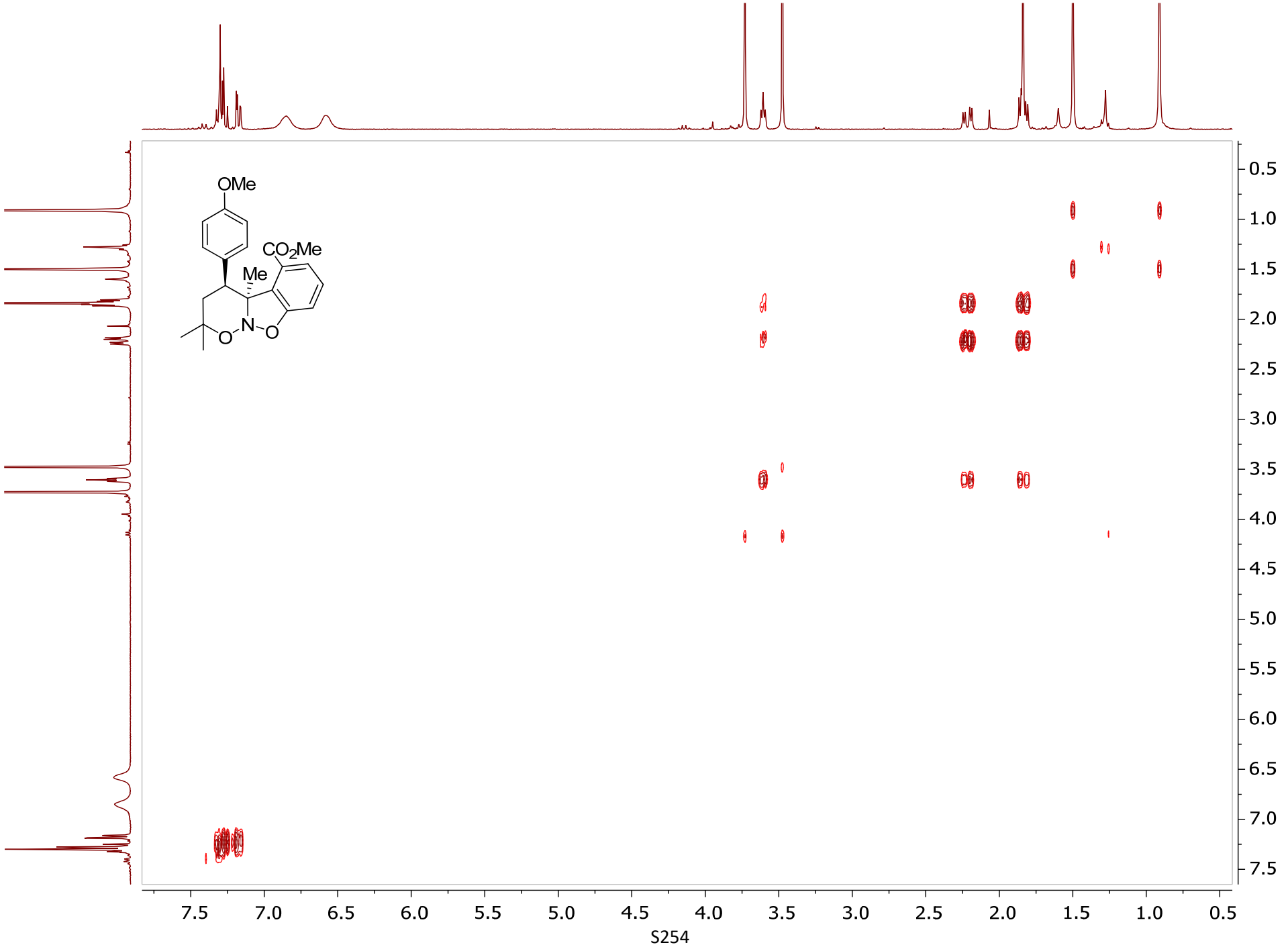
^{13}C NMR (75 MHz, $CDCl_3$)



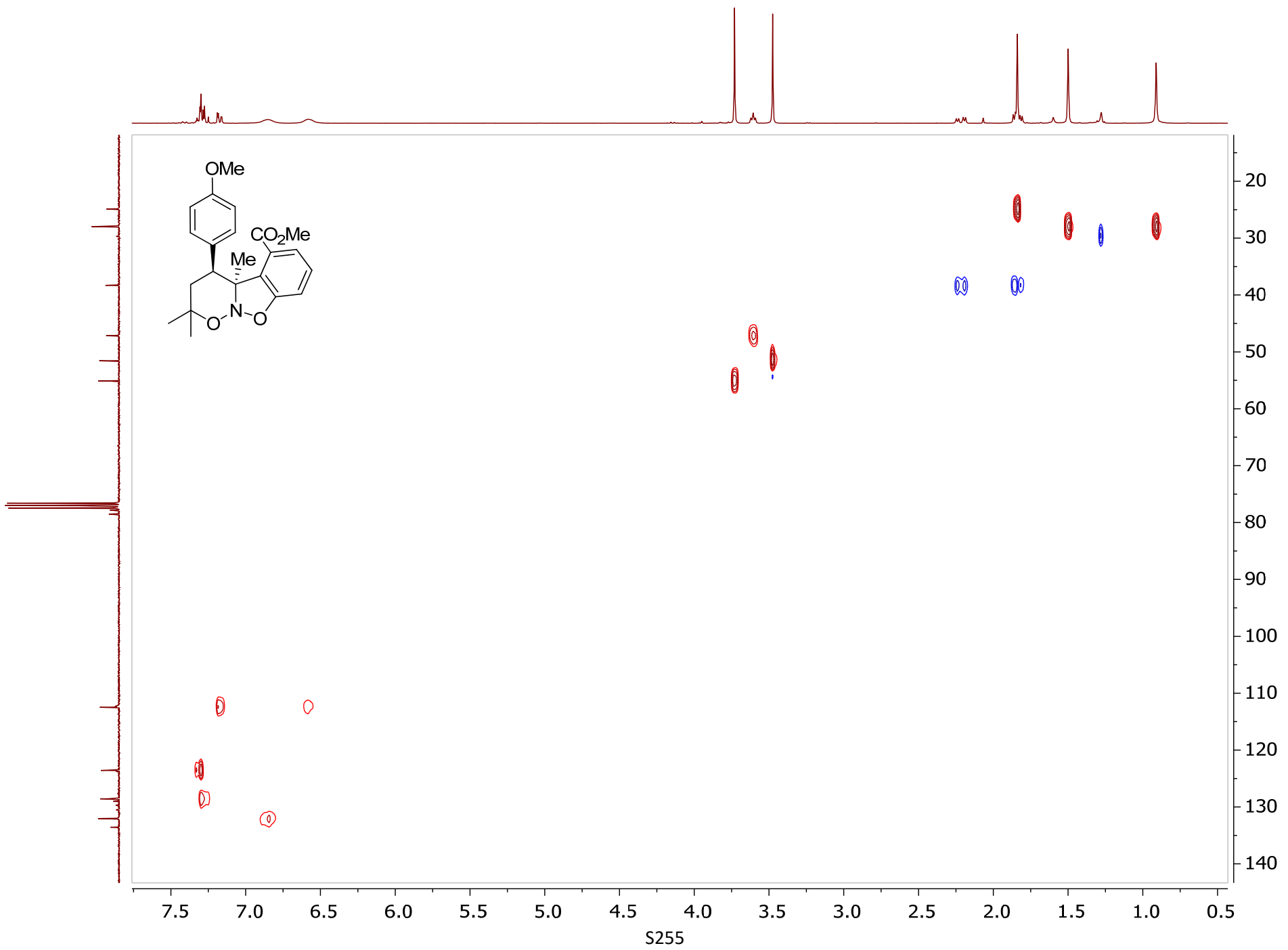
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



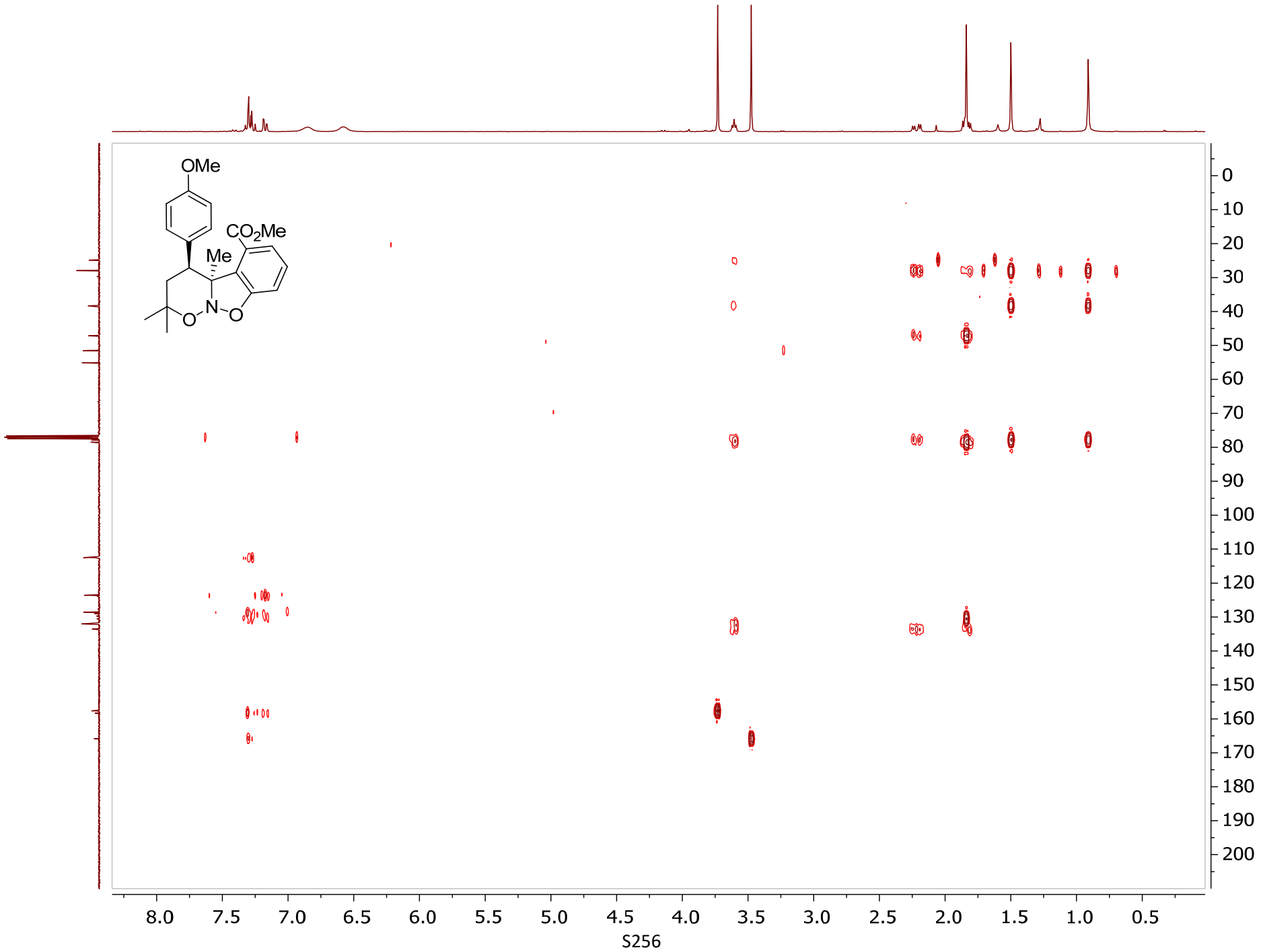
^{1}H-^{1}H COSY ($CDCl_3$))



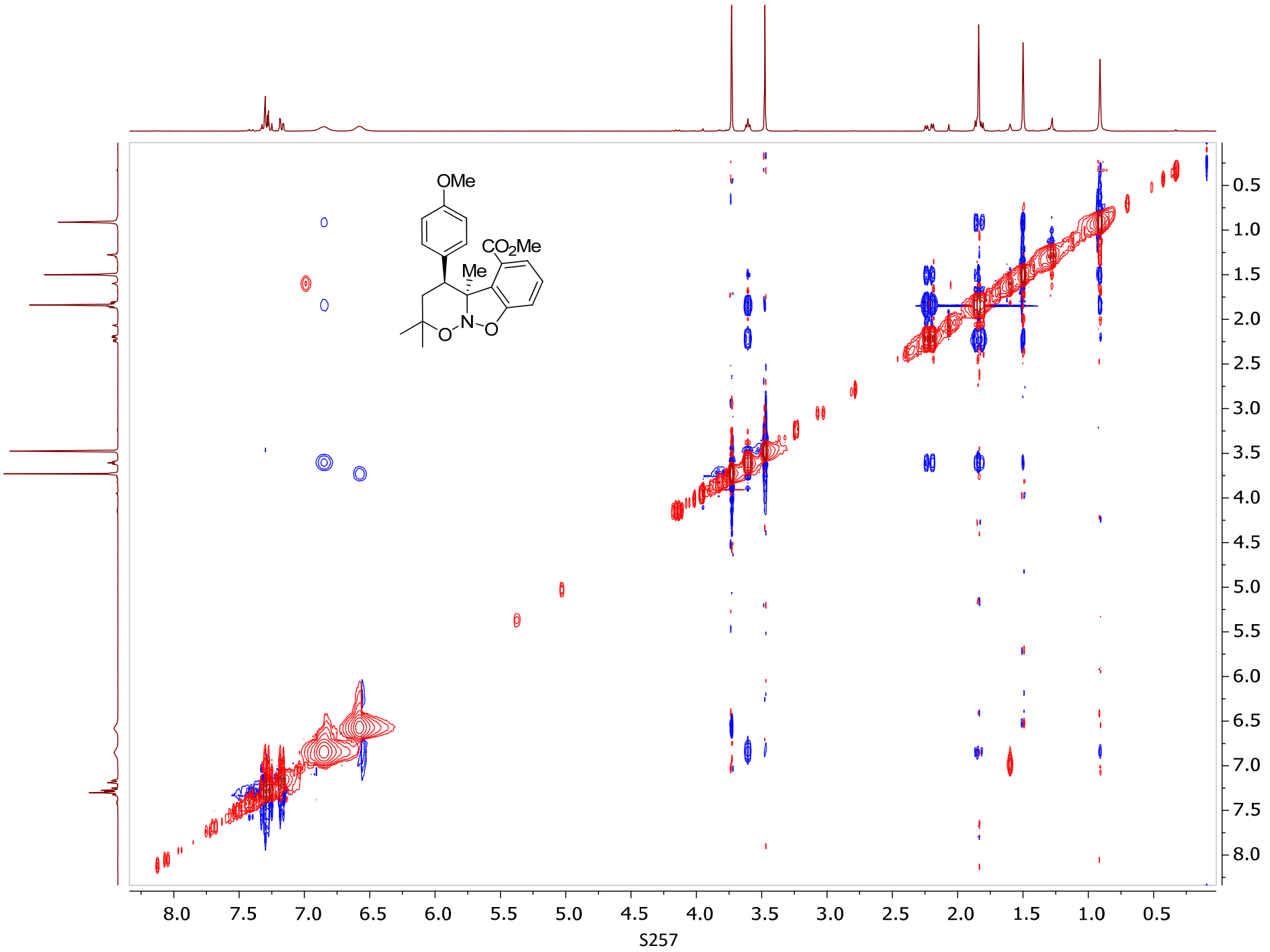
^{1}H-^{13}C HSQC ($CDCl_3$))



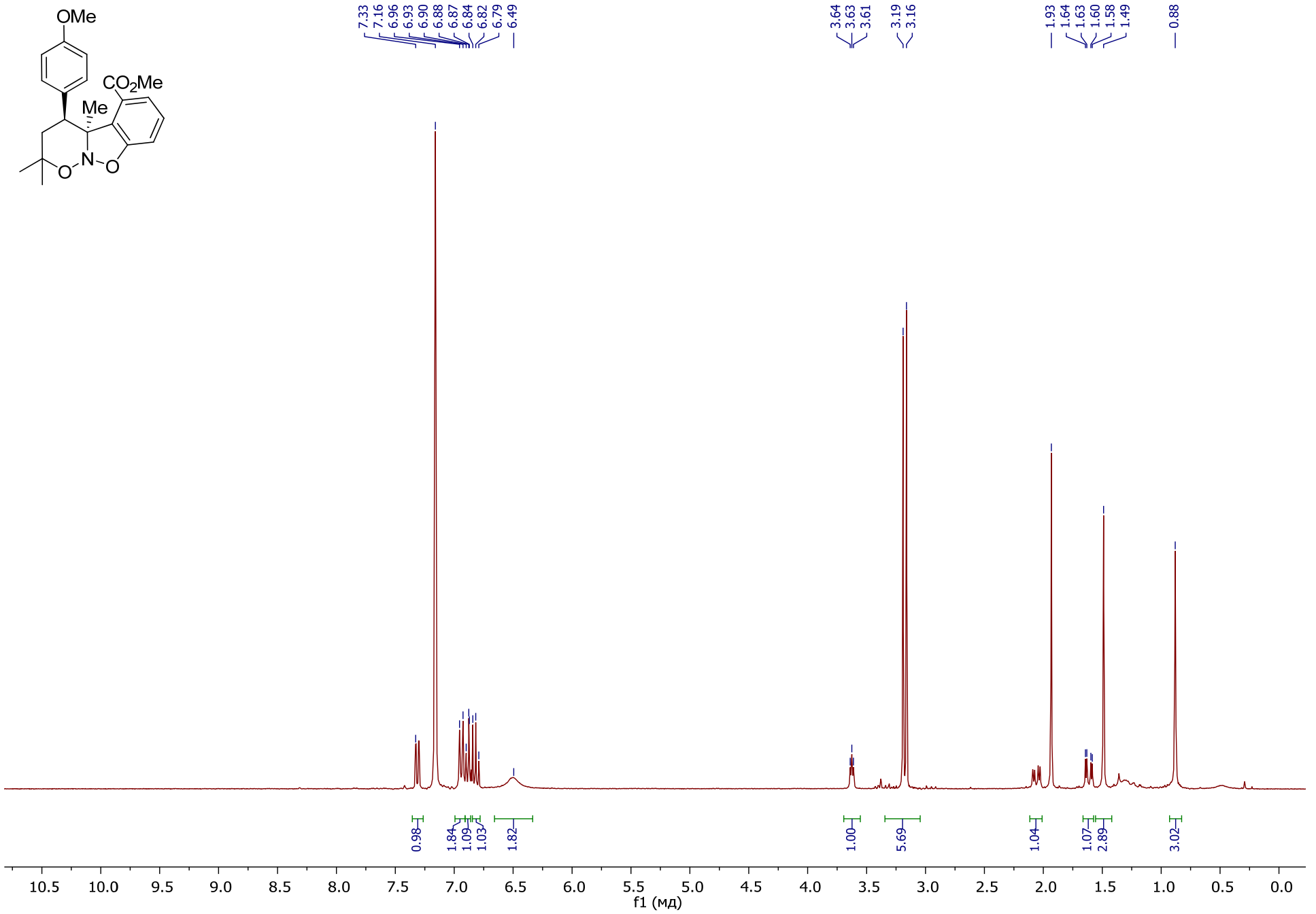
^{1}H-^{13}C HMBC ($CDCl_3$)



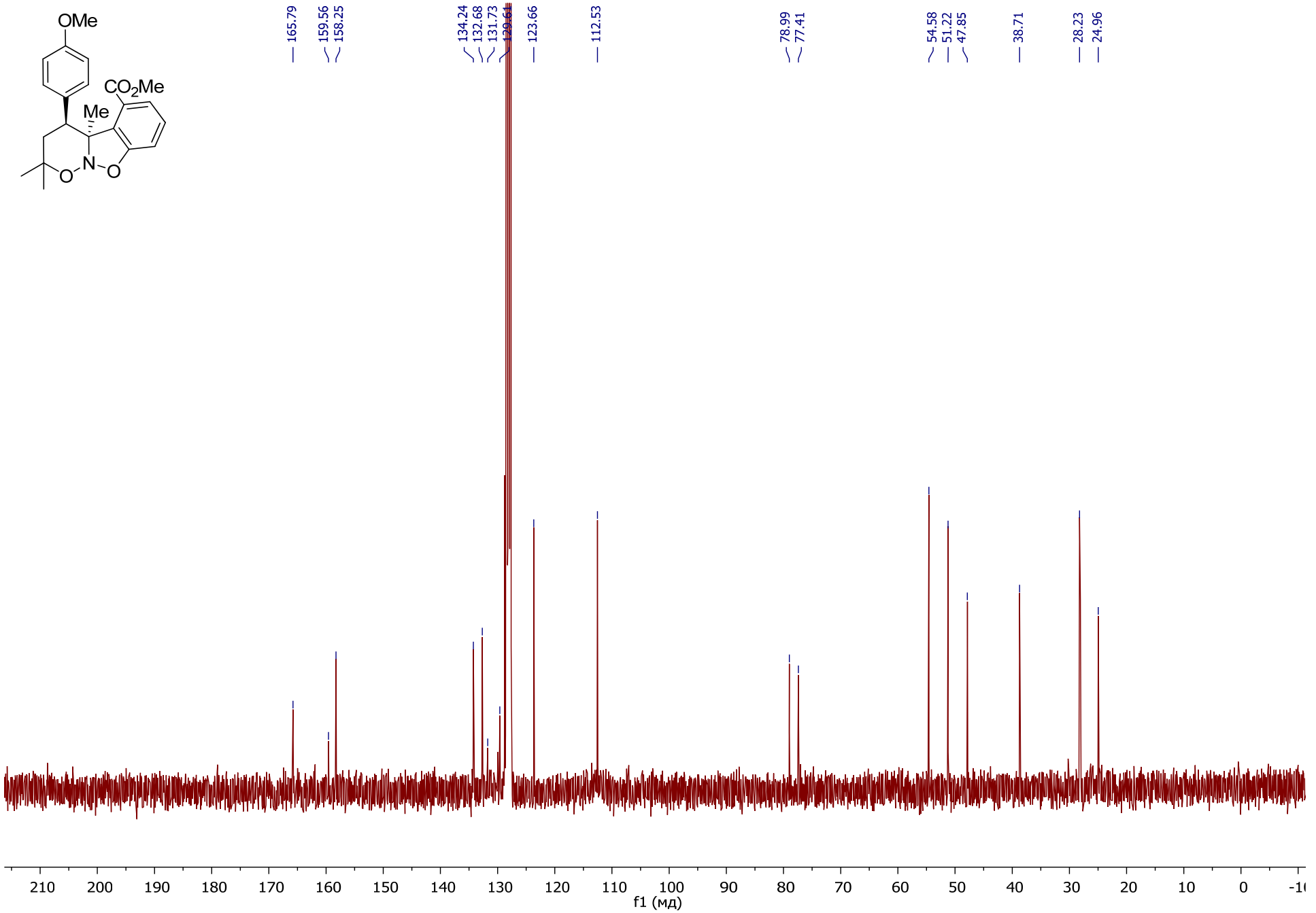
^{1}H-^{1}H NOESY ($CDCl_3$)



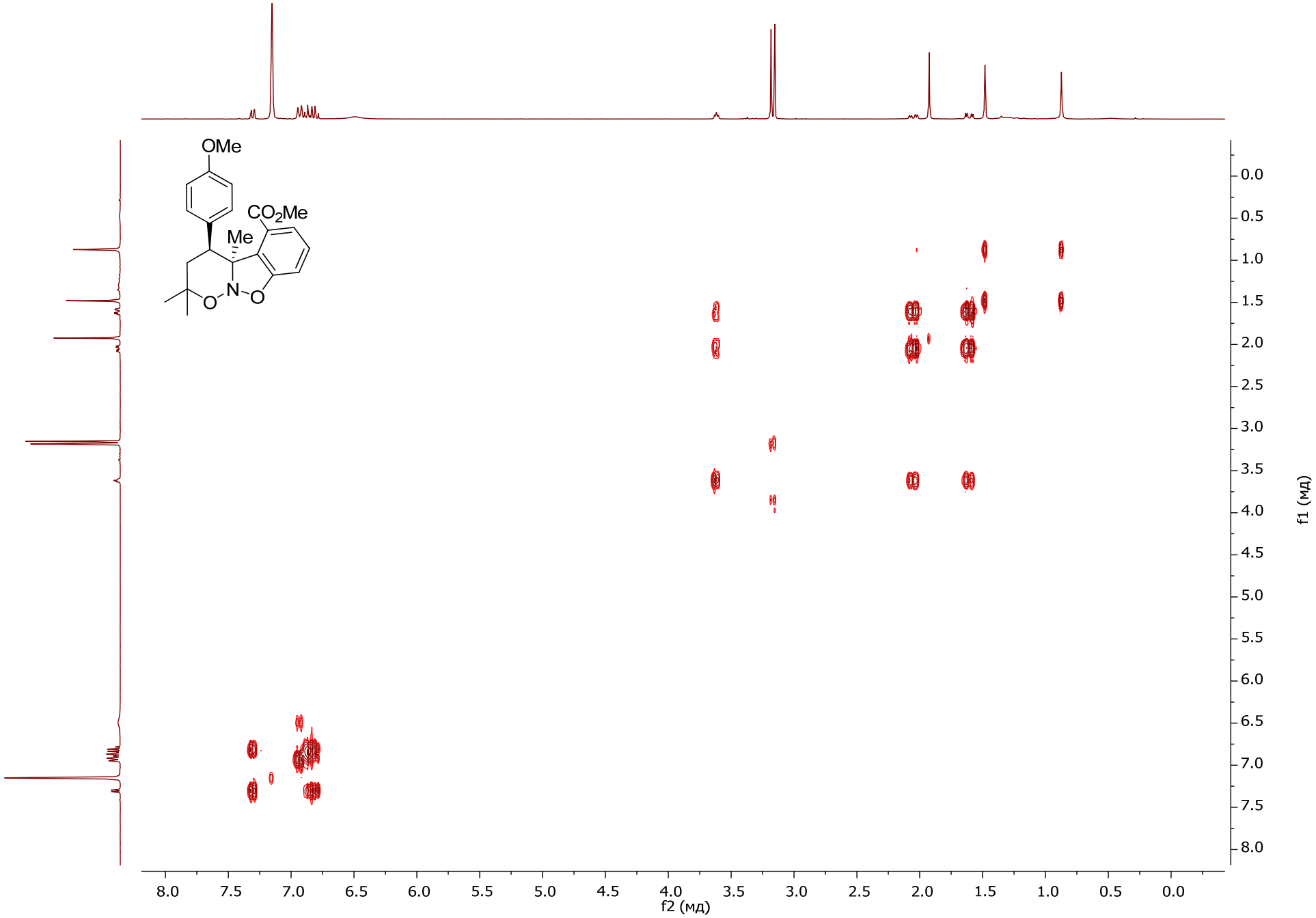
^{1}H NMR (300 MHz, benzene-d_6)



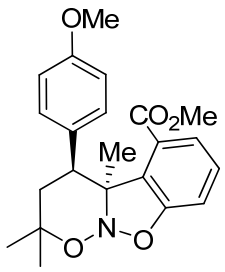
^{13}C NMR (75 MHz, benzene-d_6)



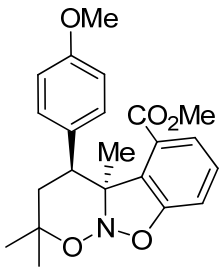
^{1}H-^{1}H COSY (benzene-d_6)



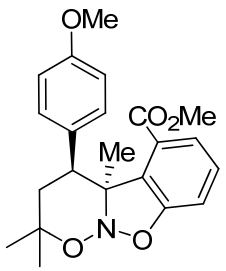
^{1}H-^{13}C HSQC (benzene-d_6)

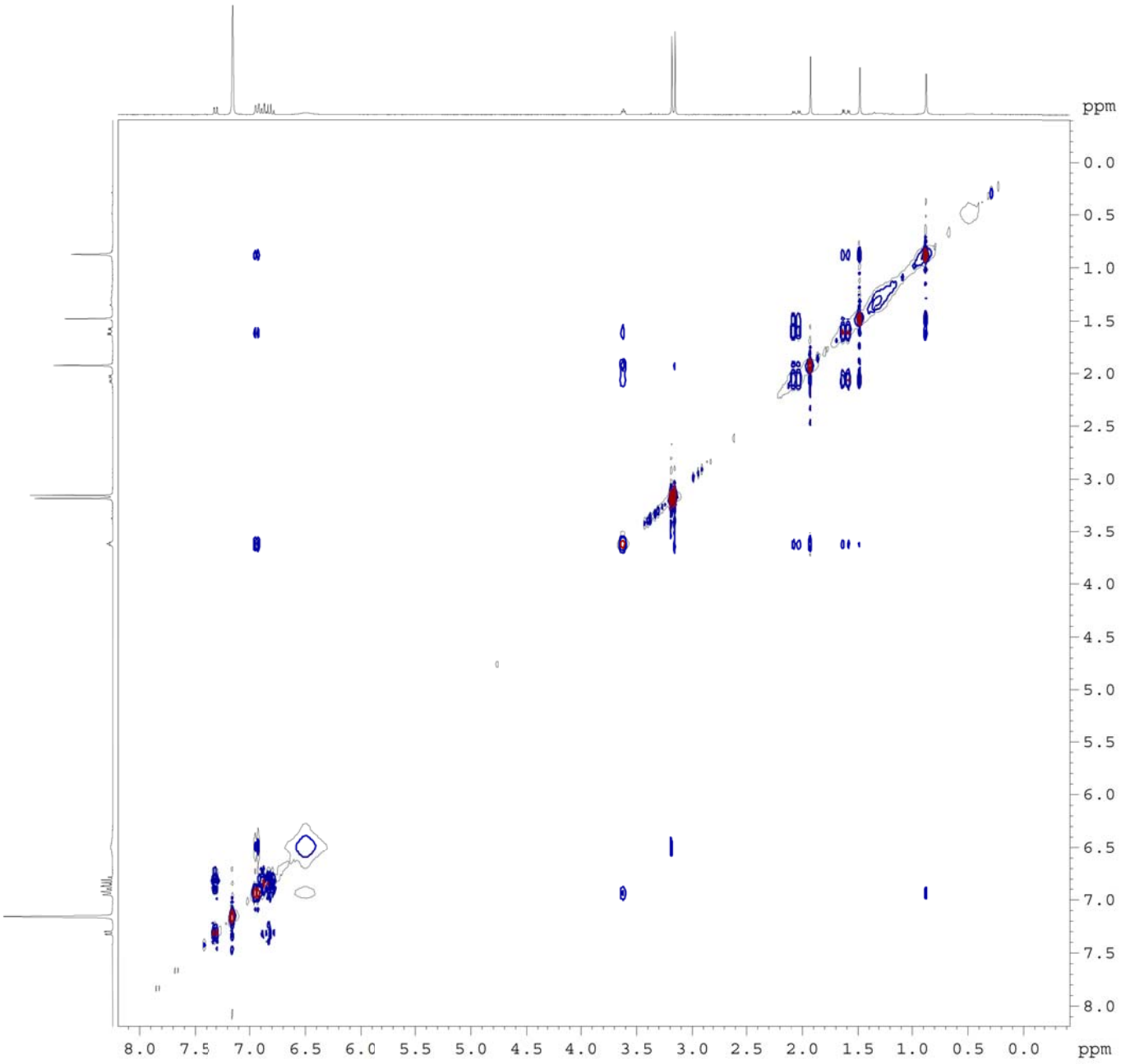


^{1}H-^{13}C HMBC (benzene-d$_6$)

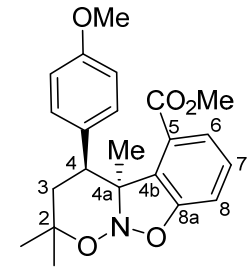


^{1}H-^{1}H NOESY (benzene-d_6)



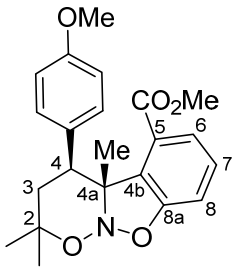


5-Methoxy-4-(4-methoxyphenyl)-2,2,4a-trimethyl-2,3,4,4a-tetrahydrobenzo[4,5]isoxazolo[2,3-b][1,2]oxazine (*trans*-5ag and *cis*-5ag)



trans-**5ag**

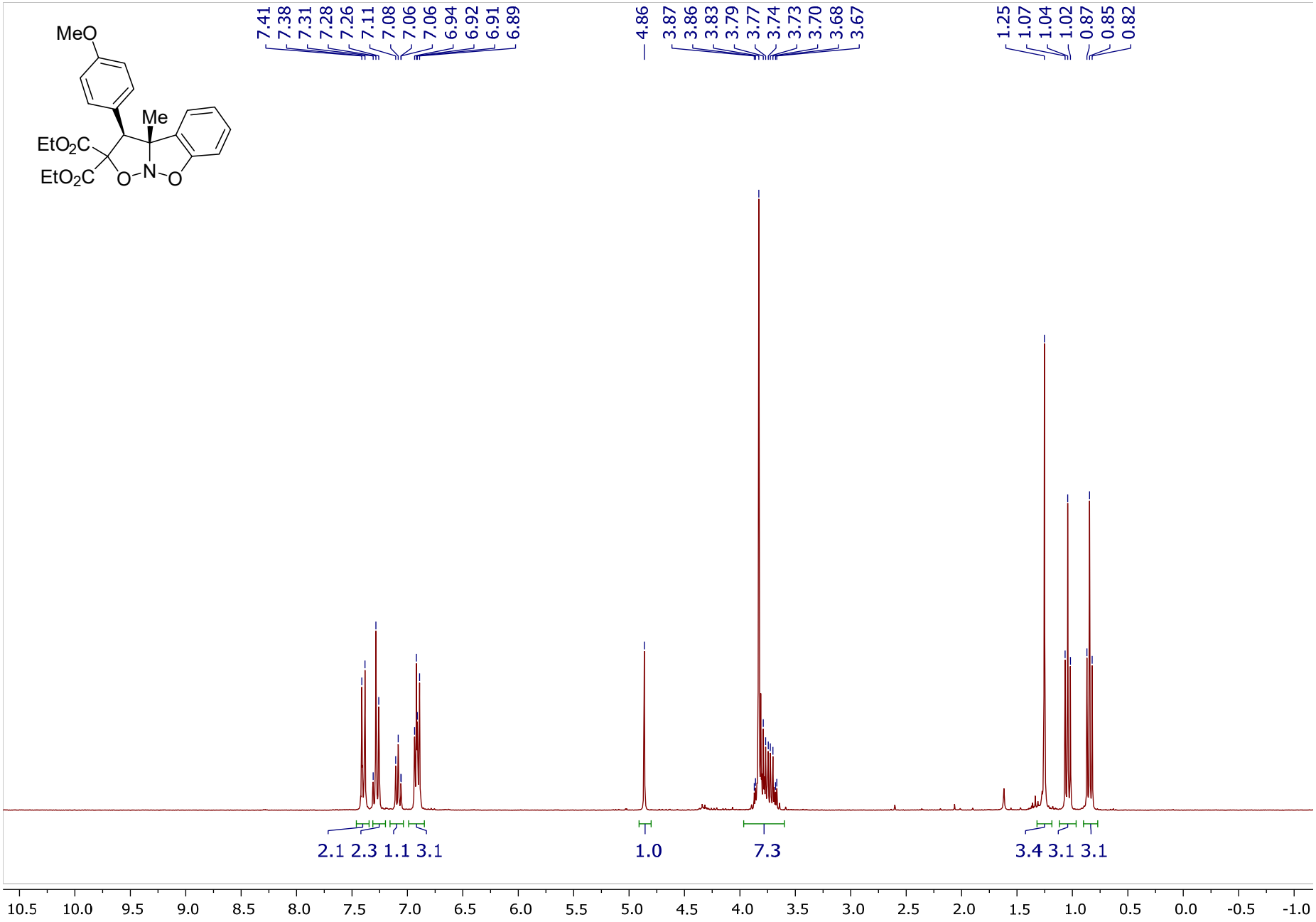
+



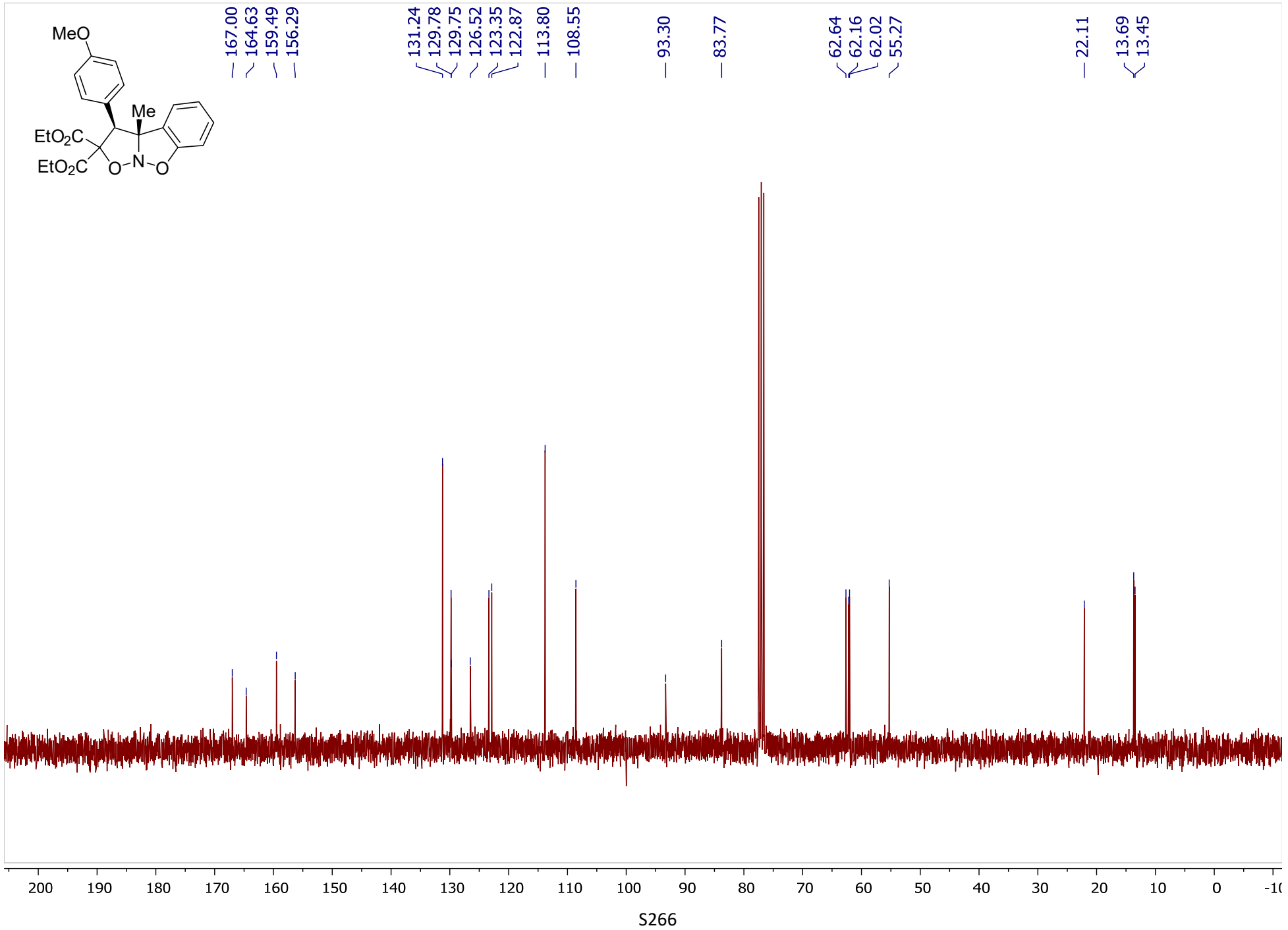
cis-**5ag**

Diethyl (3*S,3a*R**)-3-(4-methoxyphenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate 6aa**

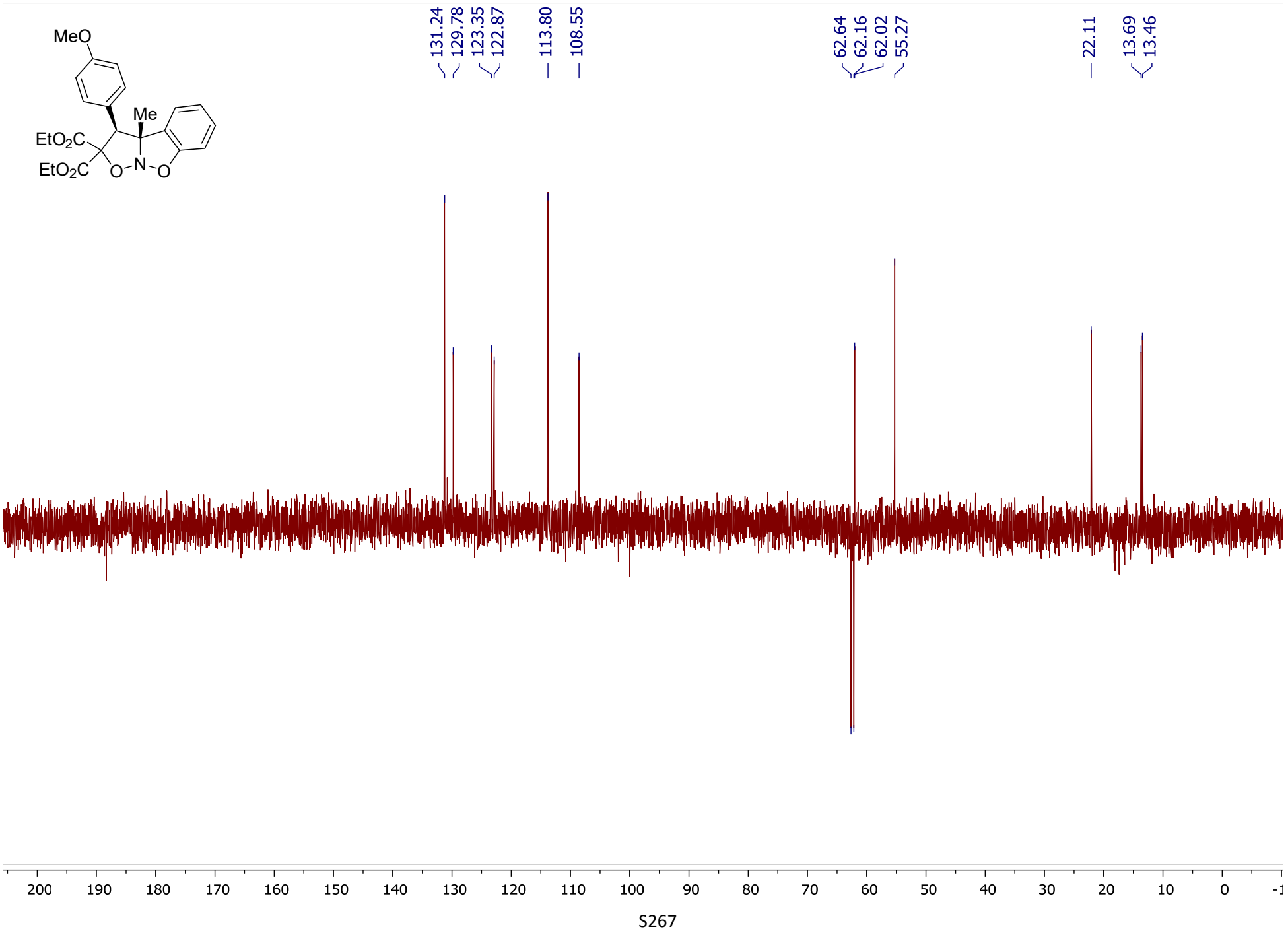
^{1}H NMR (300 MHz, $CDCl_3$)



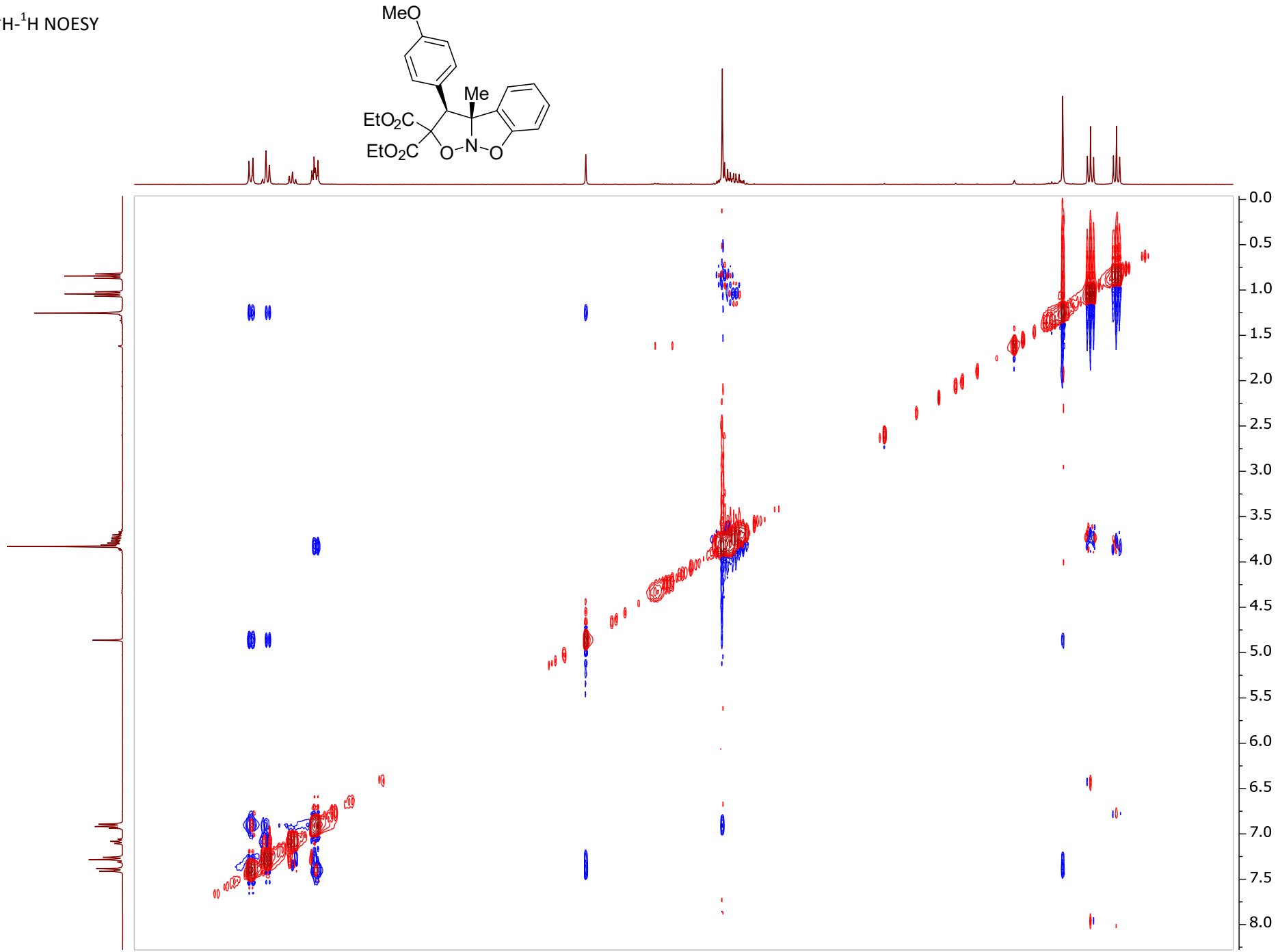
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H NOESY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Me
EtO2C
EtO2C
O
N
O
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0.5
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1.5
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2.5
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3.5
4.0
4.5
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5.5
6.0
6.5
7.0
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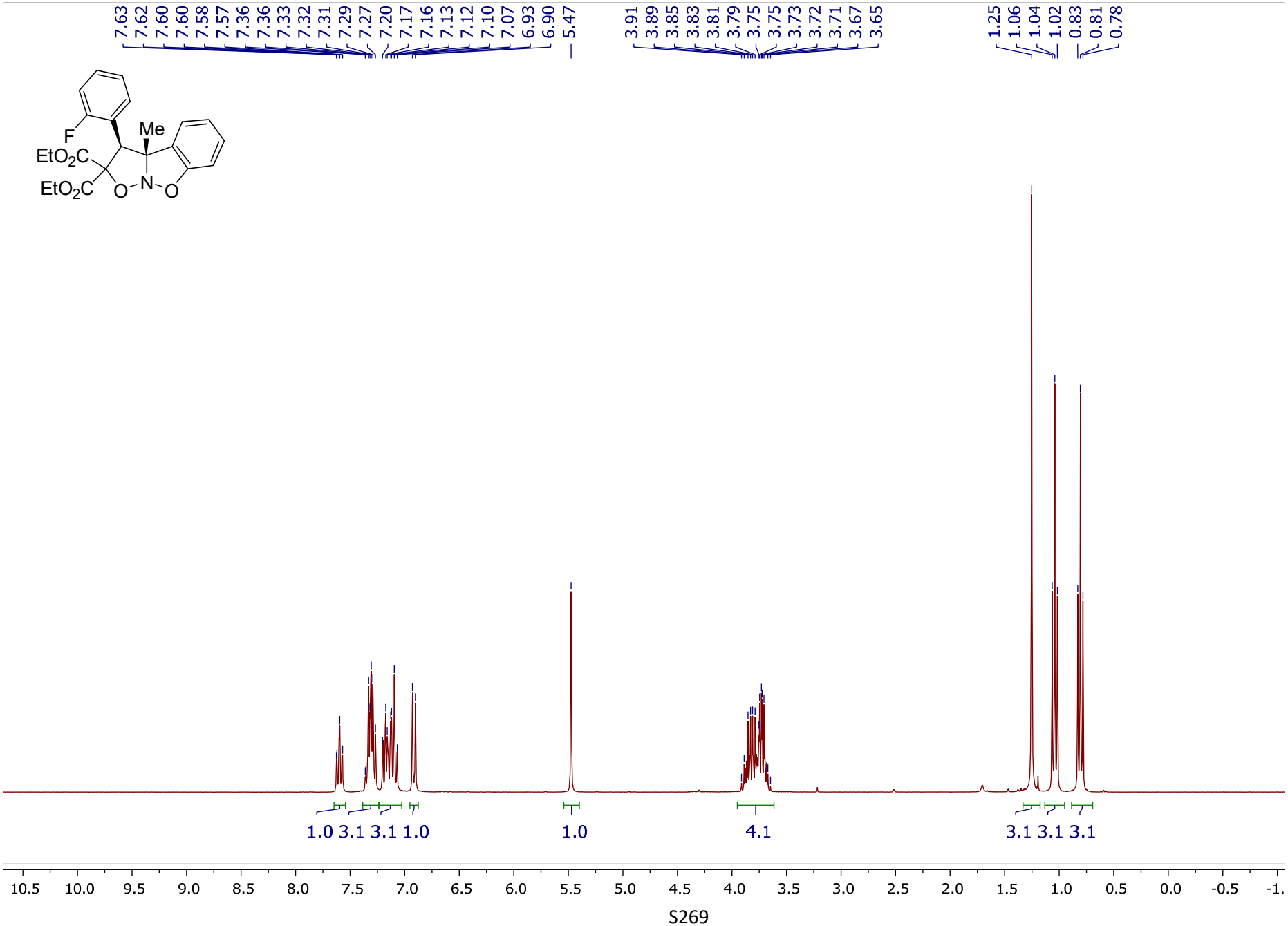
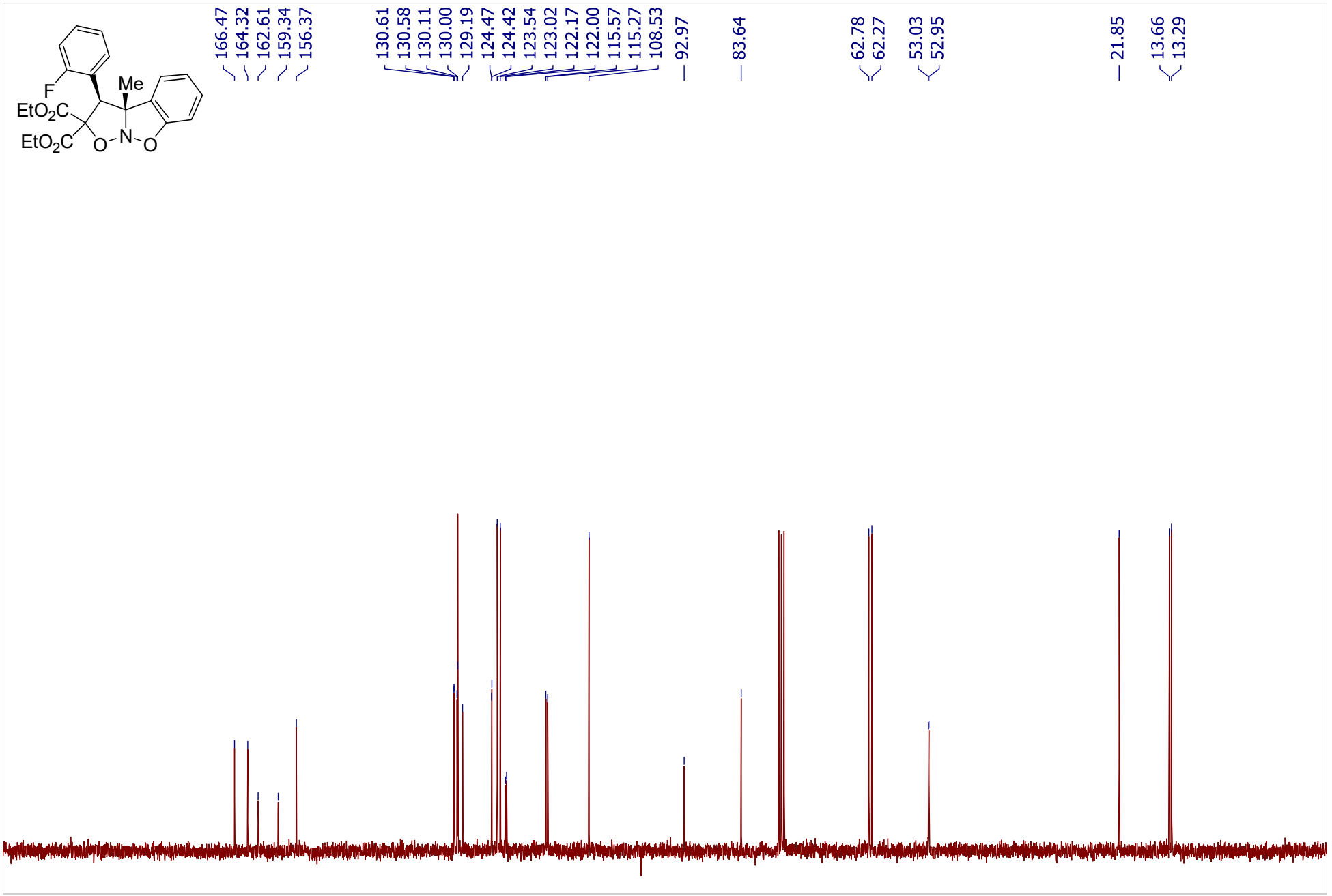
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

Diethyl (3*S,3a*R**)-3-(2-fluorophenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate 6ba**

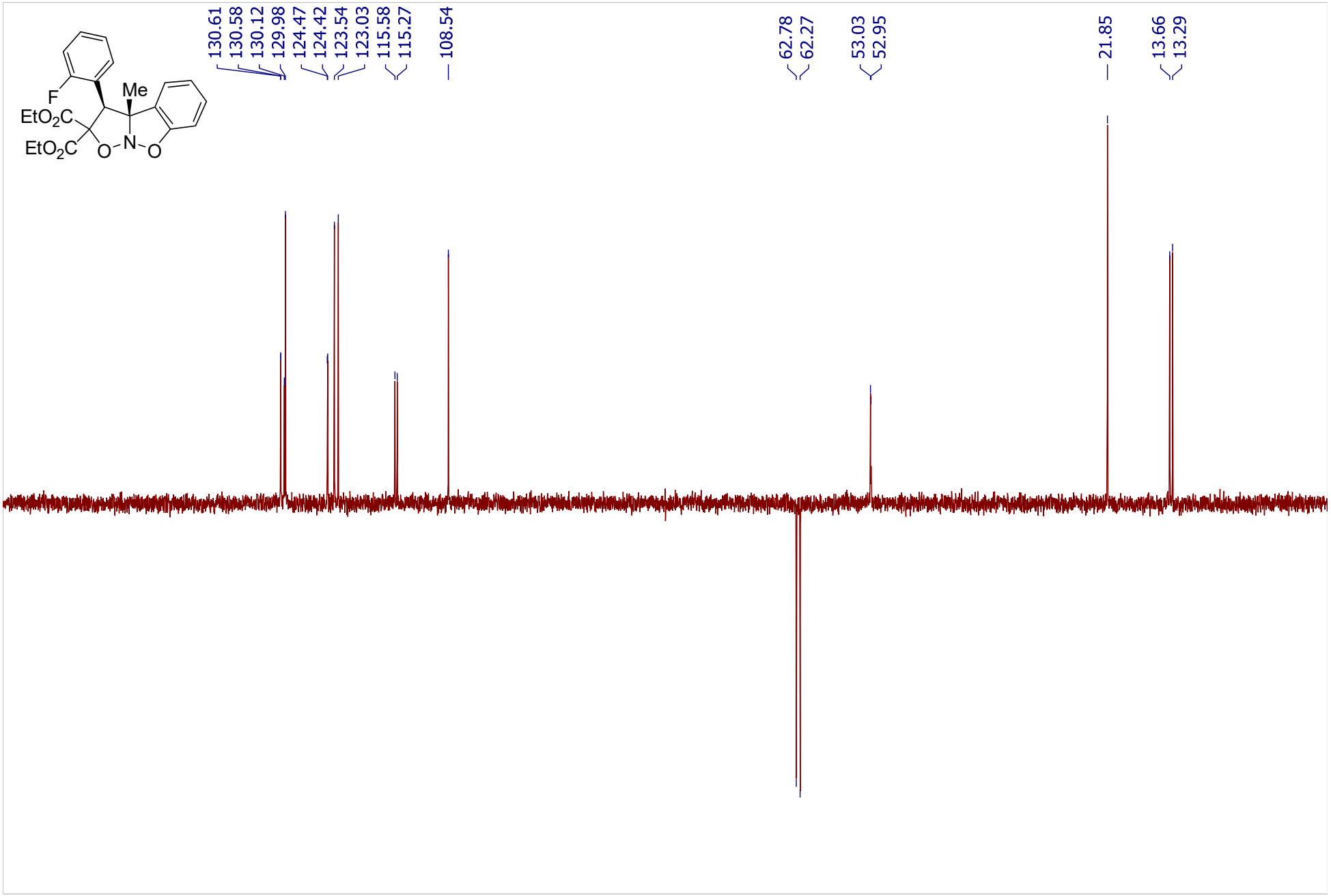
^{1}H NMR (300 MHz, $CDCl_3$)



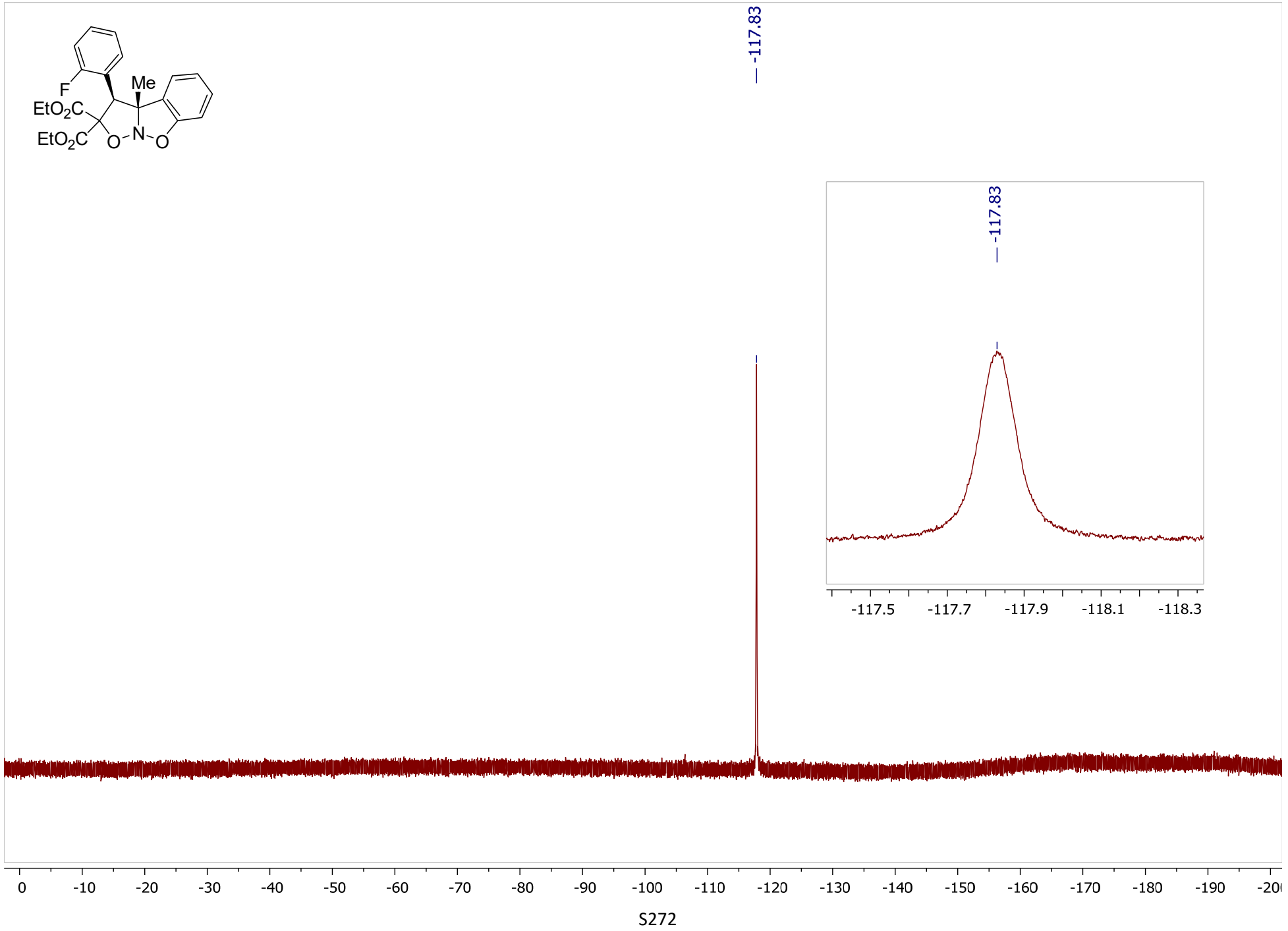
^{13}C NMR (75 MHz, $CDCl_3$)



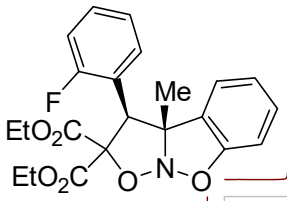
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{19}F NMR (282 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


F
Me
EtO2C
EtO2C
O
N
O

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
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7.5
8.0
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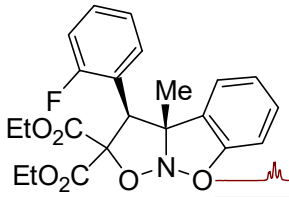
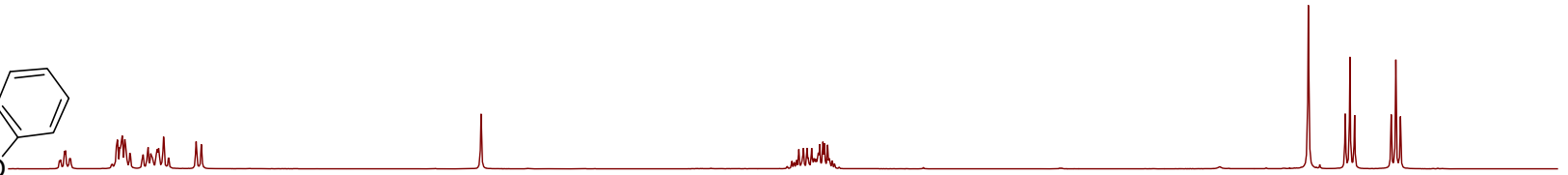
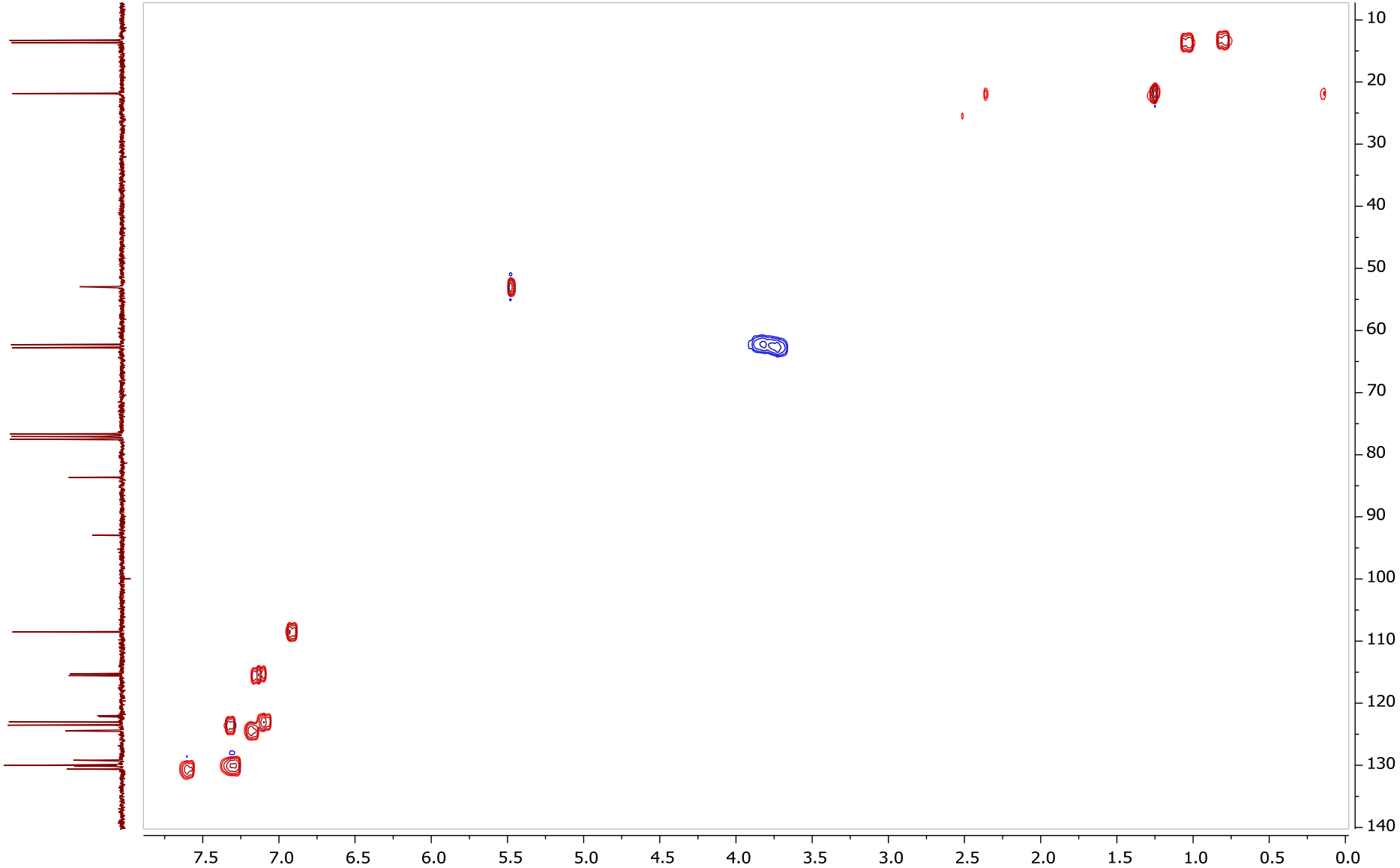
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{13}C HSQC


F
Me
EtO2C
EtO2C
O
N
O

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30
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50
60
70
80
90
100
110
120
130
140
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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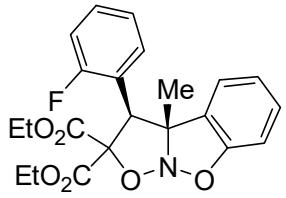
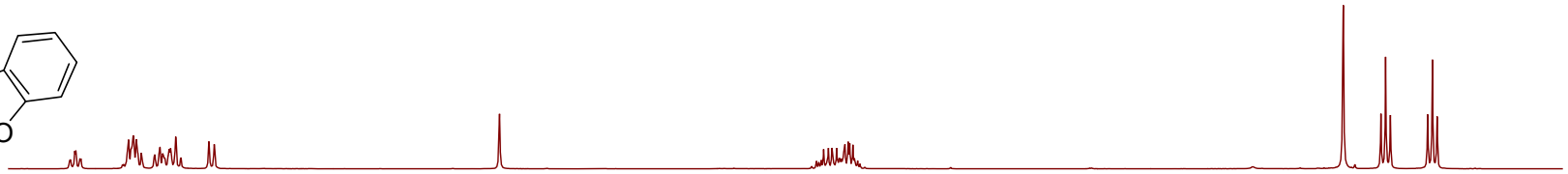
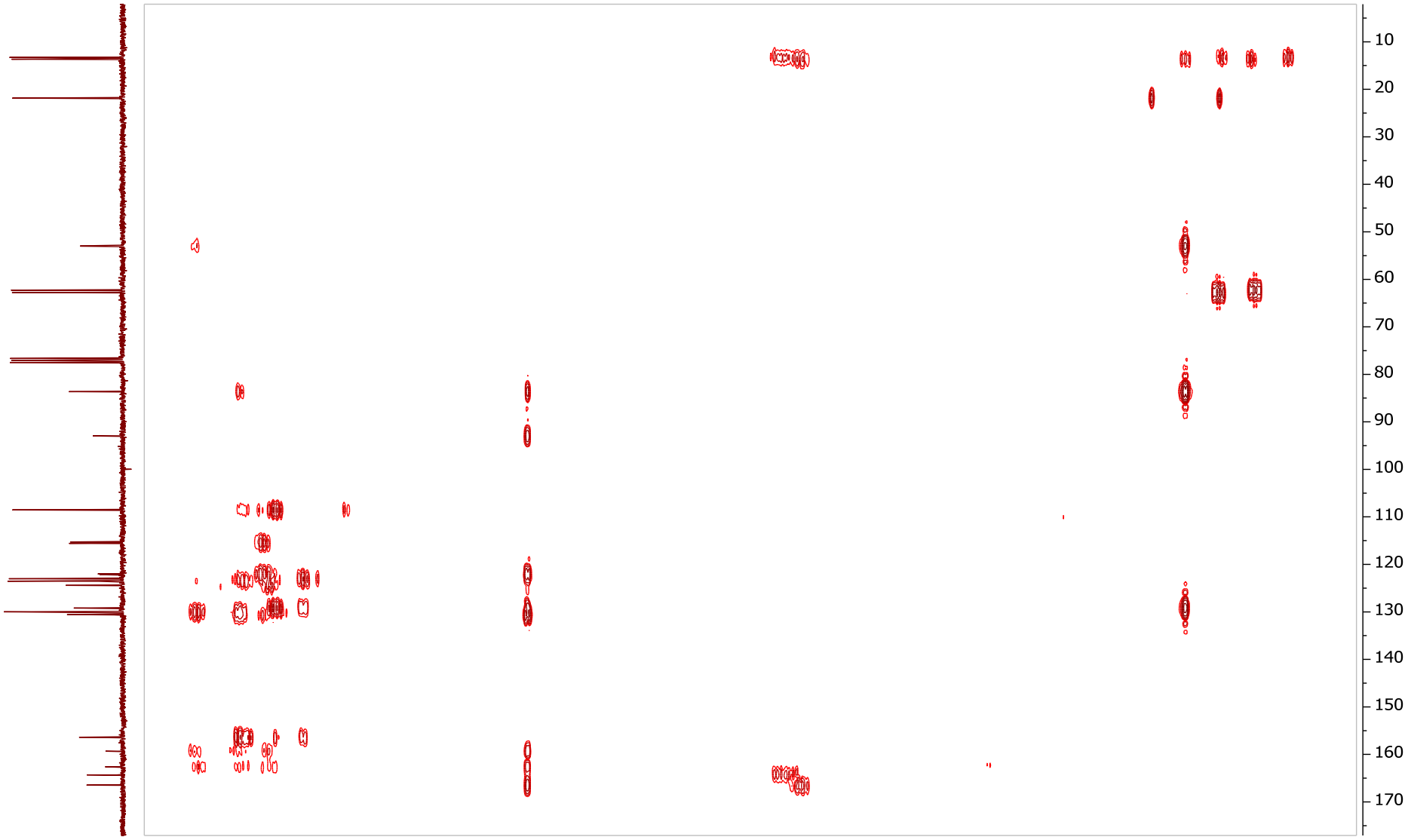
3.0
2.5
2.0
1.5
1.0
0.5
0.0

^{1}H-^{13}C HMBC


F
Me
EtO2C
EtO2C
O
N
O




10
20
30
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50
60
70
80
90
100
110
120
130
140
150
160
170
7.5
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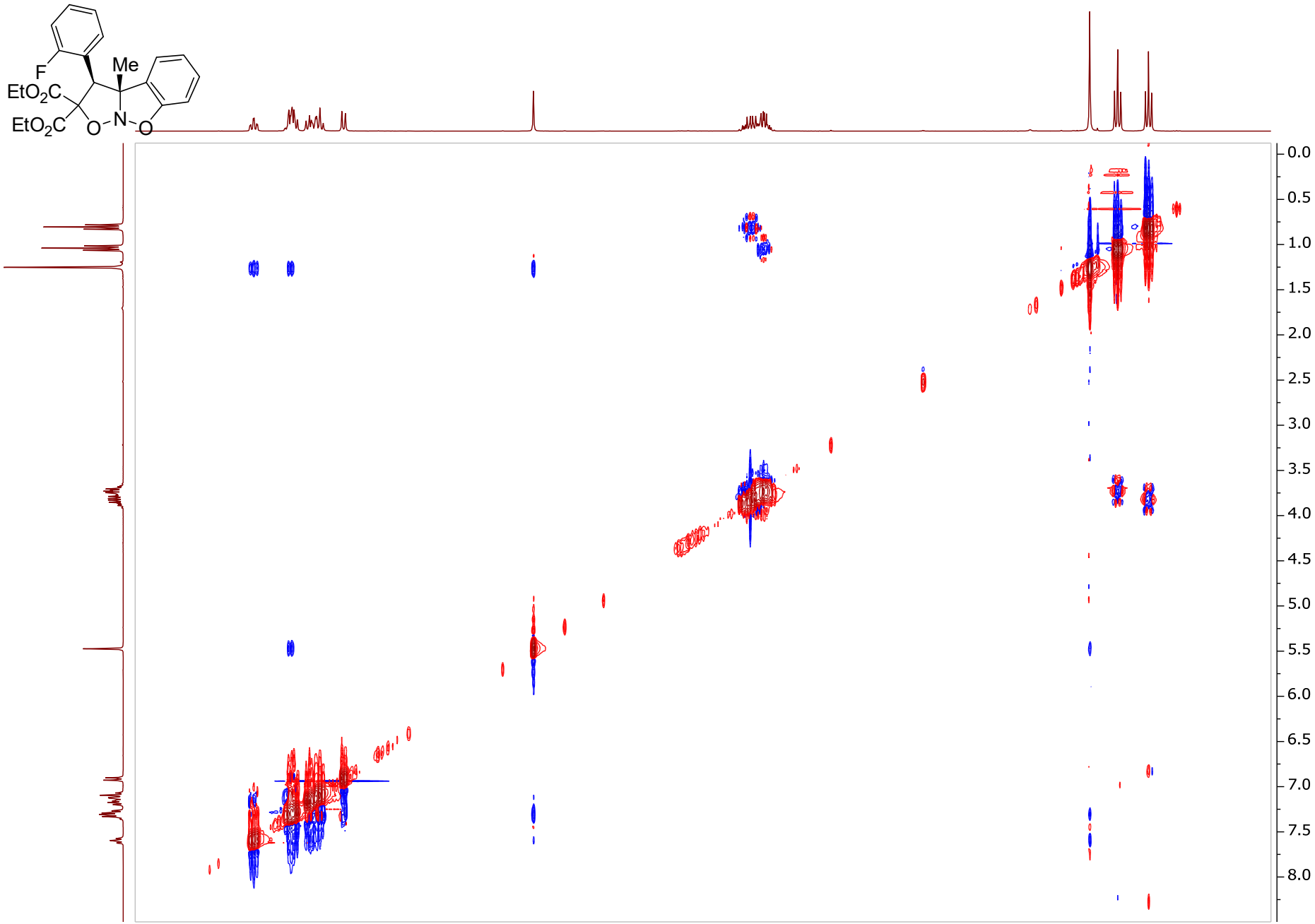
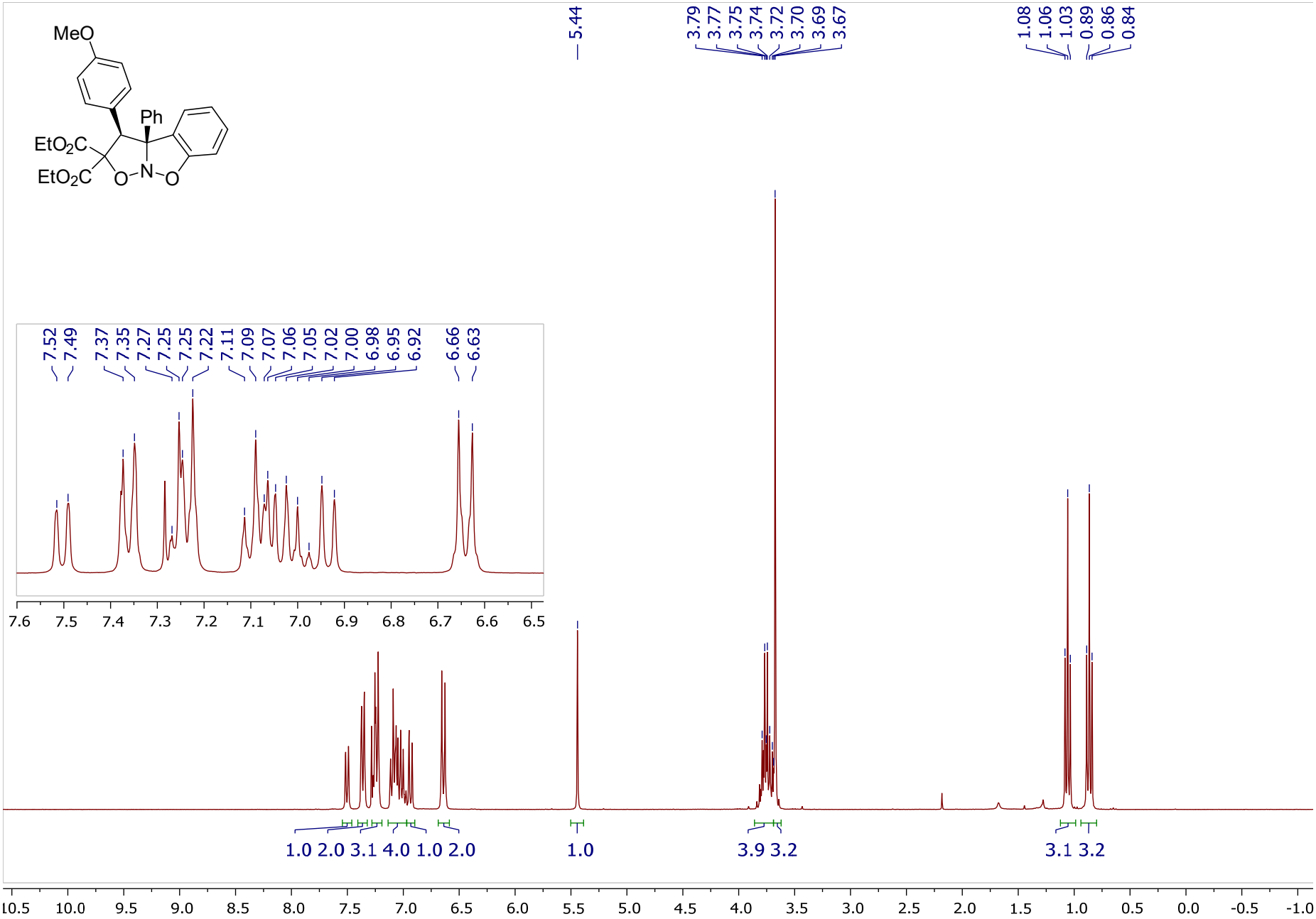
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{1}H NOESY

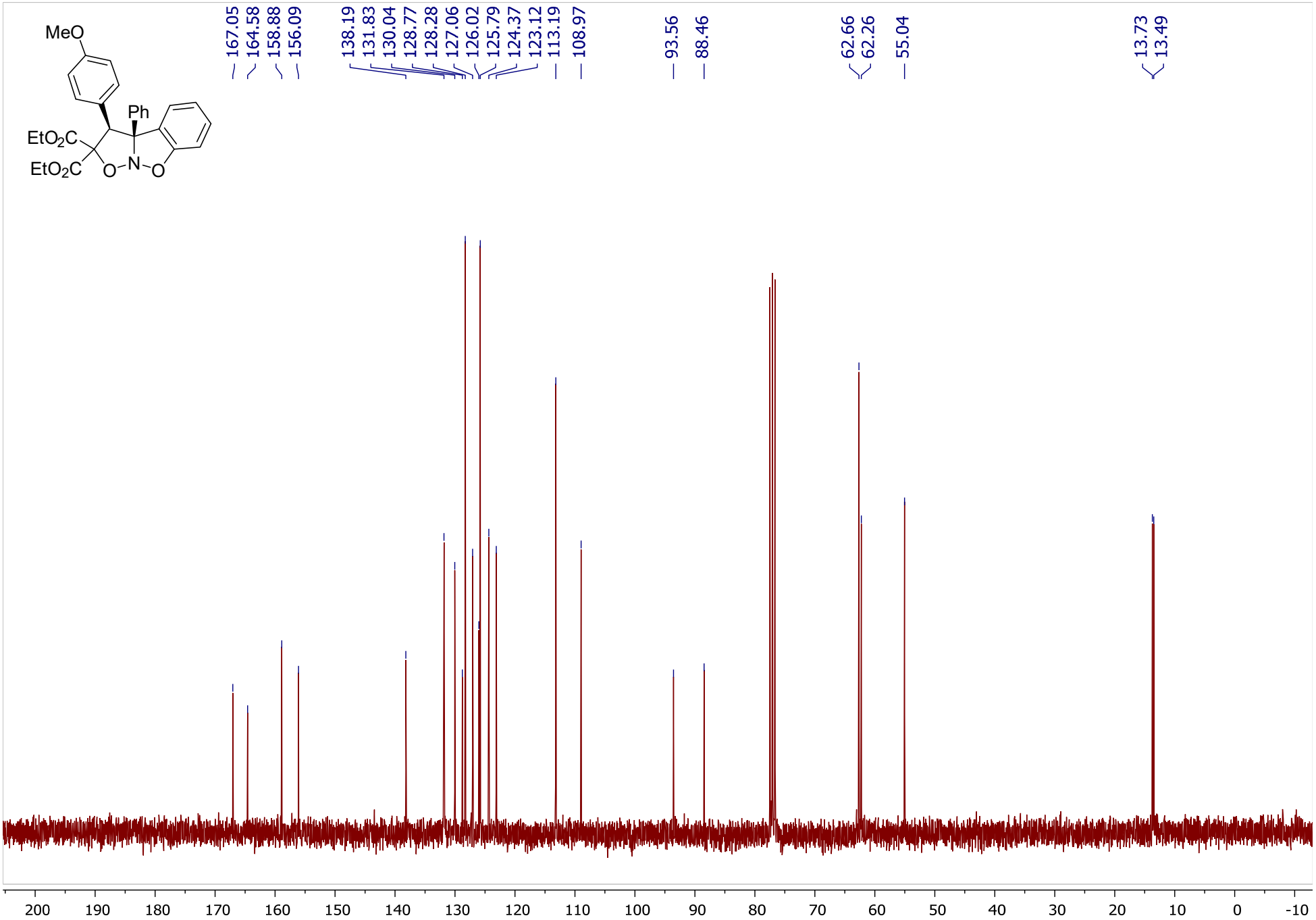

F
Me
EtO2C
EtO2C
O
N
O
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

Diethyl (3*S,3a*S**)-3-(4-methoxyphenyl)-3a-phenyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate 6ca**

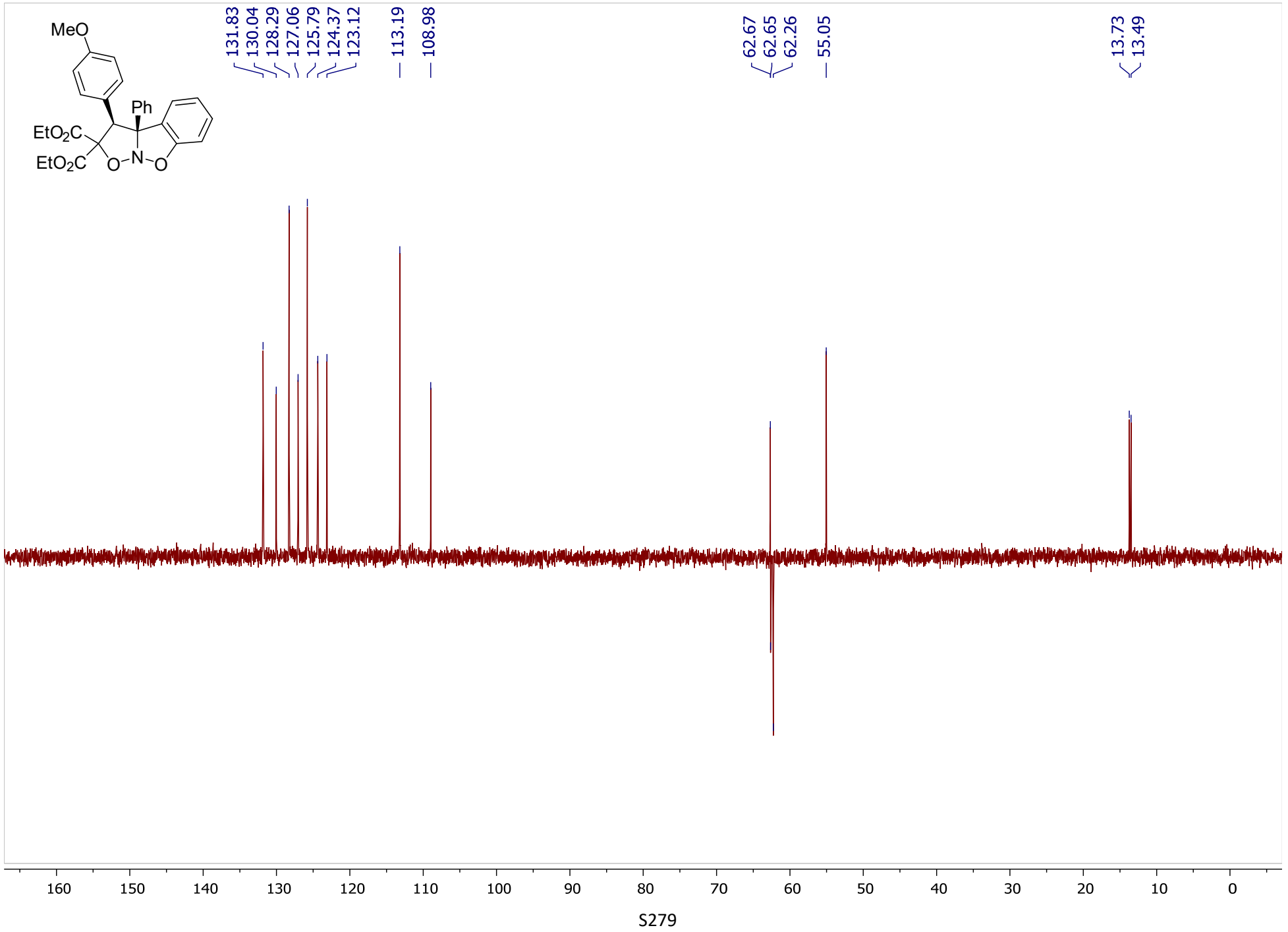
^{1}H NMR (300 MHz, $CDCl_3$)



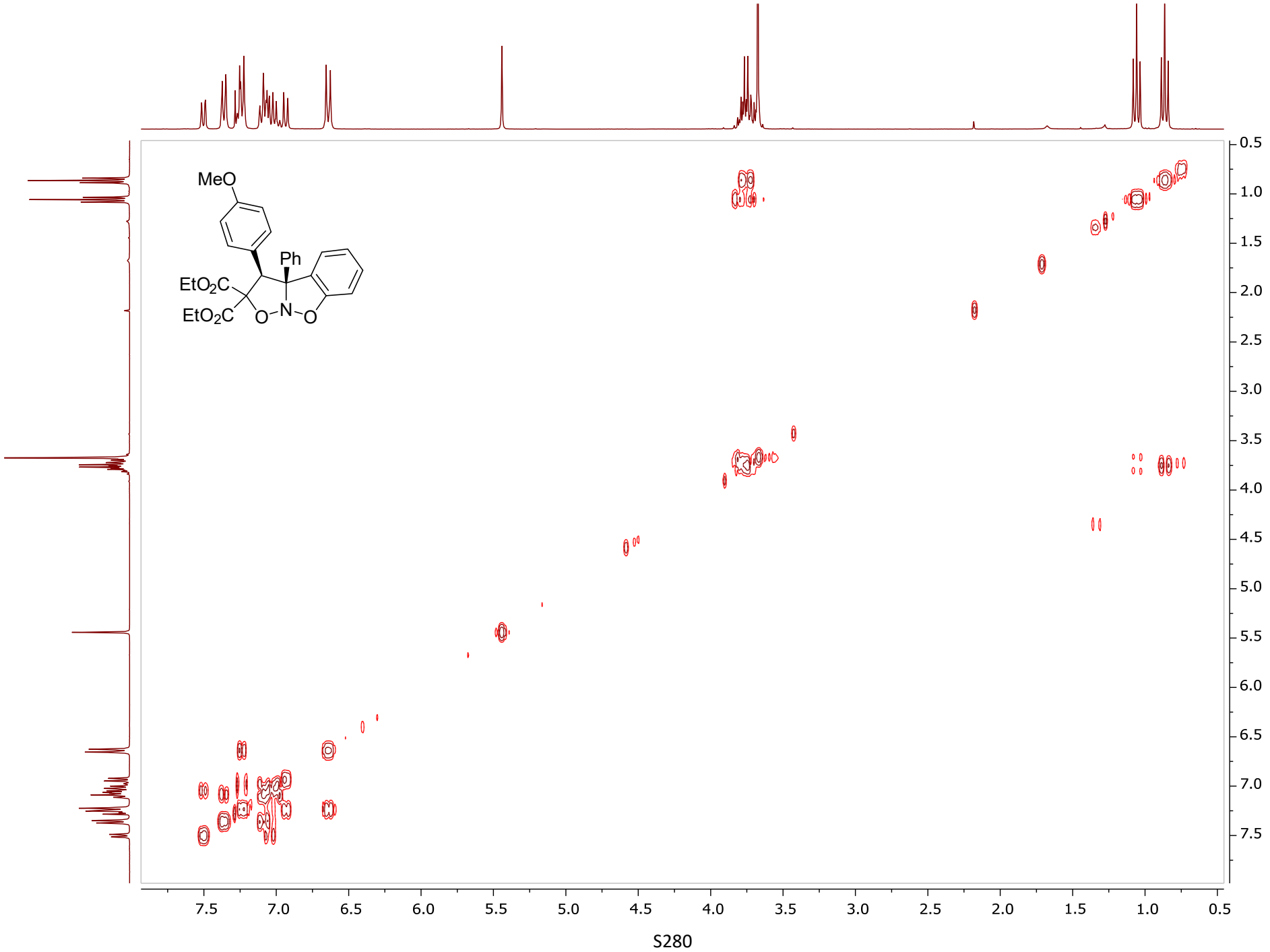
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY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Ph
EtO2C
EtO2C
O
N
O
0.5
1.0
1.5
2.0
2.5
3.0
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4.0
4.5
5.0
5.5
6.0
6.5
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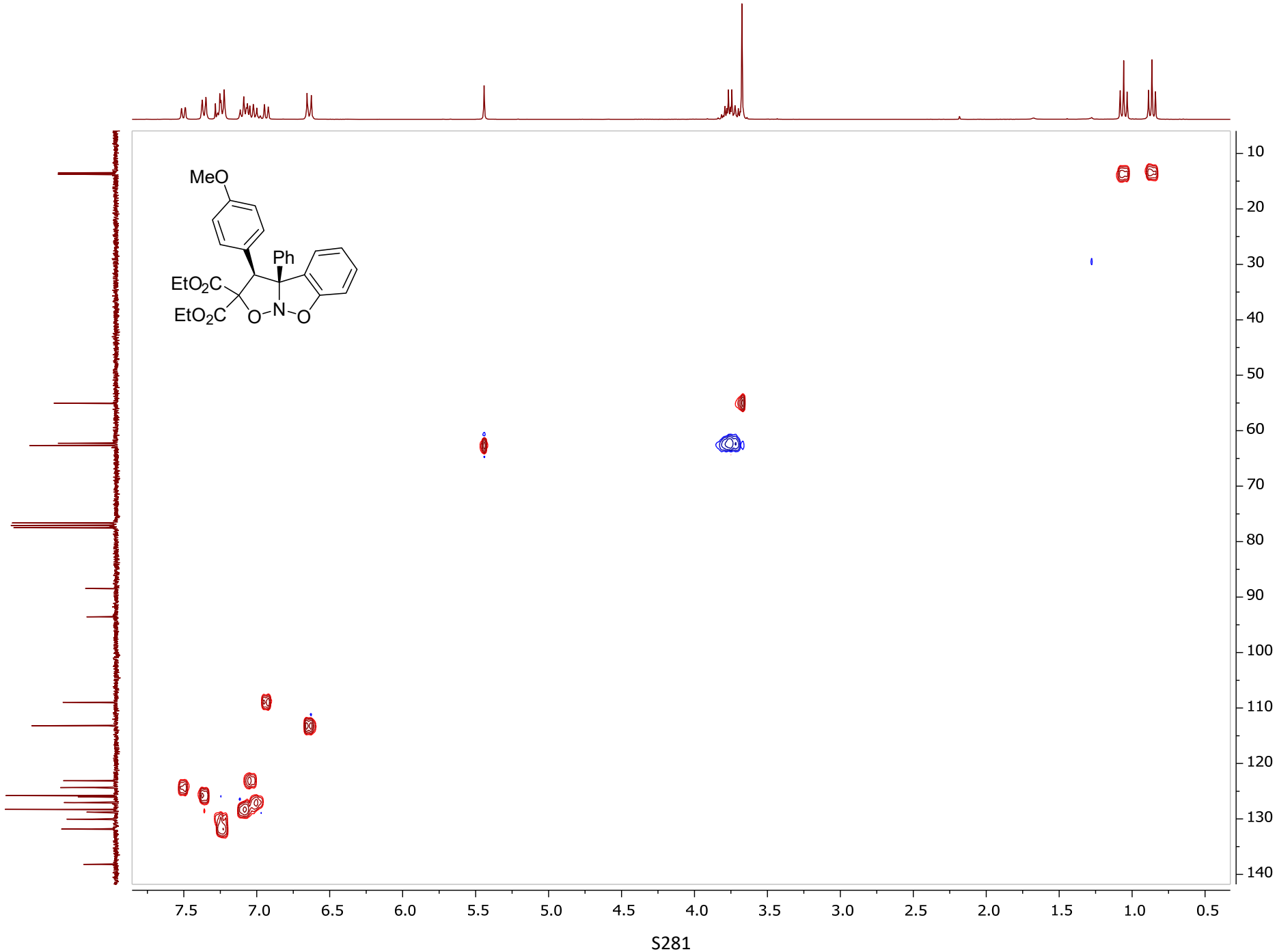
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{13}C HSQC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Ph
EtO2C
EtO2C
O
N
O
10
20
30
40
50
60
70
80
90
100
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120
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140
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6.5
6.0
5.5
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3.5
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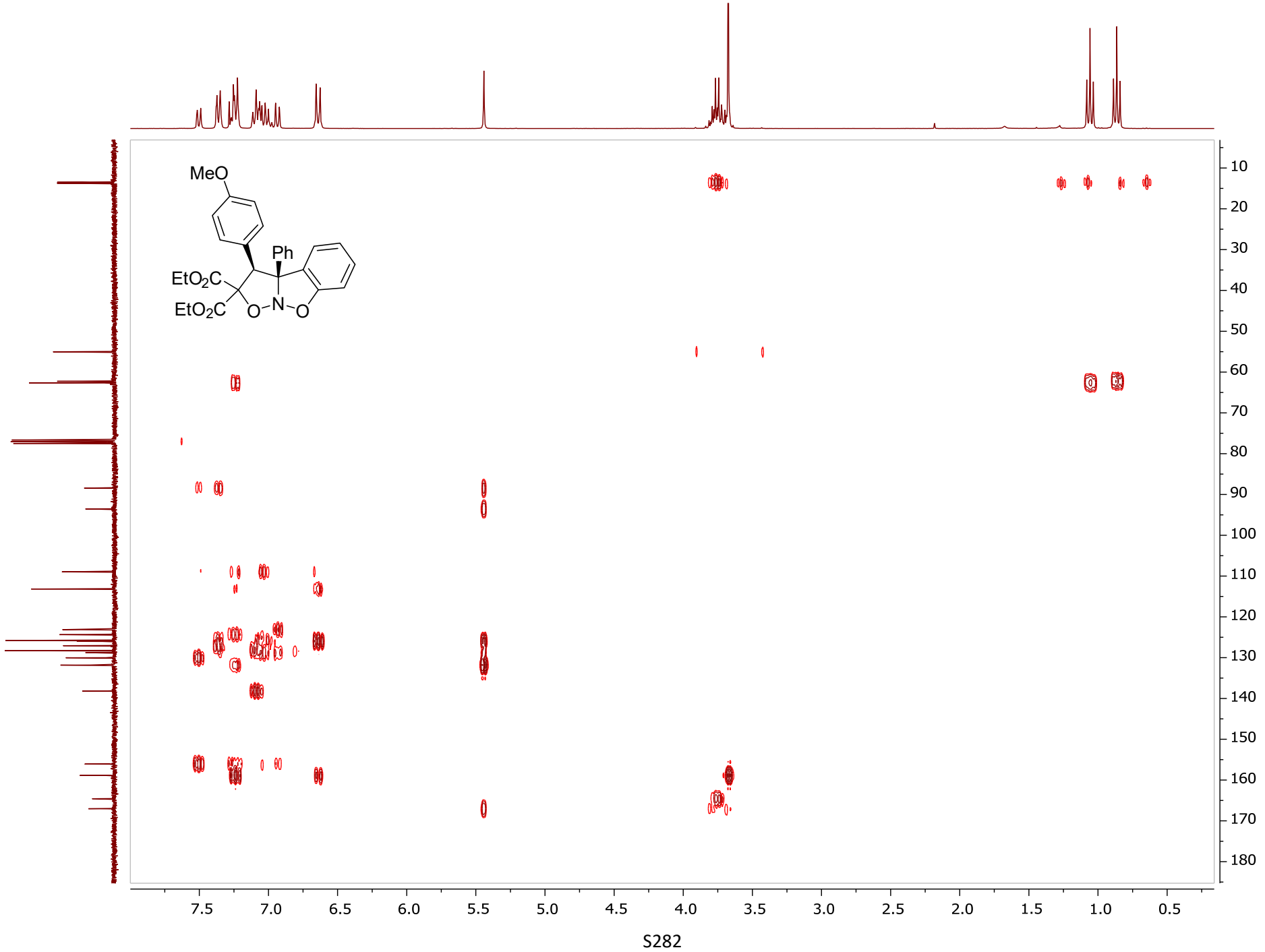
1.5
1.0
0.5

^{1}H-^{13}C HMBC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Ph
EtO2C
EtO2C
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N
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20
30
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60
70
80
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100
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160
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6.5
6.0
5.5
5.0
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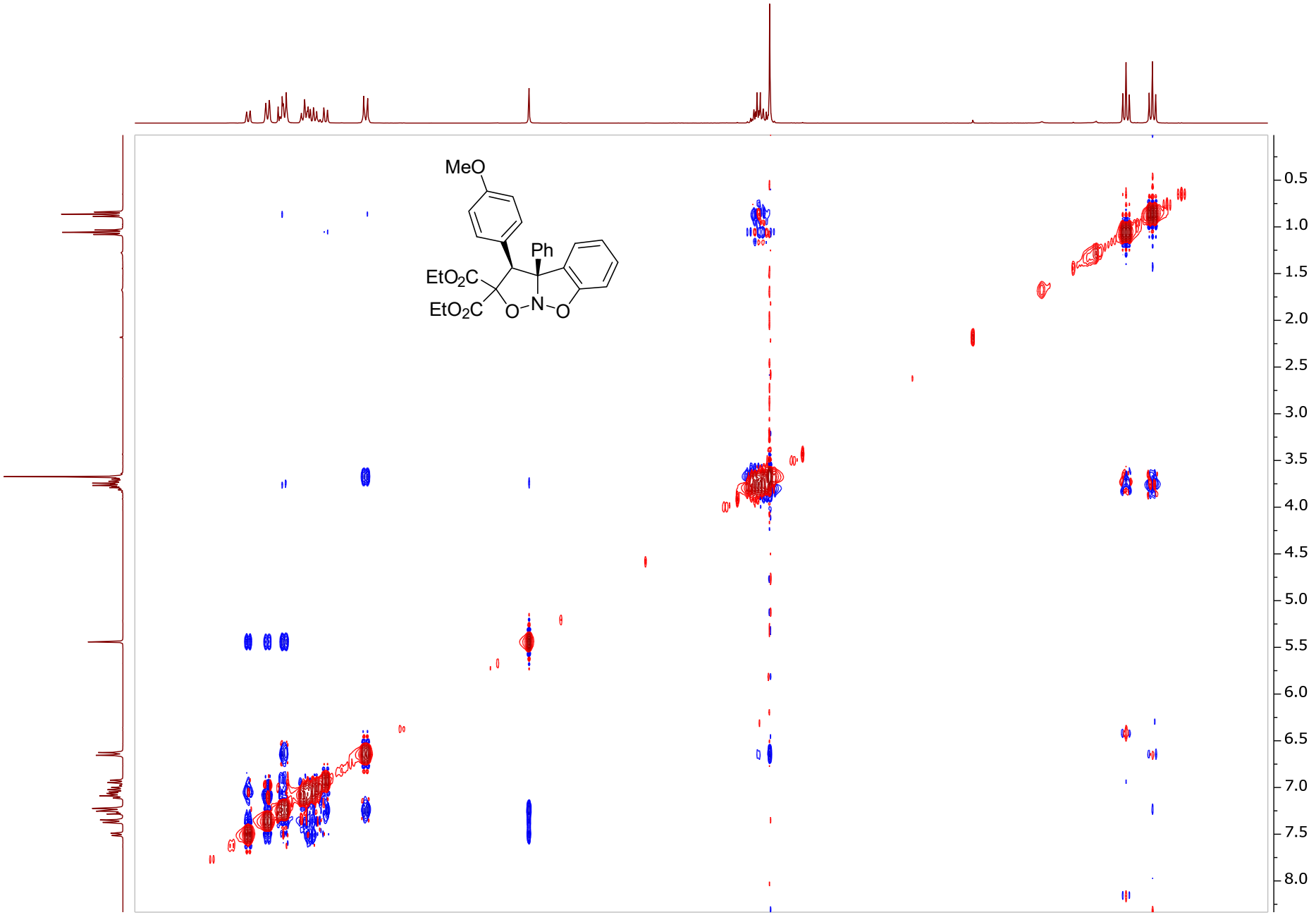
2.0
1.5
1.0
0.5

^{1}H-^{1}H NOESY


MeO
Ph
EtO2C
EtO2C
O
N
O
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1.0
1.5
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2.5
3.0
3.5
4.0
4.5
5.0
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8.0
7.5
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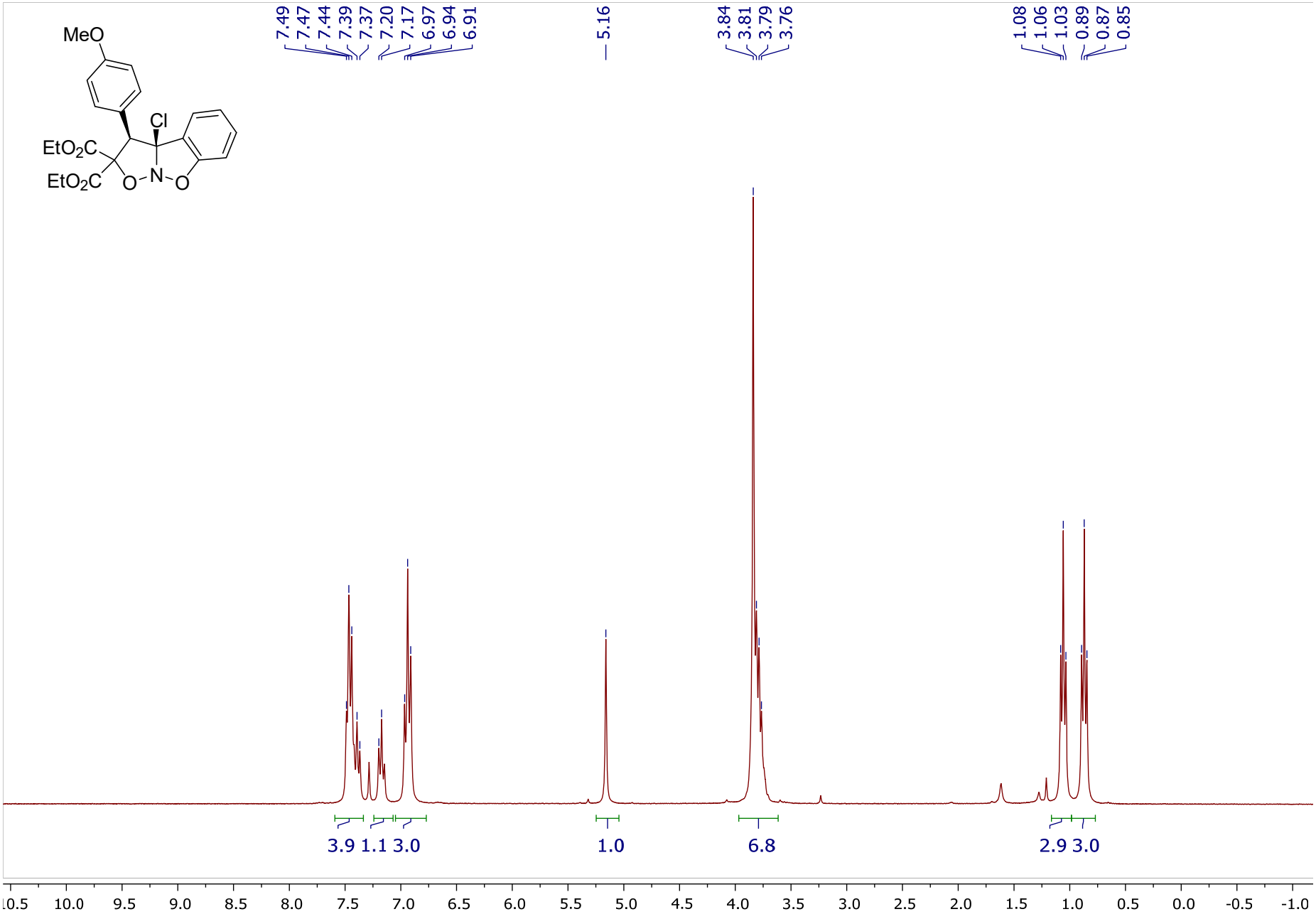
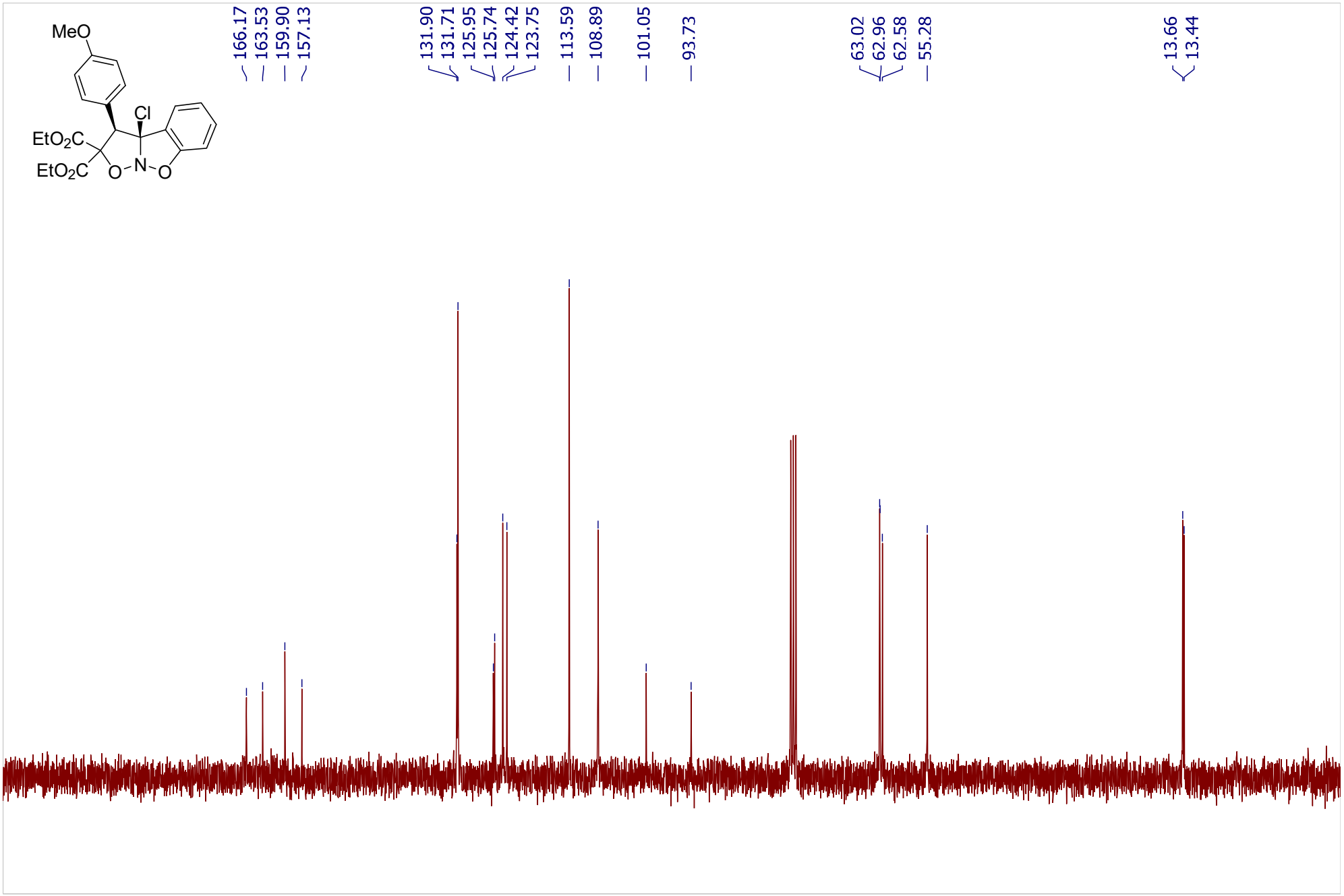
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

Diethyl (3*R,3a*S**)-3a-chloro-3-(4-methoxyphenyl)-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate 6da**

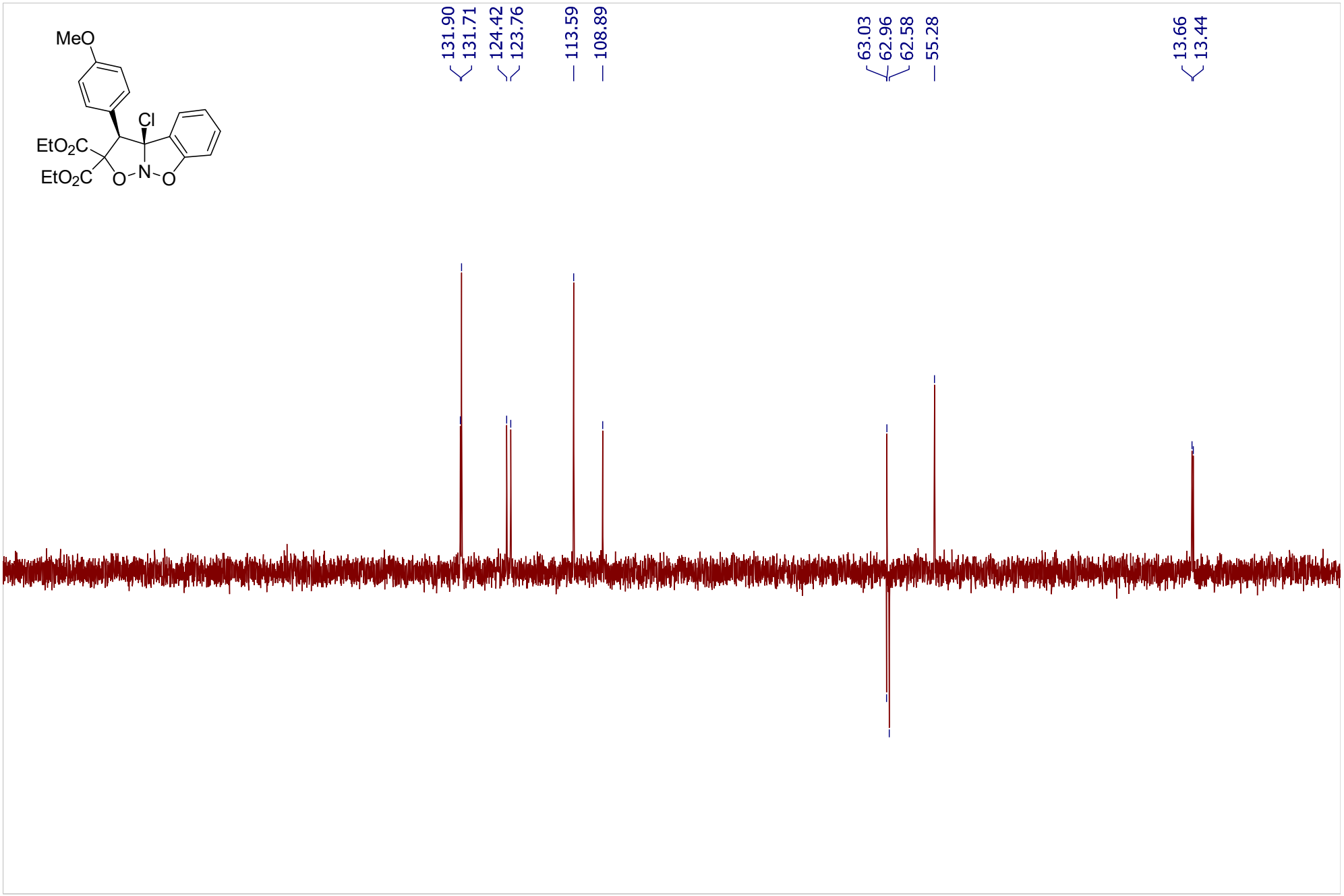
^{1}H NMR (300 MHz, $CDCl_3$)



^{13}C NMR (75 MHz, $CDCl_3$)

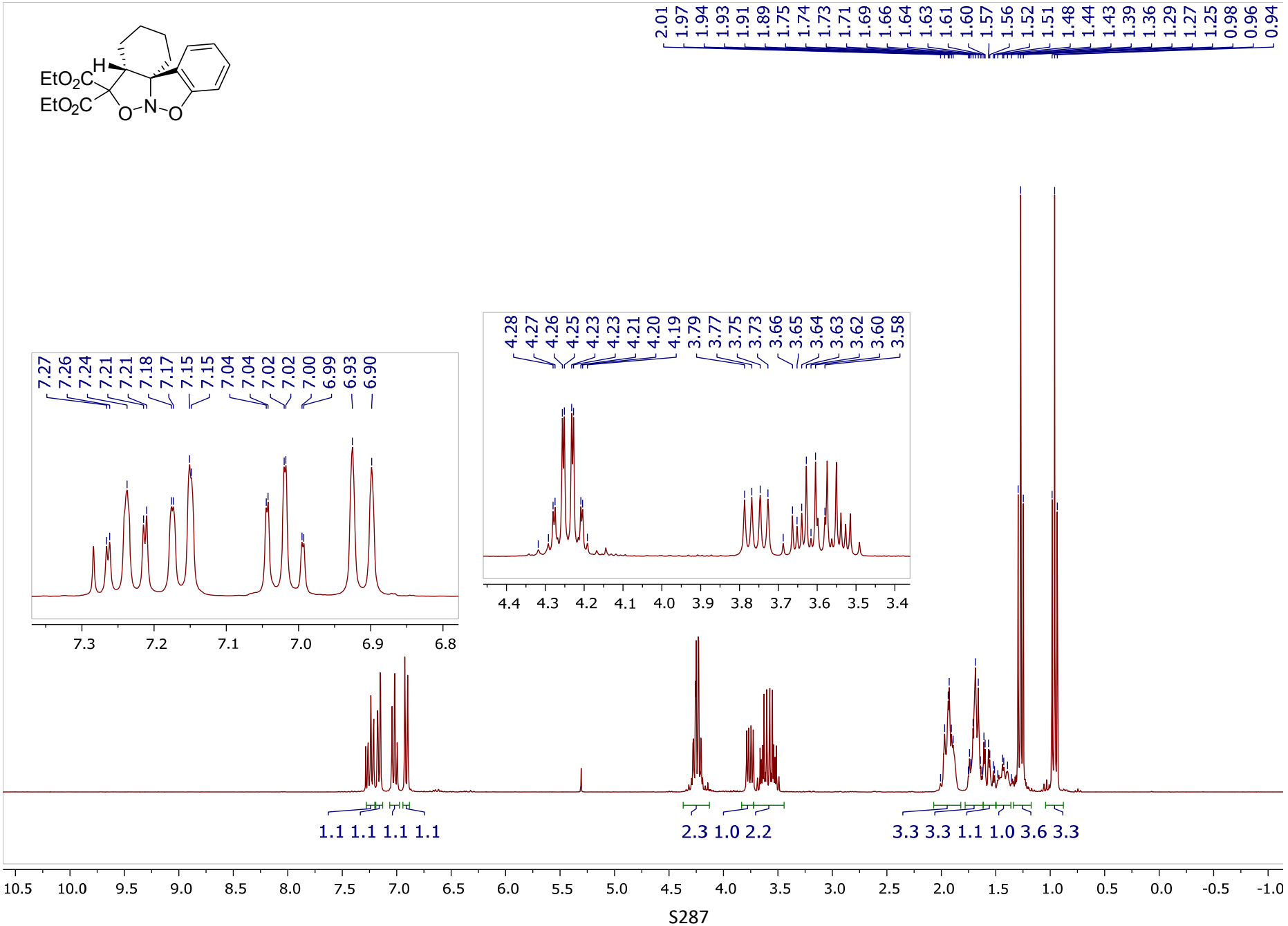


^{13}C DEPT 135 (75 MHz, $CDCl_3$)

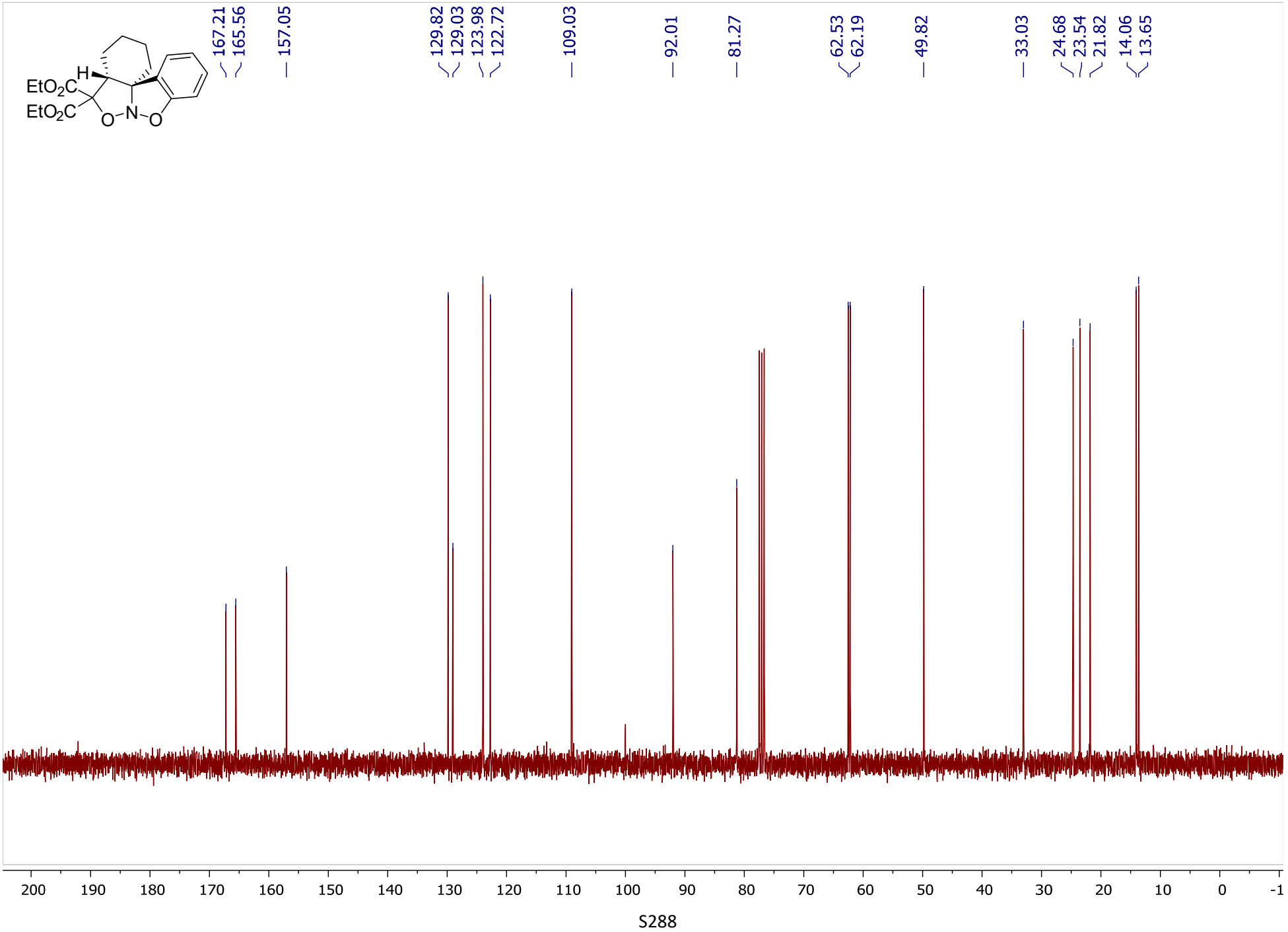


Diethyl (4a*R,12b*S**)-2,3,4,4a-tetrahydrobenzo[c]benzo[4,5]isoxazolo[2,3-b]isoxazole-5,5(1H)-dicarboxylate 6ea**

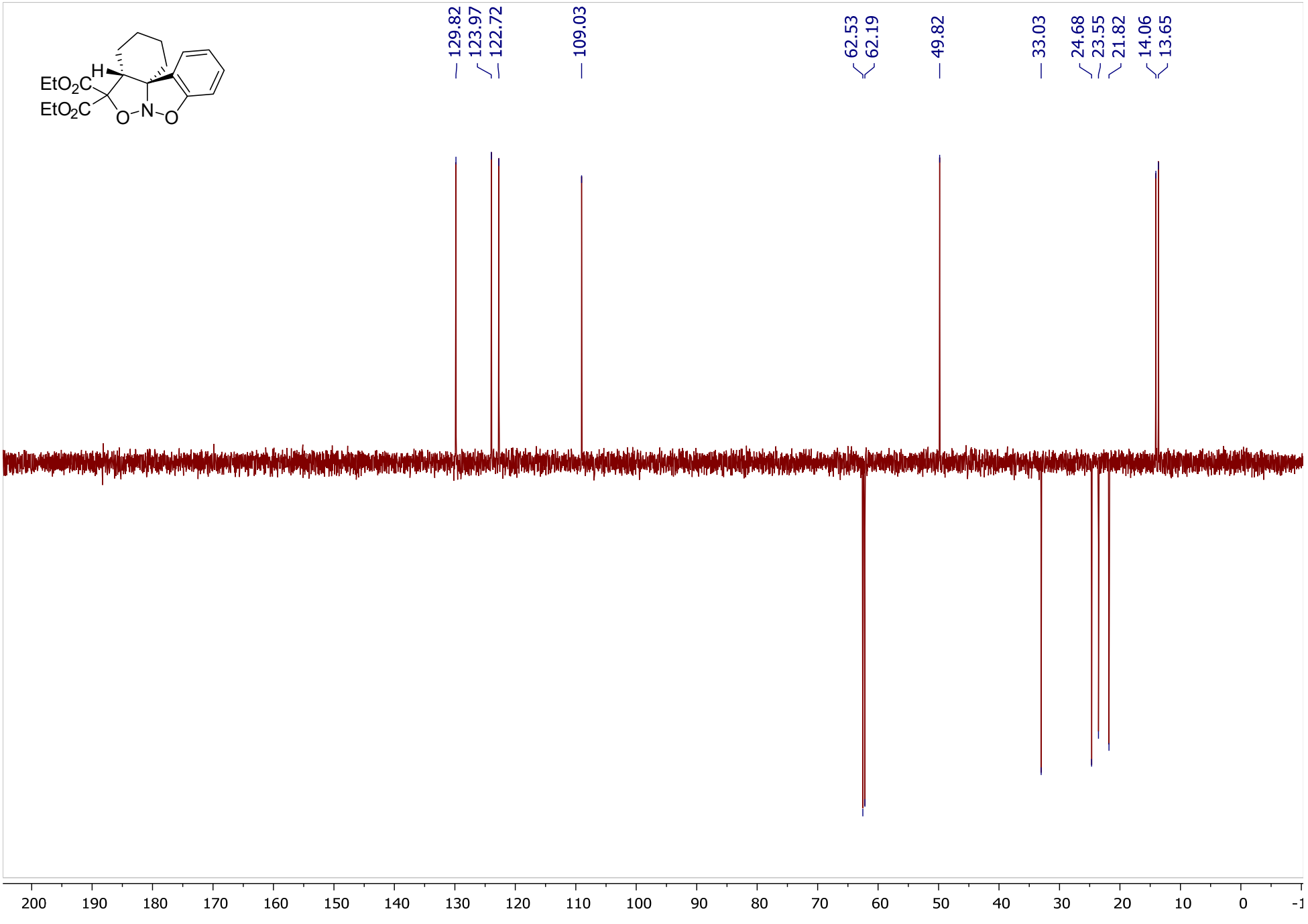
^{1}H NMR (300 MHz, $CDCl_3$)



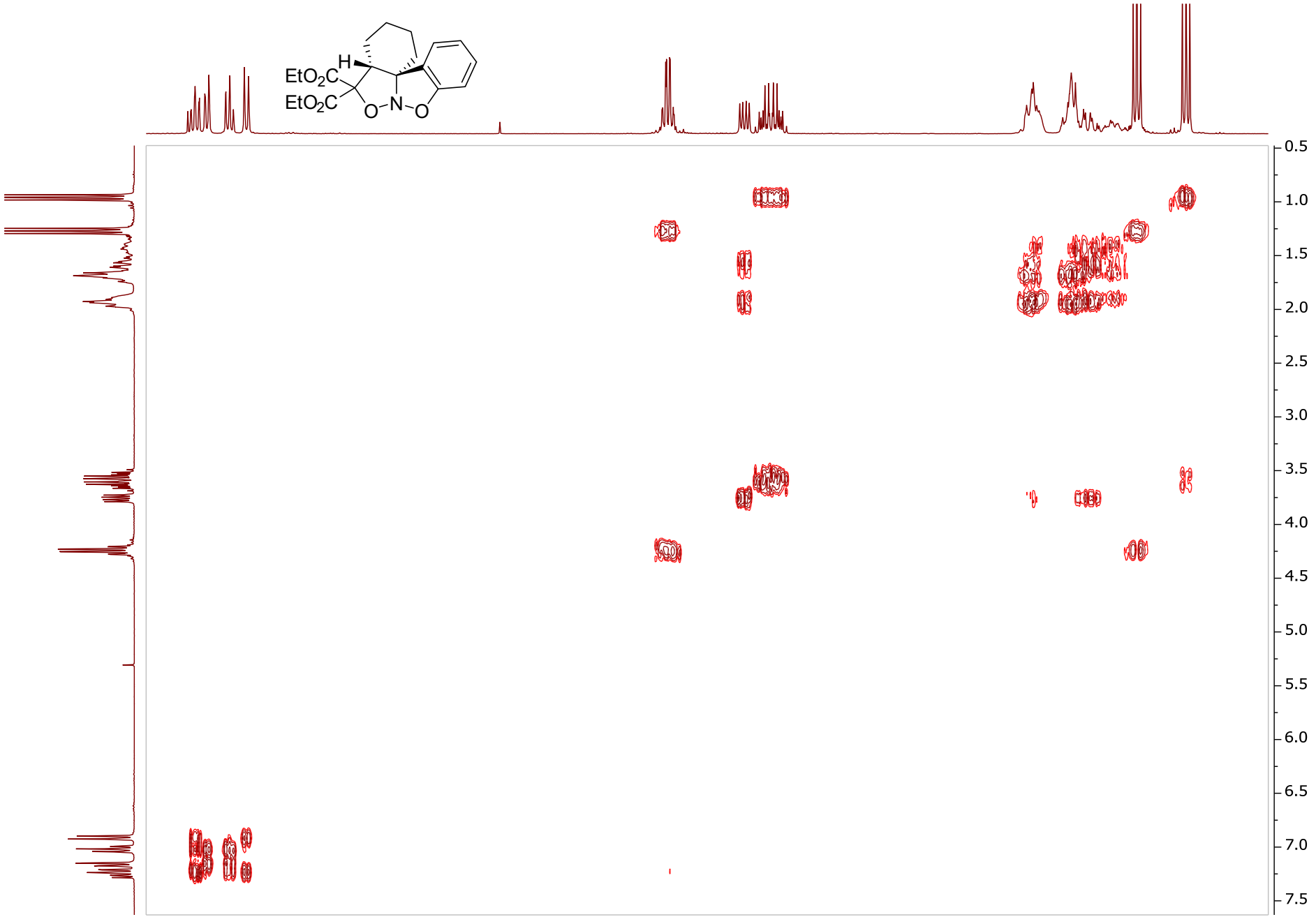
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


EtO2C
EtO2C
H
O
N
O
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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2.5
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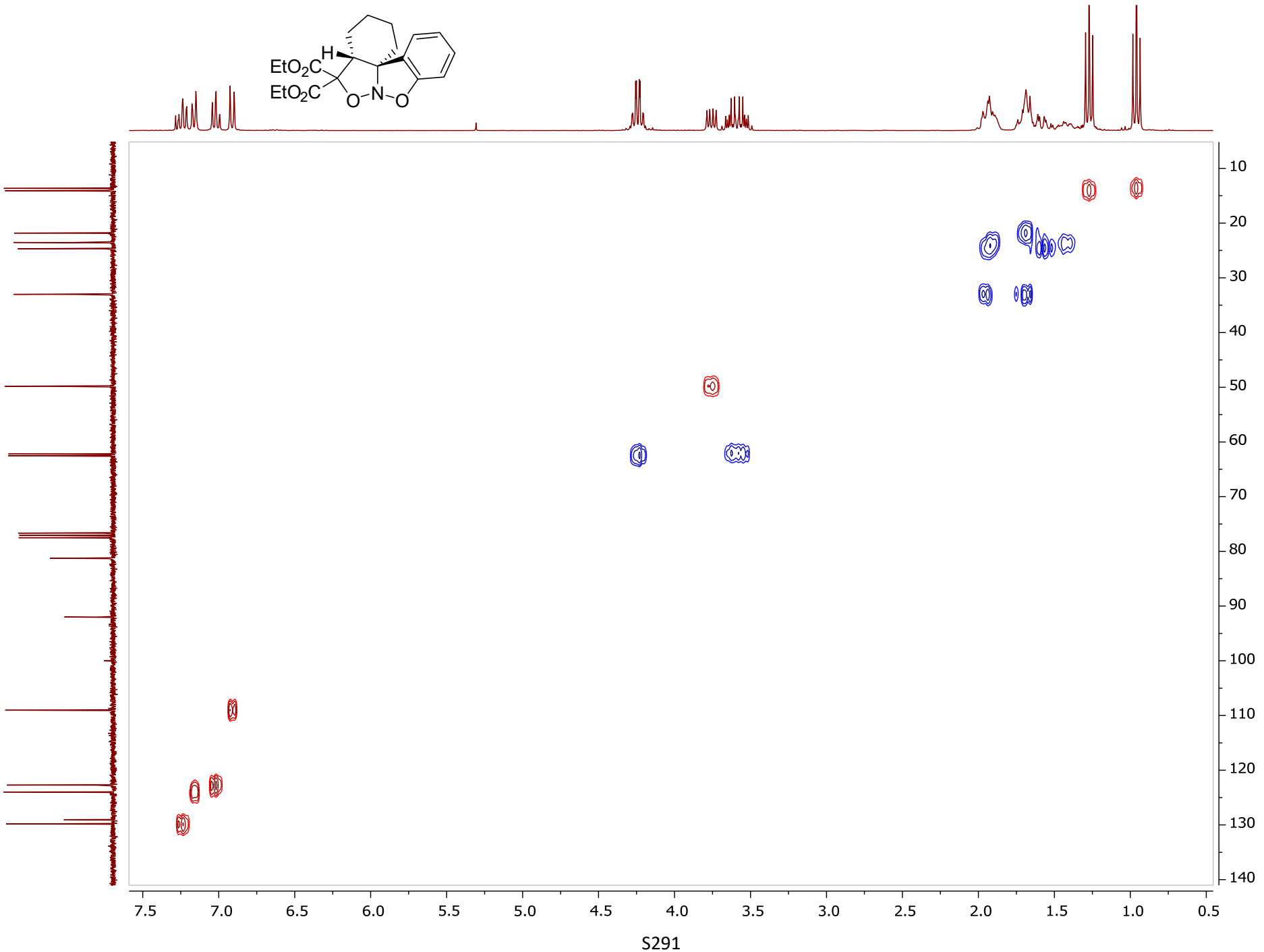
1.5
1.0
0.5

^{1}H-^{13}C HSQC


EtO2C
H
EtO2C
O
N
O
10
20
30
40
50
60
70
80
90
100
110
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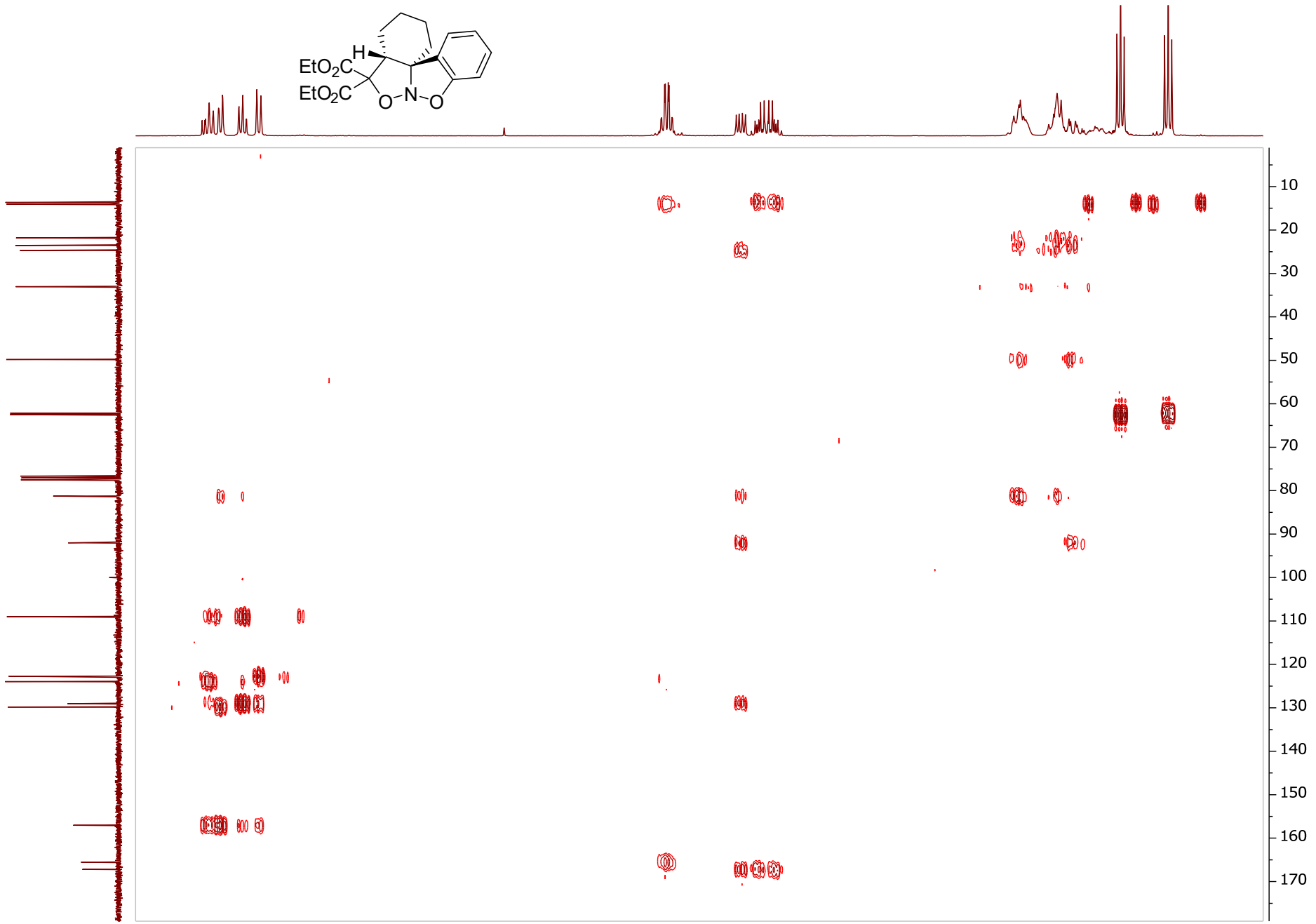
130
140
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{13}C HMBC


EtO2C
H
EtO2C
O
N
O
10
20
30
40
50
60
70
80
90
100
110
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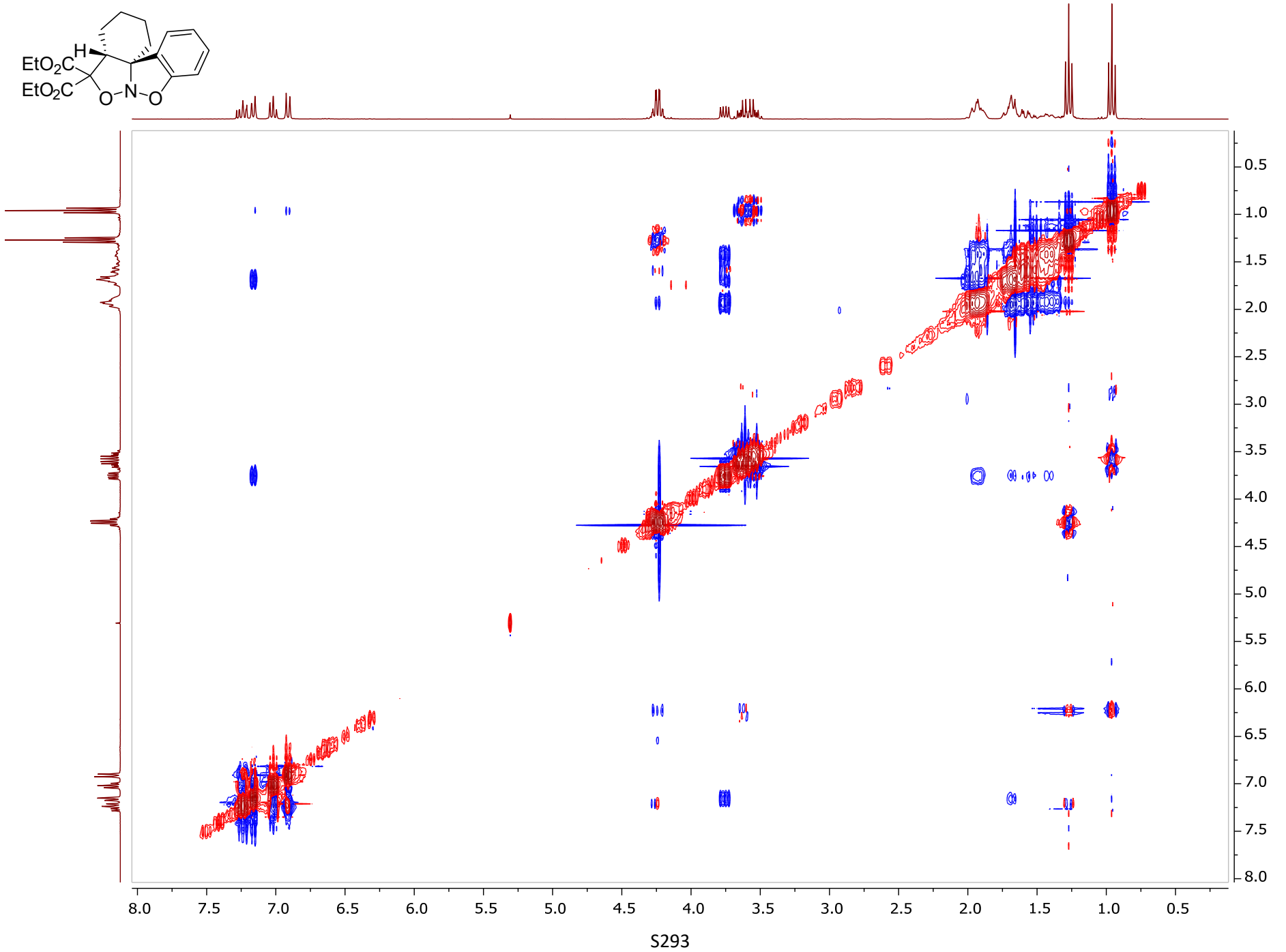
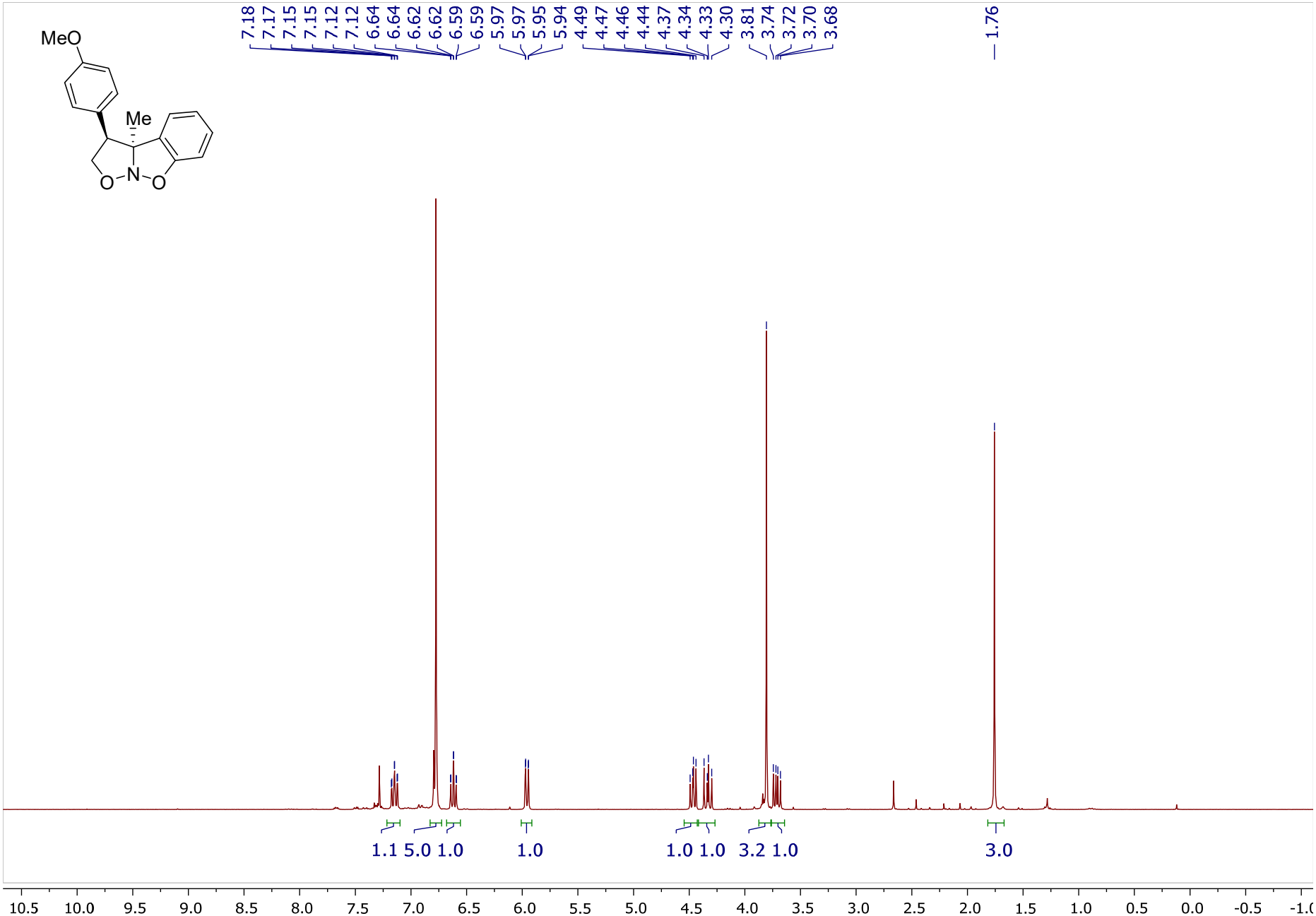
130
140
150
160
170
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{1}H NOESY

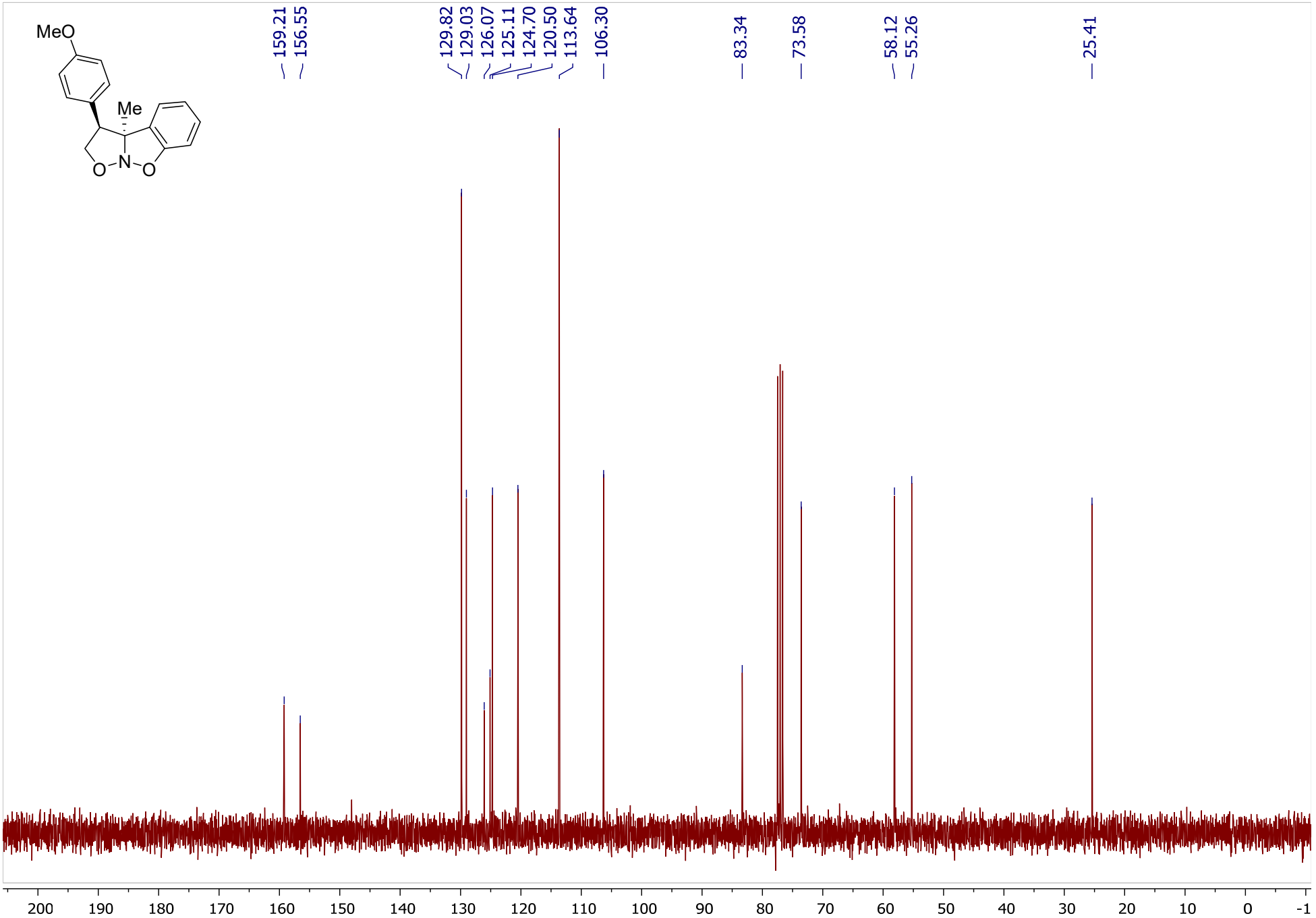

EtO2C
H
EtO2C
O
N
O
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

(3*S,3a*S**)-3-(4-Methoxyphenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole 6fa**

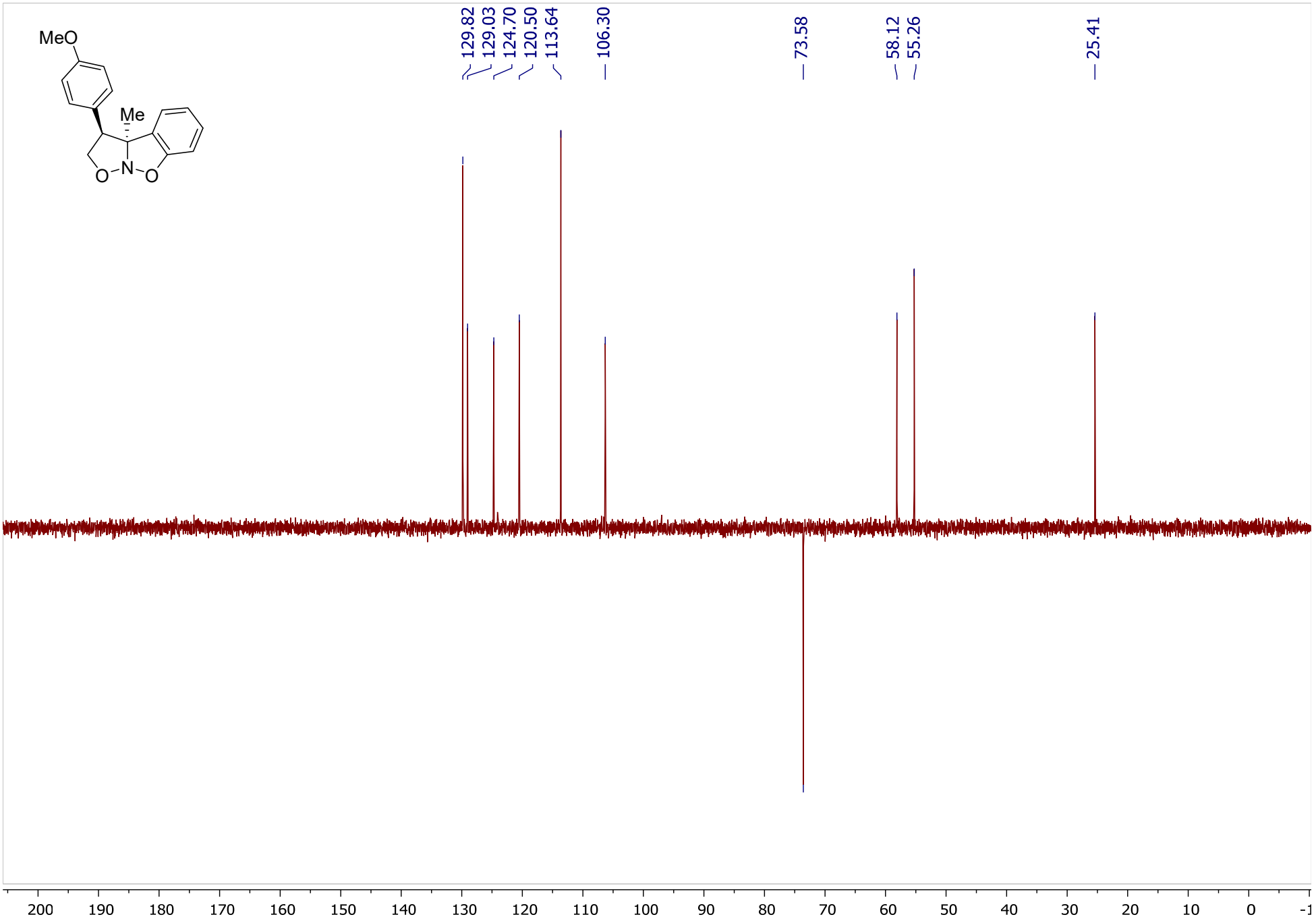
^{1}H NMR (300 MHz, $CDCl_3$)



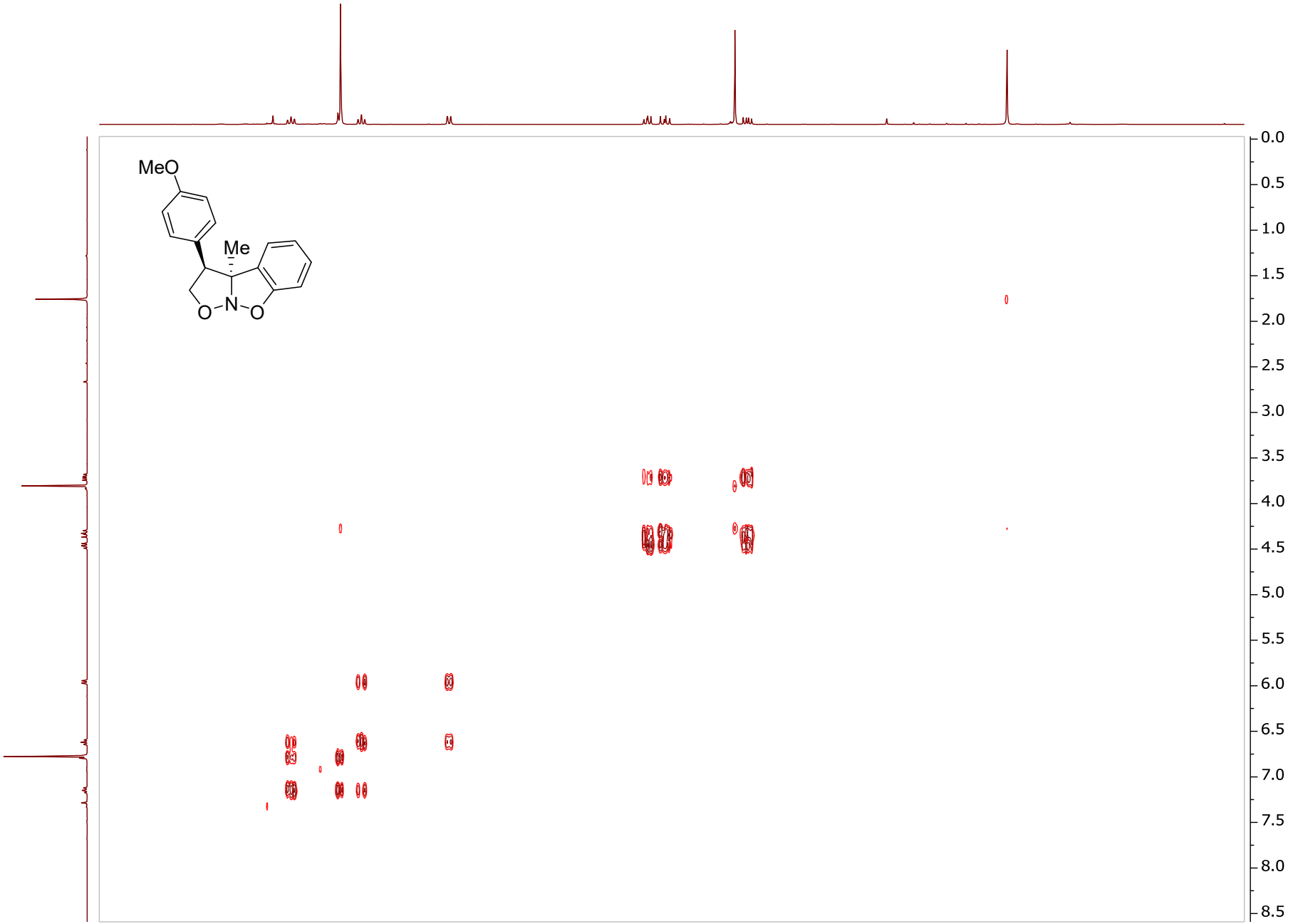
^{13}C NMR (75 MHz, $CDCl_3$)



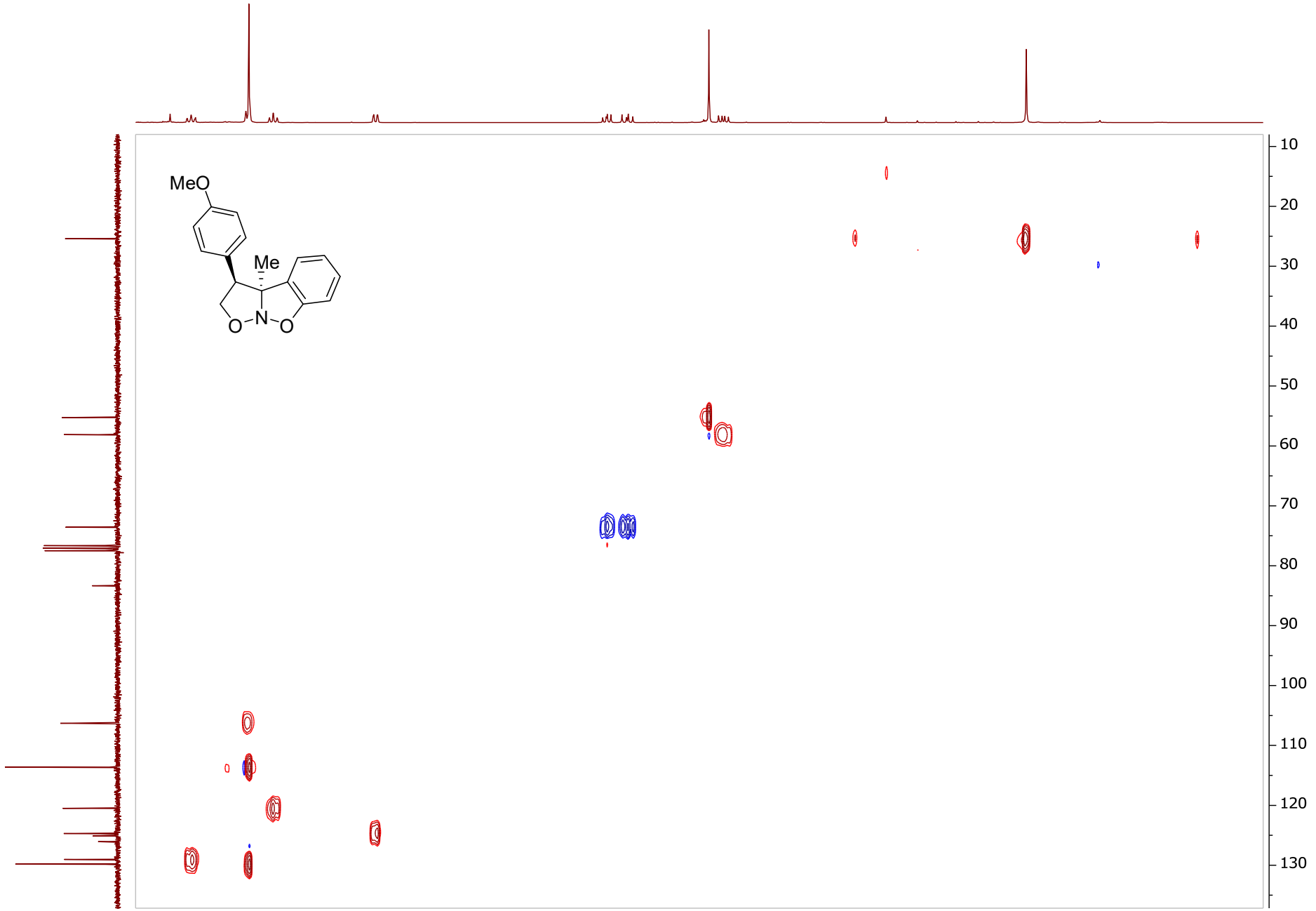
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



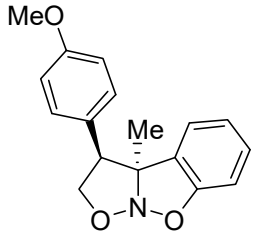
^{1}H-^{1}H COSY

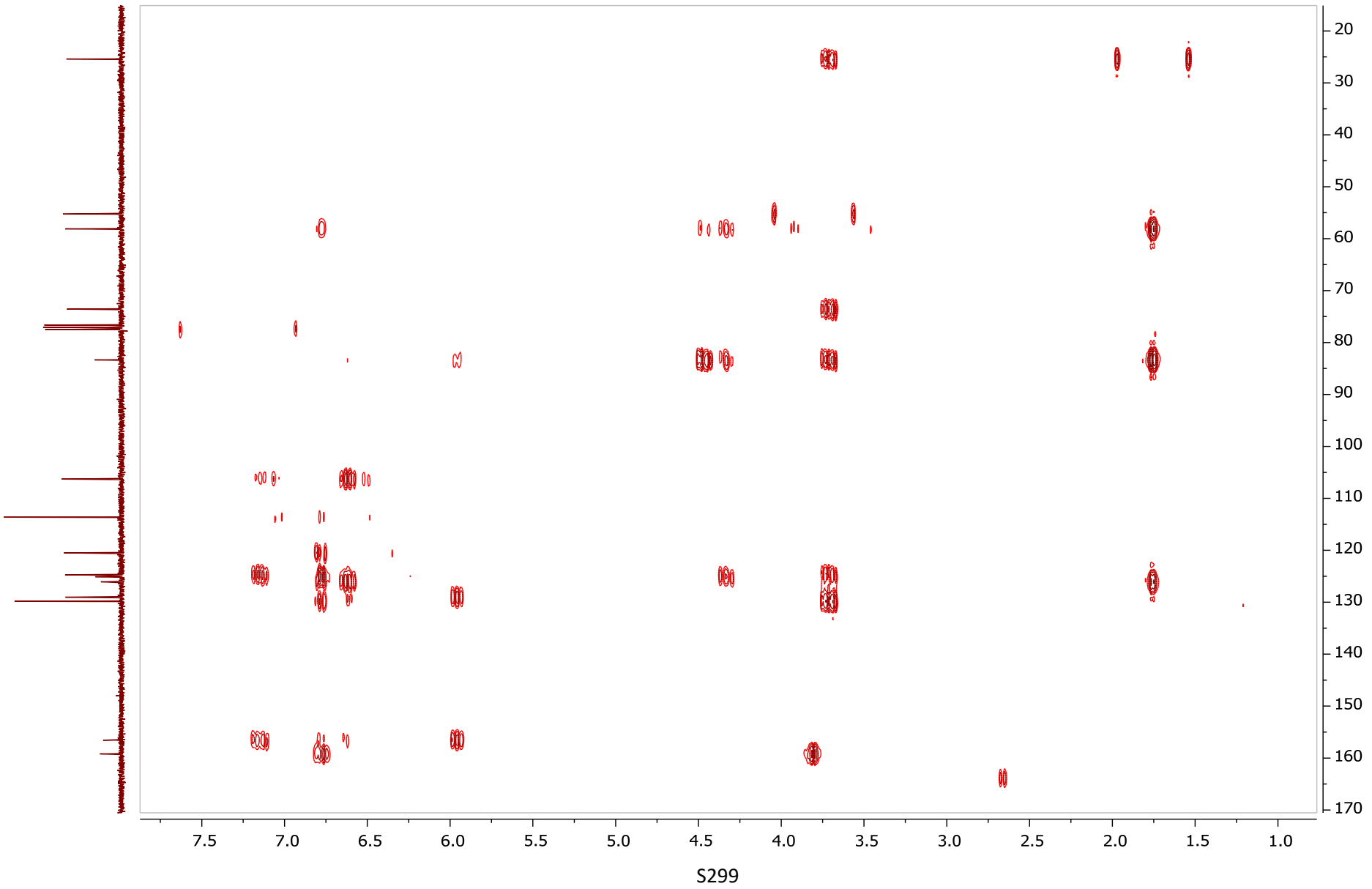

MeO
Me
O
N
O
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

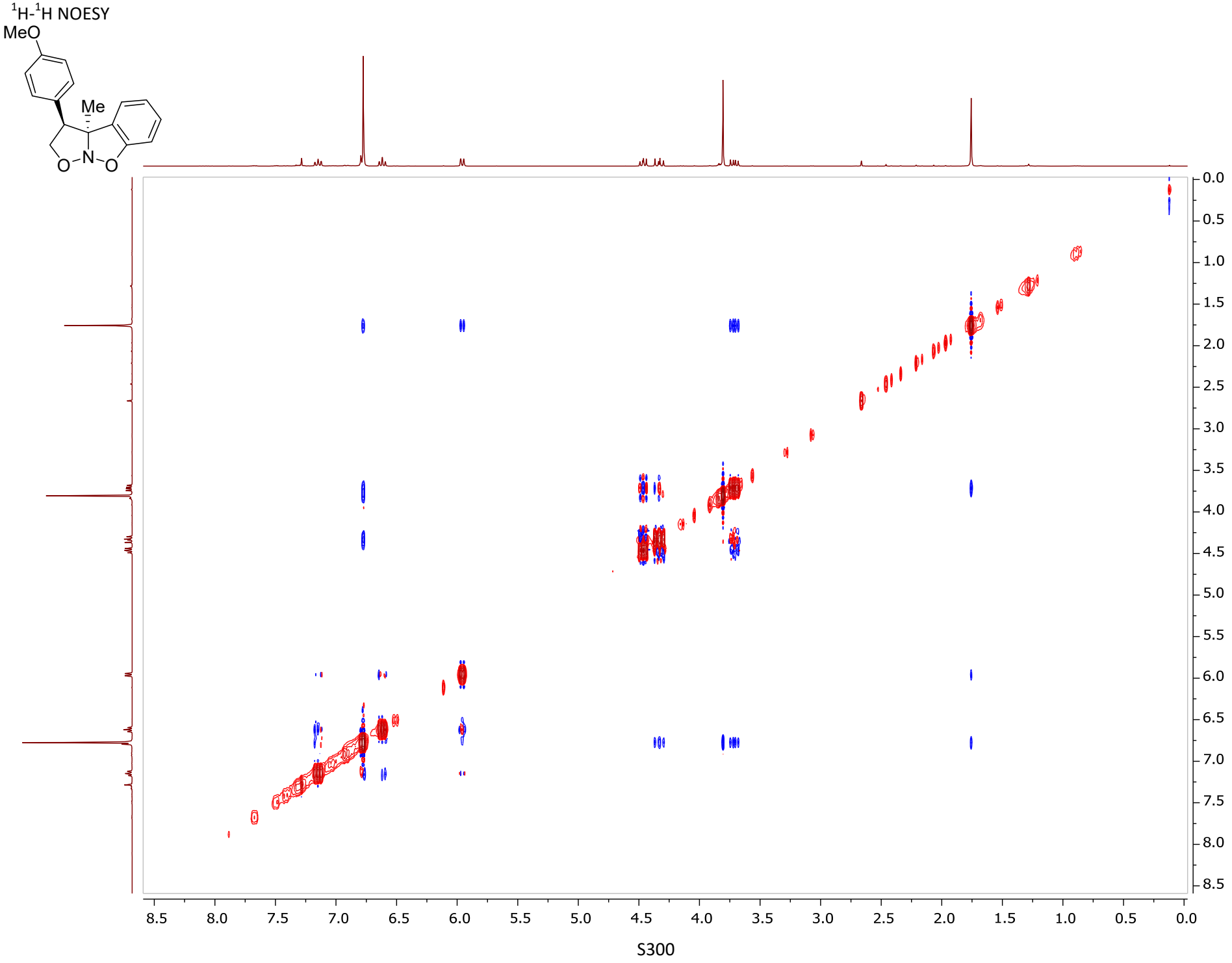
^{1}H-^{13}C HSQC


MeO
Me
O
N
O
10
20
30
40
50
60
70
80
90
100
110
120
130
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

^{1}H-^{13}C HMBC

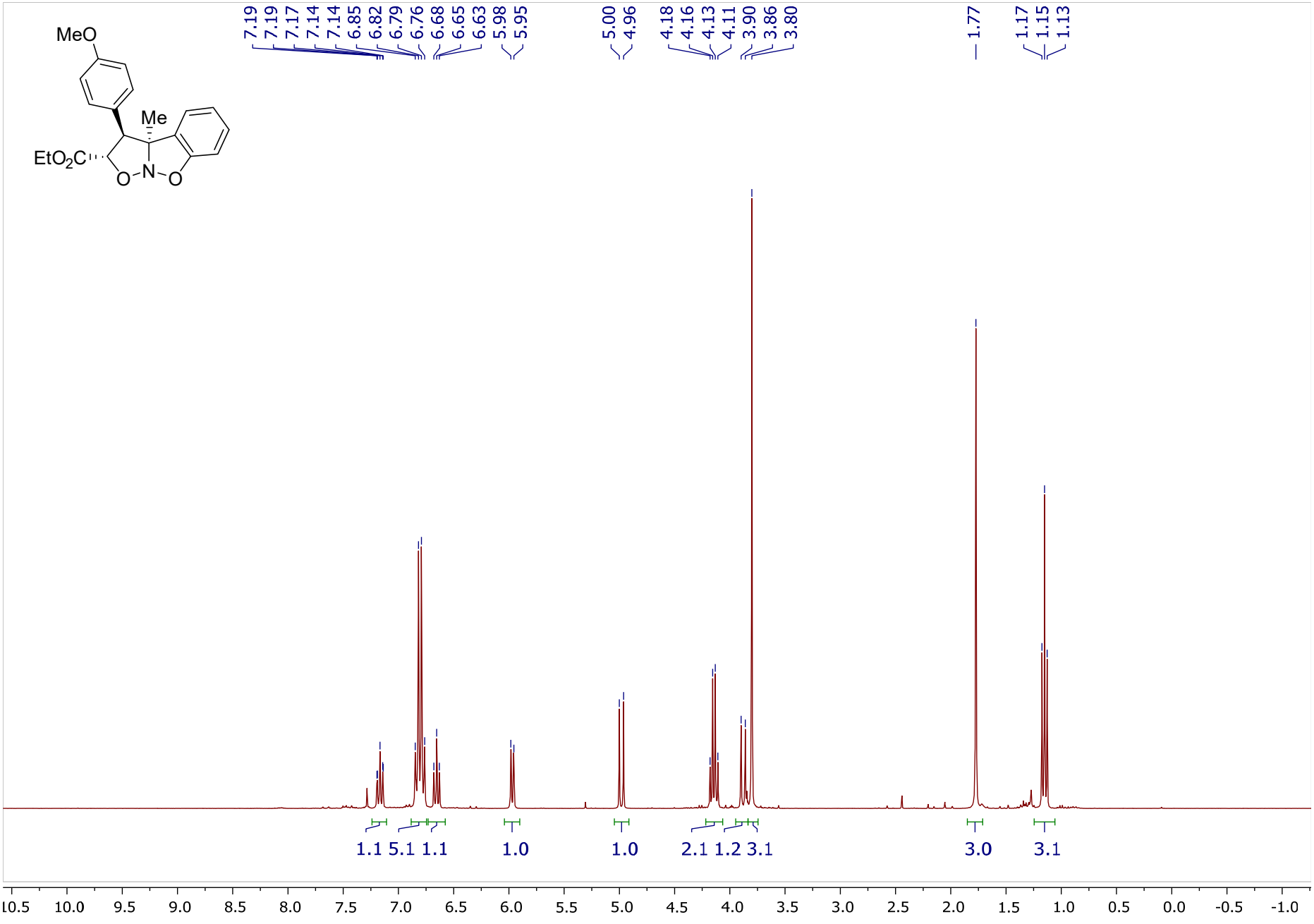

MeO
Me
O
N
O


20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
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

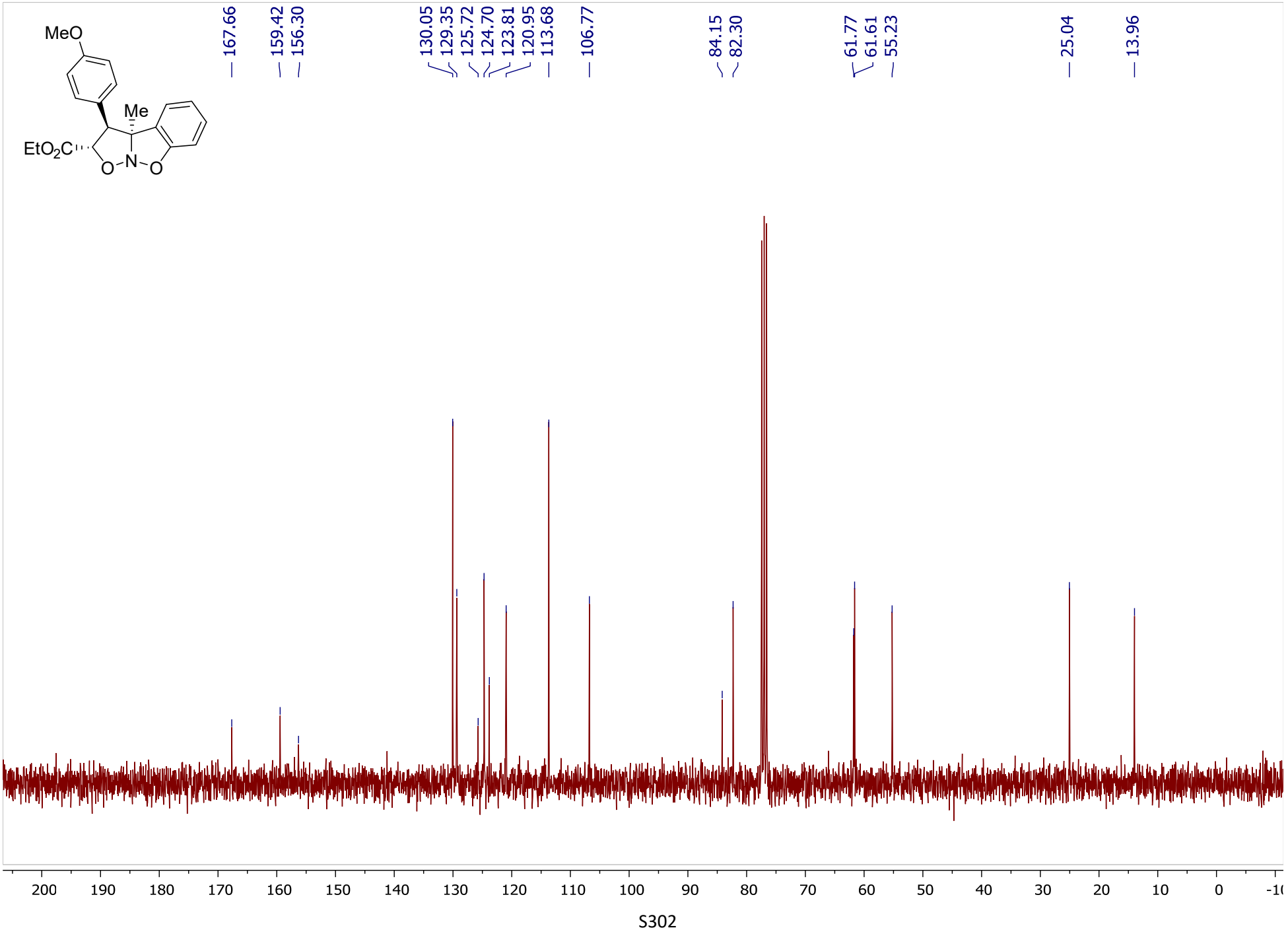

^{1}H-^{1}H NOESY
MeO
Me
O
N
O
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

Ethyl (2*S,3*S**,3a*S**)-3-(4-methoxyphenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2-carboxylate 6ga**

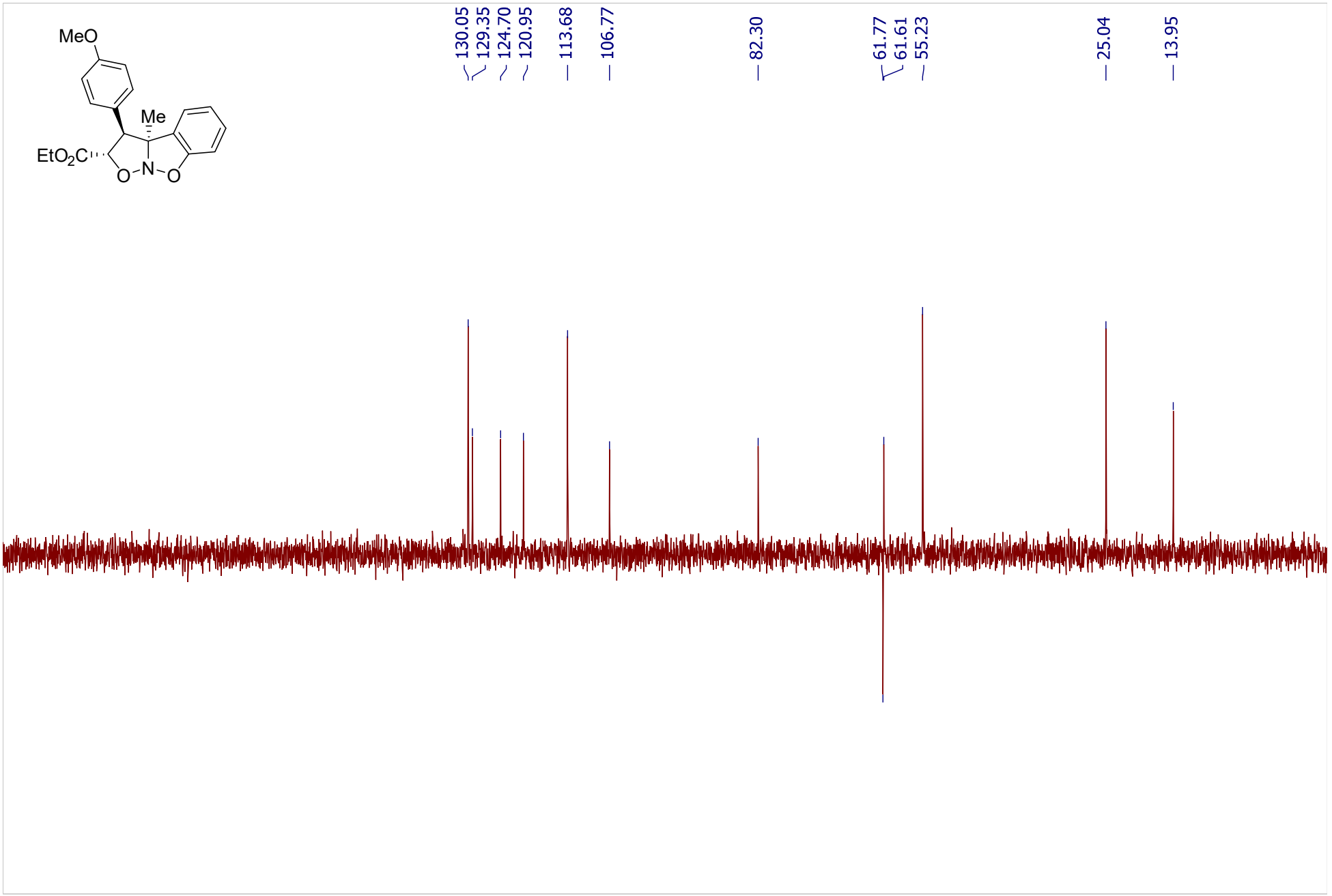
^{1}H NMR (300 MHz, $CDCl_3$)



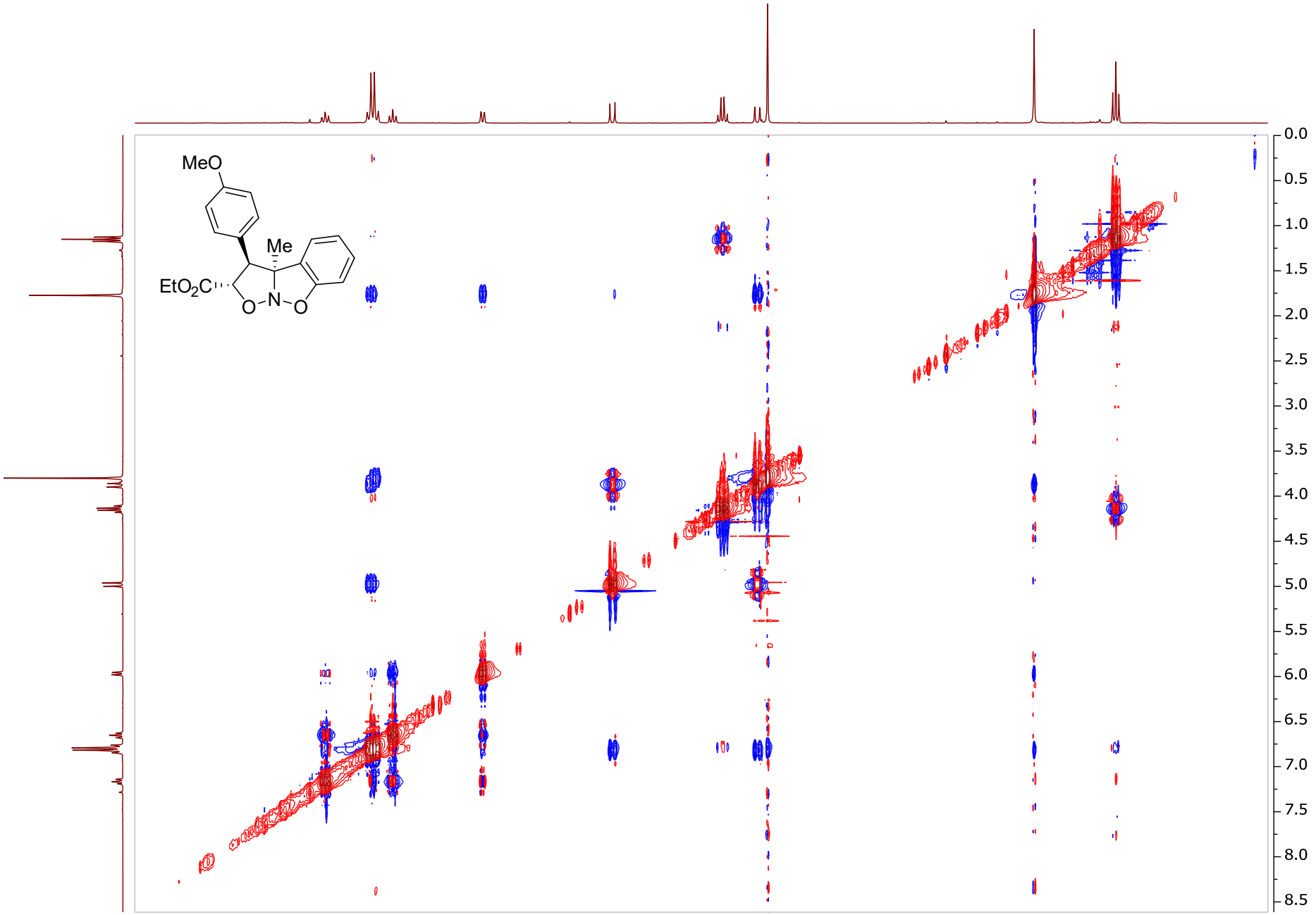
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)

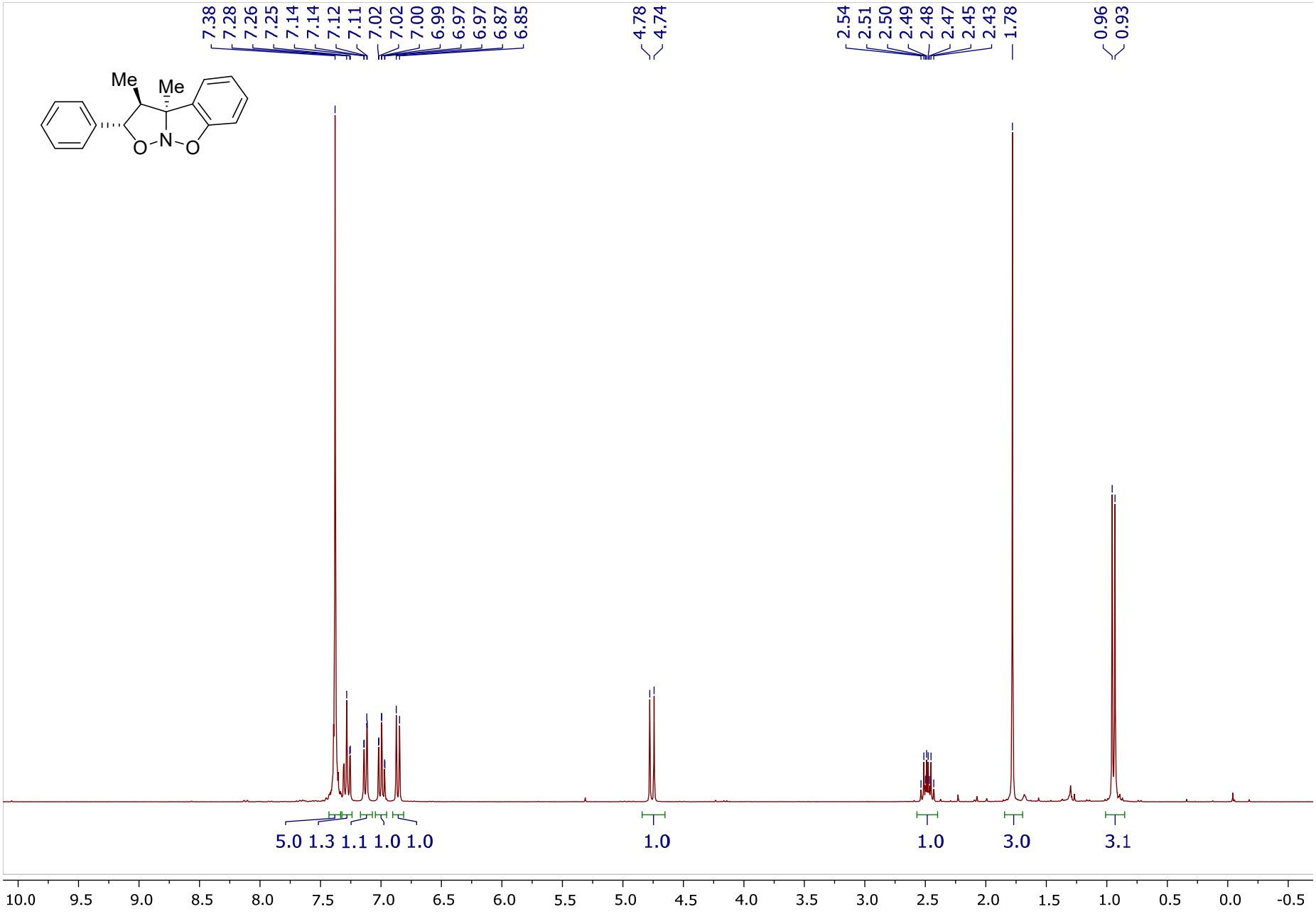


^{1}H-^{1}H NOESY

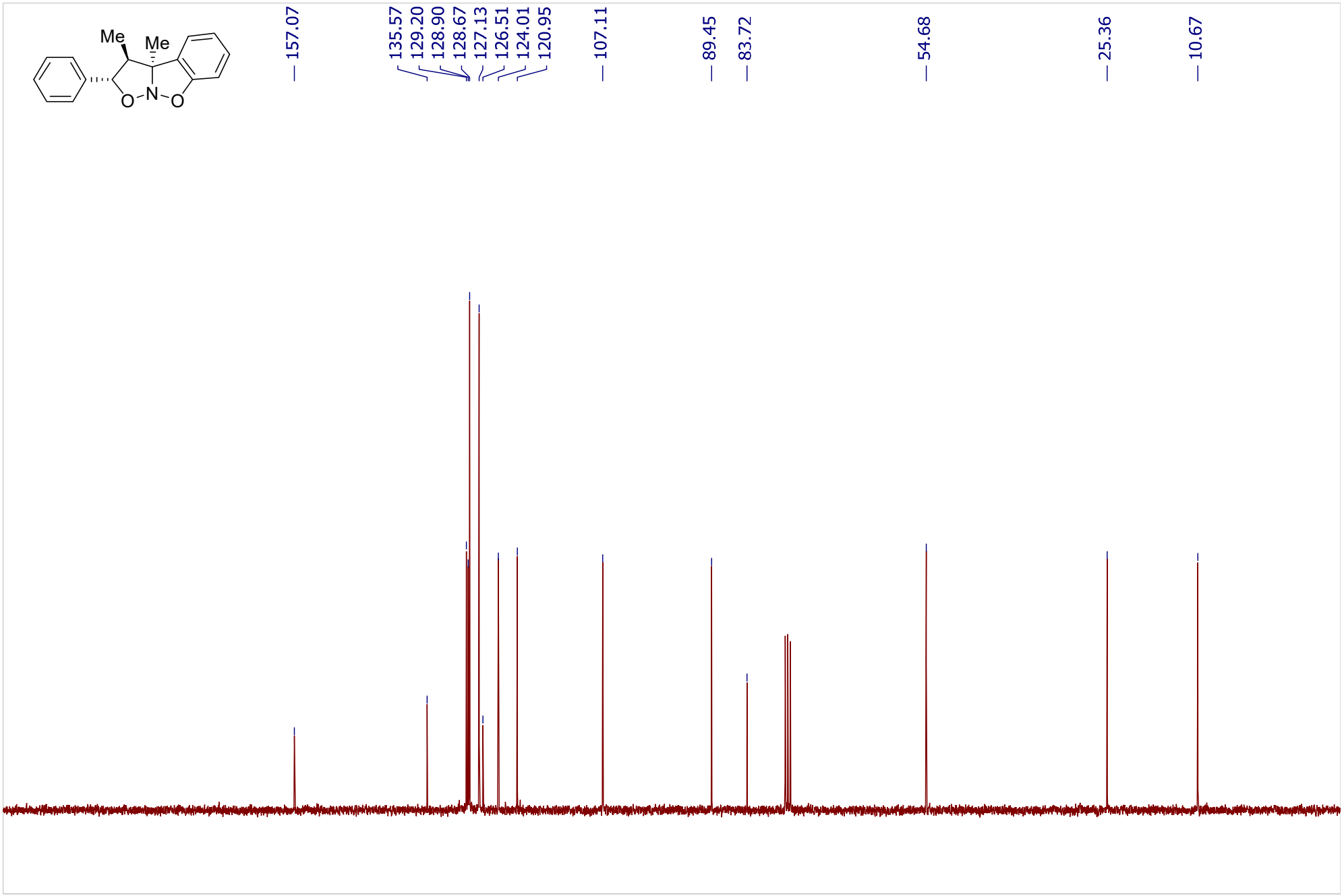

MeO
Me
EtO2C
O
N
O
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

(2*R,3*R**,3a*R**)-3,3a-Dimethyl-2-phenyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole 6ha**

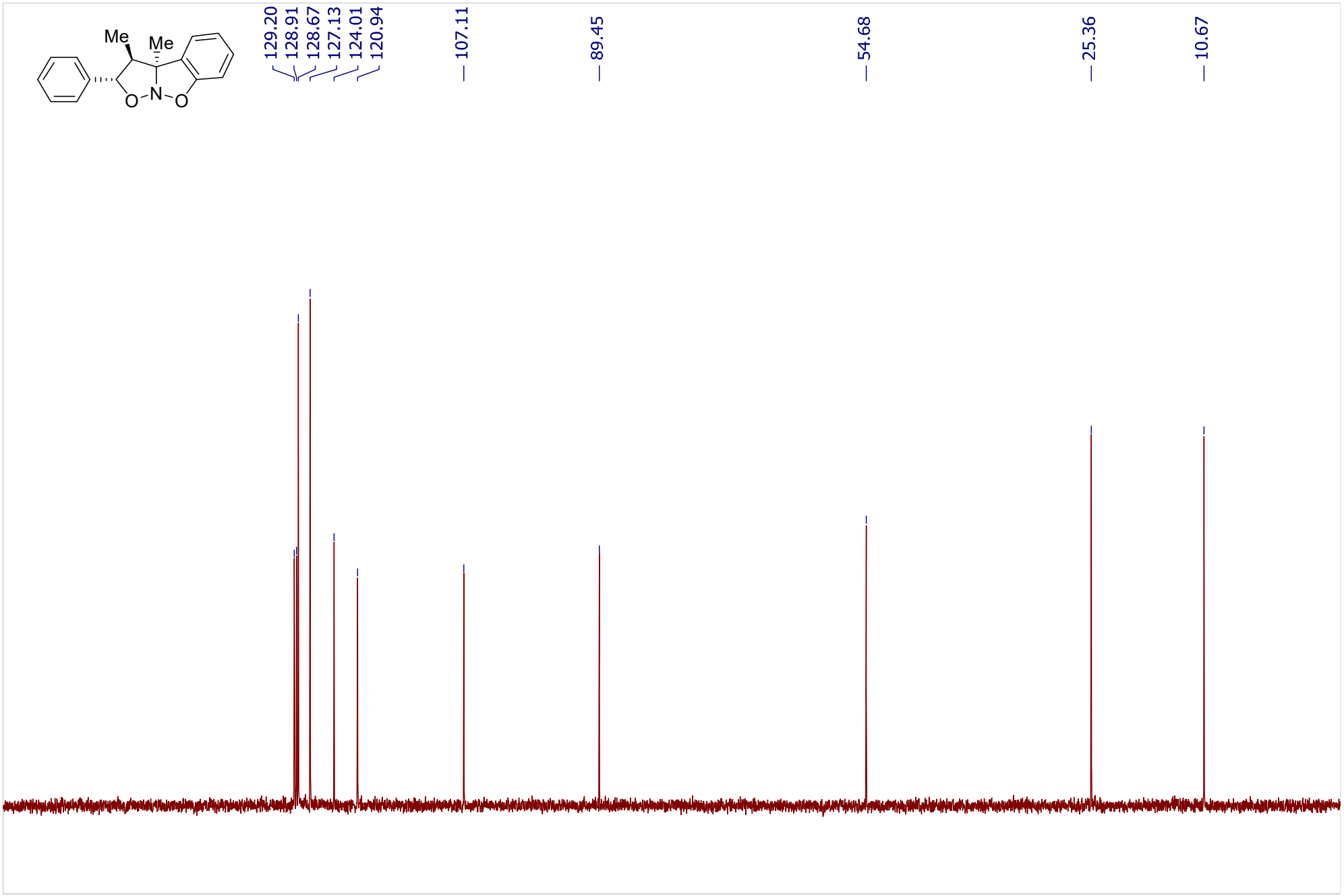
^{1}H NMR (300 MHz, $CDCl_3$)



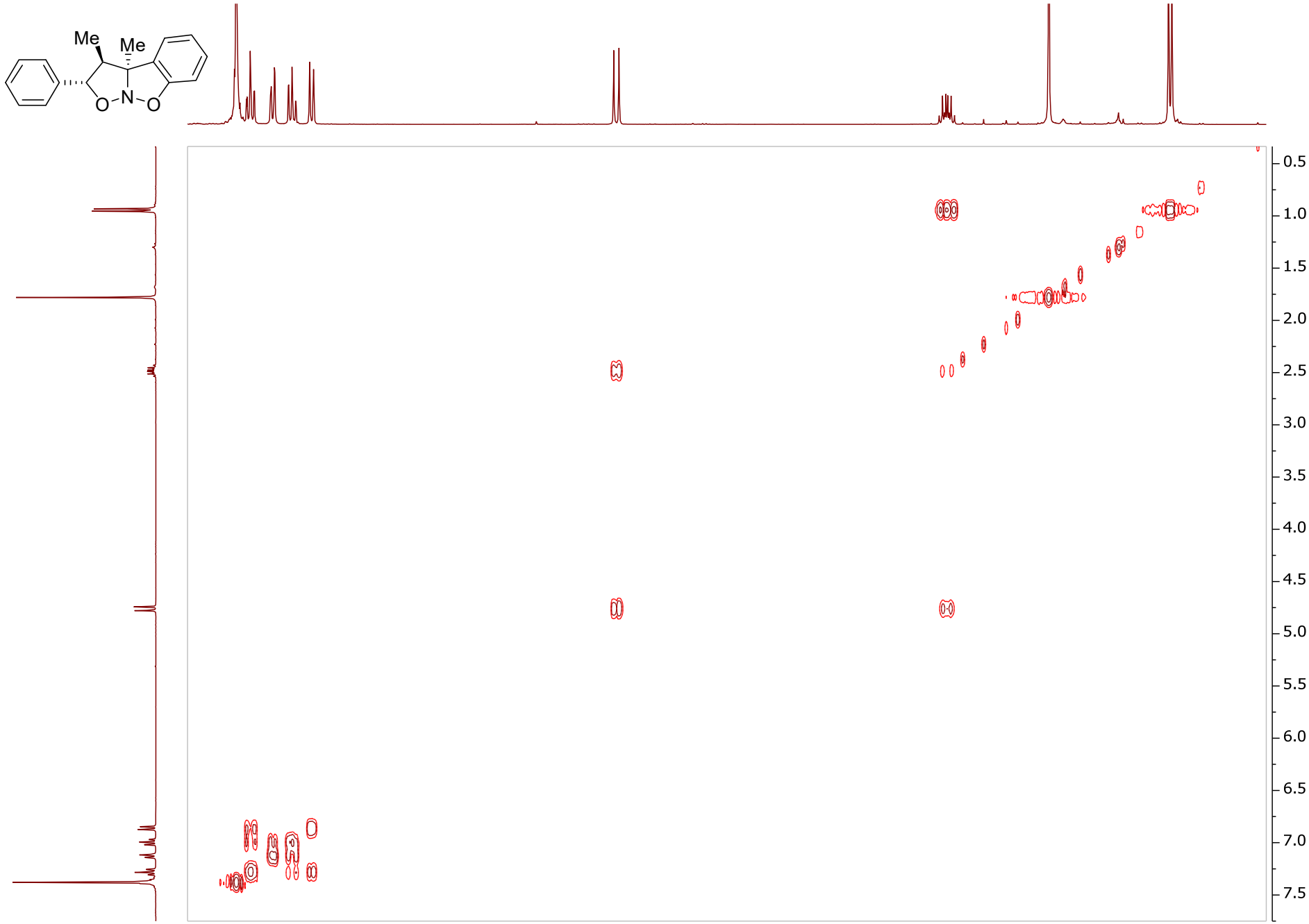
^{13}C NMR (75 MHz, $CDCl_3$)



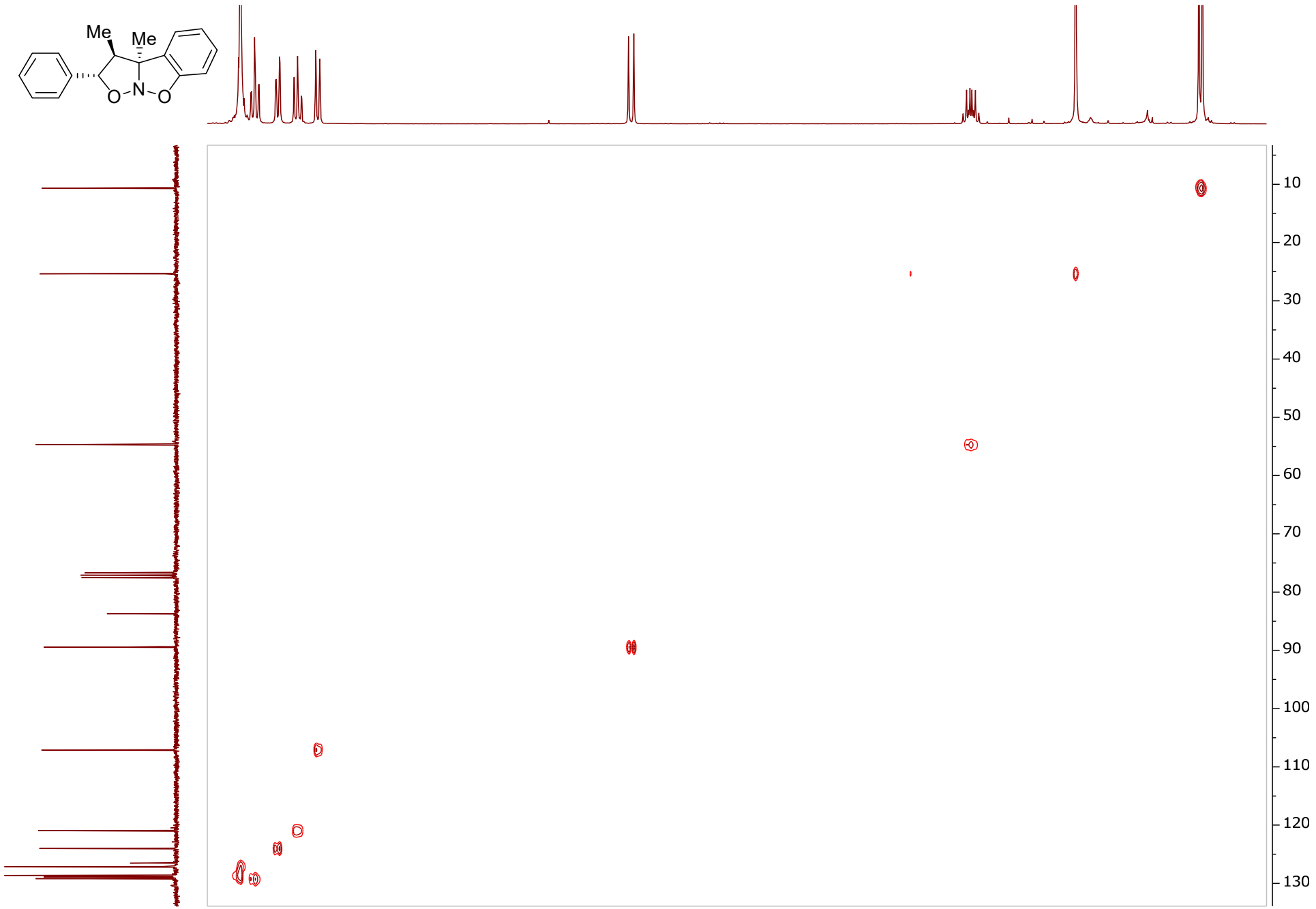
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



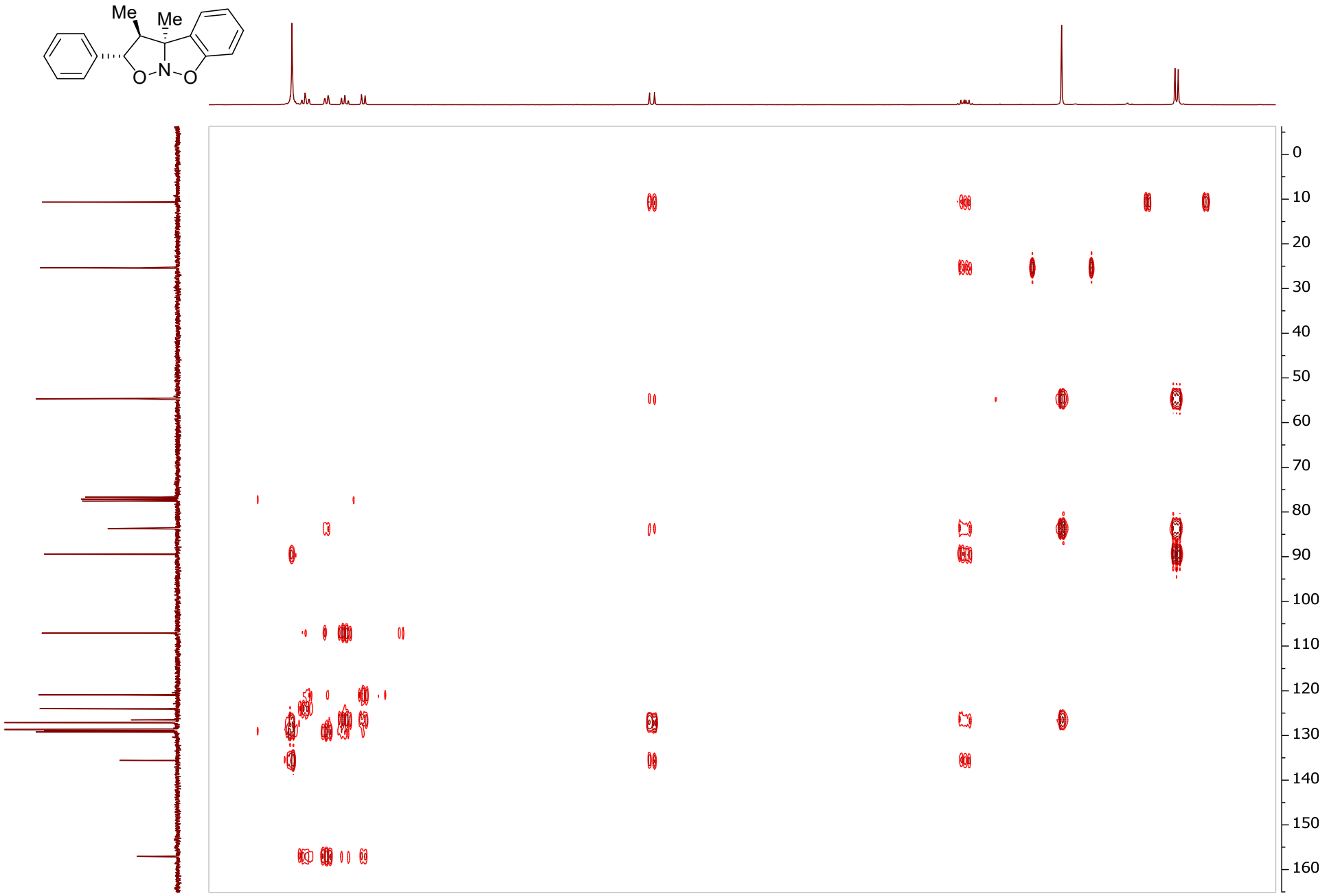
^{1}H-^{1}H COSY


Me
Me
O
N
O
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
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

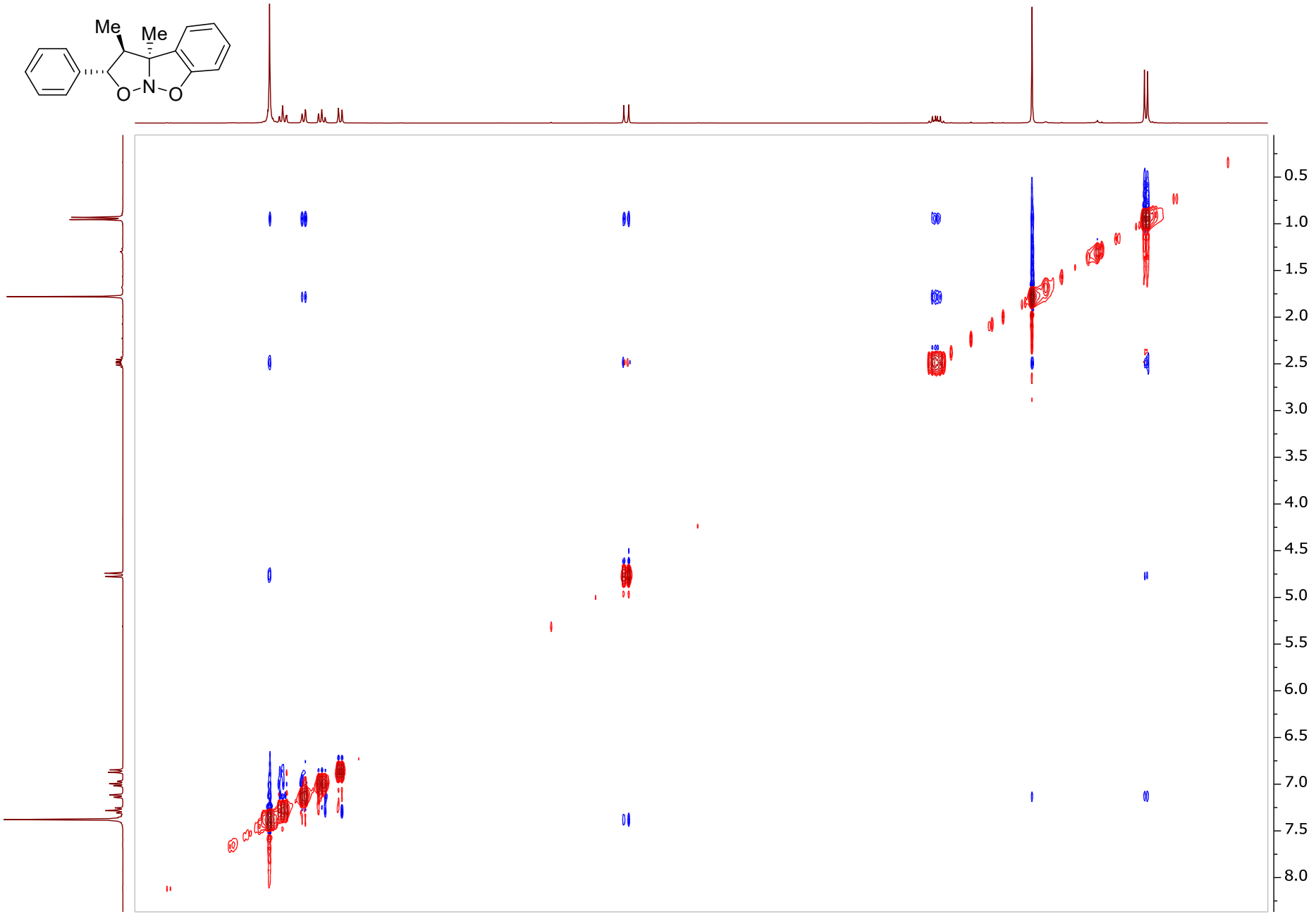
^{1}H-^{13}C HSQC


Me
Me
O
N
O
10
20
30
40
50
60
70
80
90
100
110
120
130
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

^{1}H-^{13}C HMBC

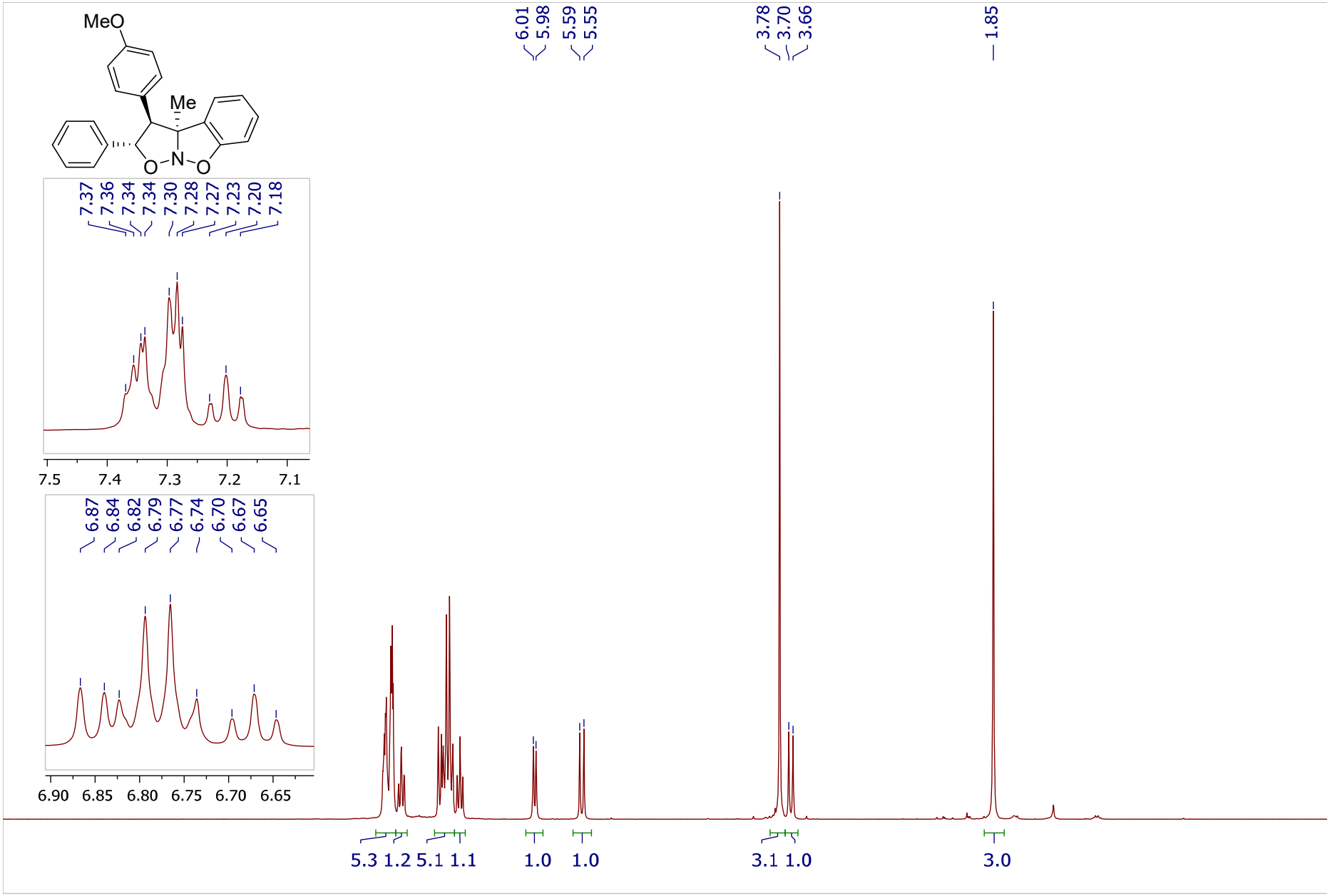

Me
Me
O
N
O
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{1}H NOESY

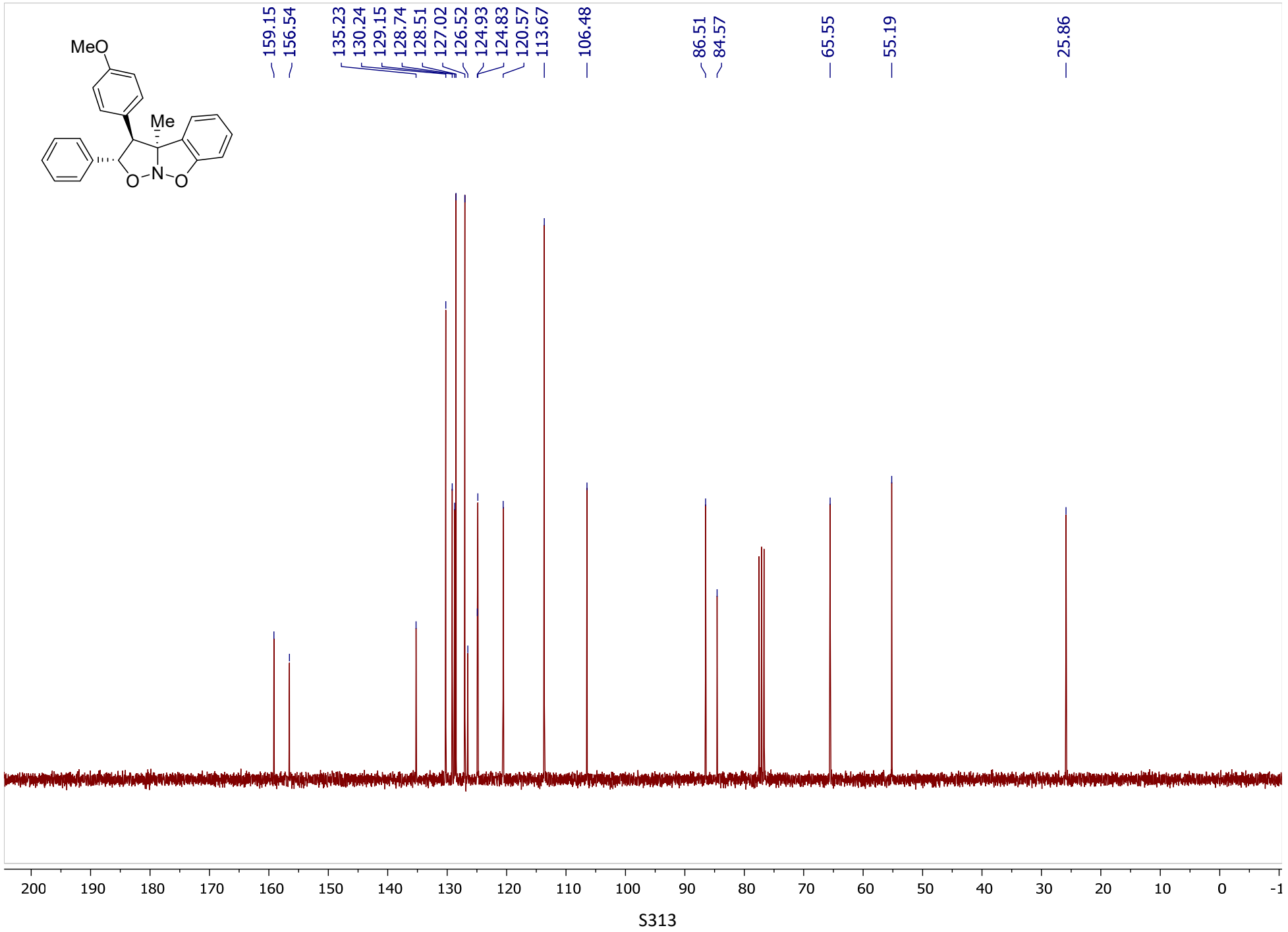

Me
Me
O
N
O
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

(2*S,3*S**,3a*S**)-3-(4-Methoxyphenyl)-3a-methyl-2-phenyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole 6ia**

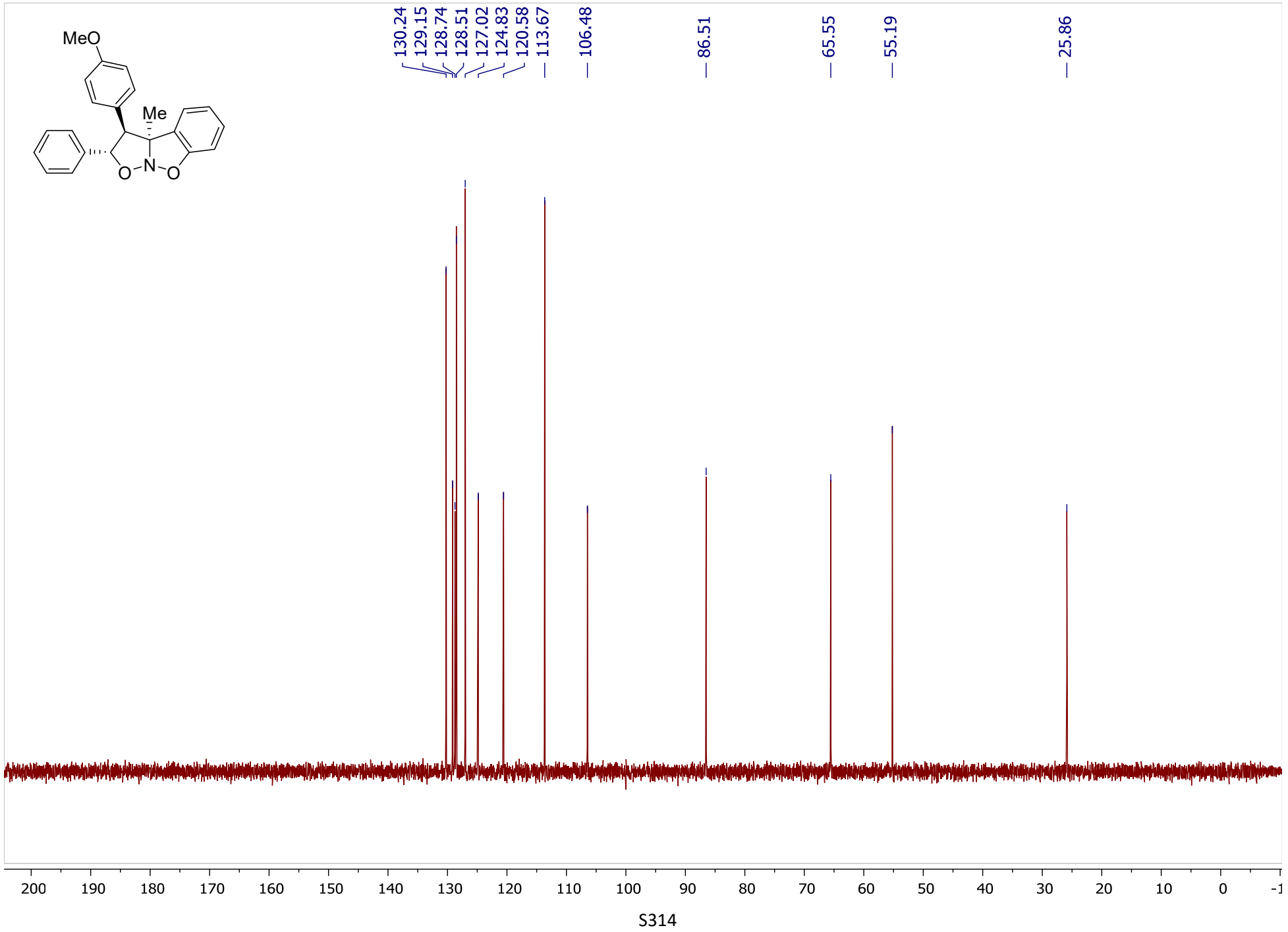
^{1}H NMR (300 MHz, $CDCl_3$)



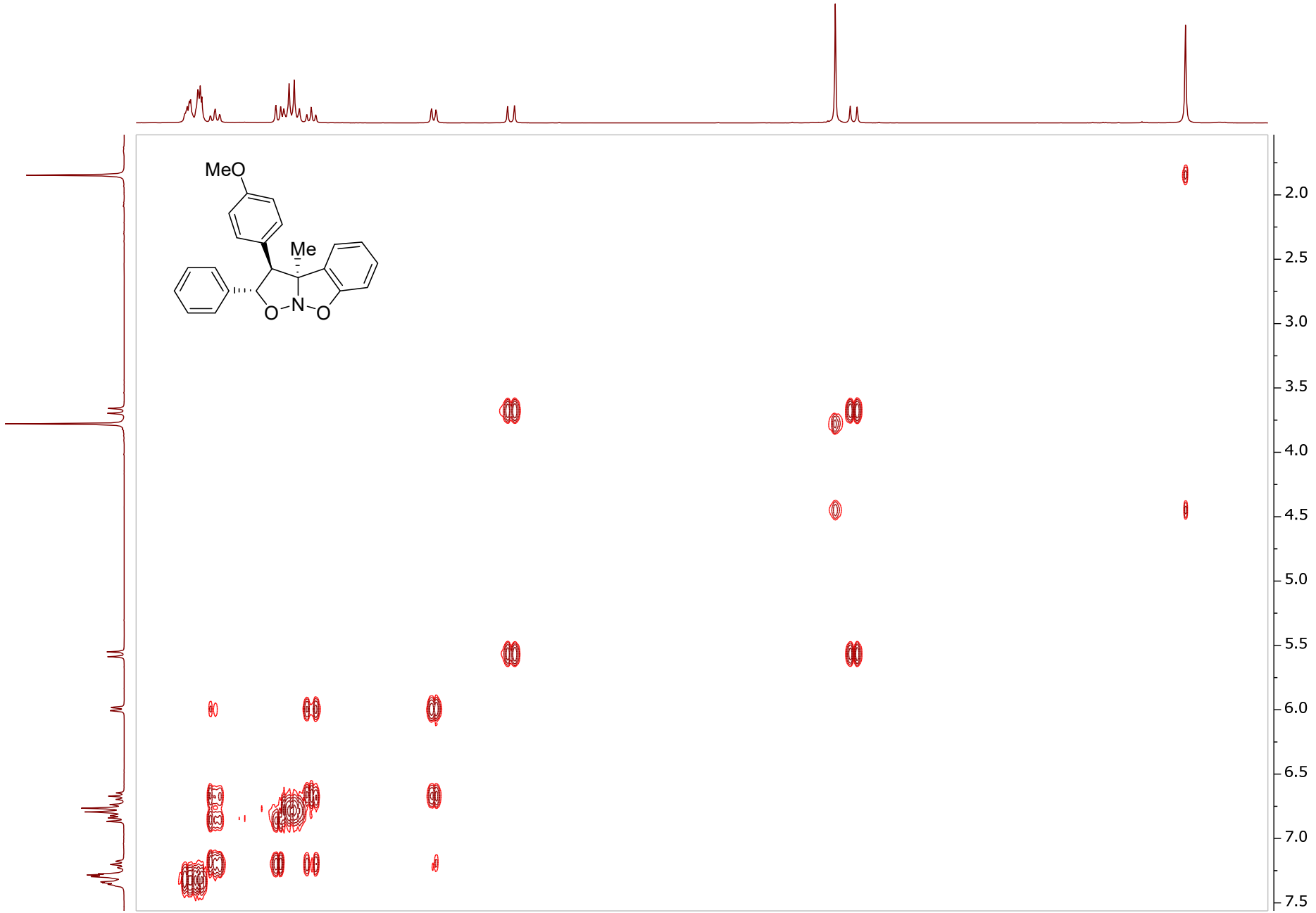
^{13}C NMR (75 MHz, $CDCl_3$)



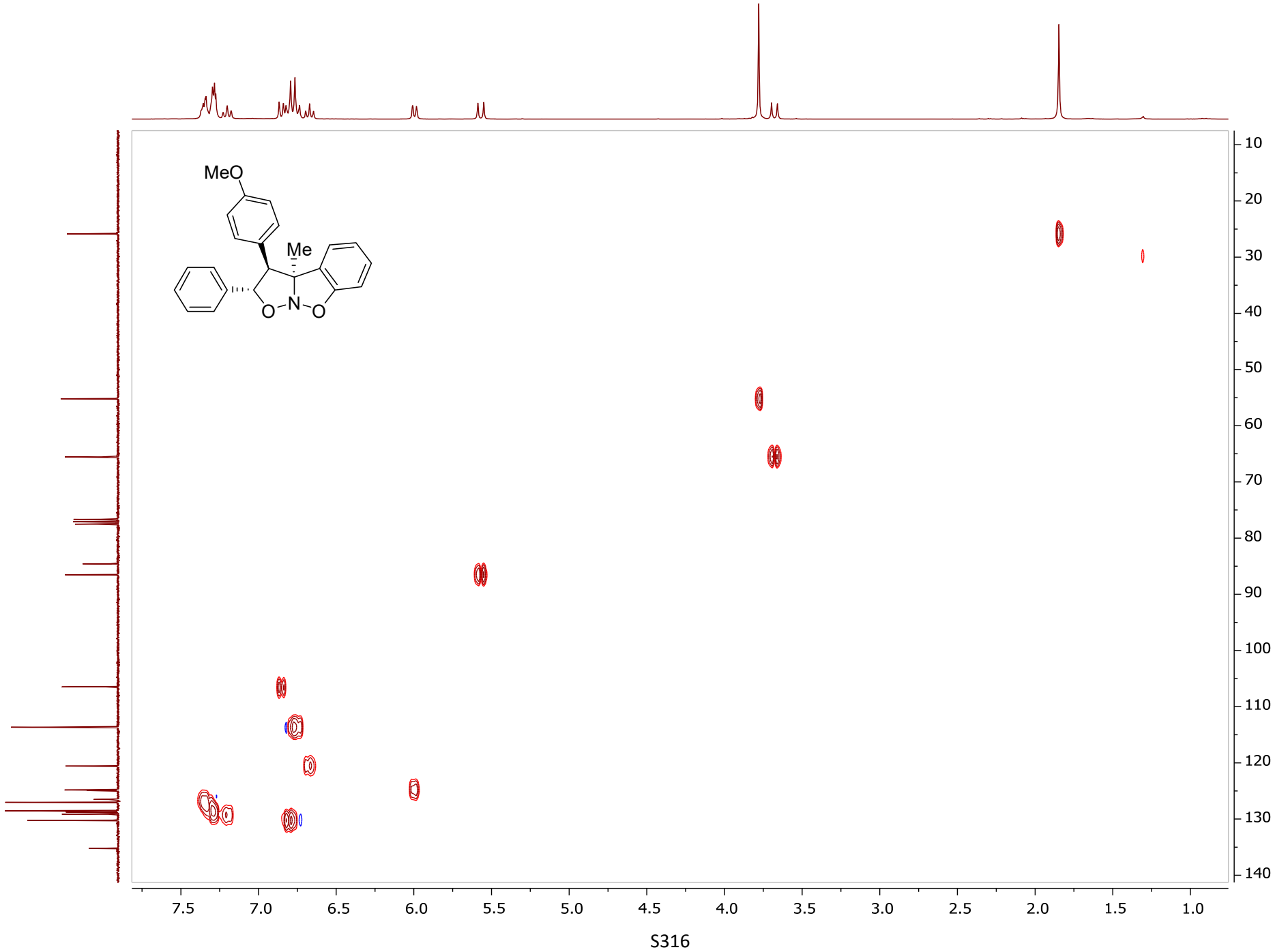
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



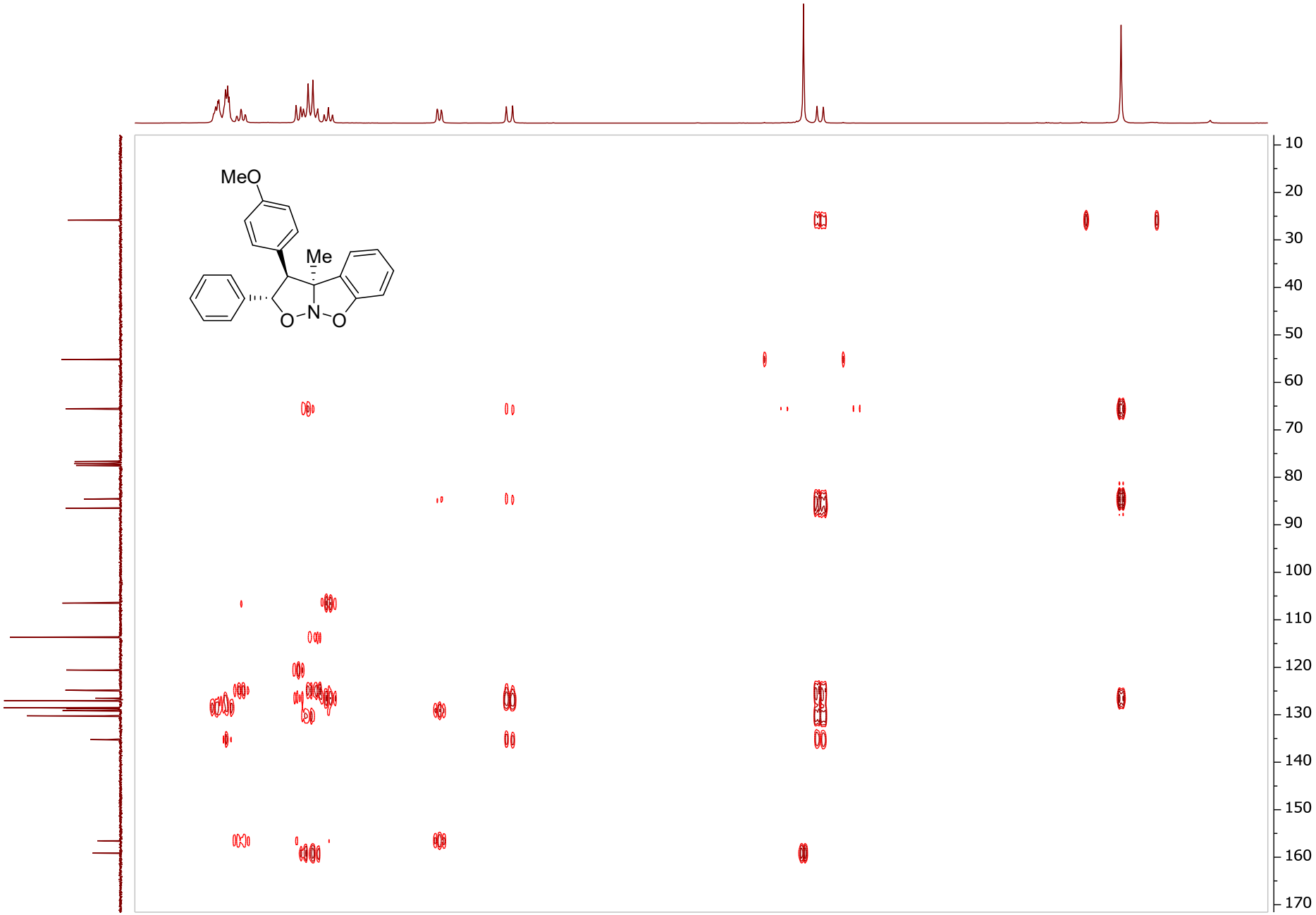
^{1}H-^{1}H COSY


MeO
Me
O
N
O
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
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5

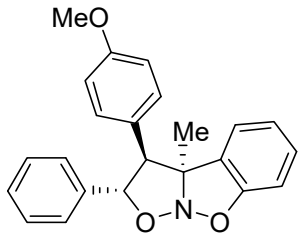
^{1}H-^{13}C HSQC

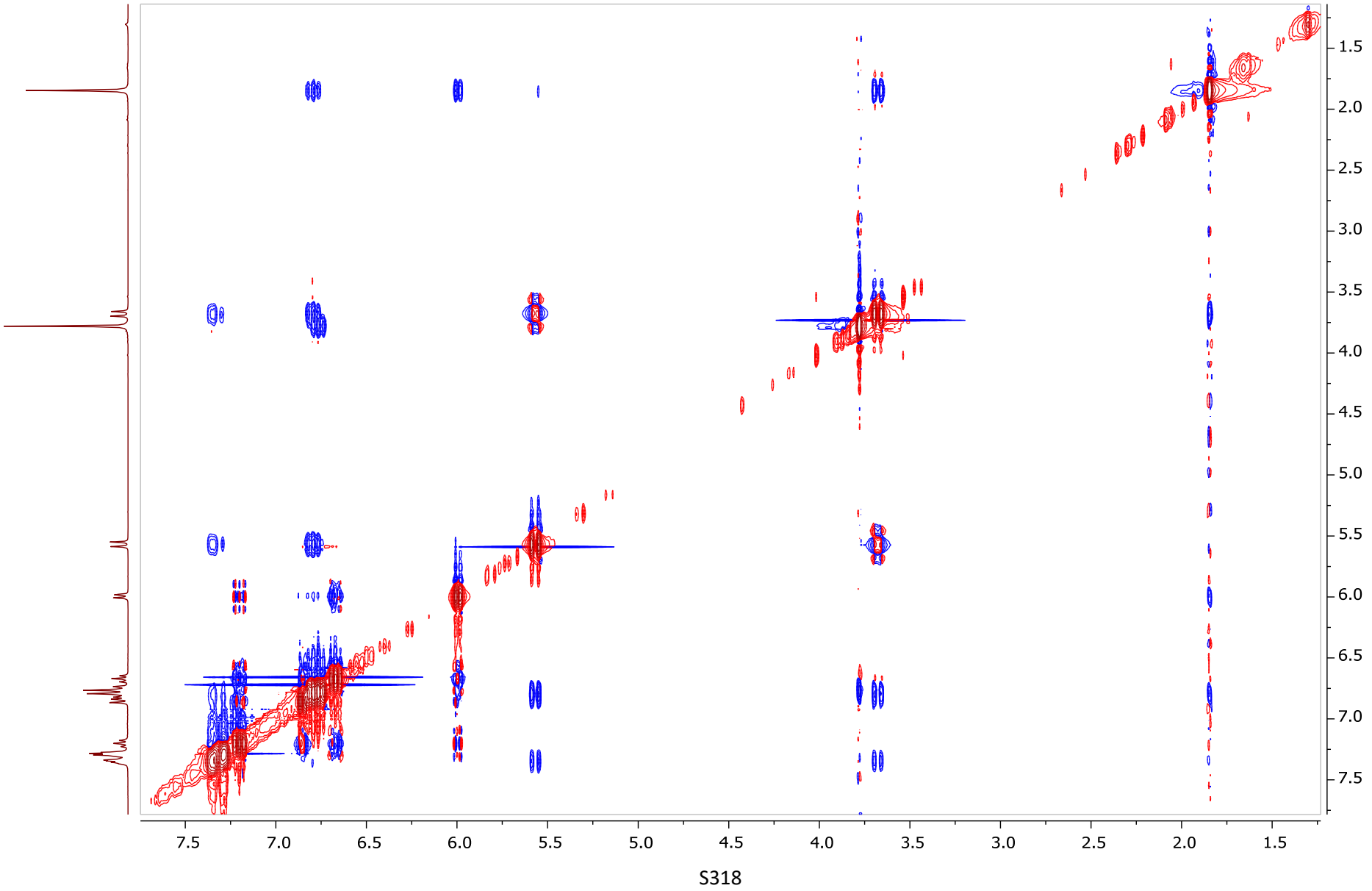

MeO
Me
O
N
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

^{1}H-^{13}C HMBC


MeO
Me
O
N
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
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

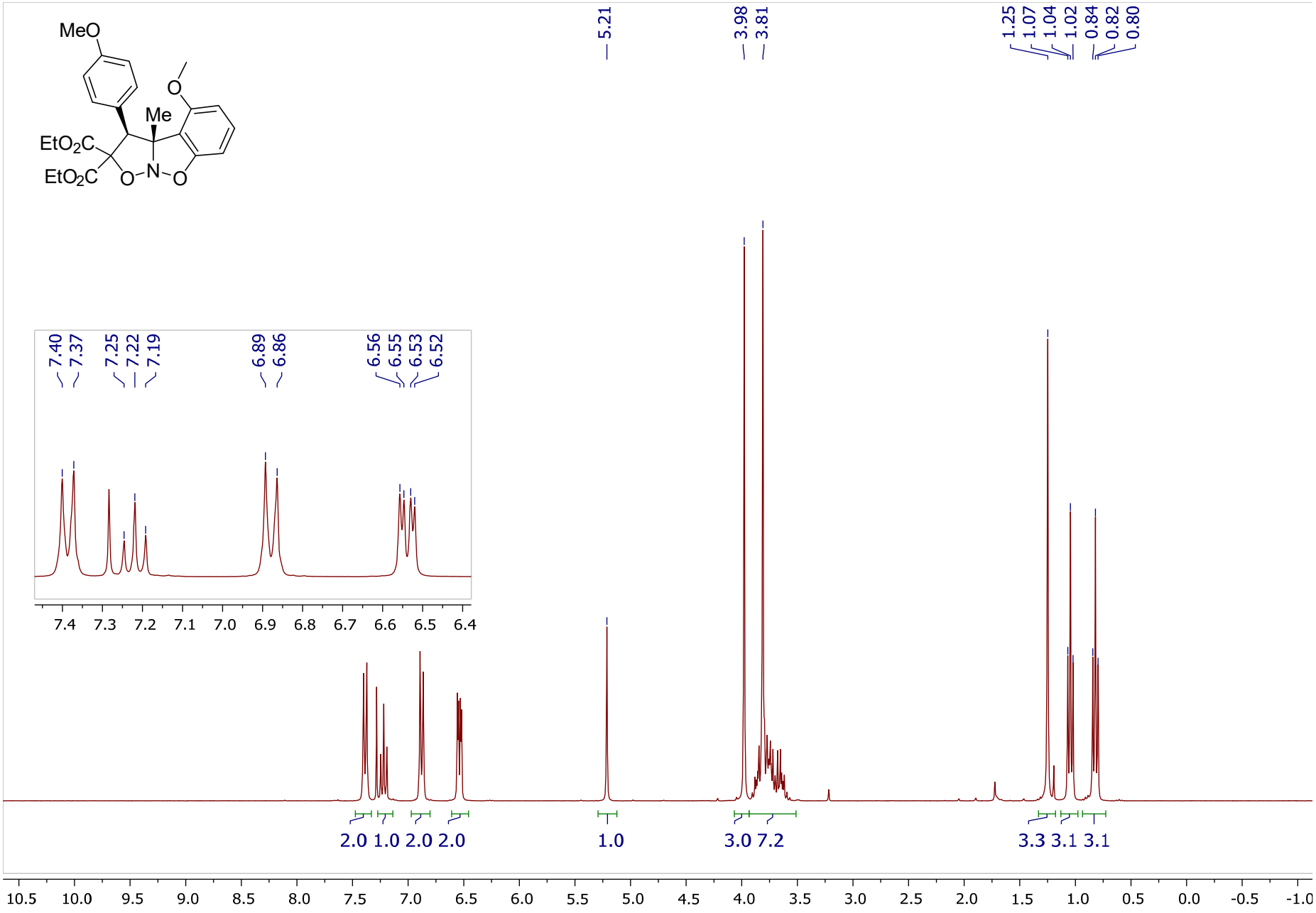
^{1}H-^{1}H NOESY


MeO
Me
O
N
O

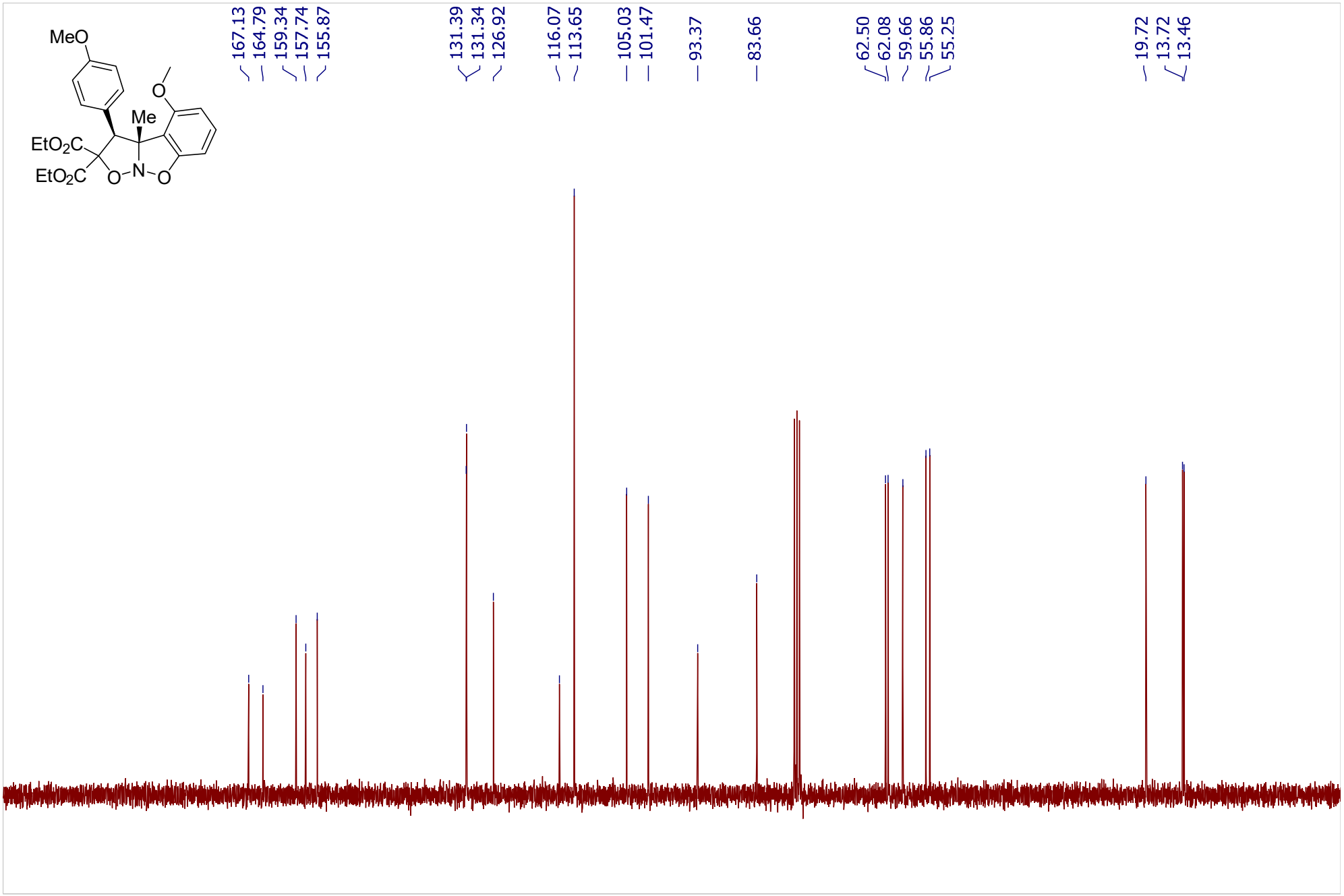

1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5

Diethyl (3*S,3a*R**)-4-methoxy-3-(4-methoxyphenyl)-3a-methyl-3,3a-dihydro-2H-benzo[d]isoxazolo[2,3-b]isoxazole-2,2-dicarboxylate 6ab**

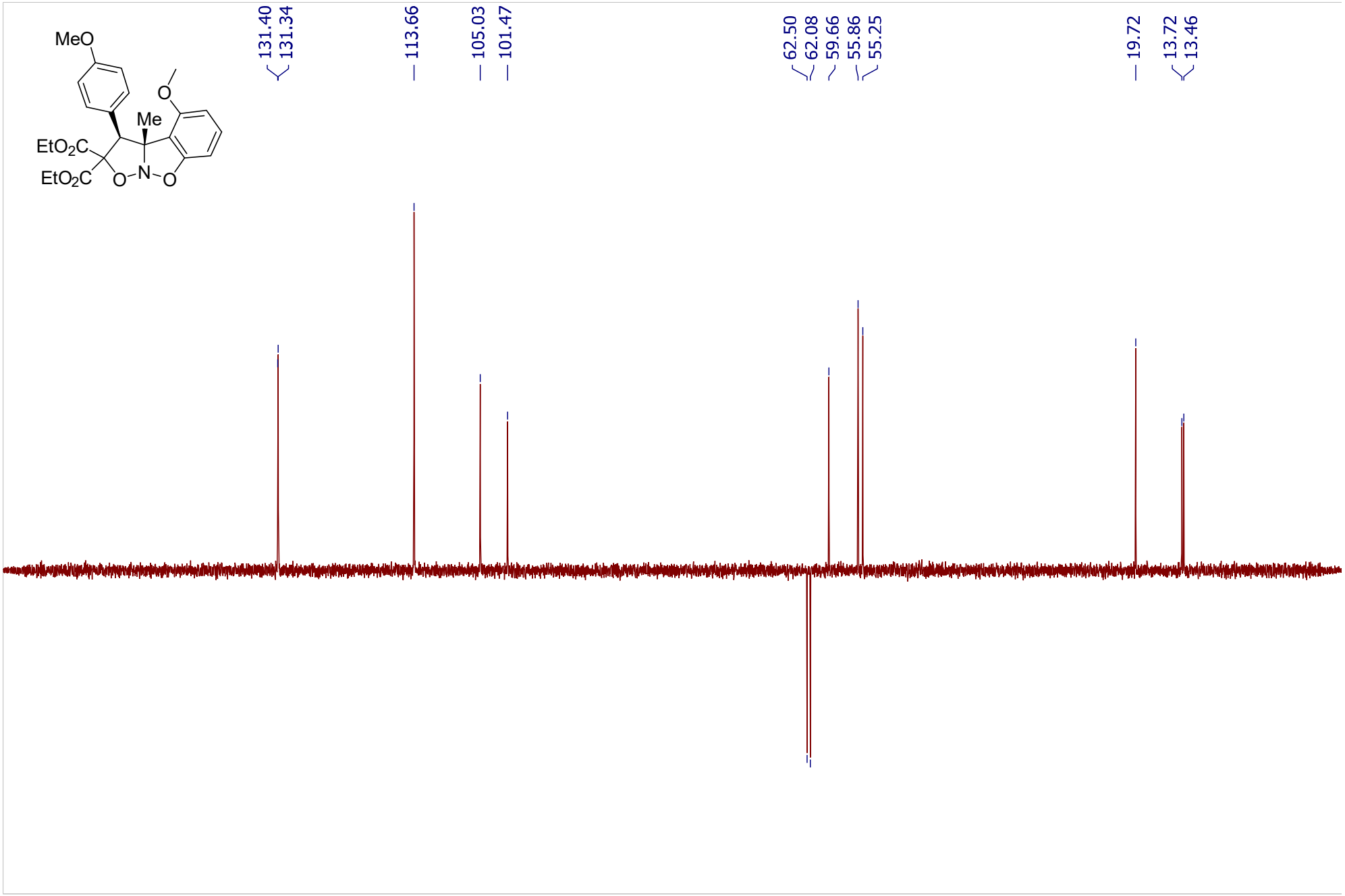
^{1}H NMR (300 MHz, $CDCl_3$)



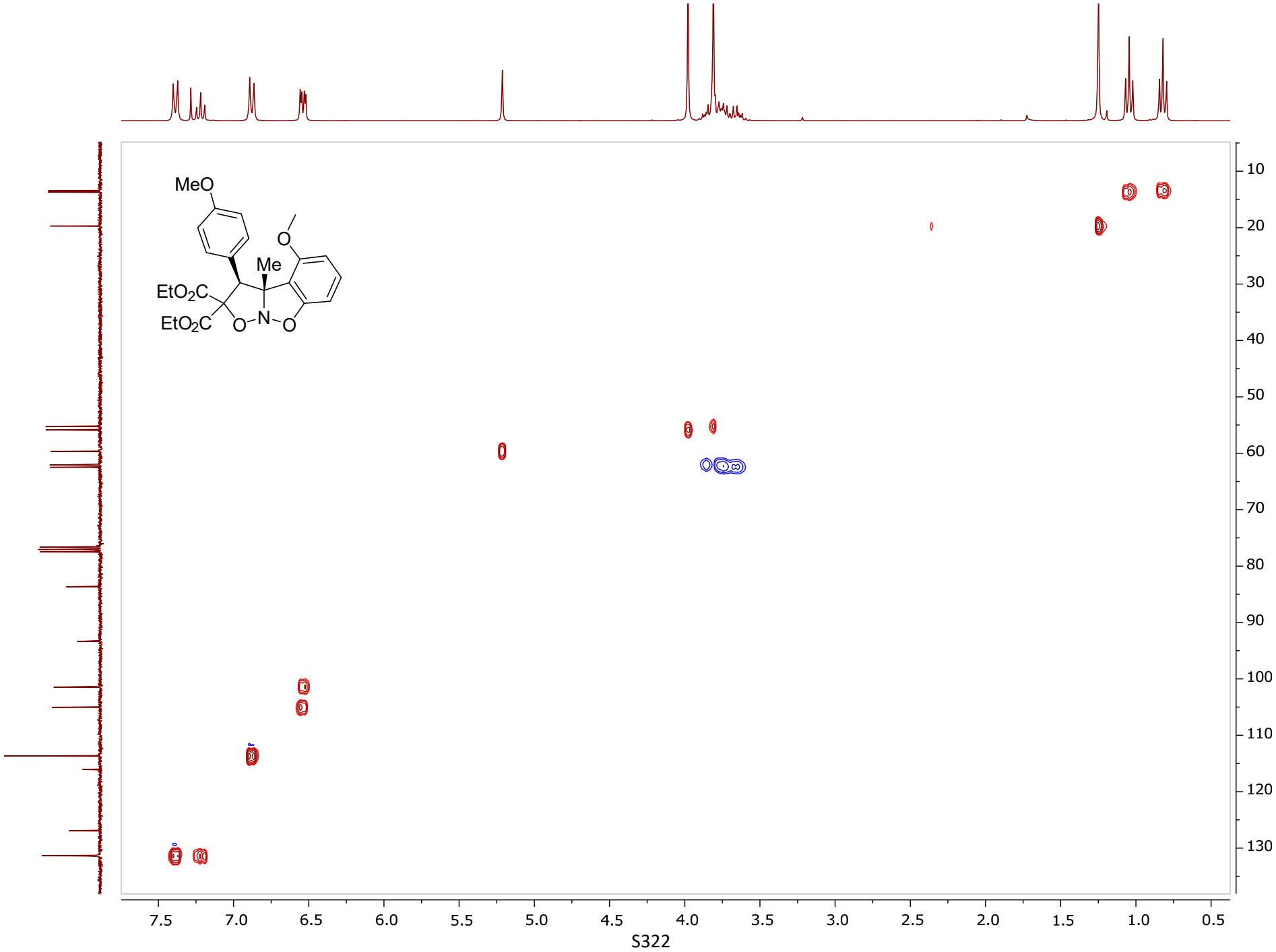
^{13}C NMR (75 MHz, $CDCl_3$)



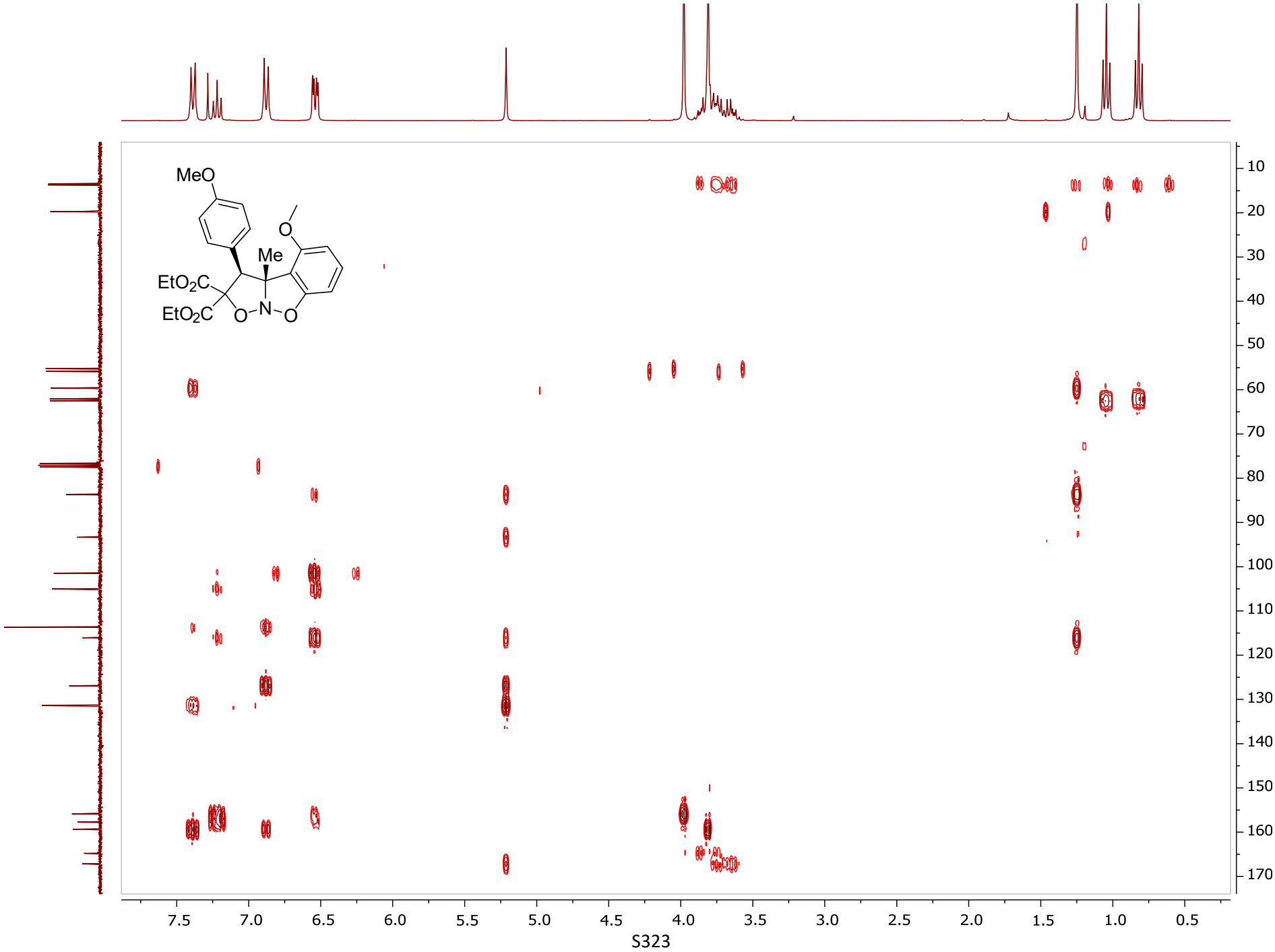
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



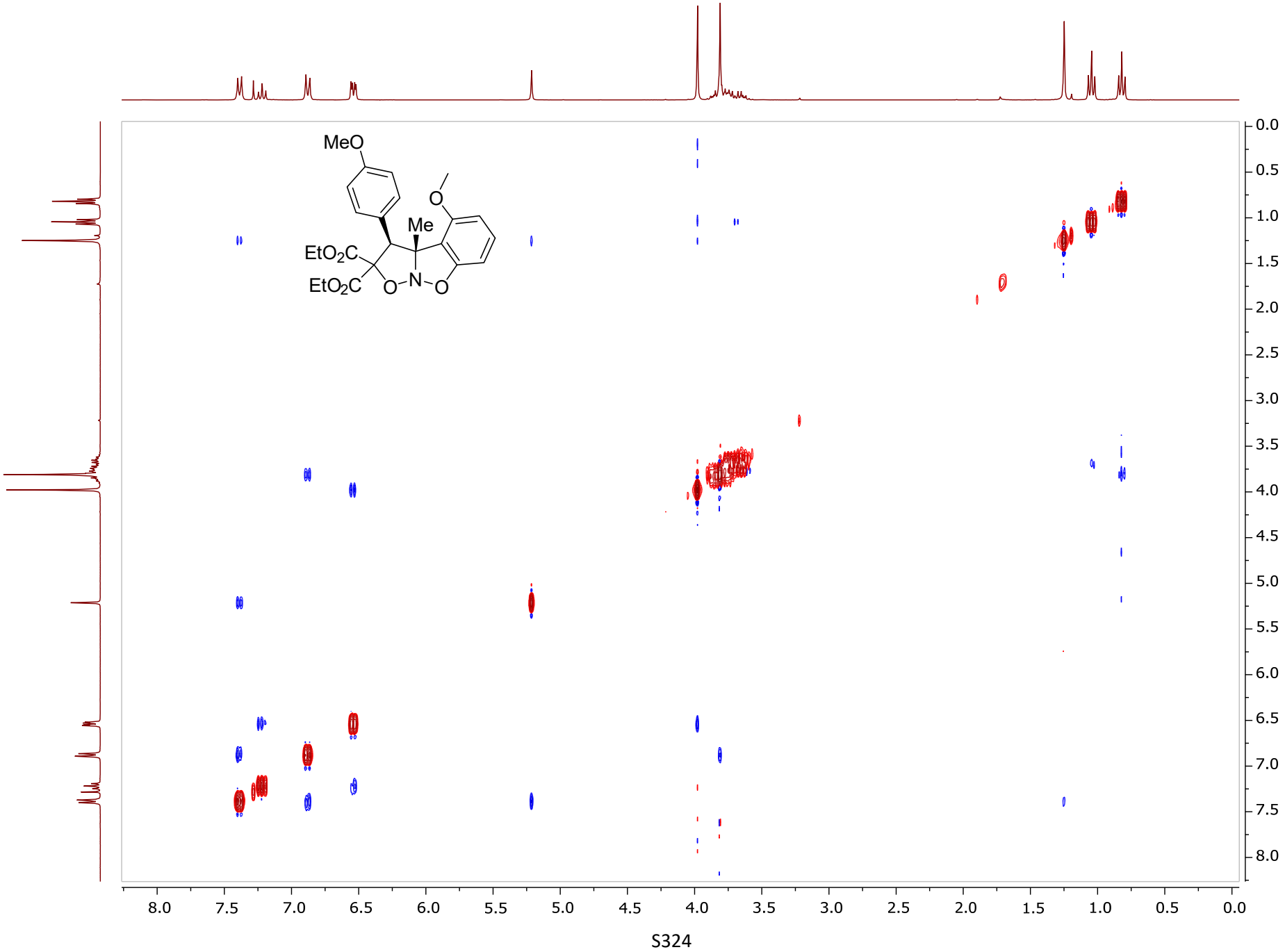
^{1}H-^{13}C HSQC


MeO
O
Me
EtO2C
EtO2C
O
N
O
10
20
30
40
50
60
70
80
90
100
110
120
130
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
S322

^{1}H-^{13}C HMBC

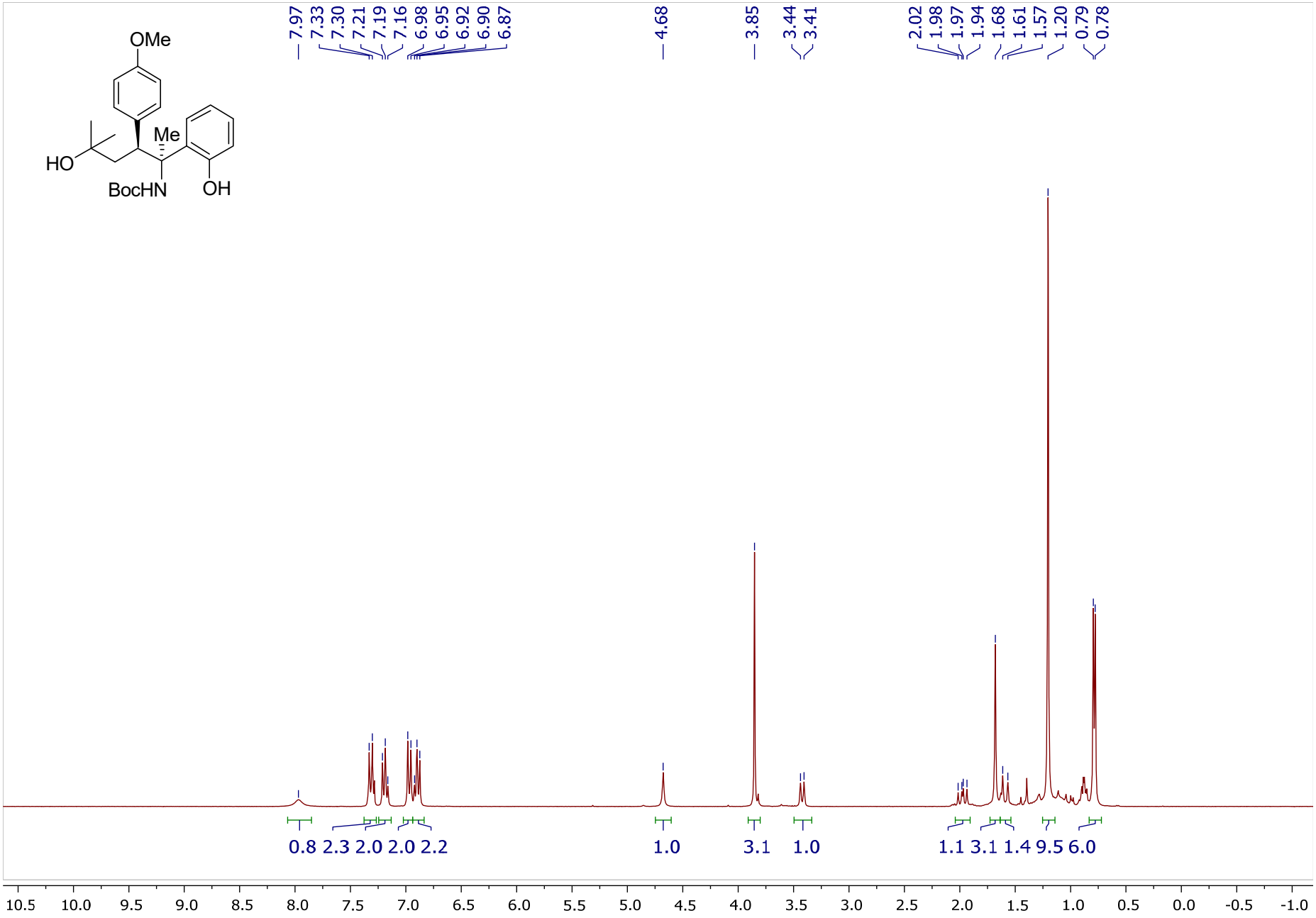

MeO
O
Me
EtO2C
EtO2C
O
N
O
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{1}H NOESY

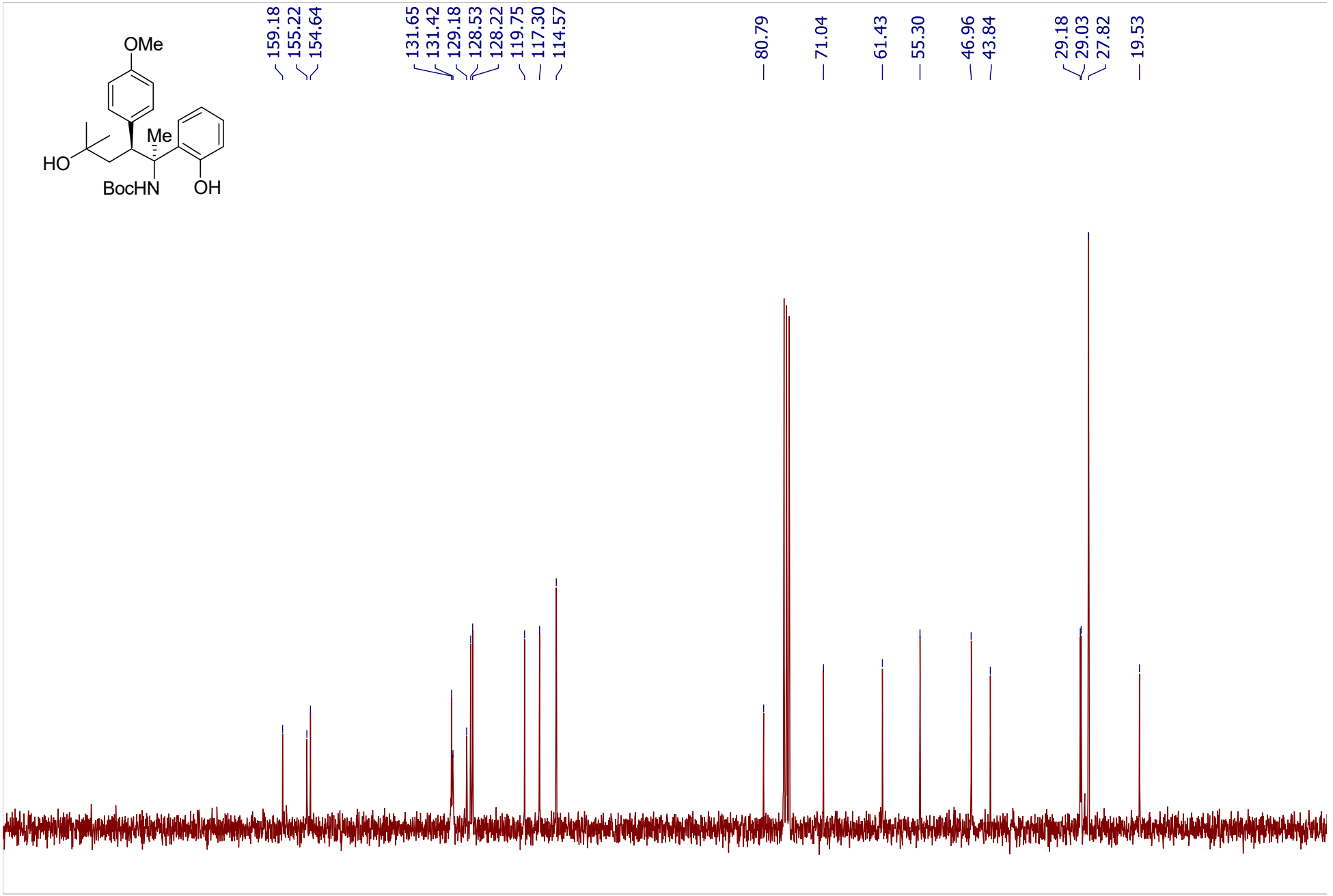

MeO
O
Me
EtO2C
EtO2C
O
N
O
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

tert-Butyl ((2*S,3*S**)-5-hydroxy-2-(2-hydroxyphenyl)-3-(4-methoxyphenyl)-5-methylhexan-2-yl)carbamate 7aa**

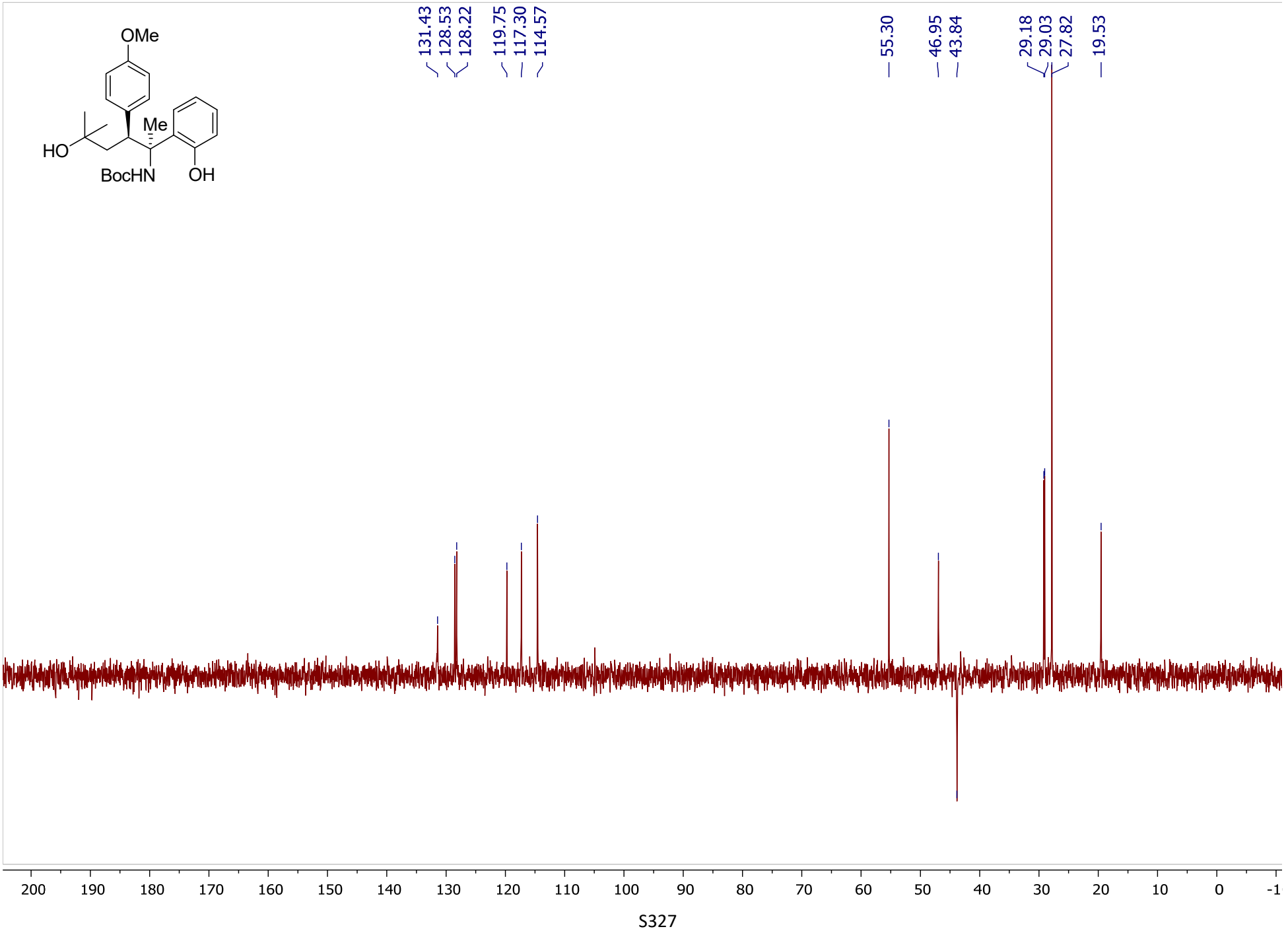
^{1}H NMR (300 MHz, $CDCl_3$)



^{13}C NMR (75 MHz, $CDCl_3$)

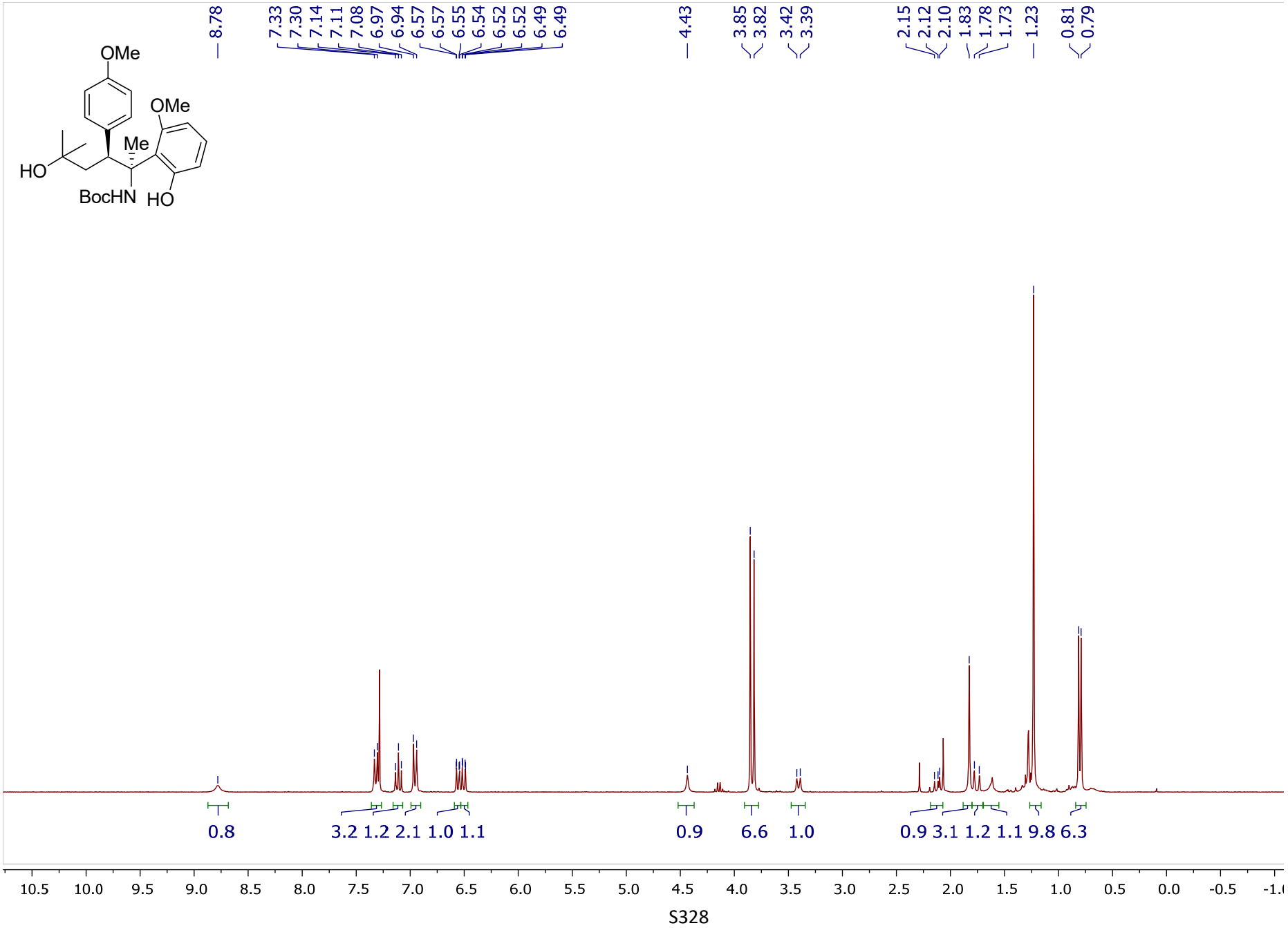


^{13}C DEPT 135 (75 MHz, $CDCl_3$)

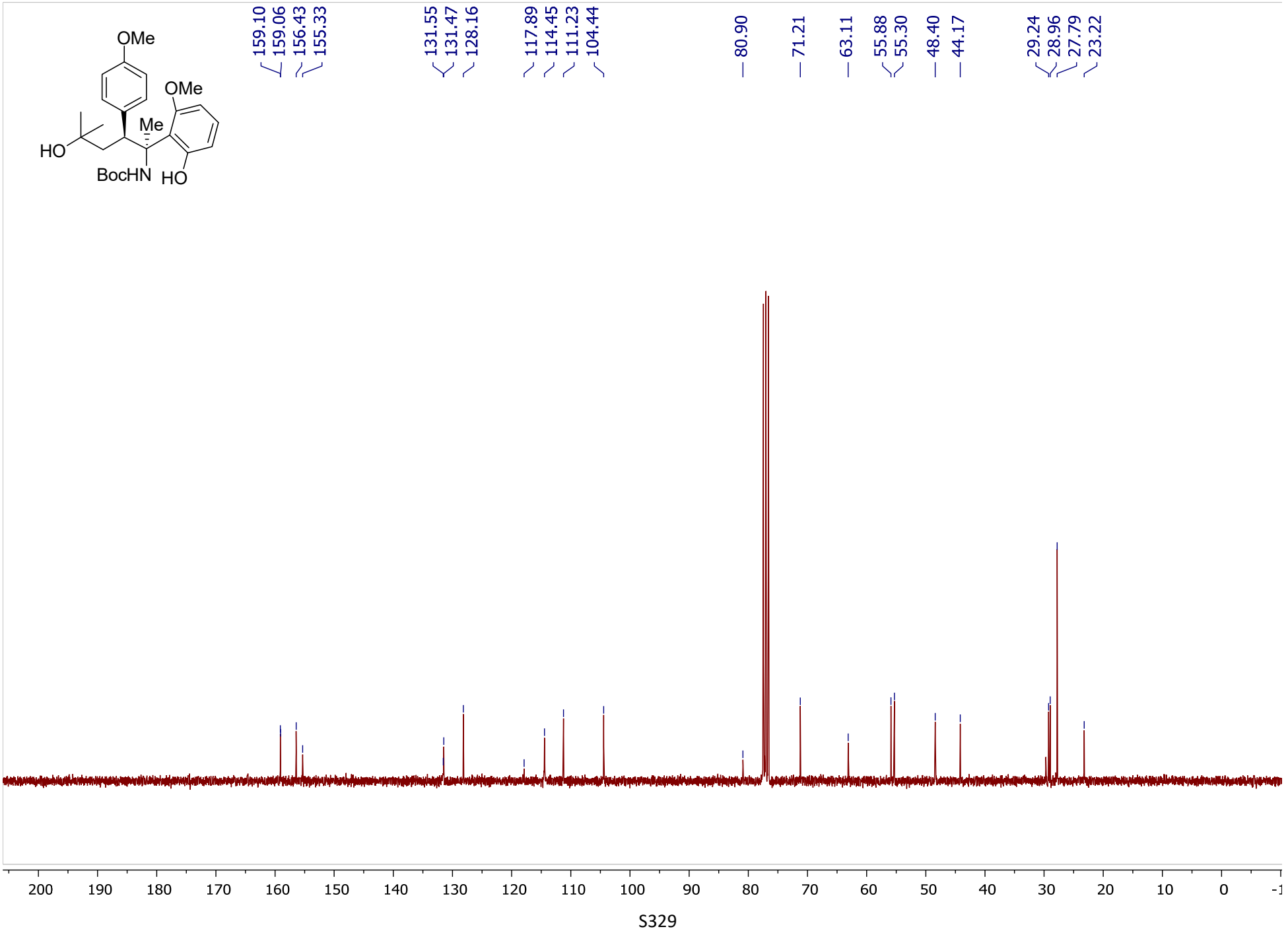


tert-Butyl ((2*S,3*S**)-5-hydroxy-2-(2-hydroxy-6-methoxyphenyl)-3-(4-methoxyphenyl)-5-methylhexan-2-ylcarbamate 7ab**

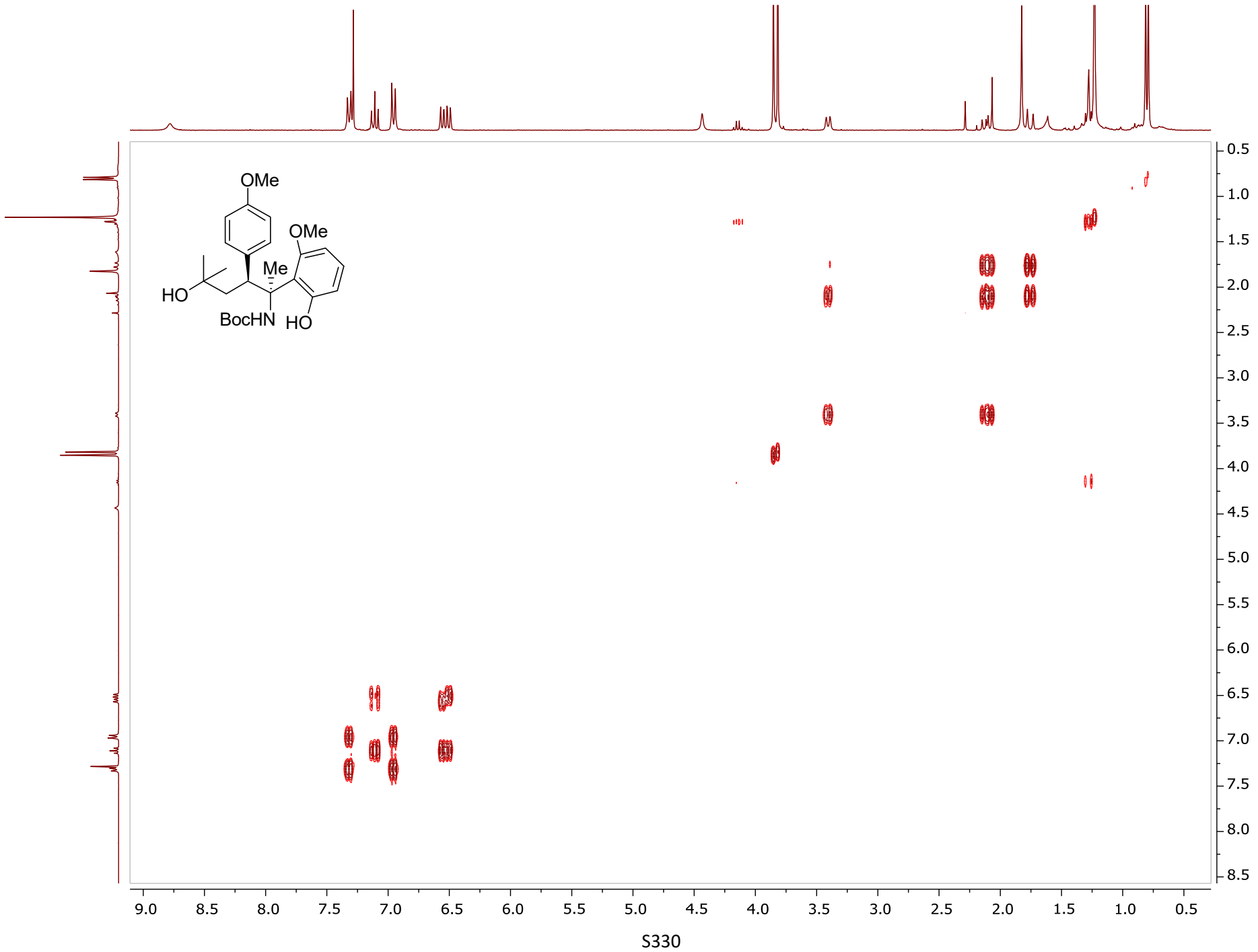
^{1}H NMR (300 MHz, $CDCl_3$)



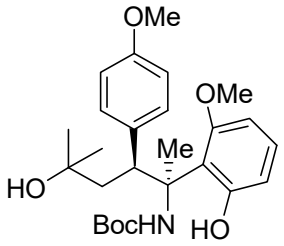
^{13}C NMR (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY

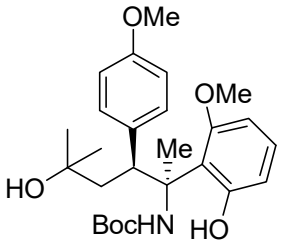

OMe
OMe
Me
HO
BocHN
HO
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

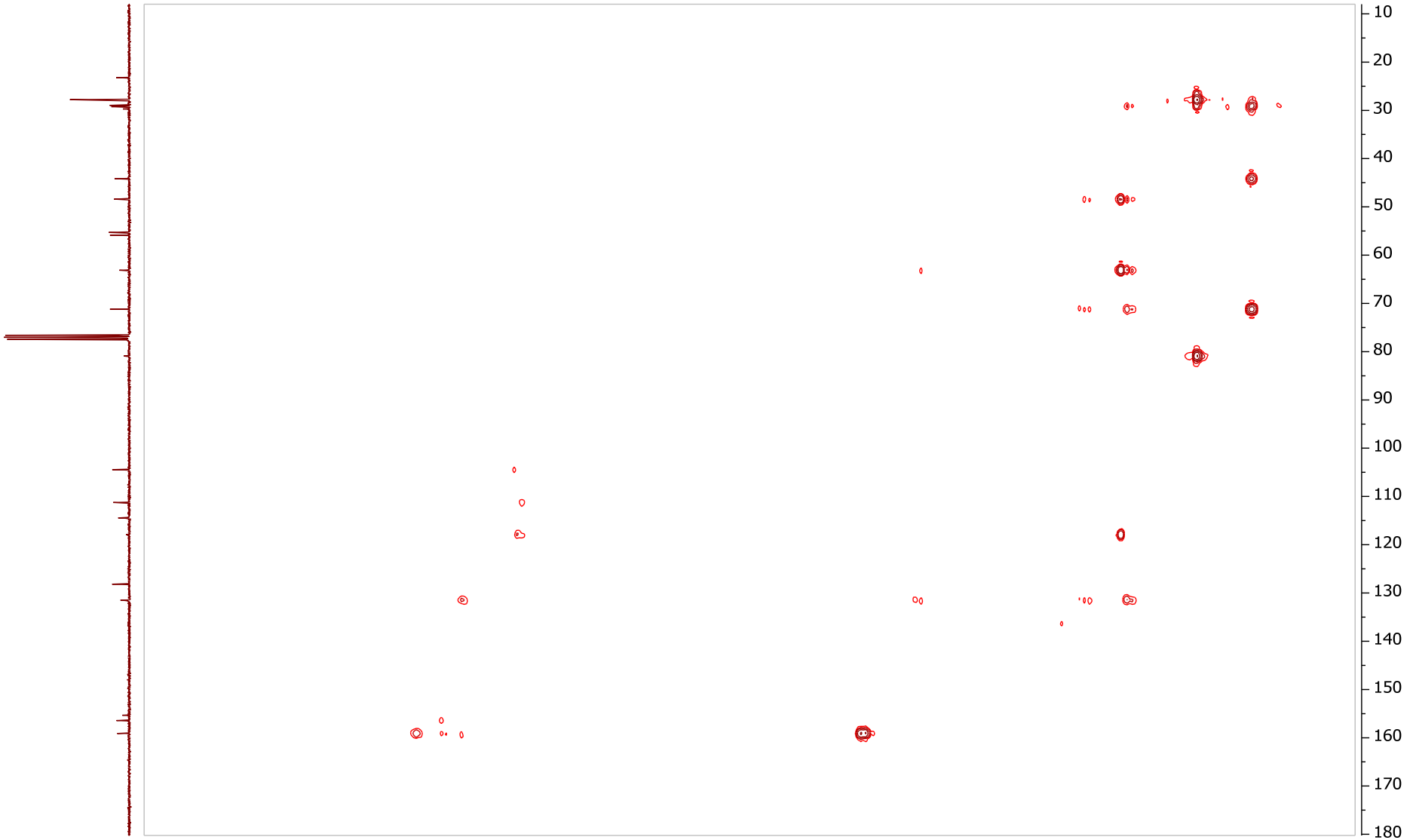
^{1}H-^{13}C HSQC


OMe
OMe
Me
HO
BocHN
HO

0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

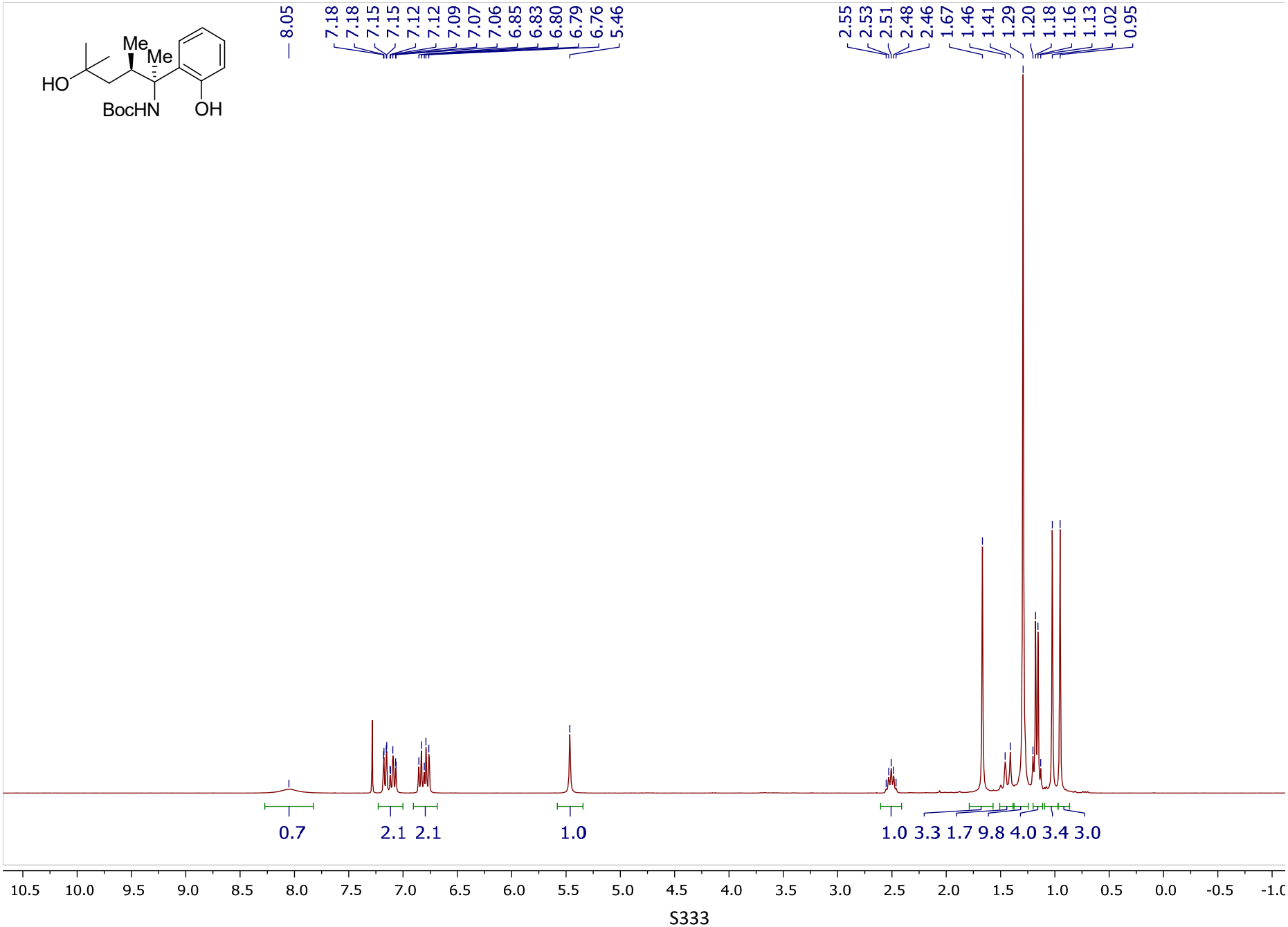
^{1}H-^{13}C HMBC


OMe
OMe
Me
HO
BocHN
HO

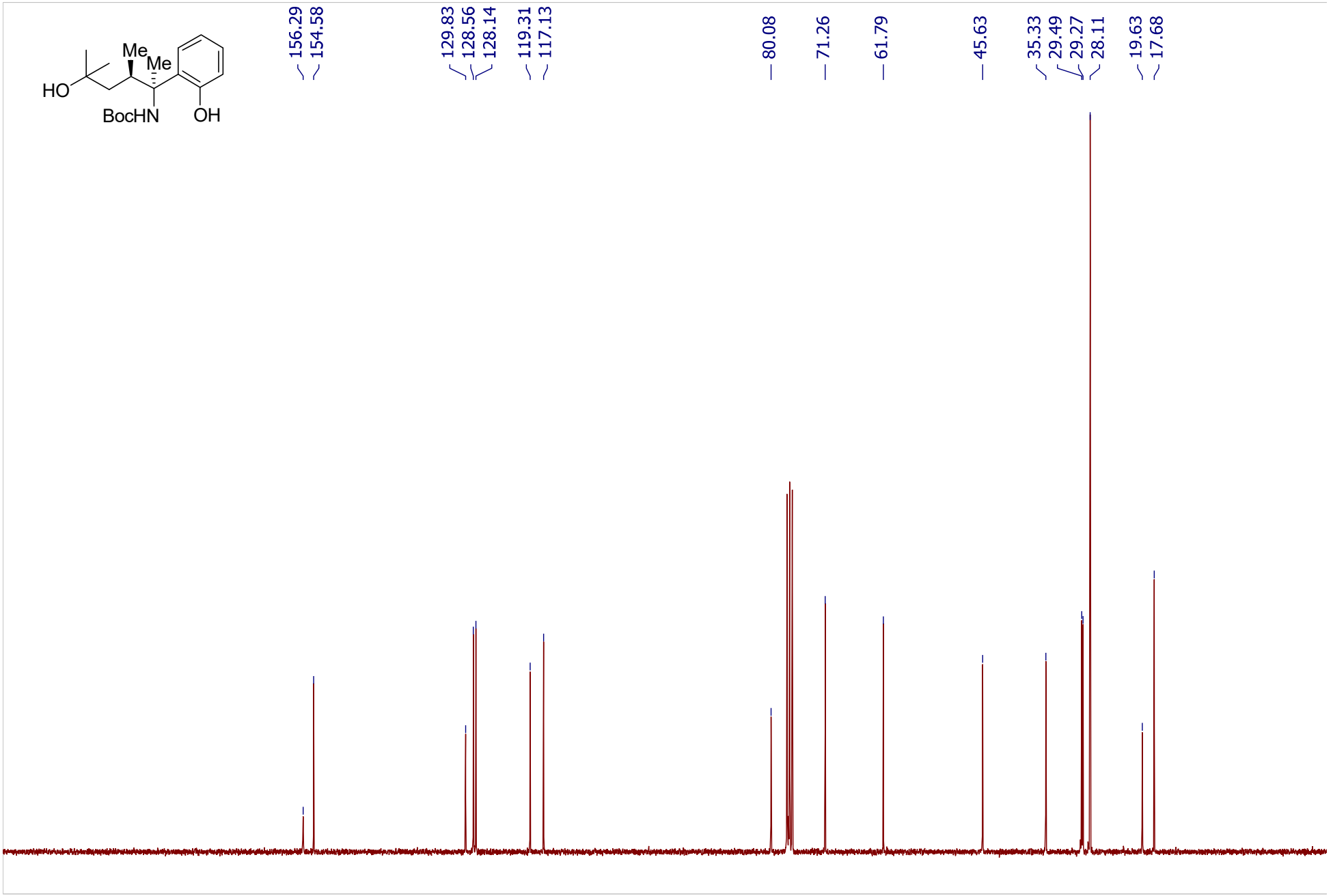

10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

***tert*-Butyl ((2*S**,3*R**)-5-hydroxy-2-(2-hydroxyphenyl)-3,5-dimethylhexan-2-yl)carbamate 7da**

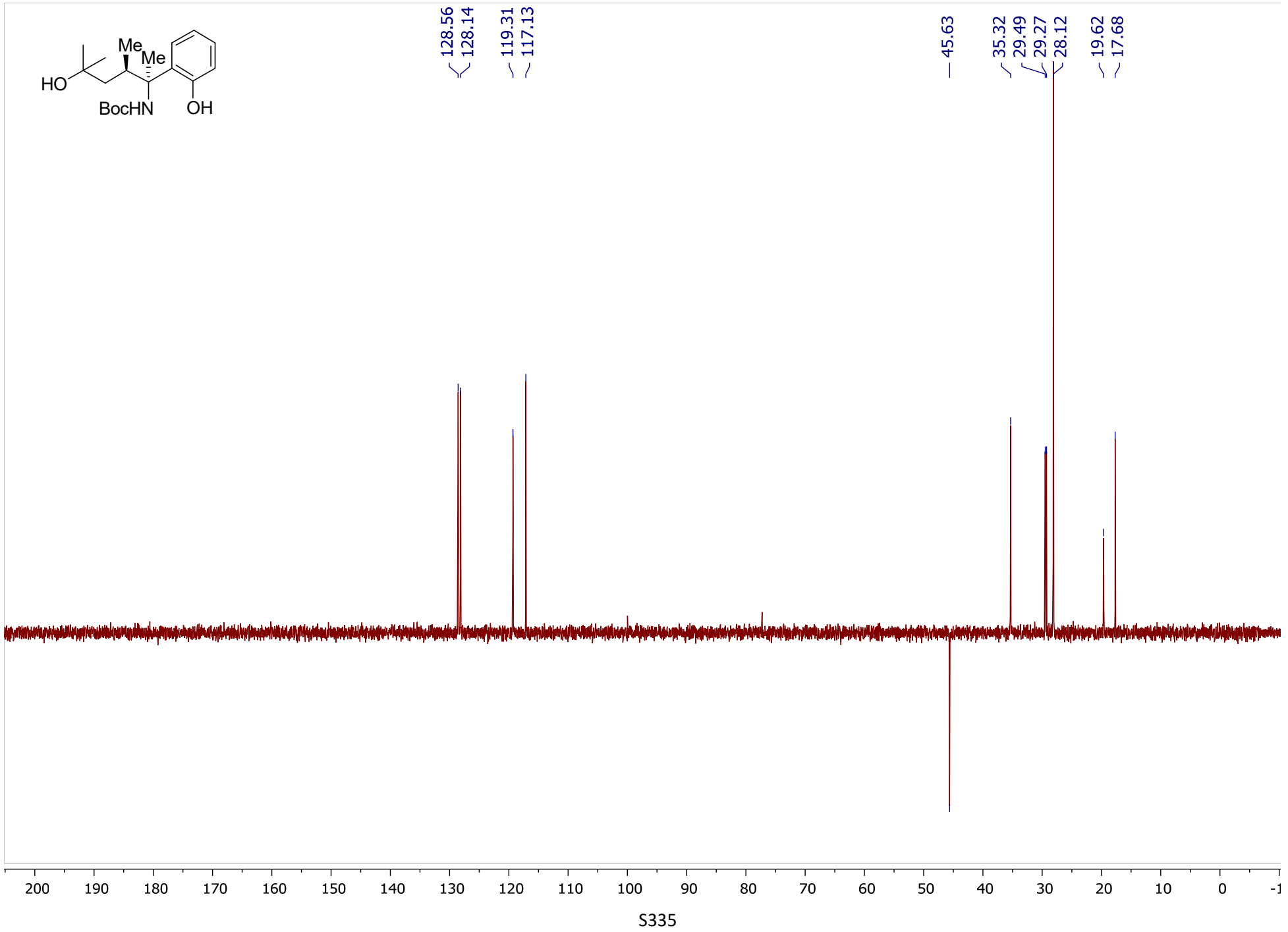
^{1}H NMR (300 MHz, $CDCl_3$)



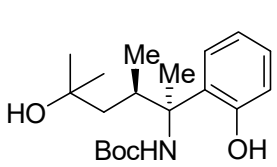
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)

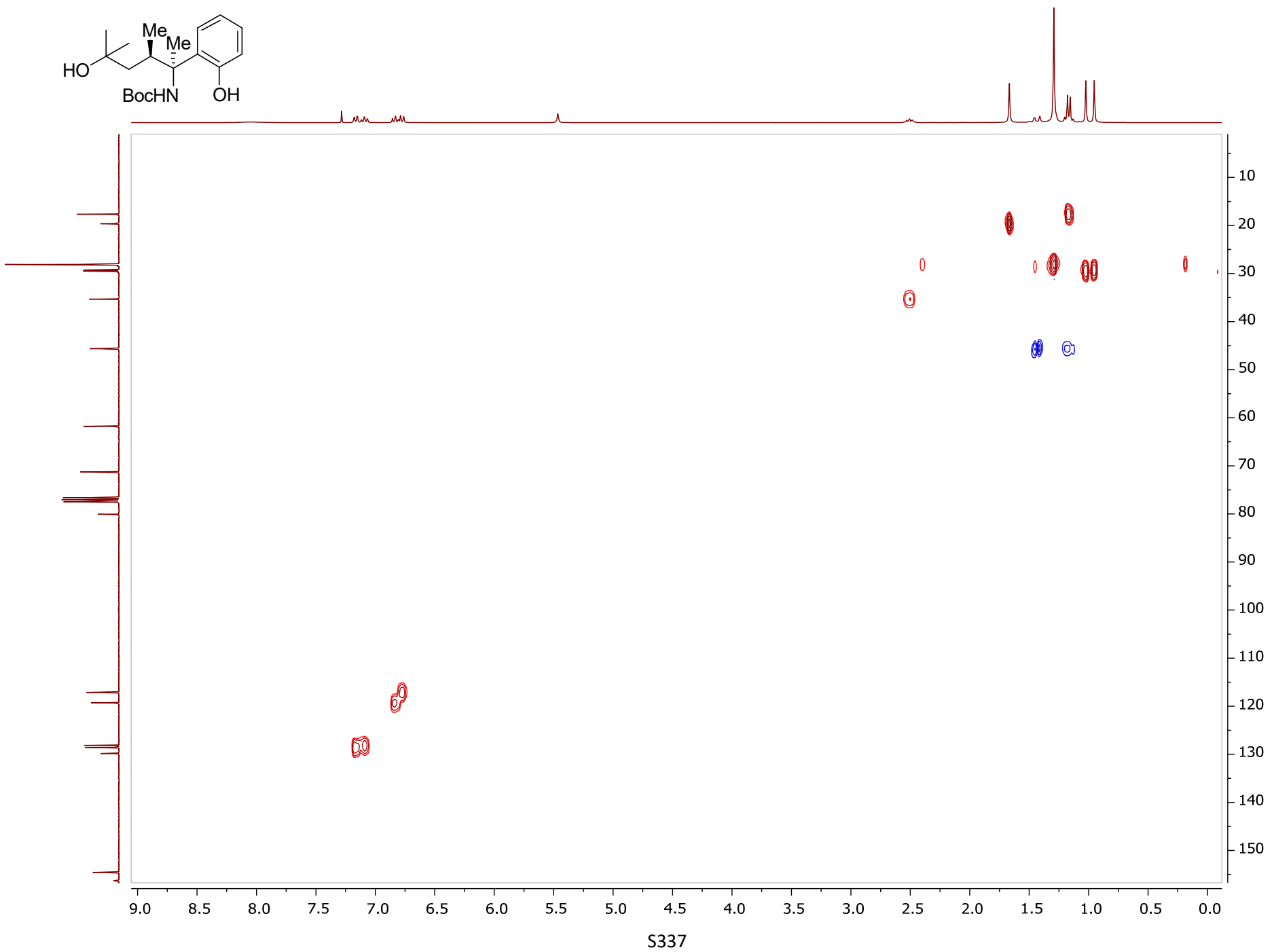


^{1}H-^{1}H COSY

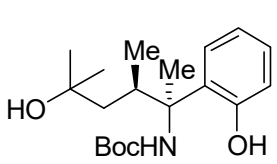

Me
Me
HO
BocHN
OH

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
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

^{1}H-^{13}C HSQC


Me
Me
HO
BocHN
OH
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
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

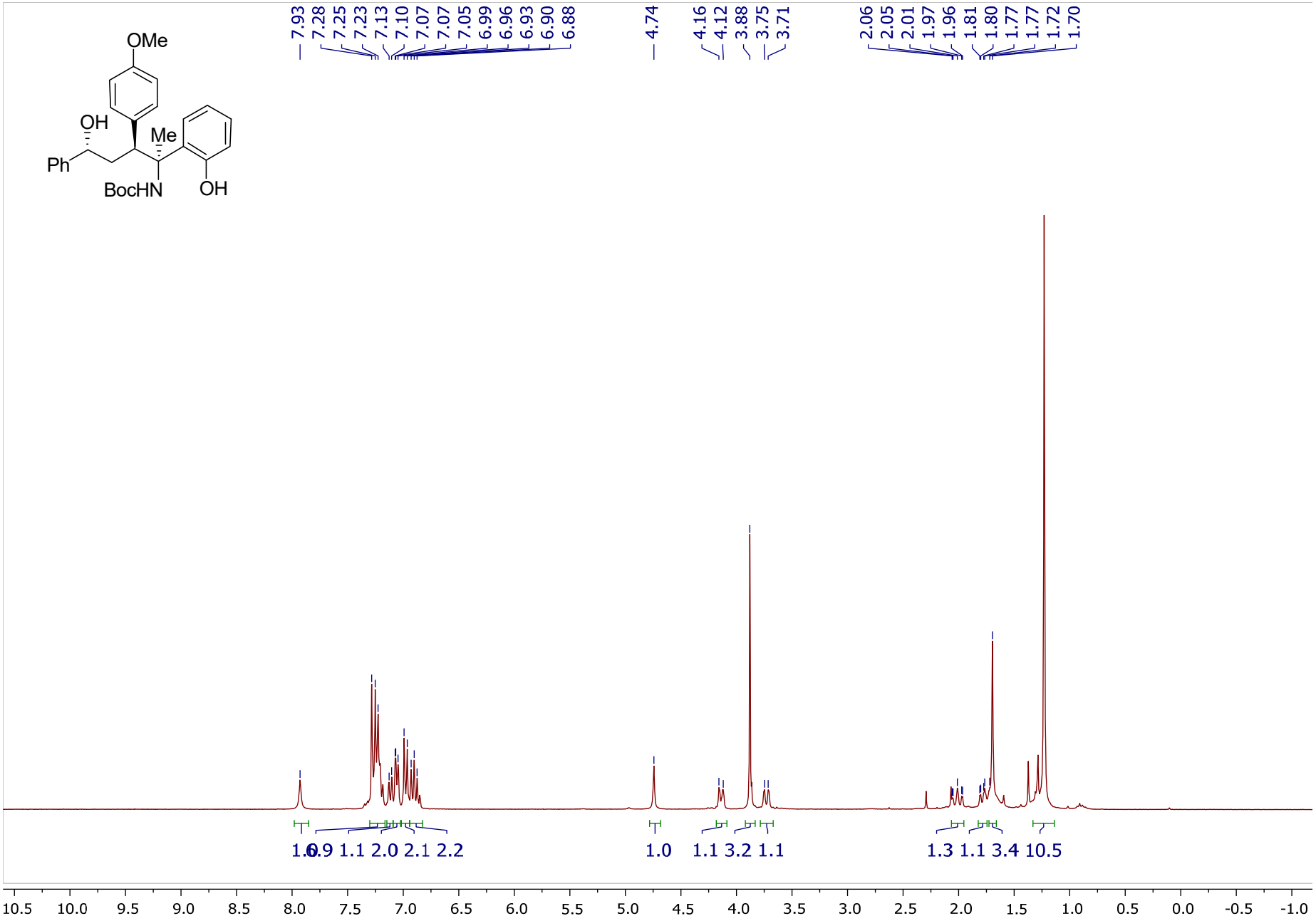
^{1}H-^{13}C HMBC


Me
Me
HO
BocHN
OH

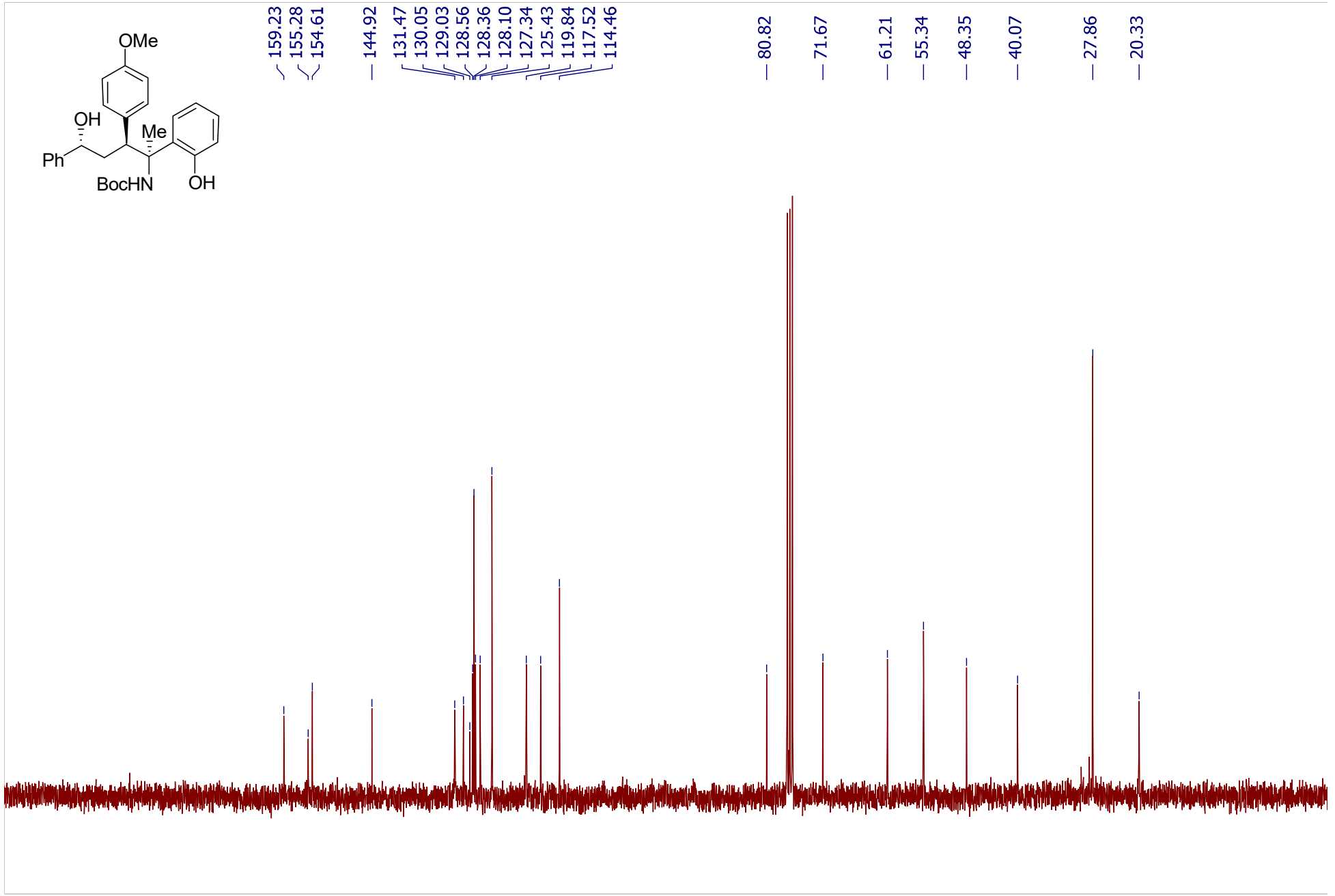
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

***tert*-Butyl (2*S**,3*S**,5*R**)-5-hydroxy-2-(2-hydroxyphenyl)-3-(4-methoxyphenyl)-5-phenylpentan-2-ylcarbamate 7ja**

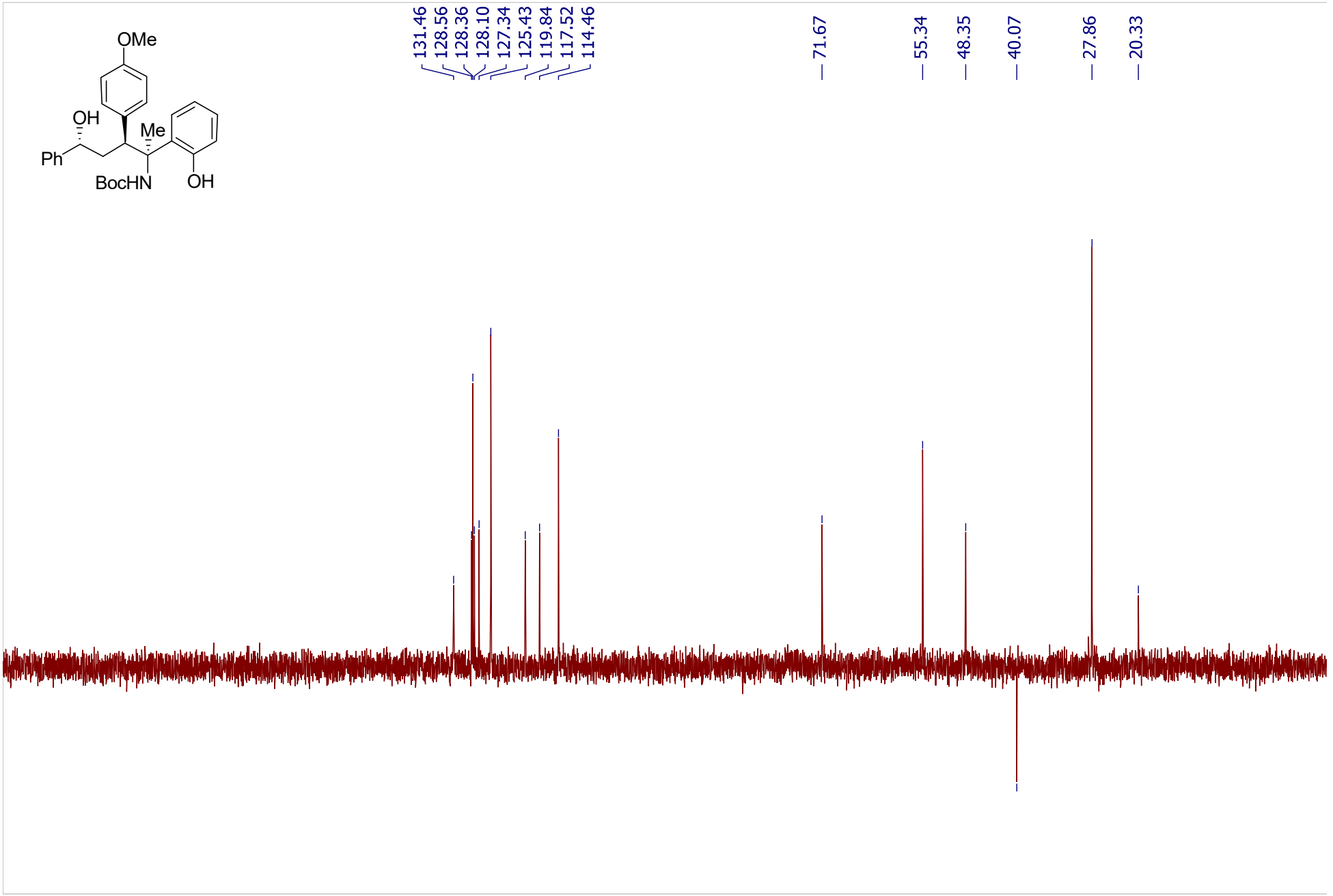
^{1}H NMR (300 MHz, $CDCl_3$)



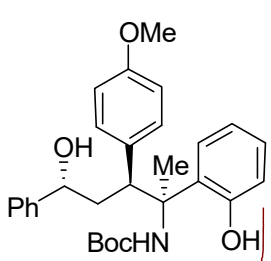
^{13}C NMR (75 MHz, $CDCl_3$)

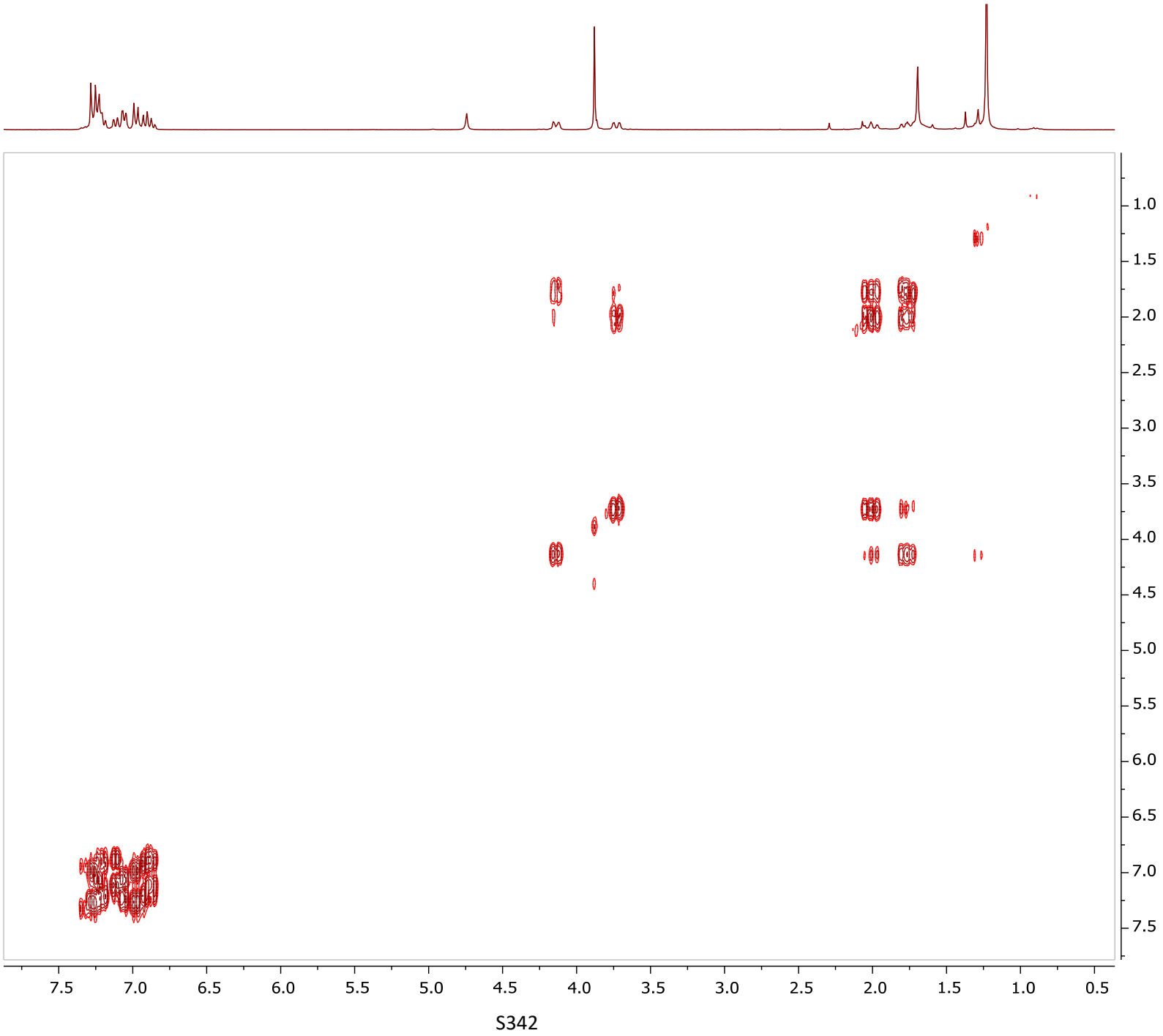


^{13}C DEPT 135 (75 MHz, $CDCl_3$)

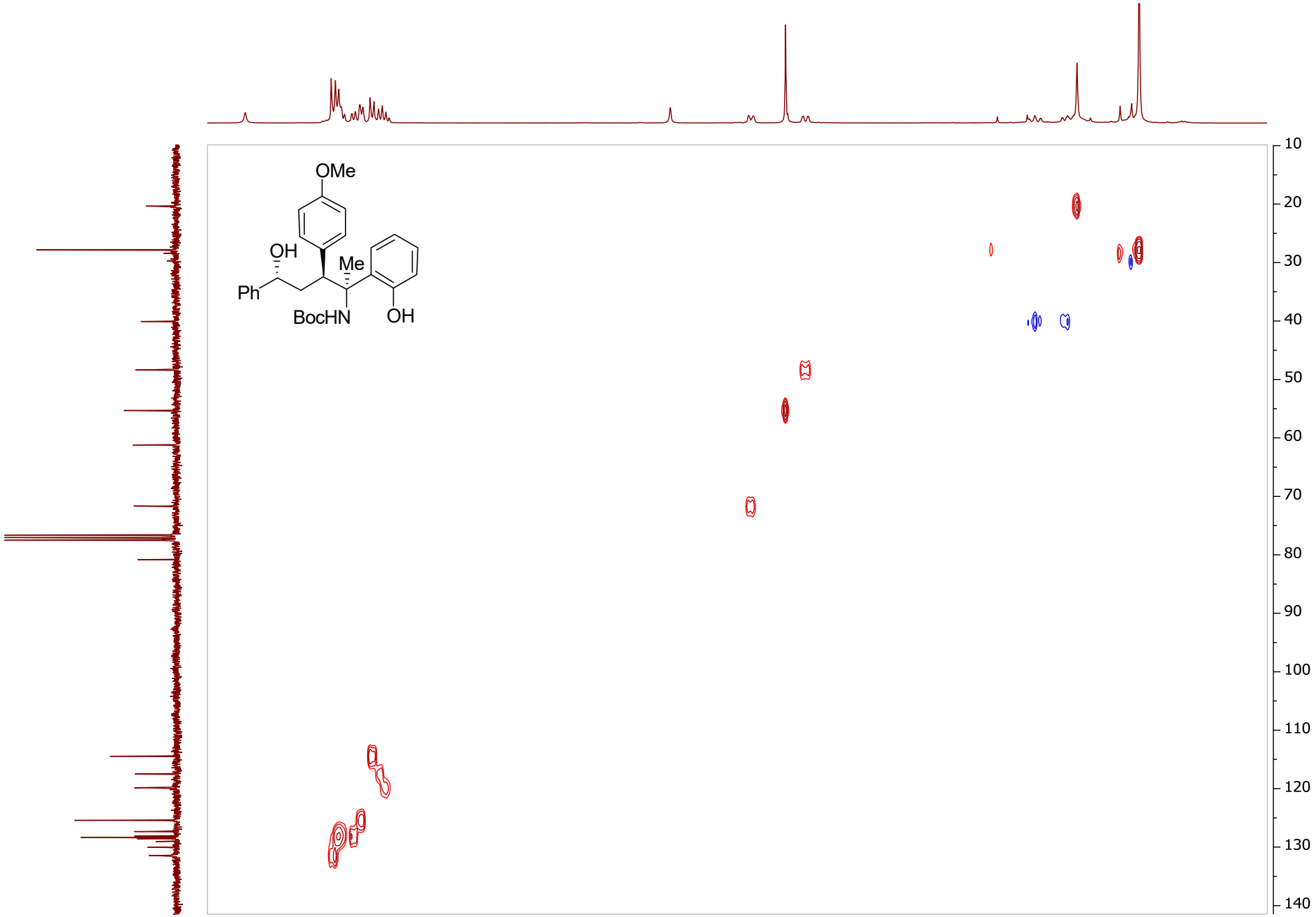


^{1}H-^{1}H COSY

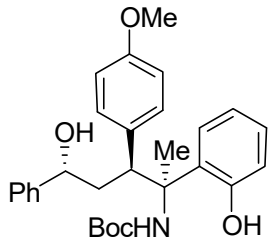

OMe
OH
Me
Ph
BocHN
OH

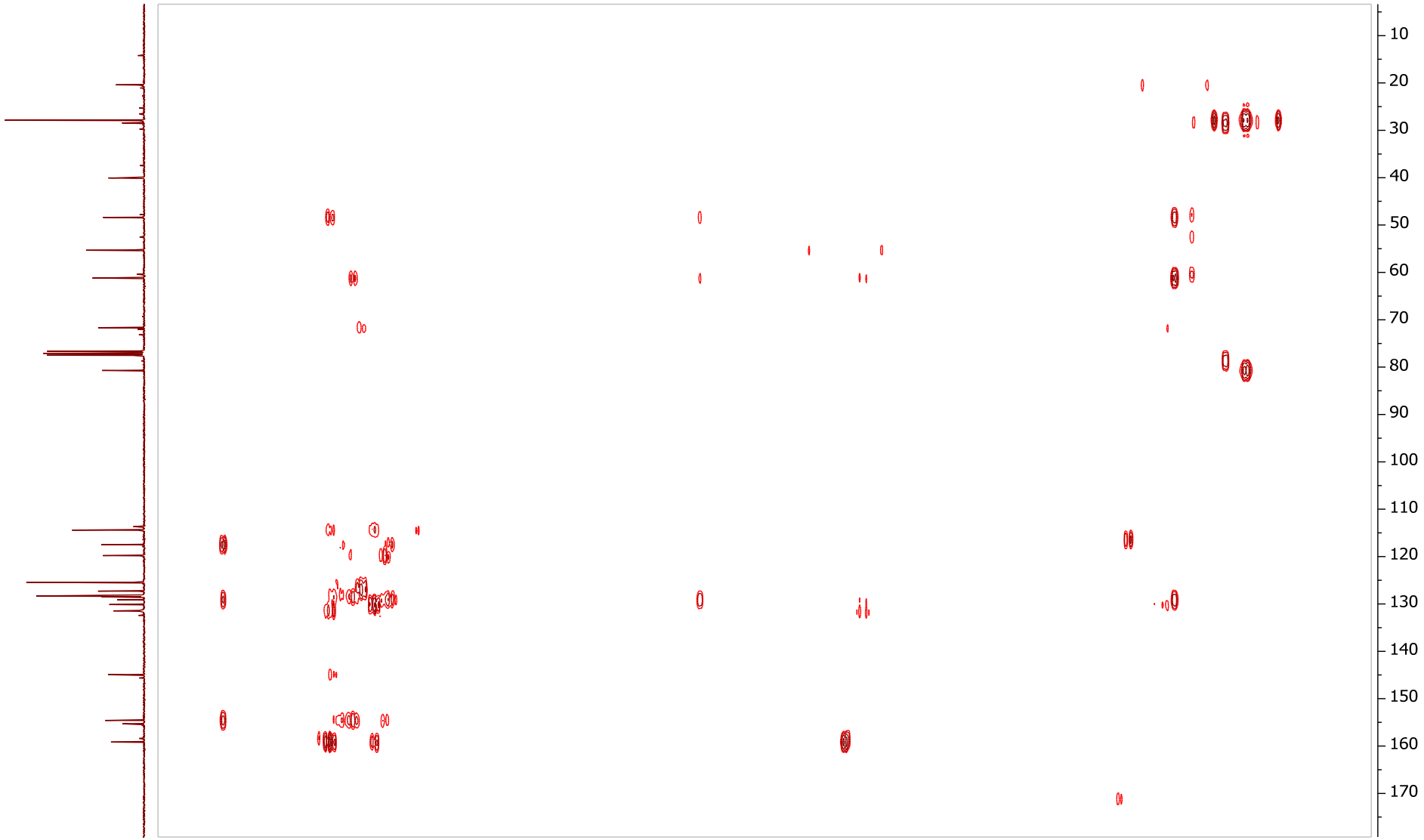

1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{13}C HSQC


OMe
OH
Me
Ph
BocHN
OH
10
20
30
40
50
60
70
80
90
100
110
120
130
140
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

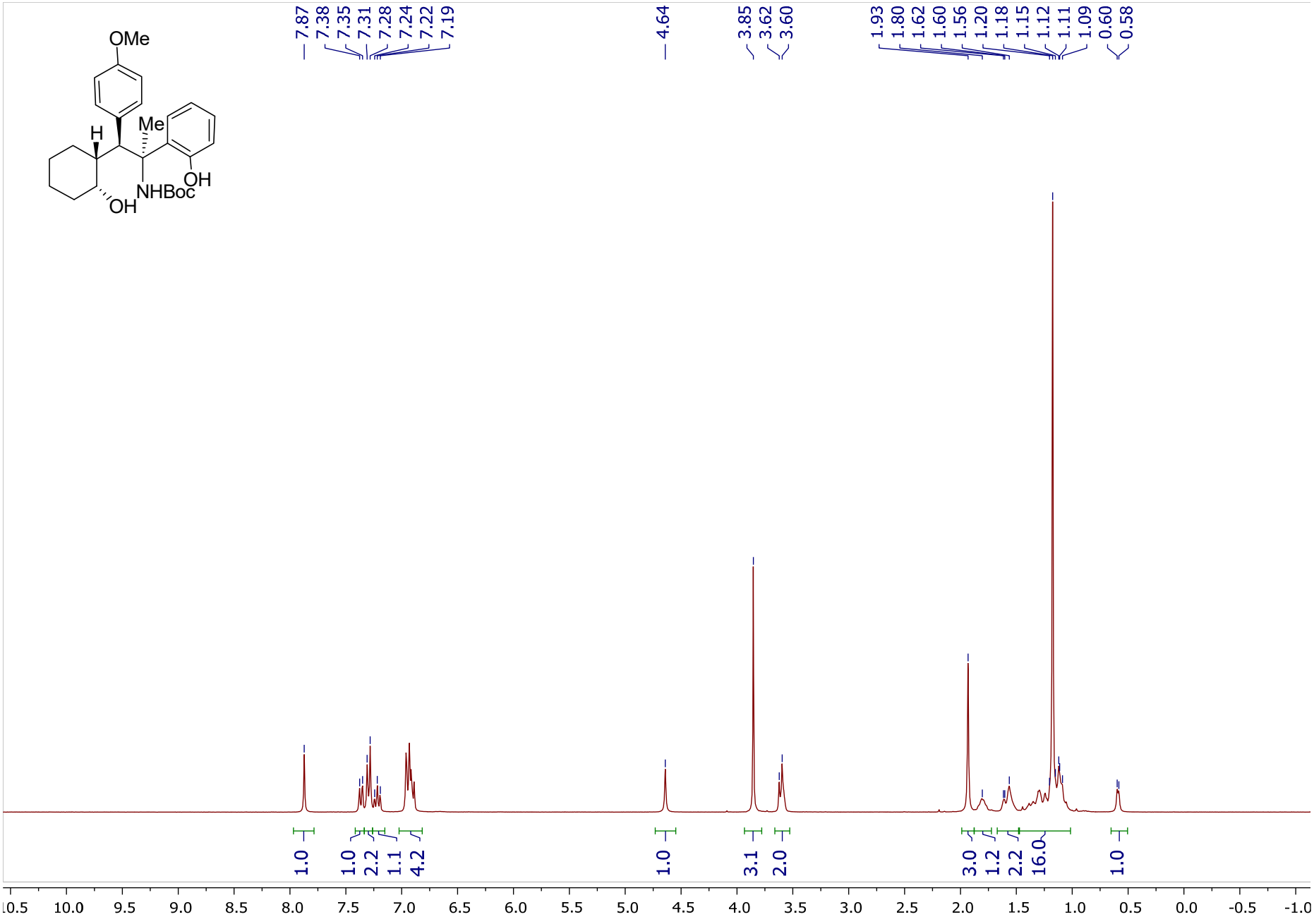
^{1}H-^{13}C HMBC


OMe
OH
Me
Ph
BocHN
OH

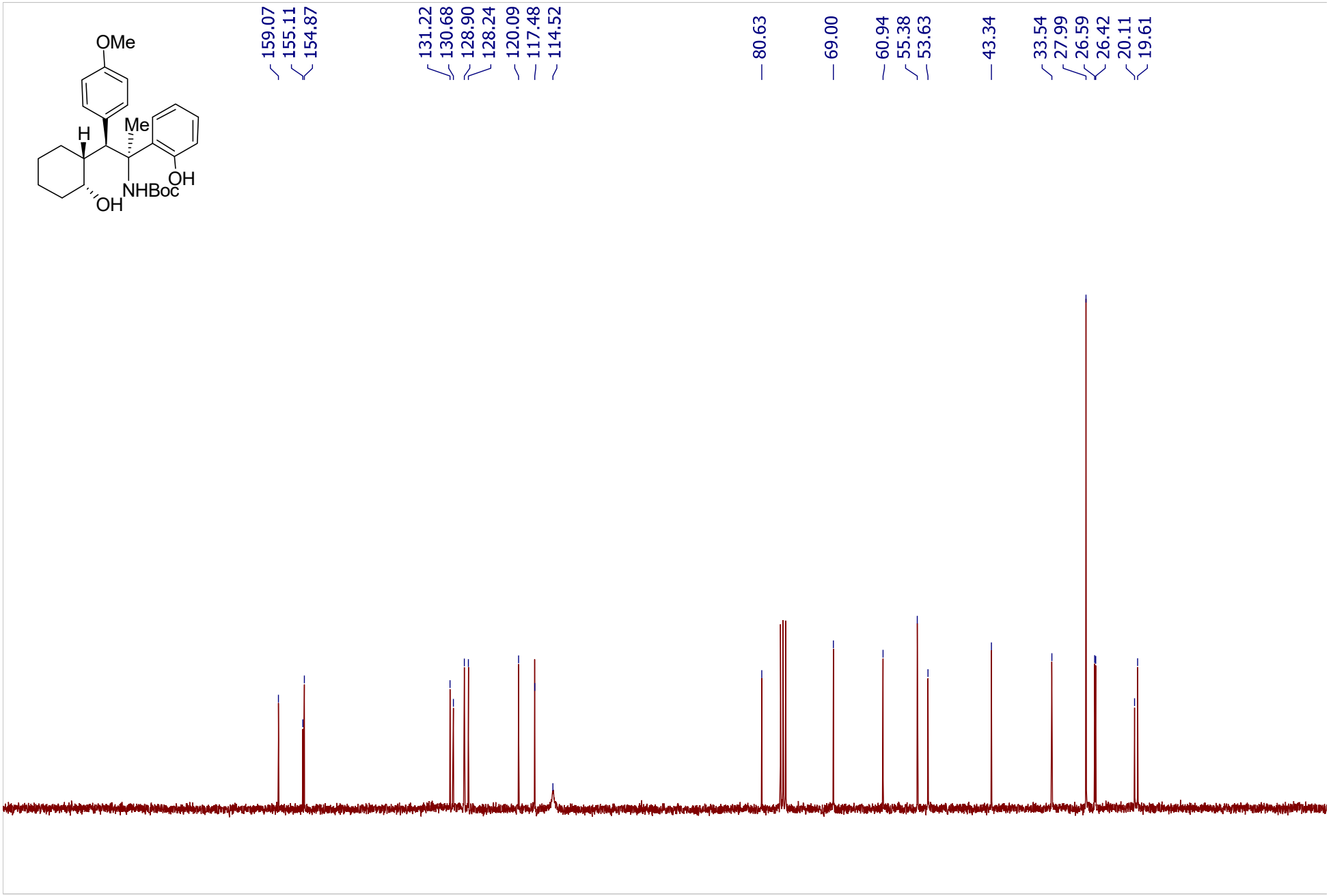

10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

tert-Butyl ((1*S,2*S**)-1-((1*R**,2*R**)-2-hydroxycyclohexyl)-2-(2-hydroxyphenyl)-1-(4-methoxyphenyl)propan-2-yl)carbamate 7la**

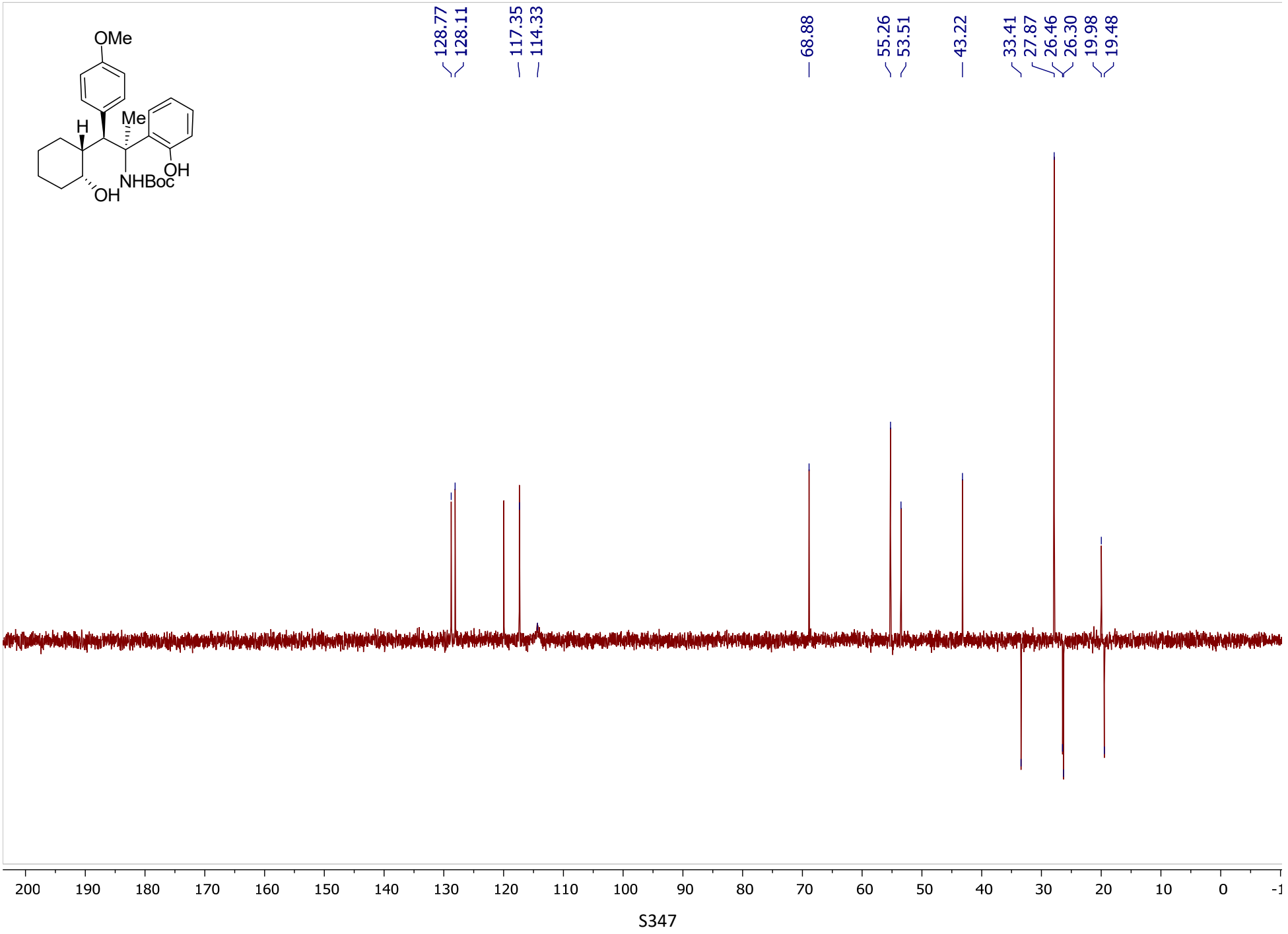
^{1}H NMR (300 MHz, $CDCl_3$)



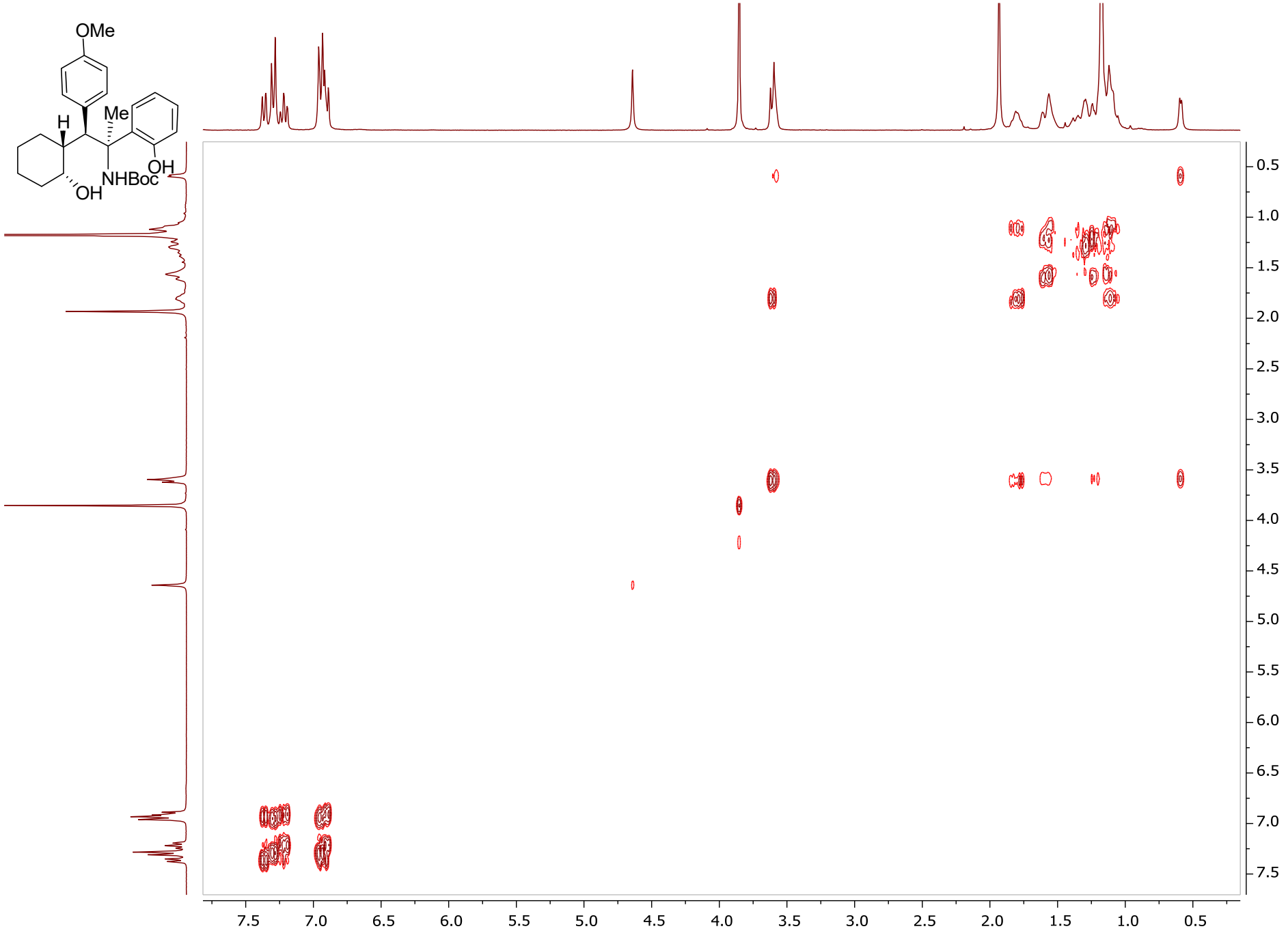
^{13}C NMR (75 MHz, $CDCl_3$)



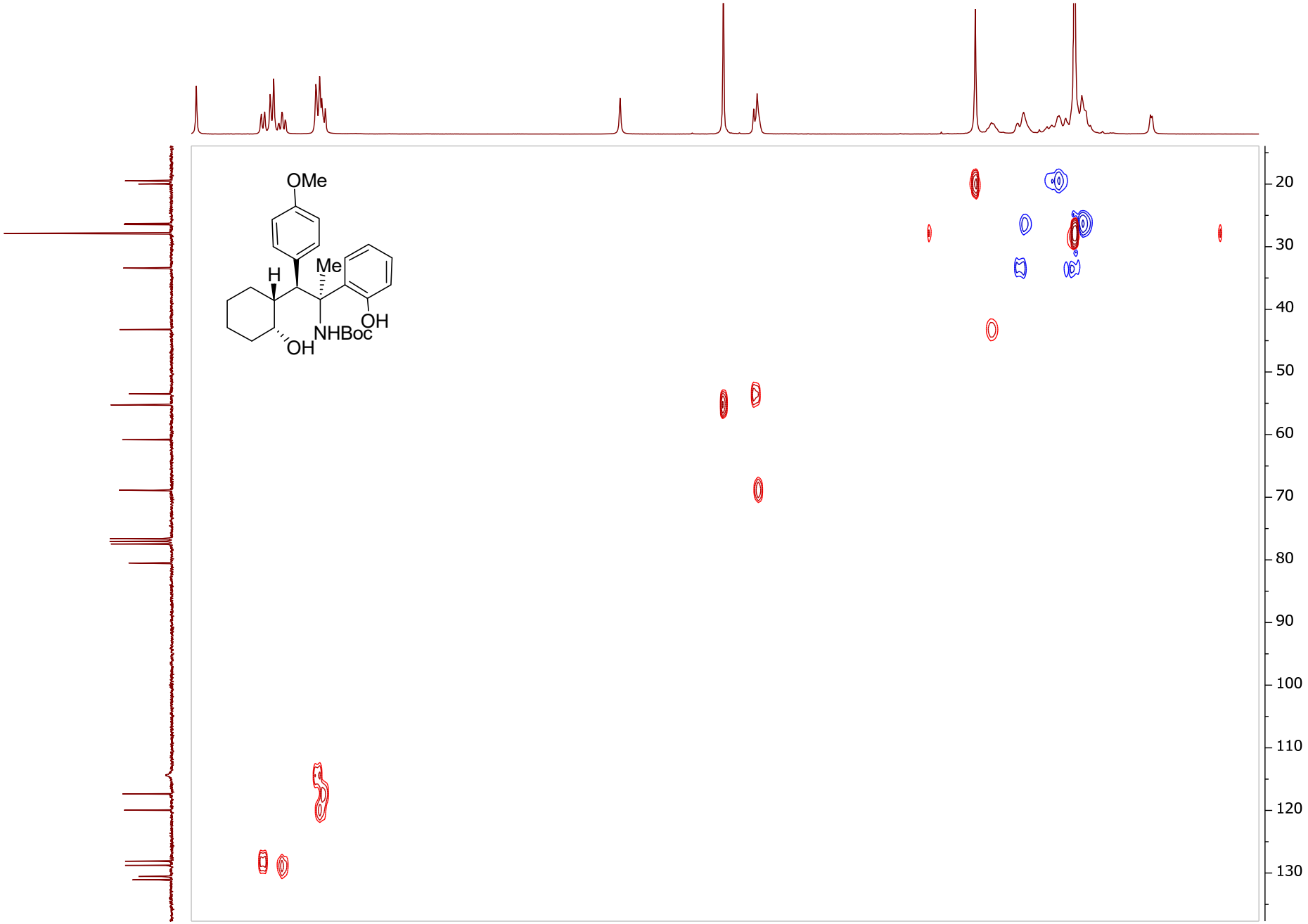
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


OMe
H
Me
OH
NHBoc
OH
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
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

^{1}H-^{13}C HSQC


OMe
H
Me
NHBoc
OH
OH
20
30
40
50
60
70
80
90
100
110
120
130
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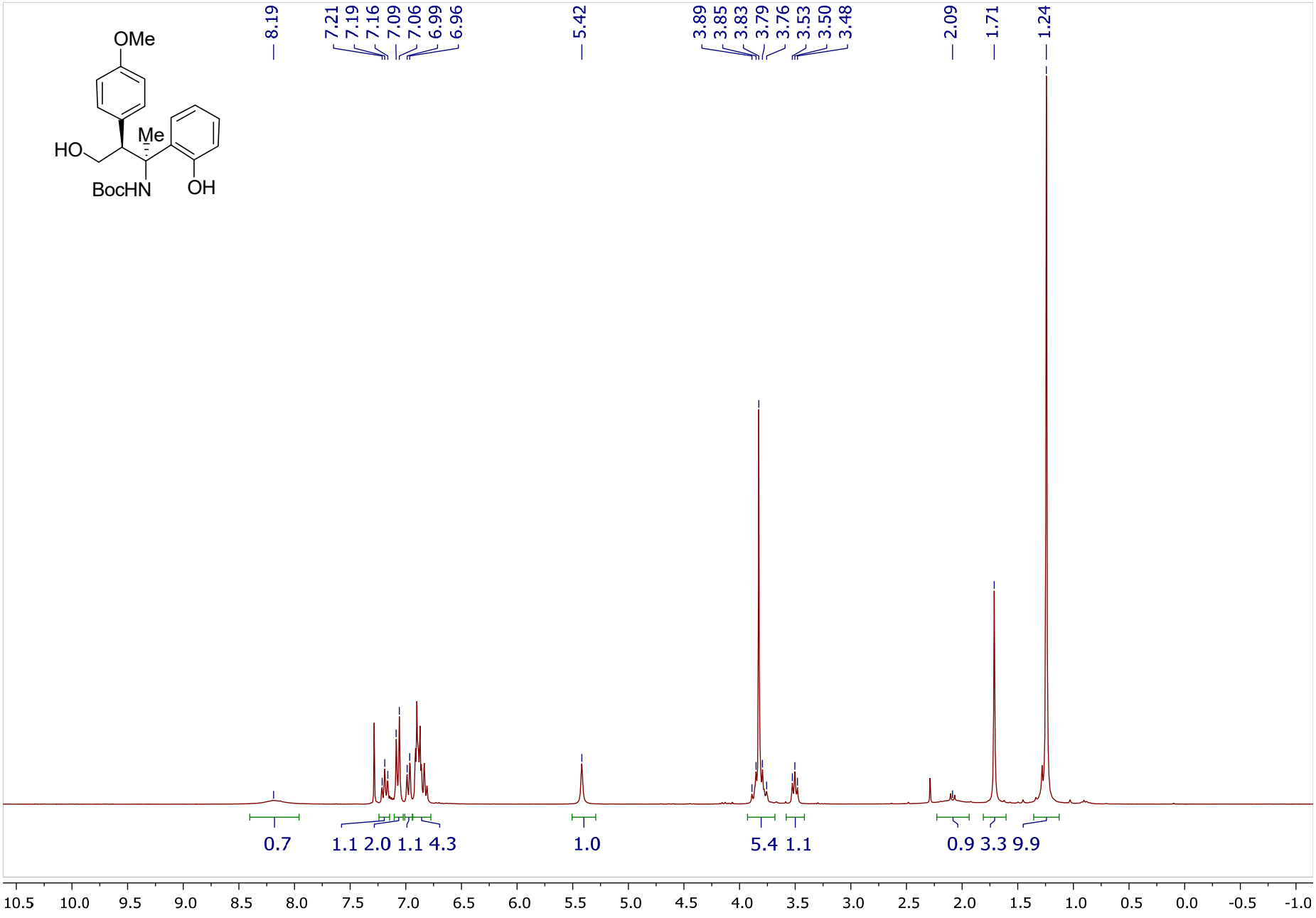
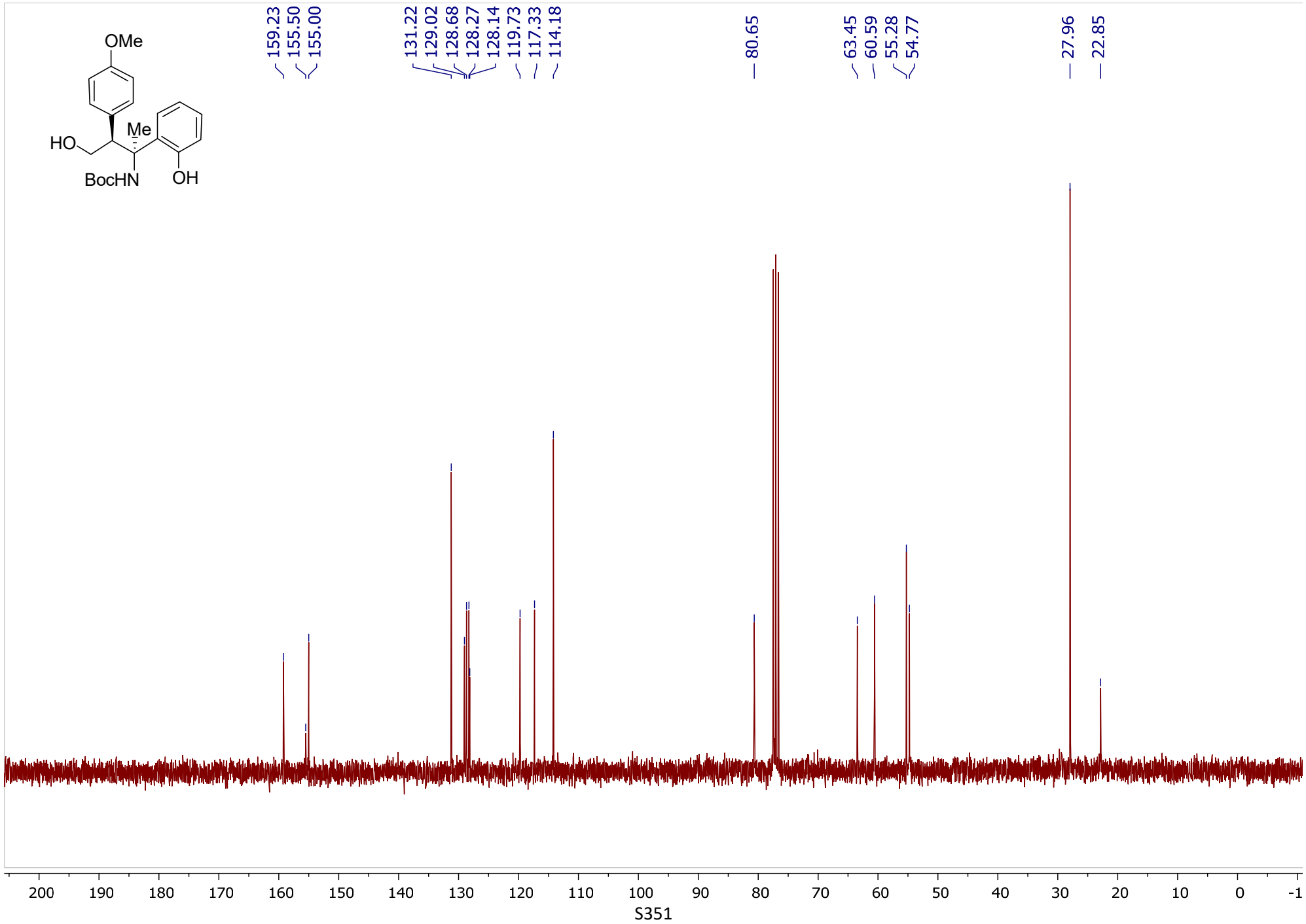
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

***tert*-Butyl ((2*S**,3*S**)-4-hydroxy-2-(2-hydroxyphenyl)-3-(4-methoxyphenyl)butan-2-yl)carbamate 8fa**

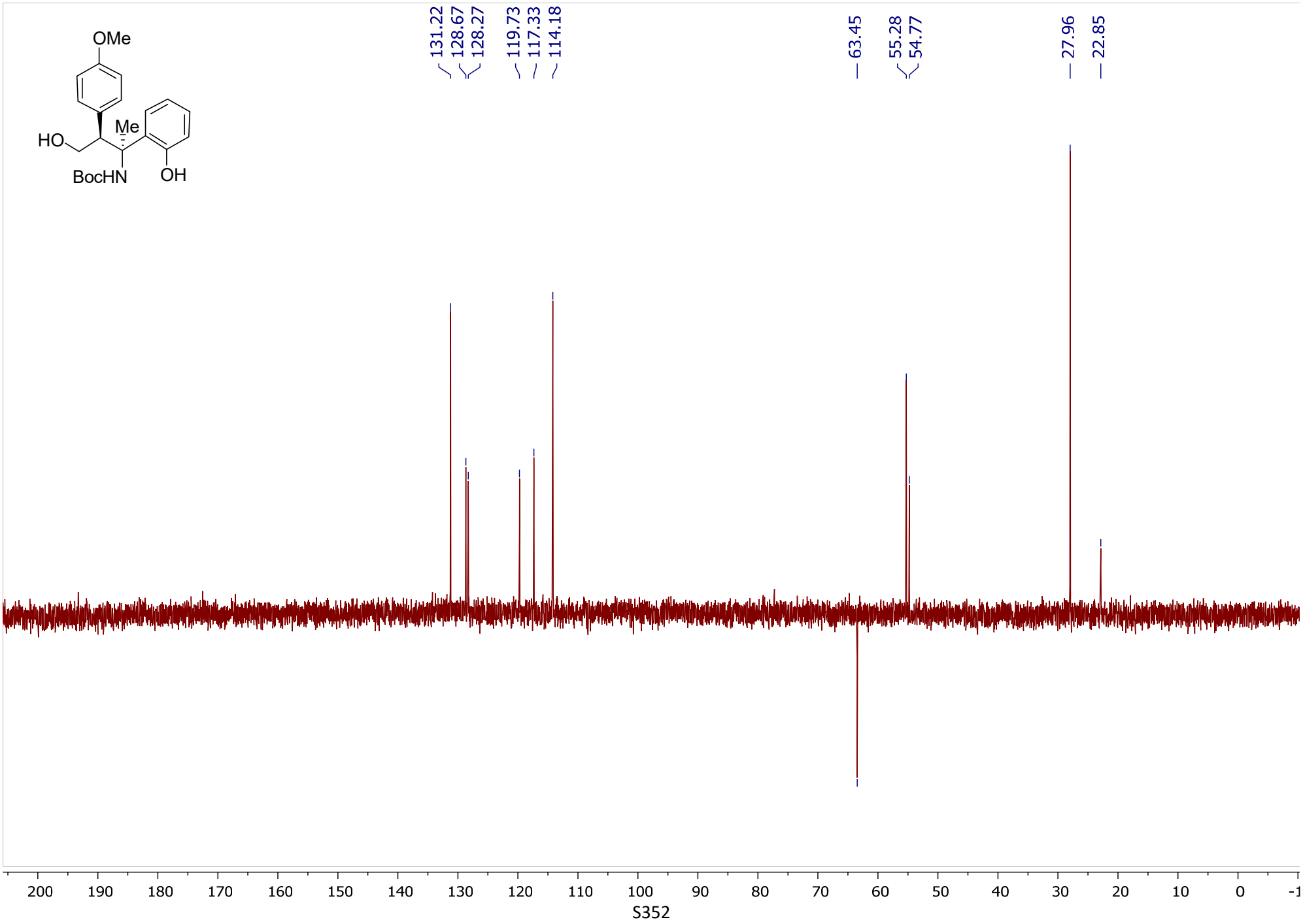
^{1}H NMR (300 MHz, $CDCl_3$)



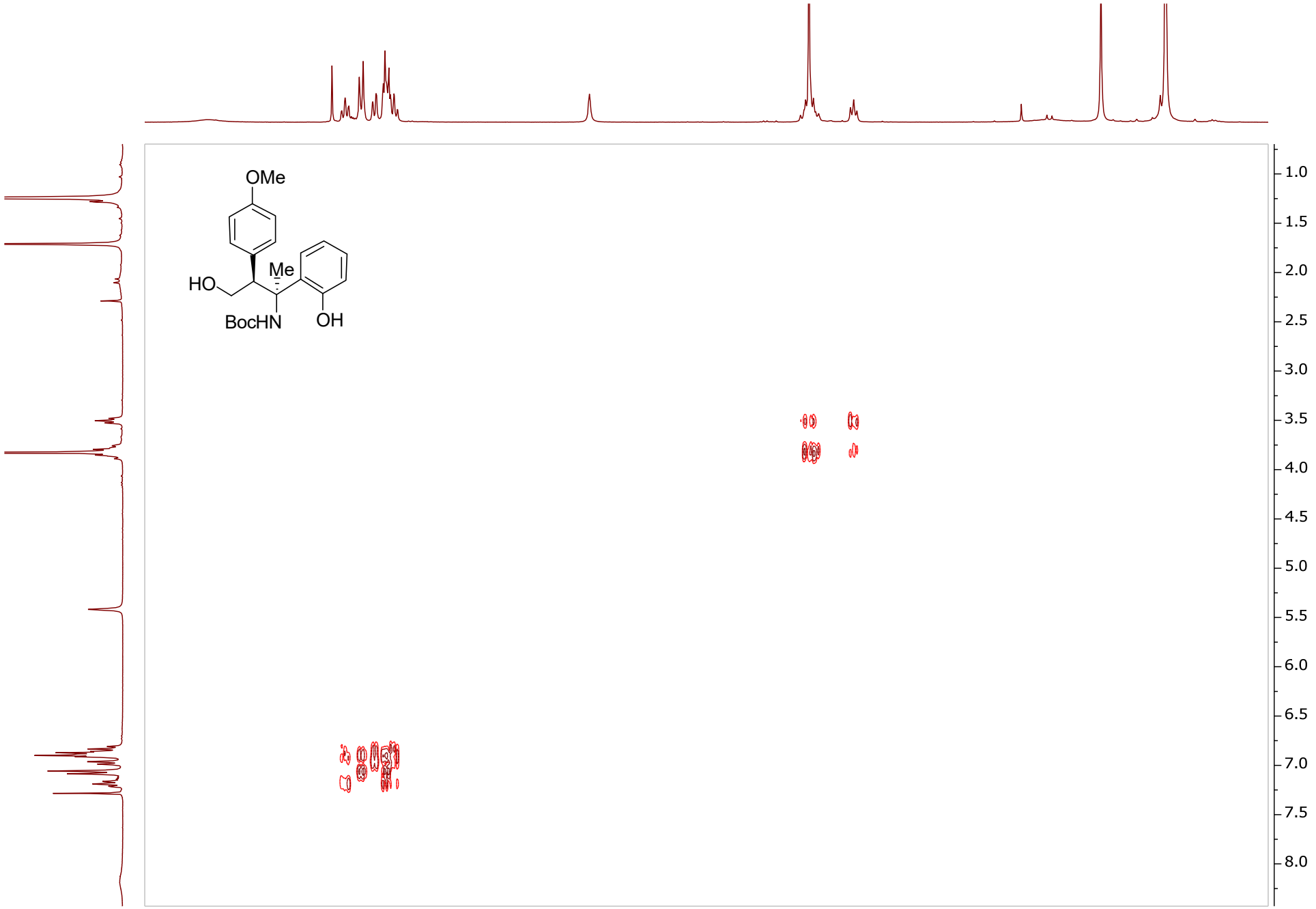
^{13}C NMR (75 MHz, $CDCl_3$)



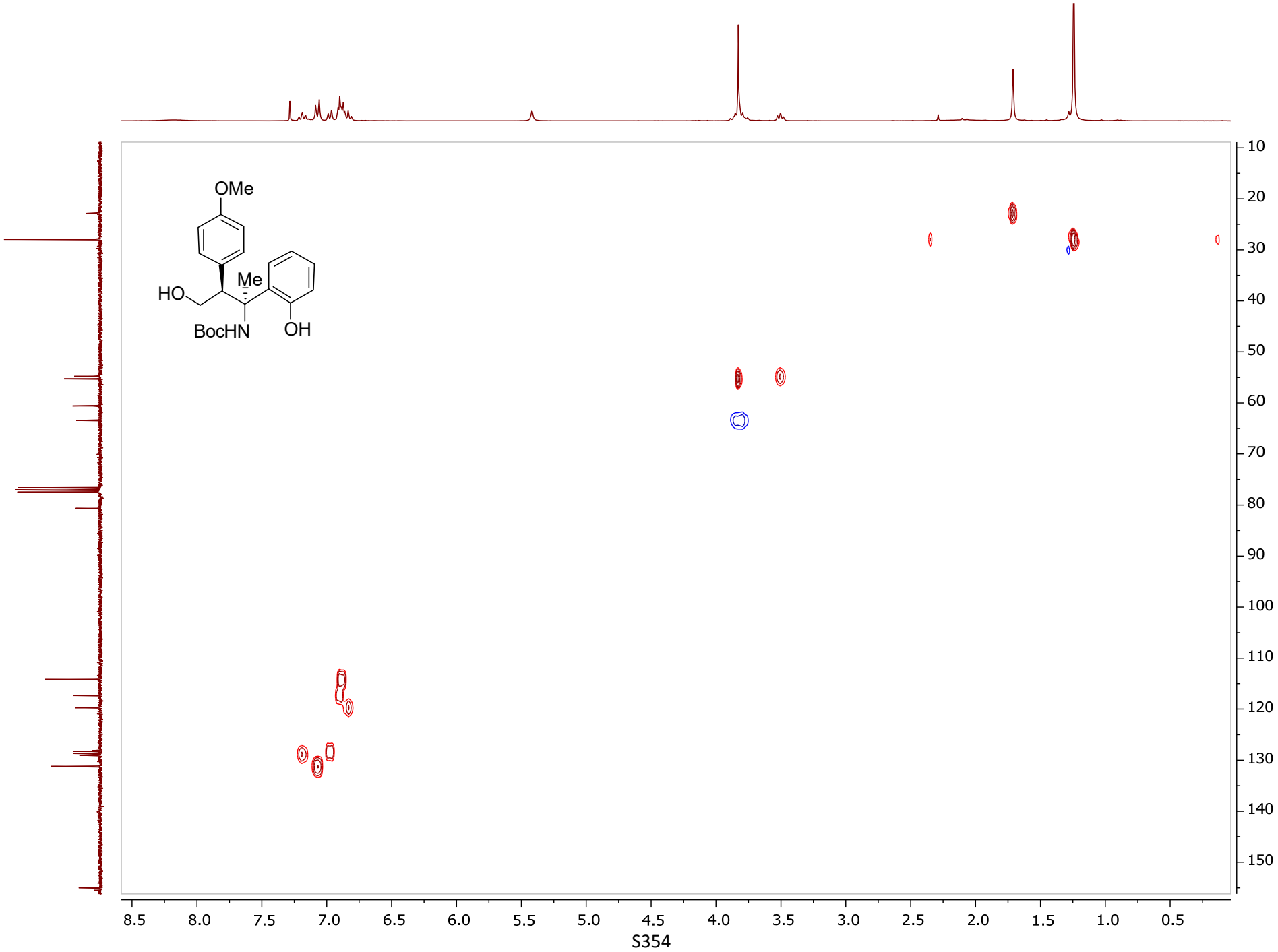
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY

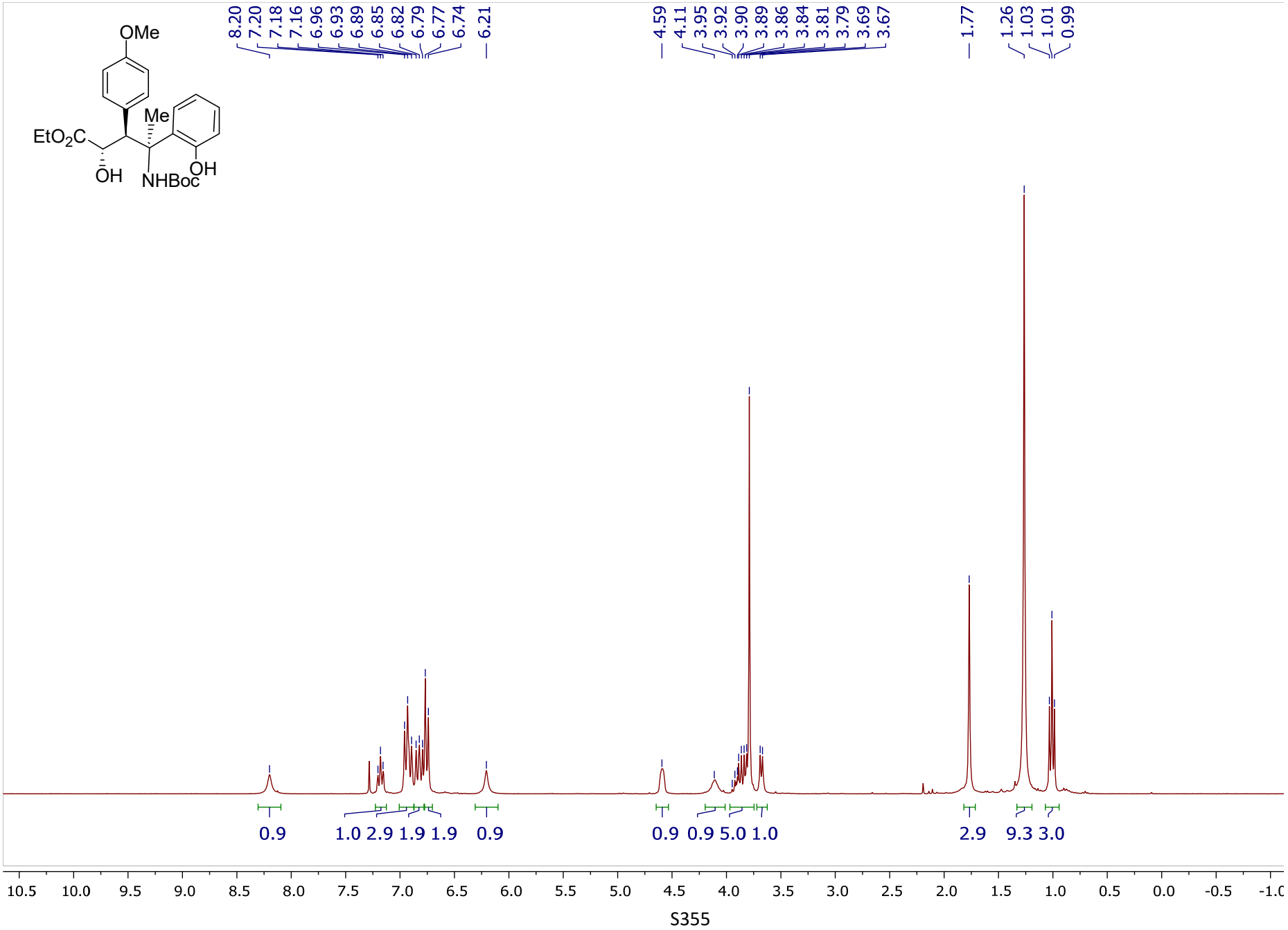

OMe
Me
HO
BocHN
OH
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{13}C HSQC

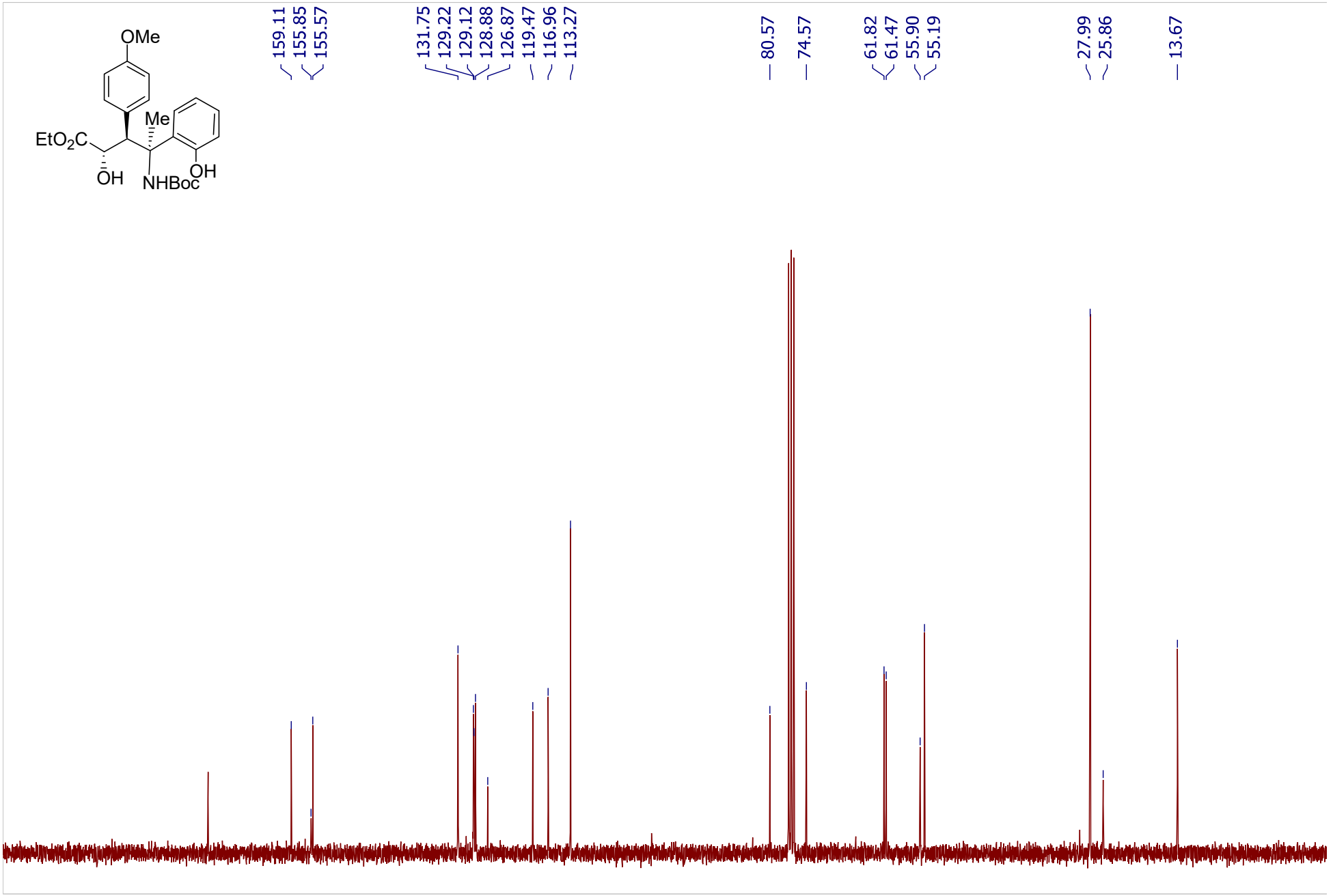

OMe
Me
HO
BocHN
OH
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

(2*S,3*S**,4*S**)-Ethyl 4-(*tert*-butoxycarbonylamino)-2-hydroxy-4-(2-hydroxyphenyl)-3-(4-methoxyphenyl)pentanoate 8ga**

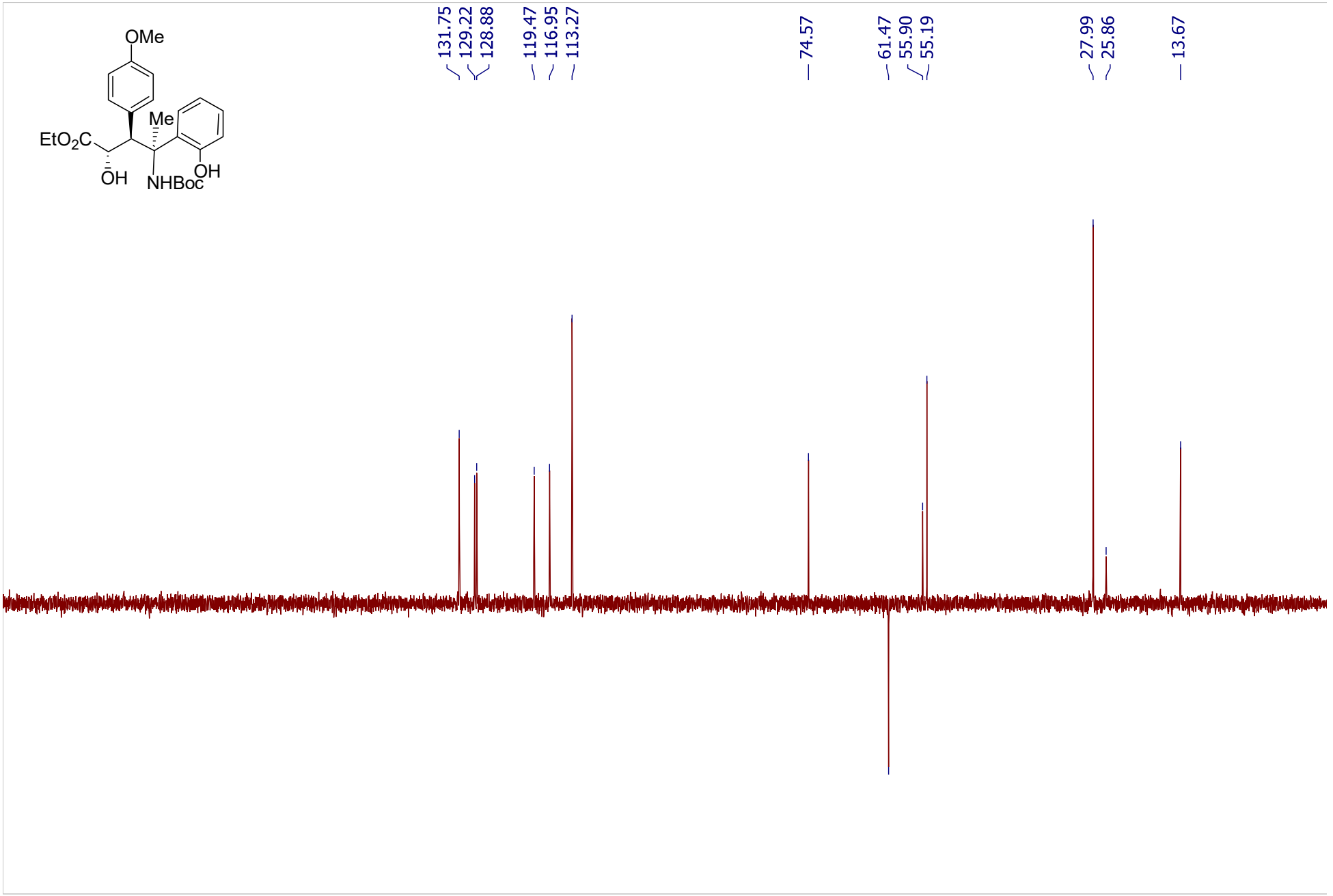
^{1}H NMR (300 MHz, $CDCl_3$)



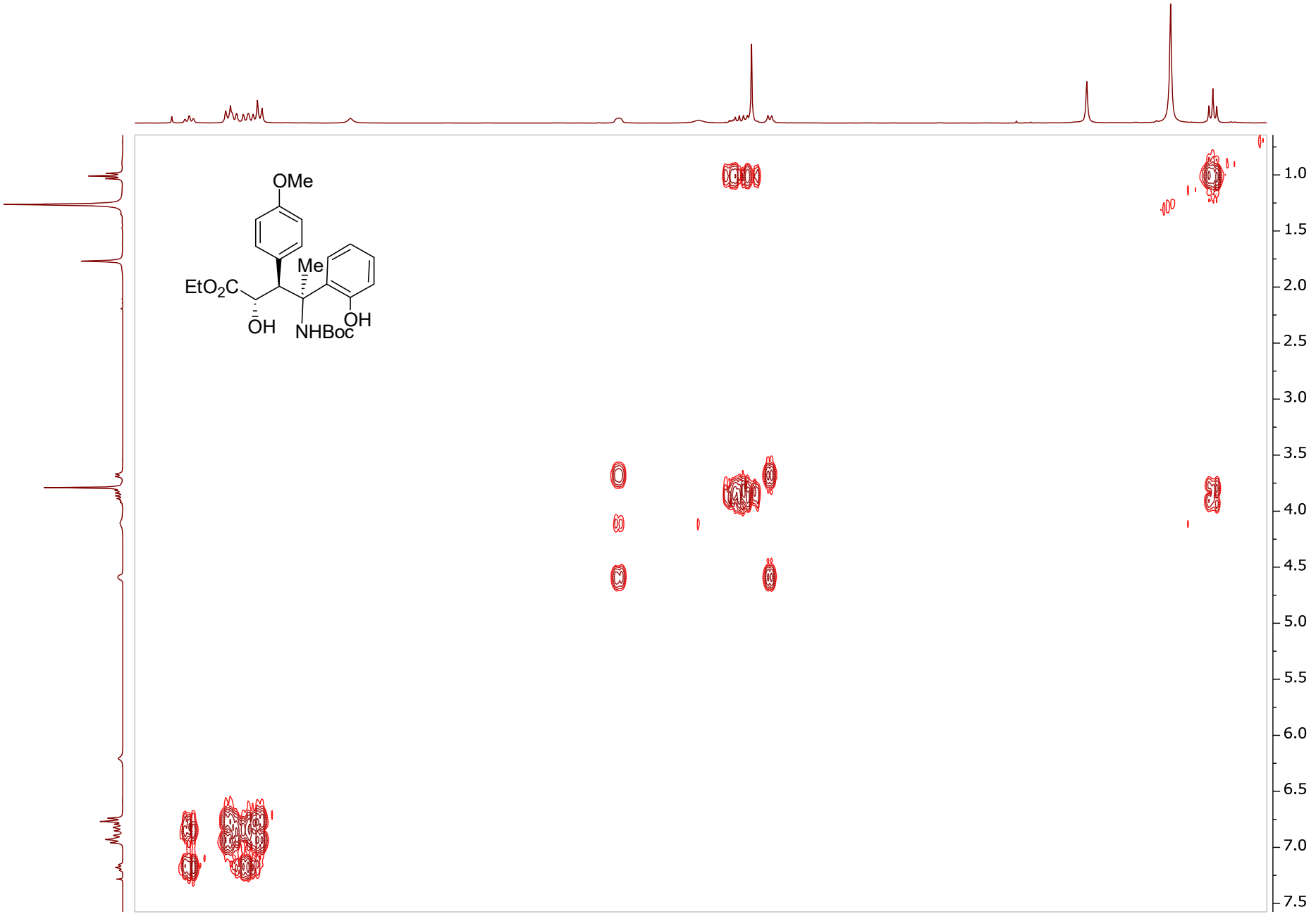
^{13}C NMR (75 MHz, $CDCl_3$)



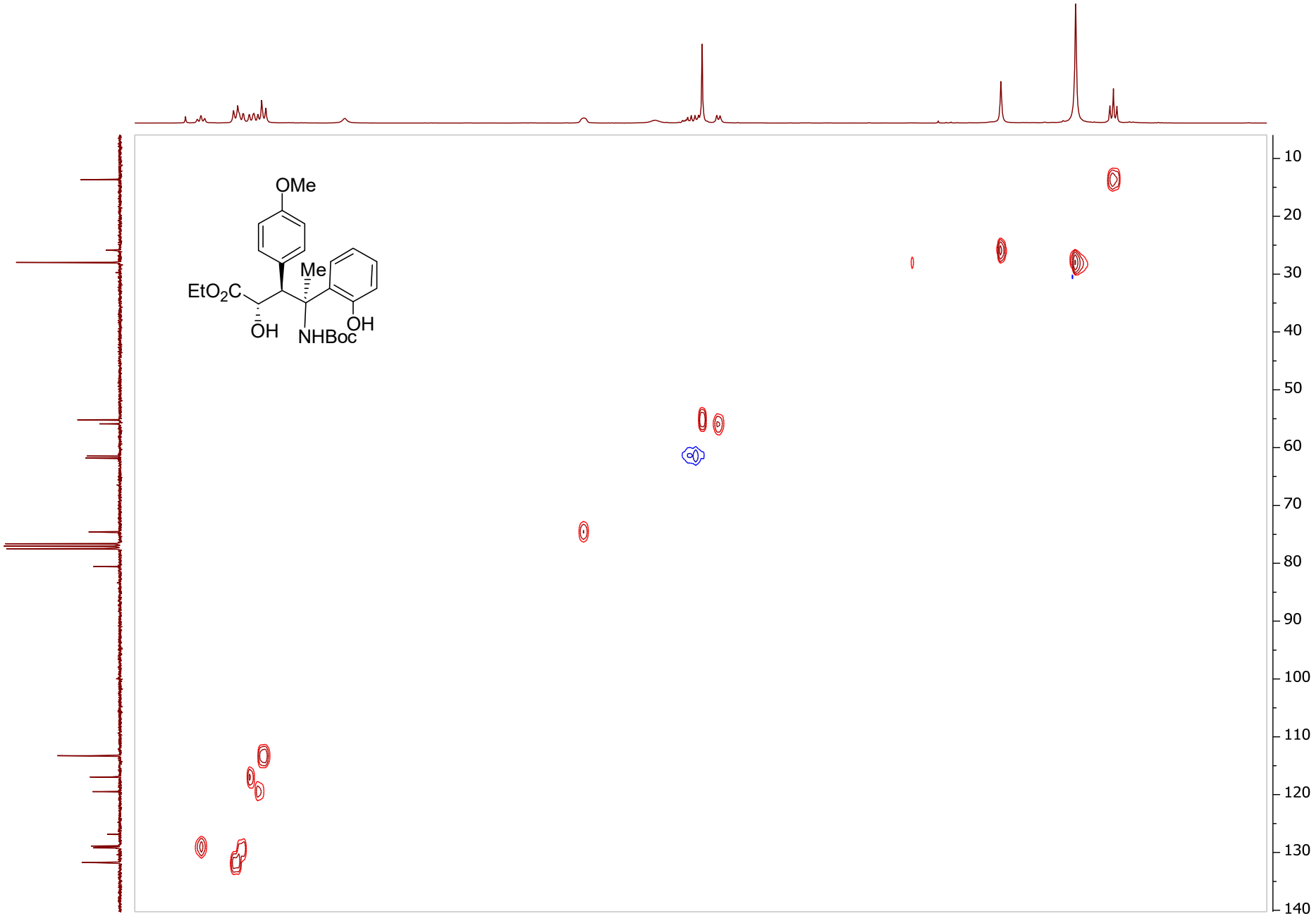
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{1}H COSY


OMe
Me
EtO2C
OH
NHBoc
OH
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
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

^{1}H-^{13}C HSQC


OMe
Me
EtO2C
OH
NHBoc
OH
10
20
30
40
50
60
70
80
90
100
110
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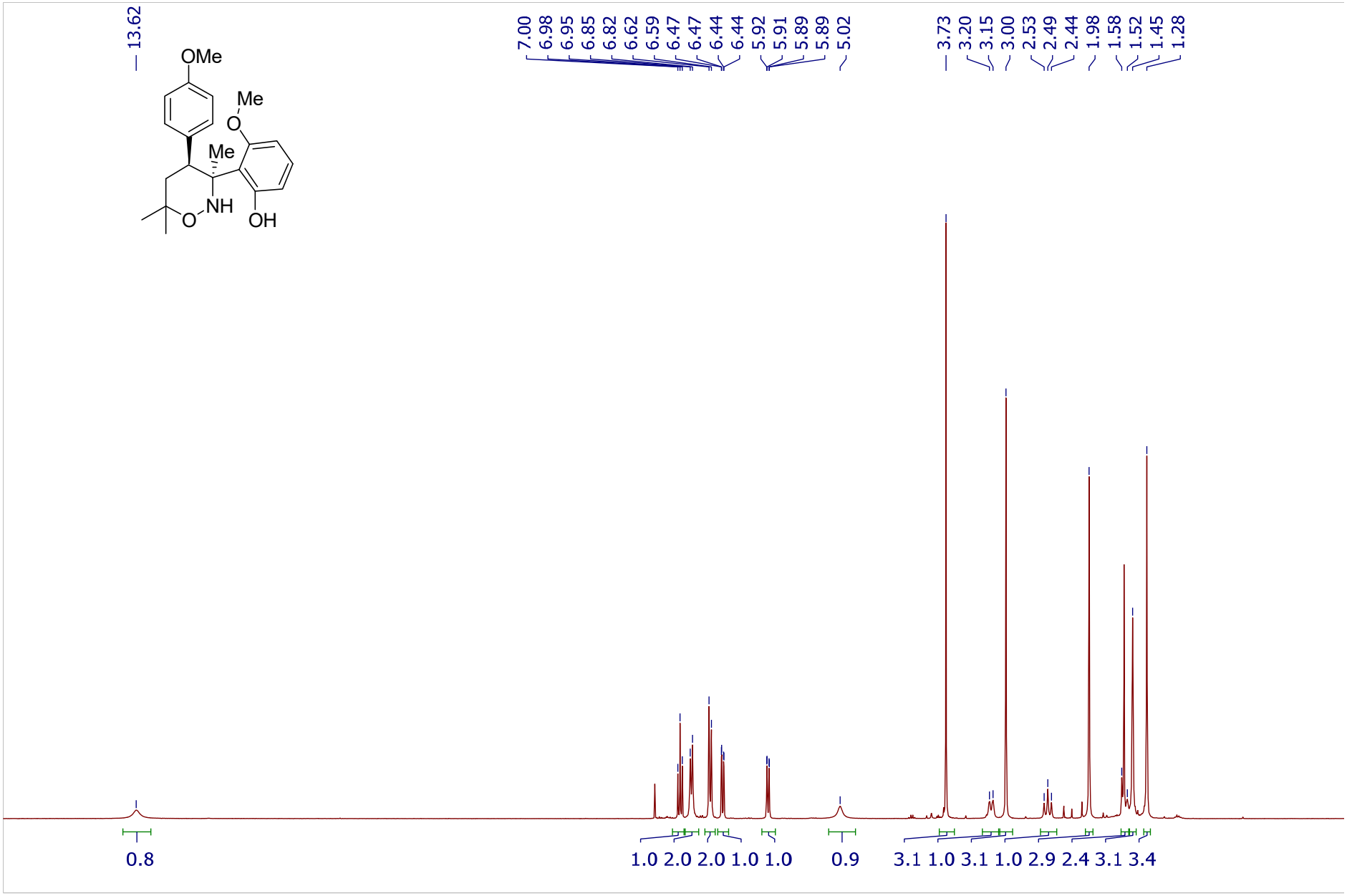
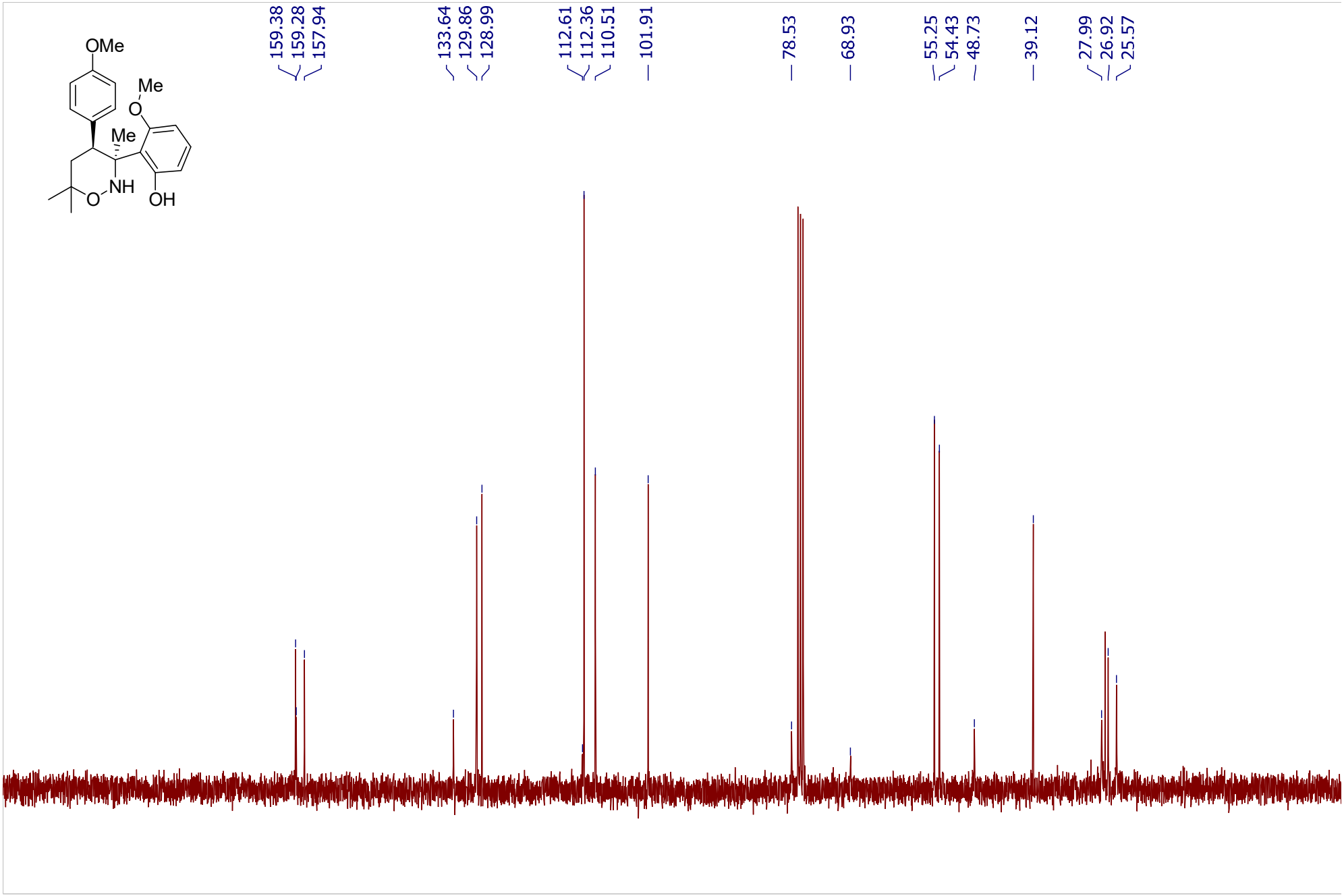
130
140
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

3-Methoxy-2-((3*S,4*S**)-4-(4-methoxyphenyl)-3,6,6-trimethyl-1,2-oxazinan-3-yl)phenol 12ab**

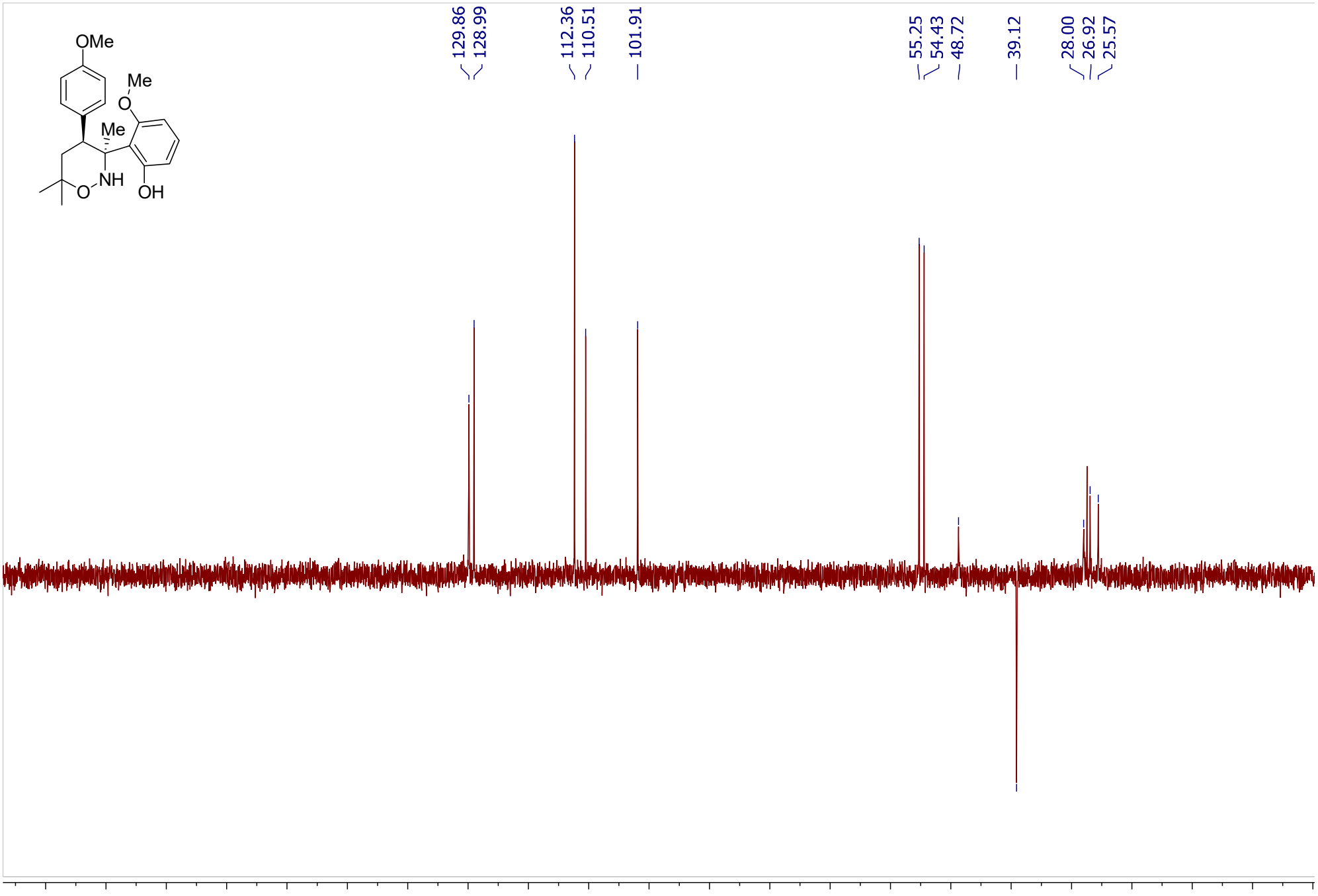
^{1}H NMR (300 MHz, $CDCl_3$)



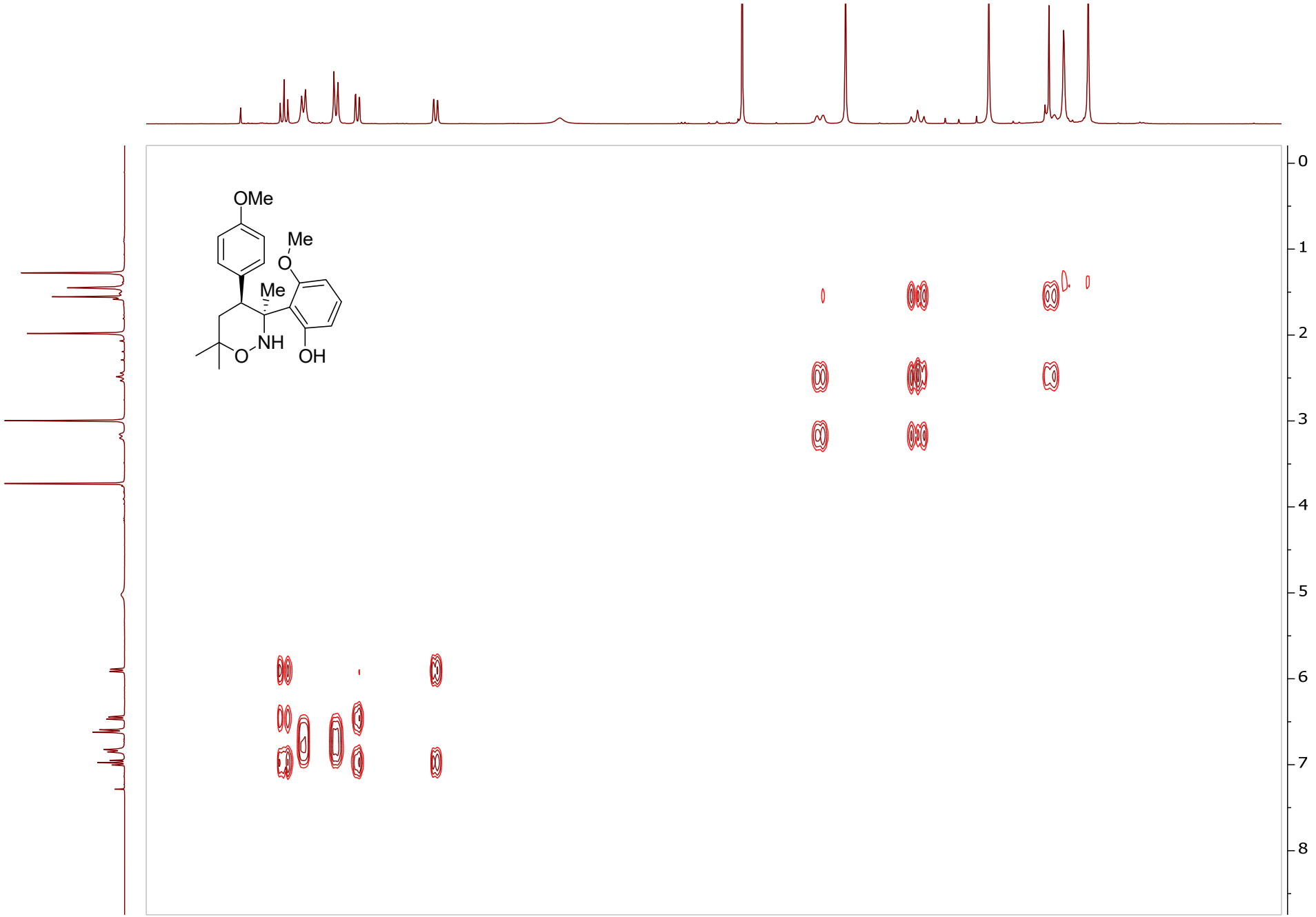
^{13}C NMR (75 MHz, $CDCl_3$)



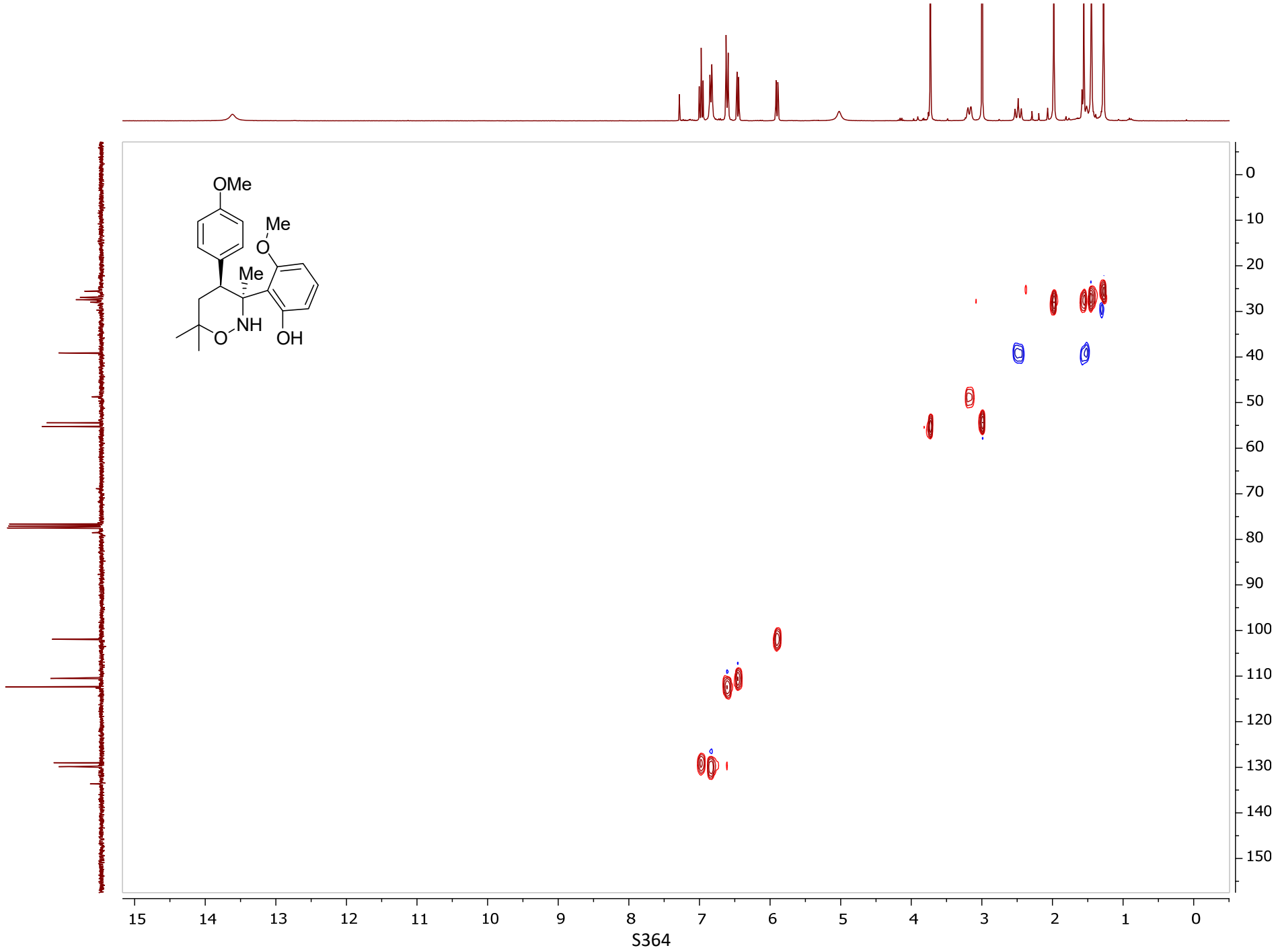
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



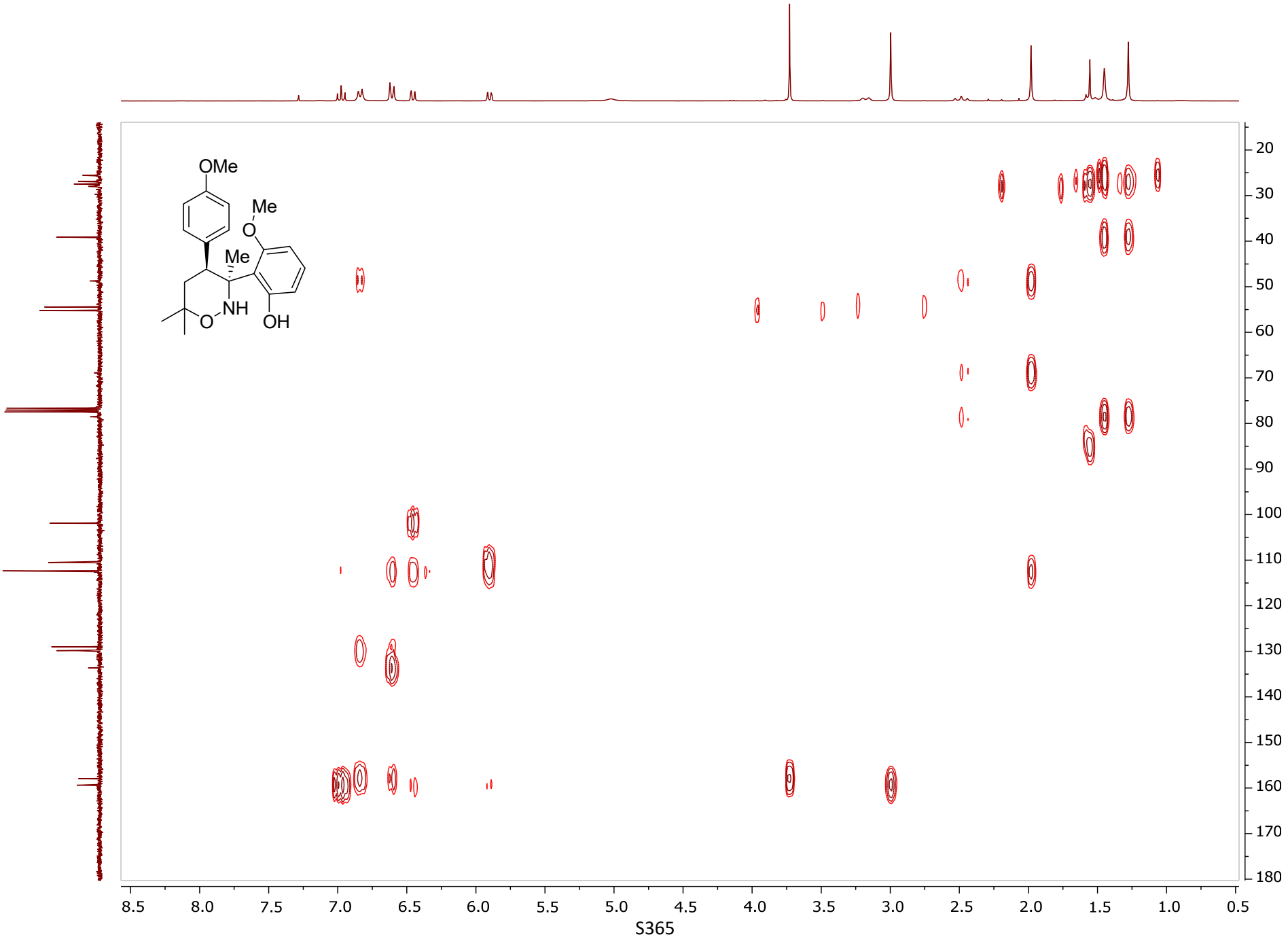
^{1}H-^{1}H COSY


OMe
Me
O
Me
NH
O
OH
0
1
2
3
4
5
6
7
8
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

^{1}H-^{13}C HSQC


OMe
Me
O
Me
NH
O
OH
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0

^{1}H-^{13}C HMBC


OMe
Me
O
Me
NH
O
OH
20
30
40
50
60
70
80
90
100
110
120
130
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170
180
8.5
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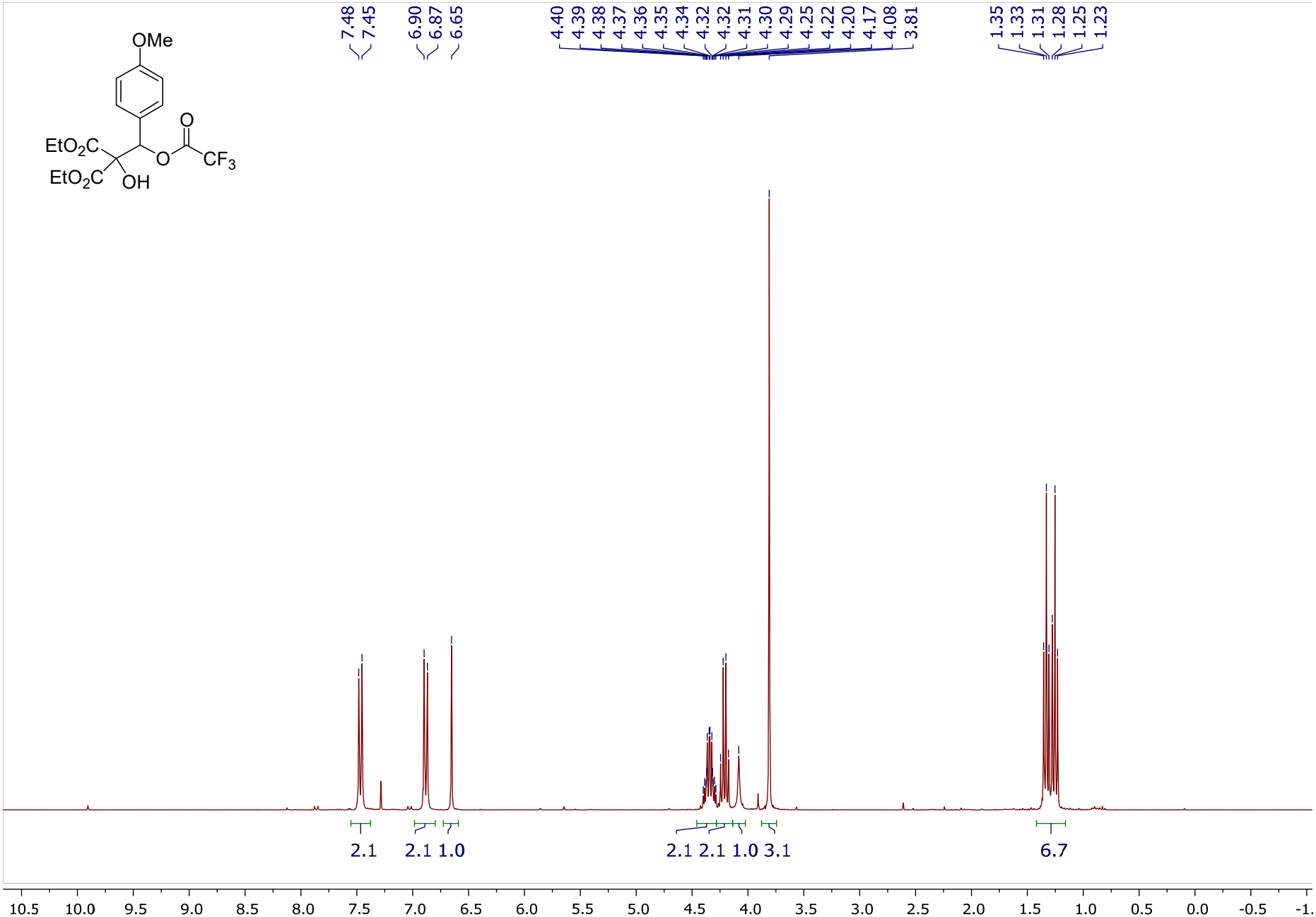
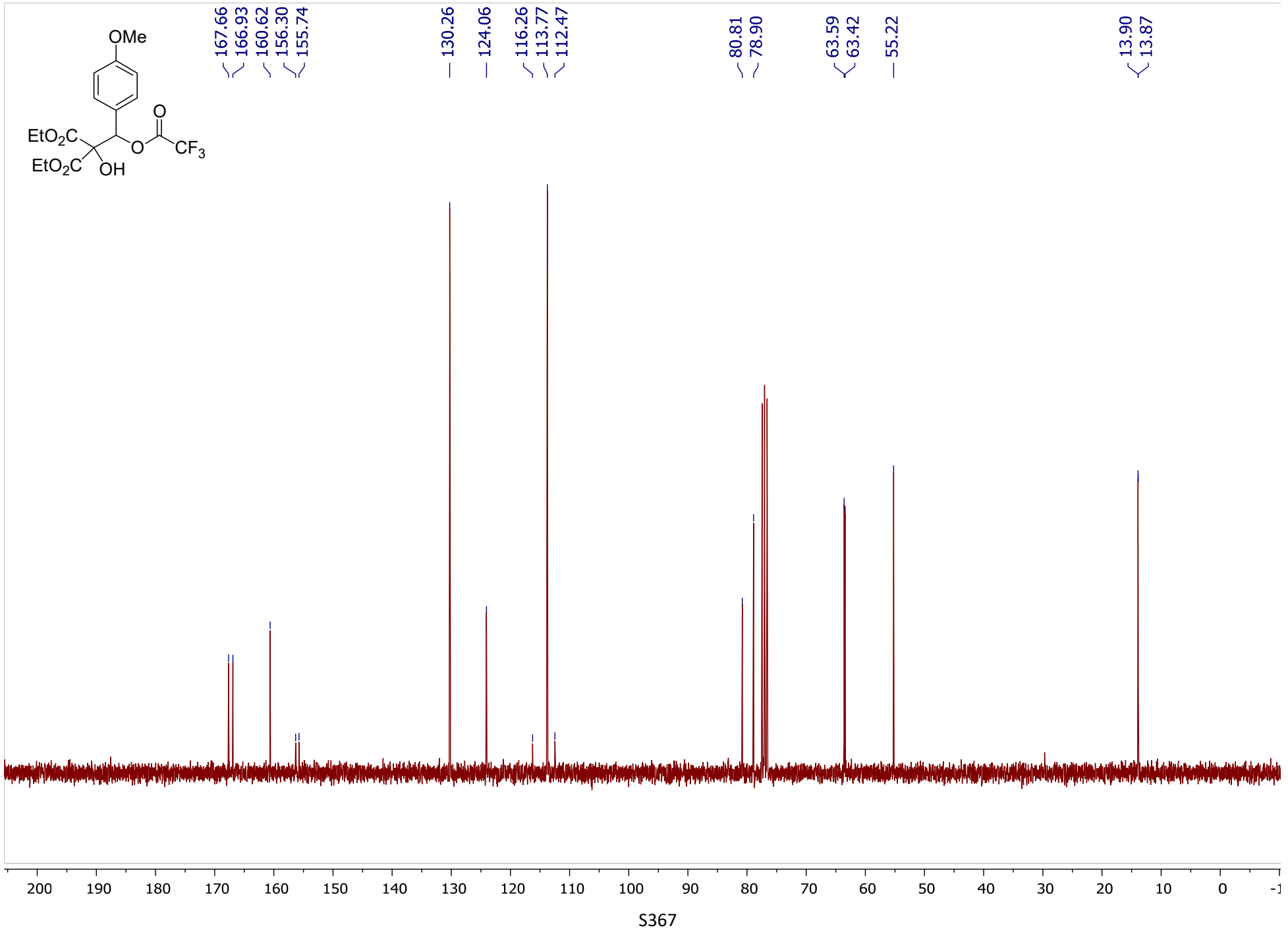
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

Diethyl 2-hydroxy-2-((4-methoxyphenyl)(2,2,2-trifluoroacetoxy)methyl)malonate 13

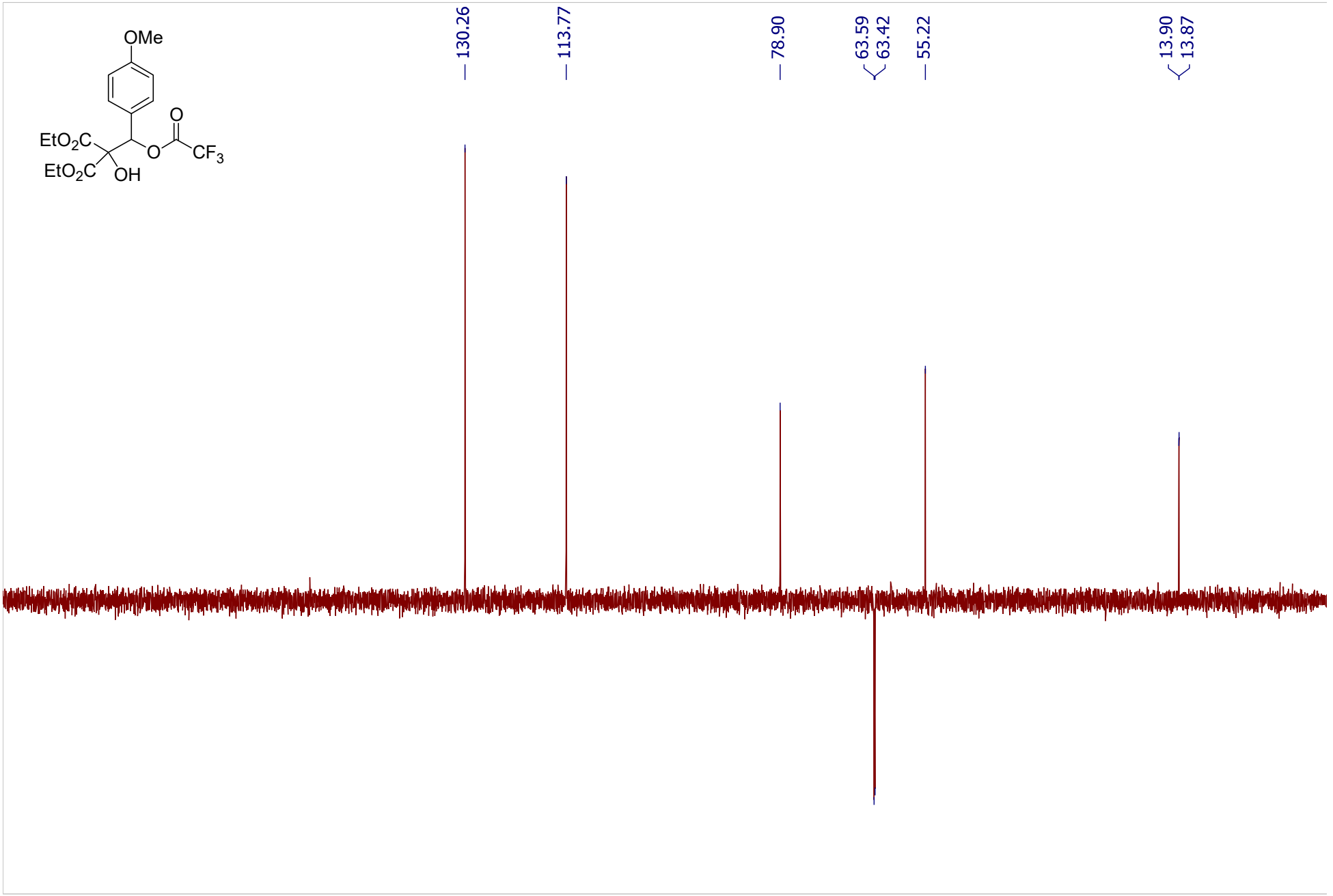
^{1}H NMR (300 MHz, $CDCl_3$)



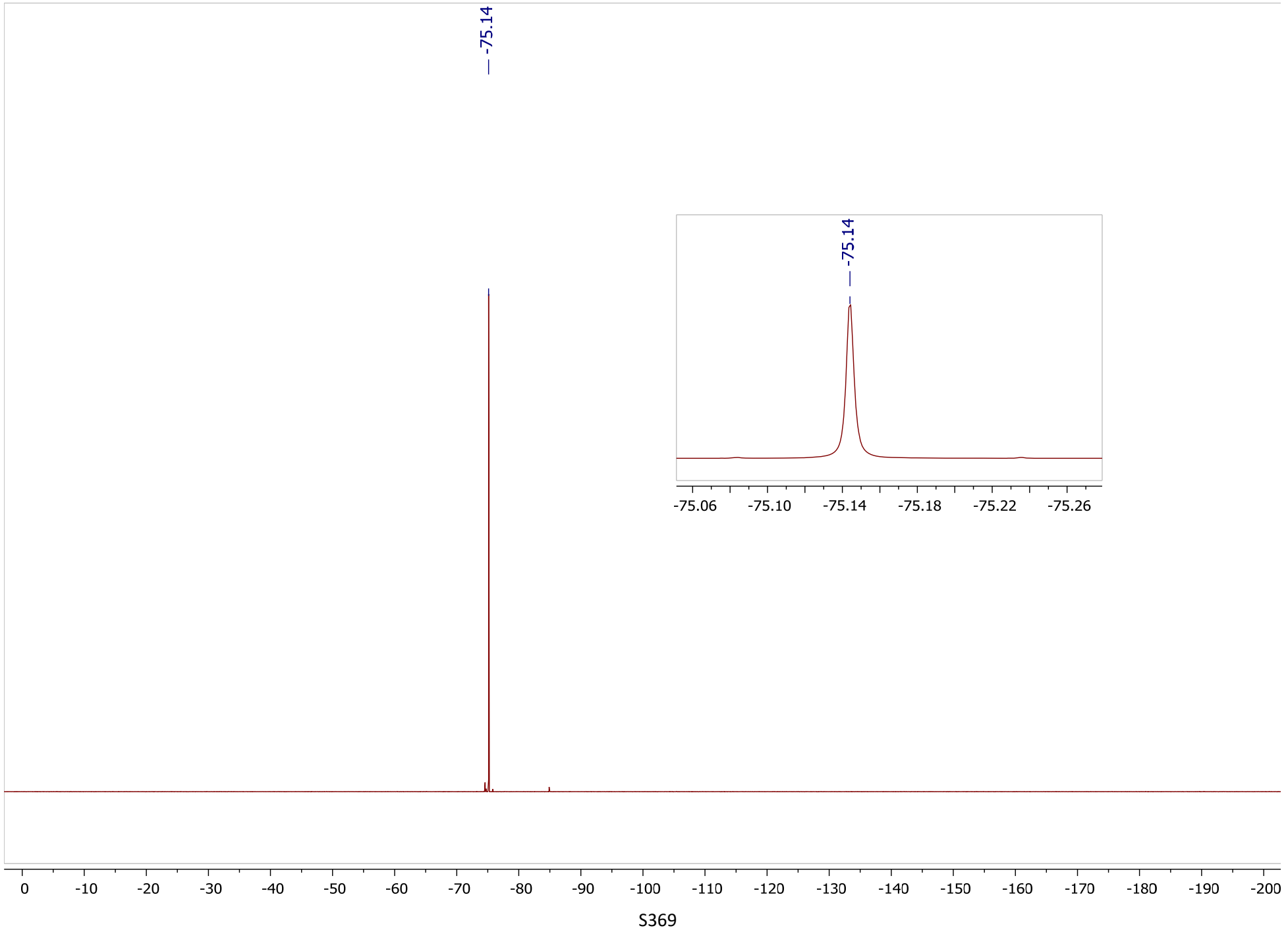
^{13}C NMR (75 MHz, $CDCl_3$)



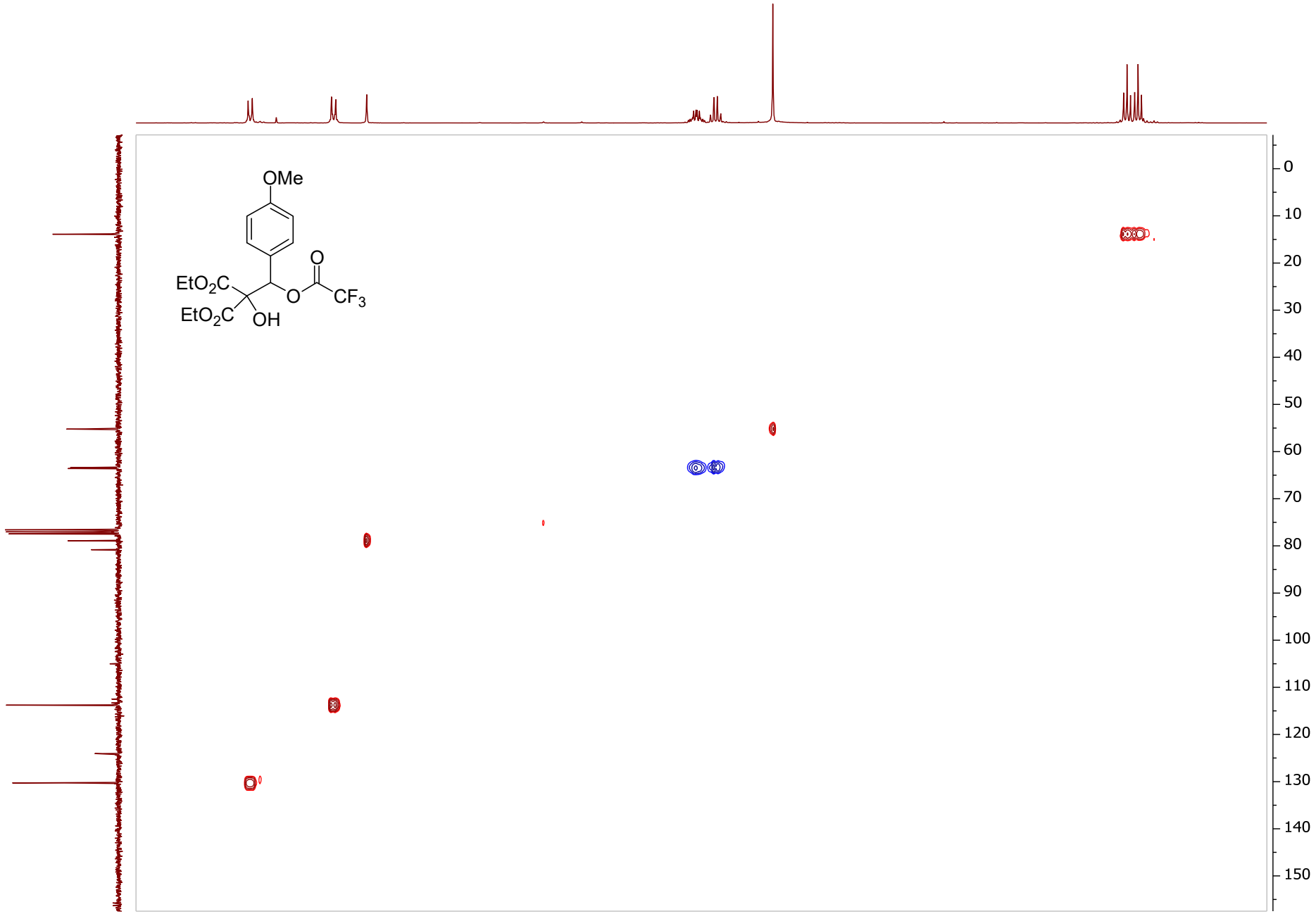
^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{19}F NMR (282 MHz, $CDCl_3$)



^{1}H-^{13}C HSQC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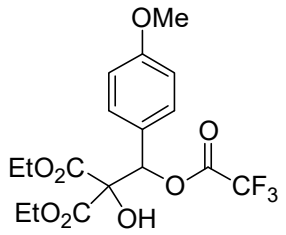
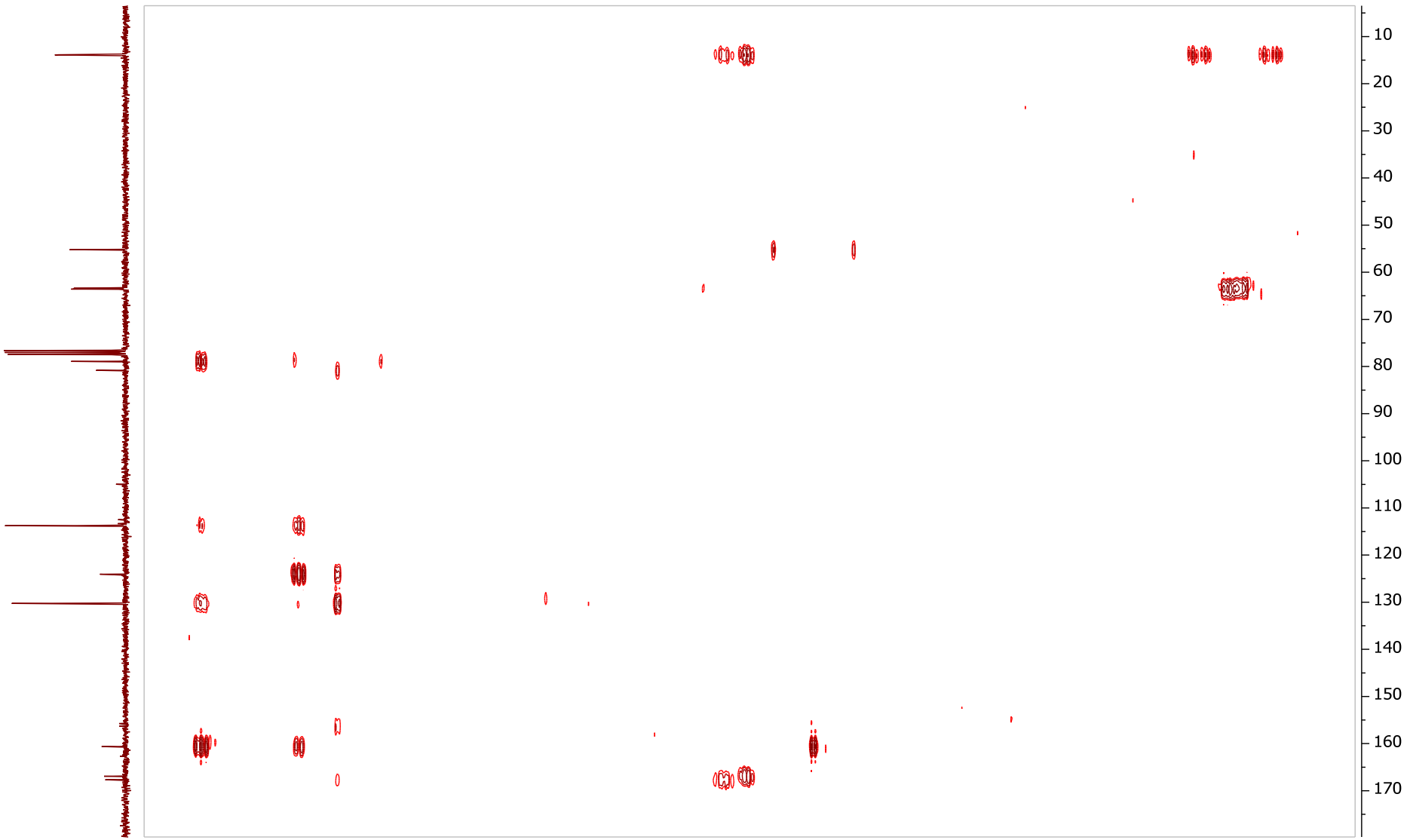
O
EtO2C
O
CF3
EtO2C
OH
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

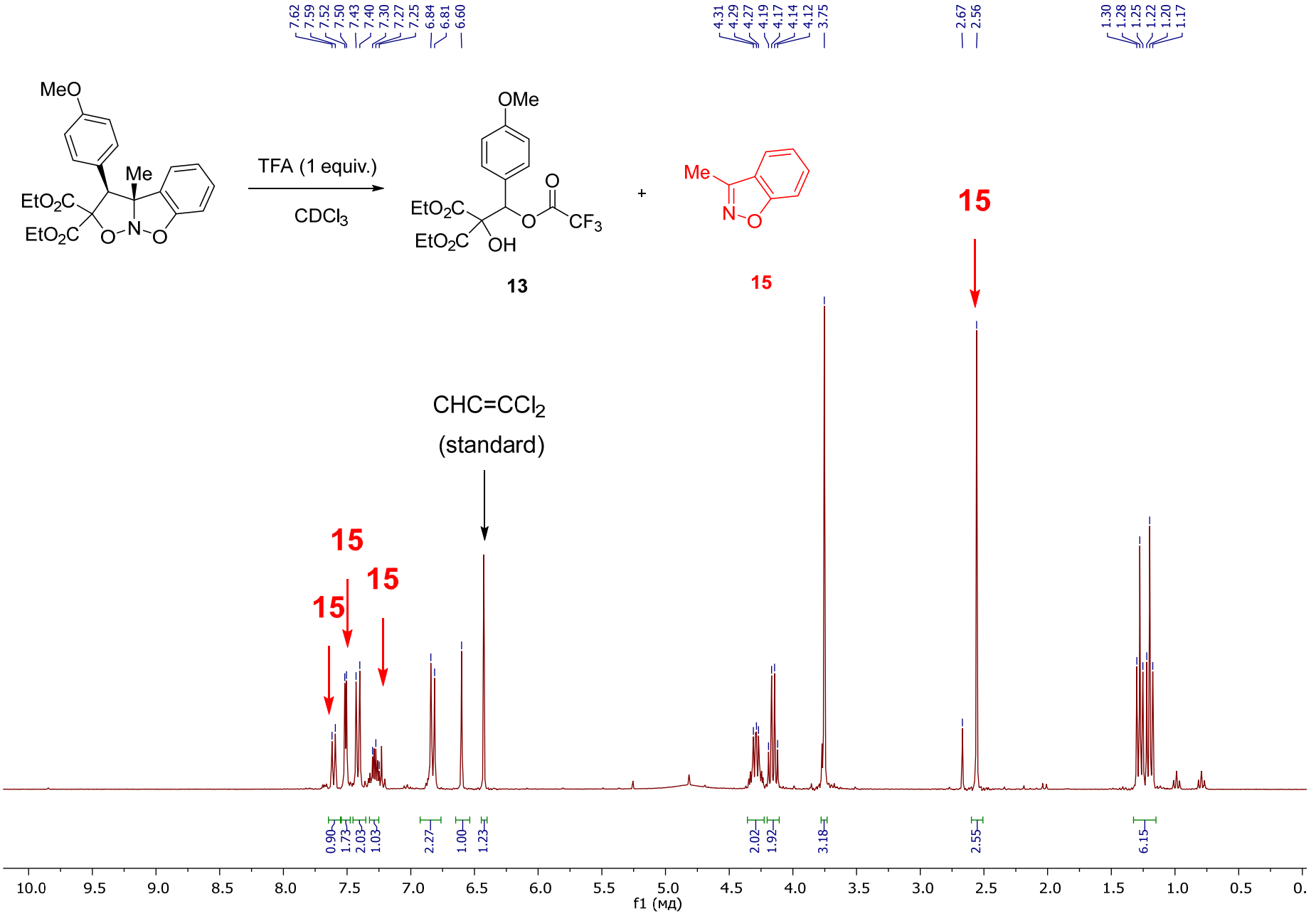
^{1}H-^{13}C HMBC


OMe
O
EtO2C
O
CF3
EtO2C
OH

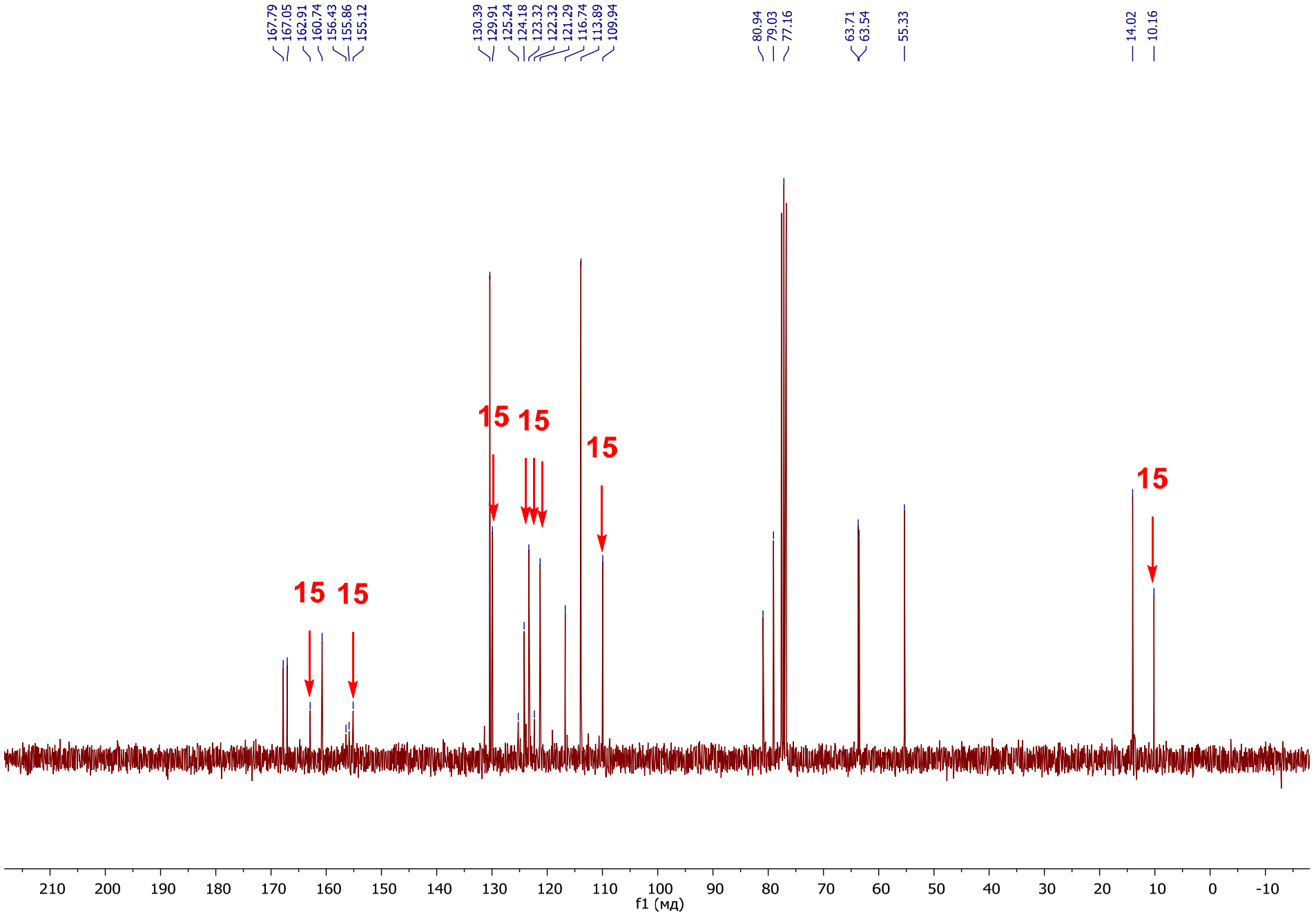

10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

Detection of 3-methyl benzisoxazoles 15 in reaction mixture

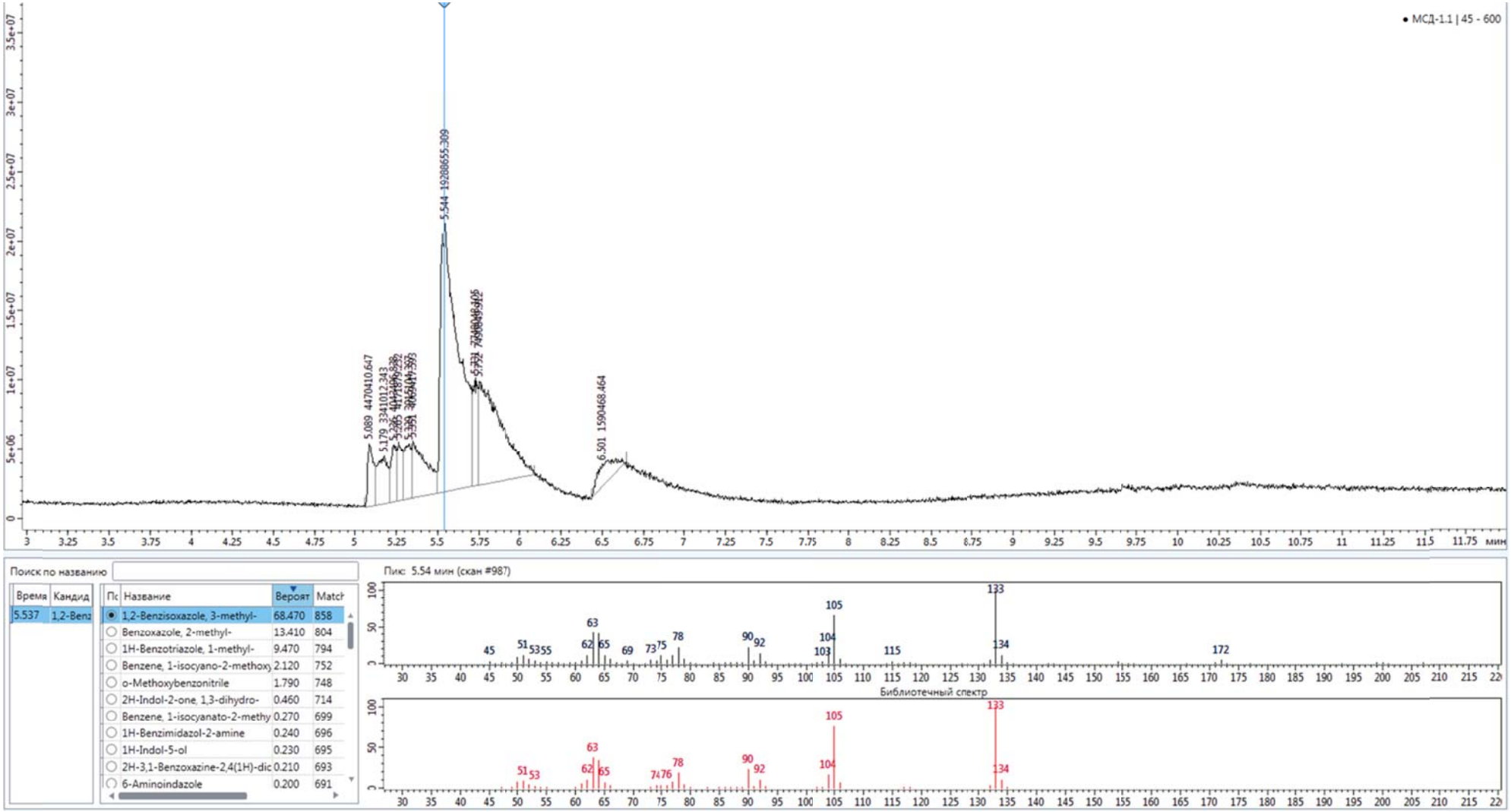
^{1}H NMR (300 MHz, $CDCl_3$) of reaction mixture



^{13}C NMR (75 MHz, $CDCl_3$) of reaction mixture

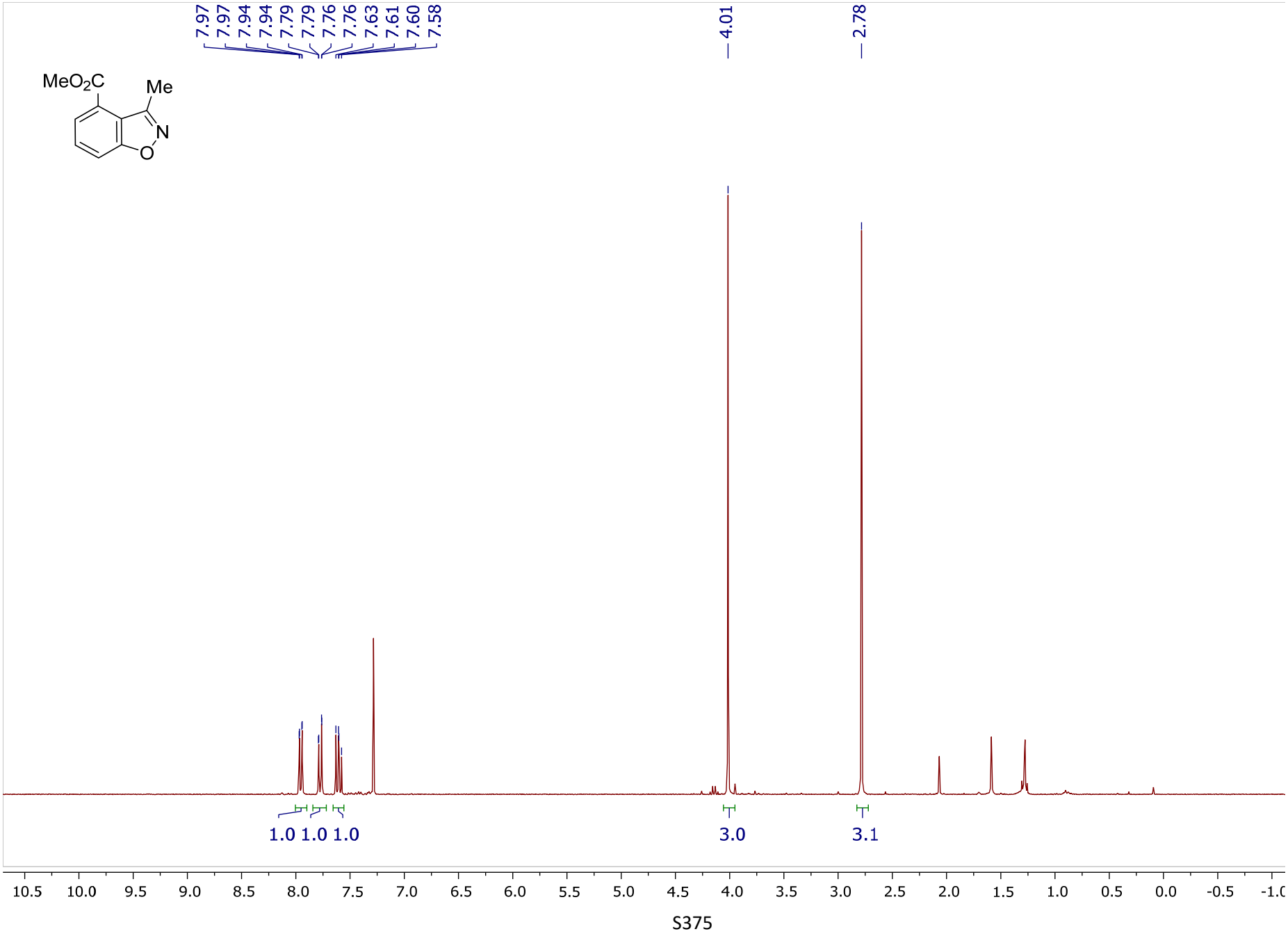


GC-MS chromatogram and MS database search

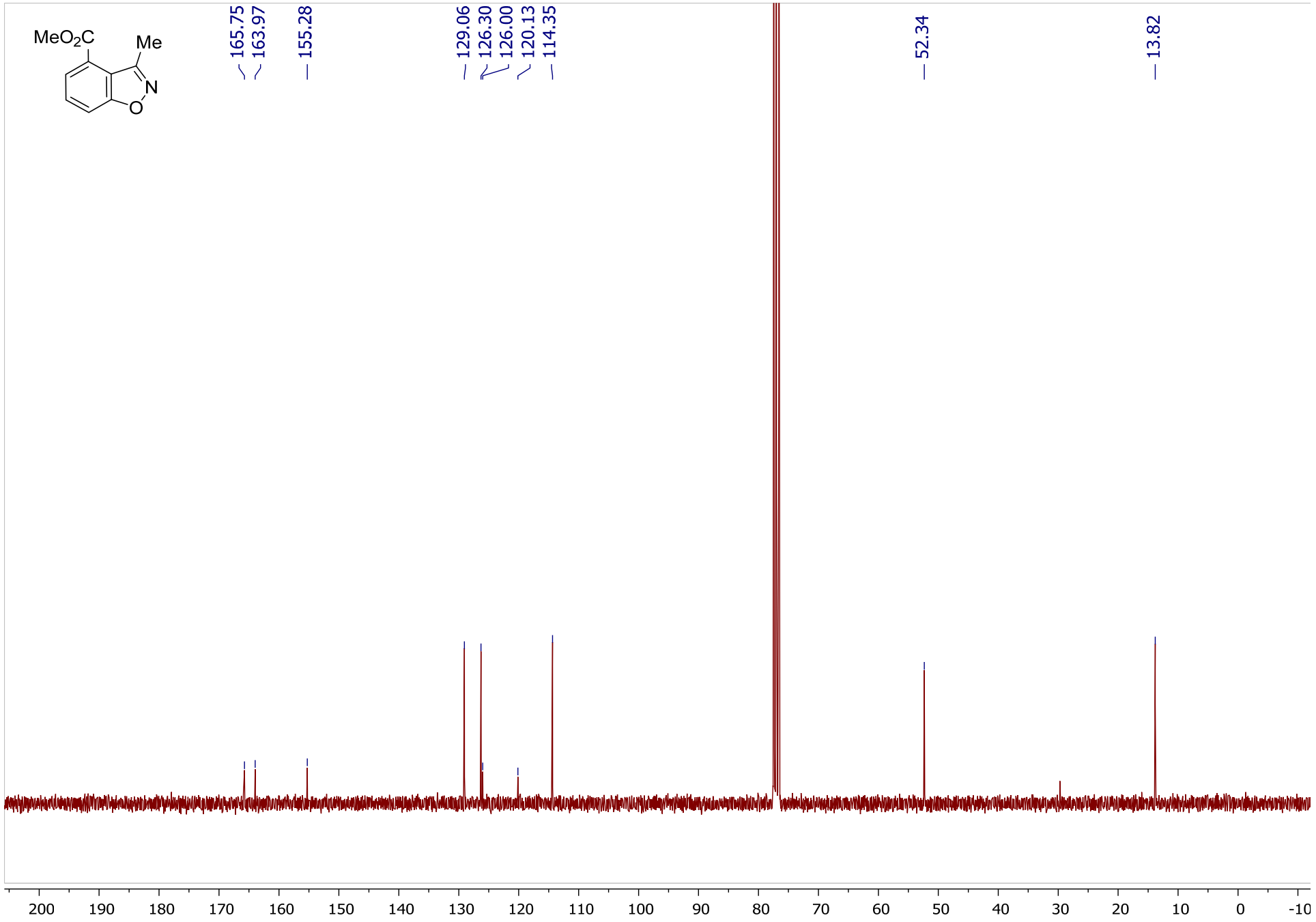


Methyl 3-methylbenzo[d]isoxazole-4-carboxylate 15g

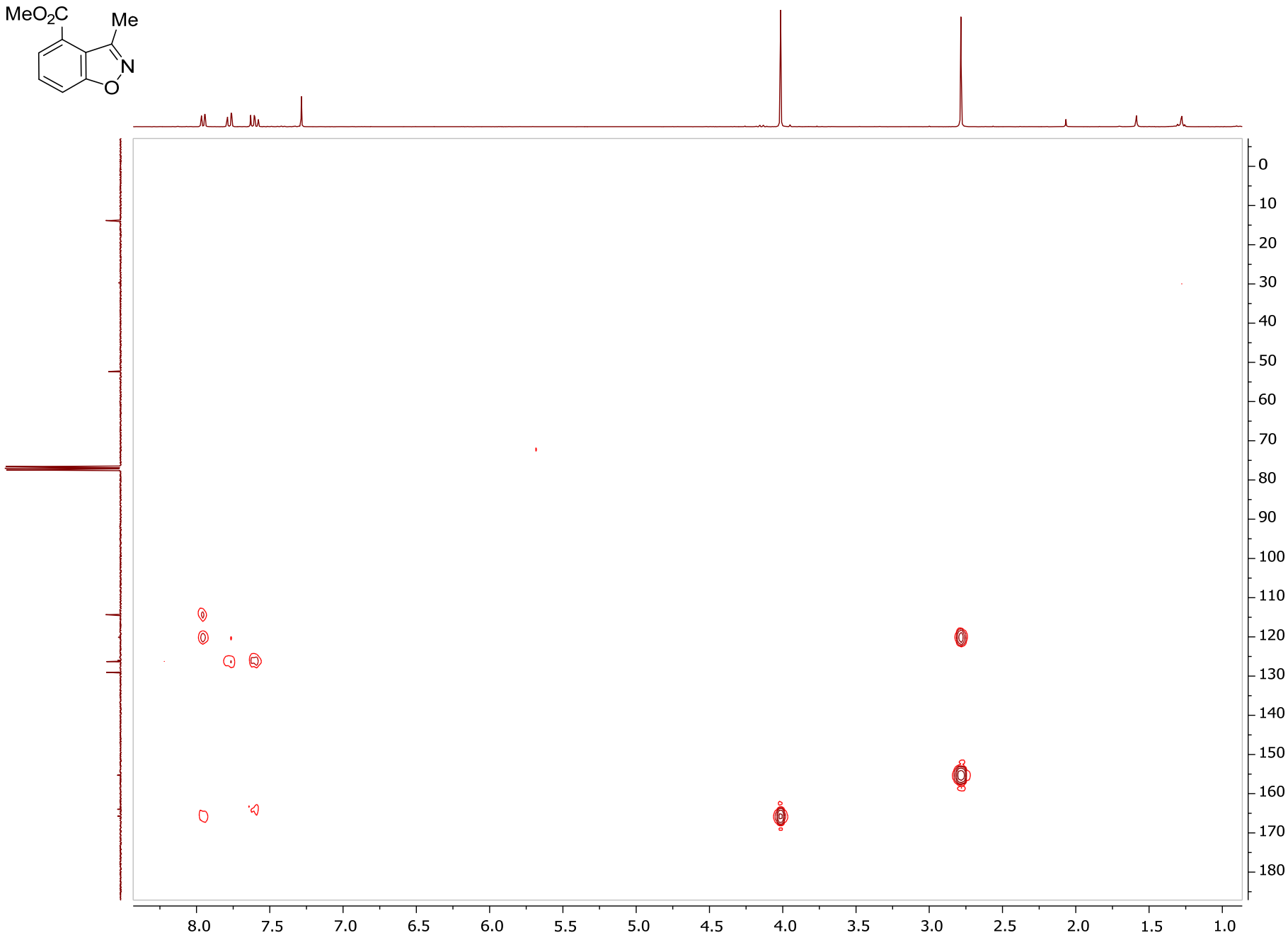
^{1}H NMR (300 MHz, $CDCl_3$)



^{13}C NMR (75 MHz, $CDCl_3$)



^{1}H-^{13}C HMBC


MeO2C
Me
N
O
0
10
20
30
40
50
60
70
80
90
100
110
120
130
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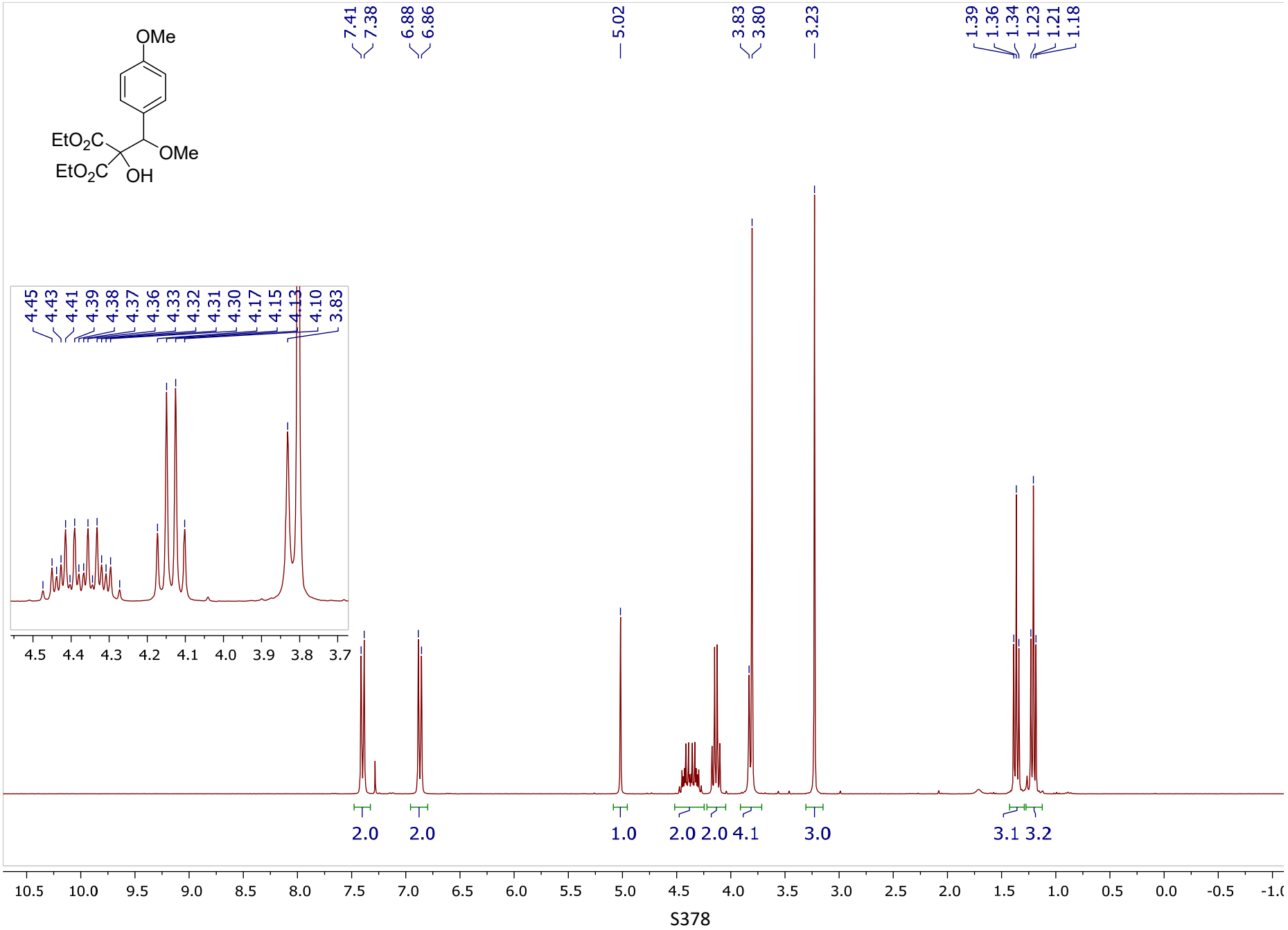
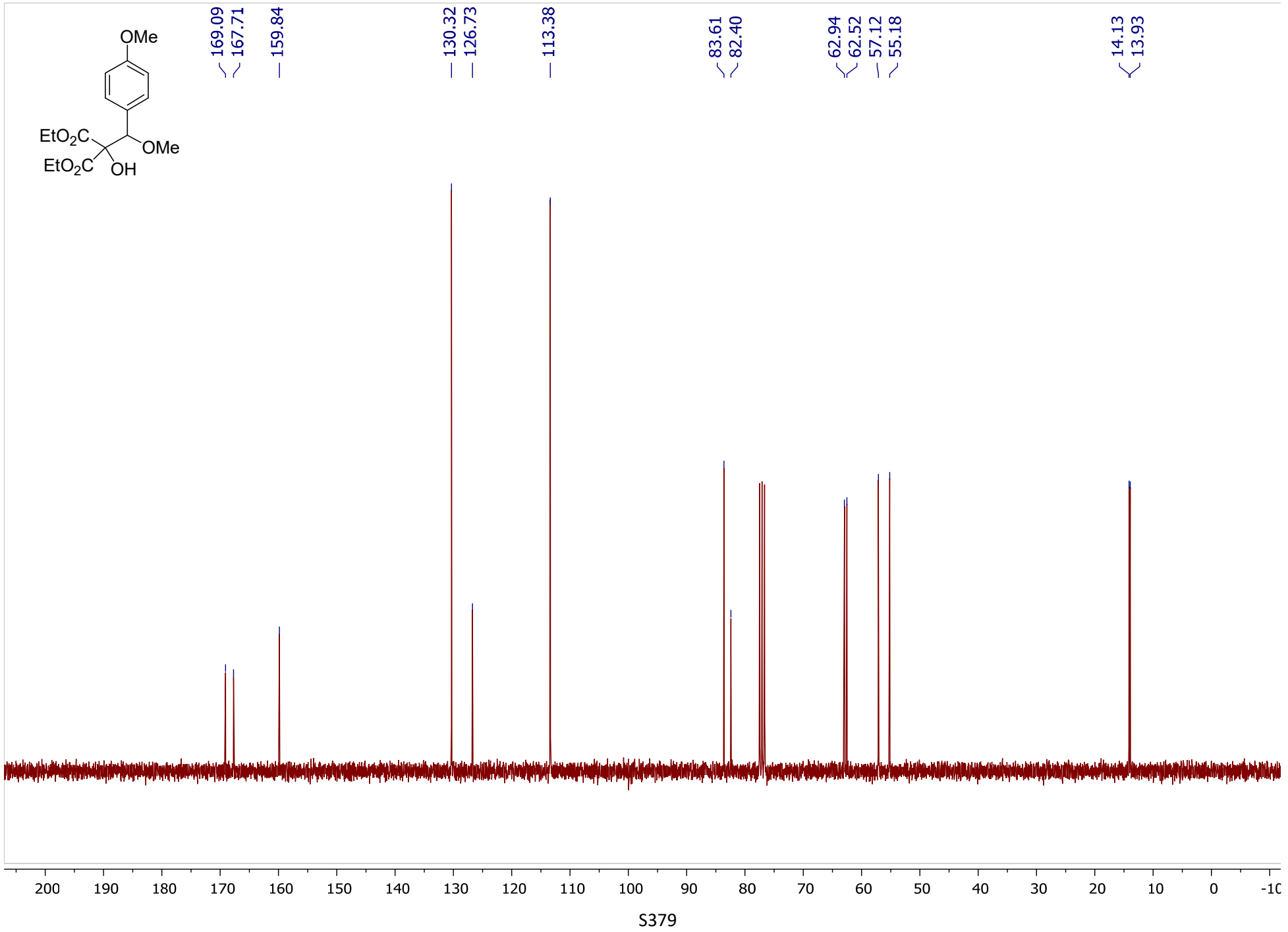
150
160
170
180
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

Diethyl 2-hydroxy-2-(methoxy(4-methoxyphenyl)methyl)malonate 14

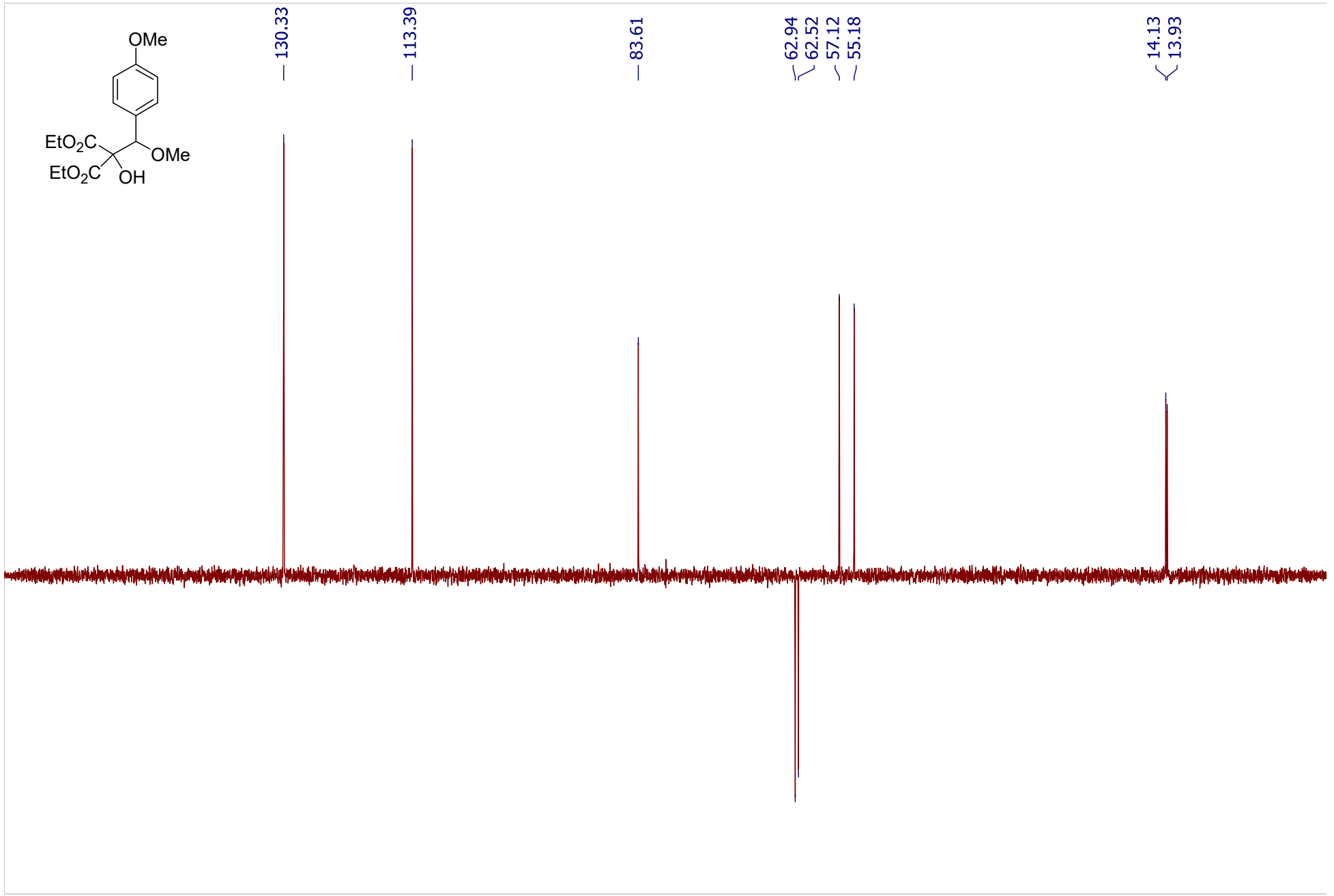
^{1}H NMR (300 MHz, $CDCl_3$)



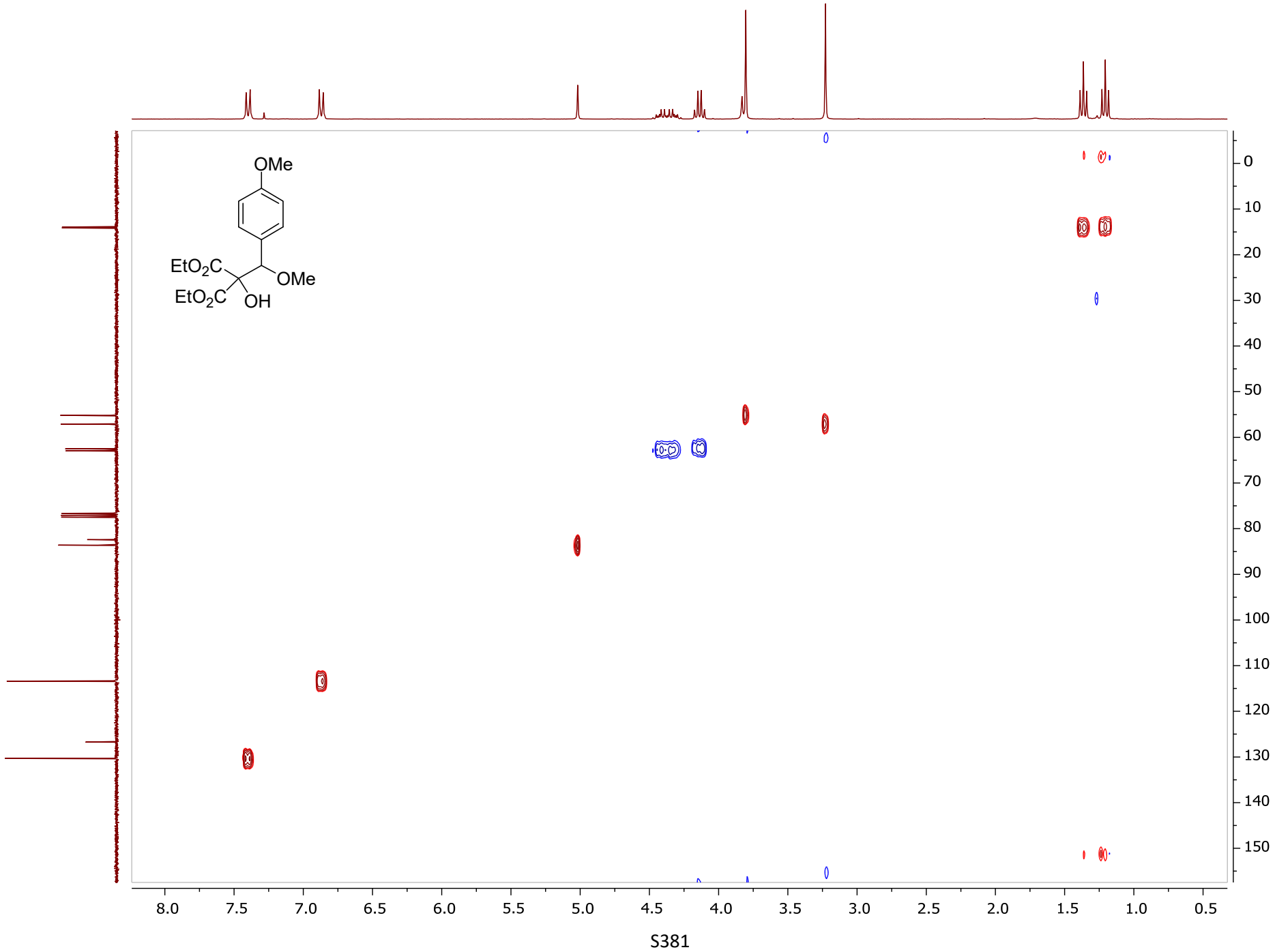
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{13}C HSQC


OMe
EtO2C
OMe
EtO2C
OH
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
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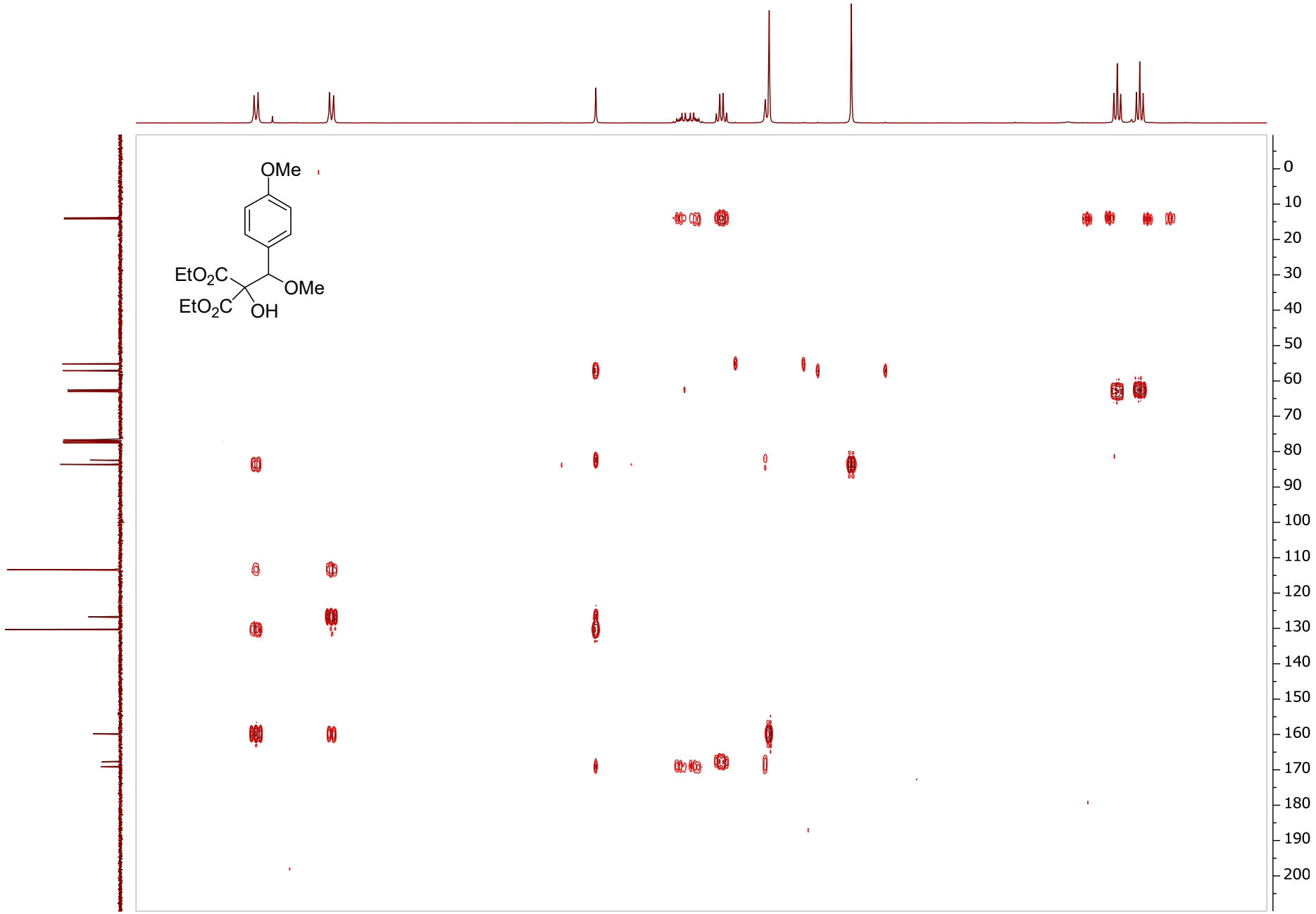
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{13}C HMBC


OMe
EtO2C
OMe
EtO2C
OH
0
10
20
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40
50
60
70
80
90
100
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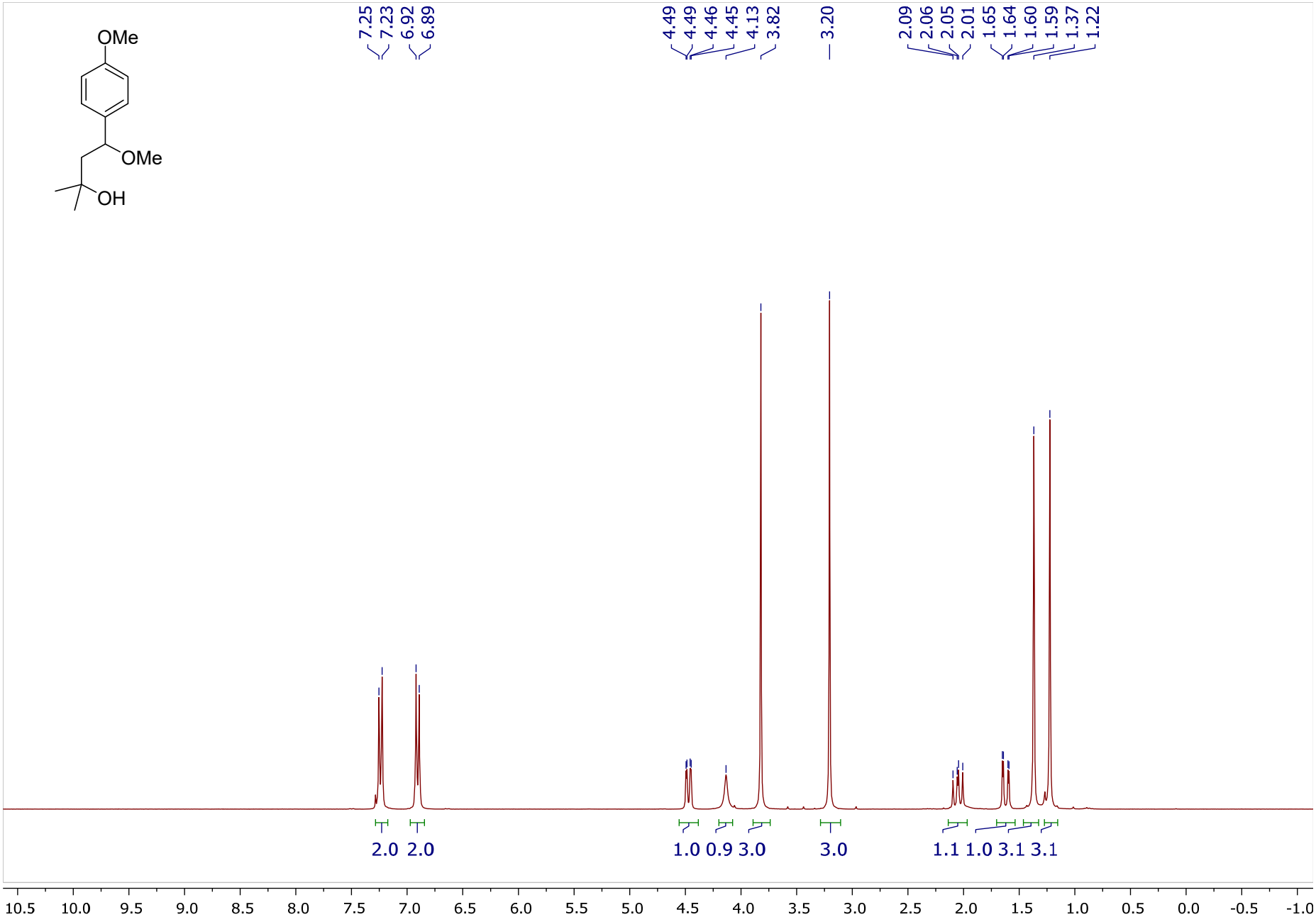
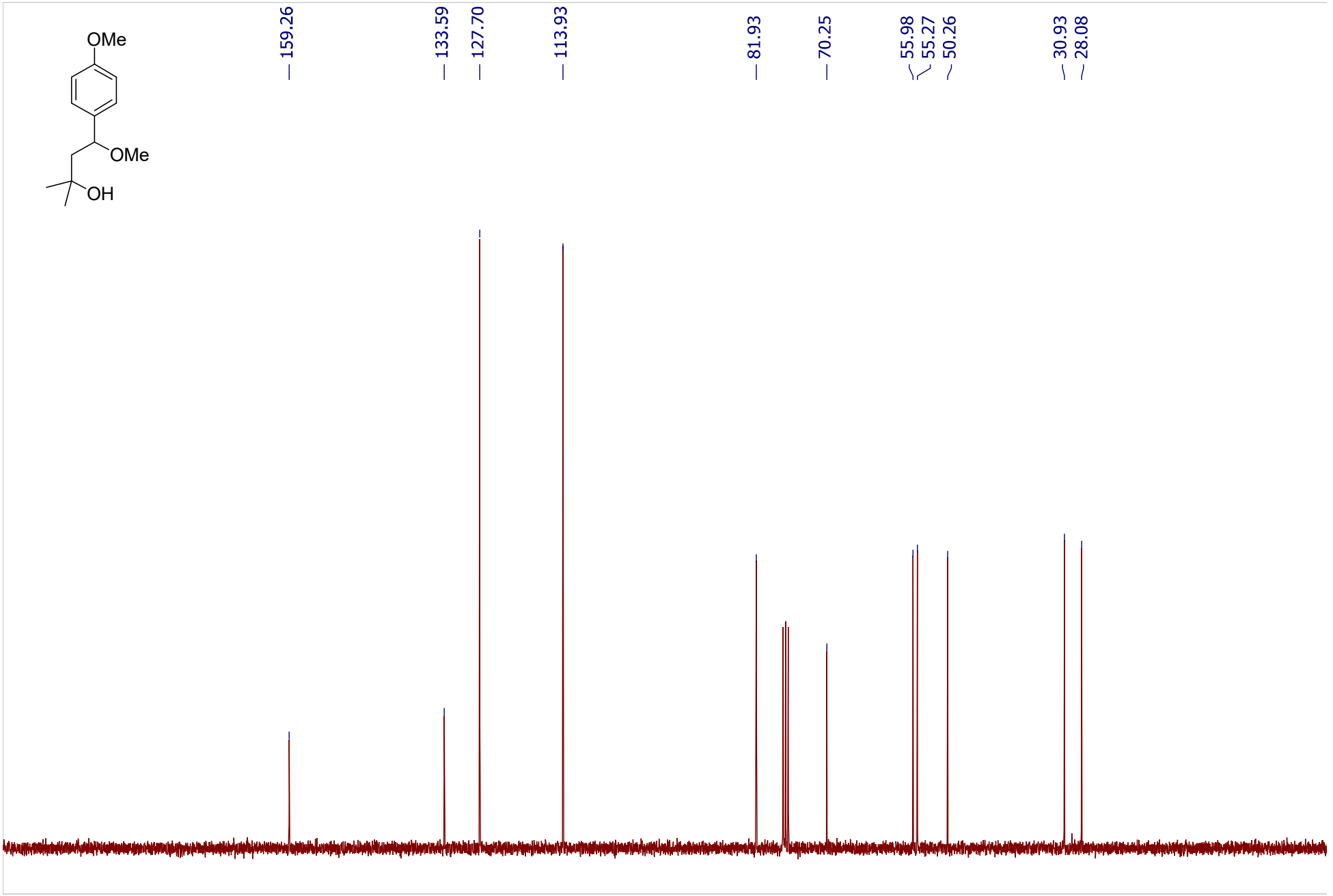
120
130
140
150
160
170
180
190
200
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

4-Methoxy-4-(4-methoxyphenyl)-2-methylbutan-2-ol 16

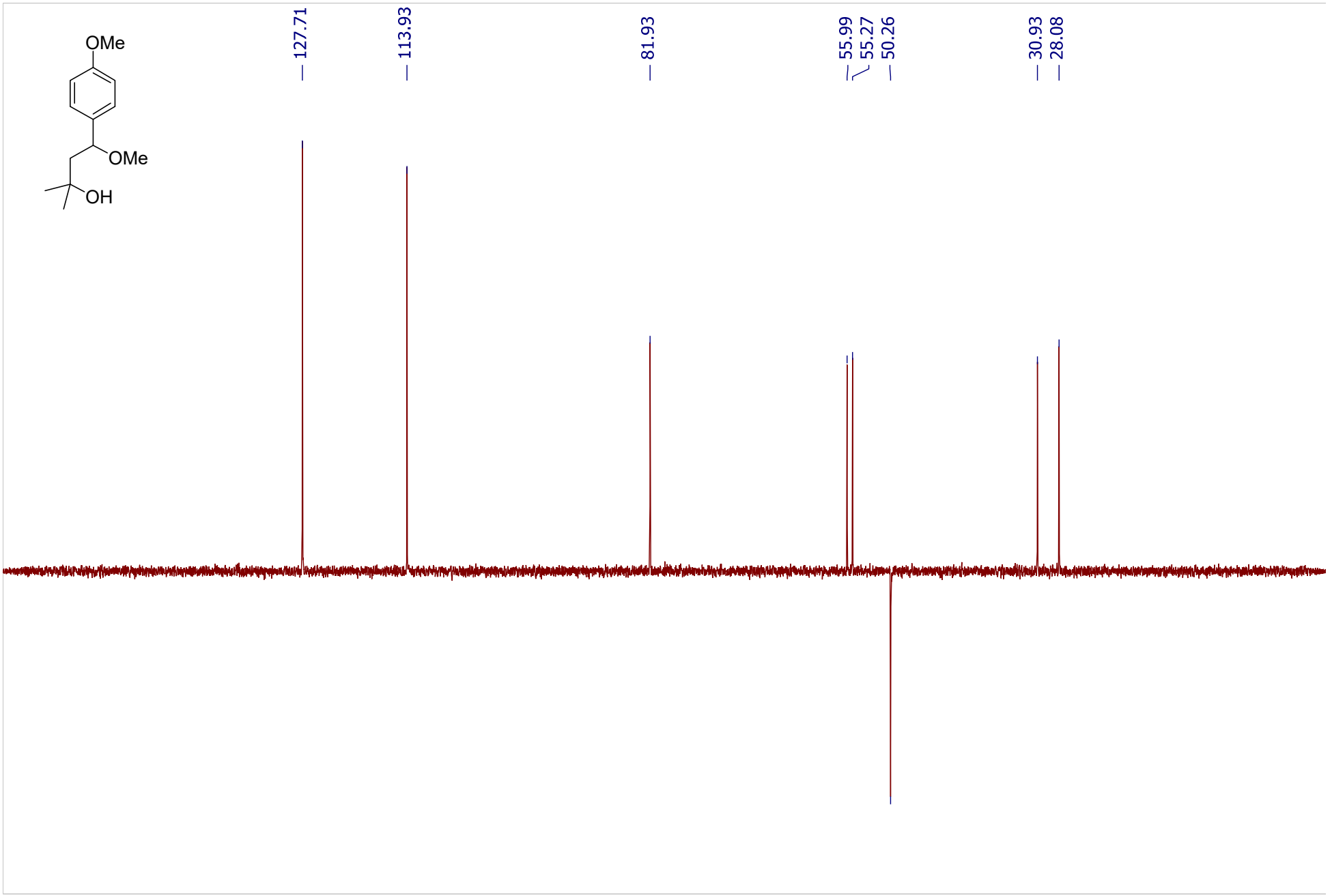
^{1}H NMR (300 MHz, $CDCl_3$)



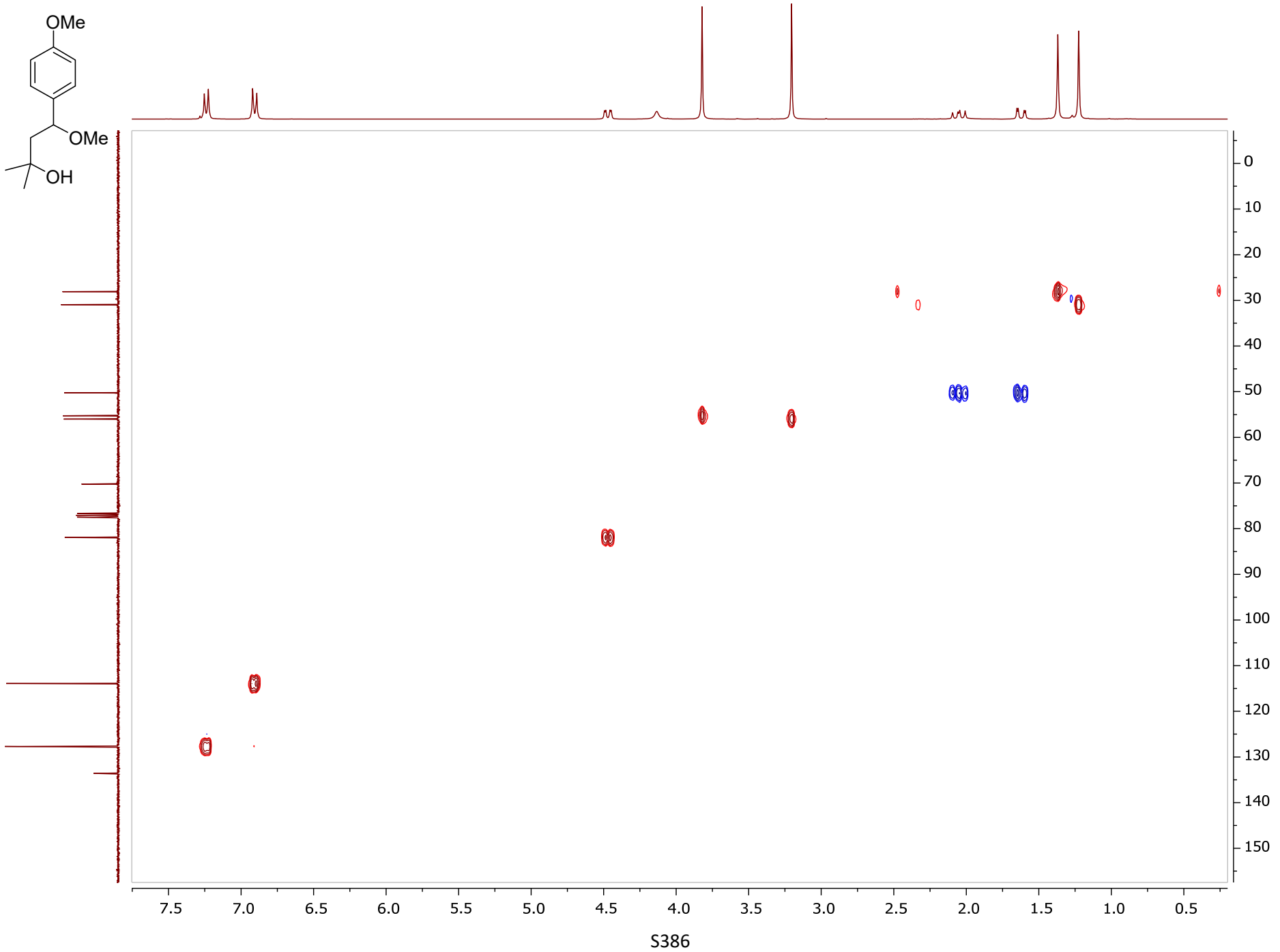
^{13}C NMR (75 MHz, $CDCl_3$)



^{13}C DEPT 135 (75 MHz, $CDCl_3$)



^{1}H-^{13}C HSQC


OMe
OMe
OH
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
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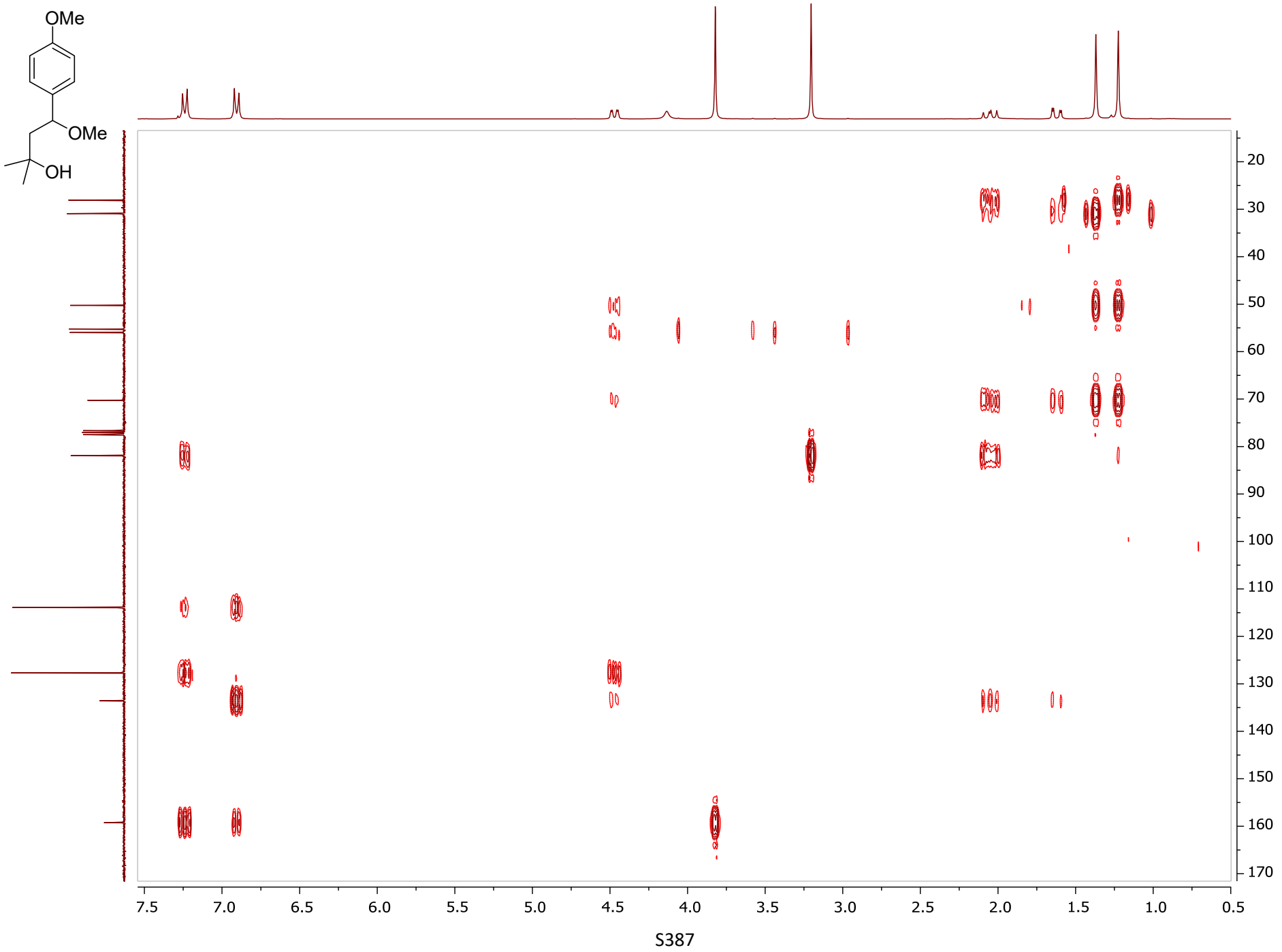
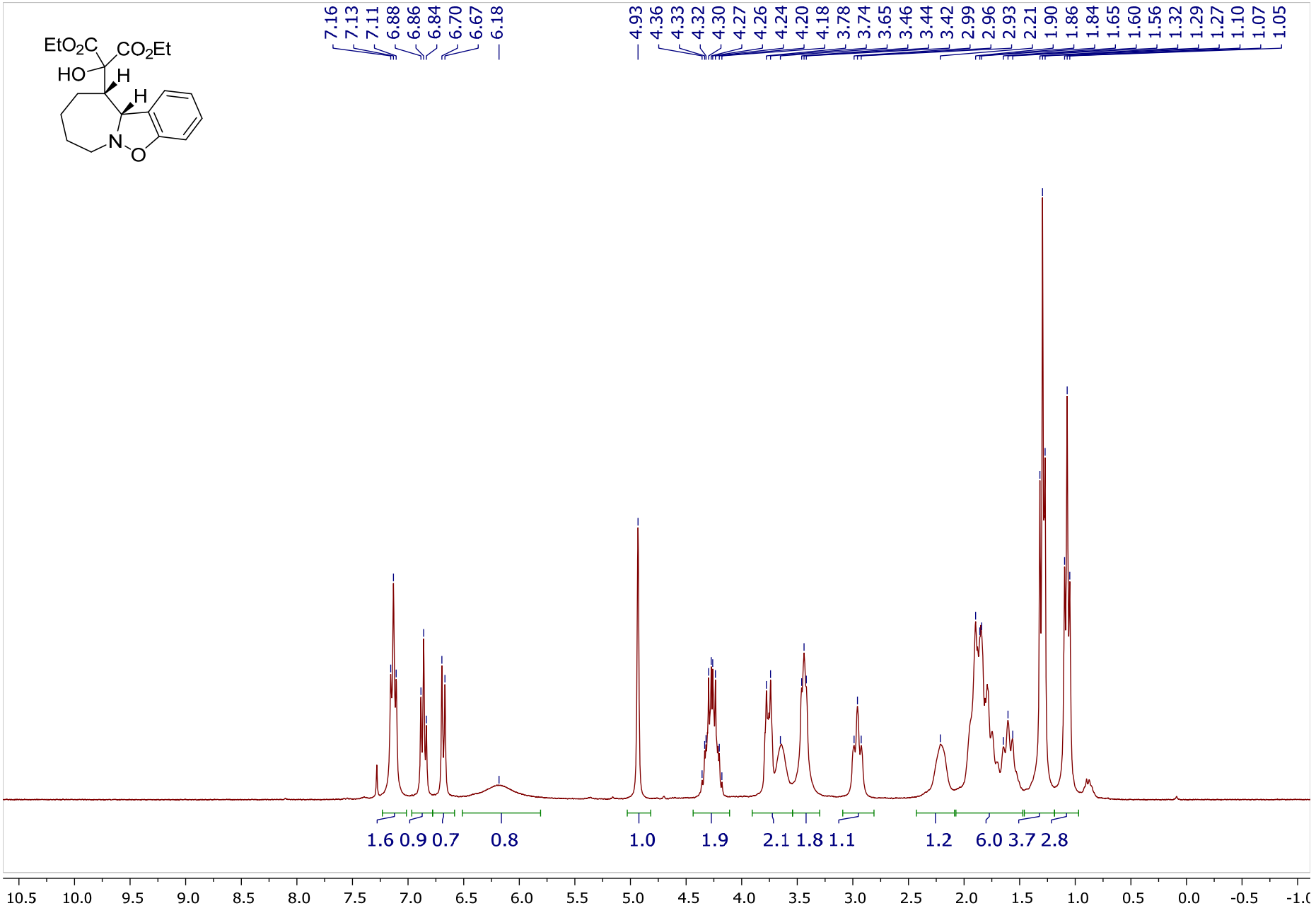
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5

^{1}H-^{13}C HMBC

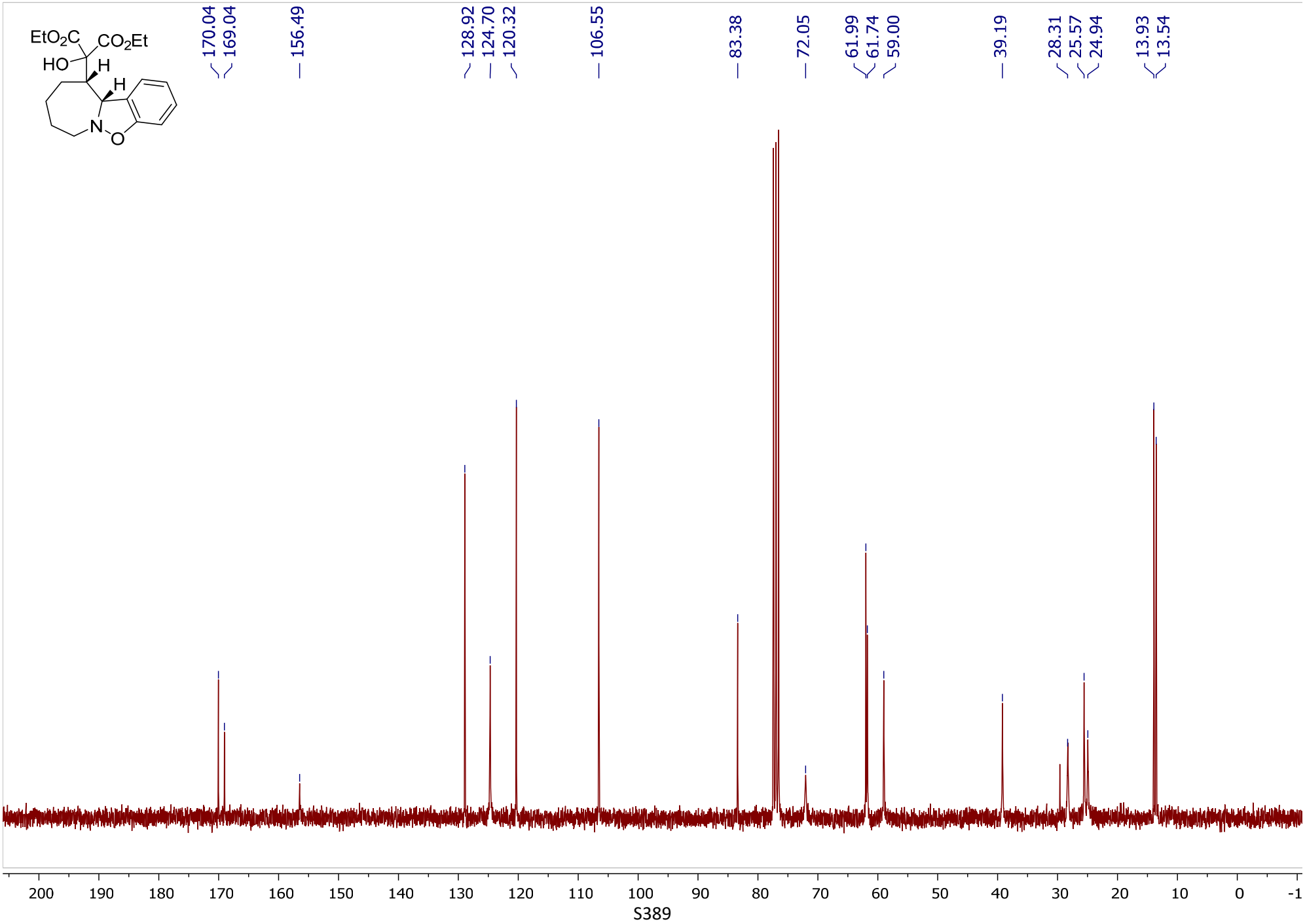

OMe
OMe
OH
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170

Diethyl 2-((11*S,11a*R**)-7,8,9,10,11,11a-hexahydrobenzo[4,5]isoxazolo[2,3-a]azepin-11-yl)-2-hydroxymalonate 17**

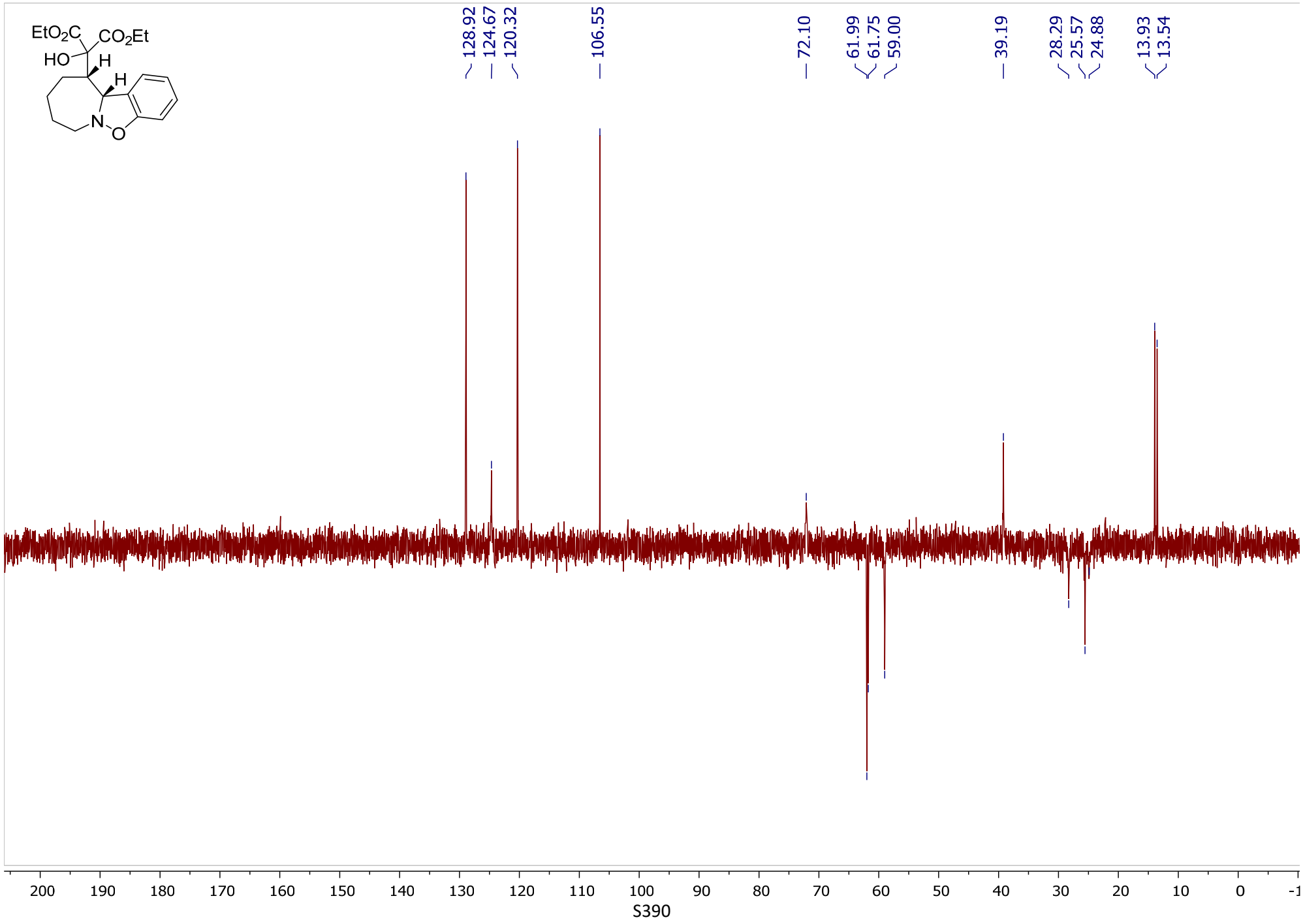
^{1}H NMR (300 MHz, 323K, $CDCl_3$)



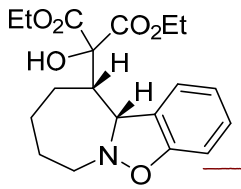
^{13}C NMR (75 MHz, 323K, $CDCl_3$)

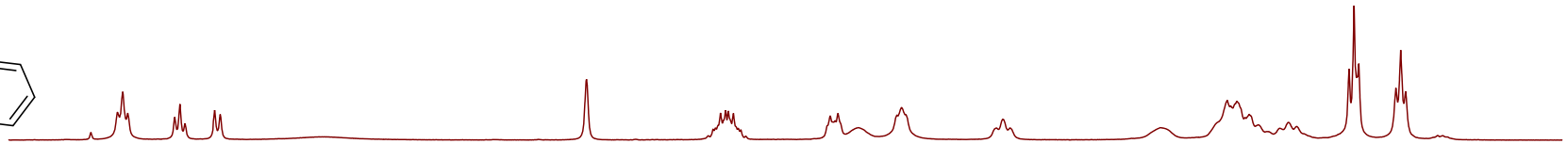


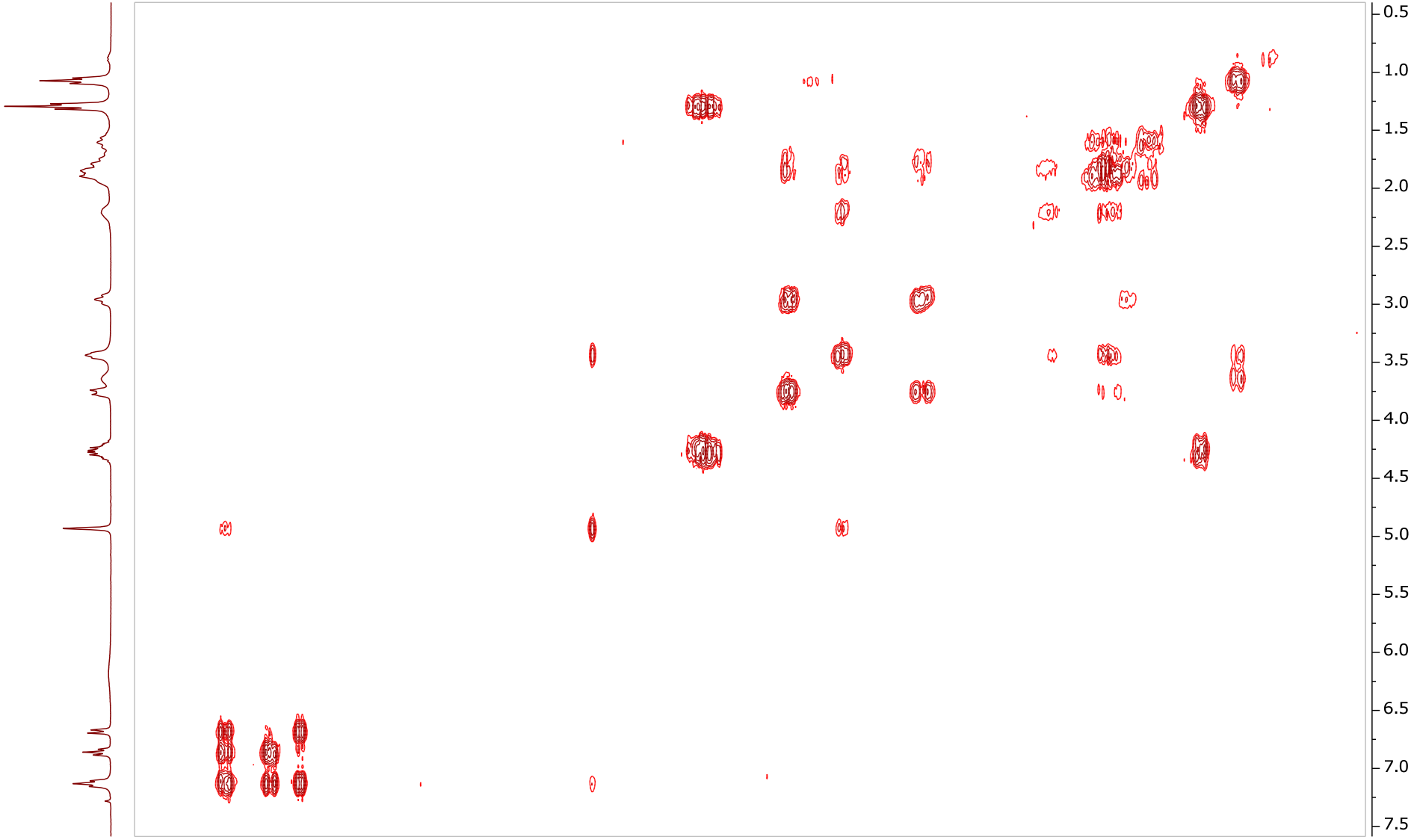
^{13}C DEPT 135 (75 MHz, 323K, $CDCl_3$)



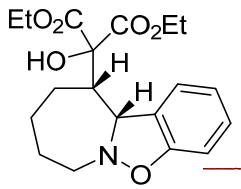
^{1}H-^{1}H COSY (323K)

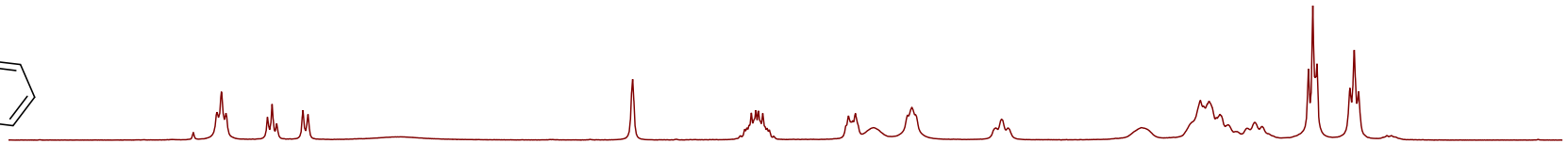


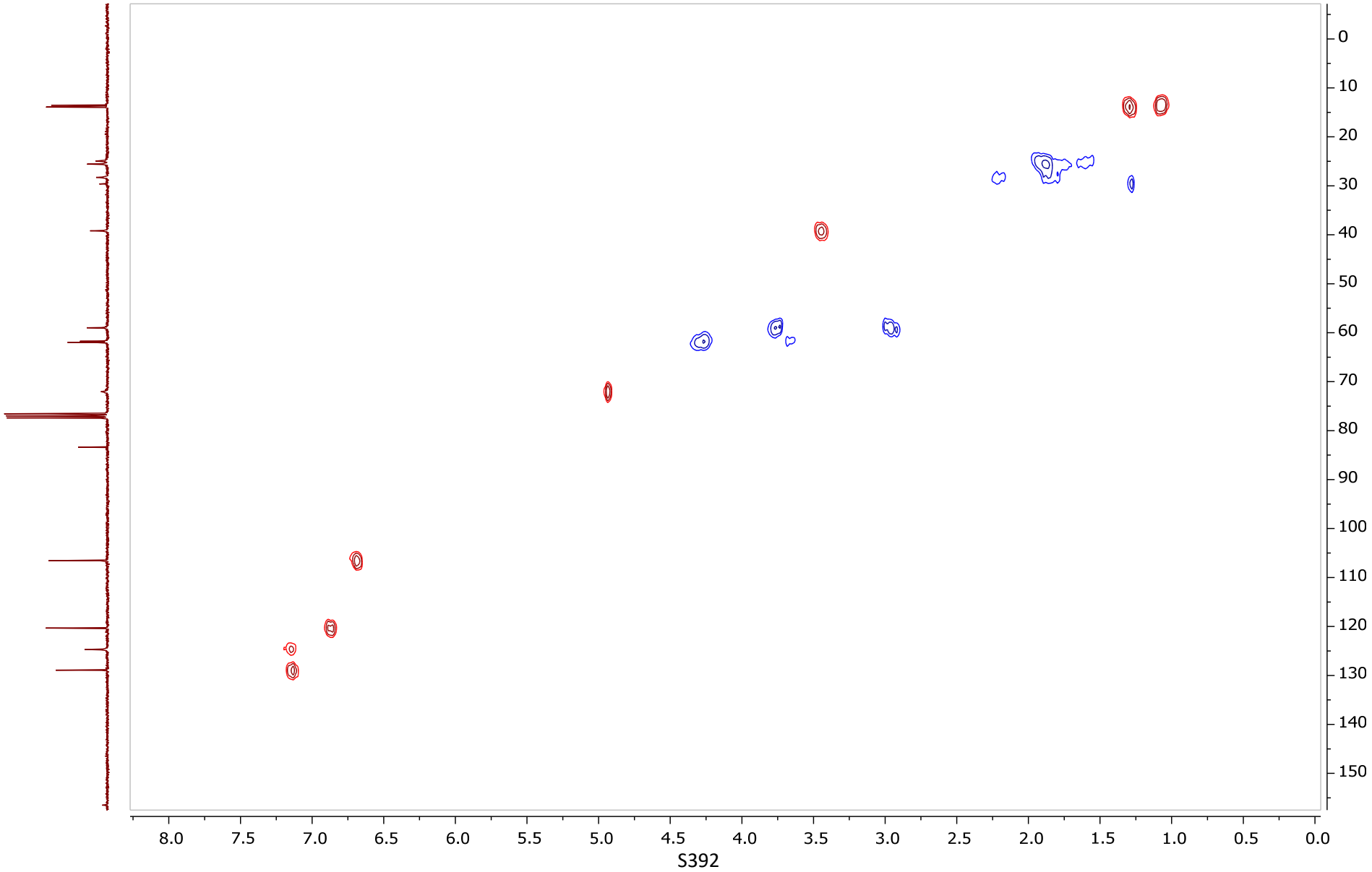




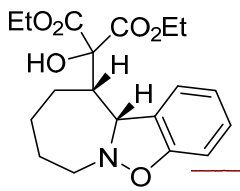
^{1}H-^{13}C HSQC (323K)

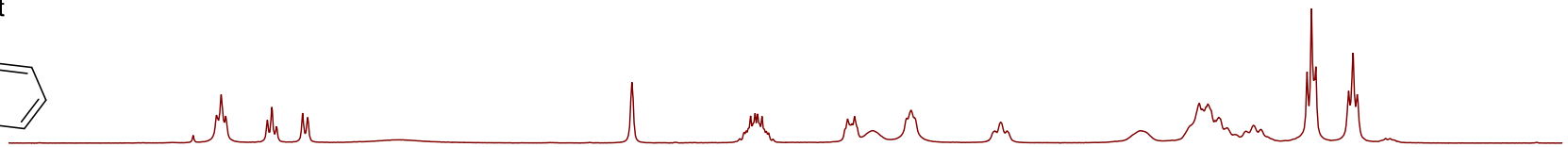


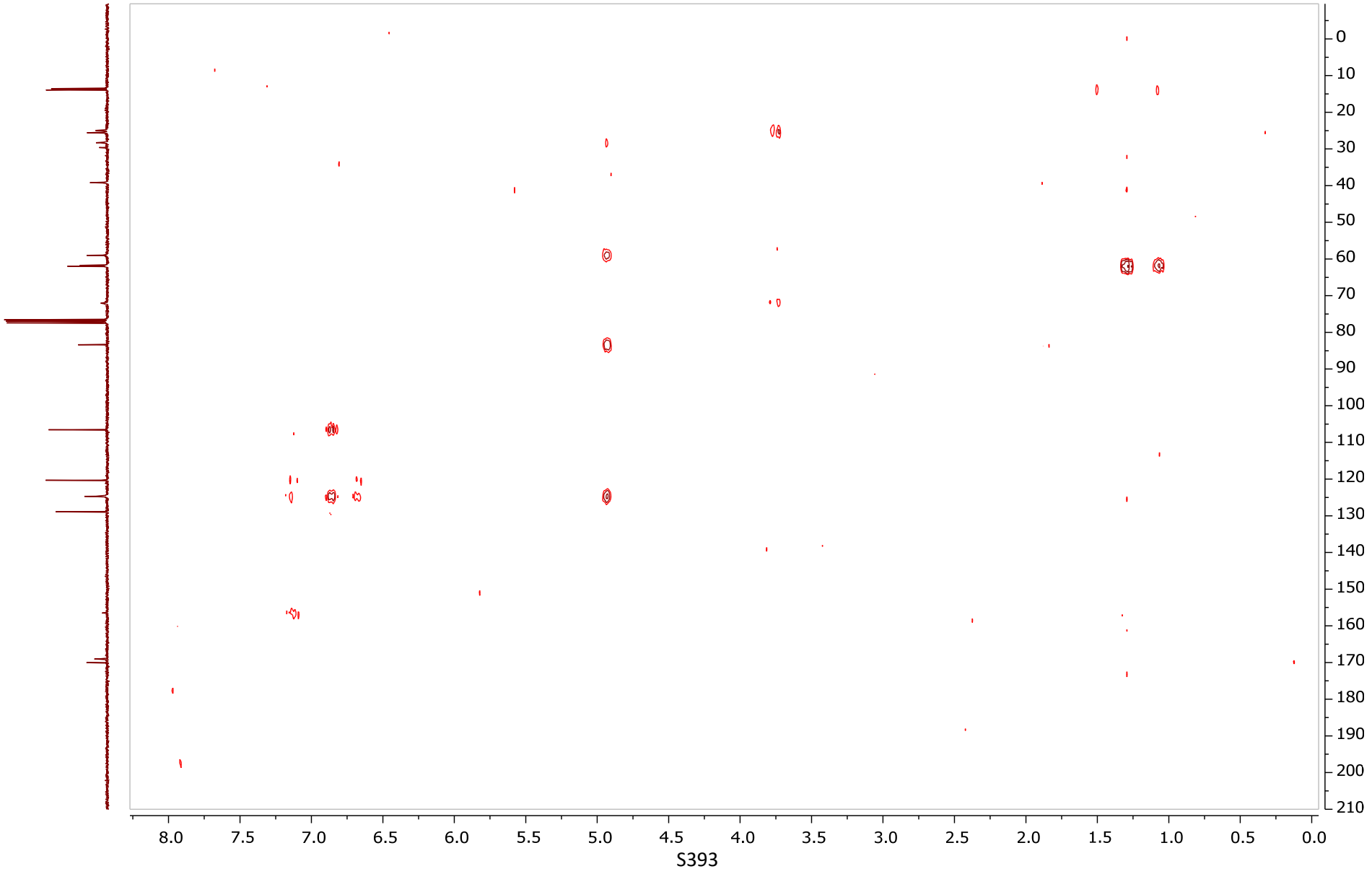




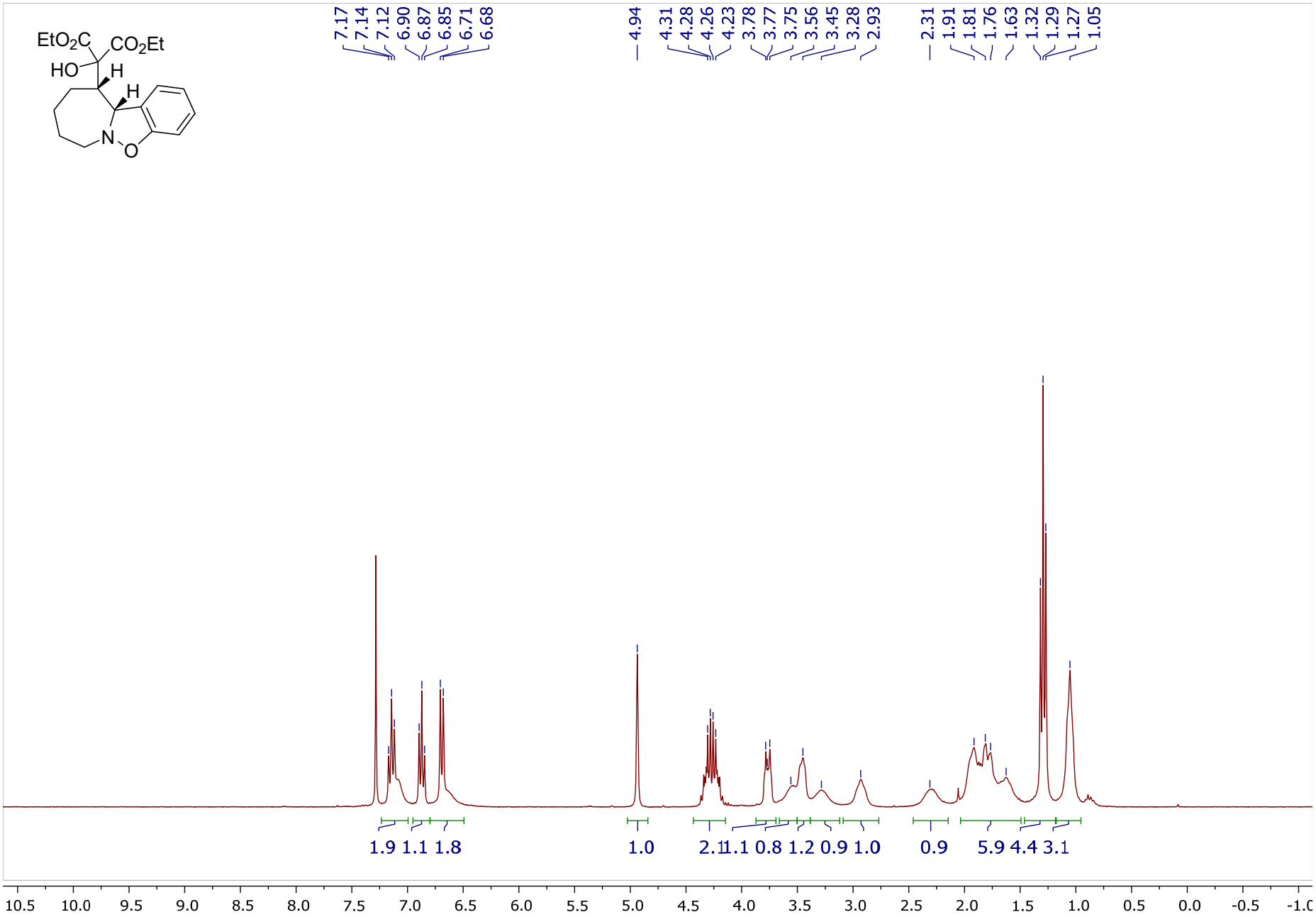
^{1}H-^{13}C HMBC (323K)



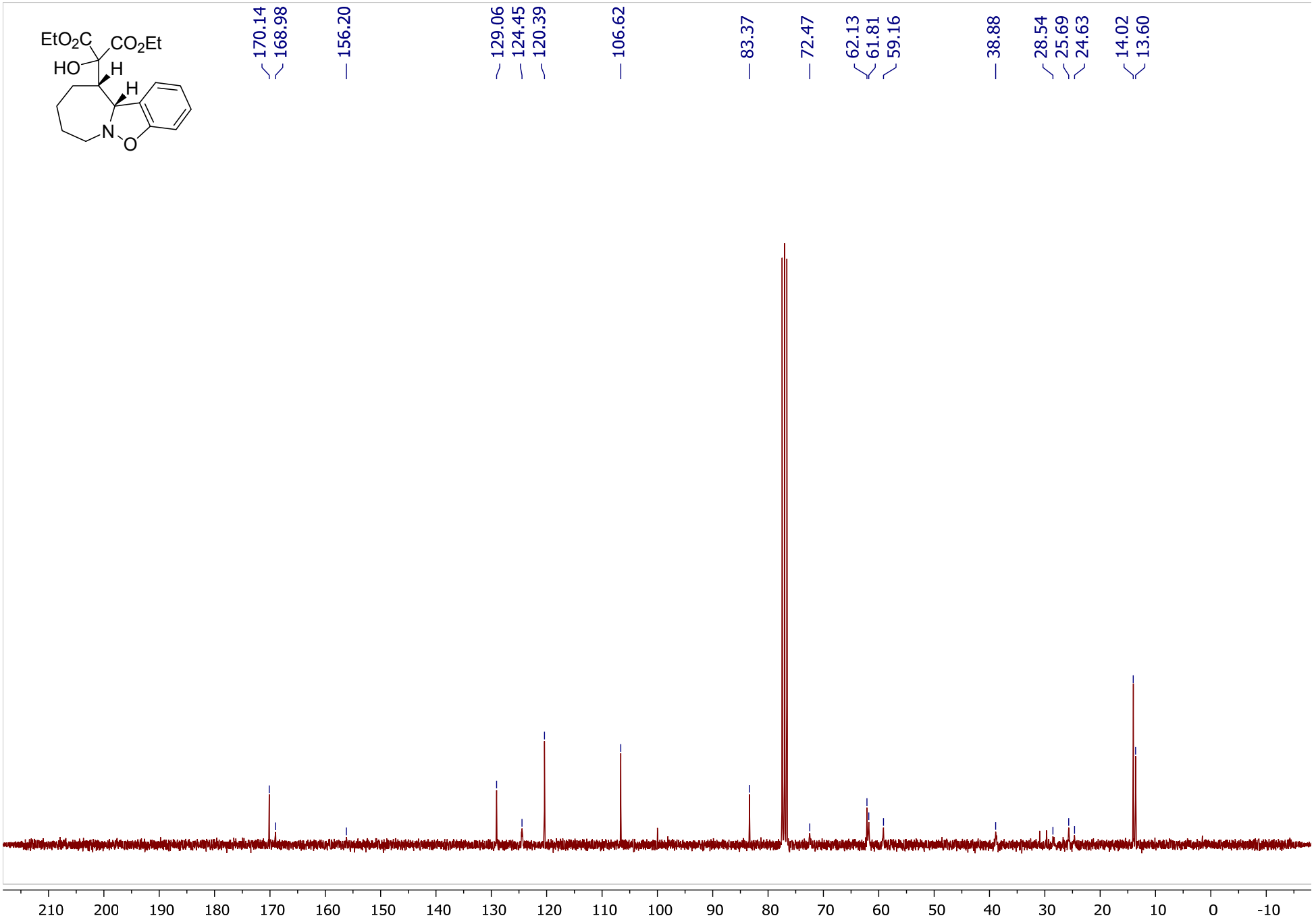




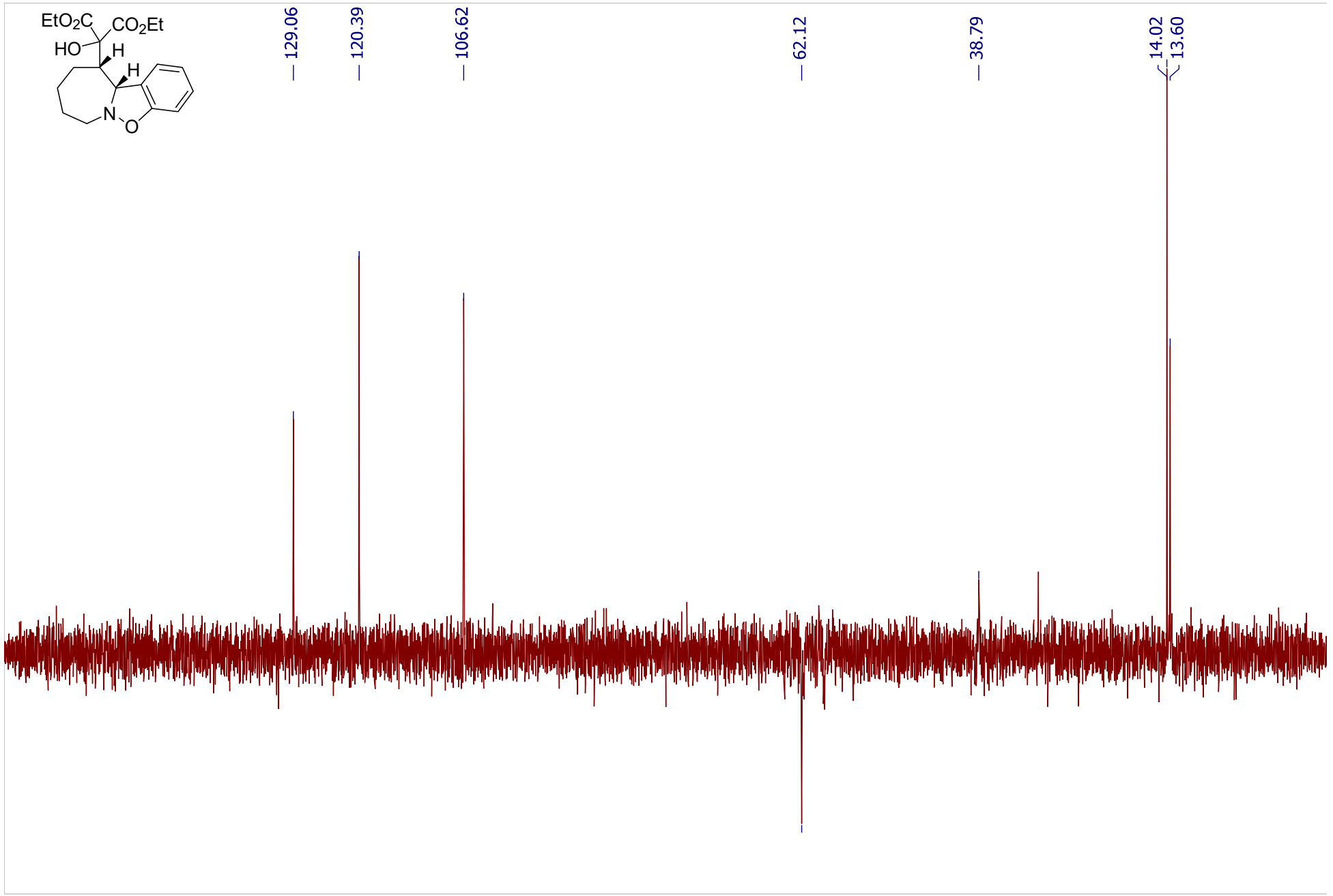
^{1}H NMR (300 MHz, $CDCl_3$) at r.t.



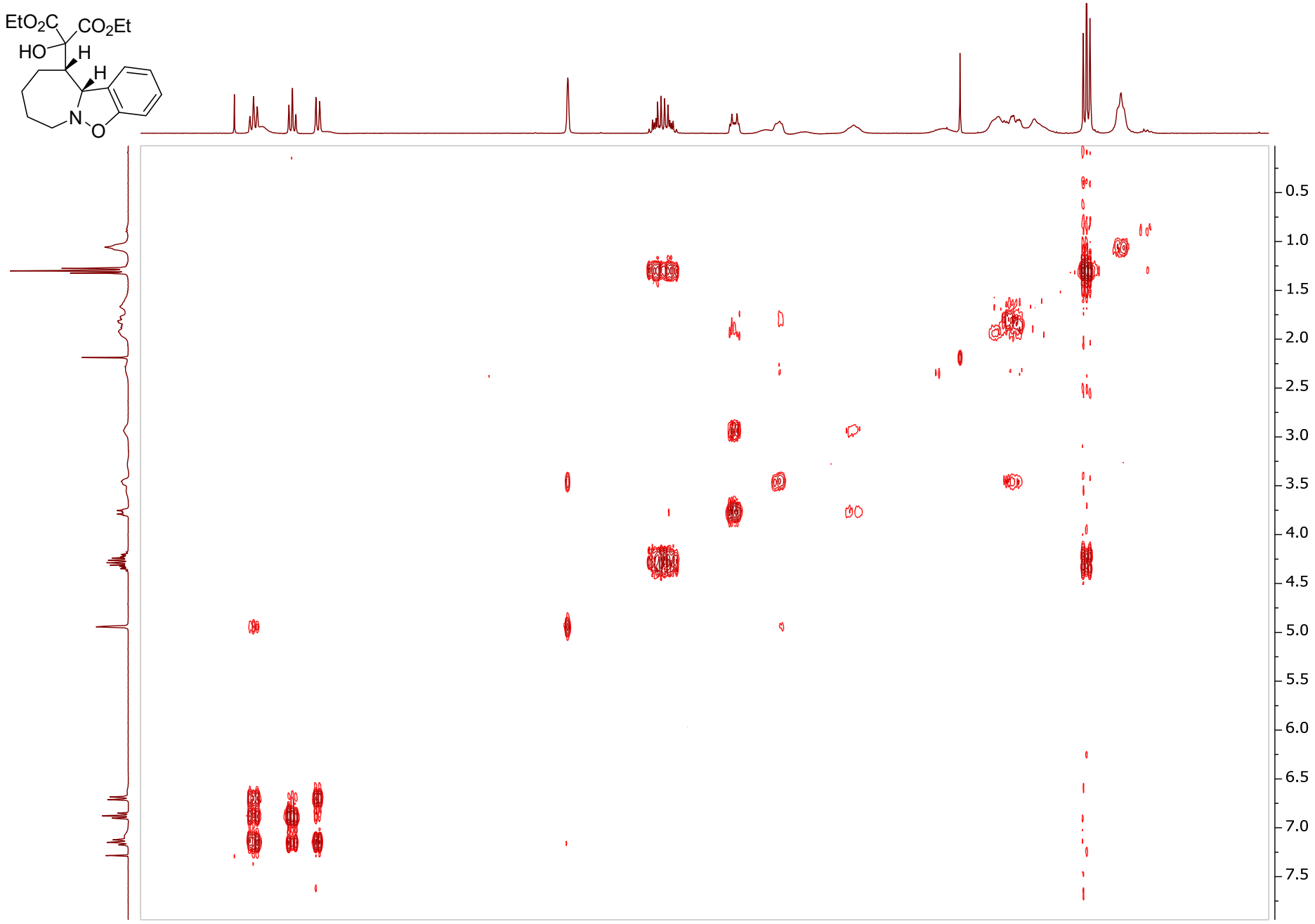
^{13}C NMR (75 MHz, $CDCl_3$) at r.t.



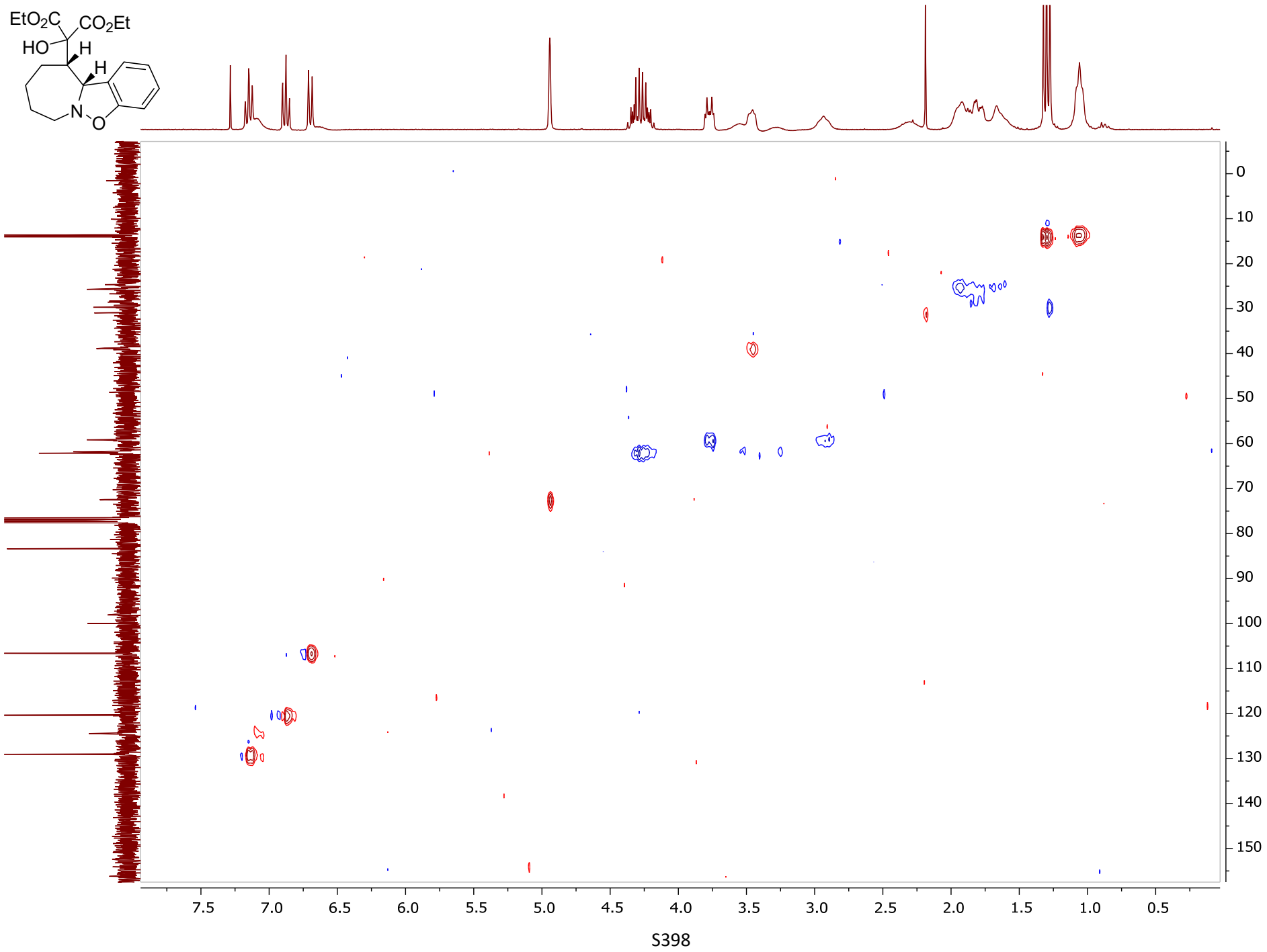
^{13}C DEPT 135 (75 MHz, $CDCl_3$) at r.t.



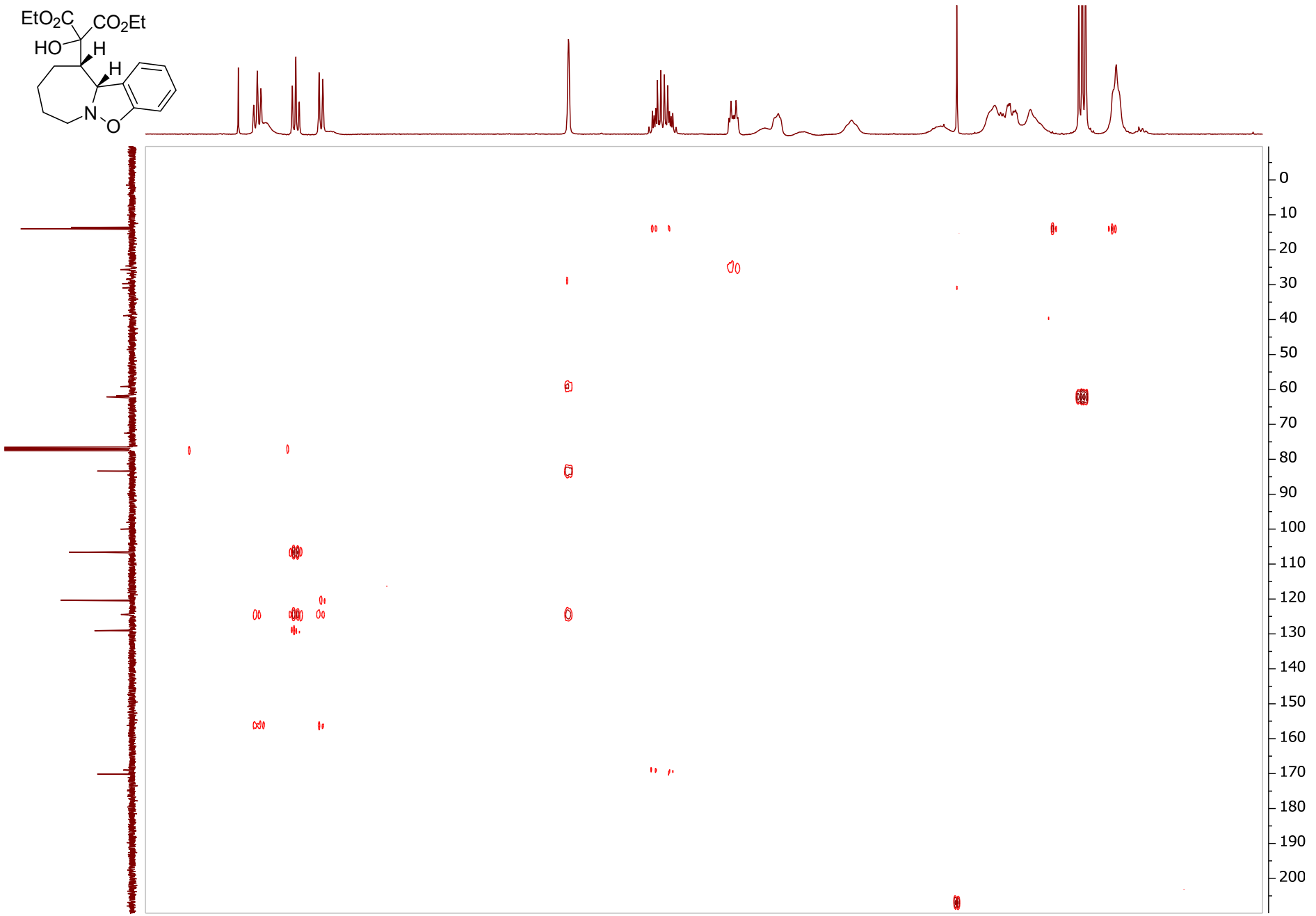
^{1}H-^{1}H COSY at r.t.



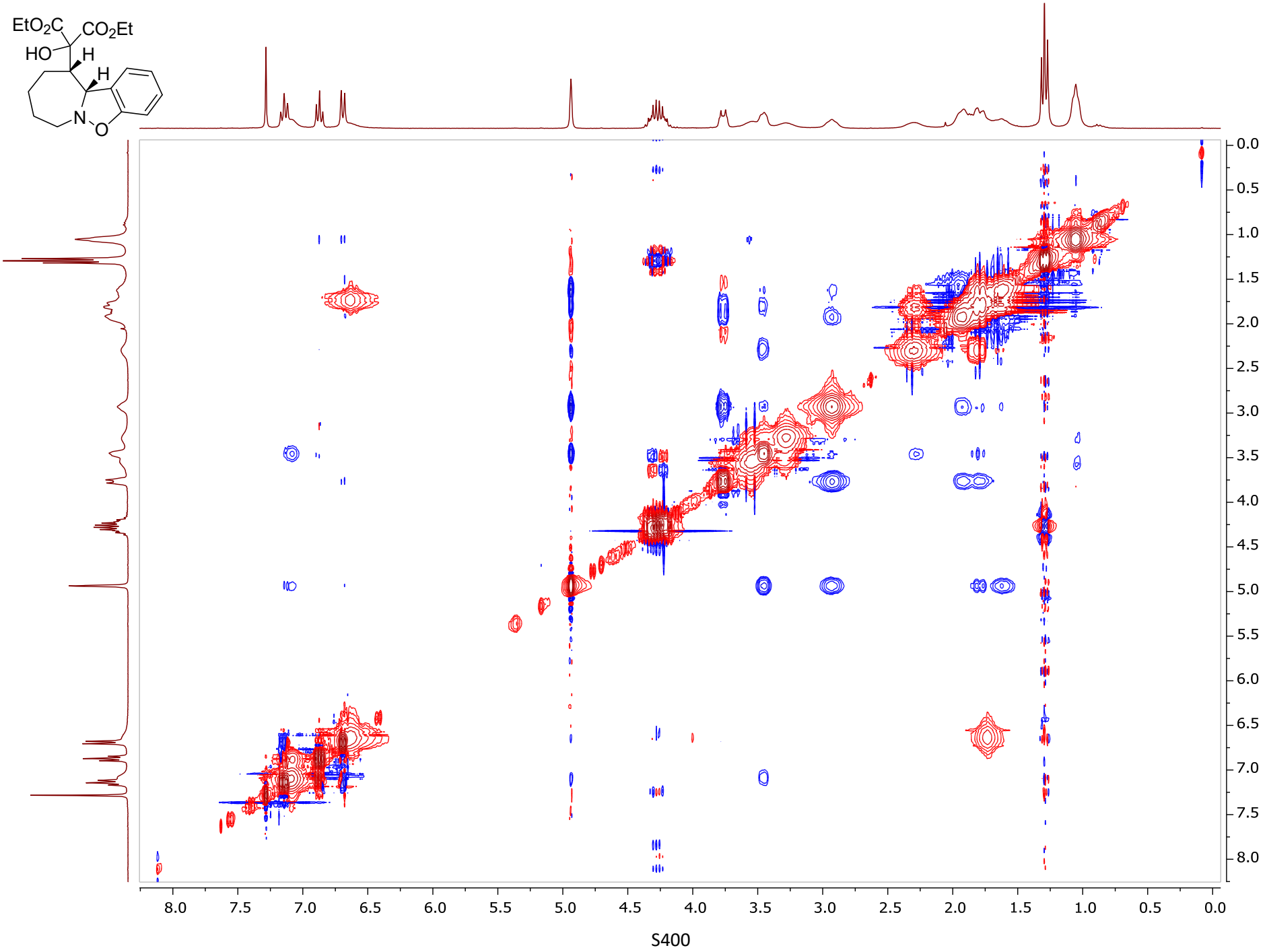
^{1}H-^{13}C HSQC at r.t.



^{1}H-^{13}C HMBC at r.t.



^{1}H-^{1}H NOESY at r.t.



S400