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SUPPORTING INFORMATION

# Sulfamide Instead Urea in Biginelli Reaction: From Black Box to Reality

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## Table of Contents



## General Information

The solvents were purified according to the standard procedures. All starting materials were obtained from Enamine Ltd. Melting points were measured on automated melting point system. $^{1}$H and $^{13}$C, spectra were recorded on a Bruker Avance 500 spectrometer (at 500 MHz for Protons and 126 MHz for Carbon-13) and Varian Unity Plus 400 spectrometer (at 400 MHz for protons, 101 MHz for Carbon-13, and 376 MHz for Fluorine-19). Tetramethylsilane ($^{1}$H, $^{13}$C) was added as an internal standard. Preparative HPLC analyses were done on an Agilent 1200 instrument. Mass spectra were recorded on Agilent 1100 LCMSD SL instrument (chemical ionization (APCI)). High-resolution mass spectra (HRMS) were obtained on an Agilent 1260 Infinity UHPLC instrument coupled with an Agilent 6224 Accurate Mass TOF mass spectrometer.
All crystallographic measurements were performed on a Bruker Smart Apex II diffractometer operating in the ω and θ scans mode with graphite-monochromated Mo-$K_\alpha$ radiation (λ = 0.71073 Å). The data were corrected for Lorentz-polarization effects and for the effects of absorption (multi-scans method was applied for all compounds). The structures were solved by direct methods and refined by the full-matrix least-squares technique in the anisotropic approximation for non-hydrogen atoms using the Bruker SHELXTL program package.
Full crystallographic details have been deposited at Cambridge Crystallographic Data Centre (CCDC). Any request to the CCDC for these materials should quote the full literature citation and reference number CCDC 2252701-2252705, 2309237.

**Three-component condensation. General procedure.**
Corresponding acetoacetamide **2.1**-**2.5** (2 mmol), aldehyde **3.1**–**3.12** (2 mmol) and sulfamide **1.1**–**1.3** (2 mmol) were dissolved in DMF (2 ml). TMSCl (1.4 ml, 11 mmol) was added to the mixture under vigorous stirring in an Ar atmosphere and stirred for 24 h and 40 h for sulfamide **1.1** and **1.2**, **1.3**, correspondingly. The lower layer of the reaction mixture was separated with a syringe and further processed as indicated:
**Protocol B (acidic**): the solution was poured into 50 ml of stirring water, stirred for 30 minutes, the precipitate formed was filtered, washed and dried on the filter.
**Protocol C (urotropine):** the solution was added dropwise (2 drops/s) to a cooled to 5° solution of hexamethylenetetramine (3.75 g, 26.8 mmol) in water (15 ml) under vigorous stirring. The precipitate formed was filtered in 10–15 minutes, washed and dried on the filter.
**Protocol D (morpholine):** the solution was added dropwise (2 drops/s) to cooled to 5° solution of N-methylmorpholine (3.0 ml, 27.2 mmol) in of water (15 ml) under vigorous stirring. The precipitate formed was filtered in 10–15 minutes, washed and dried on the filter.
For purification, the crude products were dissolved in a minimum volume of acetone (3–5 ml), hexane was added dropwise with stirring until the precipitation formed. The product was filtered off, washed with an acetone–hexane mixture with the same ratio and dried.
**Two-component condensation**.
The synthesis was performed similarly to the three-component one starting from 2 mmol of **8a,d** and acetoacetamide **2.3** in 2 ml of DMF and 0.7 ml of TMSCl (5.5 mmol). Processing was performed according to protocol C or D.

## Analytical data

*(3R*,4S*)-N,N-diethyl-5-methyl-3-phenyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide (**7ca**).*
White powder, mp = 204−206 °C. Yield = 64 % (416 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 7.66 (d, *J* = 11.3 Hz, 1H), 7.35 (s, 5H), 4.80 (t, *J* = 10.8 Hz, 1H), 3.89 (d, *J* = 10.4 Hz, 1H), 3.27 – 3.03 (m, 2H), 3.08 – 2.91 (m, 1H), 2.93 – 2.74 (m, 1H), 2.08 (s, 3H), 0.85 (t, *J* = 6.9 Hz, 3H), 0.54 (t, *J* = 7.0 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, Chloroform-*d*) δ 184.6, 171.7, 141.8, 133.8, 132.4, 63.8, 54.6, 47.1, 45.1, 30.7, 18.5, 17.3. LCMS, positive mode, m/z: 324 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{15}H_{22}N_3O_3S^+$ $[M+H]^+$: 324.1376, found 324.1374. Anal. calcd. for $C_{15}H_{21}N_3O_3S$: C, 55.71; H, 6.55; N, 12.99; S, 9.91. Found: C, 56.07; H, 6.82; N, 12.90; S, 9.77.

*(3R*,4S*)-5-methyl-N,3-diphenyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7da)***
Thin white needles, mp = 186−190 °C. Yield = 21% (144 mg). $^1$H NMR (400 MHz, DMSO-$d_6$) δ 10.43 (s, 1H), 7.73 (d, *J* = 12.0 Hz, 1H), 7.42 (d, *J* = 7.4 Hz, 2H), 7.39 – 7.30 (m, 5H), 7.26 (t, *J* = 7.8 Hz, 2H), 7.06 (t, *J* = 7.4 Hz, 1H), 4.89 (t, *J* = 11.4 Hz, 1H), 3.85 (d, *J* = 10.9 Hz, 1H), 2.20 (s, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 179.4, 166.0, 138.1, 137.1, 129.3, 129.1, 129.0, 127.9, 124.8, 120.1, 58.1, 53.8, 26.0. LCMS, positive mode, m/z: 344 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{17}H_{18}N_3O_3S^+$ $[M+H]^+$: 344.1063, found 344.1062. Anal. calcd. for $C_{17}H_{17}N_3O_3S$: C, 59.46; H, 4.99; N, 12.24; S, 9.34. Found: C, 59.81; H, 5.29; N, 12.58; S, 9.12.

*(3R*,4S*)-N,5-dimethyl-N,3-diphenyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7ea)***
Light-gray powder, mp = 200−205 °C. Yield = 50% (357 mg). $^1$H NMR (302 MHz, DMSO-$d_6$) δ 7.52 – 7.35 (m, 5H), 7.37 – 7.26 (m, 2H), 7.28 – 7.08 (m, 4H), 4.79 (d, *J* = 10.4 Hz, 1H), 3.40 (d, *J* = 10.5 Hz, 1H), 3.04 (s, 3H), 2.18 (s, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 179.1, 167.5, 142.4, 136.9, 130.2, 129.3, 129.2, 128.8, 127.7, 127.5, 58.8, 50.5, 37.8, 26.7. LCMS, positive mode, m/z: 358 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{18}H_{20}N_3O_3S^+$ $[M+H]^+$: 358.1220, found 358.1220. Anal. calcd. for $C_{18}H_{19}N_3O_3S$: C, 60.49; H, 5.36; N, 11.76; S, 8.97. Found: C, 60.54; H, 5.43; N, 11.67; S, 8.67.

*(3R*,4S*)-3-(4-methoxyphenyl)-N,N,5-trimethyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7bb).***
White powder, mp = 165−168 °C. Yield = 14% (91 mg). $^1$H NMR (500 MHz, DMSO-$d_6$) δ 7.58 (d, *J* = 11.3 Hz, 1H), 7.27 (d, *J* = 8.6 Hz, 2H), 6.92 (d, *J* = 8.6 Hz, 2H), 4.64 (t, *J* = 10.8 Hz, 1H), 4.02 (d, *J* = 10.5 Hz, 1H), 3.74 (s, 3H), 2.69 (s, 3H), 2.55 (s, 3H), 2.08 (s, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 180.2, 168.1, 159.7, 129.0, 128.9, 114.4, 58.5, 55.6, 49.6, 37.7, 35.7, 26.0. LCMS, positive mode, m/z: 326 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{14}H_{20}N_3O_4S^+$ $[M+H]^+$: 326.1169, found 326.1167. Anal. calcd. for $C_{14}H_{19}N_3O_4S$: C, 51.68; H, 5.89; N, 12.91; S, 9.85. Found: C, 51.42; H, 5.99; N, 13.02; S, 9.95.

*(3R*,4S*)-N,N-diethyl-3-(4-methoxyphenyl)-5-methyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7cb).***
Colorless crystalline powder, mp = 180−184 °C. Yield = 45% (317 mg). $^1$H NMR (302 MHz, DMSO-$d_6$) δ 7.56 (s, 1H), 7.26 (d, *J* = 8.3 Hz, 2H), 6.90 (d, *J* = 8.2 Hz, 2H), 4.72 (d, *J* = 10.2 Hz, 1H), 3.87 (d, *J* = 10.4 Hz, 1H), 3.71 (s, 3H), 3.31 – 3.06 (m, 2H), 3.08 – 2.77 (m, 2H), 2.07 (s, 3H), 0.86 (t, *J* = 7.0 Hz, 3H), 0.61 (t, *J* = 7.0 Hz, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 184.7, 171.9, 164.5, 134.0, 133.8, 119.1, 63.2, 60.3, 54.7, 47.0, 45.1, 30.7, 18.6, 17.3. LCMS, positive mode, m/z: 354 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{16}H_{24}N_3O_4S^+$ $[M+H]^+$: 354.1482, found 354.1479. Anal. calcd. for $C_{16}H_{23}N_3O_4S$: C, 54.37; H, 6.56; N, 11.89; S, 9.07. Found: C, 54.26; H, 6.82; N, 11.68; S, 8.80.

*(3R*,4S*)-3-(4-methoxyphenyl)-5-methyl-N-phenyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7db)***
White powder, mp = 186−190 °C. Yield = 44% (328 mg). $^1$H NMR (302 MHz, DMSO-$d_6$) δ 10.43 (s, 1H), 7.62 (d, *J* = 11.9 Hz, 1H), 7.36 (dd, *J* = 11.9, 8.2 Hz, 4H), 7.25 (t, *J* = 7.8 Hz, 2H), 7.04 (t, *J* = 7.4 Hz, 1H), 6.88 (d, *J* = 8.3 Hz, 2H), 4.83 (t, *J* = 11.4 Hz, 1H), 3.83 (d, *J* = 10.9 Hz, 1H), 3.68 (s, 3H), 2.19 (s, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 179.4, 166.2, 159.6, 138.2, 129.3, 129.2, 124.8, 120.1, 114.4, 57.5, 55.5, 53.9, 26.0. LCMS, positive mode, m/z: 374 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{18}H_{20}N_3O_4S^+$ $[M+H]^+$: 374.1169, found 374.1167. Anal. calcd. for $C_{18}H_{19}N_3O_4S$: C, 57.90; H, 5.13; N, 11.25; S, 8.59. Found: C, 57.61; H, 5.07; N, 11.03; S, 8.91.

*(3R*,4S*)-3-(4-methoxyphenyl)-N,5-dimethyl-N-phenyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7eb)***
White powder, mp = 173−175 °C. Yield = 50% (386 mg). $^1$H NMR (500 MHz, DMSO-$d_6$) δ 7.40 – 7.25 (m, 5H), 7.09 (d, *J* = 8.3 Hz, 2H), 6.96 (d, *J* = 8.5 Hz, 2H), 4.72 (t, *J* = 10.9 Hz, 1H), 3.81 (s, 3H), 3.39 (d, *J* = 10.4 Hz, 1H), 3.06 (s, 3H), 2.17 (s, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 183.8, 172.3, 164.7, 147.2, 134.9, 133.8, 133.5, 132.3, 119.2, 63.0, 60.5, 55.4, 42.5, 31.4. LCMS, negative mode, m/z: 386 $[M]^-$. HRMS (ESI–TOF) calcd. for $C_{19}H_{22}N_3O_4S^+$ $[M+H]^+$: 388.1326, found 388.1317. Anal. calcd. for $C_{19}H_{21}N_3O_4S$: C, 58.90; H, 5.46; N, 10.85; S, 8.27. Found: C, 59.25; H, 5.80; N, 11.00; S, 8.59.

*(3R*,4S*)-3-(3,4-dimethoxyphenyl)-N,N,5-trimethyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7bc)***
Colorless crystals, mp = 192−194 °C. Yield = 48% (340 mg). $^1$H NMR (400 MHz, DMSO-$d_6$) δ 7.59 (d, *J* = 10.9 Hz, 1H), 7.06 (s, 1H), 6.92 (d, *J* = 8.2 Hz, 1H), 6.81 (dd, *J* = 8.2, 2.0 Hz, 1H), 4.64 (t, *J* = 10.7 Hz, 1H), 4.06 (d, *J* = 10.5 Hz, 1H), 3.75 (s, 6H), 2.72 (s, 3H), 2.57 (s, 3H), 2.09 (s, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 180.8, 168.8, 149.8, 149.8, 129.9, 120.6, 112.4, 111.6, 59.4, 56.6, 56.5, 50.2, 38.4, 36.3, 26.6. LCMS, negative mode, m/z: 354 $[M-H]^-$. HRMS (ESI–TOF) calcd. for $C_{15}H_{22}N_3O_5S^+$ $[M+H]^+$: 356.1275, found 356.1281. Anal. calcd. for $C_{15}H_{21}N_3O_5S$: C, 50.69; H, 5.96; N, 11.82; S, 9.02. Found: C, 50.68; H, 5.77; N, 11.89; S, 8.88.

*(3R*,4S*)-3-(3,4-dimethoxyphenyl)-N,N-diethyl-5-methyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7cc)***
White powder, mp = 173−176 °C. Yield = 49% (375 mg). $^1$H NMR (302 MHz, DMSO-$d_6$) δ 7.56 (d, *J* = 10.6 Hz, 1H), 7.04 (s, 1H), 6.96 – 6.73 (m, 2H), 4.71 (t, *J* = 10.5 Hz, 1H), 3.90 (d, *J* = 10.4 Hz, 1H), 3.71 (d, *J* = 3.7 Hz, 6H), 3.23 – 3.08 (m, 2H), 3.11 – 2.80 (m, 2H), 2.07 (s, 3H), 0.86 (t, *J* = 7.0 Hz, 3H), 0.59 (t, *J* = 7.0 Hz, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 180.5, 167.8, 149.9, 130.1, 120.9, 112.5, 111.8, 59.4, 56.6, 50.5, 43.0, 41.1, 26.6, 14.5, 13.2. LCMS, negative mode, m/z: 382 $[M-H]^-$. HRMS (ESI–TOF) calcd. for $C_{17}H_{26}N_3O_5S^+$ $[M+H]^+$: 384.1588, found 384.1586. Anal. calcd. for $C_{17}H_{25}N_3O_5S$: C, 53.25; H, 6.57; N, 10.96; S, 8.36. Found: C, 53.50; H, 6.69; N, 11.09; S, 8.40.

*(3R*,4S*)-3-(4-bromophenyl)-N,N,5-trimethyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7bd)***
White powder, mp = 183−187 °C. Yield = 12% (90 mg). $^1$H NMR (302 MHz, DMSO-$d_6$) δ 7.74 (d, *J* = 10.4 Hz, 1H), 7.59 (d, *J* = 8.0 Hz, 2H), 7.31 (d, *J* = 8.1 Hz, 2H), 4.72 (t, *J* = 10.6 Hz, 1H), 4.05 (d, *J* = 10.5 Hz, 1H), 2.70 (s, 3H), 2.57 (s, 3H), 2.09 (s, 3H). $^{13}$C{$^1$H} NMR (76 MHz, DMSO-$d_6$) δ 180.6, 168.4, 136.8, 132.7, 130.4, 123.0, 59.1, 49.8, 38.4, 36.3, 26.6. LCMS, negative mode, m/z: 374 $[M]^-$. HRMS (ESI–TOF) calcd. for $C_{13}H_{17}BrN_3O_3S^+$ $[M+H]^+$: 374.0169, found 374.0169. Anal. calcd. for $C_{13}H_{16}BrN_3O_3S$: C, 41.72; H, 4.31; N, 11.23; S, 8.57; Br, 21.35. Found: C, 41.71; H, 4.50; N, 11.17; S, 8.29; Br, 21.01.

*(3R*,4S*)-3-(4-bromophenyl)-N,N-diethyl-5-methyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7cd).***

White powder, mp = 193−196 °C. Yield = 29% (239 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 7.72 (d, $J$ = 11.2 Hz, 1H), 7.58 (d, $J$ = 8.5 Hz, 2H), 7.31 (d, $J$ = 8.5 Hz, 2H), 4.79 (t, $J$ = 10.8 Hz, 1H), 3.89 (d, $J$ = 10.4 Hz, 1H), 3.23 – 3.09 (m, 2H), 3.13 – 2.99 (m, 1H), 2.88 (dq, $J$ = 14.3, 7.0 Hz, 1H), 2.08 (s, 3H), 0.86 (t, $J$ = 7.0 Hz, 3H), 0.58 (t, $J$ = 7.0 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, Chloroform-$d$) δ 184.5, 171.6, 141.1, 136.8, 134.7, 127.0, 63.2, 54.3, 47.1, 45.2, 30.7, 18.6, 17.3. LCMS, positive mode, m/z: 402 $[M]^+$. HRMS (ESI–TOF) calcd. for $C_{15}H_{21}BrN_3O_3S^+$ $[M+H]^+$: 402.0482, found 402.0474. Anal. calcd. for $C_{15}H_{20}BrN_3O_3S$: C, 44.78; H, 5.01; N, 10.44; S, 7.97; Br, 19.86. Found: C, 44.98; H, 4.82; N, 10.27; S, 8.08; Br, 19.74.

*(3R*,4S*)-3-(4-bromophenyl)-N,5-dimethyl-N-phenyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7ed).***
White powder, mp = 178−180 °C. Yield = 35% (305 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 7.62 (d, $J$ = 8.0 Hz, 2H), 7.52 – 7.19 (m, 5H), 7.12 (d, $J$ = 8.1 Hz, 2H), 6.38 (br, 1H), 4.76 (t, $J$ = 10.6 Hz, 1H), 3.44 (d, $J$ = 10.5 Hz, 1H), 3.07 (s, 3H), 2.19 (s, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 179.0, 167.4, 142.4, 136.2, 132.2, 130.2, 129.9, 128.8, 127.4, 122.5, 58.3, 50.2, 37.8, 26.8. LCMS, negative mode, m/z: 434 $[M-H]^-$. HRMS (ESI–TOF) calcd. for $C_{18}H_{19}BrN_3O_3S^+$ $[M+H]^+$: 436.0325, found 436.0326. Anal. calcd. for $C_{18}H_{18}BrN_3O_3S$: C, 49.55; H, 4.16; N, 9.63; S, 7.35; Br, 18.31. Found: C, 49.31; H, 4.15; N, 9.89; S, 7.59; Br, 18.42.

*(3R*,4S*)-N,N-diethyl-5-methyl-3-(4-nitrophenyl)-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7ce).***
Yellowish powder. Crude. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 8.25 (d, $J$ = 8.5 Hz, 2H), 7.91 (s, 1H), 7.65 (d, $J$ = 8.4 Hz, 2H), 4.98 (d, $J$ = 10.4 Hz, 1H), 3.97 (d, $J$ = 10.4 Hz, 1H), 3.24 – 3.11 (m, 2H), 3.14 – 2.79 (m, 2H), 2.11 (s, 3H), 0.87 (t, $J$ = 7.0 Hz, 3H), 0.57 (t, $J$ = 7.0 Hz, 3H). LCMS, positive mode, m/z: 369 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{15}H_{21}N_4O_5S^+$ $[M+H]^+$: 369.1227, found 369.1221.

*(3R*,4S*)-3-(2-bromophenyl)-N,N-diethyl-5-methyl-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7cf)***
White powder, mp = 169−171 °C. Yield = 25% (201 mg). $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 7.80 (d, $J$ = 7.8 Hz, 1H), 7.63 (d, $J$ = 8.1 Hz, 1H), 7.57 – 7.43 (m, 2H), 7.30 (t, $J$ = 7.7 Hz, 1H), 5.45 (t, $J$ = 8.9 Hz, 1H), 4.20 (dd, $J$ = 10.9, 2.9 Hz, 1H), 3.29 – 3.17 (m, 1H), 3.05 (p, $J$ = 7.3 Hz, 3H), 2.10 (t, $J$ = 2.0 Hz, 3H), 0.82 (t, $J$ = 7.0 Hz, 3H), 0.73 (t, $J$ = 7.0 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 180.0, 166.3, 136.5, 133.4, 131.2, 130.2, 128.8, 123.9, 57.3, 48.3, 42.4, 40.0, 26.1, 14.2, 12.5. LCMS, negative mode, m/z: 402 $[M-H]^-$. HRMS (ESI–TOF) calcd. for $C_{15}H_{21}BrN_3O_3S^+$ $[M+H]^+$: 402.0482, found 402.0480. Anal. calcd. for $C_{15}H_{20}BrN_3O_3S$: C, 44.78; H, 5.01; N, 10.44; S, 7.97; Br, 19.86. Found: C, 44.77; H, 5.00; N, 10.19; S, 7.99; Br, 20.10.

*(3R*,4S*)-N,N-diethyl-5-methyl-3-(thiophen-3-yl)-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7ci)***
Grey powder, mp = 196−199 °C. Yield = 39% (257 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 7.65 (d, $J$ = 11.6 Hz, 1H), 7.54 (dd, $J$ = 5.1, 2.9 Hz, 1H), 7.45 (s, 1H), 7.14 (d, $J$ = 5.0 Hz, 1H), 4.92 (t, $J$ = 11.0 Hz, 1H), 3.83 (d, $J$ = 10.3 Hz, 1H), 3.19 (q, $J$ = 7.5 Hz, 2H), 3.15 – 3.03 (m, 1H), 2.91 (dq, $J$ = 14.2, 6.7 Hz, 1H), 2.07 (s, 3H), 0.90 (t, $J$ = 7.0 Hz, 3H), 0.63 (t, $J$ = 7.0 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 179.8, 167.2, 138.0, 127.7, 127.0, 124.4, 54.8, 49.6, 42.4, 26.1, 13.9, 12.7. LCMS, positive mode, m/z: 330 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{13}H_{20}N_3O_3S_2^+$ $[M+H]^+$: 330.0941, found 330.0937. Anal. calcd. for $C_{13}H_{19}N_3O_3S_2$: C, 47.40; H, 5.81; N, 12.76; S, 19.46. Found: C, 47.71; H, 5.46; N, 13.00; S, 19.51.

*(3R*,4S*)-N,N-diethyl-5-methyl-3-(1-methyl-1H-pyrazol-4-yl)-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7cj)***
White powder, mp = 161−165 °C. Yield = 35% (229 mg). $^{1}$H NMR (500 MHz, DMSO-$d_6$) δ 7.60 (d, $J$ = 3.3 Hz, 1H), 7.53 (dd, $J$ = 11.6, 3.2 Hz, 1H), 7.38 (d, $J$ = 3.3 Hz, 1H), 4.81 – 4.68 (m, 1H), 3.83 – 3.78 (m, 1H), 3.76 (d, $J$ = 3.3 Hz, 3H), 3.27 – 3.15 (m, 3H), 3.12 – 2.96 (m, 1H), 2.06 (d, $J$ = 3.3 Hz, 3H), 0.93 (td, $J$ = 7.0, 3.3 Hz, 3H), 0.72 (td, $J$ = 7.2, 3.2 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 179.8, 167.3, 137.5, 129.7, 117.9, 51.0, 49.9, 42.6, 26.1, 14.0, 12.6. LCMS, positive mode, m/z: 328 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{13}H_{20}N_3O_3S_2^+$ $[M+H]^+$: 330.0941, found 330.0937. Anal. calcd. for $C_{13}H_{21}N_5O_3S$: C, 47.69; H, 6.47; N, 21.39; S, 9.79. Found: C, 47.30; H, 6.62; N, 21.51; S, 10.05.

*(3R*,4S*)-N,N-diethyl-5-methyl-3-(5-methylfuran-2-yl)-3,4-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(7ck)***
White powder, mp = 169−171 °C. Yield = 36% (236 mg). $^{1}$H NMR (500 MHz, DMSO-$d_6$) δ 7.65 (d, $J$ = 7.9 Hz, 1H), 6.28 (d, $J$ = 3.2 Hz, 1H), 6.04 (d, $J$ = 3.1 Hz, 1H), 4.82 (t, $J$ = 9.5 Hz, 1H), 4.00 (d, $J$ = 10.4 Hz, 1H), 3.31 – 3.08 (m, 4H), 2.21 (s, 3H), 2.08 (s, 3H), 0.93 (t, $J$ = 7.0 Hz, 3H), 0.87 (t, $J$ = 7.1 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 179.5, 166.8, 152.3, 148.1, 109.8, 107.2, 52.8, 47.3, 42.5, 26.1, 14.1, 13.7, 12.7. LCMS, negative mode, m/z: 326 $[M-H]^-$. HRMS (ESI–TOF) calcd. for $C_{14}H_{22}N_3O_4S^+$ $[M+H]^+$: 328.1326, found 328.1324. Anal. calcd. for $C_{14}H_{21}N_3O_4S$: C, 51.36; H, 6.47; N, 12.83; S, 9.79. Found: C, 51.41; H, 6.14; N, 12.72; S, 9.61.

*(S*)-2-((R*)-(3,4-dimethoxyphenyl)(sulfamoylamino)methyl)-N,N-diethyl-3-oxobutanamide* ***(8cc)***
White powder, mp = 125−129 °C. Yield = 43% (345 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 7.29 (d, $J$ = 10.9 Hz, 1H), 7.09 (d, $J$ = 2.0 Hz, 1H), 6.97 – 6.69 (m, 2H), 6.41 (s, 2H), 4.93 (t, $J$ = 11.0 Hz, 1H), 3.90 (d, $J$ = 11.1 Hz, 1H), 3.69 (d, $J$ = 9.5 Hz, 6H), 3.23 – 2.78 (m, 4H), 2.31 (s, 3H), 0.83 (t, $J$ = 7.0 Hz, 3H), 0.66 (t, $J$ = 7.0 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 205.1, 165.7, 149.1, 148.8, 133.6, 121.2, 112.3, 111.9, 65.2, 58.7, 56.4, 56.4, 55.9, 42.5, 27.4, 15.2, 13.5. HRMS (ESI–TOF) calcd. for $C_{17}H_{27}N_3NaO_6S^+$ $[M+Na]^+$: 424.1513, found 424.1510. Anal. calcd. for $C_{17}H_{27}N_3O_6S$: C, 50.86; H, 6.78; N, 10.47; S, 7.99. Found: C, 50.92; H, 6.49; N, 10.07; S, 7.83.

*(S*)-2-((R*)-(4-bromophenyl)(sulfamoylamino)methyl)-3-oxo-N-phenylbutanamide* ***(8dd).***
White powder, mp = 160−163 °C. Yield = 30% (253 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 10.09 (s, 1H), 7.67 (d, $J$ = 10.1 Hz, 1H), 7.50 – 7.29 (m, 6H), 7.19 (t, $J$ = 7.8 Hz, 2H), 6.98 (t, $J$ = 7.4 Hz, 1H), 6.51 (s, 2H), 5.00 (t, $J$ = 10.8 Hz, 1H), 3.89 (d, $J$ = 11.3 Hz, 1H), 2.36 (s, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 202.7, 164.3, 140.4, 138.6, 131.1, 130.5, 129.0, 124.3, 120.8, 120.0, 68.4, 56.9, 28.3. LCMS, positive mode, m/z: 440 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_{17}H_{18}BrN_3NaO_4S^+$ $[M+Na]^+$: 462.0094, found 462.0092. Anal. calcd. for $C_{17}H_{18}BrN_3O_4S$: C, 46.37; H, 4.12; N, 9.54; S, 7.28; Br, 18.15. Found: C, 46.18; H, 3.96; N, 9.25; S, 7.63; Br, 17.91.

*(S*)-2-((R*)-(4-nitrophenyl)(sulfamoylamino)methyl)-3-oxo-N-phenylbutanamide* ***(8de).***

Yellowish powder, mp = 175−179 °C. Yield = 30% (245 mg). $^{1}$H NMR (500 MHz, DMSO-$d_6$) δ 10.12 (s, 1H), 8.11 (d, $J$ = 8.2 Hz, 2H), 7.84 (d, $J$ = 10.0 Hz, 1H), 7.68 (d, $J$ = 8.4 Hz, 2H), 7.30 (d, $J$ = 7.9 Hz, 2H), 7.18 (t, $J$ = 7.8 Hz, 2H), 6.98 (t, $J$ = 7.4 Hz, 1H), 6.59 (s, 2H), 5.13 (t, $J$ = 10.6 Hz, 1H), 3.93 (d, $J$ = 11.4 Hz, 1H), 2.36 (s, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 202.7, 164.6, 149.4, 147.7, 139.1, 130.2, 129.6, 125.0, 124.0, 120.6, 68.4, 57.4, 29.0. LCMS, negative mode, m/z: 405 [M-H]$^-$. HRMS (ESI–TOF) calcd. for $C_{17}H_{18}N_4NaO_6S^+$ [M+Na]$^+$: 429.0839, found 429.0837. Anal. calcd. for $C_{17}H_{18}N_4O_6S$: C 50.24; H 4.46; N 13.79; S 7.89. Found: C 50.64; H 4.52; N 13.99; S 7.81.

*Ethyl 3-(4-methoxyphenyl)-5,6-dimethyl-3,6-dihydro-2H-1,2,6-thiadiazine-4-carboxylate 1,1-dioxide* ***(9ab)***
Light yellow oil. Yield = 9% (61 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 7.96 (d, $J$ = 7.8 Hz, 1H), 7.18 (d, $J$ = 8.3 Hz, 2H), 6.83 (d, $J$ = 8.2 Hz, 2H), 5.28 (d, $J$ = 7.6 Hz, 1H), 3.79 (q, $J$ = 7.1 Hz, 2H), 3.69 (s, 3H), 3.11 (s, 3H), 2.29 (s, 3H), 0.80 (t, $J$ = 7.0 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 166.6, 159.2, 148.4, 131.2, 129.8, 113.7, 108.0, 60.0, 58.4, 55.5, 32.0, 17.6, 14.0. LCMS, positive mode, m/z: 341 [M+H]$^+$. HRMS (ESI–TOF) calcd. for $C_{15}H_{21}N_2O_5S^+$ [M+H]$^+$: 341.1166, found 341.1164. Anal. calcd. for $C_{15}H_{20}N_2O_5S$: C, 52.93; H, 5.92; N, 8.23; S, 9.42. Found: C, 53.31; H, 5.91; N, 8.61; S, 9.18.

*N,N-diethyl-3-(4-methoxyphenyl)-5,6-dimethyl-3,6-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(9cb)***
White powder, mp = 155−157 °C. Yield = 51% (375 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 7.69 (dd, $J$ = 51.5, 7.2 Hz, 1H), 7.28 (d, $J$ = 8.3 Hz, 2H), 6.83 (dd, $J$ = 11.6, 8.2 Hz, 2H), 5.31 – 4.73 (m, 1H), 3.70 (s, 3H), 3.29 – 3.06 (m, 2H), 3.02 (s, 3H), 2.98 – 2.73 (m, 2H), 1.90 – 1.67 (m, 3H), 1.08 (t, $J$ = 7.0 Hz, 1H), 0.72 (t, $J$ = 6.9 Hz, 2H), 0.65 (t, $J$ = 6.2 Hz, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 166.6, 165.9*, 159.1, 136.3*, 134.0, 130.3*, 129.4, 128.8*, 128.3, 118.8*, 117.9, 113.5, 113.1*, 60.2*, 60.0, 55.2, 55.1*, 41.4*, 41.2, 37.5*, 36.6, 34.2, 17.7, 14.4*, 12.8, 12.1*, 11.7 (* - due to hindered rotation). LCMS, positive mode, m/z: 368 [M+H]$^+$. HRMS (ESI–TOF) calcd. for $C_{17}H_{26}N_3O_4S^+$ [M+H]$^+$: 368.1639, found 368.1635. Anal. calcd. for $C_{17}H_{25}N_3O_4S$: C, 55.57; H, 6.86; N, 11.44; S, 8.72. Found: C, 55.39; H, 6.88; N, 11.08; S, 8.41.

*3-(4-methoxyphenyl)-5,6-dimethyl-N-phenyl-3,6-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(9db)***
White powder. Yield = 15% (116 mg). $^{1}$H NMR (302 MHz, DMSO-$d_6$) δ 9.86 (s, 1H), 7.72 (d, $J$ = 7.4 Hz, 1H), 7.36 (dd, $J$ = 13.8, 8.2 Hz, 4H), 7.18 (t, $J$ = 7.8 Hz, 2H), 6.95 (t, $J$ = 7.4 Hz, 1H), 6.78 (d, $J$ = 8.3 Hz, 2H), 5.38 (d, $J$ = 7.0 Hz, 1H), 3.65 (s, 3H), 3.06 (s, 3H), 2.06 (s, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 166.1, 159.3, 139.8, 139.1, 130.5, 130.2, 128.9, 123.9, 120.1, 117.0, 113.6, 59.4, 55.4, 33.4, 18.5. LCMS, negative mode, m/z: 386 [M-H]$^-$. HRMS (ESI–TOF) calcd. for $C_{19}H_{22}N_3O_4S^+$ [M+H]$^+$: 388.1326, found 388.1321. Anal. calcd. for $C_{19}H_{21}N_3O_4S$: C, 58.90; H, 5.46; N, 10.85; S, 8.27. Found: C, 59.23; H, 5.76; N, 10.79; S, 8.49.

*5,6-dimethyl-3-(4-nitrophenyl)-N-phenyl-3,6-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(9de)***
White powder, mp = 169−172 °C. Yield = 35% (283 mg). $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 10.07 (s, 1H), 8.22 (d, $J$ = 4.2 Hz, 1H), 8.14 (d, $J$ = 8.5 Hz, 2H), 7.74 (d, $J$ = 8.5 Hz, 2H), 7.43 (d, $J$ = 8.0 Hz, 2H), 7.22 (t, $J$ = 7.8 Hz, 2H), 7.00 (t, $J$ = 7.4 Hz, 1H), 5.65 (s, 1H), 3.13 (s, 3H), 2.17 (s, 3H). $^{13}$C{$^{1}$H} NMR (76 MHz, DMSO-$d_6$) δ 165.5, 147.0, 145.8, 141.1, 138.5, 130.0, 128.6, 123.6, 123.0, 119.6, 113.6, 58.0, 32.5, 18.1. LCMS, positive mode, m/z: 403 [M+H]$^+$. HRMS (ESI–TOF) calcd. for $C_{18}H_{19}N_4O_5S^+$ [M+H]$^+$: 403.1071, found 403.1066. Anal. calcd. for $C_{18}H_{18}N_4O_5S$: C, 53.72; H, 4.51; N, 13.92; S, 7.97. Found: C, 53.32; H, 4.37; N, 13.97; S, 7.93.

*N,N-diethyl-3-(4-methoxyphenyl)-5-methyl-6-phenyl-3,6-dihydro-2H-1,2,6-thiadiazine-4-carboxamide 1,1-dioxide* ***(10cb)***
White powder, mp = 187−190 °C. Yield = 56% (481 mg). $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 8.03 (dd, $J$ = 55.2, 7.1 Hz, 1H), 7.51 (t, $J$ = 7.2 Hz, 2H), 7.46 – 7.32 (m, 5H), 6.89 (dd, $J$ = 15.1, 8.3 Hz, 2H), 5.21 (dd, $J$ = 74.5, 7.0 Hz, 1H), 3.74 (d, $J$ = 4.0 Hz, 3H), 3.54 – 3.34 (m, 1H), 3.29 – 2.84 (m, 3H), 1.62 – 1.42 (m, 3H), 1.14 (t, $J$ = 6.9 Hz, 1H), 0.76 (t, $J$ = 7.0 Hz, 1H), 0.69 (q, $J$ = 6.8 Hz, 4H). LCMS, positive mode, m/z: 430 [M+H]$^+$. HRMS (ESI–TOF) calcd. for $C_{22}H_{28}N_3O_4S^+$ [M+H]$^+$: 430.1795, found 430.1792. Anal. calcd. for $C_{22}H_{27}N_3O_4S$: C, 61.52; H, 6.34; N, 9.78; S, 7.46. Found: C, 61.85; H, 6.07; N, 9.89; S, 7.09.

*(S*)-2-((R*)-(4-bromophenyl)((N-methylsulfamoyl)amino)methyl)-3-oxo-N-phenylbutanamide* ***(11dd)***
White powder, mp = 146−151 °C. Yield = 18% (164 mg). $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 10.10 (s, 1H), 7.87 (d, $J$ = 10.0 Hz, 1H), 7.45 (d, $J$ = 8.5 Hz, 2H), 7.38 (d, $J$ = 8.0 Hz, 2H), 7.31 (d, $J$ = 8.0 Hz, 2H), 7.20 (t, $J$ = 7.8 Hz, 2H), 6.99 (t, $J$ = 7.4 Hz, 1H), 6.67 (q, $J$ = 5.0 Hz, 1H), 4.86 (t, $J$ = 10.5 Hz, 1H), 3.97 (d, $J$ = 11.0 Hz, 1H), 2.34 (s, 3H), 2.05 (d, $J$ = 5.0 Hz, 3H). $^{13}$C NMR (76 MHz, DMSO-$d_6$) δ 201.8, 163.6, 139.8, 138.1, 130.6, 130.0, 128.6, 123.8, 120.5, 119.5, 67.4, 56.3, 28.4, 27.7. LCMS, negative mode, m/z: 452 [M-H]$^-$. HRMS (ESI–TOF) calcd. for $C_{18}H_{21}BrN_3O_4S^+$ [M+H]$^+$: 454.0431, found 454.0425. Anal. calcd. for $C_{18}H_{20}BrN_3O_4S$: C, 47.58; H, 4.44; N, 9.28; S, 7.06; Br, 17.59. Found: C, 47.98; H, 4.54; N, 9.18; S, 7.12; Br, 17.95.

*N-(4-methoxybenzylidene)sulfamide* ***(12b)***
White powder, mp = 169−171 °C. Yield = 41% (0.88 g). $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 8.81 (s, 1H), 7.93 (d, $J$ = 8.7 Hz, 2H), 7.24 (s, 2H), 7.11 (d, $J$ = 8.7 Hz, 2H), 3.85 (s, 3H). $^{13}$C{$^{1}$H} NMR (126 MHz, DMSO-$d_6$) δ 165.86, 164.09, 132.64, 125.13, 114.85, 55.68. LCMS, positive mode, m/z: 215 [M+H]$^+$. HRMS (ESI–TOF) calcd. for $C_8H_{11}N_2O_3S^+$ [M+H]$^+$: 215.0485, found 215.0483. Anal. calcd. for $C_8H_{10}N_2O_3S$: C 44.85; H 4.70; N 13.08; S 14.97. Found: C 44.32; H 4.37; N 13.17; S 14.93.

*N-(4-bromobenzylidene)sulfamide* ***(12d)***
White powder, mp = 241−243 °C. Yield = 9% (0.238 g). $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 8.91 (s, 1H), 7.92 (d, $J$ = 8.2 Hz, 2H), 7.79 (d, $J$ = 8.2 Hz, 2H), 7.37 (br. s, 2H). $^{13}$C{$^{1}$H} NMR (126 MHz, DMSO-$d_6$) δ 192.28, 165.78, 132.45, 132.05, 128.13. LCMS, positive mode, m/z: 263 [M+H]$^+$. HRMS (ESI–TOF) calcd. for $C_7H_8BrN_2O_2S^+$ [M+H]$^+$: 262.9484, found 262.9474. Anal. calcd. for $C_7H_7BrN_2O_2S$: C 31.95; H 2.68; Br 30.37, N 10.65; S 12.19. Found: C 32.15; H 2.73; Br 30.12, N 10.34; S 12.29.

*N-(4-methoxybenzylidene)-N'-methylsulfamide* ***(14b)***
White powder, mp = 115−117 °C. Yield = 41% (2.09 g). $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 8.83 (s, 1H), 7.98 (d, $J$ = 8.5 Hz, 2H), 7.87 (br. d, $J$ = 4.7 Hz, 1H), 7.12 (d, $J$ = 8.5 Hz, 2H), 3.87 (s, 3H), 2.55 (d, $J$ = 5.2 Hz, 3H). $^{13}$C{$^{1}$H} NMR (126 MHz, DMSO-$d_6$) δ 168.09,

164.34, 132.93, 125.06, 114.83, 55.72, 29.01. LCMS, positive mode, m/z: 229 $[M+H]^+$. HRMS (ESI–TOF) calcd. for $C_9H_{13}N_2O_3S^+$ $[M+H]^+$: 229.0641, found 229.0638. Anal. calcd. for $C_9H_{12}N_2O_3S$: C 47.35; H 5.50; N 12.27; S 14.05. Found: C 47.46; H 5.37; N 12.17; S 14.03.

*(3S*,7S*)-2,6-dimethyl-3,7-bis(4-nitrophenyl)-1,5,2,4,6,8-dithiatetrazocane 1,1,5,5-tetraoxide* ***(15e)***
Yellow crystalline powder. Yield = 30% (147mg). $^1$H NMR (400 MHz, DMSO-$d_6$) δ 9.47 (d, $J$ = 10.6 Hz, 1H), 8.35 (d, $J$ = 9.3 Hz, 2H), 7.70 (d, $J$ = 8.5 Hz, 2H), 6.59 (d, $J$ = 10.5 Hz, 1H), 3.34 (s, 3H), 2.63 (s, 3H). LCMS, negative mode, m/z: 485 $[M-H]^-$. HRMS (ESI–TOF) calcd. for $C_{16}H_{19}N_6O_8S_2^+$ $[M+H]^+$: 487.0700, found 487.0691. Anal. calcd. for $C_{14}H_{17}N_3O_6S$: C, 47.32; H, 4.82; N, 11.82; S, 9.02. Found: C, 47.09; H, 4.79; N, 11.66; S, 8.99.

**Figure S1.** NMR reaction profile for **7ca**.

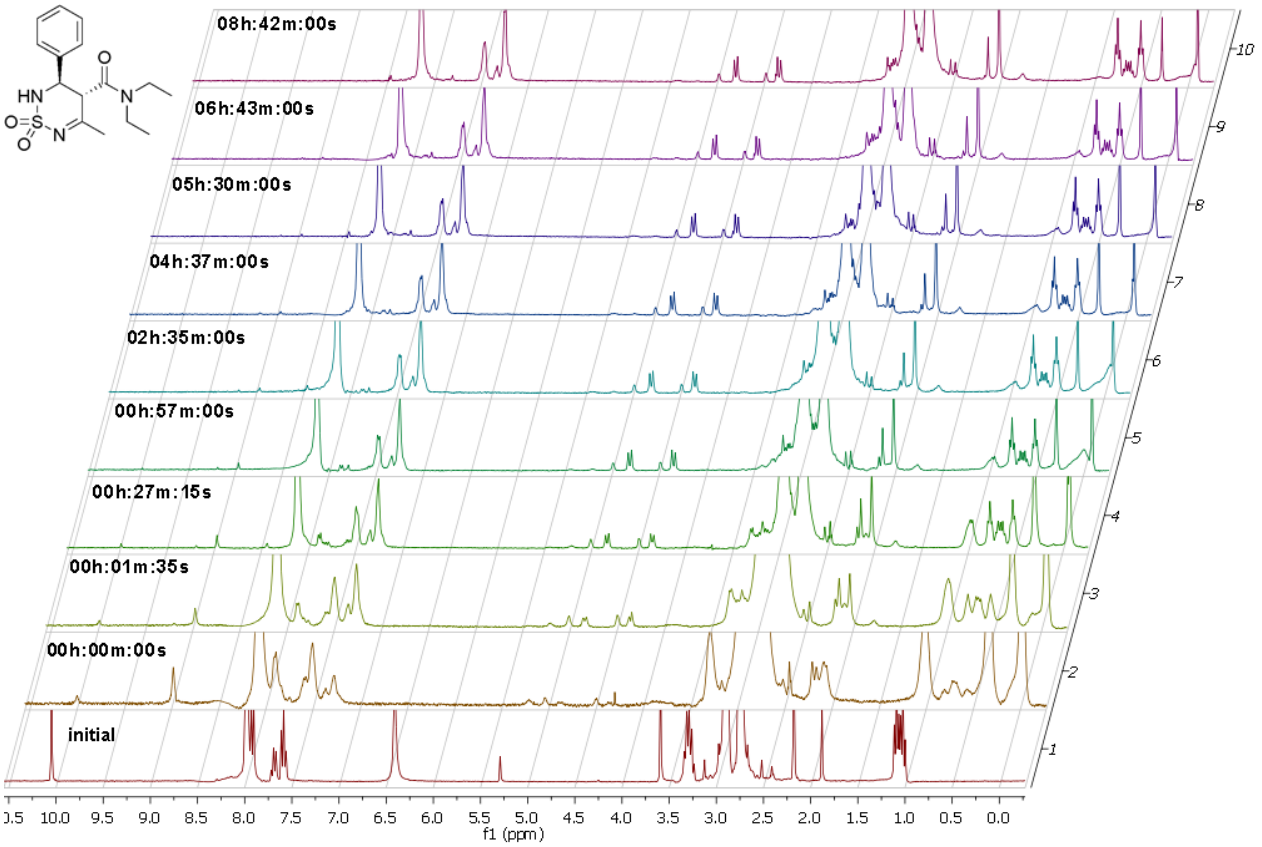



**Figure S2.** Degradation of **7cc**, 2 weeks.

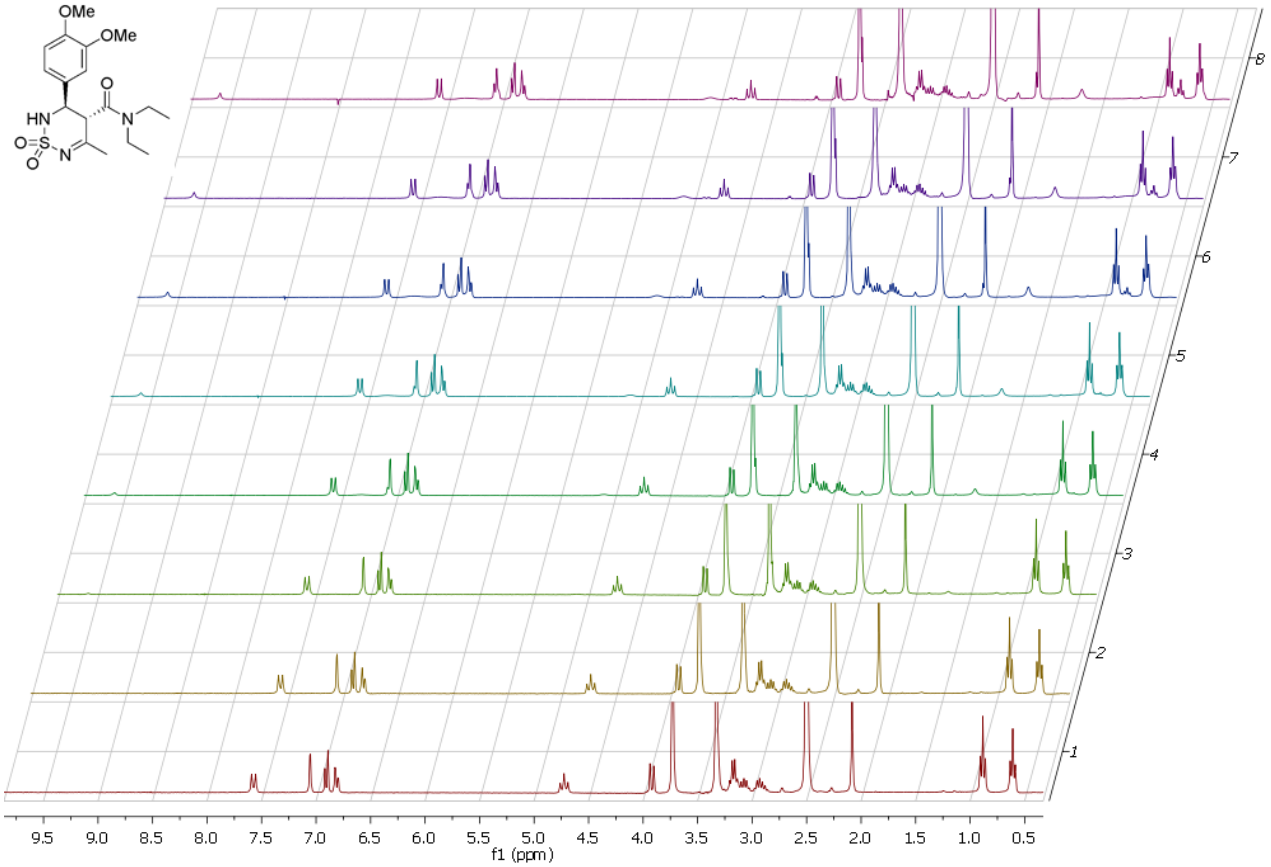


**Figure S3.** Degradation of **7cd**, 2 weeks.

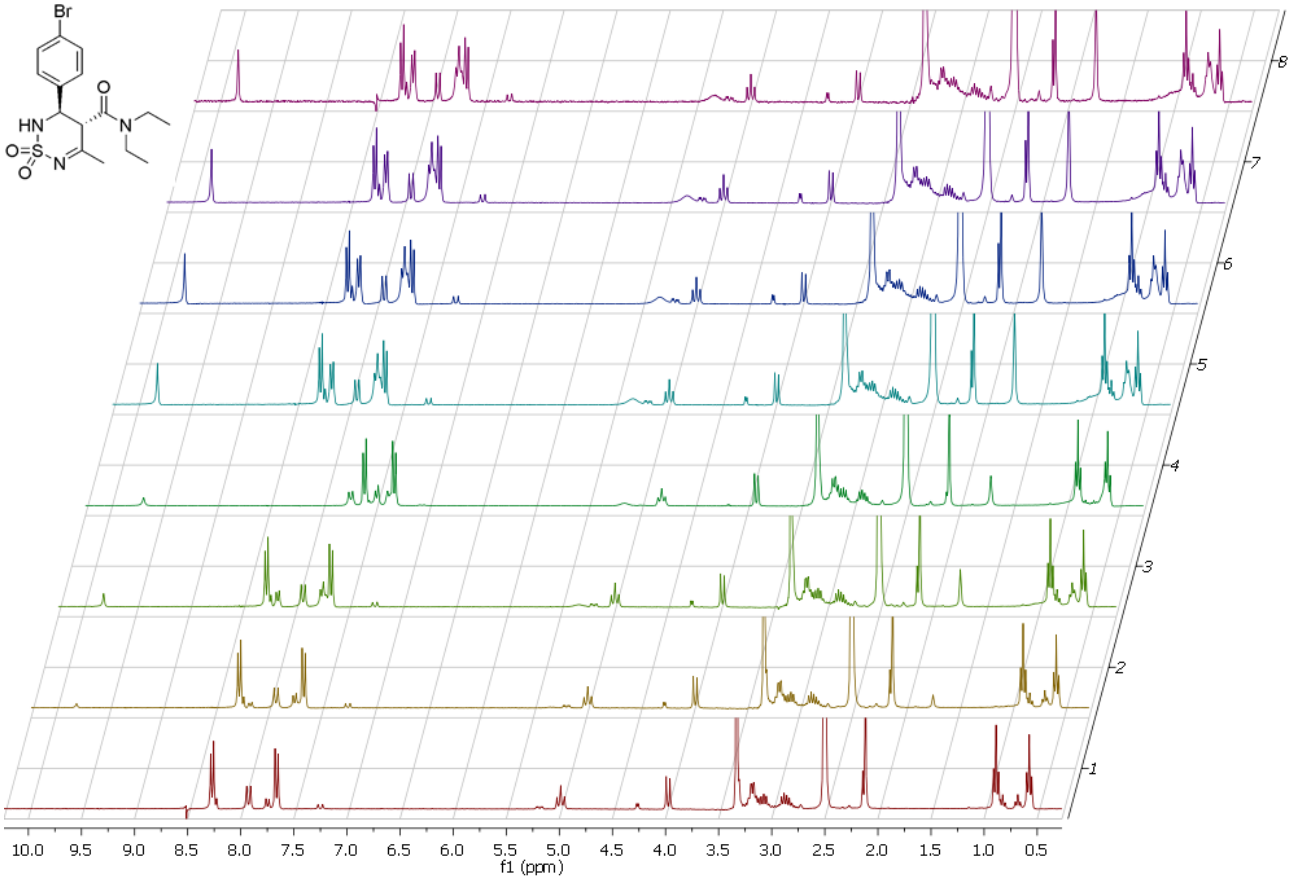



**Figure S4.** Degradation of **7ce**, 2 weeks.

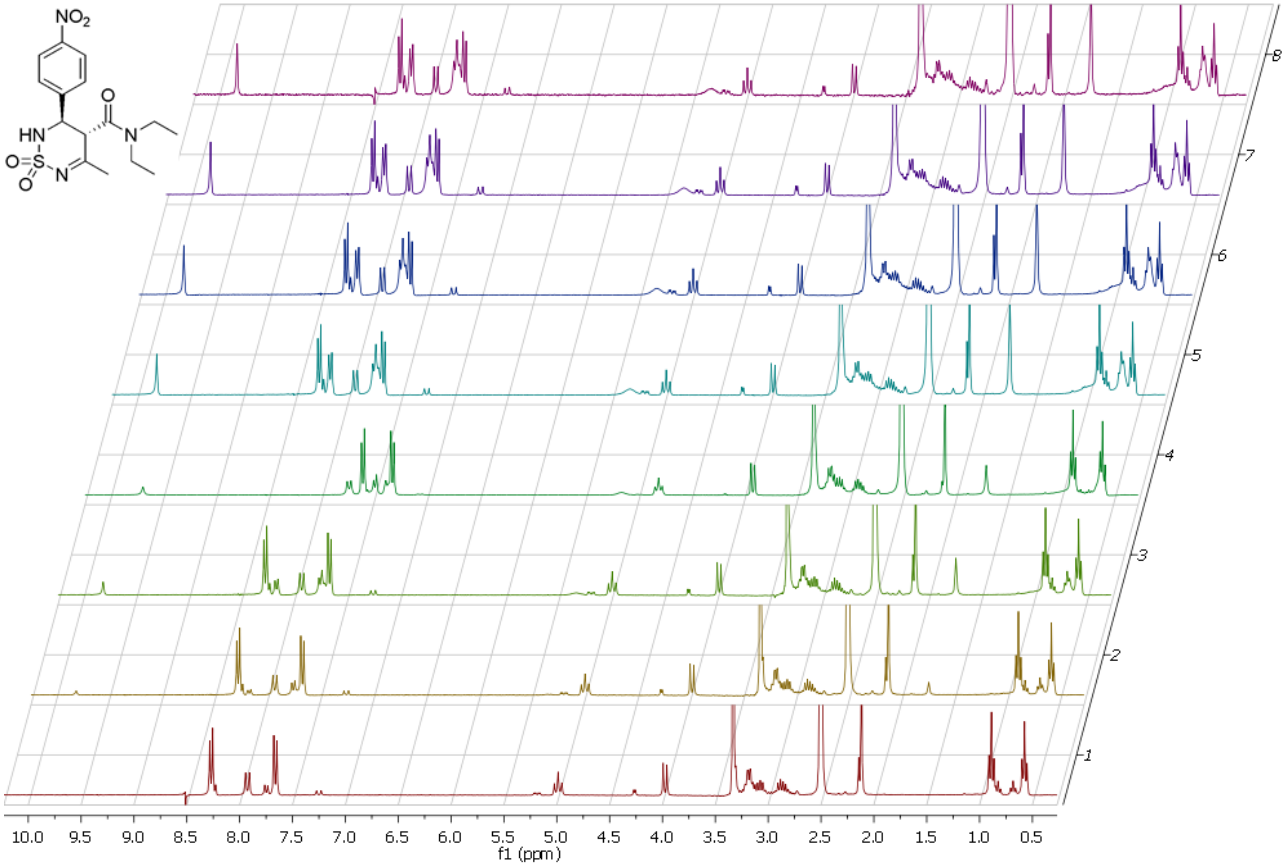


**Figure S5.** Temperature NMR for **9cb**.

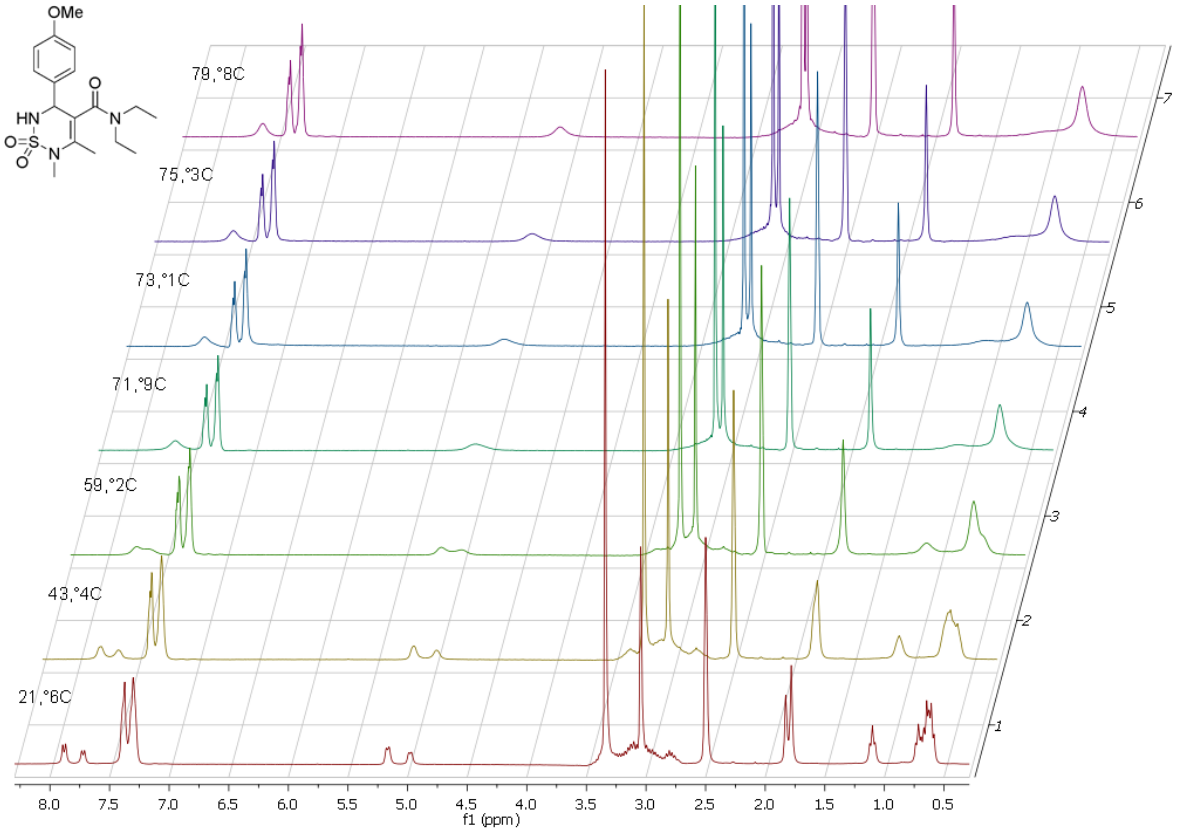



**Figure S6.** Temperature NMR for **10cb**.

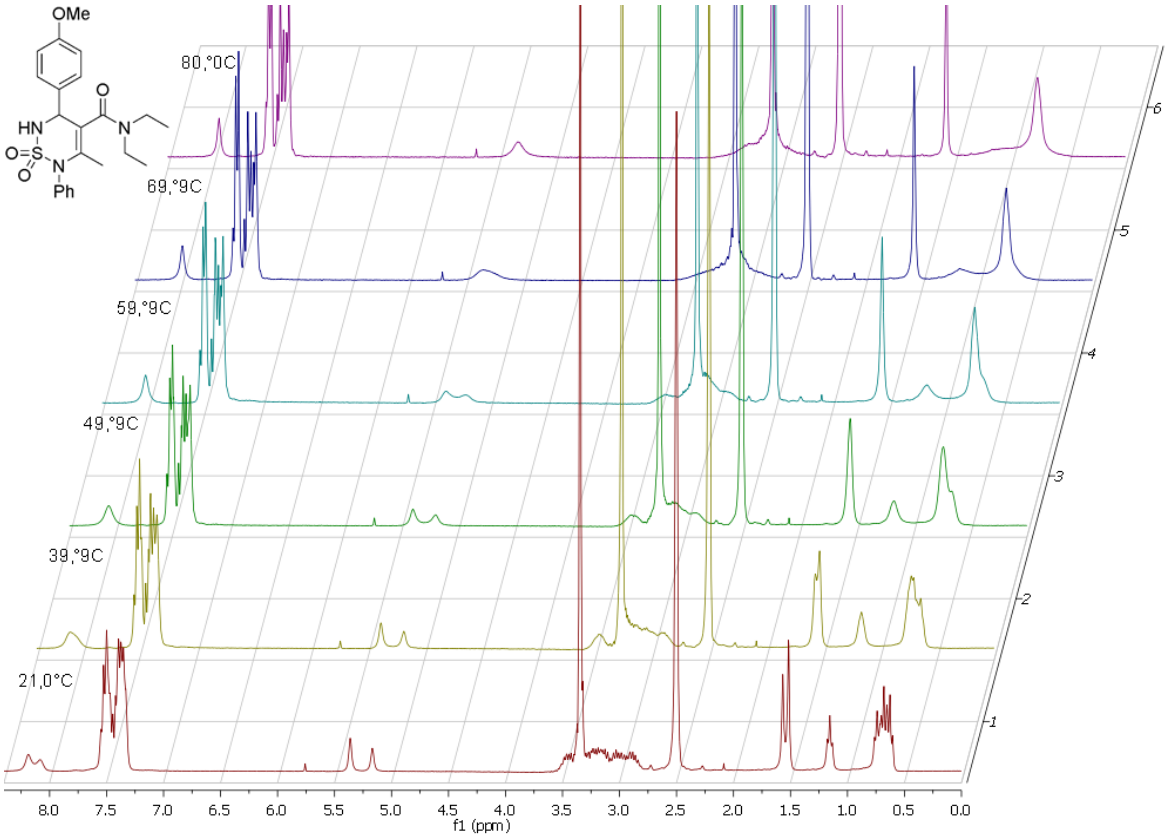
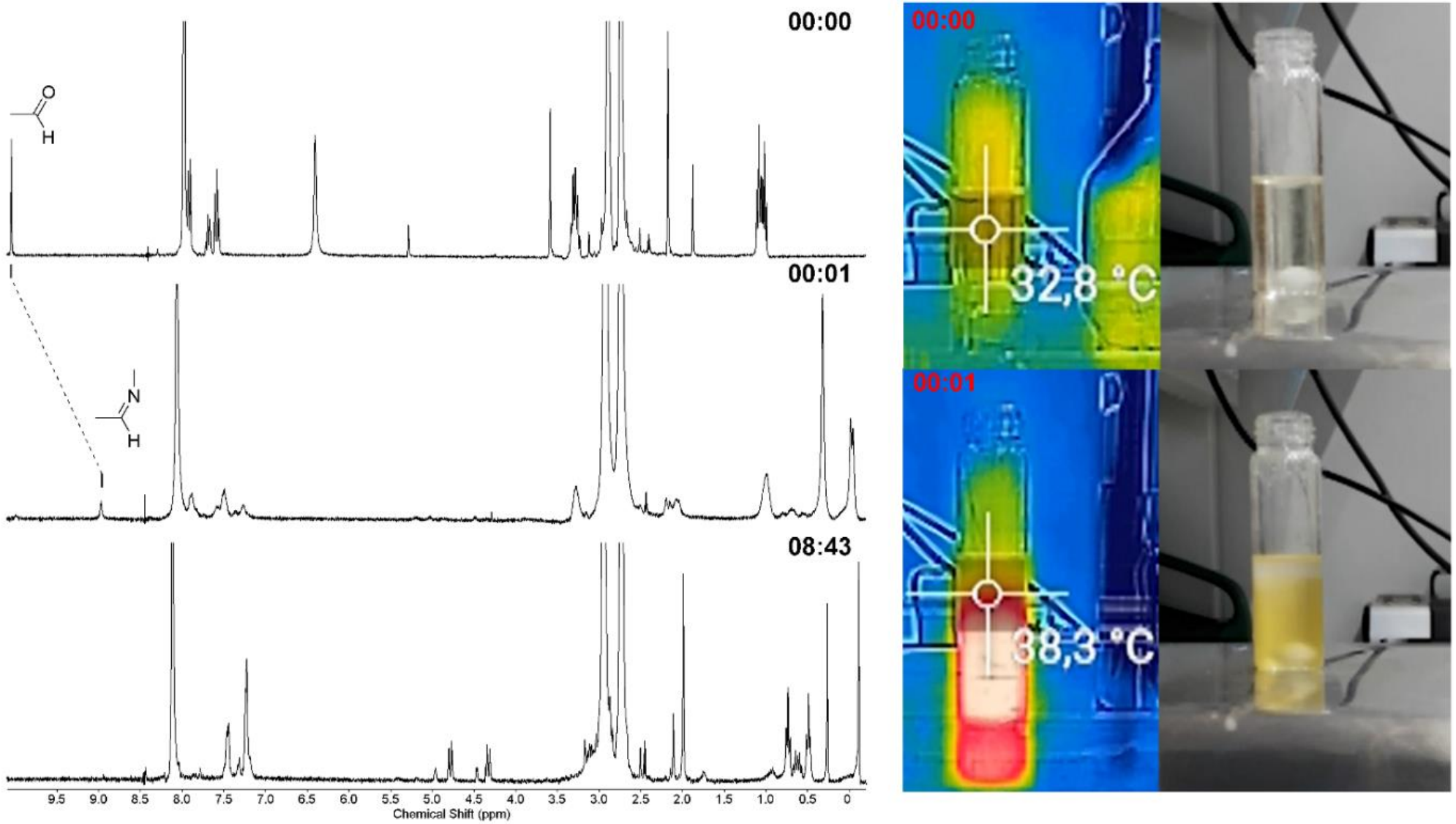
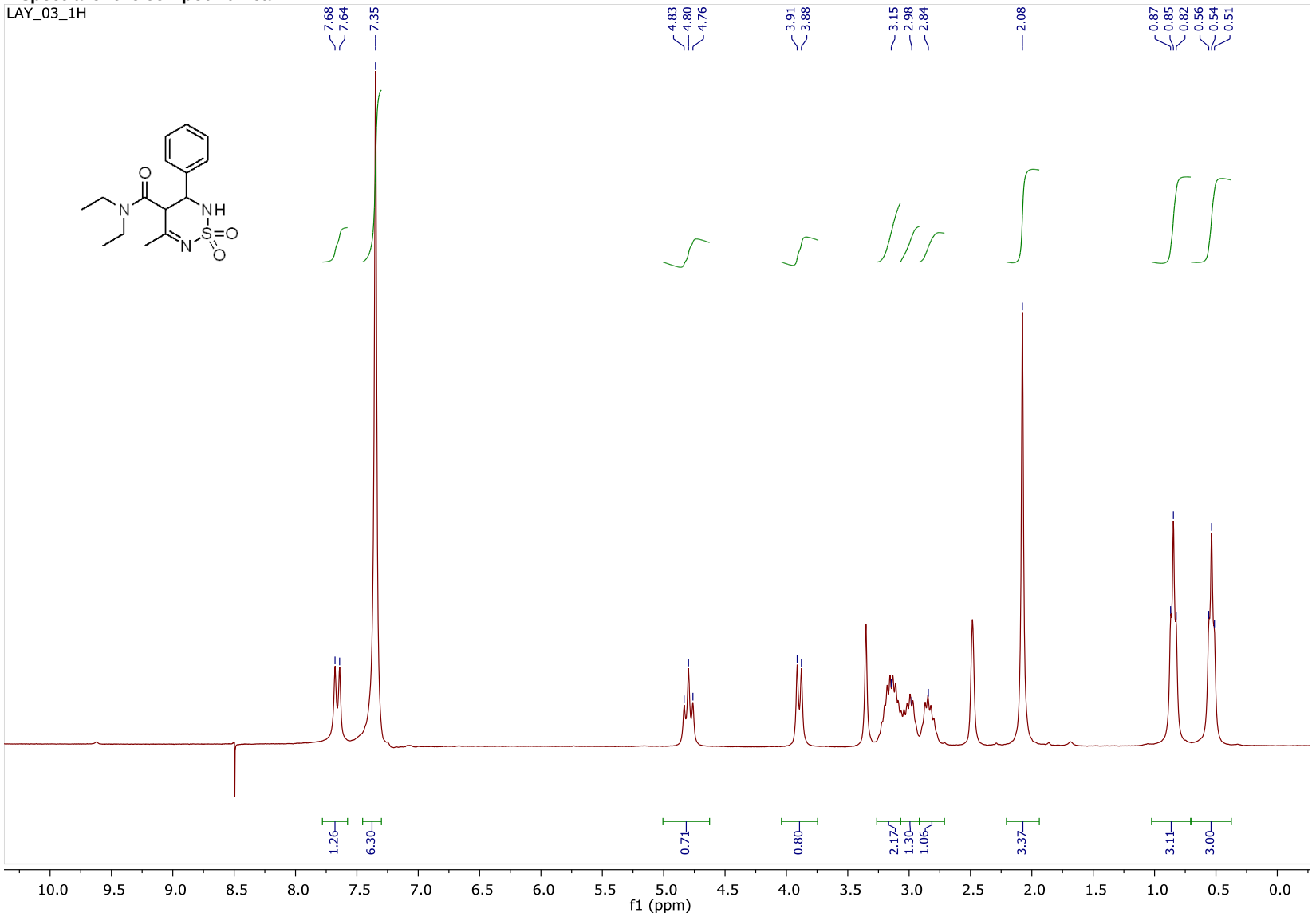


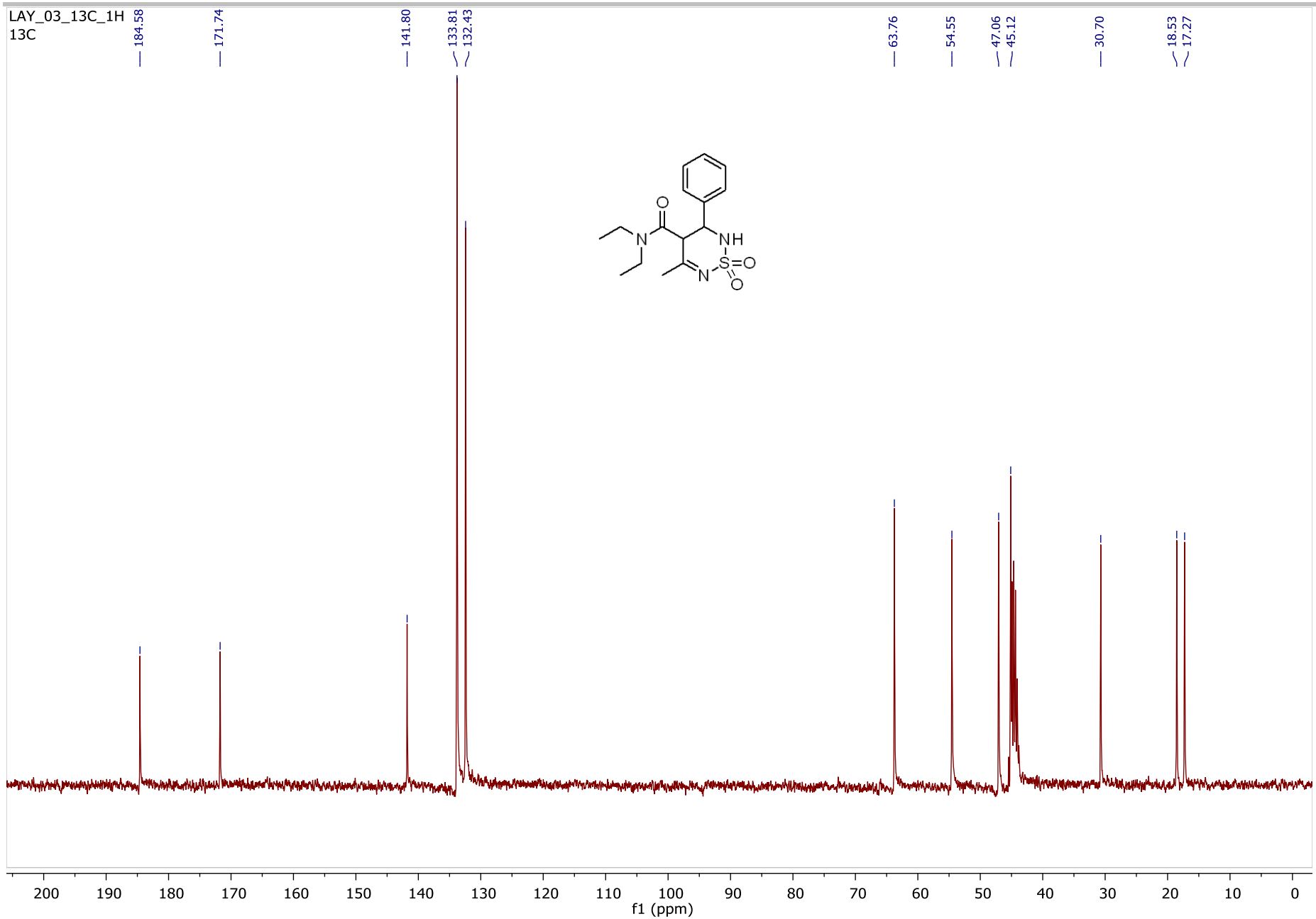
**Figure S7.** Thermal profile of the initial steps of the reaction and the $^{1}$H NMR spectra of the reaction mixtures (the time scale in hours).



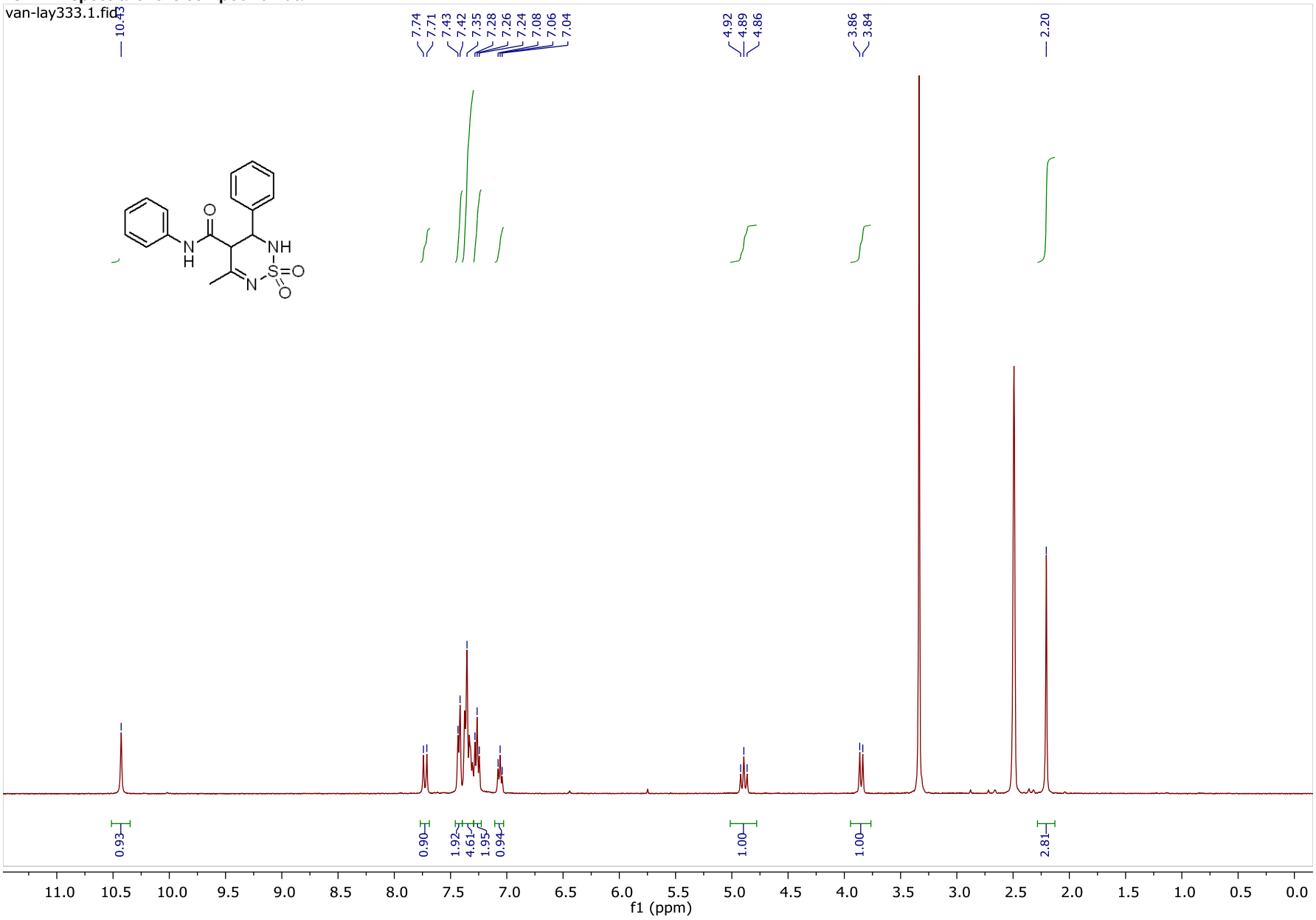
**NMR spectra**

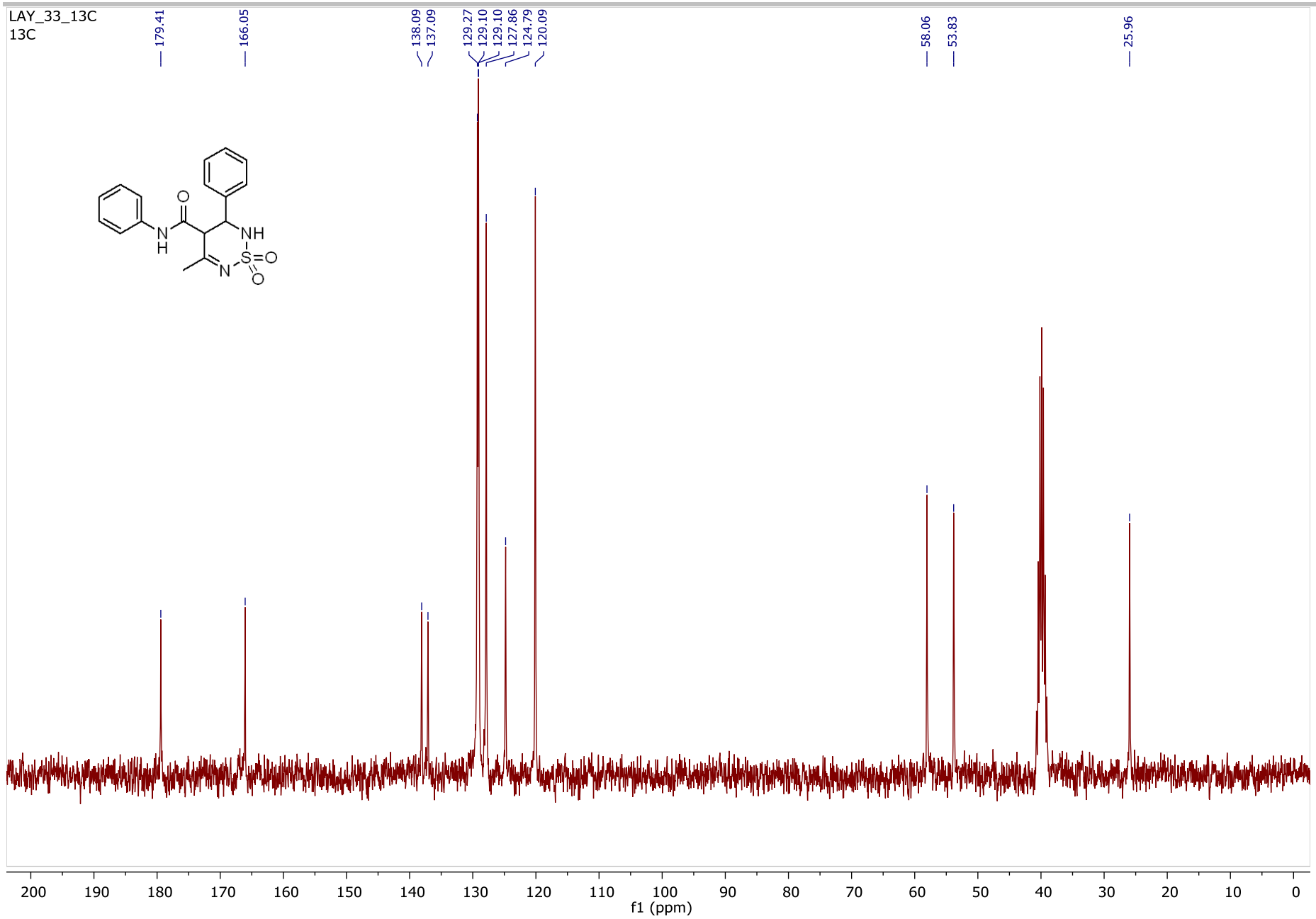
**$^{1}$H and $^{13}$C NMR spectra of the compound 7ca**



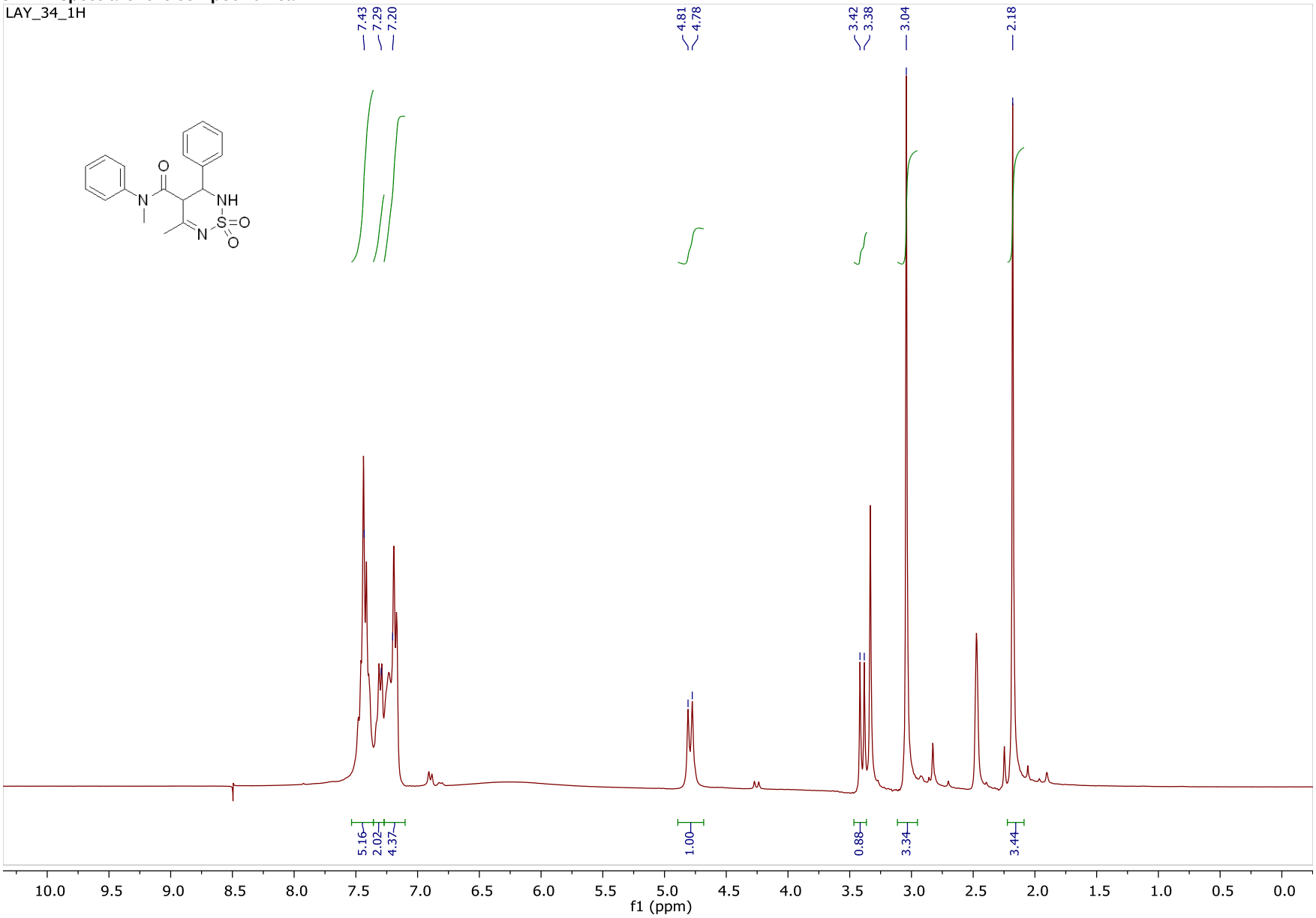

LAY_03_13C_1H
13C
184.58
171.74
141.80
133.81
132.43
63.76
54.55
47.06
45.12
30.70
18.53
17.27
O
N
NH
S
O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

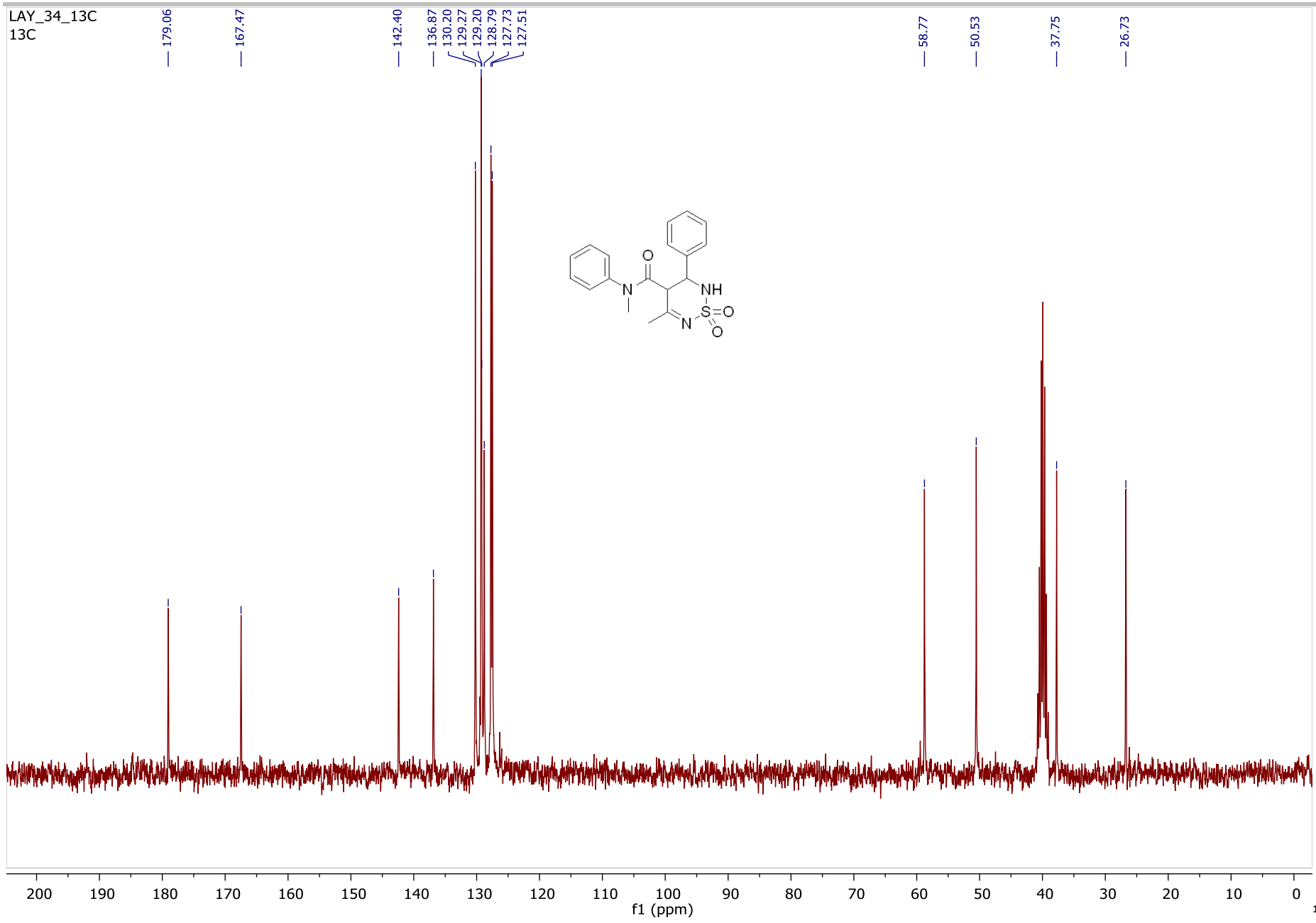
**$^{1}$H and $^{13}$C NMR spectra of the compound 7da**




LAY_33_13C
13C
179.41
166.05
138.09
137.09
129.27
129.10
129.10
127.86
124.79
120.09
58.06
53.83
25.96
O
N
H
NH
S
O
O
N
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

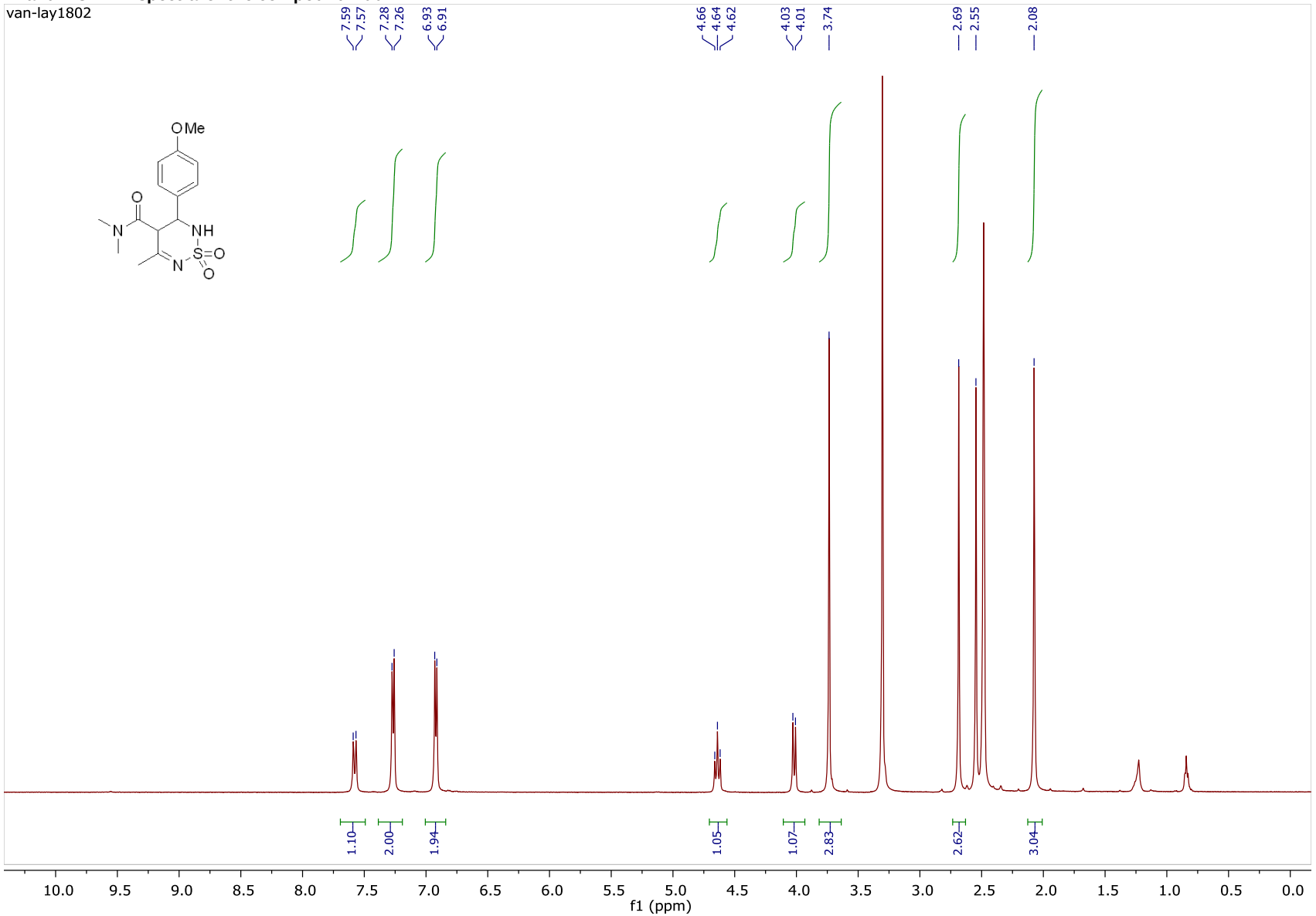
**$^{1}$H and $^{13}$C NMR spectra of the compound 7ea**

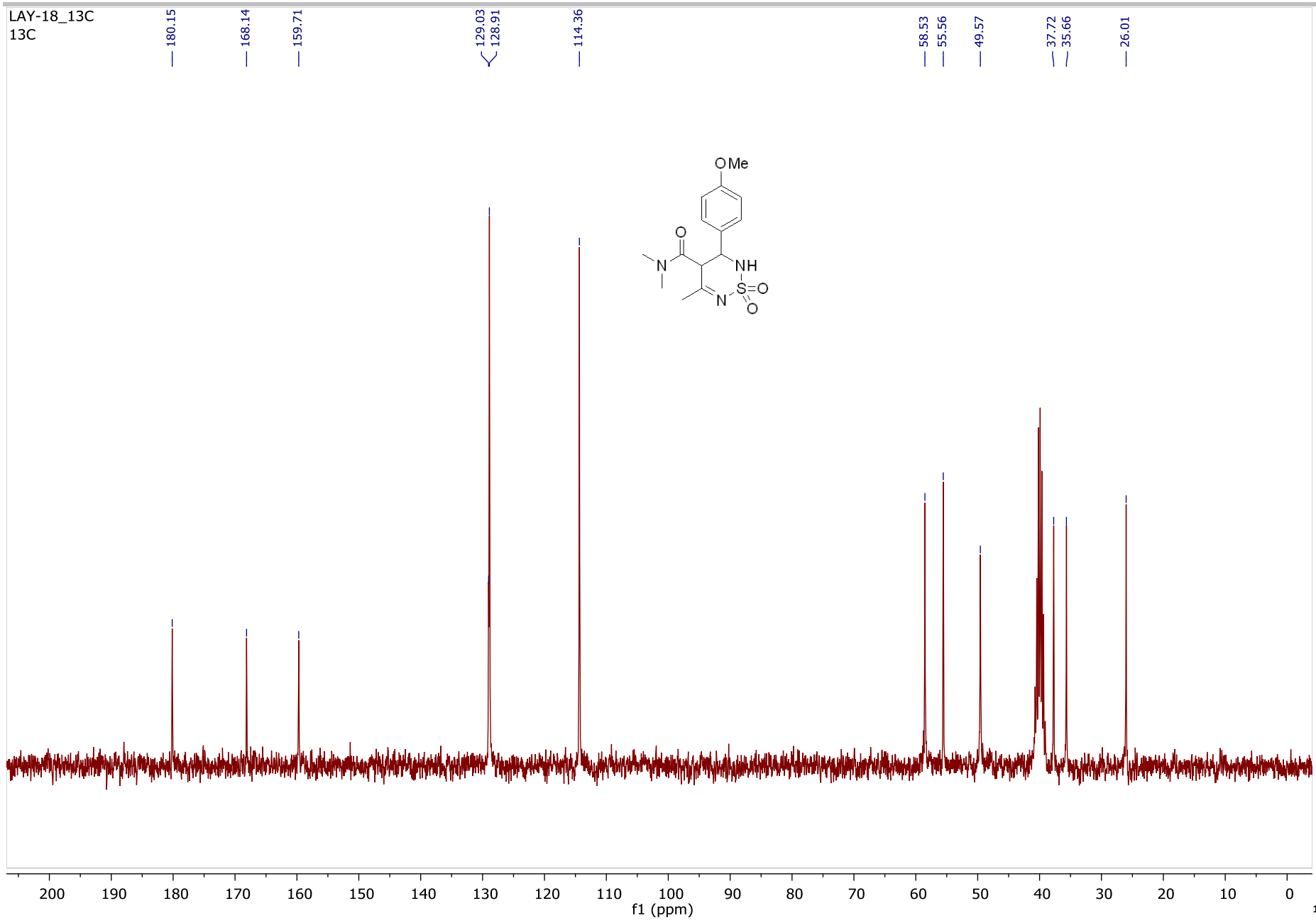



LAY_34_13C
13C
179.06
167.47
142.40
136.87
130.20
129.27
129.20
128.79
127.73
127.51
58.77
50.53
37.75
26.73
O
N
NH
S=O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

$^{1}$H and

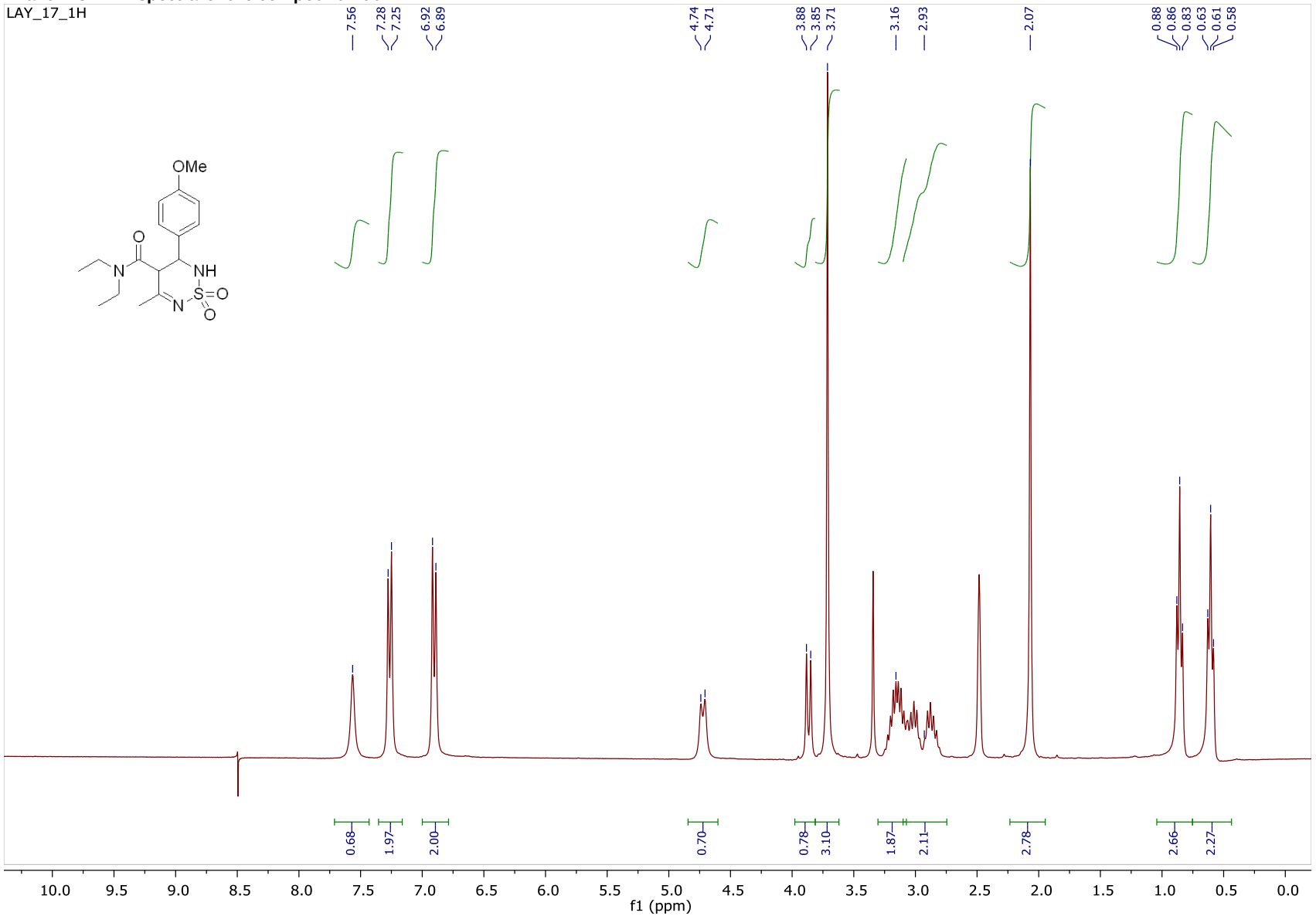
**$^{1}$H and $^{13}$C NMR spectra of the compound 7bb**

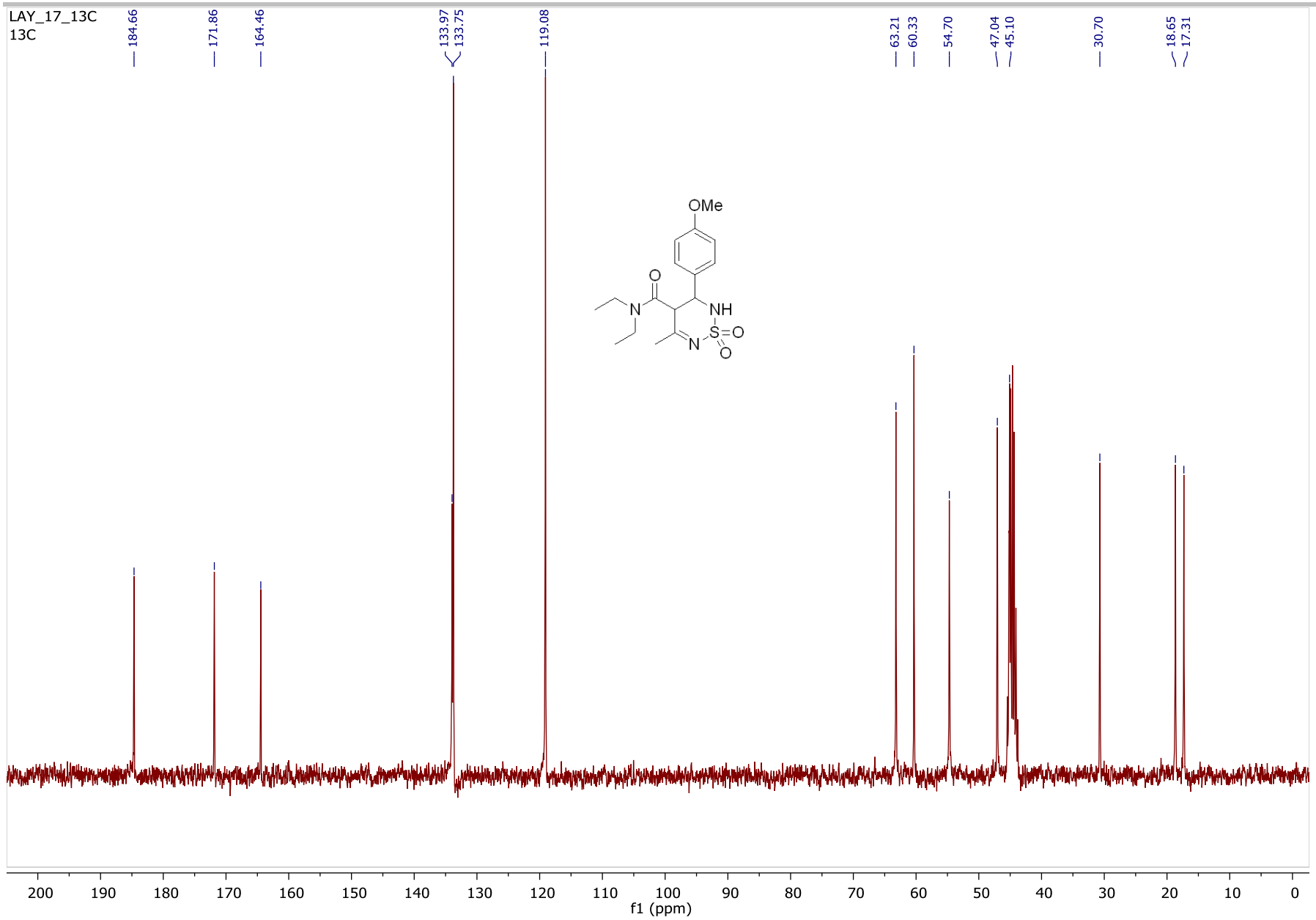



LAY-18_13C
13C
180.15
168.14
159.71
129.03
128.91
114.36
58.53
55.56
49.57
37.72
35.66
26.01
OMe
O
N
NH
S=O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

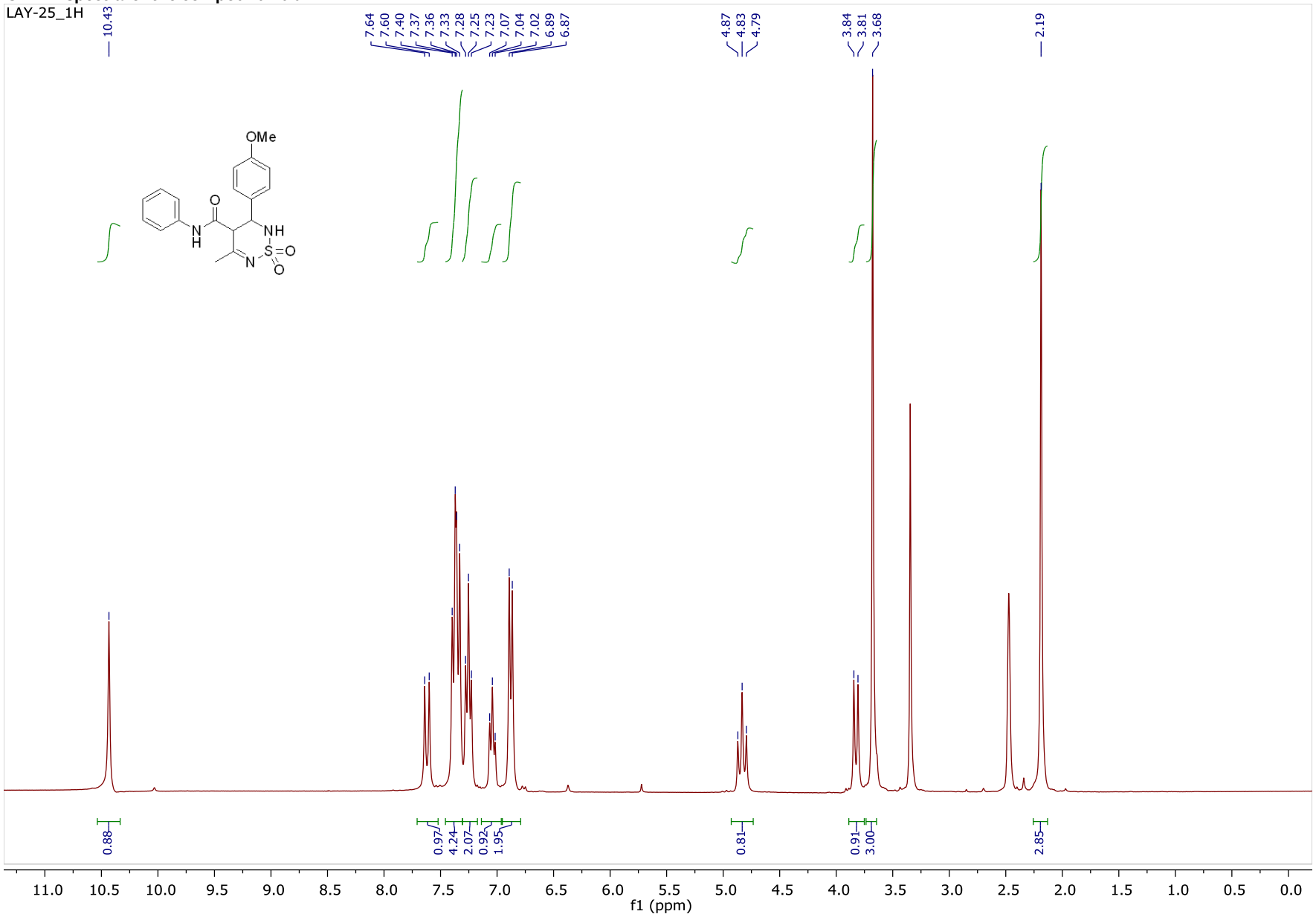
$^{1}$H and

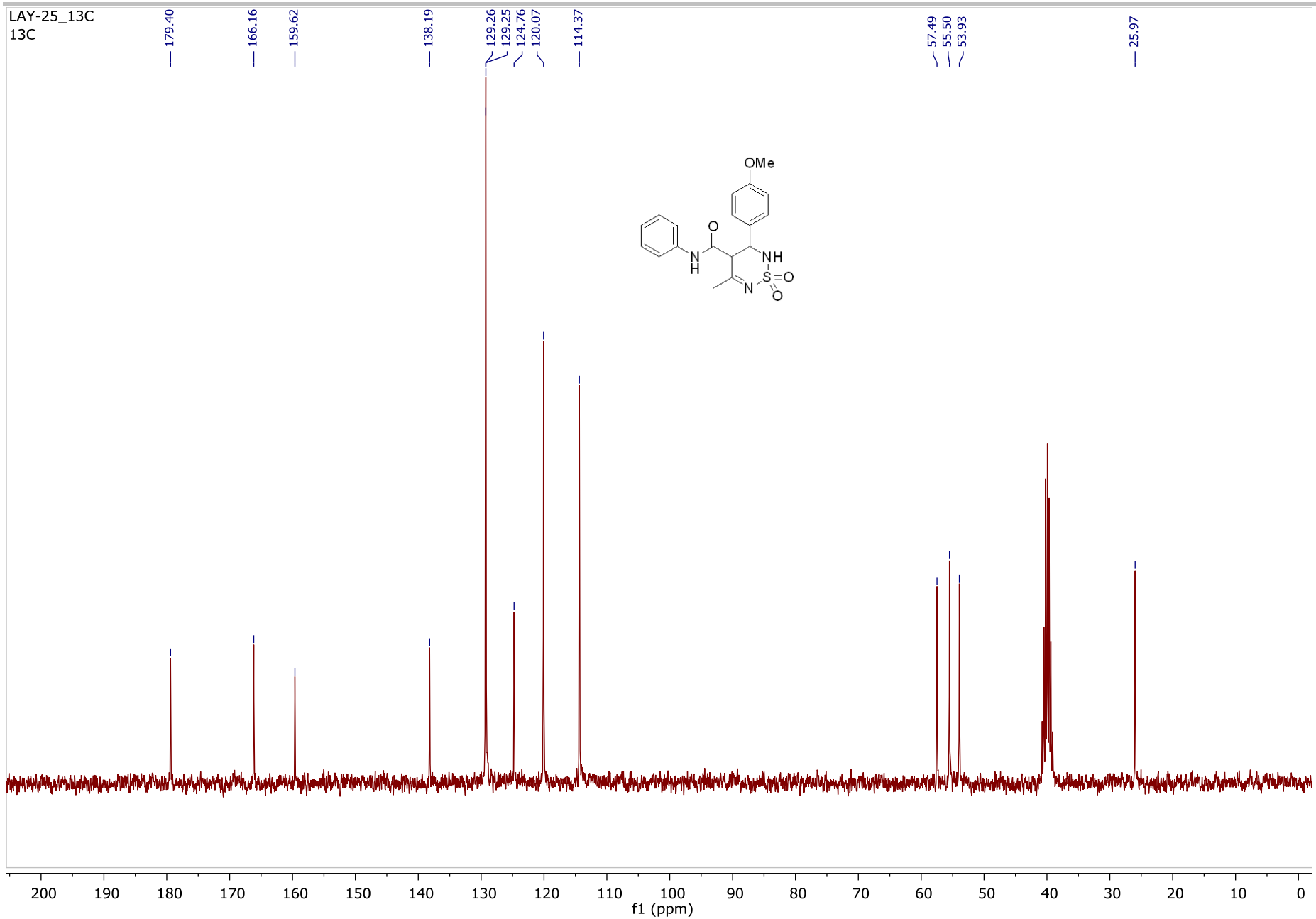
**$^{1}$H and $^{13}$C NMR spectra of the compound 7cb**



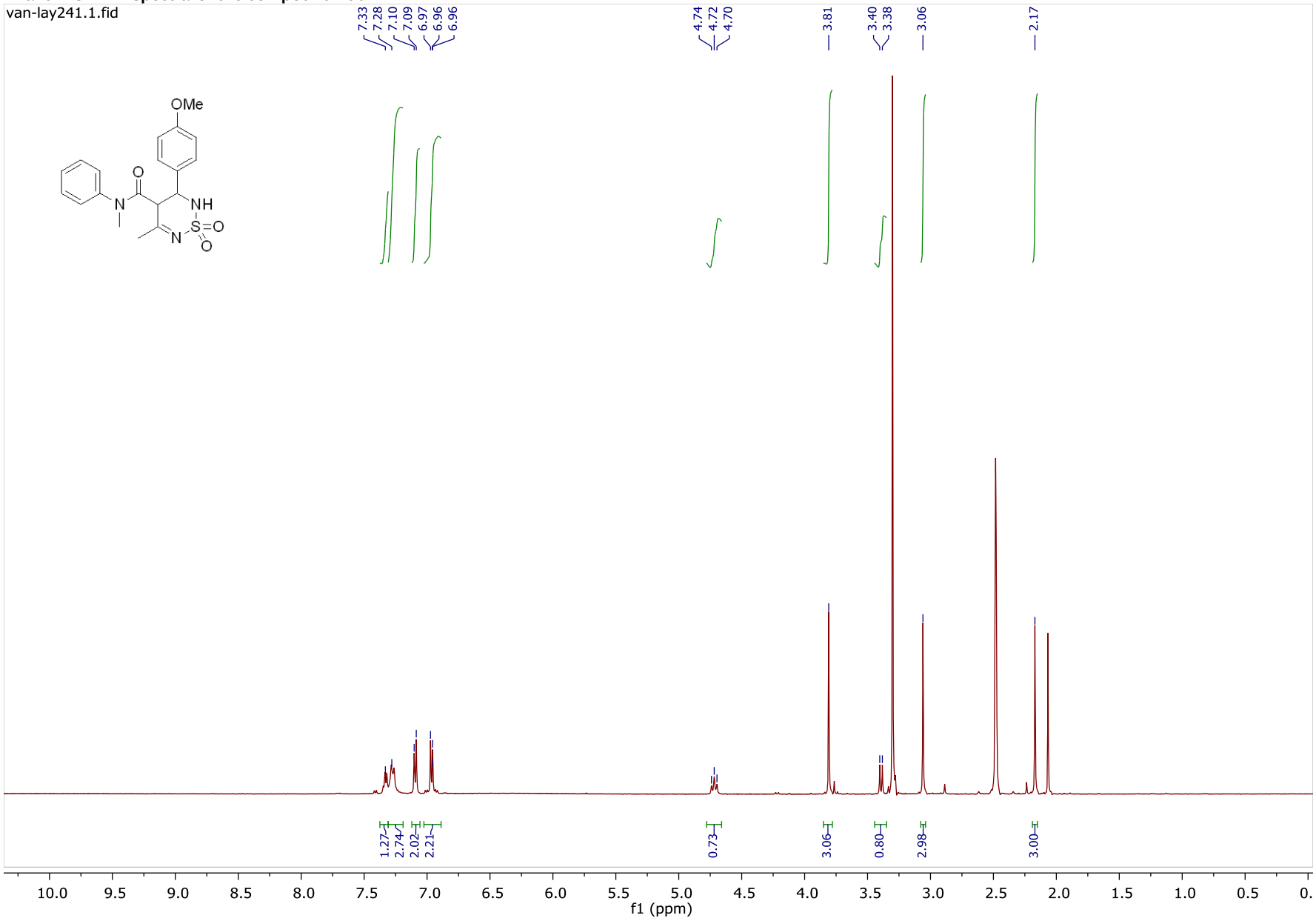

LAY_17_13C
13C
184.66
171.86
164.46
133.97
133.75
119.08
63.21
60.33
54.70
47.04
45.10
30.70
18.65
17.31
OMe
O
N
NH
S
O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

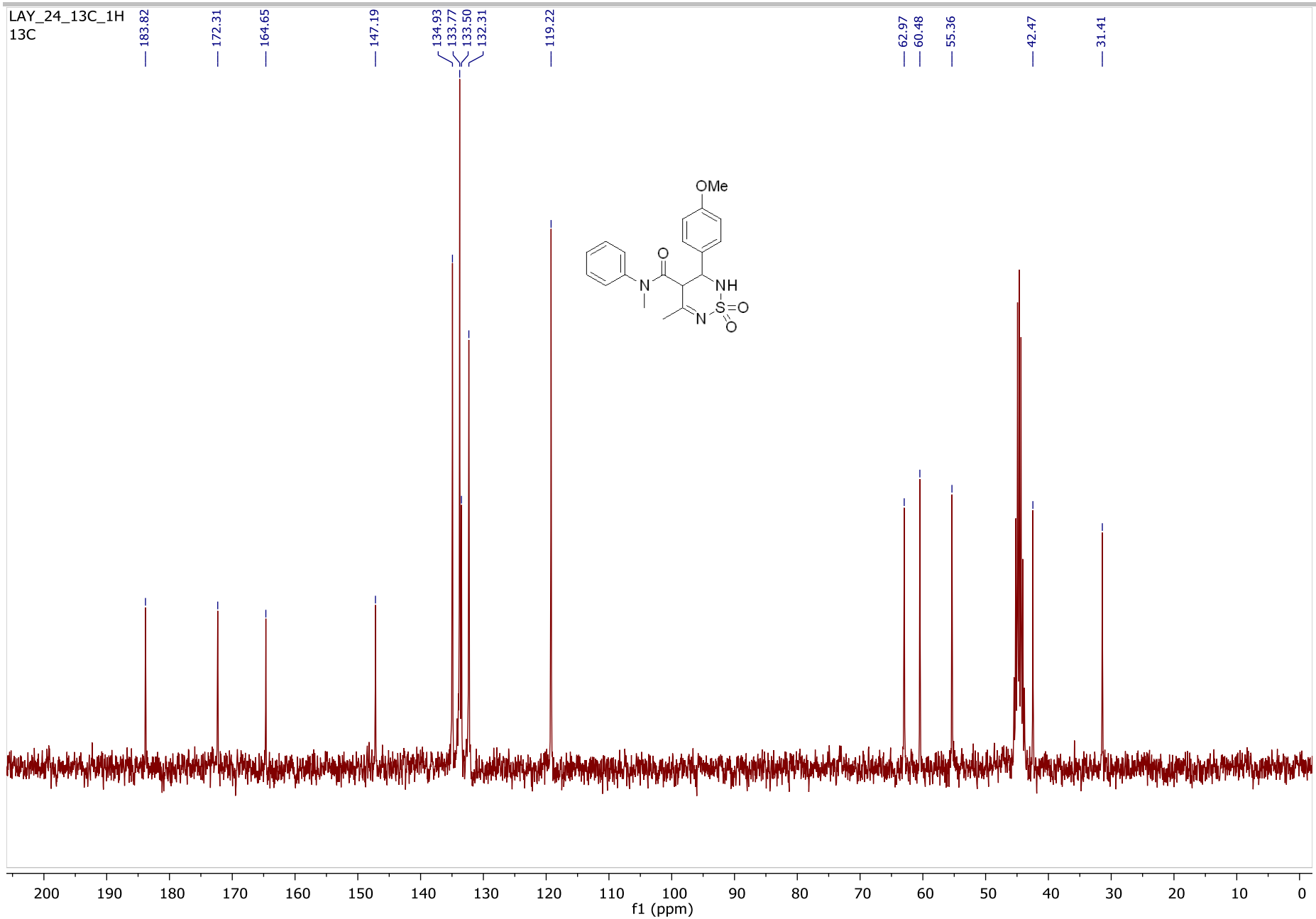
**$^{1}$H and $^{13}$C NMR spectra of the compound 7db**



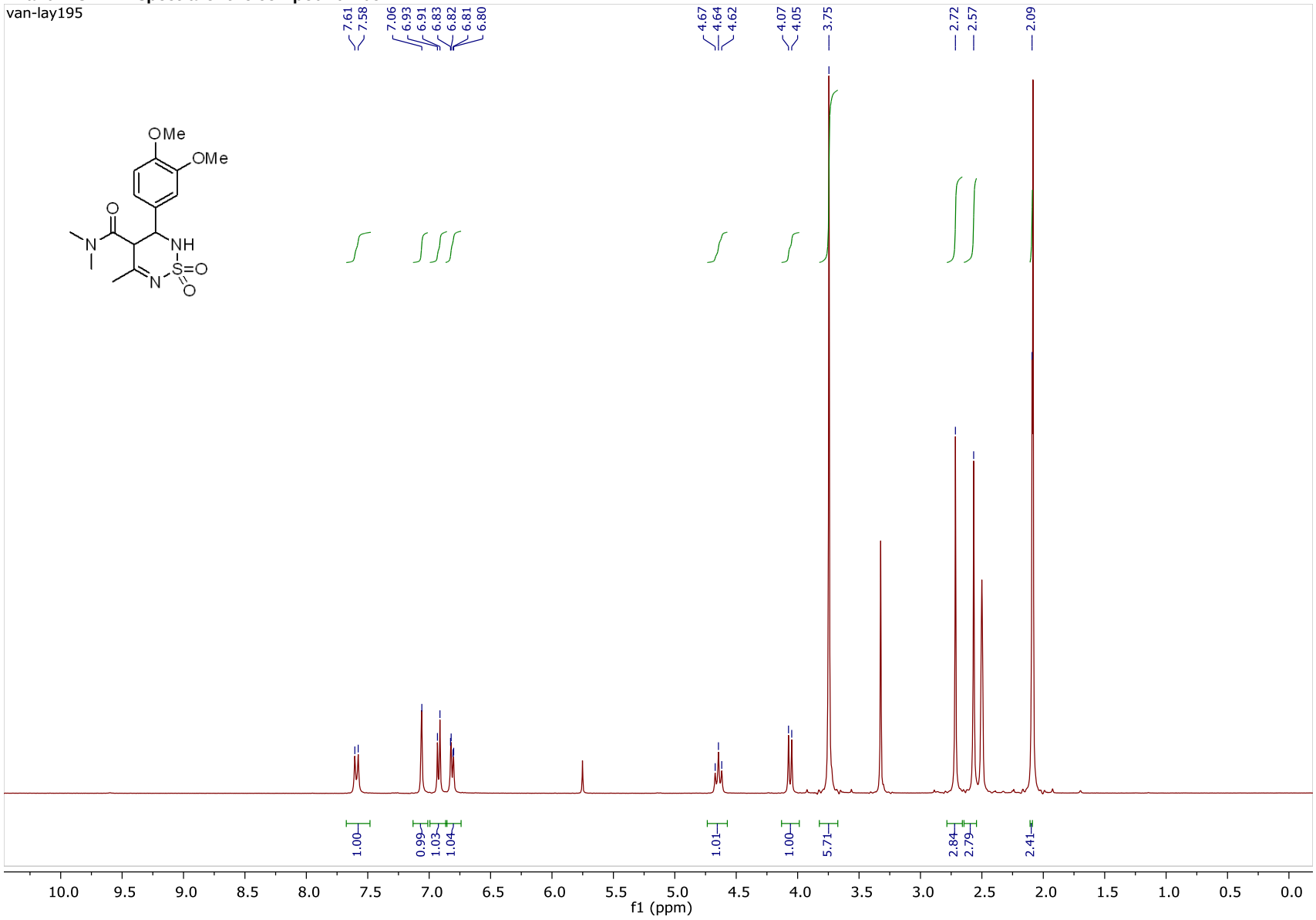

LAY-25_13C
13C
179.40
166.16
159.62
138.19
129.26
129.25
124.76
120.07
114.37
57.49
55.50
53.93
25.97
OMe
O
N
H
NH
S
O
O
N
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

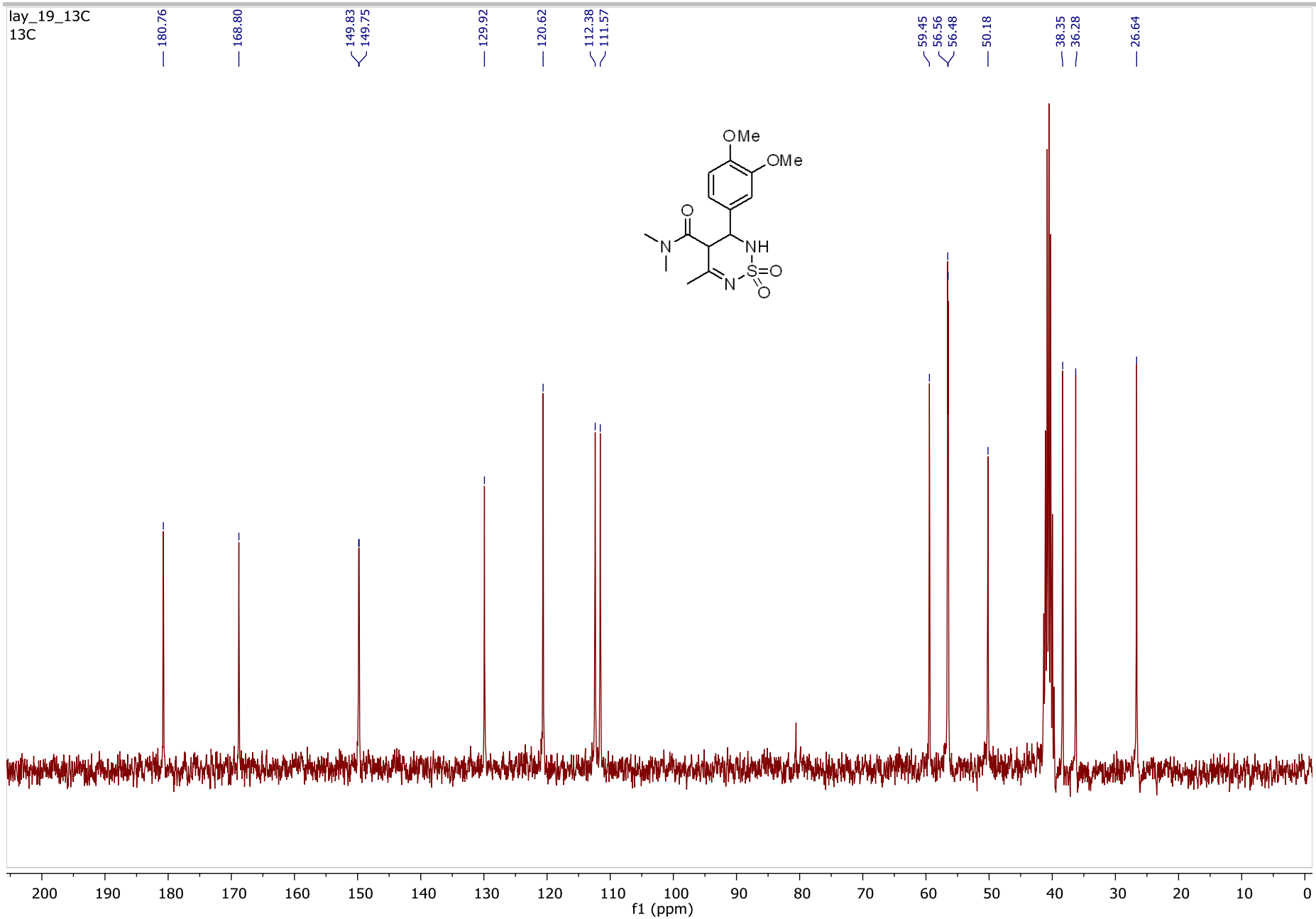
**$^{1}$H and $^{13}$C NMR spectra of the compound 7eb**



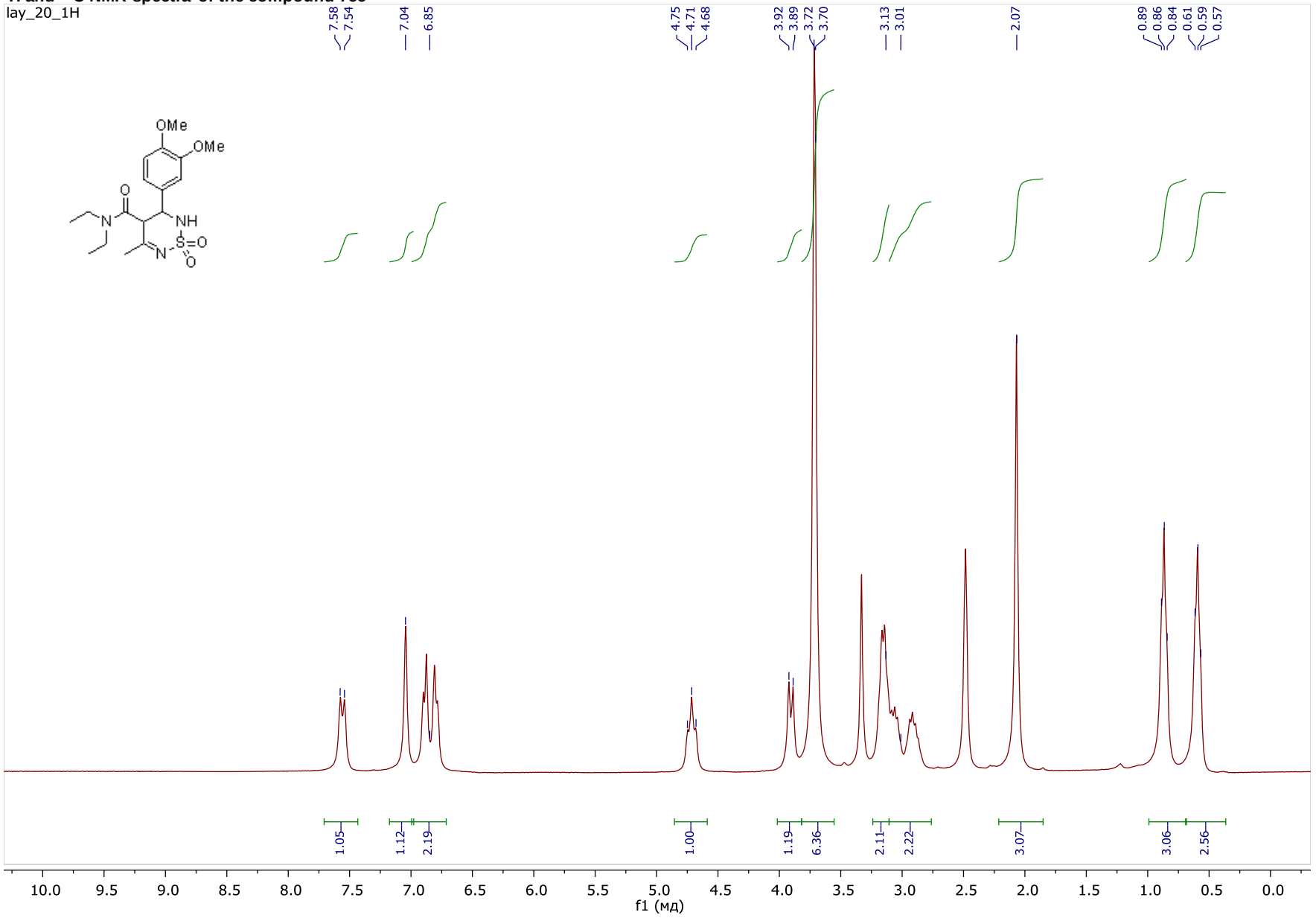

LAY_24_13C_1H
13C
183.82
172.31
164.65
147.19
134.93
133.77
133.50
132.31
119.22
62.97
60.48
55.36
42.47
31.41
OMe
O
N
NH
N
S
O
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

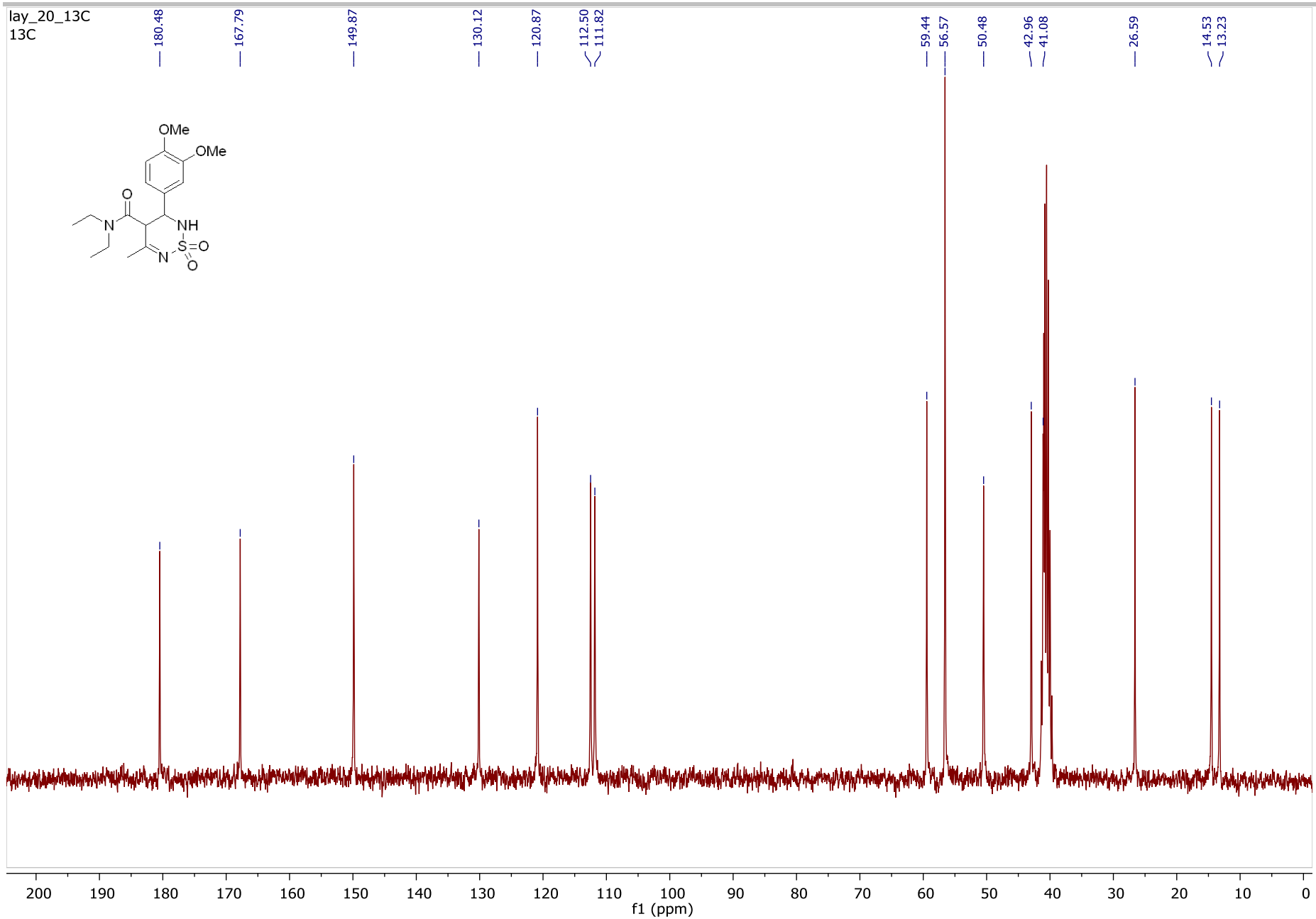
**$^{1}$H and $^{13}$C NMR spectra of the compound 7bc**



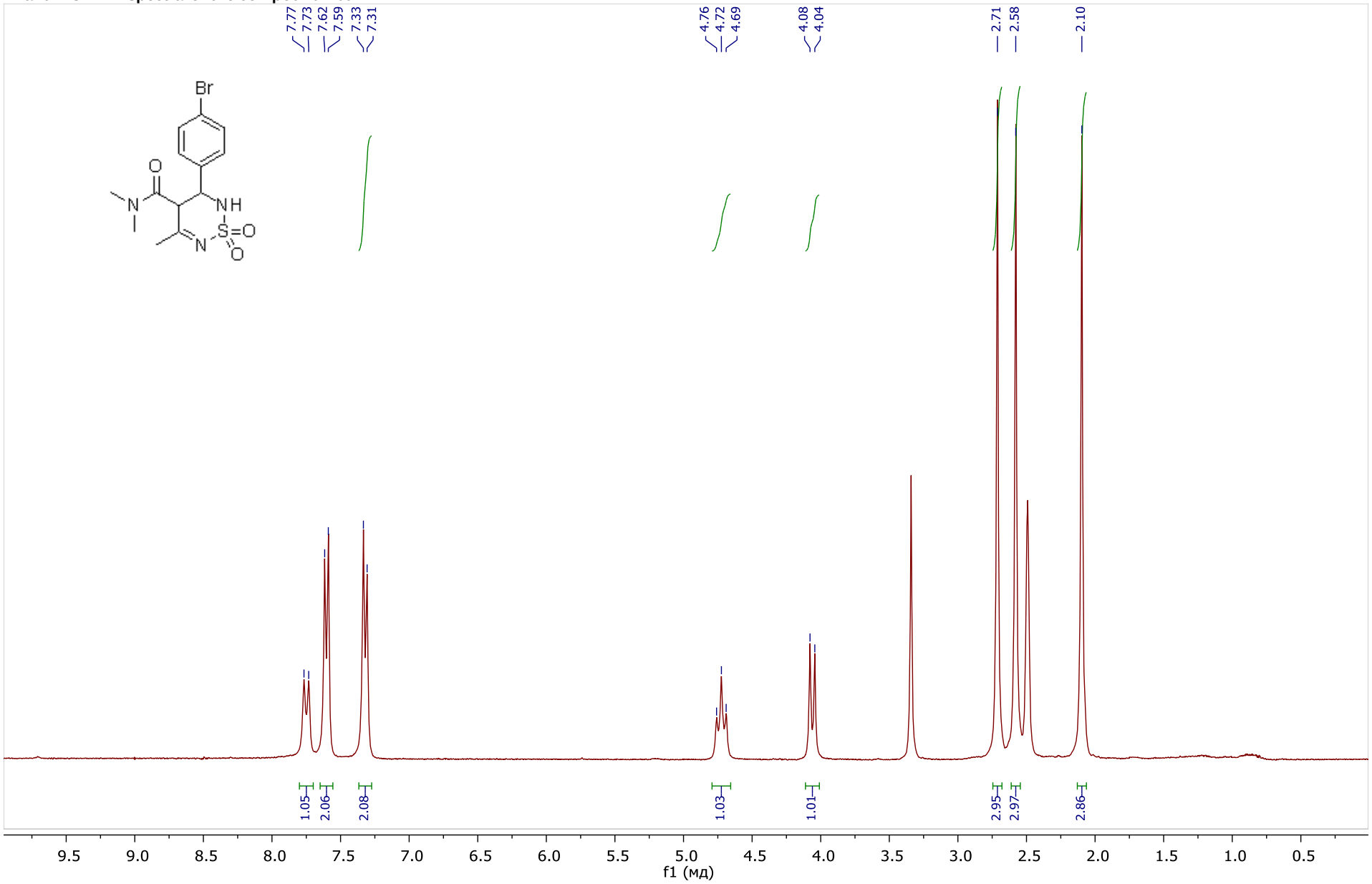

lay_19_13C
13C
180.76
168.80
149.83
149.75
129.92
120.62
112.38
111.57
59.45
56.56
56.48
50.18
38.35
36.28
26.64
OMe
OMe
O
N
NH
S=O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

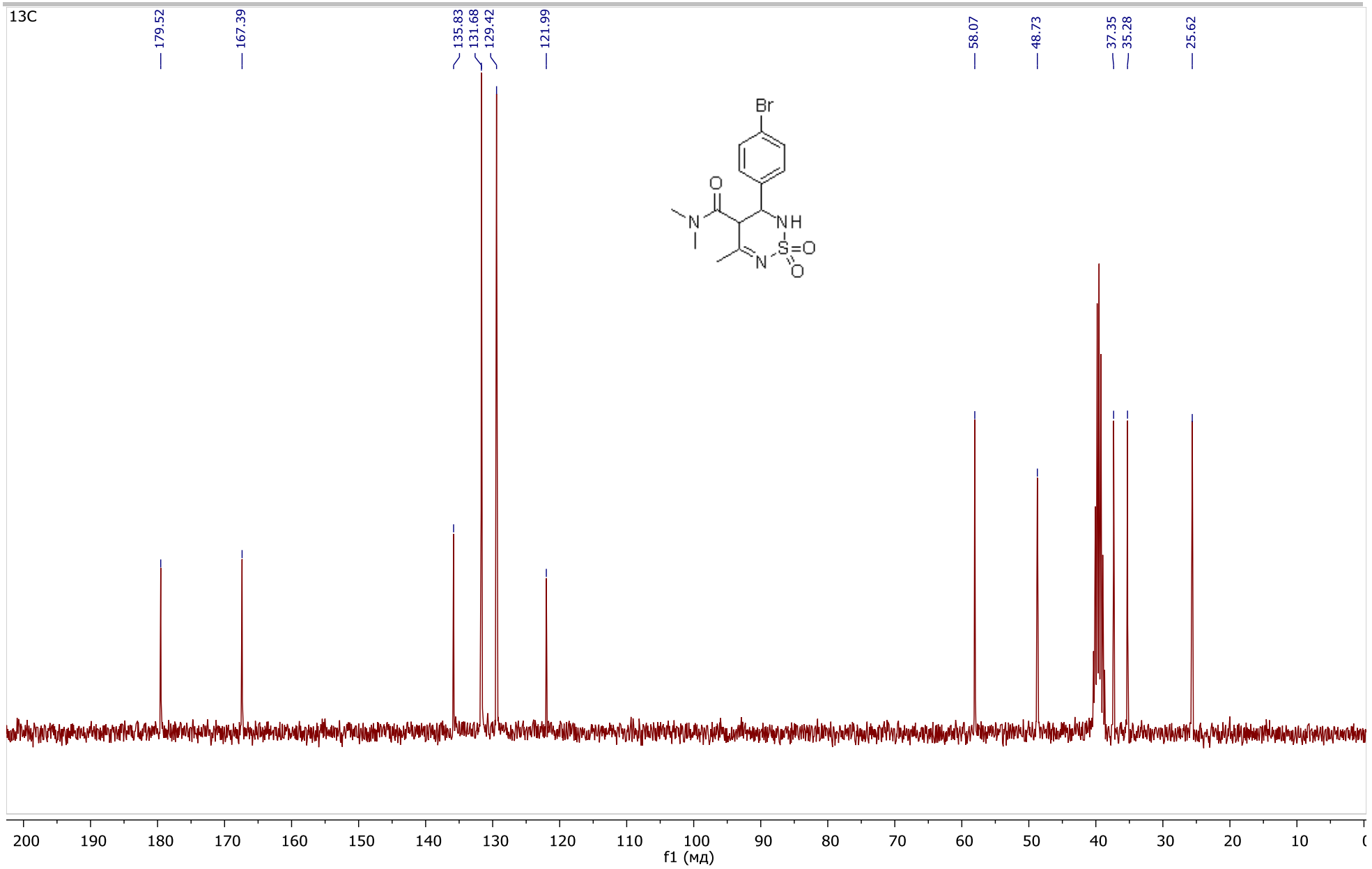
**$^{1}$H and $^{13}$C NMR spectra of the compound 7cc**



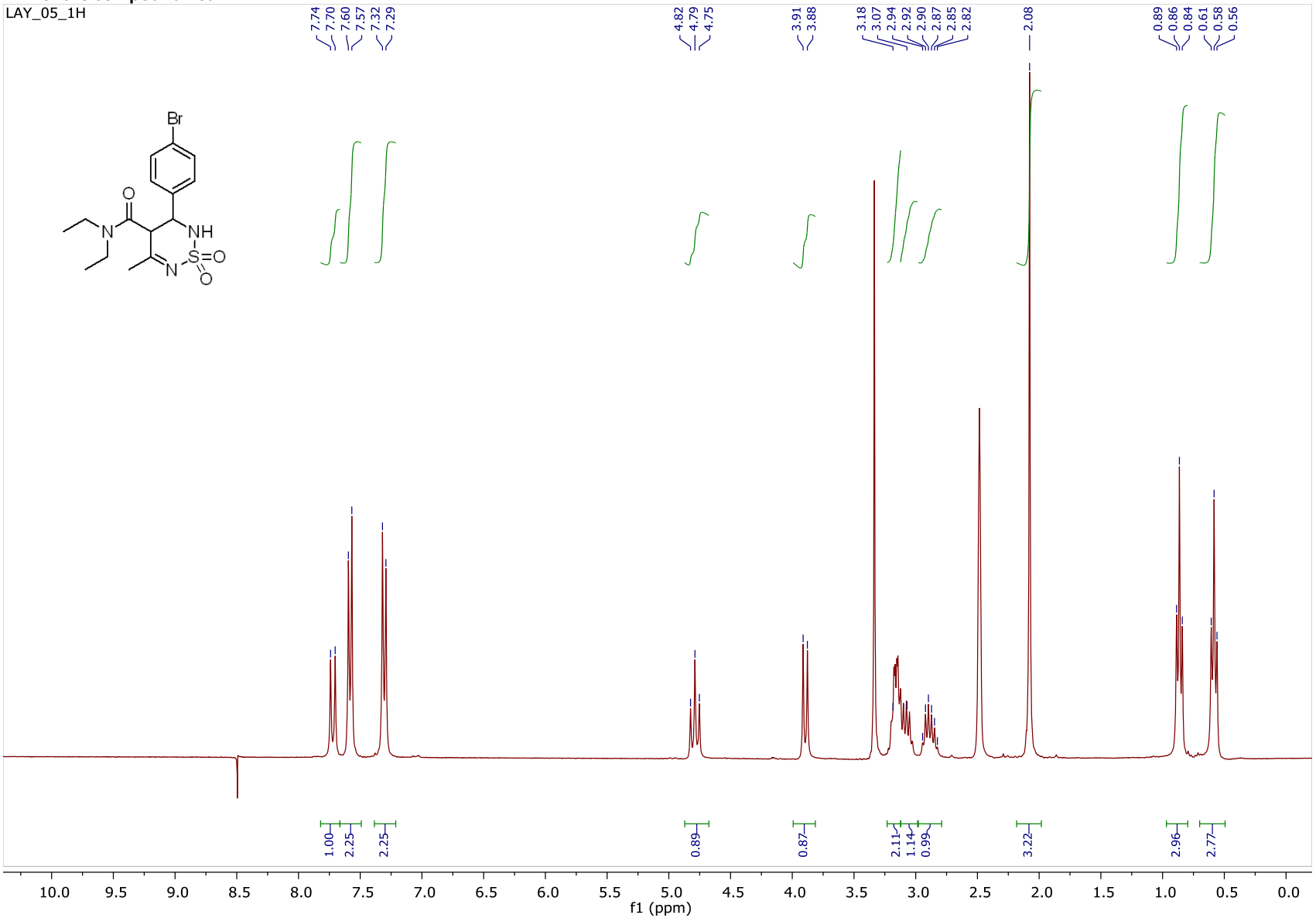

lay_20_13C
13C
180.48
167.79
149.87
130.12
120.87
112.50
111.82
59.44
56.57
50.48
42.96
41.08
26.59
14.53
13.23
OMe
OMe
O
N
NH
S
O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

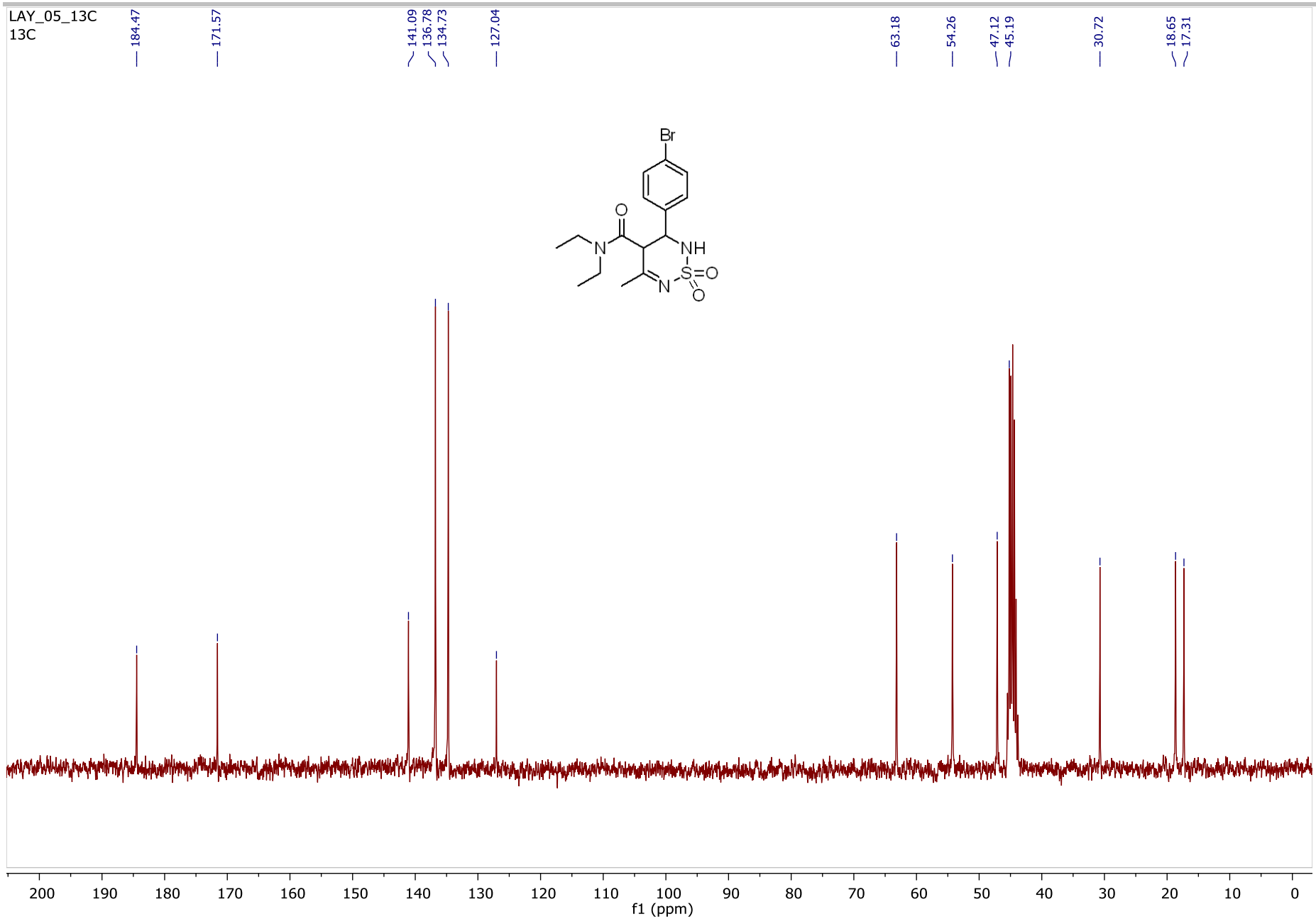
**$^{1}$H and $^{13}$C NMR spectra of the compound 7bd**



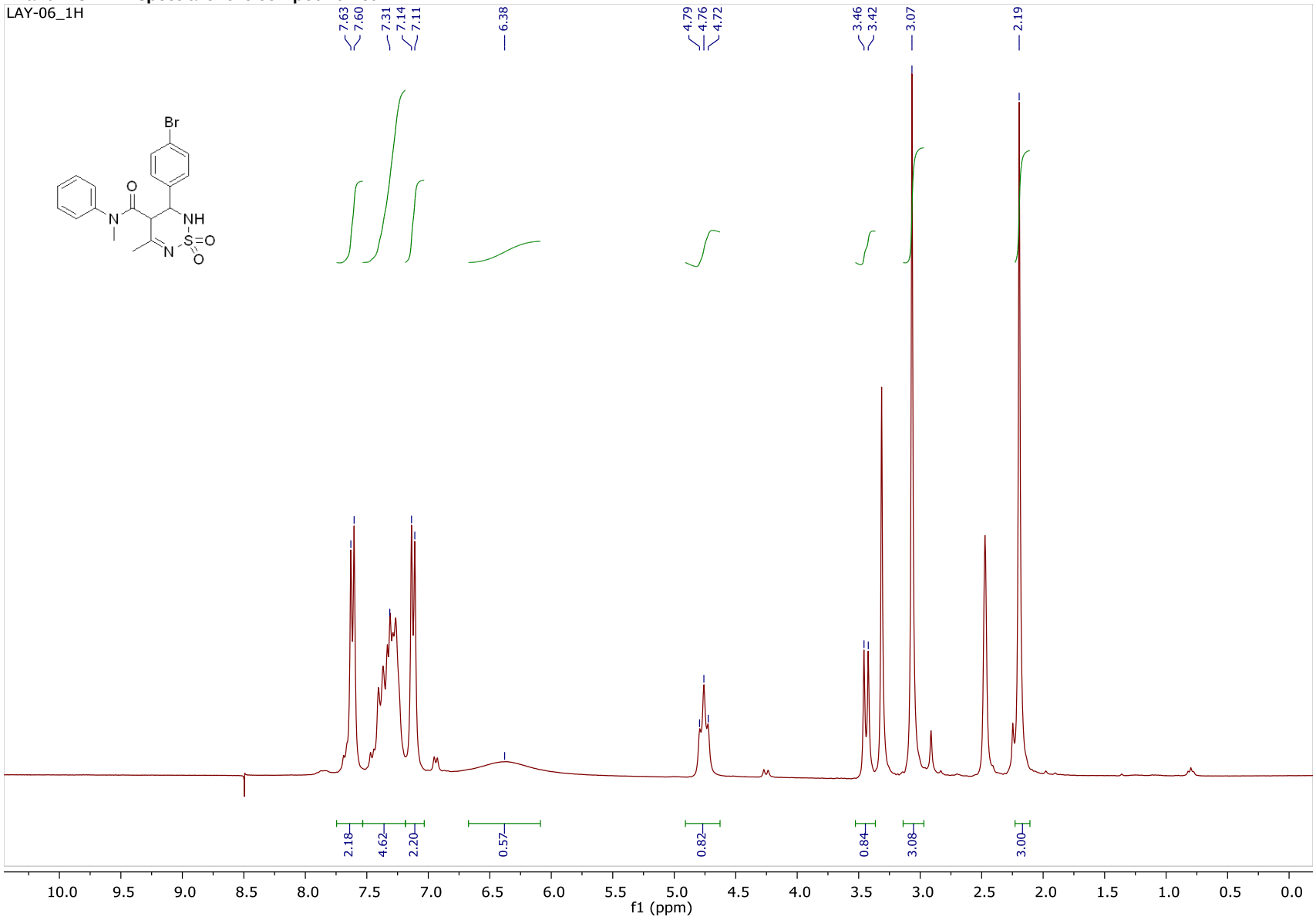

13C
179.52
167.39
135.83
131.68
129.42
121.99
58.07
48.73
37.35
35.28
25.62
Br
O
N
NH
S=O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (мд)

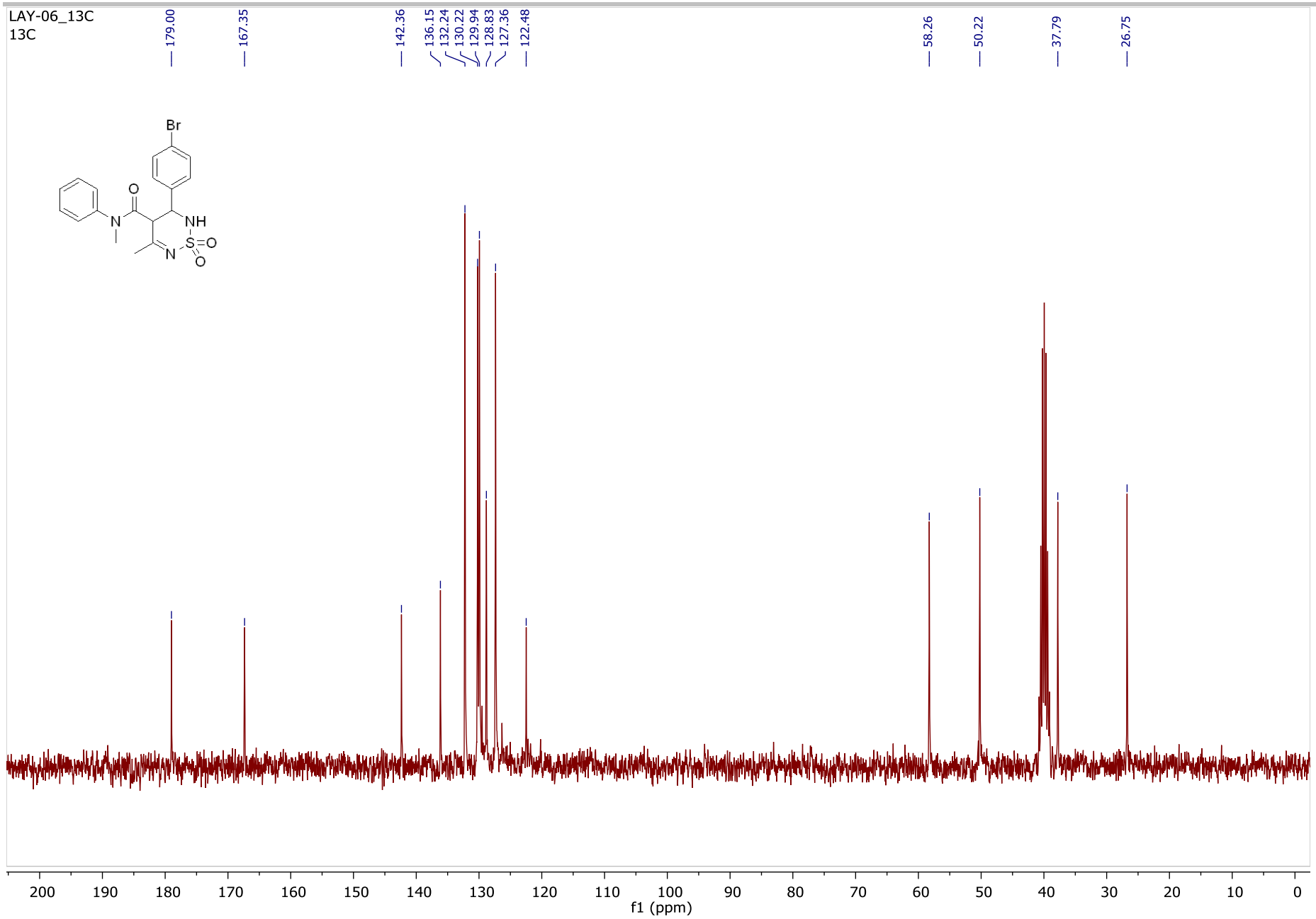
**$^{1}$H and $^{13}$C NMR of the compound 7cd**



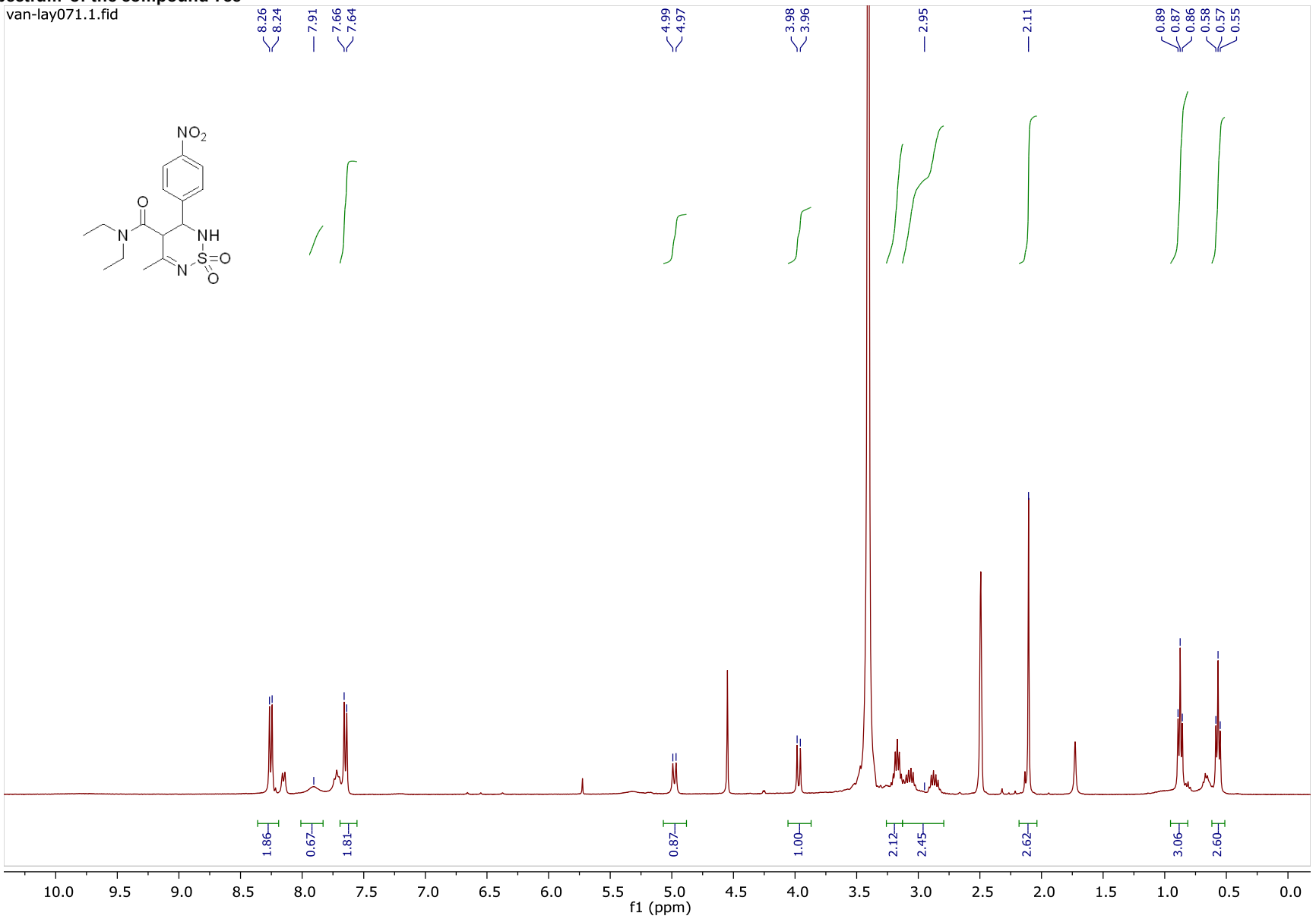

LAY_05_13C
13C
184.47
171.57
141.09
136.78
134.73
127.04
63.18
54.26
47.12
45.19
30.72
18.65
17.31
Br
O
N
NH
S
O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

**$^{1}$H and $^{13}$C NMR spectra of the compound 7ed**

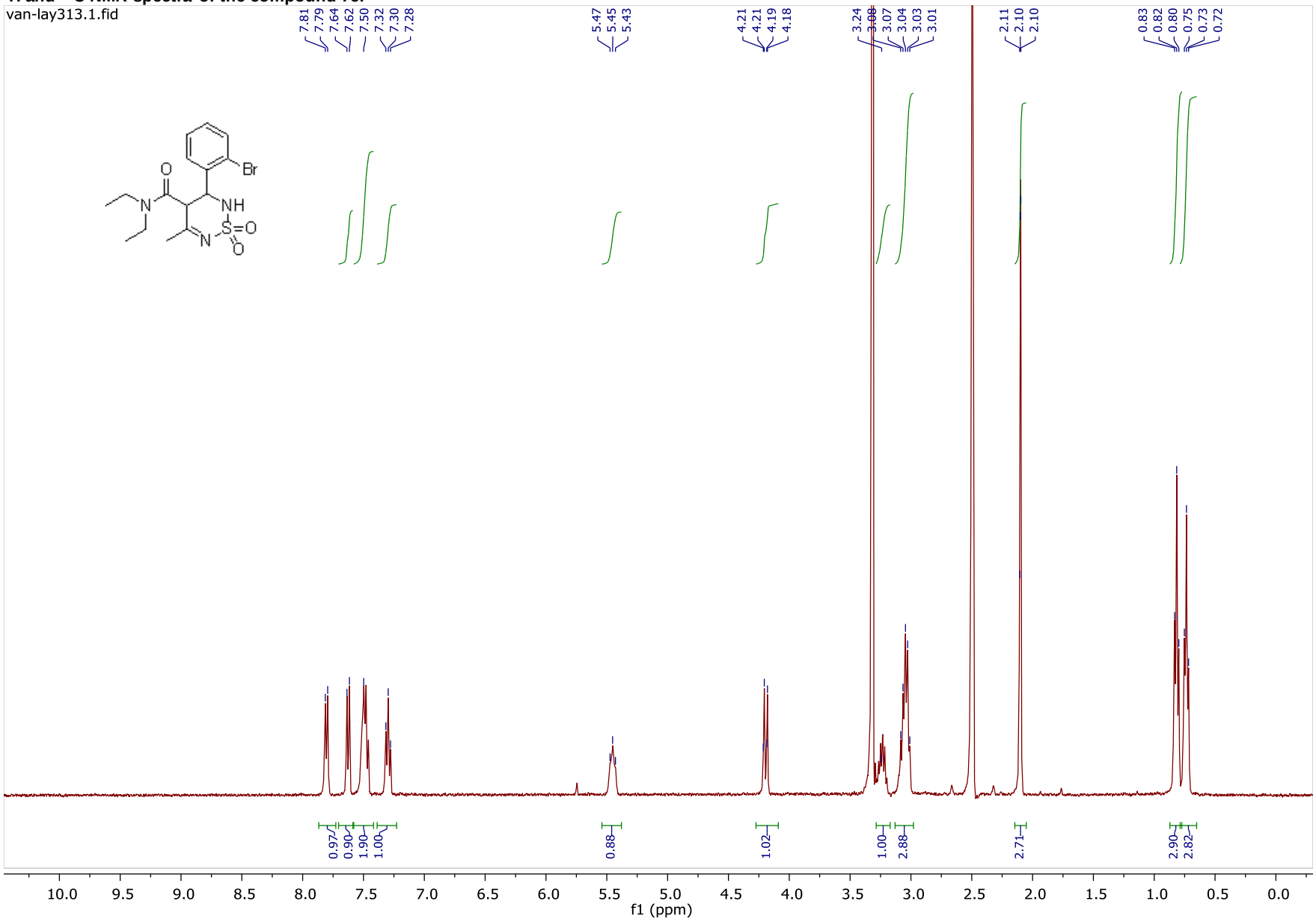


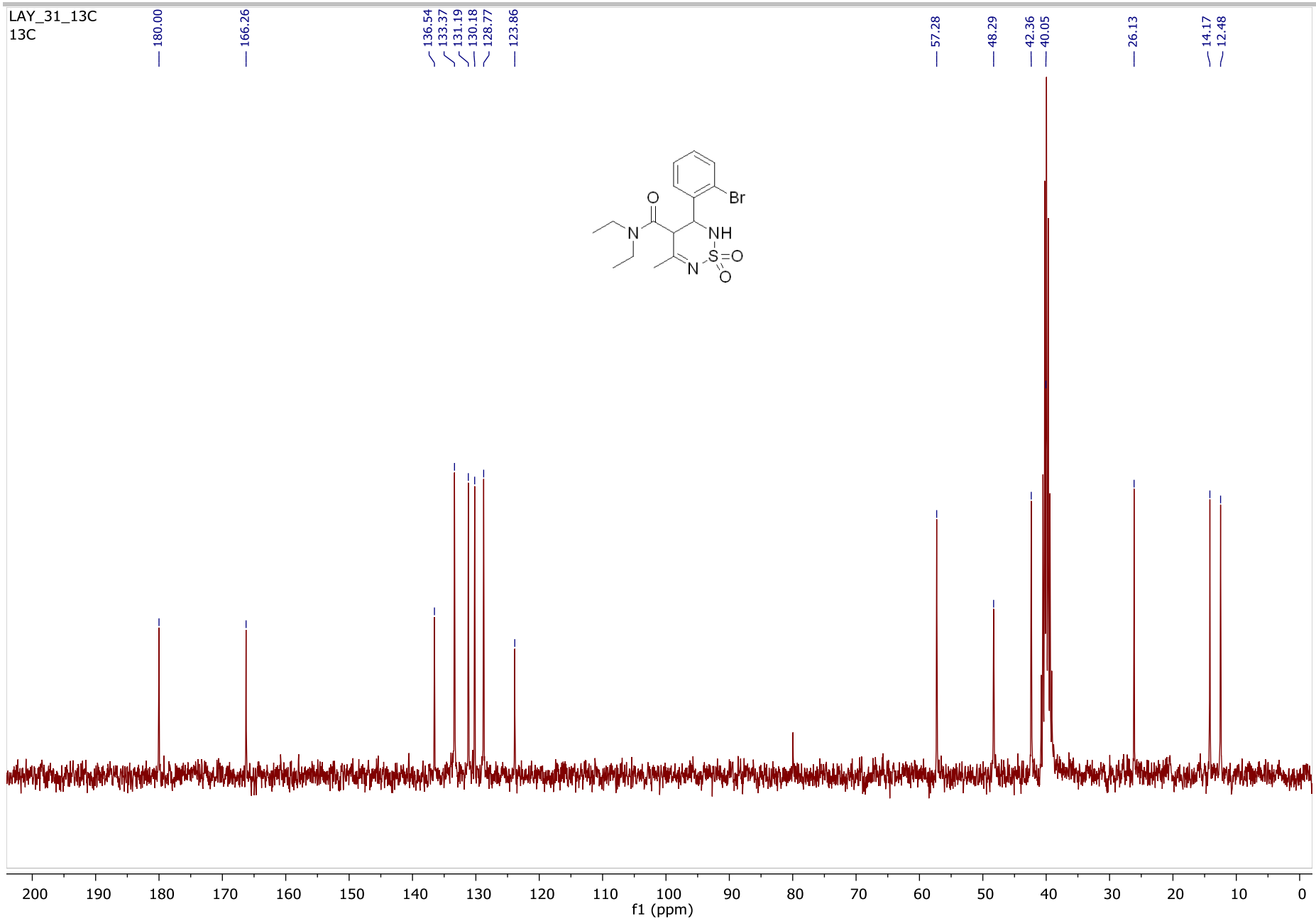

LAY-06_13C
13C
179.00
167.35
142.36
136.15
132.24
130.22
129.94
128.83
127.36
122.48
58.26
50.22
37.79
26.75
Br
O
N
NH
S=O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

**$^1$H NMR spectrum of the compound 7ce**

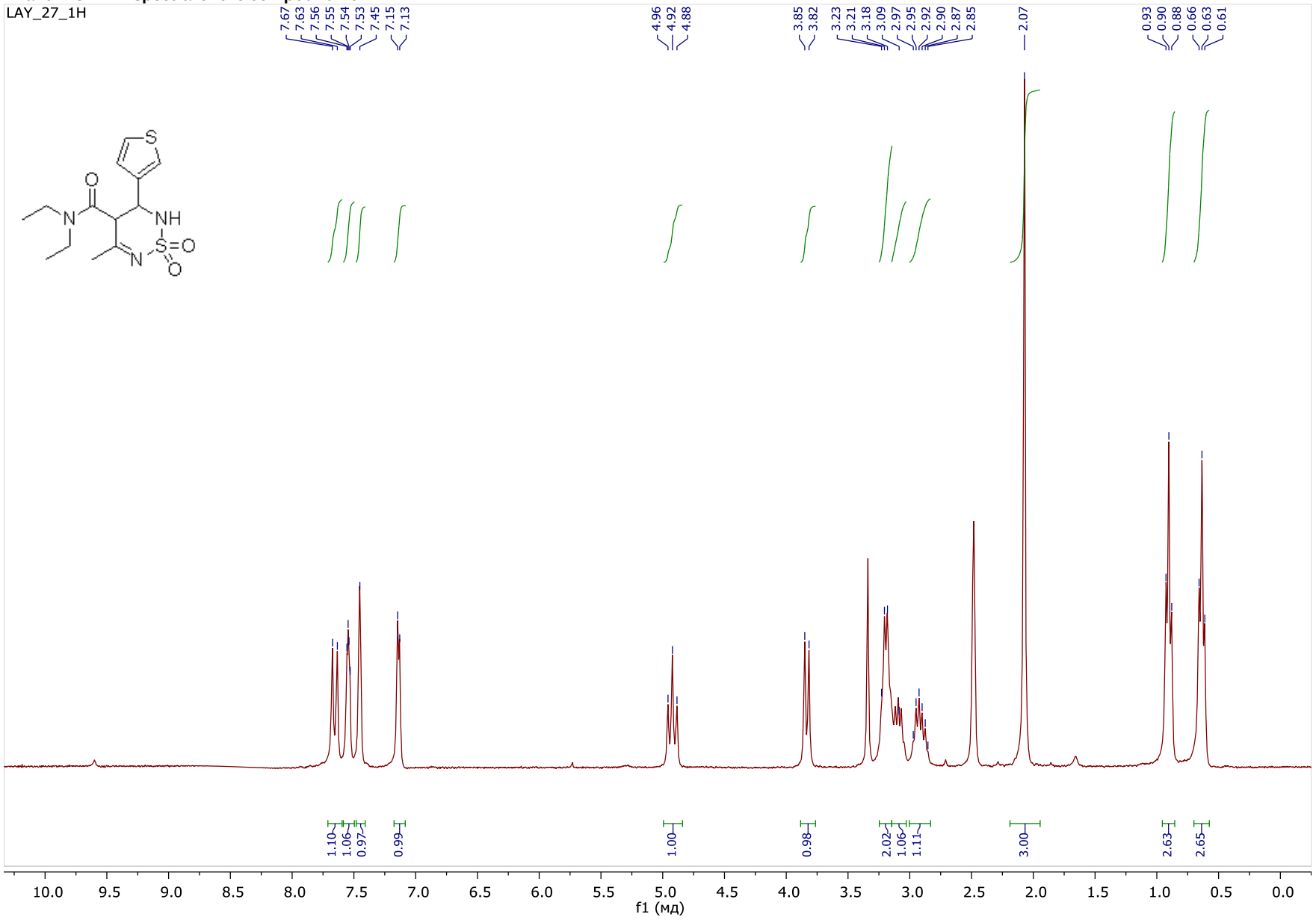


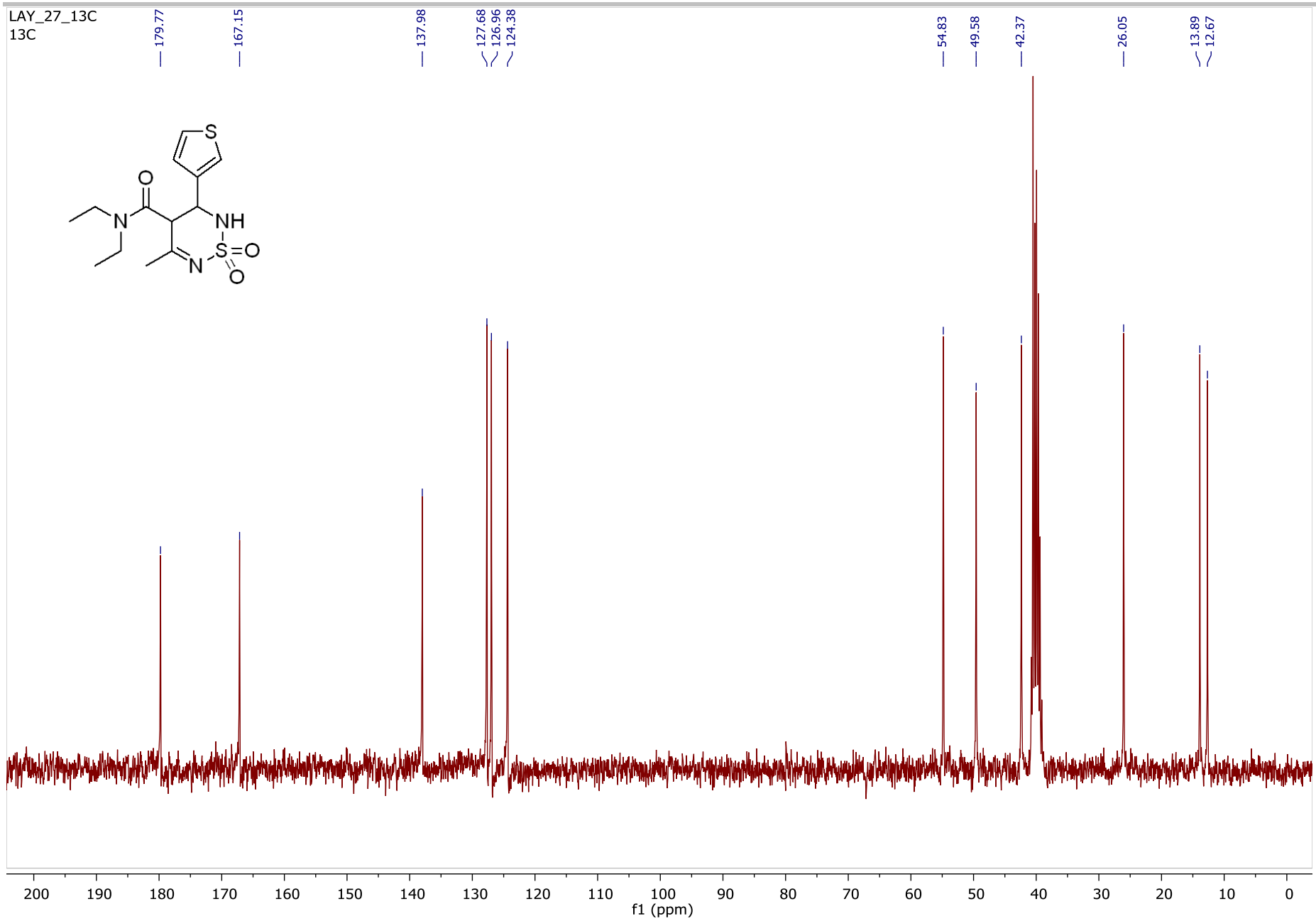
**$^{1}$H and $^{13}$C NMR spectra of the compound 7cf**



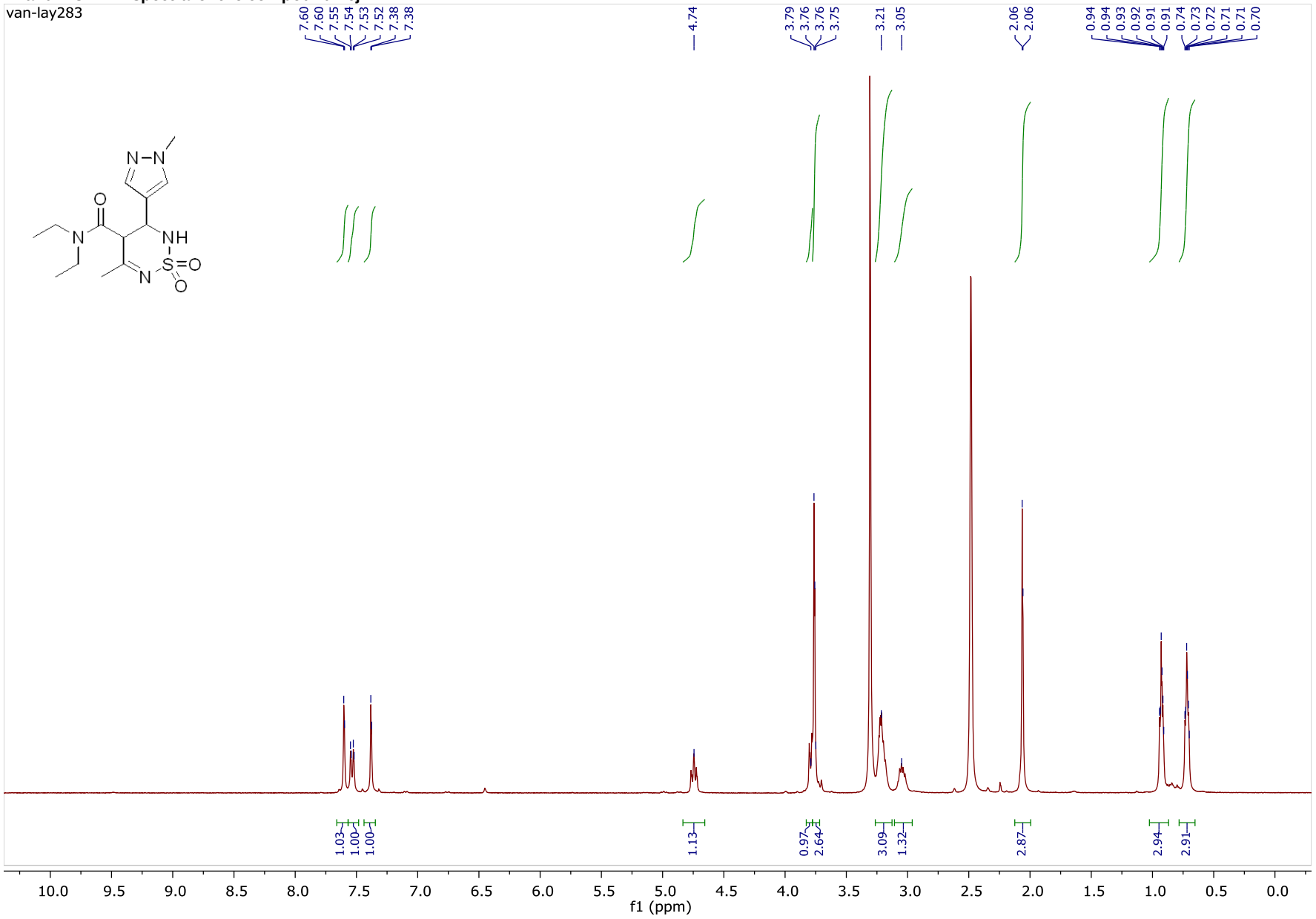

LAY_31_13C
13C
180.00
166.26
136.54
133.37
131.19
130.18
128.77
123.86
57.28
48.29
42.36
40.05
26.13
14.17
12.48
Br
O
N
NH
S
O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

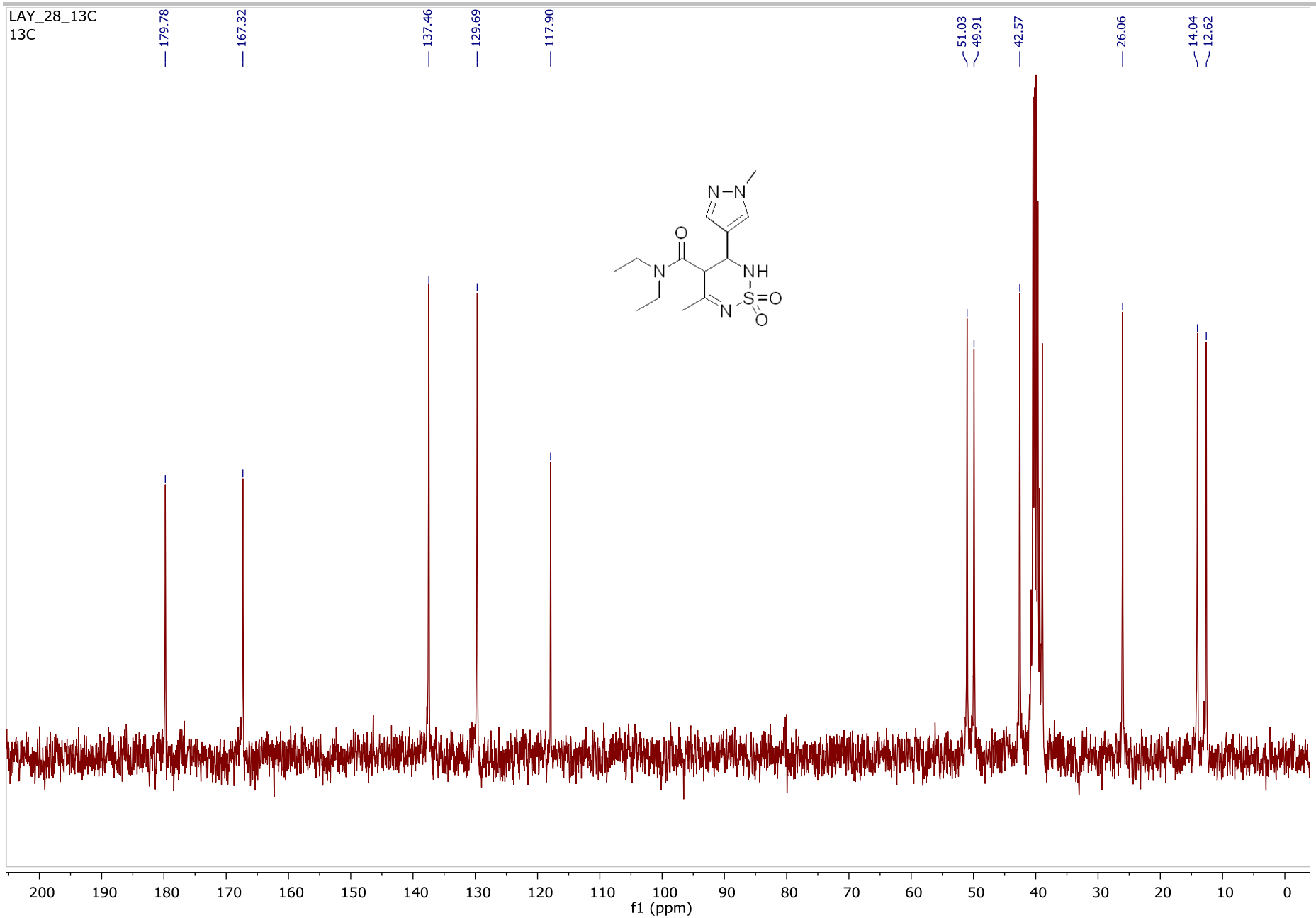
**$^{1}$H and $^{13}$C NMR spectra of the compound 7ci**



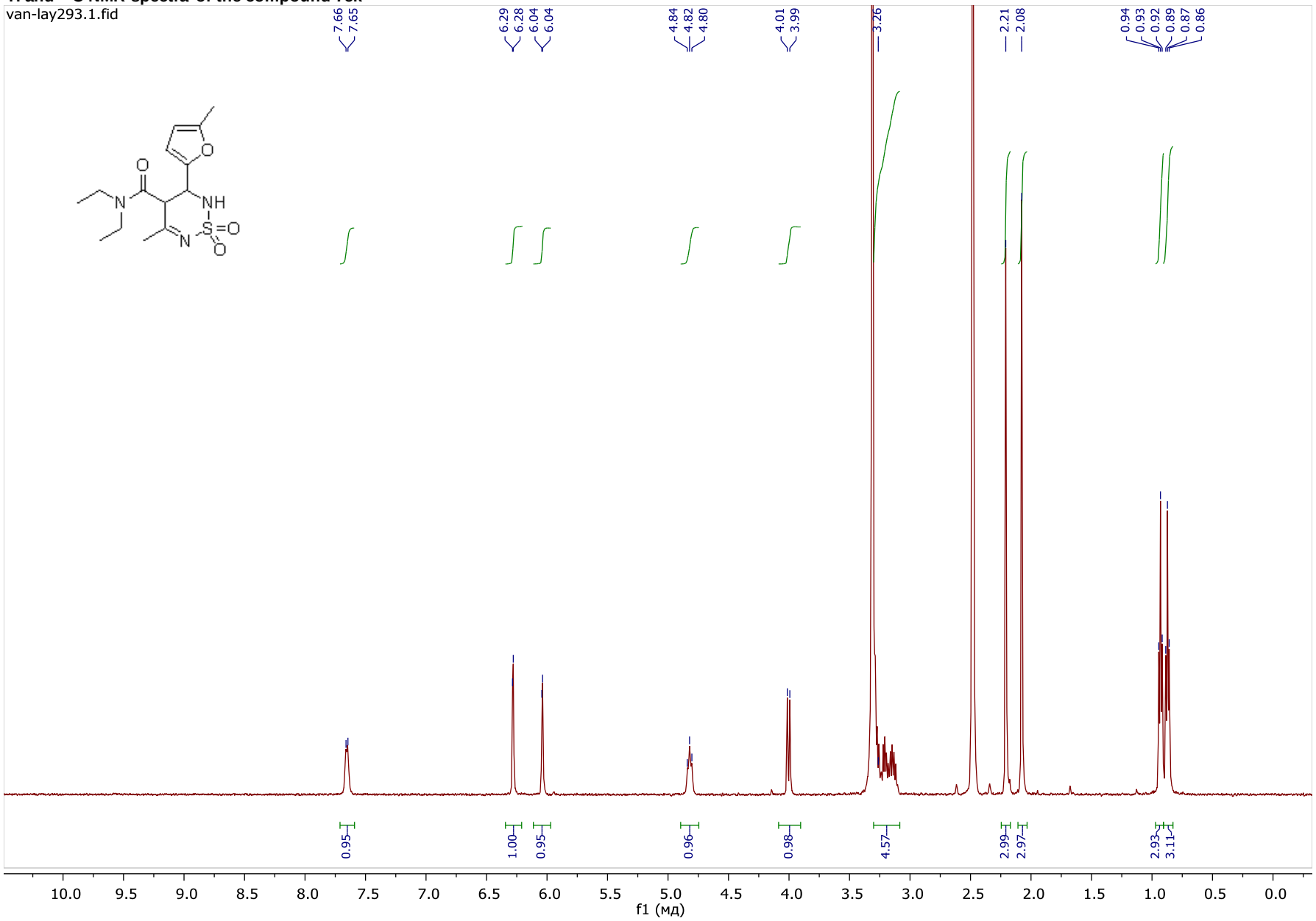

LAY_27_13C
13C
179.77
167.15
137.98
127.68
126.96
124.38
54.83
49.58
42.37
26.05
13.89
12.67
S
O
N
NH
S
O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

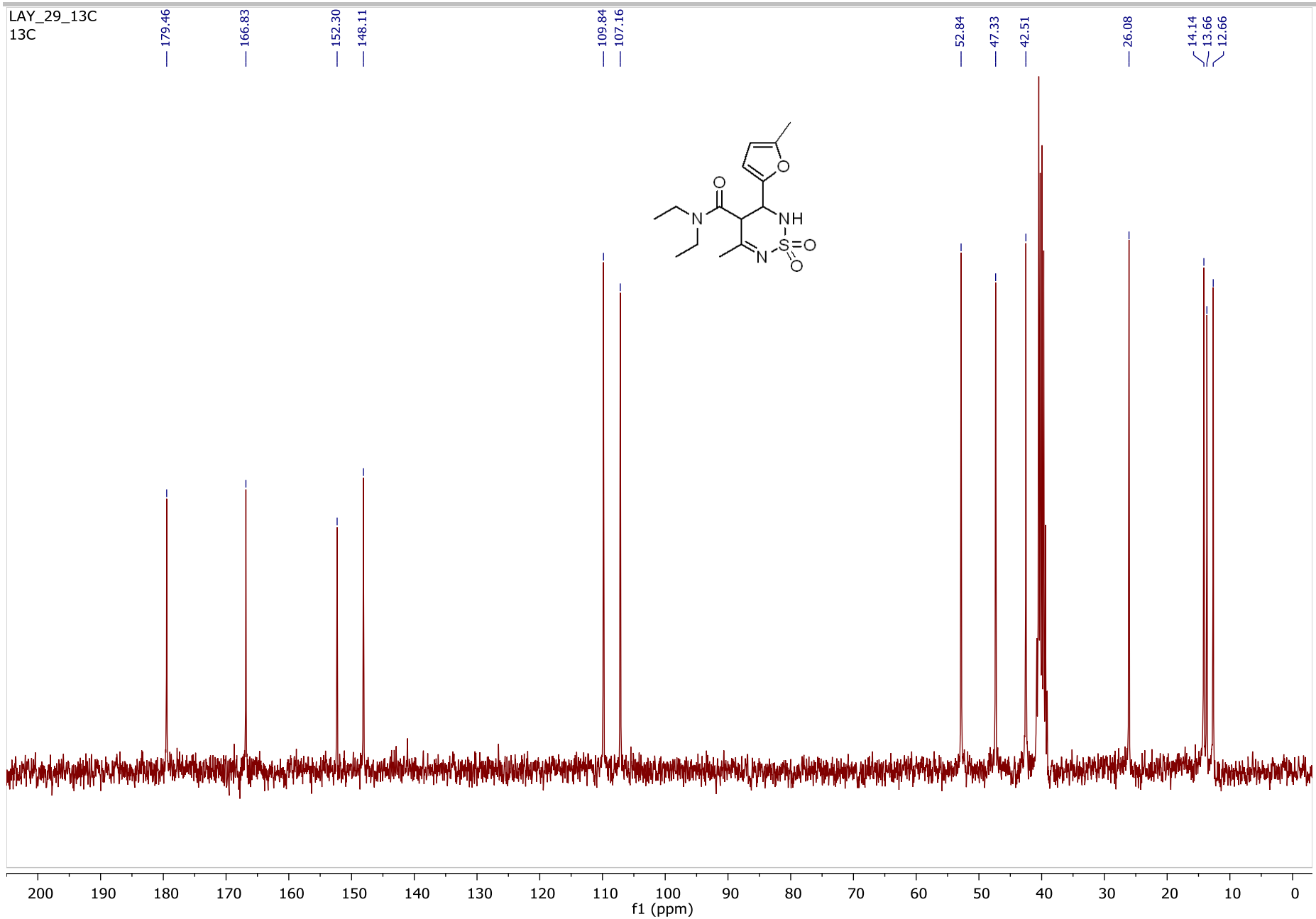
**$^{1}$H and $^{13}$C NMR spectra of the compound 7cj**



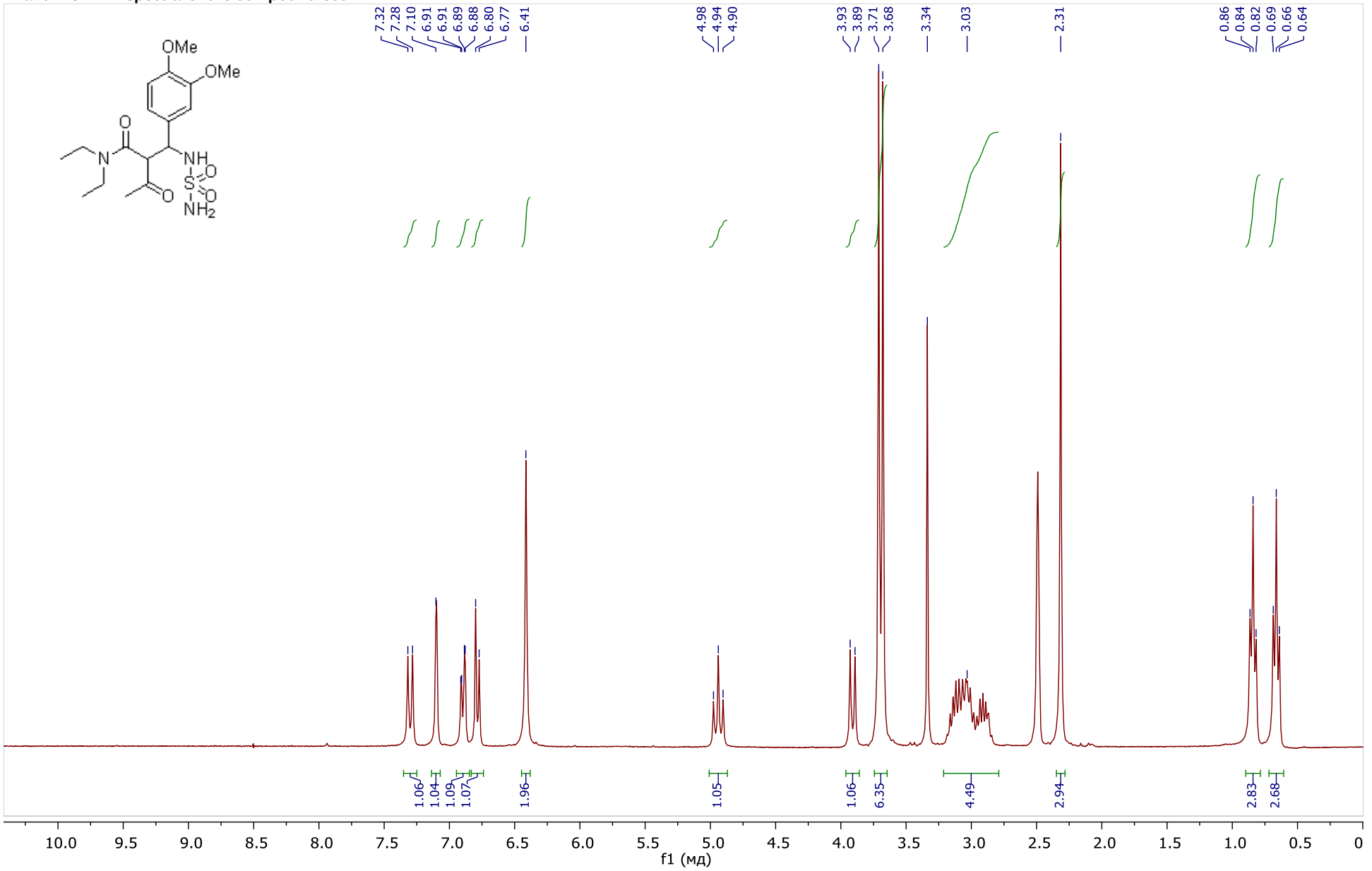

LAY_28_13C
13C
179.78
167.32
137.46
129.69
117.90
51.03
49.91
42.57
26.06
14.04
12.62
O
N
N
NH
S=O
N
O
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

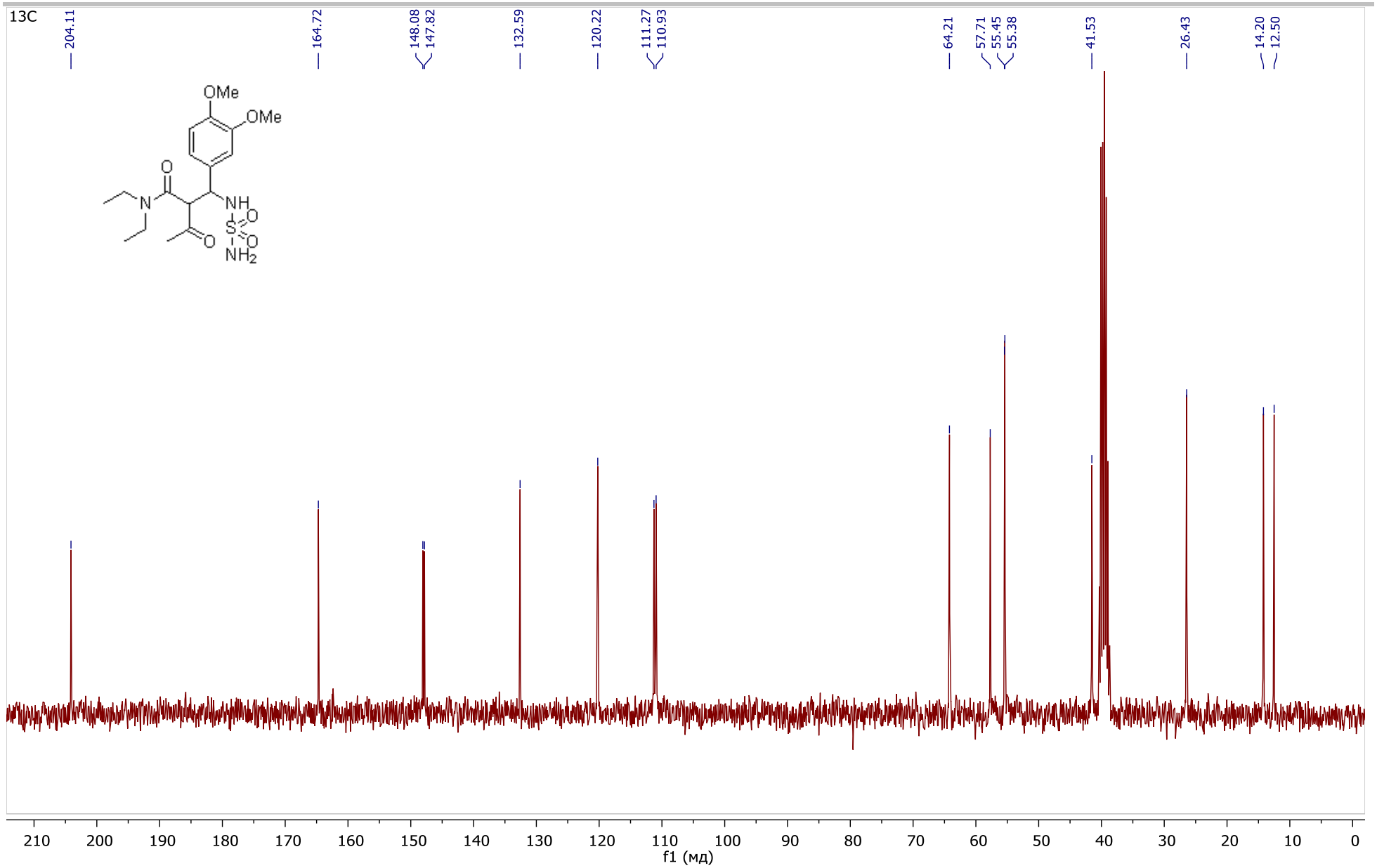
**$^{1}$H and $^{13}$C NMR spectra of the compound 7ck**



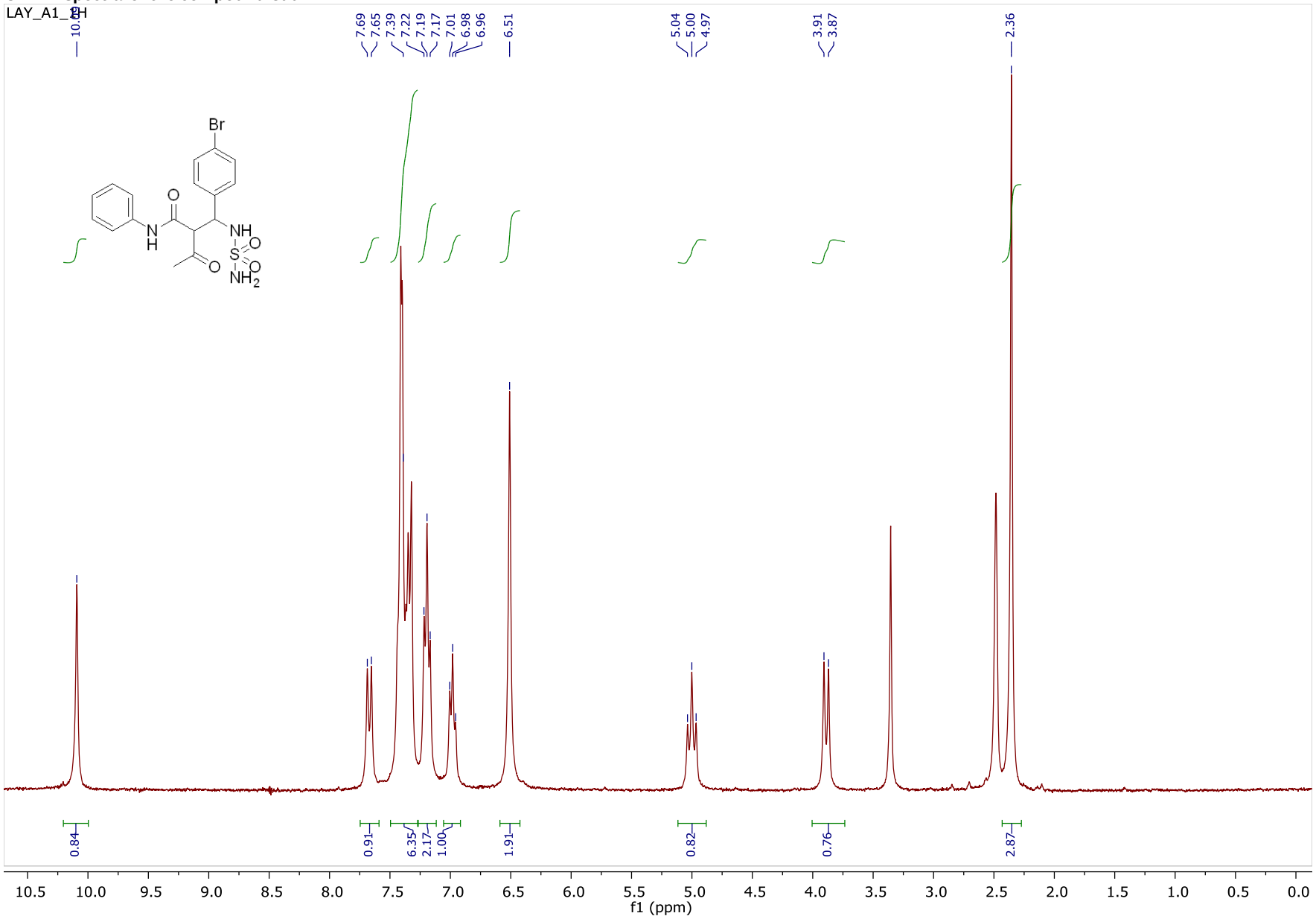

LAY_29_13C
13C
179.46
166.83
152.30
148.11
109.84
107.16
52.84
47.33
42.51
26.08
14.14
13.66
12.66
O
O
N
NH
S
O
O
N
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

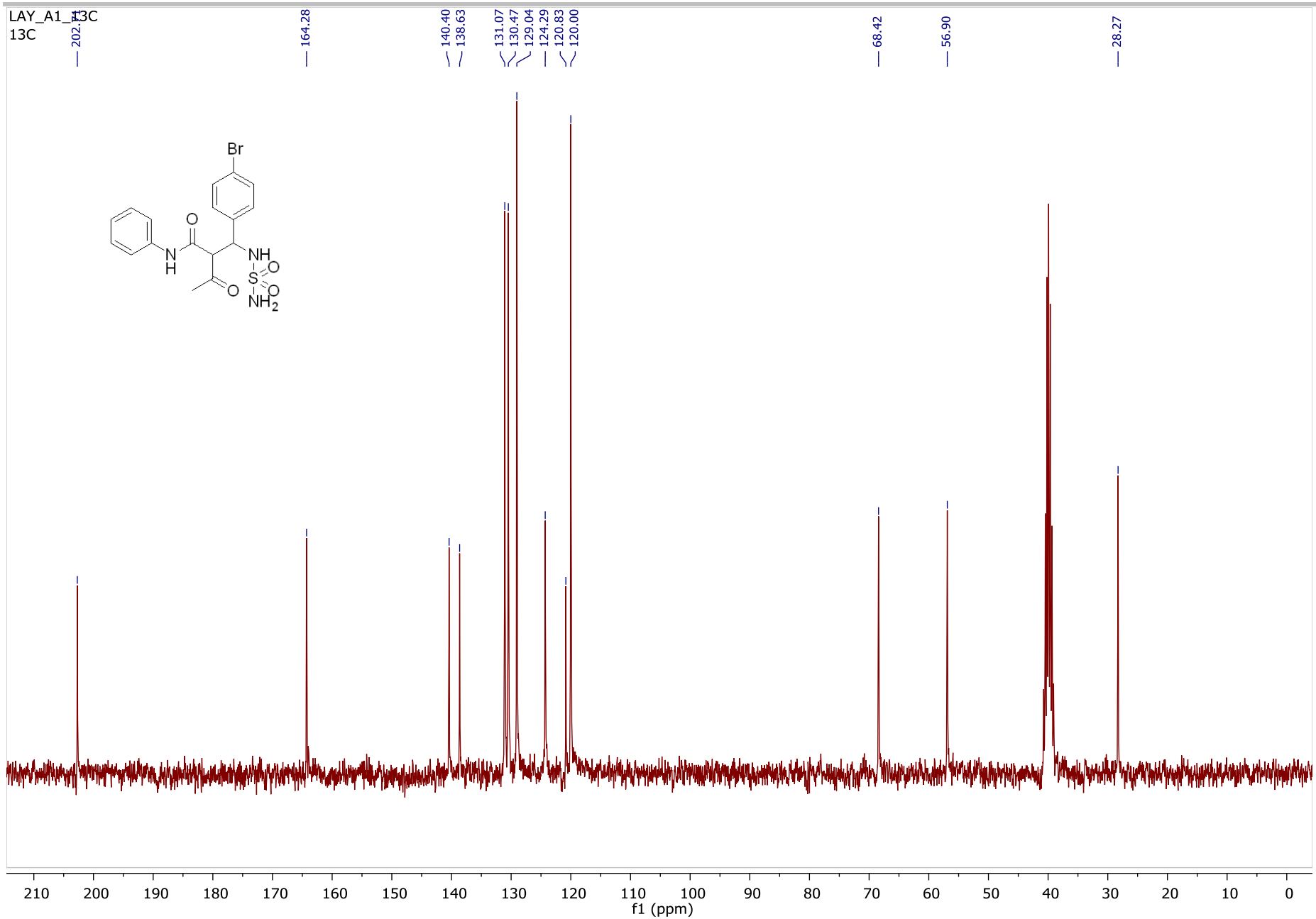
**$^{1}$H and $^{13}$C NMR spectra of the compound 8cc**



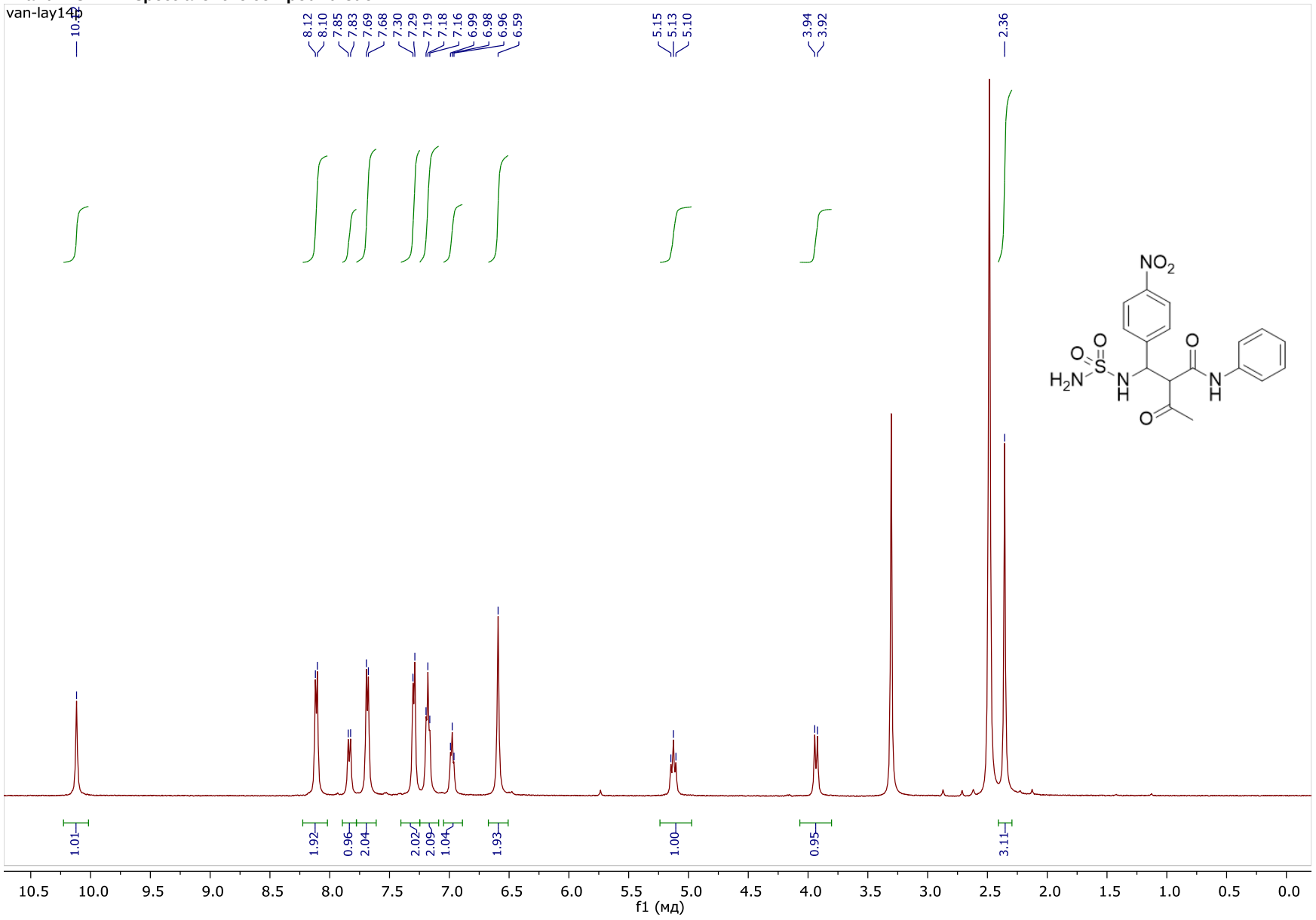

13C
204.11
164.72
148.08
147.82
132.59
120.22
111.27
110.93
64.21
57.71
55.45
55.38
41.53
26.43
14.20
12.50
OMe
OMe
O
N
NH
O
S
O
O
NH2
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (мд)

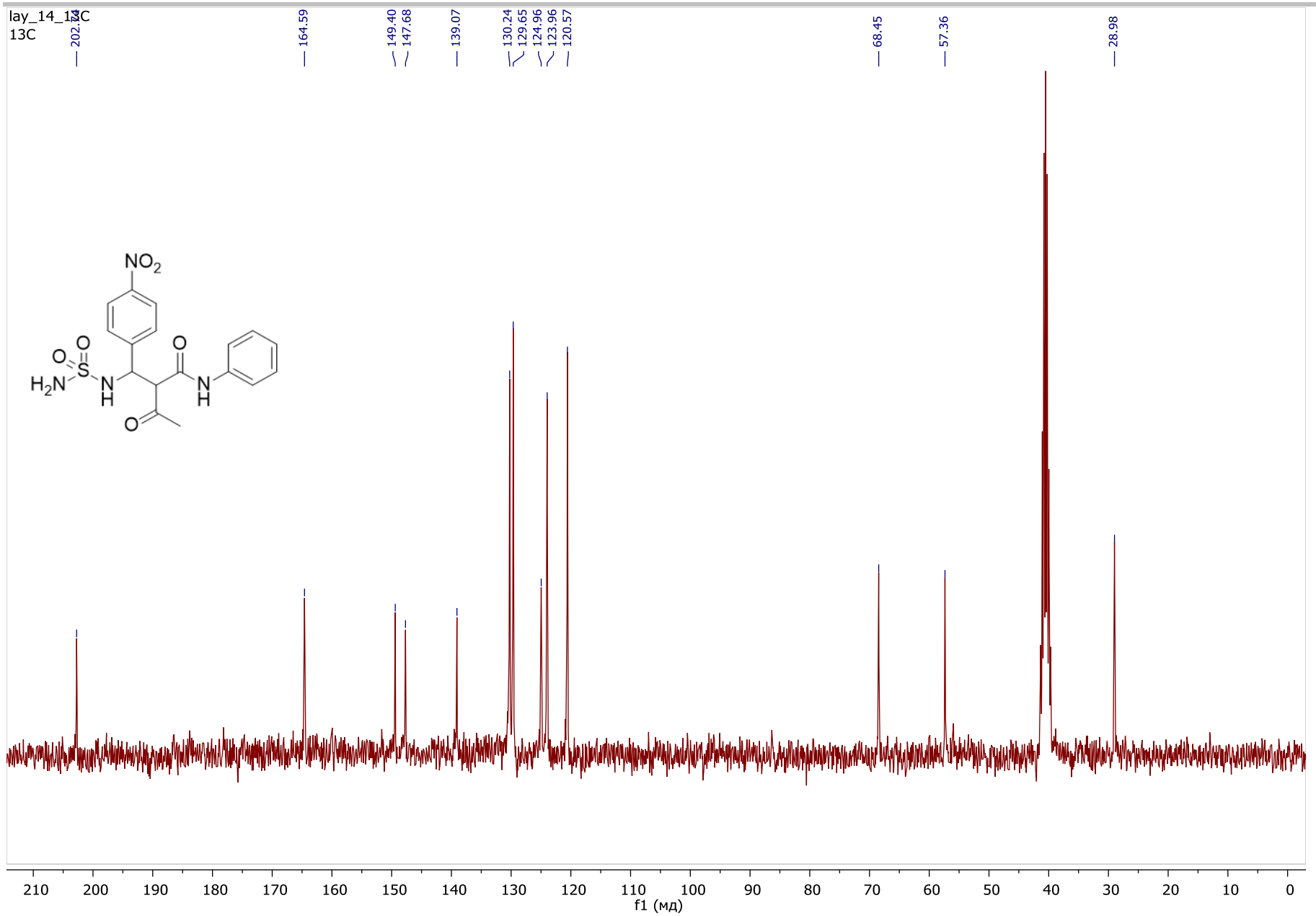
**$^{1}$H and $^{13}$C NMR spectra of the compound 8dd**



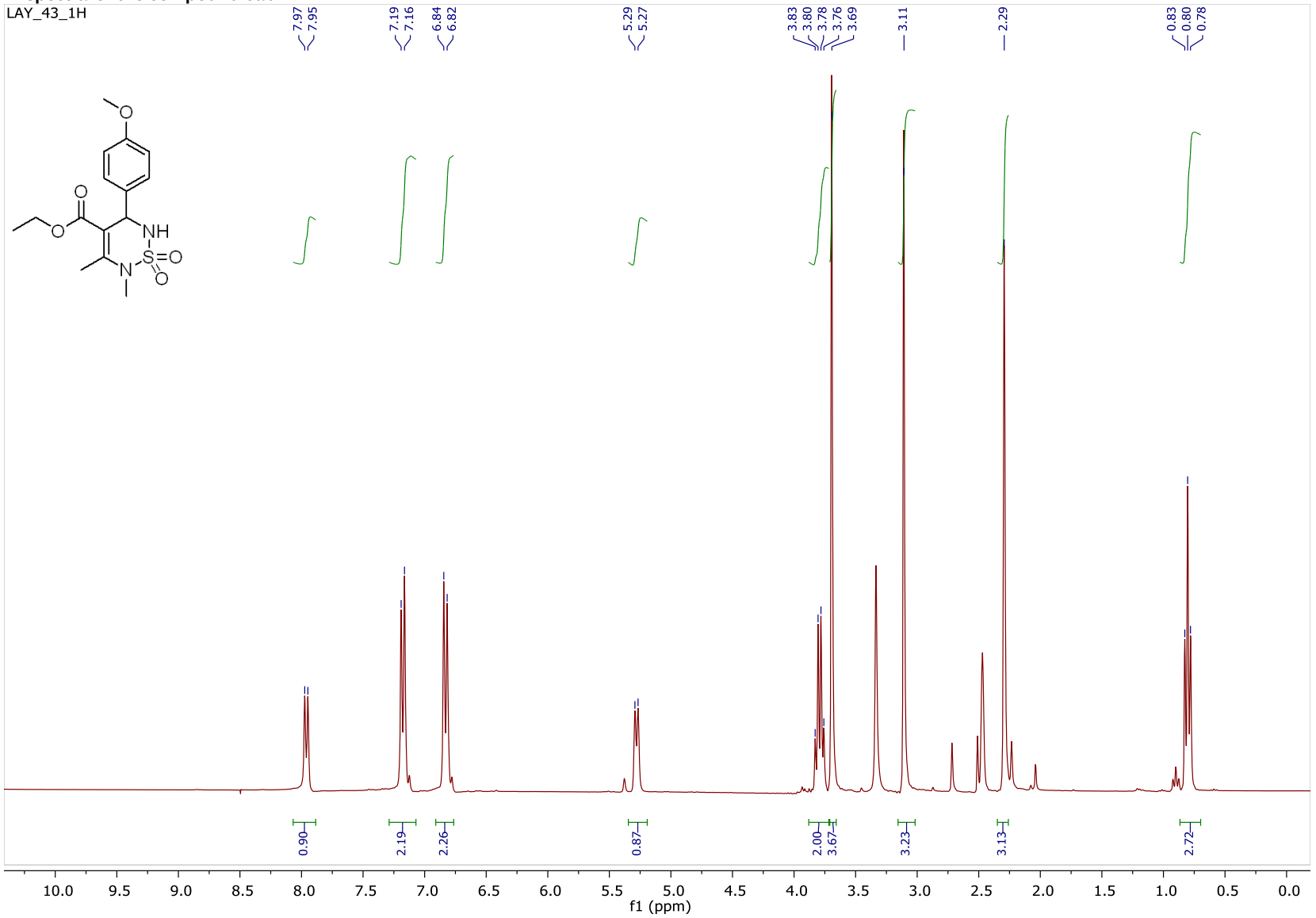

LAY_A1_13C
13C
202.11
164.28
140.40
138.63
131.07
130.47
129.04
124.29
120.83
120.00
68.42
56.90
28.27
Br
O
N
H
NH
S
O
O
NH2
O
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

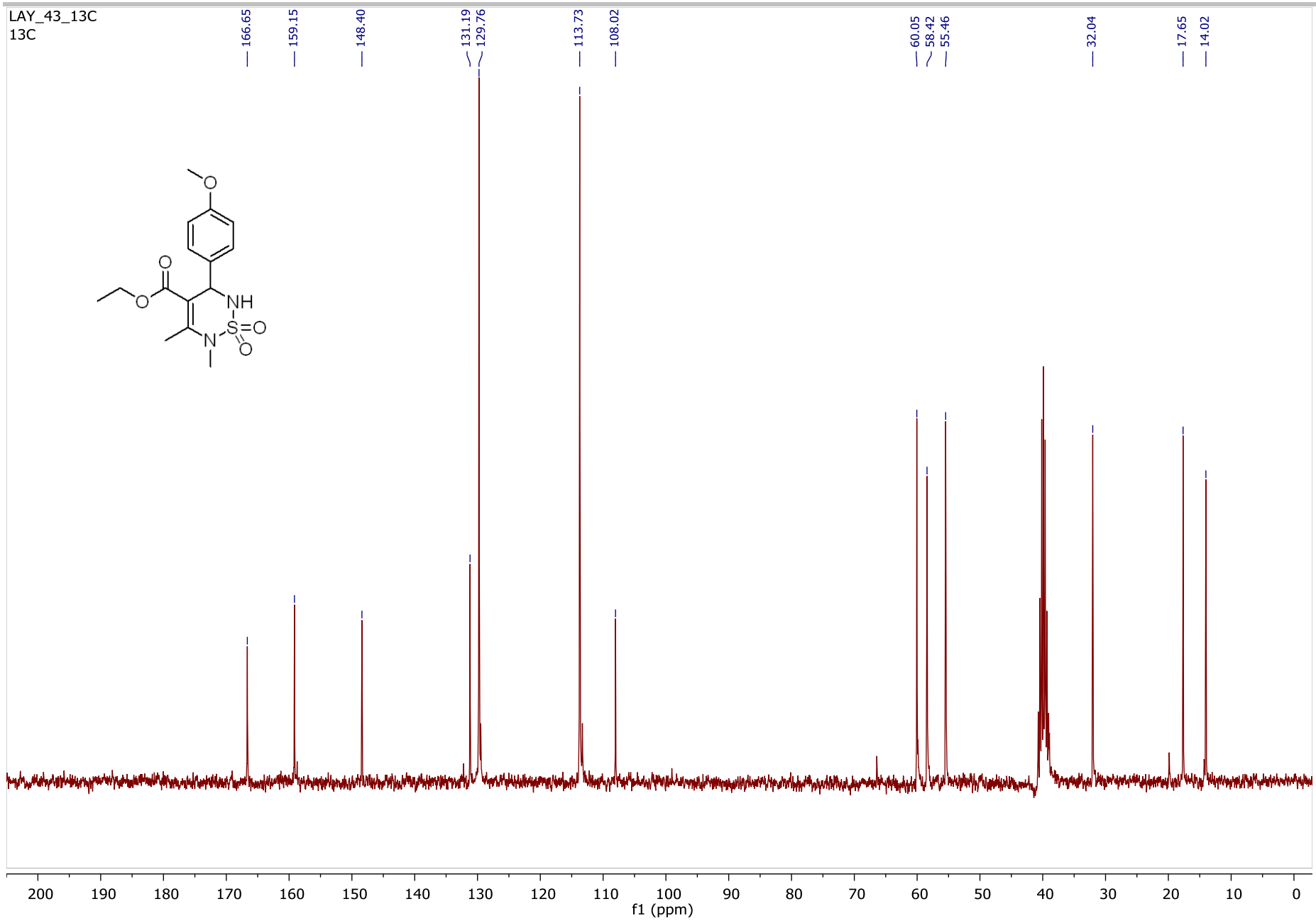
**$^{1}$H and $^{13}$C NMR spectra of the compound 8de**



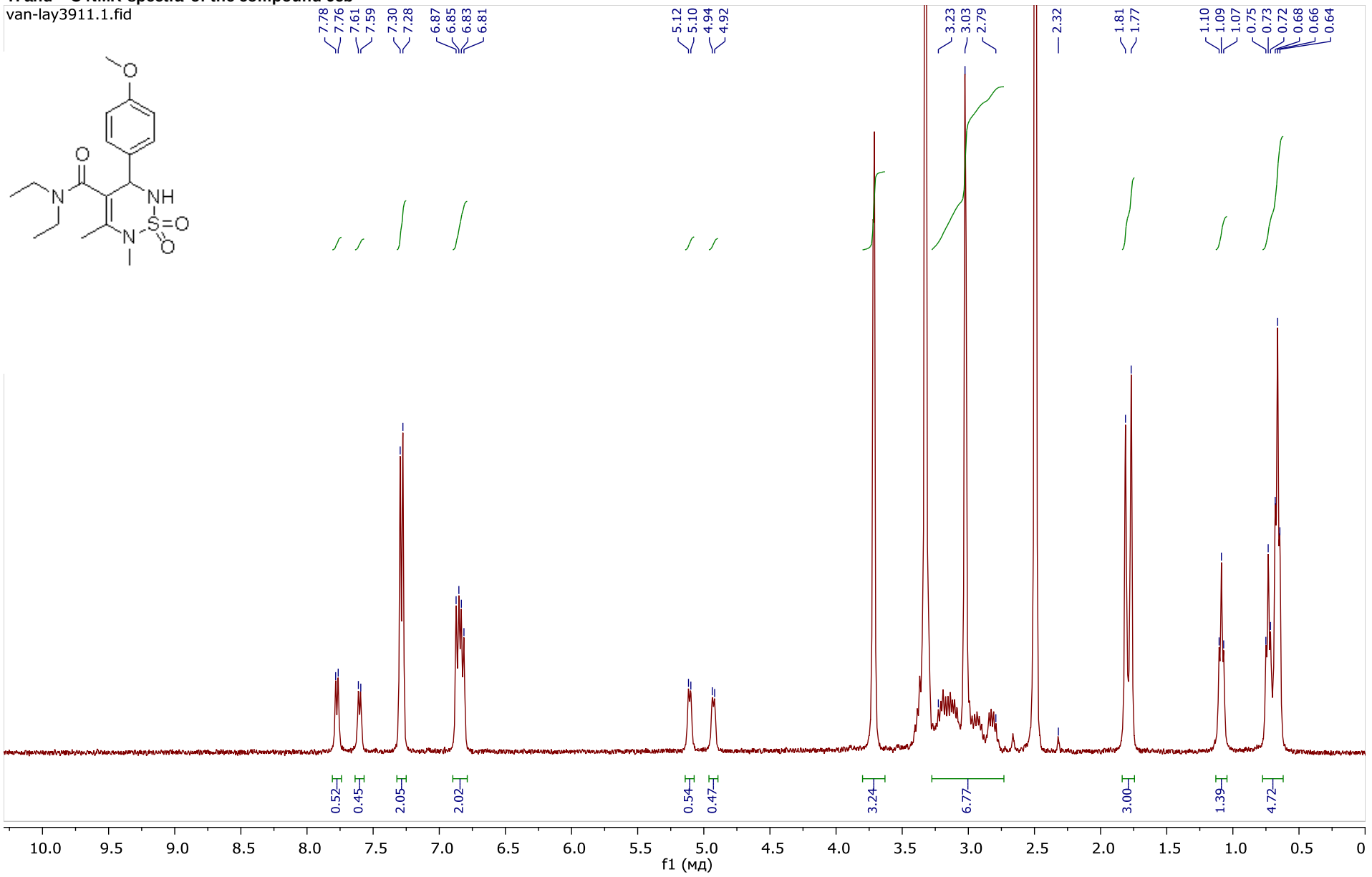

lay_14_13C
13C
202.74
164.59
149.40
147.68
139.07
130.24
129.65
124.96
123.96
120.57
68.45
57.36
28.98
NO2
H2N
S
O
N
H
O
O
O
N
H
O
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (мд)

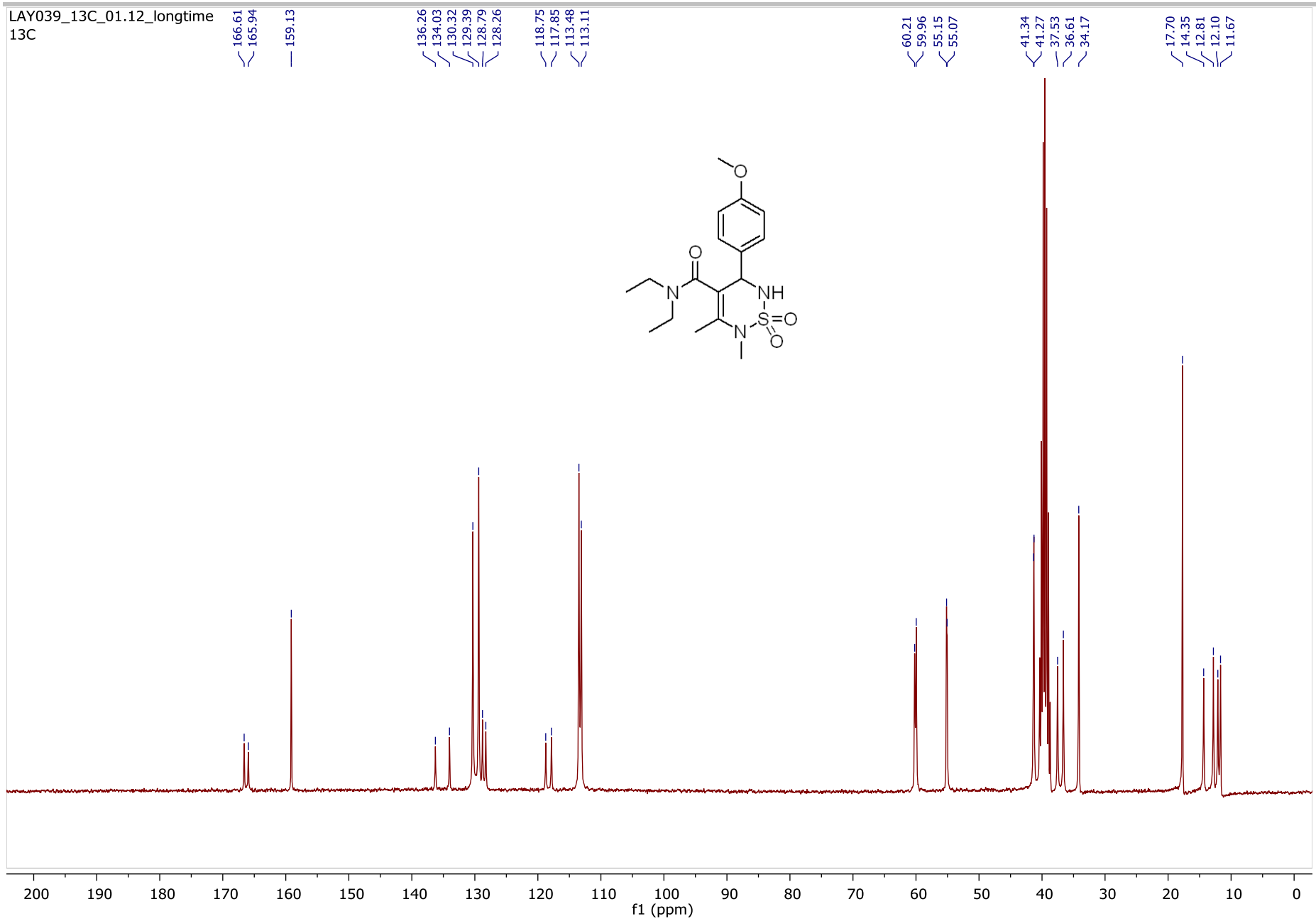
**$^{1}$H and $^{13}$C NMR spectra of the compound 9ab**



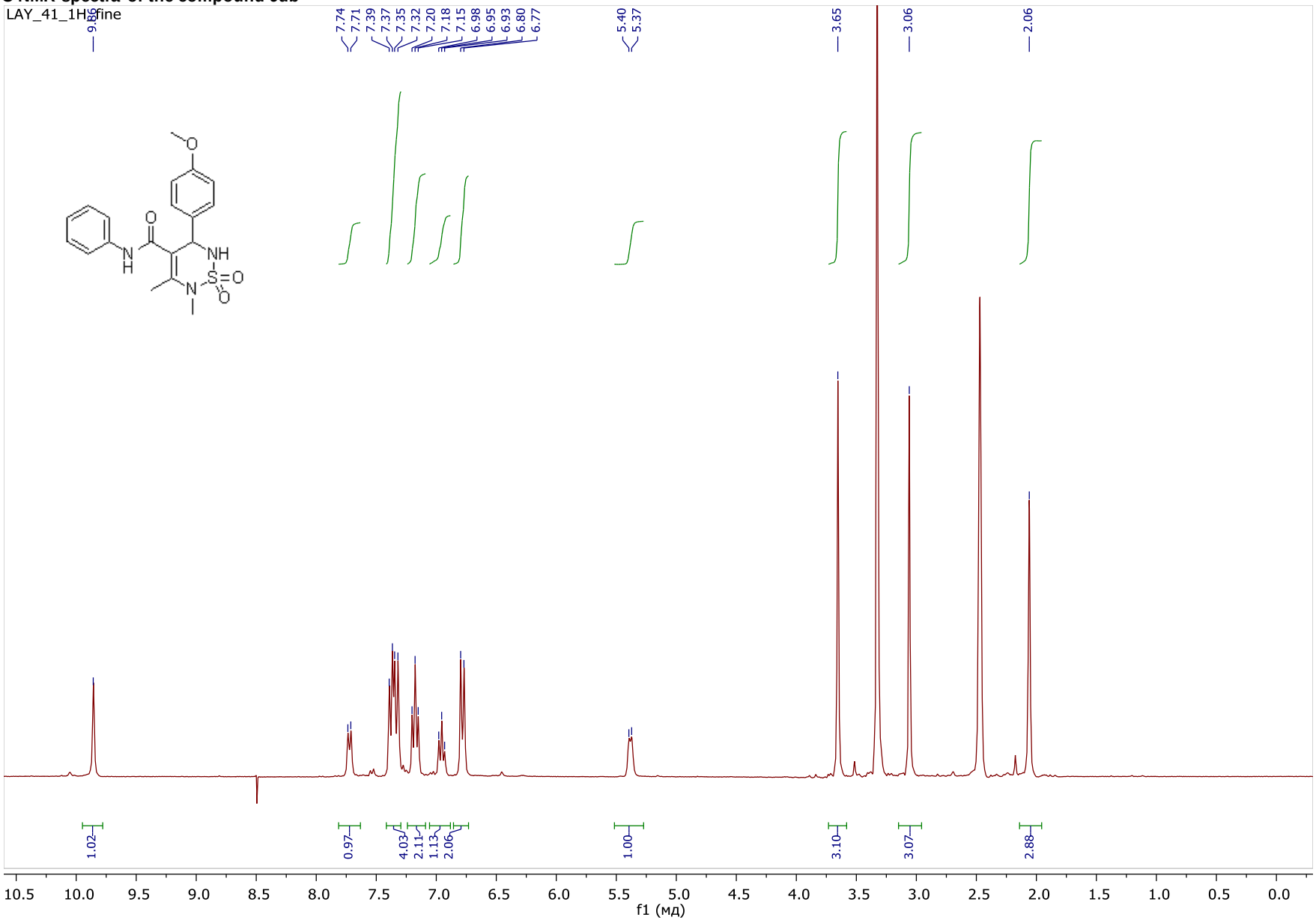

LAY_43_13C
13C
166.65
159.15
148.40
131.19
129.76
113.73
108.02
60.05
58.42
55.46
32.04
17.65
14.02
NH
S
O
N
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

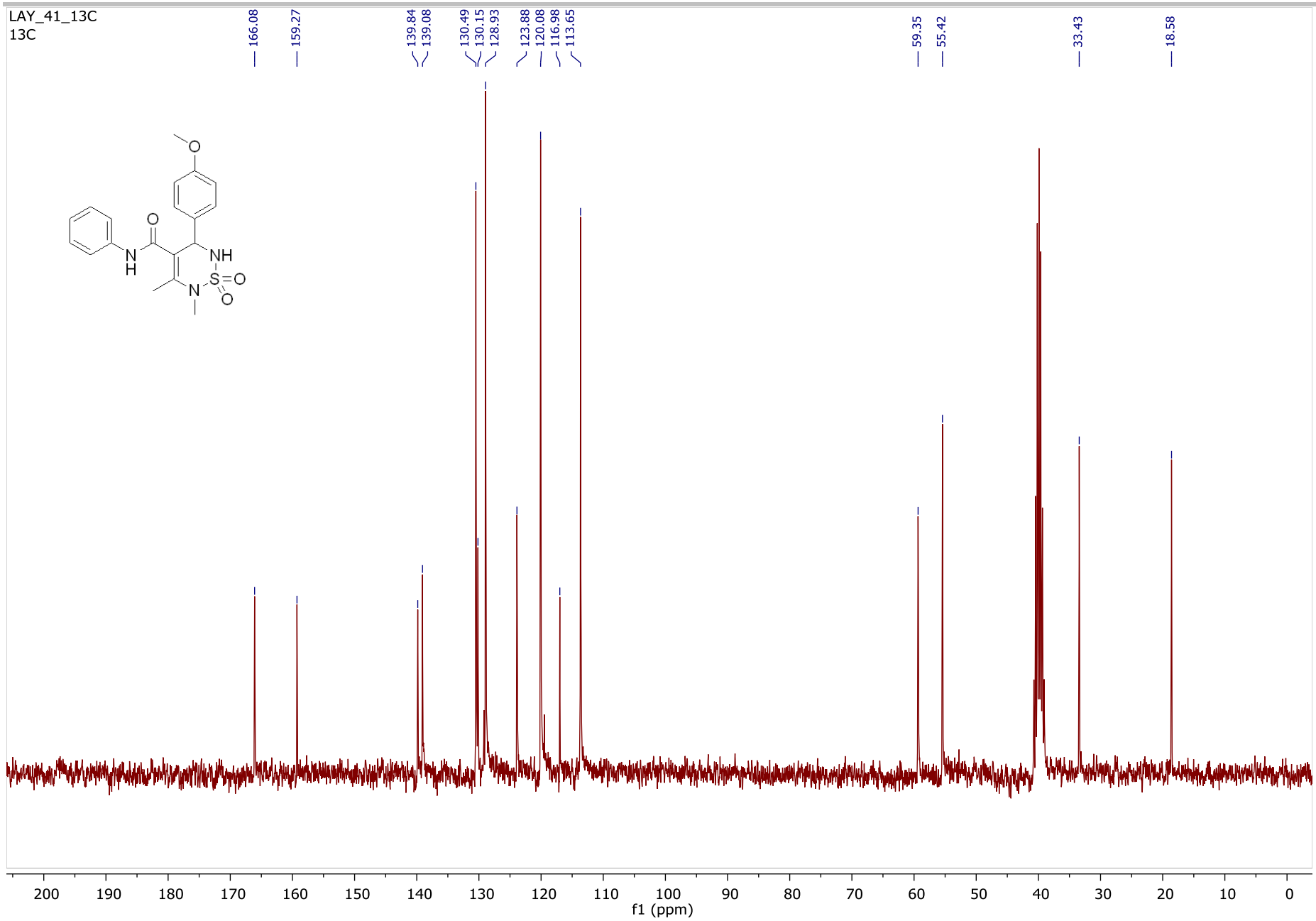
**$^{1}$H and $^{13}$C NMR spectra of the compound 9cb**



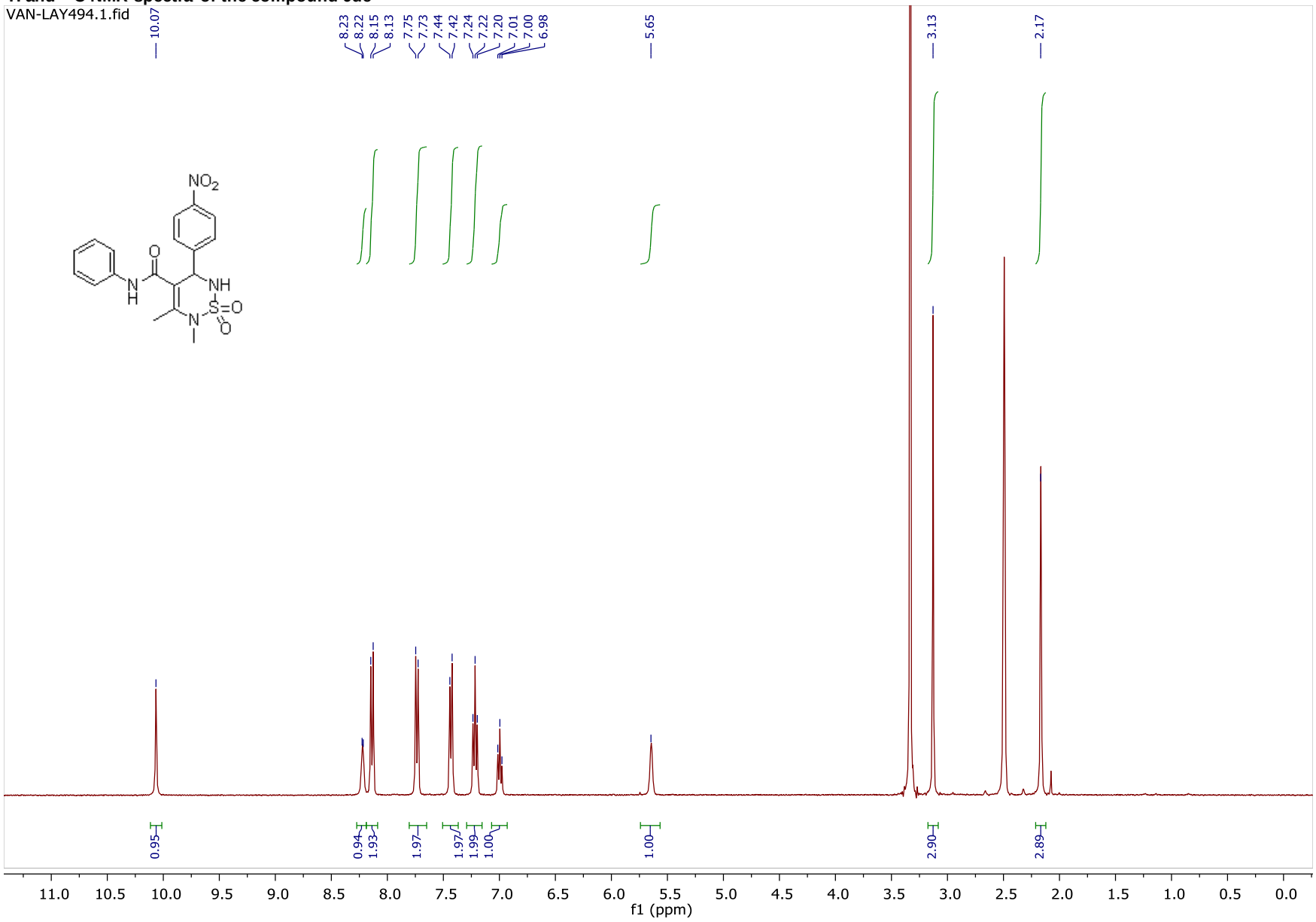

LAY039_13C_01.12_longtime
13C
166.61
165.94
159.13
136.26
134.03
130.32
129.39
128.79
128.26
118.75
117.85
113.48
113.11
60.21
59.96
55.15
55.07
41.34
41.27
37.53
36.61
34.17
17.70
14.35
12.81
12.10
11.67
O
O
N
NH
S=O
O
N
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

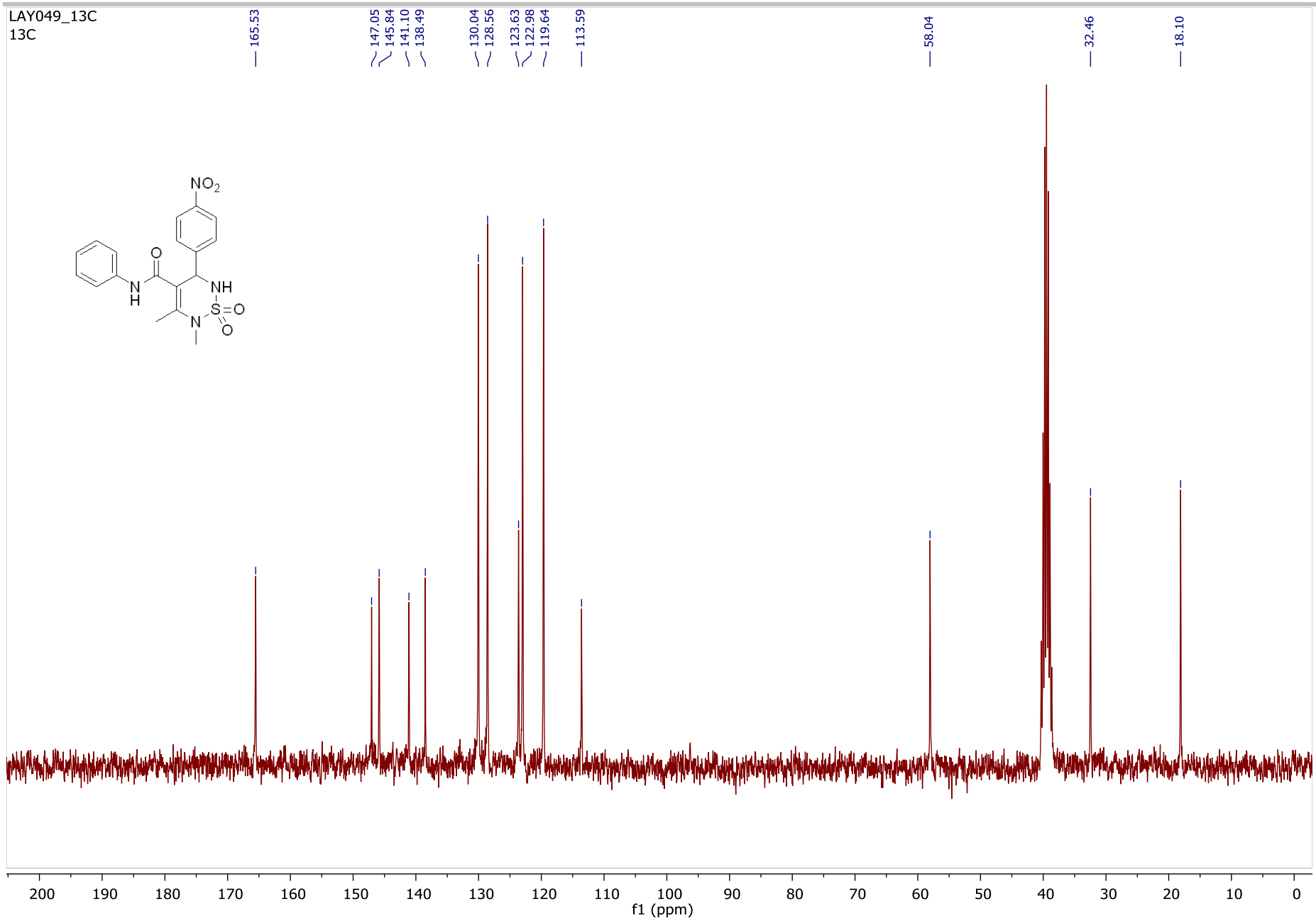
**$^{1}$H and $^{13}$C NMR spectra of the compound 9db**



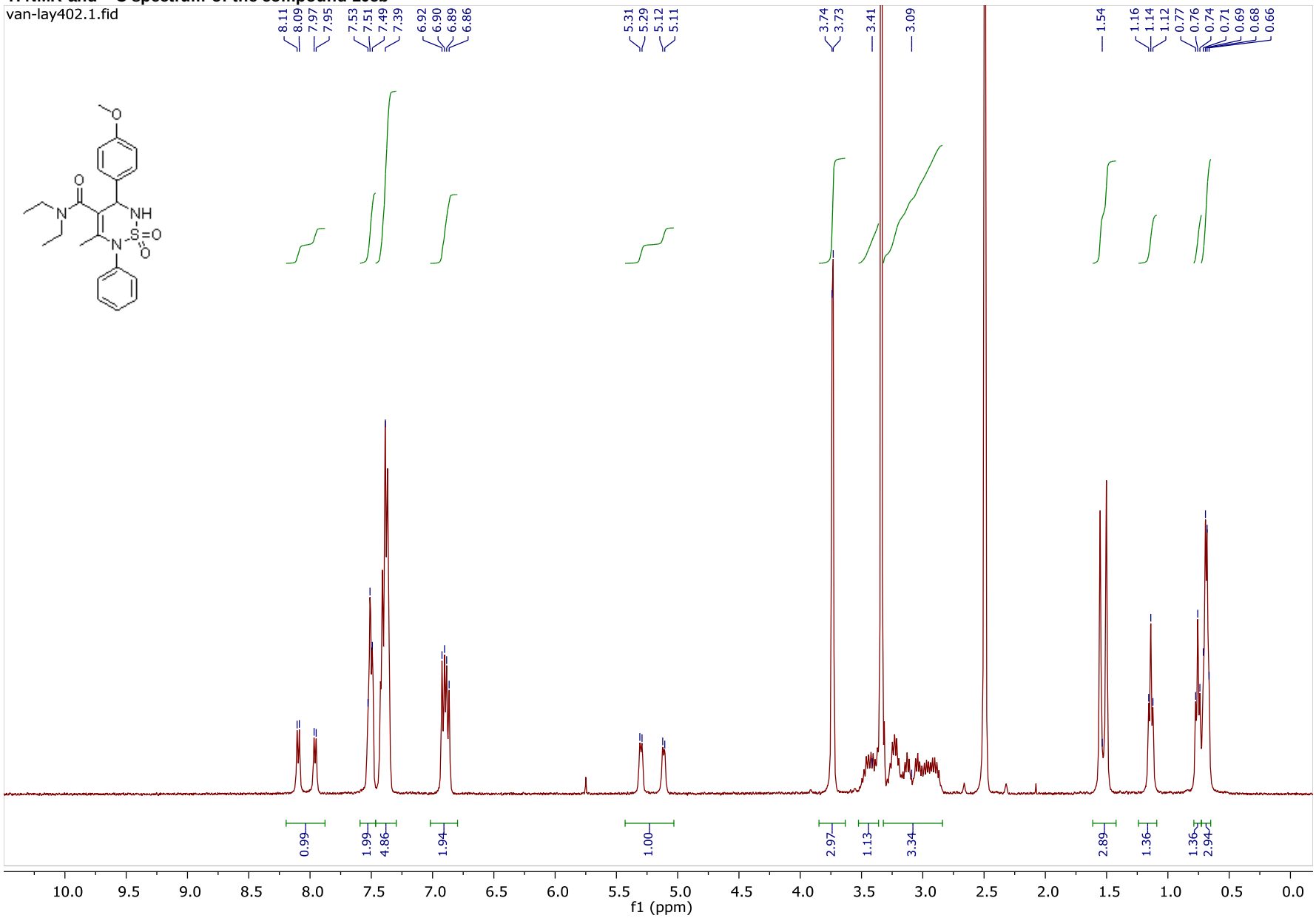

LAY_41_13C
13C
166.08
159.27
139.84
139.08
130.49
130.15
128.93
123.88
120.08
116.98
113.65
59.35
55.42
33.43
18.58
O
O
N
H
NH
S
O
O
N
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

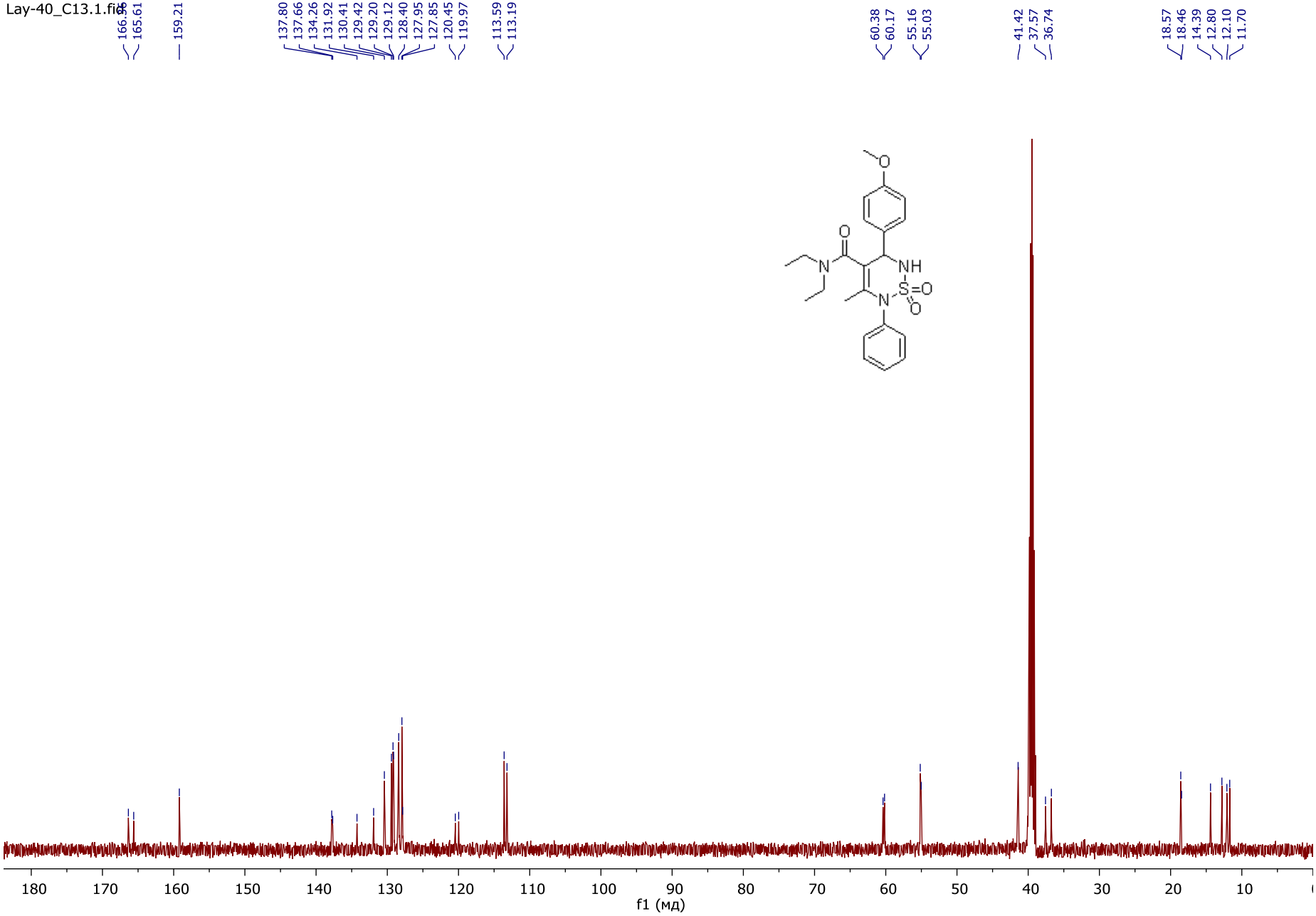
**$^{1}$H and $^{13}$C NMR spectra of the compound 9de**



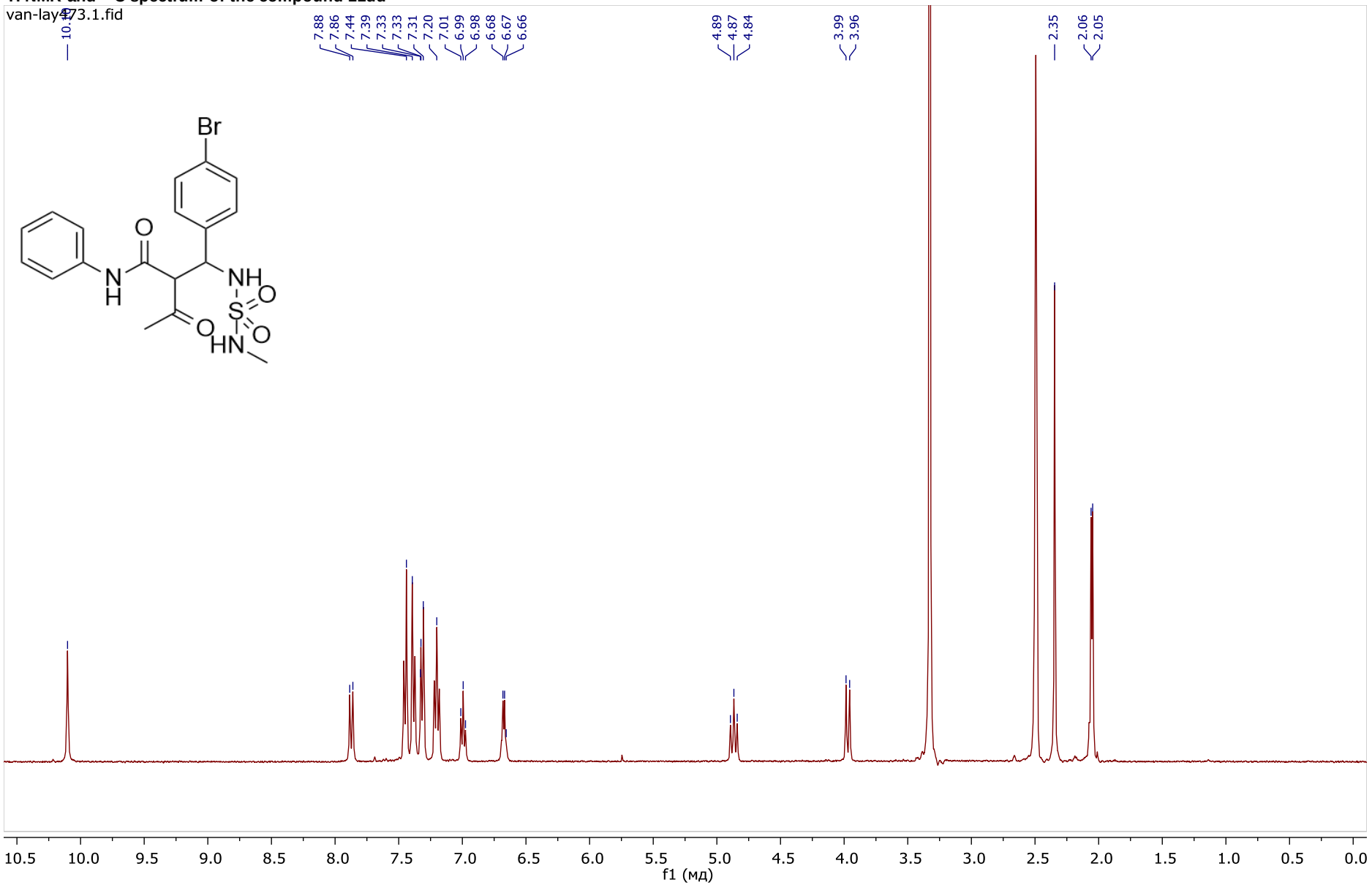

LAY049_13C
13C
165.53
147.05
145.84
141.10
138.49
130.04
128.56
123.63
122.98
119.64
113.59
58.04
32.46
18.10
NO2
O
N
H
NH
S
O
O
N
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

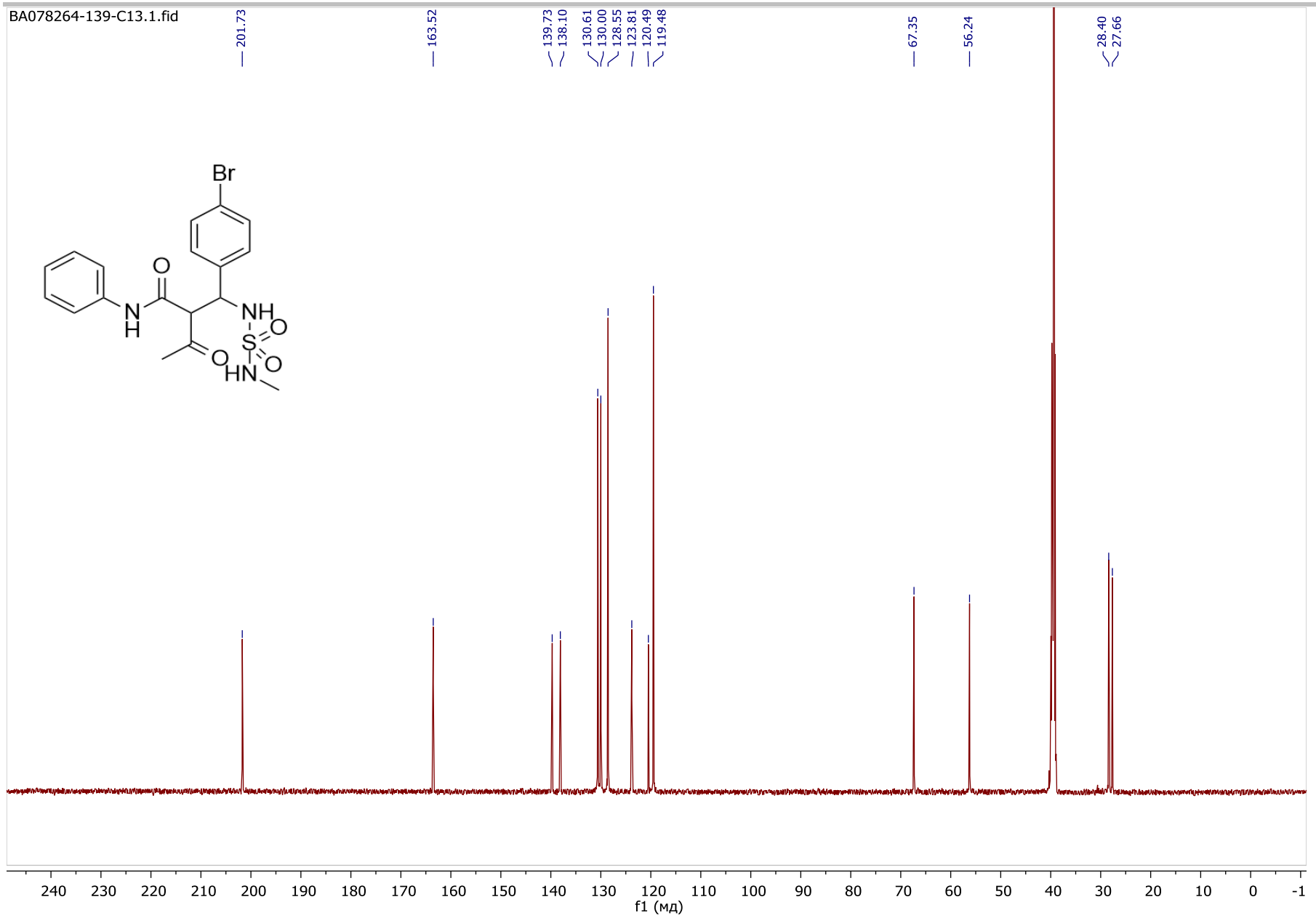
**$^{1}$H NMR and $^{13}$C spectrum of the compound 10cb**



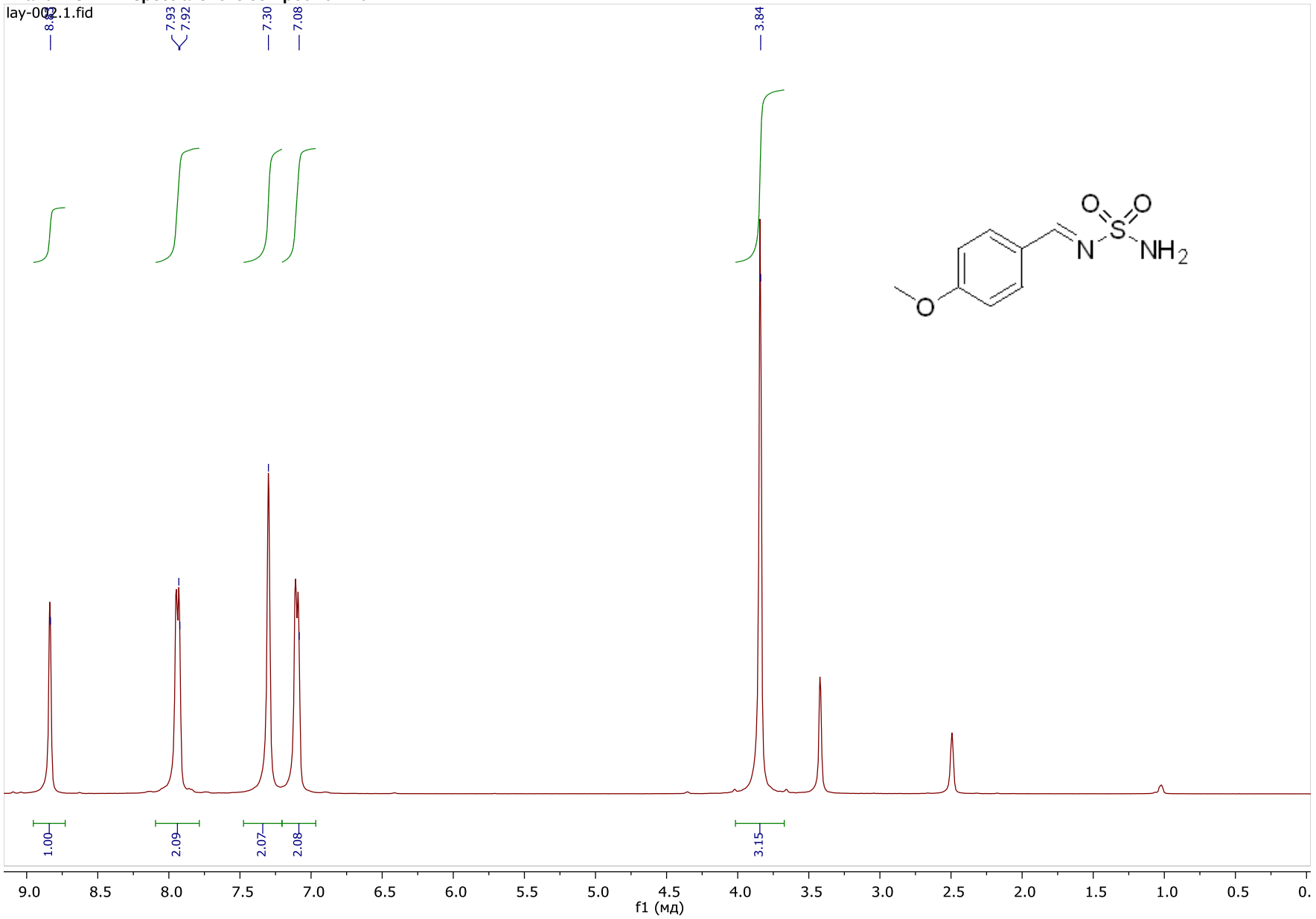

Lay-40_C13.1.fid
166.36
165.61
159.21
137.80
137.66
134.26
131.92
130.41
129.42
129.20
129.12
128.40
127.95
127.85
120.45
119.97
113.59
113.19
60.38
60.17
55.16
55.03
41.42
37.57
36.74
18.57
18.46
14.39
12.80
12.10
11.70
O
O
N
NH
S
O
O
N
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (мд)

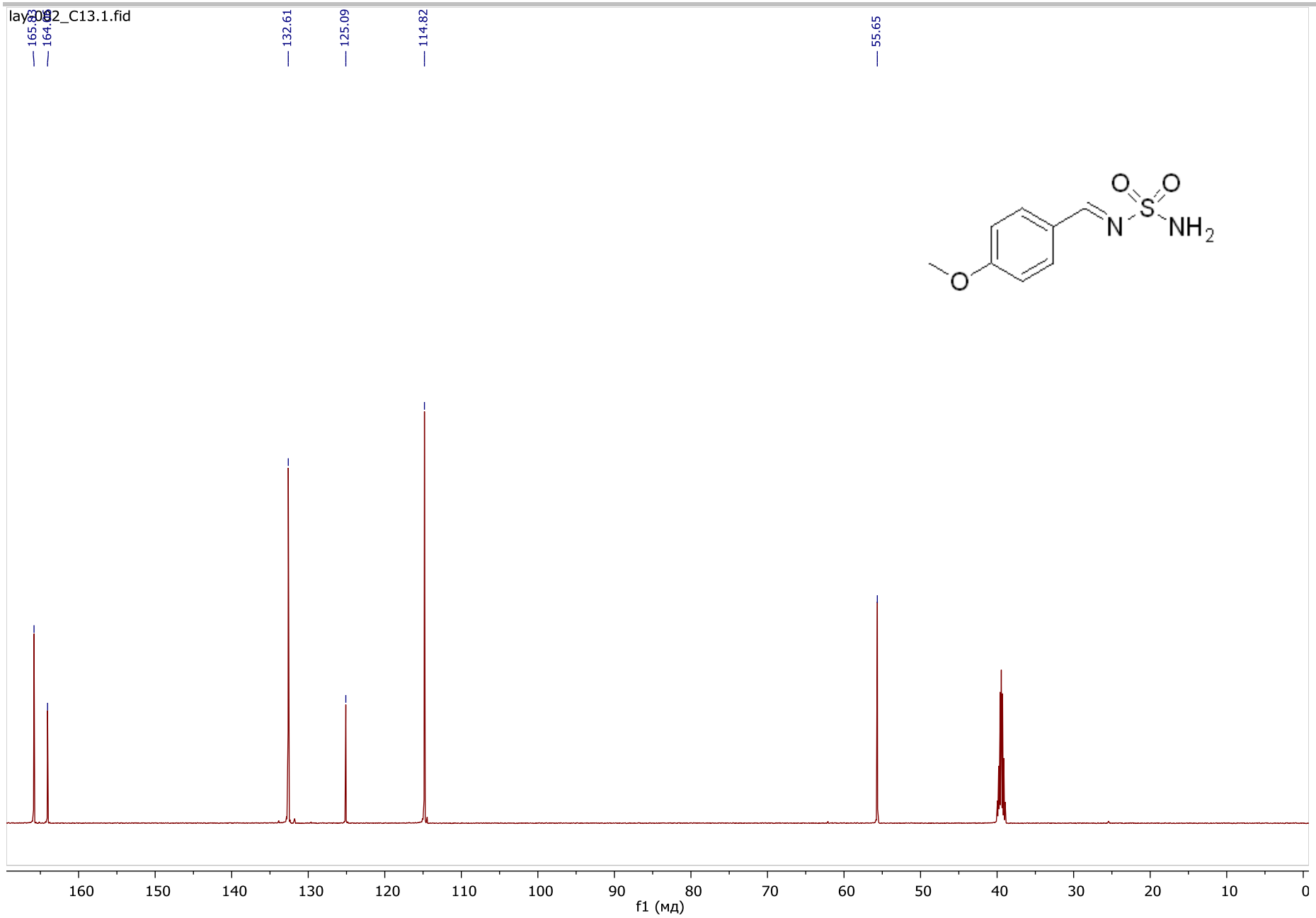
**$^{1}$H NMR and $^{13}$C spectrum of the compound 11dd**



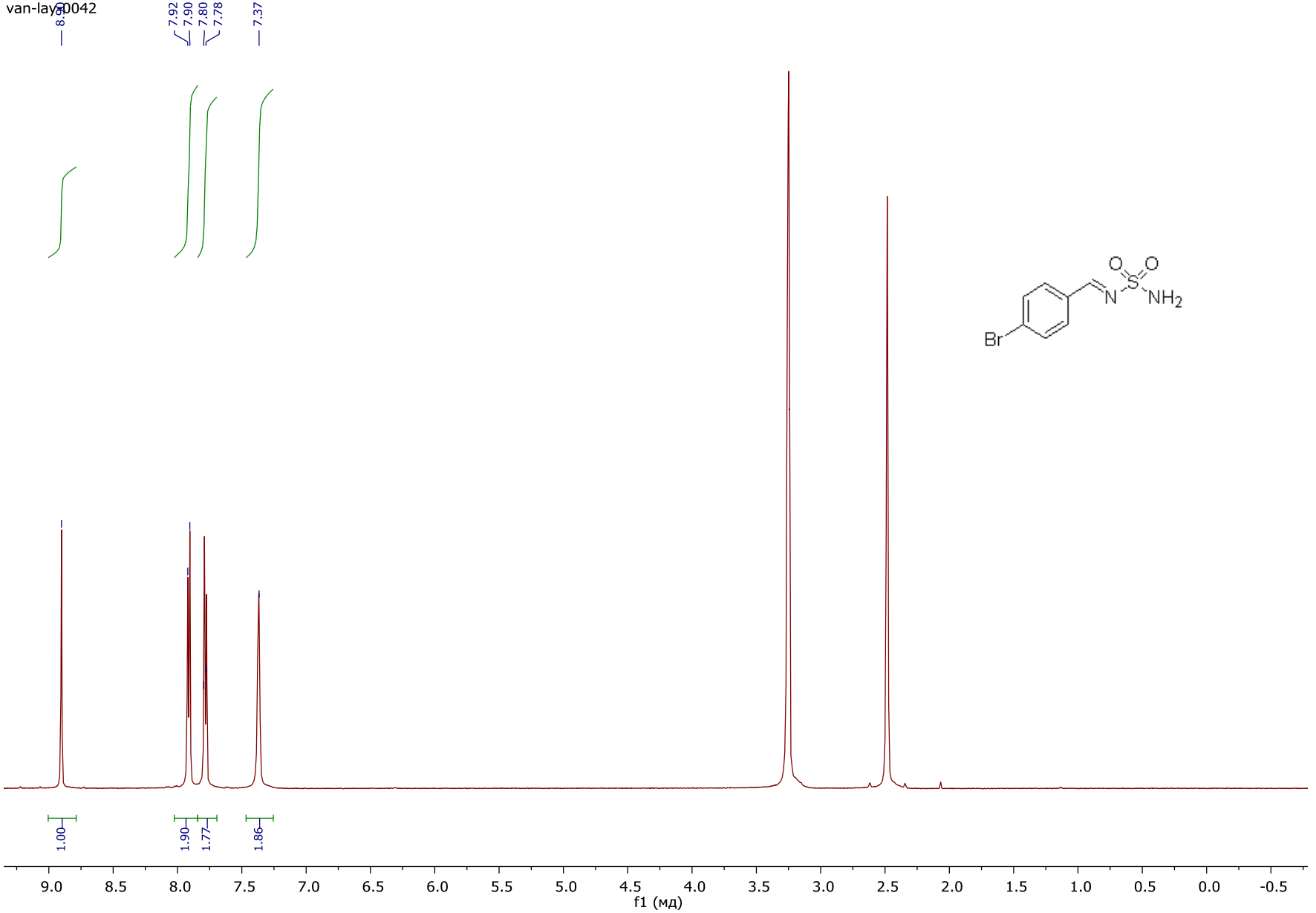

BA078264-139-C13.1.fid
201.73
163.52
139.73
138.10
130.61
130.00
128.55
123.81
120.49
119.48
67.35
56.24
28.40
27.66
Br
O
N
H
NH
O
S
O
O
HN
240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -1
f1 (мд)

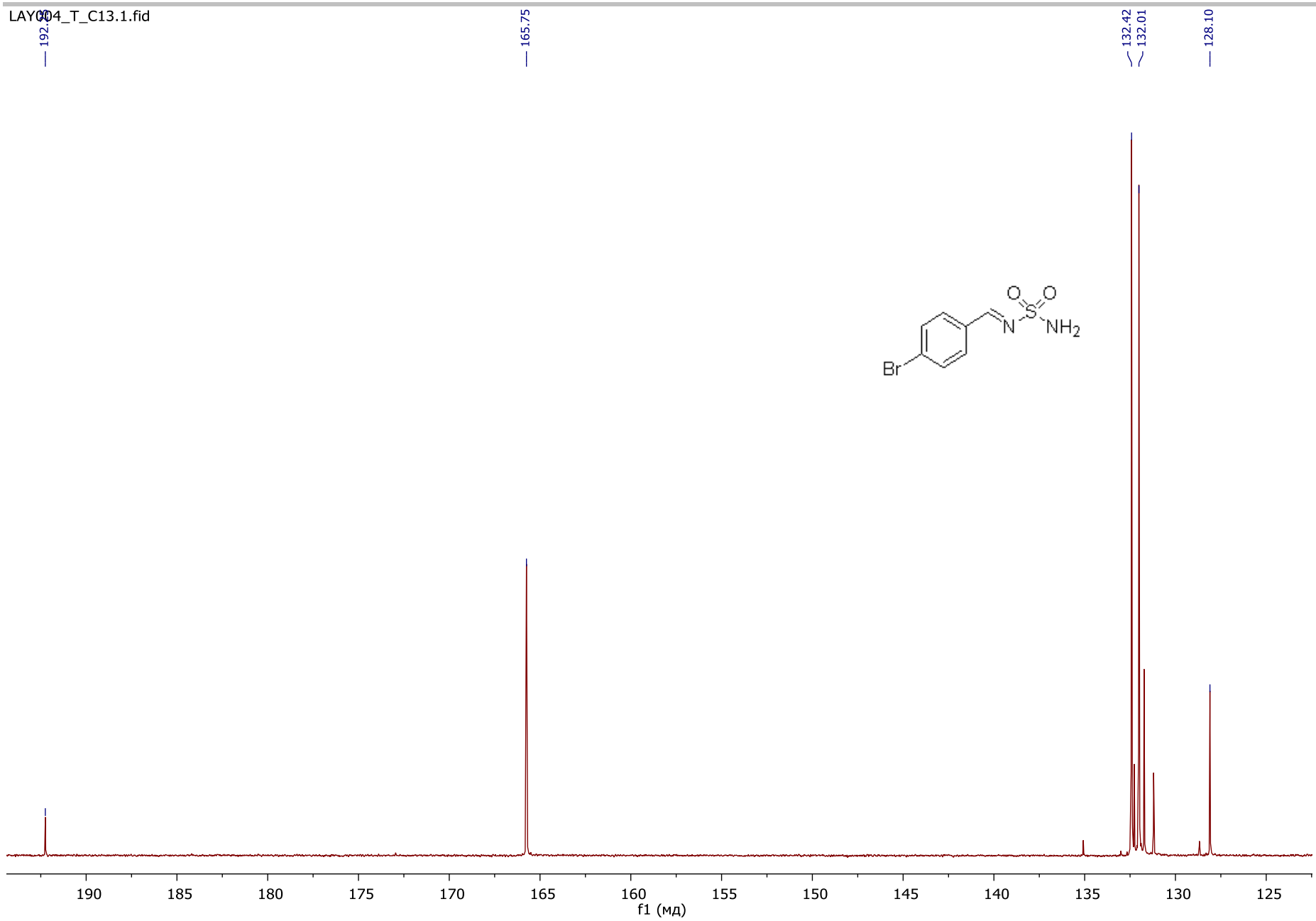
**$^{1}$H and $^{13}$C NMR spectra of the compound 12b**



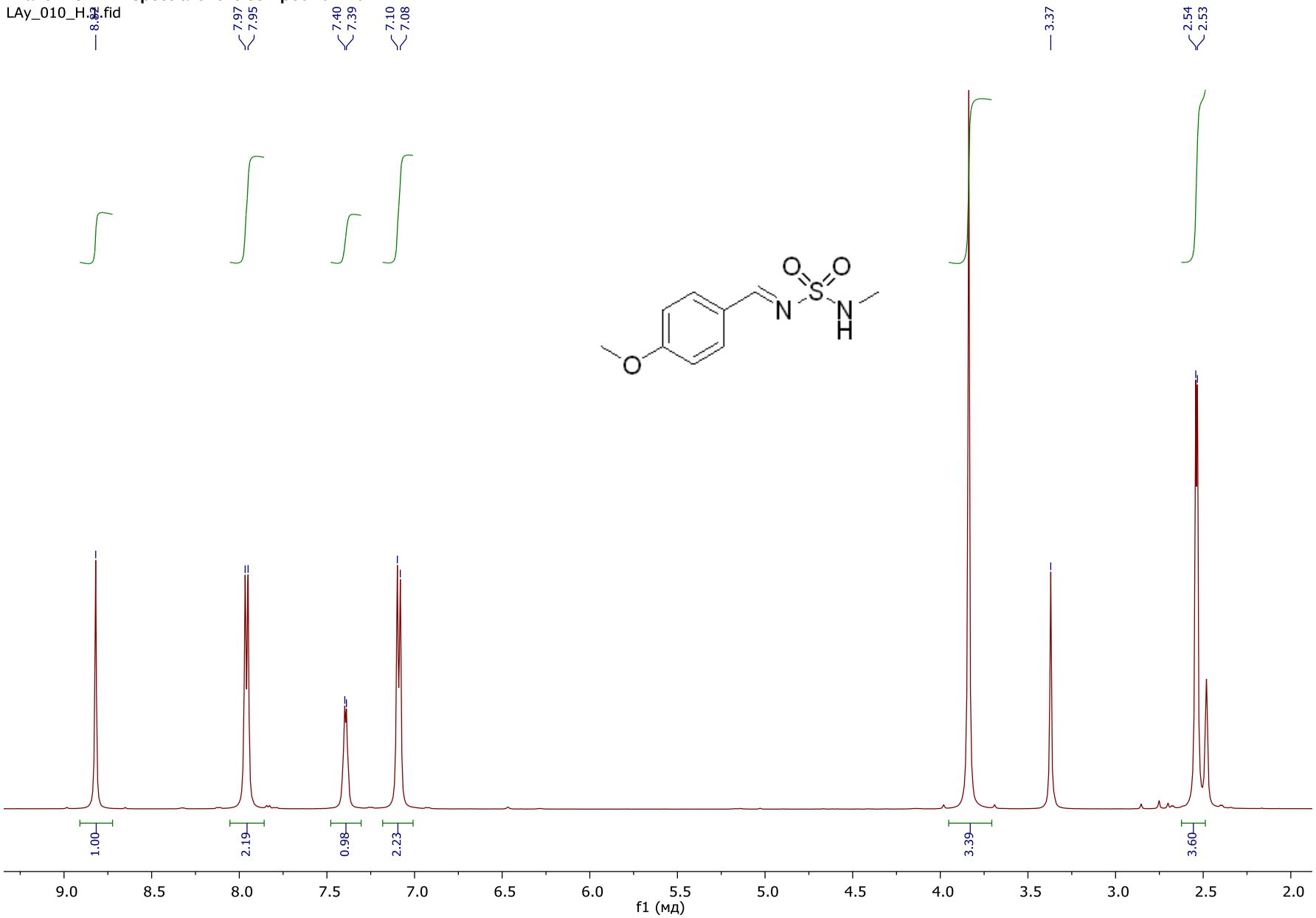

lay-092_C13.1.fid
165.80
164.82
132.61
125.09
114.82
55.65
O
O
S
N
NH2
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (мд)

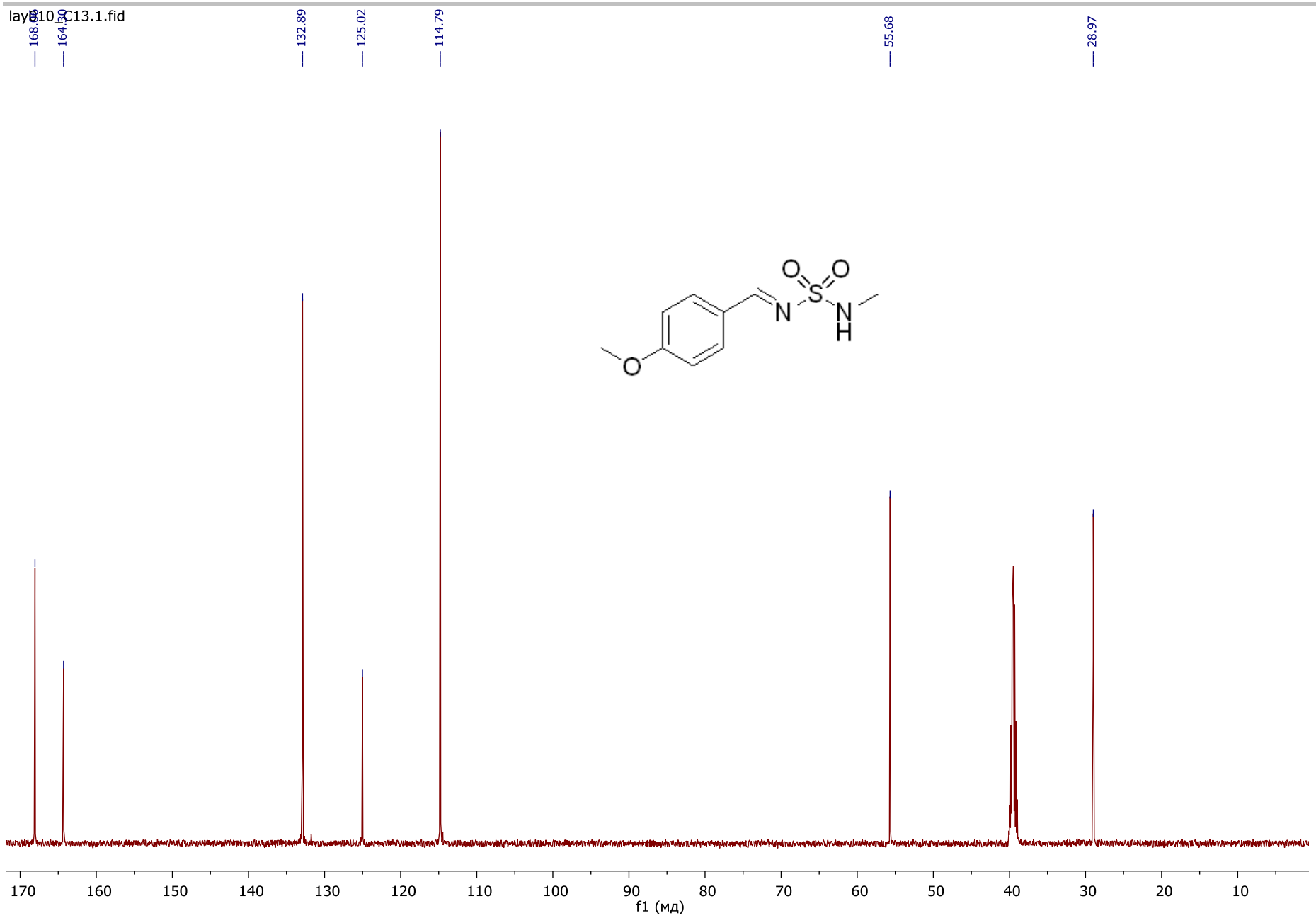
**$^{1}$H and $^{13}$C NMR spectra of the compound 12d**



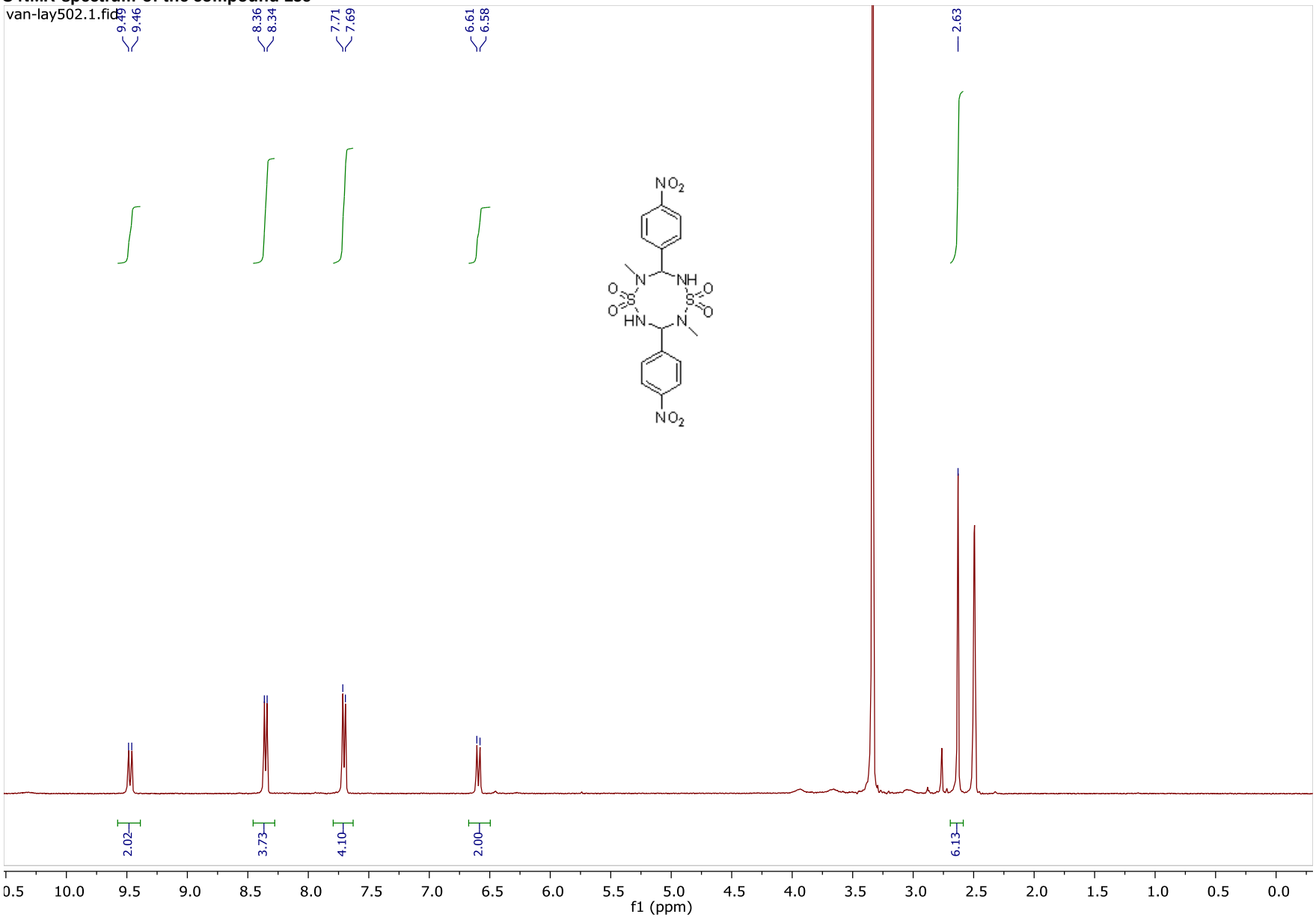

LAY004_T_C13.1.fid
192.
165.75
132.42
132.01
128.10
O
O
S
N
NH2
Br
190
185
180
175
170
165
160
155
150
145
140
135
130
125
f1 (мд)

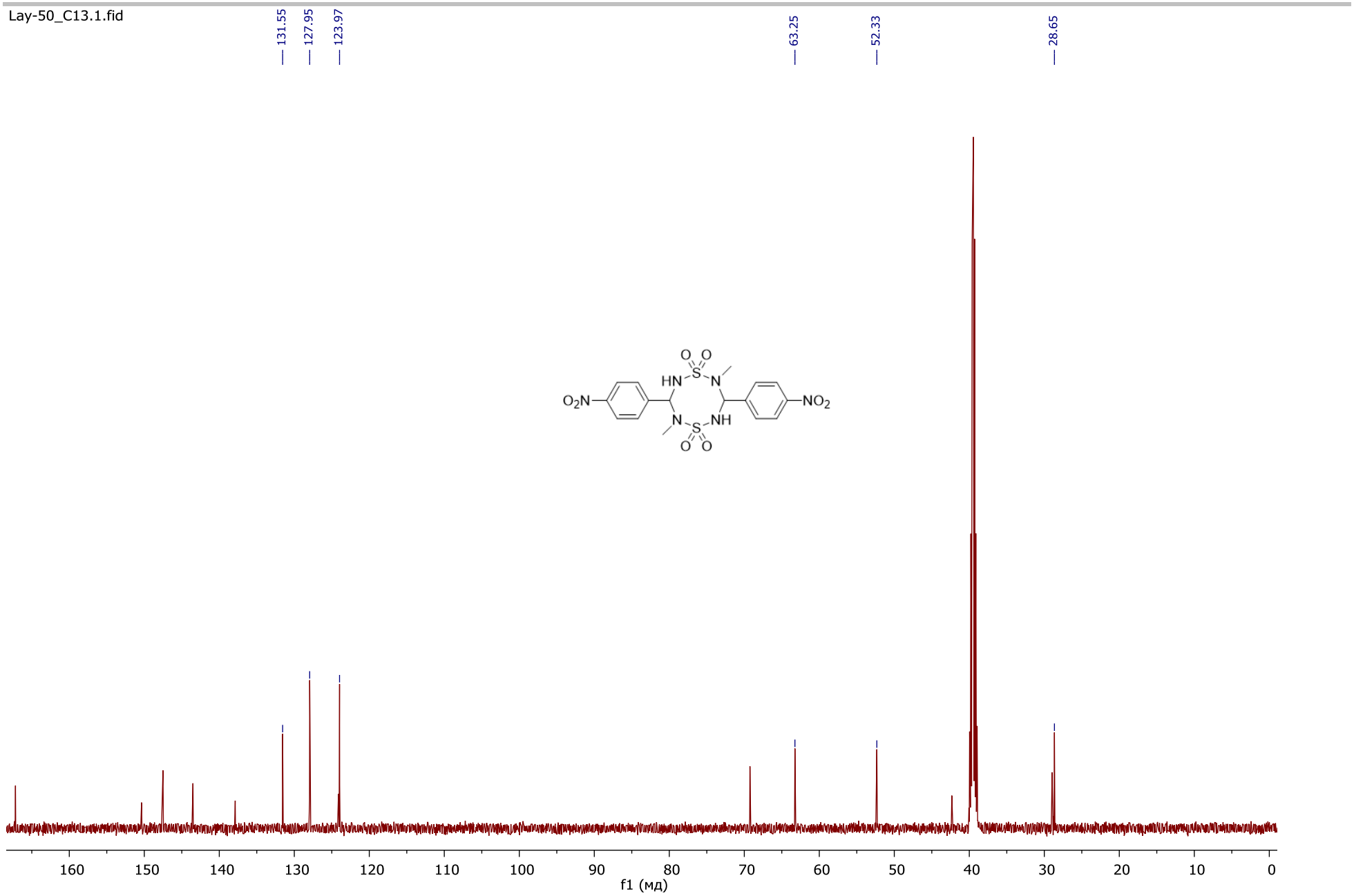
**$^{1}$H and $^{13}$C NMR spectra of the compound 14b**




layB10_C13.1.fid
168.61
164.30
132.89
125.02
114.79
55.68
28.97
O
O
S
N
N
H
O
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (мд)

**$^{1}$H and $^{13}$C NMR spectrum of the compound 15e**




Lay-50_C13.1.fid
131.55
127.95
123.97
63.25
52.33
28.65
O2N
NO2
HN
N
S
NH
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (мд)