

Supporting Information

Thiamine carbene liganded gold (I) chloride catalyzes an efficient aldehyde-alkyne-amine coupling reaction in water

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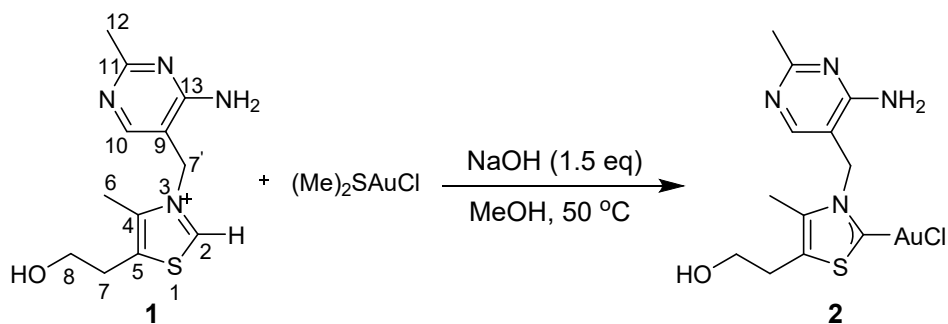
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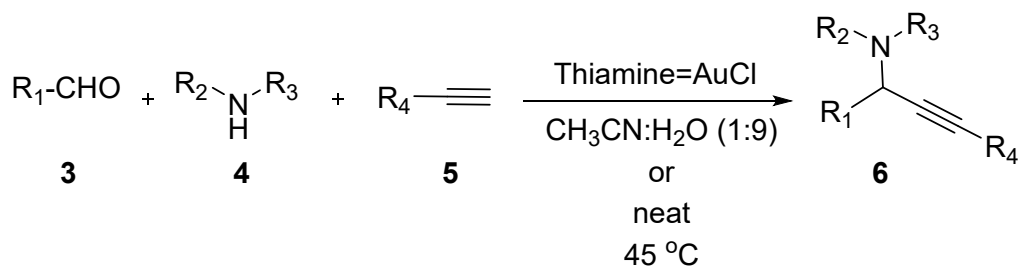
General Considerations: All the solvents were distilled prior to use. Dry solvents were prepared according to the standard procedures. All other reagents were used as received from either Aldrich or TCI. Reactions requiring inert atmosphere were carried out under nitrogen argon atmosphere. ^1H NMR spectra were measured on a Bruker AVANCE 400 MHz spectrometer. Chemical shifts were reported in ppm using tetramethylsilane in CDCl_3 as an internal standard. ^{13}C NMR spectra were recorded on a Bruker 100 MHz spectrometer with complete proton decoupling. Chemical shifts were reported in ppm using the residual solvent as an internal standard. The high-resolution mass spectra (ESI-HRMS) were collected on Agilent MS-TOF or 6540 Q-TOF. Reactions were monitored by thin-layer chromatography (TLC, 0.25 mm) on pre-coated silica gel plates. Flash chromatography was performed with silica gel 60 (particle size 0.040–0.062 mm).

General Procedure A for Synthesis of Thiamine-gold (I) Catalyst



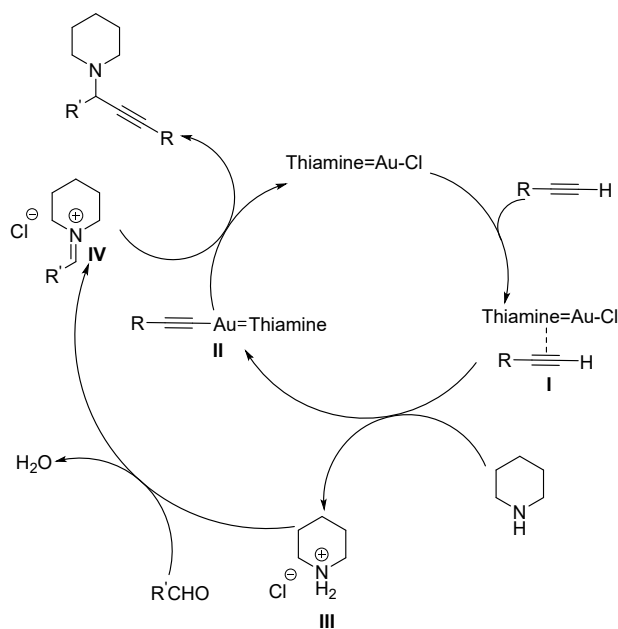
To a stirred solution of thiamine.HCl **1** (100 mg, 1 equiv.) in MeOH (10 mL) at $45\text{ }^\circ\text{C}$ was added NaOH (18 mg, 1.5 equiv. in 1 mL MeOH) under N_2 atmosphere. The reaction mixture was stirred at $50\text{ }^\circ\text{C}$ for 10 min, then added $(\text{Me})_2\text{SAuCl}$ (87 mg, 1 equiv.). Reaction was then stirred 6 h at $50\text{ }^\circ\text{C}$ under N_2 protection. The resulting reaction mixture was passed through a column filled with Amberlite ionic resin to afford thiamine= AuCl (**2**) as light-yellow solid in a yield of 98% (143 mg) after evaporating the solvent. ^1H NMR (400 MHz, $\text{DMSO}-d_6$): δ 7.61 (s, 2H), 7.26 (s, 1H), 5.53 (s, 2H), 3.58 (d, $J = 0.4\text{ Hz}$, 2H), 2.90 (t, $J = 0.4\text{ Hz}$, 2H), 2.36 (s, 3H), 2.29 (s, 3H); ^{13}C NMR (100 MHz, $\text{DMSO}-d_6$): δ 190.3, 160.9, 141.4, 134.3, 108.1, 60.1, 52.5, 30.0, 24.2, 12.0; ESI-HRMS: calculated for $\text{C}_{12}\text{H}_{18}\text{AuClN}_4\text{OS}$ $[\text{M}+\text{H}]^+$ 497.0477, found 497.0466.

General Procedure B for Synthesis of propargylamines



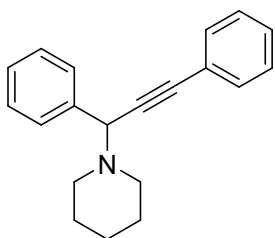
To a stirred solution of aldehyde **3** (1 equiv.), amine **4** (1.1 equiv) and Thiamine=AuCl (0.02 equiv.) in CH₃CN:H₂O (1:9, 2 mL) was added alkyne **5** (1.1 equiv.) at 45 °C. The reaction was carried out at 45 °C and monitored by GCMS and TLC. After complete conversion, the reaction mixture was cooled to room temperature and the solvent was removed under reduced pressure. The crude product was diluted with ethyl acetate (10 mL), washed with saturated NaHCO₃ solution (1 × 10 mL). The aqueous layer was separated and extracted with EtOAc (3 × 15 mL). The organic layer was dried over anhydrous Na₂SO₄, filtered and concentrated under reduced pressure to give crude product. The crude product was purified by column chromatography over silica gel using EtOAc/hexane to give the product **6**.

A reaction mechanism is proposed for the synthesis of propargylamines catalyzed by Thiamine=AuCl, as shown below:



Scheme S1. Proposed mechanism for the catalysis by Thiamine=AuCl.

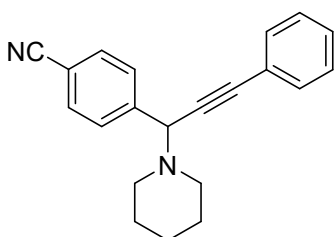
Preparation of compound 6a: Following the general procedure B, the reaction of benzaldehyde



3a (100 mg, 0.98 mmol) with piperidine 4a (83 mg, 1 mmol) and phenylacetylene 5a (106 mg, 1 mmol) was catalyzed by thiamine=AuCl (10 mg, 0.019 mmol) at 45 °C for 3.5 h to afford compound 6a (228 mg, 88% yield), as a white solid. TLC: R_f 0.40 (5% EtOAc in hexane); ^1H NMR (400 MHz, CDCl_3): δ 7.53-7.56 (m, 2H), 7.41-7.44 (m, 2H), 7.18-

7.29 (m, 6H), 4.70 (t, 1H), 2.47 (t, $J = 5.2$ Hz, 4H), 1.48-1.55 (m, 4H), 1.35-1.37 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 138.7, 131.9, 128.6, 128.4, 128.1, 127.5, 123.4, 87.9, 86.2, 62.5, 50.8, 26.3, 24.5; ESI-HRMS: calculated for $\text{C}_{20}\text{H}_{22}\text{N}[\text{M}+\text{H}]^+$ 276.1752, found 276.1748.

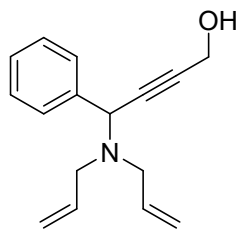
Preparation of compound 6b: Following the general procedure B, the reaction of *p*-CN-



benzaldehyde 3b (100 mg, 0.76 mmol) with piperidine 4a (71 mg, 0.83 mmol) and phenylacetylene 5a (85 mg, 0.83 mmol) was catalyzed by thiamine=AuCl (8 mg, 0.016 mmol) at 45 °C for 5 h to afford compound 6b (195 mg, 86% yield) as a white solid. TLC: R_f 0.30 (10% EtOAc in hexane); ^1H NMR (400 MHz, CDCl_3): δ 7.77-

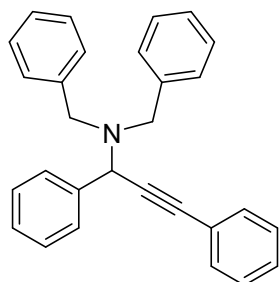
7.80 (m, 2H), 7.64-7.66 (m, 2H), 7.51-7.53 (m, 2H), 7.34-7.36 (m, 3H), 4.82 (s, 1H), 2.50-2.55 (m, 4H), 1.55-1.65 (m, 4H), 1.44-1.47 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 143.8, 131.3, 131.2, 128.4, 127.8, 127.7, 122.1, 122.1, 118.3, 110.6, 88.3, 83.6, 61.3, 50.1, 25.5, 23.6; ESI-HRMS: calculated for $\text{C}_{21}\text{H}_{21}\text{N}_2[\text{M}+\text{H}]^+$ 301.1704, found 301.1705.

Preparation of compound 6c: Following the general procedure B, the

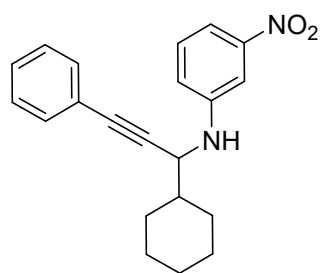


reaction of benzaldehyde 3a (100 mg, 0.94 mmol) with diallylamine 4b (100 mg, 1.03 mmol) and propargyl alcohol 5b (62 mg, 1.03 mmol) was catalyzed by thiamine=AuCl (9 mg, 0.018 mmol) at 45 °C for 7 h to afford compound 6c (177 mg, 78% yield) as a light-yellow color liquid. TLC: R_f 0.25 (10% EtOAc in hexane); ^1H NMR (600 MHz, CDCl_3): δ 7.59-7.61 (m, 2H), 7.33-

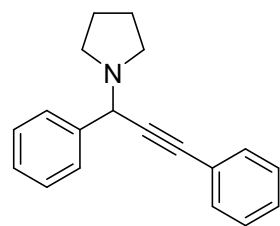
7.34 (m, 2H), 7.25-7.27 (m, 1H), 5.77-5.86 (m, 2H), 5.22-5.27 (m, 2H), 5.12 (d, $J = 6.0$ Hz, 2H), 4.92 (s, 1H), 4.43-4.44 (m, 2H), 3.19-3.22 (m, 2H), 2.97-3.01 (m, 2H); ^{13}C NMR (150 MHz, CDCl_3): δ 136.0, 133.8, 128.7, 128.4, 128.3, 128.2, 127.7, 127.3, 126.9, 126.6, 117.8, 97.3, 95.9, 53.4, 51.3; ESI-HRMS: calculated for $\text{C}_{16}\text{H}_{20}\text{NO}[\text{M}+\text{H}]^+$ 242.1544, found 242.1553.



Preparation of compound 6d: Following the general procedure B, the reaction of benzaldehyde **3a** (50 mg, 0.471 mmol) with dibenzylamine **4c** (102 mg, 0.518 mmol) and phenylacetylene **5a** (53 mg, 0.518 mmol) was catalyzed by thiamine=AuCl (5 mg, 0.009 mmol) at 45 °C for 5 h to afford compound **6d** (164 mg, 90% yield) as a yellow liquid. TLC: R_f 0.30 (2% EtOAc in hexane); $^1\text{H NMR}$ (400 MHz, CDCl_3): δ 7.65 (d, $J = 8.0$ Hz, 2H), 7.55 (d, $J = 8.0$ Hz, 2H), 7.35 (d, $J = 4.0$ Hz, 4H), 7.22-7.31 (m, 9H), 7.12-7.17 (m, 3H), 4.8 (s, 1H), 3.72 (d, $J = 12$ Hz, 2H), 3.46 (d, $J = 16$ Hz, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3): δ 139.7, 139.3, 132.1, 129.1, 128.6, 128.5, 128.4, 128.3, 127.6, 127.2, 123.4, 88.8, 84.9, 56.2, 54.8; **ESI-HRMS:** calculated for $\text{C}_{29}\text{H}_{26}\text{N}[\text{M}+\text{H}]^+$ 388.2065, found 388.2060.



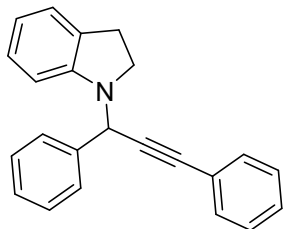
Preparation of compound 6e: Following the general procedure B, the reaction of cyclohexanecarboxaldehyde **3c** (50 mg, 0.44 mmol) with *m*-nitroaniline **4d** (63 mg, 0.48 mmol) and phenylacetylene **5a** (48 mg, 0.48 mmol) was catalyzed by thiamine=AuCl (5 mg, 0.009 mmol) at 45 °C for 3 h to afford compound **6e** (135 mg, 92% yield) as a yellow solid. TLC: R_f 0.30 (5% EtOAc in hexane); $^1\text{H NMR}$ (600 MHz, CDCl_3): δ 7.56-7.58 (m, 2H), 7.36-7.38 (m, 2H), 7.25-7.31 (m, 4H), 6.98-7.00 (m, 1H), 4.20 (d, 2H), 1.95-2.03 (m, 2H), 1.81-1.85 (m, 2H), 1.71-1.79 (m, 2H), 1.19-1.38 (m, 5H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3): δ 149.4, 147.9, 131.8, 129.7, 128.3, 122.8, 119.8, 112.3, 107.8, 87.7, 84.6, 51.7, 42.5, 30.0, 28.9, 26.3, 26.1, 26.0; **ESI-HRMS:** calculated for $\text{C}_{21}\text{H}_{22}\text{N}_2\text{O}_2[\text{M}+\text{Na}]^+$ 357.1578, found 357.1576.



Preparation of compound 6f: Following the general procedure B, the reaction of benzaldehyde **3a** (50 mg, 0.471 mmol) with pyrrolidine **4e** (37 mg, 0.518 mmol) and phenylacetylene **5a** (53 mg, 0.518 mmol) was catalyzed by thiamine=AuCl (5 mg, 0.009 mmol) at 45 °C for 8 h to afford compound **6f** (113 mg, 92% yield) as a white solid. TLC: R_f 0.30 (5% EtOAc in hexane); $^1\text{H NMR}$ (400 MHz, CDCl_3): δ 7.53-7.55 (m, 2H), 7.40-7.42 (m, 2H), 7.28-7.30 (m, 2H), 7.19-7.27 (m, 4H), 4.83 (s, 1H), 2.63 (m, 4H), 1.73 (m, 4H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3):

δ 139.5, 131.9, 128.5, 128.4, 128.2, 127.7, 123.3, 87.1, 86.7, 59.2, 50.4, 23.6; **ESI-HRMS**: calculated for $C_{19}H_{20}N[M+H]^+$ 262.1595, found 262.1598.

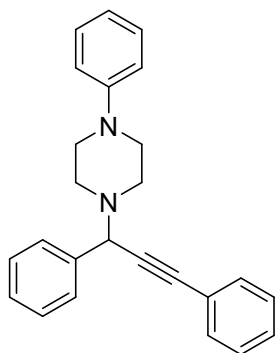
Preparation of compound 6g: Following the general procedure B, the reaction of benzaldehyde



3a (50 mg, 0.471 mmol) with indoline **4f** (61 mg, 0.518 mmol) and phenylacetylene **5a** (54 mg, 0.518 mmol) was catalyzed by thiamine=AuCl (5 mg, 0.009 mmol) at 45 °C for 4 h to afford compound **6g** (128 mg, 85% yield), as a light-yellow liquid. TLC: R_f 0.30 (5% EtOAc in hexane); **1H NMR (600 MHz, $CDCl_3$)**: δ 7.61-7.65 (m, 2H), 7.30-7.32 (m, 4H), 7.22-

7.25 (m, 1H), 7.15-7.18 (m, 3H), 6.99-7.02(m, 2H), 6.60-6.65(m, 2H), 5.72 (s, 1H), 3.33-3.37(m, 1H), 3.08-3.12 (m, 1H), 2.79-2.89 (m, 2H); **^{13}C NMR (150 MHz, $CDCl_3$)**: δ 149.7, 136.9, 130.8, 129.6, 127.4, 127.2, 127.1, 126.8, 126.7, 126.0, 123.5, 121.7, 117.6, 107.4, 85.7, 84.3, 52.3, 48.6, 27.1; **ESI-HRMS**: calculated for $C_{23}H_{20}N[M+H]^+$ 310.1595, found 310.1594.

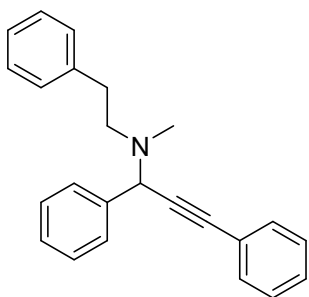
Preparation of compound 6h: Following the general procedure B, the reaction of benzaldehyde



3a (50 mg, 0.471 mmol) with 1-phenylpiperazine **4g** (84 mg, 0.518 mmol) and phenylacetylene **5a** (53 mg, 0.518 mmol) was catalyzed by thiamine=AuCl (5 mg, 0.009 mmol) at 45 °C for 7.5 h to afford compound **6h** (142 mg, 86% yield) as a yellow liquid. TLC: R_f 0.30 (5% EtOAc in hexane); **1H NMR (400 MHz, $CDCl_3$)**: δ 7.39-7.59 (m, 2H), 7.25-7.30 (m, 2H), 7.20-7.23 (m, 2H), 7.15-7.17 (m, 4H), 7.12-7.14 (m, 2H), 6.76-6.83 (m, 2H), 6.72-6.74 (m, 1H), 4.79 (s, 1H), 3.09-3.13 (m, 4H), 2.68-2.71 (m,

4H); **^{13}C NMR (100 MHz, $CDCl_3$)**: δ 150.5, 137.1, 130.9, 128.2, 127.7, 127.5, 127.4, 126.9, 122.1, 118.8, 115.2, 87.6, 84.2, 60.8, 48.6, 48.4; **ESI-HRMS**: calculated for $C_{25}H_{25}N_2[M+H]^+$ 353.2017, found 353.2022.

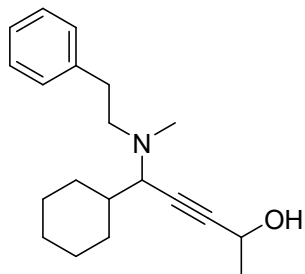
Preparation of compound 6i: Following the general procedure B, the



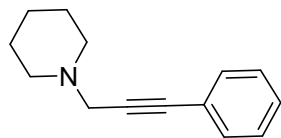
reaction of benzaldehyde **3a** (50 mg, 0.471 mmol) with N-methyl-2-phenylethan-1-amine **4h** (70 mg, 0.518 mmol) and phenylacetylene **5a** (53 mg, 0.518 mmol) was catalyzed by thiamine=AuCl (5 mg, 0.009 mmol) at 45 °C for 8.5 h to afford compound **6i** (134 mg, 88% yield) as a white solid. TLC: R_f 0.30 (5% EtOAc in hexane); **1H NMR (400 MHz, $CDCl_3$)**: δ 7.49-7.51 (m, 2H), 7.41-7.43 (m, 2H), 7.16-7.28 (m, 8H),

7.07-7.11 (m, 3H), 4.89 (s, 1H), 2.67-2.81 (m, 4H), 2.23 (m, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ 139.6, 137.9, 131.0, 127.9, 127.5, 127.5, 127.4, 127.3, 126.6, 125.1, 122.3, 87.4, 84.1, 59.8, 55.4, 37.2, 33.7; **ESI-HRMS**: calculated for $\text{C}_{24}\text{H}_{24}\text{N}[\text{M}+\text{H}]^+$ 326.1908, found 326.1911.

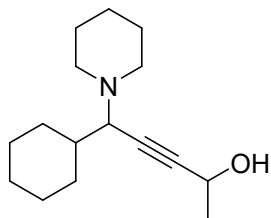
Preparation of compound 6j: Following the general procedure B, the reaction of cyclohexanecarboxaldehyde **3c** (50 mg, 0.44 mmol) with 2-phenylethan-1-amine **4h** (65 mg, 0.48 mmol) and but-3-yn-2-ol **5c** (34 mg, 0.48 mmol) was catalyzed by thiamine= AuCl (5 mg, 0.009 mmol) at 45 °C for 6 h to afford compound **6j** (119 mg, 90% yield) as a yellow liquid. TLC: R_f 0.30 (5% EtOAc in hexane); ^1H NMR (400 MHz, CDCl_3): δ 7.22-7.18 (m, 2H), 7.14-7.11 (m, 3H), 4.50-4.48 (m, 1H), 2.98 (dd, $J = 4.0, 12$ Hz, 1H), 2.69-2.58 (m, 4H), 2.75-2.56 (m, 3H), 2.17 (s, 3H), 1.87 (dd, $J = 4.0, 16$ Hz, 3H), 1.68-1.56 (m, 3H), 1.38 (d, $J = 4$ Hz, 3H), 1.09-1.03 (m, 3H), 0.89-0.79 (m, 1H), 0.77-0.68 (m, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 140.8, 128.9, 128.3, 126.0, 88.3, 81.0, 62.2, 58.6, 56.7, 40.0, 38.2, 34.6, 31.3, 30.3, 26.7, 26.2, 26.0, 25.1; **ESI-HRMS**: calculated for $\text{C}_{20}\text{H}_{30}\text{NO}[\text{M}+\text{H}]^+$ 300.2327, found 300.2328.



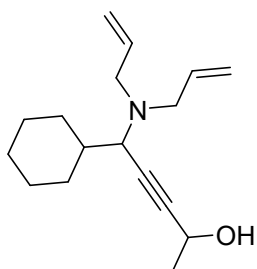
Preparation of compound 6k: Following the general procedure B, the reaction of paraformaldehyde **3d** (50 mg, 1.66 mmol) with piperidine **4a** (156 mg, 1.83 mmol) and phenylacetylene **5a** (187 mg, 1.83 mmol) was catalyzed by thiamine= AuCl (16 mg, 0.06 mmol) at 45 °C for 7.5 h to afford compound **6k** (154 mg, 93% yield) as a white solid. TLC: R_f 0.30 (5% EtOAc in hexane); ^1H NMR (400 MHz, CDCl_3): δ 7.37-7.34 (m, 2H), 7.22-7.20 (m, 3H), 3.40 (s, 2H), 2.49 (s, 4H), 1.59-1.54 (m, 4H), 1.39-1.35 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 131.7, 128.2, 128.0, 123.3, 85.0, 53.5, 48.5, 25.9, 23.9; **ESI-HRMS**: calculated for $\text{C}_{14}\text{H}_{18}\text{N}[\text{M}+\text{H}]^+$ 200.1439, found 200.1445.



Preparation of compound 6l: Following the general procedure B, the reaction of cyclohexanecarboxaldehyde **3c** (50 mg, 0.44 mmol) with piperidine **4a** (42 mg, 0.48 mmol) and but-3-yn-2-ol **5c** (34 mg, 0.48 mmol) was catalyzed by thiamine= AuCl (5 mg, 0.009 mmol) at 45 °C for 8 h to afford compound **6a** (99 mg, 90% yield) as a yellow liquid. TLC: R_f 0.30 (5% EtOAc in hexane); ^1H NMR (400 MHz, CDCl_3): δ 4.55-4.49 (m, 1H), 2.85 (d, $J =$



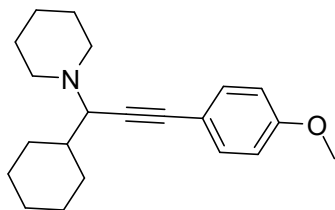
12Hz, 1H), 2.50-2.44 (m, 2H), 2.27-2.22 (m, 2H), 1.93-1.82 (m, 3H), 1.69-1.45 (m, 8H), 1.40 (d, $J = 4$ Hz, 3H), 1.36-1.32 (m, 2H), 1.19-1.05 (m, 3H), 0.92-0.76 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 88.2, 81.4, 63.7, 58.5, 39.3, 31.1, 30.4, 26.8, 26.2, 26.1, 25.1, 24.6; ESI-HRMS: calculated for $\text{C}_{16}\text{H}_{28}\text{NO}[\text{M}+\text{H}]^+$ 250.2170, found 250.2170.



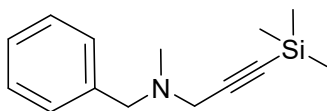
Preparation of compound 6m: Following the general procedure B, the reaction of cyclohexanecarboxaldehyde **3c** (50 mg, 0.44 mmol) with diallylamine **4b** (47 mg, 0.48 mmol) and but-3-yn-2-ol **5c** (34 mg, 0.48 mmol) was catalyzed by thiamine= AuCl (4 mg, 0.008 mmol) at 45 °C for 7.5 h afforded compound **6m** (97 mg, 85% yield) as a yellow liquid. TLC: R_f 0.30 (5% EtOAc in hexane); ^1H NMR (600 MHz, CDCl_3): δ 5.74-5.68 (m,

2H), 5.14 (d, $J = 1.8$ Hz, 2H), 4.53-4.50 (m, 1H), 3.16 (d, $J = 1.2$ Hz, 2H), 3.09 (d, $J = 1.2$ Hz, 1H), 2.74 (dd, $J = 0.6, 1.2$ Hz, 2H), 1.99 (d, $J = 1.2$ Hz, 1H), 1.90 (d, $J = 1.2$ Hz, 1H), 1.79 (s, 1H), 1.66-1.65 (m, 3H), 1.57-1.55 (m, 1H), 1.40 (d, $J = 0.6$ Hz, 3H), 1.20-1.06 (m, 3H), 0.88-0.71 (m, 2H); ^{13}C NMR (150 MHz, CDCl_3): δ 136.9, 116.8, 87.6, 81.6, 58.6, 58.1, 53.9, 40.0, 31.3, 30.4, 26.8, 26.2, 26.0, 25.1; ESI-HRMS: calculated for $\text{C}_{17}\text{H}_{28}\text{NO}[\text{M}+\text{H}]^+$ 262.2170, found 262.2171.

Preparation of compound 6n: Following the general procedure B, the reaction of cyclohexanecarboxaldehyde **3c** (50 mg, 0.44 mmol) with piperidine **4i** (42 mg, 0.48 mmol) and *p*-MeO-phenylacetylene **5d** (64 mg, 0.48 mmol) was catalyzed by thiamine= AuCl (5 mg, 0.008 mmol) at 45 °C for 7 h to afford compound **6n** (121 mg, 88% yield) as a white solid.



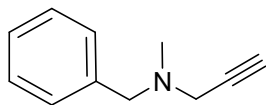
TLC: R_f 0.30 (5% EtOAc in hexane); ^1H NMR (400 MHz, CDCl_3): δ 7.31-7.29 (m, 2H), 6.78-6.74 (m, 2H), 3.73 (s, 3H), 3.0 (d, $J = 18$ Hz, 1H), 2.58-2.53 (m, 2H), 2.35-2.30 (m, 2H), 2.04-1.93 (m, 2H), 1.70-1.65 (m, 2H), 1.56-1.46 (m, 5H), 1.39-1.35 (m, 2H), 1.25-1.07 (m, 4H), 0.99-0.80 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 159.2, 133.17, 113.9, 64.5, 55.4, 39.7, 31.4, 30.6, 26.9, 26.4, 26.2, 24.8; ESI-HRMS: calculated for $\text{C}_{21}\text{H}_{30}\text{NO}[\text{M}+\text{H}]^+$ 312.2327, found 312.2335.



Preparation of compound 6o: Following the general procedure B, the reaction of paraformaldehyde **3d** (50 mg, 1.66 mmol) with *N*-methylbenzylamine **4i** (221 mg, 1.83 mmol) and trimethylsilylacetylene **5e** (180 mg, 1.83 mmol) was catalyzed by thiamine= AuCl (16 mg, 0.033 mmol) at 45 °C for 5 h to afford compound **6o** (231 mg, 81% yield)

as a colorless liquid. TLC: R_f 0.30 (5% EtOAc in hexane); $^1\text{H NMR}$ (400 MHz, CDCl_3): δ 7.32-7.37 (m, 4H), 7.26-7.30 m, 1H), 3.58 (s, 2H), 3.32 (s, 2H), 2.35 (s, 3H), 0.23 (s, 9H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3): δ 137.5, 128.3, 127.4, 126.3, 100.0, 89.3, 59.1, 45.0, 40.9, 0.74.

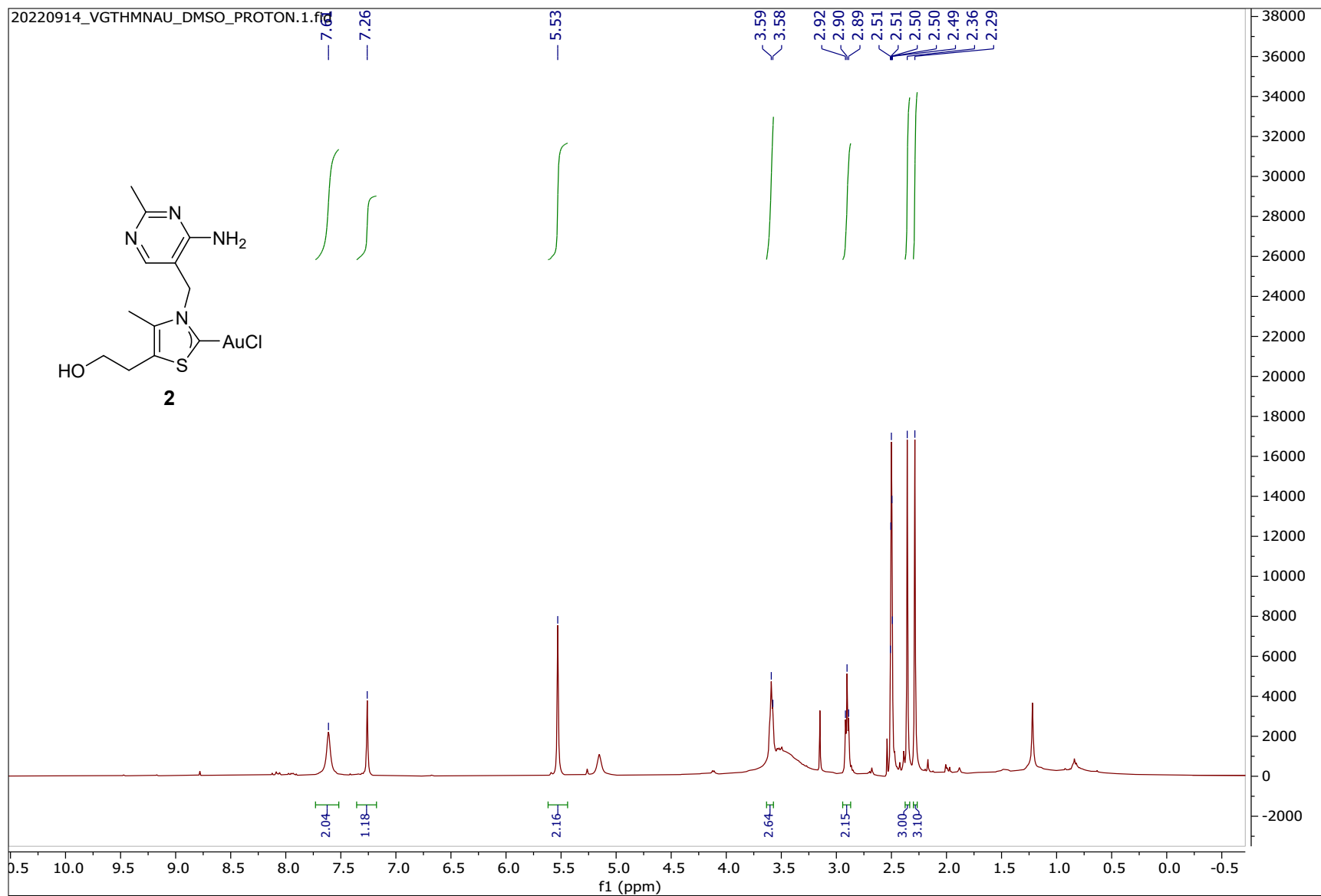
Preparation of compound 7: To a stirred solution of **3d** (50 mg, 1.66 mmol), **4i** (221 mg, 1.83 mmol) and Thiamine= AuCl (16 mg, 0.033 mmol) in $\text{CH}_3\text{CN}:\text{H}_2\text{O}$ (1:9, 2 mL) was added trimethylsilylacetylene **5e** (180 mg, 1.83 mmol) at 45 °C.

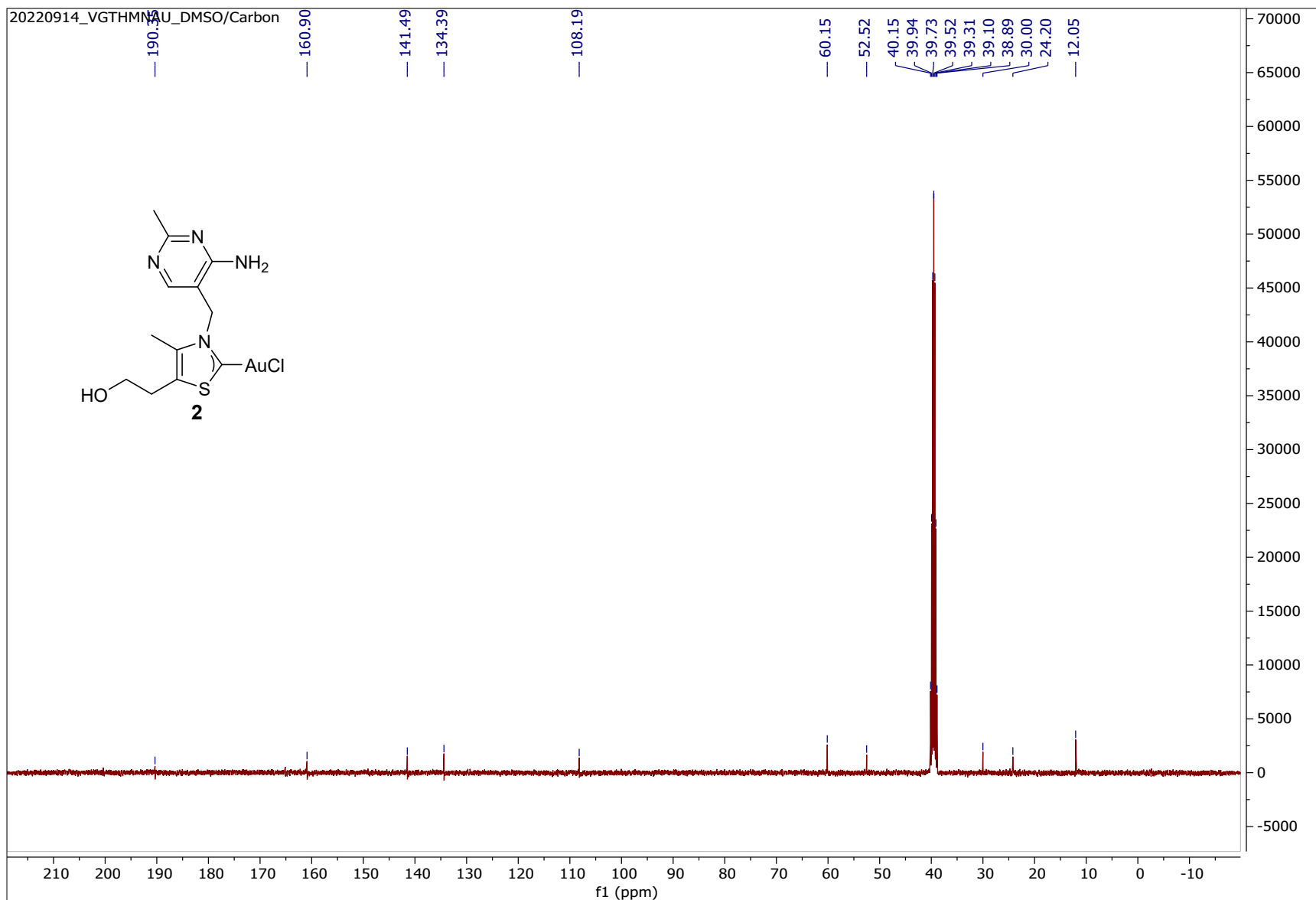


The reaction was carried out at 45 °C and monitored by TLC. After completion of reaction as indicated by TLC, the reaction mixture was added K_2CO_3 and then stirred at room temperature for 3h. After the solvent was removed under reduced pressure, the crude product was diluted with ethyl acetate (10 mL) and washed with saturated NaHCO_3 solution (1 \times 10 mL). The aqueous layer was separated and extracted with EtOAc (3 \times 15 mL). The organic layer was dried over anhydrous Na_2SO_4 , filtered and concentrated under reduced pressure to give crude product. The crude product was purified by column chromatography over silica gel using 5% EtOAc/hexane to give the product **7** (231 mg, 81% yield) as a colorless liquid. TLC: R_f 0.30 (5% EtOAc in hexane); $^1\text{H NMR}$ (600 MHz, CDCl_3): δ 7.29-7.35 (m, 4H), 7.23-7.27 m, 1H), 3.57 (s, 2H), 3.30 (d, 2H), 2.34 (s, 3H), 2.28 (t, J = 0.6 Hz, 1H); $^{13}\text{C NMR}$ (150 MHz, CDCl_3): δ 137.7, 128.5, 127.7, 126.6, 77.9, 72.8, 59.3, 44.2, 41.1. **ESI-HRMS:** calculated for $\text{C}_{11}\text{H}_{14}\text{N}$ $[\text{M}+\text{H}]^+$ 160.1126, found 160.1116.

References:

1. H.-L. Yang, P. Cai, Q.-H. Liu, X.-L. Yang, F. Li, J. Wang, J.-J. Wu, X.-B. Wang and L.-Y. Kong, *Eur. J. Med. Chem.*, 2017, **138**, 715–728.

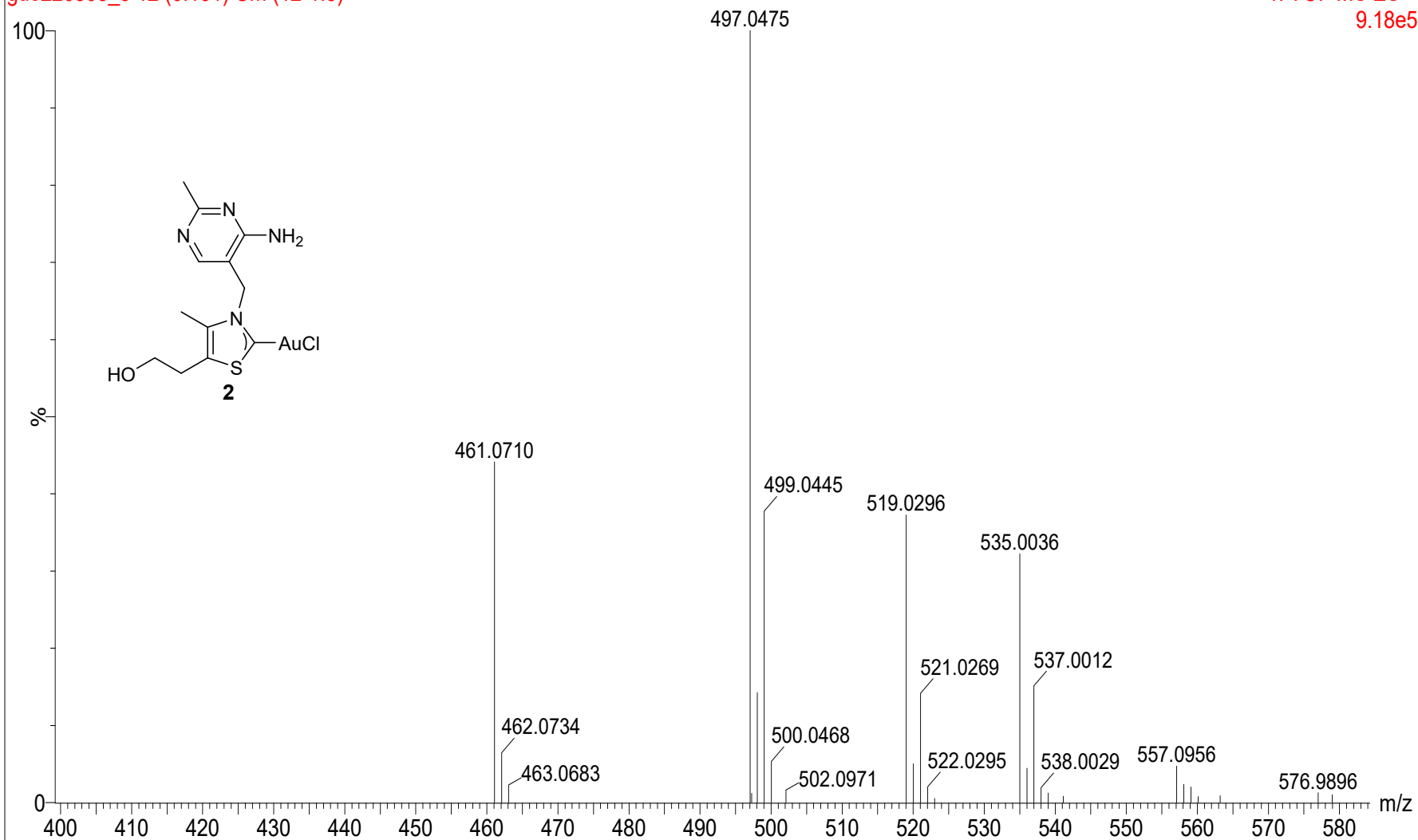


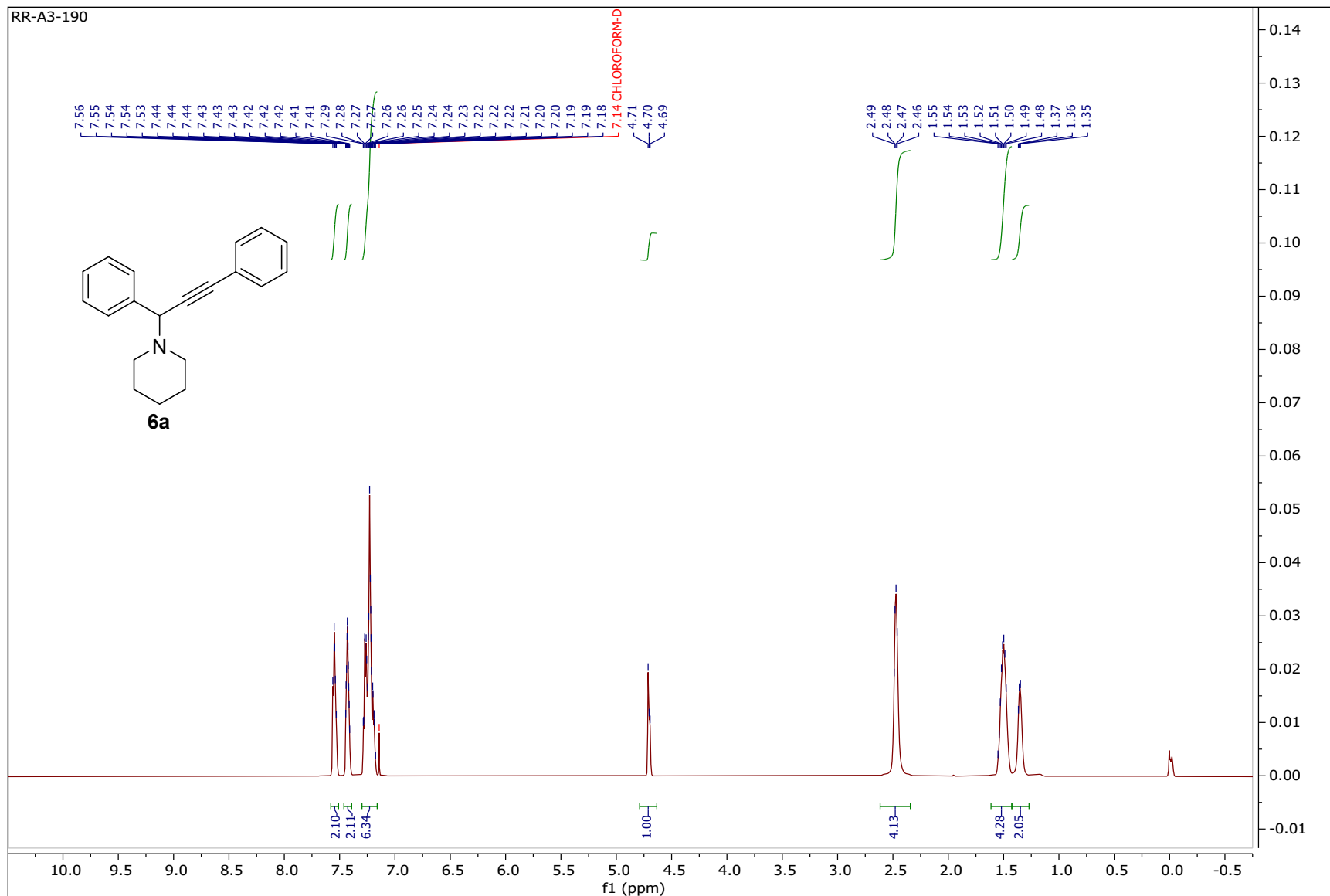


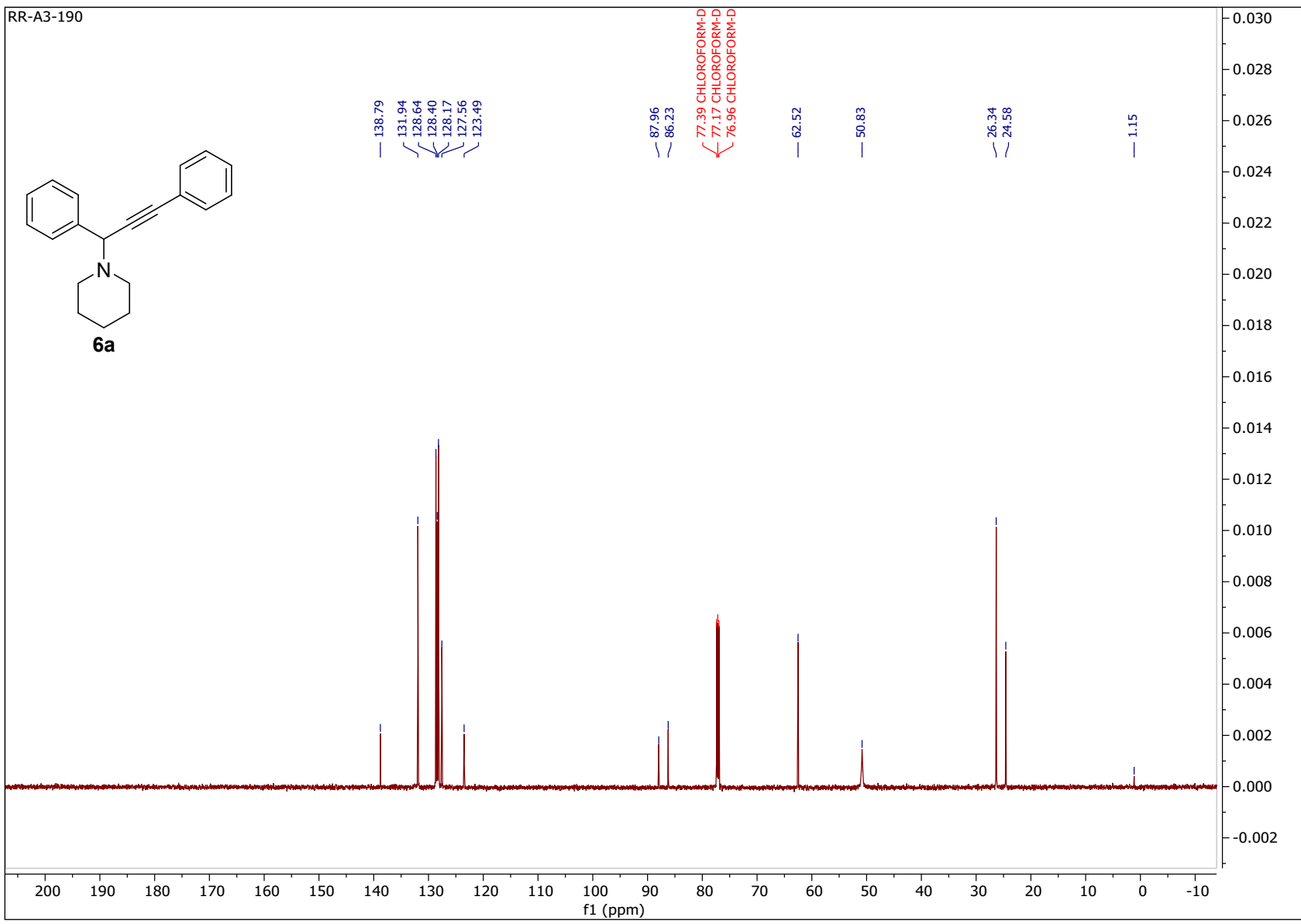
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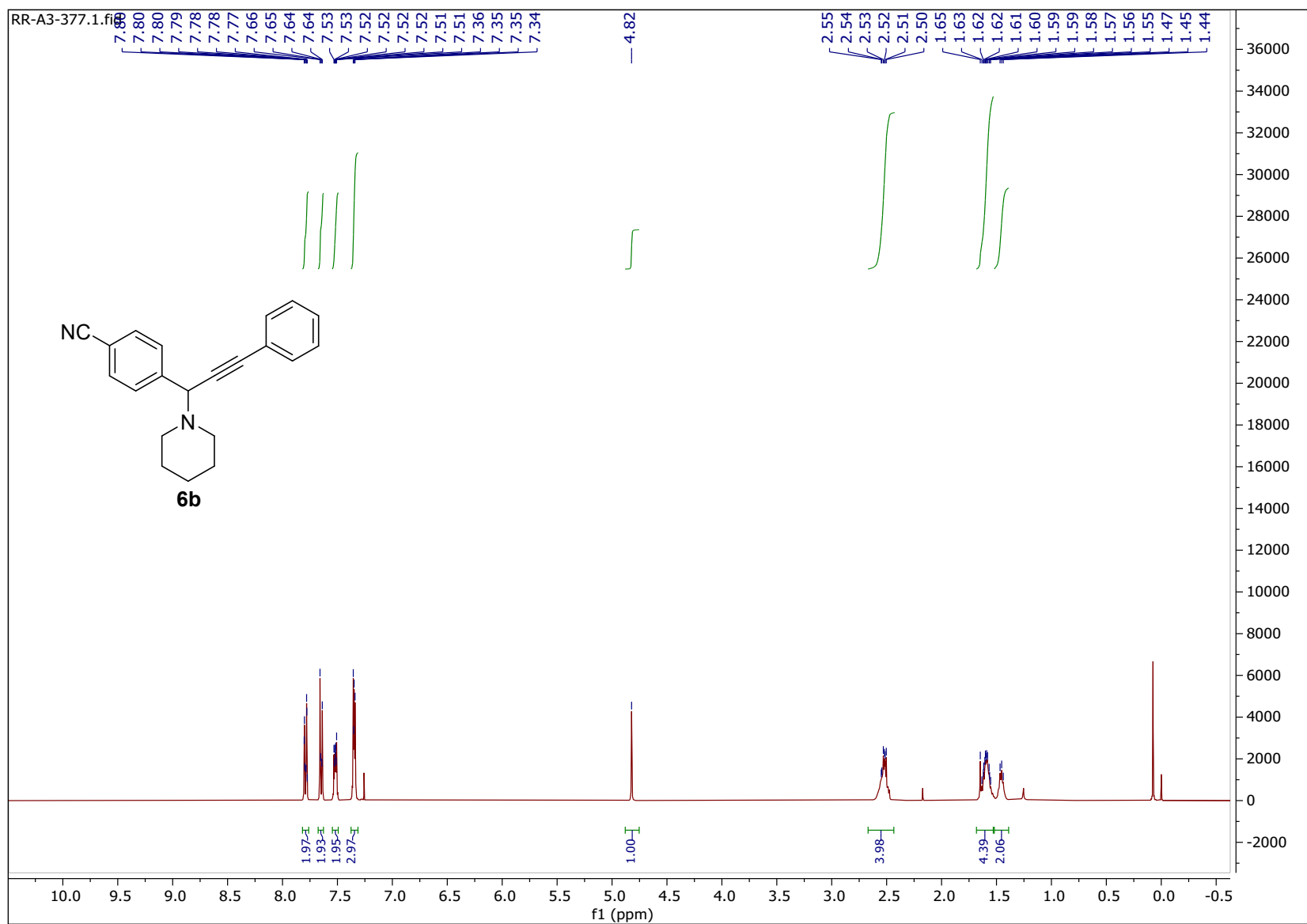
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1: TOF MS ES+
9.18e5

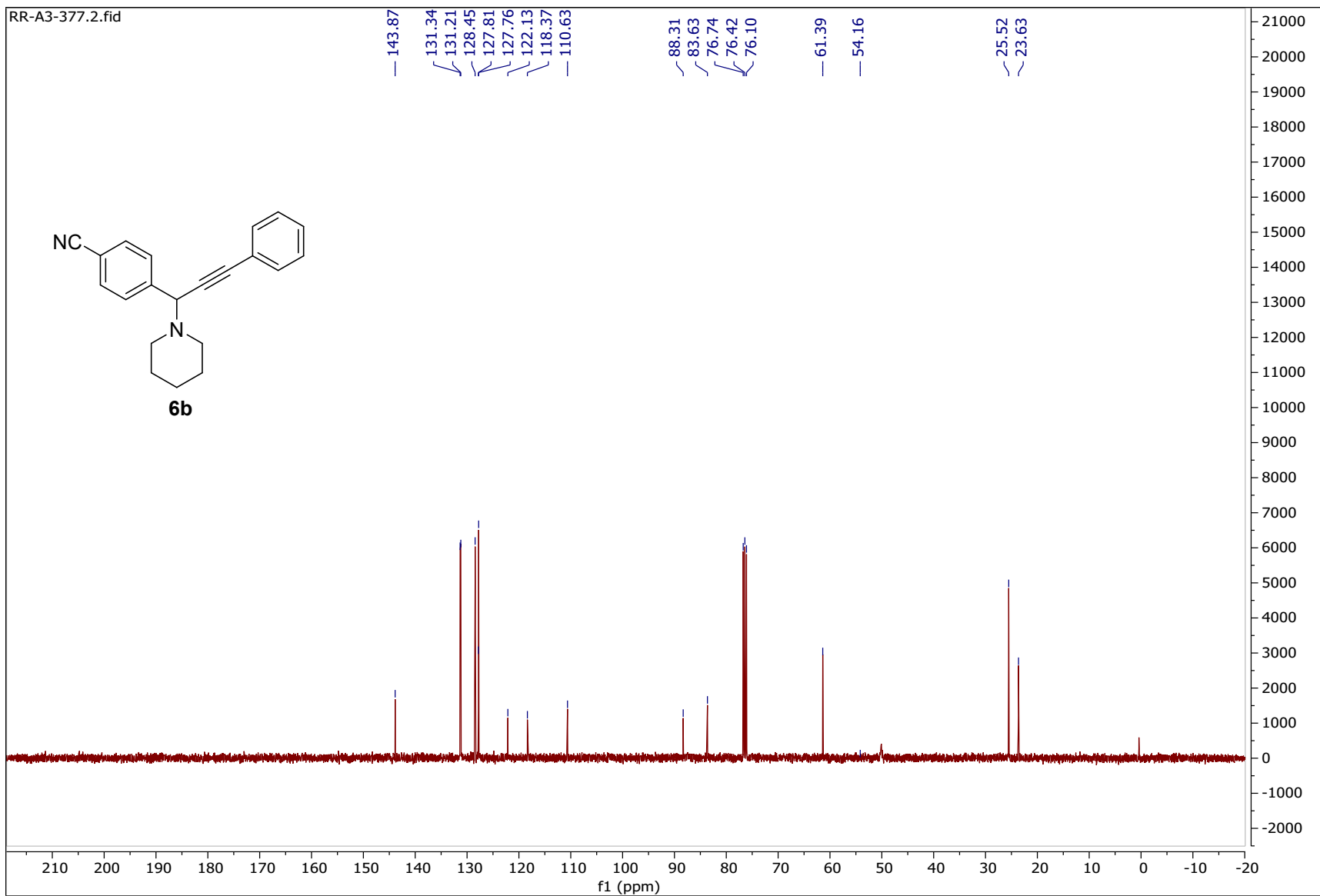
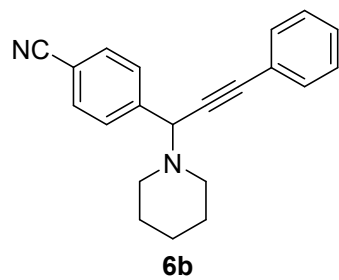


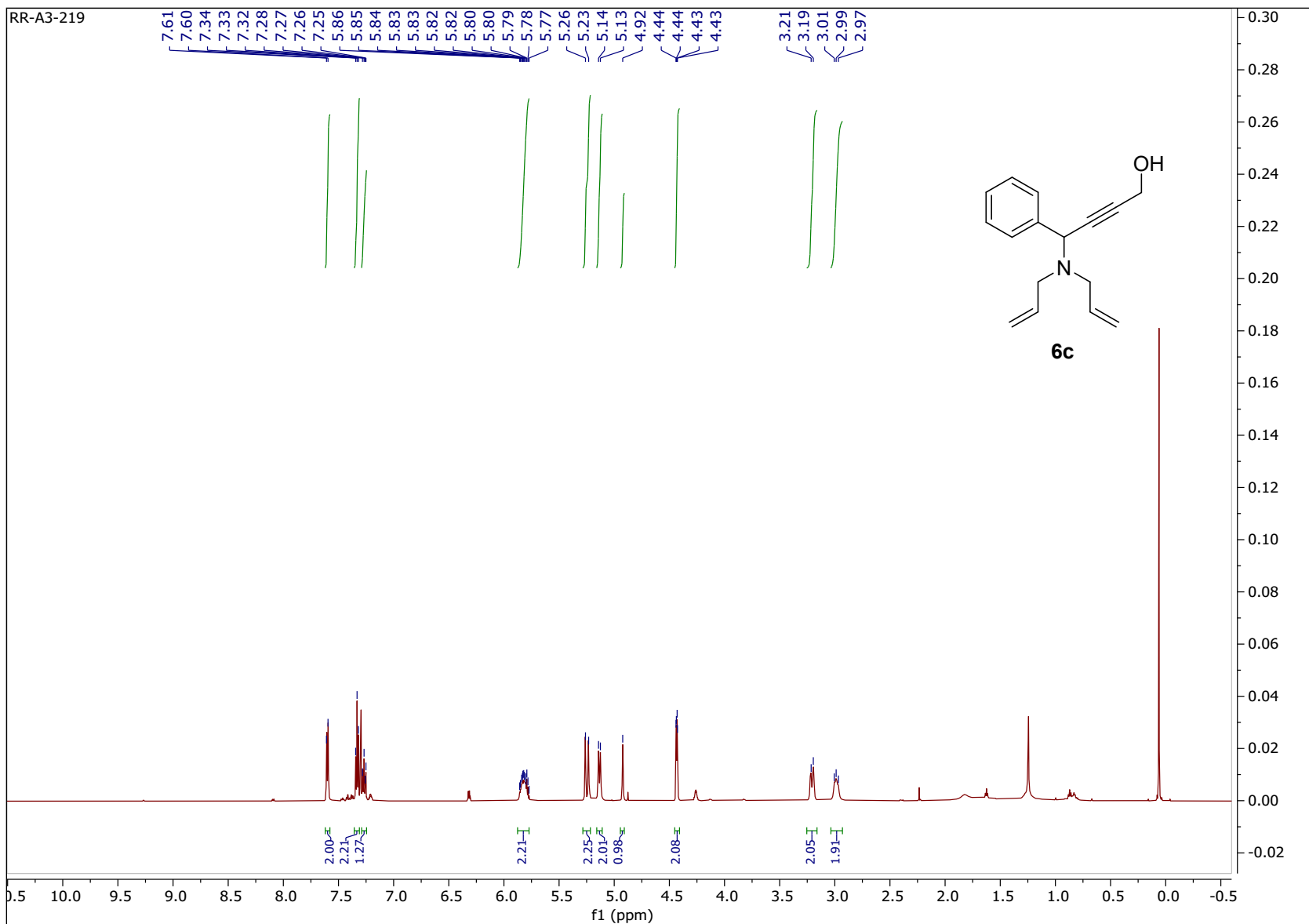


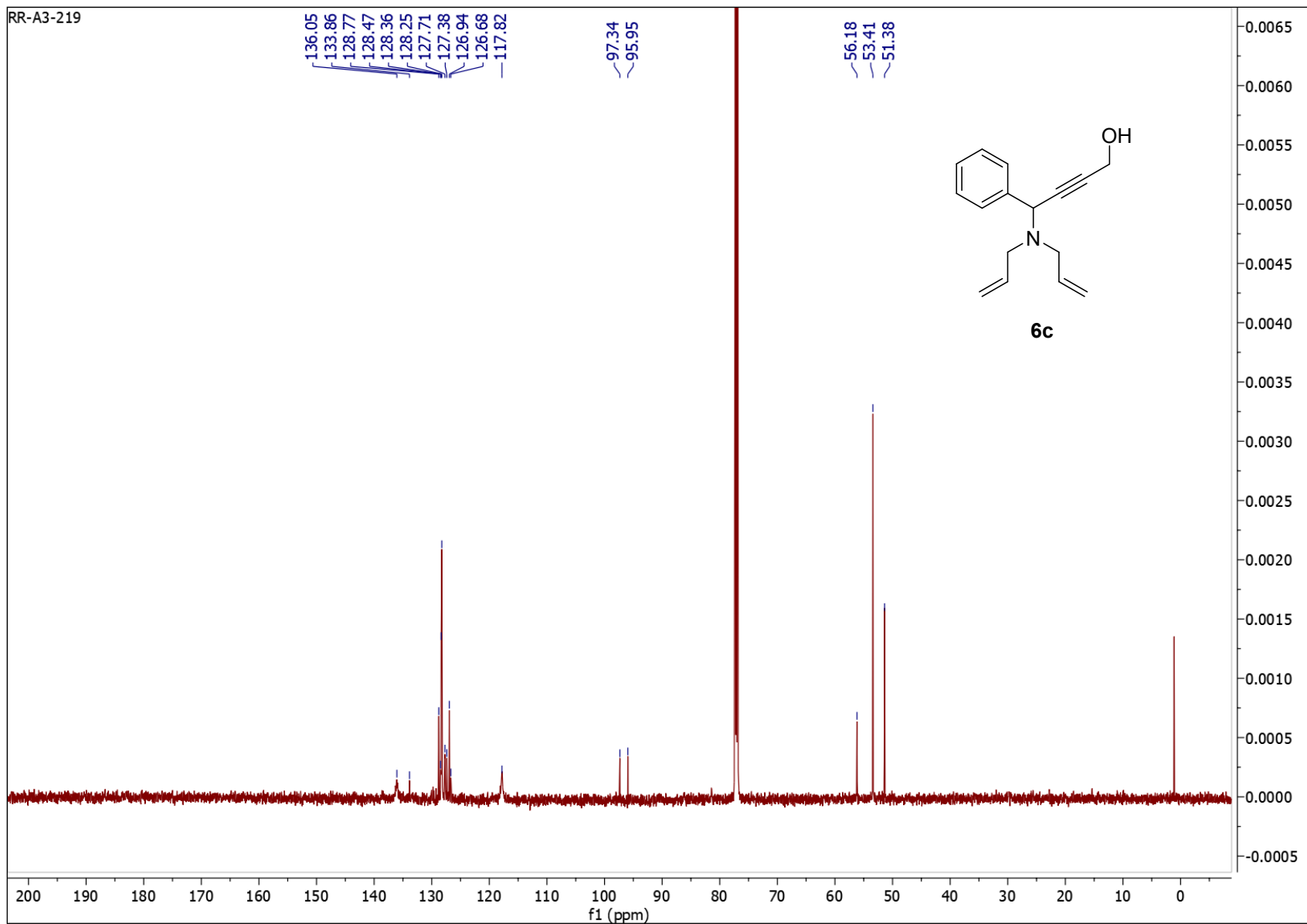


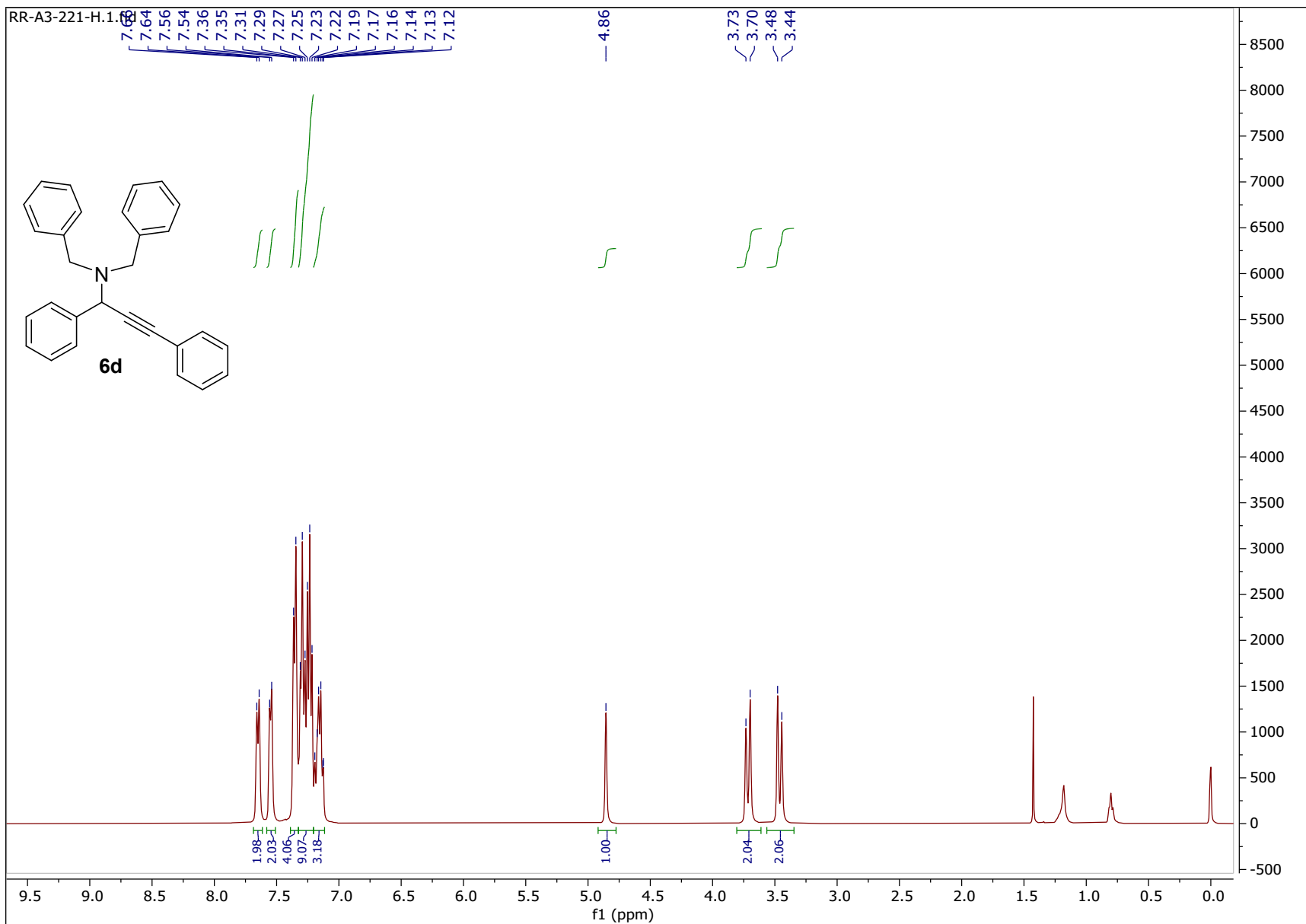


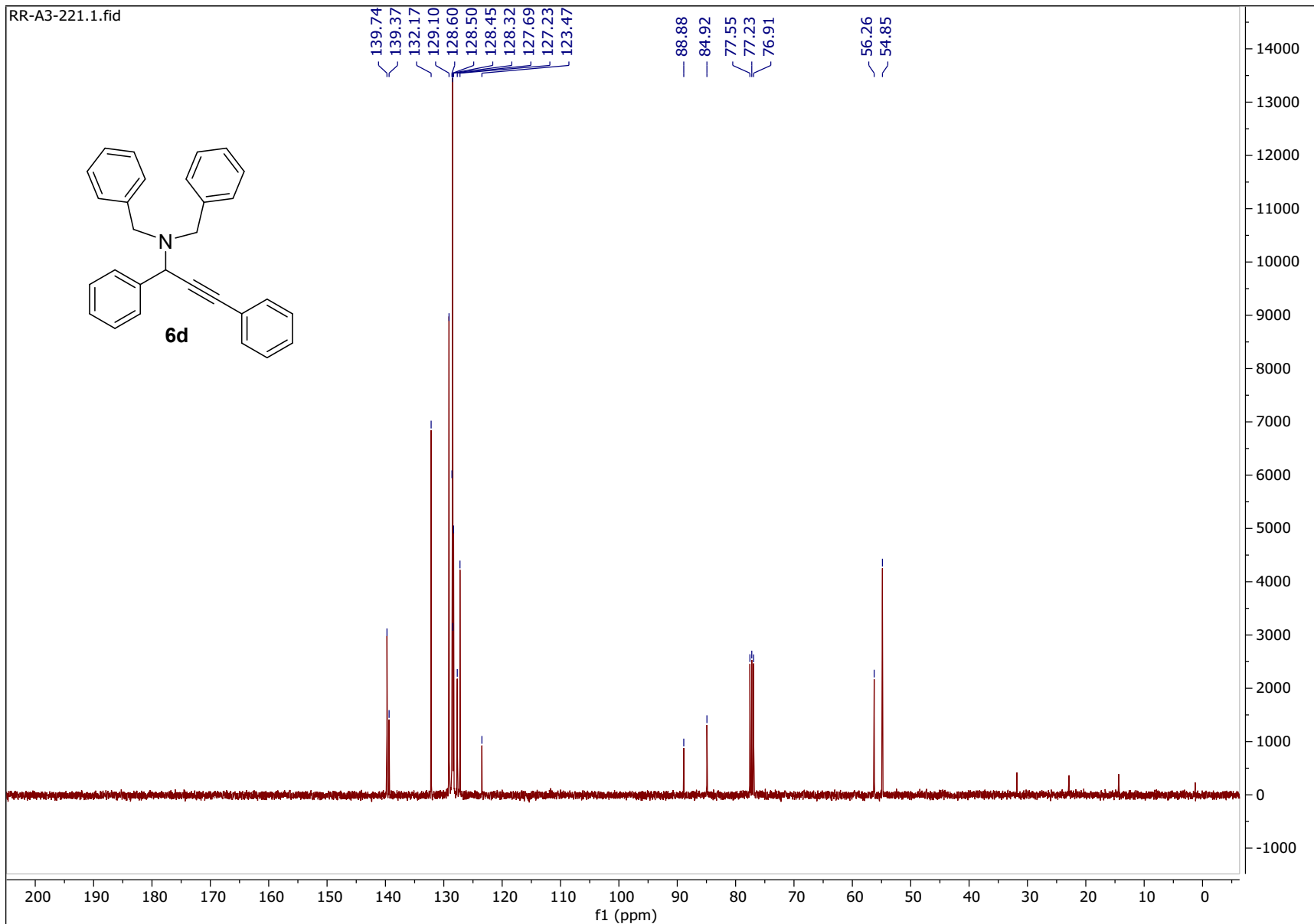
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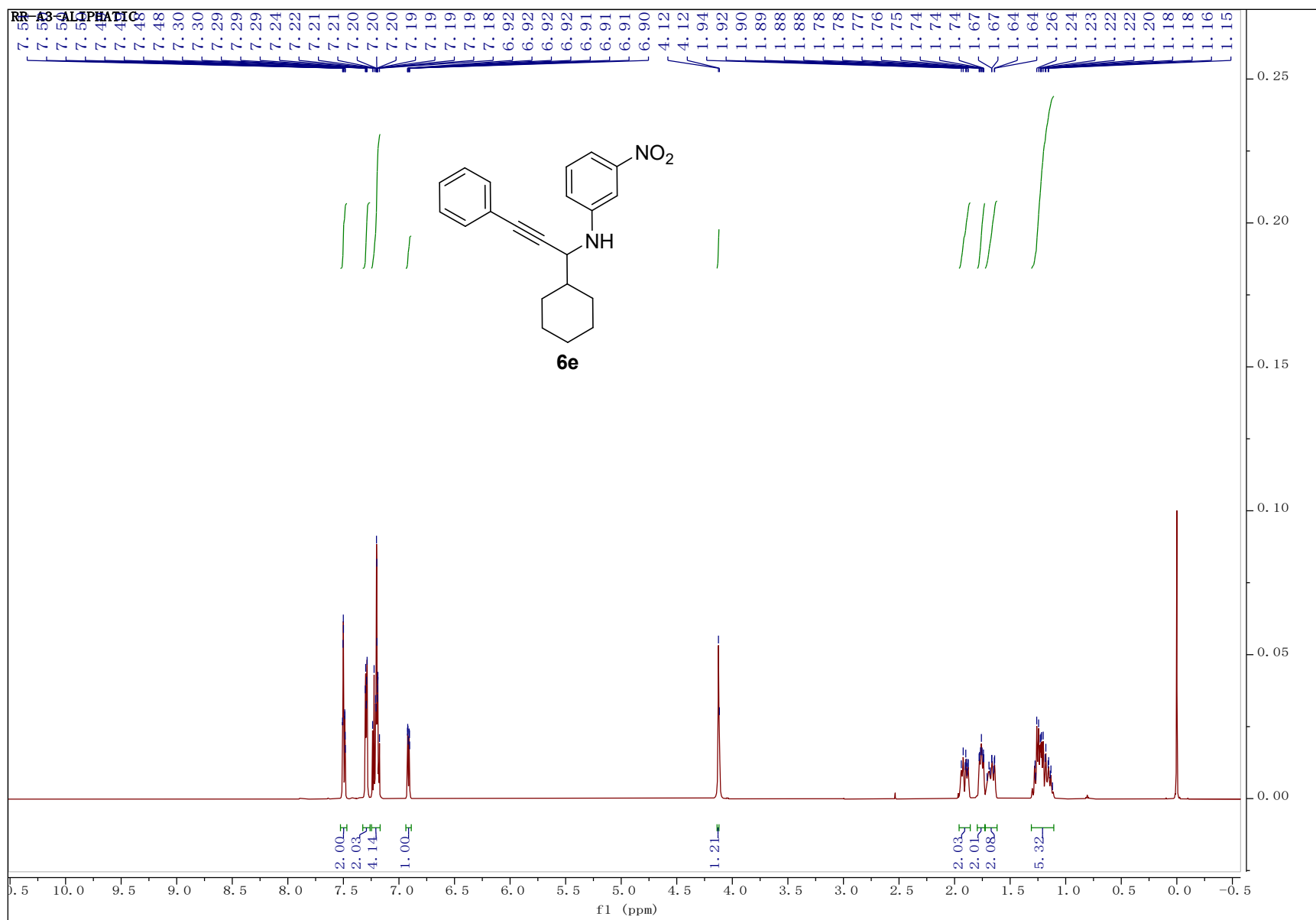


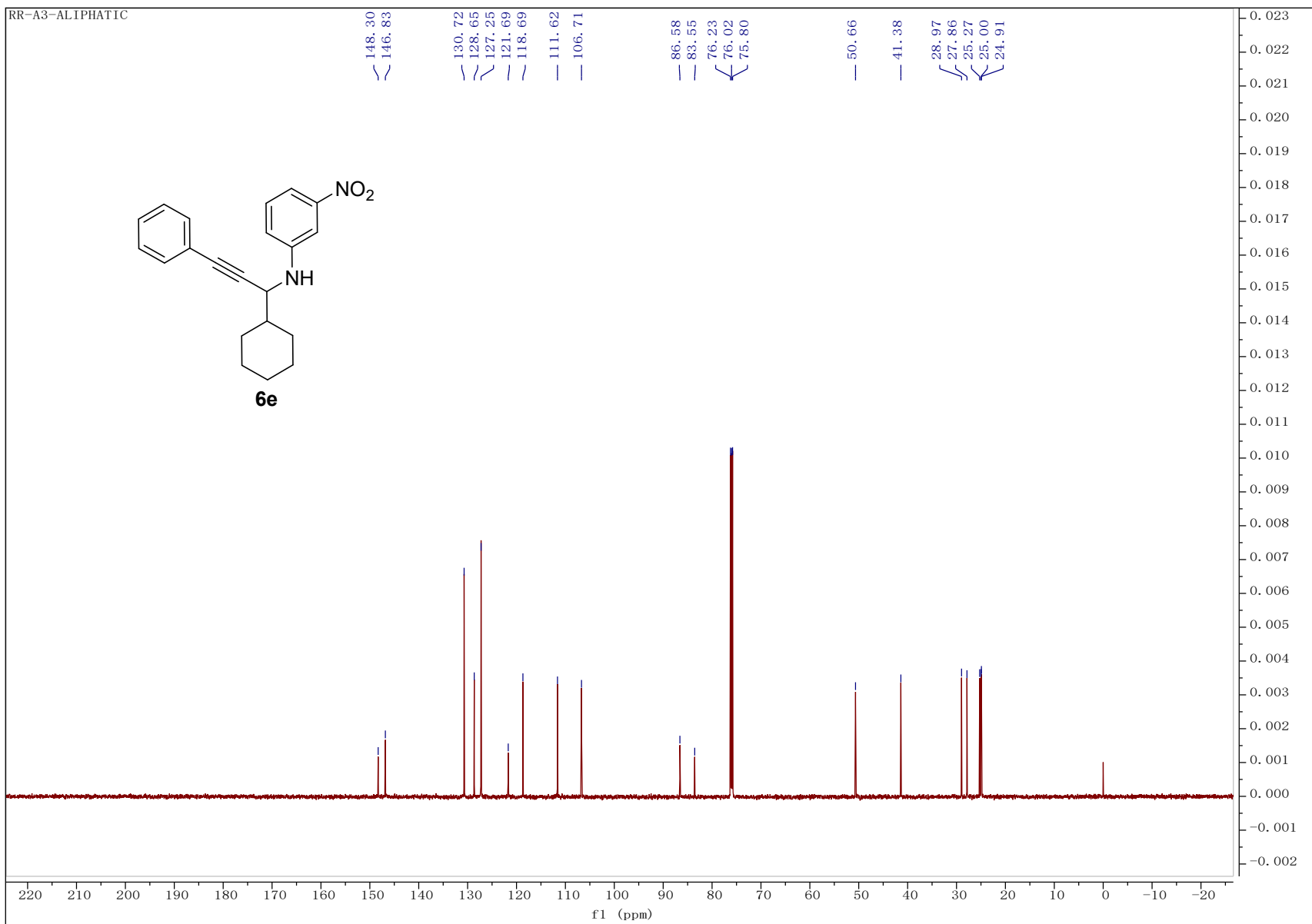


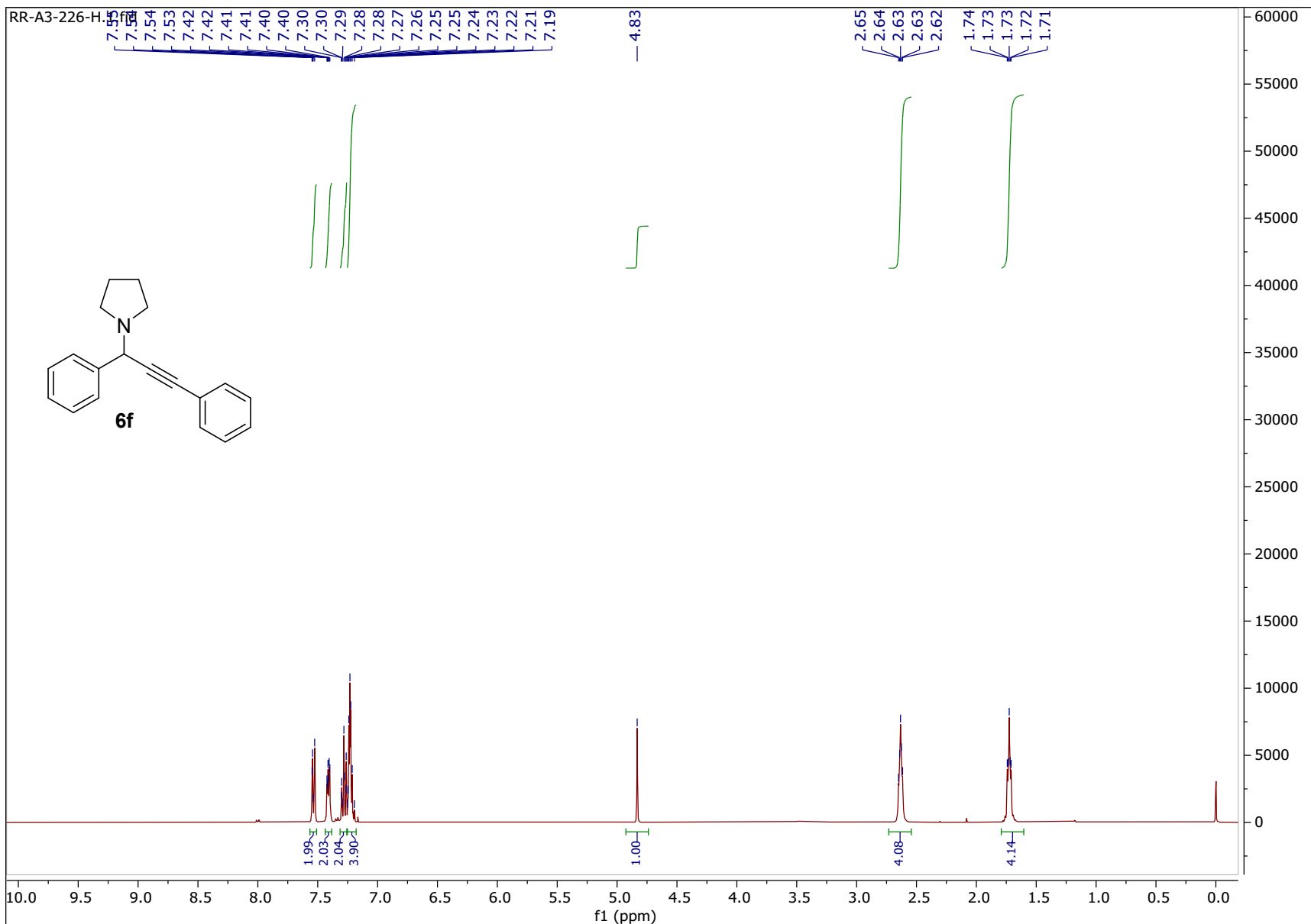


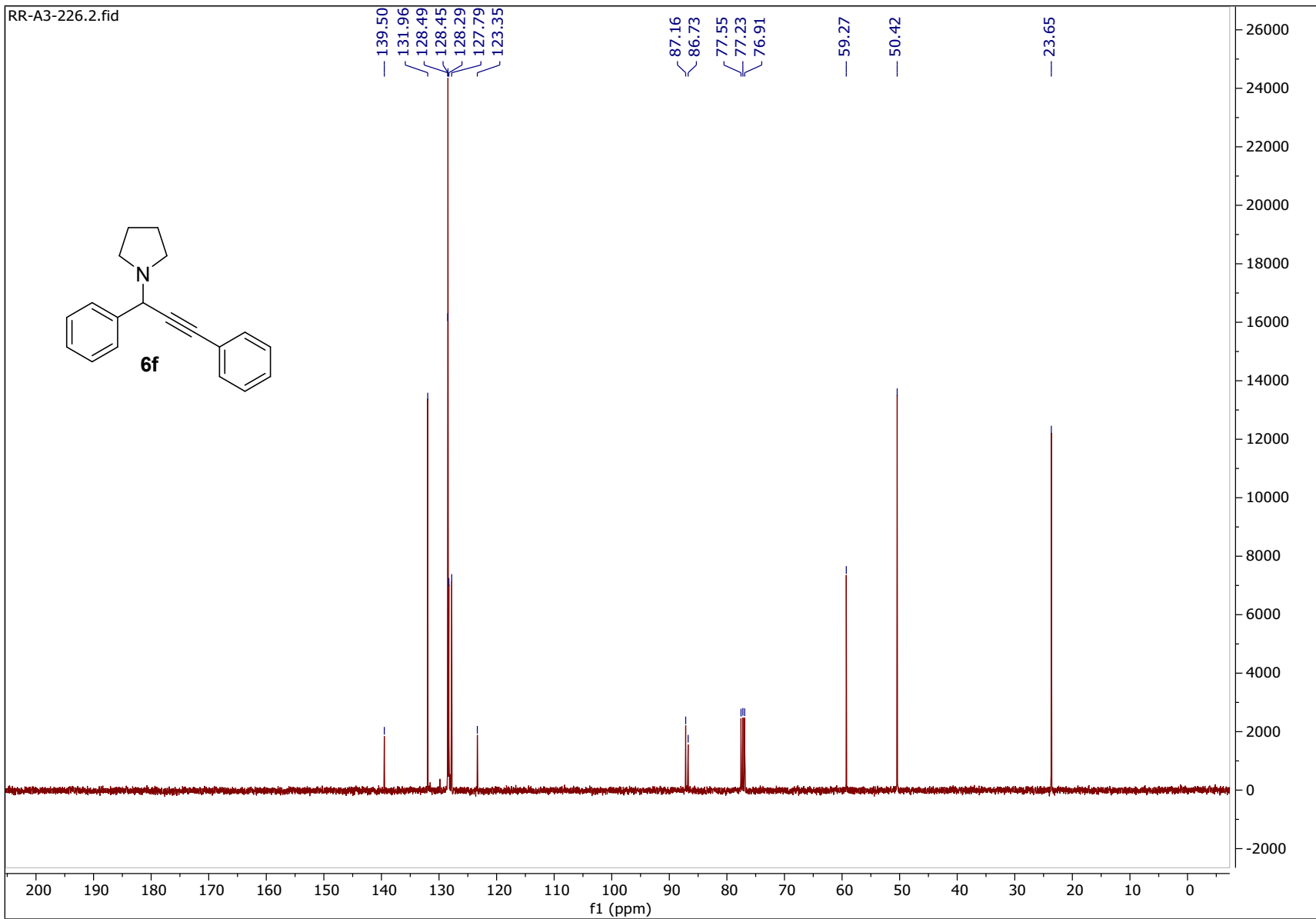


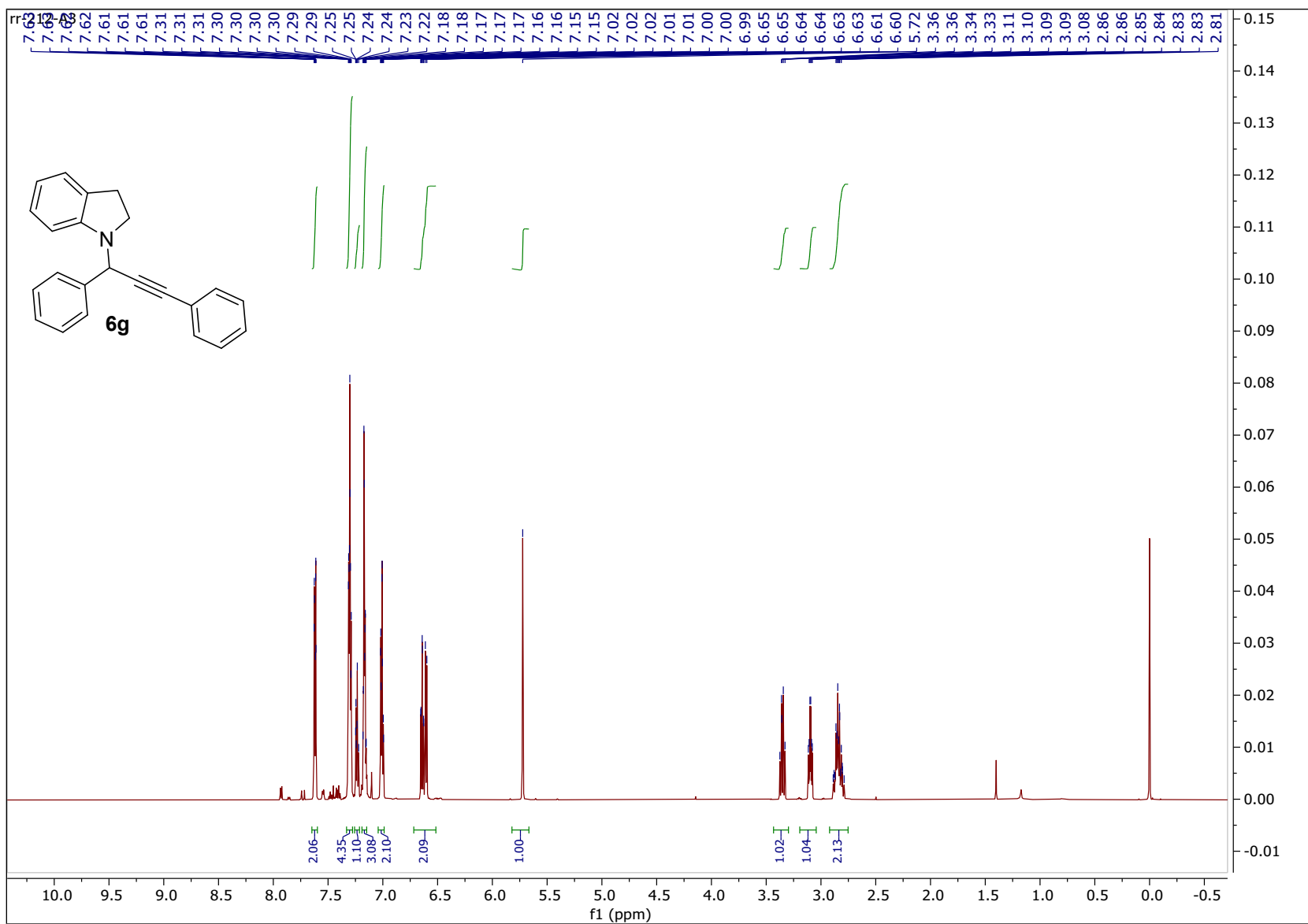


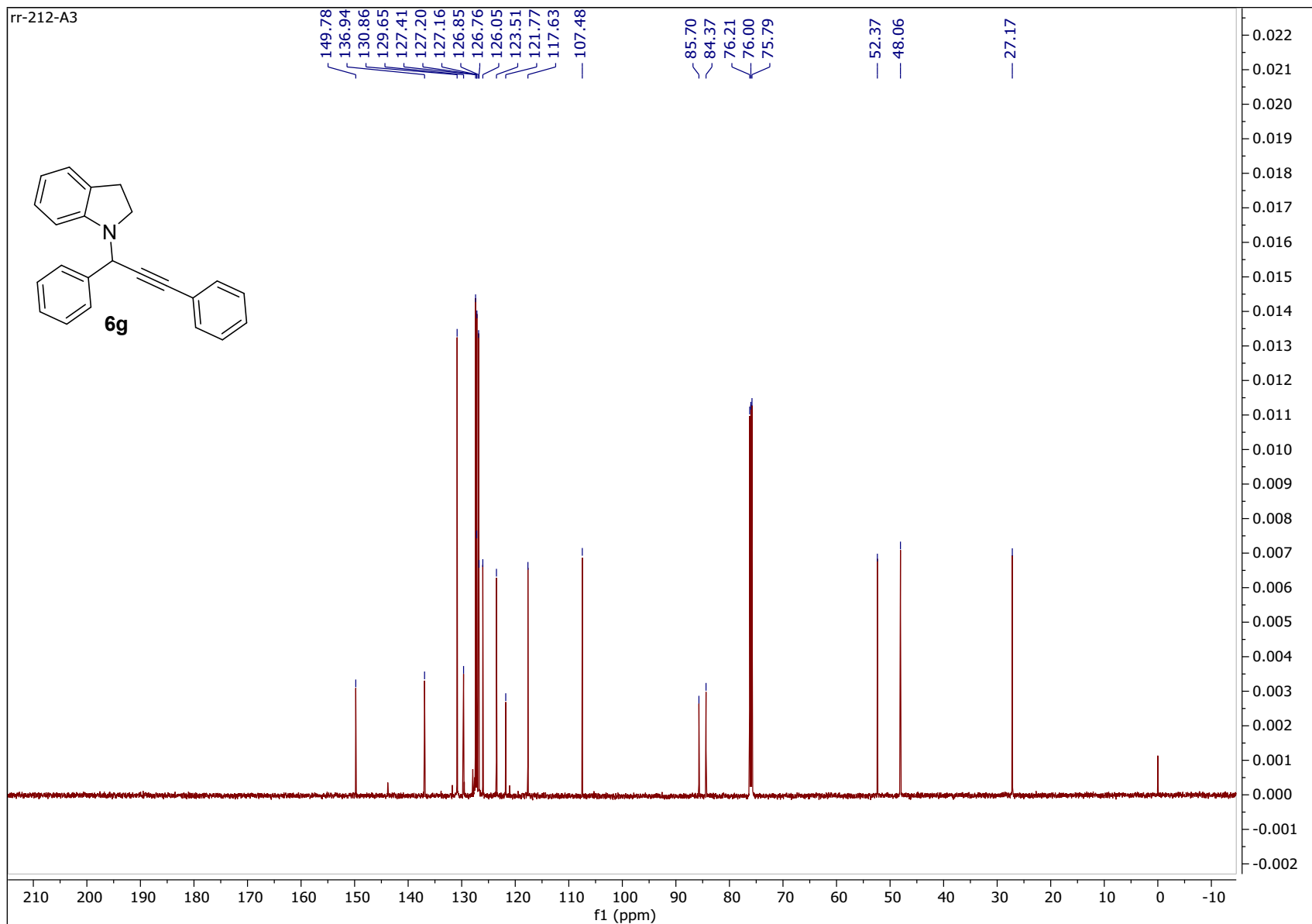


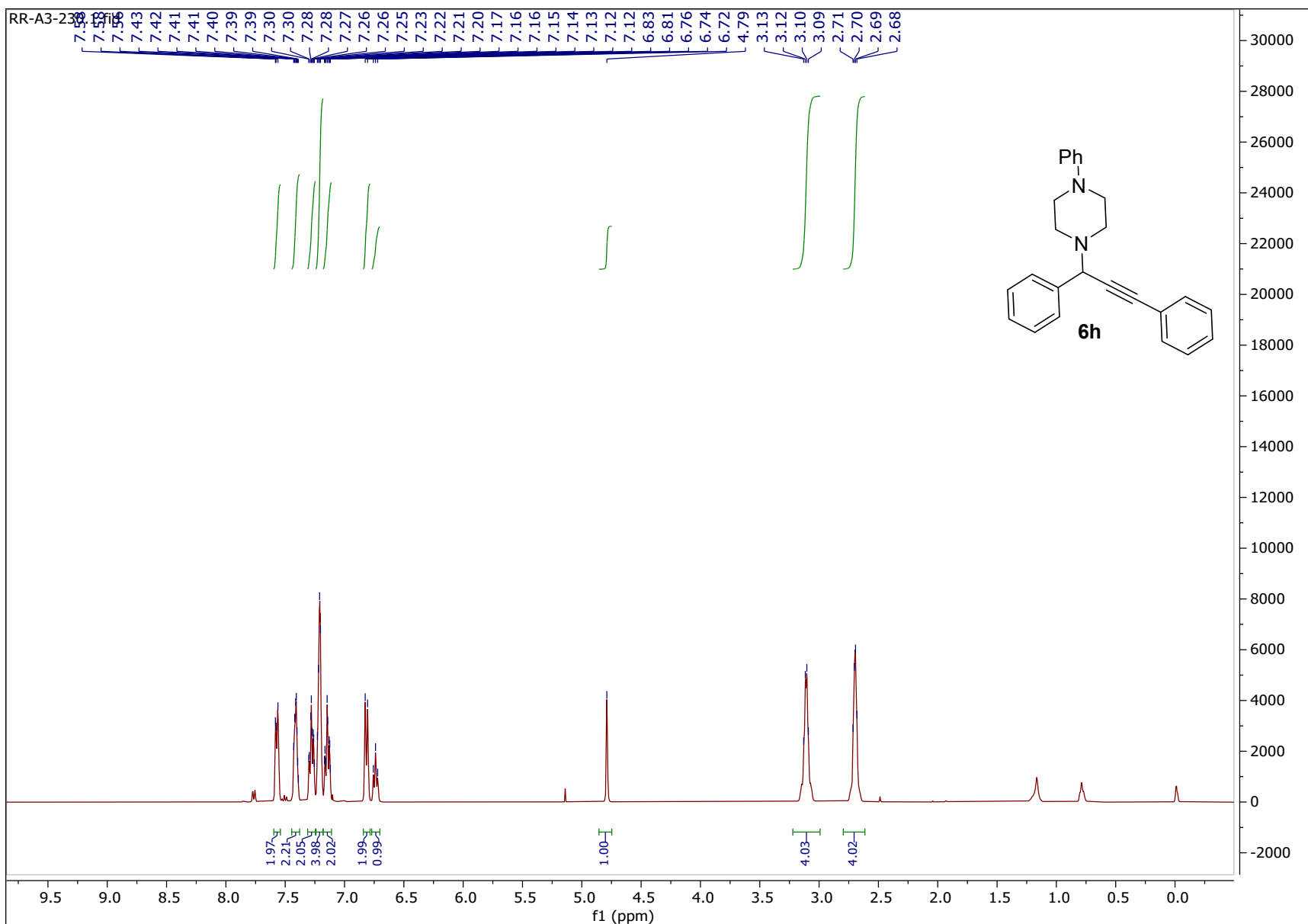


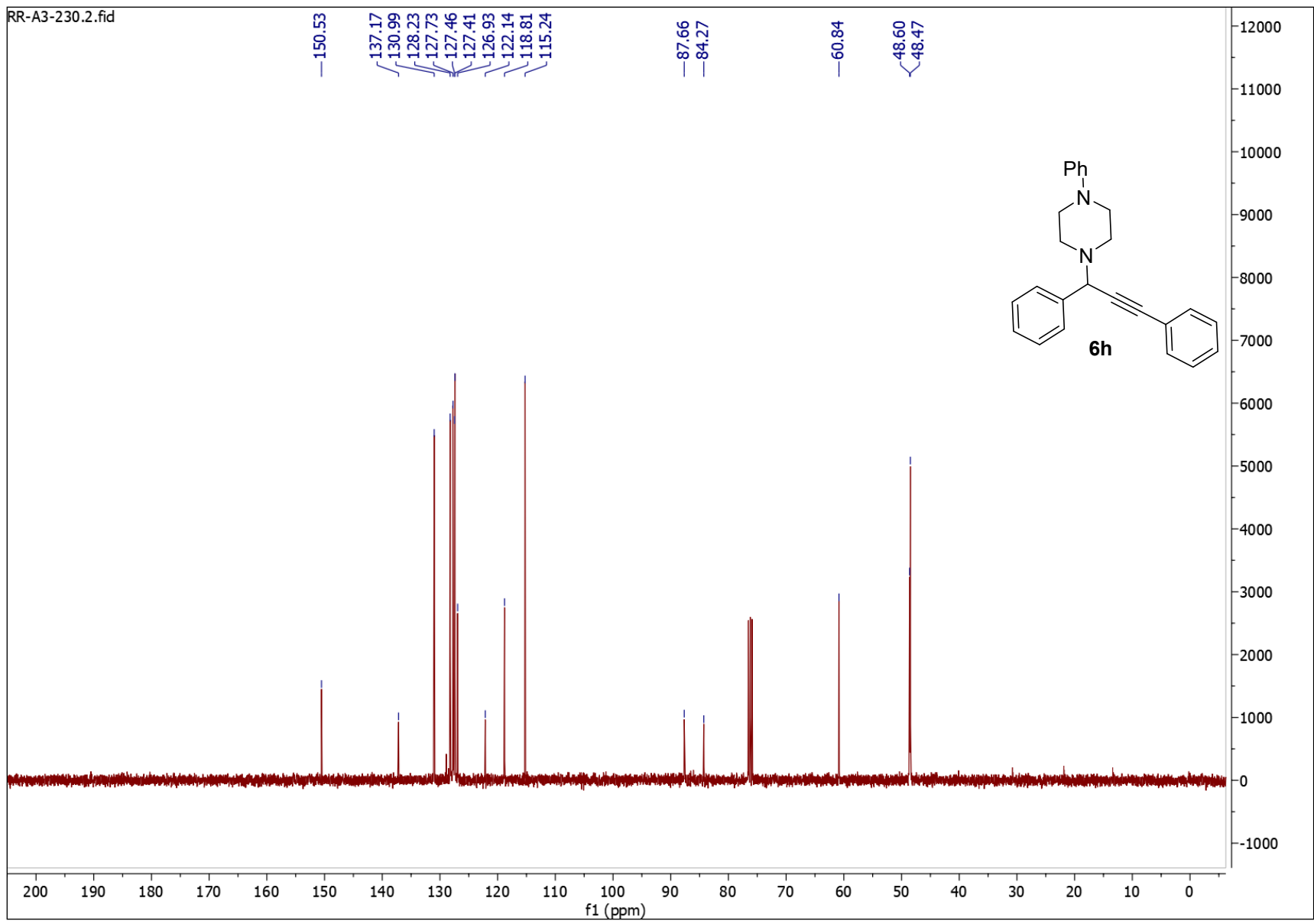


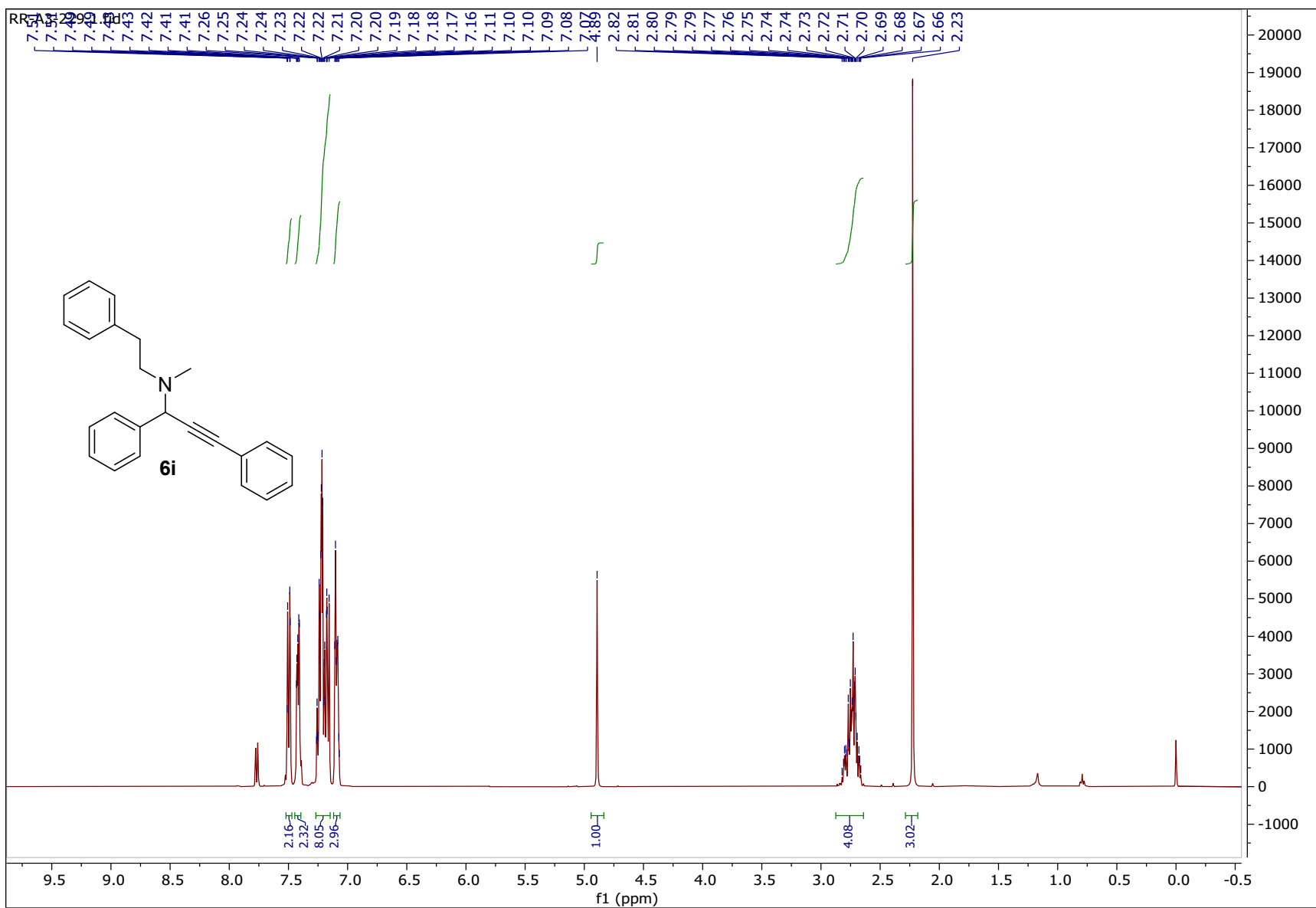


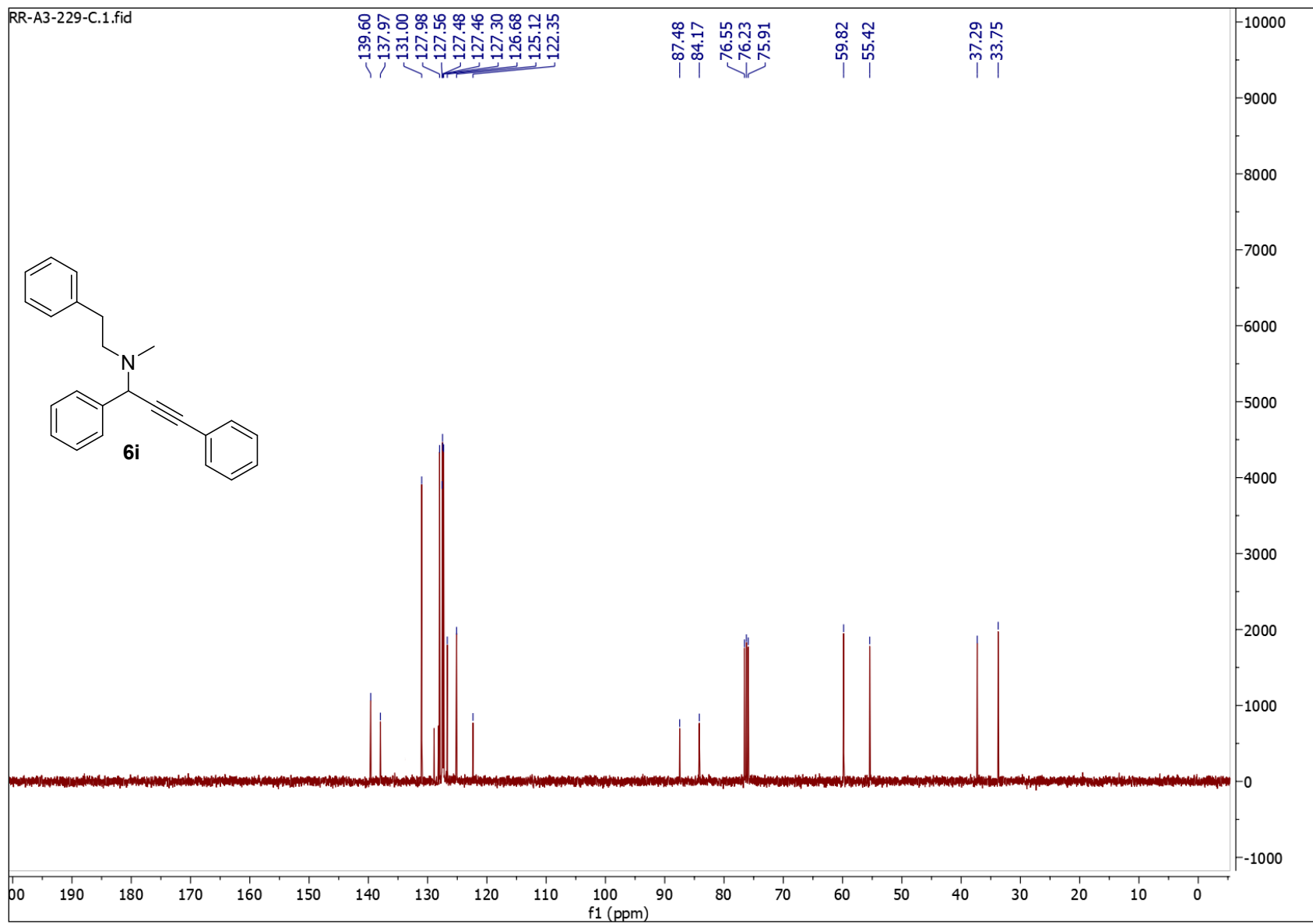


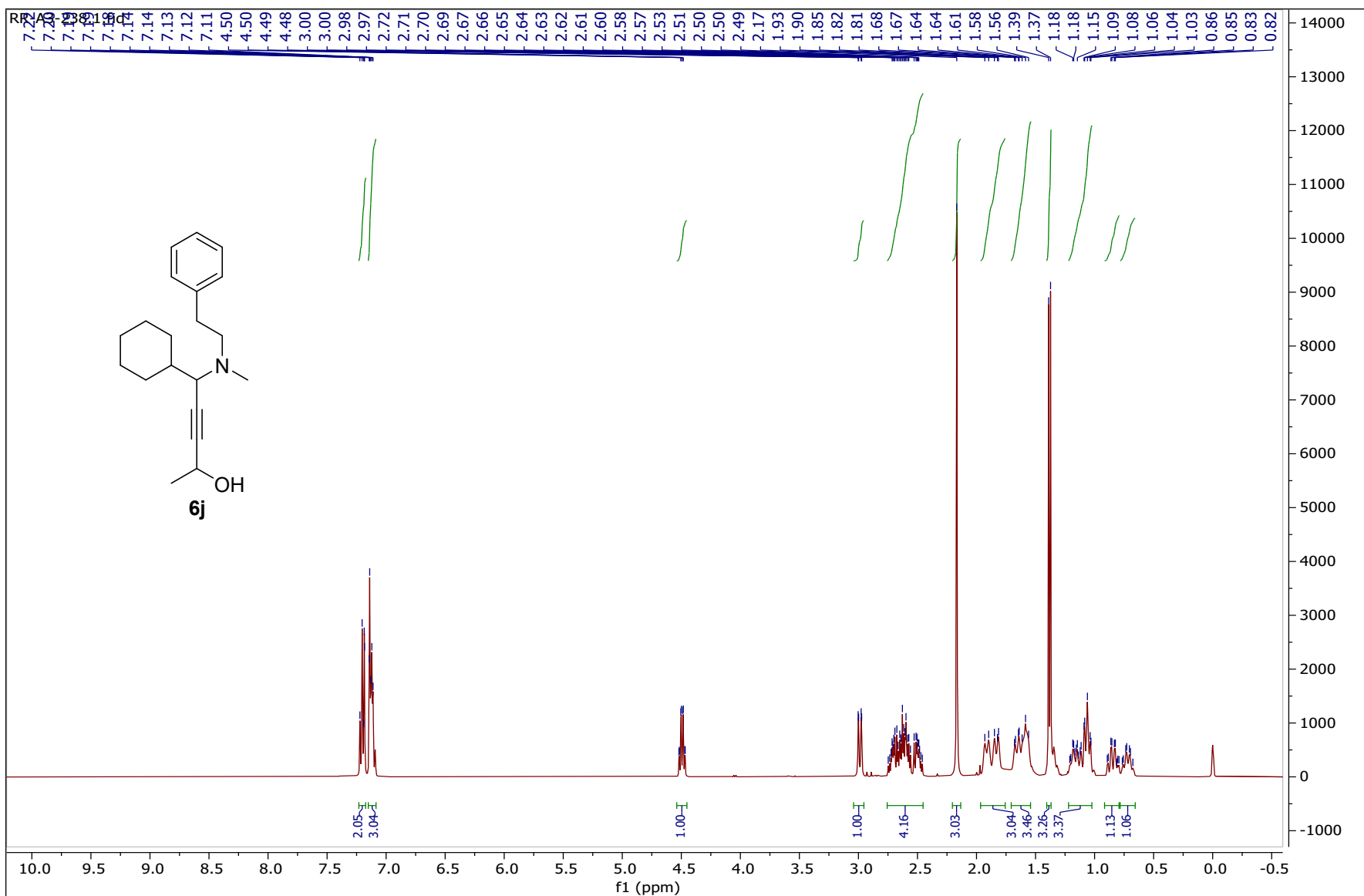


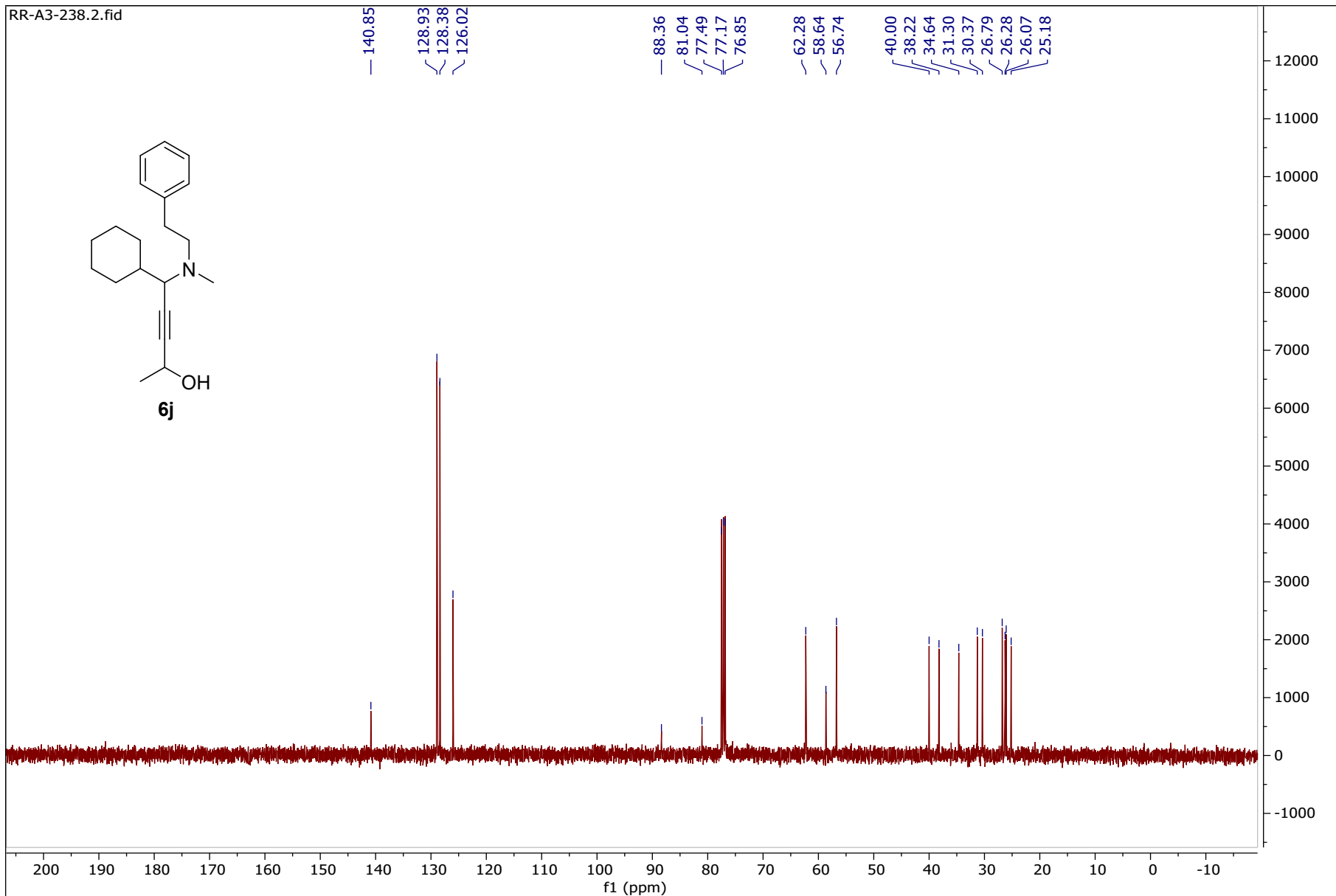


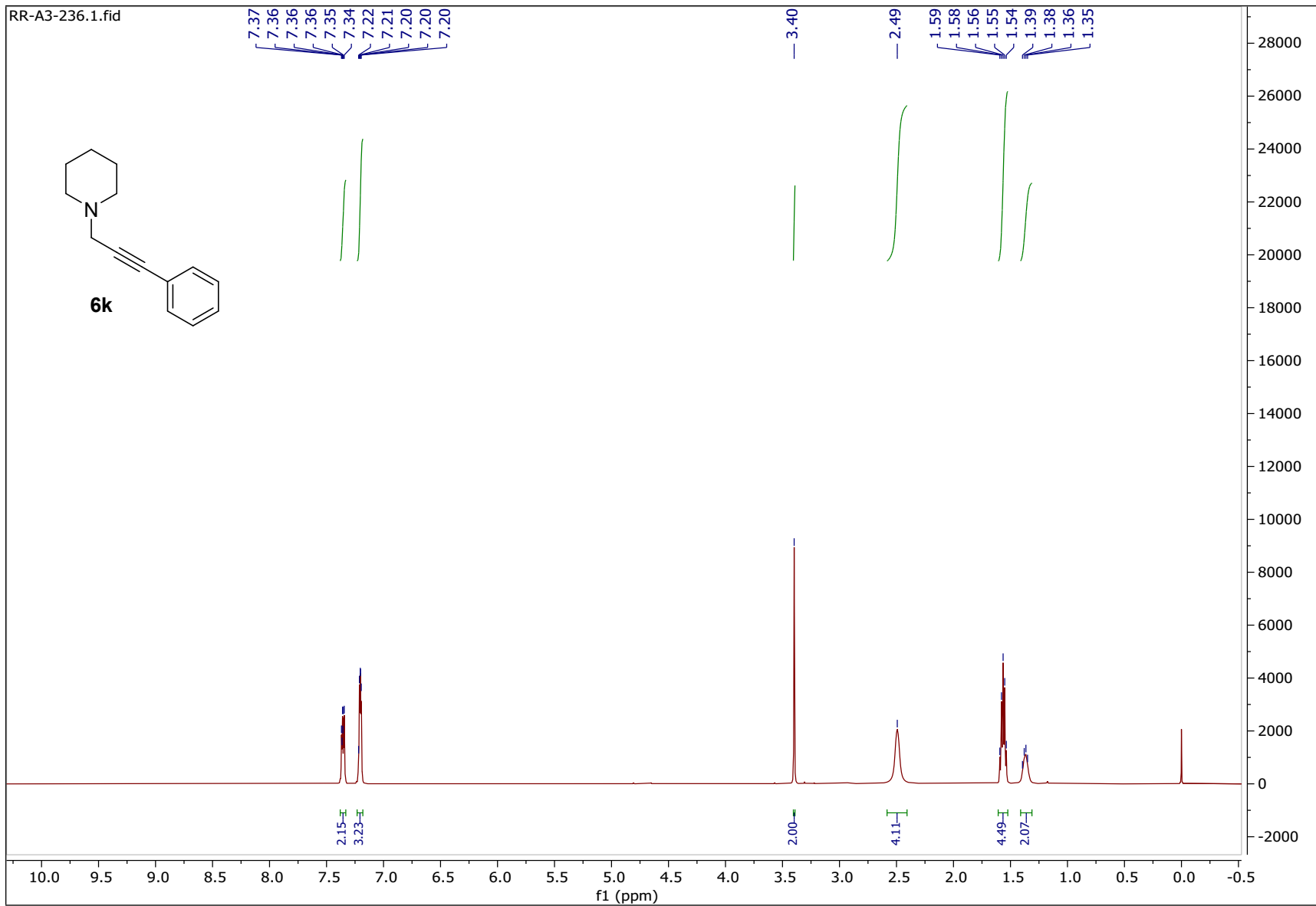




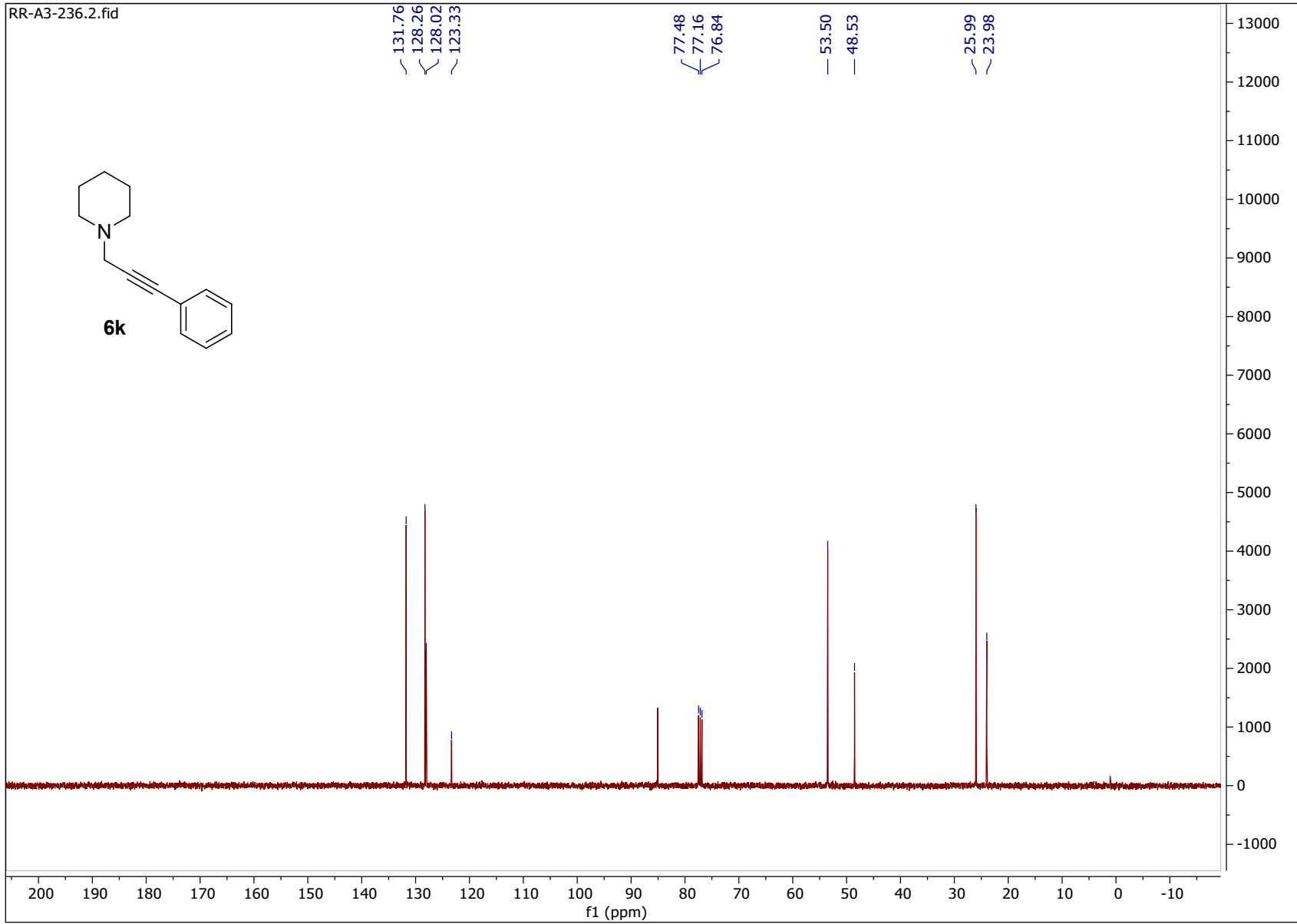
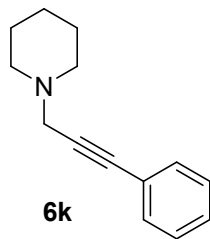


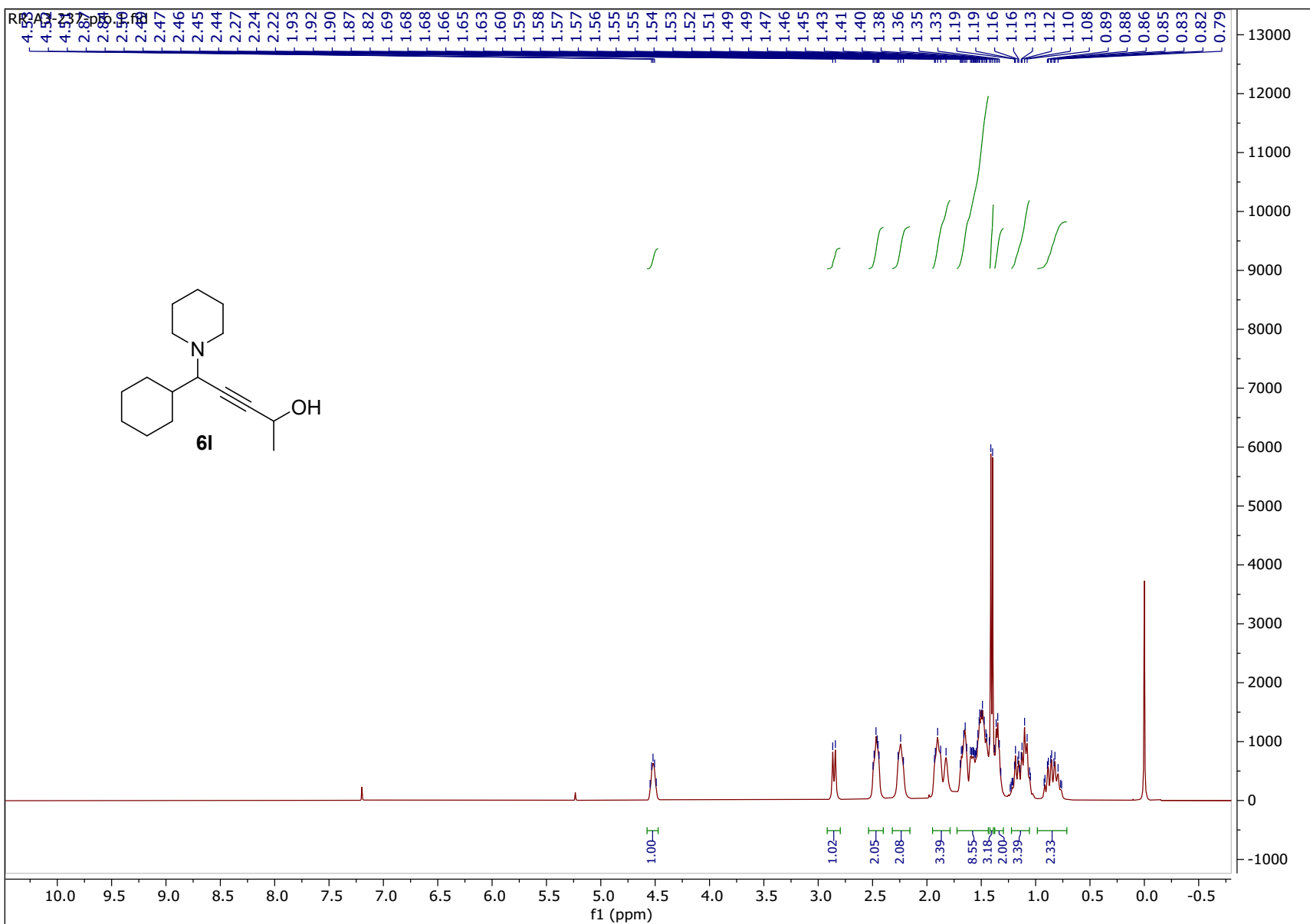




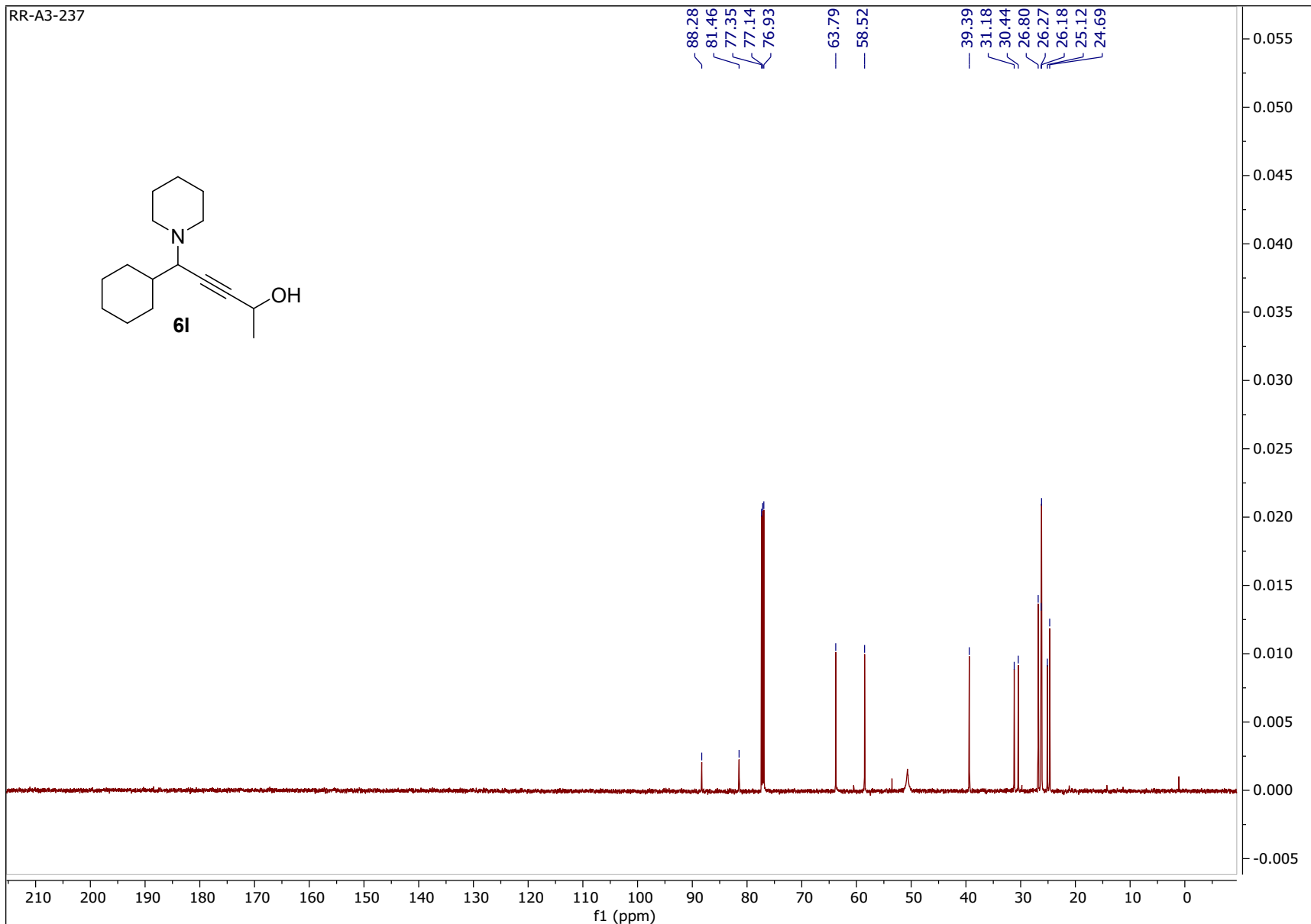
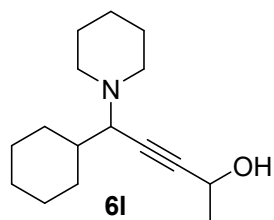


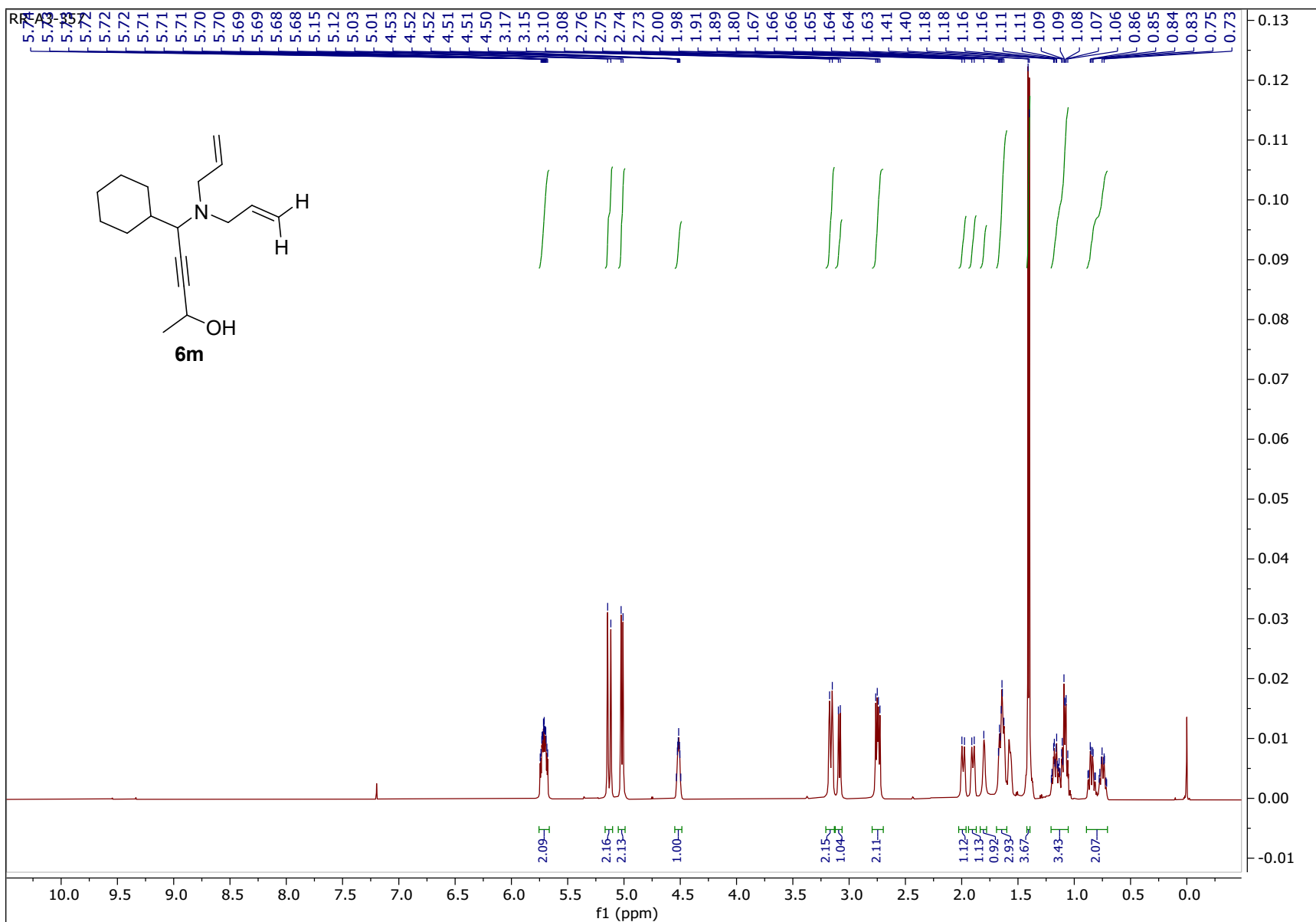
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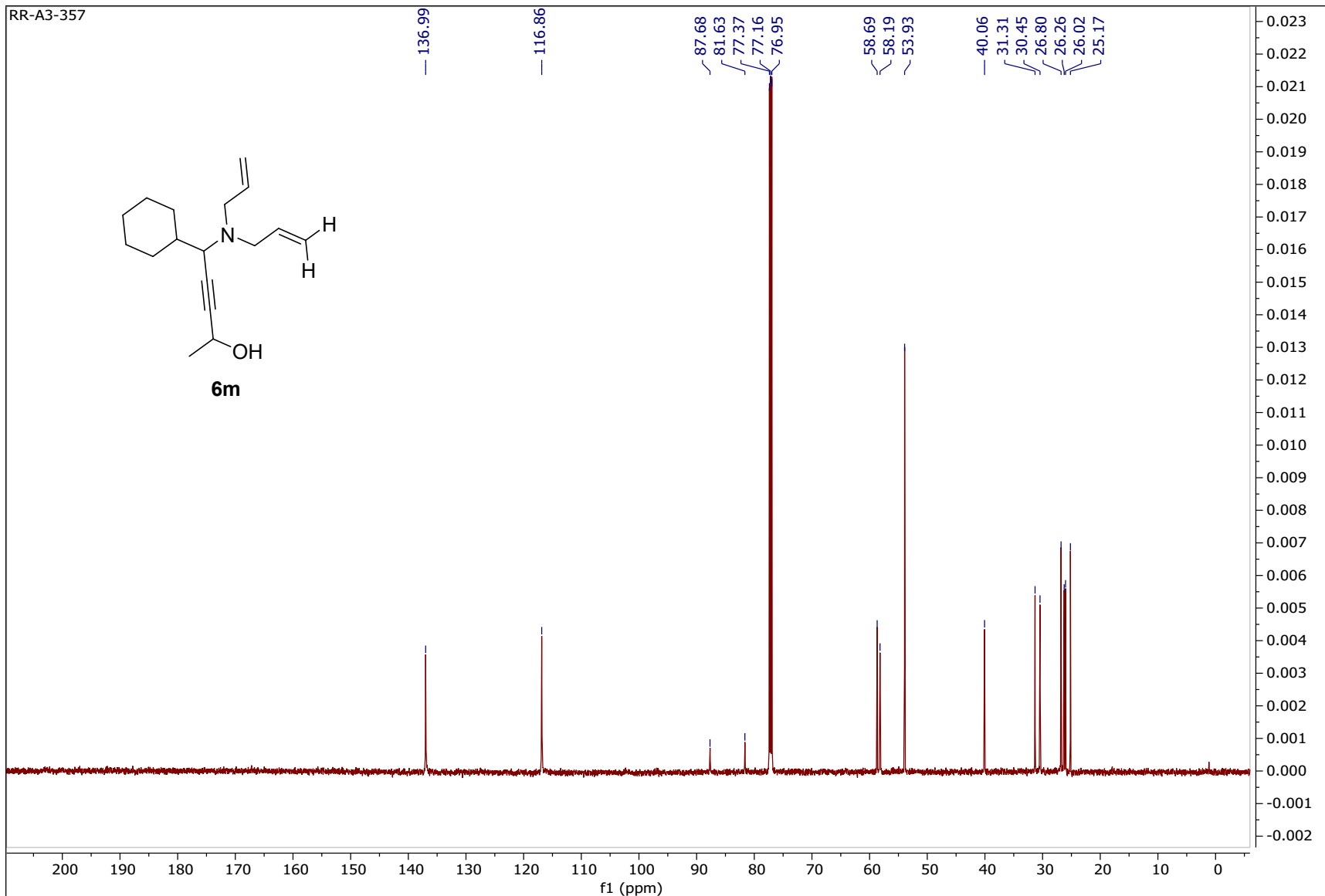


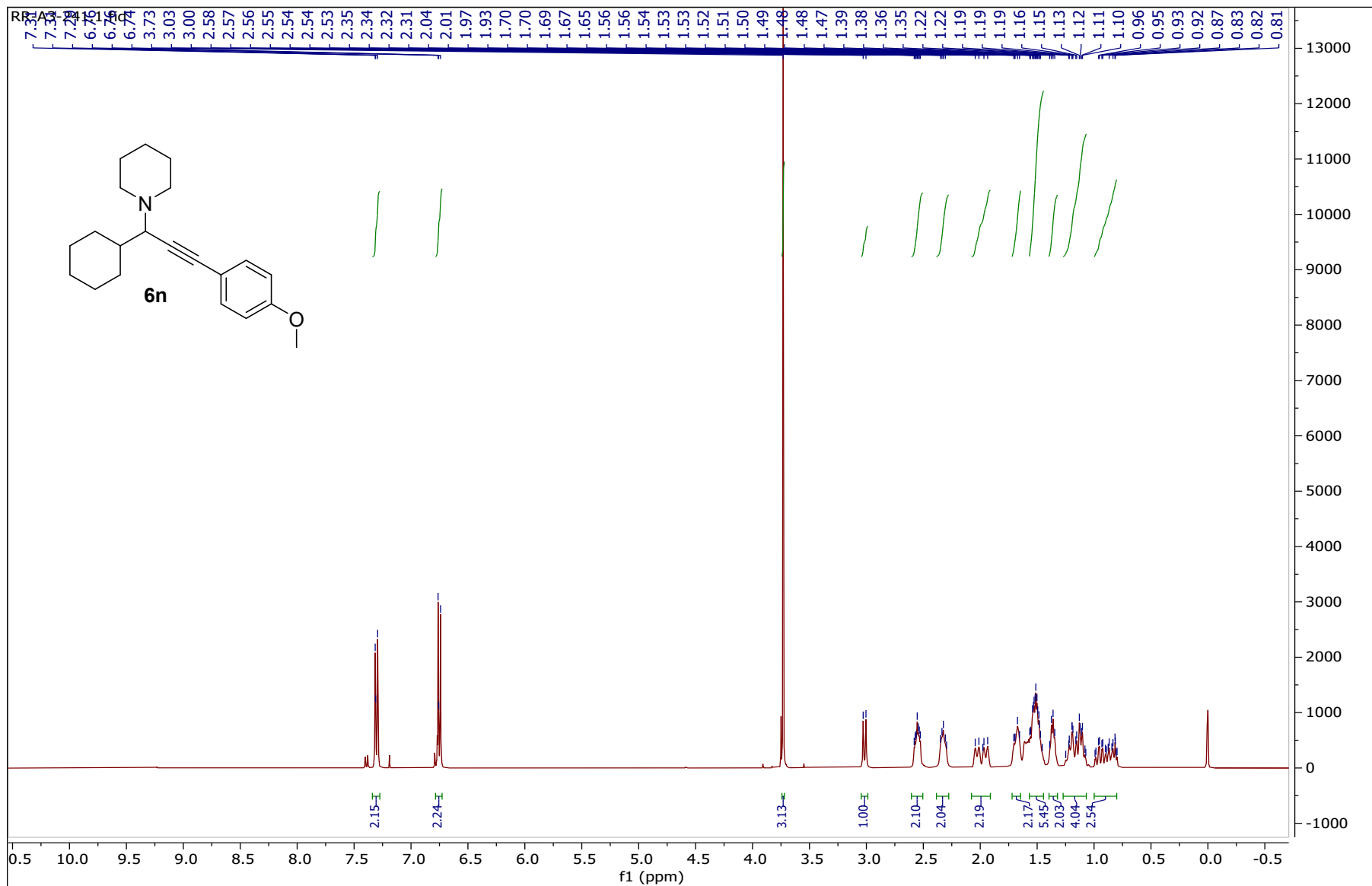


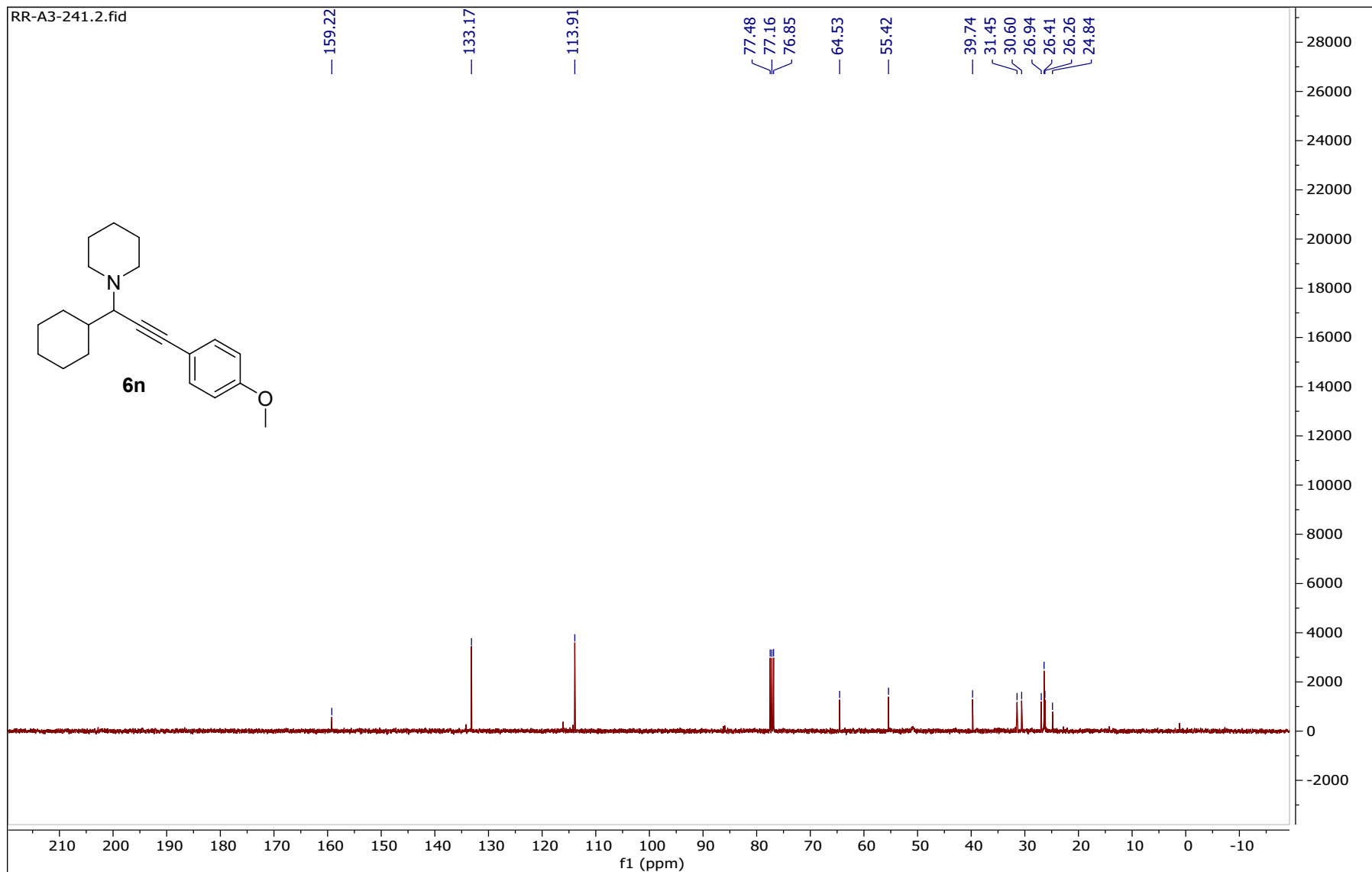
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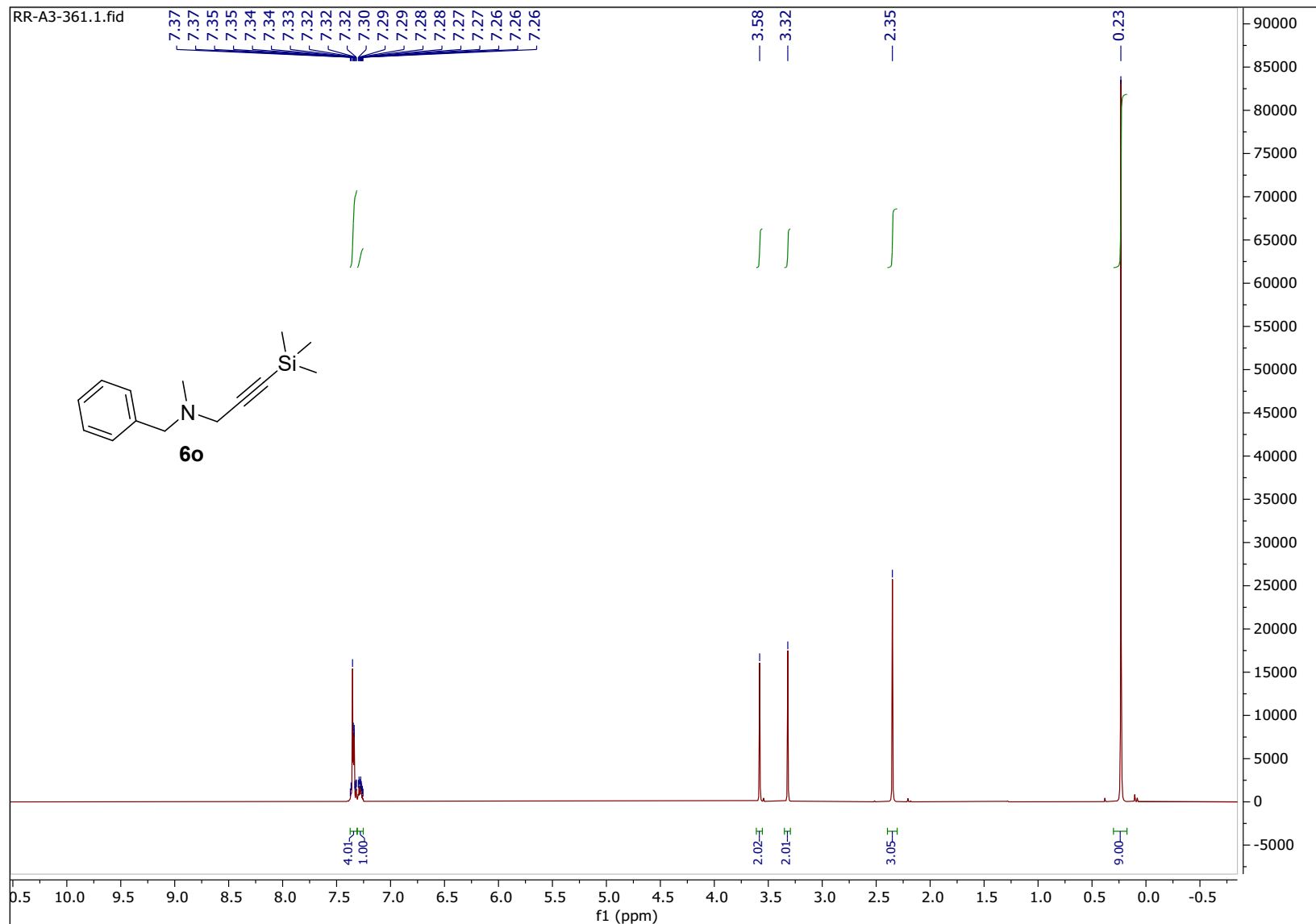


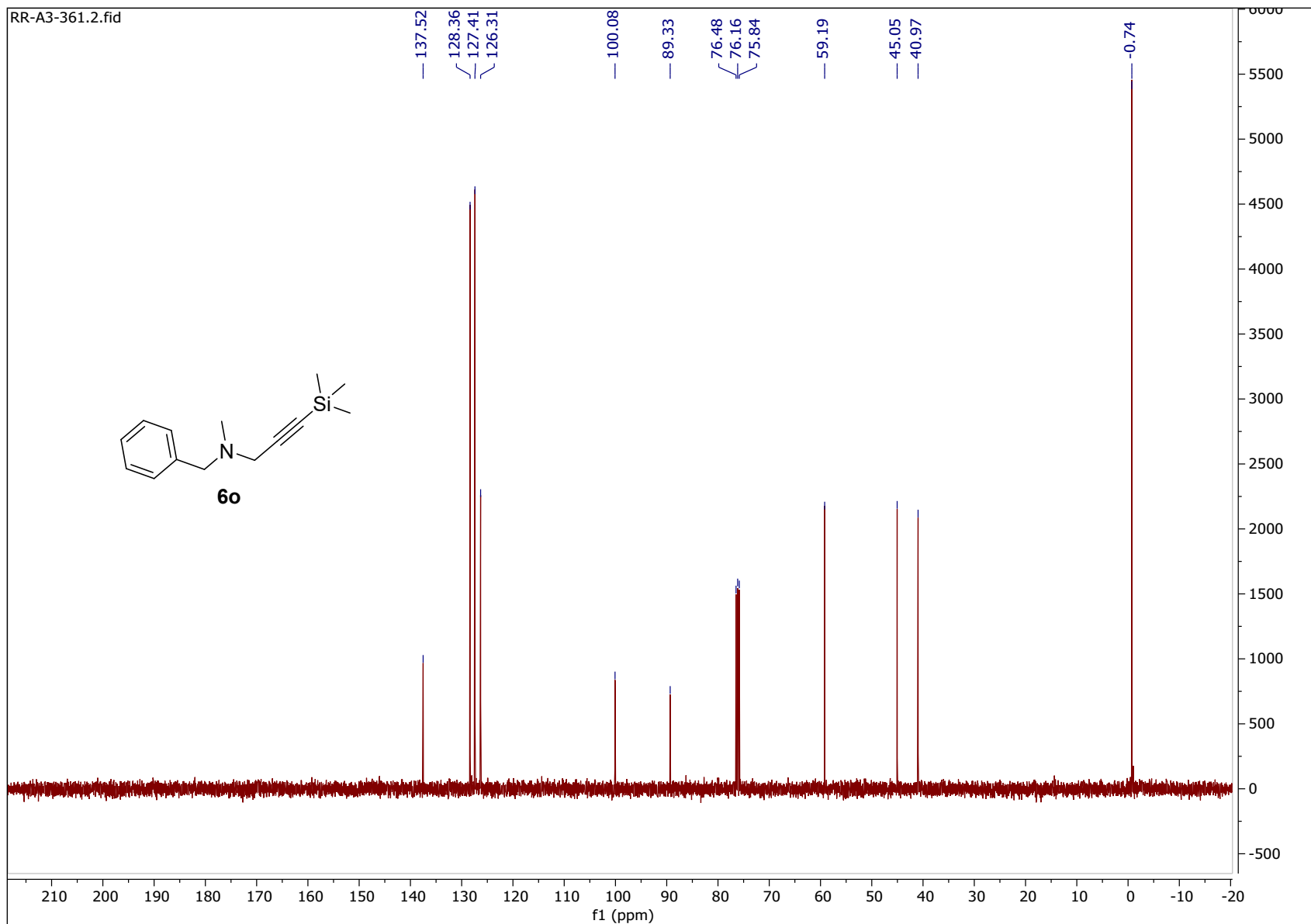


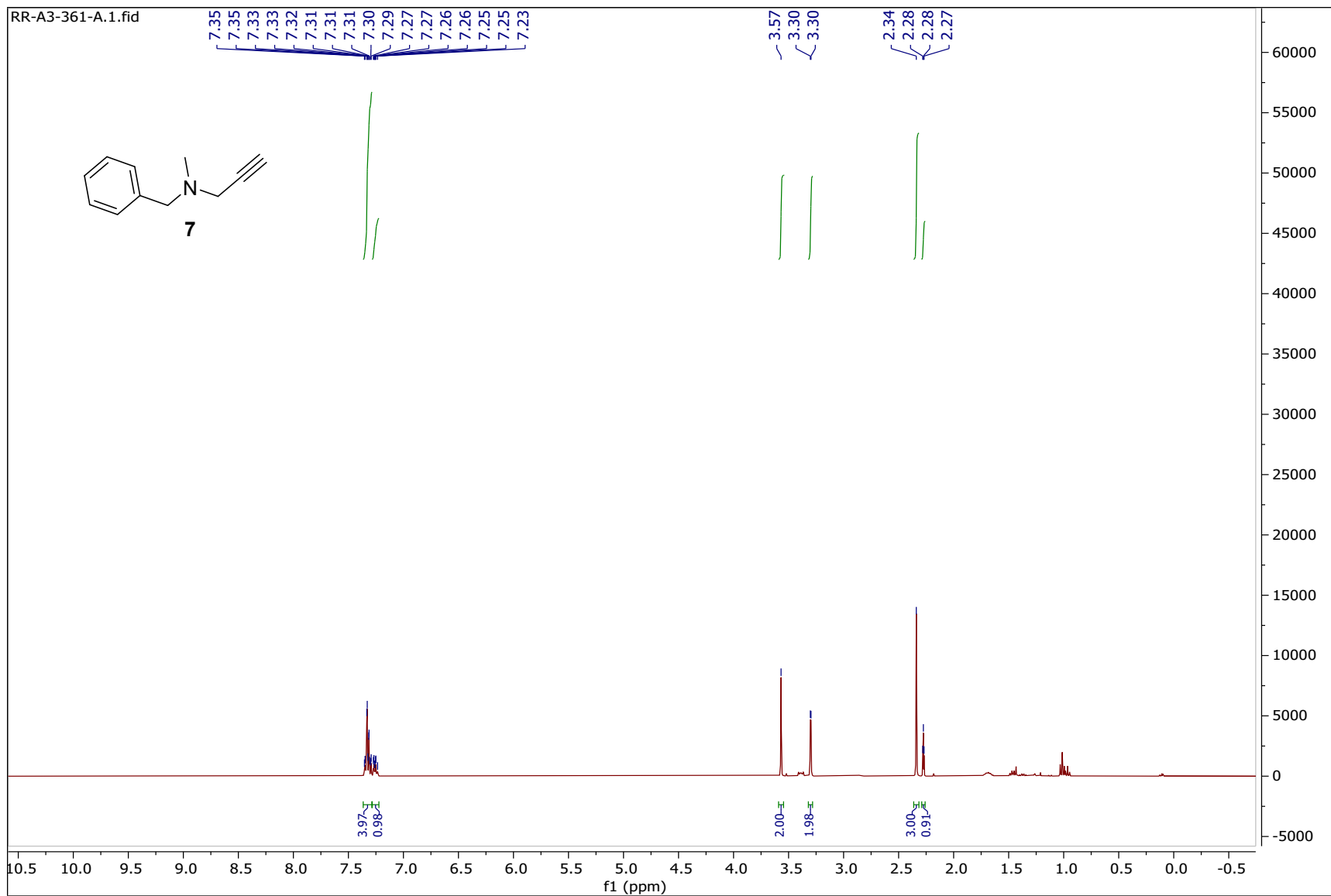




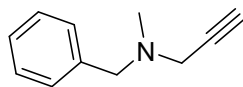








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