

Electronic Supplementary Information for:

**Synthesis of Carboxy ATTO 647N Using Redox Cycling for Xanthone Access**

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## EXPERIMENTAL METHODS

**General Considerations:** Reactions were performed in the piece of glassware specified in each protocol. Purification by flash chromatography was performed with 60 Å silica gel purchased from Sorbent Technologies, Inc. HPLC purification was performed on a Shimadzu Prominence HPLC equipped with a Zorbax SB-C<sub>18</sub> preparatory column (21.2 x 250 mm) with 7.0 μm packing material. Any reaction run in anhydrous conditions was performed in glassware that was flame-dried under vacuum prior to reaction. The <sup>1</sup>H NMR and <sup>13</sup>C NMR spectra were recorded on a Bruker AVANCE III 500 NMR, supported by NSF grant 1 S10 OD021508-01. Chemical shifts are reported in parts per million (δ) referenced internally to the residual solvent peak. Deuterated NMR solvents were obtained from Cambridge Isotope Laboratories and used as received. LCMS spectra were recorded on an Agilent Technologies 6130 single quadrupole LCMS using electrospray ionization. Reactions were monitored at 280 nm. High resolution mass spectra were recorded on an Agilent Technologies 6530 Accurate Mass Q-TOF using electrospray ionization. Infrared spectra were recorded on a Perkin-Elmer 1600 spectrometer using a diamond ATR unit.

**Materials:** The following solvents were purchased from commercial sources and used without further purification: methanol Certified ACS (Fisher Scientific), ethanol absolute (Fisher Scientific), 1,2-dichloroethane (99.8%+) (Fisher Scientific), 1-methyl-2-pyrrolidinone (Fisher Scientific), 37% hydrogen chloride solution (Fisher Scientific), benzyl alcohol (99%) (Fisher Scientific), chlorobenzene (99%+) (Acros Organics), acetic anhydride certified ACS (Fischer), *N,N*-dimethylformamide Certified ACS (Fischer Scientific). Toluene Certified ACS was distilled over P<sub>2</sub>O<sub>5</sub> dried with 4 Å mol sieves (Fischer Scientific). The following solvents were treated with a Vacuum Atmospheres Company Solvent Purification System (SPS) for drying and then stored on activated 4 Å mol sieves: tetrahydrofuran stab. 0.025% BHT (Fischer Scientific), dichloromethane (99.9%) (Fischer Scientific), and *N,N*-dimethylformamide certified ACS (Fischer Scientific). Acetone certified ACS (Fischer Scientific) was dried with K<sub>2</sub>CO<sub>3</sub> overnight and filtered prior to use. The following compounds were purchased from commercial sources and used without purification unless indicated: 3-bromoaniline 98% (Millipore Sigma), mesityl oxide 98% (Millipore Sigma), boron trifluoride etherate, ca. 48% BF<sub>3</sub> (Acros Organics), epichlorohydrin 99% (Acros Organics), *n*-butyllithium solution 2.5 M in hexanes (Millipore Sigma), *t*-butyllithium solution 1.7 M in hexanes (Millipore Sigma), boron trichloride solution 1.0 M in methylene chloride (Millipore Sigma), 10% wt. Pd/C (Millipore Sigma), KHSO<sub>4</sub> puriss. (Millipore Sigma), H<sub>3</sub>PO<sub>4</sub> 85% wt. in H<sub>2</sub>O (Millipore Sigma), phosphorus pentoxide (≥98.5%) (Millipore Sigma), iodine (Millipore Sigma), Na<sub>3</sub>PO<sub>4</sub> tribasic dodecahydrate ≥ 98% (Millipore Sigma), 2-bromobenzoic acid 97% (Aldrich), thionyl chloride (99.5%+) (Acros organics), 2-amino-2-methylpropan-1-ol (Spectrum Products), juololidine 98% (Alfa Aesar), 4-(Methylamino)butyric acid hydrochloride 99% (Millipore Sigma), fluoro-dipyrrolidinocarbenium hexafluorophosphate ≥99% (Millipore Sigma), *N,N*-diisopropylethylamine dried over NaOH (Millipore Sigma), phosphorous (V) 99.999% (Acros Organics), *N,N,N',N'*-tetramethylethylenediamine ≥99.5%, sodium borohydride ≥98% (Millipore Sigma), di-*tert*-butyl dicarbonate reagentPlus ≥99% (Millipore Sigma), 4-(methylamino)butyric acid hydrochloride 99% (Millipore Sigma).

**2,3,6,7-tetrahydro-1*H*,5*H*-pyrido[3,2,1-*ij*]quinoline-9-carbaldehyde (16):**

To a 100 mL round-bottomed flask under an argon atmosphere, *N,N*-dimethylformamide (21 mL) was added by syringe, which was cooled to 0 °C with an external ice bath. POCl<sub>3</sub> (4.7 mL, 50.3 mmol) was added dropwise by syringe and then stirred for 30 minutes at this temperature. To the reaction mixture, a solution of julolidine **15** (7.0 g, 40.5 mmol) in *N,N*-dimethylformamide (10 mL) was added dropwise by syringe. Following addition, the reaction was allowed to warm to room temperature and then placed in a pre-heated oil bath at 90 °C and stirred for 1.5 hours. Upon cooling to room temperature, the reaction was added to a 1 L Erlenmeyer flask with water (400 mL). Solid KOH pellets were added until the solution was ~pH 12–13. The solution was extracted with EtOAc (4 x 50 mL) and the organic extracts were combined and dried over Na<sub>2</sub>SO<sub>4</sub>. Following filtration, the solution was concentrated by rotary evaporation and the green solid was triterated with hexanes and decanted until no color was produced, giving **16** (6.5 g, 32.3 mmol) as a green-brown solid in 80% yield, which was used without further purification. This compound is known.<sup>1</sup> <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 9.58 (s, 1H), 7.27 (s, 2H), 3.27 (t, *J* = 5.8 Hz, 4H), 2.75 (t, *J* = 6.3 Hz, 4H), 1.95 (p, *J* = 6.1 Hz, 4H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ: 90.1, 147.9, 129.4, 124.0, 120.3, 50.0, 27.7, 21.3.

**(2,3,6,7-tetrahydro-1*H*,5*H*-pyrido[3,2,1-*ij*]quinolin-9-yl)methanol (10):**

Compound **16** (1.2 g, 5.97 mmol) was charged to a 100 mL round-bottomed flask equipped with a magnetic stirbar. Ethanol (25 mL) was added by graduate cylinder. NaBH<sub>4</sub> (350 mg, 9.2 mmol) was added in five portions at room temperature over the course of 30 minutes and the reaction was stirred for 1 hour following addition. The reaction was quenched by the addition of water (25 mL). The aqueous layer was extracted with EtOAc (3 x 25 mL) and the organic layers were combined and dried over MgSO<sub>4</sub>, filtered and concentrated. The reaction was purified with silica gel flash chromatography (hexanes to 4:1 hexanes/EtOAc) giving **10** (938 mg, 4.6 mmol) in 77% yield as either a white solid if concentrated from hexanes/EtOAc or as a red oil if concentrated from methylene chloride. The primary alcohol oxidizes readily and thus was used immediately upon isolation. Note: the alcohol degraded rapidly in CHCl<sub>3</sub> on the time scale of <sup>13</sup>C NMR analysis and thus the reported spectra are taken in different solvents. <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 6.80 (s, 2H), 4.47 (s, 2H), 3.13 (t, *J* = 5.6 Hz, 4H), 2.75 (t, *J* = 6.4 Hz, 4H), 1.94–2.0 (m, 4H), 1.42 (s, 1H). <sup>13</sup>C-NMR (126 MHz, CD<sub>3</sub>OD) δ: 142.2, 128.5, 126.1, 121.5, 64.1, 49.9, 27.3, 22.0. HRMS (ESI) *m/z*: (M+1H)<sup>+</sup> Calcd for C<sub>13</sub>H<sub>18</sub>NO 204.1383; found 204.1387.

**7-bromo-2,2,4-trimethyl-1,2-dihydroquinoline (17):** To a flame-dried 100 mL round-bottomed flask equipped with a magnetic stir bar was added 3-bromoaniline (**14**) (6.31 mL, 58.0 mmol) and mesityl oxide (**13**) (13.269 mL, 116 mmol) both *via* syringe. Iodine (1.2g, 4.7 mmol) was charged to the RBF and the flask placed under a flow of N<sub>2</sub>. Anhydrous toluene (30 mL) was added *via* syringe. The reaction was placed in a pre-heated oil bath at 110 °C and stirred for 18 hours. After cooling to room temperature, the reaction was concentrated by rotary evaporation. The crude solid was dissolved in methylene chloride and pre-adsorbed to silica gel. This was purified by silica gel flash chromatography with neat hexanes to 50:1 hexanes/EtOAc, providing **17** (7.89 g, 31.3 mmol) as a yellow oil, which precipitated into a yellow-brown solid in a 54% yield. This compound is known.<sup>2</sup> <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 6.88 (d, *J* = 8.1 Hz, 1H), 6.73 (d, *J* = 8.1 Hz, 1H), 6.56 (s, 1H), 5.31 (s, 1H), 1.95 (s, 3H), 1.27 (s, 6H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ: 144.3, 128.6, 127.9, 121.7, 120.5, 119.9, 115.4, 52.2, 31.8, 18.5.

**7-bromo-1-ethyl-2,2,4-trimethyl-1,2-dihydroquinoline (12):** Meerwein's reagent (triethyloxonium tetrafluoroborate)<sup>3</sup> was generated by the careful addition of boron trifluoride etherate (4.62 mL, 37.4 mmol) to a stirred solution of epichlorohydrin (2.48 mL, 30.7 mmol) in anhydrous diethyl ether (100 mL) under argon in a flame-dried 250 mL round-bottomed flask. The solution was then heated at reflux for two hours. The solid Meerwein's salt precipitated out of solution, the ether was decanted and the reaction dried under high-vacuum for 30 minutes to afford a fluffy white solid. The RBF was placed under a flow of N<sub>2</sub> and 1,2-dichloroethane (50 mL) was added via syringe, with **17** (7.01g, 27.8 mmol) charged to the round-bottomed flask, which was then placed in a pre-heated oil bath at 80 °C and stirred for 18 hours. After cooling to room temperature, the solvent was removed by rotary evaporation. The crude solid was dissolved in methylene chloride and pre-adsorbed to silica gel. The compound was purified by silica gel flash chromatography with neat hexanes to 100:1 hexanes/EtOAc, providing **12** (5.59 g, 20.0 mmol) as a yellow oil in 71% yield. <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 6.86 (d, *J* = 8.2 Hz, 1H), 6.69 (d, *J* = 8.1 Hz, 1H), 6.58 (s, 1H), 5.21 (s, 1H), 3.20 (q, *J* = 7.1 Hz, 2H), 1.94 (s, 3H), 1.32 (s, 6H), 1.20 (t, *J* = 7.0 Hz, 3H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ 144.8, 129.4, 127.1, 124.9, 122.6, 121.4, 117.8, 112.8, 57.1, 38.1, 28.8, 18.6, 14.0. HRMS (ESI) *m/z*: (M+1H)<sup>+</sup> for C<sub>14</sub>H<sub>19</sub>NBr calcd 280.0695; found 280.0700.

**2-(1-ethyl-2,2,4-trimethyl-1,2-dihydroquinolin-7-yl)propan-2-ol (18):**

A solution of **12** (4.0 g, 14.39 mmol) in anhydrous THF (40 mL) was prepared in a flame-dried 100 mL round-bottomed flask equipped with magnetic stirbar. This was placed in external dry ice/acetone bath, cooling it to -78 °C. 2.5 M *n*-BuLi solution in hexanes (6.9 mL, 17.29 mmol) was slowly added and stirred for 30 minutes. A solution of anhydrous acetone (6 mL, 80.99 mmol) cooled to -78 °C was added in two rapid additions via syringe and then stirred for a further 1 h at this temperature. The reaction was warmed to room temperature and then added to an ice-cold solution of 20% NH<sub>4</sub>Cl (100 mL). The aqueous mixture was extracted with EtOAc (3 x 50 mL) and dried over MgSO<sub>4</sub>, which was filtered and the solvent removed by rotary evaporation. The crude product was purified by silica gel flash chromatography with 9:1 hexanes/EtOAc, providing **18** (3.05 g, 11.80 mmol) as a yellow oil in 82% yield. <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 7.01 (d, *J* = 8.0 Hz, 1H), 6.66 (d, *J* = 7.2 Hz, 2H), 5.18 (s, 1H), 3.36 (q, *J* = 7.0 Hz, 2H), 1.96 (s, 3H), 1.58 (s, 6H), 1.22 (t, *J* = 7.0 Hz, 3H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ: 149.6, 143.4, 128.9, 127.3, 123.5, 121.1, 72.7, 57.0, 38.0, 31.6, 28.9, 18.7, 14.3. HRMS (ESI) *m/z*: (M+1H)<sup>+</sup> C<sub>17</sub>H<sub>26</sub>NO calcd 260.2009; found 260.2016.

**2-(1-ethyl-2,2,4-trimethyl-1,2,3,4-tetrahydroquinolin-7-yl)propan-2-ol (19):**

To a 250-mL round-bottomed flask equipped with magnetic stirbar, **18** (2.0 g, 7.72 mmol) and 10% wt. Pd/C (300 mg) were charged, with EtOH (100 mL) added by graduated cylinder. The solution was sparged with 2 large balloons of nitrogen gas followed by 3 large balloons of hydrogen gas and then stirred for 18 hours under a hydrogen atmosphere at room temperature. The reaction mixture was filtered through a pad of celite and the solvent removed by rotary evaporation to give **19** (1.91 g, 7.33 mmol) as a clear, redish oil in 95% yield without further purification. <sup>1</sup>H-NMR (400 MHz, CDCl<sub>3</sub>) δ: 7.11 (d, *J* = 7.8 Hz, 2H), 6.75 (s, 1H), 6.70 (d, *J* = 7.9 Hz, 1H), 3.48 (dq, *J* = 14.2, 7.0 Hz, 1H), 3.23 (dq, *J* = 14.0, 6.9 Hz, 1H), 2.85-2.90 (m, 1H), 1.71 (dd, *J* = 12.9, 4.6 Hz, 2H), 1.59 (s, 6H), 1.32 (d, *J* = 6.3 Hz, 6H), 1.22 (t, *J* = 7.0 Hz, 3H), 1.19 (s, 3H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ: 147.8, 144.5, 125.9, 125.6, 110.9, 107.2, 72.6, 54.4, 46.9, 39.0, 31.6, 29.98, 27.0, 25.2, 20.0, 15.8. HRMS (ESI) *m/z*: (M+1H)<sup>+</sup> for C<sub>17</sub>H<sub>28</sub>NO calcd 262.2165; found 262.2168.

**1-ethyl-2,2,4-trimethyl-7-(prop-1-en-2-yl)-1,2,3,4-tetrahydroquinoline (11):**

To a 6-dram vial equipped with magnetic stirrer and a teflon cap, **19** (1.5 g, 5.74 mmol) and KHSO<sub>4</sub> (780 mg, 5.73 mmol) were charged, with anhydrous chlorobenzene (8 mL) added by syringe. The vial was sealed with teflon tape and the reaction mixture was placed in a pre-heated oil bath at 140 °C and stirred for 10 minutes. After cooling to room temperature, the reaction was poured in sat. NaHCO<sub>3</sub> (20 mL). The layers were separated and the aqueous was further extracted with EtOAc (3 x 15 mL). The combined organic layers were dried over Na<sub>2</sub>SO<sub>4</sub>, filtered and the solvent removed under reduced pressure. The oil was purified by flushing through a plug of silica gel with 1:1 hexanes/EtOAc to give **11** (1.17 g, 4.82 mmol) as a yellow oil in 84% yield. <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 7.11 (d, *J* = 8.1 Hz, 1H), 6.74 (d, *J* = 8.1 Hz, 1H), 6.67 (s, 1H), 5.30 (s, 1H), 5.01 (s, 1H), 3.43-3.51 (m, 1H), 3.19-3.26 (m, 1H), 2.86-2.93 (m, 1H), 2.15 (s, 3H), 1.72 (dd, *J* = 13.2 Hz, 4.9 Hz, 1H), 1.57 (t, *J* = 12.9 Hz, 1H), 1.33 (d, *J* = 5.2 Hz, 6H), 1.23 (t, *J* = 7.2 Hz, 3H), 1.18 (s, 3H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ 144.4, 144.4, 140.1, 127.0, 125.7, 112.5, 111.2, 108.3, 54.3, 47.0, 39.0, 29.8, 27.1, 25.1, 22.0, 20.0, 15.1. HRMS (ESI) *m/z*: (M+1H)<sup>+</sup> for C<sub>17</sub>H<sub>26</sub>N calcd 244.2060; found 244.2065.

**Xanthone (6):**

To a stirred solution of **11** (1.3 g, 5.35 mmol) and alcohol **10** (1.06 g, 5.22 mmol) in anhydrous CH<sub>2</sub>Cl<sub>2</sub> (20 mL) prepared in a 50-mL round-bottomed flask under argon cooled to -78 °C, 1.0 M BCl<sub>3</sub> in CH<sub>2</sub>Cl<sub>2</sub> (5.7 mL, 5.7 mmol) was added drop-wise by syringe and stirred overnight, allowing the reaction to slowly warm to room temperature. Separately, to a 100-mL pear-shaped flask, a solution of 85% phosphoric acid (3.2 mL) was added to solid P<sub>2</sub>O<sub>5</sub> (7.5 g, 53.2 mmol) and stirred at 120 °C for 20 minutes, using a spatula to break up chunks of P<sub>2</sub>O<sub>5</sub> to produce a viscous oil. After cooling to room temperature, the CH<sub>2</sub>Cl<sub>2</sub> reaction mixture was added to the phosphoric acid and the CH<sub>2</sub>Cl<sub>2</sub> was removed by heavy nitrogen flow. Once most solvent was removed, the resulting mixture was stirred at 115 °C for 3 hours, which boiled off residual CH<sub>2</sub>Cl<sub>2</sub>. This reaction can "foam up" and produced a very viscous substance. Using a heat gun to warm the sides of the flask that are not in direct contact with the heat bath can help to keep the foam in solution. Once the reaction has settled, it will appear as a dark orange viscous oil. Upon cooling to room temperature, ice and solid KOH were added until the pH was ~12, turning the orange melt into a dark blue solution. The aqueous solution was extracted with CH<sub>2</sub>Cl<sub>2</sub> (3 x 50 mL), washed with brine (1 x 30 mL) then dried over Na<sub>2</sub>SO<sub>4</sub>. Note: excess CH<sub>2</sub>Cl<sub>2</sub> may be needed to rinse the glassware and get all of the oil into solution. Following filtration and solvent evaporation, the crude solid was transferred to a 100-mL round-bottomed flask equipped with a magnetic stirrer. *N*-Methyl-2-pyrrolidinone (20 mL), I<sub>2</sub> (1.32 g, 5.22 mmol), Na<sub>3</sub>PO<sub>4</sub> (3.96 g, 10.4 mmol) and H<sub>2</sub>O (0.5 mL) were added and the reaction mixture which was capped with a rubber septum and secured with teflon tape. The solution was stirred at 23 °C for 5 min before being placed in a pre-heated oil bath at 115 °C and stirred for 8 hours. At this time, some xanthone was observable by TLC, an additional spatula tip of both I<sub>2</sub> and Na<sub>3</sub>PO<sub>4</sub> were added and the solution stirred at 75 °C overnight. After cooling to room temperature, the reaction was filtered through a pad of celite, which was washed with methylene chloride and methanol until colorless. The crude organic solution was concentrated by rotary evaporation with the remaining NMP removed by vacuum distillation (50-65 °C, 25 mm Hg). The crude mixture was dissolved in sat. aqueous NaHCO<sub>3</sub> (100 mL) and then extracted with CH<sub>2</sub>Cl<sub>2</sub> (5 x 100 mL), the organic extracts were combined and dried over Na<sub>2</sub>SO<sub>4</sub>. Note: some emulsification occurred, this was broken up with additional CH<sub>2</sub>Cl<sub>2</sub>. The solution was filtered, concentrated, pre-adsorbed onto silica gel and purified with silica gel column

chromatography (8:2 hexanes/CH<sub>2</sub>Cl<sub>2</sub> to 6:2:2 hexanes/CH<sub>2</sub>Cl<sub>2</sub>/EtOAc) to give **6** as a bright yellow solid (921 mg, 2.08 mmol) in 40% yield. <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 8.07 (s, 1H), 8.00 (s, 1H), 6.56 (s, 1H), 3.52-3.60 (m, 1H), 3.33-3.38 (m, 1H), 3.29 (q, *J* = 6.3 Hz, 4H), 3.02-3.03 (t, *J* = 5.8 Hz, 2H), 2.88-2.94 (m, 1H), 2.82 (t, *J* = 6.2 Hz, 3H), 1.97 (h, *J* = 6.8 Hz, 4H), 1.82 (s, 6H), 1.76 (dd, *J* = 13.2 Hz, 4.3 Hz, 1H), 1.60 (t, *J* = 5.6 Hz, 1H), 1.43 (d, *J* = 6.5 Hz, 3H), 1.38 (s, 3H), 1.28 (t, *J* = 6.8 Hz, 3H), 1.25 (s, 3H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ: 181.4, 154.3, 148.2, 147.5, 146.2, 126.8, 126.6, 124.2, 120.7, 119.8, 118.8, 117.4, 107.8, 55.2, 50.9, 50.2, 46.5, 39.2, 37.6, 31.2, 30.9, 29.8, 28.2, 27.7, 26.9, 25.8, 22.0, 21.7, 19.8, 14.6. HRMS (ESI) *m/z*: (M+1H)<sup>+</sup> for C<sub>30</sub>H<sub>39</sub>N<sub>2</sub>O calcd 443.3057; found 443.3062.

### **2-bromo-*N*-(1-hydroxy-2-methylpropan-2-yl)benzamide (22):**

To a solution of thionyl chloride (25 mL) with 10 drops of DMF in a 100-mL round-bottomed flask equipped with magnetic stirbar, 2-bromobenzoic acid (**22**) (5.0 g, 24.8 mmol) as a solid was slowly added. The resulting mixture was placed in a pre-heated oil bath at 80 °C and stirred at this temperature for 3 hours. Upon cooling to room temperature, the solvent was carefully removed by rotary evaporation. CH<sub>2</sub>Cl<sub>2</sub> (50 mL) was added and removed under reduced pressure. The crude reaction was placed under high vacuum for 1 h. The solid was dissolved in CH<sub>2</sub>Cl<sub>2</sub> (50 mL) and added by addition funnel to a stirred solution of 2-amino-2-methylpropan-1-ol (5.3 mL, 55.5 mmol), DIPEA (7.5 mL, 43.1 mmol), and CH<sub>2</sub>Cl<sub>2</sub> (50 mL) in a 250-mL flame-dried round-bottomed flask cooled in a 0 °C ice bath. The reaction mixture was stirred overnight at room temperature. Saturated NaHCO<sub>3</sub> aqueous solution (100 mL) was added to the reaction mixture, and the layers were separated. The aqueous layer was further extracted with CH<sub>2</sub>Cl<sub>2</sub> (3 x 50 mL) and the organic layers were combined and dried with Na<sub>2</sub>SO<sub>4</sub>, filtered, and evaporated to give **22** (6.1 g, 22.3 mmol) as a white solid in 90% yield without further purification. This compound is known.<sup>4</sup> <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 7.56 (d, *J* = 8.1 Hz, 1H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.34 (t, *J* = 7.4 Hz, 1H), 7.25 (td, *J* = 7.8 Hz, 1.7 Hz, 1H), 6.1 (s, 1H), 4.4 (s, 1H), 1.39 (s, 6H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ: 168.4, 138.1, 133.3, 131.3, 129.3, 127.6, 119.3, 70.3, 57.1, 24.5. HRMS (ESI) *m/z*: (M+1H)<sup>+</sup> for C<sub>11</sub>H<sub>15</sub>NO<sub>2</sub>Br 272.0281; found 272.0286.

### **2-(2-bromophenyl)-4,4-dimethyl-4,5-dihydrooxazole (23):**

To a 50-mL round-bottomed flask equipped with a magnetic stir bar, **22** (5.0 g, 18.4 mmol) was charged. Thionyl chloride (20 mL) was added by syringe and the reaction was stirred at room temperature for 1.5 hours.<sup>4</sup> The solvent was removed by rotary evaporation and the reaction diluted with water. Solid NaHCO<sub>3</sub> was added slowly until pH 8. The aqueous layer was extracted with EtOAc (3 x 25 mL), the organic extracts were combined, washed with brine (1 x 50 mL), dried over Na<sub>2</sub>SO<sub>4</sub>, and filtered and concentrated. The reaction was purified with silica gel flash chromatography with 7:3 hexanes/EtOAc to neat EtOAc to give **23** (3.8 g, 15.1 mmol) in an 82% yield. This compound is known.<sup>4</sup> <sup>1</sup>H-NMR (500 MHz, CDCl<sub>3</sub>) δ: 7.57 (d, *J* = 7.4 Hz, 1H), 7.54 (d, *J* = 8.0 Hz, 1H), 7.25 (t, *J* = 7.7 Hz, 1H), 7.19 (t, *J* = 7.7 Hz, 1H), 4.06 (s, 2H), 1.33 (s, 6H). <sup>13</sup>C-NMR (126 MHz, CDCl<sub>3</sub>) δ: 160.7, 132.6, 130.5, 130.2, 129.3, 126.0, 120.8, 78.4, 67.1, 27.2. HRMS (ESI) *m/z*: (M+1H)<sup>+</sup> for C<sub>11</sub>H<sub>13</sub>NOBr calcd 254.0175; found 254.0181.

### **Benzoic Acid (8):**

To a flame-dried 25-mL round-bottomed flask flushed with argon and equipped with a magnetic stir bar was added a solution of aryl oxazole **23** (481 mg, 1.7 mmol) in anhydrous THF (3 mL). After cooling to -78 °C, 1.7 M *t*-BuLi in hexanes (1.1 mL, 1.87 mmol) was added dropwise and

the resulting mixture was stirred for an additional 30 minutes at this temperature, generating the reactive intermediate. Ketone **6** (117 mg, 0.26 mmol), and *N,N,N',N'*-tetramethylethylenediamine (0.395 mL, 2.6 mmol) in anhydrous THF (4 mL) were cooled to  $-78^{\circ}\text{C}$  and added dropwise to the reaction mixture in four portions over 30 minutes by syringe. The dry ice/acetone bath (500 mL capacity) was fully filled with dry ice, covered with tinfoil and cotton, and the reaction was left stirring overnight, coming to room temperature very slowly. The reaction was quenched by the addition of AcOH (1 mL) in MeOH (5 mL). The reaction was stirred for an additional 10 minutes at room temperature and concentrated by rotary evaporation. The reaction was taken up in methylene chloride (20 mL) and washed with water (20 mL). The aqueous layer was extracted with  $\text{CH}_2\text{Cl}_2$  (2 x 30 mL), or until colorless. The organic extracts were combined and washed with brine (1 x 20 mL), dried over  $\text{Na}_2\text{SO}_4$ , filtered and solvent removed by rotary evaporation. The crude blue solid was transferred to a 100-mL round-bottomed flask with 30 mL of 6N HCl then placed in a pre-heated oil bath at  $90^{\circ}\text{C}$  and stirred for 18 hours at this temperature. If oxazole remained after this time, the reaction duration was extended. Upon cooling to room temperature, the reaction was quenched by careful addition of solid  $\text{Na}_2\text{CO}_3$ , extracted with  $\text{CH}_2\text{Cl}_2$  (3 x 20 mL) and the organic extracts were combined, dried over  $\text{Na}_2\text{SO}_4$ , filtered and concentrated. The reaction was purified with silica gel flash chromatography (99:1  $\text{CH}_2\text{Cl}_2/\text{MeOH}$  to 91:9  $\text{CH}_2\text{Cl}_2/\text{MeOH}$ ) giving **8** (83.6 mg, 0.14 mmol) as a dark blue solid in 54% yield, presumed to be the chloride salt. Note: unreacted ketone **6** could be isolated with these chromatography conditions by eluting 98:2  $\text{CH}_2\text{Cl}_2/\text{MeOH}$  for an extended time prior to changing the gradient, if desired.  $^1\text{H}$ -NMR (500 MHz,  $\text{DMSO}-d_6$ )  $\delta$ : 8.13 (t,  $J = 6.8$  Hz, 1H), 7.78 (t,  $J = 7.8$  Hz, 1H), 7.70 (t,  $J = 7.9$  Hz, 1H), 7.28 (d,  $J = 7.6$  Hz, 1H), 6.87 (s, 1H), 6.55 (d,  $J = 31.2$  Hz, 1H), 6.44 (s, 1H), 4.07 (broad s, 2H), 3.72-3.83 (m, 1H), 3.57-3.67 (m, 1H), 3.50 (dd,  $J = 27.1$  Hz,  $J = 6.17$  Hz, 4H), 2.61-2.70 (m, 1H), 2.47-2.50 (m, 2H), 1.95-2.00 (m, 2H), 1.87 (s, 3H), 1.79 (broad s, 6H), 1.39 (q,  $J = 6.3$  Hz, 4H), 1.25 (dd,  $J = 11.3$  Hz,  $J = 6.2$  Hz, 6H), 0.88 (t,  $J = 8.4$  Hz, 3H)  $^{13}\text{C}$ -NMR (126 MHz,  $\text{DMSO}-d_6$ )  $\delta$ : 166.6, 132.8, 130.5, 129.8, 128.9, 128.2, 123.0, 123.0, 122.9, 122.8, 120.3, 118.1, 111.2, 79.3, 57.7, 51.9, 51.3, 44.7, 31.0, 30.7, 30.6, 30.3, 29.0, 28.9, 27.5, 27.4, 26.1, 26.0, 25.9, 20.7, 20.5, 18.9, 18.7, 14.5. HRMS (ESI)  $m/z$ :  $(\text{M}^+)^+$  for  $\text{C}_{37}\text{H}_{43}\text{N}_2\text{O}_2$  calcd 547.3319; found 547.3318.

Note: The NMR spectra were evaluated in  $\text{DMSO}-d_6$ , the ortho carboxylic acid is known to lactonize in aprotic conditions and this was observed. The  $\text{ESI}^+$  HRMS was evaluated in  $\text{MeOH}/\text{H}_2\text{O}$ , promoting the open form and was thus observed in that analysis.

#### ATTO 647N Methyl Ester (**24**):

Benzoic acid **8** (50 mg, 0.085 mmol) was charged to a flame-dried 25 mL round-bottomed flask equipped with a magnetic stirbar and placed under argon. Anhydrous 1,2-dichloroethane (9 mL) was added via syringe followed by  $\text{POCl}_3$  (300  $\mu\text{L}$ , 3.2 mmol) also by syringe. The reaction was placed in a preheated oil bath ( $75^{\circ}\text{C}$ ) and stirred for 2 hours. After cooling to room temperature, the solvent was removed by rotary evaporation.  $\text{CH}_2\text{Cl}_2$  (20 mL) was added and removed by rotary evaporation, and then placed under high vacuum (25 mm Hg) for one hour. To the round-bottomed flask, anhydrous methylene chloride (3 mL) was added by syringe and the reaction was placed in an external ice bath ( $-15^{\circ}\text{C}$ ; ethylene glycol and dry ice). Separately, a solution of 4-(methylamino)butyric acid hydrochloride (114 mg, 0.75 mmol) in methylene chloride (3 mL) with triethylamine (150  $\mu\text{L}$ , 1.1 mmol) was prepared. After the reaction mixture had stirred for 10 minutes in the external bath, the free-based amine was added via syringe in one addition. The reaction was stirred at the same temperature for 20 minutes and then allowed to warm to  $23^{\circ}\text{C}$  and

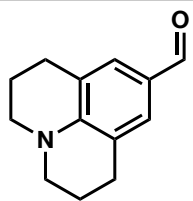
stirred for an additional 20 minutes. 1 N HCl (5 mL) was added by syringe and the two layers separated. The aqueous layer was further extracted with methylene chloride (2 x 10 mL). The organic layers were combined, washed with brine (1 x 5 mL) and dried over Na<sub>2</sub>SO<sub>4</sub>. The solvent was removed by rotary evaporation and the crude methyl ester was taken directly to the next reaction without purification. (SI-42 for LCMS trace). LRMS (ESI)  $m/z$ : (M<sup>+</sup>)<sup>+</sup> for C<sub>43</sub>H<sub>54</sub>N<sub>3</sub>O<sub>3</sub> calcd 660.42 found 660.4. Note: two peaks are observable in the absorbance trace of the LCMS, corresponding to the two inseparable atropisomers of **24**.

#### Carboxy ATTO 647N (**2**):

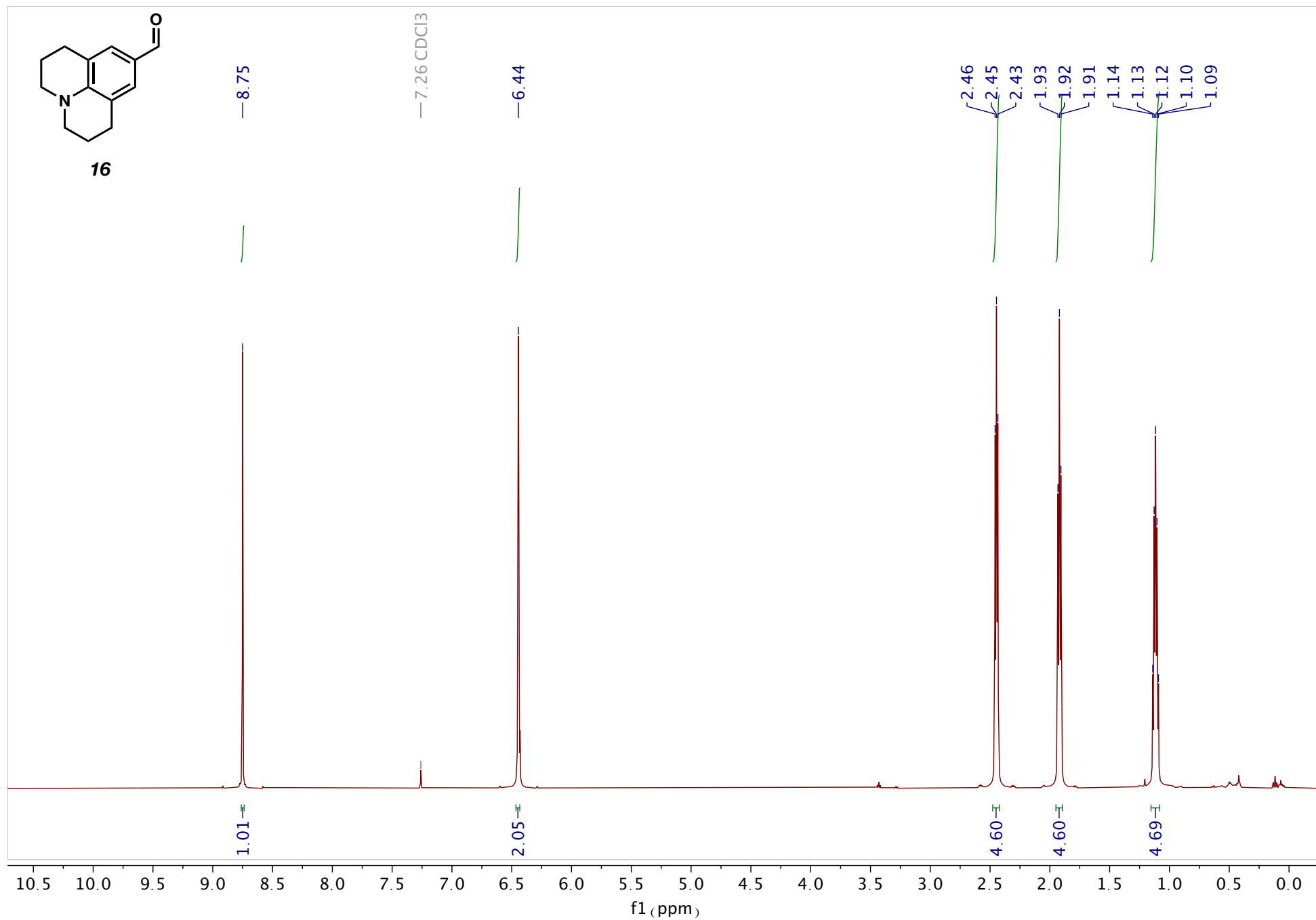
To a 50 mL round-bottomed flask equipped with a magnetic stir bar, crude methyl ester **24** (0.085 mmol) was charged. THF (15 mL) was added by syringe followed by DI water (10 mL). The reaction was placed in a pre-cooled ice bath (0 °C) and stirred for 10 minutes. A solution of 1 N NaOH (0.425 mL, 0.425 mmol) was added by syringe and the reaction stirred at this same temperature for 3 hours and then acidified with glacial AcOH (0.5 mL, 8.75 mmol). The reaction was concentrated by rotary evaporation and then purified by reverse phase preparatory HPLC (3:1 CH<sub>3</sub>CN/H<sub>2</sub>O with 0.1% H<sub>2</sub>CO<sub>2</sub>) to give inseparable atropisomers of the title compound **2** as a dark blue solid (54 mg, 0.078 mmol) in 91% yield for the two steps. <sup>1</sup>H-NMR (500 MHz, CD<sub>3</sub>OD) δ: 8.51 (s, 1H), 7.66 (t,  $J$  = 4.8 Hz, 2H), 7.55 – 7.58 (m, 1H), 7.34 – 7.39 (m, 1H), 6.90 (s, 1H), 6.78 (d,  $J$  = 16.9 Hz, 2H), 3.79 – 3.85 (m, 1H), 3.64 (t,  $J$  = 7.5 Hz, 2H), 3.56 (d,  $J$  = 6.5 Hz, 2H), 3.53 ( $J$  = 5.2 Hz, 2H), 3.41 – 3.48 (m, 1H), 3.30 (s, 3H), 3.17 (t,  $J$  = 5.9 Hz, 2H), 3.05 – 3.15 (m, 2H), 2.87 (d,  $J$  = 25.1 Hz, 3H), 2.71 – 2.79 (m, 1H), 2.57 (d,  $J$  = 18.5 Hz, 2H), 1.97 – 2.08 (m, 4H), 1.88 (d,  $J$  = 6.8 Hz, 3H), 1.82 (d,  $J$  = 6.8 Hz, 3H), 1.70 (d,  $J$  = 18.2 Hz, 2H), 1.46 (s, 3H), 1.33 (s, 6H), 1.27 (s, 2H), 1.01 (t,  $J$  = 8.4 Hz, 3H). <sup>13</sup>C-NMR (126 MHz, CD<sub>3</sub>OD) δ: 169.8, 169.2, 160.8, 160.7, 157.8, 157.8, 153.3, 153.2, 152.2, 150.0, 149.9, 136.1, 136.0, 135.4, 135.1, 134.6, 134.5, 130.9, 130.6, 130.4, 130.2, 128.8, 128.7, 128.6, 128.2, 126.8, 126.8, 123.3, 122.9, 122.8, 120.6, 119.0, 111.3, 111.3, 69.9, 57.6, 57.5, 51.8, 51.1, 46.1, 44.9, 44.8, 40.4, 39.7, 39.6, 36.8, 36.6, 31.1, 30.3, 30.1, 29.7, 29.4, 29.0, 27.2, 27.1, 26.1, 26.1, 24.9, 24.7, 22.2, 22.1, 20.3, 20.2, 18.0, 17.5, 13.4, 13.3. FTIR (powder): 2992, 2928, 1622, 1592, 1450, 1425, 1313, 1168 cm<sup>-1</sup>. HRMS (ESI)  $m/z$  (M<sup>+</sup>)<sup>+</sup> for C<sub>42</sub>H<sub>52</sub>N<sub>3</sub>O<sub>3</sub> calcd 646.4003; found 646.4006.



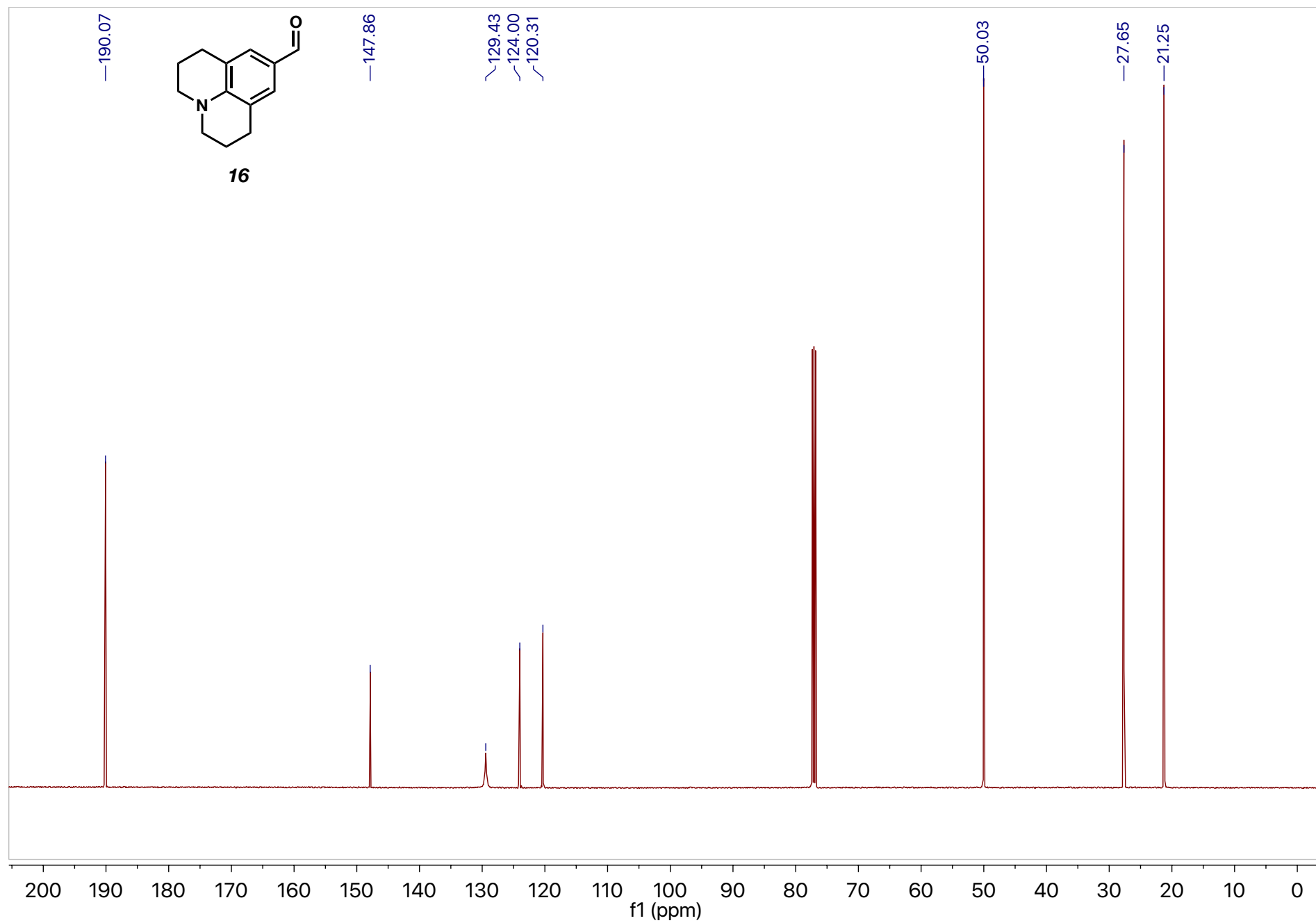
$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz



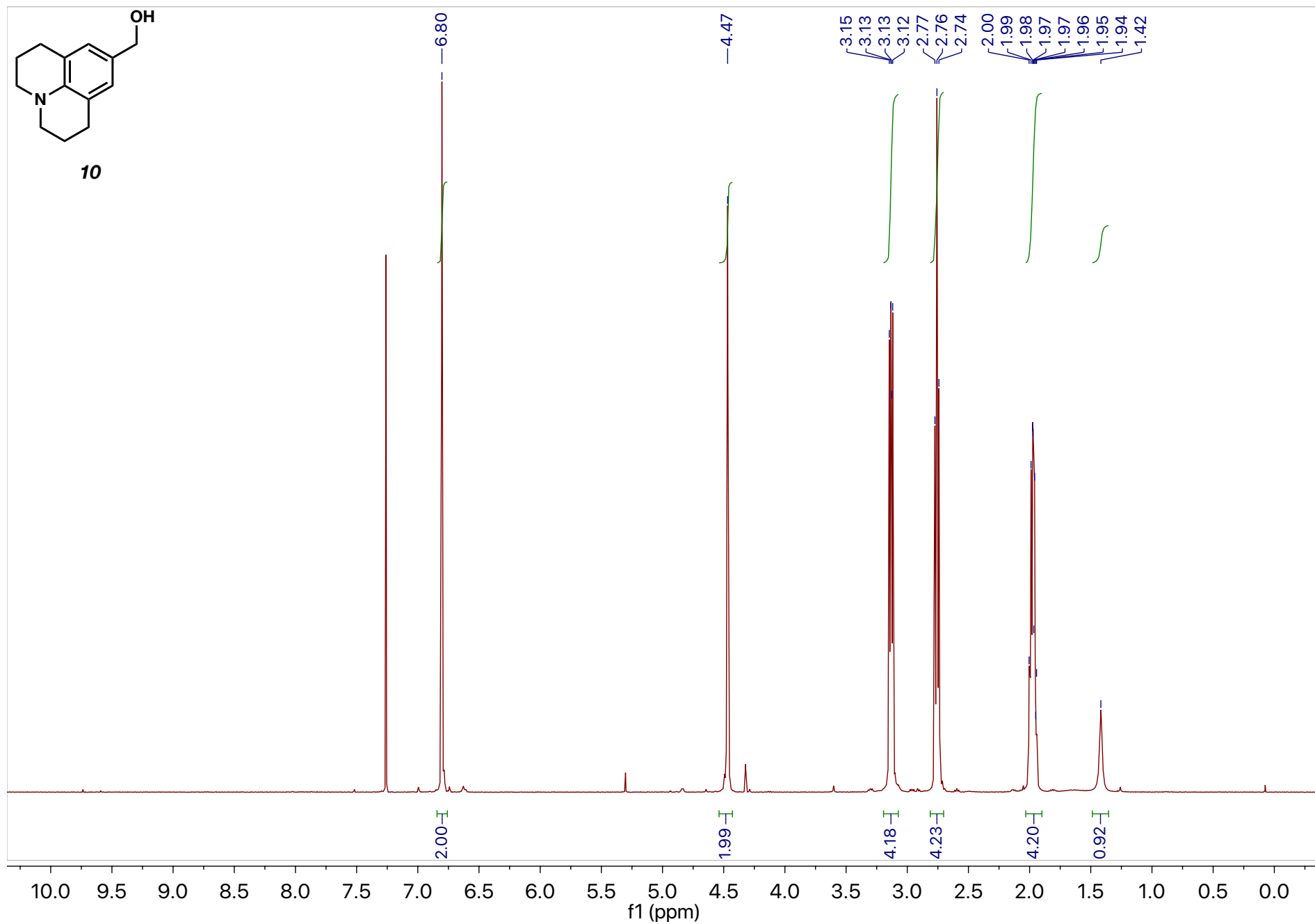
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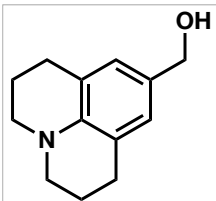
$^{13}\text{C}$  NMR,  $\text{CDCl}_3$ , 126 MHz



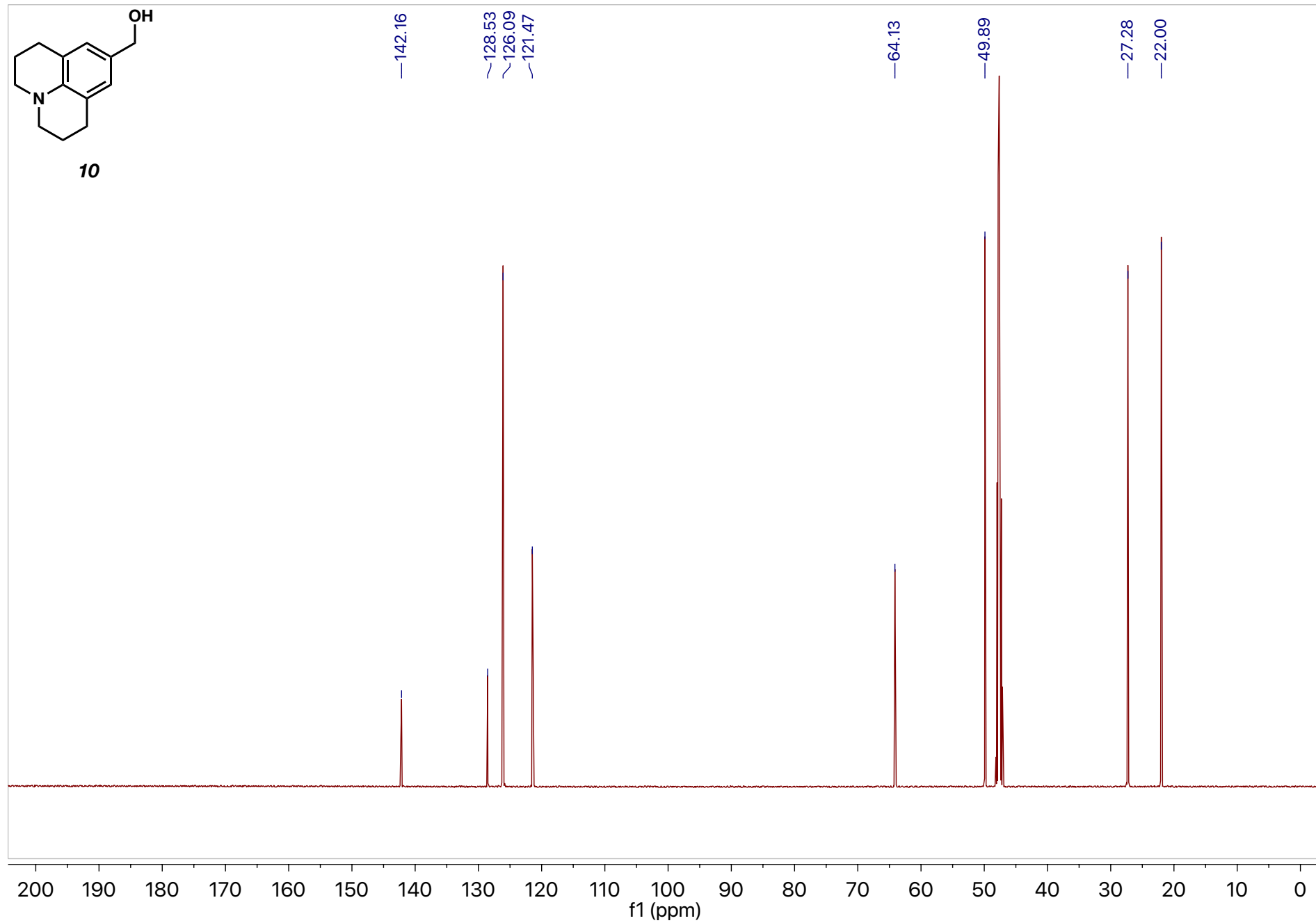
$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz



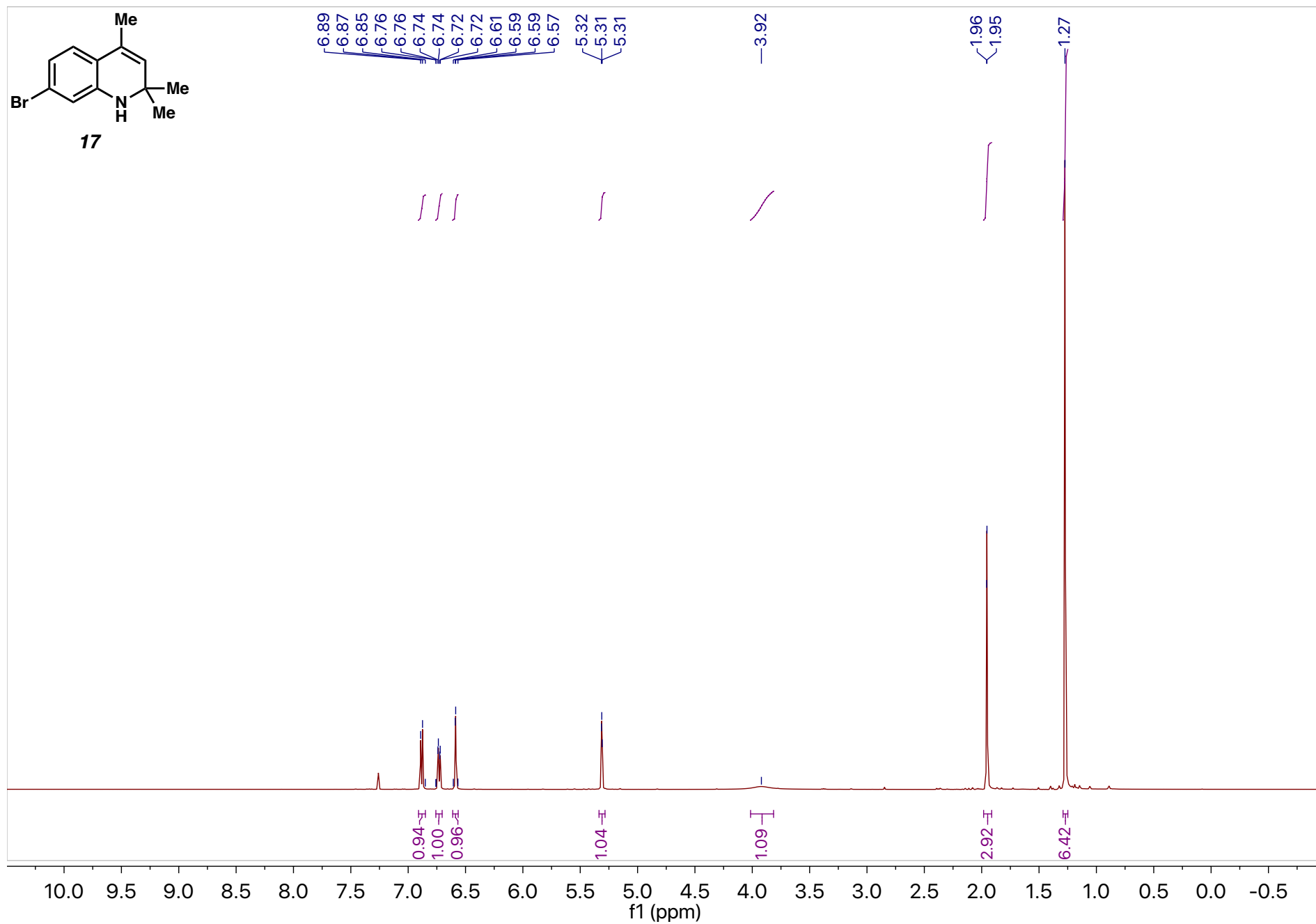
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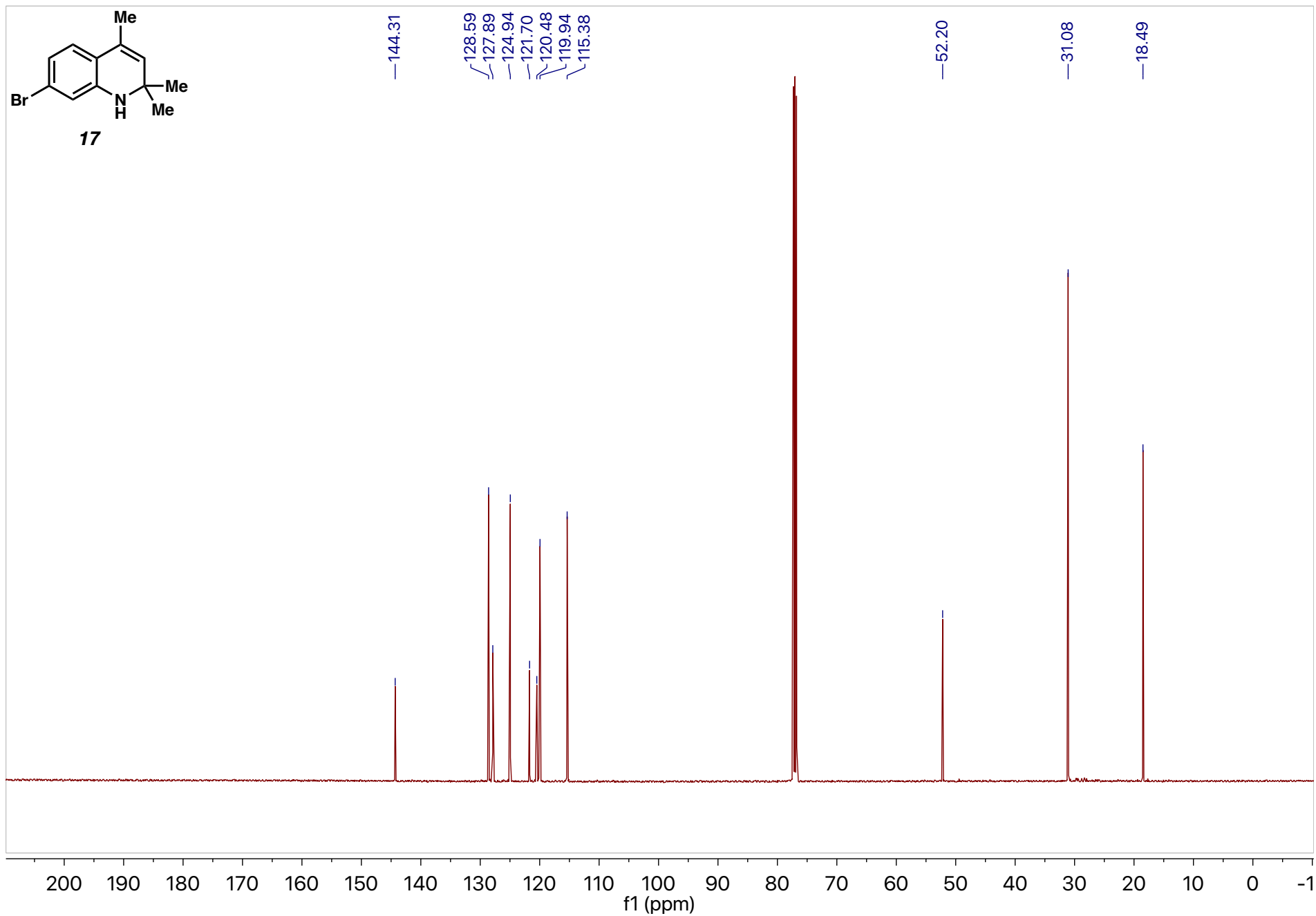
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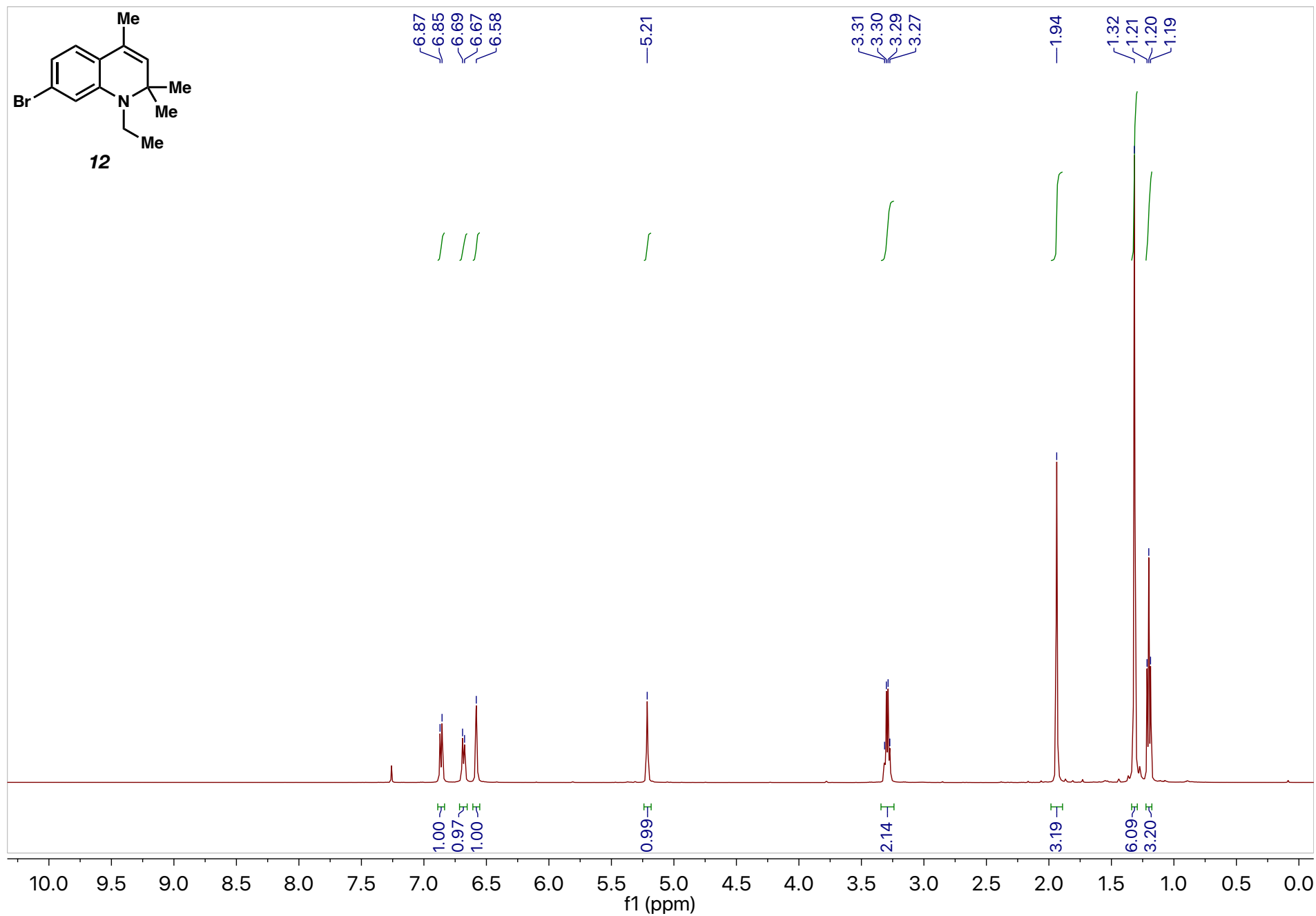
$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz



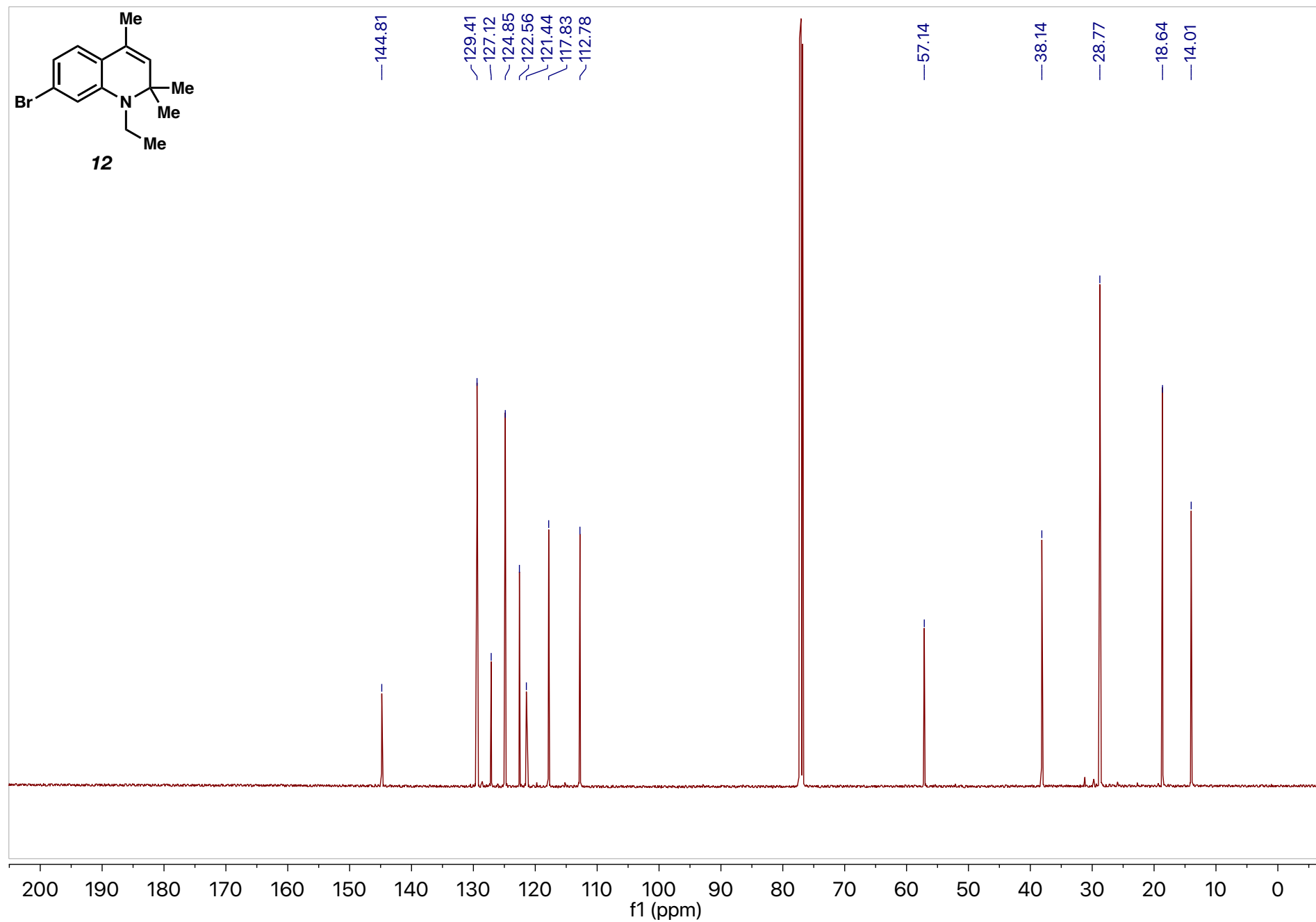
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$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz

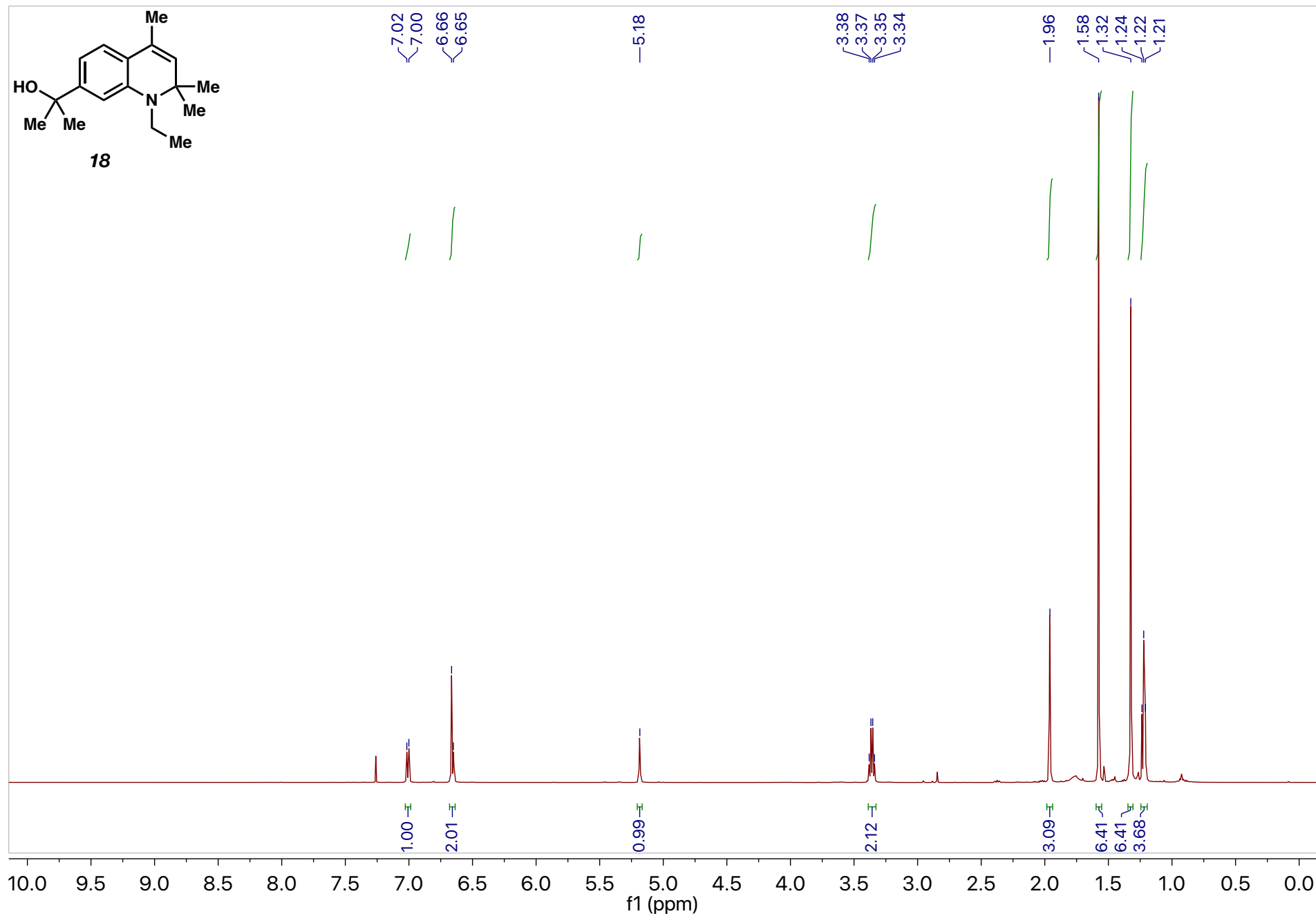


$^{13}\text{C}$  NMR,  $\text{CDCl}_3$ , 126 MHz

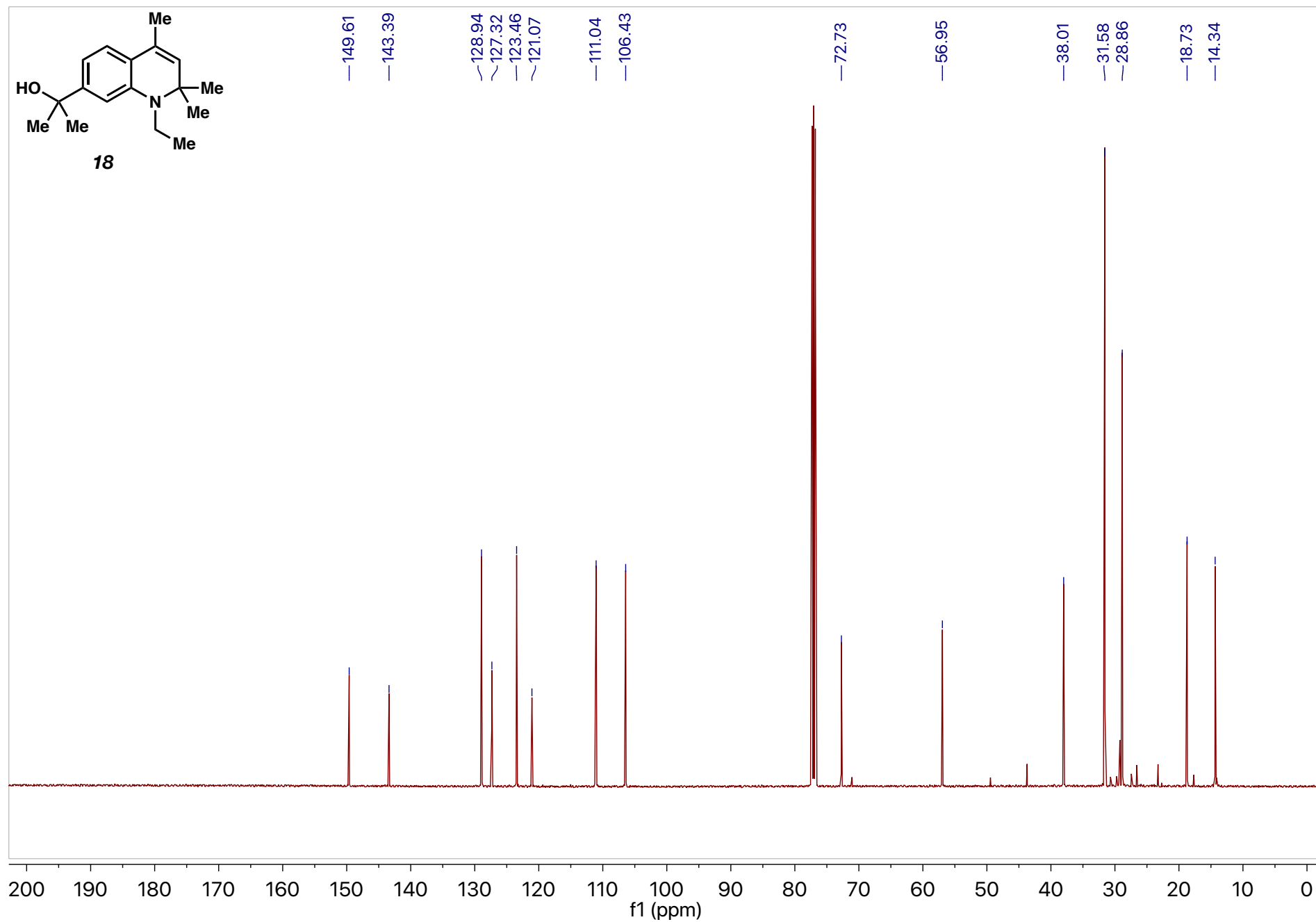




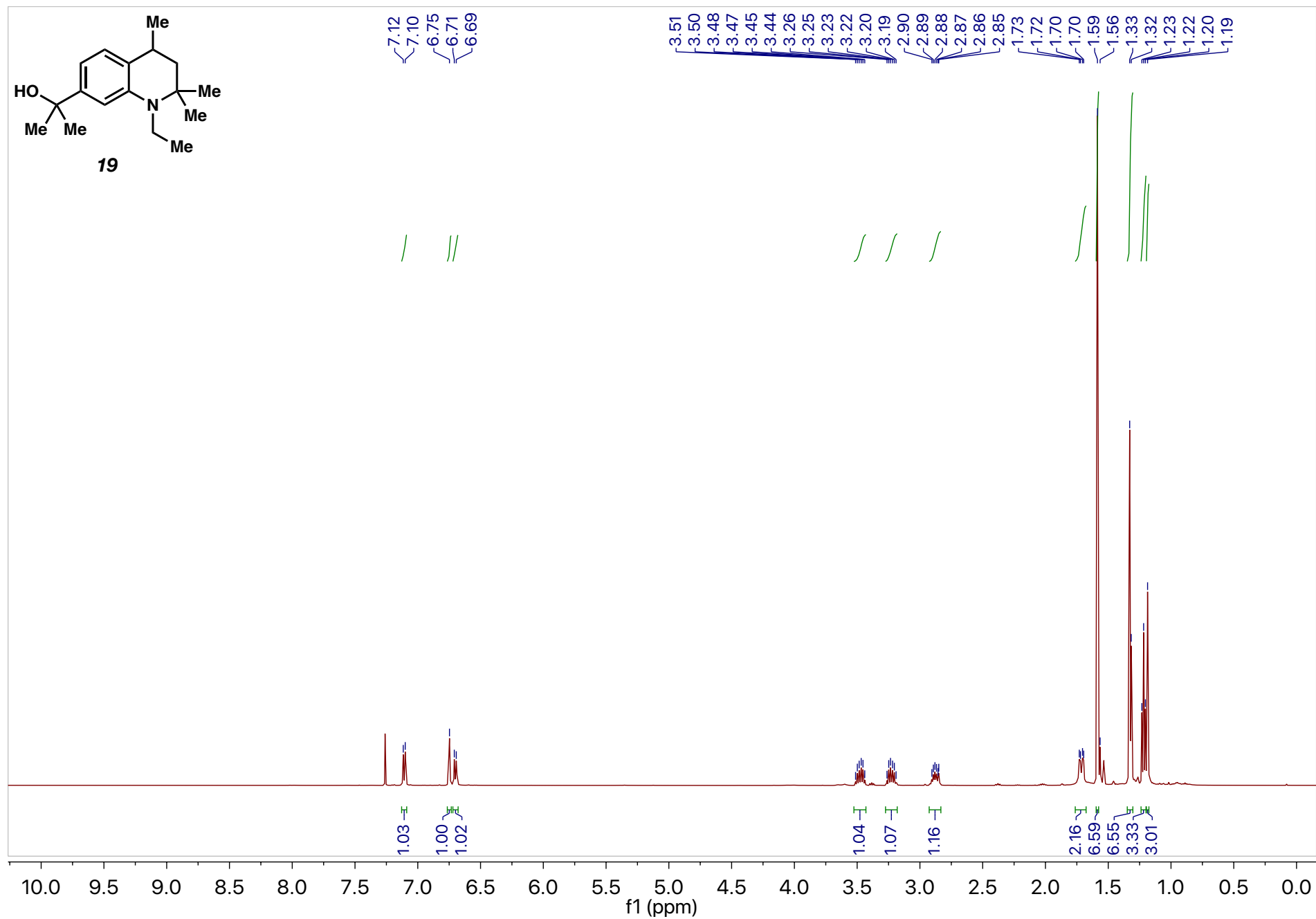
$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz



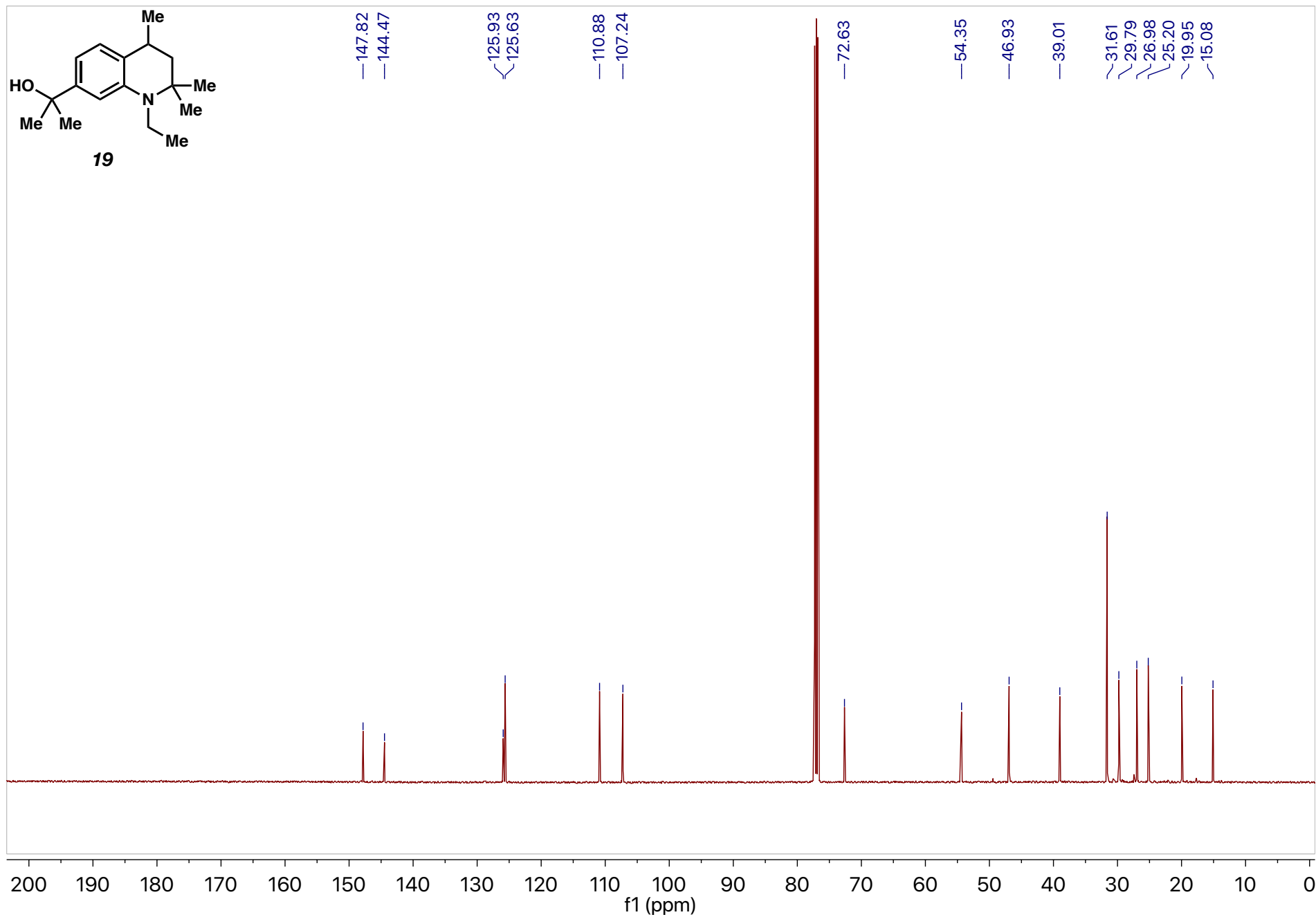
$^{13}\text{C}$  NMR,  $\text{CDCl}_3$ , 126 MHz



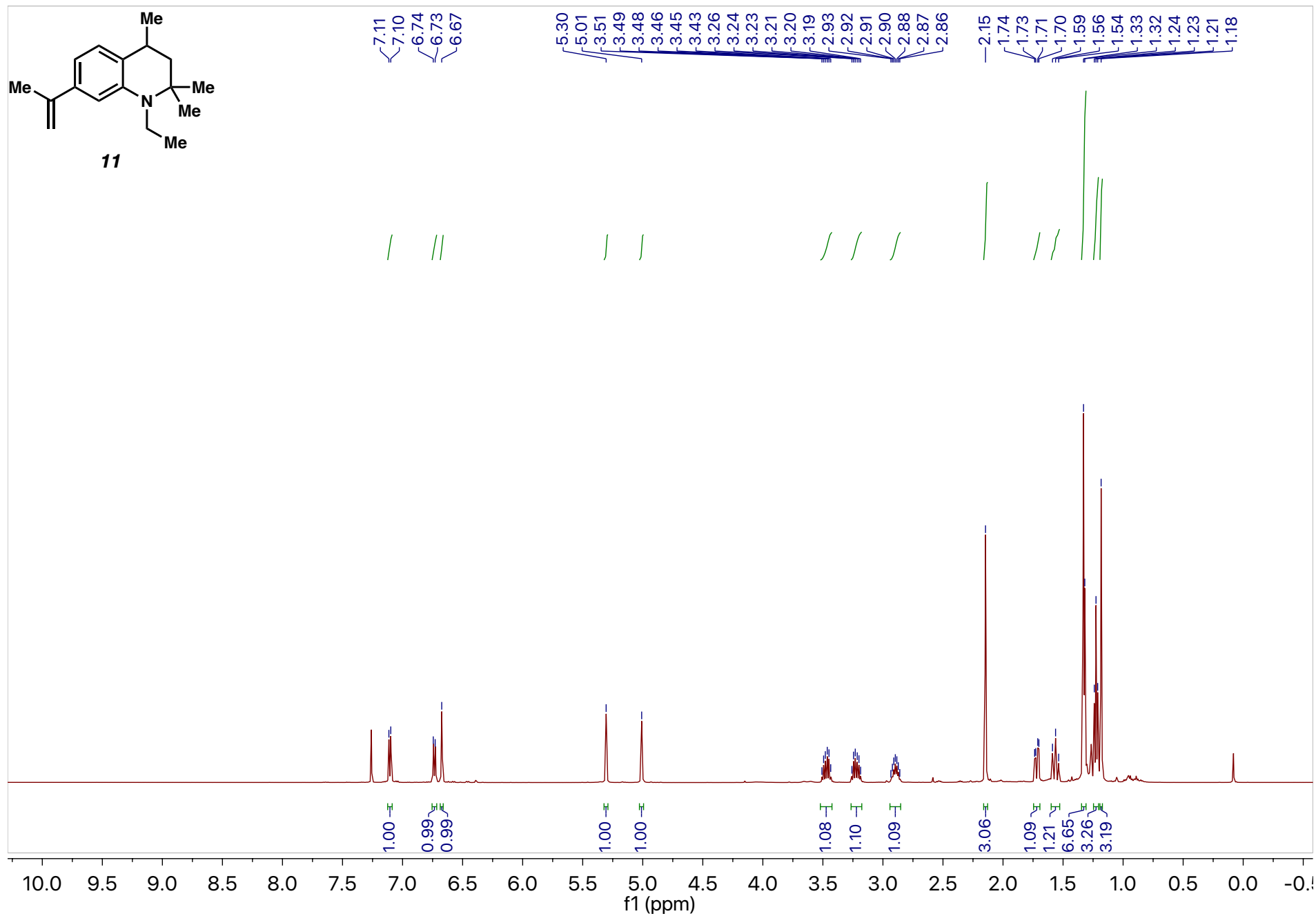
$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 400 MHz



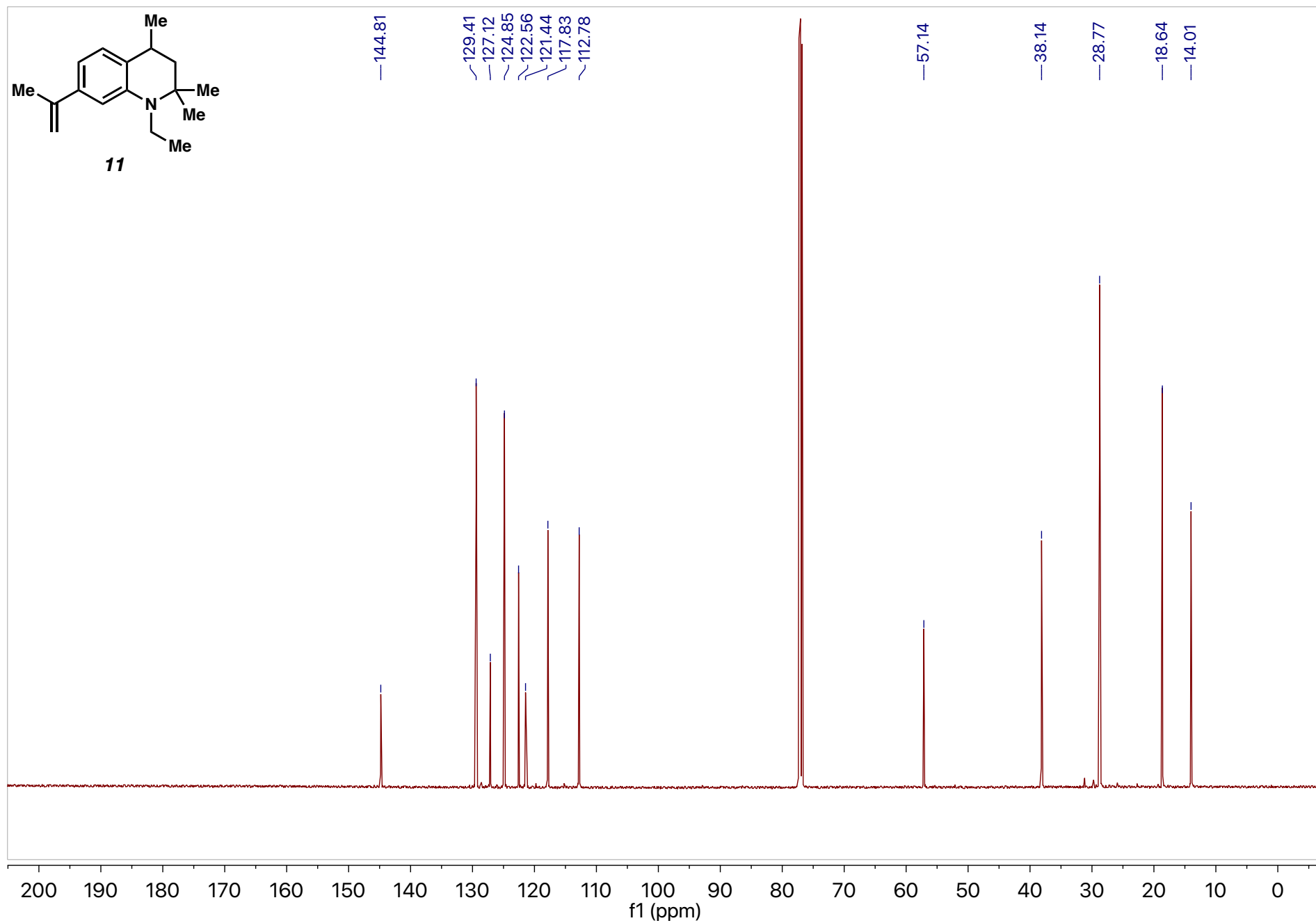
$^{13}\text{C}$  NMR,  $\text{CDCl}_3$ , 126 MHz



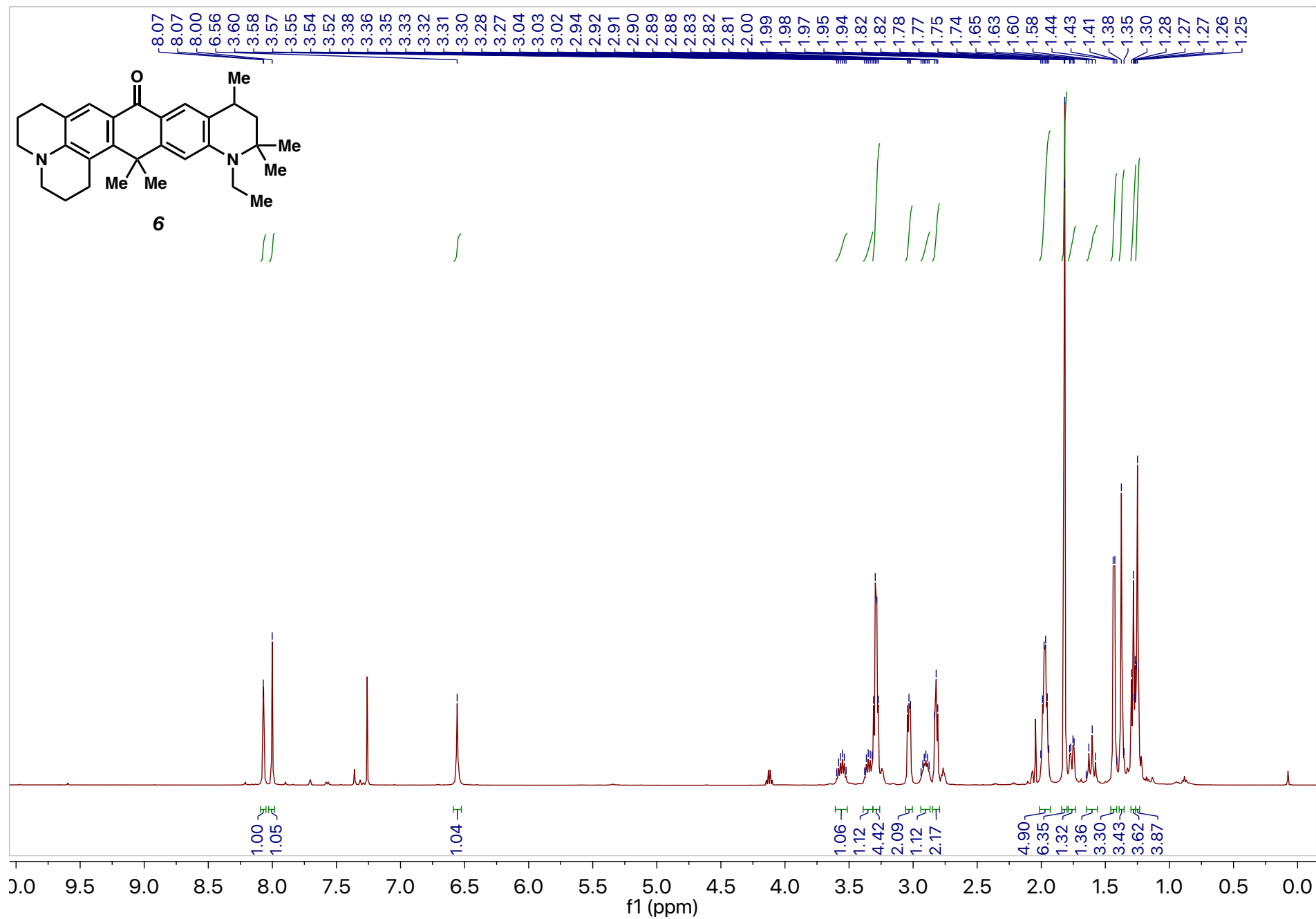
$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz



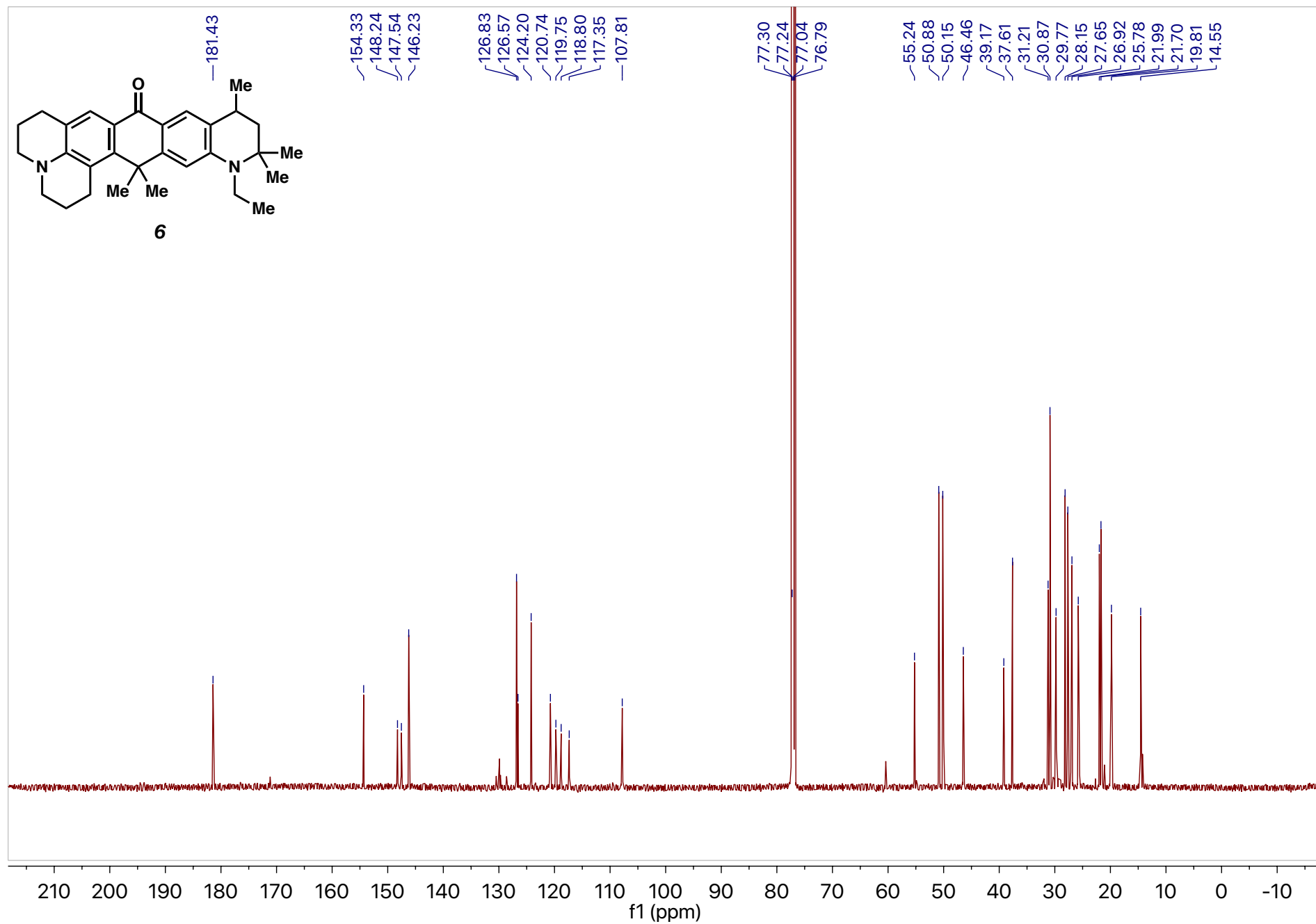
$^{13}\text{C}$  NMR,  $\text{CDCl}_3$ , 126 MHz



$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz

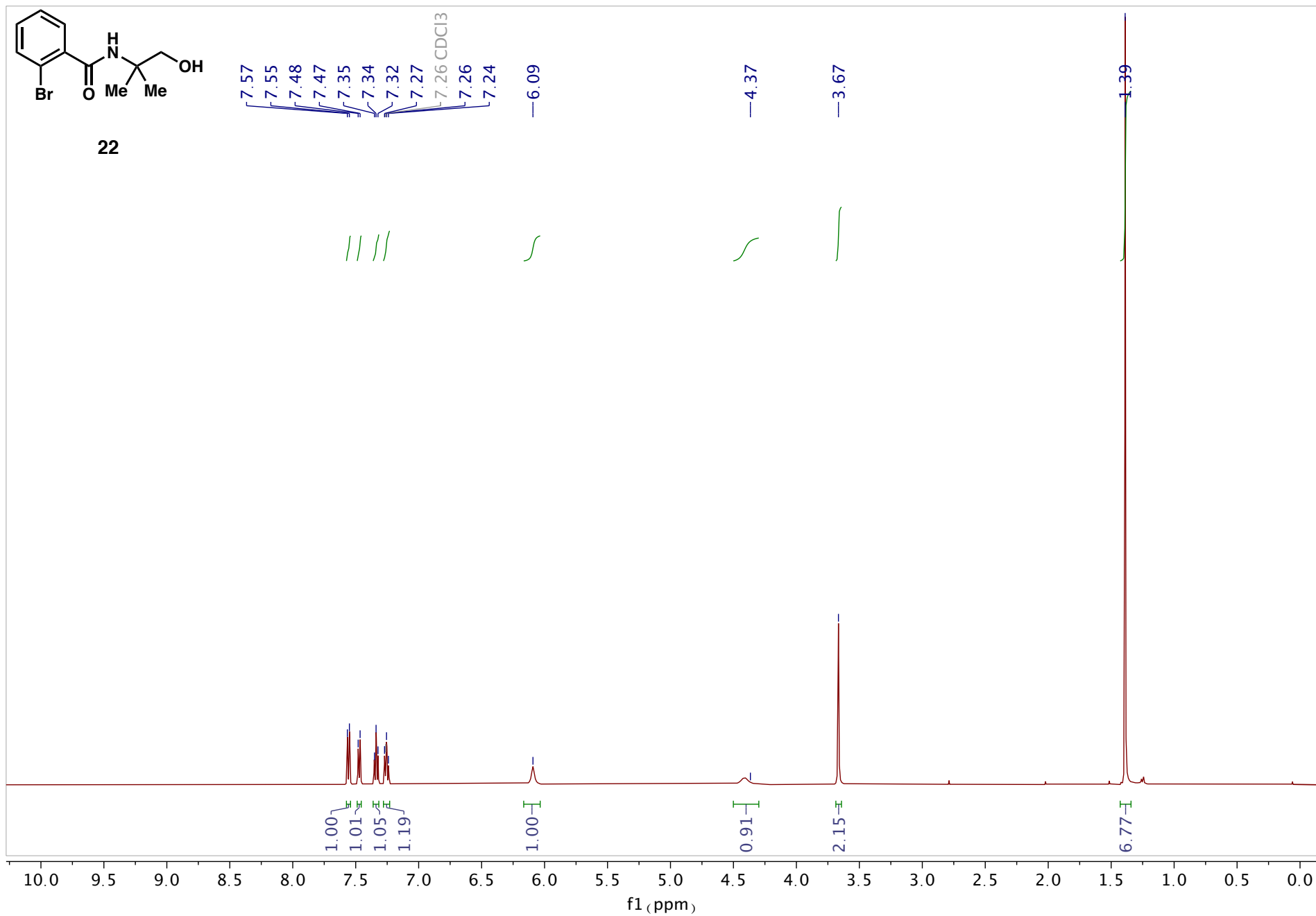


$^{13}\text{C}$  NMR,  $\text{CDCl}_3$ , 126 MHz

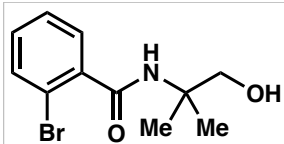




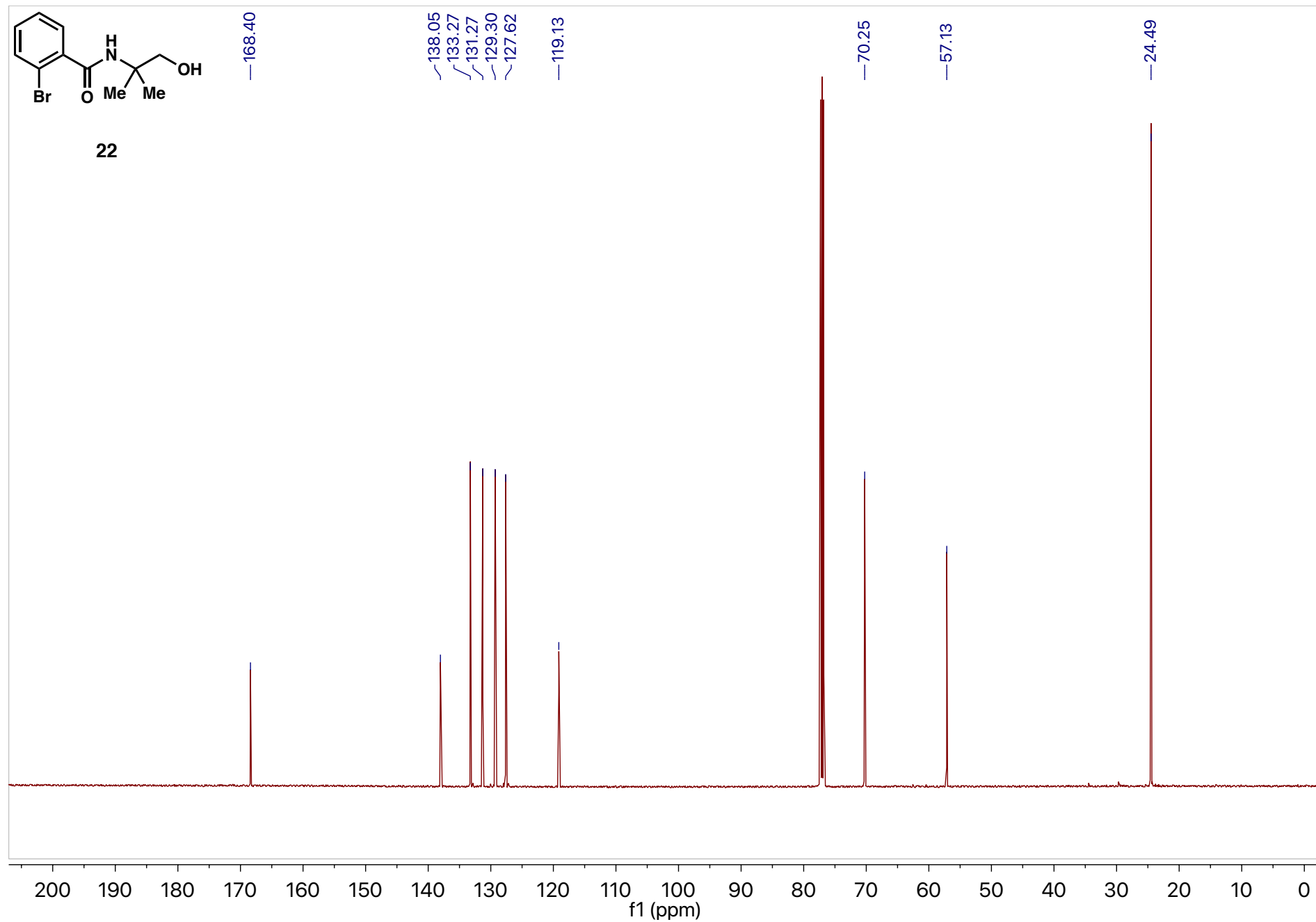
$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz



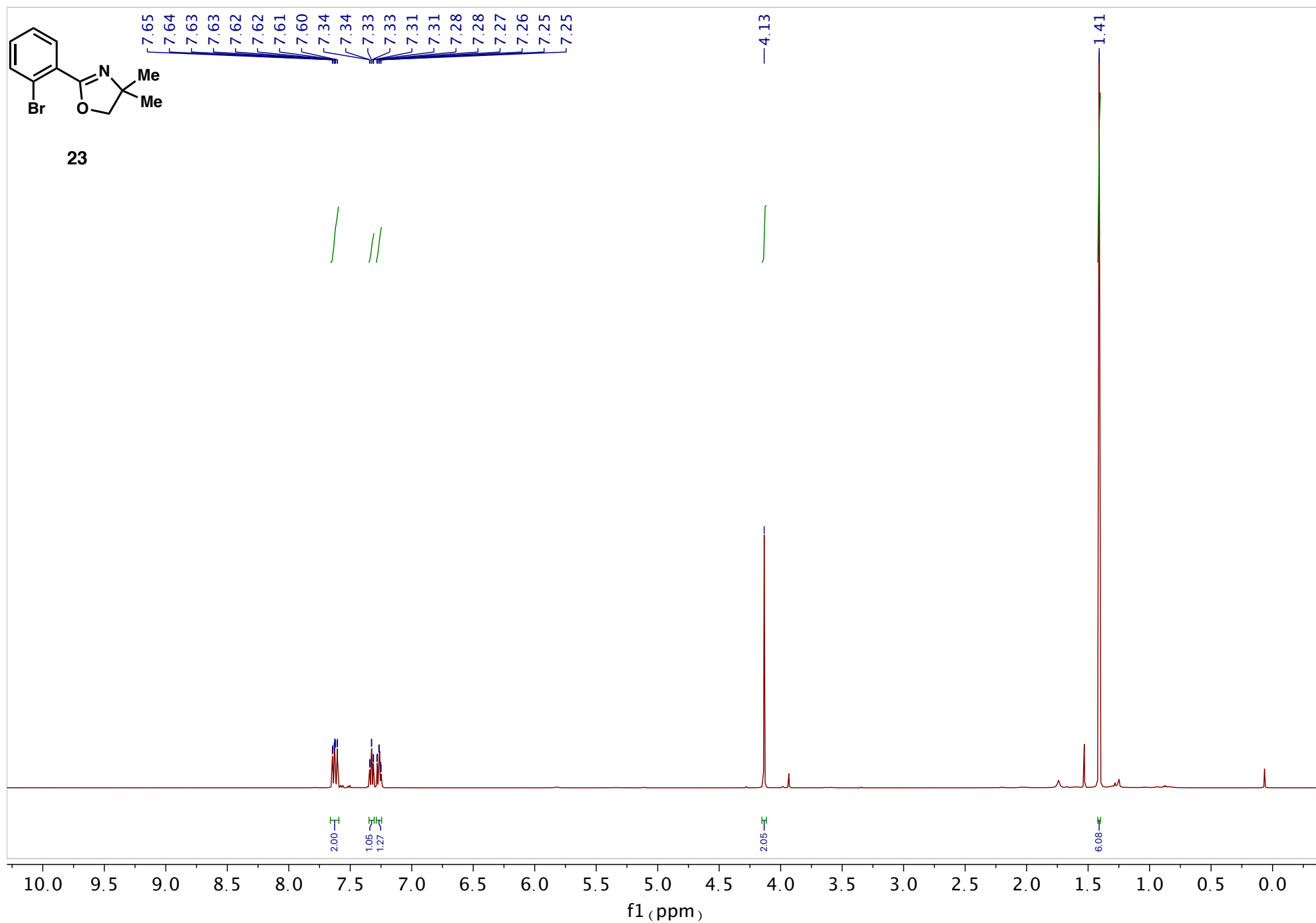
$^{13}\text{C}$  NMR,  $\text{CDCl}_3$ , 126 MHz



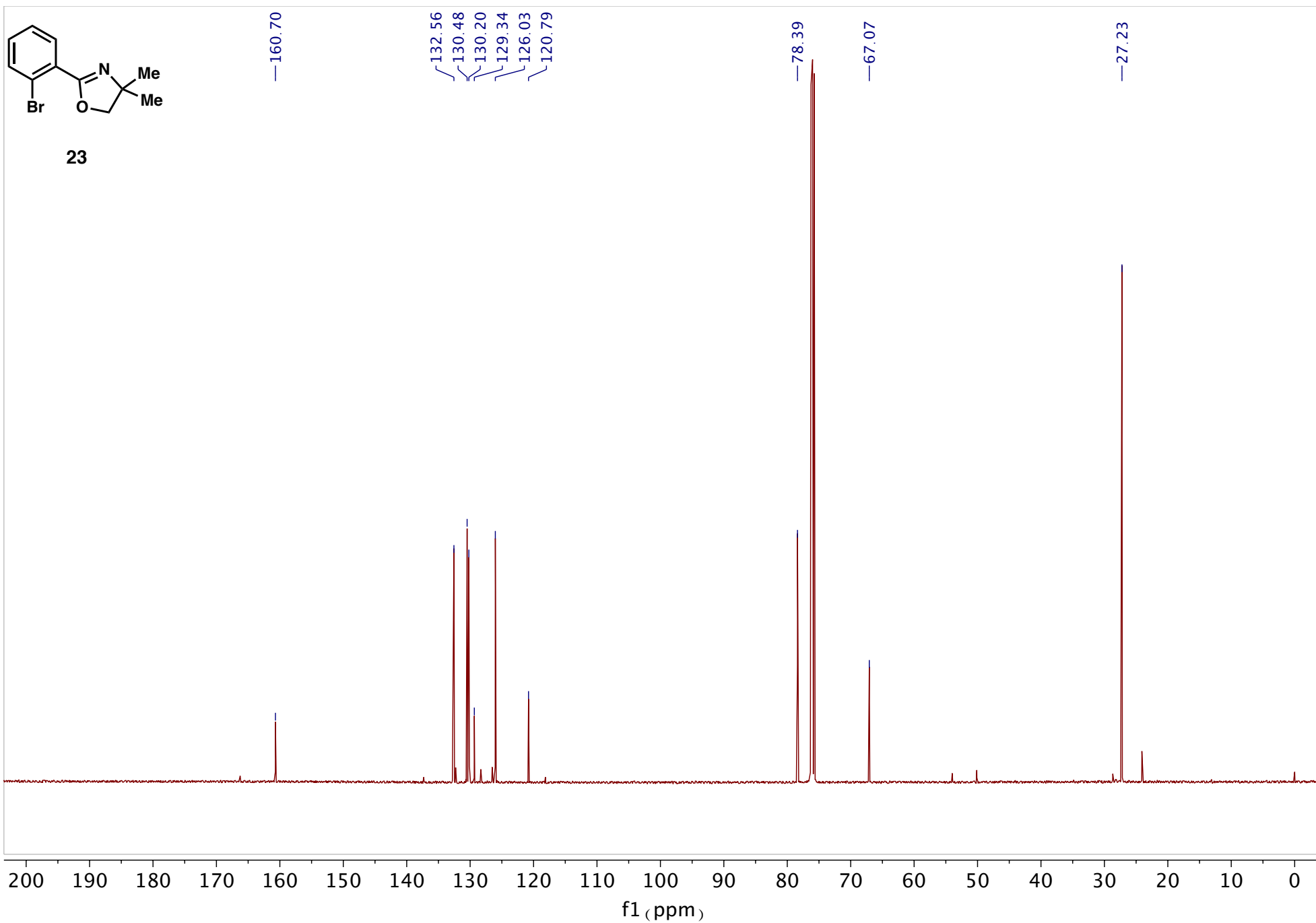
22



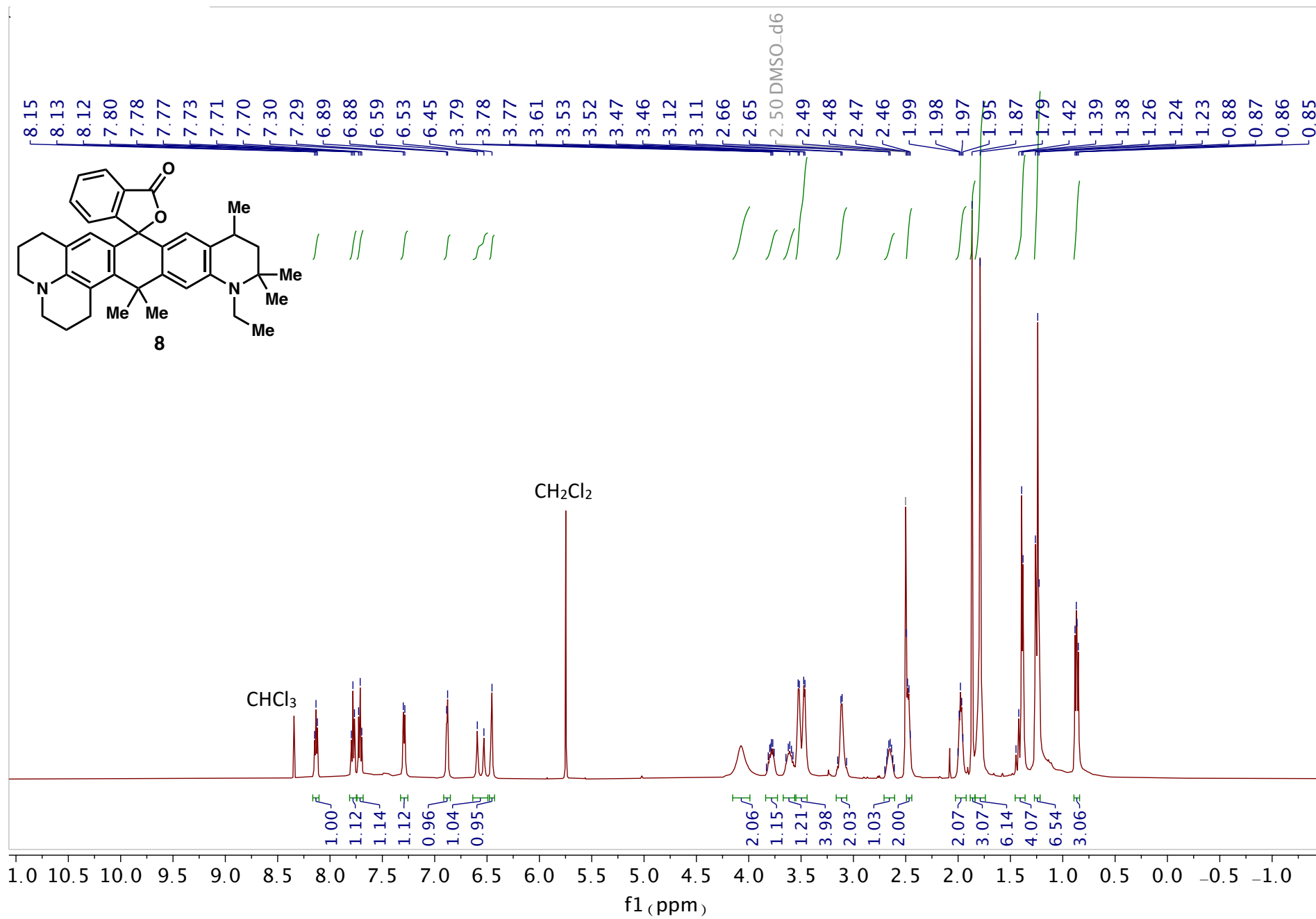
$^1\text{H}$  NMR,  $\text{CDCl}_3$ , 500 MHz



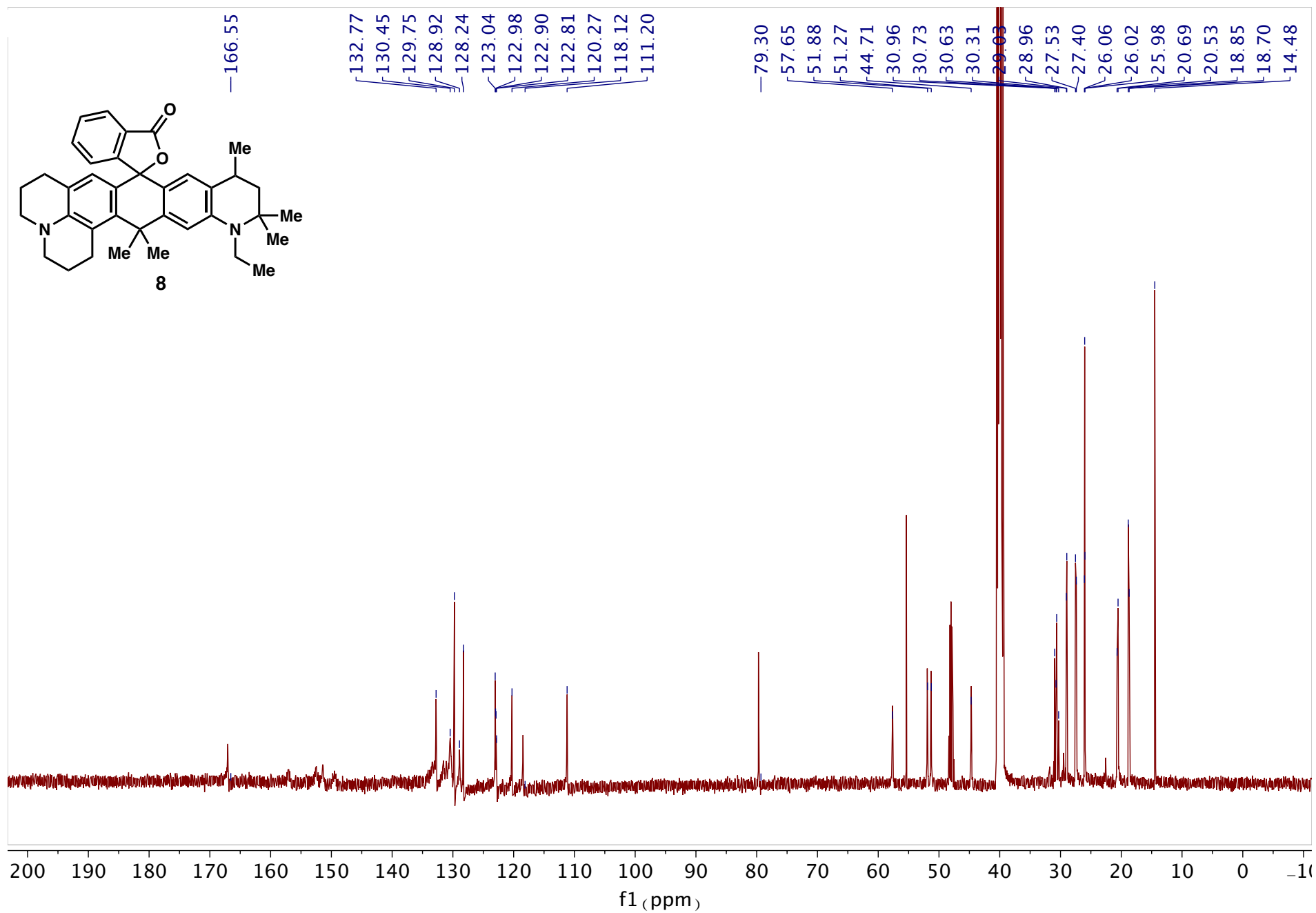
$^{13}\text{C}$  NMR,  $\text{CDCl}_3$ , 126 MHz



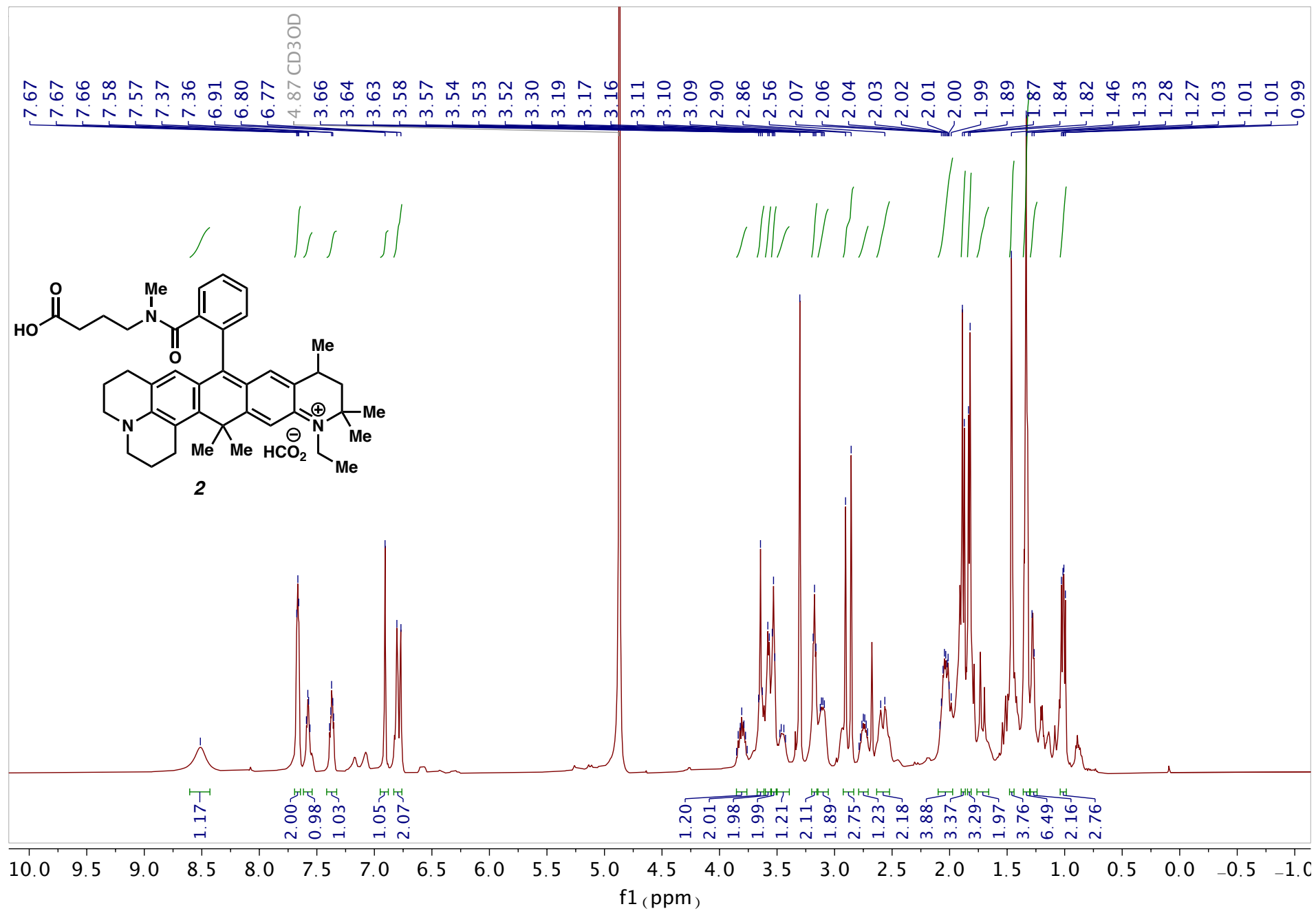
$^1\text{H}$  NMR, DMSO- $d_6$ , 500 MHz



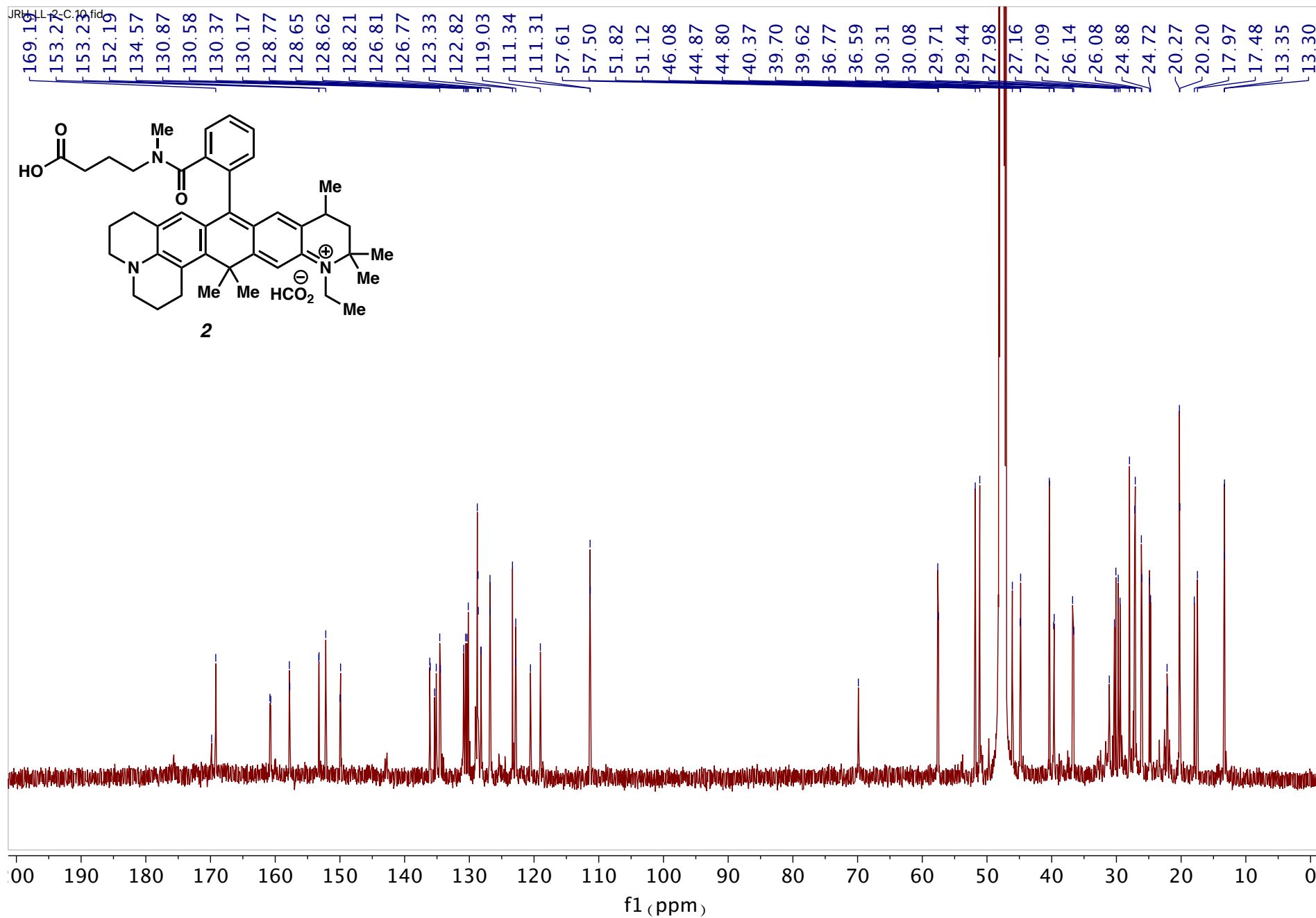
$^{13}\text{C}$  NMR, DMSO- $d_6$ , 126 MHz



$^1\text{H}$  NMR,  $\text{CD}_3\text{OD}$ , 500 MHz



$^{13}\text{C}$  NMR,  $\text{CD}_3\text{OD}$ , 126 MHz





## Target Compound Screening Report

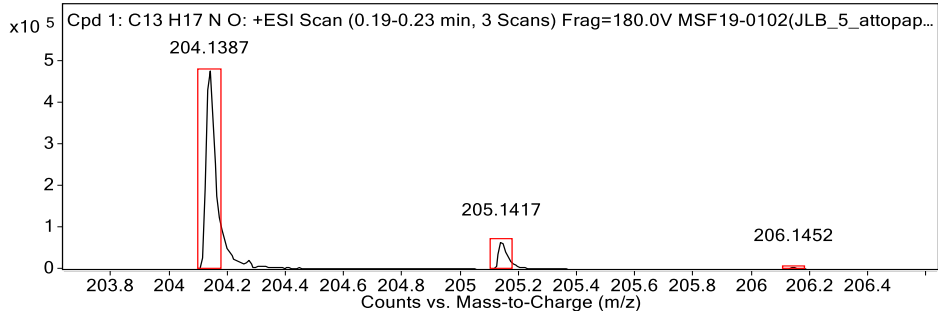
### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

**Data File** MSF19-0102(JLB\_5\_attpaper\_8)\_hrESIpos2.d  
**Position** P1-C1  
**Acq Method** pos.m

**Sample Name** 0102(JLB\_5\_attpaper\_8)  
**Instrument Name** Instrument 1  
**Acquired Time** 1/28/2019 11:48:50 AM

**Comment** 0102(JLB\_5\_attpaper\_8)  
**User Name**  
**DA Method** KS.m

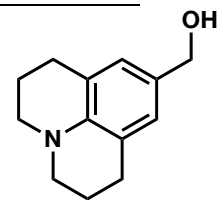
#### MS Zoomed Spectrum



#### MS Spectrum Peak List

Obs. m/z	Calc. m/z	Charge	Abundance	Formula	Ion Species	Tgt Mass Error (ppm)
204.1387	204.1383	1	480517	C <sub>13</sub> H <sub>17</sub> NO	(M+H) <sup>+</sup>	-1.92
205.1417	205.1415	1	66784	C <sub>13</sub> H <sub>17</sub> NO	(M+H) <sup>+</sup>	-0.65
206.1452	206.1444	1	5311	C <sub>13</sub> H <sub>17</sub> NO	(M+H) <sup>+</sup>	-3.92
218.1546			1292645			

--- End Of Report ---



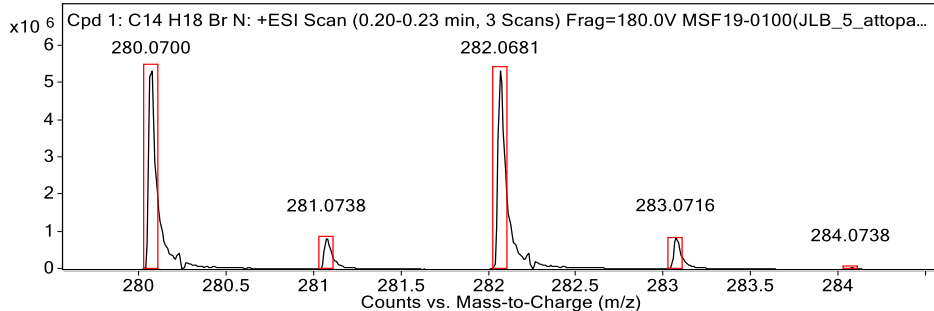
**10**

## Target Compound Screening Report

### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

<b>Data File</b> MSF19-0100(JLB_5_attopaper_3)_hrESIpos1.d	<b>Sample Name</b> 0100(JLB_5_attopaper_3)	<b>Comment</b> 0100(JLB_5_attopaper_3)
<b>Position</b> P1-B8	<b>Instrument Name</b> Instrument 1	<b>User Name</b>
<b>Acq Method</b> pos.m	<b>Acquired Time</b> 1/28/2019 11:40:04 AM	<b>DA Method</b> KS.m

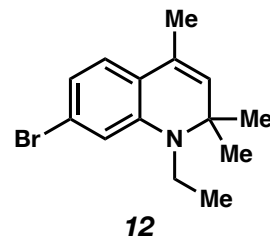
#### MS Zoomed Spectrum



#### MS Spectrum Peak List

Obs. m/z	Calc. m/z	Charge	Abundance	Formula	Ion Species	Tgt Mass Error (ppm)
280.0700	280.0695	1	5436155	C <sub>14</sub> H <sub>18</sub> BrN	(M+H) <sup>+</sup>	-1.66
281.0738	281.0728	1	858218	C <sub>14</sub> H <sub>18</sub> BrN	(M+H) <sup>+</sup>	-3.44
282.0681	282.0676	1	5476293	C <sub>14</sub> H <sub>18</sub> BrN	(M+H) <sup>+</sup>	-1.69
283.0716	283.0708	1	864823	C <sub>14</sub> H <sub>18</sub> BrN	(M+H) <sup>+</sup>	-3.02
284.0738	284.0740	1	57346	C <sub>14</sub> H <sub>18</sub> BrN	(M+H) <sup>+</sup>	0.65
285.0733	285.0772	1	3858	C <sub>14</sub> H <sub>18</sub> BrN	(M+H) <sup>+</sup>	13.88

--- End Of Report ---



## Target Compound Screening Report

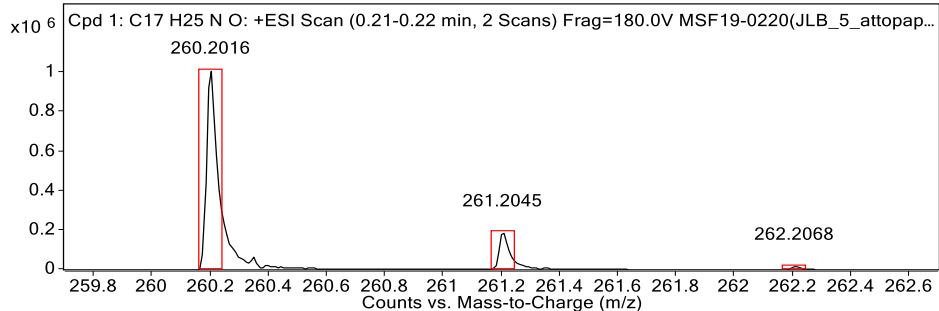
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**Data File** MSF19-0220(JLB\_5\_attpaper\_4)\_hrESIpos2.d  
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**Acq Method** pos.m

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**Comment** 0220(JLB\_5\_attpaper\_4)  
**User Name**  
**DA Method** KS.m

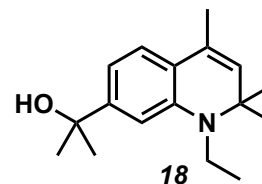
#### MS Zoomed Spectrum



#### MS Spectrum Peak List

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261.2045	261.2042	1	189438	C <sub>17</sub> H <sub>25</sub> NO	(M+H) <sup>+</sup>	-1.07
262.2068	262.2072	1	19743	C <sub>17</sub> H <sub>25</sub> NO	(M+H) <sup>+</sup>	1.72
263.2075	263.2101	1	1673	C <sub>17</sub> H <sub>25</sub> NO	(M+H) <sup>+</sup>	9.66

--- End Of Report ---

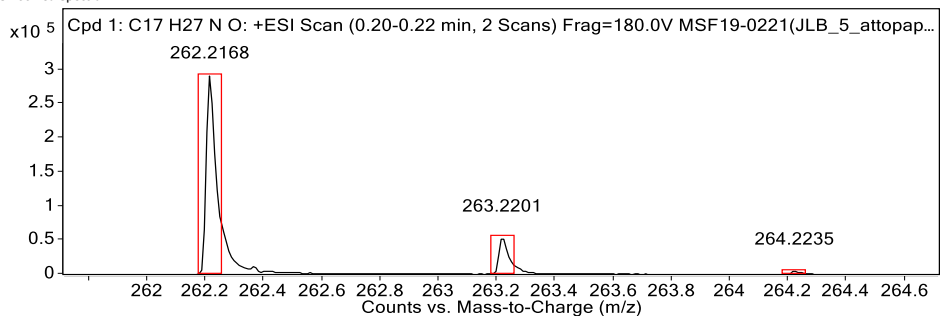


## Target Compound Screening Report

### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

<b>Data File</b> MSF19-0221(JLB_5_attopaper_5)_hrESIpos1.d	<b>Sample Name</b> 0221(JLB_5_attopaper_5)	<b>Comment</b> 0221(JLB_5_attopaper_5)
<b>Position</b> P1-E9	<b>Instrument Name</b> Instrument 1	<b>User Name</b>
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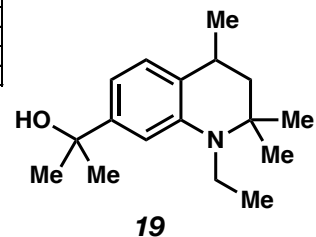
#### MS Zoomed Spectrum



#### MS Spectrum Peak List

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263.2201	263.2198	1	53811	C <sub>17</sub> H <sub>27</sub> NO	(M+H) <sup>+</sup>	-1.09
264.2235	264.2229	1	5408	C <sub>17</sub> H <sub>27</sub> NO	(M+H) <sup>+</sup>	-2.44
265.1949	265.2257	1	397	C <sub>17</sub> H <sub>27</sub> NO	(M+H) <sup>+</sup>	116.16

--- End Of Report ---

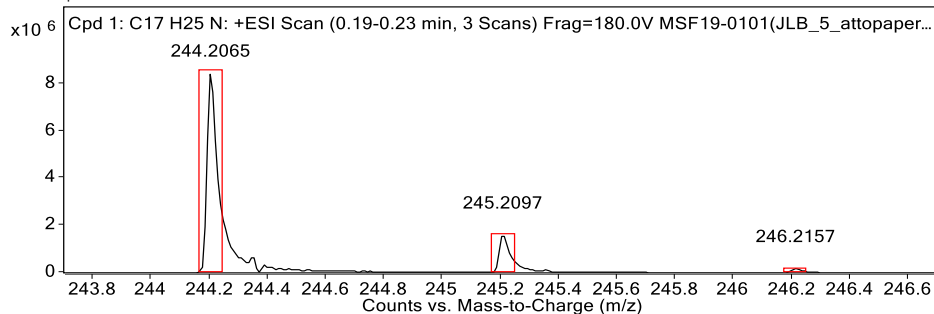


## Target Compound Screening Report

### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

<b>Data File</b> MSF19-0101(JLB_5_attpaper_6)_hrESIpos1.d	<b>Sample Name</b> 0101(JLB_5_attpaper_6)	<b>Comment</b> 0101(JLB_5_attpaper_6)
<b>Position</b> P1-B9	<b>Instrument Name</b> Instrument 1	<b>User Name</b>
<b>Acq Method</b> pos.m	<b>Acquired Time</b> 1/28/2019 11:42:25 AM	<b>DA Method</b> KS.m

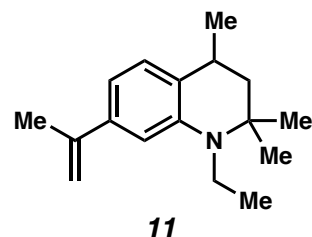
MS Zoomed Spectrum



MS Spectrum Peak List

Obs. m/z	Calc. m/z	Charge	Abundance	Formula	Ion Species	Tgt Mass Error (ppm)
244.2065	244.2060	1	8533553	C <sub>17</sub> H <sub>25</sub> N	(M+H) <sup>+</sup>	-1.95
245.2097	245.2093	1	1610931	C <sub>17</sub> H <sub>25</sub> N	(M+H) <sup>+</sup>	-1.9
246.2157	246.2125	1	191540	C <sub>17</sub> H <sub>25</sub> N	(M+H) <sup>+</sup>	-12.84
247.2214	247.2158	1	15588	C <sub>17</sub> H <sub>25</sub> N	(M+H) <sup>+</sup>	-22.56

--- End Of Report ---



## Target Compound Screening Report

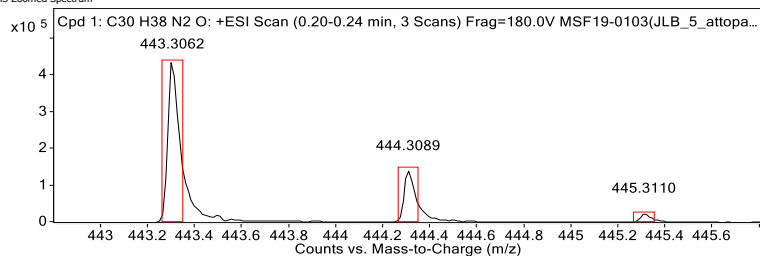
### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

**Data File** MSF19-0103(JLB\_5\_attopaper\_C13H38N2O)\_hrESIspos1.d  
**Position** P1-C2  
**Acq Method** pos.m

**Sample Name** 0103(JLB\_5\_attopaper\_C13H38N2O)  
**Instrument Name** Instrument 1  
**Acquired Time** 1/28/2019 11:50:58 AM

**Comment** 0103(JLB\_5\_attopaper\_C13H38N2O)  
**User Name**  
**DA Method** KS.m

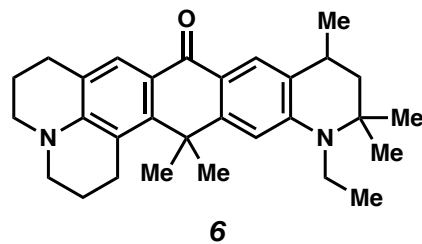
MS Zoomed Spectrum



#### MS Spectrum Peak List

Obs. m/z	Calc. m/z	Charge	Abundance	Formula	Ion Species	Tgt Mass Error (ppm)
443.3062	443.3057	1	440256	C30H38N2O	(M+H) <sup>+</sup>	-1.22
444.3089	444.3089	1	139447	C30H38N2O	(M+H) <sup>+</sup>	0.19
445.3110	445.3121	1	23943	C30H38N2O	(M+H) <sup>+</sup>	2.62
446.3101	446.3152	1	2690	C30H38N2O	(M+H) <sup>+</sup>	11.52

--- End Of Report ---



## Target Compound Screening Report

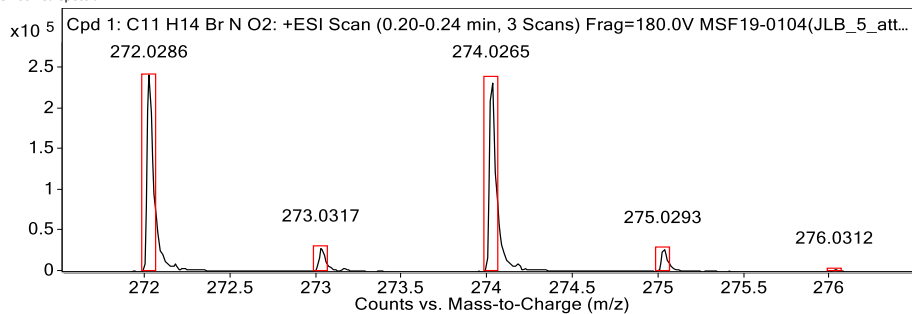
### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

**Data File** MSF19-0104(JLB\_5\_attpaper\_10)\_hrESIpos1.d  
**Position** P1-C3  
**Acq Method** pos.m

**Sample Name** 0104(JLB\_5\_attpaper\_10)  
**Instrument Name** Instrument 1  
**Acquired Time** 1/28/2019 11:52:23 AM

**Comment** 0104(JLB\_5\_attpaper\_10)  
**User Name**  
**DA Method** KS.m

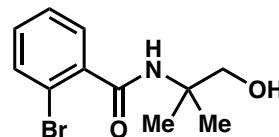
MS Zoomed Spectrum



#### MS Spectrum Peak List

Obs. m/z	Calc. m/z	Charge	Abundance	Formula	Ion Species	Tgt Mass Error (ppm)
272.0286	272.0281	1	241475	C <sub>11</sub> H <sub>14</sub> BrNO <sub>2</sub>	(M+H) <sup>+</sup>	-1.93
273.0317	273.0313	1	29705	C <sub>11</sub> H <sub>14</sub> BrNO <sub>2</sub>	(M+H) <sup>+</sup>	-1.43
274.0265	274.0261	1	233340	C <sub>11</sub> H <sub>14</sub> BrNO <sub>2</sub>	(M+H) <sup>+</sup>	-1.59
275.0293	275.0293	1	27798	C <sub>11</sub> H <sub>14</sub> BrNO <sub>2</sub>	(M+H) <sup>+</sup>	-0.02
276.0312	276.0317	1	2510	C <sub>11</sub> H <sub>14</sub> BrNO <sub>2</sub>	(M+H) <sup>+</sup>	1.67
277.0225	277.0342	1	334	C <sub>11</sub> H <sub>14</sub> BrNO <sub>2</sub>	(M+H) <sup>+</sup>	42.05
296.0086			355360			

--- End Of Report ---



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## Target Compound Screening Report

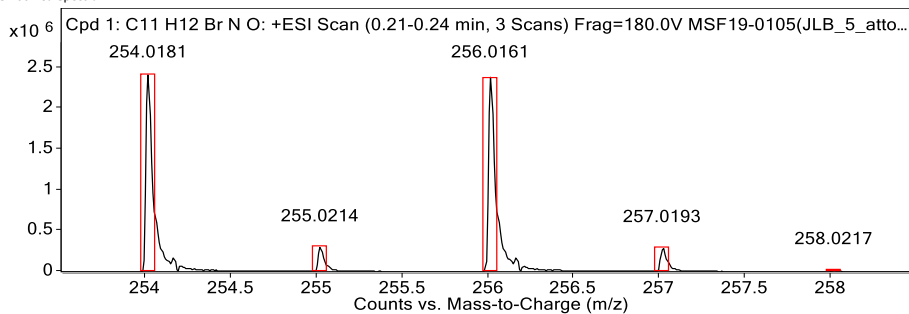
### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

**Data File** MSF19-0105(JLB\_5\_attopaper\_11)\_hrESIpos1.d  
**Position** P1-C4  
**Acq Method** pos.m

**Sample Name** 0105(JLB\_5\_attopaper\_11)  
**Instrument Name** Instrument 1  
**Acquired Time** 1/28/2019 11:57:32 AM

**Comment** 0105(JLB\_5\_attopaper\_11)  
**User Name**  
**DA Method** KS.m

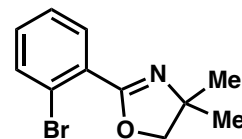
MS Zoomed Spectrum



#### MS Spectrum Peak List

Obs. m/z	Calc. m/z	Charge	Abundance	Formula	Ion Species	Tgt Mass Error (ppm)
254.0181	254.0175	1	2412240	C <sub>11</sub> H <sub>12</sub> BrNO	(M+H) <sup>+</sup>	-2.18
255.0214	255.0207	1	298567	C <sub>11</sub> H <sub>12</sub> BrNO	(M+H) <sup>+</sup>	-2.51
256.0161	256.0155	1	2372977	C <sub>11</sub> H <sub>12</sub> BrNO	(M+H) <sup>+</sup>	-2.16
257.0193	257.0187	1	289412	C <sub>11</sub> H <sub>12</sub> BrNO	(M+H) <sup>+</sup>	-2.43
258.0217	258.0214	1	19057	C <sub>11</sub> H <sub>12</sub> BrNO	(M+H) <sup>+</sup>	-1.24
259.0244	259.0240	1	1315	C <sub>11</sub> H <sub>12</sub> BrNO	(M+H) <sup>+</sup>	-1.75

--- End Of Report ---



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## Target Compound Screening Report

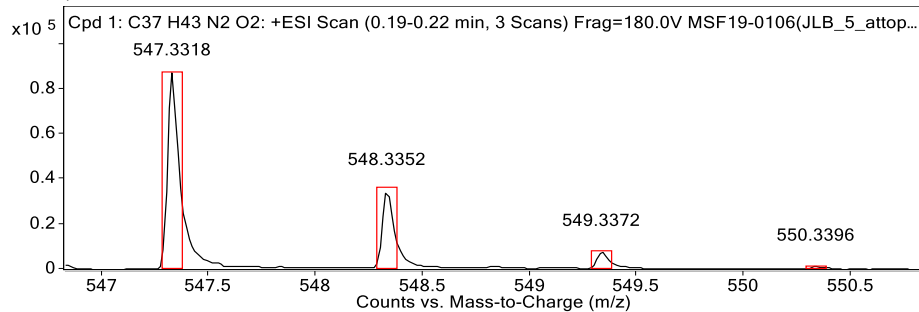
### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

**Data File** MSF19-0106(JLB\_5\_attopaper\_12)\_hrESIpos2.d  
**Position** P1-C5  
**Acq Method** pos.m

**Sample Name** 0106(JLB\_5\_attopaper\_12)  
**Instrument Name** Instrument 1  
**Acquired Time** 1/28/2019 12:04:34 PM

**Comment** 0106(JLB\_5\_attopaper\_12)  
**User Name**  
**DA Method** KS.m

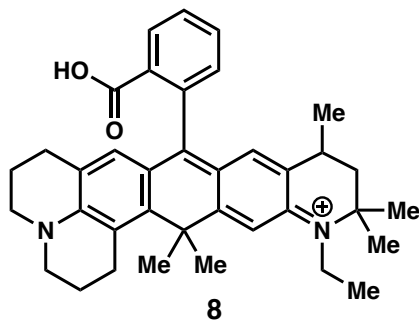
#### MS Zoomed Spectrum



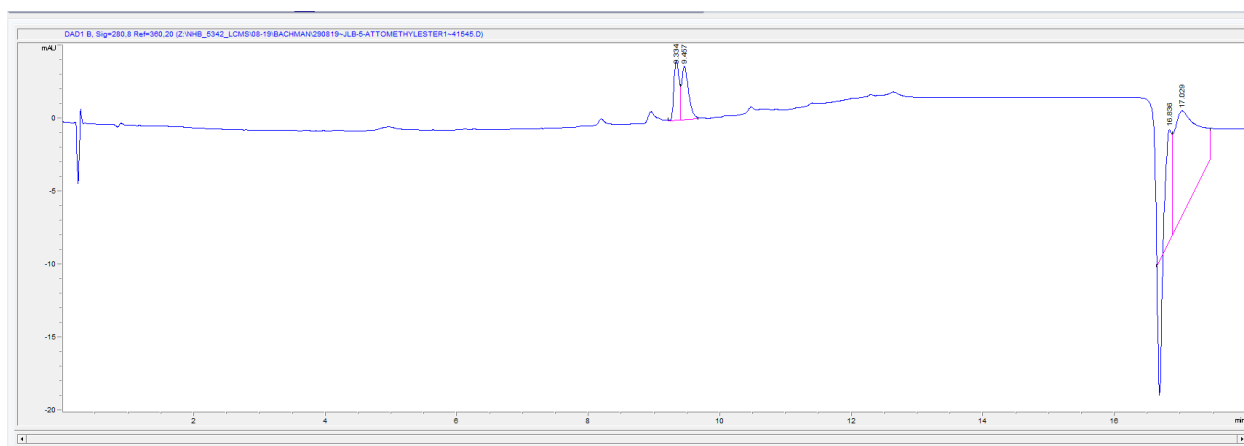
#### MS Spectrum Peak List

Obs. m/z	Calc. m/z	Charge	Abundance	Formula	Ion Species	Tgt Mass Error (ppm)
547.3318	547.3319	1	87350	C37H43N2O2	M+	0.18
548.3352	548.3352	1	34895	C37H43N2O2	M+	0.03
549.3372	549.3384	1	7855	C37H43N2O2	M+	2.06
550.3396	550.3414	1	1321	C37H43N2O2	M+	3.34
959.9692			512522			

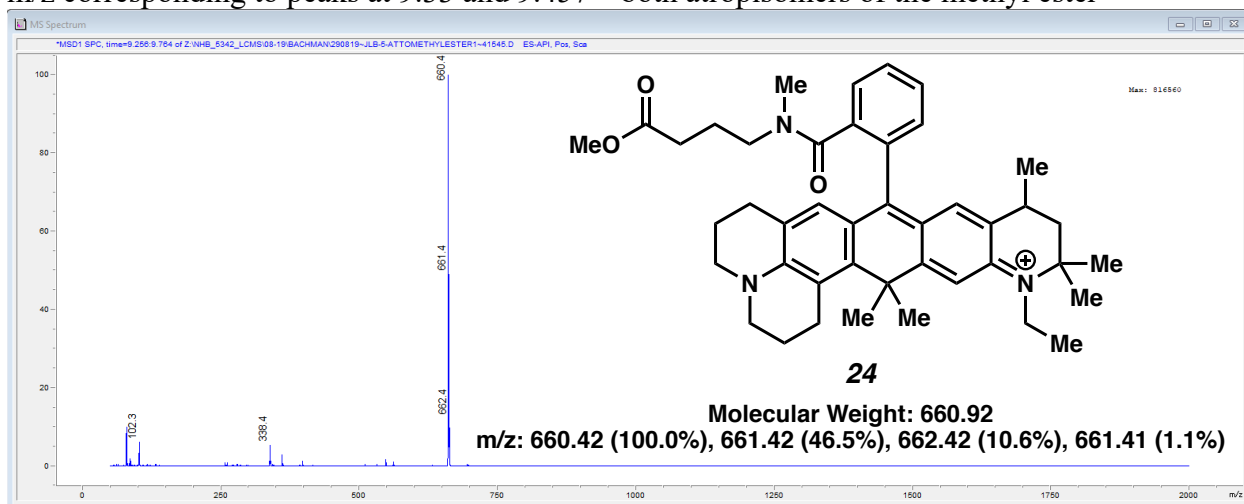
--- End Of Report ---



ESI<sup>+</sup> LCMS trace (UV 280 nm):



m/z corresponding to peaks at 9.33 and 9.457 – both atropisomers of the methyl ester



## Target Compound Screening Report

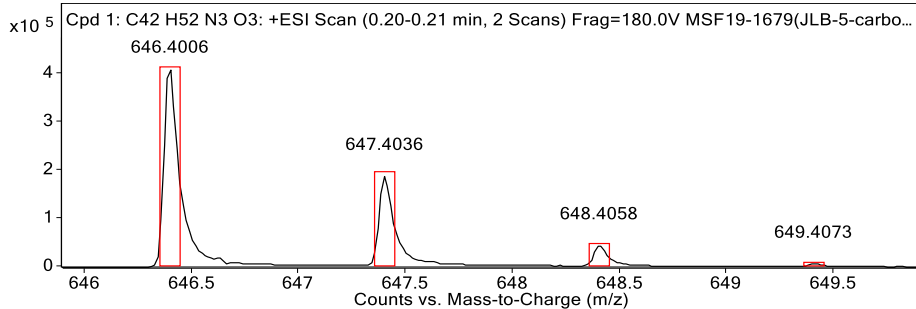
### Results Acquired by The University of Texas at Austin Mass Spectrometry Facility

**Data File** MSF19-1679(JLB-5-carboxy-647N)\_hrESIpos1.d  
**Position** P1-B1  
**Acq Method** FIA\_pos.m

**Sample Name** 1679(JLB-5-carboxy-647N)  
**Instrument Name** Instrument 1  
**Acquired Time** 8/30/2019 12:50:33 PM

**Comment** 1679(JLB-5-carboxy-647N)  
**User Name**  
**DA Method** KS.m

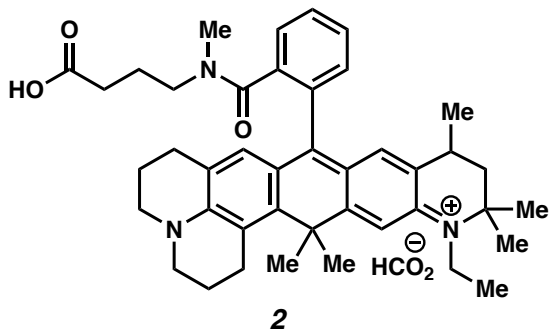
#### MS Zoomed Spectrum



#### MS Spectrum Peak List

Obs. m/z	Calc. m/z	Charge	Abundance	Formula	Ion Species	Tgt Mass Error (ppm)
646.4006	646.4003	1	412461	C42H52N3O3	M+	-0.49
647.4036	647.4036	1	188959	C42H52N3O3	M+	-0.04
648.4058	648.4067	1	45184	C42H52N3O3	M+	1.42
649.4073	649.4097	1	6847	C42H52N3O3	M+	3.69
650.4089	650.4127	1	1054	C42H52N3O3	M+	5.76

--- End Of Report ---



## References:

1. Cai, G.; Bozhkova, N.; Odingo, J.; Berova, N.; Nakanishi, K., Circular dichroism exciton chirality method. New red-shifted chromophores for hydroxyl groups. *J. Am. Chem. Soc.* **1993**, *115* (16), 7192-7198.
2. Koide, Y.; Urano, Y.; Hanaoka, K.; Piao, W.; Kusakabe, M.; Saito, N.; Terai, T.; Okabe, T.; Nagano, T., Development of NIR Fluorescent Dyes Based on Si-rhodamine for in Vivo Imaging. *J. Am. Chem. Soc.* **2012**, *134* (11), 5029-5031.
3. Meerwein, H., Triethyloxonium Fluoborate. *Organic Syntheses* **1966**, *46*, 113.
4. Meyers, A. I.; Temple, D. L., Syntheses via 2-oxazolines. III. Formation of substituted benzoic acids or esters utilizing the Grignard reagent of 2-(bromophenyl)-2-oxazolines. *J. Am. Chem. Soc.* **1970**, *92* (22), 6646-6647.