Supporting Information

Lewis acid-catalyzed [2π+2σ] cycloaddition of dihydropyridines with bicyclobutanes

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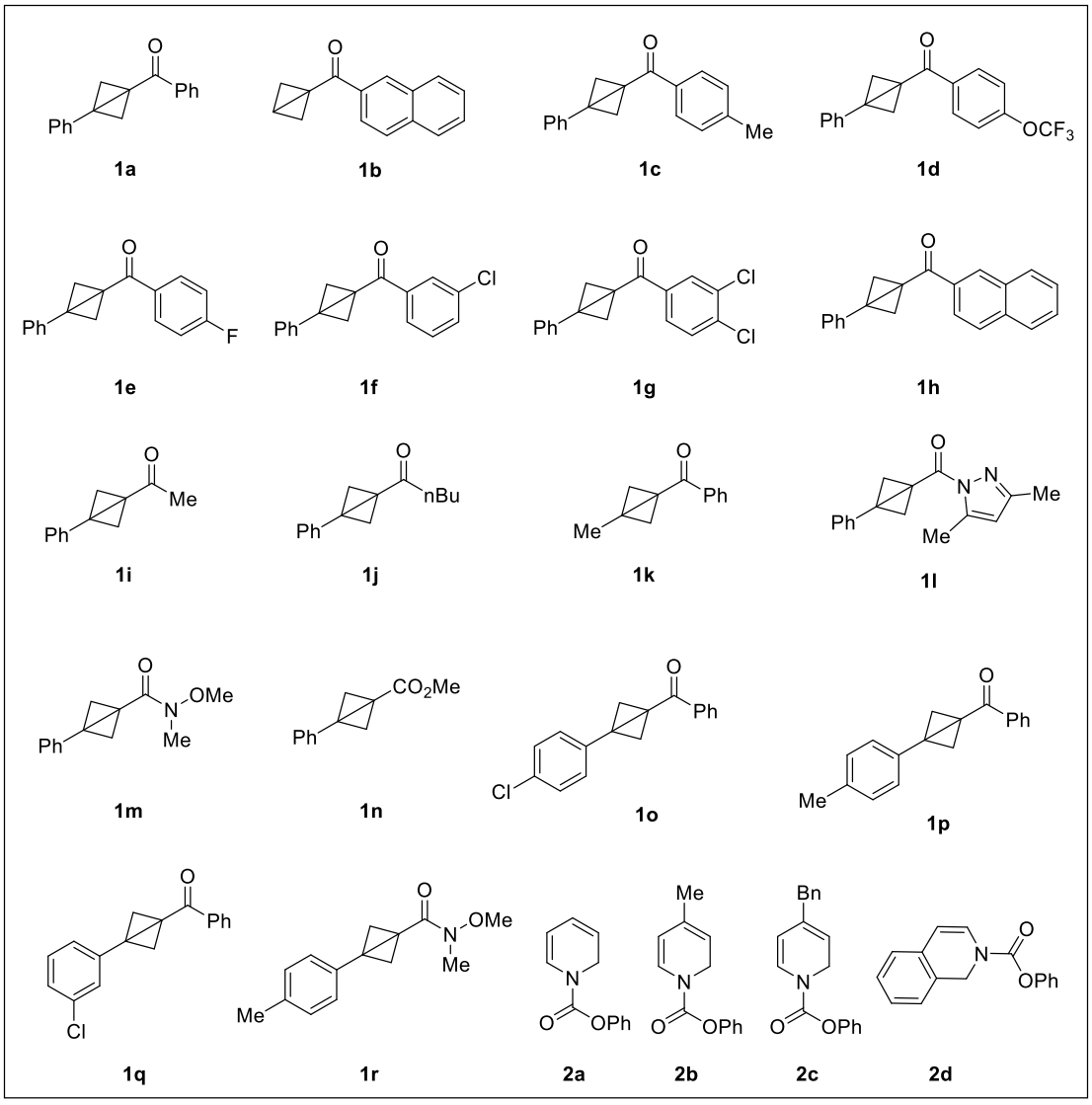
1. General Information

Unless otherwise noted, all reactions were carried out under an atmosphere of argon in oven-dried glassware. The solvents used were purified by distillation over standard drying agents and were stored over molecular sieves under argon. Reaction temperatures are reported as the temperature of the medium surrounding the vessel. Commercially available chemicals were used as received if not stated otherwise. Column chromatography was carried out using Acros Organics silica gel (35-70 mesh) under a positive pressure of argon, eluting with the specified solvent system. NMR-spectra were recorded on a Bruker Avance II 400 spectrometer. Chemical shifts (δ) are reported in parts per million (ppm) and were calibrated using tetramethylsilane (0 ppm) or residual undeuterated solvent as an internal reference ($CDCl_3$: ^{1}H NMR = 7.26 ppm, ^{13}C NMR = 77.16 ppm; DMSO-d_6: ^{1}H NMR = 2.50 ppm, ^{13}C NMR = 39.52 ppm). ^{19}F NMR spectra are not calibrated by an internal reference. The following abbreviations or combinations thereof were used to explained the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, dd = doublet of doublet, ddd = doublet of doublet of doublet, td = triplet of doublet, tdd = triplet of doublet of doublet. Coupling constants, *J*, were reported in hertz (Hz). High-resolution mass spectra (HRMS) were obtained by the MS service of the Organisch-Chemisches Institut, Westfälische Wilhelms-Universität Münster, using electrospray ionisation (ESI) on a Bruker Daltonics, MicroToF spectrometer. TLC plates were visualized by exposure to short wave ultraviolet light (254 nm, 365 nm).

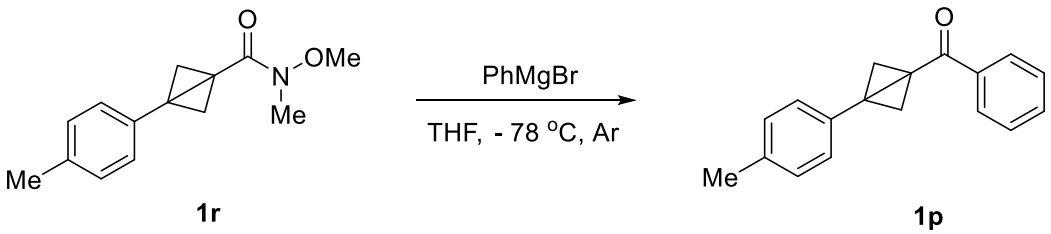
2. Experimental Procedure and Analytical Data of Products

2.1 Starting Material Synthesis



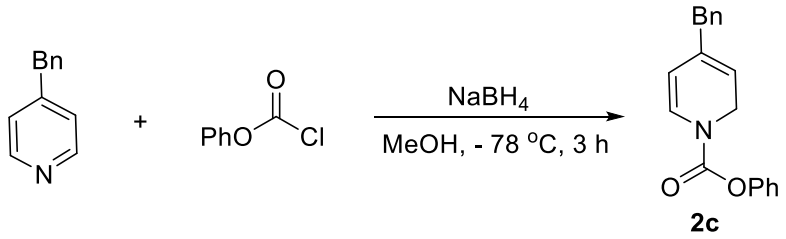
BCB substrates **1a**[1], **1b**[2], **1c-1g**[1], **1h**[2], **1i**[1], **1j**[3], **1k**[4], **1l**[5], **1m**[2], **1n**[6], **1o**[3], **1q**[3], **1r**[4] and dihydropyridines **2a-2b**[7] and dihydroisoquinoline **2d**[8] are literature known compounds and were prepared according to previously reported methods.

Preparation of phenyl(3-(p-tolyl)bicyclo[1.1.0]butan-1-yl)methanone (1p)



In a 100 ml Schlenk tube containing *N*-methoxy-*N*-methyl-3-(p-tolyl)bicyclo[1.1.0] butane-1-carboxamide **1r** (1 mmol, 231 mg) in THF (10 mL) at –78 °C, PhMgBr (3 M in Et_2O, 1 mL) was added dropwise under Ar. After stirring at –78 °C for 1 h, the cooling was removed and continue to stir at room temperature for 1 h. Quenched with sat. NH_4Cl (10 mL) and extracted with EtOAc (2 x 10 mL). The combined organic layers were dried over anhydrous $MgSO_4$, filtered and concentrated by rotary evaporation (water bath temperature < 40 °C). The mixture was purified by silica gel column chromatography (EtOAc/Pentane = 1/60) to afford **1p** (198 mg, 80% yield) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/10): 0.3. **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.47 (dd, *J* = 8.0, 1.2 Hz, 2H), 7.33-7.37 (m, 1H), 7.22-7.25 (m, 2H), 6.92-6.96 (m, 4H), 3.05 (t, *J* = 1.2 Hz, 2H), 2.19 (s, 3H), 1.79 (t, *J* = 1.2 Hz, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 196.6, 138.5, 137.1, 131.8, 129.7, 129.2, 128.4, 128.1, 126.0, 39.2, 37.8, 31.2, 21.2; **HRMS (ESI)** m/z calculated for $[C_{17}H_{14}NaO]^+$ ($[M+Na]^+$): 271.1099, found: 271.1091.

Preparation of phenyl 4-benzylpyridine-1(2H)-carboxylate (**2c**):

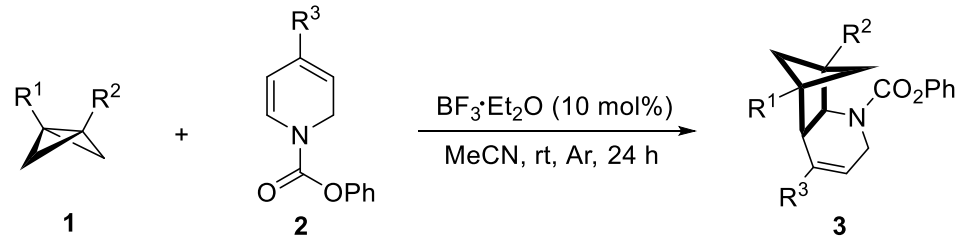


2c

Following a known procedure[7]: Phenyl chloroformate (5 mmol, 782.8 mg) was added dropwise to a MeOH solution (15 mL) of $NaBH_4$ (5 mmol, 189.2 mg) and 4-benzylpyridine (5 mmol, 846.1 mg) at −78 °C under argon. The reaction was maintained at −78 °C for 3 h and then quenched by water (20 ml). The mixture was extracted with Et_2O (2 x 15 mL). The combined organic layer was washed with 1N NaOH (2 x 20 mL) followed by 1N HCl (2 x 20 mL) then dried over sodium sulfate. After filtration, the solvents were removed by evaporation. The mixture was purified by silica gel column chromatography (Et_2O/Pentane = 1/60) to afford **2c** (0.87 g, 60%) as a colorless oil. It was used immediately in order to prevent decomposition. $\mathbf{R_f}$ (EtOAc/Pentane = 1/50): 0.2. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.00-7.27 (m, 10H), 6.75 and 6.70 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 1H), 5.13-5.20 (m, 1H), 5.03 and 4.97 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 1H), 4.33-4.45 (m, 2H), 3.25 (s, 2H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 152.5, 151.5, 151.0, 150.9, 138.71, 138.68, 133.6, 133.2, 129.4, 129.0, 128.5, 126.4, 126.2, 125.8, 125.7, 125.5, 121.6, 115.2, 114.7, 108.4, 108.0, 44.5, 44.2, 40.9, 40.8; **HRMS (ESI)** m/z calculated for $[C_{19}H_{17}NNaO_2]^+$ ($[M+Na]^+$): 314.1157, found: 314.1154.

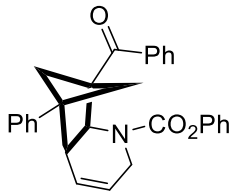
2.2 Substrate Scope

General procedure:



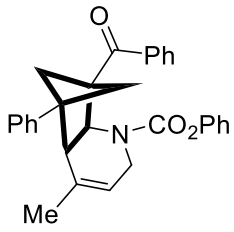
To an oven-dried 10 mL Schlenk tube equipped with a Teflon-coated magnetic stir bar was added BCBs **1** (0.2 mmol, 1 equiv) and the dihydropyridines **2** (0.24 mmol, 1.2 equiv). The tube was evacuated and backfilled with argon three times. Subsequently, MeCN (2 mL) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg) were added successively under positive argon pressure. The reaction mixture was stirred at room temperature for 24 h, then, it was transferred to a 50 mL flask with DCM (3 mL) and a spoon of silica gel was added. After removal of the solvent under reduced pressure, the crude mixture was purified by silica gel column chromatography to afford the pure products **3**.

Phenyl 7-benzoyl-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b] pyridine-1-carboxylate (**3a**)



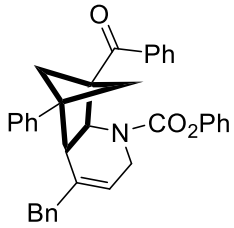
Following the general procedure, using phenyl(3-phenylbicyclo[1.1.0]butan-1-yl) methanone **1a** (0.2 mmol, 46.9 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/20) yielded **3a** (51.9 mg, 60%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.2. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.84 (t, *J* = 7.2 Hz, 2H), 6.90-7.45 (m, 11H), 6.68 and 6.40 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 2H), 5.91-5.99 (m, 1H), 5.60-5.63 (m, 1H), 5.20 and 5.30 (dd, *J* = 8.4, 2.0 Hz, and dd, *J* = 8.0, 2.0 Hz, 1H), 4.35-4.42 (m, 1H), 3.91-4.13 (m, 1H), 3.10-3.18 (m, 1H), 2.42-2.47 (m, 2H), 2.15-2.19 (m, 1H), 1,95-1.97 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.3, 199.9, 154.6, 154.0, 151.3, 150.6, 140.4, 140.2, 137.6, 136.7, 132.9, 132.5, 129.2, 128.8, 128.6, 128.51, 128.49, 128.48, 128.40, 127.0, 126.9, 126.2, 125.23, 125.18, 125.02, 124.95, 124.93, 124.2, 121.7, 121.1, 59.9, 59.5, 59.2, 59.1, 54.01, 53.98, 48.7, 48.4, 44.4, 44.0, 42.9, 42.8, 39.9, 39.7; **HRMS (ESI)** m/z calculated for $[C_{29}H_{25}NNaO_3]^+$ ($[M+Na]^+$): 458.1732, found: 458.1725.

Phenyl 7-benzoyl-4-methyl-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b]pyridine-1-carboxylate (**3b**)



To an oven-dried 10 mL Schlenk tube equipped with a Teflon-coated magnetic stir bar was added phenyl(3-phenylbicyclo[1.1.0]butan-1-yl) methanone **1a** (0.2 mmol, 46.9 mg). The tube was evacuated and backfilled with argon three times. Subsequently, phenyl 4-methylpyridine-1(2H)-carboxylate **2b** (0.24 mmol, 51.7 mg) which was dissolved in MeCN (2 mL) was added under positive argon pressure, followed by $BF_3 \cdot Et_2O$ (10 mol%, 2.8 mg). The reaction mixture was stirred at room temperature for 24 h, then, it was transferred to a 50 mL flask with DCM (3 mL) and a spoon of silica gel was added. After removal of the solvent under reduced pressure, the crude mixture was purified by silica gel column chromatography (EtOAc/DCM/Pentane = 1/1/20) yielded **3b** (28.5 mg, 32%) as a colorless solid. $\mathbf{R_f}$(EtOAc/Pentane = 1/5): 0.3. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.84-7.87 (m, 2H), 6.90-7.44 (m, 11H), 6.72 and 6.39 (d, *J* = 8.0 Hz, and d, *J* = 8.4 Hz, 2H), 5.69 and 5.65 (d, *J* = 7.0 Hz, and d, *J* = 7.0 Hz, 1H), 5.29 and 5.13 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 4.43 and 4.39 (d, *J* = 5.6 Hz, and d, *J* = 6.0 Hz, 1H), 3.88-4.11 (m, 1H), 3.10 and 3.06 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 2.44-2.57 (m, 2H), 2.12 and 2.09 (d, *J* = 6.8 Hz, and d, *J* = 7.2 Hz, 1H), 1.97-1.99 (m, 1H), 1.08 (s, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.6, 200.0, 154.4, 153.8, 151.4, 150.7, 141.8, 141.6, 137.6, 136.7, 134.3, 133.9, 133.0, 132.6, 129.2, 128.8, 128.7, 128.6, 128.55, 128.51, 128.47, 128.4, 127.02, 126.95, 126.10, 126.08, 125.2, 125.0, 121.7, 121.2, 121.0, 120.3, 60.4, 60.3, 60.1, 59.7, 55.04, 55.00, 49.5, 49.3, 49.1, 49.0, 43.2, 43.1, 39.6, 39.4, 23.4, 23.3; **HRMS (ESI)** m/z calculated for $[C_{30}H_{27}NNaO_3]^+$ ($[M+Na]^+$): 472.1889, found: 472.1882.

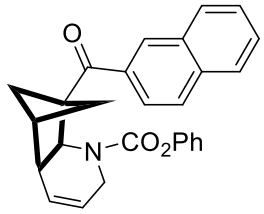
Phenyl 7-benzoyl-4-benzyl-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b]pyridine-1-carboxylate (**3c**)



To an oven-dried 10 mL Schlenk tube equipped with a Teflon-coated magnetic stir bar was added phenyl(3-phenylbicyclo[1.1.0]butan-1-yl) methanone **1a** (0.2 mmol, 46.9 mg). The tube was evacuated and backfilled with argon three times. Subsequently, phenyl 4-benzylpyridine-1(2H)-carboxylate **2c** (0.24 mmol, 69.9 mg) which was dissolved in MeCN (2 mL) was added under positive argon pressure, followed by $BF_3 \cdot Et_2O$ (10 mol%, 2.8 mg). The reaction mixture was stirred at room temperature for 24 h, then, it was transferred to a 50 mL flask with DCM (3 mL) and a spoon of silica gel was added. After removal of the solvent under reduced pressure, the crude

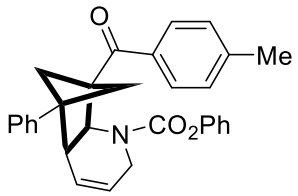
mixture was purified by silica gel column chromatography (EtOAc/Pentane = 1/30) yielded **3c** (48.0 mg, 46%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.3. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.79-7.83 (m, 2H), 7.08-7.39 (m, 12H), 6.89-7.00 (m, 2H), 6.76-6.79 (m, 2H), 6.72 and 6.37 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 2H), 5.66 and 5.59 (d, *J* = 5.6 Hz, and d, *J* = 5.6 Hz, 1H), 5.19 and 5.04 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 4.47 and 4.42 (d, *J* = 4.0 Hz, and d, *J* = 4.4 Hz, 1H), 4.13 and 3.95 (d, *J* = 18.0 Hz, and d, *J* = 18.4 Hz, 1H), 3.03 (t, *J* = 8.8 Hz, 1H), 2.76 (d, *J* = 15.2 Hz, 1H), 2.54-2.60 (m, 1H), 2.28-2.45 (m, 2H), 2.05-2.09 (m, 1H), 1.96 (d, *J* = 7.6 Hz, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.5, 199.9, 154.3, 153.7, 151.3, 150.6, 141.7, 141.6, 138.82, 138.76, 137.8, 137.47, 137.46, 136.5, 132.9, 132.5, 129.3, 129.2, 129.1, 128.8, 128.71, 128.66, 128.5, 128.39, 128.36, 128.33, 127.3, 127.2, 126.3, 126.23, 126.21, 125.2, 124.9, 122.5, 121.9, 121.6, 121.0, 60.4, 60.2, 60.1, 59.7, 55.3, 55.2, 49.0, 48.9, 46.8, 46.5, 43.4, 43.3, 42.4, 42.3, 39.8, 39.6; **HRMS (ESI)** m/z calculated for $[C_{36}H_{31}NNaO_3]^+$ ($[M+Na]^+$): 548.2202, found: 548.2197.

Phenyl 7-(2-naphthoyl)-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b] pyridine-1-carboxylate (**3d**)



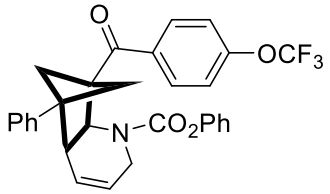
Following the general procedure but with DCM as solvent, using bicyclo[1.1.0]butan-1-yl(naphthalen-2-yl) methanone **1b** (0.2 mmol, 41.7 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/20) yielded **3d** (10.6 mg, 13%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.2. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 8.26 (d, *J* = 5.6 Hz, 1H), 7.66-7.89 (m, 4H), 7.39-7.50 (m, 2H), 6.74-7.03 (m, 3H), 6.45 and 6.30 (d, *J* = 7.6 Hz, and d, *J* = 8.0 Hz, 2H), 5.91-5.96 (m, 2H), 5.06 and 4.86 (d, *J* = 8.0 Hz, and d, *J* = 8.4 Hz, 1H), 4.34-4.39 (m, 1H), 4.06 and 3.90 (d, *J* = 18.4 Hz, and d, *J* = 19.2 Hz, 1H), 3.13 and 3.09 (d, *J* = 7.2 Hz, and d, *J* = 8.4 Hz, 1H), 2.37-2.39 (m, 1H), 1.85-2.16 (m, 4H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.8, 200.5, 154.7, 154.0, 151.1, 150.5, 135.43, 135.39, 135.21, 134.1, 132.6, 132.5, 130.3, 129.74, 129.68, 129.0, 128.6, 128.4, 128.22, 128.19, 128.12, 127.81, 127.76, 126.8, 126.7, 126.6, 126.5, 125.1, 124.8, 124.7, 124.4, 124.2, 123.5, 121.5, 120.9, 63.9, 63.6, 58.0, 57.9, 44.3, 43.9, 43.1, 43.0, 40.6, 40.5, 39.6, 39.2, 38.0, 37.7; **HRMS (ESI)** m/z calculated for $[C_{27}H_{23}NNaO_3]^+$ ($[M+Na]^+$): 432.1576, found: 432.1569.

Phenyl 7-(4-methylbenzoyl)-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methano cyclopenta[b]pyridine-1-carboxylate (**3e**)



Following the general procedure, using (3-phenylbicyclo[1.1.0]butan-1-yl)(p-tolyl) methanone **1c** (0.2 mmol, 49.7 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/15) yielded **3e** (47.8 mg, 53%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.3. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.71-7.76 (m, 2H), 6.90-7.27 (m, 10H), 6.66 and 6.41 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 2H), 5.88-5.97 (m, 1H), 5.57-5.62 (m, 1H), 5.18 and 5.00 (d, *J* = 8.0 Hz, and d, *J* = 8.4 Hz, 1H), 4.34-4.40 (m, 1H), 4.09 and 3.91 (d, *J* = 18.4 Hz, and d, *J* = 18.4 Hz, 1H), 3.08-3.16 (m, 1H), 2.41-2.45 (m, 2H), 2.14-2.28 (m, 4H), 1.92-1.95 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 199.7, 199.5, 154.5, 153.9, 151.3, 150.6, 143.7, 143.2, 140.4, 140.3, 135.1, 134.2, 129.11, 129.07, 128.74, 128.72, 128.6, 128.45, 128.42, 126.91, 126.86, 126.2, 125.2, 125.1, 125.0, 124.91, 124.87, 124.2, 121.6, 121.1, 59.9, 59.5, 59.1, 59.0, 53.9, 48.6, 48.4, 44.3, 43.9, 42.9, 42.7, 39.8, 39.6, 21.7, 21.6; **HRMS (ESI)** m/z calculated for $[C_{30}H_{27}NNaO_3]^+$ ($[M+Na]^+$): 472.1889, found: 472.1881.

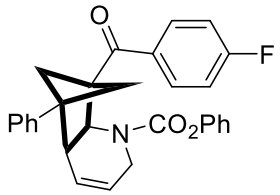
Phenyl 5-phenyl-7-(4-(trifluoromethoxy)benzoyl)-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b]pyridine-1-carboxylate (**3f**)



Following the general procedure, using (3-phenylbicyclo[1.1.0]butan-1-yl) (4-(trifluoromethoxy)phenyl)methanone **1d** (0.2 mmol, 63.7 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/DCM/Pentane = 1/1/20) yielded **3f** (61.4 mg, 59%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.4. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.86 (dd, *J* = 15.6, 8.8 Hz, 2H), 6.90-7.29 (m, 10H), 6.72 and 6.41 (d, *J* = 7.6 Hz, and d, *J* = 8.0 Hz, 2H), 5.90-5.97 (m, 1H), 5.59-5.62 (m, 1H), 5.17 and 4.99 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 4.33-4.42 (m, 1H), 4.10 and 3.92 (d, *J* = 18.4 Hz, and d, *J* = 18.8 Hz, 1H), 3.11-3.17 (m, 1H), 2.40-2.49 (m, 2H), 2.14-2.21 (m, 1H), 1.93 (d, *J* = 6.8 Hz, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 198.9, 198.2, 154.8, 153.8, 152.3, 152.1, 151.2, 150.3, 140.1, 140.0, 135.9 ,134.8, 130.6, 130.4, 129.3, 128.9, 128.6, 128.5, 127.1, 127.0, 126.2, 125.4, 125.1, 125.0, 124.9, 124.7, 124.1, 121.6, 120.8, 120.4 (q, $J_{C\text{-}F}$ = 257.2 Hz), 120.28 (q, $J_{C\text{-}F}$ = 256.1 Hz), 120.26, 120.19, 59.9, 59.4, 59.3, 59.1, 54.1, 54.0, 48.6, 48.4, 44.4, 43.9, 43.0, 42.8, 39.8, 39.5; **^{19}F NMR**

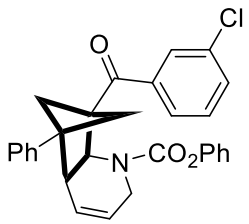
(376 MHz, $CDCl_3$) δ -57.5, -57.6; **HRMS (ESI)** m/z calculated for $[C_{30}H_{24}F_3NNaO_4]^+$ ($[M+Na]^+$): 542.1555, found: 542.1550.

Phenyl 7-(4-fluorobenzoyl)-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b]pyridine-1-carboxylate (**3g**)



Following the general procedure, using (4-fluorophenyl)(3-phenylbicyclo[1.1.0]butan-1-yl)methanone **1e** (0.2 mmol, 50.4 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/DCM/Pentane = 1/1/20) yielded **3g** (50.2 mg, 55%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.2. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.81-7.87 (m, 2H), 6.87-7.28 (m, 10H), 6.74 and 6.45 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 2H), 5.90-5.98 (m, 1H), 5.58-5.63 (m, 1H), 5.17 and 5.00 (d, *J* = 8.0 Hz, and d, *J* = 8.4 Hz, 1H), 4.34-4.40 (m, 1H), 4.09 and 3.92 (d, *J* = 18.4 Hz, and d, *J* = 18.8 Hz, 1H), 3.11-3.17 (m, 1H), 2.40-2.45 (m, 2H), 2.15-2.18 (m, 1H), 1.92-1.96 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 198.8, 198.3, 165.5 (d, $J_{C\text{-}F}$ = 253.5 Hz), 165.4 (d, $J_{C\text{-}F}$ = 252.4 Hz), 154.7, 153.9, 151.2, 150.5, 140.2, 140.1, 134.0 (d, $J_{C\text{-}F}$ = 2.7 Hz), 133.1 (d, $J_{C\text{-}F}$ = 2.1 Hz), 131.2 (d, $J_{C\text{-}F}$ = 9.2 Hz), 131.0 (d, $J_{C\text{-}F}$ = 9.2 Hz), 129.2, 128.9, 128.53, 128.50, 127.04, 126.99, 126.2, 125.3, 125.12, 125.07, 124.84, 124.80, 124.2, 121.6, 120.9, 115.51 (d, $J_{C\text{-}F}$ = 21.7 Hz), 115.47 (d, $J_{C\text{-}F}$ = 21.5 Hz), 59.8, 59.5, 59.2, 59.1, 54.0, 48.6, 48.5, 44.3, 43.9, 42.9, 42.8, 39.8, 39.6; **^{19}F NMR** (376 MHz, $CDCl_3$) δ -105.2, -106.3; **HRMS (ESI)** m/z calculated for $[C_{29}H_{24}FNNaO_3]^+$ ($[M+Na]^+$): 476.1638, found: 476.1633.

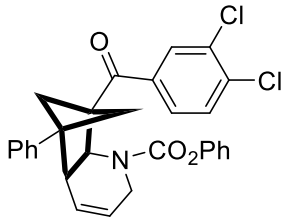
Phenyl 7-(3-chlorobenzoyl)-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methano cyclopenta[b]pyridine-1-carboxylate (**3h**)



Following the general procedure, using (3-chlorophenyl)(3-phenylbicyclo[1.1.0]butan-1-yl)methanone **1f** (0.2 mmol, 53.7 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/DCM/Pentane = 1/1/20) yielded **3h** (67.2 mg, 71%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.3. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.78-7.91 (m, 2H), 7.04-7.51 (m, 10H), 6.85 and 6.61 (d, *J* = 8.0 Hz, and

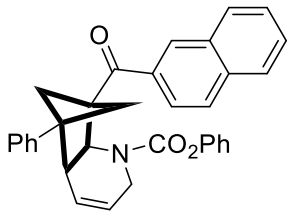
d, *J* = 8.0 Hz, 2H), 6.02-6.10 (m, 1H), 5.71-5.74 (m, 1H), 5.29 and 5.10 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 1H), 3.22-3.30 (m, 1H), 4.23 and 4.04 (dd, *J* = 18.8, 2.4 Hz, and dd, *J* = 18.8, 2.4 Hz, 1H), 3.22-3.30 (m, 1H), 2.52-2.58 (m, 2H), 2.26-2.31 (m, 1H), 2.05-2.08 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 199.0, 198.5, 154.7, 153.7, 151.2, 150.3, 140.1, 140.0, 139.1, 138.0, 134.7, 134.6, 132.7, 132.4, 129.7, 129.2, 128.9, 128.7, 128.52, 128.49, 127.1, 127.0, 126.6, 126.5, 126.2, 125.3, 125.1, 124.9, 124.8, 124.7, 124.1, 121.6, 120.9, 59.9, 59.5, 59.2, 59.1, 54.03, 54.01, 48.5, 48.3, 44.3, 43.8, 42.9, 42.8, 39.8, 39.6; **HRMS (ESI)** m/z calculated for $[C_{29}H_{24}ClNNaO_3]^+$ ($[M+Na]^+$): 492.1342, found: 492.1335.

Phenyl 7-(3,4-dichlorobenzoyl)-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b]pyridine-1-carboxylate (**3i**)



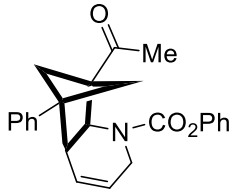
Following the general procedure, using (3,4-dichlorophenyl)(3-phenylbicyclo[1.1.0]butan-1-yl)methanone **1g** (0.2 mmol, 60.6 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/DCM/Pentane = 1/2/20) yielded **3i** (62.1 mg, 57%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.4. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.88 and 7.83 (d, *J* = 2.0 Hz, and d, *J* = 1.6 Hz, 1H), 6.65 and 6.59 (dd, *J* = 8.4, 2.0 Hz, and dd, *J* = 8.4, 1.6 Hz, 1H), 6.94-7.40 (m, 9H), 6.75 and 6.50 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 2H), 5.90-5.97 (m, 1H), 5.58-5.62 (m, 1H), 5.14 and 5.94 (dd, *J* = 8.4, 2.0 Hz, and dd, *J* = 8.4, 2.0 Hz, 1H), 4.32-4.41 (m, 1H), 4.09 and 3.90 (dd, *J* = 14.4, 2.4 Hz, and dd, *J* = 14.8, 2.4 Hz, 1H), 3.10-3.18 (m, 1H), 2.36-2.47 (m, 2H), 2.15-2.20 (m, 1H), 1.91-1.96 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 198.0, 197.5, 154.8, 153.6, 151.2, 150.2, 139.9, 139.8, 137.3, 137.1, 136.9, 136.0, 133.0, 132.9, 130.6, 130.5, 130.44, 130.38, 129.3, 128.9, 128.6, 128.5, 127.53, 127.47, 127.14, 127.08, 126.2, 125.4, 125.2, 124.80, 124.76, 124.5, 124.1, 121.5, 120.6, 59.9, 59.5, 59.3, 59.2, 54.1, 48.5, 48.3, 44.3, 43.9, 43.0, 42.8, 39.8, 39.4; **HRMS (ESI)** m/z calculated for $[C_{29}H_{23}Cl_2NNaO_3]^+$ ($[M+Na]^+$): 526.0953, found: 526.0944.

Phenyl 7-(2-naphthoyl)-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methano cyclopenta[b]pyridine-1-carboxylate (**3j**)



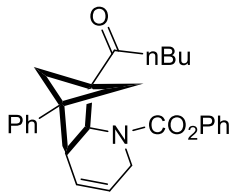
Following the general procedure but with DCM as solvent, using naphthalen-2-yl(3-phenylbicyclo[1.1.0]butan-1-yl)methanone **1h** (0.2 mmol, 56.9 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3 \cdot Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/10) yielded **3j** (41.1 mg, 42%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.2. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 8.33 (d, *J* = 4.0 Hz, 1H), 7.67-7.93 (m, 4H), 7.39-7.50 (m, 2H), 7.12-7.29 (m, 5H), 6.76-7.03 (m, 3H), 6.47 and 6.32 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 2H), 5.93-6.01 (m, 1H), 5.62-5.66 (m, 1H), 5.28 and 5.07 (d, *J* = 8.0 Hz, and d, *J* = 8.4, Hz, 1H), 4.36-4.43 (m, 1H), 4.16 and 3.99 (d, *J* = 18.4 Hz, and d, *J* = 18.8 Hz, 1H), 3.15-3.21 (m, 1H), 2.48-2.56 (m, 2H), 2.16-2.25 (m, 1H), 2.02-2.05 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.2, 199.9, 154.7, 153.9, 151.1, 150.4, 140.4, 140.3, 135.5, 135.4, 135.2, 134.1, 132.6, 132.5, 130.4, 129.8, 129.7, 129.1, 128.6, 128.53, 128.51, 128.48, 128.30, 128.25, 128.19, 127.83, 127.77, 127.02, 126.97, 126.7, 126.6, 126.3, 125.19, 125.16, 125.0, 124.92, 124.86, 124.7, 124.3, 124.2, 121.5, 120.9, 60.1, 59.8, 59.3, 59.1, 54.1, 54.0, 48.8, 48.4, 44.4, 44.0, 43.0, 42.9, 40.1, 39.8; **HRMS (ESI)** m/z calculated for $[C_{33}H_{27}NNaO_3]^+$ ($[M+Na]^+$): 508.1889, found: 508.1883.

Phenyl 7-acetyl-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta [b]pyridine-1-carboxylate (**3k**)



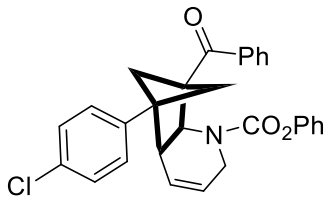
Following the general procedure, using 1-(3-phenylbicyclo[1.1.0]butan-1-yl)ethan-1-one **1i** (0.2 mmol, 34.4 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3 \cdot Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/20) yielded **3k** (30.5 mg, 41%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.2. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 6.99-7.31 (m, 10H), 5.85-5.94 (m, 1H), 5.55-5.59 (m, 1H), 4.95 and 4.87 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 4.33-4.41 (m, 1H), 4.00 and 3.83 (d, *J* = 18.4 Hz, and d, *J* = 18.8, Hz, 1H), 3.03-3.05 (m, 1H), 2.07-2.21 (m, 5H), 1.95 (d, *J* = 6.8 Hz, 1H), 1.76 and 1.71 (d, *J* = 7.2 Hz, and d, *J* = 7.6 Hz, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 209.3, 208.9, 155.1, 154.1, 151.4, 151.1, 140.2, 140.1, 129.5, 129.4, 128.5, 127.04, 126.99, 126.22, 126.19, 125.7, 125.5, 125.1, 125.0, 124.9, 124.3, 121.80, 121.76, 60.2, 60.1, 57.7, 57.6, 54.0, 53.9, 46.9, 46.4, 43.9, 43.6, 42.7, 42.6, 37.7, 37.0, 27.5, 27.1; **HRMS (ESI)** m/z calculated for $[C_{24}H_{23}NNaO_3]^+$ ($[M+Na]^+$): 396.1576, found: 396.1569.

Phenyl 7-pentanoyl-5-phenyl-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta [b]pyridine-1-carboxylate (**3l**)



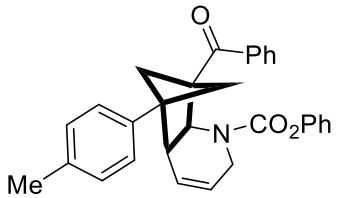
Following the general procedure, using 1-(3-phenylbicyclo[1.1.0]butan-1-yl)pentan-1-one **1j** (0.2 mmol, 42.9 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/20) yielded **3l** (34.4 mg, 41%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.5. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 6.99-7.29 (m, 10H), 5.85-5.95 (m, 1H), 5.55-5.60 (m, 1H), 4.96 and 4.84 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 4.35-4.43 (m, 1H), 4.00 and 3.91 (d, *J* = 18.0 Hz, and d, *J* = 18.8, Hz, 1H), 3.01-3.05 (m, 1H), 2.29-2.74 (m, 2H), 2.11-2.22 (m, 2H), 1.94-1.97 (m, 1H), 1.75 and 1.69 (d, *J* = 7.6 Hz, and d, *J* = 8.0 Hz, 1H), 1.11-1.46 (m, 4H), 0.80 and 0.67 (t, *J* = 7.2 Hz, and t, *J* = 7.2, Hz, 3H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 211.2, 210.7, 154.9, 154.0, 151.5, 151.1, 140.4, 140.2, 129.3, 128.5, 127.0, 126.9, 126.2, 125.5, 125.4, 125.3, 125.1, 124.4, 121.9, 121.6, 59.7, 57.9, 57.7, 54.2, 54.1, 46.6, 46.4, 43.9, 43.5, 42.6, 42.4, 39.6, 39.2, 38.0, 37.4, 25.5, 25.2, 22.5, 22.4, 14.1, 13.8; **HRMS (ESI)** m/z calculated for $[C_{27}H_{29}NNaO_3]^+$ ($[M+Na]^+$): 438.2045, found: 438.2039.

Phenyl 7-benzoyl-5-(4-chlorophenyl)-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b]pyridine-1-carboxylate (3m)



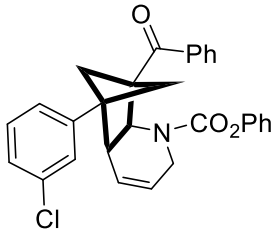
Following the general procedure, using (3-(4-chlorophenyl)bicyclo[1.1.0]butan-1-yl)(phenyl)methanone **1o** (0.2 mmol, 53.7 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/20) yielded **3m** (40.1 mg, 43%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.2. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.82 (t, *J* = 7.6 Hz, 2H), 6.90-7.45 (m, 10H), 6.67 and 6.40 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 2H), 5.92-6.00 (m, 1H), 5.58 (d, *J* = 10.4 Hz, 1H), 5.20 and 5.02 (d, *J* = 8.0 Hz, and d, *J* = 8.0 Hz, 1H), 4.35-4.41 (m, 1H), 4.10 and 3.92 (d, *J* = 18.4 Hz, and d, *J* = 18.8 Hz, 1H), 3.07-3.14 (m, 1H), 2.40-2.45 (m, 2H), 2.12-2.16 (m, 1H), 1.93 (d, *J* = 3.6 Hz, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.0, 199.7, 154.6, 153.9, 151.2, 150.5, 138.9, 138.8, 137.5, 136.6, 133.0, 132.84, 132.77, 132.6, 129.2, 128.8, 128.70, 128.67, 128.60, 128.49, 128.46, 128.42, 127.7, 125.3, 125.1, 124.8, 124.58, 124.56, 121.6, 121.1, 59.8, 59.5, 59.1, 59.0, 53.5, 48.5, 48.3, 44.3, 43.9, 42.9, 42.8, 39.9, 39.7; **HRMS (ESI)** m/z calculated for $[C_{29}H_{24}ClNNaO_3]^+$ ($[M+Na]^+$): 492.1342, found: 492.1338.

Phenyl 7-benzoyl-5-(p-tolyl)-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta [b]pyridine-1-carboxylate (3n)



Following the general procedure, using phenyl(3-(p-tolyl)bicyclo[1.1.0]butan-1-yl)methanone **1p** (0.2 mmol, 49.7 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/20) yielded **3n** (66.2 mg, 74%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.25. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.97 (t, *J* = 7.6 Hz, 2H), 7.04-7.55 (m, 10H), 6.80 and 6.53 (d, *J* = 7.6 Hz, and d, *J* = 7.6 Hz, 2H), 5.73-6.10 (m, 2H), 5.32 and 5.14 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 4.51 (d, *J* = 18.4 Hz, 1H), 4.23 and 4.06 (d, *J* = 18.4 Hz, and d, *J* = 18.8 Hz, 1H), 3.21-3.29 (m, 1H), 2.53-2.58 (m, 2H), 2.40 (s, 3H), 2.24-2.28 (m, 1H), 2.05-2.08 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.3, 200.0, 154.6, 153.9, 151.2, 150.6, 137.6, 137.3, 137.2, 136.65, 136.57, 136.50, 132.9, 132.5, 129.15, 129.12, 128.8, 128.6, 128.5, 128.4, 128.3, 126.1, 125.24, 125.18, 125.03, 124.96, 124.8, 124.1, 121.6, 121.1, 59.9, 59.5, 59.2, 59.1, 53.74, 53.71, 48.7, 48.5, 44.2, 43.8, 42.9, 42.7, 39.9, 39.7, 21.2; **HRMS (ESI)** m/z calculated for $[C_{30}H_{27}NNaO_3]^+$ ($[M+Na]^+$): 472.1889, found: 472,1883.

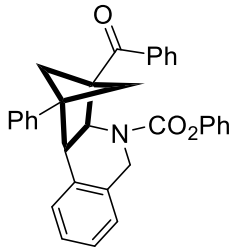
Phenyl 7-benzoyl-5-(3-chlorophenyl)-2,4a,5,6,7,7a-hexahydro-1H-5,7-methanocyclopenta[b]pyridine-1-carboxylate (3o)



Following the general procedure, using (3-(3-chlorophenyl)bicyclo[1.1.0]butan-1-yl)(phenyl)methanone **1q** (0.2 mmol, 53.7 mg), phenyl pyridine-1(2H)-carboxylate **2a** (0.24 mmol, 48.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/Pentane = 1/15) yielded **3o** (42.1 mg, 45%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.15. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.82 (t, *J* = 7.6 Hz, 2H), 6.90-7.45 (m, 10H), 6.67 and 6.40 (d, *J* = 7.6 Hz, and d, *J* = 7.6 Hz, 2H), 5.93-6.00 (m, 1H), 5.58-5.61 (m, 1H), 5.20 and 5.02 (d, *J* = 7.6 Hz, and d, *J* = 8.0 Hz, 1H), 4.35-4.42 (m, 1H), 4.10 and 3.93 (d, *J* = 17.6 Hz, and d, *J* = 18.8, 2.4 Hz, 1H), 3.09-3.16 (m, 1H), 2.41-2.45 (m, 2H), 2.13-2.18 (m, 1H), 1.92-1.95 (m, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.0, 199.6, 154.6, 153.9, 151.2, 150.5, 142.5,

142.4, 137.5, 136.6, 134.5, 134.4, 133.0, 132.6, 129.9, 129.2, 128.8, 128.6, 128.50, 128.46, 128.43, 127.22, 127.17, 126.5, 125.4, 125.3, 125.1, 124.7, 124.5, 121.6, 121.1, 59.8, 59.4, 59.1, 58.9, 53.6, 48.5, 48.3, 44.3, 43.9, 42.9, 42.8, 39.9, 39.7; **HRMS (ESI)** m/z calculated for $[C_{29}H_{24}ClNNaO_3]^+$ ($[M+Na]^+$): 492.1342, found: 492.1337.

Phenyl 3-benzoyl-1-phenyl-1,2,3,3a,5,9b-hexahydro-4H-1,3-methanocyclopenta [c]isoquinoline-4-carboxylate (3p)

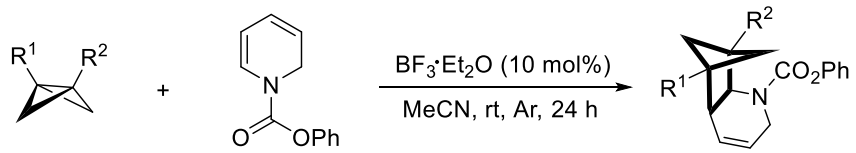


Following the general procedure, using phenyl(3-phenylbicyclo[1.1.0]butan-1-yl) methanone **1a** (0.2 mmol, 46.9 mg), phenyl isoquinoline-2(1H)-carboxylate **2d** (0.24 mmol, 60.3 mg) and $BF_3{\cdot}Et_2O$ (10 mol%, 2.8 mg), and stirring at room temperature for 24 h. Purification by column chromatography (EtOAc/DCM/Pentane = 1/1/20) yielded **3p** (43.8 mg, 45%) as a colorless solid. $\mathbf{R_f}$ (EtOAc/Pentane = 1/5): 0.2. **^{1}H NMR** (400 MHz, $CDCl_3$) (2 rotamers) δ 7.94 and 7.89 (d, *J* = 7.6 Hz, and d, *J* = 7.6 Hz, 2H), 6.79-7.44 (m, 15H), 6.36 and 6.16 (d, *J* = 7.6 Hz, and d, *J* = 7.6 Hz, 2H), 5.60 and 5.47 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 5.13 (d, *J* = 17.2 Hz, 1H), 4.84 and 4.65 (d, *J* = 16.8 Hz, and d, *J* = 16.8 Hz, 1H), 3.79 and 3.75 (d, *J* = 8.4 Hz, and d, *J* = 8.4 Hz, 1H), 2.58-2.67 (m, 1H), 2.40-2.48 (m, 1H), 2.27 and 2.22 (d, *J* = 6.8 Hz, and d, *J* = 7.2 Hz, 1H), 1.89 (d, *J* = 9.2 Hz, 1H); **^{13}C NMR** (101 MHz, $CDCl_3$) δ 200.8, 199.9, 154.4, 153.9, 151.3, 150.8, 140.3, 140.2, 137.4, 136.6, 133.2, 132.92, 132.86, 132.8, 132.6, 130.5, 130.4, 129.2, 128.9, 128.73, 128.67, 128.5, 128.4, 128.25, 128.21, 127.03, 126.98, 126.81, 126.77, 126.71, 126.6, 126.24, 126.17, 125.3, 125.1, 121.7, 121.2, 60.7, 60.3, 59.9, 59.7, 56.2, 56.1, 48.9, 48.8, 48.6, 48.3, 45.5, 45.1, 39.9, 39.6; **HRMS (ESI)** m/z calculated for $[C_{33}H_{27}NNaO_3]^+$ ($[M+Na]^+$): 508.1889, found: 508.1885.

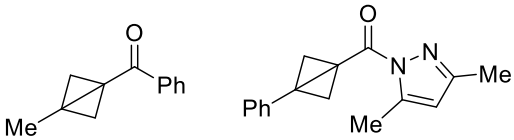
2.3 Unsuccessful Substrates

The following Table S1 lists the BCB substrates that were unsuccessfully tested. The reactions were carried out according to General Procedure and were analyzed by crude ^{1}H NMR with CH_2Br_2 as an internal standard.

Table S1. Unsuccessful BCB substrates (see next page)



unsuccessful substrates:



1k	**1l**	**1m**	**1n**
n.d.	trace	trace	n.d.

2.4 Sensitivity Assessment

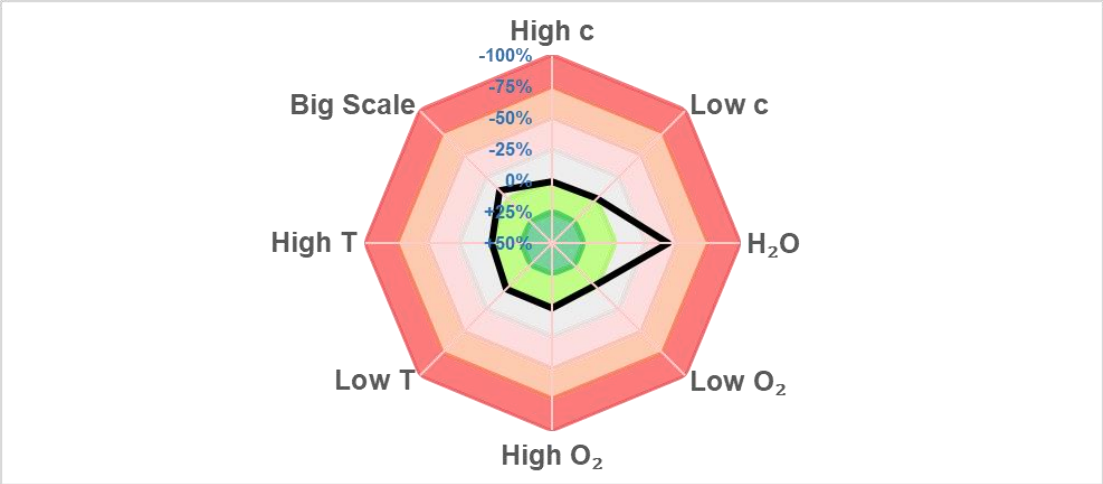
In 2019, our group reported an approach to evaluate the condition-based sensitivity of a chemical reaction to ultimately increase the reproducibility of a new synthetic method.[9] The following reaction parameters have been screened following the standard condition in 0.1 mmol scale (see Table S2, except big scale reaction), and the yields were determined by ^{1}H NMR analysis of the crude mixture with CH_2Br_2 as an internal standard.

Standard conditions:
To an oven-dried 10 mL Schlenk tube equipped with a Teflon-coated magnetic stir bar was added BCB **1a** (0.1 mmol, 23.4 mg) and the dihydropyridine **2a** (0.12 mmol, 24.1 mg). The tube was evacuated and backfilled with argon three times. Subsequently, MeCN (1 mL) and $BF_3{\cdot}Et_2O$ (10 mol%, 1.4 mg) were added successively under positive argon pressure. The reaction mixture was stirred at room temperature for 24 h. After removal of the solvent under reduced pressure, CH_2Br_2 (0.1 mmol, 17.4 mg) was added as an internal standard, and the yield was determined by ^{1}H NMR analysis of the crude mixture.

Big scale experiment:
To an oven-dried 100 mL Schlenk tube equipped with a Teflon-coated magnetic stir bar was added BCB **1a** (2 mmol, 468.6 mg) and the dihydropyridine **2a** (2.4 mmol, 482.9 mg). The tube was evacuated and backfilled with argon three times. Subsequently, MeCN (20 mL) and $BF_3{\cdot}Et_2O$ (10 mol%, 28.4 mg) were added successively under positive argon pressure. The reaction mixture was stirred at room temperature for 24 h. After removal of the solvent under reduced pressure, the crude mixture was subjected to ^{1}H NMR analysis with CH_2Br_2 as an internal standard, and the yield was determined to be 59%. Purification by silica gel column chromatography (EtOAc/pentane =1/10) afforded the desired product **3a** (425.0 mg, 49%) as a colorless solid.

Table S2. Sensitivity assessment

Entry	Description	Deviation from Standard Condition	Yield (%)	Deviation (%)
1	high *c*	THF (0.9 mL)	70	1
2	low *c*	THF (1.1 mL)	69	0
3	high H_2O	+ H_2O (10 μL)	26	-43
4	low O_2	degassing by freeze-pump-thaw	71	2
5	high O_2	+ 10 mL air	67	-2
6	low *T*	at 10 °C	67	-2
7	high *T*	at 50 °C	70	1
8	big scale	2 mmol scale (20 times of standard scale)	59	-10
9	control	-	69	-



Comment: Condition-based sensitivity screening indicated that the moisture suppressed the reaction, while O_2 level, substrate concentration, temperature and scale did not affect the reaction notably.

2.5 Crystal Structure

X-Ray diffraction: Data sets for compound **3a** were collected with a Bruker D8 Venture Photon III Diffractometer. Programs used: data collection: *APEX4* Version 2021.4-0 [10] (Bruker AXS Inc., **2021**); cell refinement: *SAINT* Version 8.40B (Bruker AXS Inc., **2021**); data reduction: *SAINT* Version 8.40B (Bruker AXS Inc., **2021**); absorption correction, *SADABS* Version 2016/2 (Bruker AXS Inc., **2021**); structure solution *SHELXT*-Version 2018-3 [11] (Sheldrick, G. M. *Acta Cryst.*, **2015**, *A71*, 3-8); structure refinement *SHELXL*- Version 2018-3 [12] (Sheldrick, G. M. *Acta Cryst.*, **2015**, *C71* (1), 3-8) and graphics, *XP* [13] (Version 5.1, Bruker AXS Inc., Madison, Wisconsin, USA, **1998**). *R*-values are given for observed reflections, and *w*R^2 values are given for all reflections.

X-ray crystal structure analysis of 3a (glo10671): A colorless, prism-like specimen of $C_{29}H_{25}NO_3$, approximate dimensions 0.040 mm x 0.075 mm x 0.080 mm, was used for the X-ray crystallographic analysis. The X-ray intensity data were measured on a single crystal diffractometer Bruker D8 Venture Photon III system equipped with a micro focus tube Cu ImS (CuKα, λ = 1.54178 Å) and a MX mirror monochromator. A

total of 1754 frames were collected. The total exposure time was 19.51 hours. The frames were integrated with the Bruker SAINT software package using a wide-frame algorithm. The integration of the data using a triclinic unit cell yielded a total of 16744 reflections to a maximum θ angle of 68.37° (0.83 Å resolution), of which 4021 were independent (average redundancy 4.164, completeness = 99.2%, R_{int} = 5.41%, R_{sig} = 4.46%) and 3436 (85.45%) were greater than $2\sigma(F^2)$. The final cell constants of a = 10.2511(3) Å, b = 10.3159(3) Å, c = 12.0215(3) Å, α = 106.4120(10)°, β = 105.6360(10)°, γ = 103.9880(10)°, volume = 1102.62(5) $Å^3$, are based upon the refinement of the XYZ-centroids of 7620 reflections above 20 σ(I) with 9.519° < 2θ < 136.7°. Data were corrected for absorption effects using the multi-scan method (SADABS). The ratio of minimum to maximum apparent transmission was 0.779. The calculated minimum and maximum transmission coefficients (based on crystal size) are 0.9480 and 0.9740. The structure was solved and refined using the Bruker SHELXTL Software Package, using the space group *P*-1, with Z = 2 for the formula unit, $C_{29}H_{25}NO_3$. The final anisotropic full-matrix least-squares refinement on F^2 with 298 variables converged at R1 = 4.22%, for the observed data and wR2 = 11.79% for all data. The goodness-of-fit was 1.061. The largest peak in the final difference electron density synthesis was 0.210 $e^-/Å^3$ and the largest hole was -0.235 $e^-/Å^3$ with an RMS deviation of 0.049 $e^-/Å^3$. On the basis of the final model, the calculated density was 1.312 g/cm^3 and F(000), 460 e^-. CCDC Nr.: 2400706.

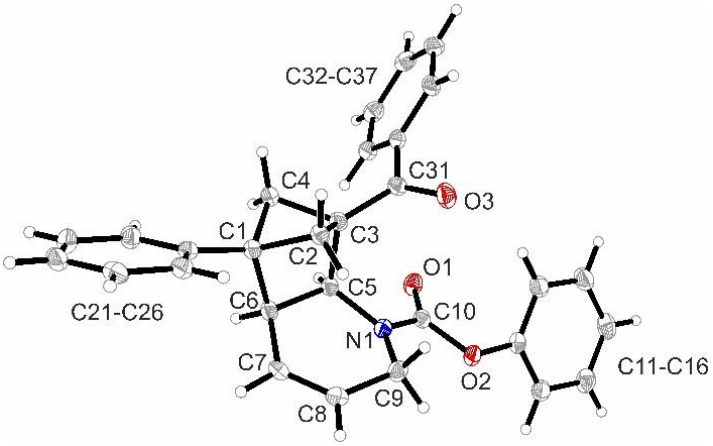


Figure S1: Crystal structure of compound **3a**.
Thermal ellipsoids are shown at 50% probability.

3. References

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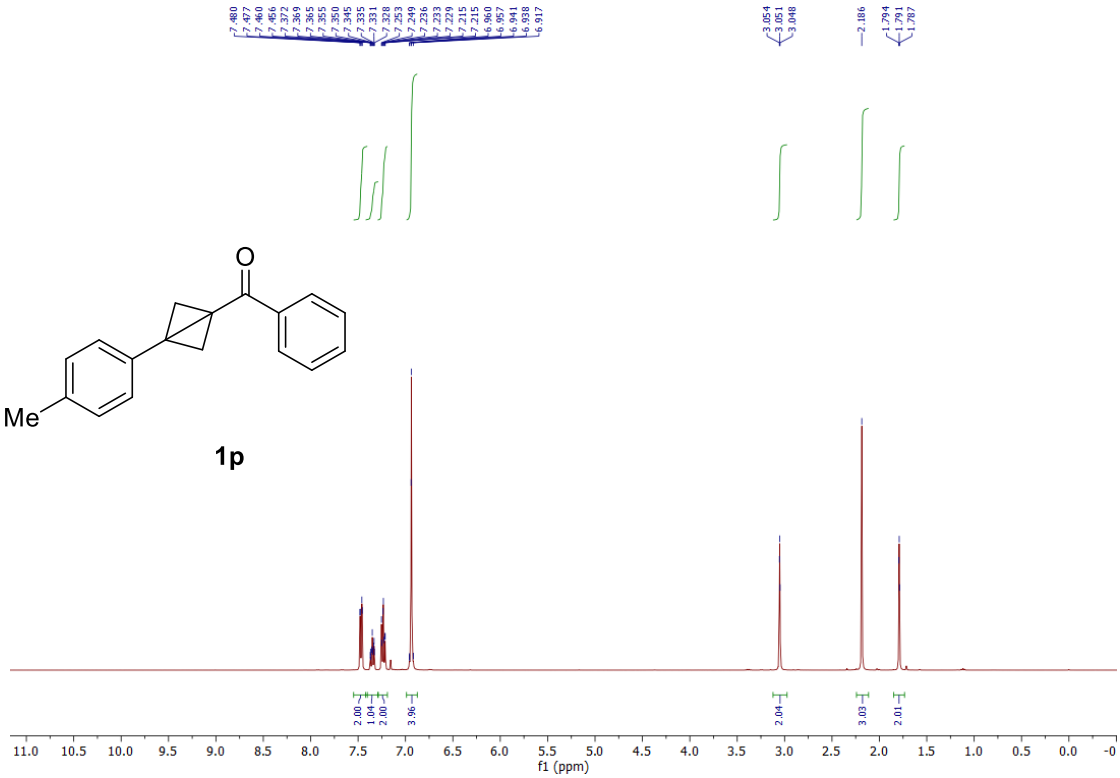
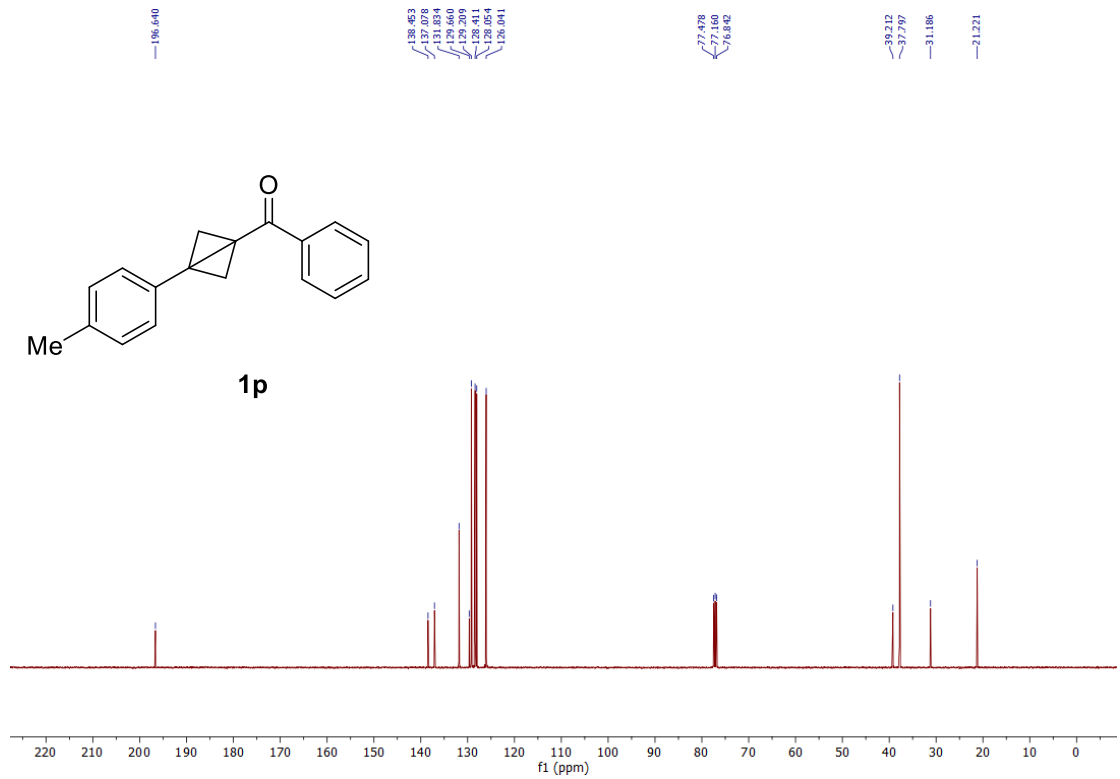
4. NMR Spectra of Products

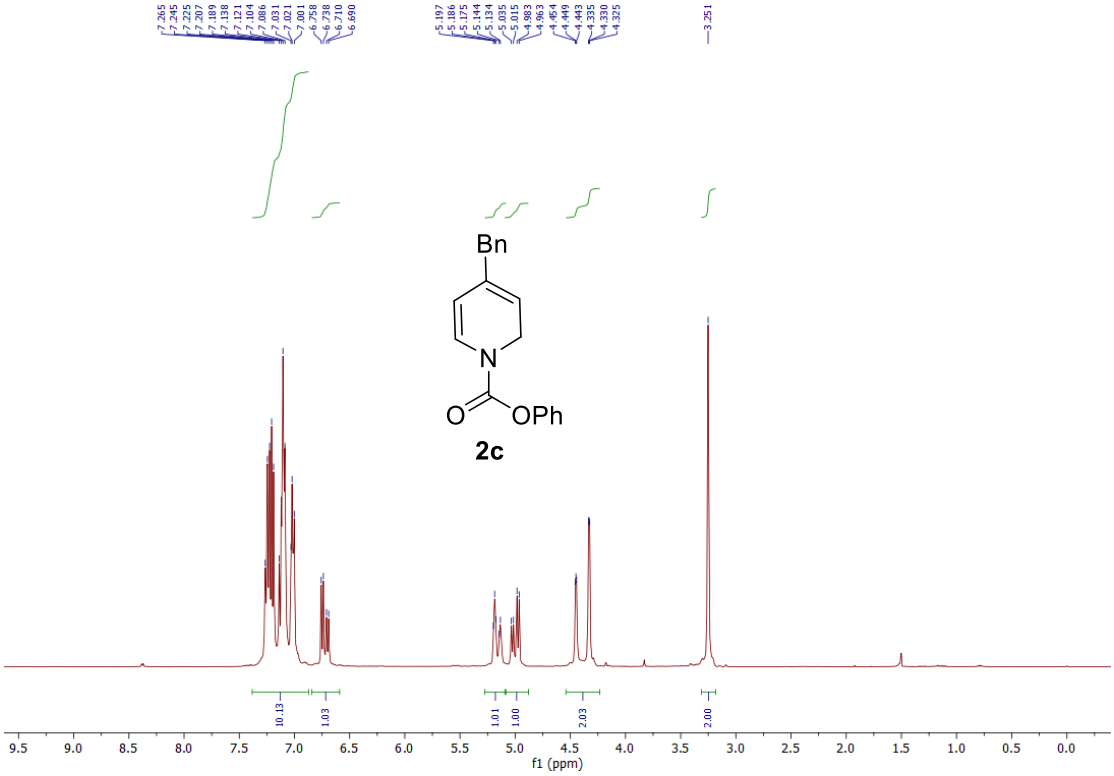
1p, ^{1}H NMR (400 MHz, $CDCl_3$)



1p, ^{13}C NMR (101 MHz, $CDCl_3$)



2c, ^{1}H NMR (400 MHz, $CDCl_3$)



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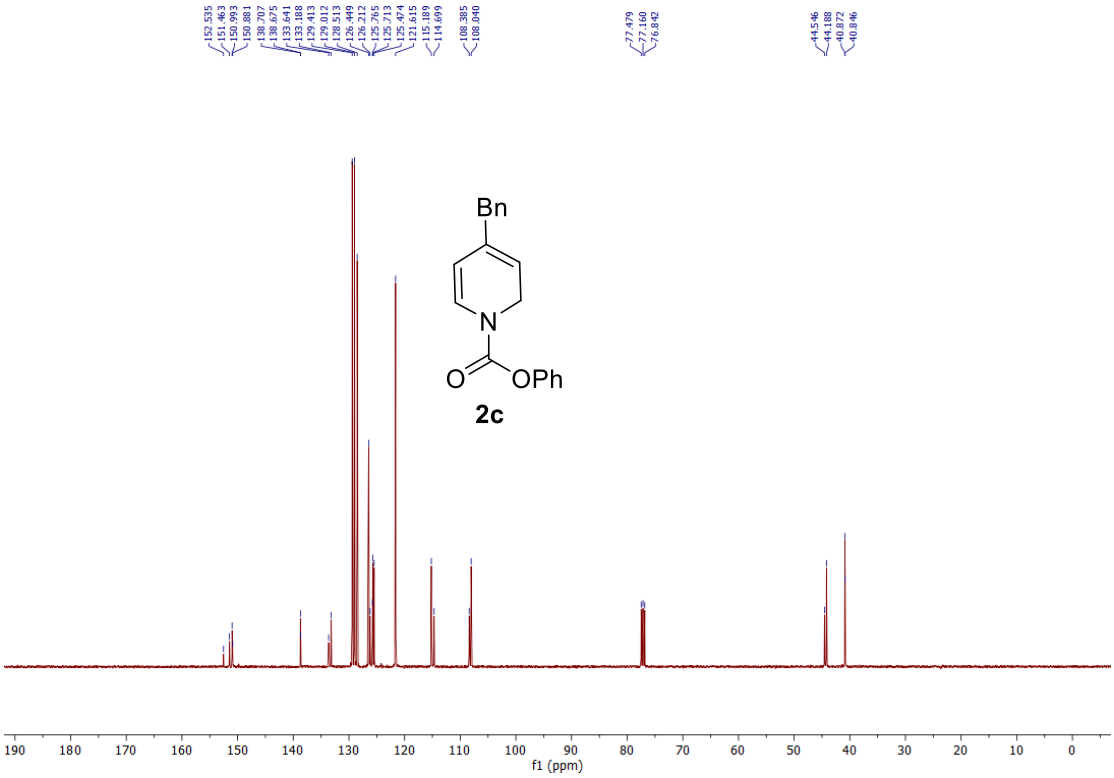
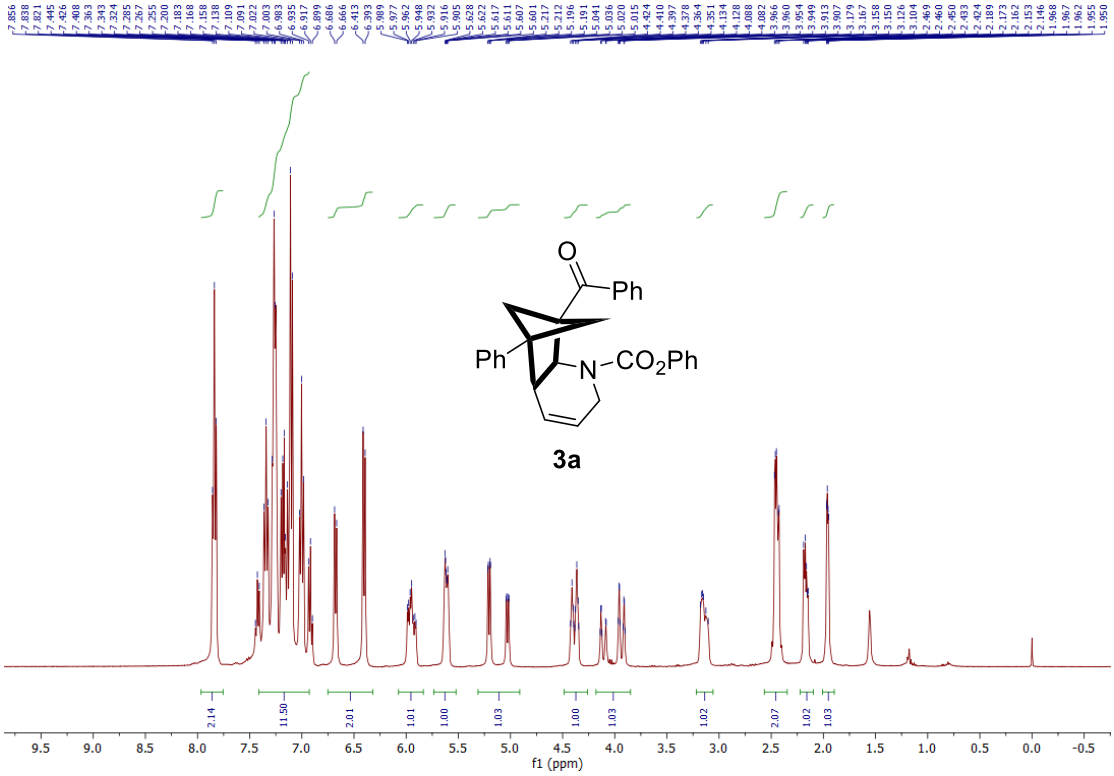


3a, ^{1}H NMR (400 MHz, $CDCl_3$)



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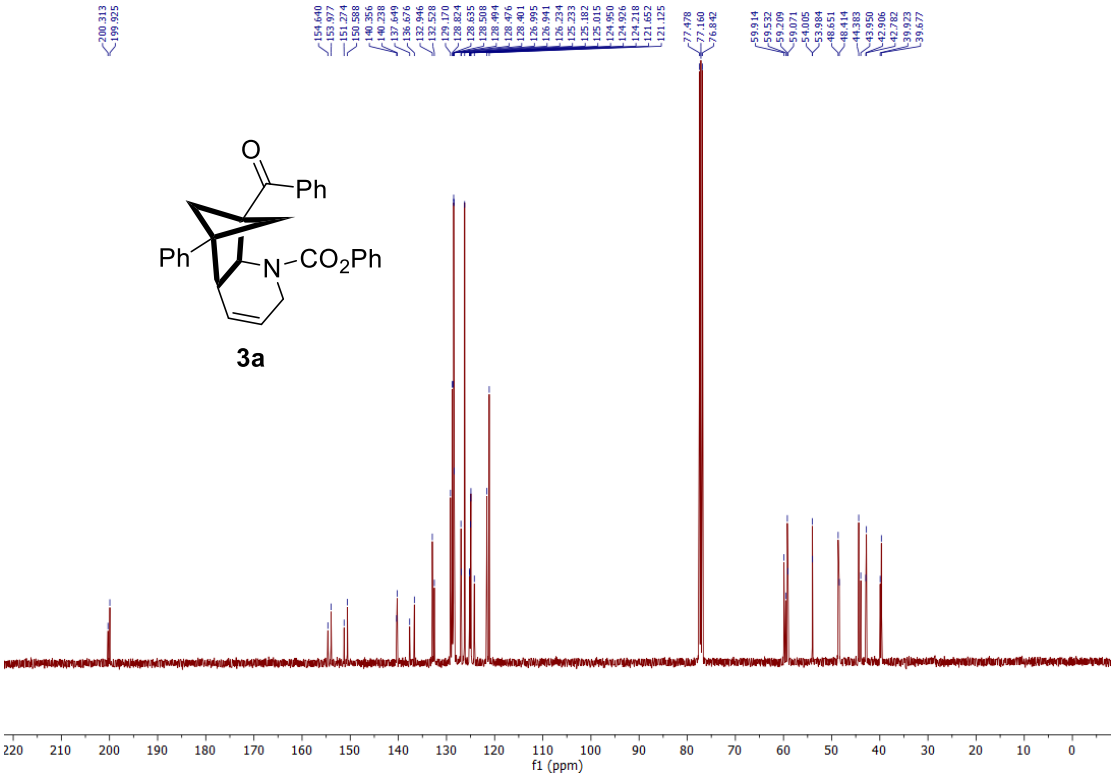

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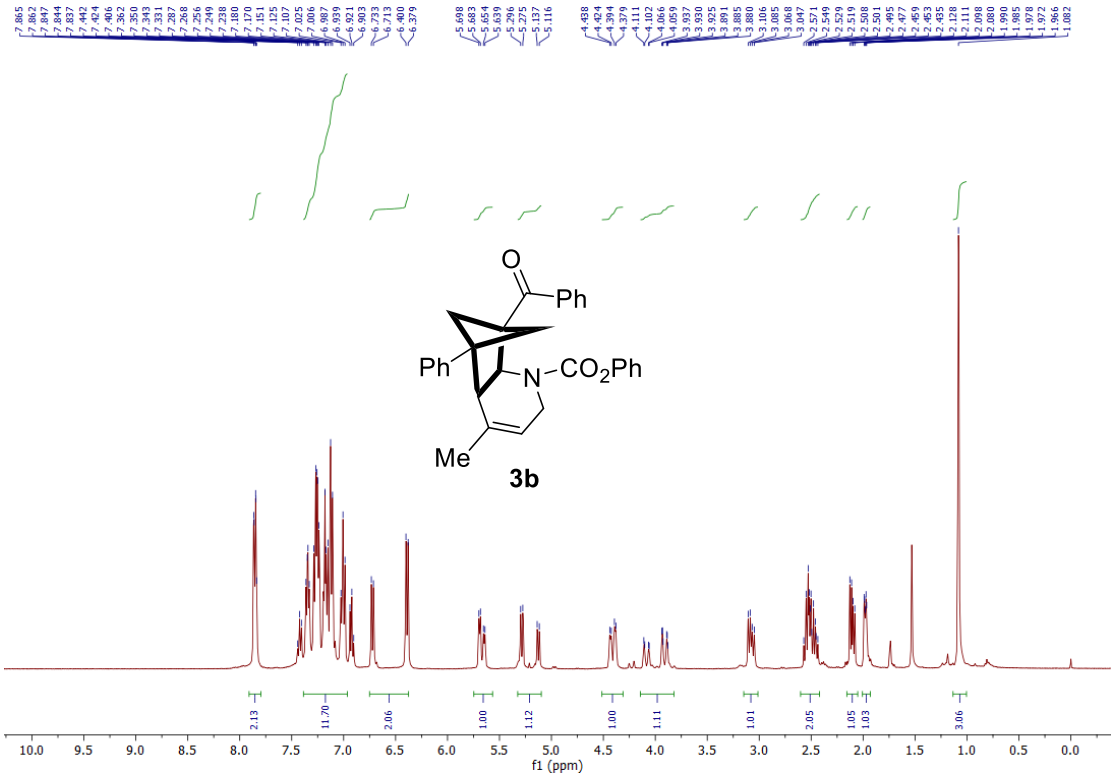

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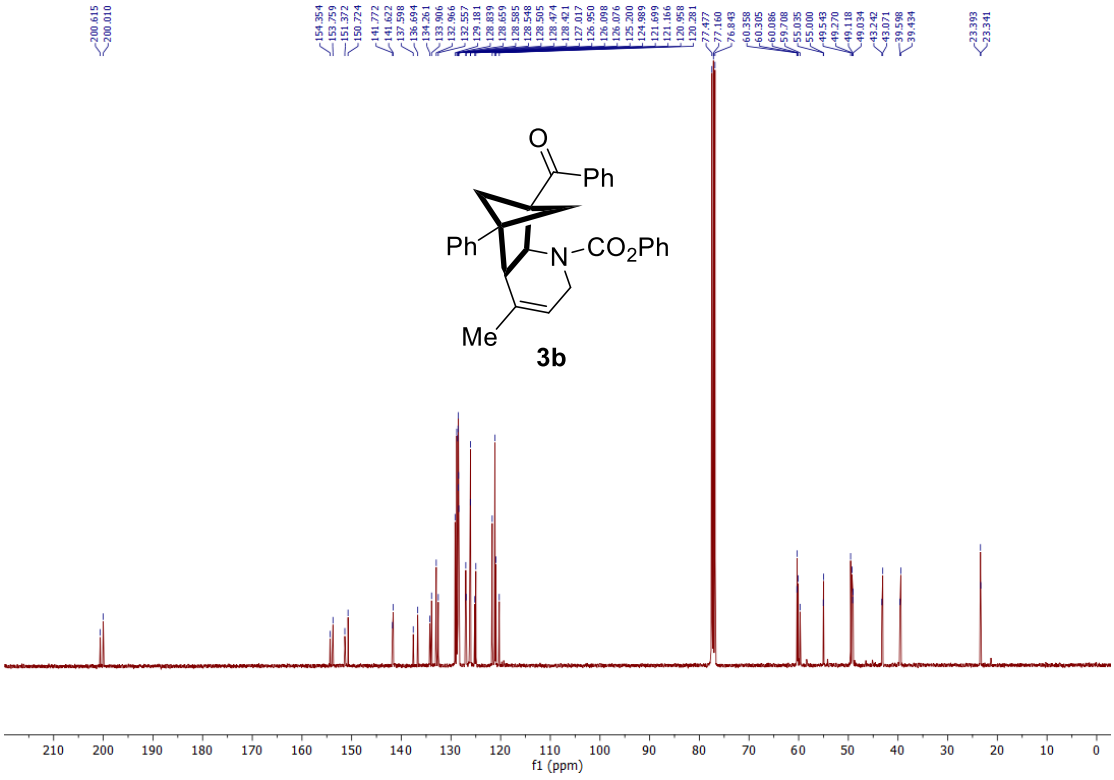

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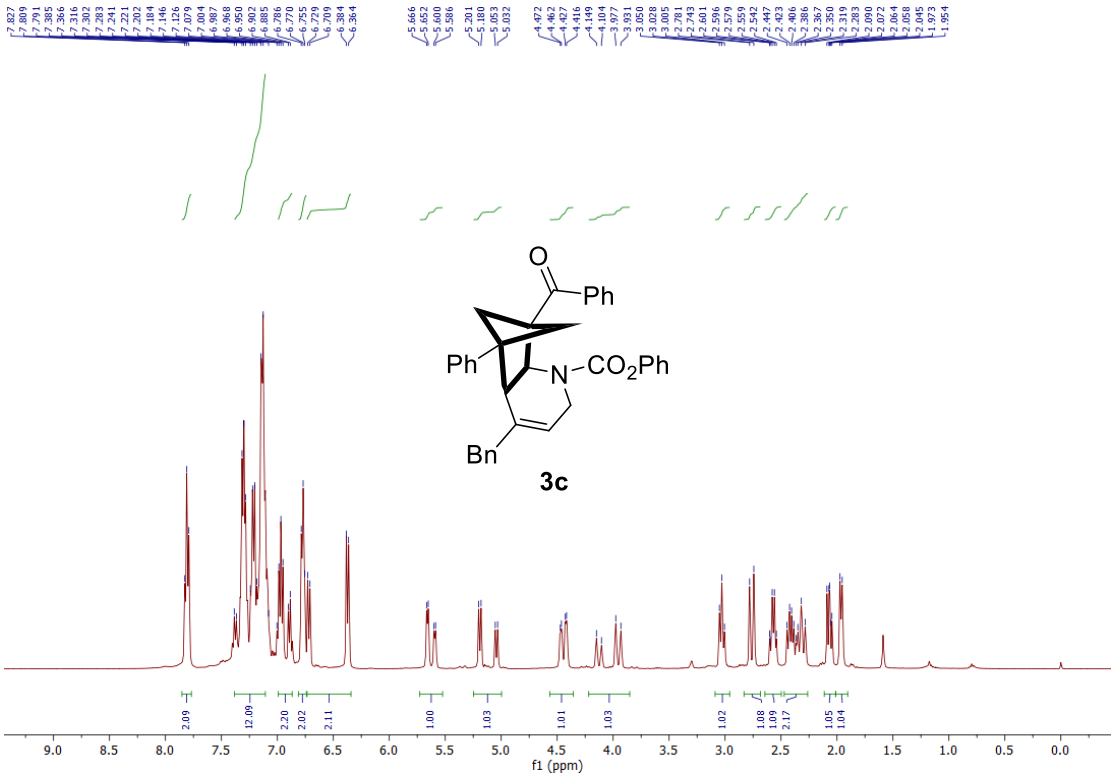

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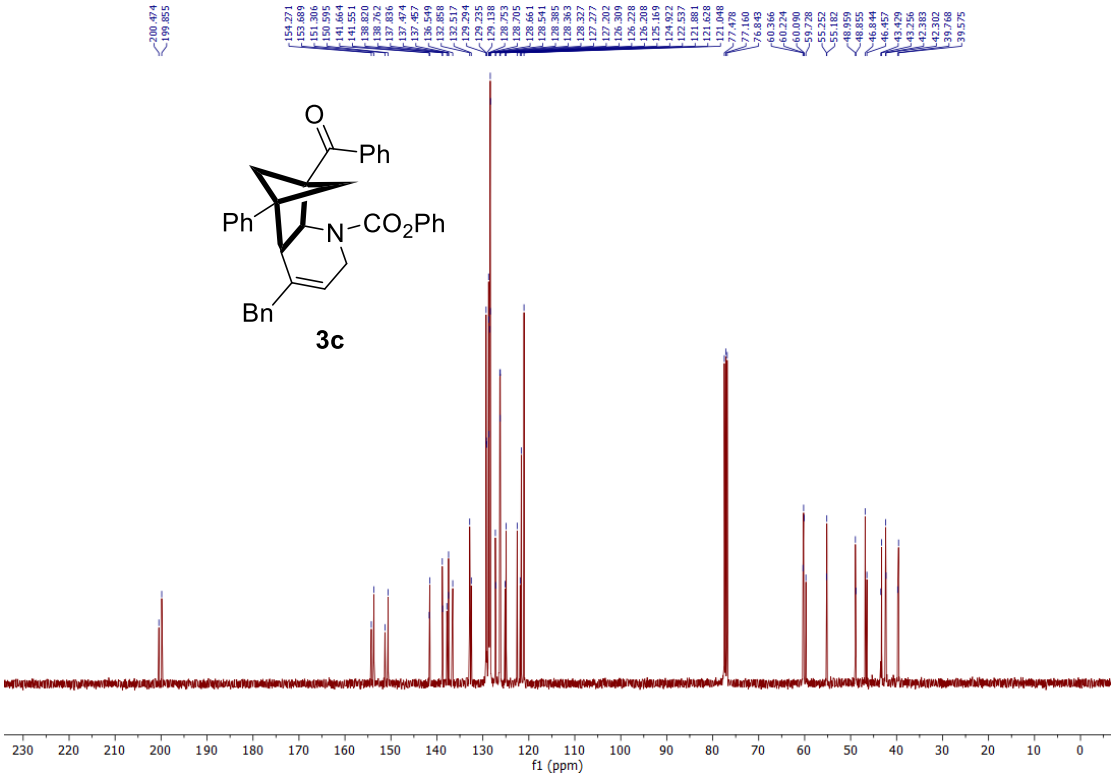

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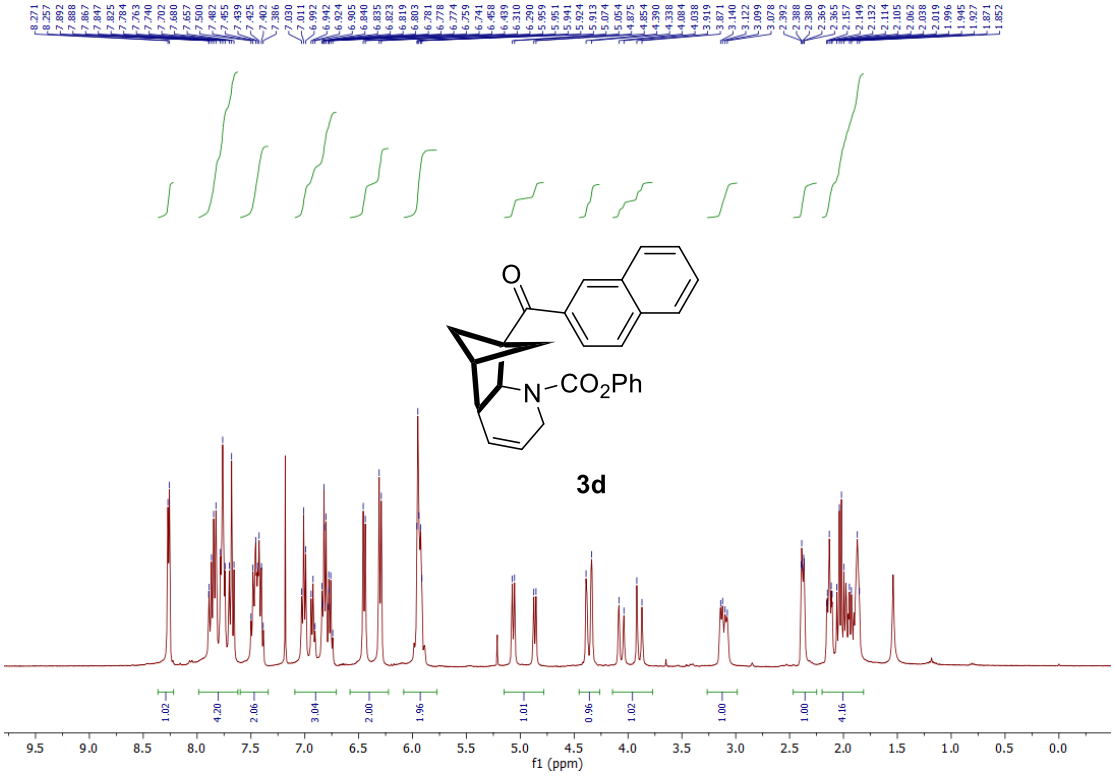

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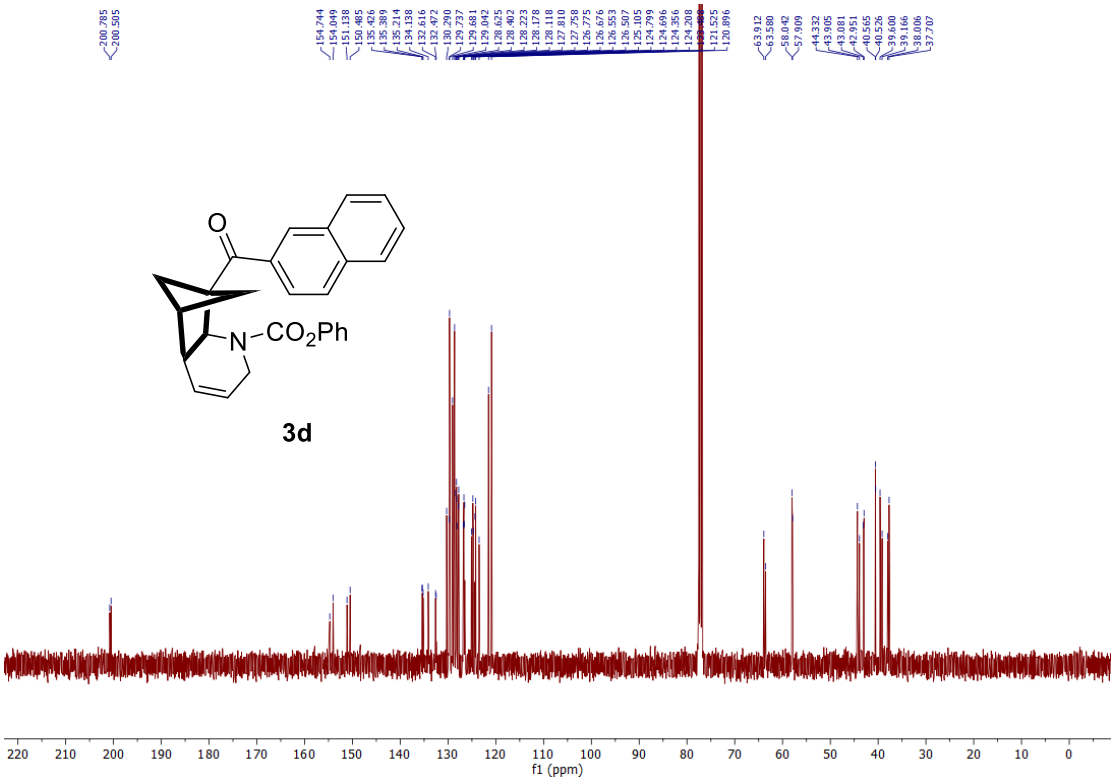

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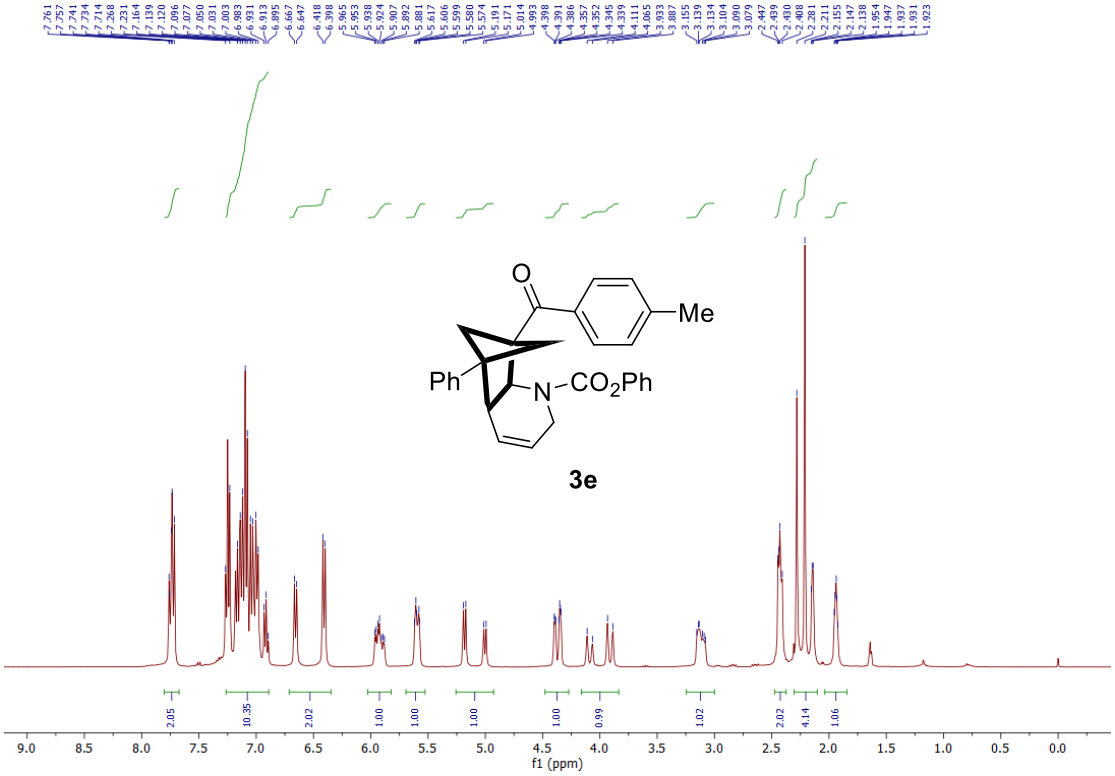

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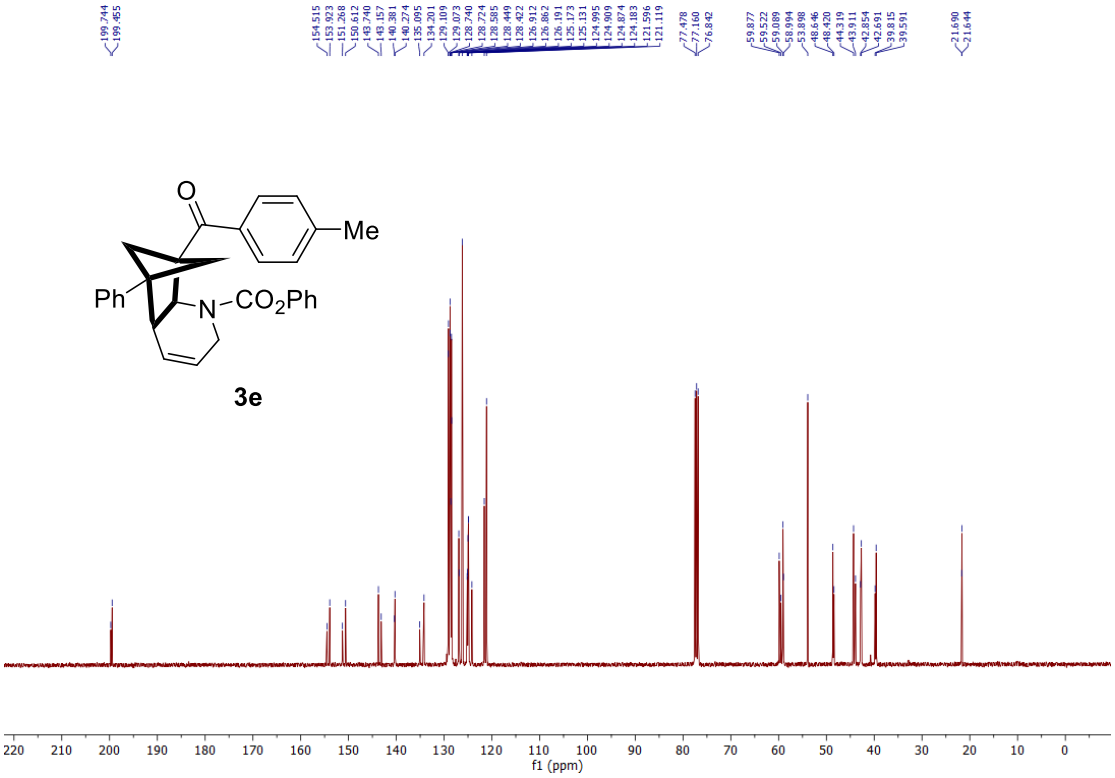

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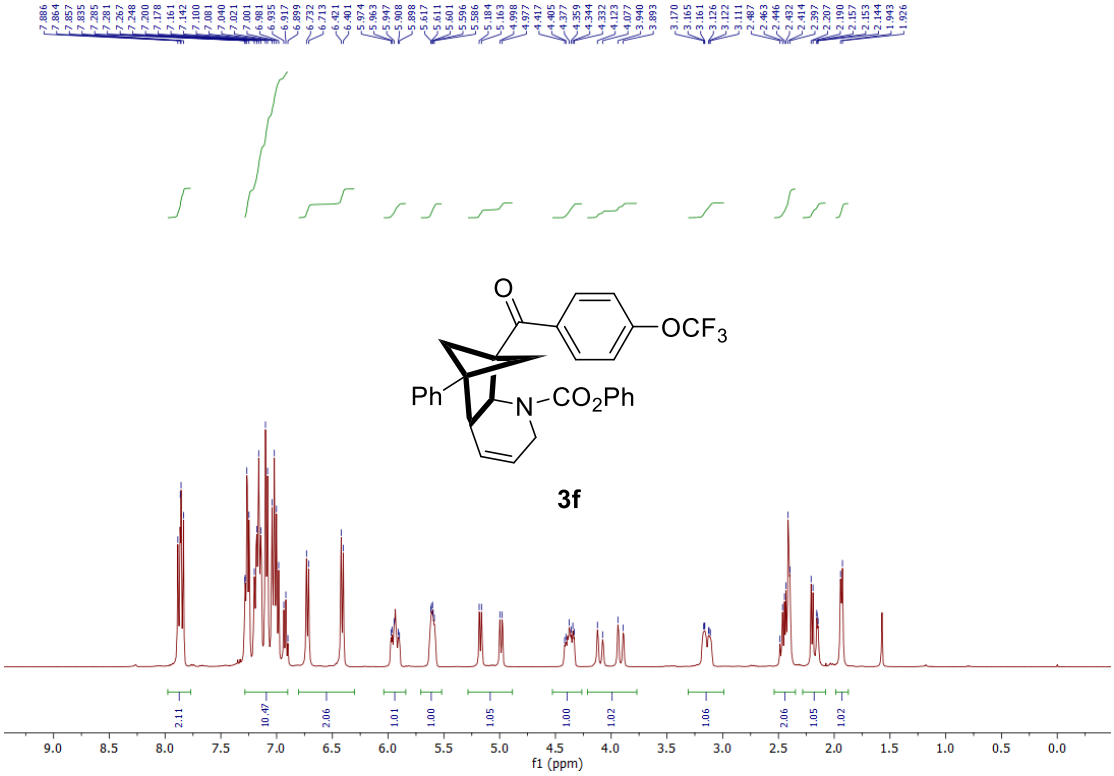

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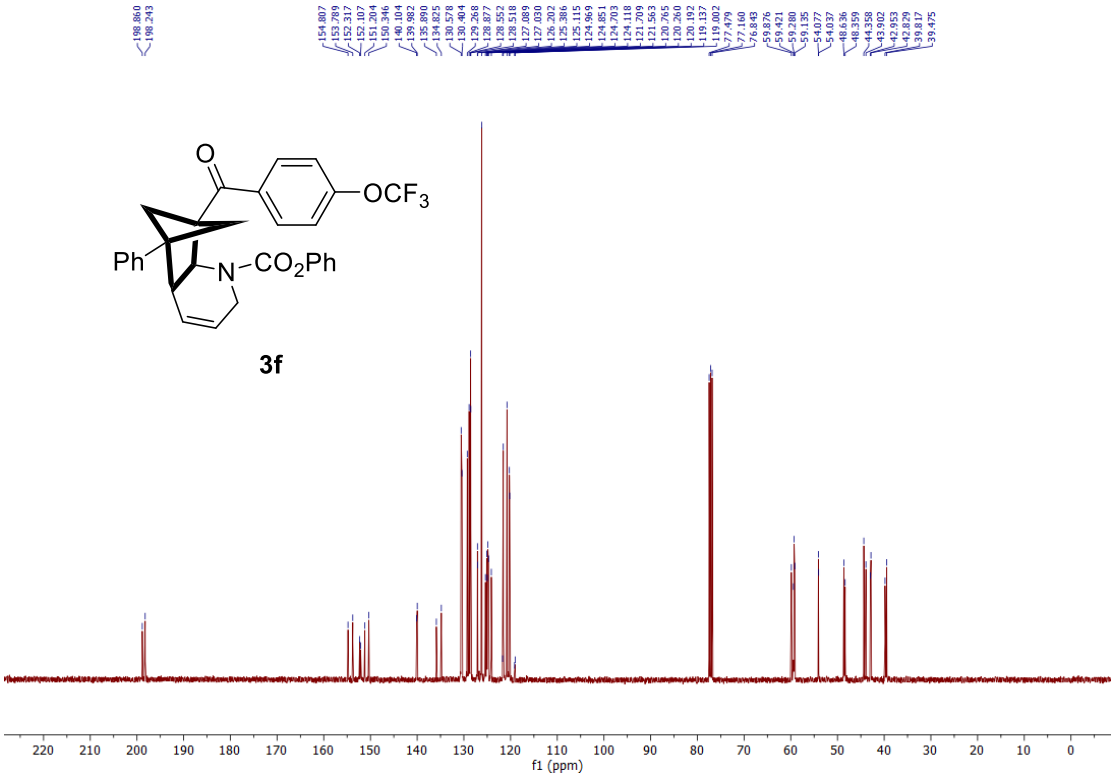
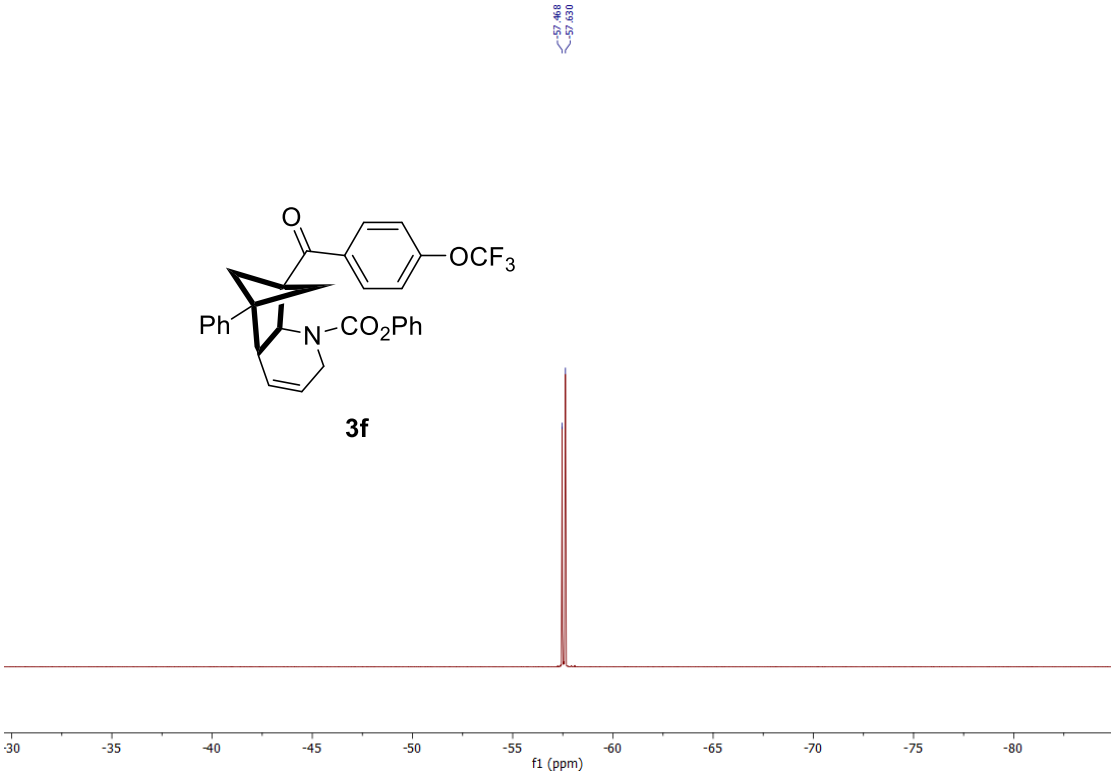
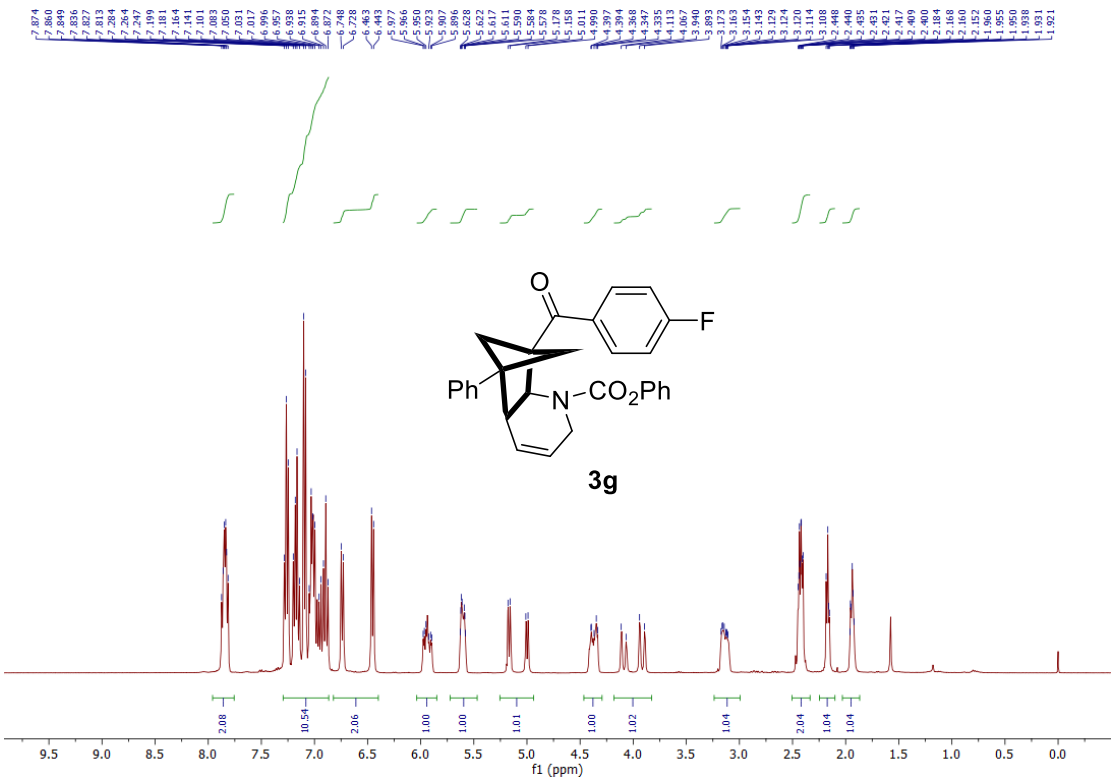


3f, ^{19}F NMR (376 MHz, $CDCl_3$)



3g, ^{1}H NMR (400 MHz, $CDCl_3$)



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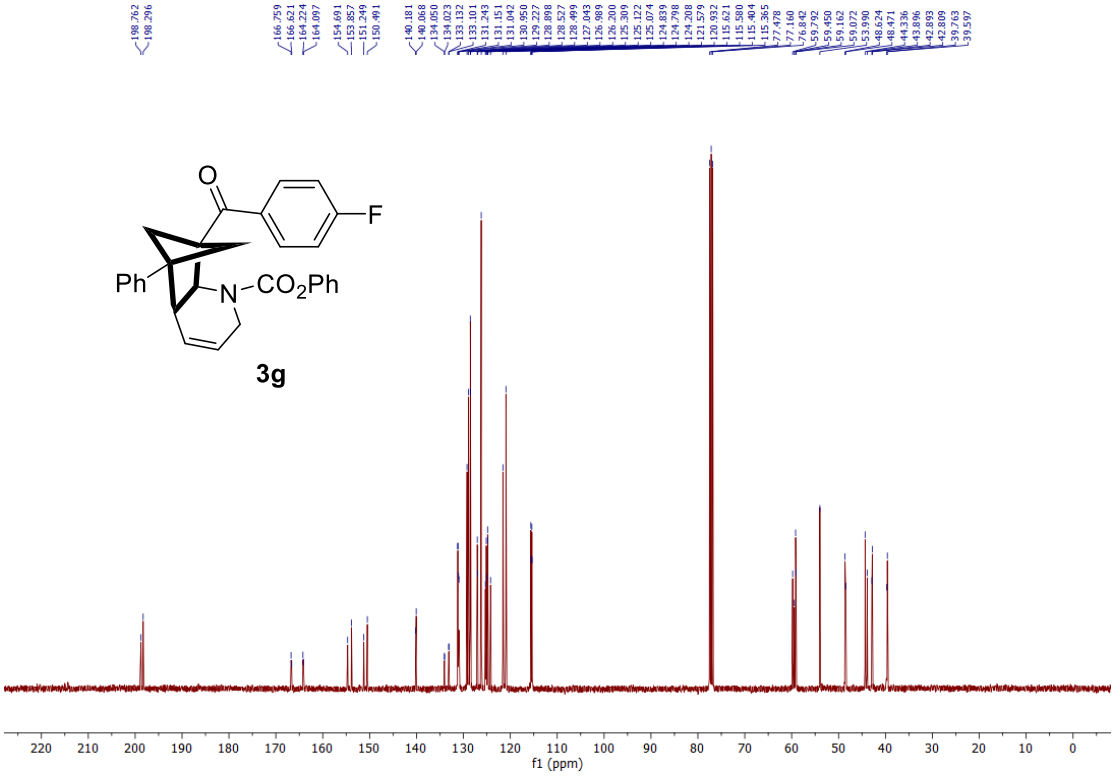

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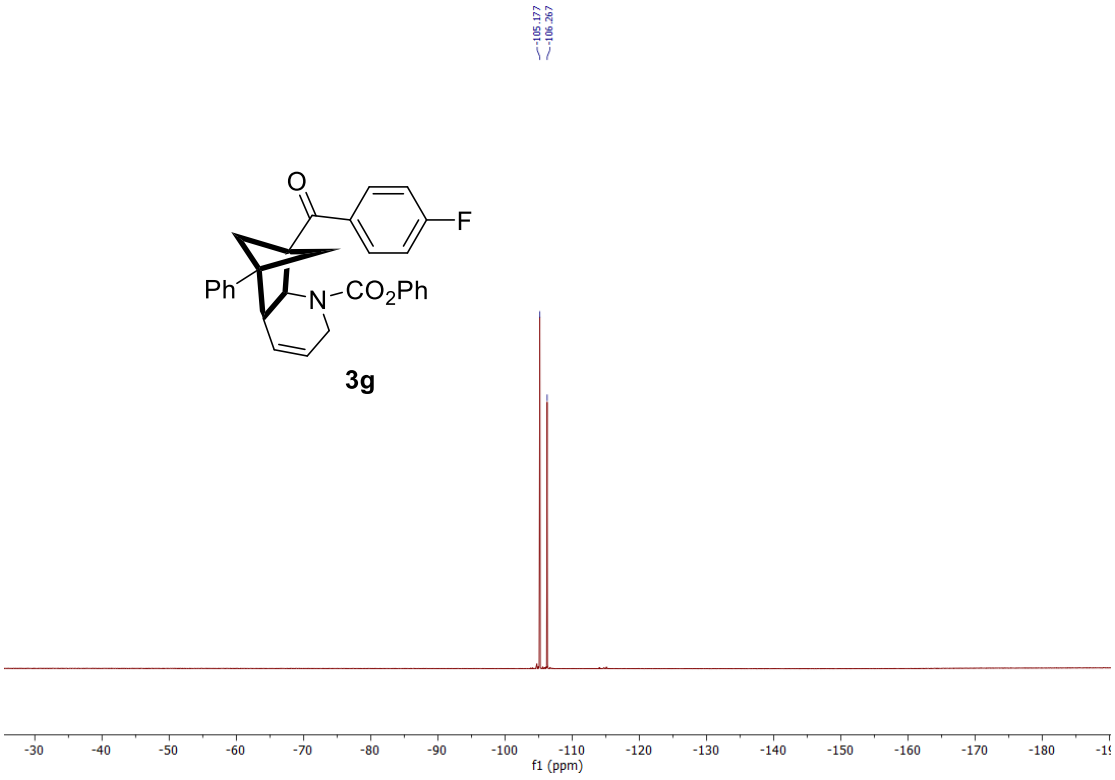
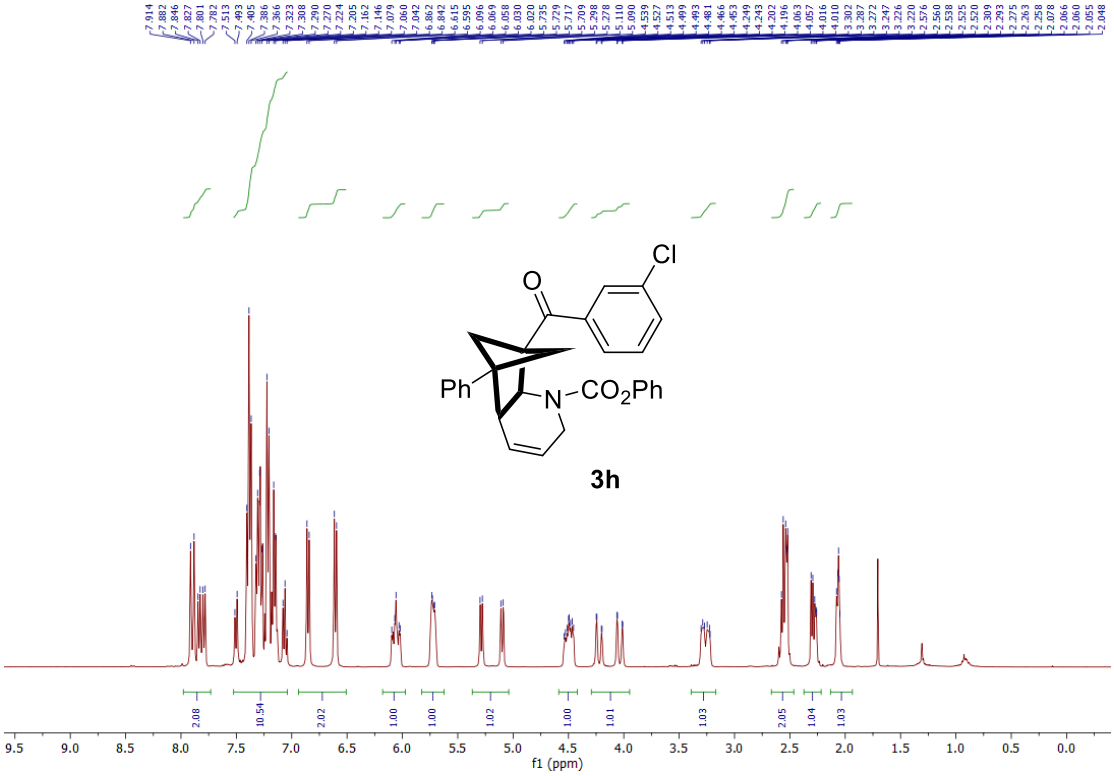
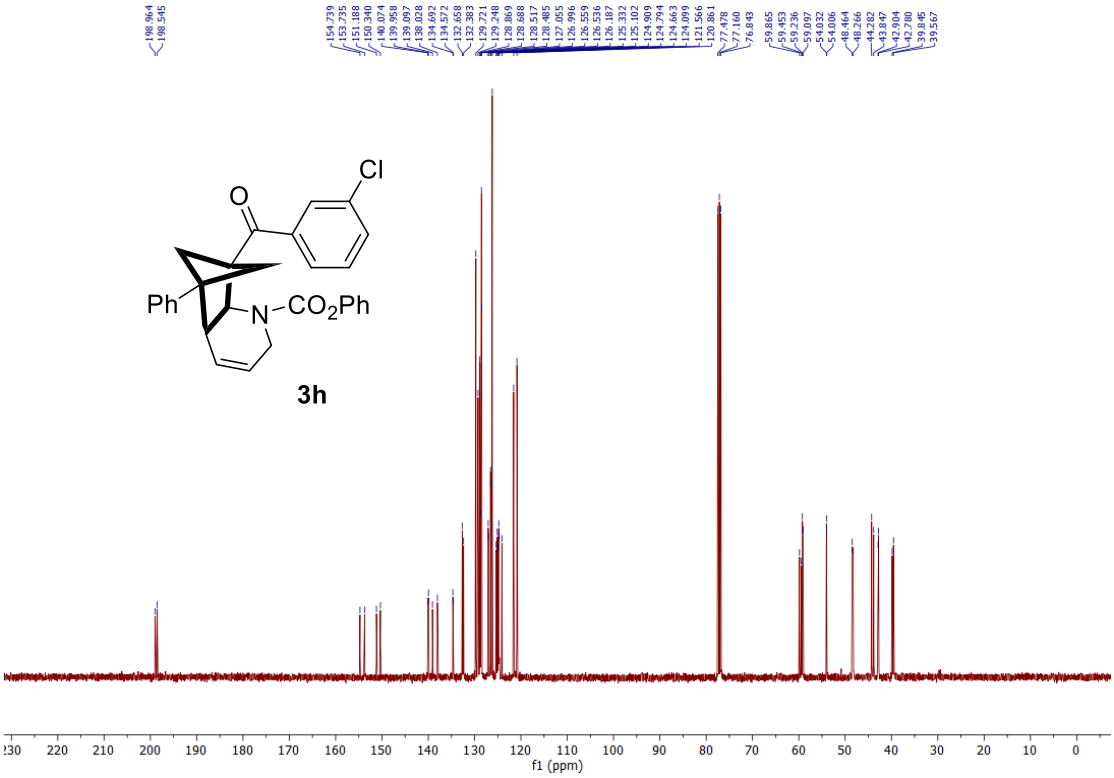


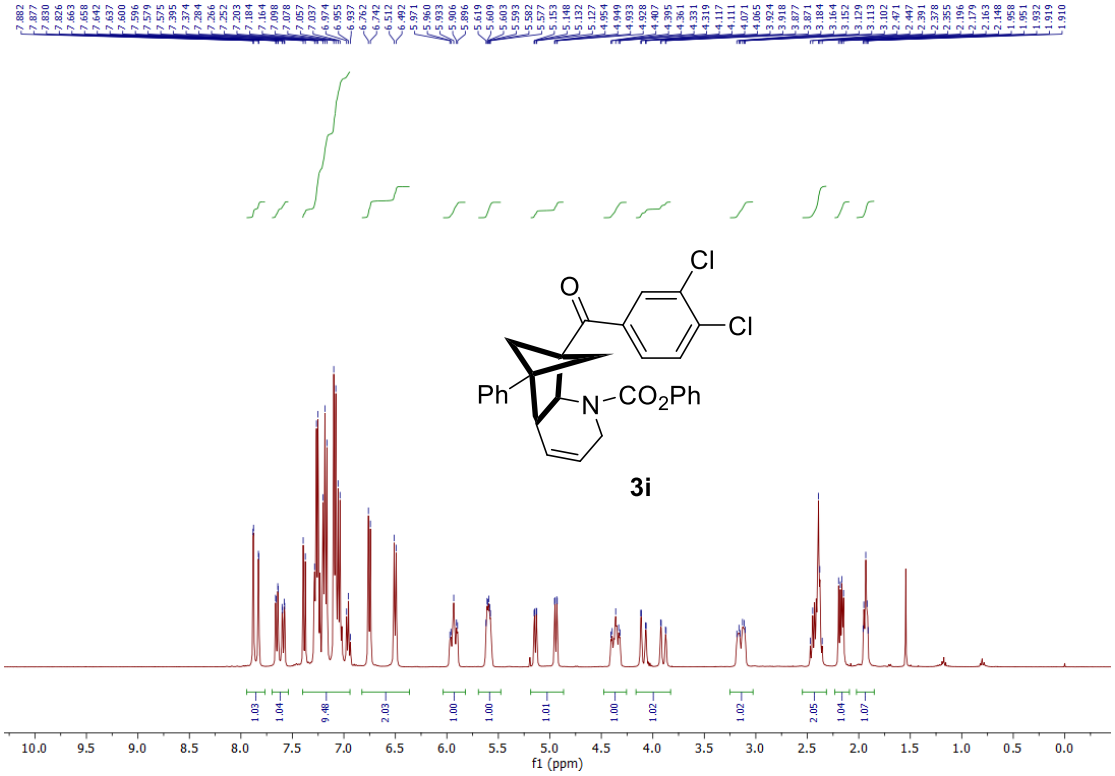
3h, ^{1}H NMR (400 MHz, $CDCl_3$)



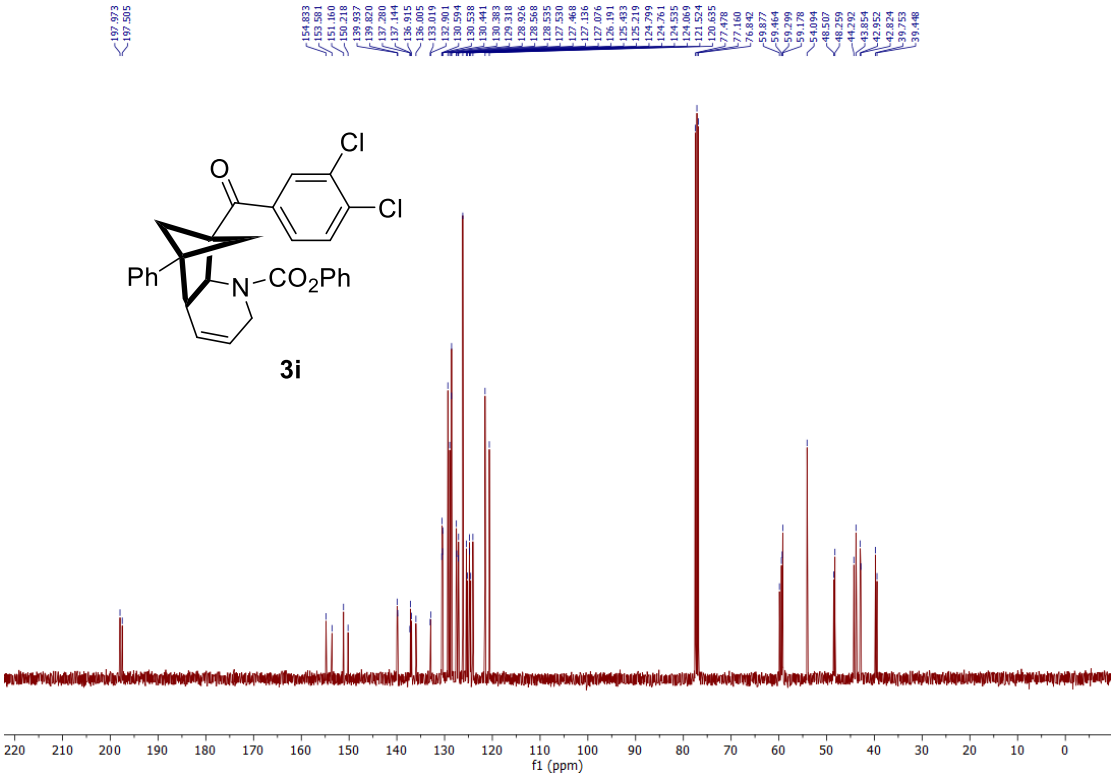
3h, ^{13}C NMR (101 MHz, $CDCl_3$)



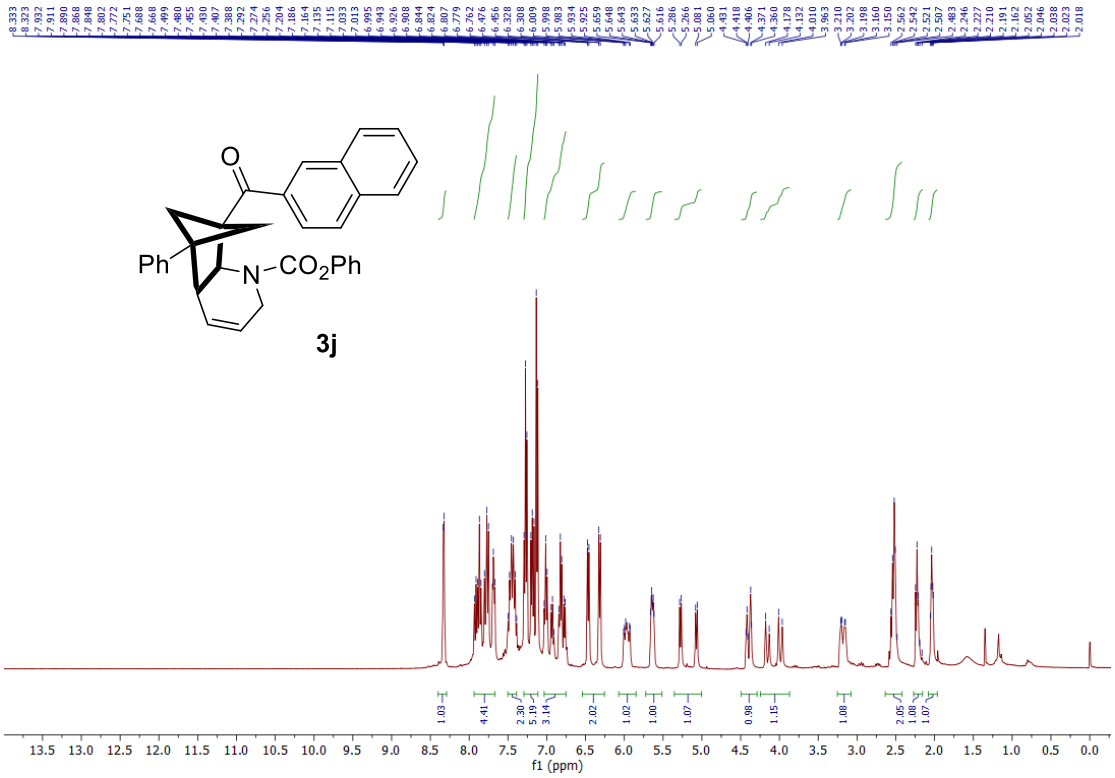
3i, ^{1}H NMR (400 MHz, $CDCl_3$)



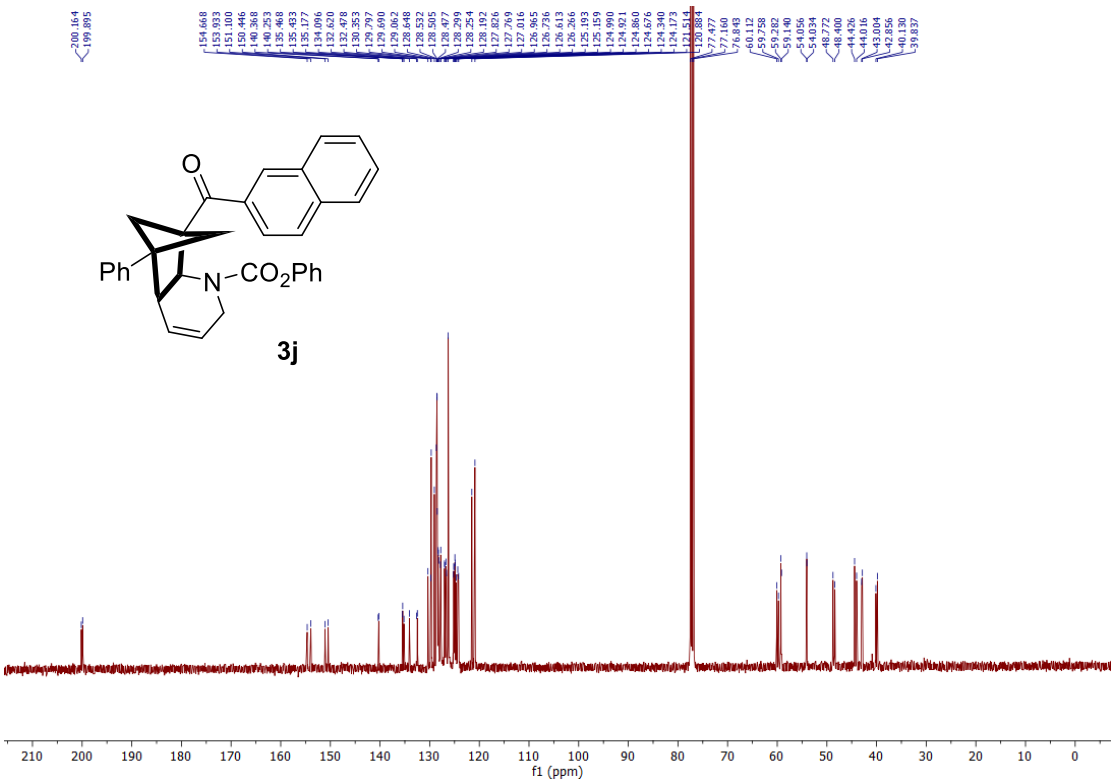
3i, ^{13}C NMR (101 MHz, $CDCl_3$)



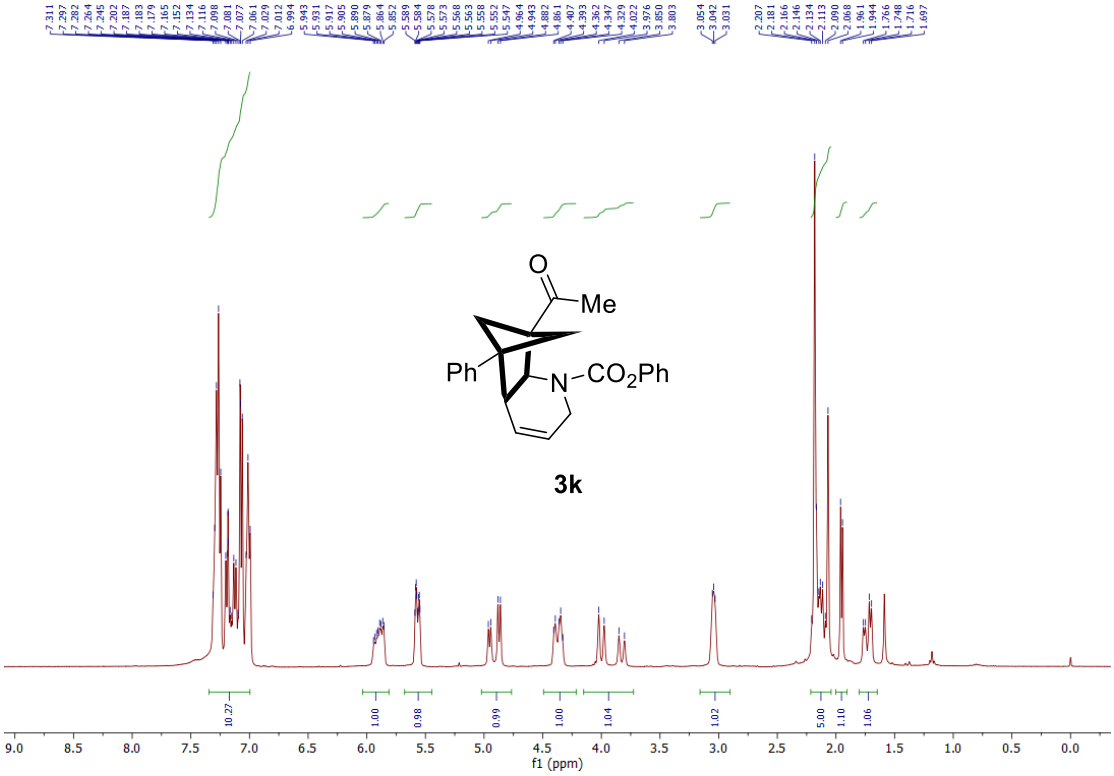
3j, ^{1}H NMR (400 MHz, $CDCl_3$)



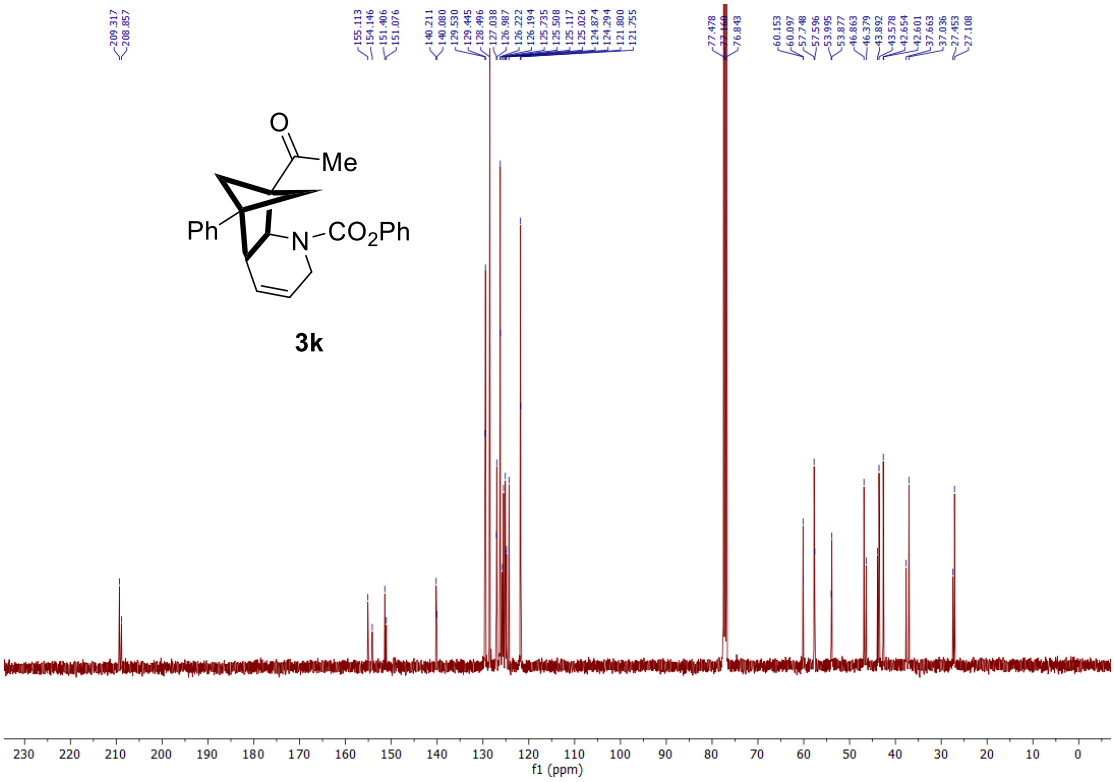
3j, ^{13}C NMR (101 MHz, $CDCl_3$)



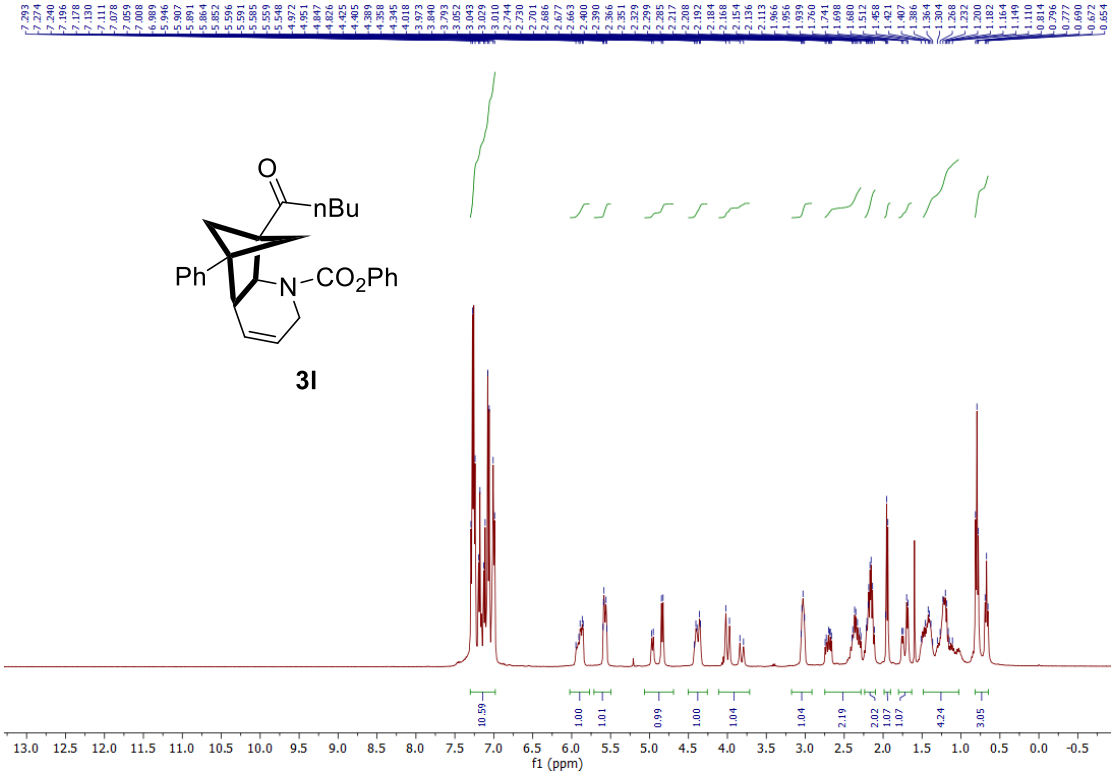
3k, ^{1}H NMR (400 MHz, $CDCl_3$)



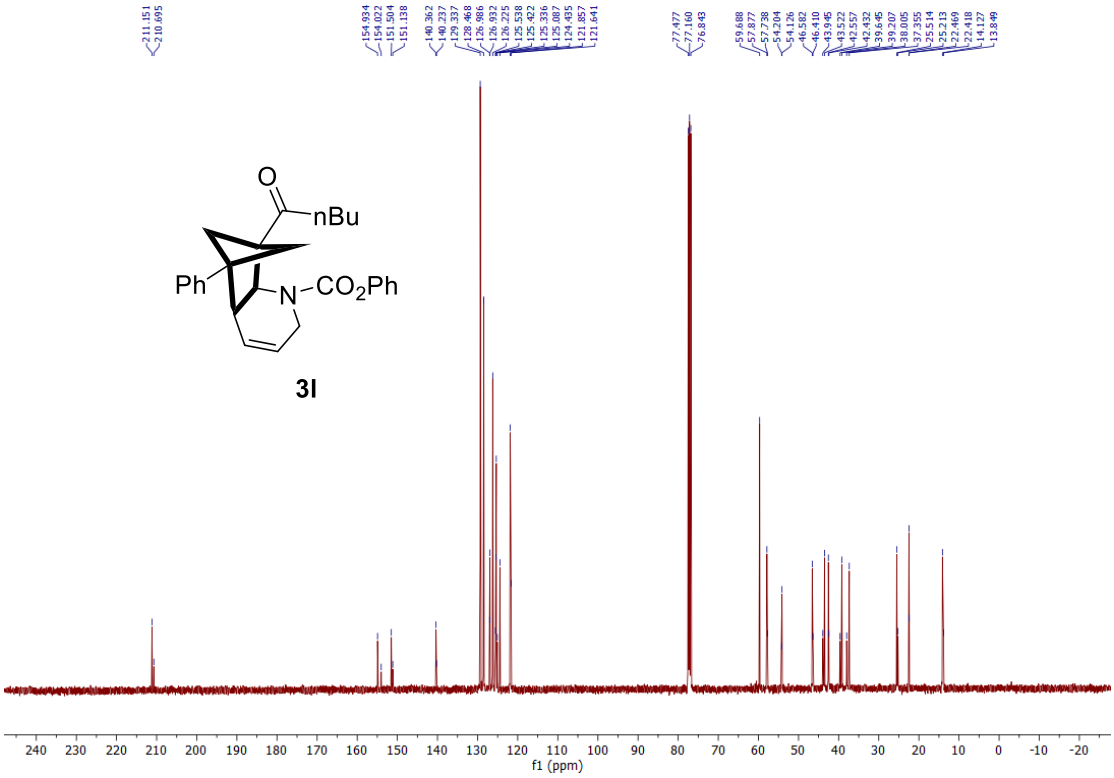
3k, ^{13}C NMR (101 MHz, $CDCl_3$)



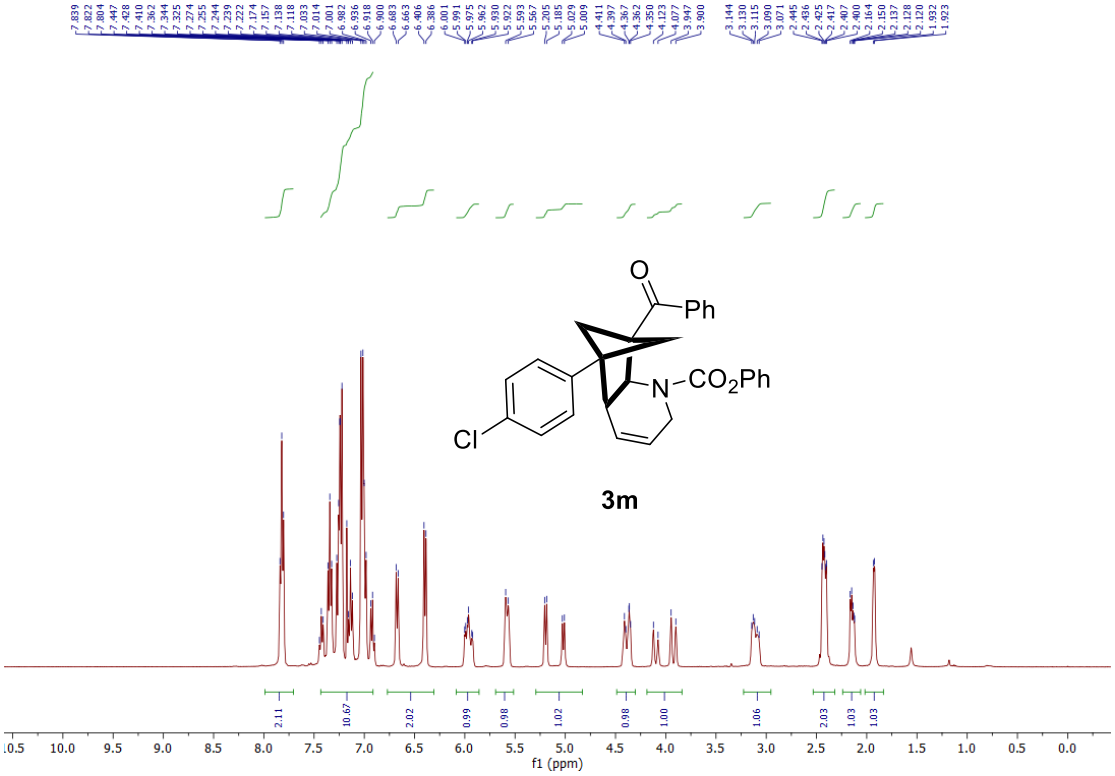
3l, ^{1}H NMR (400 MHz, $CDCl_3$)



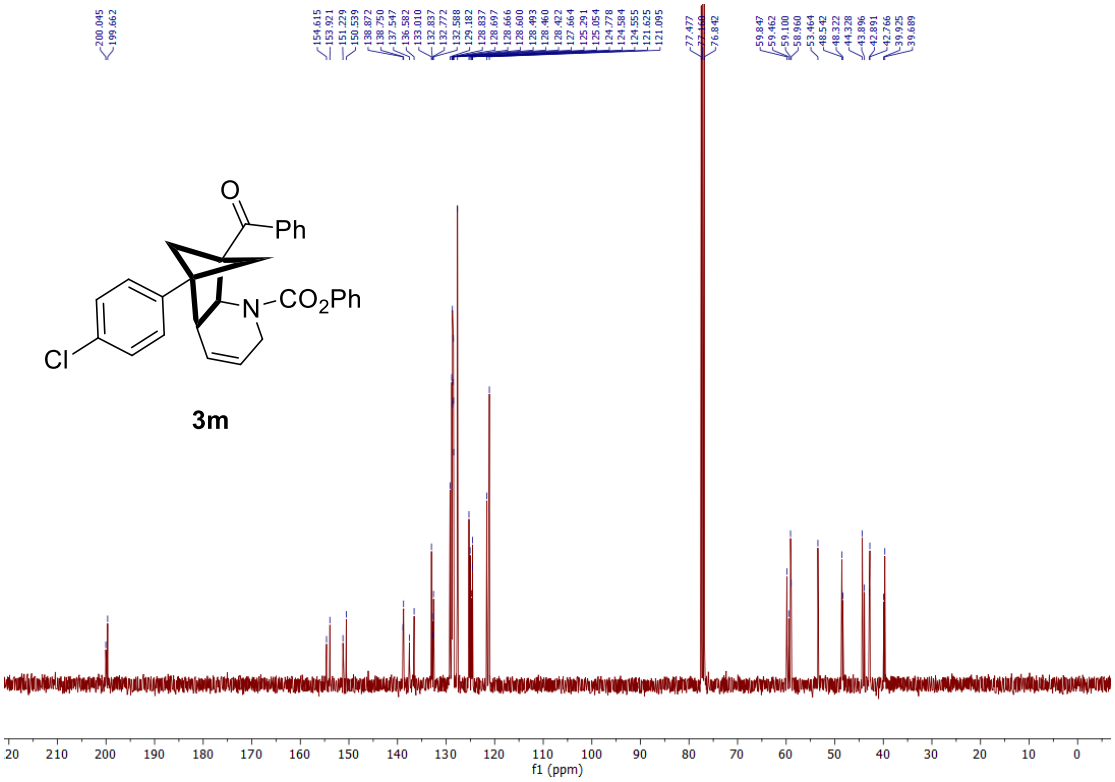
3l, ^{13}C NMR (101 MHz, $CDCl_3$)



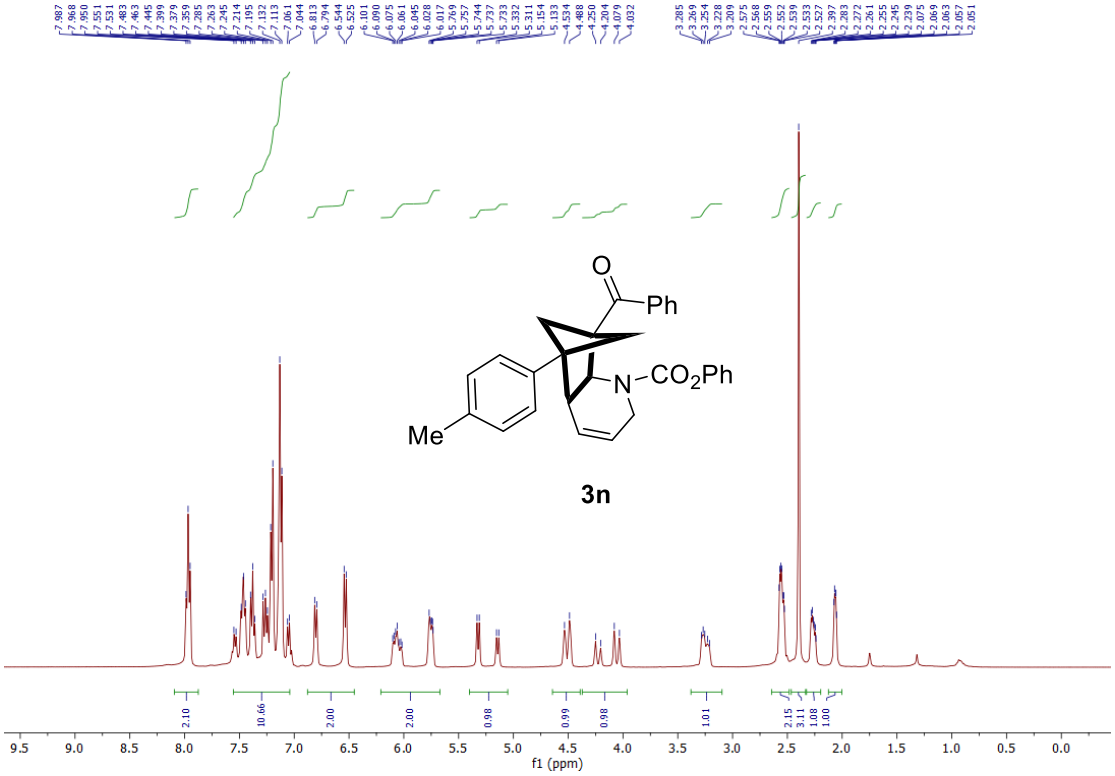
3m, ^{1}H NMR (400 MHz, $CDCl_3$)



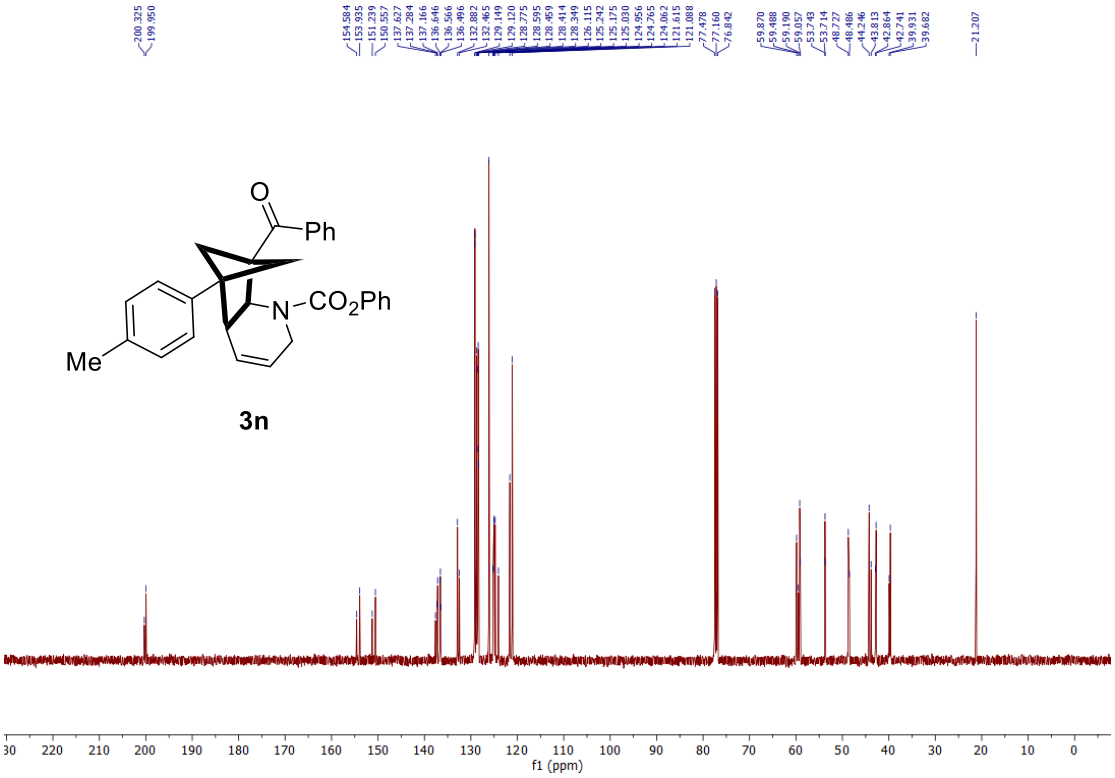
3m, ^{13}C NMR (101 MHz, $CDCl_3$)



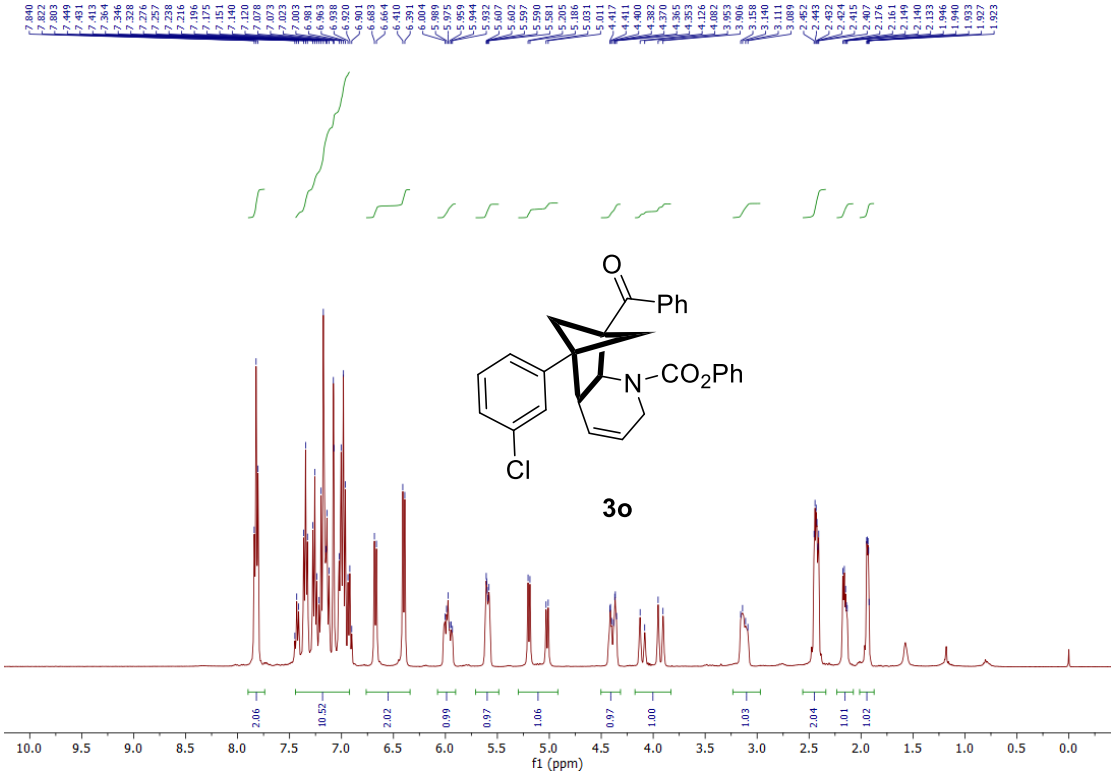
3n, ^{1}H NMR (400 MHz, $CDCl_3$)



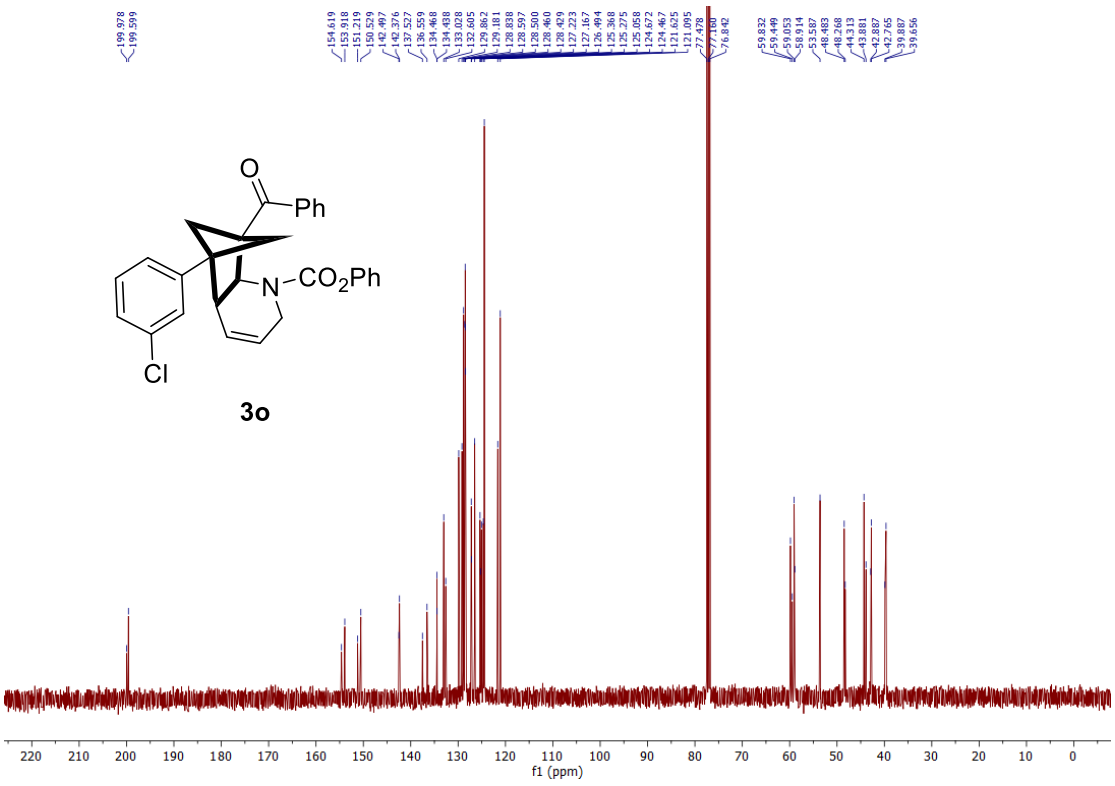
3n, ^{1}H NMR (400 MHz, $CDCl_3$)



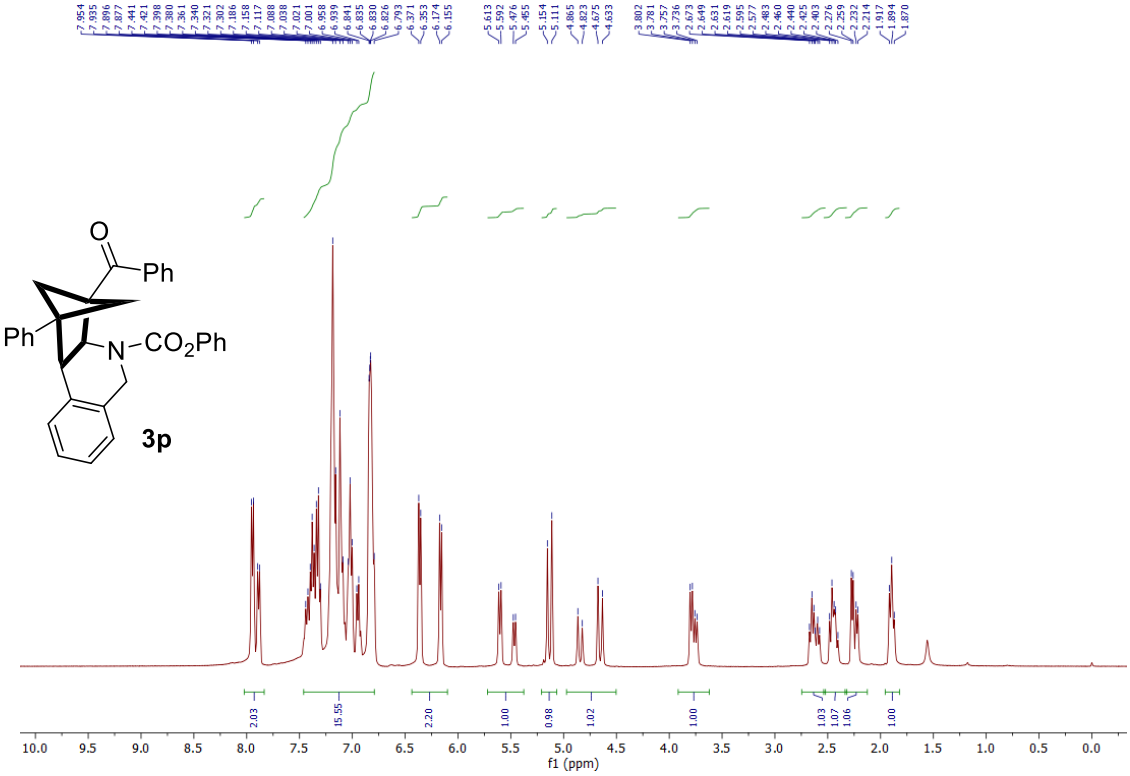
3o, ^{1}H NMR (400 MHz, $CDCl_3$)



3o, ^{1}H NMR (400 MHz, $CDCl_3$)



3p, ^{1}H NMR (400 MHz, $CDCl_3$)



3p, ^{1}H NMR (400 MHz, $CDCl_3$)