

Substrate-Controlled C-H or C-C Alkynylation of Cyclopropanes: Generation of Aryl Radical Cations by Direct Light Activation of Hypervalent Iodine Reagents

Tin V. T. Nguyen, Matthew D. Wodrich and Jerome Waser*

SUPPORTING INFORMATION

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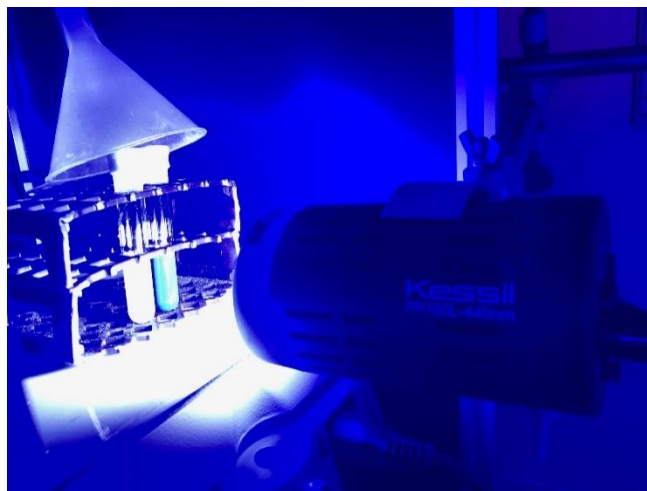
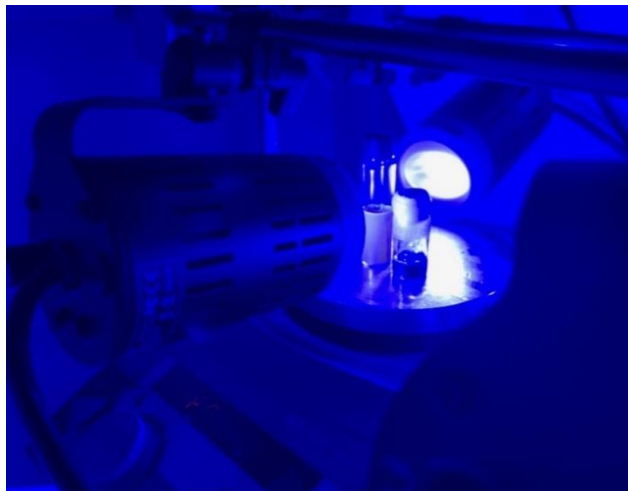
General methods

For quantitative flash chromatography, distilled technical grade solvents were used. THF, Et₂O, toluene, hexane and CH₂Cl₂ were dried by passage over activated alumina under nitrogen atmosphere (H₂O content < 7 ppm, Karl-Fischer titration). All chemicals were purchased and used as received unless stated otherwise. Chromatographic purification was performed as flash chromatography using Macherey-Nagel silica 40-63, 60 Å, using the solvents indicated as eluent with 0.1-0.5 bar pressure. TLC was performed on Merck silica gel 60 F254 TLC plastic or aluminium plates and visualized with UV light, permanganate stain. Melting points were measured on a calibrated Büchi B-540 melting point apparatus using open glass capillaries. ¹H-NMR spectra were recorded at room temperature on a Bruker DPX-400 400 MHz spectrometer in CDCl₃, Acetone-*d*₆, CD₃CN or CD₃OD, all signals are reported in ppm with the internal chloroform signal at 7.26 ppm, the internal acetone signal at 2.09 ppm, the internal acetonitrile signal at 1.94 ppm and the internal methanol signal at 3.34 ppm as standard. The data is being reported as (s = singlet, d = doublet, t = triplet, q = quadruplet, p = quintet, m = multiplet or unresolved, br = broad signal, integration, coupling constant(s) in Hz, interpretation). ¹³C-NMR spectra were recorded with 1H-decoupling on a Bruker DPX-400 101 MHz spectrometer in CDCl₃, Acetone-*d*₆, CD₃CN or CD₃OD, all signals are reported in ppm with the internal chloroform signal at 77.0 ppm, Acetone-*d*₆ signal at 29.8 ppm, CD₃CN signal at 1.3 ppm or CD₃OD signal at 49.0 ppm as standard. Infrared spectra were recorded on a JASCO FT-IR B4100 or a Bruker Alpha-P spectrophotometer with an ATR device and a ZnSe prism and are reported as cm⁻¹ (w = weak, m = medium, s = strong). High resolution mass spectrometric measurements were performed by the mass spectrometry service of ISIC at the EPFL on a MICROMASS (ESI) Q-TOF Ultima API. HPLC measurements were done on a Agilent 1260 Infinity autosampler using a CHIRALPAK IA, IB, IC or IF column from DAICEL Chemical. The specific solvents and concentrations (in g/100 mL) are indicated.

All photocatalyzed reactions were carried out in oven dried glassware and under inert atmosphere (freeze pump thaw solvent stored on molecular sieves and under argon for maximum one week) unless specified otherwise. They were placed on a stirring plate with Kessil lamps (440 nm, 40 W) irradiating from both sides (the hood was free and coated with aluminum foil for personal protection). The distance between the Kessil lamps and the vials was approximatively 10 cm. Long irradiation resulted in temperature increasing up to 50 °C during overnight reactions unless a fan was used in which case the temperature raised to 30-35°C.

Photochemical experimental set-ups

0.2 mmol scale reactions (both set-ups can be used without affecting the yields)



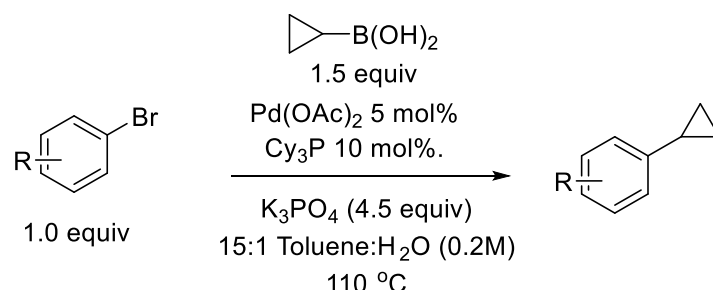
2 mmol scale reaction



Synthesis of arylcyclopropanes, aminocyclopropanes.

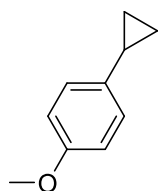
- Compound **1u** (cyclopropyl benzene), **7a**, **7b**, **7c** are commercially available and were used as received without further purification.

General procedure A



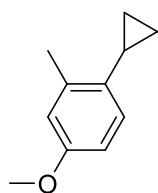
Following reported procedure,¹ to a solution of aryl bromide (5.00 mmol, 1.00 equiv) in 15:1 toluene:water (32 mL) was added potassium phosphate tribasic potassium (4.78 g, 22.5 mmol, 4.50 equiv), cyclopropylboronic acid (644 mg, 7.50 mmol, 1.50 equiv), 0.5 mL tricyclohexylphosphine (1M solution in toluene) and palladium(II) diacetate (56.1 mg, 250 μ mol, 0.0500 equiv). The resulting mixture was heated to 110 °C and was stirred at this temperature overnight. The reaction mixture was then cooled to room temperature, diluted with DCM (100 mL) and washed with water (100 mL). The aqueous layer was extracted with DCM (3 $\times$ 100 mL). The combined organic layers were washed with brine (50 mL), dried over Na₂SO₄, filtered and concentrated under reduced pressure. The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 40 g, gradient of pentane: ethyl acetate from 99:1 to 95:5). to obtain the product.

1-Cyclopropyl-4-methoxybenzene (**1a**)



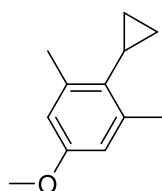
Following the general procedure A, starting from 1-bromo-4-methoxybenzene (935 mg, 5.00 mmol, 1.00 equiv), 1-cyclopropyl-4-methoxybenzene **1a** (580 mg, 3.91 mmol, 78% yield) was obtained as a colorless liquid. ¹H NMR (400 MHz, CDCl₃) δ 7.09 – 6.97 (m, 2H, ArH), 6.90 – 6.77 (m, 2H, ArH), 3.78 (s, 3H, OCH₃), 1.86 (m, 1H, CHCH₂), 0.98 – 0.84 (m, 2H, CHCH₂), 0.71 – 0.57 (m, 2H, CHCH₂). ¹³C NMR (101 MHz, CDCl₃) δ 157.7, 136.0, 127.0, 113.9, 55.4, 14.7, 8.6. Consistent with reported data.¹

1-Cyclopropyl-4-methoxy-2-methylbenzene (**1b**)



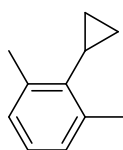
Following the general procedure A, starting from 1-bromo-4-methoxy-2-methylbenzene (1.01 g, 5.00 mmol, 1.00 equiv), obtained 1-cyclopropyl-4-methoxy-2-methylbenzene **1b** (622 mg, 3.83 mmol, 77% yield) as colorless oil. **R_f** = 0.44 (SiO₂, 40:1 pentane:ethyl acetate) **¹H NMR** (400 MHz, CDCl₃) δ 6.94 (d, *J* = 8.4 Hz, 1H), 6.73 (d, *J* = 2.8 Hz, 1H), 6.66 (dd, *J* = 8.4, 2.8 Hz, 1H, *ArH*), 3.78 (s, 3H, *ArH*), 2.41 (s, 3H, *ArCH*₃), 1.81 (tt, *J* = 8.4, 5.4 Hz, 1H, *CHCH*₂), 0.99 – 0.79 (m, 2H, *CHCH*₂), 0.67 – 0.52 (m, 2H, *CHCH*₂). **¹³C NMR** (101 MHz, CDCl₃) δ 157.8, 139.5, 133.6, 127.2, 115.6, 110.6, 55.3, 19.9, 13.0, 6.5. **HRMS** (APPI/LTQ-Orbitrap) *m/z*: [M]⁺ Calcd for C₁₁H₁₄O⁺ 162.1039; Found 162.1038.

2-Cyclopropyl-5-methoxy-1,3-dimethylbenzene (**1c**)



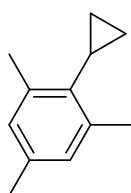
Following the general procedure A, starting from 2-bromo-5-methoxy-1,3-dimethylbenzene (1.08 g, 5.00 mmol, 1.00 equiv), obtained 2-cyclopropyl-5-methoxy-1,3-dimethylbenzene **1c** (630 mg, 3.57 mmol, 71% yield) as a colorless oil. **R_f** = 0.47 (SiO₂, 40:1 pentane:ethyl acetate) **¹H NMR** (400 MHz, CDCl₃) δ 6.57 (s, 2H, *ArH*), 3.77 (s, 3H, OCH₃), 2.42 (s, 6H, *ArCH*₃), 1.71 – 1.58 (m, 1H, *ArCHCH*₂), 1.05 – 0.89 (m, 2H, *CHCH*₂), 0.57 – 0.43 (m, 2H, *CHCH*₂). **¹³C NMR** (101 MHz, CDCl₃) δ 157.7, 140.4, 131.7, 113.2, 55.2, 21.0, 11.5, 8.2. **HRMS** (APPI/LTQ-Orbitrap) *m/z*: [M]⁺ Calcd for C₁₂H₁₆O⁺ 176.1196; Found 176.1193.

2-Cyclopropyl-1,3-dimethylbenzene (**1d**)



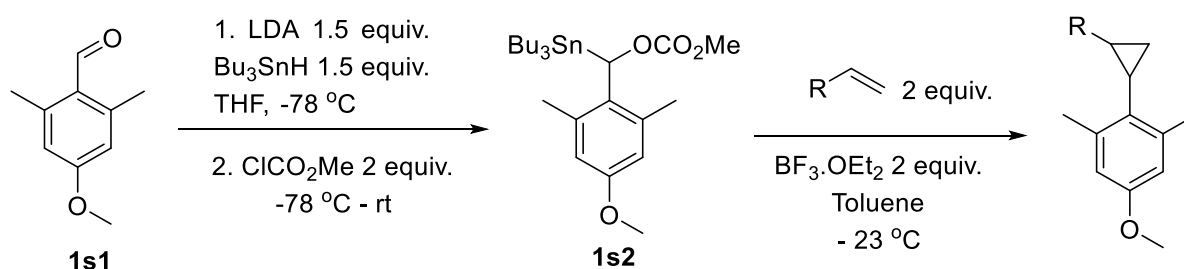
Following the general procedure A, starting from 2-bromo-1,3-dimethylbenzene (925 mg, 5.00 mmol, 1.00 equiv), 2-cyclopropyl-1,3-dimethylbenzene (**1d**) (530 mg, 3.62 mmol, 72% yield) was obtained as a colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.09 – 6.95 (m, 3H, ArH), 2.43 (s, 6H, ArCH₃), 1.71 (ddd, J =14.4, 8.4, 6.0 Hz, 1H, ArCHCH₃), 1.10 – 0.97 (m, 2H, CH₂), 0.60 – 0.49 (m, 2H, CH₂). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 139.1, 139.0, 127.9, 126.1, 20.7, 12.2, 8.1. HRMS (APPI/LTQ-Orbitrap) m/z : $[\text{M}]^+$ Calcd for $\text{C}_{11}\text{H}_{14}^+$ 146.1090; Found 146.1088 Consistent with reported data.²

2-Cyclopropyl-1,3,5-trimethylbenzene (**1e**)



Following the reported procedure.³ 2-cyclopropyl-1,3,5-trimethylbenzene (**1e**) was obtained as a colorless oil (504 mg, 63%). $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 6.87 (s, 2H, ArH), 2.43 (s, 6H, CH₃Ar), 2.30 (s, 3H, CH₃Ar), 1.70 (m, 1H, CHCH₂), 1.08 – 0.98 (m, 2H, CHCH₂), 0.55 (m, 2H, CHCH₂). Consistent with reported data.³

General procedure B

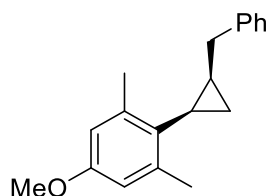


Following slightly modified reported procedure,⁴ dry tetrahydrofuran (80 mL) was cooled to -78 °C, then a solution of lithium diisopropylamide (2.0 M in heptane/tetrahydrofuran/ethylbenzene, 19.00 mL, 37.50 mmol) was added, followed by tributyltin hydride (9.81 mL, 37.5 mmol) dropwise. After 5 minutes, the mixture was warm to 0 °C for 0.5 hours, then recooled to -78 °C. 2,6-Dimethyl-4-methoxybenzaldehyde **1s1** (30 mmol) was added dropwise, and the reaction mixture was stirred at this temperature overnight. Afterwards, methyl chloroformate (3.41 mL, 44.1 mmol) was added dropwise, the

cooling bath was removed, and the mixture was allowed to stir overnight at room temperature. Then a solution of saturated aqueous ammonium chloride (100 mL) was added followed by extraction with ethyl acetate. The organic extract was dried, filtered and concentrated. The residue was purified by chromatography (silica gel, ethyl acetate in hexanes) which afforded (6.90 g, 13.5 mmol, 45% yield) of the desired product **1s2**

Following a reported procedure,⁴ to a 50 mL oven-dried round-bottom flask equipped with a stirring bar was added the solution of **1s2** (1.0 mmol, 1.0 equiv) and the corresponding alkene (2 mmol, 2 equiv) in toluene (3.5 mL) under nitrogen atmosphere at room temperature. The reaction was cooled to -23 °C. $\text{BF}_3 \cdot \text{OEt}_2$ (156 mg, 1.10 mmol, 1.10 equiv) was added dropwise and the reaction mixture was stirred at this temperature overnight. After the reaction reached completion according to the TLC analysis, the reaction mixture was quenched with sat. NaHCO_3 and extracted with EtOAc for 3 times. The combined organic layers were washed with brine, dried over Na_2SO_4 and filtered. After concentration under reduced pressure, the crude residue was purified by column chromatography (PE : EtOAc) to afford the arylcyclopropanes.

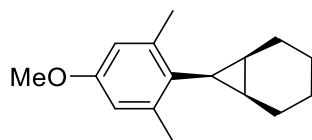
2-(-2-Benzylcyclopropyl)-5-methoxy-1,3-dimethylbenzene (**1f**)



Following the general procedure B, starting from **1s2** (513 mg, 1.00 mmol, 1.00 equiv) and allyl benzene (236 mg, 2.00 mmol, 2.00 equiv), 2-(-2-benzylcyclopropyl)-5-methoxy-1,3-dimethylbenzene (**1f**) was obtained as a colorless oil (152 mg, 0.570 mmol, 57% yield). dr. > 20:1. R_f = 0.34 (SiO_2 , 40:1 pentane:ethyl acetate) $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.32 – 7.24 (m, 2H, ArH), 7.19 (m, 3H, ArH), 6.62 (s, 2H, ArH), 3.80 (s, 3H, ArOCH_3), 2.89 (dd, J = 14.8, 3.8 Hz, 1H, CHCH_2Ar), 2.43 (s, 6H, ArCH_3), 1.93 (q, J = 8.0 Hz, 1H, CHAr), 1.68 – 1.55 (m, 1H, CHCH_2Ar), 1.54 – 1.44 (m, 1H, CHCH_2Ar), 1.29 (tdd, J = 8.4, 5.0, 1.2 Hz, 1H, CHCH_2Ar), 0.68 (dt, J = 6.8, 5.1 Hz, 1H, CHCH_2Ar). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 157.5, 142.3, 128.5, 128.3, 125.8, 113.5, 55.2, 35.6, 21.3, 18.3, 18.3, 14.6. 2 carbon signals were not resolved. IR (ν_{max} , cm^{-1}) 3023 (m), 2993 (m), 2955 (m), 2919 (m), 1578 (m), 1499 (m), 1483 (s), 1468 (m), 1450 (s), 1439 (m), 1309 (s),

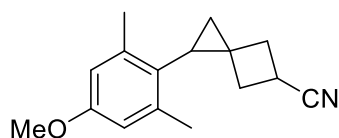
1190 (m), 1172 (s), 1147 (s), 1074 (s), 848 (m). **HRMS (ESI/QTOF) m/z:** [M + H]⁺ Calcd for C₁₉H₂₃O⁺ 267.1743; Found 267.1741.

7-(4-Methoxy-2,6-dimethylphenyl)bicyclo[4.1.0]heptane (**1g**)



Following the general procedure B, starting from **1s2** (513 mg, 1.00 mmol, 1.00 equiv) and cyclohexene (164 mg, 2.00 mmol, 2.00 equiv), 7-(4-methoxy-2,6-dimethylphenyl)bicyclo[4.1.0]heptane **1g** was obtained as colorless oil (80.6 mg, 0.350 mmol, 35% yield). **R_f** = 0.50 (SiO₂, 40:1 pentane:ethyl acetate). dr. : 86:14. **¹H NMR** (400 MHz, CDCl₃) δ 6.58 (s, 2H, ArH), 3.77 (s, 3H, ArOCH₃), 2.37 (s, 6H, ArCH₃), 1.87 – 1.77 (m, 2H, CH₂), 1.71 (t, *J* = 8.5 Hz, 1H, CHCHCH₂), 1.28 – 1.24 (m, 3H, CHCHCH₂), 1.12 – 1.05 (m, 2H, CH₂), 1.03 – 0.93 (m, 2H, CH₂), 0.86 (t, *J* = 7.2 Hz, 1H, CHCHCH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 157.4, 141.2, 127.5, 113.1, 55.1, 20.7, 20.7, 20.5, 20.1, 14.6. **IR** (ν_{max}, cm⁻¹) 2999 (m), 2991 (m), 2922 (s), 2851 (s), 1603 (s), 1577 (m), 1484 (s), 1464 (s), 1313 (s), 1189 (m), 1154 (m), 1145 (s), 1064 (s), 850 (m), 833 (m). **HRMS (Sicrit plasma/LTQ-Orbitrap) m/z:** [M]⁺ Calcd for C₁₆H₂₂O⁺ 230.1665; Found 230.1662.

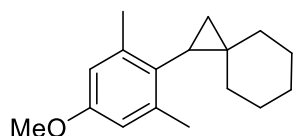
1-(4-Methoxy-2,6-dimethylphenyl)spiro[2.3]hexane-5-carbonitrile (**1h**)



Following the general procedure B, starting from **1s2** (513 mg, 1.00 mmol, 1.00 equiv) and 3-Methylenecyclobutanecarbonitrile (186 mg, 0.200 mmol, 2.00 equiv), 1-(4-methoxy-2,6-dimethylphenyl)spiro[2.3]hexane-5-carbonitrile **1h** was obtained as pale yellow oil (65 mg, 0.27 mmol, 27%). dr. 53:47. **R_f** = 0.58 (SiO₂, 10:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 6.58 (s, 2H, ArH), 3.76 (s, 3H, ArOCH₃), 3.33 (tt, *J* = 9.4, 8.1 Hz, 1H, CH₂), 2.90 (dd, *J* = 11.8, 8.1 Hz, 1H, CH₂), 2.53 (ddt, *J* = 11.5, 9.4, 1.7 Hz, 1H, CH₂), 2.40 (d, *J* = 0.7 Hz, 6H, ArCH₃), 2.33 – 2.30 (m, 1H, CH₂CH), 2.06 – 1.99 (m, 1H, CH₂CH), 1.73 – 1.68 (m, 1H, CH₂), 1.30 – 1.26

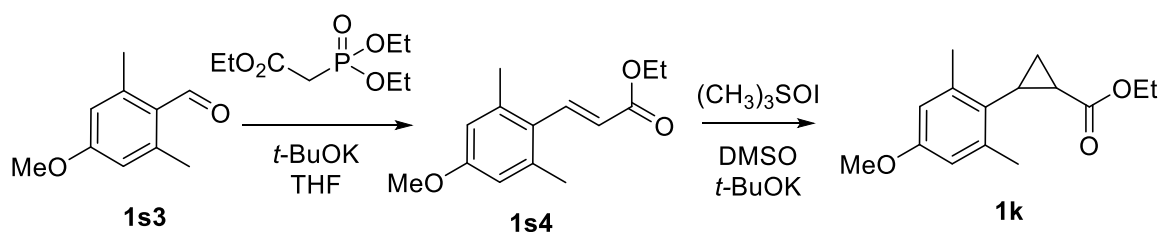
(m, 1H, CH₂), 0.88 – 0.85 (m, 1H, CH₂). ¹³C NMR (101 MHz, CDCl₃) δ 157.7, 140.0, 127.5, 122.7, 113.7, 55.2, 35.6, 33.2, 23.7, 23.3, 22.4, 21.4, 17.4. IR (vmax, cm⁻¹) 2938 (m), 2859 (w), 2838 (w), 2236 (w), 1734 (w), 1603 (s), 1486 (s), 1453 (m), 1313 (s), 1197 (m), 1150 (s), 1067 (s), 856 (m). HRMS (ESI/QTOF) m/z: [M + H]⁺ Calcd for C₁₆H₂₀NO⁺ 242.1539; Found 242.1539.

1-(4-Methoxy-2,6-dimethylphenyl)spiro[2.5]octane (1i)



Following the general procedure B, starting from **1s2** (513 mg, 1.00 mmol, 1.00 equiv) and methylenecyclohexane (192 mg, 2.00 mmol, 2.00 equiv). 1-(4-methoxy-2,6-dimethylphenyl)spiro[2.5]octane **1i** was obtained as colorless oil (139 mg, 0.570 mmol, 57% yield). R_f = 0.62 (SiO₂, 40:1 pentane:ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 6.54 (s, 2H, ArH), 3.76 (s, 3H, ArOCH₃), 2.34 (s, 6H, ArCH₃), 1.98 (tdd, *J* = 12.8, 3.7, 1.6 Hz, 1H, CH₂), 1.78 – 1.68 (m, 2H, CH₂), 1.62 – 1.59 (m, 1H, CHCH₂), 1.59 – 1.55 (m, 1H, CH₂), 1.53 – 1.44 (m, 1H, CH₂), 1.44 – 1.37 (m, 1H, CH₂), 1.36 – 1.15 (m, 2H, CH₂), 1.05 – 0.96 (m, 1H, CH₂), 0.89 (ddd, *J* = 8.7, 4.5, 1.8 Hz, 1H, CH₂), 0.58 (ddd, *J* = 6.3, 4.5, 1.6 Hz, 1H, CH₂), 0.53 – 0.46 (m, 1H, CH₂). ¹³C NMR (101 MHz, CDCl₃) δ 157.1, 129.2, 113.2, 55.1, 36.8, 31.9, 26.8, 26.4, 25.8, 25.6, 21.4, 20.5. Two carbon signals were not resolved. IR (vmax, cm⁻¹) 2923 (s), 2848 (s), 1605 (m), 1482 (m), 1448 (m), 1318 (m), 1314 (s), 1193 (m), 1150 (s), 1072 (m), 852 (m). HRMS (nanochip-ESI/LTQ-Orbitrap) m/z: [M]⁺ Calcd for C₁₇H₂₄O⁺ 244.1822; Found 244.1821.

Ethyl 2-(4-methoxy-2,6-dimethylphenyl)cyclopropane-1-carboxylate (1k)

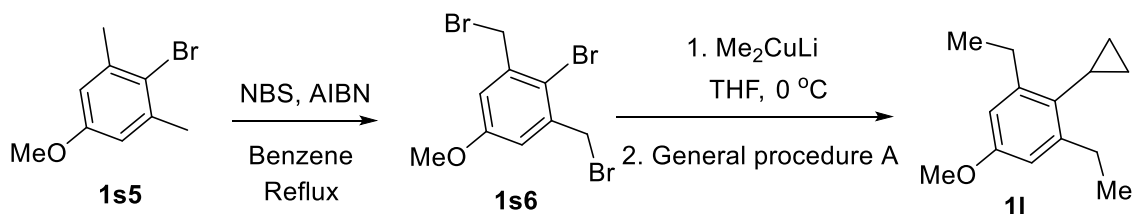


Following a reported procedure,⁵ to a solution of potassium tertbutoxide (5.31 g, 45.0 mmol, 2.00 equiv), triethyl phosphonoacetate (9.30 mL, 45.0 mmol, 2.00 equiv) in freshly distilled THF (120 mL), was added 4'-methoxy-2',6'-dimethylbenzaldehyde **1s3** (4.14 g, 25.2 mmol, 1.00 equiv) in one portion at room temperature. The reaction was stirred at room

temperature for 2 h. Then AcOEt and H₂O were added to the solution, the organic layer was evaporated in vacuo and the residue was purified by silica-gel column chromatography to give product **1s4**. NMR analysis was consistent with reported value.⁵

Following a reported procedure with a little modification,⁶ a suspension of trimethylsulfoxonium iodide (264 mg, 1.20 mmol, 1.20 equiv.) and potassium *tert*-butoxide (168 mg, 1.50 mmol, 1.50 equiv) in anhydrous DMSO (5.00 mL) was stirred for 1 h. A DMSO solution (5.00 mL) of **1s4** (234 mg, 1.00 mmol, 1.00 equiv) was added at 0 °C. The reaction mixture was stirred at 50 °C for 2 h. Another suspension of trimethylsulfoxonium iodide (66 mg, 0.30 mmol, 0.30 equiv.) and potassium *tert*-butoxide (33 mg, 0.30 mmol, 0.30 equiv) in DMSO (2.00 mL) was added to the reaction mixture and the reaction was stirred at 50 °C for 24 h. The solution was poured into a brine solution (10 mL) and extracted with ethyl acetate (3x10 mL). The combined organic layers were washed with water and dried over MgSO₄, concentrated and purified by Column chromatography (SiO₂, 20:1 pentane:ethyl acetate) to afford cyclopropane **1k** (trans) as sticky solid (37 mg, 0.15 mmol, 15% yield). **R_f** = 0.41 (SiO₂, 20:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 6.56 (s, 2H, ArH), 4.31 – 4.14 (m, 2H, OCH₂CH₃), 3.76 (s, 3H, OCH₃), 2.36 (s, 6H, ArCH₃), 2.27 (ddd, *J* = 8.8, 7.2, 4.8 Hz, 1H, ArCHCH₂), 1.70 (dd, *J* = 8.9, 4.1 Hz, 1H, COCHCH₂), 1.65 (ddd, *J* = 9.0, 5.3, 4.1 Hz, 1H, CHCH₂), 1.31 (t, *J* = 7.1 Hz, 3H, OCH₂CH₃), 1.12 (ddd, *J* = 8.1, 7.1, 3.9 Hz, 1H, CHCH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 174.5, 158.2, 140.0, 128.7, 113.5, 60.7, 55.2, 23.4, 23.0, 21.0, 17.8, 14.6.; Found 248.1403. **IR** (vmax, cm⁻¹) 2980 (w), 2838 (w), 1724 (s), 1605 (m), 1449 (m), 1313 (s), 1191 (s), 1173 (s), 1149 (s), 1068 (m), 860 (m). **HRMS** (Sicrit plasma/LTQ-Orbitrap) *m/z*: [M]⁺ Calcd for C₁₅H₂₀O₃⁺ 248.1407

2-Cyclopropyl-1,3-diethyl-5-methoxybenzene (1l)



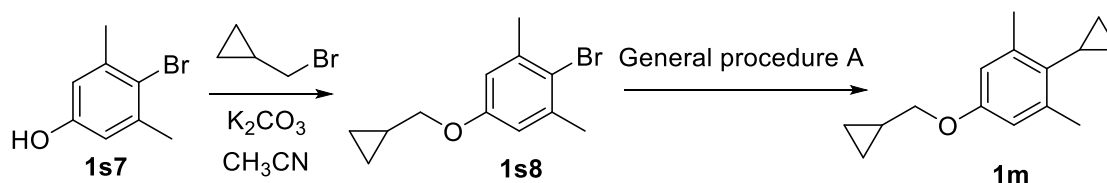
Following a reported procedure,⁷ to a solution of compound **1s5** (1.90 g, 8.88 mmol, 1.00 equiv) in benzene (25 mL) was added N-bromosuccinimide (3.32 g, 18.6 mmol, 2.00 equiv) and azobisisobutyronitrile (145 mg, 0.890 mmol, 0.10 equiv). The reaction mixture was

heated to reflux for 3 hours, then NBS (0.330 g, 1.86 mmol, 0.20 equiv) and azobisisobutyronitrile (14.5 mg, 0.0890 mmol, 0.01 equiv) were added and the reflux continued for 30 minutes. The solvent was removed, and the residue was extracted with ethyl acetate, washed with brine, and dried over anhydrous Na₂SO₄. The solvent was concentrated in vacuo, and the residue was purified by column chromatography (pentane/ethyl acetate=25:1) to obtain **1s6** as a white solid (0.910 g, 2.44 mmol, 27% yield). Analytical data was consistent with reported value.⁷

Following a reported procedure,⁸ a solution of lithium dimethylcuprate which had been prepared from cuprous iodide (609.0 mg, 3.20 mmol, 1.00 equiv) and methyllithium (4.0 mL, 1.6 M in Et₂O, 6.4 mmol, 2 equiv) in dry THF was added to a solution of **1s6** (744 mg, 2.00 mmol, 1.00 equiv) in dry THF (10 mL) at 0 °C. The mixture was stirred at 0 °C for 2 h, then quenched with methanol. Saturated NH₄Cl (10 mL) was added, extracted with ethyl acetate (3x10 mL), the combined organic layers were dried over Na₂SO₄, concentrated in vacuo, purified by flash column chromatography (SiO₂, Gradient 100:0 to 40:1 pentane:ethyl acetate) to give the desired product (1.120 mmol, 270.0 mg, 56%). The product was directly used for the next step.

Following general procedure A, starting from the corresponding aryl bromide from previous step, 2-cyclopropyl-1,3-diethyl-5-methoxybenzene (**1l**) was obtained as colorless oil (97.9 mg, 0.480 mmol, 24% yield for 2 steps). *R_f* = 0.65 (SiO₂, 40:1 pentane:ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 6.60 (s, 2H, ArH), 3.79 (s, 3H, ArOCH₃), 2.87 (q, *J* = 7.5 Hz, 4H, ArCH₂CH₃), 1.71 – 1.59 (m, 1H, CHCH₂), 1.23 (t, *J* = 7.6 Hz, 6H, ArCH₂CH₃), 1.06 – 0.95 (m, 2H, CHCH₂), 0.57 – 0.46 (m, 2H, CHCH₂). ¹³C NMR (101 MHz, CDCl₃) δ 158.2, 146.6, 130.6, 111.4, 55.2, 26.6, 15.2, 10.8, 8.3. IR (ν_{max}, cm⁻¹) 2965 (s), 2935 (m), 2874 (m), 2835 (w), 1603 (s), 1469 (s), 1333 (s), 1288 (m), 1146 (s), 1145 (s), 1087 (m), 1080 (m), 1033 (s). HRMS (ESI/QTOF) *m/z*: [M + H]⁺ Calcd for C₁₄H₂₁O⁺ 205.1587; Found 205.1593.

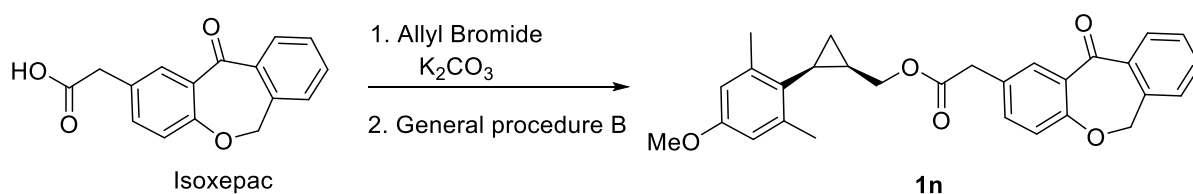
2-Cyclopropyl-5-(cyclopropylmethoxy)-1,3-dimethylbenzene (**1m**)



Following a slightly modified reported procedure, to a solution of **1s7** (402 mg, 2.00 mmol, 1.00 equiv) in acetonitrile (20 mL) was added K₂CO₃ (0.910 g, 6.57 mmol, 3.20 equiv) at room temperature. Then a solution of (bromomethyl)cyclopropane (810 mg, 6.00 mmol, 3.00 equiv) in acetonitrile (10 mL) was added at room temperature and the reaction mixture was stirred at 50 °C overnight. Then, the reaction mixture was filtrated and concentrated under vacuum. The product **1s8** was directly used for the next step without further purification.

Following general procedure A, 2-cyclopropyl-5-(cyclopropylmethoxy)-1,3-dimethylbenzene **1m** was obtained as colorless oil (142.7 mg, 0.660 mmol, 33% yield). *R*_f = 0.56 (SiO₂, 40:1 pentane:ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 6.56 (s, 2H, ArH), 3.75 (d, *J* = 7.0 Hz, 2H, ArOCH₂), 2.39 (s, 6H, ArCH₃), 1.62 (ddd, *J* = 14.1, 8.4, 5.7 Hz, 1H, CHCH₂), 1.32 – 1.20 (m, 1H, CHCH₂), 1.02 – 0.91 (m, 2H, CHCH₂), 0.67 – 0.57 (m, 2H, CHCH₂), 0.48 (td, *J* = 6.0, 4.2 Hz, 2H, CHCH₂), 0.32 (dt, *J* = 6.0, 4.6 Hz, 2H, CHCH₂). ¹³C NMR (101 MHz, CDCl₃) δ 157.1, 140.3, 131.6, 113.9, 72.7, 21.0, 11.5, 10.5, 8.2, 3.3. IR (ν_{max}, cm⁻¹) 3080 (m), 3004 (m), 2865 (m), 1605 (s), 1487 (s), 1311 (s), 1147 (s), 1069 (s), 1046 (s), 1023 (s). HRMS (Sicrit plasma/LTQ-Orbitrap) *m/z*: [M + H]⁺ Calcd for C₁₅H₂₁O⁺ 217.1587; Found 217.1583.

4-Methoxy-2,6-dimethylphenyl)cyclopropyl)methyl 2-(11-oxo-6,11 dihydrodibenzo[b,e]oxepin-2-yl)acetate (**1n**)

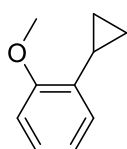


To a solution of Isoxepac (536 mg, 2.00 mmol, 1.00 equiv) in DMF (20 mL) was added K₂CO₃ (817 mg, 6.00 mmol, 3.00 equiv) then allyl bromide (0.52 mL, 6.0 mmol, 3.00 equiv). The mixture was stirred overnight, then the mixture was extracted with Et₂O (3x20 mL) and H₂O (20 mL), and the organics were washed with brine, dried over Na₂SO₄, and the solvent was evaporated. The product was directly used for the next step without further purification.

Following general procedure B, product **1n** was obtained as sticky solid (301 mg, 0.660 mmol, 33% yield for 2 steps). *dr.* >20:1. *R*_f = 0.26 (SiO₂, 10:1 pentane:ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 8.10 (d, *J* = 2.4 Hz, 1H, ArH), 7.89 (dd, *J* = 7.7, 1.4 Hz, 1H, ArH), 7.56 (td, *J* = 7.4, 1.4 Hz, 1H, ArH), 7.47 (td, *J* = 7.6, 1.3 Hz, 1H, ArH), 7.42 – 7.34 (m, 2H, ArH), 7.01 (d, *J* = 8.5 Hz,

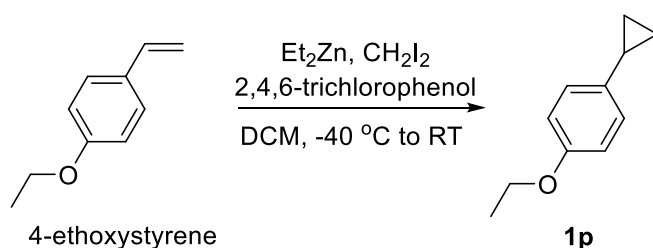
1H, ArH), 6.52 (s, 2H, ArH), 5.18 (s, 2H, ArCH₂), 4.14 (dd, *J* = 11.1, 5.6 Hz, 1H, COOCH₂CH), 3.74 (s, 3H, ArOCH₃), 3.59 (s, 2H, ArCH₂), 3.36 (dd, *J* = 11.6, 8.7 Hz, 1H, COOCH₂CH), 2.35 (s, 6H, ArCH₃), 1.96 (q, *J* = 8.1 Hz, 1H, CHCH₂), 1.61 – 1.53 (m, 1H, CHCH₂), 1.34 – 1.28 (m, 1H, CH₂CHAR), 0.79 (dt, *J* = 7.0, 5.3 Hz, 1H, CH₂CHAR). ¹³C NMR (101 MHz, CDCl₃) δ 191.0, 171.6, 160.5, 157.7, 140.6, 140.1, 136.4, 135.7, 132.9, 132.5, 129.6, 129.4, 128.0, 127.9, 126.8, 125.2, 121.1, 113.6, 73.7, 66.6, 55.2, 40.4, 21.2, 18.1, 15.9, 12.7. IR (ν_{max}, cm⁻¹) 2931 (w), 2366 (w), 1733 (s), 1648 (s), 1605 (m), 1489 (s), 1414 (m), 1300 (s), 1141 (s), 1015 (m), 761 (m). HRMS (ESI/QTOF) *m/z*: [M + Na]⁺ Calcd for C₂₉H₂₈NaO₅⁺ 479.1829; Found 479.1833.

1-Cyclopropyl-2-methoxybenzene (1o)



Following the general procedure A, starting from 1-bromo-2-methoxybenzene (935 mg, 5.00 mmol, 1.00 equiv), obtained 1-cyclopropyl-2-methoxybenzene (**1o**) (620 mg, 4.18 mmol, 84% yield) as colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.57 – 7.50 (m, 1H, ArH), 7.37 – 7.17 (m, 3H, ArH), 4.26 (s, 3H, OCH₃), 2.60 – 2.53 (m, 1H, CHCH₂), 1.41 – 1.25 (m, 2H, CHCH₂), 1.13 – 1.00 (m, 2H, CHCH₂). ¹³C NMR (101 MHz, CDCl₃) δ 158.4, 132.1, 126.4, 124.9, 120.7, 110.3, 55.7, 9.4, 7.8. HRMS (APPI/LTQ-Orbitrap) *m/z*: [M]⁺ Calcd for C₁₀H₁₂O⁺ 148.0883; Found 148.0880. Consistent with reported data.⁹

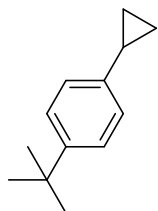
1-cyclopropyl-4-ethoxybenzene (1p)



Following reported procedure,¹ in a 150 mL oven-dried round-bottom flask, was added 2,4,6-trichlorophenol (1.18 g, 6.0 mmol, 2.5 equiv) under nitrogen atmosphere. DCM (60 mL, 0.1 M) was added into the flask and the reaction mixture was cooled to -40 °C. ZnEt₂ (1.0 M, 6.0 mL, 6.0 mmol, 2.50 equiv) was added slowly into the flask by syringe and the reaction mixture was stirred at this temperature for 15 minutes. CH₂I₂ (2.57 g, 9.06 mmol, 4.00 equiv) was

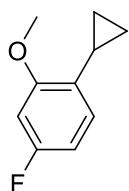
added slowly by syringe and the reaction mixture was stirred at this temperature for another 15 minutes. Next, the corresponding solution of 4-ethoxystyrene (355.2 mg, 2.40 mmol, 1.00 equiv) in DCM (10 mL) was added by syringe and the reaction mixture was allowed to warm to room temperature and was stirred overnight. After the reaction reached completion (as judged by ^1H -NMR), the reaction mixture was quenched with sat. NH_4Cl (30 mL) in 30 minutes and extracted with DCM (50 mL) for 3 times. The combined organic layers were washed with aq. NaOH (1.0 M, 30 mL) and brine (20 mL), dried over Na_2SO_4 and filtered. The mixture was concentrated under reduced pressure, the crude residue was purified by column chromatography on Biotage (Büchi flashpure cartridge 40 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) to afford the desired compound 1-cyclopropyl-4-ethoxybenzene (243.2 mg, 1.50 mmol, 63%) as colorless oil. **Rf** = 0.50 (SiO_2 , 40:1 pentane:ethyl acetate). ^1H NMR (400 MHz, CDCl_3) δ 7.08 – 6.97 (m, 2H), 6.86 – 6.77 (m, 2H), 4.01 (q, J = 7.0 Hz, 2H), 1.86 (tt, J = 8.5, 5.1 Hz, 1H), 1.41 (t, J = 7.0 Hz, 3H), 0.95 – 0.87 (m, 2H), 0.63 (dt, J = 6.5, 4.5 Hz, 2H). ^{13}C NMR (101 MHz, CDCl_3) δ 157.0, 135.8, 126.9, 114.5, 63.6, 15.0, 14.7, 8.6. **HRMS** (APCI/QTOF) m/z : $[\text{M} + \text{H}]^+$ Calcd for $\text{C}_{11}\text{H}_{15}\text{O}^+$ 163.1117; Found 163.1113

1-Tert-butyl-4-cyclopropylbenzene (**1q**)



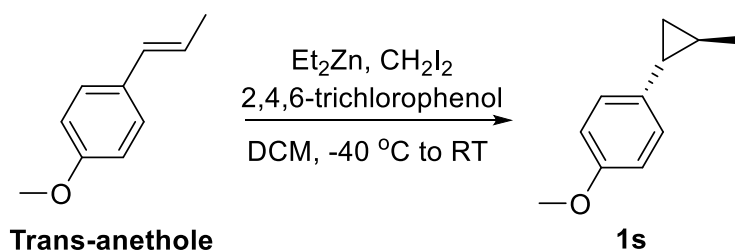
Following the general procedure A, starting from 1-bromo-4-tert-butylbenzene (1.07 g, 5.00 mmol, 1.00 equiv), 1-tert-butyl-4-cyclopropylbenzene (**1q**) (710 mg, 4.07 mmol, 81% yield) was obtained as a colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 7.33 – 7.27 (m, 2H, ArH), 7.07 – 7.00 (m, 2H, ArH), 1.88 (tt, J = 8.4, 5.1 Hz, 1H, ArCH), 1.31 (s, 9H, $\text{C}(\text{CH}_3)_3$), 0.97 – 0.89 (m, 2H, CHCH_2), 0.74 – 0.64 (m, 2H, CHCH_2). ^{13}C NMR (101 MHz, CDCl_3) δ 148.4, 141.0, 125.5, 125.3, 34.5, 31.5, 15.0, 9.1. **HRMS** (APPI/LTQ-Orbitrap) m/z : $[\text{M}]^+$ Calcd for $\text{C}_{13}\text{H}_{18}^+$ 174.1403; Found 174.1400. Consistent with reported data.¹⁰

1-cyclopropyl-4-fluoro-2-methoxybenzene (**1r**)



Following the general procedure A, starting from 1-bromo-4-fluoro-2-methoxybenzene (1.03 g, 5.00 mmol, 1.00 equiv), obtained 1-cyclopropyl-4-fluoro-2-methoxybenzene **1r** (540 mg, 3.25 mmol, 65% yield) as a colorless oil. *R_f* = 0.53 (SiO₂, 40:1 pentane:ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 6.89 – 6.75 (m, 1H, *ArH*), 6.64 – 6.52 (m, 2H, *ArH*), 3.85 (s, 3H, OCH₃), 2.13 – 1.99 (m, 1H, CHCH₂), 0.97 – 0.83 (m, 2H, CHCH₂), 0.66 – 0.53 (m, 2H, CHCH₂). ¹³C NMR (101 MHz, CDCl₃) δ 161.8 (d, *J* = 242.6 Hz), 159.4 (d, *J* = 9.5 Hz), 127.5 (d, *J* = 3.2 Hz), 125.9 (d, *J* = 9.7 Hz), 106.5 (d, *J* = 20.9 Hz), 98.7 (d, *J* = 25.7 Hz), 55.8, 9.3, 7.4. ¹⁹F NMR (376 MHz, CDCl₃) δ -115.4. HRMS (APPI/LTQ-Orbitrap) *m/z*: [M]⁺ Calcd for C₁₀H₁₁FO⁺ 166.0788; Found 166.0787

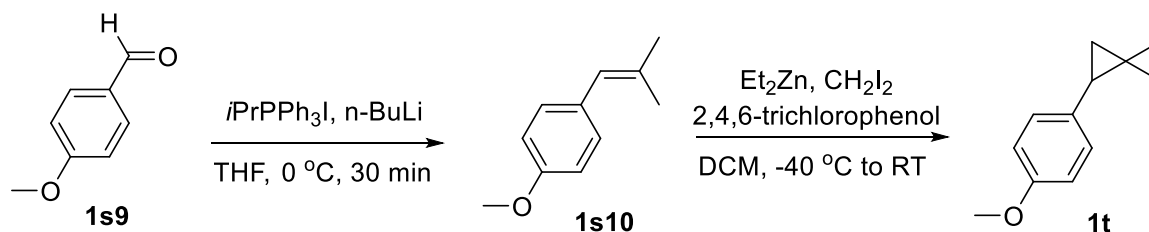
1-methoxy-4-(2-methylcyclopropyl)benzene (**1s**)



Following reported procedure,¹⁰ in a 250 mL oven-dried round-bottom flask was added 2,4,6-trichlorophenol (2.46 g, 12.50 mmol, 2.5 equiv) under nitrogen atmosphere. DCM (120 mL) was added into the flask and the reaction mixture was cooled to -40 °C. ZnEt₂ (1.0 M, 12.5 mL, 12.50 mmol, 2.50 equiv) was added slowly into the flask by syringe and the reaction mixture was stirred at this temperature for 15 minutes. CH₂I₂ (5.29 g, 20.00 mmol, 4.00 equiv) was added slowly by syringe and the reaction mixture was stirred at this temperature for another 15 minutes. Next, the corresponding solution of *trans*-anethole (741.0 mg, 5.00 mmol, 1.00 equiv) in DCM (20 mL) was added by syringe and the reaction mixture was allowed to warm to room temperature and was stirred at this temperature overnight. After the reaction reached completion (as judged by ¹H-NMR), the reaction mixture was quenched with sat. NH₄Cl (60 mL) for 30 minutes and extracted with DCM (100 mL) for 3 times. The combined organic layers were washed with aq. NaOH (1.0 M, 60 mL) and brine (40 mL), dried over Na₂SO₄ and filtered. The resulted mixture was concentrated under reduced pressure, the crude residue was purified by column chromatography on Biotage (Büchi flashpure cartridge 40 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) to afford the desired compound 1-methoxy-4-(2-methylcyclopropyl)benzene **1s** (388.76 mg, 2.40 mmol, 48%) as colorless oil.

^1H NMR (400 MHz, CDCl_3) δ 7.01 – 6.96 (m, 2H, ArH), 6.84 – 6.78 (m, 2H, ArH), 3.80 (s, 3H, OCH_3), 1.60 – 1.51 (m, 1H, ArCHCH $_2$), 1.19 (d, J = 5.9 Hz, 3H, CH_2CHCH_3), 1.04 – 0.93 (m, 1H, CHCH $_3$) 0.84 – 0.79 (m, 1H, ArCHCH $_2$), 0.69 – 0.62 (m, 1H, ArCHCH $_2$). ^{13}C NMR (101 MHz, CDCl_3) δ 157.6, 136.1, 126.7, 113.8, 55.4, 23.5, 19.3, 17.3, 16.9. Consistent with reported data.¹⁰

Synthesis of 1-(2,2-dimethylcyclopropyl)-4-methoxybenzene (**1t**)

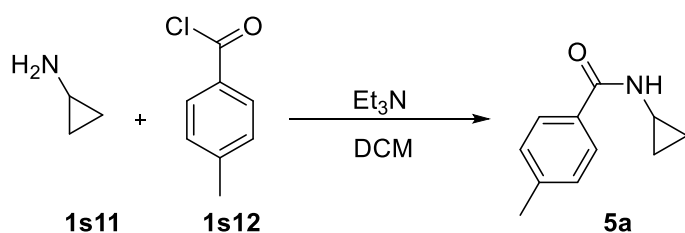


Following reported procedure,¹⁰ to a 250 mL oven-dried round-bottom flask, isopropyltriphenylphosphonium iodide (6.0 g, 14 mmol, 1.2 equiv) and anhydrous THF (70 mL) were added. The reaction flask was capped with rubber septum and three cycles of evacuate-refill with nitrogen were performed, then the reaction mixture was cooled to $0\text{ }^\circ\text{C}$. $n\text{-BuLi}$ (2.5 M, 5.6 mL, 14 mmol, 1.2 equiv) was added dropwise by syringe and the reaction mixture was stirred at this temperature for 30 minutes. A solution of aldehyde **1s9** (1577 mg, 11.60 mmol, 1.0 equiv) in THF (20 mL) was added by syringe and the reaction mixture was allowed to warm to room temperature, and then stirred overnight. After the reaction reached completion (as judged by TLC analysis), the reaction mixture was quenched by sat. NH_4Cl (30 mL) and extracted with EtOAc (100 mL) for 3 times. The combined organic layers were washed with H_2O_2 (10 wt% in water, 10 mL) and brine (20 mL), dried over Na_2SO_4 , and filtered. After that, the mixture was concentrated under reduced pressure, the crude residue was purified by column chromatography (Pentane:EtOAc = 50:1 to 10:1) to afford the desired alkene **1s10** as colorless oil.

Following reported procedure,¹⁰ to a 150 mL oven-dried round-bottom flask, was added 2,4,6-trichlorophenol (1.23 g, 6.25 mmol, 2.5 equiv) under nitrogen atmosphere. DCM (60 mL) was added into the flask and the reaction mixture was cooled to $-40\text{ }^\circ\text{C}$. ZnEt_2 (1.0 M, 6.25 mL, 2.5 equiv) was added slowly into the flask by syringe and the reaction mixture was stirred at this temperature for 15 minutes. CH_2I_2 (2.39 g, 10.0 mmol, 4.0 equiv) was added slowly by syringe and the reaction mixture was stirred at this temperature for another 15 minutes. Next, a

solution of alkene **1s10** (405 mg, 2.50 mmol, 1.0 equiv) in DCM (10 mL) was added by syringe and the reaction mixture was allowed to warm to room temperature and was stirred at this temperature overnight. After the reaction reached completion, the reaction mixture was quenched with sat. NH_4Cl (30 mL) in 30 minutes and extracted with DCM (50 mL) for 3 times. The combined organic layers were washed with aq. NaOH (1.0 M, 30 mL) and brine, dried over Na_2SO_4 and filtered. After the volatile materials were removed under reduced pressure, the crude residue was purified by column chromatography on Biotage (Büchi flashpure cartridge 40 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) to afford 1-(2,2-dimethylcyclopropyl)-4-methoxybenzene (**1t**) (228.82 mg, 1.30 mmol, 52%) as colorless oil $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.1 – 7.0 (m, 2H), 6.9 – 6.8 (m, 2H), 3.8 (d, J = 1.6 Hz, 3H), 1.9 – 1.7 (m, 1H), 1.2 (d, J = 1.6 Hz, 3H), 0.8 (d, J = 1.7 Hz, 3H), 0.8 – 0.6 (m, 2H). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 157.7, 132.6, 130.0, 113.4, 55.4, 29.0, 27.5, 20.6, 18.6, 18.5. Consistent with reported data.¹⁰

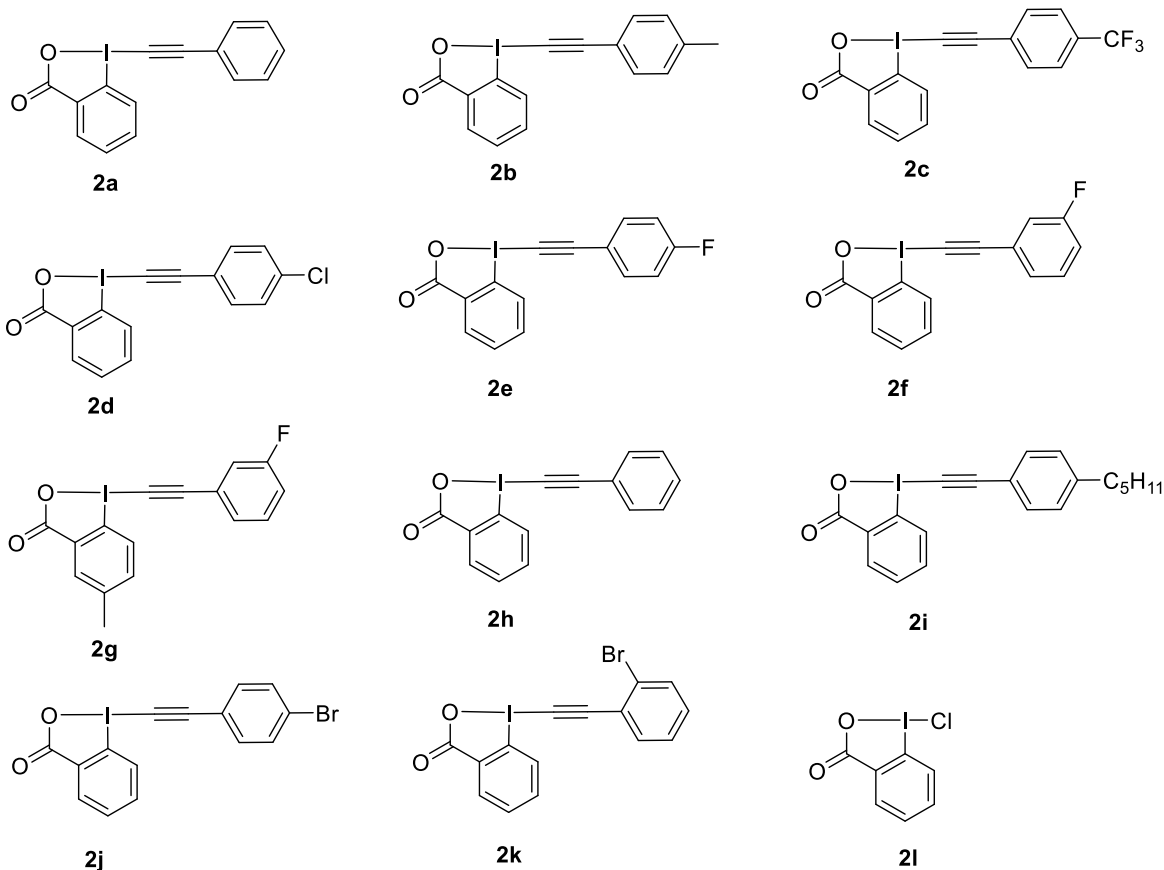
N-cyclopropyl-4- methylbenzamide (**5a**)



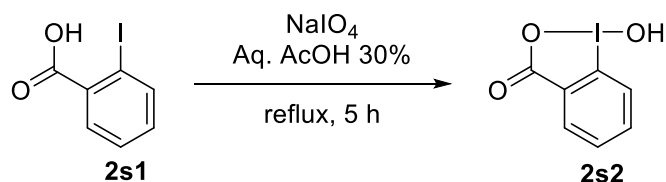
Following a reported procedure,¹¹ to a solution of cyclopropylamine (**1s11**) (0.70 mL, 10 mmol, 1.1 equiv.) and triethylamine (1.40 mL, 10.0 mmol, 1.1 equiv.) in dichloromethane (10 mL) was slowly added a solution of 4-methylbenzoyl chloride (**1s12**) (1.41 g, 9.09 mmol) in dichloromethane (10 mL) at 0 °C. The reaction mixture was stirred at room temperature for 16 hours. Upon completion, the mixture was quenched by the addition of 1 N HCl (10 mL). The aqueous layer was then extracted with dichloromethane. The organic extract was washed with 1 M NaOH (10 mL) and brine (10 mL), dried over Na_2SO_4 , filtered and concentrated in vacuo. The crude product **5a** was pure enough to be used as such, without further purification.

$^1\text{H NMR}$ (400 MHz, CDCl_3): δ = 7.72 – 7.55 (m, 2H, ArH), 7.23 – 7.11 (m, 2H, ArH), 6.33 (d, J = 39.2 Hz, 1H, NH), 2.88 (tt, J = 7.2, 3.5 Hz, 1H, CH), 2.37 (d, J = 3.1 Hz, 3H, CH_3), 0.92 – 0.75 (m, 2H, CH_2), 0.68 – 0.54 (m, 2H, CH_2). Data correspond to the reported values.¹¹

Synthesis of hypervalent iodine reagents

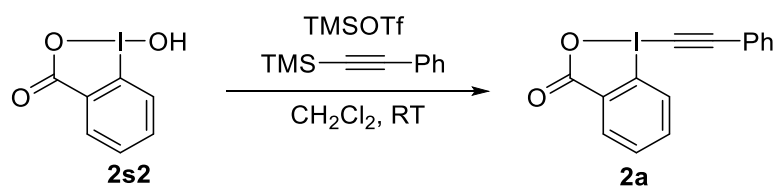


1-Hydroxy-1,2-benziodoxol-3-(1*H*)-one (BIOH, **2s2**)

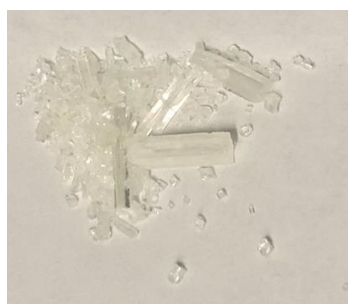


Following a reported procedure,¹² NaIO_4 (40.5 g, 189 mmol, 1.05 equiv) and 2-iodobenzoic acid (**2s1**) (44.8 g, 180 mmol, 1.0 equiv) were suspended in 30% (v:v) aq. AcOH (350 mL). The mixture was vigorously stirred and refluxed for 5 h. The reaction mixture was then diluted with cold water (250 mL) and allowed to cool to rt, protecting it from light. After 1 h, the crude product was collected by filtration, washed on the filter with ice water (3 x 150 mL) and acetone (3 x 150 mL), and air-dried in the dark overnight to afford 1-hydroxy-1,2-benziodoxol-3-(1*H*)-one BIOH (**2s2**) (44.3 g, 168 mmol, 93% yield) as a white solid. ¹H NMR (400 MHz, DMSO-*d*₆) δ 8.02 (dd, *J* = 7.7, 1.4 Hz, 1H, ArH), 7.97 (m, 1H, ArH), 7.85 (dd, *J* = 8.2, 0.7 Hz, 1H, ArH), 7.71 (td, *J* = 7.6, 1.2 Hz, 1H, ArH). ¹³C NMR (100 MHz, DMSO-*d*₆) δ 167.7, 134.5, 131.5, 131.1, 130.4, 126.3, 120.4. Consistent with reported data.¹²

1-[Phenylethynyl]-1,2-benziodoxol-3(1H)-one (PhEBX) (**2a**)



Trimethylsilyltriflate (9.1 mL, 50 mmol, 1.1 equiv) was added dropwise to a suspension of 2-iodosylbenzoic acid (**2s2**) (12.1 g, 45.8 mmol, 1.0 equiv) in CH₂Cl₂ (120 mL) at 0 °C. The mixture was stirred for 1 h, followed by the dropwise addition of trimethyl(phenylethynyl)silane (8.8 mL, 50 mmol, 1.1 equiv) (slightly exothermic). The resulting suspension was stirred for 6 h at RT, during this time a white solid was formed. A saturated solution of NaHCO₃ (120 mL) was added and the mixture was stirred vigorously for 30 min. The mixture was extracted with H₂O and DCM (3x50 mL), washed with brine, then dried over Na₂SO₄, filtered and evaporated under reduced pressure. The resulting solid was recrystallized in EtOAc:MeOH (2:1) (40 mL/grams). The solution was left to cool to RT overnight. The slow recrystallization is important to obtain pure product **2a** (photo of crystal obtained below). The crystal formed was filtered and dried under high vacuum to afford PhEBX (**2a**) (5.89 g, 16.95 mmol, 37 % yield) as colorless crystals. ¹H NMR (400 MHz, CDCl₃) δ 8.47 – 8.38 (m, 1H, ArH), 8.31 – 8.20 (m, 1H, ArH), 7.83 – 7.72 (m, 2H, ArH), 7.64 – 7.57 (m, 2H, ArH), 7.54 – 7.39 (m, 3H, ArH). ¹³C NMR (101 MHz, CDCl₃) δ 166.6, 135.1, 133.0, 132.7, 131.8, 131.5, 130.9, 128.9, 126.4, 120.7, 116.3, 106.7, 50.4. Consistent with reported data.¹³

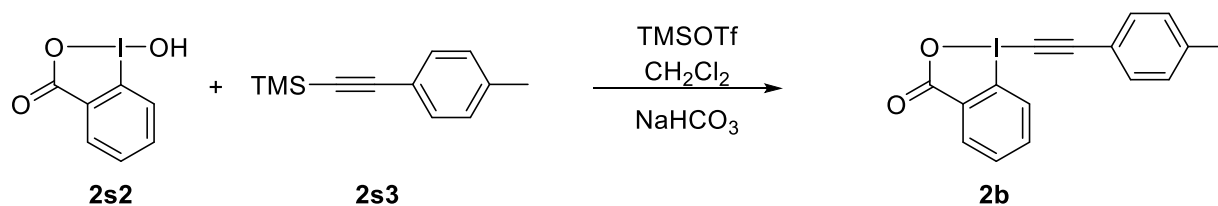


PhEBX with crystallization at RT



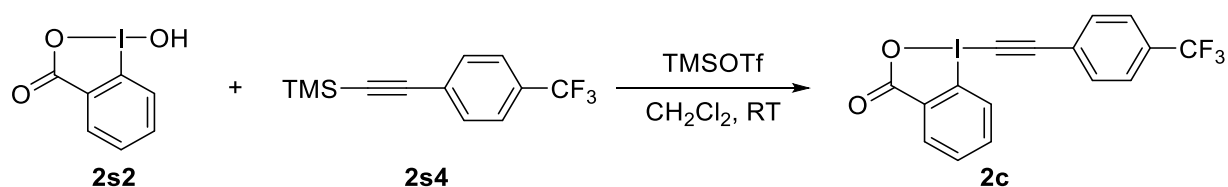
PhEBX with fast crystallization in the fridge

1-(p-Tolyethynyl)-1,2-benziodoxol-3(1H)-one (**2b**)



Following a reported procedure,¹⁴ trimethylsilyl triflate (1.0 mL, 5.5 mmol, 1.1 equiv) was added to a suspension of 2-iodosylbenzoic acid (**2s2**) (1.32 g, 5.00 mmol, 1.00 equiv) in CH₂Cl₂ (15 mL) at room temperature. The resulting suspension was stirred for 3 h, followed by the drop wise addition of trimethyl(p-tolyethynyl)silane (**2s3**) (1.04 g, 5.50 mmol, 1.10 equiv). The resulting suspension was stirred for 6 h at room temperature. A saturated solution of NaHCO₃ (20 mL) was then added and the mixture was stirred vigorously for 30 minutes. The mixture was extracted with H₂O and DCM (3x20 mL), washed with brine, then dried over Na₂SO₄, filtered and evaporated under reduced pressure. The resulting solid was recrystallized in EtOAc:MeOH (2:1) (40 ml/gram). The solution was left to cool to RT overnight.. The crystal formed was filtered and dried under high vacuum to afford **2b** (0.620 g, 1.71 mmol, 34%) as a white crystals. ¹H NMR (400 MHz, CDCl₃) δ 8.47 – 8.38 (m, 1H, ArH), 8.30 – 8.20 (m, 1H, ArH), 7.82 – 7.71 (m, 2H, ArH), 7.53 – 7.46 (m, 2H, ArH), 7.28 – 7.20 (m, 2H, ArH), 2.43 (s, 3H, ArCH₃). ¹³C NMR (100 MHz, CDCl₃): δ 166.7, 141.7, 135.0, 133.0, 132.6, 131.7, 131.5, 129.7, 126.4, 117.6, 116.4, 107.3, 49.5, 21.9. Consistent with reported data.¹⁴

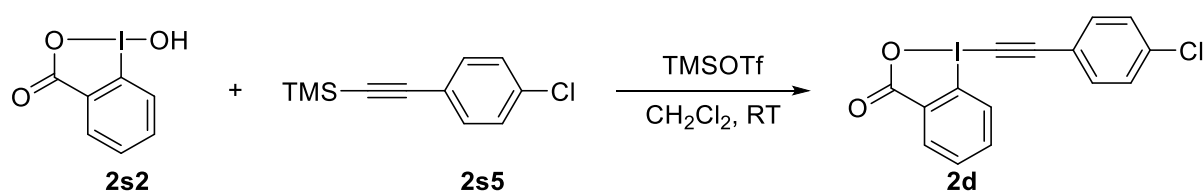
1-(p-trifluoromethylethynyl)-1,2-benziodoxol-3(1H)-one (**2c**)



Following a reported procedure,¹⁴ trimethylsilyl triflate (1.0 mL, 5.5 mmol, 1.1 equiv) was added to a suspension of BIOH (**2s2**) (1.3 g, 5.0 mmol, 1.0 equiv) in CH₂Cl₂ (15 mL) at RT. The resulting suspension was stirred for 1 h, followed by the dropwise addition of trimethyl((4-(trifluoromethyl)phenyl)ethynyl)silane (**2s4**) (1.3 mL, 5.5 mmol, 1.1 equiv), which was dissolved in CH₂Cl₂ (1 mL). The resulting suspension was stirred for 6 h at RT. A saturated solution of NaHCO₃ (20 mL) was then added and the mixture was stirred vigorously for 30 min, the two layers were separated and the organic layer was washed with sat. NaHCO₃ (20 mL), dried over MgSO₄, filtered and evaporated under reduced pressure. The resulting solid

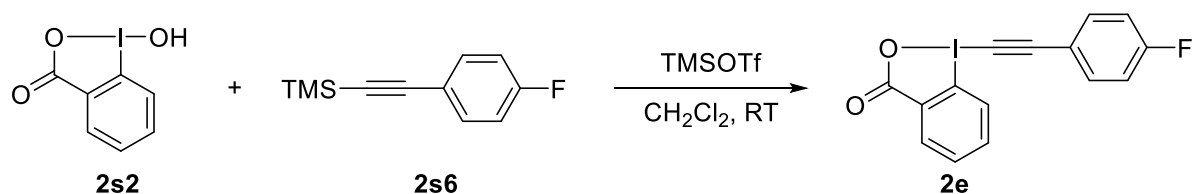
was boiled in CH₃CN (20 mL). The mixture was cooled down, filtered and dried under high vacuum to afford **2c** (1.12 g, 2.69 mmol, 54% yield) as a pale yellow solid. ¹H NMR (400 MHz, CDCl₃) δ 8.51 – 8.40 (m, 1H, ArH), 8.29 – 8.18 (m, 1H, ArH), 7.85 – 7.76 (m, 2H, ArH), 7.76 – 7.67 (m, 4H, ArH). ¹³C NMR (101 MHz, CDCl₃) δ 166.6, 135.0, 133.0, 132.6, 132.2 (q, *J* = 33.0 Hz), 131.7, 131.2, 126.3, 125.7 (q, *J* = 3.6 Hz), 124.4, 123.4 (q, *J* = 272.6 Hz), 116.1, 104.2, 53.7. Consistent with reported data.¹⁴

1-[4-Chlorophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2d**)



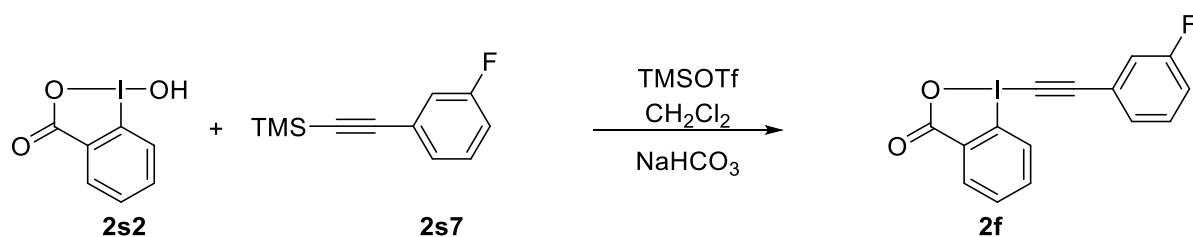
Following a reported procedure,¹⁵ Trimethylsilyl triflate (1.0 mL, 5.5 mmol, 1.1 equiv) was added to a suspension of BIOH (**2s2**) (1.32 g, 5.00 mmol, 1.0 equiv) in CH₂Cl₂ (15 mL) at RT. The resulting suspension was stirred for 1 h, followed by the dropwise addition of ((4-Chlorophenyl)ethynyl)trimethylsilane **2s5** (0.68 mL, 5.00 mmol, 1.0 equiv), which was dissolved in CH₂Cl₂ (5 mL). The resulting suspension was stirred for 6 h at RT. A saturated solution of NaHCO₃ (20 mL) was then added and the mixture was stirred vigorously for 30 minutes, the two layers were separated. The mixture was extracted with H₂O and DCM (3x20 mL), washed with brine, then dried over Na₂SO₄ filtered and evaporated under reduced pressure. The resulting solid was recrystallized in EtOAc:MeOH (2:1) (40 mL/gram). The solution was left to cool to RT overnight. The crystal formed was filtered and dried under high vacuum to afford (**2d**) as a white solid (658 mg, 1.72 mmol, 34%). ¹H NMR (400 MHz, CDCl₃) δ 8.48 – 8.39 (m, 1H, ArH), 8.27 – 8.17 (m, 1H, ArH), 7.84 – 7.69 (m, 2H, ArH), 7.57 – 7.49 (m, 2H, ArH), 7.46 – 7.38 (m, 2H, ArH). ¹³C NMR (100 MHz, CDCl₃) δ 166.9, 137.4, 135.1, 134.2, 132.8, 131.9, 131.4, 129.4, 126.3, 119.1, 116.3, 105.3, 51.8. Consistent with reported data.¹⁵

1-[4-Fluorophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2e**)



Following a reported procedure,¹⁵ Trimethylsilyl triflate (1.0 mL, 5.5 mmol, 1.1 equiv) was added to a suspension of 2-iodosylbenzoic acid (**2s2**) (1.32 g, 5.00 mmol, 1.0 equiv) in CH_2Cl_2 (15 mL) at RT. The resulting suspension was stirred for 1 h, followed by the drop wise addition of ((4-fluorophenyl)ethynyl)trimethylsilane (**2s6**) (1.1 mL, 5.5 mmol, 1.1 equiv), which was dissolved in CH_2Cl_2 (1 mL). The resulting suspension was stirred for 6 h at RT. A saturated solution of NaHCO_3 (20 mL) was then added and the mixture was stirred vigorously for 30 minutes, the two layers were separated. The mixture was extracted with H_2O and DCM (3x20 mL), washed with brine, then dried over Na_2SO_4 filtered and evaporated under reduced pressure. The resulting solid was recrystallized in EtOAc:MeOH (2:1) (40 mL/gram). The solution was left to cool to RT overnight. The crystal formed was filtered and dried under high vacuum to afford product **2e** (739 mg, 2.02 mmol, 40%) as a white solid. ¹H NMR (400 MHz, CDCl_3) δ 8.49 – 8.38 (m, 1H, ArH), 8.28 – 8.18 (m, 1H, ArH), 7.83 – 7.73 (m, 2H, ArH), 7.65 – 7.55 (m, 2H, ArH), 7.19 – 7.09 (m, 2H, ArH). ¹⁹F NMR (376 MHz, CDCl_3) δ -105.85. Consistent with reported data.¹⁵

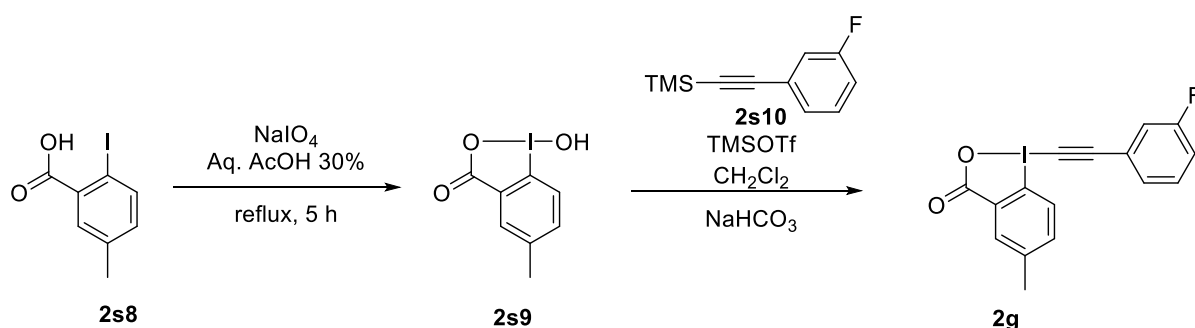
1-[3-Fluorophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2f**)



Following reported procedure,¹⁴ Trimethylsilyl triflate (0.44 mL, 2.5 mmol, 1.1 equiv) was added to a suspension of 2-iodosylbenzoic acid (**2s2**) (0.589 g, 2.23 mmol, 1.00 equiv) in CH_2Cl_2 (6.8 mL) at RT. The resulting suspension was stirred for 1 h, followed by the dropwise addition of ((3-fluorophenyl)ethynyl)trimethylsilane (**2s7**) (0.50 mL, 2.5 mmol, 1.1 equiv). The resulting suspension was stirred for 6 h at RT. A saturated solution of NaHCO_3 (10 mL) was then added and the mixture was stirred vigorously for 30 minutes, resulting in a suspension.

The mixture was extracted with H₂O and DCM (3x10 mL), washed with brine, then dried over Na₂SO₄, filtered and evaporated under reduced pressure. The resulting solid was recrystallized in EtOAc:MeOH (2:1) (40 mL/gram). The solution was left to cool to RT and kept in fridge overnight. The crystal formed was filtered and dried under high vacuum to afford product **2f** (384 mg, 1.05 mmol, 47% yield) as colorless crystals. ¹H NMR (400 MHz, DMSO-*d*₆) δ 8.35 (dd, *J* = 8.3, 0.9 Hz, 1H, ArH), 8.14 (dd, *J* = 7.4, 1.7 Hz, 1H, ArH), 7.93 (ddd, *J* = 8.5, 7.2, 1.7 Hz, 1H, ArH), 7.82 (td, *J* = 7.3, 0.9 Hz, 1H, ArH), 7.68 – 7.60 (m, 1H, ArH), 7.63 – 7.52 (m, 2H, ArH), 7.50 – 7.39 (m, 1H, ArH). ¹⁹F NMR (376 MHz, DMSO) δ -111.75. Consistent with reported data.¹⁴

Synthesis of **2g**



Following reported procedure,¹⁴ NaIO₄ (4.05 g, 18.9 mmol, 1.05 equiv) and 2-iodo-5-methylbenzoic acid (**2s8**) (4.7 g, 18 mmol, 1.0 equiv) were suspended in 30% (v:v) aq. AcOH (35 mL). The mixture was vigorously stirred and refluxed for 5 h. The reaction mixture was then diluted with cold water (25 mL) and allowed to cool to rt, protecting it from light. After 1 h, the crude product was collected by filtration, washed on the filter with ice water (3 x 15 mL) and acetone (3 x 15 mL), and air-dried in the dark overnight to afford BIOH-a (**2s9**) (3.95 g, 14.2 mmol, 79% yield) as a white solid.

Trimethylsilyl triflate (0.44 mL, 2.5 mmol, 1.1 equiv) was added to a suspension BIOH-a (**2s9**) (0.620 g, 2.23 mmol, 1.00 equiv) in CH₂Cl₂ (6.8 mL) at RT. The resulting suspension was stirred for 1 h, followed by the dropwise addition of ((3-fluorophenyl)ethynyl)trimethylsilane (**2s10**) (0.50 mL, 2.5 mmol, 1.1 equiv). The resulting suspension was stirred for 6 h at RT. A saturated solution of NaHCO₃ (10 mL) was then added and the mixture was stirred vigorously for 30 minutes, resulting in a suspension. The mixture was extracted with H₂O and DCM (3x10 mL), washed with brine, then dried over Na₂SO₄, filtered and evaporated under reduced pressure. The resulting solid was recrystallized in EtOAc:MeOH (2:1) (40 mL/gram). The solution was left

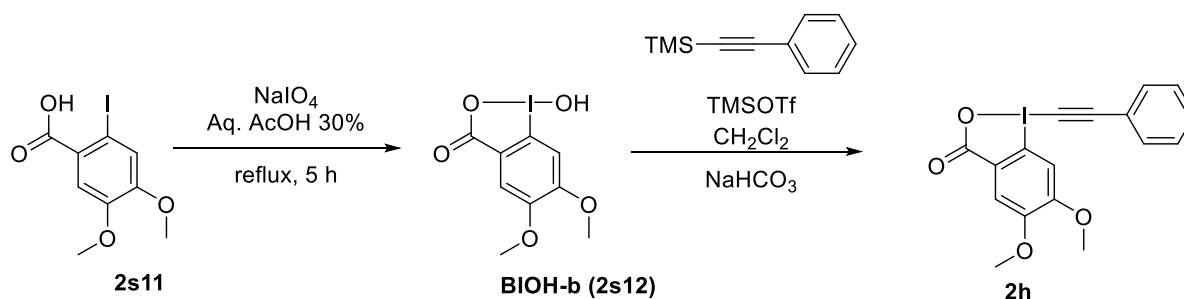
to cool to RT and kept in fridge overnight. The crystal formed was filtered and dried under high vacuum to afford product **2g** (354 mg, 0.932 mmol, 42% yield) as colorless crystals.

¹H NMR (400 MHz, CDCl₃) δ 8.23 (d, *J* = 2.1 Hz, 1H, ArH), 8.05 (d, *J* = 8.5 Hz, 1H, ArH), 7.58 (dd, *J* = 8.6, 2.2 Hz, 1H, ArH), 7.45 – 7.35 (m, 2H, ArH), 7.30 – 7.26 (m, 1H, ArH), 7.24 – 7.15 (m, 1H, ArH), 2.51 (s, 3H, ArCH₃). **¹⁹F NMR** (376 MHz, CDCl₃) δ -111.26,

¹³C NMR (101 MHz, CDCl₃) δ 166.7, 162.3 (d, *J* = 248.6 Hz), 142.7, 136.0, 133.2, 131.0, 130.5 (d, *J* = 8.5 Hz), 128.7 (d, *J* = 3.3 Hz), 125.9, 122.4 (d, *J* = 9.4 Hz), 119.6 (d, *J* = 23.2 Hz), 118.2 (d, *J* = 21.2 Hz), 112.3, 104.4 (3.3 Hz), 51.8, 20.8.

HRMS (ESI/QTOF) *m/z*: [M + H]⁺ Calcd for C₁₆H₁₁FIO₂⁺ 380.9782; Found 380.9784.

Synthesis of 2h

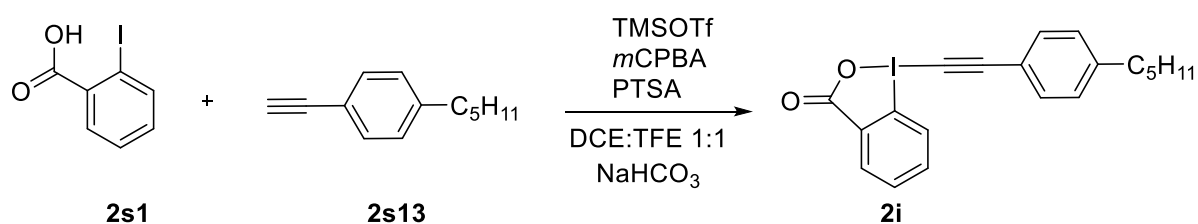


Following reported procedure,¹⁶ NaIO₄ (1.25 g, 5.84 mmol, 1.05 equiv) and 2-iodo 4,5-dimethoxybenzoic acid (**2s11**) (1.71 g, 5.56 mmol, 1.00 equiv) were suspended in 30% (v:v) aq. AcOH (15 mL). The mixture was vigorously stirred and refluxed for 4 h. The reaction mixture was then diluted with cold water (40 mL) and allowed to cool to RT, protecting it from light. The crude product was collected by filtration, washed on the filter with ice water (3x4 mL) and acetone (3x4 mL), and air-dried in the dark to give the pure product BIOH-b (**2s12**) (1.51 g, 4.67 mmol, 84%) as a colorless solid. Trimethylsilyl triflate (400 μL, 2.20 mmol, 1.10 equiv) was added to a suspension of BIOH-b (**2s12**) (648 mg, 2.00 mmol, 1.00 equiv) in CH₂Cl₂ (10 mL) at RT. The resulting yellow mixture was stirred for 1 h, followed by the dropwise addition of trimethyl(phenylethynyl)silane (430 μL, 2.20 mmol, 1.10 equiv). The resulting suspension was stirred for 6 h at RT, during this time a yellow suspension was formed. A saturated solution of NaHCO₃ (10 mL) was then added. The two layers were separated and the aqueous layer was extracted with DCM (10 mL). The combined organic extracts were dried over MgSO₄, filtered and evaporated under reduced pressure. The resulting solid was

recrystallized in CH₃CN (50 mL) and a few EtOH to afford **2h** (306 mg, 0.752 mmol, 38%) as a colorless solid.

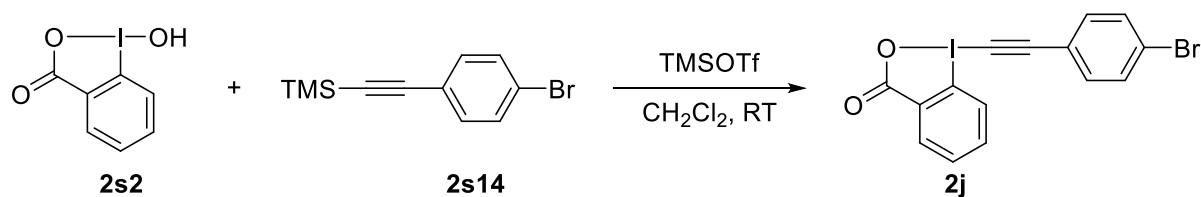
¹H NMR (400 MHz, CDCl₃) δ 7.84 (s, 1 H, ArH), 7.66 (s, 1 H, ArH), 7.61 – 7.53 (m, 2 H, ArH), 7.53 – 7.38 (m, 3 H, ArH), 4.00 (s, 3 H, OCH₃), 3.94 (s, 3 H; OCH₃). ¹³C NMR (101 MHz, CDCl₃) δ 167.0, 155.0, 152.3, 132.7, 130.9, 129.0, 124.6, 120.7, 113.4, 107.8, 106.4, 105.5, 56.8, 56.6, 51.4. Consistent with reported data.¹⁶

1-[4-Pentylphenylethynyl]-1,2-benziodoxol-3(1H)-one (**2i**)



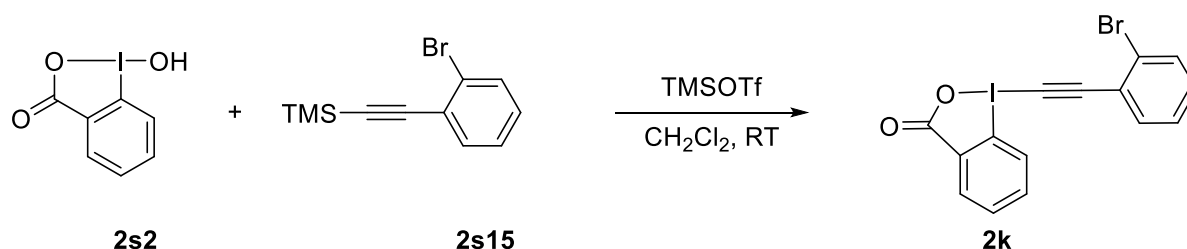
Following a reported procedure,¹⁷ in a sealed tube, 2-iodobenzoic acid (**2s1**) (1.00 g, 4.03 mmol, 1.00 equiv), 4-methylbenzenesulfonic acid (775 mg, 4.03 mmol, 1.00 equiv) and mCPBA (994 mg, 4.44 mmol, 1.10 equiv) were suspended in DCE:TFE 1:1 (12 mL) and stirred for 1 h at 55 °C. After 1 h, 1-ethynyl-4-pentylbenzene (**2s13**) (1.1 mL, 5.6 mmol, 1.4 equiv) was added and the reaction was stirred at 55 °C for 24 h. After 24 h, the solvent was evaporated and the residue was redissolved in CH₂Cl₂ (20 mL) and stirred vigorously with NaHCO₃ sat. (30 mL). After 1 h, the reaction mixture was transferred into a separating funnel and the layers were separated. The aqueous layer was extracted with CH₂Cl₂ (2x50 mL). The combined organic layers were washed with sat. NaHCO₃, dried over MgSO₄, filtered and concentrated under vacuum. The resulting solid was boiled in MeCN (20 mL), then filtered and the collected solid was further purified by column chromatography using pure ethyl acetate. Trituration in pentane afforded **2i** (176 mg, 0.421 mmol, 10%) as a pale yellow solid. ¹H NMR (400 MHz, Chloroform-d) δ 8.48 – 8.38 (m, 1H, ArH), 8.30 – 8.20 (m, 1H, ArH), 7.82 – 7.71 (m, 2H, ArH), 7.55 – 7.48 (m, 2H, ArH), 7.26 – 7.23 (m, 2H, ArH), 2.72 – 2.56 (m, 2H, ArCH₂), 1.70 – 1.57 (m, 2H, ArCH₂CH₂), 1.42 – 1.24 (m, 4H, CH₂CH₂CH₃), 0.90 (t, *J* = 6.8 Hz, 3H, CH₂CH₃). ¹³C NMR (101 MHz, Chloroform-d) δ 166.6, 146.7, 135.0, 133.0, 132.6, 131.7, 131.5, 129.0, 126.3, 117.7, 116.4, 107.4, 49.4, 36.2, 31.5, 31.0, 22.6, 14.1. Consistent with reported data.¹⁷

1-[4-Bromophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2j**)



Following reported procedure,¹² trimethylsilyl triflate (1.0 mL, 5.5 mmol, 1.1 equiv) was added to a suspension of 2-iodosylbenzoic acid (**2s2**) (1.3 g, 5.0 mmol, 1.0 equiv) in CH_2Cl_2 (15 mL) at RT. The resulting suspension was stirred for 1 h, followed by the dropwise addition of ((4-bromophenyl)ethynyl)trimethylsilane (**2s14**) (1.39 g, 5.5 mmol, 1.1 equiv), which was dissolved in CH_2Cl_2 (1 mL). The resulting suspension was stirred for 6 h at RT. A saturated solution of NaHCO_3 (20 mL) was then added and the mixture was stirred vigorously for 30 min, the two layers were separated and the organic layer was washed with sat. The mixture was extracted with H_2O and DCM (3x20 mL), washed with brine, then dried over Na_2SO_4 , filtered and evaporated under reduced pressure. The resulting solid was recrystallized in EtOAc:MeOH (2:1) (40 mL/gram). The solution was left to cool to RT overnight. The crystal formed was filtered and dried under high vacuum to afford product **2j** (1.35 g, 3.15 mmol, 63% yield) as a colorless crystal. ¹H NMR (400 MHz, CDCl_3) δ 8.47 – 8.39 (m, 1H, ArH), 8.27 – 8.17 (m, 1H, ArH), 7.84 – 7.73 (m, 2H, ArH), 7.63 – 7.54 (m, 2H, ArH), 7.51 – 7.42 (m, 2H, ArH). ¹³C NMR (101 MHz, CDCl_3) δ 166.6, 135.1, 134.3, 132.8, 132.3, 131.9, 131.4, 126.3, 125.7, 119.6, 116.3, 105.4, 52.2. Consistent with reported data.¹²

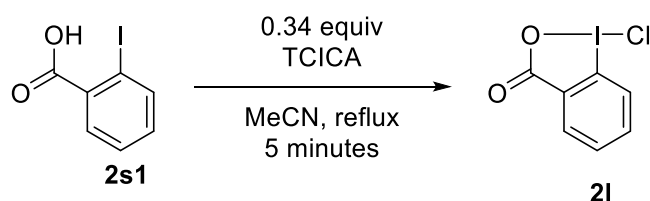
1-[2-Bromophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2k**)



Following reported procedure,¹² trimethylsilyl triflate (0.42 mL, 2.4 mmol, 1.1 equiv) was added to a suspension of BIOH (**2s2**) (0.562 g, 2.13 mmol, 1.00 equiv) in CH_2Cl_2 (6 mL) at RT. The resulting suspension was stirred for 1 h, followed by the drop wise addition of ((2-bromophenyl)ethynyl)trimethylsilane (**2s15**) (607.2 mg, 2.4 mmol, 1.1 equiv). The resulting

suspension was stirred for 6 h at RT. A saturated solution of NaHCO₃ (10 mL) was then added and the mixture was stirred vigorously for 1 h resulting in a persistent emulsion/suspension. The mixture was diluted with CHCl₃ (10 mL), water (5 mL) and MeOH (ca. 2 mL) to afford 2 distinct layers. The two layers were separated, and the organic layer was washed with sat. NaHCO₃ (5 mL), dried over Na₂SO₄, filtered, and evaporated under reduced pressure. The resulting solid was recrystallized in EtOAc:MeOH (7:3 v:v) (ca. 20 mL). The solution was left to cool to RT then was placed in the freezer (-20 °C) overnight. The crystals were filtered and washed with Et₂O affording **2k** (465 mg, 1.09 mmol, 51% yield) as a pale yellow solid. ¹H NMR (400 MHz, CDCl₃) δ 8.50 – 8.39 (m, 2H, ArH), 7.85 – 7.72 (m, 2H, ArH), 7.72 – 7.65 (m, 1H, ArH), 7.65 – 7.58 (m, 1H, ArH), 7.45 – 7.29 (m, 2H, ArH). ¹³C NMR (101 MHz, CDCl₃) δ 166.6, 135.2, 134.7, 133.0, 132.7, 131.9, 131.8, 131.3, 127.6, 126.8, 126.4, 123.2, 116.5, 104.3, 55.4. Consistent with reported data.¹²

1-Chloro-1,2- benziodoxol-3(1H)-one (**2l**)

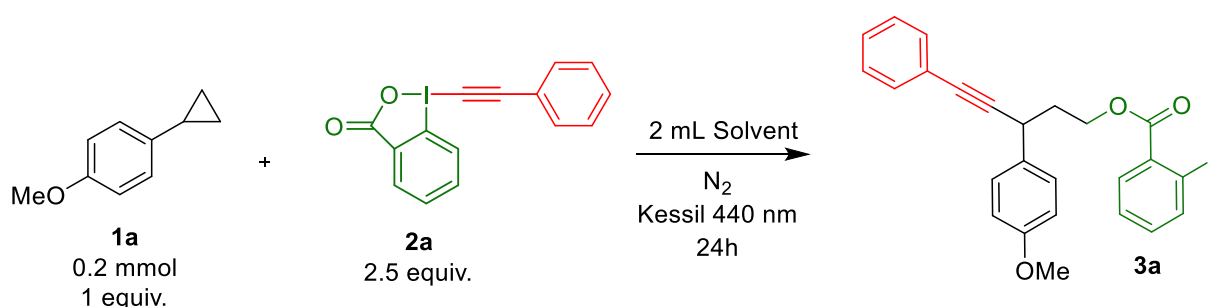


Following reported procedure,¹⁸ a 250 mL three-necked, round-bottom flask equipped with a massive magnetic stirring bar, under Ar, condenser, and dropping funnel. The flask was charged under Ar with solid 2-iodobenzoic acid **2s1** (20.0 g, 0.0790 mol, 1.00 equiv), and anhydrous MeCN (150 mL) was added. The resulting stirred suspension was heated to 75 °C in an oil bath. The dropping funnel was charged with a solution of trichloroisocyanuric acid (6.37 g, 0.027 mol, 1.02 Cl⁺ equiv) in 30 mL of anhydrous MeCN. The solution of trichloroisocyanuric acid was dropped into the vigorously stirred reaction mixture within 5 min. During the addition of the trichloroisocyanuric acid solution, formation of insoluble isocyanuric acid became apparent. The dropping funnel was rinsed with further anhydrous MeCN (100 mL). After addition was complete, the reaction mixture was refluxed for an additional 5 min. The reaction mixture was vacuum-filtered with a tightly packed pad of Celite (1 cm thick), and the filter cake was rinsed with additional hot MeCN (100–200 mL). The combined filtrates were evaporated, and the resulting yellow solid was filtered and washed with a small amount of cold MeCN. The mother liquor from filtration was partially

concentrated on a rotavap, giving a second crop of crystals. The combined crops were dried for 2 h under high vacuum to give product as free-flowing light yellow crystals (16.70 g, 0.059 mol, 75% yield). **¹H NMR** (400 MHz, CDCl₃) δ 8.30 – 8.18 (m, 2H), 8.00 (ddd, *J* = 8.6, 7.2, 1.7 Hz, 1H), 7.80 (td, *J* = 7.4, 0.8 Hz, 1H). Consistent with reported data.¹⁸

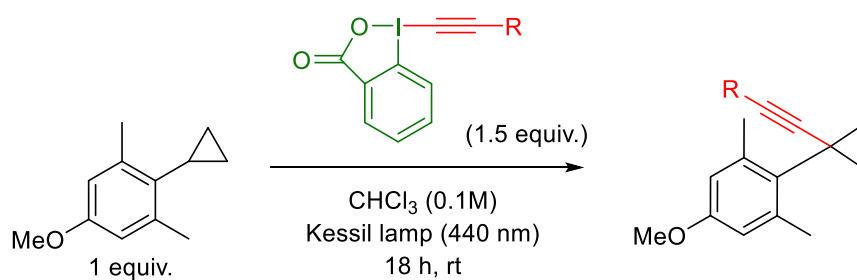
Optimization

In a 12*75 mm Borosilicate glass tube, **PhEBX 2a** was added. The tube was then closed with a rubber septum and sealed off with parafilm. Three cycle of evacuate-refill with nitrogen were performed to remove O₂ and CHCl₃ (0.1M) was added, followed by the addition of **1a**. The reaction mixture was stirred at room temperature under irradiation of Kessil lamps (440 nm). It should be noted that chloroform can be used from commercially sealed-cap bottle under inert atmosphere or it is recommended to conduct three cycle of Freeze-Pump-Thaw for other sources of chloroform before use. The reaction was monitored by NMR with CH₂Br₂ as internal standard. NMR yield was determined by integration of ArCH NMR of products.



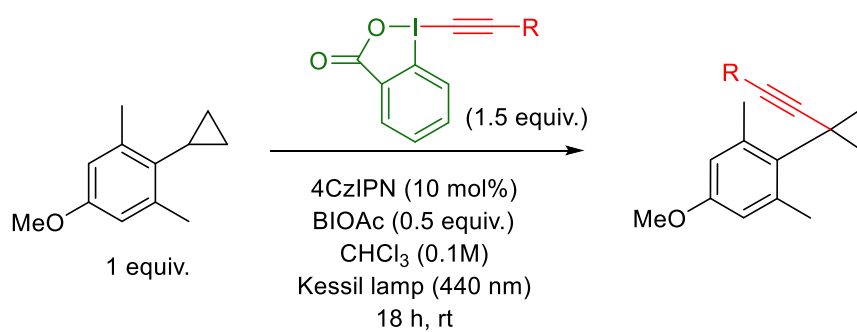
Entry	Variation from standard condition	Conversion (%)	NMR yield (%)
1	CHCl ₃	100	72
2	DCE	62	20
3	MeOH	64	12
4	CH ₃ CN/EtOAc	42/19	5/3
5	DMSO or THF	<5	0
6	4 mL CHCl ₃	100	50
7	1 mL CHCl ₃	84	63
8	CHCl ₃ , only 1a , without 2a	0	0
9	CHCl ₃ , with 1.5 equiv. of BIOH	100	63
10	CHCl ₃ , with 1.5 equiv. of K ₂ CO ₃	58	24

Results with other hypervalent iodine reagents.



Entry	R	Conversion (%)	NMR yield (%)
1	-TIPS	3	0
2	-CH ₂ CH ₂ Cl	5	0
3	-Cyclopropyl	24	21 (product 4s1 , isolated 19%)

Photocatalysis protocol develop by Studer and co-workers (Ref 1j)



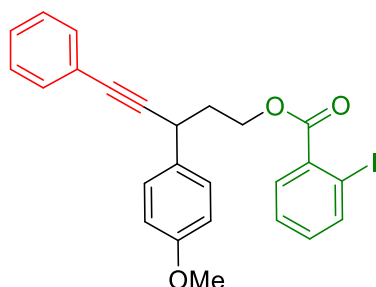
Entry	R	Conversion (%)	NMR yield (%)
1	-TIPS	78	Trace
2	-CH ₂ CH ₂ Cl	75	trace
3	-Cyclopropyl	93	20

Synthesis of alkynylated products

General Procedure C (GP C):

In a 12*75 mm Borosilicate glass tube, aryl ethynyl benziodoxolone (0.5 mmol, 2.5 equiv) was added. The tube was then closed with a rubber septum and sealed off with parafilm. Three cycle of evacuate-refill with nitrogen were performed to remove O₂ and CHCl₃ (2.0 mL, 0.1M) was added, followed by the addition of starting material (0.2 mmol). The reaction mixture was stirred at room temperature under irradiation of Kessil lamps (440 nm). It should be noted that chloroform can be used from commercially sealed-cap bottle under inert atmosphere or it is recommended to conduct three cycle of Freeze-Pump-Thaw for other sources of chloroform before use. The reaction was monitored by NMR with CH₂Br₂ as internal standard. Upon completion by either full conversion of starting material or hypervalent iodine reagents, the mixture was concentrated in vacuo and purified by on Biotage (Büchi flashpure cartridge 25 g) to obtained the products.

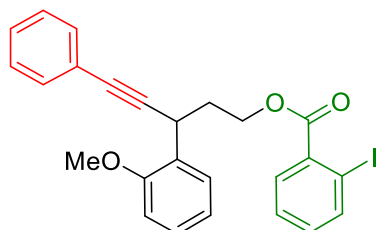
3-(4-Methoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3a**)



Following the general procedure C, starting from phenyl ethynyl benziodoxolone (**2a**) (174 mg, 500 μ mol, 2.50 equiv) and 1-cyclopropyl-4-methoxybenzene (**1a**) (29.6 mg, 200 μ mol, 1.00 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane : EtOAc from 5 : 95 to 88 : 12), affording 3-(4-methoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3a**) (67.5 mg, 136 μ mol, 68% yield) as colorless oil. **R_f** = 0.29 (SiO₂, 20:1 Pentane/ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.99 (d, *J* = 7.9 Hz, 1H, *ArH*), 7.77 (dd, *J* = 7.7, 1.9 Hz, 1H, *ArH*), 7.44 (td, *J* = 4.3, 1.7 Hz, 2H, *ArH*), 7.40 – 7.34 (m, 3H, *ArH*), 7.32 – 7.27 (m, 3H, *ArH*), 7.15 (t, *J* = 7.7 Hz, 1H, *ArH*), 6.92 – 6.86 (m, 2H, *ArH*), 4.57 (dt, *J* = 12.7, 6.6 Hz, 1H, OCH₂CH₂), 4.48 (dt, *J* = 11.3, 5.8 Hz, 1H, OCH₂CH₂), 4.11 (t, *J* = 7.4 Hz, 1H, CHCH₂), 3.81 (s, 3H, OCH₃), 2.29 (q, *J* = 6.8 Hz, 2H, OCH₂CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 166.6, 158.8, 141.4, 135.4, 133.2, 132.8, 131.8, 131.2, 128.6, 128.4, 128.1, 128.0,

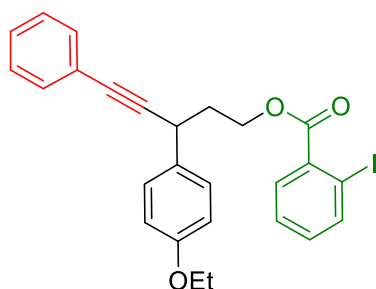
123.5, 114.2, 94.2, 90.5, 84.0, 63.8, 55.5, 37.3, 34.7. IR ($\nu_{\max}$, cm^{-1}) 2923 (m), 2852 (w), 2358 (w), 1727 (s), 1677 (m), 1601 (s), 1462 (m), 1292 (s), 1250 (s), 1173 (m), 743 (m). HRMS (APCI/QTOF) m/z : $[M + H]^+$ Calcd for $\text{C}_{25}\text{H}_{22}\text{IO}_3^+$ 497.0608; Found 497.0604.

3-(2-Methoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (3b)



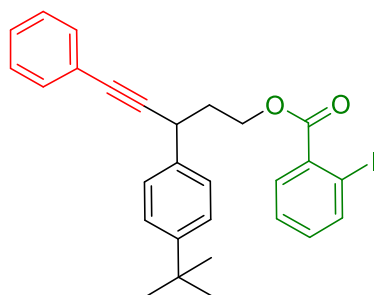
Following the general procedure C, starting from 1-cyclopropyl-2-methoxybenzene (**1o**) (29.6 mg, 200 μmol , 1.00 equiv) and phenyl ethynyl benziodoxolone (**2a**) (174 mg, 500 μmol , 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 2:98 to 90:10) affording 3-(2-methoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3b**) (64.7 mg, 130 μmol , 65% yield) as colorless oil. R_f = 0.59 (SiO_2 , 10:1 Pentane/ethyl acetate). $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.95 (dd, J = 8.0, 1.2 Hz, 1H, ArH), 7.79 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 7.62 (dd, J = 7.6, 1.8 Hz, 1H, ArH), 7.44 – 7.38 (m, 2H, ArH), 7.31 (td, J = 7.6, 1.2 Hz, 1H, ArH), 7.27 – 7.18 (m, 4H, ArH), 7.09 (td, J = 7.6, 1.8 Hz, 1H, ArH), 6.95 (td, J = 7.5, 1.1 Hz, 1H, ArH), 6.83 (dd, J = 8.2, 1.1 Hz, 1H, ArH), 4.56 (dd, J = 8.7, 5.3 Hz, 1H, CHCH_2), 4.53 – 4.43 (m, 2H, OCH_2CH_2), 3.78 (s, 3H, OCH_3), 2.31 (dtd, J = 14.0, 7.0, 5.3 Hz, 1H, OCH_2CH_2), 2.17 (ddt, J = 14.3, 8.8, 5.8 Hz, 1H, OCH_2CH_2). $^{13}\text{C NMR}$ (101 MHz, CDCl_3) δ 166.4, 156.3, 141.5, 135.1, 132.7, 131.8, 131.3, 129.4, 128.7, 128.4, 128.3, 128.3, 128.0, 123.7, 121.0, 110.6, 94.3, 90.7, 83.5, 64.1, 55.5, 35.5, 29.0. IR ($\nu_{\max}$, cm^{-1}) 2925 (w), 2237 (m), 1496 (s), 1487 (m), 1302 (m), 1255 (m), 1234 (m), 1207 (s), 1127 (m), 1114 (m), 1108 (m), 1056 (s), 1046 (m), 755 (s). HRMS (ESI/QTOF) m/z : $[M + \text{Na}]^+$ Calcd for $\text{C}_{25}\text{H}_{21}\text{INaO}_3^+$ 519.0428; Found 519.0429.

3-(4-Ethoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (3c)



Following the general procedure C, starting from 1-cyclopropyl-4-ethoxybenzene (**1p**) (32.4 mg, 200 μ mol, 1.00 equiv) and phenyl ethynyl benziiodoxolone (**2a**) (174 mg, 500 μ mol, 2.50 equiv.). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 98:2 to 90:10, affording 3-(4-ethoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3c**) (54.1 mg, 103 μ mol, 51% yield) as pale yellow oil. R_f = 0.27 (SiO₂, 20:1 Pentane/ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 7.99 (d, J = 7.9 Hz, 1H, ArH), 7.77 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 7.44 (dd, J = 6.7, 3.0 Hz, 2H, ArH), 7.40 – 7.33 (m, 3H, ArH), 7.33 – 7.27 (m, 3H, ArH), 7.15 (td, J = 7.7, 1.7 Hz, 1H, ArH), 6.88 (d, J = 8.5 Hz, 2H, ArH), 4.56 (dt, J = 11.1, 6.6 Hz, 1H, OCH₂CH₂CH), 4.48 (dt, J = 11.4, 5.9 Hz, 1H, OCH₂CH₂CH), 4.10 (t, J = 7.4 Hz, 1H, CCCHCH₂), 4.02 (q, J = 7.0 Hz, 2H, OCH₂CH₃), 2.36 – 2.20 (m, 2H, OCH₂CH₂CH), 1.41 (t, J = 7.0 Hz, 3H, OCH₂CH₃). ¹³C NMR (101 MHz, CDCl₃) δ 166.6, 158.2, 141.4, 135.4, 133.0, 132.8, 131.8, 131.2, 128.6, 128.4, 128.1, 128.0, 123.6, 114.8, 94.2, 90.6, 84.0, 63.8, 63.6, 37.4, 34.7, 15.0. IR (ν_{max} , cm⁻¹) 2957 (w), 2924 (m), 2227 (w), 1725 (s), 1713 (m), 1508 (m), 1289 (s), 1247 (s), 1205 (m), 1133 (m), 1043 (m), 1013 (m), 758 (m), 741 (m). HRMS (ESI/QTOF) m/z : [M + Na]⁺ Calcd for C₂₆H₂₃INaO₃⁺ 533.0584; Found 533.0591.

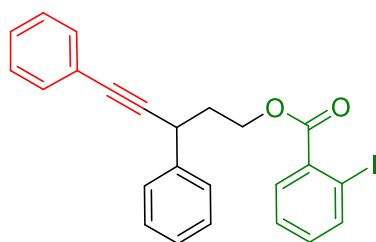
3-(4-(tert-butyl)phenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3d**)



Following the general procedure C, starting from 1-*tert*-butyl-4-cyclopropylbenzene (**1q**) (34.9 mg, 200 μ mol, 1.00 equiv), phenyl ethynyl benziiodoxolone (**2a**) (139 mg, 400 μ mol, 2.00 equiv) and 10-phenyl-9-(2,4,6-trimethylphenyl)acridin-10-ium tetrafluoroborate (1.85 mg, 4.00 μ mol, 0.0200 equiv) under kessil lamp 467 nm. The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 99:1 to 92:8) affording 3-(4-(*tert*-butyl)phenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3d**) (53.2 mg, 102 μ mol, 51% yield) as pale yellow oil. R_f : 0.55 (SiO₂, 20:1 Pentane/ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 8.00 (dd, J = 7.9, 1.2 Hz, 1H, ArH), 7.81 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 7.48 – 7.44 (m, 2H, ArH), 7.41 – 7.36 (m, 5H, ArH), 7.33–7.27 (m, 3H, ArH), 7.15 (td, J = 7.7, 1.7

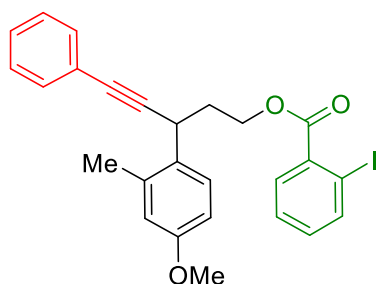
Hz, 1H, ArH), 4.60 (ddd, $J = 11.1, 7.4, 6.1$ Hz, 1H, OCH₂CH₂), 4.51 (dt, $J = 11.4, 5.9$ Hz, 1H, OCH₂CH₂), 4.18 – 4.11 (m, 1H, CHCH₂), 2.40 – 2.24 (m, 2H, OCH₂CH₂), 1.33 (s, 9H, C(CH₃)₃). **¹³C NMR** (101 MHz, CDCl₃) δ 166.6, 150.1, 142.2, 141.4, 138.0, 135.4, 132.7, 131.8, 131.2, 128.9, 128.3, 128.0, 127.3, 125.8, 125.5, 123.6, 94.1, 90.5, 84.0, 63.9, 37.2, 35.0, 34.6, 31.5. **IR** ($\nu_{\max}$, cm⁻¹) 2953 (m), 2868 (w), 2196 (w), 1711 (s), 1289 (s), 1269 (s), 1249 (s), 1228 (m), 1125 (s), 1105 (s), 1014 (s), 752 (s), 741 (s). **HRMS** (ESI/QTOF) m/z : [M + H]⁺ Calcd for C₂₈H₂₈IO₂⁺ 523.1129; Found 523.1136.

3,5-Diphenylpent-4-yn-1-yl 2-iodobenzoate (3e)



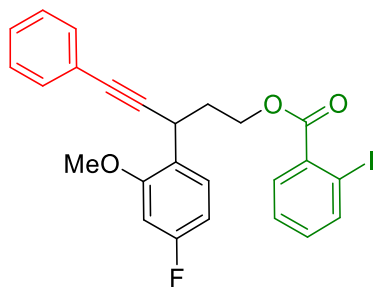
Following the general procedure C, starting from cyclopropylbenzene (23.6 mg, 200 μ mol, 1.00 equiv), phenyl ethynyl benziodoxolone (**2a**) (139 mg, 400 μ mol, 2.00 equiv) and 10-phenyl-9-(2,4,6-trimethylphenyl)acridin-10-ium tetrafluoroborate (1.85 mg, 4.00 μ mol, 0.0200 equiv) under kessil lamp 467 nm. The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 99:1 to 92:8) affording 3,5-diphenylpent-4-yn-1-yl 2-iodobenzoate (**3e**) (37.2 mg, 79.8 μ mol, 40% yield) as colorless oil. **R_f**: 0.46 (SiO₂, 20:1 Pentane/ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 8.00 (dd, $J = 8.0, 1.2$ Hz, 1H, ArH), 7.77 (dd, $J = 7.8, 1.7$ Hz, 1H, ArH), 7.49 (d, $J = 1.6$ Hz, 1H, ArH), 7.47 – 7.43 (m, 3H, ArH), 7.37 (dddd, $J = 7.8, 5.9, 4.8, 1.4$ Hz, 3H, ArH), 7.33 – 7.26 (m, 4H, ArH), 7.15 (td, $J = 7.6, 1.7$ Hz, 1H, ArH), 4.59 (ddd, $J = 11.2, 7.5, 6.0$ Hz, 1H, OCH₂CH₂), 4.50 (dt, $J = 11.3, 5.9$ Hz, 1H, OCH₂CH₂), 4.17 (dd, $J = 8.5, 6.3$ Hz, 1H, CHCH₂), 2.39 – 2.25 (m, 2H, OCH₂CH₂). **¹³C NMR** (101 MHz, CDCl₃): ¹³C NMR (101 MHz, CDCl₃) δ 166.6, 141.4, 141.2, 135.4, 132.8, 131.8, 131.2, 128.9, 128.4, 128.1, 128.0, 127.6, 127.2, 123.5, 94.1, 90.2, 84.2, 63.8, 37.3, 35.5. **IR** ($\nu_{\max}$, cm⁻¹) 3061 (w), 2957 (w), 2198 (w), 1711 (s), 1706 (m), 1289 (s), 1271 (s), 1249 (s), 1231 (m), 1133 (s), 1102 (m), 1013 (s), 757 (s), 741 (s), 714 (s). **HRMS** (ESI/QTOF) m/z : [M + Na]⁺ Calcd for C₂₄H₁₉INaO₂⁺ 489.0322; Found 489.0331.

3-(4-Methoxy-2-methylphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3f**)



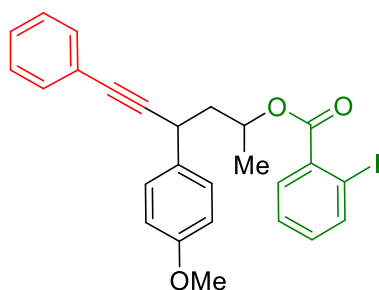
Following the general procedure C, starting from 1-cyclopropyl-4-methoxy-2-methylbenzene **1b** (32.4 mg, 200 μmol , 1.00 equiv) and **PhEBX** (174 mg, 500 μmol , 2.50 equiv), The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 97:3 to 90:10) affording 3-(4-methoxy-2-methylphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3f**) (62.3 mg, 122 μmol , 61% yield) as colorless oil. **R_f** = 0.31 (SiO₂, 20:1 Pentane/ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 8.00 (dd, J = 7.9, 1.2 Hz, 1H, ArH), 7.79 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 7.51 (d, J = 8.5 Hz, 1H, ArH), 7.46 – 7.41 (m, 2H, ArH), 7.38 (td, J = 7.6, 1.2 Hz, 1H, ArH), 7.29 (dp, J = 4.6, 1.7 Hz, 3H, ArH), 7.15 (td, J = 7.6, 1.7 Hz, 1H, ArH), 6.78 (dd, J = 8.5, 2.8 Hz, 1H, ArH), 6.72 (d, J = 2.8 Hz, 1H, ArH), 4.61 (ddd, J = 11.1, 8.0, 5.7 Hz, 1H, OCH₂CH₂), 4.54 (dt, J = 11.2, 5.6 Hz, 1H, OCH₂CH₂), 4.27 (dd, J = 9.1, 5.6 Hz, 1H, CCCHCH₂), 3.79 (s, 3H, OCH₃), 2.39 (s, 3H, ArCH₃), 2.25 (dq, J = 14.0, 8.4, 5.6 Hz, 2H, OCH₂CH₂CH). **¹³C NMR** (101 MHz, CDCl₃) δ 166.6, 158.5, 141.5, 136.5, 135.3, 134.2, 132.8, 131.8, 131.6, 131.1, 128.8, 128.4, 128.0, 123.6, 116.3, 111.8, 94.2, 90.9, 83.4, 64.0, 55.4, 36.0, 31.4, 19.7. **IR** (ν_{max} , cm⁻¹) 2957 (m), 2363 (w), 1727 (s), 1721 (s), 1609 (m), 1582 (m), 1502 (s), 1288 (s), 1267 (m), 1250 (s), 758 (s), 742 (s). **HRMS** (ESI/QTOF) m/z : [M + H]⁺ Calcd for C₂₆H₂₄IO₃⁺ 511.0765; Found 511.0764.

3-(4-Fluoro-2-methoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3h**)



Following the general procedure C, starting from 1-cyclopropyl-4-fluoro-2-methoxybenzene (**1r**) (33.2 mg, 200 μ mol, 1.00 equiv) and phenyl ethynyl benziodoxolone (**2a**) (174 mg, 500 μ mol, 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flash pure cartridge 25 g, gradient of Pentane:EtOAc from 95:5 to 88:12) affording 3-(4-fluoro-2-methoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodobenzoate (**3h**) (47.1 mg, 91.6 μ mol, 46% yield) as pale yellow oil. *R_f* = 0.33 (SiO₂, 10:1 Pentane/ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 8.00 (dd, *J* = 7.9, 1.2 Hz, 1H, ArH), 7.81 (dd, *J* = 7.8, 1.7 Hz, 1H, ArH), 7.59 (dd, *J* = 8.5, 6.7 Hz, 1H, ArH), 7.49 – 7.42 (m, 2H, ArH), 7.36 (td, *J* = 7.6, 1.2 Hz, 1H, ArH), 7.30 (m, 3H, ArH), 7.14 (td, *J* = 7.7, 1.7 Hz, 1H, ArH), 6.68 (td, *J* = 8.3, 2.5 Hz, 1H, ArH), 6.60 (dd, *J* = 10.8, 2.5 Hz, 1H, ArH), 4.60 – 4.45 (m, 3H, OCH₂CH₂ and CCCHCH₂), 3.80 (s, 3H, OCH₃), 2.30 (m, 1H, CH₂CH₂CH), 2.18 (m, 1H, CH₂CH₂CH). ¹³C NMR δ 166.4, 162.9 (d, *J* = 245.1 Hz), 157.3 (d, *J* = 9.7 Hz), 141.5, 135.0, 132.8, 131.8, 131.3, 129.7, 129.5 (d, *J* = 9.8 Hz), 128.4, 128.0 (d, *J* = 17.2 Hz), 125.0 (d, *J* = 3.1 Hz), 123.5, 107.1 (d, *J* = 21.2 Hz), 99.0 (d, *J* = 26.0 Hz), 94.4, 90.4, 83.6, 64.0, 55.8, 35.5, 28.7. ¹⁹F NMR (376 MHz, CDCl₃) δ -113.0. IR (ν_{max} , cm⁻¹) 2957 (w), 2843 (w), 2227 (w), 1724 (s), 1601 (s), 1496 (s), 1282 (s), 1248 (s), 1151 (s), 1133 (s), 1104 (s), 952 (s), 835 (s), 758 (s), 741 (s). HRMS (ESI/QTOF) *m/z*: [M + H]⁺ Calcd for C₂₅H₂₁FO₃⁺ 515.0514; Found 515.0527.

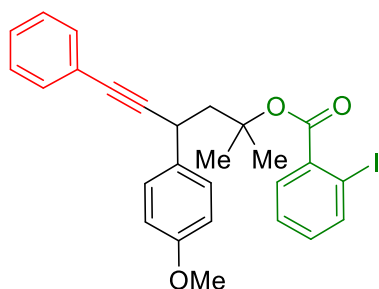
4-(4-Methoxyphenyl)-6-phenylhex-5-yn-2-yl 2-iodobenzoate (**3i**)



Following the general procedure C, starting from 1-methoxy-4-(2-methylcyclopropyl)benzene (**1s**) (32.4 mg, 200 μ mol, 1.00 equiv) and phenyl ethynyl benziodoxolone (**2a**) (174 mg, 500 μ mol, 2.50 equiv) The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 95:5 to 90:10) affording 4-(4-methoxyphenyl)-6-phenylhex-5-yn-2-yl 2-iodobenzoate (**3i**) as a colorless oil (mixture of two diastereomers, 71.5 mg, 140 μ mol, 70% yield, dr 2:1, the ratio was determined by integration

of the ^1H NMR signals for the benzylic protons ArCH). **R_f** = 0.3 (SiO₂, 10:1 Pentane/ethyl acetate). **^1H NMR** (400 MHz, CDCl₃ signals for major diastereomer) δ 7.98 (d, J = 7.9 Hz, 1H, ArH), 7.76 (dd, J = 7.7, 1.7 Hz, 1H, ArH), 7.48 – 7.43 (m, 2H, ArH), 7.39 – 7.36 (m, 3H, ArH), 7.29 – 7.27 (m, 3H, ArH), 7.16 – 7.13 (m, 1H, ArH), 6.91 – 6.87 (m, 2H, ArH), 5.54 (dq, J = 9.6, 6.2, 3.3 Hz, 1H, OCH(CH₃)CH₂), 4.10 (dd, J = 10.5, 5.0 Hz, 1H, CH₂CHCC), 3.80 (s, 3H, OCH₃), 2.27 (ddd, J = 14.5, 9.7, 5.0 Hz, 1H, CHCH₂CH(CH₃)), 2.10 – 2.05 (m, 1H, CHCH₂CH(CH₃)), 1.47 (d, J = 6.2 Hz, 3H, OCHCH₃). **^{13}C NMR** (101 MHz, CDCl₃ signals for major diastereomer) δ 166.3, 158.7, 141.3, 136.2, 133.7, 132.5, 131.9, 130.8, 128.7, 128.5, 128.3, 128.0, 123.6, 114.2, 93.9, 90.4, 84.2, 71.5, 55.4, 45.0, 34.7, 20.6. **IR** (ν_{max} , cm⁻¹) 2931 (w), 2836 (w), 2250 (w), 1726 (s), 1705 (m), 1511 (s), 1464 (m), 1287 (s), 1249 (s), 1177 (m), 1130 (s), 1101 (m), 1065 (m), 1038 (s), 1014 (m), 829 (m), 758 (s), 740 (s). **HRMS** (ESI/QTOF) m/z : [M + Na]⁺ Calcd for C₂₆H₂₃INaO₃⁺ 533.0584; Found 533.0589.

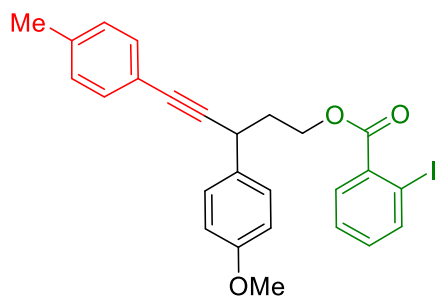
4-(4-Methoxyphenyl)-2-methyl-6-phenylhex-5-yn-2-yl 2-iodobenzoate (**3j**)



Following the general procedure C, starting from 1-(2,2-dimethylcyclopropyl)-4-methoxybenzene (**1t**) (35.3 mg, 200 μmol , 1.00 equiv) and phenyl ethynyl beniodoxolone (**2a**) (174 mg, 500 μmol , 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 95:5 to 88:12) affording 4-(4-methoxyphenyl)-2-methyl-6-phenylhex-5-yn-2-yl 2-iodobenzoate (**3j**) (56.8 mg, 108 μmol , 54% yield) as colorless oil. **R_f** = 0.33 (SiO₂, 20:1 Pentane/ethyl acetate). **^1H NMR** : (400 MHz, CDCl₃) δ 7.94 (dd, J = 7.9, 1.2 Hz, 1H, ArH), 7.69 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 7.38 (d, J = 8.7 Hz, 2H, ArH), 7.36 – 7.32 (m, 2H, ArH), 7.31 – 7.26 (m, 3H, ArH), 7.25 (d, J = 1.7 Hz, 1H, ArH), 7.09 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 6.89 – 6.84 (m, 2H, ArH), 4.12 – 4.05 (m, 1H, CH₂CHCC), 3.79 (s, 3H, OCH₃), 2.54 – 2.46 (m, 2H, OCCH₂CH), 1.82 (s, 3H, CH₂C(CH₃)₂), 1.76 (s, 3H, CH₂C(CH₃)₂). **^{13}C NMR** (101 MHz, CDCl₃) δ 166.0, 158.5, 141.1,

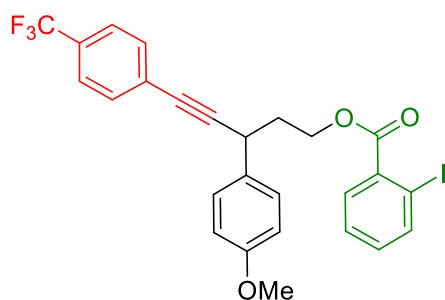
136.7, 134.9, 132.2, 131.6, 131.0, 128.6, 128.3, 127.9, 127.8, 123.8, 114.2, 93.8, 92.5, 84.2, 83.6, 55.4, 49.2, 33.4, 27.2, 26.6. **IR** ($\nu_{\max}$, cm^{-1}) 2977 (w), 2932 (w), 2835 (w), 2359 (w), 1723 (s), 1610 (w), 1583 (w), 1512 (s), 1299 (s), 1251 (s), 1122 (s), 1103 (m), 758 (m), 741 (s). **HRMS** (ESI/QTOF) m/z : $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{27}\text{H}_{25}\text{INaO}_3^+$ 547.0741; Found 547.0740.

3-(4-Methoxyphenyl)-5-(p-tolyl)pent-4-yn-1-yl 2-iodobenzoate (**3k**)



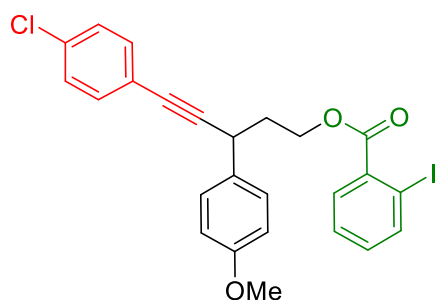
Following the general procedure C, starting from 1-cyclopropyl-4-methoxybenzene (**1a**) (29.6 mg, 200 μmol , 1.00 equiv) and 1-(*p*-tolylethynyl)-1,2-benziodoxol-3(1H)-one (**2b**) (181 mg, 500 μmol , 2.50 equiv) The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 99:5 to 88:12) affording 3-(4-methoxyphenyl)-5-(*p*-tolyl)pent-4-yn-1-yl 2-iodobenzoate (**3k**) (45.8 mg, 89.7 μmol , 45% yield) as pale yellow oil. R_f = 0.4 (SiO_2 , 10:1 Pentane/ethyl acetate). **^1H NMR** (400 MHz, CDCl_3) δ 7.99 (dd, J = 7.9, 1.2 Hz, 1H, ArH), 7.77 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 7.41 – 7.35 (m, 3H, ArH), 7.35 – 7.31 (m, 2H, ArH), 7.15 (td, J = 7.7, 1.7 Hz, 1H, ArH), 7.12 – 7.08 (m, 2H, ArH), 6.93 – 6.86 (m, 2H, ArH), 4.57 (dt, J = 11.1, 6.6 Hz, 1H, OCH_2CH_2), 4.48 (dt, J = 11.3, 5.9 Hz, 1H, OCH_2CH_2), 4.10 (dd, J = 8.1, 6.7 Hz, 1H, CCCHCH_2), 3.80 (s, 3H, OCH_3), 2.34 (s, 3H, ArCH_3), 2.28 (dtd, J = 8.0, 6.1, 1.8 Hz, 2H, $\text{CH}_2\text{CH}_2\text{CH}$). **^{13}C NMR** (101 MHz, CDCl_3) δ 166.6, 158.8, 141.4, 138.1, 135.4, 133.3, 132.7, 131.7, 131.2, 129.1, 128.6, 128.0, 120.5, 114.2, 94.1, 89.7, 84.1, 63.8, 55.4, 37.4, 34.7, 21.6. **IR** ($\nu_{\max}$, cm^{-1}) 2956 (w), 2923 (w), 1728 (m), 1610 (w), 1584 (w), 1512 (s), 1462 (m), 1288 (m), 1251 (s), 1133 (m), 820 (m), 743 (m). **HRMS** (APPI/LTQ-Orbitrap) m/z : $[\text{M} + \text{H}]^+$ Calcd for $\text{C}_{26}\text{H}_{24}\text{IO}_3^+$ 511.0765; Found 511.0782.

3-(4-Methoxyphenyl)-5-(4-(trifluoromethyl)phenyl)pent-4-yn-1-yl 2-iodobenzoate (**3l**)



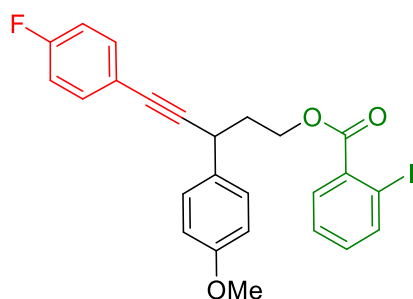
Following the general procedure C, starting from 1-cyclopropyl-4-methoxybenzene (**1a**) (29.6 mg, 200 μ mol, 1.00 equiv) and 1-[4-trifluoromethylphenylethynyl]-1,2-benziodoxol-3(1H)-one (**2c**) (208 mg, 500 μ mol, 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of Pentane:EtOAc from 97:3 to 88:12) affording 3-(4-methoxyphenyl)-5-(4-(trifluoromethyl)phenyl)pent-4-yn-1-yl 2-iodobenzoate (**3l**) (71.4 mg, 127 μ mol, 63% yield) as pale yellow oil. R_f = 0.29 (SiO₂, 20:1 Pentane/ethyl acetate). $^1\text{H NMR}$ (400 MHz, CDCl₃) δ 8.00 (dd, J = 8.0, 1.2 Hz, 1H, ArH), 7.76 (dd, J = 7.8, 1.8 Hz, 1H, ArH), 7.57 – 7.49 (m, 4H, ArH), 7.40 – 7.33 (m, 3H, ArH), 7.16 (dd, J = 7.7, 1.8 Hz, 1H, ArH), 6.93 – 6.85 (m, 2H, ArH), 4.56 (dt, J = 11.1, 6.6 Hz, 1H, OCH₂CH₂), 4.47 (dt, J = 11.4, 5.9 Hz, 1H, OCH₂CH₂), 4.12 (t, J = 7.4 Hz, 1H, CCCHCH₂), 3.81 (s, 3H, OCH₃), 2.40 – 2.25 (m, 2H, CH₂CH₂CH). $^{13}\text{C NMR}$ (101 MHz, CDCl₃) δ 166.6, 158.9, 141.5, 135.3, 132.8, 132.6, 132.1, 131.2, 130.0, 129.7, 128.6, 128.0, 127.4, 125.3 (q, J = 3.8 Hz), 114.4, 94.2, 93.4, 82.7, 63.6, 55.5, 37.1, 34.7. $^{19}\text{F NMR}$ (377 MHz, CDCl₃) δ -62.8. IR (ν_{max} , cm⁻¹) 2956 (w), 2932 (w), 2838 (w), 2233 (w), 1511 (m), 1323 (s), 1251 (s), 1176 (m), 1167 (m), 1127 (s), 1105 (m), 1067 (m). HRMS (ESI/QTOF) m/z : [M + H]⁺ Calcd for C₂₆H₂₁F₃IO₃⁺ 565.0482; Found 565.0477.

5-(4-Chlorophenyl)-3-(4-methoxyphenyl)pent-4-yn-1-yl 2-iodobenzoate (**3m**)



Following the general procedure C, starting from 1-cyclopropyl-4-methoxybenzene (**1a**) (29.6 mg, 200 μmol , 1.00 equiv) and 1-[4-chlorophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2d**) (191 mg, 500 μmol , 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 95:5 to 85:15) affording 5-(4-chlorophenyl)-3-(4-methoxyphenyl)pent-4-yn-1-yl 2-iodobenzoate (**3m**) (67.2 mg, 127 μmol , 63% yield) as pale yellow oil. **Rf** = 0.2 (SiO_2 , 10:1 pentane:ethyl acetate). **^1H NMR** (400 MHz, CDCl_3) δ 8.00 (dd, J =7.9, 1.2 Hz, 1H, ArH), 7.76 (dd, J =7.8, 1.7 Hz, 1H, ArH), 7.42 – 7.33 (m, 5H, ArH), 7.27 (s, 1H, ArH), 7.25 (d, J =1.7 Hz, 1H, ArH), 7.15 (td, J =7.7, 1.7 Hz, 1H, ArH), 6.93 – 6.86 (m, 2H, ArH), 4.55 (dt, J =11.1, 6.6 Hz, 1H, OCH_2CH_2), 4.46 (dt, J =11.4, 5.9 Hz, 1H, OCH_2CH_2), 4.09 (m, 1H, CCCHCH_2), 3.80 (s, 3H, OCH_3), 2.36 – 2.21 (m, 2H, $\text{CH}_2\text{CH}_2\text{CH}$). **^{13}C NMR** (101 MHz, CDCl_3) δ 166.6, 158.8, 141.5, 135.3, 134.0, 133.1, 132.9, 132.8, 131.2, 128.7, 128.6, 128.0, 122.0, 114.3, 94.2, 91.6, 82.9, 63.7, 55.5, 37.2, 34.7. **IR** (ν_{max} , cm^{-1}) 2956 (w), 2925 (w), 2838 (w), 2229 (w), 1725 (m), 1512 (m), 1488 (m), 1289 (s), 1250 (s), 1133 (m), 1094 (m), 1014 (m), 829 (m), 742 (m). **HRMS** (ESI/QTOF) m/z : $[\text{M} + \text{H}]^+$ Calcd for $\text{C}_{25}\text{H}_{21}\text{ClIO}_3^+$ 531.0218; Found 531.0223.

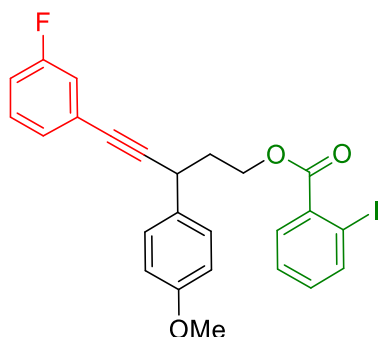
5-(4-Fluorophenyl)-3-(4-methoxyphenyl)pent-4-yn-1-yl 2-iodobenzoate (**3n**)



Following the general procedure C, starting from 1-cyclopropyl-4-methoxybenzene (**1a**) (29.6 mg, 200 μmol , 1.00 equiv) and 1-[4-fluorophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2e**) (183 mg, 500 μmol , 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 95:5 to 85:15) affording 5-(4-fluorophenyl)-3-(4-methoxyphenyl)pent-4-yn-1-yl 2-iodobenzoate (**3n**) (41.4 mg, 80.5 μmol , 40% yield) as pale yellow oil. **Rf** = 0.29 (SiO_2 , 20:1 pentane:ethyl acetate). **^1H NMR** (400 MHz, CDCl_3) δ 8.00 (dd, J =8.0, 1.2 Hz, 1H, ArH), 7.76 (dd, J =7.8, 1.7 Hz, 1H, ArH), 7.42 – 7.34 (m, 5H, ArH), 7.15 (td, J =7.7, 1.7 Hz, 1H, ArH), 6.98 (t, J =8.7 Hz, 2H, ArH), 6.92 – 6.85 (m, 2H, ArH), 4.55 (dt, J =11.3, 6.6 Hz, 1H, OCH_2CH_2), 4.46 (dt, J =11.3, 5.9 Hz, 1H,

OCH₂CH₂), 4.09 (t, *J* = 7.4 Hz, 1H, CCCHCH₂), 3.80 (s, 3H, OCH₃), 2.34 – 2.23 (m, 2H, CH₂CH₂CH). **¹³C NMR** (201 MHz, CDCl₃) δ 166.6, 162.4 (d, *J* = 248.8 Hz), 158.8, 141.5, 135.4, 133.7 (d, *J* = 8.4 Hz), 133.1, 132.8, 131.2, 128.6, 128.0, 119.6, 115.6 (d, *J* = 22.2 Hz), 114.3, 94.2, 90.2, 82.9, 63.8, 55.5, 37.3, 34.6. **¹⁹F NMR** (377 MHz, CDCl₃) δ -111.6. **IR** (ν_{max}, cm⁻¹) 2959 (m), 2929 (w), 2228 (w), 2150 (w), 1721 (m), 1600 (m), 1505 (s), 1288 (s), 1265 (s), 1255 (s), 1249 (s), 1231 (s), 1094 (m), 1030 (m), 1015 (s), 837 (s), 740 (s). **HRMS** (APCI/QTOF) *m/z*: [M + H]⁺ Calcd for C₂₅H₂₁FIO₃⁺ 515.0514; Found 515.0515.

5-(3-Fluorophenyl)-3-(4-methoxyphenyl)pent-4-yn-1-yl 2-iodobenzoate (**3o**)

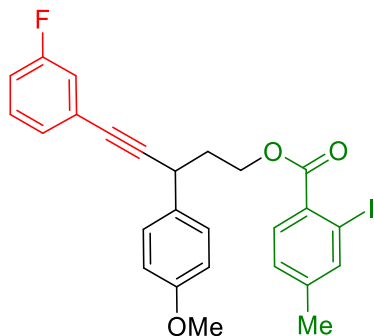


Following the general procedure C, starting from 1-cyclopropyl-4-methoxybenzene (**1a**) (29.6 mg, 200 μmol, 1.00 equiv) and 1-[3-fluorophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2f**) (183 mg, 500 μmol, 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 95:5 to 85:15) affording 5-(3-fluorophenyl)-3-(4-methoxyphenyl)pent-4-yn-1-yl 2-iodobenzoate (**3o**) (28.2 mg, 54.8 μmol, 27% yield) as pale yellow oil. *R_f* = 0.26 (SiO₂, 10:1 pentane:ethyl acetate).

¹H NMR (400 MHz, CDCl₃) δ 8.00 (dd, *J* = 7.9, 1.2 Hz, 1H, ArH), 7.77 (dd, *J* = 7.8, 1.7 Hz, 1H, ArH), 7.41 – 7.33 (m, 3H, ArH), 7.26 – 7.19 (m, 2H, ArH), 7.18 – 7.10 (m, 2H, ArH), 7.03 – 6.96 (m, 1H, ArH), 6.93 – 6.87 (m, 2H, ArH), 4.59 – 4.51 (m, 1H, OCH₂CH₂), 4.50 – 4.42 (m, 1H, OCH₂CH₂), 4.10 (t, *J* = 7.4 Hz, 1H, CCCHCH₂), 3.81 (s, 3H, OCH₃), 2.29 (dt, *J* = 7.3, 6.2 Hz, 2H, CH₂CH₂CH). **¹³C NMR** (101 MHz, CDCl₃) δ 166.5, 162.3 (d, *J* = 246.2 Hz), 158.7, 141.3, 135.2, 134.1, 132.7, 131.1, 129.8 (d, *J* = 8.7 Hz), 128.5, 127.9, 127.6 (d, *J* = 3.2 Hz), 125.2 (d, *J* = 9.5 Hz), 118.5 (d, *J* = 22.6 Hz), 115.3 (d, *J* = 21.2 Hz), 114.2, 94.0, 91.6, 82.7 (d, *J* = 3.4 Hz), 63.5, 55.3, 37.1, 34.5. **¹⁹F NMR** (377 MHz, CDCl₃) δ -113.2. **IR** (ν_{max}, cm⁻¹) 2931 (w), 2836 (w), 2229 (w), 1726 (m), 1581 (m), 1510 (s), 1288 (s), 1247 (s), 1176 (m), 1015 (m), 785 (m), 740 (s).

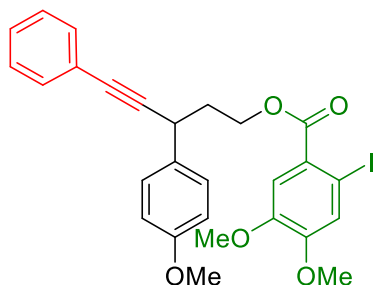
HRMS (APCI/QTOF) m/z : $[M + H]^+$ Calcd for $C_{25}H_{21}FIO_3^+$ 515.0514; Found 515.0528.

5-(3-Fluorophenyl)-3-(4-methoxyphenyl)pent-4-yn-1-yl 2-iodo-4-methylbenzoate (3p)



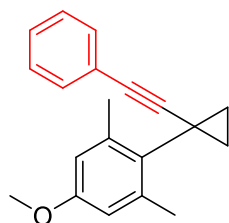
Following the general procedure C, starting from 1-cyclopropyl-4-methoxybenzene (**1a**) (29.6 mg, 200 μ mol, 1.00 equiv) and 1-[3-fluorophenylethynyl]-5-methyl-1,2-benziodoxol-3(1H)-one (**2g**) (190 mg, 500 μ mol, 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 95:5 to 85:15) affording 5-(3-fluorophenyl)-3-(4-methoxyphenyl)pent-4-yn-1-yl 2-iodo-4-methylbenzoate (**3p**) (54.3 mg, 103 μ mol, 51% yield) as pale yellow oil. **Rf** = 0.32 (SiO_2 , 20:1 pentane:ethyl acetate). **1H NMR** (400 MHz, $CDCl_3$) δ 7.84 (d, J = 8.1 Hz, 1H, *ArH*), 7.57 (dd, J = 2.2, 0.8 Hz, 1H, *ArH*), 7.40 – 7.33 (m, 2H, *ArH*), 7.26 – 7.18 (m, 2H, *ArH*), 7.12 (ddd, J = 9.5, 2.6, 1.4 Hz, 1H, *ArH*), 6.96 – 7.02 (m, 2H, *ArH*), 6.92 – 6.88 (m, 2H, *ArH*), 4.54 (dt, J = 11.1, 6.7 Hz, 1H, OCH_2CH_2), 4.46 (dt, J = 11.3, 6.0 Hz, 1H, OCH_2CH_2), 4.10 (t, J = 7.4 Hz, 1H, $CCCHCH_2$), 3.80 (s, 3H, OCH_3), 2.32 (s, 3H, $ArCH_3$), 2.32 – 2.26 (m, 2H, CH_2CH_2CH). **^{13}C NMR** (101 MHz, $CDCl_3$) δ 166.8, 162.5 (d, J = 246.2 Hz), 158.8, 141.2, 138.3, 135.2, 133.8, 132.8, 131.9, 129.9 (d, J = 8.6 Hz), 128.6, 127.7 (d, J = 3.0 Hz), 125.4 (d, J = 9.4 Hz), 118.6 (d, J = 22.7 Hz), 115.4 (d, J = 21.3 Hz), 114.3, 91.7, 90.0, 82.8 (d, J = 3.3 Hz), 63.6, 55.4, 37.2, 34.6, 20.9. **^{19}F NMR** (377 MHz, $CDCl_3$) δ -113.2. **IR** (ν_{max} , cm^{-1}) 2958 (w), 2836 (w), 2363 (w), 2232 (w), 1724 (s), 1611 (m), 1579 (m), 1512 (s), 1294 (s), 1249 (s), 1203 (s), 1173 (m), 1108 (m), 1036 (m), 1015 (m), 779 (m). **HRMS** (APCI/QTOF) m/z : $[M + H]^+$ Calcd for $C_{26}H_{23}FIO_3^+$ 529.0670; Found 529.0679.

3-(4-Methoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodo-4,5-dimethoxybenzoate (**3q**)



Following the general procedure C, starting from 1-cyclopropyl-4-methoxybenzene (**1a**) (29.6 mg, 200 μmol , 1.00 equiv) and 4,5-dimethoxy-1-[phenylethynyl]-1,2-benziodoxol-3(1H)-one (**2h**) (204 mg, 500 μmol , 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 85:15 to 70:30) affording 3-(4-methoxyphenyl)-5-phenylpent-4-yn-1-yl 2-iodo-4,5-dimethoxybenzoate (**3q**) (33.7 mg, 60.6 μmol , 30% yield) as colorless oil. **Rf** = 0.14 (SiO_2 , 10:1 pentane:ethyl acetate). **^1H NMR** (400 MHz, CDCl_3) δ 7.46 – 7.41 (m, 3H, ArH), 7.38 (d, J = 8.3 Hz, 3H, ArH), 7.32 – 7.27 (m, 3H, ArH), 6.92 – 6.86 (m, 2H, ArH), 4.61 – 4.51 (m, 1H, OCH_2CH_2), 4.51 – 4.43 (m, 1H, OCH_2CH_2), 4.11 (dd, J = 8.2, 6.6 Hz, 1H, CCCHCH_2), 3.92 (s, 3H, OCH_3), 3.88 (s, 3H, OCH_3), 3.80 (s, 3H, OCH_3), 2.35 – 2.22 (m, 2H, $\text{CH}_2\text{CH}_2\text{CH}$). **^{13}C NMR** (201 MHz, CDCl_3) δ 165.7, 158.8, 152.0, 148.8, 133.2, 131.8, 128.6, 128.4, 128.1, 126.6, 123.8, 123.5, 114.2, 114.2, 90.6, 84.6, 84.0, 63.7, 56.4, 56.2, 55.5, 37.4, 34.7. **IR** (ν_{max} , cm^{-1}) 2960 (m), 2924 (m), 2849 (w), 1720 (m), 1510 (s), 1261 (s), 1246 (s), 1204 (s), 1174 (s), 1111 (m), 1024 (s), 795 (m). **HRMS** (ESI/QTOF) m/z : $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{27}\text{H}_{25}\text{INaO}_5^+$ 579.0639; Found 579.0658.

5-Methoxy-1,3-dimethyl-2-(1-(phenylethynyl)cyclopropyl)benzene (**4a**)



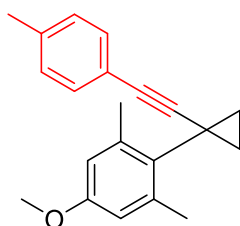
Following the general procedure C, starting from **1c** (35.3 mg, 200 μmol , 1.00 equiv) and **2a** (104 mg, 300 μmol , 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to

95:5) affording (**4a**) (46.1 mg, 167 μ mol, 83% yield) as white solid. **MP**: 60 - 62°C. **Rf** = 0.55 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.37 – 7.31 (m, 2H, ArH), 7.23 (m, 3H, ArH), 6.59 (s, 2H, ArH), 3.78 (s, 3H, OCH₃), 2.53 (s, 6H, 2xArCH₃), 1.55 – 1.49 (m, 2H, CH^aH^bCH^aH^b), 1.17 – 1.09 (m, 2H, CH^aH^bCH^aH^b). **¹³C NMR** (101 MHz, CDCl₃) δ 158.3, 140.1, 131.8, 131.1, 128.2, 127.4, 124.2, 113.6, 94.5, 75.6, 55.2, 20.9, 19.8, 13.0. **IR** ($\nu_{\max}$, cm⁻¹) 3005 (w), 2955 (w), 2922 (w), 2836 (w), 2226 (w), 1597 (m), 1484 (m), 1329 (m), 1313 (m), 1158 (s), 1058 (m), 756 (s). **HRMS** (ESI/QTOF) m/z : [M + H]⁺ Calcd for C₂₀H₂₁O⁺ 277.1587; Found 277.1587.

*Scale-up experiment

In a schlenk tube 50 ml, **2a** (3 mmol, 1.5 equiv) was added. The tube was then closed with a rubber septum and sealed off with parafilm. Three cycles of evacuate-refill with nitrogen were performed to remove O₂ and CHCl₃ (20 mL) was added, followed by three cycles of Freeze Pump Thaw to completely remove O₂. After that, **1c** (353 mg, 2.00 mmol, 1.00 equiv) was added under N₂ atmosphere and the top of the schlenk tube was sealed again with parafilm. The reaction was monitored by NMR with CH₂Br₂ as internal standard. Upon complete conversion of the starting material, the mixture was concentrated in vacuo and purified by column chromatography on Biotage (Büchi flashpure cartridge 40 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) to give product **4a** (511 mg, 1.85 mmol, 92% yield).

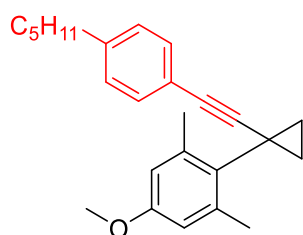
5-Methoxy-1,3-dimethyl-2-(1-(p-tolylethynyl)cyclopropyl)benzene (**4b**)



Following the general procedure C, starting from **1c** (35.3 mg, 200 μ mol, 1.00 equiv) and 1-[tolylethynyl]-1,2-benziodoxol-3(1H)-one (**2b**) (109 mg, 300 μ mol, 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) affording **4b** (37.9 mg, 131 μ mol, 65% yield) as pale yellow oil. **Rf** = 0.6 (SiO₂, 20:1 pentane:ethyl acetate). **¹H NMR** : ¹H NMR (400 MHz, CDCl₃) δ 7.22 (d, J = 8.0 Hz, 2H, ArH), 7.04 (d, J = 8.0 Hz, 2H, ArH), 6.58 (s, 2H, ArH), 3.77

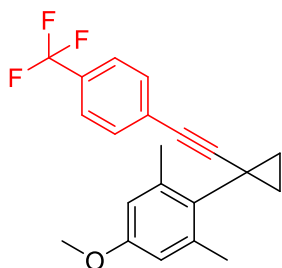
(s, 3H, OCH₃), 2.53 (s, 6H, ArCH₃), 2.31 (s, 3H), 1.51 (m, 2H, CH^aH^bCH^aH^b), 1.13 – 1.05 (m, 2H, CH^aH^bCH^aH^b). **¹³C NMR** ¹³C NMR (101 MHz, CDCl₃) δ 158.3, 140.1, 137.4, 131.7, 131.3, 128.9, 121.1, 113.6, 93.7, 75.6, 55.2, 21.5, 20.9, 19.8, 13.1. **IR** (film): IR (ν_{max}, cm⁻¹) 2921 (m), 2838 (w), 2226 (w), 1604 (s), 1507 (m), 1484 (m), 1468 (m), 1462 (m), 1327 (s), 1311 (s), 1193 (m), 1157 (s), 1057 (m), 818 (s). **HRMS** (APPI/LTQ-Orbitrap) m/z: [M]⁺ Calcd for C₂₁H₂₂O⁺ 290.1665; Found 290.1671.

5-Methoxy-1,3-dimethyl-2-(1-((4-pentylphenyl)ethynyl)cyclopropyl)benzene (4c)



Following the general procedure C, starting from **1c** (35.3 mg, 200 μmol, 1.00 equiv) and 1-[4-*n*-pentylphenylethynyl]-1,2-benziodoxol-3(1H)-one (**2i**) (125 mg, 300 μmol, 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) affording **4c** (27.9 mg, 80.5 μmol, 40% yield) as pale yellow oil. **R_f** = 0.57 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** : ¹H NMR (400 MHz, CDCl₃) δ 7.26 – 7.20 (m, 2H, ArH), 7.07 – 7.01 (m, 2H, ArH), 6.58 (s, 2H, ArH), 3.77 (s, 3H, OCH₃), 2.57 – 2.53 (m, 2H, ArCH₂CH₂), 2.52 (s, 6H, ArCH₃) 1.61 – 1.54 (m, 2H, ArCH₂CH₂), 1.53 – 1.47 (m, 2H, CH^aH^bCH^aH^b), 1.35 – 1.23 (m, 4H, ArC₂H₄C₂H₄), 1.13 – 1.03 (m, 2H, CH^aH^bCH^aH^b), 0.87 (t, *J* = 7.0 Hz, 3H, ArC₄H₈CH₃). **¹³C NMR** : ¹³C NMR (101 MHz, CDCl₃) δ 158.3, 142.5, 140.1, 131.7, 131.3, 128.3, 121.3, 113.5, 93.7, 75.6, 55.2, 35.9, 31.5, 31.1, 22.6, 20.9, 19.8, 14.1, 13.1. **IR** (film): IR (ν_{max}, cm⁻¹) 2957 (s), 2924 (s), 2856 (m), 2224 (w), 1604 (s), 1508 (s), 1485 (s), 1462 (m), 1328 (s), 1312 (s), 1155 (s), 1061 (s), 855 (m), 835 (s). **HRMS** (APPI/LTQ-Orbitrap) m/z: [M]⁺ Calcd for C₂₅H₃₀O⁺ 346.2291; Found 346.2304.

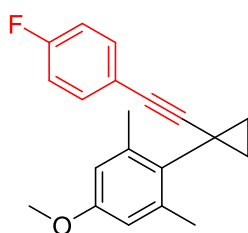
5-Methoxy-1,3-dimethyl-2-(1-((4-(trifluoromethyl)phenyl)ethynyl)cyclopropyl)benzene (4d)



Following the general procedure C, starting from **1c** (35.3 mg, 200 μmol , 1.00 equiv) and 1-[4-trifluoromethylphenylethynyl]-1,2-benziodoxol-3(1H)-one **2c** (124 mg, 300 μmol , 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) affording **4d** (55.8 mg, 162 μmol , 81% yield) as pale yellow oil.

Rf = 0.58 (SiO_2 , 40:1 pentane:ethyl acetate). **$^1\text{H NMR}$** (400 MHz, CDCl_3) δ 7.59 – 7.35 (m, 4H, ArH), 6.60 (s, 2H, ArH), 3.78 (s, 3H, OCH_3), 2.53 (s, 6H, Ar CH_3), 1.61 – 1.53 (m, 2H, $\text{CH}^a\text{H}^b\text{CH}^a\text{H}^b$), 1.20 – 1.09 (m, 2H, $\text{CH}^a\text{H}^b\text{CH}^a\text{H}^b$). **$^{13}\text{C NMR}$** (101 MHz, CDCl_3) δ 158.5, 140.1, 132.0, 130.6, 129.3, 128.1, 127.4, 125.1 (q, J = 3.8 Hz), 113.7, 97.4, 74.5, 55.2, 20.9, 20.0, 13.0. **$^{19}\text{F NMR}$** (377 MHz, CDCl_3) δ -62.7. **IR** (film): IR (ν_{max} , cm^{-1}) 2956 (w), 2925 (w), 2838 (w), 2226 (w), 2118 (w), 1604 (m), 1487 (m), 1322 (s), 1159 (s), 1126 (s), 1066 (s), 842 (m). **HRMS** (APPI/LTQ-Orbitrap) m/z : $[\text{M}]^+$ Calcd for $\text{C}_{21}\text{H}_{19}\text{F}_3\text{O}^+$ 344.1383; Found 344.1386.

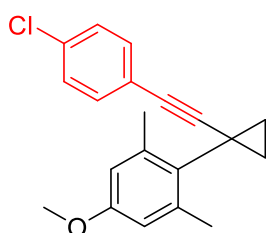
2-(1-((4-Fluorophenyl)ethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene (**4e**)



Following the general procedure C, starting from **1c** (35.3 mg, 200 μmol , 1.00 equiv) and 1-[4-Fluorophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2e**) (110 mg, 300 μmol , 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) affording **4e** (41.3 mg, 140 μmol , 70% yield) as pale yellow oil. **Rf** = 0.53 (SiO_2 , 40:1 pentane:ethyl acetate). **$^1\text{H NMR}$** : $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.34 – 7.27 (m, 2H, ArH), 6.96 – 6.88 (m, 2H, ArH), 6.58 (s, 2H, ArH), 3.77 (s, 3H, OCH_3), 2.52 (s, 6H, Ar CH_3), 1.53 – 1.48 (m, 2H, $-\text{CH}^a\text{H}^b\text{CH}^a\text{H}^b-$), 1.13 – 1.06 (m, 2H, -

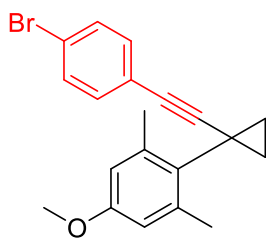
$\text{CH}^a\text{H}^b\text{CH}^a\text{H}^b$ -). **^{13}C NMR** : ^{13}C NMR (101 MHz, CDCl_3) δ 162.1 (d, $J = 249.5$ Hz), 158.4, 140.1, 133.6, 133.6, 131.0, 120.22 (d, $J = 3.6$ Hz), 115.5, 115.3, 113.6, 94.1, 74.5, 55.2, 20.9, 19.8, 13.0. **^{19}F NMR** (377 MHz, CDCl_3) δ -112.5. **IR** (ν_{max} , cm^{-1}) 3002 (w), 2955 (w), 2837 (w), 2228 (w), 1892 (w), 1603 (s), 1505 (s), 1484 (m), 1468 (m), 1329 (m), 1313 (s), 1223 (s), 1192 (m), 1158 (s), 1059 (m), 836 (s). **HRMS** (APPI/LTQ-Orbitrap) m/z : $[\text{M}]^+$ Calcd for $\text{C}_{20}\text{H}_{19}\text{FO}^+$ 294.1414; Found 294.1429.

2-(1-((4-Chlorophenyl)ethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene (**4f**)



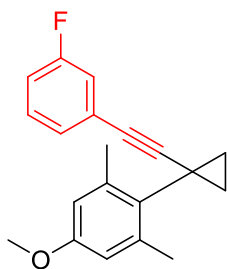
Following the general procedure C, starting from **1c** (35.3 mg, 200 μmol , 1.00 equiv) and 1-1-[4-chlorophenylethynyl]-1,2-benziodoxol-3(1H)-one (**2d**) (115 mg, 300 μmol , 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) affording **4f** (49.2 mg, 158 μmol , 79% yield) as white solid. **MP** : 73 $^{\circ}\text{C}$ - 75 $^{\circ}\text{C}$. **Rf** = 0.52 (SiO_2 , 40:1 pentane:ethyl acetate). **^1H NMR** (400 MHz, CDCl_3) δ 7.26 – 7.16 (m, 4H, ArH), 6.58 (s, 2H, ArH), 3.77 (s, 3H, OCH_3), 2.52 (s, 6H, ArCH_3), 1.54 – 1.48 (m, 2H, $-\text{CH}^a\text{H}^b\text{CH}^a\text{H}^b-$), 1.14 – 1.07 (m, 2H, $-\text{CH}^a\text{H}^b\text{CH}^a\text{H}^b-$). **^{13}C NMR** (101 MHz, CDCl_3) δ 158.4, 140.1, 133.3, 133.1, 130.8, 128.5, 122.7, 113.6, 95.6, 74.5, 55.2, 20.9, 19.9, 13.0. **IR** (ν_{max} , cm^{-1}) 3089 (w), 3003 (m), 2954 (m), 2837 (w), 2226 (m), 1603 (s), 1488 (s), 1314 (s), 1158 (s), 828 (s). **HRMS** (APPI/LTQ-Orbitrap) m/z : $[\text{M}]^+$ Calcd for $\text{C}_{20}\text{H}_{19}\text{ClO}^+$ 310.1119; Found 310.1133.

2-(1-((4-Bromophenyl)ethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene (4g)



Following the general procedure C, starting from **1c** (35.3 mg, 200 μ mol, 1.00 equiv) and 1-[4-bromophenylethynyl]-1,2-benziodoxol-3(1H)-one **2j** (128 mg, 300 μ mol, 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) affording **4g** (54.8 mg, 154 μ mol, 77% yield) as white solid. **MP**: 74 °C – 76 °C. **R_f** = 0.57 (SiO₂, 20:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.41 – 7.33 (m, 2H, ArH), 7.22 – 7.15 (m, 2H, ArH), 6.59 (s, 2H, ArH), 3.77 (s, 3H, OCH₃), 2.52 (s, 6H, ArCH₃), 1.55 – 1.48 (m, 2H, -CH^aH^bCH^aH^b-), 1.16 – 1.08 (m, 2H, CH^aH^bCH^aH^b). **¹³C NMR** (101 MHz, CDCl₃) δ 158.4, 140.1, 133.3, 131.4, 130.8, 123.2, 121.5, 113.6, 95.8, 74.6, 55.2, 20.9, 19.9, 13.0. **IR** (ν_{max} , cm⁻¹) 3001 (w), 2954 (m), 2837 (w), 2225 (w), 1602 (s), 1484 (s), 1326 (s), 1312 (s), 1157 (s), 1066 (s), 1058 (s), 823 (s). **HRMS** (APPI/LTQ-Orbitrap) m/z : [M + H]⁺ Calcd for C₂₀H₂₀BrO⁺ 355.0692; Found 355.0707.

2-(1-((3-Fluorophenyl)ethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene (4h)

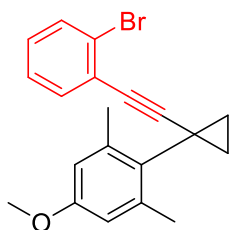


Following the general procedure C, starting from **1c** (35.3 mg, 200 μ mol, 1.00 equiv) and 1-[3-fluorophenylethynyl]-1,2-benziodoxol-3(1H)-one **2f** (110 mg, 300 μ mol, 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) affording **4h** (36.2 mg, 123 μ mol, 61% yield) as pale yellow oil. **R_f** = 0.3 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.18 (td, J = 8.0, 5.9 Hz, 1H, ArH), 7.10 (dt, J = 7.7, 1.3 Hz, 1H, ArH), 7.02 (ddd, J = 9.8, 2.7, 1.5 Hz, 1H, ArH), 6.96 – 6.89 (m, 1H, ArH), 6.59 (s, 2H, ArH), 3.77 (s, 3H, OCH₃), 2.52 (s,

6H, ArCH₃), 1.55 – 1.49 (m, 2H, CH^aH^bCH^aH^b), 1.15 – 1.09 (m, 2H, CH^aH^bCH^aH^b). ¹³C NMR (101 MHz, CDCl₃) δ 162.4 (d, *J* = 245.8 Hz), 158.4, 140.1, 130.8, 129.7 (d, *J* = 8.7 Hz), 127.7 (d, *J* = 2.9 Hz), 126.1 (d, *J* = 9.6 Hz), 118.6 (d, *J* = 22.5 Hz), 114.8 (d, *J* = 21.1 Hz), 113.6, 95.7, 74.5 (d, *J* = 3.4 Hz), 55.2, 20.9, 19.9, 13.0. ¹⁹F NMR (377 MHz, CDCl₃) δ -113.6. IR (ν_{max}, cm⁻¹) 2957 (m), 2837 (w), 2220 (m), 1606 (s), 1579 (s), 1487 (s), 1467 (m), 1315 (s), 1159 (s), 1059 (m), 920 (s), 783 (s).

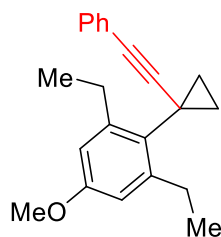
HRMS (APPI/LTQ-Orbitrap) *m/z*: [M + H]⁺ Calcd for C₂₀H₂₀FO⁺ 295.1493; Found 295.1489.

2-(1-((2-Bromophenyl)ethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene (4i)



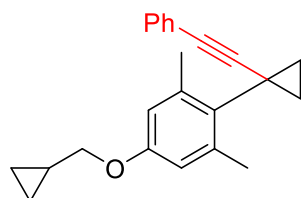
Following the general procedure C, starting from **1c** (35.3 mg, 200 μmol, 1.00 equiv) and 1-[2-bromophenylethynyl]-1,2-benziodoxol-3(1H)-one **2k** (128 mg, 300 μmol, 1.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 95:5) affording **4i** (38.5 mg, 108 μmol, 54% yield) as pale yellow oil. *R_f* = 0.5 (SiO₂, 40:1 pentane:ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 7.51 (dd, *J* = 8.0, 1.3 Hz, 1H, ArH), 7.35 (dd, *J* = 7.7, 1.7 Hz, 1H, ArH), 7.17 (td, *J* = 7.6, 1.3 Hz, 1H, ArH), 7.07 (ddd, *J* = 8.1, 7.4, 1.7 Hz, 1H, ArH), 6.62 – 6.56 (m, 2H, ArH), 3.77 (s, 3H, OCH₃), 2.54 (s, 6H, ArCH₃), 1.66 – 1.56 (m, 2H, CH^aH^bCH^aH^b), 1.20 – 1.09 (m, 2H, CH^aH^bCH^aH^b). ¹³C NMR (101 MHz, CDCl₃) δ 158.4, 140.2, 133.3, 132.3, 130.7, 128.6, 126.9, 126.1, 126.1, 113.6, 99.7, 74.4, 55.2, 20.9, 20.0, 13.2. IR (ν_{max}, cm⁻¹) 3001 (w), 2955 (w), 2836 (w), 2229 (w), 1750 (w), 1603 (s), 1485 (m), 1467 (s), 1330 (m), 1314 (s), 1158 (s), 1058 (m), 1028 (m), 754 (s). HRMS (APPI/LTQ-Orbitrap) *m/z*: [M]⁺ Calcd for C₂₀H₁₉BrO⁺ 354.0614; Found 354.0630.

1,3-Diethyl-5-methoxy-2-(1-(phenylethynyl)cyclopropyl)benzene (4j)



Following the general procedure C, starting from **1l** (40.8 mg, 200 μ mol, 1.00 equiv) and **PhEBX** (139.2 mg, 400 μ mol, 2.0 equiv). After reaction, **1l** (22.3 mg, 109 μ mol, 55%) was recovered and 1,3-diethyl-5-methoxy-2-(1-(phenylethynyl)cyclopropyl)benzene **4j** (25.5 mg, 0.840 mmol, 42% yield) was obtained as off-white amorphous solid. R_f = 0.38 (SiO₂, 50:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.32 – 7.28 (m, 2H, ArH), 7.24 – 7.19 (m, 3H, ArH), 6.64 (s, 2H, ArH), 3.80 (s, 3H, ArOCH₃), 3.09 (dq, J = 15.1, 7.6 Hz, 2H, ArCH₂CH₃), 2.89 (dq, J = 14.9, 7.5 Hz, 2H, ArCH₂CH₃), 1.55 – 1.52 (m, 2H, ArCCH₂), 1.33 (t, J = 7.5 Hz, 6H, ArCH₂CH₃), 1.16 – 1.08 (m, 2H, ArCCH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 158.9, 146.2, 131.7, 130.4, 128.2, 127.4, 124.2, 111.6, 95.7, 75.8, 55.2, 26.2, 20.2, 15.3, 12.4. **IR** ($\nu_{\max}$, cm⁻¹) 2964 (m), 2933 (m), 2226 (w), 1751 (w), 1601 (s), 1467 (s), 1331 (m), 1155 (s), 1102 (m), 1035 (m). **HRMS** (APCI/QTOF) m/z : [M + H]⁺ Calcd for C₂₂H₂₅O⁺ 305.1900; Found 305.1903.

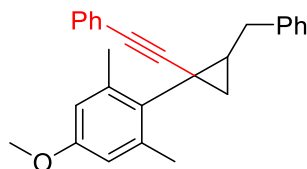
5-(Cyclopropylmethoxy)-1,3-dimethyl-2-(1-(phenylethynyl)cyclopropyl)benzene (**4k**)



Following the general procedure C, starting from **1m** (43.2 mg, 200 μ mol, 1.00 equiv) and **PhEBX** (139.2 mg, 400.0 μ mol, 2.00 equiv). 5-(cyclopropylmethoxy)-1,3-dimethyl-2-(1-(phenylethynyl)cyclopropyl)benzene **4k** (46.8 mg, 0.148 mmol, 74% yield) was obtained as sticky solid. R_f = 0.40 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.36 – 7.29 (m, 2H, ArH), 7.22 (dd, J = 5.1, 2.0 Hz, 3H, ArH), 6.59 (s, 2H, ArH), 3.76 (d, J = 6.9 Hz, 2H, ArOCH₂), 2.51 (s, 6H, ArCH₃), 1.51 (q, J = 4.2 Hz, 2H, CH₂), 1.31 – 1.22 (m, 1H, CHCH₂), 1.09 (q, J = 4.2 Hz, 2H, CH₂), 0.69 – 0.58 (m, 2H, CH₂), 0.38 – 0.28 (m, 2H, CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 157.8, 140.1, 131.8, 131.0, 128.2, 127.4, 124.2, 114.2, 94.6, 75.5, 72.7, 20.9, 19.8, 13.0, 10.5, 3.3. **IR** ($\nu_{\max}$, cm⁻¹) 3081 (w), 3007 (m), 2917 (m), 2226 (w), 1603 (s), 1486 (s), 1312

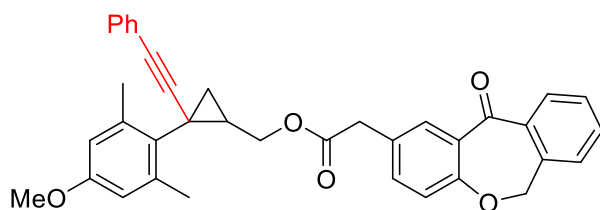
(s), 1157 (s), 1051 (s). **HRMS** (ESI/QTOF) m/z : $[M + H]^+$ Calcd for $C_{23}H_{25}O^+$ 317.1900; Found 317.1906.

2-Benzyl-1-(phenylethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene (4l)



Following the general procedure C, starting from **1f** (73.0 mg, 200.0 μ mol, 1.00 equiv) and **PhEBX** (139 mg, 400 μ mol, 2.00 equiv). 2-Benzyl-1-(phenylethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene **4l** (43.6 mg, 119 μ mol, 60% yield for two diastereomers combined) was obtained as a mixture of two diastereomers, pale yellow oil. dr. 70:30. NMR signal at $ArCH_2$ was used to determine dr. **Rf** = 0.47 (SiO_2 , 40:1 pentane:ethyl acetate). **1H NMR** ($ArCH_2$ of minor diastereomers: 3.43 (dd, J = 14.8, 4.8 Hz, 1H). Major diastereomers: **1H NMR** (400 MHz, $CDCl_3$) δ 7.36 – 7.31 (m, 3H, ArH), 7.29 (dd, J = 7.0, 1.6 Hz, 2H, ArH), 7.24 – 7.21 (m, 3H, ArH), 7.18 – 7.13 (m, 2H, ArH), 6.70 – 6.60 (m, 2H, ArH), 3.81 (s, 3H, $ArOCH_3$), 3.19 (dd, J = 14.7, 4.0 Hz, 1H, $ArCH_2$), 2.65 (s, 3H, $ArCH_3$), 2.49 (s, 3H, $ArCH_3$), 2.08 – 1.97 (m, 1H, $ArCH_2CH$), 1.80 – 1.72 (m, 1H, $ArCCH_2$), 1.65 (dd, J = 14.7, 10.7 Hz, 1H, $ArCH_2$), 1.09 – 1.02 (m, 1H, $ArCCH_2$). **^{13}C NMR** (101 MHz, $CDCl_3$) δ 158.2, 141.1, 140.0, 131.8, 128.8, 128.5, 128.2, 127.4, 126.1, 124.2, 114.0, 113.8, 95.2, 75.8, 55.2, 35.7, 30.7, 25.4, 21.5, 20.9, 19.1. **IR** (ν_{max} , cm^{-1}) 2947 (m), 2938 (m), 2837 (m), 2218 (w), 1601 (s), 1487 (s), 1447 (s), 1314 (s), 1308 (s), 1194 (m), 1153 (s), 1075 (m). **HRMS** (APPI/LTQ-Orbitrap) m/z : $[M + H]^+$ Calcd for $C_{27}H_{27}O^+$ 367.2056; Found 367.2060.

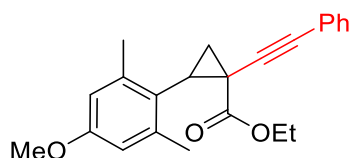
((1R,2S)-2-(4-Methoxy-2,6-dimethylphenyl)-2-(phenylethynyl)cyclopropyl)methyl 2-(11-oxo-6,11-dihydrodibenzo[b,e]oxepin-2-yl)acetate (4m)



Following the general procedure C, starting from **1n** (91.3 mg, 200 μ mol, 1.00 equiv) and **PhEBX** (139.2 mg, 400.0 μ mol, 2.00 equiv). ((1R,2S)-2-(4-Methoxy-2,6-dimethylphenyl)-2-(phenylethynyl)cyclopropyl)methyl 2-(11-oxo-6,11-dihydrodibenzo[b,e]oxepin-2-yl)acetate

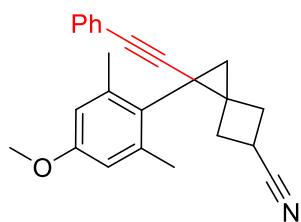
4m (79.0 mg, 0.142 mmol, 71% yield for two diastereomers combined) as sticky solid. **Rf** = 0.16 (SiO₂, 10:1 pentane:ethyl acetate). dr. 55:45. NMR signal at COOCH₂CH was used to determine dr. ¹H NMR COOCH₂CH of minor diastereomer 4.53 (dd, *J* = 7.3, 3.1 Hz, 2H). Major diastereomer: ¹H NMR (400 MHz, CDCl₃) δ 8.11 (d, *J* = 2.4 Hz, 1H, ArH), 7.89 – 7.86 (m, 1H, ArH), 7.50 – 7.45 (m, 2H, ArH), 7.43 – 7.41 (m, 1H, ArH), 7.38 – 7.36 (m, 1H, ArH), 7.25 – 7.18 (m, 5H, ArH), 7.02 (d, *J* = 8.4 Hz, 1H, ArH), 6.57 – 6.55 (m, 2H, ArH), 5.19 (s, 2H, ArCH₂), 4.39 – 4.28 (m, 1H, COOCH₂CH), 3.75 (s, 3H, ArOCH₃), 3.60 (s, 2H, ArCH₂), 3.37 (dd, *J* = 11.7, 8.7 Hz, 1H, COOCH₂CH), 2.50 (s, 3H, ArCH₃), 2.45 (s, 3H, ArCH₃), 2.16 – 2.03 (m, 1H, CHCH₂), 1.82 – 1.75 (m, 1H, CH₂CHAr), 1.16 (dd, *J* = 6.5, 5.0 Hz, 1H, CH₂CHAr). ¹³C NMR (101 MHz, CDCl₃) δ 191.0, 171.5, 160.6, 158.4, 140.6, 140.0, 136.4, 135.7, 132.9, 132.6, 131.8, 129.6, 128.2, 127.9, 127.7, 125.3, 123.8, 121.2, 114.2, 113.8, 93.8, 76.4, 73.8, 65.3, 55.2, 40.3, 27.5, 23.2, 21.4, 20.5, 19.2. IR (ν_{max}, cm⁻¹) 2969 (m), 2251 (w), 1734 (s), 1647 (m), 1601 (s), 1490 (s), 1413 (m), 1300 (s), 1282 (s), 1221 (s), 1156 (s), 1139 (s), 1016 (s), 910 (m). HRMS (ESI/QTOF) *m/z*: [M + H]⁺ Calcd for C₃₇H₃₃O₅⁺ 557.2323; Found 557.2318.

2-(4-Methoxy-2,6-dimethylphenyl)-1-(phenylethynyl)cyclopropane-1-carboxylate (**4n**)



Following the general procedure C, starting from **1k** (25.0 mg, 100 μmol, 1.00 equiv) and **PhEBX** (69.9 mg, 200 μmol, 2.0 equiv). After reaction, **1k** (14.5 mg, 58 μmol, 58%) was recovered and Ethyl 2-(4-methoxy-2,6-dimethylphenyl)-1-(phenylethynyl)cyclopropane-1-carboxylate **4n** (12.2 mg, 35.0 μmol, 35% yield) was obtained as single diastereomer, sticky solid. **Rf** = 0.28 (SiO₂, 20:1 pentane:ethyl acetate). ¹H NMR (400 MHz, CDCl₃) δ 7.37 – 7.30 (m, 2H, ArH), 7.26 – 7.21 (m, 3H, ArH), 6.60 – 6.52 (m, 2H, ArH), 3.98 (q, *J* = 7.1 Hz, 2H, CH₃CH₂CO), 3.75 (s, 3H, ArOCH₃), 2.58 (dd, *J* = 8.4, 6.5 Hz, 1H, CHCH₂), 2.49 (s, 3H, ArCH₃), 2.44 (s, 3H, ArCH₃), 1.98 (dd, *J* = 8.5, 4.6 Hz, 1H, CHCH₂), 1.92 (dd, *J* = 6.5, 4.7 Hz, 1H, CHCH₂), 1.09 (t, *J* = 7.1 Hz, 3H, CH₃CH₂CO). ¹³C NMR (101 MHz, CDCl₃) δ 170.4, 158.3, 140.2, 139.3, 131.9, 128.3, 128.0, 126.4, 123.4, 113.8, 113.7, 92.3, 60.8, 55.1, 31.8, 25.4, 23.5, 21.4, 20.2, 14.1. IR (ν_{max}, cm⁻¹) 2981 (w), 2359 (w), 2229 (w), 1728 (s), 1602 (m), 1487 (m), 1379 (m), 1322 (m), 1191 (s), 1159 (s). HRMS (ESI/QTOF) *m/z*: [M + H]⁺ Calcd for C₂₃H₂₅O₃⁺ 349.1798; Found 349.1803.

1-(4-Methoxy-2,6-dimethylphenyl)-1-(phenylethynyl)spiro[2.3]hexane-5-carbonitrile (4o**)**

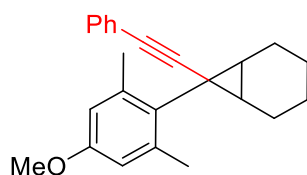


Following the general procedure C, starting from **1h** (48.2 mg, 200 μ mol, 1.00 equiv) and **PhEBX** (139.2 mg, 400.0 μ mol, 2.00 equiv). 1-(4-methoxy-2,6-dimethylphenyl)-1-(phenylethynyl)spiro[2.3]hexane-5-carbonitrile **4o** (43.1 mg, 0.127 mmol, 63% yield for two diastereomer combined) as colorless oil. dr. : 57:43. NMR signal was used to determine dr at $-CH_2$: 2.17 – 2.09 (m, 1st diastereomer) and 2.33 – 2.24 (m, 2nd diastereomer). **Rf** = 0.42 (SiO₂, 10:1 pentane:ethyl acetate). **HRMS** (Sicrit plasma/LTQ-Orbitrap) m/z : [M + H]⁺ Calcd for C₂₄H₂₄NO⁺ 342.1852; Found 342.1840. **IR** (ν_{max} , cm⁻¹) 2997 (w), 2936 (m), 2849 (w), 2237 (w), 1736 (m), 1601 (m), 1487 (m), 1303 (m), 1153 (s), 910 (s).

1st diastereomer (**4o1**): **¹H NMR** (400 MHz, CDCl₃) δ 7.35 – 7.29 (m, 2H, ArH), 7.26 – 7.22 (m, 3H, ArH), 6.65 – 6.56 (m, 2H, ArH), 3.77 (s, 3H, ArOCH₃), 3.35 – 3.24 (m, 1H, CHCH₂), 3.12 (dd, J = 12.8, 10.0 Hz, 1H, CH₂), 2.70 (dd, J = 12.9, 6.5 Hz, 1H, CH₂), 2.48 (s, 3H, ArCH₃), 2.42 (s, 3H, ArCH₃), 2.33 – 2.24 (m, 2H, CH₂), 1.64 (d, J = 5.6 Hz, 1H, CH₂), 1.28 (d, J = 5.5 Hz, 1H, CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 158.4, 131.8, 128.3, 127.8, 127.3, 123.6, 122.9, 114.4, 113.8, 90.9, 79.3, 55.2, 32.6, 32.4, 30.9, 30.8, 23.0, 21.3, 20.4, 17.3.

2nd diastereomer (**4o2**): **¹H NMR** (400 MHz, CDCl₃) δ 7.37 – 7.31 (m, 2H, ArH), 7.26 – 7.22 (m, 3H, ArH), 6.67 – 6.54 (m, 2H, ArH), 3.77 (s, 3H, ArOCH₃), 3.39 – 3.27 (m, 1H, CHCH₂), 3.19 – 3.10 (m, 1H, CH₂), 2.64 (s, 3H, ArCH₃), 2.64 – 2.55 (m, 1H, CH₂), 2.50 – 2.42 (m, 1H, CH₂), 2.41 (s, 3H, ArCH₃), 2.17 – 2.09 (m, 1H, CH₂), 1.63 (d, J = 5.3 Hz, 1H, CH₂), 1.28 (d, J = 5.3 Hz, 1H, CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 158.4, 140.8, 139.4, 131.9, 128.3, 127.8, 127.2, 123.6, 122.4, 114.4, 113.8, 90.8, 79.0, 55.2, 33.4, 33.1, 31.2, 30.9, 22.6, 21.3, 21.1, 16.1.

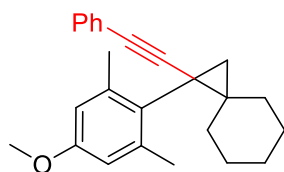
7-(4-Methoxy-2,6-dimethylphenyl)-7-(phenylethynyl)bicyclo[4.1.0]heptane (**4p**)



Following the general procedure C, starting from **1g** (45.9 mg, 200 μ mol, 1.00 equiv) and **PhEBX** (139.2 mg, 400.0 μ mol, 2.00 equiv). 7-(4-Methoxy-2,6-dimethylphenyl)-7-(phenylethynyl)bicyclo[4.1.0]heptane **4p** (33.7 mg, 102 μ mol, 51% yield) was obtained as a single diastereomer, white solid. **Mp** : 77 – 79°C. **Rf** = 0.37 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) 7.33 – 7.27 (m, 2H, ArH), 7.24 – 7.17 (m, 3H, ArH), 6.61 (s, 2H, ArH), 3.78 (s, 3H, ArOCH₃), 2.48 (s, 6H, ArCH₃), 2.00 – 1.89 (m, 2H, CH₂), 1.78 (m, 2H, ArCCHCH₂), 1.27 (m, 2H, CH₂), 1.17 – 1.07 (m, 2H, CH₂), 1.05 – 0.94 (m, 2H, CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 158.1, 141.3, 131.8, 131.8, 128.2, 128.1, 127.2, 126.3, 124.6, 113.5, 96.8, 74.2, 55.1, 27.1, 20.5, 20.3, 20.2, 20.0. **IR** ($\nu_{\max}$, cm⁻¹) 2942 (s), 2936 (s), 2932 (s), 2863 (m), 2856 (m), 2213 (w), 1601 (s), 1488 (s), 1321 (s), 1193 (m), 1159 (s), 856 (m). **HRMS** (Sicrit plasma/LTQ-Orbitrap) m/z : [M + H]⁺ Calcd for C₂₄H₂₇O⁺ 331.2056; Found 331.2052.

1-(4-Methoxy-2,6-dimethylphenyl)-1-(phenylethynyl)spiro[2.5]octane (**4q1**)

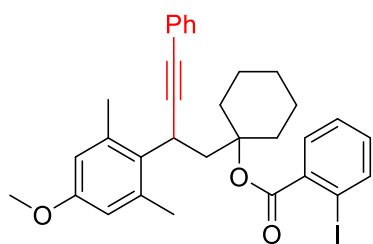
Following the general procedure C, starting from **1i** (48.8 mg, 200 μ mol, 1.00 equiv) and **PhEBX** (139.2 mg, 400.0 μ mol, 2.00 equiv). 1-(4-methoxy-2,6-dimethylphenyl)-1-(phenylethynyl)spiro[2.5]octane **4q1** (30 mg, 0.088 mmol, 44% yield) as colorless oil and 1-(2-(4-methoxy-2,6-dimethylphenyl)-4-phenylbut-3-yn-1-yl)cyclohexyl 2-iodobenzoate **4q2** (20 mg, 0.034 mmol, 17% yield) as pale yellow oil.



Rf = 0.28 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.35 – 7.29 (m, 2H, ArH), 7.24 – 7.16 (m, 3H, ArH), 6.59 (d, J = 2.9 Hz, 1H, ArH), 6.54 (d, J = 2.8 Hz, 1H, ArH), 3.76 (s, 3H, ArOCH₃), 2.46 (s, 3H, ArCH₃), 2.44 (s, 3H, ArCH₃), 1.98 – 1.70 (m, 4H, CH₂), 1.65 – 1.40 (m, 3H, CH₂), 1.32 – 1.19 (m, 3H, CH₂), 1.03 (dd, J = 4.5, 1.4 Hz, 1H, CH₂), 0.57 – 0.48 (m, 1H,

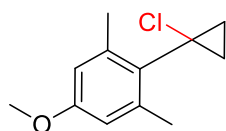
CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 157.8, 141.0, 139.6, 131.8, 129.4, 128.2, 127.2, 124.6, 113.6, 113.5, 93.3, 78.4, 55.1, 34.0, 33.1, 32.7, 30.1, 26.6, 26.1, 25.9, 24.9, 21.4, 20.7. **IR** (ν_{max}, cm⁻¹) 2939 (s), 2920 (s), 2851 (s), 2220 (w), 1727 (m), 1602 (s), 1486 (s), 1445 (s), 1309 (s), 1152 (s), 1069 (s), 855 (m). **HRMS** (APPI/LTQ-Orbitrap) m/z: [M]⁺ Calcd for C₂₅H₂₈O⁺ 344.2135; Found 344.2140.

1-(2-(4-Methoxy-2,6-dimethylphenyl)-4-phenylbut-3-yn-1-yl)cyclohexyl 2-iodobenzoate (4q2)



Rf = 0.28 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.90 (ddd, *J* = 8.0, 6.6, 1.4 Hz, 2H, ArH), 7.30 - 7.23 (m, 1H, ArH), 7.21 - 7.12 (m, 5H, ArH), 7.03 (td, *J* = 7.6, 1.8 Hz, 1H, ArH), 6.62 - 6.46 (m, 2H, ArH), 4.48 (dd, *J* = 10.3, 3.8 Hz, 1H, ArCH), 3.74 (s, 3H, ArOCH₃), 3.03 (dd, *J* = 14.7, 10.3 Hz, 1H, ArCHCH₂), 2.78 - 2.70 (m, 1H, CH₂), 2.65 (s, 3H, ArCH₃), 2.56 - 2.51 (m, 1H, CH₂), 2.32 (s, 3H, ArCH₃), 2.23 (dd, *J* = 14.7, 3.8 Hz, 1H, ArCHCH₂), 1.81 - 1.70 (m, 2H, CH₂), 1.68 - 1.61 (m, 5H, CH₂), 1.42 - 1.33 (m, 1H, CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 165.3, 157.7, 141.6, 139.0, 136.2, 135.7, 132.3, 131.4, 131.2, 128.1, 127.8, 127.4, 124.1, 115.4, 113.9, 94.5, 92.3, 85.9, 82.2, 55.2, 41.4, 35.1, 34.9, 27.2, 25.7, 22.3, 22.2, 21.6. **IR** (ν_{max}, cm⁻¹) 2934 (m), 2860 (m), 2251 (w), 1724 (s), 1602 (m), 1303 (s), 1289 (s), 1245 (s), 1129 (s). **HRMS** (ESI/QTOF) m/z: [M + Na]⁺ Calcd for C₃₂H₃₃INaO₃⁺ 615.1367; Found 615.1367

2-(1-chlorocyclopropyl)-5-methoxy-1,3-dimethylbenzene (4r)

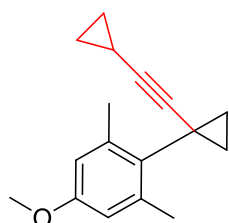


Following the general procedure C, starting from **1c** (35.3 mg, 200 μmol, 1.00 equiv) and Cl-HIR **2l** reagent (84.7 mg, 350 μmol, 1.5 equiv) under 427 nm kessil lamp. Product 2-(1-chlorocyclopropyl)-5-methoxy-1,3-dimethylbenzene **4r** was obtained as colorless oil (36.5 mg, 0.174 mmol, 87%). Note that the product is not very stable in silicagel, therefore, a short

pad of silicagel with 10% of ethylacetate in pentane were used for column chromatography to make sure the product was not staying too long in silicagel.

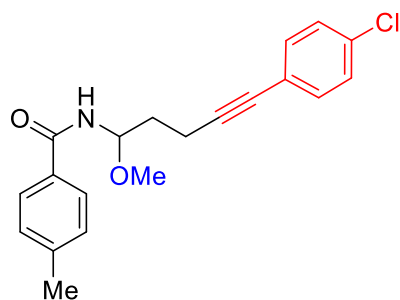
Rf = 0.35 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 6.58 (s, 2H, ArH), 3.77 (s, 3H, ArOCH₃), 2.51 (s, 6H, ArCH₃), 1.23 – 1.19 (m, 2H, CH₂), 0.88 – 0.83 (m, 2H, CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 159.0, 140.3, 130.6, 113.8, 55.2, 54.0, 20.6, 16.1. **IR** ($\nu_{\max}$, cm⁻¹) 3004 (w), 2957 (m), 2922 (m), 2839 (w), 1731 (w), 1604 (s), 1486 (m), 1455 (m), 1377 (m), 1315 (s), 1216 (s), 1158 (s), 1099 (m), 1058 (m), 1025 (m), 939 (w), 861 (m), 741 (m). **HRMS** (APPI/LTQ-Orbitrap) m/z : [M]⁺ Calcd for C₁₂H₁₅ClO⁺ 210.0806; Found 210.0804.

2-(1-(cyclopropylethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene (4s1)



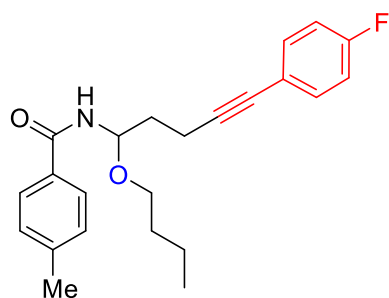
Following the general procedure C, starting from **1c** (17.8 mg, 100 μ mol, 1.00 equiv). Product 2-(1-(cyclopropylethynyl)cyclopropyl)-5-methoxy-1,3-dimethylbenzene **4r** was obtained as off white amorphous solid (4.56 mg, 0.0189 mmol, 19%). **Rf** = 0.27 (SiO₂, pentane). **¹H NMR** (400 MHz, CDCl₃) δ 6.54 (s, 2H, ArH), 3.75 (s, 3H, ArOCH₃), 2.45 (s, 6H, ArCH₃), 1.32 – 1.27 (m, 2H, CCH₂), 1.13 (tt, J = 8.2, 5.0 Hz, 1H), 0.94 – 0.89 (m, 2H, CCH₂), 0.69 – 0.61 (m, 2H, CHCH₂), 0.57 – 0.48 (m, 2H, CHCH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 158.4, 140.1, 132.1, 113.8, 80.1, 78.7, 55.5, 21.1, 19.6, 12.8, 8.7, 0.1. **IR** ($\nu_{\max}$, cm⁻¹) 3006 (m), 2959 (m), 2924 (m), 2837 (m), 2362 (m), 1747 (m), 1603 (s), 1485 (s), 1319 (s), 1160 (s). **HRMS** (Sicrit plasma/LTQ-Orbitrap) m/z : [M + H]⁺ Calcd for C₁₇H₂₁O⁺ 241.1587; Found 241.1578.

N-(5-(4-chlorophenyl)-1-methoxypent-4-yn-1-yl)-4-methylbenzamide (6a)



In a 12*75 mm Borosilicate glass tube, **2a** (95.6 mg, 250 μ mol, 2.50 equiv) and N-cyclopropyl-4-methylbenzamide (**5a**) (17.5 mg, 100 μ mol, 1.00 equiv) were added. The tube was then closed with a rubber septum and sealed off with parafilm. Three cycles of evacuate-refill with nitrogen were performed to remove O₂ and DCM (1.0 mL, 0.1M) was added, followed by the addition of methanol (6.41 mg, 200 μ mol, 2.00 equiv). The reaction mixture was stirred at room temperature under irradiation of Kessil lamps (440 nm). The reaction was monitored by NMR with CH₂Br₂ as an internal standard. Upon completion by either full conversion of starting material or hypervalent iodine reagents, the mixture was concentrated in vacuo and purified by column chromatography to give product **6a** (18.1 mg, 52.7 μ mol, 53% yield) as a white solid. ¹H NMR (400 MHz, CDCl₃) δ 7.67 (d, *J* = 8.2 Hz, 2H, ArH), 7.25 (d, *J* = 8.5 Hz, 2H, ArH), 7.23 (d, *J* = 8.7 Hz, 2H, ArH), 7.15 (d, *J* = 8.0 Hz, 2H, ArH) 6.63 (d, *J* = 9.6 Hz, 1H, NH), 5.53 (dt, *J* = 9.6, 5.7 Hz, 1H, NHCH), 3.43 (s, 3H, OCH₃), 2.65 (dt, *J* = 17.1, 7.0 Hz, 1H, CHCH₂CH₂), 2.54 (dt, *J* = 17.1, 6.9 Hz, 1H, CHCH₂CH₂), 2.36 (s, 3H, ArCH₃), 2.09 – 1.94 (m, 2H, CHCH₂CH₂). ¹³C NMR (101 MHz, CDCl₃) δ 167.5, 142.6, 133.9, 133.0, 131.0, 129.4, 128.6, 127.2, 127.1, 122.1, 90.4, 80.7, 80.6, 56.3, 34.2, 21.6, 15.0. HRMS (ESI/QTOF) *m/z*: [M + Na]⁺ Calcd for C₂₀H₂₀ClNNaO₂⁺ 364.1075; Found 364.1075 Consistent with reported value.¹⁹

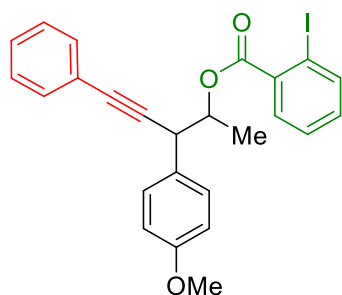
N-(1-butoxy-5-(4-fluorophenyl)pent-4-yn-1-yl)-4-methylbenzamide (**6b**)



In a 12*75 mm Borosilicate glass tube, **2a** (91.5 mg, 250 μ mol, 2.50 equiv) and N-cyclopropyl-4-methylbenzamide (**5a**) (17.5 mg, 100 μ mol, 1.00 equiv) were added. The tube was then closed with a rubber septum and sealed off with parafilm. Three cycles of evacuate-refill with nitrogen were performed to remove O₂ and DCM (1.0 mL, 0.1 M) was added, followed by the addition of methanol (6.41 mg, 200 μ mol, 2.00 equiv). The reaction mixture was stirred at room temperature irradiating with Kessil lamps (440 nm). The reaction was monitored by NMR with CH₂Br₂ as an internal standard. Upon completion by either full conversion of starting material or hypervalent iodine reagents, the mixture was concentrated in vacuo and

purified by column chromatography to give product **6b** as a white solid (18.7 mg, 50.9 μ mol, 51% yield) **¹H NMR** (400 MHz, CDCl₃) δ 7.67 (d, J = 8.1 Hz, 2H, ArH), 7.35 – 7.29 (m, 2H, ArH), 7.16 (d, J = 8.0 Hz, 2H, ArH), 6.99 – 6.91 (m, 2H, ArH), 6.60 (d, J = 9.5 Hz, 1H, NH), 5.61 (ddd, J = 9.5, 6.3, 5.5 Hz, 1H, NHCH), 3.67 (dt, J = 9.5, 6.6 Hz, 1H, OCH₂CH₂), 3.55 (dt, J = 9.6, 6.6 Hz, 1H, OCH₂CH₂), 2.65 (dt, J = 17.0, 6.9 Hz, 1H, CHCH₂CH₂), 2.54 (dt, J = 17.1, 7.0 Hz, 1H, CHCH₂CH₂), 2.39 (s, 3H, ArCH₃), 2.12 – 1.93 (m, 2H, CHCH₂CH₂), 1.59 – 1.48 (m, 2H, OCH₂CH₂), 1.46 – 1.32 (m, 2H, OCH₂CH₂CH₂), 0.90 (t, J = 7.4 Hz, 3H, CH₂CH₃). **¹³C NMR** (101 MHz, CDCl₃) δ 167.1, 162.2 (d, J = 248.5 Hz), 142.3, 133.4 (d, J = 8.3 Hz), 131.1, 129.3, 127.0, 119.6 (d, J = 3.4 Hz), 115.4 (d, J = 21.9 Hz), 88.9, 80.3, 79.2, 68.4, 34.4, 31.8, 21.5, 19.4, 15.0, 13.9. **¹⁹F NMR** (376 MHz, CDCl₃) δ -112.0. **HRMS** (ESI/QTOF) m/z : [M + Na]⁺ Calcd for C₂₃H₂₆FNNaO₂⁺ 390.1840; Found 390.1846. Consistent with reported value.¹⁹

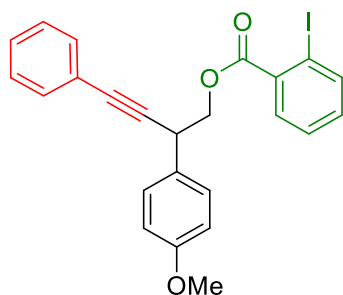
3-(4-Methoxyphenyl)-5-phenylpent-4-yn-2-yl 2-iodobenzoate (**8a**)



Following the general procedure C, starting from 1-methoxy-4-[(E)-prop-1-enyl]benzene (**7a**) (29.6 mg, 200 μ mol, 1.00 equiv) and phenyl ethynyl benziiodoxolone (**2a**) (174 mg, 500 μ mol, 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 95:5 to 88:12) affording 3-(4-methoxyphenyl)-5-phenylpent-4-yn-2-yl 2-iodobenzoate (**8a**) as colorless oil (55.8 mg, 112 μ mol, 56% yield for two diastereomers combined, dr 2:1, the ratio was determined by integration of the ¹H NMR peaks of the benzylic protons ArCH). **Rf** = 0.35 (SiO₂, 20:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃, signals for major diastereomer) δ 7.98 (dt, J = 7.9, 1.4 Hz, 1H, ArH), 7.78 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 7.44 – 7.41 (m, 2H, ArH), 7.41 – 7.38 (m, 2H, ArH), 7.36-7.37 (m, 1H, ArH), 7.31 – 7.27 (m, 3H, ArH), 7.13 (td, J = 7.7, 1.7 Hz, 1H, ArH), 6.93 – 6.86 (m, 2H, ArH), 5.49 (p, J = 6.3 Hz, 1H, OCH(CH₃)CH₂), 4.18 (d, J = 5.9 Hz, 1H, ArCHCH(CH₃)), 3.81 (s, 3H, OCH₃), 1.42 (d, J = 6.3 Hz, 3H, CH(CH₃)). **¹³C NMR** (101 MHz, CDCl₃,

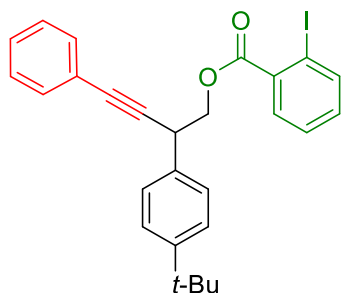
signals for major diastereomer) δ 165.8, 159.2, 141.4, 135.3, 132.7, 131.8, 131.1, 129.9, 129.7, 128.4, 128.2, 128.0, 123.4, 114.0, 94.3, 88.3, 84.6, 74.7, 55.4, 43.4, 17.7. **IR** ($\nu_{\max}$, cm^{-1}) 2987 (w), 2933 (w), 2836 (w), 1738 (m), 1721 (s), 1512 (m), 1289 (s), 1250 (s), 1179 (m), 1129 (m), 1101 (m), 1065 (m), 1057 (m), 1032 (m), 1012 (m), 833 (m), 758 (m), 741 (s). **HRMS** (ESI/QTOF) m/z : $[\text{M} + \text{Na}]^+$ Calcd for $\text{C}_{25}\text{H}_{21}\text{INaO}_3^+$ 519.0428; Found 519.0436.

2-(4-Methoxyphenyl)-4-phenylbut-3-yn-1-yl 2-iodobenzoate (**8b**)



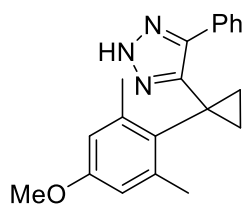
Following the general procedure C, starting from 1-ethenyl-4-methoxybenzene (**7b**) (26.8 mg, 200 μmol , 1.00 equiv) and phenyl ethynyl benziodoxolone (**2a**) (174 mg, 500 μmol , 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 95:5 to 90:10) affording 2-(4-methoxyphenyl)-4-phenylbut-3-yn-1-yl 2-iodobenzoate (**8b**) (42.6 mg, 88.3 μmol , 44% yield) as colorless oil. R_f = 0.33 (SiO_2 , 20:1 pentane:ethyl acetate). **^1H NMR** (400 MHz, CDCl_3) δ 7.99 (dd, J = 7.9, 1.2 Hz, 1H, ArH), 7.81 (dd, J = 7.8, 1.7 Hz, 1H, ArH), 7.49 – 7.42 (m, 4H, ArH), 7.37 (td, J = 7.6, 1.2 Hz, 1H, ArH), 7.33 – 7.27 (m, 3H, ArH), 7.15 (td, J = 7.7, 1.7 Hz, 1H, ArH), 6.95 – 6.88 (m, 2H, ArH), 4.63 – 4.51 (m, 2H, OCH_2CH), 4.34 (t, J = 7.2 Hz, 1H, OCH_2CHCC), 3.82 (s, 3H, OCH_3). **^{13}C NMR** (101 MHz, CDCl_3) δ 166.2, 159.2, 141.6, 134.8, 132.9, 131.9, 131.3, 129.7, 129.3, 128.4, 128.3, 128.0, 123.3, 114.3, 94.4, 88.2, 84.4, 69.1, 55.5, 37.6. **IR** ($\nu_{\max}$, cm^{-1}) 3058 (w), 2954 (w), 2836 (w), 2061 (w), 1728 (s), 1610 (m), 1583 (m), 1511 (s), 1463 (m), 1307 (m), 1287 (m), 1246 (s), 1178 (m), 1132 (m), 1098 (m), 1033 (m), 1013 (m), 830 (m), 758 (m), 740 (s). **HRMS** (APPI/LTQ-Orbitrap) m/z : $[\text{M} + \text{H}]^+$ Calcd for $\text{C}_{24}\text{H}_{20}\text{IO}_3^+$ 483.0452; Found 483.0460.

2-(4-(*Tert*-butyl)phenyl)-4-phenylbut-3-yn-1-yl 2-iodobenzoate (**8c**)



Following the general procedure C, starting from 1-*tert*-butyl-4-ethenylbenzene (**7c**) (32.1 mg, 200 μ mol, 1.00 equiv) and phenyl ethynyl benziodoxolone (**2a**) (174 mg, 500 μ mol, 2.50 equiv). The crude mixture was purified by column chromatography on Biotage (Büchi flashpure cartridge 25 g, gradient of pentane: ethyl acetate from 99:1 to 90:10) affording 2-(4-(*tert*-butyl)phenyl)-4-phenylbut-3-yn-1-yl 2-iodobenzoate (**8c**) (48.8 mg, 96.0 μ mol, 48% yield) as colorless oil. *R_f* = 0.55 (SiO₂, 10:1 pentane:ethyl acetate). **¹H NMR** : (400 MHz, CDCl₃) δ 7.99 (dd, *J* = 7.9, 1.2 Hz, 1H, *ArH*), 7.80 (dd, *J* = 7.8, 1.7 Hz, 1H, *ArH*), 7.47 (d, *J* = 1.9 Hz, 1H, *ArH*), 7.46-7.44 (m, 2H, *ArH*), 7.42 (s, 1H, *ArH*), 7.40 – 7.34 (m, 3H, *ArH*), 7.32 – 7.29 (m, 3H, *ArH*), 7.18 – 7.13 (m, 1H, *ArH*), 4.59 (d, *J* = 7.2 Hz, 2H, OCH₂CH₂), 4.38 (t, *J* = 7.2 Hz, 1H, CCCHCH₂), 1.33 (s, 9H, C(CH₃)₃). **¹³C NMR** (101 MHz, CDCl₃) δ 166.2, 150.8, 141.5, 134.9, 134.6, 132.9, 131.9, 131.4, 128.4, 128.2, 128.0, 127.9, 125.8, 123.4, 94.4, 88.2, 84.4, 69.1, 37.9, 34.7, 31.5. **IR** (ν_{max} , cm⁻¹) 2954 (m), 2868 (w), 2200 (w), 1729 (s), 1463 (m), 1288 (s), 1269 (s), 1249 (s), 1134 (s), 1100 (s), 1017 (m), 759 (s), 740 (s). **HRMS** (APPI/LTQ-Orbitrap) *m/z*: [M + H]⁺ Calcd for C₂₇H₂₆IO₂⁺ 509.0972; Found 509.0986.

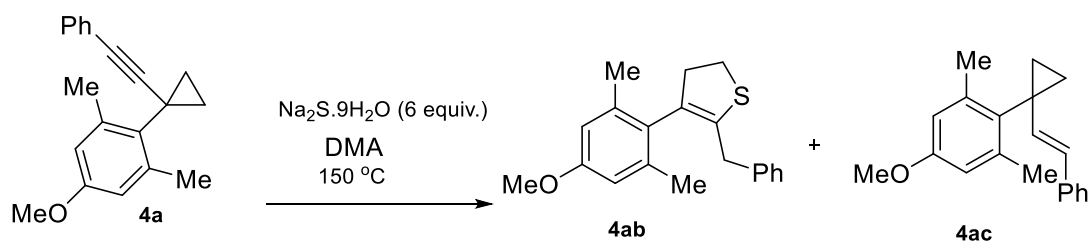
4-(1-(4-methoxy-2,6-dimethylphenyl)cyclopropyl)-5-phenyl-2H-1,2,3-triazole (4aa)



Following a reported procedure,²⁰ in a 12*75 mm Borosilicate glass tube, evacuated and backfilled with nitrogen 3 times, under a nitrogen atmosphere, a solution of alkynylcyclopropane **4a** (27.6 mg, 0.100 mmol, 1.00 equiv) in anhydrous acetonitrile (2.0 mL) was added followed by the addition of NaN₃ (9.80 mg, 0.150 mmol, 1.50 equiv) and PhI(OAc)₂ (32.2 mg, 0.100 mmol, 1.00 equiv). The reaction mixture was stirred at room temperature for

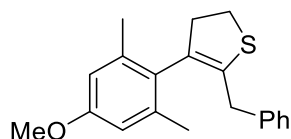
12 h. Upon completion of the reaction as indicated by TLC (40:1 pentane:ethyl acetate), the reaction mixture was concentrated under vacuum and purified by flash column chromatography (SiO₂, 4:1 pentane:ethyl acetate) to afford 4-(1-(4-methoxy-2,6-dimethylphenyl)cyclopropyl)-5-phenyl-2H-1,2,3-triazole (**4aa**) (21.3 mg, 0.067 mmol, 67% yield) as colorless oil. **Rf** = 0.18 (SiO₂, 4:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.26 – 7.22 (m, 1H, ArH), 7.19 – 7.14 (m, 2H, ArH), 6.98 – 6.94 (m, 2H, ArH), 6.38 (s, 2H, ArH), 3.71 (s, 3H, ArOCH₃), 2.19 (s, 6H, ArCH₃), 1.68 – 1.61 (m, 2H, CH₂), 1.17 – 1.10 (m, 2H, CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 158.5, 140.6, 131.4, 130.4, 129.7, 128.2, 127.8, 127.6, 113.7, 55.2, 21.1, 20.3, 18.9. One aromatic carbon not resolved. **IR** (ν_{max}, cm⁻¹) 2928 (m), 2247 (w), 2105 (m), 1603 (s), 1319 (s), 1162 (s), 1058 (s), 1034 (s), 1016 (s), 912 (m). **HRMS** (ESI/QTOF) m/z: [M + H]⁺ Calcd for C₂₀H₂₂N₃O⁺ 320.1757; Found 320.1761.

5-Benzyl-4-(4-methoxy-2,6-dimethylphenyl)-2,3-dihydrothiophene (4ab)



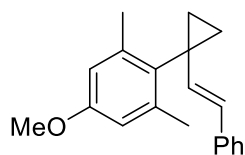
Following a reported procedure,²⁰ in a 12*75 mm Borosilicate glass tube, evacuated and backfilled with nitrogen 3 times, under a nitrogen atmosphere, a solution of alkynylcyclopropane **4a** (27.6 mg, 0.100 mmol, 1.00 equiv) and $\text{Na}_2\text{S}\cdot 9\text{H}_2\text{O}$ (0.14 g, 0.60 mmol, 6.00 equiv) in DMA (0.5 mL) was added. The reaction mixture was stirred at $150\text{ }^\circ\text{C}$ for 12 h. Upon completion of the reaction as indicated by TLC (40:1 pentane:ethyl acetate), ethyl acetate was added. The solution was washed with water and extracted with ethyl acetate. The organic layers were combined, dried over sodium sulfate, concentrated under vacuum and purified by flash column chromatography to afford the compound 5-benzyl-4-(4-methoxy-2,6-dimethylphenyl)-2,3-dihydrothiophene **4ab** (13.0 mg, 0.0419 mmol, 42% yield) and (E)-5-methoxy-1,3-dimethyl-2-(1-styrylcyclopropyl)benzene **4ac** (8.90 mg, 0.032 mmol, 32% yield).

5-benzyl-4-(4-methoxy-2,6-dimethylphenyl)-2,3-dihydrothiophene (4ab)



Rf = 0.50 (SiO_2 , 40:1 pentane:ethyl acetate). **^1H NMR** (400 MHz, CDCl_3) δ 7.27 – 7.22 (m, 2H, ArH), 7.21 – 7.16 (m, 1H, ArH), 7.11 – 7.06 (m, 2H, ArH), 6.63 (s, 2H, ArH), 3.79 (s, 3H, ArOCH_3), 3.30 (s, 2H, PhCH_2), 3.27 (t, J = 8.4 Hz, 2H, SCH_2), 2.91 (tt, J = 8.4, 1.5 Hz, 2H, SCH_2CH_2), 2.18 (s, 6H, ArCH_3). **^{13}C NMR** (101 MHz, CDCl_3) δ 158.6, 138.8, 138.3, 135.8, 129.8, 128.8, 128.8, 128.4, 126.4, 112.9, 55.2, 40.6, 35.5, 31.1, 20.3. **IR** (ν_{max} , cm^{-1}) 2934 (m), 2834 (m), 1604 (s), 1489 (m), 1320 (s), 1193 (m), 1153 (s), 1072 (s), 855 (m). **HRMS** (Sicrit plasma/LTQ-Orbitrap) m/z : $[\text{M} + \text{H}]^+$ Calcd for $\text{C}_{20}\text{H}_{23}\text{OS}^+$ 311.1464; Found 311.1458.

(E)-5-Methoxy-1,3-dimethyl-2-(1-styrylcyclopropyl)benzene (4ac)



R_f = 0.56 (SiO₂, 40:1 pentane:ethyl acetate). **¹H NMR** (400 MHz, CDCl₃) δ 7.24 (d, *J* = 1.3 Hz, 4H, ArH), 7.14 (ddt, *J* = 6.1, 4.5, 3.2 Hz, 1H, ArH), 6.62 (s, 2H, ArH), 5.84 (d, *J* = 15.7 Hz, 1H, PhCH), 5.78 (d, *J* = 15.8 Hz, 1H, PhCHCH), 3.80 (s, 3H, ArOCH₃), 2.34 (s, 6H, ArCH₃), 1.24 – 1.18 (m, 2H, CH₂), 1.12 – 1.06 (m, 2H, CH₂). **¹³C NMR** (101 MHz, CDCl₃) δ 158.1, 140.6, 137.9, 137.0, 131.2, 128.6, 126.9, 126.6, 125.8, 113.5, 55.2, 24.6, 20.9, 18.4. **IR** (ν_{max}, cm⁻¹) 2998 (m), 2954 (m), 2836 (w), 1640 (m), 1603 (s), 1488 (s), 1449 (m), 1314 (s), 1193 (m), 1159 (s), 1106 (m), 1060 (s), 965 (m), 856 (m), 745 (s). **HRMS** (Sicrit plasma/LTQ-Orbitrap) *m/z*: [M + H]⁺ Calcd for C₂₀H₂₃O⁺ 279.1743; Found 279.1740.

Computational Details.

An initial pool of conformers for each C-H and C-C activation transition state were generated using CREST²¹ with frozen bond distances corresponding to those bonds formed/broken at the TS. For each substrate/TS combination, ten unique conformers were generated. The geometries of each of these species was optimized at the ω B97X-D²²/def2-SVPD²³ level in implicit chloroform solvent using the SMD solvation model²⁴ as implemented in Gaussian16.²⁵ Single point energies were then obtained on the optimized ω B97X-D/def2-SVPD geometries at the DLPNO-CCSD(T)²⁶/def2-TZVP level using TightPNO²⁷ as implemented in Orca.²⁸ TS structures having the lowest energies at the DLPNO-CCSD(T)/def2-TZVP// ω B97X-D/def2-SVPD level were used for further analysis of the reaction pathways reported in the main text. All species were subsequently characterized as either minima (zero imaginary frequencies) or transition states (one imaginary frequency) by examining the vibrational frequencies. Free energy corrections were established using the rigid-rotor harmonic oscillator model and corrected for translational entropy in solution using the method of Martin, Hay, and Pratt²⁹ (12.47 mol/L for chloroform) in the GoodVibes package.³⁰ Reported free energies include the sum of electronic energies at the DLPNO-CCSD(T)/def2-TZVP// ω B97X-D/def2-SVPD level with solvation and free energy corrections at the ω B97X-D/def2-SVPD level.

Rotational profiles of substrates **1a** and **1c** were obtained by constraining the C-C-C-H dihedral angle (see below) and partially optimizing the geometry at the ω B97X-D/def2-SVPD level. The plots shown in Figure S1 are electronic energies.

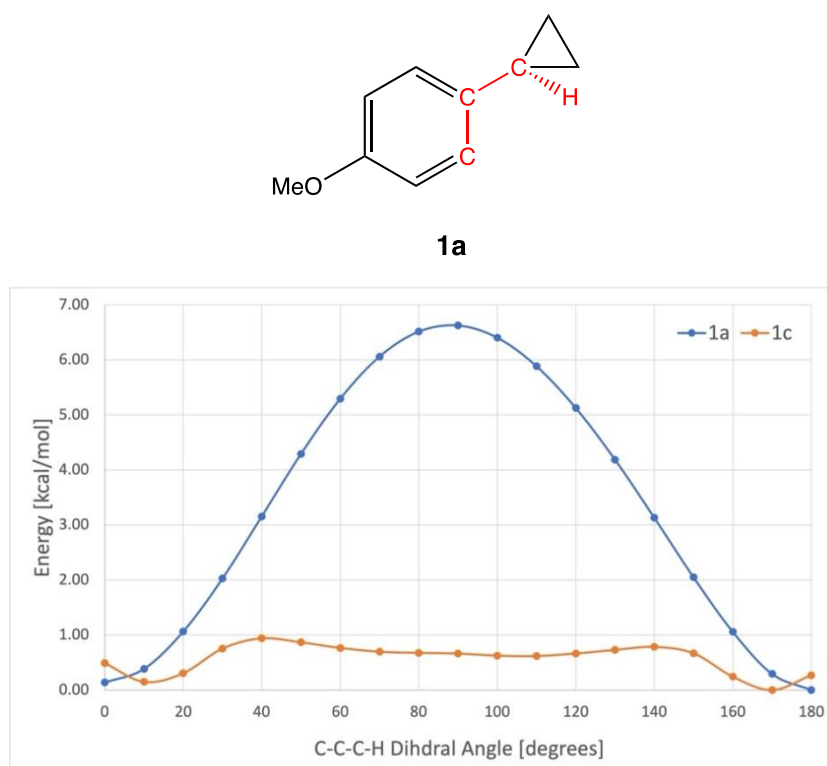


Figure S1. Rotational profiles of **1a** and **1c**. Computations at the ω B97X-D/def2-SVPD level.

Table S1. Relative free energies (from separated reactants) of relevant species. Reported free energies include single point electronic energies at the DLPNO-CCSD(T)/def2-TZVP// ω B97X-D/def2-SVPD level as well as free energy and solvation corrections (SMD model in chloroform) at the ω B97X-D/def2-SVPD level. Values in kcal/mol.

	Substrate 1a	Substrate 1c
CH – Reaction Complex	-3.65	-7.58
CH – Transition State	9.60	-7.95 ^a
CH – Product Complex	-24.34	-28.34
CC – Reaction Complex	-10.59	-7.96
CC – Transition State	-2.04	-1.76
CC – Product Complex	-40.90	-39.93

a) The electronic energy of this transition state lies 2.55 kcal/mol above the reaction complex at the ω B97X-D/def2-SVPD (optimization) level.

Table S2. Electronic energies, free energy corrections, and solvation corrections of relevant species. DLPNO-CCSD(T)/def2-TZVP electronic energies were computed on optimized geometries at the ω B97X-D/def2-SVPD level. Values in Hartree.

	ω B97X-D/def2-SVPD Electronic Energies	ω B97X-D/def2-SVPD Free Energy Corrections	ω B97X-D/def2-SVPD Solvation Corrections	DLPNO- CCSD(T)/def2-TZVP// ω B97X-D/def2-SVPD Single Point Electronic Energies	Total Free Energy
Hypervalent Iodine – Anion	-717.097833	0.062295	-0.076164	-716.111566	-716.125435
Substrate 1a					
1a – Radical Cation	-462.810986	0.165593	-0.072085	-462.369607	-462.276099
I _{C-H}	- 1179.944924	0.242751	-0.0490507	-1178.601057	- 1178.407357
TS _{C-H}	- 1179.935998	0.239369	-0.030426	-1178.595177	- 1178.386234
II _{C-H}	- 1179.960280	0.241498	-0.024318	-1178.657508	- 1178.440328
I _{C-C}	- 1179.946849	0.243449	-0.0467964	-1178.615057	- 1178.418404
TS _{C-C}	- 1179.931703	0.243275	-0.041447	-1178.606615	- 1178.404787
II _{C-C}	- 1179.991364	0.248053	-0.0250113	-1178.689757	- 1178.466715
Substrate 1c					
1c – Radical Cation	-541.370297	0.219286	-0.069981	-540.855145	-540.705840
I _{C-H}	- 1258.509751	0.296898	-0.042420	-1257.097840	- 1256.843362
TS _{C-H}	- 1258.505693	0.293706	-0.032572	-1257.105078	- 1256.843944
II _{C-H}	- 1258.527420	0.294619	-0.024339	-1257.146711	- 1256.876431
I _{C-C}	- 1258.506669	0.297009	-0.037950	-1257.103014	- 1256.843955
TS _{C-C}	- 1258.490202	0.296177	-0.043847	-1257.086407	- 1256.834078
II _{C-C}	- 1258.546794	0.300303	-0.026420	-1257.168792	- 1256.894909

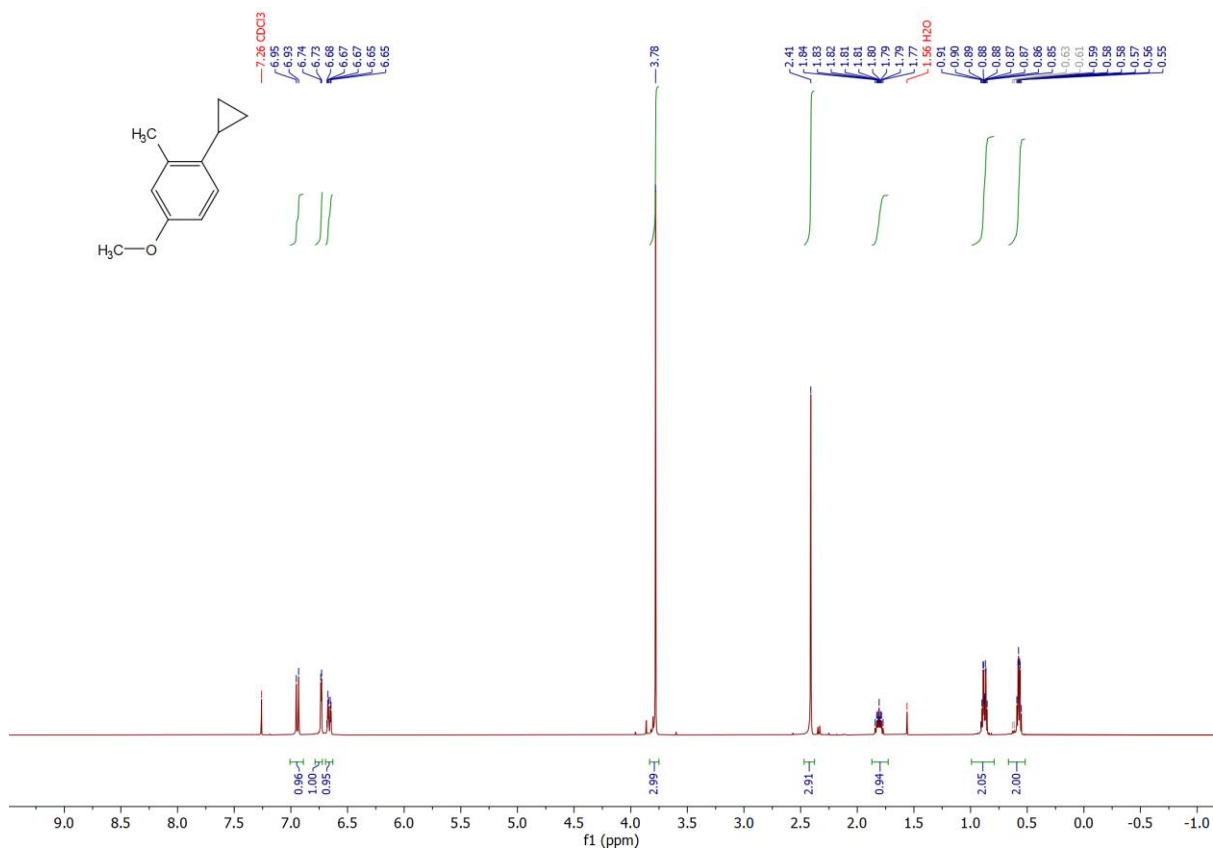
Table S3. Rotational profiles around the C-C-C-H dihedral angle for 1a and 1c. Computations at the ω B97X-D/def2-SVPD level.

Dihedral Angle	Electronic Energy 1a (hartree)	Relative Energy 1a (kcal/mol)	Electronic Energy 1c (hartree)	Relative Energy 1c (kcal/mol)
0	-462.7390033	0.14	-541.2998484	0.49
10	-462.7386084	0.38	-541.3003924	0.15
20	-462.7375261	1.06	-541.3001412	0.31
30	-462.7359897	2.03	-541.2994279	0.75
40	-462.7341918	3.16	-541.2991324	0.94

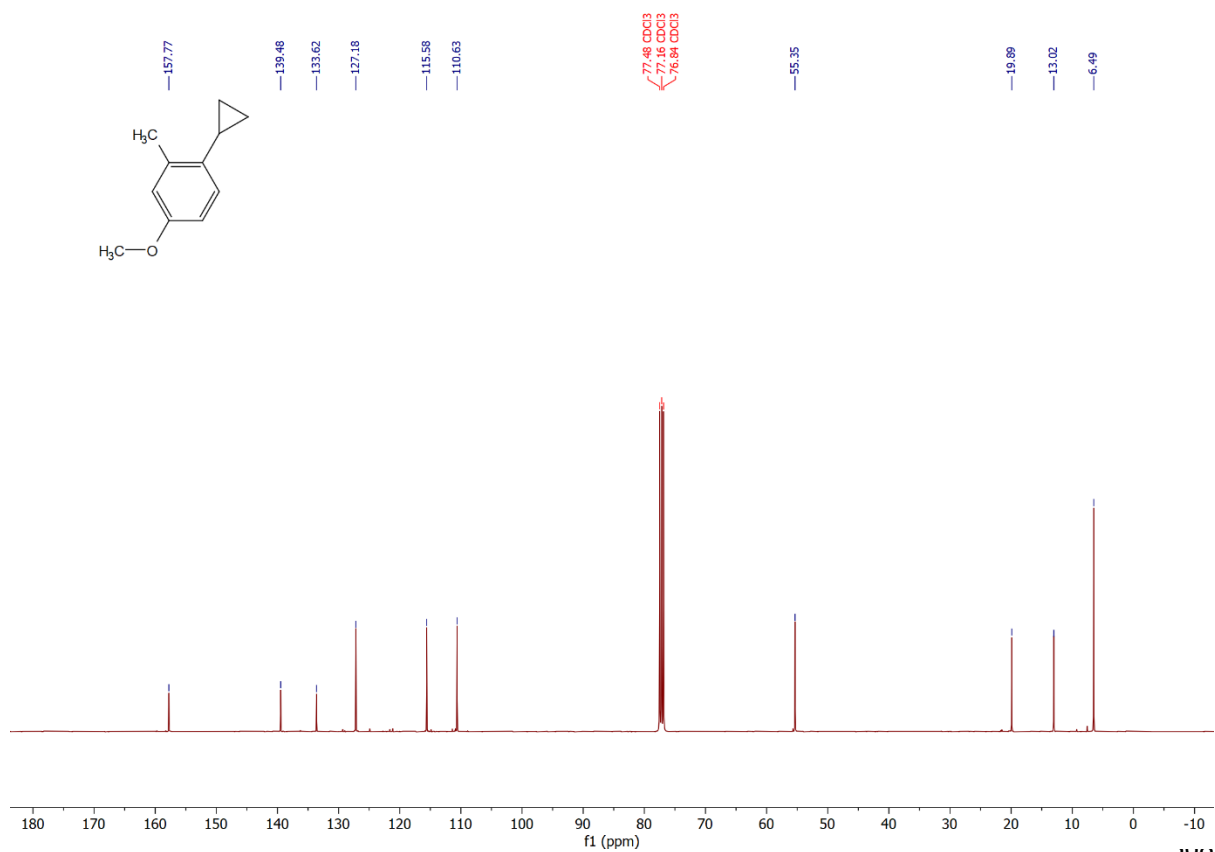
50	-462.7323808	4.29	-541.2992485	0.87
60	-462.7307856	5.29	-541.2994093	0.77
70	-462.7295661	6.06	-541.2995195	0.70
80	-462.7288425	6.51	-541.2995518	0.68
90	-462.728665	6.62	-541.2995728	0.66
100	-462.7290185	6.40	-541.2996335	0.63
110	-462.7298445	5.88	-541.2996453	0.62
120	-462.7310535	5.12	-541.2995705	0.66
130	-462.7325483	4.19	-541.2994670	0.73
140	-462.7342289	3.13	-541.2993799	0.78
150	-462.7359542	2.05	-541.2995641	0.67
160	-462.7375351	1.06	-541.3002406	0.24
170	-462.7387524	0.29	-541.3006297	0.00
180	-462.7392206	0.00	-541.3001999	0.27

NMR spectra

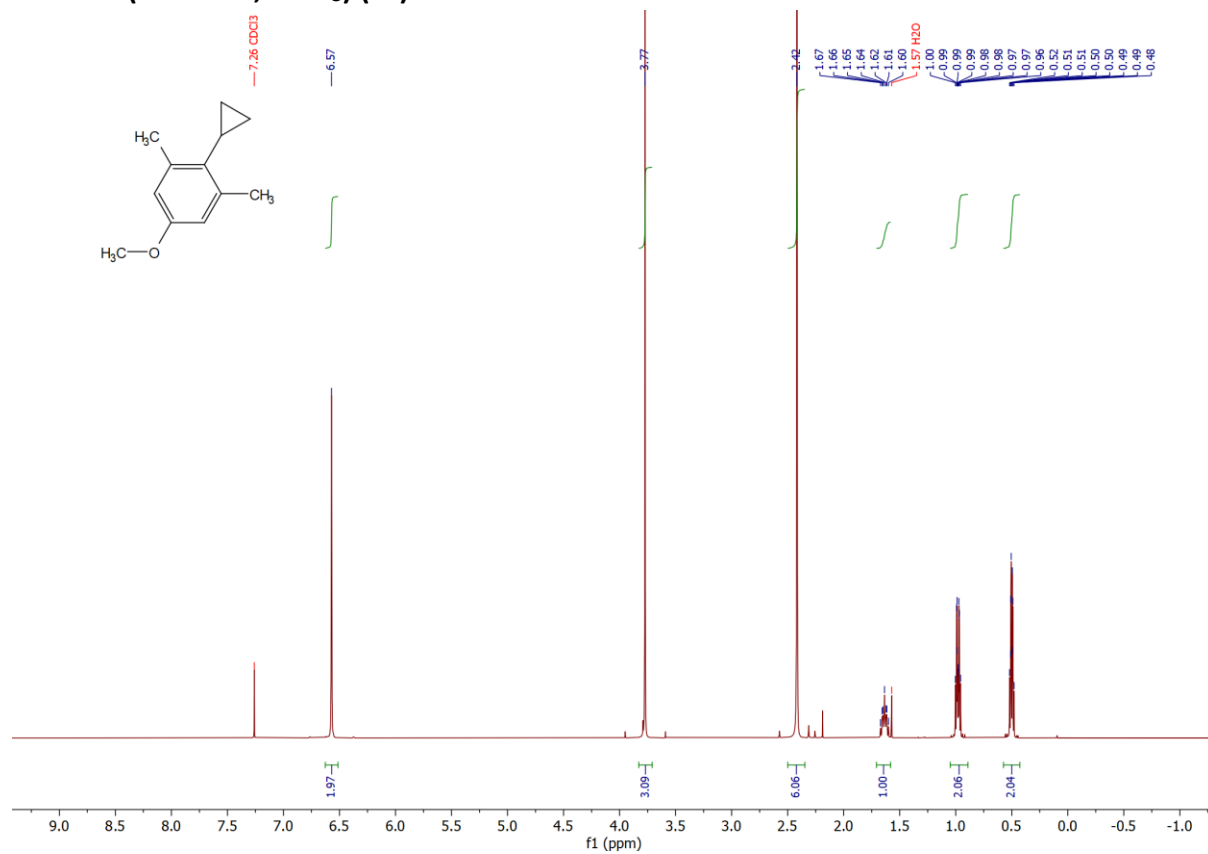
^1H -NMR (400 MHz, CDCl_3) (1b)



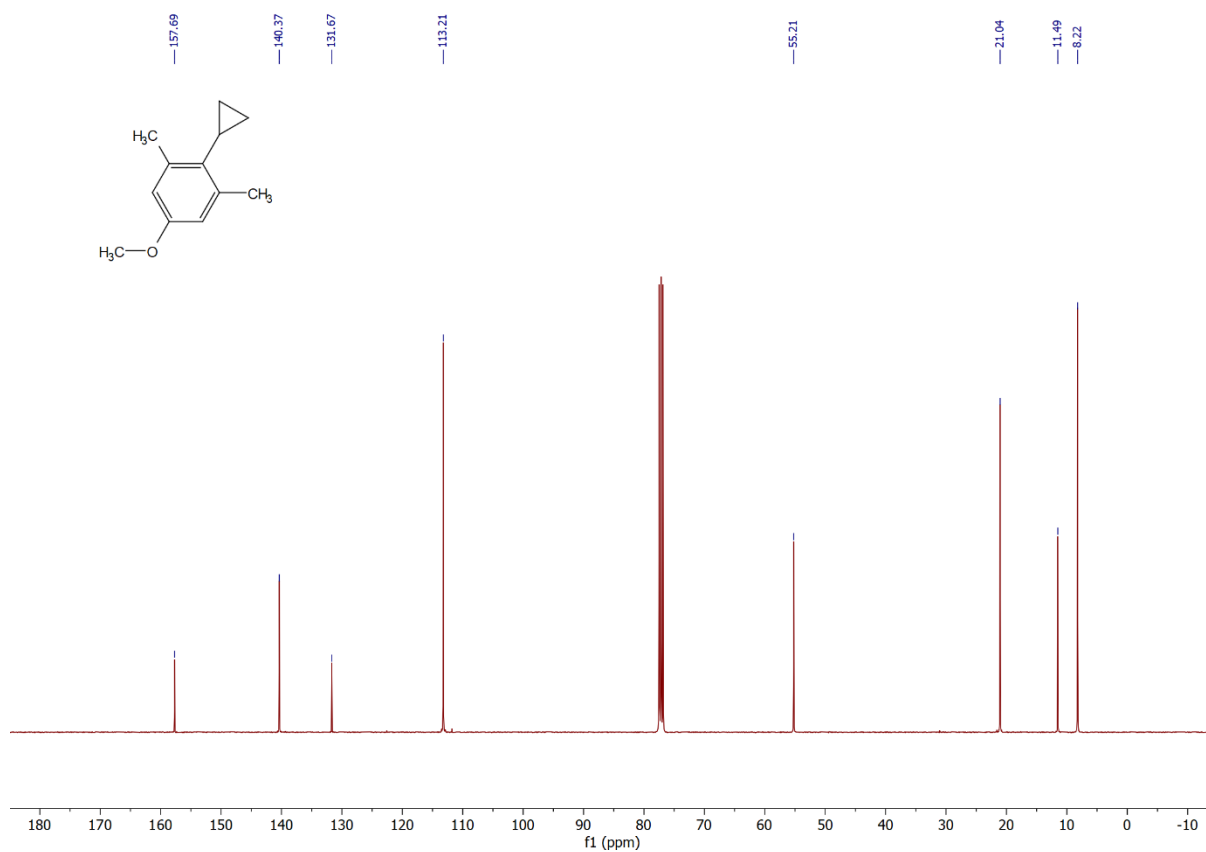
^{13}C NMR (101 MHz, CDCl_3) (1b)



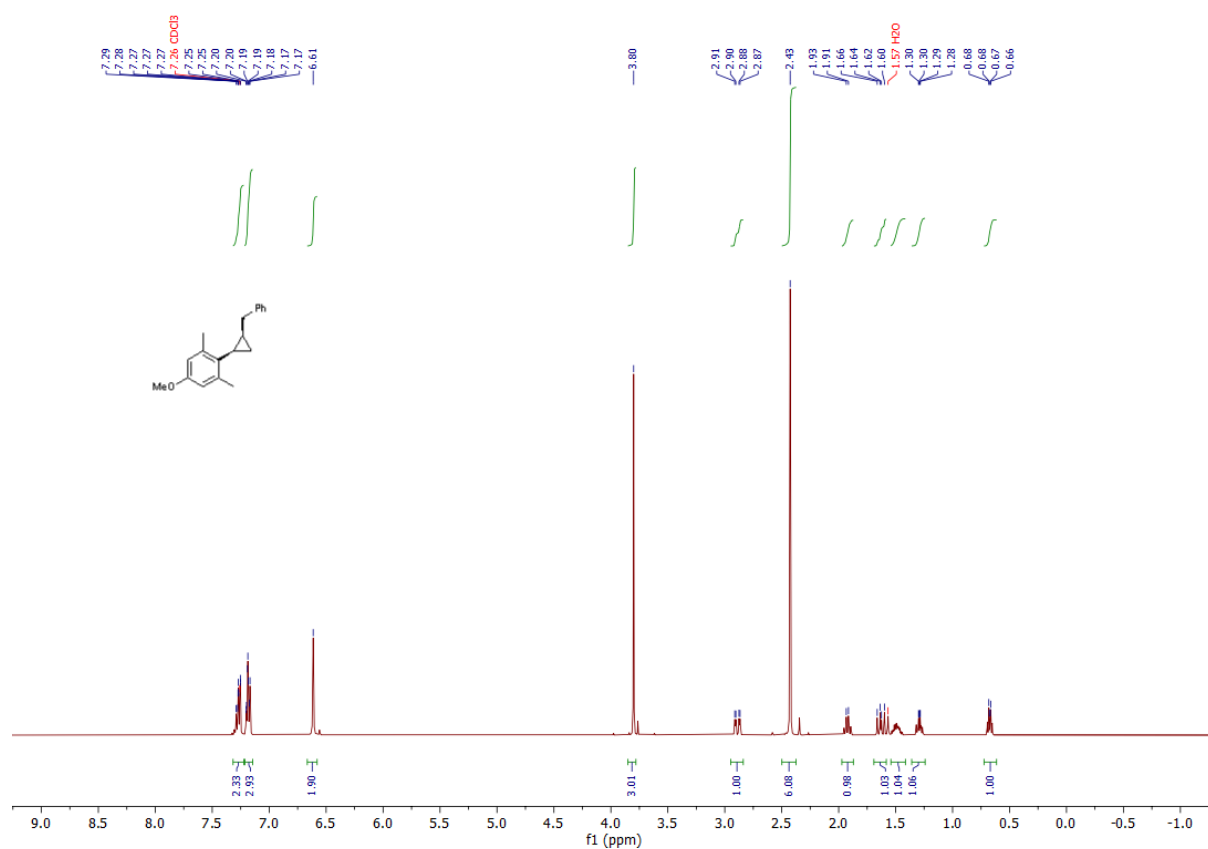
^1H -NMR (400 MHz, CDCl_3) (1c)



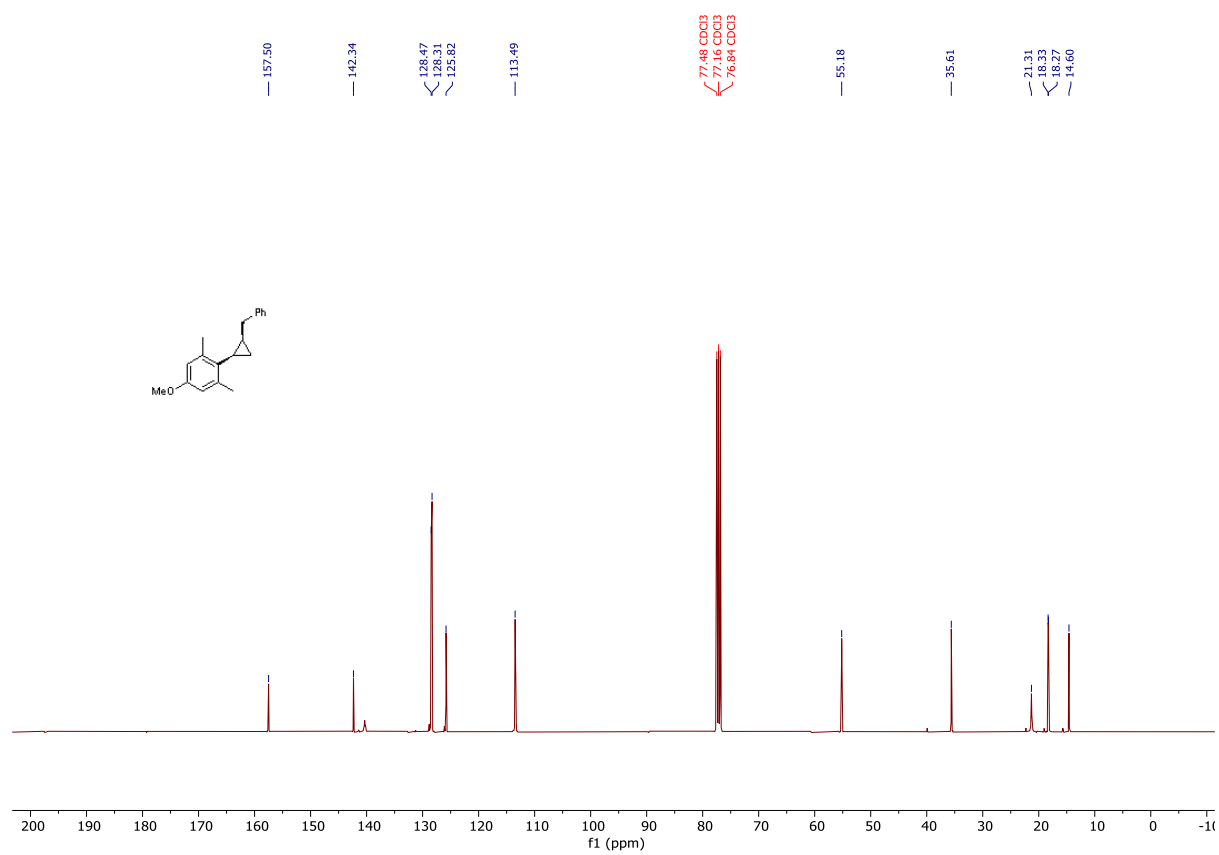
^{13}C -NMR (101 MHz, CDCl_3) (1c)



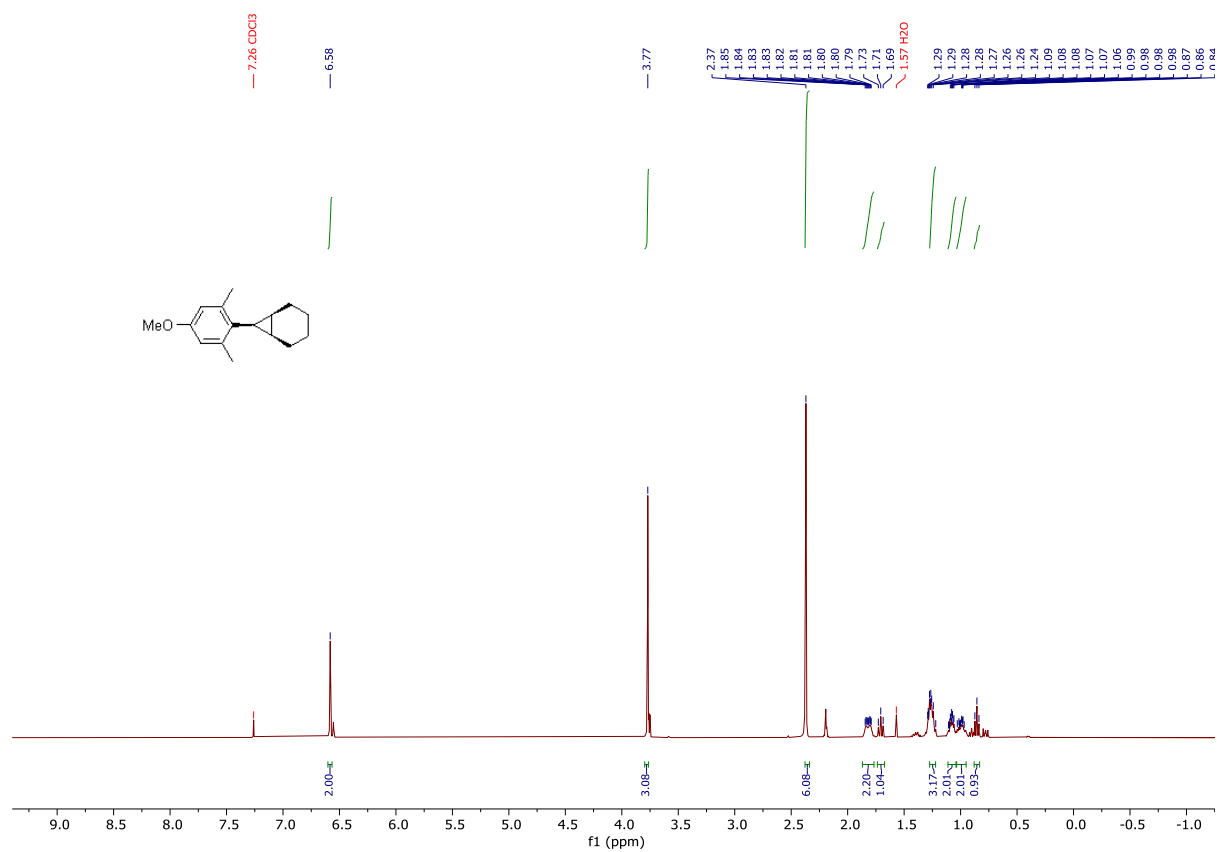
^1H -NMR (400 MHz, CDCl_3) (1f)



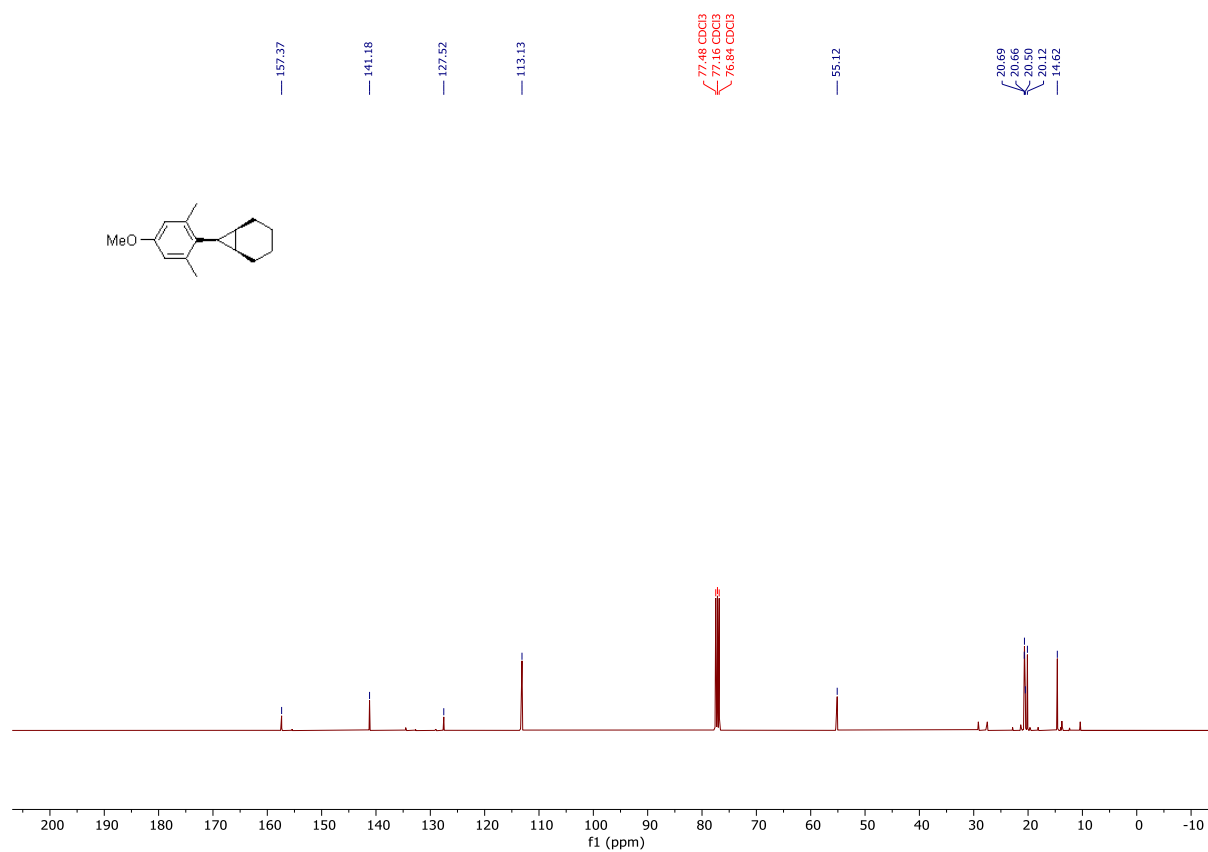
^{13}C -NMR (101 MHz, CDCl_3) (1f)



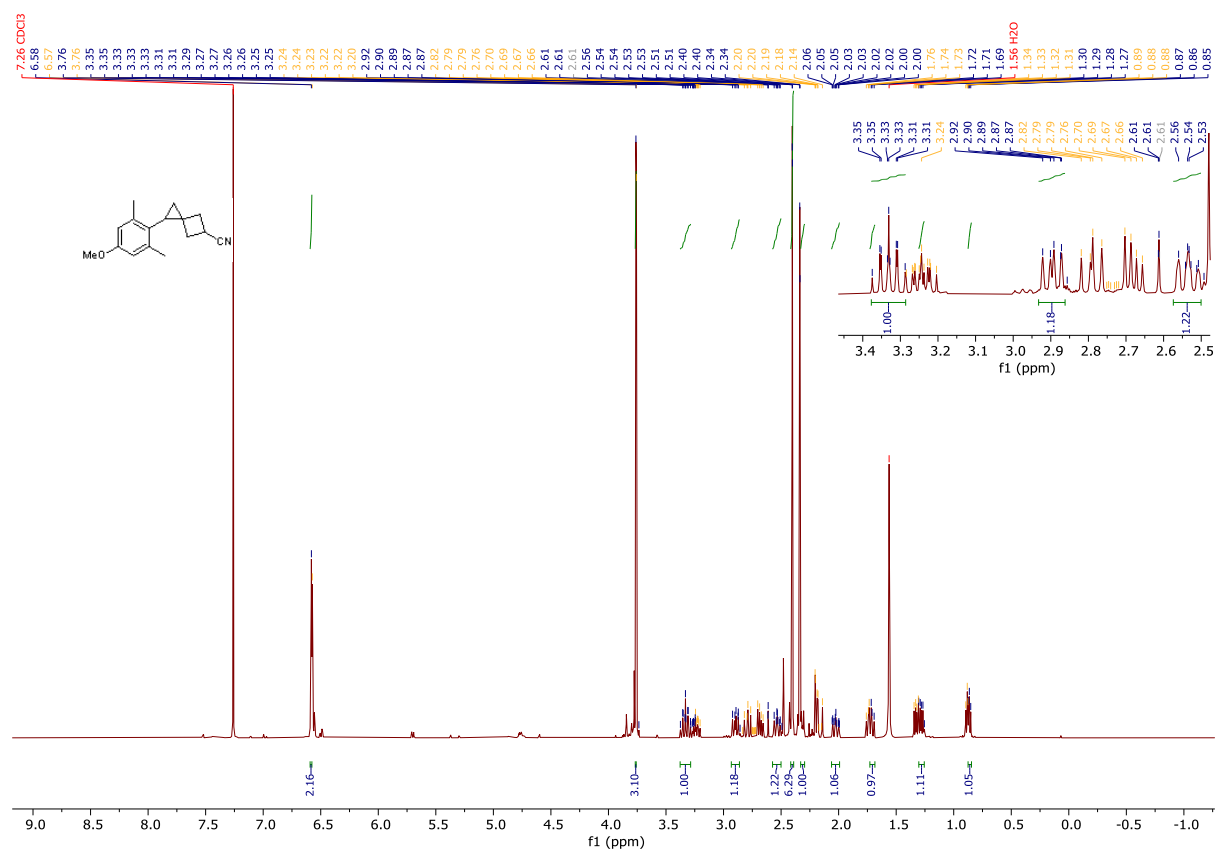
^1H -NMR (400 MHz, CDCl_3) (1g)



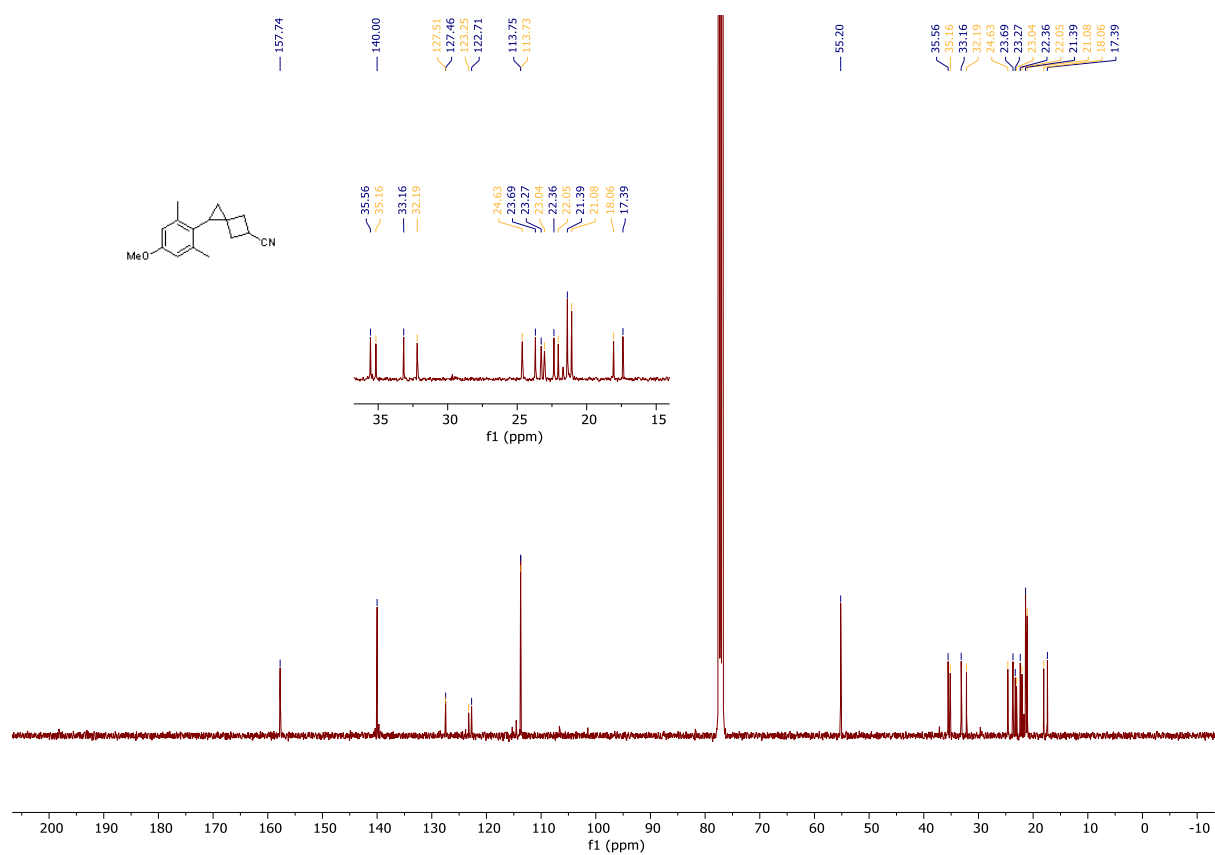
^{13}C NMR (101 MHz, CDCl_3) (1g)



^1H -NMR (400 MHz, CDCl_3) (1h) Orange: Major diastereomer, Blue: Minor diastereomer



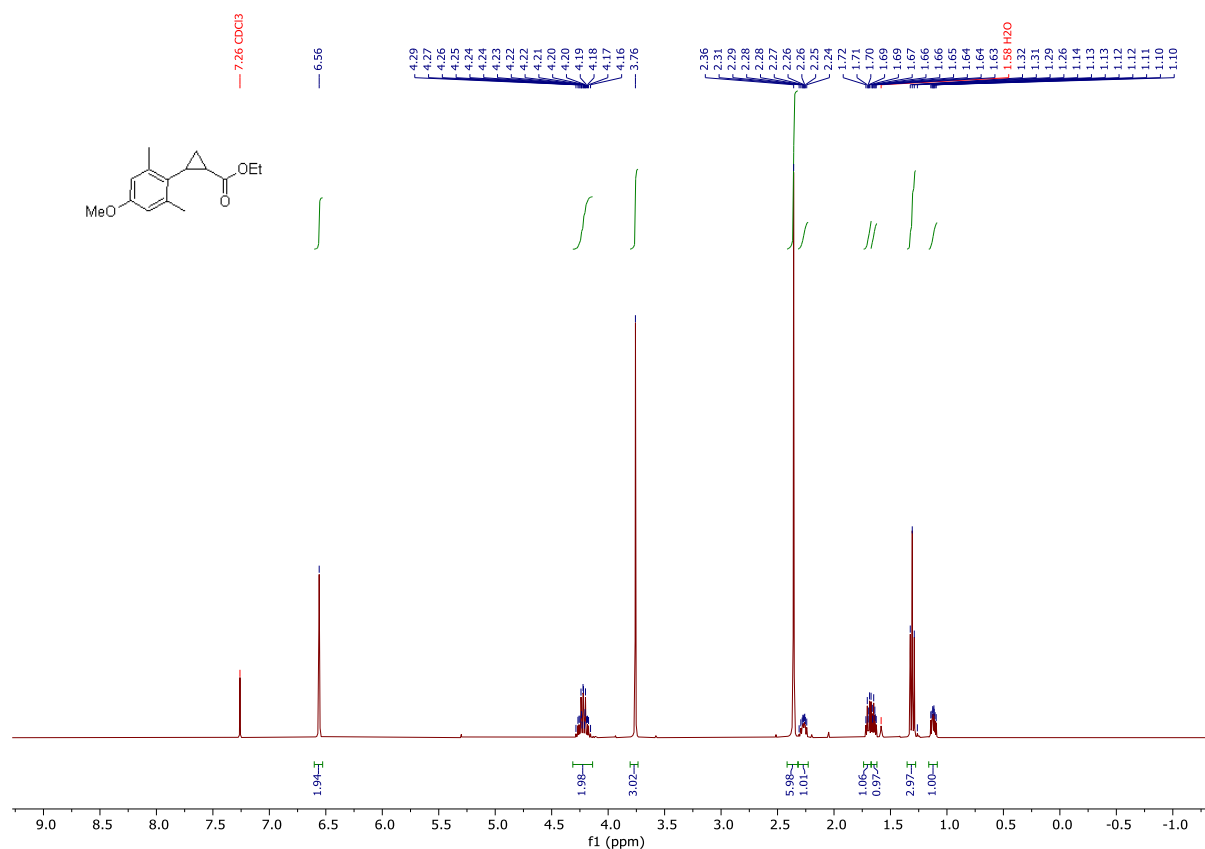
^{13}C -NMR (101 MHz, CDCl_3) (1h)



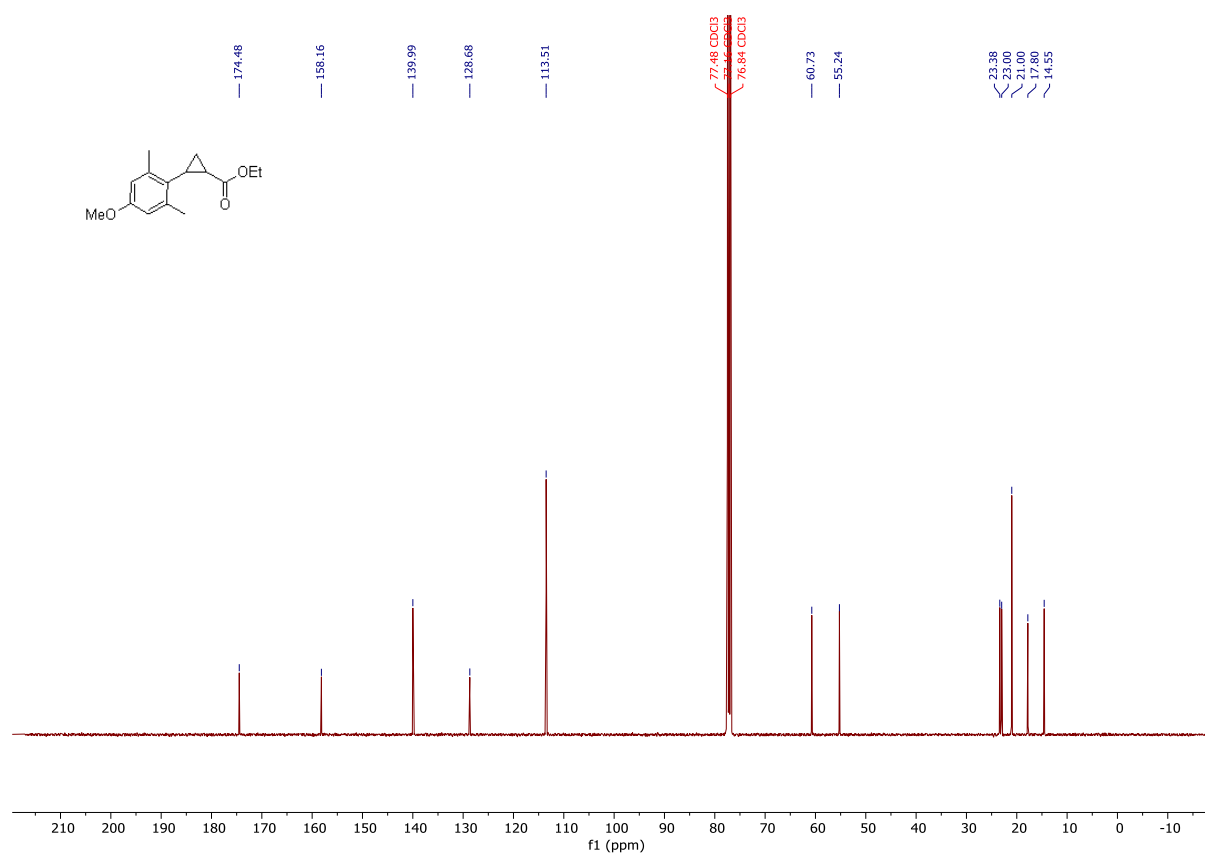
[illegible]

Chemical structure of 2-(2,4,6-trimethylphenyl)bicyclo[3.1.0]hexane is shown. The ¹³C NMR spectrum (CDCl₃) displays peaks at the following chemical shifts (ppm): 157.14, 129.24, 113.23, 77.48 (CDCl₃), 77.16 (CDCl₃), 76.84 (CDCl₃), 55.13, 36.81, 34.99, 34.59, 26.38, 25.75, 25.62, 21.35, and 20.51.

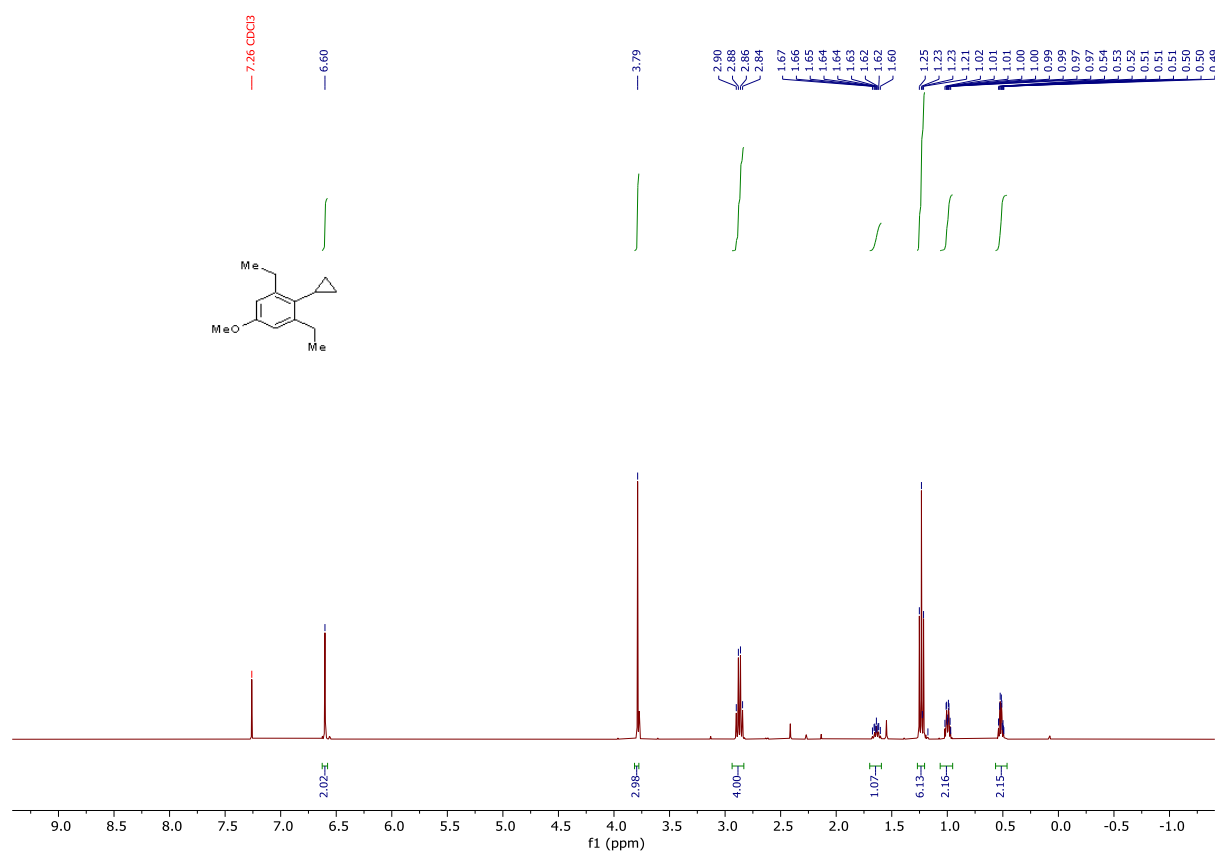
^1H -NMR (400 MHz, CDCl_3) (1k)



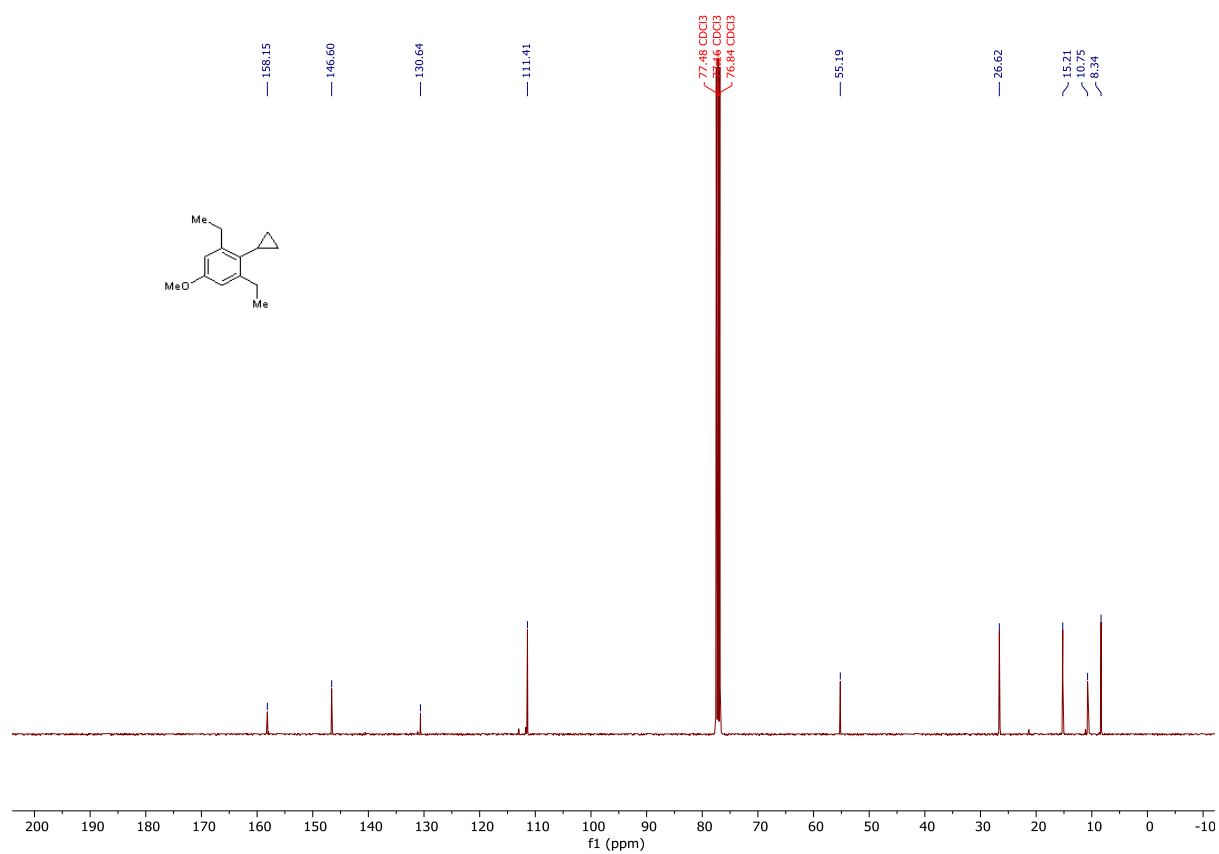
^{13}C NMR (101 MHz, CDCl_3) (1k)



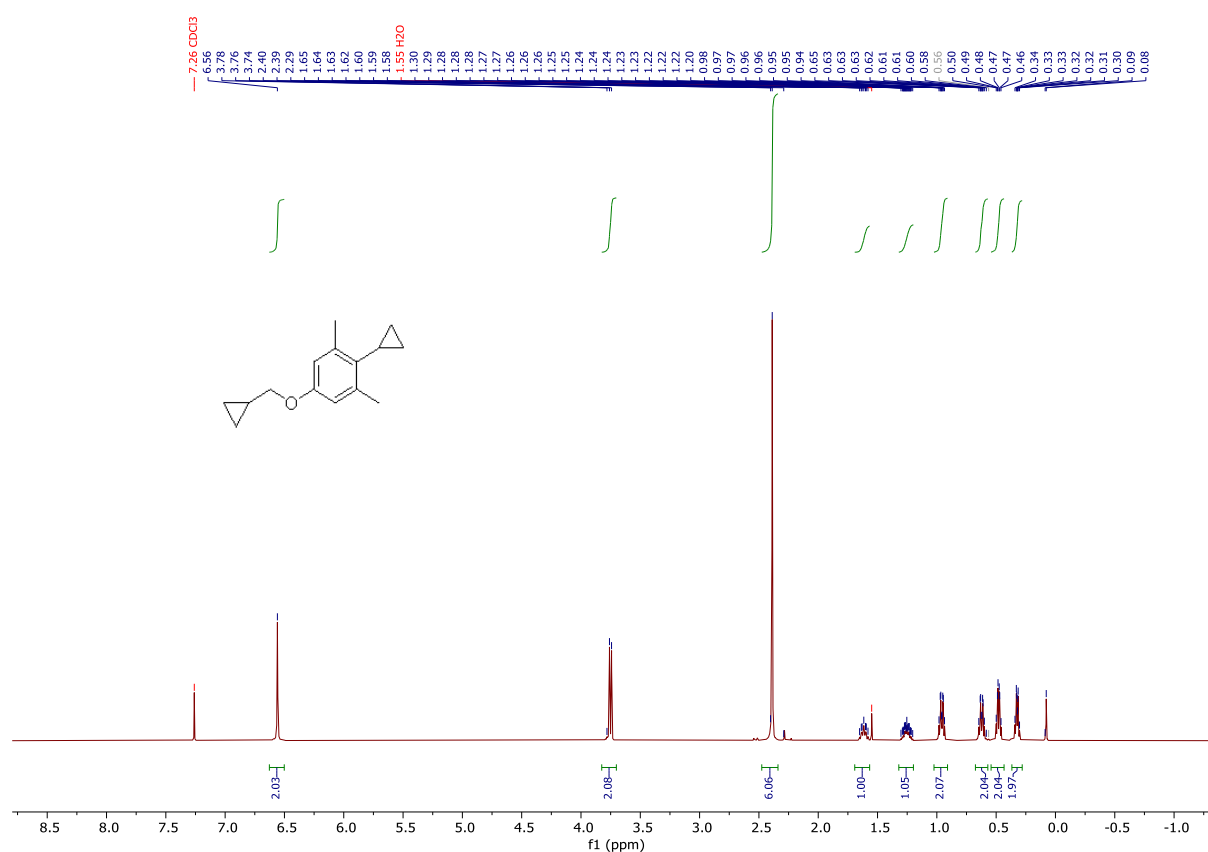
^1H -NMR (400 MHz, CDCl_3) (1l)



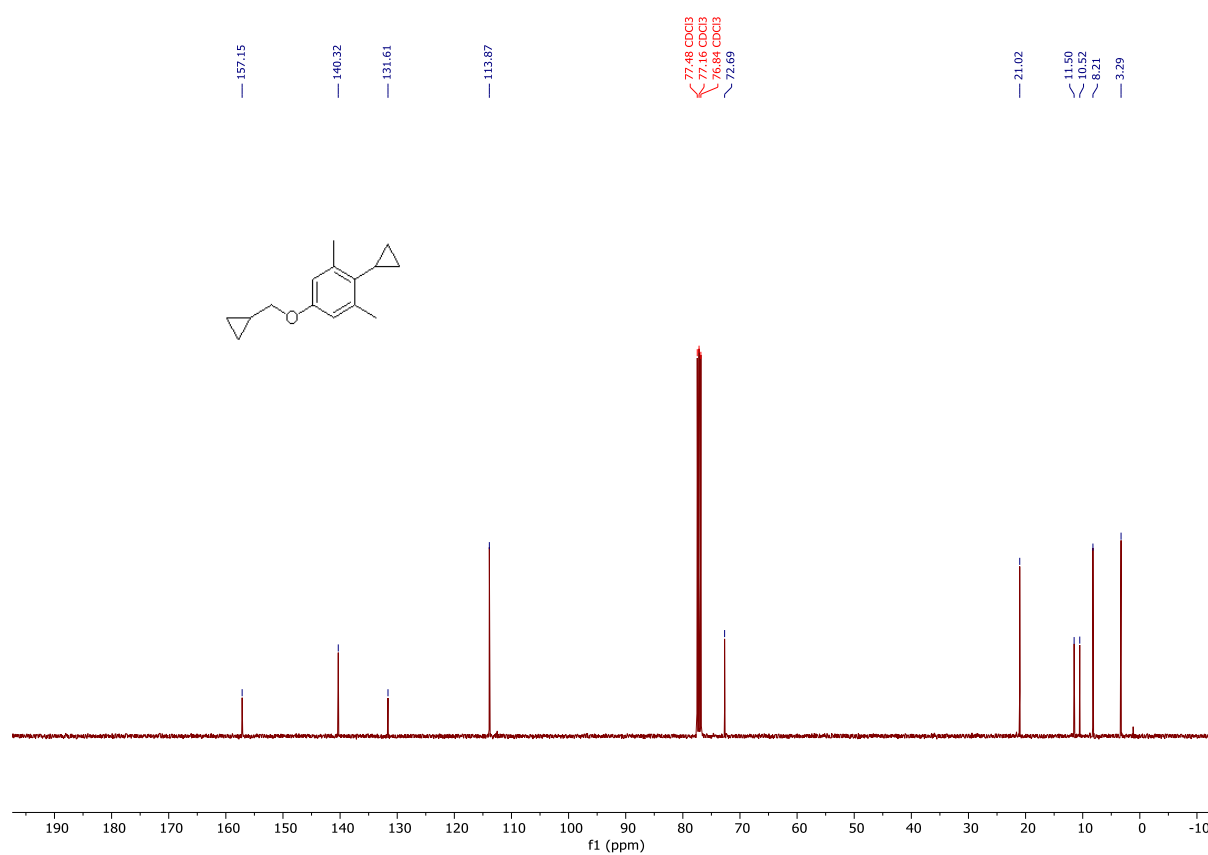
^{13}C -NMR (101 MHz, CDCl_3) (1l)



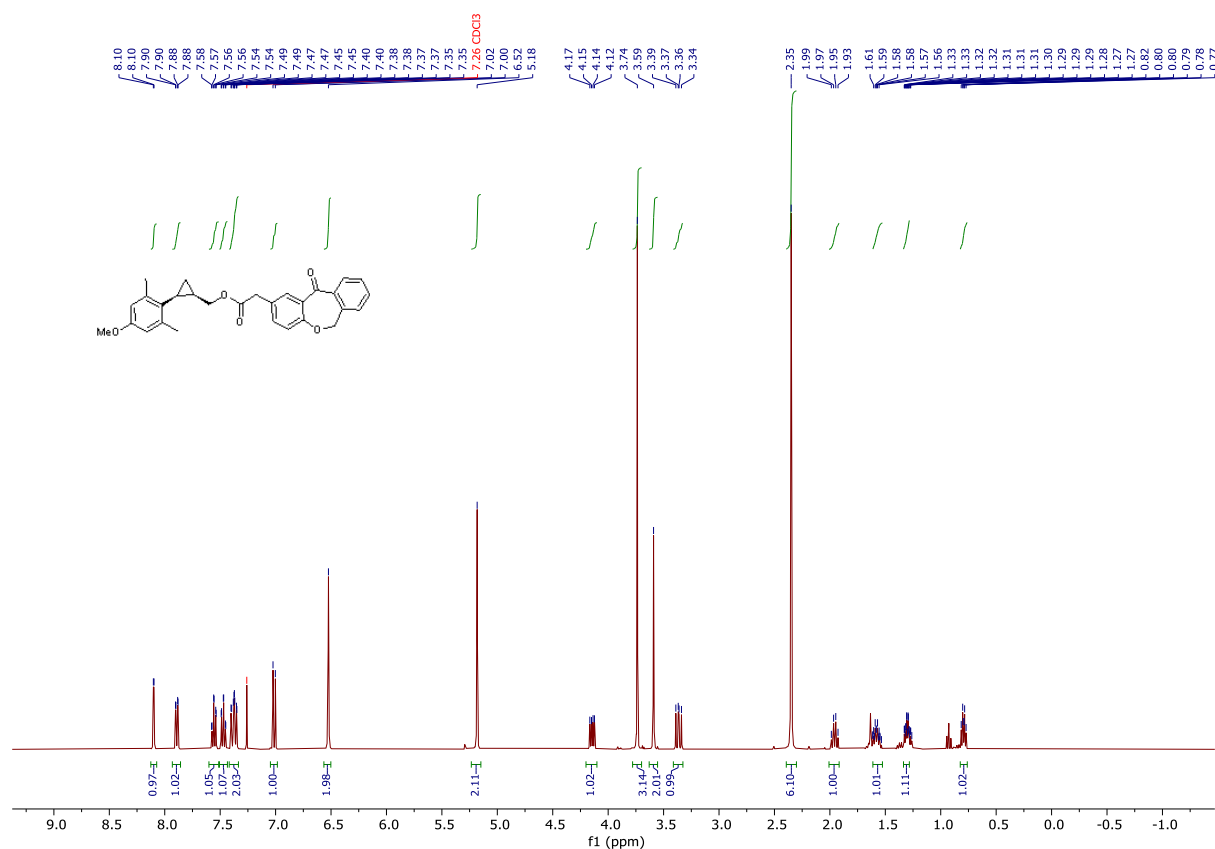
^1H -NMR (400 MHz, CDCl_3) (1m)



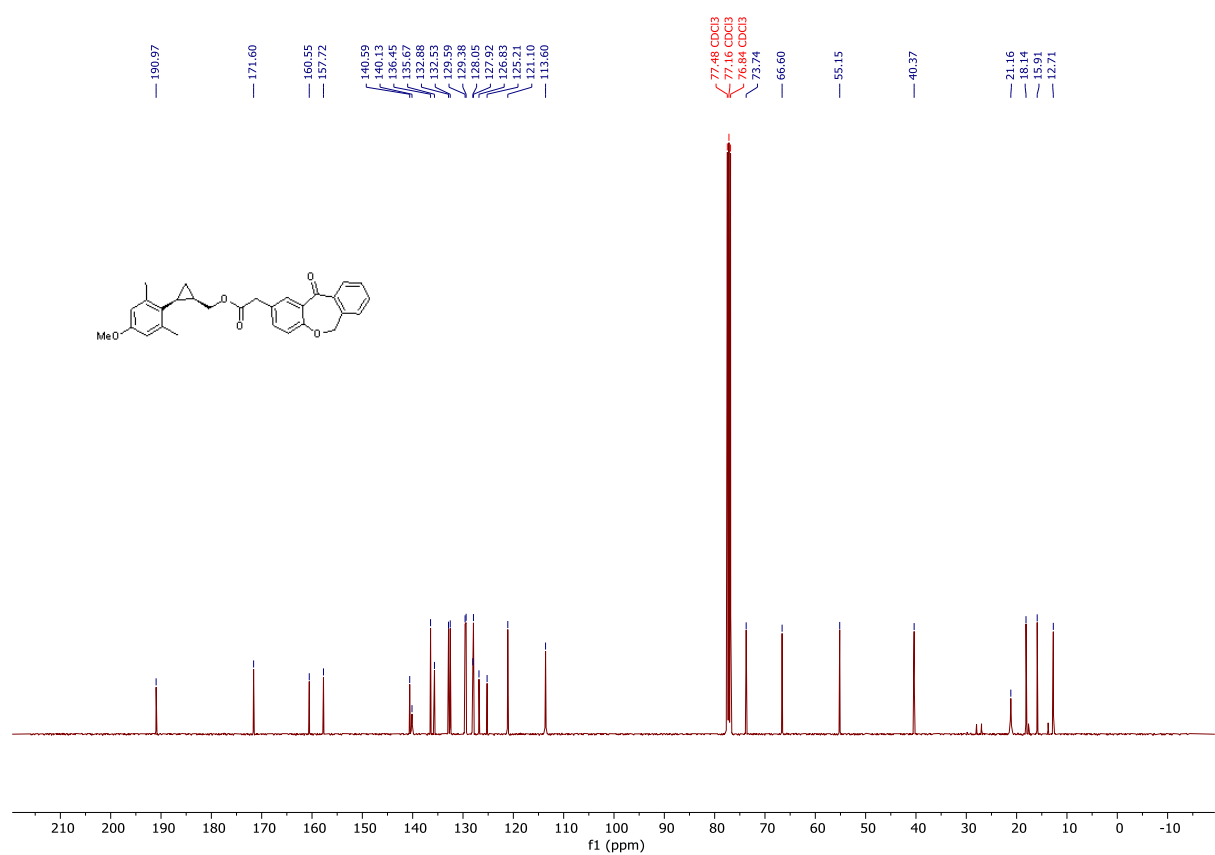
^{13}C NMR (101 MHz, CDCl_3) (1m)



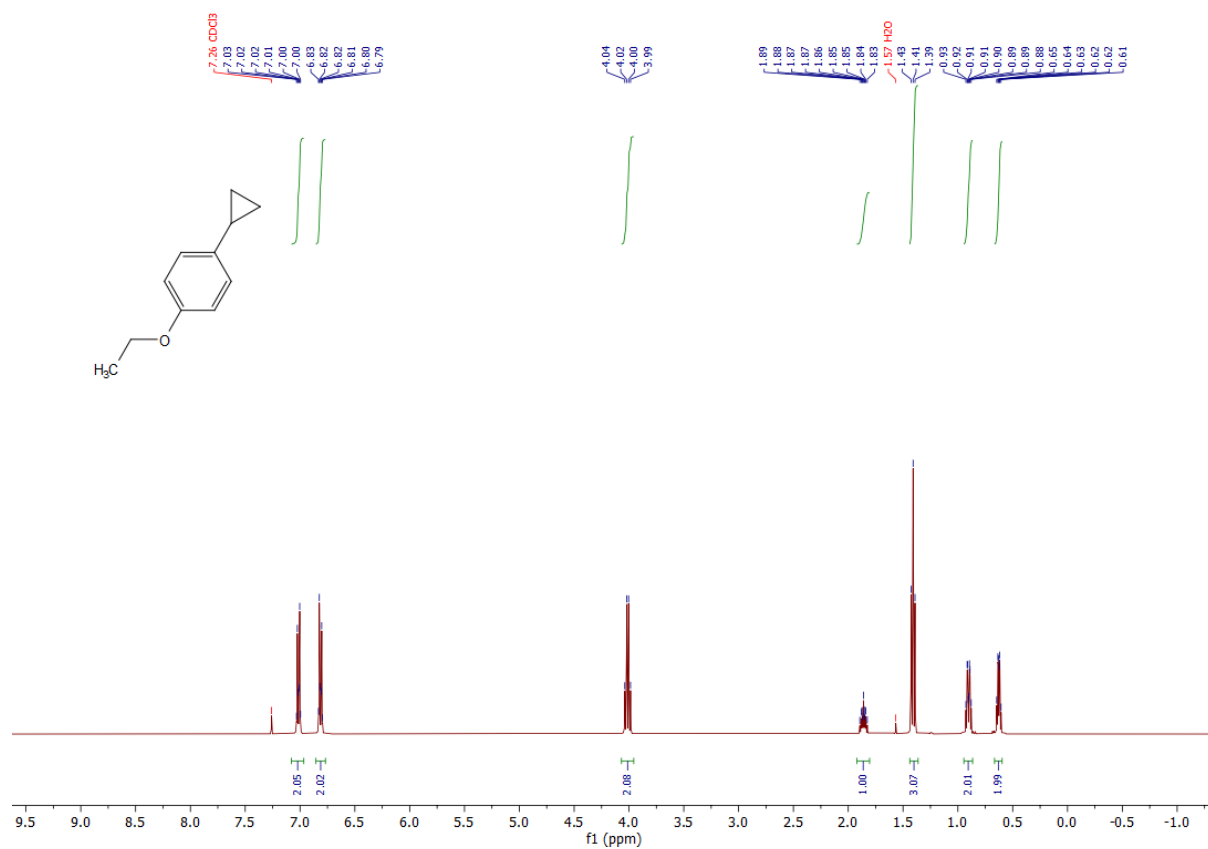
¹H-NMR (400 MHz, CDCl₃) (1n)



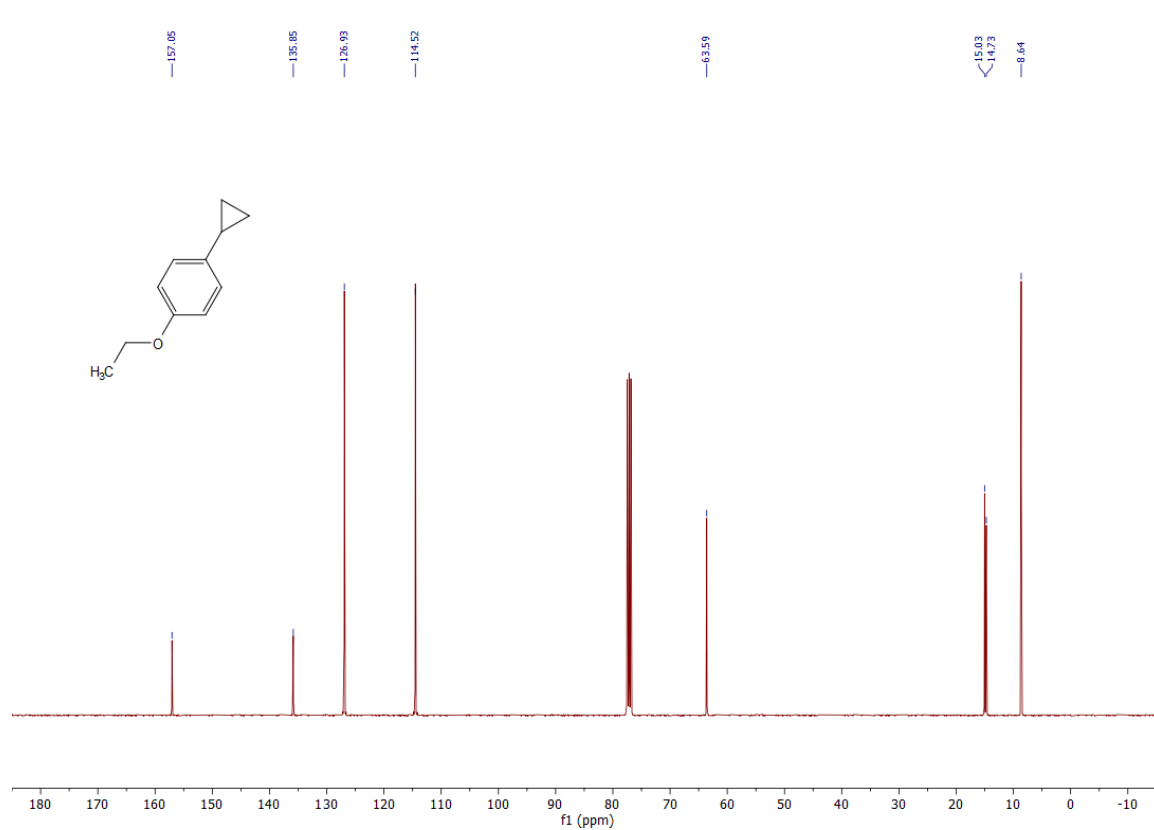
¹³C-NMR (101 MHz, CDCl₃) (1n)



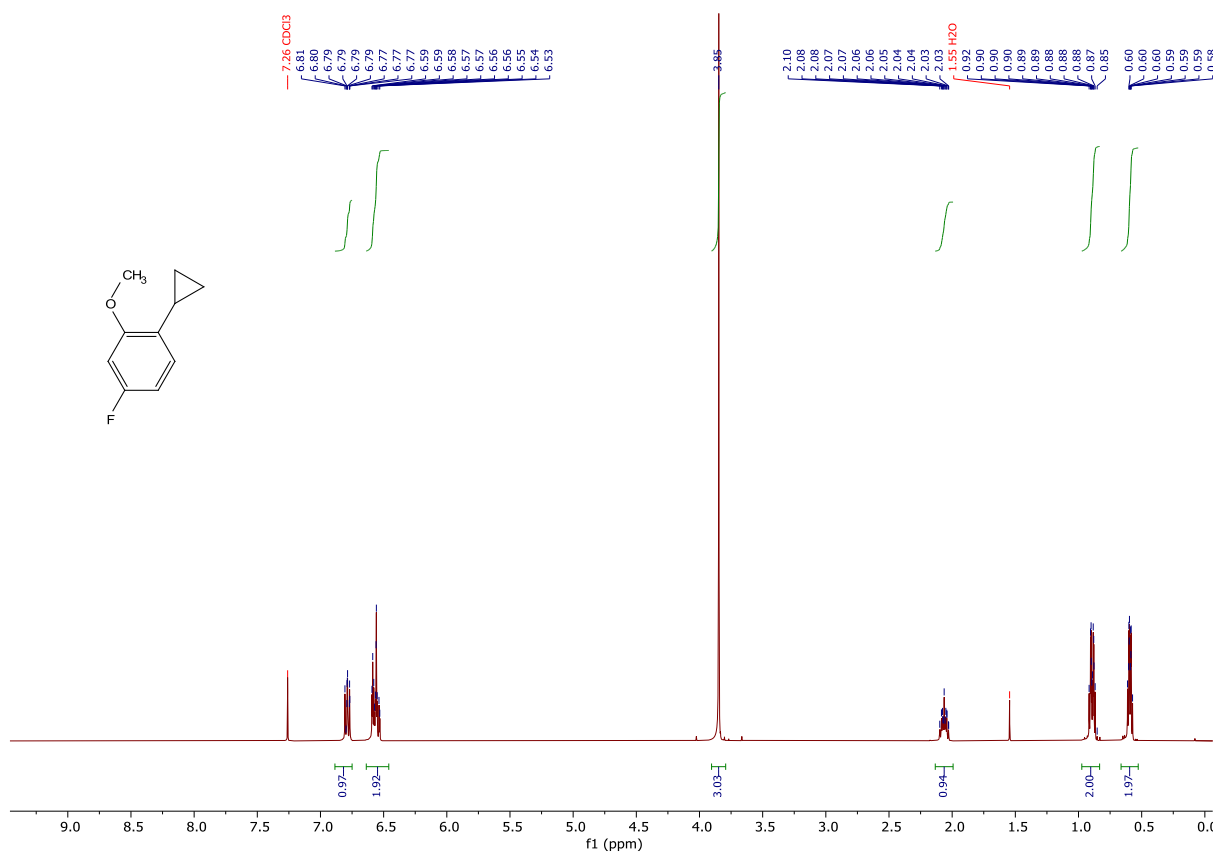
^1H -NMR (400 MHz, CDCl_3) (1p)



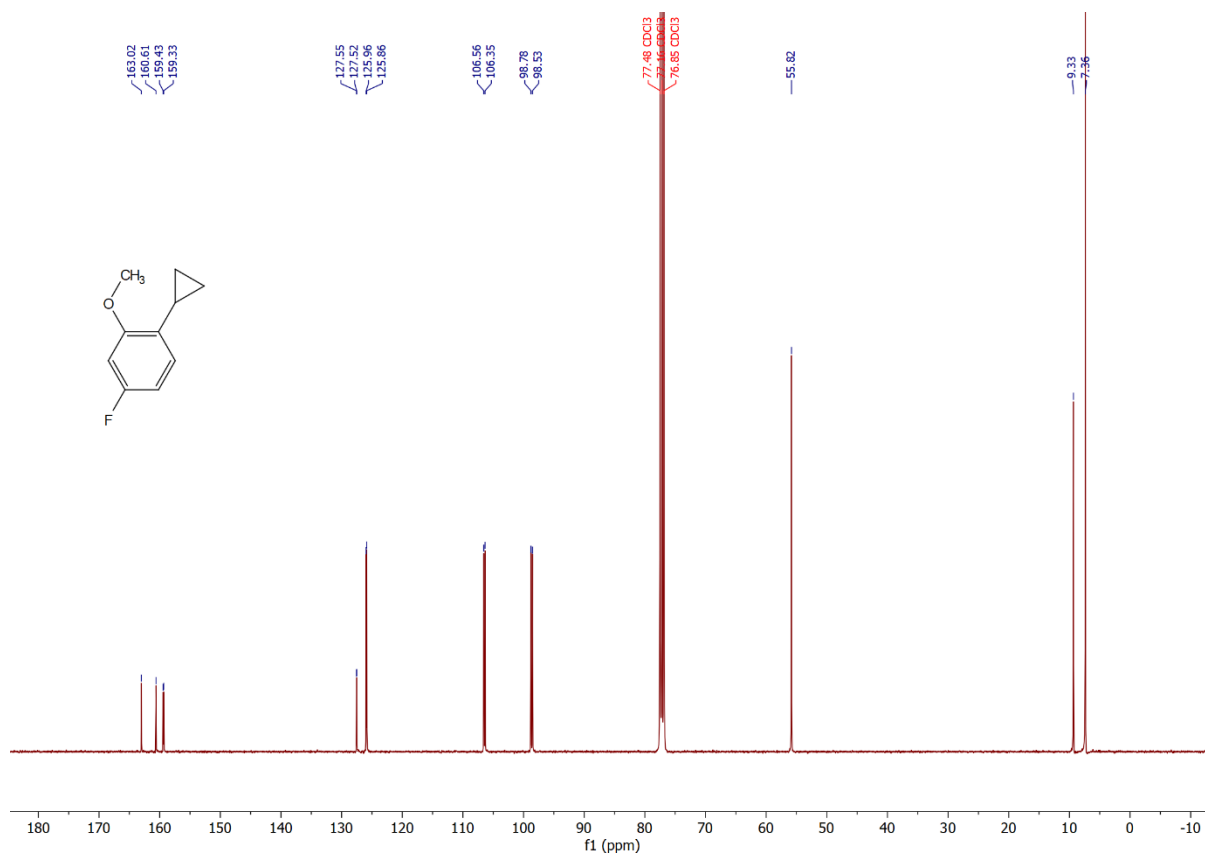
^{13}C NMR (101 MHz, CDCl_3) (1p)



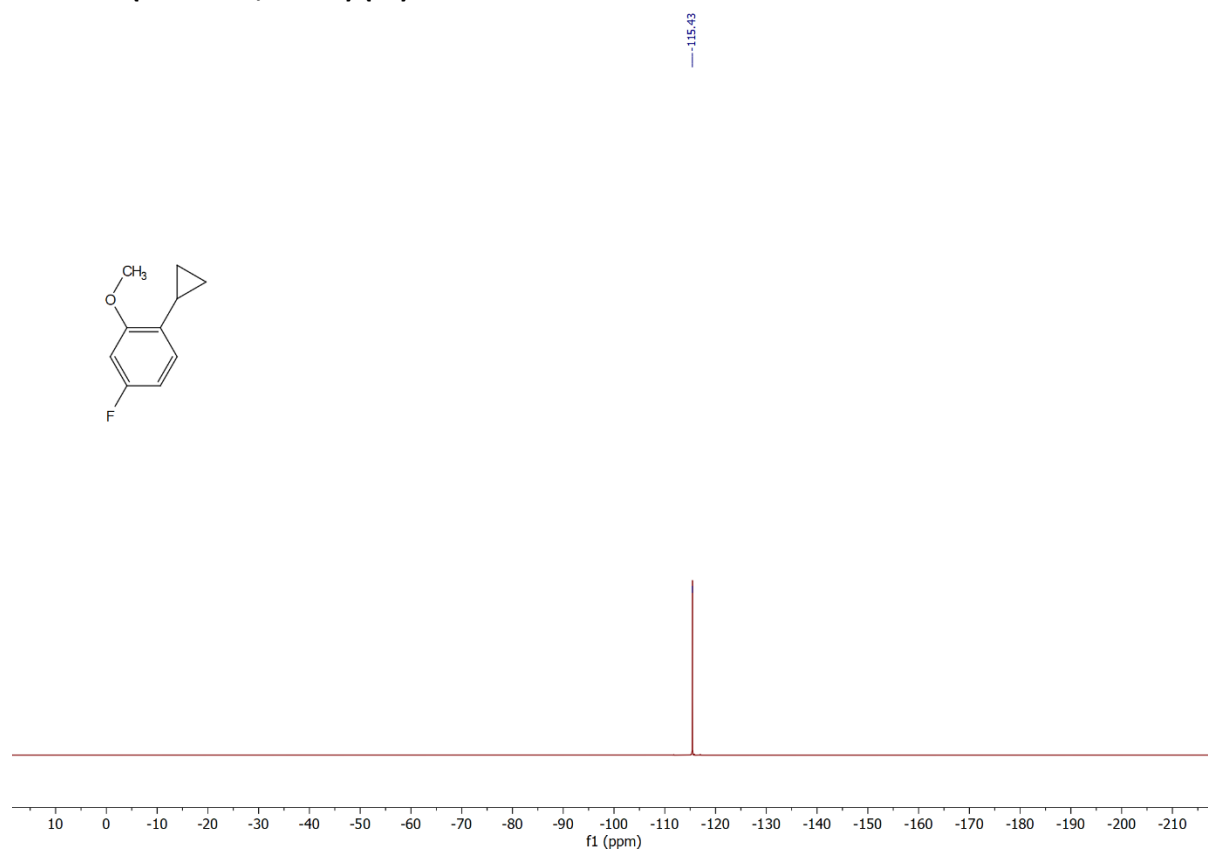
¹H-NMR (400 MHz, CDCl₃) (1r)



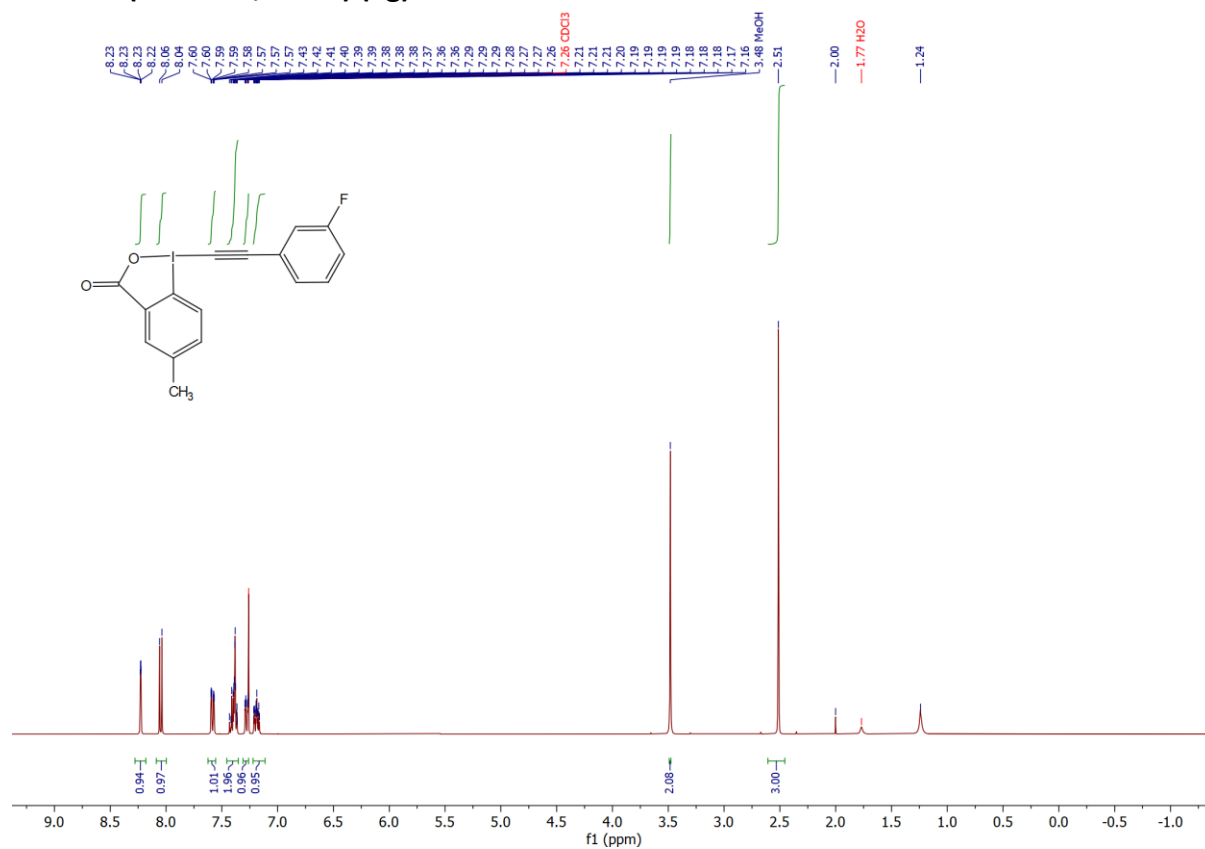
¹³C NMR (101 MHz, CDCl₃) (1r)



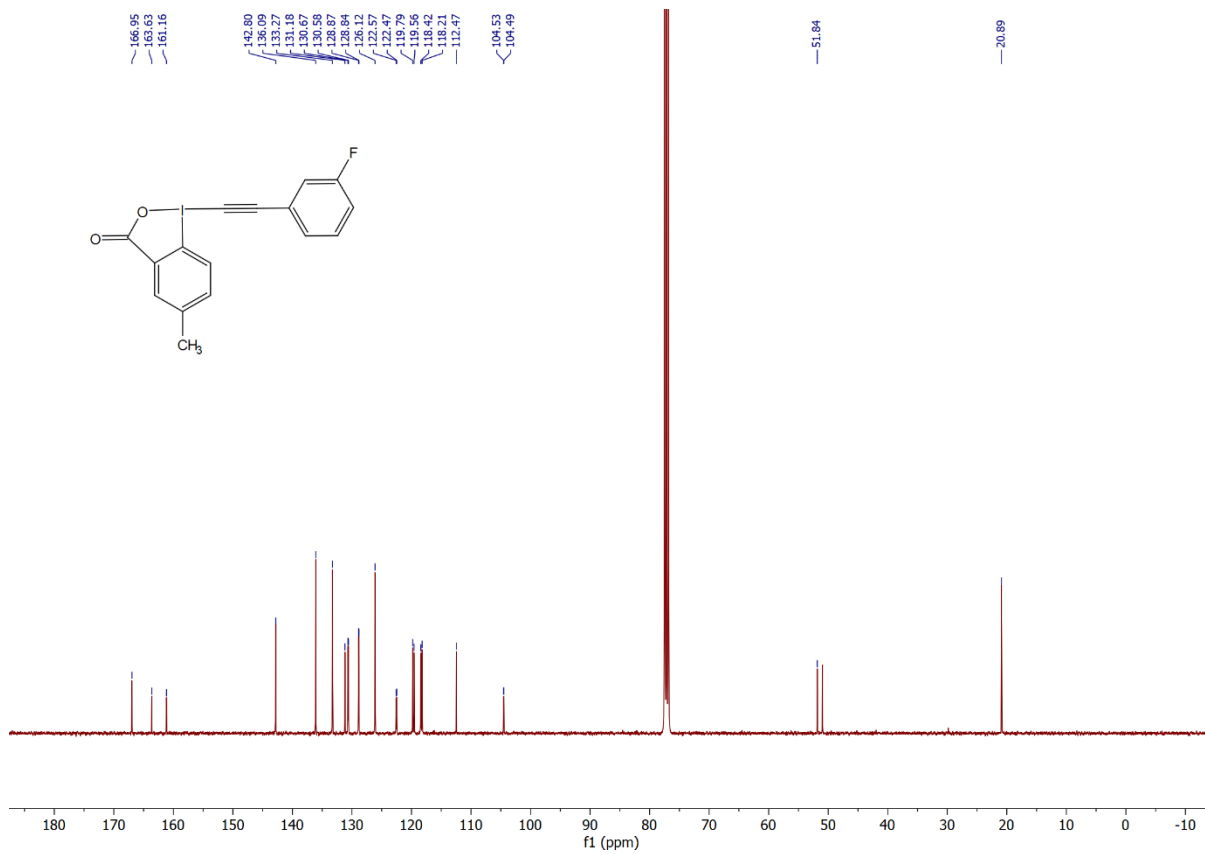
^{19}F NMR (377 MHz, CDCl_3) (1r)



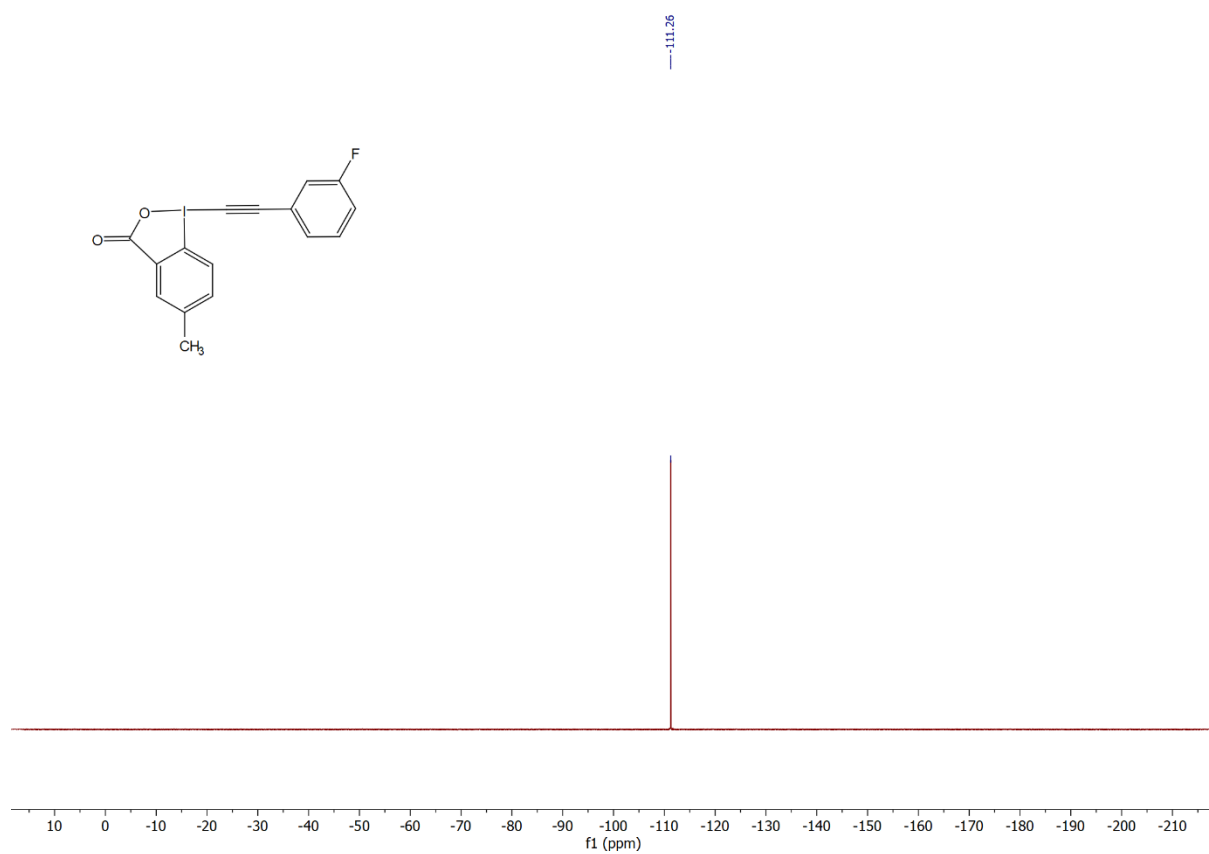
^1H -NMR (400 MHz, CDCl_3) (2g)



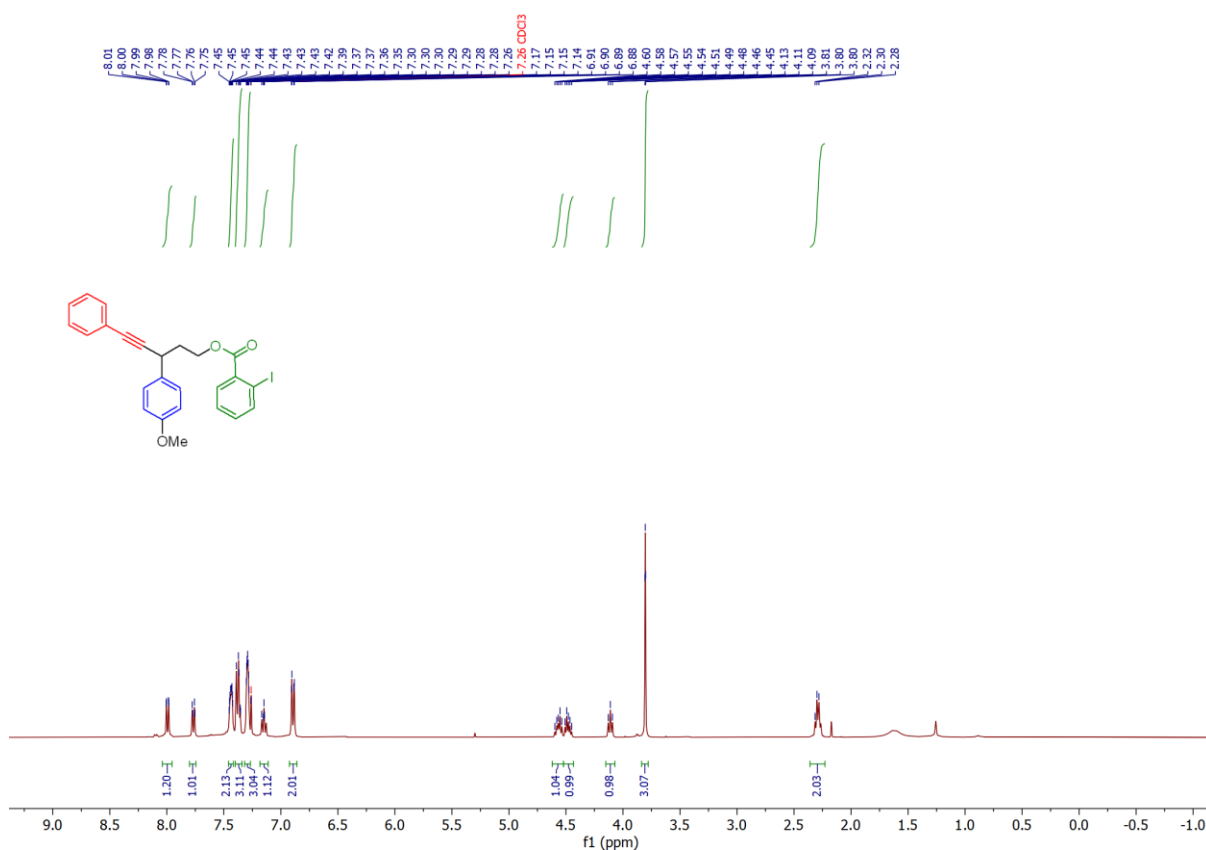
^{13}C -NMR (101 MHz, CDCl_3) (1r)



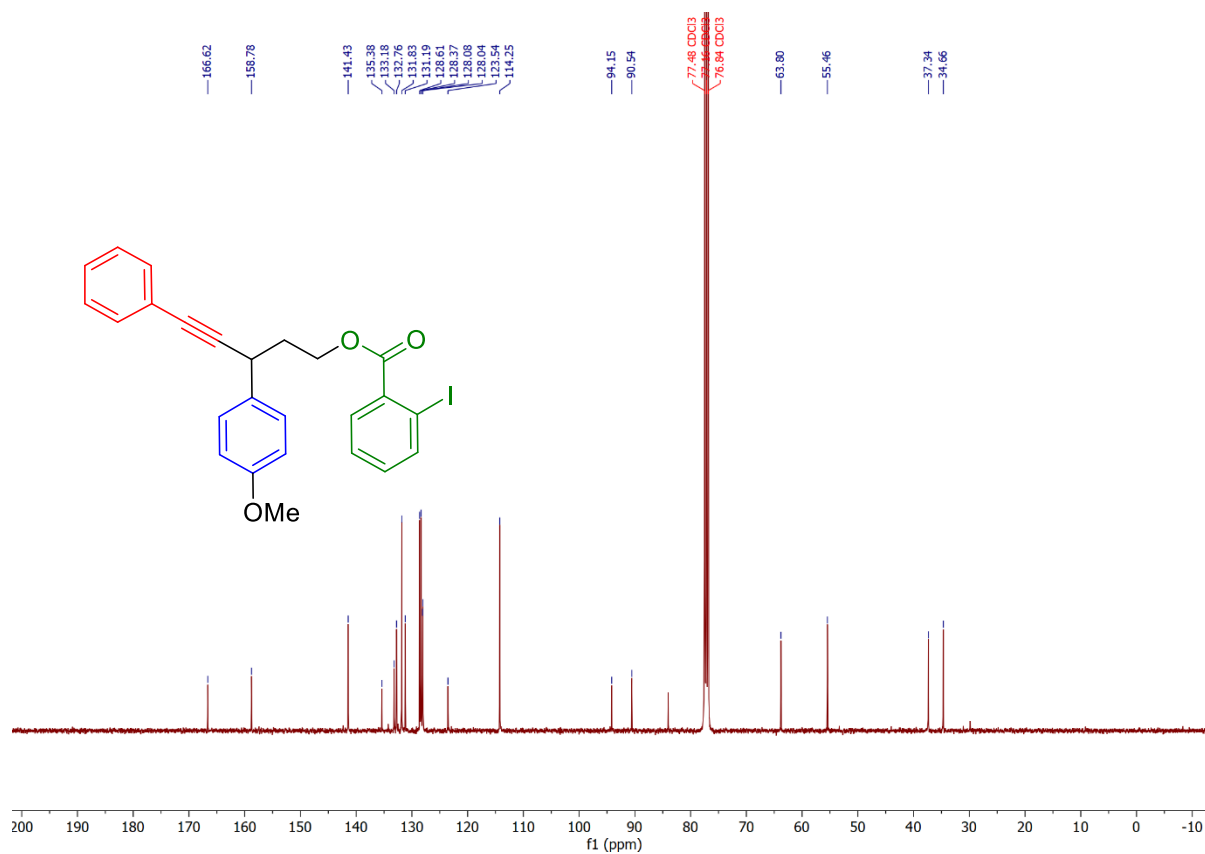
^{19}F NMR (377 MHz, CDCl_3) (2g)



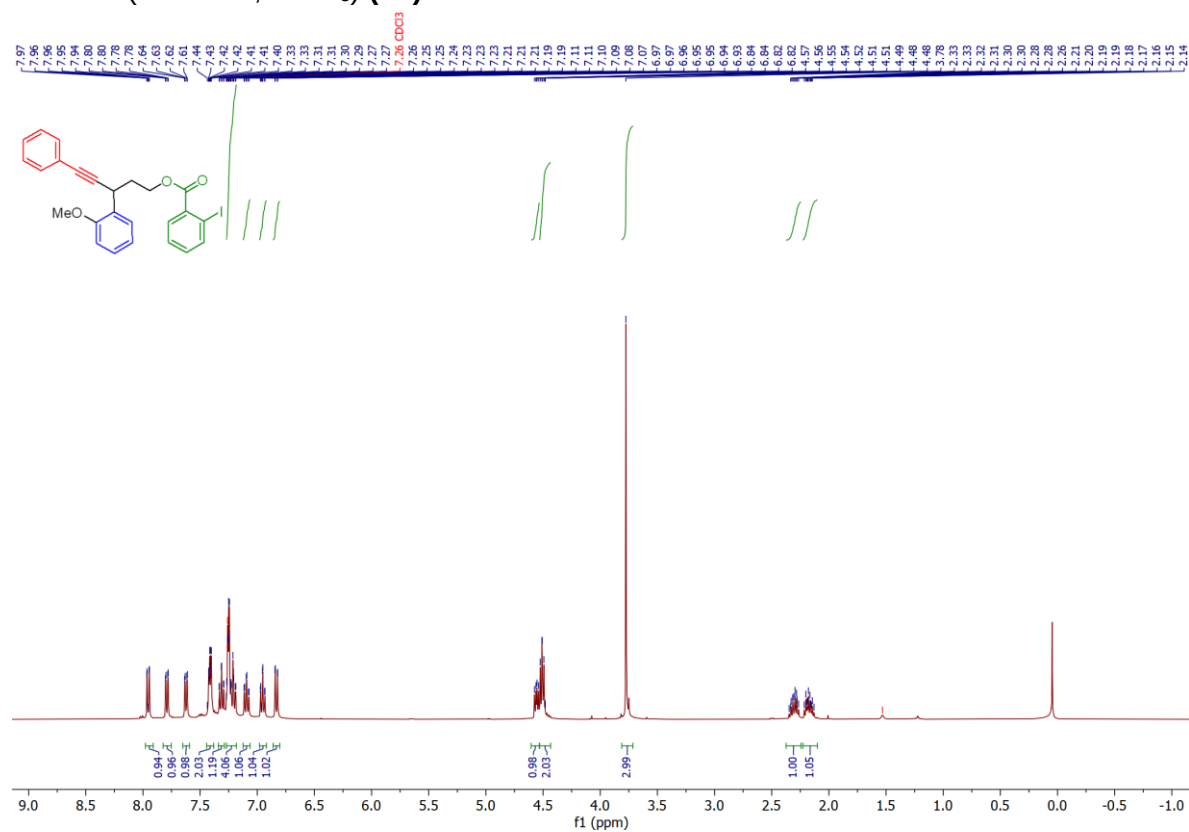
¹H NMR (400 MHz, CDCl₃) (3a)



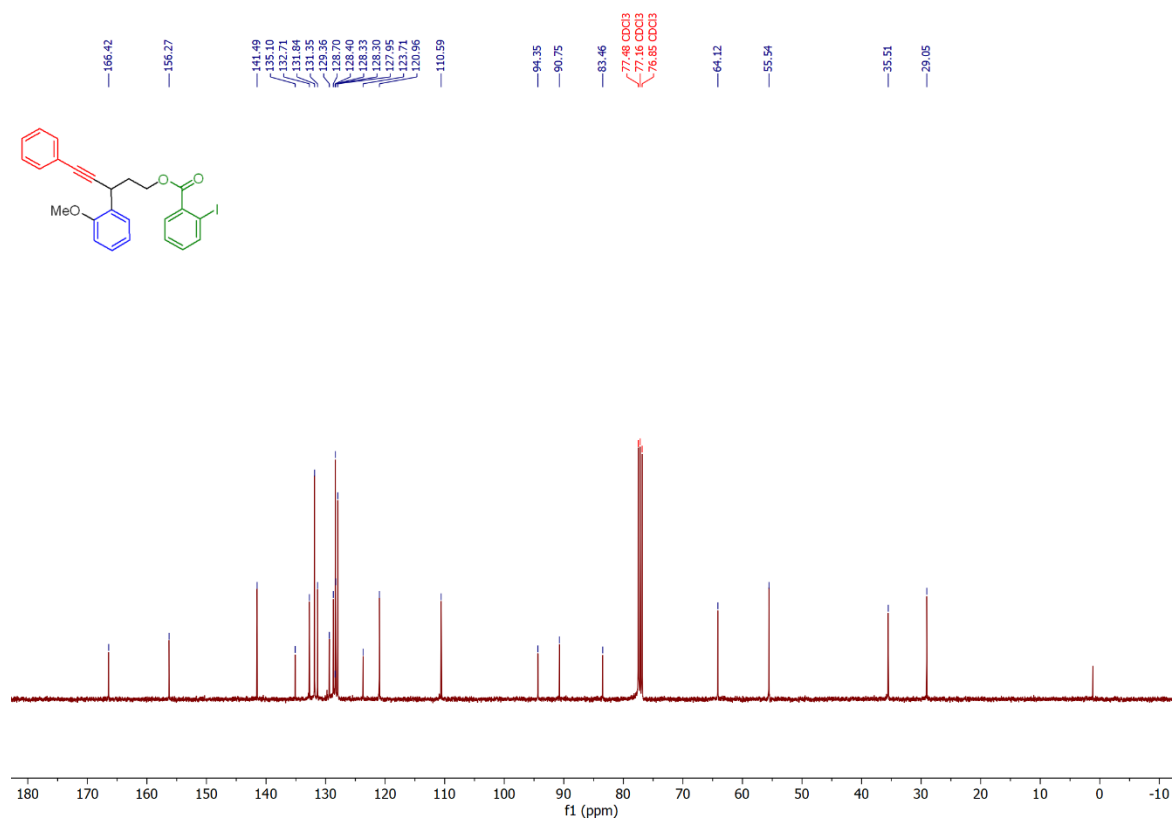
¹³C NMR (101 MHz, CDCl₃) (3a)



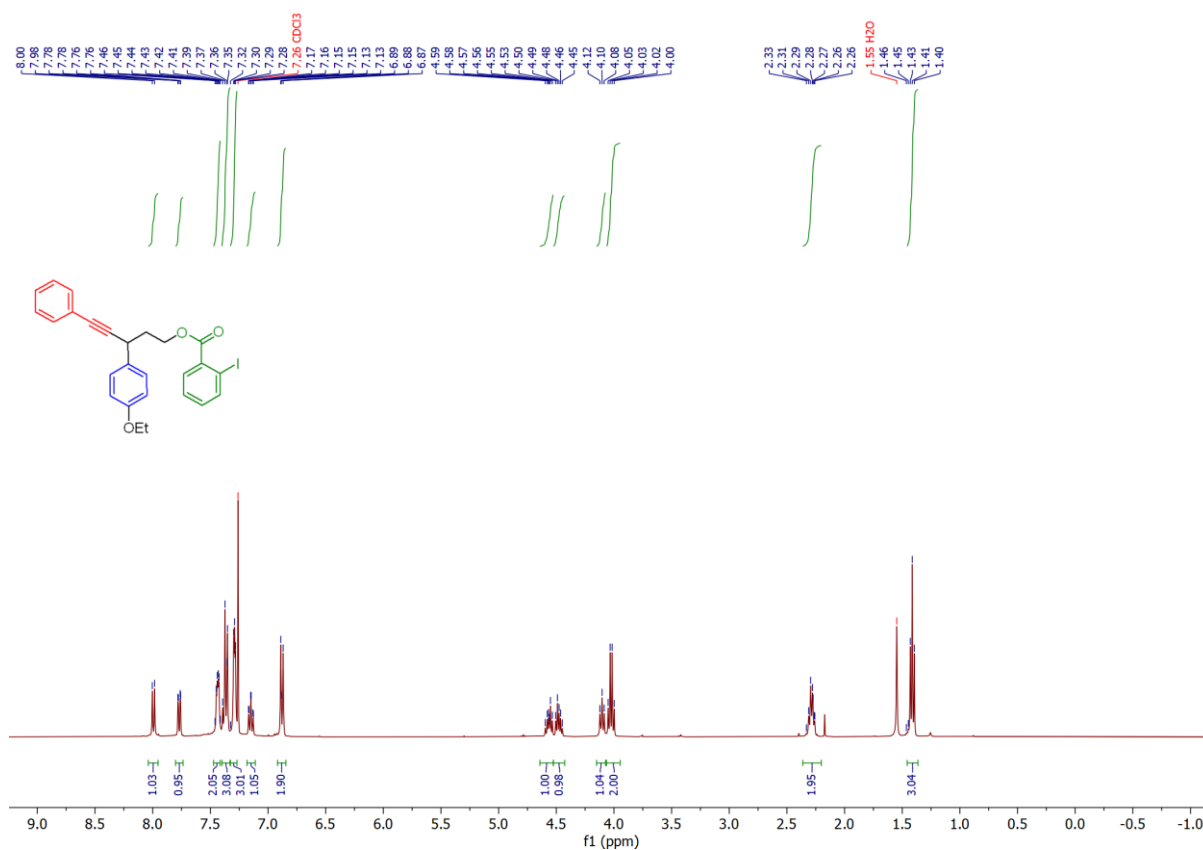
^1H NMR (400 MHz, CDCl_3) (3b)



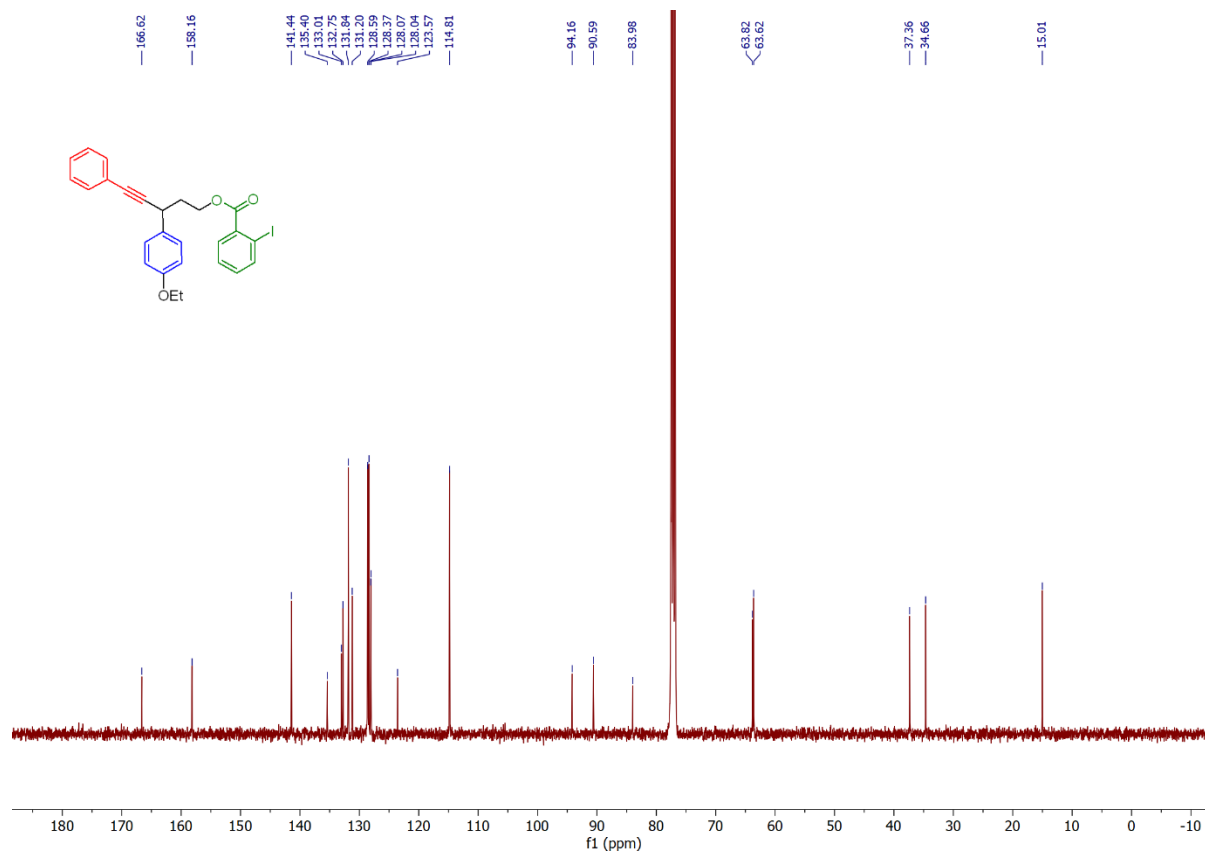
^{13}C NMR (101 MHz, CDCl_3) (3b)



^1H NMR (400 MHz, CDCl_3) (3c)



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



Chemical structure of compound 10: CC(C)(C)c1ccc(cc1C#Cc2ccc(cc2)COC(=O)c3ccc(I)cc3)c4ccccc4

¹H NMR spectrum (CDCl₃) of compound 10. The x-axis represents the chemical shift in ppm (f1), ranging from -1.0 to 9.0. The spectrum shows several peaks corresponding to the structure, with integration values indicated below the peaks.

Integration values (from left to right): 1.01, 1.01, 1.99, 3.00, 1.06, 1.04, 1.04, 1.03, 2.02, 9.05.

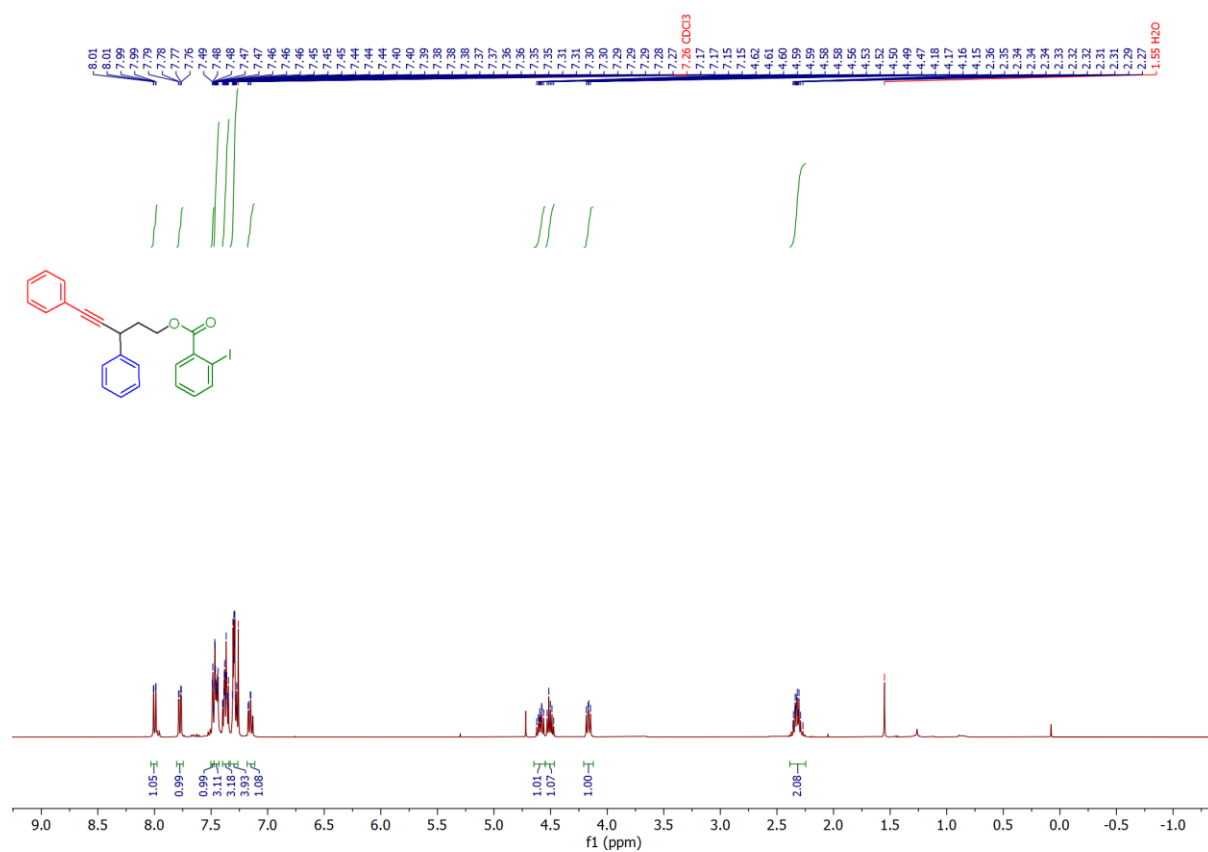
Peak list (ppm): 8.01, 8.01, 7.99, 7.99, 7.82, 7.82, 7.80, 7.79, 7.76, 7.76, 7.65, 7.65, 7.45, 7.45, 7.44, 7.44, 7.40, 7.40, 7.39, 7.38, 7.38, 7.37, 7.37, 7.36, 7.36, 7.31, 7.31, 7.30, 7.30, 7.30, 7.29, 7.29, 7.29, 7.28, 7.28, 7.17, 7.17, 7.15, 7.15, 7.15, 7.15, 7.13, 7.13, 4.62, 4.61, 4.60, 4.59, 4.59, 4.58, 4.57, 4.56, 4.53, 4.52, 4.50, 4.49, 4.48, 4.16, 4.14, 4.14, 4.12, 2.35, 2.34, 2.33, 2.33, 2.32, 2.32, 2.31, 2.31, 2.30, 2.29, 1.33.

Chemical structure: CC(C)(C)c1ccc(cc1)C#CC(C)COC(=O)c2ccccc2I

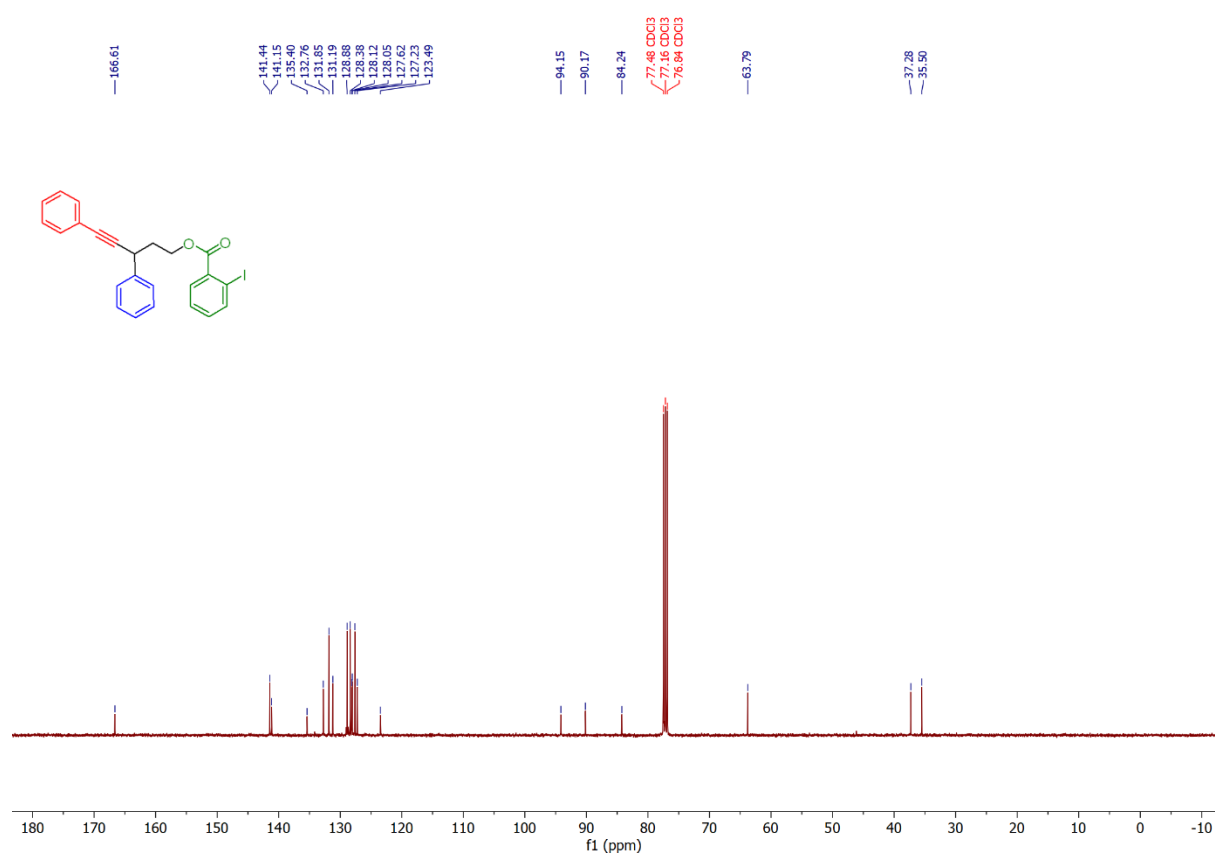
¹³C NMR spectrum (ppm):

- 166.54
- 150.08
- 141.44
- 138.01
- 135.41
- 132.74
- 131.84
- 131.18
- 128.35
- 128.05
- 127.76
- 125.71
- 123.58
- 94.16
- 90.48
- 84.00
- 77.48 CDCl₃
- 77.16 CDCl₃
- 76.84 CDCl₃
- 63.88
- 37.19
- 34.96
- 34.61
- 31.51

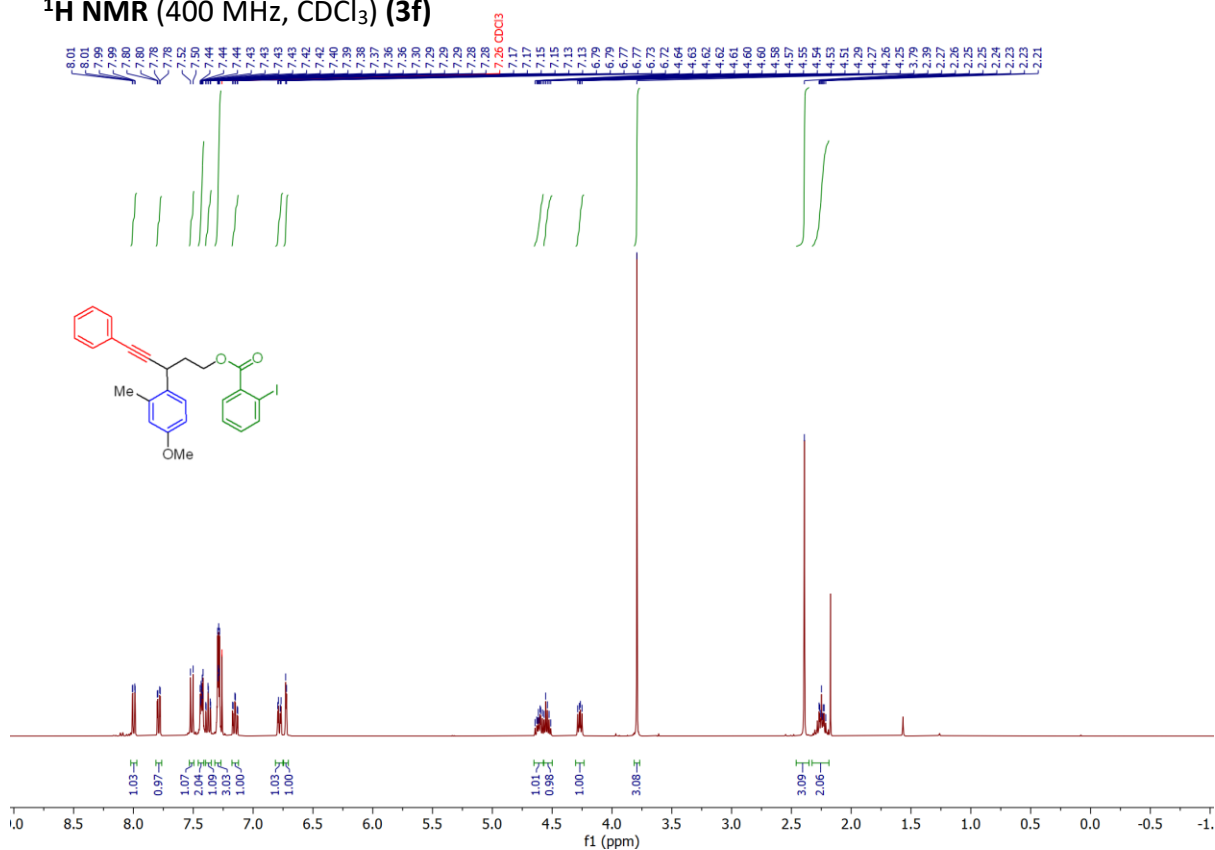
¹H NMR (400 MHz, CDCl₃) (3e)



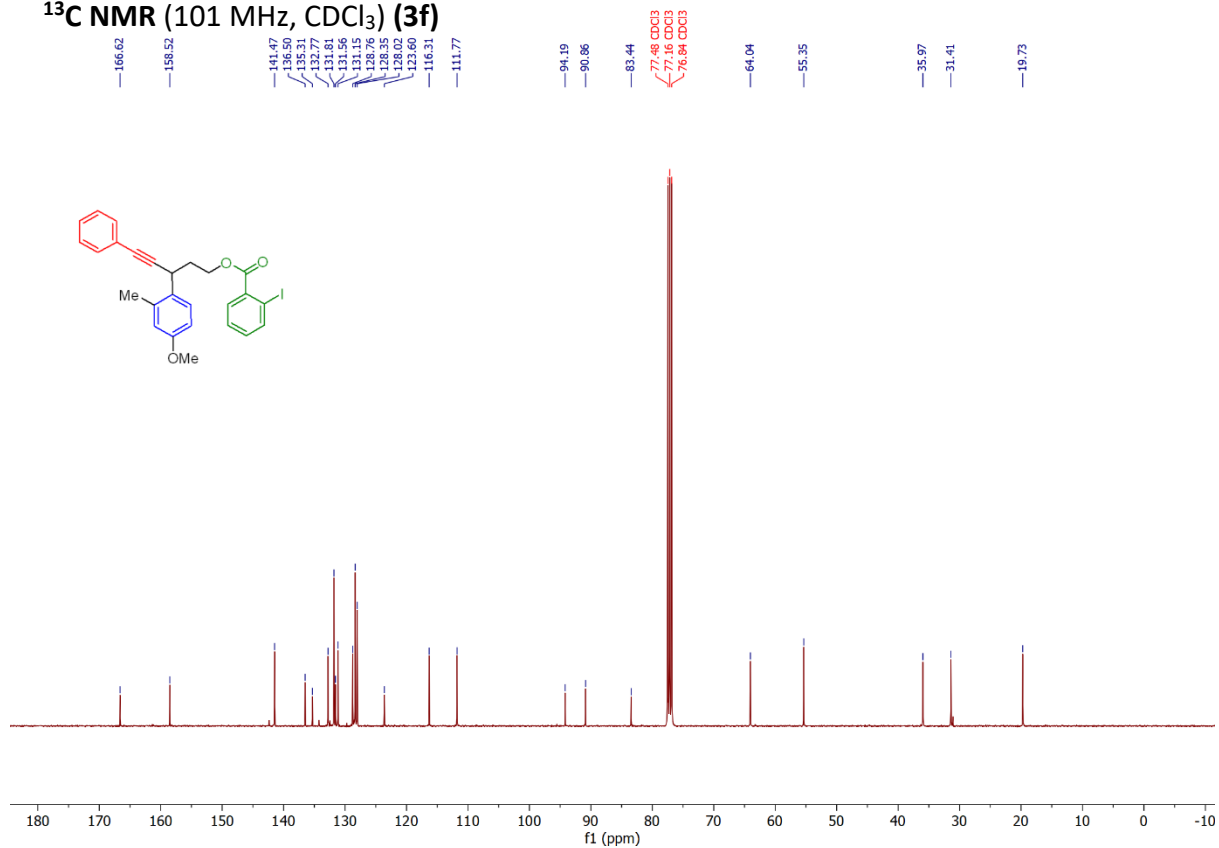
¹³C NMR (101 MHz, CDCl₃): (3e)



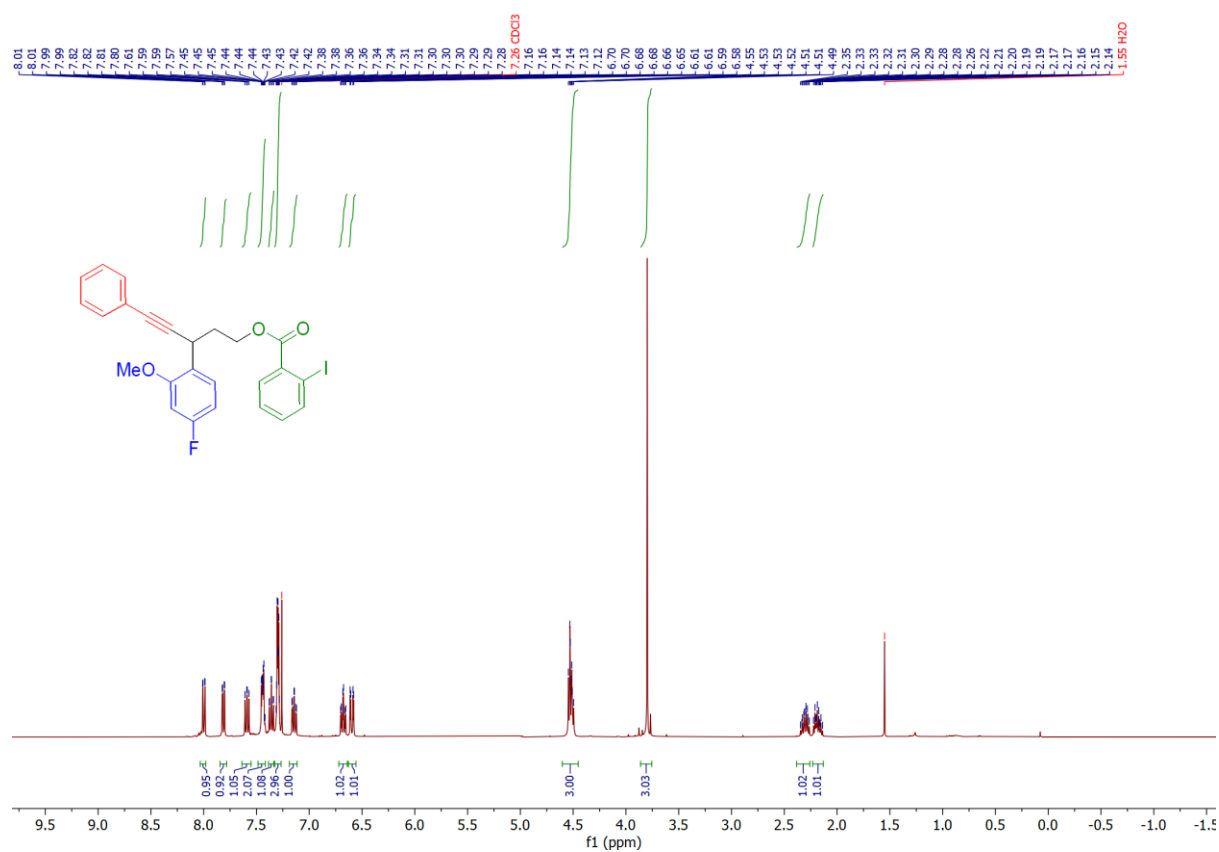
¹H NMR (400 MHz, CDCl₃) (3f)



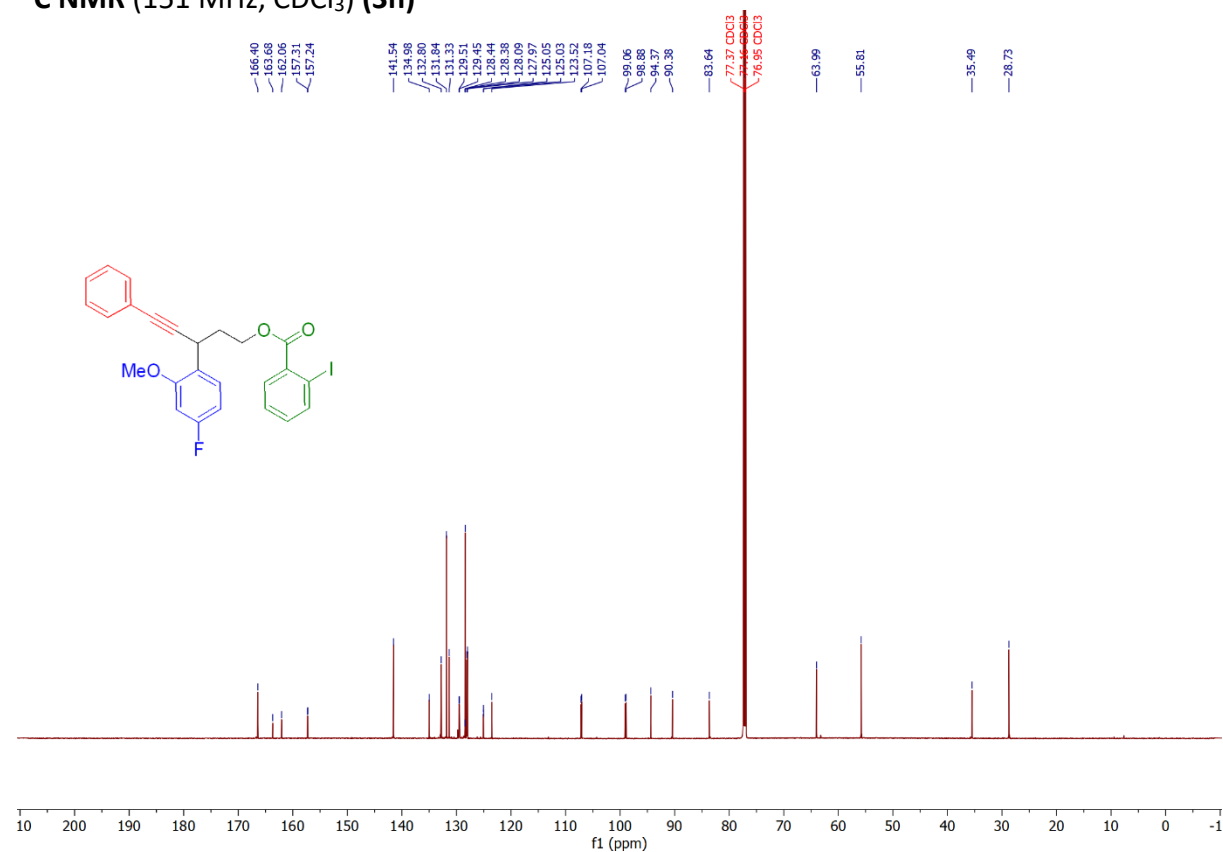
¹³C NMR (101 MHz, CDCl₃) (3f)



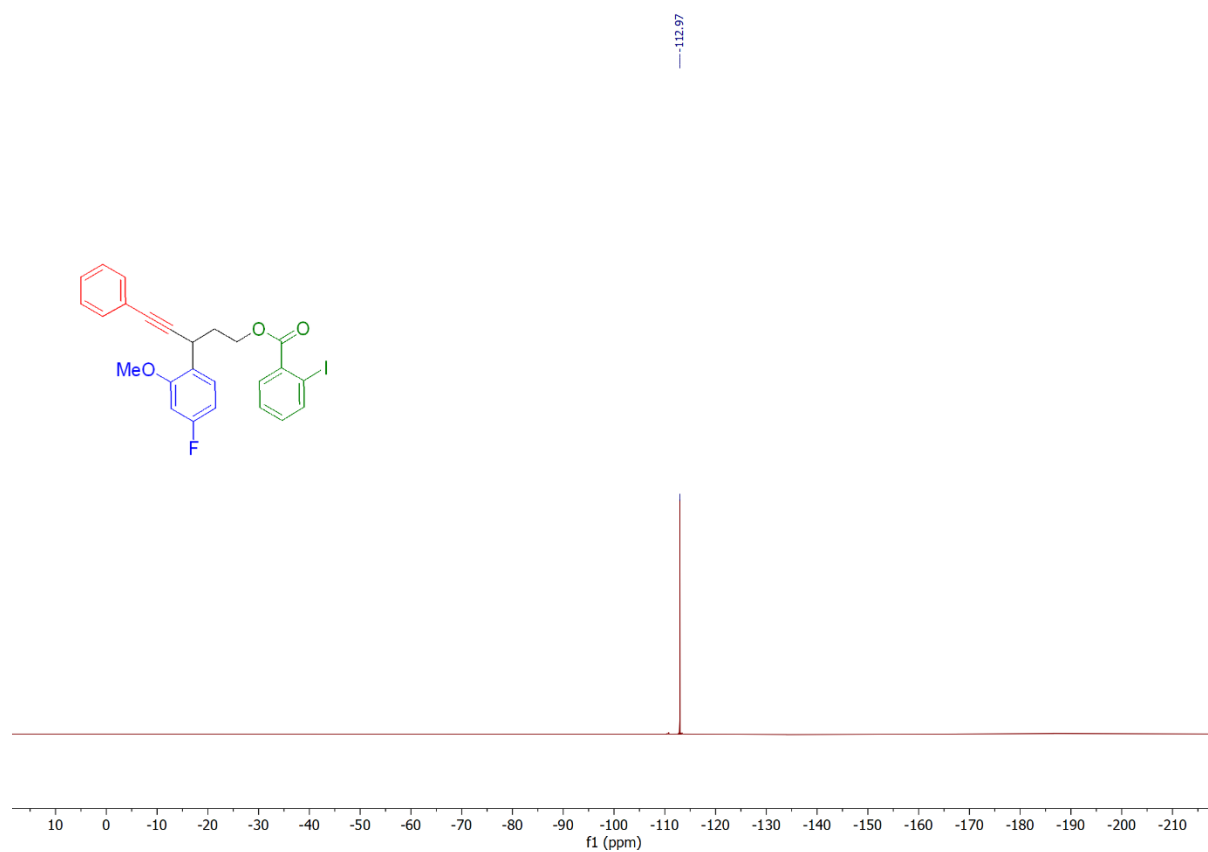
^1H NMR (400 MHz, CDCl_3) (3h)



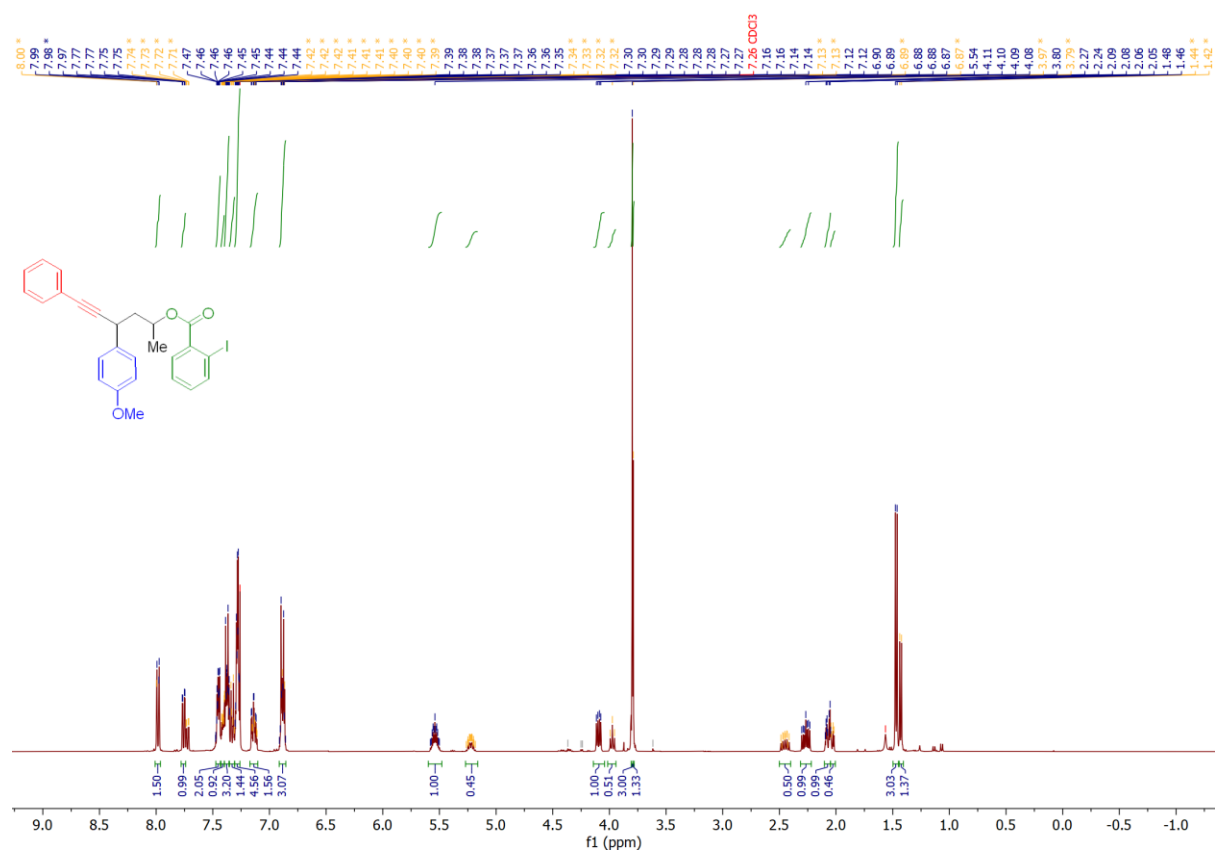
^{13}C NMR (151 MHz, CDCl_3) (3h)



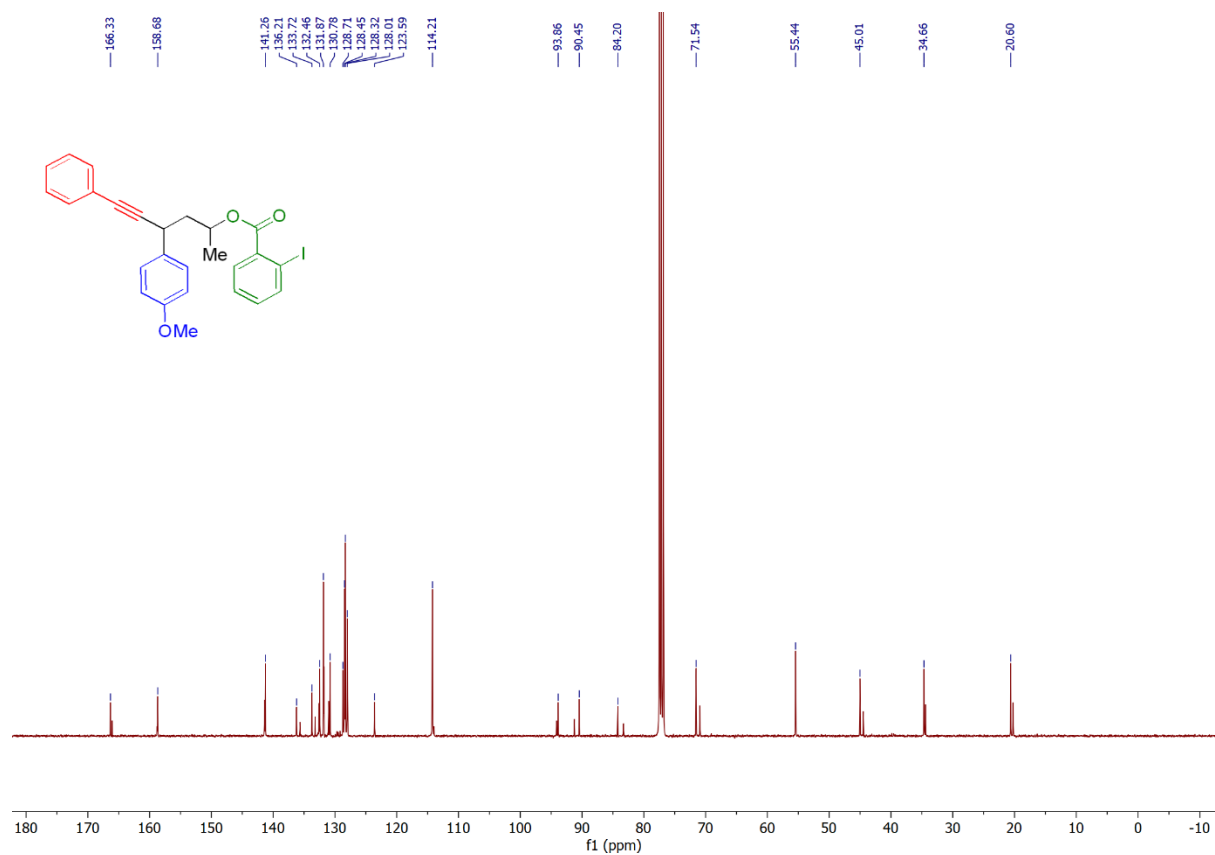
^{19}F NMR (376 MHz, CDCl_3) (3h)



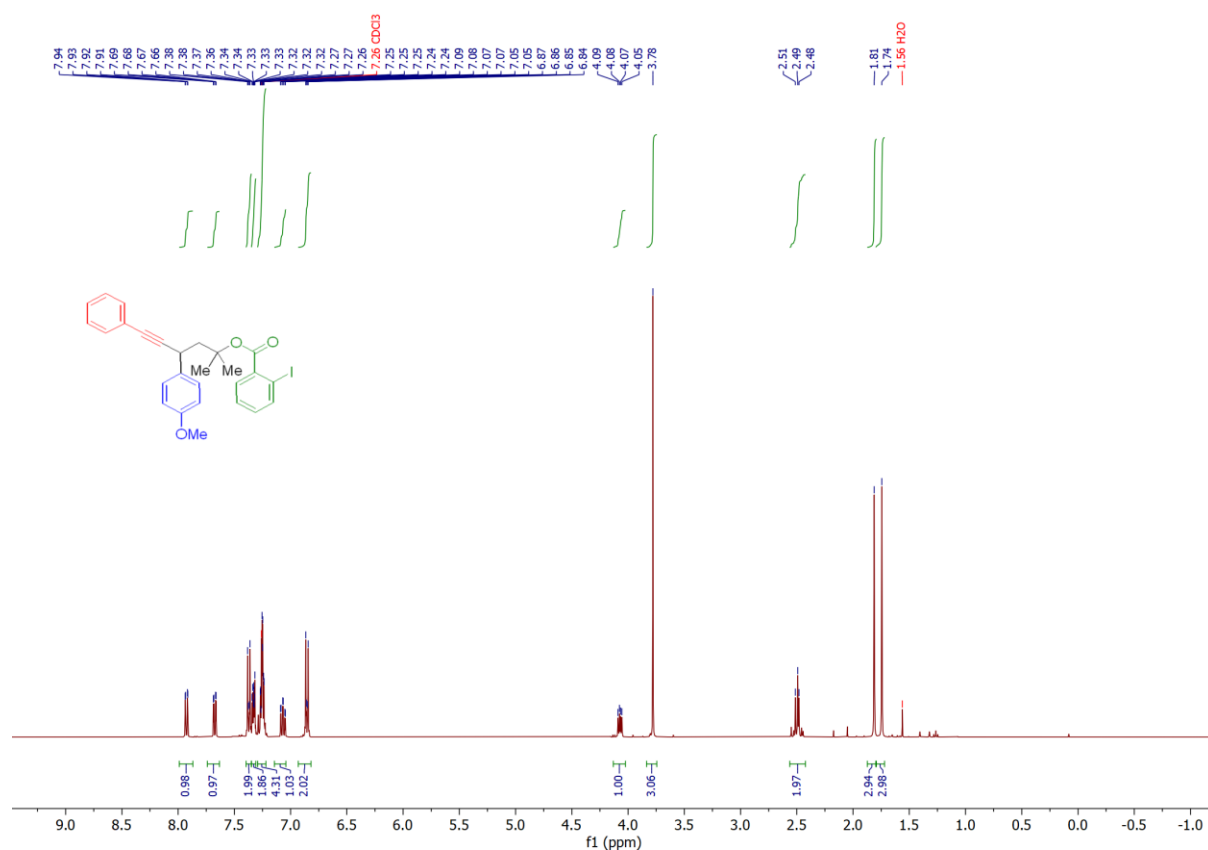
¹H NMR (400 MHz, CDCl₃) (3i) Blue : major diastereomer. Organe : minor diastereomer



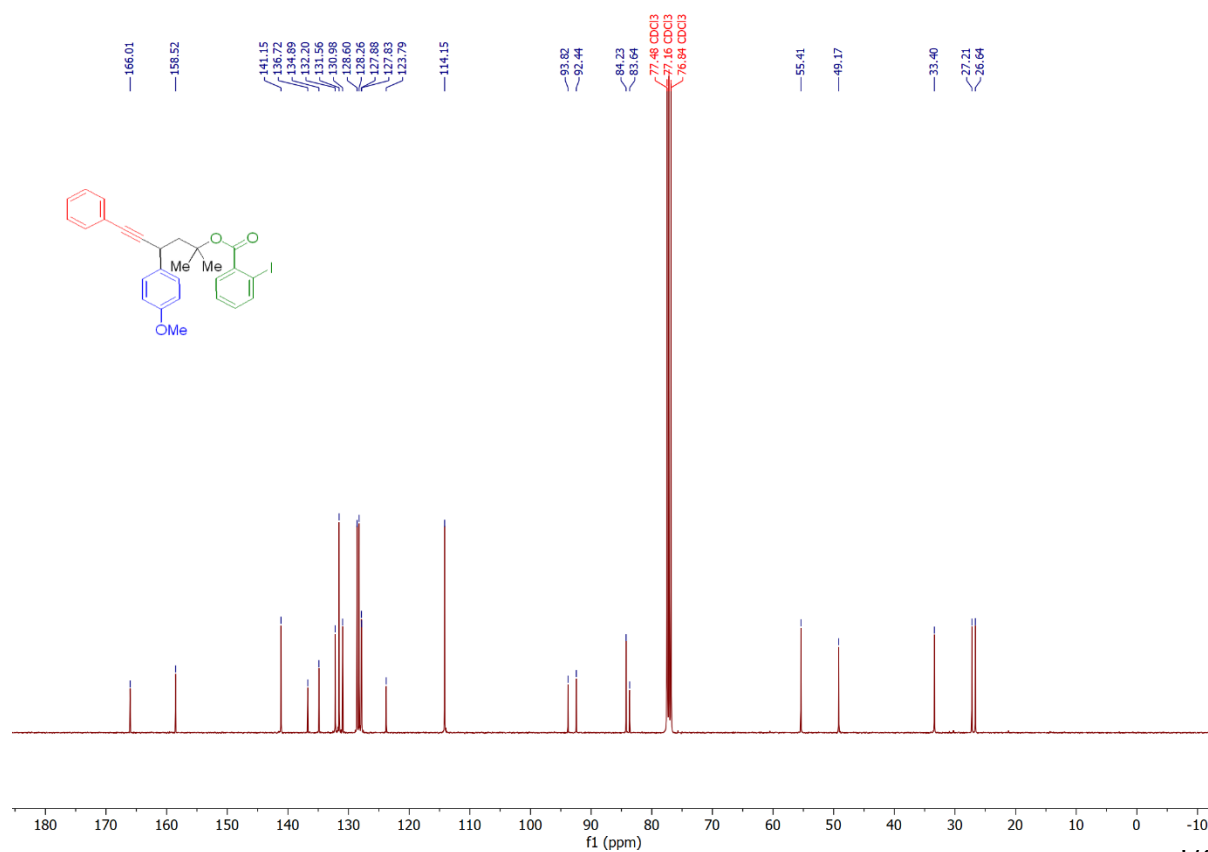
¹³C NMR (101 MHz, CDCl₃) (3i)



¹H NMR (400 MHz, CDCl₃) (3j)



¹³C NMR (101 MHz, CDCl₃) (3j)



Chemical Structure of 10: COc1ccc(cc1)C#CC(C)(Cc2ccc(I)cc2)C3=CC=CC=C3

¹H NMR Spectrum (CDCl₃):

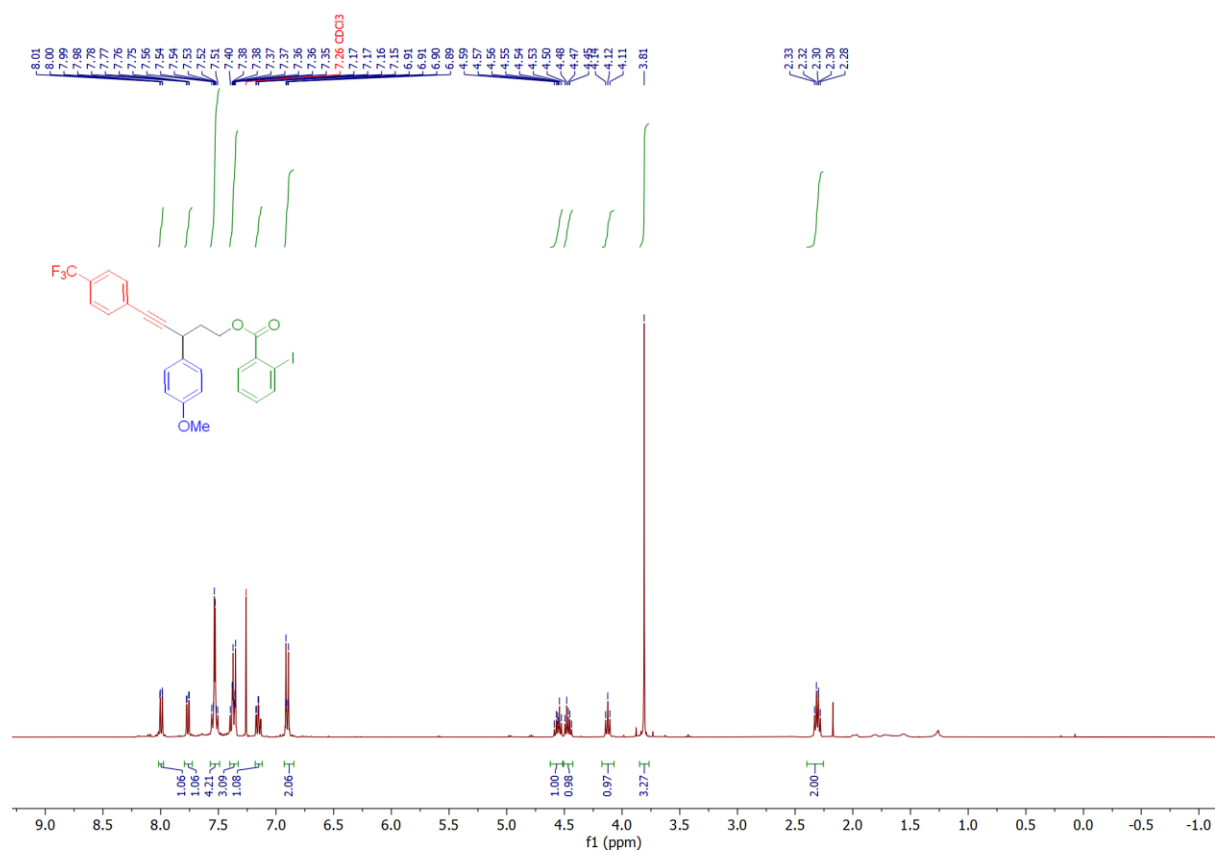
Chemical Shift (ppm)	Integration
8.01, 8.00, 7.99, 7.98, 7.78, 7.77, 7.76, 7.75	1.06, 1.03
7.40, 7.39, 7.38, 7.38, 7.37, 7.36, 7.36, 7.34, 7.33, 7.32, 7.32, 7.17, 7.15, 7.13, 7.13, 7.11, 7.11, 7.11, 7.09, 7.09, 6.90, 6.90, 6.89, 6.88, 6.80, 6.80, 4.57, 4.55, 4.53, 4.51, 4.49, 4.46, 4.46, 4.45, 4.12, 4.10, 4.10, 3.80, 3.80, 3.80, 2.31, 2.30, 2.29, 2.28, 2.28, 2.27, 2.27, 2.26, 2.25	3.06, 2.08, 1.17, 2.03, 2.04, 1.03, 1.02, 1.02, 3.00, 2.31, 2.02

Chemical structure of compound 10: CC1=CC=C(C#CC(C2=CC=C(OC)C=C2)C(C3=CC=CC=C3)COC(=O)C4=CC=CC=C4I)C1

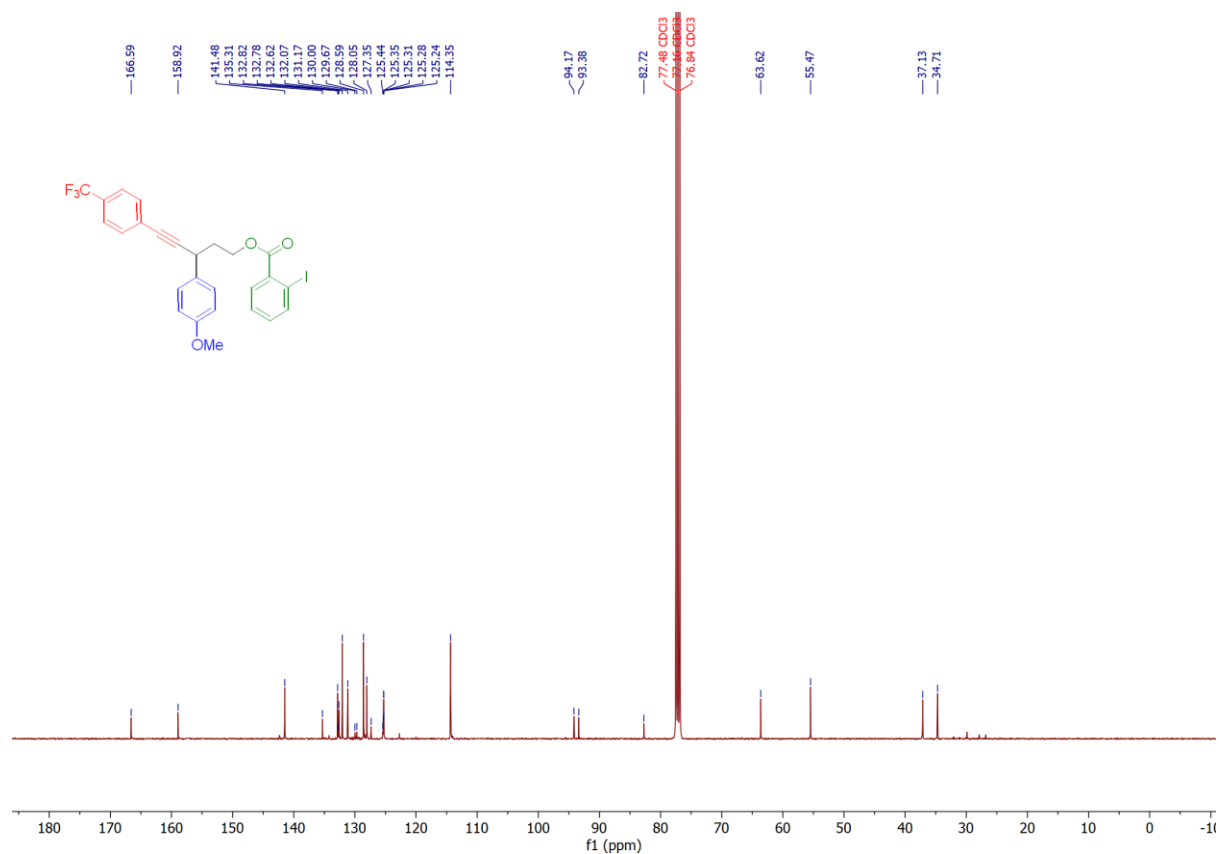
¹³C NMR spectrum (CDCl₃) of compound 10. The x-axis represents the chemical shift in ppm, ranging from 180 to -10. The spectrum shows several peaks corresponding to the structure, with the following chemical shifts labeled:

- 166.61
- 158.75
- 141.42
- 138.10
- 135.42
- 133.34
- 132.73
- 131.69
- 131.19
- 128.61
- 128.03
- 120.46
- 114.22
- 94.15
- 89.74
- 84.08
- 77.48 (CDCl₃)
- 76.84 (CDCl₃)
- 76.84 (CDCl₃)
- 63.83
- 55.45
- 37.39
- 34.67
- 21.58

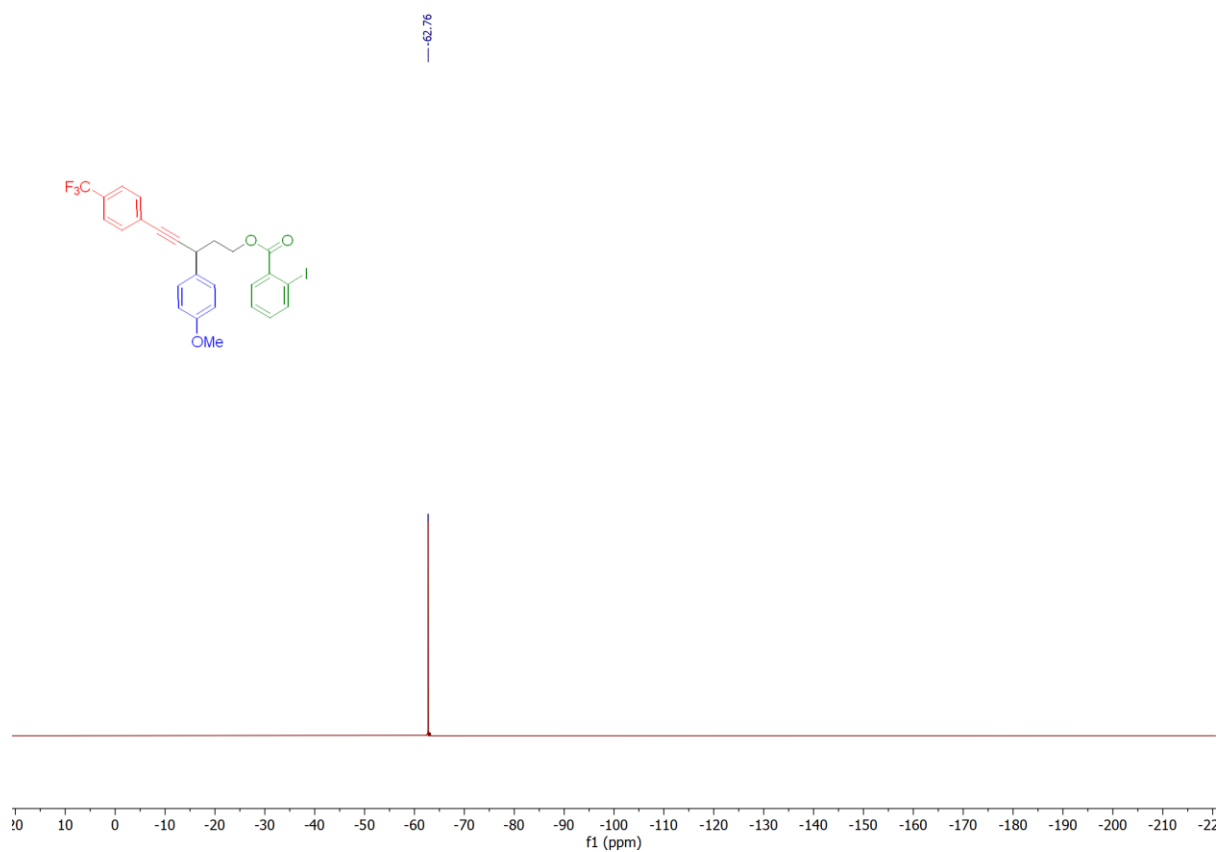
^1H NMR (400 MHz, CDCl_3) (3I)



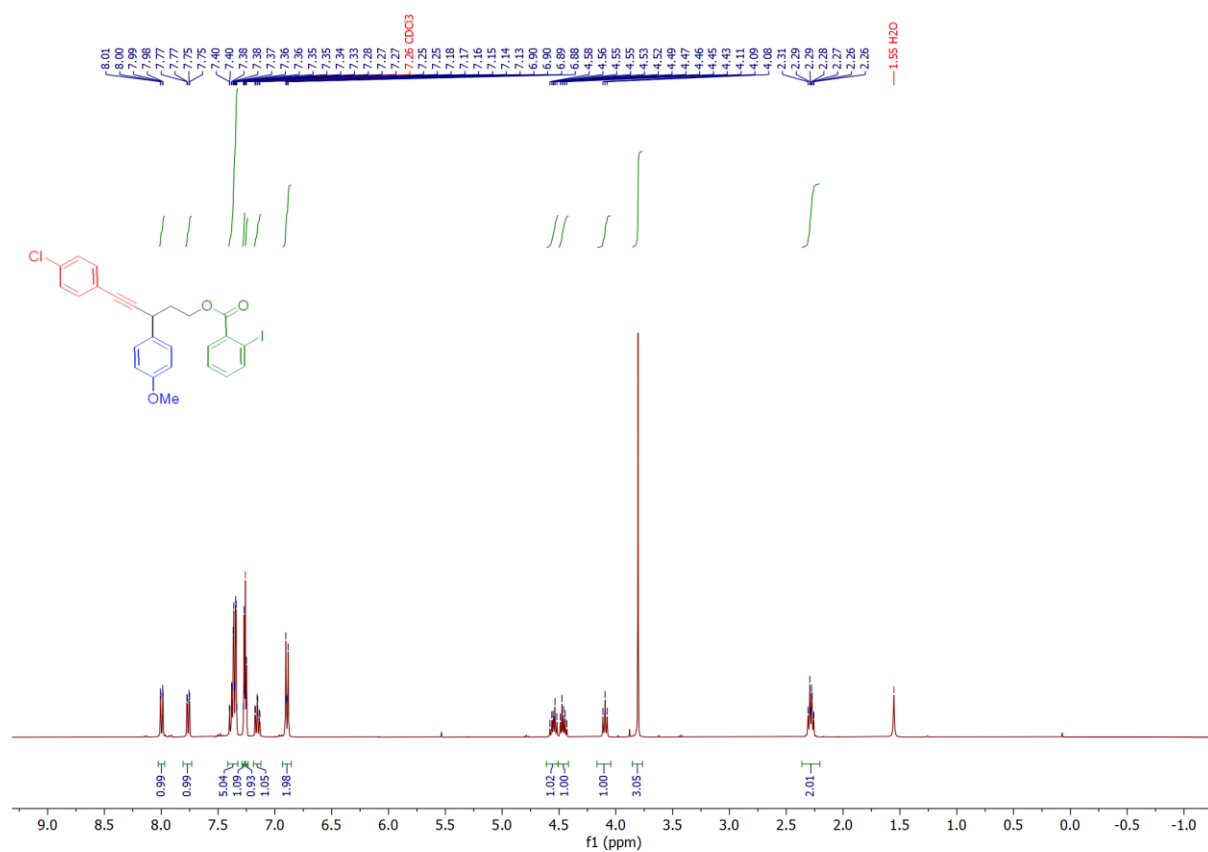
^{13}C NMR (101 MHz, CDCl_3) (3I)



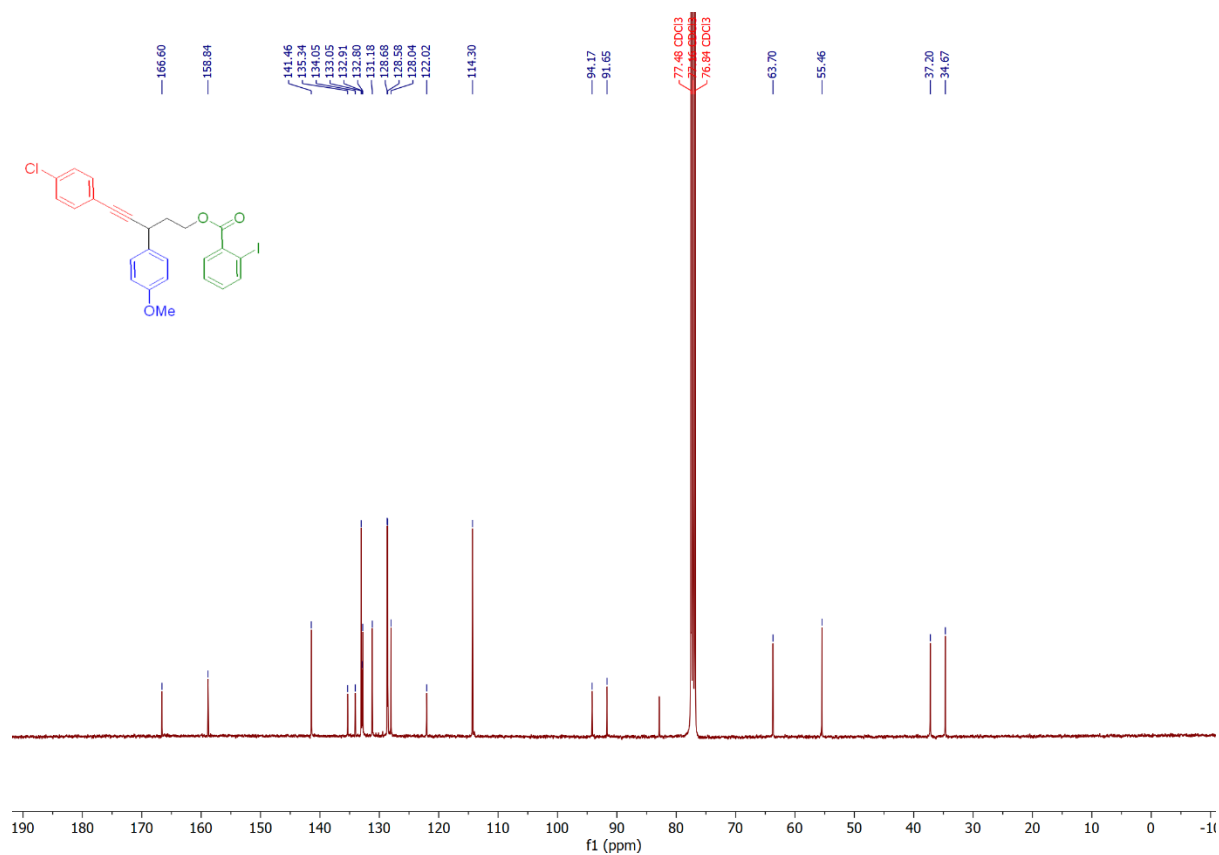
^{19}F NMR (377 MHz, CDCl_3) (3I)



¹H NMR (400 MHz, CDCl₃) (3m)



¹³C NMR (101 MHz, CDCl₃) (3m)



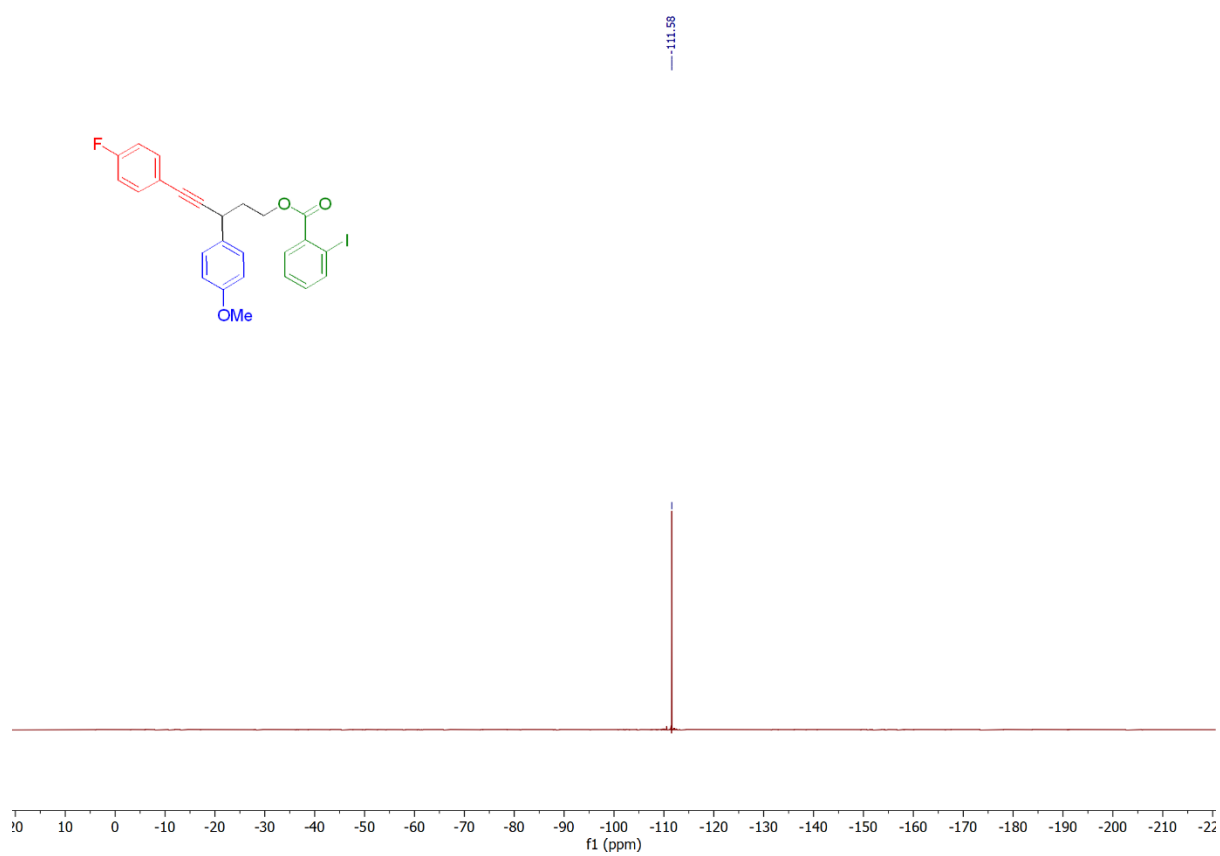
[illegible]

Chemical structure of compound 10: COc1ccc(cc1)C#CC(CO)COc2ccccc2I

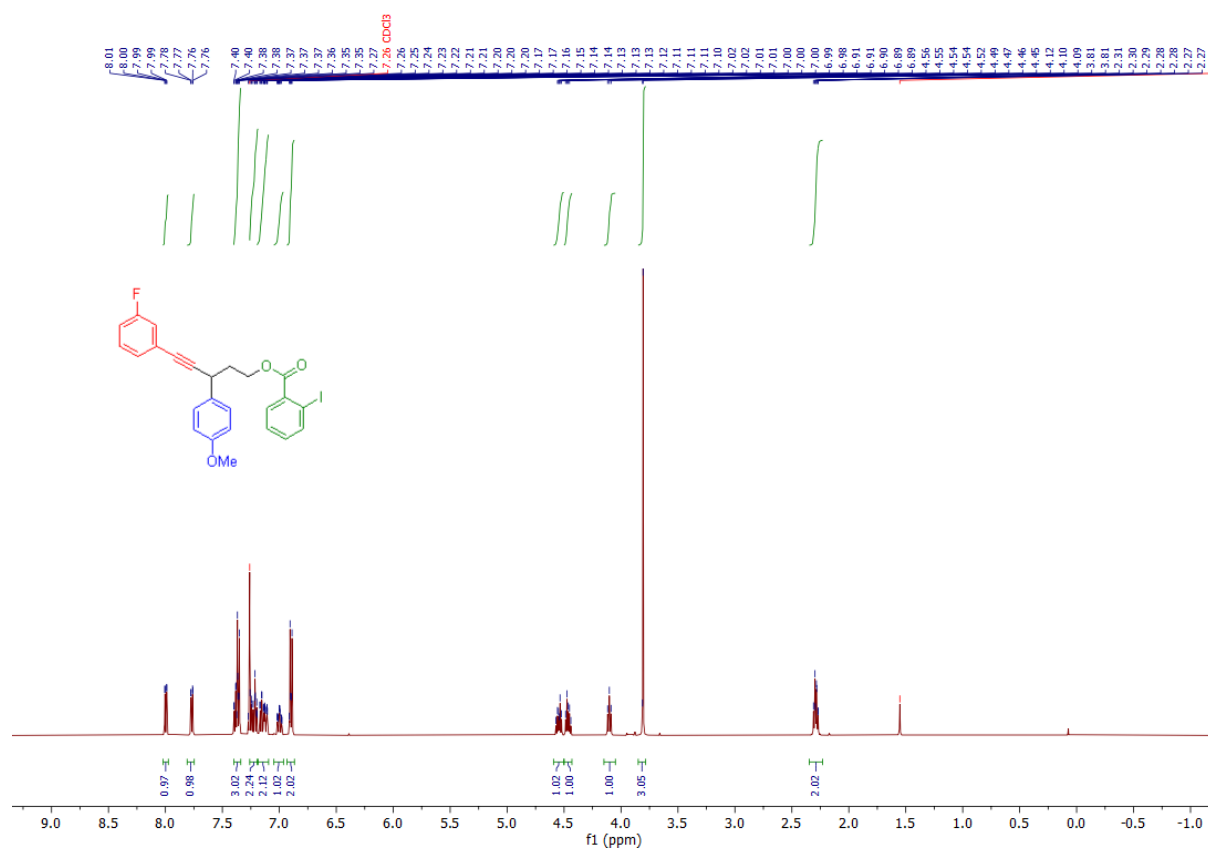
¹³C NMR spectrum (CDCl₃) of compound 10. The spectrum shows peaks corresponding to the chemical structure, with the following chemical shifts (ppm) labeled:

- 166.62, 163.06, 161.82, 159.83 (Aromatic carbons)
- 141.47, 135.36, 133.68, 133.64, 133.07, 132.88, 131.99, 128.59, 128.05, 119.61, 115.66, 115.55, 114.28 (Aromatic carbons)
- 94.17, 90.23, 82.91 (Alkyne carbons)
- 63.76, 55.47 (Methoxy carbons)
- 37.27, 34.63 (Aliphatic carbons)

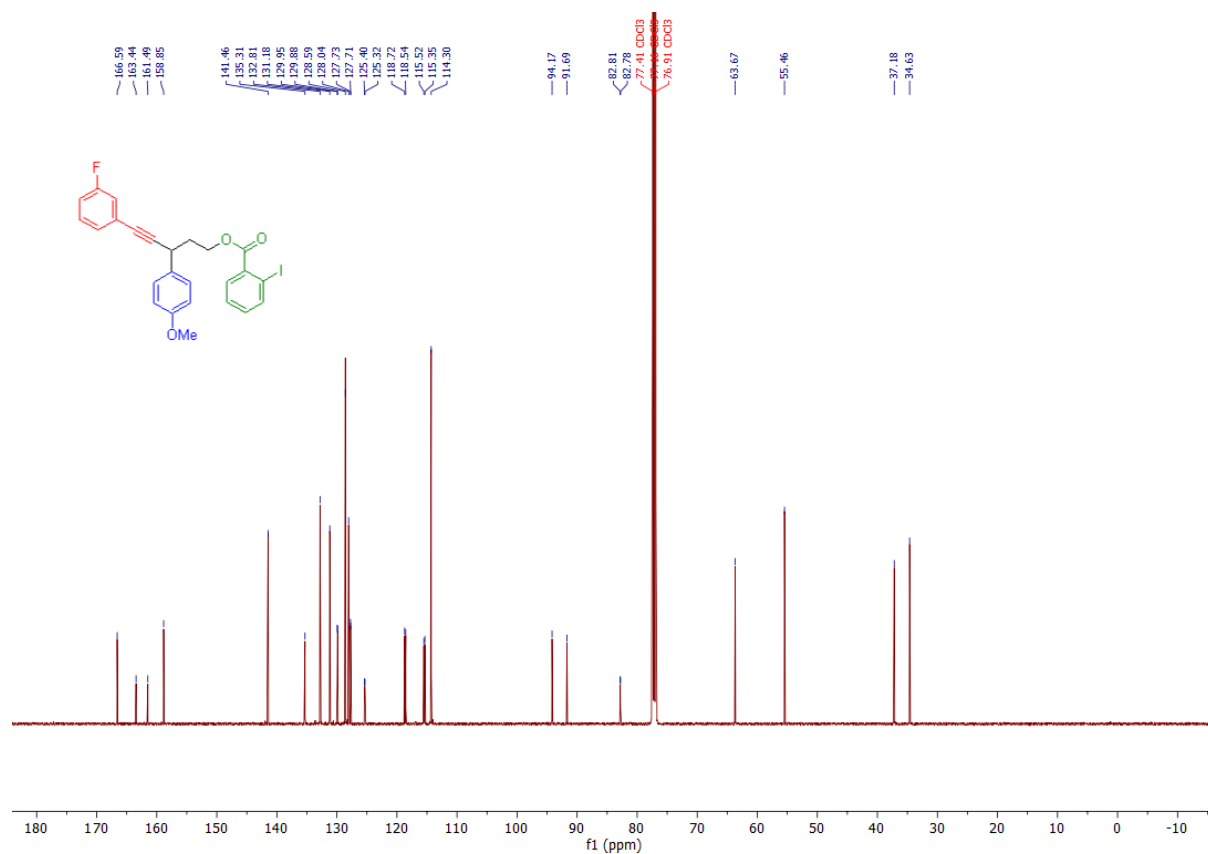
^{19}F NMR (377 MHz, CDCl_3) (3n)



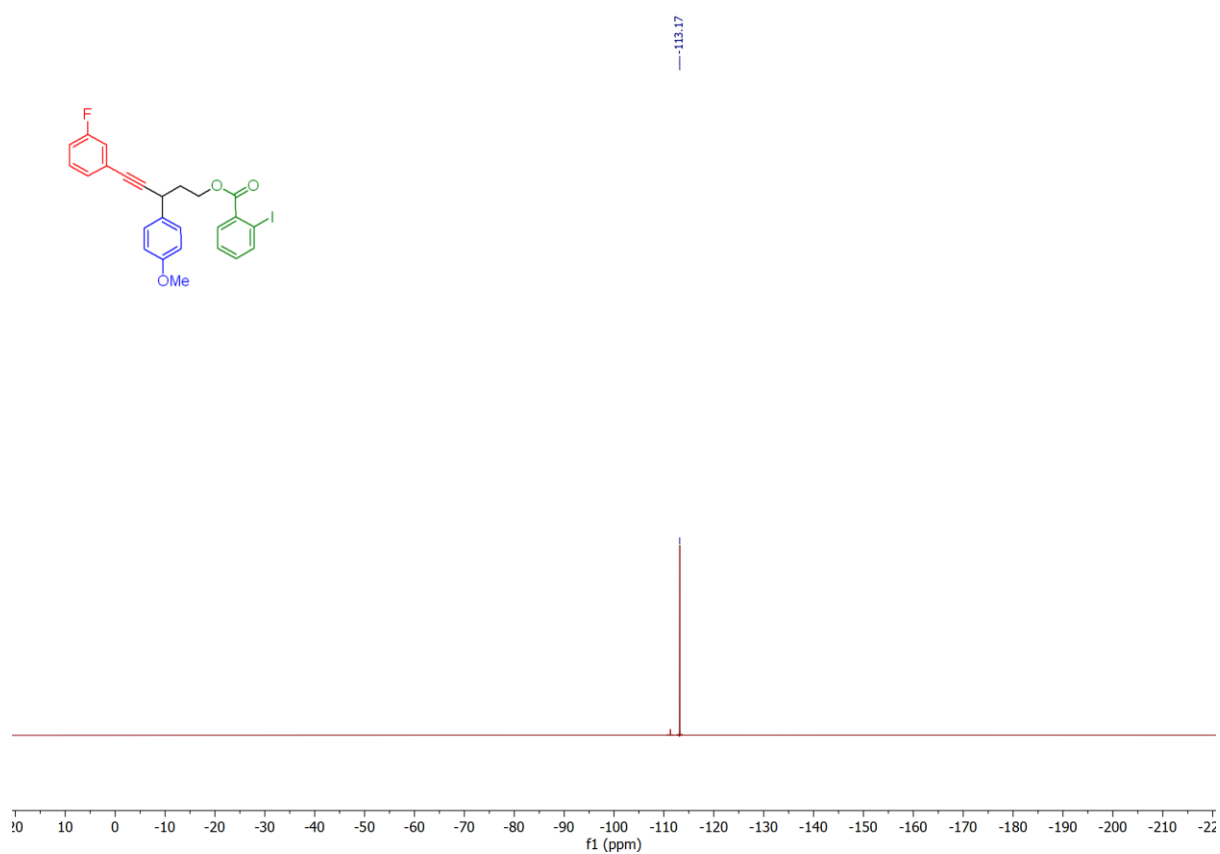
^1H NMR (400 MHz, CDCl_3) (3o)



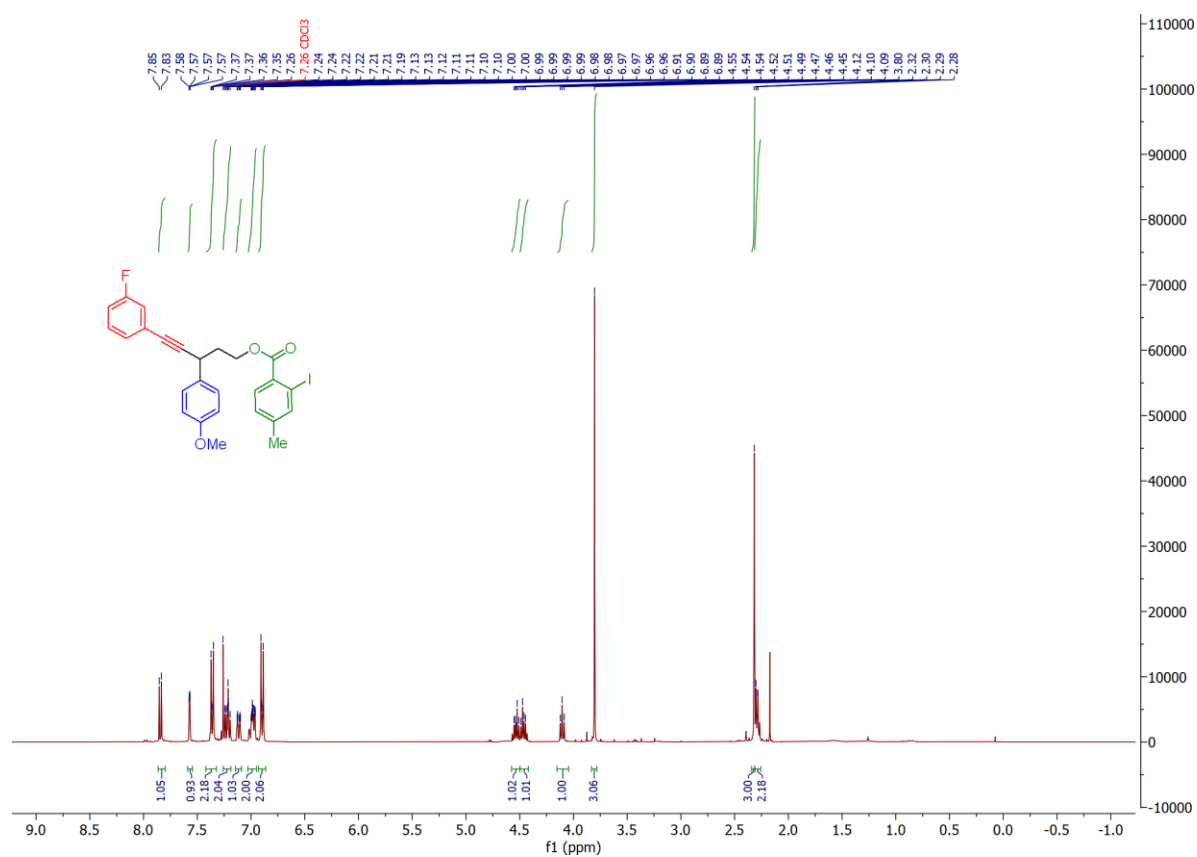
^{13}C NMR (101 MHz, CDCl_3) (3o)



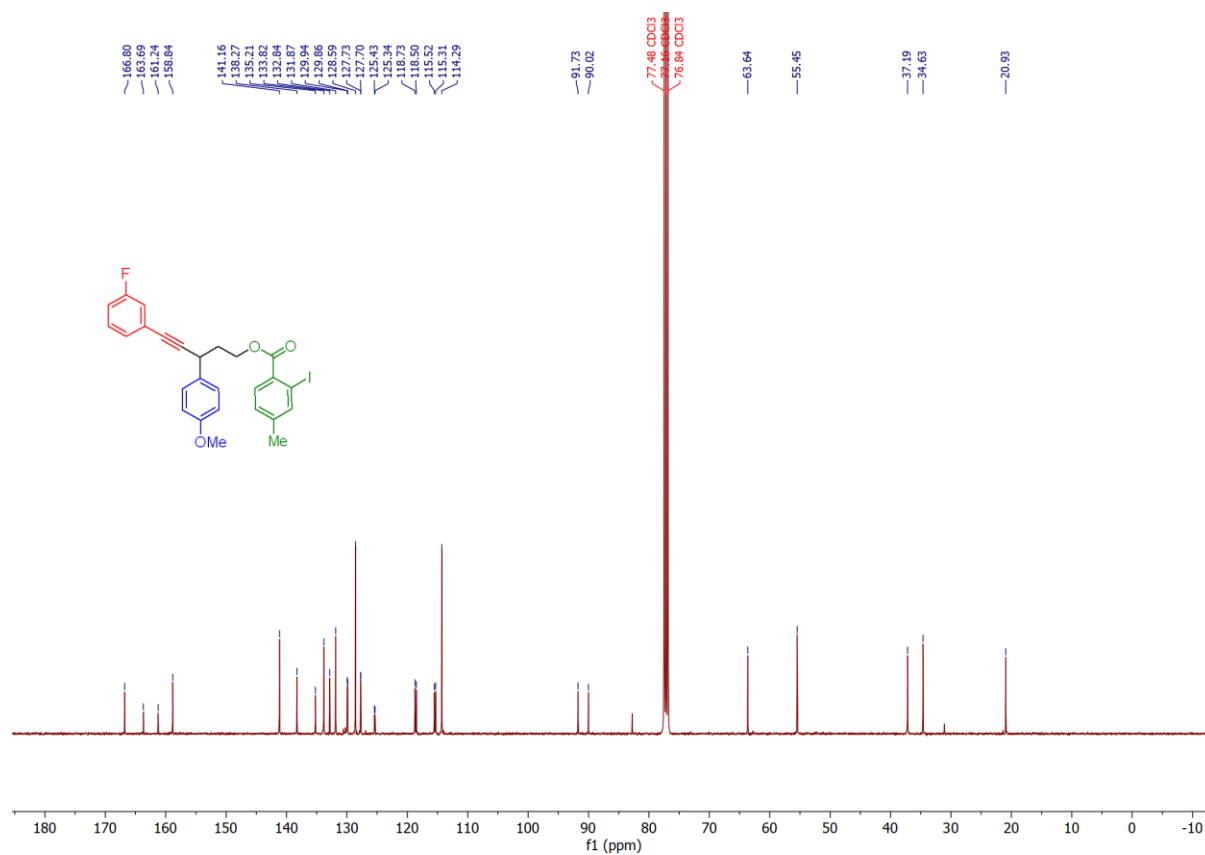
^{19}F NMR (377 MHz, CDCl_3) (3o)



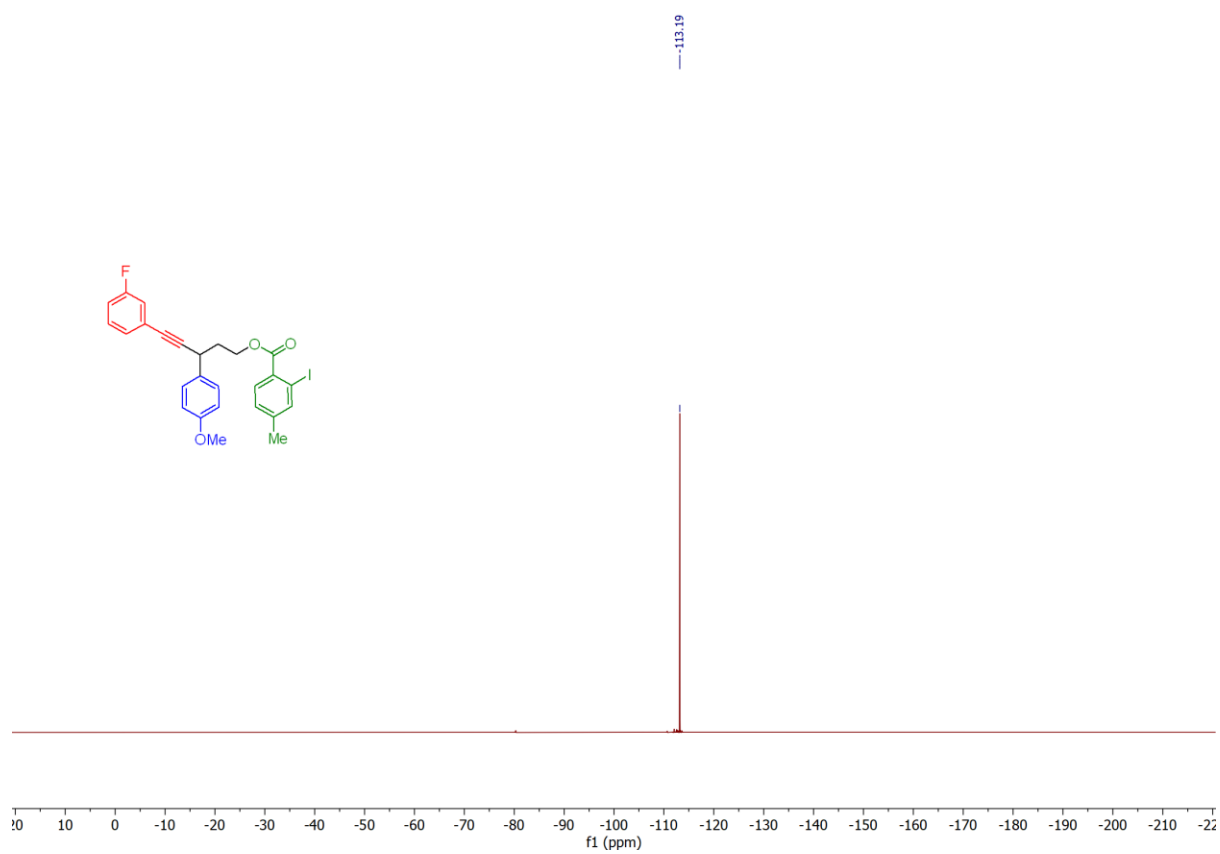
¹H NMR (400 MHz, CDCl₃) (3p)



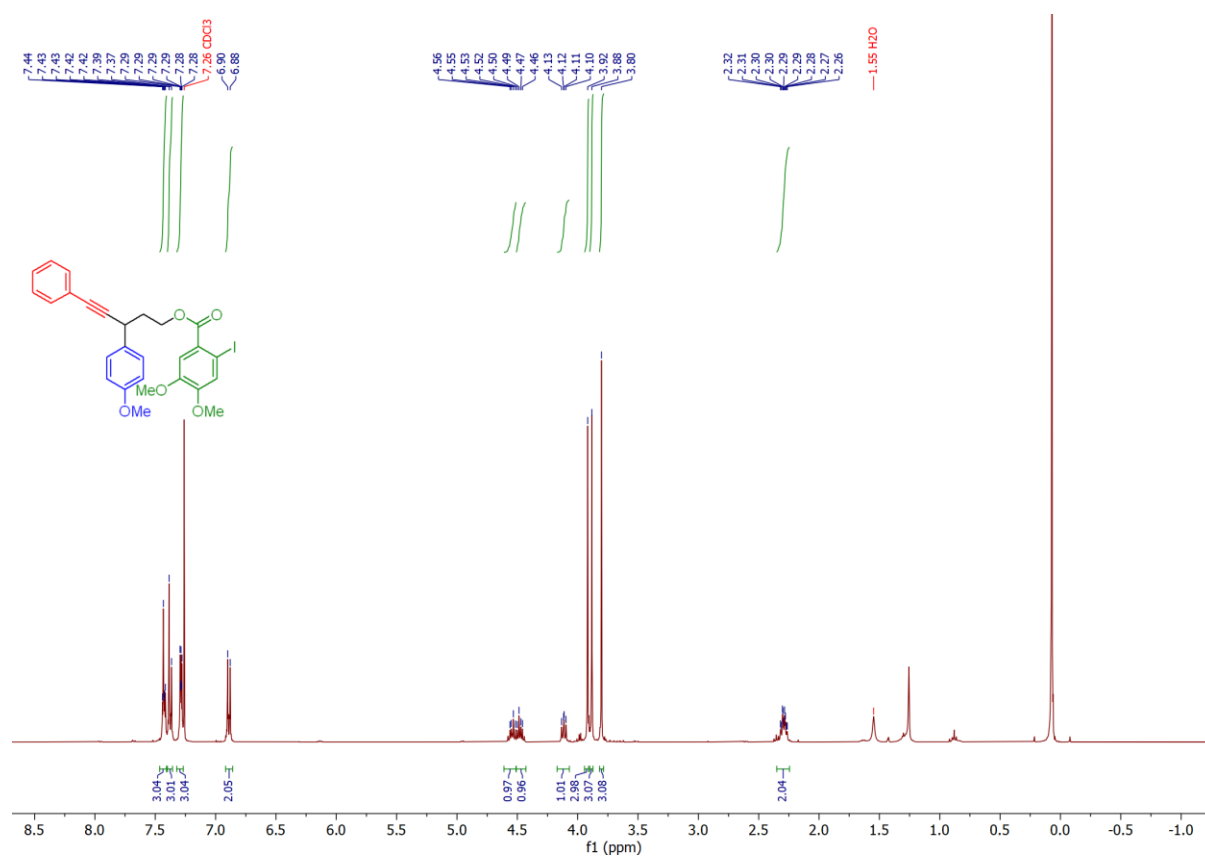
¹³C NMR (101 MHz, CDCl₃) (3p)



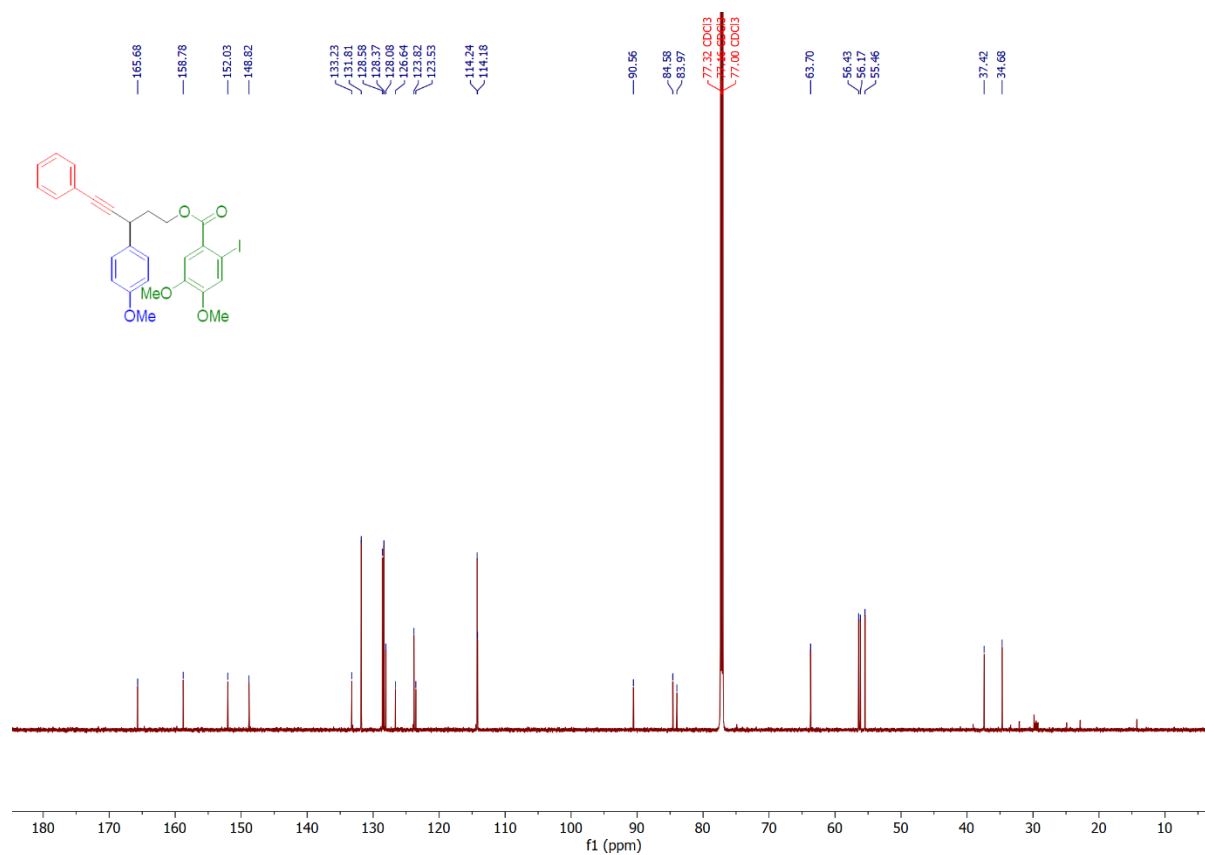
^{19}F NMR (377 MHz, CDCl_3) (3p)



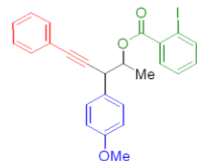
¹H NMR (400 MHz, CDCl₃) (3q)



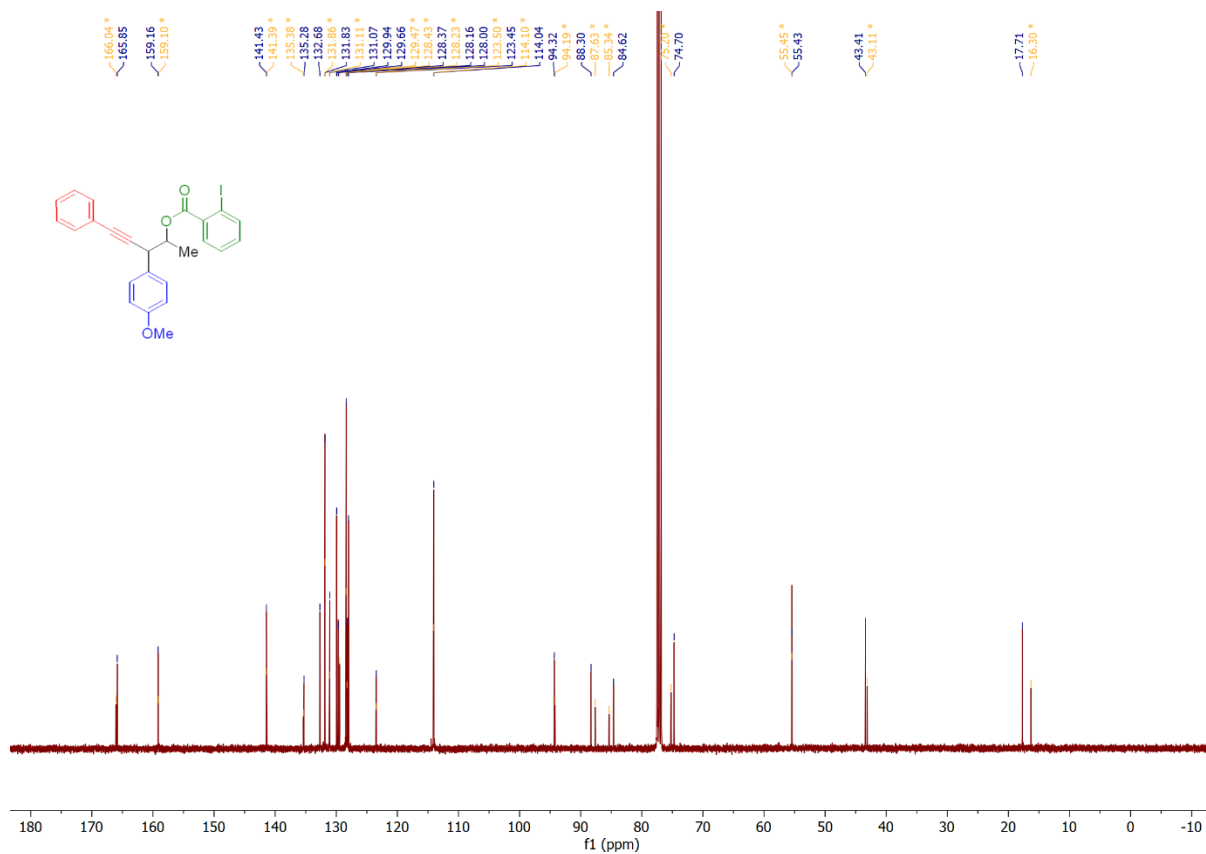
¹³C NMR (201 MHz, CDCl₃) (3q)



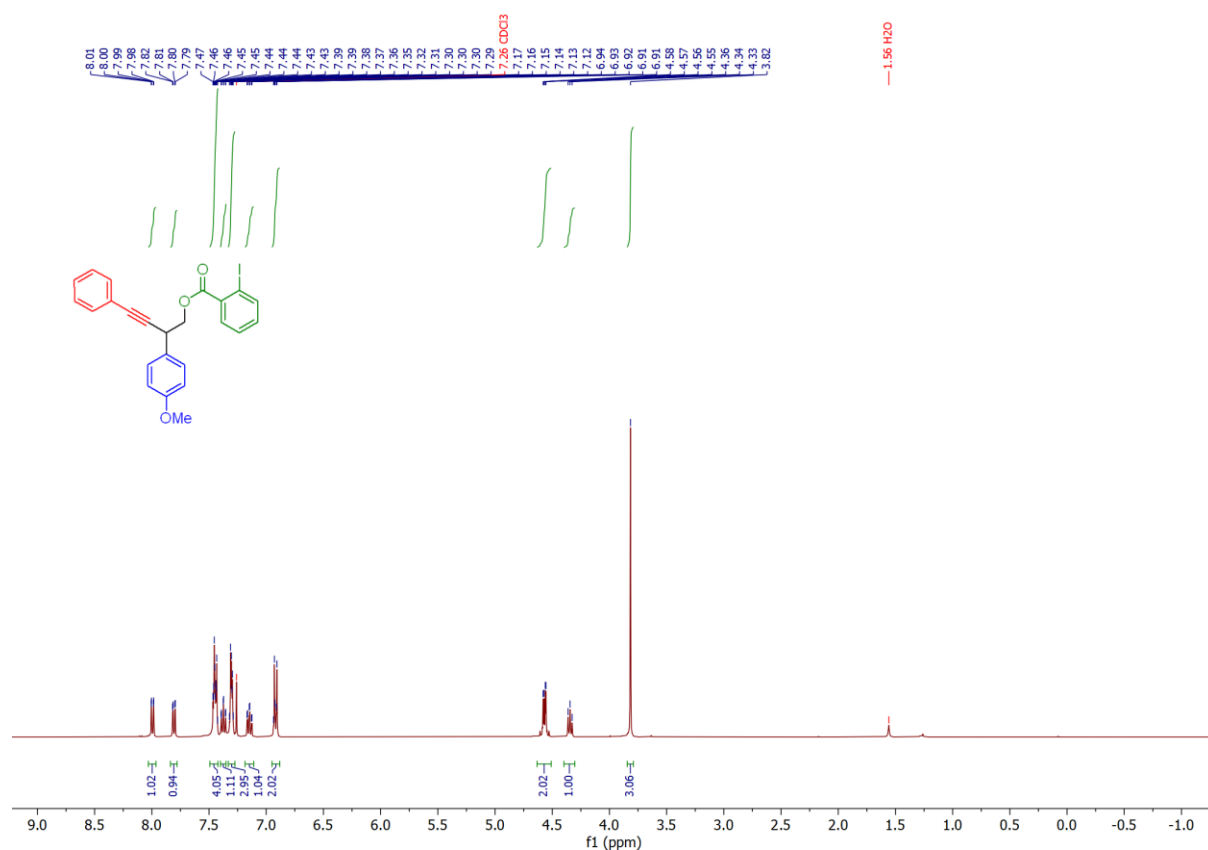
¹H NMR (400 MHz, CDCl₃ (8a))



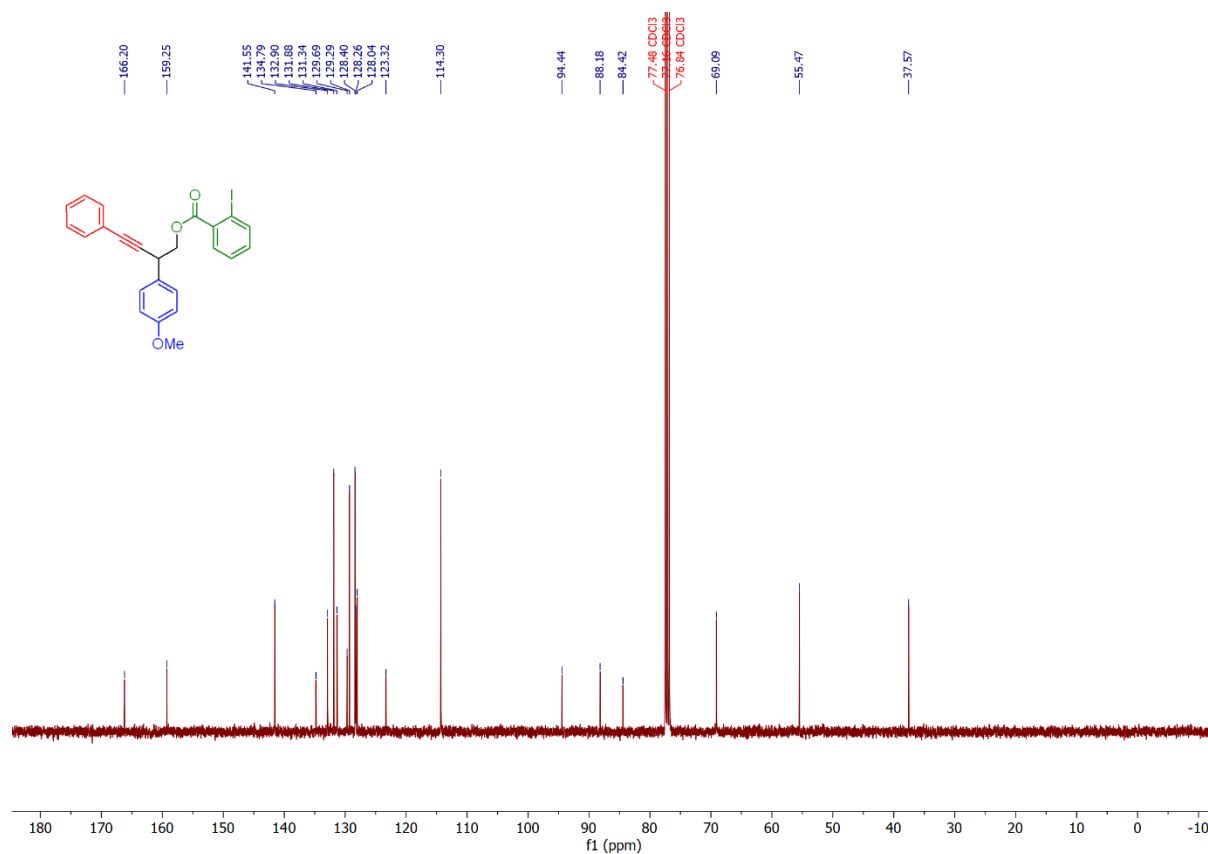
¹³C NMR (101 MHz CDCl₃ (8a))



^1H NMR (400 MHz, CDCl_3) (8b)



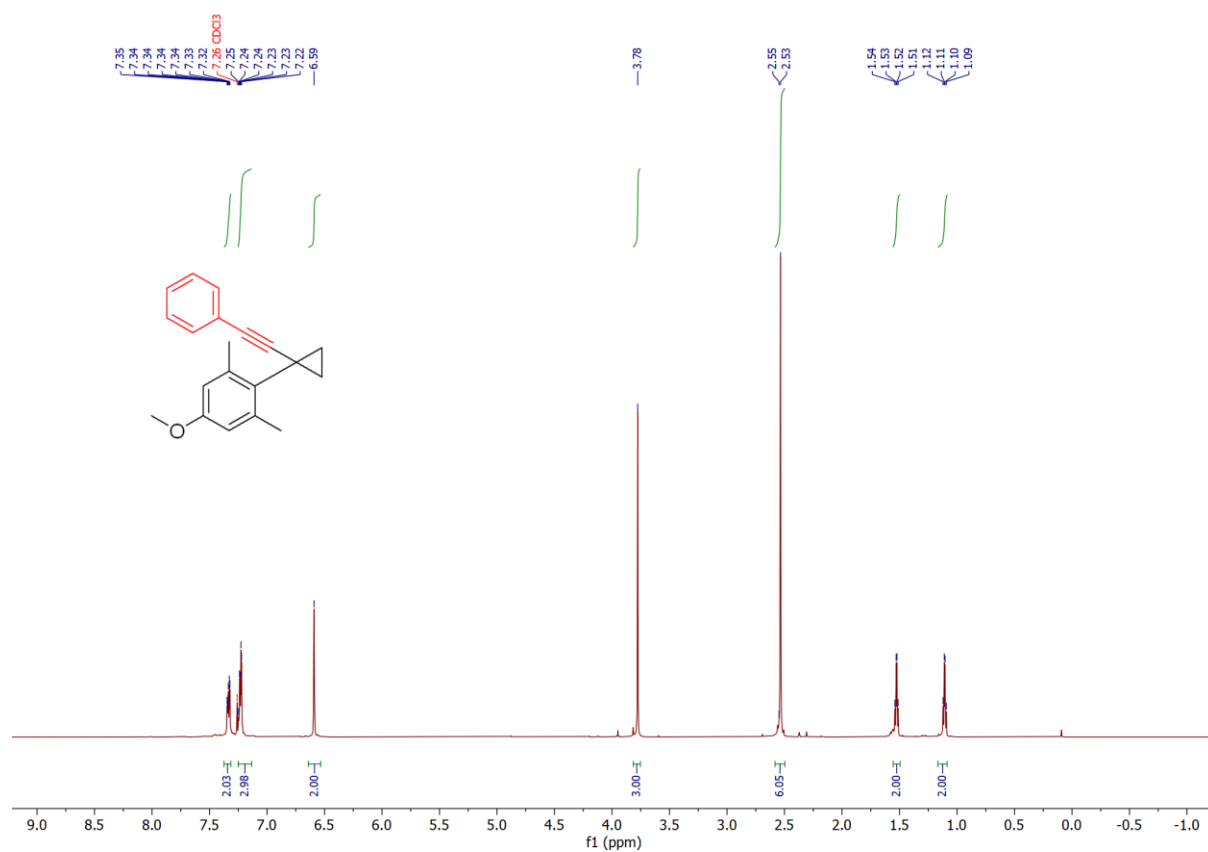
^{13}C NMR (101 MHz, CDCl_3) (8b)



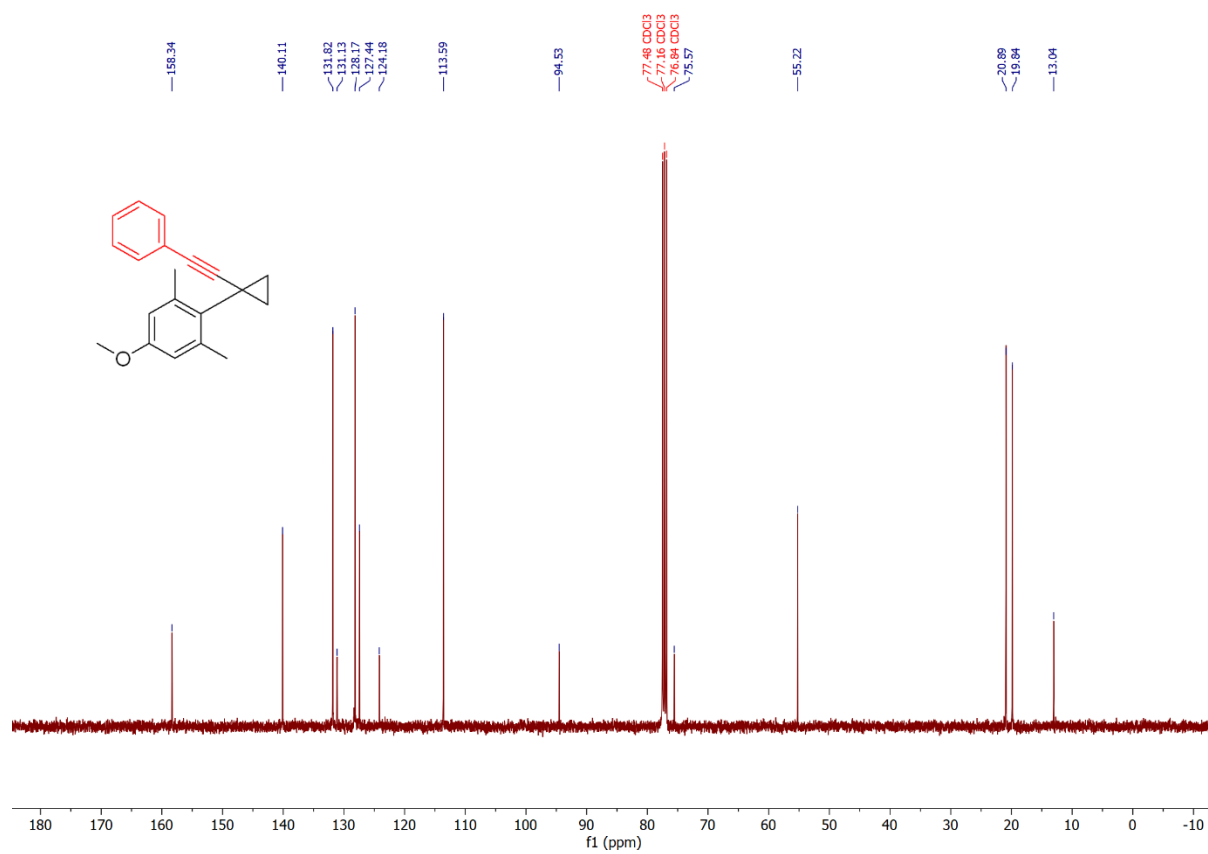
Chemical structure of compound 10 is shown above the spectrum. The spectrum displays the following labeled peaks (ppm):

- 166.23
- 150.75
- 141.53
- 134.87
- 132.87
- 131.93
- 131.38
- 128.38
- 128.23
- 128.01
- 127.93
- 125.94
- 123.37
- 94.42
- 88.17
- 84.40
- 69.05
- 37.89
- 34.68
- 31.55
- 31.50

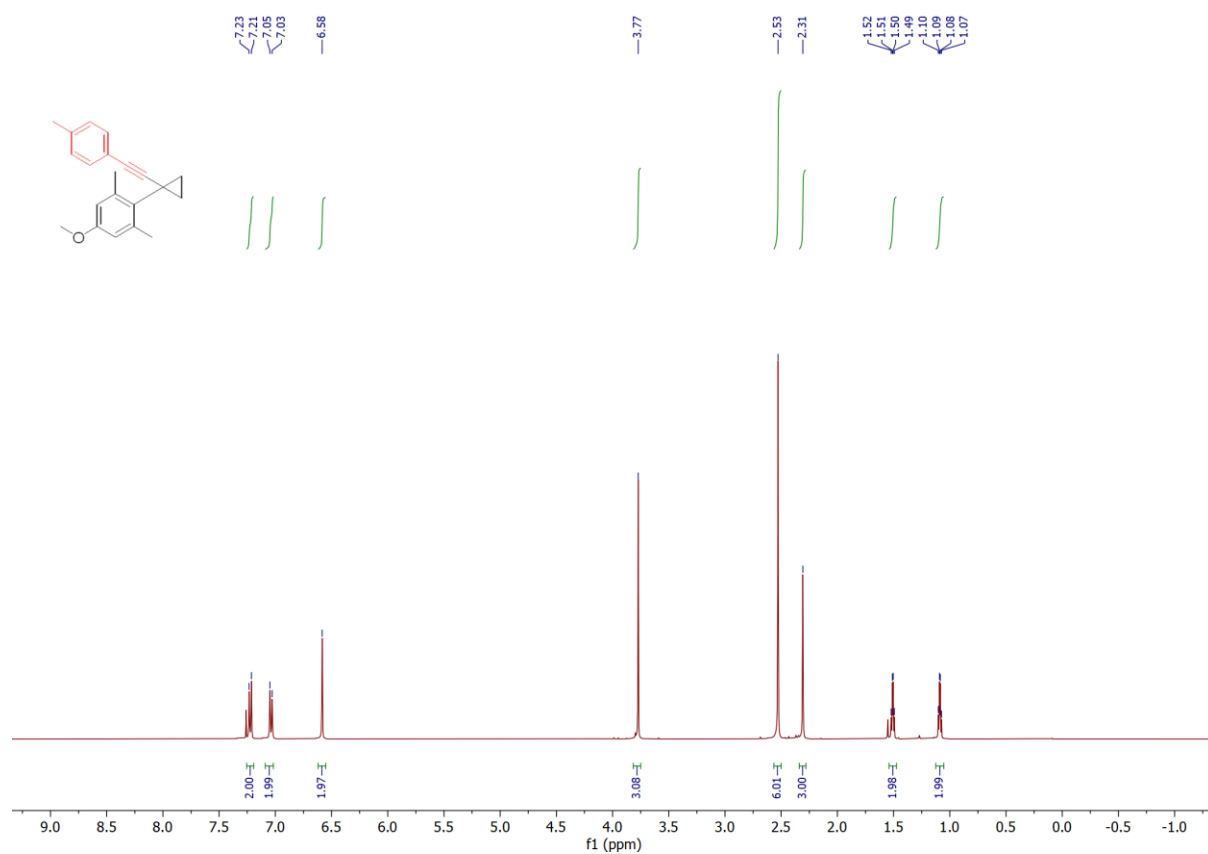
¹H NMR (400 MHz, CDCl₃) (4a)



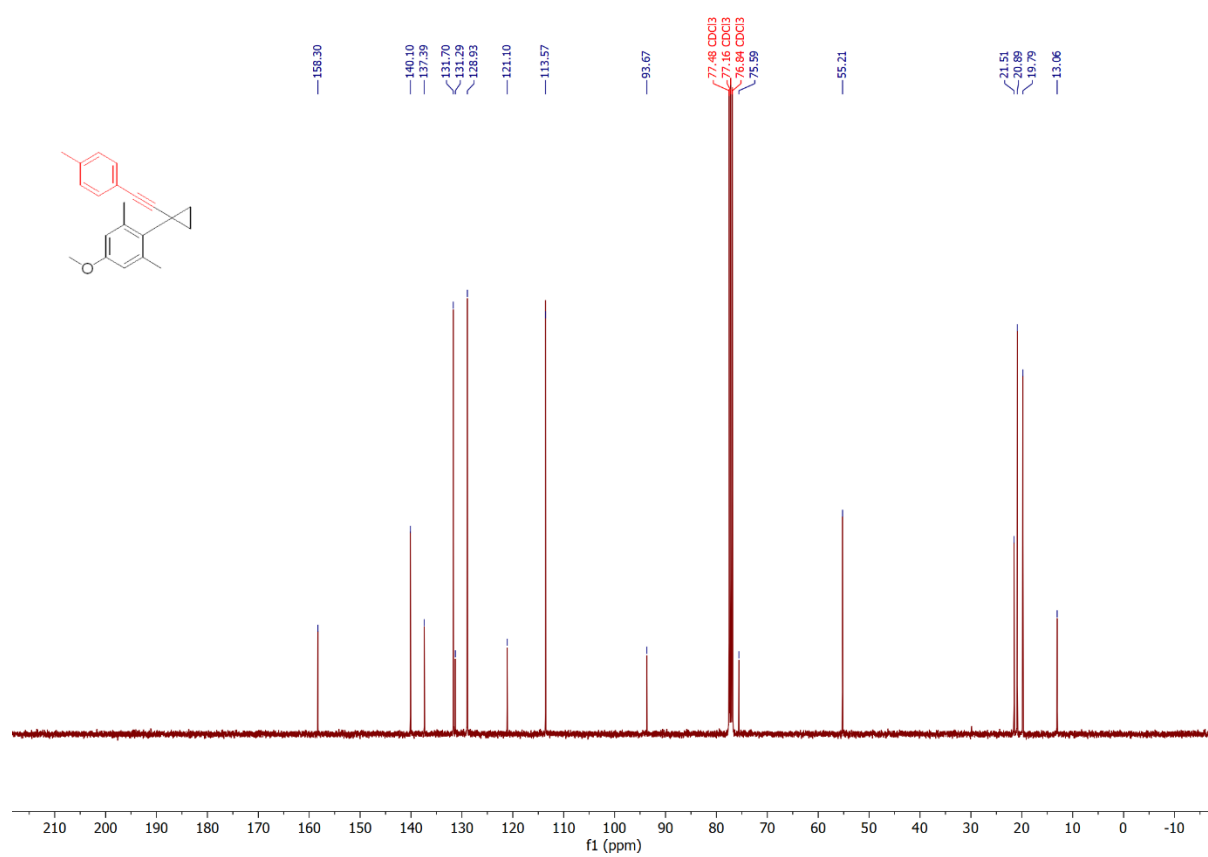
¹³C NMR (101 MHz, CDCl₃) (4a)



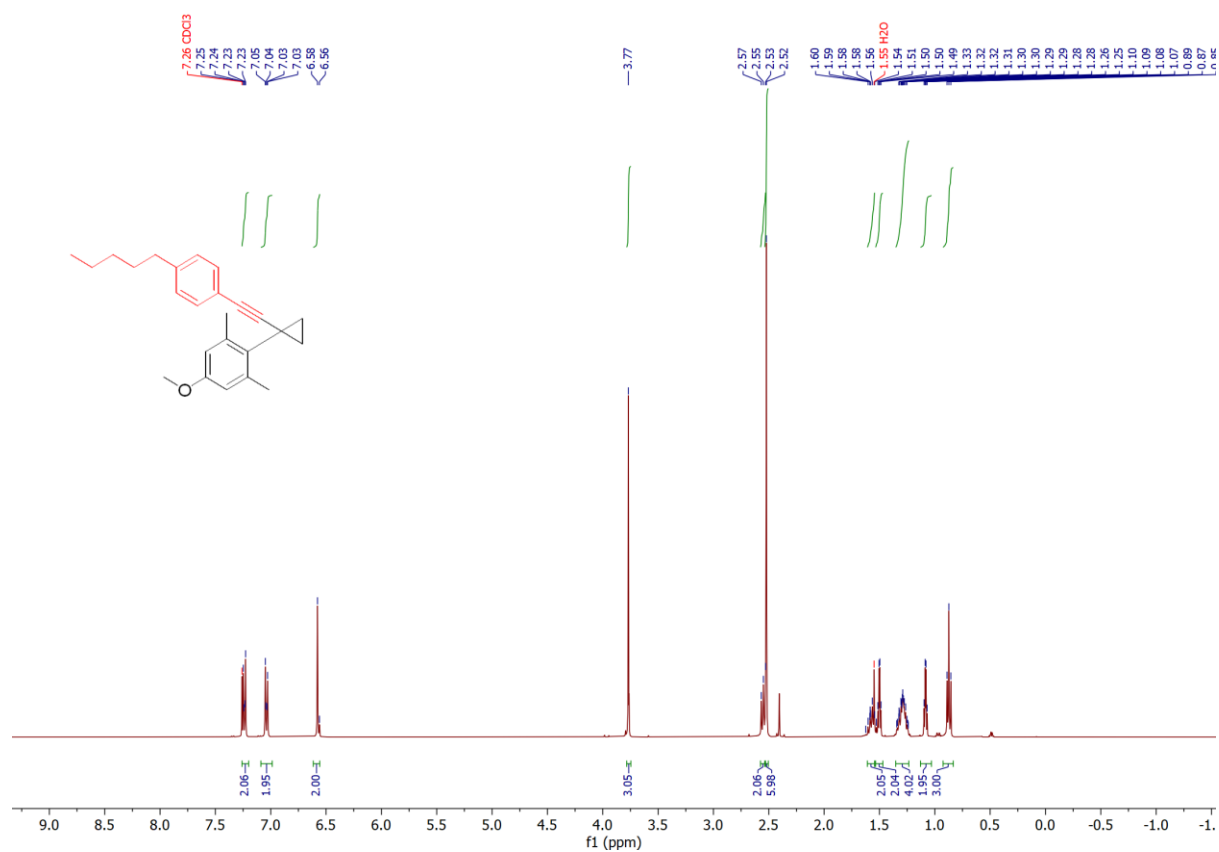
^1H NMR (400 MHz, CDCl_3) (4b)



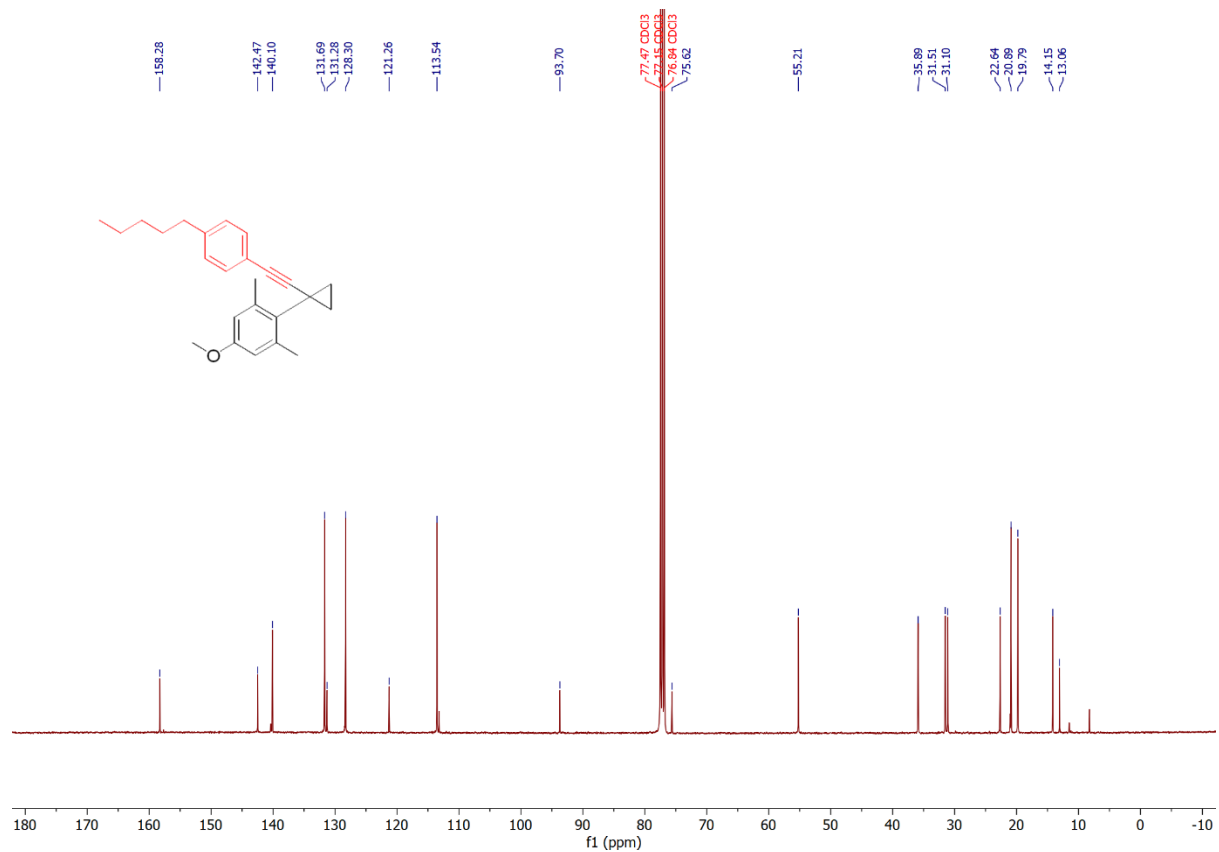
^{13}C NMR (101 MHz, CDCl_3) (4b)



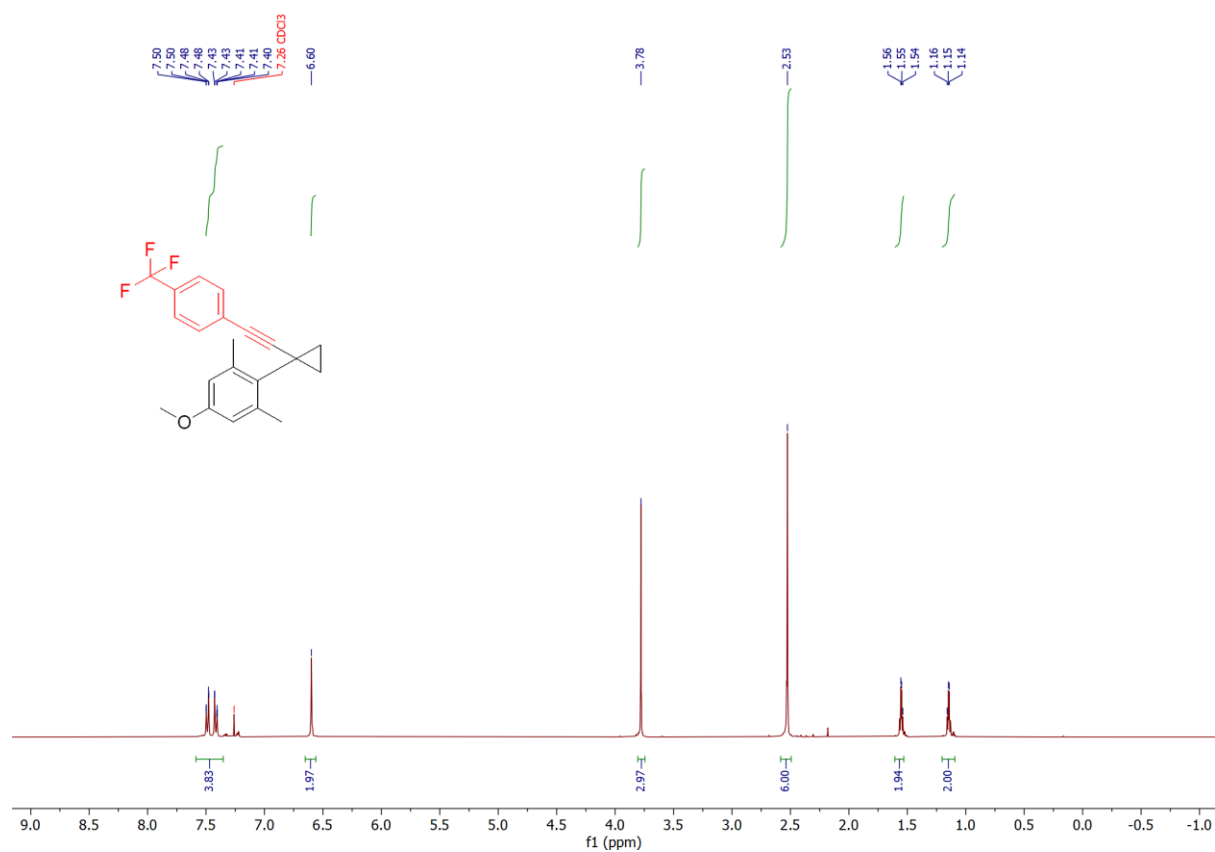
¹H NMR (400 MHz, CDCl₃) (4c)



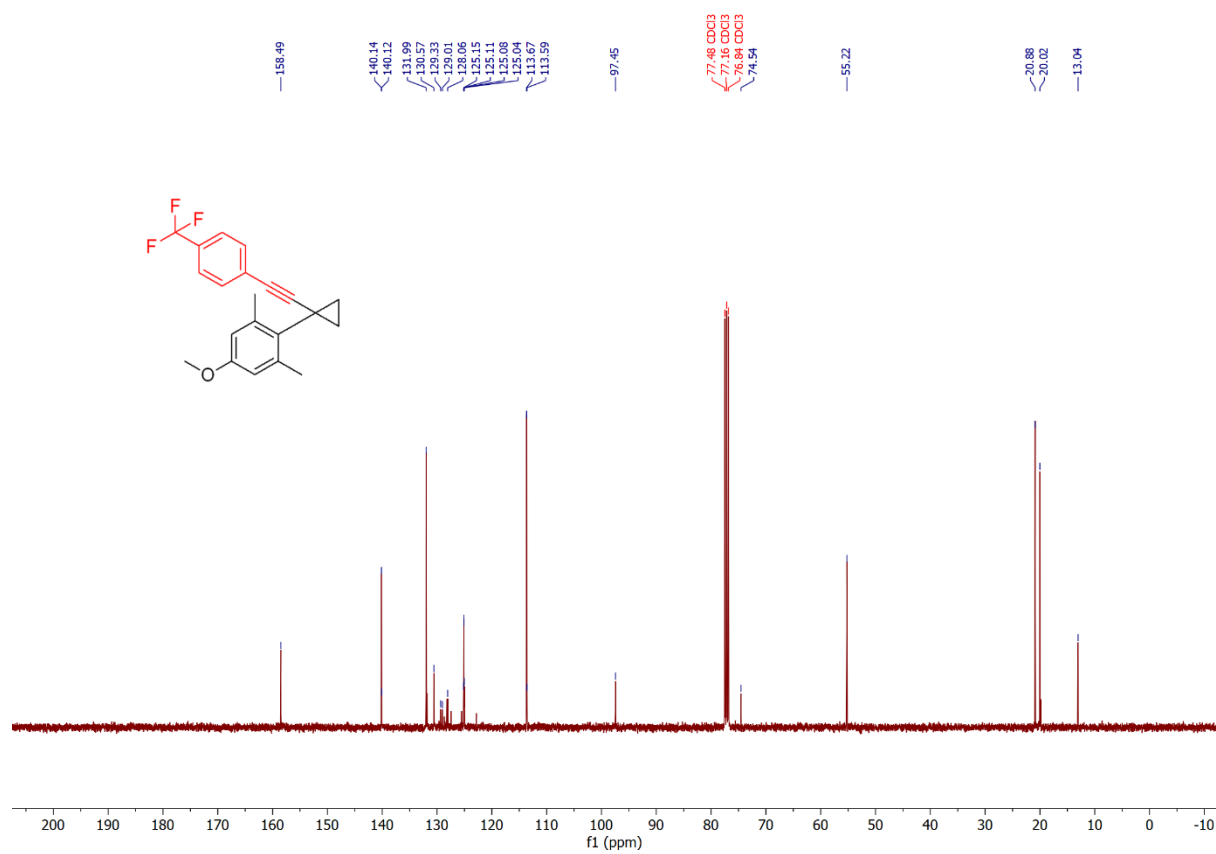
¹³C NMR (101 MHz, CDCl₃) (4c)



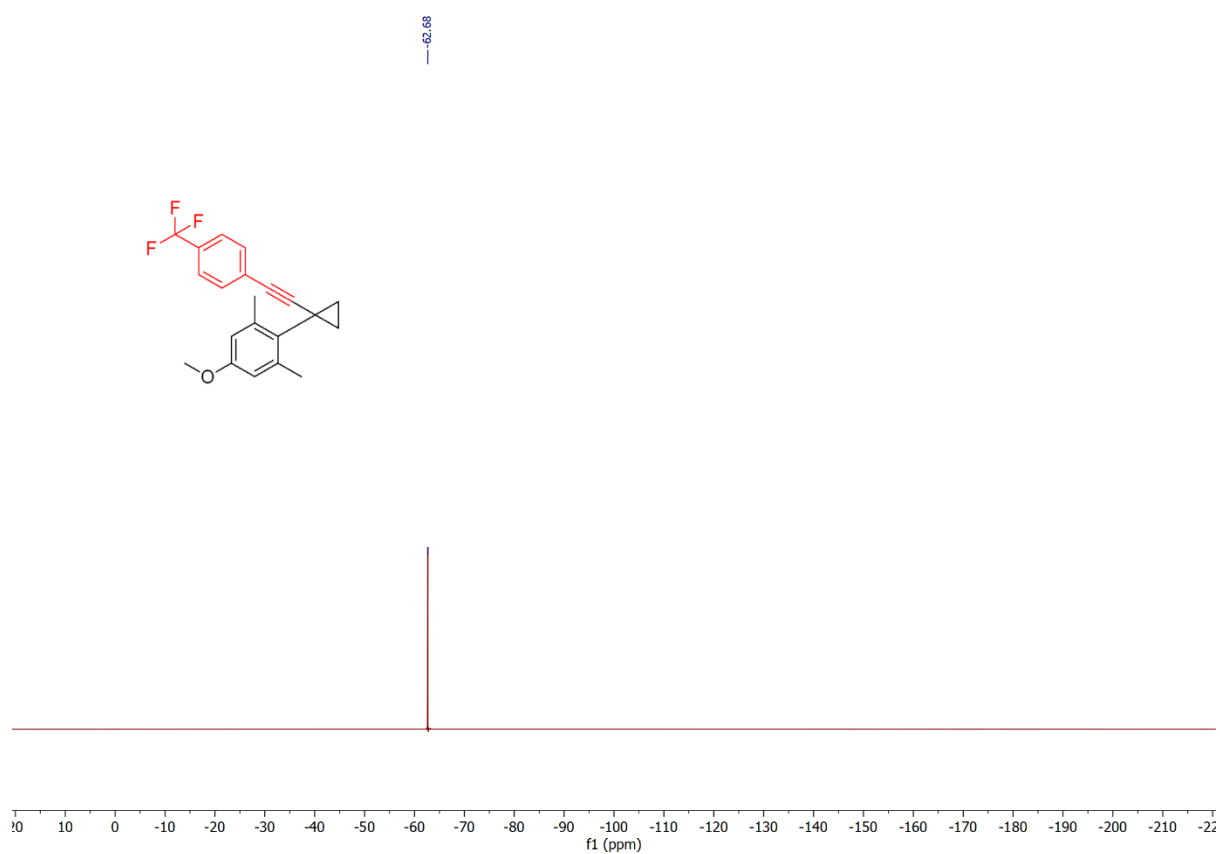
^1H NMR (400 MHz, CDCl_3) (4d)



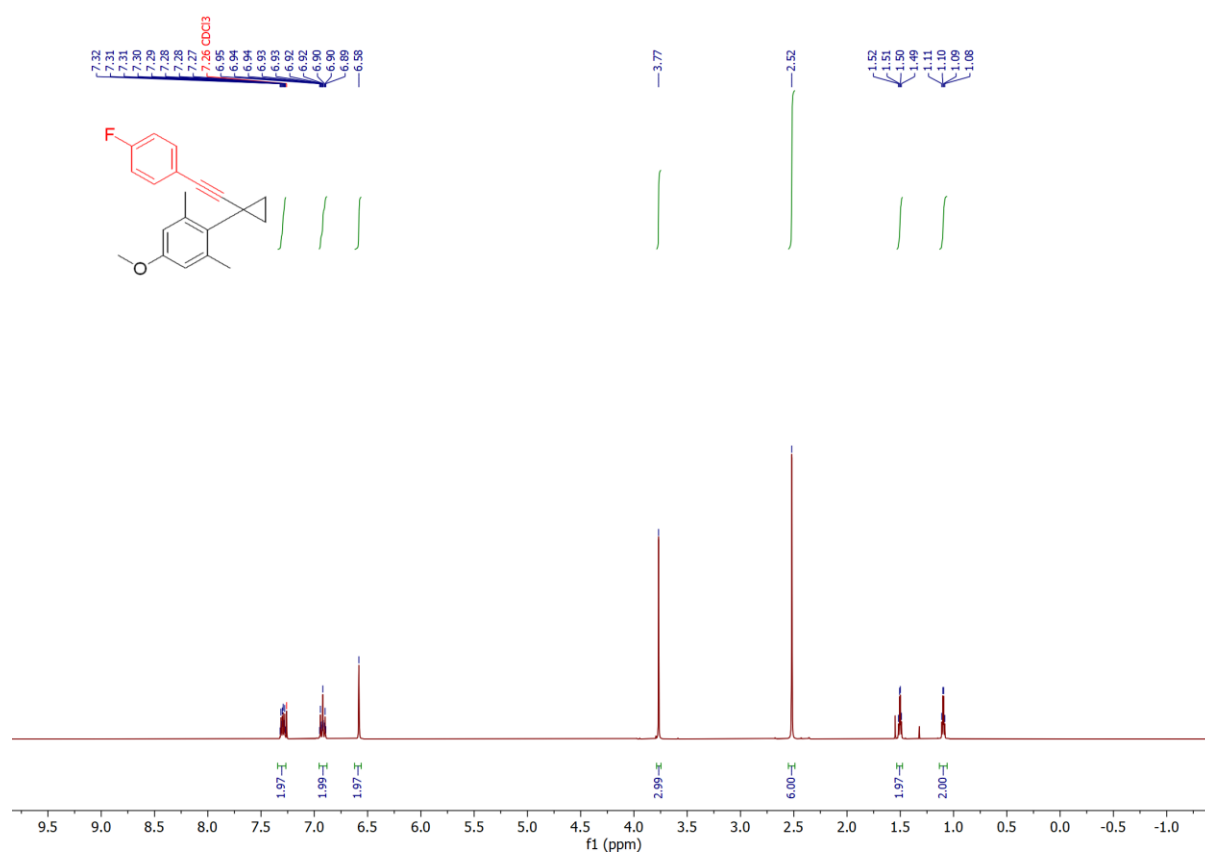
^{13}C NMR (101 MHz, CDCl_3) (4d)



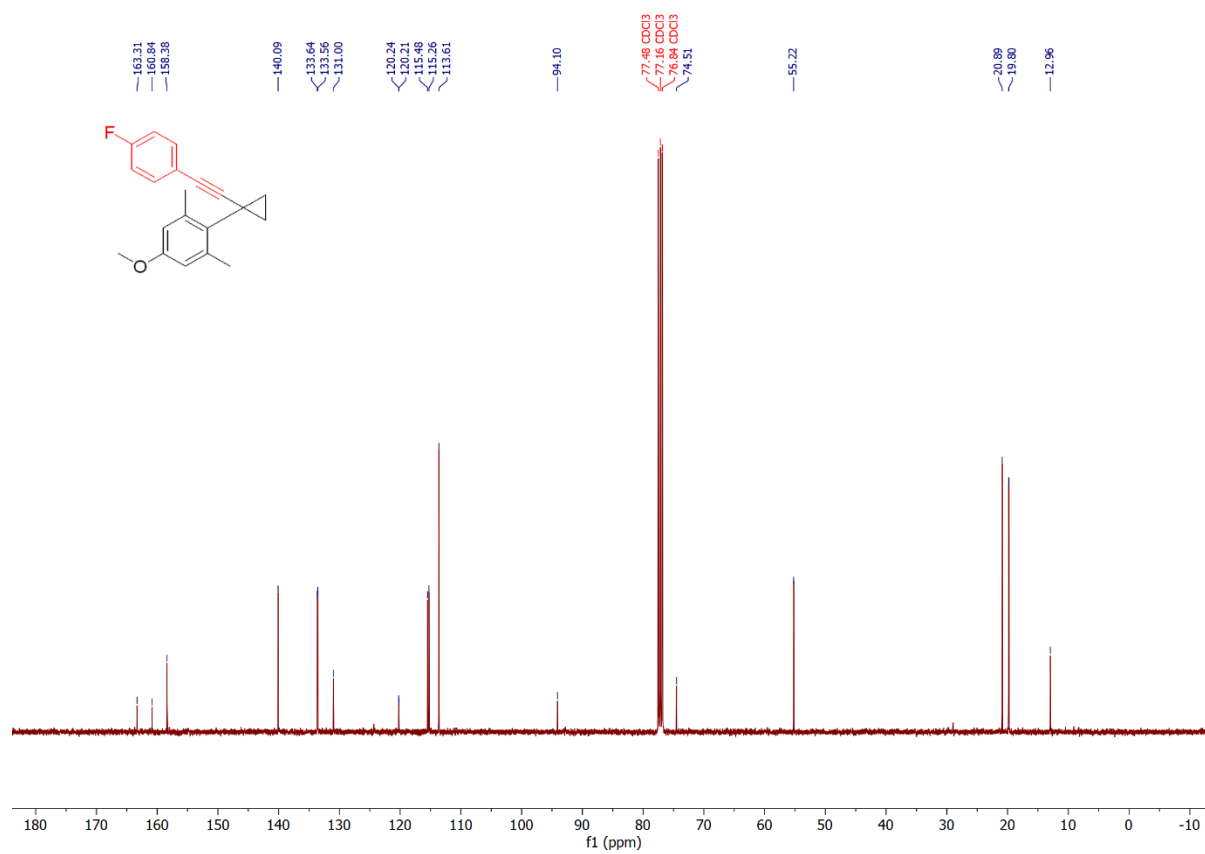
^{19}F NMR (377 MHz, CDCl_3) (4d)



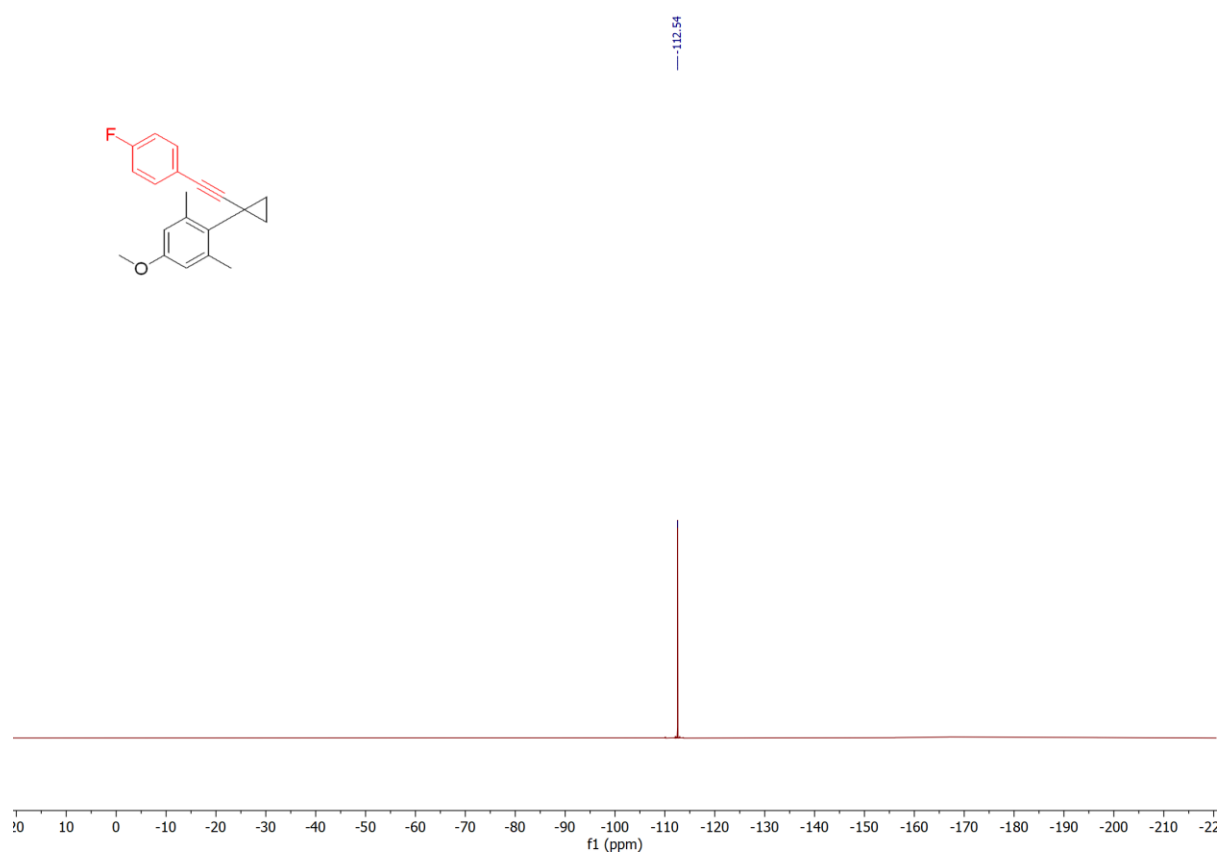
¹H NMR (400 MHz, CDCl₃) (4e)



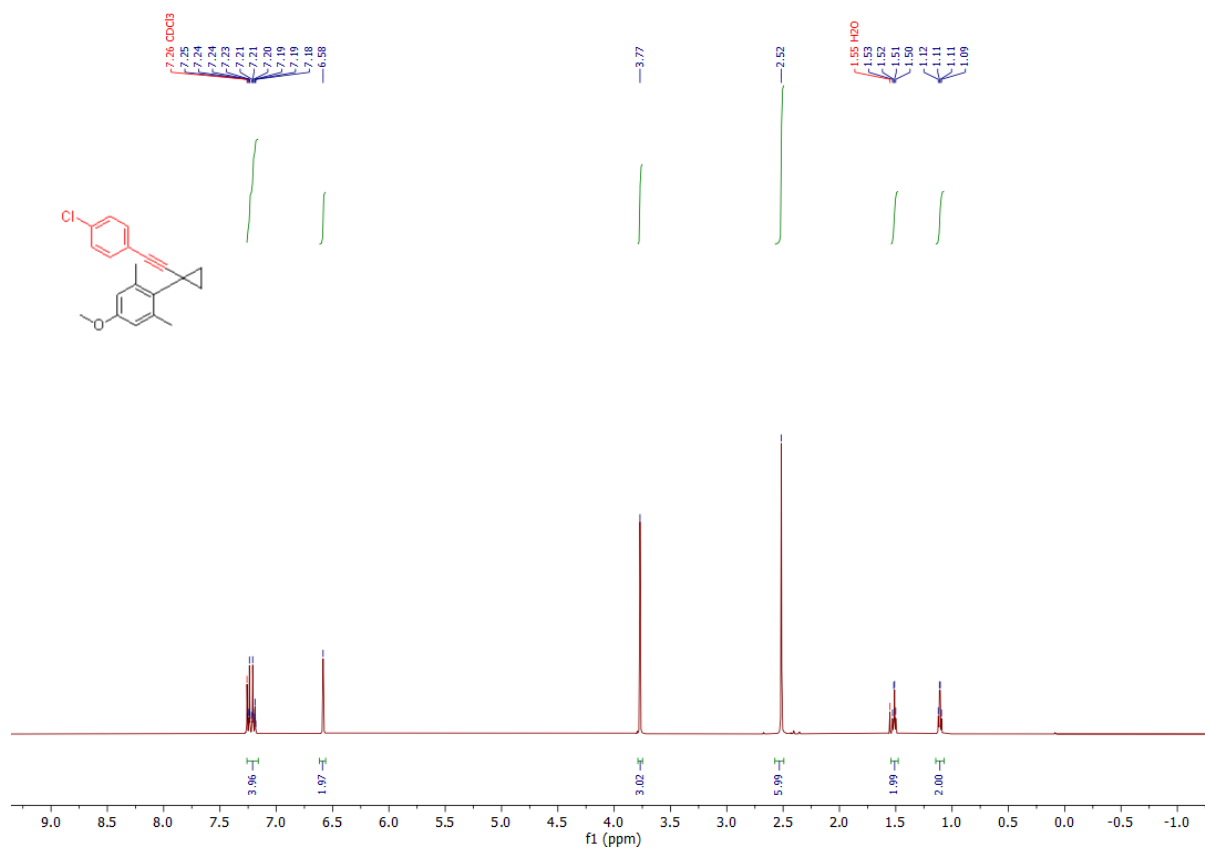
¹³C NMR (101 MHz, CDCl₃) (4e)



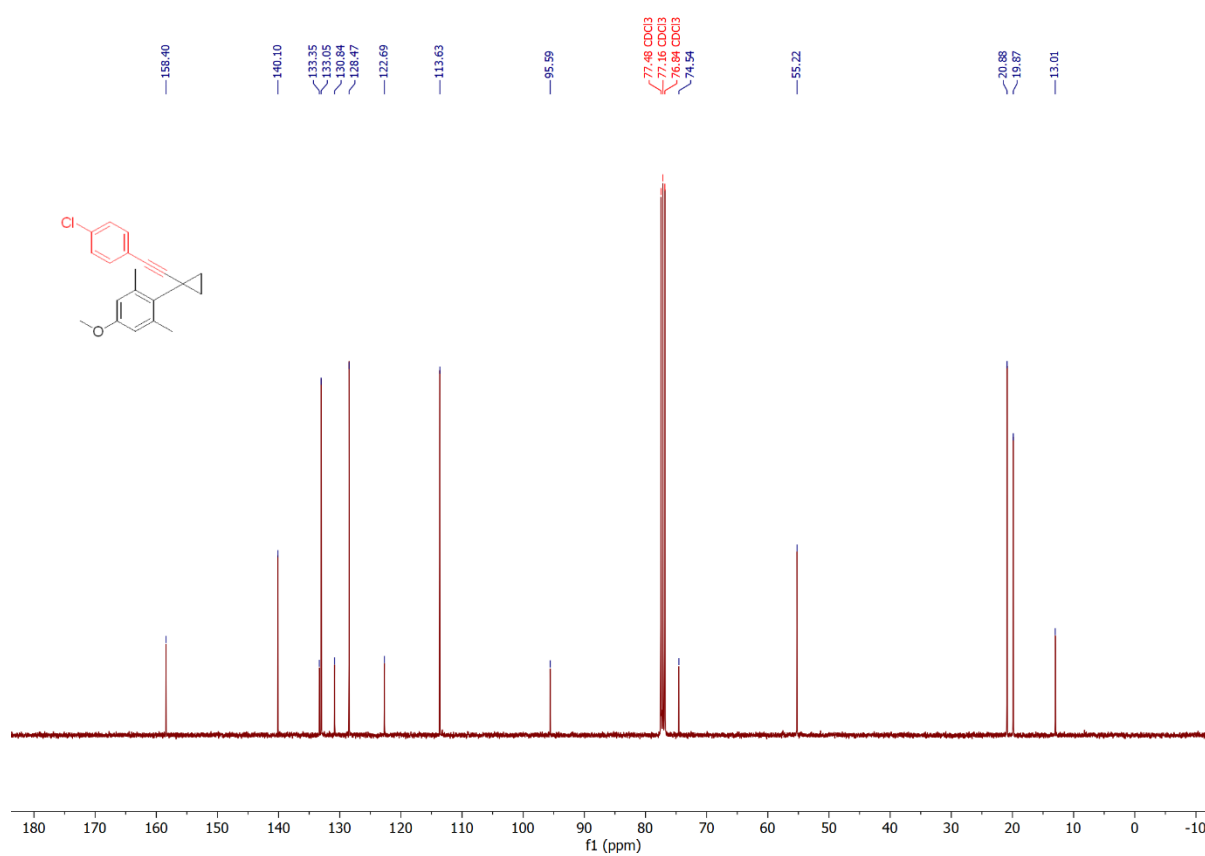
^{19}F NMR (377 MHz, CDCl_3) (4e)



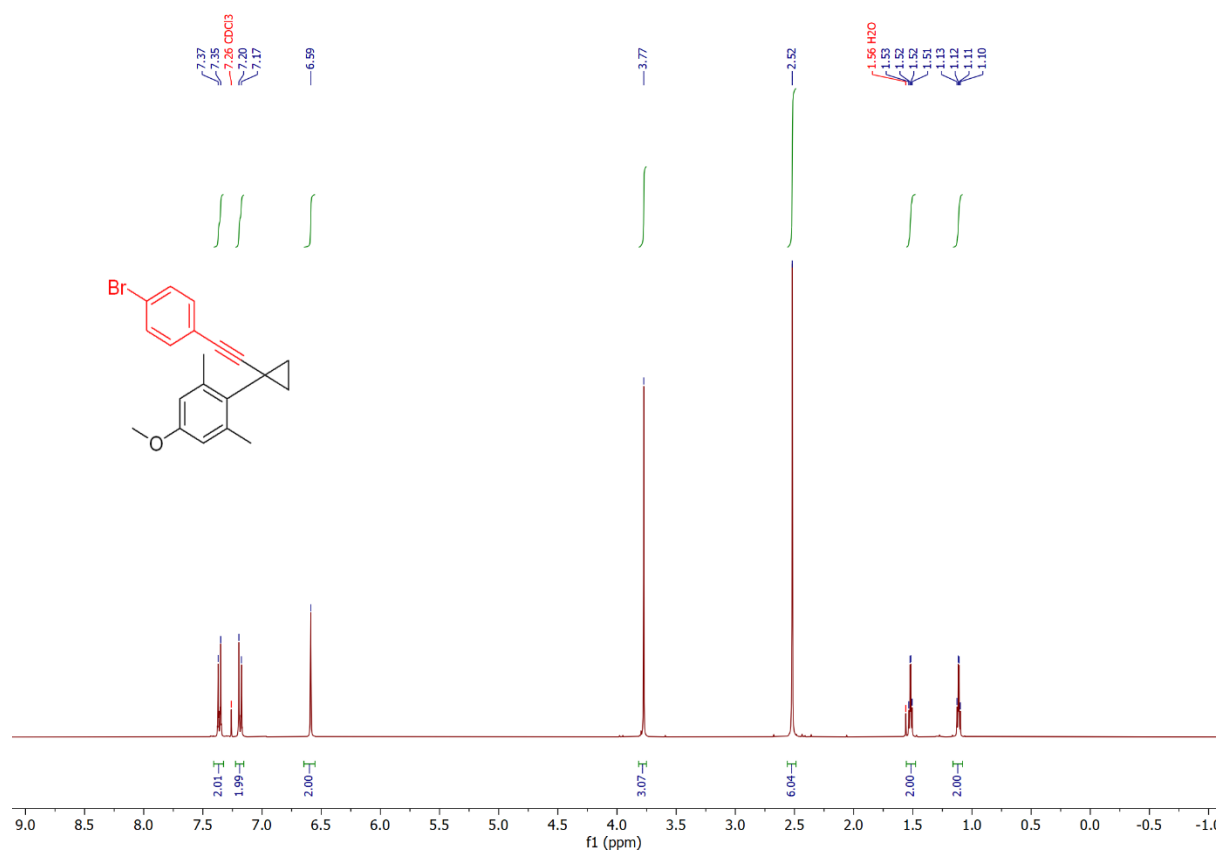
¹H NMR (400 MHz, CDCl₃) (4f)



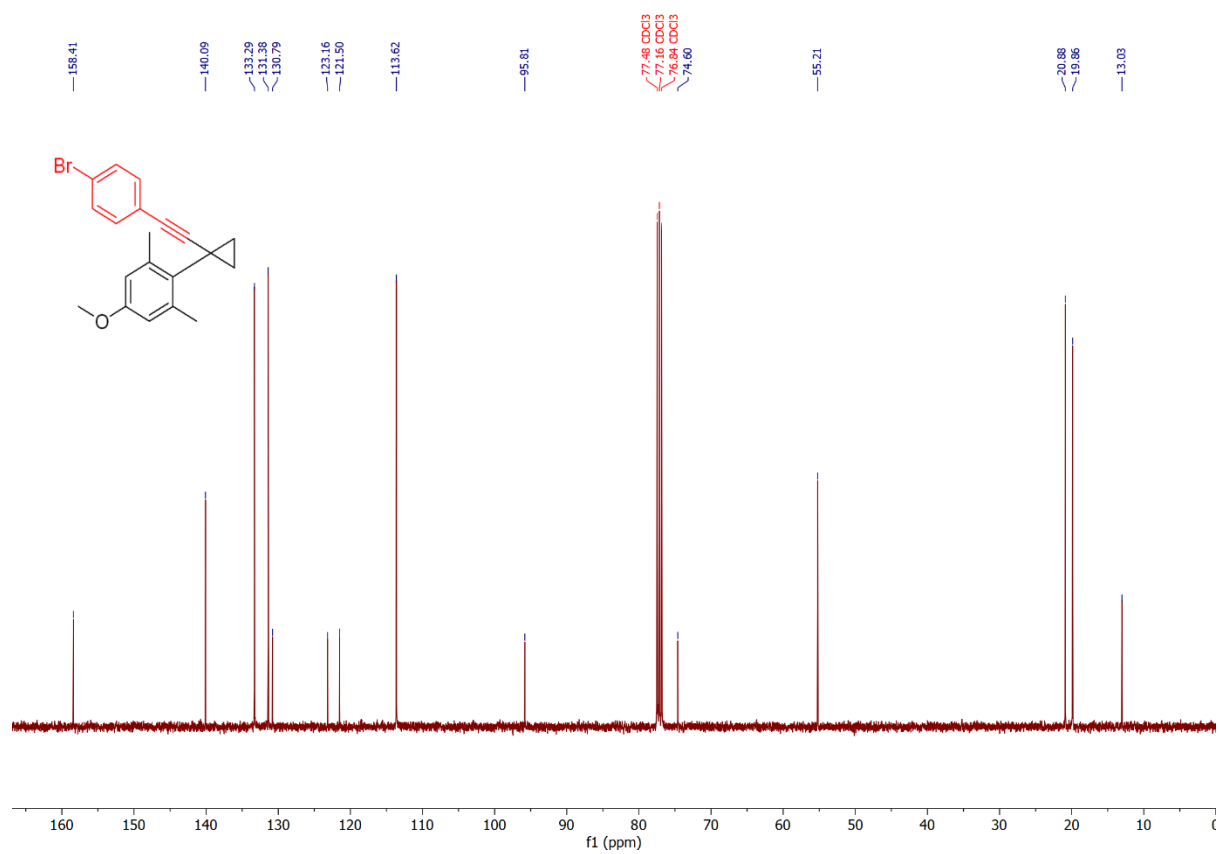
¹³C NMR (101 MHz, CDCl₃) (4f)



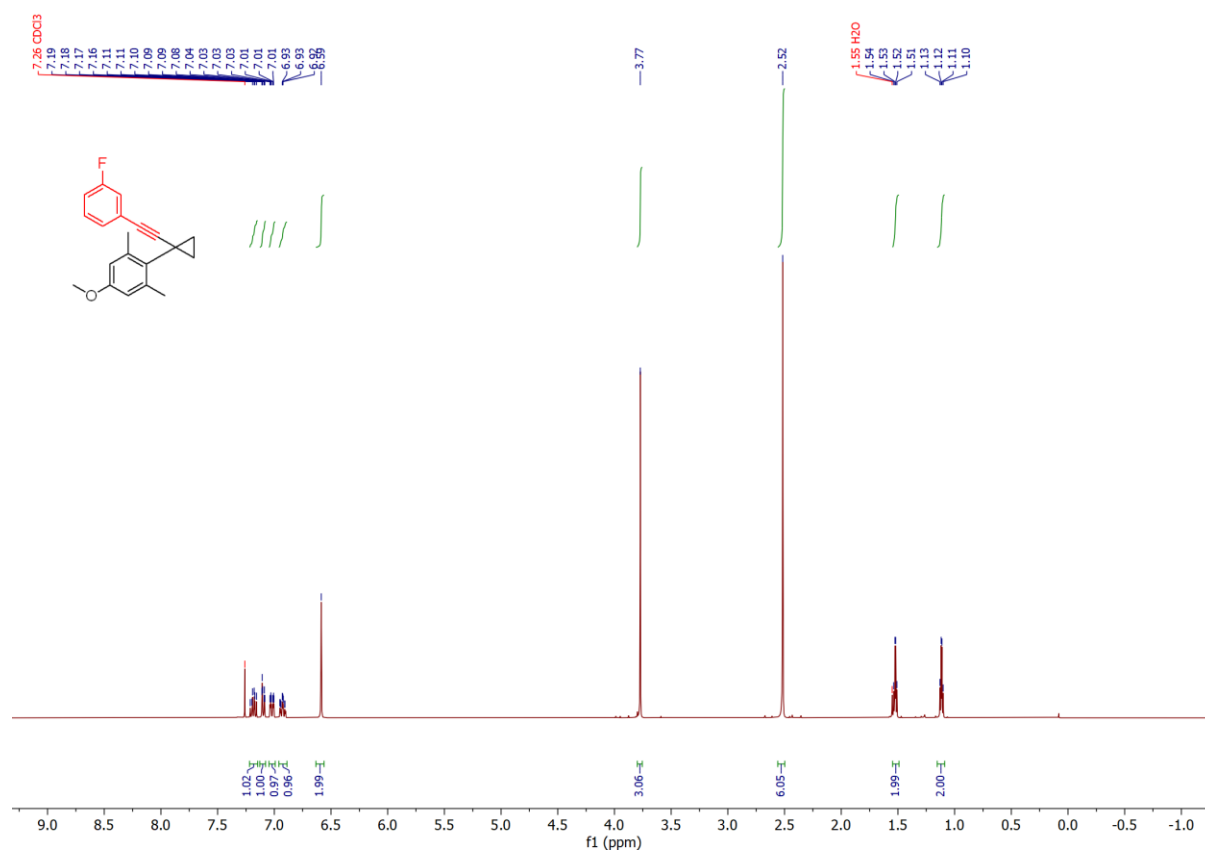
^1H NMR (400 MHz, CDCl_3) (4g)



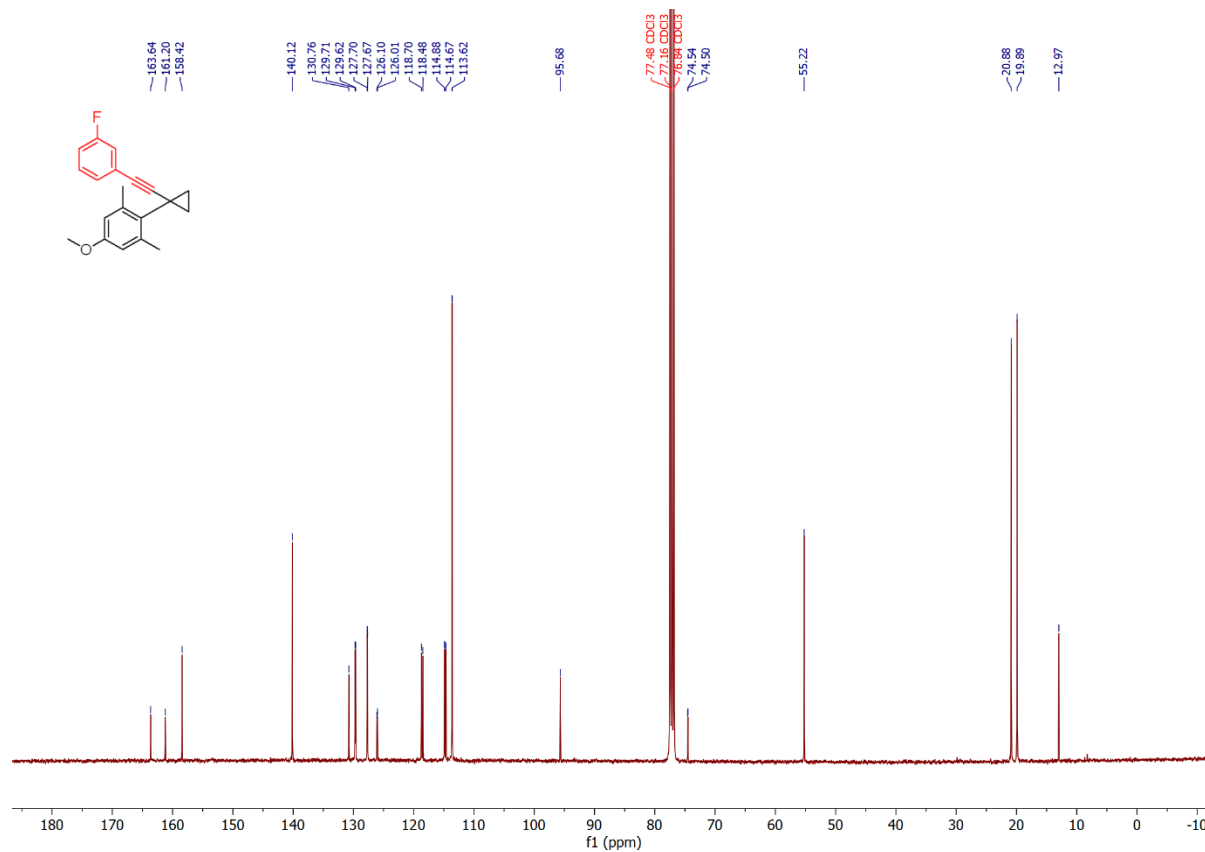
^{13}C NMR (101 MHz, CDCl_3) (4g)



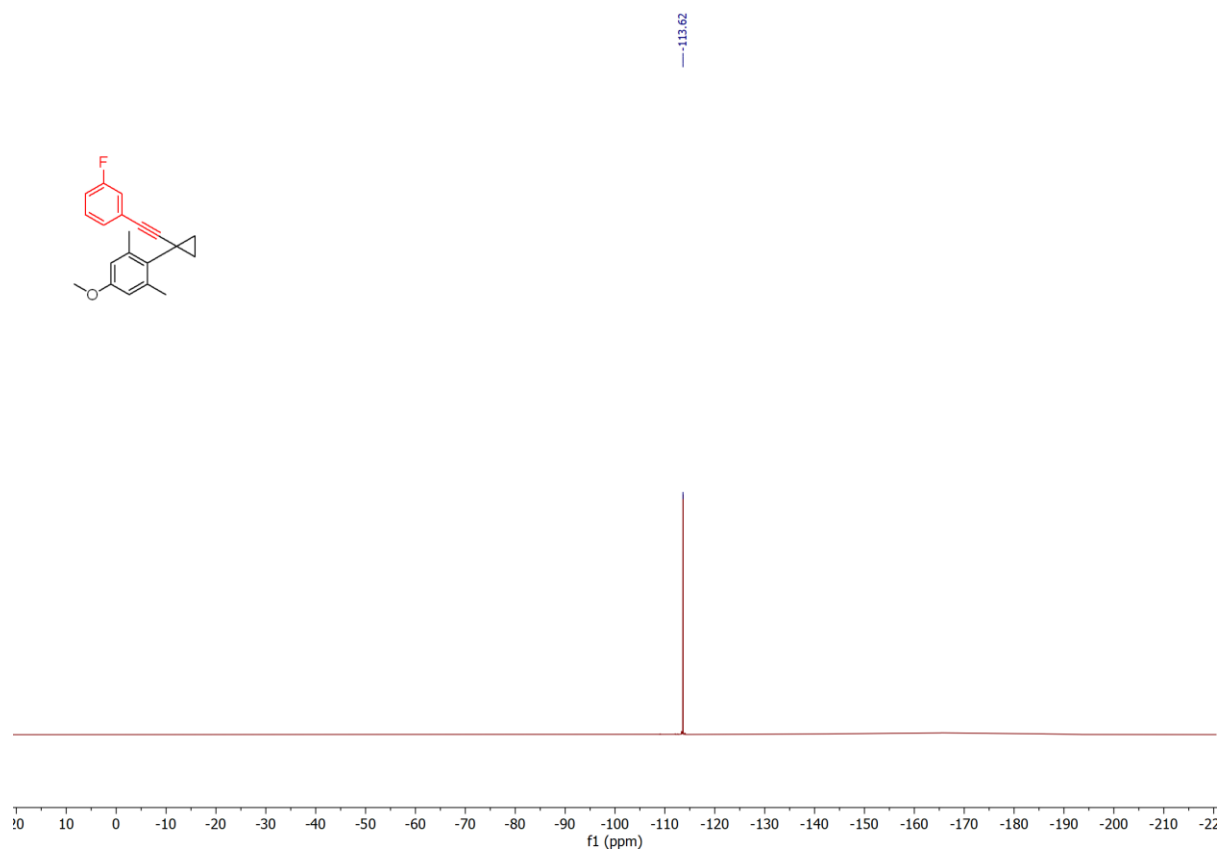
¹H NMR (400 MHz, CDCl₃) (4h)



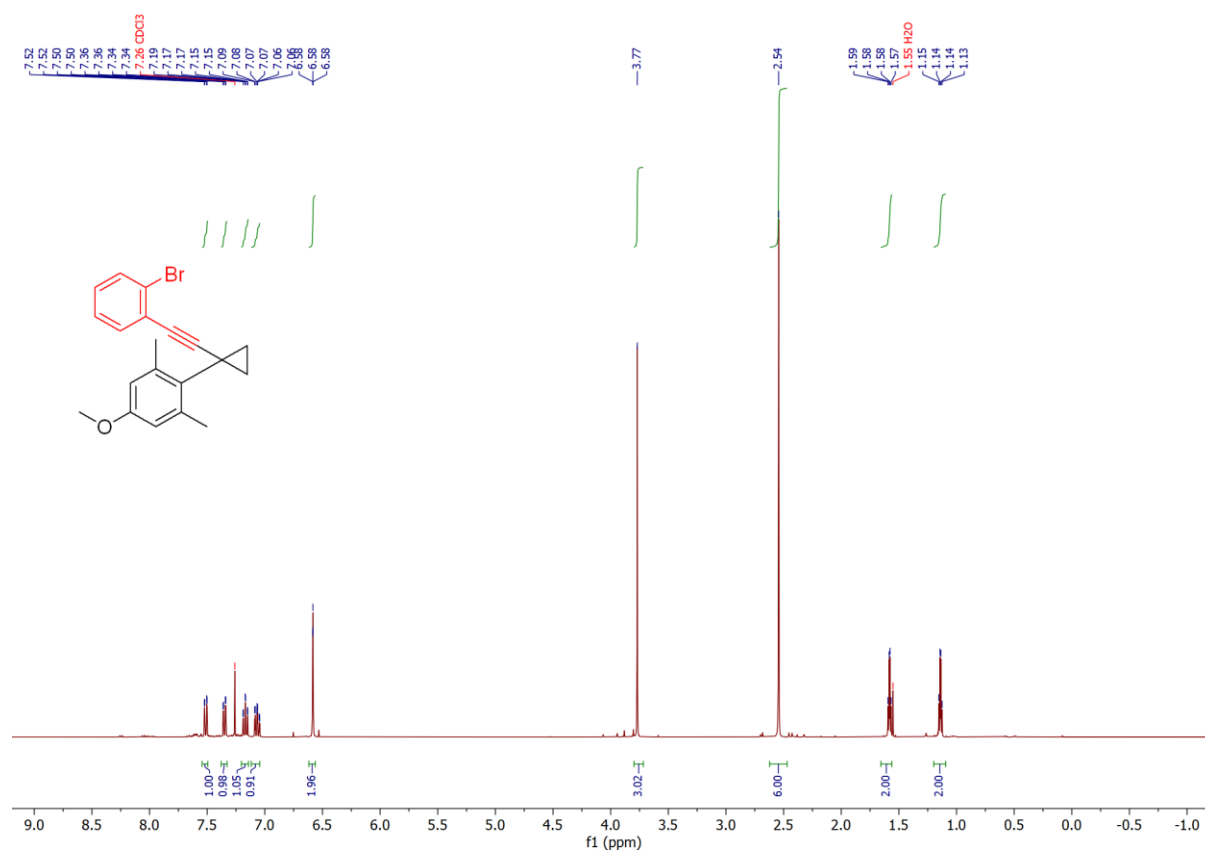
¹³C NMR (101 MHz, CDCl₃) (4h)



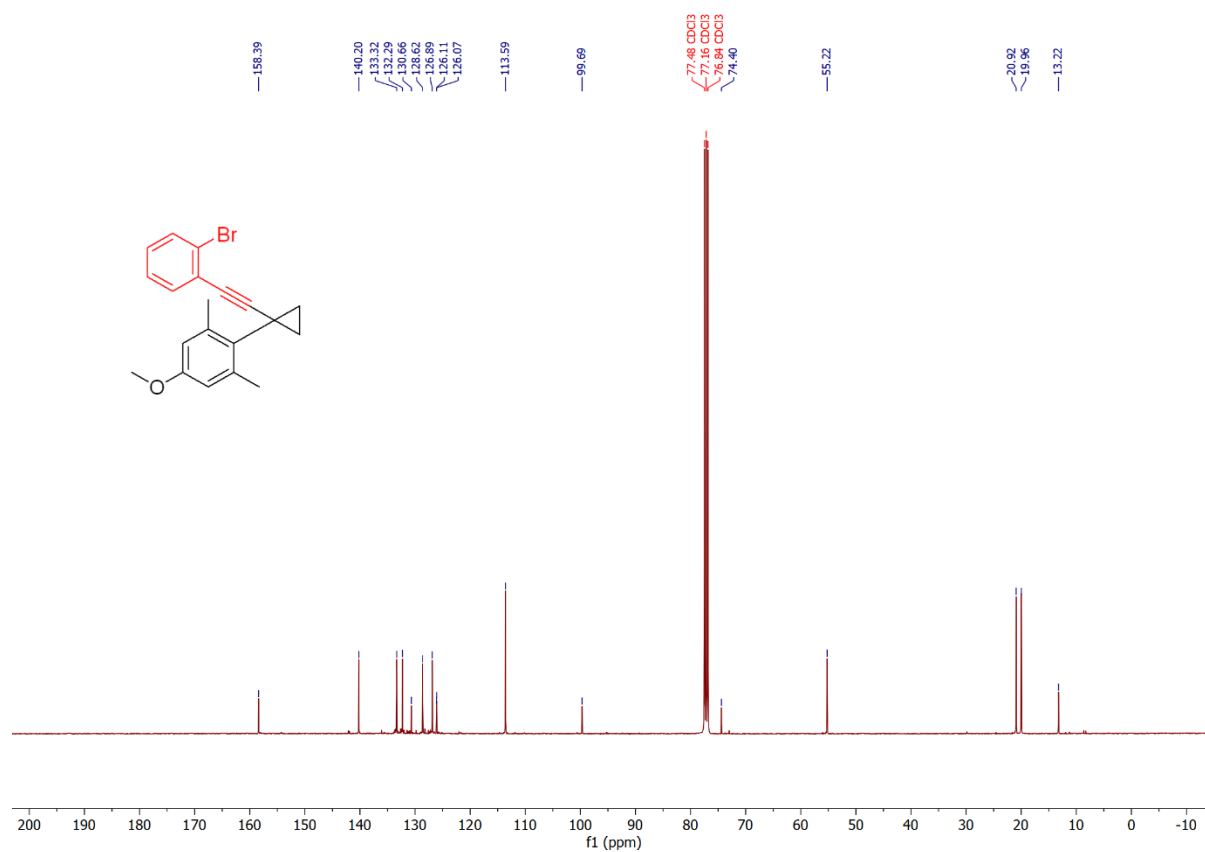
^{19}F NMR (377 MHz, CDCl_3) (4h)



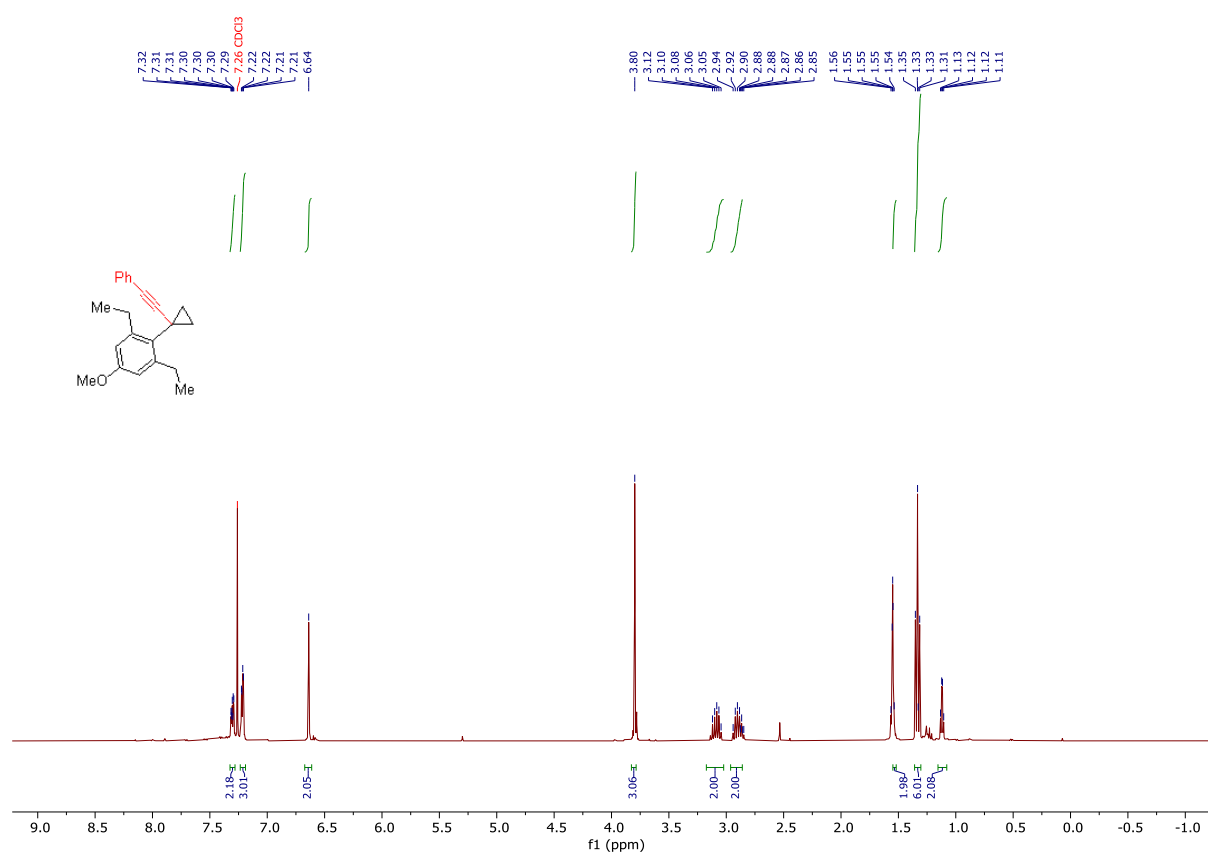
¹H NMR (400 MHz, CDCl₃) (4i)



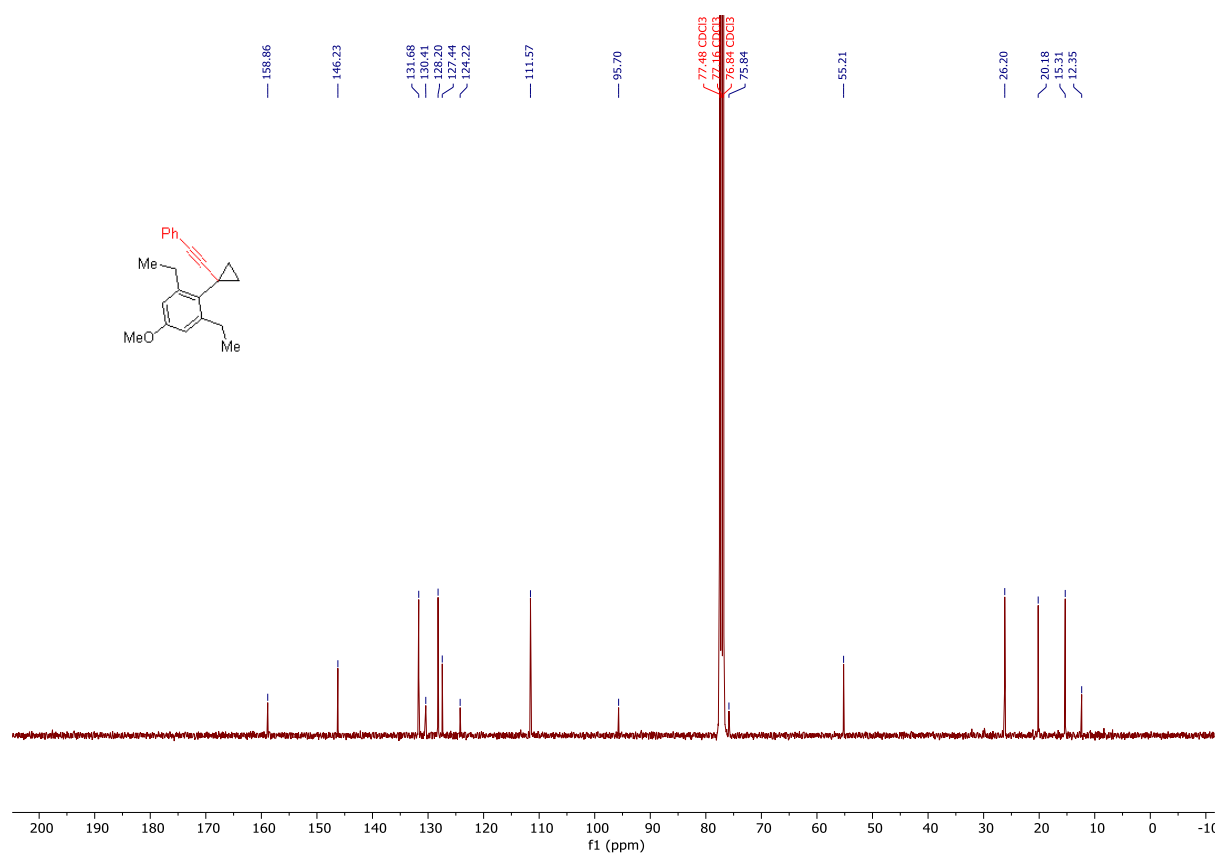
¹³C NMR (101 MHz, CDCl₃) (4i)



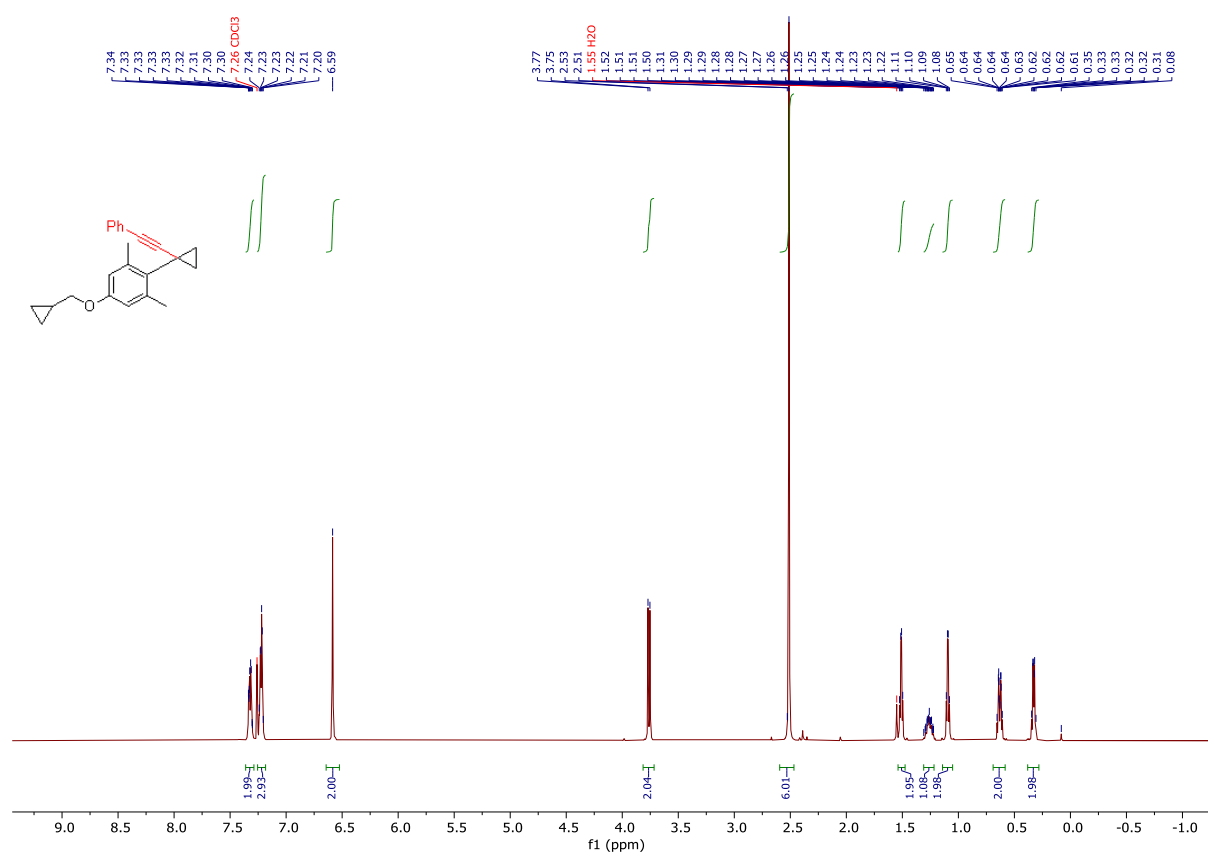
^1H NMR (400 MHz, CDCl_3) (4j)



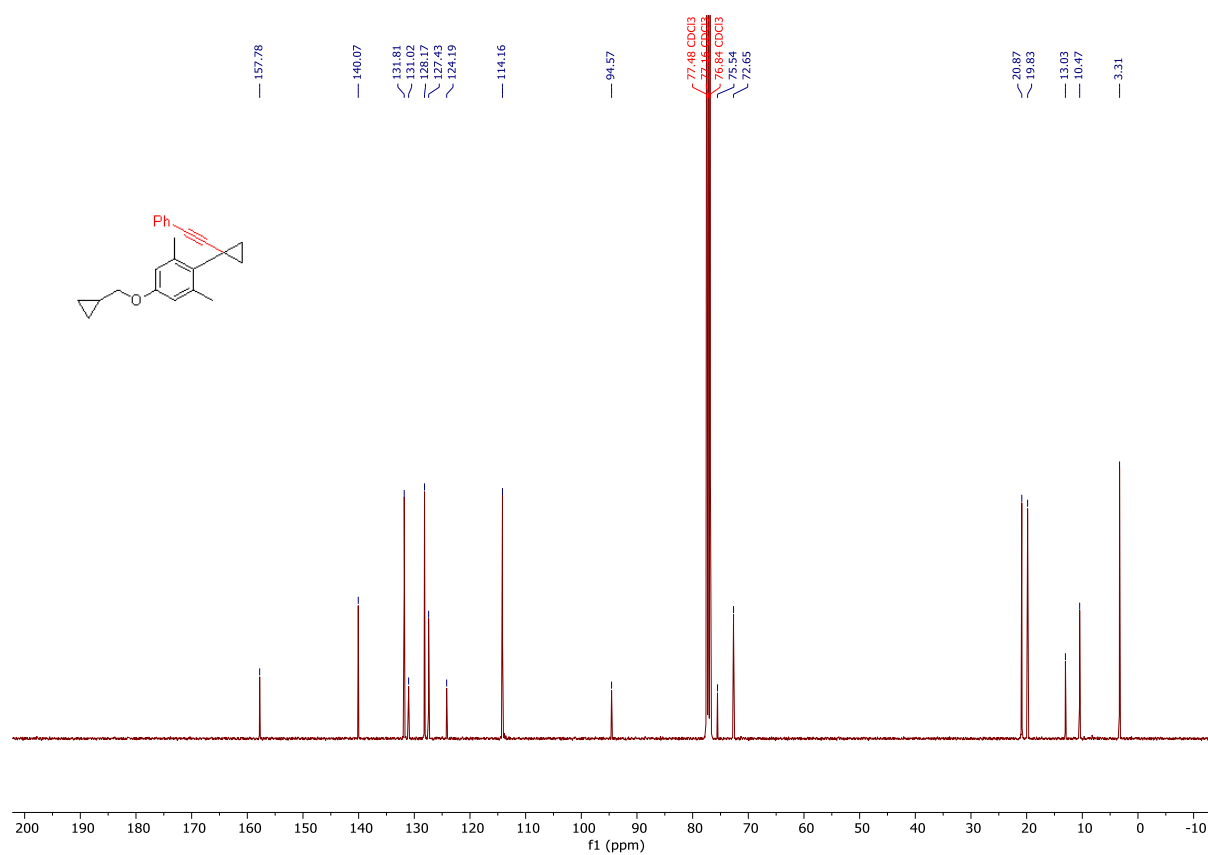
^{13}C NMR (101 MHz, CDCl_3) (4j)



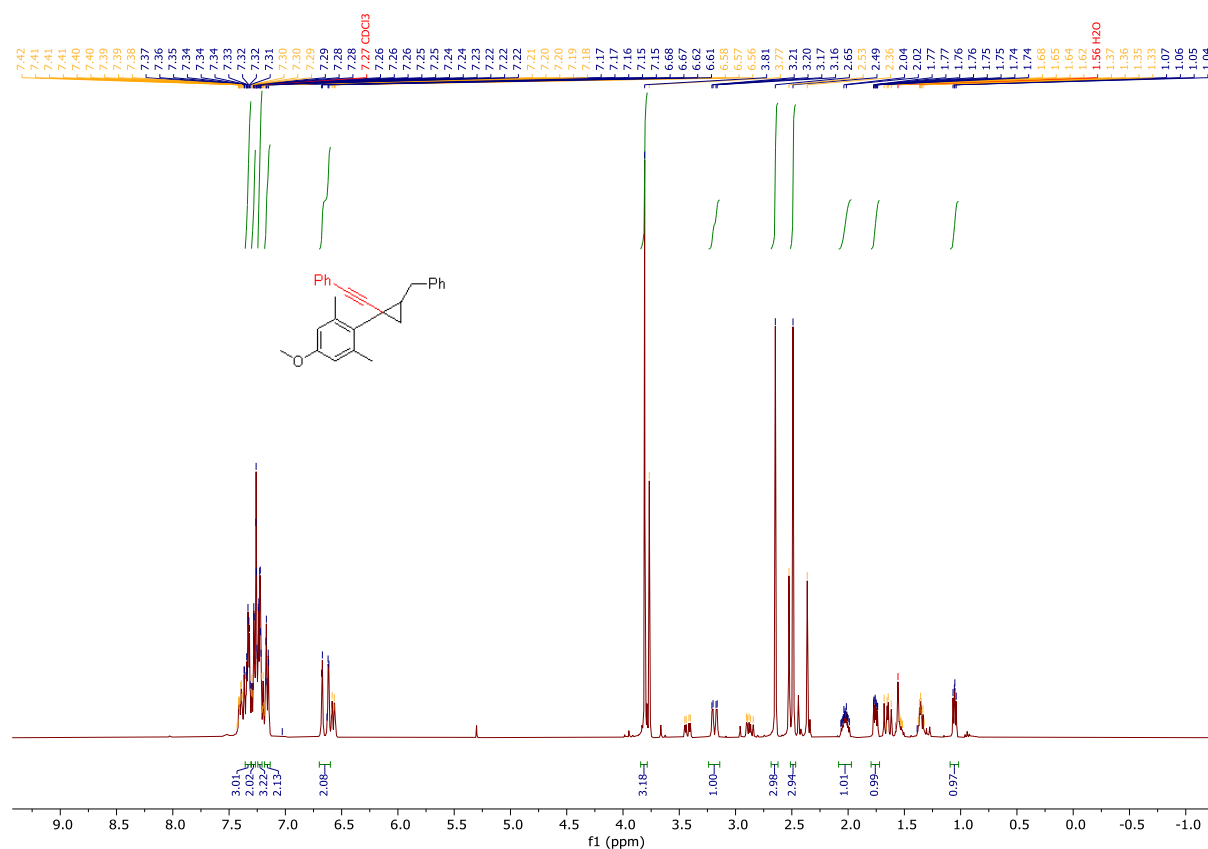
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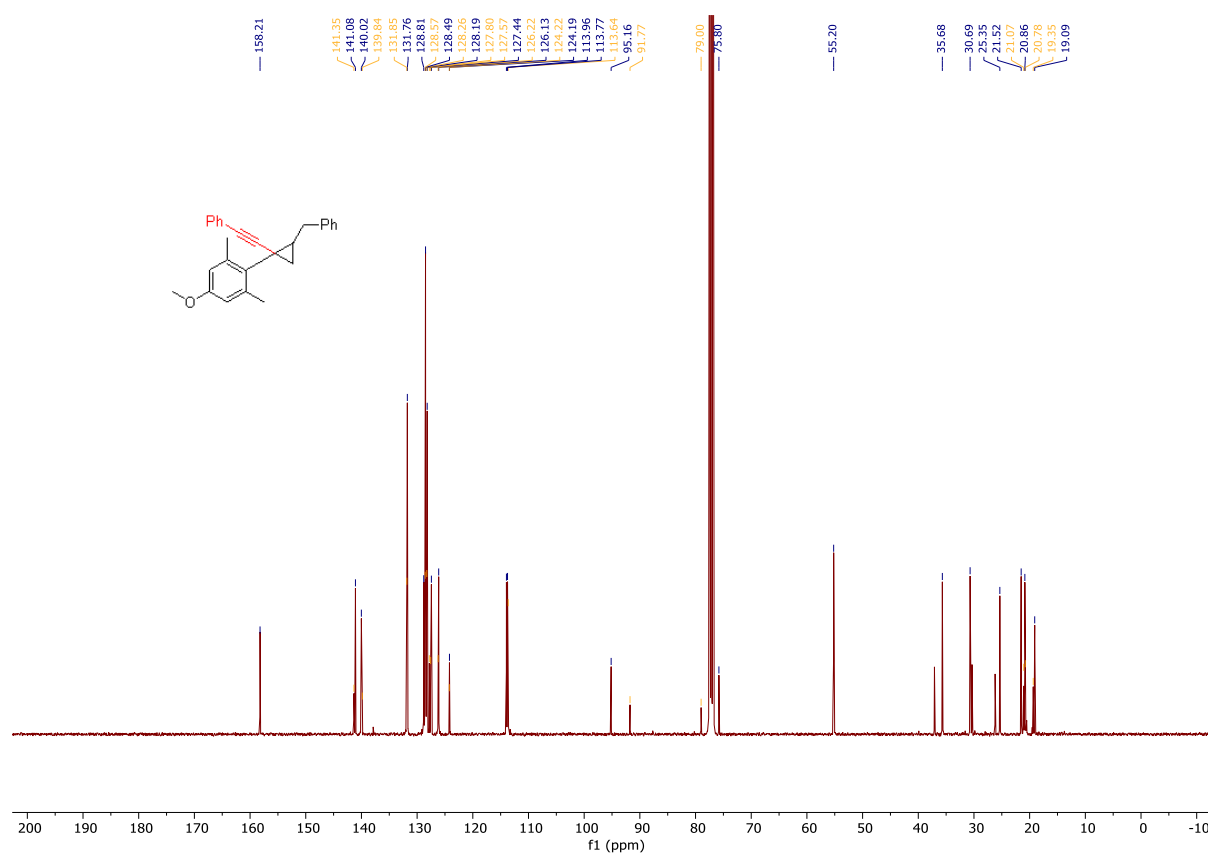
¹³C NMR (101 MHz, CDCl₃) (4k)



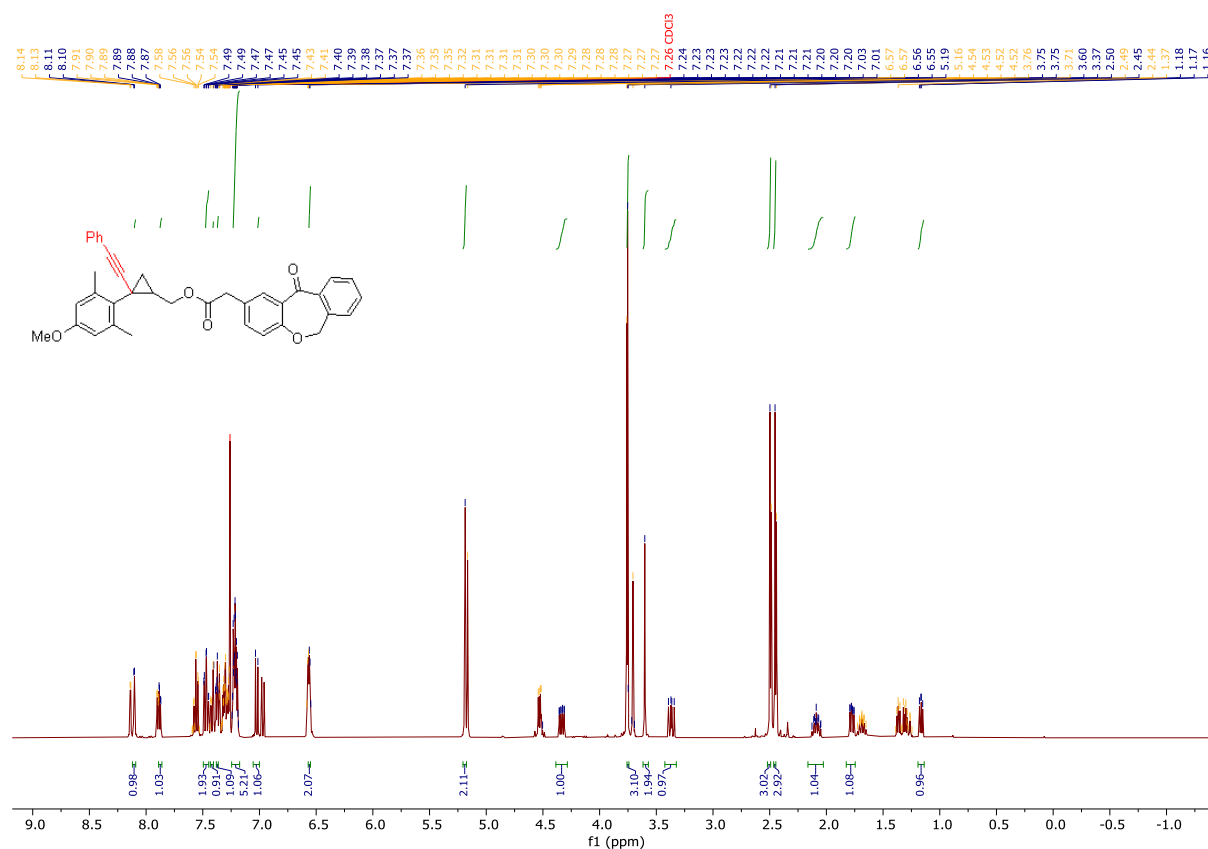
¹H NMR (400 MHz, CDCl₃) (4I): Blue : Major diastereomer, Organge: minor diastereomer



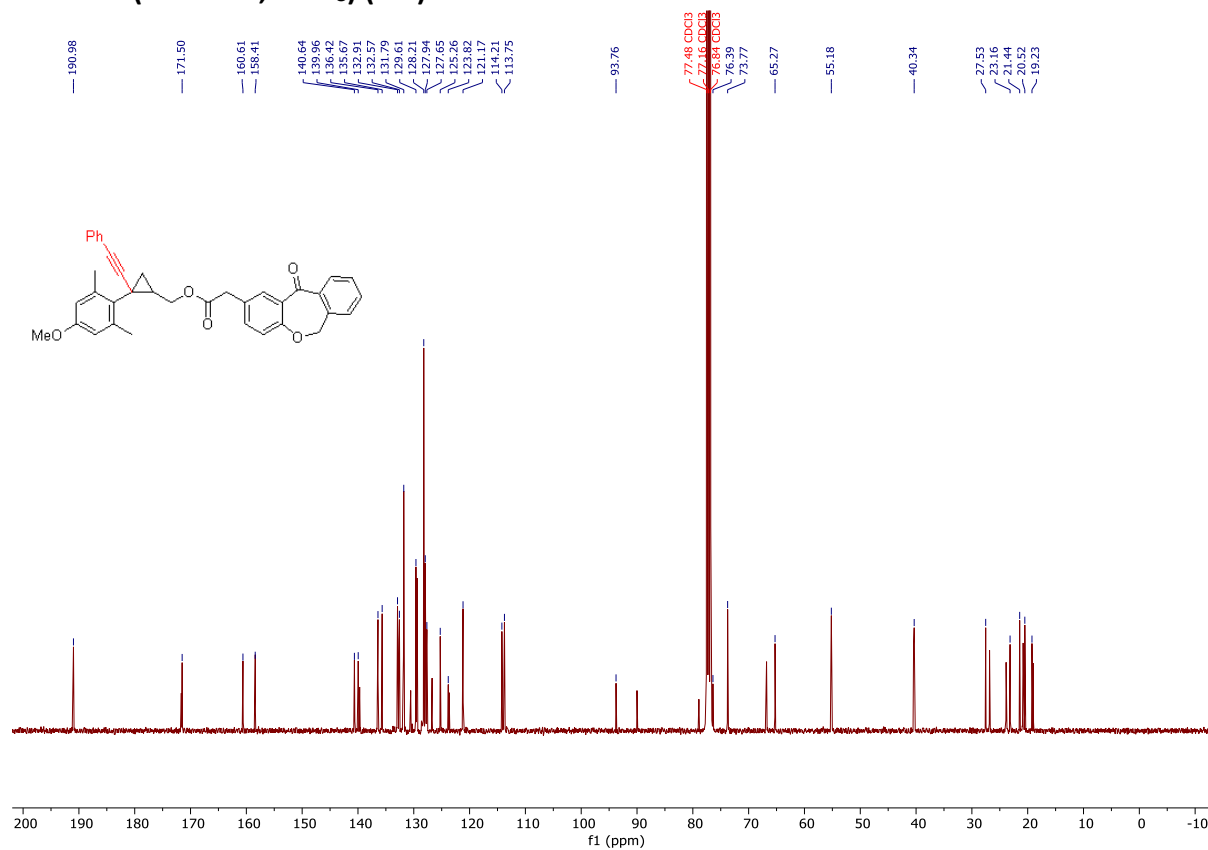
¹³C NMR (101 MHz, CDCl₃) (4I)



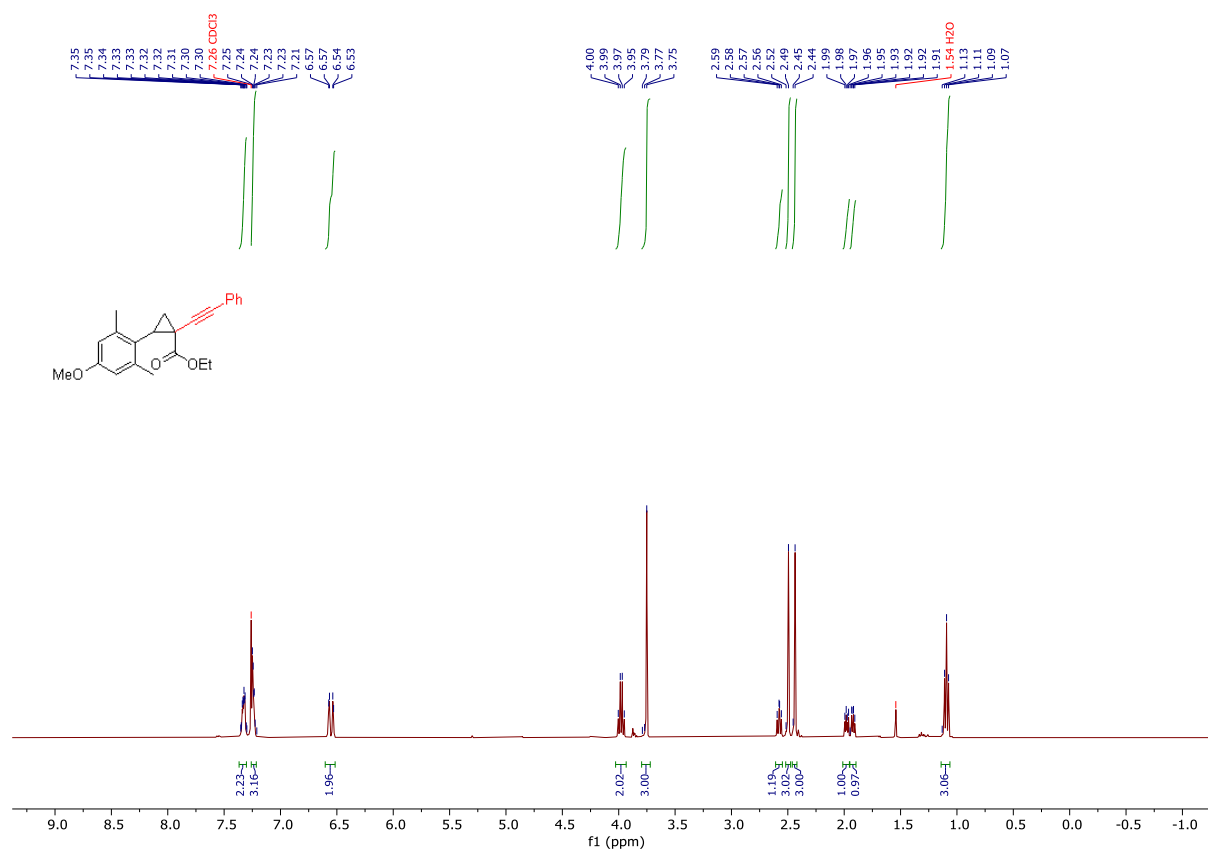
¹H NMR (400 MHz, CDCl₃) (4m) Blue : Major diastereomer, Organge: minor diastereomer



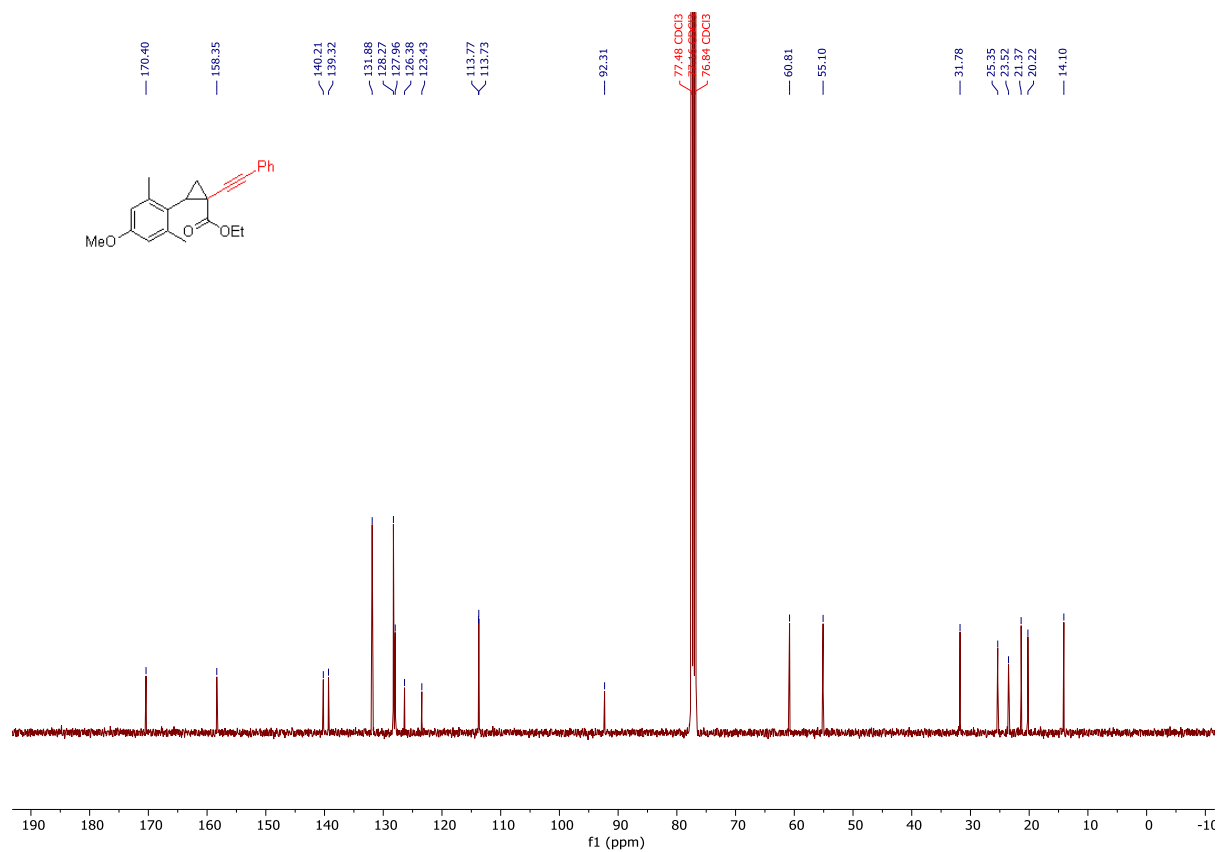
¹³C NMR (101 MHz, CDCl₃) (4m)



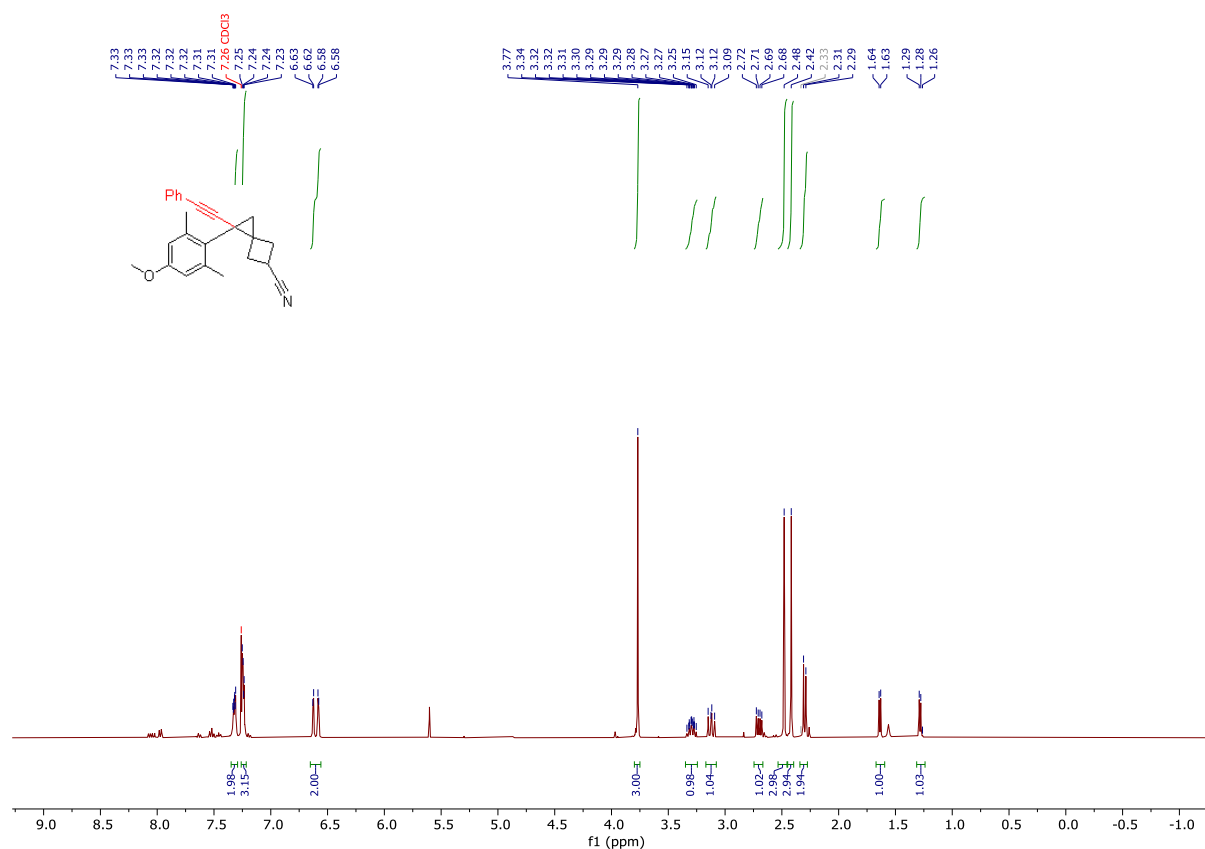
^1H NMR (400 MHz, CDCl_3) (4n)



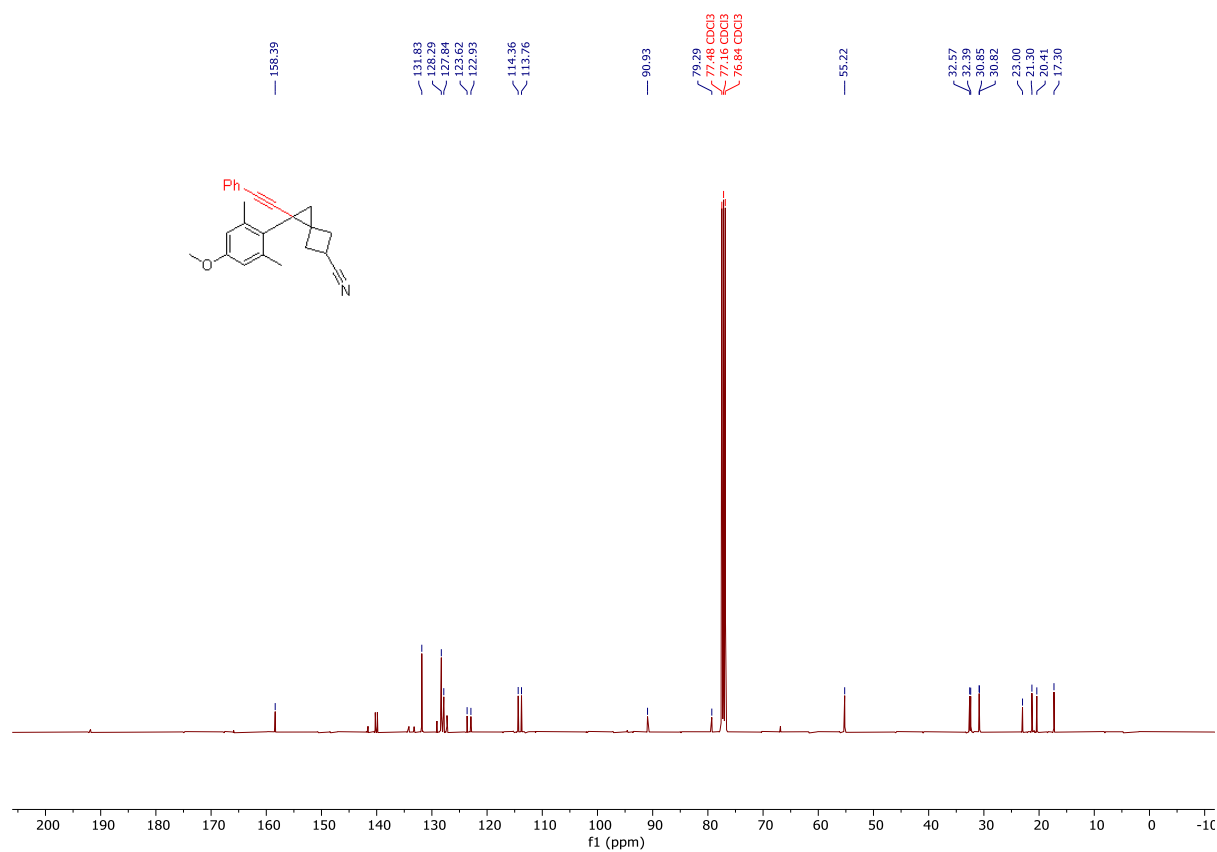
^{13}C NMR (101 MHz, CDCl_3) (4n)



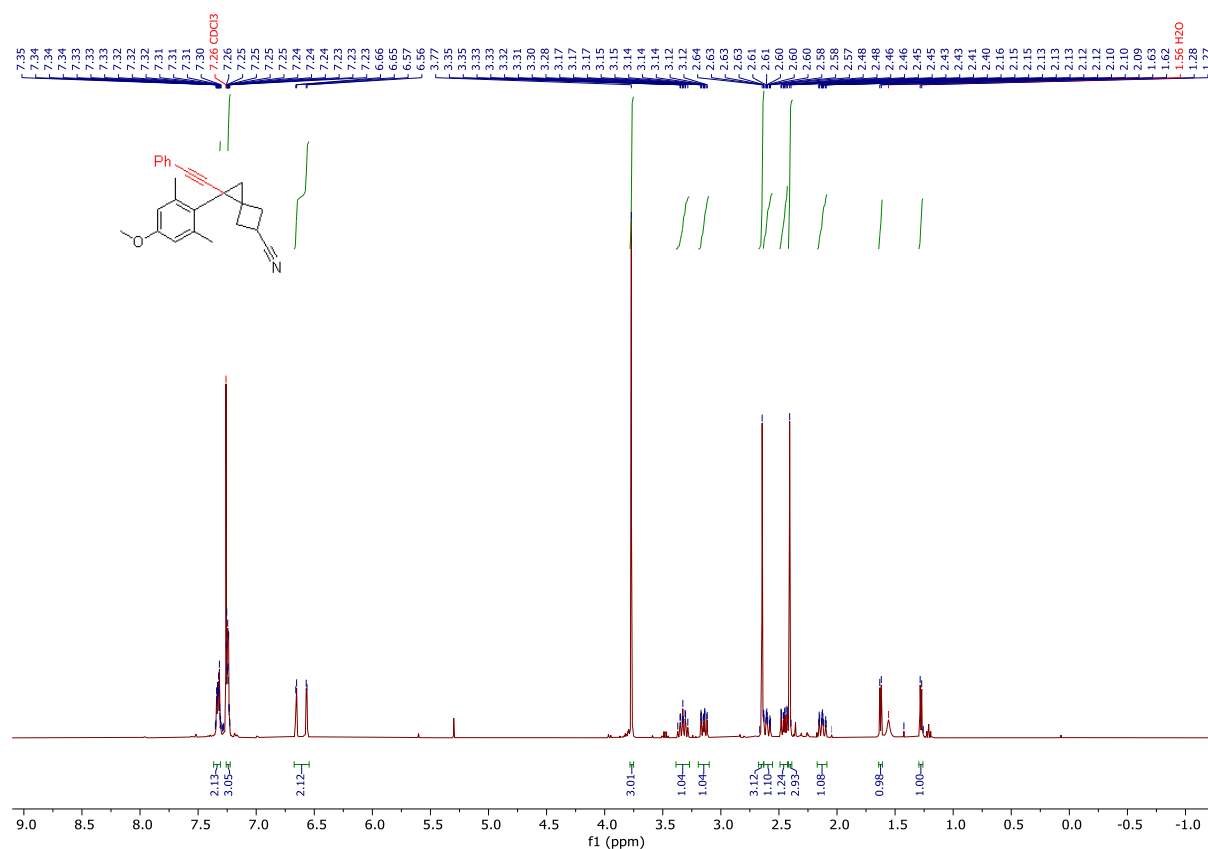
^1H NMR (400 MHz, CDCl_3) (4o1) – 1st diastereomer



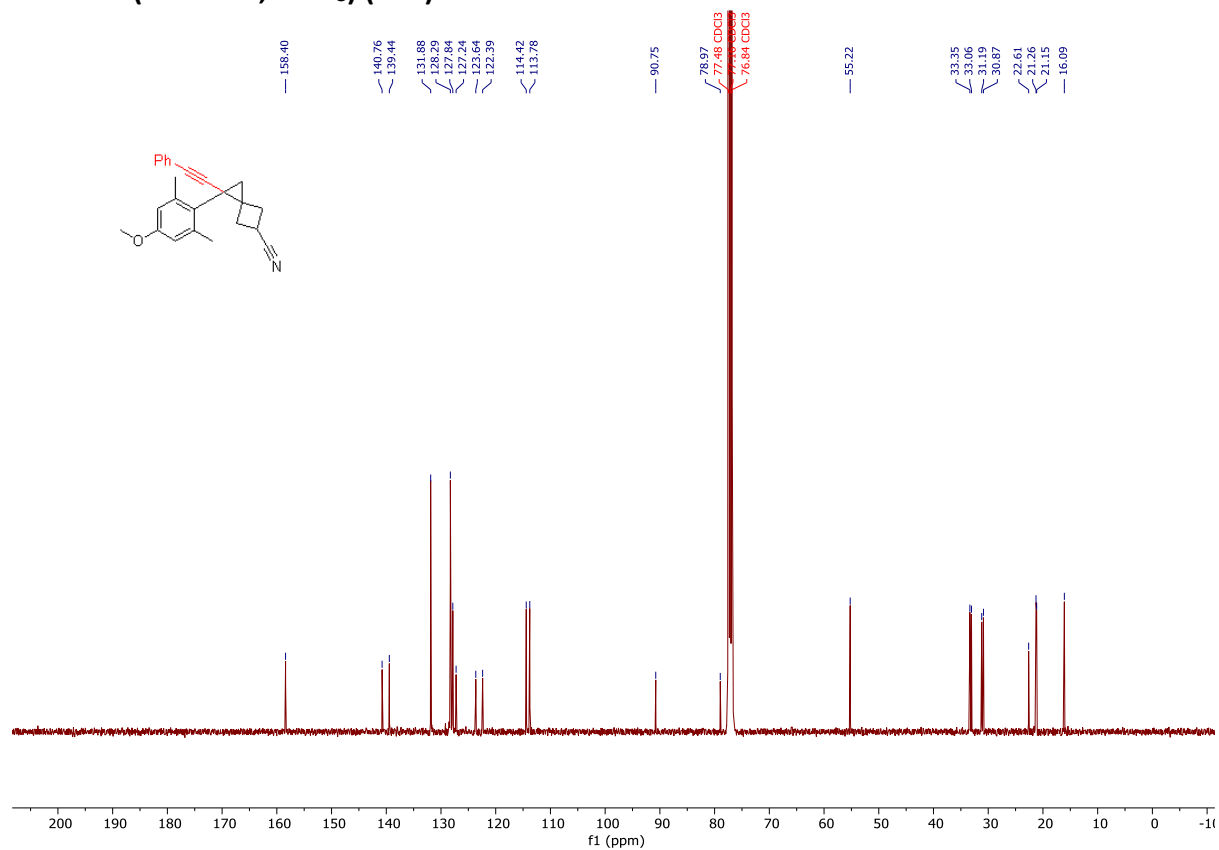
^{13}C NMR (101 MHz, CDCl_3) (4o1) – 1st diastereomer



¹H NMR (400 MHz, CDCl₃) (4o2) – 2nd diastereomer



¹³C NMR (101 MHz, CDCl₃) (4o2) – 2nd diastereomer



COc1ccc(cc1)C2CC2

Ph

MeO

CDCl₃

7.31, 7.31, 7.31, 7.30, 7.30, 7.30, 7.29, 7.29, 7.28, 7.28, 7.28, 7.24, 7.23, 7.23, 7.23, 7.22, 7.22, 7.21, 7.21, 7.21, 7.20, 7.19, 7.19, 7.18, 7.18, 6.61, 3.78, 2.48, 1.96, 1.95, 1.95, 1.94, 1.94, 1.94, 1.93, 1.93, 1.92, 1.92, 1.91, 1.91, 1.91, 1.90, 1.80, 1.80, 1.79, 1.79, 1.78, 1.78, 1.77, 1.77, 1.76, 1.55 H₂O, 1.30, 1.29, 1.29, 1.28, 1.28, 1.27, 1.27, 1.26, 1.25, 1.25, 1.24, 1.24, 1.13, 1.13, 1.12, 1.12, 1.11, 1.11, 1.10, 1.10, 1.09, 1.09, 1.08, 1.07, 1.07, 1.03, 1.03, 1.02, 1.02, 1.01, 0.99, 0.99, 0.98, 0.97

2.00, 3.05, 1.98, 3.04, 6.02, 2.03, 1.94, 2.02, 1.95, 1.98

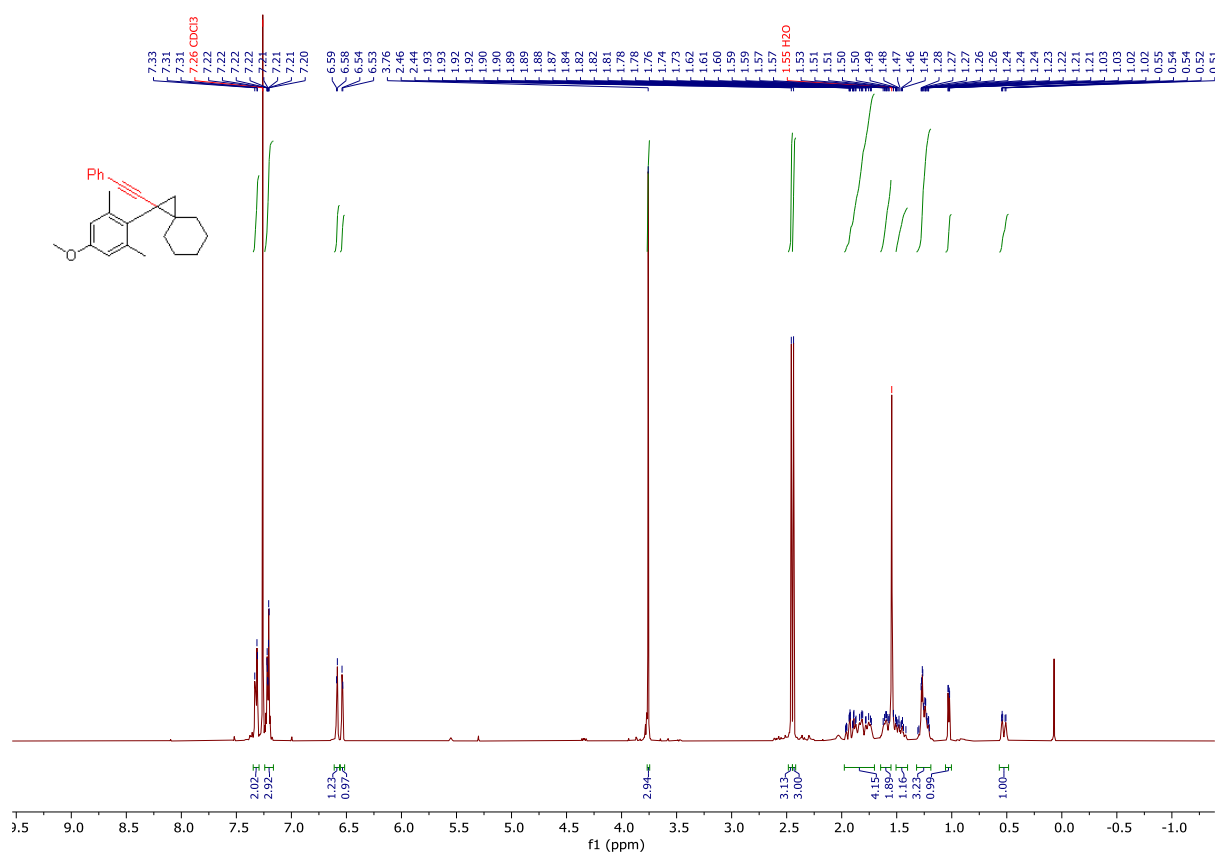
f1 (ppm)

Chemical structure: COc1ccc(cc1)C2(CCC2)c3ccccc3

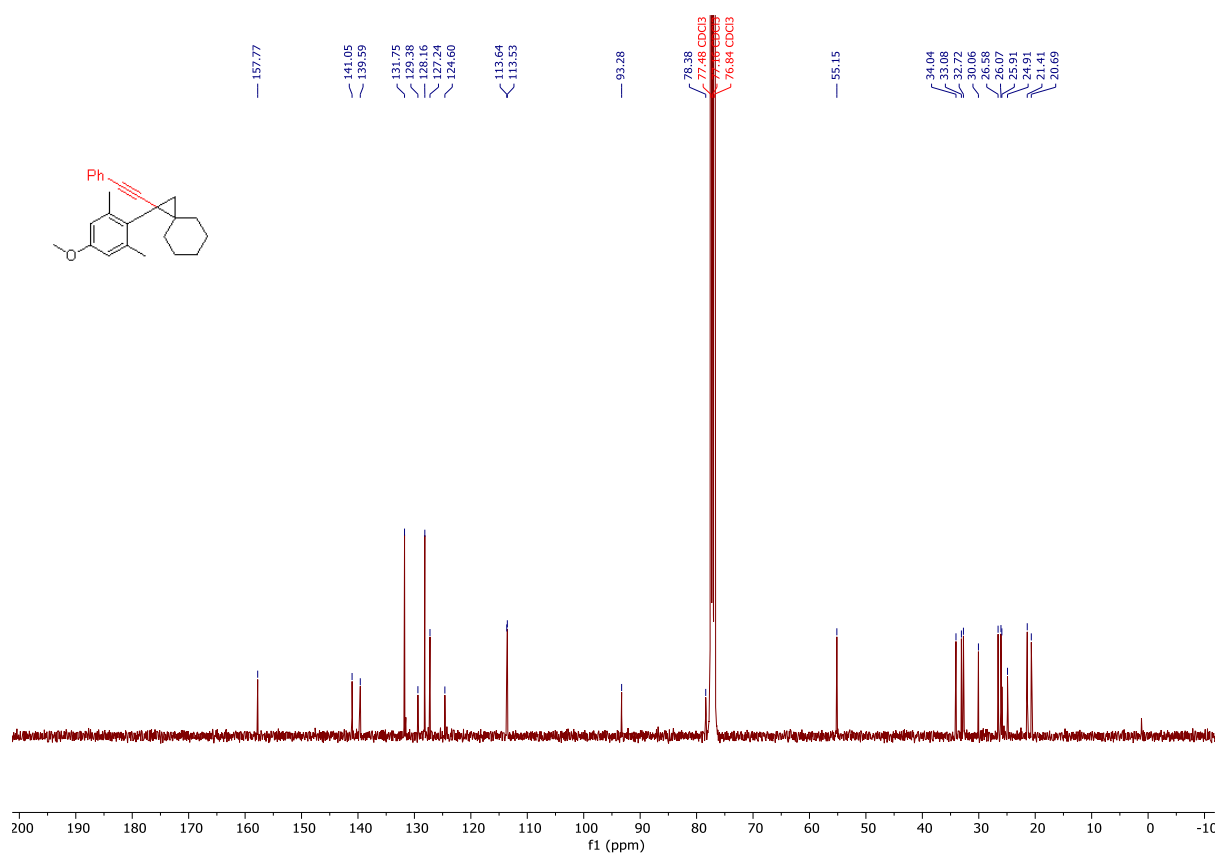
¹³C NMR spectrum (CDCl₃) peaks (ppm):

- 158.06
- 141.34
- 131.80
- 131.75
- 128.16
- 128.13
- 127.18
- 126.30
- 124.55
- 113.55
- 96.83
- 77.48 (CDCl₃)
- 76.84 (CDCl₃)
- 74.20
- 55.13
- 27.14
- 20.52
- 20.30
- 20.15
- 20.00

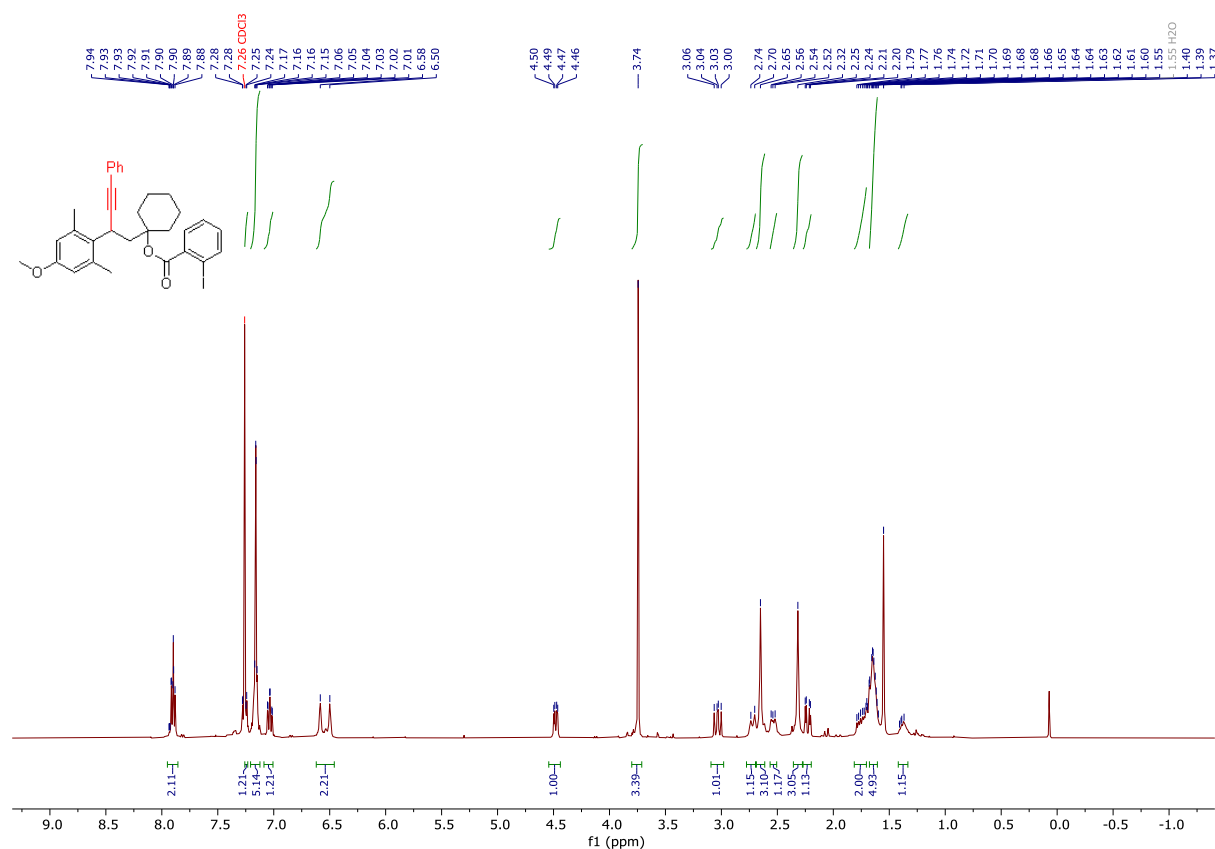
¹H NMR (400 MHz, CDCl₃) (4q1)



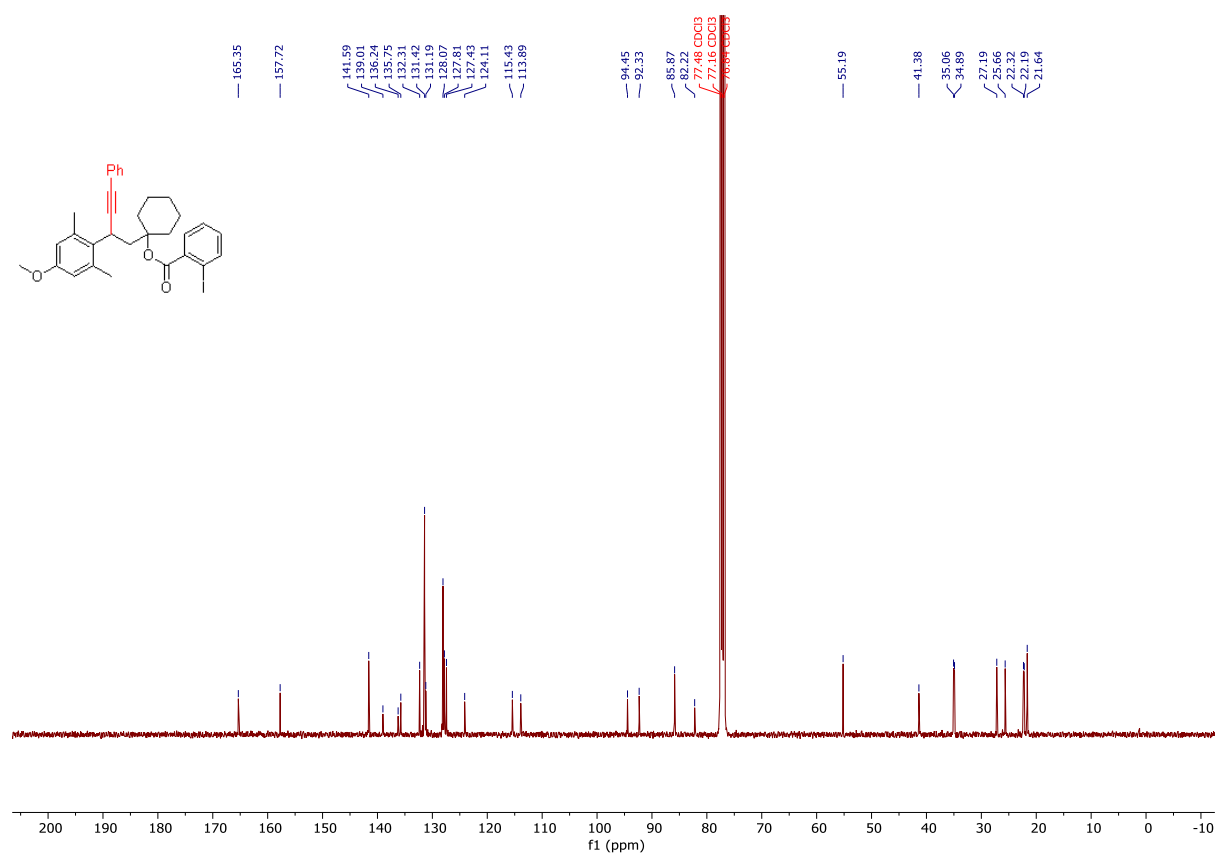
¹³C NMR (101 MHz, CDCl₃) (4q1)



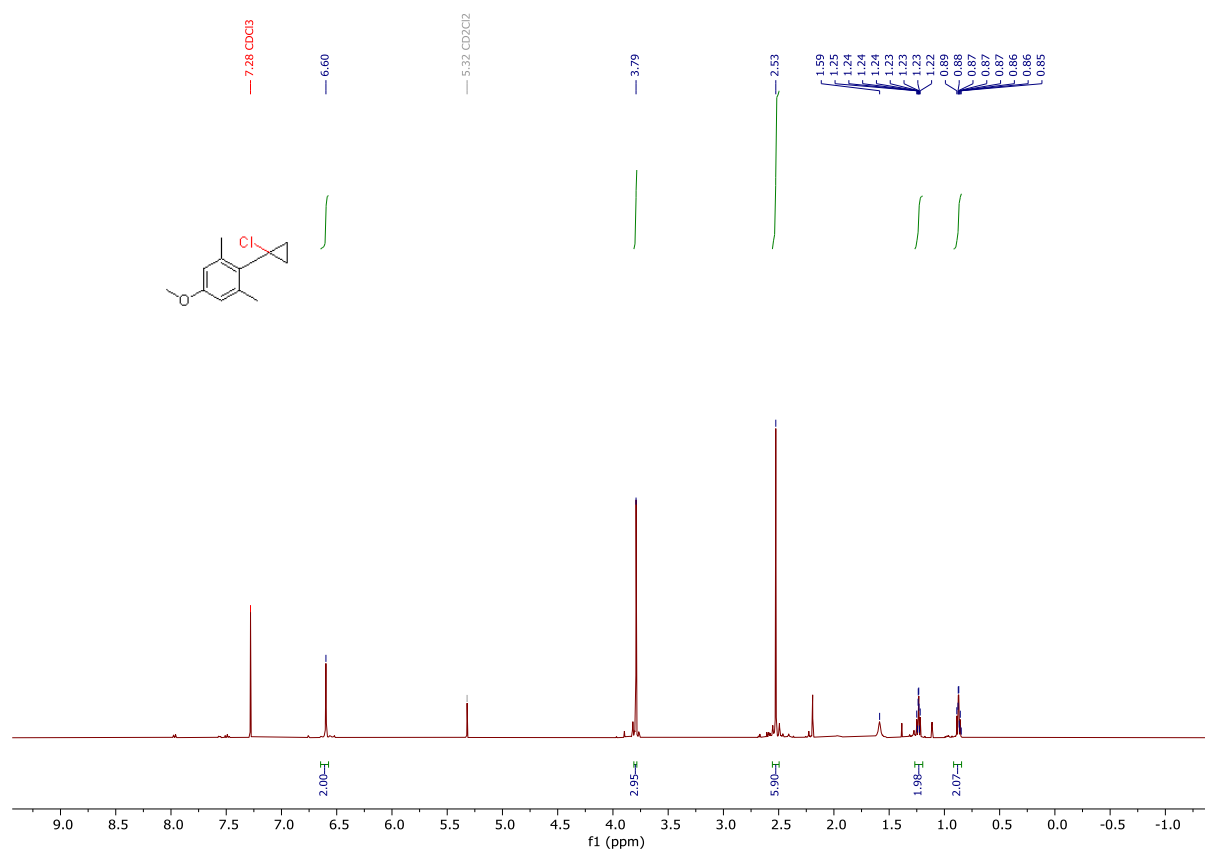
¹H NMR (400 MHz, CDCl₃) (4q2)



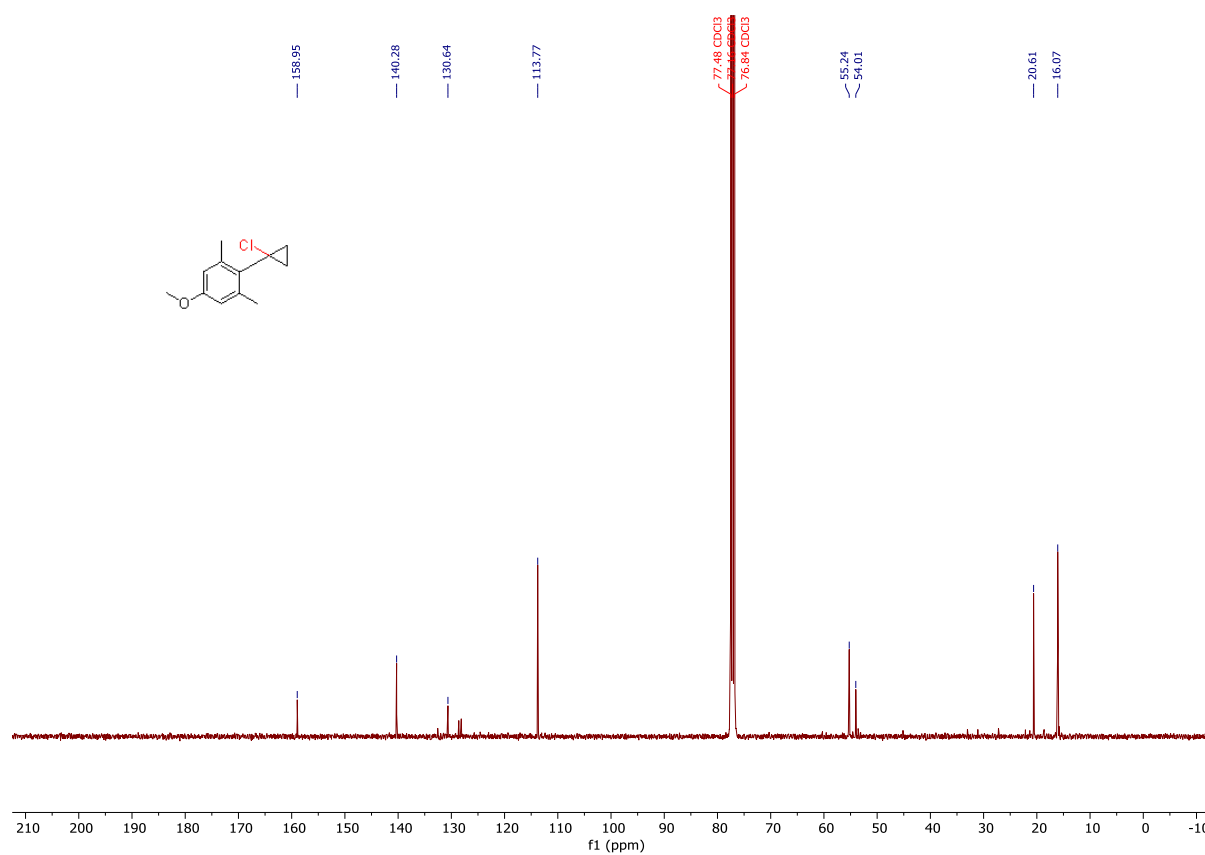
¹³C NMR (101 MHz, CDCl₃) (4q2)



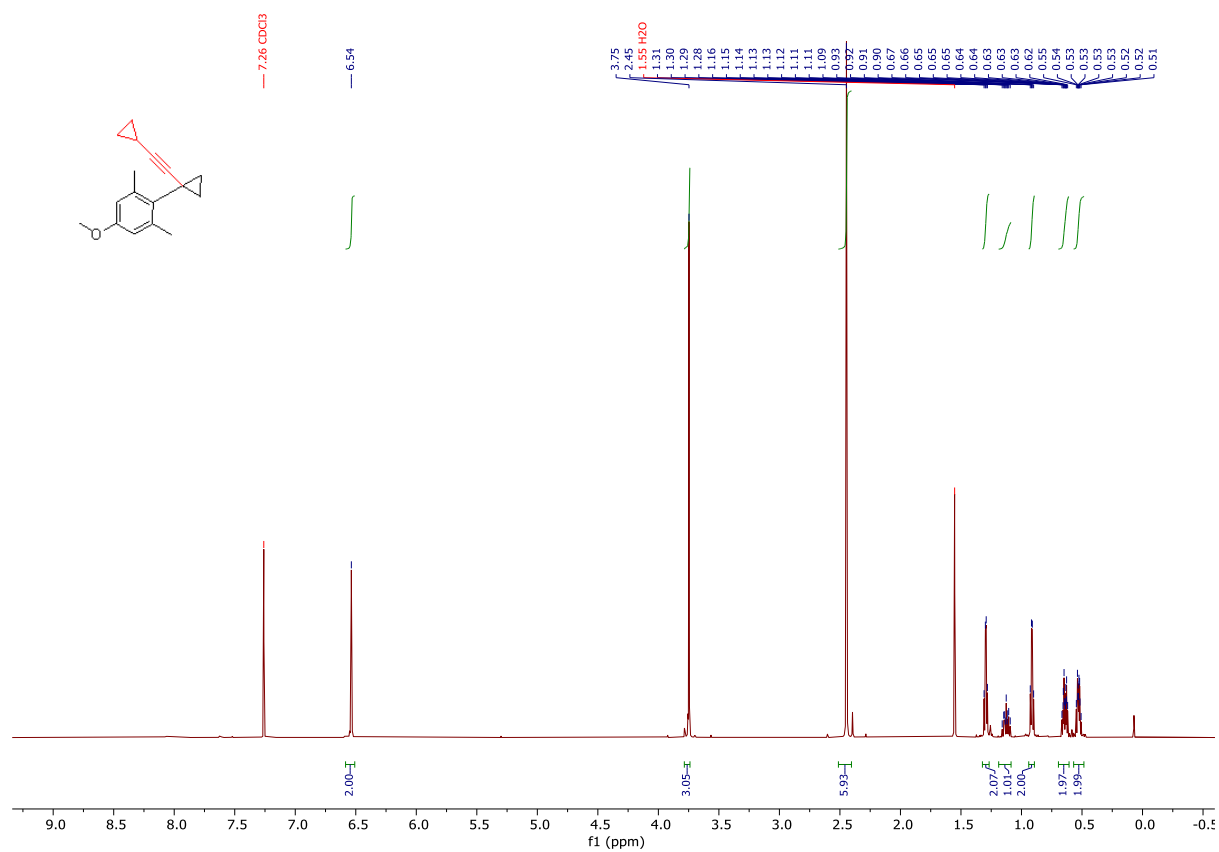
^1H NMR (400 MHz, CDCl_3) (4r)



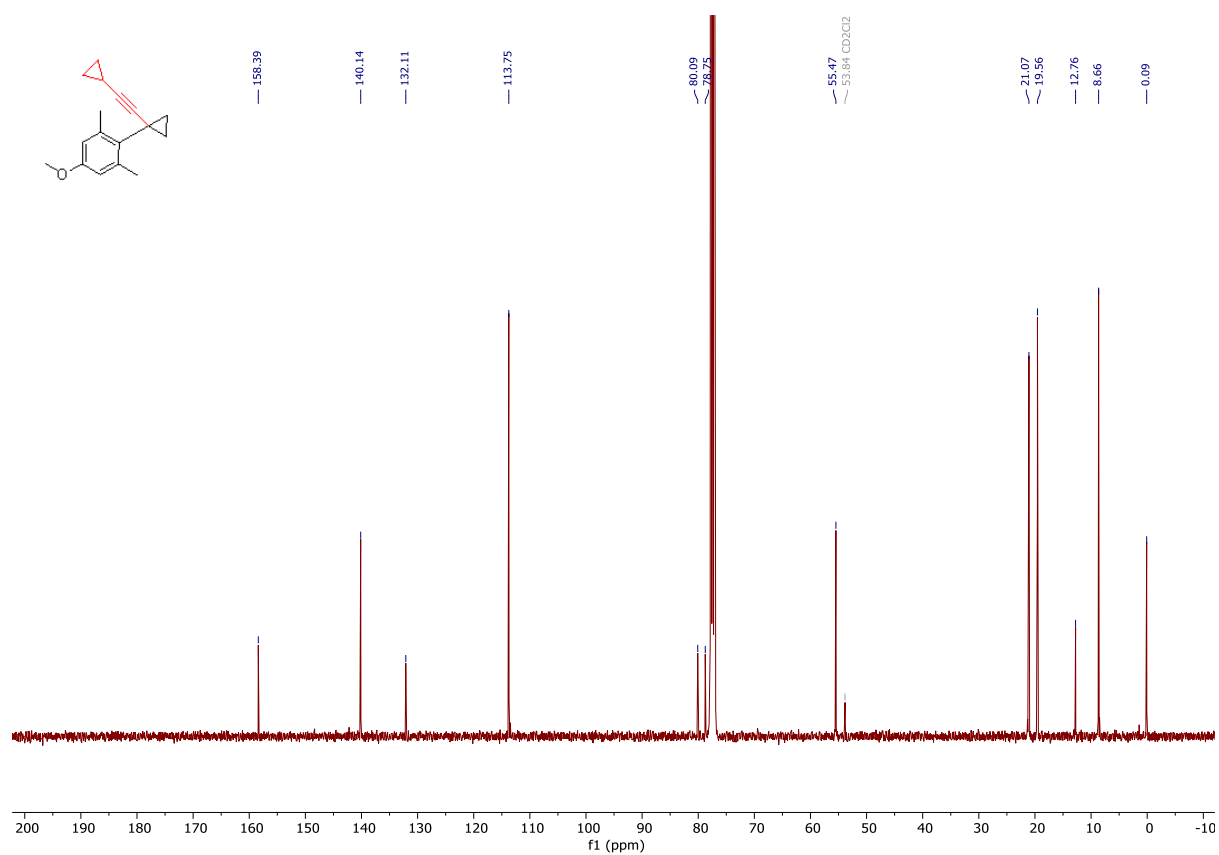
^{13}C NMR (101 MHz, CDCl_3) (4r)



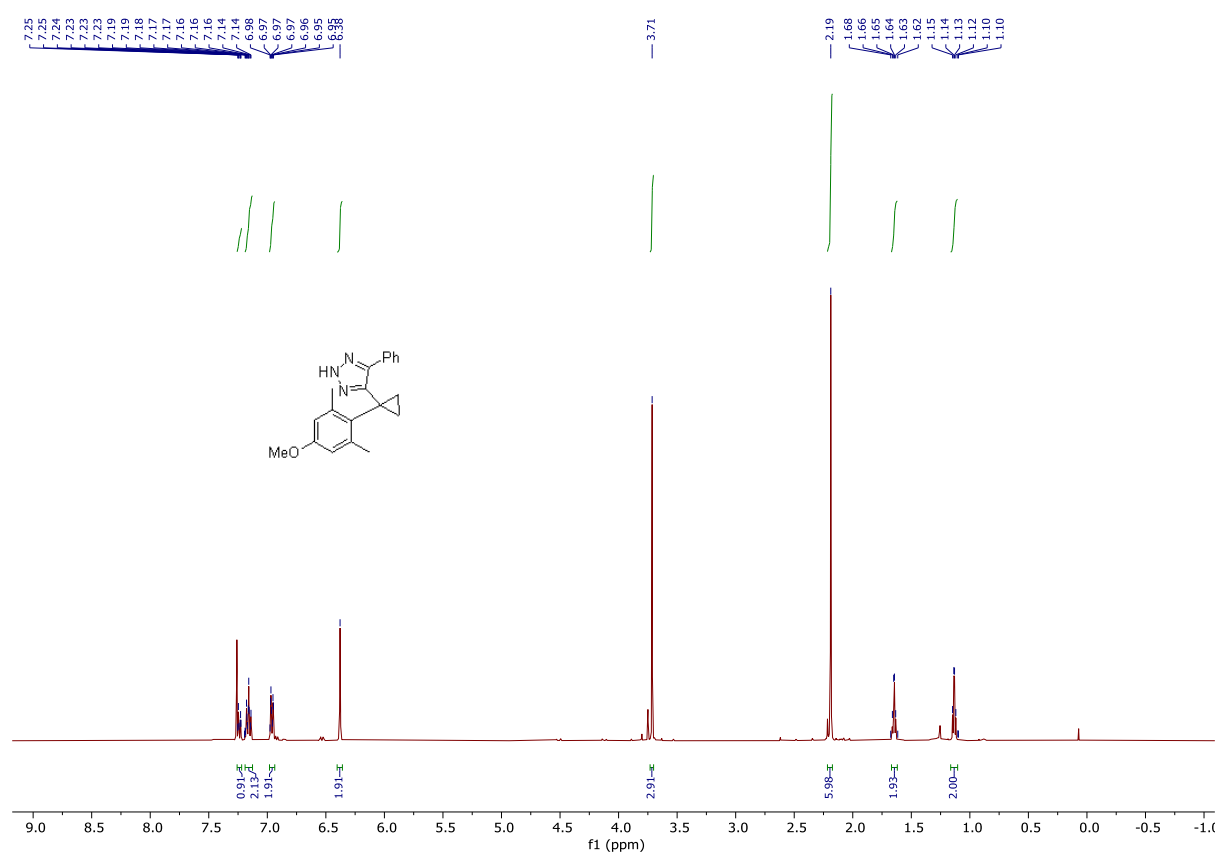
¹H NMR (400 MHz, CDCl₃) (4s1)



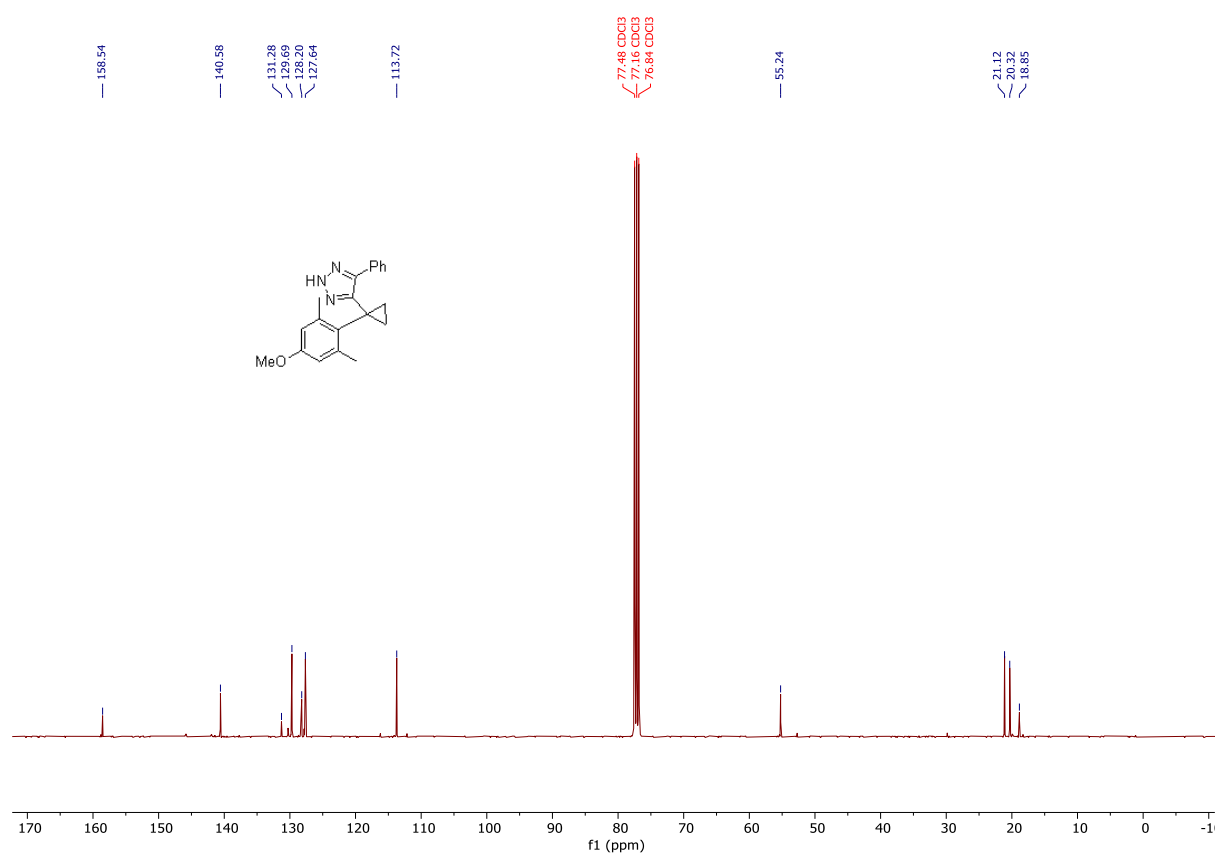
¹³C NMR (101 MHz, CDCl₃) (4s1)



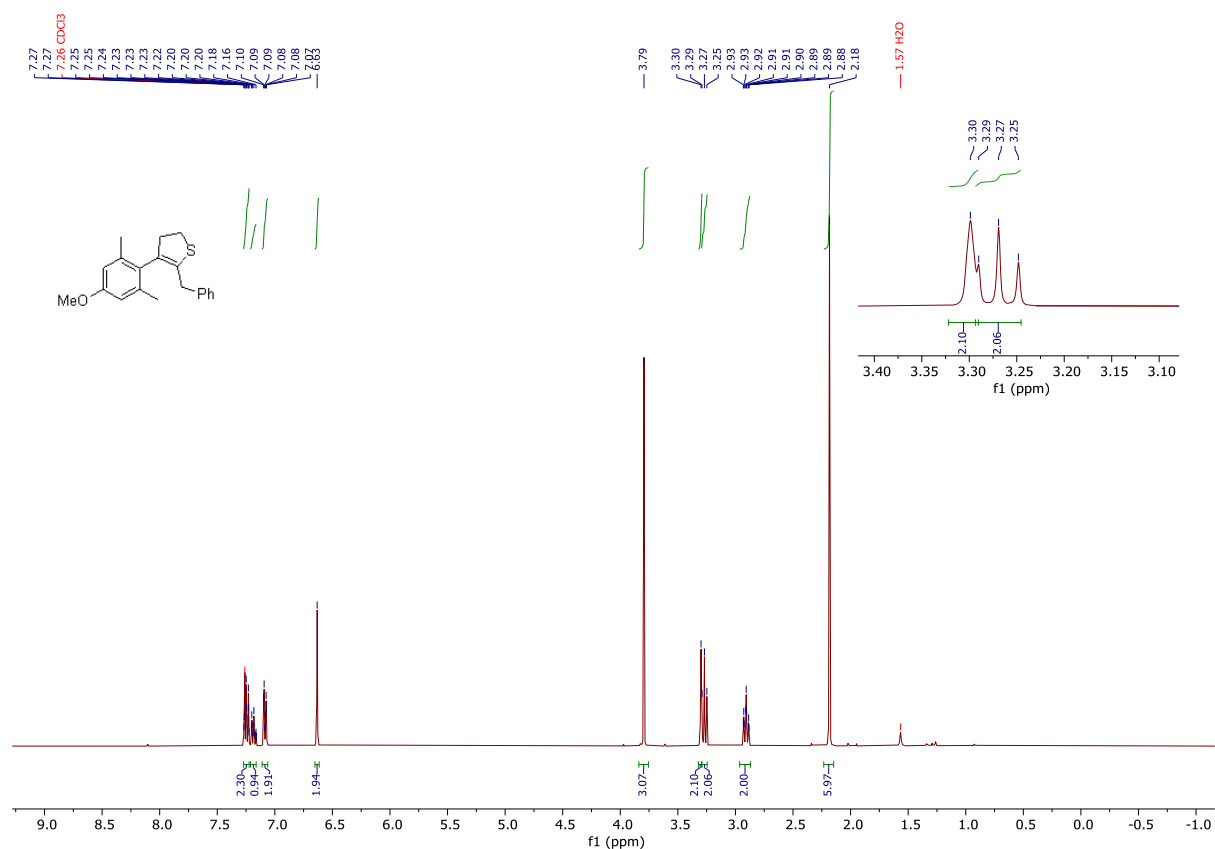
¹H NMR (400 MHz, CDCl₃) (4aa)



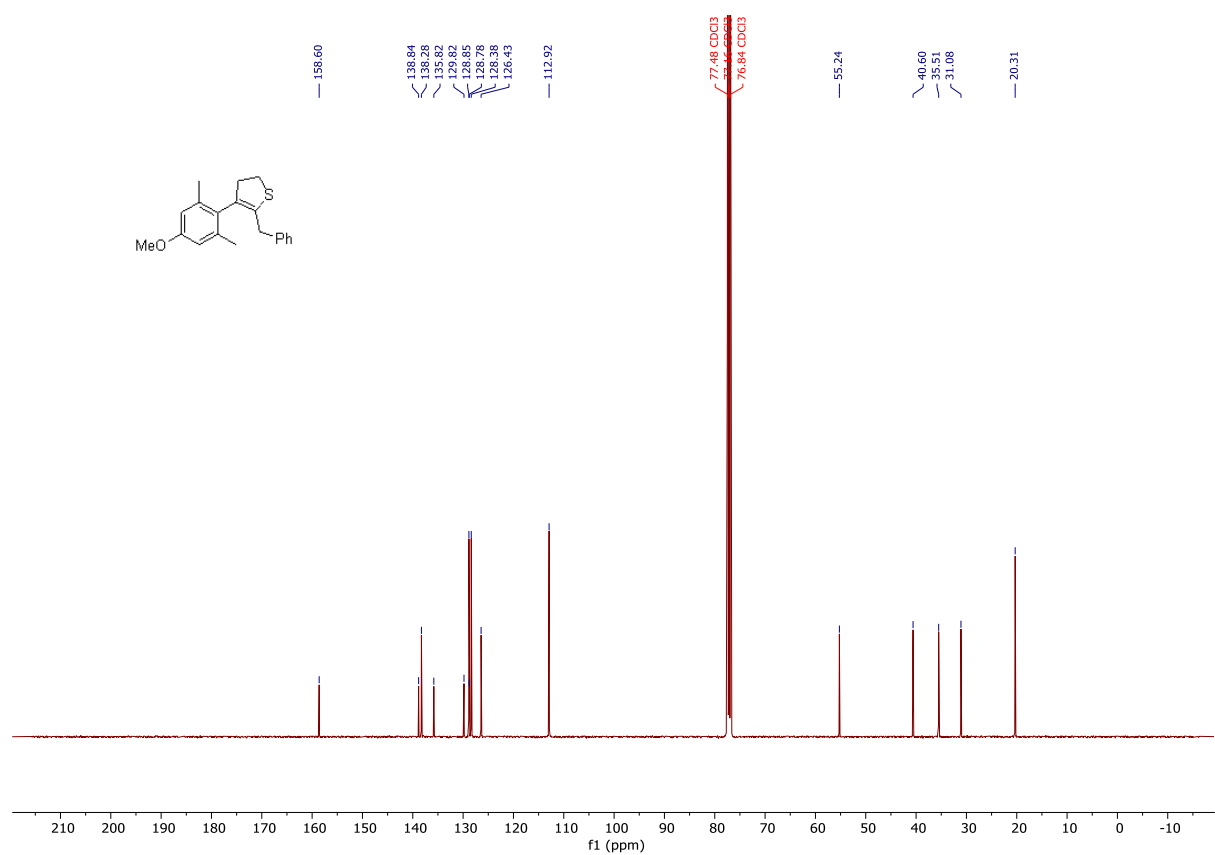
¹³C NMR (101 MHz, CDCl₃) (4aa)



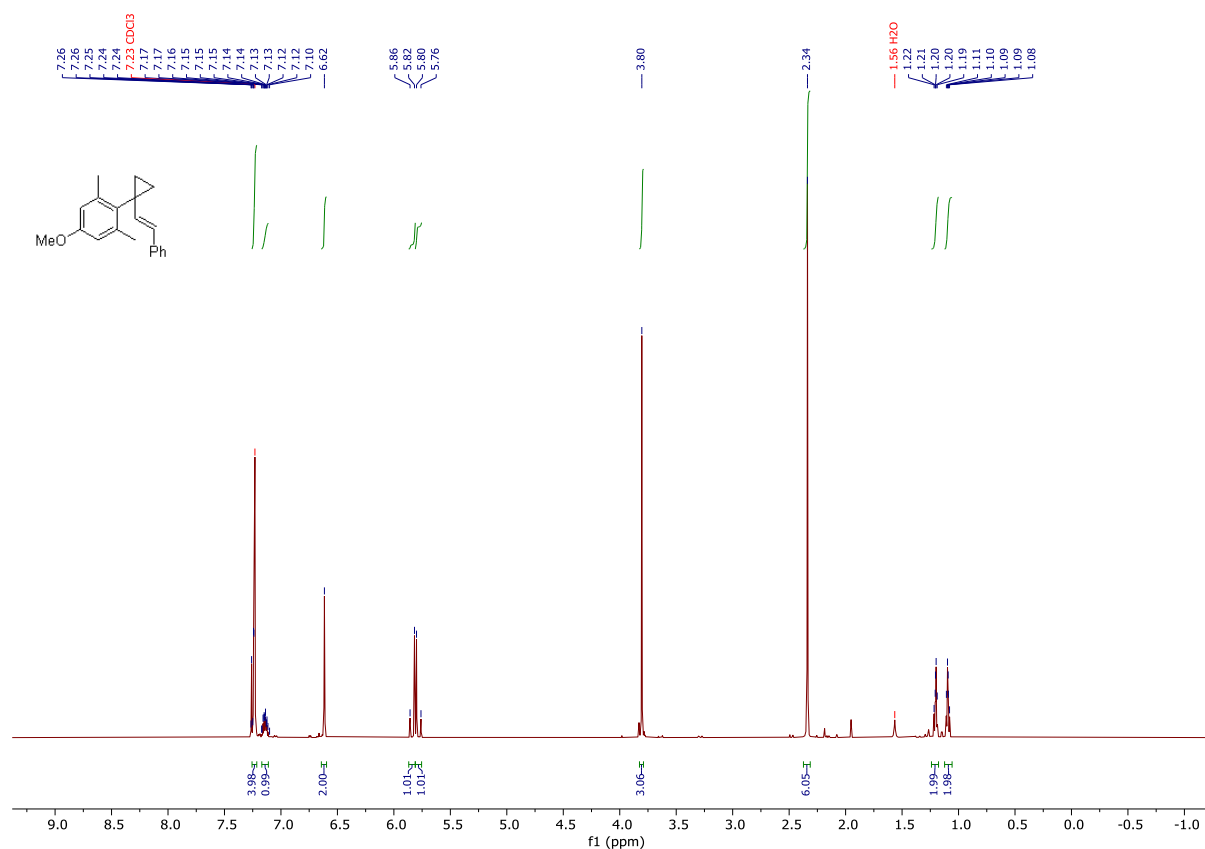
^1H NMR (400 MHz, CDCl_3) (4ab)



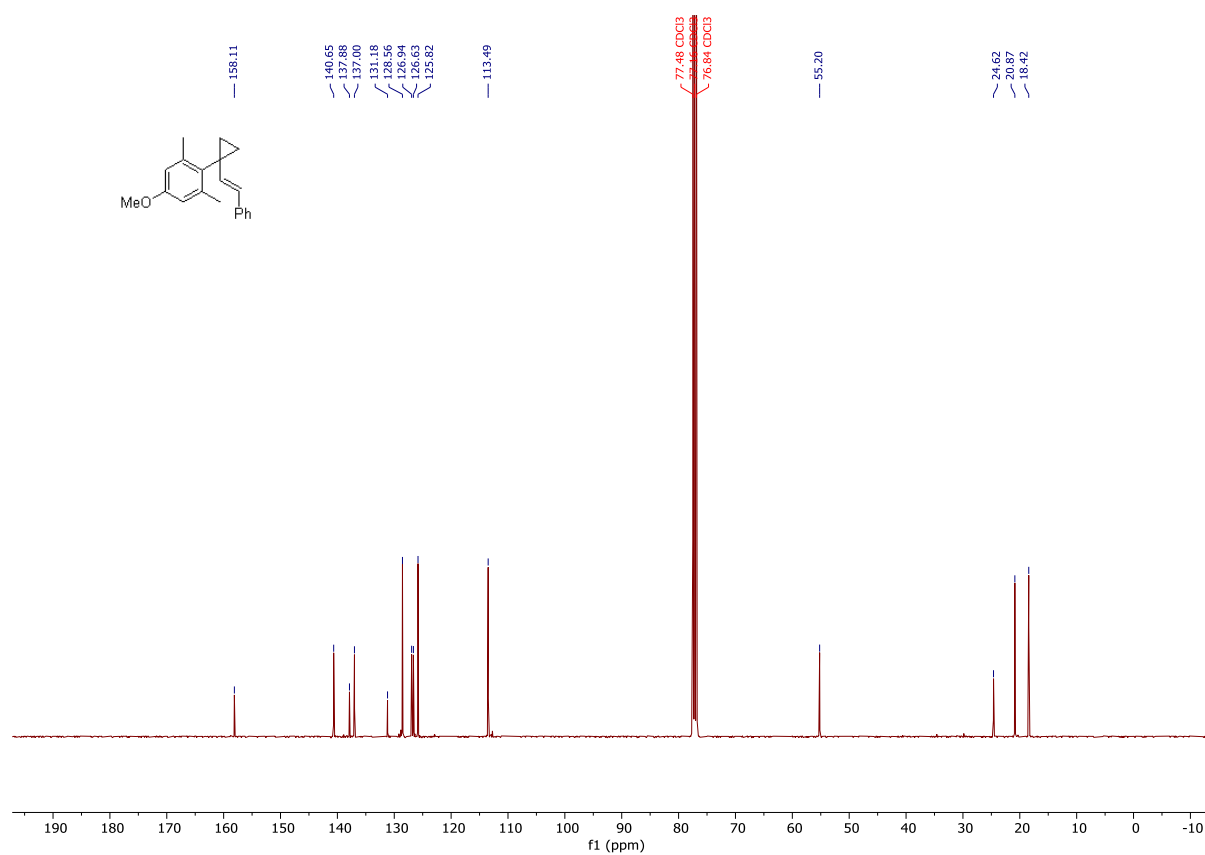
^{13}C NMR (101 MHz, CDCl_3) (4ab)



^1H NMR (400 MHz, CDCl_3) (4ac)



^{13}C NMR (101 MHz, CDCl_3) (4ac)



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