Supporting Information

Nucleophilic Ring-Opening of Donor-Acceptor Cyclopropanes Catalyzed by Brønsted acid in Hexafluoroisopropanol

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General Information, Materials & General Procedures
All arylation/cyclopropane opening reactions were performed in 10 mL glass pressure tubes under an atmosphere of air. Elevated temperatures were achieved by way of a stirrer-hotplate, metal heating block and thermocouple. Purification of reaction products was carried out by flash column chromatography using Merck silica gel (40-63 µm). Analytical thin layer chromatography (TLC) was performed on aluminum sheets precoated with silica gel 60 F254 (Merck), cut to size. Visualization was accomplished with UV light followed by staining with basic $KMnO_4$ solution and heating.

^{1}H-NMR spectra were recorded on a Bruker UltraShield 400 (400 MHz) spectrometer at ambient temperature and are reported in ppm using solvent as internal standard ($CDCl_3$ at 7.26 ppm). ^{13}C-NMR spectra were recorded on a Bruker UltraShield Plus 400 (100 MHz) spectrometer at ambient temperature and are reported in ppm using solvent as internal standard ($CDCl_3$ at 77.16 ppm). ^{19}F-NMR spectra were recorded on a Bruker UltraShield 400 (376.5 MHz) spectrometer at ambient temperature and are reported in ppm using trifluoroacetic acid as external standard (at –76.55 ppm). Data are reported as: multiplicity (ap = apparent, br = broad, s = singlet, d = doublet, t = triplet, q = quartet, quint = quintet, sext = sextet, m = multiplet, dd = doublet of doublets, ddd = doublet of doublet of doublets, dddd = doublet of doublet of doublet of doublets, qd = quartet of doublets, dt = doublet of triplets, dm = doublet of multiplets, td = triplet of doublets, quintd = quintet of doublets), coupling constants (in Hz) and integration. In cases where compounds were isolated as mixtures of regioisomers, signals corresponding to protons of the major regioisomer were integrated as integer values matching the number of protons in the molecule. Non-integer integration values correspond to signals of protons of minor regioisomers or to overlapping signals of regioisomers.

High resolution mass spectrometry (HRMS) analysis was performed on MicroTOF-Q Bruker (ESI) and ThermoScientific Exactive Plus EMR/Trace 1300 GC (APPI) instruments.

Materials: All commercial materials were purchased from Sigma-Aldrich, Alfa Aesar and FluoroChem, and were used as received, without further purification. Triflic acid (TfOH) *ReagentPlus*®, ≥99% (CAS: 1493-13-6) was purchased from Sigma Aldrich, and HFIP (CAS: 920-66-1) from FluoroChem. Tris(pentafluorophenyl)borane $B(C_6F_5)$ was purchased from Alfa Aesar and used without precaution to exclude air or moisture. It is known to rapidly hydrate to $B(C_6F_5)\bullet H_2O$ under such conditions.[1]

Preparation of Donor-Acceptor Cyclopropanes: Donor-acceptor cyclopropane diesters **1a**- **1j** were prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence, according to unchanged literature procedures, in comparable yields to those reported and with corresponding analytical data.[2,3] Donor-acceptor cyclopropane **1k**[4] was prepared by Corey-Chaykovsky cyclopropanation of *trans*-chalcone according to a literature procedure and with corresponding analytical data. Cyclopropanes **1l**-**1p** were prepared according to a two-step aldol condensation/Corey-Chaykovsky sequence, according to unchanged literature procedures, in comparable yields to those reported and with corresponding analytical data.

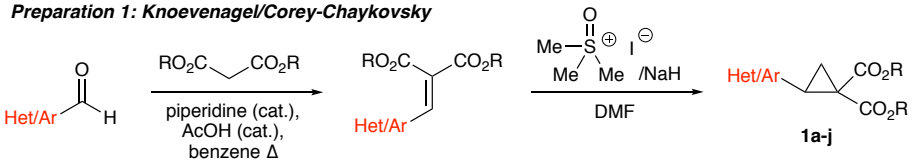
General Procedure A – A 10 mL Pyrex tube was charged with a stir bar, followed by the requisite cyclopropane (0.25 mmol), nucleophile (0.50 mmol), HFIP (0.125mL) and finally TfOH (2.2 µL, 10 mol%). The reaction was then stirred at ambient temperature until TLC showed disappearance of starting material (typically ca. 3 hours). At completion, the crude reaction mixture was concentrated *in vacuo* onto silica gel and purified by flash column chromatography over silica in the eluent system stated to give the desired ring-opened product.

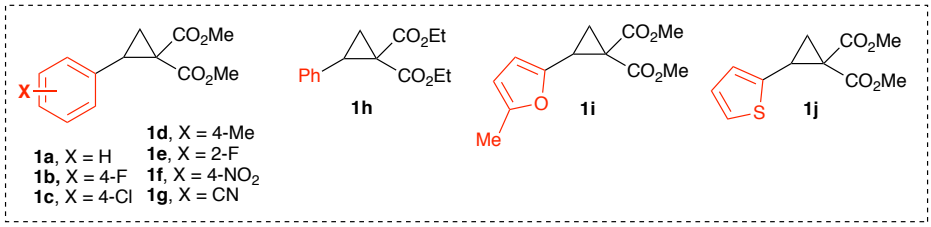
General Procedure B – A 10 mL Pyrex tube was charged with a stir bar, followed by the requisite cyclopropane (0.25 mmol), nucleophile (0.50 mmol), HFIP or $MeNO_2$ (0.125 mL) and finally $B(C_6F_5)\bullet H_2O$ (6.6 mg, 5 mol%). The reaction was then stirred at ambient temperature until TLC showed disappearance of starting material (typically ca. 3 hours). At completion, the crude reaction mixture was concentrated *in vacuo* onto silica gel and purified by flash column chromatography over silica in the eluent system stated to give the desired ring-opened product.

[1] Bergquist, C.; Bridgewater, B. M.; Harlan, C. J.; Norton, J. R.; Friesner, R. A.; Parkin, G. *J. Am. Chem. Soc.* **2000**, *122*, 10581.
[2] M. K. Ghorai, R. Talukdar, D. P. Tiwari *Org. Lett.* **2014**, *16*, 2204.
[3] A. F. G. Goldberg, N. R. O'Connor, R. A. Craigll, B. M. Stolz *Org. Lett.* **2012**, *14*, 5314.
[4] J. A. Ciaccio, C. E. Aman *Synth. Commun.* **2006**, *36*, 1333.

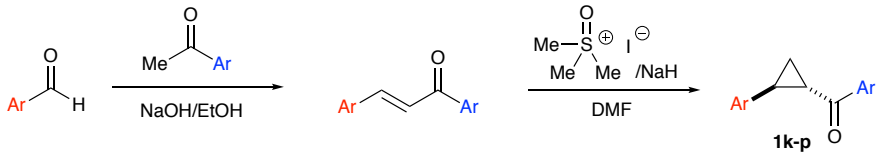
1. Synthetic Overview & Characterization Data for Cyclopropanes

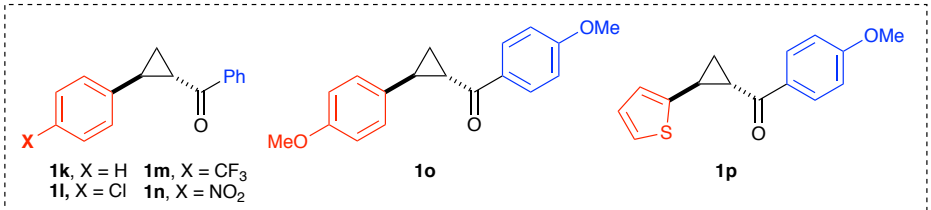
Preparation 1: Knoevenagel/Corey-Chaykovsky



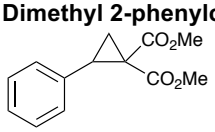


Preparation 2: Aldol Condensation/Corey-Chaykovsky



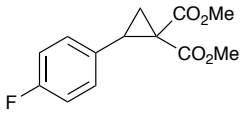


Dimethyl 2-phenylcyclopropane-1,1-dicarboxylate (1a)



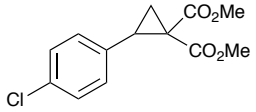
Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[2]
Yield: 1.37 g, 97%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.31-7.20 (5H, m), 3.81 (3H, s), 3.38 (3H, s), 3.25 (1H, t, J = 8.6 Hz), 2.22 (1H, dd, J = 8.0, 5.2 Hz), 1.77 (1H, dd, J = 9.3, 5.2 Hz).

Dimethyl 2-(4-fluorophenyl)cyclopropane-1,1-dicarboxylate (1b)



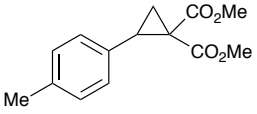
Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[2]
Yield: 1.03 g, 82%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.16 (2H, dd, J = 8.6, 5.4 Hz), 6.96 (2H, t, J = 8.6 Hz), 3.79 (3H, s), 3.75 (3H, s), 3.19 (1H, t, J = 8.6 Hz), 2.15 (1H, dd, J = 8.0, 5.3 Hz), 1.74 (1H, dd, J = 9.3, 5.3 Hz); **^{19}F NMR:** (376 MHz, $CDCl_3$) δ -116.8.

Dimethyl 2-(4-chlorophenyl)cyclopropane-1,1-dicarboxylate (1c)



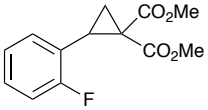
Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[2]
Yield: 0.126 g, 9%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.24 (2H, d, J = 8.4 Hz), 7.12 (2H, d, J = 8.4 Hz), 3.79 (3H, s), 3.40 (3H, s), 3.18 (1H, t, J = 8.8 Hz), 2.15 (1H, dd, J = 8.0, 5.6 Hz), 1.74 (1H, dd, J = 9.2, 5.2 Hz).

2-(*p*-Toluyl)cyclopropane-1,1-dicarboxylate (1d)



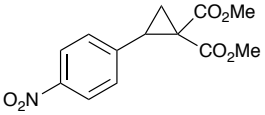
Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[5]
Yield: 0.380 g, 31%; **^{1}H NMR**: (400 MHz, $CDCl_3$) δ 7.07 (4H, s), 3.78 (3H, s), 3.38 (3H, s), 3.19 (1H, t, *J* = 8.8 Hz), 2.30 (3H, s), 2.17 (1H, dd, *J* = 8.4, 5.0 Hz), 1.72 (1H, dd, *J* = 9.6, 5.0 Hz).

2-(*o*-Fluorophenyl)cyclopropane-1,1-dicarboxylate (1e)



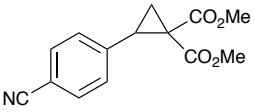
Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[6]
Yield: 0.270 g, 37%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.25–7.18 (1H, m), 7.10–6.97 (3H, m), 3.80 (3H, s), 3.39 (3H, s), 3.27 (1H, t, *J* = 8.6 Hz), 2.20 (1H, dd, *J* = 8.0, 5.2 Hz), 1.78 (1H, dd, *J* = 9.2, 5.2 Hz); **^{19}F NMR** (376.5 MHz, $CDCl_3$, CF_3CO_2H - ext. std.) δ (ppm): –114.76 to –114.90 (1F, m).

Dimethyl 2-(4-nitrophenyl)cyclopropane-1,1-dicarboxylate (1f)



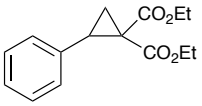
Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[7]
Yield: 0.408 g, 29%; **^{1}H NMR:** (400 MHz, $CDCl_3$) *δ* 8.14 (2H, d, *J* = 8.4 Hz), 7.36 (2H, d, *J* = 8.8 Hz), 3.81 (3H, s), 3.42 (3H, s), 3.28 (1H, t, *J* = 8.6 Hz), 2.22 (1H, dd, *J* = 7.6, 5.4 Hz), 1.83 (1H, dd, *J* = 9.2, 5.6 Hz).

Dimethyl 2-(4-cyanophenyl)cyclopropane-1,1-dicarboxylate (1g)



Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[8]
Yield: 0.691g, 67%; **^{1}H NMR:** (400 MHz, $CDCl_3$) *δ* 7.58 (2H, d, *J* = 8.2 Hz), 7.31 (2H, d, *J* = 8.2 Hz), 3.81 (3H, s), 3.41 (3H, s), 3.25 (1H, t, *J* = 8.5 Hz), 2.20 (1H, dd, *J* = 8.0, 5.5 Hz), 1.81 (1H, dd, *J* = 9.1, 5.4 Hz).

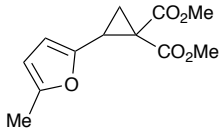
Diethyl 2-phenylcyclopropane-1,1-dicarboxylate (1h)



Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[9]
Yield: 0.850 g, 65%; **^{1}H NMR:** (400 MHz, $CDCl_3$) *δ* 7.30-7.22 (5H, m), 4.23 (2H, q, *J* = 6.9 Hz), 3.86 (2H, q, *J* = 7.1 Hz), 3.24 (1H, t, *J* = 8.6 Hz), 2.20 (1H, dd, *J* = 8.0, 5.2 Hz), 1.73 (1H, dd, *J* = 9.2, 5.2 Hz), 1.32-1.29 (3H, m), 0.88 (3H, t, *J* = 7.1 Hz).

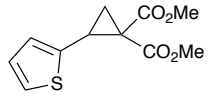
[5] R. Talukdar, Tiwari, D. P., Saha, A., Ghorai, M. K. *Org. Lett.* **2014**, *16*, 3954.
[6] J. Zhang, H. Jiang, S. Zhu *Adv. Synth. Catal.* **2017**, *359*, 2924.
[7] C. Perreault, S. R. Goudreau, L. E. Zimmer, A. B. Charette *Org. Lett.* **2008**, *10*, 689.
[8] K. L. Ivanov, E. V. Villemson, E. M. Budynina, O. A. Ivanova, I. V. Trushkov, M. Y. Melnikov *Chem. Eur. J.* **2015**, *21*, 4975.
[9] R. Dey, P. Banerjee *Org. Lett.* **2017**, *19*, 304.

Dimethyl 2-(5-methylfuran-2-yl)cyclopropane-1,1-dicarboxylate (1i)



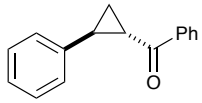
Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[10]
Yield: 1.12 g, 94%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 5.98 (1H, d, J = 3.1 Hz), 5.84 (1H, d, J = 2.3 Hz), 3.80 (3H, s), 3.56 (3H, s), 3.04 (1H, t, J = 8.6 Hz), 2.22 (3H, s), 2.04 (1H, ddd, J = 7.7, 5.0 Hz), 1.75 (1H, dd, J = 9.5, 5.0 Hz).

Dimethyl 2-(thiophen-2-yl)cyclopropane-1,1-dicarboxylate (1j)



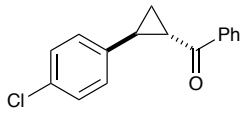
Prepared via a two-step Knoevenagal/Corey-Chaykovsky sequence according to a literature procedure and with corresponding analytical data.[2]
Yield: 1.17g, 97%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.16 (1H, dd, J = 5.1, 0.6 Hz), 6.90 (1H, dd, J = 5.1, 3.5 Hz), 6.83 (1H, d, J = 3.5 Hz), 3.78 (3H, s), 3.48 (3H, s), 3.29 (1H, t, J = 8.5 Hz), 2.15 (1H, dd, J = 7.7, 5.2 Hz), 1.83 (1H, dd, J = 9.2, 5.2 Hz).

***trans*-Phenyl(2-phenylcyclopropyl)methanone (1k)**



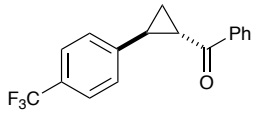
Donor-acceptor cyclopropane **1k** was prepared by Corey-Chaykovsky cyclopropanation of *trans*-chalcone according to a literature procedure and with corresponding analytical data.[4]
Yield: 0.829 g, 75%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.01-7.99 (2H, m), 7.58-7.54 (1H, m), 7.46 (2H, t, J = 7.5 Hz), 7.32 (2H, t, J = 7.6 Hz), 7.25-7.22 (1H, m), 7.19 (2H, dd, J = 8.0, 1.0 Hz), 2.91 (1H, ddd, J = 8.1, 5.1, 4.0 Hz), 2.71 (1H, ddd, J = 9.1, 6.5, 4.0 Hz).

***trans*-(2-(4-Chlorophenyl)cyclopropyl)(phenyl)methanone (1l)**



Prepared via a two-step aldol condensation/Corey-Chaykovsky sequence, according to a literature procedure and with corresponding analytical data.[11]
Yield: 0.726 g, 57%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.01 (2H, d, J = 7.4 Hz), 7.60 (1H, t, J = 7.4 Hz), 7.49 (2H, t, J = 7.7 Hz), 7.30 (2H, d, J = 8.4 Hz), 7.13 (2H, d, J = 8.4 Hz), 2.91-2.86 (1H, m), 2.72-2.67 (1H, m), 1.94 (1H, dt, J = 9.1, 4.6 Hz), 1.54 (1H, ddd, J = 8.0, 6.6, 4.3 Hz).

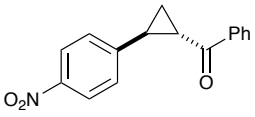
***trans*-Phenyl(2-(4-(trifluoromethyl)phenyl)cyclopropyl)methanone (1m)**



Prepared via a two-step aldol condensation/Corey-Chaykovsky sequence, according to a literature procedure and with corresponding analytical data.[11]
Yield: 1.08 g, 74%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.98 (2H, d, J = 8.8 Hz), 7.11 (2H, d, J = 8.7 Hz), 6.94 (2H, d, J = 8.8 Hz), 6.85 (2H, d, J = 8.7 Hz), 3.87 (3H, s), 3.80 (3H, s), 2.80-2.76 (1H, m), 2.65-2.60 (1H, m), 1.86 (1H, ddd, J = 9.1, 4.9, 4.2 Hz), 1.47 (1H, ddd, J = 7.9, 6.7, 4.1 Hz); **^{19}F NMR:** (376 MHz, $CDCl_3$) δ -62.4.

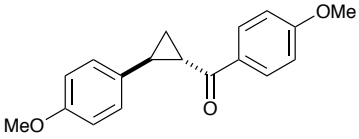
[10] Ivanova, Olga A.; Budynina, Ekaterina M.; Chagarovskiy, Alexey O.; Kaplun, Alexey E.; Trushkov, Igor V.; Melnikov, Mikhail Ya *Adv. Synth. Catal.* **2011,** *353*, 1125.
[11] P. Cotugno, A. Monopoli, F. Ciminale, A. Milella, A. Nacci *Angew. Chem. Int. Ed.* **2014**, *53*, 13563.

***trans*-(2-(4-Nitrophenyl)cyclopropyl)(phenyl)methanone (1n)**



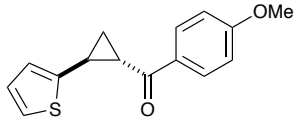
Prepared as a yellow solid via a two-step aldol condensation/Corey-Chaykovsky sequence, according to a literature procedure and with corresponding analytical data.[12]
Yield: 0.765 g, 57%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.21 (2H, d, J = 8.8 Hz), 7.99 (2H, dd, J = 8.3, 1.1 Hz), 7.65 (1H, tt, J = 7.4, 1.4 Hz), 7.53 (2H, t, J = 7.7 Hz), 7.34 (2H, d, J = 8.8 Hz), 3.05 (1H, ddd, J = 8.3, 5.4, 4.0 Hz), 2.82 (1H, ddd, J = 9.0, 6.6, 4.0 Hz), 2.04 (1H, dt, J = 9.0, 5.0 Hz), 1.72 (1H, ddd, J = 8.2, 6.6, 4.6 Hz).

***trans*-(4-Methoxyphenyl)(2-(4-methoxyphenyl)cyclopropyl)methanone (1o)**



Prepared via a two-step aldol condensation/Corey-Chaykovsky sequence, according to a literature procedure and with corresponding analytical data.[13]
Yield: 0.801 g, 57%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.01 (2H, d, J = 8.6 Hz), 7.13 (2H, d, J = 8.5 Hz), 6.96 (2H, d, J = 8.6 Hz), 6.87 (2H, d, J = 8.5 Hz), 3.89 (3H, s), 3.82 (3H, s), 2.80 (1H, dt, J = 8.2, 4.3 Hz), 2.67-2.62 (1H, m), 1.88 (1H, dt, J = 9.0, 4.5 Hz), 1.49 (1H, td, J = 7.1, 4.1 Hz).

***trans*-(4-Methoxyphenyl)(2-(thiophen-2-yl)cyclopropyl)methanone (1p)**

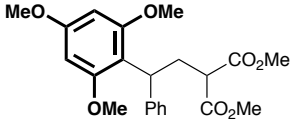


Prepared via a two-step aldol condensation/Corey-Chaykovsky sequence, according to a literature procedure.[14]
Yield: 0.959 g, 74%; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.00 (2H, d, J = 8.8 Hz), 7.12 (1H, dd, J = 4.9, 1.0 Hz), 6.97-6.92 (3H, m), 6.88 (1H, dt, J = 3.5, 0.5 Hz), 3.88 (3H, s), 2.91-2.82 (2H, m), 1.91 (1H, ddd, J = 9.0, 5.2, 4.0 Hz), 1.51 (1H, ddd, J = 8.1, 6.5, 4.0 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 196.3, 163.5, 145.0, 130.6, 130.4, 127.0, 124.0, 123.1, 113.8, 55.5, 29.6, 24.6, 19.8.

[12] L. A. Yanovskaya, V. A. Dombrovsky, O. S. Chizov, B. M. Zolotarev, O. A. Subbotin, V. F. Kucherov *Tetrahedron*, **1972**, *28*, 1565.
[13] L. Feng, H. Yan, C. Yang, D. Chen, W. Xia *J. Org. Chem.* **2016**, *81*, 7008.
[14] Paxton, R. J.; Taylor, R. J. K *Synlett*, **2007**, *4*, 633.

2. Characterization Data for Ring-Opened Products

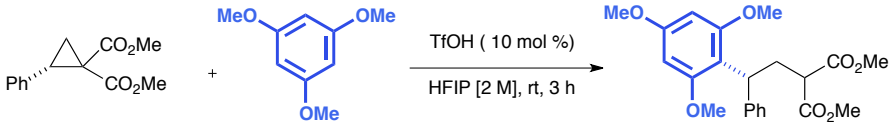
Dimethyl 2-(2-phenyl-2-(2,4,6-trimethoxyphenyl)ethyl)malonate (2a)



The title compound was prepared according to *General Procedure A* from cyclopropane **1a** (0.059 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-30% EtOAc in petroleum ether) gave **2a** as a colourless liquid. Analytical data are in agreement with the literature.[15]

Yield: 0.096 g, 95%; $\mathbf{R_f}$ = 0.23 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2955, 2839, 1751, 1732, 1603, 1589; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.29 (2H, d, J = 7.4 Hz), 7.21 (2H, t, J = 7.6 Hz), 7.11 (1H, t, J = 7.3 Hz), 6.10 (2H, s), 4.63 (1H, dd, J = 10.9, 5.6 Hz), 3.78 (3H, s), 3.71 (3H, s), 3.70 (6H, s), 3.63 (3H, s), 3.26 (1H, dd, J = 9.4, 5.4 Hz), 2.92 (1H, ddd, J = 13.3, 11.6, 5.4 Hz), 2.74 (1H, ddd, J = 13.3, 9.4, 5.6 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.3, 170.0, 160.0, 159.4, 144.4, 127.7, 127.7, 125.4, 111.3, 91.1, 55.6, 55.2, 52.4, 52.3, 50.7, 37.0, 31.0.

(*R*)-Dimethyl 2-(2-phenyl-2-(2,4,6-trimethoxyphenyl)ethyl)malonate ((*R*)-2a)



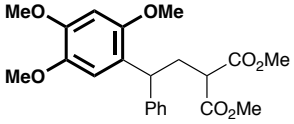
(*S*)-1a
(>99% ee)

(*R*)-2a
(>90% ee)

The title compound was prepared according to *General Procedure A* from enantiopure cyclopropane **(*S*)-1a** (0.059 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-30% EtOAc in petroleum ether) gave **(*R*)-2a** as a colourless liquid.

Yield: 0.082 g, 81%; **Optical rotation:** α_D^{25} = +55.6 ($CHCl_3$, *c* 0.196); {lit.[15] +49.3 ($CHCl_3$, *c* 0.142). **Chiral HPLC Analysis:** >90% ee (full baseline separation could not be obtained for a precise ee value) Chiralpak IB Column (Hexane/iPrOH 97:3, 1.0 mL/min).

Dimethyl 2-(2-phenyl-2-(2,4,5-trimethoxyphenyl)ethyl)malonate (2b)

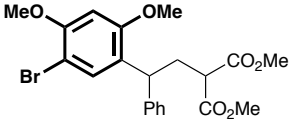


The title compound was prepared according to *General Procedure A* from cyclopropane **1a** (0.059 g, 0.25 mmol), 1,2,4-trimethoxybenzene (0.075 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-40% EtOAc in petroleum ether) gave **2b** as a colourless oil.

Yield: 0.086 g, 85%; $\mathbf{R_f}$ = 0.14 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2953, 1751, 1732, 1514; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.31-7.26 (4H, m), 7.21-7.16 (1H, m), 6.75 (1H, s), 6.51 (1H, s), 4.39 (1H, t, J = 8.1 Hz), 3.88 (3H, s), 3.81 (3H, s), 3.75 (3H, s), 3.72 (3H, s), 3.71 (3H, s), 3.32 (1H, dd, J = 7.6, 7.0 Hz), 2.73-2.56 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.0, 169.8, 151.6, 148.3, 143.8, 143.2, 128.4, 128.0, 126.3, 123.2, 112.4, 98.0, 56.9, 56.5, 56.2, 52.6, 52.5, 50.2, 40.8, 33.9; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{22}H_{26}O_7Na$ Found: 425.1546, requires 425.1571 (+5.9 ppm).

[15] R. Talukdar, A. Saha, D. P. Tiwari, M. K. Ghorai *Tetrahedron* **2016**, *72*, 613.

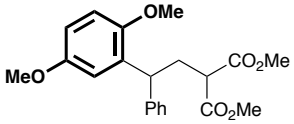
Dimethyl 2-(2-(5-bromo-2,4-dimethoxyphenyl)-2-phenylethyl)malonate (2c)



The title compound was prepared according to *General Procedure A* from cyclopropane **1a** (0.059 g, 0.25 mmol), 1-bromo-2,4-dimethoxybenzene (0.072 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-35% EtOAc in petroleum ether) gave **2c** as a colourless oil.

Yield: 0.057 g, 51%; $\mathbf{R_f}$ = 0.21 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2953, 2845, 1751, 1732, 1599; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.33 (1H, s), 7.31-7.28 (2H, m), 7.25 (1H, d, J = 6.9 Hz), 7.22-7.17 (1H, m), 6.45 (1H, s), 4.32 (1H, t, J = 8.1 Hz), 3.89 (3H, s), 3.79 (3H, s), 3.73 (3H, s), 3.71 (3H, s), 3.29 (1H, t, J = 7.4 Hz), 2.69-2.54 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.9, 169.8, 157.4, 155.3, 143.0, 131.8, 128.5, 128.1, 126.5, 125.8, 102.1, 96.9, 56.5, 55.9, 52.7, 52.6, 50.2, 40.6, 33.8; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{21}H_{23}{}^{79}BrO_6Na$ Found: 473.0554, requires 473.0570 (+3.4 ppm).

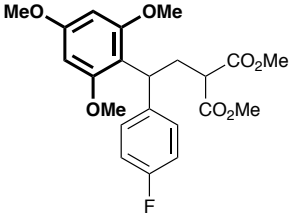
Dimethyl 2-(2-(2,5-dimethoxyphenyl)-2-phenylethyl)malonate (2d)



The title compound was prepared according to *General Procedure A* from cyclopropane **1a** (0.059 g, 0.25 mmol), 1,4-dimethoxybenzene (0.069 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-30% EtOAc in petroleum ether) gave **2d** as a colourless oil.

Yield: 0.045 g, 48%; $\mathbf{R_f}$ = 0.42 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2955, 2842, 1743, 1737, 1604,; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.29 (2H, s), 7.28 (2H, s), 7.20 (1H, dq, J = 8.7, 4.3 Hz), 6.82 (1H, d, J = 3.0 Hz), 6.79 (1H, d, J = 8.8 Hz), 6.72 (1H, dd, J = 8.8, 3.0 Hz), 4.43 (1H, t, j = 8.1 Hz), 3.76 (3H, s), 3.73 (3H, s), 3.73 (3H, s), 3.71 (3H, s), 3.33 (1H, t, J = 7.4 Hz), 2.72-2.58 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.0, 169.8, 153.8, 151.5, 143.2, 133.2, 128.4, 128.2, 126.4, 114.8, 111.9, 111.4, 56.2, 55.7, 52.6, 52.5, 50.2, 41.2, 33.8; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{21}H_{24}O_6Na$ Found: 395.1449, requires 395.1465 (+4.0 ppm).

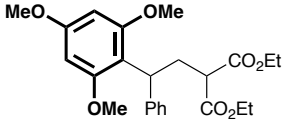
Dimethyl 2-(2-(4-fluorophenyl)-2-(2,4,6-trimethoxyphenyl)ethyl)malonate (2e)



The title compound was prepared according to *General Procedure A* from cyclopropane **1b** (0.063 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-30% EtOAc in petroleum ether) gave **2e** as a colourless liquid. Analytical data are in agreement with the literature.[15]

Yield: 0.081 g, 71%; $\mathbf{R_f}$ = 0.23 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2953, 2843, 1751, 1732, 1603, 1593; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.28-7.24 (2H, m), 6.91 (2H, t, J = 8.8 Hz), 6.12 (2H, s), 4.60 (1H, dd, J = 10.9, 5.6 Hz), 3.81 (3H, s), 3.73 (3H, s), 3.72 (6H, s), 3.64 (3H, s), 3.25 (1H, dd, J = 9.4, 5.4 Hz), 2.90 (1H, ddd, J = 13.3, 10.9, 5.4 Hz), 2.71 (1H, ddd, J = 13.3, 9.4, 5.6 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.3, 170.0, 161.1 (d, J = 242.8 Hz), 160.2, 159.4, 140.2 (d, J = 3.3 Hz), 129.2 (d, J = 7.8 Hz), 114.4 (d, J = 20.8 Hz), 111.2, 91.2, 55.7, 55.4, 52.6, 52.5, 50.8, 36.5, 31.3; **^{19}F NMR:** (376 MHz, $CDCl_3$) δ -118.5.

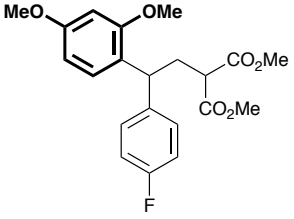
Diethyl 2-(2-phenyl-2-(2,4,6-trimethoxyphenyl)ethyl)malonate (2f)



The title compound was prepared according to *General Procedure A* from cyclopropane **1h** (0.066 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-25% EtOAc in petroleum ether) gave **2f** as a colourless liquid.

Yield: 0.087 g, 81%; **R_f** = 0.35 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2940, 2839, 1748, 1730, 1605, 1592; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.30 (2H, d, J = 7.5 Hz), 7.21 (2H, t, J = 7.6 Hz), 7.10 (1H, t, J = 7.3 Hz), 6.10 (2H, s), 4.64 (1H, dd, J = 10.7, 5.8 Hz), 4.25-4.04 (4H,m), 3.78 (3H, s), 3.71 (6H, s), 3.21 (1H, dd, J = 9.3, 5.4 Hz), 2.90 (1H, ddd, J = 13.4, 10.8, 5.4 Hz), 2.73 (1H, ddd, J = 13.4, 9.3, 5.8 Hz), 1.25 (3H, t, J = 7.2 Hz), 1.21 (3H, t, J = 7.2 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.1, 169.7, 160.1, 159.5, 144.7, 127.9, 127.8, 125.5, 111.5, 91.2, 61.3, 61.2, 55.7, 55.4, 51.2, 37.3, 31.2, 14.2, 14.1; **HRMS:** (ESI$^+$) $[M+H]^+$ $C_{24}H_{31}O_7$ Found: 431.2063, requires 431.2064 (+0.3 ppm).

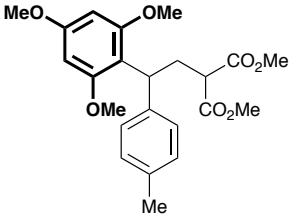
Dimethyl 2-(2-(2,4-dimethoxyphenyl)-2-(4-fluorophenyl)ethyl)malonate (2g)



The title compound was prepared according to *General Procedure A* from cyclopropane **1b** (0.063 g, 0.25 mmol), 1,3-dimethoxybenzene (0.065 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-30% EtOAc in petroleum ether) gave **2g**, as the major regioisomer, as a colourless liquid.

Yield: 0.061 g, 63%; **R_f** = 0.30 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2955, 2839, 1751, 1730, 1605, 1585, 1505; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ *(only data from the major regioisomer is reported)* 7.21 (2H, dd, J = 8.6, 5.5 Hz), 7.09 (1H, d, J = 8.4 Hz), 6.96 (2H, t, J = 8.7 Hz), 6.47 (1H, dd, J = 8.4, 2.4 Hz), 6.43 (1H, d, J = 2.4 Hz), 4.31 (1H, t, J = 8.1 Hz), 3.80 (3H, s), 3.75 (3H, s), 3.72 (3H, s), 3.71 (3H, s), 3.29 (1H, t, J = 7.4 Hz), 2.67-2.54 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ *(only data from the major regioisomer is reported)* 169.9, 169.7, 161.3 (d, J = 244.0 Hz), 159.5, 158.0, 139.5 (d, J = 2.9 Hz), 129.4 (d, J = 7.9 Hz), 128.1, 123.9, 115.0 (d, J = 21.1 Hz), 104.3, 98.6, 55.4, 55.3, 52.5, 52.4, 50.1, 40.0, 33.9; **^{19}F NMR:** (376 MHz, $CDCl_3$) δ -117.3 (major) and -118.3 (minor).

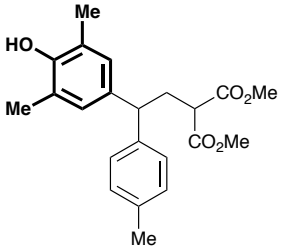
Dimethyl 2-(2-(*p*-tolyl)-2-(2,4,6-trimethoxyphenyl)ethyl)malonate (2h)



The title compound was prepared according to *General Procedure A* from cyclopropane **1d** (0.064 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.086 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (15% EtOAc in petroleum ether) gave **2h** as a colourless oil. with analytical data in agreement with the literature.[15]

Yield: 0.114 g, quantitative; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.18 (2H, d, J = 8.0 Hz), 7.02 (2H, d, J = 7.9 Hz), 6.09 (2H, s), 4.58 (1H, dd, J = 10.9, 5.7 Hz), 3.78 (3H, s), 3.71 (6H, s), 3.70 (3H, s), 3.62 (3H, s), 3.24 (1H, dd, J = 9.3, 5.5 Hz), 2.91 (1H, ddd, J = 13.4, 10.9, 5.5 Hz), 2.71 (1H, ddd, J = 13.4, 9.3, 5.7 Hz), 2.27 (3H, s).

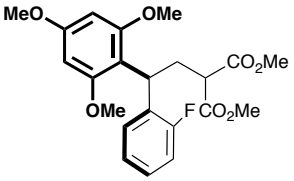
Dimethyl 2-(2-(4-hydroxy-3,5-dimethylphenyl)-2-(*p*-tolyl)ethyl)malonate (2i)



The title compound was prepared according to *General Procedure A* from cyclopropane **1d** (0.059 g, 0.24 mmol), 2,6-dimethylphenol (0.059 g, 0.48 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 1 h. Purification by flash column chromatography over silica (10-15% EtOAc in petroleum ether) gave **2i** as a yellow oil.

Yield: 0.085 g, 97%; $\mathbf{R_f}$ = 0.10 (petroleum ether/EtOAc 9:1); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.09 (s, 4H), 6.81 (s, 2H), 4.48 (s, 1H), 3.75 (t, J = 8.0 Hz, 1H), 3.71 (s, 3H), 3.70 (s, 3H), 3.27 (t, J = 7.6 Hz, 1H), 2.58 (t, J = 7.6 Hz, 2H), 2.29 (s, 3H), 2.19 (s, 6H); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.0, 150.9, 141.0, 136.1, 135.3, 129.4, 128.0, 127.7, 123.1, 52.6, 50.2, 47.6, 34.8, 21.1, 16.2; **HRMS:** (APPI$^+$) $[M+H]^+$ $C_{22}H_{26}O_5$ Found: 371.1856, requires 371.1853 (+0.32 ppm).

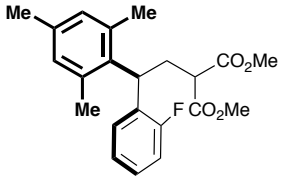
Dimethyl 2-(2-(2-fluorophenyl)-2-(2,4,6-trimethoxyphenyl)ethyl)malonate (2j)



The title compound was prepared according to *General Procedure A* from cyclopropane **1e** (0.051 g, 0.20 mmol), 1,3,5-trimethoxybenzene (68.9 mg, 0.410 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at 40 ºC for 4 h. Purification by flash column chromatography over silica (15-18% EtOAc in petroleum ether) gave **2j** as an off-white solid.

Yield: 0.089 g, quantitative; $\mathbf{R_f}$ = 0.07 (petroleum ether/EtOAc 9:1); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.47–7.39 (m, 1H), 7.12–7.07 (m, 1H), 7.07–6.98 (m, 1H), 6.91–6.87 (m, 1H), 6.08 (s, 2H), 4.83 (dd, J = 11.2, 5.2 Hz, 1H), 3.77 (s, 3H), 3.73 (s, 3H), 3.70 (6H), 3.61 (3H), 3.28 (dd, J = 8.8, 5.6 Hz, 1H), 2.89 (ddd, J = 13.2, 11.2, 5.6 Hz, 1H), 2.65 (ddd, J = 13.6, 8.8, 5.2 Hz, 1H); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.4, 170.0, 161.0 (d, J = 244.5 Hz), 160.3, 159.6, 131.0 (d, J = 13.7 Hz), 129.7 (d, J = 4.5 Hz), 127.1 (d, J = 8.2 Hz), 123.2 (d, J = 3.3 Hz), 114.9 (d, J = 22.4 Hz), 110.1, 91.2, 55.8, 55.7, 55.4, 55.3, 52.5, 52.5, 50.6, 31.2 (d, J = 2.0 Hz), 30.8; **^{19}F NMR** (376.5 MHz, $CDCl_3$, CF_3CO_2H - ext. std.) δ (ppm): –115.14 to –115.25 (m, 1F); **HRMS:** (APPI$^+$) $[M]^+$ $C_{22}H_{25}FO_7$ Found: 420.1578, requires 420.1579 -0.20 ppm).

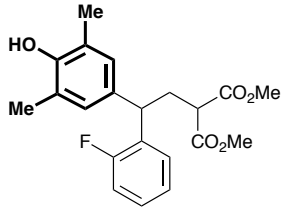
Dimethyl 2-(2-(2-fluorophenyl)-2-mesitylethyl)malonate (2k)



The title compound was prepared according to *General Procedure A* from cyclopropane **1e** (0.052 g, 0.20 mmol), mesitylene (56.8 μL, 0.408 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at 50 ºC for 24 h. Purification by flash column chromatography over silica (3% EtOAc in petroleum ether) gave **2k** as a colourless oil.

Yield: 0.068 g, 89%; $\mathbf{R_f}$ = 0.42 (petroleum ether/EtOAc 9:1); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.32 (t, J = 7.6 Hz, 1H), 7.23–7.18 (m, 1H), 7.08 (td, J = 7.6, 0.8 Hz, 1H), 7.00–6.90 (m, 1H), 6.79 (s, 2H), 4.65 (t, J = 8.0 Hz, 1H), 3.75 (s, 3H), 3.62 (s, 3H), 3.38 (t, J = 7.2 Hz, 1H), 2.91 (dt, J = 14.0 Hz, 7.2 Hz, 1H), 2.99–2.85 (m, 1H), 2.78–2.64 (m, 1H), 2.23 (br s, 9H); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.9, 169.9, 161.7 (d, J = 245.5 Hz), 137.3, 136.2, 134.7, 130.5 (m), 129.3, 129.2 (d, J = 2.3 Hz), 127.9 (d, J = 8.4 Hz), 123.6 (d, J = 3.4 Hz), 115.8 (d, J = 22.4 Hz), 52.8, 52.7, 50.0, 37.5, 30.4, 21.3, 21.3, 20.8; **^{19}F NMR** (376.5 MHz, $CDCl_3$, CF_3CO_2H - ext. std.) δ (ppm): –112.44 to –112.57 (m, 1F); **HRMS:** (APPI$^+$) $[M-H]^+$ $C_{22}H_{24}FO_4$ Found: 371.1654, requires 371.1653 (+0.10 ppm).

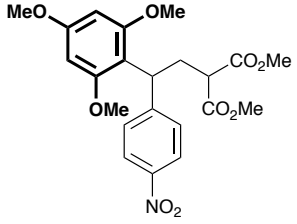
Dimethyl-2-(2-(2-fluorophenyl)-2-(3,5-dimethyl-4-hydroxophenyl)ethyl)malonate (2l)



The title compound was prepared according to *General Procedure A* from cyclopropane **1e** (0.052 g, 0.21 mmol), 2,6-dimethylphenol (50.2 mg, 0.411 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at 50 ºC for 24 h. Purification by flash column chromatography over silica (10% EtOAc in petroleum ether) gave **2l** as a pale yellow oil.

Yield: 0.072 g, 93%; $\mathbf{R_f}$ = 0.07 (petroleum ether/EtOAc 9:1); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.33-7.25 (m, 1H), 7.22-7.13 (m, 1H), 7.09 (t, J = 7.4 Hz, 1H), 7.02-6.94 (m, 1H), 6.85 (s, 2H), 4.52 (s, 1H), 4.15 (t, J = 8.0 Hz, 1H), 3.71(s, 3H), 3.70 (s, 3H), 3.29 (t, J = 7.4 Hz, 1H), 2.70-2.54 (m, 2H), 2.19 (s, 6H); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.8, 169.8, 160.7 (d, J = 244.0 Hz), 151.0, 133.9, 130.9 (d, J = 14.2 Hz), 128.4 (d, J = 4.2 Hz), 128.2, 128.1, 124.4 (d, J = 3.5 Hz), 123.2, 115.7 (d, J = 22.5 Hz), 52.7, 52.7, 50.1, 40.5 (d, J = 2.4 Hz), 33.8, 31.1, 16.2; **^{19}F NMR** (376.5 MHz, $CDCl_3$, CF_3CO_2H - ext. std.) δ (ppm): –116.27 to –116.47 (m, 1F); **HRMS:** (APPI$^+$) [M-H]$^+$ $C_{21}H_{22}FO_5$ Found: 373.1446, requires 373.1446 (+0.09 ppm).

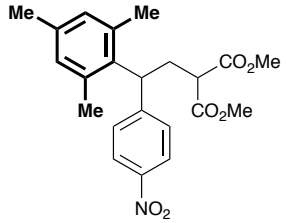
Dimethyl 2-(2-(4-nitrophenyl)-2-(2,4,6-trimethoxyphenyl)ethyl)malonate (2m)



The title compound was prepared according to *General Procedure A* from cyclopropane **1f** (0.062 g, 0.22 mmol), 1,3,5-trimethoxybenzene (0.075 g, 0.45 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at 50 ºC for 24 h. Purification by flash column chromatography over silica (20-25% EtOAc in petroleum ether) gave **2m** as a yellow oil.

Yield: 0.092 g, 94%; $\mathbf{R_f}$ = 0.06 (petroleum ether/EtOAc 9:1); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.06 (d, J = 8.4 Hz, 2H), 7.41 (d, J = 8.8 Hz, 2H), 6.09 (s, 2H), 4.69 (dd, J = 11.2, 4.8 Hz, 1H), 3.79 (s, 3H), 3.73 (s, 3H), 3.69 (s, 6H), 3.62 (s, 3H), 3.22 (dd, J = 9.6, 5.2 Hz, 1H), 2.90 (ddd, J = 13.2, 11.6, 5.2 Hz, 1H), 2.72 (ddd, J = 13.2, 9.6, 5.2 Hz, 1H); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.1, 169.8, 160.8, 159.3, 152.8, 146.0, 128.5, 123.1, 109.8, 91.1, 55.7, 55.4, 52.7, 52.6, 50.5, 37.0, 30.4; **HRMS:** (APPI$^+$) [M]$^+$ $C_{22}H_{25}NO_9$ Found: 447.1524, requires 447.1534 (+1.06 ppm).

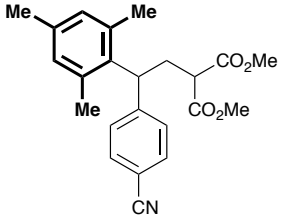
Dimethyl 2-(2-mesityl-2-(4-nitrophenyl)ethyl)malonate (2n)



The title compound was prepared according to *General Procedure A* from cyclopropane **1f** (0.062 g, 0.22 mmol), mesitylene (60.2 μL, 0.433 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at 50 ºC for 24 h. Purification by flash column chromatography over silica (5% EtOAc in petroleum ether) gave **2n** as a yellow oil.

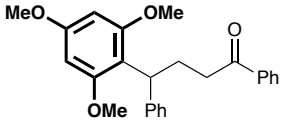
Yield: 0.085 g, 99%; $\mathbf{R_f}$ = 0.28 (petroleum ether/EtOAc 9:1); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.11 (d, J = 8.8 Hz, 2H), 7.31 (d, J = 8.4 Hz, 2H), 6.85 (s, 2H), 4.61 (dd, J = 10.4, 5.4 Hz, 1H), 3.75 (s, 3H), 3.62 (s, 3H), 3.23 (dd, J = 9.2, 5.0 Hz, 1H), 3.02 (ddd, J = 13.6, 9.2, 6.0 Hz, 1H), 2.80–2.68 (m, 1H), 2.43–1.75 (m, 9H); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.8, 169.8, 151.4, 146.3, 137.3, 137.1, 134.4, 128.0, 123.6, 52.9, 52.8, 49.8, 41.6, 30.6, 21.2, 20.9; **HRMS:** (APPI$^+$) [M]$^+$ $C_{22}H_{25}NO_6$ Found: 399.1678, requires 399.1676 (+0.50 ppm).

Dimethyl 2-(2-(4-cyanophenyl)-2-mesitylethyl)malonate (2o)



The title compound was prepared according to *General Procedure A* from cyclopropane **1g** (0.065 g, 0.25 mmol), mesitylene (0.070 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at 50 ºC for 3 h. Purification by flash column chromatography over silica (20% EtOAc in petroleum ether) gave **2o** as a colourless oil.
Yield: 0.056 g, 60%; $\mathbf{R_f}$ = 0.44 (petroleum ether/EtOAc 8:2); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.56 (2H, d, J = 8.4 Hz), 7.28 (2H, d, J = 8.0 Hz), 6.86 (2H, br s), 4.60 (1H, dd, J = 10.7, 5.7 Hz), 3.76 (3H, s), 3.63 (3H, s), 3.25 (1H, dd, J = 9.1, 5.2 Hz), 3.01 (1H, ddd, J = 14.1, 8.8, 5.5 Hz), 2.73 (1H, ddd, J = 13.8, 10.8, 5.2 Hz), 2.27 (3H, s), 2.11 (6H, br s); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.6, 149.0, 137.2, 136.8, 134.3, 132.1, 130.7 (br), 127.8, 118.9, 109.7, 52.7, 52.6, 49.7, 41.5, 30.3, 21.1, 20.7; **HRMS:** ($APPI^+$) $[M]^+$ $C_{23}H_{25}NO_4$ Found: 379.1179, requires 379.1178 (+0.10 ppm).

1,4-Diphenyl-4-(2,4,6-trimethoxyphenyl)butan-1-one (2p)

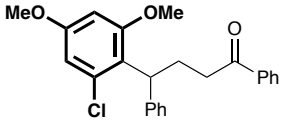


The title compound was prepared according to *General Procedure A* from cyclopropane **1k** (0.056 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-25% EtOAc in petroleum ether) gave **2p** as a white solid.
Yield: 0.098 g, 98%

10 x Scale-Up Procedure
The title compound was prepared according to *General Procedure A* from cyclopropane **1k** (0.556 g, 2.50 mmol), 1,3,5-trimethoxybenzene (0.841 g, 5.00 mmol) and TfOH (11.1 μL, 5 mol%) in HFIP (1.25 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-25% EtOAc in petroleum ether) gave **2p** as a white solid.
Yield: 0.971 g, 99%

$\mathbf{R_f}$ = 0.38 (petroleum ether/EtOAc 8:2); **mp:** 96-97 ºC; **IR ν_{max} / cm^{-1} (film):** 2933, 2834, 1682; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.91-7.89 (2H, m), 7.54 (1H, t, J = 7.4 Hz), 7.44 (2H, t, J = 7.6 Hz), 7.38 (2H, d, J = 7.5 Hz), 7.26 (2H, t, J = 7.6 Hz), 7.15 (1H, t, J = 7.3 Hz), 6.14 (2H, s), 4.72 (1H, dd, J = 10.0, 6.2 Hz), 3.82 (3H, s), 3.70 (6H, s), 2.99 (1H, ddd, J = 16.2, 9.4, 6.7 Hz), 2.87 (1H, ddd, J = 15.9, 9.8, 5.7 Hz), 2.87 (1H, ddd, J = 15.9, 9.8, 5.7 Hz), 2.77-2.60 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.9, 159.8, 159.4, 145.3, 137.3, 132.7, 128.5, 128.1, 127.9, 127.7, 125.3, 112.9, 91.2, 55.6, 55.3, 38.8, 37.6, 26.7; **HRMS:** (ESI^+) $[M+Na]^+$ $C_{25}H_{26}O_4Na$ Found: 413.1690, requires 413.1723 (+8.0 ppm).

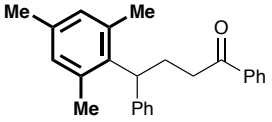
4-(2-Chloro-4,6-dimethoxyphenyl)-1,4-diphenylbutan-1-one (2q)



The title compound was prepared according to *General Procedure A* from cyclopropane **1k** (0.056 g, 0.25 mmol), 5-chloro-1,3-dimethoxybenzene (0.067 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-15% EtOAc in petroleum ether) gave a 2:1 mixture of **2q** and **2q'** as a pale yellow oil. **Combined Yield:** 0.072 g, 71%. *Repurification by careful column chromatography allowed partial separation of the regioisomers and the major regioisomer (as depicted) to be characterized.*

Major regioisomer (2q): A pale yellow oil; $\mathbf{R_f}$ = 0.53 (petroleum ether/EtOAc 8:2); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.90 (2H, d, J = 7.1 Hz), 7.55 (1H, t, J = 7.4 Hz), 7.44 (2H, t, J = 7.6 Hz), 7.36 (2H, d, J = 7.6 Hz), 7.27 (2H, t, J = 7.4 Hz), 7.17 (1H, t, J = 7.3 Hz), 6.56 (1H, d, J = 2.4 Hz), 6.33 (1H, d, J = 2.4 Hz), 4.82 (1H, dd, J = 9.7, 6.1 Hz), 3.79 (3H, s), 3.62 (3H, s), 3.03 (1H, ddd, J = 16.5, 9.8, 6.4 Hz), 2.87 (1H, ddd, J = 16.6, 9.7, 5.2 Hz), 2.80-2.65 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.3, 159.8, 159.1, 143.6, 137.0, 135.5, 132.8, 128.4, 128.0, 127.7, 125.6, 122.7, 106.1, 98.6, 55.5, 37.2, 25.7; **HRMS:** (ESI^+) $[M+Na]^+$ $C_{24}H_{23}{}^{35}ClO_3Na$ Found: 417.1236, requires 417.1228 (-1.9 ppm).

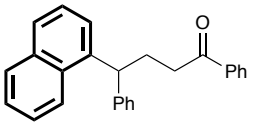
4-Mesityl-1,4-diphenylbutan-1-one (2r)



The title compound was prepared according to *General Procedure A* from cyclopropane **1k** (0.056 g, 0.25 mmol), mesitylene (0.070 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-5% EtOAc in petroleum ether) gave **2r** as a white solid.

Yield: 0.078 g, 89%; $\mathbf{R_f}$ = 0.70 (petroleum ether/EtOAc 8:2); **mp:** 92-94 ºC; **IR ν_{max} / cm^{-1} (film):** 1688; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.89-7.87 (2H, m), 7.57 (1H, t, J = 7.4 Hz), 7.45 (2H, t, J = 7.6 Hz), 7.32-7.25 (4H, m), 7.21 (1H, t, J = 6.9 Hz), 6.87 (2H, s), 4.68 (1H, dd, J = 10.3, 5.3 Hz), 3.04 (1H, td, J = 13.6, 6.6 Hz), 2.95-2.83 (2H, m), 2.60-2.46 (1H, m), 2.31 (3H, s), 2.21 (6H, br s); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.3, 144.1, 137.4, 137.2, 137.0, 135.8, 133.0, 130.4 (br), 128.6, 128.3, 128.1, 127.3, 125.6, 42.7, 36.8, 25.6, 21.5, 20.9; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{25}H_{26}ONa$ Found: 365.1908, requires 365.1876 (-8.9 ppm).

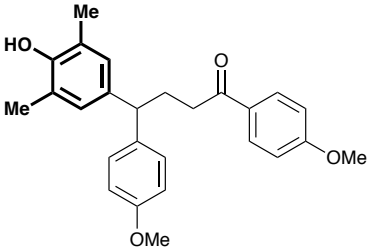
4-(Naphthalen-1-yl)-1,4-diphenylbutan-1-one (2s)



The title compound was prepared according to *General Procedure A* from cyclopropane **1k** (0.056 g, 0.25 mmol), naphthalene (0.064 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-10% EtOAc in petroleum ether) gave a 2:1 regioisomeric mixture of **2s** and its regioisomer as a yellow oil.

Yield: 0.072 g, 82%; $\mathbf{R_f}$ = 0.58 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 3053, 3026, 1680, 1597, 1578; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ *(only characteristic peaks reported)* 4.92 (2.3H, t, J = 7.7 Hz) *major regioisomer* and 4.25 (1H, t, J = 7.8 Hz) *minor regioisomer*; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{26}H_{22}ONa$ Found: 373.1533, requires 373.1563 (+8.1 ppm).

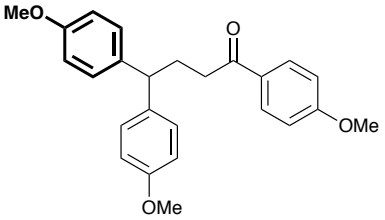
4-(4-Hydroxy-3,5-dimethylphenyl)-1,4-bis(4-methoxyphenyl)butan-1-one (2t)



The title compound was prepared according to *General Procedure A* from cyclopropane **1o** (0.071 g, 0.25 mmol), 2,6-dimethylphenol (0.061 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-35% EtOAc in petroleum ether) gave **2t** as a yellow oil.

Yield: 0.079 g, 78%; $\mathbf{R_f}$ = 0.26 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 3446 (br), 1667, 1599, 1572, 1510; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.84 (2H, d, J = 8.9 Hz), 7.18 (2H, d, J = 8.7 Hz), 6.89 (2H, d, J = 8.9 Hz), 6.86 (2H, s), 6.83 (2H, d, J = 8.7 Hz), 4.61 (1H, br s), 3.85 (3H, s), 3.82 (1H, t, J = 8.0 Hz), 3.77 (3H, s), 2.86 (2H, t, J = 7.5 Hz), 2.40 (2H, q, J = 7.6 Hz), 2.20 (6H, s); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 199.1, 163.5, 158.0, 150.7, 137.4, 136.6, 130.4, 130.2, 128.8, 128.0, 123.1, 114.0, 113.7, 55.6, 55.3, 49.2, 36.9, 30.6, 16.2; **HRMS:** (ESI$^+$) $[M+K]^+$ $C_{26}H_{28}O_4K$ Found: 443,1635, requires 443.1619 (-3.5 ppm).

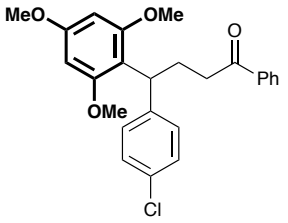
1,4,4-Tris(4-methoxyphenyl)butan-1-one (2u)



The title compound was prepared according to *General Procedure A* from cyclopropane **1o** (0.071 g, 0.25 mmol), anisole (0.054 mL g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-25% EtOAc in petroleum ether) gave **2u** as a white solid.

Yield: 0.081 g, 83%; $\mathbf{R_f}$ = 0.37 (petroleum ether/EtOAc 8:2); **mp:** 95-96 ºC; **IR ν_{max} / cm^{-1} (film):** 1672, 1595; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.85 (2H, d, J = 8.9 Hz), 7.17 (4H, d, J = 8.7 Hz), 6.89 (2H, d, J = 8.9 Hz), 6.84 (4H, d, J = 8.7 Hz), 3.92 (1H, t, J = 7.9 Hz), 3.85 (3H, s), 3.77 (3H, s), 2.87 (2H, t, J = 7.5 Hz), 2.43 (2H, q, J = 7.6 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 198.8, 163.4, 158.0, 137.1, 130.4, 130.2, 128.8, 114.0, 113.7, 55.5, 55.3, 49.0, 36.7, 30.6; **HRMS:** (ESI$^+$) $[M+H]^+$ $C_{25}H_{27}O_4$ Found: 391.1912, requires 391.1904 (-2.1 ppm).

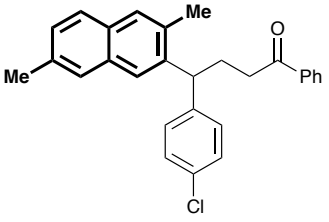
1-Phenyl-4-(4-chlorophenyl)-4-(2,4,6-trimethoxyphenyl)butan-1-one (2v)



The title compound was prepared according to *General Procedure A* from cyclopropane **1l** (0.064 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-30% EtOAc in petroleum ether) gave **2v** as a white solid.

Yield: 0.100 g, 94%; $\mathbf{R_f}$ = 0.39 (petroleum ether/EtOAc 8:2); **mp:** 116-117 ºC; **IR ν_{max} / cm^{-1} (film):** 2839, 1688, 1593; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.87 (2H, d, J = 8.3 Hz), 7.54 (1H, t, J = 7.3 Hz), 7.43 (2H, t, J = 7.7 Hz), 7.28 (2H, d, J = 7.5 Hz), 7.20 (2H, d, J = 8.5 Hz), 6.11 (2H, s), 4.64 (1H, dd, J = 10.0, 6.1 Hz), 3.81 (3H, s), 3.68 (3H, s), 2.95 (1H, ddd, J = 16.4, 9.0, 7.1 Hz), 2.83 (1H, ddd, J = 16.0, 9.5, 5.9 Hz), 2.70-2.53 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.7, 160.0, 159.3, 143.9, 143.9, 137.3, 132.8, 130.9, 129.4, 128.5, 128.2, 127.8, 112.4, 91.2, 55.7, 55.4, 38.2, 37.4, 26.4; **HRMS:** (ESI$^+$) $[M+H]^+$ $C_{25}H_{26}{}^{35}ClO_4$ Found: 425.1530, requires 425.1514 (-3.7 ppm).

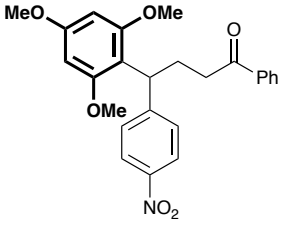
4-(4-Chlorophenyl)-4-(3,7-dimethylnaphthalen-2-yl)-1-phenylbutan-1-one (2w)



The title compound was prepared according to *General Procedure A* from cyclopropane **1l** (0.064 g, 0.25 mmol), 2,6-dimethylnaphthalene (0.078 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-10% EtOAc in petroleum ether) gave a 3:1 regioisomeric mixture of **2w** and **2w'** as an off-white solid.

Yield: 0.085 g, 82%; $\mathbf{R_f}$ = 0.67 (petroleum ether/EtOAc 8:2); **mp:** 129-132 ºC; **IR ν_{max} / cm^{-1} (film):** 1682; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ *(only characteristic peaks reported)* 4.82 (3.4H, t, J = 7.8 Hz), 2.52 (10H, s), 2.48 (10H, s) *major regioisomer* and 4.33 (1H, t, J = 7.8 Hz), 2.54 (3H, s), 2.35 (3H, s) *minor regioisomer*; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{28}H_{25}{}^{35}ClONa$ Found: 435.1502, requires 435.1486 (-3.6 ppm).

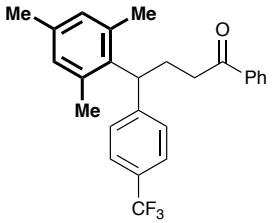
4-(4-Nitrophenyl)-1-phenyl-4-(2,4,6-trimethoxyphenyl)butan-1-one (2x)



The title compound was prepared according to *General Procedure A* from cyclopropane **1n** (0.067 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at 80 ºC for 3 h. Purification by flash column chromatography over silica (0-25% EtOAc in petroleum ether) gave **2x** as a yellow oil.

Yield: 0.097 g, 89%; $\mathbf{R_f}$ = 0.21 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2837, 1682, 1593, 1512; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.07 (2H, d, J = 8.8 Hz), 7.86-7.83 (2H, m), 7.52 (1H, t, J = 7.4 Hz), 7.45 (2H, d, J = 8.5 Hz), 7.41 (2H, t, J = 7.7 Hz), 6.08 (2H, s), 4.73 (1H, dd, J = 10.2, 5.8 Hz), 3.79 (3H, s), 3.63 (6H, s), 2.95 (1H, dt, J = 16.9, 7.8 Hz), 2.82 (1H, ddd, J = 16.9, 8.3, 5.4 Hz), 2.71-2.56 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.3, 160.4, 159.2, 153.8, 145.8, 137.2, 132.9, 128.6, 128.5, 128.1, 123.0, 111.2, 91.0, 55.6, 55.4, 38.5, 36.8, 25.7; **HRMS:** (ESI$^+$) $[M+H]^+$ $C_{25}H_{26}NO_6$ Found: 436.1765, requires 436.1755 (-2.3 ppm).

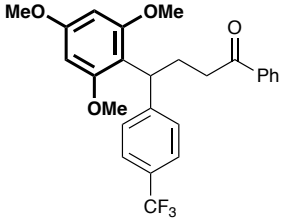
4-Mesityl-1-phenyl-4-(4-(trifluoromethyl)phenyl)butan-1-one (2y)



The title compound was prepared according to *General Procedure A* from cyclopropane **1m** (0.073 g, 0.25 mmol), mesitylene (0.070 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-10% EtOAc in petroleum ether) gave **2y** as a white solid.

Yield: 0.095 g, 93%; $\mathbf{R_f}$ = 0.70 (petroleum ether/EtOAc 8:2); **mp:** 129-130 ºC; **IR ν_{max} / cm^{-1} (film):** 1680, 1614; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.83 (2H, dd, J = 8.3, 1.2 Hz), 7.56-7.51 (3H, m), 7.42 (2H, t, J = 7.7 Hz), 7.33 (2H, d, J = 8.2 Hz), 6.84 (2H, s), 4.65 (1H, dd, J = 10.5, 4.3 Hz), 3.01-2.94 (1H, m), 2.91-2.82 (2H, m), 2.55-2.47 (1H, m), 2.27 (3H, s), 2.14 (6H, br s); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 199.9, 148.4, 137.0, 136.8, 136.3, 136.2, 133.0, 130.3, 128.5, 128.0, 127.9 (app. d, J = 32.2 Hz), 127.4, 125.1 (q, J = 3.5 Hz), 124.4 (q, J = 271.7 Hz), 42.6, 36.3, 25.4, 21.3, 20.8; **^{19}F NMR:** (376 MHz, $CDCl_3$) δ -62.3; **HRMS:** (ESI$^+$) $[M+H]^+$ $C_{26}H_{26}F_3O$ Found: 411.1943, requires 411.1930 (-3.2 ppm).

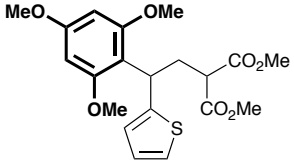
1-Phenyl-4-(4-(trifluoromethyl)phenyl)-4-(2,4,6-trimethoxyphenyl)butan-1-one (2z)



The title compound was prepared according to *General Procedure A* from cyclopropane **1m** (0.073 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 16 h. Purification by flash column chromatography over silica (0-30% EtOAc in petroleum ether) gave **2z** as a colourless oil.

Yield: 0.097 g, 85%; $\mathbf{R_f}$ = 0.41 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2839, 1684, 1608, 1589; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.86-7.84 (2H, m), 7.54-7.50 (1H, m), 7.47-7.39 (6H, m), 6.09 (2H, s), 4.70 (1H, dd, J = 10.1, 6.0 Hz), 3.79 (3H, s), 3.65 (3H, s), 2.94 (1H, ddd, J = 16.4, 9.0, 7.1 Hz), 2.82 (1H, ddd, J = 16.7, 8.8, 5.3 Hz), 2.72-2.55 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.5, 160.1, 159.2, 149.5, 137.2, 132.7, 128.4, 128.1, 128.0, 127.4 (q, J = 32.0), 124.6 (q, J = 271.7 Hz), 124.5 (q, J = 3.4 Hz), 111.8, 91.0, 55.5, 55.2, 38.5, 37.1, 26.0; **^{19}F NMR:** (376 MHz, $CDCl_3$) δ -62.1; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{26}H_{25}F_3O_4Na$ Found: 481.1604, requires 481.1597 (-1.5 ppm).

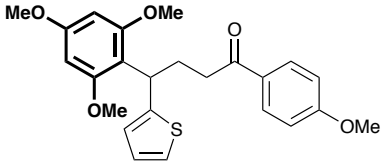
Dimethyl 2-(2-(thiophen-2-yl)-2-(2,4,6-trimethoxyphenyl)ethyl)malonate (3a)



The title compound was prepared according to *General Procedure B* from cyclopropane **1j** (0.061 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and $B(C_6F_5)\bullet H_2O$ (6.6 mg, 5 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-35% EtOAc in petroleum ether) gave **3a** as a colourless liquid. Analytical data are in agreement with the literature.[15]

Yield: 0.061 g, 60%; $\mathbf{R_f}$ = 0.29 (petroleum ether/EtOAc 8:2); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.04 (1H, dd, J = 4.9, 1.4 Hz), 6.86-6.83 (2H, m), 6.11 (2H, s), 4.85 (1H, dd, J = 10.3, 6.1 Hz), 3.79 (3H, s), 3.74 (6H, s), 3.71 (3H, s), 3.63 (3H, s), 3.25 (1H, dd, J = 9.2, 5.7 Hz), 2.90 (1H, ddd, J = 13.4, 10.4, 5.7 Hz), 2.76 (1H, ddd, J = 13.4, 9.2, 6.1 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.1, 169.8, 160.3, 148.6, 125.9, 123.7, 122.7, 110.6, 91.1, 55.6, 55.3, 52.4, 52.4, 50.5, 33.5, 32.9.

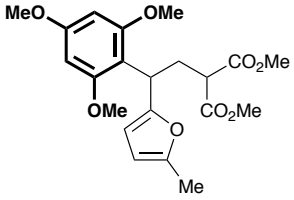
1-(4-Methoxyphenyl)-4-(thiophen-2-yl)-4-(2,4,6-trimethoxyphenyl)butan-1-one (3b)



The title compound was prepared according to *General Procedure B* from cyclopropane **1p** (0.065 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and $B(C_6F_5)\bullet H_2O$ (6.6 mg, 5 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-20% EtOAc in petroleum ether) gave **3b** as a colourless oil.

Yield: 0.099 g, 93%; $\mathbf{R_f}$ = 0.22 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2938;2835, 1672, 1599; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.84 (2H, d, J = 8.9 Hz), 7.05 (app. t. J = 3.2 Hz), 6.89-6.86 (4H, m), 6.12 (2H, s), 4.89 (1H, dd, J = 9.3, 6.8 Hz), 3.84 (3H, s), 3.80 (3H, s), 3.72 (6H, s), 2.88 (1H, ddd, J = 15.9, .1, 6.8 Hz), 2.77 (1H, ddd, J = 15.6, 9.6, 5.7 Hz), 2.72-2.57 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 199.3, 163.2, 160.1, 159.3, 149.7, 130.4, 130.3, 126.0, 123.6, 122.5, 113.6, 112.1 91.2, 55.7, 55.5, 55.3, 37.1, 35.3, 29.1; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{24}H_{26}O_5SNa$ Found: 449.1408, requires 449.1393 (-3.4 ppm).

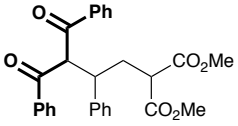
Dimethyl 2-(2-(5-methylfuran-2-yl)-2-(2,4,6-trimethoxyphenyl)ethyl)malonate (3c)



The title compound was prepared according to *General Procedure B* from cyclopropane **1i** (0.060 g, 0.25 mmol), 1,3,5-trimethoxybenzene (0.084 g, 0.50 mmol) and $B(C_6F_5)\bullet H_2O$ (6.6 mg, 5 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-35% EtOAc in petroleum ether) gave **3c** as a colourless liquid.

Yield: 0.004 g, trace; $\mathbf{R_f}$ = 0.30 (petroleum ether/EtOAc 8:2); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 6.11 (2H, s), 5.82-5.80 (2H, m), 4.58 (1H, t, J = 8.0 Hz), 3.80 (3H, s), 3.72 (3H, s), 3.71 (6H, s), 3.60 (3H, s), 3.26 (1H, t, J = 7.5 Hz), 2.71 (2H, t, J = 7.8 Hz), 2.20 (3H, s); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.2, 169.8, 160.2, 159.6, 155.7 149.5, 108.9, 105.7, 105.0, 91.2, 55.7, 55.2, 52.4 (app. d, J = 3.1 Hz), 50.3, 32.0, 30.5, 13.6; **HRMS:** (APPI$^+$) $[M]^+$ $C_{21}H_{26}O_8$ Found: 406.1624, requires 406.1622 (+0.19 ppm).

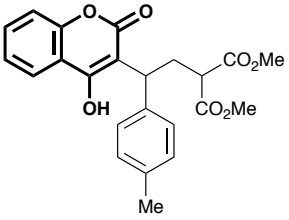
Dimethyl 2-(3-benzoyl-4-oxo-2,4-diphenylbutyl)malonate (4a)



The title compound was prepared according to *General Procedure A* from cyclopropane **1a** (0.059 g, 0.25 mmol), dibenzoylmethane (0.056 g, 0.25 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (10-30% EtOAc in petroleum ether) gave **4a** as a white solid.

Yield: 0.089 g, 78%; $\mathbf{R_f}$ = 0.23 (petroleum ether/EtOAc 8:2); **mp:** 98-101 ºC; **IR ν_{max} / cm^{-1} (film):** 1751, 1730, 1688, 1665; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 8.05 (2H, d, J = 7.3 Hz), 7.74 (2H, d, J = 7.3 Hz), 7.56 (1H, t, J = 7.4 Hz), 7.47-7.40 (4H, m), 7.31-7.27 (2H, m), 7.25-7.23 (2H, m), 7.18 (2H, t, J = 7.5 Hz), 7.09 (1H, t, J = 7.2 Hz), 5.67 (1H, d, J = 10.3 Hz), 3.98 (1H, td, J = 10.4, 4.6 Hz), 3.76 (3H, d, J = 2.3 Hz), 3.50 (3H, d, J = 2.3 Hz), 3.16 (1H, dd, J = 9.1, 5.6 Hz), 2.40-2.35 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 194.2, 194.1, 169.5, 169.1, 139.2, 136.9, 136.7, 133.7 133.2, 128.9 (2C), 128.9, 128.6, 128.5, 128.5, 127.3, 64.5, 52.6, 52.4, 49.9, 44.7, 32.9; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{28}H_{26}O_6Na$ Found: 481.1617, requires 481.1622 (+0.9 ppm).

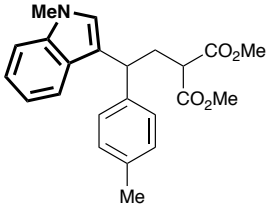
Dimethyl 2-(2-(4-hydroxy-2-oxo-2H-chromen-3-yl)-2-(p-tolyl)ethyl)malonate (4b)



The title compound was prepared according to *General Procedure A* from cyclopropane **1d** (0.063 g, 0.25 mmol), 4-hydroxycoumarin (0.049 g, 0.30 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (10-30% EtOAc in petroleum ether) gave **4b** as a white solid.

Yield: 0.052 g, 50%; $\mathbf{R_f}$ = 0.21 (petroleum ether/EtOAc 7:3); **mp:** 152-154 ºC; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.90 (1H, d, J = 7.9 Hz), 7.52 (1H, td, J = 7.8, 1.1 Hz), 7.34 (2H, d, J = 7.8 Hz), 7.27 (2H, app. d, J = 8.1 Hz), 7.14 (2H, d, J = 7.9 Hz), 4.51 (1H, dd, J = 9.6, 6.0 Hz), 3.76 (3H, s), 3.72 (3H, s), 3.51 (1H, dd, J = 8.6, 6.1 Hz), 2.96 (1H, ddd, J = 14.4, 9.3, 5.6 Hz), 2.82 (1H, ddd, J = 14.1, 8.3, 6.1 Hz), 2.32 (3H, s); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.9, 170.1, 162.6, 161.0, 152.7, 137.3, 136.8, 132.0, 129.4, 127.7, 123.9, 123.4, 116.4, 116.1, 107.2, 53.1, 52.8, 49.8, 37.5, 29.6, 21.0.

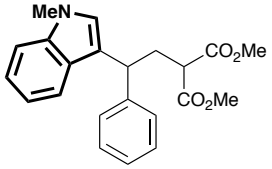
Dimethyl 2-(2-(1-methyl-1*H*-indol-3-yl)-2-(*p*-tolyl)ethyl)malonate (4c)



The title compound was prepared according to *General Procedure B* from cyclopropane **1d** (0.063 g, 0.25 mmol), 1-methylindole (0.062 mL, 0.50 mmol) and $B(C_6F_5)\bullet H_2O$ (6.6 mg, 5 mol%) in $MeNO_2$ (0.125 mL) and stirred at 80 ºC for 24 h. Purification by flash column chromatography over silica (10-30% EtOAc in petroleum ether) gave **4c** as an off-white solid.

Yield: 0.081 g, 85%; $\mathbf{R_f}$ = 0.34 (petroleum ether/EtOAc 8:2); **mp:** 96-98 ºC; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.50 (1H, d, J = 8.0 Hz), 7.29 (1H, d, J = 7.8 Hz), 7.24-7.19 (3H, m), 7.13 (2H, d, J = 7.9 Hz), 7.06 (1H, t, J = 7.4 Hz), 6.90 (1H, s), 4.21 (1H, t, J = 7.9 Hz), 3.77 (6H, s), 3.70 (3H, s), 3.43 (1H, dd, J = 8.1, 6.6 Hz), 2.85 (1H, dt, J = 14.1, 7.2 Hz), 2.62 (1H, ddd, J = 13.9, 8.9, 6.5 Hz), 2.34 (3H, s); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 170.0, 169.9, 140.4, 137.3, 135.9, 129.2, 127.8, 127.2, 126.0, 121.7, 119.6, 118.9, 117.5, 109.1, 52.5, 52.4, 50.1, 40.2, 35.1, 32.7, 21.0; **HRMS:** (APPI$^+$) $[M]^+$ $C_{23}H_{25}NO_4$ Found: 379.1778, requires 379.1778 (+0.03 ppm).

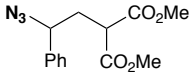
Dimethyl 2-(2-(1-methyl-1*H*-indol-3-yl)-2-phenylethyl)malonate (4d)



The title compound was prepared according to *General Procedure B* from cyclopropane **1a** (0.059 g, 0.25 mmol), 1-methylindole (0.062 mL, 0.50 mmol) and $B(C_6F_5)•H_2O$ (13.2 mg, 10 mol%) in $MeNO_2$ (0.125 mL) and stirred at 80 ºC for 24 h. Purification by flash column chromatography over silica (10-25% EtOAc in petroleum ether) gave **4d** as a colourless oil. Analytical data are in agreement with the literature.[15]

Yield: 0.062 g, 68%**; ^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.49 (1H, d, J = 8.0 Hz), 7.36-7.28 (5H, m), 7.24-7.20 (2H, m), 7.07-7.03 (1H, m), 6.91 (1H, s), 4.25 (1H, t, J = 7.9 Hz), 3.78 (3H, s), 3.77 (3H, s), 3.70 (3H, s), 3.44 (1H, dd, J = 7.8, 6.9 Hz), 2.89-2.82 (1H, m), 2.65 (1H, ddd, J = 13.9, 8.7, 6.7 Hz).

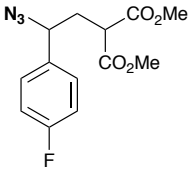
Dimethyl 2-(2-azido-2-phenylethyl)malonate (4e)



The title compound was prepared according to *General Procedure A* from cyclopropane **1a** (0.059 g, 0.25 mmol), azidotrimethylsilane (0.066 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (10% EtOAc in petroleum ether) gave **4e** as a colourless liquid. Analytical data are in agreement with the literature.[16]

Yield: 0.045 g, 65%; **R_f** = 0.66 (petroleum ether/EtOAc 8:2); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.42-7.35 (3H, m), 7.34-7.31 (2H, m), 4.55 (1H, t, J = 7.3 Hz), 3.75 (3H, s), 3.74 (3H, s), 3.54 (1H, t, J = 7.3 Hz), 2.34 (2H, dd, J = 7.7, 7.0 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.3, 169.2, 138.4, 129.0, 128.7, 126.9, 63.9, 52.8, 48.7, 35.3.

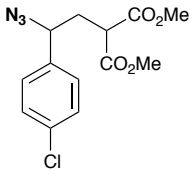
Dimethyl 2-(2-azido-2-(4-fluorophenyl)ethyl)malonate (4f)



The title compound was prepared according to *General Procedure A* from cyclopropane **1b** (0.063 g, 0.25 mmol), azidotrimethylsilane (0.066 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-15% EtOAc in petroleum ether) gave **4f** as a colourless liquid. Analytical data are in agreement with the literature.[16]

Yield: 0.048 g, 65%; **R_f** = 0.65 (petroleum ether/EtOAc 8:2); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.30 (2H, dd, J = 8.7, 5.3 Hz), 7.08 (2H, t, J = 8.6 Hz), 4.54 (1H, t, J = 7.3 Hz), 3.75 (3H, s), 3.74 (3H, s), 3.52 (1H, t, J = 7.2 Hz), 2.30 (2H, t, J = 6.9 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.2, 169.1, 162.7 (d, J = 247.6 Hz), 134.3 (d, J = 3.0 Hz), 128.7 (d, J = 8.4 Hz), 116.0 (d, J = 21.8 Hz), 63.2, 52.8, 48.6, 35.4; **^{19}F NMR:** (376 MHz, $CDCl_3$) δ -112.9.

Dimethyl 2-(2-azido-2-(4-chlorophenyl)ethyl)malonate (4g)

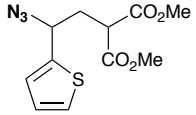


The title compound was prepared according to *General Procedure A* from cyclopropane **1c** (0.067 g, 0.25 mmol), azidotrimethylsilane (0.066 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-15% EtOAc in petroleum ether) gave **4g** as a colourless liquid.

Yield: 0.044 g, 56%; **R_f** = 0.60 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 2955, 2100, 1732; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.39 (2H, d, J = 8.5 Hz), 7.28 (2H, d, J = 8.5 Hz), 4.57 (1H, t, J = 7.3 Hz), 3.78 (3H, s), 3.76 (3H, s), 3.55 (1H, t, J = 7.3 Hz), 2.32 (1H, t, J = 7.3 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.2, 169.2, 137.1, 134.7, 129.3, 128.4, 63.3, 52.9, 48.7, 35.4; **HRMS:** (ESI$^+$) $[M+Na]^+$ $C_{13}H_{14}{}^{35}ClN_3O_4Na$ Found: 334.0560, requires 334.0565 (+1.6 ppm).

[16] K. L. Ivanov, E. V. Villemson, E. M. Budynina, O. A. Ivanova, I. V. Trushkov, M. Y. Melnikov, *Chem. Eur.-J.* **2015**, *21*, 4975.

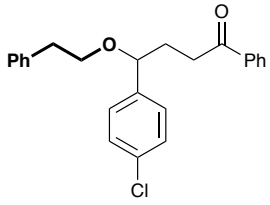
Dimethyl 2-(2-azido-2-(thiophen-2-yl)ethyl)malonate (4h)



The title compound was prepared according to *General Procedure B* from cyclopropane **1j** (0.061 g, 0.25 mmol), azidotrimethylsilane (0.066 mL, 0.50 mmol) and $B(C_6F_5)•H_2O$ (6.6 mg, 5 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-15% EtOAc in petroleum ether) gave **4h** as a colourless liquid. Analytical data are in agreement with the literature.[16]

Yield: 0.048 g, 68%; $\mathbf{R_f}$ = 0.60 (petroleum ether/EtOAc 8:2); **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.32 (1H, dd, J = 5.1, 1.0 Hz), 7.05 (1H, dd, J = 3.4, 0.5 Hz), 7.01 (1H, dd, J = 5.0, 3.5 Hz), 4.81 (1H, t, J = 7.4 Hz), 3.76 (3H, s), 3.75 (3H, s), 3.58 (1H, t, J = 7.2 Hz), 2.43 (2H, t, J = 7.4 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 169.2, 169.1, 141.2, 127.0, 126.3, 126.1, 59.2, 52.9, 48.7, 35.6.

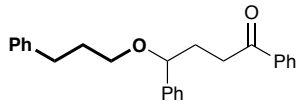
4-(4-Chlorophenyl)-4-phenethoxy-1-phenylbutan-1-one (4i)



The title compound was prepared according to *General Procedure A* from cyclopropane **1l** (0.064 g, 0.25 mmol), 2-phenylethanol (0.060 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-10% EtOAc in petroleum ether) gave **4i** as an off-white solid.

Yield: 0.085 g, 90%; $\mathbf{R_f}$ = 0.83 (petroleum ether/EtOAc 8:2); **mp:** 87-88 °C; **IR ν_{max} / cm^{-1} (film):** 1680; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.92 (2H, dd, J = 8.3, 1.3 Hz), 7.61-7.57 (1H, m), 7.48 (2H, t, J = 7.6 Hz), 7.33-7.26 (4H, m), 7.23-7.19 (5H, m), 4.35 (1H, t, J = 6.5 Hz), 3.59 (1H, dt, J = 9.3, 6.8 Hz), 3.48 (1H, dt, J = 9.3, 6.9 Hz), 3.02 (2H, t, J = 7.2 Hz), 2.92-2.81 (2H, m), 2.11 (2H, q, J = 6.9 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.0, 141.1, 139.2, 137.1, 133.2, 133.1, 129.1, 128.7, 128.6, 128.4, 128.2, 127.9, 126.3, 80.6, 69.8, 36.5, 34.5, 32.7; **HRMS:** (ESI^+) $[M+K]^+$ $C_{24}H_{23}{}^{35}ClO_2K$ Found: 417.1054, requires 417.1018 (-8.7 ppm).

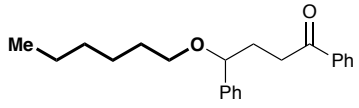
1,4-Diphenyl-4-(3-phenylpropoxy)butan-1-one (4j)



The title compound was prepared according to *General Procedure A* from cyclopropane **1k** (0.056g, 0.25 mmol), 3-phenylpropanol (0.068 mL, 0.50 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-10% EtOAc in petroleum ether) gave **4j** as an off-white solid.

Yield: 0.065 g, 73%; $\mathbf{R_f}$ = 0.83 (petroleum ether/EtOAc 8:2); **mp:** 76-77 °C; **IR ν_{max} / cm^{-1} (film):** 1680; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.99 (2H, d, J = 7.3 Hz), 7.58 (1H, t, J = 7.3 Hz), 7.48 (2H, t, J = 7.6 Hz), 7.41-7.36 (4H, m), 7.34-7.26 (3H, m), 7.20 (1H, d, J = 7.2 Hz), 7.16 (2H, d, J = 7.3 Hz), 4.38 (1H, dd, J = 7.6, 5.5 Hz), 3.41 (1H, dt, J = 9.3, 6.3 Hz), 3.31 (1H, dt, J = 9.3, 6.3 Hz), 3.13 (2H, td, J = 7.1, 2.6 Hz), 2.77-2.63 (2H, m), 2.28-2.14 (2H, m), 1.93-1.86 (2H, m); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.2, 142.7, 142.2, 137.2, 133.1, 128.7, 128.5, 128.4, 128.2, 127.7, 126.7, 125.8, 81.2, 68.2, 34.8, 32.8, 32.6, 31.6; **HRMS:** (ESI^+) $[M+Na]^+$ $C_{25}H_{26}O_2Na$ Found: 381.1829, requires 381.1825 (-1.1 ppm).

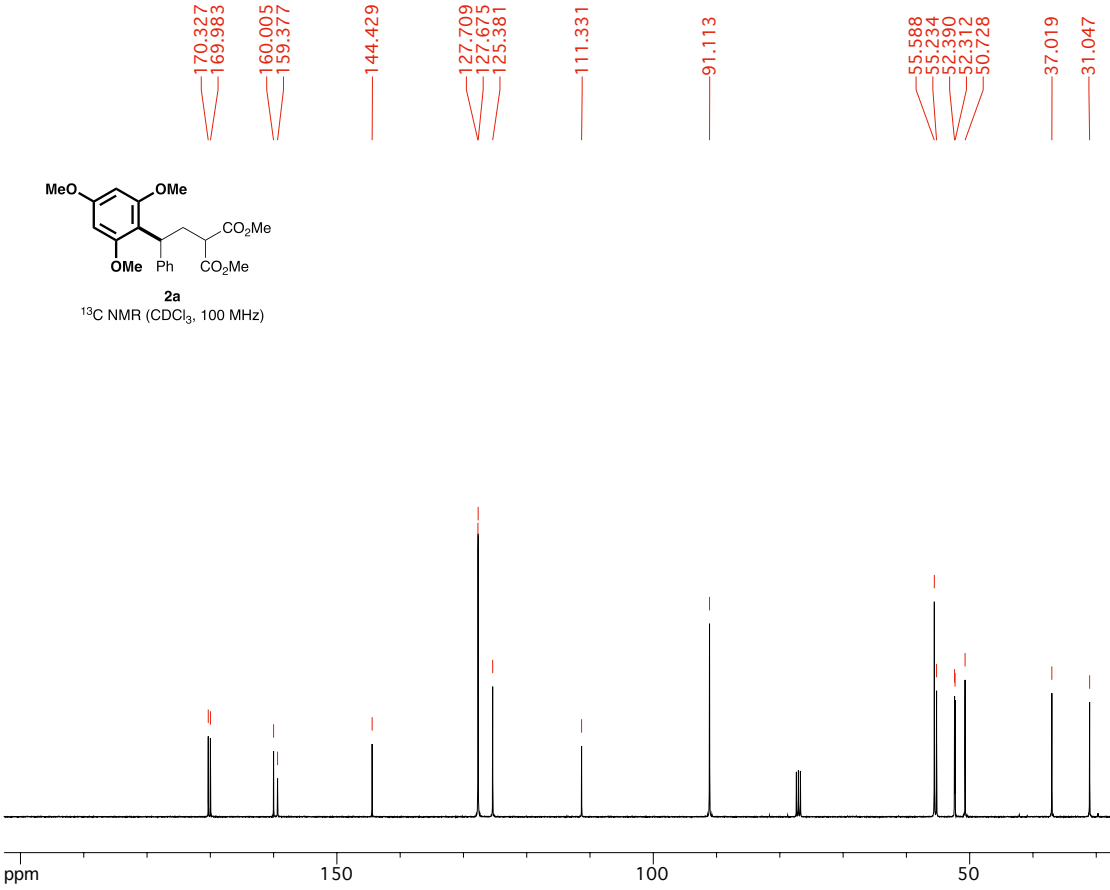
4-(Hexyloxy)-1,4-diphenylbutan-1-one (4k)



The title compound was prepared according to *General Procedure A* from cyclopropane **1k** (0.056g, 0.25 mmol), 1-hexanol (0.093 mL, 0.75 mmol) and TfOH (2.2 μL, 10 mol%) in HFIP (0.125 mL) and stirred at room temperature for 3 h. Purification by flash column chromatography over silica (0-5% EtOAc in petroleum ether) gave **4k** as a colourless liquid.

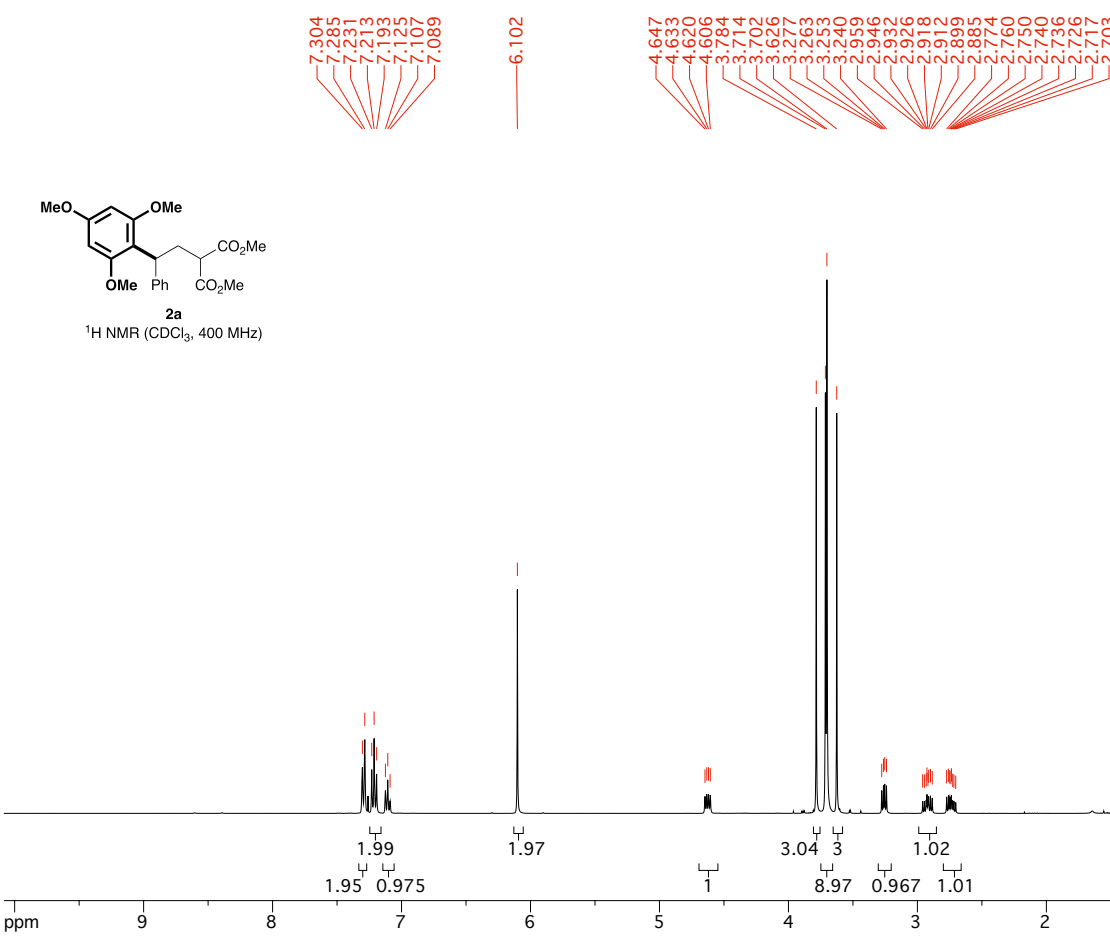
Yield: 0.060 g, 74%; $\mathbf{R_f}$ = 0.84 (petroleum ether/EtOAc 8:2); **IR ν_{max} / cm^{-1} (film):** 1681; **^{1}H NMR:** (400 MHz, $CDCl_3$) δ 7.98-7.96 (2H, m), 7.59-7.56 (1H, m), 7.47 (2H, t, J = 7.6 Hz), 7.39-7.27 (5H, m), 4.35 (1H, t, J = 6.6 Hz), 3.36 (1H, dt, J = 9.2, 6.7 Hz), 3.25 (1H, dt, J = 9.2, 6.6 Hz), 3.18-3.04 (2H, m), 2.19-2.14 (2H, m), 1.61-1.52 (2H, m), 1.37-1.22 (6H, m), 0.88 (3H, t, J = 7.0 Hz); **^{13}C NMR:** (100 MHz, $CDCl_3$) δ 200.1, 142.7, 137.1, 132.9, 128.5, 128.4, 128.0, 127.4, 126.5, 81.0, 69.0, 34.7, 32.8, 31.7, 29.9, 25.9, 22.6, 14.0; **HRMS:** ($APPI^+$) $[M]^+$ $C_{22}H_{28}O_2$ Found: 324.2084, requires 324.2084 (+0.04 ppm).

3. NMR Spectra of Products



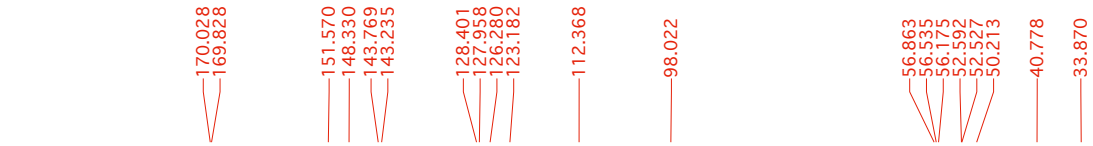
2a

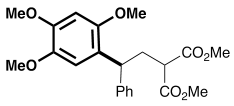
^{13}C NMR ($CDCl_3$, 100 MHz)



2a

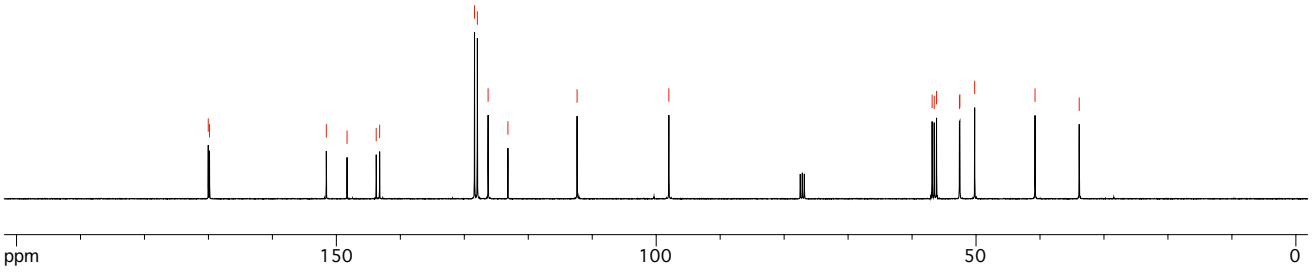
^{1}H NMR ($CDCl_3$, 400 MHz)

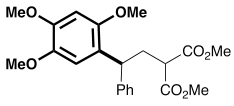




2b

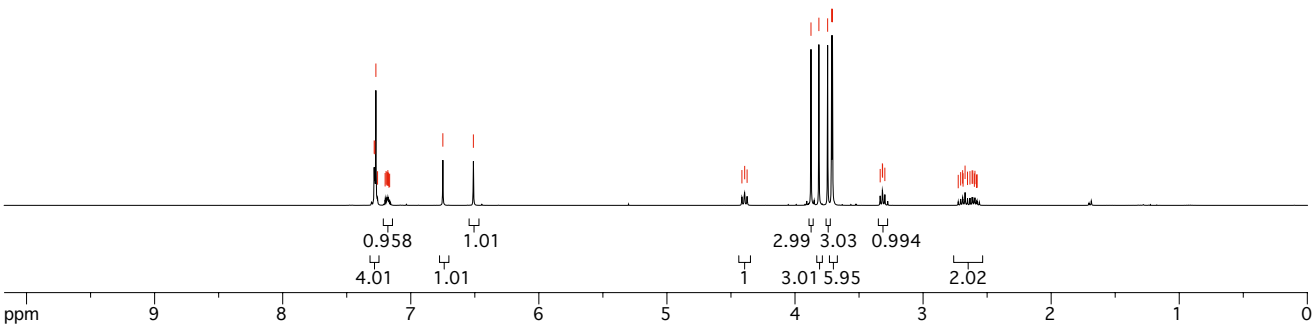
^{13}C NMR ($CDCl_3$, 100 MHz)

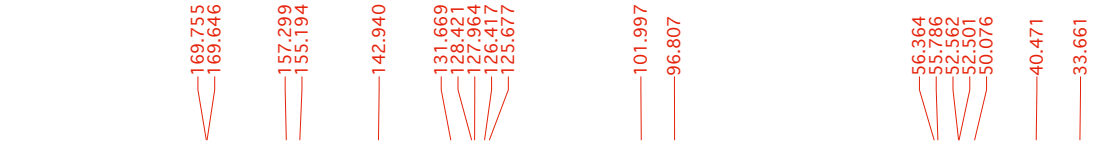


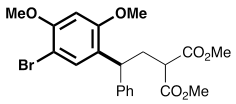


2b

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

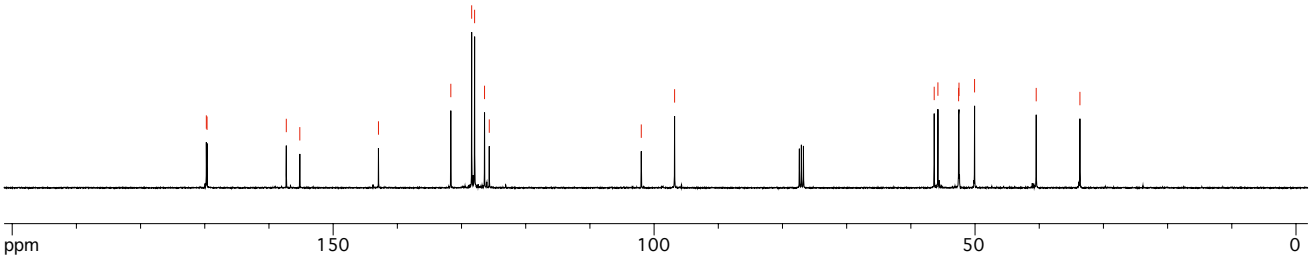


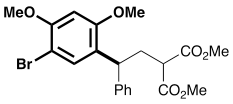




2c

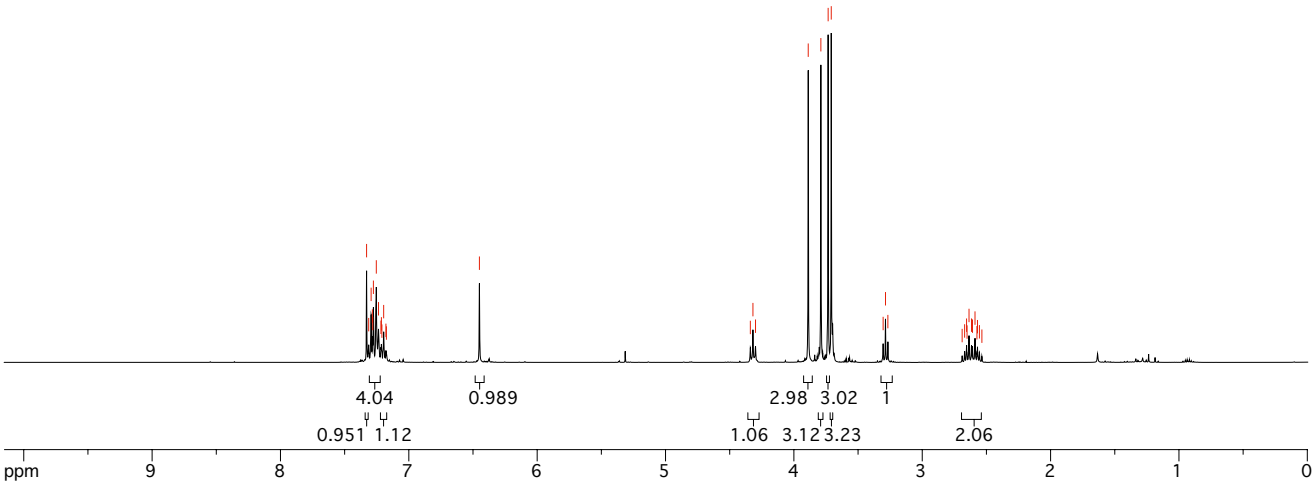
^{1}H NMR ($CDCl_3$, 400 MHz)

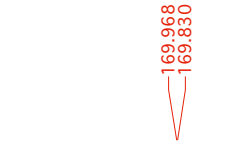




2c

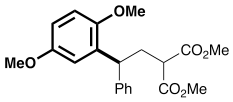
^{1}H NMR ($CDCl_3$, 400 MHz)





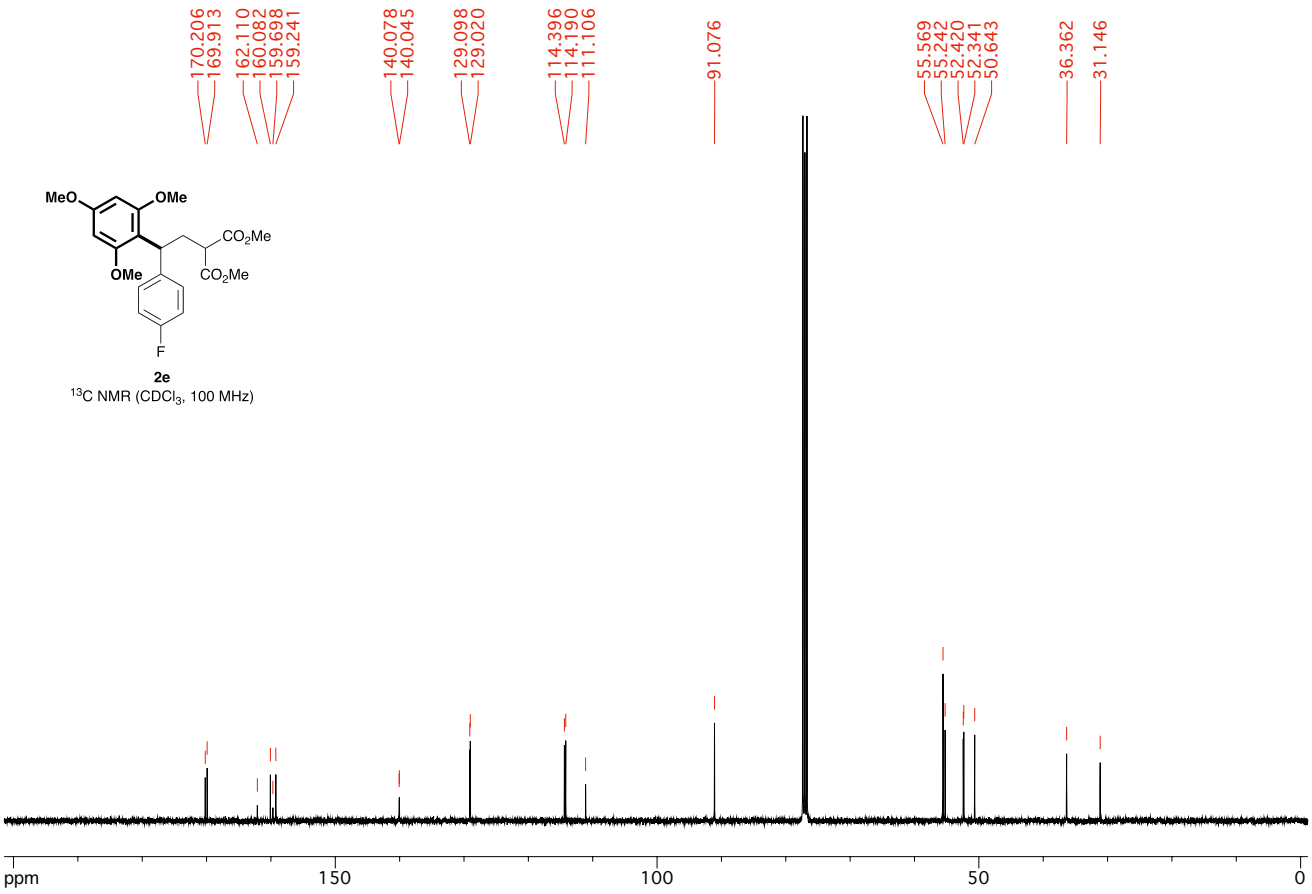
2d

^{13}C NMR ($CDCl_3$, 100 MHz)



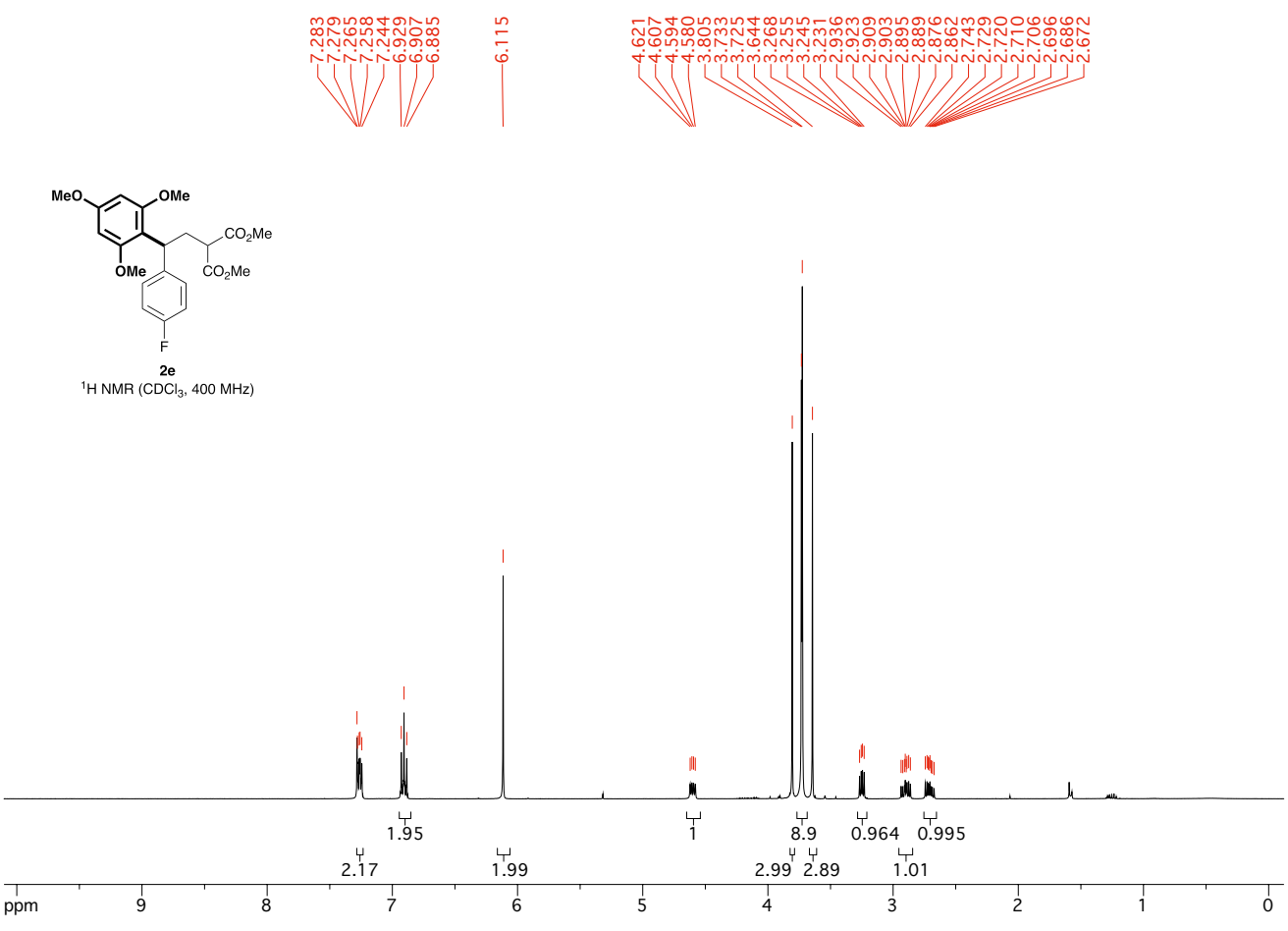
2d

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



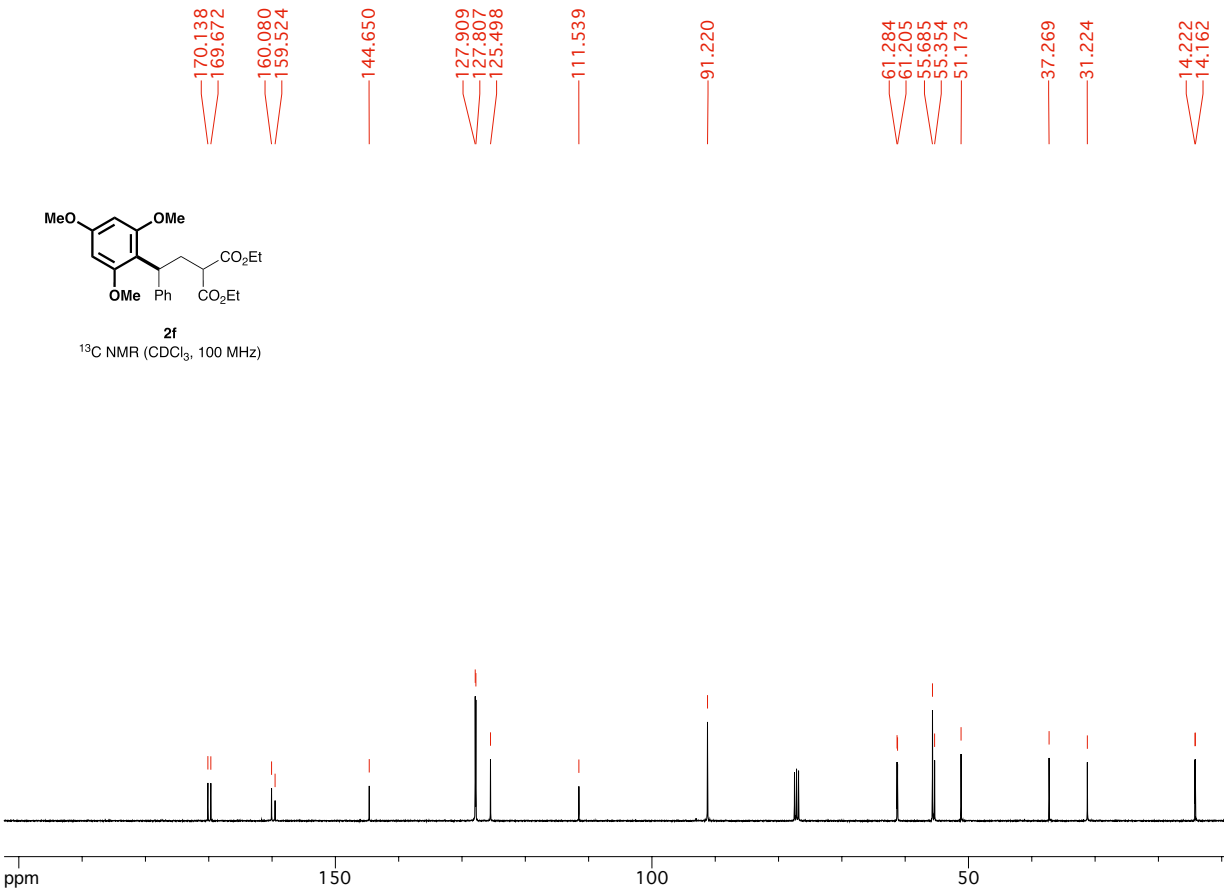
2e

^{13}C NMR ($CDCl_3$, 100 MHz)

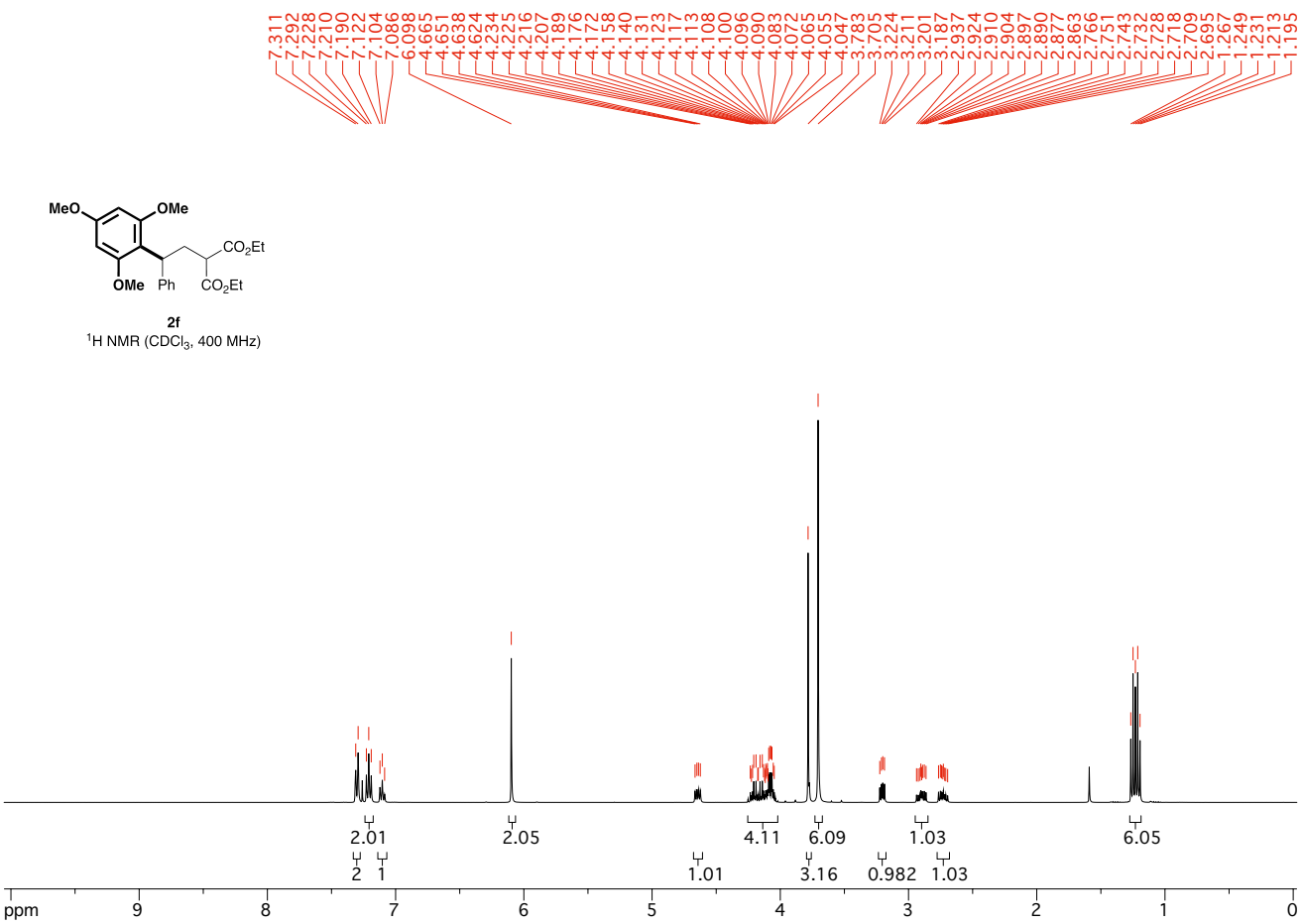


2e

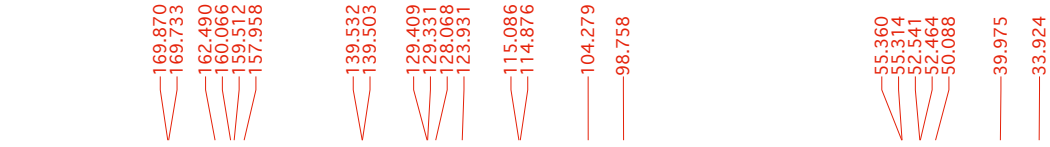
^{1}H NMR ($CDCl_3$, 400 MHz)

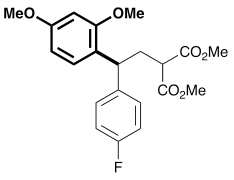


2f
^{13}C NMR ($CDCl_3$, 100 MHz)



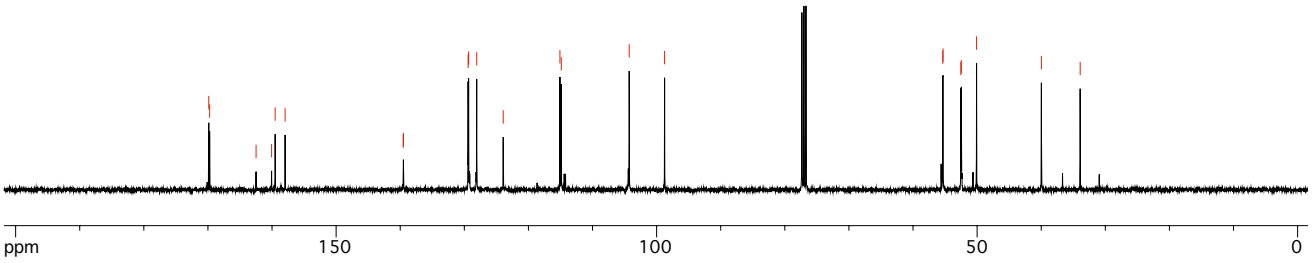
2f
^{1}H NMR ($CDCl_3$, 400 MHz)

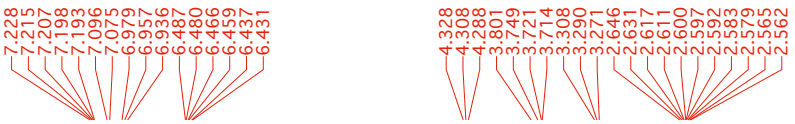


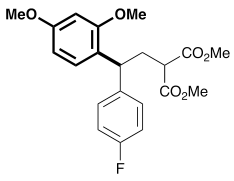


2g

^{13}C NMR ($CDCl_3$, 100 MHz)

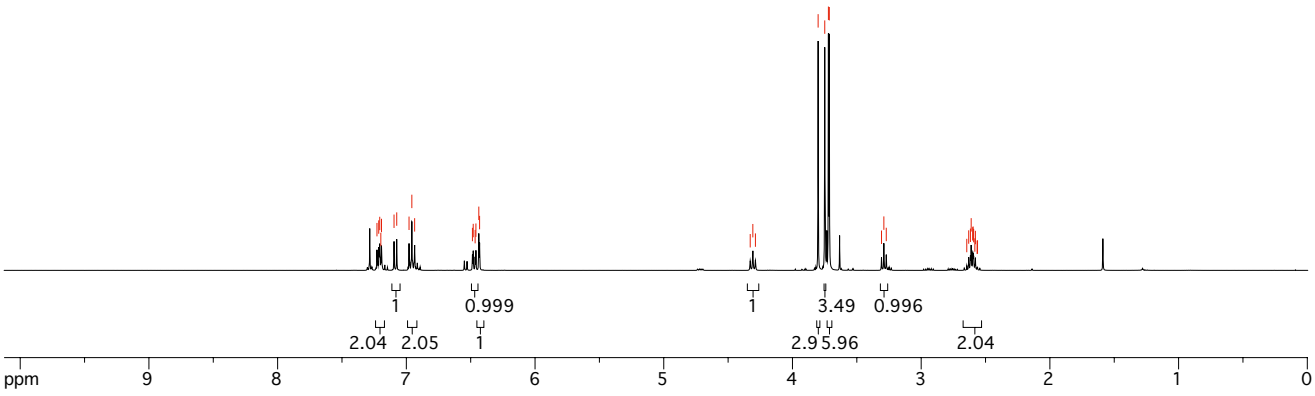


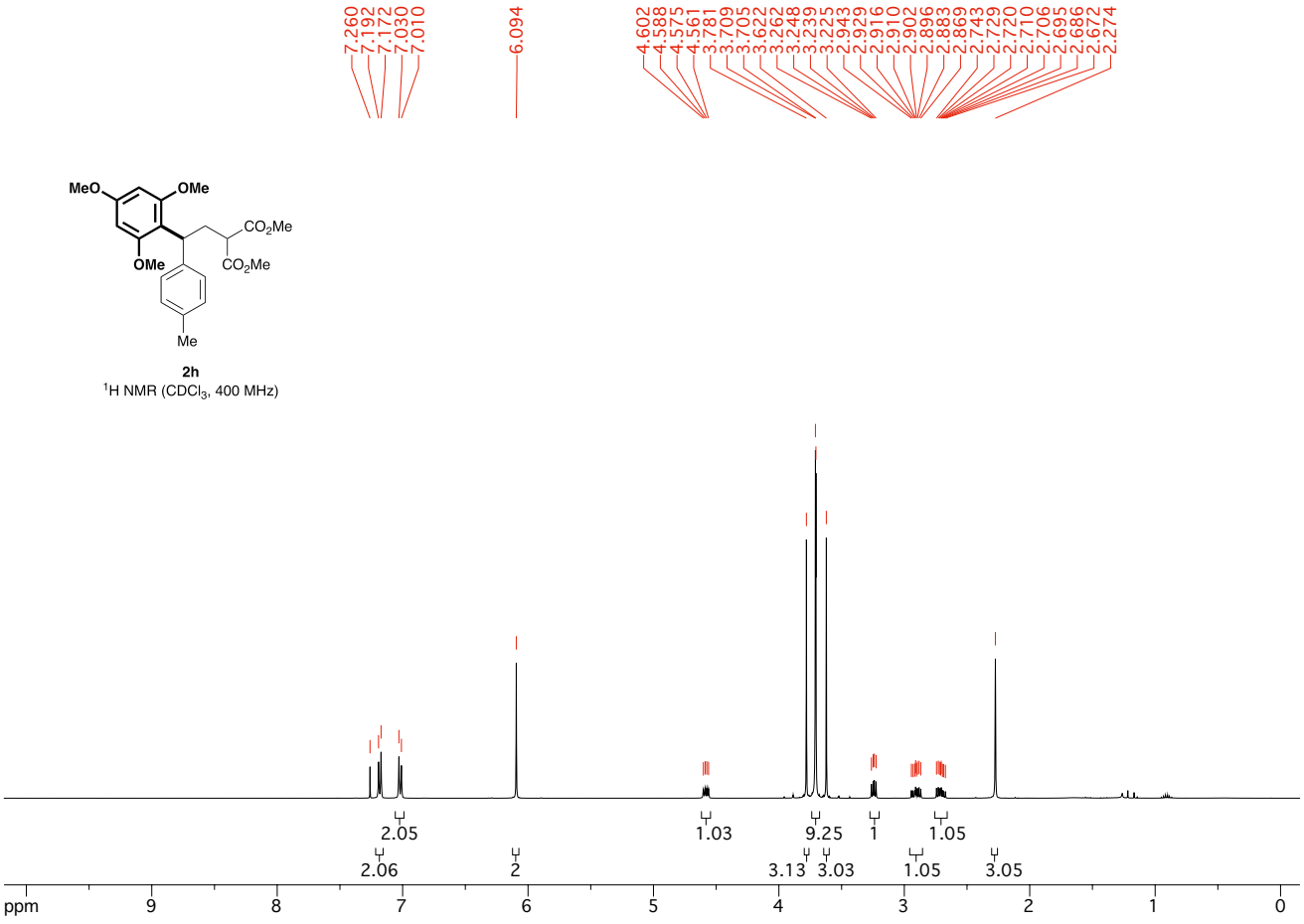




2g

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

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2.672
2.274
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OMe
OMe
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9.25
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1.05
2.06
2
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1
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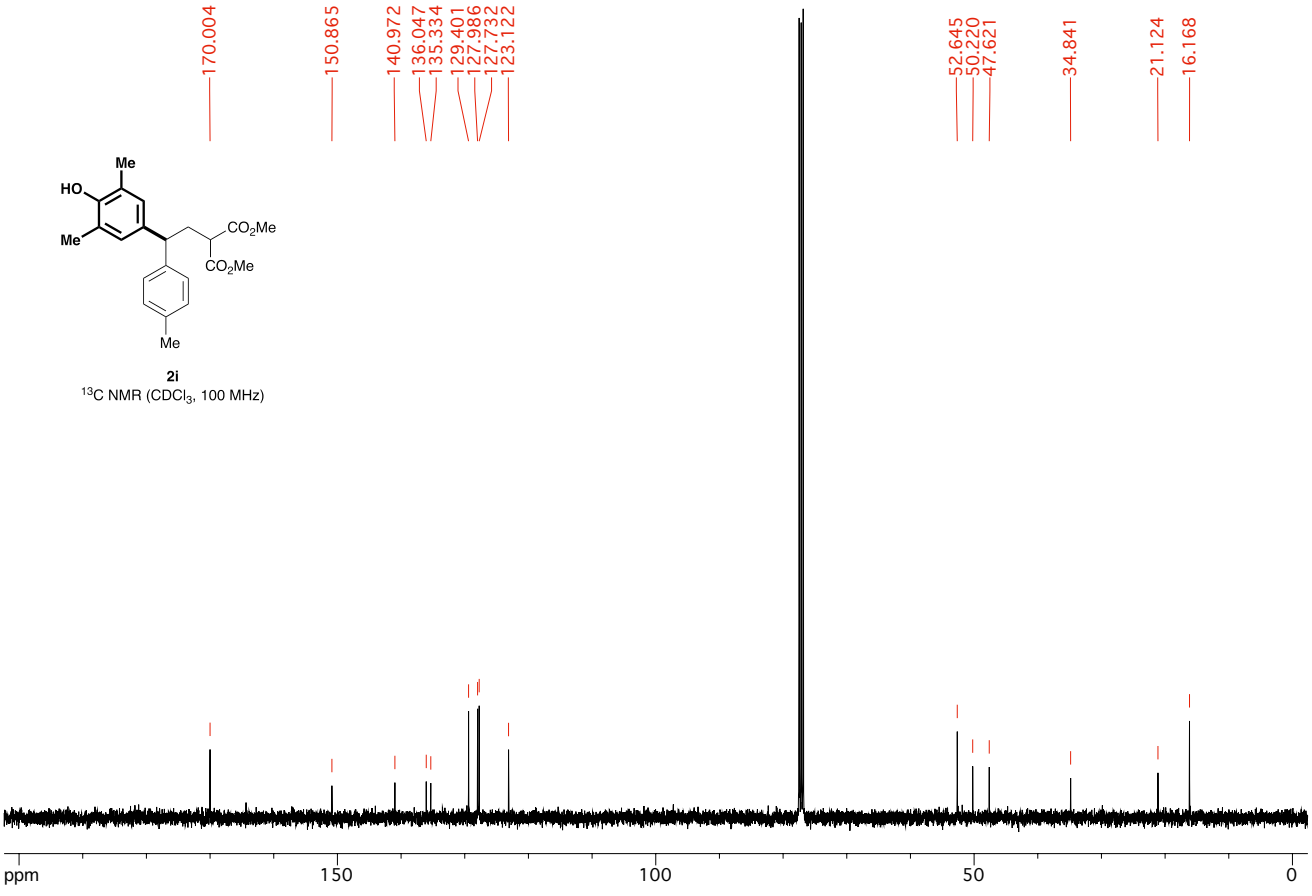
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2i
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ppm
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100
50
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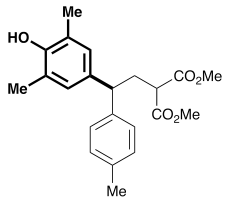
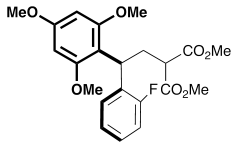
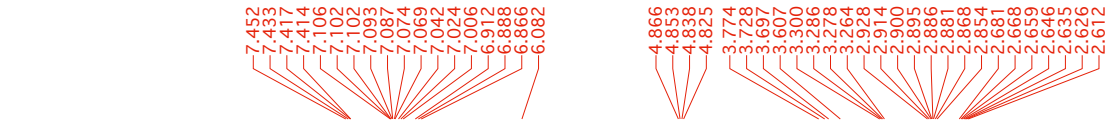
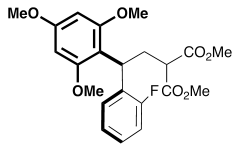


2i
^{1}H NMR ($CDCl_3$, 400 MHz)



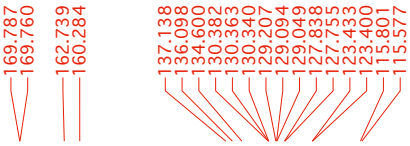
2j
^{13}C NMR ($CDCl_3$, 100 MHz)

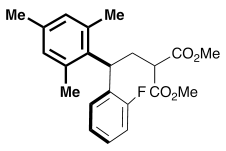




2j

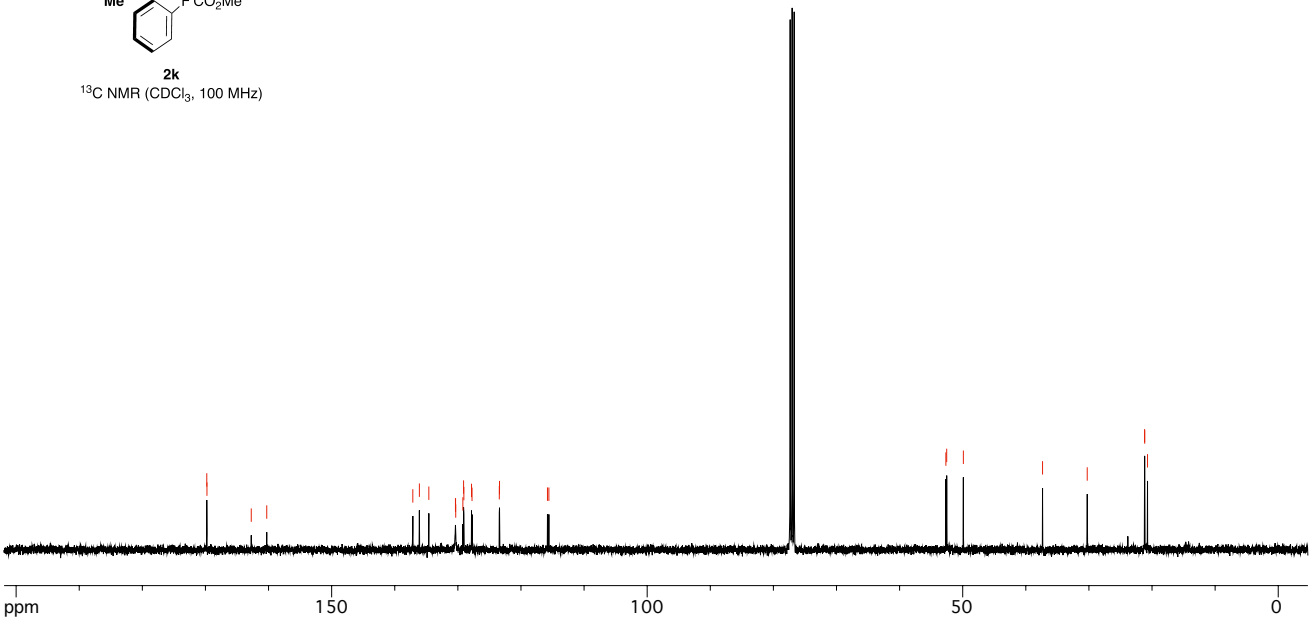
^{1}H NMR ($CDCl_3$, 400 MHz)

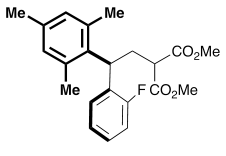




2k

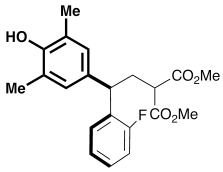
^{13}C NMR ($CDCl_3$, 100 MHz)





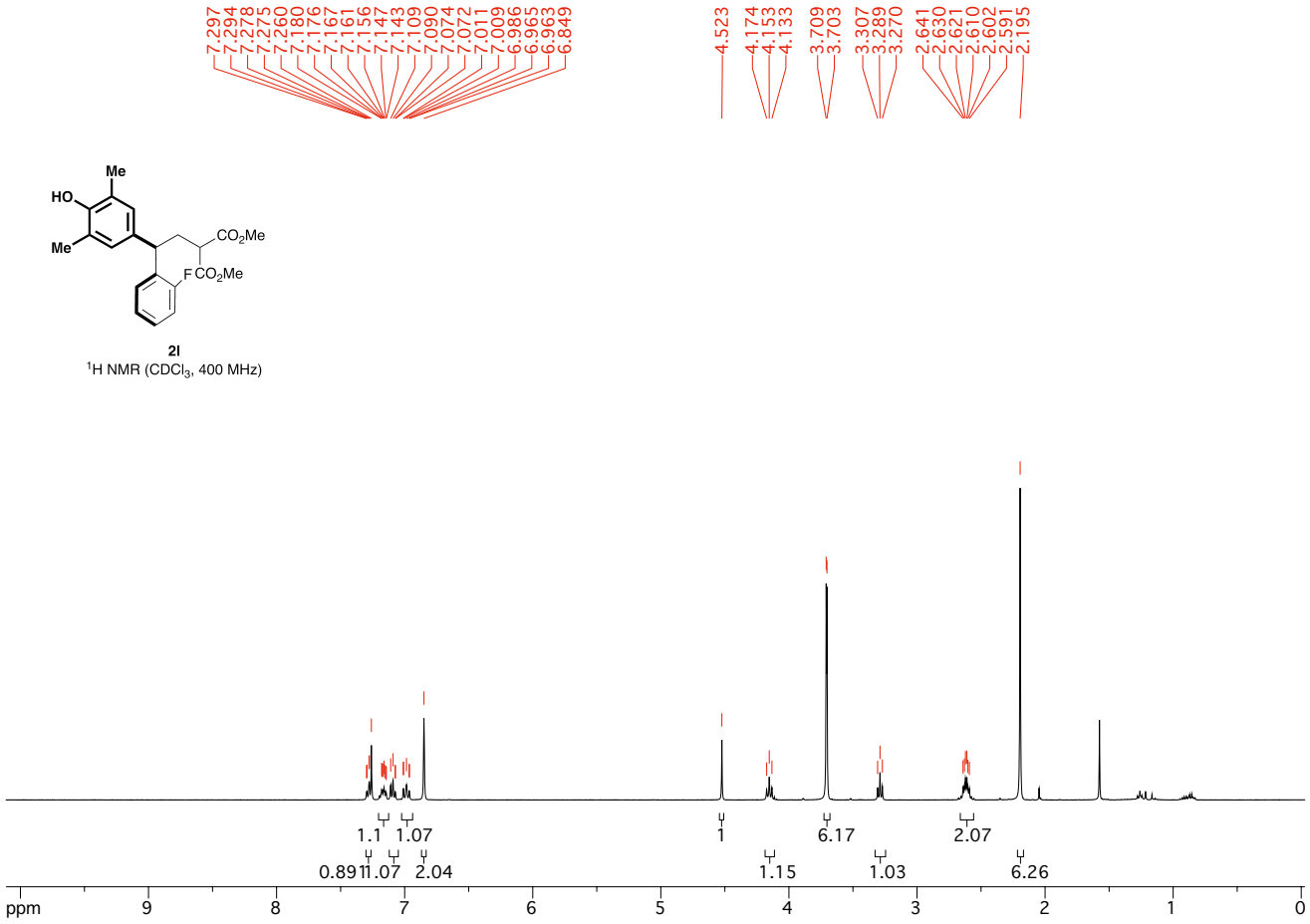
2k

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



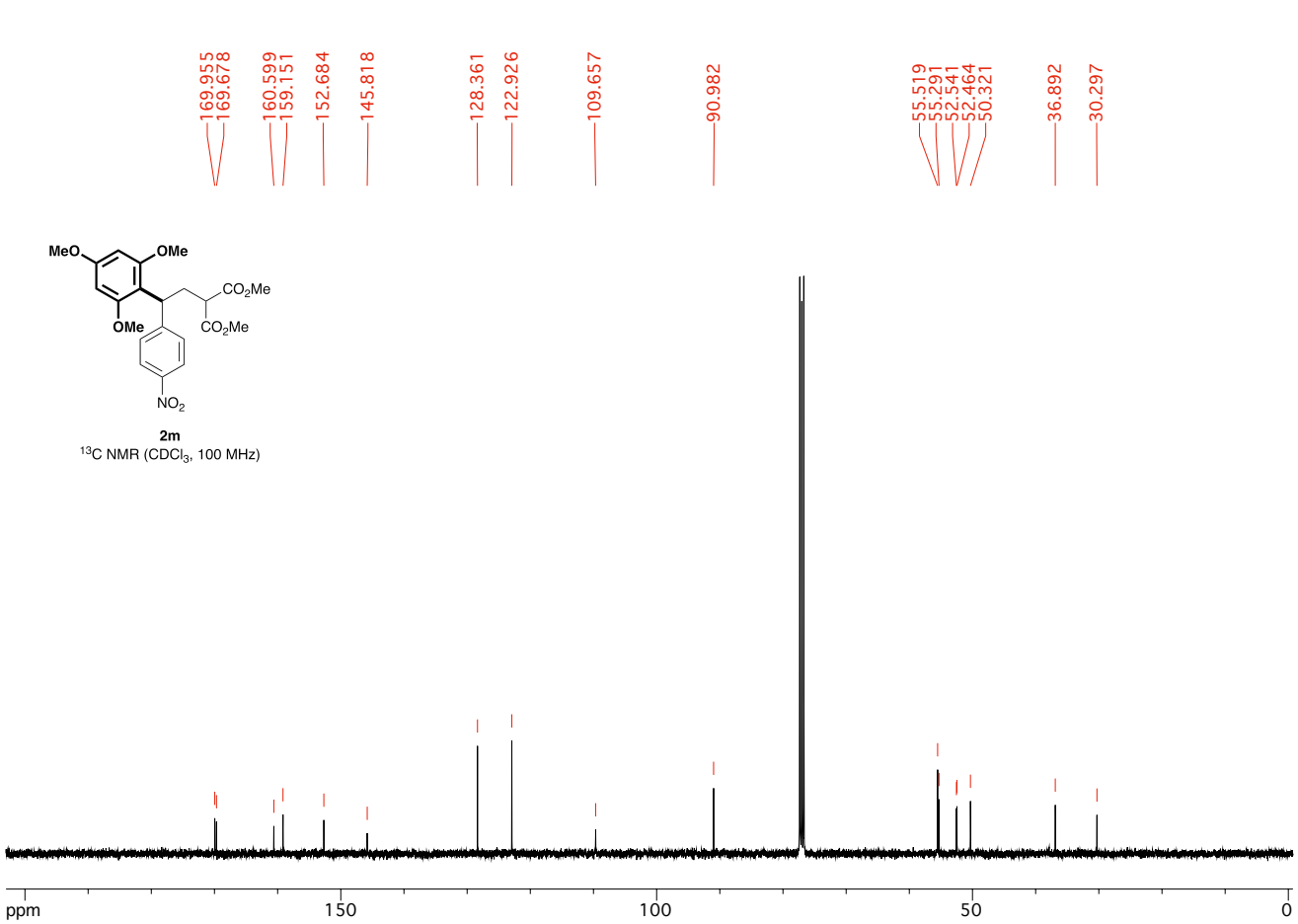
2l

^{13}C NMR ($CDCl_3$, 100 MHz)



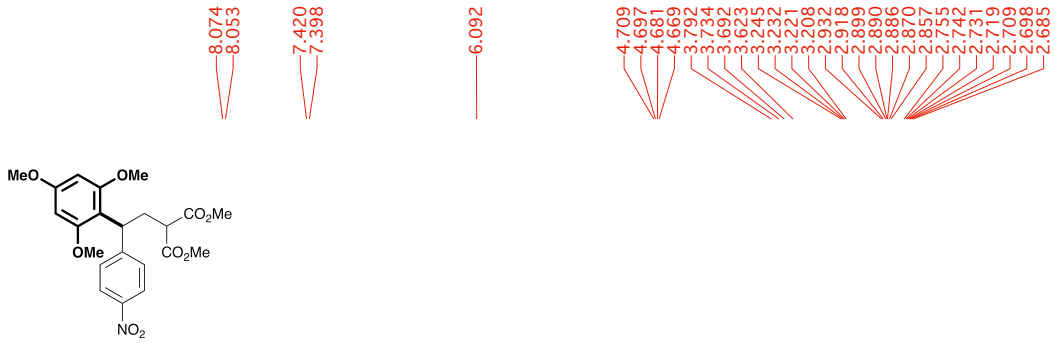
2l

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

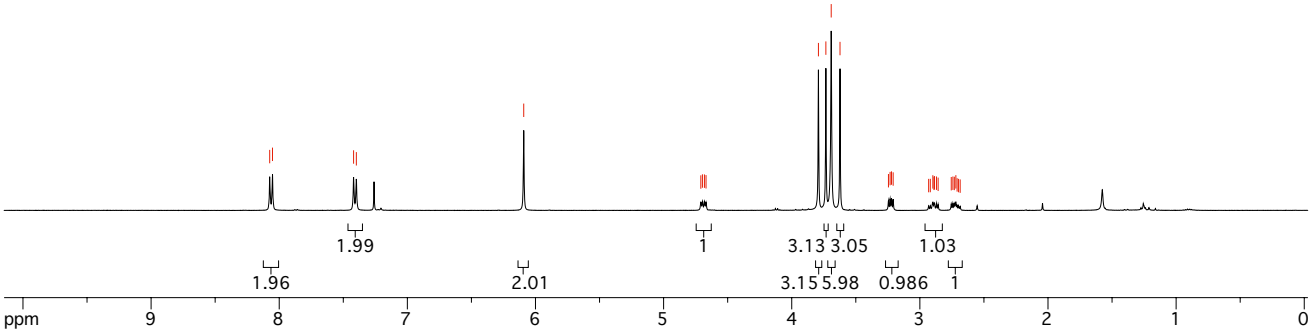


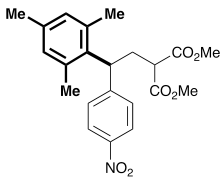
2m

^{13}C NMR ($CDCl_3$, 100 MHz)

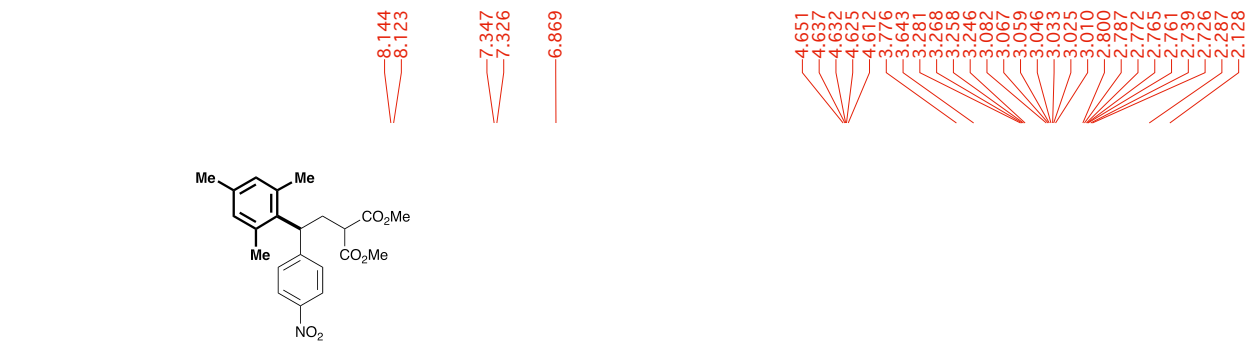


2m
^{1}H NMR ($CDCl_3$, 400 MHz)

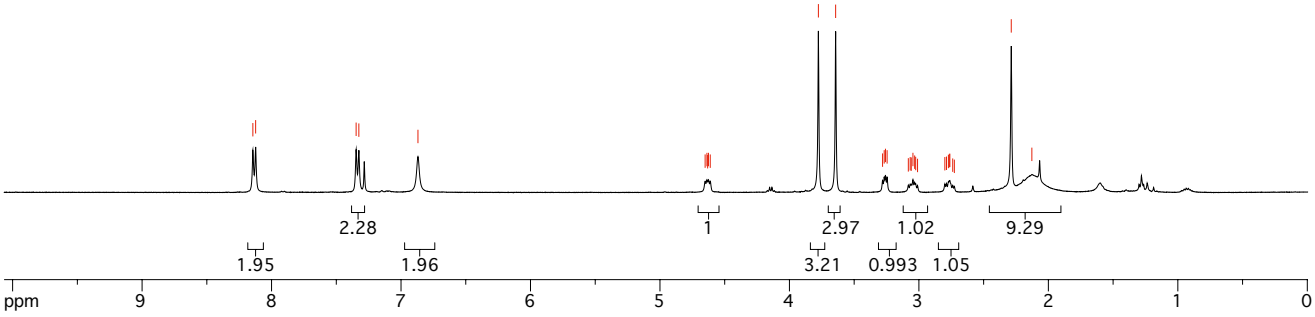


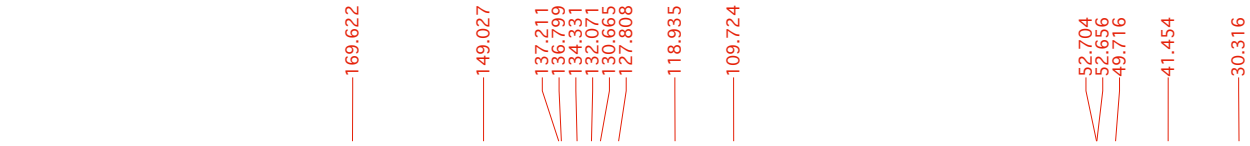


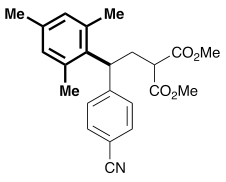
2n
^{13}C NMR ($CDCl_3$, 100 MHz)



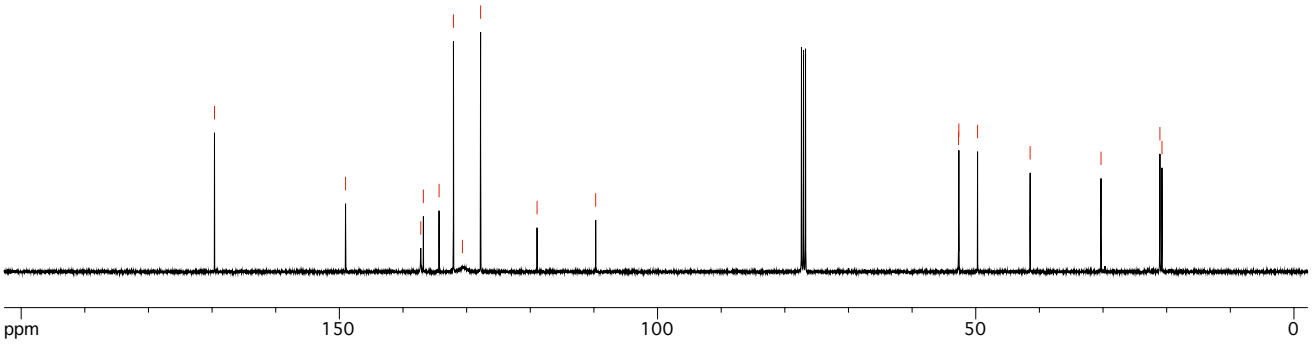
2n
^{1}H NMR ($CDCl_3$, 400 MHz)

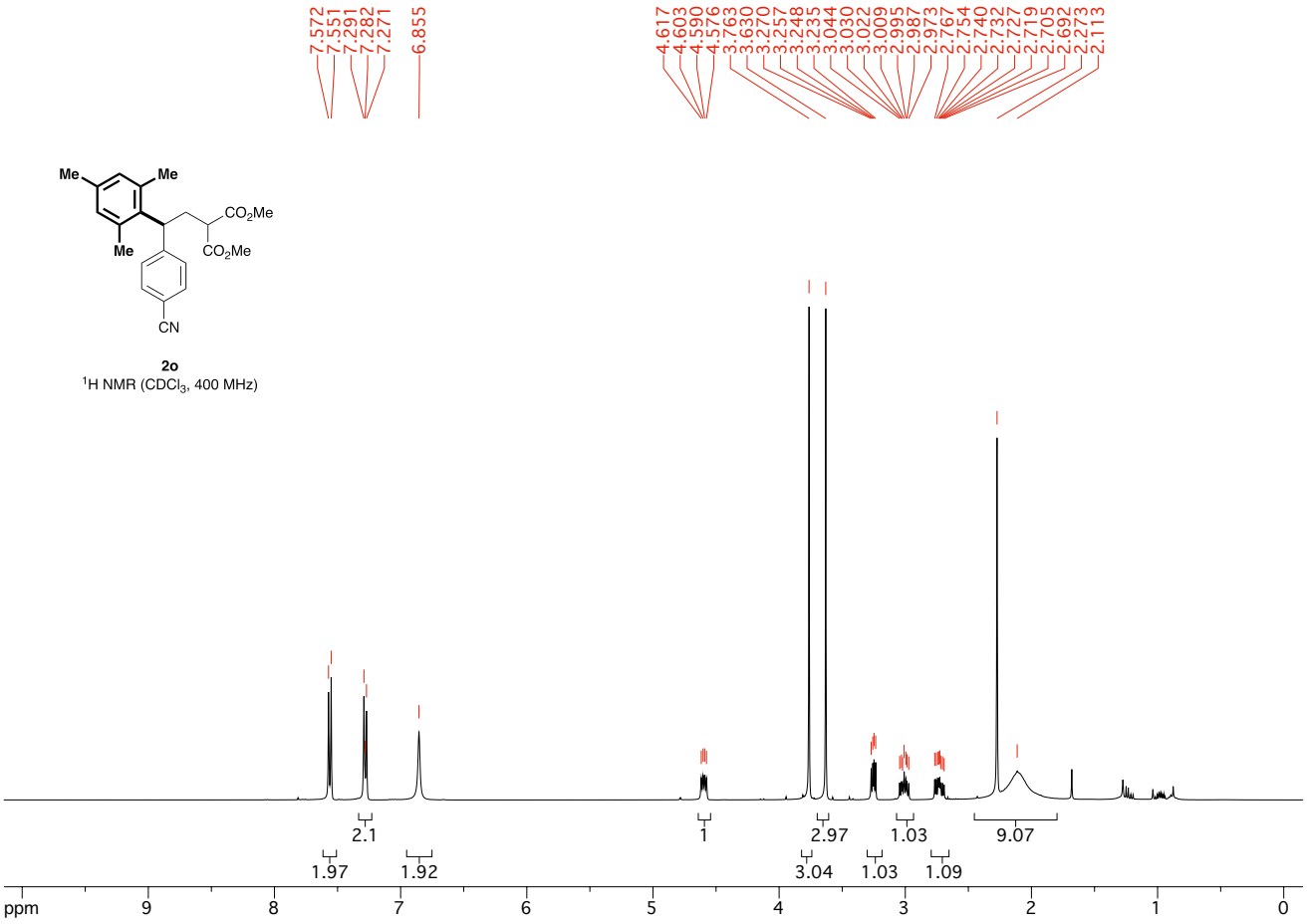




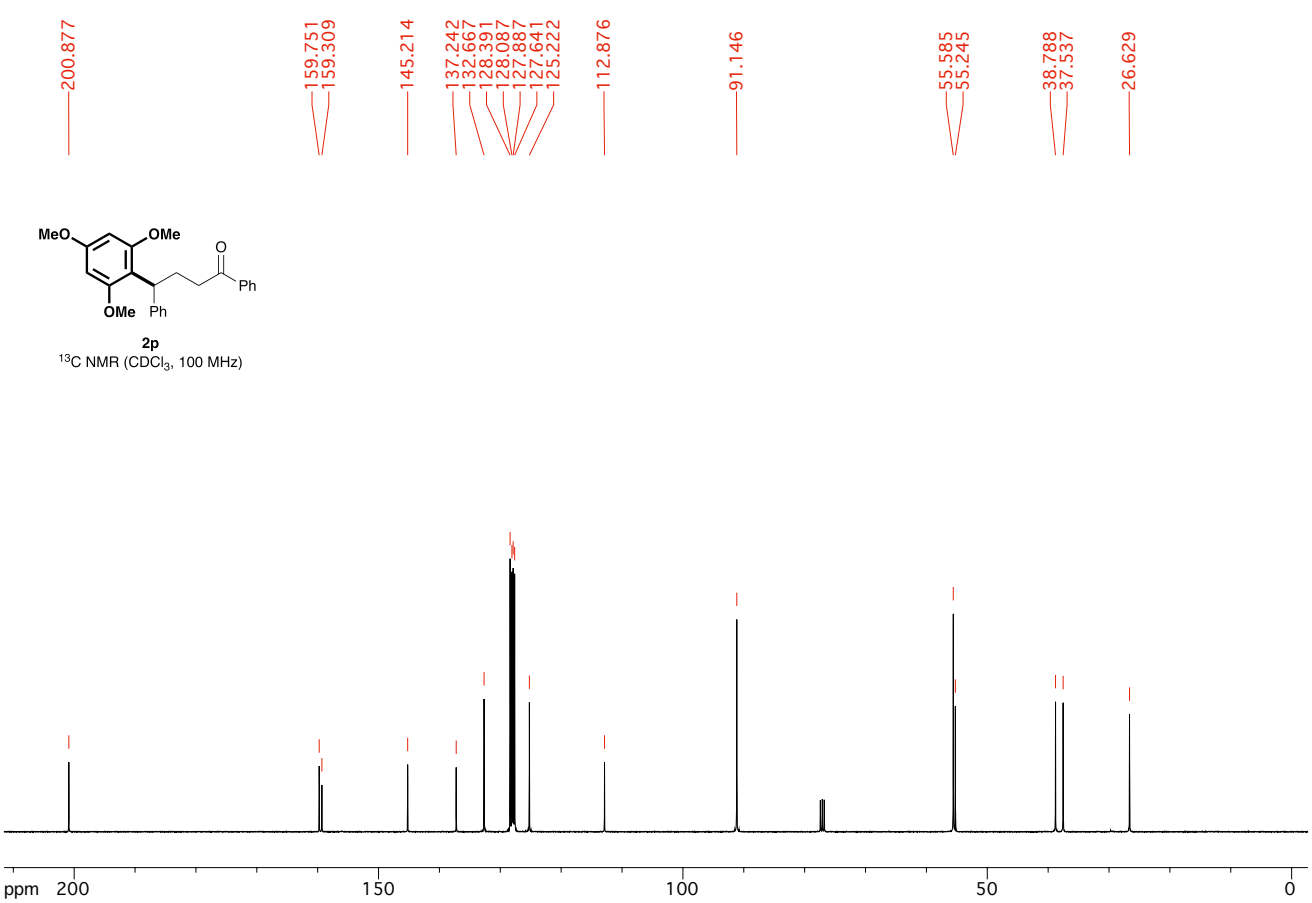


2o
^{13}C NMR ($CDCl_3$, 100 MHz)

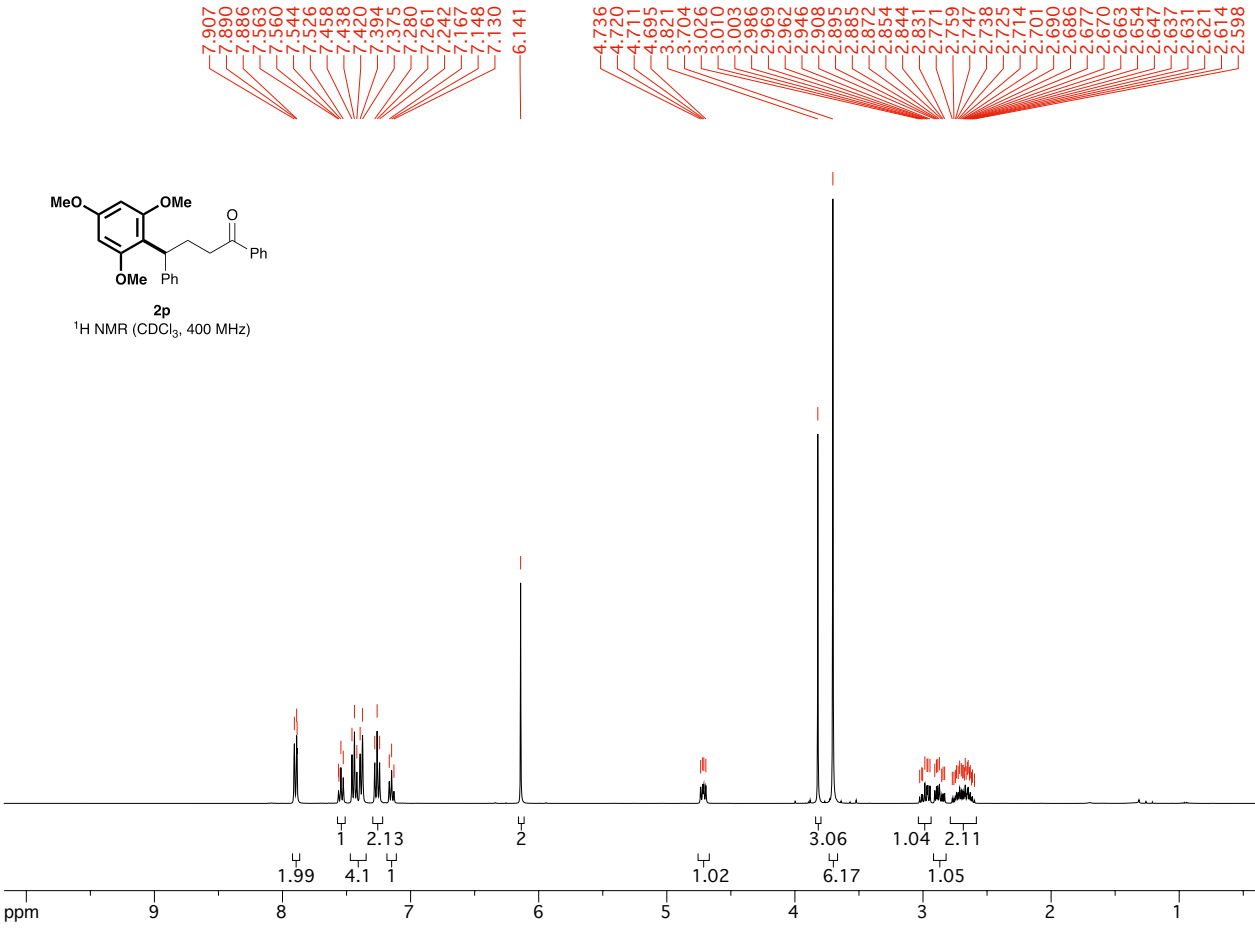


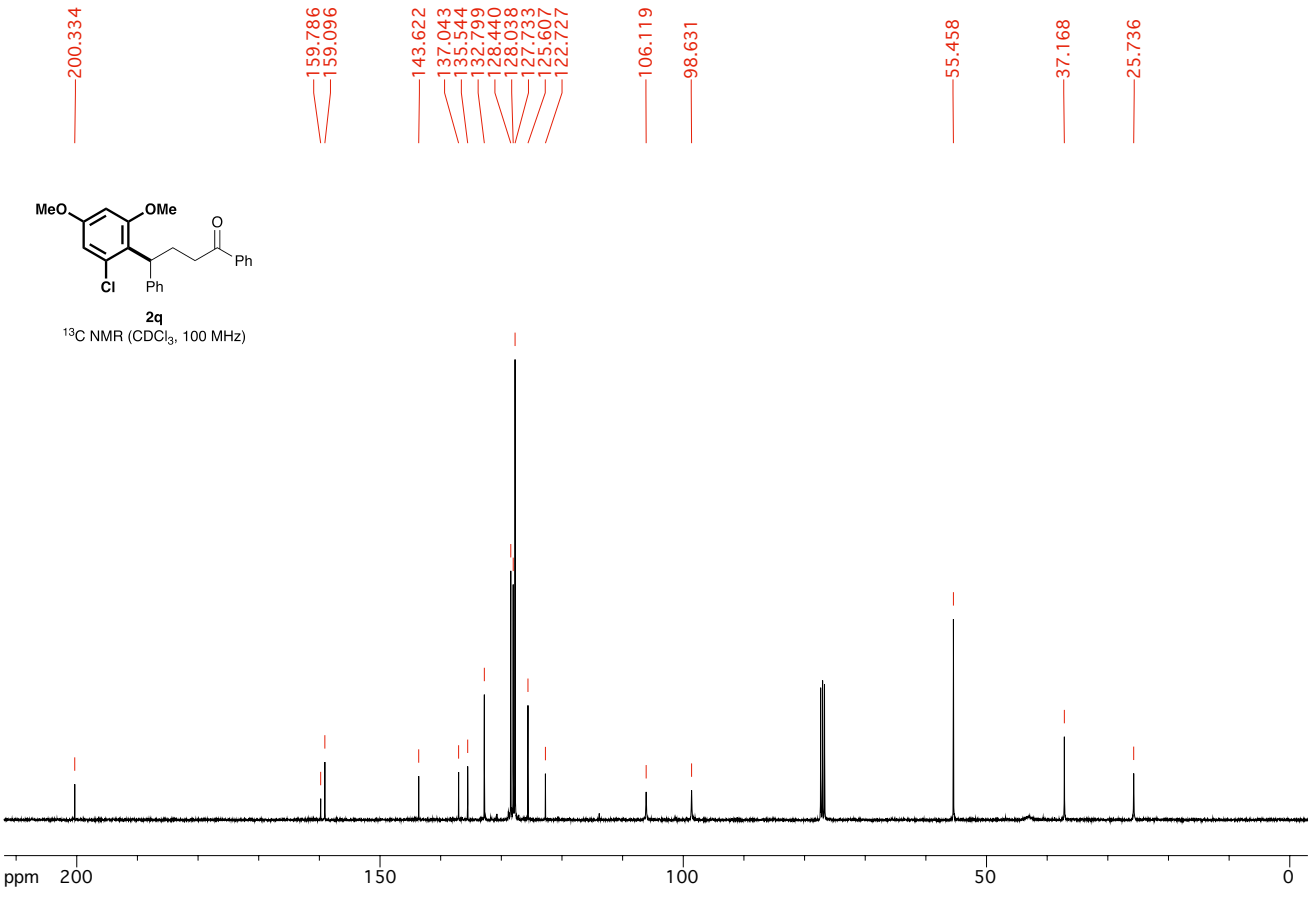


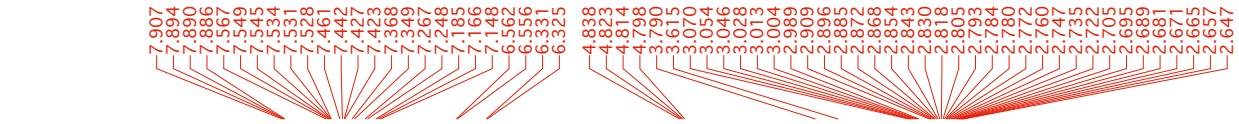
2o
^{1}H NMR ($CDCl_3$, 400 MHz)

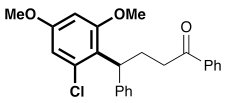


2p
^{13}C NMR ($CDCl_3$, 100 MHz)


7.907
7.890
7.886
7.563
7.560
7.544
7.526
7.458
7.438
7.420
7.394
7.375
7.280
7.261
7.242
7.167
7.148
7.130
6.141
4.736
4.720
4.711
4.695
3.821
3.704
3.026
3.010
3.003
2.986
2.969
2.962
2.946
2.908
2.895
2.885
2.872
2.854
2.844
2.831
2.771
2.759
2.747
2.738
2.725
2.714
2.701
2.690
2.686
2.677
2.670
2.663
2.654
2.647
2.637
2.631
2.621
2.614
2.598
MeO
OMe
OMe
Ph
O
Ph
2p
1H NMR (CDCl3, 400 MHz)
1
2.13
2
3.06
1.04
2.11
1.99
4.1
1
1.02
6.17
1.05
ppm
9
8
7
6
5
4
3
2
1
0

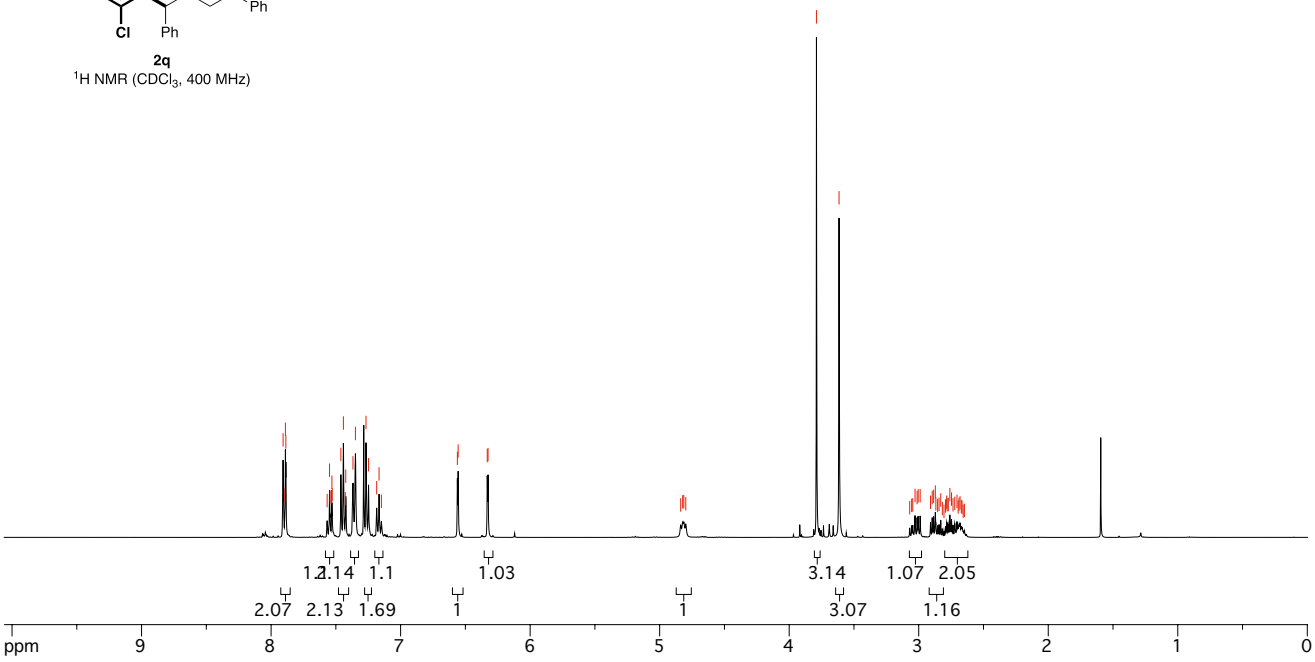

200.334
159.786
159.096
143.622
137.043
135.544
132.799
128.440
128.038
127.733
125.607
122.727
106.119
98.631
55.458
37.168
25.736
MeO
OMe
Cl
Ph
O
Ph
2q
13C NMR (CDCl3, 100 MHz)
ppm
200
150
100
50
0

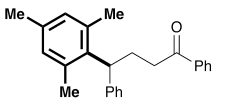




2q

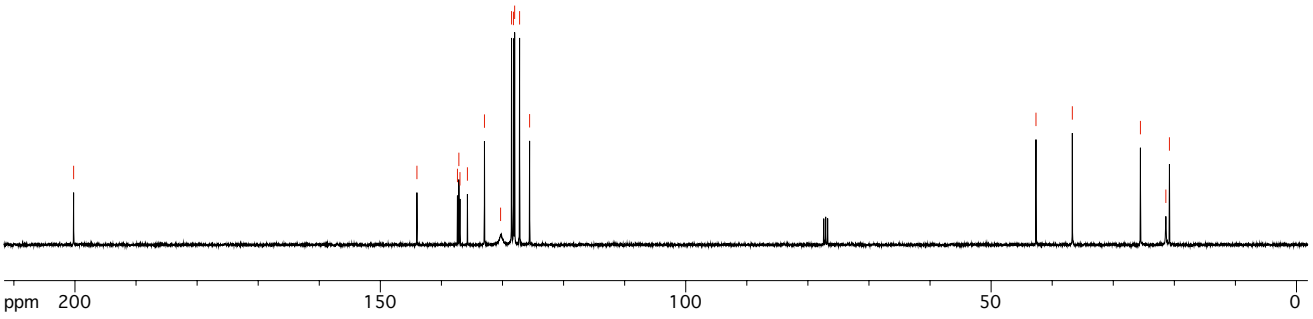
^{1}H NMR ($CDCl_3$, 400 MHz)

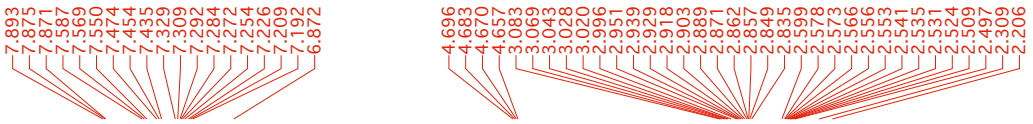


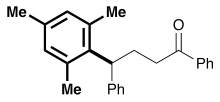


2r

^{13}C NMR ($CDCl_3$, 100 MHz)

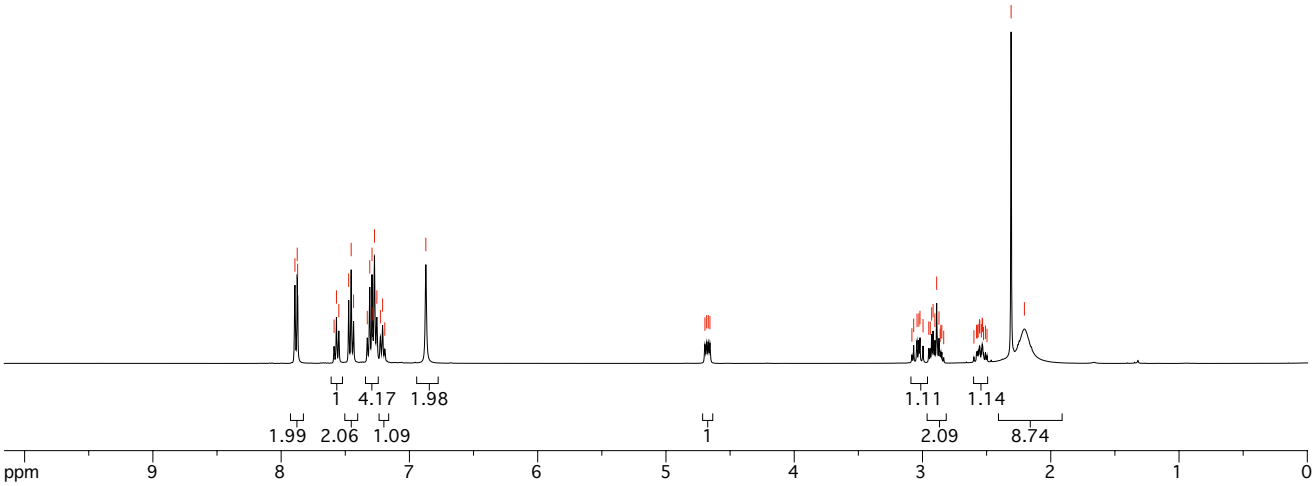


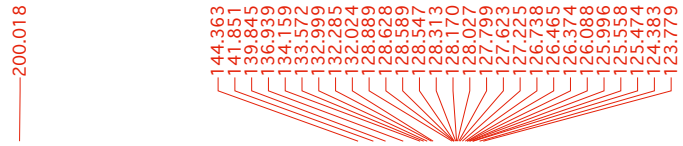


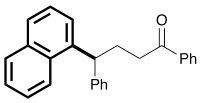


2r

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

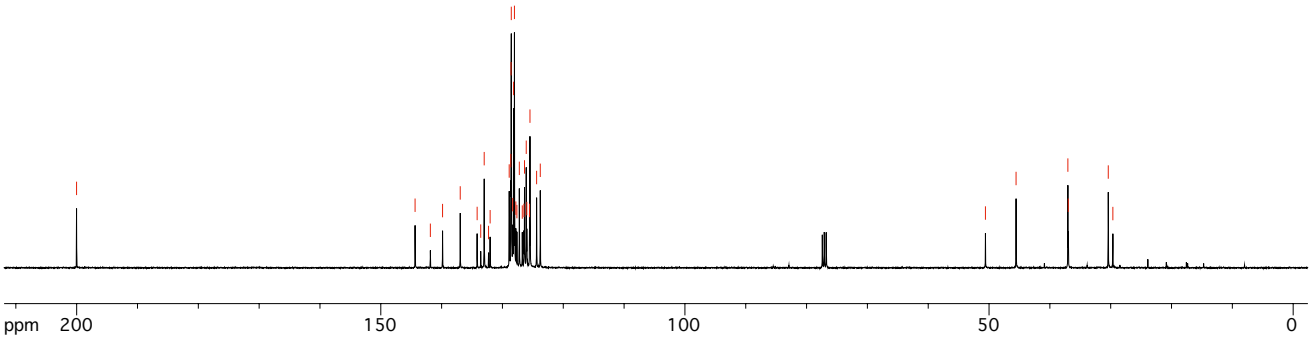


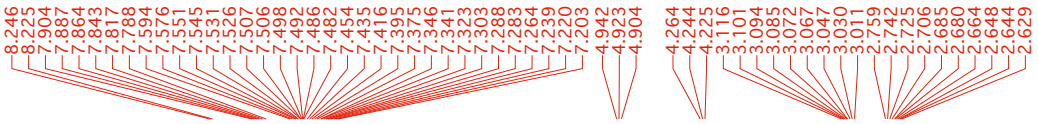


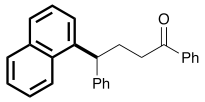


2s (plus regioisomer)

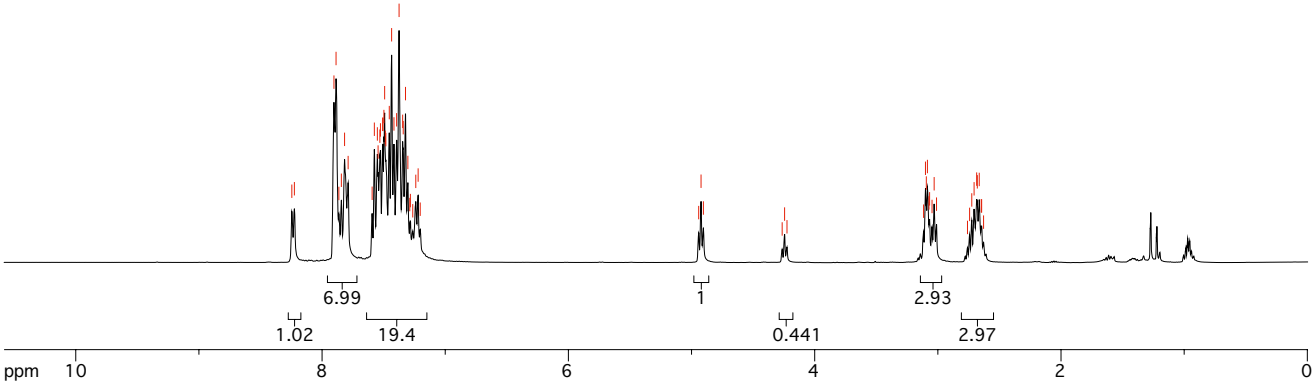
^{13}C NMR ($CDCl_3$, 100 MHz)

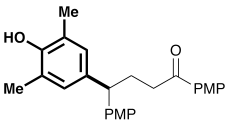




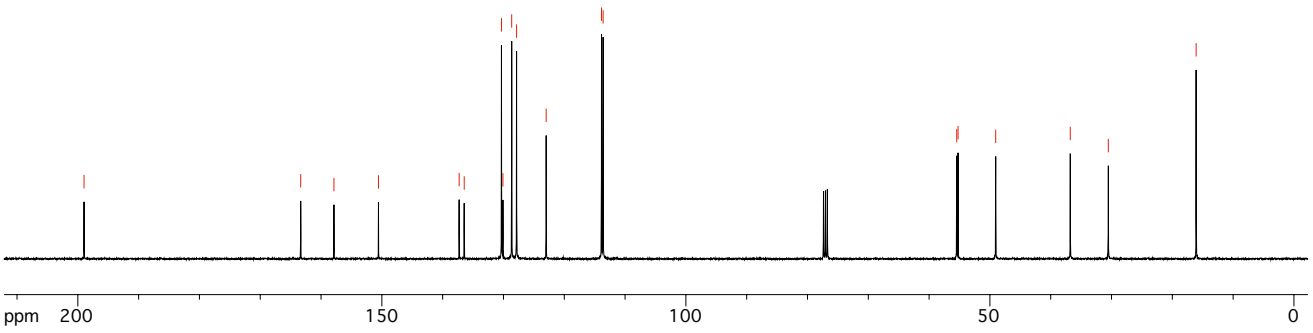


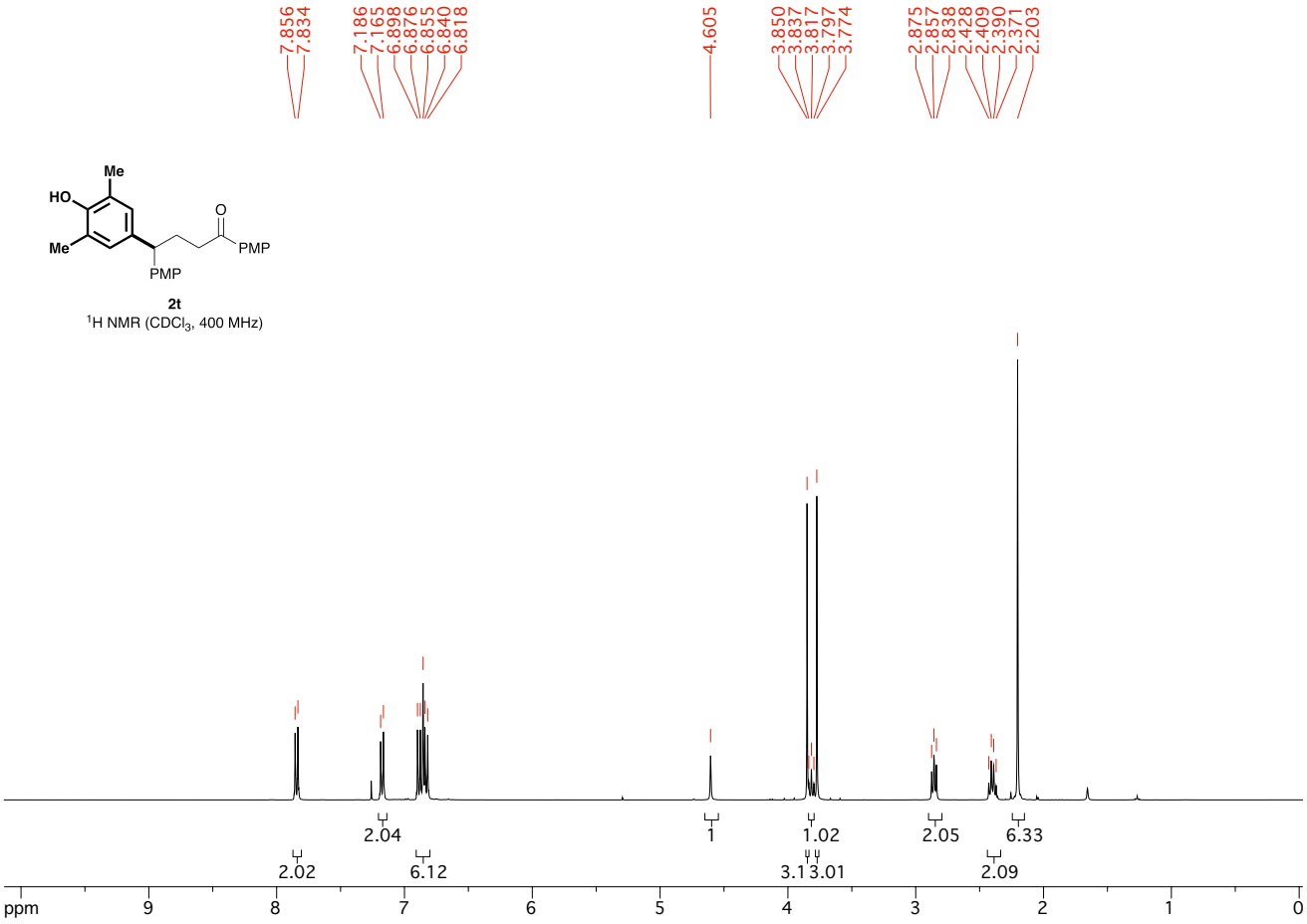
2s (plus regioisomer)
^{1}H NMR ($CDCl_3$, 400 MHz)





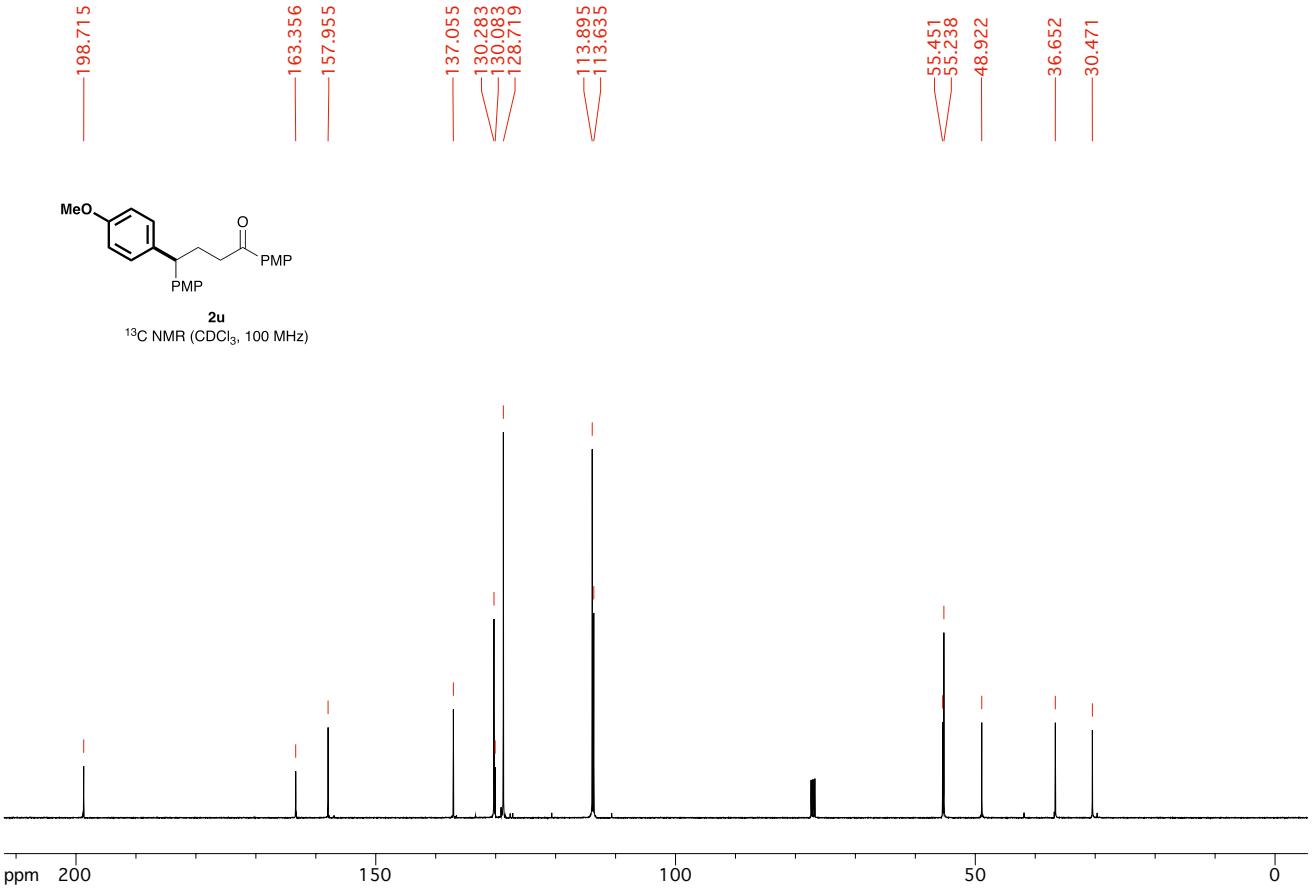
2t
^{13}C NMR ($CDCl_3$, 100 MHz)





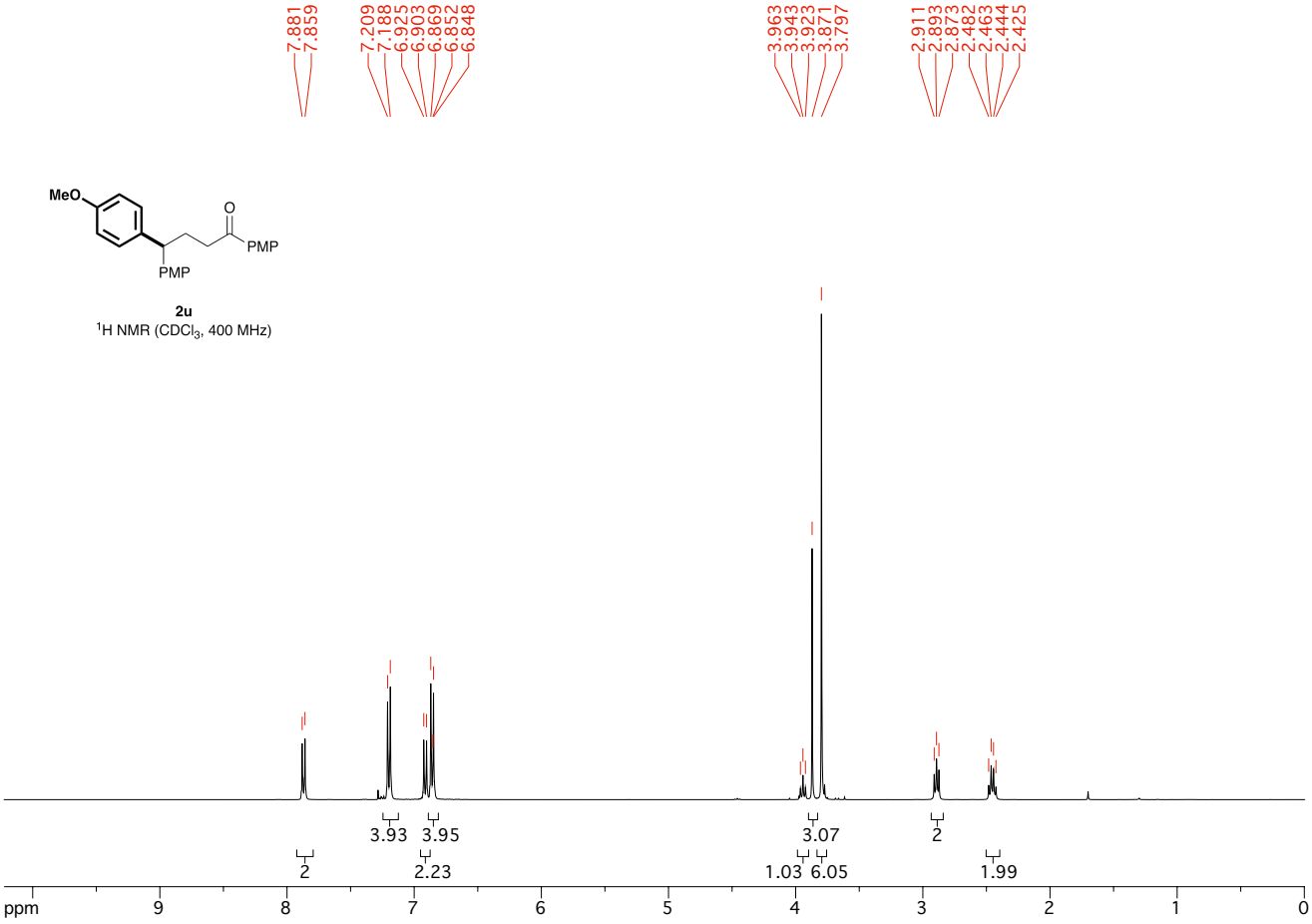
2t

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



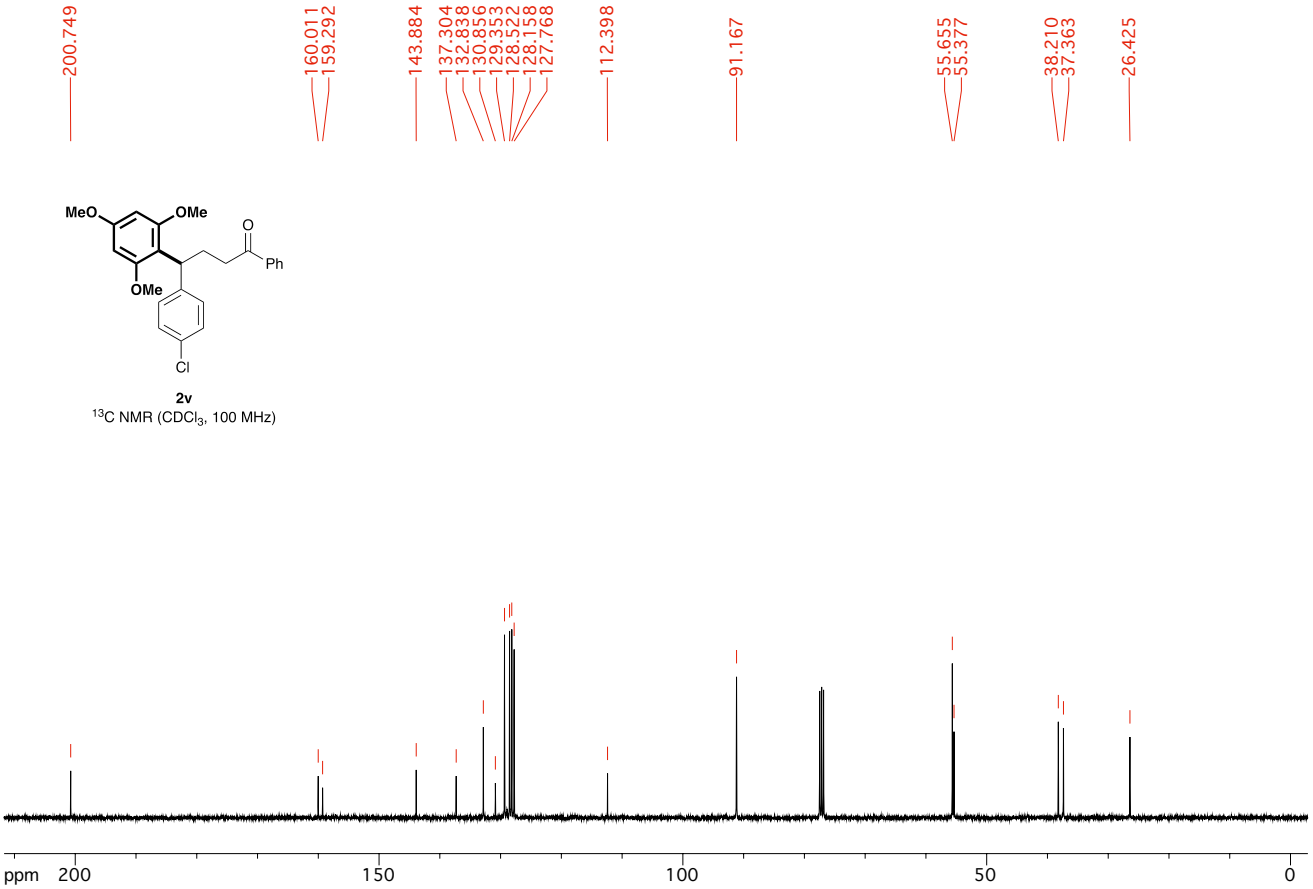
2u

^{13}C NMR ($CDCl_3$, 100 MHz)



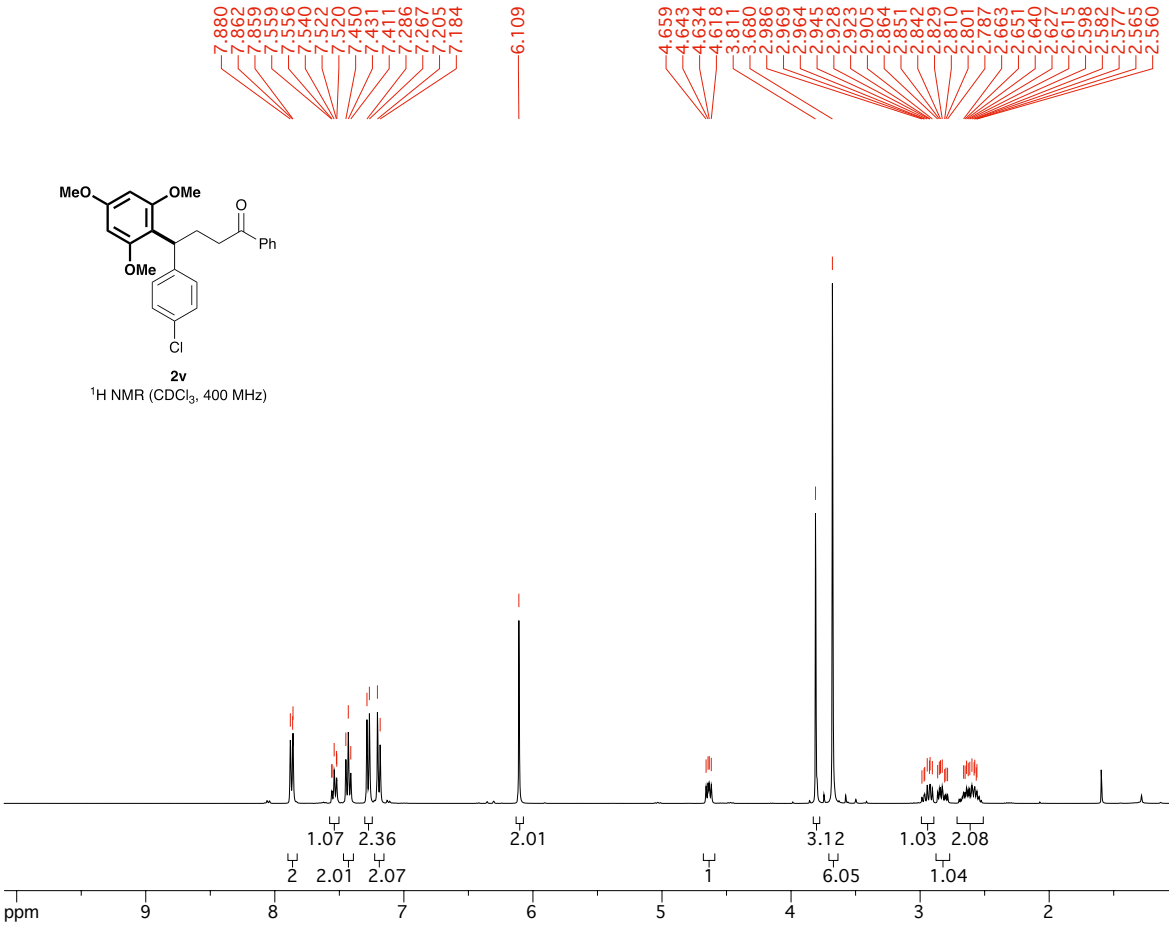
2u

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

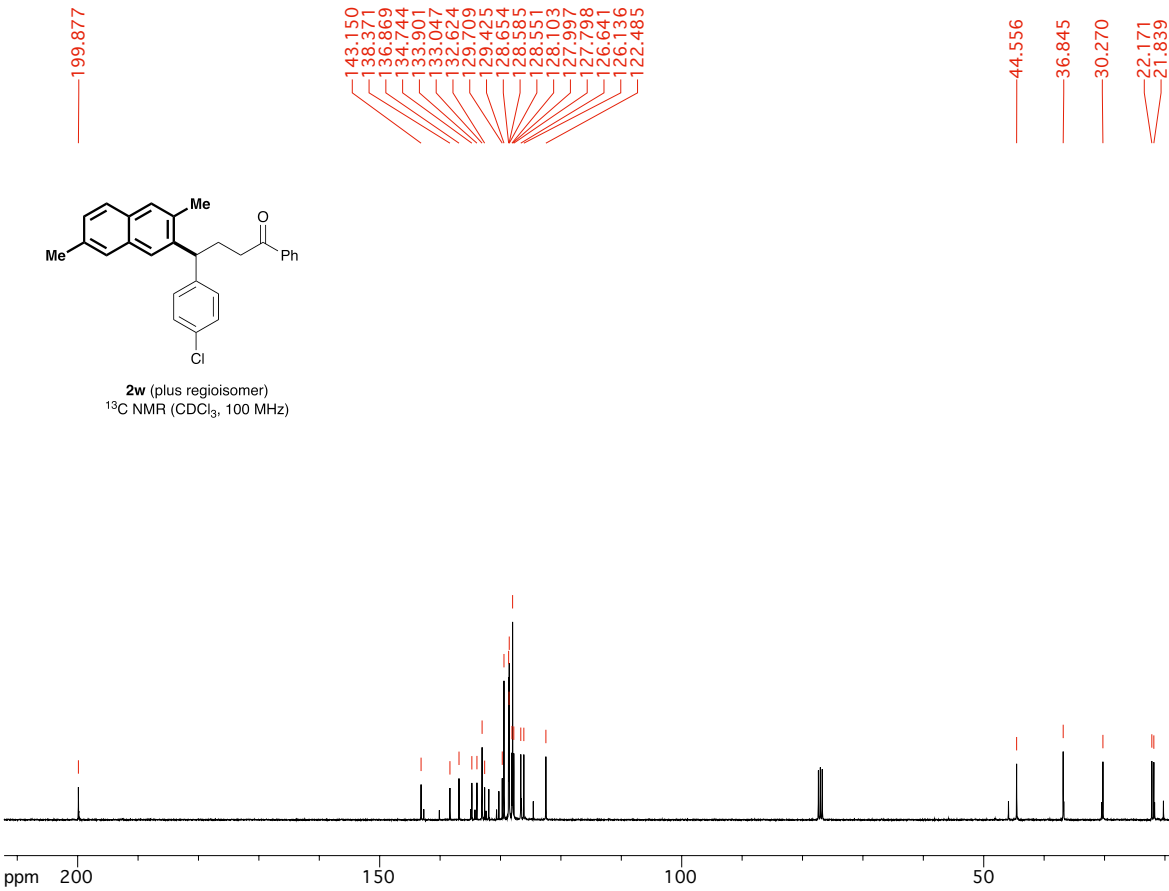


2v

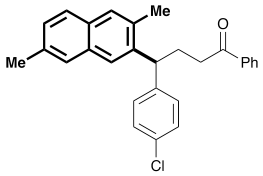
^{13}C NMR ($CDCl_3$, 100 MHz)



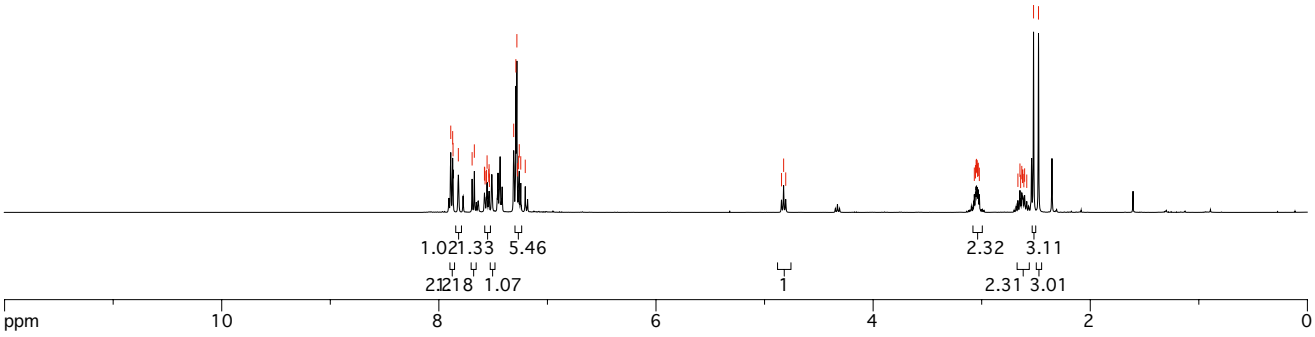
2v
^{1}H NMR ($CDCl_3$, 400 MHz)

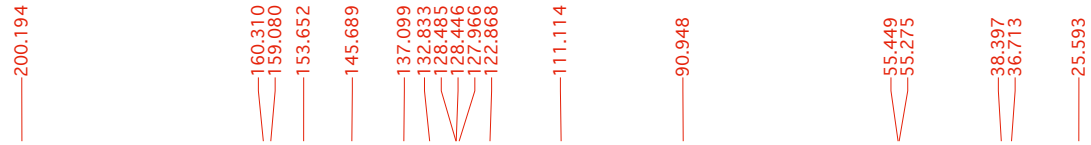


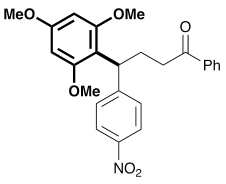
2w (plus regioisomer)
^{13}C NMR ($CDCl_3$, 100 MHz)



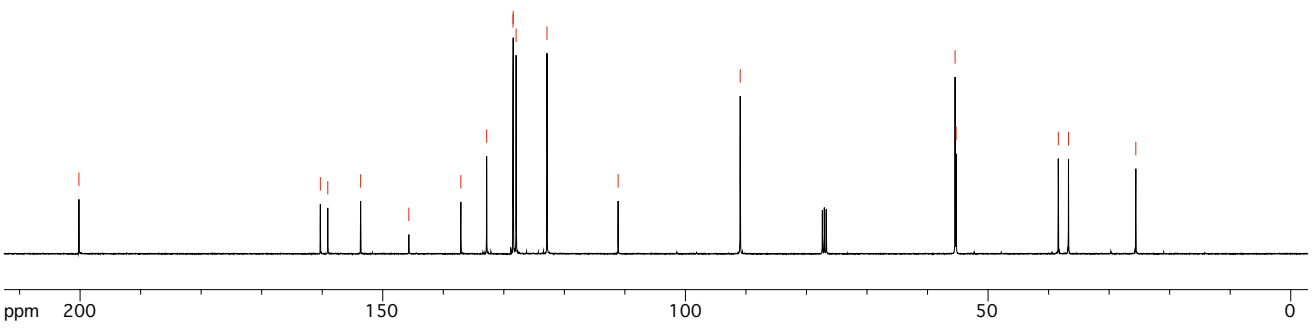
2w (plus regioisomer)
^{1}H NMR ($CDCl_3$, 400 MHz)

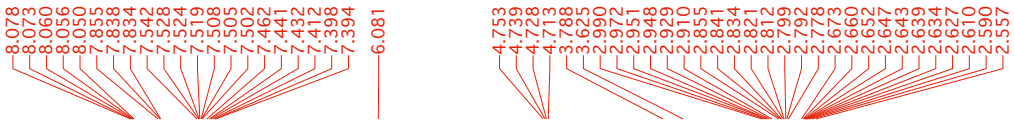


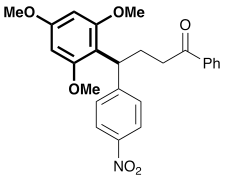




2x
^{13}C NMR ($CDCl_3$, 100 MHz)

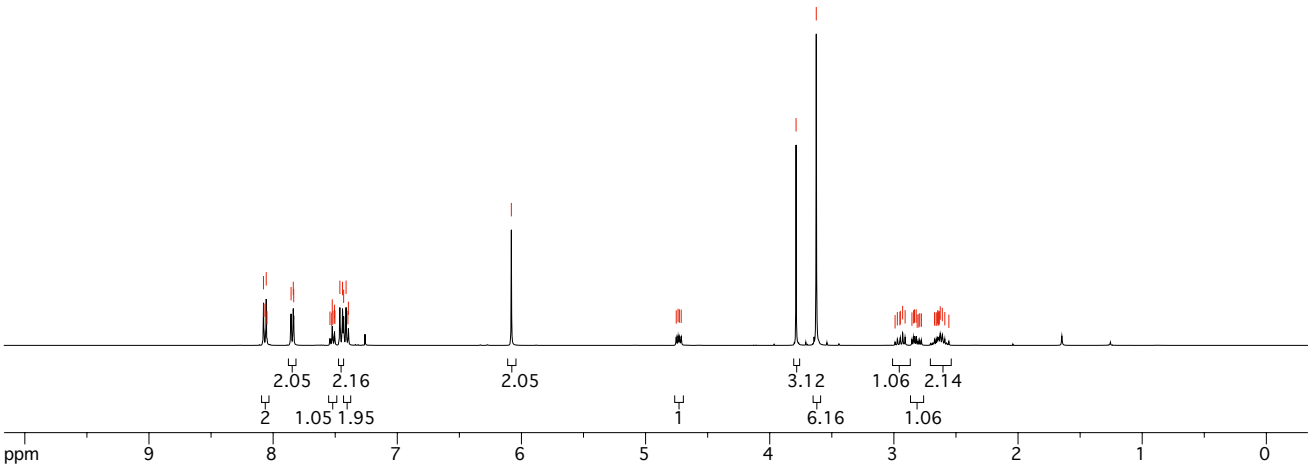


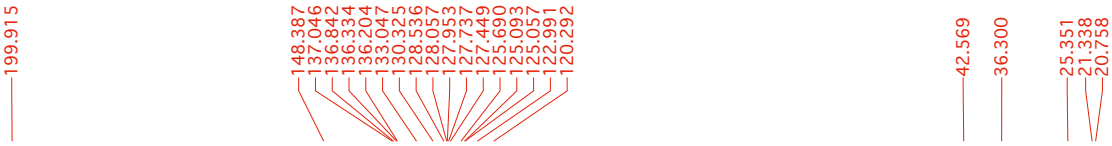


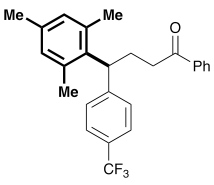


2x

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

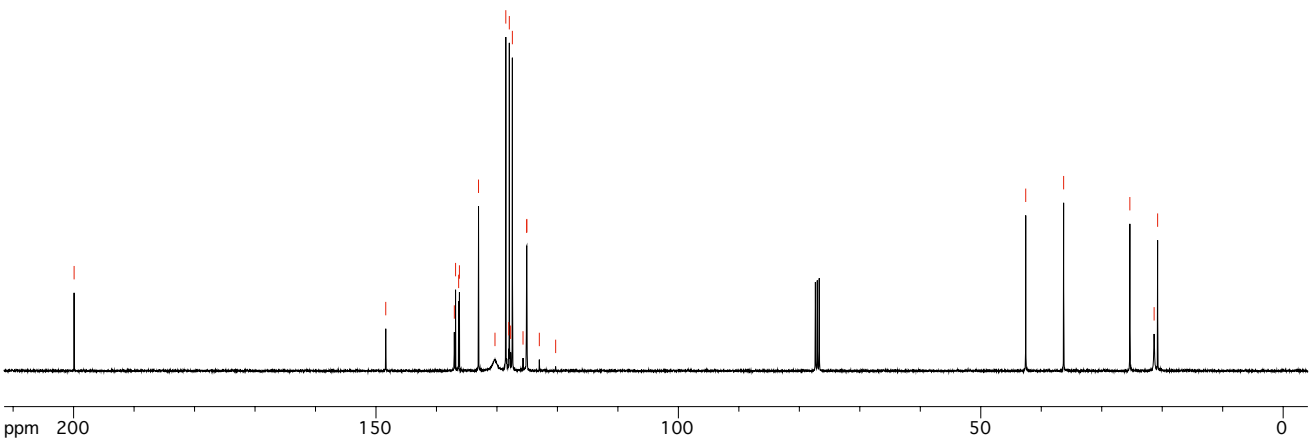


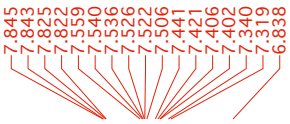


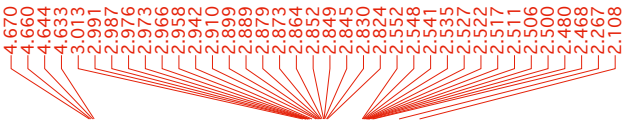


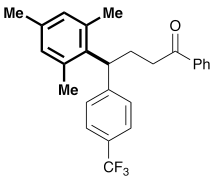
2y

^{13}C NMR ($CDCl_3$, 100 MHz)

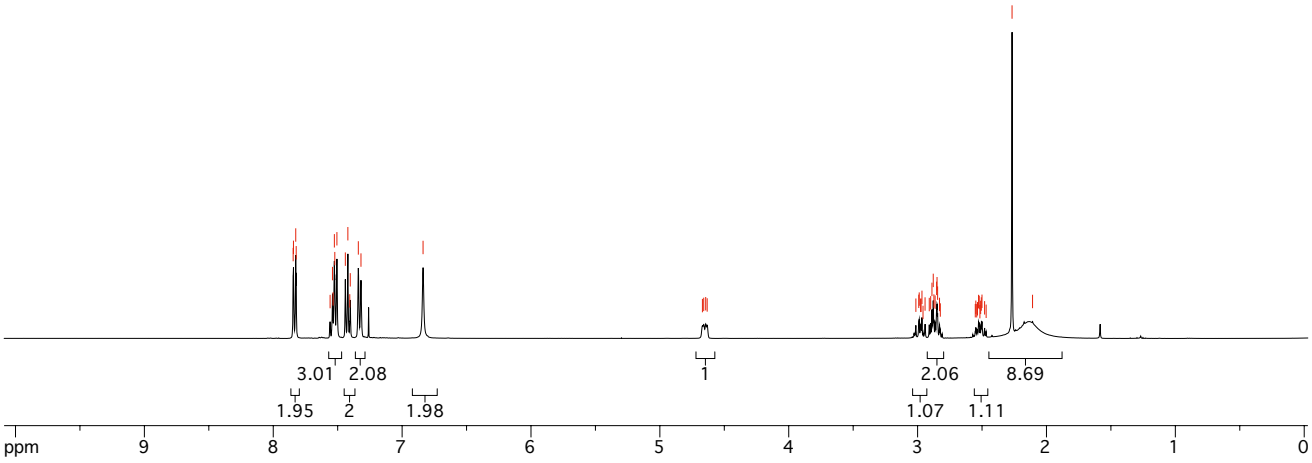


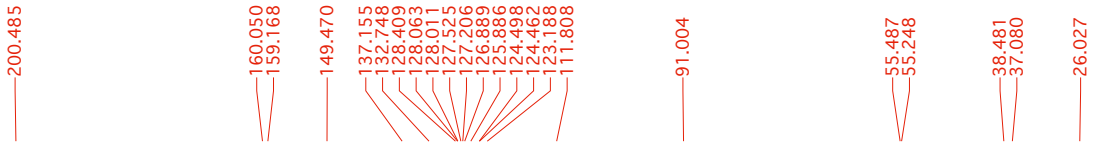


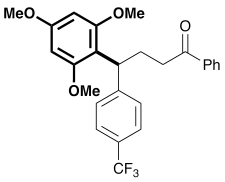




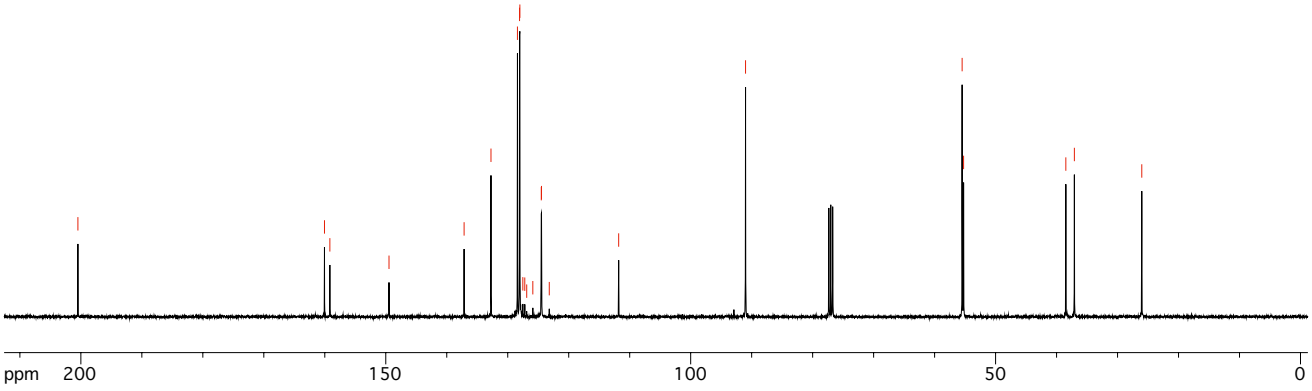
2y
^{1}H NMR ($CDCl_3$, 400 MHz)

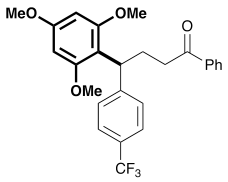






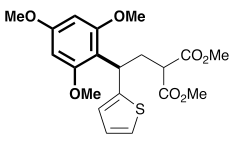
2z
^{13}C NMR ($CDCl_3$, 100 MHz)





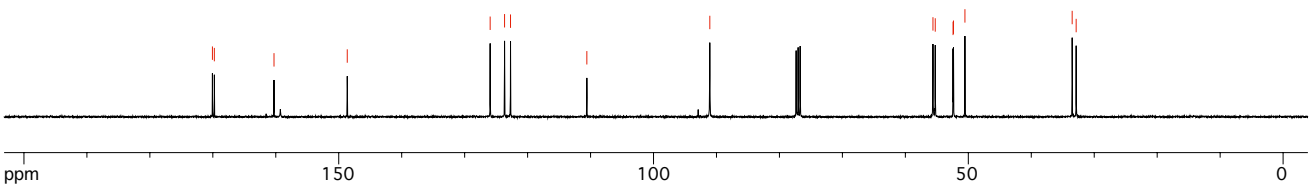
2z

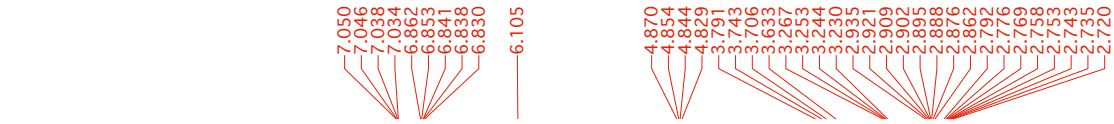
^{1}H NMR ($CDCl_3$, 400 MHz)

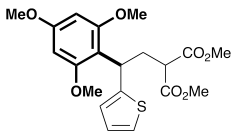


3a

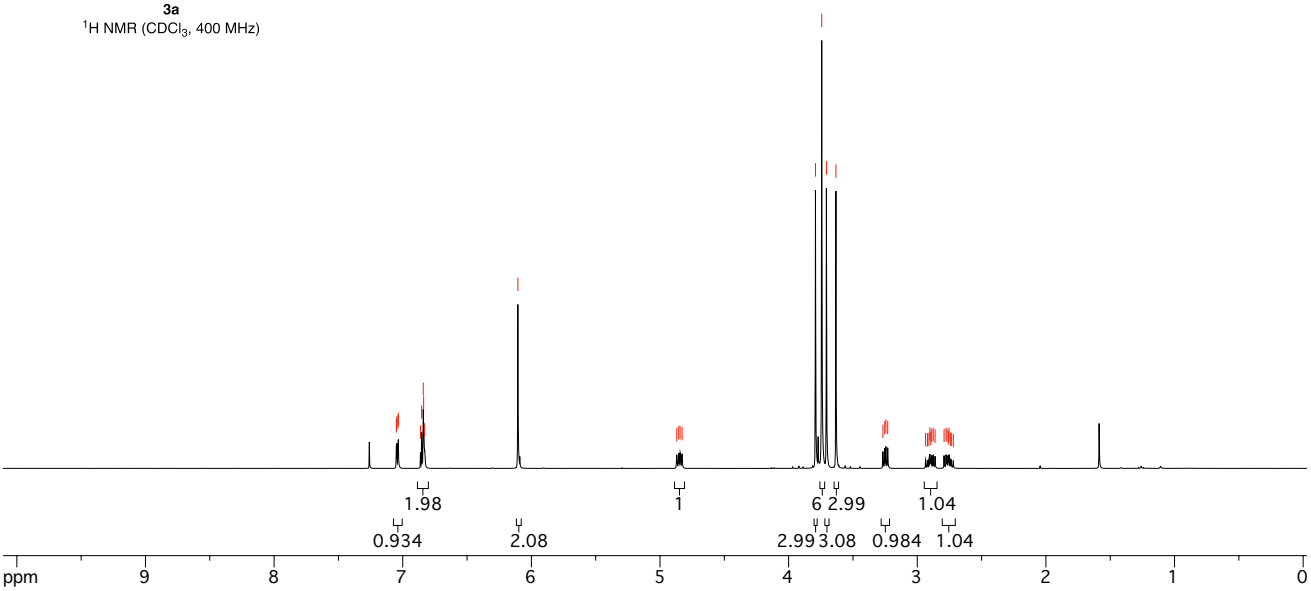
^{13}C NMR ($CDCl_3$, 100 MHz)

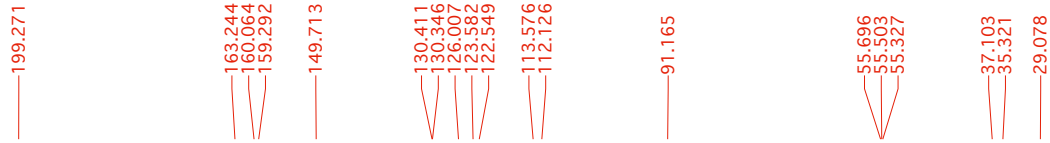


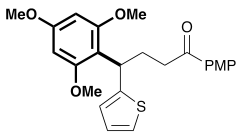




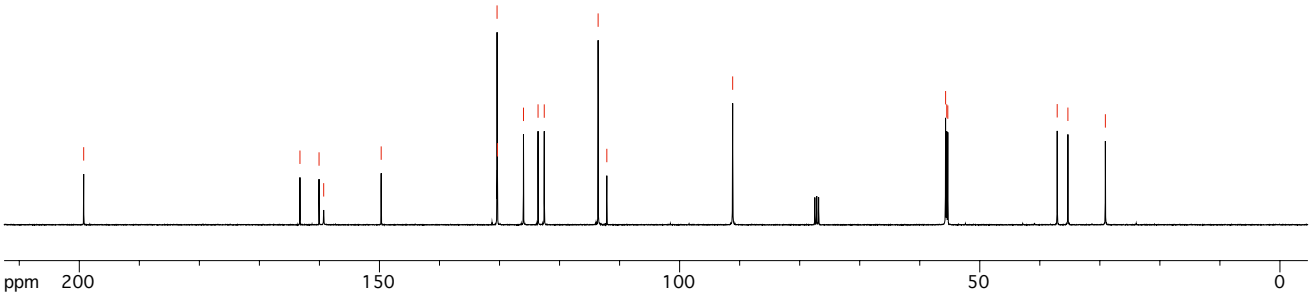
3a
^{1}H NMR ($CDCl_3$, 400 MHz)

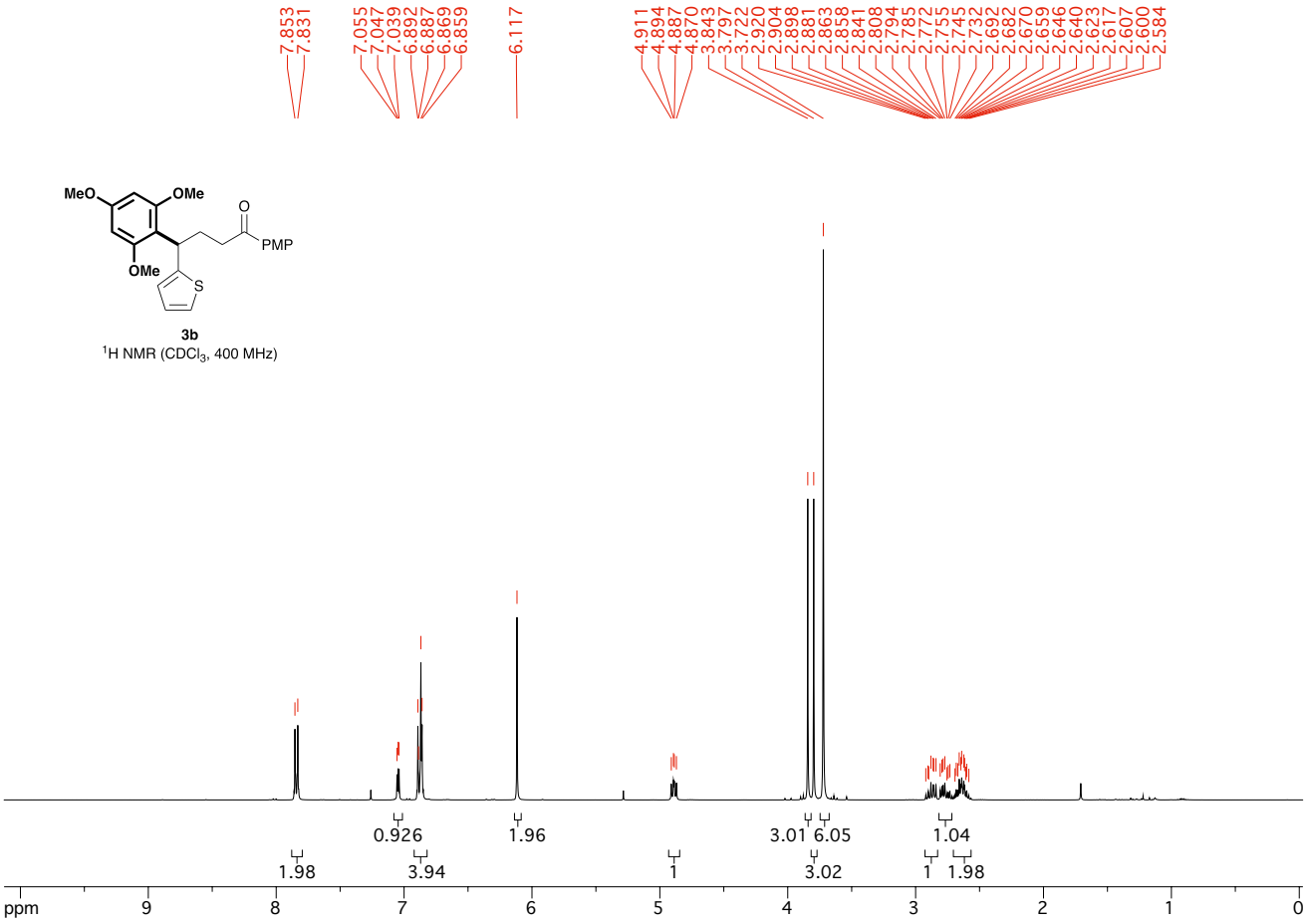




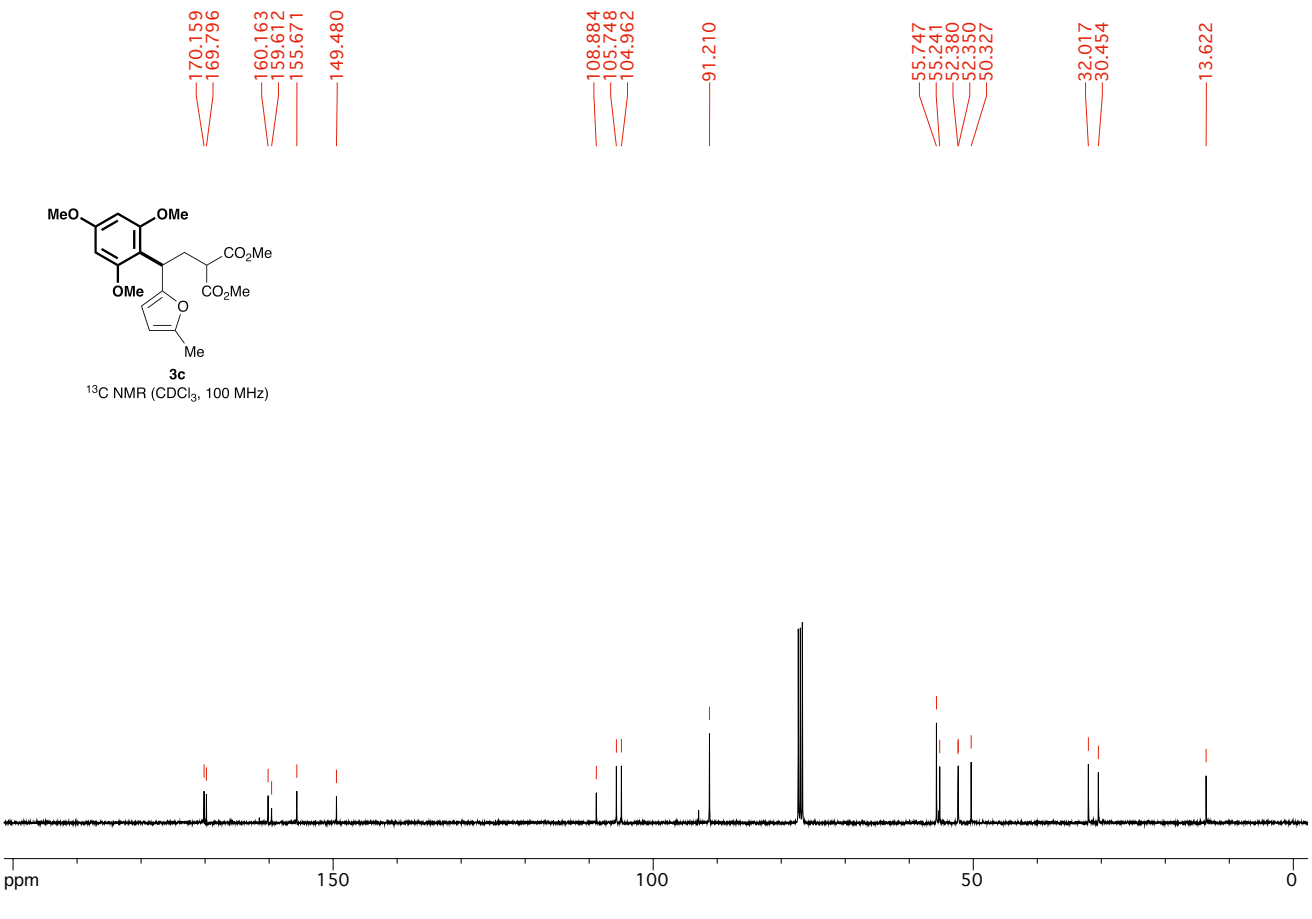


3b
^{13}C NMR ($CDCl_3$, 100 MHz)

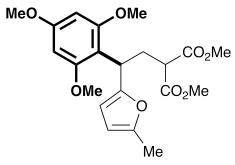




3b
^{1}H NMR ($CDCl_3$, 400 MHz)

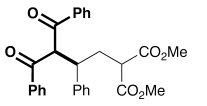


3c
^{13}C NMR ($CDCl_3$, 100 MHz)



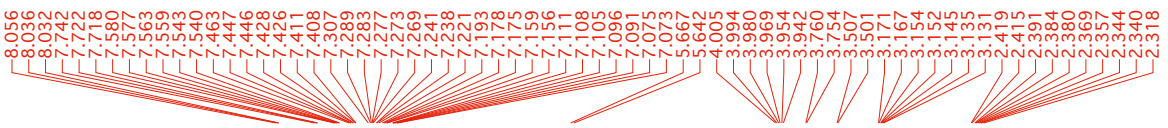
3c

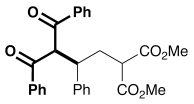
^{1}H NMR ($CDCl_3$, 400 MHz)



4a

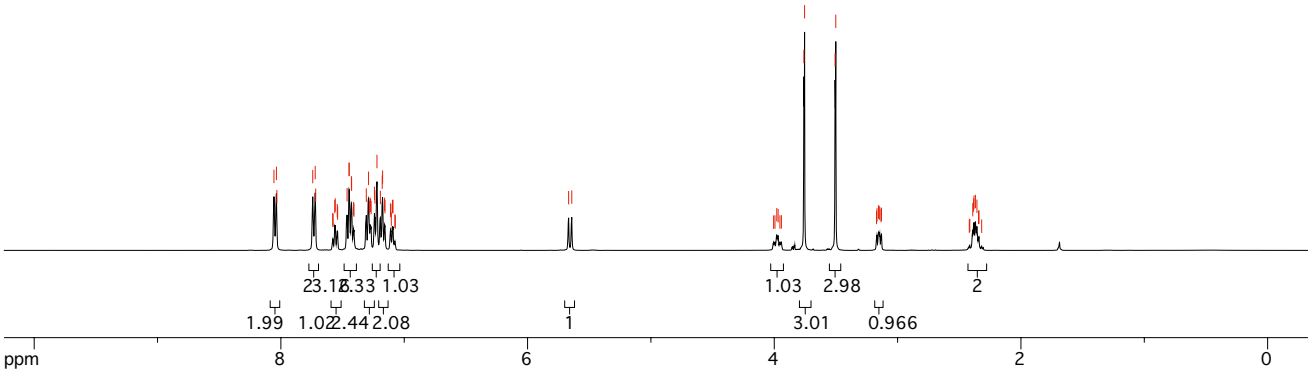
^{13}C NMR ($CDCl_3$, 100 MHz)

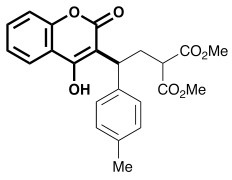




4a

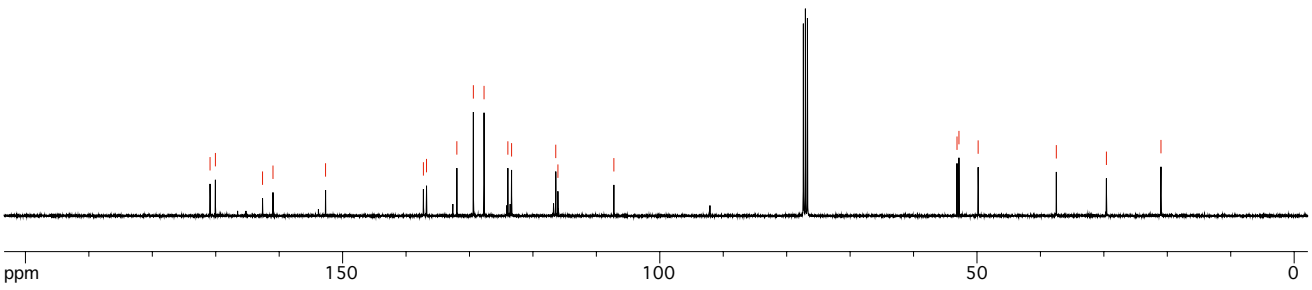
^{1}H NMR ($CDCl_3$, 400 MHz)

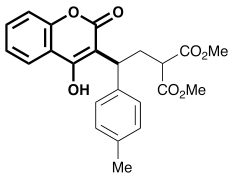




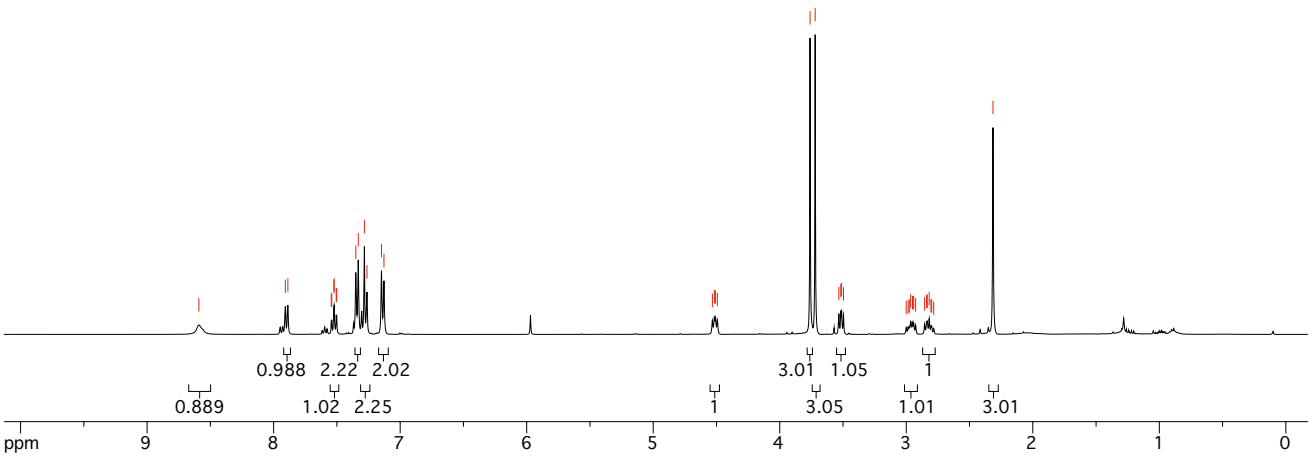
4b

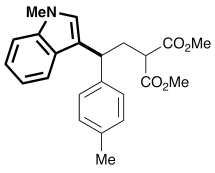
^{13}C NMR ($CDCl_3$, 100 MHz)



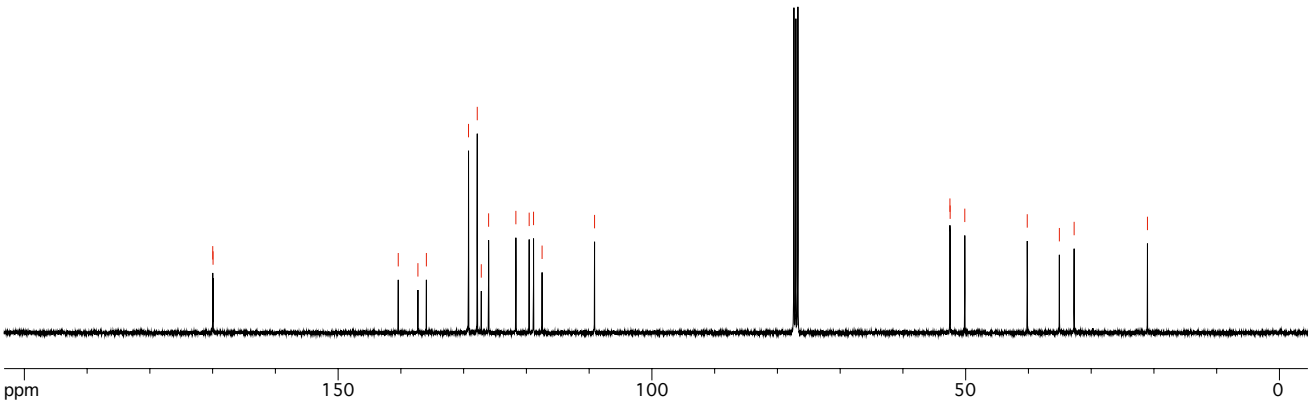


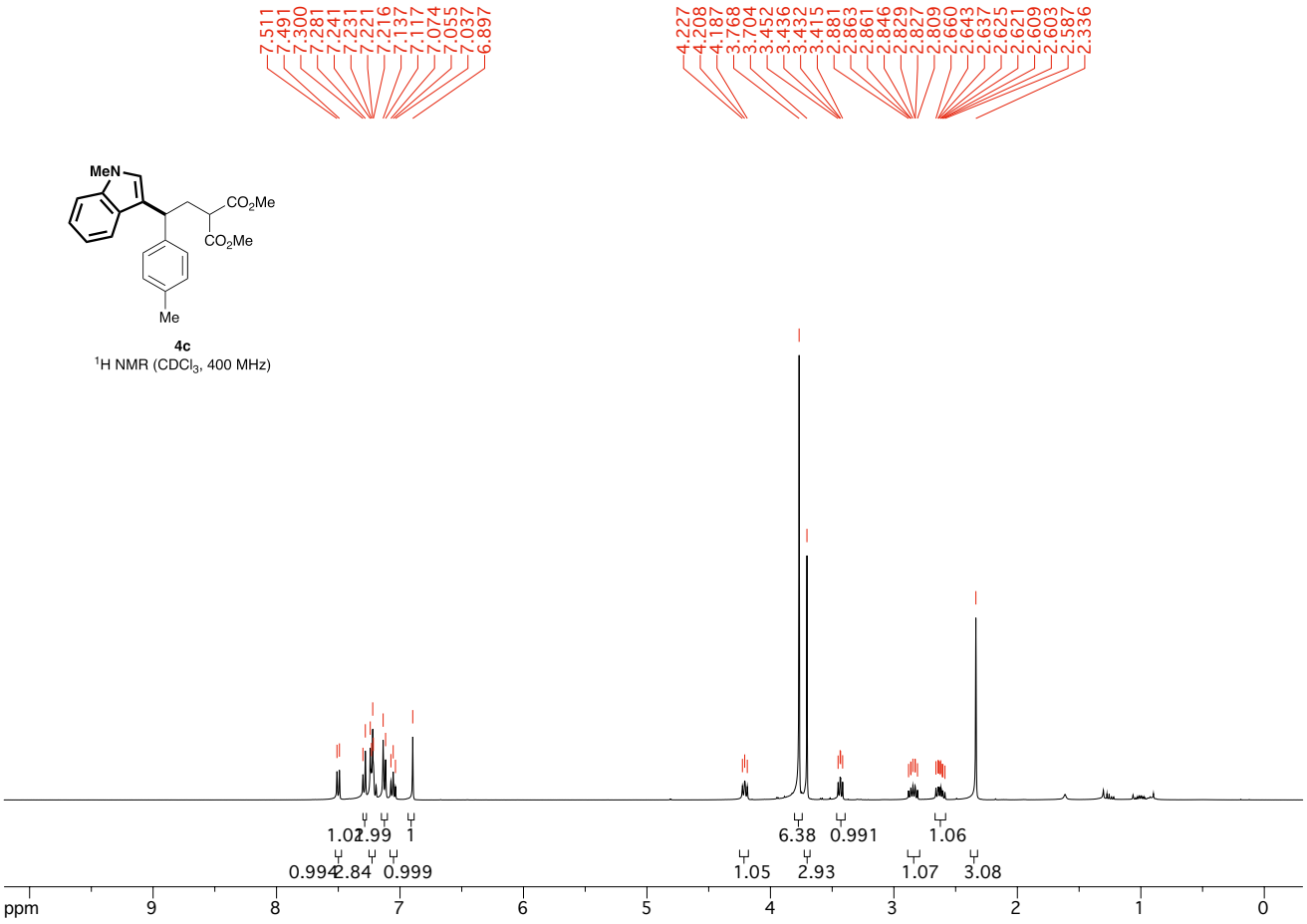
4b
^{1}H NMR ($CDCl_3$, 400 MHz)



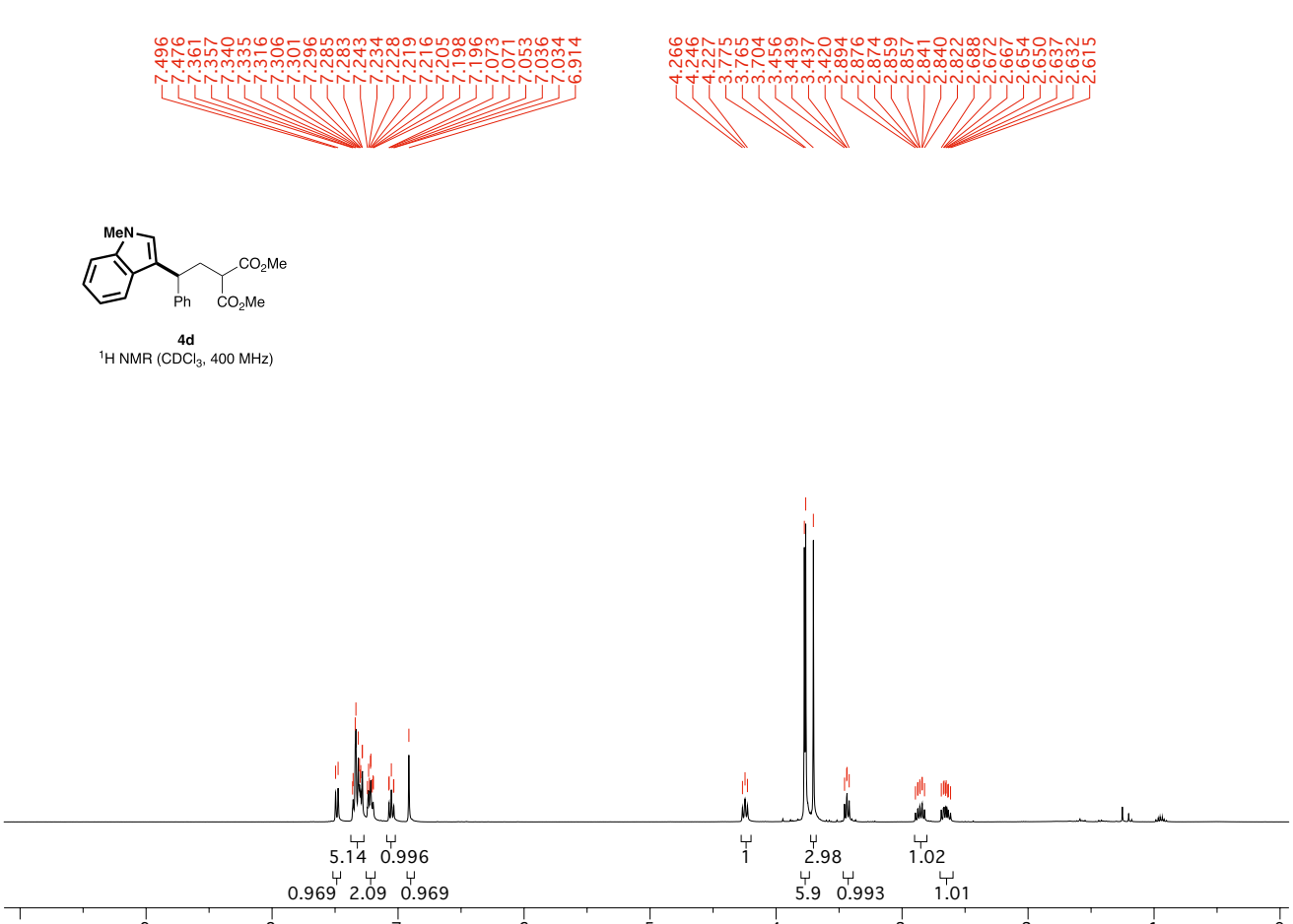


4c
^{13}C NMR ($CDCl_3$, 100 MHz)

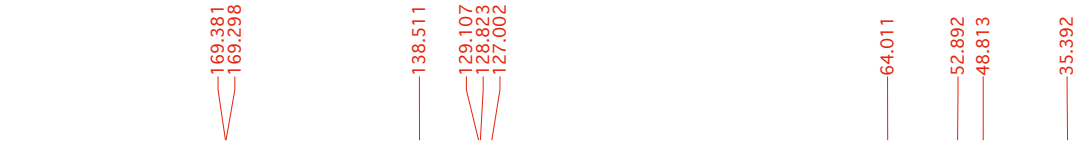


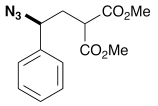


4c
^{1}H NMR ($CDCl_3$, 400 MHz)



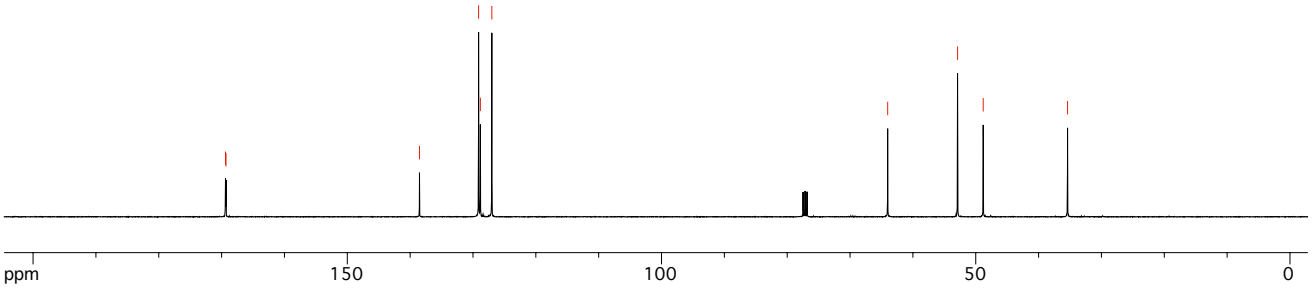
4d
^{1}H NMR ($CDCl_3$, 400 MHz)

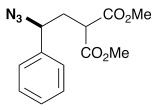




4e

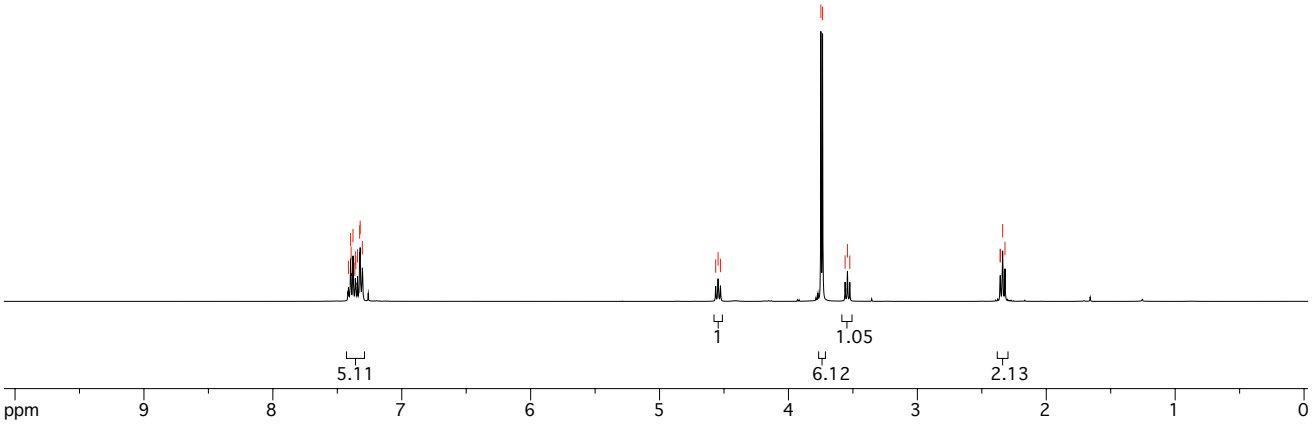
^{13}C NMR ($CDCl_3$, 100 MHz)

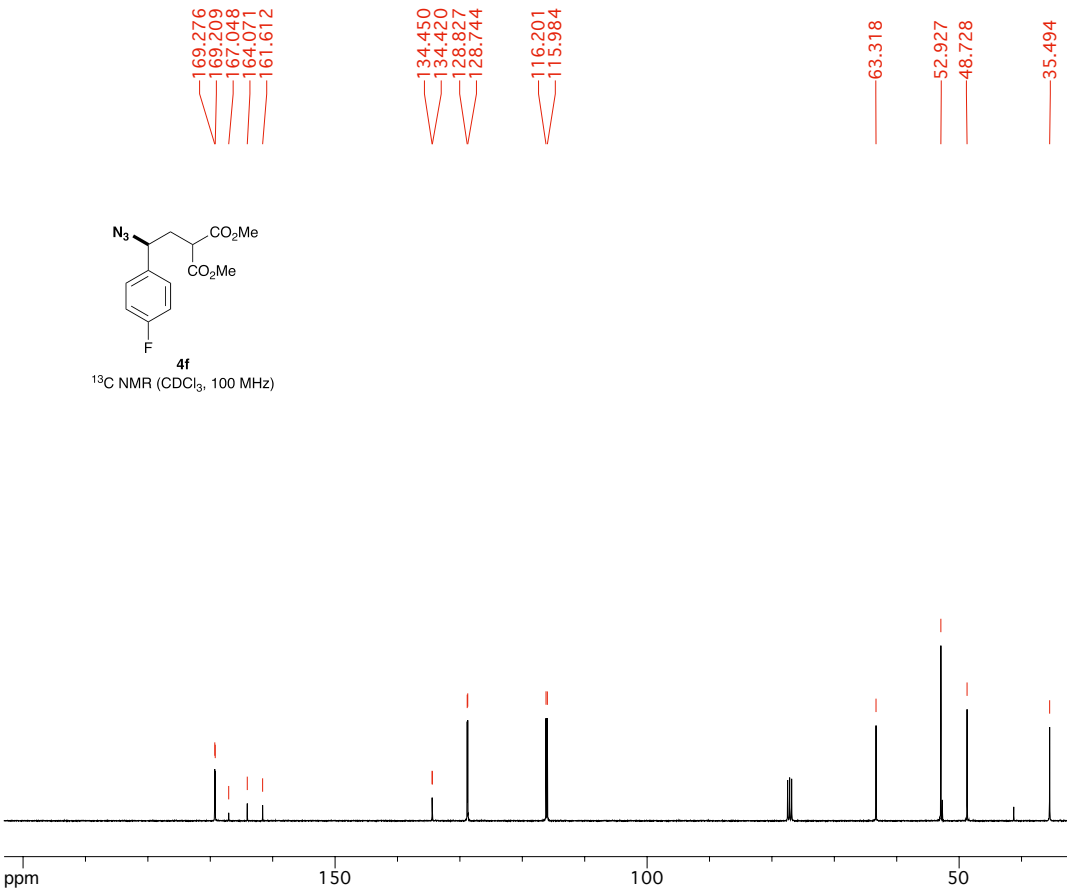




4e

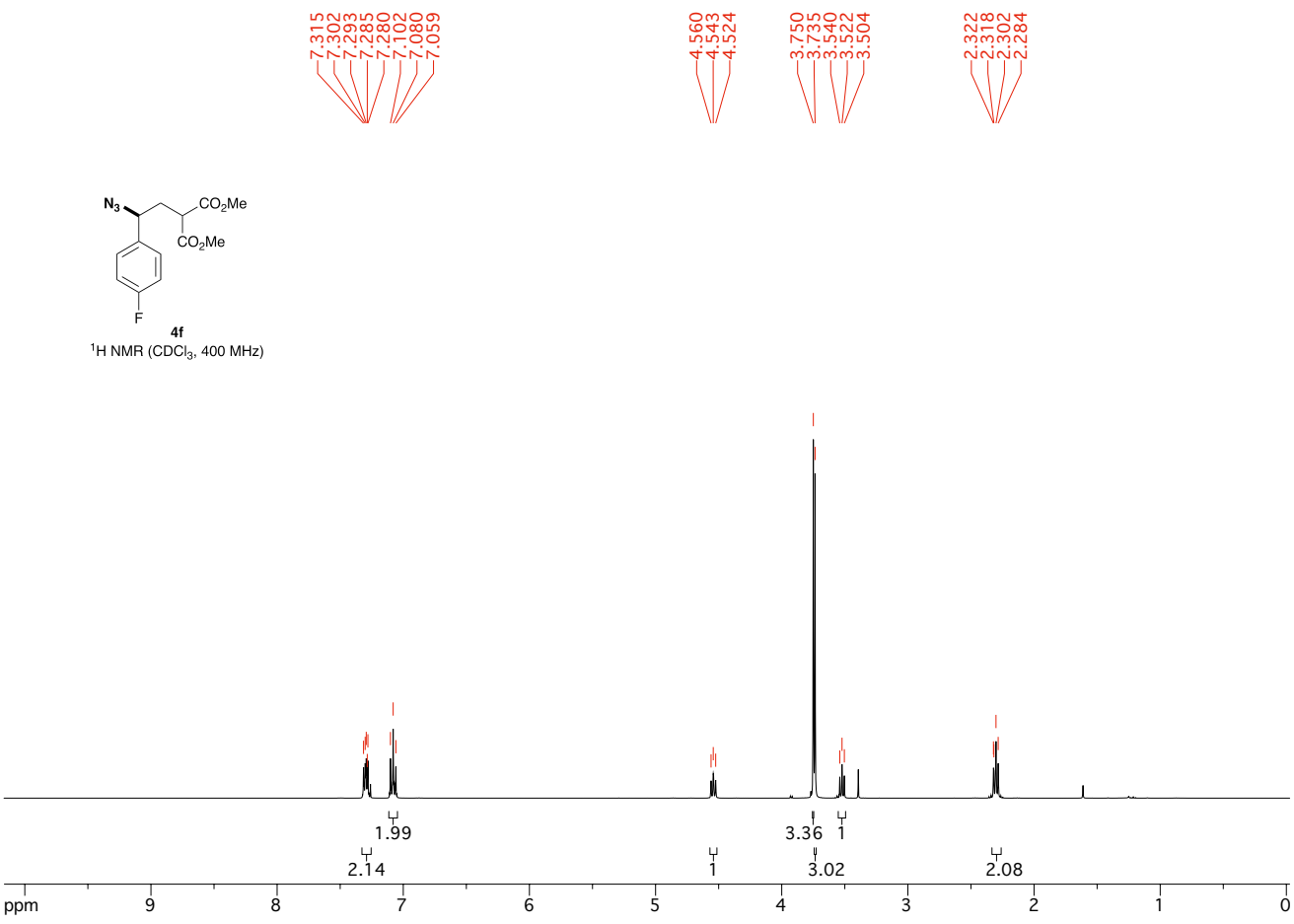
^{1}H NMR ($CDCl_3$, 400 MHz)





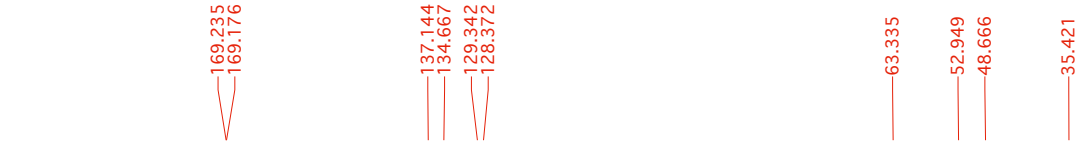
4f

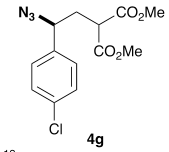
^{13}C NMR ($CDCl_3$, 100 MHz)



4f

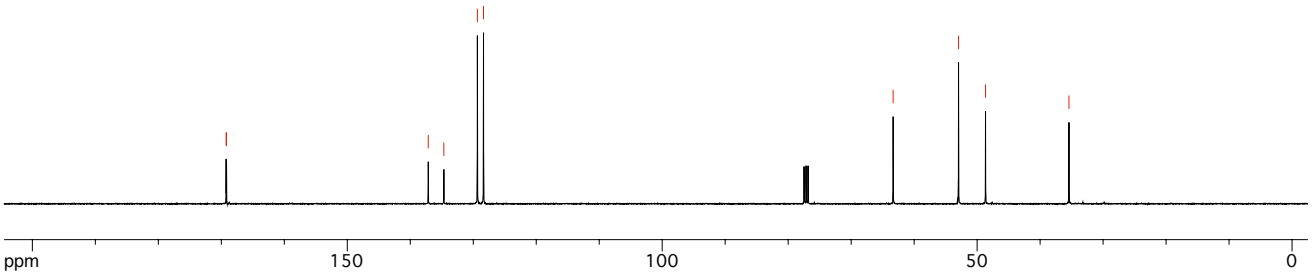
^{1}H NMR ($CDCl_3$, 400 MHz)

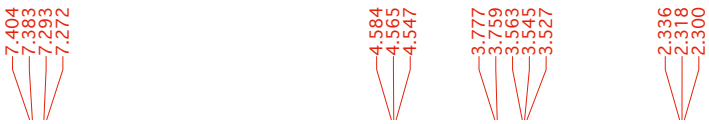


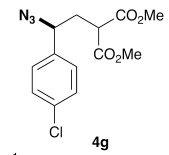


4g

^{13}C NMR ($CDCl_3$, 100 MHz)

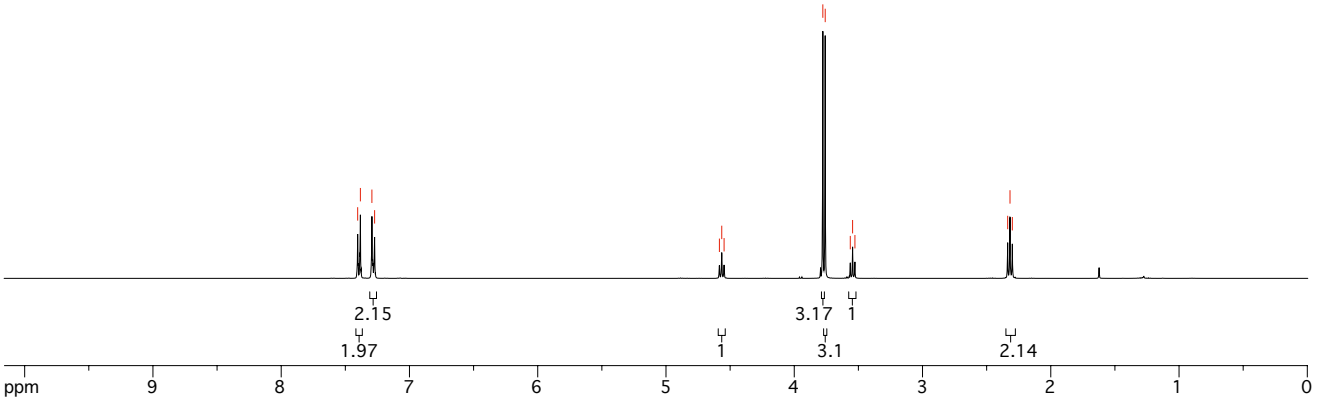


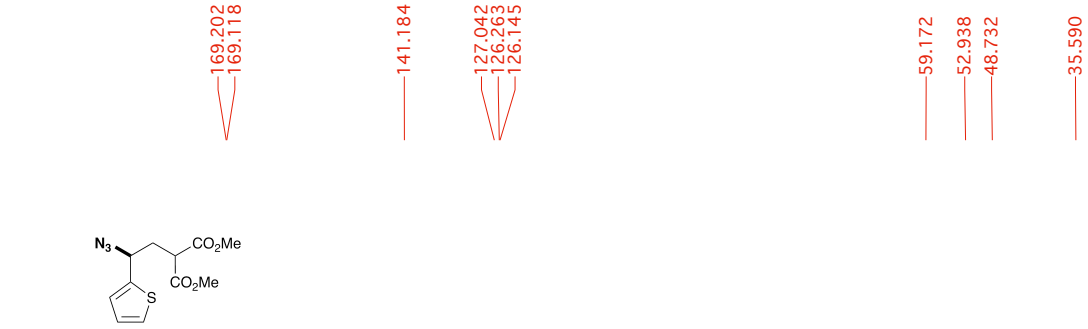




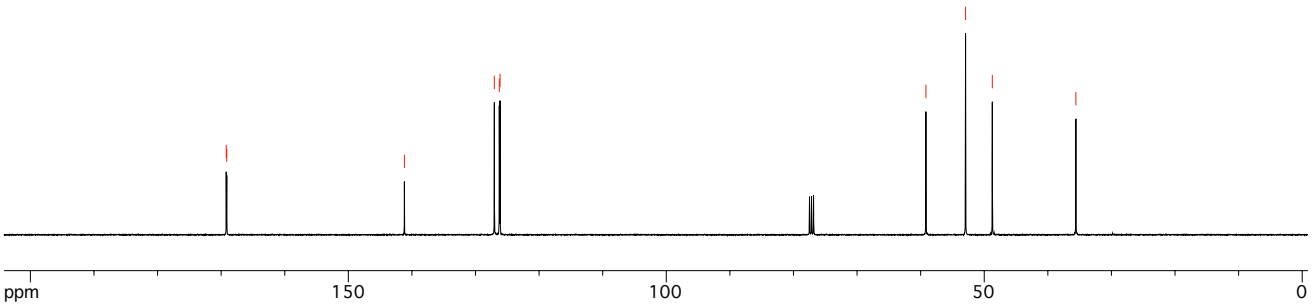
4g

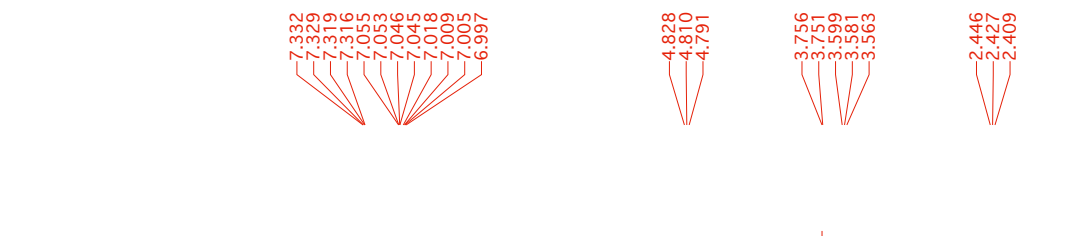
^{1}H NMR ($CDCl_3$, 400 MHz)



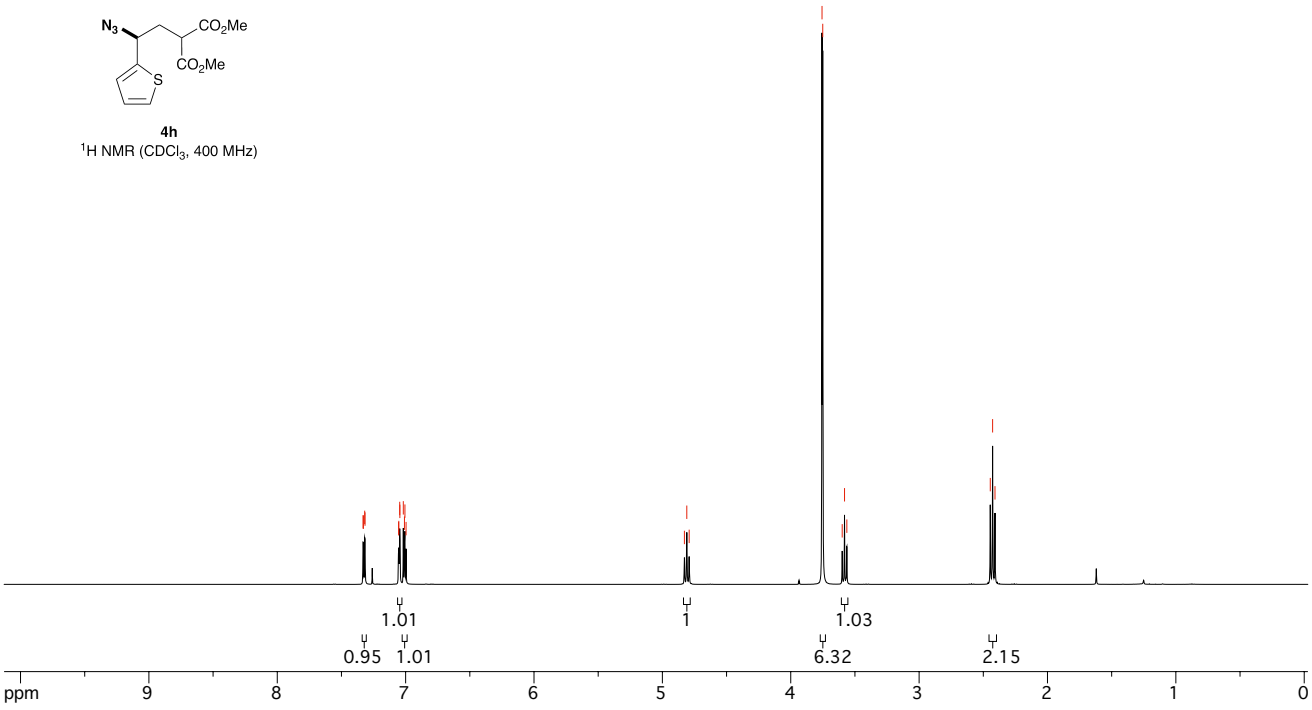


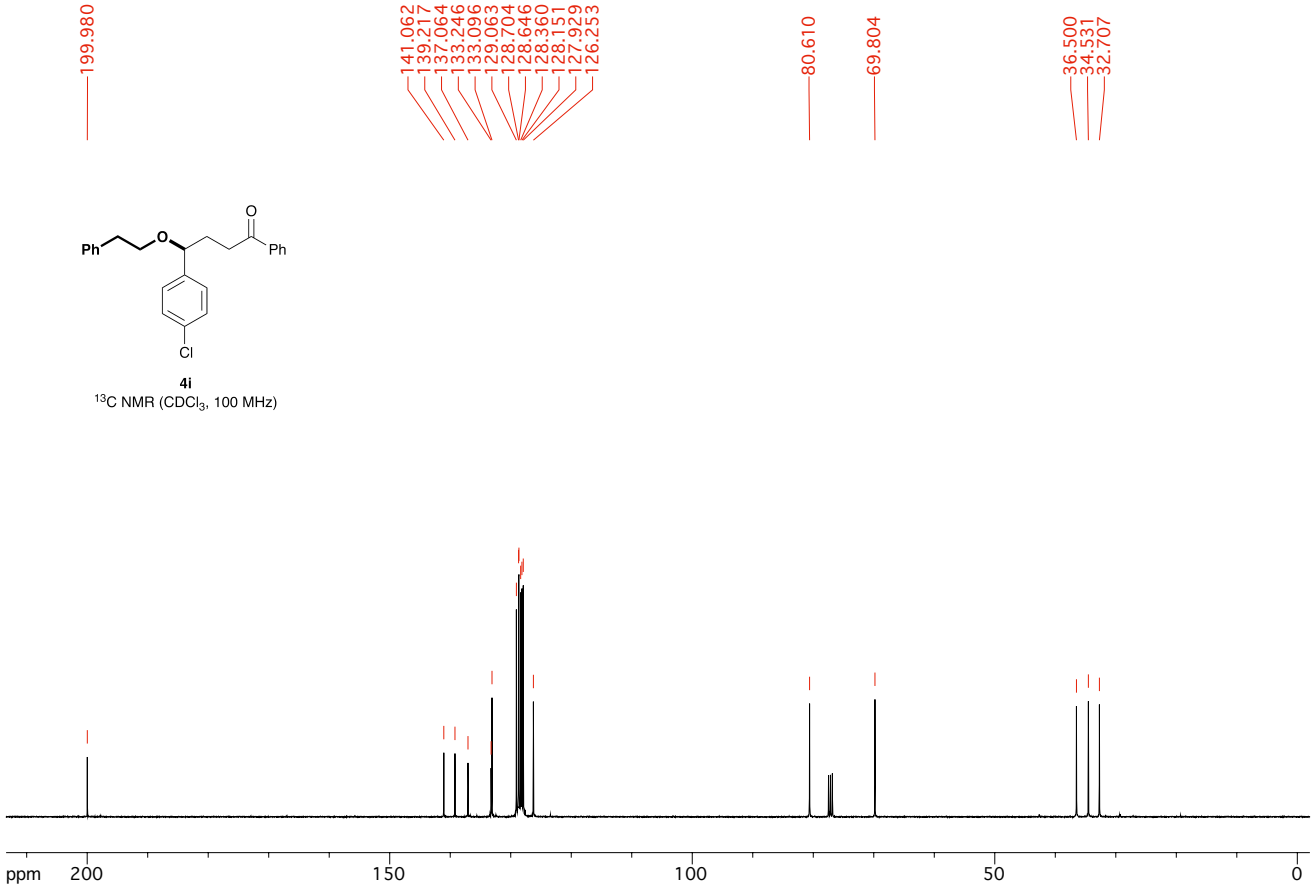
4h
^{13}C NMR ($CDCl_3$, 100 MHz)



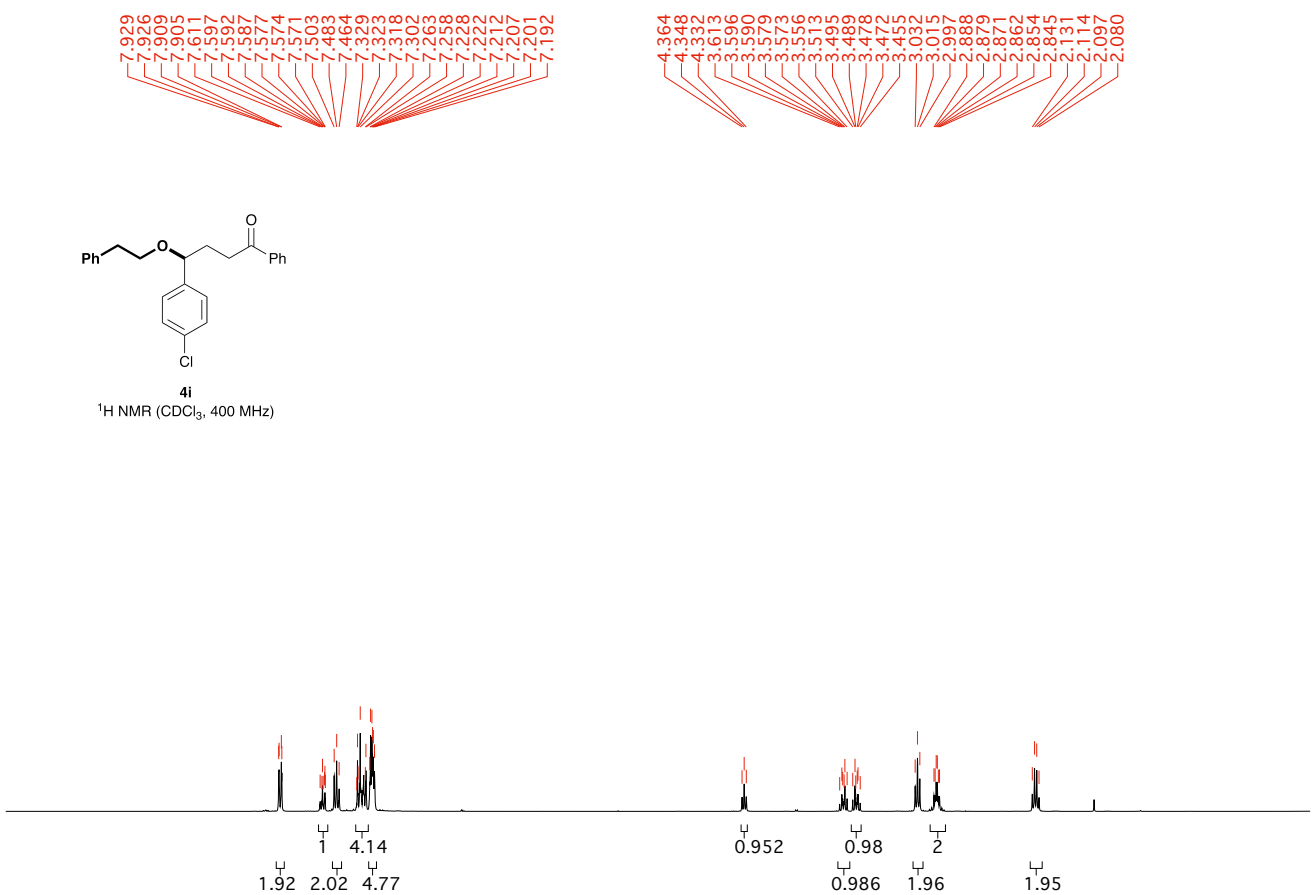


4h
^{1}H NMR ($CDCl_3$, 400 MHz)

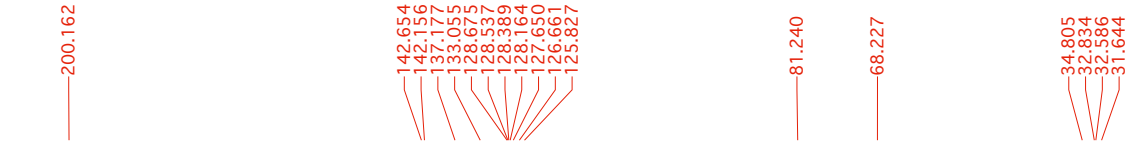


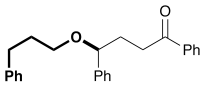


4i
^{13}C NMR ($CDCl_3$, 100 MHz)



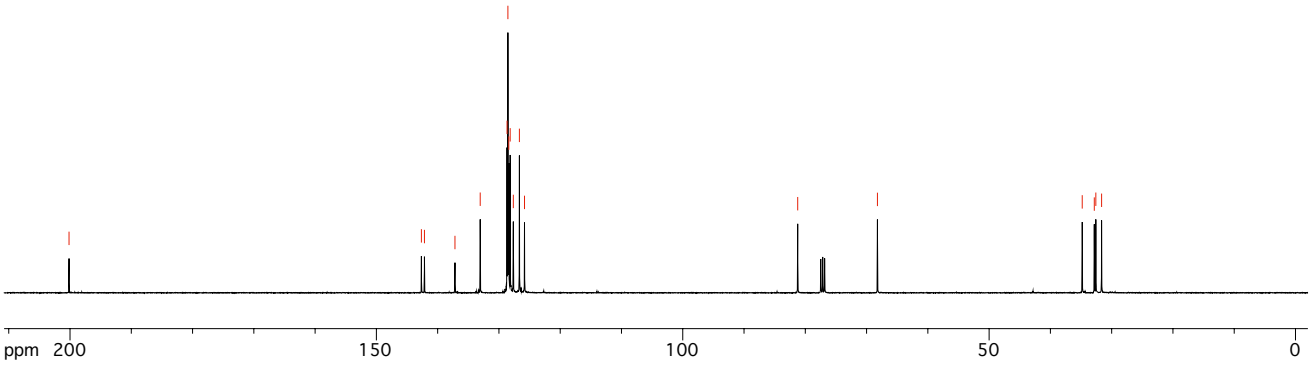
4i
^{1}H NMR ($CDCl_3$, 400 MHz)

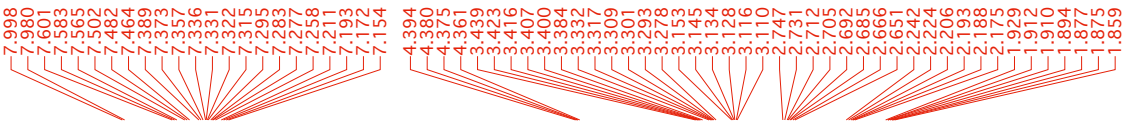


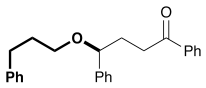


4j

^{13}C NMR ($CDCl_3$, 100 MHz)

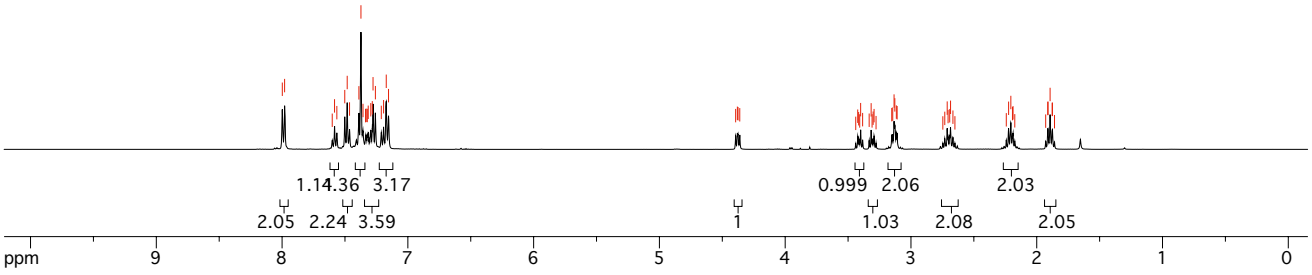


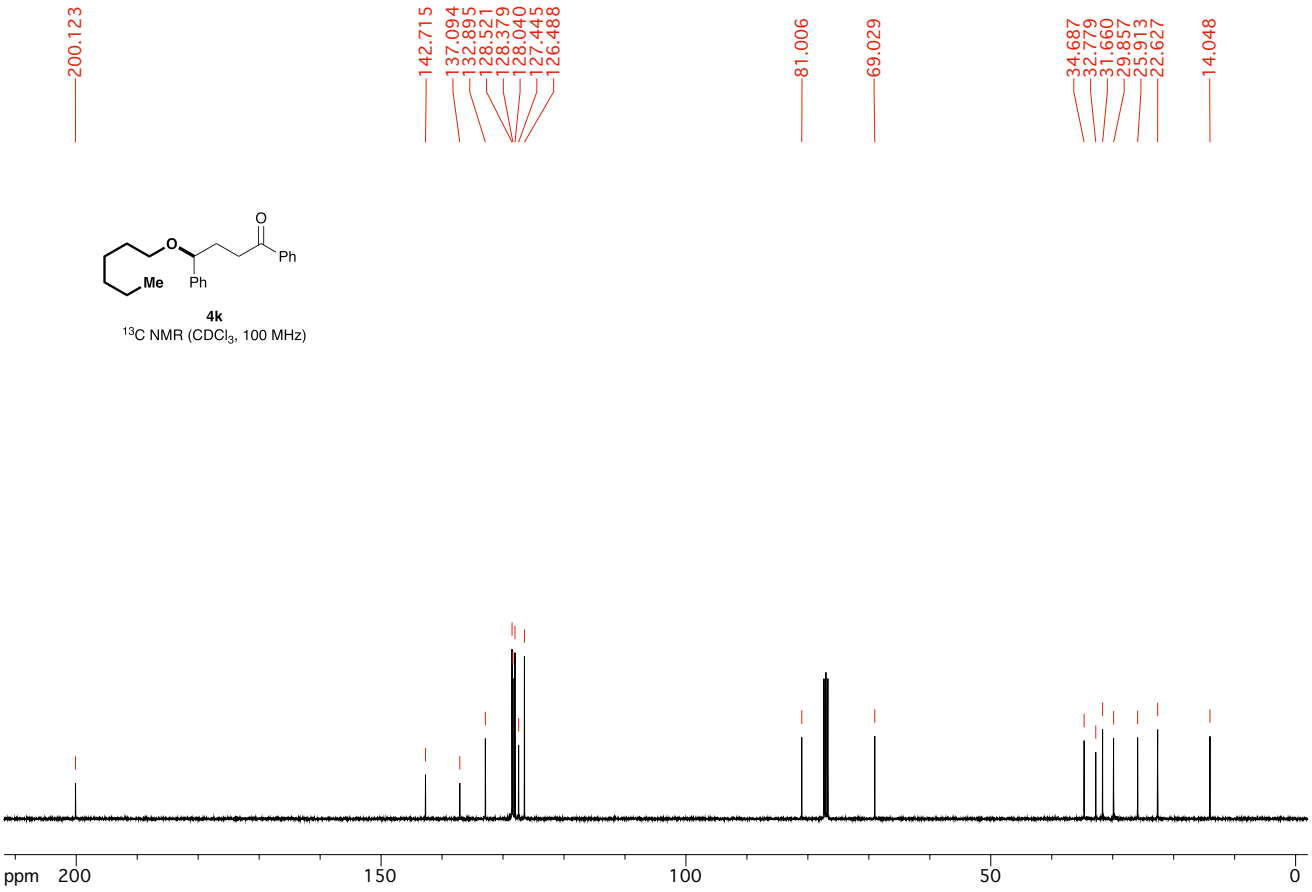




4j

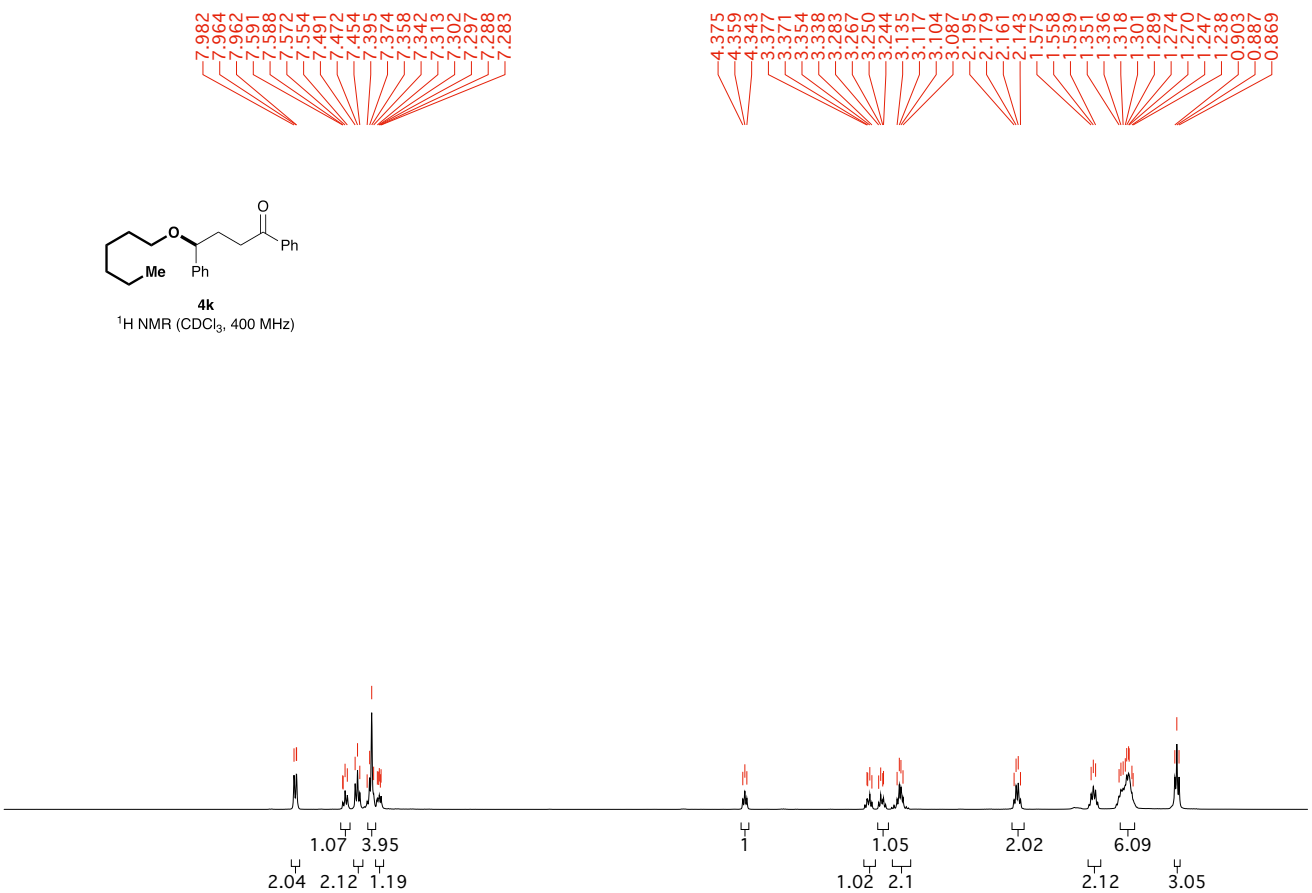
^{1}H NMR ($CDCl_3$, 400 MHz)





4k

^{13}C NMR ($CDCl_3$, 100 MHz)



4k

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