Supporting Information for:

Pd-Catalyzed Enantio- and Regioselective Formation of Allylic Aryl Ethers

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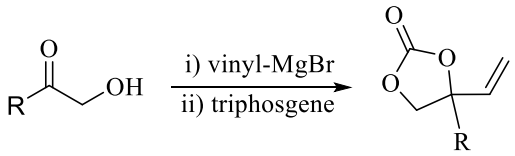
S2. General comments

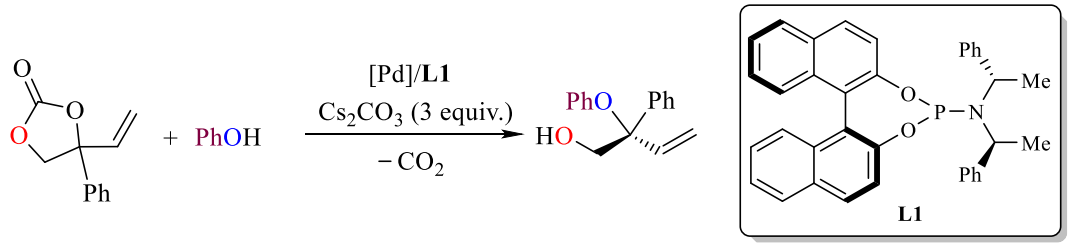
Commercially available phenols and solvents were purchased from Aldrich or TCI, and used without further purification. The palladium precursors and bases were purchased from Aldrich. Phosphoramidites **L1**, **L3-L6**, **L8-L12** were purchased from Aldrich or Strem; **L2**[1] and **L7**[2] were prepared according to previously reported procedures. All racemic allylic aryl ethers compounds were made using (*rac*)-**L1**. ^{1}H NMR, ^{13}C NMR, ^{19}F NMR spectra were recorded at room temperature on a Bruker AV-400 or AV-500 spectrometer and referenced to the residual deuterated solvent signals. All reported NMR values are given in parts per million (ppm). FT-IR measurements were carried out on a Bruker Optics FTIR Alpha spectrometer. Chiral high-performance liquid chromatography (HPLC) analysis, Mass spectrometric analyses and X-ray diffraction studies were performed by the Research Support Group at ICIQ.

S2. Typical procedure for the preparation of cyclic vinyl-carbonates



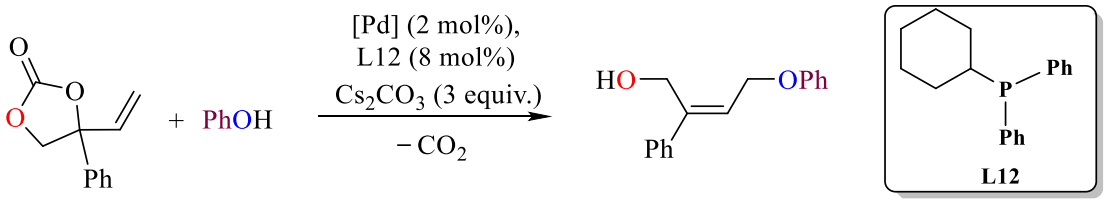
The vinyl-carbonates can be easily prepared according to a previous reported procedure with minor modifications.[3] To a solution of the respective hydroxy methyl ketone (5 mmol, 1 equiv) in THF (20 mL) was added vinyl magnesium bromide (1.0 M in THF, 2.5 equiv) at 0 °C. The reaction was stirred under an N_2 atmosphere at room temperature for 2 h. The reaction mixture was then quenched with saturated aqueous NH_4Cl, and extracted with EtOAc. The combined organic layers were dried over anhydrous Na_2SO_4, filtered and concentrated affording a light yellow oil. To a solution of the latter in CH_2Cl_2 (30 mL) was added pyridine (20 mmol, 4 equiv) and triphosgene (2.5 mmol, 0.5 equiv) at 0 °C. The reaction was stirred under an N_2 atmosphere at room temperature for 2 h. The reaction mixture was then quenched with saturated aqueous NH_4Cl, washed with H_2O, and extracted with CH_2Cl_2. The combined organic layers were dried over anhydrous Na_2SO_4, filtered and concentrated. The residue was purified by flash chromatography on silica to afford the corresponding carbonate.

S3. Typical procedure for the formation of branched aryl ethers



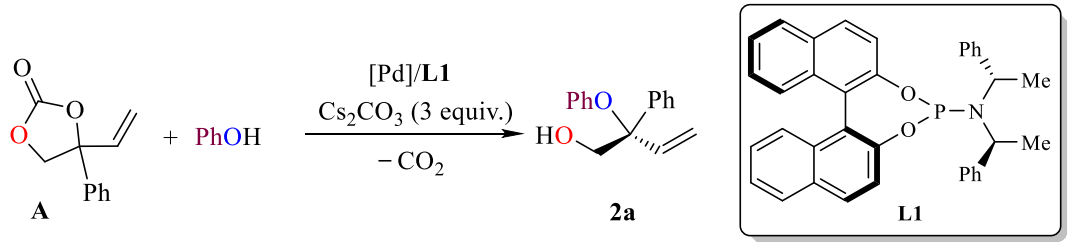
Carbonate (0.2 mmol, 0.038, 1 equiv) was combined with $Pd_2(dba)_3{\cdot}CHCl_3$ (0.0041 g, 2.0 mol%), **L1** (0.0086 g, 8.0 mol%) and phenol (0.0282 g, 1.5 equiv) in THF (0.30 mL) at room temperature in air. The reaction mixture was stirred at 0 ^oC for 36 h, after which the reaction mixture was mixed with 15 mL CH_2Cl_2 and then washed with NaOH (0.1 N, 2 × 5 mL), brine (10 mL), dried ($MgSO_4$), filtered and the solvent was removed in vacuo. The residue was subjected to flash column chromatography and the pure product was isolated (40.8 mg, 85%) (Hexane : EA = 50 : 1, R_f = 0.15). The *ee* values were determined by HPLC equipped with a chiral column.

S3. Typical procedure for the formation of linear aryl ethers.



Carbonate (0.2 mmol, 0.038, 1 equiv) was combined with $Pd_2(dba)_3{\cdot}CHCl_3$ (0.0041 g, 2.0 mol%), **L12** (0.0043 g, 8.0 mol%) and phenol (0.0282 g, 1.5 equiv) in THF (0.20 mL) at room temperature in air. The reaction mixture was stirred at room temperature for 12 h. Once the reaction had finished, the reaction mixture was purified by flash column chromatography (Hexane : EA = 10 : 1, R_f = 0.2) and the pure product was isolated (45.5 mg, 95%).

S4: Typical procedure for the formation of 2a at a 1.1 mmol scale.

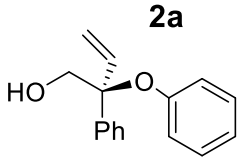


Vinyl cyclic carbonate **A** (1.1 mmol, 0.209 g, 1 equiv) was combined with $Pd_2(dba)_3 \cdot CHCl_3$ (0.0226 g, 2.0 mol %), **L1** (0.0473 g, 8.0 mol %) and phenol (0.1551 g, 1.5 equiv) in THF (1.65 mL) at rt open to air. The reaction mixture was stirred at 0 °C for 36 h, after which the reaction mixture was mixed with 30 mL of CH_2Cl_2 and then washed with NaOH (0.1 M, 2 × 10 mL), brine (10 mL), dried over $MgSO_4$ and filtered. The solvent was removed in vacuo. The residue was subjected to flash column chromatography (Hexane : EA = 50 : 1, R_f = 0.15), and the pure product **2a** was isolated (213.5 mg, 81%) with an *er* of 95:5 as determined by HPLC equipped with a chiral column).

Cf. Scheme 3 in the main text: scale 0.20 mmol, yield of **2a** is 85%, *er* = 95:5.

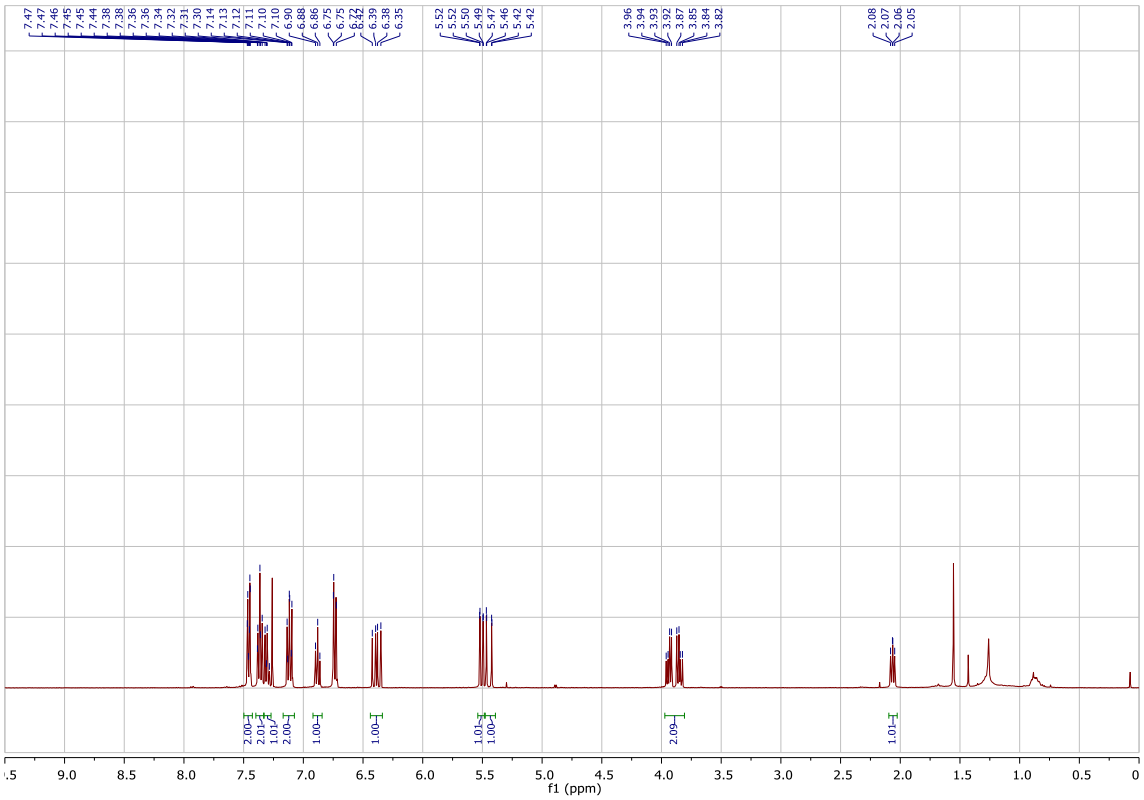
S5. IR, NMR spectra, HRMS and HPLC results

2a



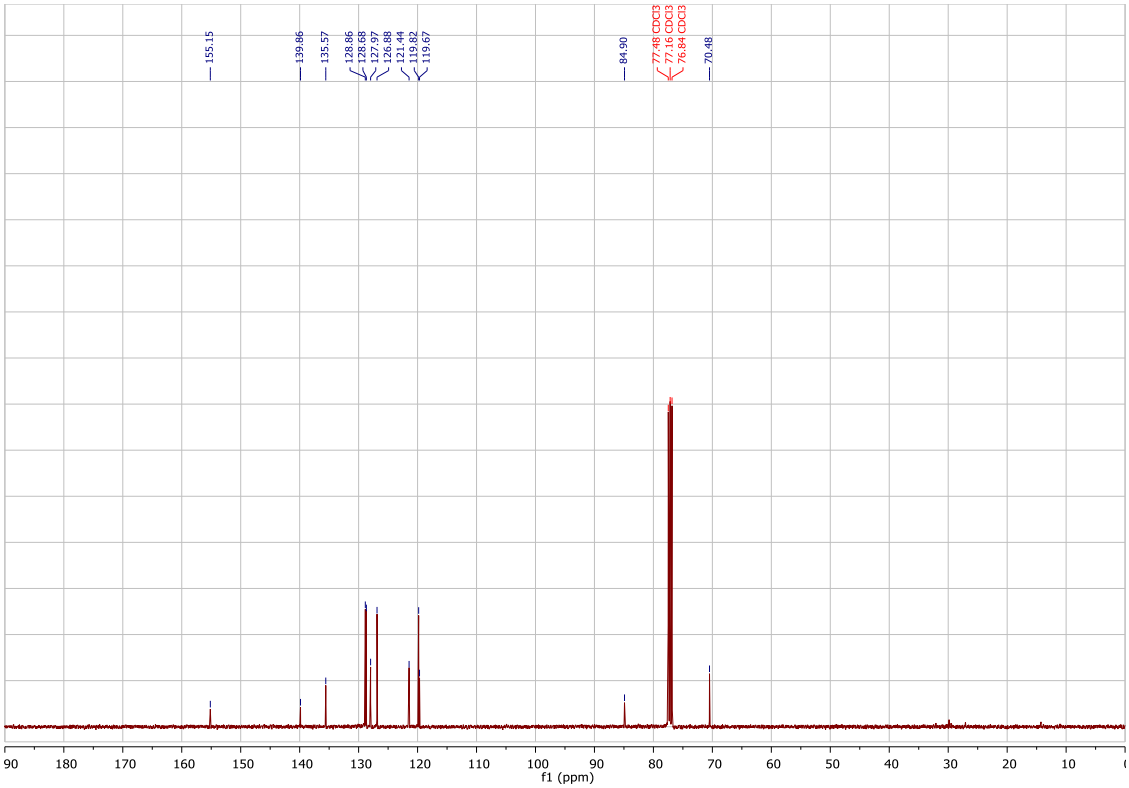
Scale: 0.2 mmol; isolated 40.8 mg (85% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



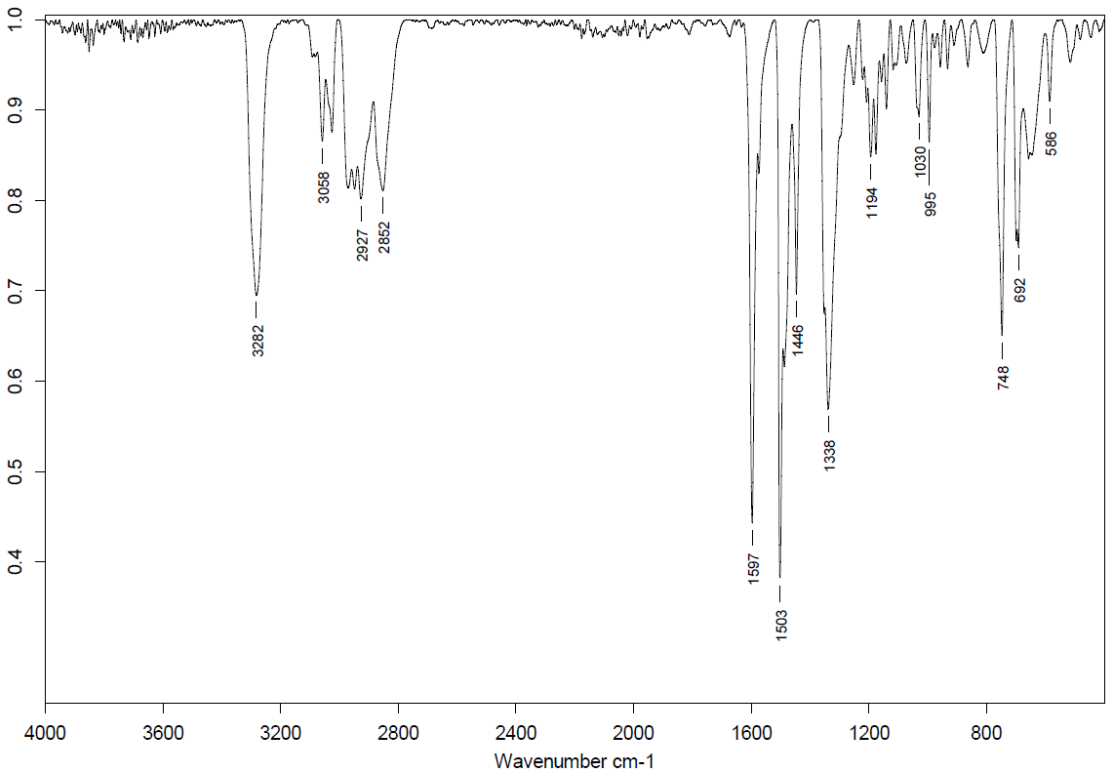
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 – 7.43 (m, 2H), 7.40 – 7.33 (m, 2H), 7.33 – 7.27 (m, 1H), 7.17 – 7.07 (m, 2H), 6.88 (t, *J* = 7.4 Hz, 1H), 6.39 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.51 (dd, *J* = 11.2, 1.0 Hz, 1H), 5.44 (dd, *J* = 17.5, 1.0 Hz, 1H), 3.97 – 3.81 (m, 2H), 2.06 (dd, *J* = 7.5, 6.3 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 155.15, 139.86, 135.57, 128.86, 128.68, 127.97, 126.88, 121.44, 119.82, 119.67, 84.90, 70.48.

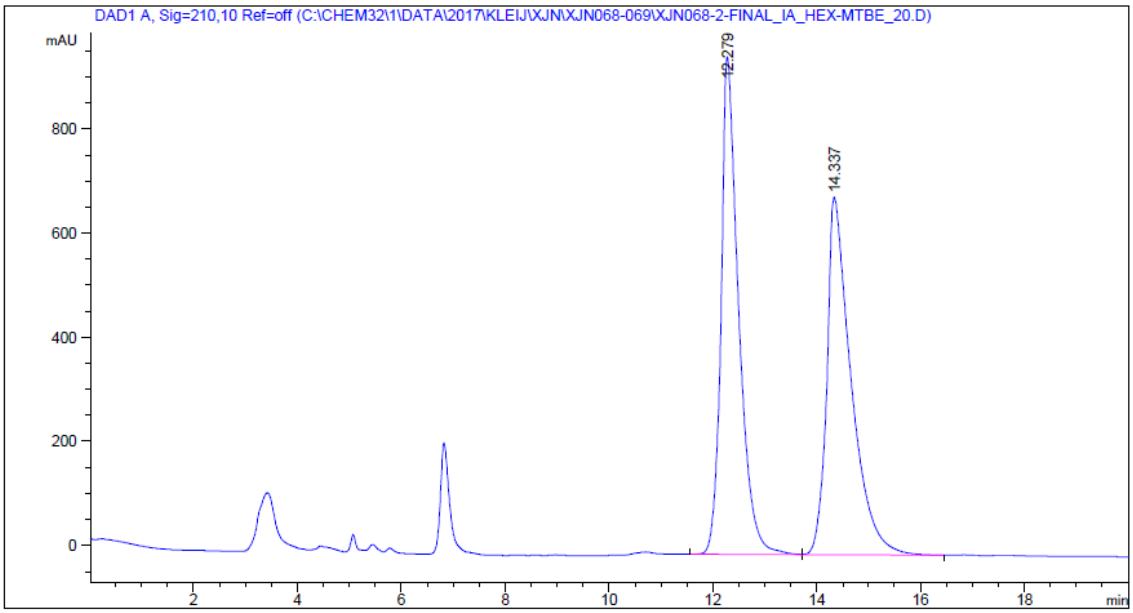
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 263.1043 $(M + Na)^+$, found: 263.1043.

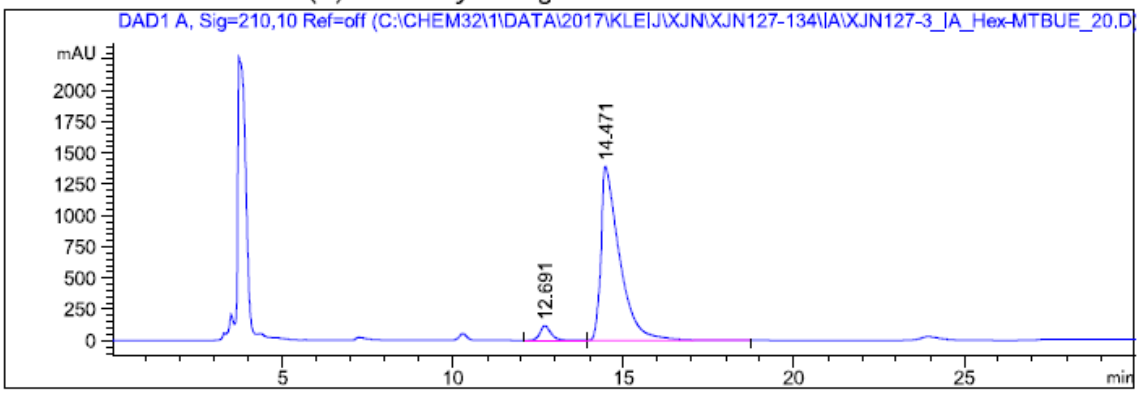
HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 95 : 5 *er*; $[\alpha]_D^{25} = -56.03$ (*c* = 0.12, $CHCl_3$). (Hex: hexane; MTBE: methyl *tert*-butyl ether)

Additional Info : Peak(s) manually integrated



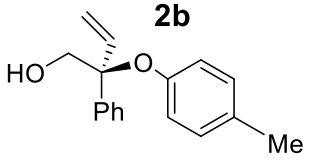
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.279	BB	0.3362	2.24259e4	954.30103	50.1758
2	14.337	BB	0.4587	2.22687e4	686.01563	49.8242

Additional Info : Peak(s) manually integrated



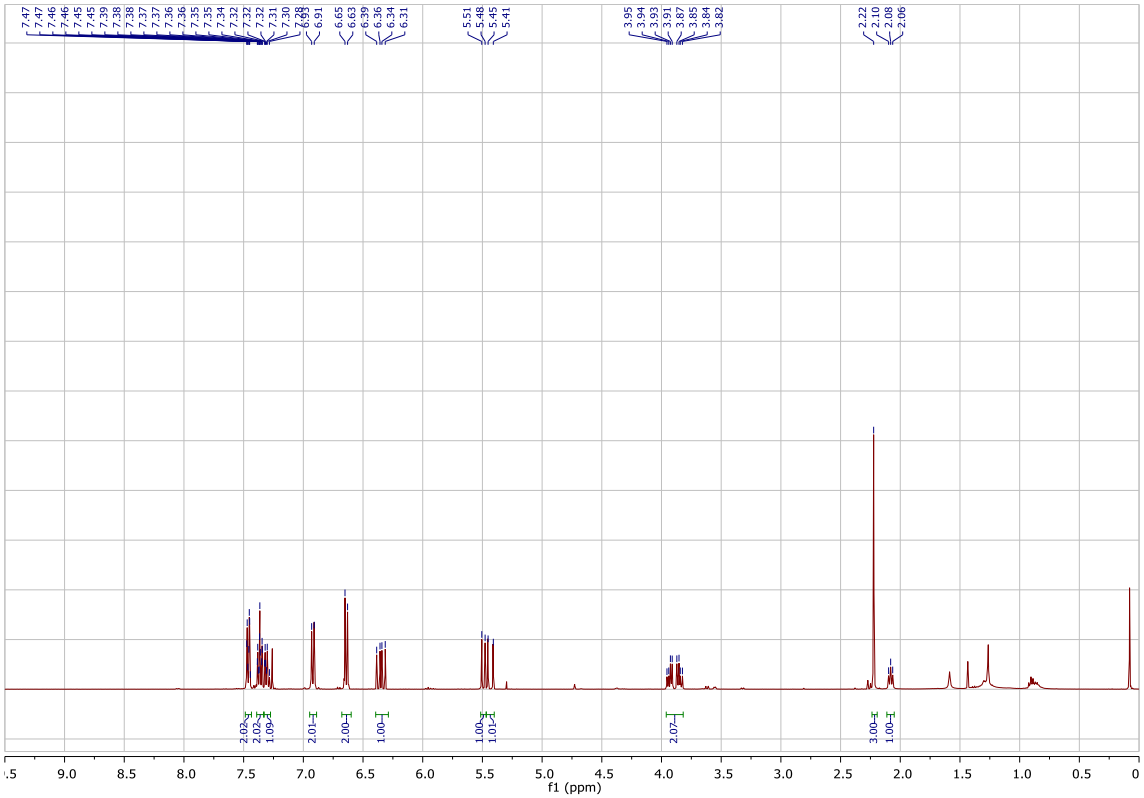
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.691	BV	0.3372	2723.81982	118.92472	4.8827
2	14.471	VB	0.5383	5.30613e4	1393.40503	95.1173

2b



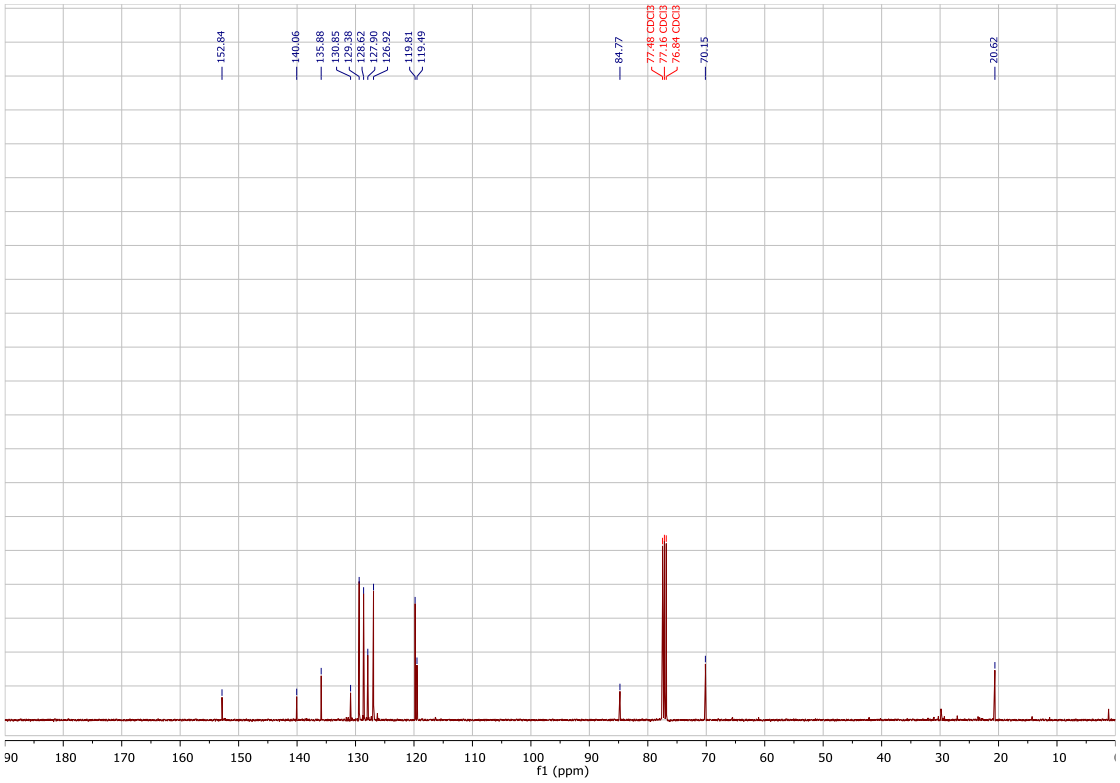
Scale: 0.2 mmol; isolated 43.5 mg (86% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



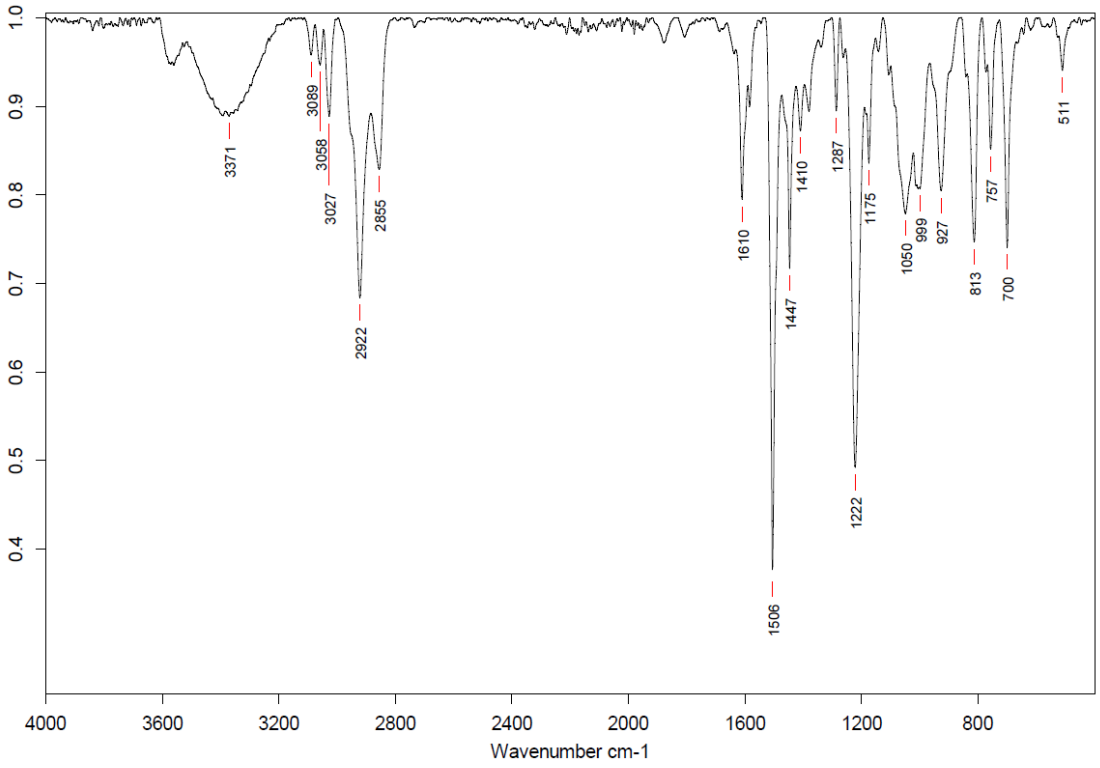
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 – 7.43 (m, 2H), 7.39 – 7.33 (m, 2H), 7.33 – 7.27 (m, 1H), 6.92 (d, *J* = 8.7 Hz, 2H), 6.64 (d, *J* = 8.6 Hz, 2H), 6.35 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.49 (d, *J* = 11.1 Hz, 1H), 5.43 (d, *J* = 17.5 Hz, 1H), 3.96 – 3.82 (m, 2H), 2.22 (s, 3H), 2.08 (t, *J* = 6.8 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



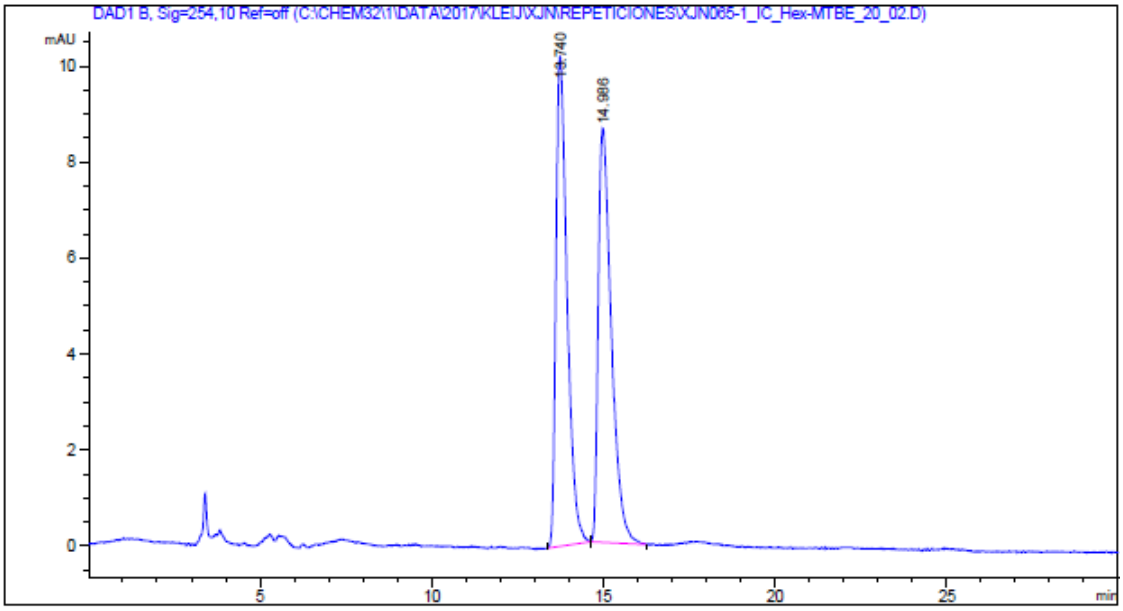
^{13}C NMR (101 MHz, $CDCl_3$) δ 152.84, 140.06, 135.88, 130.85, 129.38, 128.62, 127.90, 126.92, 119.81, 119.49, 84.77, 70.15, 20.62.

IR spectrum (neat)



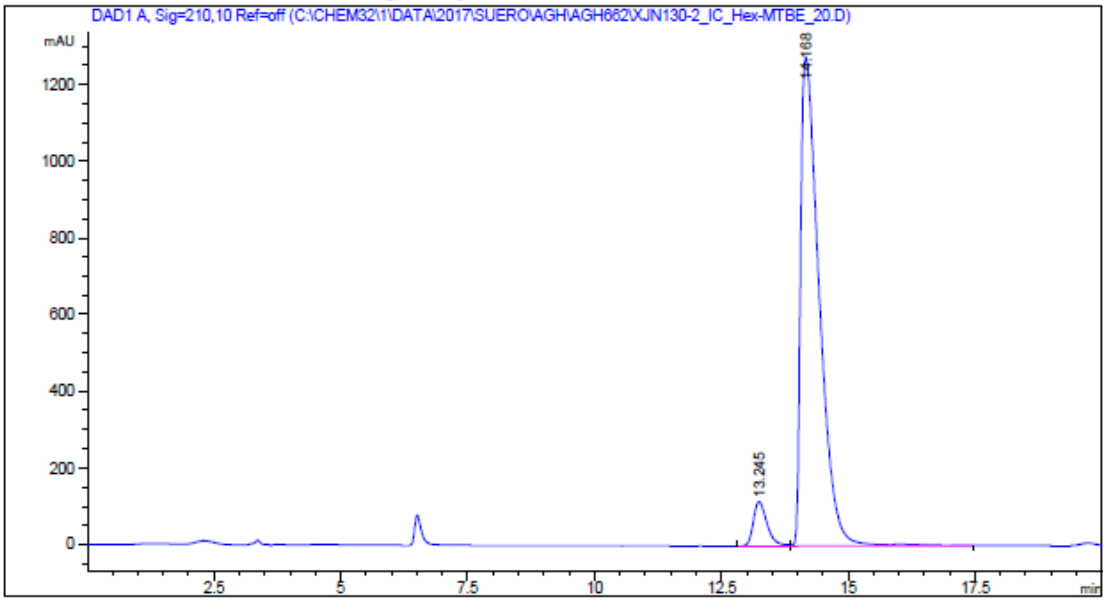
HRMS (ESI+, MeOH): *m/z* calcd. 277.1199 $(M + Na)^+$, found: 277.1197.

HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 94 : 6 *er*; $[\alpha]_D^{25} = -46.21$ (*c* = 0.11, $CHCl_3$).

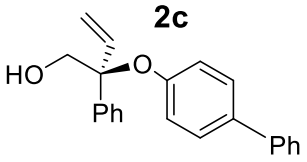


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.740	BB	0.3426	230.06252	10.22144	50.1916
2	14.986	BB	0.3924	228.30615	8.63555	49.8084

Additional Info : Peak(s) manually integrated

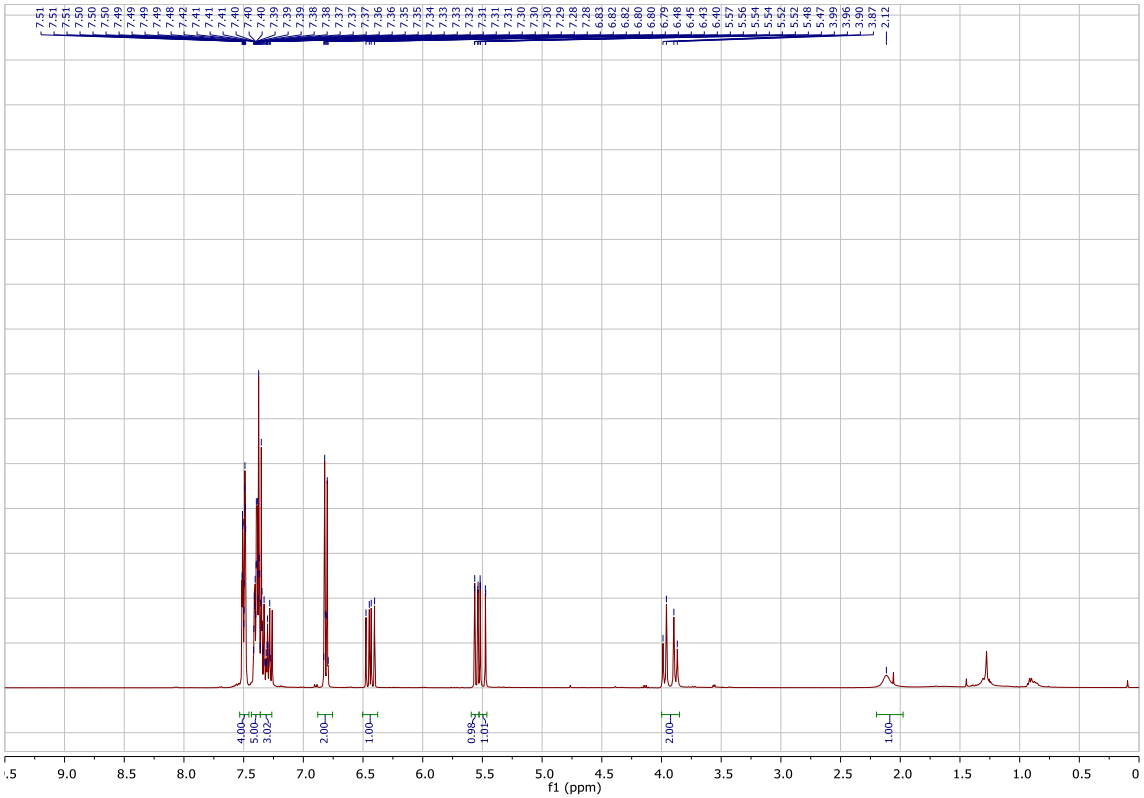


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.245	BV	0.2856	2154.69971	115.53063	6.2254
2	14.168	VV R	0.3901	3.24567e4	1275.29614	93.7746



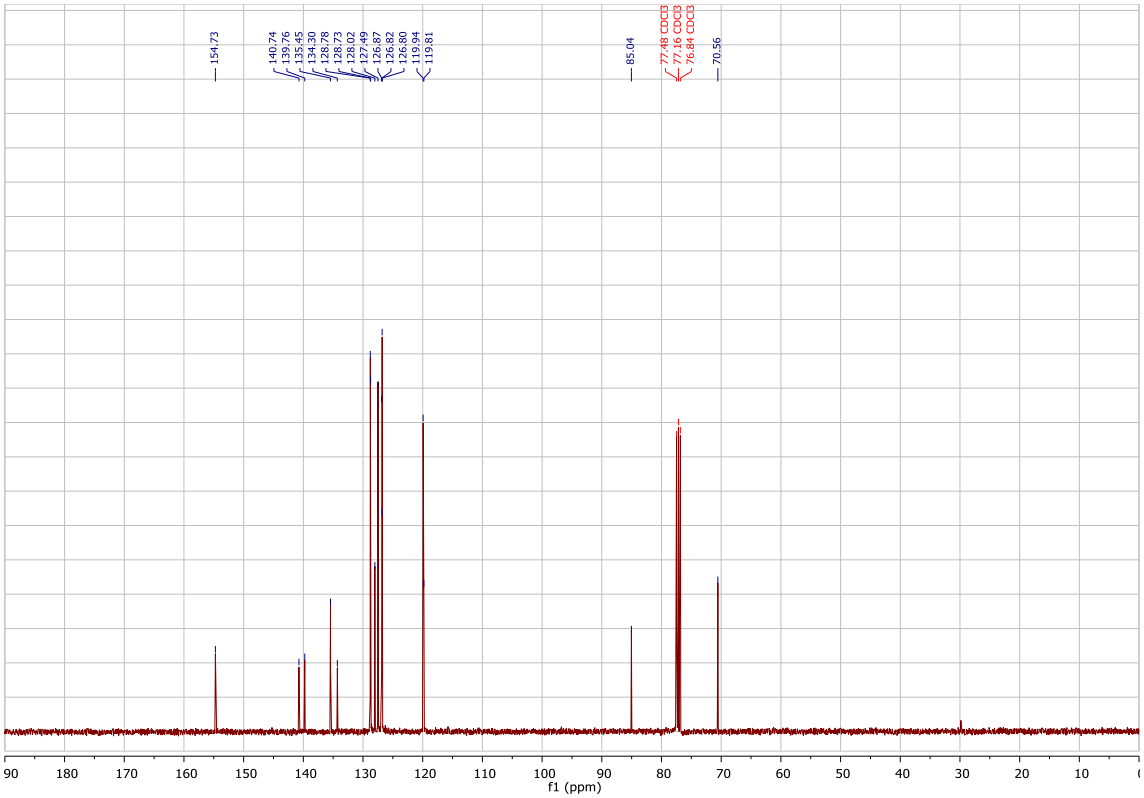
Scale: 0.2 mmol; isolated 37.0 mg (59% yield), light yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



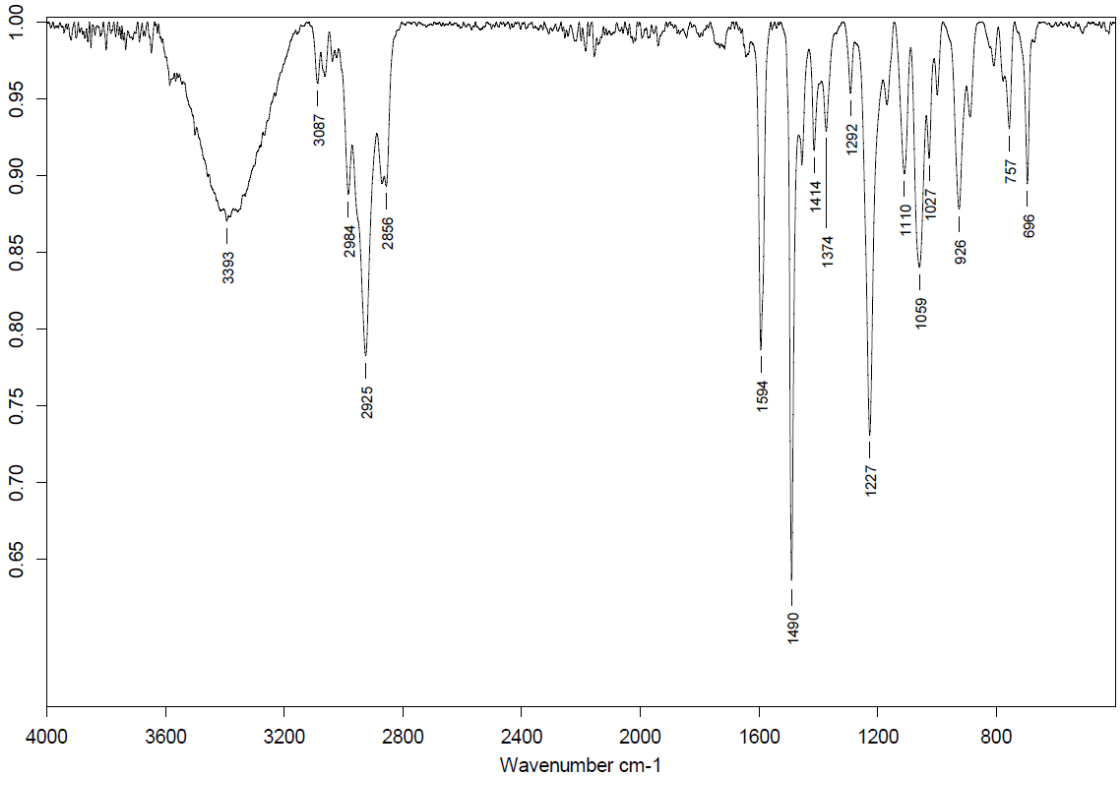
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 – 7.46 (m, 4H), 7.43 – 7.36 (m, 5H), 7.36 – 7.26 (m, 3H), 6.88 – 6.76 (m, 2H), 6.44 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.55 (dd, *J* = 11.2, 1.0 Hz, 1H), 5.50 (dd, *J* = 17.5, 1.0 Hz, 1H), 4.00 – 3.85 (m, 2H), 2.12 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 154.73, 140.74, 139.76, 135.45, 134.30, 128.78, 128.73, 128.02, 127.49, 126.87, 126.82, 126.80, 119.94, 119.81, 85.04, 70.56.

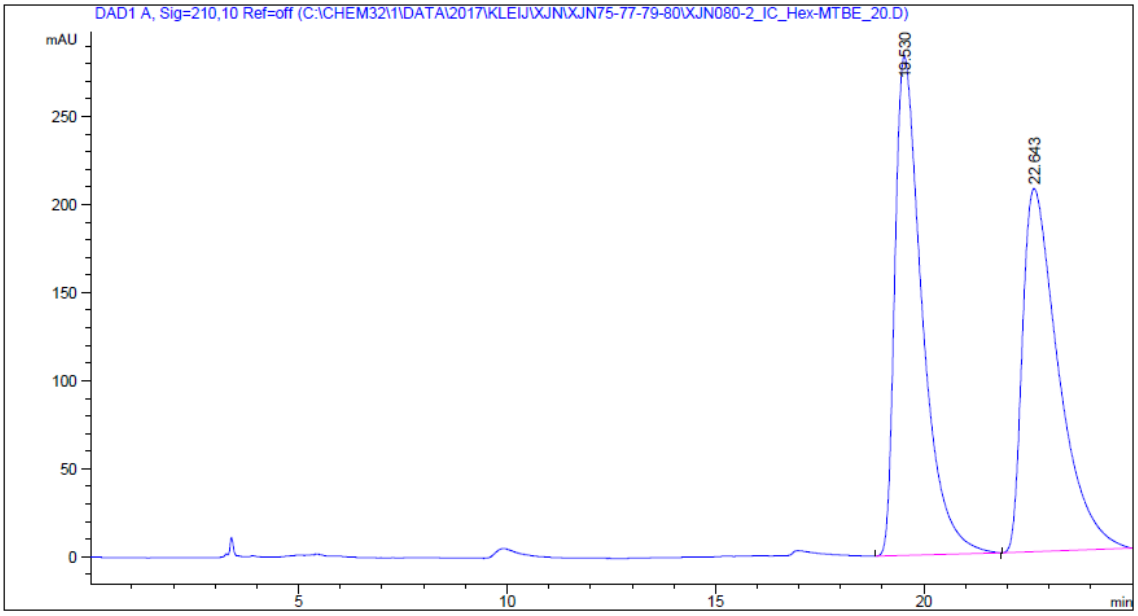
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 339.1356 $(M + Na)^+$, found: 339.1365.

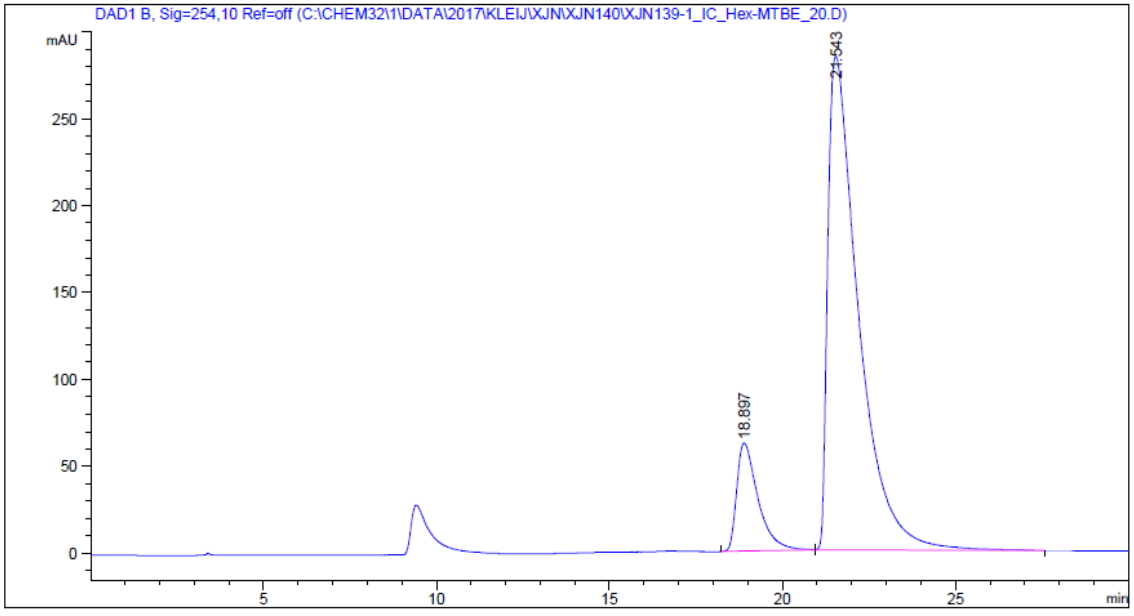
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 87 : 13 *er*; $[\alpha]_D^{25}$ = –44.09 (*c* = 0.10, $CHCl_3$).

Additional Info : Peak(s) manually integrated



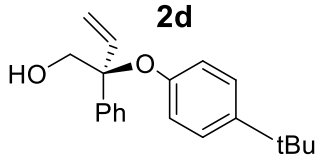
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	19.530	BB	0.6850	1.28953e4	283.31763	51.0383
2	22.643	BBA	0.9019	1.23706e4	206.20113	48.9617

Additional Info : Peak(s) manually integrated



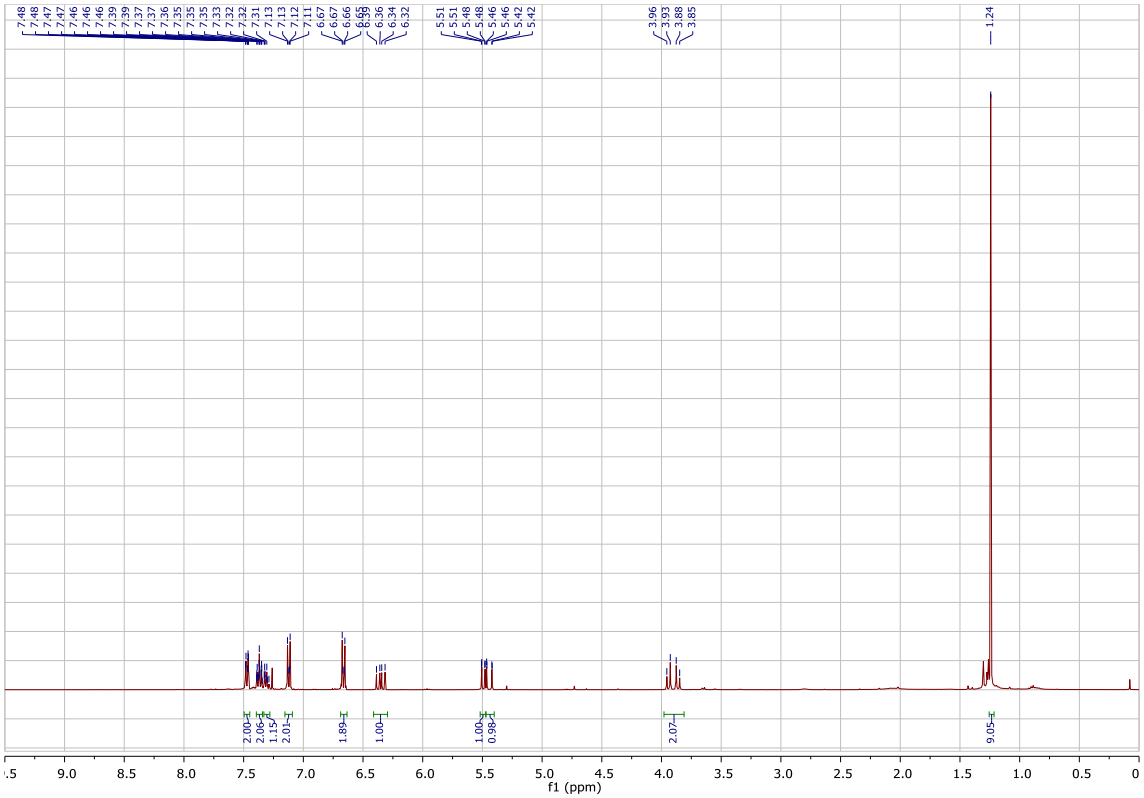
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	18.897	BB	0.6361	2652.93579	62.13355	13.1756
2	21.543	BB	0.9042	1.74822e4	283.99249	86.8244

2d



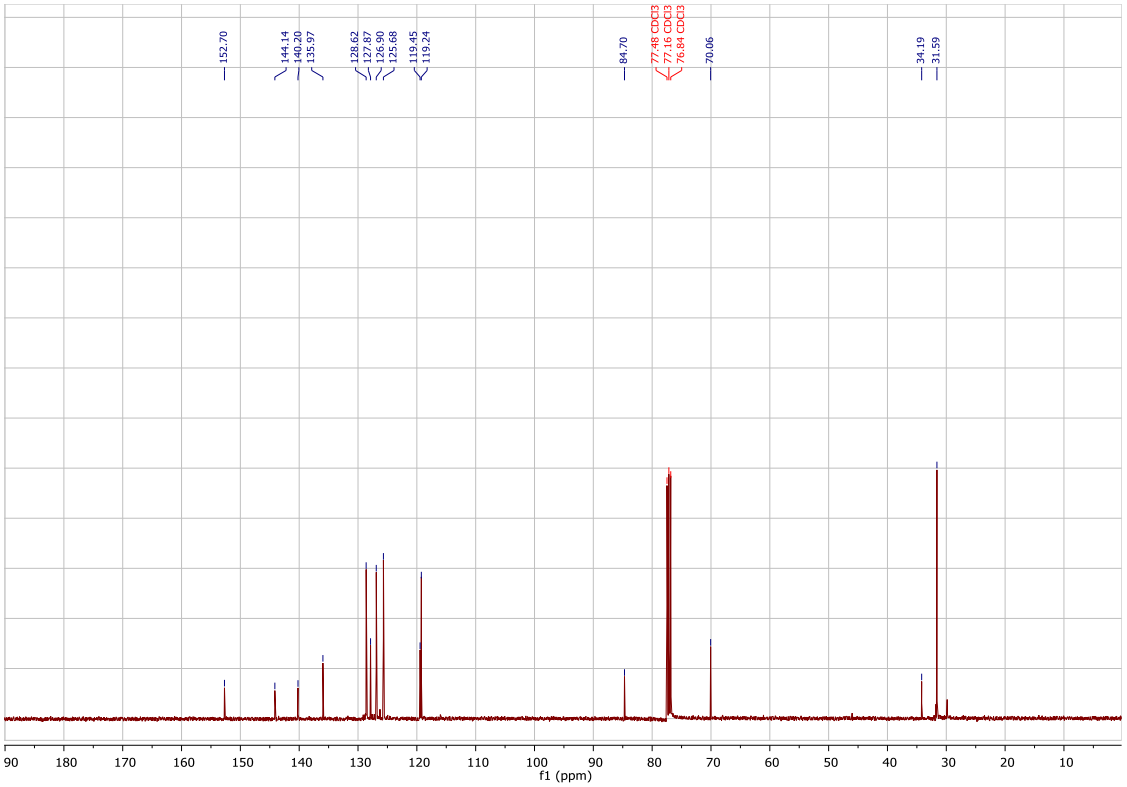
Scale: 0.2 mmol; isolated 47.9 mg (81% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



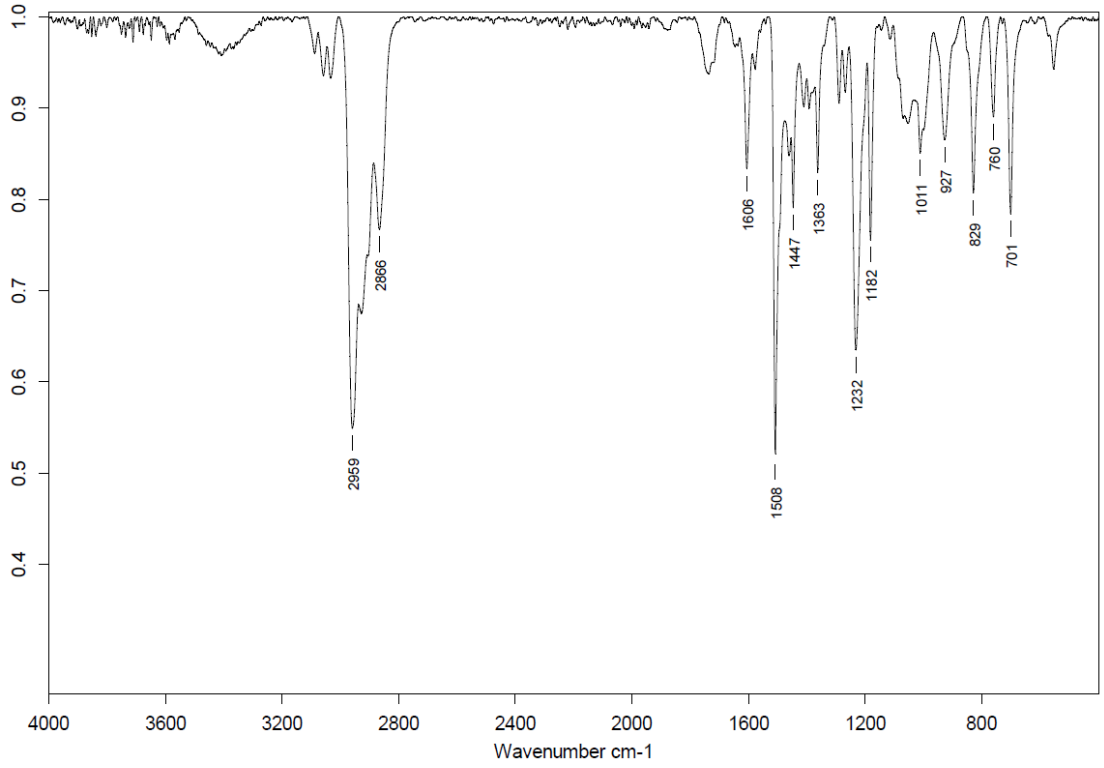
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 – 7.45 (m, 2H), 7.39 – 7.34 (m, 2H), 7.33 – 7.28 (m, 1H), 7.15 – 7.09 (m, 2H), 6.69 – 6.63 (m, 2H), 6.35 (dd, *J* = 17.5, 11.2 Hz, 1H), 5.49 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.44 (dd, *J* = 17.5, 1.1 Hz, 1H), 3.98 – 3.81 (m, 2H), 1.24 (s, 9H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 152.70, 144.14, 140.20, 135.97, 128.62, 127.87, 126.90, 125.68, 119.45, 119.24, 84.70, 70.06, 34.19, 31.59.

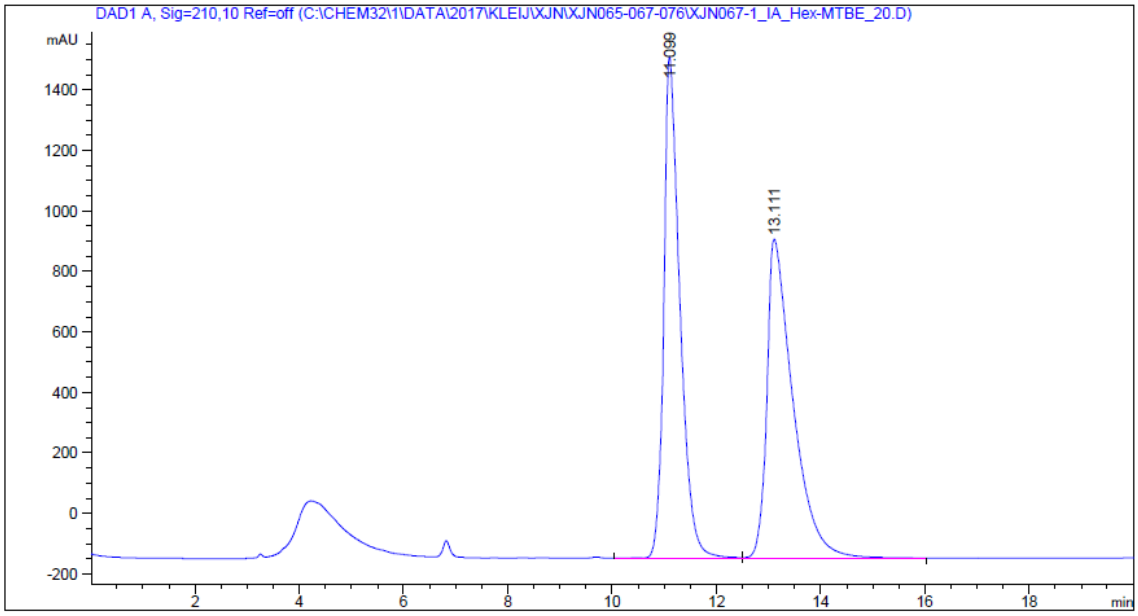
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 319.1669 $(M + Na)^+$, found: 319.1668.

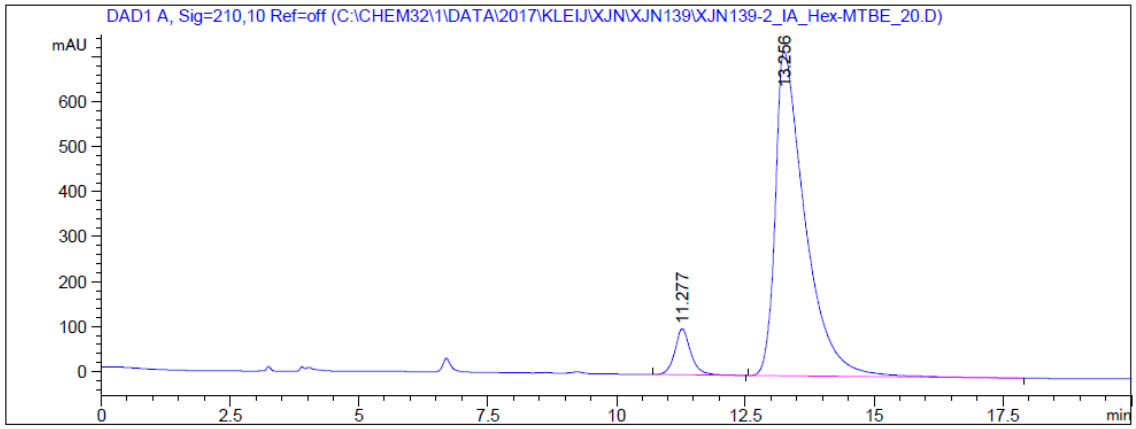
HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 93 : 7 *er*; $[\alpha]_D^{25}$ = –31.72 (*c* = 0.10, $CHCl_3$).

Additional Info : Peak(s) manually integrated

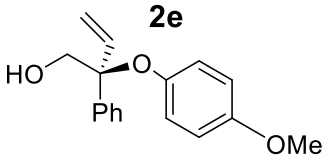


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.099	VV R	0.3155	3.57627e4	1657.73132	49.4024
2	13.111	VB	0.4991	3.66279e4	1054.78235	50.5976

Additional Info : Peak(s) manually integrated

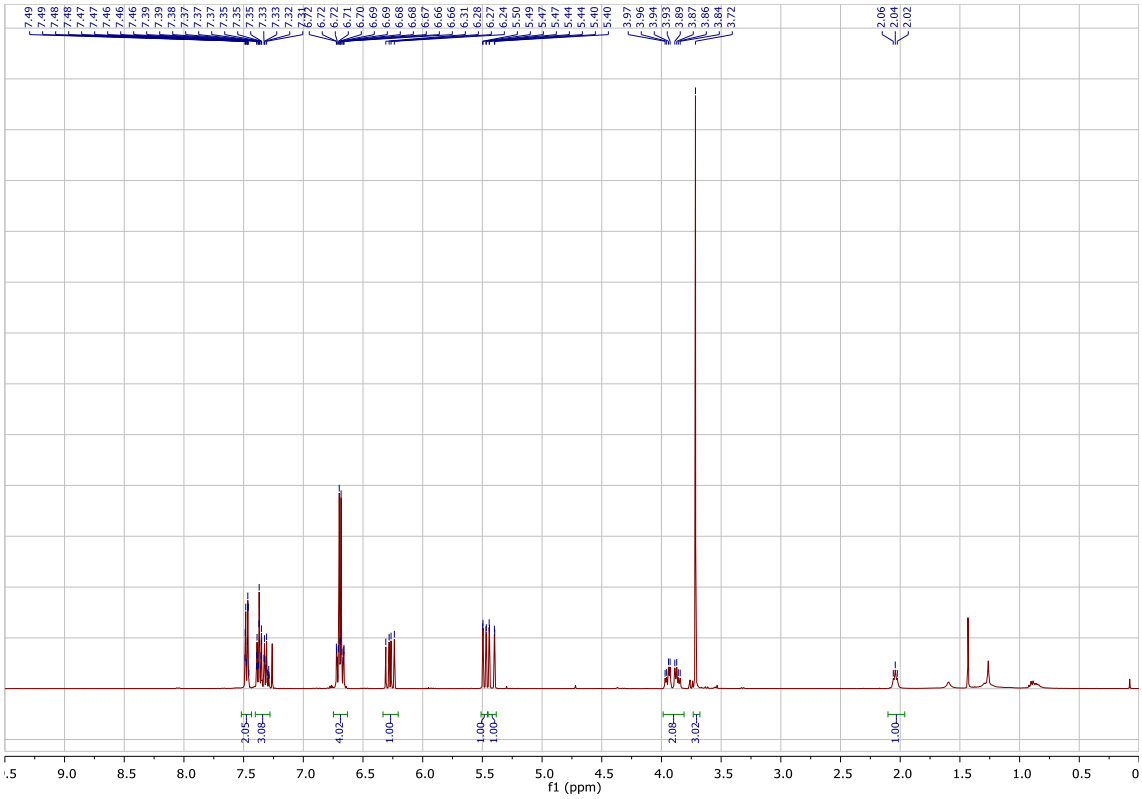


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.277	BB	0.3170	2191.47070	101.87803	7.0105
2	13.256	BB	0.5803	2.90682e4	721.05310	92.9895



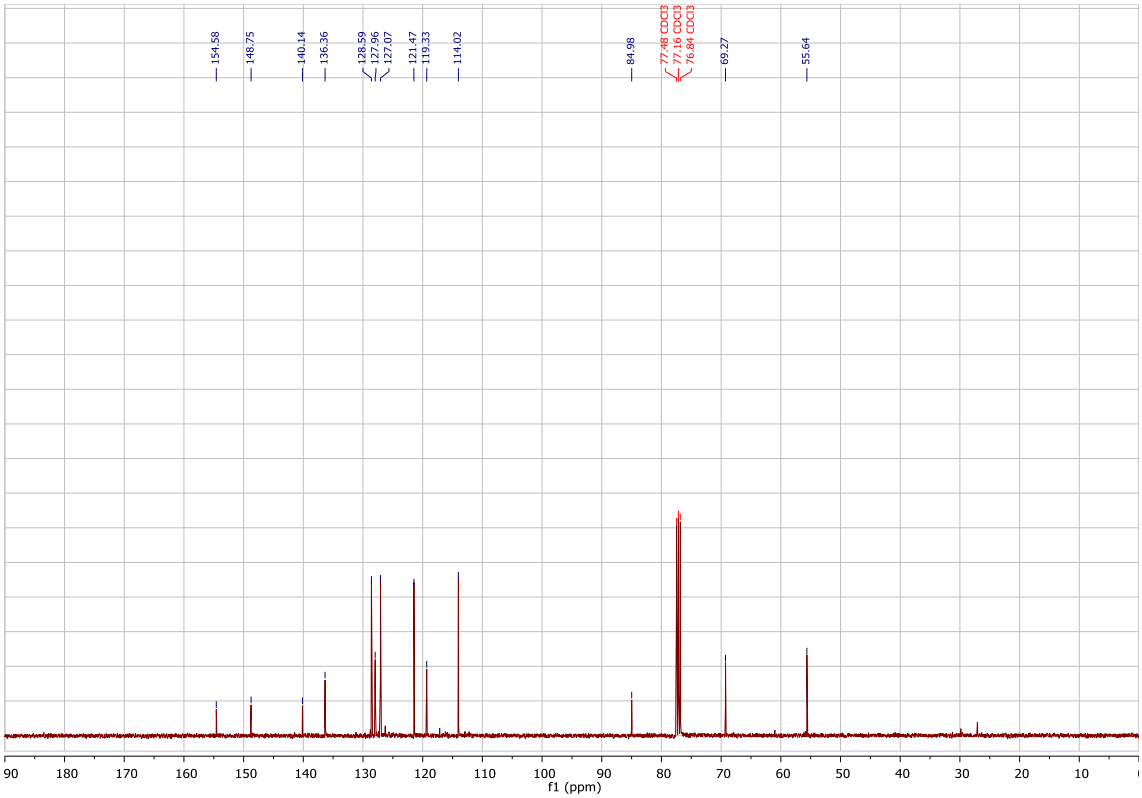
Scale: 0.2 mmol; isolated 45.5 mg (85% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



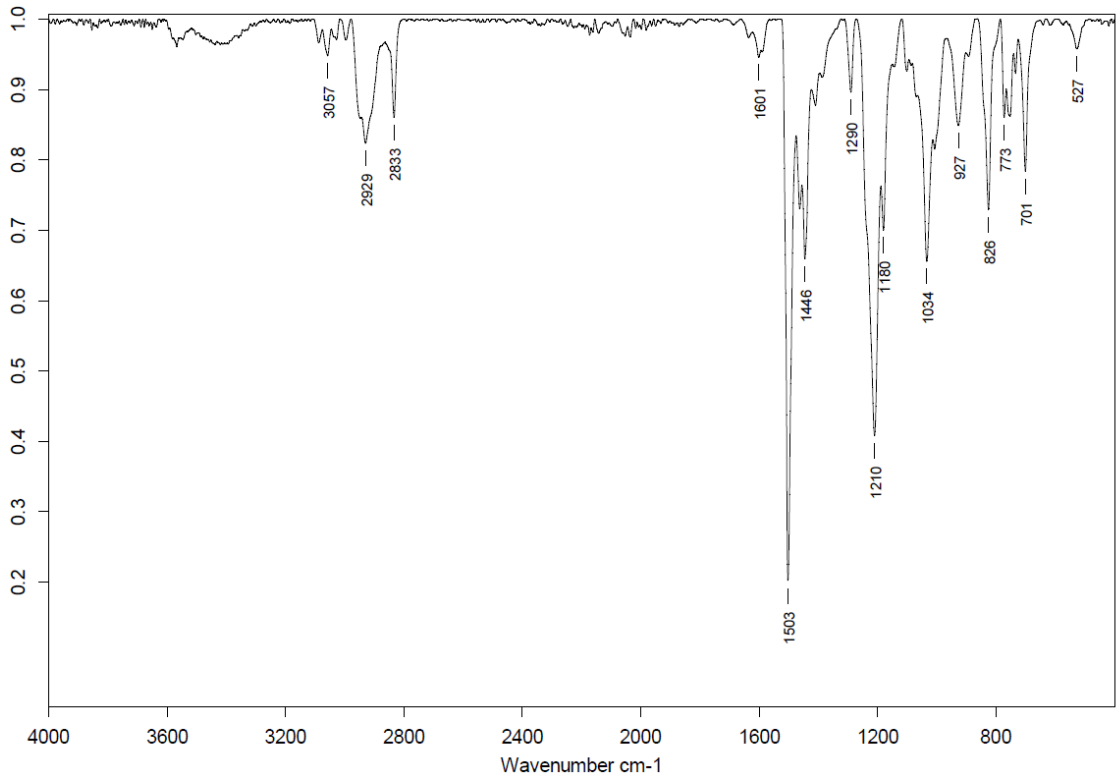
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 – 7.43 (m, 2H), 7.40 – 7.28 (m, 3H), 6.75 – 6.63 (m, 4H), 6.27 (dd, *J* = 17.6, 11.1 Hz, 1H), 5.48 (dd, *J* = 11.1, 1.1 Hz, 1H), 5.42 (dd, *J* = 17.6, 1.1 Hz, 1H), 3.99 – 3.81 (m, 2H), 3.72 (s, 3H), 2.04 (t, *J* = 6.7 Hz, 1H).

^{1}H NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 154.58, 148.75, 140.14, 136.36, 128.59, 127.96, 127.07, 121.47, 119.33, 114.02, 84.98, 69.27, 55.64.

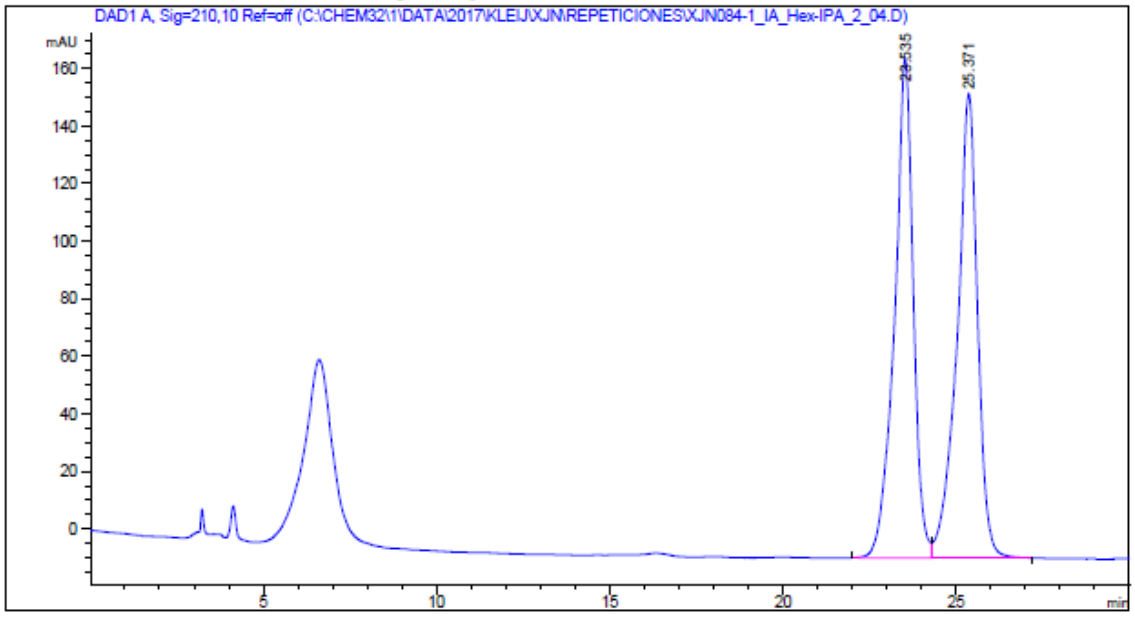
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 293.1148 $(M + Na)^+$, found: 293.1155.

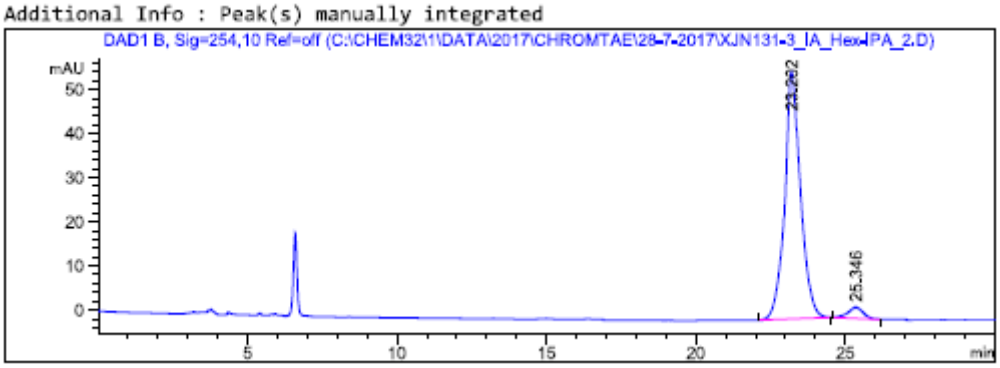
HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/IPA = 98 : 2, 1 mL/min; 96 : 4 *er*; $[\alpha]_D^{25}$ = –39.25 (*c* = 0.11, $CHCl_3$).

Additional Info : Peak(s) manually integrated

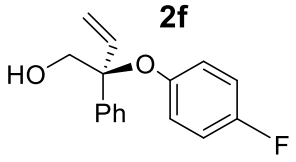


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	23.535	BV	0.5443	6552.61328	173.61475	49.6331
2	25.371	VB	0.5925	6649.49854	161.46825	50.3669

Additional Info : Peak(s) manually integrated

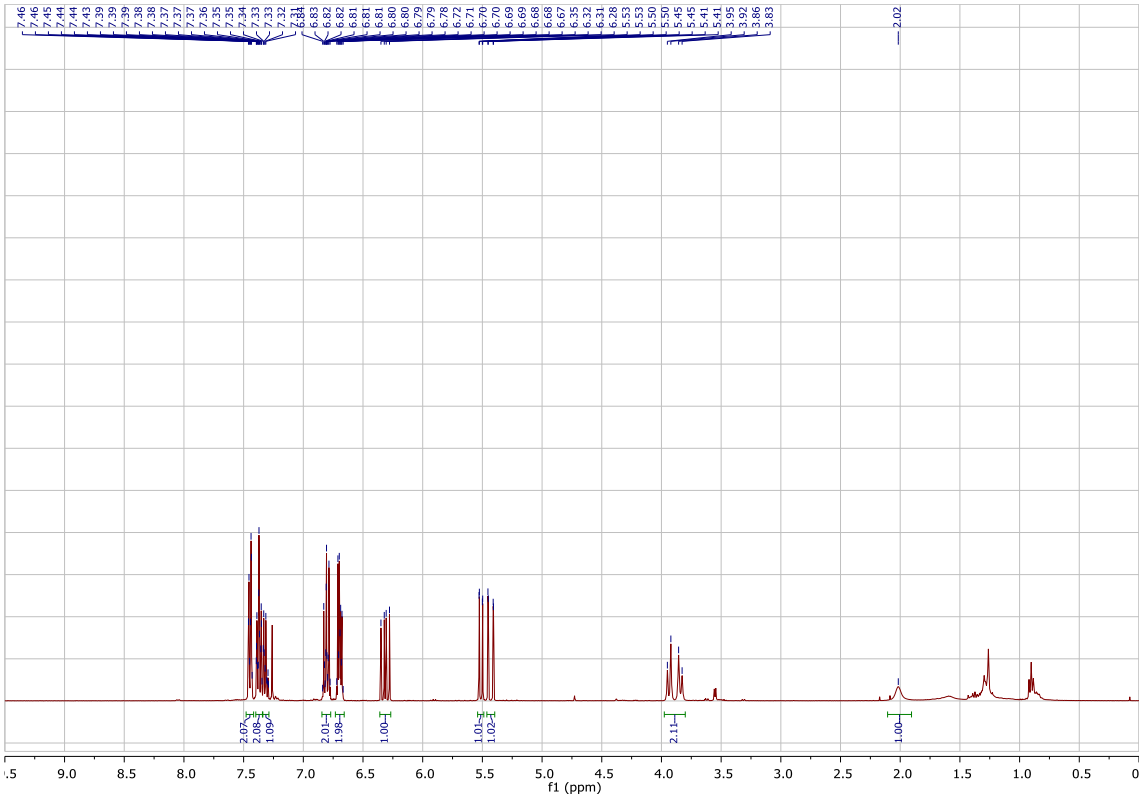


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	23.202	BB	0.5320	2062.57007	55.96486	95.8979
2	25.346	BB	0.4544	88.22784	2.53289	4.1021



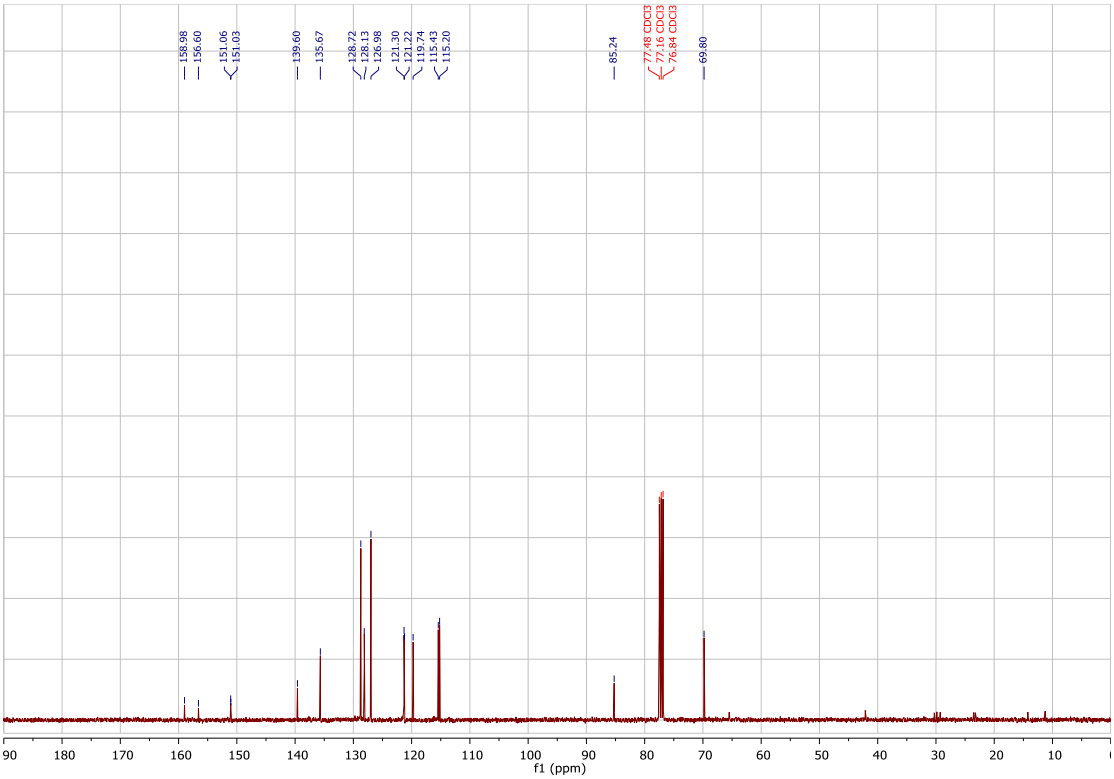
Scale: 0.2 mmol; isolated 39.0 mg (76% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



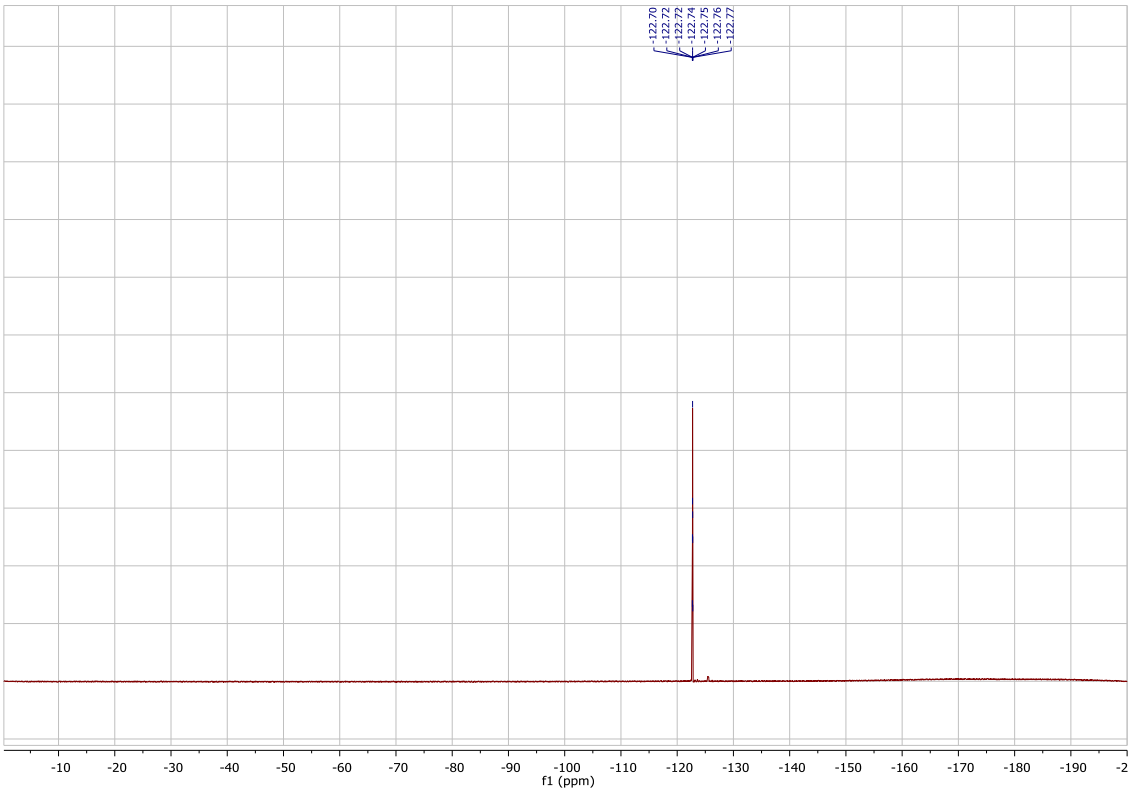
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 – 7.42 (m, 2H), 7.40 – 7.34 (m, 2H), 7.34 – 7.29 (m, 1H), 6.84 – 6.77 (m, 2H), 6.73 – 6.66 (m, 2H), 6.31 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.51 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.43 (dd, *J* = 17.5, 1.0 Hz, 1H), 3.98 – 3.80 (m, 2H), 2.02 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



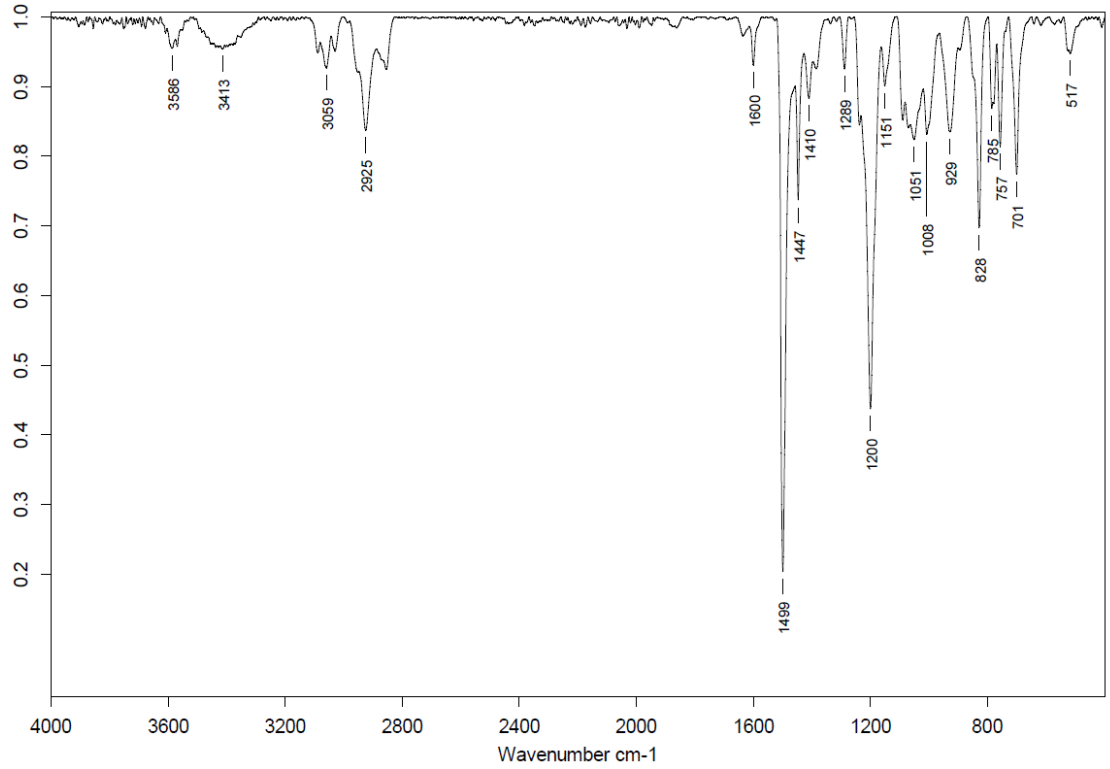
^{13}C NMR (101 MHz, $CDCl_3$) δ 158.98, 156.60, 151.06, 151.03, 139.60, 135.67, 128.72, 128.13, 126.98, 121.30, 121.22, 119.74, 115.43, 115.20, 85.24, 69.80.

^{19}F NMR spectrum ($CDCl_3$)



^{19}F NMR (376 MHz, $CDCl_3$) δ -122.74 (tt, J = 8.5, 4.6 Hz).

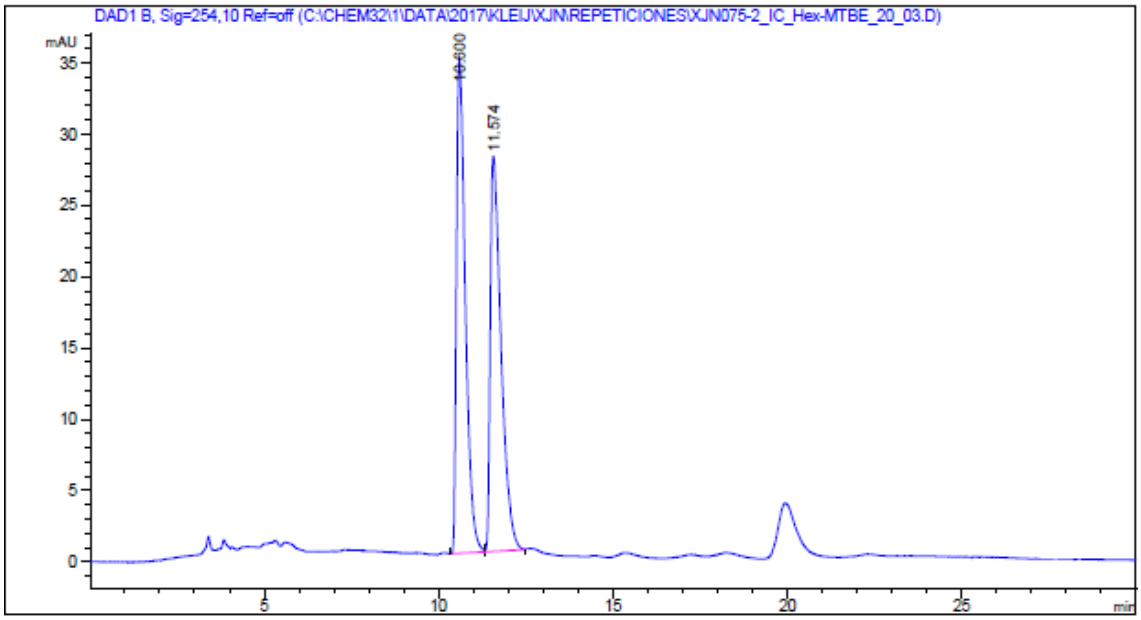
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 281.0948 $(M + Na)^+$, found: 281.0942.

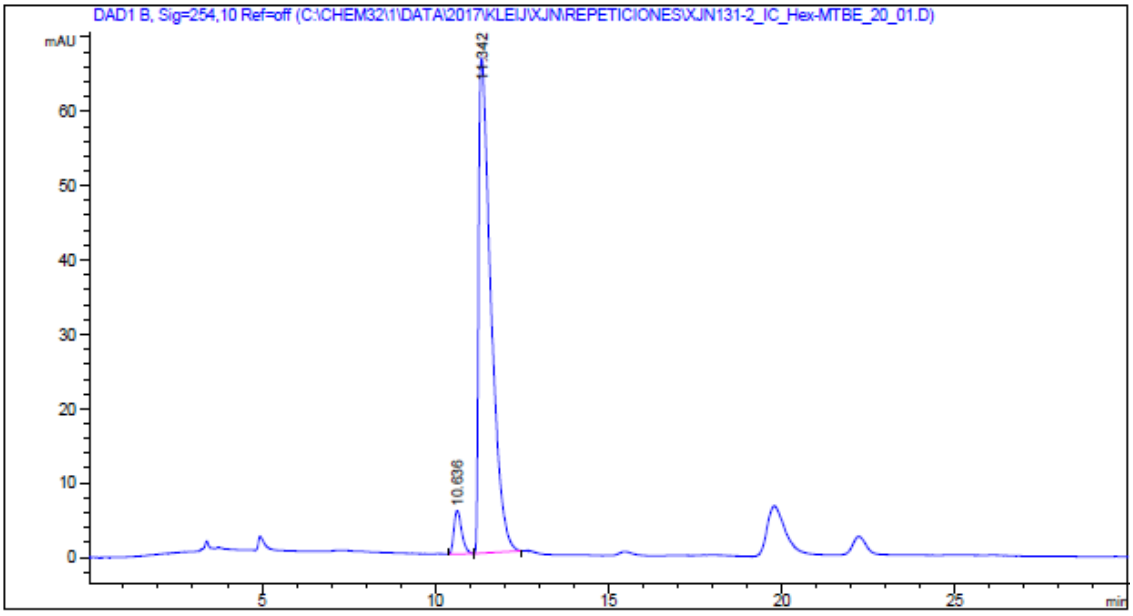
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 95 : 5 *er*; $[\alpha]_D^{25}$ = –44.70 (*c* = 0.10, $CHCl_3$).

Additional Info : Peak(s) manually integrated

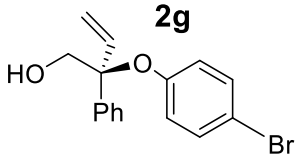


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.600	BV	0.2653	610.44183	34.69475	50.4617
2	11.574	VB	0.3260	599.27106	27.73917	49.5383

Additional Info : Peak(s) manually integrated

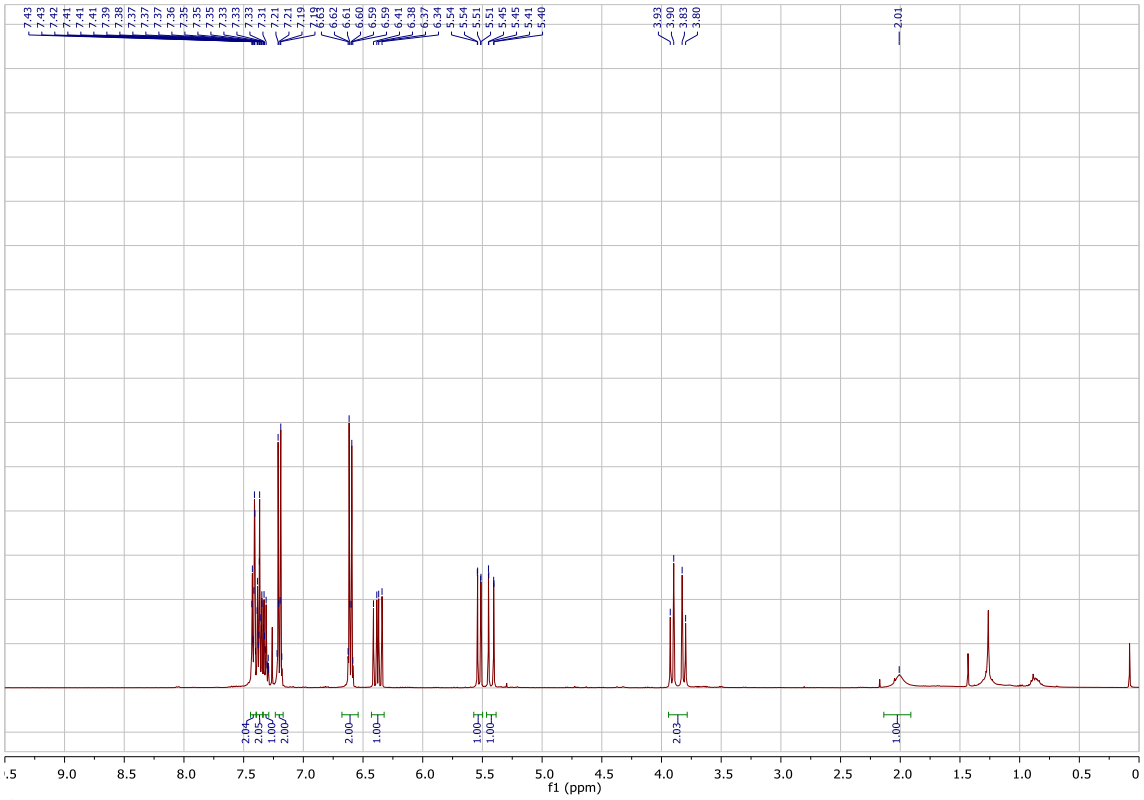


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.636	BB	0.2384	90.91647	5.81561	5.2699
2	11.342	BB	0.3620	1634.28052	66.65661	94.7301



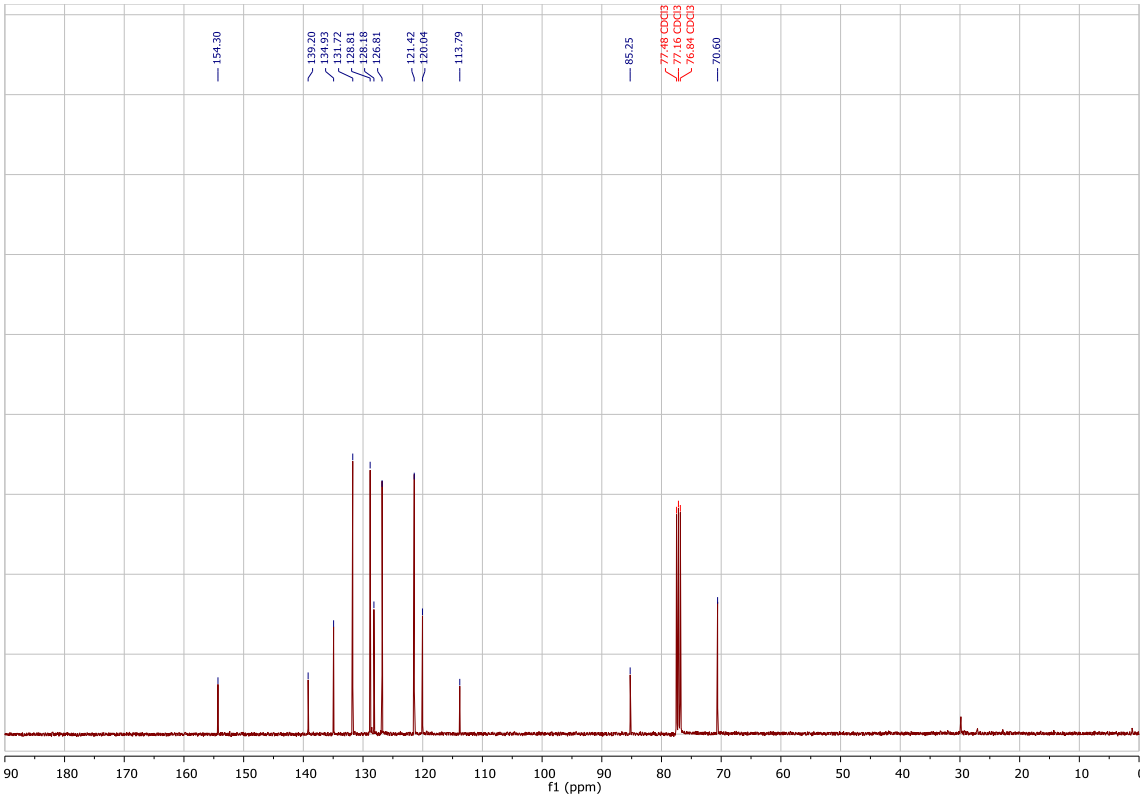
Scale: 0.2 mmol; isolated 52.7 mg (83% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



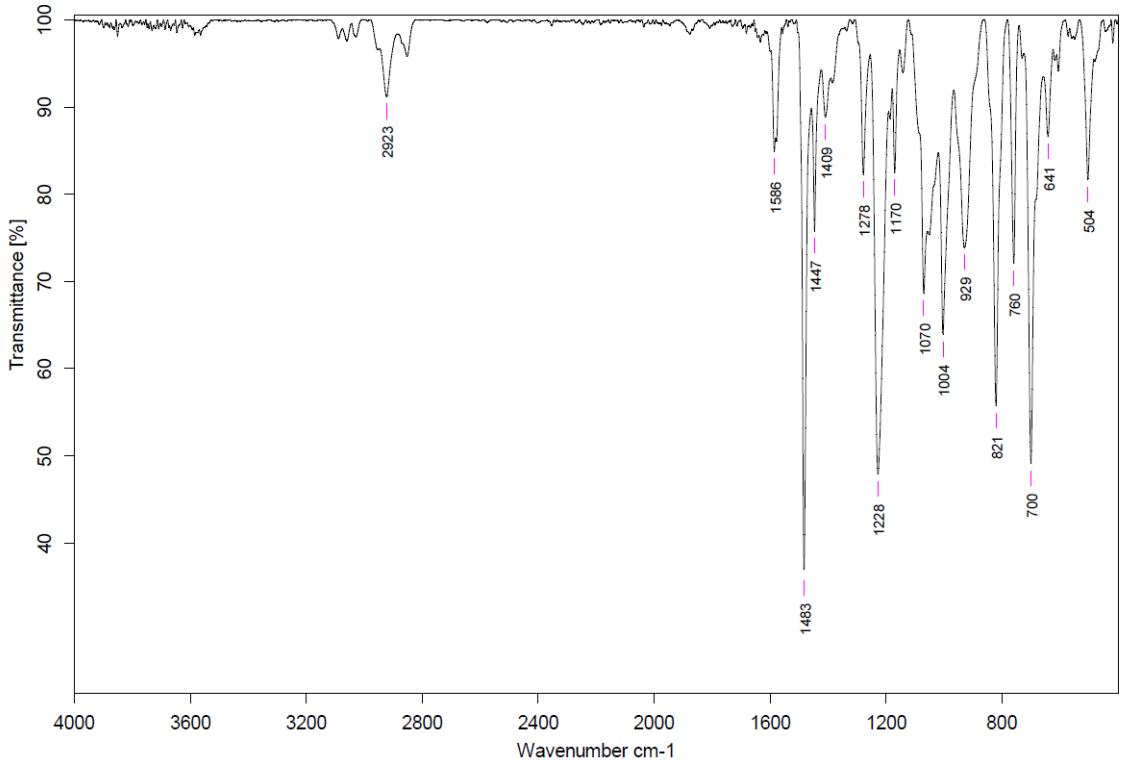
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 – 7.40 (m, 2H), 7.39 – 7.34 (m, 2H), 7.34 – 7.29 (m, 1H), 7.23 – 7.17 (m, 2H), 6.68 – 6.54 (m, 2H), 6.38 (dd, *J* = 17.5, 11.2 Hz, 1H), 5.53 (dd, *J* = 11.1, 0.9 Hz, 1H), 5.43 (dd, *J* = 17.5, 0.9 Hz, 1H), 3.94 – 3.78 (m, 2H), 2.01 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 154.30, 139.20, 134.93, 131.72, 128.81, 128.18, 126.81, 121.42, 120.04, 113.79, 85.25, 70.60.

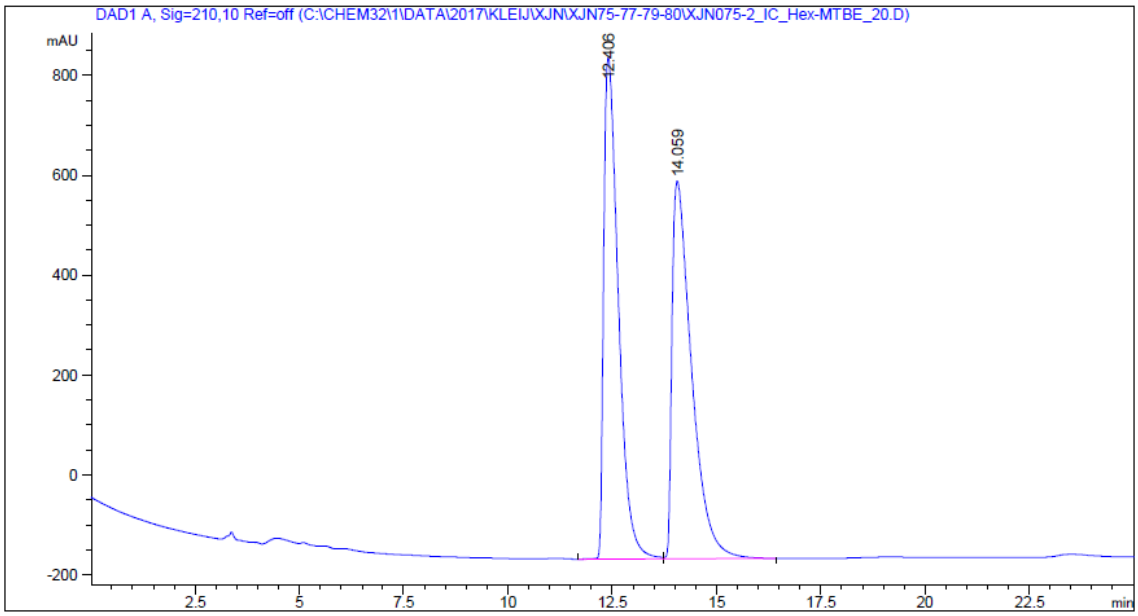
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 341.0148 $(M + Na)^+$, found: 341.0145.

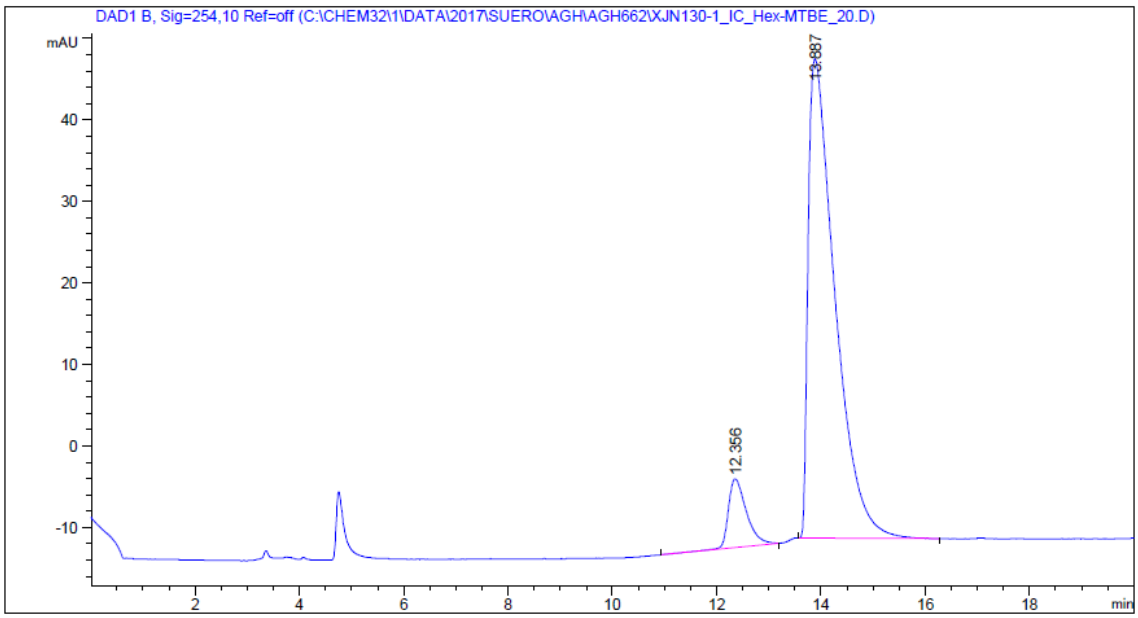
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 91 : 9 *er*; $[\alpha]_D^{25}$ = –40.73 (*c* = 0.09, $CHCl_3$).

Additional Info : Peak(s) manually integrated

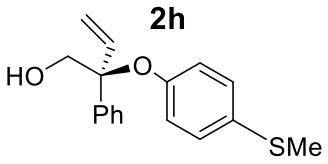


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.406	BV	0.3783	2.44396e4	1003.01770	49.8384
2	14.059	VB	0.4875	2.45981e4	756.26312	50.1616

Additional Info : Peak(s) manually integrated

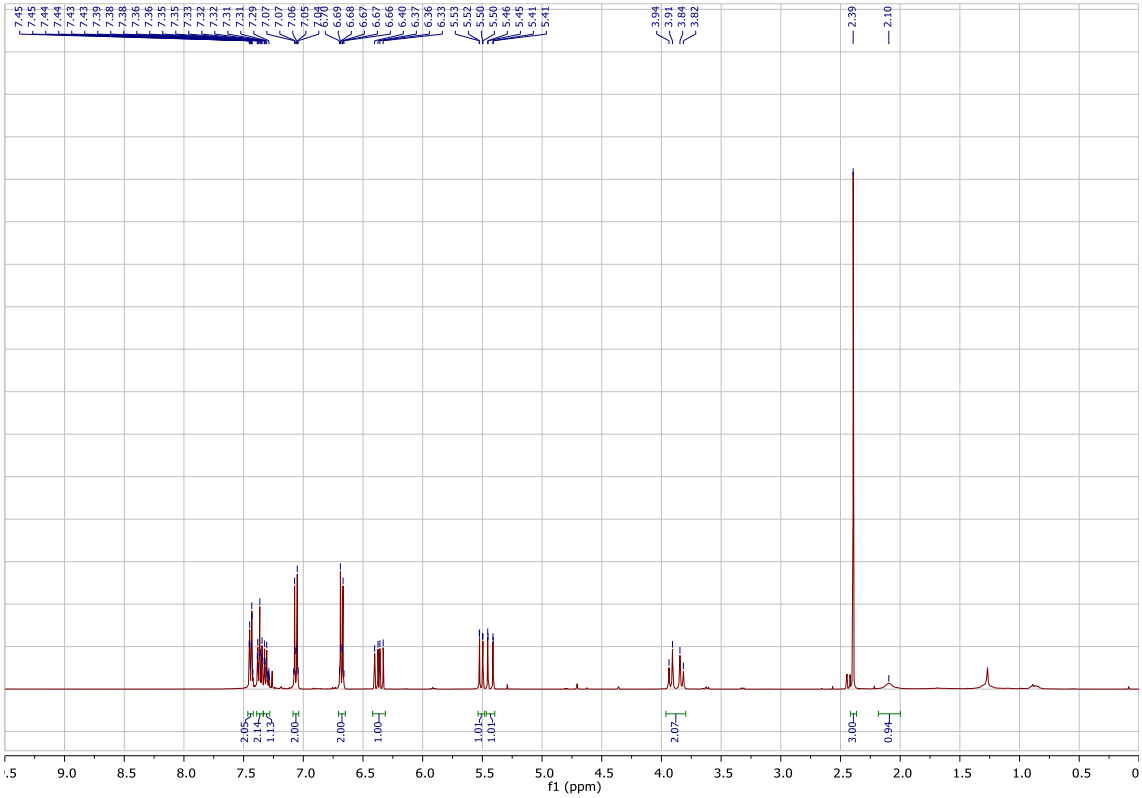


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.356	BB	0.3629	202.63643	8.41640	8.8105
2	13.887	BB	0.5260	2097.29761	58.81979	91.1895



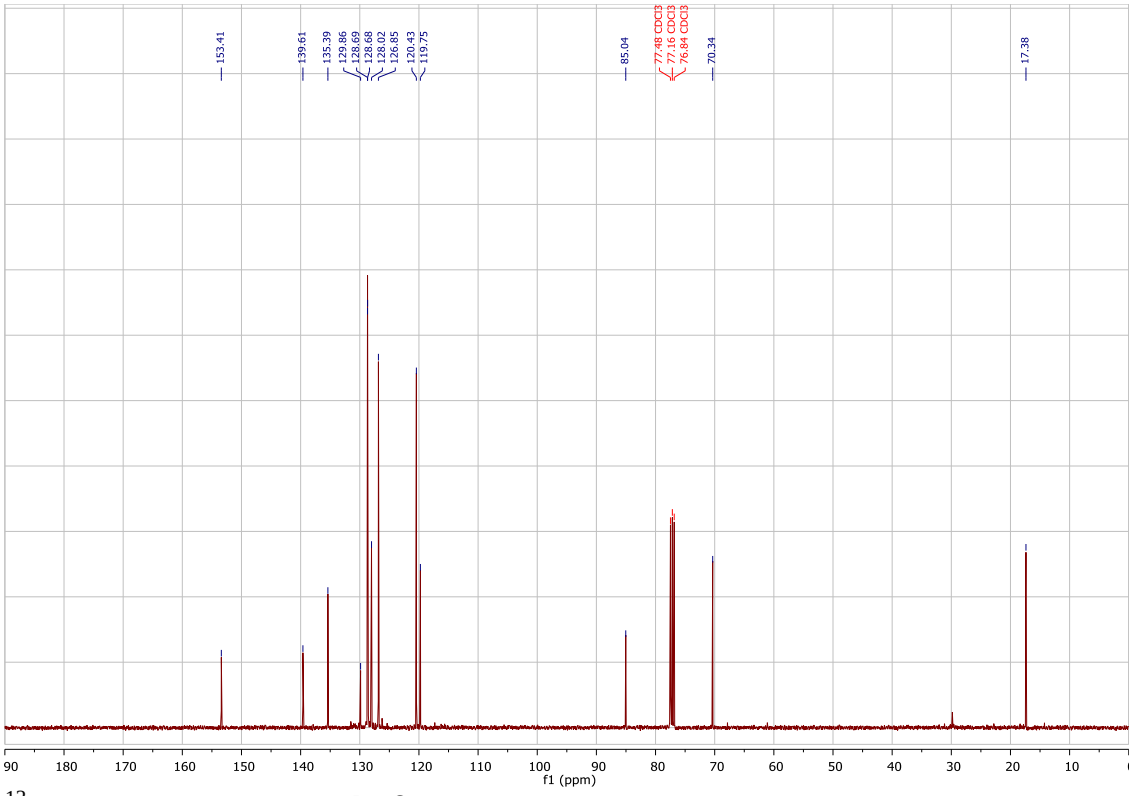
Scale: 0.2 mmol; isolated 45.7 mg (80% yield), light yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



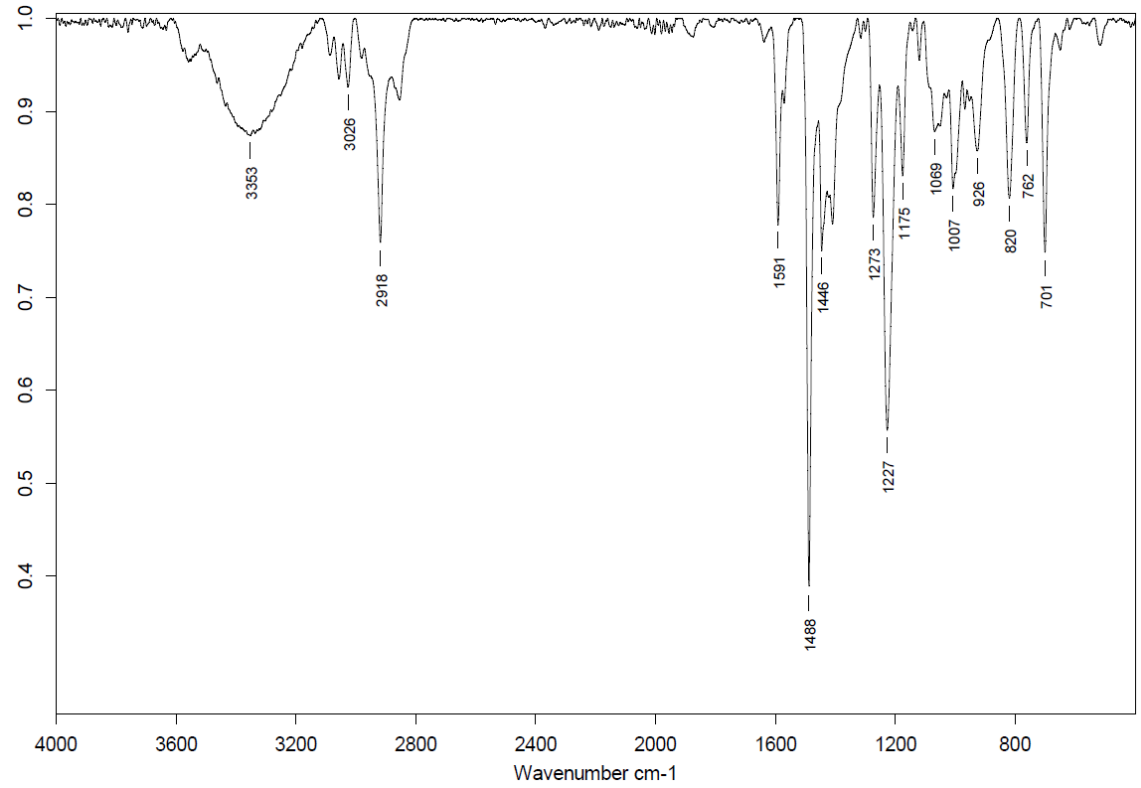
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.42 (m, 2H), 7.39 – 7.34 (m, 2H), 7.33 – 7.28 (m, 1H), 7.09 – 7.04 (m, 2H), 6.70 – 6.65 (m, 2H), 6.37 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.51 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.43 (dd, *J* = 17.5, 1.0 Hz, 1H), 3.96 – 3.80 (m, 2H), 2.39 (s, 3H), 2.10 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



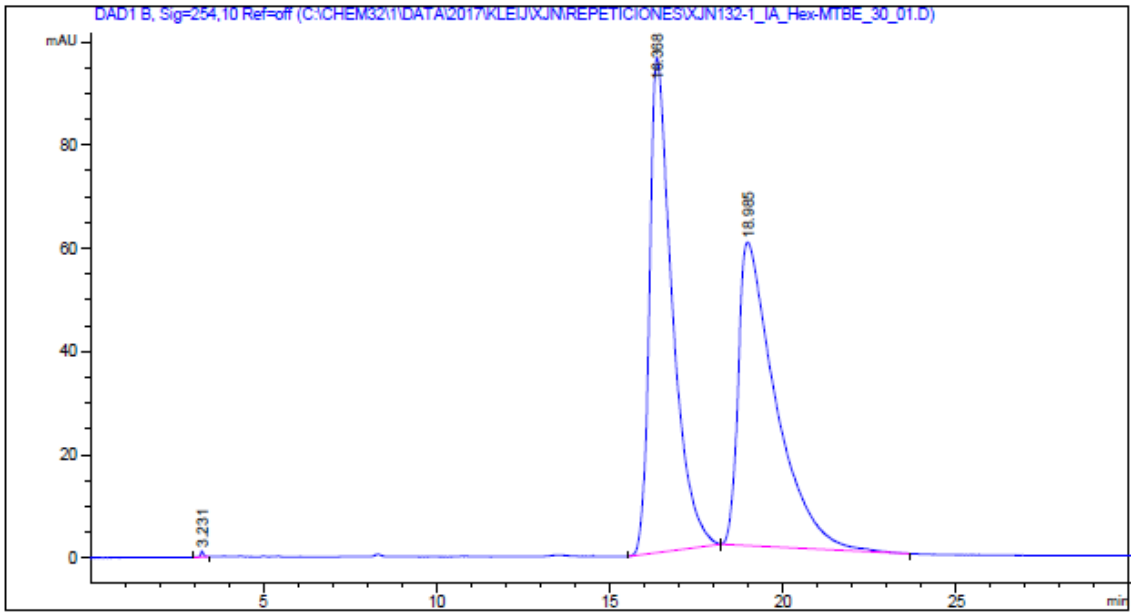
^{13}C NMR (101 MHz, $CDCl_3$) δ 153.41, 139.61, 135.39, 129.86, 128.69, 128.68, 128.02, 126.85, 120.43, 119.75, 85.04, 70.34, 17.38.

IR spectrum (neat)



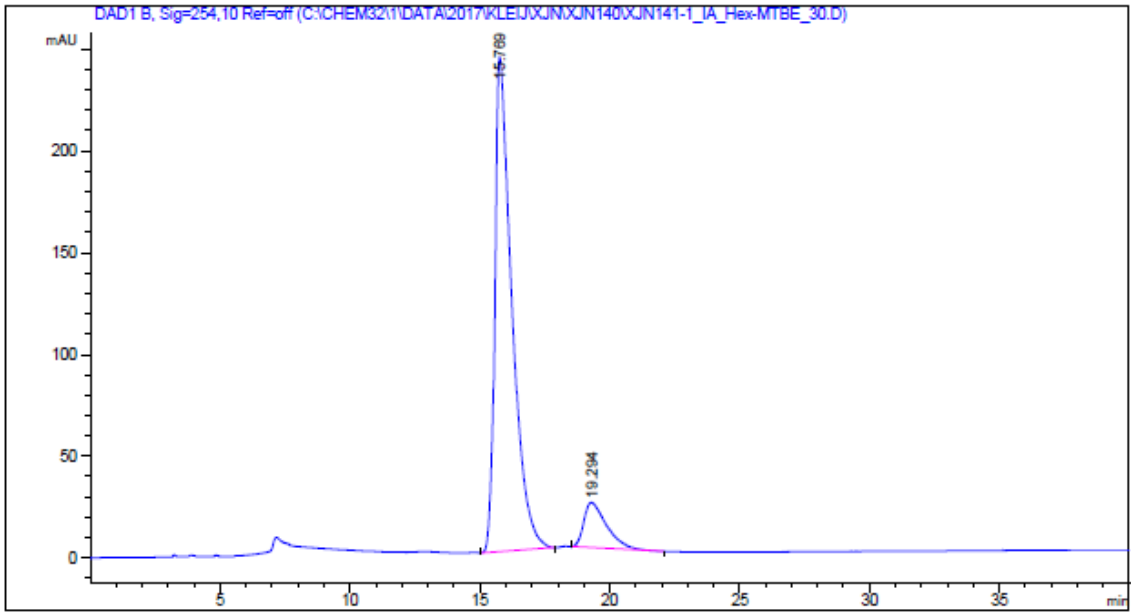
HRMS (ESI+, MeOH): *m/z* calcd. 309.0920 $(M + Na)^+$, found: 309.0921.

HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 89 : 11 *er*; $[\alpha]_D^{25}$ = –33.99 (*c* = 0.12, $CHCl_3$).

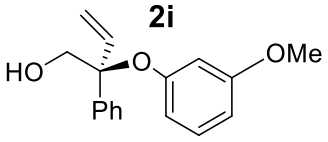


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	3.231	BB	0.0837	6.32915	1.15846	0.0720
2	16.368	BB	0.6603	4393.03076	95.93186	49.9414
3	18.985	BB	1.0219	4397.01514	58.83359	49.9867

Additional Info : Peak(s) manually integrated

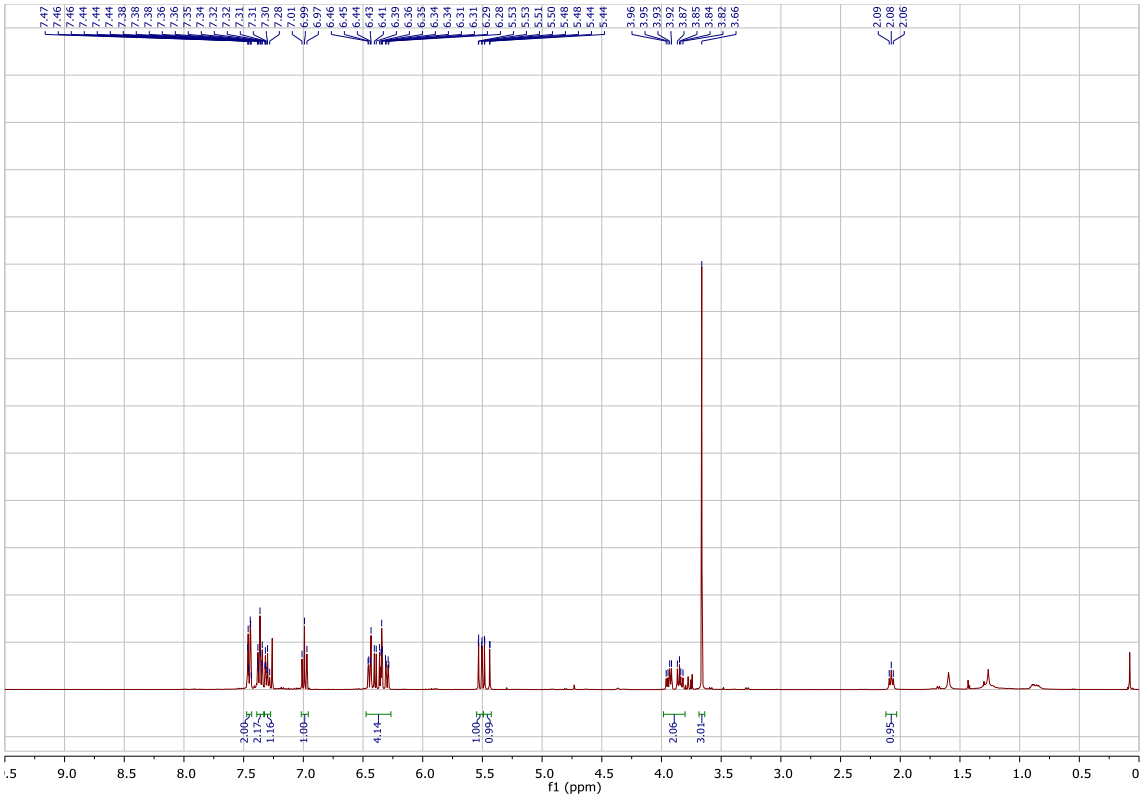


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	15.769	BB	0.6479	1.10365e4	242.97923	88.9968
2	19.294	BB	0.8642	1364.50171	22.22851	11.0032



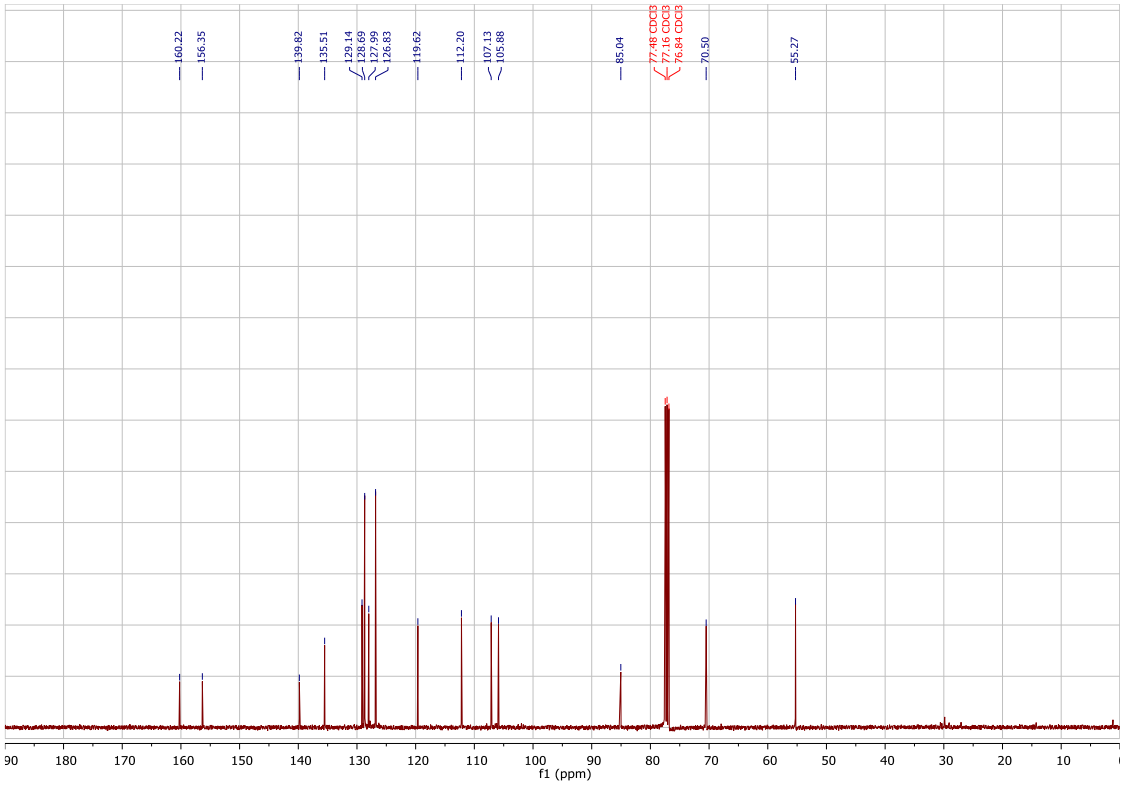
Scale: 0.2 mmol; isolated 41 mg (76% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



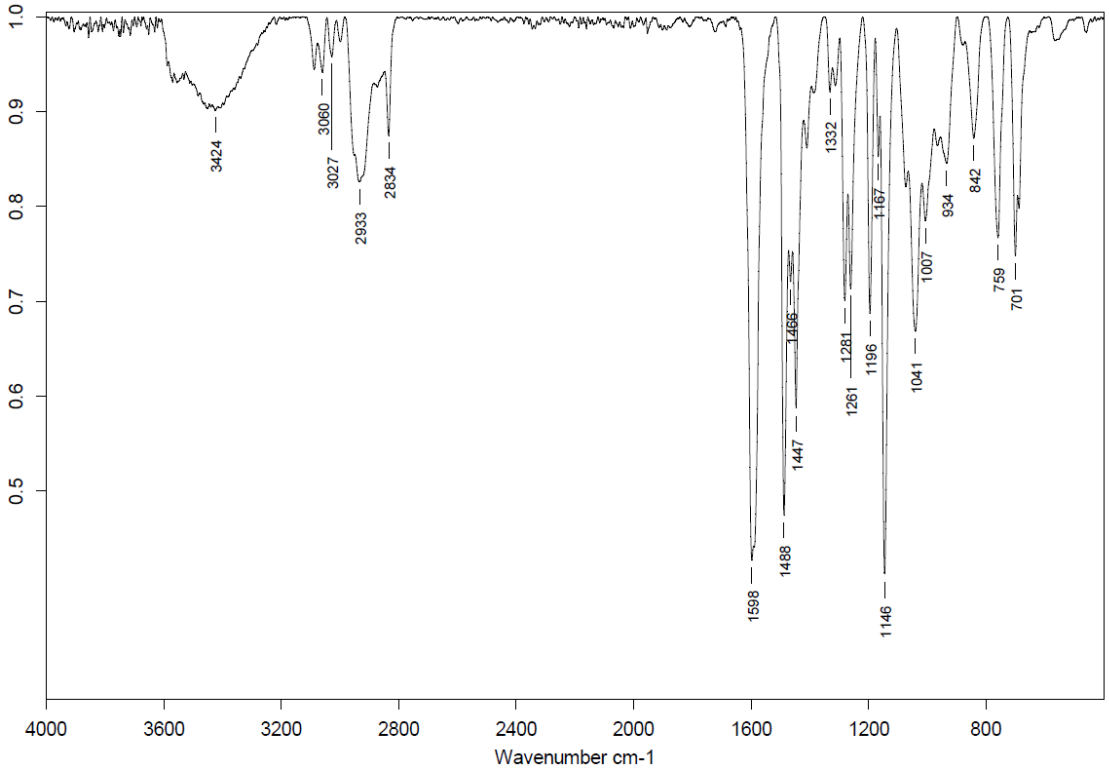
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (m, 2H), 7.39 – 7.33 (m, 2H), 7.33 – 7.27 (m, 1H), 6.99 (t, *J* = 8.2 Hz, 1H), 6.47 – 6.27 (m, 4H), 5.52 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.46 (dd, *J* = 17.5, 1.0 Hz, 1H), 3.98 – 3.80 (m, 2H), 3.66 (s, 3H), 2.08 (t, *J* = 6.9 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 160.22, 156.35, 139.82, 135.51, 129.14, 128.69, 127.99, 126.83, 119.62, 112.20, 107.13, 105.88, 85.04, 70.50, 55.27.

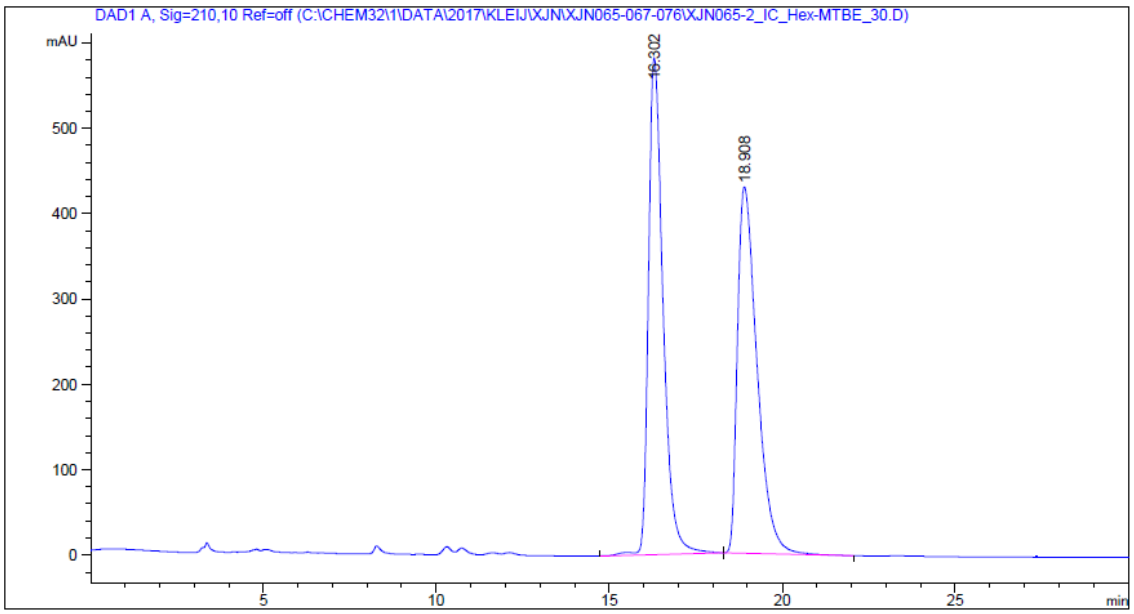
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 293.1157 $(M + Na)^+$, found: 293.1148.

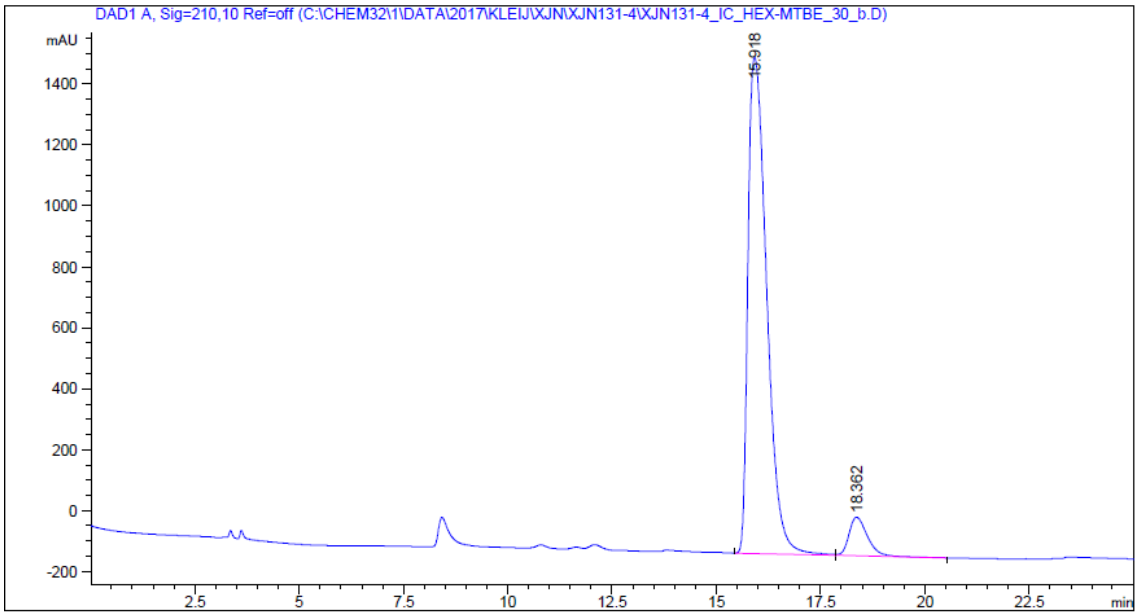
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 93 : 7 *er*; $[\alpha]_D^{25} = -38.13$ (*c* = 0.10, $CHCl_3$).

Additional Info : Peak(s) manually integrated

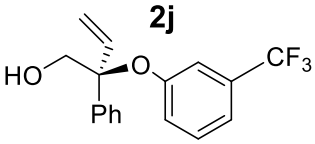


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	16.302	BB	0.4488	1.70972e4	581.85236	50.3448
2	18.908	BB	0.6020	1.68630e4	429.51129	49.6552

Additional Info : Peak(s) manually integrated

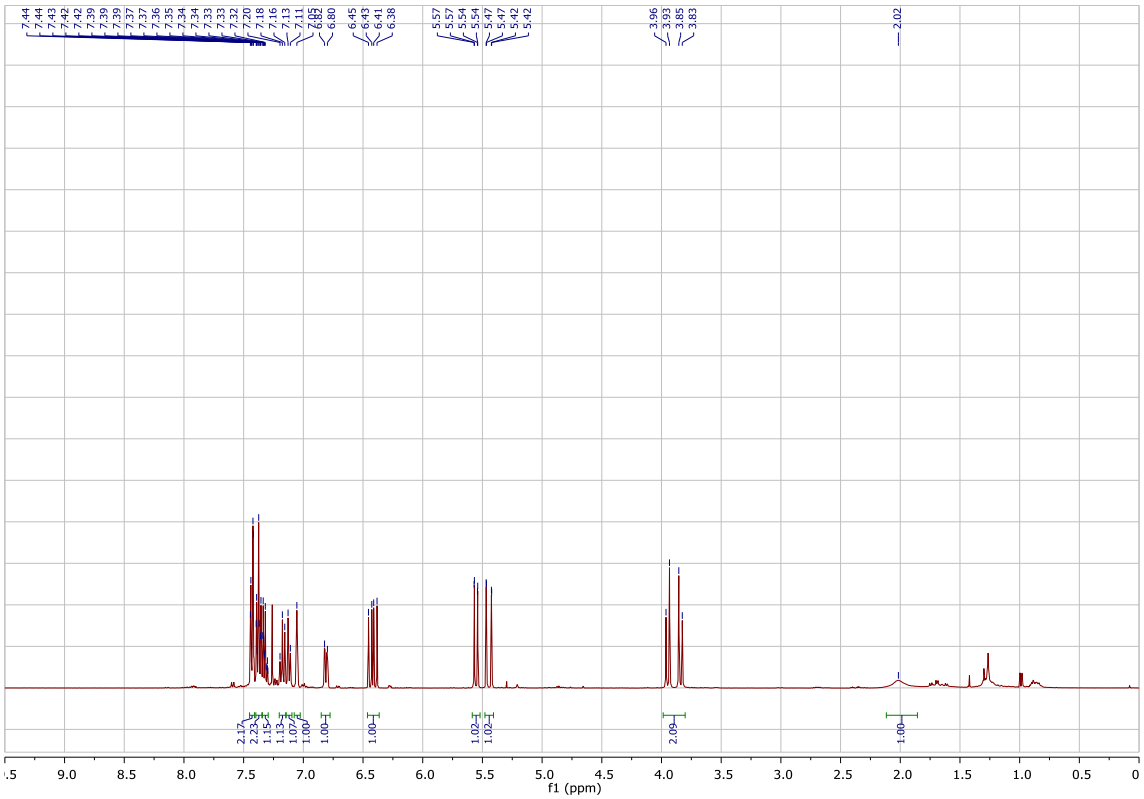


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	15.918	BV	0.4887	5.06374e4	1628.62683	92.8431
2	18.362	VB	0.4712	3903.44067	126.79259	7.1569



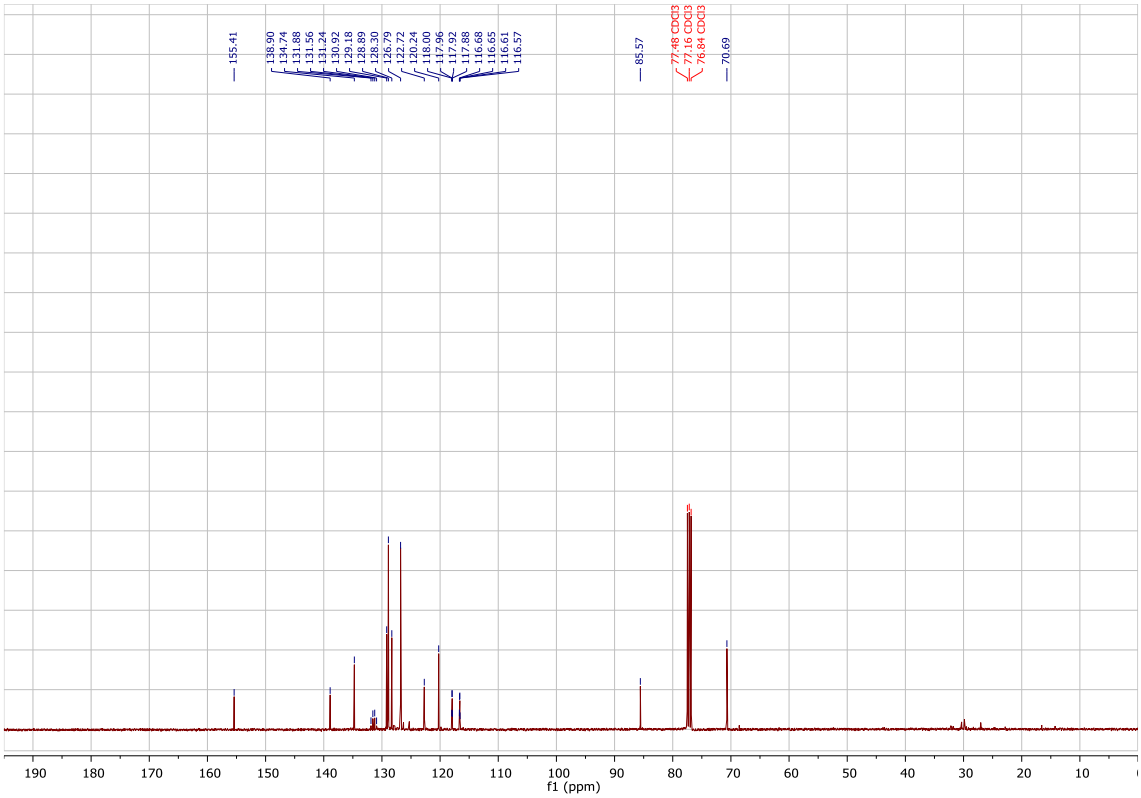
Scale: 0.2 mmol; isolated 35.7 mg (58% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



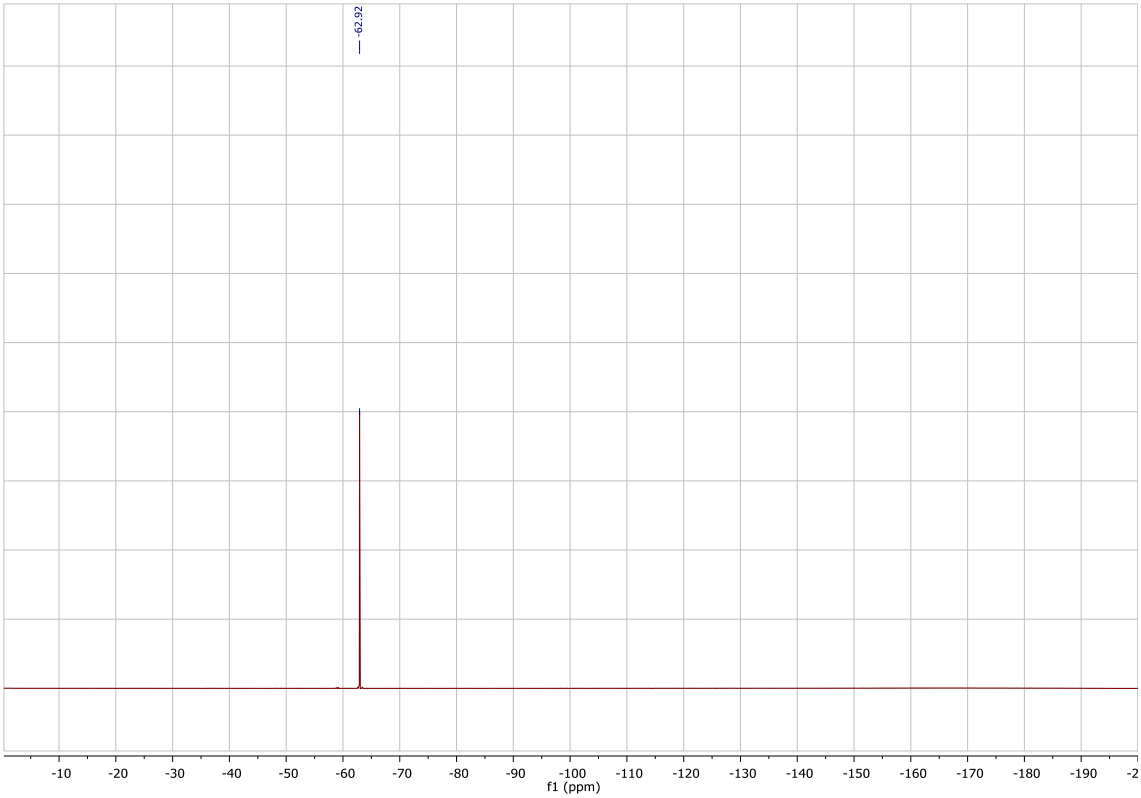
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (m, 2H), 7.40 – 7.35 (m, 2H), 7.34 – 7.29 (m, 1H), 7.18 (t, *J* = 7.9 Hz, 1H), 7.12 (d, *J* = 7.7 Hz, 1H), 7.05 (s, 1H), 6.81 (d, *J* = 9.6 Hz, 1H), 6.42 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.55 (dd, *J* = 11.1, 0.9 Hz, 1H), 5.45 (dd, *J* = 17.5, 0.9 Hz, 1H), 3.99 – 3.80 (m, 2H), 2.02 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



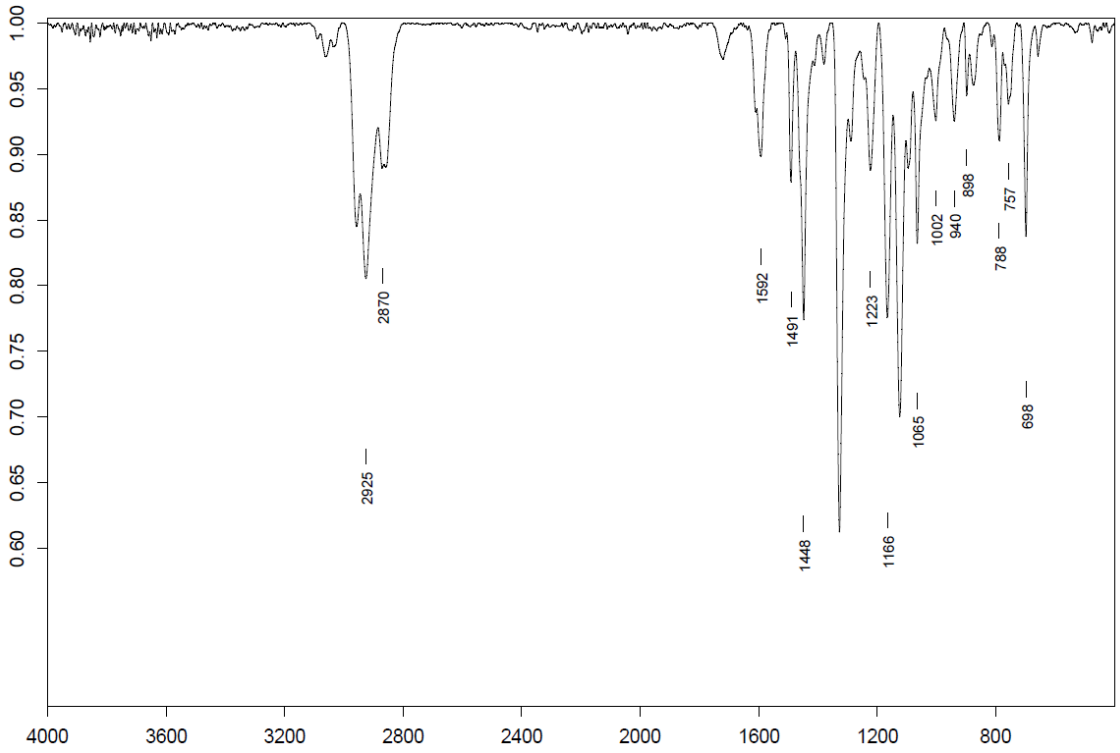
^{13}C NMR (101 MHz, $CDCl_3$) δ 155.41, 138.90, 134.74, 131.40 (q, *J* = 32.32 Hz), 129.18, 128.89, 128.30, 126.79, 122.72, 120.24, 117.94 (q, J = 4.04 Hz), 116.63 (q, *J* = 4.04 Hz), 85.57, 70.69.

^{19}F NMR spectrum ($CDCl_3$)



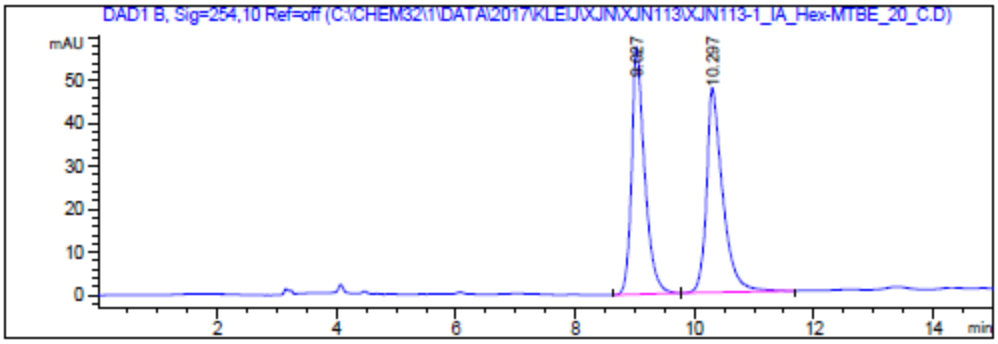
^{19}F NMR (376 MHz, $CDCl_3$) δ -62.92.

IR spectrum (neat)



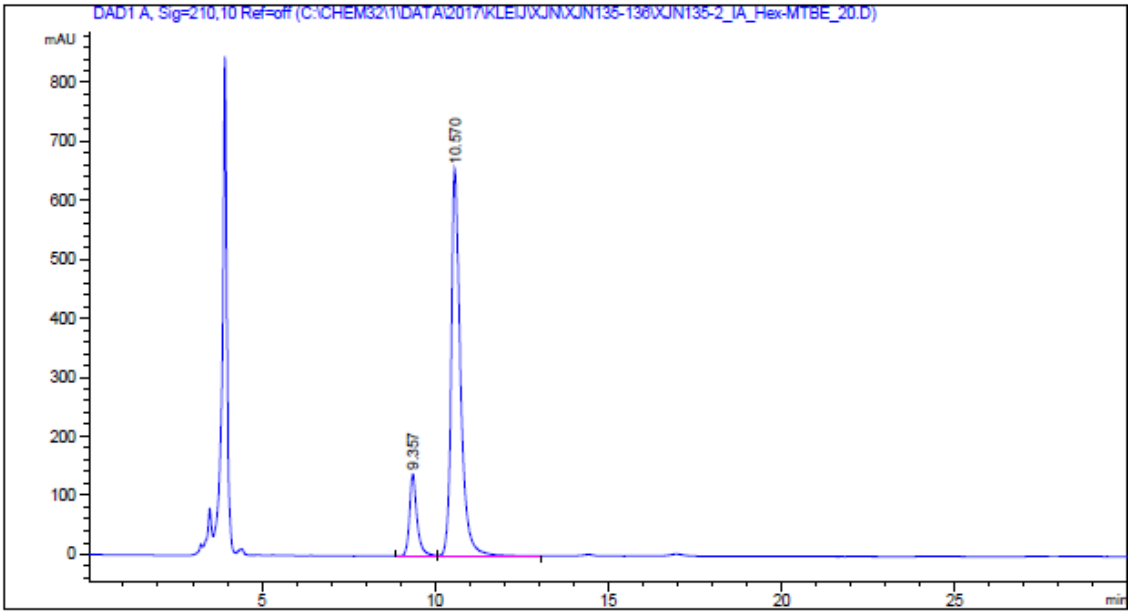
HRMS (ESI+, MeOH): *m/z* calcd. 331.0916 $(M + Na)^+$, found: 331.0922.

HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 85 : 15 *er*; $[\alpha]_D^{25}$ = –43.10 (*c* = 0.11, $CHCl_3$).

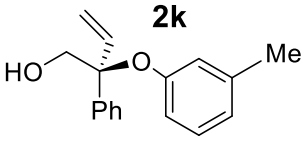


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.027	BB	0.2214	872.97479	57.40595	49.3845
2	10.297	BB	0.2695	894.73419	47.56058	50.6155

Additional Info : Peak(s) manually integrated

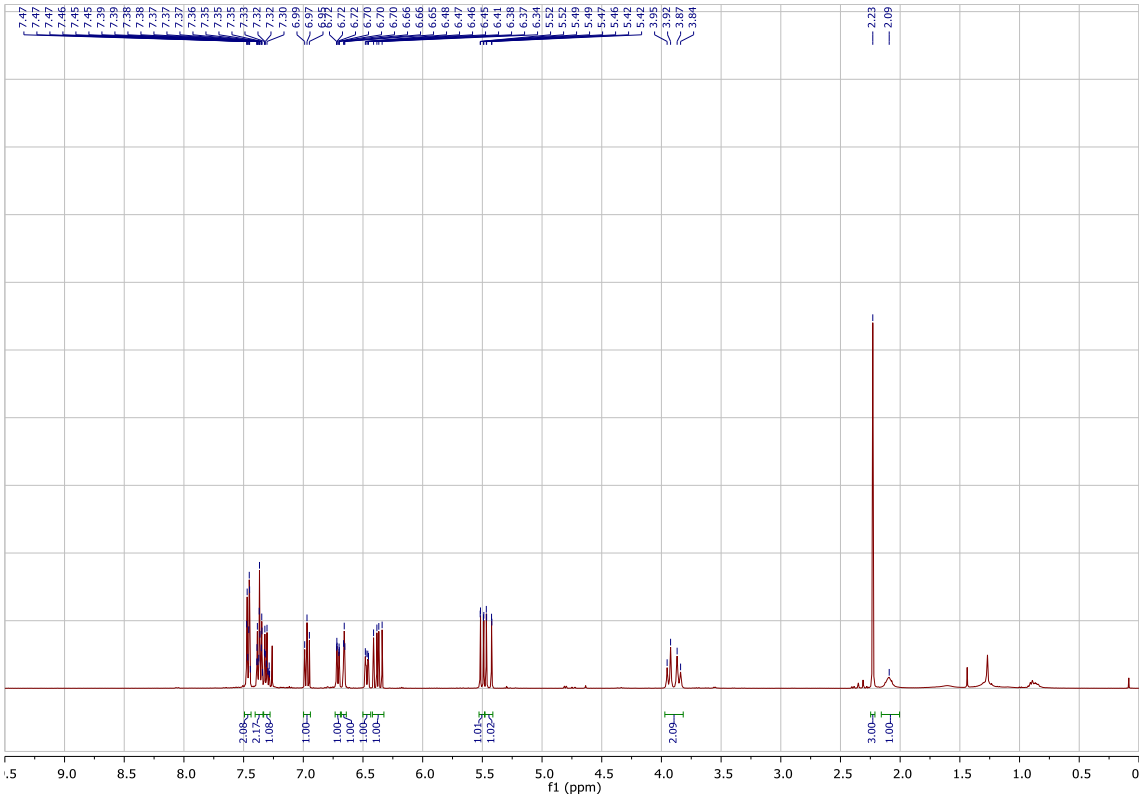


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.357	BV	0.2197	2099.95581	139.46379	14.6686
2	10.570	VB	0.2691	1.22160e4	656.40436	85.3314



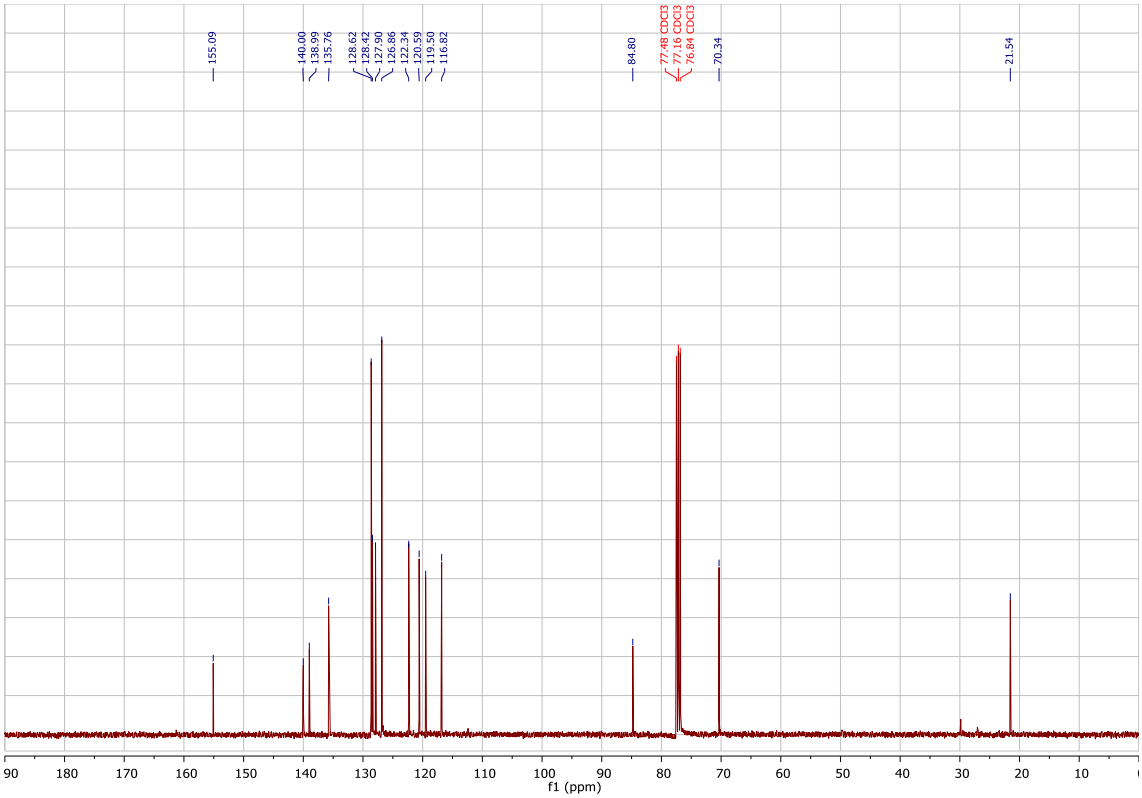
Scale: 0.2 mmol; isolated 42.6 mg (84% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



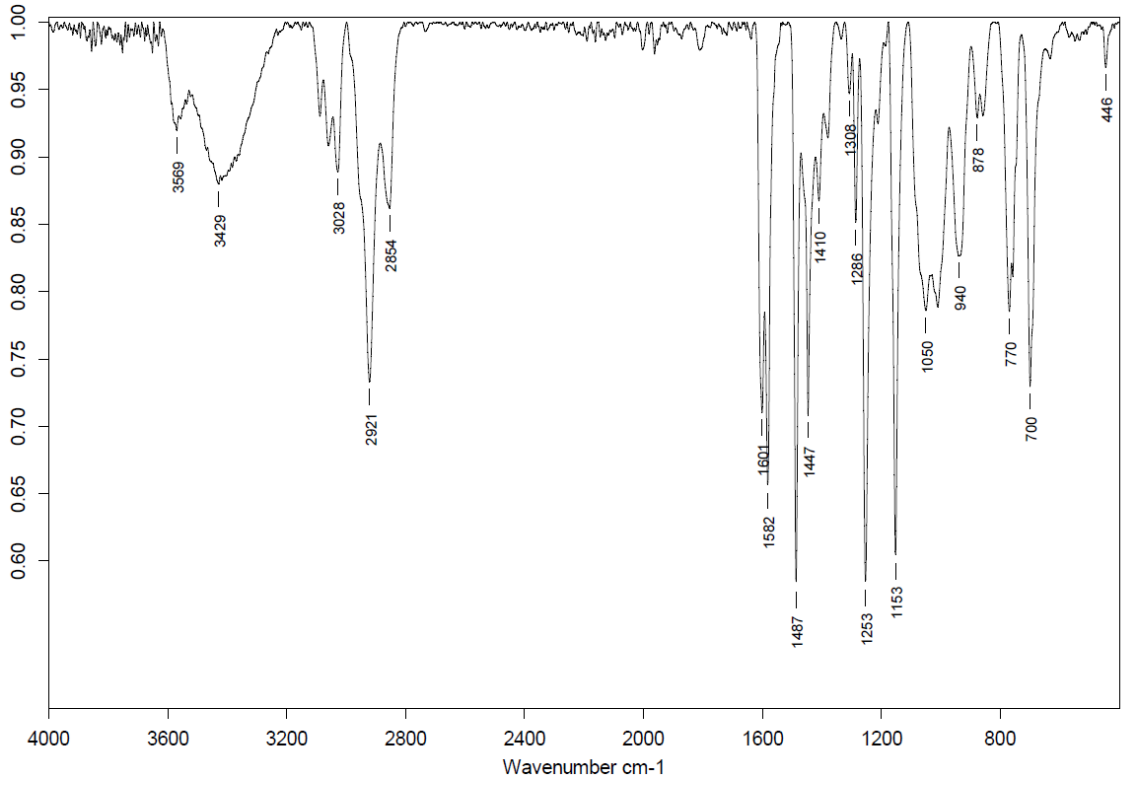
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 – 7.44 (m, 2H), 7.40 – 7.34 (m, 2H), 7.33 – 7.28 (m, 1H), 6.97 (t, *J* = 7.9 Hz, 1H), 6.71 (m, 1H), 6.66 (t, *J* = 2.0 Hz, 1H), 6.47 (dd, *J* = 8.2, 2.4 Hz, 1H), 6.38 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.50 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.44 (dd, *J* = 17.5, 1.0 Hz, 1H), 3.97 – 3.82 (m, 2H), 2.23 (s, 3H), 2.09 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 155.09, 140.00, 138.99, 135.76, 128.62, 128.42, 127.90, 126.86, 122.34, 120.59, 119.50, 116.82, 84.80, 70.34, 21.54.

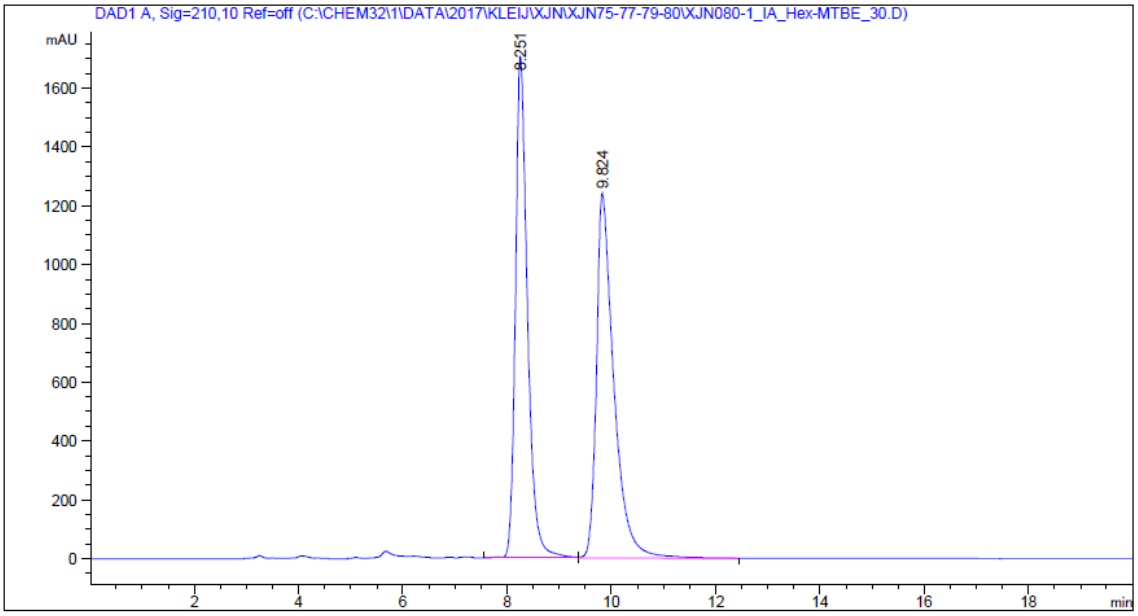
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 277.1199 $(M + Na)^+$, found: 277.1186.

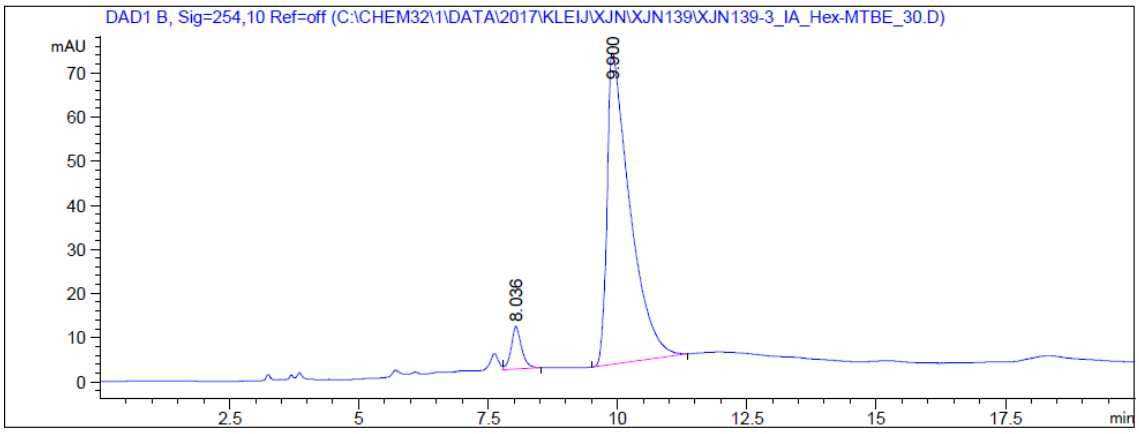
HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 94 : 6 *er*; $[\alpha]_D^{25} = -40.14$ (*c* = 0.11, $CHCl_3$).

Additional Info : Peak(s) manually integrated



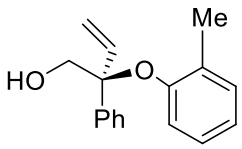
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.251	VV R	0.2370	2.73893e4	1705.96655	48.8045
2	9.824	VB	0.3343	2.87311e4	1240.05713	51.1955

Additional Info : Peak(s) manually integrated



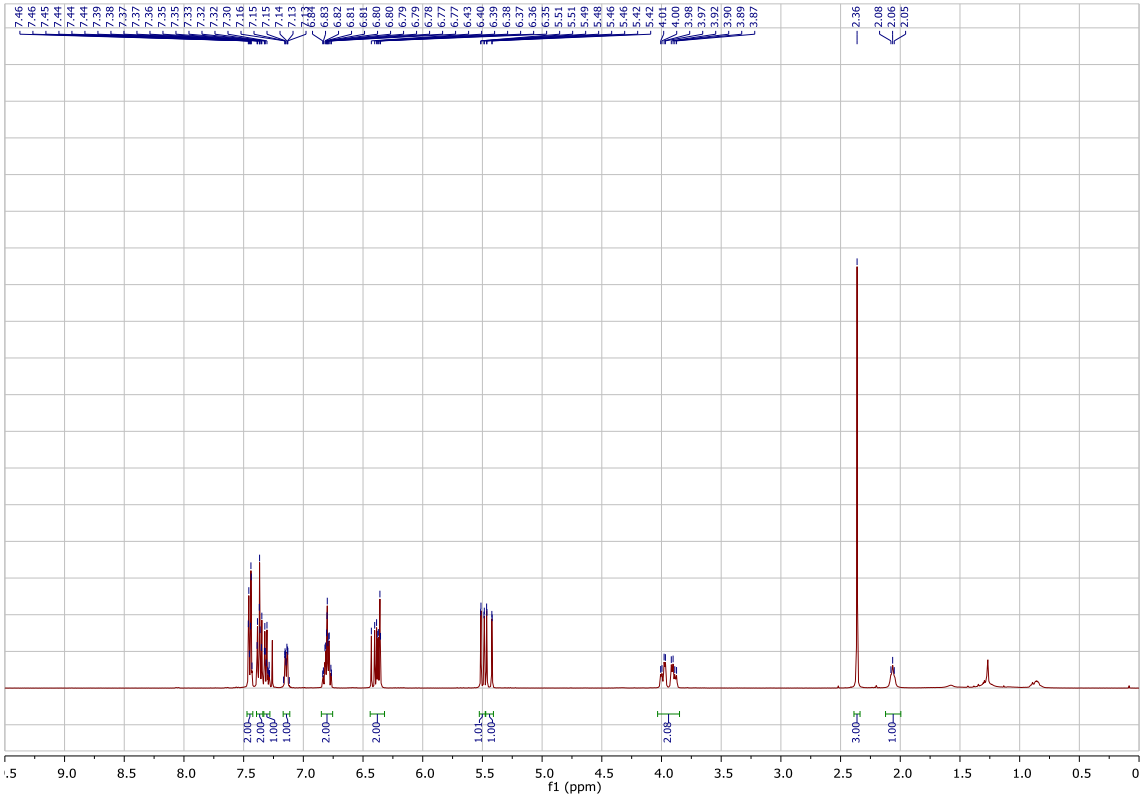
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	8.036	VB	0.2069	134.32574	9.61825	5.8234
2	9.900	BB	0.4288	2172.34546	70.63331	94.1766

2l



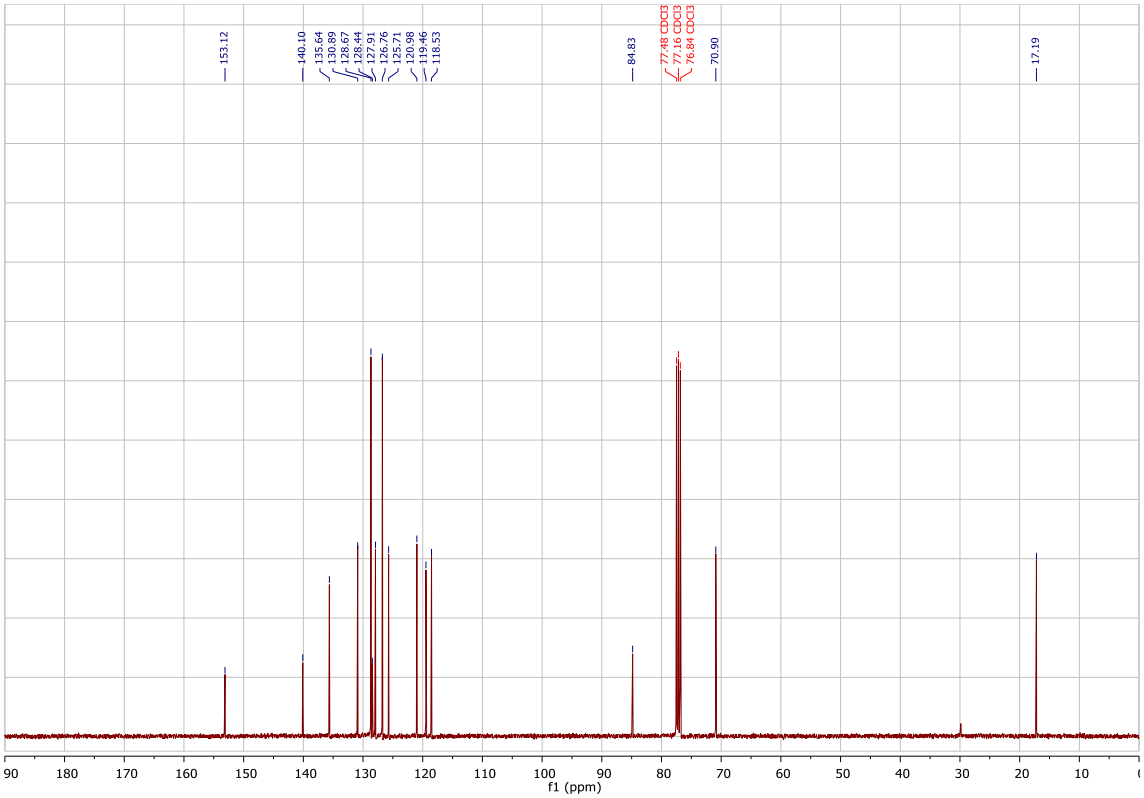
Scale: 0.2 mmol; isolated 44.2 mg (87% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



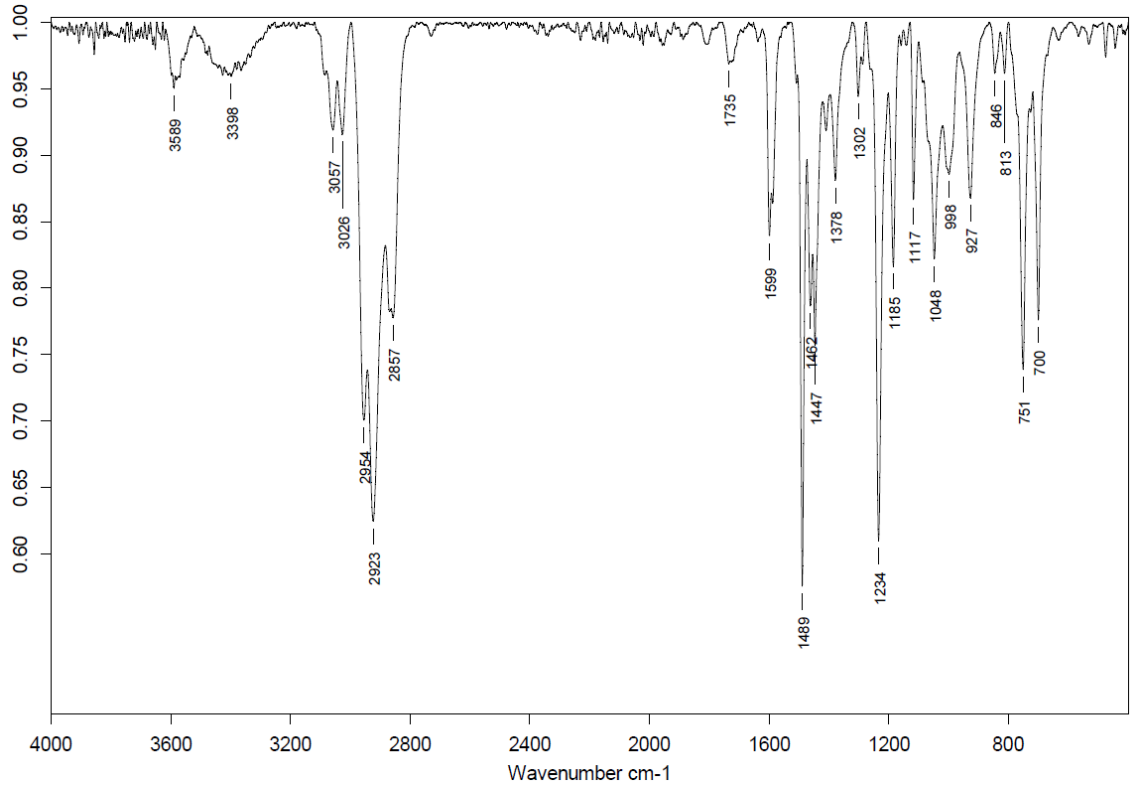
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 – 7.42 (m, 2H), 7.37 (m, 2H), 7.33 – 7.28 (m, 1H), 7.17 – 7.11 (m, 1H), 6.85 – 6.75 (m, 2H), 6.44 – 6.32 (m, 2H), 5.50 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.44 (dd, *J* = 17.5, 1.0 Hz, 1H), 4.03 – 3.85 (m, 2H), 2.36 (s, 3H), 2.06 (t, *J* = 5.6 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



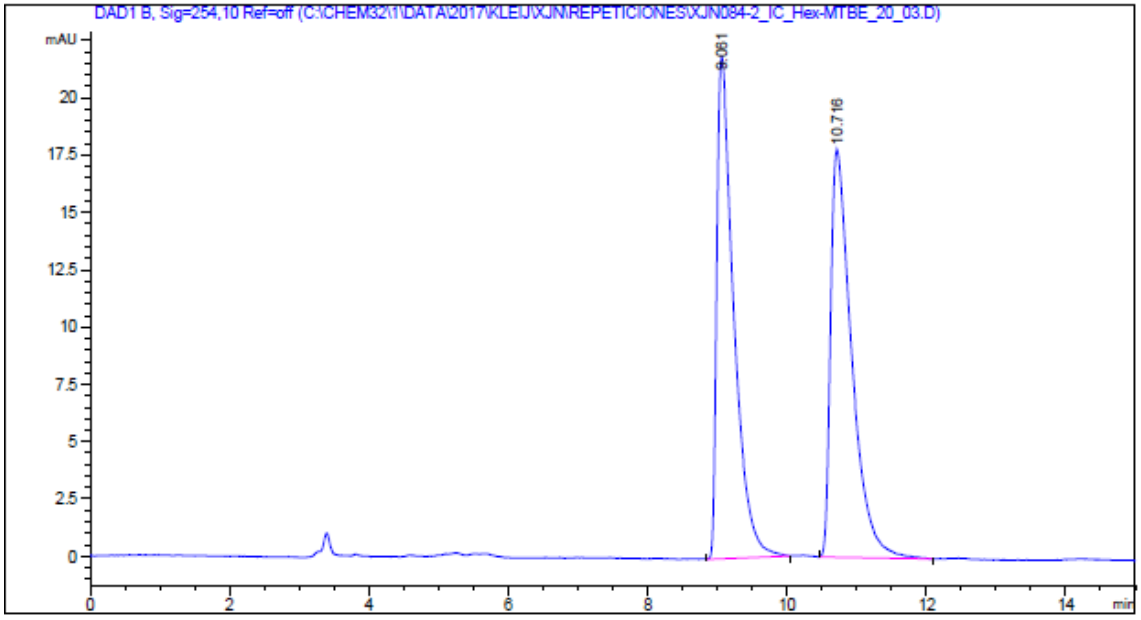
^{13}C NMR (101 MHz, $CDCl_3$) δ 153.12, 140.10, 135.64, 130.89, 128.67, 128.44, 127.91, 126.76, 125.71, 120.98, 119.46, 118.53, 84.83, 70.90, 17.19.

IR spectrum (neat)



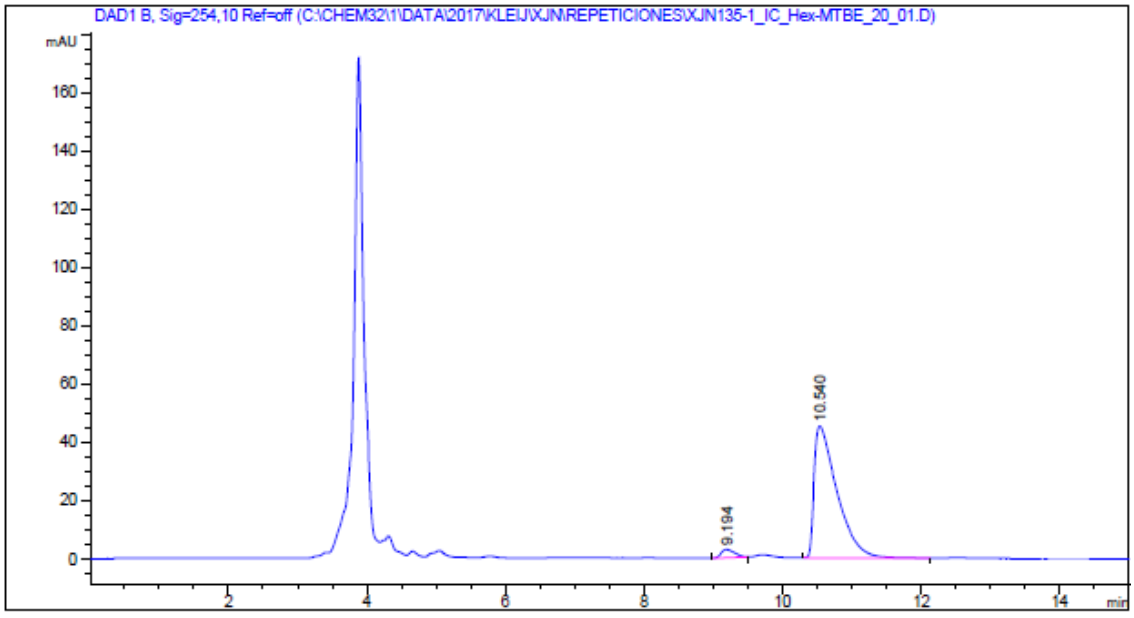
HRMS (ESI+, MeOH): *m/z* calcd. 277.1199 $(M + Na)^+$, found: 277.1199.

HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 96 : 4 *er*; $[\alpha]_D^{25}$ = –41.26 (*c* = 0.10, $CHCl_3$).

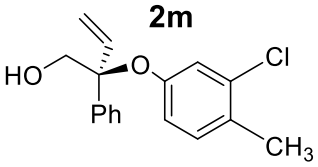


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.061	BB	0.2489	369.42191	21.88714	49.7089
2	10.716	BB	0.3172	373.74802	17.78487	50.2911

Additional Info : Peak(s) manually integrated

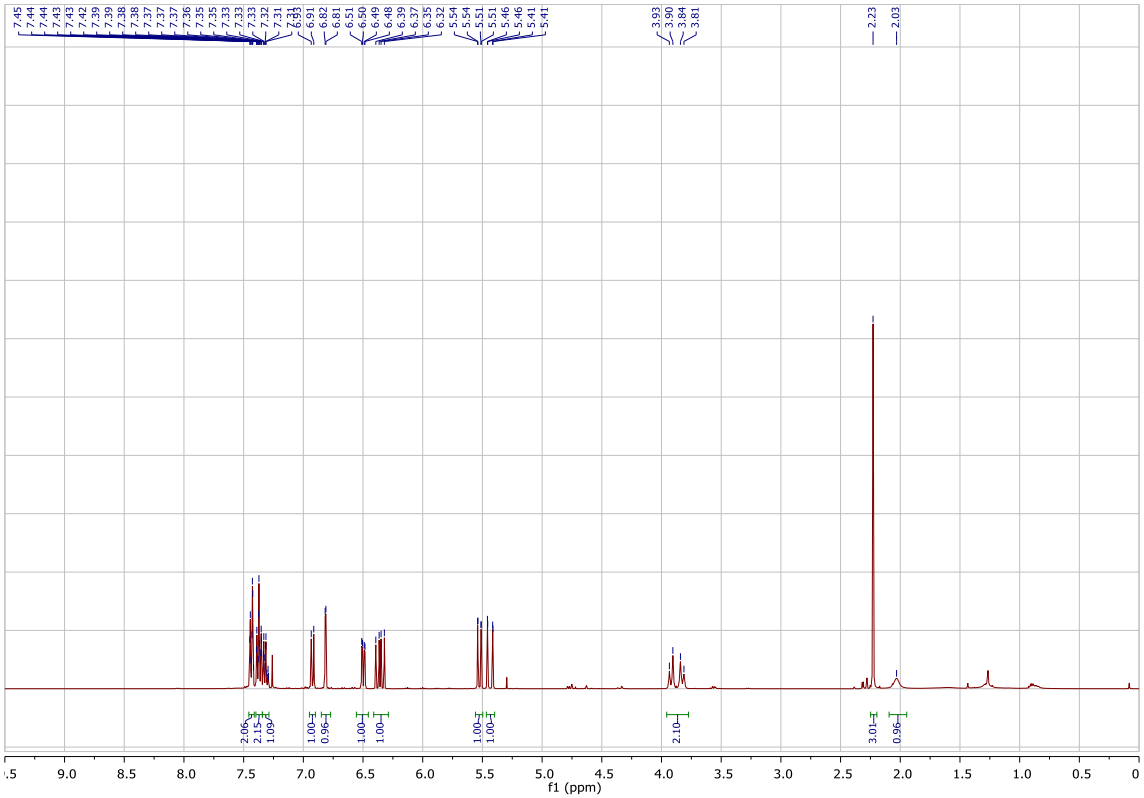


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.194	BB	0.2015	38.97160	2.88663	3.6171
2	10.540	BB	0.3398	1038.44873	45.24434	96.3829



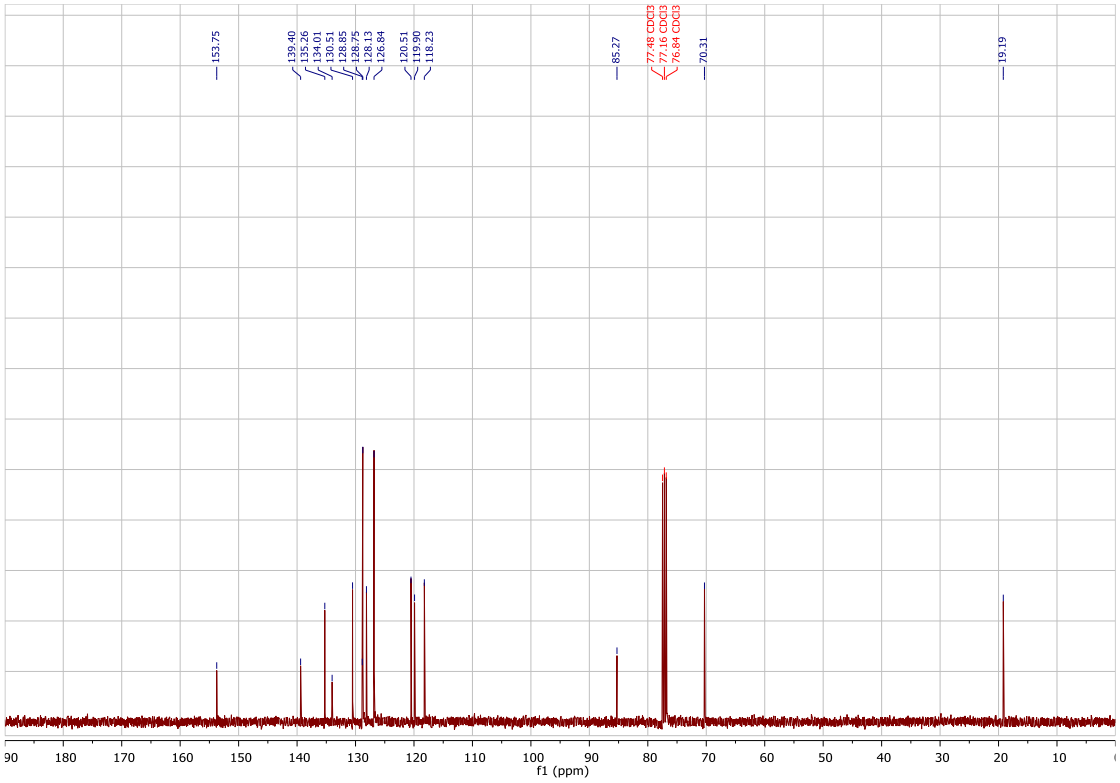
Scale: 0.2 mmol; isolated 41.0 mg (72% yield), light yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



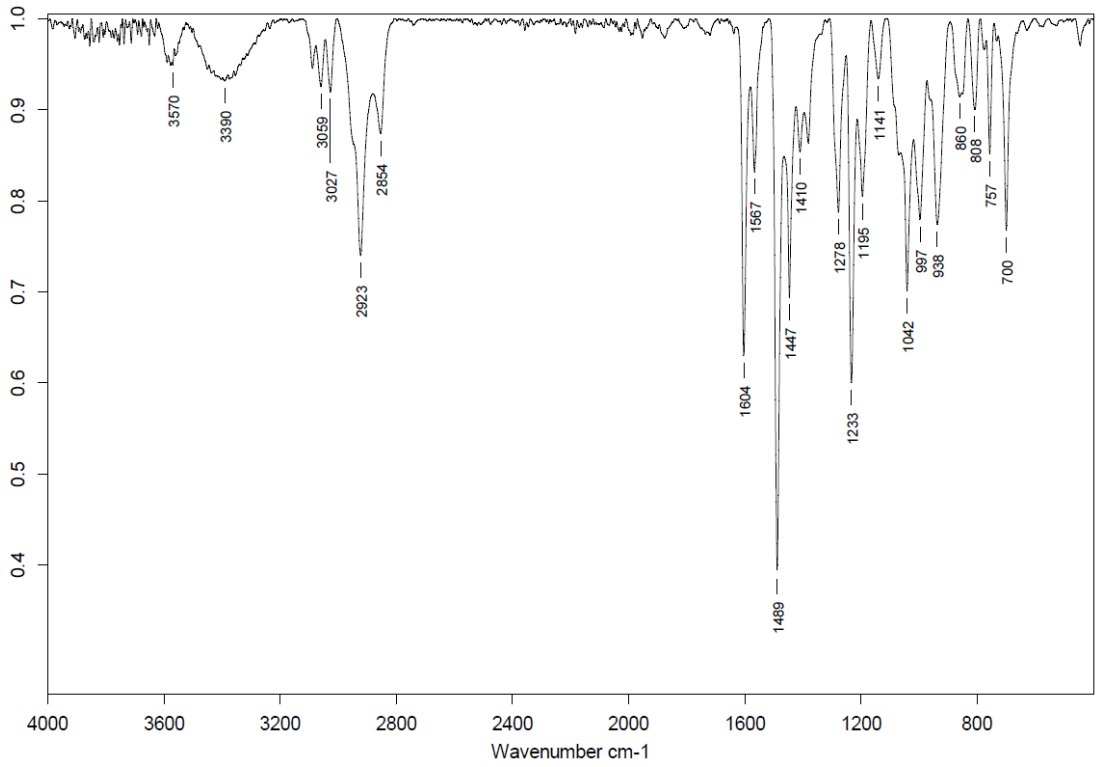
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.41 (m, 2H), 7.37 (m, 2H), 7.34 – 7.29 (m, 1H), 6.92 (d, *J* = 8.4 Hz, 1H), 6.81 (d, *J* = 2.5 Hz, 1H), 6.50 (dd, *J* = 8.4, 2.5 Hz, 1H), 6.36 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.52 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.43 (dd, *J* = 17.5, 1.0 Hz, 1H), 3.96 – 3.77 (m, 2H), 2.23 (s, 3H), 2.03 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 153.75, 139.40, 135.26, 134.01, 130.51, 128.85, 128.75, 128.13, 126.84, 120.51, 119.90, 118.23, 85.27, 70.31, 19.19.

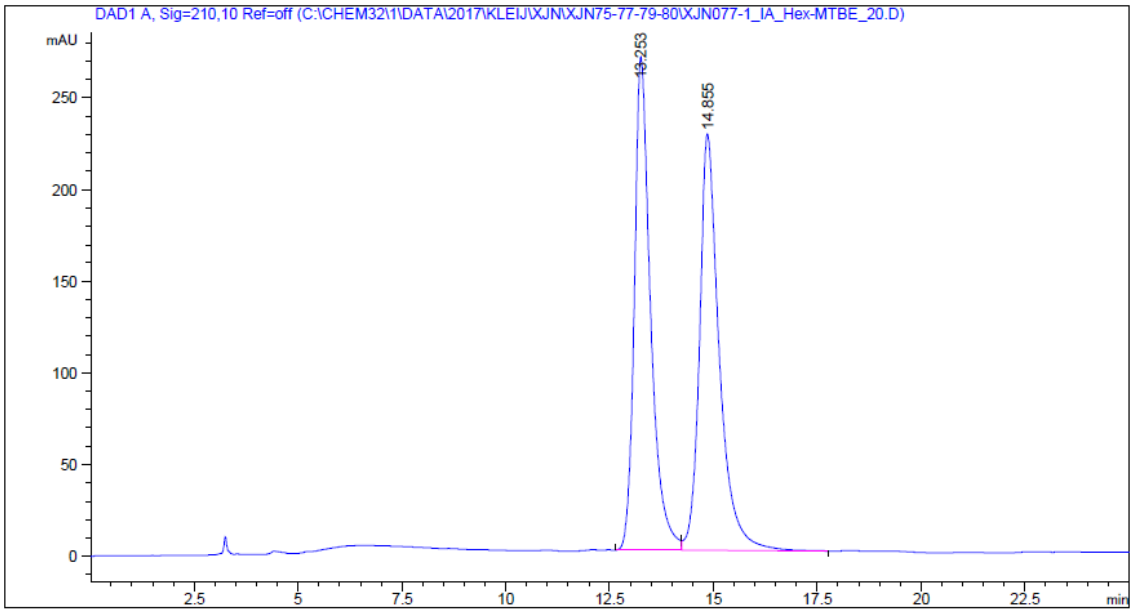
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 311.0809 $(M + Na)^+$, found: 311.0801.

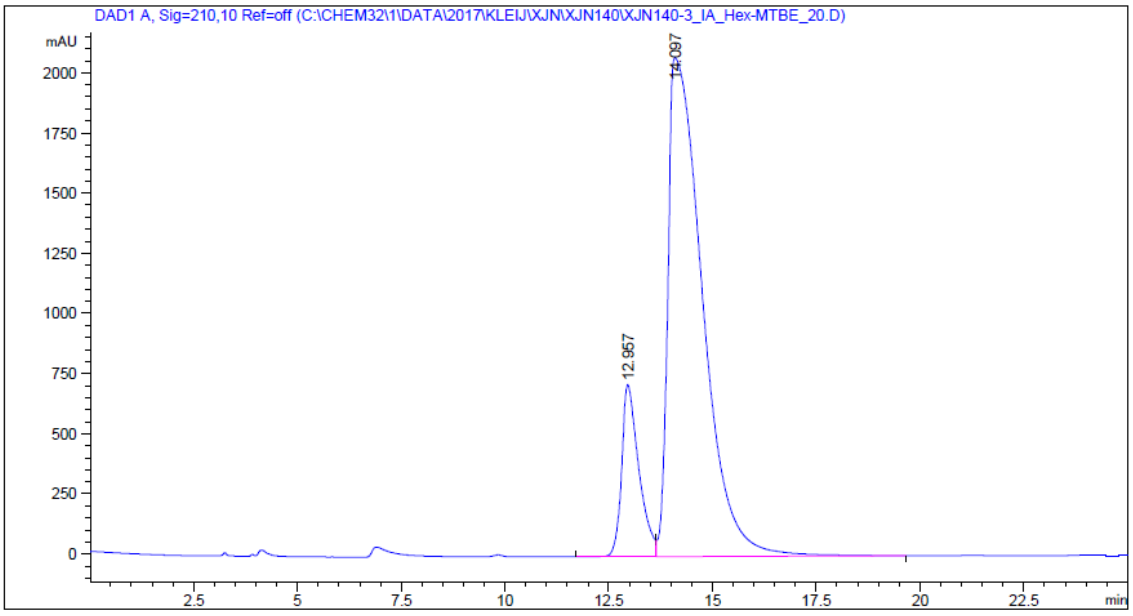
HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 85 : 15 *er*; $[\alpha]_D^{25} = -43.90$ (*c* = 0.13, $CHCl_3$).

Additional Info : Peak(s) manually integrated

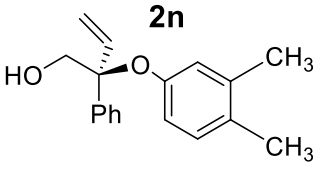


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.253	BV	0.3966	7303.77637	269.10730	49.2131
2	14.855	VB	0.4811	7537.33203	227.17477	50.7869

Additional Info : Peak(s) manually integrated

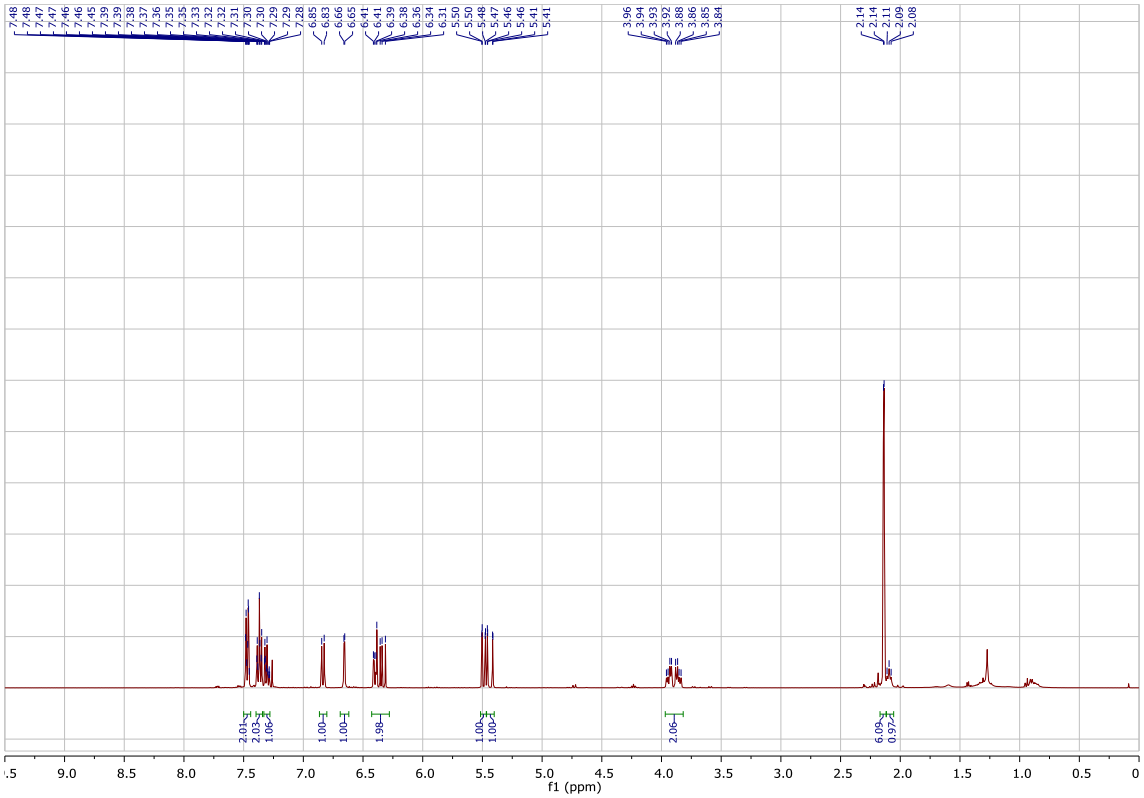


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.957	BV	0.4181	2.05781e4	714.26385	14.6588
2	14.097	VB	0.7222	1.19802e5	2073.24976	85.3412



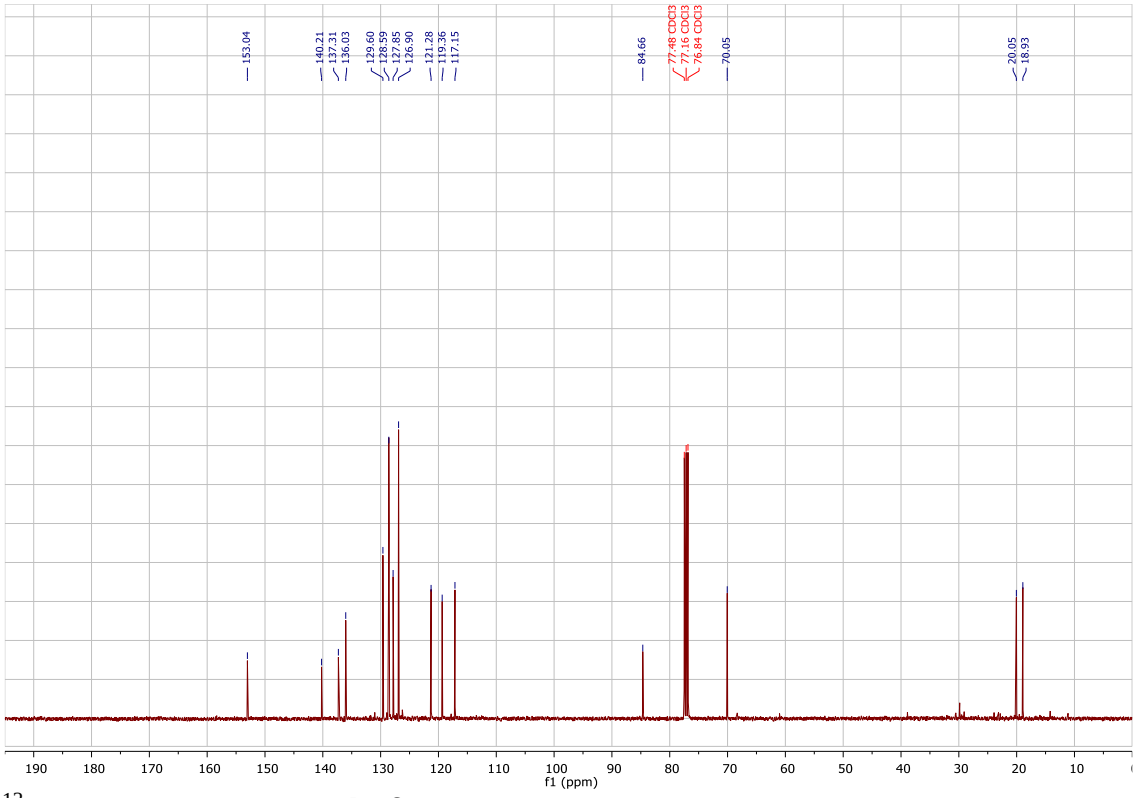
Scale: 0.2 mmol; isolated 42.8 mg (80% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



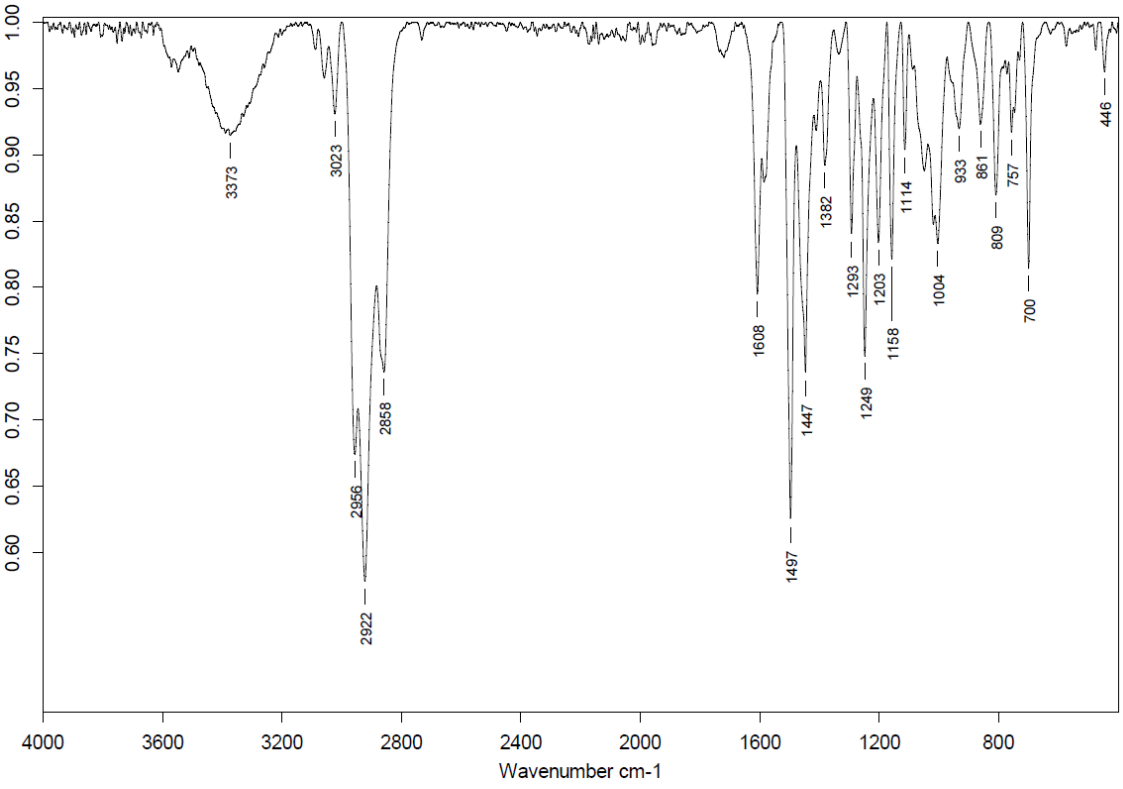
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 – 7.44 (m, 2H), 7.40 – 7.34 (m, 2H), 7.33 – 7.28 (m, 1H), 6.84 (d, *J* = 8.3 Hz, 1H), 6.66 (d, *J* = 2.7 Hz, 1H), 6.43 – 6.28 (m, 2H), 5.49 (dd, *J* = 11.1, 1.1 Hz, 1H), 5.44 (dd, *J* = 17.5, 1.1 Hz, 1H), 3.97 – 3.82 (m, 2H), 2.14 (d, *J* = 2.1 Hz, 6H), 2.09 (t, *J* = 6.8 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 153.04, 140.21, 137.31, 136.03, 129.60, 128.59, 127.85, 126.90, 121.28, 119.36, 117.15, 84.66, 70.05, 20.05, 18.93.

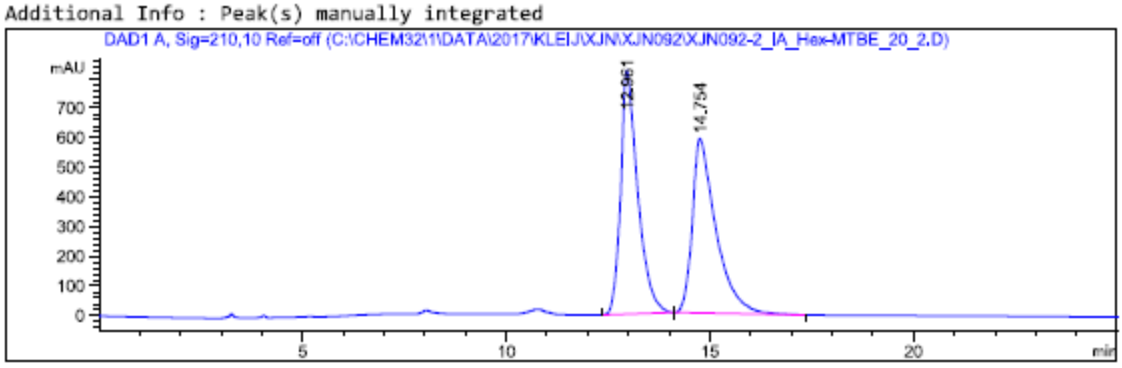
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 291.1356 $(M + Na)^+$, found: 291.1355.

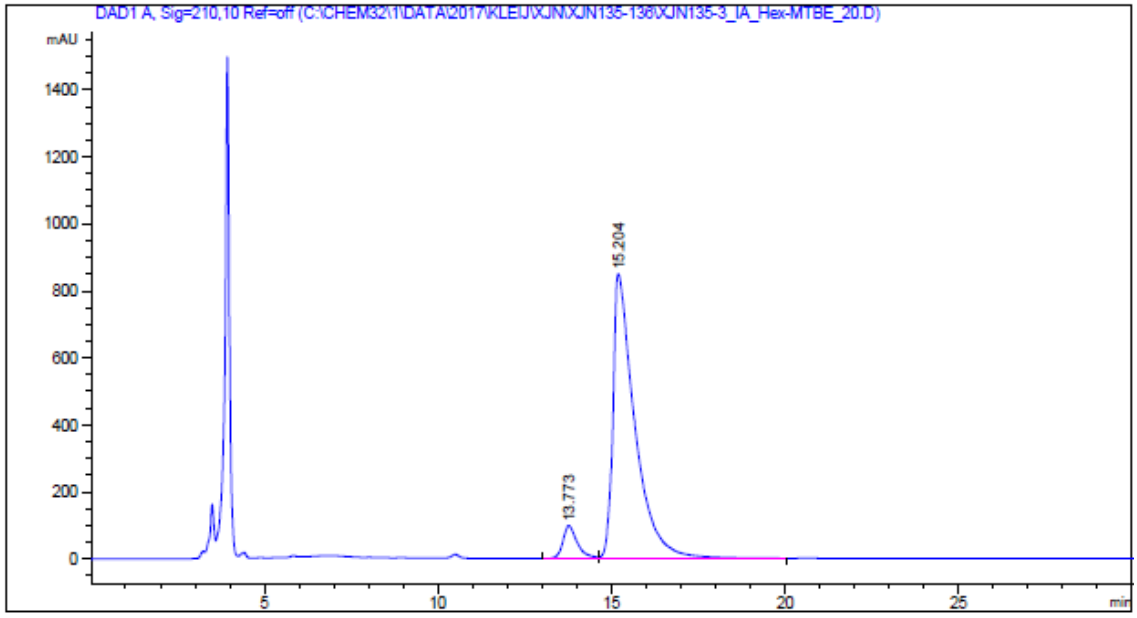
HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 93 : 7 *er*; $[\alpha]_D^{25} = -39.95$ (*c* = 0.12, $CHCl_3$).

Additional Info : Peak(s) manually integrated

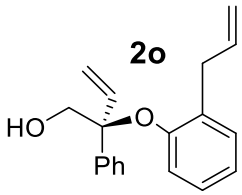


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.961	BB	0.4224	2.40954e4	821.00067	50.2627
2	14.754	BB	0.5762	2.38435e4	589.14026	49.7373

Additional Info : Peak(s) manually integrated

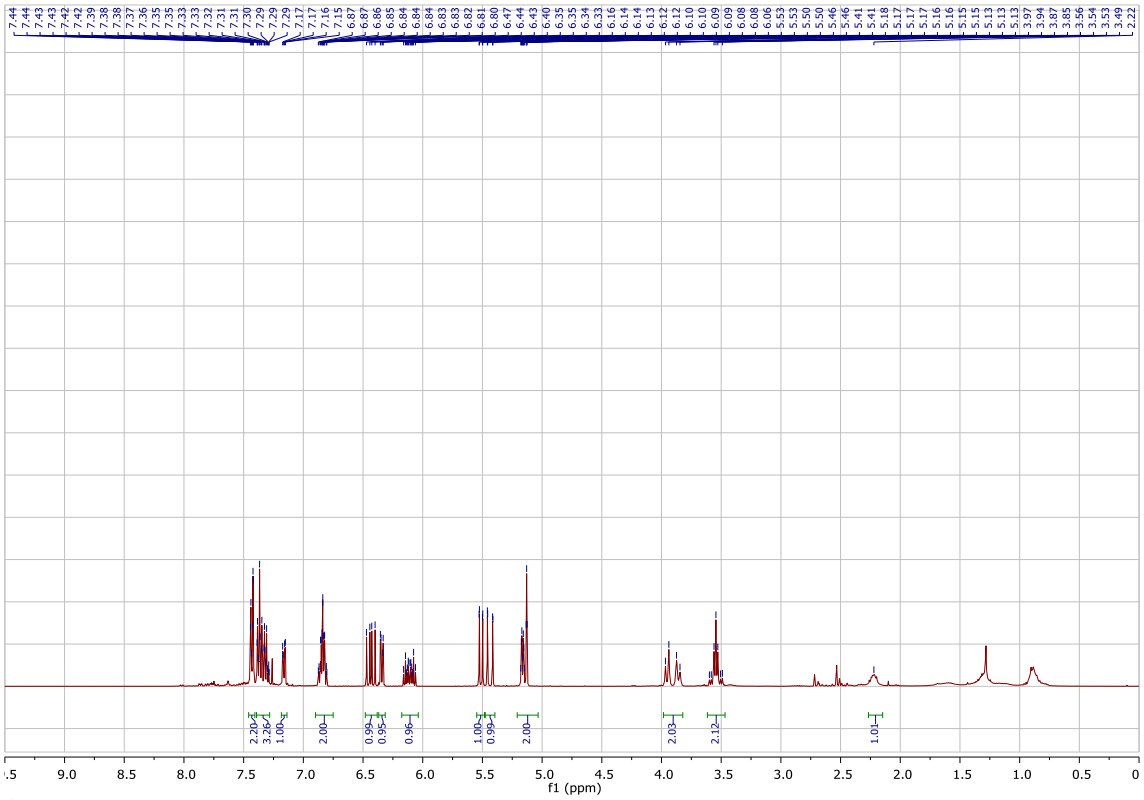


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	13.773	BV	0.4232	2840.13110	98.26805	7.0650
2	15.204	VB	0.6227	3.73600e4	850.18097	92.9350



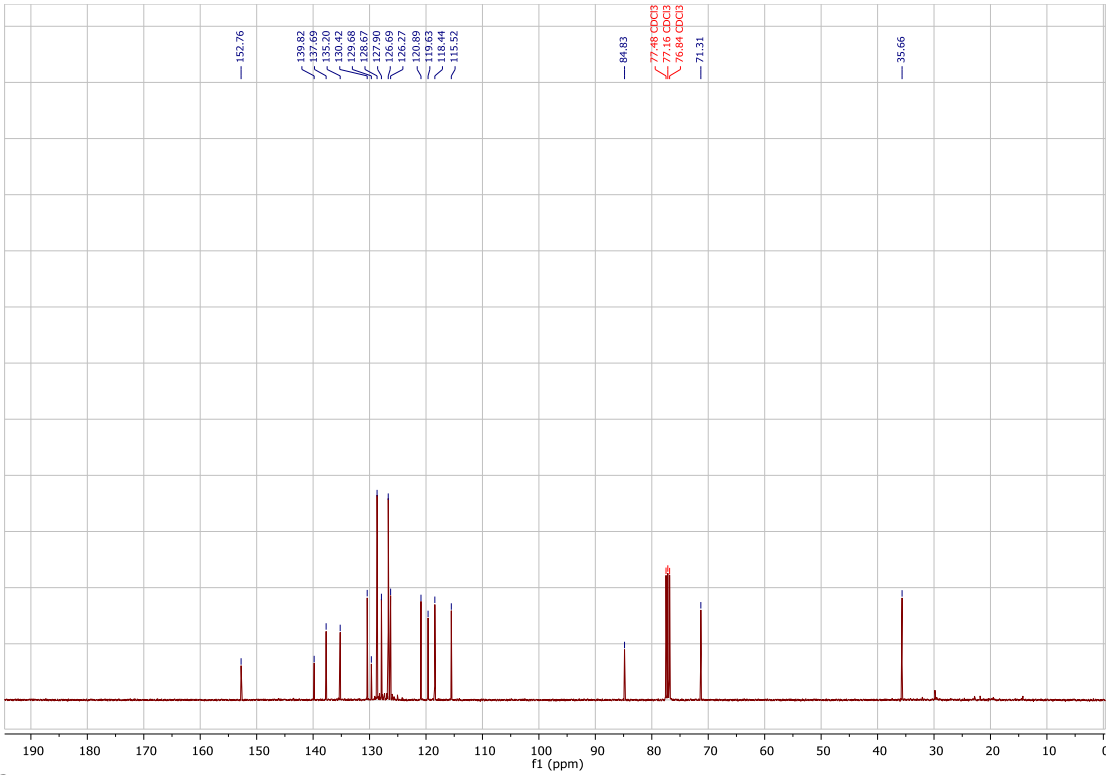
Scale: 0.2 mmol; isolated 43.7 mg (78% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



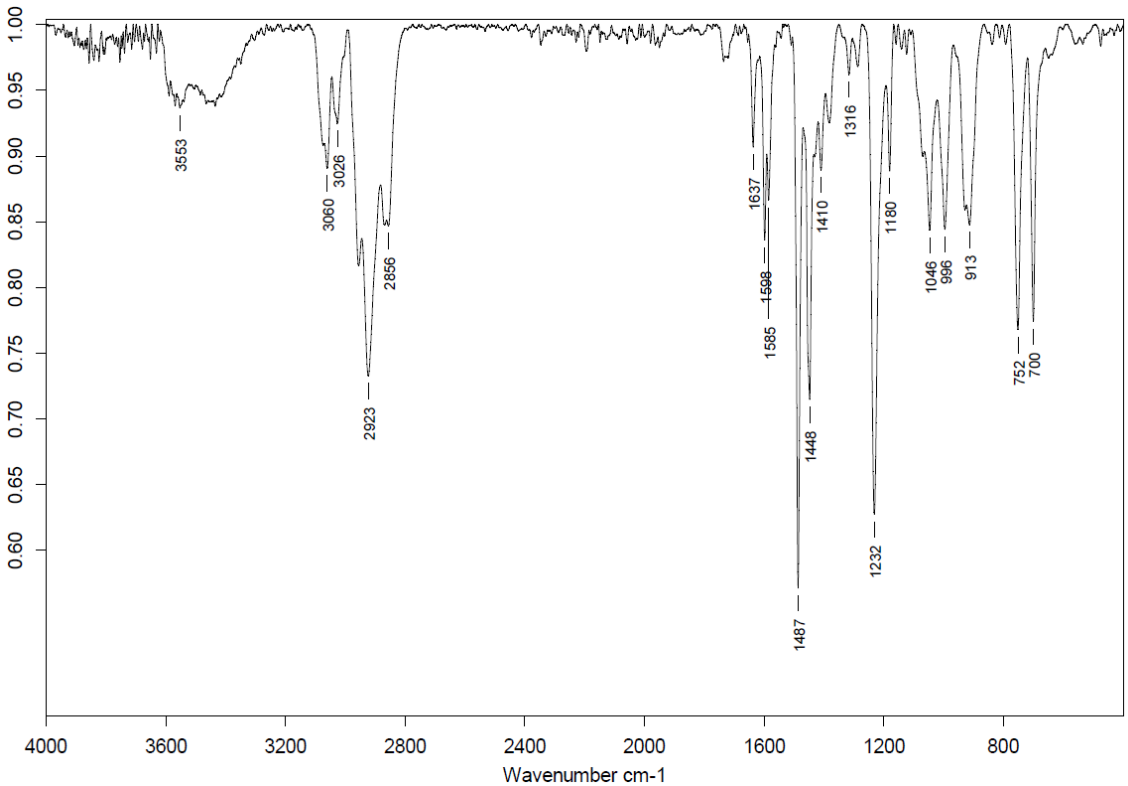
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.41 (m, 2H), 7.39 – 7.28 (m, 3H), 7.16 (dd, *J* = 6.8, 2.4 Hz, 1H), 6.90 – 6.75 (m, 2H), 6.43 (dd, *J* = 17.5, 11.2 Hz, 1H), 6.34 (dd, *J* = 7.6, 1.8 Hz, 1H), 6.11 (ddt, *J* = 15.7, 11.0, 6.3 Hz, 1H), 5.51 (dd, *J* = 11.2, 1.0 Hz, 1H), 5.44 (dd, *J* = 17.5, 1.0 Hz, 1H), 5.21 – 5.03 (m, 2H), 3.98 – 3.82 (m, 2H), 3.62 – 3.47 (m, 2H), 2.22 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 152.76, 139.82, 137.69, 135.20, 130.42, 129.68, 128.67, 127.90, 126.69, 126.27, 120.89, 119.63, 118.44, 115.52, 84.83, 71.31, 35.66.

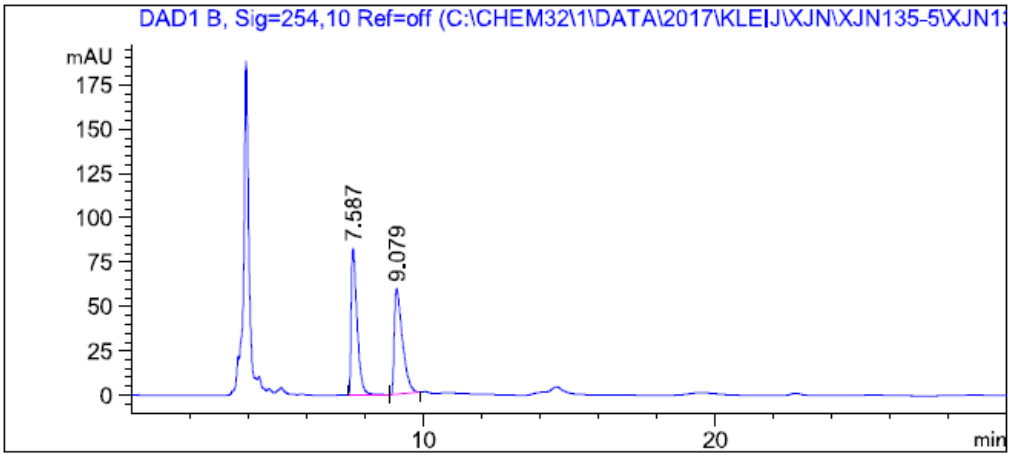
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 303.1356 $(M + Na)^+$, found: 303.1352.

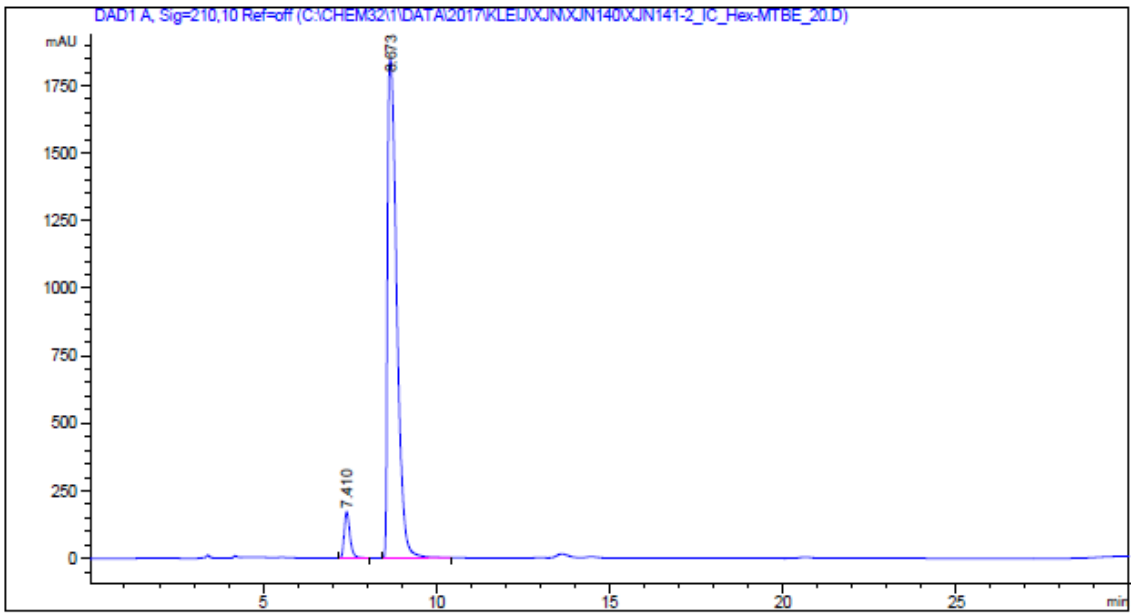
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 94.5 : 5.5 *er*; $[\alpha]_D^{25} = -70.28$ (*c* = 0.12, $CHCl_3$).

Additional Info : Peak(s) manually integrated

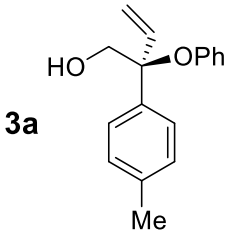


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.587	BB	0.2099	1164.79968	82.91244	50.4167
2	9.079	BB	0.2905	1145.54321	59.53025	49.5833

Additional Info : Peak(s) manually integrated



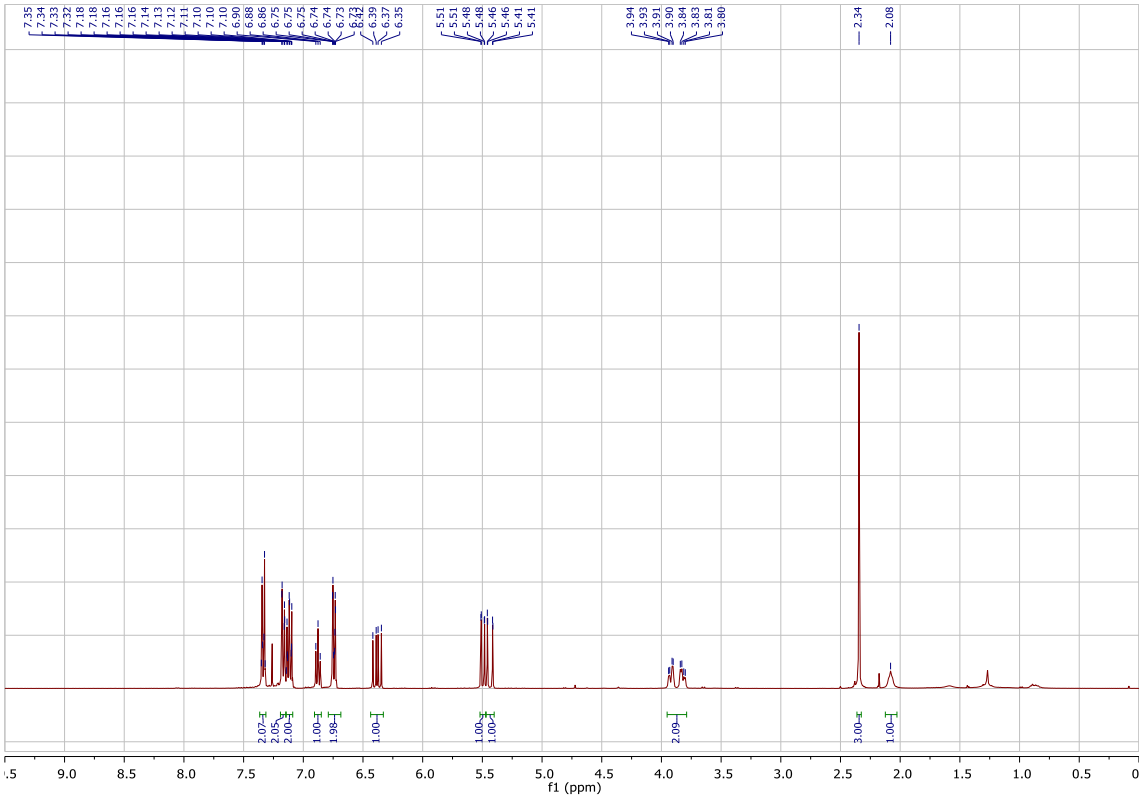
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.410	BB	0.1729	1948.24023	171.06516	5.4703
2	8.673	BB	0.2846	3.36668e4	1847.68799	94.5297



3a

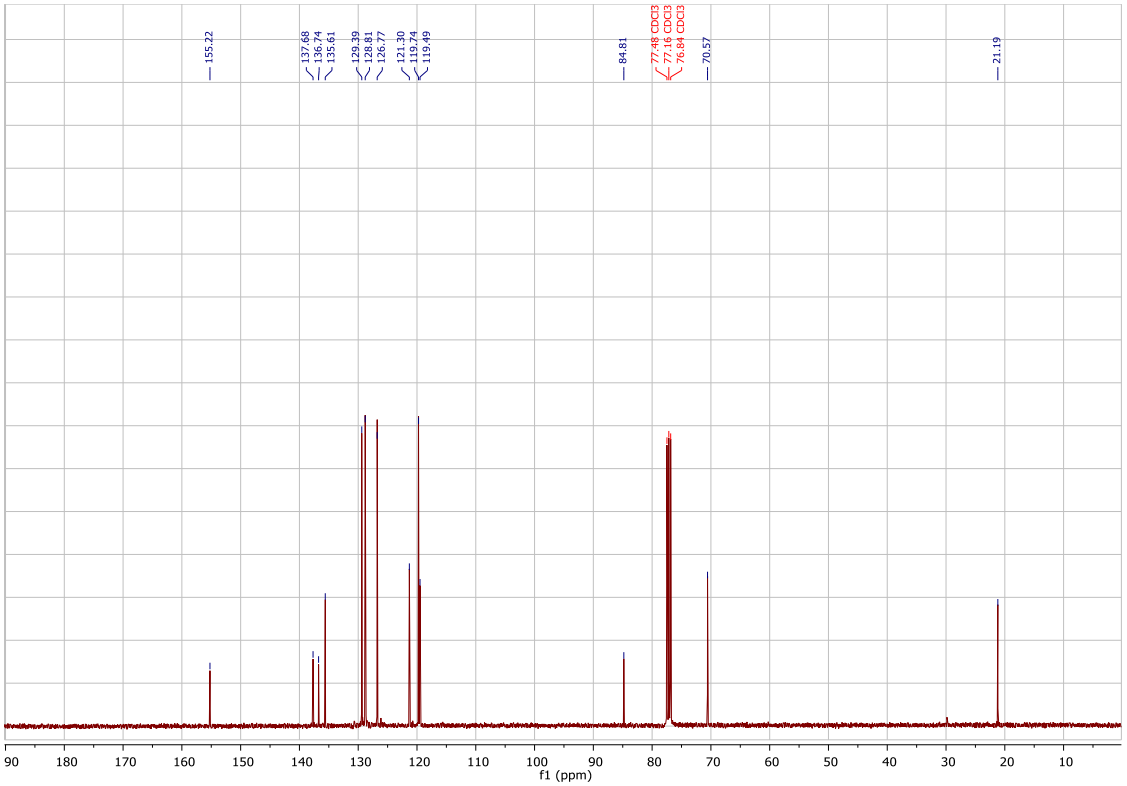
Scale: 0.2 mmol; isolated 43.2 mg (85% yield), light yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



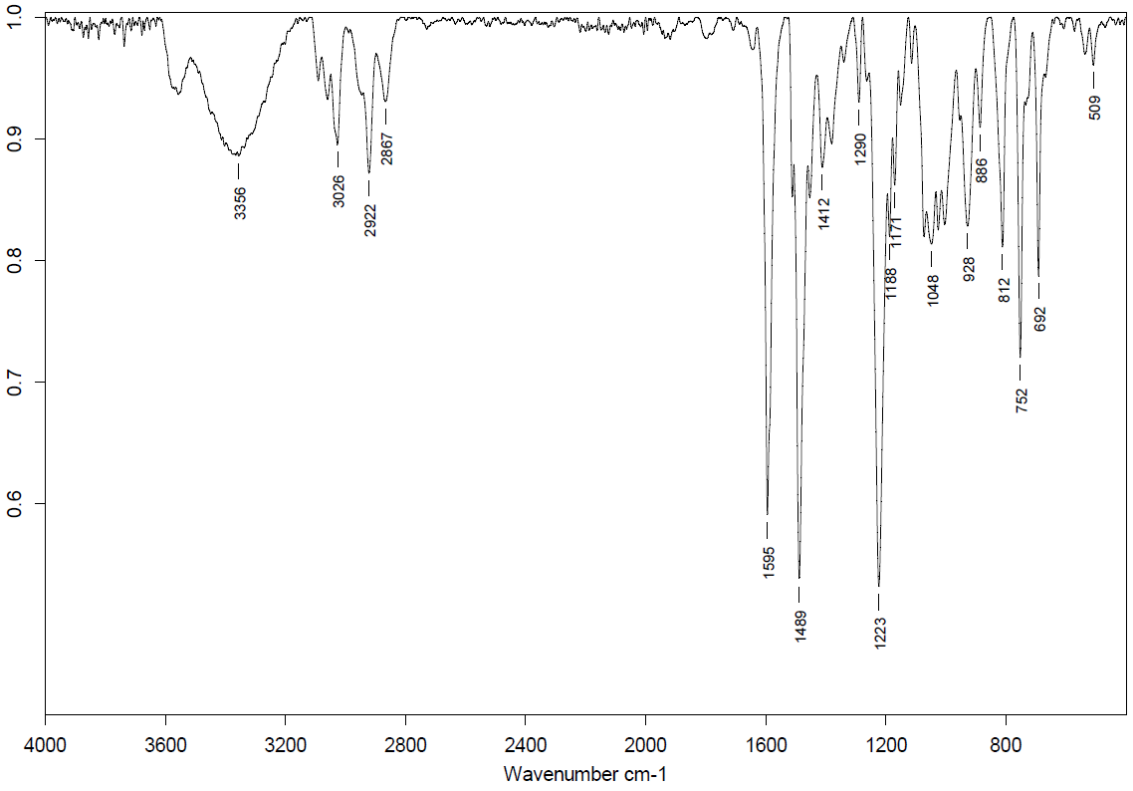
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 – 7.31 (m, 2H), 7.19 – 7.15 (m, 2H), 7.14 – 7.09 (m, 2H), 6.88 (t, *J* = 7.3 Hz, 1H), 6.79 – 6.69 (m, 2H), 6.38 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.50 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.44 (dd, *J* = 17.5, 1.1 Hz, 1H), 3.87 (m, 2H), 2.34 (s, 3H), 2.08 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 155.22, 137.68, 136.74, 135.61, 129.39, 128.81, 126.77, 121.30, 119.74, 119.49, 84.81, 70.57, 21.19.

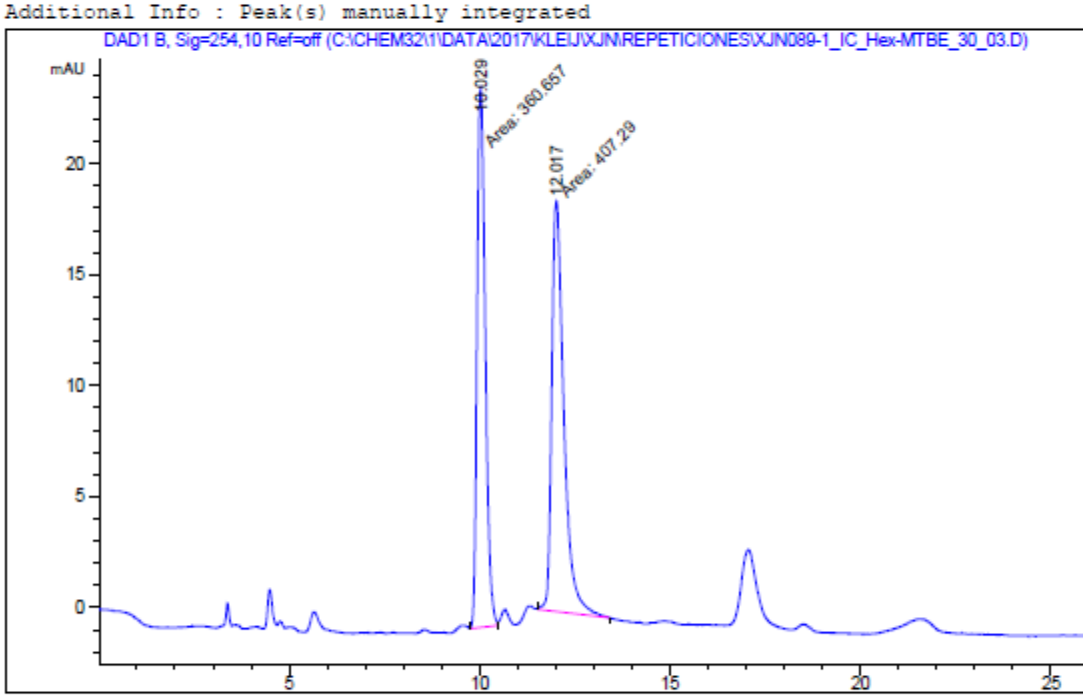
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 277.1199 $(M + Na)^+$, found: 277.1193.

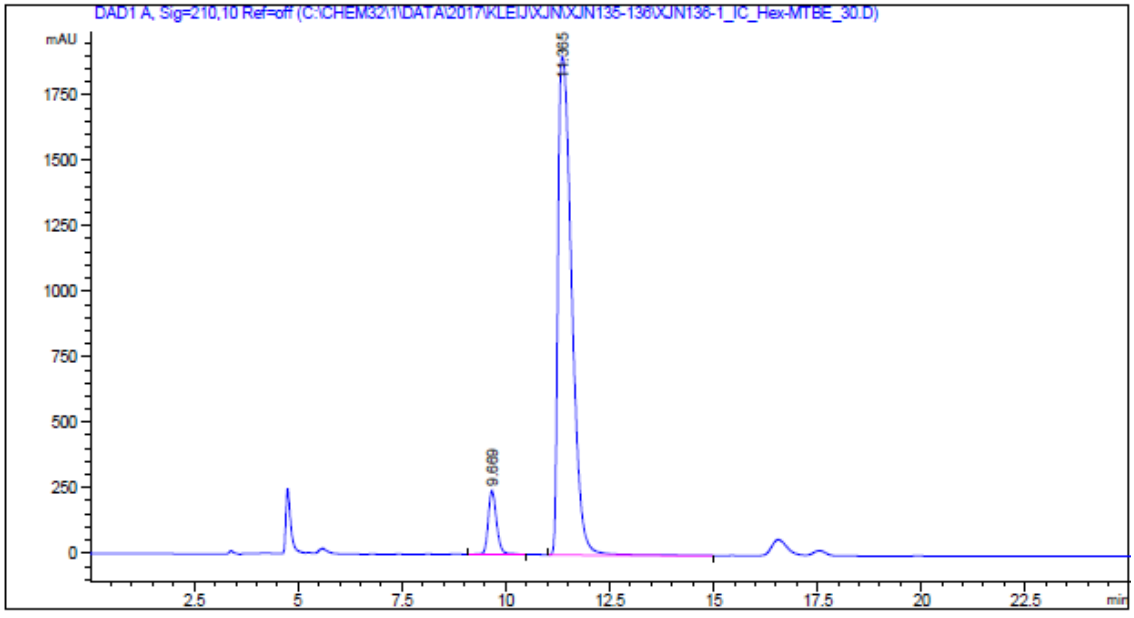
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 93 : 7 *er*; $[\alpha]_D^{25} = -38.01$ (*c* = 0.12, $CHCl_3$).

Additional Info : Peak(s) manually integrated

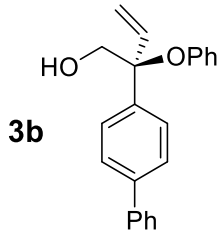


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.029	MM	0.2467	360.65744	24.36497	46.9638
2	12.017	MM	0.3665	407.28979	18.52077	53.0362

Additional Info : Peak(s) manually integrated



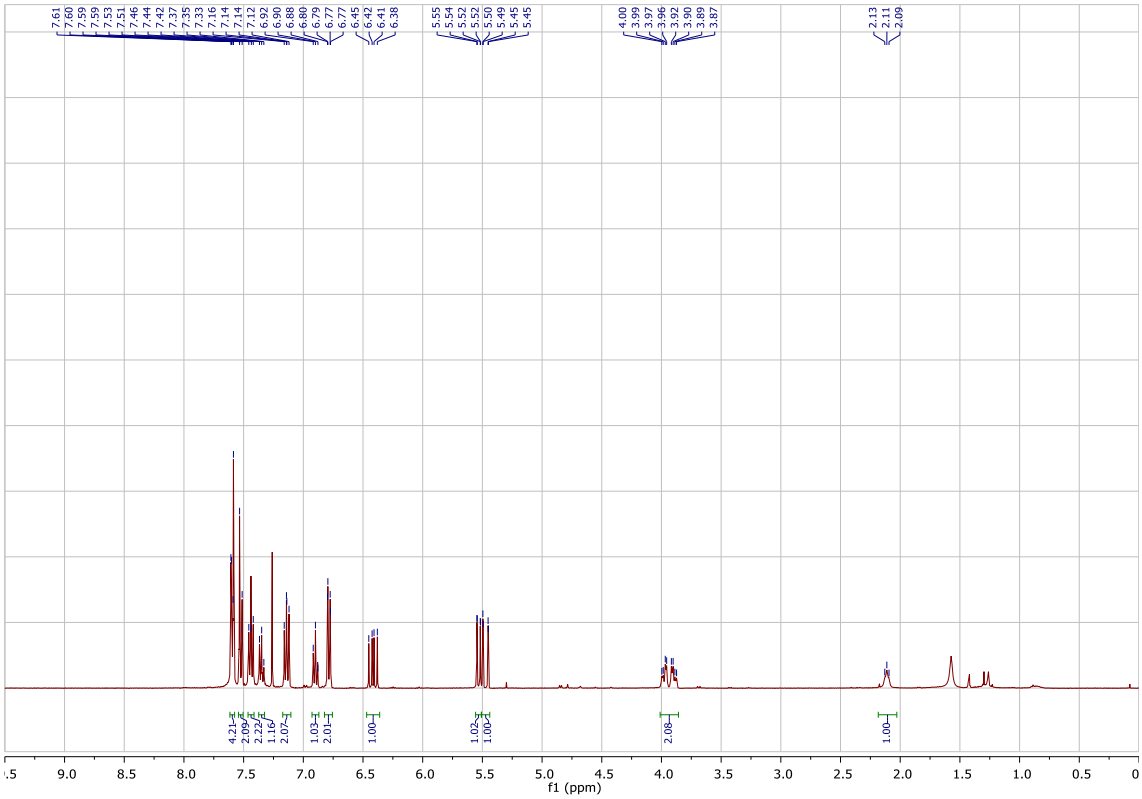
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.669	BB	0.2137	3418.67285	243.69025	7.2626
2	11.365	BB	0.3634	4.36535e4	1904.31519	92.7374



3b

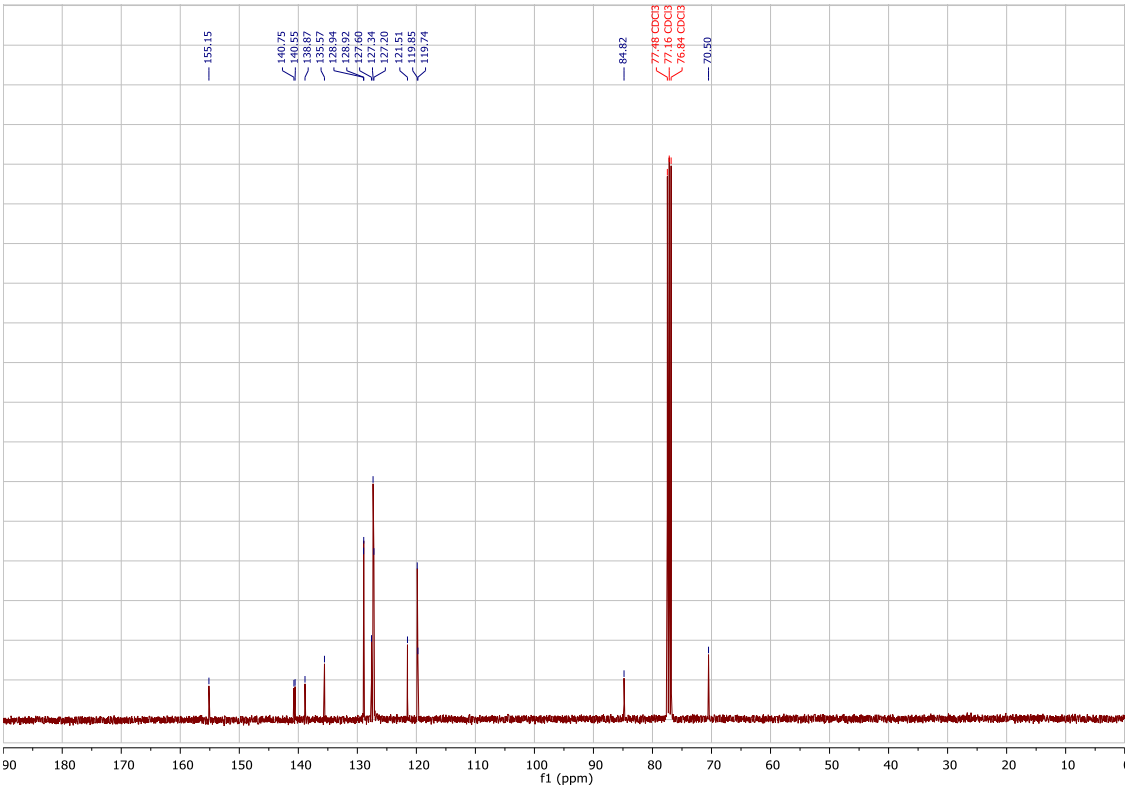
Scale: 0.2 mmol; isolated 45.5 mg (72% yield), yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



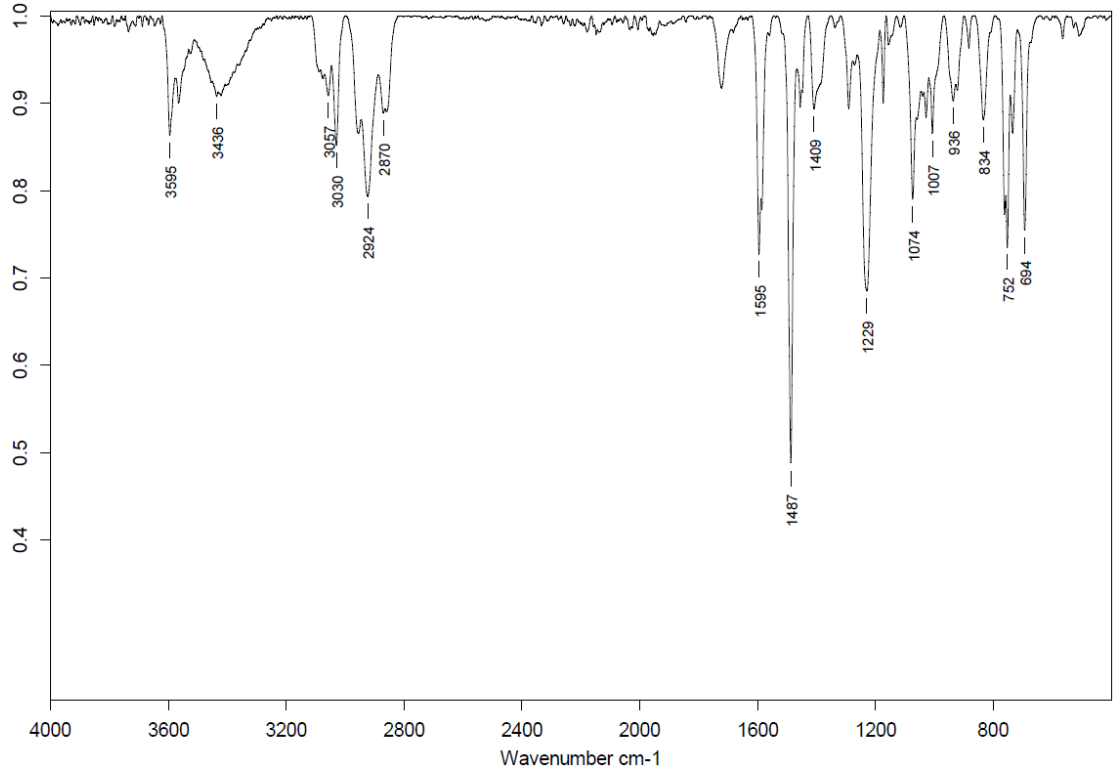
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 – 7.58 (m, 4H), 7.52 (d, *J* = 8.6 Hz, 2H), 7.46 – 7.41 (m, 2H), 7.35 (t, *J* = 7.3 Hz, 1H), 7.14 (m, 2H), 6.90 (t, *J* = 7.9 Hz, 1H), 6.78 (m, 2H), 6.42 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.53 (dd, *J* = 11.2, 1.0 Hz, 1H), 5.47 (dd, *J* = 17.5, 1.0 Hz, 1H), 4.01 – 3.86 (m, 2H), 2.12 (d, *J* = 6.9 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 155.15, 140.75, 140.55, 138.87, 135.57, 128.94, 128.92, 127.60, 127.34, 127.20, 121.51, 119.85, 119.74, 84.82, 70.50.

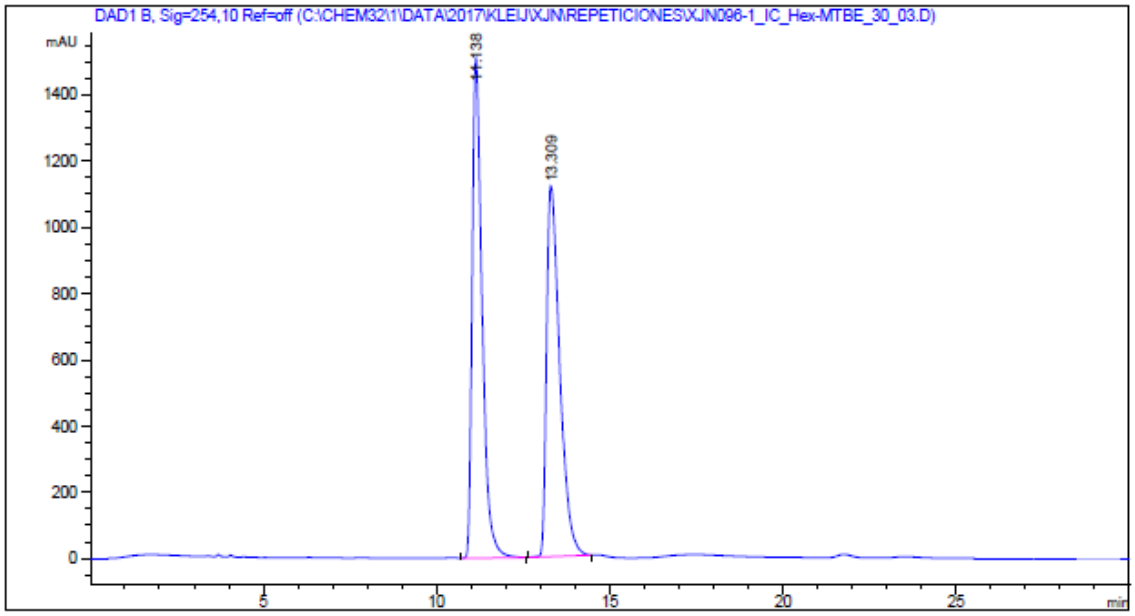
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 339.1356 $(M + Na)^+$, found: 339.1363.

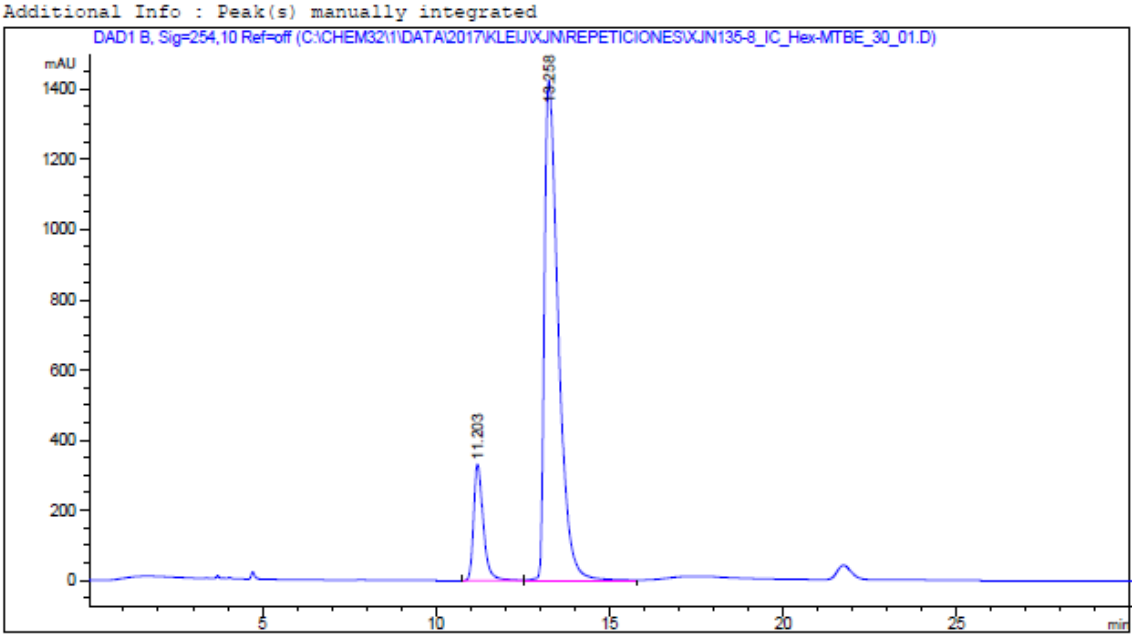
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 86: 14 *er*; $[\alpha]_D^{25} = -29.27$ (*c* = 0.11, $CHCl_3$).

Additional Info : Peak(s) manually integrated

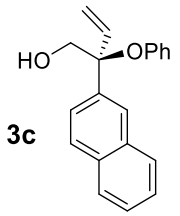


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.138	BB	0.3054	3.01609e4	1507.87073	50.4730
2	13.309	BB	0.4029	2.95956e4	1117.77344	49.5270

Additional Info : Peak(s) manually integrated

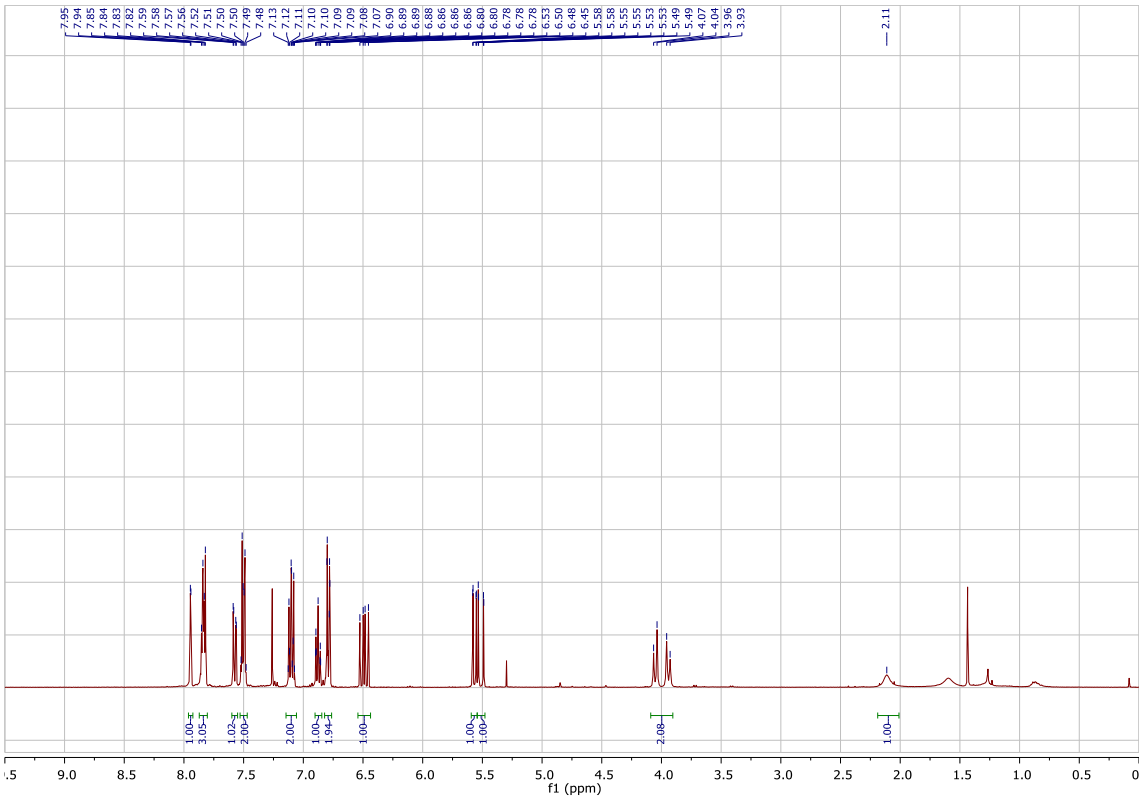


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.203	BB	0.2954	6399.44287	331.20605	13.9429
2	13.258	BB	0.4215	3.94981e4	1424.50488	86.0571



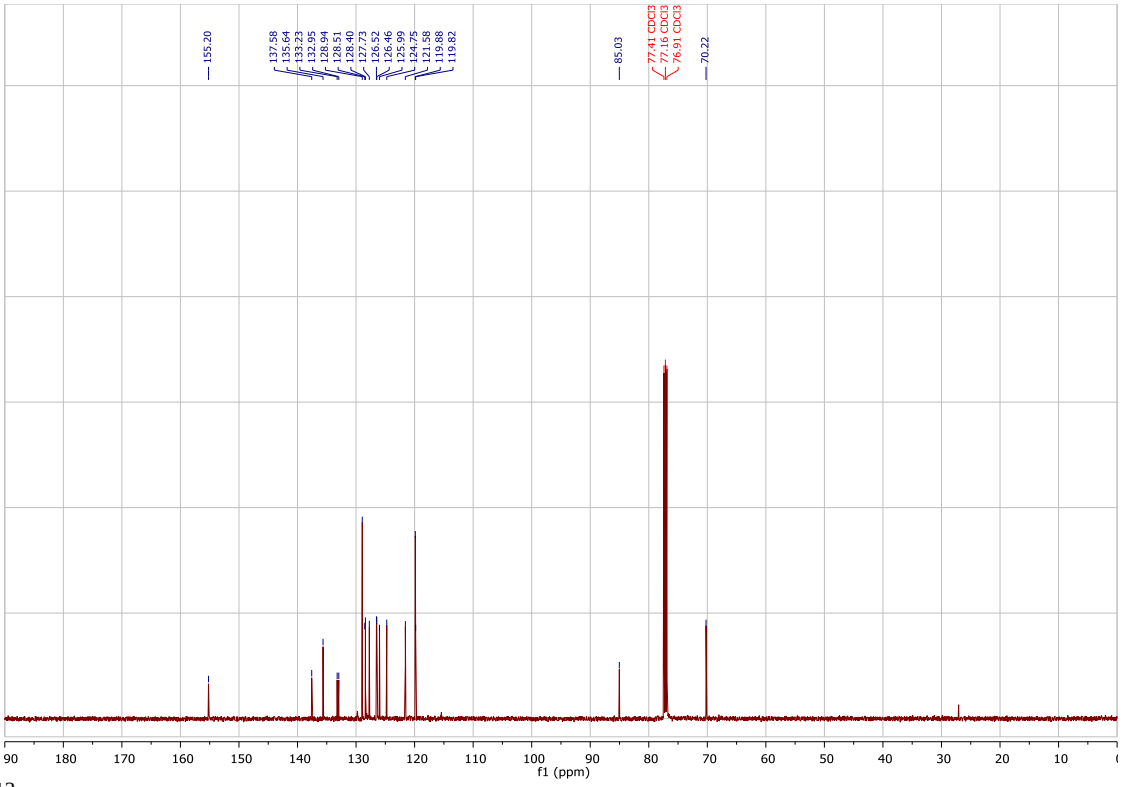
Scale: 0.2 mmol; isolated 33.6 mg (58% yield), light yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



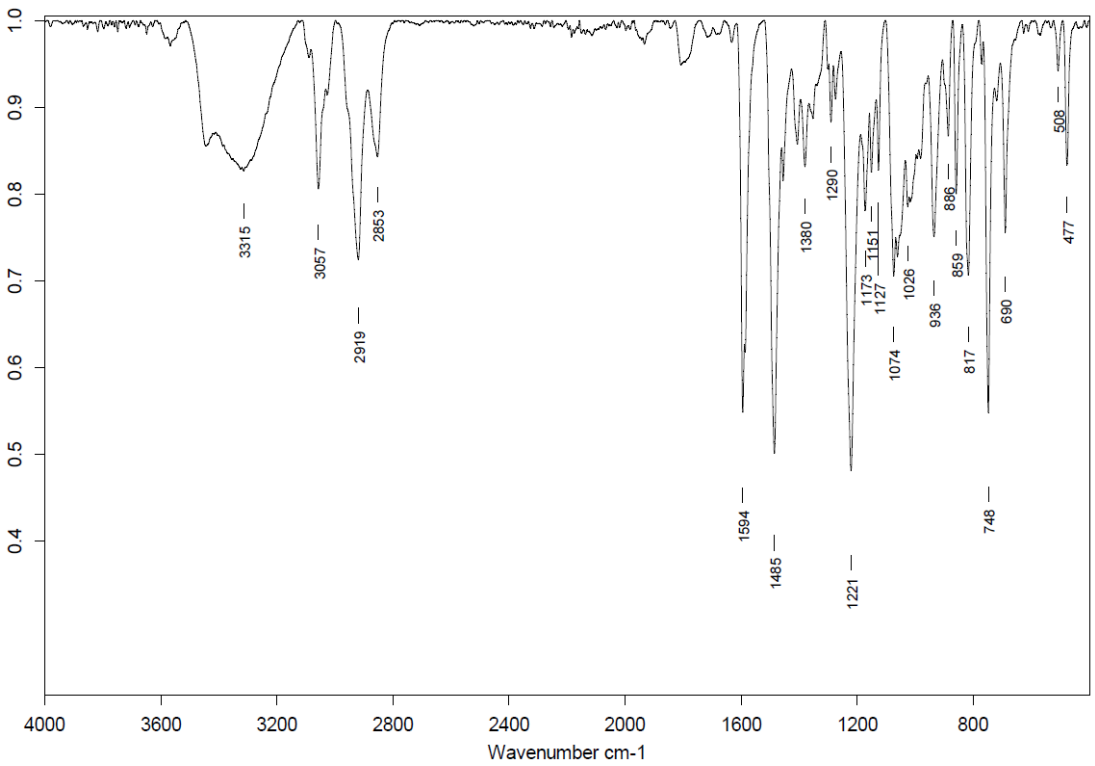
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.94 (d, *J* = 1.8 Hz, 1H), 7.84 (m, 3H), 7.57 (m, 1H), 7.50 (m, 2H), 7.10 (m, 2H), 6.90 – 6.84 (m, 1H), 6.82 – 6.76 (m, 2H), 6.49 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.57 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.51 (dd, *J* = 17.5, 1.0 Hz, 1H), 4.09 – 3.90 (m, 2H), 2.11 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (126 MHz, $CDCl_3$) δ 155.20, 137.58, 135.64, 133.23, 132.95, 128.94, 128.51, 128.40, 127.73, 126.52, 126.46, 125.99, 124.75, 121.58, 119.88, 119.82, 85.03, 70.22.

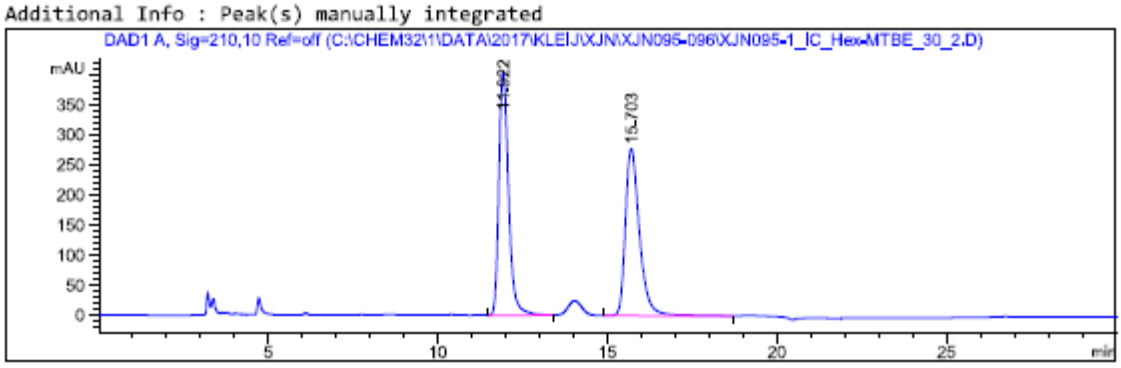
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 313.1199 $(M + Na)^+$, found: 313.1202.

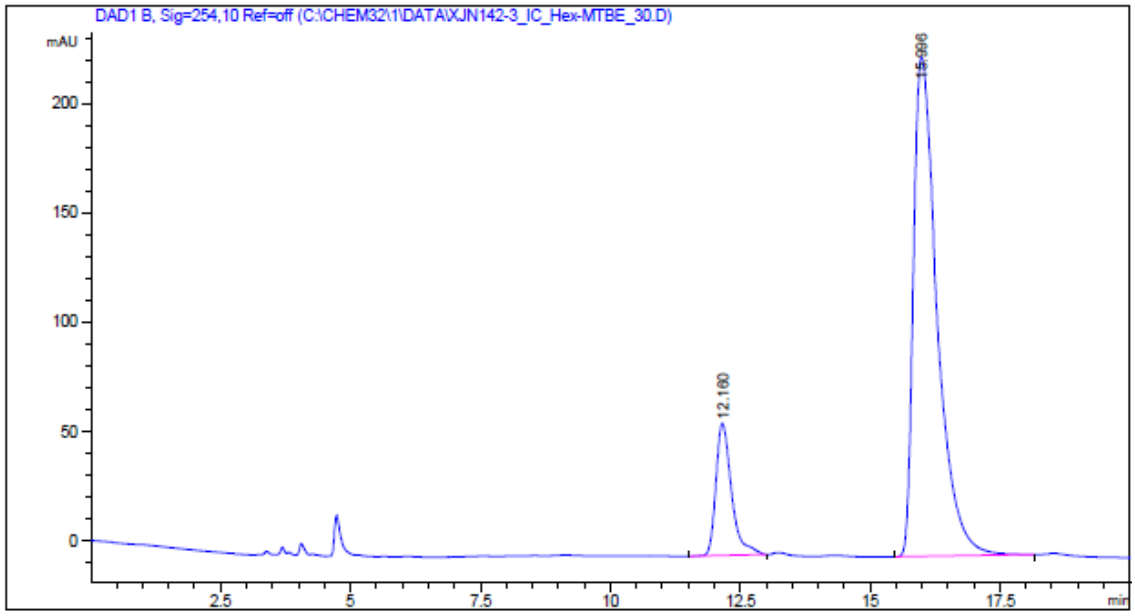
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 85 : 15 *er*; $[\alpha]_D^{25} = -51.92$ (*c* = 0.12, $CHCl_3$).

Additional Info : Peak(s) manually integrated

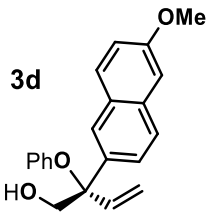


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.922	BB	0.3032	8022.47070	404.73987	50.1476
2	15.703	BB	0.4403	7975.26123	276.63397	49.8524

Additional Info : Peak(s) manually integrated

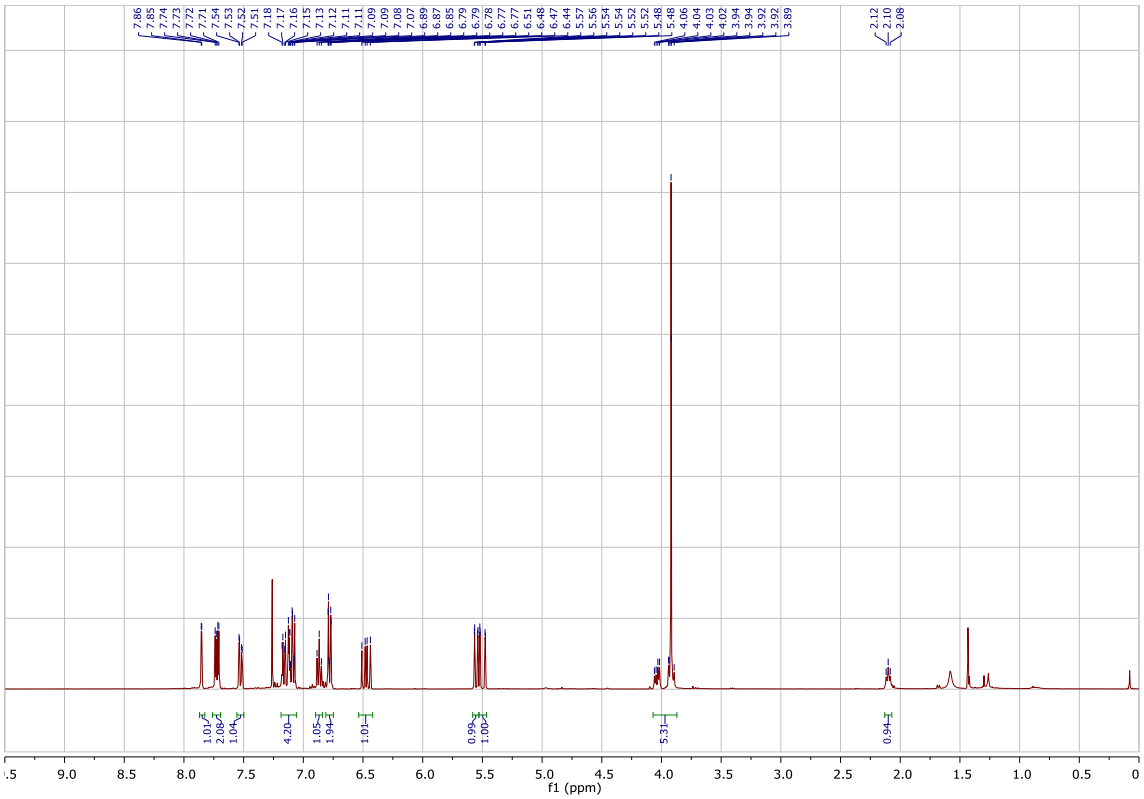


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.160	BB	0.3194	1272.73230	60.50556	14.9878
2	15.996	BB	0.4610	7219.05713	228.23291	85.0122



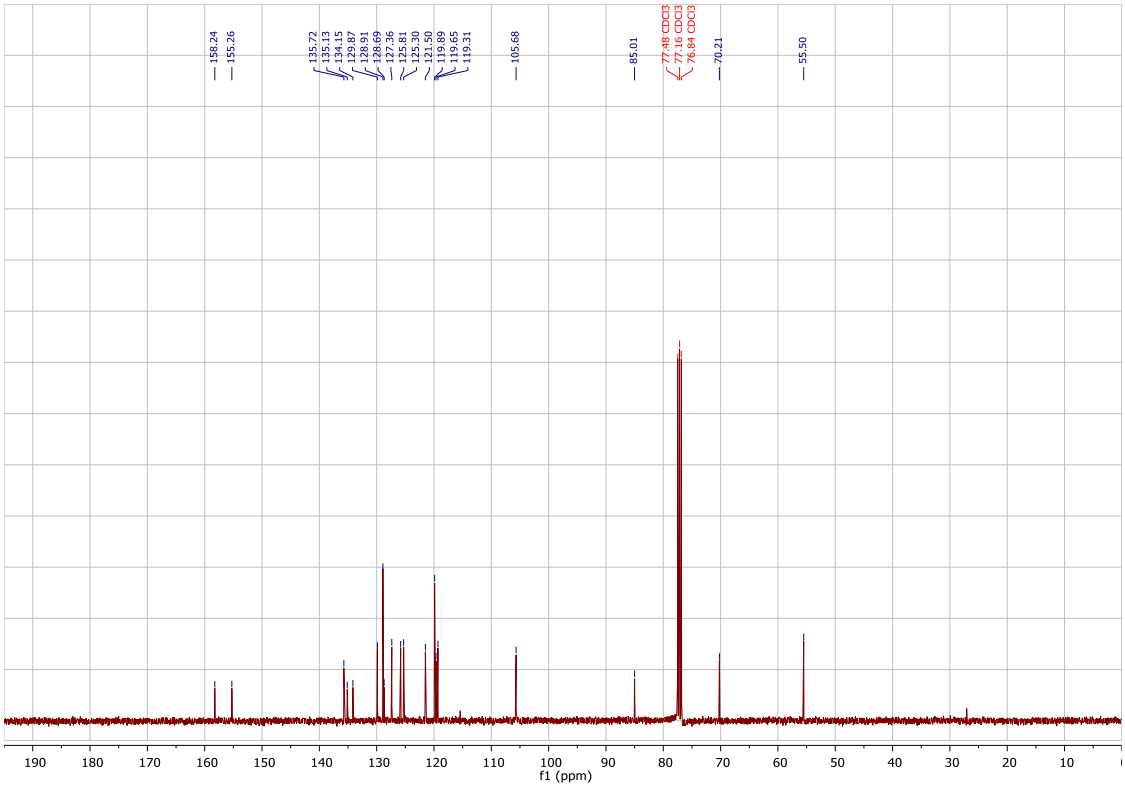
Scale: 0.2 mmol; isolated 48.0 mg (75% yield), light yellow solid, Hexane : EA = 20 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



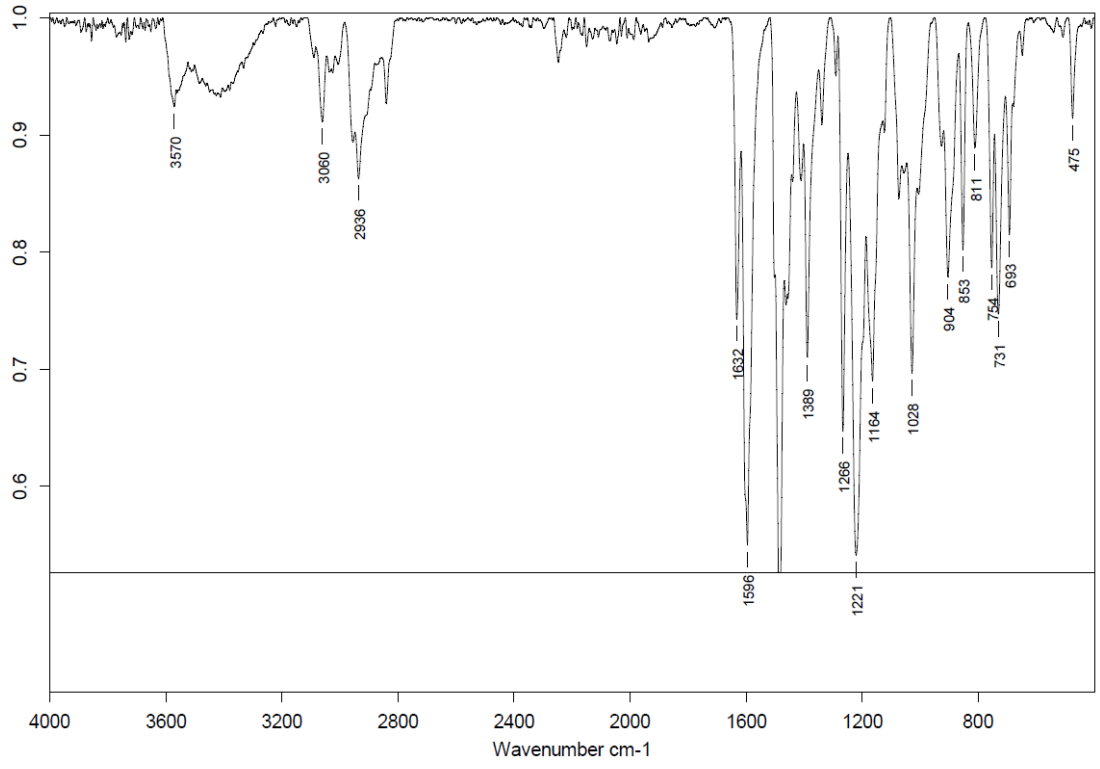
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 1.7 Hz, 1H), 7.72 (m, 2H), 7.53 (m, 1H), 7.19 – 7.06 (m, 4H), 6.87 (t, *J* = 7.4 Hz, 1H), 6.78 (m, 2H), 6.47 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.55 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.50 (dd, *J* = 17.5, 1.0 Hz, 1H), 4.07 – 3.87 (m, 5H), 2.10 (t, *J* = 6.9 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



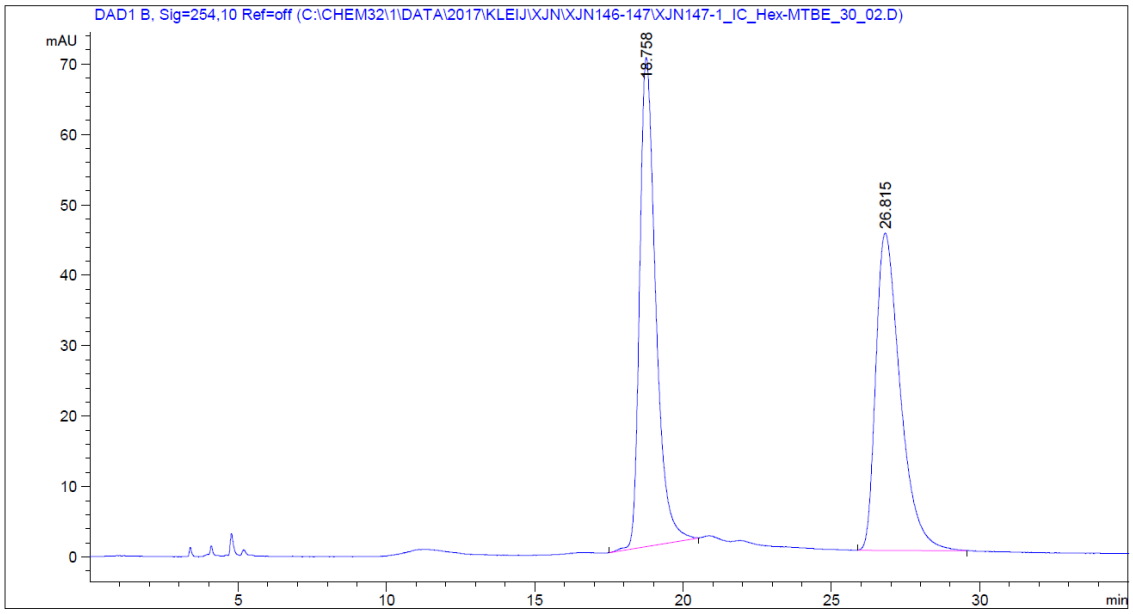
^{13}C NMR (101 MHz, $CDCl_3$) δ 158.24, 155.26, 135.72, 135.13, 134.15, 129.87, 128.91, 128.69, 127.36, 125.81, 125.30, 121.50, 119.89, 119.65, 119.31, 105.68, 85.01, 70.21, 55.50.

IR spectrum (neat)

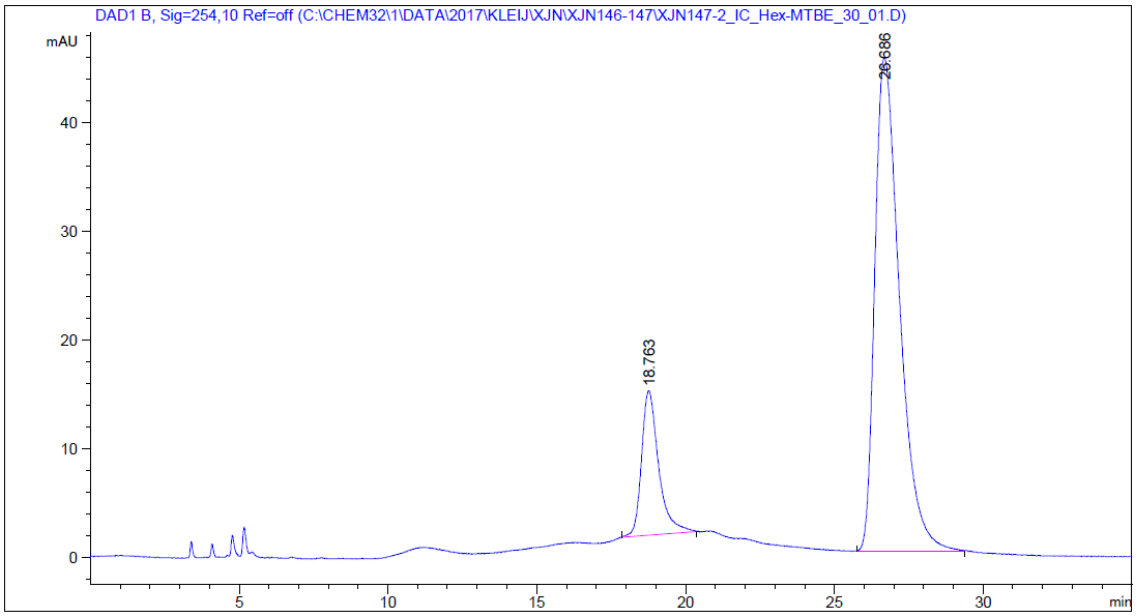


HRMS (ESI+, MeOH): *m/z* calcd. 343.1305 $(M + Na)^+$, found: 343.1303.

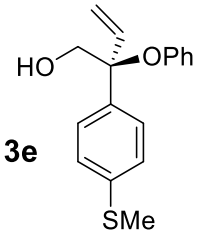
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 83 : 17 *er*; $[\alpha]_D^{25} = -55.49$ (*c* = 0.11, $CHCl_3$).



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	18.758	BB	0.5713	2619.39697	69.55901	50.3424
2	26.815	BB	0.8768	2583.76416	45.06886	49.6576



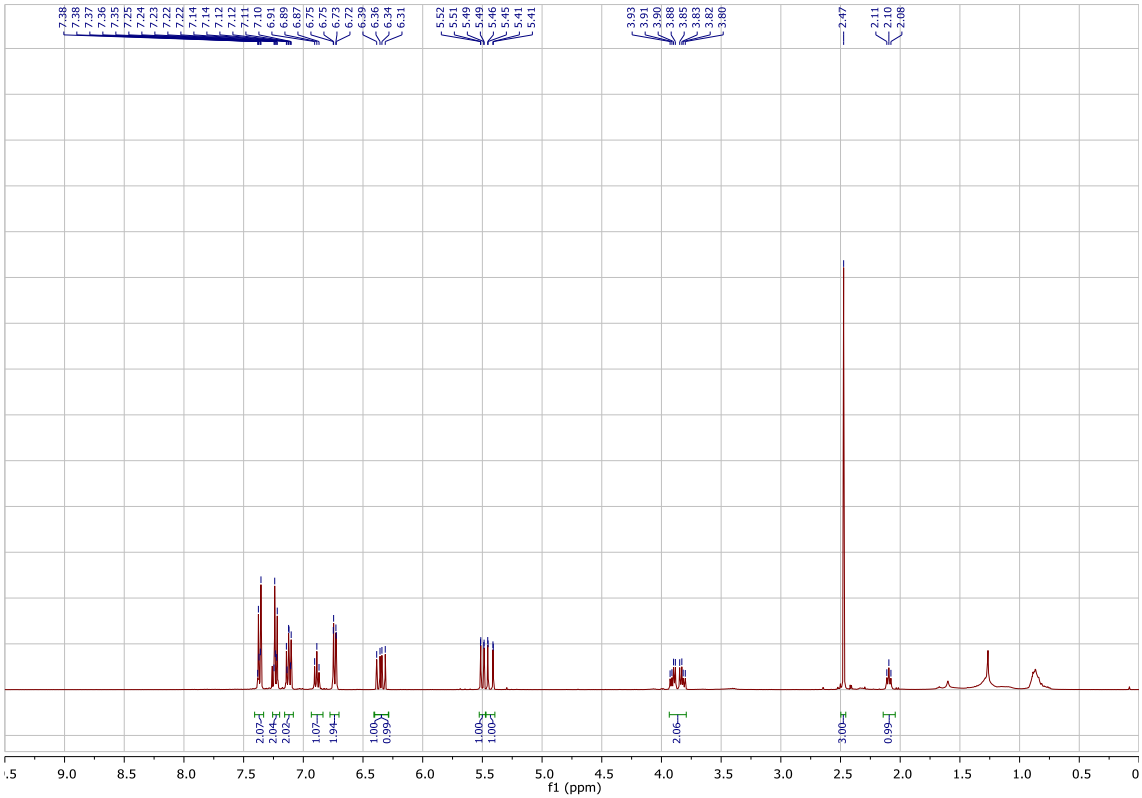
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	18.763	BB	0.5905	529.19904	13.29073	16.7911
2	26.686	BB	0.8619	2622.45801	45.40374	83.2089



3e

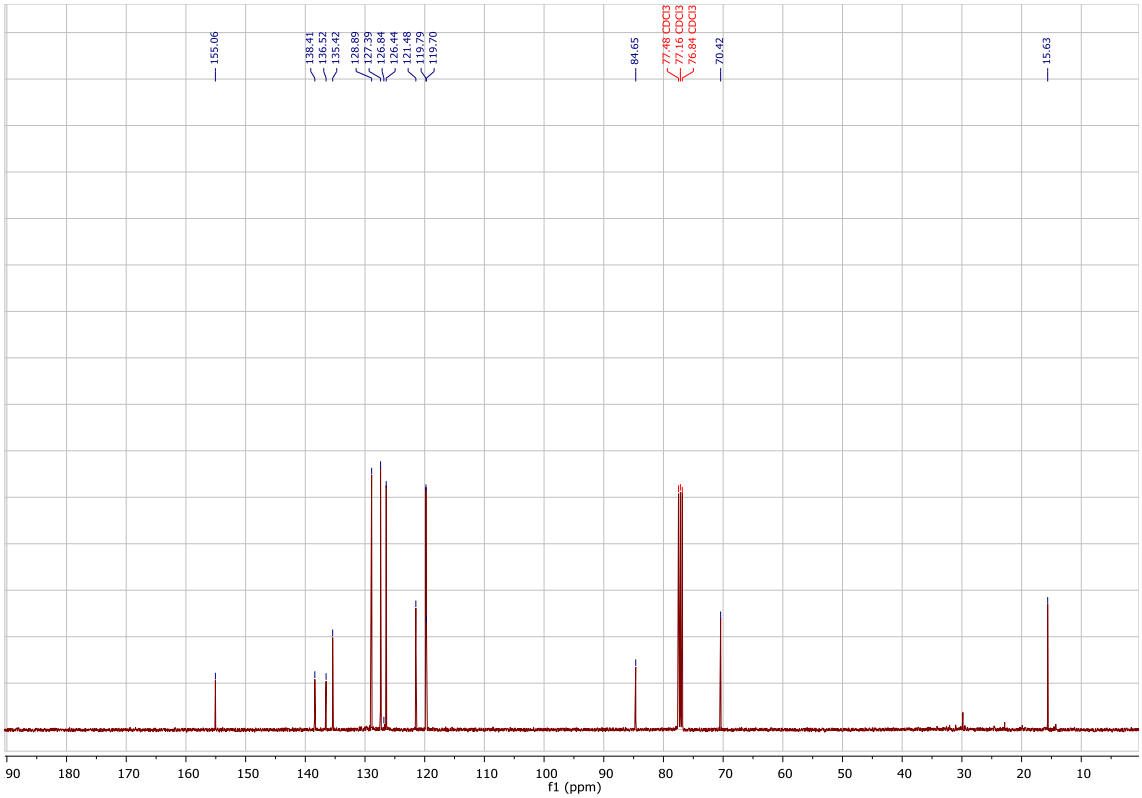
Scale: 0.2 mmol; isolated 46.3 mg (81% yield), light yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



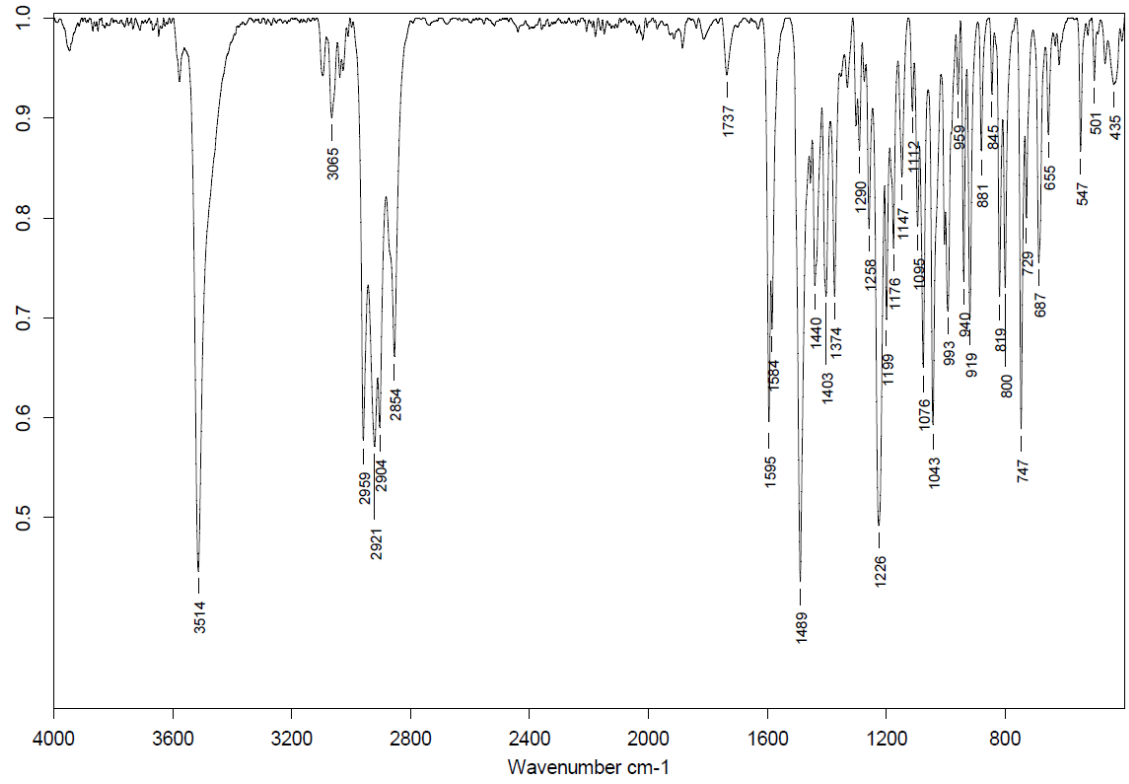
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.33 (m, 2H), 7.26 – 7.20 (m, 2H), 7.16 – 7.08 (m, 2H), 6.89 (t, *J* = 7.4 Hz, 1H), 6.74 (dd, *J* = 8.7, 1.0 Hz, 2H), 6.35 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.50 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.43 (dd, *J* = 17.5, 1.0 Hz, 1H), 3.93 – 3.79 (m, 2H), 2.47 (s, 3H), 2.09 (t, *J* = 6.9 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 155.06, 138.41, 136.52, 135.42, 128.89, 127.39, 126.44, 121.48, 119.79, 119.70, 84.65, 70.42, 15.63.

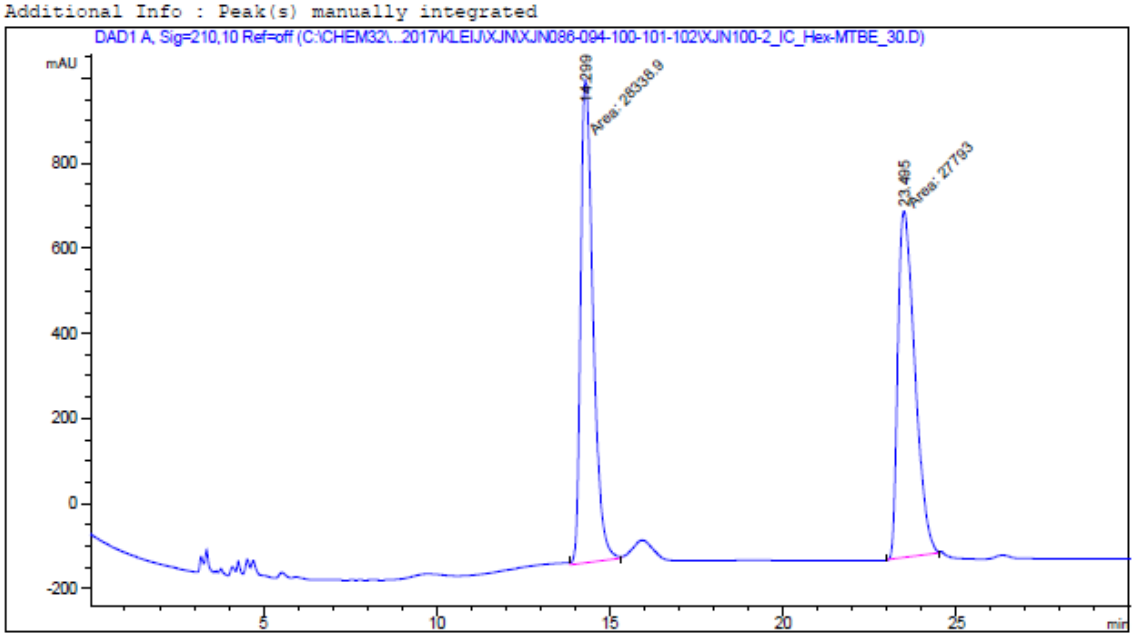
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 309.0920 $(M + Na)^+$, found: 309.0917.

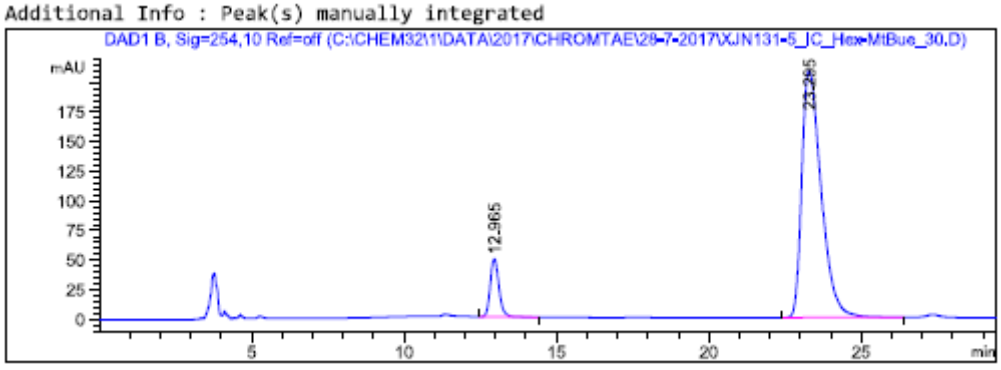
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 90.5 : 9.5 *er*; $[\alpha]_D^{25} = -36.48$ (*c* = 0.10, $CHCl_3$).

Additional Info : Peak(s) manually integrated



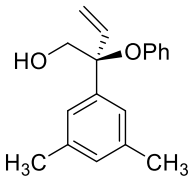
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	14.299	MM	0.4159	2.83389e4	1135.74902	50.4862
2	23.495	MM	0.5687	2.77930e4	814.59003	49.5138

Additional Info : Peak(s) manually integrated



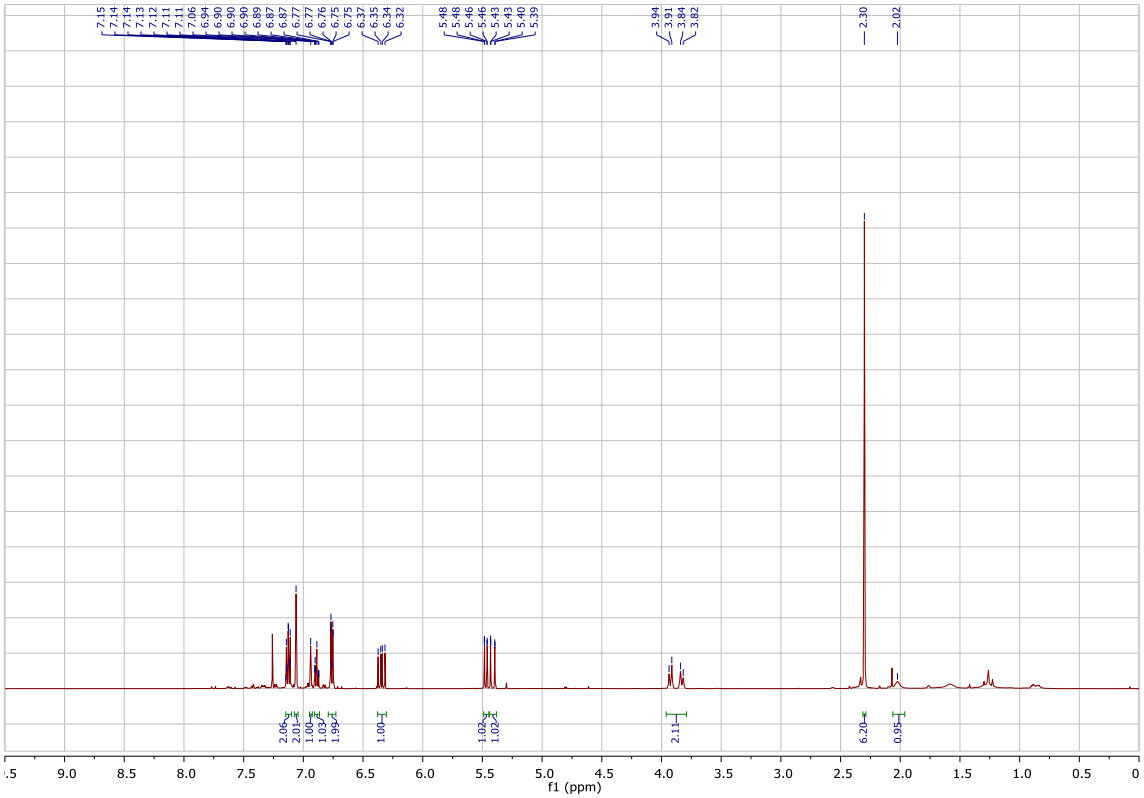
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.965	BB	0.3022	961.42004	48.72560	9.4434
2	23.295	BB	0.6787	9219.40625	208.18417	90.5566

3f



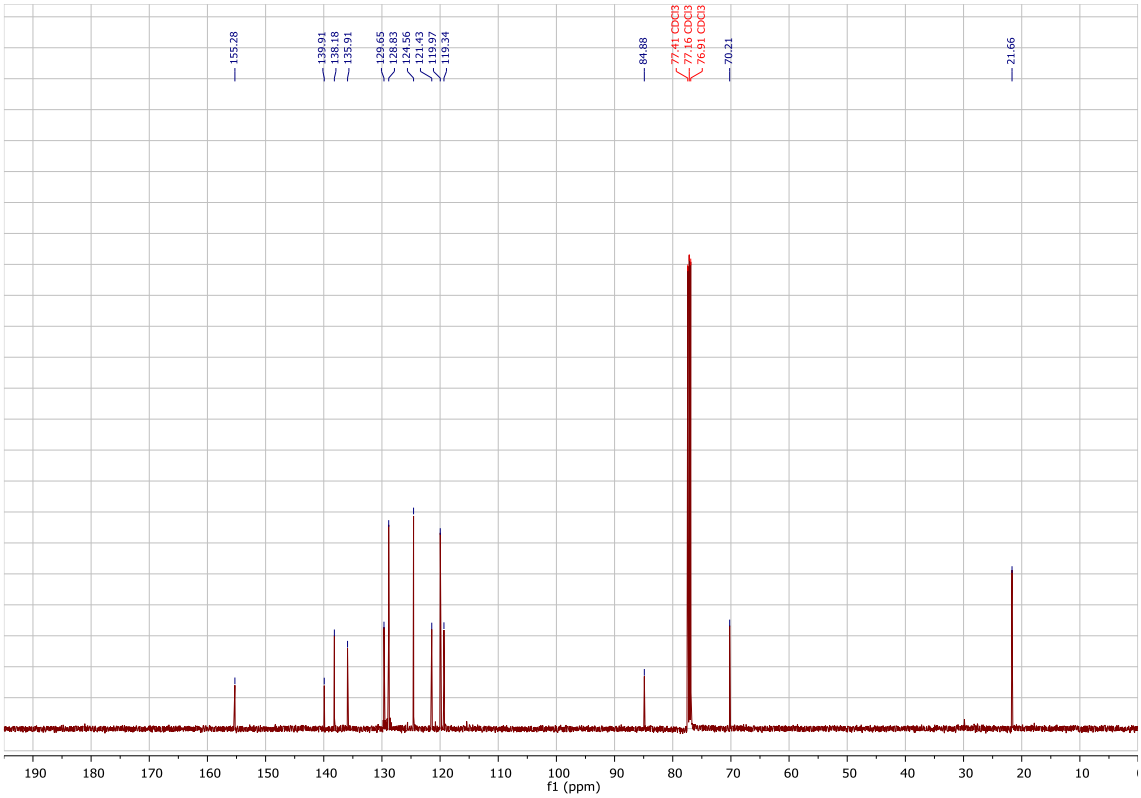
Scale: 0.2 mmol; isolated 30.5 mg (57% yield), yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



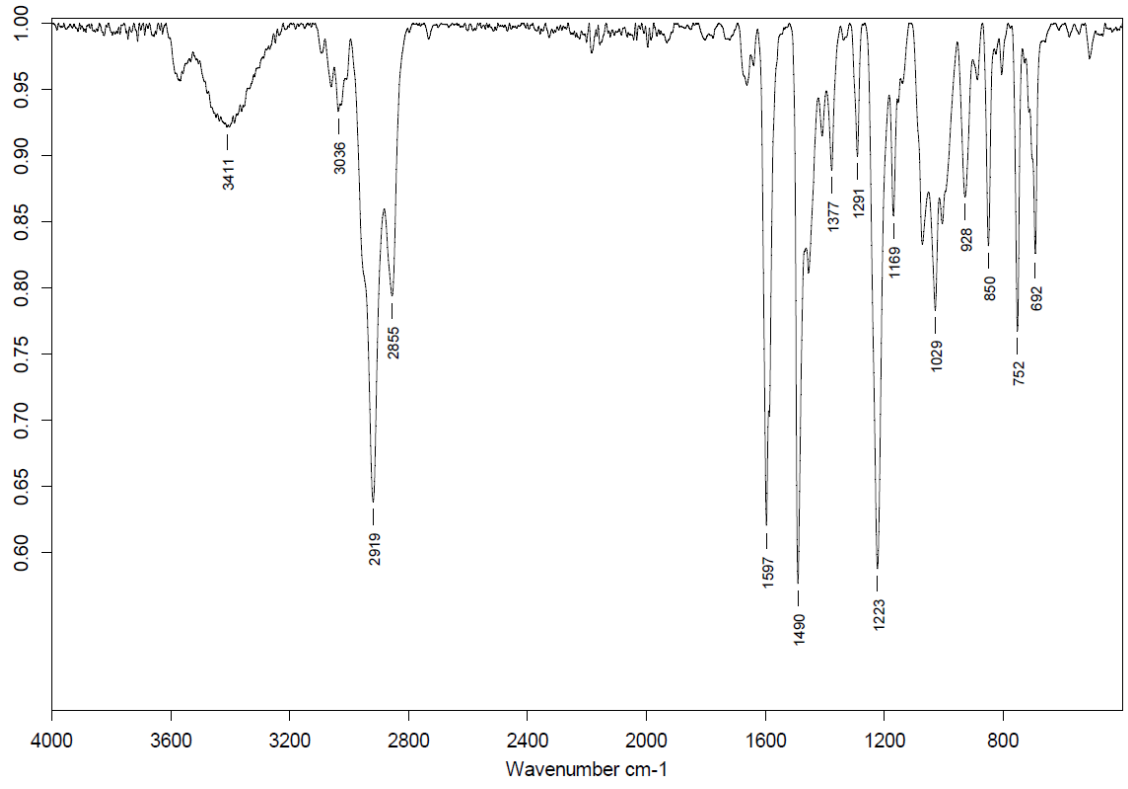
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.15 – 7.10 (m, 2H), 7.06 (s, 2H), 6.94 (s, 1H), 6.91 – 6.86 (m, 1H), 6.79 – 6.73 (m, 2H), 6.34 (dd, *J* = 17.6, 11.1 Hz, 1H), 5.47 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.41 (dd, *J* = 17.6, 1.0 Hz, 1H), 3.96 – 3.79 (m, 2H), 2.30 (s, 6H), 2.02 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



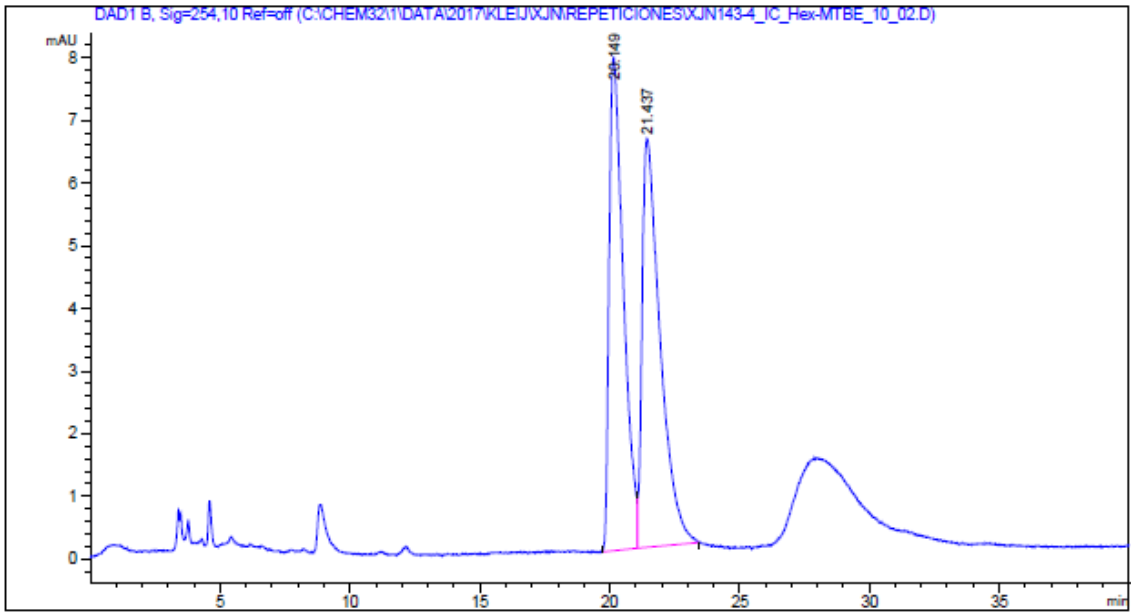
^{13}C NMR (126 MHz, $CDCl_3$) δ 155.28, 139.91, 138.18, 135.91, 129.65, 128.83, 124.56, 121.43, 119.97, 119.34, 84.88, 70.21, 21.66.

IR spectrum (neat)



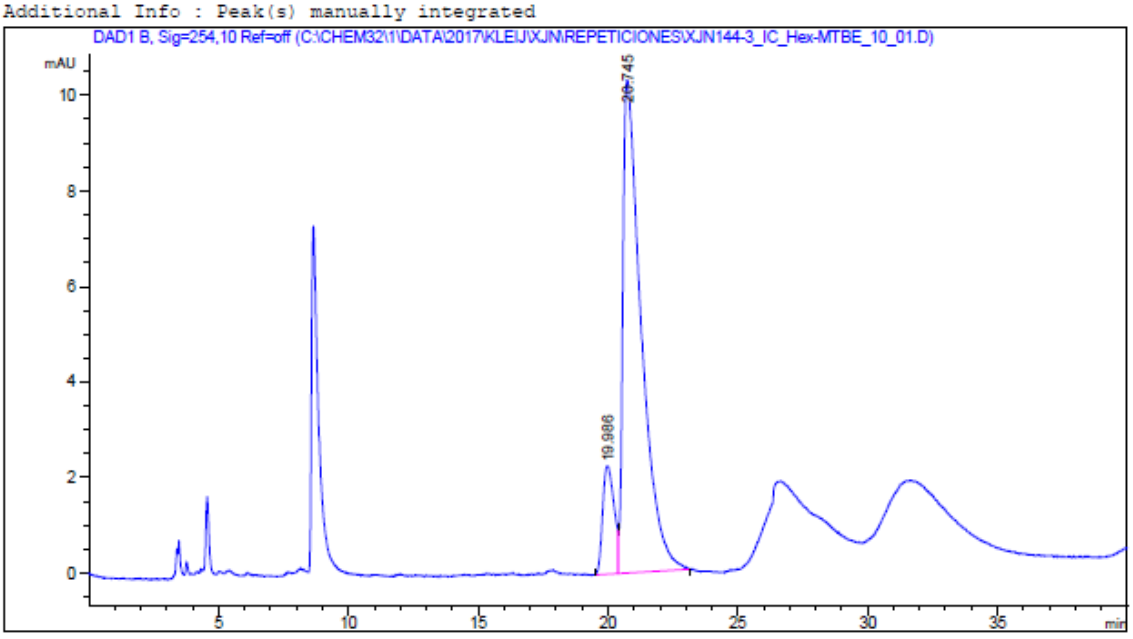
HRMS (ESI+, MeOH): *m/z* calcd. 291.1356 $(M + Na)^+$, found: 291.1361.

HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 88 : 12 *er*; $[\alpha]_D^{25}$ = +3.1 (*c* = 0.07, $CHCl_3$).

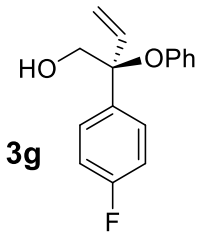


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	20.149	BV	0.5286	299.43106	7.85807	48.7049
2	21.437	VB	0.6344	315.35565	6.51896	51.2951

Additional Info : Peak(s) manually integrated



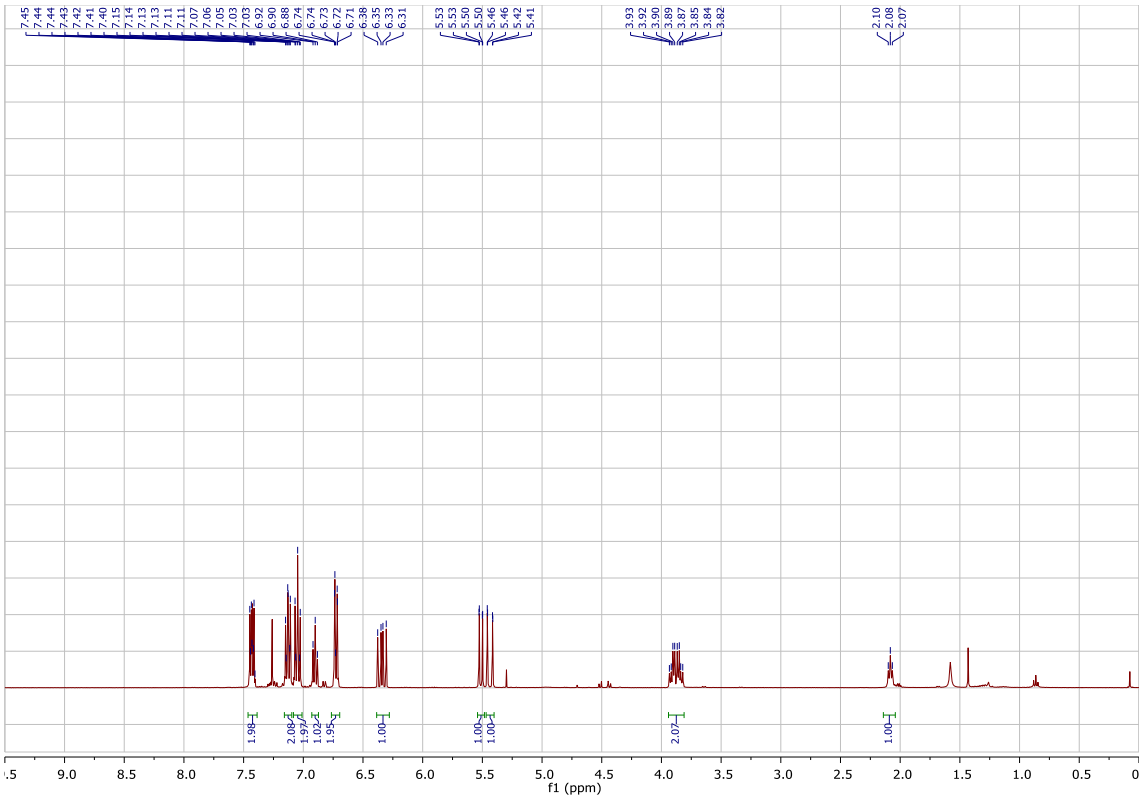
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	19.986	BV	0.3913	69.15713	2.25822	11.9634
2	20.745	VB	0.6576	508.91318	10.31584	88.0366



3g

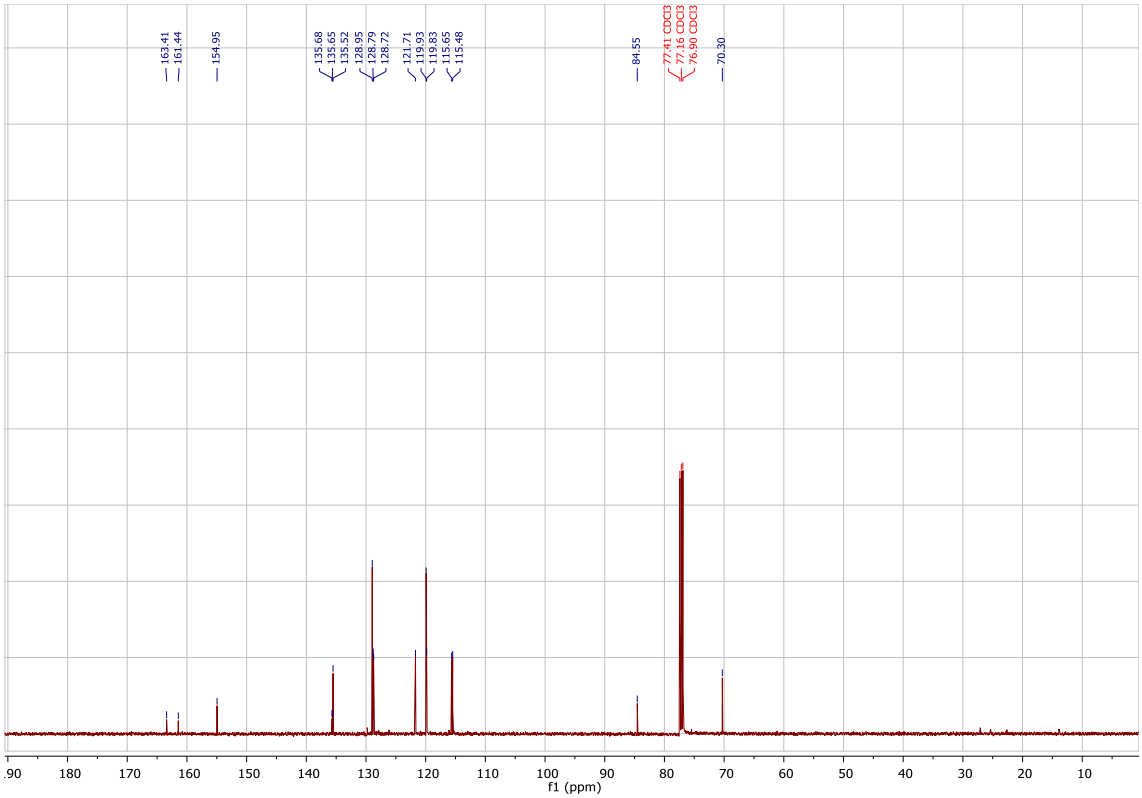
Scale: 0.2 mmol; isolated 42.8 mg (83% yield), white solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



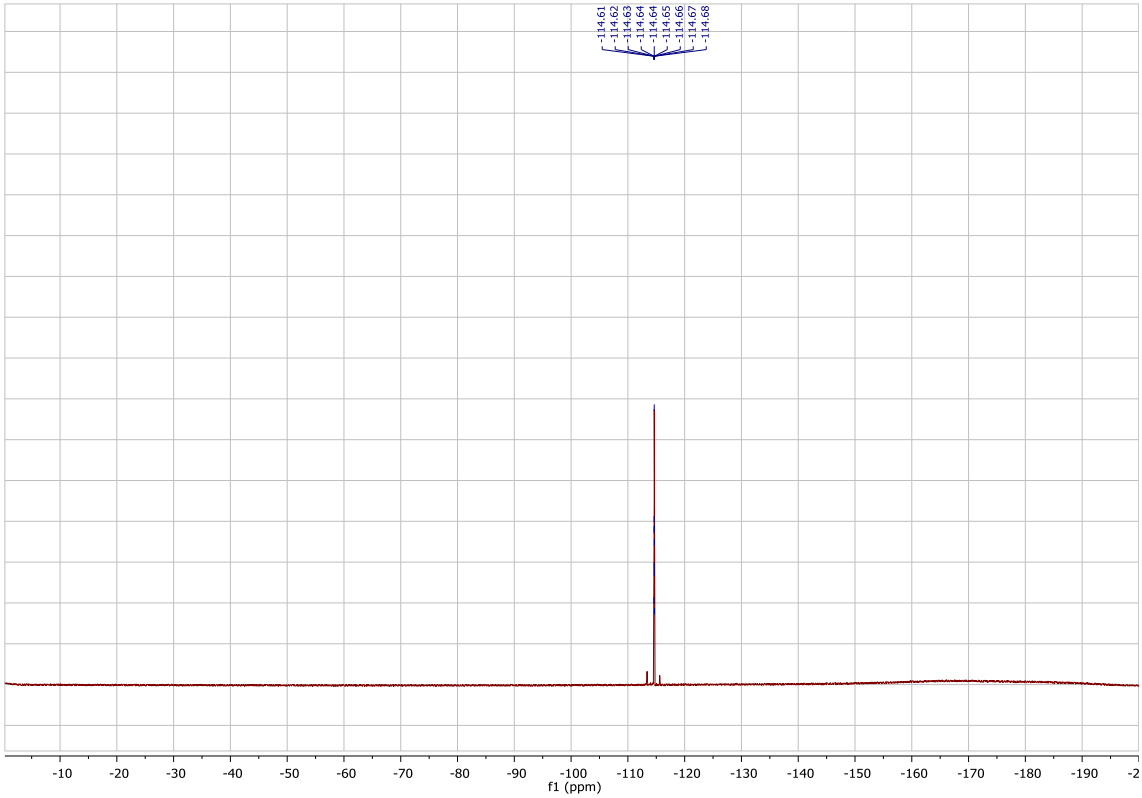
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.39 (m, 2H), 7.16 – 7.10 (m, 2H), 7.08 – 7.01 (m, 2H), 6.90 (t, *J* = 7.4 Hz, 1H), 6.76 – 6.69 (m, 2H), 6.34 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.54 – 5.41 (m, 2H), 3.94 – 3.81 (m, 2H), 2.08 (t, *J* = 6.9 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



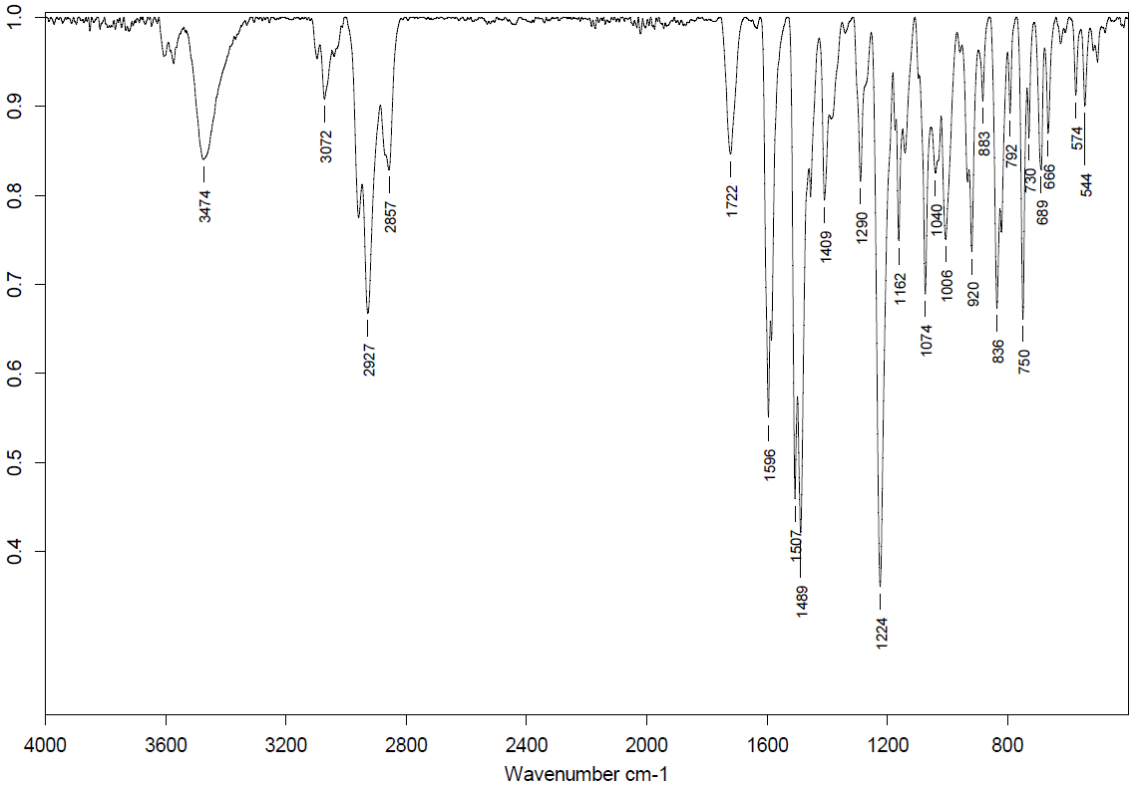
^{13}C NMR (126 MHz, $CDCl_3$) δ 163.41, 161.44, 154.95, 135.68, 135.65, 135.52, 128.95, 128.79, 128.72, 121.71, 119.93, 119.83, 115.65, 115.48, 84.55, 70.30.

^{13}C NMR spectrum ($CDCl_3$)



^{19}F NMR (376 MHz, $CDCl_3$) δ -114.64 (tt, J = 8.5, 5.2 Hz).

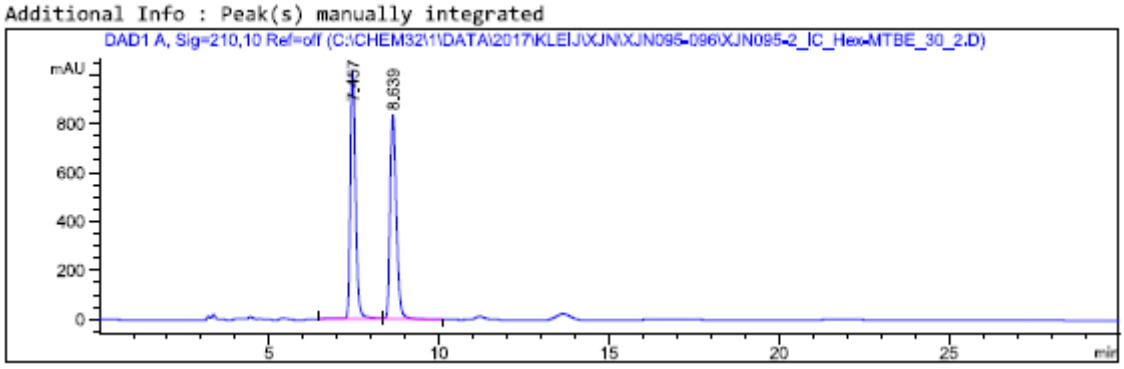
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 281.0948 $(M + Na)^+$, found: 281.0957.

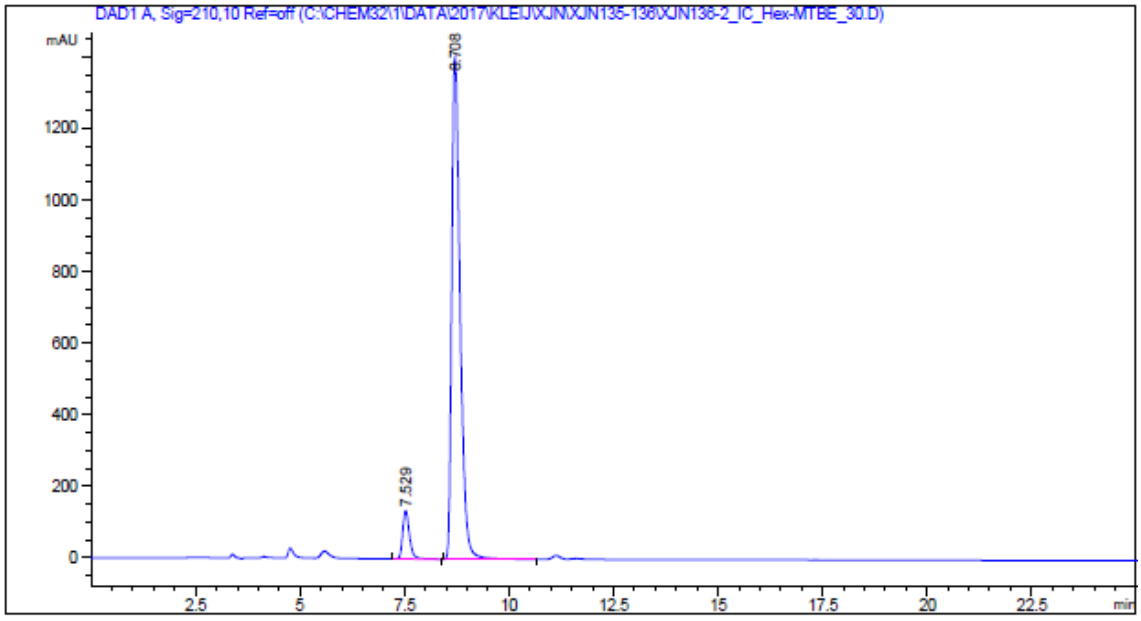
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 93 : 7 *er*; $[\alpha]_D^{25}$ = –40.14 (*c* = 0.13, $CHCl_3$).

Additional Info : Peak(s) manually integrated

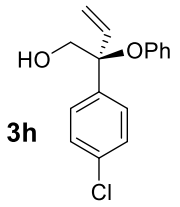


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.457	BB	0.1617	1.07189e4	1010.75592	50.4827
2	8.639	BB	0.1955	1.05139e4	831.71912	49.5173

Additional Info : Peak(s) manually integrated



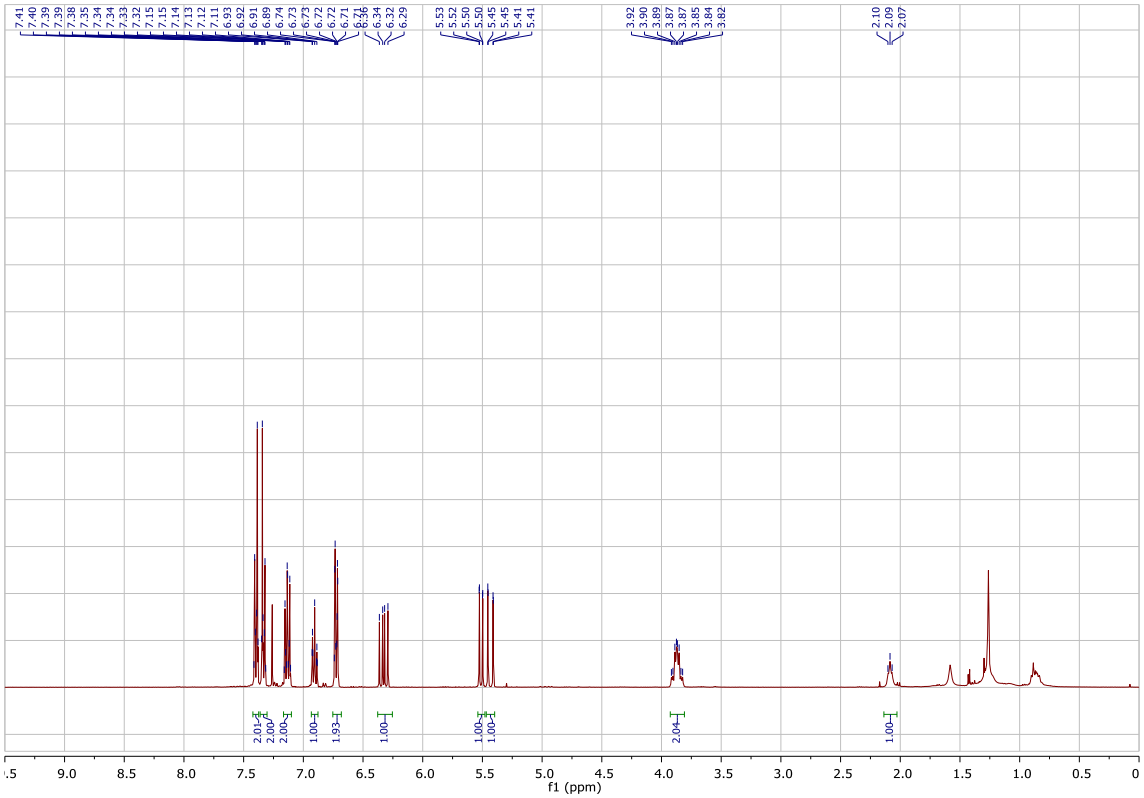
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.529	BB	0.1704	1508.91357	134.99863	7.1503
2	8.708	BB	0.2171	1.95940e4	1401.91418	92.8497



3h

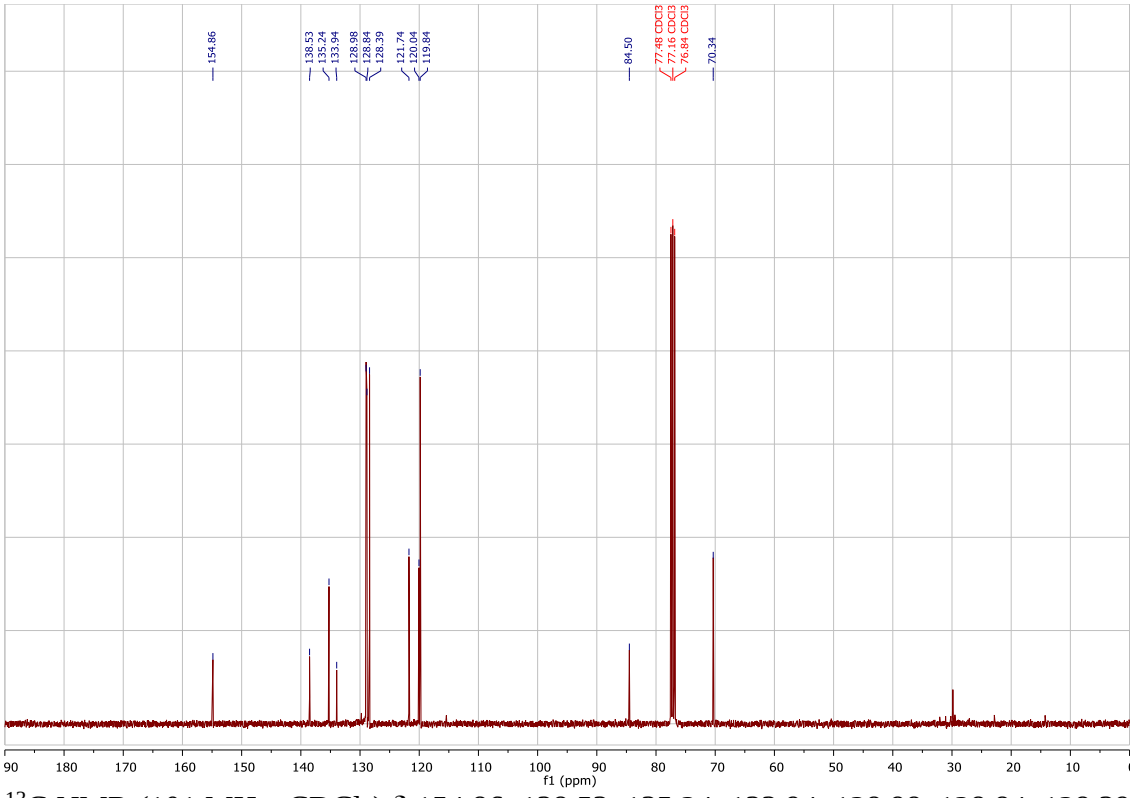
Scale: 0.2 mmol; isolated 34.5 mg (63% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



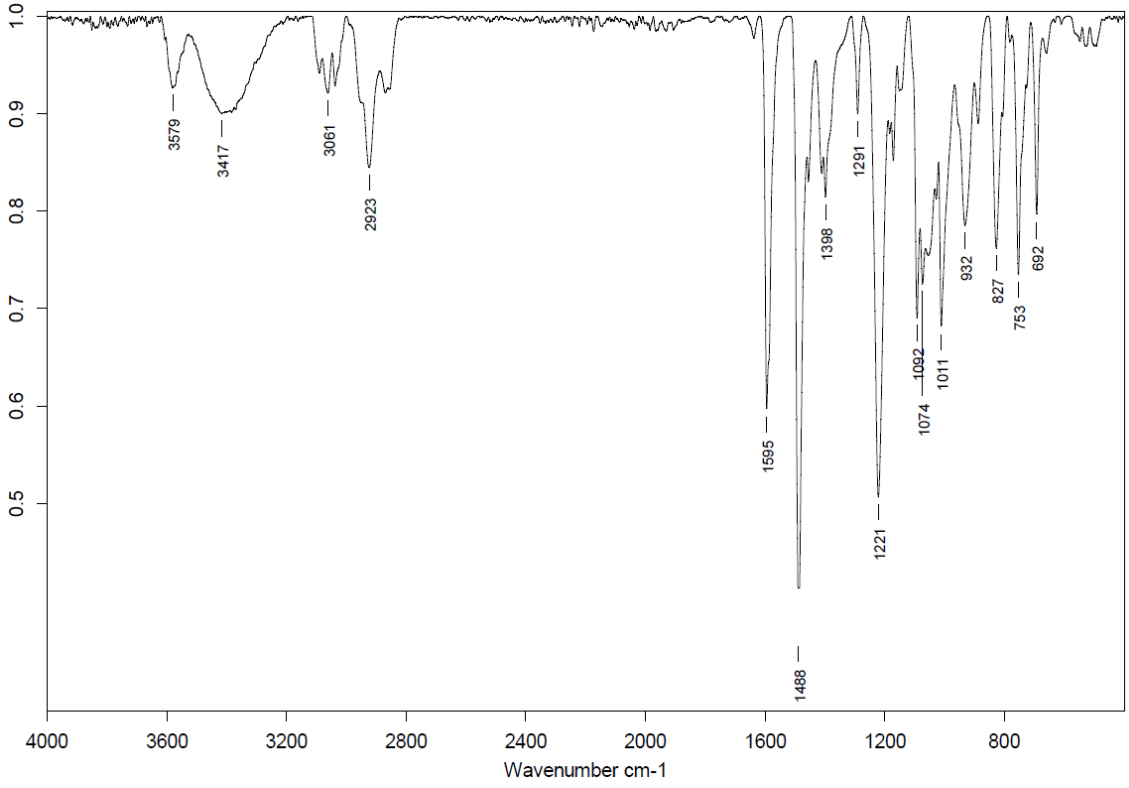
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.37 (m, 2H), 7.36 – 7.30 (m, 2H), 7.17 – 7.10 (m, 2H), 6.93 – 6.88 (m, 1H), 6.75 – 6.68 (m, 2H), 6.33 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.51 (dd, *J* = 11.1, 0.9 Hz, 1H), 5.43 (dd, *J* = 17.5, 0.9 Hz, 1H), 3.87 (qd, *J* = 11.6, 5.4 Hz, 2H), 2.09 (t, *J* = 6.9 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 154.86, 138.53, 135.24, 133.94, 128.98, 128.84, 128.39, 121.74, 120.04, 119.84, 84.50, 70.34.

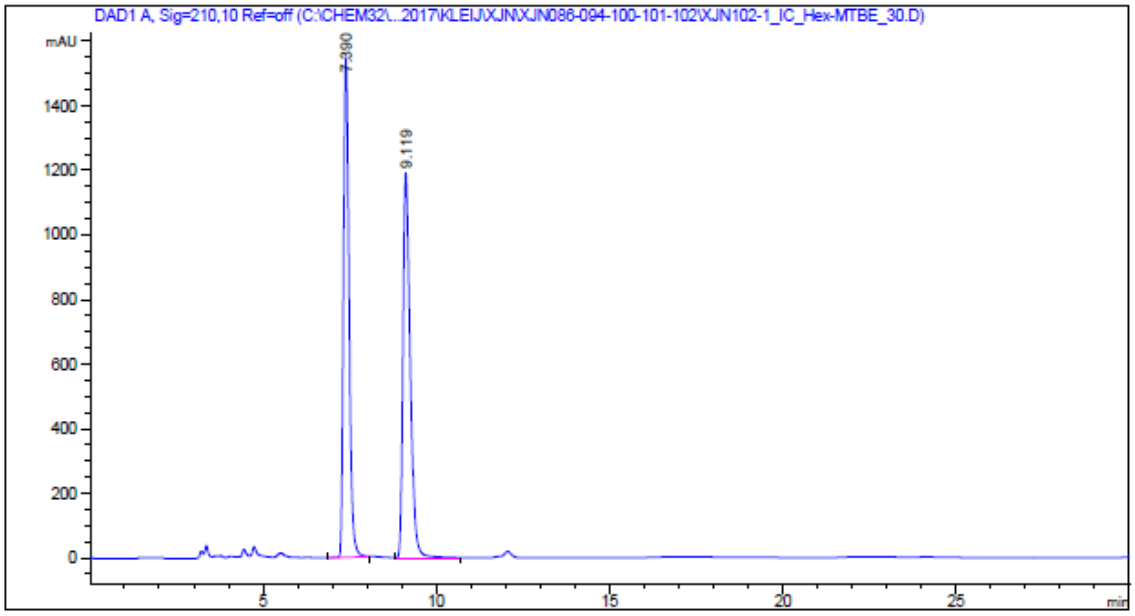
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 297.0653 $(M + Na)^+$, found: 297.0662.

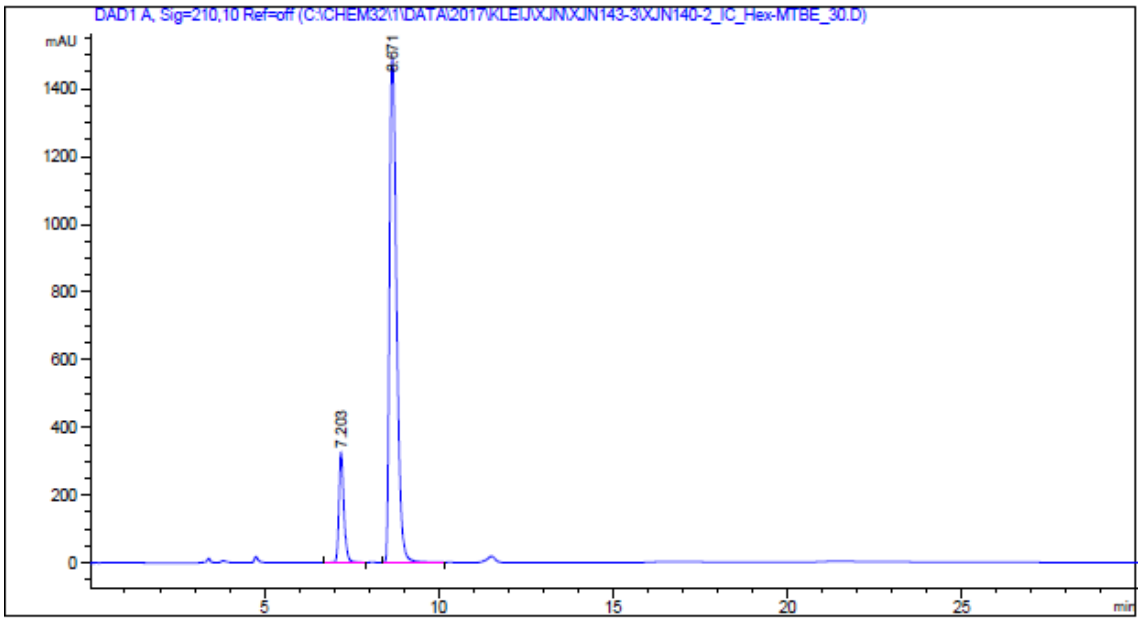
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 86 : 14 *er*; $[\alpha]_D^{25}$ = –38.00 (*c* = 0.09, $CHCl_3$).

Additional Info : Peak(s) manually integrated

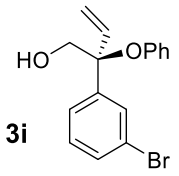


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.390	BB	0.1707	1.70563e4	1545.73035	49.2974
2	9.119	BB	0.2254	1.75425e4	1194.12488	50.7026

Additional Info : Peak(s) manually integrated



Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	7.203	BB	0.1570	3324.09351	325.89645	13.8170
2	8.671	BB	0.2147	2.07339e4	1486.62756	86.1830



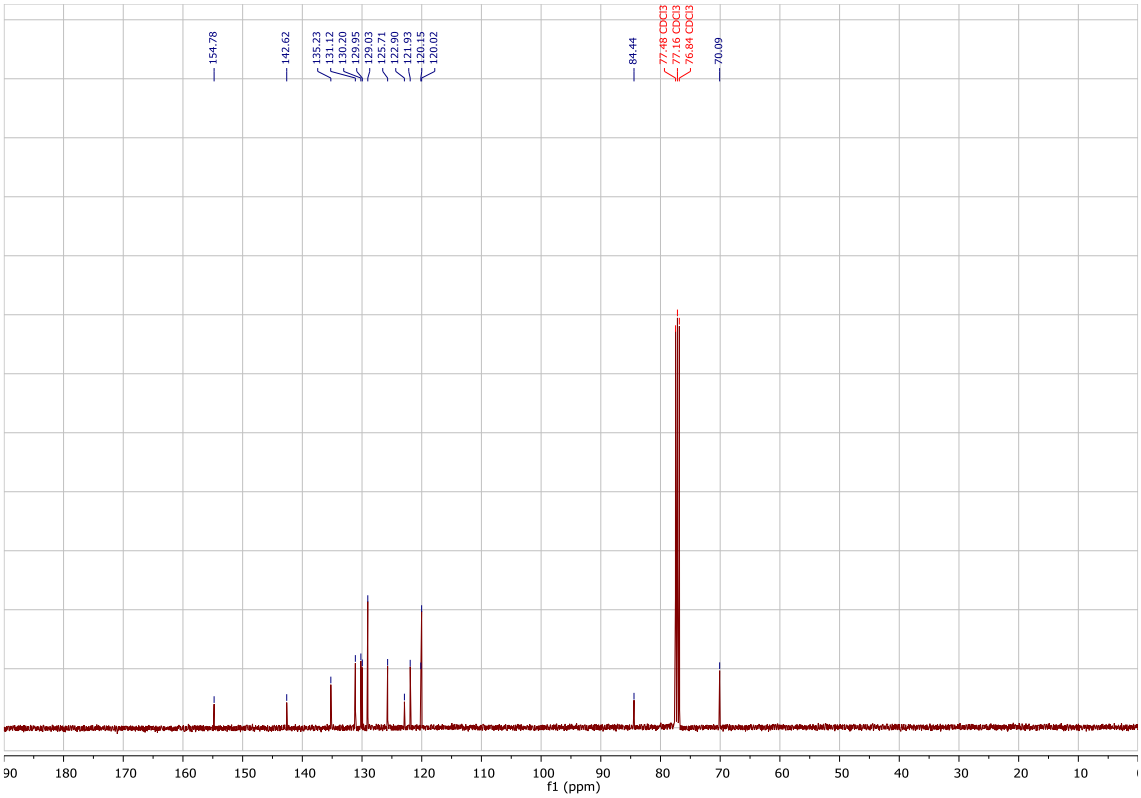
3i

Scale: 0.2 mmol; isolated 31.1 mg (49% yield), yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)

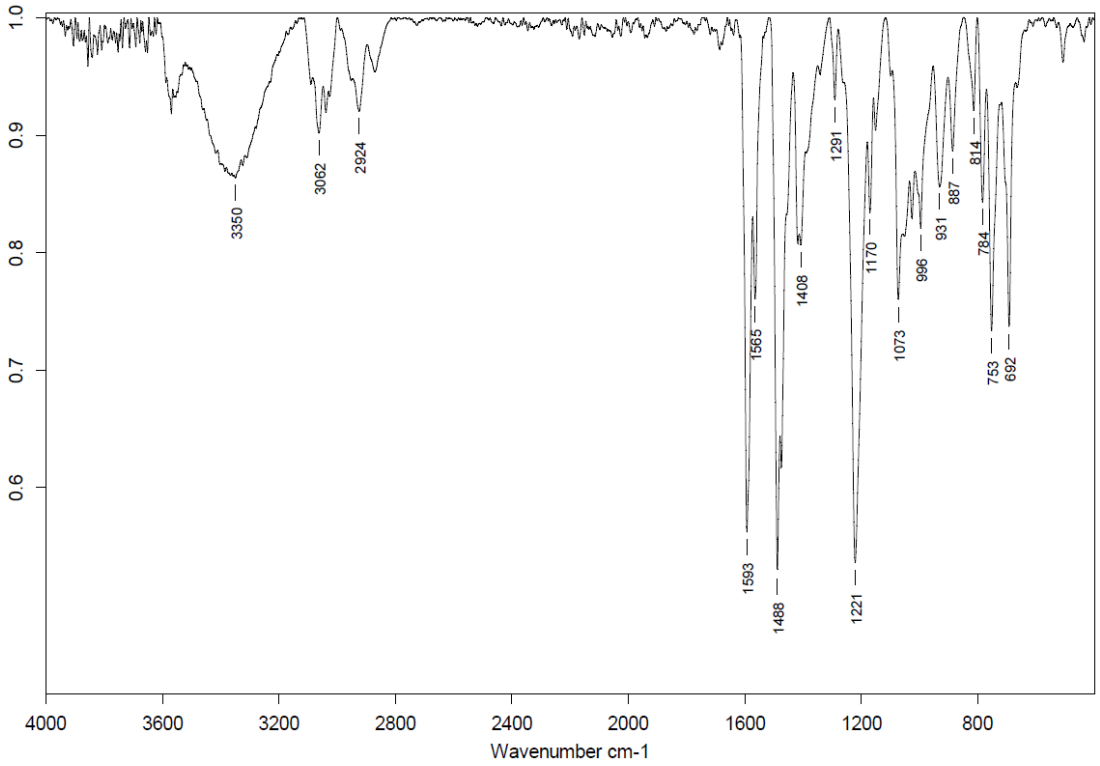
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.63 (t, *J* = 1.8 Hz, 1H), 7.45 (m, 1H), 7.39 (m, 1H), 7.23 (m, 1H), 7.19 – 7.10 (m, 2H), 6.92 (t, *J* = 7.4 Hz, 1H), 6.81 – 6.71 (m, 2H), 6.30 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.51 (dd, *J* = 11.1, 0.9 Hz, 1H), 5.43 (dd, *J* = 17.5, 0.9 Hz, 1H), 3.88 (q, *J* = 8.4, 6.7 Hz, 2H), 2.05 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 154.78, 142.62, 135.23, 131.12, 130.20, 129.95, 129.03, 125.71, 122.90, 121.93, 120.15, 120.02, 84.44, 70.09.

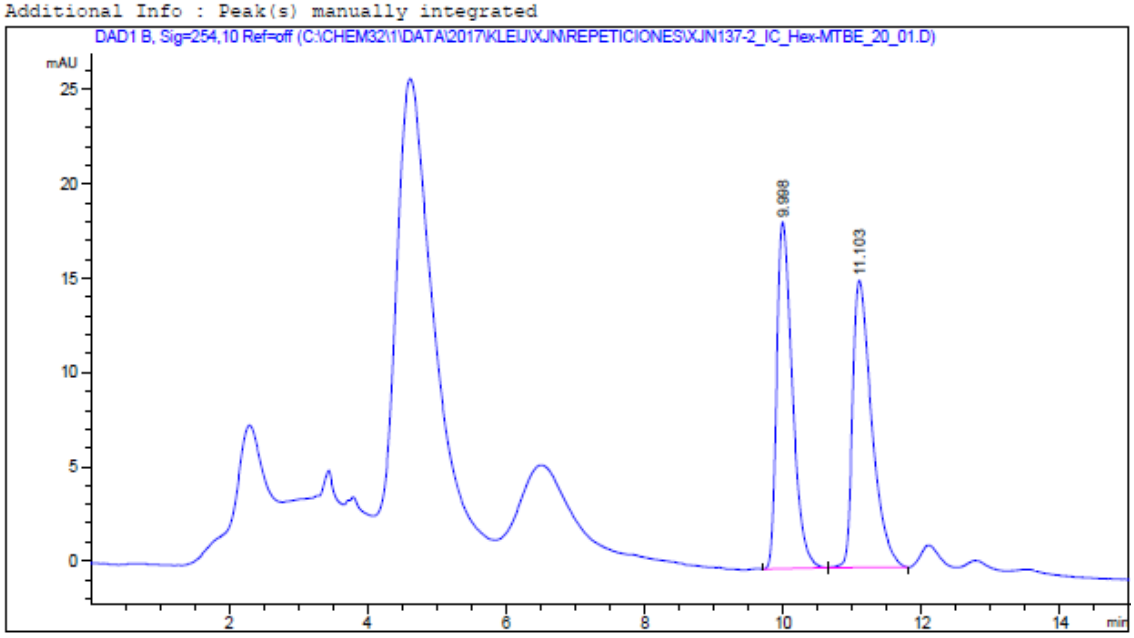
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 341.0148 $(M + Na)^+$, found: 341.0143.

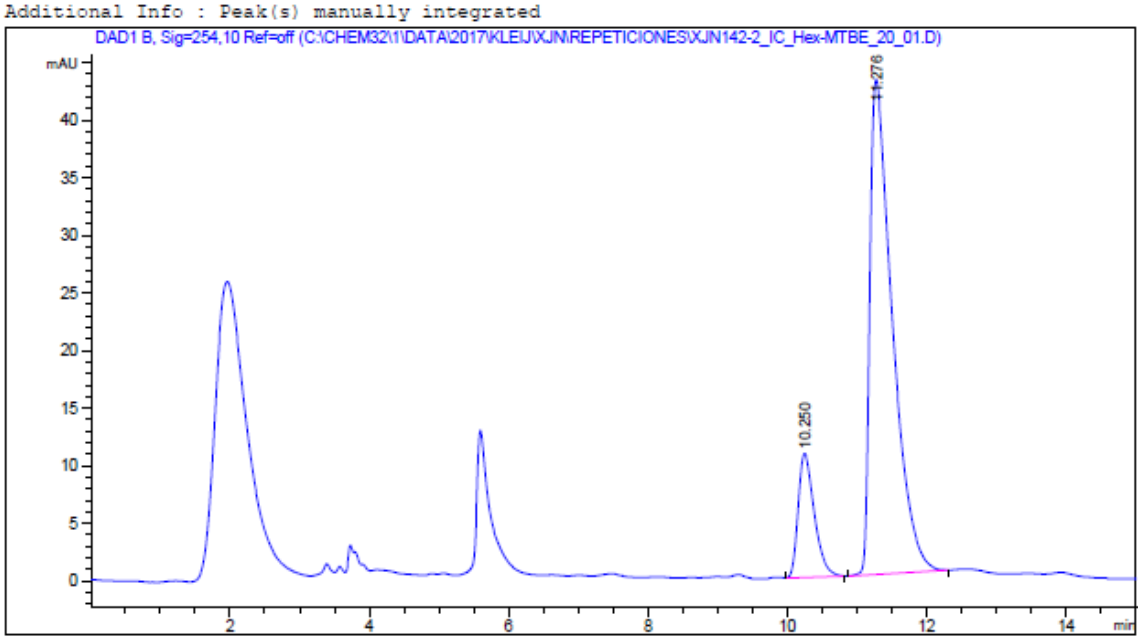
HPLC conditions: Chiralpak IC 250 x 4.6 mm, 5 μm, Hex/MTBE = 80 : 20, 1 mL/min; 85 : 15 *er*; $[\alpha]_D^{25} = -26.16$ (*c* = 0.10, $CHCl_3$).

Additional Info : Peak(s) manually integrated

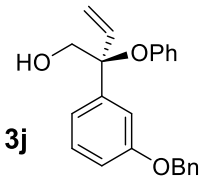


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	9.998	BB	0.2387	287.77426	18.37293	49.6360
2	11.103	BB	0.2918	291.99509	15.21965	50.3640

Additional Info : Peak(s) manually integrated



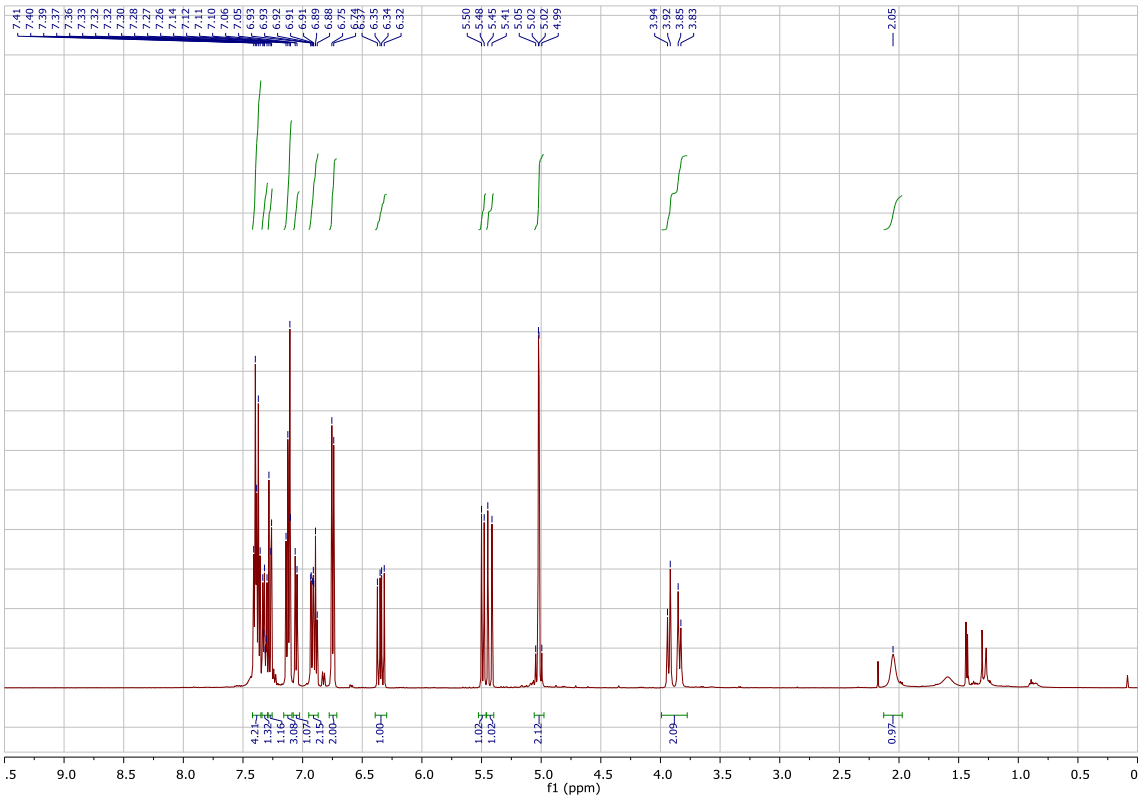
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	10.250	BB	0.2485	174.01523	10.77020	15.3657
2	11.276	BB	0.3284	958.47876	42.95053	84.6343



3j

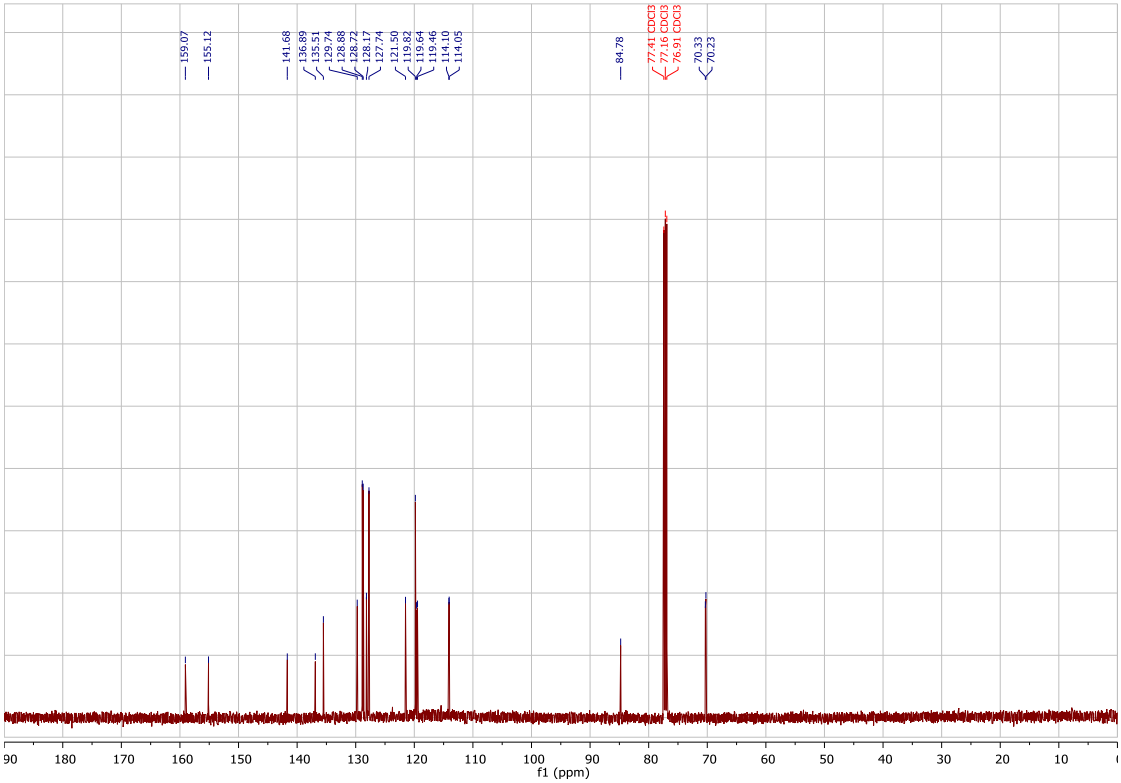
Scale: 0.2 mmol; isolated 47.0 mg (68% yield), light yellow solid, Hexane : EA = 50 : 1, R_f = 0.10

^{1}H NMR spectrum ($CDCl_3$)



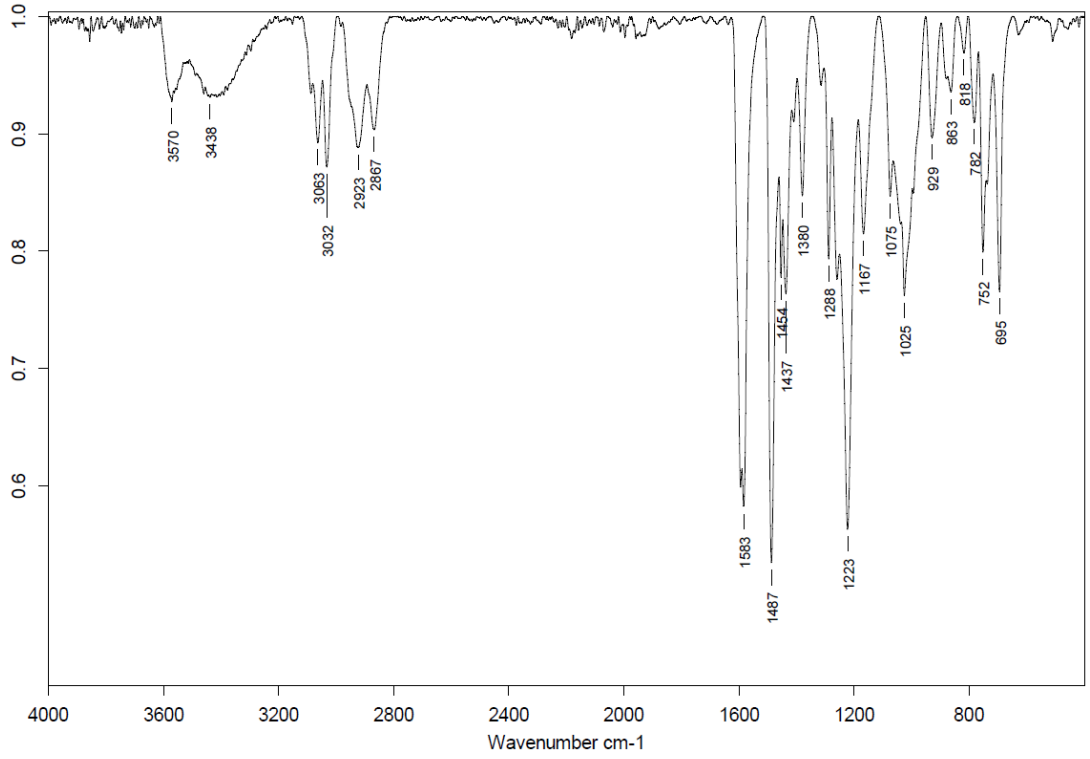
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 (m, 4H), 7.37 – 7.32 (m, 1H), 7.32 – 7.28 (m, 1H), 7.19 – 7.12 (m, 3H), 7.08 (d, *J* = 7.8 Hz, 1H), 6.98 – 6.90 (m, 2H), 6.77 (d, *J* = 7.9 Hz, 2H), 6.37 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.52 (d, *J* = 11.1 Hz, 1H), 5.46 (d, *J* = 17.5 Hz, 1H), 5.05 (d, *J* = 2.3 Hz, 2H), 4.02 – 3.80 (m, 2H), 2.08 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (126 MHz, $CDCl_3$) δ 159.07, 155.12, 141.68, 136.89, 135.51, 129.74, 128.88, 128.72, 128.17, 127.74, 121.50, 119.82, 119.64, 119.46, 114.10, 114.05, 84.78, 70.33, 70.23.

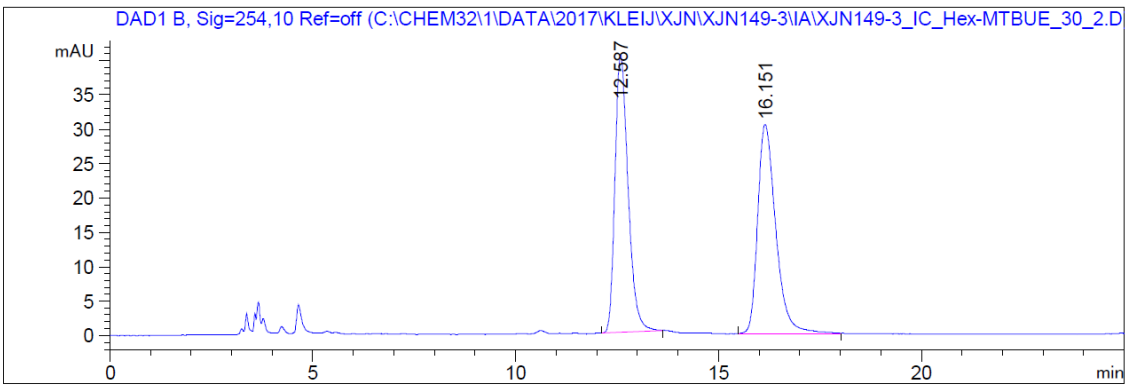
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 369.1461 $(M + Na)^+$, found: 369.1463.

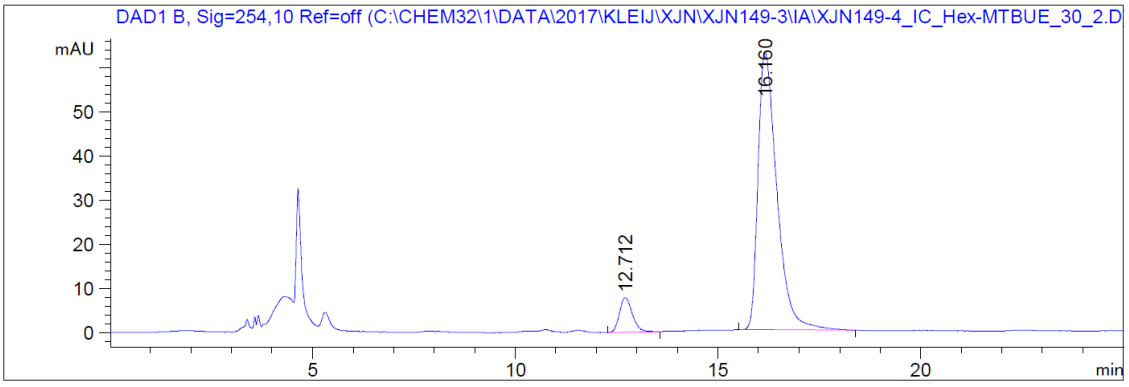
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 70 : 30, 1 mL/min; 92 : 8 *er*; $[\alpha]_D^{25} = -36.06$ (*c* = 0.10, $CHCl_3$).

Additional Info : Peak(s) manually integrated



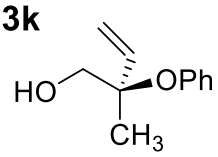
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.587	BB	0.3434	904.14587	40.35524	49.0357
2	16.151	BB	0.4668	939.70599	30.38390	50.9643

Additional Info : Peak(s) manually integrated



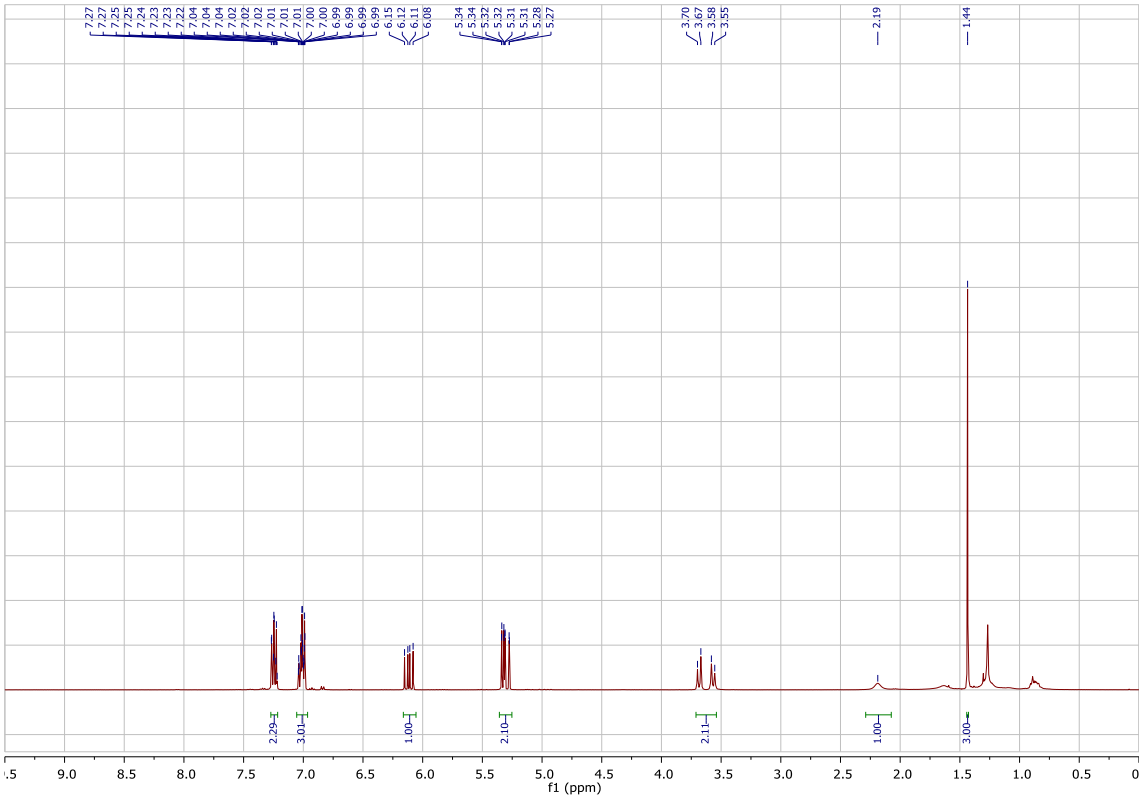
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.712	BB	0.3329	175.26665	7.89767	7.9127
2	16.160	BB	0.4903	2039.75000	62.90194	92.0873

3k



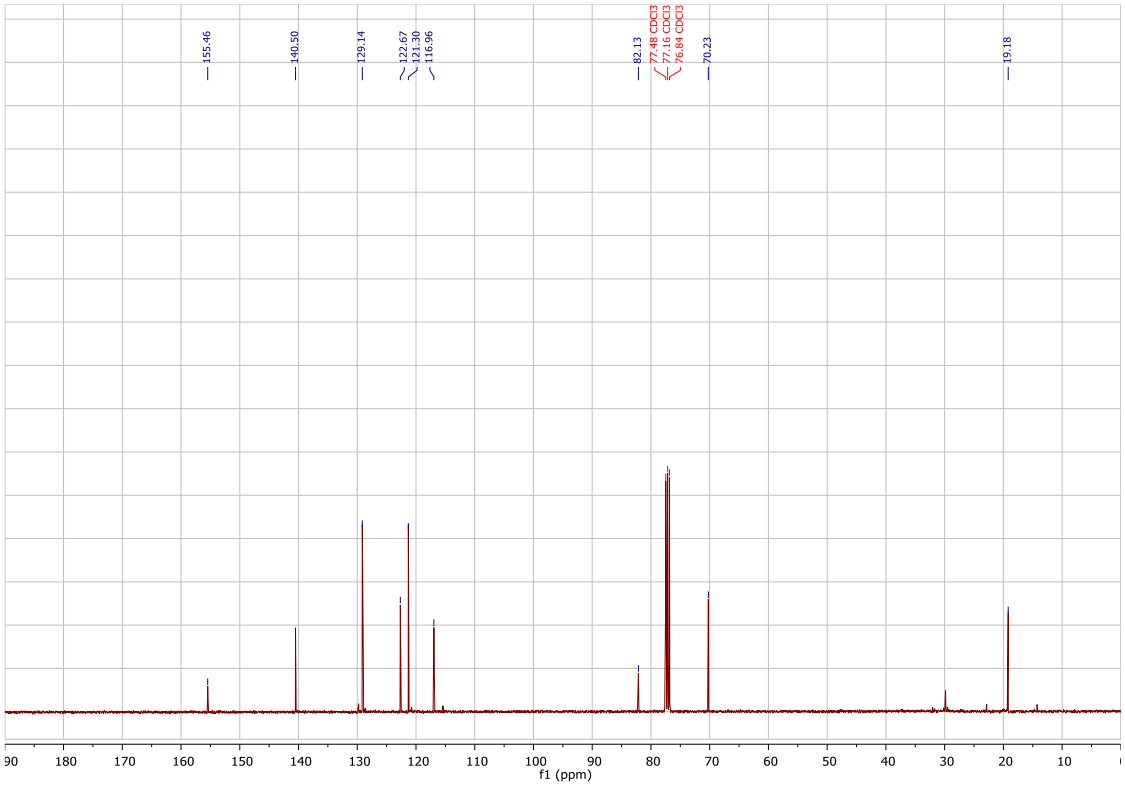
Scale: 0.2 mmol; isolated 29.5 mg (83% yield), light yellow oil, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



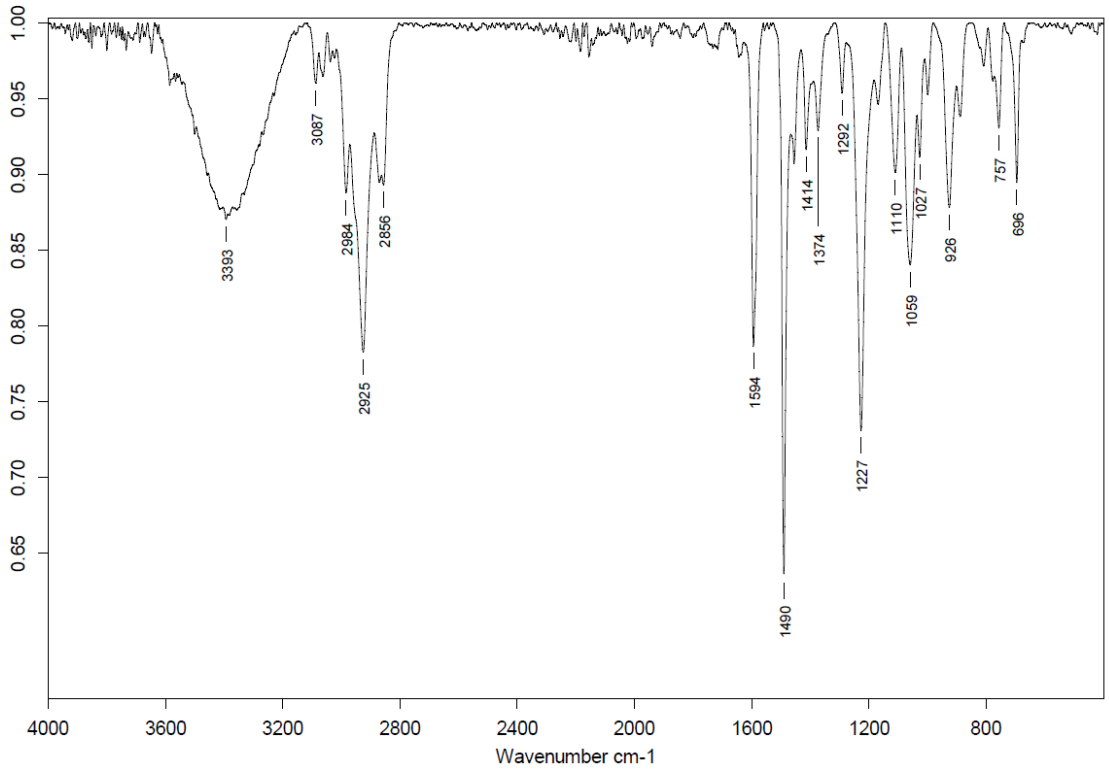
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 (m, 2H), 7.01 (m, 3H), 6.12 (dd, *J* = 17.6, 11.1 Hz, 1H), 5.36 – 5.25 (m, 2H), 3.71 – 3.54 (m, 2H), 2.19 (s, 1H), 1.44 (s, 3H).

^{13}C NMR spectrum ($CDCl_3$)



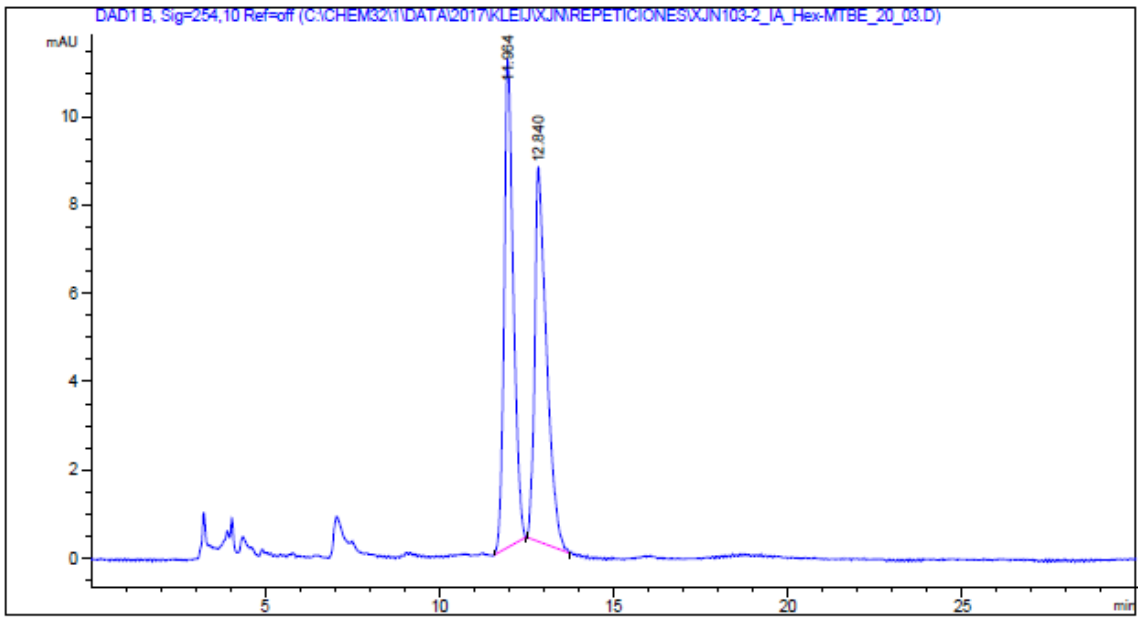
^{13}C NMR (101 MHz, $CDCl_3$) δ 155.46, 140.50, 129.14, 122.67, 121.30, 116.96, 82.13, 70.23, 19.18.

IR spectrum (neat)



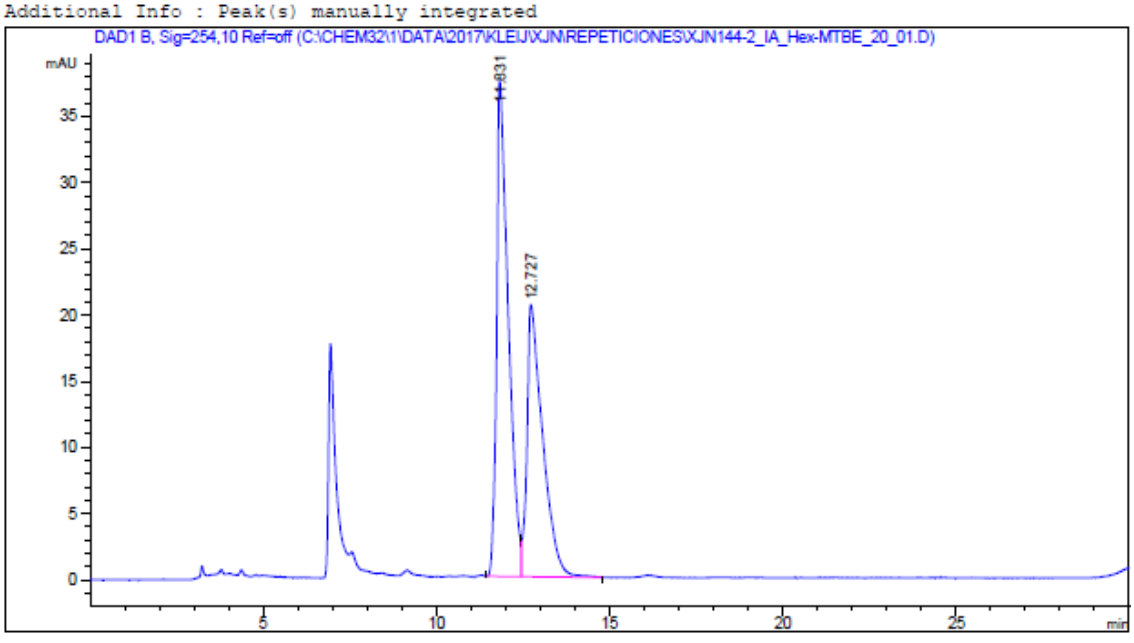
HRMS (ESI+, MeOH): *m/z* calcd. 201.0886 $(M + Na)^+$, found: 201.0883.

HPLC conditions: Chiralpak IA 250 × 4.6 mm, 5 μm, Hex/MTBE = 80:20, 1 mL/min; 57.5 : 42.5 *er*; $[\alpha]_D^{25} = -1.22$ (*c* = 0.09, $CHCl_3$).

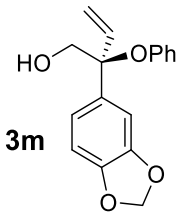


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.964	BB	0.2664	203.28680	11.06008	50.2305
2	12.840	BB	0.3232	201.42107	8.47600	49.7695

Additional Info : Peak(s) manually integrated

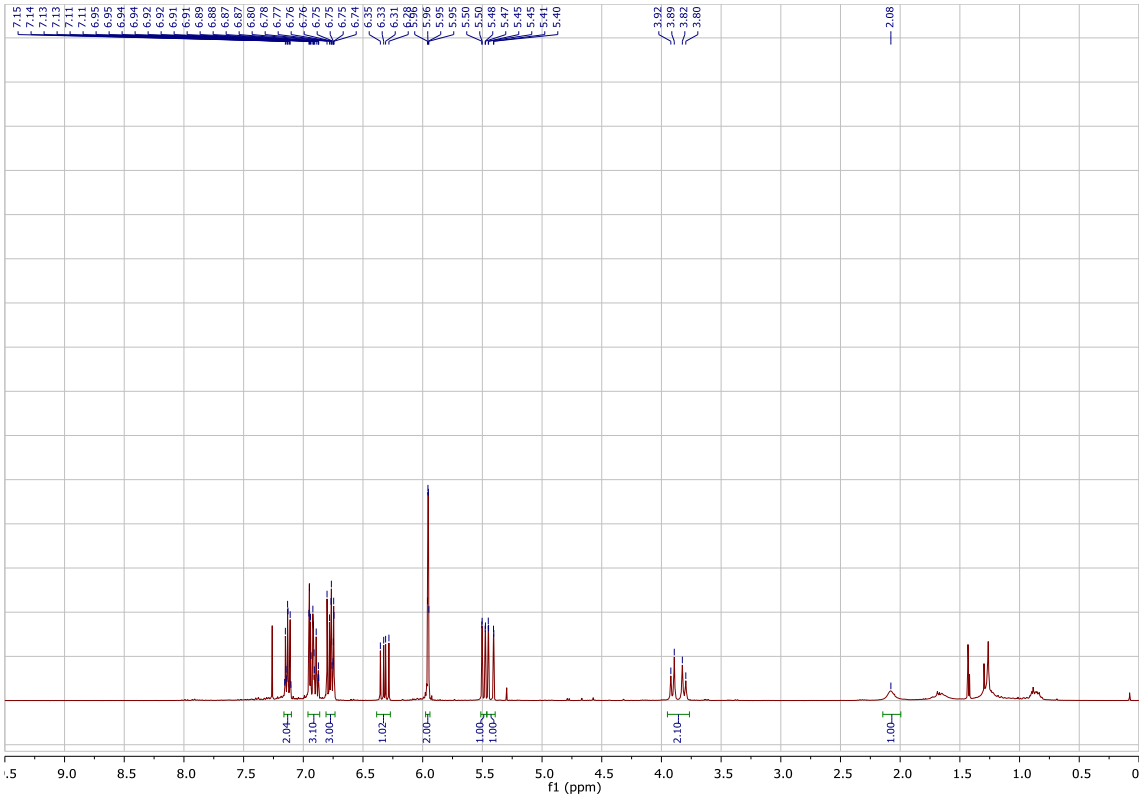


Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.831	BV	0.3293	878.45435	37.50002	57.5500
2	12.727	VB	0.4297	647.96582	20.55854	42.4500



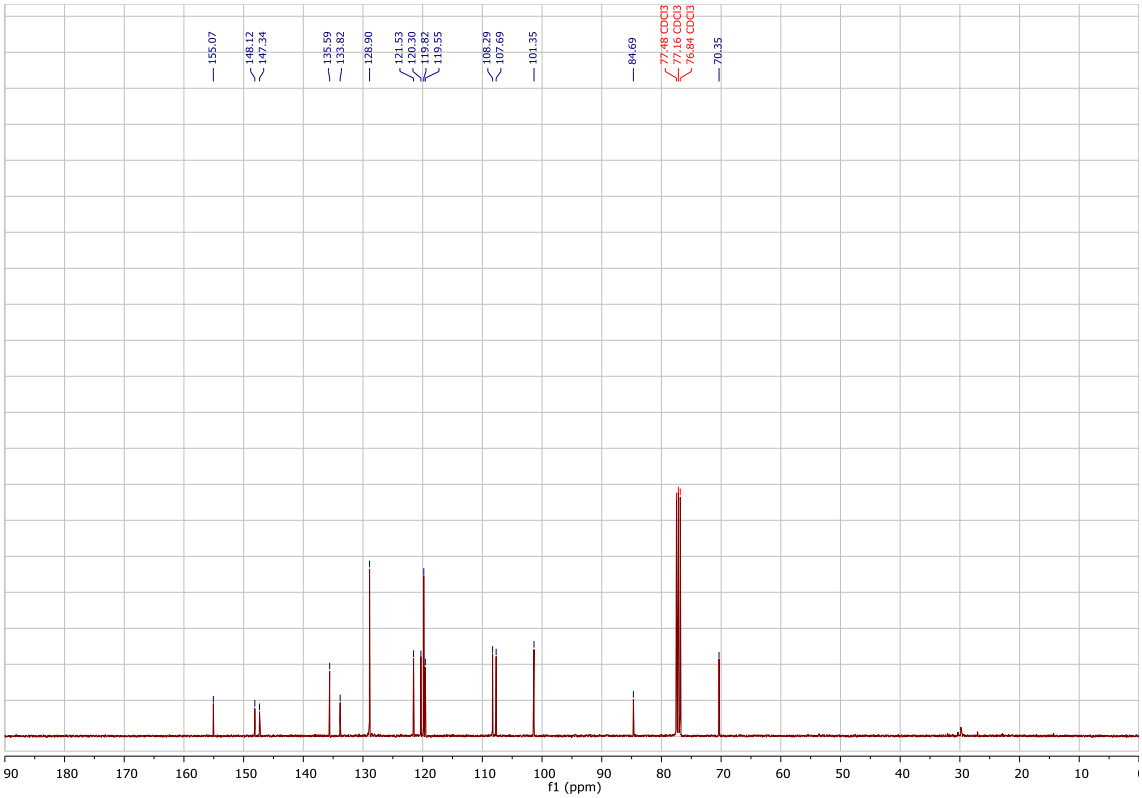
Scale: 0.2 mmol; isolated 43.7 mg (77% yield), light yellow solid, Hexane : EA = 50 : 1, R_f = 0.15

^{1}H NMR spectrum ($CDCl_3$)



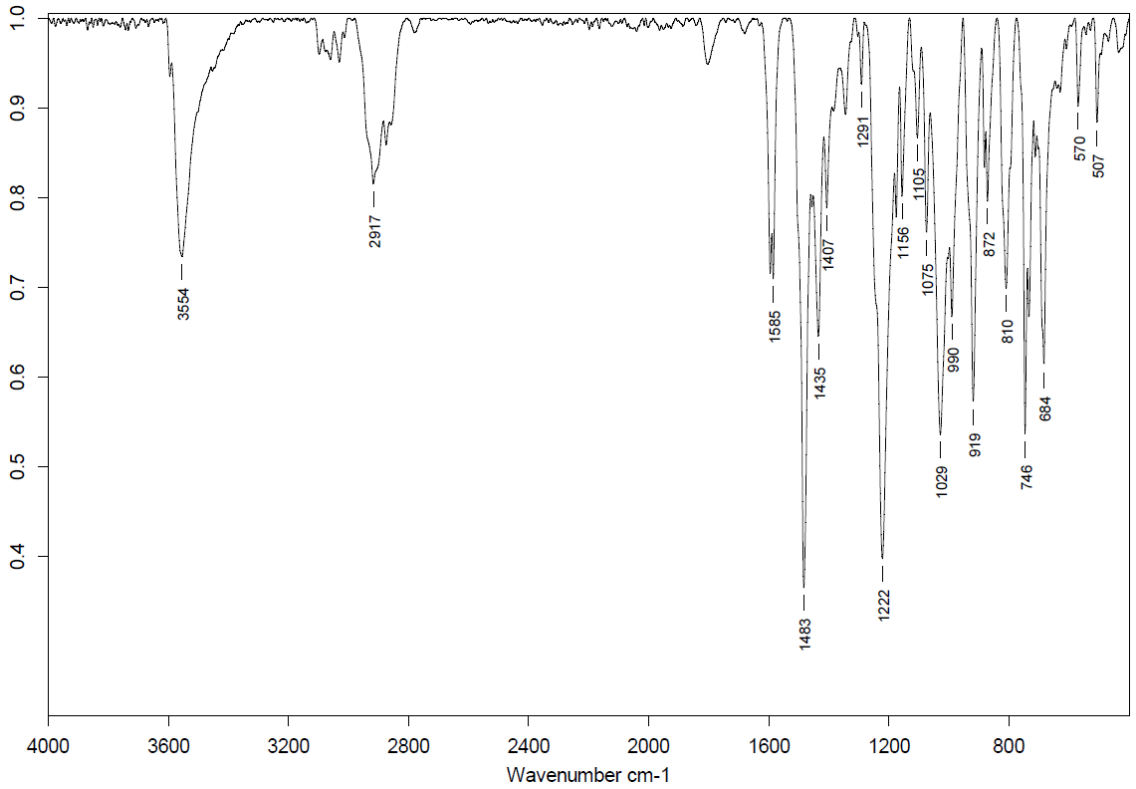
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.13 (m, 2H), 6.96 – 6.86 (m, 3H), 6.81 – 6.73 (m, 3H), 6.32 (dd, *J* = 17.5, 11.1 Hz, 1H), 5.95 (q, *J* = 1.4 Hz, 2H), 5.49 (dd, *J* = 11.1, 1.0 Hz, 1H), 5.43 (dd, *J* = 17.5, 1.0 Hz, 1H), 3.95 – 3.77 (m, 2H), 2.08 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



^{13}C NMR (101 MHz, $CDCl_3$) δ 155.07, 148.12, 147.34, 135.59, 133.82, 128.90, 121.53, 120.30, 119.82, 119.55, 108.29, 107.69, 101.35, 84.69, 70.35.

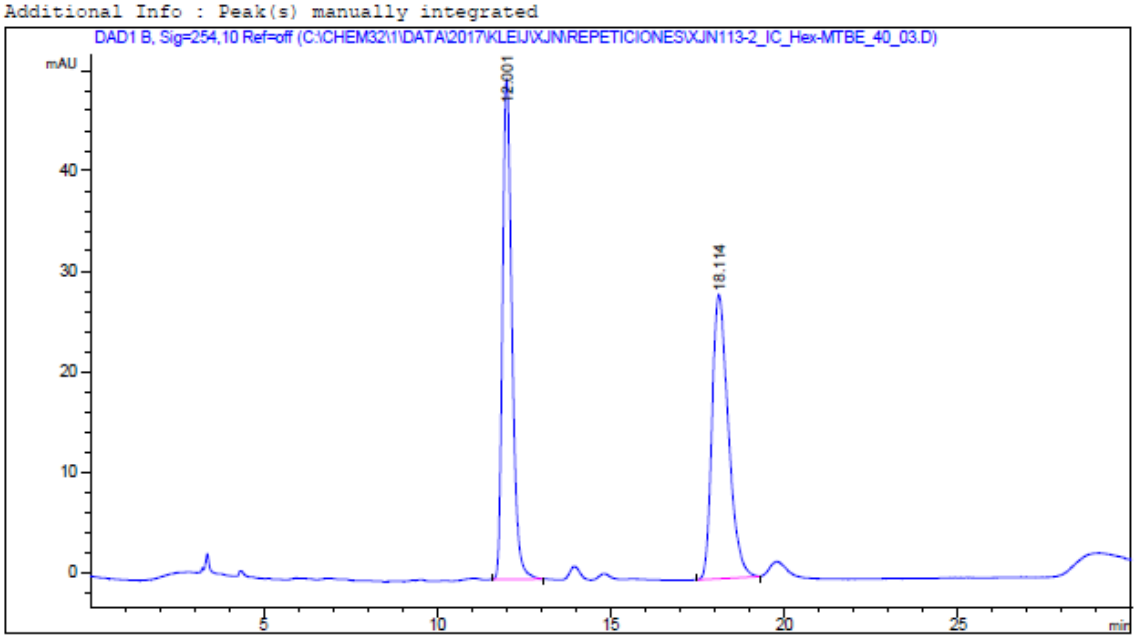
IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 307.0941 $(M + Na)^+$, found: 307.0940.

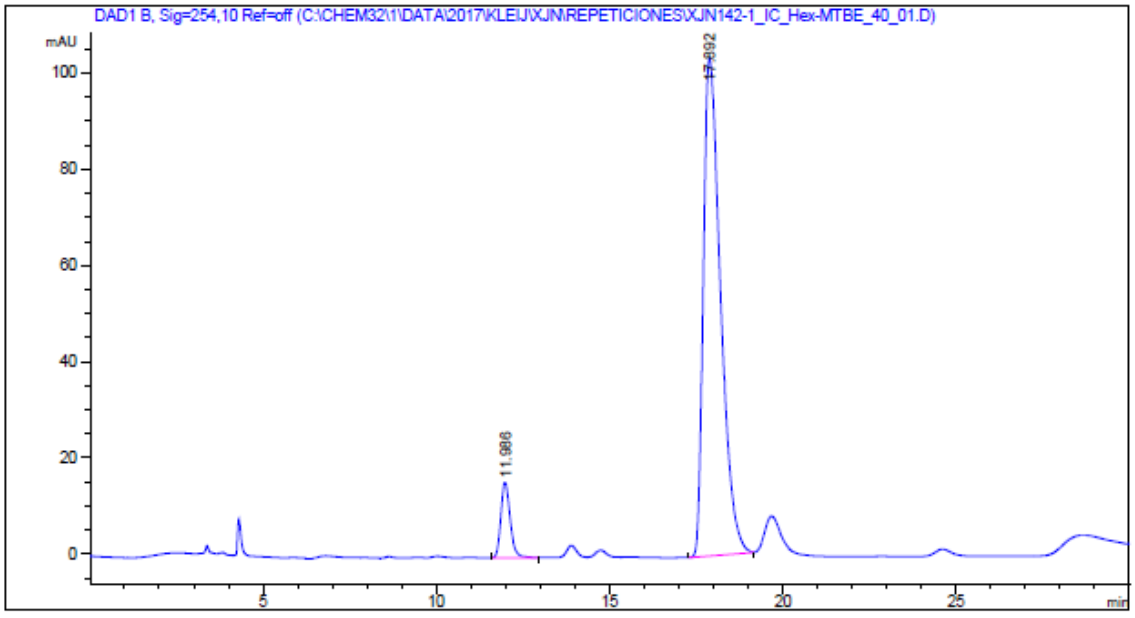
HPLC conditions: Chiralpak IC 250 × 4.6 mm, 5 μm, Hex/MTBE = 60 : 40, 1 mL/min; 92 : 8 *er*; $[\alpha]_D^{25}$ = –45.14 (*c* = 0.12, $CHCl_3$).

Additional Info : Peak(s) manually integrated



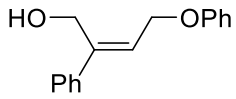
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	12.001	BB	0.2898	937.01239	49.73335	50.3473
2	18.114	BB	0.5031	924.08386	28.29279	49.6527

Additional Info : Peak(s) manually integrated



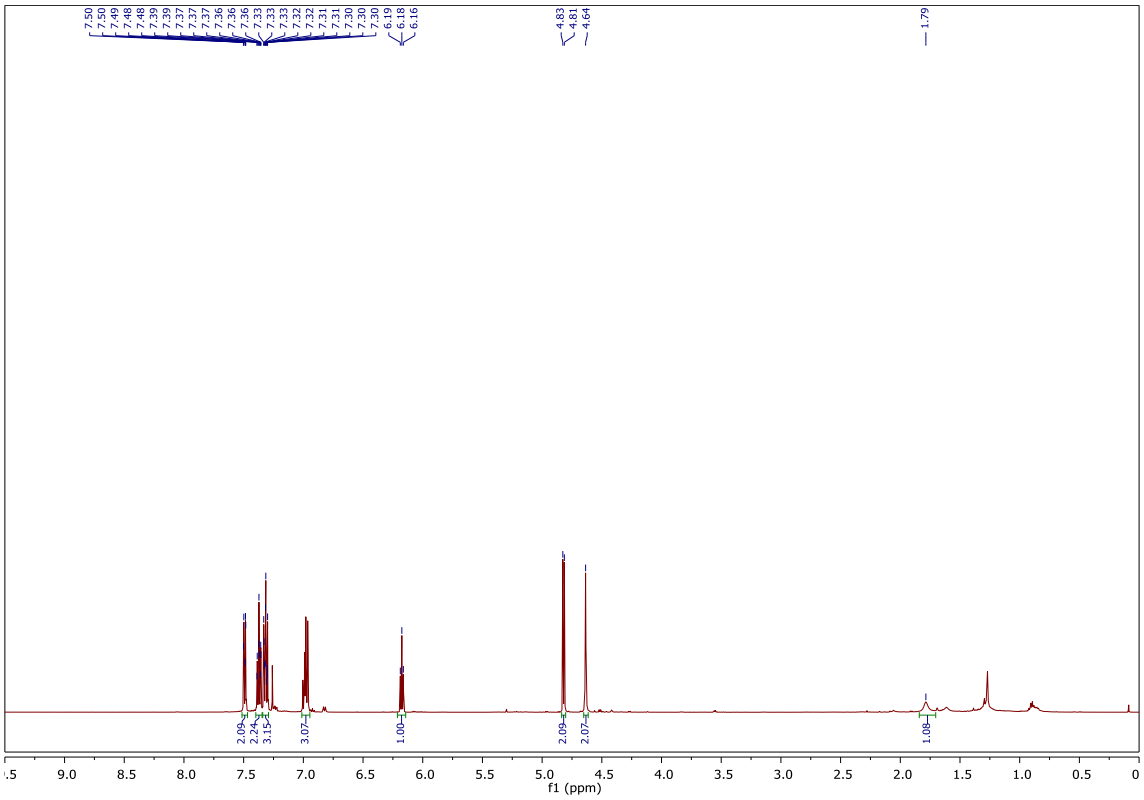
Peak #	RetTime [min]	Type	Width [min]	Area [mAU*s]	Height [mAU]	Area %
1	11.986	BB	0.2861	293.98517	15.72703	7.6229
2	17.892	BB	0.5279	3562.62305	103.42551	92.3771

4a



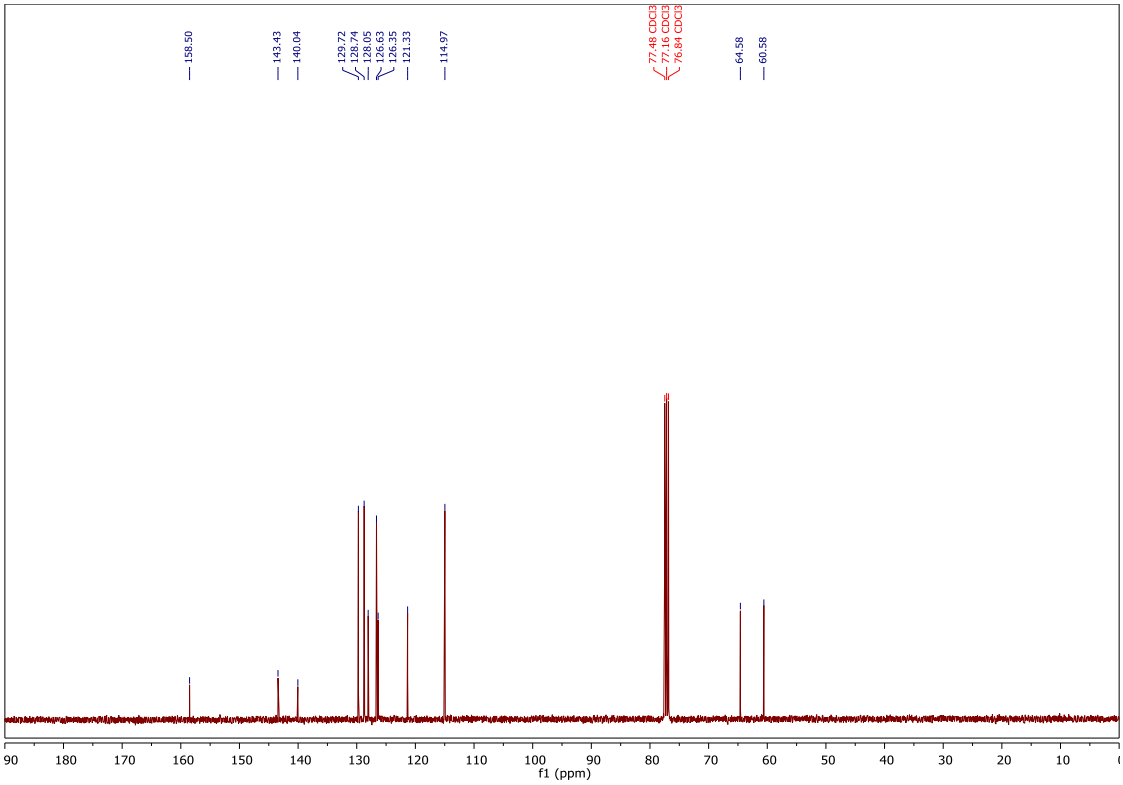
Scale: 0.2 mmol; isolated 45.5 mg (95% yield), light yellow oil, Hexane : EA = 10 : 1, R_f = 0.2

^{1}H NMR spectrum ($CDCl_3$)



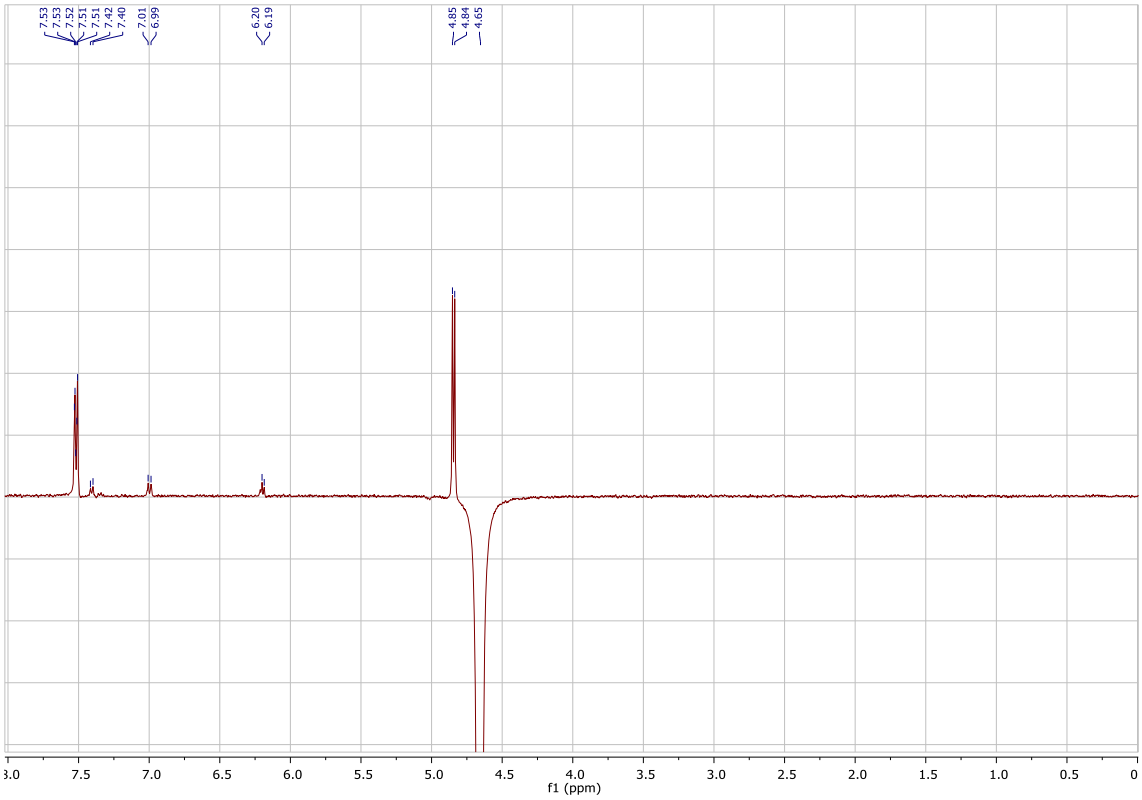
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.51 – 7.47 (m, 2H), 7.40 – 7.35 (m, 2H), 7.34 – 7.29 (m, 3H), 7.01 – 6.95 (m, 3H), 6.18 (t, *J* = 6.4 Hz, 1H), 4.82 (d, *J* = 6.4 Hz, 2H), 4.64 (s, 2H), 1.79 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)

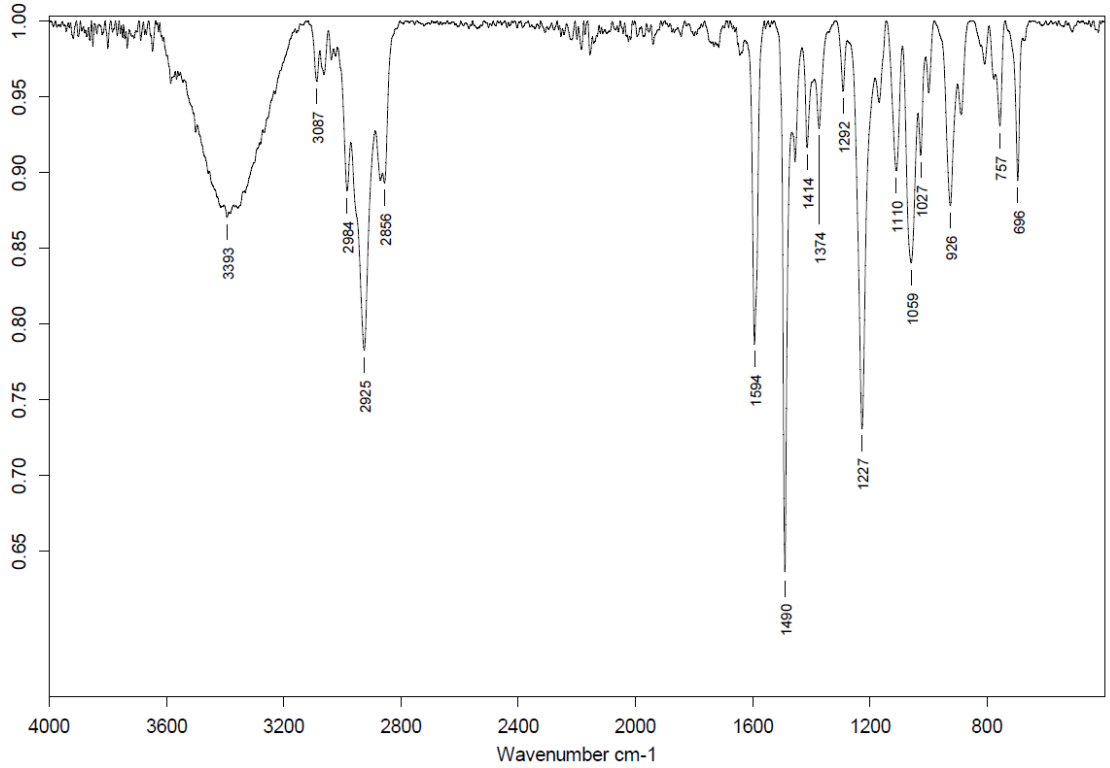


^{13}C NMR (101 MHz, $CDCl_3$) δ 158.50, 143.43, 140.04, 129.72, 128.74, 128.05, 126.63, 126.35, 121.33, 114.97, 77.48, 77.16, 76.84, 64.58, 60.58.

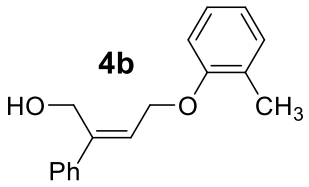
^{1}H-Selective 1D NOESY ($CDCl_3$)



IR spectrum (neat)

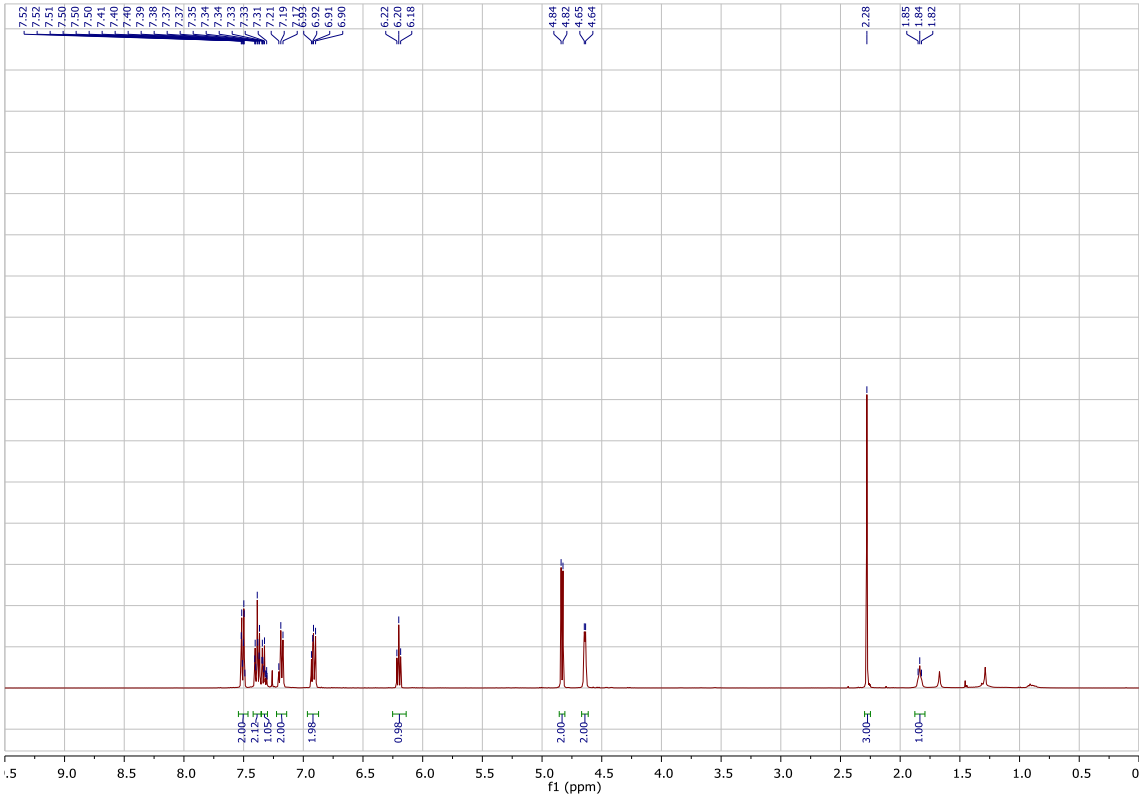


HRMS (ESI+, MeOH): *m/z* calcd. 263.1043 $(M + Na)^+$, found: 263.1042.



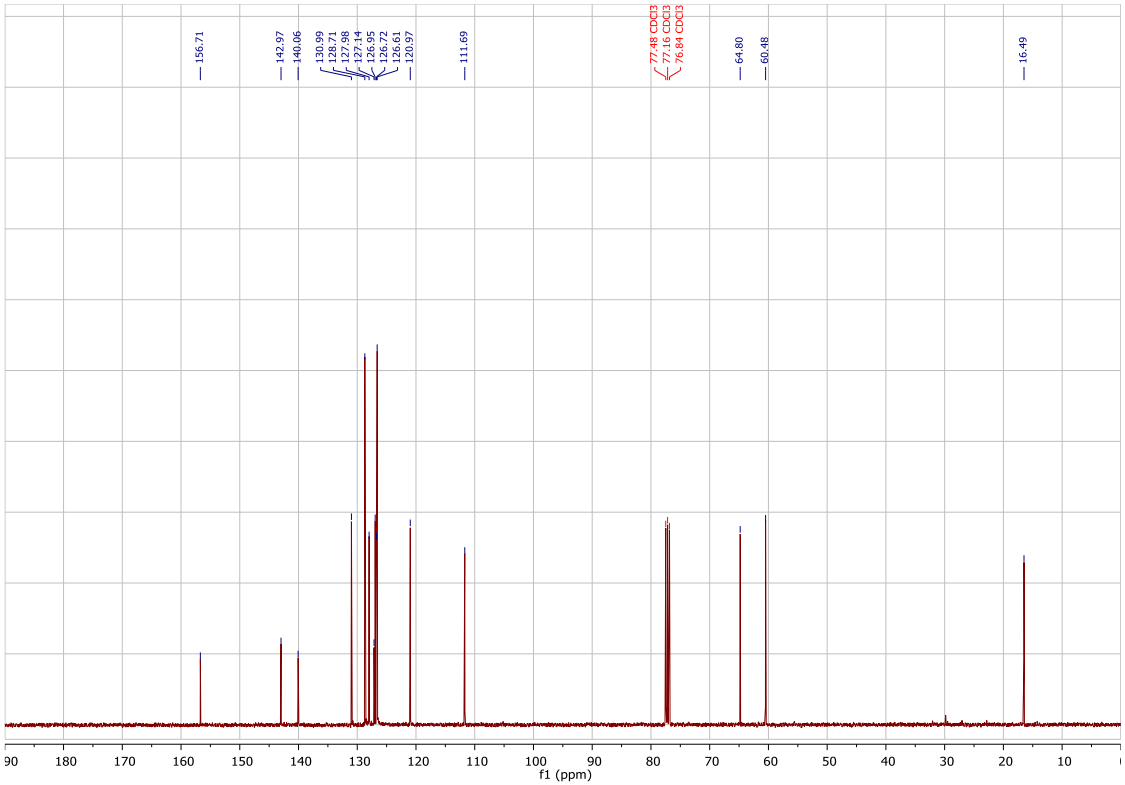
Scale: 0.2 mmol; isolated 46.2 mg (91% yield), light yellow liquid, Hexane : EA = 10 : 1, R_f = 0.2

^{1}H NMR spectrum ($CDCl_3$)



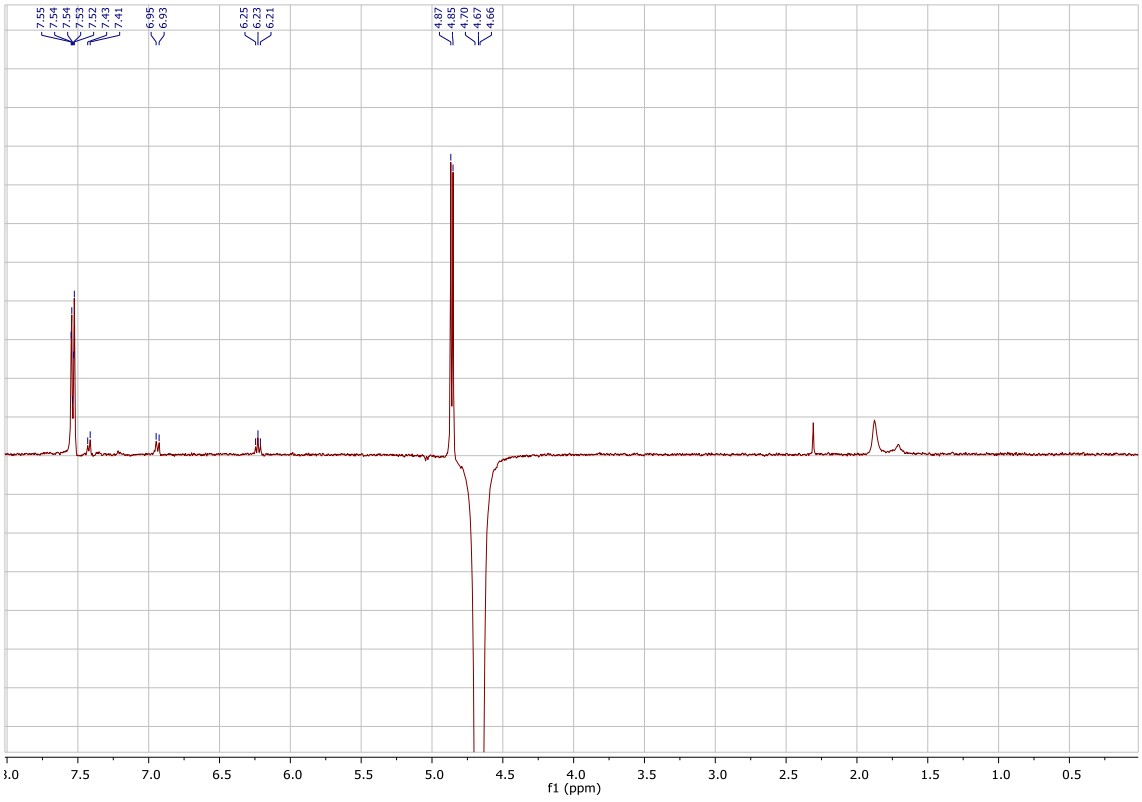
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 – 7.46 (m, 2H), 7.42 – 7.35 (m, 2H), 7.35 – 7.30 (m, 1H), 7.19 (t, *J* = 7.0 Hz, 2H), 6.97 – 6.87 (m, 2H), 6.20 (t, *J* = 6.3 Hz, 1H), 4.83 (d, *J* = 6.3 Hz, 2H), 4.64 (d, *J* = 4.3 Hz, 2H), 2.28 (s, 3H), 1.84 (t, *J* = 5.5 Hz, 1H).

^{13}C NMR spectrum ($CDCl_3$)

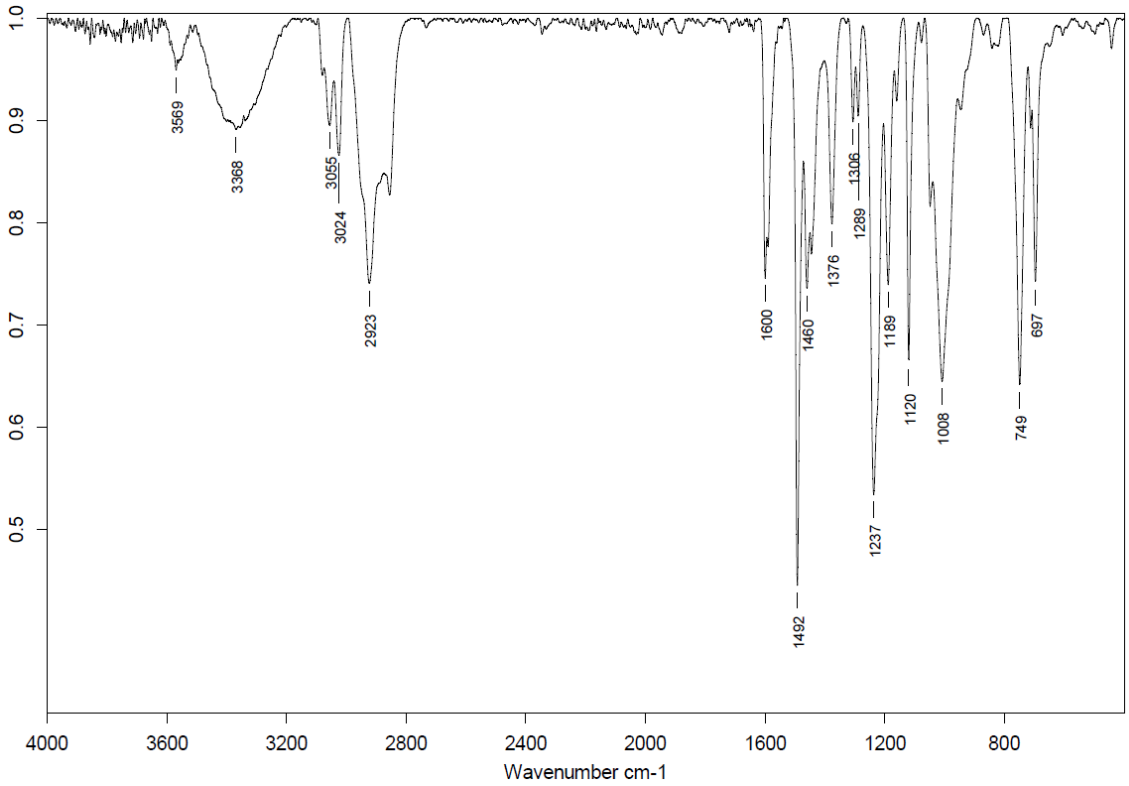


^{13}C NMR (101 MHz, $CDCl_3$) δ 156.71, 142.97, 140.06, 130.99, 128.71, 127.98, 127.14, 126.95, 126.72, 126.61, 120.97, 111.69, 64.80, 60.48, 16.49.

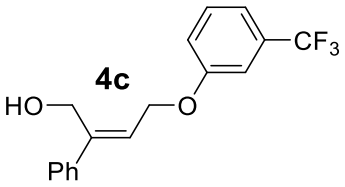
^{1}H-Selective 1D NOESY ($CDCl_3$)



IR spectrum (neat)

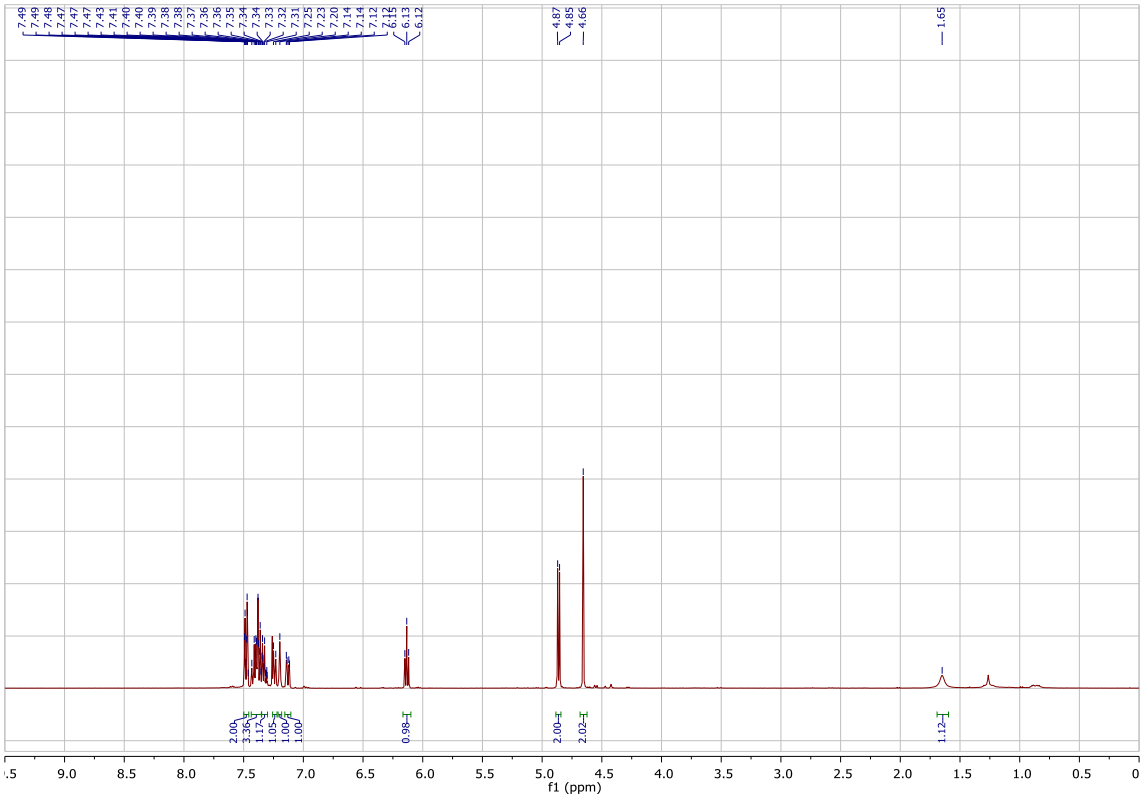


HRMS (ESI+, MeOH): *m/z* calcd. 277.1199 $(M + Na)^+$, found: 277.1186.



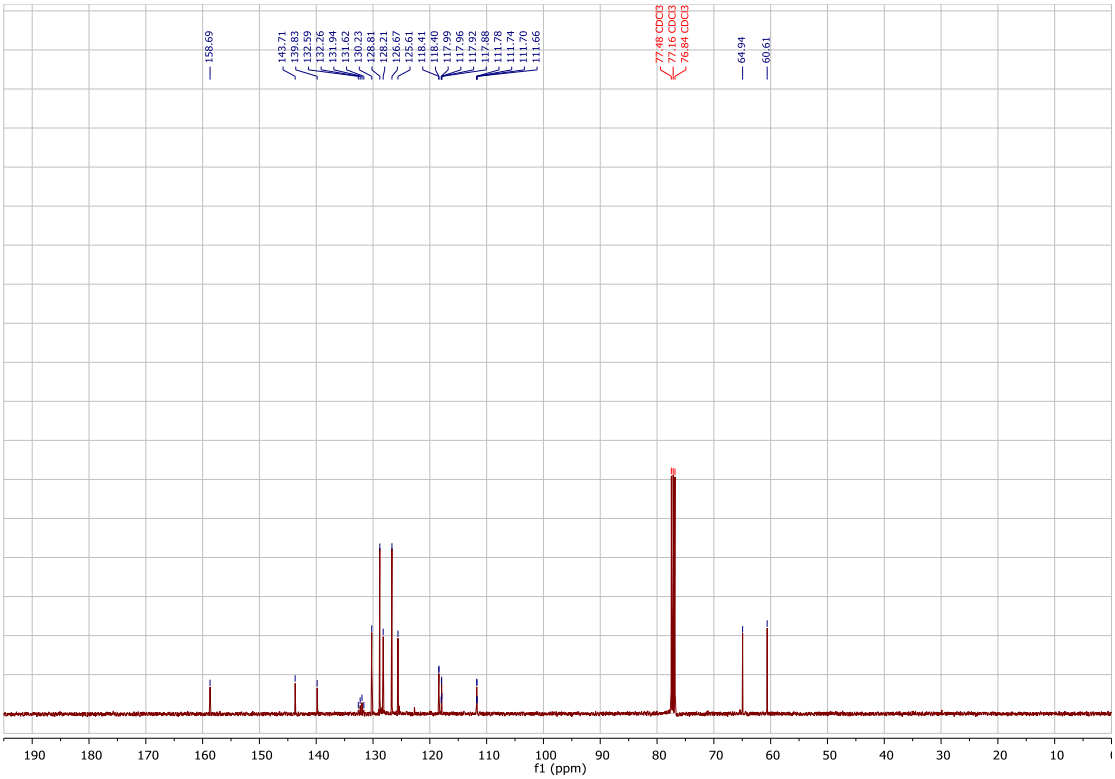
Scale: 0.2 mmol; isolated 40.0 mg (65% yield), yellow solid, Hexane : EA = 10 : 1, R_f = 0.2

^{1}H NMR spectrum ($CDCl_3$)



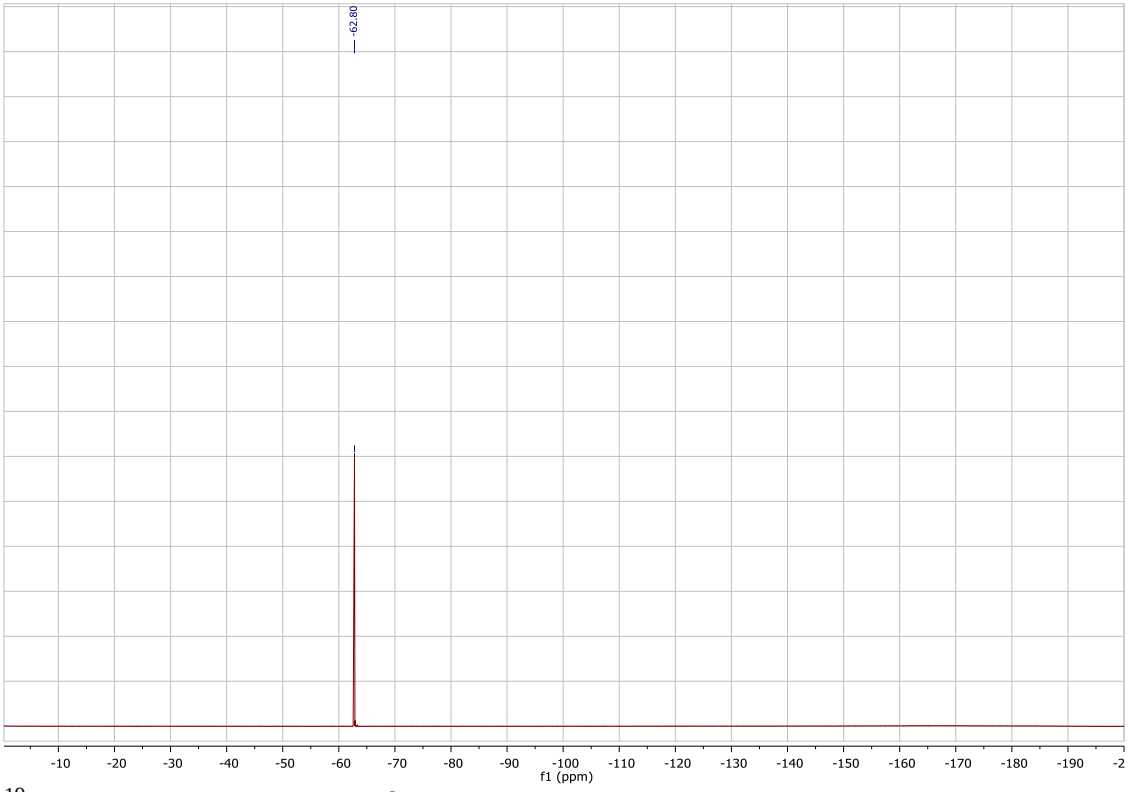
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 – 7.46 (m, 2H), 7.44 – 7.35 (m, 3H), 7.35 – 7.30 (m, 1H), 7.24 (d, *J* = 7.7 Hz, 1H), 7.20 (s, 1H), 7.13 (m, 1H), 6.13 (t, *J* = 6.4 Hz, 1H), 4.86 (d, *J* = 6.4 Hz, 2H), 4.66 (s, 2H), 1.65 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)



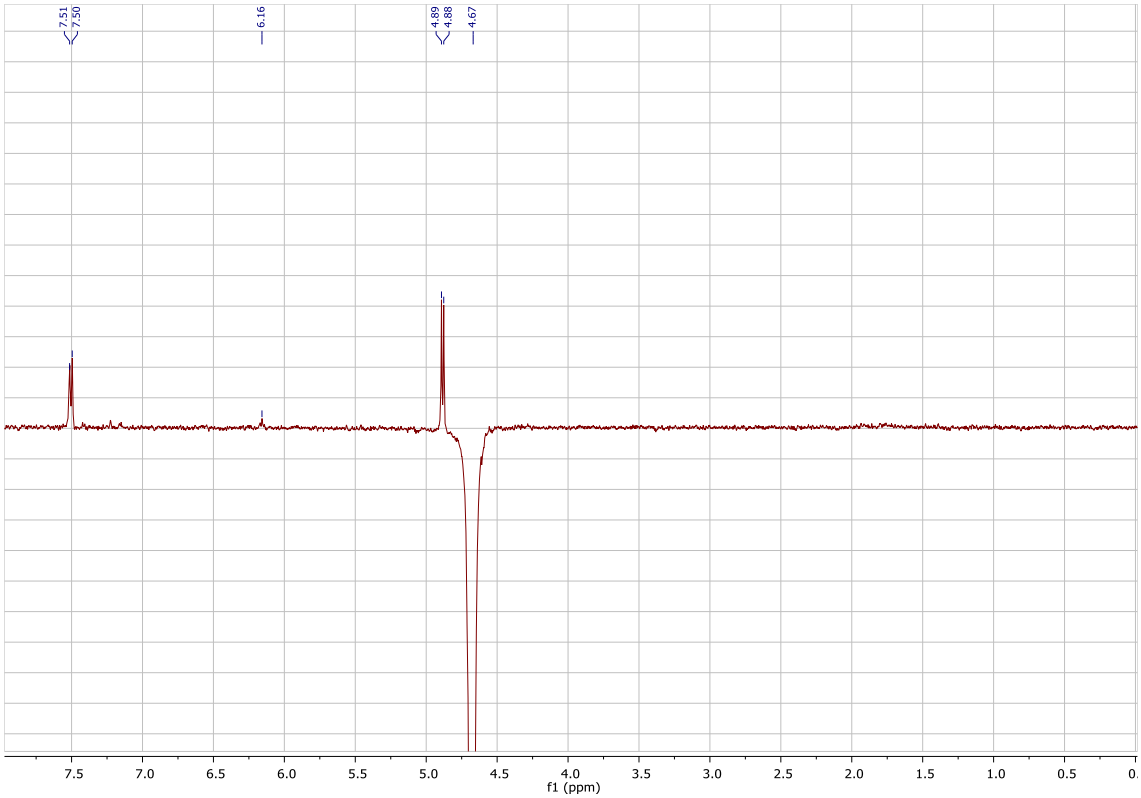
^{13}C NMR (101 MHz, $CDCl_3$) δ 158.69, 143.71, 139.83, 132.1 (q, J = 32.32 Hz), 130.22, 128.80, 128.21, 126.67, 125.61, 118.41, 118.40, 117.94 (q, *J* = 4.04 Hz), 111.72 (q, *J* = 4.04 Hz), 64.93, 60.61.

^{19}F NMR spectrum ($CDCl_3$)

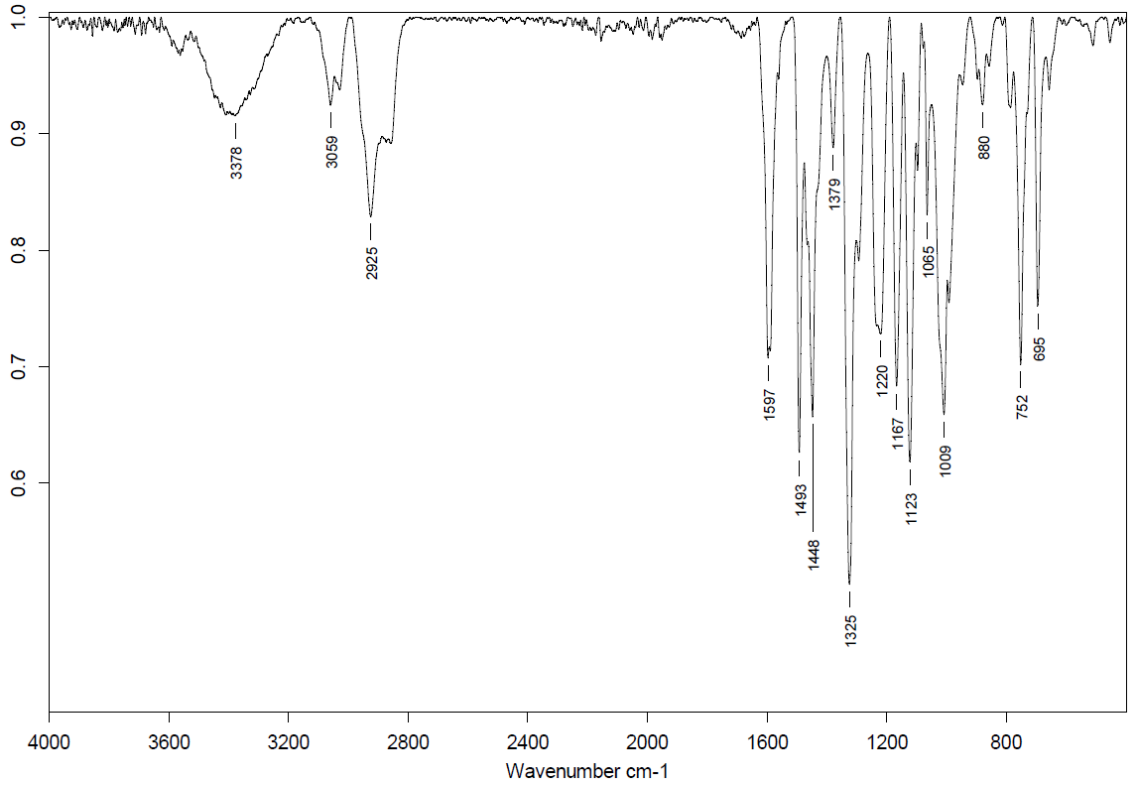


^{19}F NMR (376 MHz, $CDCl_3$) δ -62.80.

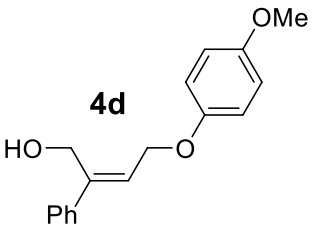
^{1}H-Selective 1D NOESY ($CDCl_3$)



IR spectrum (neat)

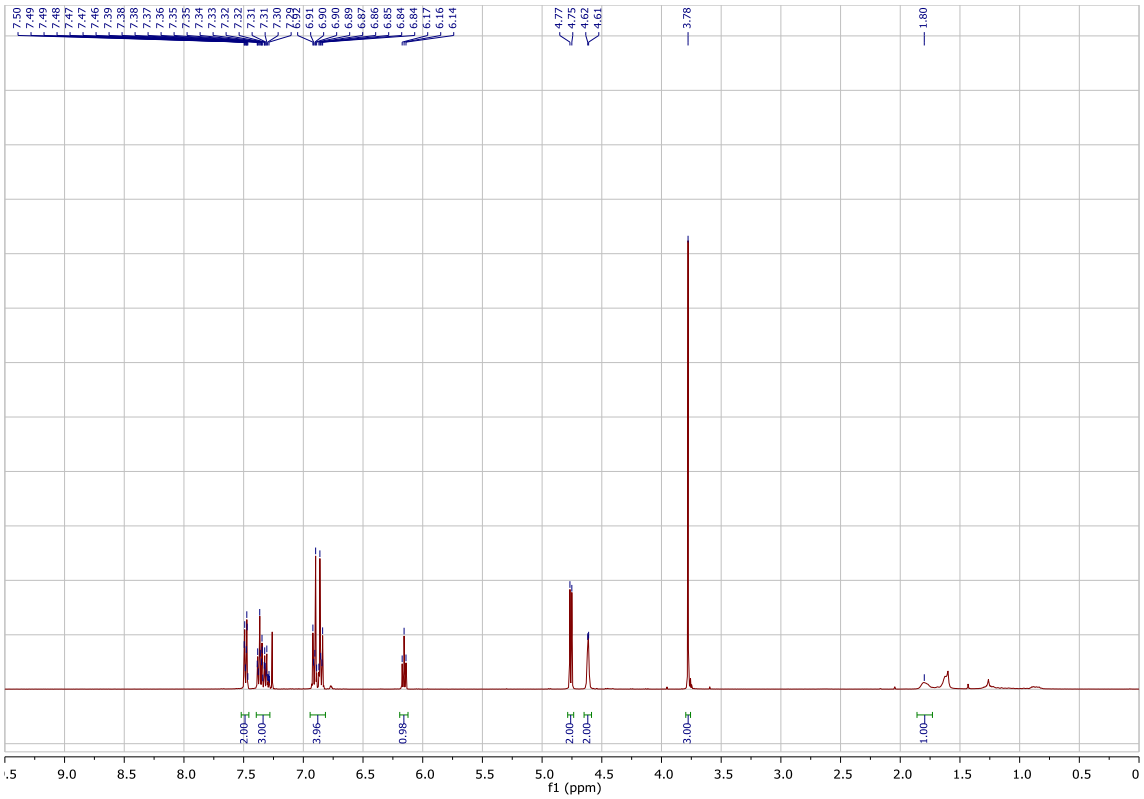


HRMS (ESI+, MeOH): *m/z* calcd. 331.0916 $(M + Na)^+$, found: 331.0916.



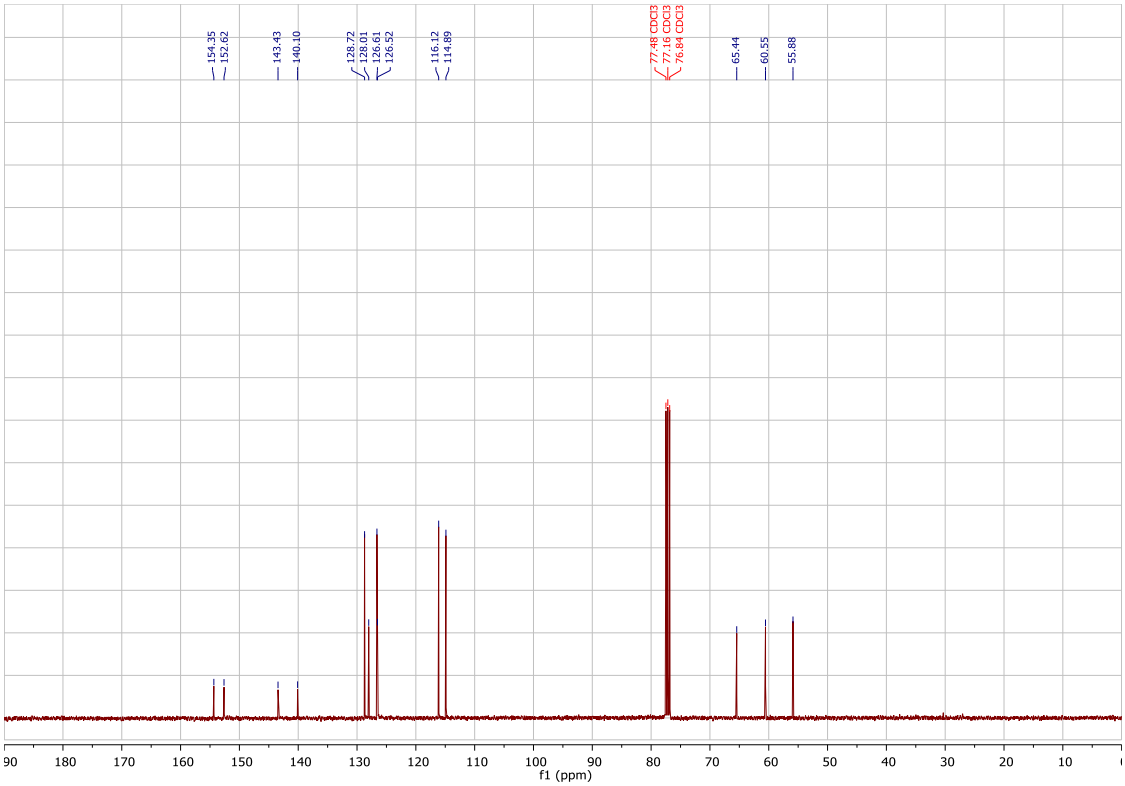
Scale: 0.2 mmol; isolated 52.9 mg (98% yield), white solid, Hexane : EA = 10 : 1, R_f = 0.2

^{1}H NMR spectrum ($CDCl_3$)



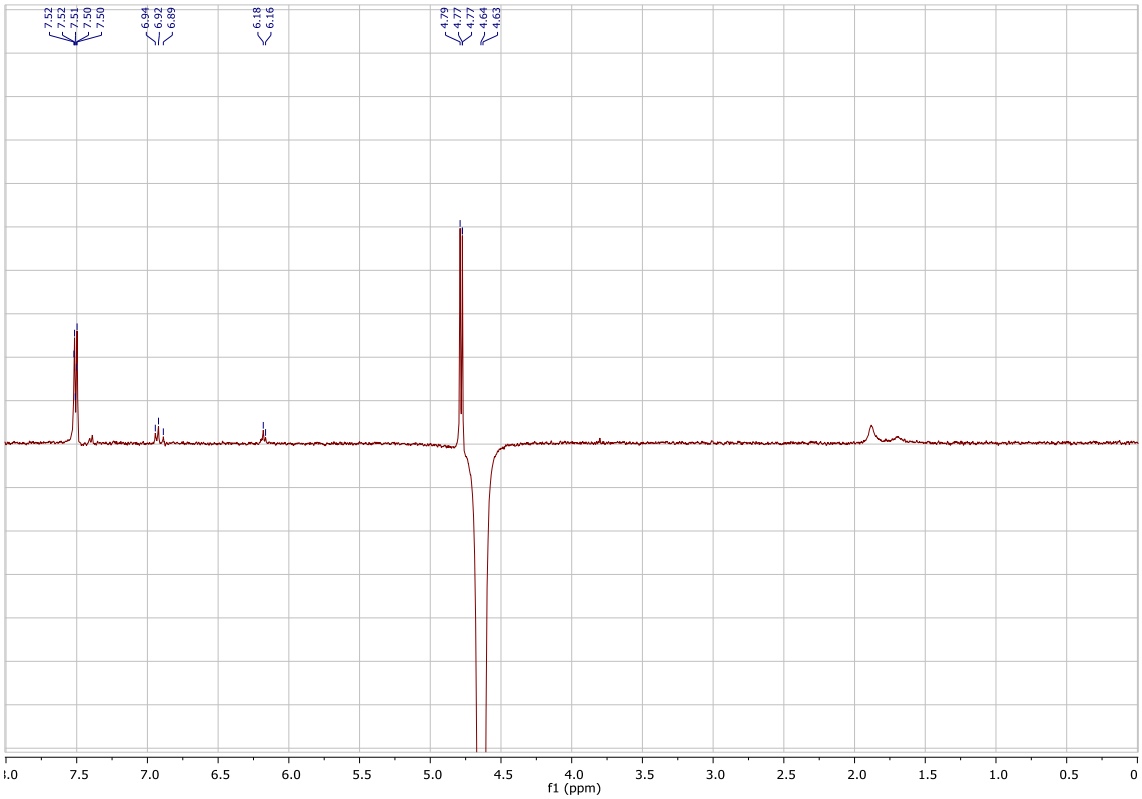
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 – 7.46 (m, 2H), 7.39 – 7.28 (m, 3H), 6.94 – 6.81 (m, 4H), 6.16 (t, *J* = 6.4 Hz, 1H), 4.76 (d, *J* = 6.4 Hz, 2H), 4.61 (d, *J* = 2.9 Hz, 2H), 3.78 (s, 3H), 1.80 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)

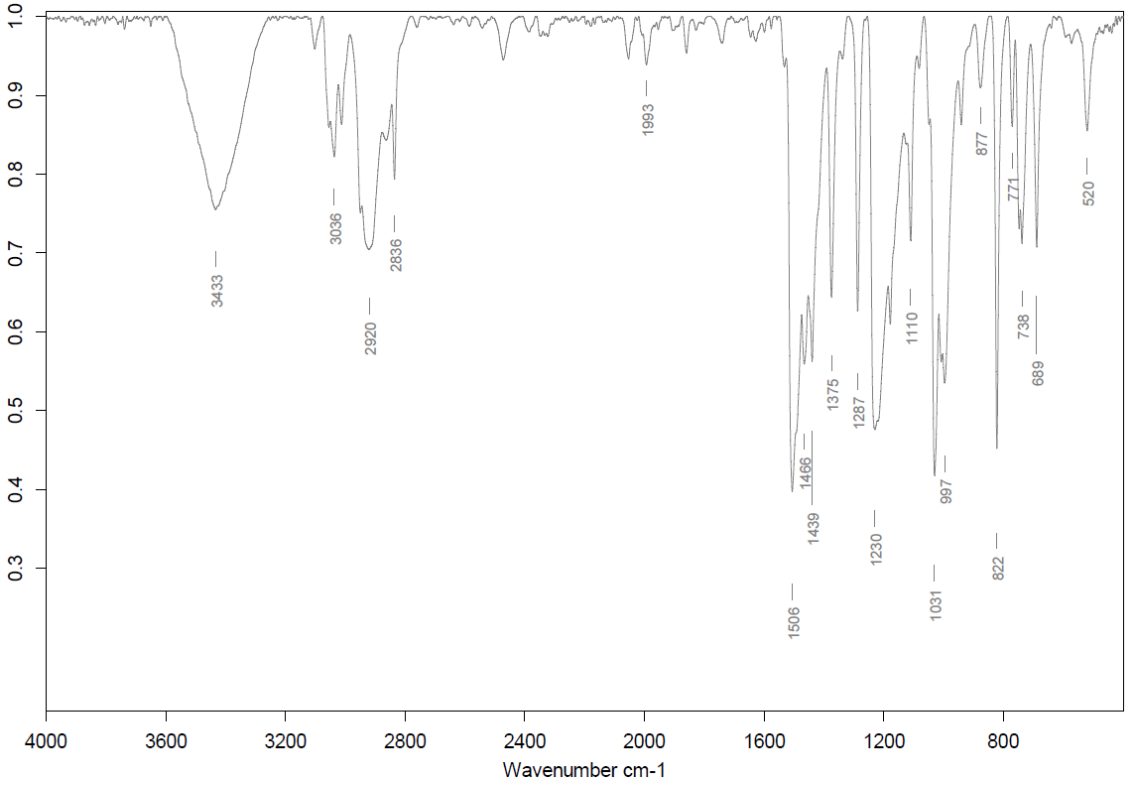


^{13}C NMR (101 MHz, $CDCl_3$) δ 154.35, 152.62, 143.43, 140.10, 128.72, 128.01, 126.61, 126.52, 116.12, 114.89, 65.44, 60.55, 55.88.

^{1}H-Selective 1D NOESY ($CDCl_3$)

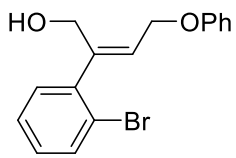


IR spectrum (neat)



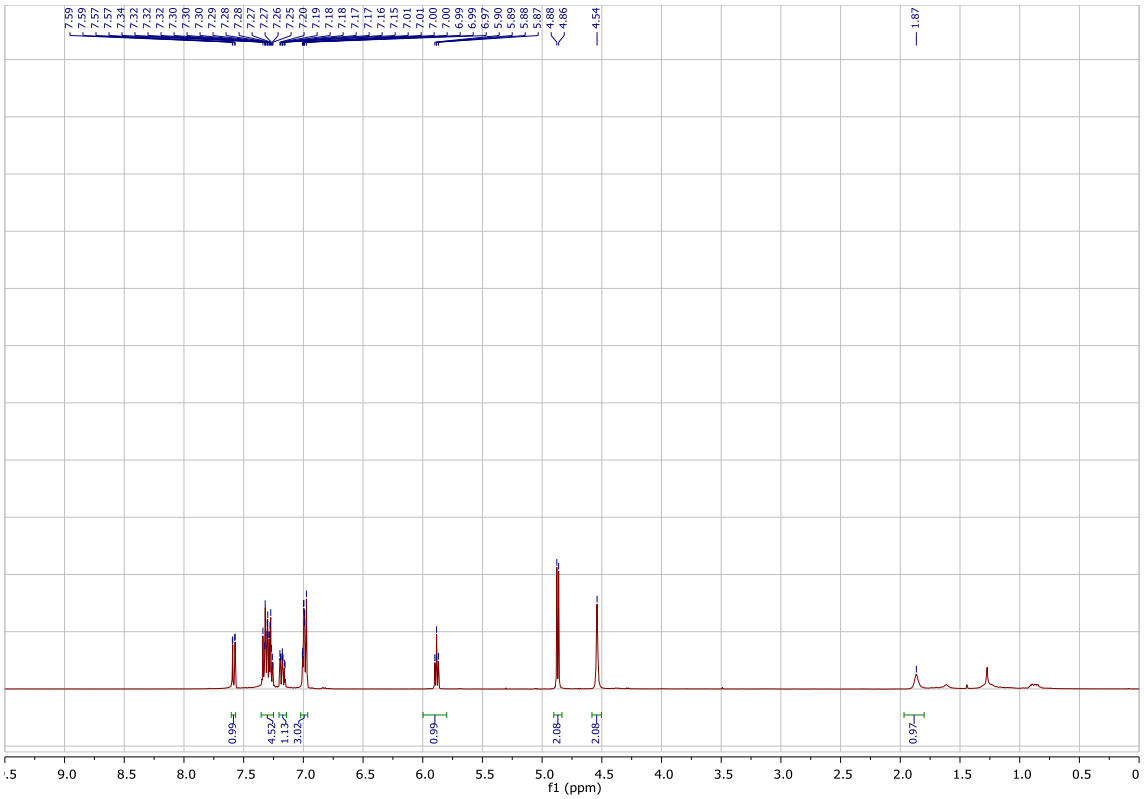
HRMS (ESI+, MeOH): *m/z* calcd. 293.1148 $(M + Na)^+$, found: 293.1137.

4e



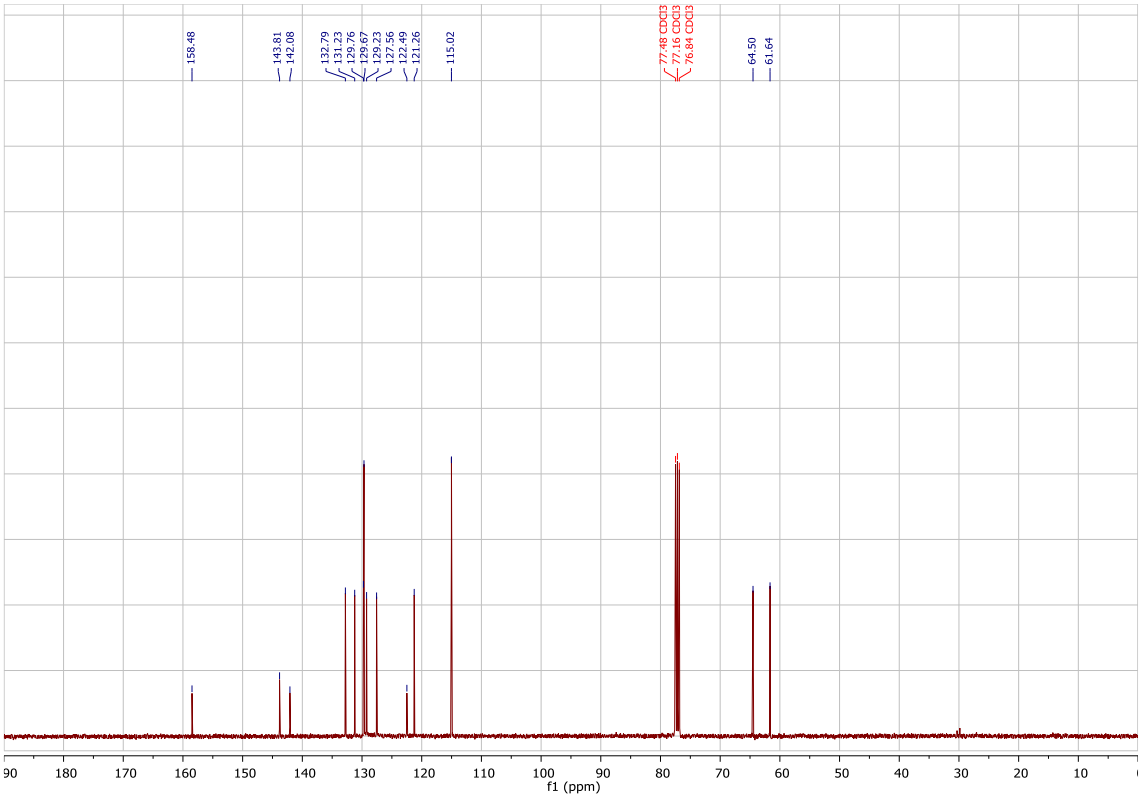
Scale: 0.2 mmol; isolated 45.8 mg (72% yield), white solid, Hexane : EA = 10 : 1, R_f = 0.2

^{1}H NMR spectrum ($CDCl_3$)



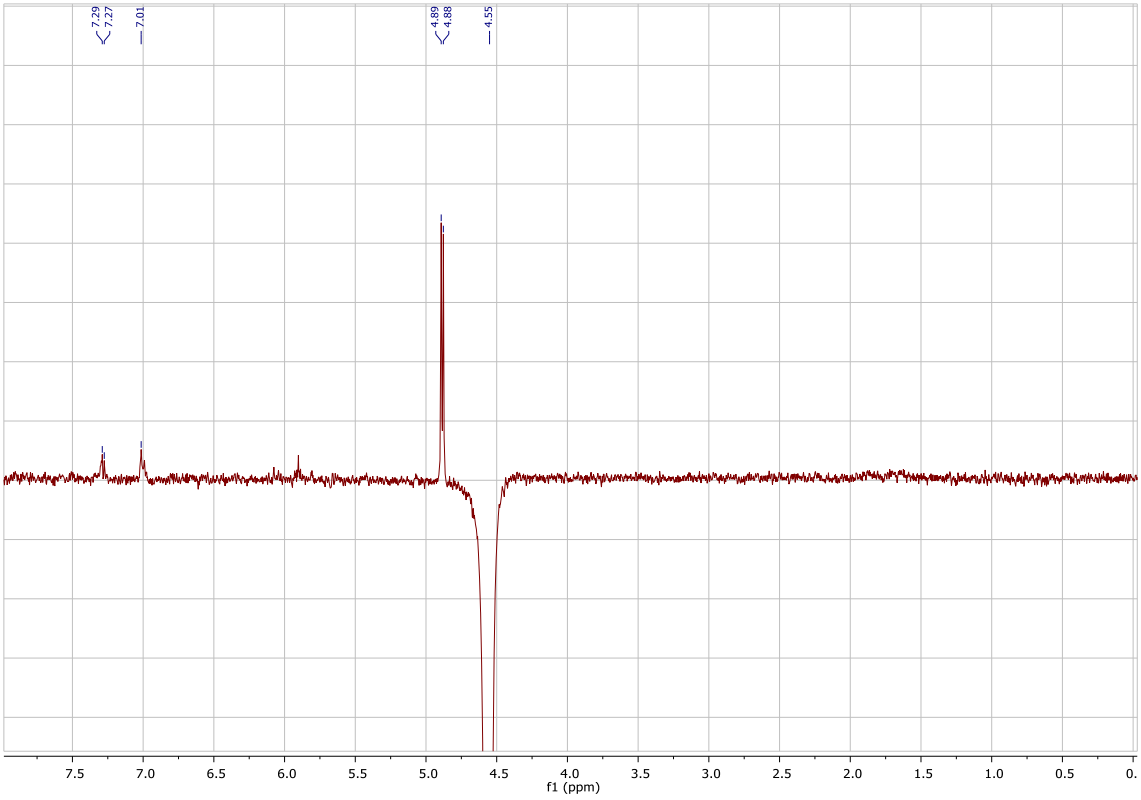
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.58 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.35 – 7.25 (m, 5H), 7.20 – 7.14 (m, 1H), 7.02 – 6.96 (m, 3H), 5.88 (t, *J* = 6.0 Hz, 1H), 4.87 (d, *J* = 6.1 Hz, 2H), 4.54 (s, 2H), 1.87 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)

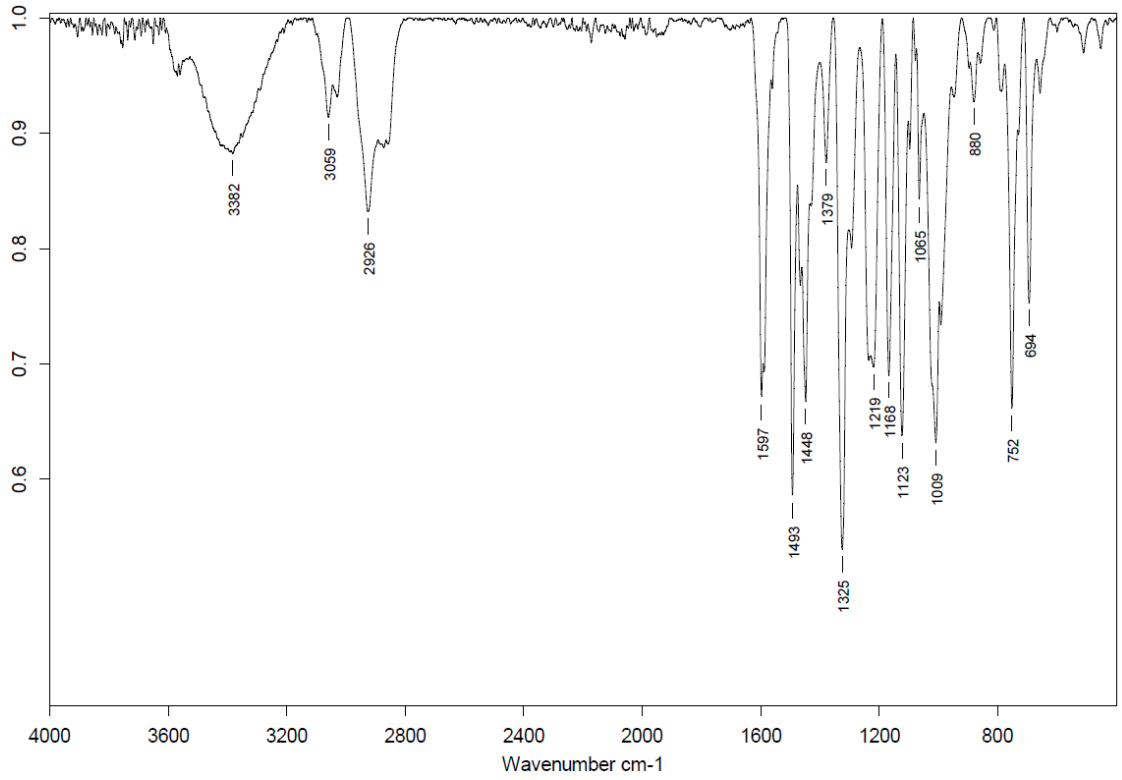


^{13}C NMR (101 MHz, $CDCl_3$) δ 158.48, 143.81, 142.08, 132.79, 131.23, 129.76, 129.67, 129.23, 127.56, 122.49, 121.26, 115.02, 64.50, 61.64.

^{1}H-Selective 1D NOESY ($CDCl_3$)

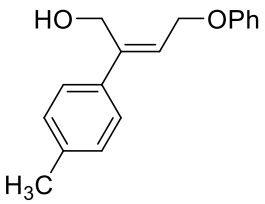


IR spectrum (neat)



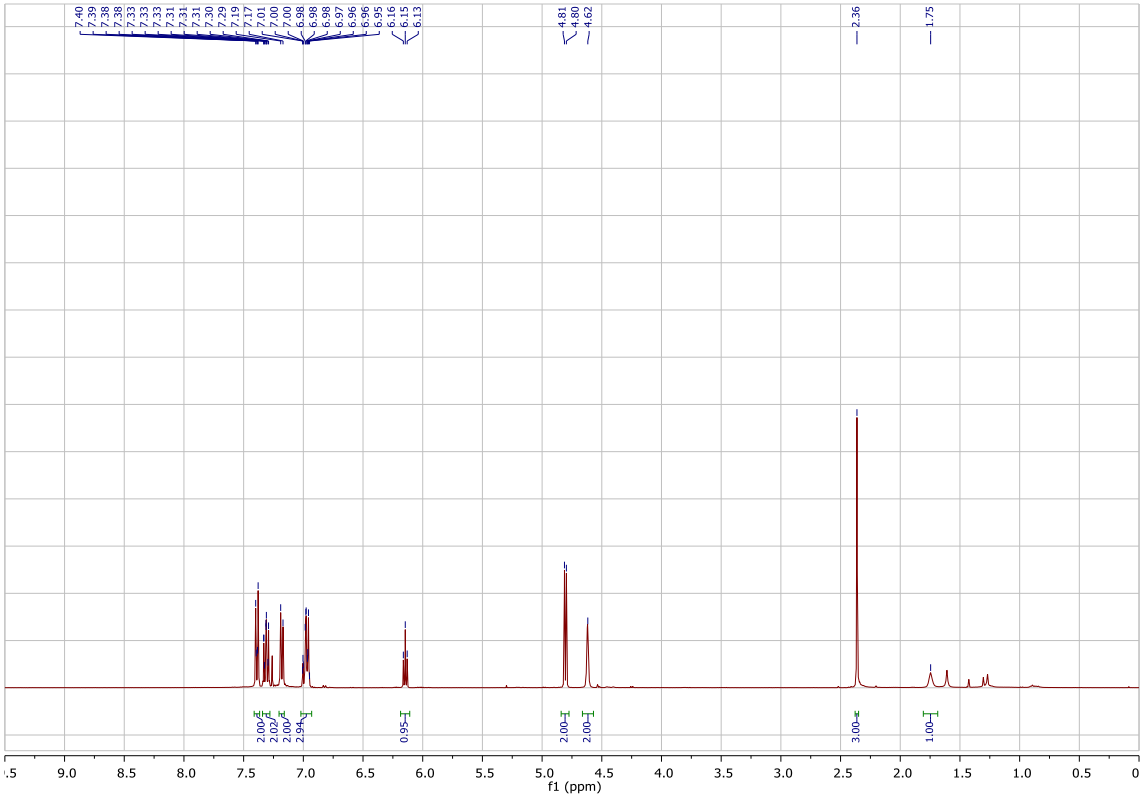
HRMS (ESI+, MeOH): *m/z* calcd. 341.0148 $(M + Na)^+$, found: 341.0133.

4f



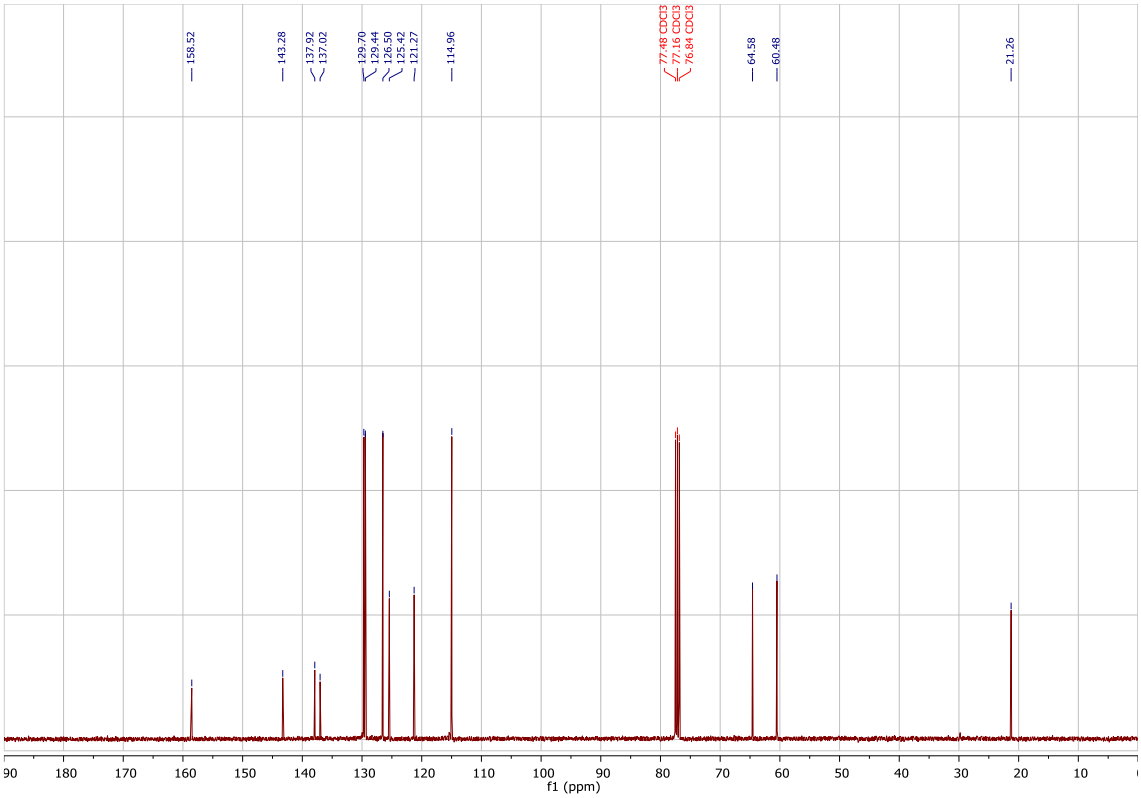
Scale: 0.2 mmol; isolated 41.1 mg (81% yield), yellow oil, Hexane : EA = 10 : 1, R_f = 0.2

^{1}H NMR spectrum ($CDCl_3$)



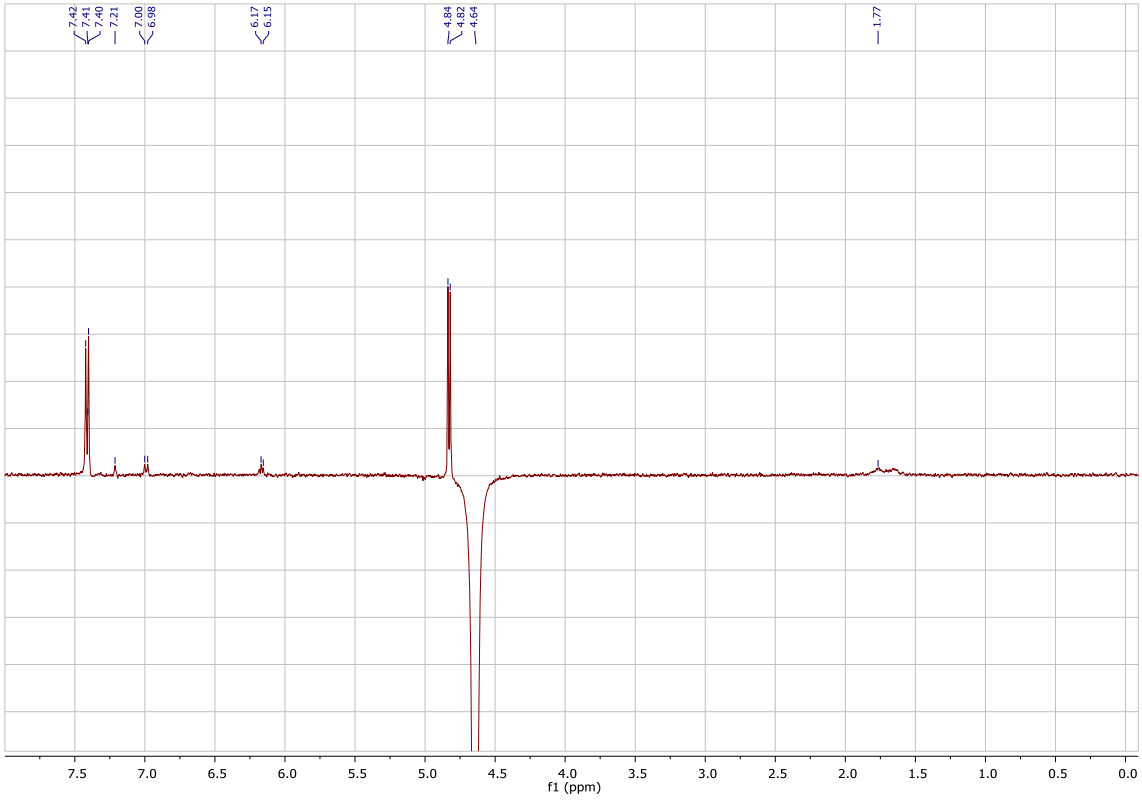
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.37 (m, 2H), 7.34 – 7.28 (m, 2H), 7.18 (d, *J* = 7.8 Hz, 2H), 7.02 – 6.93 (m, 3H), 6.15 (t, *J* = 6.4 Hz, 1H), 4.80 (d, *J* = 6.4 Hz, 2H), 4.62 (s, 2H), 2.36 (s, 3H), 1.75 (s, 1H).

^{13}C NMR spectrum ($CDCl_3$)

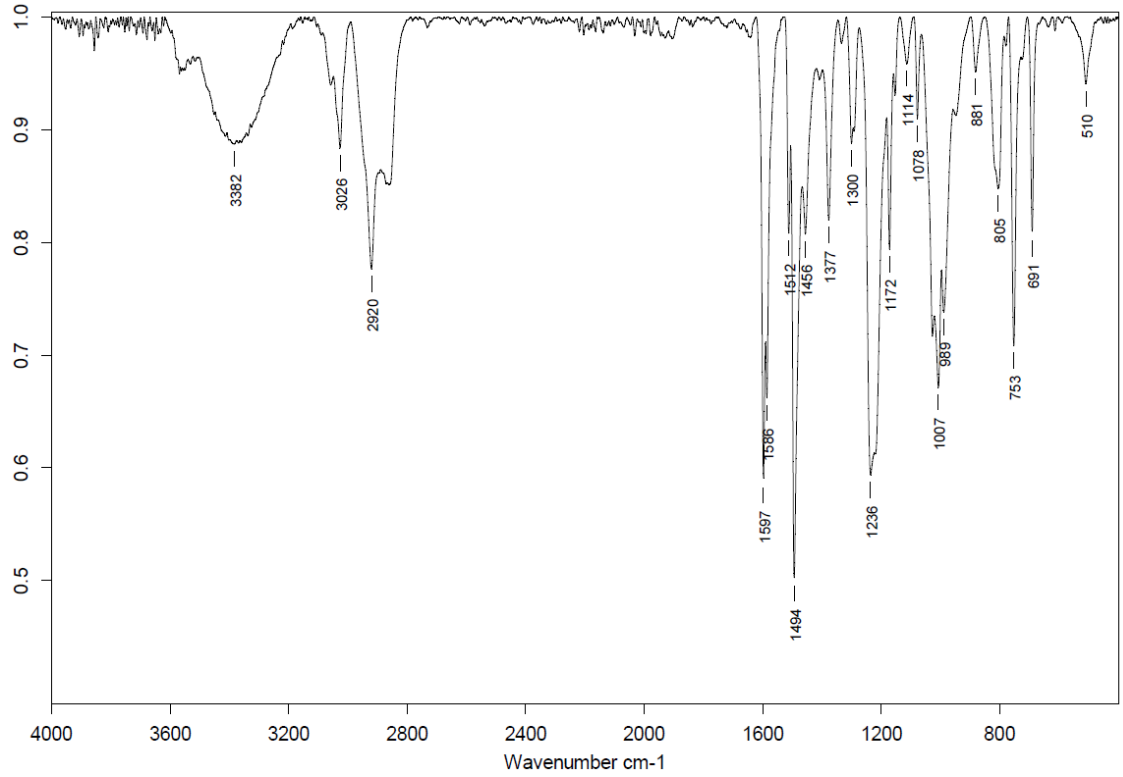


^{13}C NMR (101 MHz, $CDCl_3$) δ 158.52, 143.28, 137.92, 137.02, 129.70, 129.44, 126.50, 125.42, 121.27, 114.96, 64.58, 60.48, 21.26.

^{1}H-Selective 1D NOESY ($CDCl_3$)

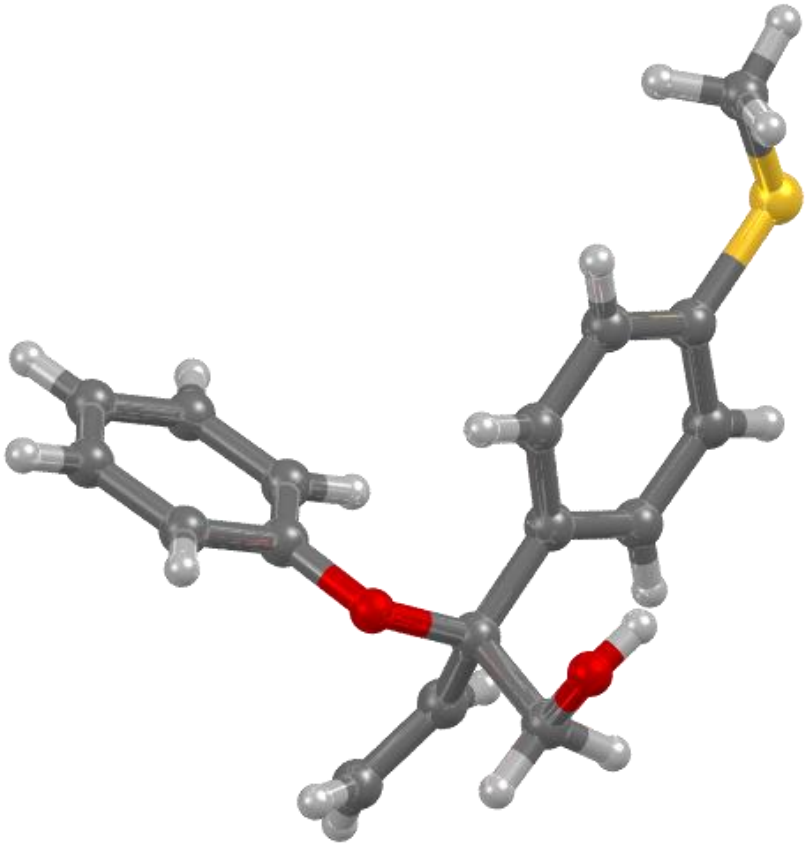


IR spectrum (neat)



HRMS (ESI+, MeOH): *m/z* calcd. 277.1199 $(M + Na)^+$, found: 277.1195.

S107. X-ray molecular structure of compound 3e



S108. References

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