Supporting Information

Intermolecular reductive coupling of aliphatic ketones with alkynes and alkenes by BCN photocatalysts

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A. General Information

All reagents and solvents were purchased commercially and without further purification. Gas chromatography mass spectra (GC-MS) were taken at Thermo Trace 1300 gas chromatograph mass spectrometer and a TR-5MS column (0.25 mm × 30 m, Film: 0.25 μm). Column chromatography was performed using silica gel (100-400 mesh) and visualization was affected at 254 nm. ^{1}H NMR (600 MHz), ^{13}C NMR (151 MHz) and ^{19}F NMR (565 MHz) NMR spectra were measured on Bruker Avance spectrometer. The chemical shifts are referenced to signals at 7.26 (for ^{1}H) and 77.0 ppm (for ^{13}C) in $CDCl_3$ indicated. NMR data are reported as follows: coupling constant (*J*, Hz), chemical shift (δ, ppm), and multiplicity (s = singlet, d = doublet, m = multiplet, dd = doublet of doublets, t = triplet, dt = doublet of triplets, q = quartet).

X-ray diffraction (XRD) measurements were accomplished using Bruker D8 Advance diffractometer with Cu Kα1 radiation (λ = 1.5406 Å). The UV-vis diffuse reflection spectroscopy (DRS) were performed on a Varian Cary 500 Scan UV-vis system. The fourier transform infrared (FT-IR) spectra were obtained on a Nicolet 670 FTIR spectrometer with KBr as the diluents. Transmission electron microscopy (TEM) was operated by Tecnai20 FEG microscope. The scanning emission microscope (SEM) measurements were carried out by using Hitachi S4800 Field Emission Scanning Electron Microscope. X-Ray photoelectron spectroscopy (XPS) data were collected on a Thermo Scientific ESCALAB250 instrument with a monochromatized Al Kα line source (200 W).

B. Synthesis of BCN

In the typical performance, the agate mortar was added boric acid (2.0 g), urea (4.0 g) and ammonium citrate (6.0 g), and the mixture were grinded for 15 min until slightly moist. Then, the mixture were added 4.54 g KCl and grinded for 15 minutes. Next, the mixture was put into a horizontal tube furnace. First, the air was removed by filling with ammonia for 10 minutes with flow rate of 250 ml min^{-1}. Later, the temperature was raised to 100 ℃ within 1 h and maintained for 30 minutes, and then raising to 1250 ℃ for 5 h with the rate of 5 ℃ min^{-1}. Finally, the catalyst was cooled to room

temperature and washed with deionized water (500 ml) and ethanol (500 ml) 3 times to remove the residual KCl and dried at 60 ℃ for 12 h, denoted as BCN.

C. Characterization of BCN

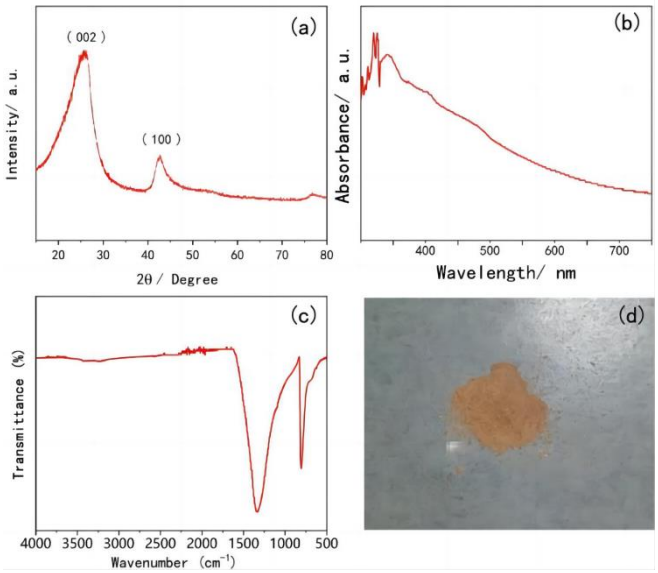


Figure S1. (a) XRD pattern of BCN; (b) UV-vis DRS of BCN; (c) FT-IR of BCN; (d) the photograph of BCN.

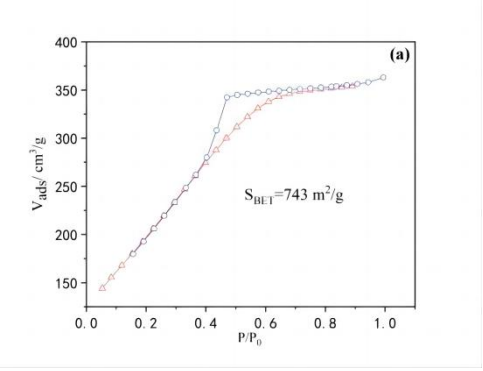


Figure S2. N_2 adsorption and desorption isotherms of BCN.

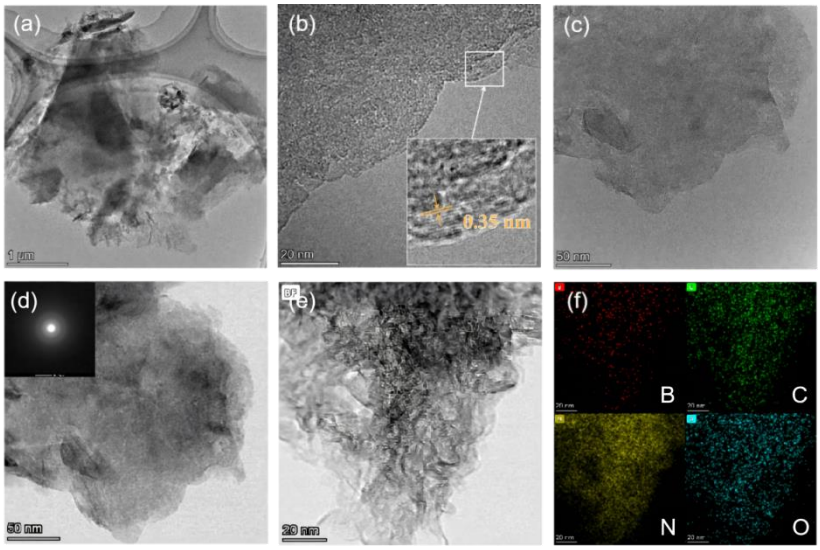


Figure S3. TEM image of (a) BCN (scale bar is 1 um); (b) BCN (scale bar is 20 nm), inset picture show the HRTEM image of BCN (scale bar is 2 nm); (c) BCN (scale bar is 50 nm); (d) inset picture show the electron diffraction pattern of BCN; (e) High-Angle Annular Dark Field (HAADF) image of BCN; (f) elemental mapping images of B, C, N, O.

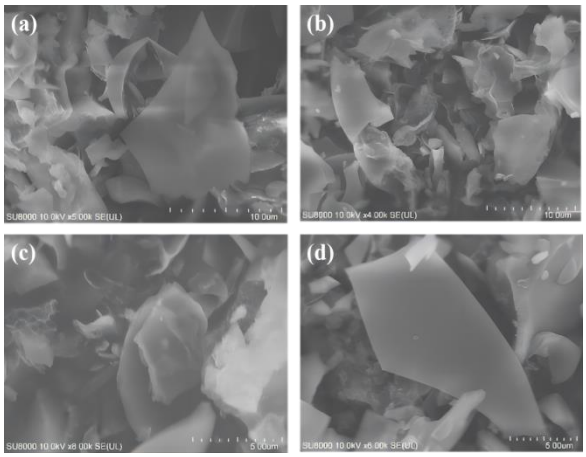


Figure S4. SEM images of (a, b) BCN (scale bar is 10 um); (c, d) BCN (scale bar is 5 um).

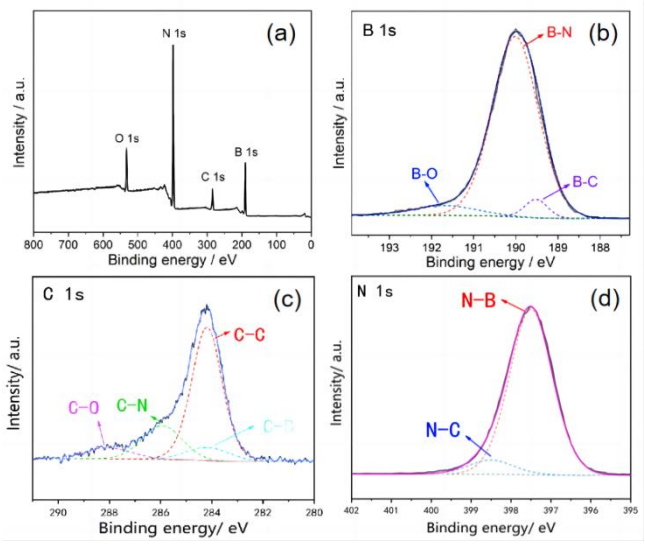
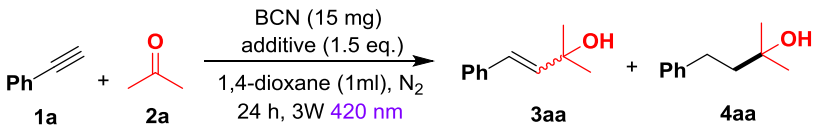


Figure S5. XPS spectra of BCN: (a) survey spectrum and high resolution spectrum of (b) B 1s, (c) C 1s, (d) N 1s.

D. Reaction condition optimizations

Table S1. Screening of additives in ketone-alkyne coupling reaction.[a]

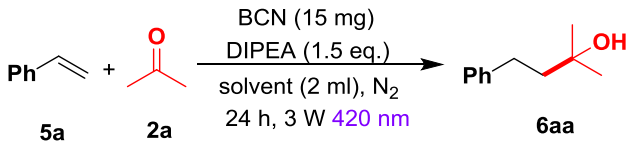


1a 2a 3aa 4aa

entry	additive	yield of **3aa**[b] (%)	yield of **4aa**[b] (%)	*E*:*Z*[b] of **3aa**
1	**DIPEA**	**69**	**8**	**83:17**
2	Et_3N	43	4	82:18
3	Ph_3N	N.D	--	--
4	i-PrOH	N.D	--	--
5	MeOH	N.D	--	--
6	TEOA	18	3	83:17
7	Sodium ascorbate	N.D	--	--

[a]Conditions: ethynylbenzene **1a** (0.2 mmol, 1.0 equiv), additive (0.3 mmol, 1.5 equiv), 1,4-dioxane (1.0 ml), acetone (1.0 mL) as co-solvent, at 25 °C under N_2. [b] Determined by ^{1}H NMR and dibromomethane as an internal standard. The ratio of *E*/*Z* was confirmed by ^{1}H NMR analysis. N.D = Not Detected.

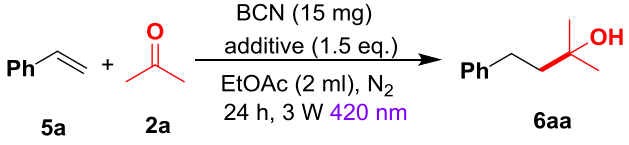
Table S2. Optimization of ketone-olefin coupling.[a]



Entry	Solvent	Yield [b] %
1	DMF	60
2	1,4-dioxane	48
3	THF	52
4	DMSO	<10
5	DMA	62
6	MeCN	53
7	**EtOAc**	**71**
8	DCM	-
9	CH_2Br_2	-
10[c]	EtOAc	N.D
11[d]	EtOAc	N.D

[a]Conditions: styrene **5a** (1.0 equiv), acetone **2a** (1.6 mmol, 8 equiv), DIPEA (0.3 mmol, 1.5 equiv), solvent (2.0 ml), at 25 °C under N_2. [b] Determined by GC-MS and acetophenone as an internal standard. [c] No light. [d] Without photocatalyst. N.D = Not Detected.

Table S3. Screening of additive for ketone-olefin coupling.[a]



Entry	Additive	Yield %[b]
1	**DIPEA**	**71**
2	Et_3N	53
3	Ph_3N	N.D
4	*i*-PrOH	N.D

5	MeOH	N.D
6	Sodium ascorbate	N.D
7	TEOA	18
8[c]	-	N.D

[a]Conditions: styrene **5a** (1.0 equiv), acetone **2a** (1.6 mmol, 8 equiv), additive (0.3 mmol, 1.5 equiv), EtOAc (2 ml), at 25 °C under N_2. [b] Determined by GC-MS and acetophenone as an internal standard. [c] Without additive. N.D = Not Detected.

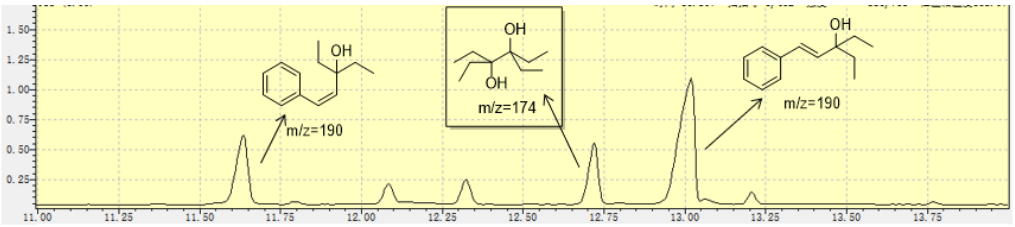


Figure S6. GC-MS spectrum of ketyl radical coupling product.

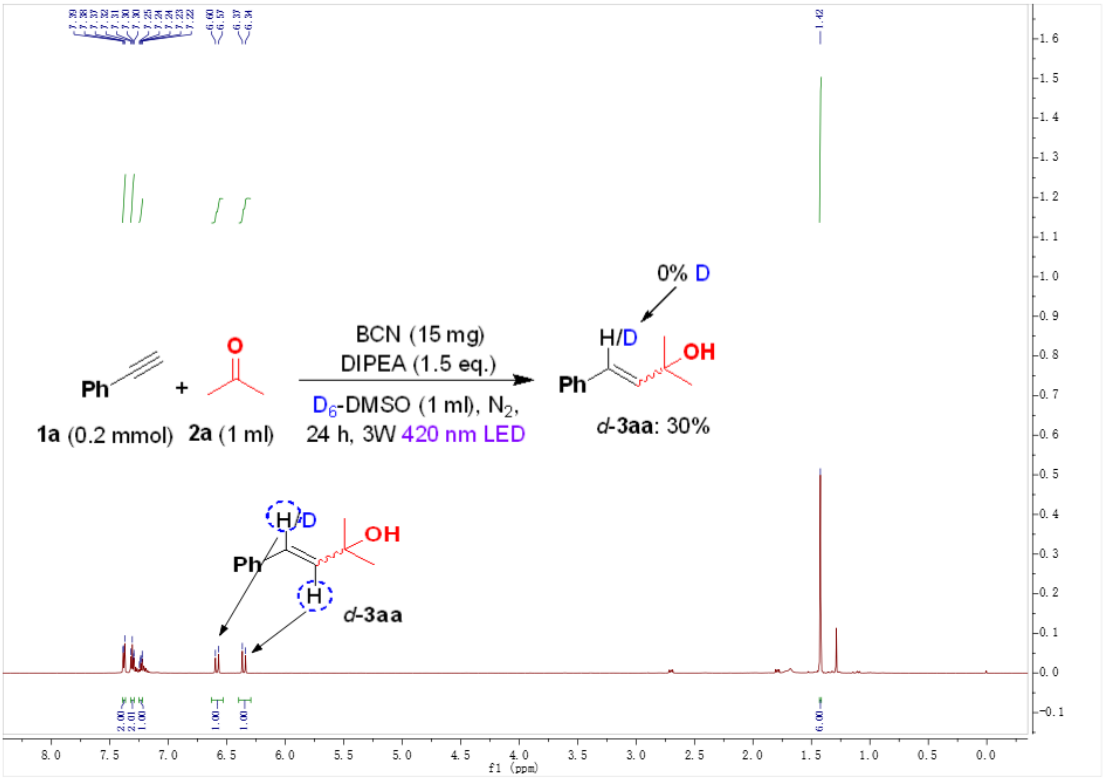


Figure S7. Instead DMSO with D_6-DMSO.

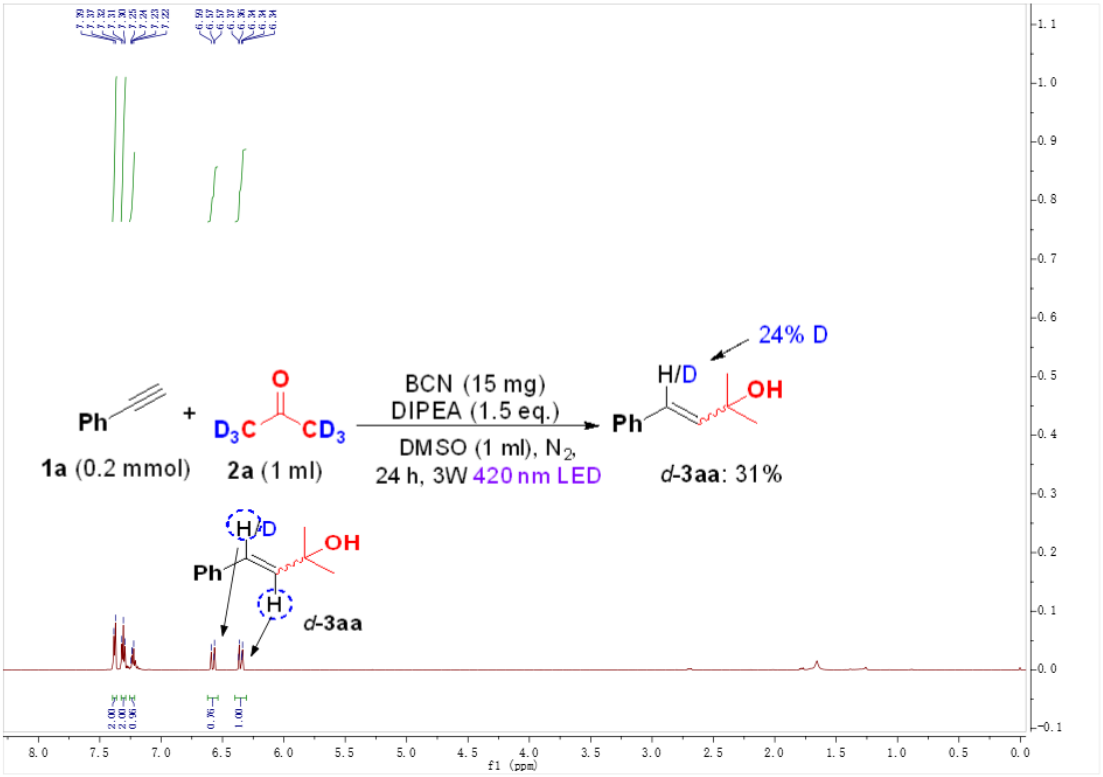


Figure S8. Instead acetone with D_6-acetone.

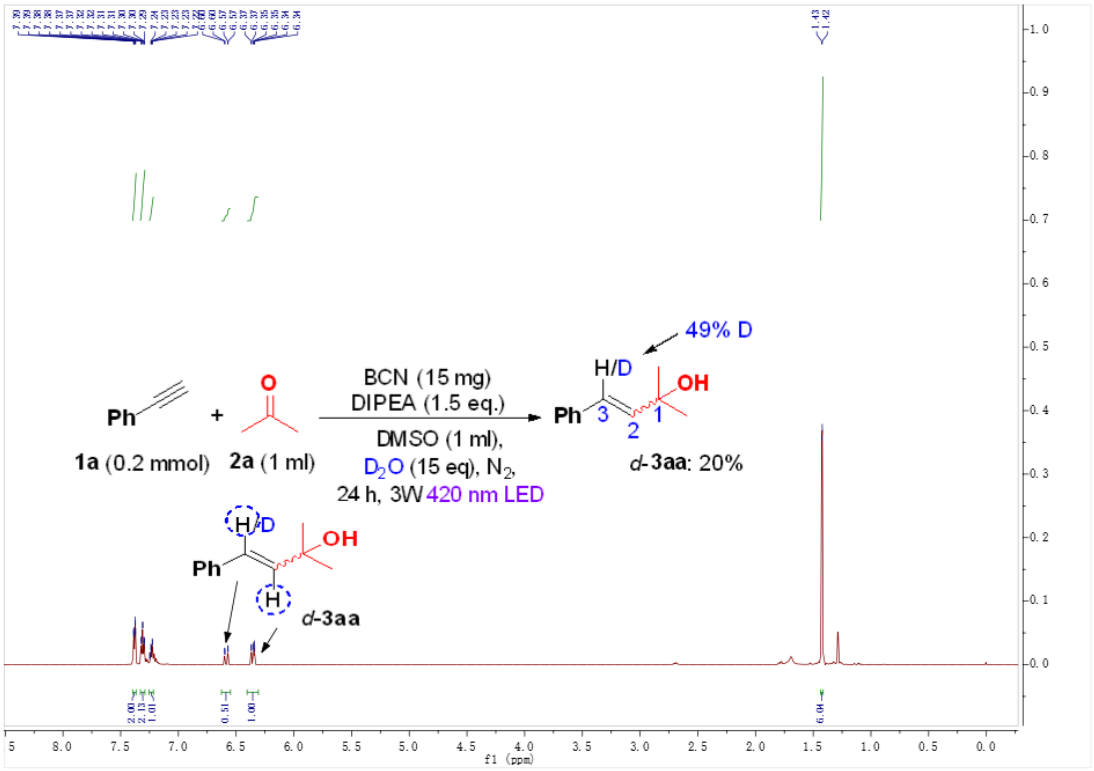
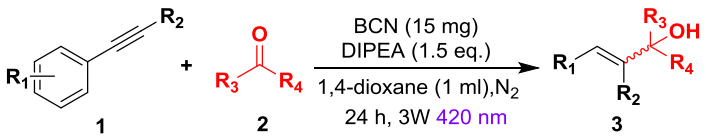


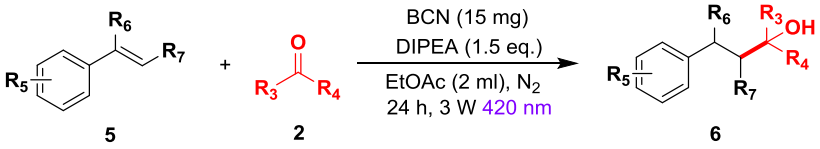
Figure S9. D_2O was employed as additive.

E. Procedure for photoredox-catalyzed ketone-alkyne reductive coupling



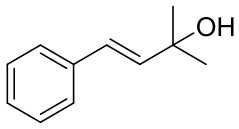
In the Schlenk tubes (10.0 ml), BCN (15.0 mg), DIPEA (0.3 mmol, 1.5 equiv), **1** (0.2 mmol), 1 ml ketone and 1,4-dioxane (1 ml) were added. The mixture exchanges N_2 three times in a vacuum. Subsequently, the reaction was carried out for 24 hours under the irradiation of the LED lamp (420 nm, 3 W) at 25 ℃. After the reaction, saturated NaCl (4.0 ml) was added to quench the reaction. Then, the mixture was extracted with ethyl acetate and dried with anhydrous Na_2SO_4, the crude product was purified by column chromatography on silica gel to obtain product.

F. Procedure for photoredox-catalyzed ketone-olefin reductive coupling



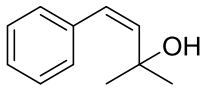
Adding the mixture of BCN (15 mg), DIPEA (0.3 mmol, 1.5 equiv), **5** (0.2 mmol) and ketone (1.6 mmol, 0.8 equiv) in EtOAc (2 ml) to a Schlenk tubes (10.0 mL). The mixture exchanges N_2 three times in a vacuum and the reaction was stirred for 24 h at 25 ℃ under the LED lamp (420 nm, 3 W). After the reaction, saturated NaCl (4.0 ml) was added to quench the reaction. Then, the mixture was extracted with ethyl acetate and dried with anhydrous Na_2SO_4, the crude product was purified by column chromatography on silica gel to obtain product.

G. Analytical Data

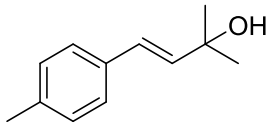


(*E*)-2-methyl-4-phenylbut-3-en-2-ol (*E*-3aa)[1]: Prepared in 69% yield (22.4 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.39 (d, J = 7.4 Hz, 2H), 7.32 (t, J = 7.7 Hz, 2H), 7.23 (t, J = 7.3 Hz, 1H), 6.59 (d, J = 16.1 Hz, 1H), 6.36 (d, J = 16.1

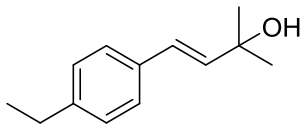
Hz, 1H), 1.68 (s, 1H), 1.43 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 137.6, 137.0, 128.7, 127.5, 126.5, 126.5, 77.4, 77.1, 77.0, 71.2, 30.0.



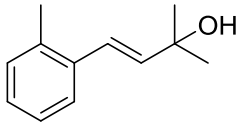
(*Z*)-2-methyl-4-phenylbut-3-en-2-ol (*Z*-3aa)[2]: colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 (dt, J = 15.1, 7.6 Hz, 4H), 7.24 (t, J = 7.2 Hz, 1H), 6.46 (d, J = 12.7 Hz, 1H), 5.76 (d, J = 12.7 Hz, 1H), 1.36 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 139.4, 137.7, 129.1, 128.2, 128.0, 127.1, 77.4, 77.2, 77.0, 72.3, 31.3.



(*E*)-2-methyl-4-(*p*-tolyl)but-3-en-2-ol (*E*-3ba)[1]: Prepared in 64% yield (22.5 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.28 (d, J = 8.0 Hz, 2H), 7.12 (d, J = 7.9 Hz, 2H), 6.56 (d, J = 16.1 Hz, 1H), 6.31 (d, J = 16.1 Hz, 1H), 2.34 (s, 3H), 1.62 (s, 1H), 1.42 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 137.4, 136.7, 134.3, 129.4, 126. 5, 126.4, 77.4, 77.2, 77.0, 71.2, 30.0, 21.3.

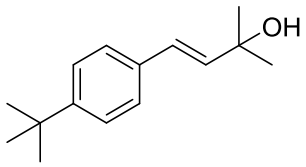


(*E*)-4-(4-ethylphenyl)-2-methylbut-3-en-2-ol (*E*-3ca)[3]: Prepared in 66% yield (25.1 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33-7.30 (m, 2H), 7.18-7.14 (m, 2H), 6.57 (d, J = 16.1 Hz, 1H), 6.32 (d, J = 16.1 Hz, 1H), 2.64 (q, J = 7.7 Hz, 2H), 1.65 (s, 1H), 1.43 (s, 6H), 1.23 (t, J = 7.6 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 143.8, 136.7, 134.5, 128.2, 126.5, 126.3, 77.4, 77.2, 77.0, 71.2, 30.0, 28.7, 15.7.

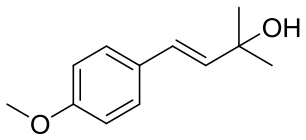


(*E*)-2-methyl-4-(*o*-tolyl)but-3-en-2-ol (*E*-3da)[1]: Prepared in 51% yield (17.9 mg, *E*/*Z* = 80:20), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.44-7.40 (m, 1H), 7.17-7.13 (m, 3H), 6.81 (d, J = 16.0 Hz, 1H), 6.24 (d, J = 15.9 Hz, 1H), 2.36 (s, 3H),

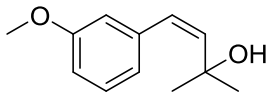
1.44 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 139.2, 136.2, 135.6, 130.4, 127.5, 126.2, 125.7, 124.3, 77.4, 77.2, 77.0, 71.4, 30.1, 20.0.



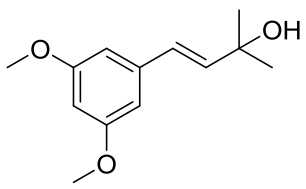
(*E*)-4-(4-(tert-butyl)phenyl)-2-methylbut-3-en-2-ol (*E*-3ea)[4]: Prepared in 59% yield (25.7 mg, *E*/*Z* = 75:25), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36-7.32 (m, 4H), 6.58 (d, *J* = 16.1 Hz, 1H), 6.33 (d, *J* = 16.1 Hz, 1H), 1.66 (s, 1H), 1.43 (s, 6H), 1.33 (s, 9H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 150.7, 137.0, 134.3, 126.3, 126.2, 125.6, 77.4, 77.2, 77.0, 71.2, 34.7, 31.4, 30.0.



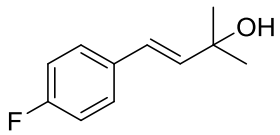
(E)**-4-(4-methoxyphenyl)-2-methylbut-3-en-2-ol (*E*-3fa)[3]:** Prepared in 66% yield (25.3 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33-7.30 (m, 2H), 6.87-6.84 (m, 2H), 6.53 (d, *J* = 16.1 Hz, 1H), 6.22 (d, *J* = 16.1 Hz, 1H), 3.80 (s, 3H), 1.66 (s, 1H), 1.42 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 159.2, 135.6, 129.8, 127.7, 126.0, 114.1, 77.4, 77.2, 77.0, 71.1, 55.4, 30.1.



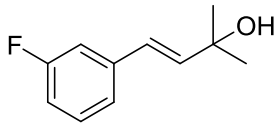
(Z)**-4-(3-methoxyphenyl)-2-methylbut-3-en-2-ol (*Z*-3ga)[3]:** Prepared in 67% yield (25.7 mg, *E*/*Z* = 82:18), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.23 (t, *J* = 8.1 Hz, 1H), 6.91 (d, *J* = 5.0 Hz, 2H), 6.79 (d, *J* = 7.3 Hz, 1H), 6.43 (d, *J* = 12.7 Hz, 1H), 5.75 (d, *J* = 12.6 Hz, 1H), 3.80 (s, 3H), 1.62 (s, 1H), 1.37 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 159.5, 139.6, 139.1, 129.3, 127.8, 121.4, 114.5, 112.8, 77.4, 77.2, 77.0, 72.2, 55.3, 31.3.



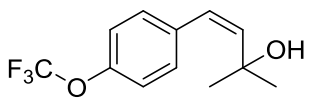
(*E*)-4-(3,5-dimethoxyphenyl)-2-methylbut-3-en-2-ol (*E*-3ha): Prepared in 65% yield (28.8 mg, *E*/*Z* = 87:13), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.53 (d, *J* = 2.3 Hz, 2H), 6.50 (d, *J* = 16.0 Hz, 1H), 6.35 (t, *J* = 2.3 Hz, 1H), 6.32 (d, *J* = 16.0 Hz, 1H), 3.78 (s, 6H), 1.70 (s, 1H), 1.41 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 161.0, 139.1, 138.2, 126.5, 104.6, 99.9, 77.4, 77.2, 77.0, 71.1, 55.4, 30.0. HRMS-ESI (m/z): $[M+H]^+$ Calcd for $C_{13}H_{19}O_3^+$ 223.1329; Found 223.1332.



(*E*)-4-(4-fluorophenyl)-2-methylbut-3-en-2-ol (*E*-3ia)[4]: Prepared in 41% yield (14.7 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36-7.32 (m, 2H), 7.02-6.98 (m, 2H), 6.55 (d, *J* = 16.1 Hz, 1H), 6.27 (d, *J* = 16.1 Hz, 1H), 1.42 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 162.4 (d, *J* = 246.1 Hz), 137.4, 133.2 (d, *J* = 4.5 Hz), 128.0 (d, *J* = 7.6 Hz), 125.4, 115.6 (d, *J* = 22.7 Hz), 77.4, 77.2, 77.0, 71.2, 30.0. ^{19}F NMR (565 MHz, $CDCl_3$) δ -114.76.

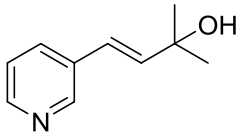


(*E*)-4-(3-fluorophenyl)-2-methylbut-3-en-2-ol (*E*-3ja)[5]: Prepared in 37% yield (13.3 mg, *E*/*Z* = 82:18), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.28-7.24 (m, 1H), 7.13 (d, *J* = 7.7 Hz, 1H), 7.08 (dt, *J* = 10.3, 1.9 Hz, 1H), 6.92 (td, *J* = 8.2, 2.3 Hz, 1H), 6.56 (d, *J* = 16.1 Hz, 1H), 6.35 (d, *J* = 16.1 Hz, 1H), 1.68 (s, 1H), 1.42 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 139.5 (d, *J* = 7.6 Hz), 139.0, 130.1 (d, *J* = 7.6 Hz), 127.7, 125.6 (d, 3.0 Hz), 122.5 (d, *J* = 1.5 Hz), 114.3 (d, *J* = 21.1 Hz), 113.0 (d, *J* = 21.1 Hz), 77.4, 77.2, 77.0, 71.2, 30.0. ^{19}F NMR (565 MHz, $CDCl_3$) δ -113.51.

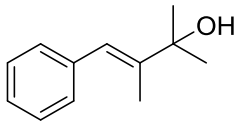


(*Z*)-2-methyl-4-(4-(trifluoromethoxy)phenyl)but-3-en-2-ol (*Z*-3ka)[3]: Prepared in 43% yield (21.1 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.43-7.39 (m, 2H), 7.16-7.14 (m, 2H), 6.39 (d, *J* = 12.1 Hz, 1H), 5.77 (d, *J* = 12.1 Hz, 1H), 1.37

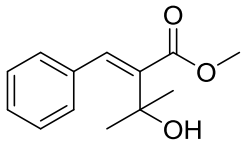
(s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 148.2, 140.1, 136.2, 130.9, 126.9, 120.6 (q, J = 256.7 Hz),120.5, 77.4, 77.2, 77.0, 72.2, 31.2. ^{19}F NMR (565 MHz, $CDCl_3$) δ -57.73.



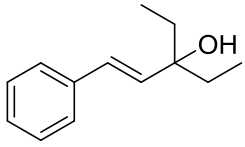
***(E)*-2-methyl-4-(pyridin-3-yl)but-3-en-2-ol (*E*-3la)[6]**: Prepared in 42% yield (13.7 mg, *E*/*Z* = 90:10), brown oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 8.59 (d, J = 2.3 Hz, 1H), 8.45 (dq, J = 4.5, 1.6 Hz, 1H), 7.70 (dt, J = 7.9, 2.0 Hz, 1H), 7.24 (ddd, J = 7.9, 4.7, 0.9 Hz, 1H), 6.58 (dd, J = 16.1, 1.3 Hz, 1H), 6.42 (dd, J = 16.2, 0.8 Hz, 1H), 1.43 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 148.5, 148.4, 140.1, 133.1, 132.8, 123.6, 123.0, 77.4, 77.2, 77.0, 71.2, 30.0.



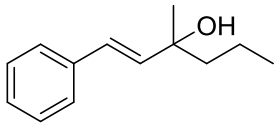
(*E*)-2,3-dimethyl-4-phenylbut-3-en-2-ol (*E*-3ma)[7]: Prepared in 40% yield (14.0 mg, *E*/*Z* = 90:10), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.34 (t, J = 7.7 Hz, 2H), 7.28-7.26 (m, 2H), 7.22 (td, J = 7.3, 1.4 Hz, 1H), 6.68 (s, 1H), 1.91 (d, J = 1.3 Hz, 3H), 1.61 (s, 1H), 1.46 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 144.8, 138.5, 129.2, 128.2, 126.3, 122.5, 77.4, 77.2, 77.0, 74.1, 29.1, 14.6.



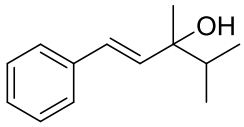
methyl (*E*)-2-benzylidene-3-hydroxy-3-methylbutanoate (*E*-3na): Prepared in 47% yield (20.6 mg, *E*/*Z* = 83:17), white solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.34- 7.29 (m, 2H), 7.28-7.26 (m, 1H), 7.24-7.21 (m, 2H), 6.86 (s, 1H), 3.65 (s, 3H), 1.53 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 170.8, 141.6, 135.7, 129.1, 128.5, 128.2, 128.0, 77.4, 77.2, 77.0, 72.2, 52.1, 29.4. HRMS-ESI (m/z): $[M+H]^+$ Calcd for $C_{13}H_{17}O_3^+$ 221.1173; Found 221.1170.



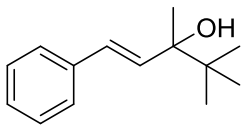
(*E*)-3-ethyl-1-phenylpent-1-en-3-ol (*E*-3ab)[3]: Prepared in 55% yield (20.9 mg, *E*/*Z* = 80:20), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.42-7.38 (m, 2H), 7.32 (dd, *J* = 8.5, 7.0 Hz, 2H), 7.23 (ddt, *J* = 7.9, 6.8, 1.3 Hz, 1H), 6.60 (d, *J* = 16.1 Hz, 1H), 6.19 (d, *J* = 16.1 Hz, 1H), 1.66 (qd, *J* = 7.5, 3.6 Hz, 4H), 0.92 (t, *J* = 7.5 Hz, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 137.3, 135.4, 128.7, 128.2, 127.4, 126.5, 77.4, 77.2, 77.0, 76.0, 33.5, 8.0.



(*E*)-3-methyl-1-phenylhex-1-en-3-ol (*E*-3ac)[8]: Prepared in 59% yield (22.4 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.40-7.37 (m, 2H), 7.32 (dd, *J* = 8.4, 7.0 Hz, 2H), 7.25-7.21 (m, 1H), 6.58 (d, *J* = 16.1 Hz, 1H), 6.29 (d, *J* = 16.1 Hz, 1H), 1.67-1.57 (m, 3H), 1.39 (s, 4H), 0.94 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 137.2, 137.0, 128.7, 127.5, 127.1, 126.5, 77.4, 77.2, 77.0, 73.4, 45.4, 28.3, 17.5, 14.7.

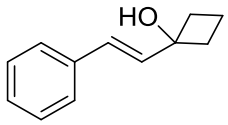


(*E*)-3,4-dimethyl-1-phenylpent-1-en-3-ol (*E*-3ad)[9]: Prepared in 51% yield (19.3 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.41-7.37 (m, 2H), 7.34-7.29 (m, 2H), 7.25-7.21 (m, 1H), 6.60 (d, *J* = 16.1 Hz, 1H), 6.31 (d, *J* = 16.1 Hz, 1H), 1.81 (p, *J* = 6.9 Hz, 1H), 1.35 (s, 3H), 0.96 (dd, *J* = 6.9, 5.1 Hz, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 137.3, 135.9, 128.7, 127.8, 127.4, 126.5, 77.4, 77.2, 77.0, 75.7, 38.4, 25.6, 17.8, 17.3.

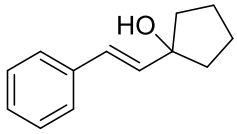


(*E*)-3,4,4-trimethyl-1-phenylpent-1-en-3-ol (*E*-3ae)[10]: Prepared in 50% yield (20.4 mg, *E*/*Z* = 83:17), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.41-7.38 (m, 2H), 7.35-7.30 (m, 2H), 7.25-7.21 (m, 1H), 6.61 (d, *J* = 16.1 Hz, 1H), 6.46 (d, *J* = 16.1 Hz, 1H), 1.36 (s, 3H), 1.01 (d, *J* = 0.8 Hz, 9H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 137.4,

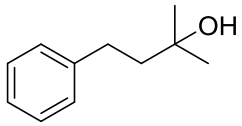
135.3, 128.7, 127.8, 127.4, 126.5, 77.5, 77.4, 77.2, 77.0, 38.0, 25.6, 23.9.



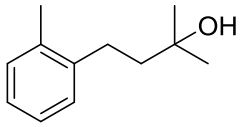
(*E*)-1-styrylcyclobutan-1-ol (*E*-3af)[11]: Prepared in 30% yield (10.4 mg, *E*/*Z* = 60:40), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.45-7.39 (m, 2H), 7.33 (dd, *J* = 8.4, 6.9 Hz, 2H), 7.24 (td, J = 7.1, 1.3 Hz, 1H), 6.64 (d, J = 16.0 Hz, 1H), 6.50 (d, J = 16.0 Hz, 1H), 2.35-2.30 (m, 2H), 2.25 (td, J = 9.3, 2.8 Hz, 2H), 1.87 (dddd, J = 11.3, 5.6, 3.5, 1.7 Hz, 1H), 1.71-1.65 (m, 1H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 137.0, 134.1, 128.7, 127.6, 126.9, 126.6, 77.4, 77.2, 77.0, 75.3, 36.6, 12.4.



(*E*)-1-styrylcyclopentan-1-ol (*E*-3ag)[12]: Prepared in 45% yield (16.9 mg, *E*/*Z* = 75:25), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.39 (d, *J* = 7.6 Hz, 2H), 7.32 (t, *J* = 7.7 Hz, 2H), 7.23 (t, *J* = 7.4 Hz, 1H), 6.67 (d, *J* = 16.0 Hz, 1H), 6.40 (d, *J* = 16.0 Hz, 1H), 1.93 (ddq, *J* = 12.1, 7.5, 3.8 Hz, 2H), 1.82 (dt, *J* = 12.3, 6.1 Hz, 2H), 1.76 (dd, *J* = 9.1, 5.3 Hz, 4H).^{13}C NMR (151 MHz, $CDCl_3$) δ 137.2, 136.1, 128.7, 127.4, 126.8, 126.5, 82.3, 77.4, 77.2, 77.0, 40.9, 23.9.

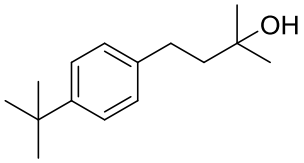


2-methyl-4-phenylbutan-2-ol (6aa)[13]: Prepared in 71% yield (23.3 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.30 (tt, *J* = 7.8, 1.7 Hz, 2H), 7.24-7.18 (m, 3H), 2.75-2.70 (m, 2H), 1.84-1.78 (m, 2H), 1.61 (s, 1H), 1.31 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 142.7, 128.5, 128.4, 125.8, 77.4, 77.2, 77.0, 71.0, 45.8, 30.9, 29.4.

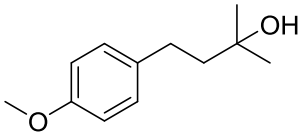


2-methyl-4-(o-tolyl)butan-2-ol (6ba)[14]: Prepared in 72% yield (25.6 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.15 (d, *J* = 6.7 Hz, 3H), 7.13-7.11 (m, 1H),

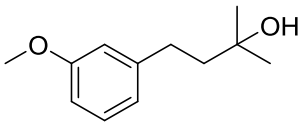
2.71-2.68 (m, 2H), 2.33 (s, 3H), 1.75-1.71 (m, 2H), 1.32 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 140.8, 135.9, 130.3, 128.8, 126.2, 126.0, 77.4, 77.2, 77.0, 71.1, 44.6, 29.3, 28.2, 19.3.



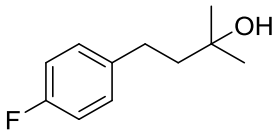
4-(4-(tert-butyl)phenyl)-2-methylbutan-2-ol (6ca)[13]: Prepared in 77% yield (33.9 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33-7.30 (m, 2H), 7.17-7.13 (m, 2H), 2.71-2.65 (m, 2H), 1.83-1.77 (m, 2H), 1.62 (s, 1H), 1.31 (s, 9H), 1.29 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 148.7, 139.5, 128.1, 125.5, 77.4, 77.2, 77.0, 71.1, 45.8, 34.5, 31.5, 30.3, 29.5.



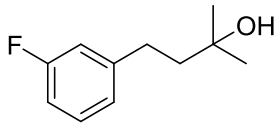
4-(4-methoxyphenyl)-2-methylbutan-2-ol (6da)[13]: Prepared in 76% yield (29.5 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.15-7.10 (m, 2H), 6.85-6.81 (m, 2H), 3.79 (s, 3H), 2.67-2.63 (m, 2H), 1.78-1.75 (m, 2H), 1.53 (s, 1H), 1.28 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 157.9, 134.7, 129.3, 114.0, 77.4, 77.2, 77.0, 71.1, 55.4, 46.1, 29.9, 29.5.



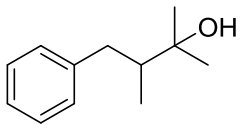
4-(3-methoxyphenyl)-2-methylbutan-2-ol (6ea): Prepared in 73% yield (28.3 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.20 (t, J = 7.8 Hz, 1H), 6.80 (d, J = 7.3 Hz, 1H), 6.77-6.72 (m, 2H), 3.80 (s, 3H), 2.72-2.66 (m, 2H), 1.83-1.77 (m, 2H), 1.29 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 159.8, 144.3, 129.5, 120.9, 114.2, 111.2, 77.4, 77.2, 77.0, 71.0, 55.3, 45.7, 30.9, 29.5. HRMS-ESI (m/z): $[M+H]^+$ Calcd for $C_{12}H_{19}O_2^+$ 195.1380; Found 195.1379.



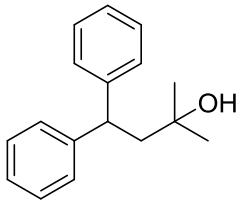
4-(4-fluorophenyl)-2-methylbutan-2-ol (6fa)[13]: Prepared in 67% yield (24.4 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.14 (ddd, J = 8.4, 5.3, 2.5 Hz, 2H), 6.99-6.94 (m, 2H), 2.73-2.64 (m, 2H), 1.78-1.74 (m, 2H), 1.29 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 161.3 (d, J = 243.1 Hz), 138.2 (d, J = 3.0 Hz), 129.7 (d, J = 7.6 Hz), 115.2 (d, J = 21.1 Hz), 77.4, 77.2, 77.0, 71.0, 46.0, 30.1, 29.5. ^{19}F NMR (565 MHz, $CDCl_3$) δ -117.82.



4-(3-fluorophenyl)-2-methylbutan-2-ol (6ga)[13]: Prepared in 60% yield (21.8 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.23 (td, J = 7.9, 6.1 Hz, 1H), 6.98 (d, J = 7.5 Hz, 1H), 6.92-6.87 (m, 2H), 2.74-2.68 (m, 2H), 1.80-1.75 (m, 2H), 1.60 (s, 1H), 1.29 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 163.1 (d, J = 244.6 Hz), 145.3 (d, J = 7.6 Hz), 129.9 (d, J = 9.1 Hz), 124.1 (d, J = 1.5 Hz), 115.3 (d, J = 19.6 Hz), 112.8 (d, J = 21.1 Hz), 77.4, 77.2, 77.0, 71.0, 45.5, 30.6, 29.5. ^{19}F NMR (565 MHz, $CDCl_3$) δ -113.71.

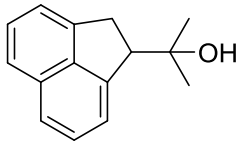


2,3-dimethyl-4-phenylbutan-2-ol (6ha)[15]: Prepared in 54% yield (19.2 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.30-7.27 (m, 2H), 7.20-7.17 (m, 3H), 3.09 (dd, J = 13.2, 3.1 Hz, 1H), 2.14 (dd, J = 13.1, 11.2 Hz, 1H), 1.75 (dqd, J = 11.1, 6.8, 3.1 Hz, 1H), 1.26 (d, J = 4.1 Hz, 6H), 0.81 (d, J = 6.8 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 142.0, 129.3, 128.4, 125.8, 77.4, 77.2, 77.0, 73.5, 46.8, 38.1, 27.8, 26.2, 14.3.

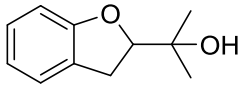


2-methyl-4,4-diphenylbutan-2-ol (6ia)[16]: Prepared in 87% yield (41.7 mg), white solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.35 (d, J = 7.8 Hz, 4H), 7.30 (t, J = 7.3 Hz, 4H),

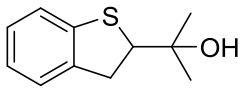
7.19 (t, *J* = 7.2 Hz, 2H), 4.25 (t, *J* = 6.8 Hz, 1H), 2.42-2.37 (m, 2H), 1.20 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 145.8, 128.8, 127.9, 126.4, 77.4, 77.2, 77.0, 71.5, 48.9, 47.7, 30.2.



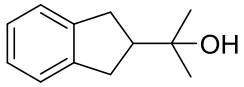
2-(1,2-dihydroacenaphthylen-1-yl)propan-2-ol (6ja)[17]: Prepared in 45% yield (19.0 mg), white solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.65 (d, *J* = 8.0 Hz, 1H), 7.61 (d, *J* = 8.2 Hz, 1H), 7.51 (d, *J* = 6.9 Hz, 1H), 7.48-7.46 (m, 1H), 7.46-7.42 (m, 1H), 7.28 (d, *J* = 6.8 Hz, 1H), 3.79 (dd, *J* = 8.3, 3.2 Hz, 1H), 3.50 (dd, *J* = 17.5, 8.4 Hz, 1H), 3.27 (dd, *J* = 17.5, 3.2 Hz, 1H), 1.32 (s, 3H), 1.15 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 144.4, 139.8, 127.9, 127.8, 123.5, 122.5, 121.4, 119.2, 113.8, 77.4, 77.2, 77.0, 73.9, 55.1, 34.7, 28.3, 26.1.



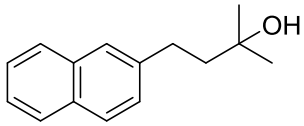
2-(2,3-dihydrobenzofuran-2-yl)propan-2-ol (6ka)[18]: Prepared in 57% yield (20.3 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.16 (d, *J* = 7.3 Hz, 1H), 7.11 (t, *J* = 7.7 Hz, 1H), 6.84 (t, *J* = 7.4 Hz, 1H), 6.79 (d, *J* = 8.0 Hz, 1H), 4.60 (t, *J* = 9.1 Hz, 1H), 3.21-3.11 (m, 2H), 1.86 (s, 1H), 1.35 (s, 3H), 1.22 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 159.6, 128.0, 125.0, 120.6, 109.3, 89.3, 77.4, 77.2, 77.0, 71.9, 30.8, 26.3, 24.1.



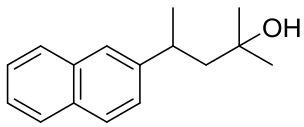
2-(2,3-dihydrobenzo[b]thiophen-2-yl)propan-2-ol (6la)[19]: Prepared in 42% yield (16.3 mg), light yellow oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.16 (d, *J* = 7.3 Hz, 1H), 7.11 (t, *J* = 7.7 Hz, 1H), 6.84 (t, *J* = 7.4 Hz, 1H), 6.79 (d, *J* = 8.0 Hz, 1H), 4.60 (t, *J* = 9.1 Hz, 1H), 3.21-3.11 (m, 2H), 1.86 (s, 1H), 1.35 (s, 3H), 1.22 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 140.2, 140.1, 127.5, 124.5, 124.5, 121.9, 77.4, 77.2, 77.0, 71.9, 62.0, 37.4, 29.0, 26.2.



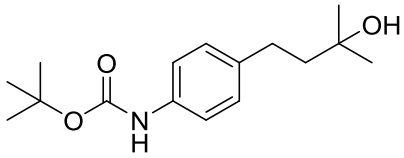
2-(2,3-dihydro-1*H*-inden-2-yl)propan-2-ol (6ma)[13]: Prepared in 83% yield (29.2 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.21 (dd, J = 5.3, 3.4 Hz, 2H), 7.15 (dd, J = 5.5, 3.2 Hz, 2H), 2.95 (qd, J = 15.6, 9.1 Hz, 4H), 2.60 (p, J = 9.1 Hz, 1H), 1.29 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 143.2, 126.3, 124.5, 77.4, 77.2, 77.0, 72.0, 50.9, 34.2, 28.2.



2-methyl-4-(naphthalen-2-yl)butan-2-ol (6na)[13]: Prepared in 67% yield (28.6 mg), white solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.81 (d, J = 8.0 Hz, 1H), 7.78 (d, J = 8.3 Hz, 2H), 7.66 (s, 1H), 7.48-7.41 (m, 2H), 7.36 (dd, J = 8.4, 1.6 Hz, 1H), 2.91- 2.86 (m, 2H), 1.92-1.86 (m, 2H), 1.34 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 140.2, 133.8, 132.1, 128.1, 127.7, 127.5, 127.4, 126.3, 126.0, 125.3, 77.4, 77.2, 77.0, 71.1, 45.7, 31.0, 29.5.

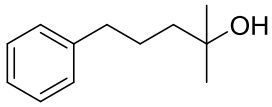


2-methyl-4-(naphthalen-2-yl)pentan-2-ol (6oa): Prepared in 49% yield (22.3 mg), white solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.81 (td, J = 8.7, 2.0 Hz, 3H), 7.68 (d, J = 1.7 Hz, 1H), 7.49-7.42 (m, 3H), 3.16 (dddd, J = 9.3, 6.9, 5.5, 2.4 Hz, 1H), 2.12 (dd, J = 14.4, 8.9 Hz, 1H), 1.86 (dd, J = 14.4, 4.5 Hz, 1H), 1.37 (d, J = 7.0 Hz, 3H), 1.18 (d, J = 13.8 Hz, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 145.7, 133.8, 132.3, 128.5, 127.7, 127.6, 126.1, 125.7, 125.5, 125.4, 77.4, 77.2, 77.0, 71.6, 51.2, 36.7, 30.0, 25.3. HRMS-ESI (m/z): $[M+H]^+$ Calcd for $C_{16}H_{21}O^+$ 229.1587; Found 229.1585.

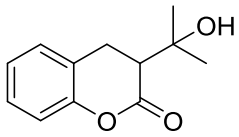


tert-butyl (4-(3-hydroxy-3-methylbutyl)phenyl)carbamate (6pa)[20]: Prepared in 84% yield (46.9 mg), yellow solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.26 (t, J = 4.4 Hz, 2H),

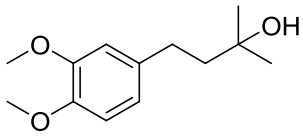
7.13-7.08 (m, 2H), 2.67-2.60 (m, 2H), 1.76-1.73 (m, 2H), 1.50 (s, 9H), 1.27 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 153.0, 137.3, 136.2, 128.9, 119.0, 80.5, 77.4, 77.2, 77.0, 71.0, 45.9, 30.2, 29.4, 28.5.



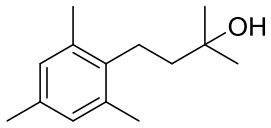
2-methyl-5-phenylpentan-2-ol (6qa)[13]: Prepared in 42% yield (14.9 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.31-7.27 (m, 2H), 7.19 (d, J = 7.3 Hz, 3H), 2.63 (t, J = 7.7 Hz, 2H), 1.74-1.66 (m, 2H), 1.54-1.49 (m, 2H), 1.21 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 142.6, 128.5, 128.4, 125.9, 77.4, 77.2, 77.0, 71.1, 43.6, 36.5, 29.4, 26.4.



3-(2-hydroxypropan-2-yl)chroman-2-one (6ra): Prepared in 42% yield (17.3 mg, 42%), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.13 (t, J = 7.7 Hz, 1H), 7.06 (d, J = 7.5 Hz, 1H), 6.87 (t, J = 8.2 Hz, 2H), 3.83 (t, J = 8.0 Hz, 1H), 2.97 (d, J = 8.1 Hz, 2H), 1.55 (s, 3H), 1.12 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 178.1, 154.4, 129.1, 128.7, 124.8, 120.5, 116.0, 88.6, 77.4, 77.2, 77.0, 45.2, 35.4, 29.0, 23.8. HRMS-ESI (m/z): $[M+H]^+$ Calcd for $C_{12}H_{15}O_3^+$ 207.1016; Found 207.1017.

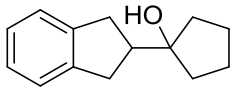


4-(3,4-dimethoxyphenyl)-2-methylbutan-2-ol (6sa)[13]: Prepared in 52% yield (23.3 mg), light yellow oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.77 (d, J = 7.9 Hz, 1H), 6.74-6.68 (m, 2H), 3.85 (s, 3H), 3.83 (s, 3H), 2.70-2.55 (m, 2H), 1.82-1.72 (m, 2H), 1.27 (s, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 149.0, 147.2, 135.2, 120.1, 111.8, 111.4, 77.4, 77.2, 77.0, 71.0, 56.0, 55.9, 45.9, 30.4, 29.4.

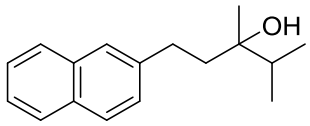


4-mesityl-2-methylbutan-2-ol (6ta)[13]: Prepared in 59% yield (24.3 mg, 59%),

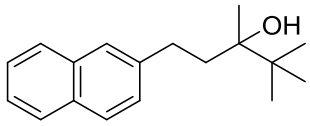
colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.85 (s, 2H), 2.74-2.64 (m, 2H), 2.31 (d, J = 2.7 Hz, 6H), 2.26 (d, J = 2.6 Hz, 3H), 1.63-1.57 (m, 2H), 1.37-1.31 (m, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 135.9, 135.1, 129.0, 77.4, 77.2, 77.0, 71.1, 43.0, 29.2, 24.2, 20.9, 19.7.



1-(2,3-dihydro-1H-inden-2-yl)cyclopentan-1-ol (6mg): Prepared in 56% yield (22.6 mg), white solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.21 (dd, *J* = 5.3, 3.3 Hz, 2H), 7.16-7.12 (m, 2H), 2.96 (qd, *J* = 15.5, 9.1 Hz, 4H), 2.67 (p, *J* = 9.0 Hz, 1H), 1.86 (tt, *J* = 9.6, 4.6 Hz, 2H), 1.71-1.66 (m, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 143.3, 126.3, 124.6, 83.9, 77.4, 77.2, 77.0, 49.3, 38.8, 34.7, 24.2. HRMS-ESI (m/z): $[M+H]^+$ Calcd for $C_{14}H_{19}O^+$ 203.1431; Found 203.1429.

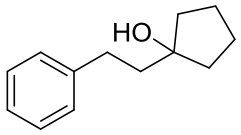


3,4-dimethyl-1-(naphthalen-2-yl)pentan-3-ol (6nd): Prepared in 43% yield (20.8 mg), white solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.81 (d, *J* = 8.0 Hz, 1H), 7.78 (d, *J* = 8.2 Hz, 2H), 7.65 (s, 1H), 7.47-7.40 (m, 2H), 7.36 (dd, *J* = 8.4, 1.5 Hz, 1H), 2.87 (dqd, *J* = 17.6, 13.5, 8.5 Hz, 2H), 1.88-1.84 (m, 2H), 1.84-1.78 (m, 1H), 1.21 (s, 3H), 0.97 (dd, *J* = 16.7, 6.9 Hz, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 140.5, 133.8, 132.1, 128.1, 127.8, 127.5, 126.3, 126.1, 125.3, 77.4, 77.2, 77.0, 74.9, 41.8, 37.2, 30.2, 23.2, 17.7, 17.1. HRMS-ESI (m/z): $[M+H]^+$ Calcd for $C_{17}H_{23}O^+$ 243.1744; Found 243.1740.

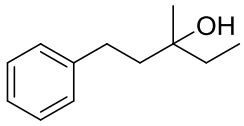


3,4,4-trimethyl-1-(naphthalen-2-yl)pentan-3-ol (6ne): Prepared in 44% yield (22.5 mg), white solid. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.81 (d, *J* = 8.0 Hz, 1H), 7.78 (d, *J* = 8.2 Hz, 2H), 7.66 (s, 1H), 7.43 (dt, *J* = 21.4, 7.0 Hz, 2H), 7.37 (d, *J* = 8.3 Hz, 1H), 2.96 (td, *J* = 12.8, 4.7 Hz, 1H), 2.85 (td, *J* = 12.8, 5.3 Hz, 1H), 1.93 (td, *J* = 13.1, 12.7, 4.7 Hz, 1H), 1.84 (td, *J* = 13.7, 13.0, 5.4 Hz, 1H), 1.66 (s, 1H), 1.28 (s, 3H), 0.98 (s,

9H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 140.9, 133.8, 132.1, 128.1, 127.8, 127.6, 127.5, 126.4, 126.1, 125.2, 77.4, 77.26, 77.0, 76.5, 38.5, 38.4, 30.8, 25.4, 21.1. HRMS-ESI (m/z): $[M+H]^+$ Calcd for $C_{18}H_{25}O^+$ 257.1900; Found 257.1902. .



1-phenethylcyclopentan-1-ol (6ag)[13]: Prepared in 51% yield (19.3 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.32-7.27 (m, 2H), 7.25-7.21 (m, 2H), 7.21- 7.17 (m, 1H), 2.82-2.74 (m, 2H), 1.94-1.90 (m, 2H), 1.88-1.82 (m, 2H), 1.73-1.62 (m, 6H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 142.8, 128.5, 128.4, 125.8, 82.6, 77.4, 77.2, 77.0, 43.6, 39.9, 31.4, 23.9.



3-methyl-1-phenylpentan-3-ol (6ah)[21]: Prepared in 75% yield (26.7 mg), colorless oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.29 (t, J = 7.6 Hz, 2H), 7.20 (dd, J = 17.7, 7.4 Hz, 3H), 2.72-2.66 (m, 2H), 1.80-1.74 (m, 2H), 1.57 (h, J = 7.4, 6.9 Hz, 2H), 1.24 (s, 3H), 0.95 (t, J = 7.5 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 142.8, 128.5, 128.5, 125.9, 77.4, 77.2, 77.0, 73.0, 43.4, 34.5, 30.4, 26.5, 8.4.

H. References

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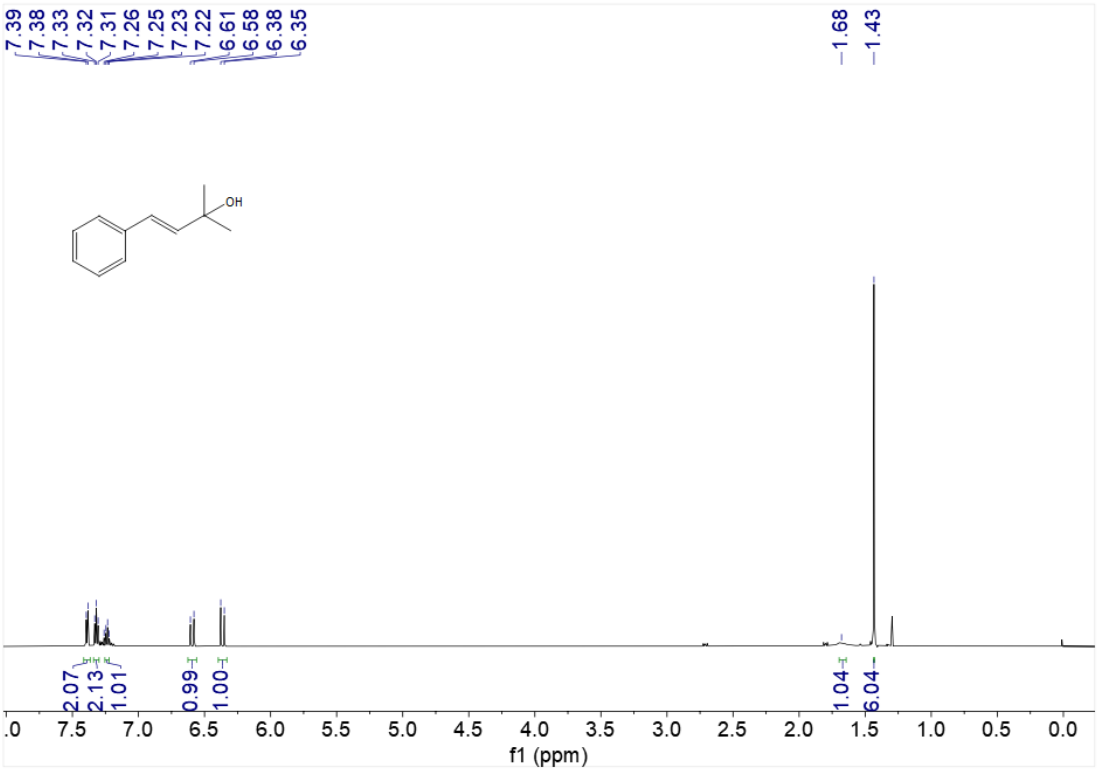
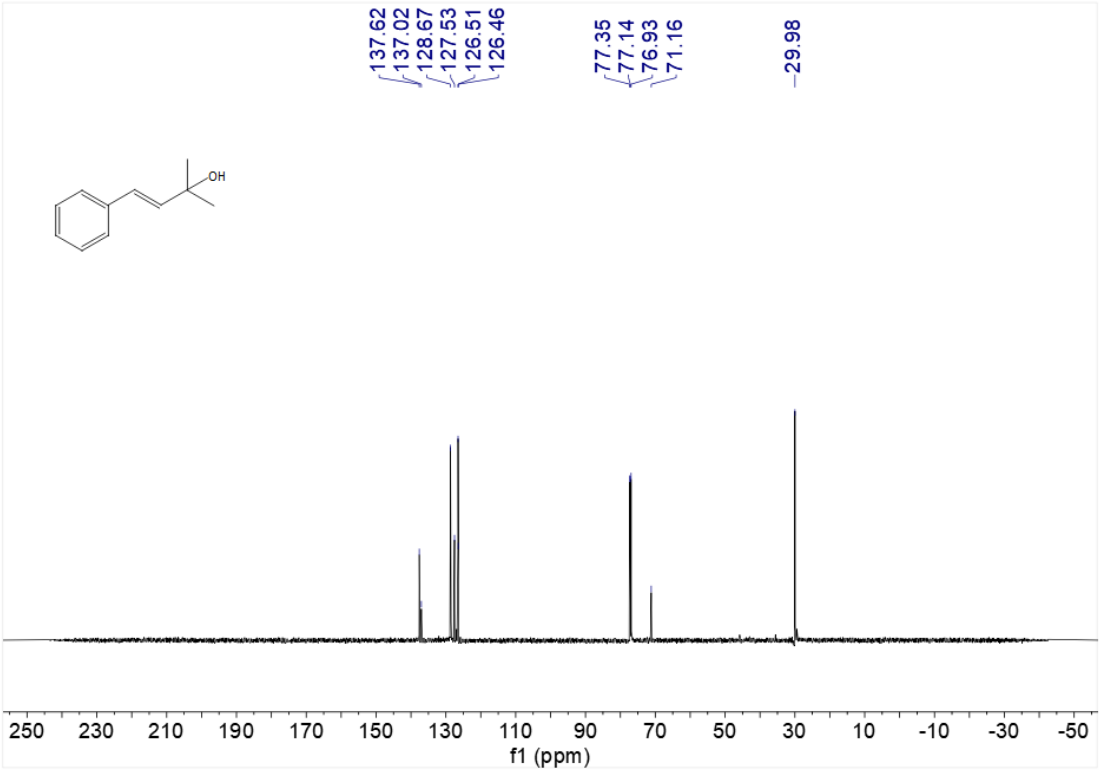
I. NMR Spectra

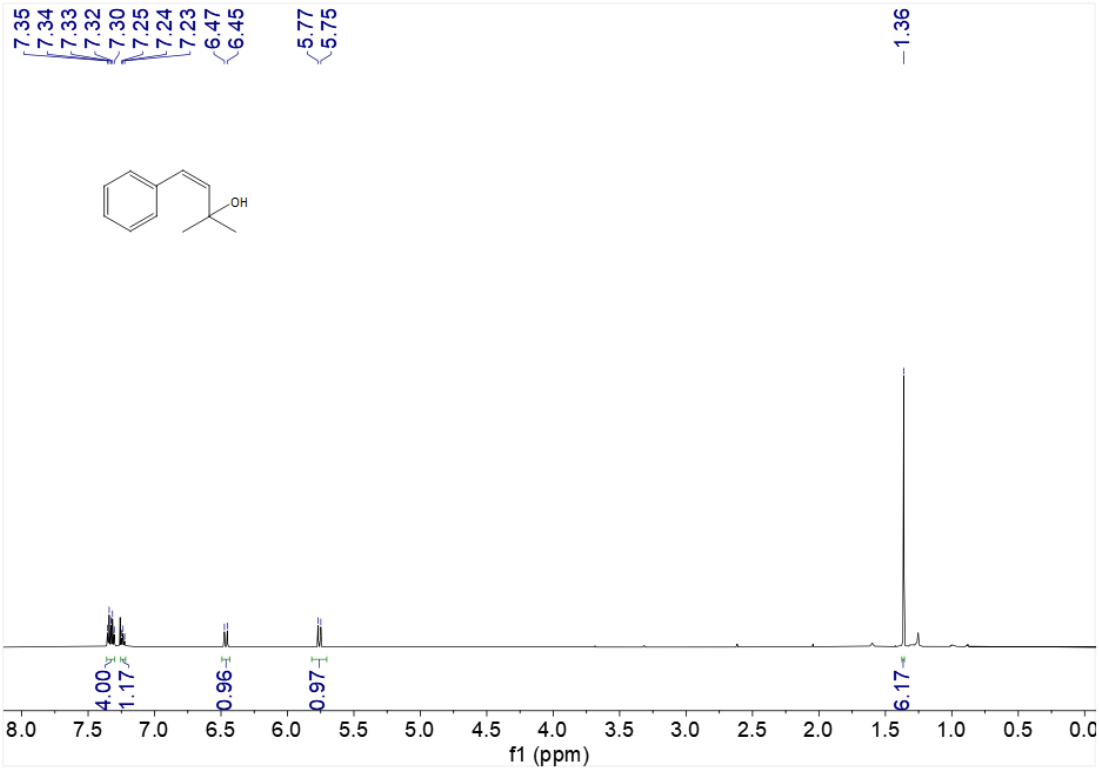
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of (*E*)-2-methyl-4-phenylbut-3-en-2-ol (*E*-3aa)



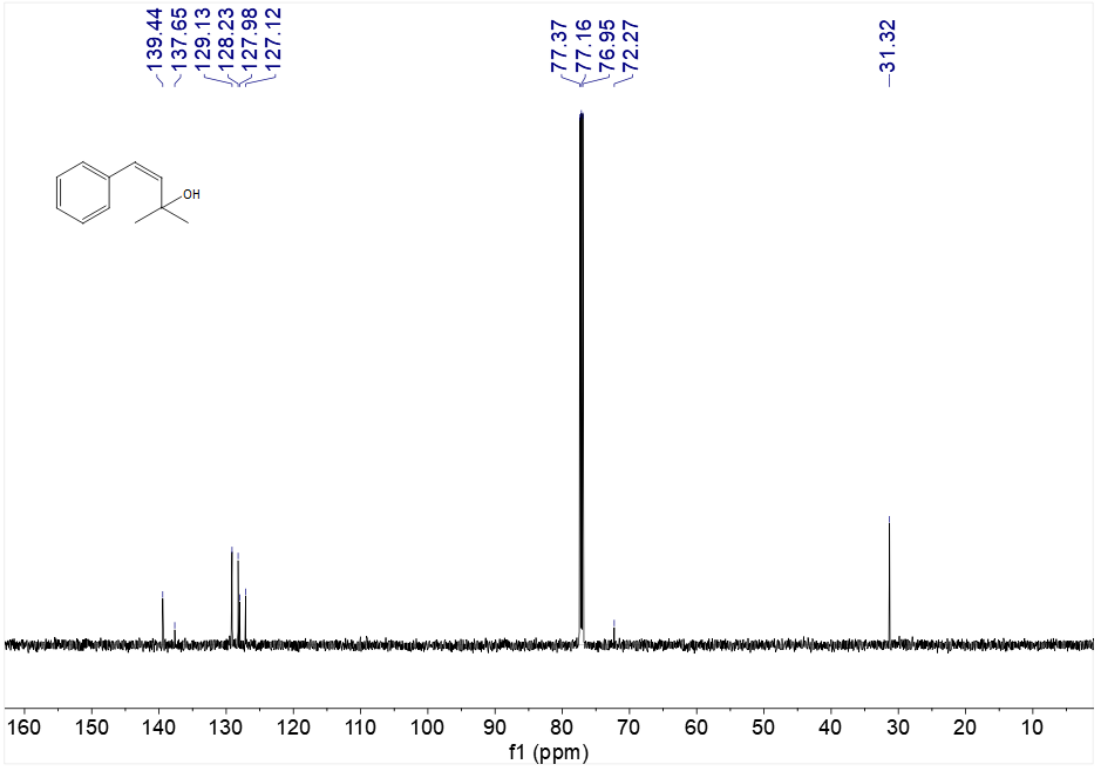
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of (*E*)-2-methyl-4-phenylbut-3-en-2-ol (*E*-3aa)



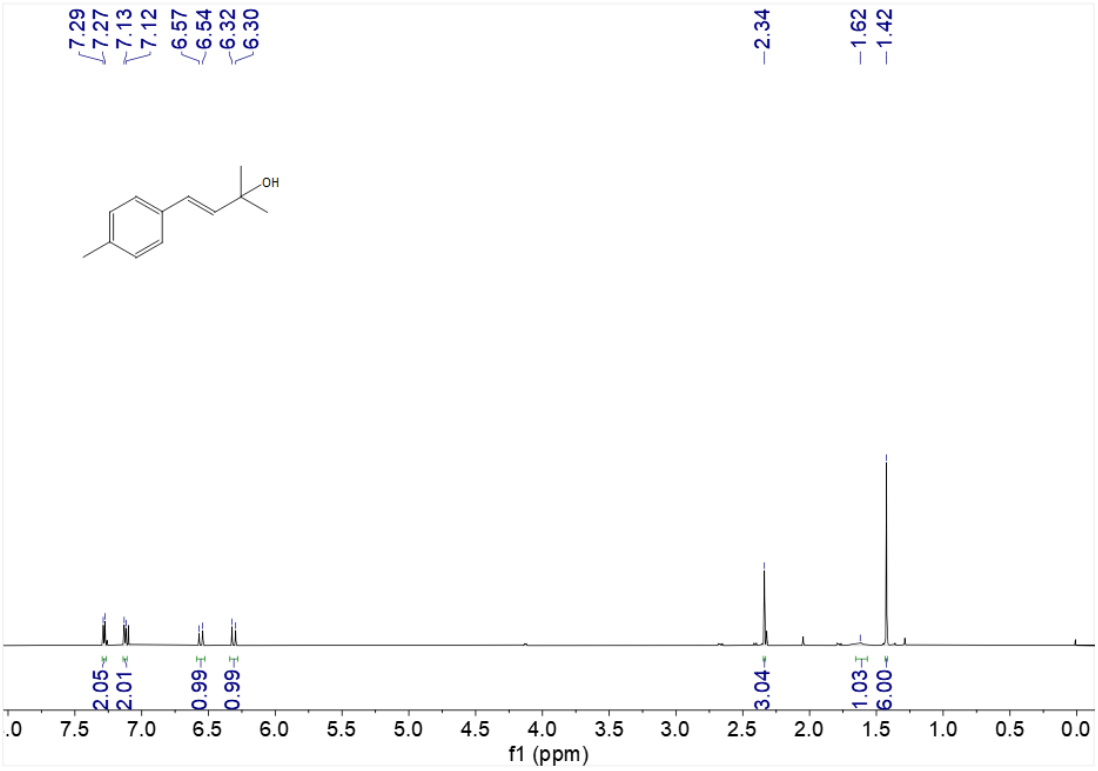
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of (*Z*)-2-methyl-4-phenylbut-3-en-2-ol (*Z*-3aa)



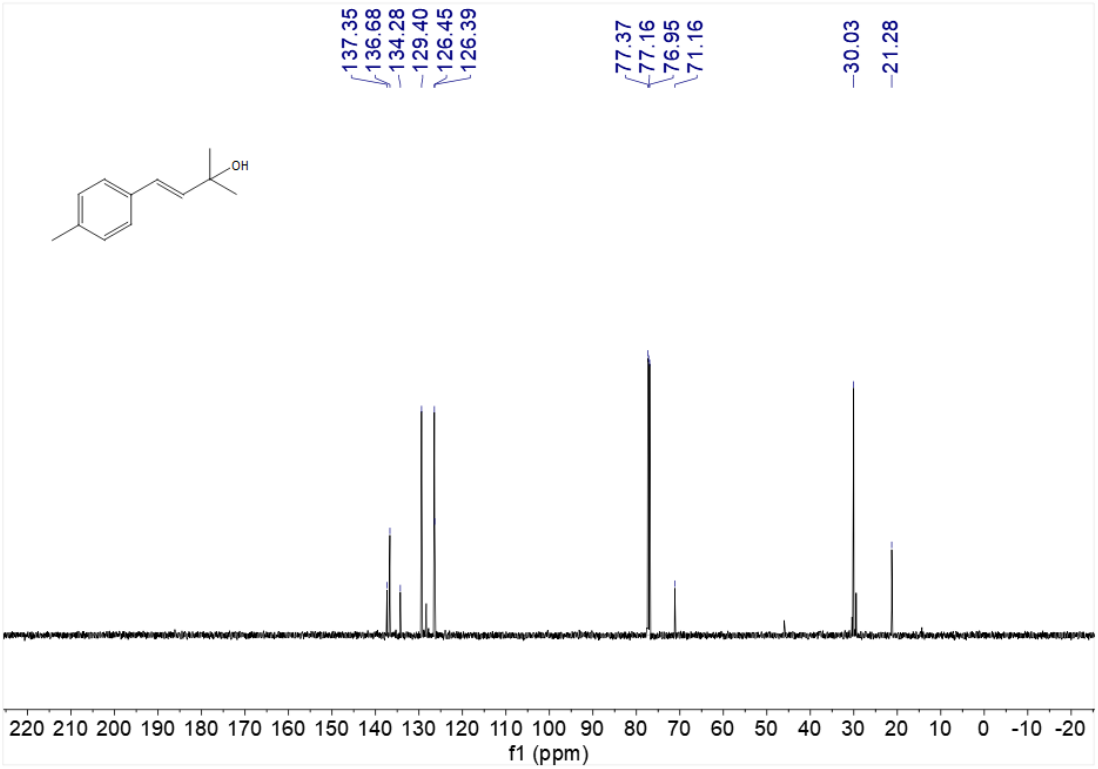
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of (*Z*)-2-methyl-4-phenylbut-3-en-2-ol (*Z*-3aa)



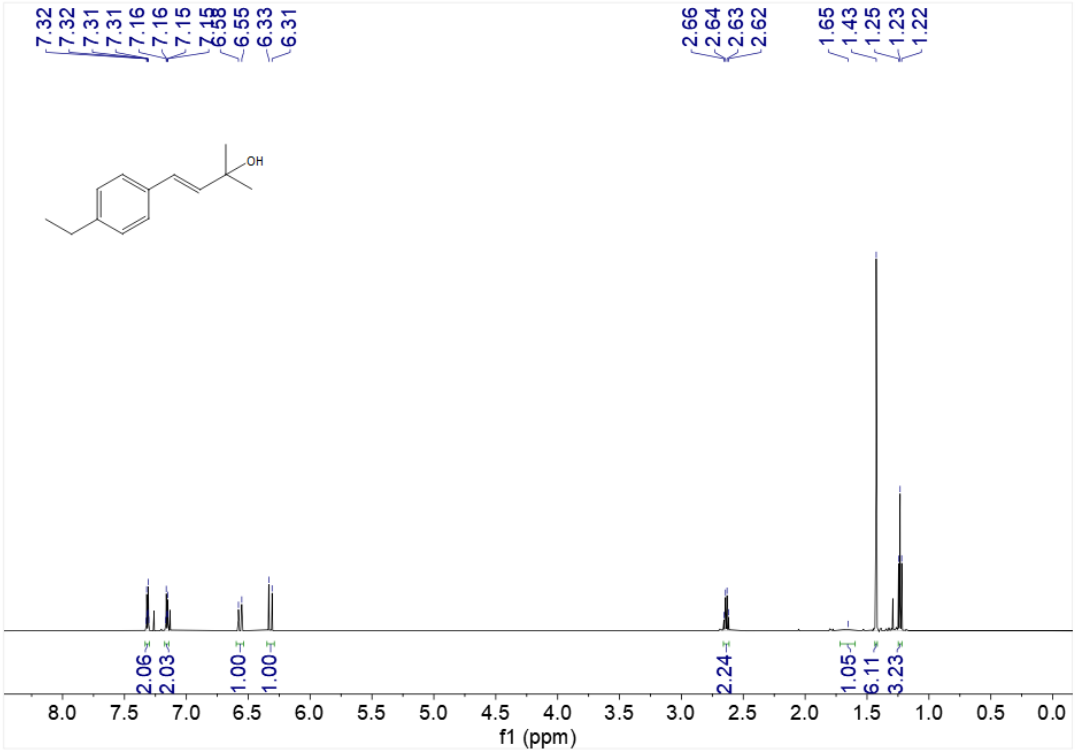
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of (*E*)-2-methyl-4-(*p*-tolyl)but-3-en-2-ol (*E*-3ba)



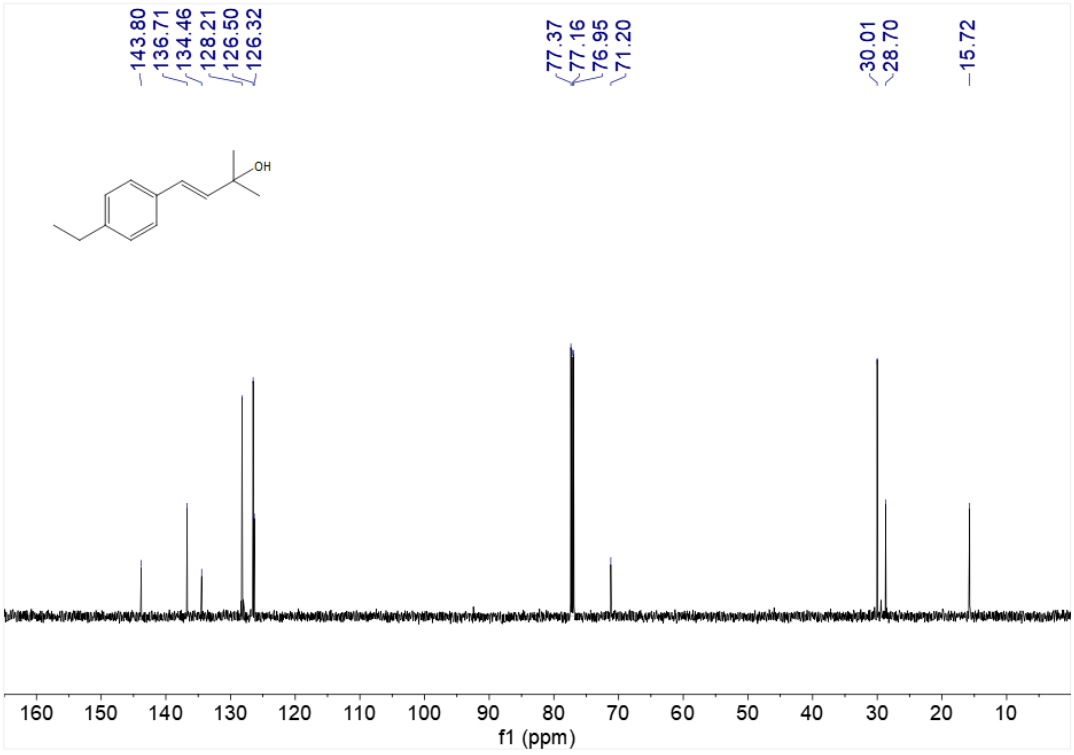
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of (*E*)-2-methyl-4-(*p*-tolyl)but-3-en-2-ol (*E*-3ba)



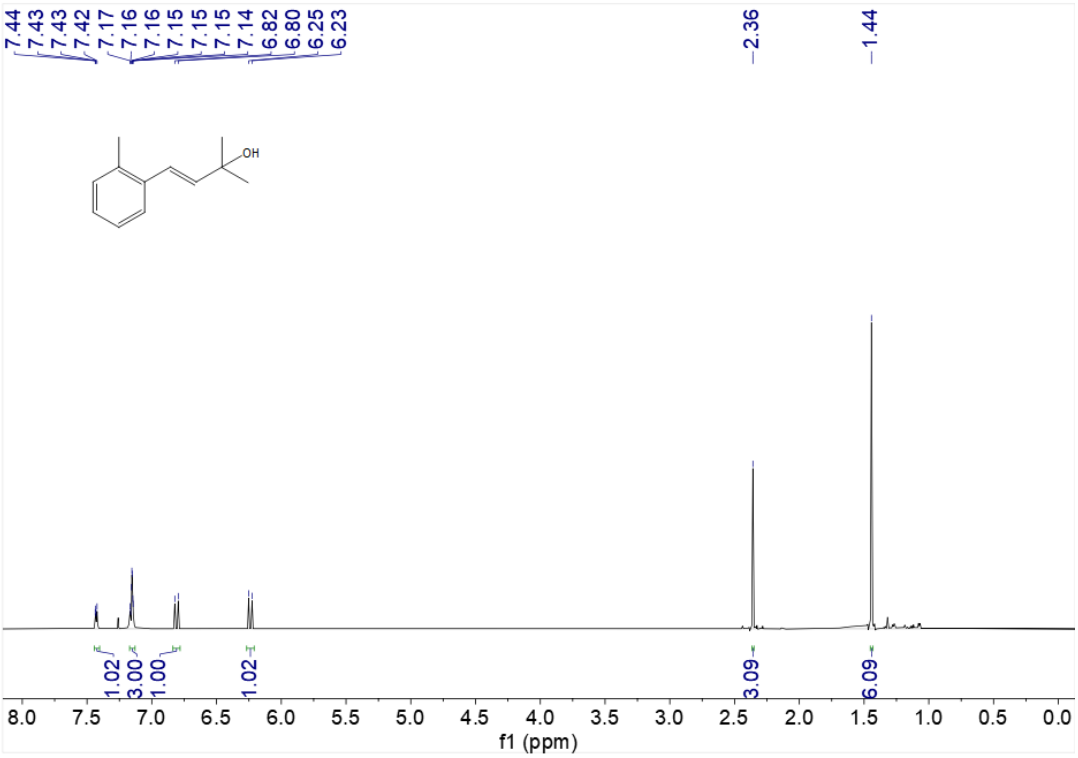
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-ethylphenyl)-2-methylbut-3-en-2-ol (*E*-3ca)



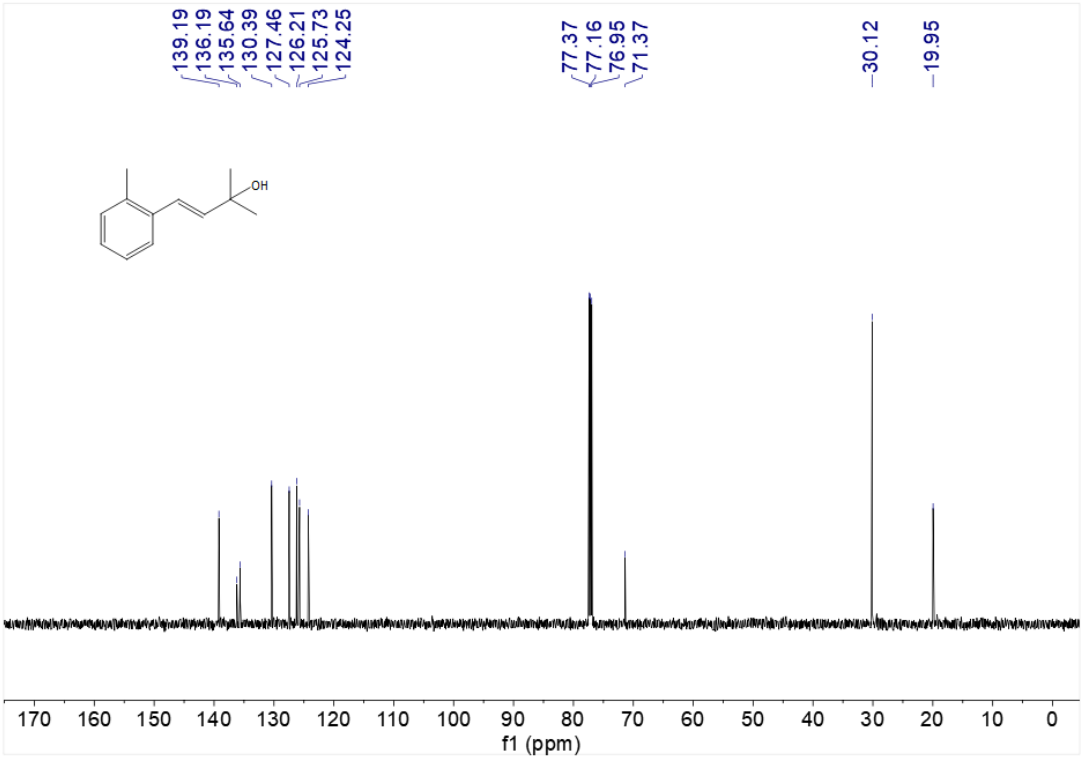
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-ethylphenyl)-2-methylbut-3-en-2-ol (*E*-3ca)



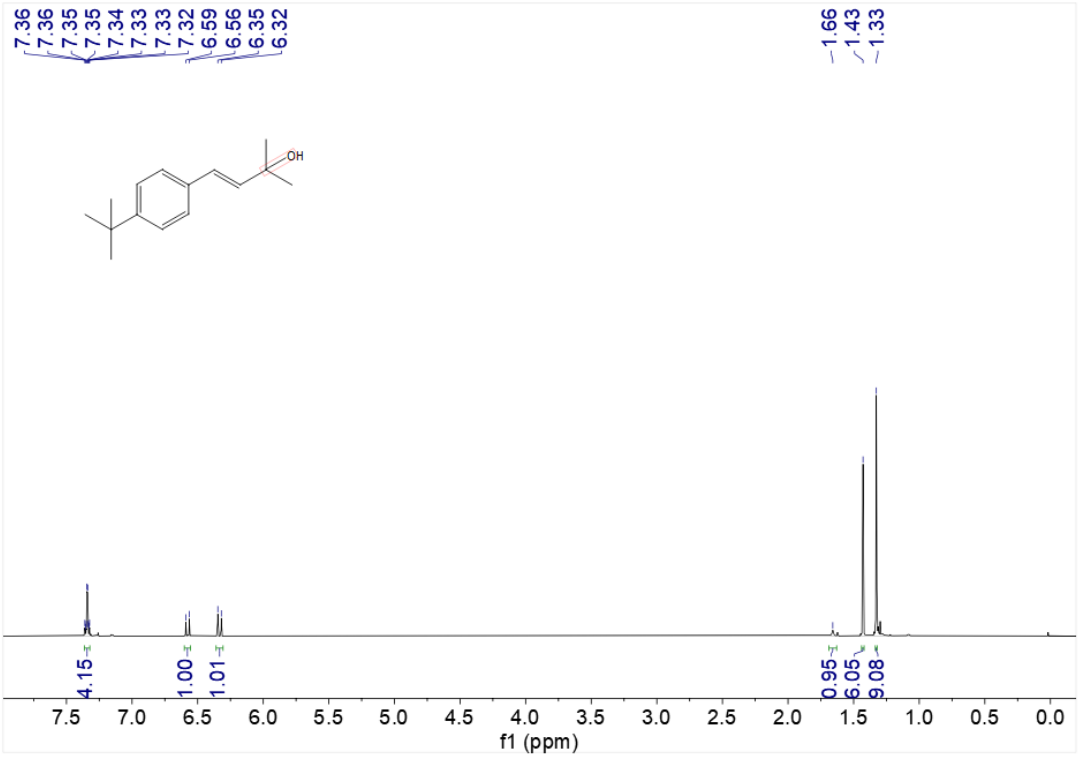
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of (*E*)-2-methyl-4-(*o*-tolyl)but-3-en-2-ol (*E*-3da)



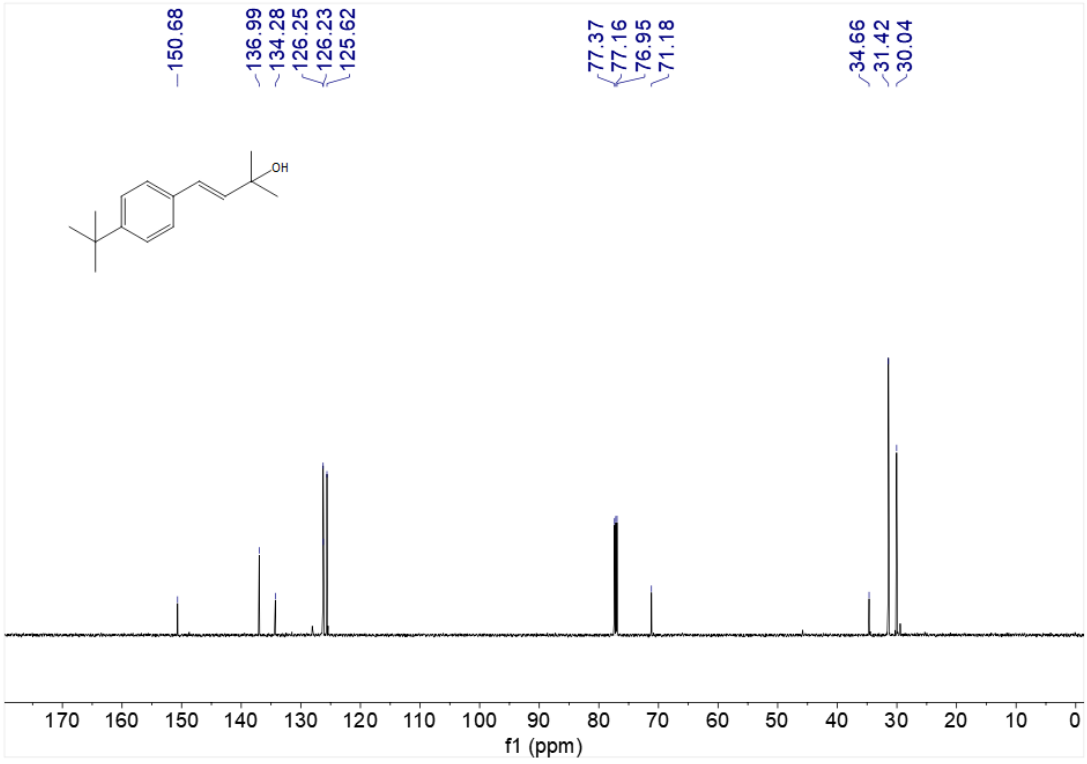
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of (*E*)-2-methyl-4-(*o*-tolyl)but-3-en-2-ol (*E*-3da)



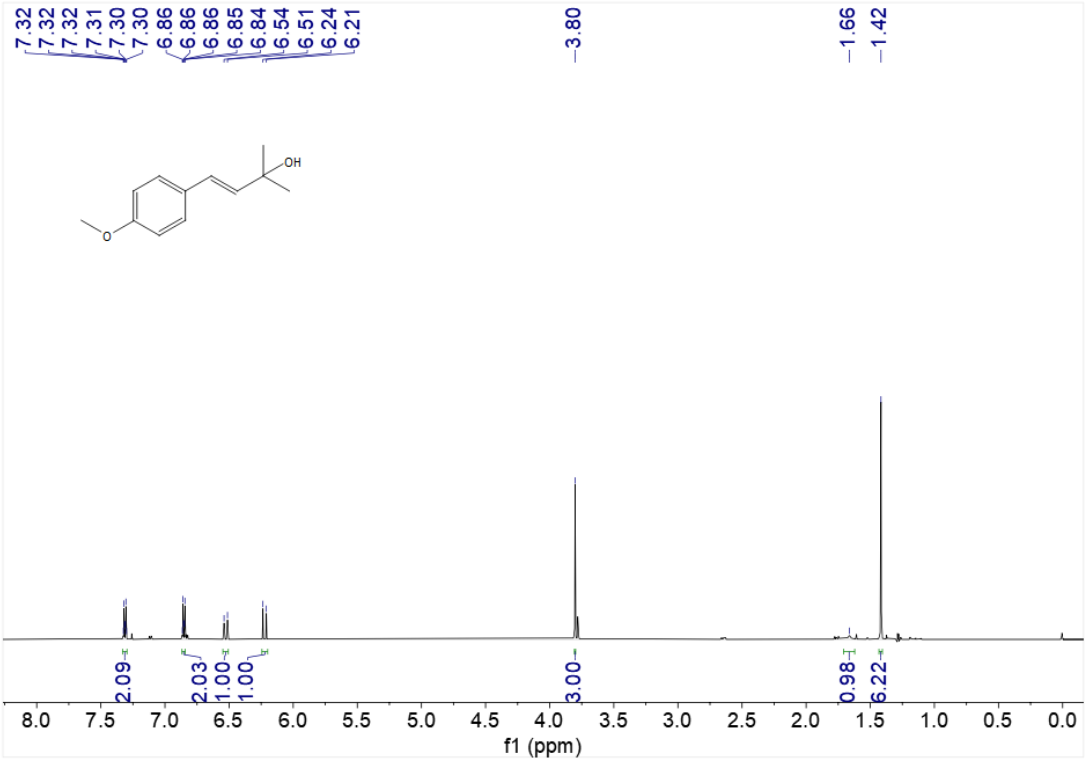
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-(tert-butyl)phenyl)-2-methylbut-3-en-2-ol (*E*-3ea)



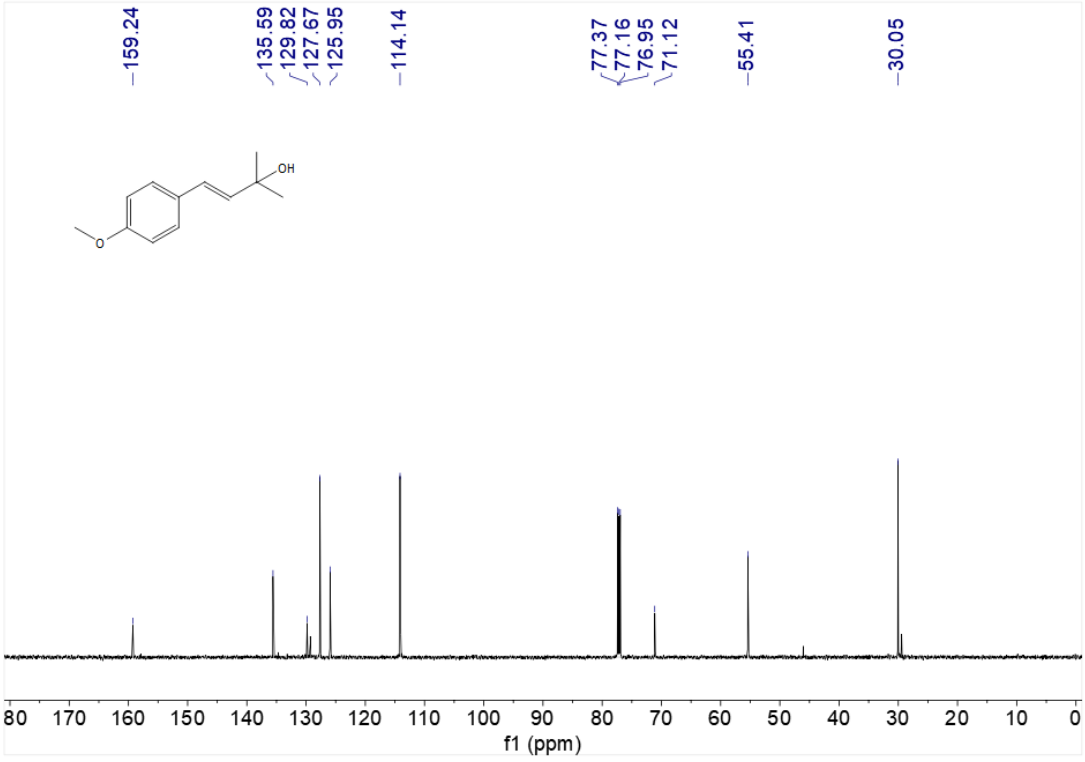
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-(tert-butyl)phenyl)-2-methylbut-3-en-2-ol (*E*-3ea)



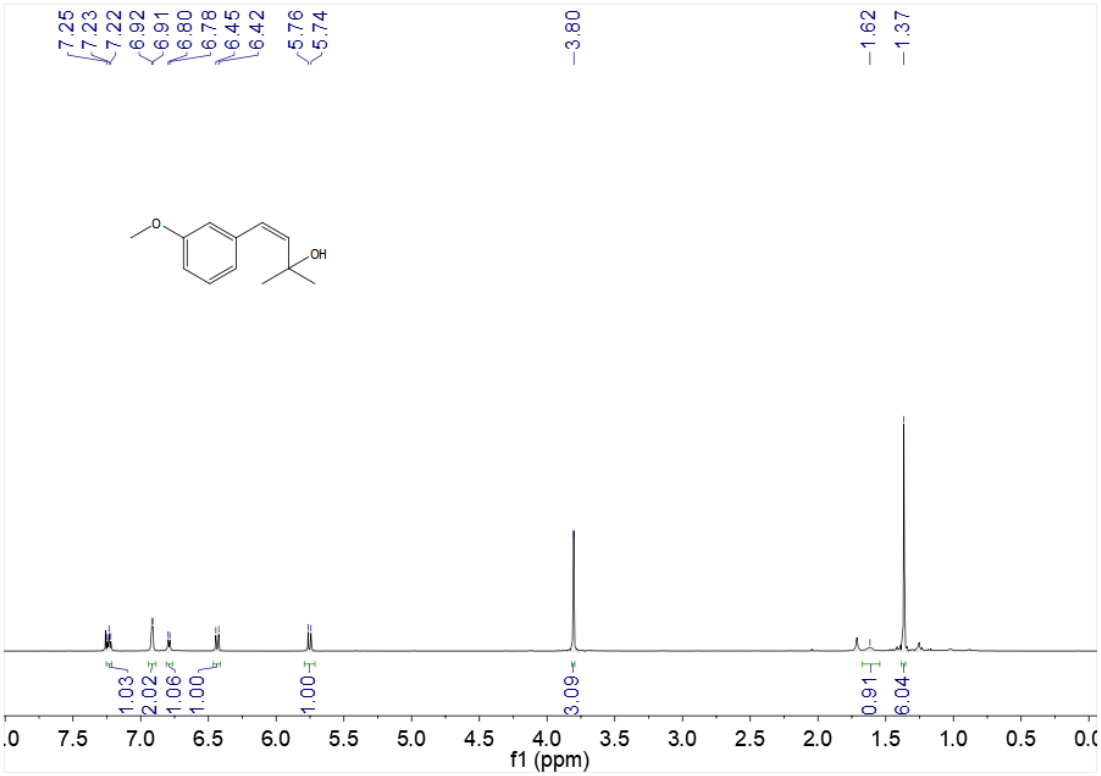
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-methoxyphenyl)-2-methylbut-3-en-2-ol (*E*-3fa)



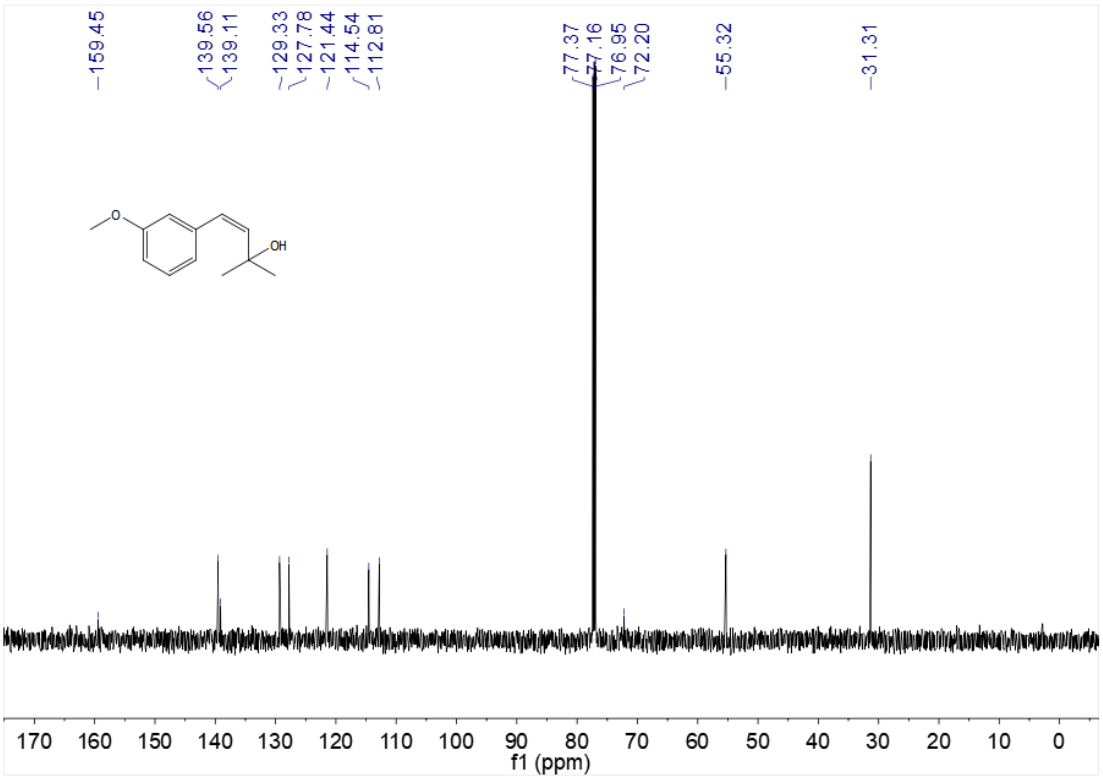
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-methoxyphenyl)-2-methylbut-3-en-2-ol (*E*-3fa)



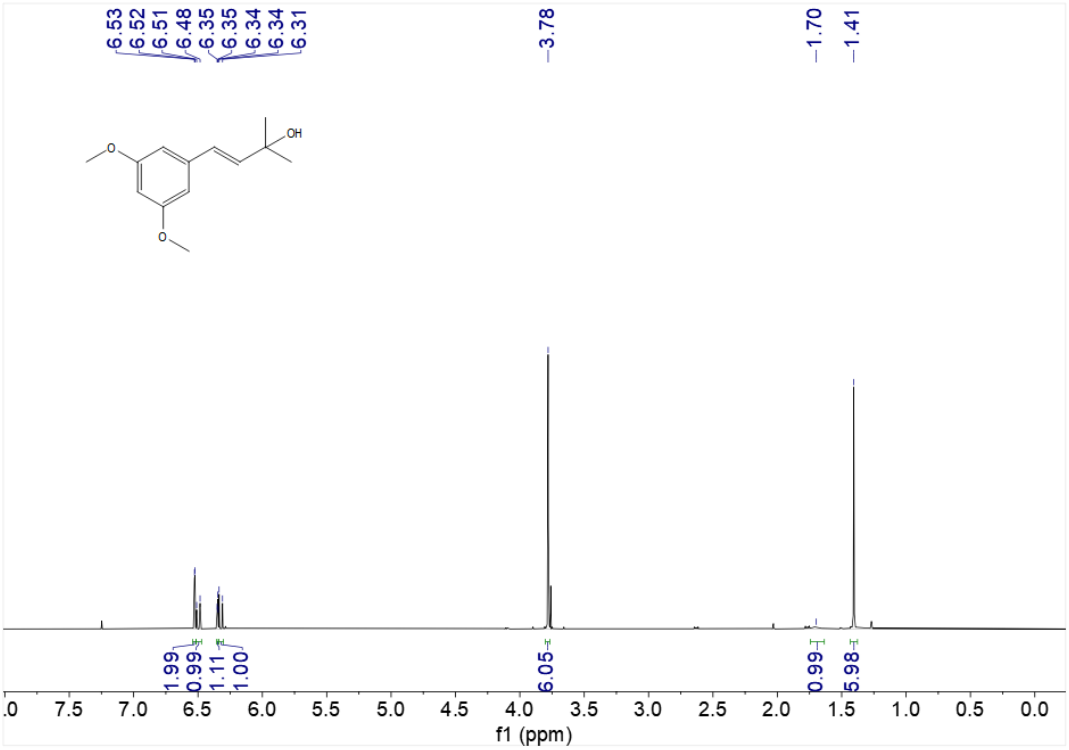
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
(*Z*)-4-(3-methoxyphenyl)-2-methylbut-3-en-2-ol (*Z*-3ga)



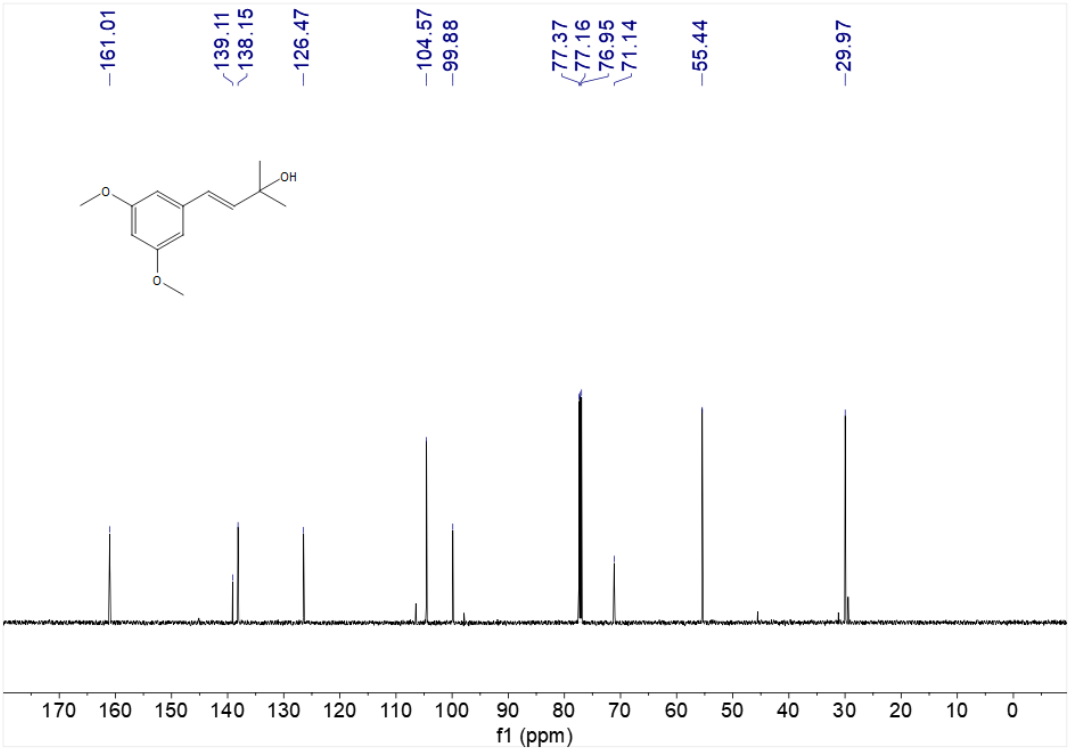
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
(*Z*)-4-(3-methoxyphenyl)-2-methylbut-3-en-2-ol (*Z*-3ga)



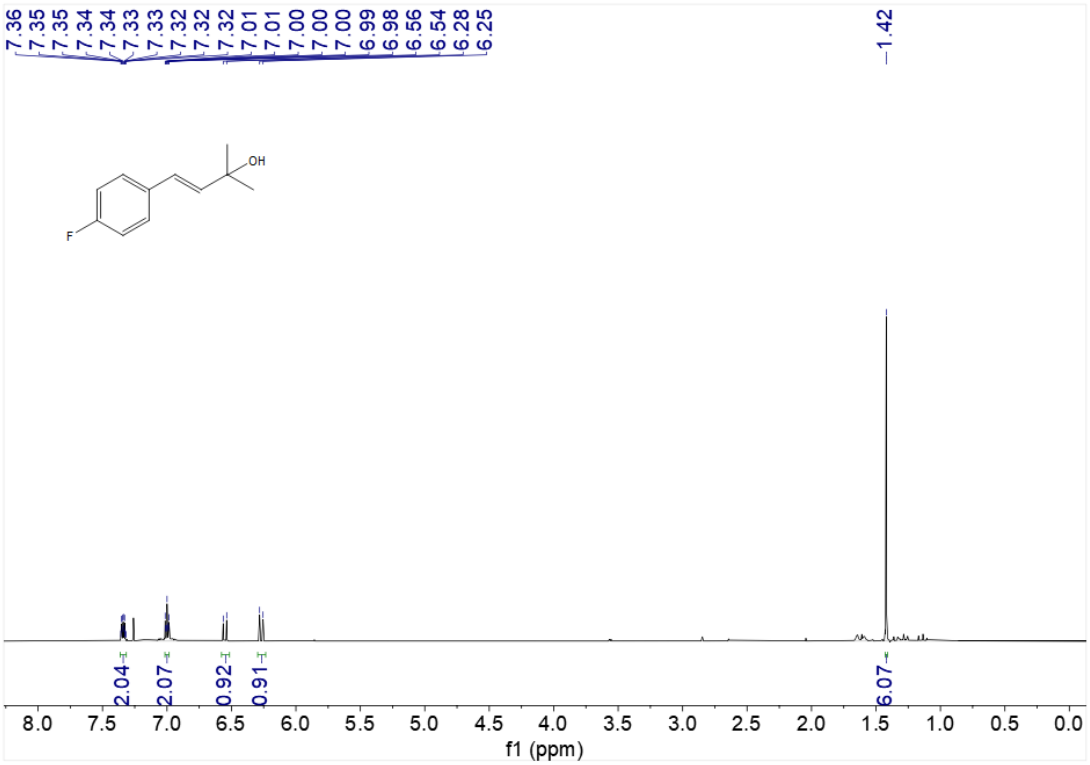
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
(*E*)-4-(3,5-dimethoxyphenyl)-2-methylbut-3-en-2-ol (*E*-3ha)



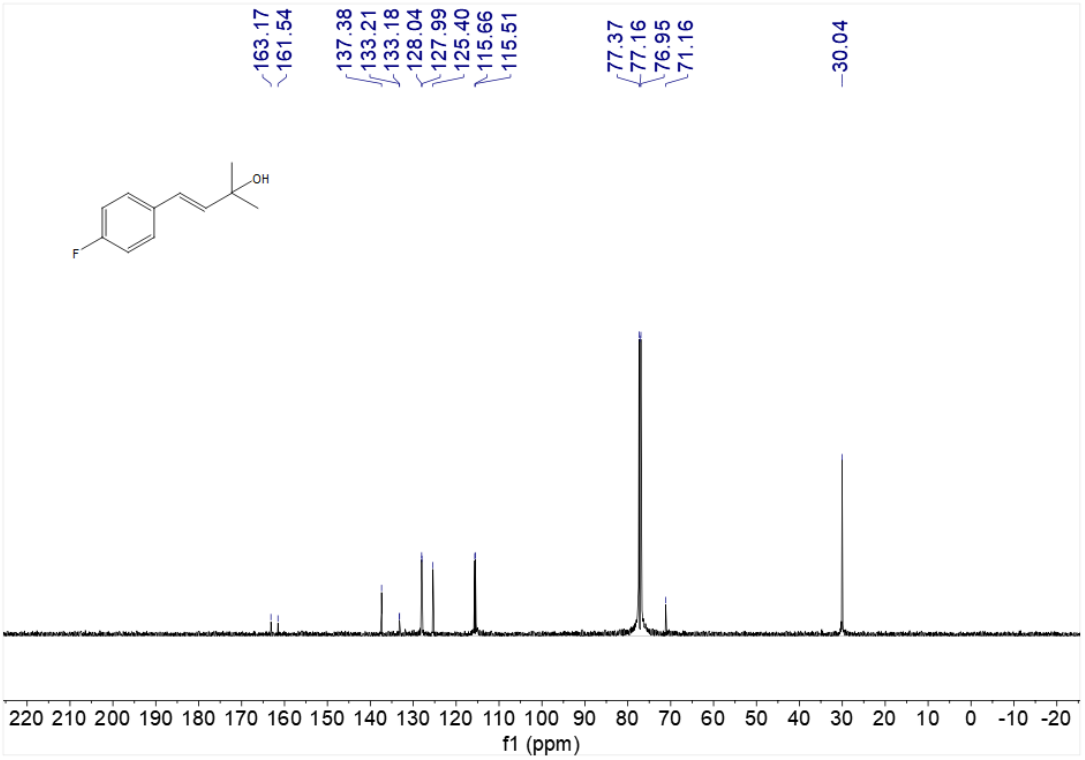
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
(*E*)-4-(3,5-dimethoxyphenyl)-2-methylbut-3-en-2-ol (*E*-3ha)



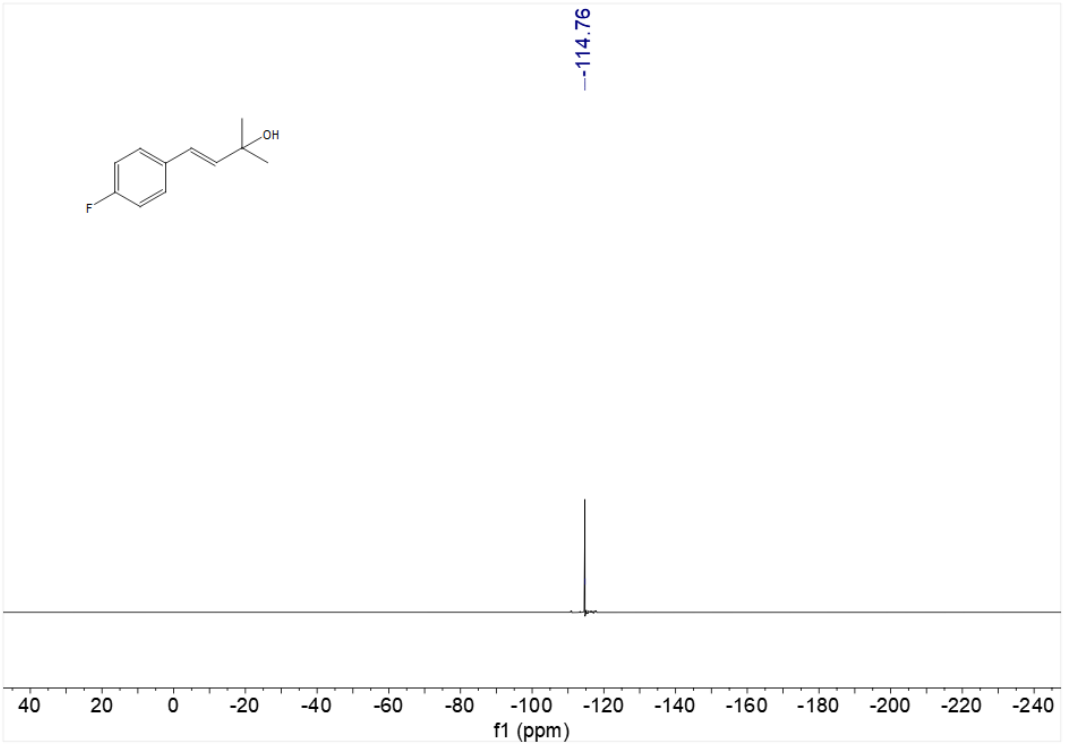
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-fluorophenyl)-2-methylbut-3-en-2-ol (*E*-3ia)



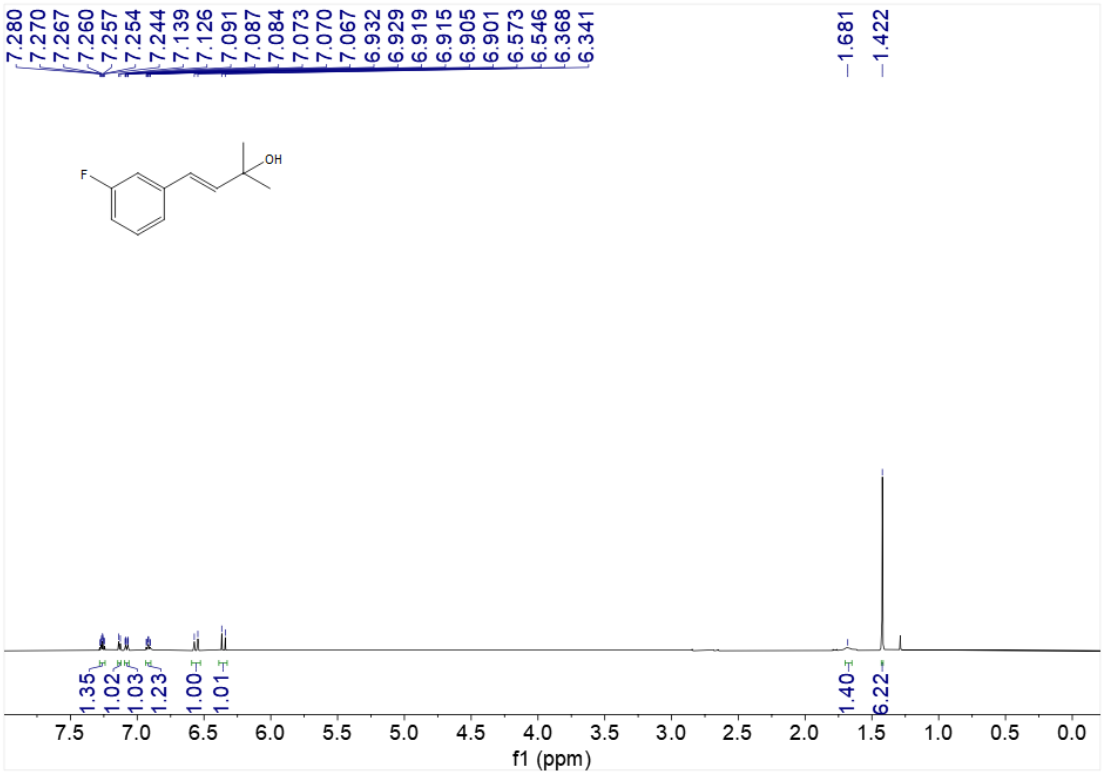
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-fluorophenyl)-2-methylbut-3-en-2-ol (*E*-3ia)



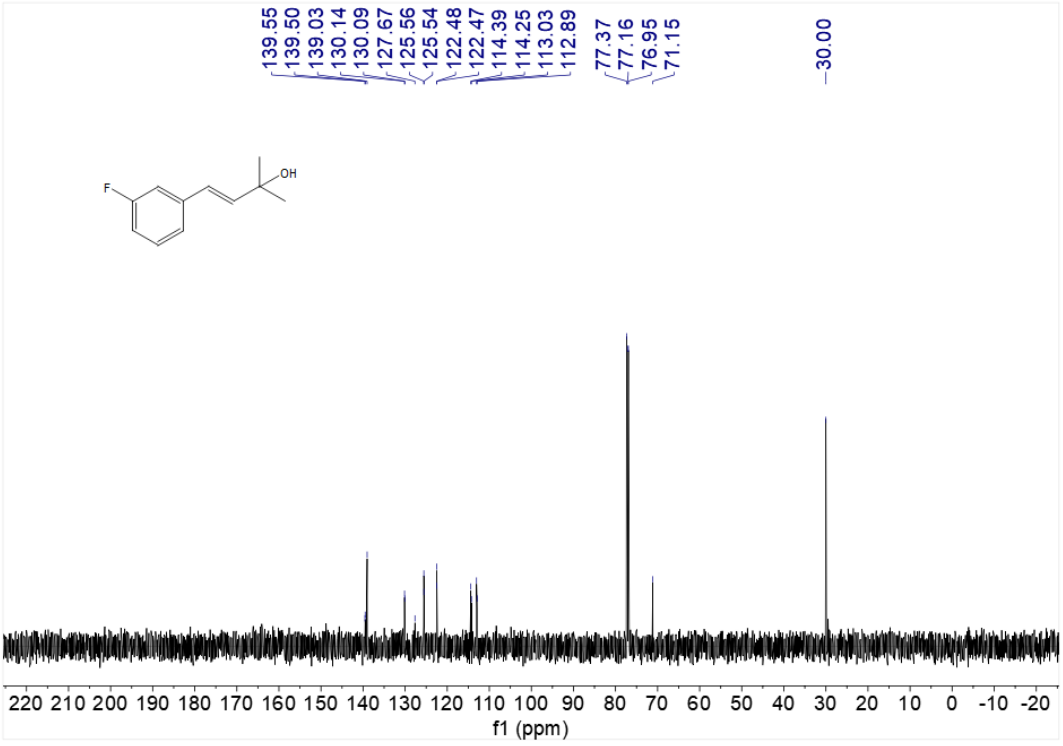
^{19}F NMR (565 MHz, $CDCl_3$) spectrum of
(*E*)-4-(4-fluorophenyl)-2-methylbut-3-en-2-ol (*E*-3ia)



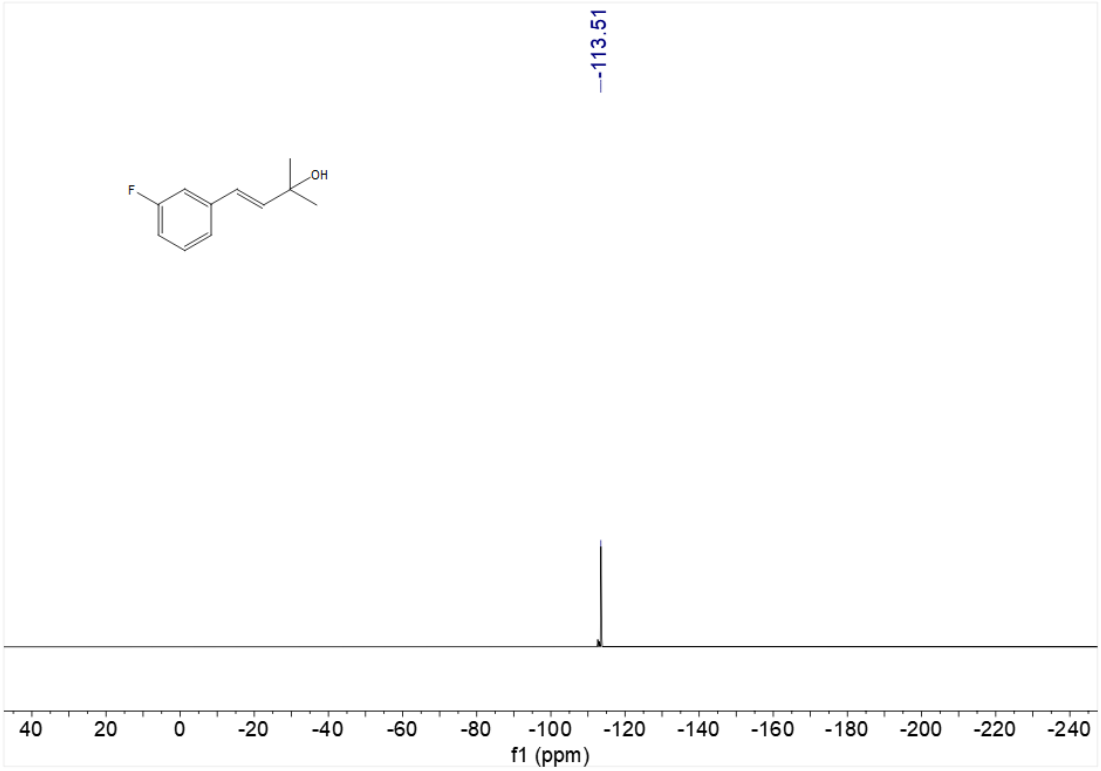
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
(*E*)-4-(3-fluorophenyl)-2-methylbut-3-en-2-ol (*E*-3ja)



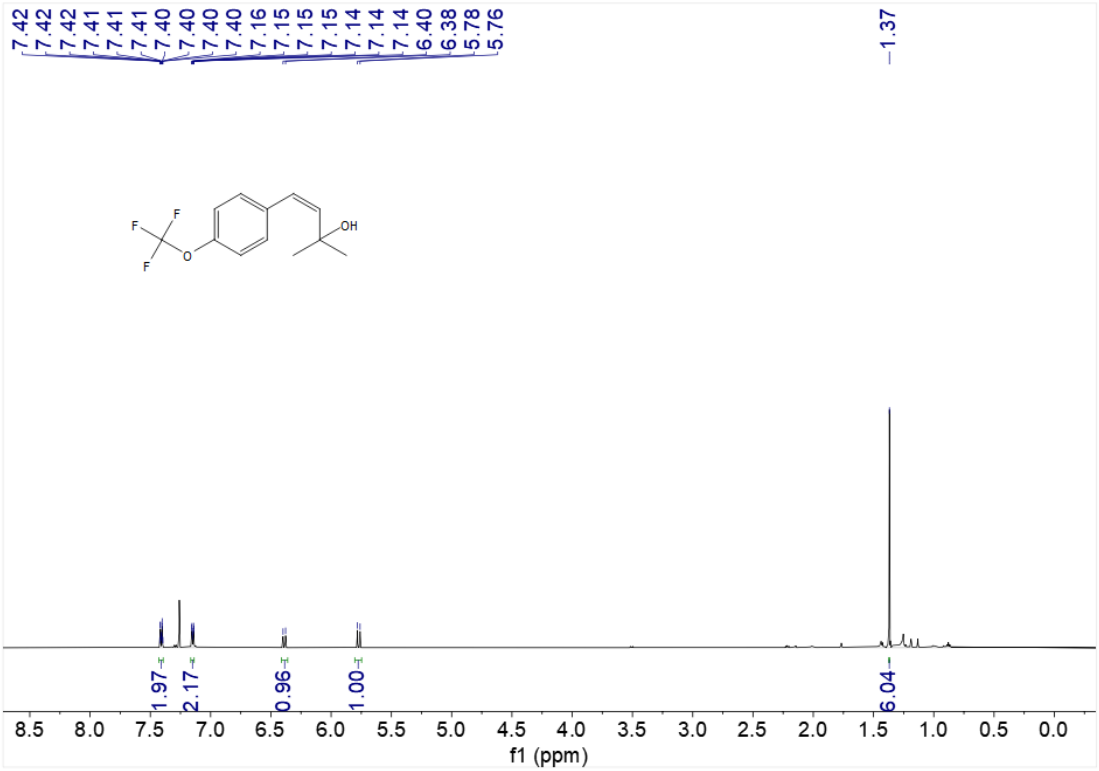
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
(*E*)-4-(3-fluorophenyl)-2-methylbut-3-en-2-ol (*E*-3ja)



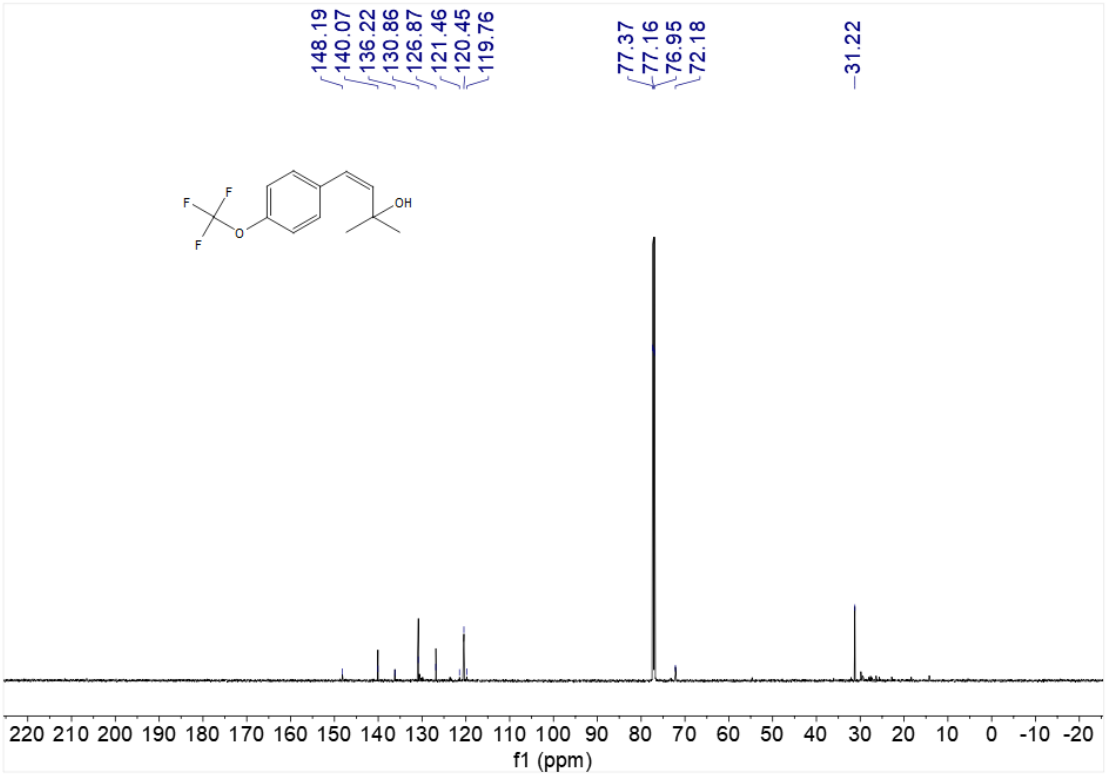
^{19}F NMR (565 MHz, $CDCl_3$) spectrum of (*E*)-4-(3-fluorophenyl)-2-methylbut-3-en-2-ol (*E*-3ja)



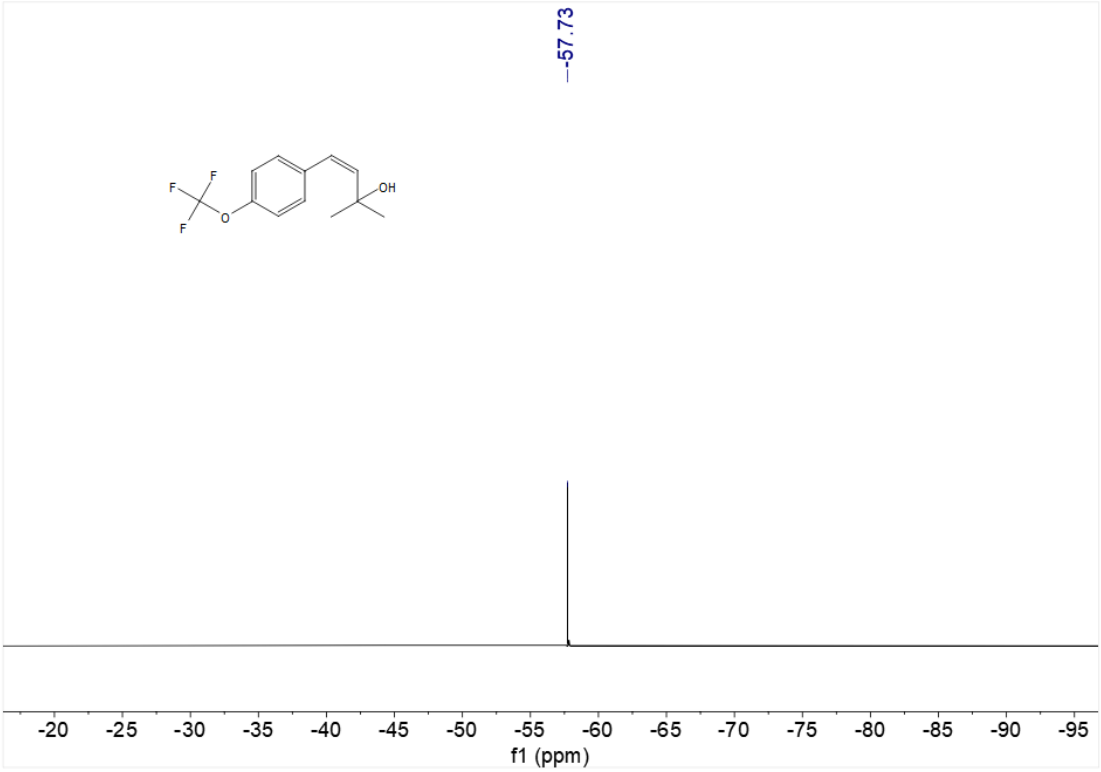
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
(*Z*)-2-methyl-4-(4-(trifluoromethoxy)phenyl)but-3-en-2-ol (*Z*-3ka)



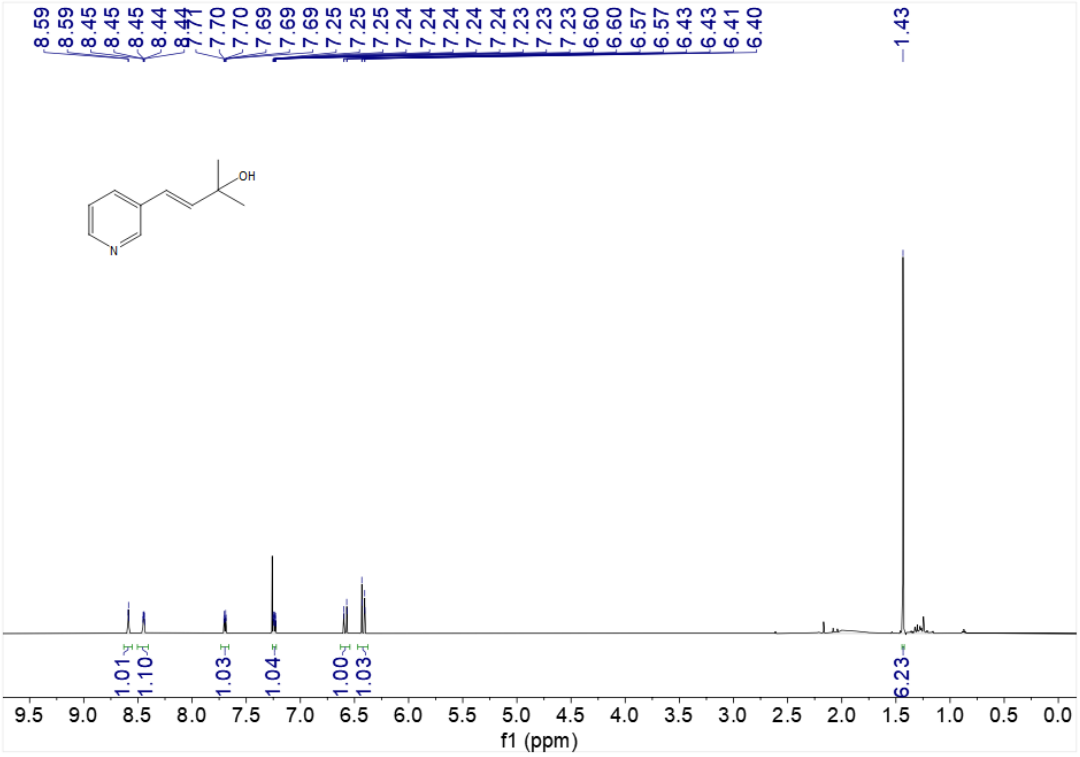
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
(*Z*)-2-methyl-4-(4-(trifluoromethoxy)phenyl)but-3-en-2-ol (Z-3ka)



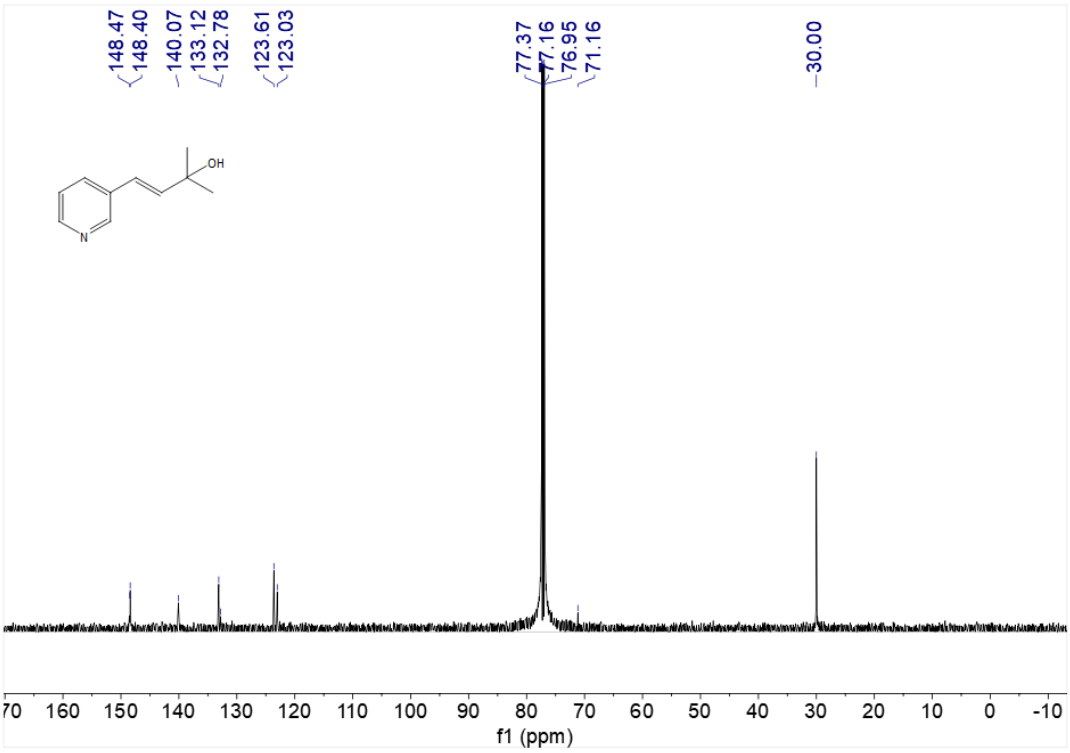
^{19}F NMR (565 MHz, $CDCl_3$) spectrum of (*Z*)-2-methyl-4-(4-(trifluoromethoxy)phenyl)but-3-en-2-ol (*Z*-3ka)



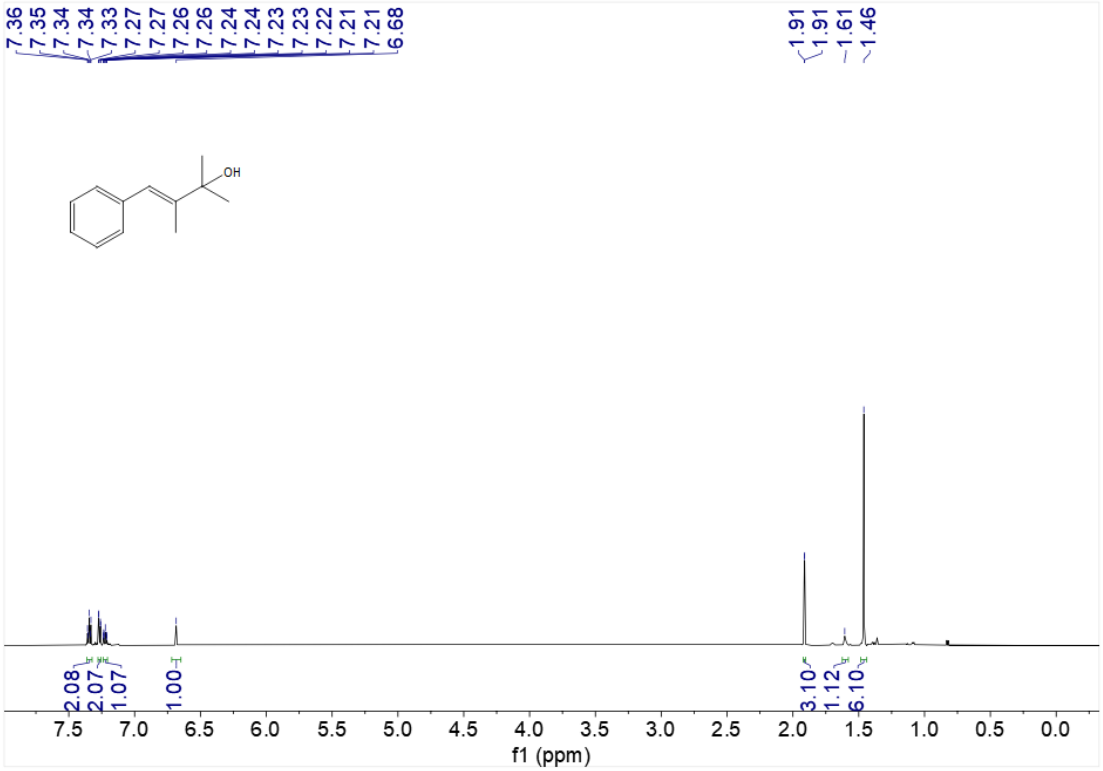
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-2-methyl-4-(pyridin-3-yl)but-3-en-2-ol (*E*-3la)



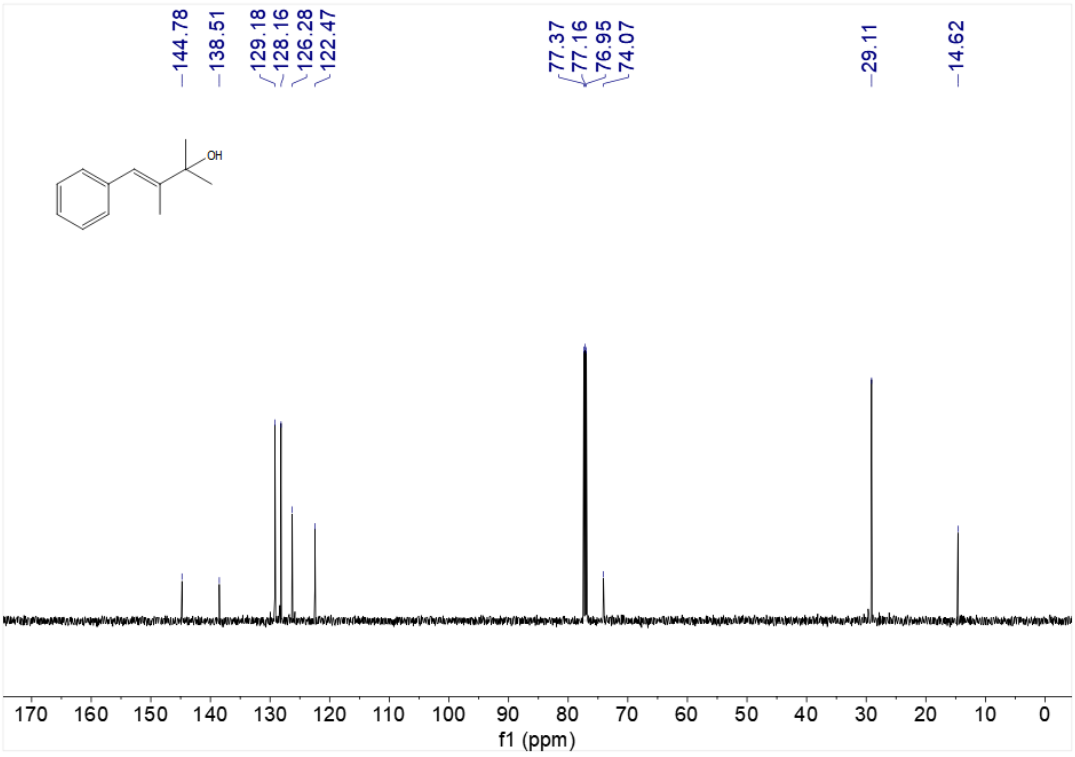
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-2-methyl-4-(pyridin-3-yl)but-3-en-2-ol (*E*-3la)



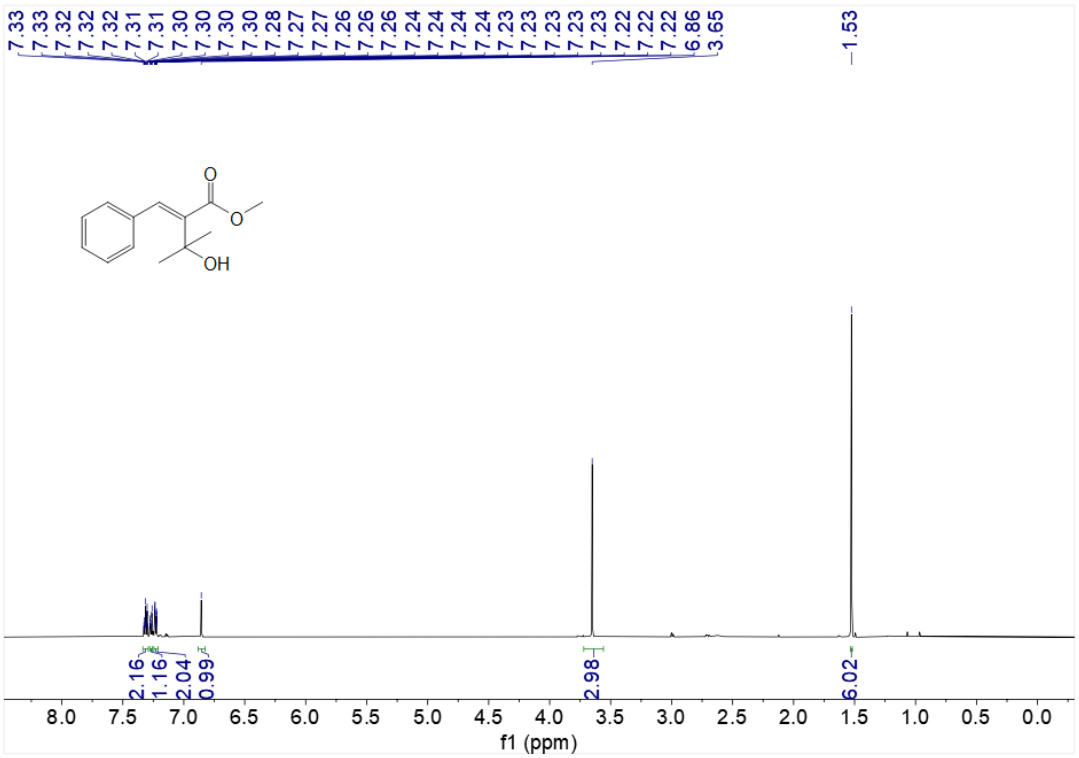
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-2,3-dimethyl-4-phenylbut-3-en-2-ol (*E*-3ma)



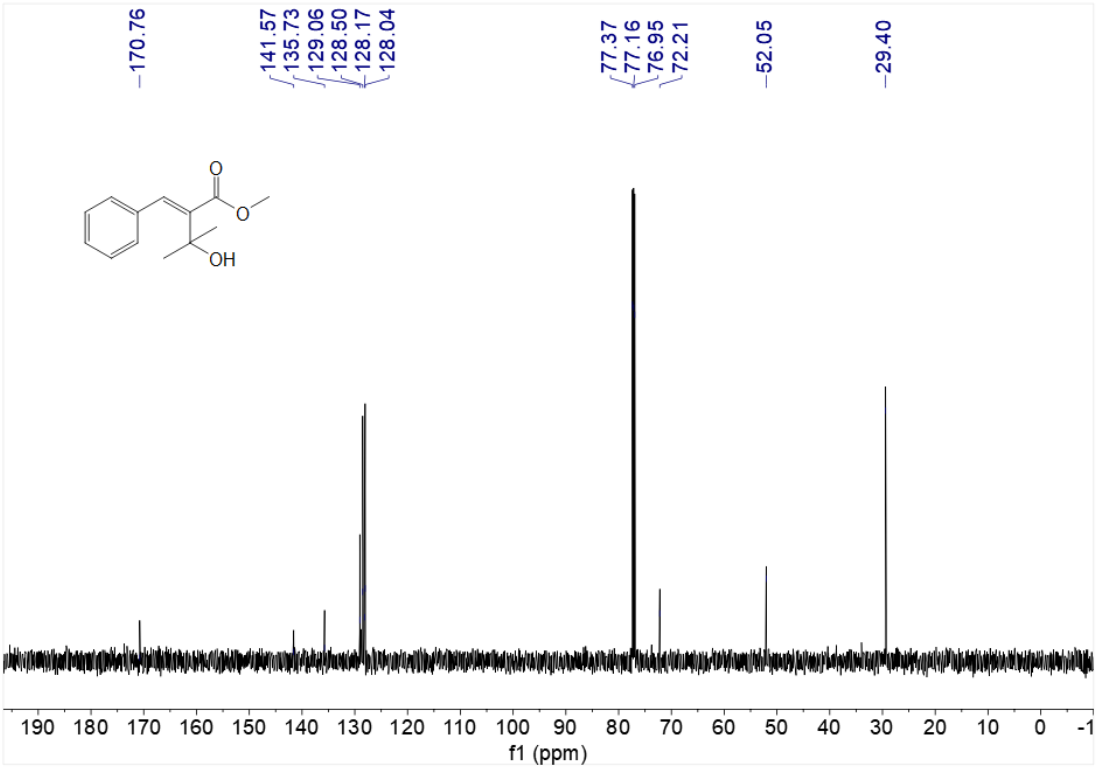
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-2,3-dimethyl-4-phenylbut-3-en-2-ol (*E*-3ma)



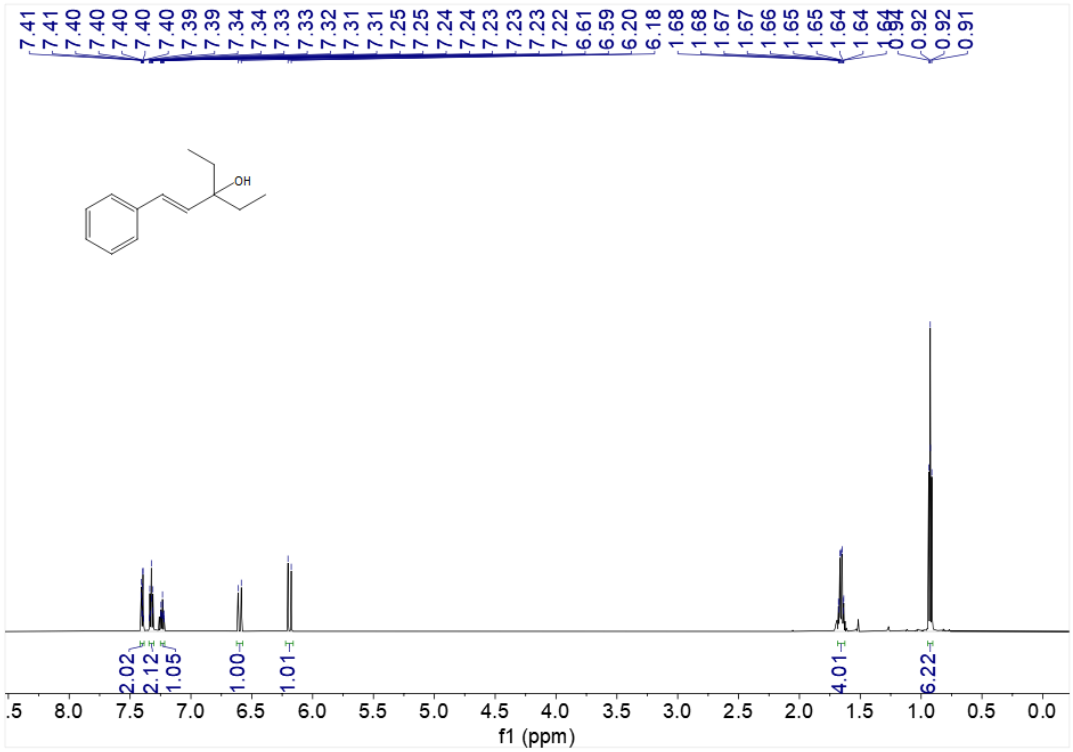
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl methyl (*E*)-2-benzylidene-3-hydroxy-3-methylbutanoate (*E*-3na)



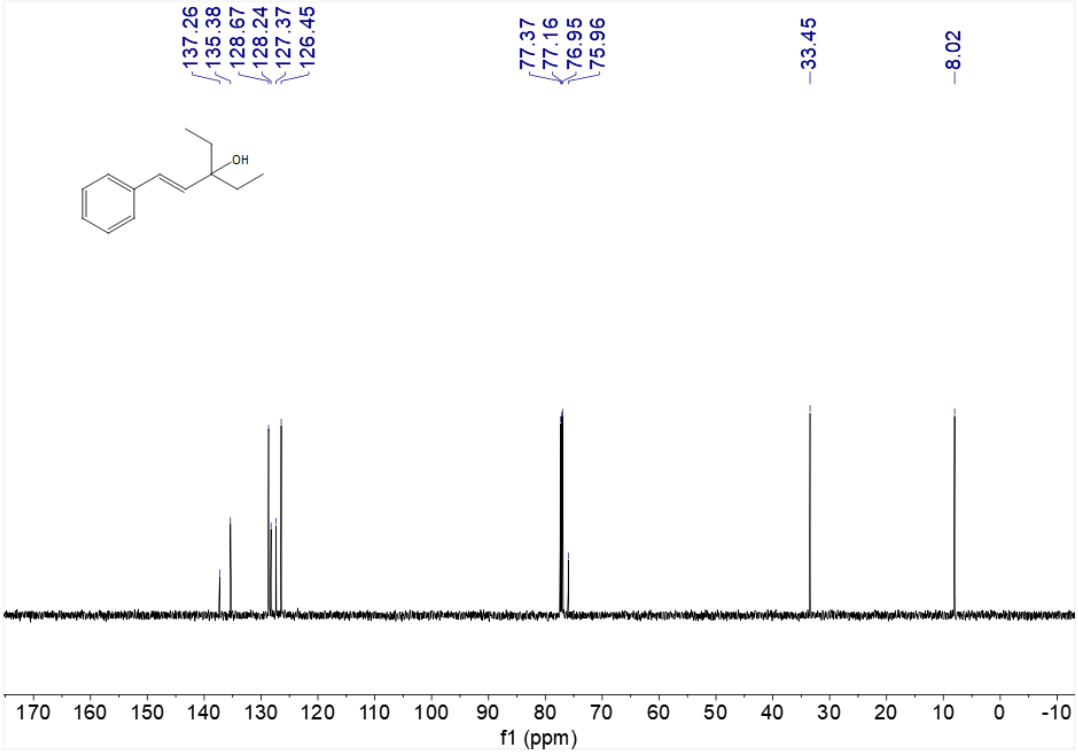
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl methyl (*E*)-2-benzylidene-3-hydroxy-3-methylbutanoate (*E*-3na)



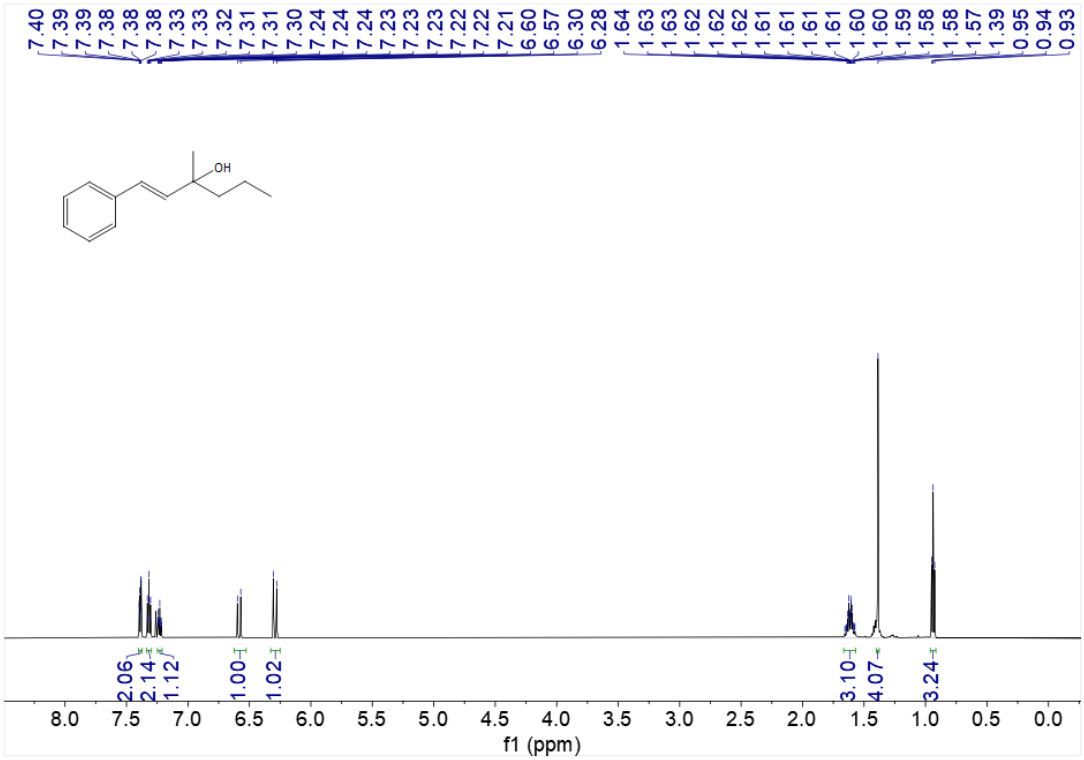
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-3-ethyl-1-phenylpent-1-en-3-ol (*E*-3ab)



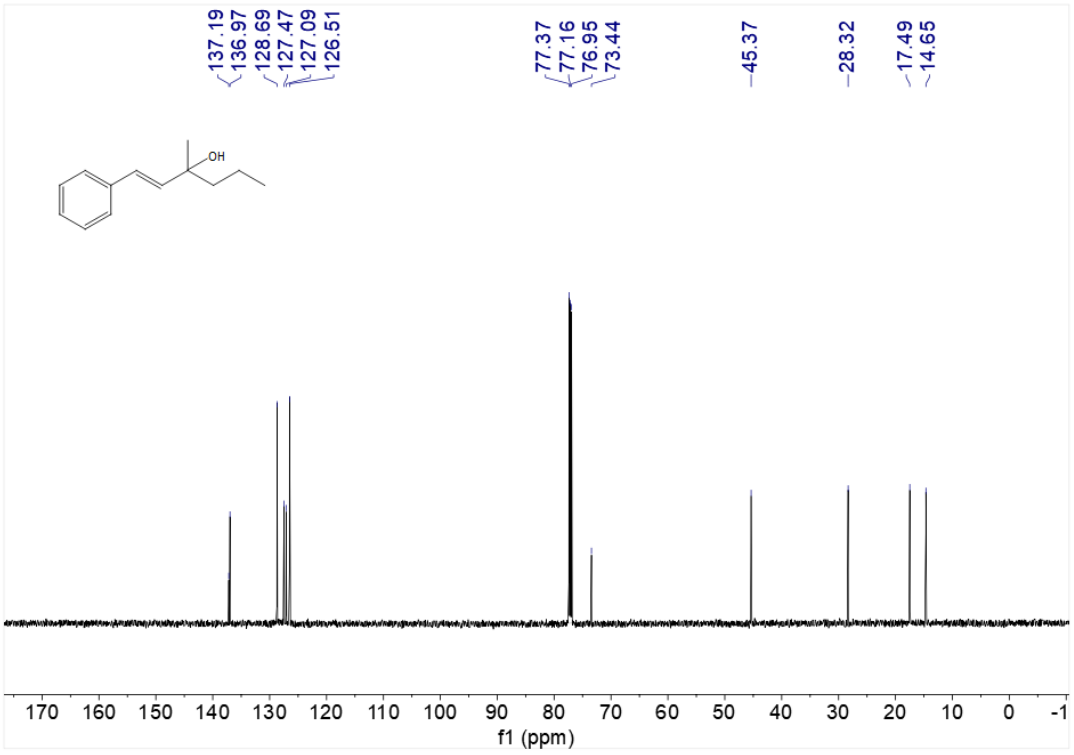
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-3-ethyl-1-phenylpent-1-en-3-ol (*E*-3ab)



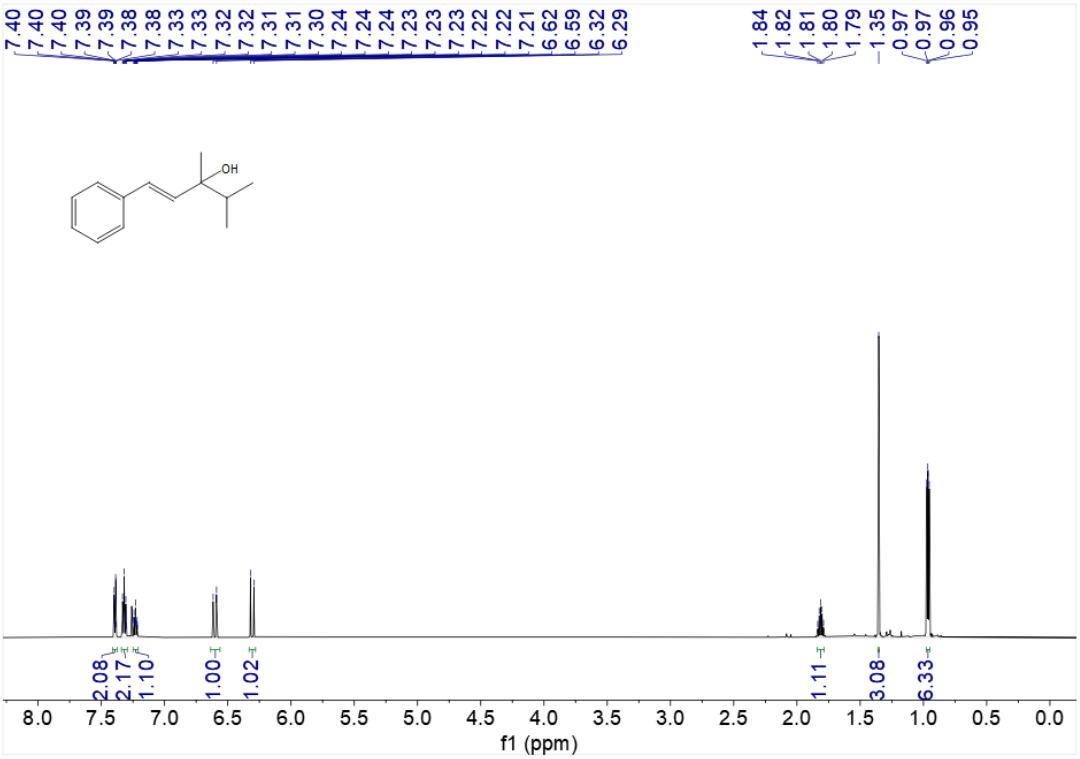
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl methyl (*E*)-3-methyl-1-phenylhex-1-en-3-ol (*E*-3ac)



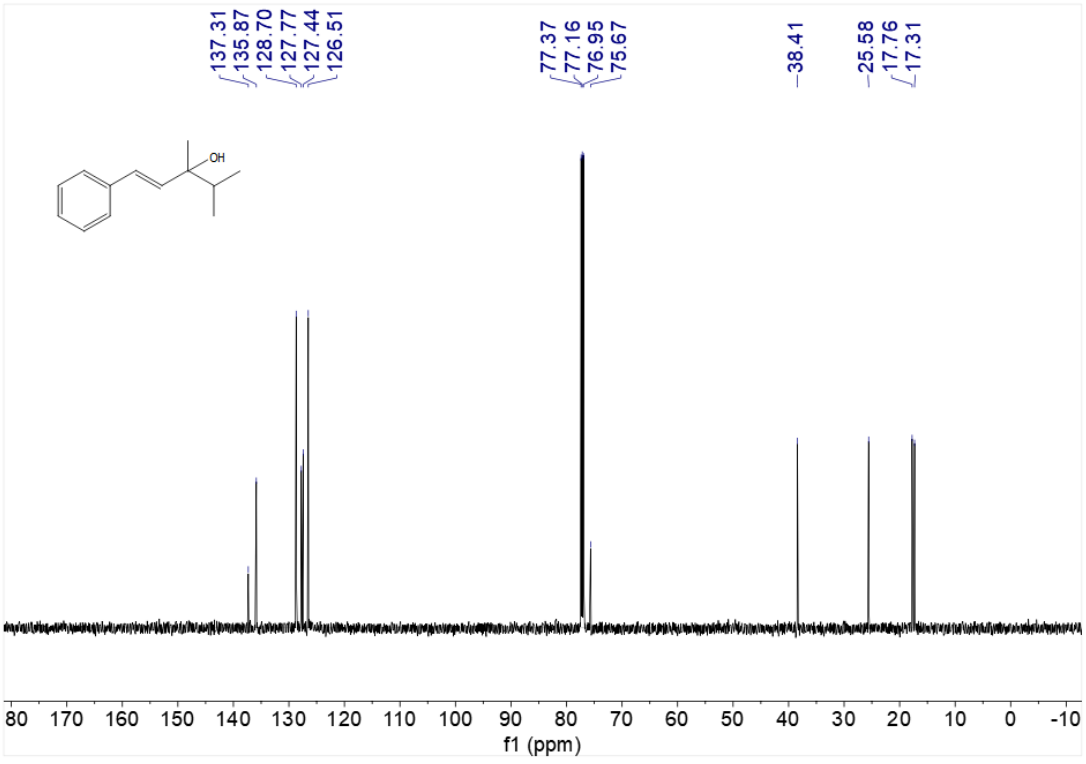
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl methyl (*E*)-3-methyl-1-phenylhex-1-en-3-ol (*E*-3ac)



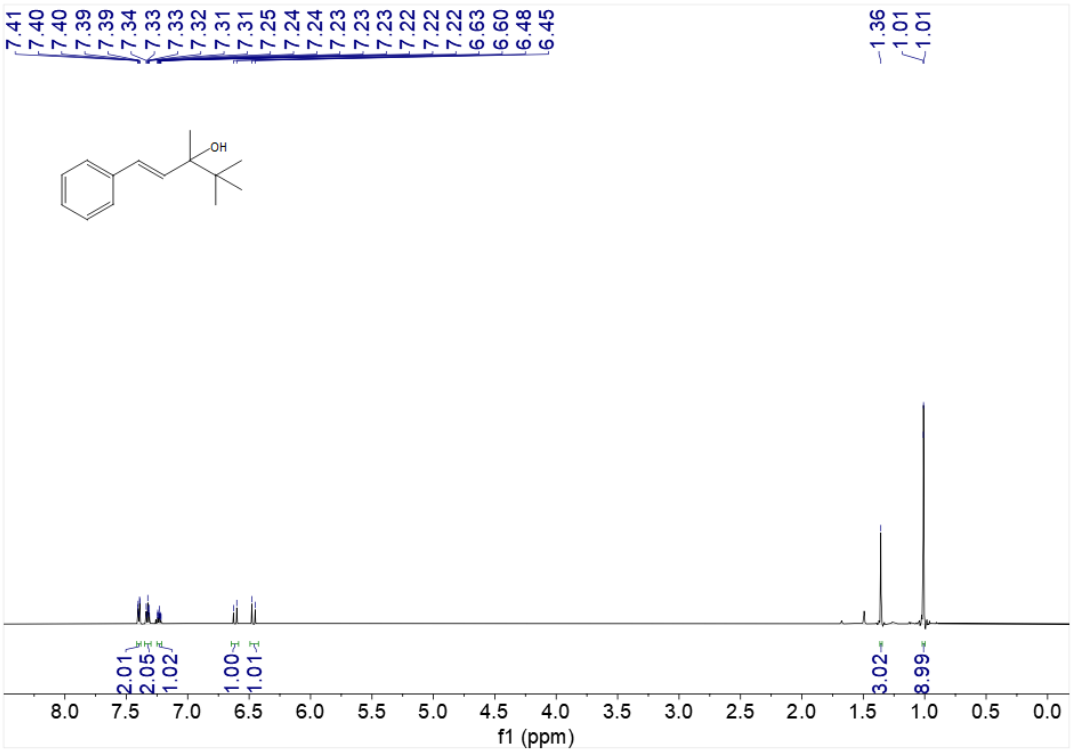
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-3,4-dimethyl-1-phenylpent-1-en-3-ol (*E*-3ad)



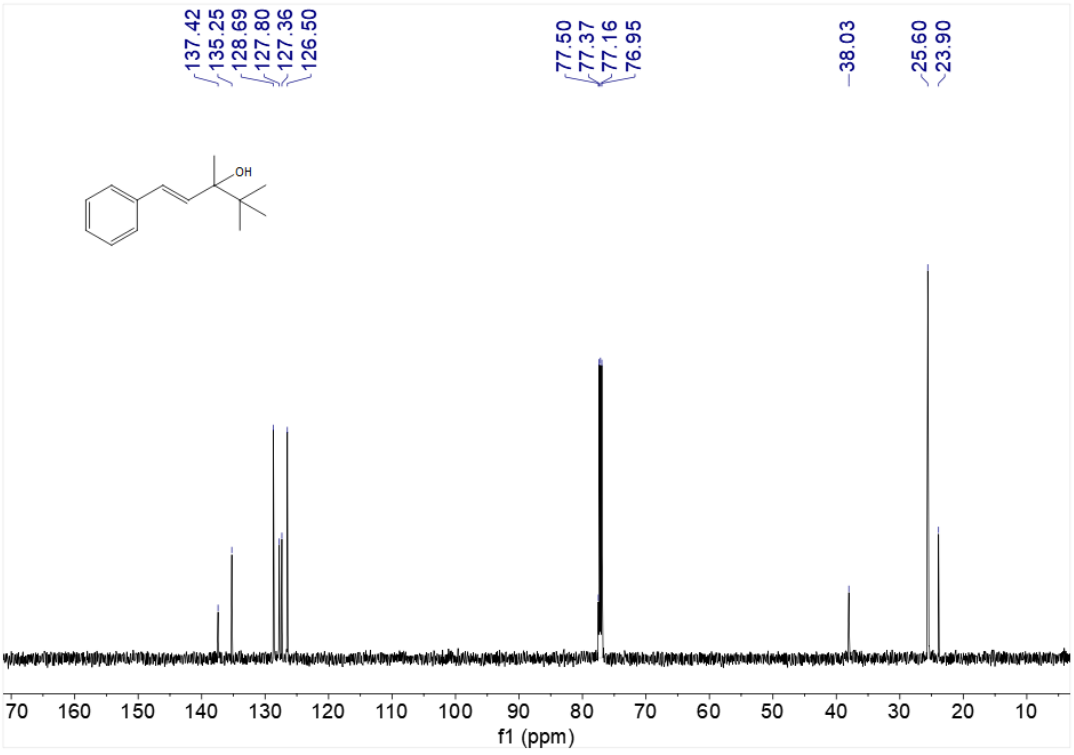
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-3,4-dimethyl-1-phenylpent-1-en-3-ol (*E*-3ad)



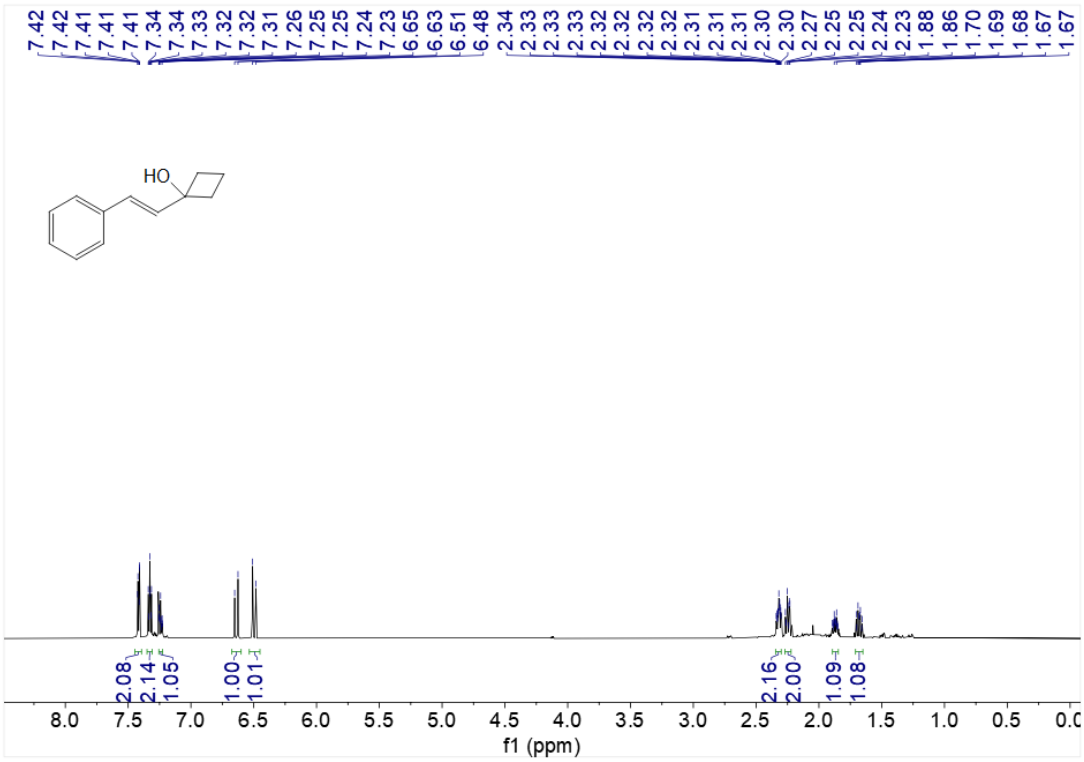
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-3,4,4-trimethyl-1-phenylpent-1-en-3-ol (*E*-3ae)



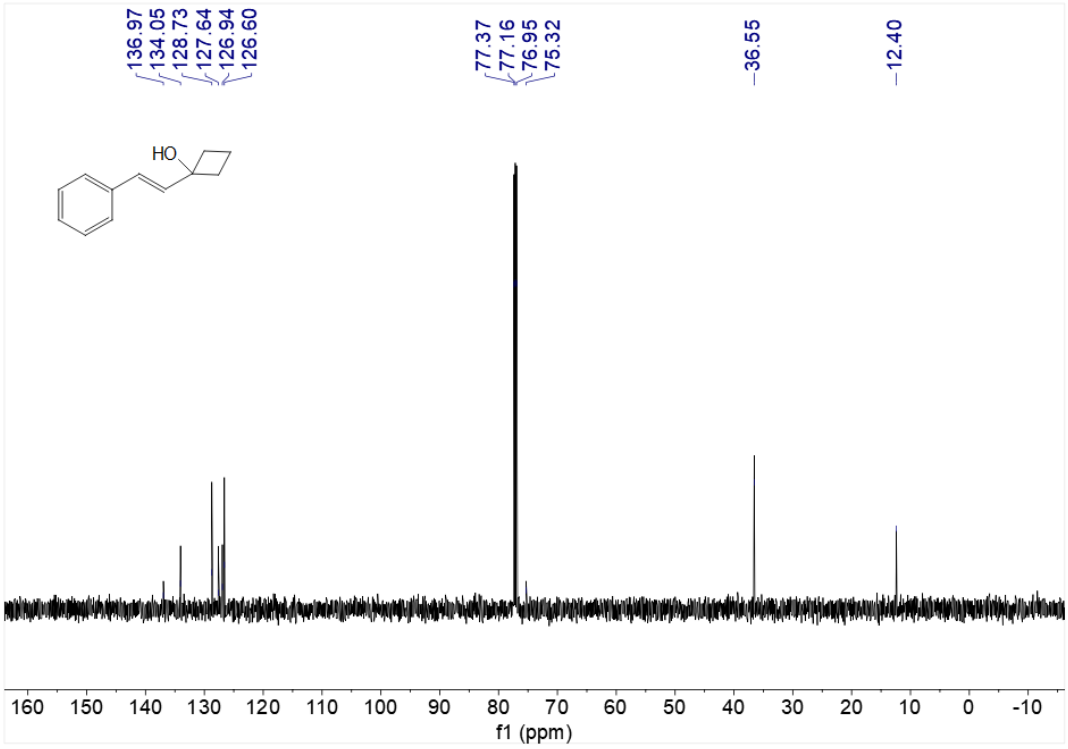
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-3,4,4-trimethyl-1-phenylpent-1-en-3-ol (*E*-3ae)



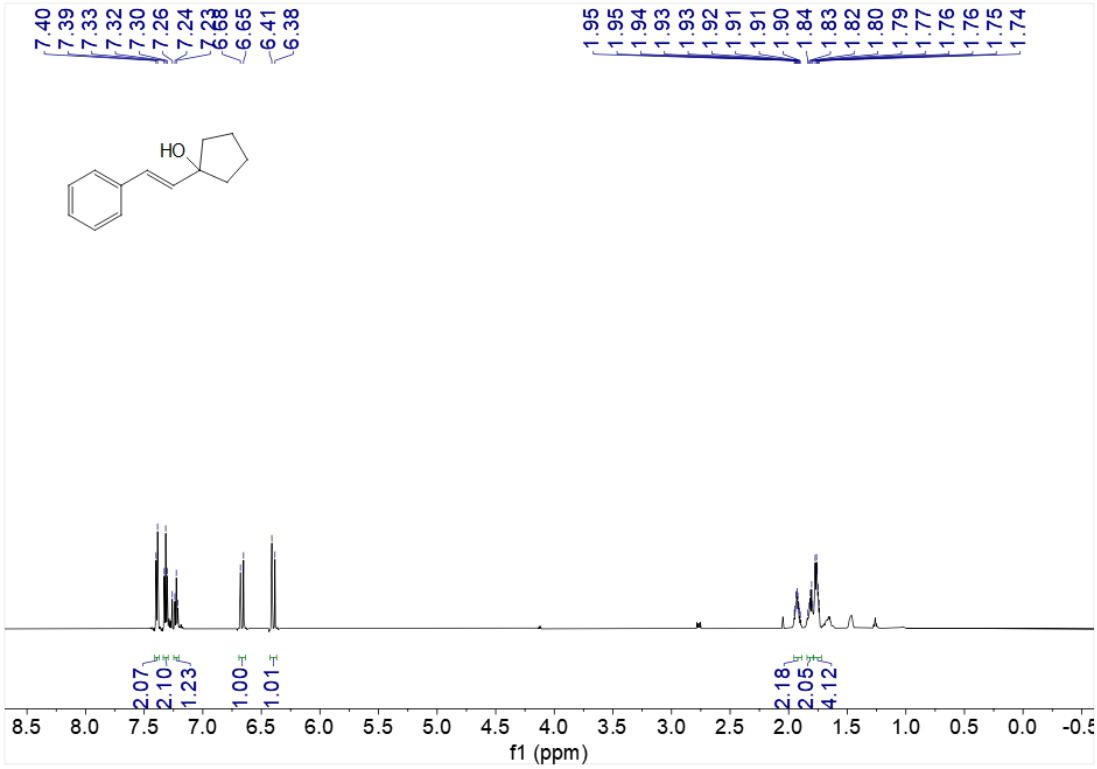
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl methyl (*E*)-1-styrylcyclobutan-1-ol (*E*-3af)



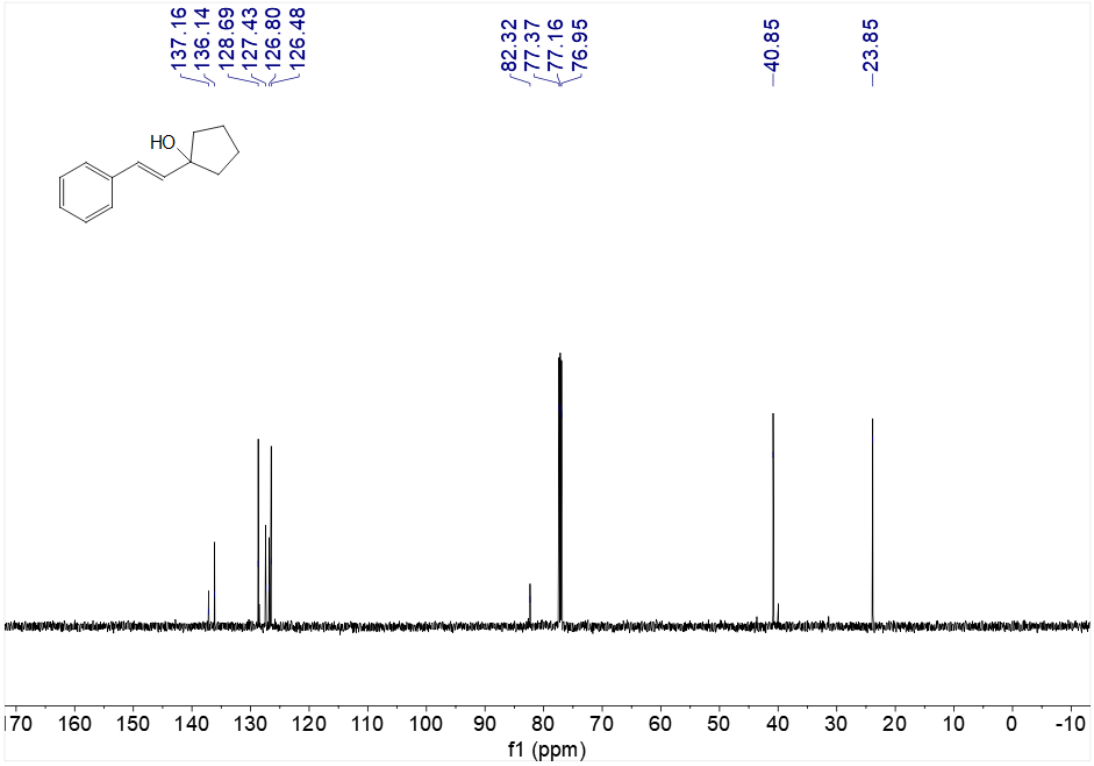
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl methyl (*E*)-1-styrylcyclobutan-1-ol (*E*-3af)



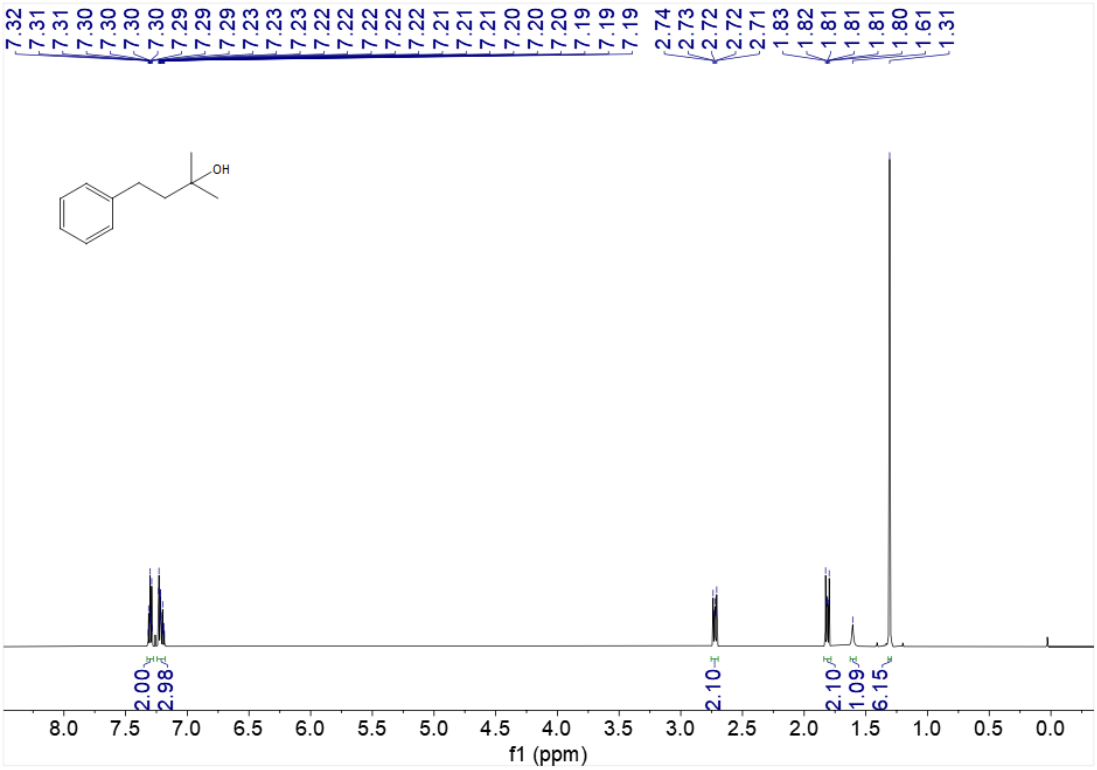
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-1-styrylcyclopentan-1-ol (*E*-3ag)



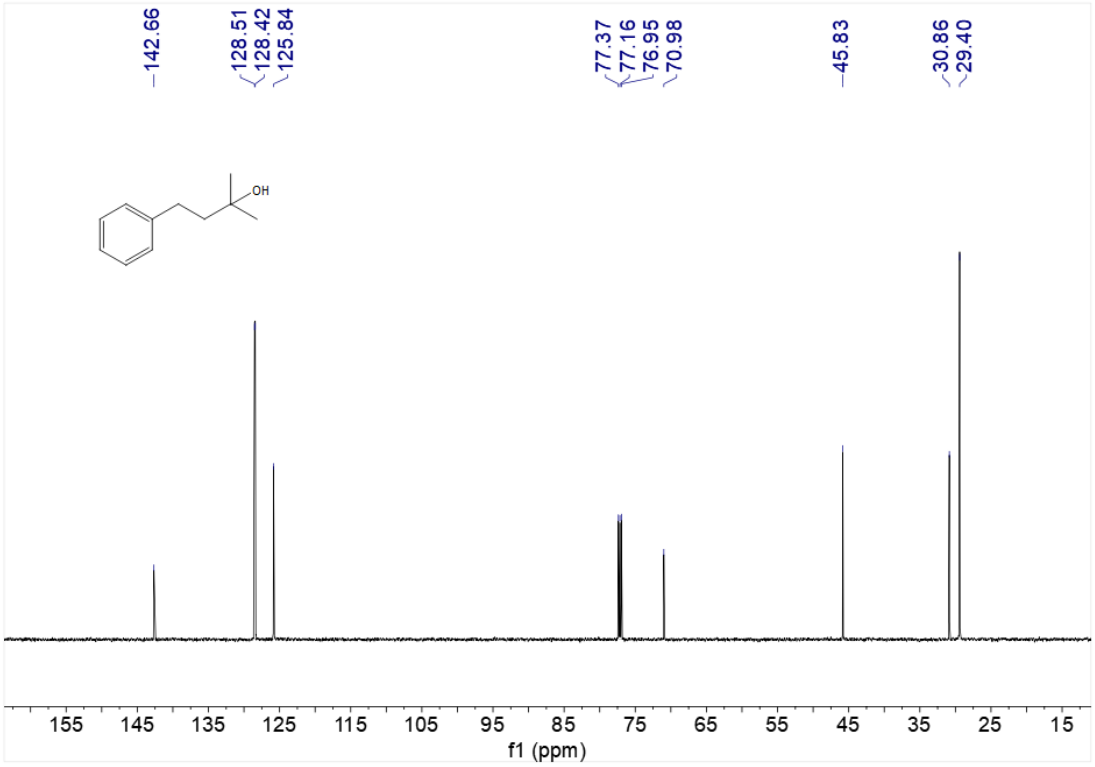
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl (*E*)-1-styrylcyclopentan-1-ol (*E*-3ag)



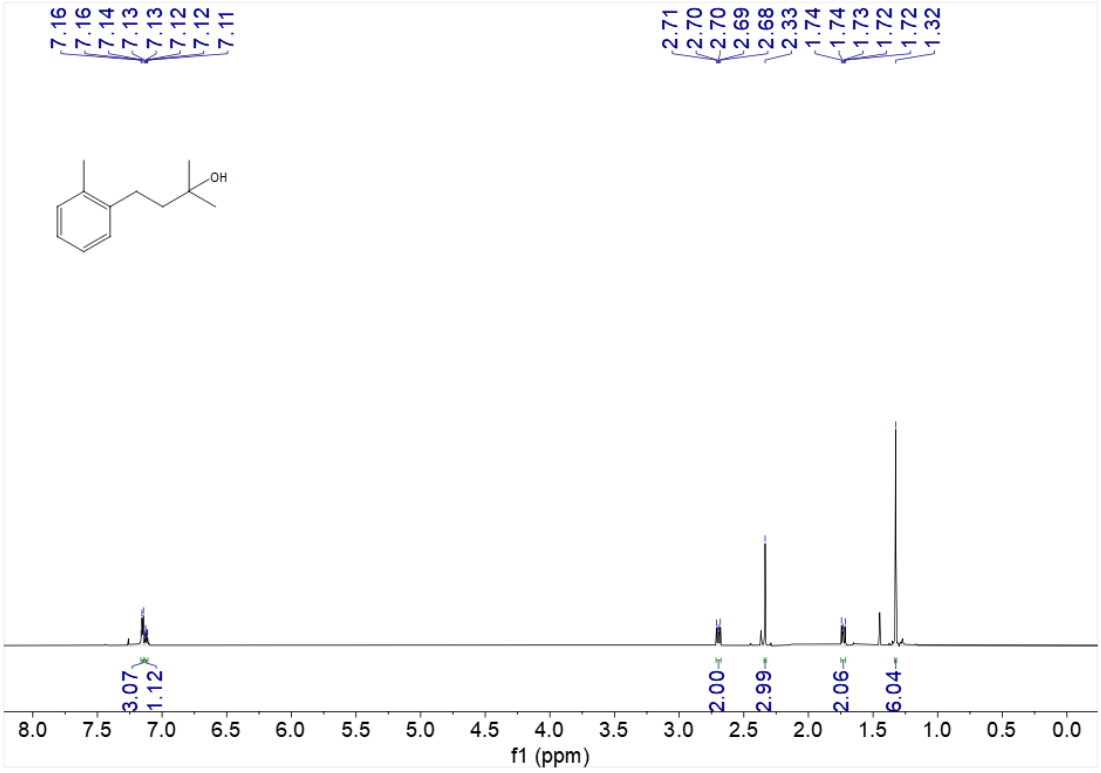
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 2-methyl-4-phenylbutan-2-ol (6aa)



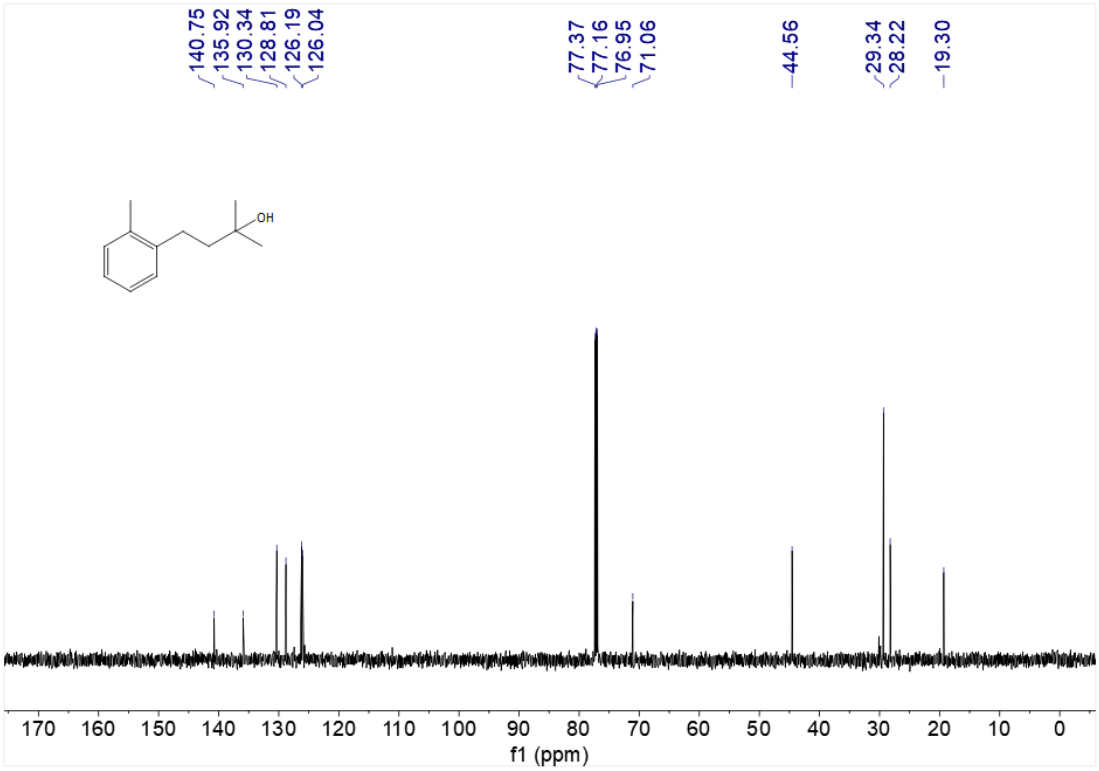
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 2-methyl-4-phenylbutan-2-ol (6aa)



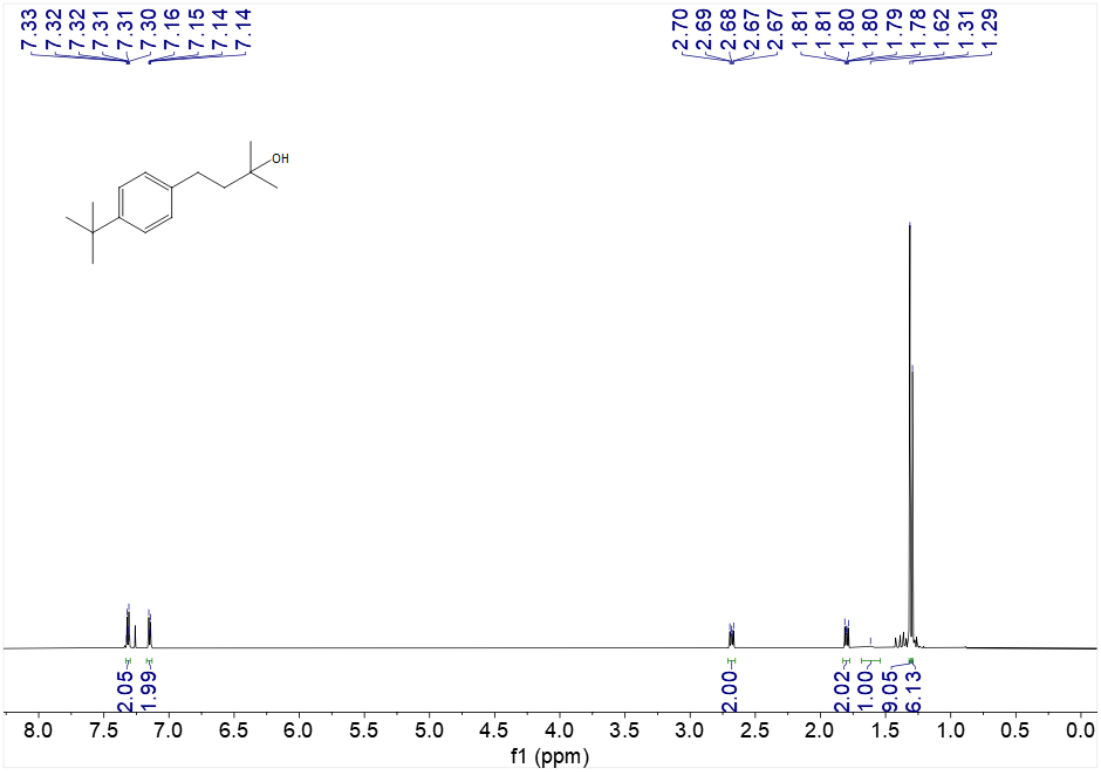
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 2-methyl-4-(o-tolyl)butan-2-ol (6ba)



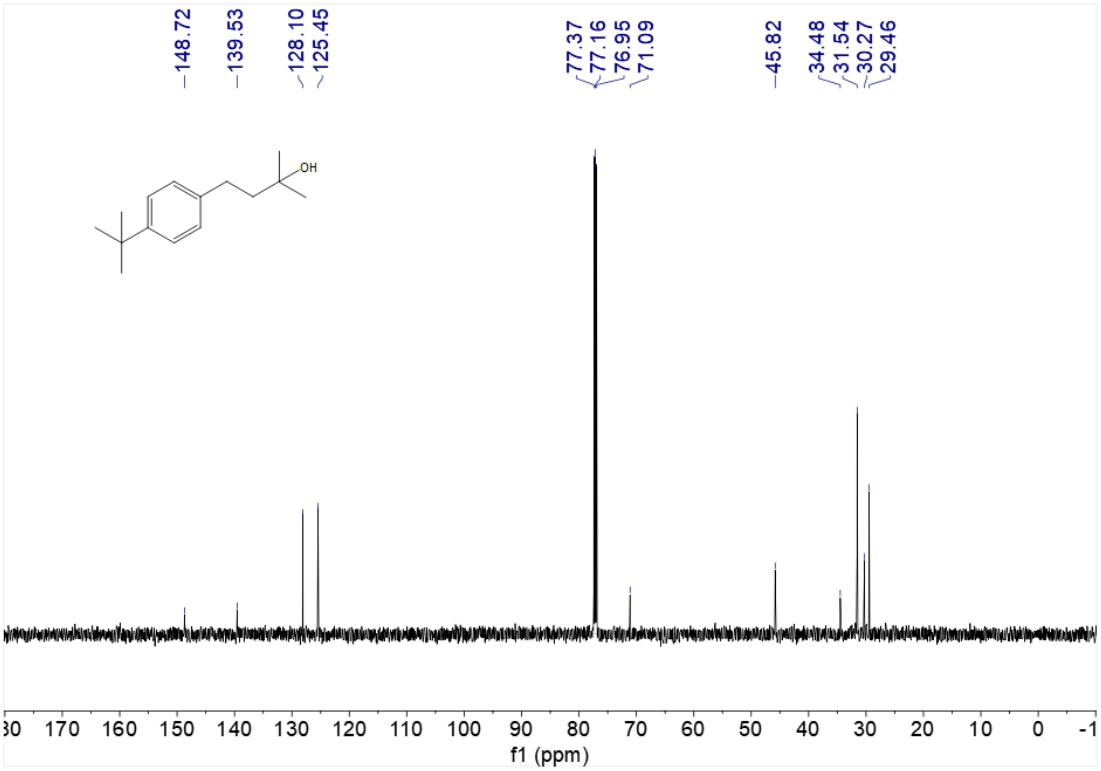
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 2-methyl-4-(o-tolyl)butan-2-ol (6ba)



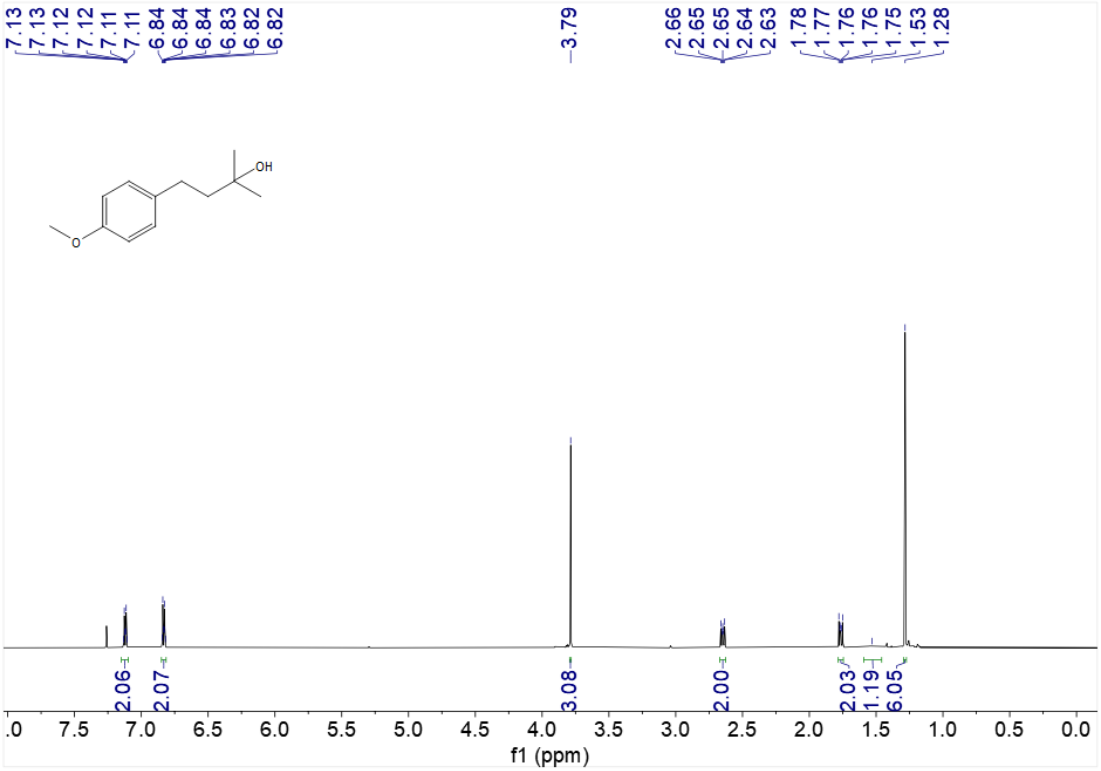
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
4-(4-(tert-butyl)phenyl)-2-methylbutan-2-ol (6ca)



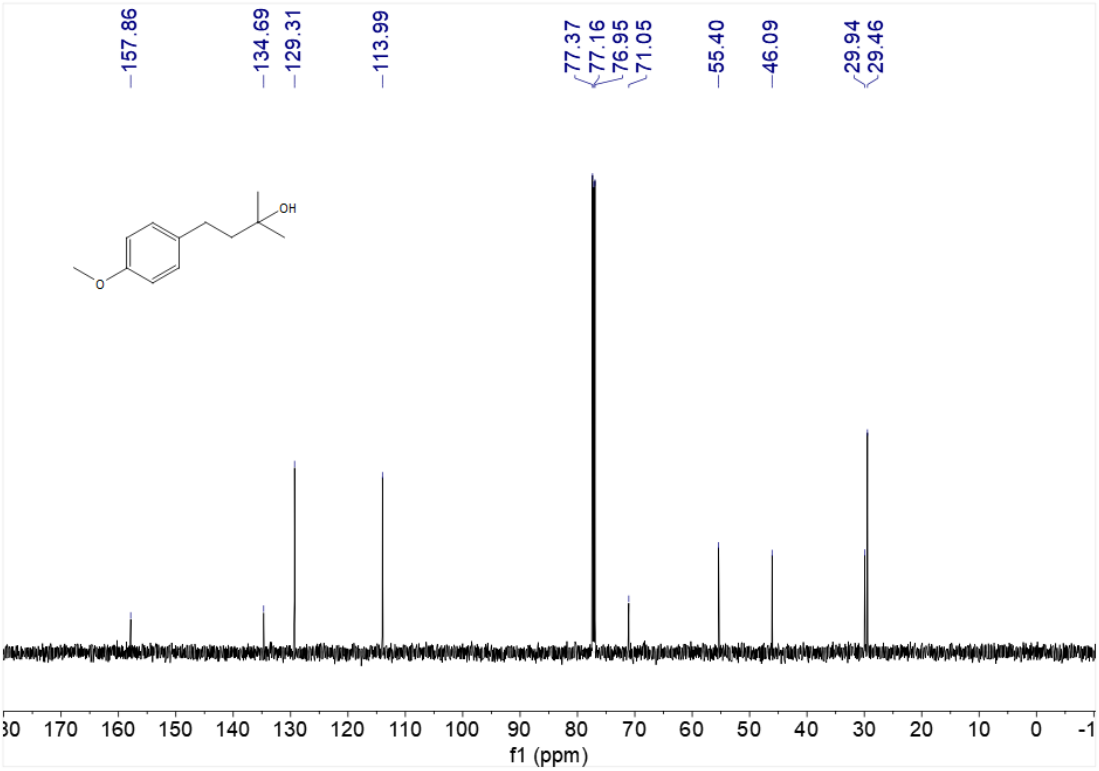
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
4-(4-(tert-butyl)phenyl)-2-methylbutan-2-ol (6ca)



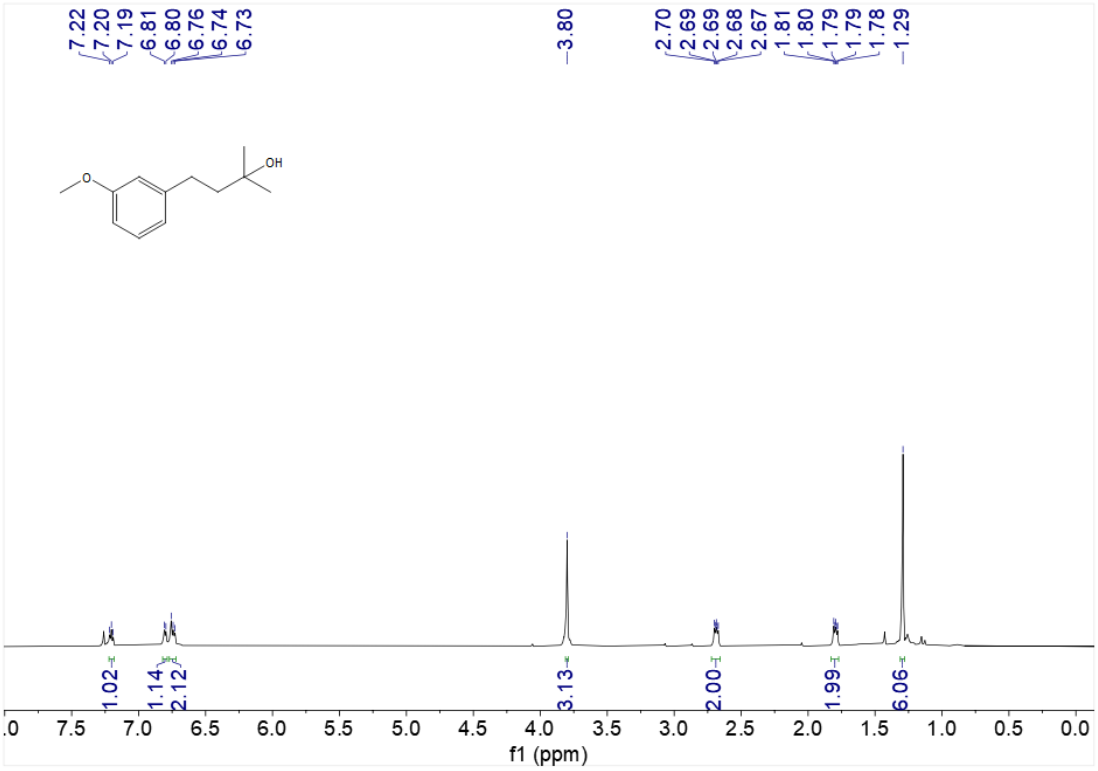
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
4-(4-methoxyphenyl)-2-methylbutan-2-ol (6da)



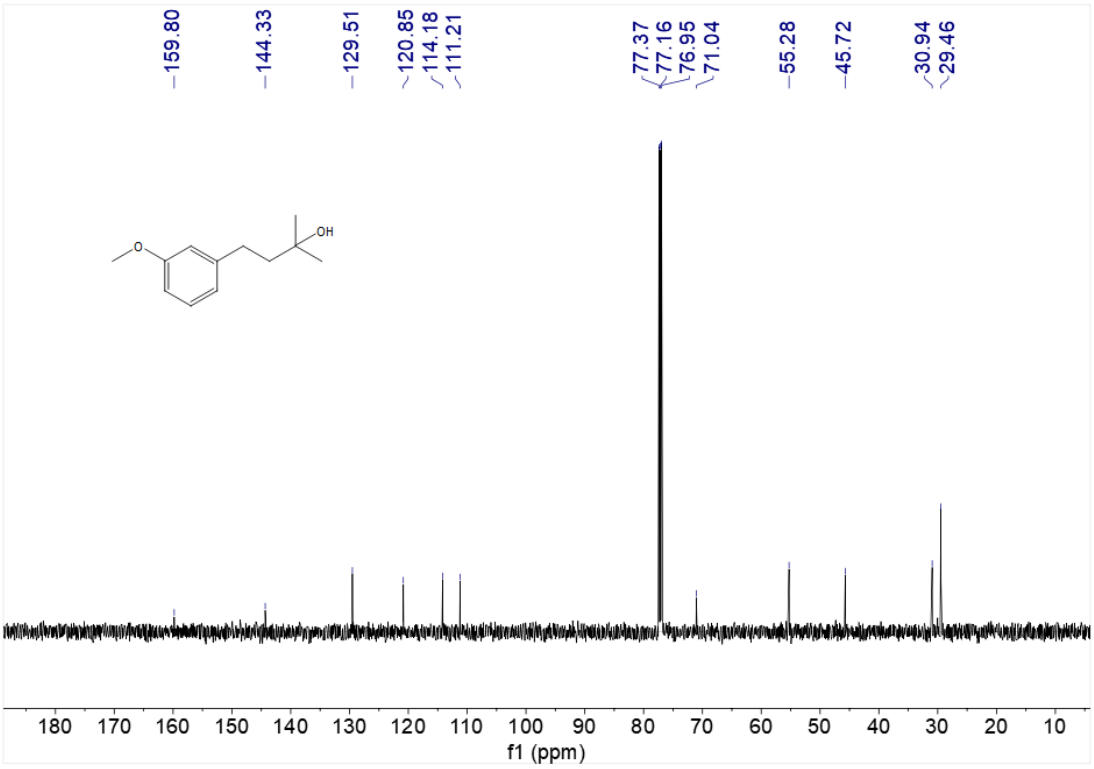
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
4-(4-methoxyphenyl)-2-methylbutan-2-ol (6da)



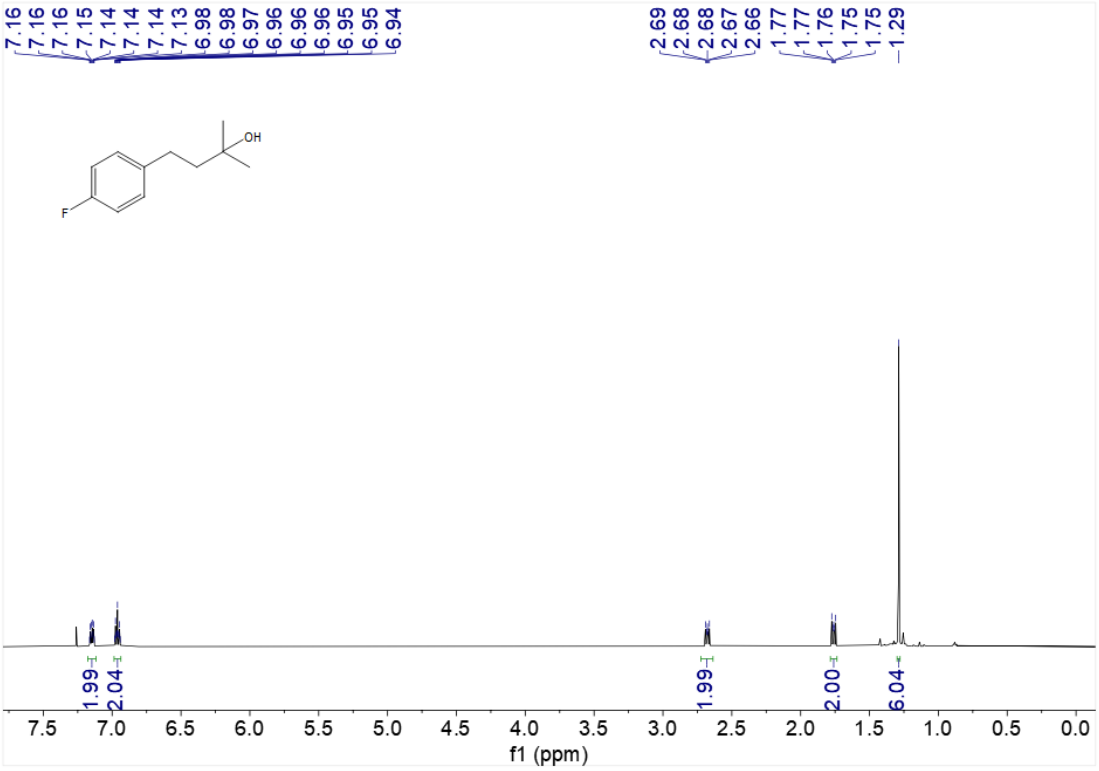
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 4-(3-methoxyphenyl)-2-methylbutan-2-ol (6ea)



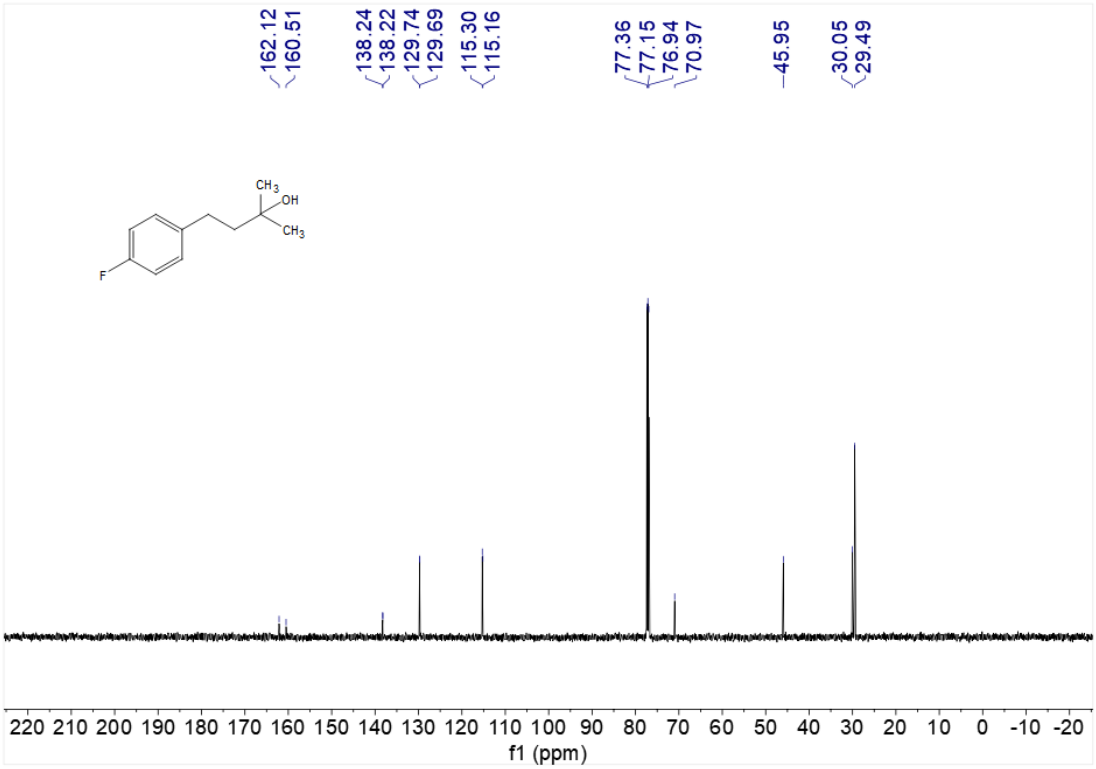
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 4-(3-methoxyphenyl)-2-methylbutan-2-ol (6ea)



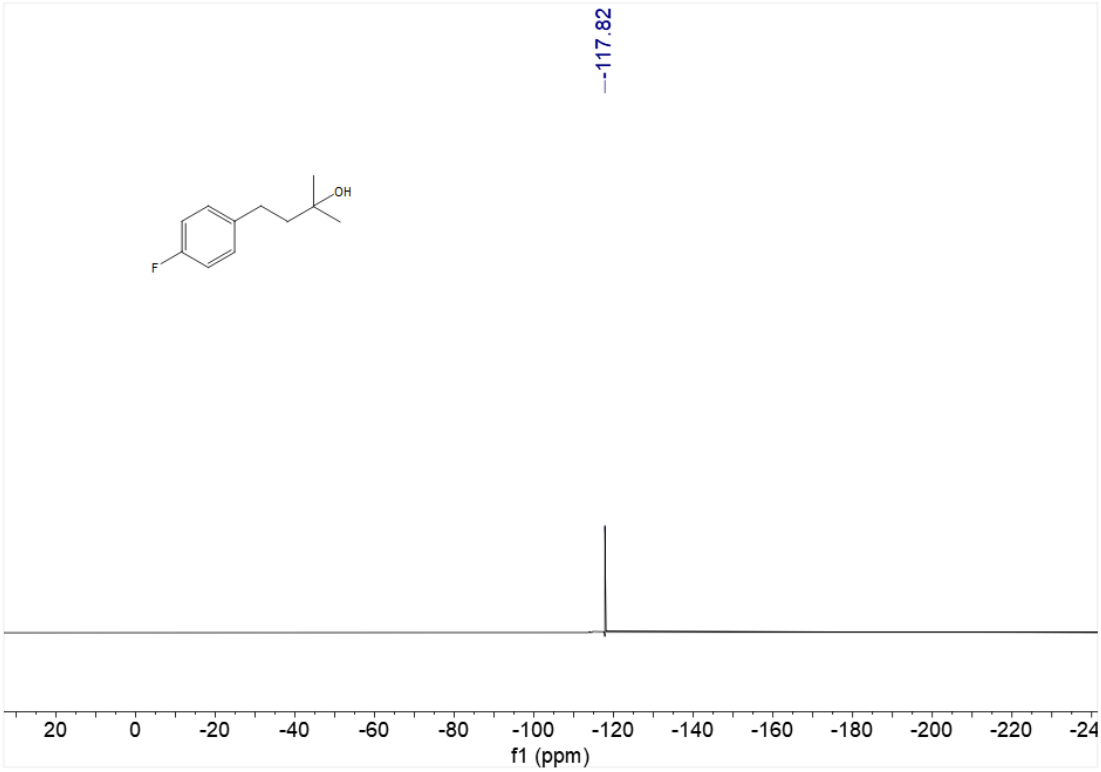
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 4-(4-fluorophenyl)-2-methylbutan-2-ol (6fa)



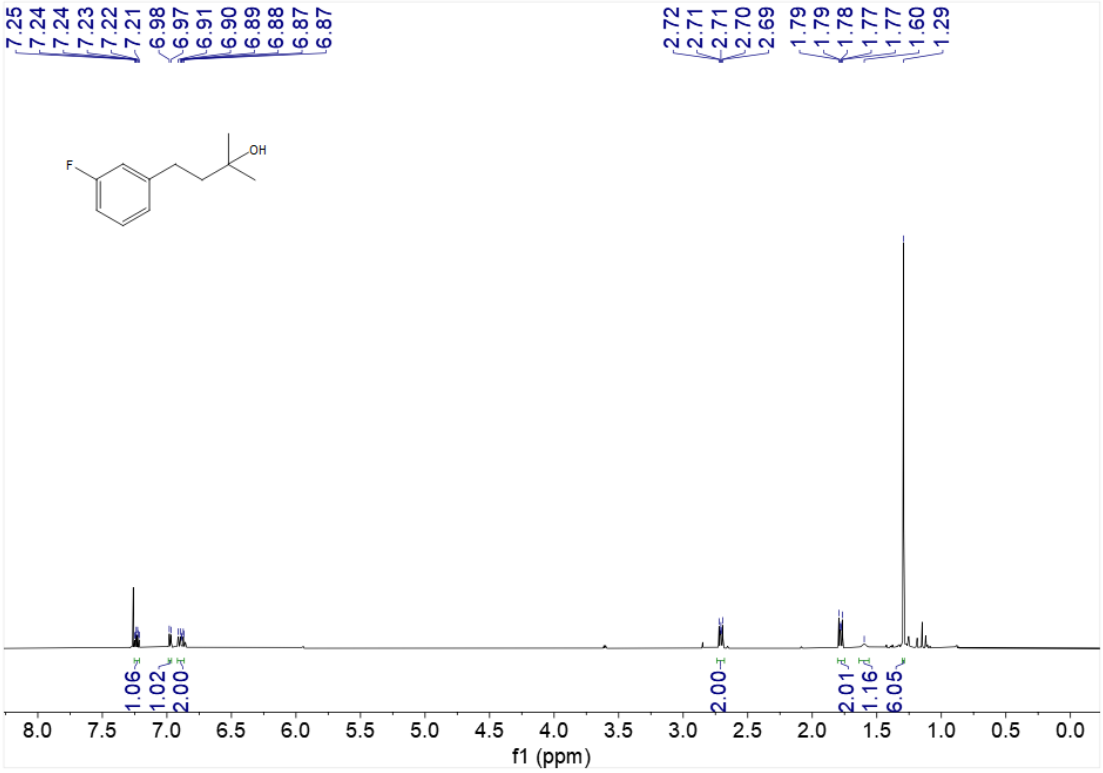
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 4-(4-fluorophenyl)-2-methylbutan-2-ol (6fa)



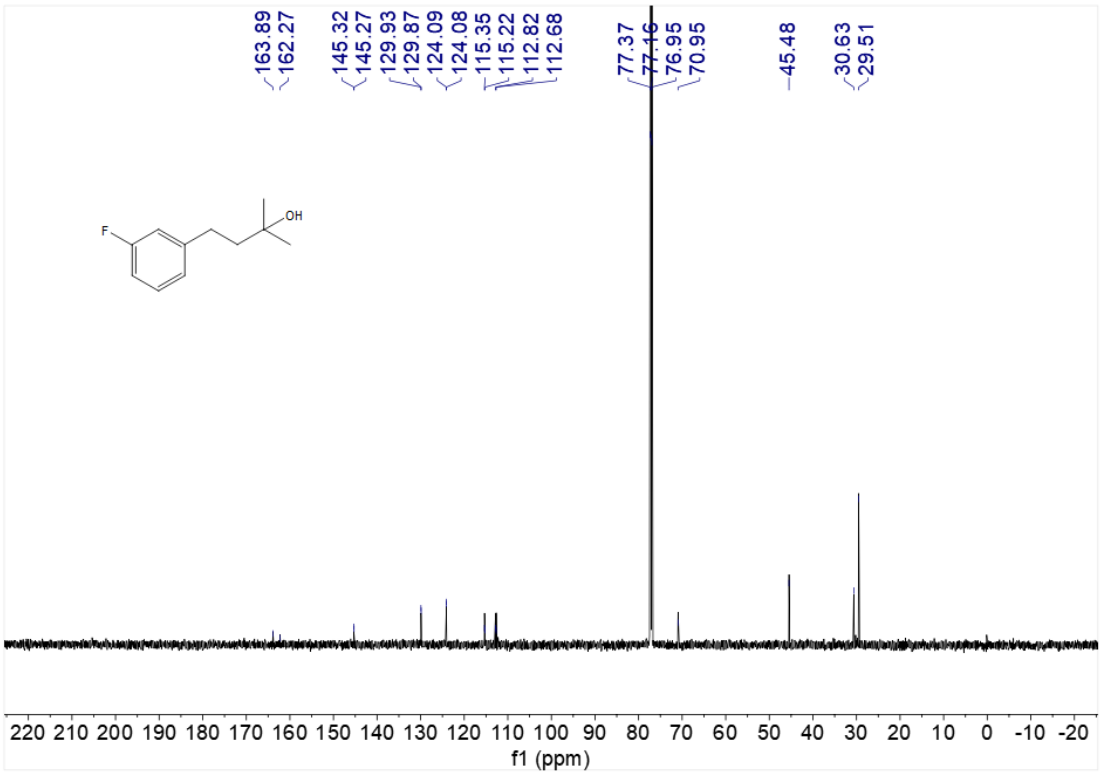
^{19}F NMR (565 MHz, $CDCl_3$) spectrum of 4-(4-fluorophenyl)-2-methylbutan-2-ol (6fa)



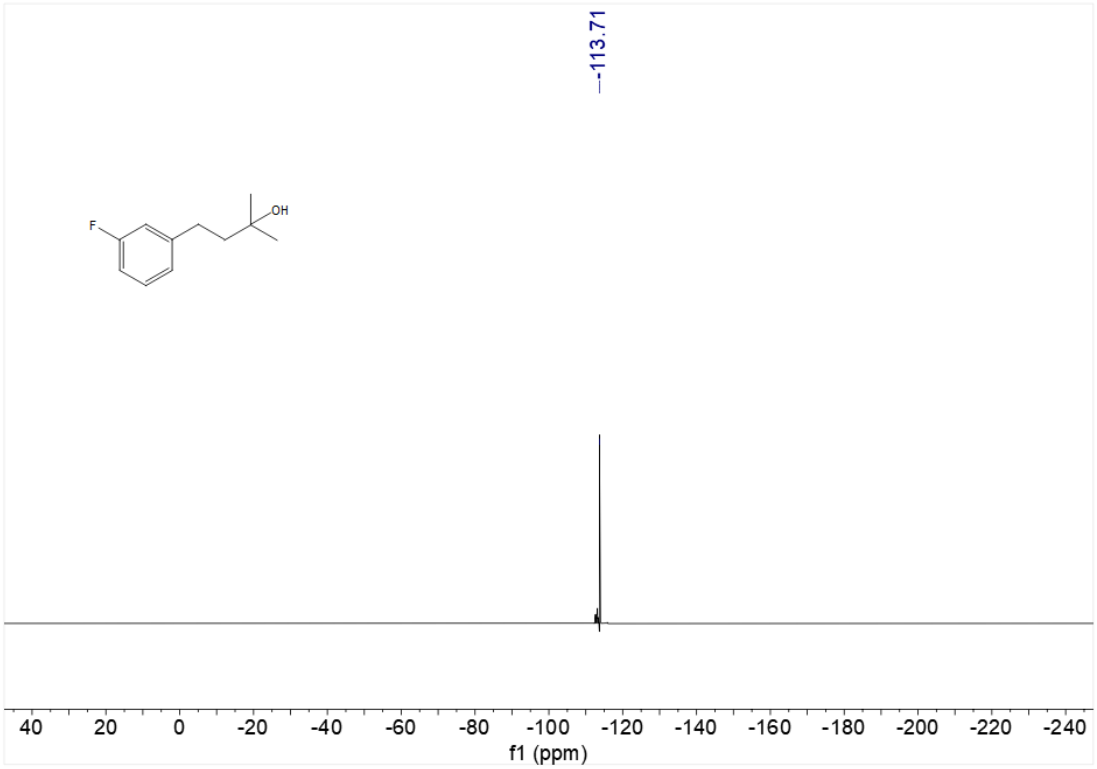
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 4-(3-fluorophenyl)-2-methylbutan-2-ol (6ga)



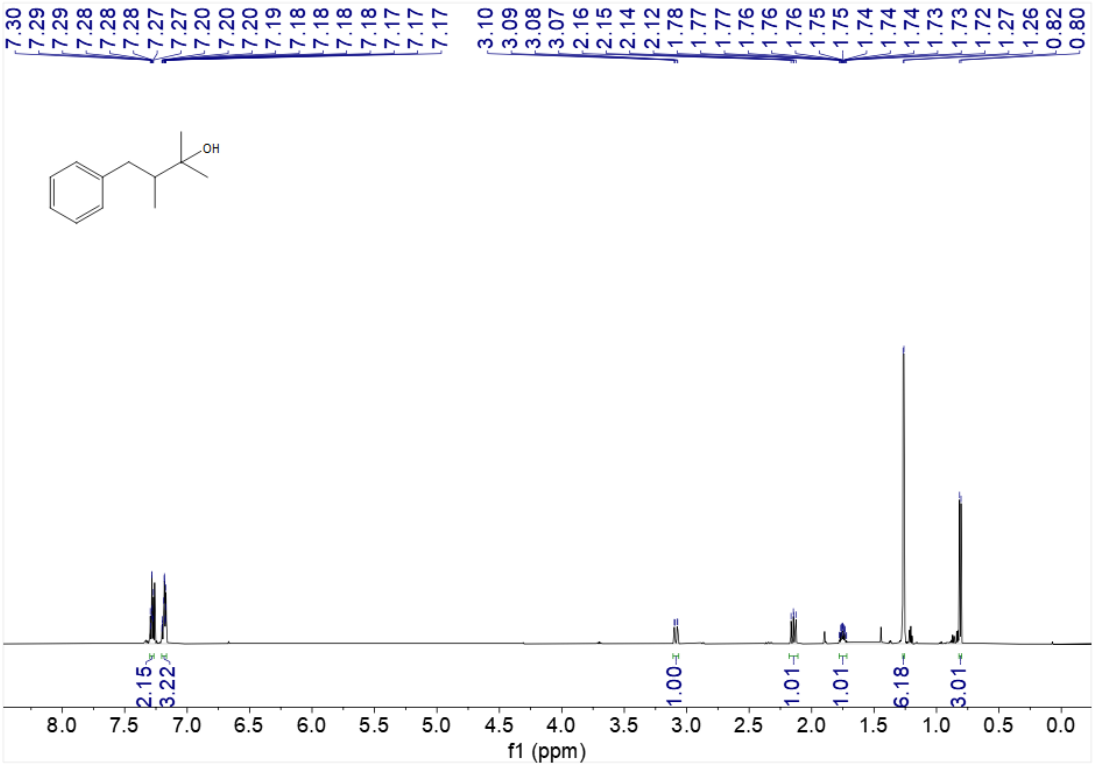
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 4-(3-fluorophenyl)-2-methylbutan-2-ol (6ga)



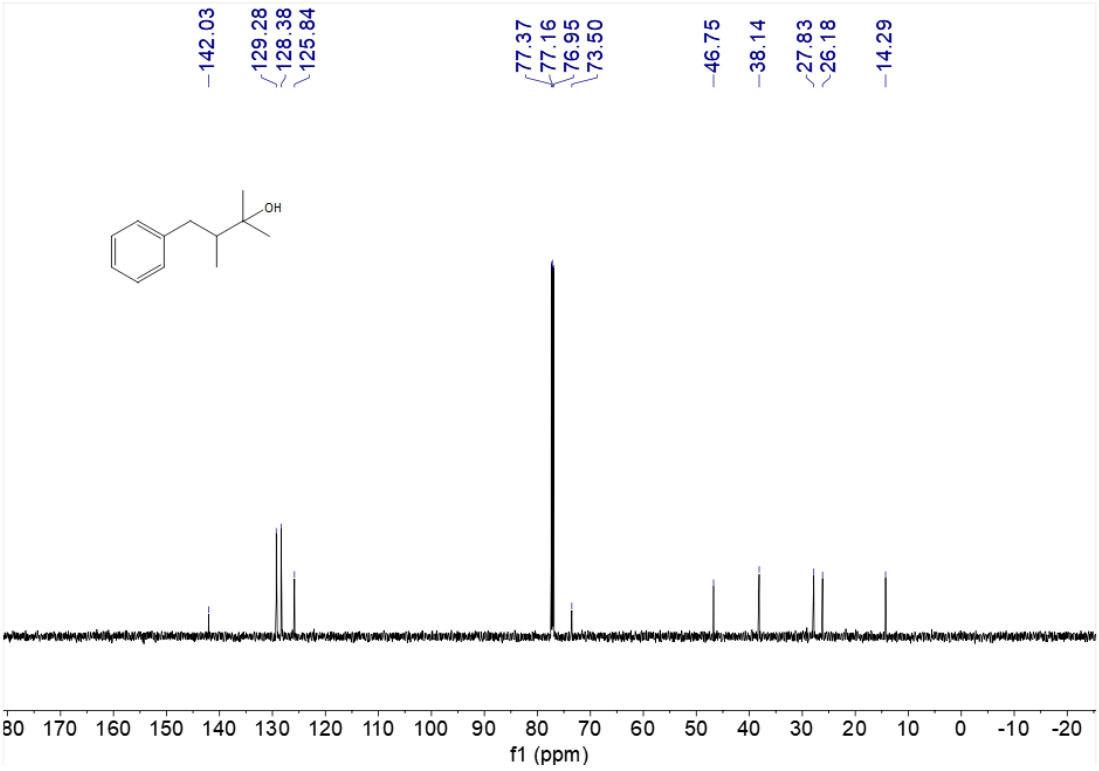
^{19}F NMR (565 MHz, $CDCl_3$) spectrum of 4-(3-fluorophenyl)-2-methylbutan-2-ol (6ga)



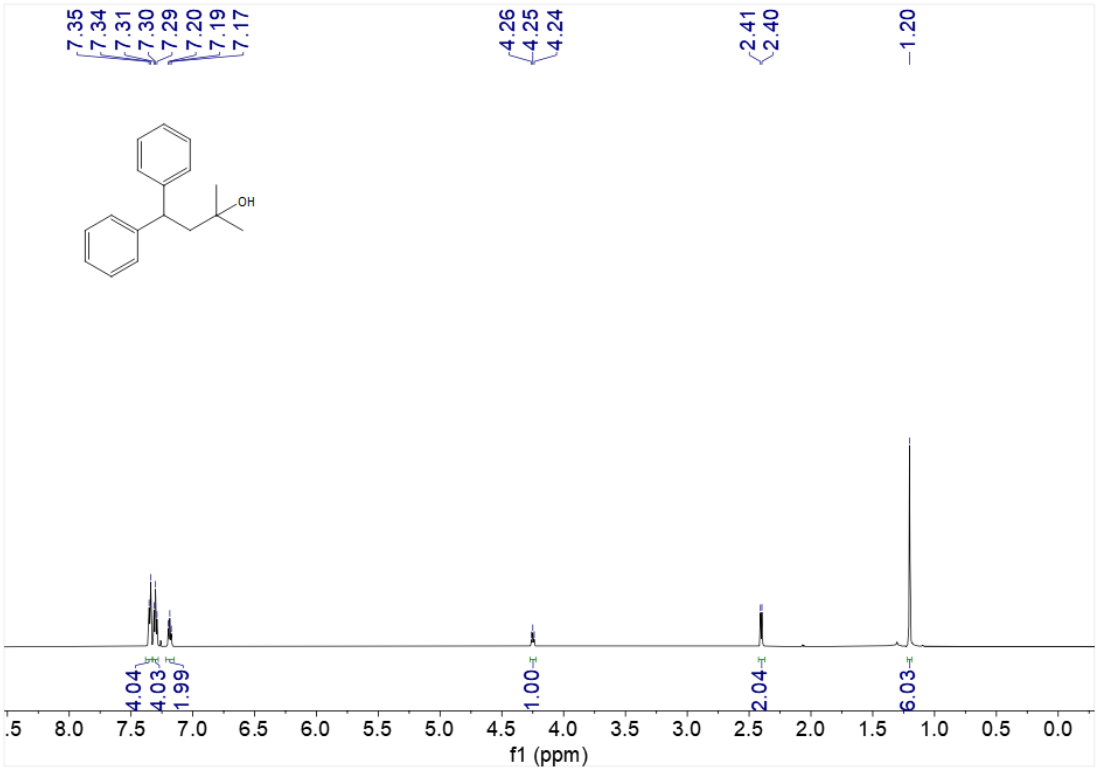
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 2,3-dimethyl-4-phenylbutan-2-ol (6ha)



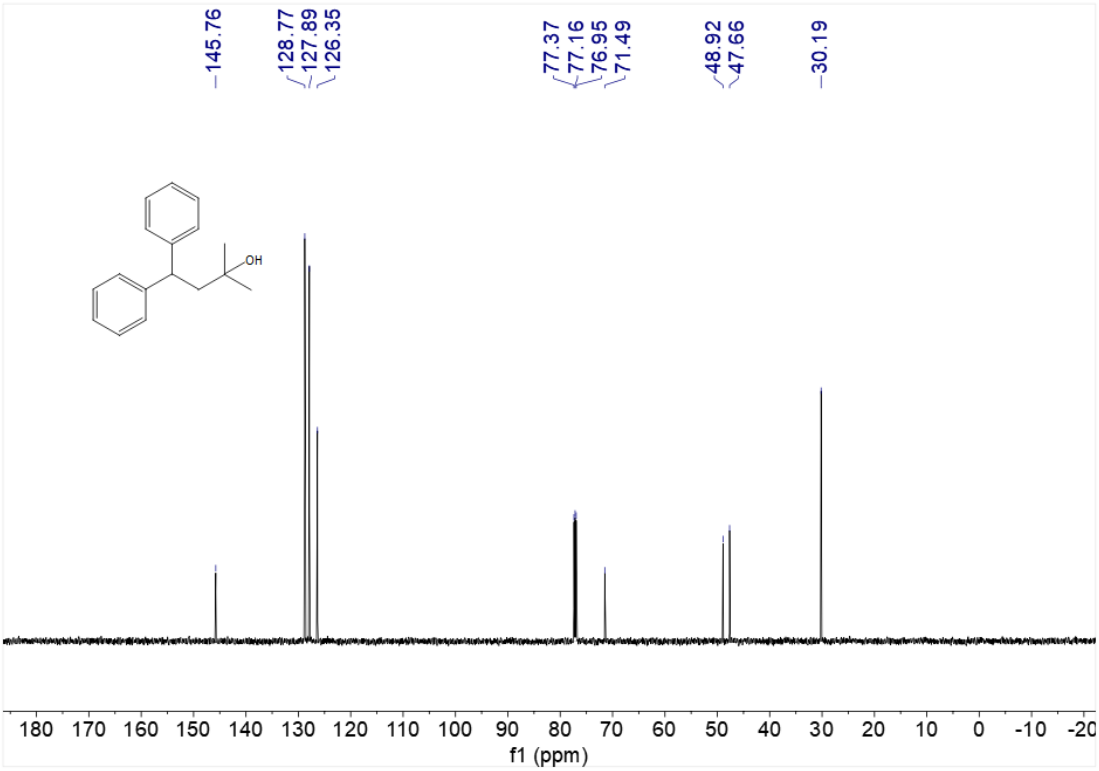
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 2,3-dimethyl-4-phenylbutan-2-ol (6ha)



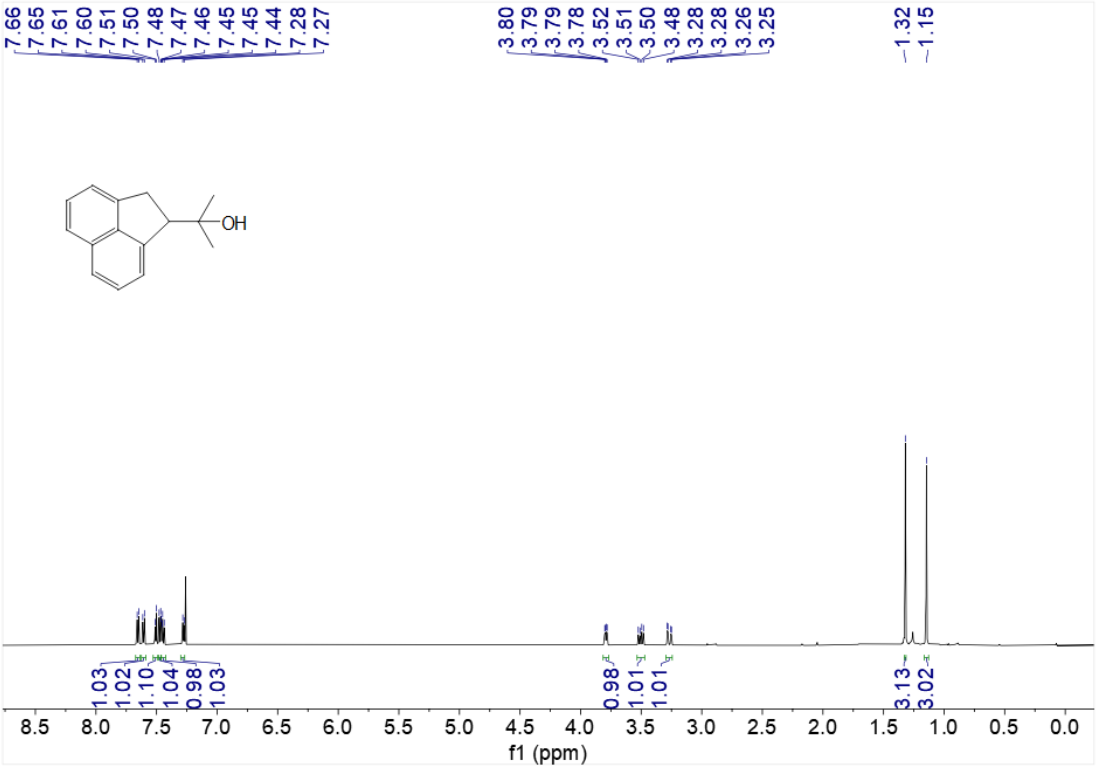
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 2-methyl-4,4-diphenylbutan-2-ol (6ia)



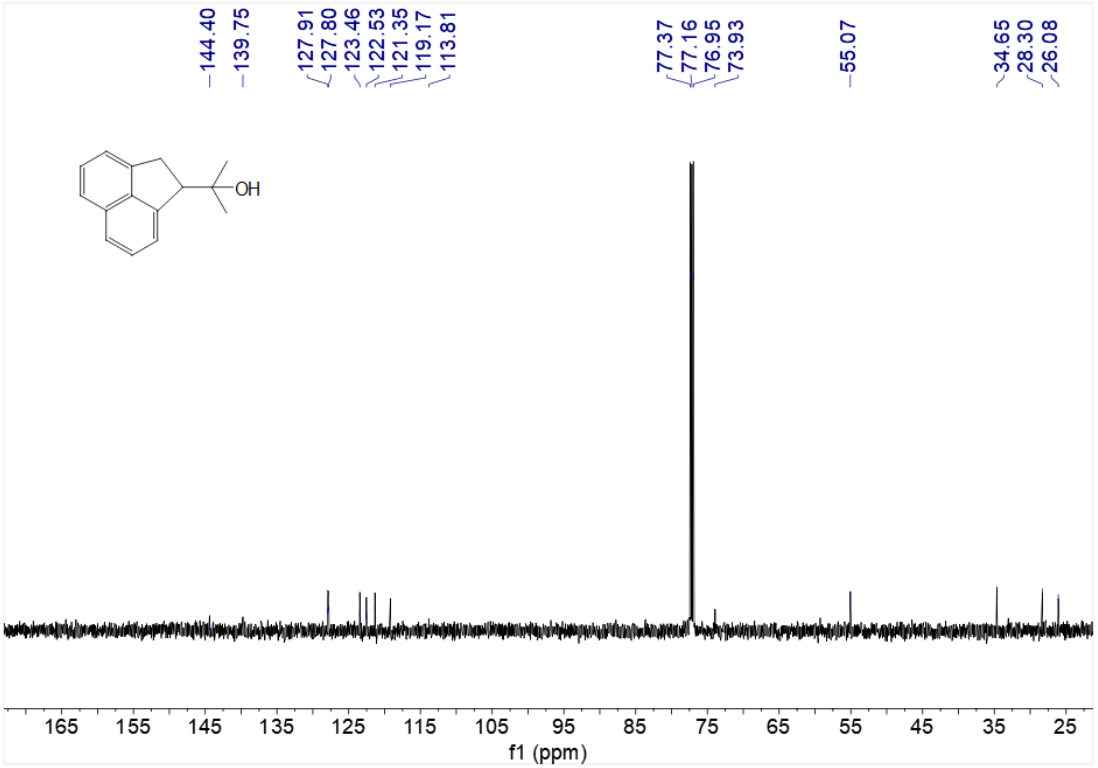
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 2-methyl-4,4-diphenylbutan-2-ol (6ia)



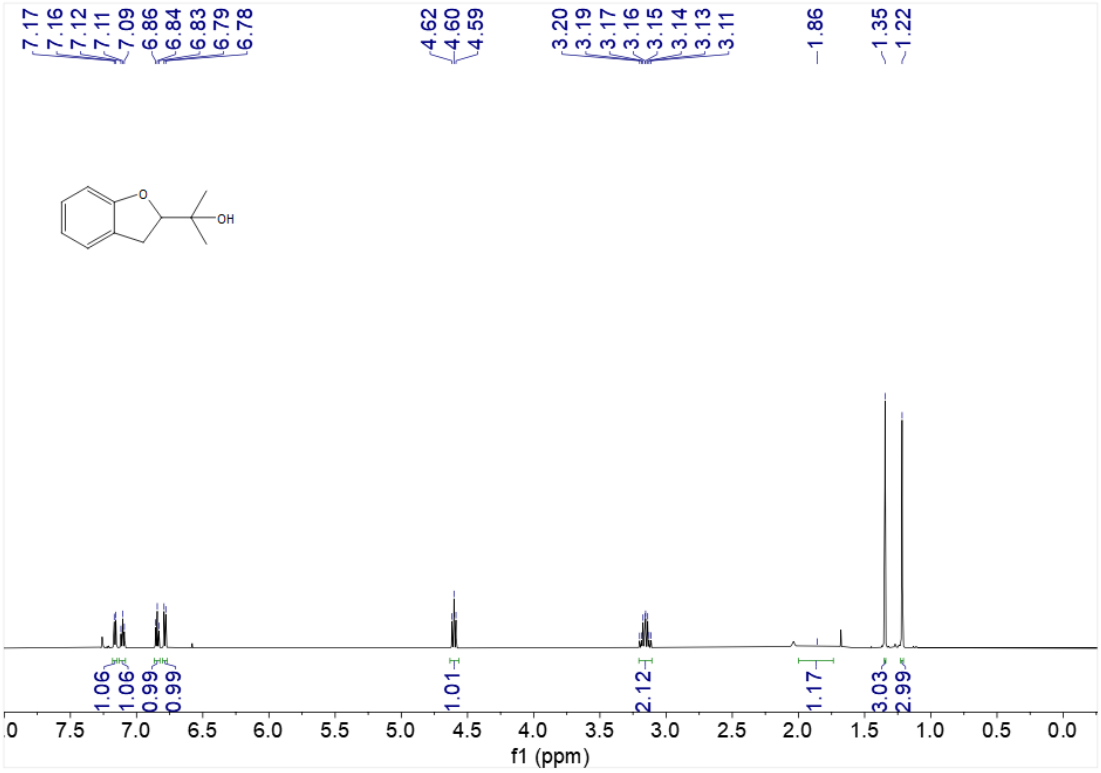
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
2-(1,2-dihydroacenaphthylen-1-yl)propan-2-ol (6ja)



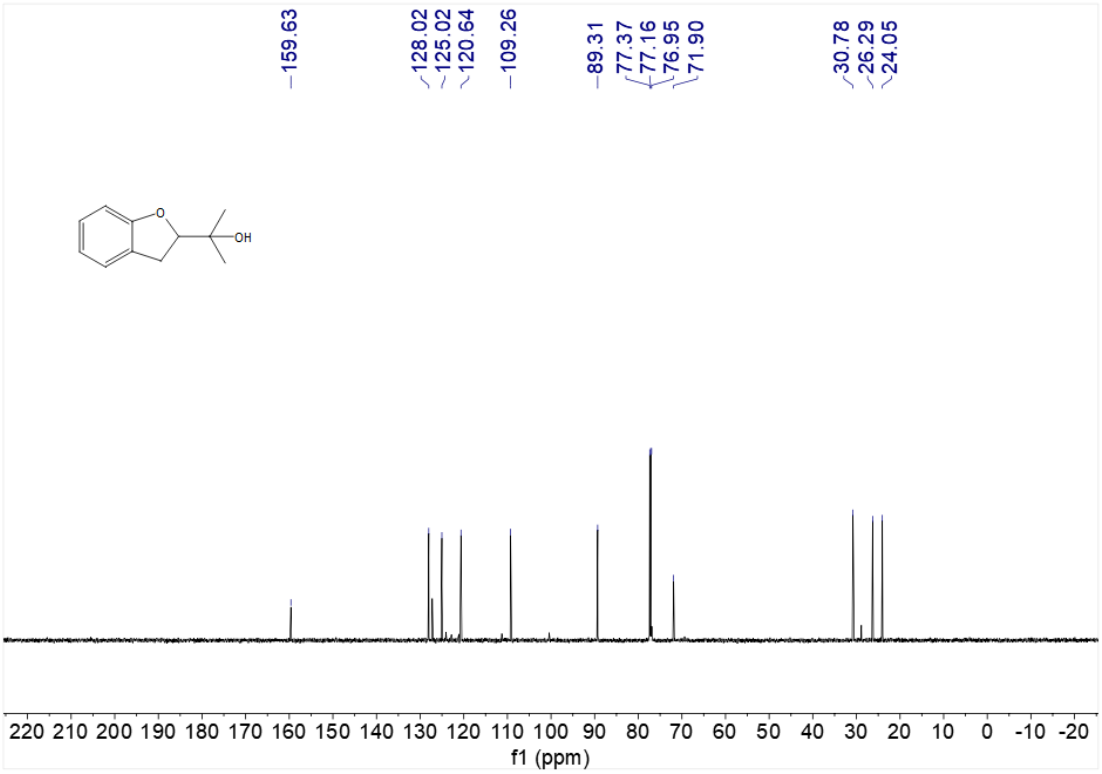
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
2-(1,2-dihydroacenaphthylen-1-yl)propan-2-ol (6ja)



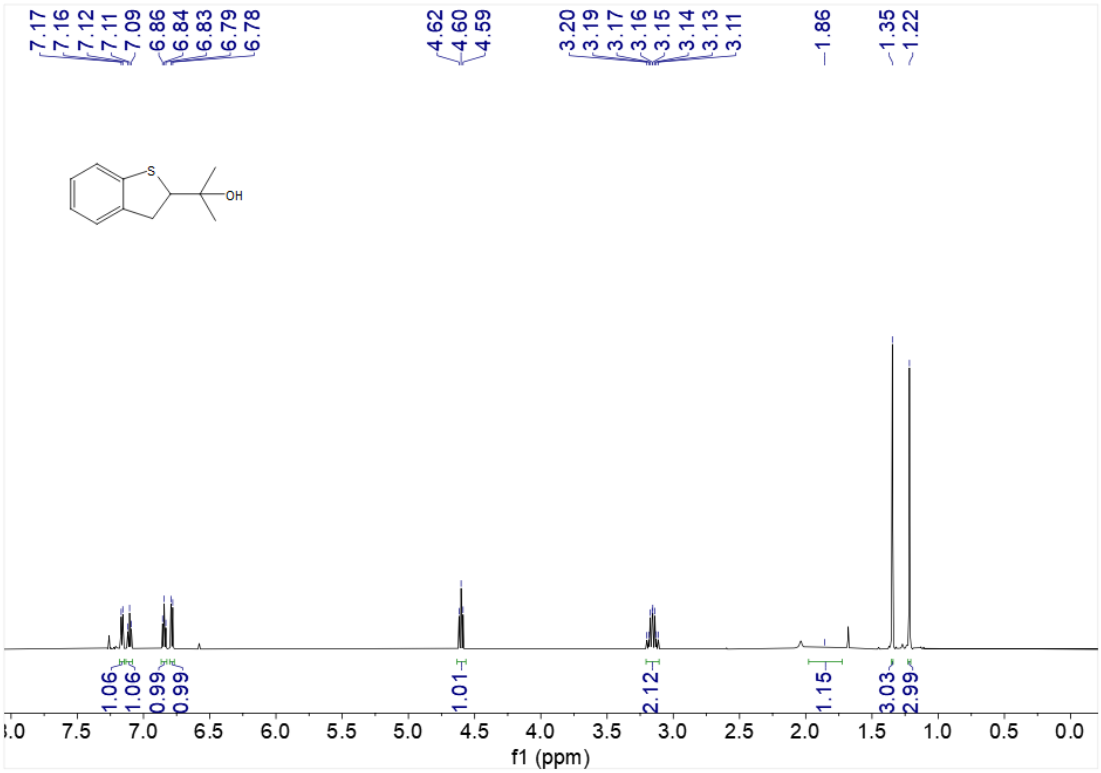
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 2-(2,3-dihydrobenzofuran-2-yl)propan-2-ol (6ka)



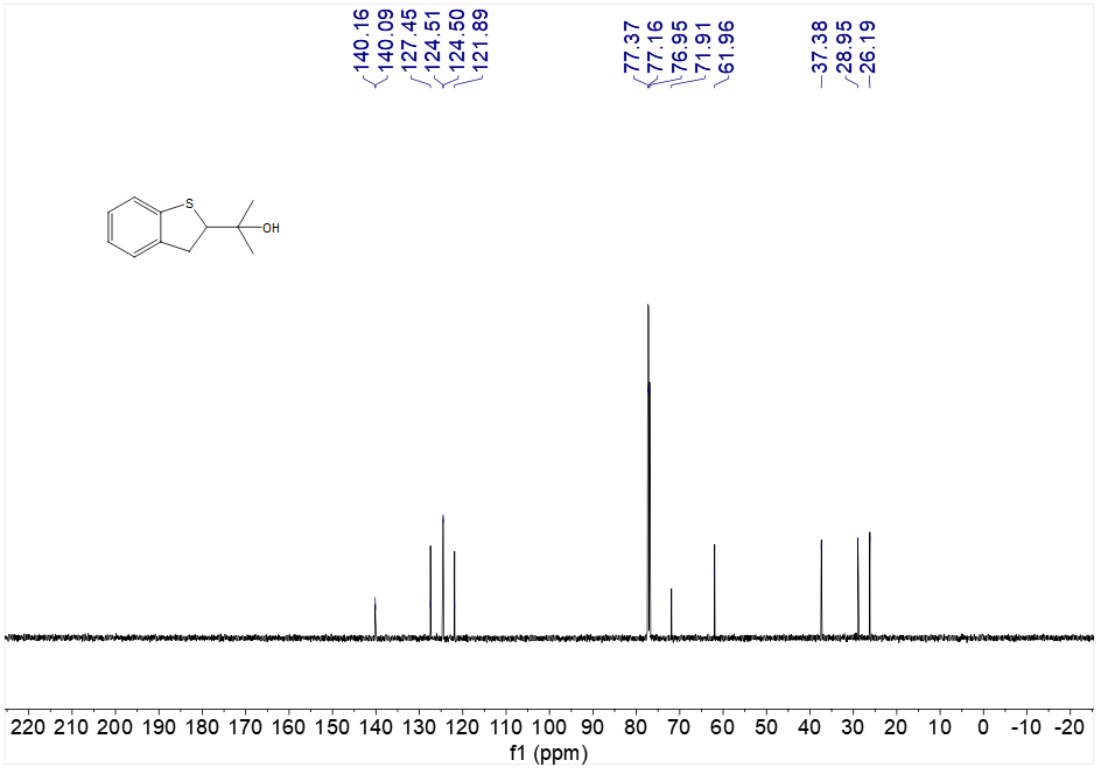
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 2-(2,3-dihydrobenzofuran-2-yl)propan-2-ol (6ka)



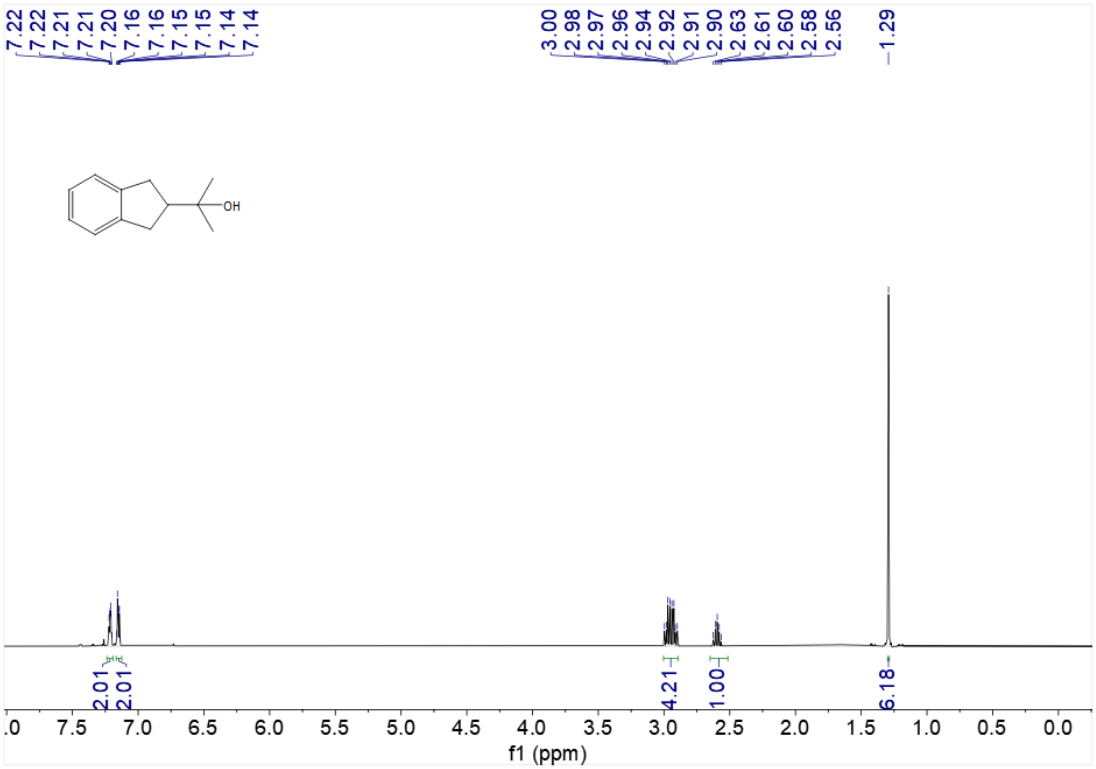
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 2-(2,3-dihydrobenzo[b]thiophen-2-yl)propan-2-ol (6la)



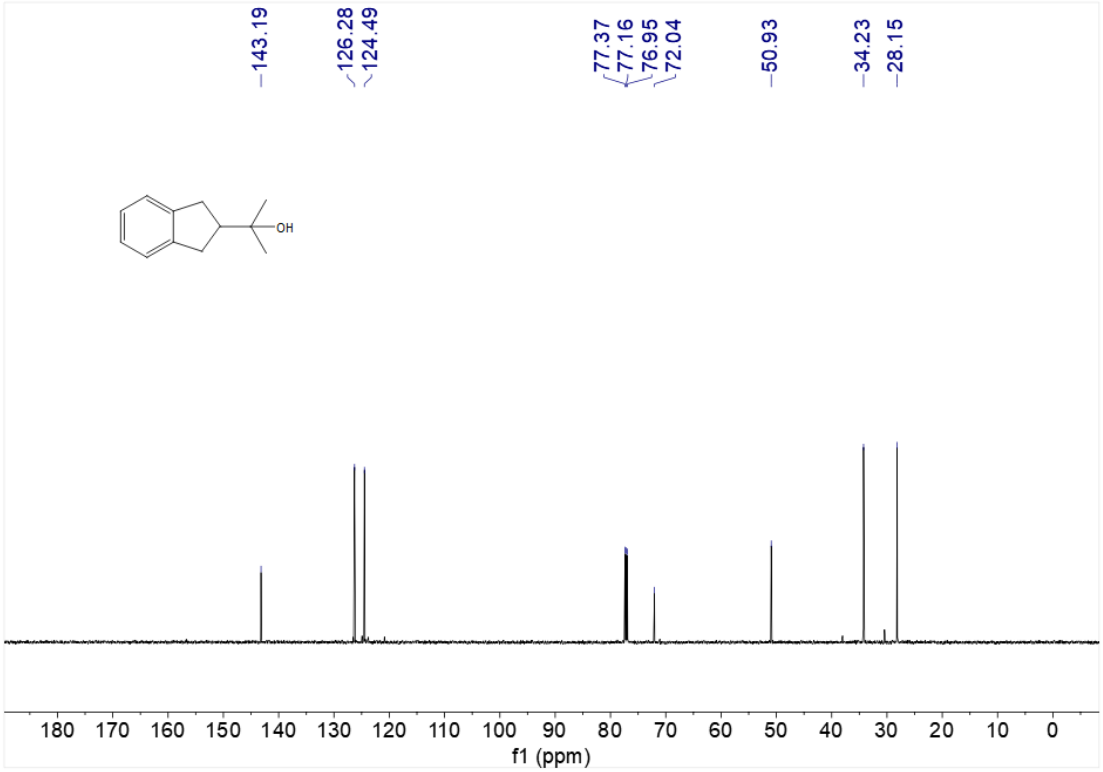
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 2-(2,3-dihydrobenzo[b]thiophen-2-yl)propan-2-ol (6la)



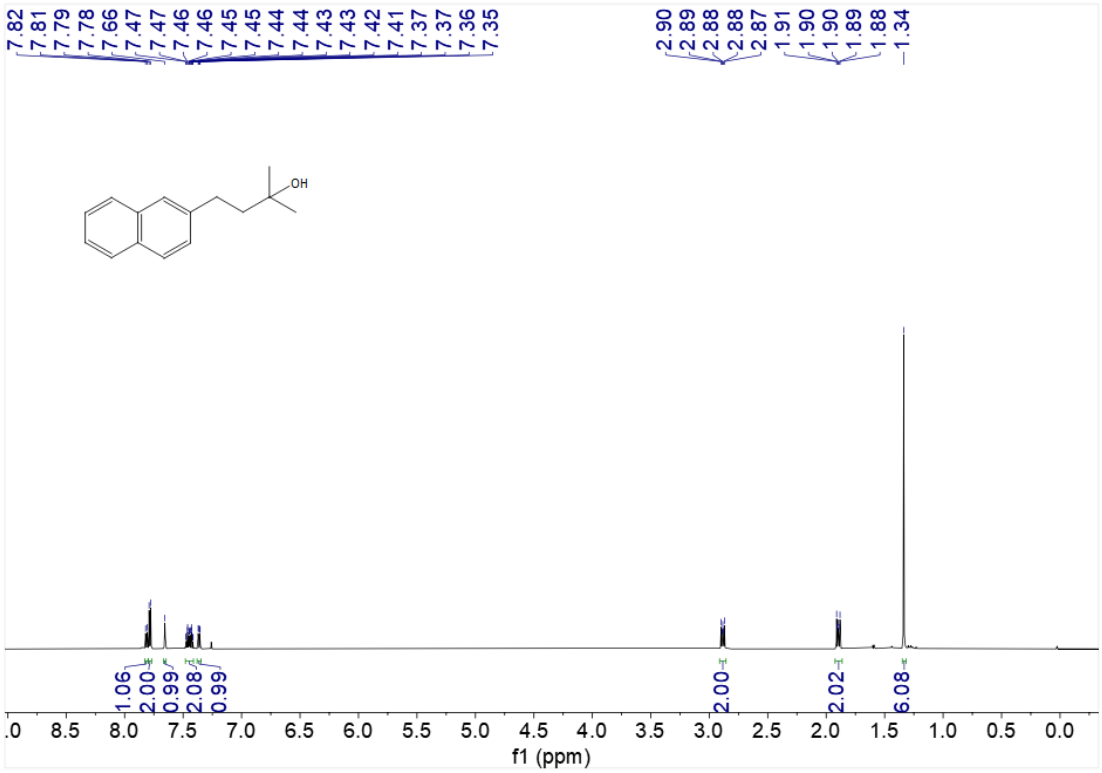
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
2-(2,3-dihydro-1H-inden-2-yl)propan-2-ol (6ma)



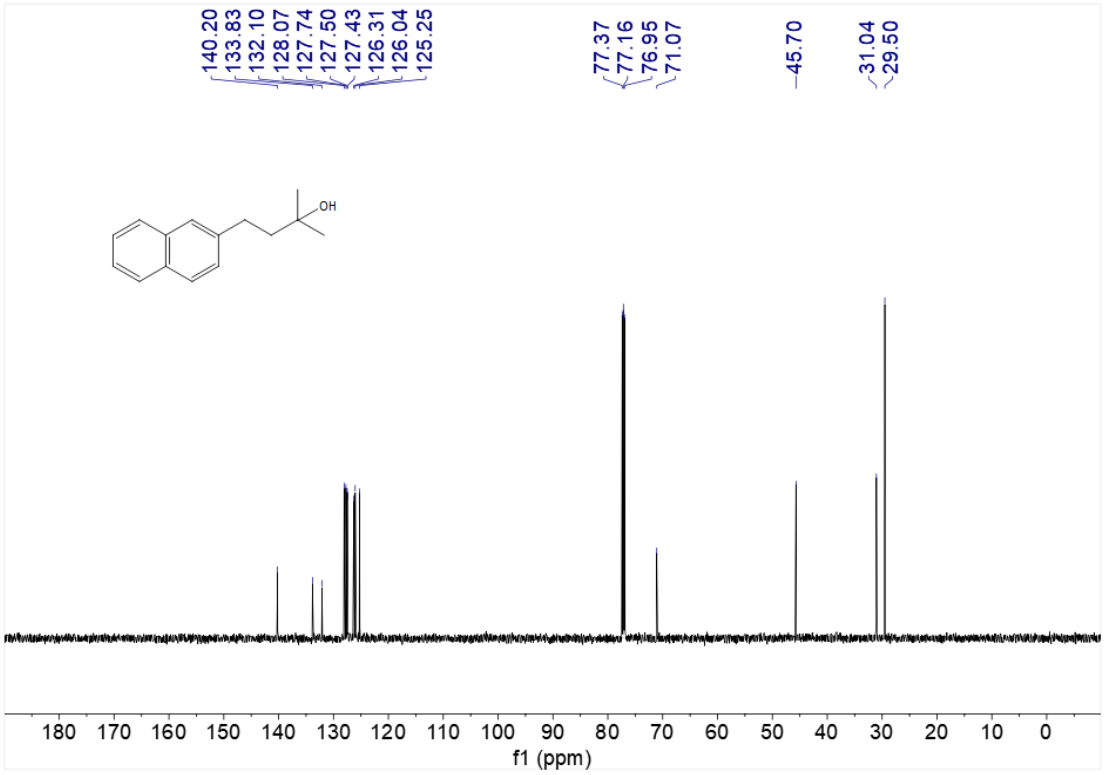
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
2-(2,3-dihydro-1H-inden-2-yl)propan-2-ol (6ma)



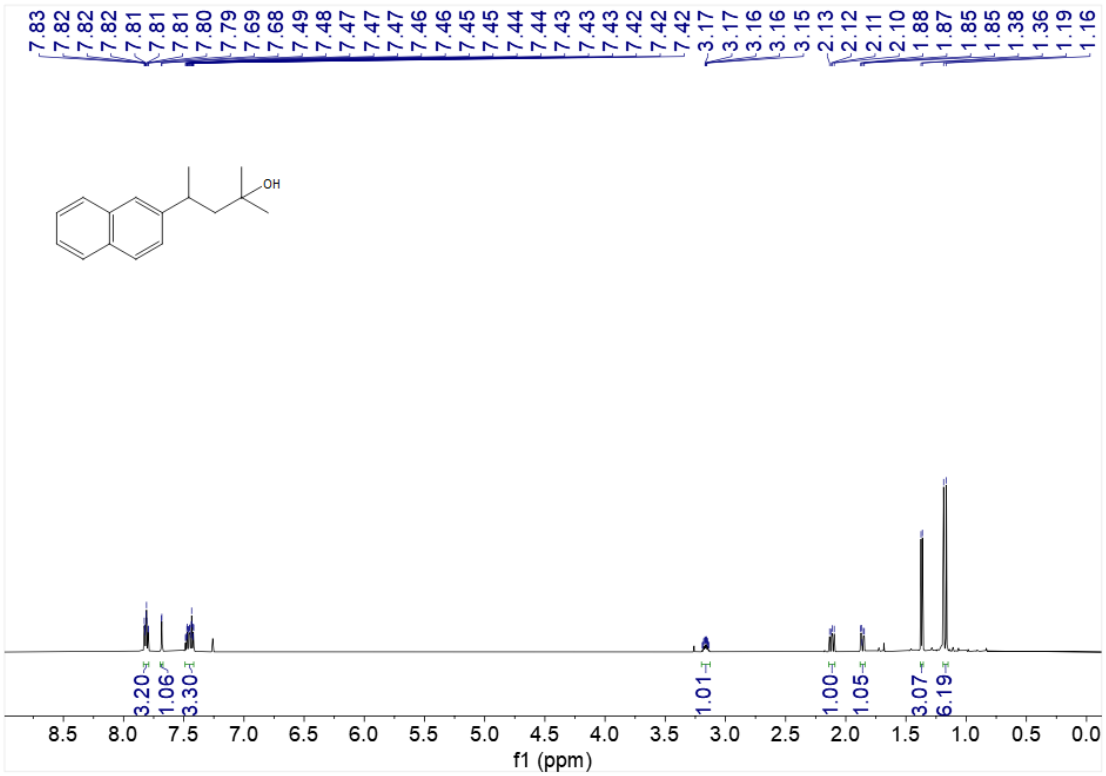
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 2-methyl-4-(naphthalen-2-yl)butan-2-ol (6na)



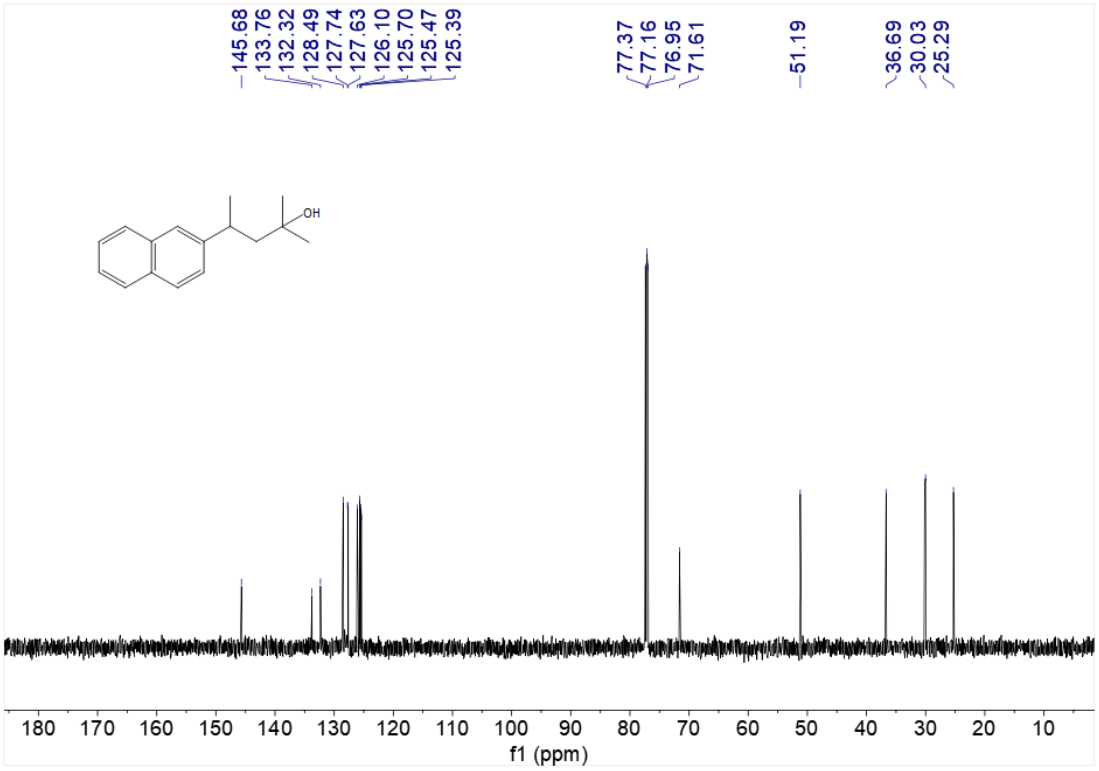
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 2-methyl-4-(naphthalen-2-yl)butan-2-ol (6na)



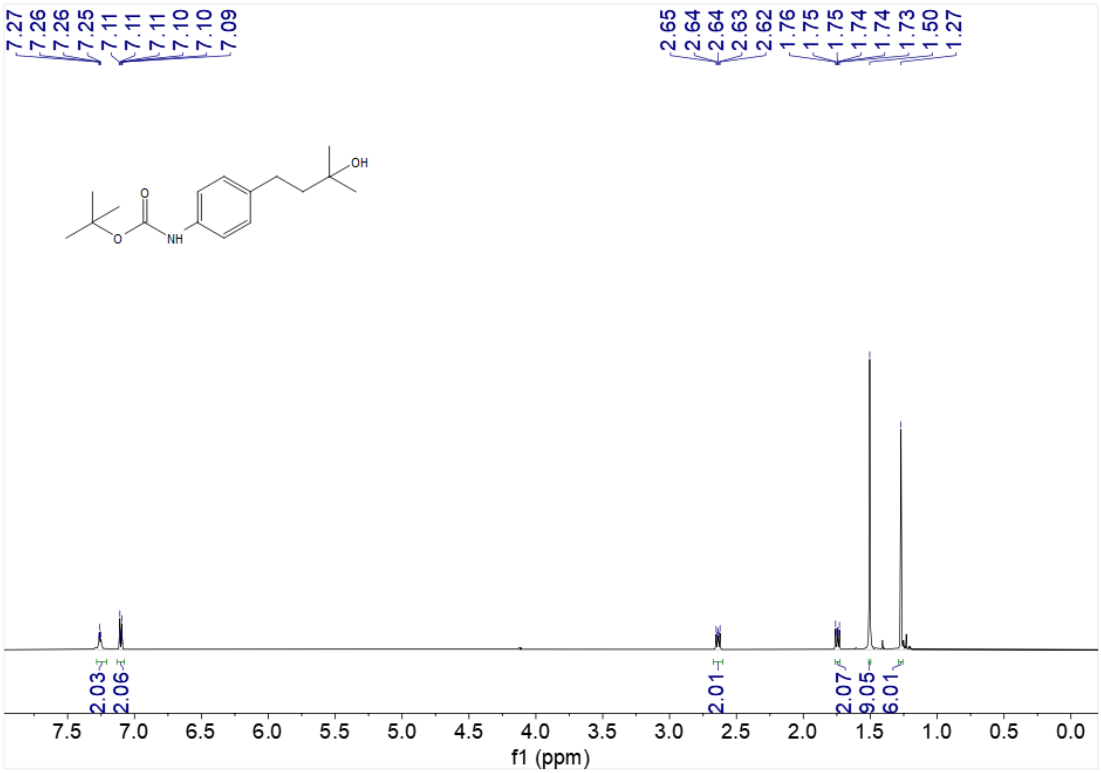
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of
2-methyl-4-(naphthalen-2-yl)pentan-2-ol (6oa)



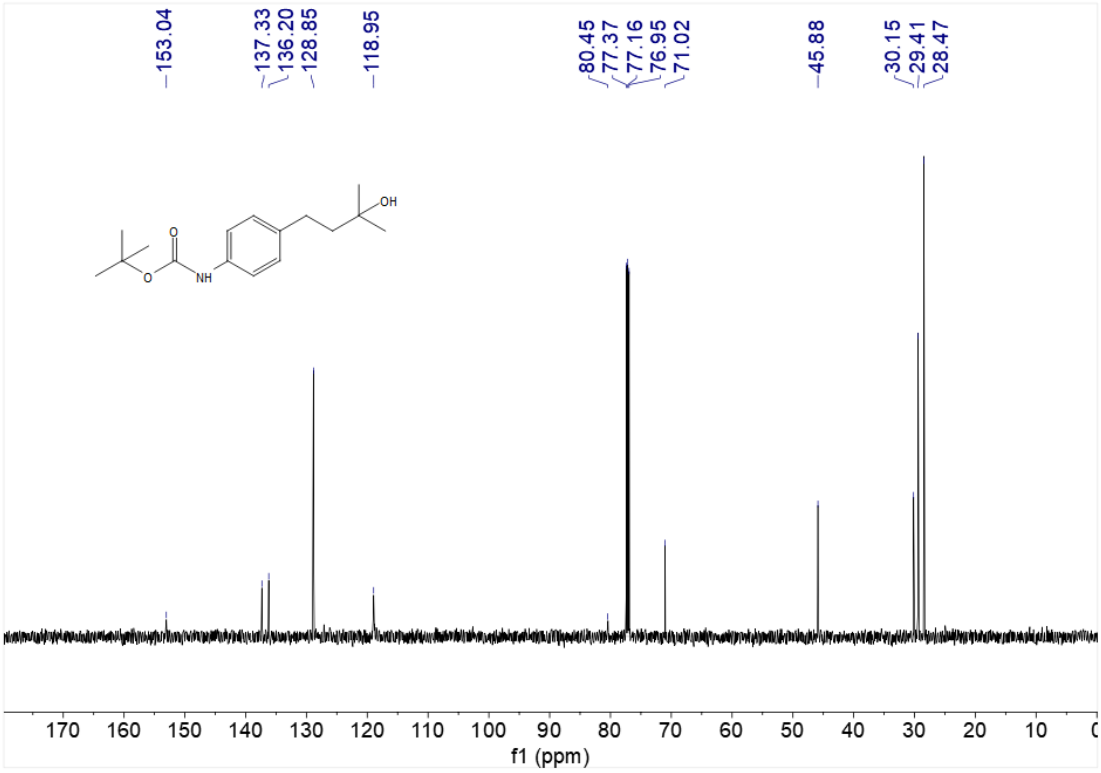
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of
2-methyl-4-(naphthalen-2-yl)pentan-2-ol (6oa)



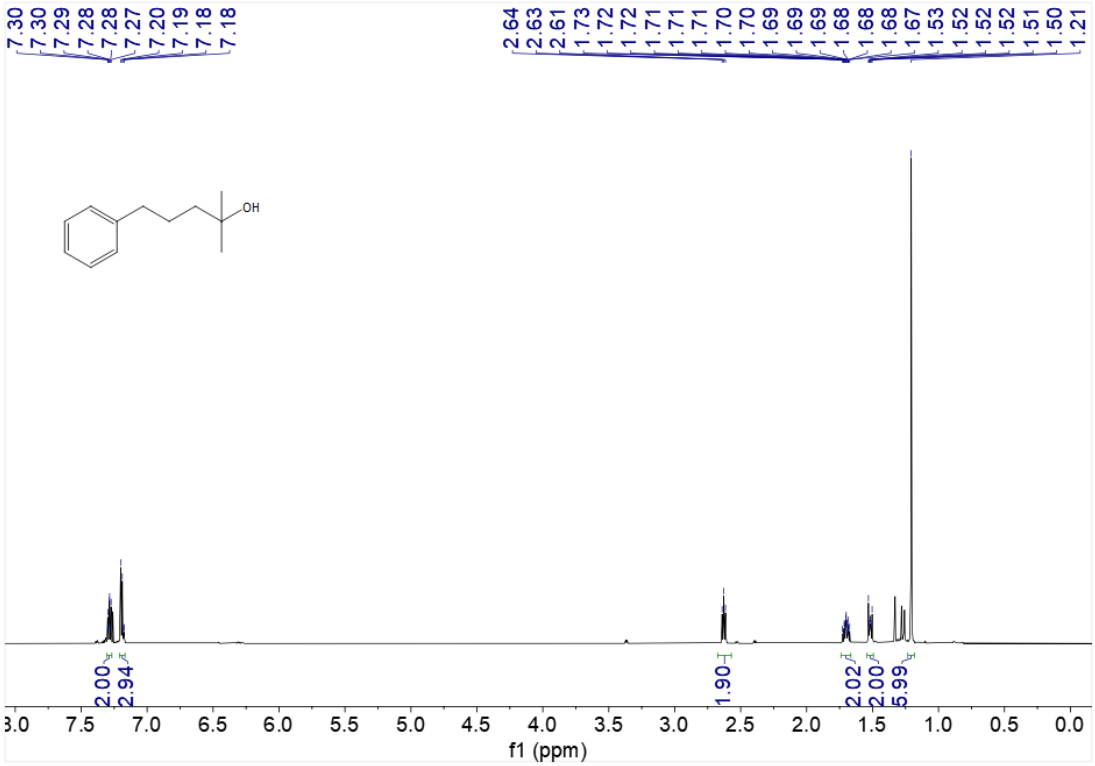
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl (4-(3-hydroxy-3-methylbutyl)phenyl)carbamate (6pa)



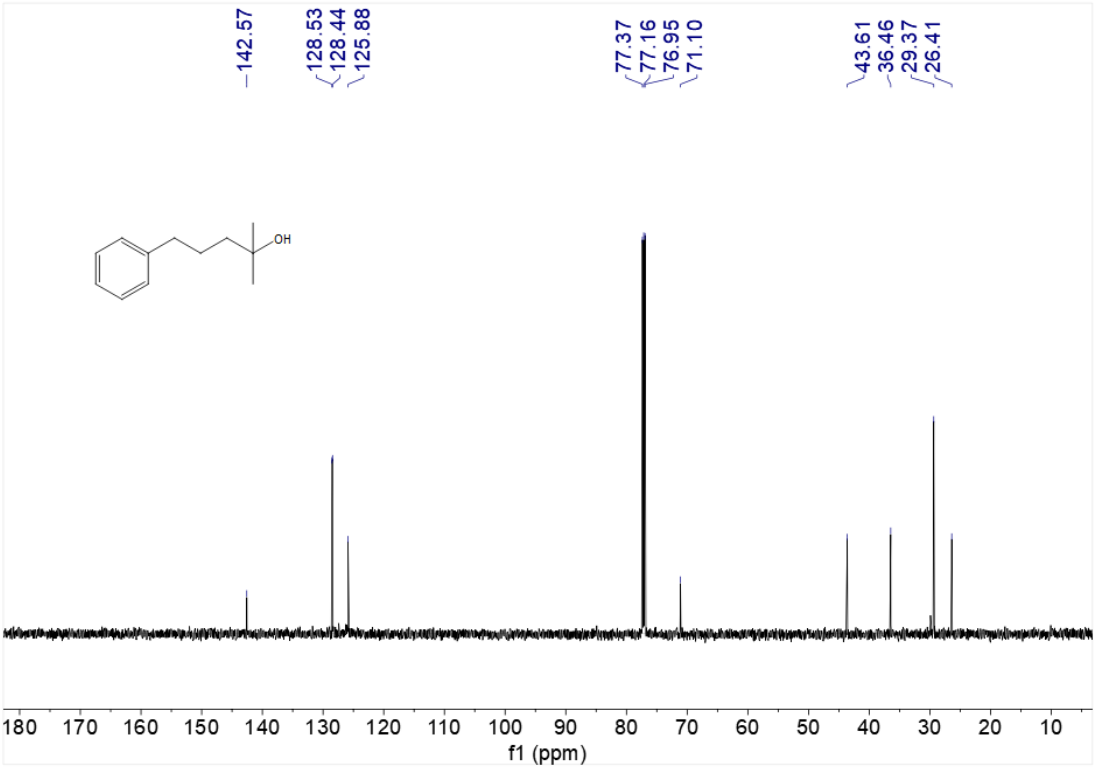
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl (4-(3-hydroxy-3-methylbutyl)phenyl)carbamate (6pa)



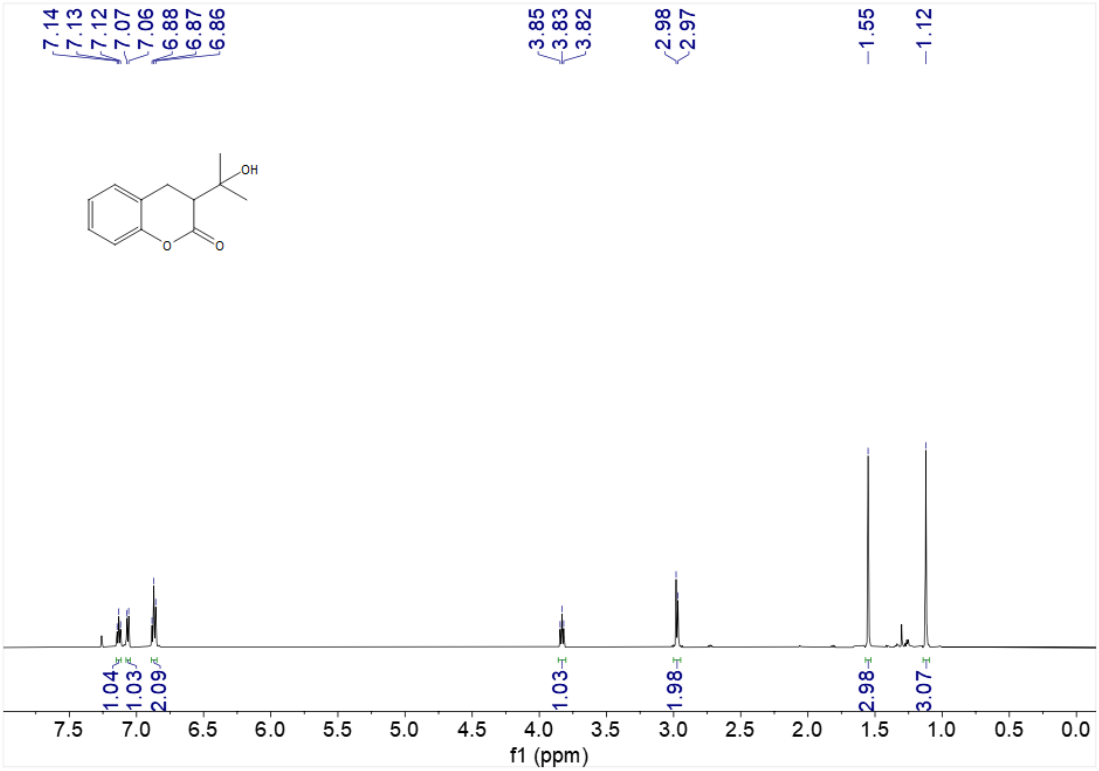
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 2-methyl-5-phenylpentan-2-ol (6qa)



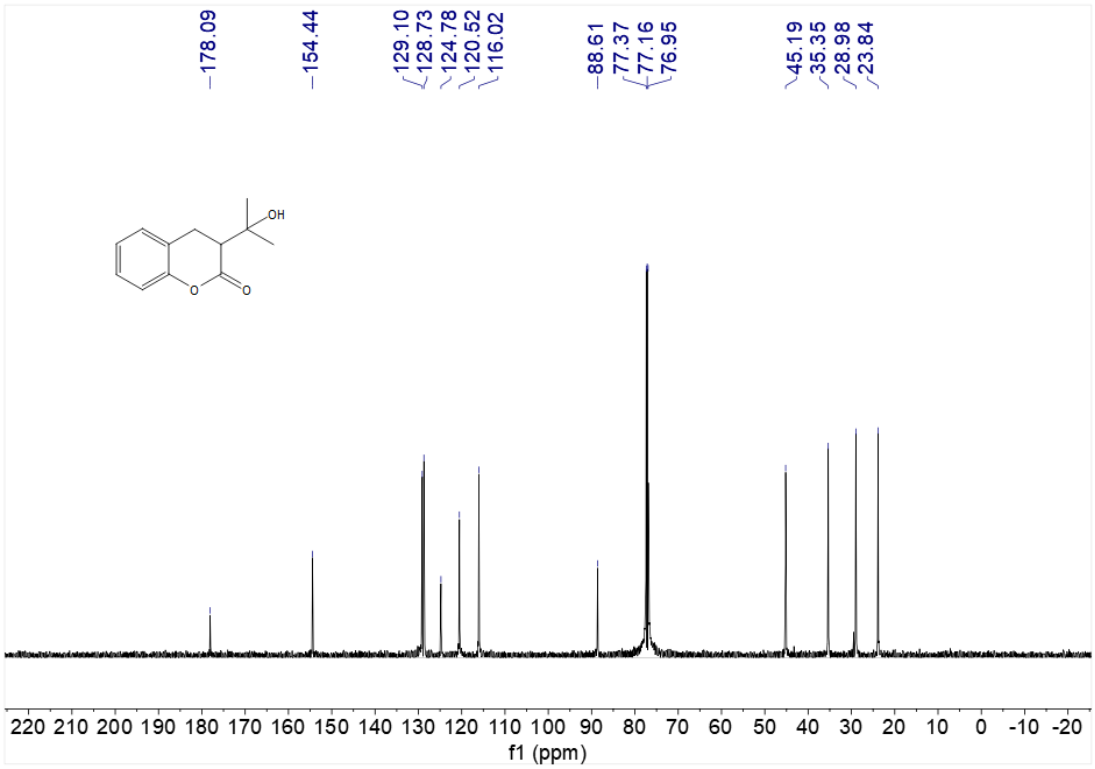
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 2-methyl-5-phenylpentan-2-ol (6qa)



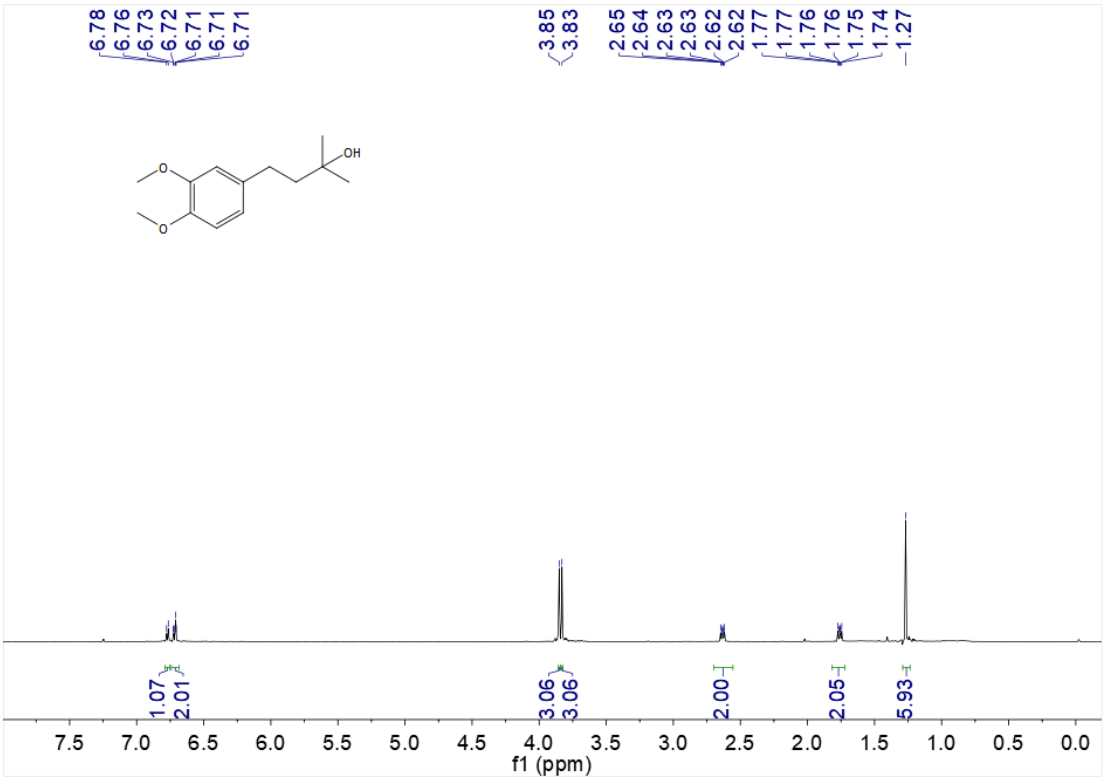
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 3-(2-hydroxypropan-2-yl)chroman-2-one (6ra)



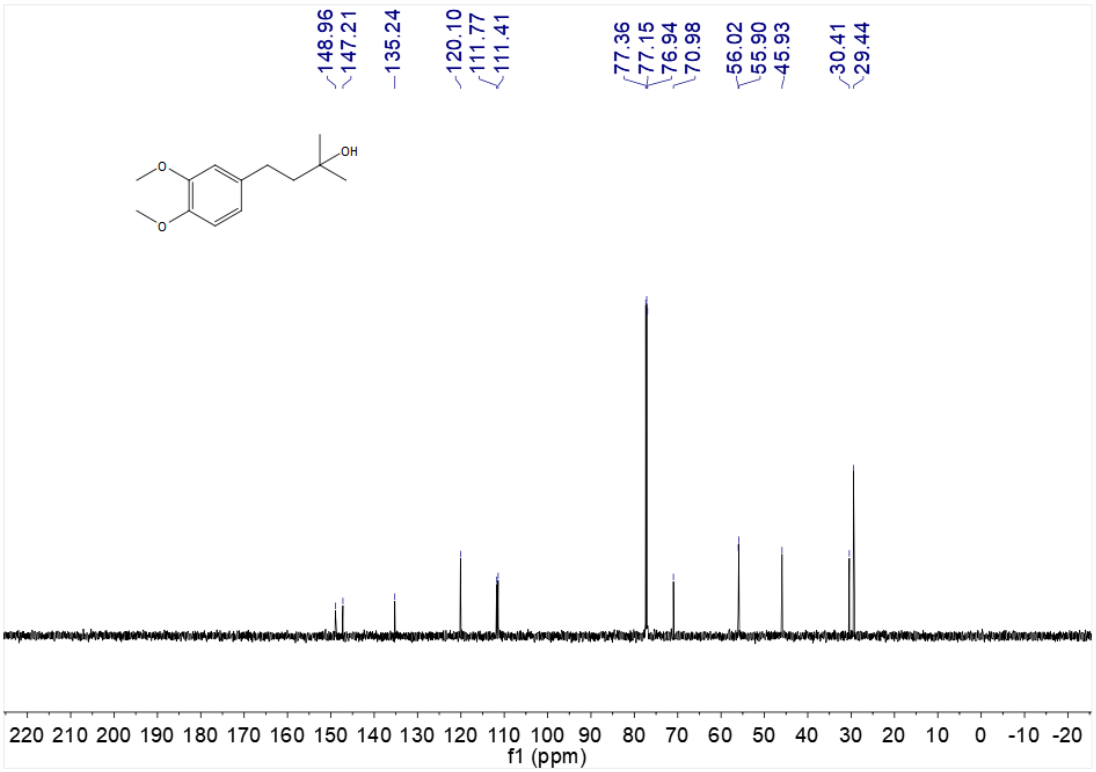
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 3-(2-hydroxypropan-2-yl)chroman-2-one (6ra)



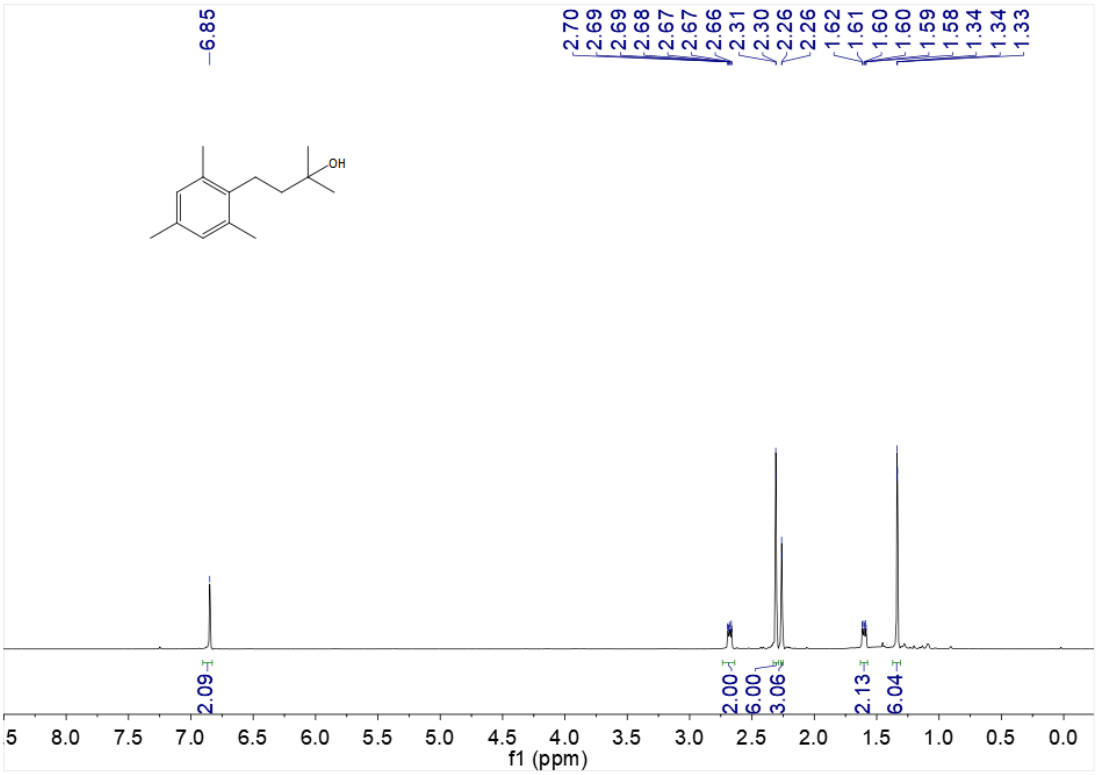
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 4-(3,4-dimethoxyphenyl)-2-methylbutan-2-ol (6sa)



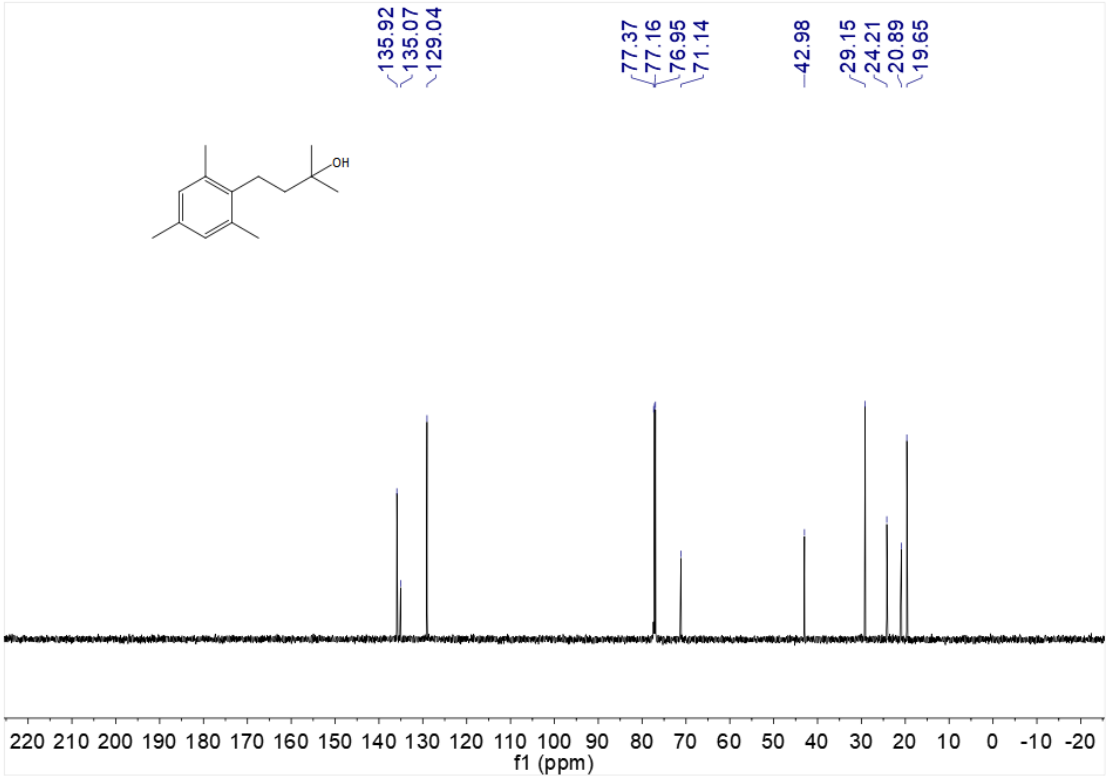
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 4-(3,4-dimethoxyphenyl)-2-methylbutan-2-ol (6sa)



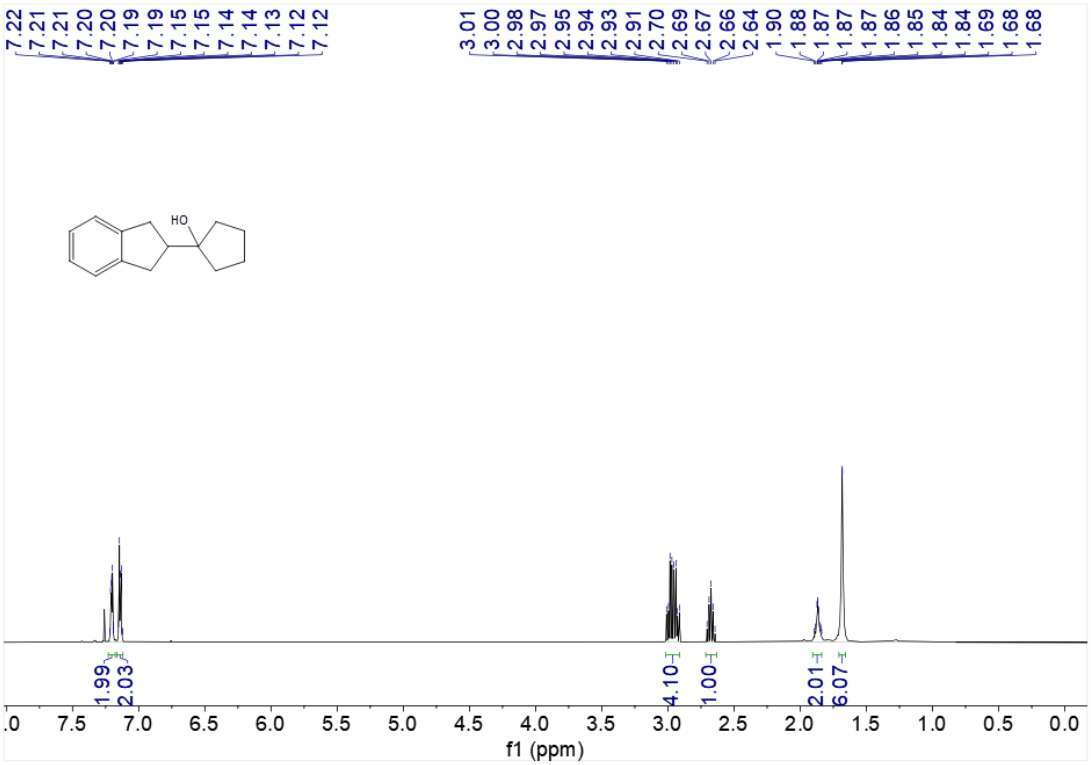
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 4-mesityl-2-methylbutan-2-ol (6ta)



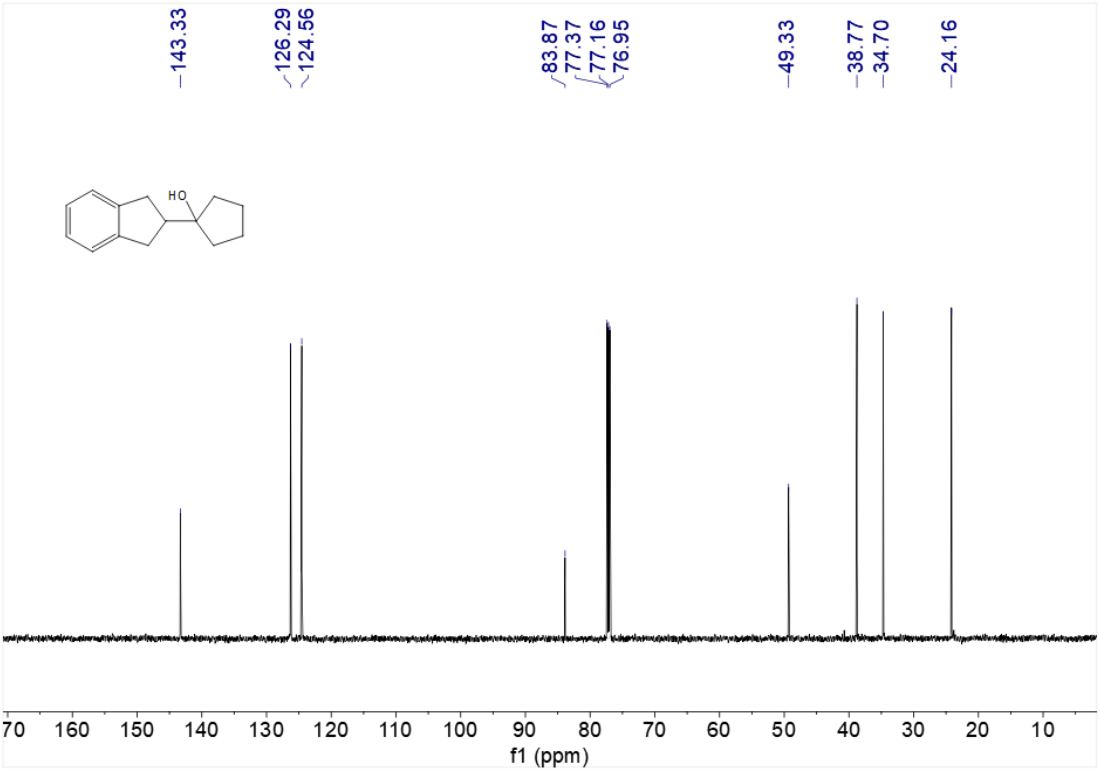
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 4-mesityl-2-methylbutan-2-ol (6ta)



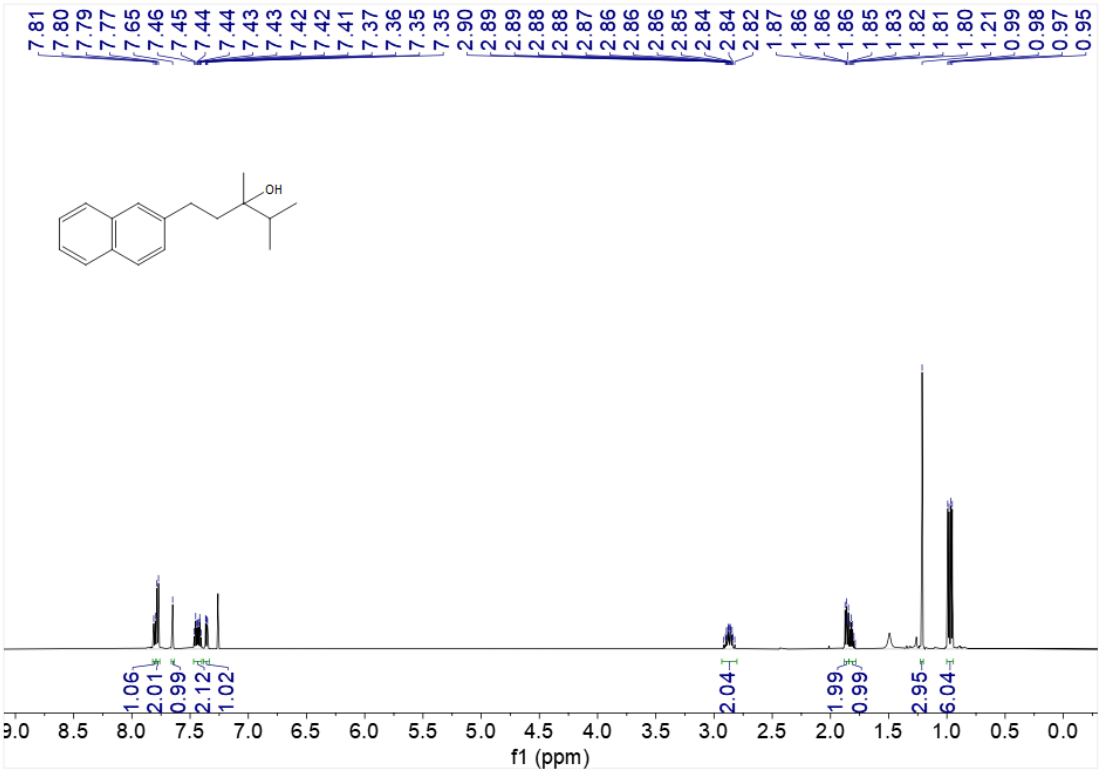
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl methyl 1-(2,3-dihydro-1H-inden-2-yl)cyclopentan-1-ol (6mg)



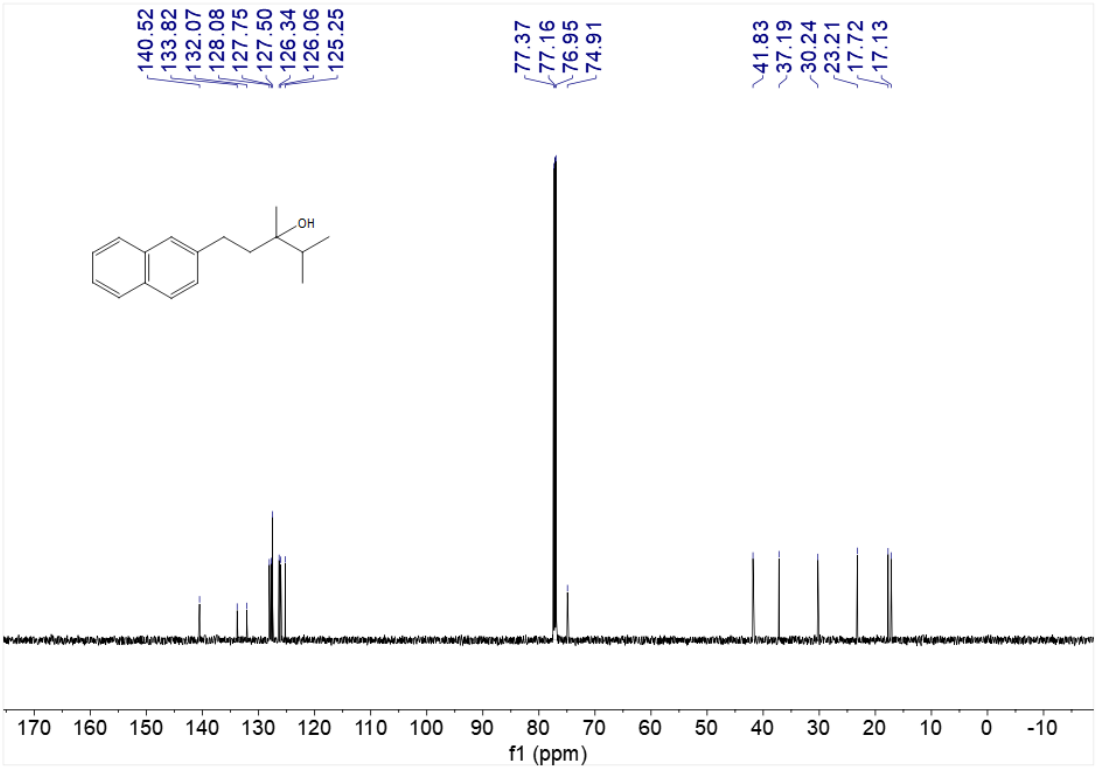
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl methyl 1-(2,3-dihydro-1H-inden-2-yl)cyclopentan-1-ol (6mg)



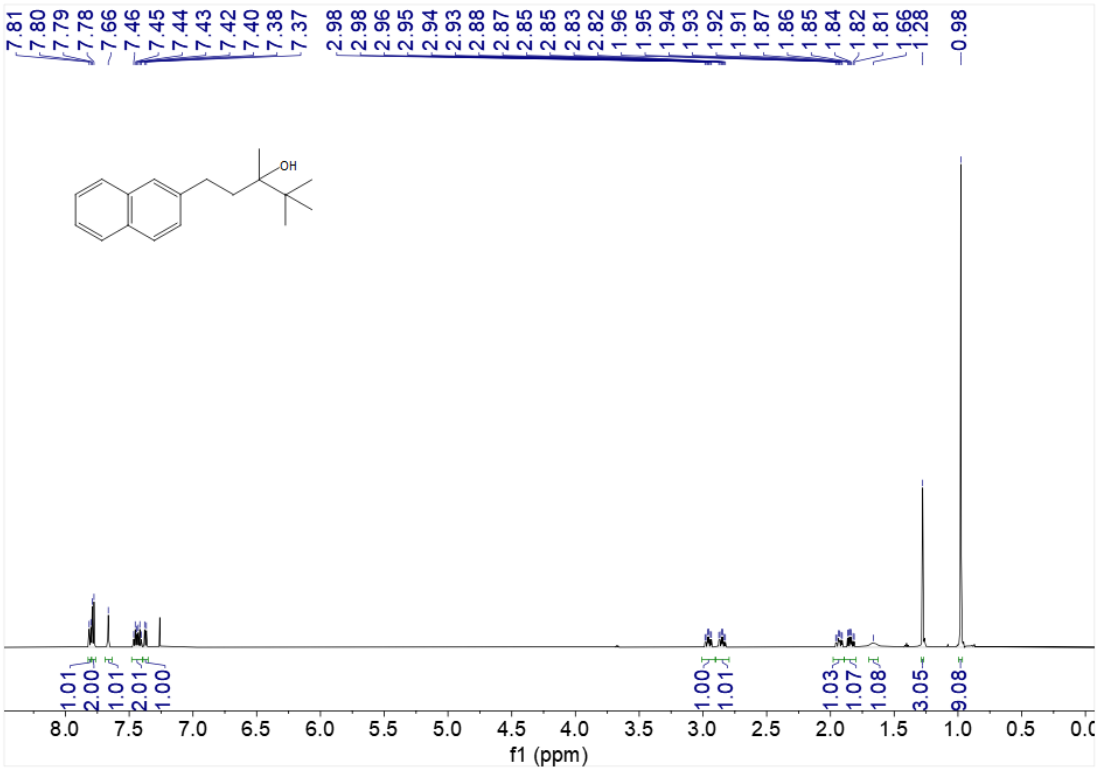
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl tert-butyl 3,4-dimethyl-1-(naphthalen-2-yl)pentan-3-ol (6nd)



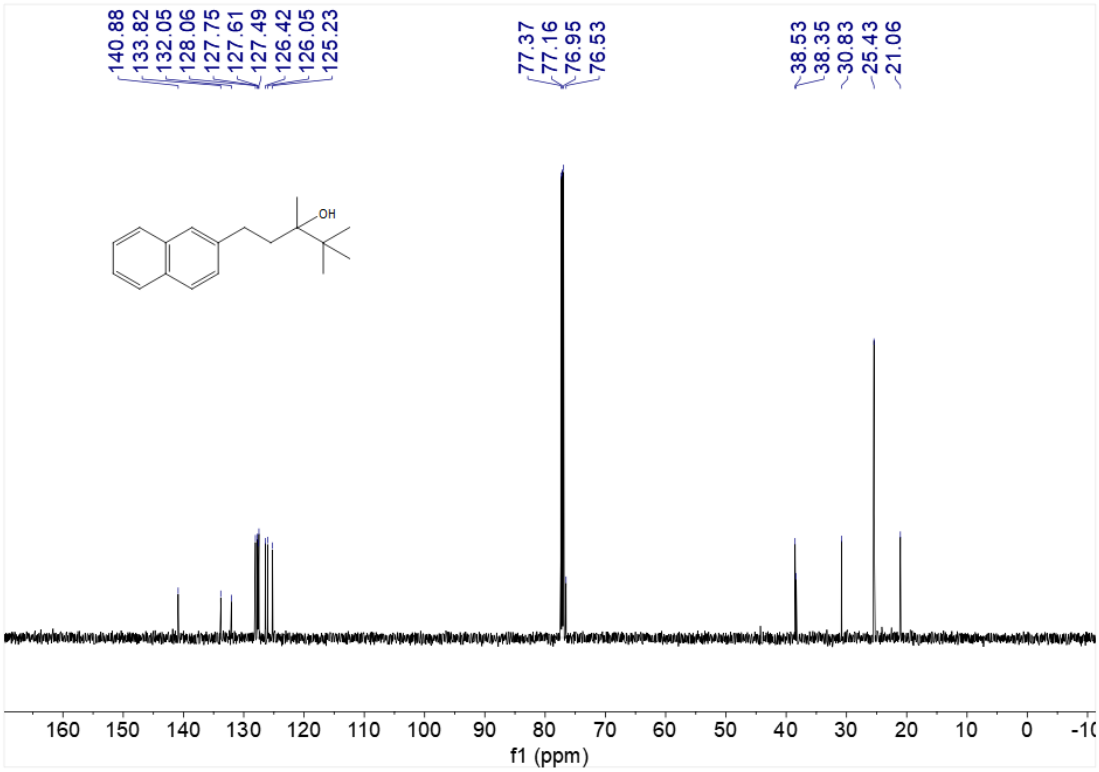
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl tert-butyl 3,4-dimethyl-1-(naphthalen-2-yl)pentan-3-ol (6nd)



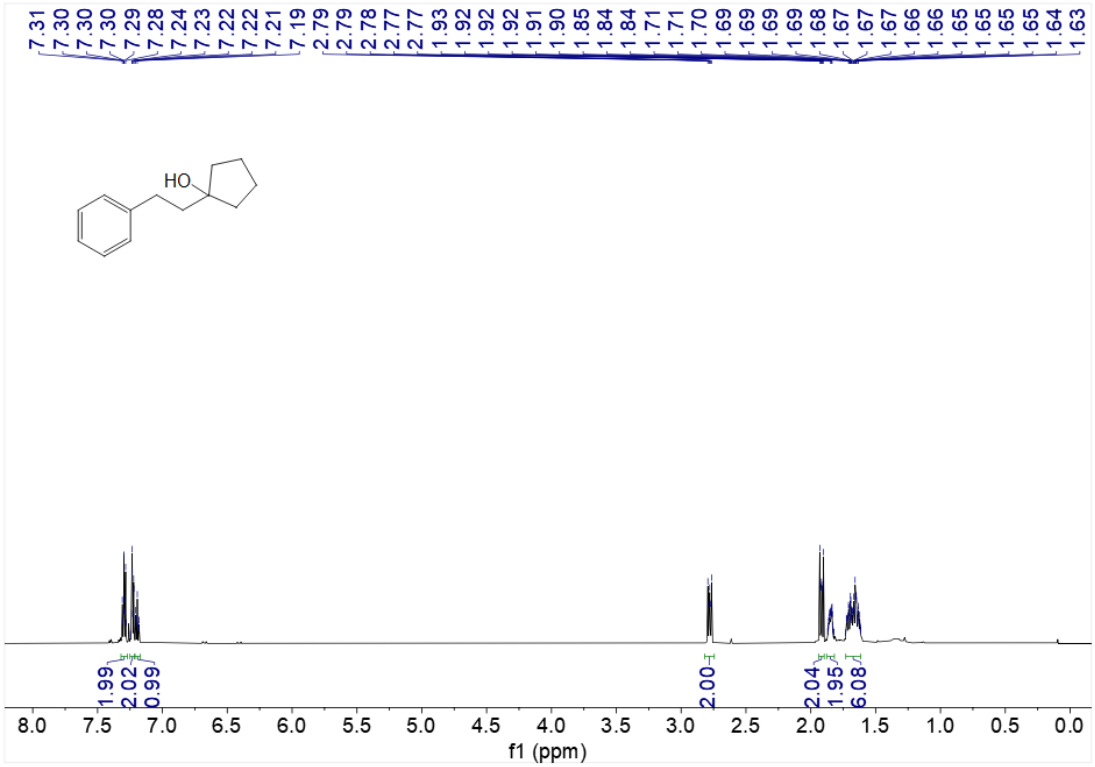
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl 3,4,4-trimethyl-1-(naphthalen-2-yl)pentan-3-ol (6ne)



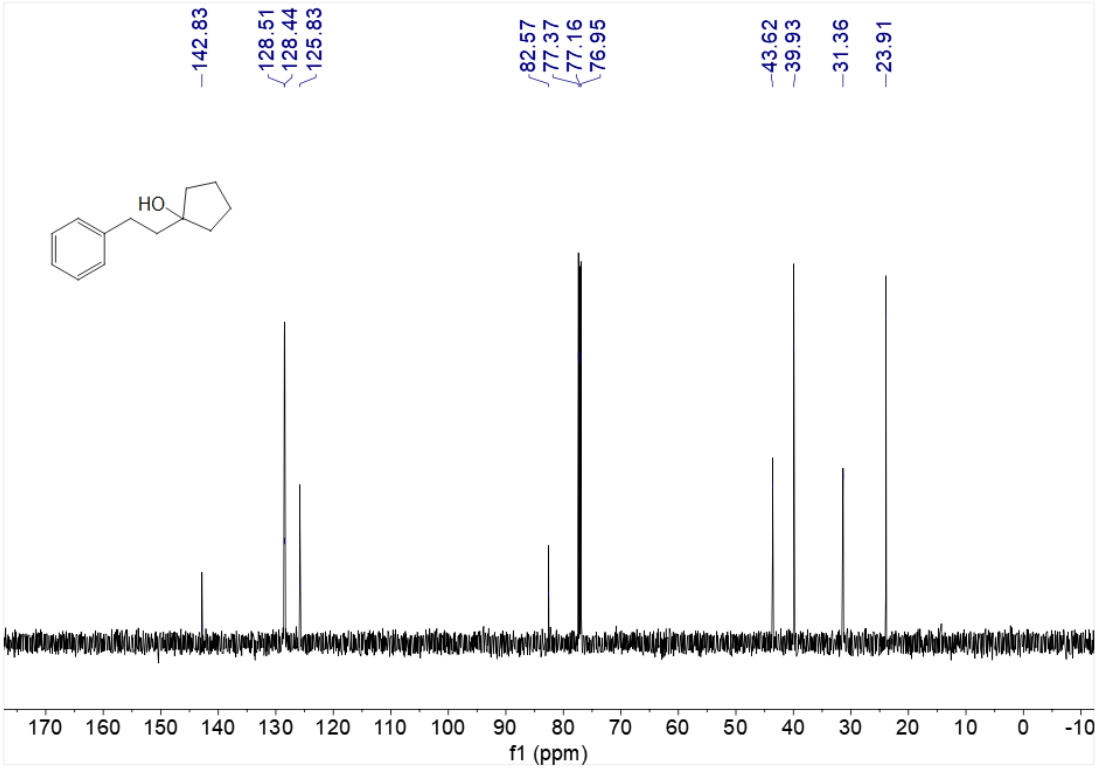
^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl 3,4,4-trimethyl-1-(naphthalen-2-yl)pentan-3-ol (6ne)



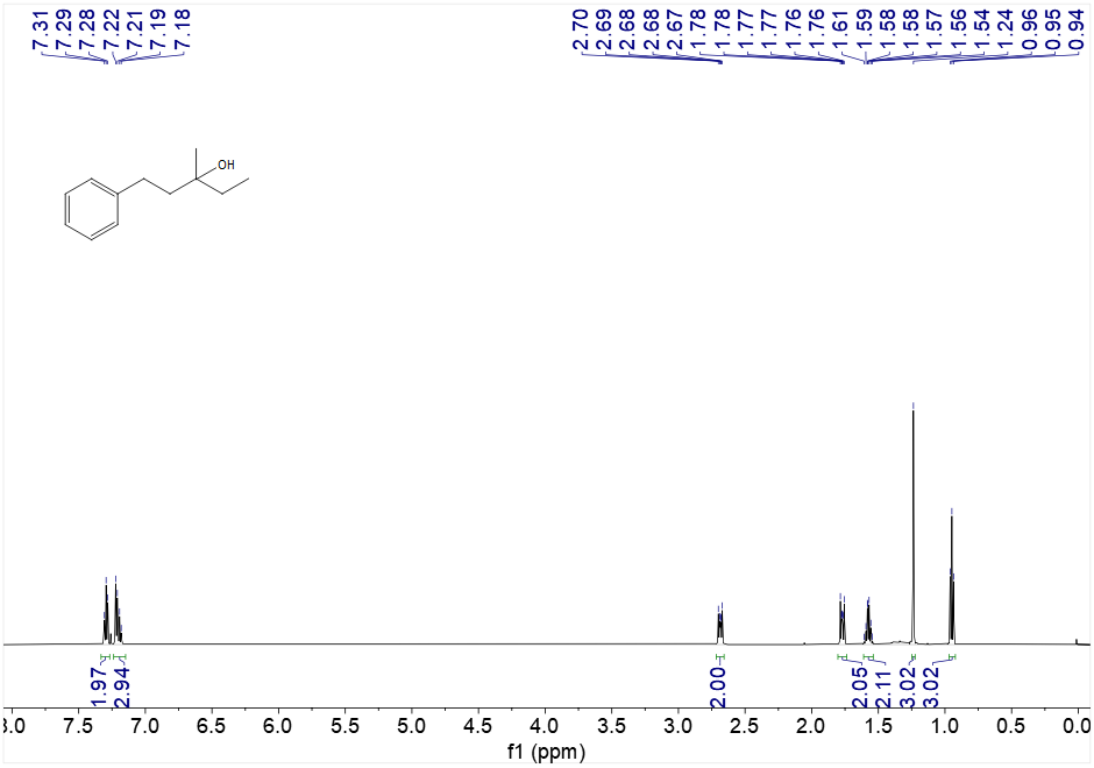
^{1}H NMR (600 MHz, $CDCl_3$) spectrum of tert-butyl 1-phenethylcyclopentan-1-ol (6ag)



^{13}C NMR (151 MHz, $CDCl_3$) spectrum of tert-butyl 1-phenethylcyclopentan-1-ol (6ag)



^{1}H NMR (600 MHz, $CDCl_3$) spectrum of 3-methyl-1-phenylpentan-3-ol (6ah)



^{13}C NMR (151 MHz, $CDCl_3$) spectrum of 3-methyl-1-phenylpentan-3-ol (6ah)