Supporting Information

Diversity-Oriented Synthesis of Fluoroalkylated Amines via Palladium-Catalyzed Divergent Fluoroalkylamination of 1,3-Dienes

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Table of Content

1. General Information S3

2. List of Substrates.....S4

3. Optimization of Reaction Conditions.....S6

4. General Experimental Procedures for Diversity-Oriented Synthesis of Fluoroalkylated Amines.....S12

5. Control Experiment S14

6. Characterization Data for New Products S15

7. References S53

8. NMR Spectra of New Products.....S55

1. General Information

1.1 Analytical Methods

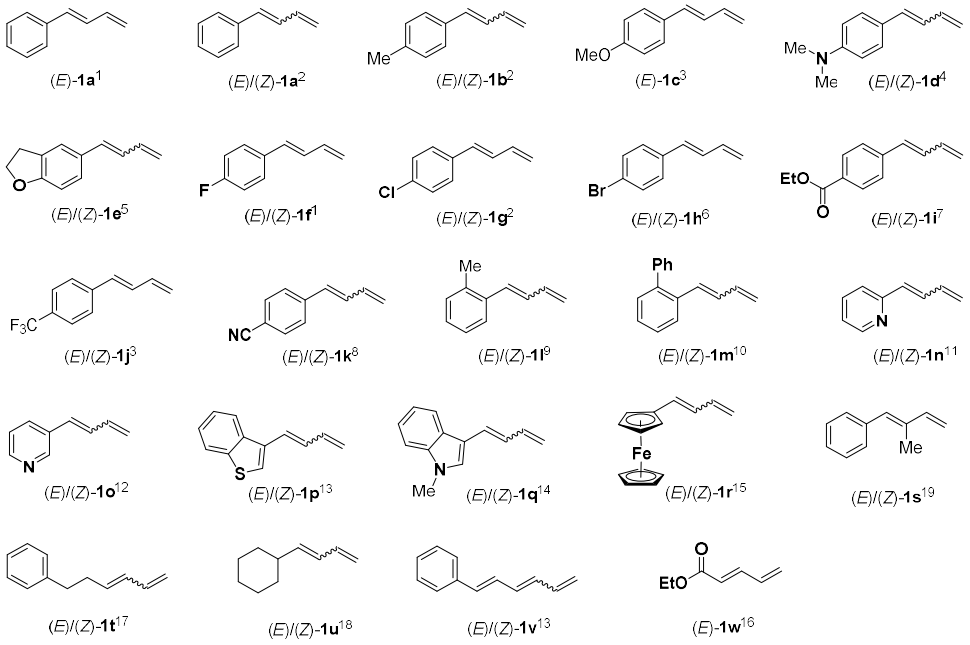
^{1}H, ^{13}C and ^{19}F NMR data were measured on a Bruker Avance-III 600 (600MHz for ^{1}H, 151 MHz for ^{13}C NMR spectroscopy) using $CDCl_3$ as the solvent. Chemical shifts are reported in parts per million (ppm, δ), downfield from tetramethylsilane (TMS, δ = 0.00 ppm) and are referenced to residual solvent ($CDCl_3$, δ = 7.26 ppm (1H) and 77.16 ppm (^{13}C)). The following abbreviations (or combinations thereof) were used to explain chemical shift (δ ppm), multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), integration, and coupling constants (*J*) in hertz (Hz). IR spectra were measured on a Nicolet IS10. Mass spectra were measured on an Agilent GC-MS5975C Plus spectrometer (EI). HRMS (ESI) analysis was measured on a Q Exactive™ Plus Orbitrap. Melting points were measured using a melting point instrument and are uncorrected.

1.2 Materials

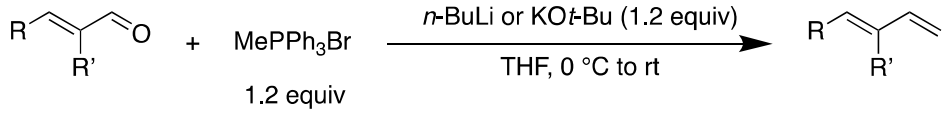
All anhydrous solvents, phosphine ligands and NBE derivatives mentioned in this text were bought from commercial sources and used as received without purification. Analytical thin-layer chromatography was performed on 0.20 mm silica gel plates (GF254) using UV light or phosphomolybdic acid as a visualizing agent. Flash column chromatography was carried out using silica gel (200-300 mesh) with the indicated solvent system. All reactions were conducted in oven-dried Schlenk tubes.

2. List of Substrates

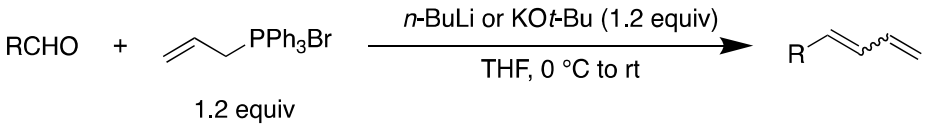
(a) Synthesis of 1,3-dienes



Dienes (*E*)-**1a**, **1c**, **1f - 1h**, **1j** and **1s** were synthesized via Wittig reaction using methyltriphenylphosphonium bromide.[1, 3, 6, 19]

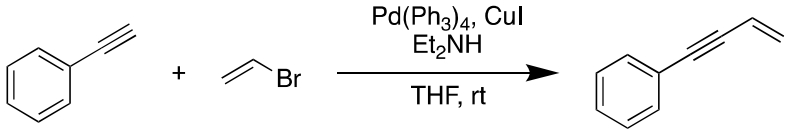


Dienes with a mixture of (*E*)/(*Z*) were synthesized via Wittig reaction using allyltriphenylphosphonium bromide.[2, 4-5, 7-15, 17-18]



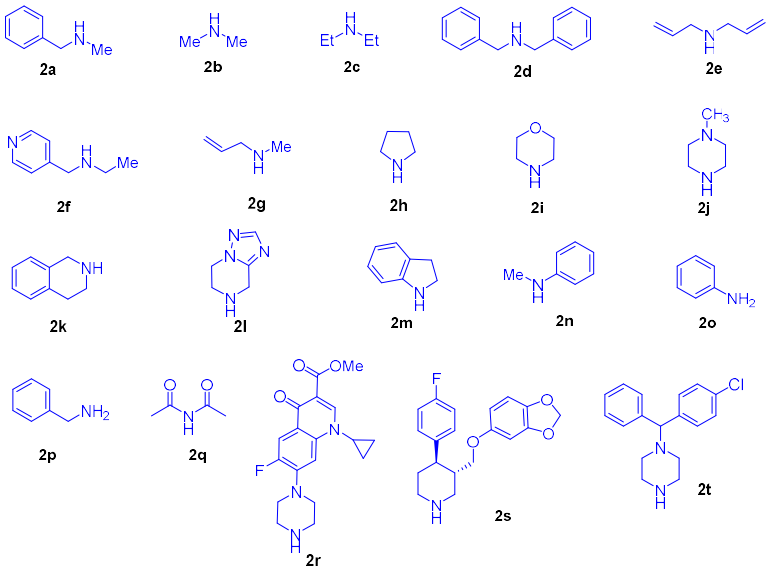
Dienes **1w** was synthesized according to literature reference.[16]

(b) Synthesis of but-3-en-1-yn-1-ylbenzene



But-3-en-1-yn-1-ylbenzene was synthesized according to literature references.[20]

Synthesis of amines

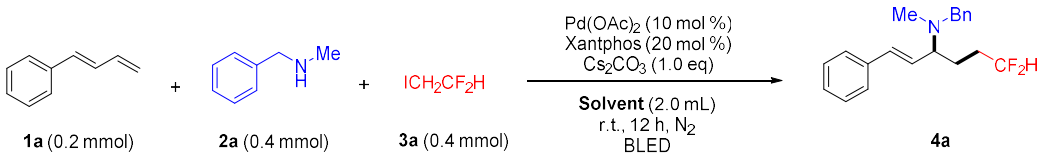


Amines **2a** - **2q, 2s** and **2t** are commercially available.

Ciprofloxacin methyl ester **2r** was synthesized according to literature reference.[21]

3. Optimization of Reaction Conditions

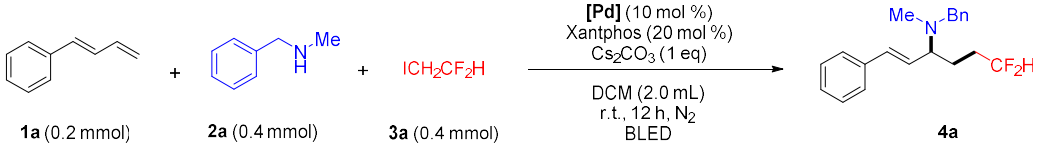
(1) Optimization of Solvents



1a (0.2 mmol) + **2a** (0.4 mmol) + **3a** (0.4 mmol) → **4a**

Entry	Solvent	Yield (%)
1	THF	0
2	**DCM**	**55**
3	DCE	53
4	Toluene	33
5	CH_3CN	20
6	Dioxane	25
7	DMF	trace
8	Hexane	9

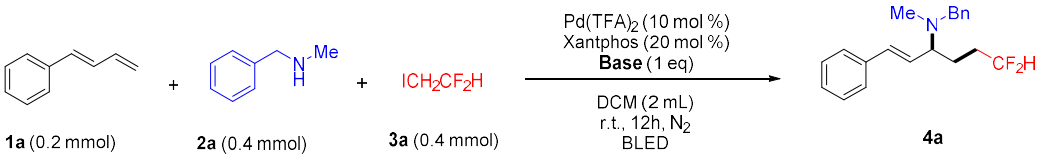
(2) **Optimization of [Pd] catalysts**



1a (0.2 mmol) **2a** (0.4 mmol) **3a** (0.4 mmol) **4a**

Entry	**Pd source**	**Yield** (%)
1	$Pd(OAc)_2$	55
2	$PdCl_2$	55
3	**$Pd(TFA)_2$**	**54**
4	$PdCl_2(CH_3CN)_2$	54
5	$Pd[P(Ph)_3]_4$	35
6	$PdCl_2(PhCN)_2$	55
7	$PdCl_2(PPh_3)_2$	55
8	$PdCl_2$(dppf)	55
9	$Pd(dba)_2$	43
10	$PdCl_2$(dippp)	40
11	$Pd_2(dba)_3$	51
12	(dppe)$PdCl_2$	31

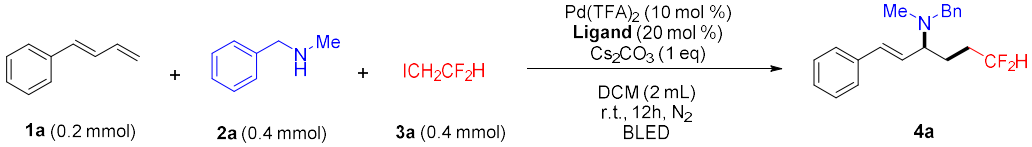
(3) **Optimization of Bases**



1a (0.2 mmol) + **2a** (0.4 mmol) + **3a** (0.4 mmol) → **4a**

Entry	Base	Yield (%)
1	**Cs_2CO_3**	**54**
2	K_2CO_3	21
3	Na_2CO_3	25
4	DIPEA	19
5	TEA	35
6	LiOH	33
7	CH_3COOK	25
8	KH_2PO_4	20
9	Pyridine	15
10	K_3PO_4	35
11	Li_2CO_3	23

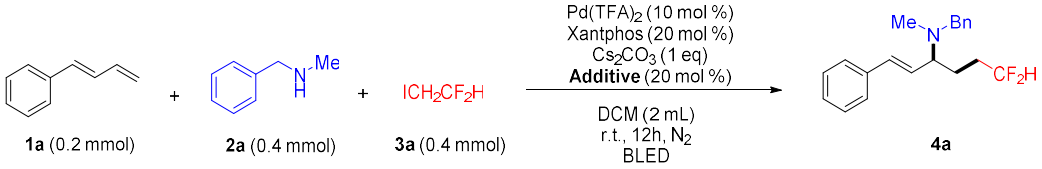
(4) **Optimization of Ligands**



1a (0.2 mmol) + **2a** (0.4 mmol) + **3a** (0.4 mmol) → **4a**

Entry	**Ligand**	**Yield** (%)
1	**Xantphos**	**54**
2	BINAP	34
3	DPPP	0
4	Tri-o-tolylphosphine	0
5	DPPPY	0
6	2,2'-Bipyridine	trace
7	1,10-Phenanthroline	trace
8	DPEPHOS	31
9	Cyclohexyldiphenylphosphine	0
10	JohnPhos	0
11	RuPhos	0
12	2,2'-Biquinoline	0

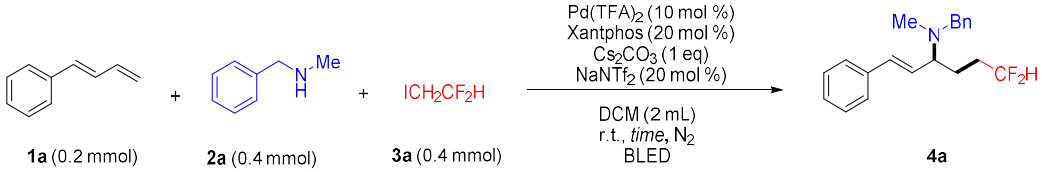
(5) **Optimization of Additives**



1a (0.2 mmol) + **2a** (0.4 mmol) + **3a** (0.4 mmol) → **4a**

Entry	**Additive**	**Yield** (%)
1	AgOAc	30
2	Ag_2CO_3	8
3	CF_3COOAg	46
4	$Ni(OTf)_2$	55
5	KPF_6	20
6	Me_3OBF_4	18
7	$AgNTf_2$	15
8	**$NaNTf_2$**	**60**

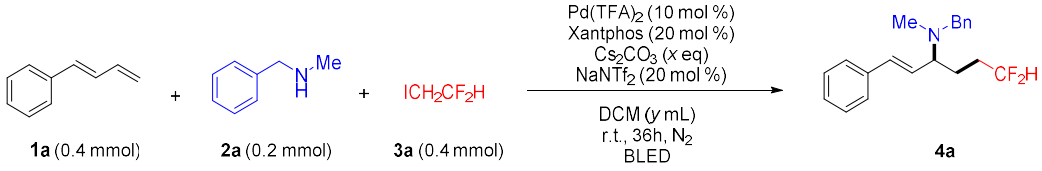
(6) **Optimization of Time**



1a (0.2 mmol) + **2a** (0.4 mmol) + **3a** (0.4 mmol) → **4a**

Entry	Time	Yield (%)
1	18	65
2	24	70
3	**36**	**73**

(7) **Optimization of Reactant Ratio**

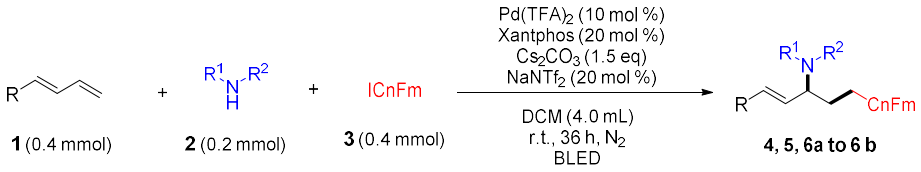


1a (0.4 mmol) + **2a** (0.2 mmol) + **3a** (0.4 mmol) → **4a**

Entry	x	y	Yield (%)
1	1	2	74
2	1.5	2	76
3	**1.5**	**4**	**80**

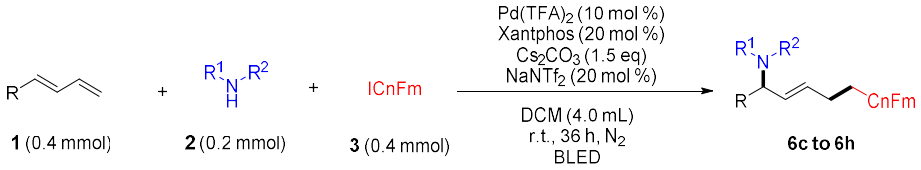
4. General Experimental Procedures for Diversity-Oriented Synthesis of Fluoroalkylated Amines

General Experimental Procedure A



A 10 mL sealed tube (with a Teflon cap) equipped with a magnetic stir bar was charged with $Pd(TFA)_2$ (0.02 mmol, 10 mol%), Xantphos (0.04 mmol, 20 mol%), $NaNTf_2$ (0.04 mmol, 20 mol%) and Cs_2CO_3 (0.3 mmol, 1.5 equiv). Then DCM (2.0 mL) was added to the mixture, followed by 1,3-diene (0.4 mmol) **1**, fluoroalkyliodide **3** (0.4 mmol) and amine **2** (0.2 mmol) via microsyringe. Finally, another portion of DCM (2.0 mL) was added. The tube was subsequently put at the center of a stir plate and irradiated with blue LEDs. The reaction was stirred vigorously (700 rpm) with cooling by a fan. After 36 hours, the resulting mixture was extracted with DCM (3 x 15 mL) and the combined organic layers were dried over anhydrous Na_2SO_4. After removal of the solvent under reduced pressure, the crude product was purified by column chromatography on silica gel to give the product **4, 5 or 6a** to **6b**.

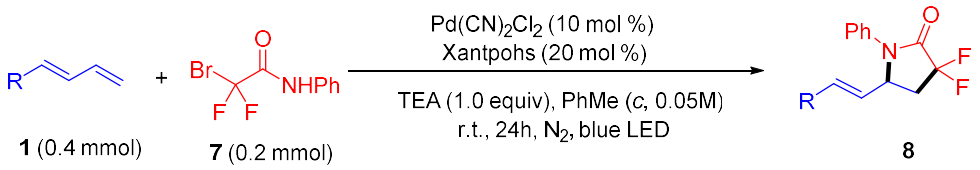
(2) General Experimental Procedure B



A 10 mL sealed tube (with a Teflon cap) equipped with a magnetic stir bar was charged with $Pd(TFA)_2$ (0.02 mmol, 10 mol%), Xantphos (0.04 mmol, 20 mol%), $NaNTf_2$ (0.04 mmol, 20 mol%) and Cs_2CO_3 (0.3 mmol, 1.5 equiv). Then DCM (2.0 mL) was added to the mixture, followed by 1,3-diene (0.4 mmol), fluoroalkyliodide (0.4 mmol) and amine (0.2 mmol) via microsyringe. Finally, another portion of DCM (2.0 mL) was added. The tube was subsequently put at the center of a stir plate and irradiated with blue LEDs. The reaction was stirred vigorously (700 rpm) with cooling by a fan. After 36 hours, the resulting mixture was extracted with DCM (3 x 15 mL) and the combined organic layers were dried over anhydrous Na_2SO_4. After

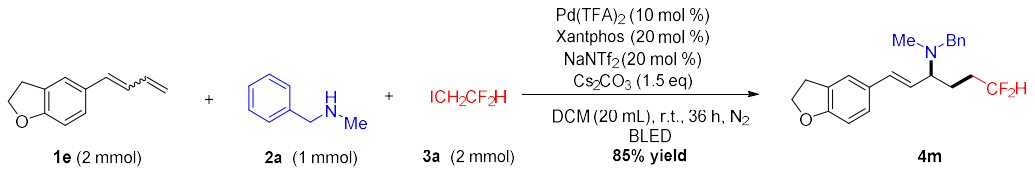
removal of the solvent under reduced pressure, the crude product was purified by column chromatography on silica gel to give the product **6c** to **6h**.

(3) General Experimental Procedure C



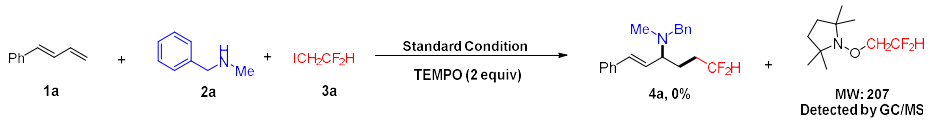
A 10 mL sealed tube (with a Teflon cap) equipped with a magnetic stir bar was charged with $Pd(CN)_2Cl_2$ (0.02 mmol, 10 mol%), Xantphos (0.04 mmol, 20 mol%), **7** (0.2 mmol, 1.0 equiv), Then PhMe (2.0 mL) was added to the mixture, followed by 1,3-diene (0.4 mmol), TEA (0.2 mmol) via microsyringe. Finally, another portion of PhMe (2.0 mL) was added. The tube was subsequently put at the center of a stir plate and irradiated with blue LEDs. The reaction was stirred vigorously (700 rpm) with cooling by a fan. After 36 hours, the resulting mixture was extracted with DCM (3 x 15 mL) and the combined organic layers were dried over anhydrous Na_2SO_4. After removal of the solvent under reduced pressure, the crude product was purified by column chromatography on silica gel to give the product **8**.

(4) Gram-scale Experiment Procedure for Gram Scale Synthesis of Product 4m

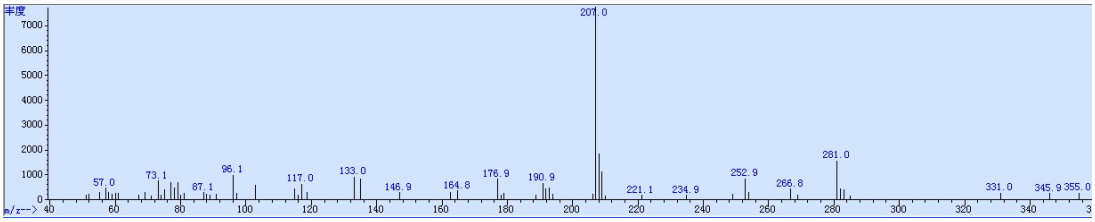


A 50 mL sealed tube (with a Teflon cap) equipped with a magnetic stir bar was charged with $Pd(TFA)_2$ (0.1 mmol), Xantphos (0.2 mmol), $NaNTf_2$ (0.2 mmol) and Cs_2CO_3 (1.5 mmol). DCM (5.0 mL) was added to the mixture, followed by **1e** (2.0 mmol), **2a** (1 mmol) and **3a** (2 mmol) via microsyringe. Finally, the rest of DCM (15.0 mL) was added. The tube was subsequently put at the center of a stir plate and irradiated with blue LEDs. The reaction was stirred vigorously (700 rpm) with cooling by a fan. After 36 hours the reaction mixture was filtered through Celite and concentrated under reduced pressure. The crude reaction mixture was purified by flash column chromatography using EtOAc/Hexane (1:9) as the eluent to afford the pure **4m** with 85% yield.

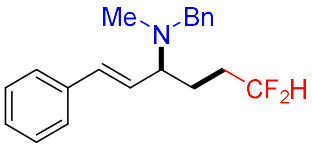
5. Control Experiment



When TEMPO (2.0 equiv) was added to this reaction under standard condition, no desired product **4a** was found, while the 1-(2,2-difluoroethoxy)-2,2,5,5-tetramethylpyrrolidine was detected by GC/MS, indicating the possibility of the fluoroalkyl radical in the reaction medium.



6. Characterization Data for New Products



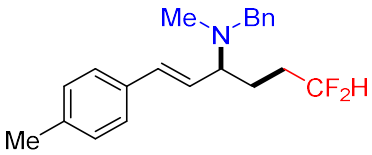
(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-phenylhex-1-en-3-amine (4a). Yellow oil, 80% yield, 50.5 mg. 81% yield, 50.9 mg when (*E*)/(*Z*)-1 was used. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4a**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.44 - 7.32 (m, 8H), 7.31 - 7.26 (m, 2H), 6.48 (d, *J* = 15.9 Hz, 1H), 6.25 (dd, *J* = 15.9, 8.9 Hz, 1H), 5.87 (tt, *J* = 56.9, 4.1 Hz, 1H), 3.72 (d, *J* = 13.3 Hz, 1H), 3.52 (d, *J* = 13.3 Hz, 1H), 3.15- 7.19 (m, 1H), 2.26 (s, 3H), 2.10 - 1.90 (m, 3H), 1.71 - 1.75 (m, *J* = 10.4, 7.5 Hz, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.69, 136.84, 133.33, 128.77, 128.65, 128.30, 127.67, 127.65, 126.93, 126.39, 117.45 (t, *J* = 238.7 Hz), 64.47, 58.48, 37.12, 31.27 (t, *J* = 21.0 Hz), 25.16 (t, *J* = 5.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.78.

HRMS(ESI) calcd. for $C_{20}H_{24}NF_2^+$[M+H]$^+$ 316.18713, found 316.18695.



(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(*p*-tolyl)hex-1-en-3-amine (4b).Pale yellow oil, 87% yield, 57.2 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4b**.

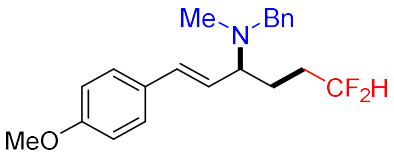
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 - 7.20 (m, 7H), 7.14 (d, *J* = 7.9 Hz, 2H), 6.41 (d, *J*

= 15.9 Hz, 1H), 6.15 (dd, *J* = 15.9, 8.9 Hz, 1H), 5.83 (tt, *J* = 56.9, 4.2 Hz, 1H), 3.68 (d, *J* = 13.3 Hz, 1H), 3.47 (d, *J* = 13.3 Hz, 1H), 3.10 - 3.13 (m, 1H), 2.34 (s, 3H), 2.21 (s, 3H), 2.03 - 1.85 (m, 3H), 1.67 - 1.71 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.72, 137.55, 134.07, 133.28, 129.38, 128.83, 128.33, 126.96, 126.53, 126.33, 117.52 (t, *J* = 238.7 Hz), 64.57, 58.47, 37.15, 31.32 (t, *J* = 20.8 Hz), 25.23 (t, *J* = 4.9 Hz), 21.24.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.71.

HRMS(ESI) calcd. for $C_{21}H_{26}NF_2^+[M+H]^+$ 330.20278, found 330.20239.



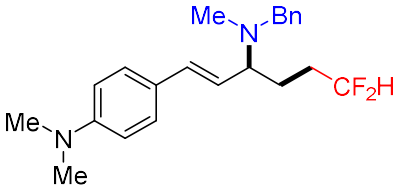
(*E*)-*N*-Benzyl-6,6-difluoro-1-(4-methoxyphenyl)-*N*-methylhex-1-en-3-amine (**4c**). Pale yellow oil, 87% yield, 60.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **4c**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36 - 7.28 (m, 6H), 7.23 (dt, *J* = 9.4, 4.8 Hz, 1H), 6.87 (d, *J* = 8.7 Hz, 2H), 6.39 (d, *J* = 15.9 Hz, 1H), 6.06 (dd, *J* = 15.9, 8.9 Hz, 1H), 5.83 (tt, *J* = 56.8, 4.1 Hz, 1H), 3.80 (s, 3H), 3.68 (d, *J* = 13.3 Hz, 1H), 3.47 (d, *J* = 13.3 Hz, 1H), 3.09 - 3.12 (m, *J* = 7.3 Hz, 1H), 2.21 (s, 3H), 2.04 - 1.85 (m, 3H), 1.72 - 1.65 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 159.33, 139.76, 132.81, 129.66, 128.83, 128.32, 127.58, 126.94, 125.30, 117.54 (t, *J* = 238.7 Hz), 114.10, 64.62, 58.45, 55.36, 37.14, 31.40 (d, *J* = 20.8 Hz), 25.28 (t, *J* = 4.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.70.

HRMS(ESI) calcd. for $C_{21}H_{26}ONF_2^+[M+H]^+$ 346.19769, found 346.19733.



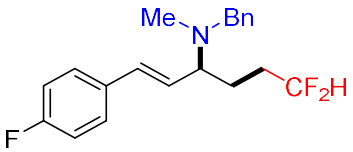
(*E*)-4-(3-(Benzyl(methyl)amino)-6,6-difluorohex-1-en-1-yl)-*N*, *N*-dimethylaniline (**4d**). Red brown oil, 47% yield, 33.9 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **4d**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.38 – 7.27 (m, 7H), 6.74 (d, *J* = 8.8 Hz, 2H), 6.41 (d, *J* = 15.8 Hz, 1H), 6.03 (dd, *J* = 15.8, 8.9 Hz, 1H), 5.88 (tt, *J* = 56.9, 4.2 Hz, 1H), 3.73 (d, *J* = 13.3 Hz, 1H), 3.53 (d, *J* = 13.3 Hz, 1H), 3.11 - 3.16 (m, 1H), 3.00 (s, 6H), 2.25 (s, 3H), 2.08 - 1.91 (m, 3H), 1.78 - 1.70 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 150.25, 139.79, 133.38, 128.88, 128.29, 127.33, 126.89, 125.32, 122.88, 117.58 (t, *J* = 238.7 Hz), 112.53, 64.86, 58.40, 40.59, 37.17, 31.40 (t, *J* = 20.8 Hz), 25.44 (t, *J* = 4.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.67.

HRMS(ESI) calcd. for $C_{22}H_{29}N_2F_2[M+H]^+$ 359.22933, found 359.22913.



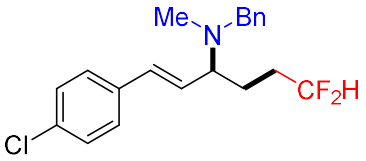
(*E*)-*N*-Benzyl-6,6-difluoro-1-(4-fluorophenyl)-*N*-methylhex-1-en-3-amine (**4e**). Red brown oil, 65% yield, 43.4 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4e**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.39 - 7.20 (m, 7H), 7.02 (t, *J* = 8.6 Hz, 2H), 6.41 (d, *J* = 15.9 Hz, 1H), 6.12 (dd, *J* = 15.9, 8.8 Hz, 1H), 5.84 (tt, *J* = 56.9, 3.8 Hz, 1H), 3.69 (d, *J* = 13.3 Hz, 1H), 3.48 (d, *J* = 13.3 Hz, 1H), 3.11 - 3.15 (m, *J* = 7.4 Hz, 1H), 2.22 (s, 3H), 2.05 -1.65 (m, 4H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 162.35(d, *J* = 246.1 Hz), 139.58, 132.98 (d, *J* = 3.3 Hz), 132.17, 128.78, 128.35, 127.90 (d, *J* = 7.7 Hz), 127.36, 127.00, 117.44 (t, *J* = 238.7 Hz), 115.55 (d, *J* = 21.0 Hz), 64.42, 58.46, 37.10, 31.25 (t, *J* = 21.2 Hz), 25.09 (t, *J* = 4.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -114.35, -115.79.

HRMS(ESI) calcd. for $C_{20}H_{23}NF_3[M+H]^+$ 334.17771, found 334.17725.



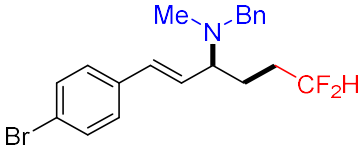
(*E*)-*N*-Benzyl-1-(4-chlorophenyl)-6,6-difluoro-*N*-methylhex-1-en-3-amine (**4f**). Pale yellow oil. 73% yield, 51.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4f**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.35 - 7.22 (m, 9H), 6.40 (d, *J* = 15.9 Hz, 1H), 6.19 (dd, *J* = 15.9, 8.8 Hz, 1H), 5.84 (tt, *J* = 56.9, 4.1 Hz, 1H), 3.68 (d, *J* = 13.3 Hz, 1H), 3.48 (d, *J* = 13.3 Hz, 1H), 3.11 - 3.15 (m, 1H), 2.22 (s, 3H), 2.05 - 1.85 (m, 3H), 1.74 - 1.64 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.55, 135.30, 133.28, 132.10, 128.80, 128.77, 128.43, 128.36, 127.61, 127.02, 117.41 (t, *J* = 238.7 Hz), 64.36, 58.48, 37.09, 31.22 (t, *J* = 21.2 Hz), 25.01 (t, *J* = 5.2 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.79.

HRMS(ESI) calcd. for $C_{20}H_{23}NClF_2[M+H]^+$ 350.14816, found 350.14786.



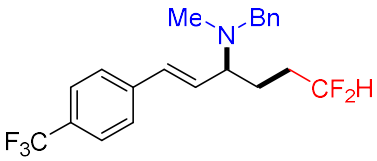
(*E*)-*N*-Benzyl-1-(4-bromophenyl)-6,6-difluoro-*N*-methylhex-1-en-3-amine (4g). Yellow oil, 20% yield, 15.2 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4g**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.4 Hz, 2H), 7.33 - 7.23 (m, 7H), 6.39 (d, *J* = 15.9 Hz, 1H), 6.21 (dd, *J* = 15.9, 8.8 Hz, 1H), 5.84 (tt, *J* = 56.9, 4.0 Hz, 1H), 3.68 (d, *J* = 13.3 Hz, 1H), 3.48 (d, *J* = 13.3 Hz, 1H), 3.11 - 3.15 (m, 1H), 2.22 (s, 3H), 2.05 - 1.87 (m, 3H), 1.71 - 1.66 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.54, 135.72, 132.13, 131.74, 128.75, 128.59, 128.34, 127.92, 127.00, 121.39, 117.39 (t, *J* = 238.8 Hz), 64.34, 58.47, 37.09, 31.20 (t, *J* = 21.0 Hz), 24.97 (t, *J* = 5.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.86.

HRMS(ESI) calcd. for $C_{20}H_{23}NBrF_2[M+H]^+$ 394.09765, found 394.09769.



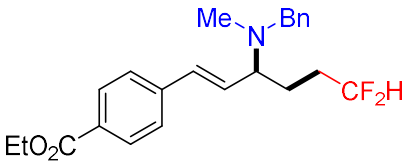
(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(4-(trifluoromethyl)phenyl)hex-1-en-3-amine (**4h**). Brown oil, 67% yield, 51.3 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4h**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.58 (d, *J* = 8.1 Hz, 2H), 7.48 (d, *J* = 8.1 Hz, 2H), 7.36 - 7.21 (m, 5H), 6.49 (d, *J* = 15.2 Hz, 1H), 6.33 (dd, *J* = 15.9, 8.7 Hz, 1H), 5.96 - 5.74 (m, 1H), 3.70 (d, *J* = 13.3 Hz, 1H), 3.50 (d, *J* = 13.3 Hz, 1H), 3.16 - 3.20 (m, 1H), 2.24 (s, 3H), 1.89 - 1.96 (m, 3H), 1.75 - 1.68 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 140.23, 139.40, 132.02, 130.59, 129.48 (d, *J* = 32.5 Hz), 128.76, 128.38, 127.08, 126.56, 125.62 (q, *J* = 3.9 Hz), 117.35 (t, *J* = 238.7 Hz), 64.26, 58.51, 37.05, 31.16 (t, *J* = 20.9 Hz), 24.87 (t, *J* = 4.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -62.45, -115.88.

HRMS(ESI) calcd. for $C_{21}H_{23}NF_5^+[M+H]^+$ 384.17452, found 384.17438.



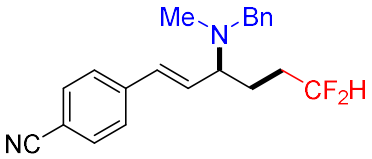
Methyl (*E*)-4-(3-(benzyl(methyl)amino)-6,6-difluorohex-1-en-1-yl) benzoate (4i). Brown oil, 57% yield, 42.7 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **4i**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.4 Hz, 2H), 7.44 (d, *J* = 8.2 Hz, 2H), 7.32 (d, *J* = 4.9 Hz, 4H), 7.27 - 7.23 (m, 1H), 6.49 (d, *J* = 15.9 Hz, 1H), 6.34 (dd, *J* = 15.9, 8.7 Hz, 1H), 5.85 (tt, *J* = 57.0, 4.1 Hz, 1H), 4.38 (q, *J* = 7.1 Hz, 2H), 3.70 (d, *J* = 13.3 Hz, 1H), 3.50 (d, *J* = 13.3 Hz, 1H), 3.15 - 3.19 (m, 1H), 2.24 (s, 3H), 2.09 - 1.88 (m, 3H), 1.74 - 1.68 (m, 1H), 1.40 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 166.39, 141.10, 139.49, 132.44, 130.57, 129.98, 129.47, 128.74, 128.35, 127.02, 126.22, 117.36 (t, *J* = 238.7 Hz), 64.33, 60.98, 58.50, 37.08, 31.18 (t, *J* = 20.8 Hz), 24.90 (t, *J* = 4.9 Hz), 14.37.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.86.

HRMS(ESI) calcd. for $C_{23}H_{28}O_2NF_2[M+H]^+$ 388.20826, found 388.20798.



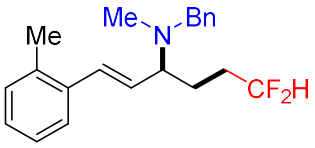
(*E*)-4-(3-(Benzyl(methyl)amino)-6,6-difluorohex-1-en-1-yl) benzonitrile (4j). Yellow oil, 48% yield, 32.6 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **4j**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.61 (d, *J* = 8.4 Hz, 2H), 7.47 (d, *J* = 8.3 Hz, 2H), 7.35 - 7.22 (m, 5H), 6.47 (d, *J* = 16.0 Hz, 1H), 6.37 (dd, *J* = 16.0, 8.6 Hz, 1H), 5.86 (tt, *J* = 57.1, 4.1 Hz, 1H), 3.70 (d, *J* = 13.3 Hz, 1H), 3.49 (d, *J* = 13.3 Hz, 1H), 3.16 - 3.20 (m, 1H), 2.24 (s, 3H), 2.06 - 1.84 (m, 3H), 1.74 - 1.67 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 141.18, 139.33, 132.49, 132.15, 131.65, 128.70, 128.38, 127.09, 126.88, 118.94, 117.28 (t, *J* = 238.7 Hz), 110.88, 64.14, 58.52, 37.04, 31.10 (t, *J* = 20.9 Hz), 24.74 (t, *J* = 5.3 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.93 (d, *J* = 6.5 Hz).

HRMS(ESI) calcd. for $C_{21}H_{23}N_2F_2[M+H]^+$ 341.18238, found 341.18213.



(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(*o*-tolyl)hex-1-en-3-amine (4k). Brown oil. 62% yield, 40.5 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4k**.

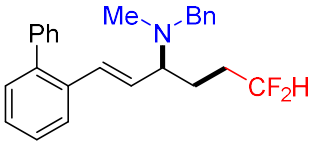
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.45 – 7.16 (m, 9H), 6.64 (d, *J* = 15.8 Hz, 1H), 6.05

(dd, J = 15.8, 8.9 Hz, 1H), 5.85 (tt, J = 57.0, 4.0 Hz, 1H), 3.71 (d, J = 13.3 Hz, 1H), 3.50 (d, J = 13.3 Hz, 1H), 3.14 - 3.17 (m, 1H), 2.36 (s, 3H), 2.24 (s, 3H), 2.06 - 1.88 (m, 3H), 1.76 - 1.67 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.59, 136.18, 135.35, 131.53, 130.39, 128.85, 128.36, 127.63, 127.02, 126.20, 125.85, 117.49 (t, J = 238.7 Hz), 64.52, 58.46, 37.13, 31.31 (t, J = 21.2 Hz), 25.21 (t, J = 4.9 Hz), 19.97.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.72.

HRMS(ESI) calcd. for $C_{21}H_{26}NF_2[M+H]^+$ 330.20278, found 330.20258.



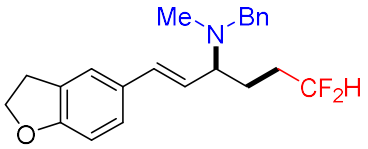
(*E*)-1-([1,1'-Biphenyl]-2-yl)-*N*-benzyl-6,6-difluoro-*N*-methylhex-1-en-3-amine (4l). Brown oil, 57% yield, 44.6 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4l**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.59 (d, J = 7.2 Hz, 1H), 7.46 – 7.18 (m, 13H), 6.43 (d, J = 15.9 Hz, 1H), 6.11 (dd, J = 15.9, 8.9 Hz, 1H), 5.79 (tt, J = 57.1, 4.0 Hz, 1H), 3.65 (d, J = 13.3 Hz, 1H), 3.42 (d, J = 13.3 Hz, 1H), 2.98 - 3.01 (m, 1H), 2.20 (s, 3H), 1.97 - 1.59 (m, 4H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 141.02, 140.84, 139.53, 135.12, 132.75, 130.26, 129.79, 128.84, 128.31, 128.18, 127.58, 127.18, 126.96, 126.30, 117.43 (t, J = 238.7 Hz), 64.28, 58.53, 37.11, 31.27 (t, J = 21.1 Hz), 25.16 (t, J = 5.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.74.

HRMS(ESI) calcd. for $C_{26}H_{28}NF_2[M+H]^+$ 392.21843, found 392.21838.



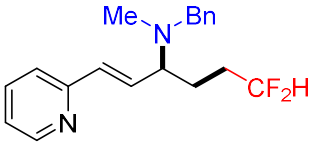
(*E*)-*N*-Benzyl-1-(2,3-dihydrobenzofuran-5-yl)-6,6-difluoro-*N*-methylhex-1-en-3-amine (4m). Yellow oil, 82% yield, 58.5 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (9:1 Hex/EtOAc) to give the product **4m**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.35 - 7.21 (m, 6H), 7.13 (d, *J* = 8.2 Hz, 1H), 6.75 (d, *J* = 8.1 Hz, 1H), 6.38 (d, *J* = 15.8 Hz, 1H), 6.03 (dd, *J* = 15.8, 8.9 Hz, 1H), 5.84 (tt, *J* = 56.8, 3.8 Hz, 1H), 4.58 (t, *J* = 8.6 Hz, 2H), 3.69 (d, *J* = 13.3 Hz, 1H), 3.48 (d, *J* = 13.3 Hz, 1H), 3.21 (t, *J* = 8.6 Hz, 2H), 3.08 - 3.12 (m, 1H), 2.21 (s, 3H), 2.03 - 1.85 (m, 3H), 1.66 - 1.71 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 159.95, 139.82, 133.19, 129.71, 128.81, 128.31, 127.60, 126.92, 126.88, 124.65, 122.60, 117.55 (t, *J* = 238.7 Hz), 109.31, 71.49, 64.64, 58.45, 37.16, 31.34 (t, *J* = 20.8 Hz), 29.65, 25.35 (t, *J* = 5.1 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.69.

HRMS(ESI) calcd. for $C_{22}H_{26}ONF_2[M+H]^+$ 358.19769, found 358.19708.



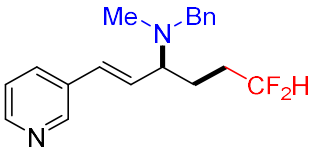
(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(pyridin-2-yl)hex-1-en-3-amine (4n). Yellow oil. 46% yield, 29.2 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (10:1 Hex/EtOAc to 5:1 Hex/EtOAc) to give the product **4n**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.58 (d, *J* = 4.6 Hz, 1H), 7.64 (t, *J* = 7.7 Hz, 1H), 7.36 - 7.13 (m, 7H), 6.77 (dd, *J* = 15.7, 8.9 Hz, 1H), 6.55 (d, *J* = 15.7 Hz, 1H), 5.84 (tt, *J* = 57.1, 3.9 Hz, 1H), 3.73 (d, *J* = 13.4 Hz, 1H), 3.53 (d, *J* = 13.4 Hz, 1H), 3.20 - 3.24 (m, 1H), 2.25 (s, 3H), 2.05 - 1.70 (m, 4H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 154.97, 149.64, 139.59, 136.60, 133.13, 132.28, 128.75, 128.31, 126.96, 122.28, 121.73, 117.42 (t, J = 239.0 Hz), 64.08, 58.41, 37.06, 31.20 (t, J = 20.8 Hz), 24.90 (t, J = 5.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.80.

HRMS(ESI) calcd. for $C_{19}H_{23}N_2F_2[M+H]^+$ 317.18238, found 317.18201.



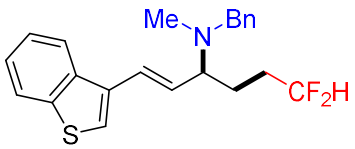
(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(pyridin-3-yl)hex-1-en-3-amine (4o). Red brown oil, 40% yield, 25.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (10:1 Hex/EtOAc to 5:1 Hex/EtOAc) to give the product **4o**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.66 - 8.45 (m, 2H), 7.71 (d, J = 7.9 Hz, 1H), 7.36 - 7.21 (m, 6H), 6.45 (d, J = 16.0 Hz, 1H), 6.30 (dd, J = 16.0, 8.7 Hz, 1H), 5.86 (tt, J = 57.1, 4.1 Hz, 1H), 3.70 (d, J = 13.3 Hz, 1H), 3.50 (d, J = 13.3 Hz, 1H), 3.20 -3.16 (m, 1H), 2.24 (s, 3H), 2.06 - 1.88 (m, 3H), 1.75 - 1.67 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 148.70, 148.29, 139.38, 132.85, 132.38, 130.25, 129.73, 128.72, 128.36, 127.05, 123.51, 117.32 (t, J = 238.7 Hz), 64.30, 58.49, 37.05, 31.15 (t, J = 20.8 Hz), 24.84 (t, J = 5.2 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.90 (d, J = 3.7 Hz).

HRMS(ESI) calcd. for $C_{19}H_{23}N_2F_2[M+H]^+$ 317.18238, found 317.18231.



(*E*)-1-(Benzo[*b*]thiophen-3-yl)-*N*-benzyl-6,6-difluoro-*N*-methylhex-1-en-3-amine

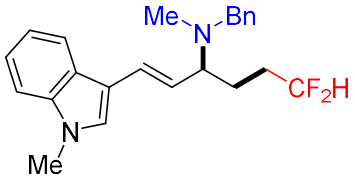
(**4p**). Red brown oil, 89% yield, 67.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **4p**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.87 (dd, *J* = 21.1, 7.7 Hz, 2H), 7.45 - 7.18 (m, 8H), 6.69 (d, *J* = 15.9 Hz, 1H), 6.24 (dd, *J* = 15.9, 8.9 Hz, 1H), 5.86 (tt, *J* = 56.8, 4.1 Hz, 1H), 3.72 (d, *J* = 13.4 Hz, 1H), 3.52 (d, *J* = 13.4 Hz, 1H), 3.20- 3.16 (m, 1H), 2.26 (s, 3H), 2.08 - 1.89 (m, 3H), 1.75 - 1.71 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 140.58, 139.64, 137.72, 133.67, 129.43, 128.86, 128.41, 127.06, 125.66, 124.62, 124.43, 123.05, 122.14, 121.99, 117.50 (t, *J* = 238.7 Hz), 64.67, 58.56, 37.17, 31.39 (d, *J* = 20.8 Hz), 25.16 (t, *J* = 5.2 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.66.

HRMS(ESI) calcd. for $C_{22}H_{24}NF_2S[M+H]^+$ 372.15920, found 372.15903.



(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(1-methyl-1*H*-indol-3-yl)hex-1-en-3-amine (4q). Yellow oil. 64% yield, 47.4 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **4q**.

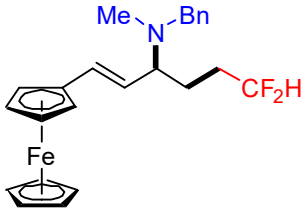
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.84 (d, *J* = 7.9 Hz, 1H), 7.37 - 7.16 (m, 9H), 7.09 (s, 1H), 6.59 (d, *J* = 16.0 Hz, 1H), 6.10 (dd, *J* = 16.0, 8.9 Hz, 1H), 5.85 (tt, *J* = 56.9, 4.2 Hz, 1H), 3.75 (s, 3H), 3.72 (d, *J* = 13.4 Hz, 1H), 3.52 (d, *J* = 13.3 Hz, 1H), 3.14 - 3.11 (m, 1H), 2.25 (s, 3H), 2.05 - 1.90 (m, 3H), 1.76 - 1.71 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.85, 137.64, 128.93, 128.32, 128.13, 126.92,

126.10, 126.05, 123.26, 122.26, 120.14, 120.03, 117.65 (t, J = 238.7 Hz), 113.22, 109.62, 65.53, 58.48, 37.21, 32.83, 31.48 (t, J = 21.1 Hz), 25.63 (t, J = 4.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.59.

HRMS(ESI) calcd. for $C_{23}H_{27}N_2F_2[M+H]^+$ 369.21338, found 369.21368.



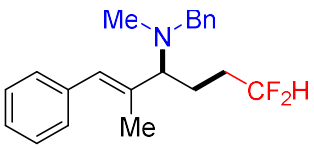
(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-ferrocenylpent-1-en-3-amine (4r). Red brown oil. 32% yield, 27.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4r**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.28 (dd, J = 48.6, 4.4 Hz, 5H), 6.19 (d, J = 15.8 Hz, 1H), 5.97 - 5.72 (m, 2H), 4.35 (d, J = 11.9 Hz, 2H), 4.22 (s, 2H), 4.11 (s, 4H), 3.68 (d, J = 13.3 Hz, 1H), 3.48 (d, J = 13.3 Hz, 1H), 3.04 - 3.00 (m, 1H), 2.20 (s, 3H), 2.04 - 1.83 (m, 3H), 1.69 - 1.59 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.70, 131.01, 128.79, 128.33, 126.95, 124.38, 117.50 (t, J = 238.7 Hz), 82.86, 69.18, 68.77, 68.75, 66.82, 66.68, 64.70, 58.43, 37.21, 31.36 (t, J = 20.8 Hz), 25.19 (t, J = 4.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.68.

HRMS(ESI) calcd. for $C_{24}H_{27}NF_2Fe[M]^+$ 423.14555, found 423.14505.



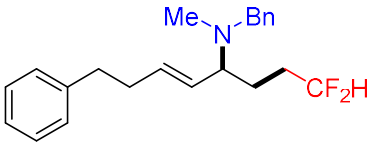
(*E*)-*N*-Benzyl-6,6-difluoro-*N*,2-dimethyl-1-phenylhex-1-en-3-amine (4s). Pale yellow oil, 46% yield, 30.3 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4s**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.35 - 7.20 (m, 10H), 6.41 (s, 1H), 5.85 (tt, *J* = 56.9, 4.3 Hz, 1H), 3.77 (d, *J* = 13.5 Hz, 1H), 3.37 (d, *J* = 13.5 Hz, 1H), 2.90 (dd, *J* = 9.5, 5.1 Hz, 1H), 2.18 (s, 3H), 2.03 - 1.96 (m, 1H), 1.92 (d, *J* = 1.3 Hz, 3H), 1.89 - 1.81 (m, 2H), 1.74 - 1.71 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 140.05, 137.77, 137.55, 129.02, 128.67, 128.28, 128.20, 126.83, 126.53, 117.34 (t, *J* = 238.8 Hz), 72.42, 59.22, 38.79, 31.78 (d, *J* = 20.8 Hz), 22.27 (d, *J* = 4.7 Hz), 14.85.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.78 (d, *J* = 42.9 Hz).

HRMS(ESI) calcd. for $C_{21}H_{26}NF_2[M+H]^+$ 330.20278, found 330.20248.



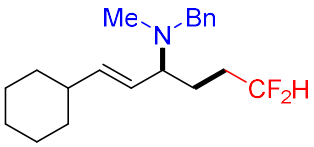
(*E*)-*N*-Benzyl-1,1-difluoro-*N*-methyl-8-phenyloct-5-en-4-amine (4t). Red brown oil. 69% yield, 47.3 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4t**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.45 - 7.05 (m, 10H), 5.83 (tt, *J* = 56.8, 4.5 Hz, 1H), 5.51 (t, *J* = 5.6 Hz, 2H), 3.65 (d, *J* = 13.2 Hz, 1H), 3.39 (d, *J* = 13.3 Hz, 1H), 3.01 - 2.97 (m, 1H), 2.71 - 2.60 (m, 2H), 2.28 - 2.25 (m, 2H), 2.15 (s, 3H), 2.03 - 1.89 (m, 3H), 1.76 - 1.74 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 142.55, 139.91, 131.54, 129.71, 128.83, 128.48, 128.35, 128.26, 126.83, 125.73, 117.00 (t, *J* = 239.2 Hz), 64.60, 58.04, 37.46, 34.48, 33.99 (t, *J* = 20.8 Hz), 32.79, 25.36 (t, *J* = 6.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -116.34.

HRMS(ESI) calcd. for $C_{22}H_{28}NF_2^+$[M+H] 344.21843, found 344.21832.



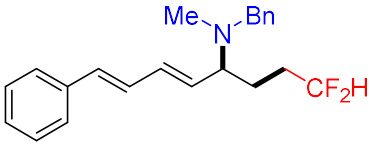
(*E*)-*N*-Benzyl-1-cyclohexyl-6,6-difluoro-*N*-methylhex-1-en-3-amine (4u). Brown oil, 70% yield, 44.7 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4u**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 - 7.21 (m, 5H), 5.81 (tt, *J* = 57.0, 4.4 Hz, 1H), 5.46 (dd, *J* = 15.5, 6.7 Hz, 1H), 5.32 (dd, *J* = 15.5, 8.8 Hz, 1H), 3.61 (d, *J* = 13.3 Hz, 1H), 3.38 (d, *J* = 13.3 Hz, 1H), 2.91 - 2.87 (m, 1H), 2.13 (s, 3H), 2.01 - 1.55 (m, 10H), 1.32 - 1.08 (m, 5H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 141.09, 139.80, 128.85, 128.24, 126.84, 124.17, 117.59 (t, *J* = 238.7 Hz), 64.28, 58.22, 40.82, 37.08, 33.38, 33.23, 31.36 (t, *J* = 20.8 Hz), 26.19, 25.23 (t, *J* = 5.2 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.69.

HRMS(ESI) calcd. for $C_{20}H_{30}NF_2$[M+H]$^+$ 322.23408, found 322.23401.



(5*E*,7*E*)-*N*-Benzyl-1,1-difluoro-*N*-methyl-8-phenylocta-5,7-dien-4-amine (4v). Yellow oil, 50% yield, 34.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4v**.

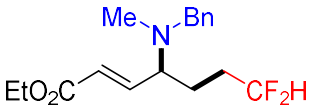
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.42 - 7.21 (m, 11H), 6.79 (dd, *J* = 15.6, 10.4 Hz, 1H),

6.55 (d, J = 15.7 Hz, 1H), 6.27 (dd, J = 15.2, 10.5 Hz, 1H), 5.94 - 5.72 (m, 2H), 3.66 (d, J = 13.3 Hz, 1H), 3.45 (d, J = 13.3 Hz, 1H), 3.09 - .05 (m, 1H), 2.19 (s, 3H), 2.00 - 1.83 (m, 3H), 1.69 - 1.61 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.62, 137.21, 133.85, 132.31, 131.89, 128.80, 128.67, 128.36, 128.31, 127.61, 126.96, 126.36, 117.45 (t, J = 238.7 Hz), 64.16, 58.44, 37.02, 31.25 (t, J = 21.1 Hz), 25.00 (t, J = 5.1 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.79.

HRMS(ESI) calcd. for $C_{22}H_{26}NF_2[M+H]^+$ 342.20278, found 342.20251.



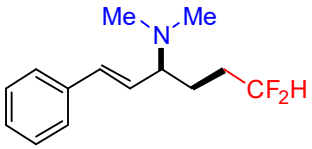
Ethyl (*E*)-4-(benzyl(methyl)amino)-7,7-difluorohept-2-enoate (4w). Dark brown oil, 32% yield, 40.2 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **4w**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.27 – 7.15 (m, 5H), 6.88 (dd, J = 15.8, 8.6 Hz, 1H), 5.87 - 5.62 (m, 2H), 4.16 (q, J = 7.1 Hz, 2H), 3.60 (d, J = 13.4 Hz, 1H), 3.40 (d, J = 13.4 Hz, 1H), 3.10 - 3.06 (q, J = 7.6 Hz, 1H), 2.14 (s, 3H), 1.97 - 1.75 (m, 3H), 1.60 - 1.55 (m, 1H), 1.25 (t, J = 7.1 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 164.94, 144.74, 138.00, 127.65, 127.35, 126.11, 123.06, 116.08 (t, J = 239.0 Hz), 61.61, 59.55, 57.39, 35.75, 29.82 (t, J = 21.2 Hz), 22.94 (t, J = 5.1 Hz), 13.23.

^{19}F NMR (565 MHz, $CDCl_3$) δ -116.07.

HRMS(ESI) calcd. for $C_{17}H_{24}O_2NF_2[M+H]^+$ 312.17696, found 312.17654.



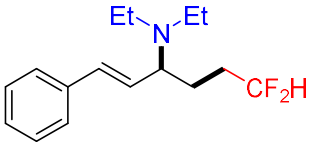
(*E*)-6,6-Difluoro-*N*, *N*-dimethyl-1-phenylhex-1-en-3-amine (5a). Dark brown oil, 42% yield, 20.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 DCM/MeOH to 20:1 DCM/MeOH) to give the product **5a**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.38 (d, *J* = 7.2 Hz, 2H), 7.33 (t, *J* = 7.6 Hz, 2H), 7.25 (t, *J* = 7.3 Hz, 1H), 6.48 (d, *J* = 15.9 Hz, 1H), 6.10 (dd, *J* = 15.9, 9.0 Hz, 1H), 5.85 (tt, *J* = 56.7, 4.0 Hz, 1H), 2.94 - 2.91 (m, 1H), 2.30 (s, 6H), 1.93 - 1.83 (m, 3H), 1.71 - 1.65 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.62, 133.67, 128.61, 127.73, 127.70, 126.37, 117.25 (t, *J* = 238.8 Hz), 67.17, 41.59, 31.15 (t, *J* = 21.1 Hz), 25.08 (t, *J* = 5.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.92.

HRMS(ESI) calcd. for $C_{14}H_{20}NF_2[M+H]^+$ 240.15583, found 240.15552.



(*E*)-*N*, *N*-Diethyl-6,6-difluoro-1-phenylhex-1-en-3-amine (5b). Dark brown oil, 75% yield, 40.1 mg). According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 DCM/MeOH to 20:1 DCM/MeOH) to give the product **5b**.

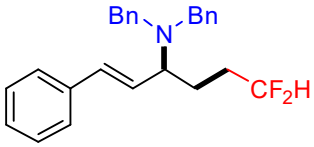
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.38 – 7.35 (m, 2H), 7.32 (t, *J* = 7.7 Hz, 2H), 7.25 – 7.22 (m, 1H), 6.44 (d, *J* = 15.9 Hz, 1H), 6.13 (dd, *J* = 15.9, 8.8 Hz, 1H), 5.88 (tt, *J* = 57.0, 4.4 Hz, 1H), 3.25 - 3.22 (m, 1H), 2.71 - 2.66 (m, 2H), 2.49 - 2.43 (m, 2H), 2.00 - 1.81 (m, 3H), 1.68 - 1.64 (m, 1H), 1.05 (t, *J* = 7.1 Hz, 6H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.91, 132.41, 128.90, 128.57, 127.48, 126.28,

117.47 (t, J = 238.7 Hz), 62.10, 43.54, 31.49 (t, J = 21.0 Hz), 25.15 (t, J = 5.0 Hz), 13.69.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.78.

HRMS(ESI) calcd. for $C_{16}H_{24}NF_2[M+H]^+$ 268.18713, found 268.18686.



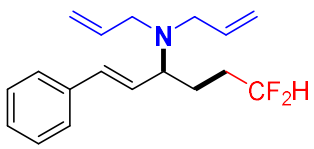
(*E*)-*N*, *N*-Dibenzyl-6,6-difluoro-1-phenylhex-1-en-3-amine (5c). Colorless oil, 64% yield, 50.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (10:1 Hex/DCM to 5:1 Hex/DCM) to give the product **5c**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.48 - 7.27 (m, 15H), 6.45 (d, J = 15.9 Hz, 1H), 6.28 (dd, J = 15.9, 8.9 Hz, 1H), 5.74 (tt, J = 57.0, 4.4 Hz, 1H), 3.92 (d, J = 13.7 Hz, 2H), 3.46 (d, J = 13.7 Hz, 2H), 3.27 - 3.20 (m, 1H), 2.17 - 2.04 (m, 1H), 2.01 - 1.93 (m, 1H), 1.91 - 1.78 (m, 1H), 1.75 - 1.67 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.99, 136.85, 133.76, 128.77, 128.69, 128.38, 127.73, 127.29, 126.99, 126.44, 117.33 (t, J = 238.8 Hz), 59.80, 53.81, 31.30 (d, J = 21.0 Hz), 24.99 (t, J = 5.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.15.

HRMS(ESI) calcd. for $C_{26}H_{28}NF_2[M+H]^+$ 392.21843, found 392.21829.



(*E*)-*N*, *N*-Diallyl-6,6-difluoro-1-phenylhex-1-en-3-amine (**5d**). Yellow oil, 26% yield, 15.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (Hex to 25:1 Hex/EtOAc) to

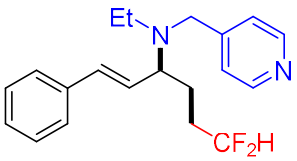
give the product **5d**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.40 - 7.22 (m, 5H), 6.41 (d, *J* = 15.9 Hz, 1H), 6.09 (dd, *J* = 15.9, 8.8 Hz, 1H), 5.97 - 5.74 (m, 3H), 5.16 (dd, *J* = 33.4, 13.6 Hz, 4H), 3.38 - 3.26 (m, 3H), 2.97 - 2.94 (m, 2H), 2.01 - 1.83 (m, 3H), 1.68 - 1.64 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.82, 133.16, 128.63, 127.63, 126.33, 117.42 (t, *J* = 238.8 Hz), 117.01, 60.95, 52.73, 31.38 (t, *J* = 21.1 Hz), 24.99 (t, *J* = 5.1 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.85 (d, *J* = 15.7 Hz).

HRMS(ESI) calcd. for $C_{18}H_{24}NF_2[M+H]^+$ 292.18713, found 292.18683.



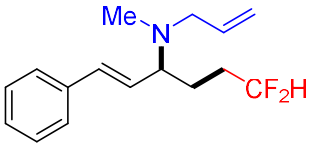
(*E*)-*N*-Ethyl-6,6-difluoro-1-phenyl-*N*-(pyridin-4-ylmethyl)hex-1-en-3-amine (5e). Red brown oil, 70% yield, 46.2 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (4:1 Hex/EtOAc to 3:2 Hex/EtOAc) to give the product **5e**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.54 (d, *J* = 5.7 Hz, 2H), 7.40 - 7.23 (m, 7H), 6.42 (d, *J* = 15.9 Hz, 1H), 6.14 (dd, *J* = 15.9, 8.8 Hz, 1H), 5.83 (tt, *J* = 56.8, 3.9 Hz, 1H), 3.84 (d, *J* = 15.1 Hz, 1H), 3.47 (d, *J* = 15.1 Hz, 1H), 3.21 - 3.17 (m, 1H), 2.69 - 2.64 (m, 1H), 2.53 - 2.48 (m, 1H), 2.06 - 1.83 (m, 3H), 1.71 - 1.66 (m, 1H), 1.07 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 150.47, 149.58, 136.61, 133.37, 128.68, 127.78, 127.45, 126.36, 123.52, 117.25 (t, *J* = 238.7 Hz), 61.61, 53.26, 43.86, 31.37 (t, *J* = 21.1 Hz), 25.09.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.90.

HRMS(ESI) calcd. for $C_{20}H_{25}N_2F_2[M+H]^+$ 331.19803, found 331.19791.



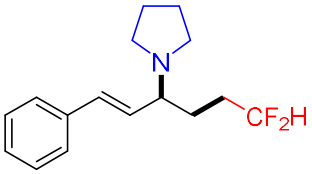
(*E*)-*N*-Allyl-6,6-difluoro-N-methyl-1-phenylhex-1-en-3-amine (5f). Yellow oil, 56% yield, 29.7 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (10:1 Hex/EtOAc to 5:1 Hex/EtOAc) to give the product **5f**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.41 - 7.22 (m, 5H), 6.45 (d, *J* = 15.9 Hz, 1H), 6.12 (dd, *J* = 15.9, 8.9 Hz, 1H), 5.97 - 5.73 (m, 2H), 5.15 (dd, *J* = 26.2, 13.6 Hz, 2H), 3.19 - 3.11 (m, 2H), 3.03 - 3.00 (m, 1H), 2.25 (s, 3H), 1.96 - 1.82 (m, 3H), 1.72 - 1.64 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.76, 136.27, 133.39, 128.64, 127.69,127.66, 126.36, 117.38 (t, *J* = 239.0 Hz), 117.27, 64.73, 57.29, 37.32, 31.31 (t, *J* = 21.1 Hz), 25.04 (t, *J* = 5.2 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.81.

HRMS(ESI) calcd. for $C_{16}H_{22}NF_2[M+H]^+$ 266.17148, found 266.17123.



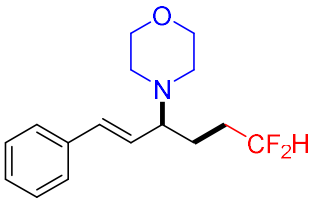
(*E*)-1-(6,6-Difluoro-1-phenylhex-1-en-3-yl)pyrrolidine (5g). Dark brown oil, 60% yield, 31.8 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 DCM/MeOH to 20:1 DCM/MeOH) to give the product **5g**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.41 - 7.29 (m, 4H), 7.24 (d, *J* = 7.3 Hz, 1H), 6.49 (d, *J* = 15.9 Hz, 1H), 6.13 (dd, *J* = 15.9, 9.0 Hz, 1H), 5.83 (tt, *J* = 57.1, 4.2 Hz, 1H), 2.91 - 2.87 (m, 1H), 2.67 - 2.59 (m, 4H), 1.99 - 1.68 (m, 8H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.42, 133.28, 129.36, 128.68, 127.87, 126.44, 117.19 (t, *J* = 239.0 Hz), 67.26, 51.75, 30.78 (t, *J* = 21.1 Hz), 26.33 (t, *J* = 4.9 Hz), 23.23.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.73.

HRMS(ESI) calcd. for $C_{16}H_{22}NF_2^+[M+H]^+$ 266.17148, found 266.17111.



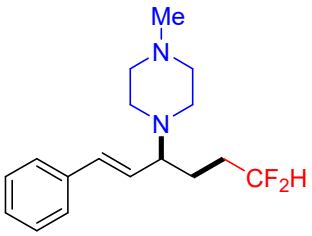
(*E*)-4-(6,6-Difluoro-1-phenylhex-1-en-3-yl) morpholine (5h). Dark brown oil, 83% yield, 46.4 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 DCM/MeOH to 20:1 DCM/MeOH) to give the product **5h**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.39 - 7.36 (m, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.28 - 7.22 (m, 1H), 6.48 (d, *J* = 15.9 Hz, 1H), 6.09 (dd, *J* = 15.9, 9.0 Hz, 1H), 5.86 (tt, *J* = 56.8, 4.0 Hz, 1H), 3.78 - 3.65 (m, 4H), 2.96 - 2.93 (m, 1H), 2.66 - 2.63 (m, 2H), 2.54 - 2.51 (m, 2H),1.94 - 1.88 (m, 3H), 1.74 - 1.62 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.44, 133.82, 128.67, 128.07, 127.84, 126.40, 117.22 (t, *J* = 239.2 Hz), 67.37, 67.16, 50.24, 30.97 (t, *J* = 21.2 Hz), 24.16 (t, *J* = 5.2 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.89.

HRMS(ESI) calcd. for $C_{16}H_{22}ONF_2[M+H]^+$ 282.16639, found 282.16617.



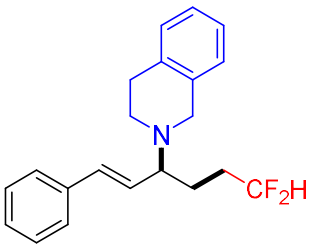
(*E*)-1-(6,6-Difluoro-1-phenylhex-1-en-3-yl)-4-methylpiperazine (5i). Dark brown oil, 82% yield, 48.2 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 DCM/MeOH to 20:1 DCM/MeOH) to give the product **5i**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.37 - 7.29 (m, 4H), 7.23 (t, *J* = 7.2 Hz, 1H), 6.46 (d, *J* = 15.9 Hz, 1H), 6.11 (dd, *J* = 15.9, 9.0 Hz, 1H), 5.85 (tt, *J* = 56.8, 3.9 Hz, 1H), 2.97 - 2.94 (m, 1H), 2.73 - 2.34 (m, 8H), 2.29 (s, 3H), 1.92 - 1.86 (m, 3H), 1.71 - 1.64 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.57, 133.40, 128.58, 128.42, 127.66, 126.33, 117.26 (t, *J* = 238.6 Hz), 66.85, 55.32, 55.15, 45.83, 31.10 (t, *J* = 21.1 Hz), 24.54 (t, *J* = 5.1 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.99.

HRMS(ESI) calcd. for $C_{17}H_{25}N_2F_2[M+H]^+$ 295.19803, found 295.19775.



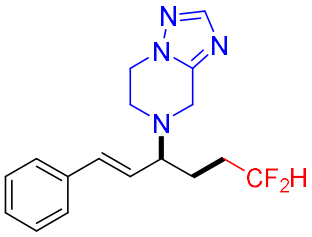
(*E*)-2-(6,6-Difluoro-1-phenylhex-1-en-3-yl)-1,2,3,4-tetrahydroisoquinoline (5j). Dark brown oil, 75% yield, 49 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (15:1 Hex/EtOAc) to give the product **5j**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.32 - 7.11 (m, 5H), 7.04 - 6.88 (m, 4H), 6.45 (d, *J* = 15.9 Hz, 1H), 6.11 (dd, *J* = 15.9, 9.0 Hz, 1H), 5.78 (tt, *J* = 57.0, 4.3 Hz, 1H), 3.78 -3.61 (m, 2H), 3.11 - 3.07 (m, 1H), 2.91 - 2.88 (m, 1H), 2.83 - 2.78m, 2H), 2.66 - 2.62 (dt, *J* = 11.7, 6.0 Hz, 1H), 1.94 - 1.82 (m, 3H), 1.73 - 1.67 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 136.68, 135.10, 134.57, 133.52, 128.71, 128.68, 128.29, 127.76, 126.70, 126.44, 126.10, 125.63, 117.37 (t, *J* = 239.0 Hz), 66.45, 52.79, 46.76, 31.20 (t, *J* = 21.1 Hz), 29.60, 24.83 (d, *J* = 5.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.83.

HRMS(ESI) calcd. for $C_{21}H_{24}NF_2[M+H]^+$ 328.18713, found 328.18680.



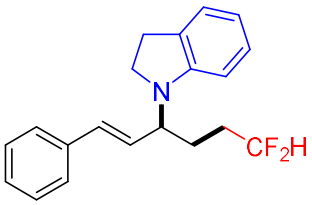
(*E*)-7-(6,6-Difluoro-1-phenylhex-1-en-3-yl)-5,6,7,8-tetrahydro-[1,2,4]triazolo[1,5-a]pyrazine (5k). Dark brown oil, 66% yield, 21.1 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (1:1 Hex/EtOAc to 1:3 Hex/EtOAc) to give the product **5k**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.86 (s, 1H), 7.38 (dd, *J* = 8.4, 1.4 Hz, 2H), 7.34 (t, *J* = 7.6 Hz, 3H), 7.30 - 7.27 (m, 1H), 6.59 (d, *J* = 15.9 Hz, 1H), 6.12 (dd, *J* = 15.9, 9.0 Hz, 1H), 5.88 (tt, *J* = 56.9, 3.8 Hz, 1H), 4.22 - 4.14 (m, 2H), 3.93 (q, *J* = 15.5 Hz, 2H), 3.31 - 3.15 (m, 2H), 2.98 - 2.94 (m, 1H), 2.06 - 1.89 (m, 4H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 151.14, 135.96, 134.86, 128.72, 128.19, 126.46, 126.05, 120.10 – 113.04 (m), 65.89, 47.28, 46.78, 45.97, 30.85, 24.71.

^{19}F NMR (565 MHz, $CDCl_3$) δ -116.18.

HRMS(ESI) calcd. for $C_{17}H_{21}N_4F_2[M+H]^+$ 319.17287, found 319.17273.



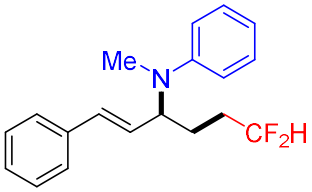
(*E*)-1-(6,6-Difluoro-1-phenylhex-1-en-3-yl)indoline (5l). Dark brown oil, 68% yield, 42.6 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (Hex to 30:1 Hex/EtOAc) to give the product **5l**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.33 - 7.26 (m, 4H), 7.21 (t, *J* = 7.2 Hz, 1H), 7.05 (t, *J* = 8.0 Hz, 2H), 6.62 (t, *J* = 7.3 Hz, 1H), 6.55 (d, *J* = 16.1 Hz, 1H), 6.50 (d, *J* = 7.7 Hz, 1H), 6.19 (dd, *J* = 16.1, 6.9 Hz, 1H), 5.90 (tt, *J* = 56.8, 3.8 Hz, 1H), 4.16 (q, *J* = 6.9 Hz, 1H), 3.48 - 3.36 (m, 2H), 3.01 - 2.94 (m, 2H), 1.99 - 1.92 (m, 4H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 151.08, 136.60, 132.66, 129.99, 128.56, 127.71, 127.34, 127.07, 126.42, 124.63, 117.43, 117.12 (t, *J* = 239.0 Hz), 107.25, 56.70, 46.76, 31.36 (t, *J* = 21.2 Hz), 28.26, 24.34 (d, *J* = 5.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.92.

HRMS(ESI) calcd. for $C_{20}H_{22}NF_2[M+H]^+$ 314.17148, found 314.17130.



(*E*)-*N*-(6,6-Difluoro-1-phenylhex-1-en-3-yl)-*N*-methylaniline (5m). Yellow oil, 49% yield, 29.5 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (Hex to 30:1 Hex/EtOAc) to give the product **5m**.

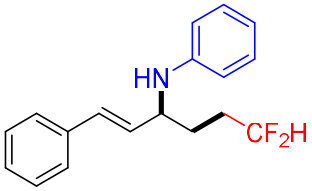
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.41 - 7.23 (m, 7H), 6.87 (d, *J* = 8.0 Hz, 2H), 6.78 (t, *J*

= 7.3 Hz, 1H), 6.52 (d, *J* = 17.5 Hz, 1H), 6.24 (dd, *J* = 16.1, 5.3 Hz, 1H), 5.88 (tt, *J* = 57.0, 3.9 Hz, 1H), 4.54 - 4.49 (m, 1H), 2.84 (s, 3H), 2.05 - 1.89 (m, 4H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 150.38, 136.72, 131.28, 129.29, 128.59, 128.29, 127.65, 126.38, 117.27, 116.96 (t, *J* = 239.0 Hz), 113.51, 59.42, 31.43, 31.37 (t, *J* = 21.1 Hz), 24.54 (t, *J* = 4.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -116.11.

HRMS(ESI) calcd. for $C_{19}H_{22}NF_2[M+H]^+$ 302.17148, found 302.17087.



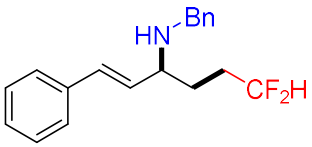
(*E*)-*N*-(6,6-Difluoro-1-phenylhex-1-en-3-yl)aniline (**5n**). Dark brown oil, 69% yield, 39.7 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **5n**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36 – 7.12 (m, 7H), 6.70 (t, *J* = 7.3 Hz, 1H), 6.64 (d, *J* = 7.8 Hz, 2H), 6.57 (d, *J* = 15.9 Hz, 1H), 6.08 (dd, *J* = 15.9, 6.5 Hz, 1H), 5.85 (tt, *J* = 56.7, 4.5 Hz, 1H), 4.03 - 4.00 (m, 1H), 2.02 - 1.94 (m, 2H), 1.86 - 1.82 (m, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 147.09, 136.59, 131.25, 130.79, 129.35, 128.63, 127.73, 126.46, 117.87, 117.01 (t, *J* = 239.2 Hz), 113.62, 55.13, 30.88 (t, *J* = 21.2 Hz), 28.27 (t, *J* = 4.8 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.91.

HRMS(ESI) calcd. for $C_{18}H_{20}NF_2[M+H]^+$ 288.15583, found 288.15552.



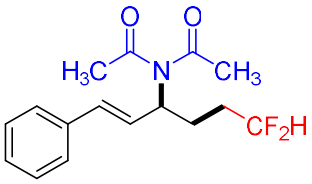
(*E*)-*N*-Benzyl-6,6-difluoro-1-phenylhex-1-en-3-amine (5o). Dark brown oil, 80% yield, 48.2 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **5o**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.42 - 7.21 (m, 10H), 6.47 (d, *J* = 15.9 Hz, 1H), 5.99 (dd, *J* = 15.9, 8.4 Hz, 1H), 5.81 (tt, *J* = 56.9, 4.4 Hz, 1H), 3.86 (d, *J* = 13.2 Hz, 1H), 3.70 (d, *J* = 13.2 Hz, 1H), 3.24 - 3.20 (m, 1H), 1.95 - 1.86 (m, 2H), 1.75 - 1.65 (m, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 140.37, 136.73, 132.27, 131.78, 128.69, 128.51, 128.23, 127.72, 127.05, 126.42, 117.31 (t, *J* = 239.0 Hz), 59.82, 51.23, 30.82 (t, *J* = 21.1 Hz), 28.26 (t, *J* = 4.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.75.

HRMS(ESI) calcd. for $C_{19}H_{22}NF_2[M+H]^+$ 302.17148, found 302.17133.



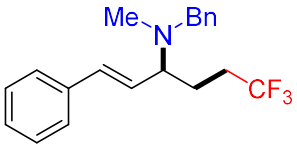
(*E*)-*N*-Acetyl-*N*-(6,6-difluoro-1-phenylhex-1-en-3-yl)acetamide (5p). Dark brown oil, 15% yield, 8.9 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (10:1 Hex/EtOAc to 7:3 Hex/EtOAc) to give the product **5p**.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.42 - 7.27 (m, 5H), 6.60 - 6.48 (m, 2H), 5.88 (tt, *J* = 56.6, 4.2 Hz, 1H), 4.77 - 4.73 (m, 1H), 2.43 (s, 6H), 2.31 - 2.13 (m, 2H), 1.95 - 1.80 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 173.78, 136.00, 133.08, 128.67, 128.17, 127.42, 126.57, 116.73 (t, J = 239.5 Hz), 59.26, 31.24 (t, J = 21.3 Hz), 26.95, 25.46 (t, J = 5.0 Hz).

^{19}F NMR (471 MHz, $CDCl_3$) δ -115.82.

HRMS(ESI) calcd. for $C_{16}H_{19}O_2NF_2Na[M+Na]^+$ 318.12714, found 318.12760.



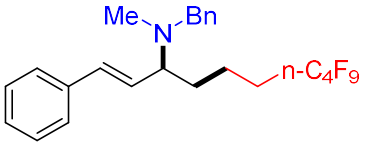
(*E*)-*N*-Benzyl-6,6,6-trifluoro-*N*-methyl-1-phenylhex-1-en-3-amine (6a). Colorless oil, 70% yield, 46.6 mg. According to general experimental procedure A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **6a**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.41 - 7.23 (m, 10H), 6.46 (d, J = 15.9 Hz, 1H), 6.21 (dd, J = 15.9, 8.8 Hz, 1H), 3.68 (d, J = 13.3 Hz, 1H), 3.48 (d, J = 13.3 Hz, 1H), 3.16 - 3.12 (m, 1H), 2.36 - 2.30 (m, 1H), 2.22 (s, 3H), 2.16 - 2.10 (m, 1H), 2.03 - 1.95 (m, 1H), 1.82 - 1.75 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 139.57, 136.71, 133.64, 128.78, 128.70, 128.36, 127.79, 127.09, 127.09, 126.44, 63.97, 58.48, 36.96, 30.97 (q, J = 28.4 Hz), 25.15 (q, J = 2.0 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -66.14.

HRMS(ESI) calcd. for $C_{20}H_{23}NF_3[M+H]^+$ 334.17771, found 334.17734.



(*E*)-*N*-Benzyl-7,7,8,8,9,9,10,10,10-nonafluoro-*N*-methyl-1-phenyldec-1-en-3-amin e (6b). Brown oil. 53% yield, 52.4 mg. According to general experimental procedure

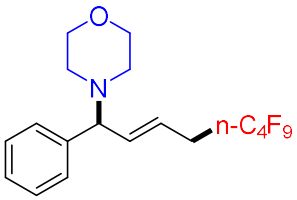
A, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **6b**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36 - 7.13 (m, 10H), 6.38 (d, *J* = 15.7 Hz, 1H), 6.19 - 6.08 (m, 1H), 3.63 (d, *J* = 13.3 Hz, 1H), 3.42 (d, *J* = 13.3 Hz, 1H), 3.08 - 3.05 (m, 1H), 2.17 (s, 3H), 2.04 - 1.95 (m, 2H), 1.82 - 1.76 (m, 1H), 1.67 - 1.51 (m, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 138.54, 135.84, 132.30, 127.78, 127.61, 127.27, 126.70, 126.58, 125.92, 125.34, 63.55, 57.41, 36.25, 31.14, 29.58 (t, *J* = 22.3 Hz), 16.18 (t, *J* = 3.3 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -81.03 - -81.06 (m), -114.50 – 114.55 (m), -124.43 – 124.49 (m), -125.99 - -126.03 (m).

HRMS(ESI) calcd. for $C_{24}H_{25}NF_9[M+H]^+$ 498.18378, found 498.18365.



(*E*)-4-(5,5,6,6,7,7,8,8,8-Nonafluoro-1-phenyloct-2-en-1-yl)morpholine (6c). Pale yellow oil, 66% yield, 57.6 mg. According to general experimental procedure B, the crude product was purified by column chromatography on silica gel (30:1 DCM/MeOH to 20:1 DCM/MeOH) to give the product **6c**.

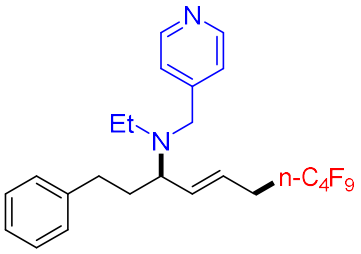
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.32 (d, *J* = 4.4 Hz, 4H), 7.25 (t, *J* = 4.3 Hz, 1H), 5.84 (dd, *J* = 15.4, 8.8 Hz, 1H), 5.65 (dt, *J* = 14.9, 7.1 Hz, 1H), 3.74 - 3.64 (m, 5H), 2.87 -2.73 (m, 2H), 2.55 - 2.25 (m, 4H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 140.92, 139.98, 128.66, 127.95, 127.46, 118.70 (t, *J* = 4.5 Hz), 74.00, 67.10, 51.90, 34.52 (t, *J* = 22.6 Hz).

^{19}F NMR (471 MHz, $CDCl_3$) δ -81.02 – 81.06 (m), -113.01 - -113.11 (m), -123.96 -

-124.02 (m), -126.00 – -126.16 (m).

HRMS(ESI) calcd. for $C_{18}H_{19}ONF_9^+[M+H]^+$ 436.13174, found 436.13138.



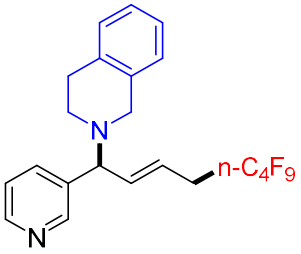
(*E*)-*N*-Ethyl-7,7,8,8,9,9,10,10,10-nonafluoro-1-phenyl-N-(pyridin-4-ylmethyl)dec-4-en-3-amine (6d). Yellow oil,86% yield, 88.2 mg. According to general experimental procedure B, the crude product was purified by column chromatography on silica gel (10:1 Hex/EtOAc to 5:1 Hex/EtOAc) to give the product **6d**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.50 (d, *J* = 6.0 Hz, 2H), 7.25 (dd, *J* = 9.4, 6.9 Hz, 4H), 7.19 – 7.10 (m, 3H), 5.70 (dd, *J* = 15.4, 8.6 Hz, 1H), 5.46 (dt, *J* = 14.9, 7.1 Hz, 1H), 3.77 (d, *J* = 15.2 Hz, 1H), 3.39 (d, *J* = 15.2 Hz, 1H), 3.12 - 3.08 (m, 1H), 2.91 - 2.84(m, 2H), 2.71 - 2.57 (m, 3H), 2.44 - 2.40 (m, 1H), 1.95 - 1.90 (m, 1H), 1.81 - 1.71 (m, 1H), 1.02 (t, *J* = 7.1 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 150.34, 149.65, 142.02, 137.13, 128.38, 128.34, 125.85, 123.40, 119.75 (t, *J* = 3.9 Hz), 61.04, 53.18, 43.99, 34.65 (t, *J* = 22.5 Hz), 34.08, 32.69, 13.75.

^{19}F NMR (565 MHz, $CDCl_3$) δ -81.09 - -81.13 (m), -113.34 – 113.39 (m), -113.96 – -124.02 (m), -126.06 - -126.14 (m).

HRMS(ESI) calcd. for $C_{24}H_{26}N_2F_9[M+H]^+$ 513.19467, found 513.19470.



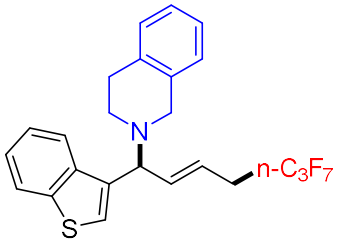
(*E*)-2-(5,5,6,6,7,7,8,8,8-Nonafluoro-1-(pyridin-3-yl)oct-2-en-1-yl)-1,2,3,4-tetrahydroisoquinoline (6e). Red brown oil, 61% yield, 58.9 mg. According to general experimental procedure B, the crude product was purified by column chromatography on silica gel (9:1:1 Hex/EtOAc/DCM to 4:1:1 Hex/EtOAc/DCM) to give the product **6e**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.65 - 8.51 (m, 2H), 7.75 (d, *J* = 7.9 Hz, 1H), 7.29 (dd, *J* = 7.9, 4.8 Hz, 1H), 7.16 - 7.07 (m, 3H), 6.95 (d, *J* = 7.0 Hz, 1H), 5.92 (dd, *J* = 15.4, 8.8 Hz, 1H), 5.76 (dt, *J* = 14.9, 7.1 Hz, 1H), 4.03 (d, *J* = 8.8 Hz, 1H), 3.73 (d, *J* = 14.9 Hz, 1H), 3.56 (d, *J* = 14.9 Hz, 1H), 2.92 - 2.82 (m, 4H), 2.77 - 2.69 (m, 2H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 149.43, 148.83, 138.92, 136.97, 135.41, 134.43, 134.29, 128.65, 126.70, 126.27, 125.73, 123.74, 119.78 (t, *J* = 4.3 Hz), 70.15, 54.19, 48.08, 34.58 (t, *J* = 22.7 Hz), 28.90.

^{19}F NMR (471 MHz, $CDCl_3$) δ -81.10 - -81.14 (m), -113.14 – -113.40 (m), -124.13 – 124.19 (m), -126.11 – -126.15 (m).

HRMS(ESI) calcd. for $C_{22}H_{20}N_2F_9[M+H]^+$ 483.14772, found 483.14752.



(*E*)-2-(1-(Benzo[b]thiophen-3-yl)-5,5,6,6,7,7,7-heptafluorohept-2-en-1-yl)-1,2,3,4-tetrahydroisoquinoline (6f). Yellow oil, 88% yield, 85.8 mg. According to general experimental procedure B, the crude product was purified by column chromatography

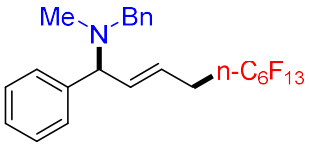
on silica gel (4:1 Hex/DCM to 1:1 Hex/DCM) to give the product **6f**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.20 - 8.12 (m, 1H), 7.89 - 7.82 (m, 1H), 7.39 - 7.29 (m, 3H), 7.15 - 7.05 (m, 3H), 6.95 (d, *J* = 7.2 Hz, 1H), 6.12 (dd, *J* = 15.4, 8.9 Hz, 1H), 5.78 (dt, *J* = 14.9, 7.2 Hz, 1H), 4.39 (d, *J* = 8.9 Hz, 1H), 3.81 (d, *J* = 14.9 Hz, 1H), 3.61 (d, *J* = 14.9 Hz, 1H), 2.91 - 2.73 (m, 6H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 141.01, 138.08, 137.86, 136.17, 135.00, 134.69, 128.67, 126.84, 126.17, 125.66, 124.57, 124.03, 123.66, 123.24, 122.87, 119.42 (t, *J* = 4.3 Hz), 67.87, 54.30, 48.13, 34.38 (t, *J* = 22.6 Hz), 29.33.

^{19}F NMR (565 MHz, $CDCl_3$) δ -80.53 - -80.56 (m), -113.73 – 113.79 (m), -127.29 – -127.33 (m).

HRMS(ESI) calcd. for $C_{24}H_{21}NF_7S[M+H]^+$ 488.12774, found 488.12500.



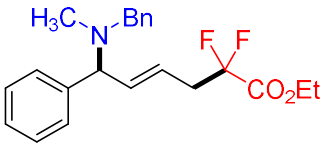
(*E*)-*N*-Benzyl-5,5,6,6,7,7,8,8,9,9,10,10,10-tridecafluoro-*N*-methyl-1-phenyldec-2-en-1-amine (6g). Yellow oil, 50% yield, 56.9 mg. According to general experimental procedure B, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **6g**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.46 - 7.25 (m, 10H), 6.00 (dd, *J* = 13.4, 8.1 Hz, 1H), 5.69 (dt, *J* = 15.0, 7.2 Hz, 1H), 4.03 (d, *J* = 8.7 Hz, 1H), 3.56- 3.48 (m, 2H), 2.93 - 2.86 (m, 2H), 2.15 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 141.78, 139.41, 128.71, 128.55, 128.24, 127.89, 127.28, 126.86, 118.96, 71.49, 58.91, 39.20, 34.73 (t, *J* = 22.5 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -80.77 – 80.81 (m), -112.88 – -112.97 (m), -121.92 - -121.93 (m), -122.86 – -122.87 (m), -123.07 - -123.08 (m), -126.09 - -126.12 (m).

HRMS(ESI) calcd. for $C_{24}H_{21}NF_{13}[M+H]^+$ 570.14520, found 570.14609.



Ethyl (*E*)-6-(Benzyl(methyl)amino)-2,2-difluoro-6-phenylhex-4-enoate (6h). Yellow oil, 60% yield, 44.8 mg. According to general experimental procedure B, the crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **6h**.

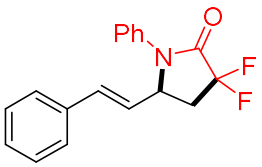
Only the data of the major product is shown here.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.46 - 7.28 (m, 10H), 5.94 - 5.91 (m, 1H), 5.67 - 5.61 (m, 1H), 4.18 (q, J = 7.1 Hz, 2H), 3.97 (d, J = 8.7 Hz, 1H), 3.55 - 3.47 (m, 2H), 2.95 - 2.80 (m, 2H), 2.12 (s, 3H), 1.27 (t, J = 7.1 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 163.83 (t, J = 32.4 Hz), 142.09, 138.79, 128.73, 128.55, 128.24, 127.89, 127.22, 126.86, 120.80, 115.37 (t, J = 251.3 Hz), 71.78, 62.82, 58.95, 39.30, 38.09 (t, J = 23.9 Hz), 13.91.

^{19}F NMR (471 MHz, $CDCl_3$) δ -103.96 – -106.41 (m).

HRMS(ESI) calcd. for $C_{22}H_{26}O_2NF_2[M+H]^+$ 374.19183, found 374.19261.



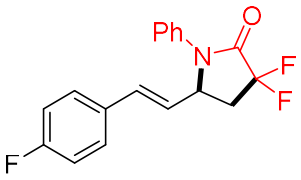
(*E*)-3,3-difluoro-1-phenyl-5-styrylpyrrolidin-2-one (8a). Colorless oil, 70% yield, 41.9 mg. According to general experimental procedure C, the crude product was purified by column chromatography on silica gel (10:1 Hex/EtOAc to 5:1 Hex/EtOAc) to give the product **8a**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.47 (d, *J* = 7.6 Hz, 2H), 7.36 (t, *J* = 7.7 Hz, 2H), 7.31 – 7.19 (m, 6H), 6.57 (d, *J* = 15.8 Hz, 1H), 5.99 (dd, *J* = 15.8, 8.6 Hz, 1H), 4.88 - 4.84 (m, 1H), 2.97 - 2.88 (m, 1H), 2.54 – 2.42 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 162.72 (t, *J* = 31.1 Hz), 136.26, 135.25, 134.96, 129.20, 128.75, 128.64, 127.03, 126.87, 126.72, 126.45, 123.49, 117.34 (t, *J* = 249.9 Hz), 76.96, 57.24 (t, *J* = 3.4 Hz), 36.84 (t, *J* = 21.8 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -101.91 - -102.41 (m), -105.35 - -105.84 (m).

HRMS(ESI) calcd. for $C_{18}H_{16}ONF_2^+$[M+H]$^+$ 300.11893, found 300.11944.



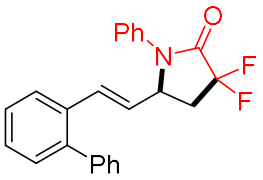
(*E*)-3,3-Difluoro-5-(4-fluorostyryl)-1-phenylpyrrolidin-2-one (**8b**). Yellow oil, 74% yield, 46.9 mg. According to general experimental procedure C, the crude product was purified by column chromatography on silica gel (10:1 Hex/EtOAc to 5:1 Hex/EtOAc) to give the product **8b**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.6 Hz, 2H), 7.37 (t, *J* = 7.9 Hz, 2H), 7.30 – 7.19 (m, 3H), 6.96 (t, *J* = 8.6 Hz, 2H), 6.54 (d, *J* = 15.8 Hz, 1H), 5.91 (dd, *J* = 15.8, 8.5 Hz, 1H), 4.88 - 4.84 (m, 1H), 2.98 - 2.89 (m, 1H), 2.53 - 2.45 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 163.65, 162.69 (t, *J* = 31.2 Hz), 162.00, 136.22, 131.45 (t, *J* = 3.1 Hz), 129.21, 128.38 (d, *J* = 8.2 Hz), 127.05, 126.18, 123.49, 118.18 (d, *J* = 251.7 Hz), 115.69 (d, *J* = 21.8 Hz), 57.16 (t, *J* = 3.5 Hz), 36.77 (t, *J* = 21.9 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -101.82 - -102.32 (m), -105.36 - -105.85 (m).

HRMS(ESI) calcd. for $C_{18}H_{15}ONF_3^+$[M+H]$^+$ 318.10898, found 318.11002.



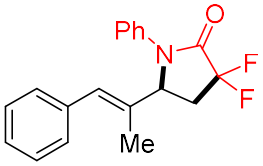
(*E*)-5-(2-([1,1'-Biphenyl]-2-yl)vinyl)-3,3-difluoro-1-phenylpyrrolidin-2-one (8c). Colorless oil, 82% yield, 61.6 mg. According to general experimental procedure C, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **8c**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.47 – 7.32 (m, 8H), 7.31 – 7.23 (m, 4H), 7.14 – 7.08 (m, 2H), 6.54 (d, *J* = 14.0 Hz, 1H), 5.89 - 5.85 (m, 1H), 4.73 – 4.69 (m, 1H), 2.88 – 2.79 (m, 1H), 2.48 – 2.36 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 162.66 (t, *J* = 31.2 Hz), 141.21, 140.29, 136.28, 134.50, 133.43, 130.30, 129.71, 129.20, 128.52, 128.22, 127.68, 127.38, 127.30, 127.12, 126.48, 117.39 (t, *J* = 249.0 Hz), 57.47 (t, *J* = 3.2 Hz), 36.58 (t, *J* = 21.8 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -101.94 - -102.42 (m), -105.28 - -105.78 (m).

HRMS(ESI) calcd. for $C_{24}H_{20}ONF_2^+$[M+H]$^+$ 376.15074, found376.14981.



(*E*)-3,3-Difluoro-1-phenyl-5-(1-phenylprop-1-en-2-yl)pyrrolidin-2-one (8d). Colorless oil, 51% yield, 32 mg. According to general experimental procedure C, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **8d**.

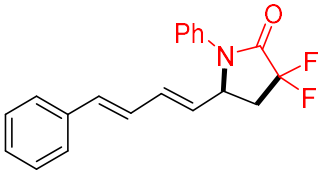
^{1}H NMR (600 MHz, $CDCl_3$) δ 7.49 (d, *J* = 7.3 Hz, 2H), 7.41 – 7.34 (m, 2H), 7.29 (d, *J* = 7.6 Hz, 2H), 7.25 – 7.19 (m, 2H), 7.12 (d, *J* = 7.4 Hz, 2H), 6.56 (s, 1H), 4.91 –

4.88 (m, 1H), 2.97 – 2.85 (m, 1H), 2.53 – 2.44 (m, 1H), 1.66 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 163.09 (t, *J* = 31.3 Hz), 136.14, 133.31, 131.26, 129.04, 128.82, 128.32, 127.34, 126.87, 123.02, 117.40 (t, *J* = 249.2 Hz), 61.86 (t, *J* = 3.0 Hz), 34.72 (t, *J* = 22.1 Hz), 12.20.

^{19}F NMR (565 MHz, $CDCl_3$) δ -101.56 - -102.05 (m), -102.70 - -103.18 (m).

HRMS(ESI) calcd. for $C_{19}H_{18}ONF_2^+$[M+H]$^+$ 314.13509, found314.13409.



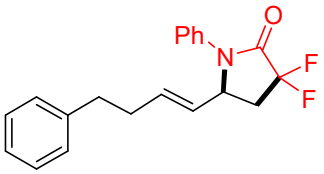
3, 3-Difluoro-1-phenyl-5-((1*E*,3*E*)-4-phenylbuta-1,3-dien-1-yl)pyrrolidin-2-one (**8e**). Colorless oil, 49% yield, 31.9 mg. According to general experimental procedure C, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **8e**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.46 – 7.21 (m, 10H), 6.63 (dd, *J* = 15.6, 10.4 Hz, 1H), 6.52 (d, *J* = 15.7 Hz, 1H), 6.35 (dd, *J* = 15.2, 10.4 Hz, 1H), 5.58 (dd, *J* = 15.2, 8.6 Hz, 1H), 4.80 - 4.76 (m, 1H), 2.93 - 2.85 (m, 1H), 2.47 – 2.39 (m, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 162.65 (t, *J* = 31.3 Hz), 136.46, 136.26, 135.13, 134.85, 129.82, 129.18, 128.73, 128.22, 126.70, 126.59, 123.45, 117.31 (t, *J* = 249.9 Hz), 56.93 (t, *J* = 3.5 Hz), 36.89 (t, *J* = 21.7 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -102.15 - -102.67 (m), -105.31 - -105.81 (m).

HRMS(ESI) calcd. for $C_{20}H_{18}ONF_2^+$[M+H]$^+$ 326.13509, found 326.13416.



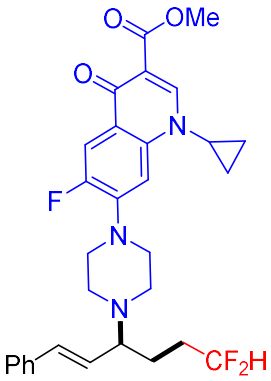
(*E*)-3,3-Difluoro-1-phenyl-5-(4-phenylbut-1-en-1-yl)pyrrolidin-2-one (8f). Colorless oil, 63% yield, 41.3 mg. According to general experimental procedure C, the crude product was purified by column chromatography on silica gel (20:1 Hex/EtOAc to 10:1 Hex/EtOAc) to give the product **8f**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.37 (d, *J* = 6.5 Hz, 4H), 7.26 – 7.20 (m, 3H), 7.15 (t, *J* = 7.4 Hz, 1H), 7.01 (d, *J* = 7.2 Hz, 2H), 5.72 – 5.64 (m, 1H), 5.24 (dd, *J* = 15.0, 7.5 Hz, 1H), 4.63 - 4.59 (m, 1H), 2.83 - 2.74 (m, 1H), 2.60 - 2.50 (m, 2H), 2.34 – 2.24 (m, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 162.66 (t, *J* = 31.2 Hz), 140.95, 136.23, 135.95, 129.06, 128.42, 128.39, 128.18, 126.89, 126.04, 123.64, 117.42 (t, *J* = 249.6 Hz), 56.88 (t, *J* = 3.3 Hz), 36.70 (t, *J* = 21.7 Hz), 35.09, 33.55.

^{19}F NMR (565 MHz, $CDCl_3$) δ -102.14 - -102.63 (m), -105.20 - -105.69 (m).

HRMS(ESI) calcd. for $C_{20}H_{20}ONF_2^+$[M+H]$^+$ 328.15074, found 328.14978.



Methyl (*E*)-1-cyclopropyl-7-(4-(6,6-difluoro-1-phenylhex-1-en-3-yl)piperazin-1-yl)-6-fluoro-4-oxo-1,4-dihydroquinoline-3-carboxylate (9a). Brown solid, 80% yield, 85.9 mg. mp: 178.8 - 199.6 ℃. The crude product was purified by column chromatography

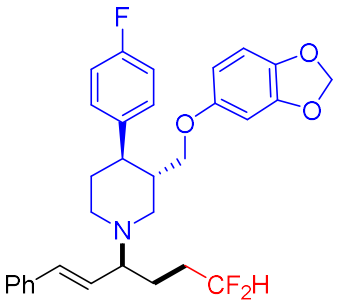
on silica gel (30:1 DCM/MeOH to 20:1 DCM/MeOH) to give the product **9a**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 8.46 (s, 1H), 7.87 (d, *J* = 13.2 Hz, 1H), 7.41 – 7.23 (m, 6H), 6.52 (d, *J* = 15.9 Hz, 1H), 6.15 (dd, *J* = 15.9, 9.0 Hz, 1H), 5.90 (tt, *J* = 57.0, 3.4 Hz, 1H), 3.86 (s, 3H), 3.48 – 3.39 (m, 1H), 3.28 – 3.27 (m, 4H), 3.14 – 3.04 (m, 1H), 2.88 - 2.87 (m, 2H), 2.74 - 2.73 (m, 2H), 1.96 - 1.93 (m, 3H), 1.80 – 1.68 (m, 1H), 1.31 - 1.30 (m, 2H), 1.10 - 1.09 (m, 2H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 173.1 (d, *J* = 1.8 Hz), 166.37, 153.39 (d, *J* = 248.9 Hz), 148.35, 144.56 (d, *J* = 10.6 Hz), 138.01, 136.38, 133.88, 128.68, 127.90, 127.74, 126.40, 122.90 (d, *J* = 6.9 Hz), 117.22 (t, *J* = 238.9 Hz), 113.16 (d, *J* = 23.2 Hz), 109.93, 104.80 (d, *J* = 2.7 Hz), 66.87, 52.02, 50.25 (d, *J* = 4.4 Hz), 49.27, 34.55, 31.07 (t, *J* = 21.2 Hz), 24.47 (t, *J* = 4.9 Hz), 8.12.

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.89, -123.41.

HRMS(ESI) calcd. for $C_{30}H_{33}O_3N_3F_3^+$[M+H]$^+$ 540.24685, found 540.24701.



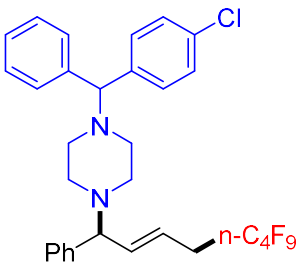
(3*S*,4*R*)-3-((Benzo[*d*][1,3]dioxol-5-yloxy)methyl)-1-((*E*)-6,6-difluoro-1-phenylhex-1-en-3-yl)-4-(4-fluorophenyl)piperidine (**9b**, *dr* = 1:1). Red brown oil, 97% yield, 101.6 mg. The crude product was purified by column chromatography on silica gel (10:1 Hex/EtOAc) to give the product **9b**.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.49 – 7.29 (m, 5H), 7.22 – 7.20 (m, 2H), 7.04 – 7.00 (m, 2H), 6.68 – 6.66 (m, 1H), 6.56 (d, *J* = 15.9 Hz, 1H), 6.41 (t, *J* = 3.1 Hz, 1H), 6.28 – 6.23 (m, 1H), 6.21 – 6.17 (m, 1H), 6.07 – 5.83 (m, 3H), 3.65 – 3.61 (m, 1H), 3.52 - 3.48 (m, 1H), 3.44 – 3.24 (m, 1H), 3.20 – 2.97 (m, 2H), 2.53 – 2.20 (m, 4H), 2.05 – 1.78 (m, 6H).

^{13}C NMR (126 MHz, $CDCl_3$) δ 161.57 (d, *J* = 244.4 Hz), 154.44, 154.40, 148.22, 141.66, 141.62, 139.8, 136.7, 133.54, 133.42, 128.89, 128.83, 128.70, 128.09, 127.77, 126.48, 119.34, 117.44 (t, *J* = 241.9 Hz), 115.44 (d, *J* = 20.2 Hz), 107.89, 105.70, 105.60, 101.11, 98.06, 98.03, 69.71, 67.19, 67.13, 56.24, 52.55, 51.18, 47.69, 44.56, 44.43, 42.58, 34.81, 34.73, 31.42 (t, *J* = 21.0 Hz), 24.95 – 24.79 (m).

^{19}F NMR (471 MHz, $CDCl_3$) δ -115.56 - -115.60 (m), -116.41 – 116.43 (m).

HRMS(ESI) calcd. for $C_{31}H_{33}O_3NF_3^+$[M+H]$^+$ 524.24070, found 524.24054.



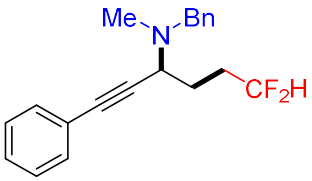
4-((4-Chlorophenyl)(phenyl)methyl)-1-((*S*,*E*)-5,5,6,6,7,7,8,8,8-nonafluoro-1-phenyloct-2-en-1-yl)piperidine (**9c,** *dr* = 1:1). Yellow oil, 80% yield, 101.4 mg. The crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **9c**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.36 – 7.14 (m, 14H), 5.86 – 5.82 (m, 1H), 5.64 – 5.59 (m, 1H), 4.19 (s, 1H), 3.71 (d, *J* = 8.7 Hz, 1H), 2.84 – 2.12 (m, 10H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 142.22, 142.19, 141.42, 142.40, 141.21, 140.38, 132.55, 132.50, 129.25, 129.23, 128.66, 128.60, 128.54, 127.97, 127.90, 127.89, 127.36, 127.16, 127.12, 118.28, 75.48, 73.68, 51.99, 51.50, 34.49 (t, *J* = 22.4 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -81.01 – -81.04 (m), -112.16 – -114.73 (m), -124.2 - -112.12 (m), -126.03 – -126.07 (m).

HRMS(ESI) calcd. for $C_{31}H_{29}ClN_2F_9^+$[M+H]$^+$635.18755, found 635.18353.



***N*-Benzyl-6,6-difluoro-*N*-methyl-1-phenylhex-1-yn-3-amine (11).** Red brown oil, 20% yield, 12.5 mg. The crude product was purified by column chromatography on silica gel (30:1 Hex/EtOAc to 20:1 Hex/EtOAc) to give the product **11**.

^{1}H NMR (600 MHz, $CDCl_3$) δ 7.40 (dd, *J* = 6.7, 3.1 Hz, 2H), 7.31 – 7.18 (m, 8H), 5.79 (tt, *J* = 56.8, 4.4 Hz, 1H), 3.67 (d, *J* = 13.1 Hz, 1H), 3.60 – 3.45 (m, 2H), 2.23 (s, 3H), 2.01 – 1.79 (m, 4H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 130.78, 128.00, 127.35, 127.31, 127.16, 126.20, 121.98, 116.06 (t, *J* = 239.0 Hz), 58.41, 54.01, 36.35, 30.22 (t, *J* = 21.3 Hz), 25.16 (t, *J* = 4.8 Hz).

^{19}F NMR (565 MHz, $CDCl_3$) δ -115.92.

HRMS(ESI) calcd. for $C_{20}H_{22}NF_2^+[M+H]^+$ 314.17148, found 314.17111.

7. References

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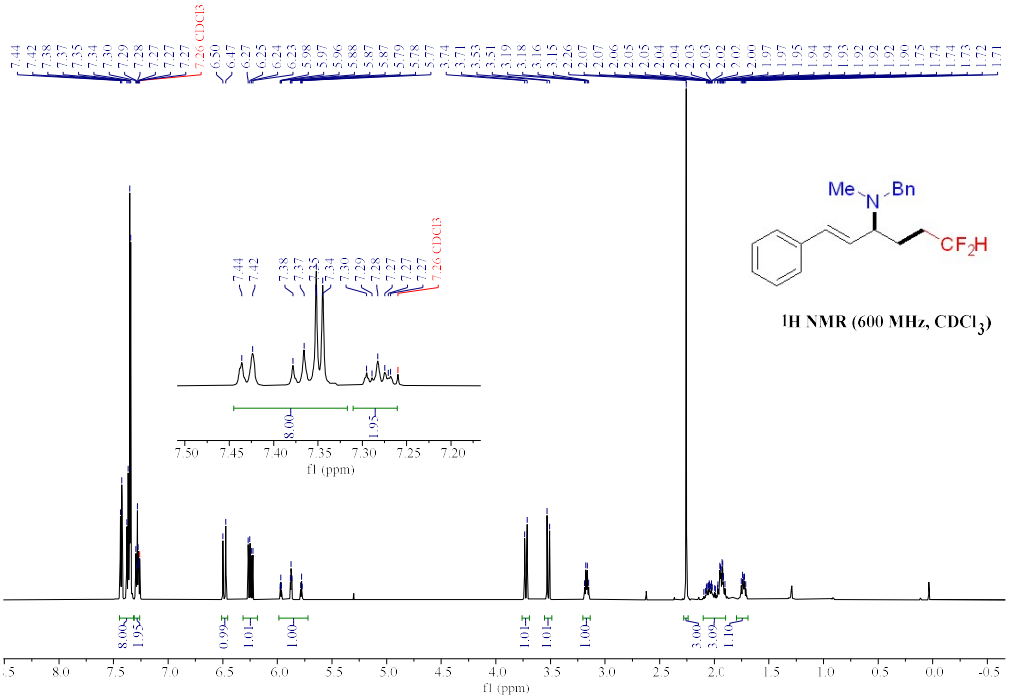
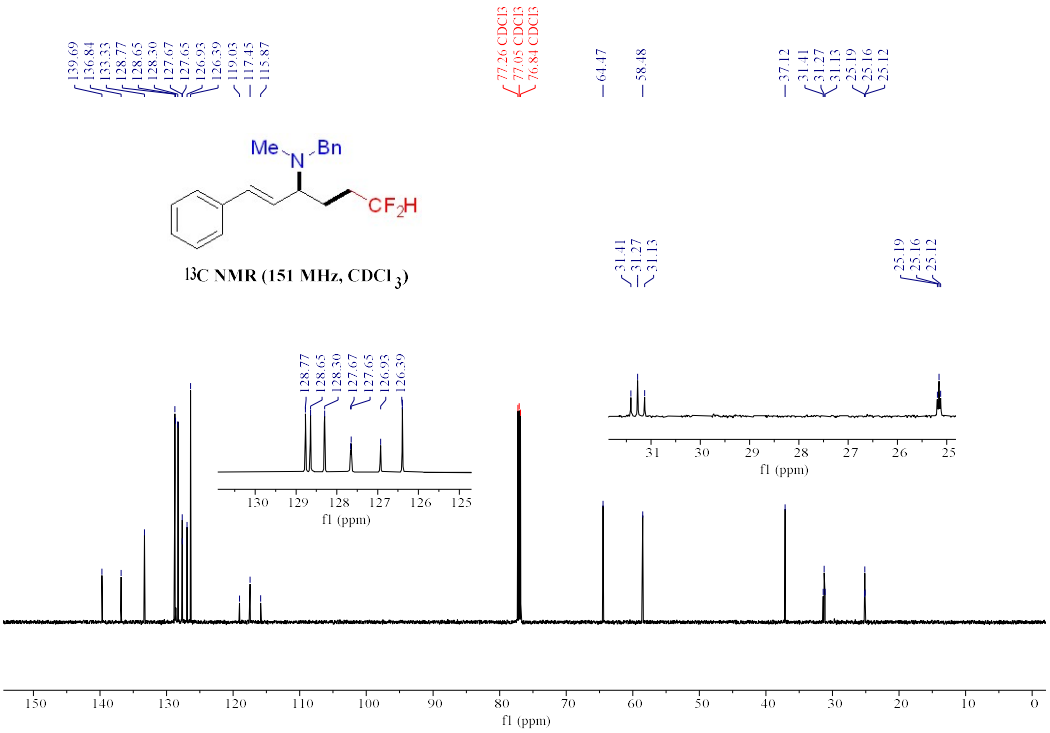
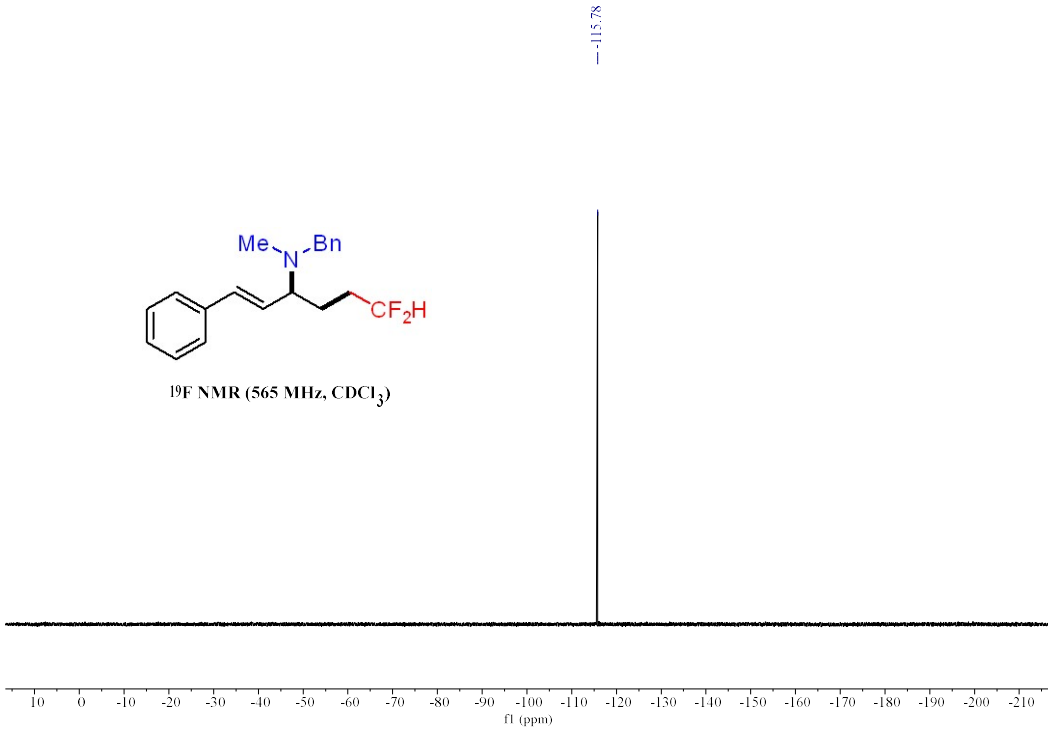
8. NMR Spectra of New Products

(*E*)-*N*-benzyl-6,6-difluoro-*N*-methyl-1-phenylhex-1-en-3-amine (4a)

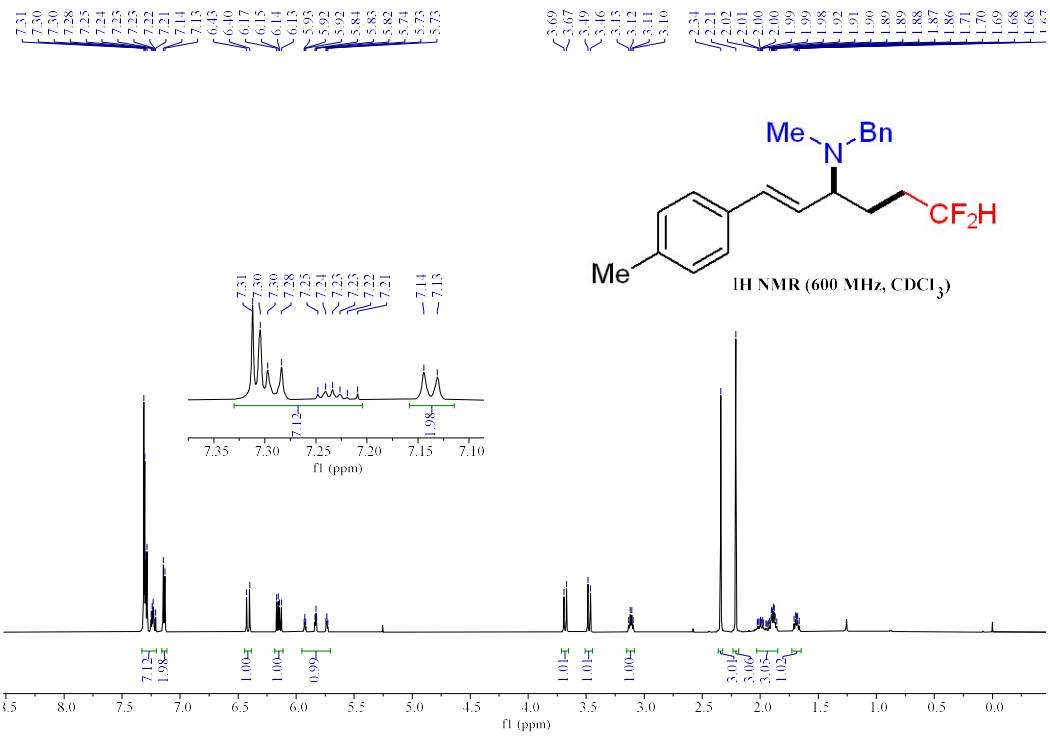


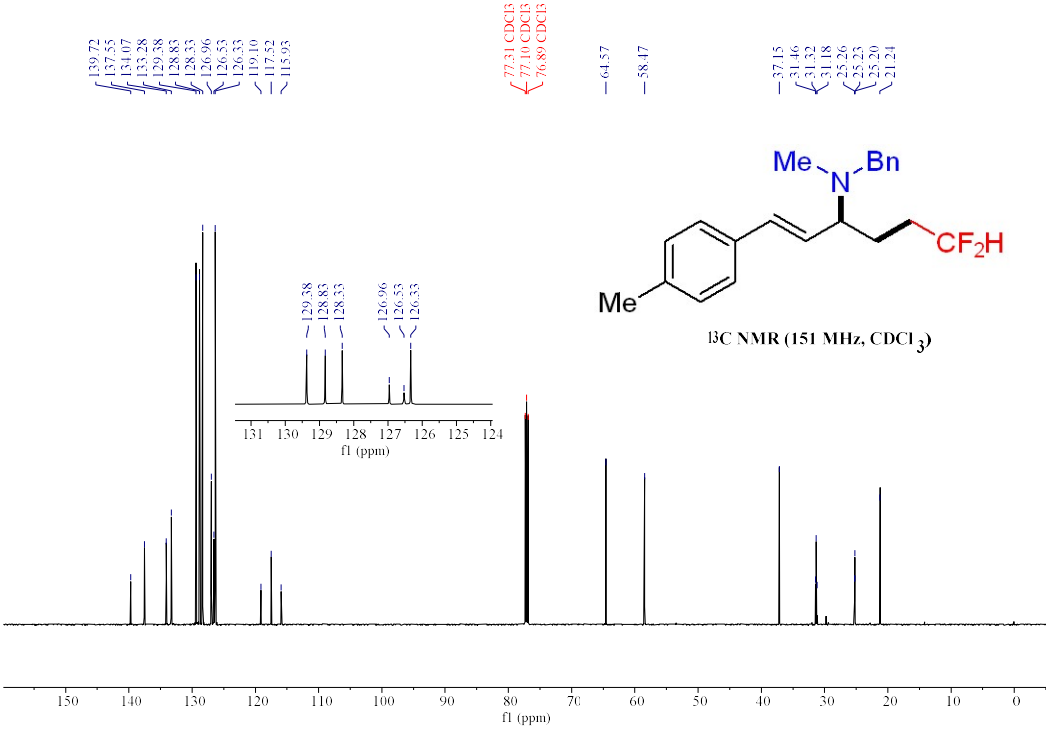


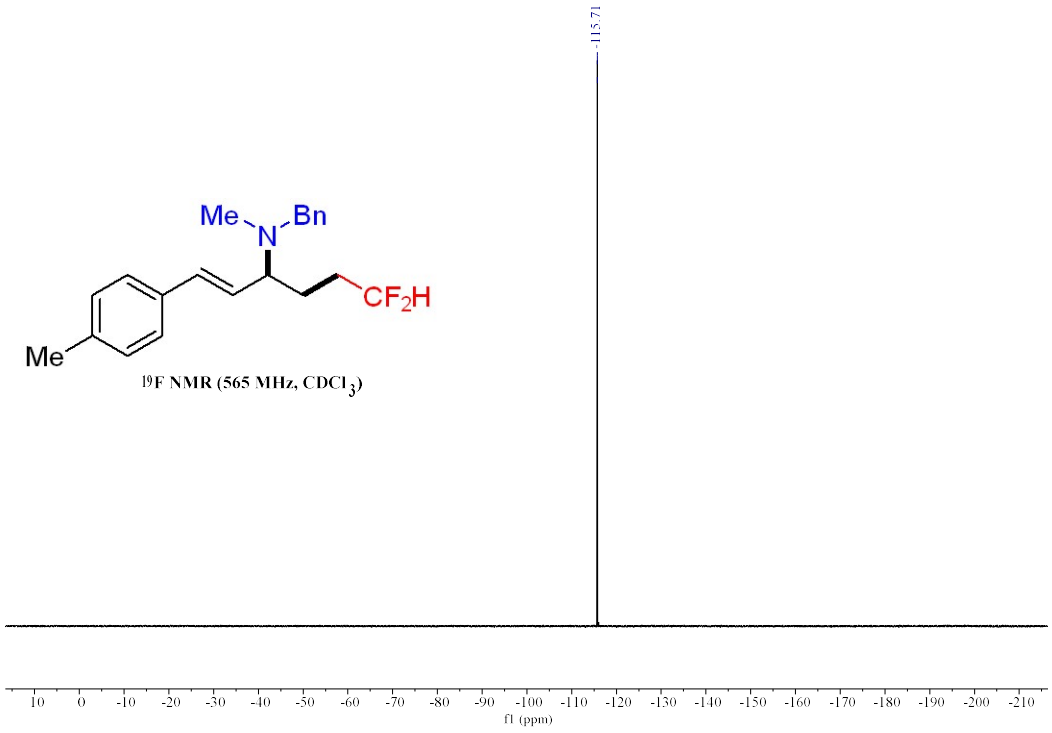


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-N-methyl-1-(p-tolyl)hex-1-en-3-amine (4b)

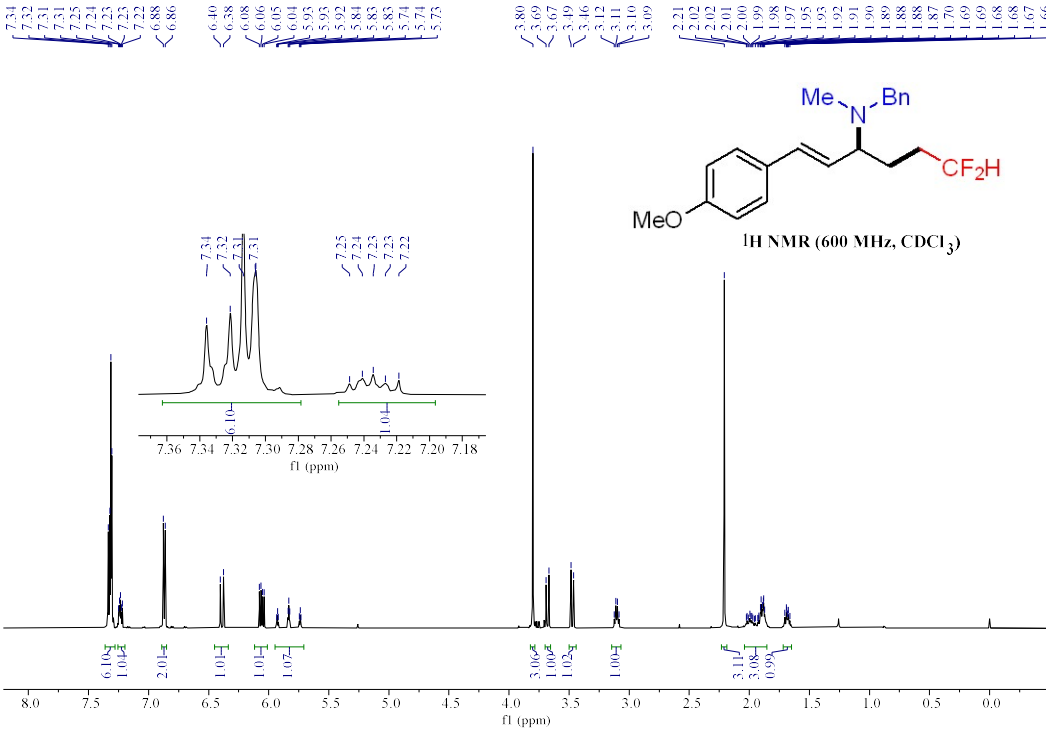


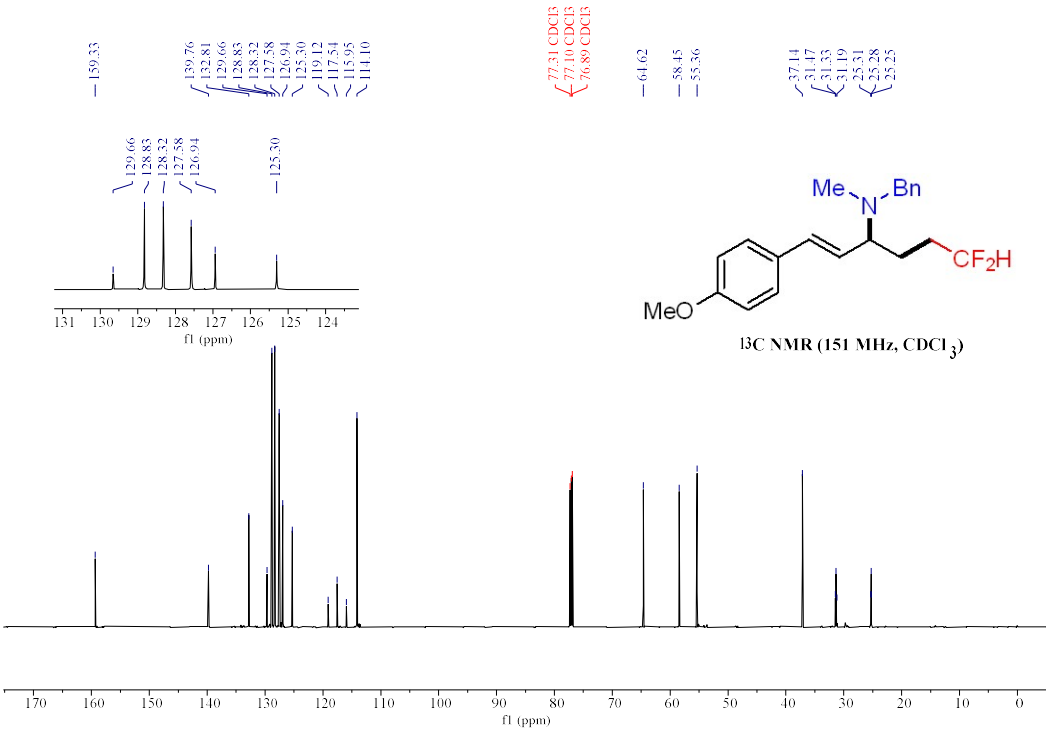


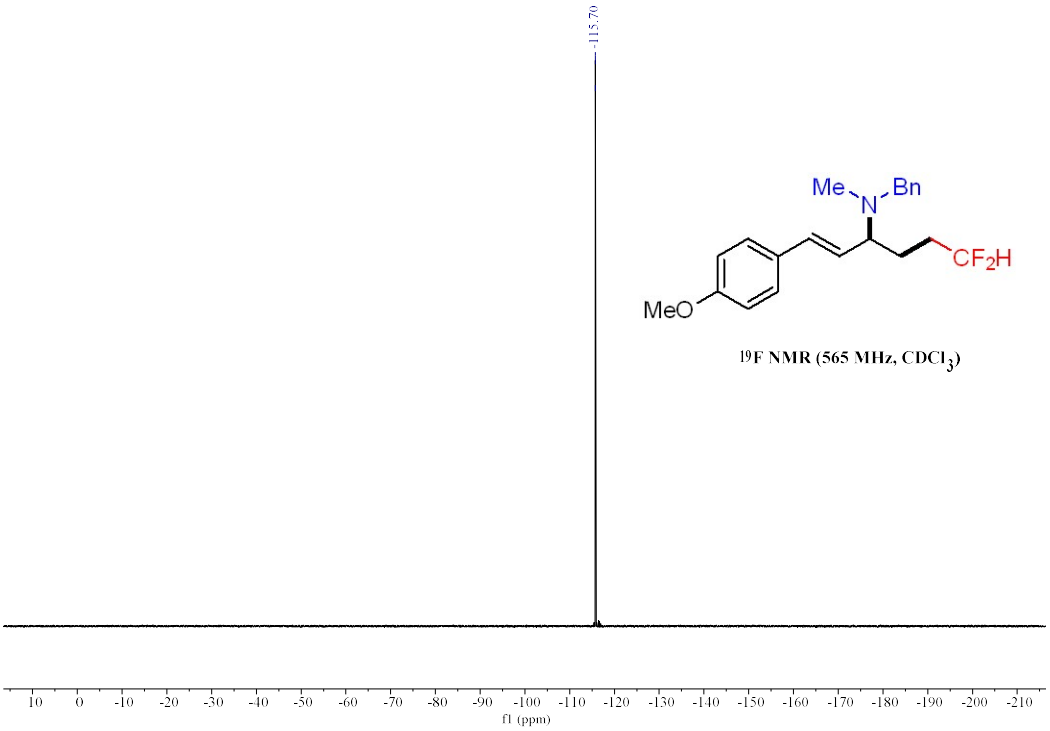


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-1-(4-methoxyphenyl)-*N*-methylhex-1-en-3-amine (4c)

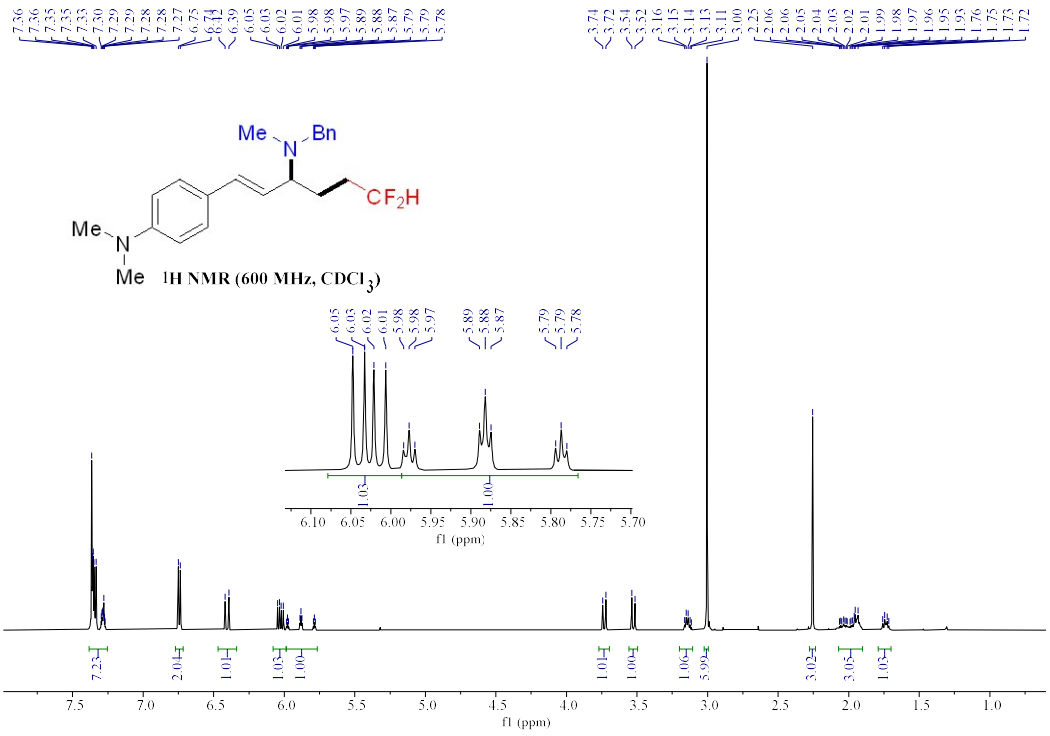


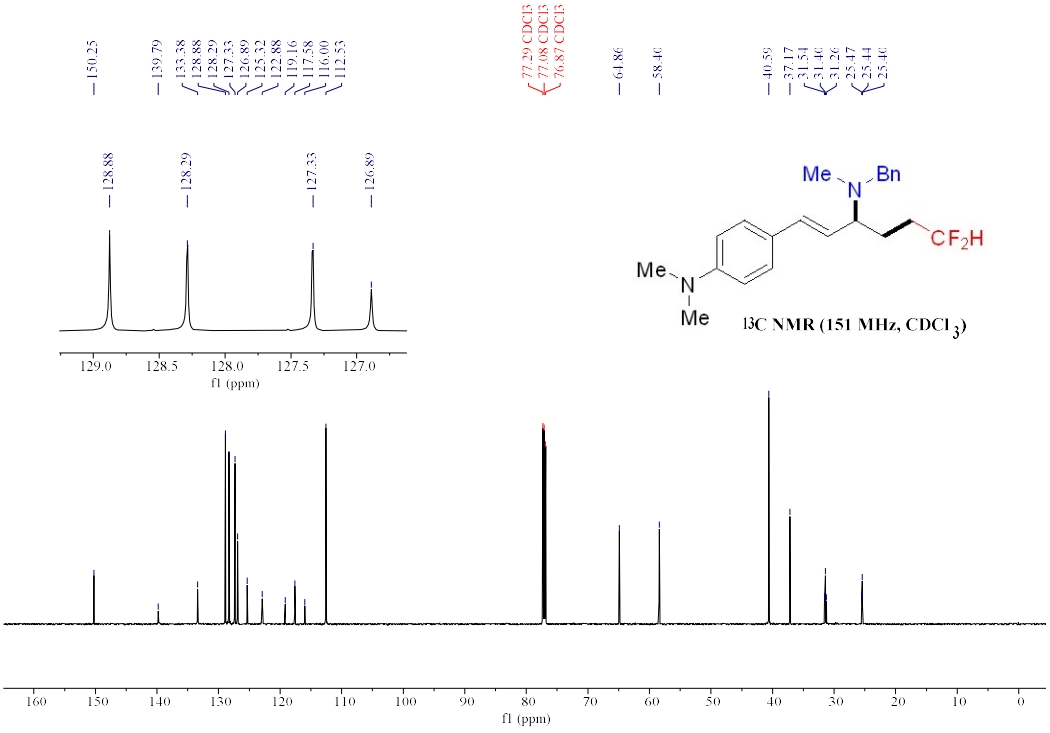


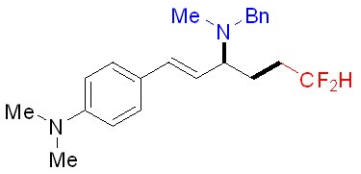


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-4-(3-(benzyl(methyl)amino)-6,6-difluorohex-1-en-1-yl)-*N*,*N*-dimethylaniline (4d)

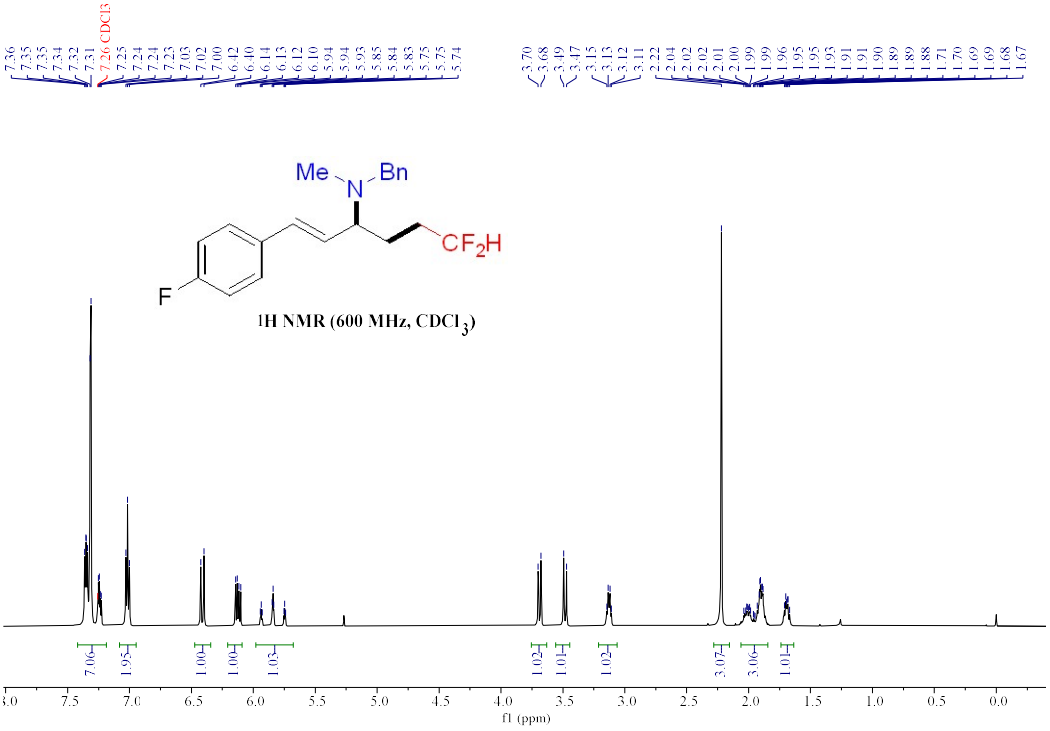


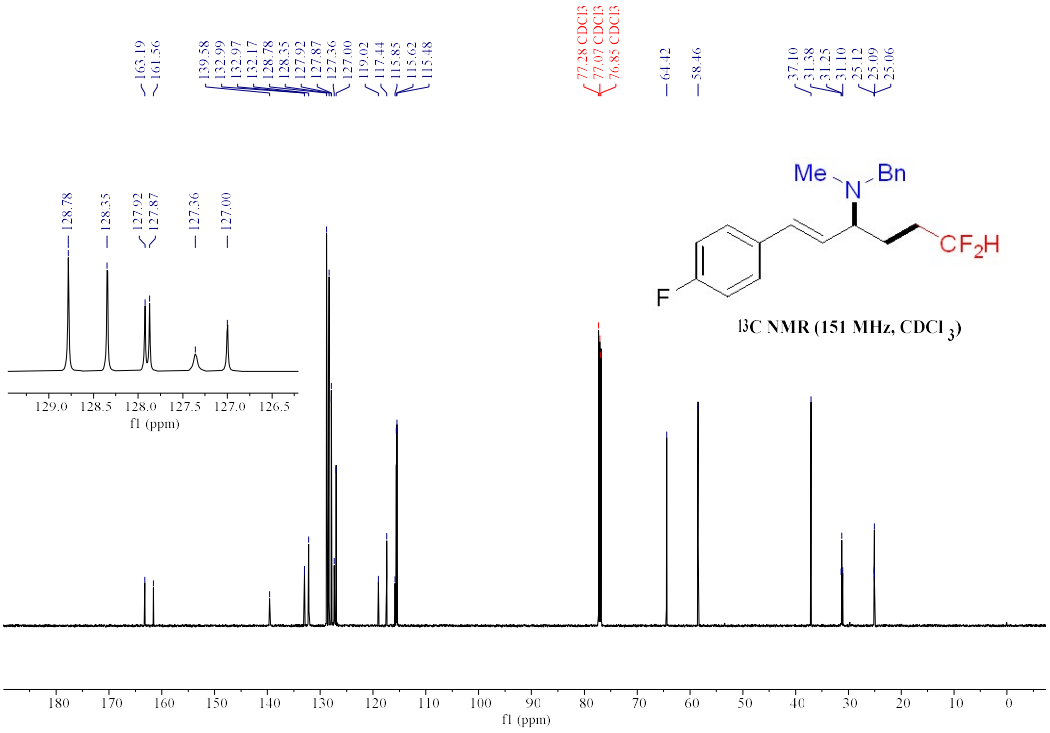


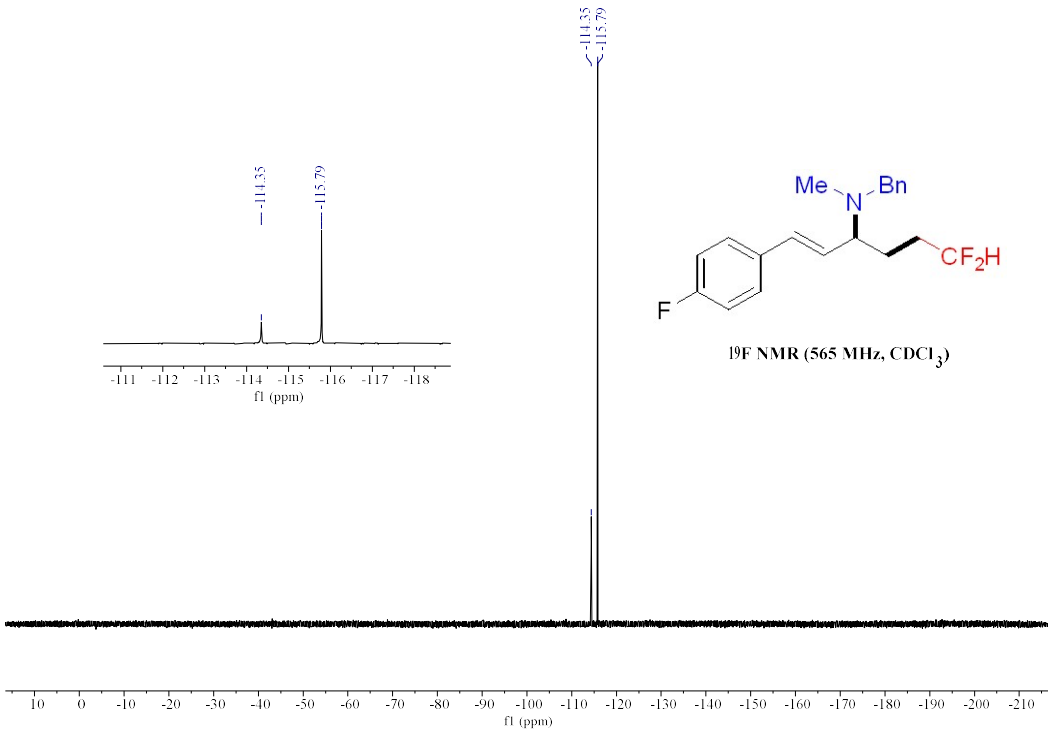


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-1-(4-fluorophenyl)-*N*-methylhex-1-en-3-amine (4e)

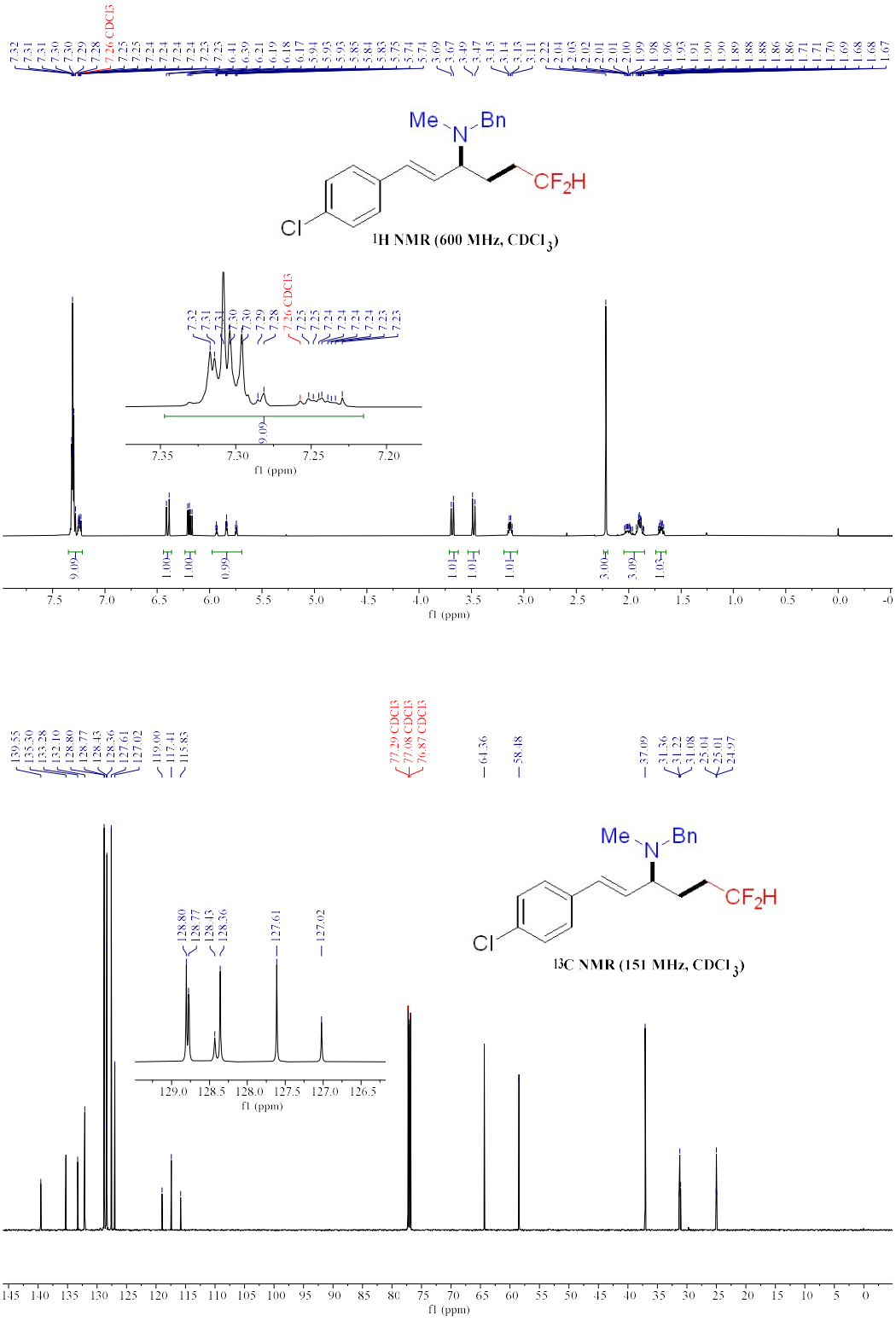


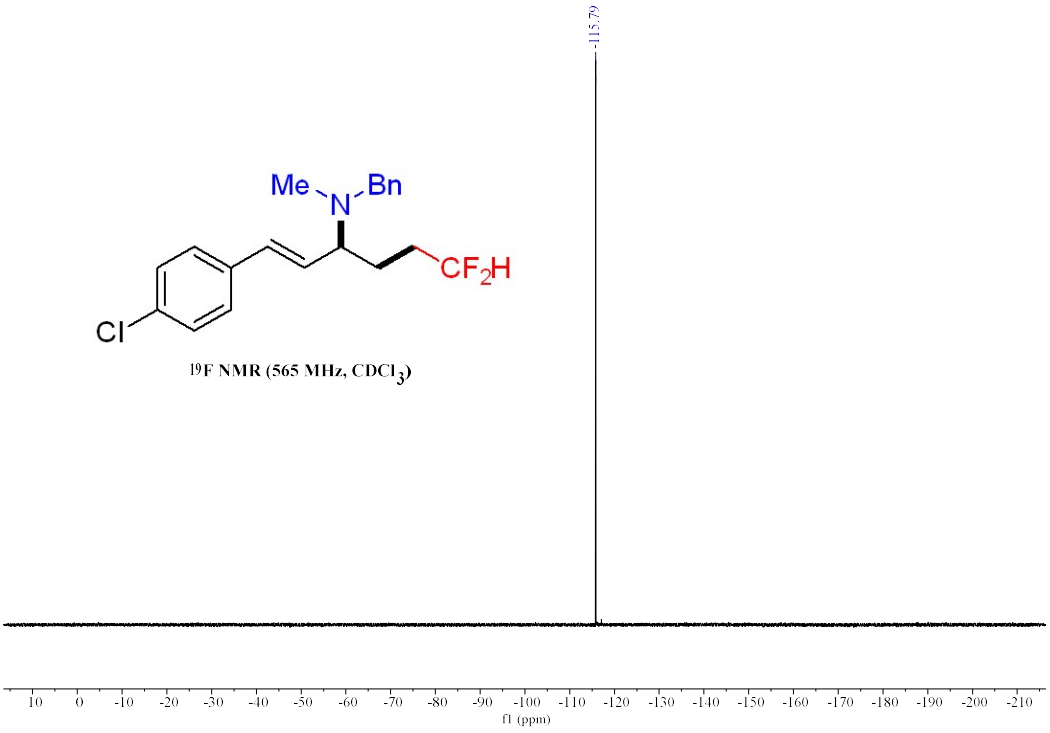




^{19}F NMR (565 MHz, $CDCl_3$)

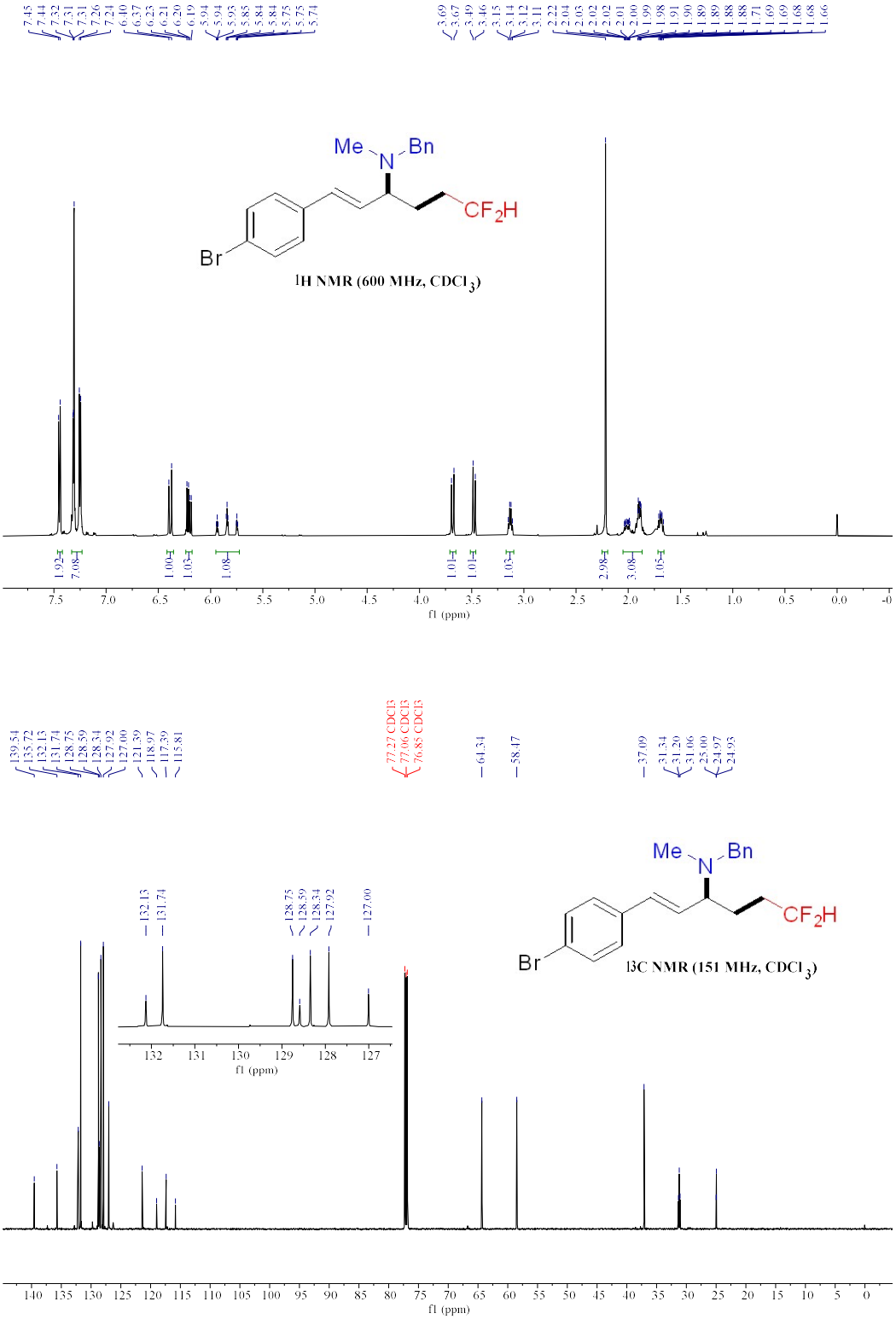
(*E*)-*N*-Benzyl-1-(4-chlorophenyl)-6,6-difluoro-*N*-methylhex-1-en-3-amine (4f)

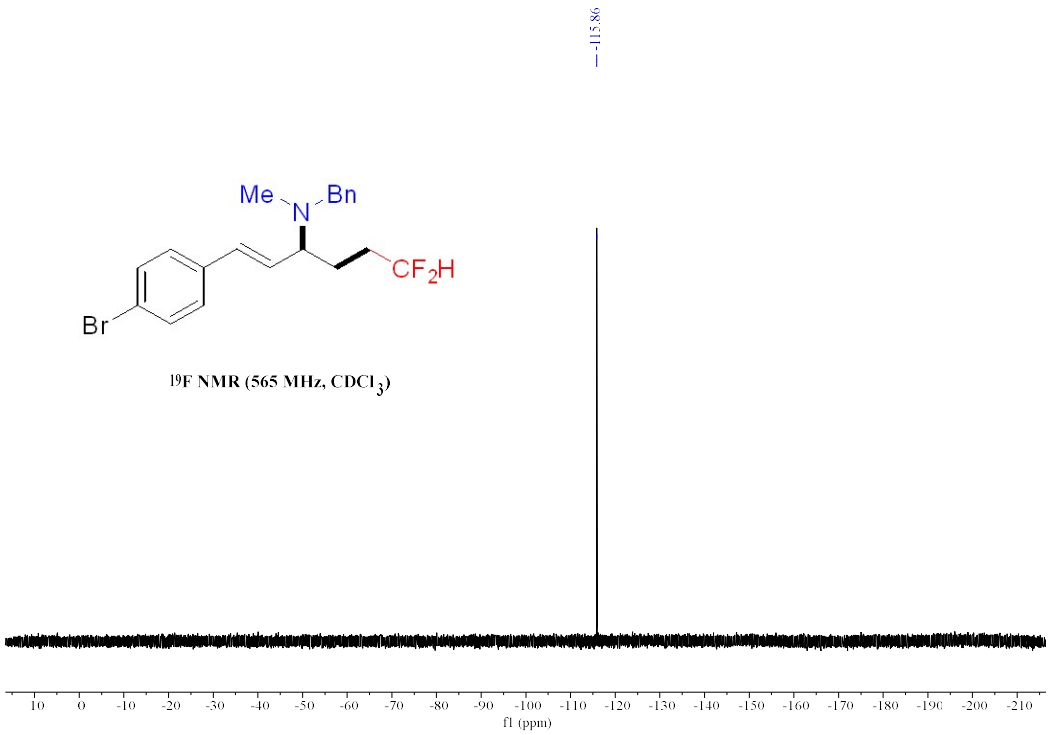




^{19}F NMR (565 MHz, $CDCl_3$)

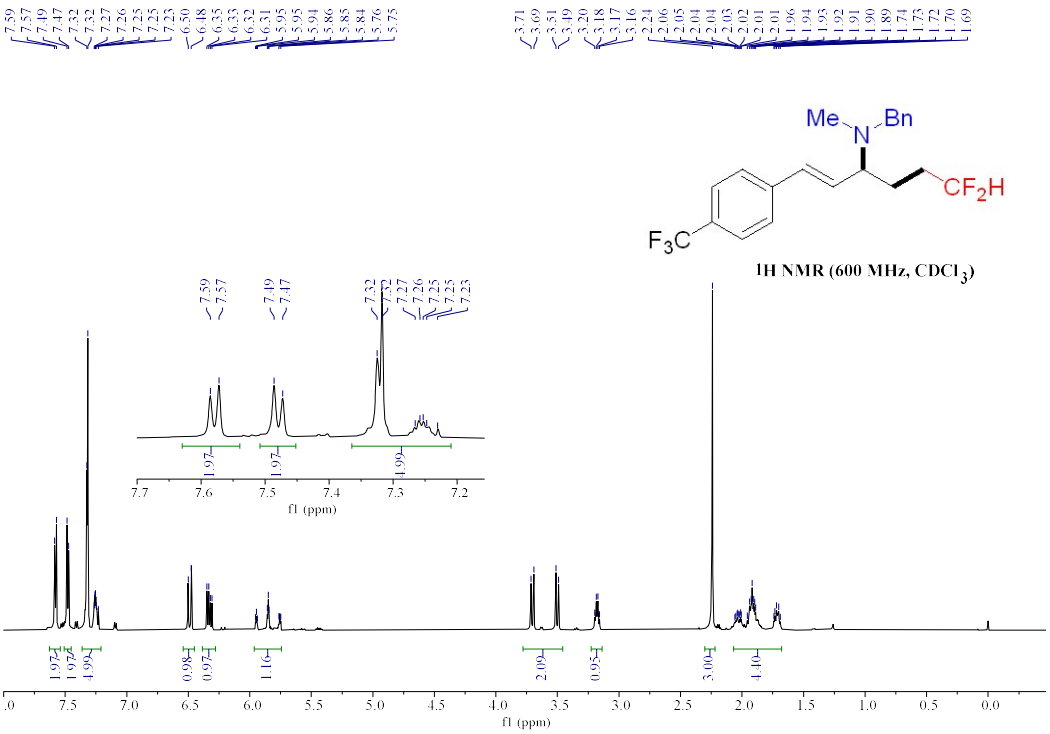
(*E*)-*N*-Benzyl-1-(4-bromophenyl)-6,6-difluoro-*N*-methylhex-1-en-3-amine (4g)

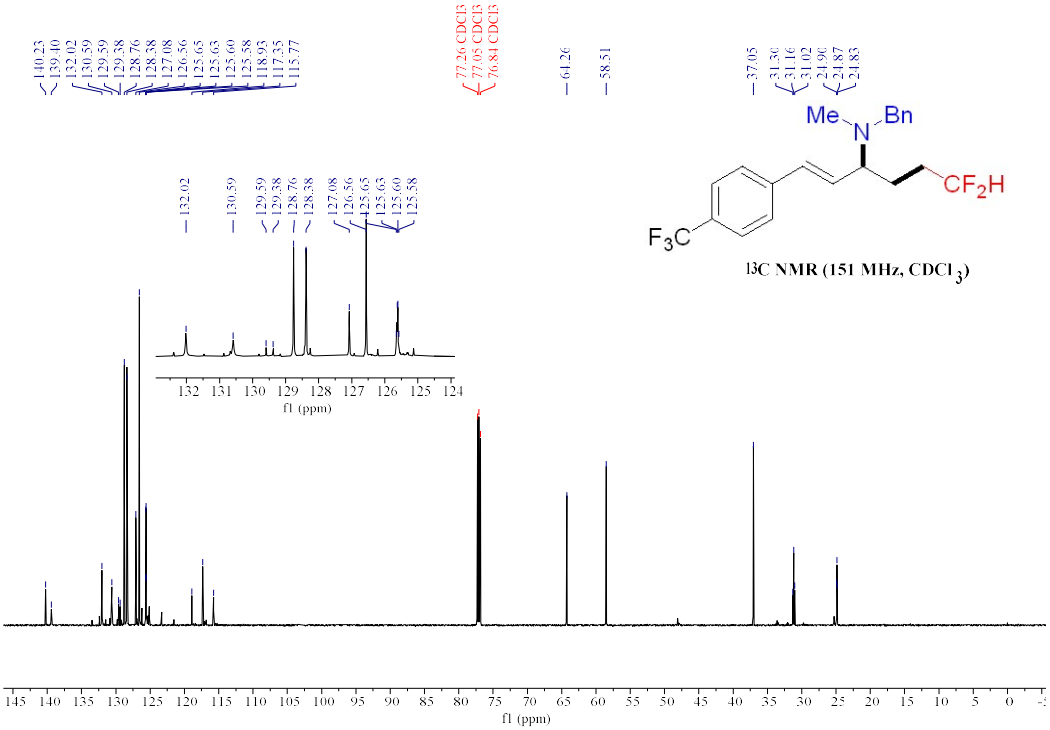


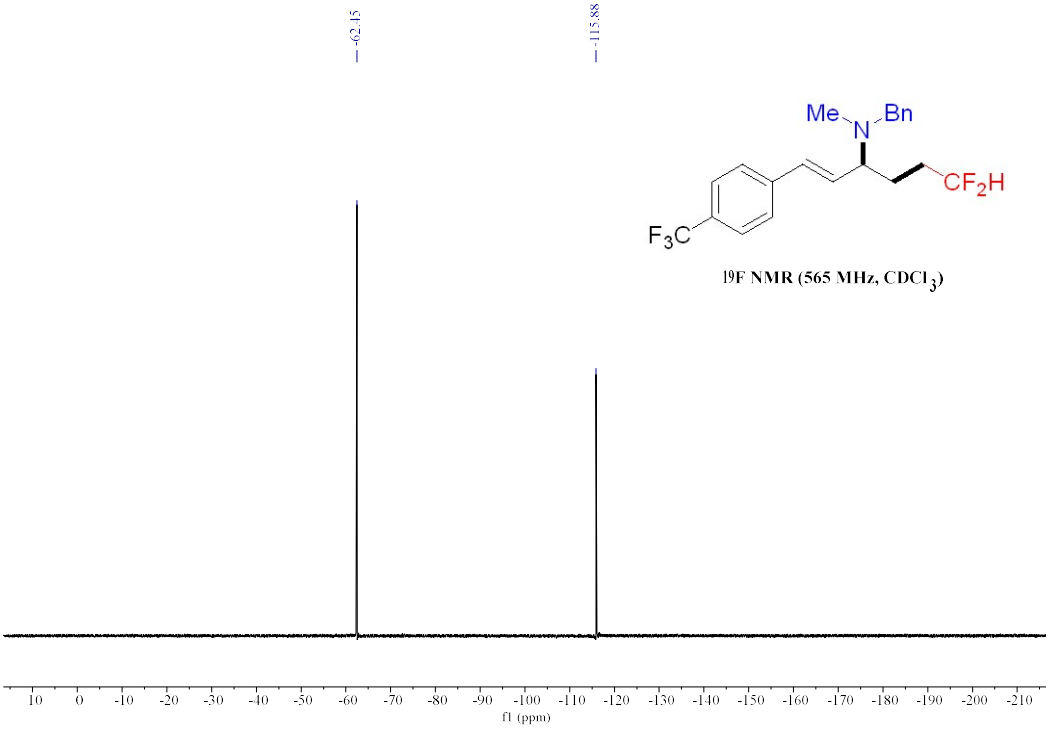


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(4-(trifluoromethyl)phenyl)hex-1-en-3-amine (4h)

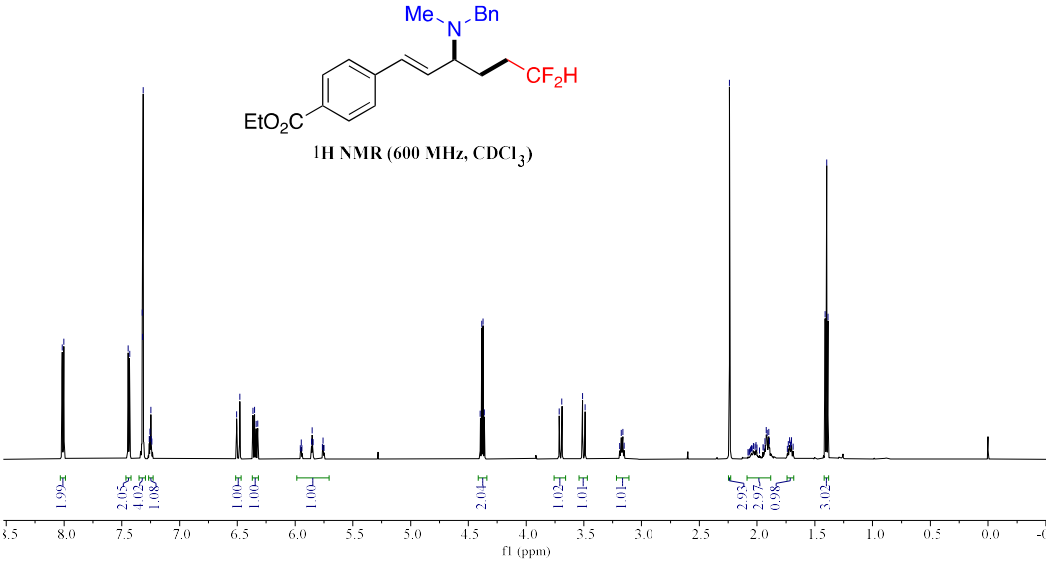


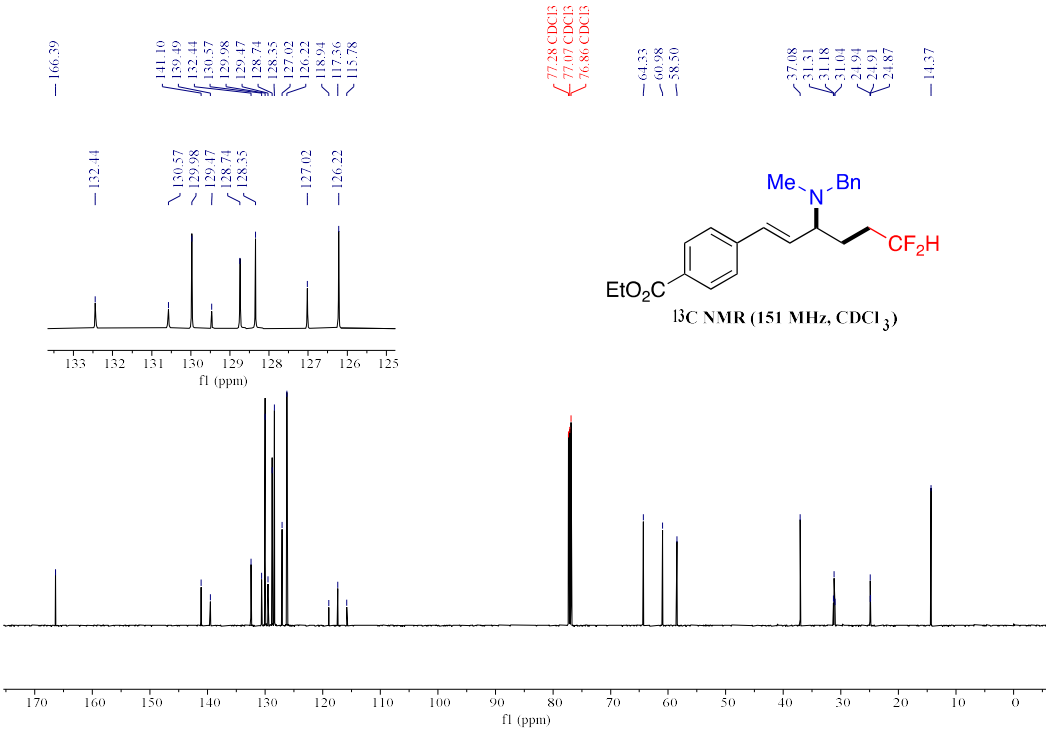


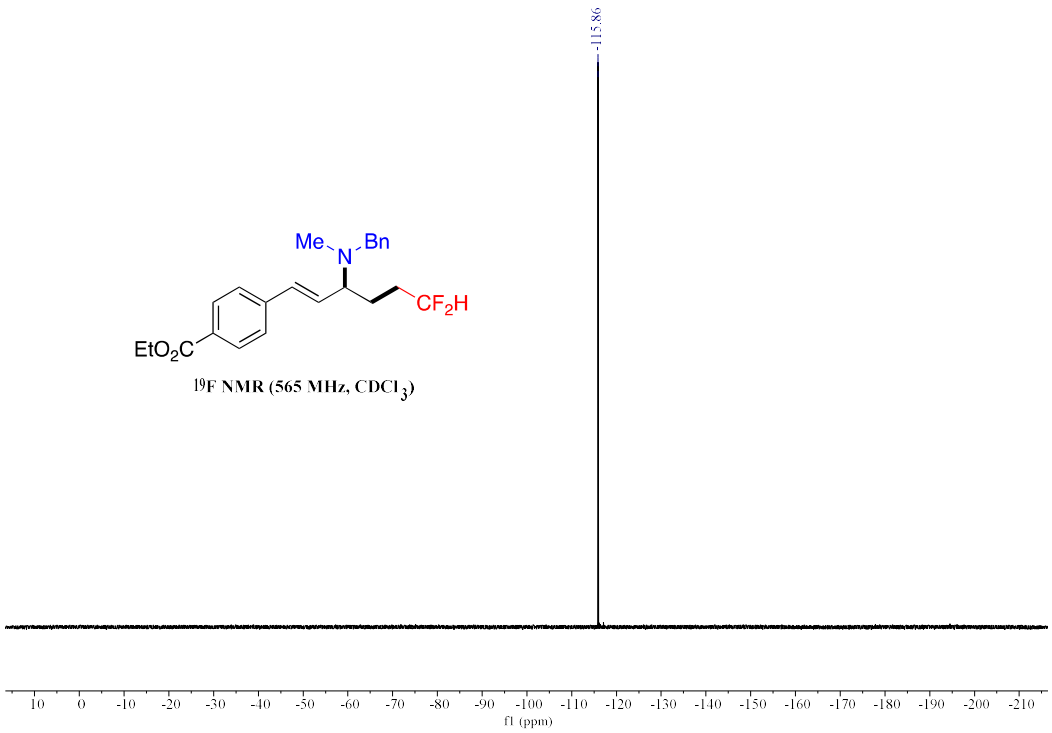


^{19}F NMR (565 MHz, $CDCl_3$)

Methyl (*E*)-4-(3-(benzyl(methyl)amino)-6,6-difluorohex-1-en-1-yl)benzoate (4i)

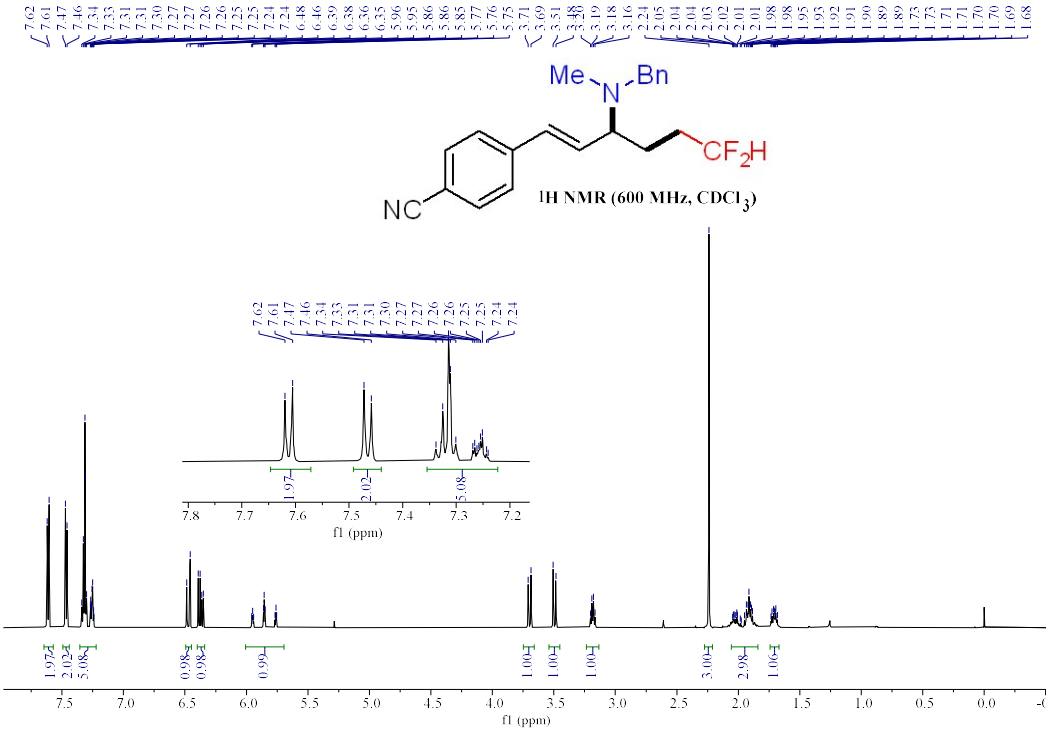


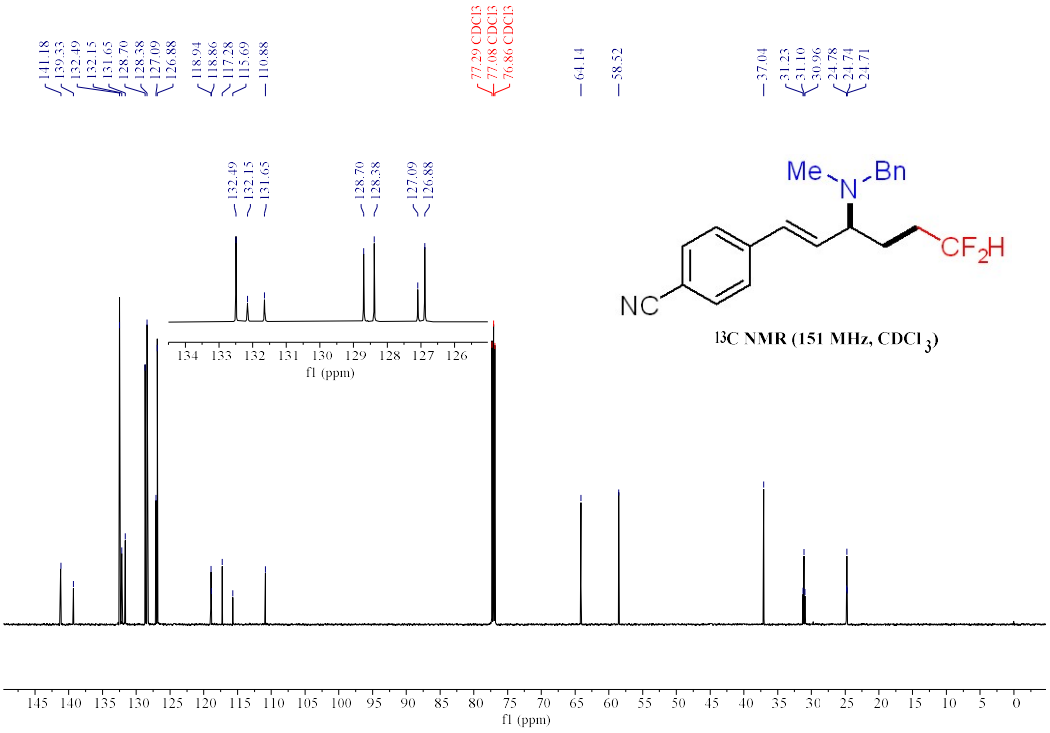


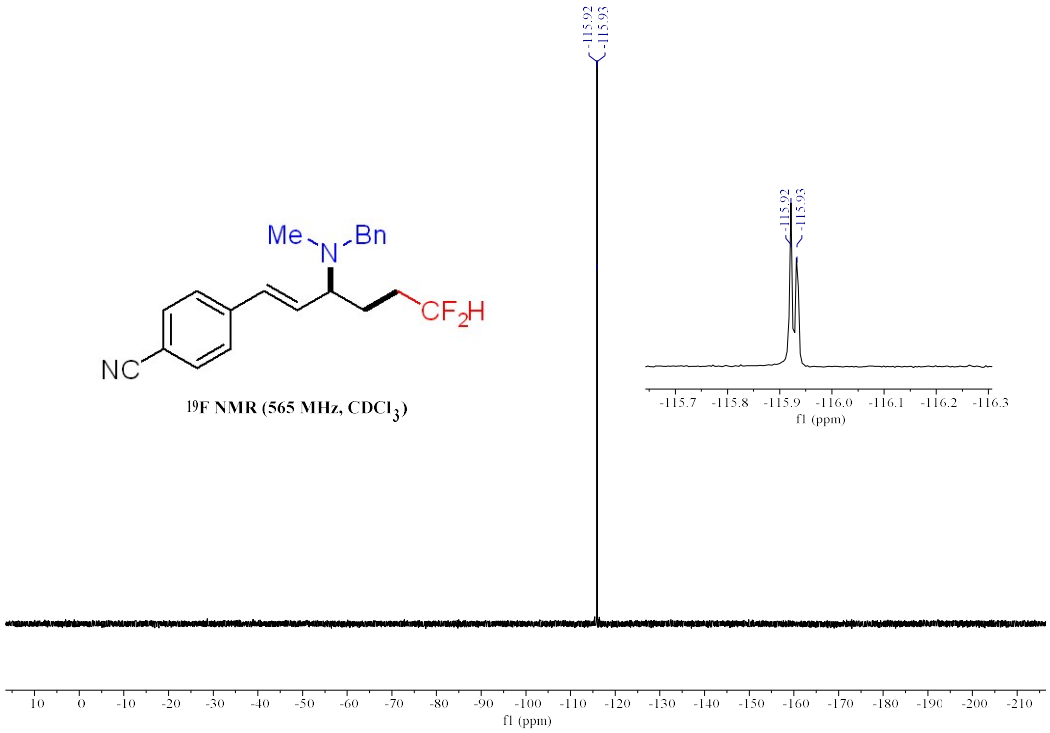


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-4-(3-(Benzyl(methyl)amino)-6,6-difluorohex-1-en-1-yl)benzonitrile (4j)

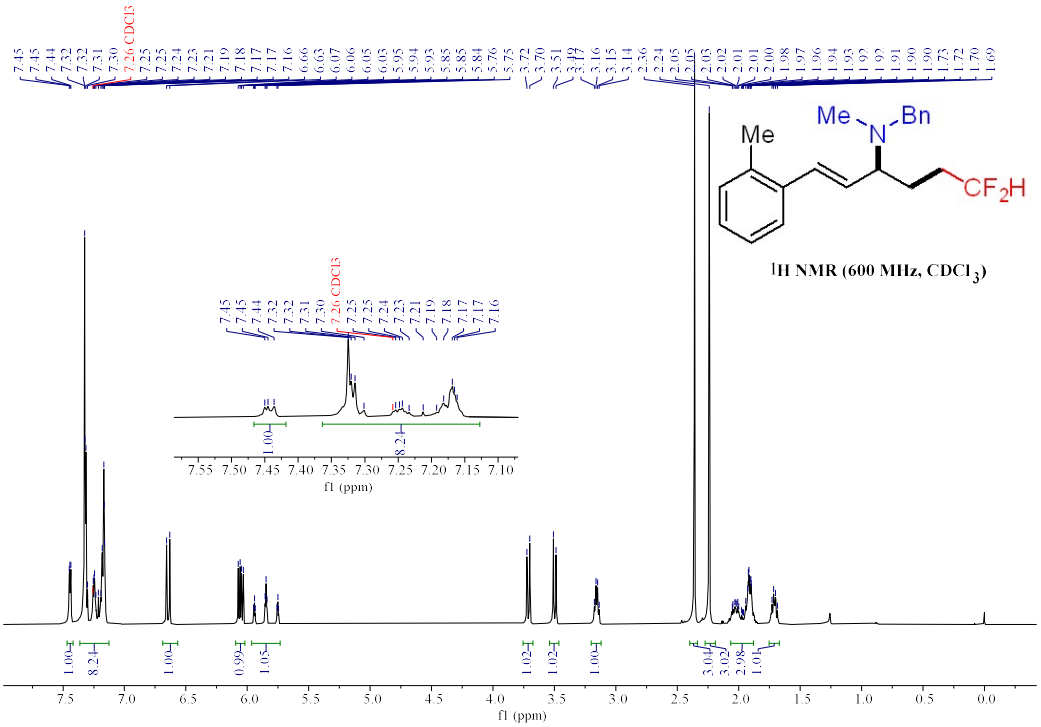


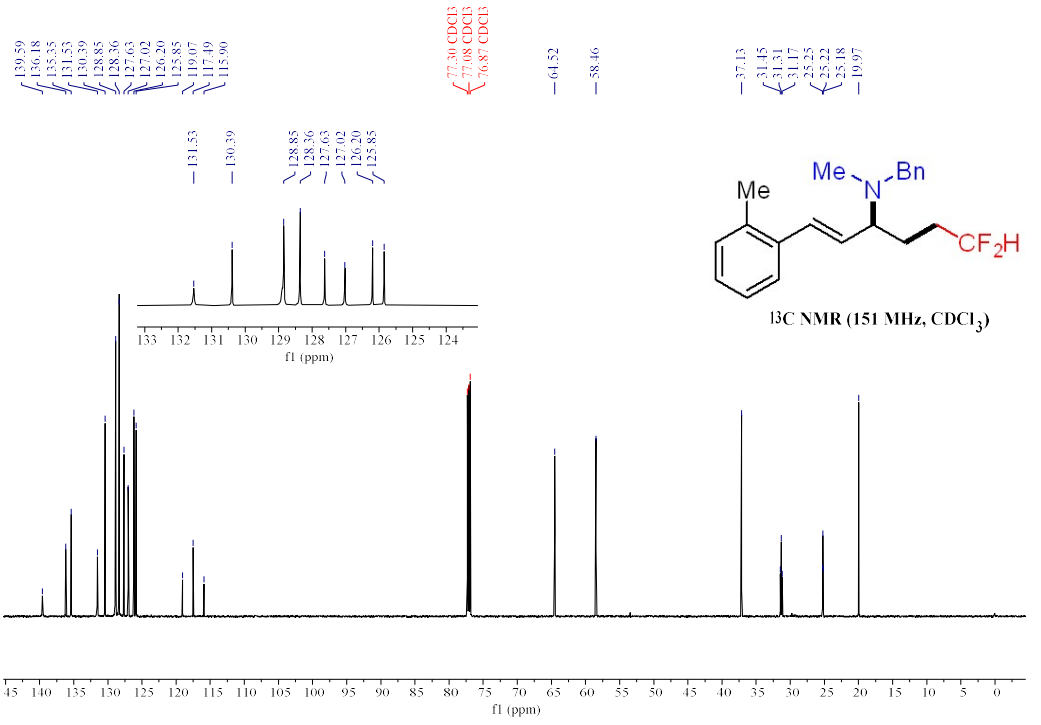


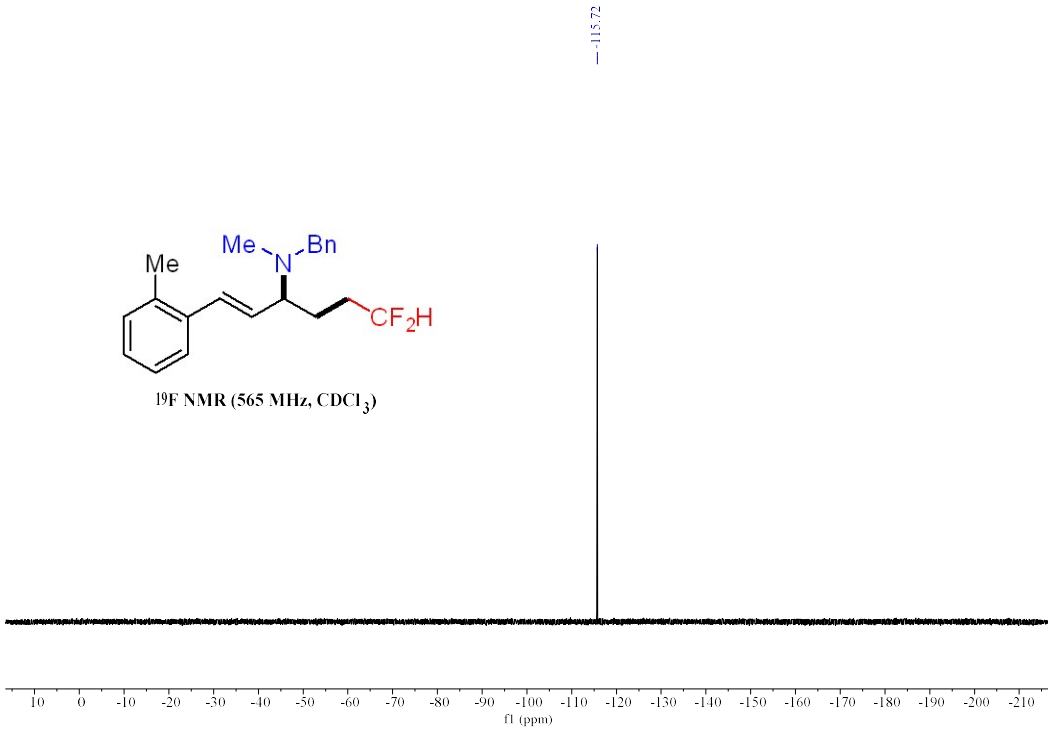


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(*o*-tolyl)hex-1-en-3-amine (5j)

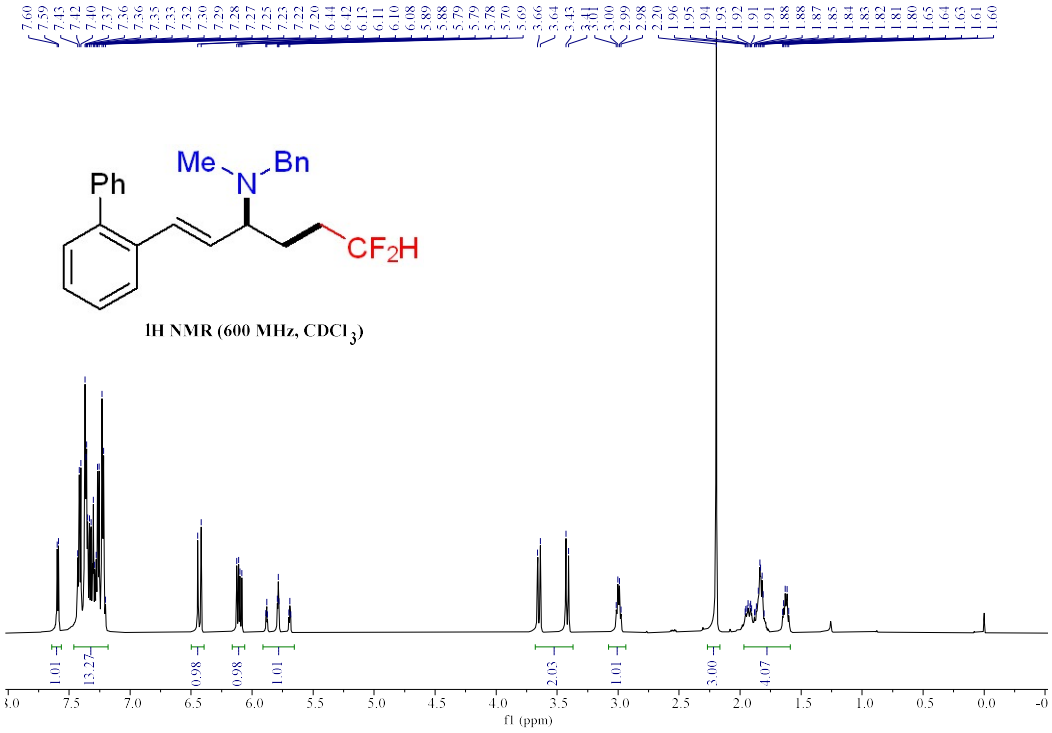


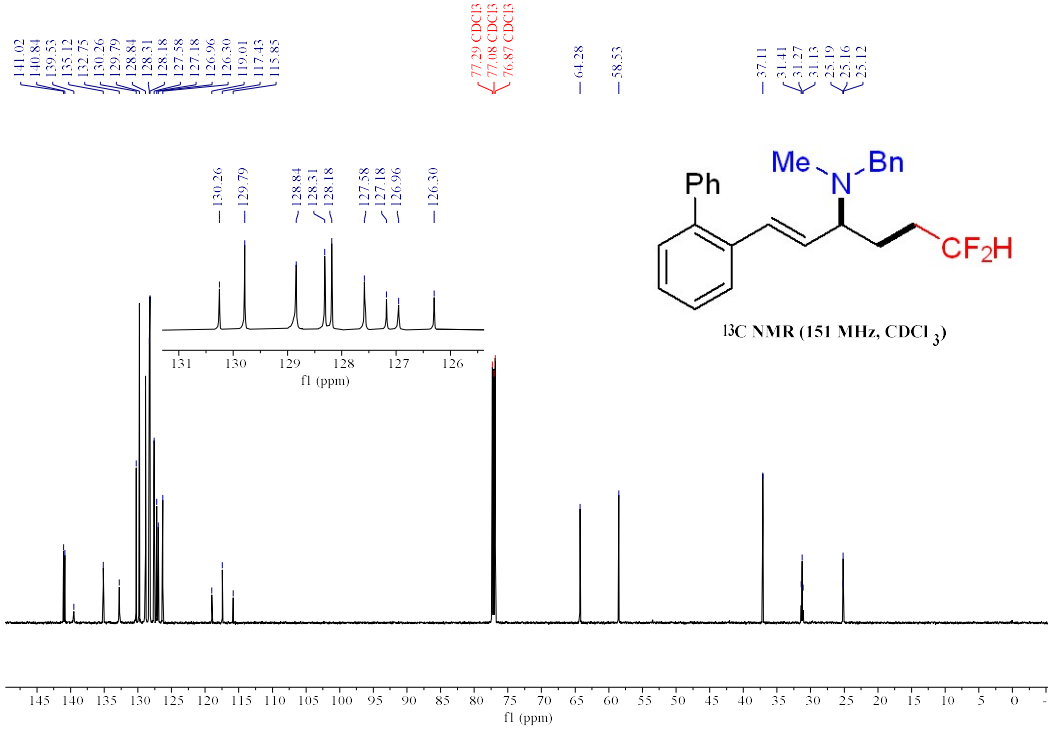


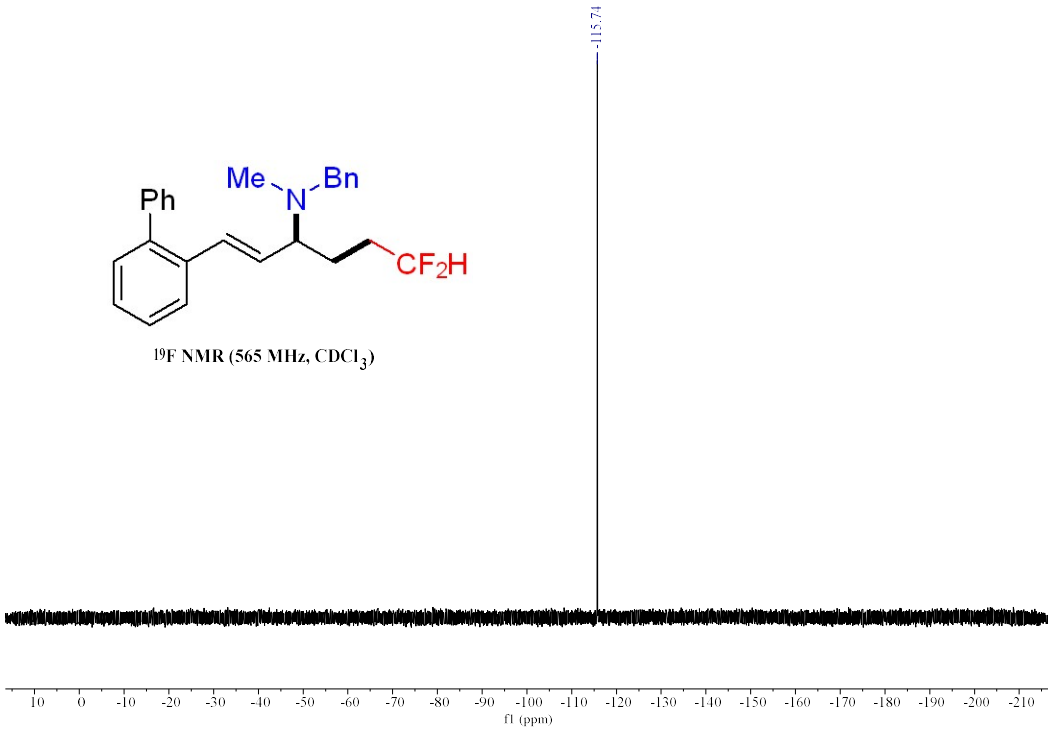


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-1-([1,1'-Biphenyl]-2-yl)-*N*-benzyl-6,6-difluoro-*N*-methylhex-1-en-3-amine (4l)

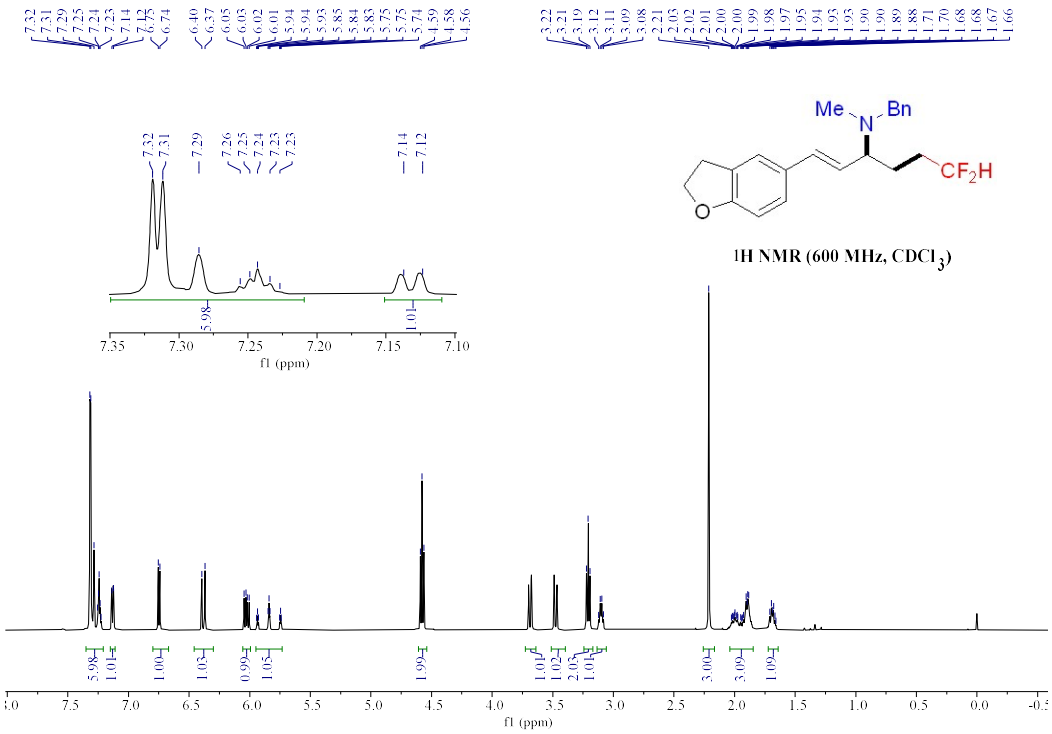


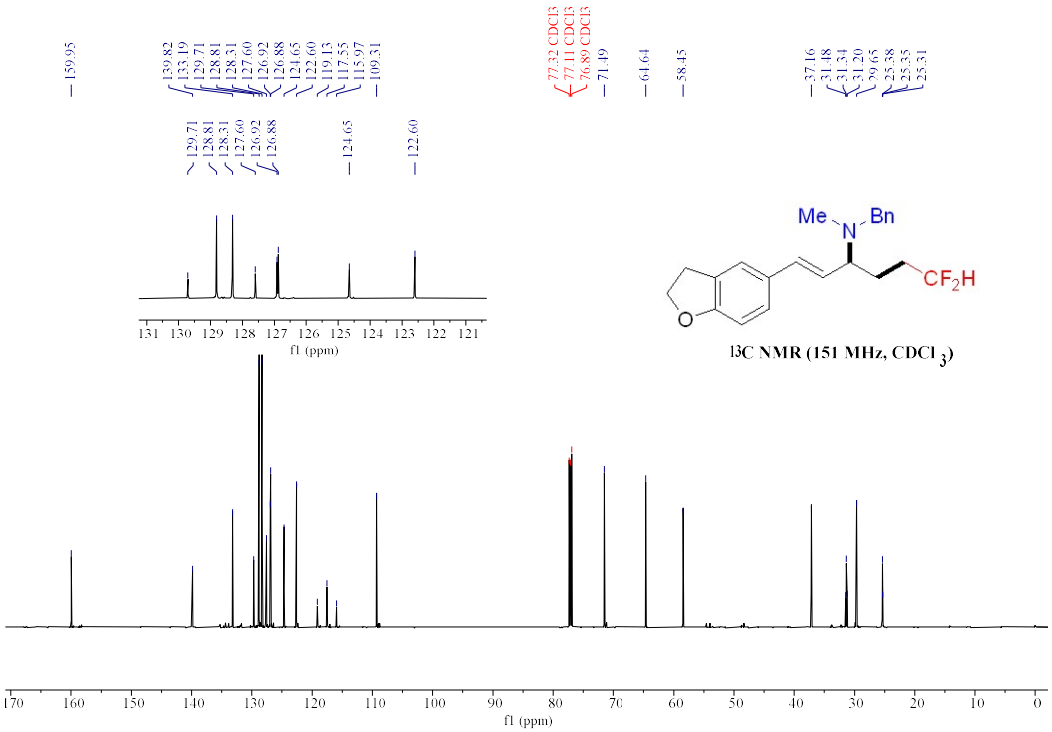


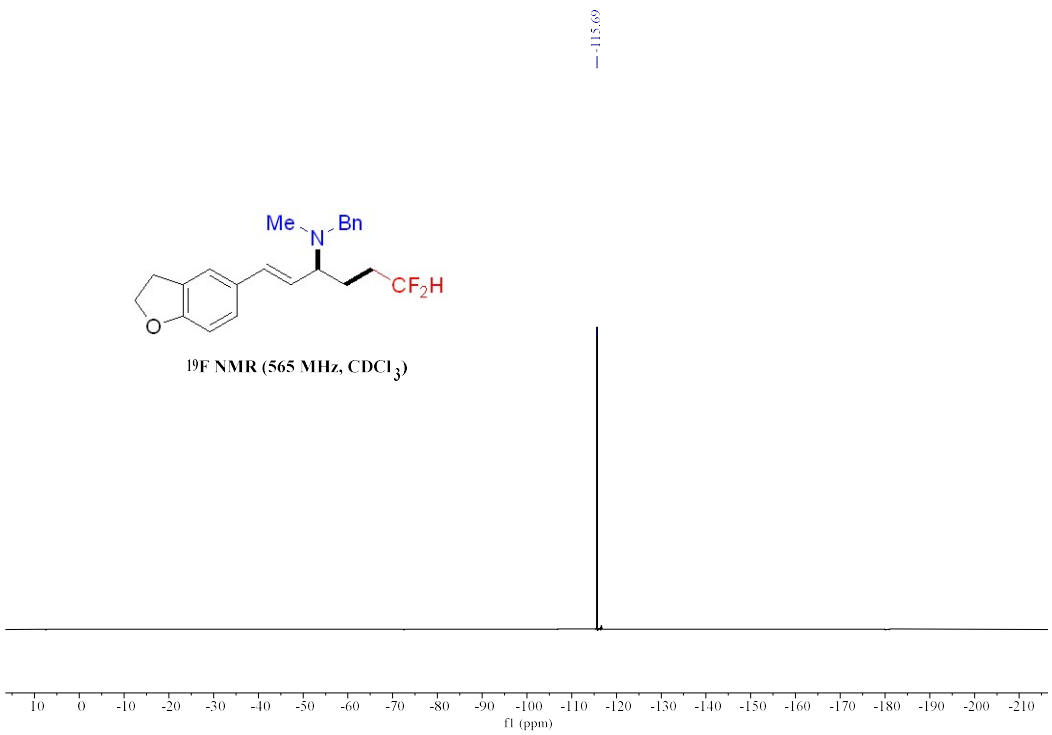


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-1-(2,3-dihydrobenzofuran-5-yl)-6,6-difluoro-*N*-methylhex-1-en-3-amine (4m)

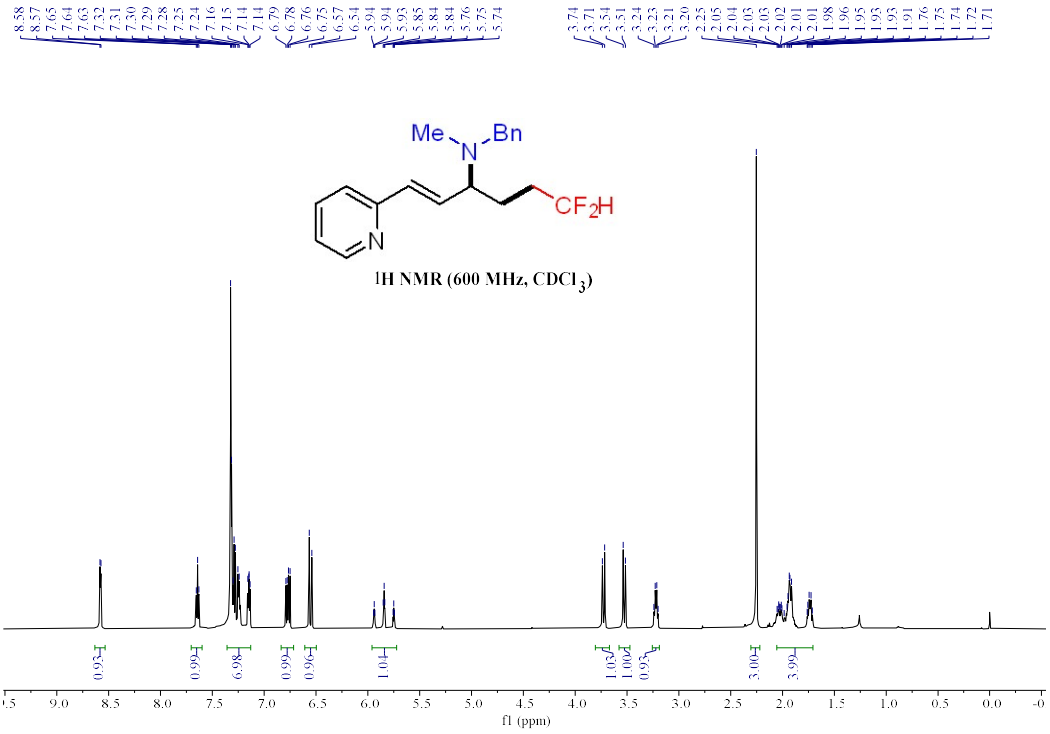


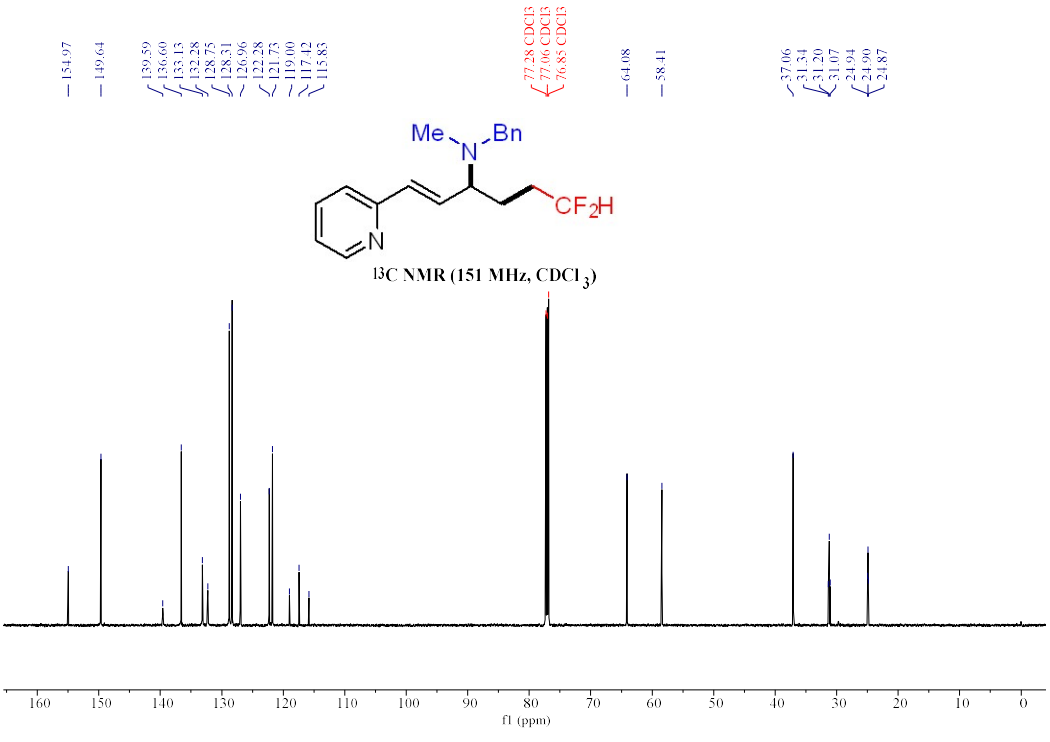


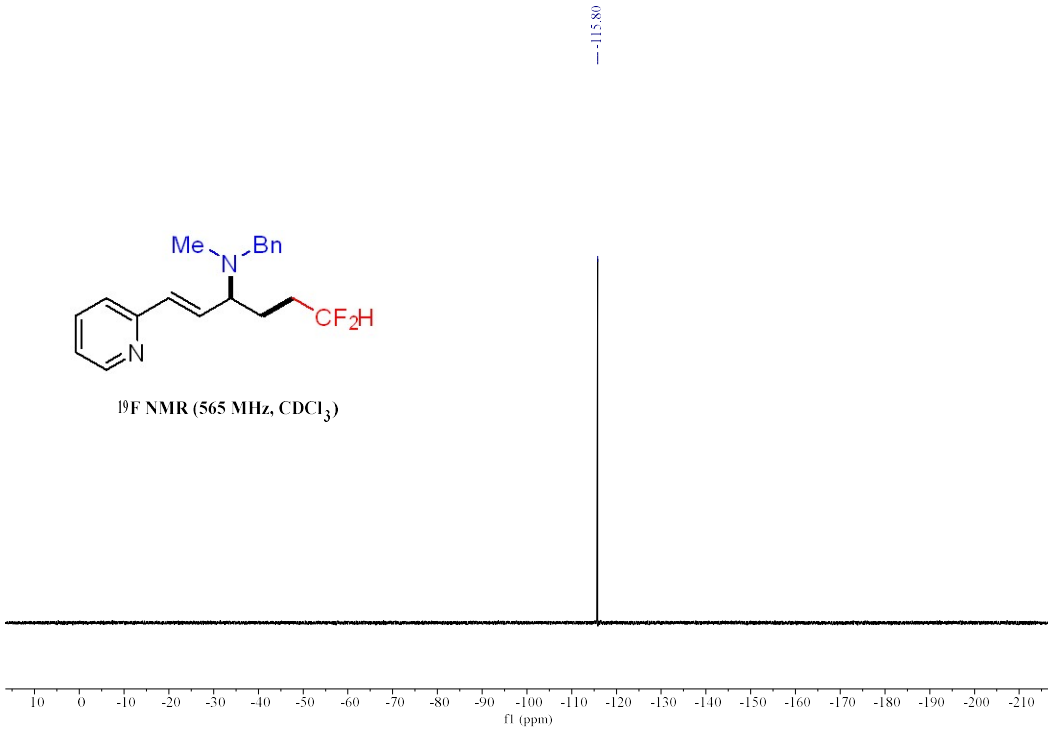


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(pyridin-2-yl)hex-1-en-3-amine (4n)

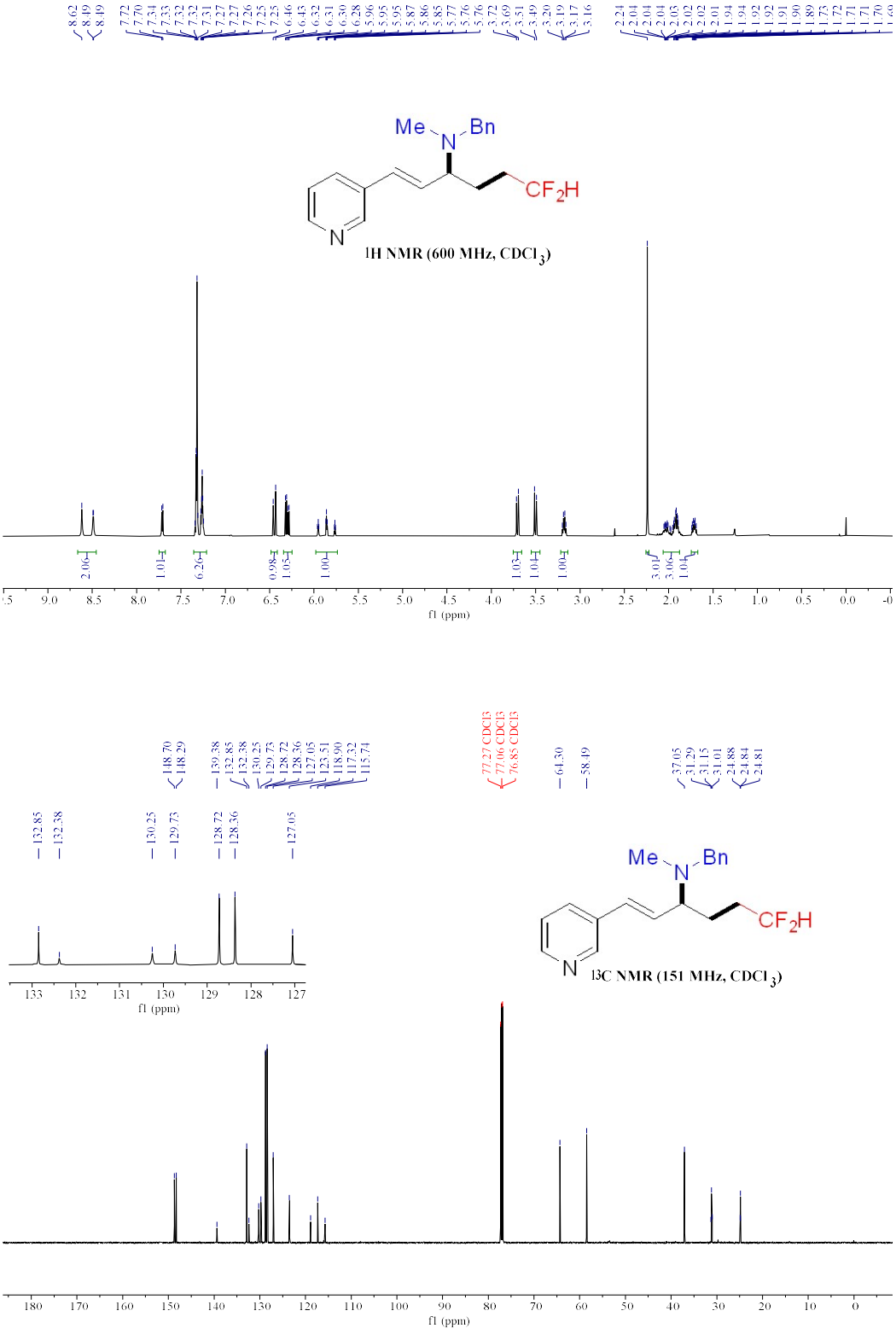


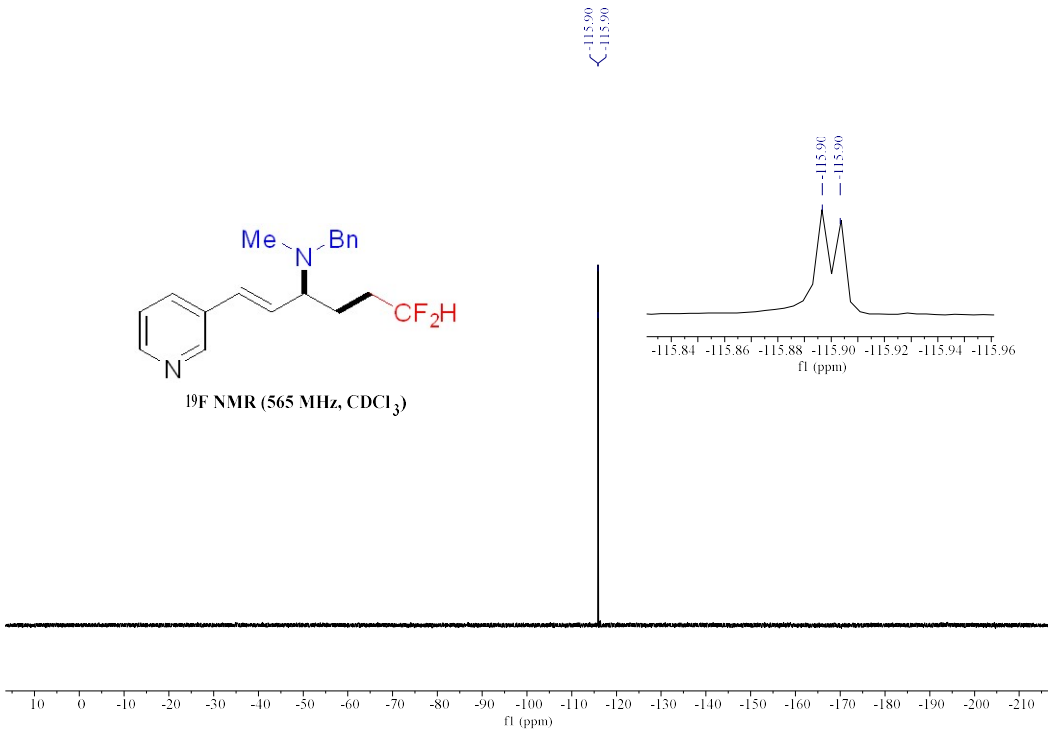




^{19}F NMR (565 MHz, $CDCl_3$)

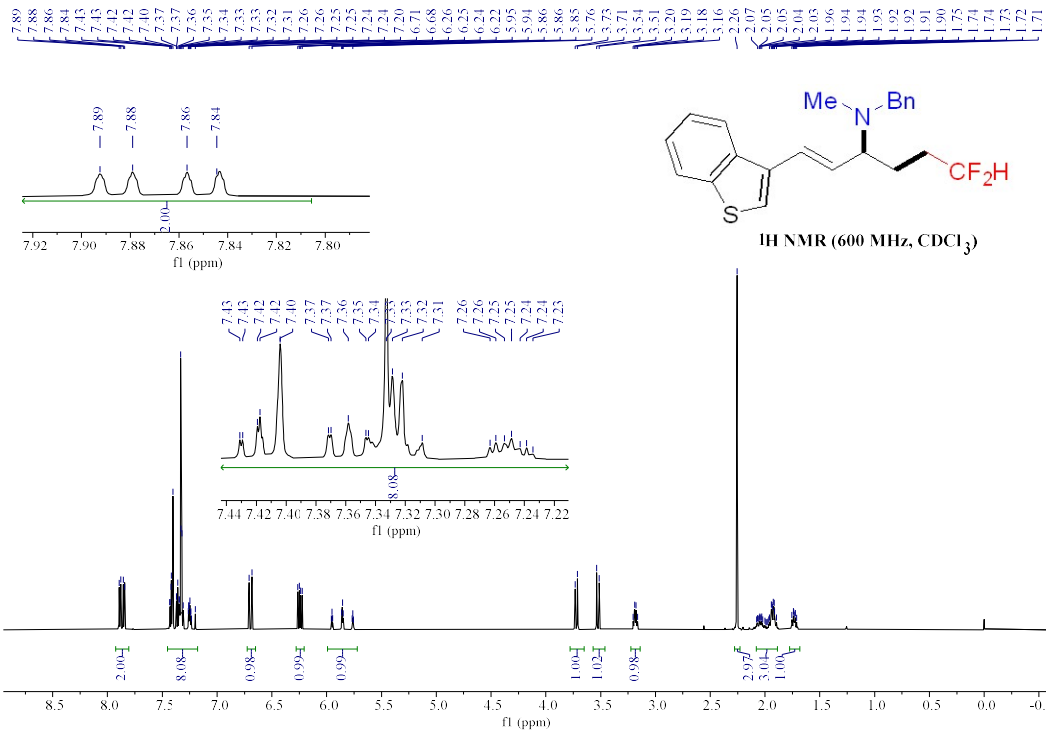
(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(pyridin-3-yl)hex-1-en-3-amine (4o)

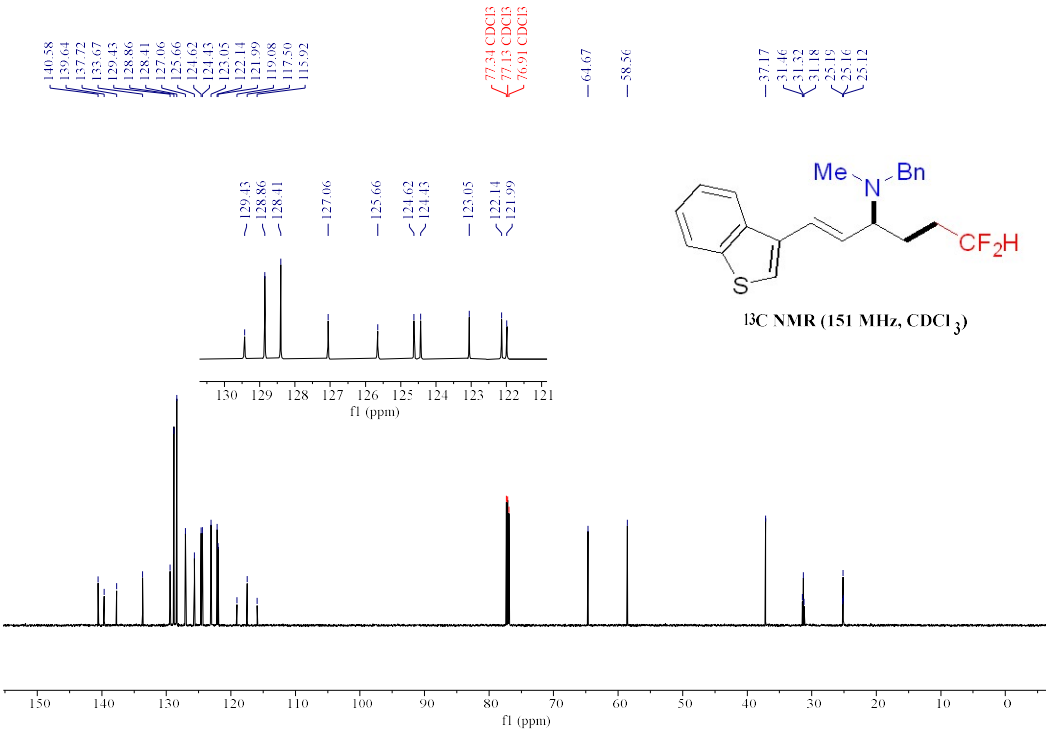


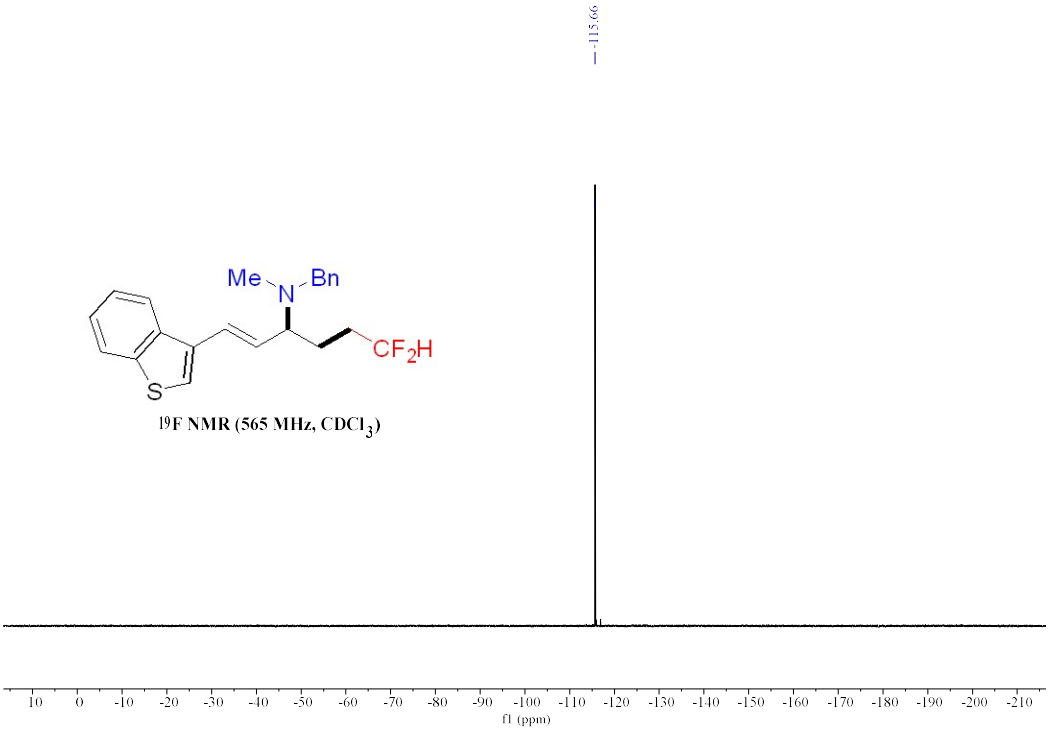


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-1-(Benzo[*b*]thiophen-3-yl)-*N*-benzyl-6,6-difluoro-*N*-methylhex-1-en-3-amine (4p)

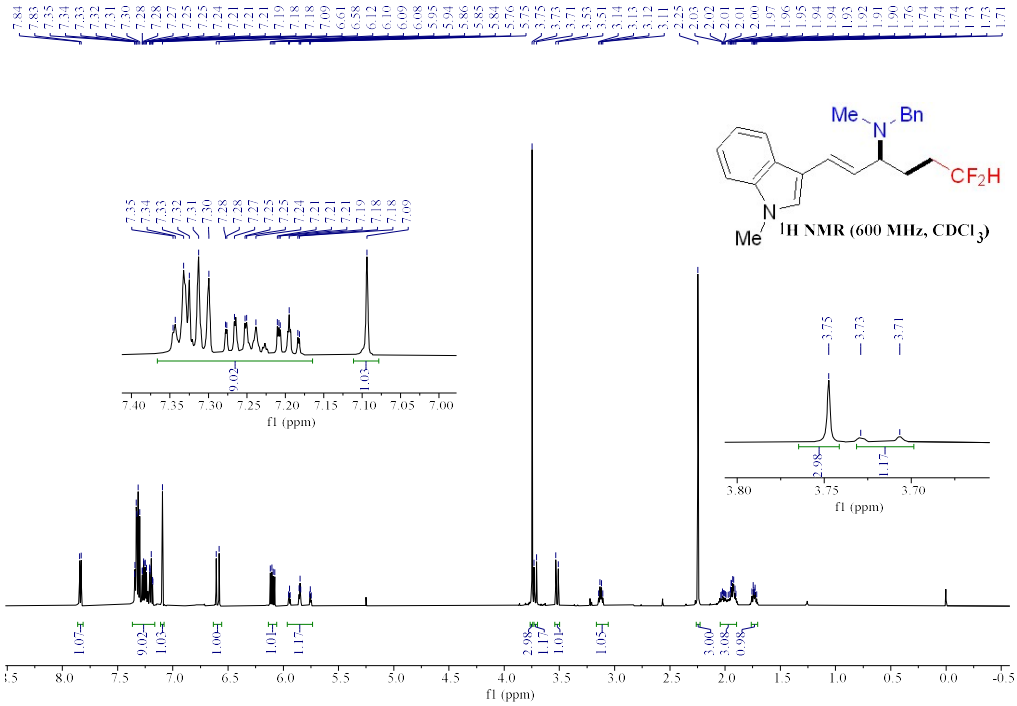


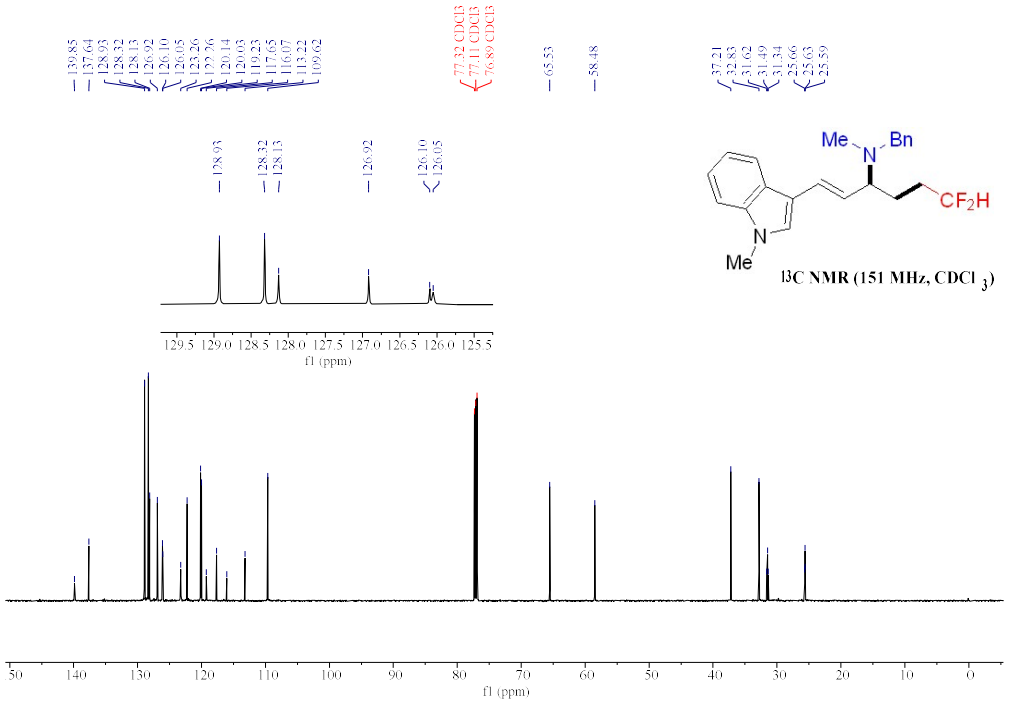


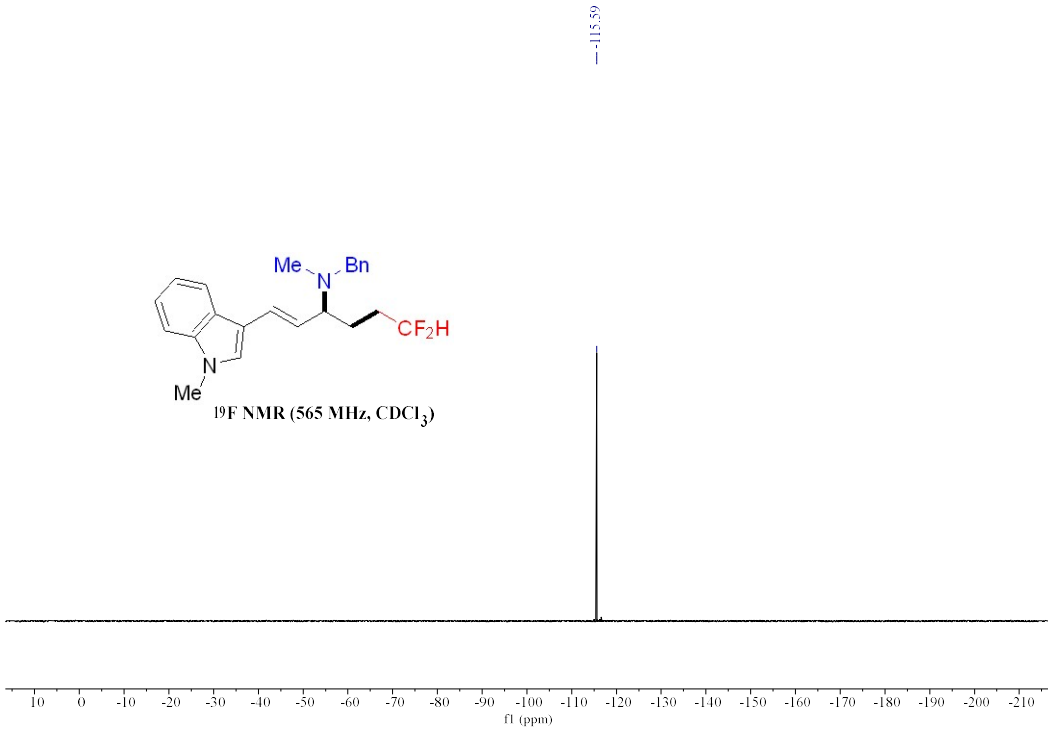


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-(1-methyl-1*H*-indol-3-yl)hex-1-en-3-amine (4q)

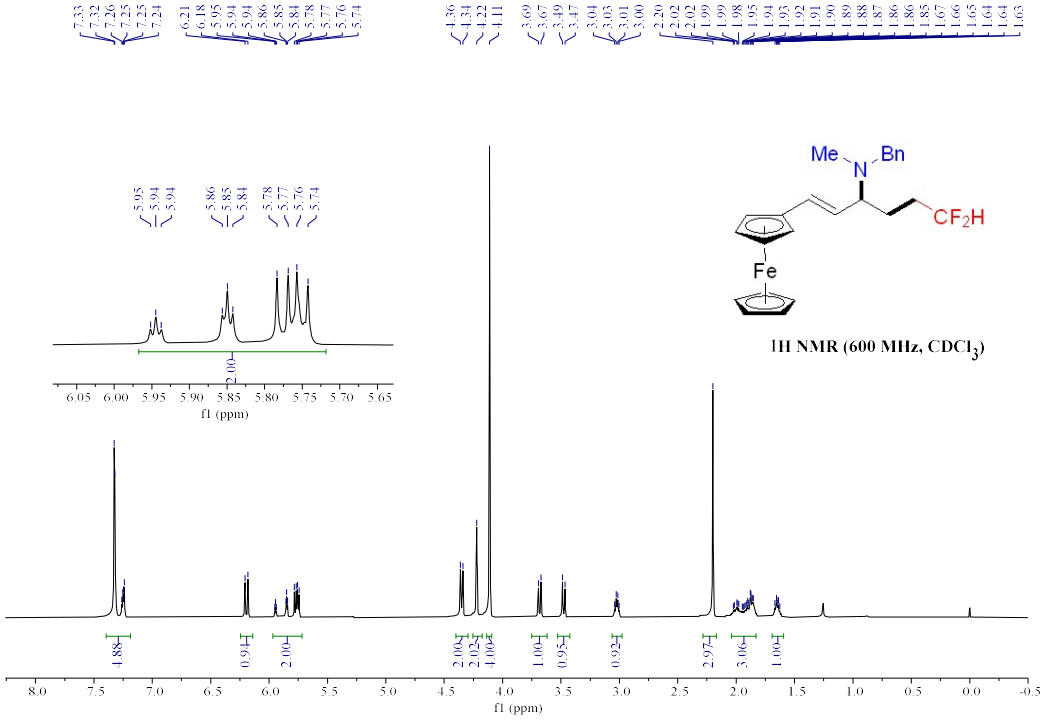


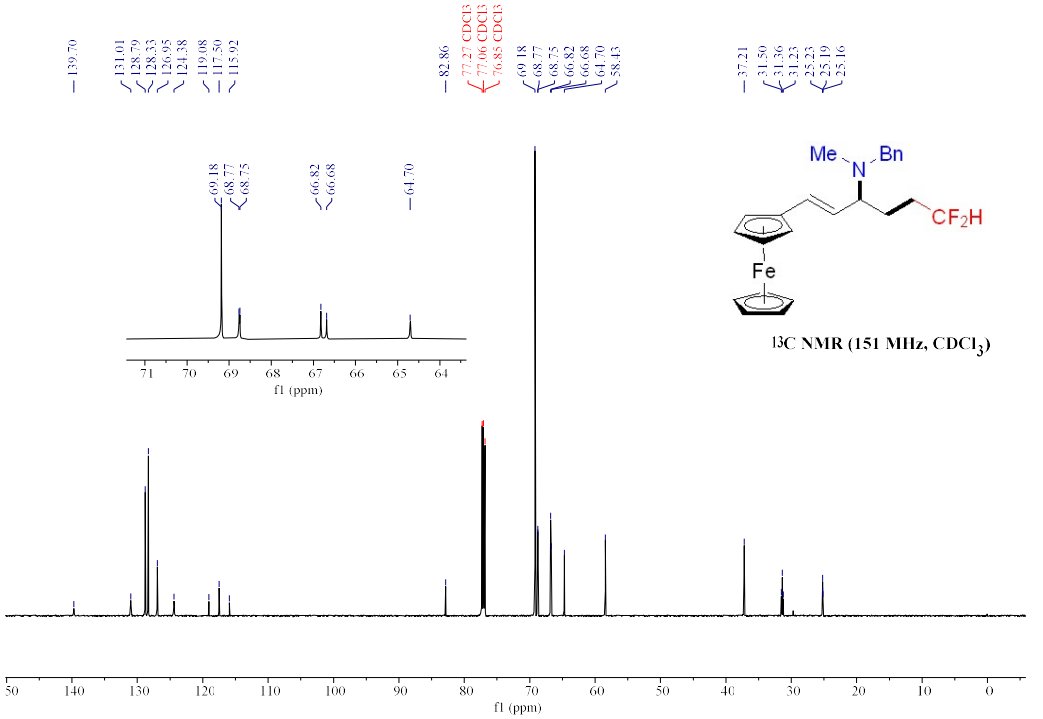


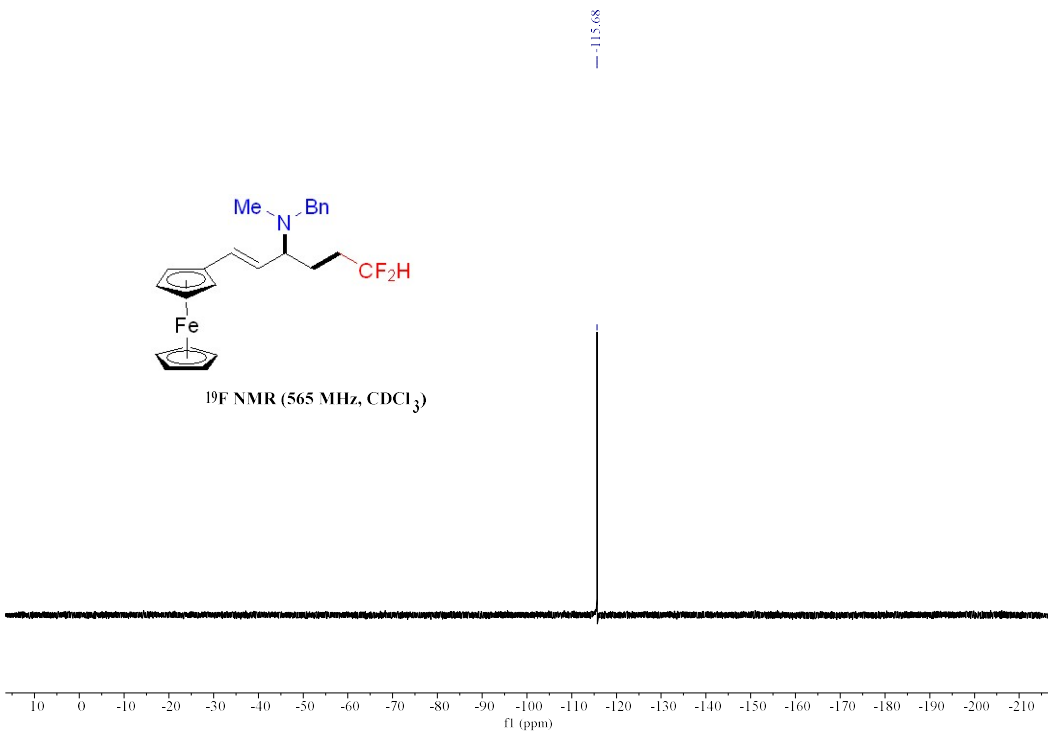


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-*N*-methyl-1-ferrocenylpent-1-en-3-amine (4r)

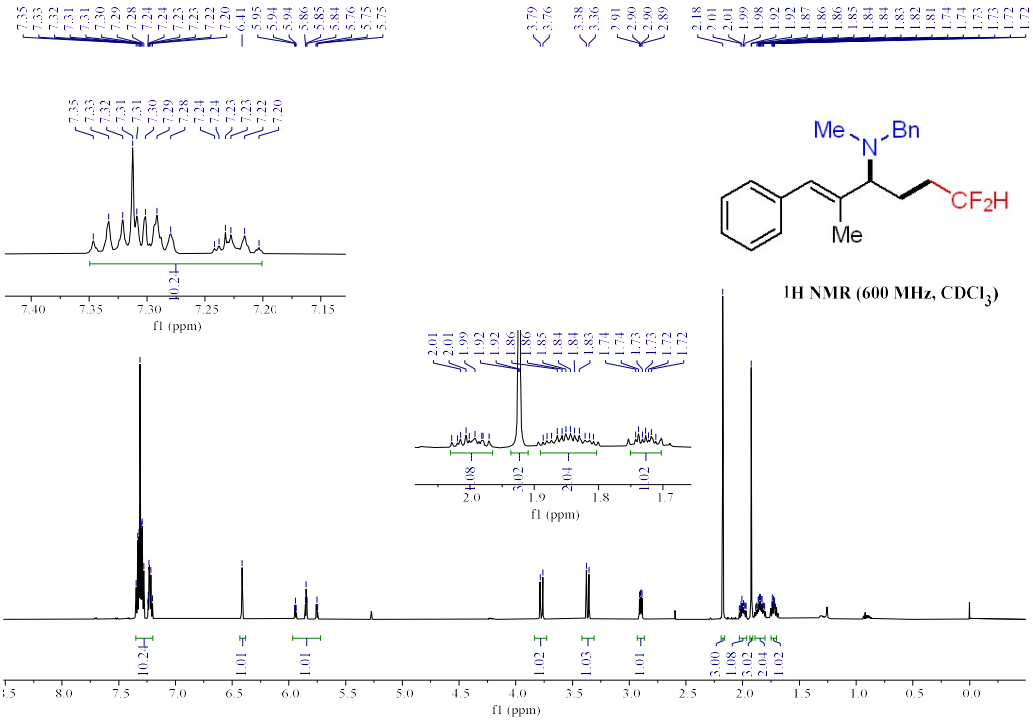


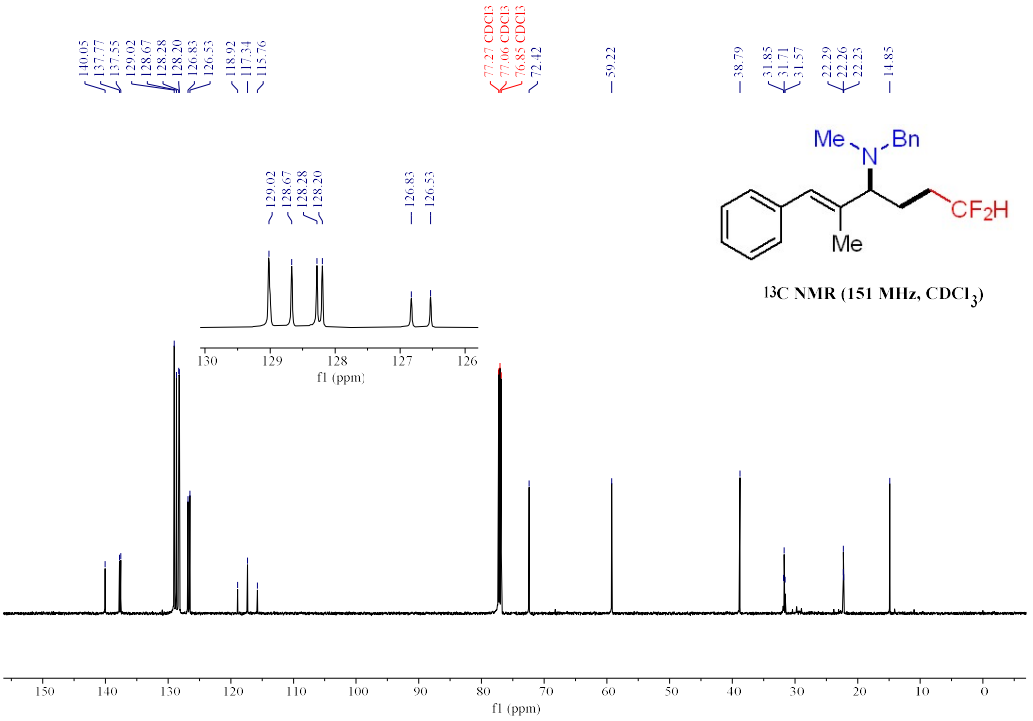


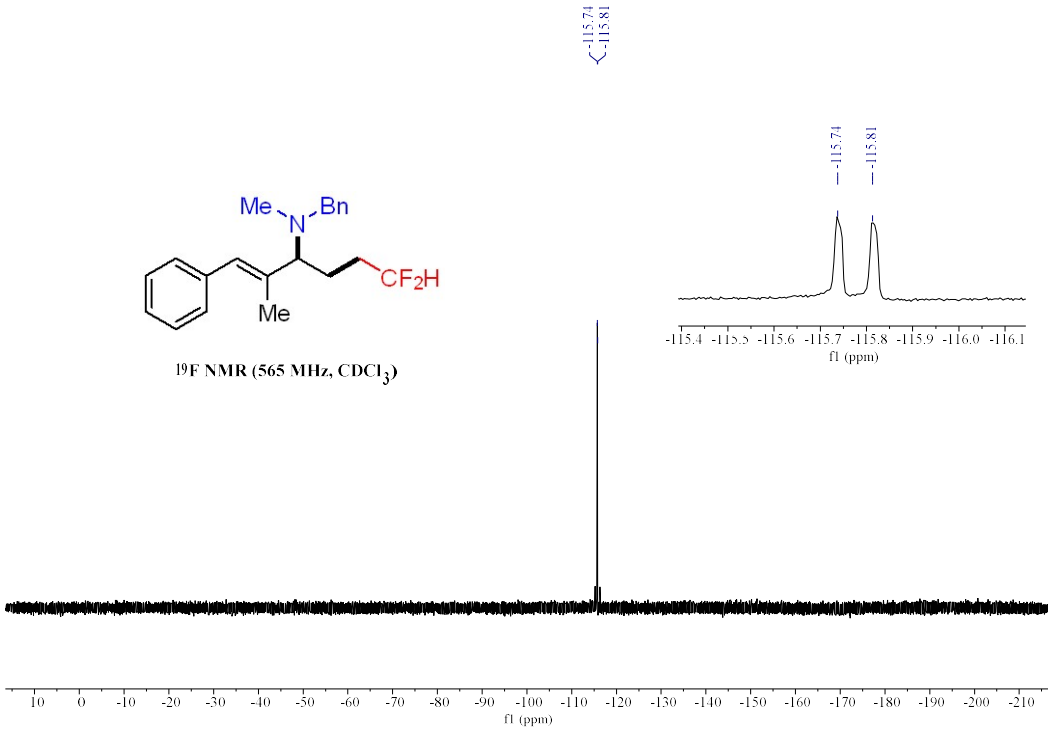


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-*N*,2-dimethyl-1-phenylhex-1-en-3-amine (4s)

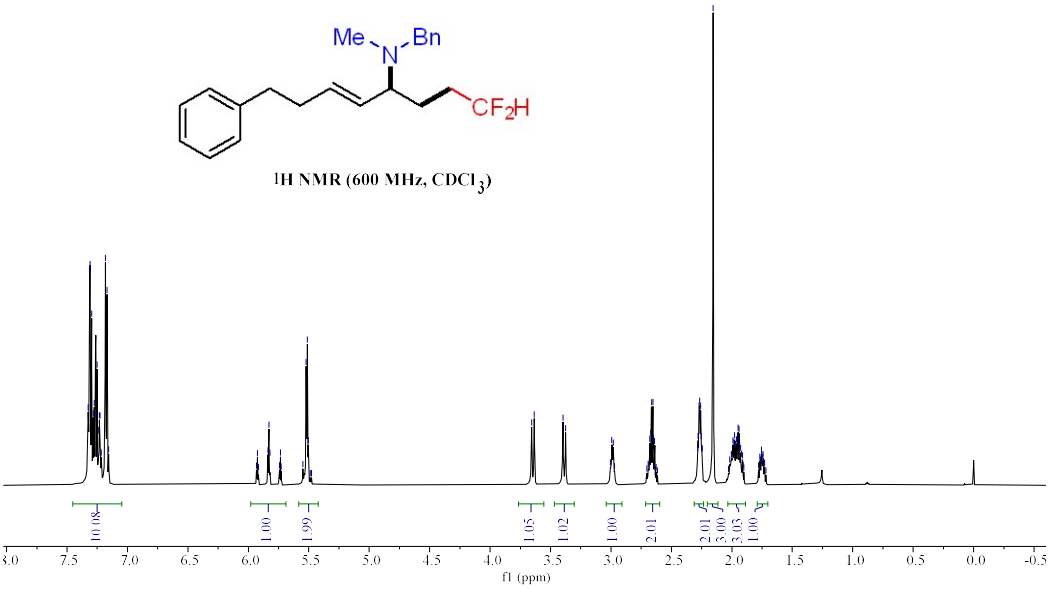


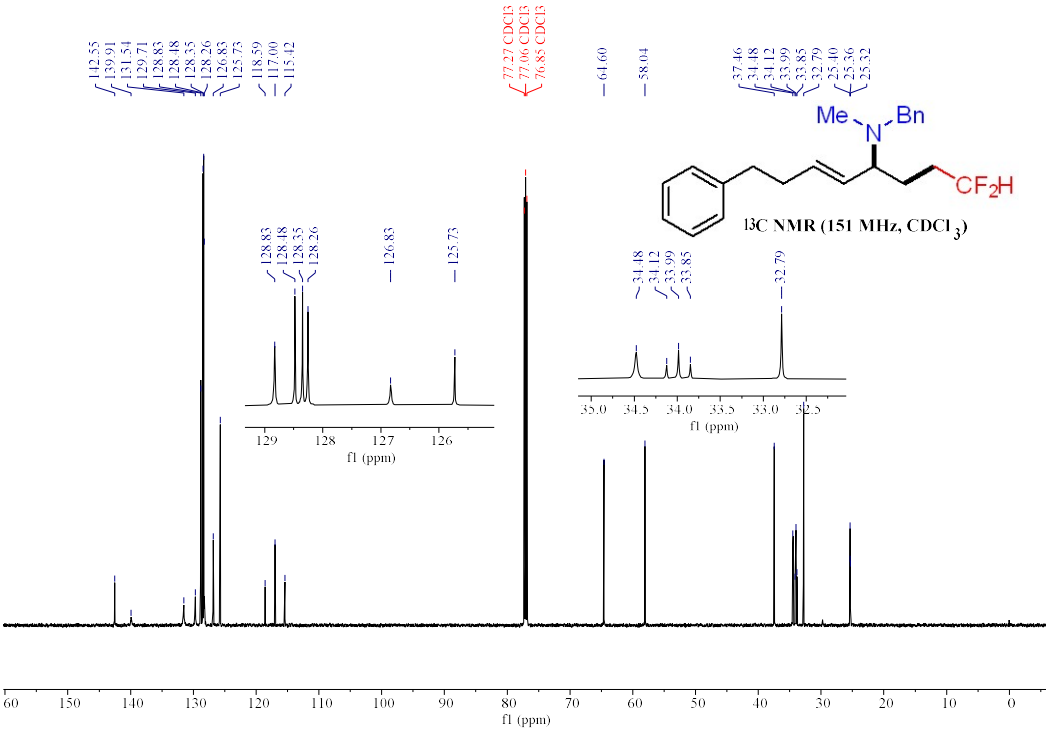


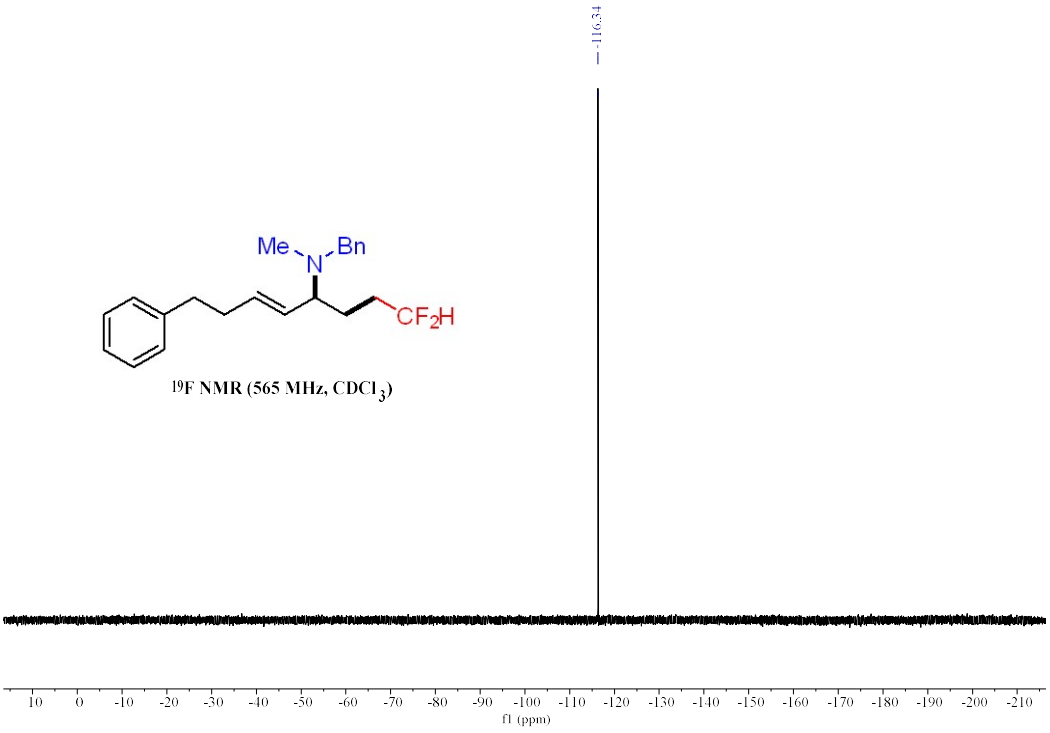


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Venzyl-1,1-difluoro-*N*-methyl-8-phenyloct-5-en-4-amine (4t)

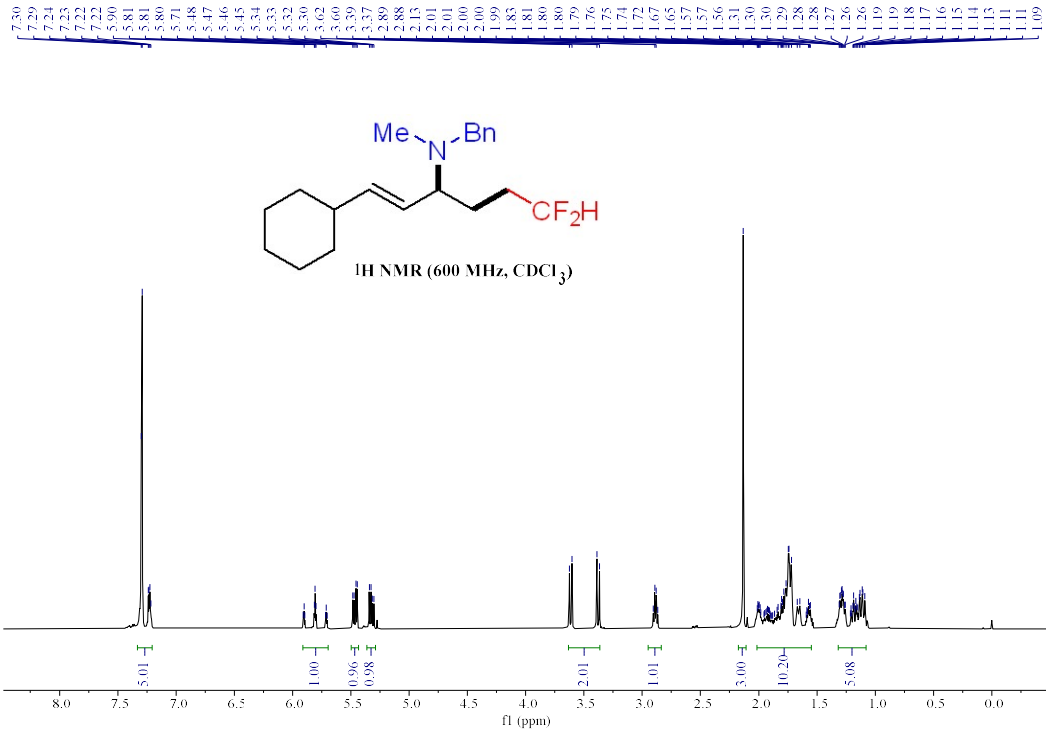


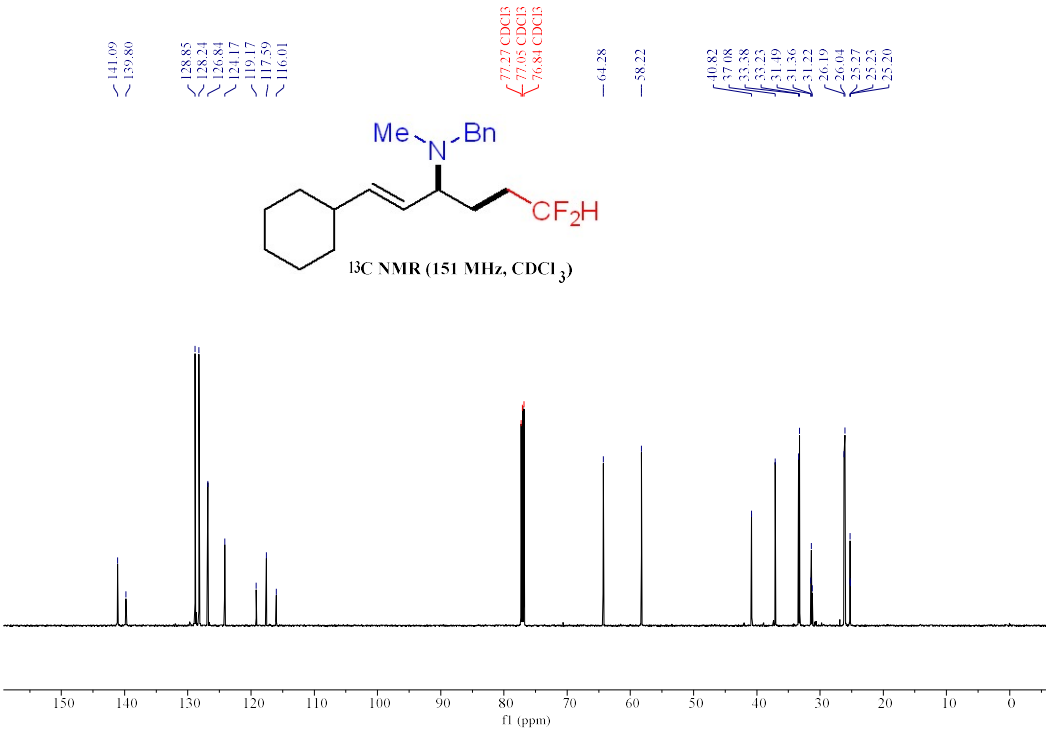


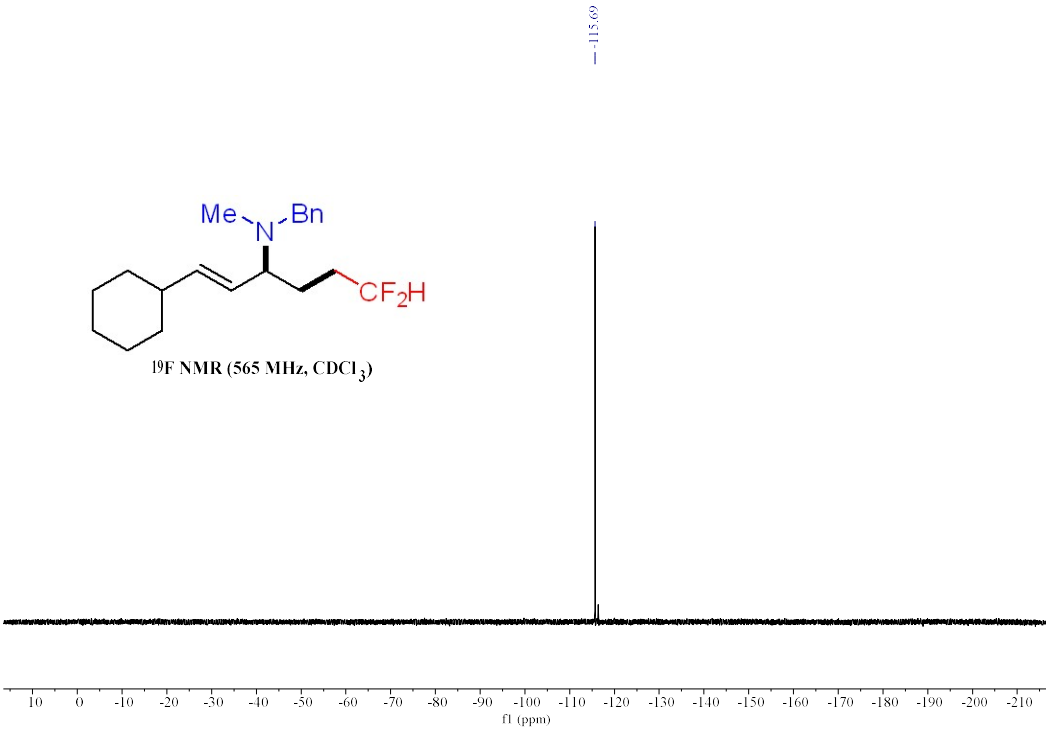


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-1-cyclohexyl-6,6-difluoro-*N*-methylhex-1-en-3-amine (4u)

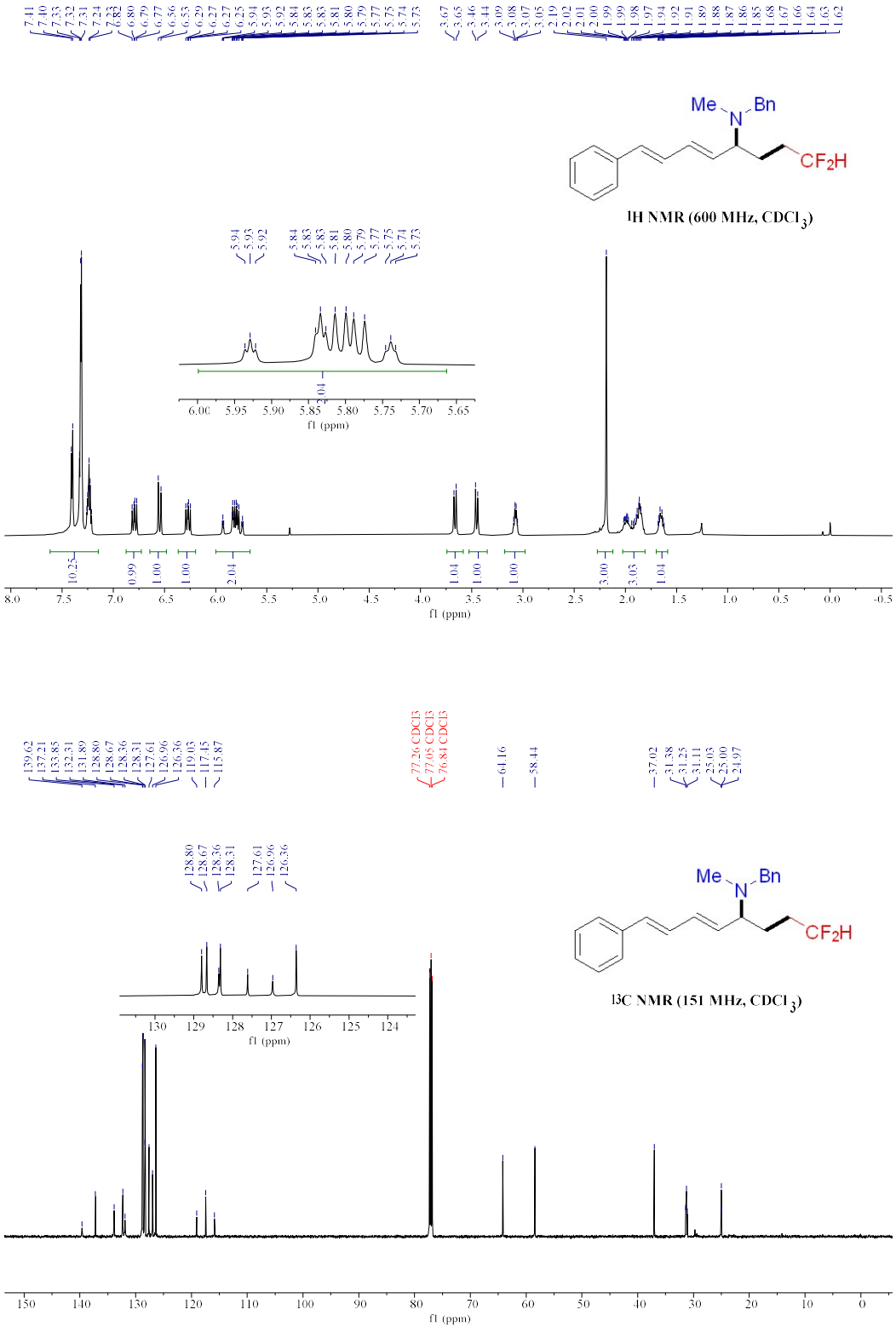


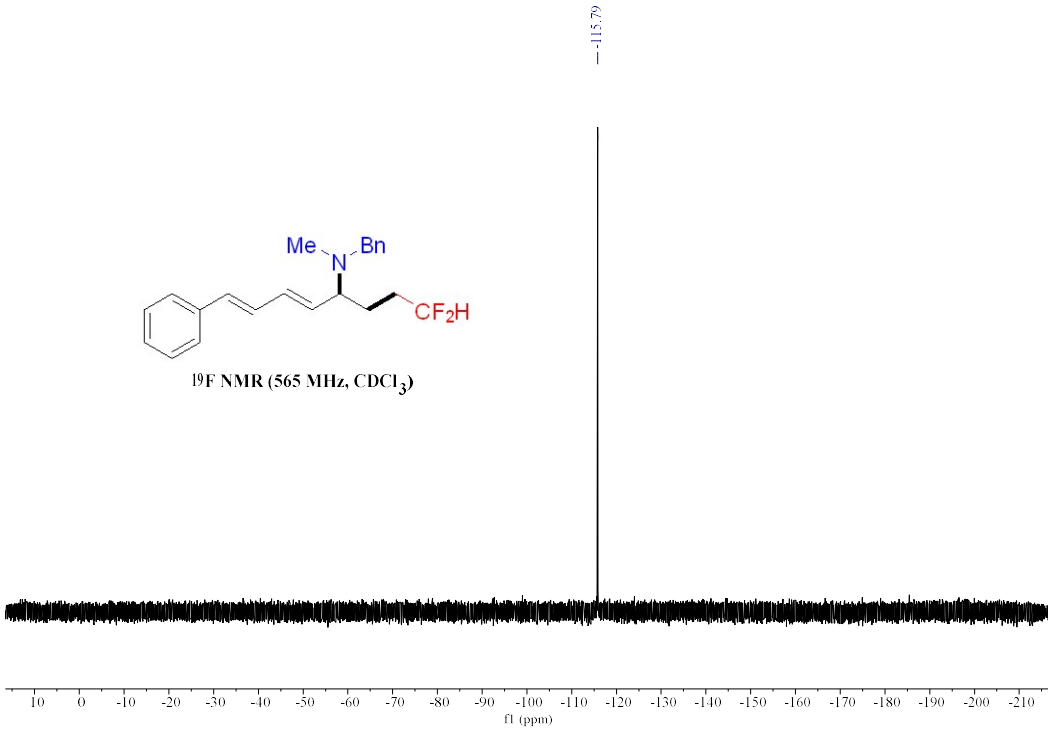




^{19}F NMR (565 MHz, $CDCl_3$)

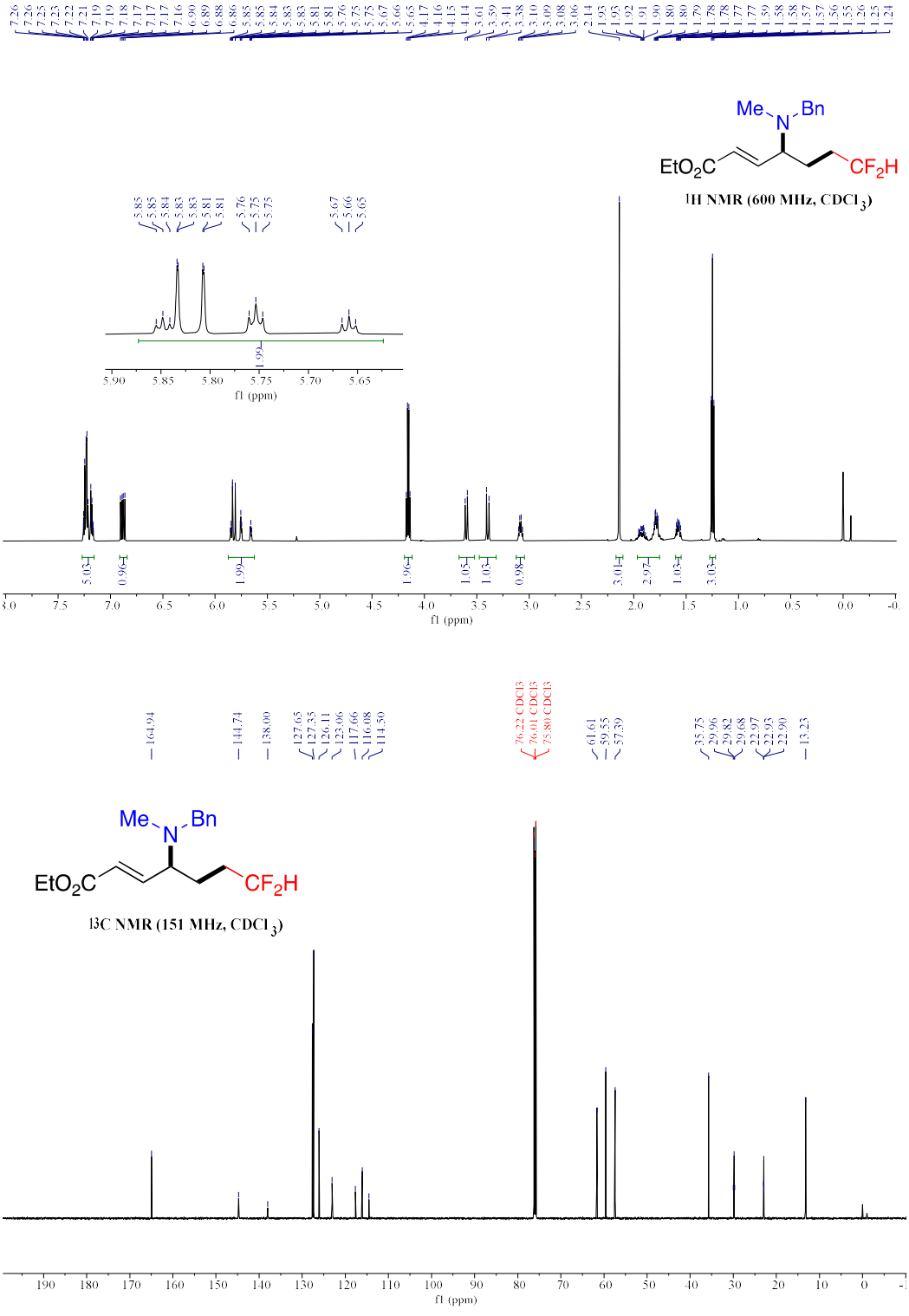
(5*E*,7*E*)-*N*-Benzyl-1,1-difluoro-*N*-methyl-8-phenylocta-5,7-dien-4-amine (4v)

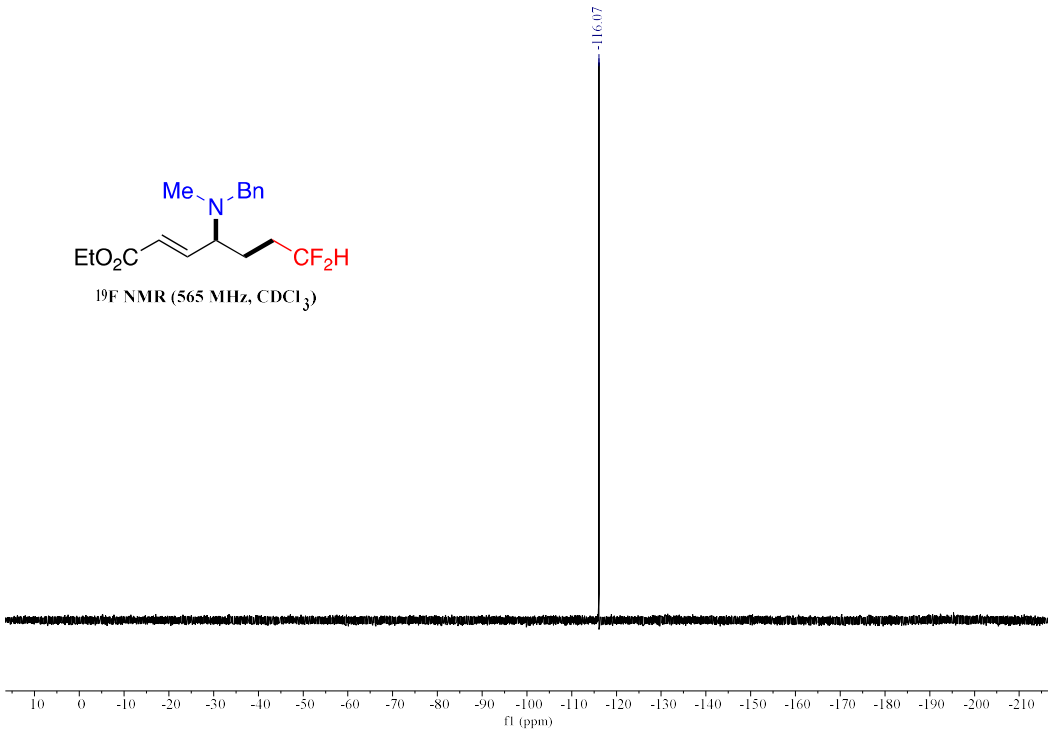




^{19}F NMR (565 MHz, $CDCl_3$)

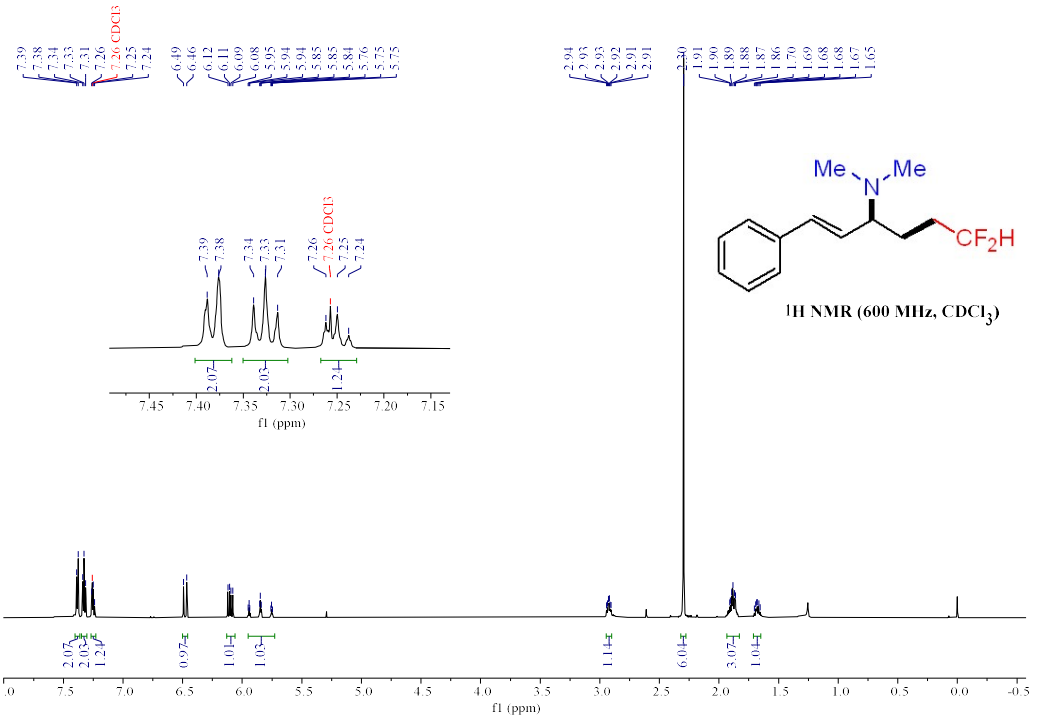
Ethyl (*E*)-4-(Benzyl(methyl)amino)-7,7-difluorohept-2-enoate (4w)

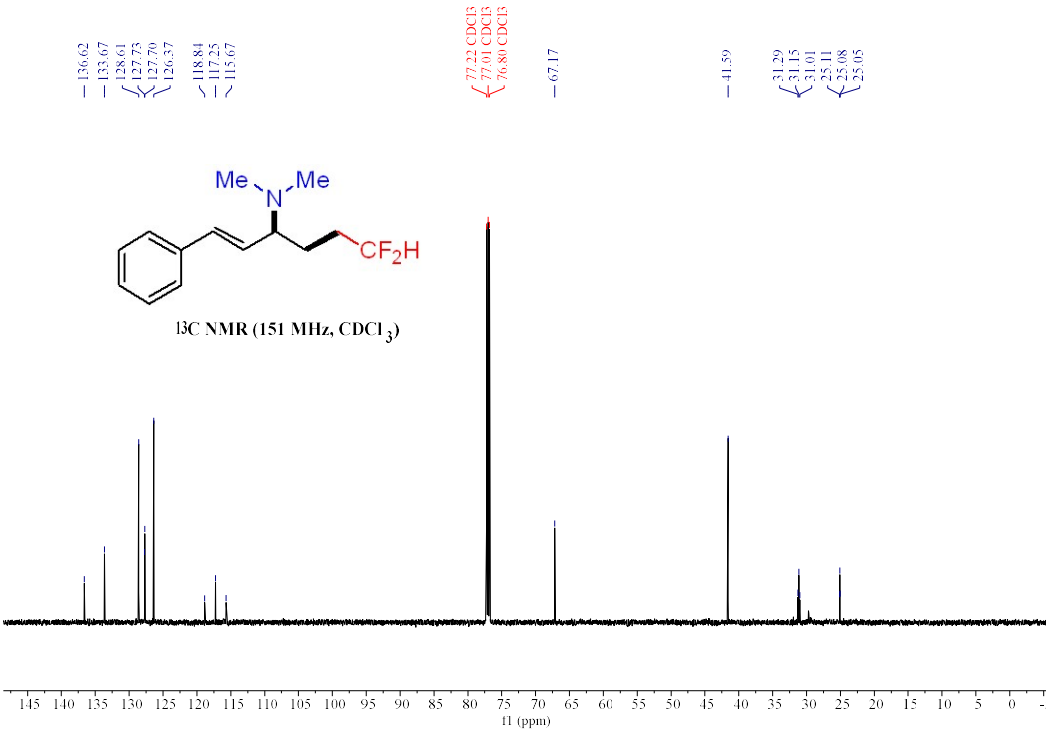


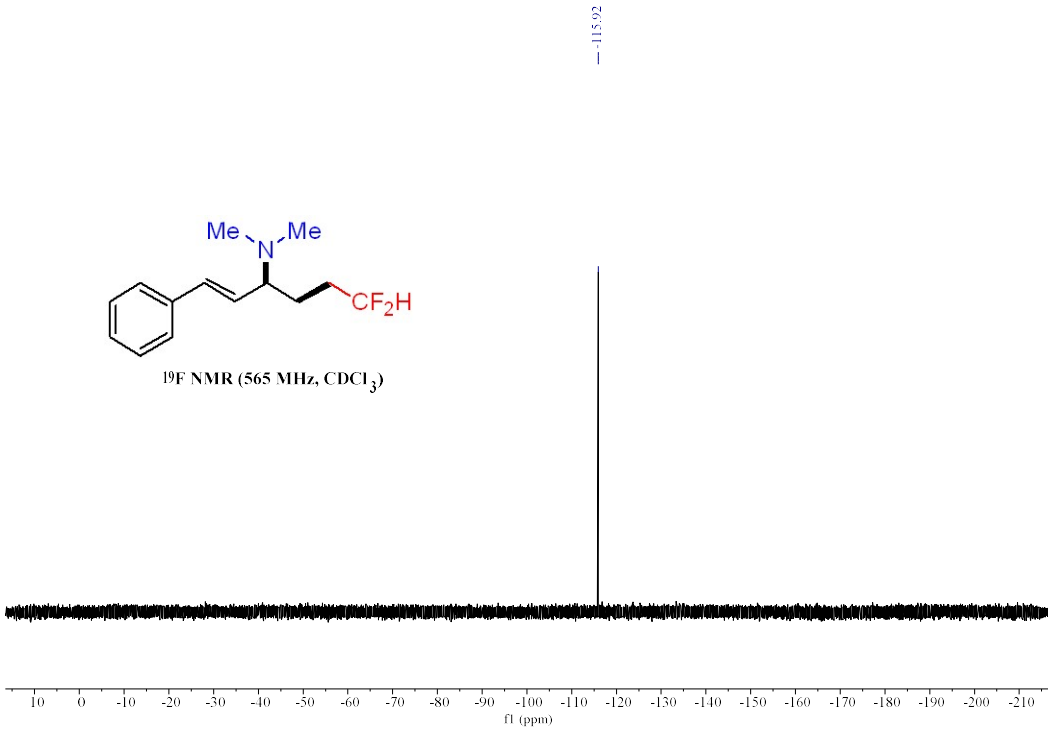


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-6,6-Difluoro-*N*,*N*-dimethyl-1-phenylhex-1-en-3-amine (5a)

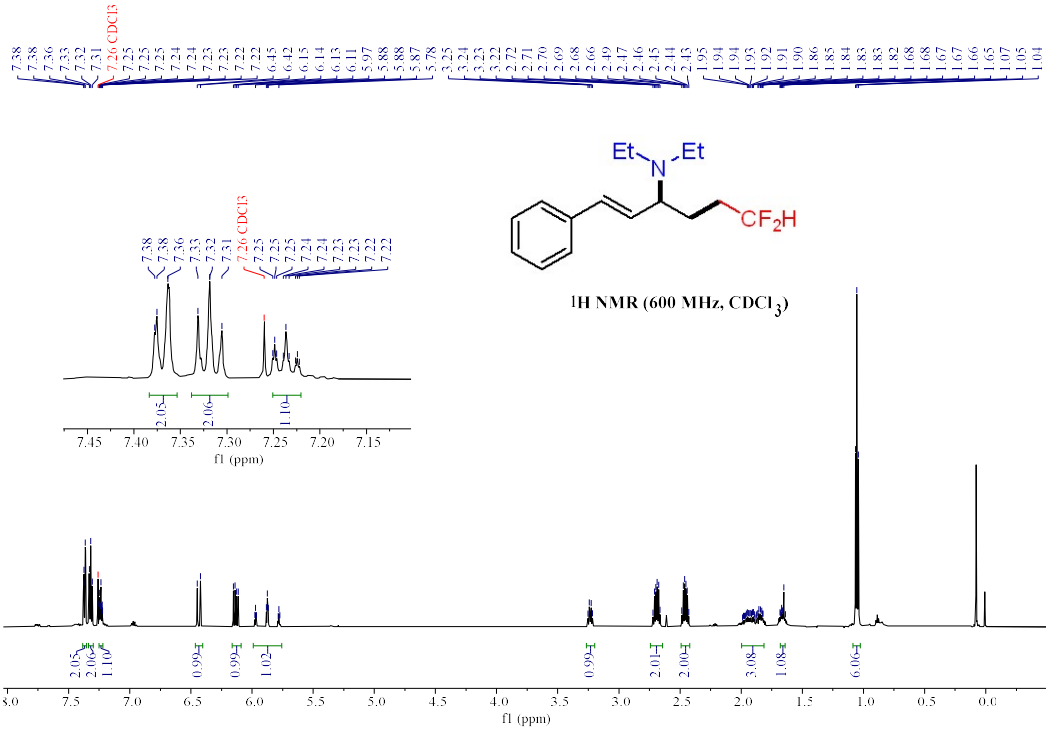


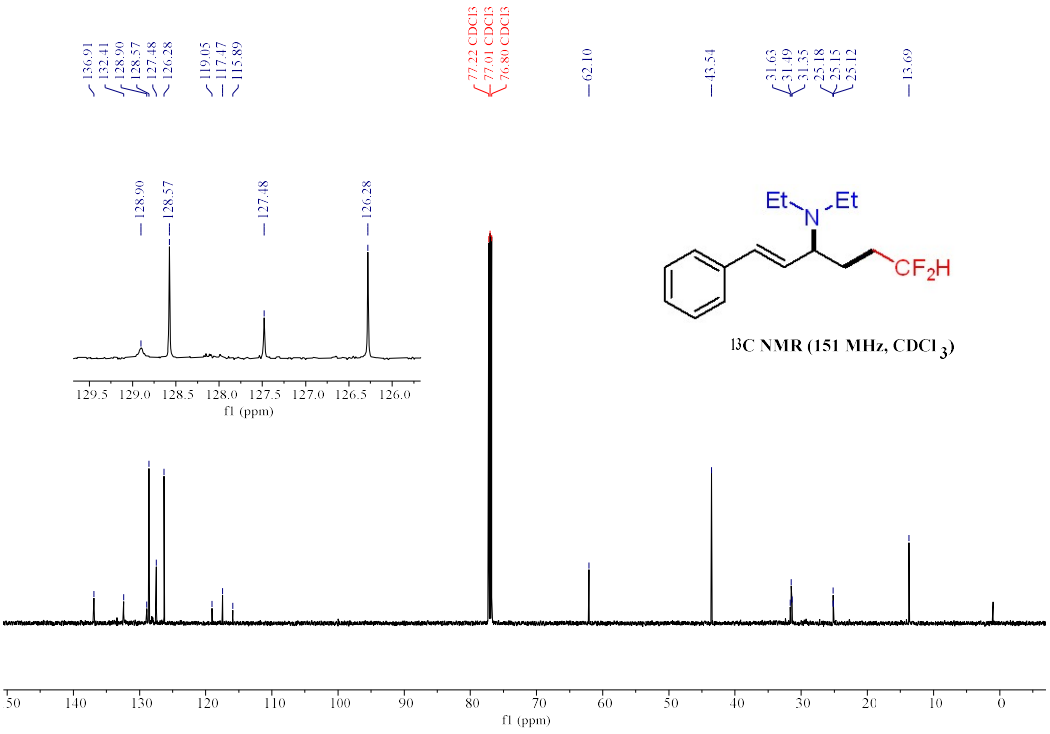


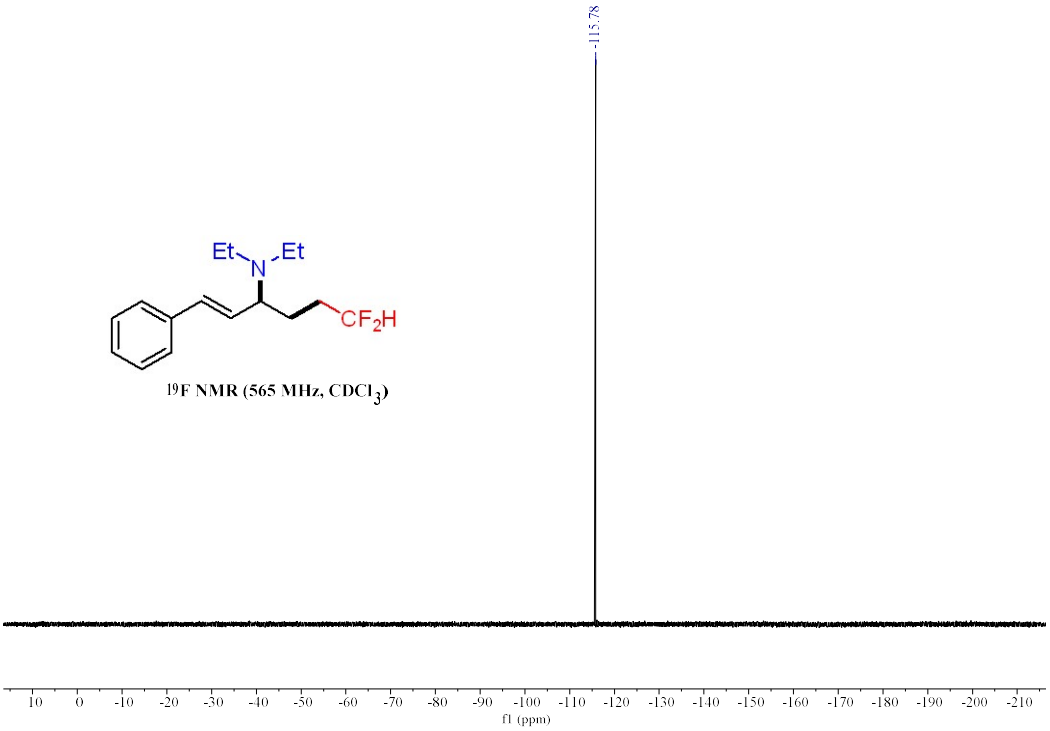


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*, *N*-Diethyl-6,6-difluoro-1-phenylhex-1-en-3-amine (5b)

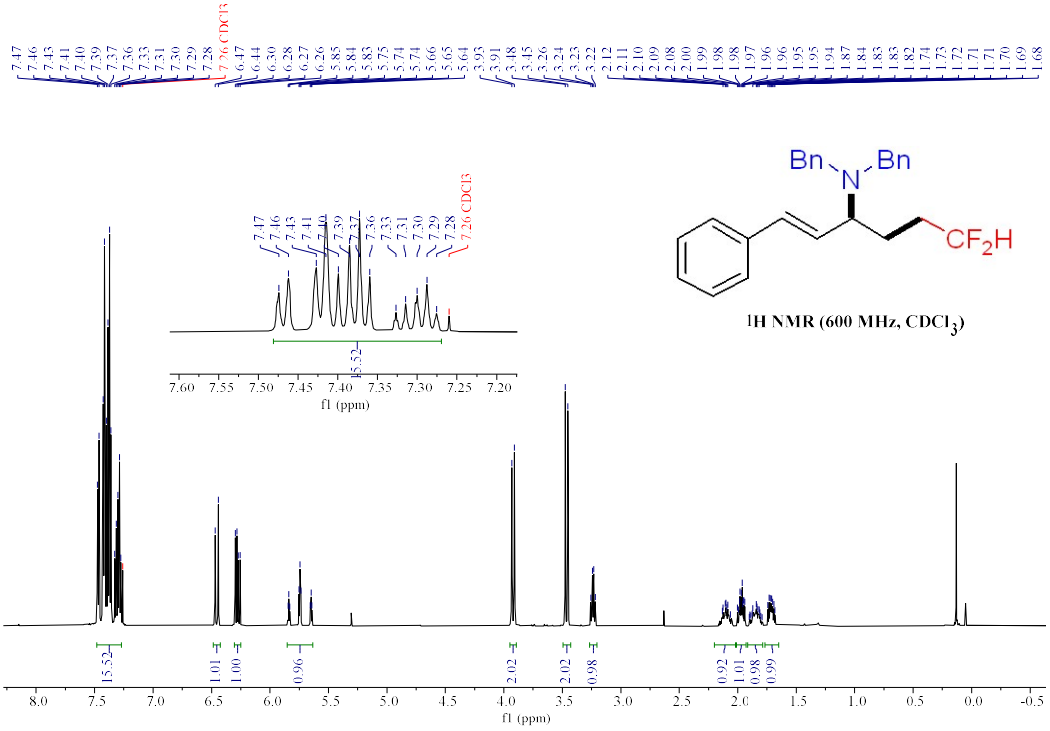


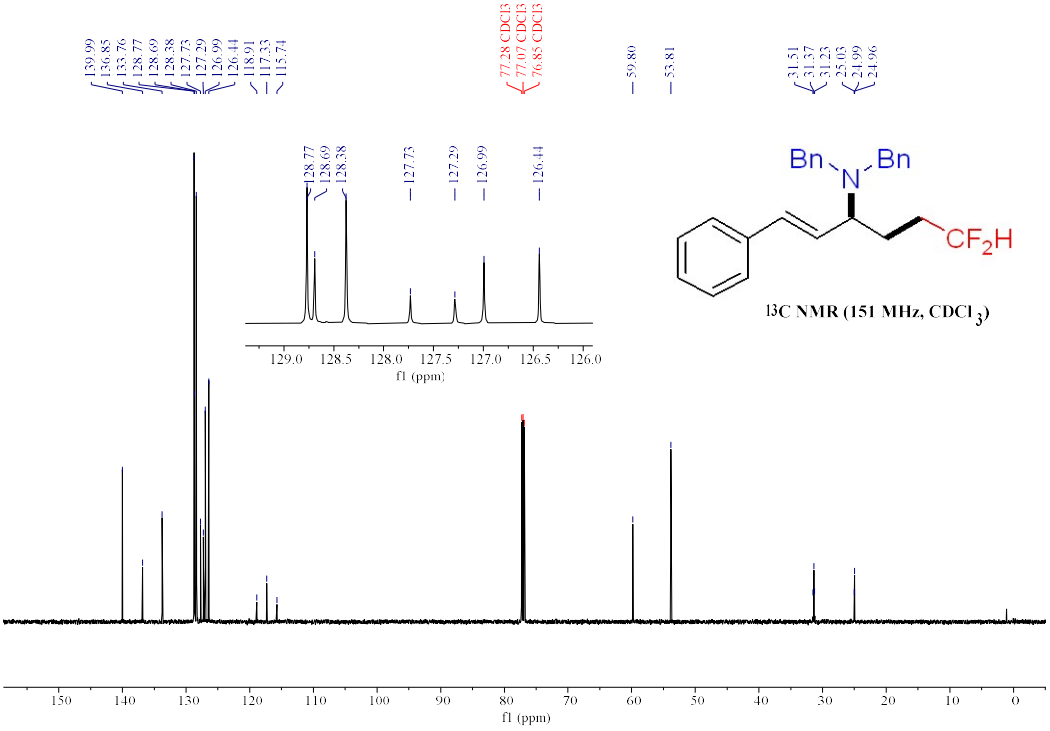


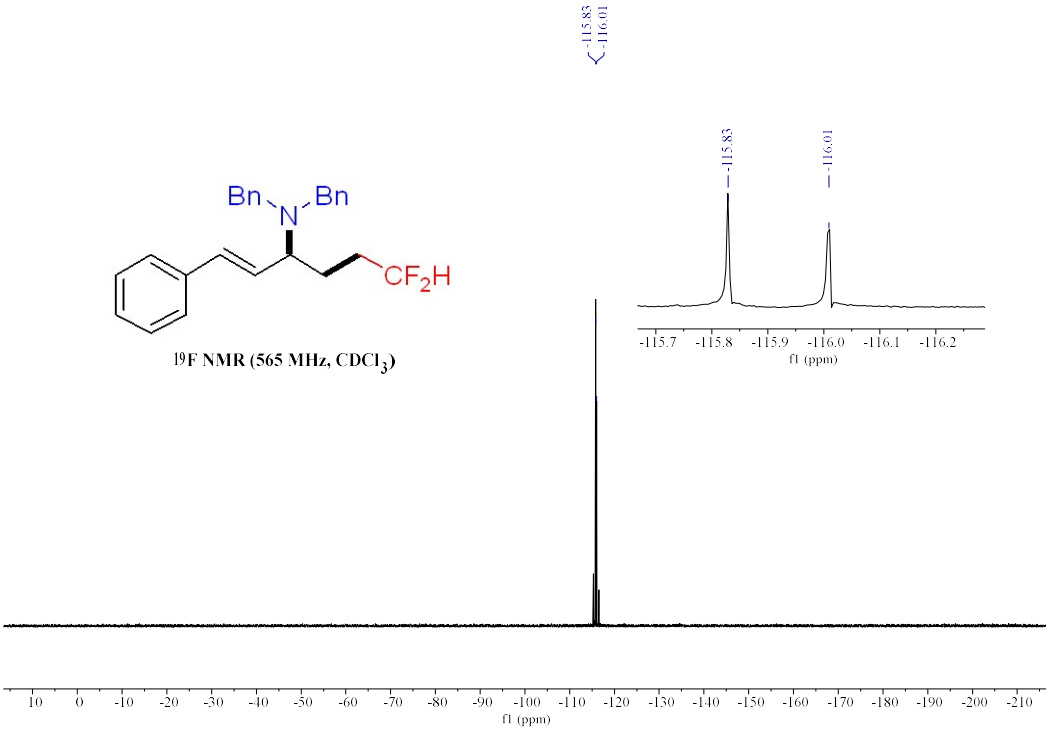


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*,*N*-Dibenzyl-6,6-difluoro-1-phenylhex-1-en-3-amine (5c)

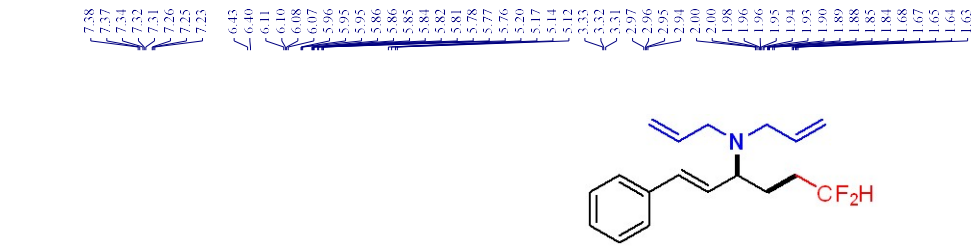




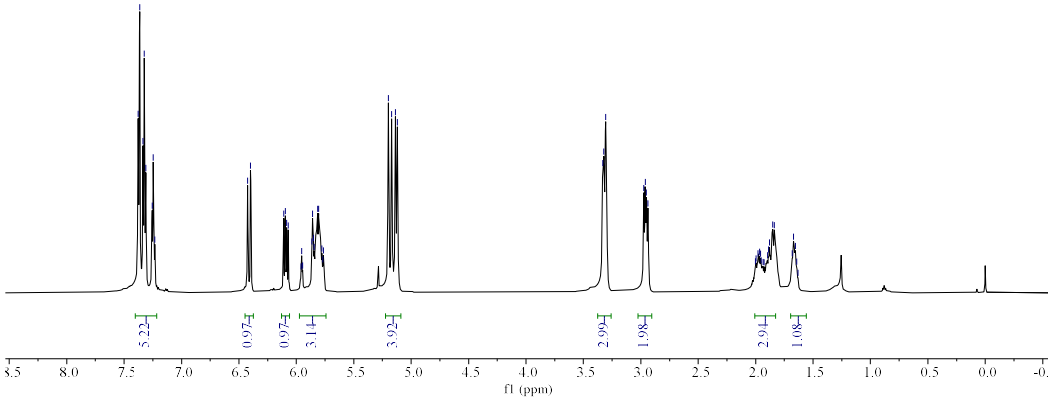


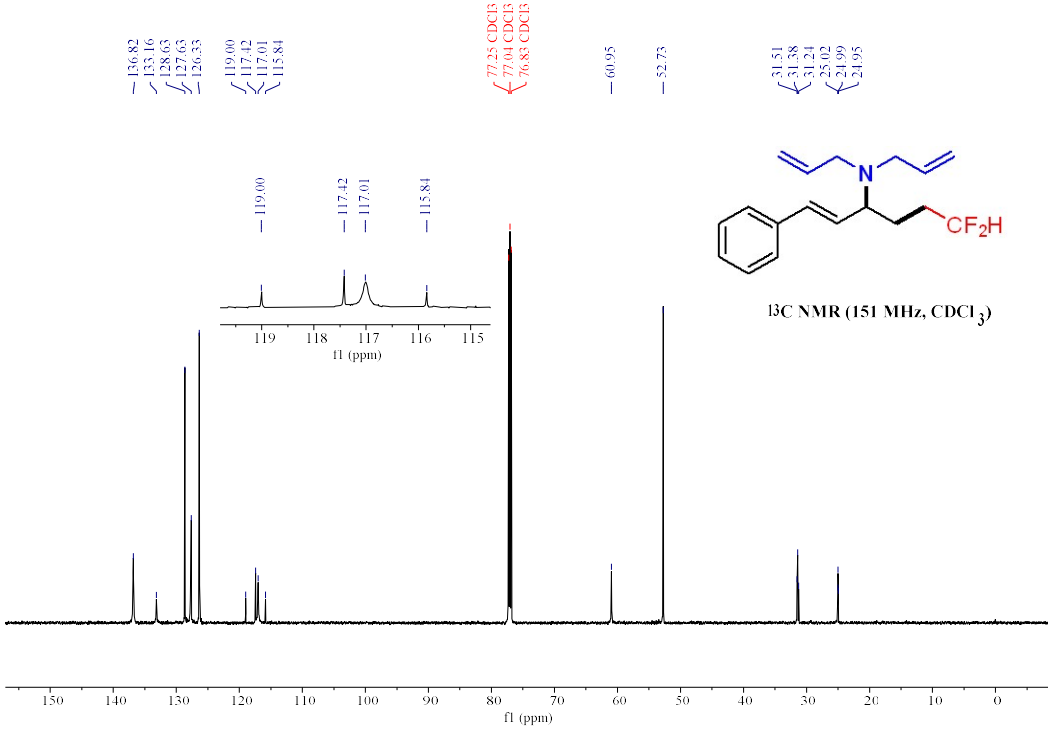
^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*,*N*-Diallyl-6,6-difluoro-1-phenylhex-1-en-3-amine (5d)

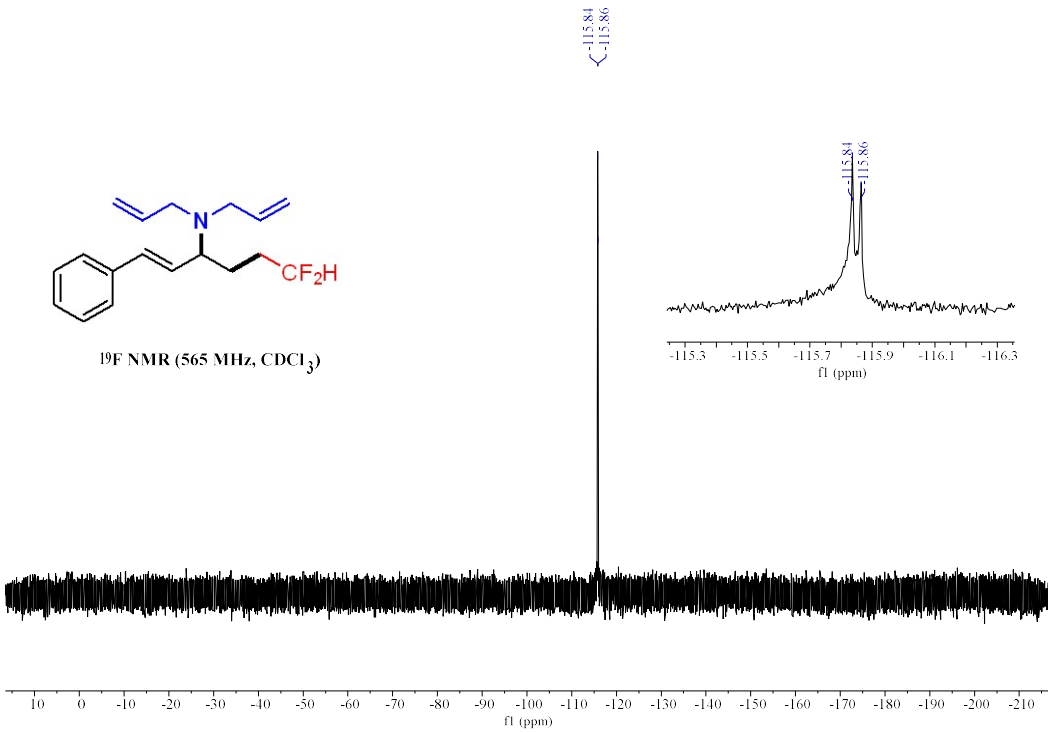


^{1}H NMR (600 MHz, $CDCl_3$)



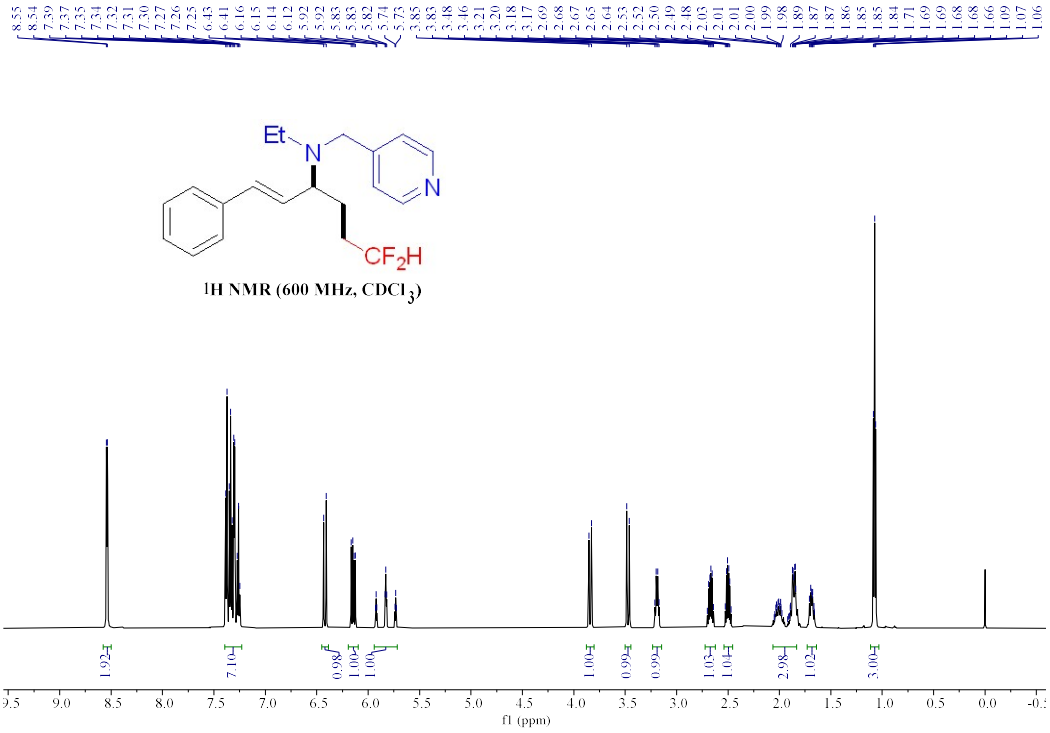


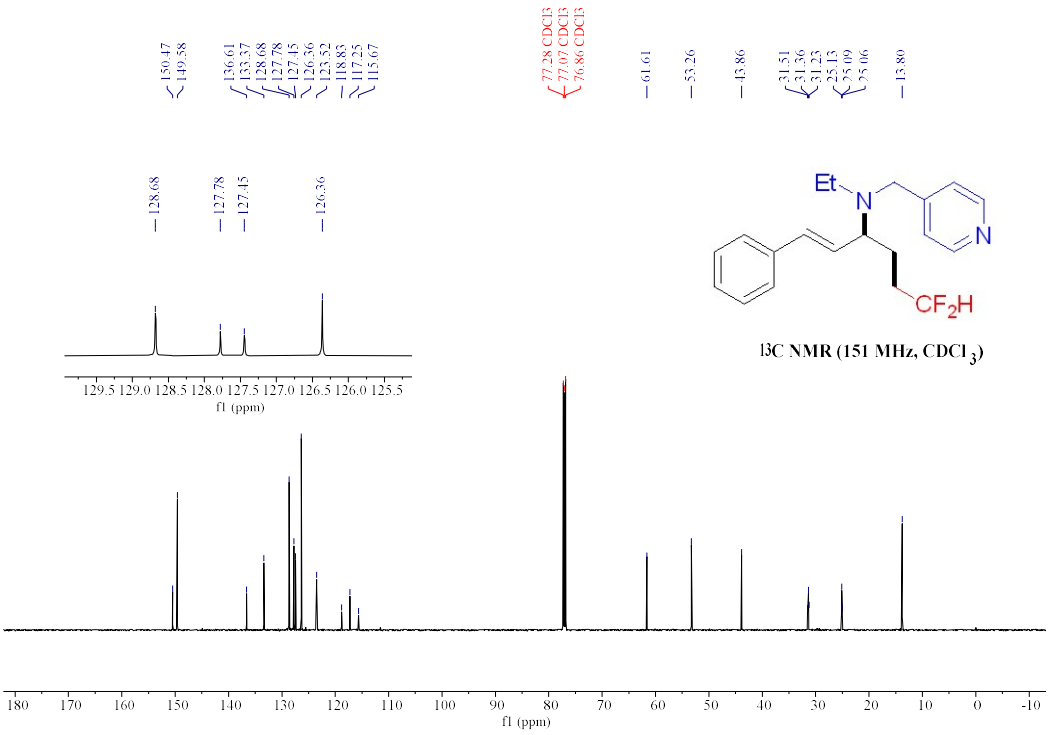
^{13}C NMR (151 MHz, $CDCl_3$)

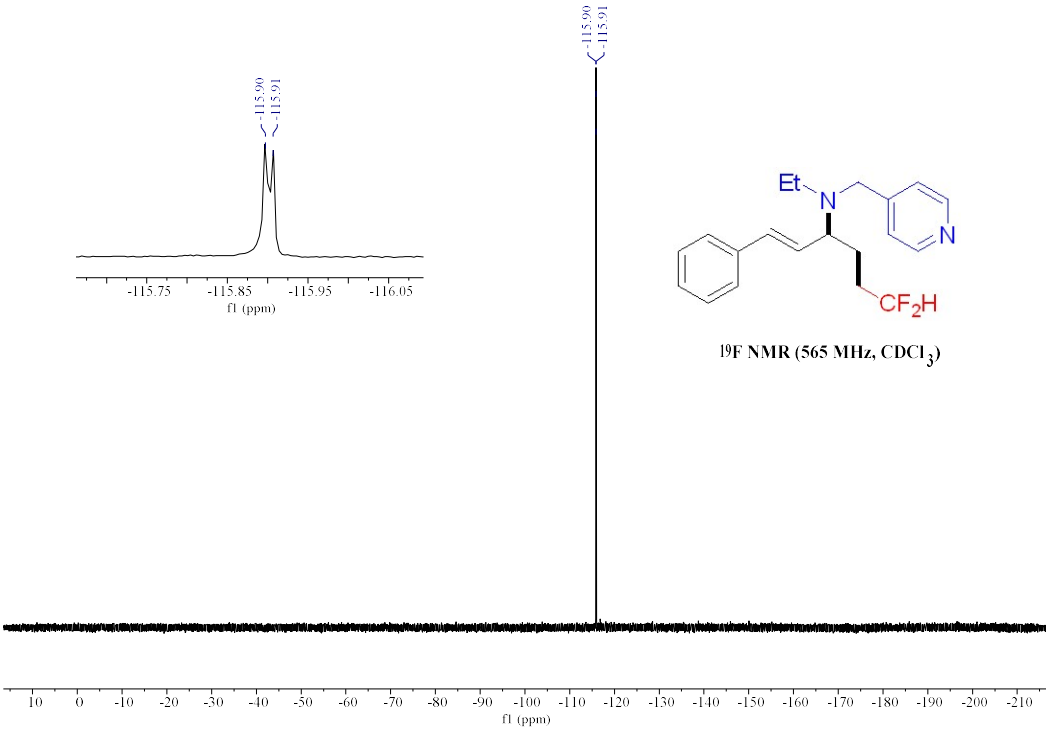


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Ethyl-6,6-difluoro-1-phenyl-*N*-(pyridin-4-ylmethyl)hex-1-en-3-amine (5e)

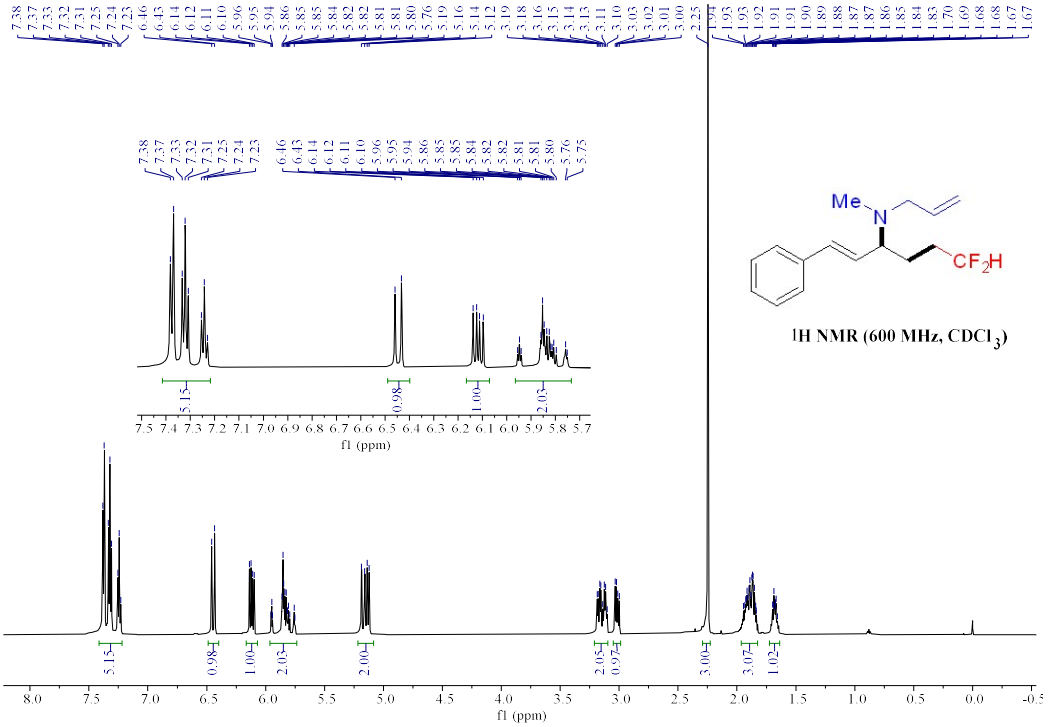


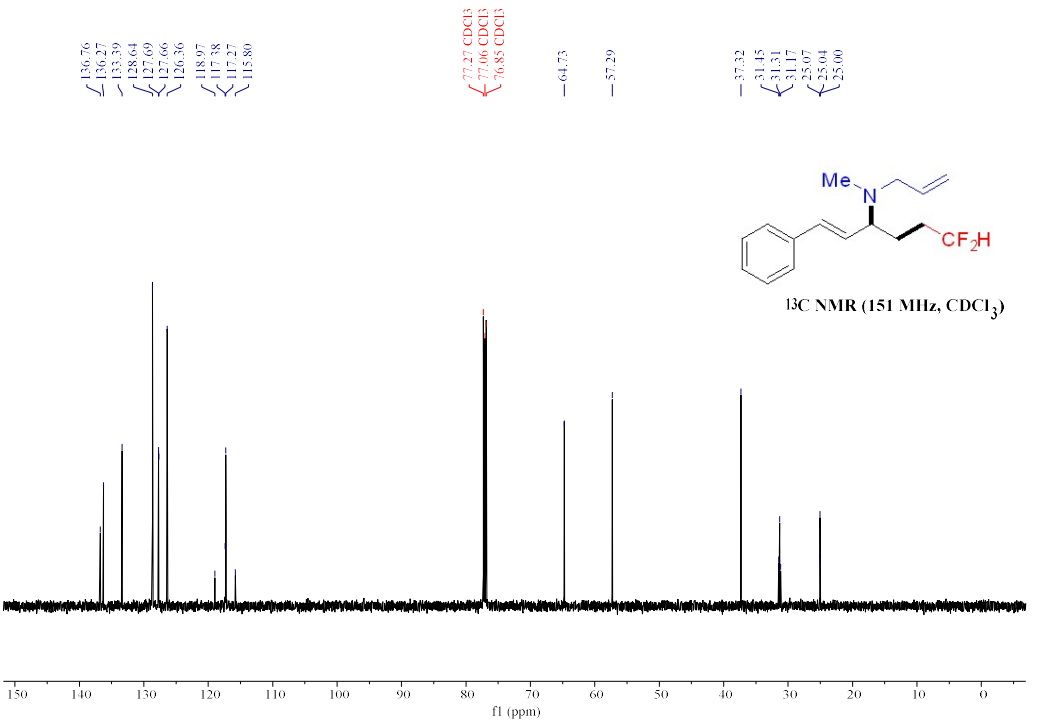


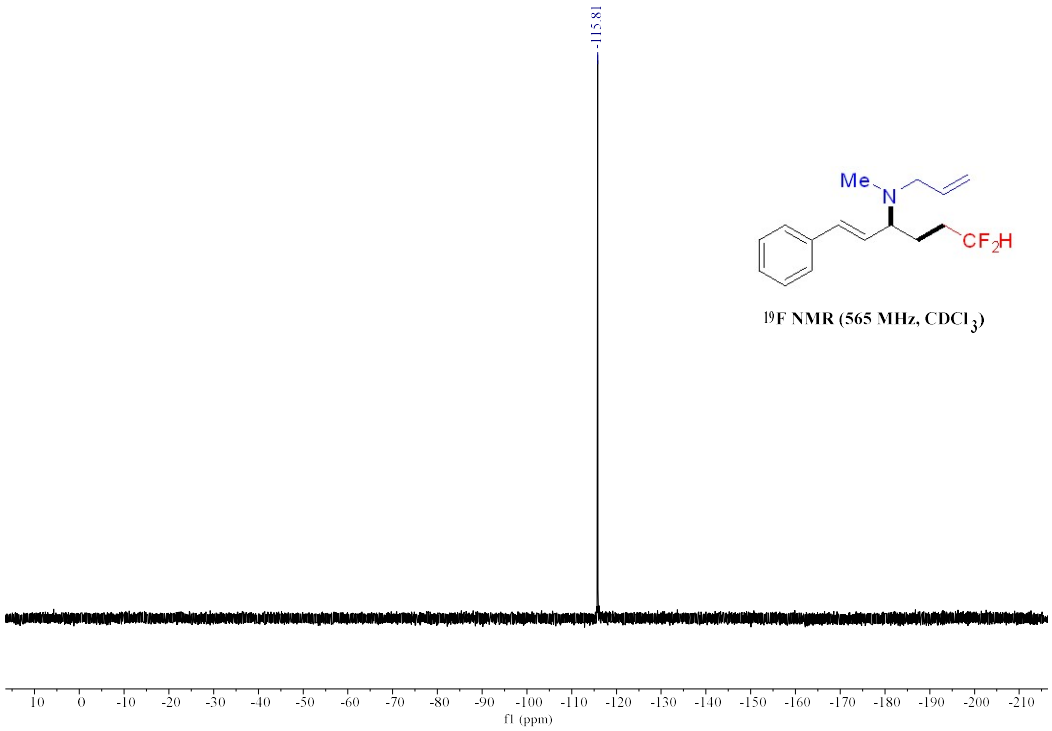


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Allyl-6,6-difluoro-N-methyl-1-phenylhex-1-en-3-amine (5f)

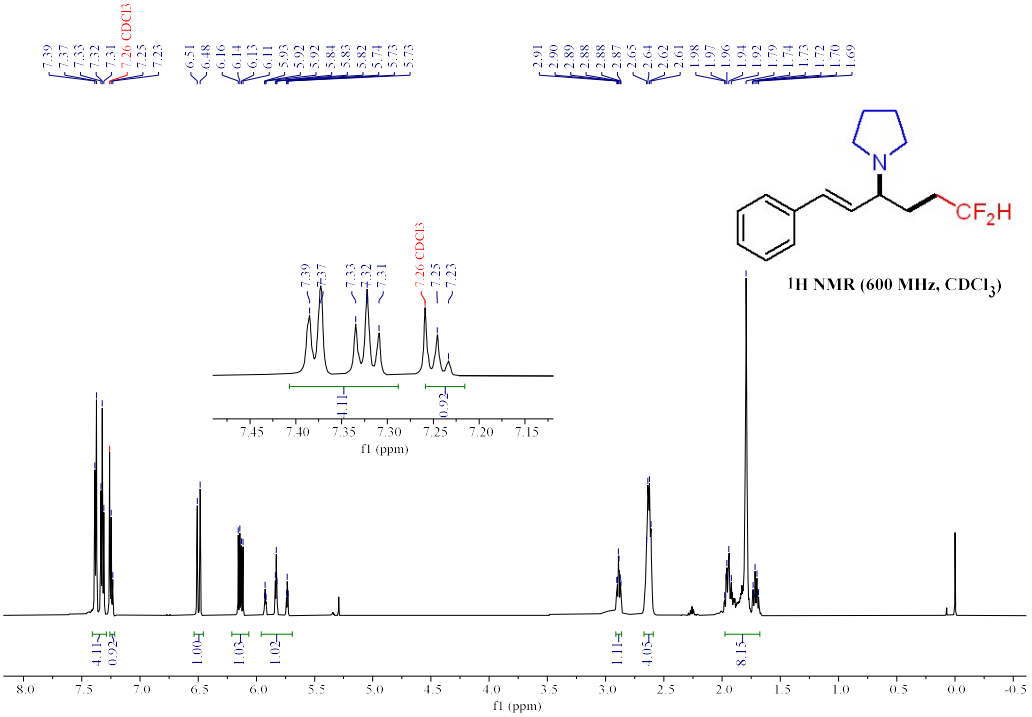


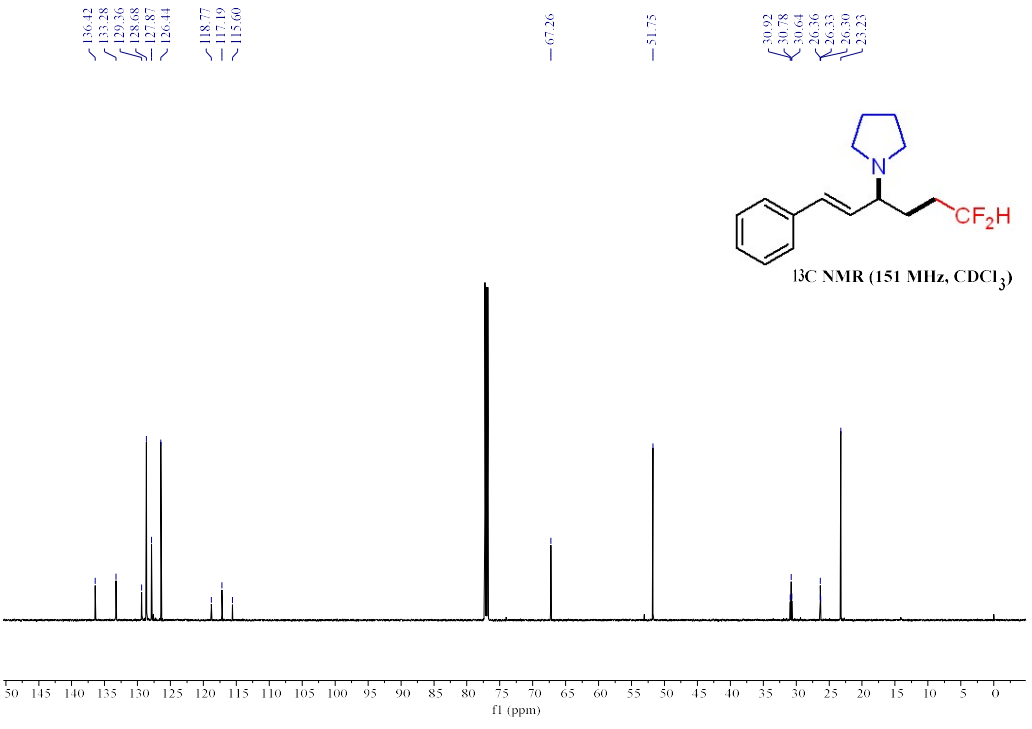


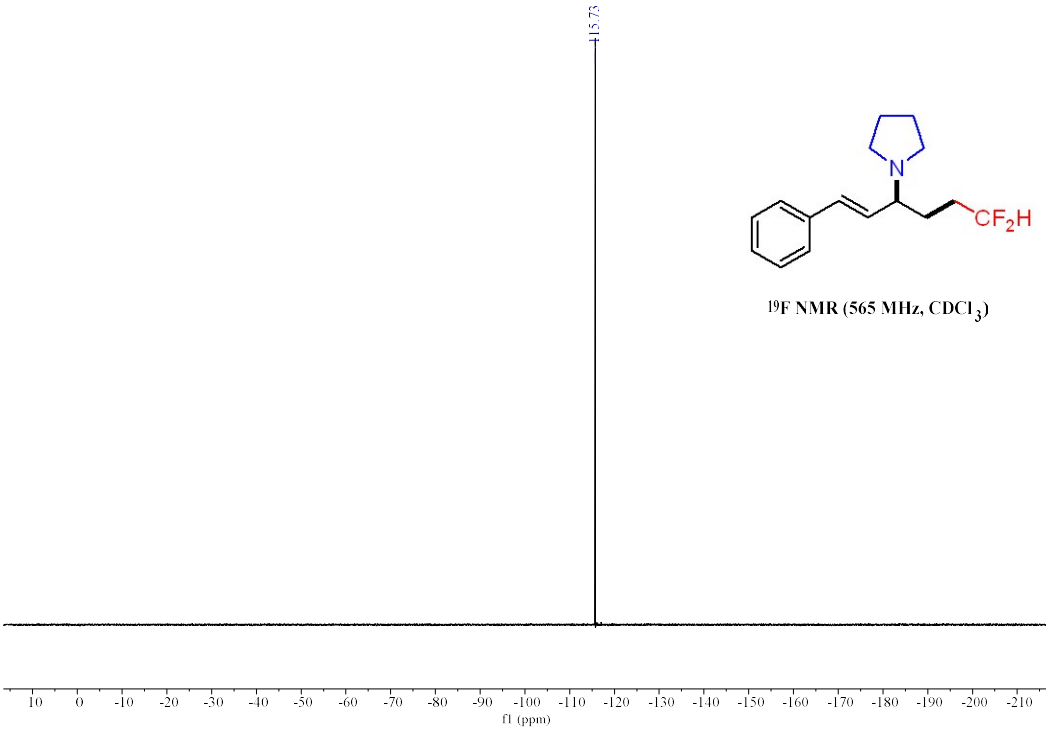


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-1-(6,6-Difluoro-1-phenylhex-1-en-3-yl)pyrrolidine (5g)

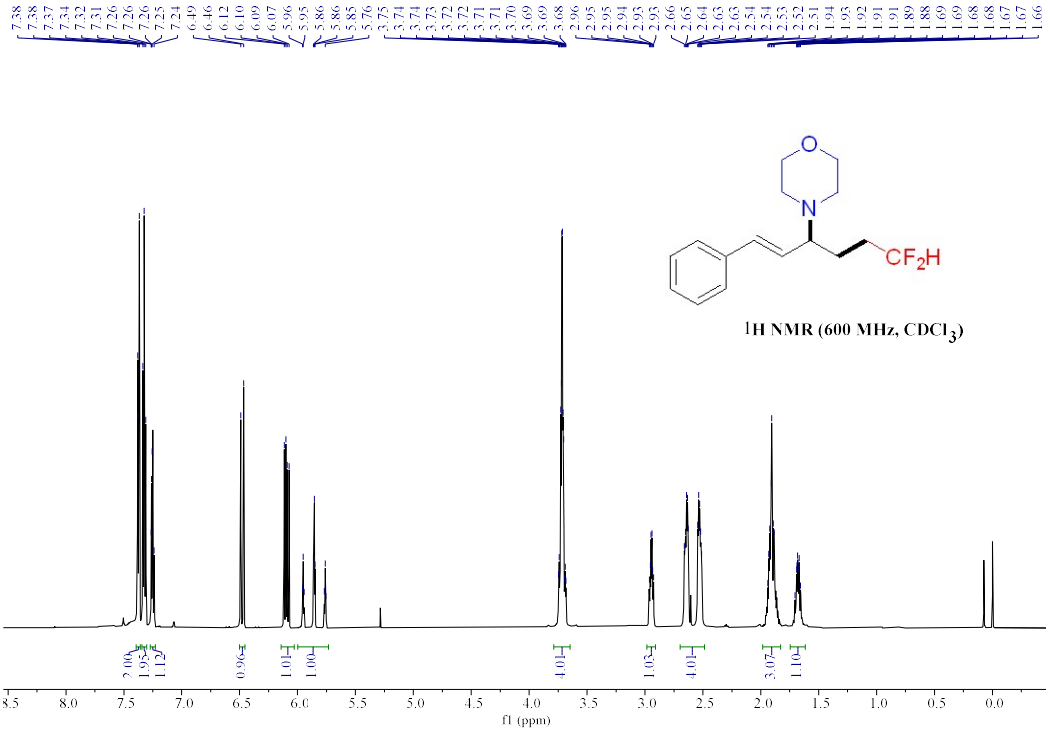


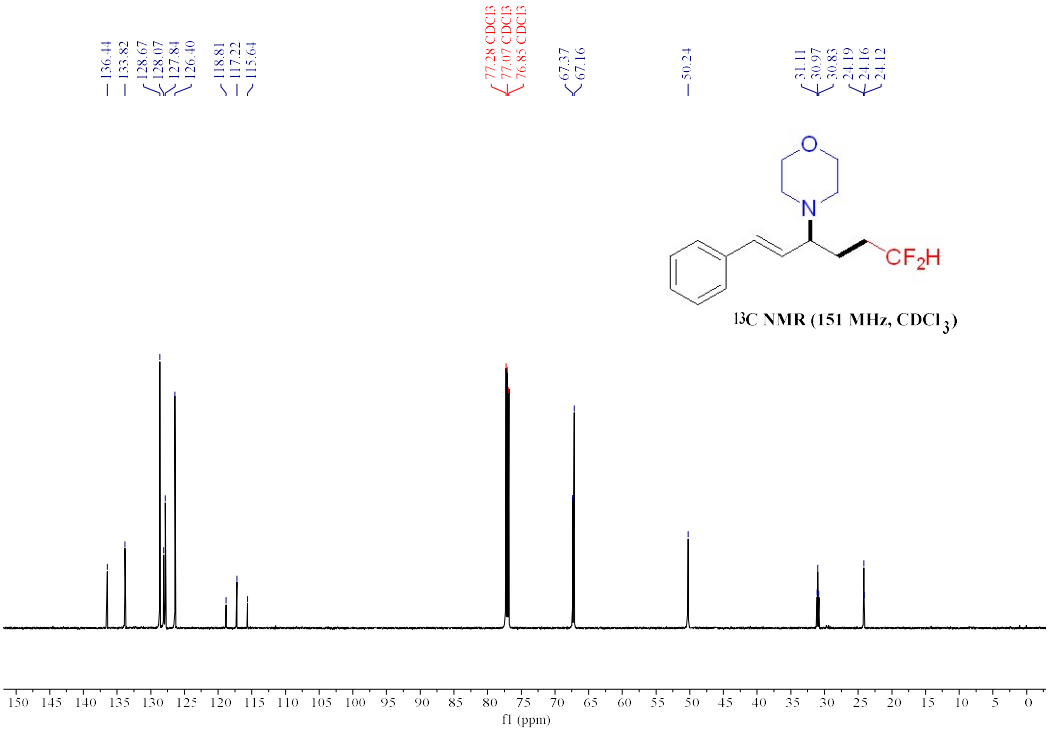


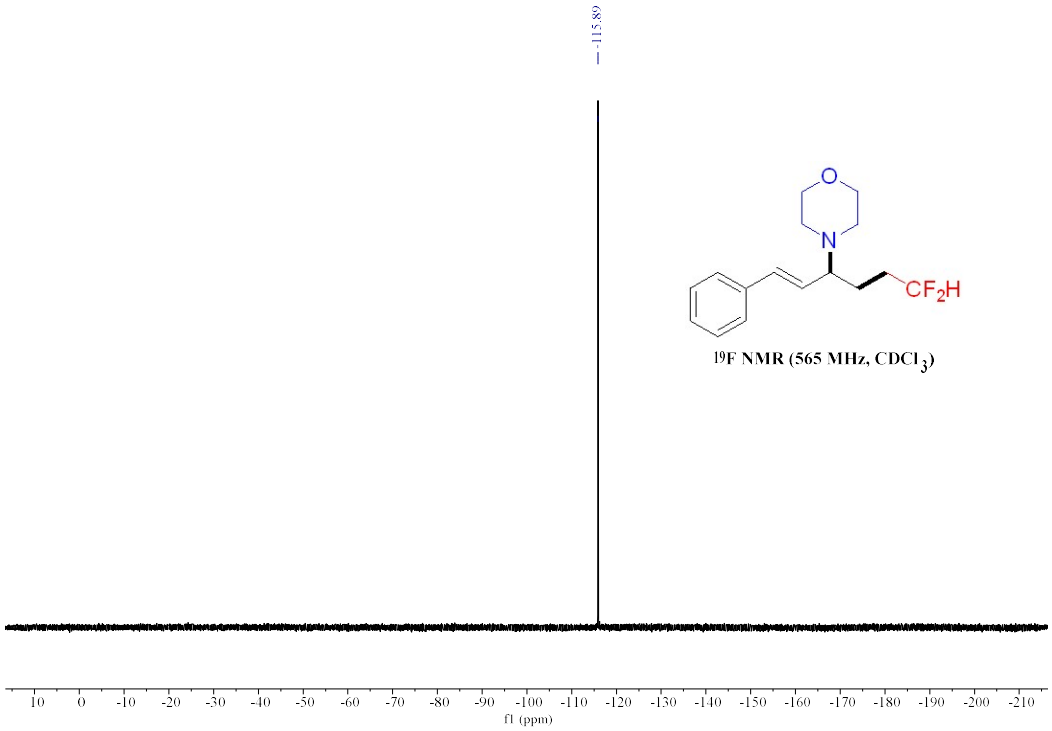


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-4-(6,6-Difluoro-1-phenylhex-1-en-3-yl)morpholine (5h)

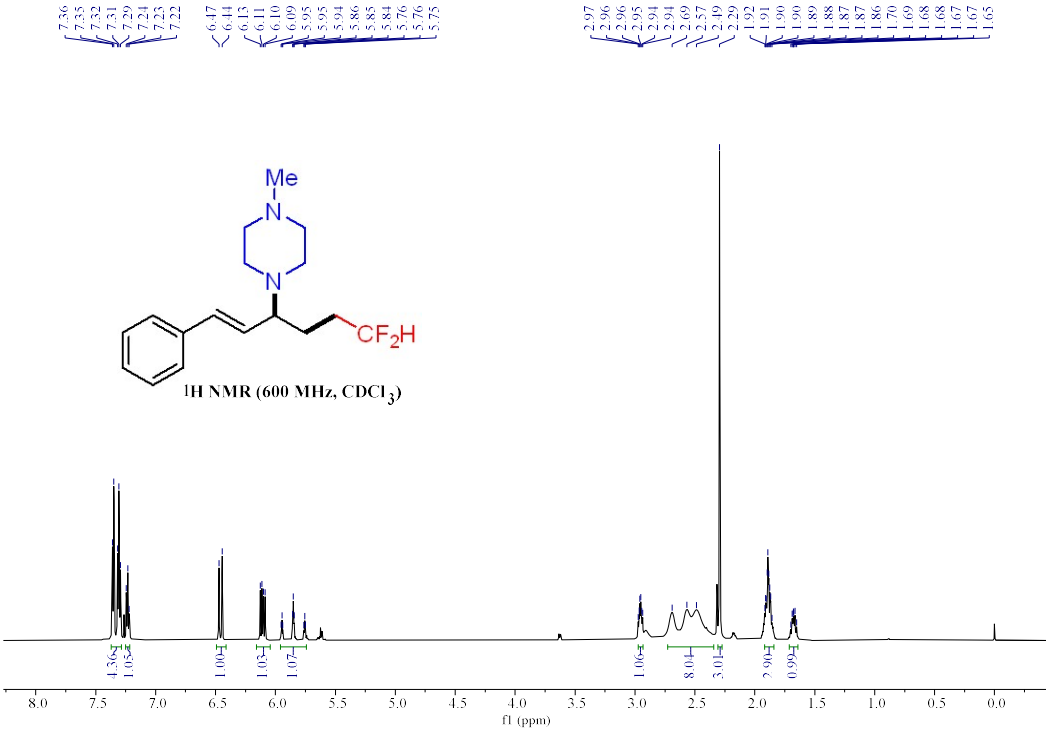


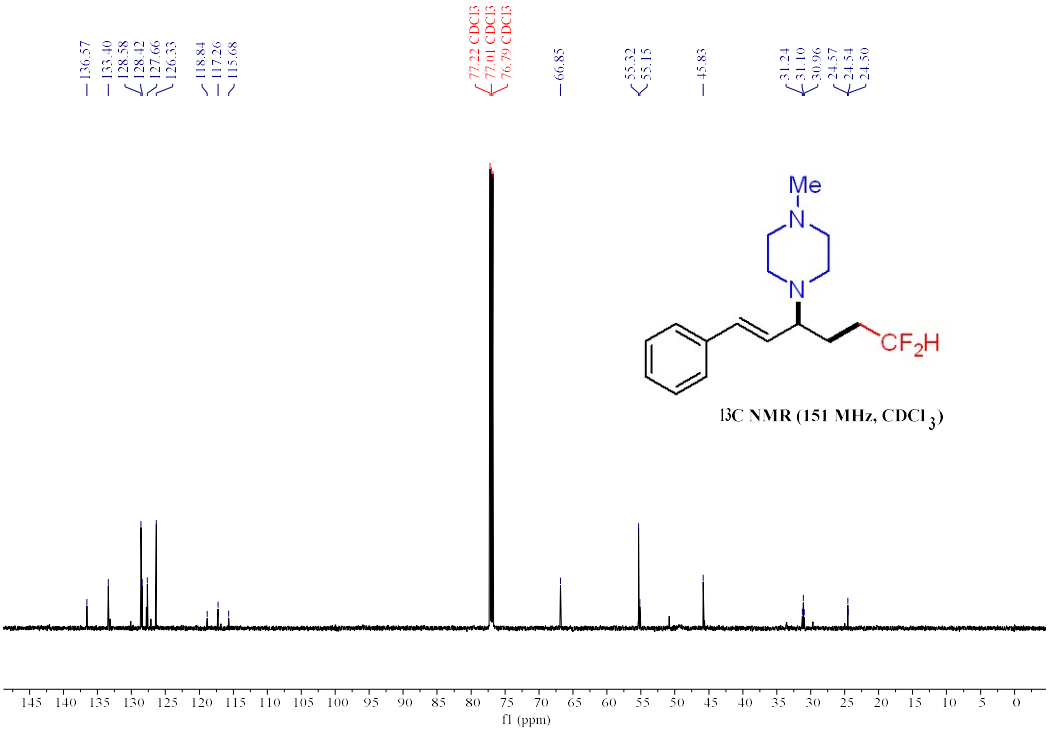


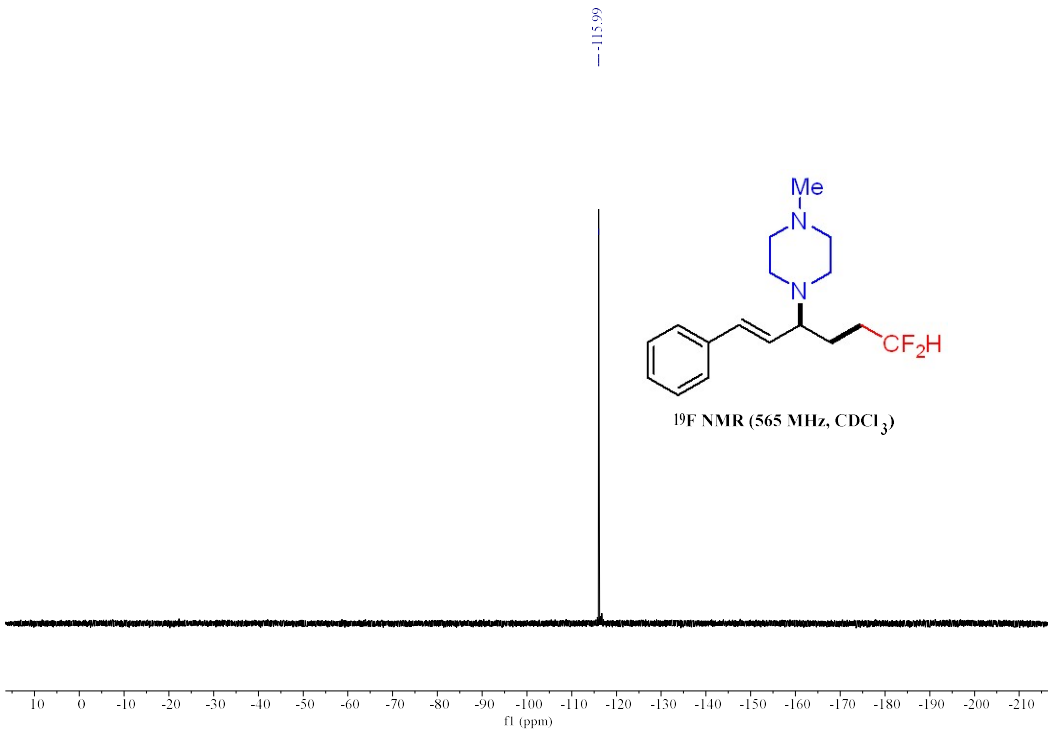


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-1-(6,6-Difluoro-1-phenylhex-1-en-3-yl)-4-methylpiperazine (5i)

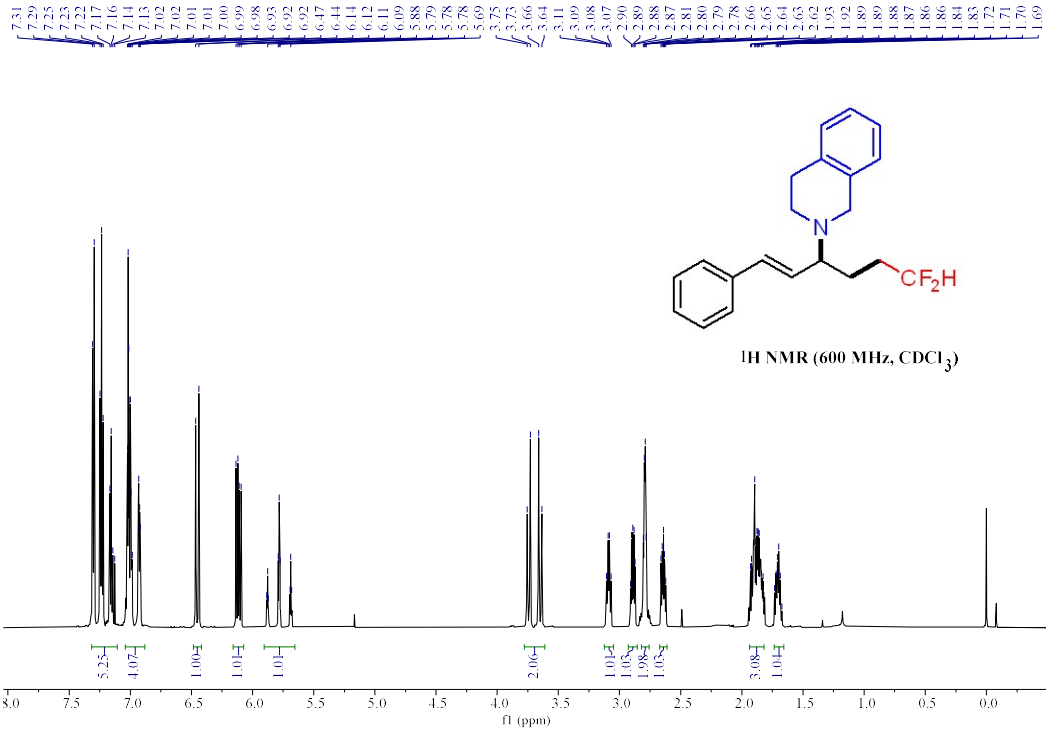


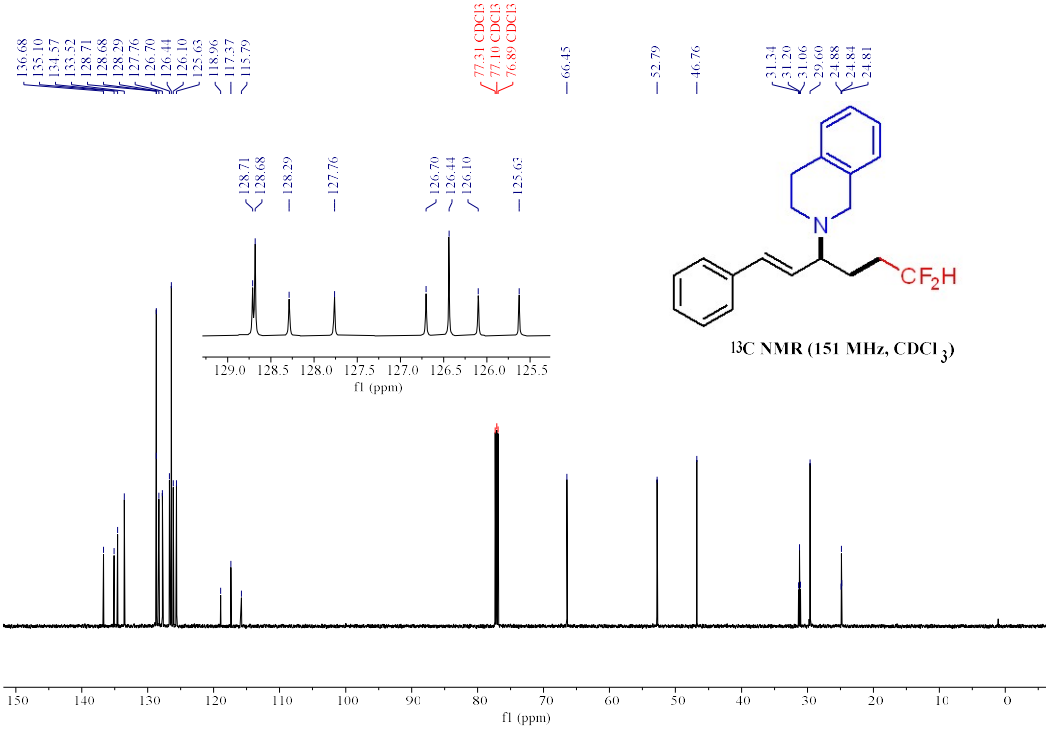


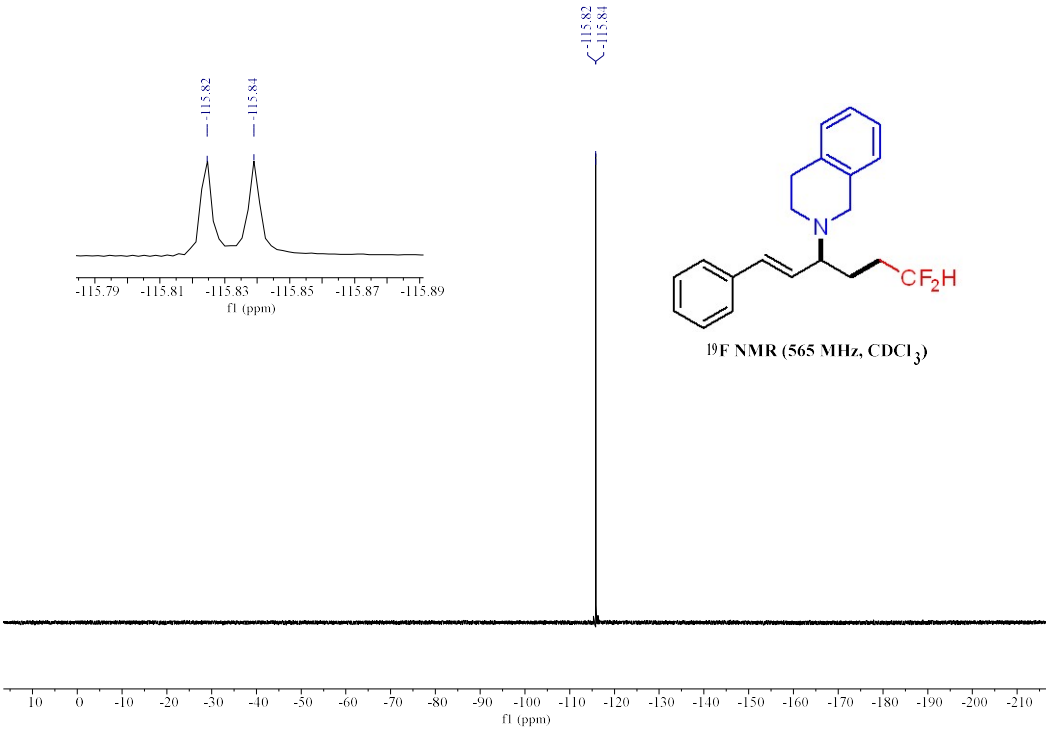


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-2-(6,6-Difluoro-1-phenylhex-1-en-3-yl)-1,2,3,4-tetrahydroisoquinoline (5j)

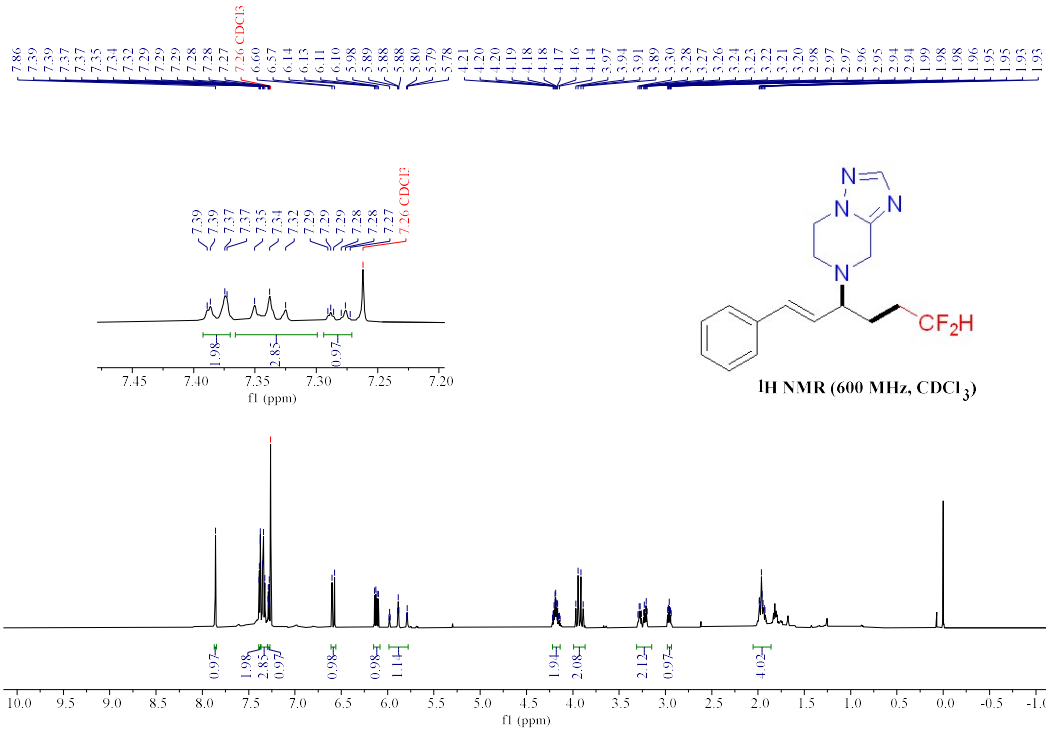


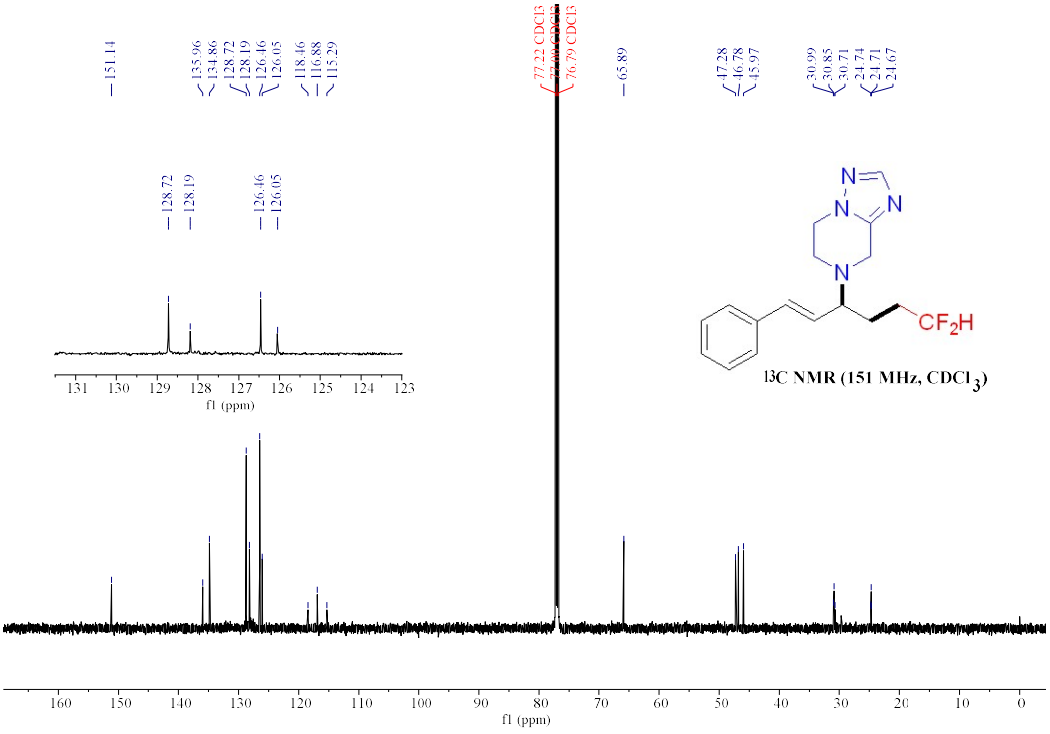


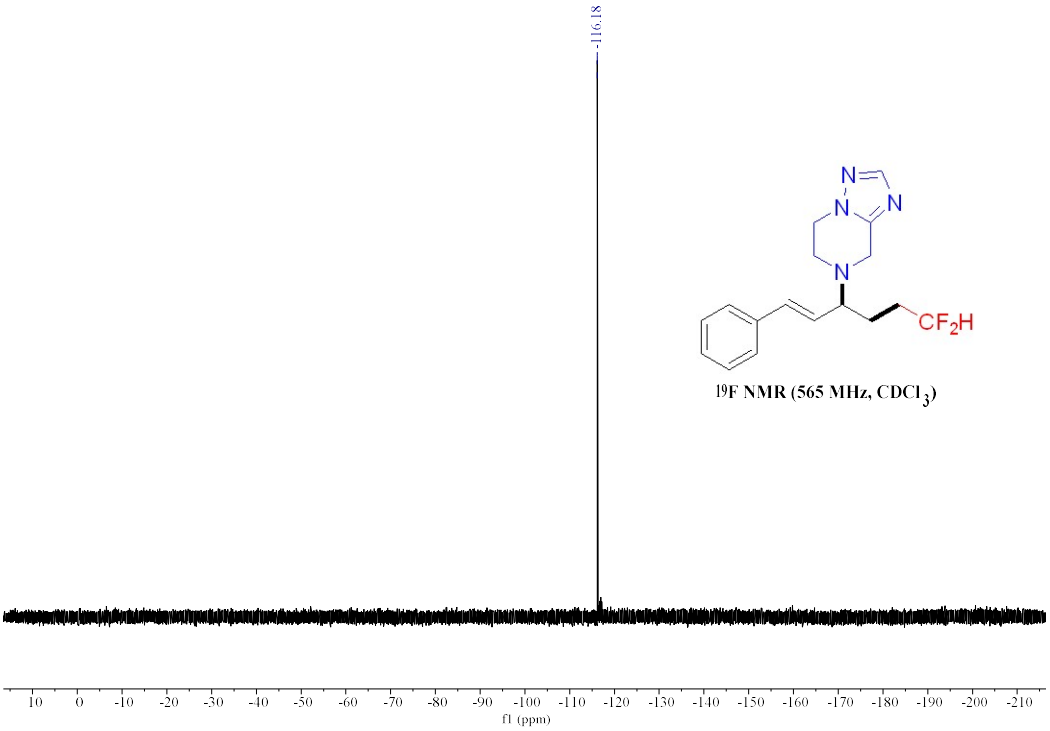


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-7-(6,6-Difluoro-1-phenylhex-1-en-3-yl)-5,6,7,8-tetrahydro-[1,2,4]triazolo[1,5-a]pyrazine (5k)

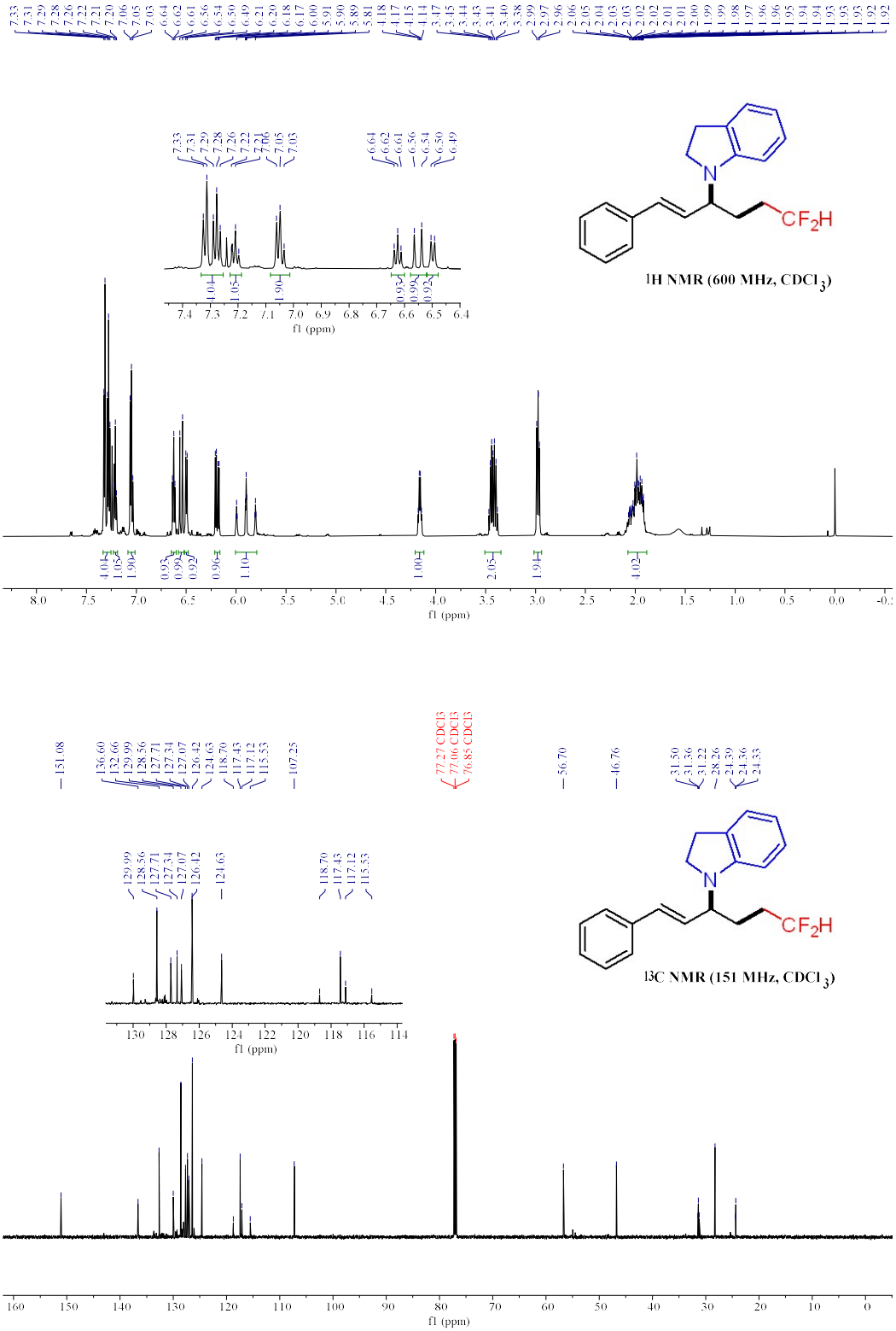


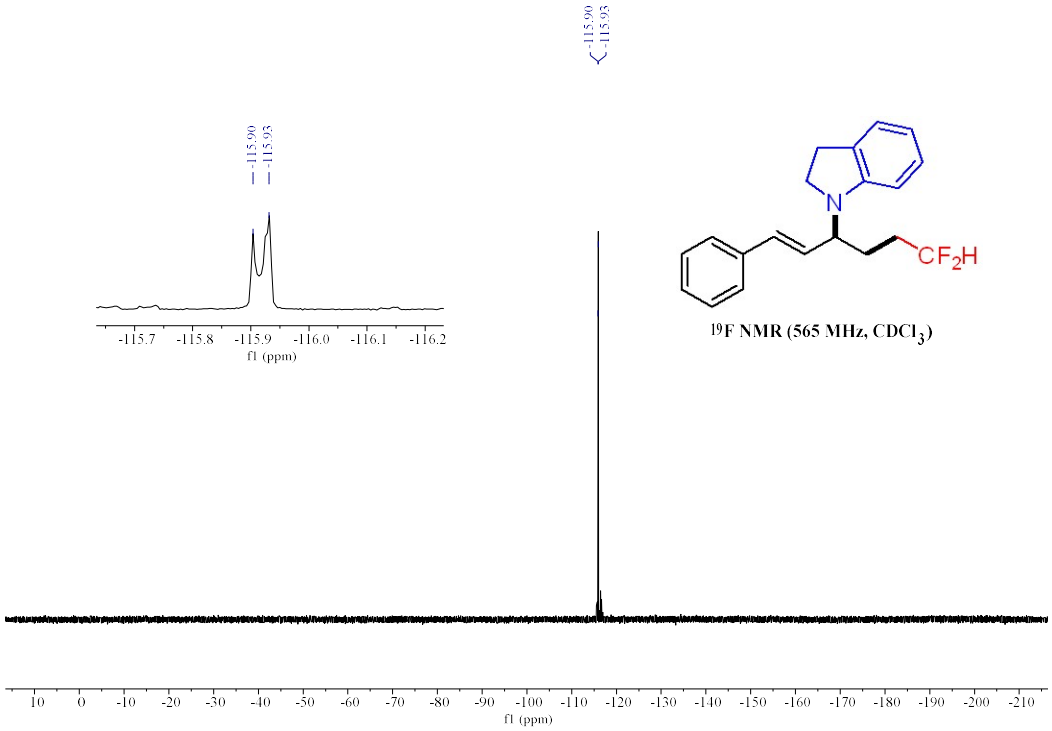




^{19}F NMR (565 MHz, $CDCl_3$)

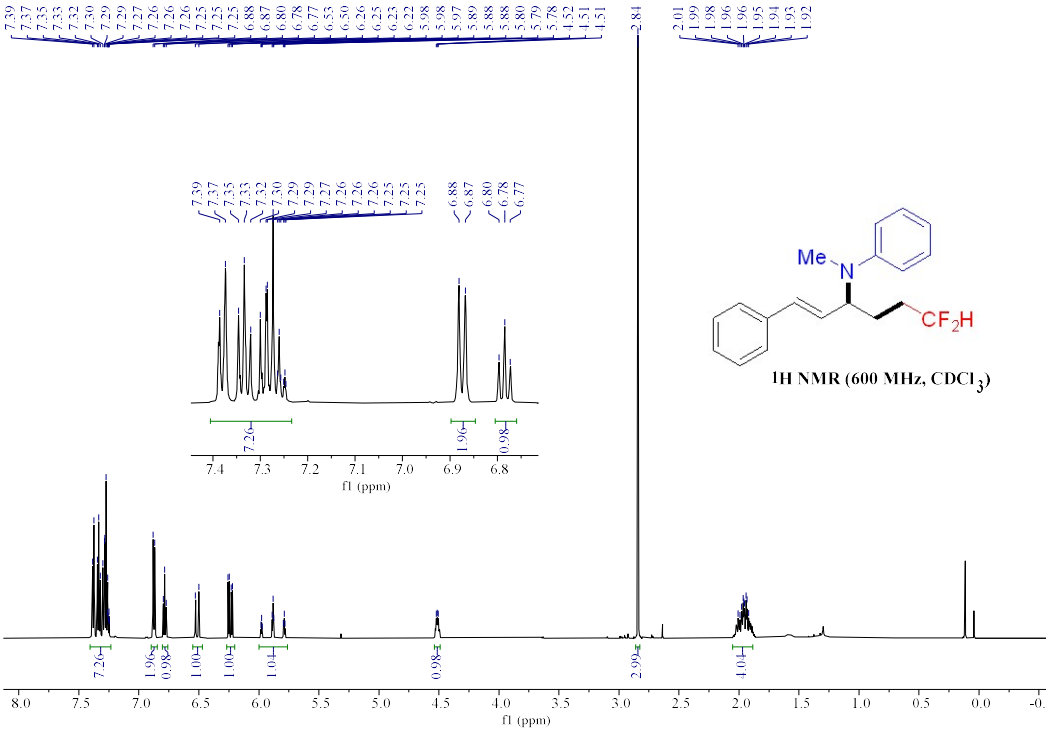
(*E*)-1-(6,6-Difluoro-1-phenylhex-1-en-3-yl)indoline (5l)

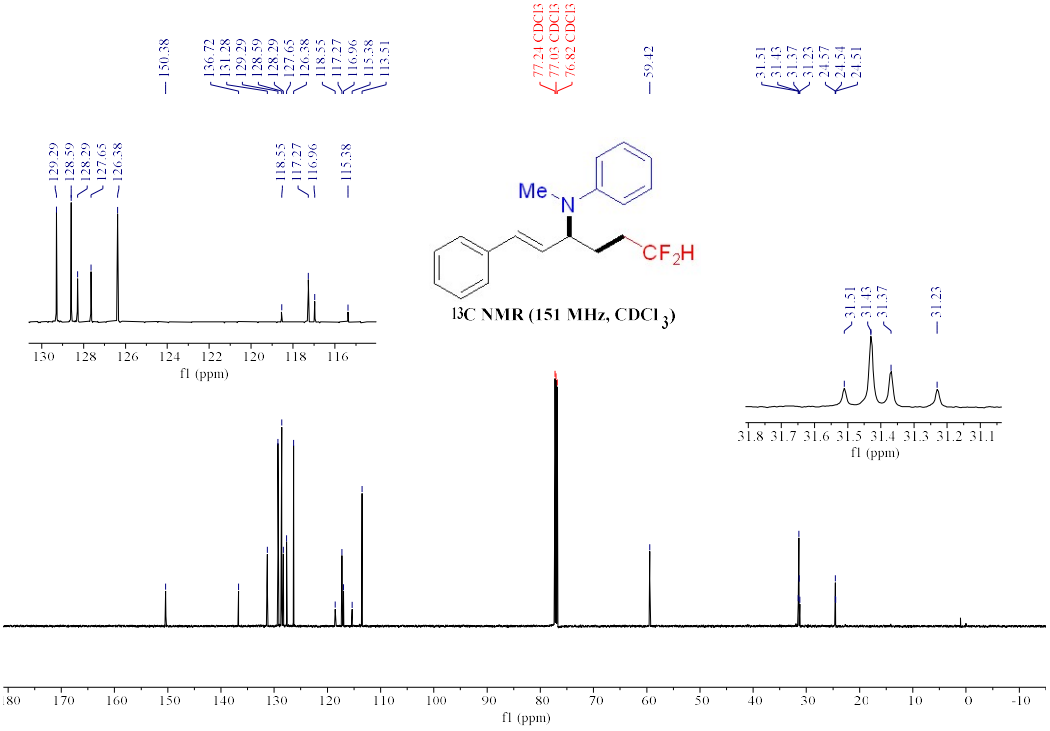


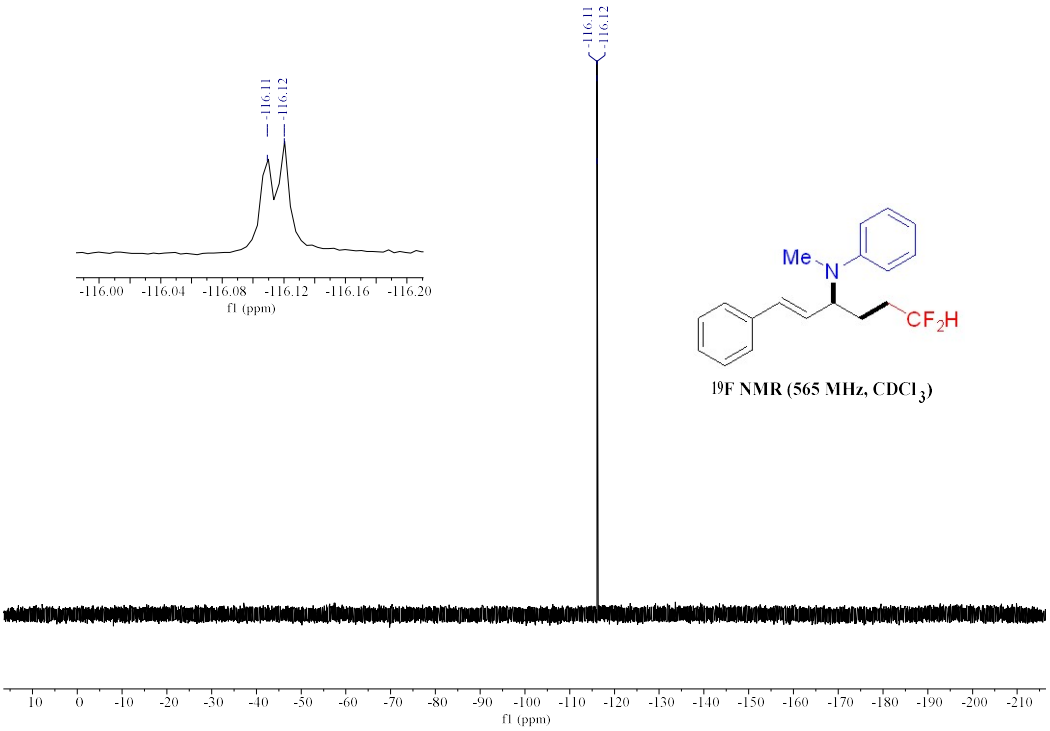


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-(6,6-Difluoro-1-phenylhex-1-en-3-yl)-*N*-methylaniline (5m)

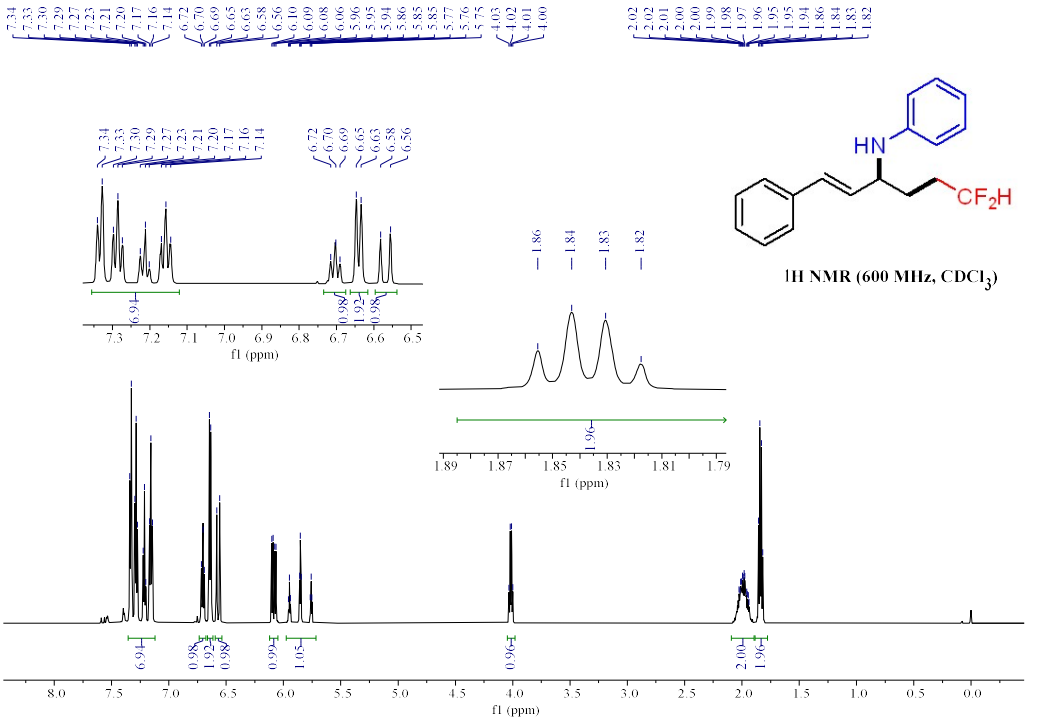


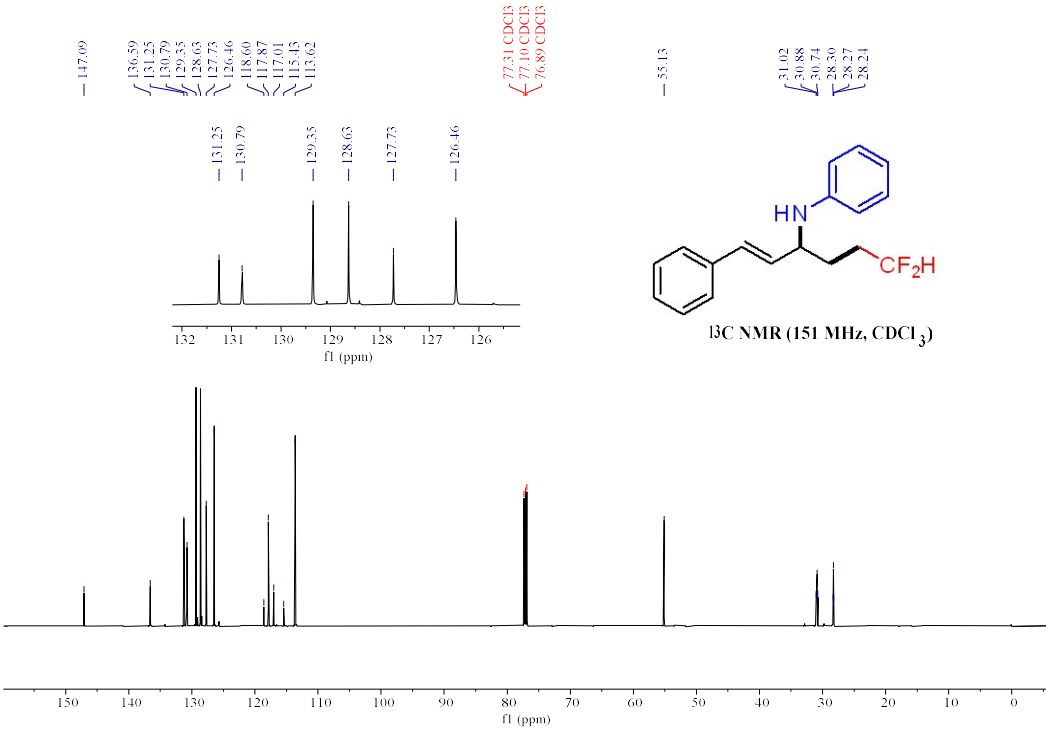


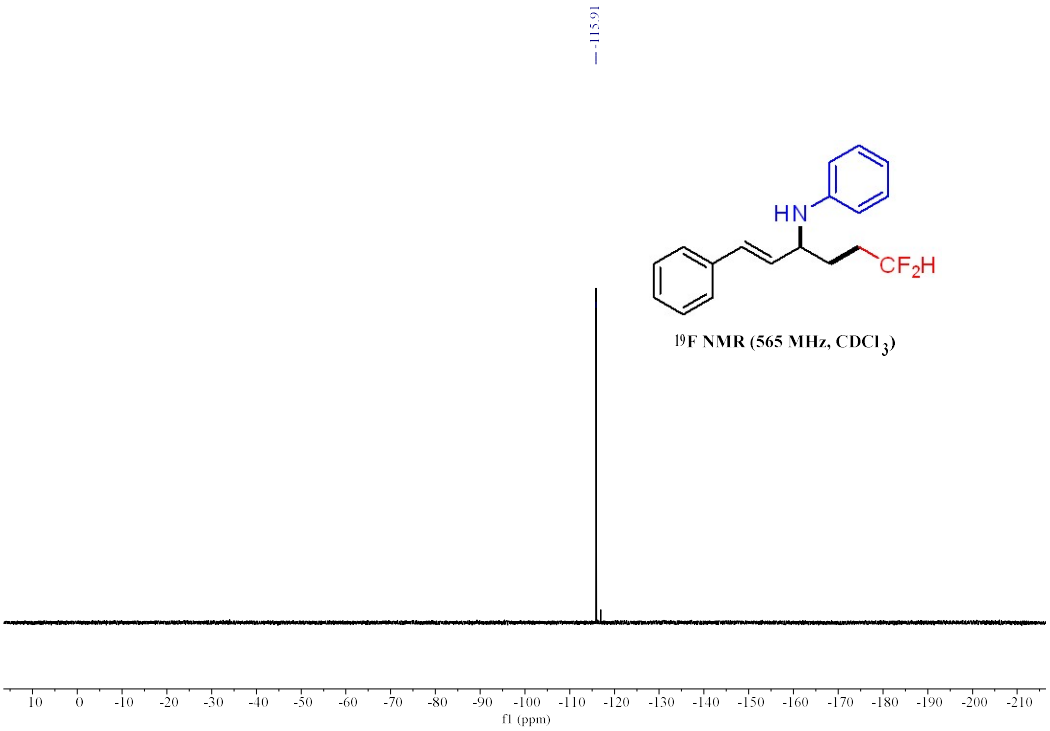


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-(6,6-Difluoro-1-phenylhex-1-en-3-yl)aniline (5n)

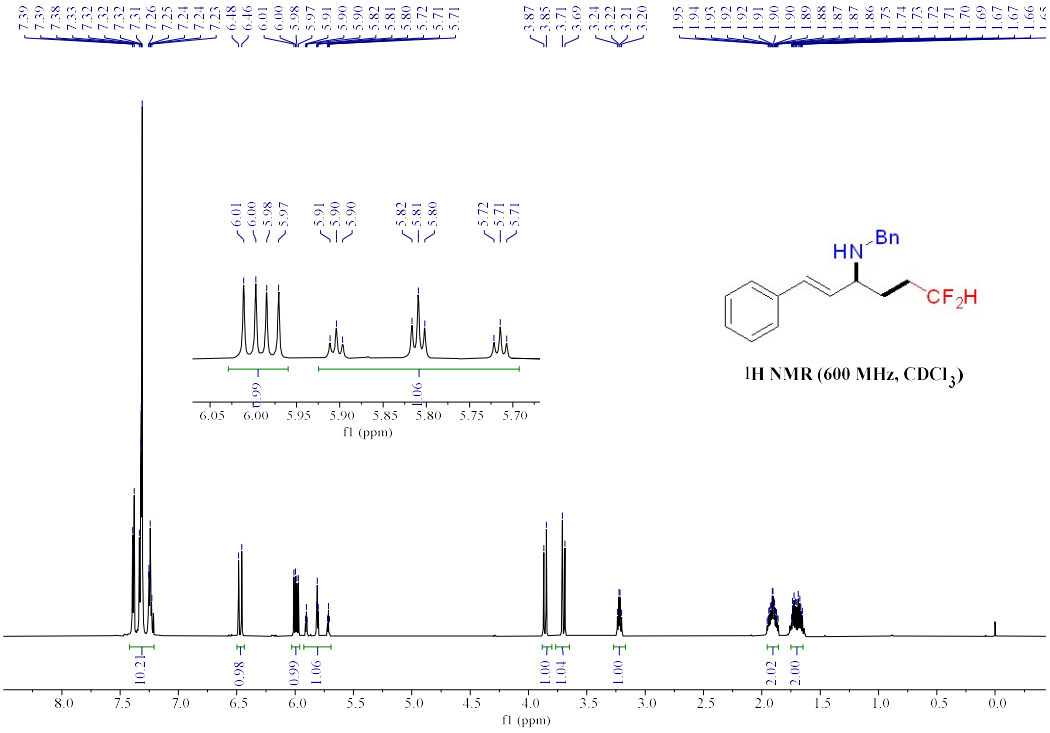


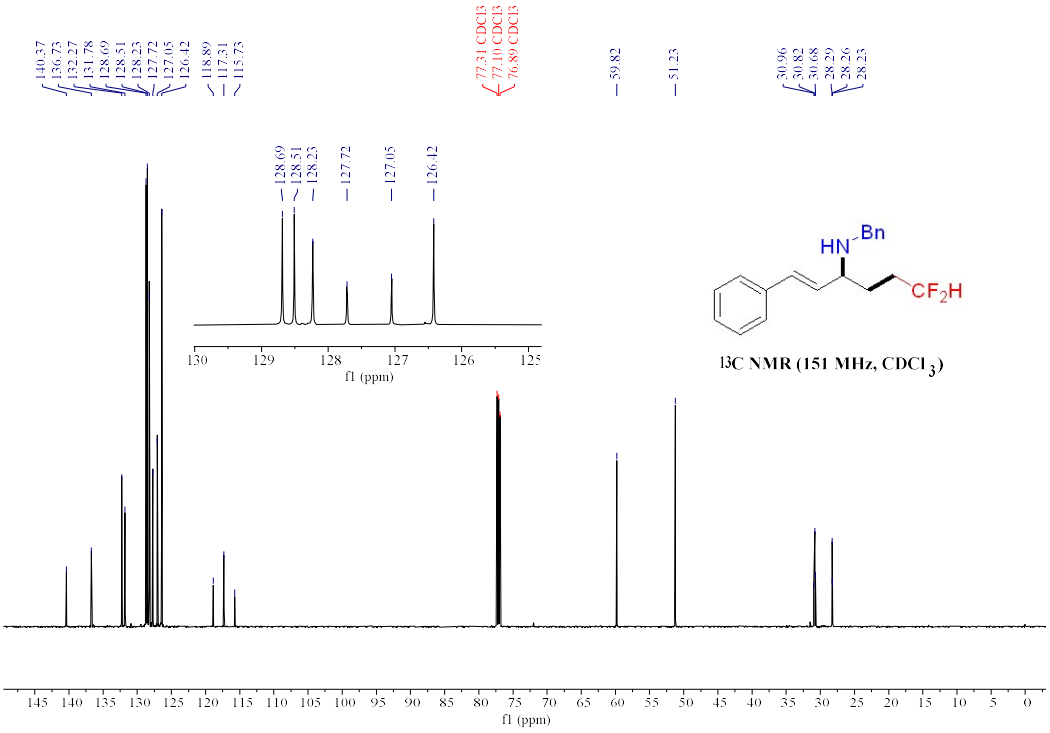


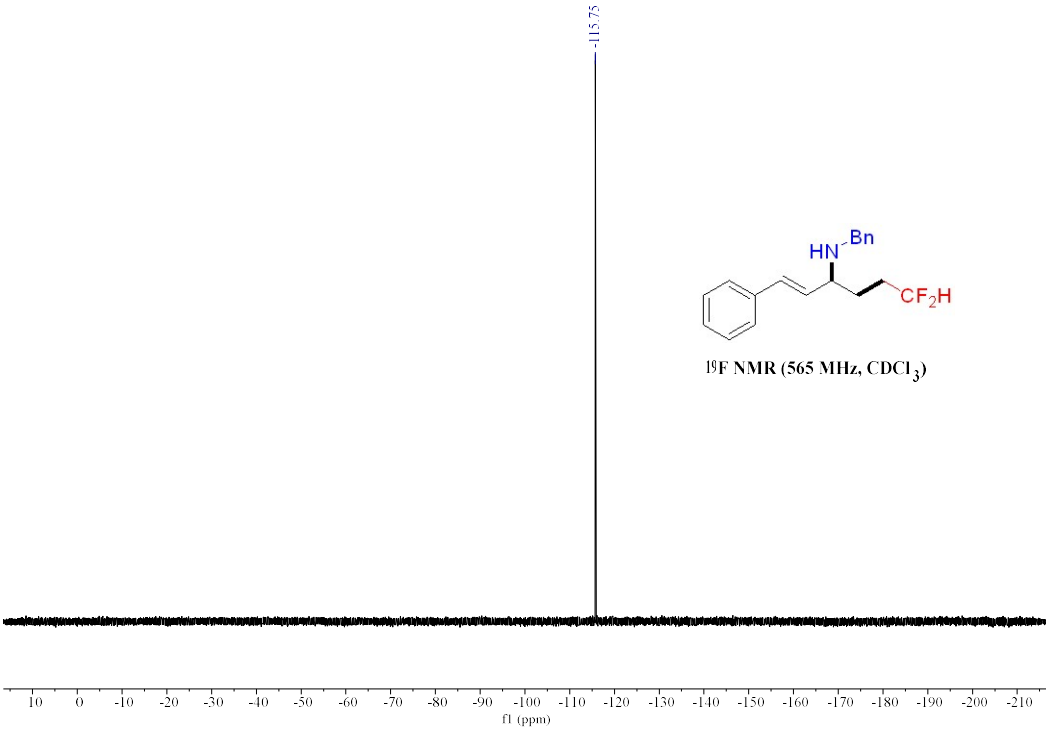


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6-difluoro-1-phenylhex-1-en-3-amine (5o)

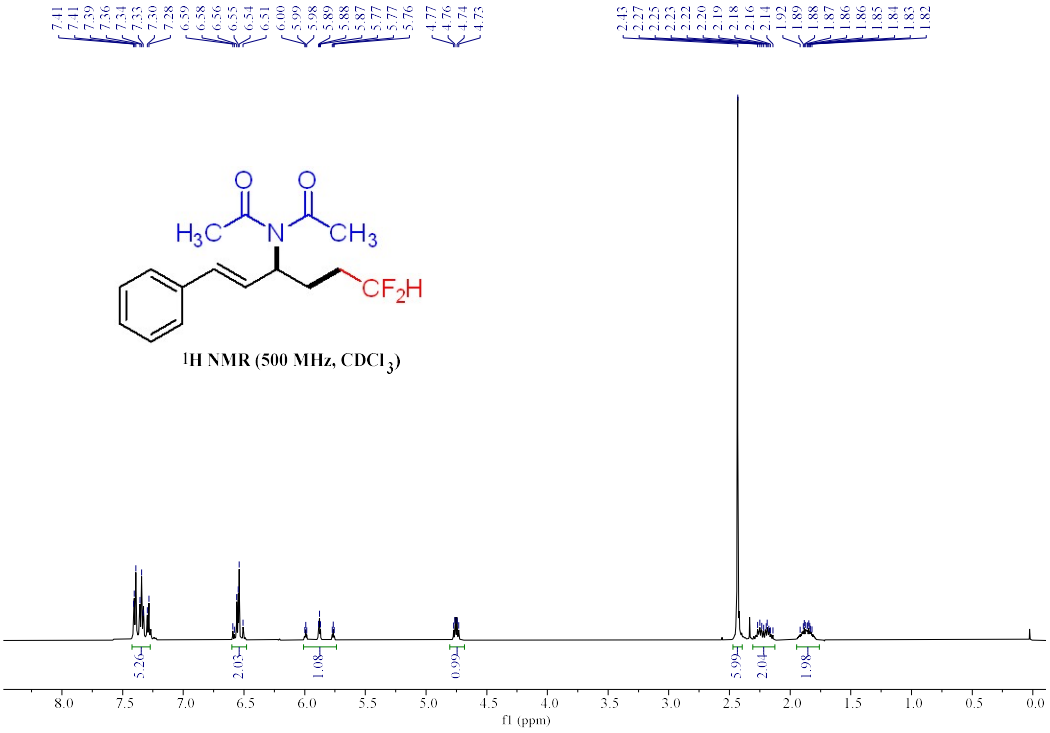


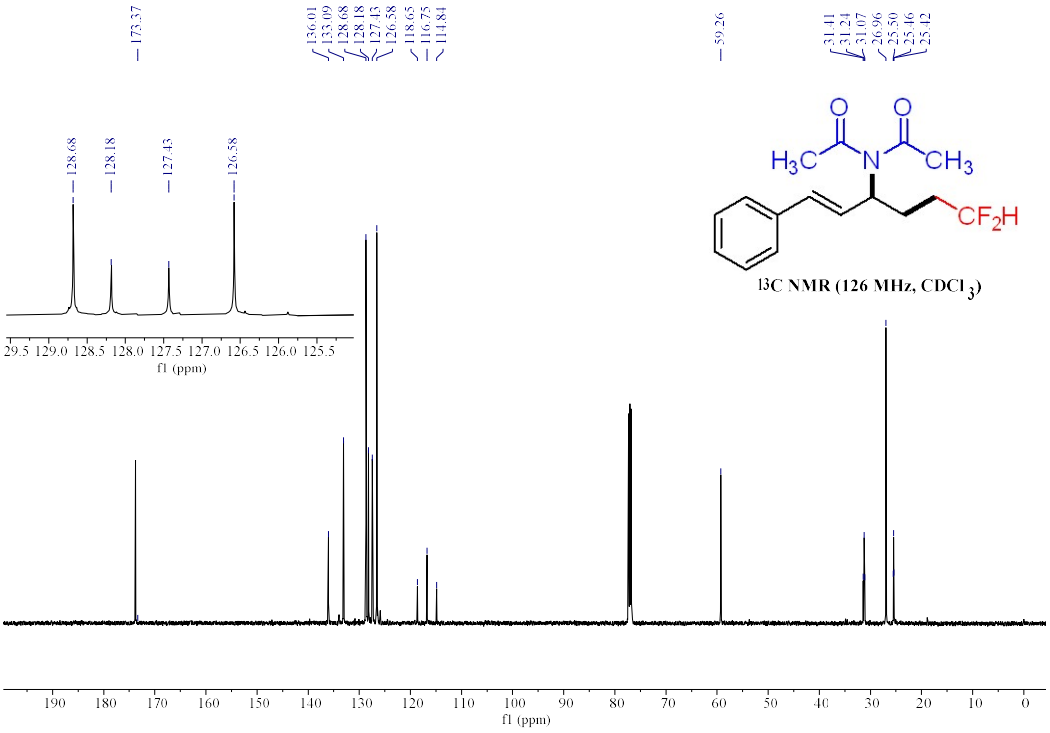


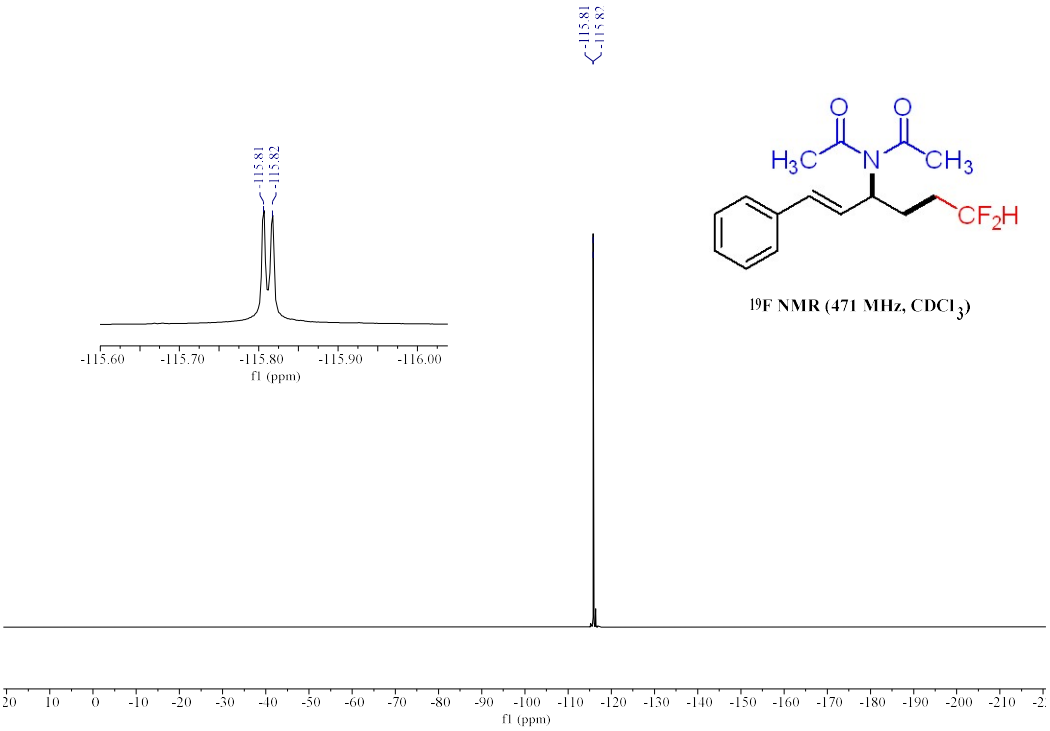


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Acetyl-*N*-(6,6-difluoro-1-phenylhex-1-en-3-yl)acetamide (5p)

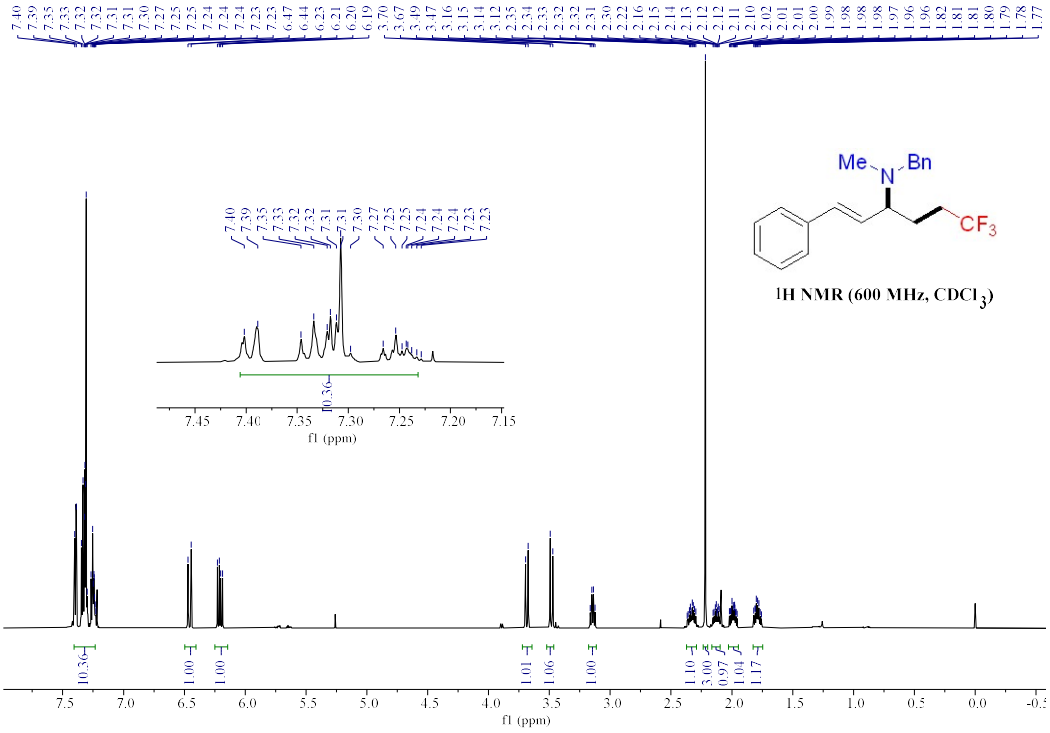


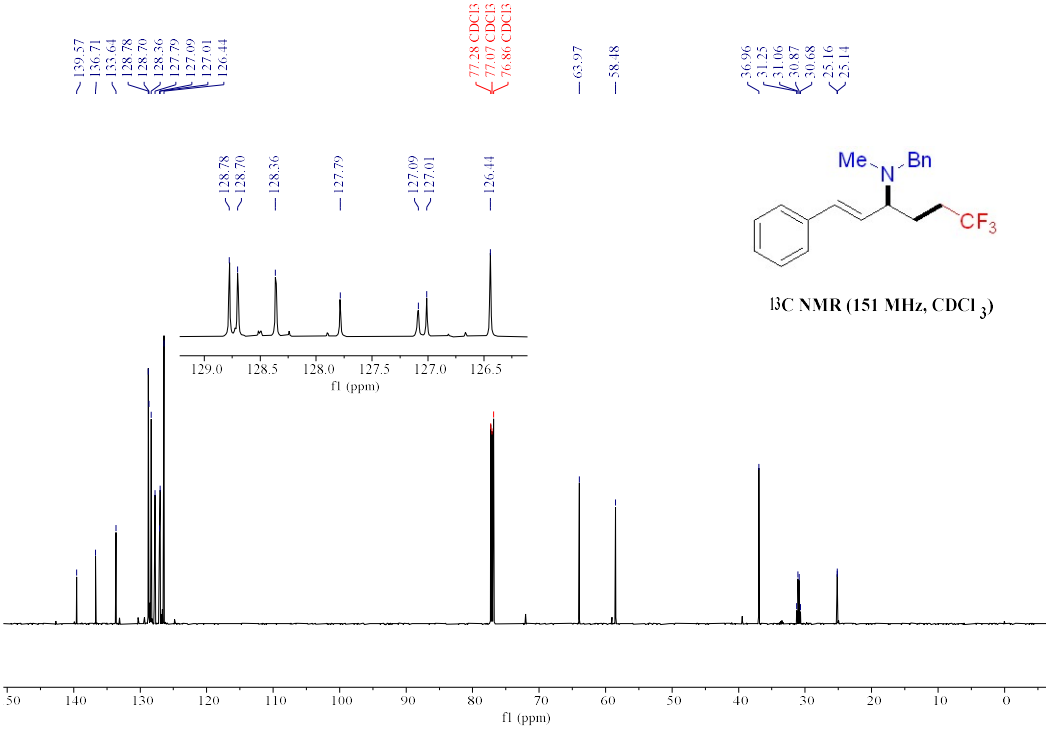


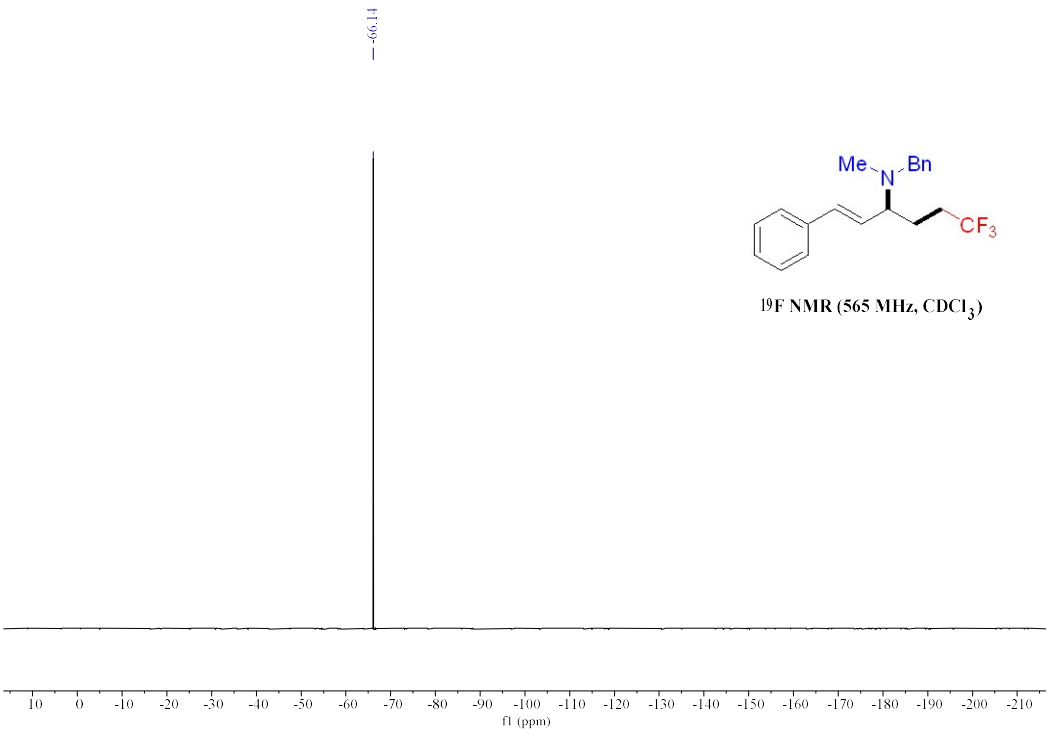


^{19}F NMR (471 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-6,6,6-trifluoro-*N*-methyl-1-phenylhex-1-en-3-amine (6a)

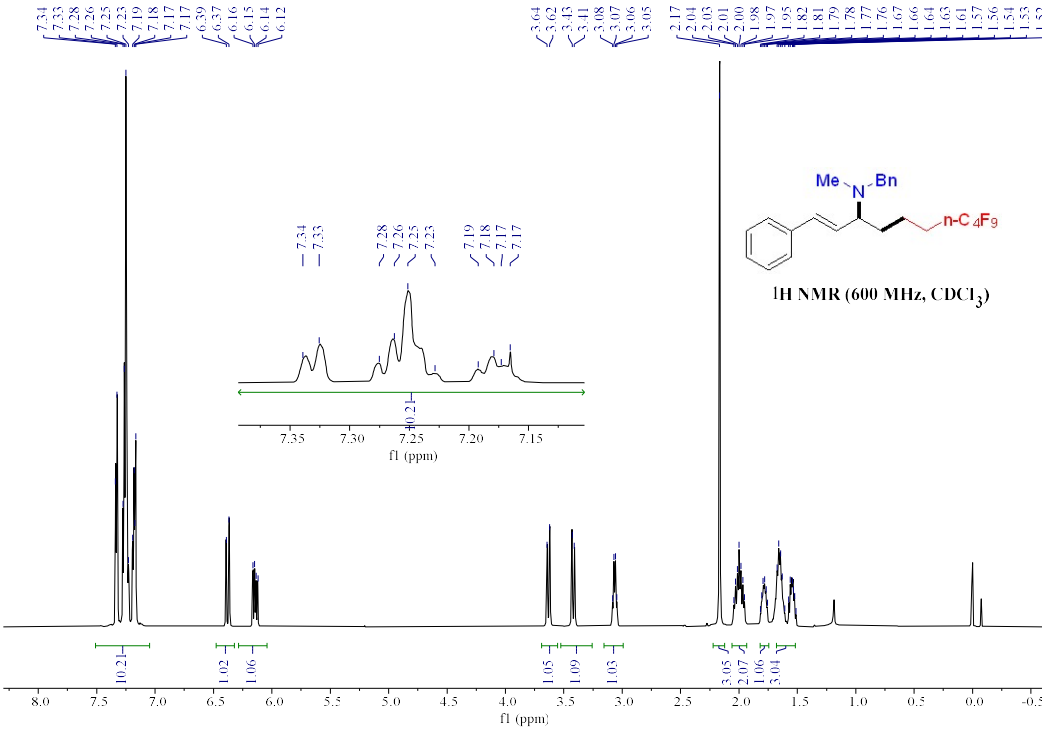


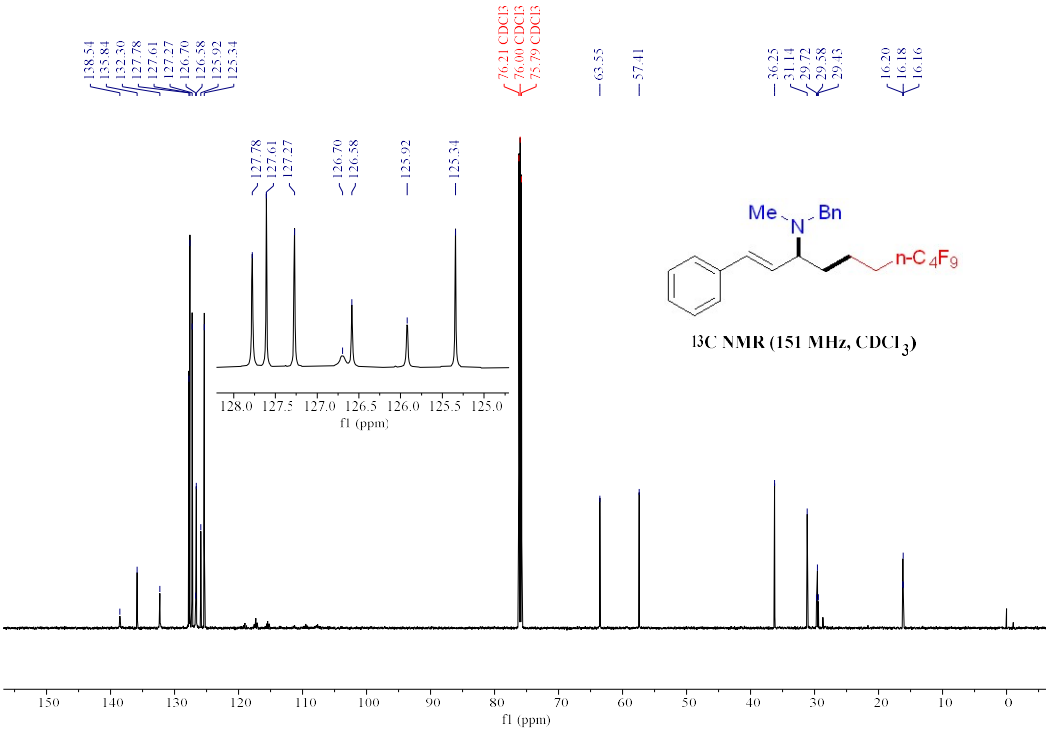


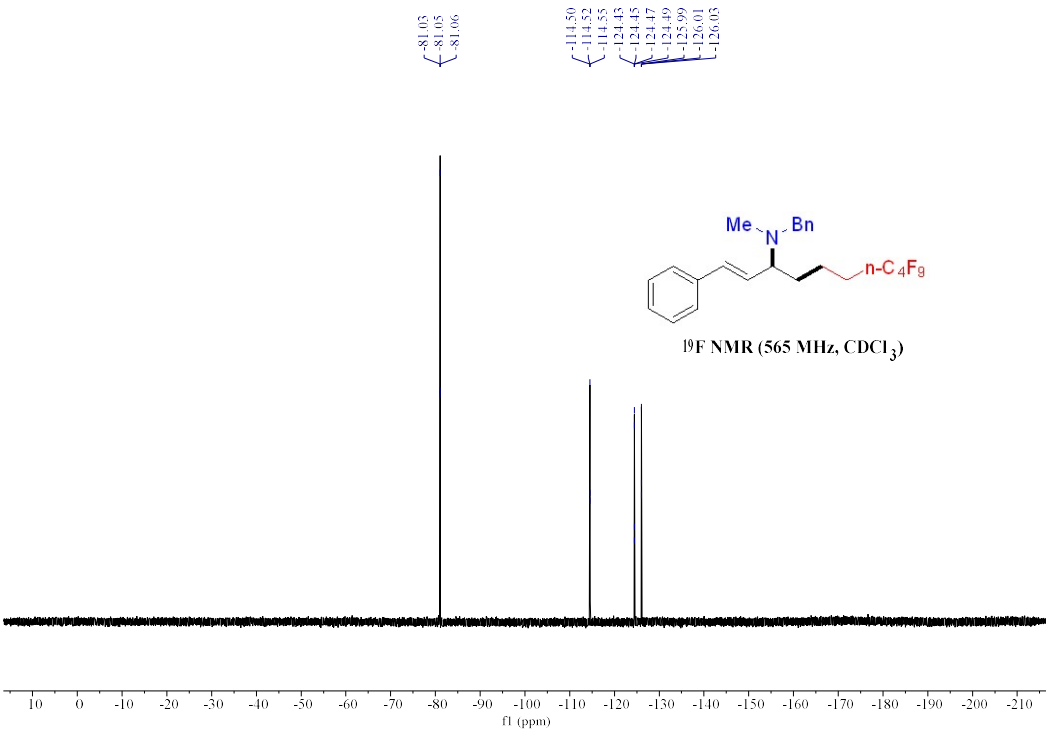


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-benzyl-7,7,8,8,9,9,10,10,10-nonafluoro-N-methyl-1-phenyldec-1-en-3-amin e (6b)

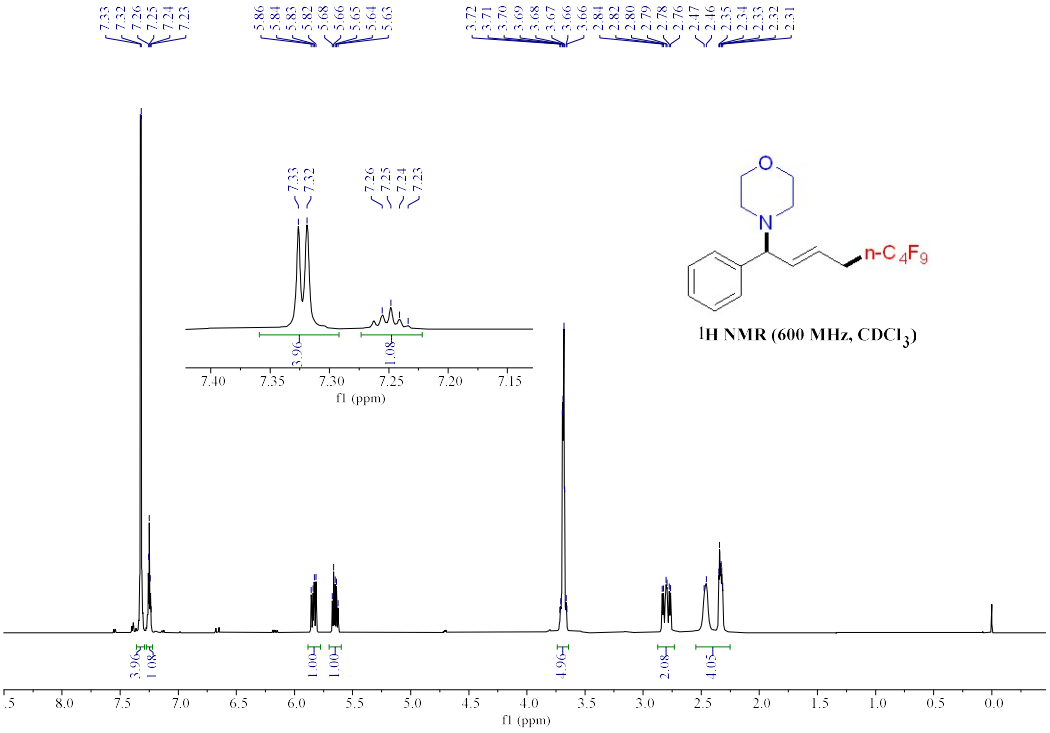


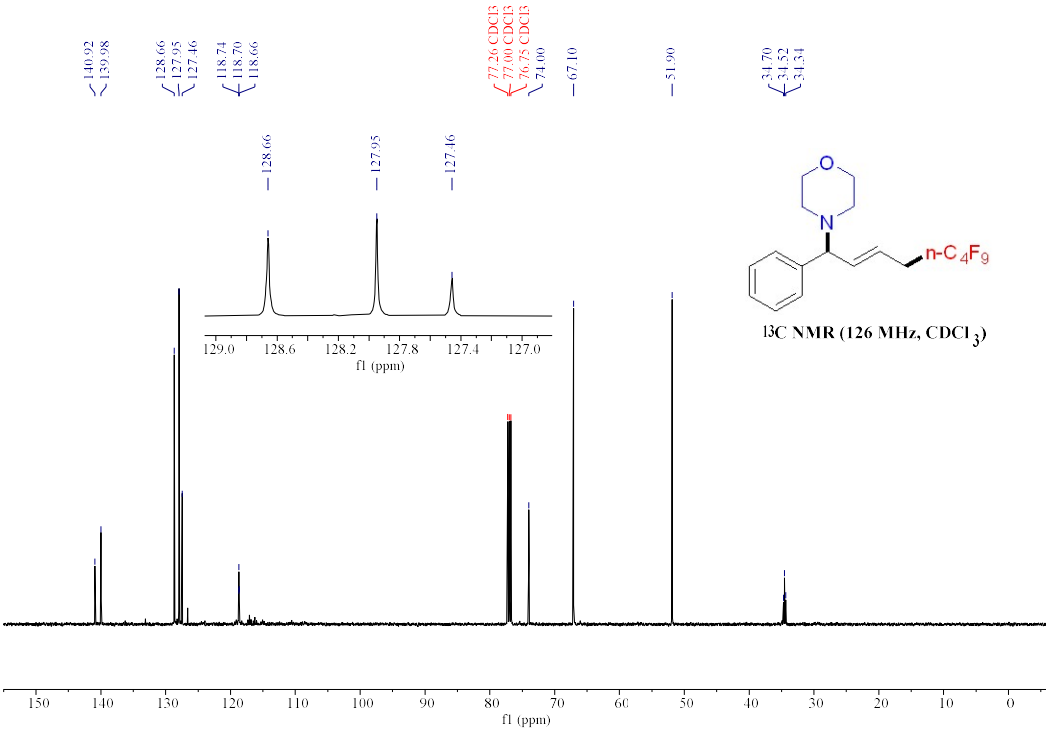


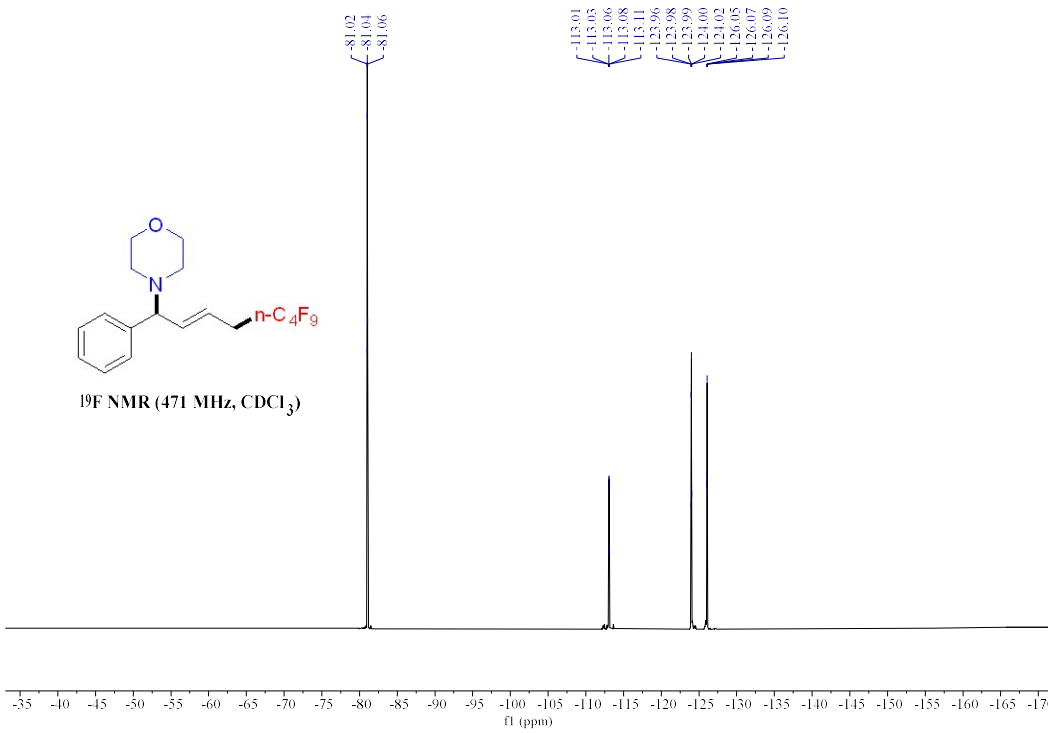


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-4-(5,5,6,6,7,7,8,8,8-Nonafluoro-1-phenyloct-2-en-1-yl)morpholine (6c)

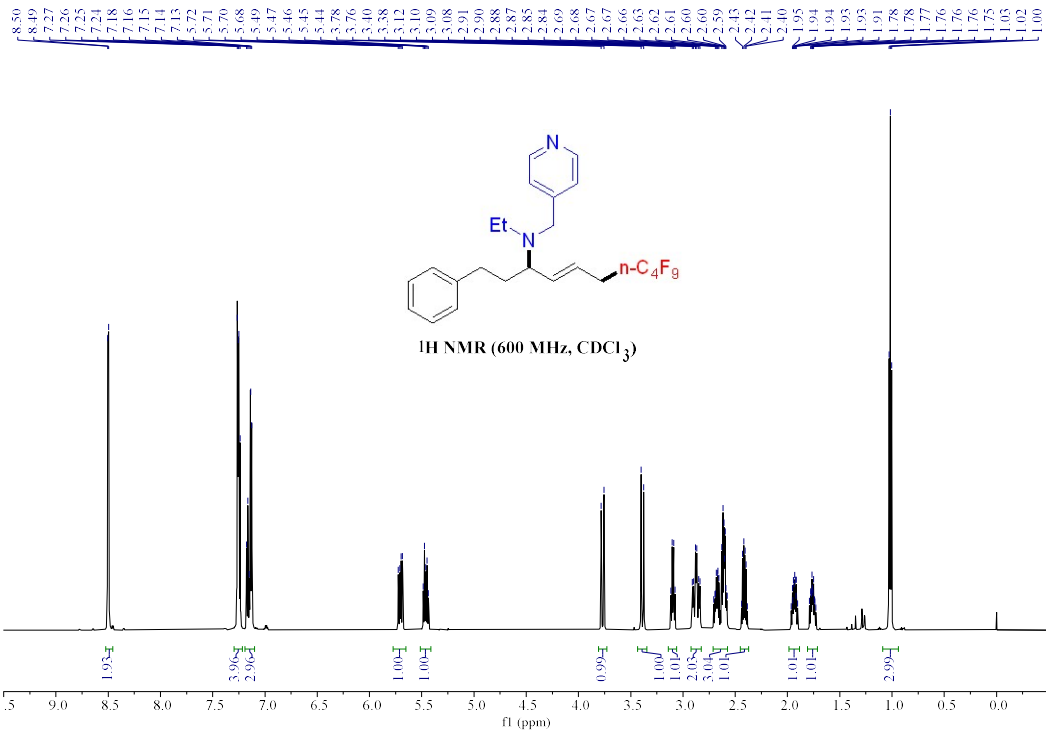


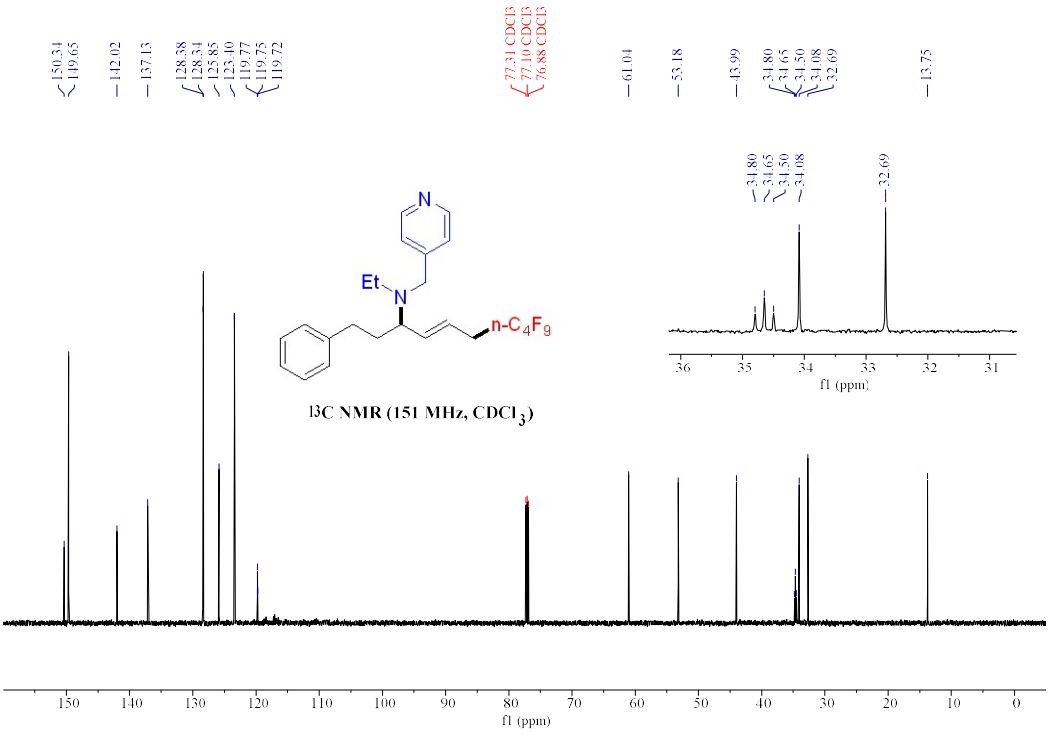


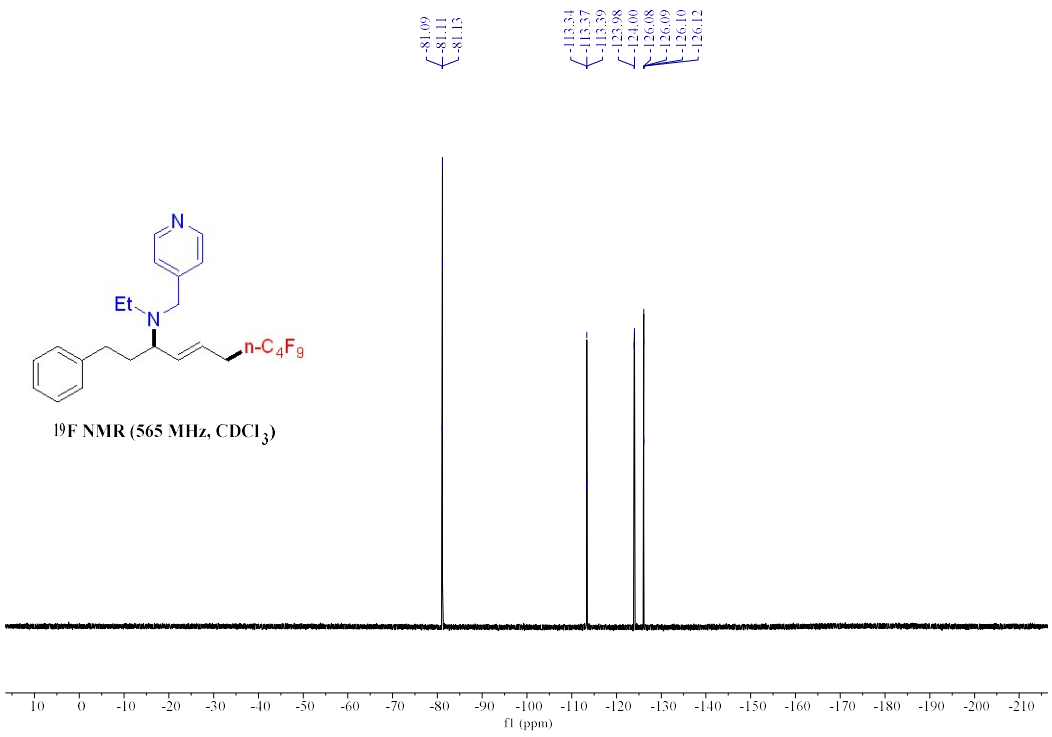


^{19}F NMR (471 MHz, $CDCl_3$)

(*E*)-*N*-Ethyl-7,7,8,8,9,9,10,10,10-nonafluoro-1-phenyl-N-(pyridin-4-ylmethyl)dec-4-en-3-amine (6d)

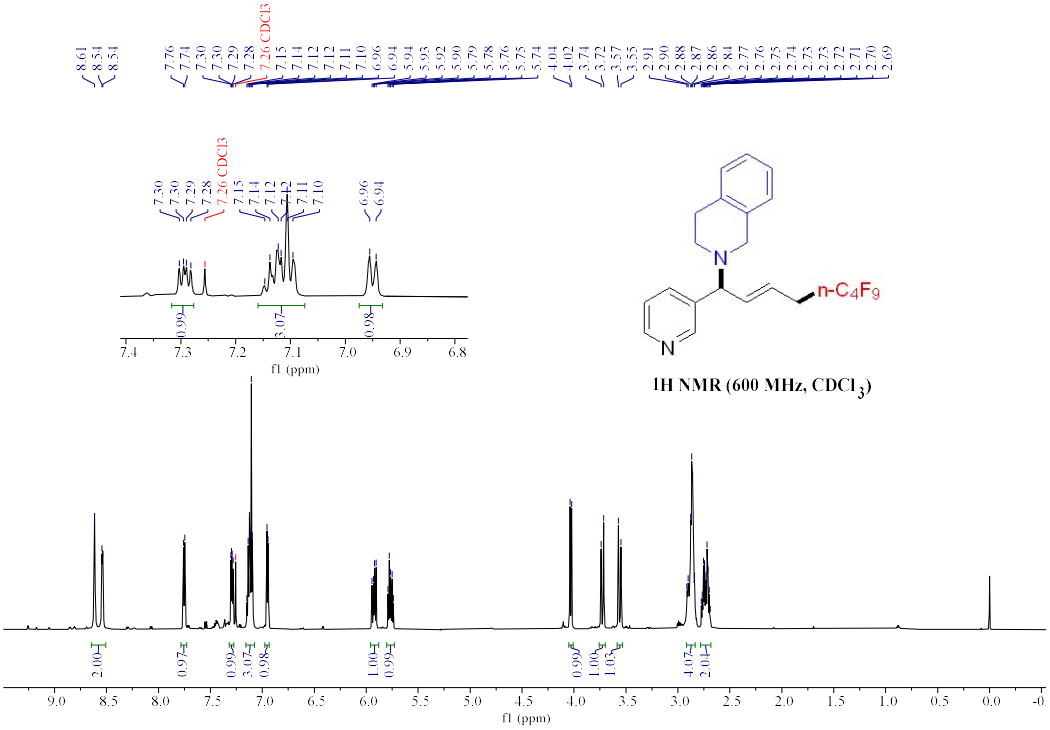


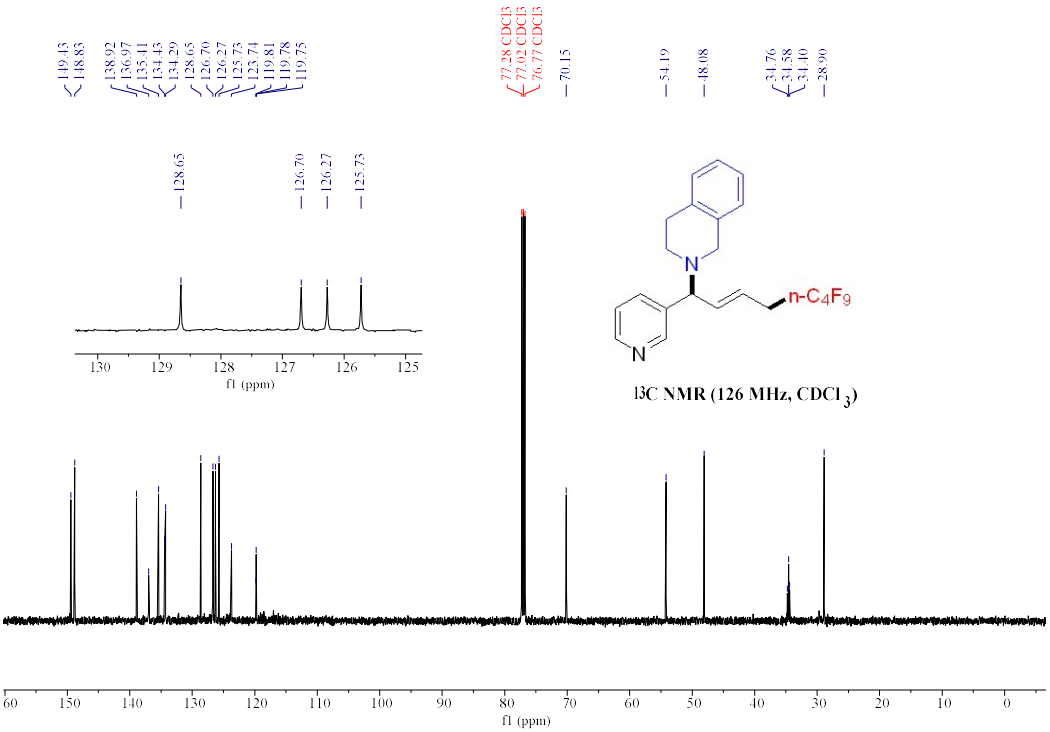


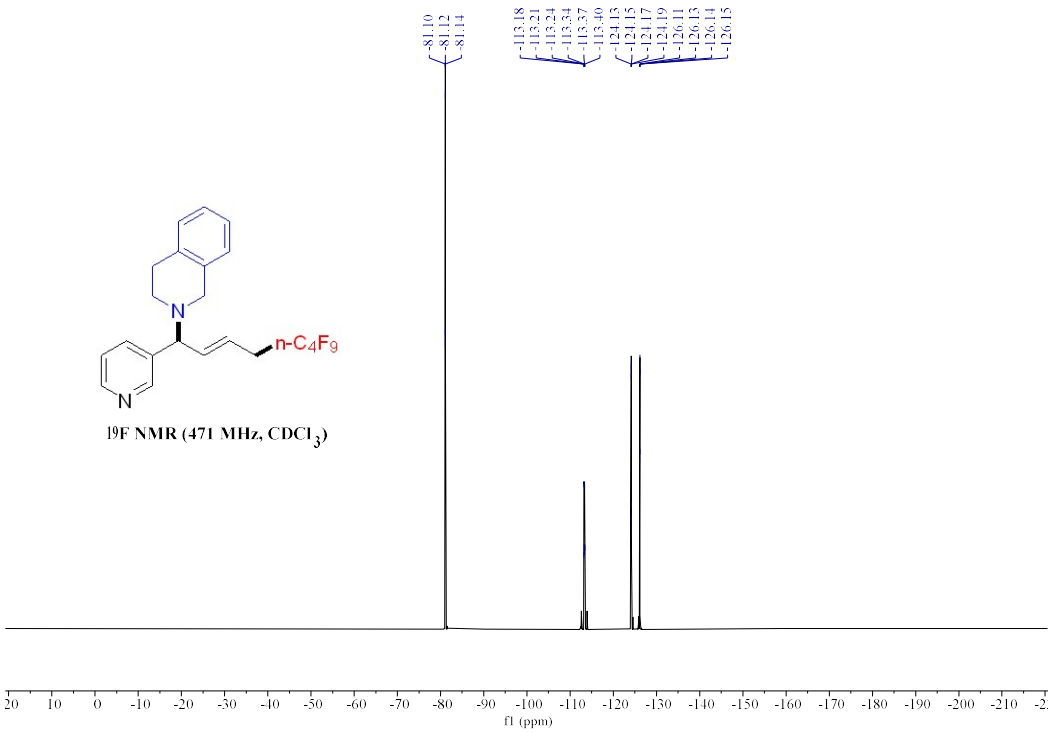


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-2-(5,5,6,6,7,7,8,8,8-Nonafluoro-1-(pyridin-3-yl)oct-2-en-1-yl)-1,2,3,4-tetrahydroisoquinoline (6e)

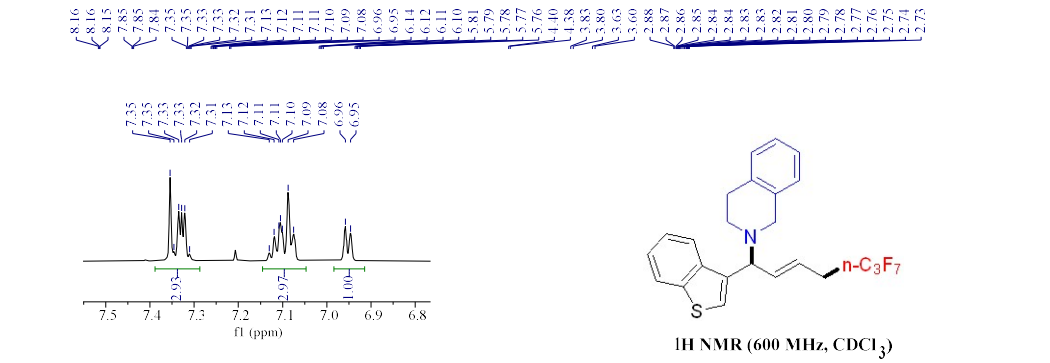


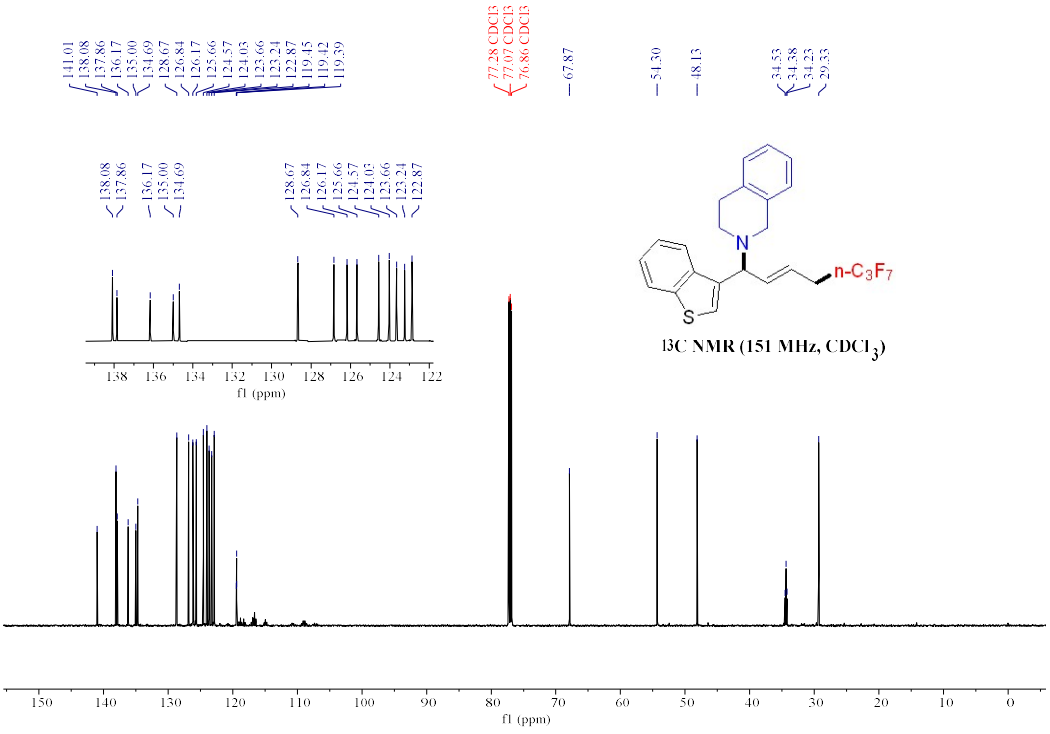


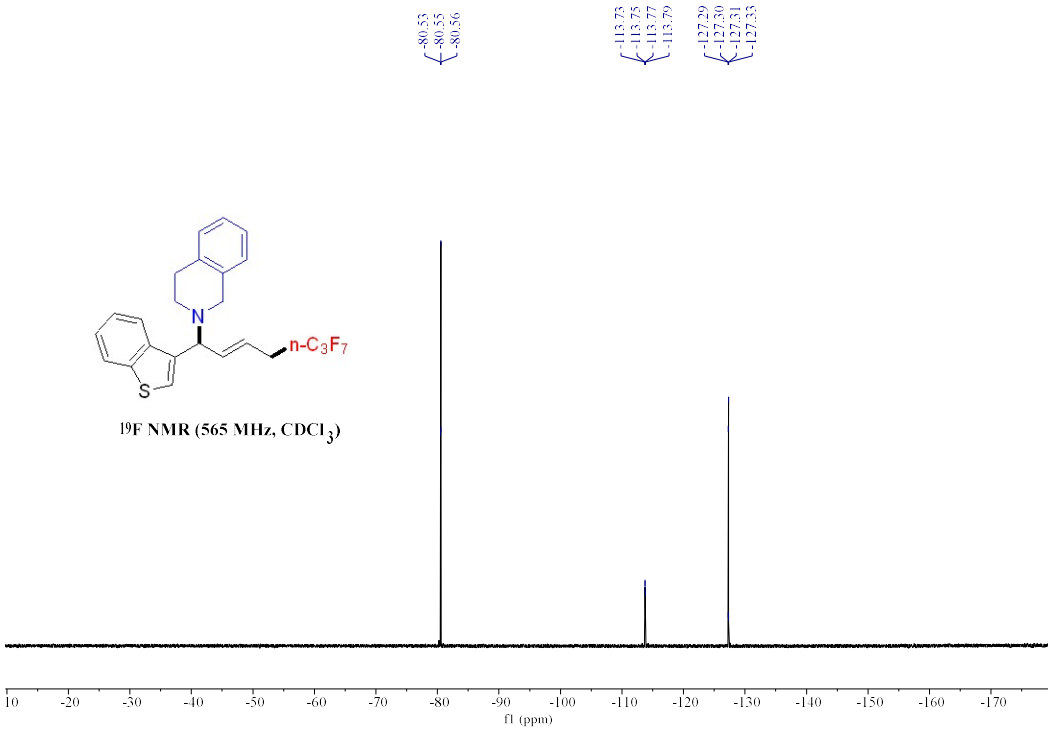


^{19}F NMR (471 MHz, $CDCl_3$)

(*E*)-2-(1-(Benzo[b]thiophen-3-yl)-5,5,6,6,7,7,7-heptafluorohept-2-en-1-yl)-1,2,3,4-tetrahydroisoquinoline (6f)

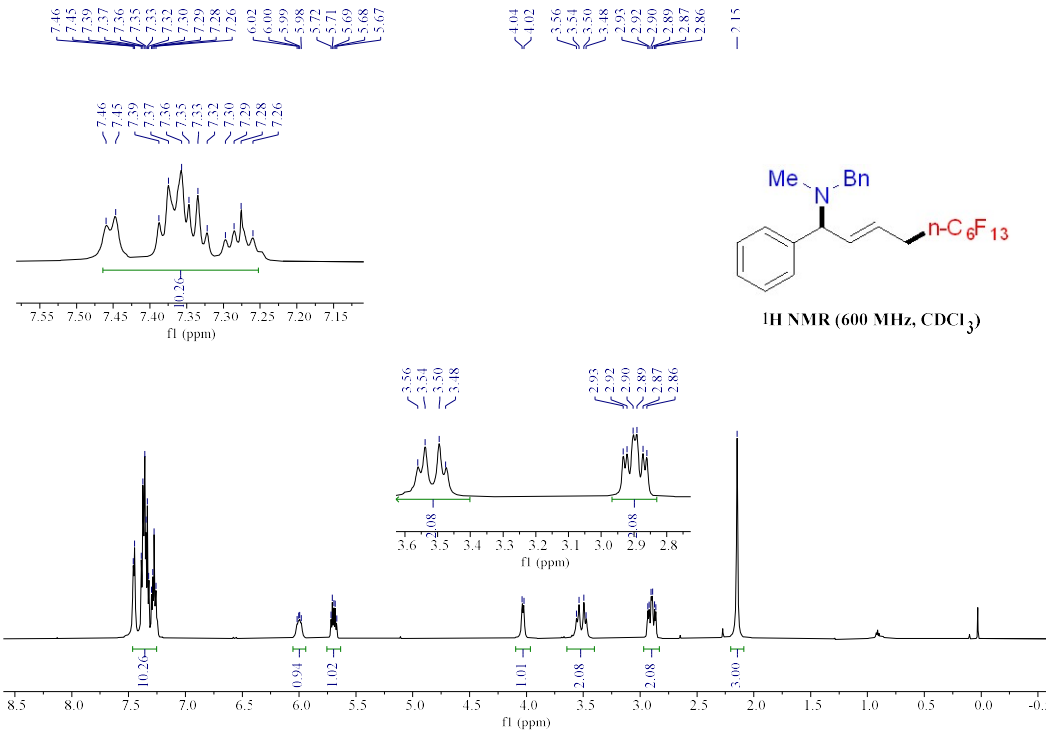


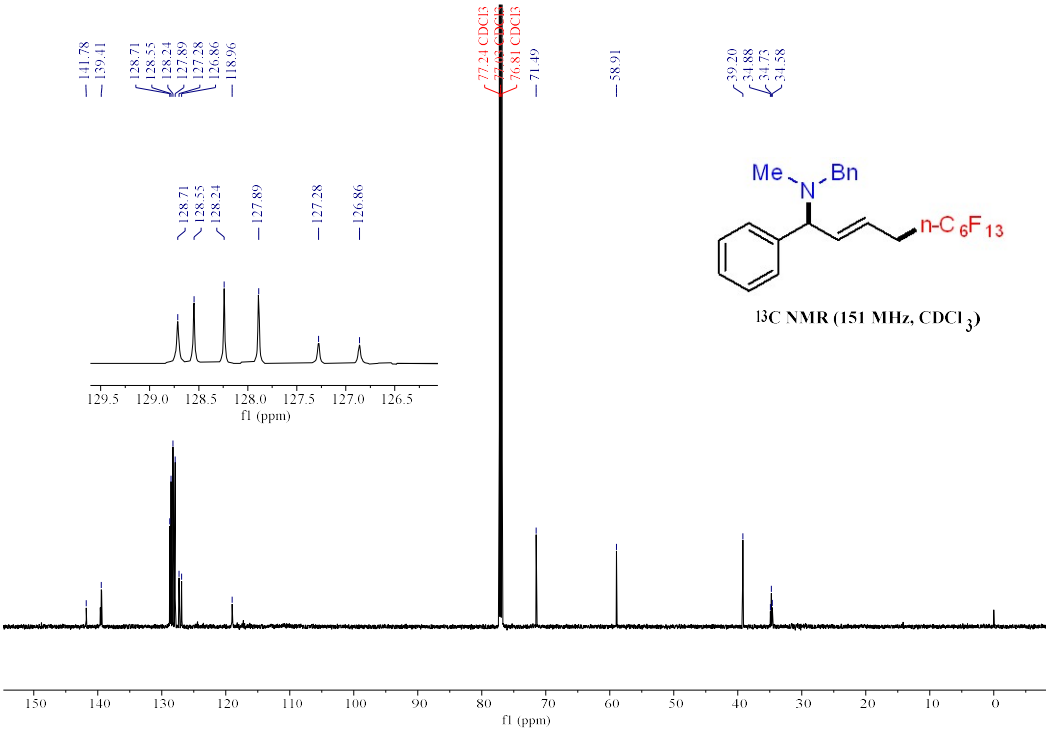


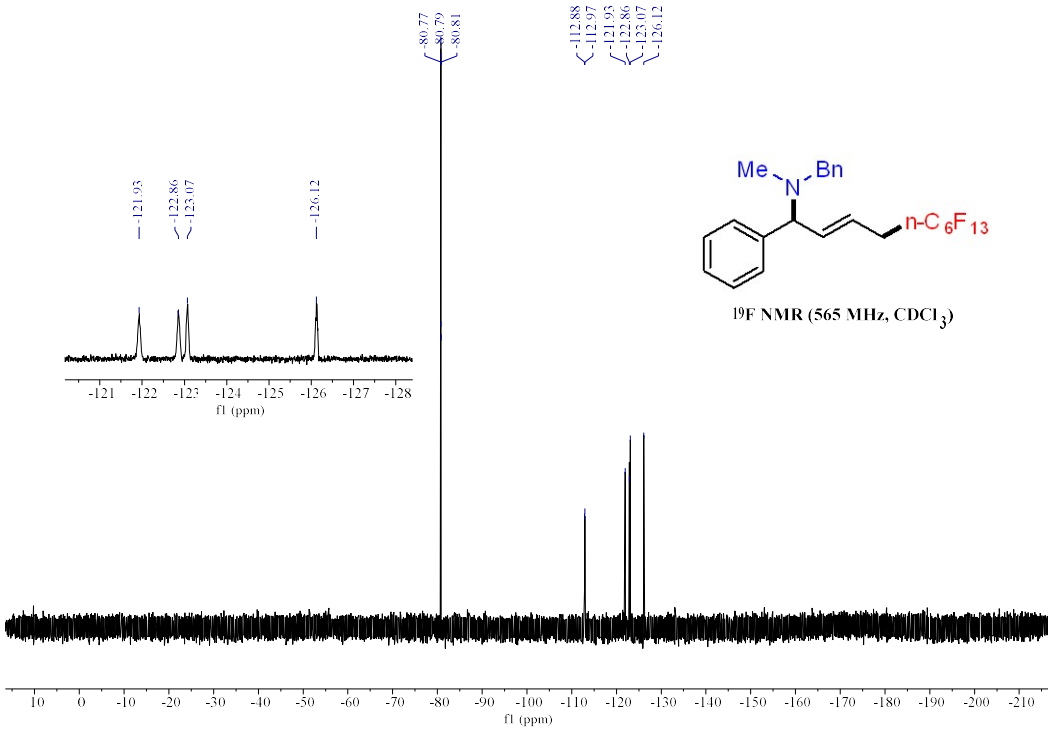


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-*N*-Benzyl-5,5,6,6,7,7,8,8,8,9,9,10,10,10-tridecafluoro-*N*-methyl-1-phenyldec-2-en-1-amine (6g)

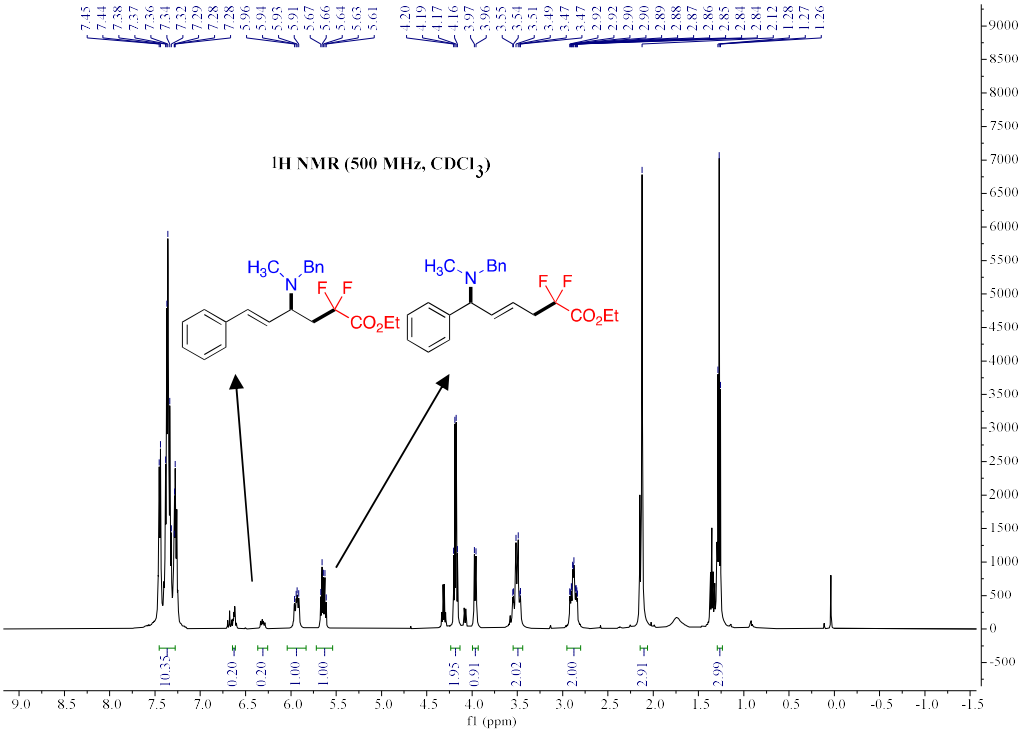






^{19}F NMR (565 MHz, $CDCl_3$)

Ethyl (*E*)-6-(benzyl(methyl)amino)-2,2-difluoro-6-phenylhex-4-enoate (6h)



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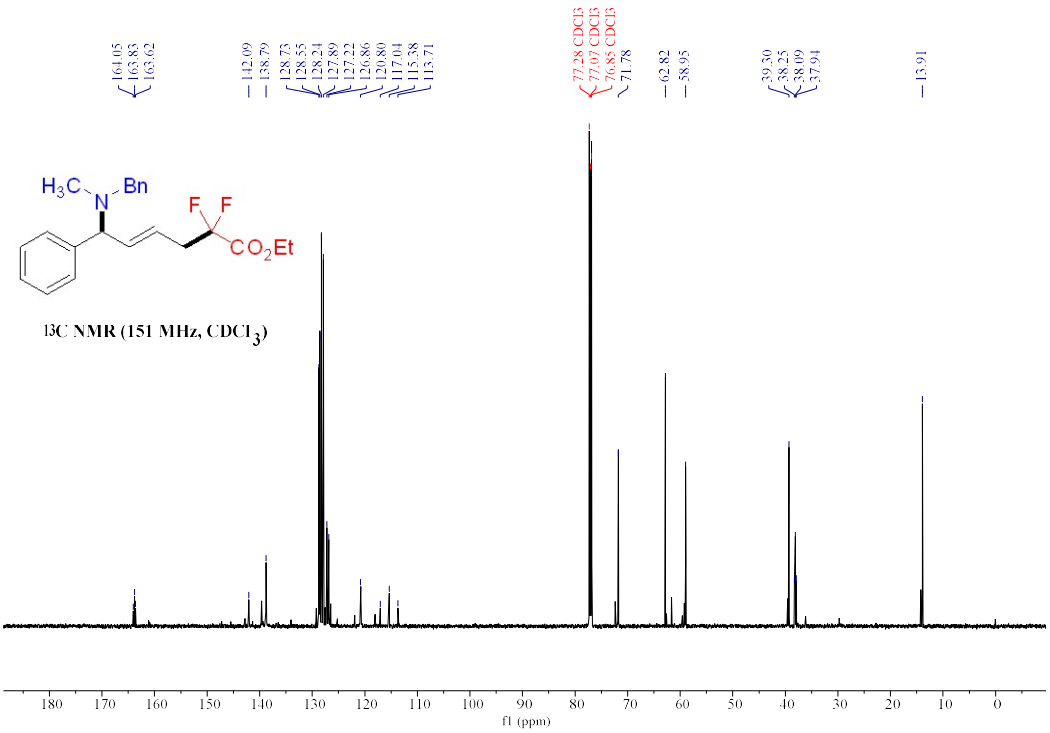
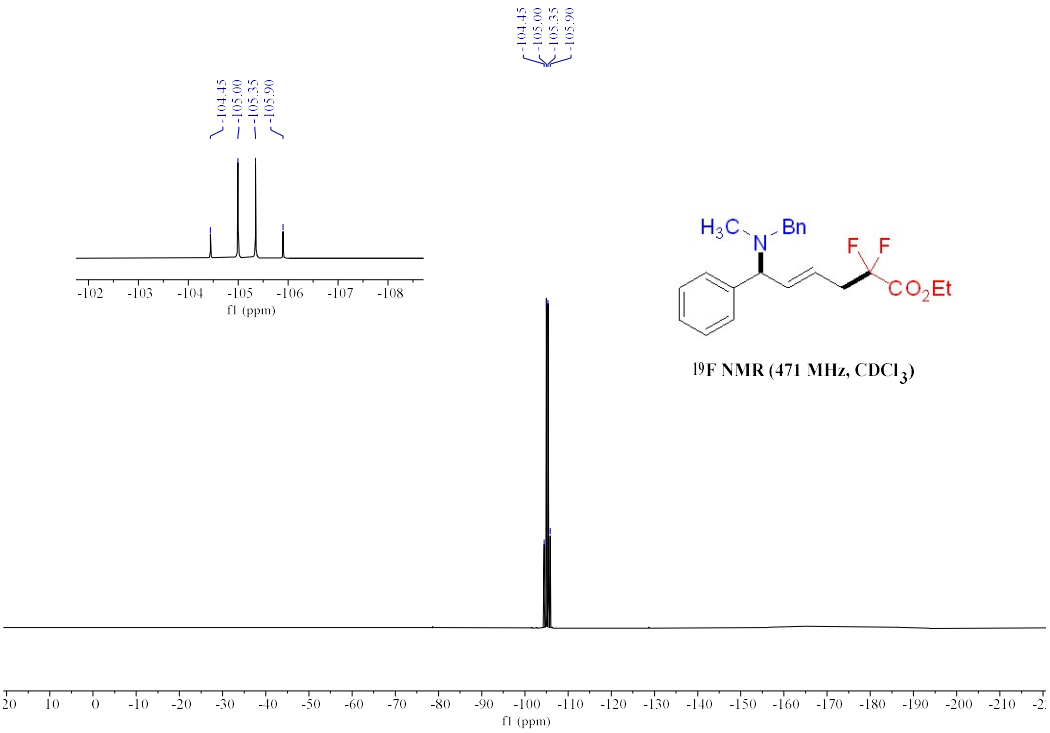
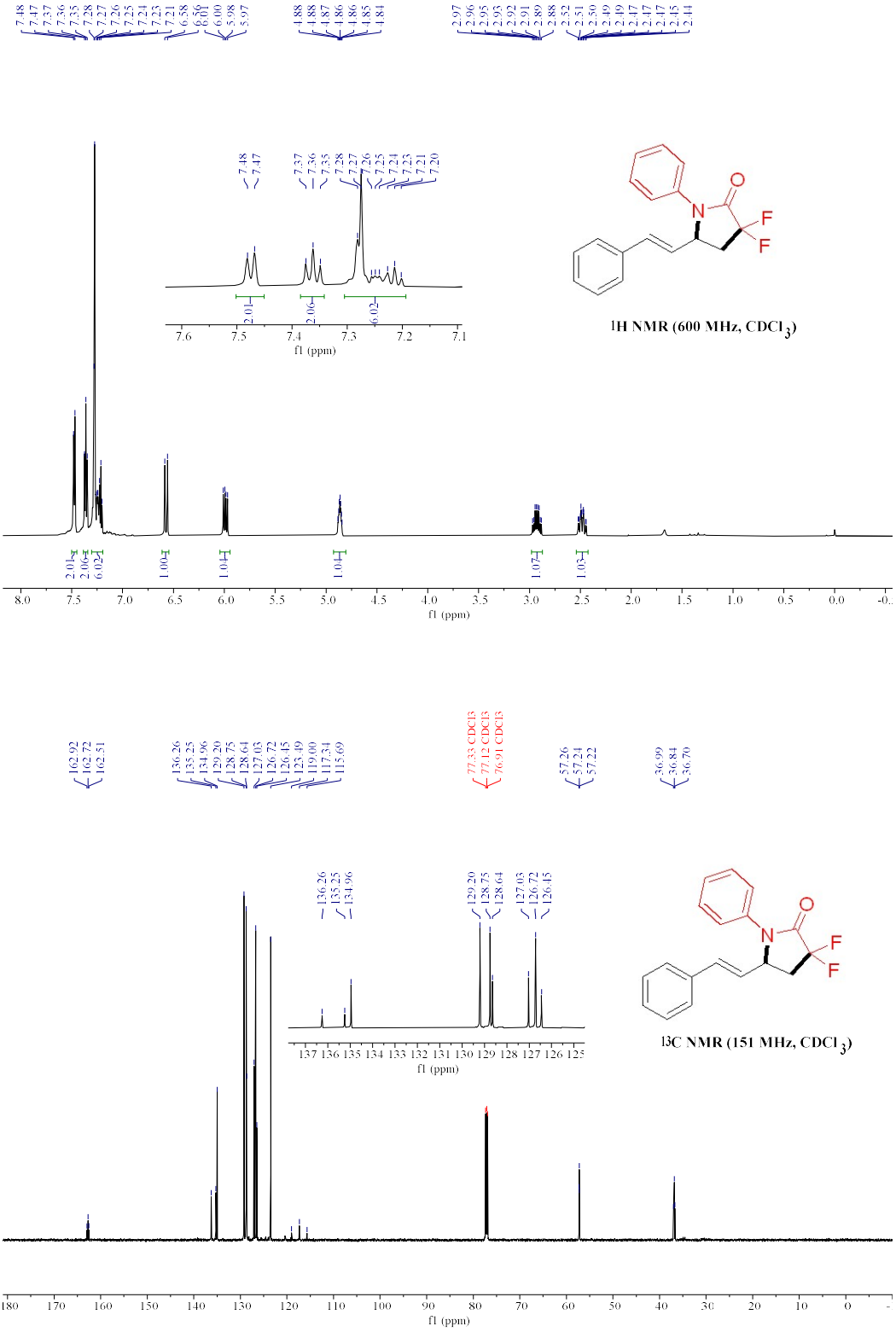
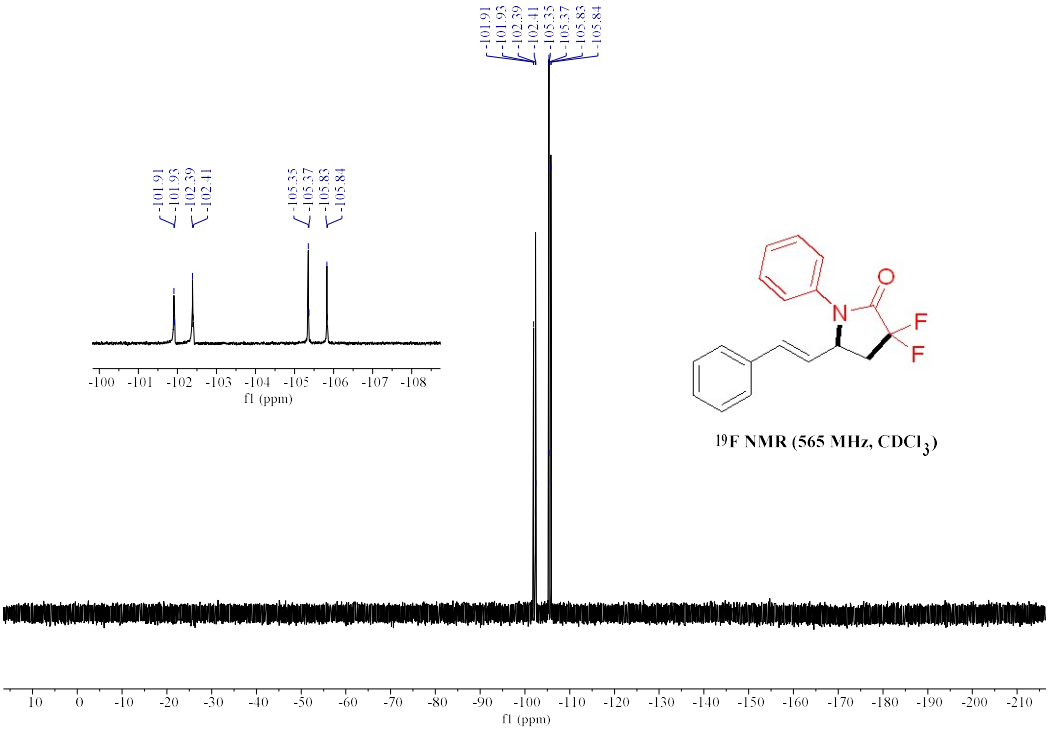




^{19}F NMR (471 MHz, $CDCl_3$)

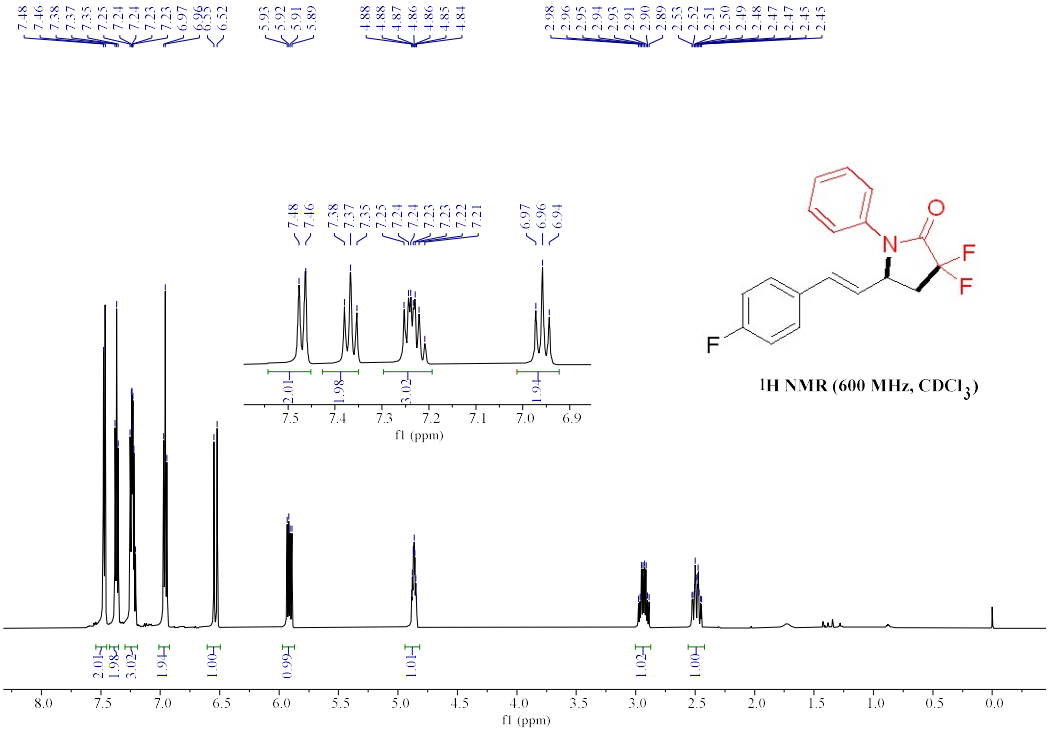
(*E*)-3,3-Difluoro-1-phenyl-5-styrylpyrrolidin-2-one (8a)

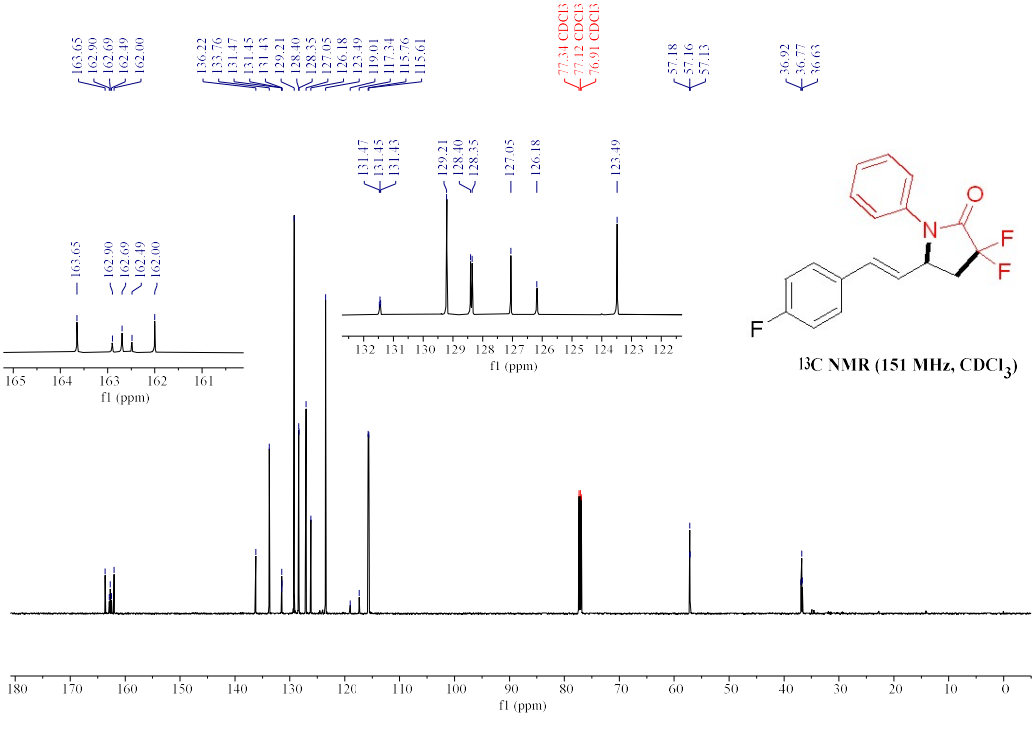


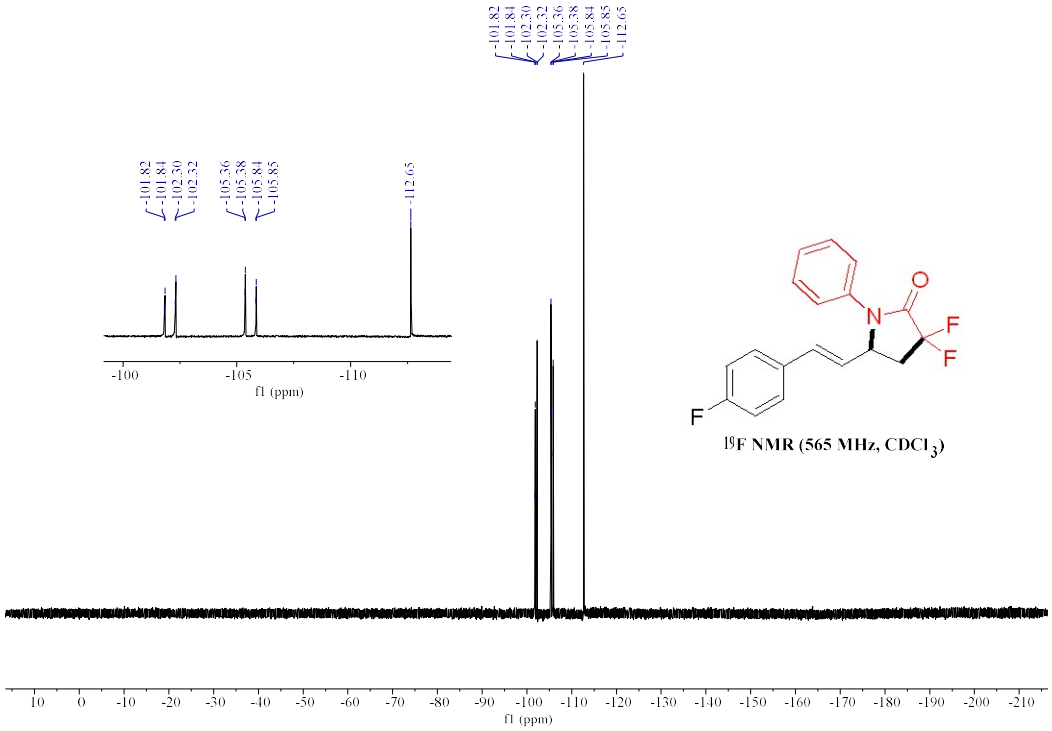


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-3,3-Difluoro-5-(4-fluorostyryl)-1-phenylpyrrolidin-2-one (8b)

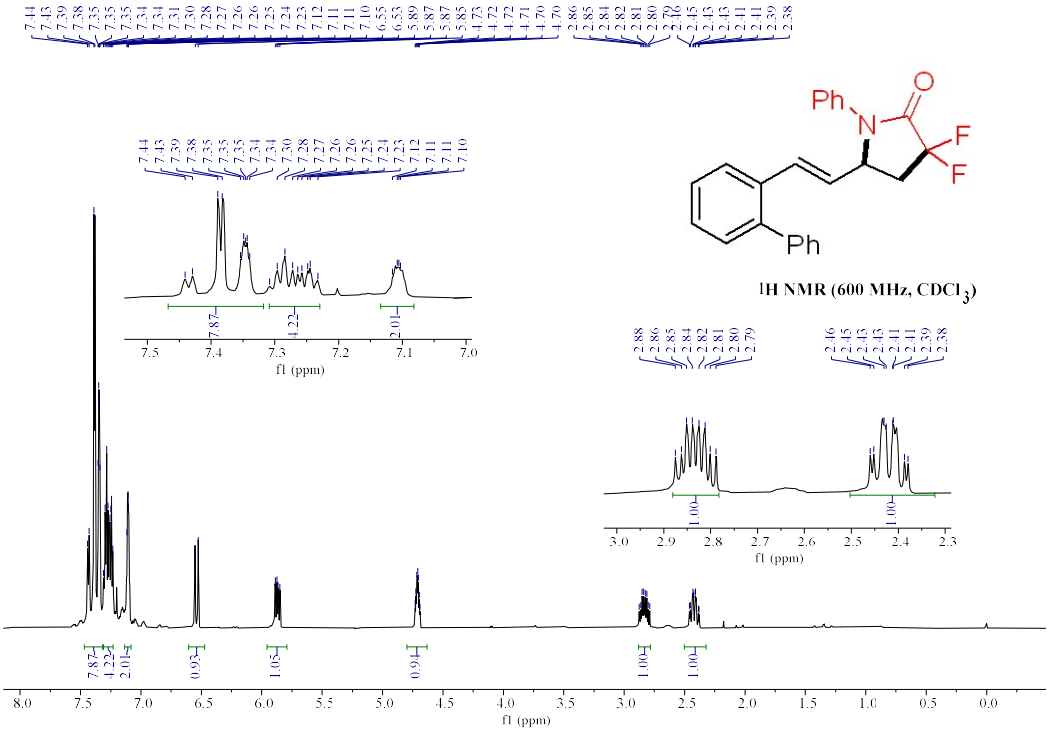


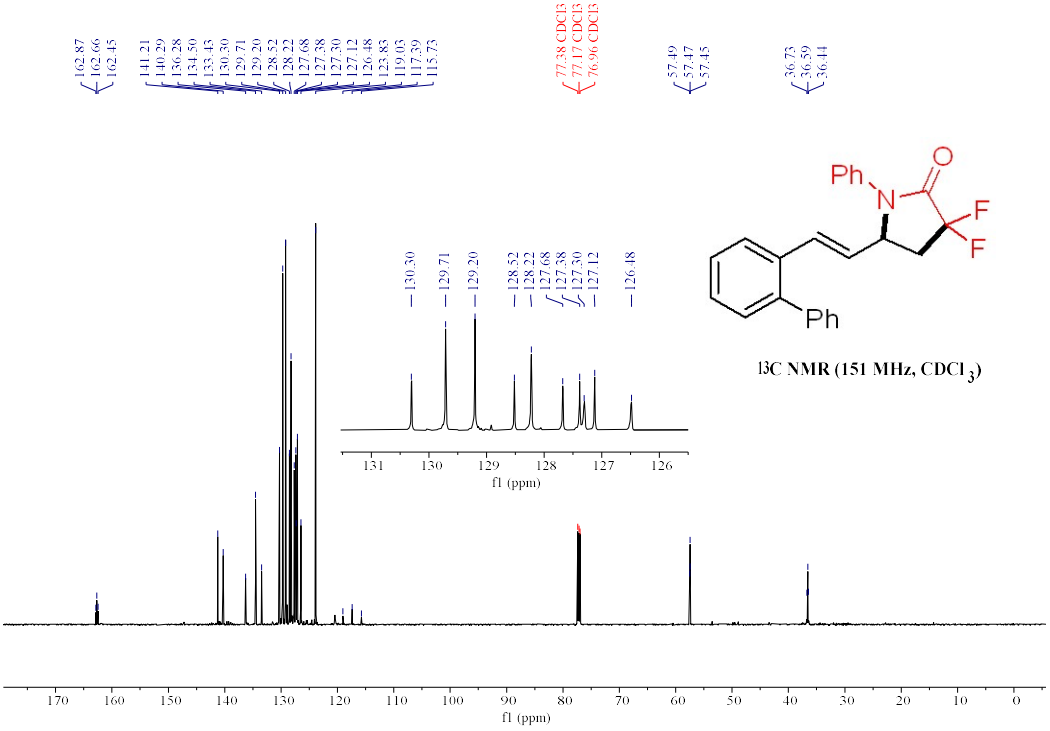


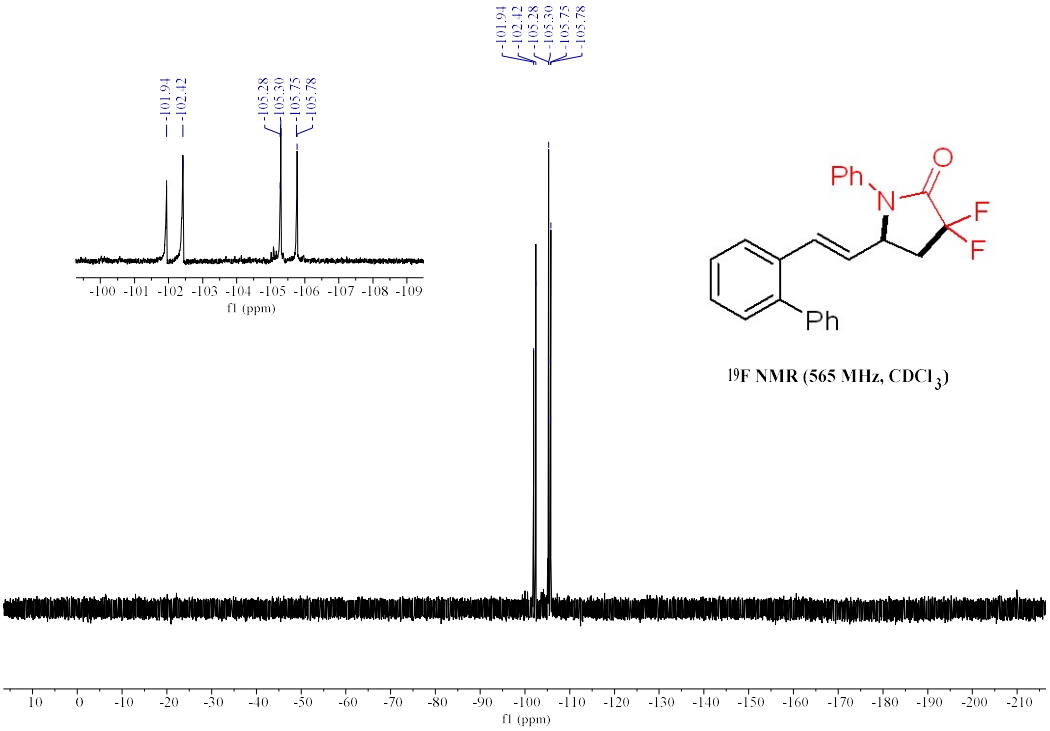


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-5-(2-([1,1'-Biphenyl]-2-yl)vinyl)-3,3-difluoro-1-phenylpyrrolidin-2-one (8c)

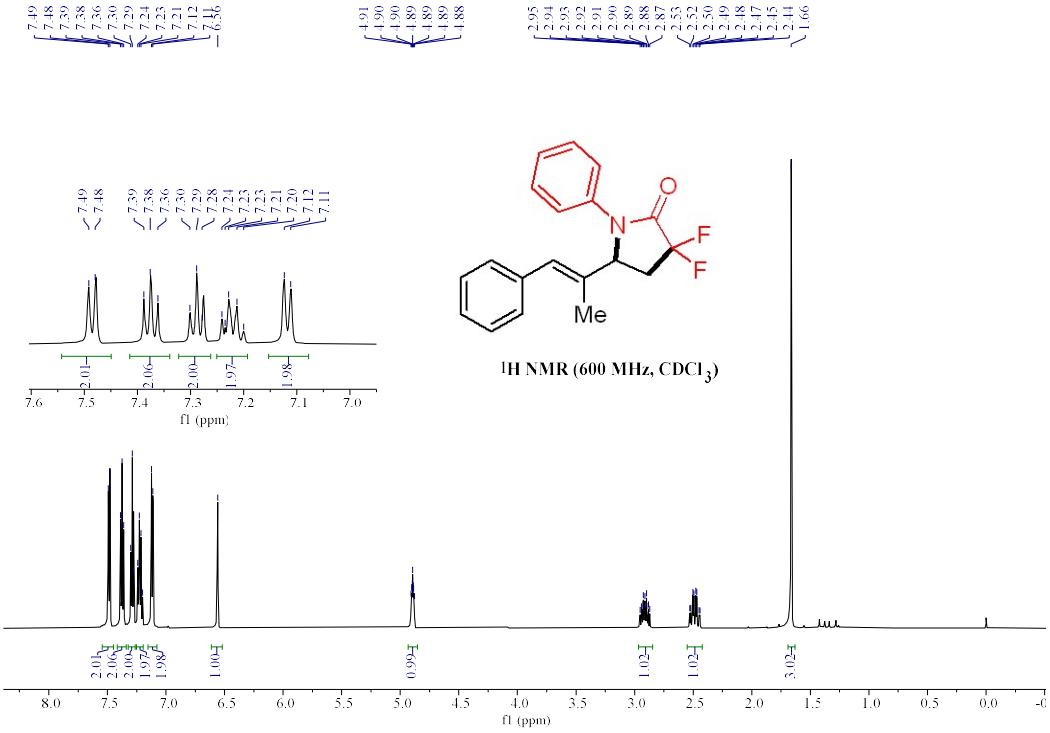


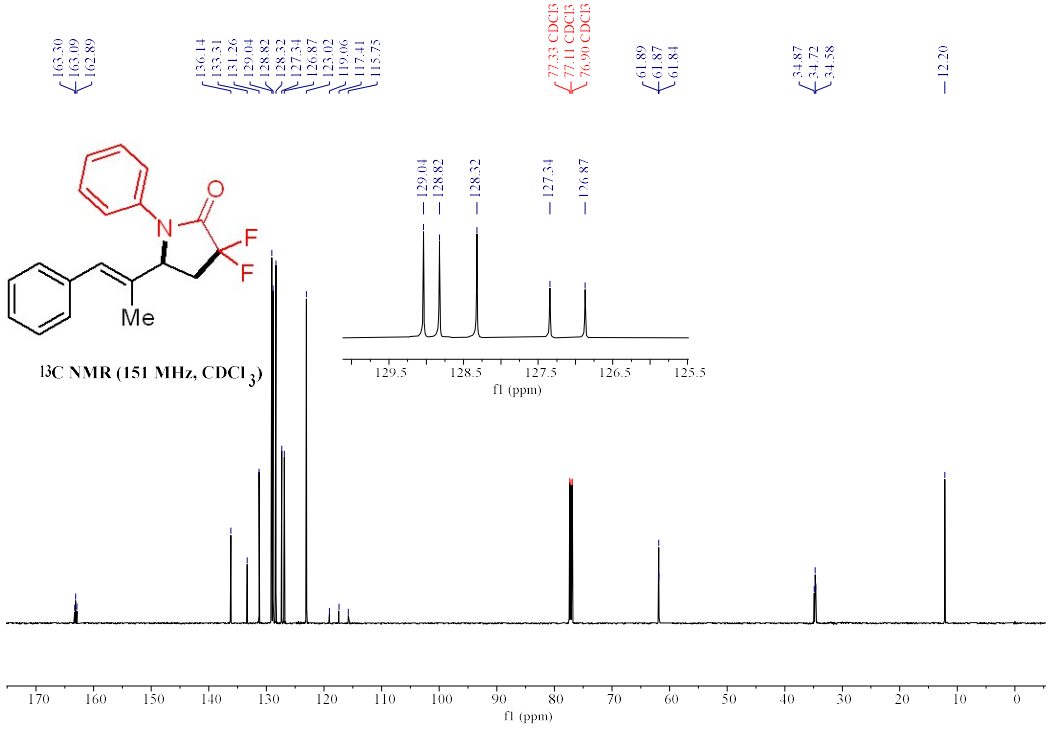


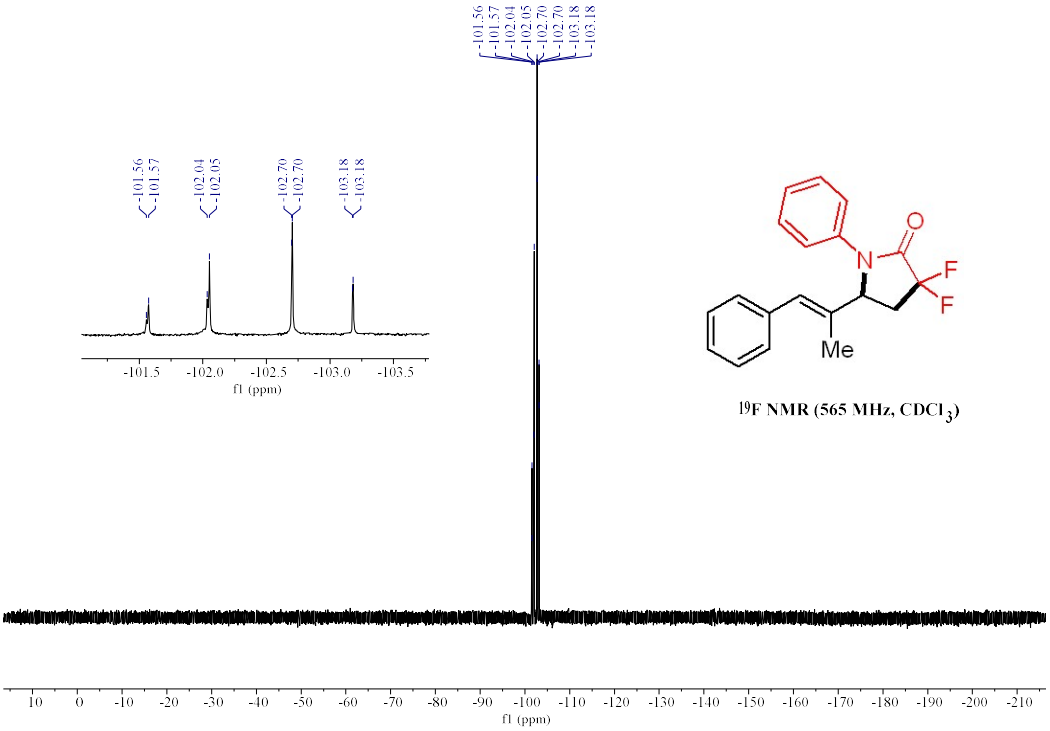


^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-3,3-Difluoro-1-phenyl-5-(1-phenylprop-1-en-2-yl)pyrrolidin-2-one (8d)

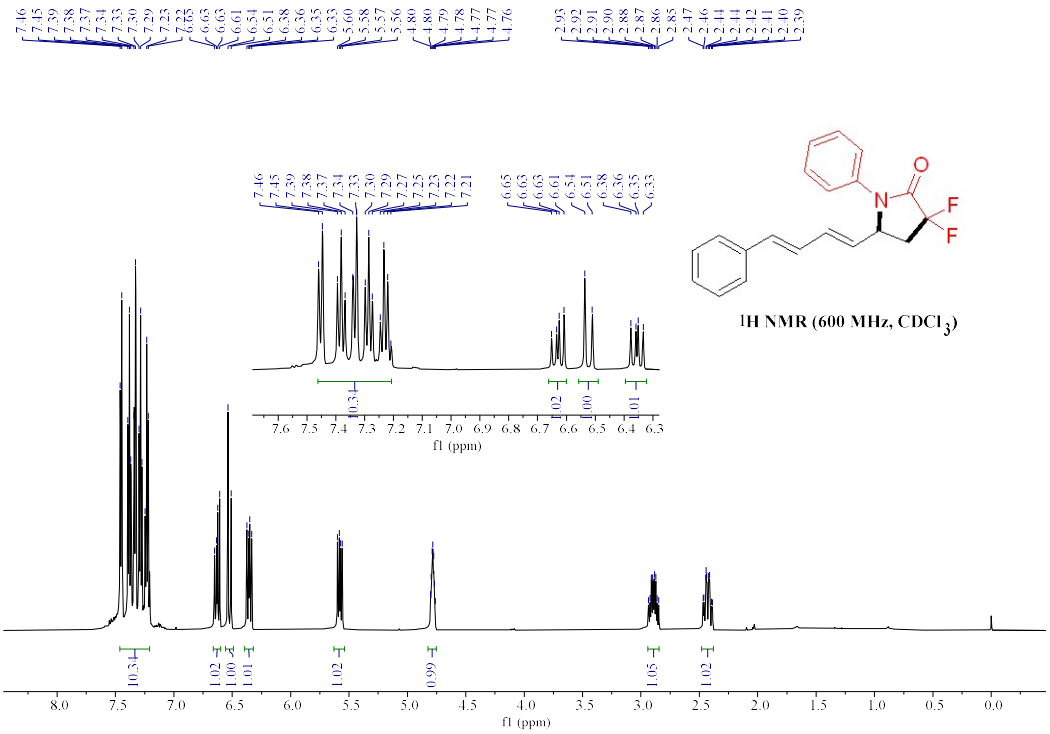


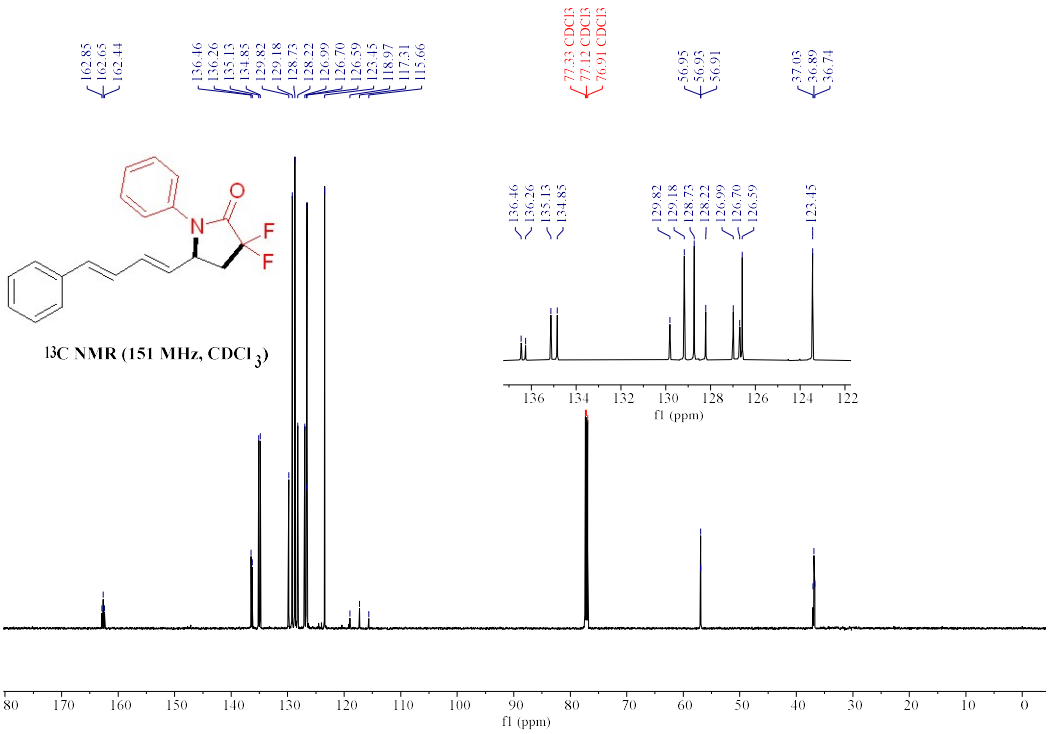


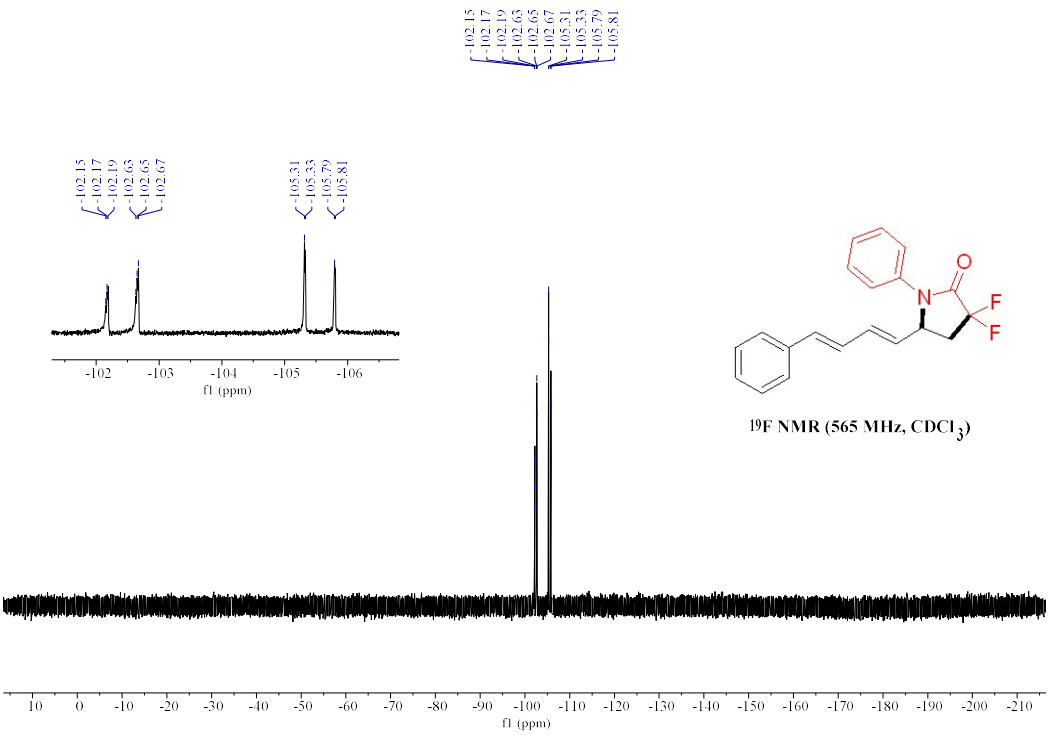


^{19}F NMR (565 MHz, $CDCl_3$)

3,3-Difluoro-1-phenyl-5-((1*E*,3*E*)-4-phenylbuta-1,3-dien-1-yl)pyrrolidin-2-one (8e)

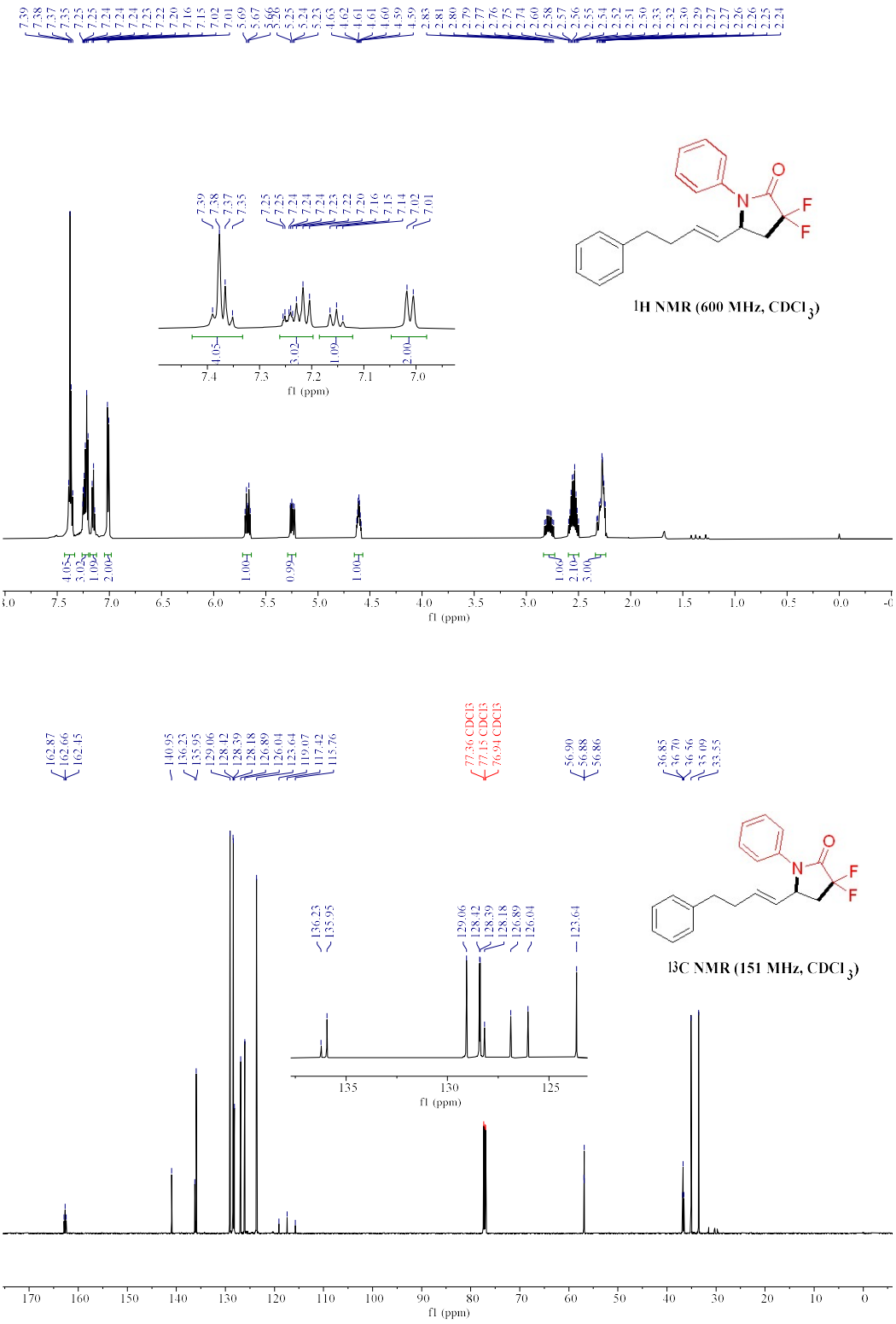


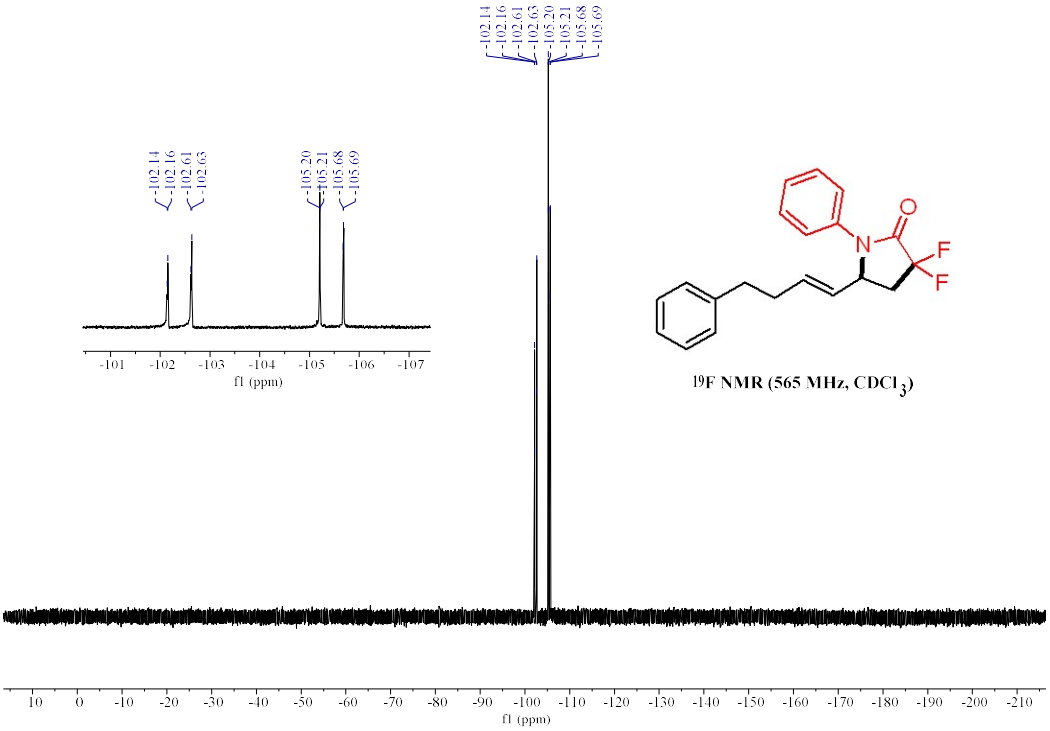




^{19}F NMR (565 MHz, $CDCl_3$)

(*E*)-3,3-Difluoro-1-phenyl-5-(4-phenylbut-1-en-1-yl)pyrrolidin-2-one (8f)

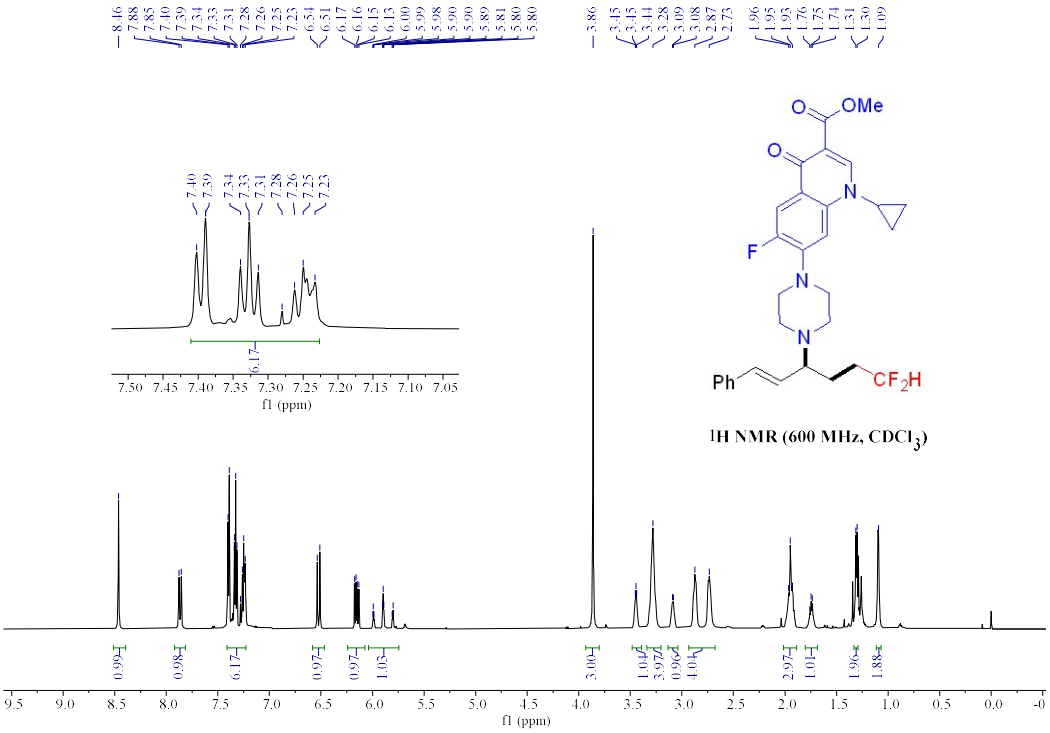


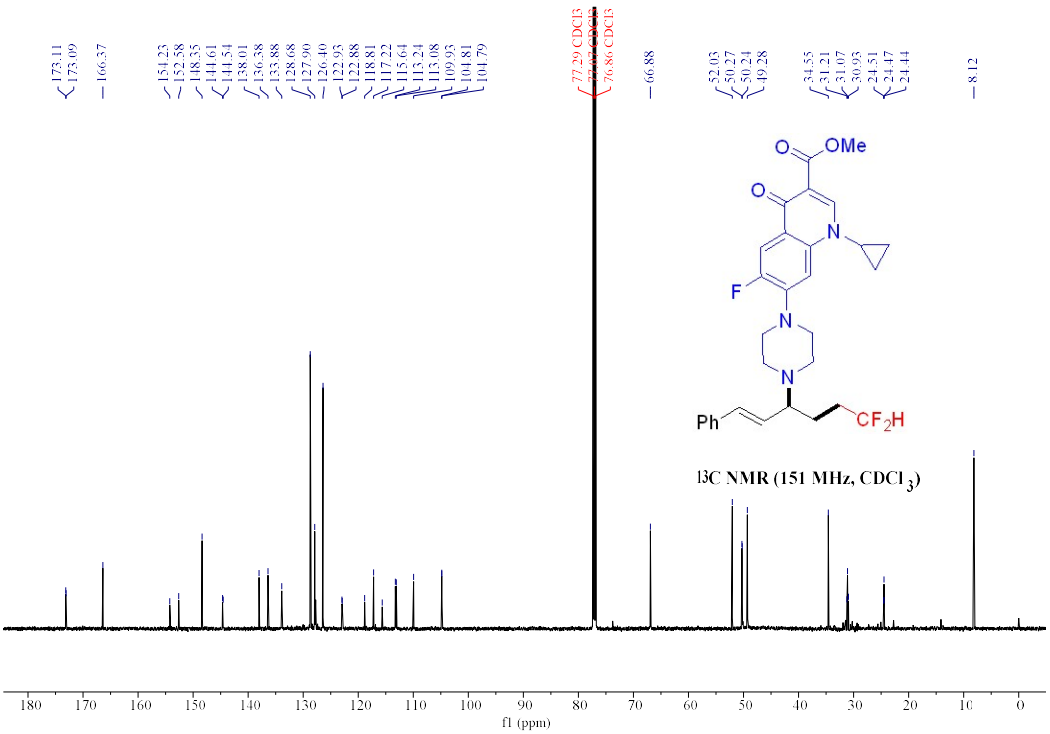


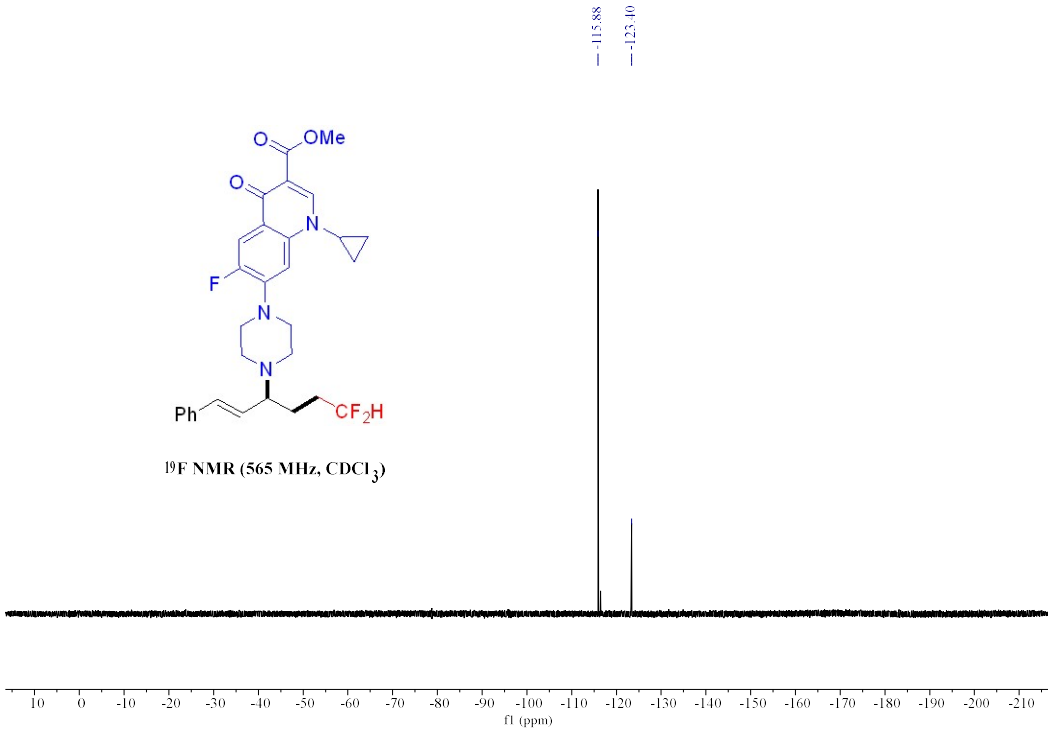
^{19}F NMR (565 MHz, $CDCl_3$)

Methyl

(*E*)-1-cyclopropyl-7-(4-(6,6-difluoro-1-phenylhex-1-en-3-yl)piperazin-1-yl)-6-fluoro-4-oxo-1,4-dihydroquinoline-3-carboxylate (9a)

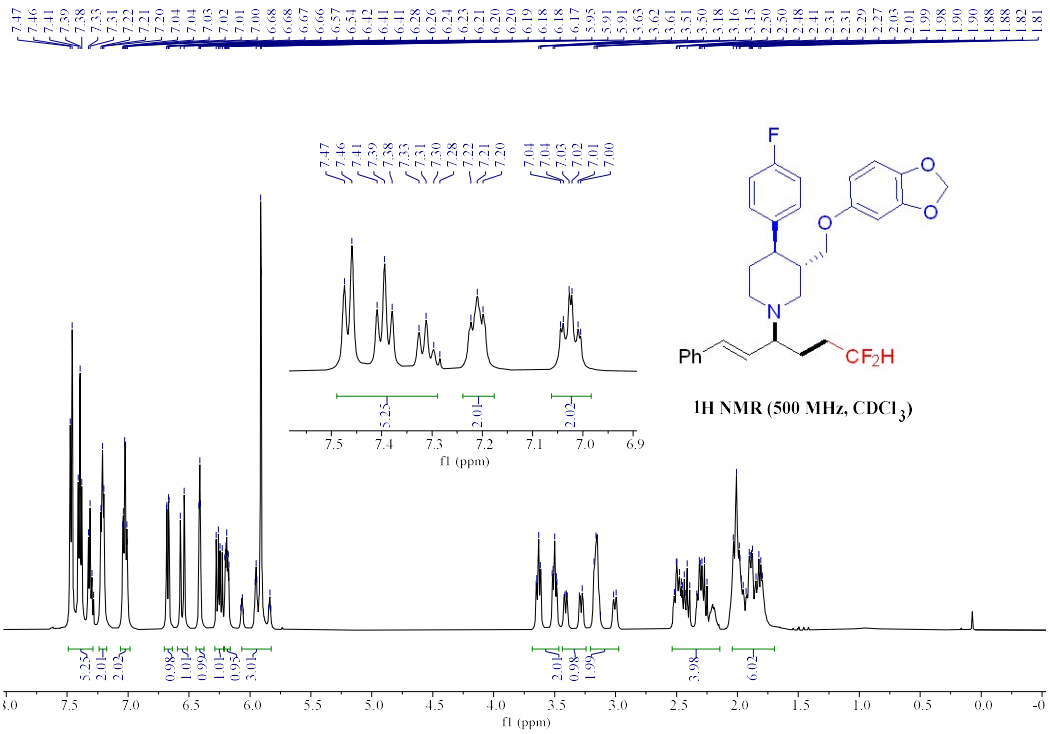


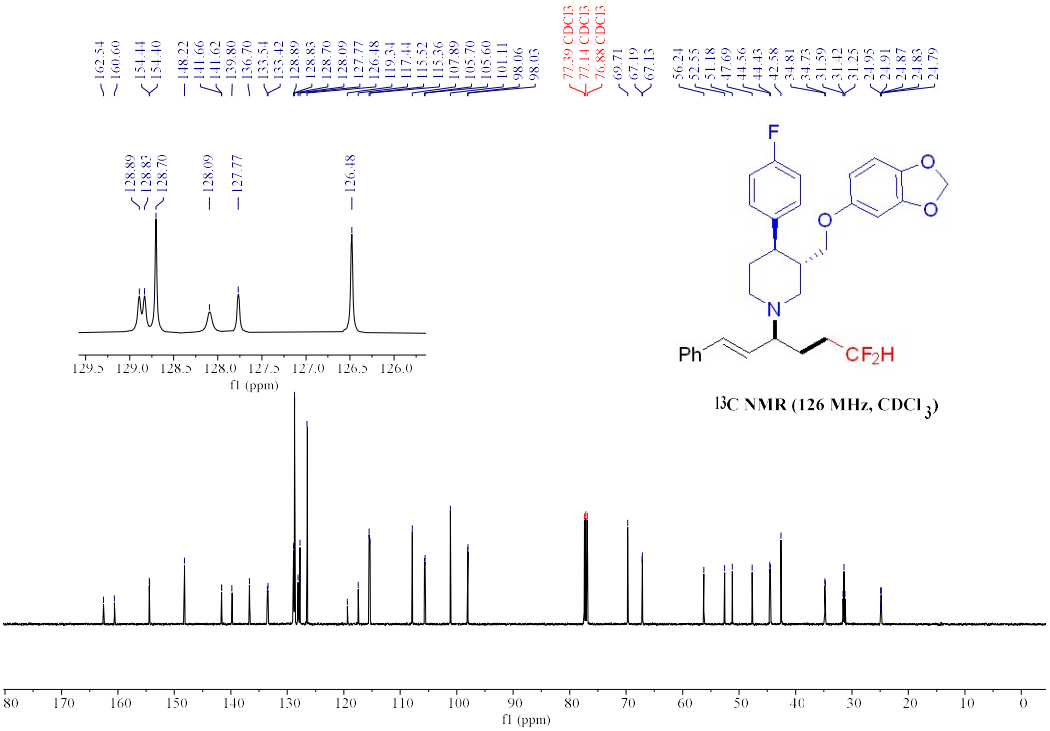


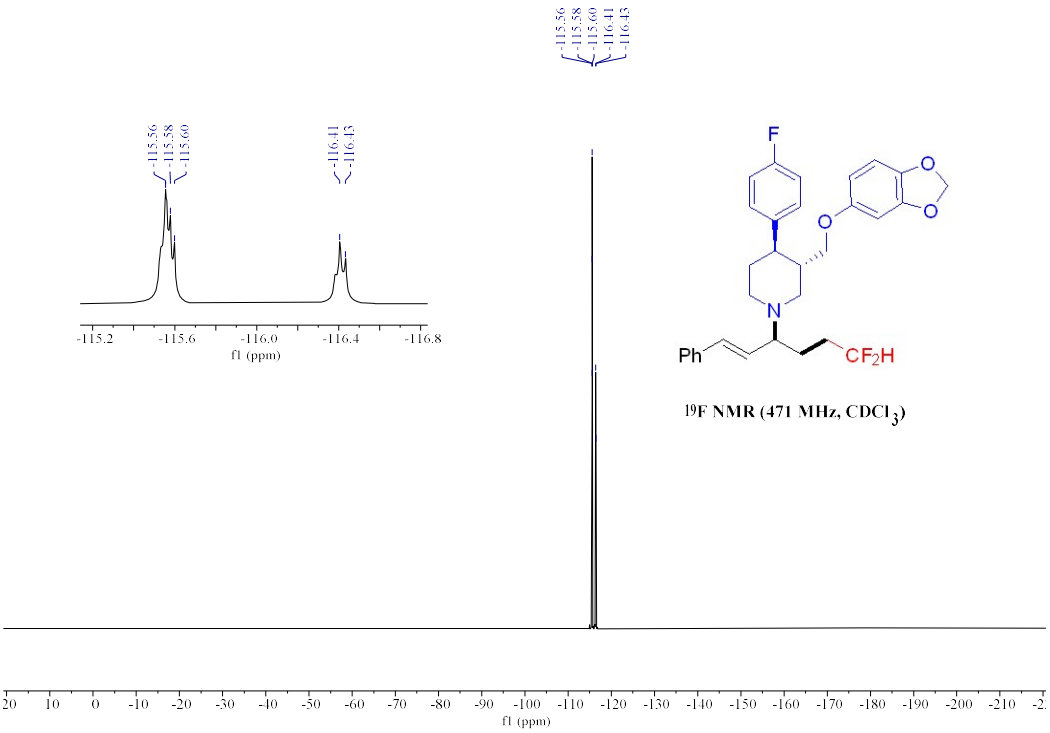


^{19}F NMR (565 MHz, $CDCl_3$)

(3*S*,4*R*)-3-((Benzo[*d*][1,3]dioxol-5-yloxy)methyl)-1-((*E*)-6,6-difluoro-1-phenylhex-1-en-3-yl)-4-(4-fluorophenyl)piperidine (9b)

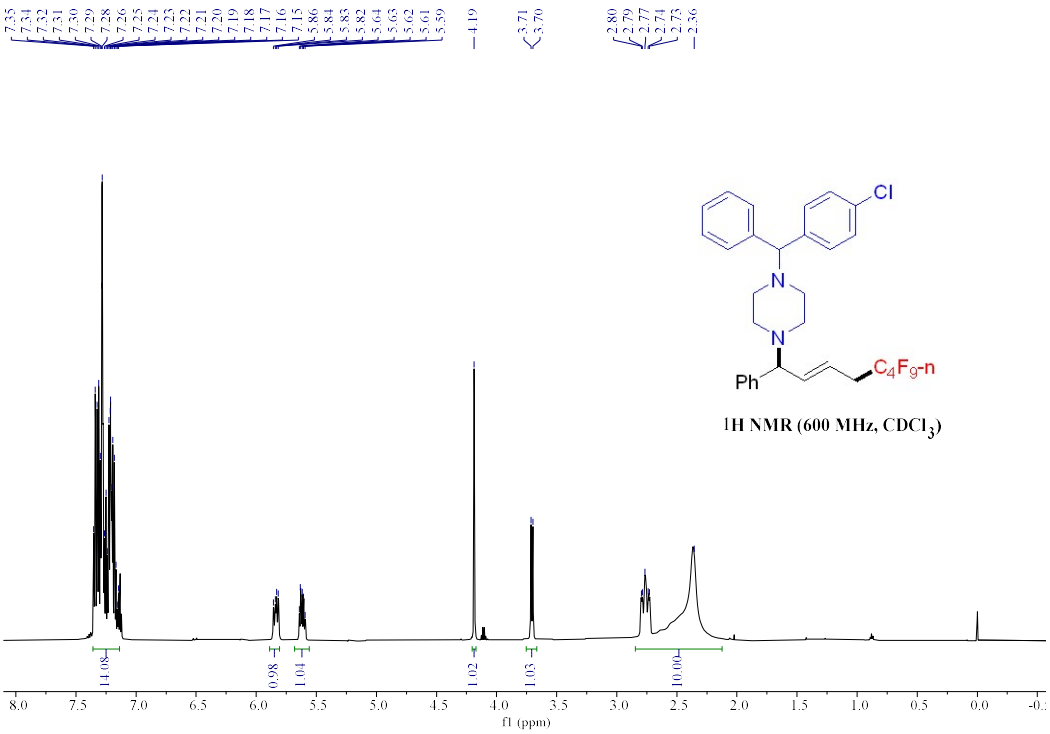




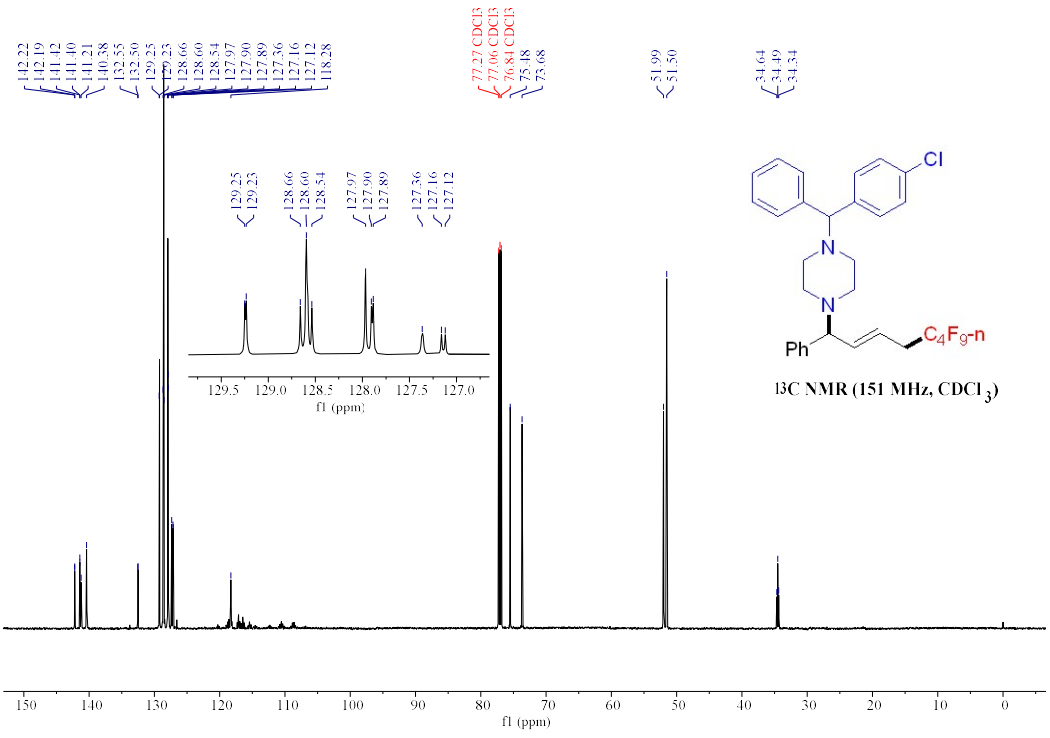


^{19}F NMR (471 MHz, $CDCl_3$)

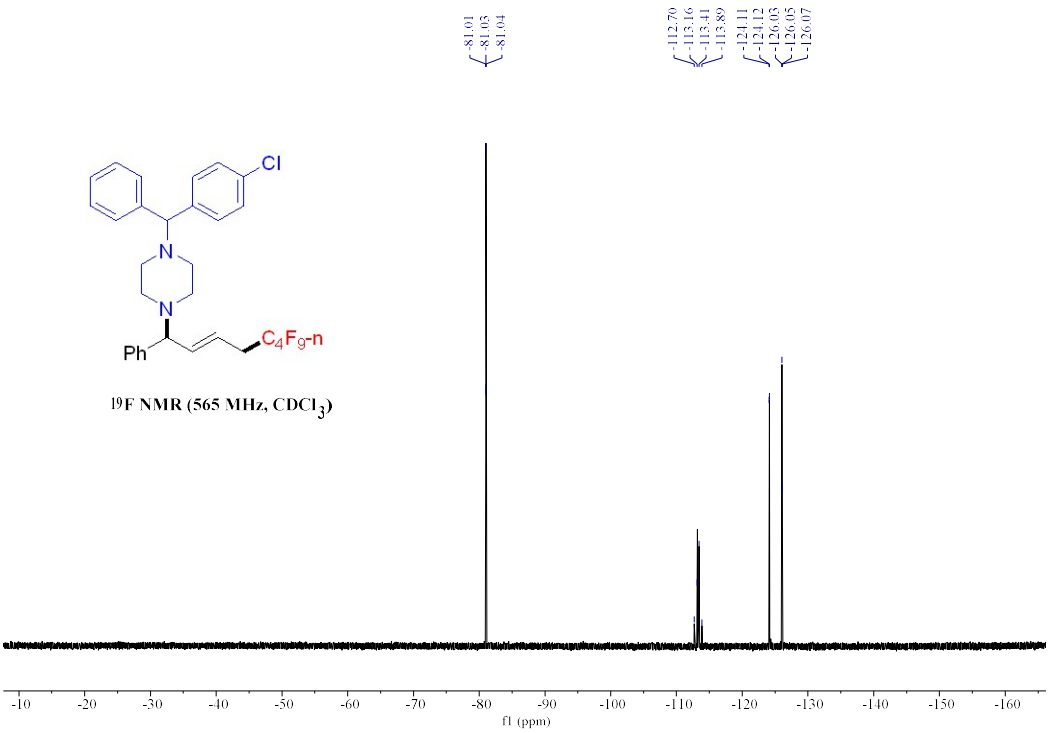
4-((4-Chlorophenyl)(phenyl)methyl)-1-((S,E)-5,5,6,6,7,7,8,8,8-nonafluoro-1-phenyloct-2-en-1-yl)piperidine (9c)



^{1}H NMR (600 MHz, $CDCl_3$)

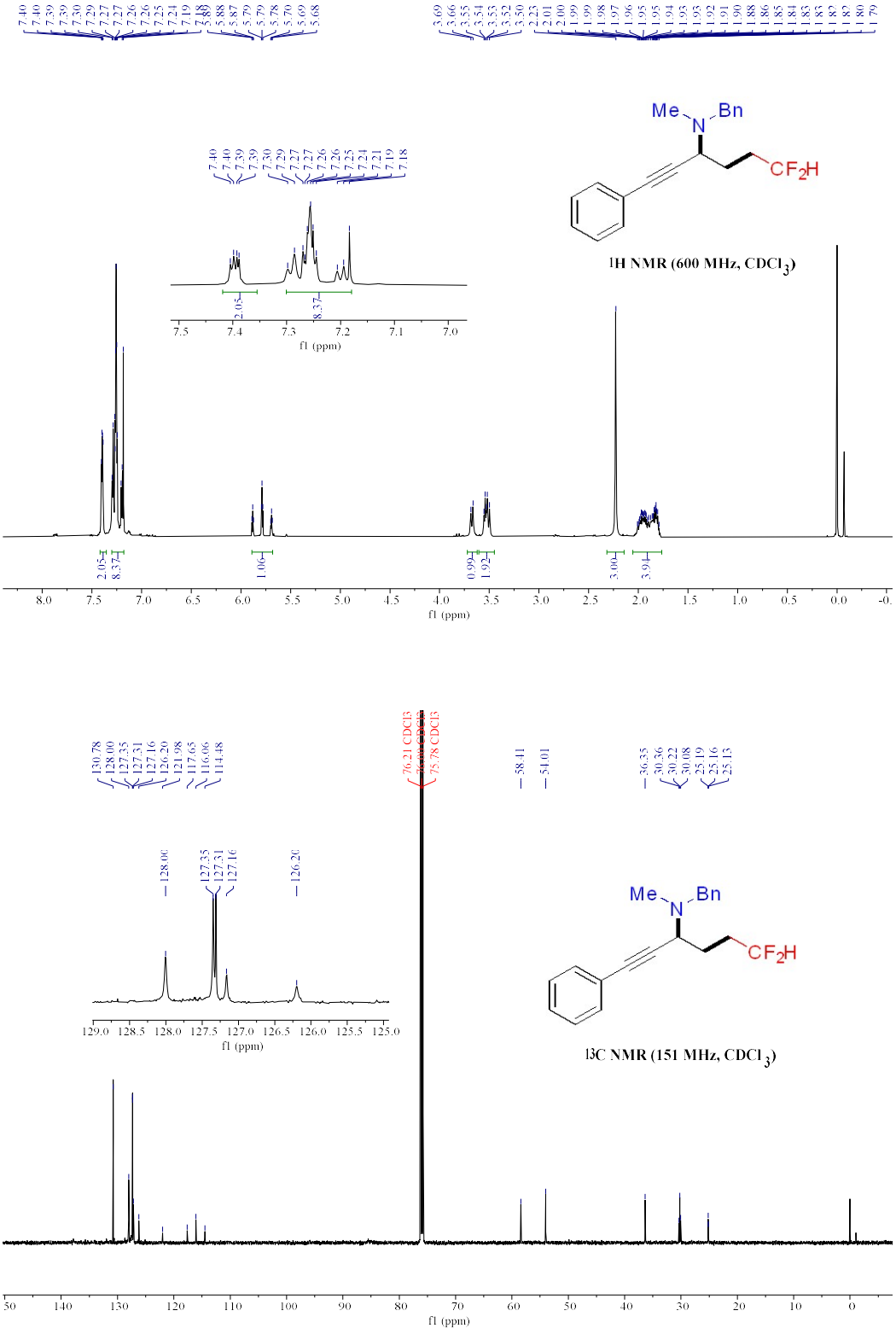


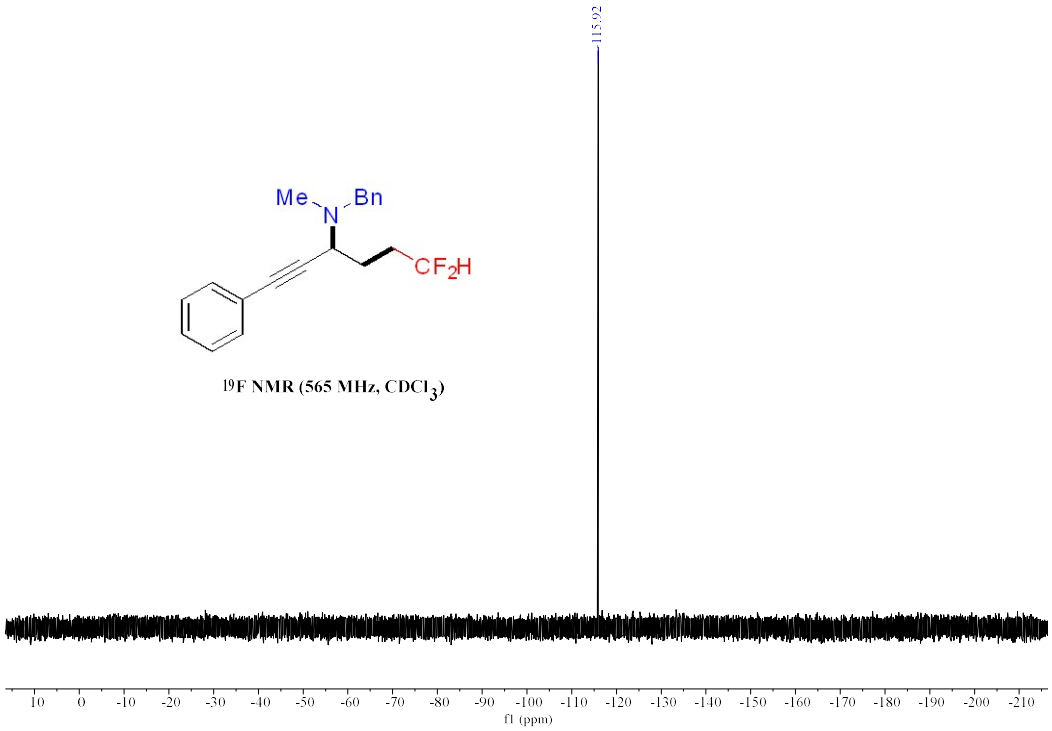
^{13}C NMR (151 MHz, $CDCl_3$)



^{19}F NMR (565 MHz, $CDCl_3$)

N-Benzyl-6,6-difluoro-*N*-methyl-1-phenylhex-1-yn-3-amine (11)





^{19}F NMR (565 MHz, $CDCl_3$)