

Supplementary Information

Programmable synthesis of difluorinated hydrocarbons from alkenes through a photocatalytic linchpin strategy

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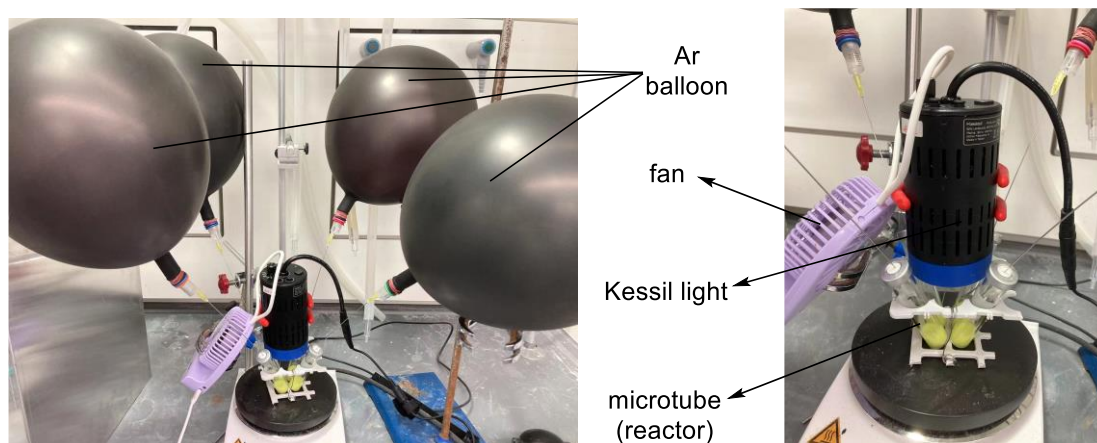
Table of contents

I. General information.....	3
II. General procedures.....	3
III. Preparation of ClCF ₂ SO ₂ Na in kilogram scale	6
IV. Evaluation of reaction conditions.....	8
V. Unsuccessful examples of chlorodifluoromathylation	11
VI. Mechanistic investigation	12
a)Identification of the reaction mass balance	12
b) Radical trapping experiments.....	12
c) Radical clock experiments	13
d) Deuterium labelling study.....	13
e) Stern-volmer fluorescence quenching studies	14
f) Determination of photochemical quantum yields	16
VII. X-Ray crystallographic data	18
VIII. Product characterizations	27
IX. Supplementary references.....	64
X. NMR spectra for product characterization.....	65

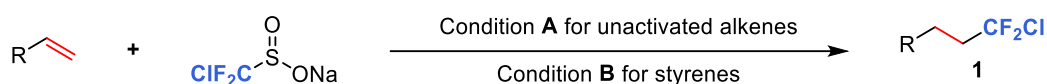
I. General information

Chemicals and solvents were purchased from commercial suppliers (Sigma Aldrich, TCI, BLD or Oakwood) and used as received. Commercial unavailable unactivated alkenes and 4CzIPN were synthesized according to literatures.^[1-3] Kessil PR160 blue LED lamps (456 nm, 40 W) were used as the light source. The purification of the products was performed by flash column chromatography using silica gel 60 (63-200 μm) from SANPONT. ^1H NMR, ^{19}F NMR, ^{11}B NMR, ^{31}P NMR, ^{13}C NMR spectra were recorded on a Bruker AV-III400 (400 MHz) or AMX500 (500 MHz) spectrometer and no reference was used in ^{19}F NMR, ^{11}B NMR, ^{31}P NMR. Chemical shifts were calibrated using residual undeuterated solvent as an internal reference (CDCl_3 : 7.26 ppm ^1H NMR, 77.16 ppm ^{13}C NMR). Multiplicity was indicated as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet), dd (doublet of doublet), dt (doublet of triplet), td (triplet of doublet), tt (triplet of triplet), ddd (doublet of doublet of doublet), dddd (doublet of doublet of doublet of doublet). High-resolution mass spectra (HRMS) were obtained on a Finnigan/MAT 95XL-T spectrometer.

II. General procedures



Supplementary Fig. 1. Reaction set-up.

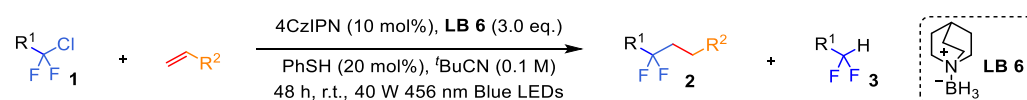


General procedure A

At argon atmosphere, an 8 mL vial equipped with a stir bar was added Mes-Acr-Me⁺ClO₄⁻ (1.6 mg, 2 mol%), ClCF₂SO₂Na (68.8 mg, 2.0 equiv.), 2-CO₂Me-PhSH (6.7 mg, 20 mol%), alkenes (0.2 mmol), followed by mixture solvent (CHCl₃/TFE = 9/1, 1.0 mL) for a reaction concentration of 0.2 M relative to alkenes. Then the vial was sealed with an argon balloon. The resulting mixture was stirred and irradiated with 40 W 456 nm blue LEDs for 18 hours (with a fan, reaction temperature approximately 25 - 30 °C). After that, the reaction mixture was concentrated under reduced pressure, purified by column chromatography over silica gel to obtain the desired chlorodifluoromethylation products.

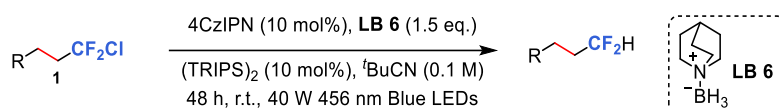
General procedure B

At argon atmosphere, an 8 mL vial equipped with a stir bar was added 4CzIPN (3.2 mg, 2 mol%), ClCF₂SO₂Na (68.8 mg, 2.0 equiv.), styrenes (0.2 mmol), followed by mixture solvent (DMSO/H₂O = 20/1, 2.0 mL) for a reaction concentration of 0.1 M relative to styrenes. Then the vial was sealed with an argon balloon. The resulting mixture was stirred and irradiated with 40 W 456 nm blue LED for 6 hours. After that, the reaction mixture was concentrated under reduced pressure, purified by column chromatography over silica gel to obtain the desired chlorodifluoromethylation products.



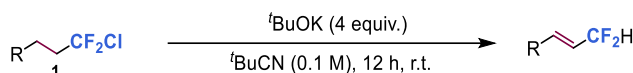
General procedure C

An 8 mL vial equipped with stir bar was added 4CzIPN (8.0 mg, 10 mol%), **LB 6** (37.5 mg, 3 equiv.), compound **1** (0.2 mmol, 2.0 equiv.), followed by ^tBuCN (2.0 mL) for a reaction concentration of 0.05 M relative to alkenes. Then the vial was sealed, and the mixture was bubbled with an argon balloon for about 5 mins at room temperature. Next, alkenes (0.1 mmol) and PhSH (20 mol%) were added. The resulting mixture was stirred and irradiated with blue LEDs (40 W, 456 nm) for 48 hours. After that, the reaction mixture was concentrated under reduced pressure, purified by column chromatography over silica gel to obtain the desired hydrodifluoroalkylation products.



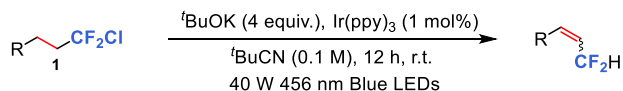
General procedure D

At argon atmosphere, an 8 mL vial equipped with a stir bar was added 4CzIPN (8 mg, 10 mol%), compound **1** (0.1 mmol, 1.0 equiv.), (TRIPS)₂ (4.7 mg, 10 mol%), **LB 6** (1.5 equiv.), followed by ^tBuCN (1.0 mL). Then the vial was sealed with an argon balloon. The resulting mixture was stirred and irradiated with blue LEDs (40 W, 456 nm) for 6 hours. After that, the reaction mixture was concentrated under reduced pressure, purified by column chromatography over silica gel to obtain the desired dechlorination products.



General procedure E

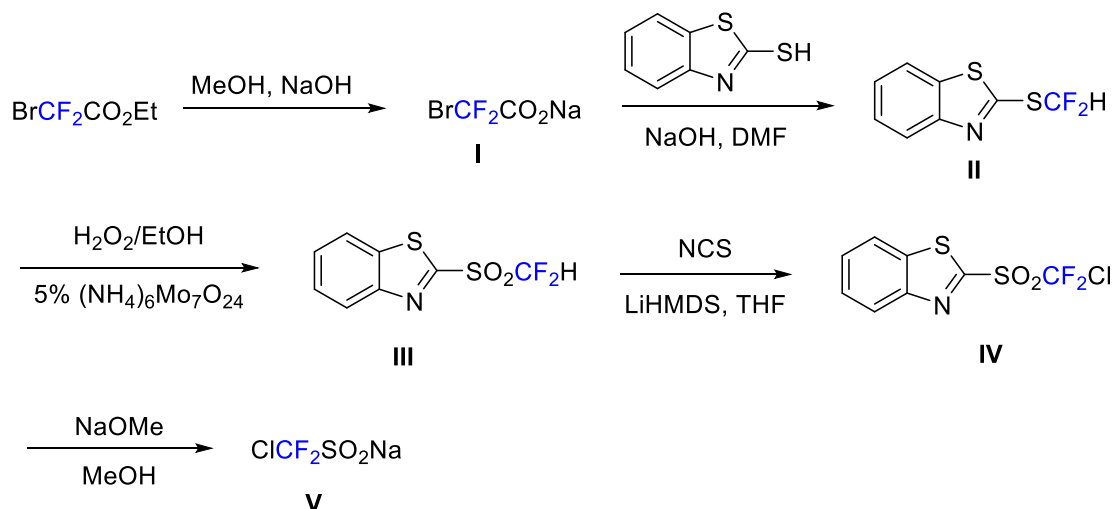
An 8 mL vial equipped with a stir bar was added compound **1** (0.2 mmol, 1.0 equiv.), ^tBuOK (89.2 mg, 4 equiv.), followed by ^tBuCN (2.0 mL). The resulting mixture was stirred for 12 hours at rt. After that, the reaction mixture was concentrated under reduced pressure, purified by column chromatography over silica gel to obtain the desired products.



General procedure F

An 8 mL vial equipped with a stir bar was added Ir(ppy)₃ (1.3 mg, 1 mol%), compound **1** (0.2 mmol, 1.0 equiv.), ^tBuOK (89.2 mg, 4 equiv.), followed by ^tBuCN (2.0 mL). The resulting mixture was stirred and irradiated with blue LEDs (40 W, 456 nm) for 12 hours. After that, the reaction mixture was concentrated under reduced pressure, purified by column chromatography over silica gel to obtain the desired products.

III. Preparation of ClCF₂SO₂Na in kilogram scale



ClCF₂SO₂Na was prepared based on a reported procedure from Hu.^[4] Methanol (116 kg) and sodium hydroxide (9.3 kg, 1.0 equiv.) were charged to a reactor (500 L), and the solution was cooled to 0±5 °C. Ethyl bromodifluoroacetate (49 kg, 1.0 equiv.) was added slowly to keep the reaction temperature below 10 °C. After charge, the reaction was allowed to warm to 25±5 °C, and stirred for 3 hrs. The mixture was concentrated under vacuum to obtain a solution of the product in methanol. The solution of the product is used directly for next step. The purity of **I** is 98.8%.

Preparation of BTSCF₂H (**II**): DMF (370 kg), BTSH (39 kg, 1.0 equiv.), and NaOH (9.4 kg, 1.01 equiv.) were added into a reactor and stirred for 20 h at 20-30 °C. The solution of **I** in methanol (assuming quantitative yield in the first step) was added slowly to the reactor. The batch was heated to 40-45 °C and stirred until IPC showed complete conversion. Water (7 volumes) was added into the reactor at 20±5 °C and the mixture was concentrated under reduced pressure to remove DMF and water. MTBE (5 volumes) and water (9 volumes) were added and the layers separated. The aqueous layer was back extracted with MTBE (3 volumes) and the combined organic layer was concentrated under reduced pressure to obtain **II** (46.5 kg, yield 85%, purity 83.4%) as a light brown oil.

Preparation of BTSCF₂H₂SO₂ (**III**): EtOH (171 kg), **II** (46.5 kg), and ammonium molybdate tetrahydrate (12.2 kg, 0.05 equiv.) was added to a reactor (500 L) at 20±5 °C. 28% Hydrogen peroxide (105 kg, 4.26 equiv.) was added slowly at 25±5 °C. The reaction was stirred at 25±5 °C for 24 h and at 40-45 °C for 18h. After cooling to 0-5 °C, the reaction was quenched with aqueous sodium sulfite (18 wt%). The resulting mixture was filtered, and washed with water (4 volumes ×3) to get the crude product. The crude product was recrystallized from EtOH (8 wt equiv.) and filtered at 0-5 °C. Later, the product was washed with EtOH (1 volume) and then dried at 45-55 °C

under vacuum oven to obtain **III** as a white solid (32.5 kg; purity 99.64%; yield 66%).

Preparation of $\text{BTSO}_2\text{CF}_2\text{Cl}$ (**IV**): THF (266 kg) was added to a reactor (1000 L) and cooled to $-70 \sim -75\text{ }^\circ\text{C}$. TEMPO (0.61 kg), **III** (32.5 kg), NCS (52 kg) were added to the reaction. LiHMDS (365.9 kg, 1 M) was added slowly at this temperature. After addition, the mixture was stirred for 2 h at this temperature. Upon completion of the reaction, the reaction mixture was transferred to a mixture of 20% aq. NH_4Cl (10 wt), ethyl acetate and TEMPO to quench the reaction. The layers were separated and the aqueous phase was back extracted with EtOAc once. The combined organic phase was washed with water (6 wt $\times$ 2), concentrated, and crystallized from EtOH (5.5 wt). The slurry was cooled to $0\text{--}5\text{ }^\circ\text{C}$, filtered, washed with EtOH (2 wt), and dried at $40\text{--}50\text{ }^\circ\text{C}$ to obtain **IV** (20.84 kg, purity 99.84%, yield 56%) as a white solid.

Preparation of $\text{ClCF}_2\text{SO}_2\text{Na}$ (**V**): MeOH (49 kg) and **IV** (20.84 kg) were added to a reactor (200 L), and cooled to $-10 \sim -5\text{ }^\circ\text{C}$. Sodium methoxide (29.3 wt%) in methanol (13.5 kg) was added dropwise at $-10 \sim -5\text{ }^\circ\text{C}$ and reacted at this temperature for 2 h. The mixture was allowed to warm to $20 \pm 5\text{ }^\circ\text{C}$ and stirred at $20 \pm 5\text{ }^\circ\text{C}$ for 90 min. The reaction mixture was washed with heptane (3 volumes $\times$ 3), and treated with activated carbon at $20 \pm 5\text{ }^\circ\text{C}$ for 1 h. The filtrate was concentrated and the MeOH solvent was replaced with toluene. MTBE (2 volumes) was added, and the resulting slurry was filtered, washed and dried to obtain **V** (11.42 kg, yield 90%, purity 94.2%) as a white solid.

IV. Evaluation of reaction conditions

Supplementary Table 1: Evaluation of chlorodifluoromethylation with unactivated alkenes

alkene, 0.2 mmol 0.4 mmol

+

→

1f

2 mol% **PC-1**
 20 mol% 2-CO₂Me-PhSH
 CHCl₃ (0.45 mL) + TFE (0.05 mL)
 40 W 456 nm Blue LEDs
 Ar, 18 h, 30 °C

Entry	Deviation from standard conditions	Conversion ^a	Yield ^a
1	None	100%	91%(86%) ^b
2	Rose Bengal instead of PC-1	< 5%	trace
3	PC-2 instead of PC-1	< 5%	trace
4	4-CzIPN instead of PC-1	100%	82%
5	No PC-1	0%	NR
6	In the dark	10%	6%
7	No 2-CO ₂ Me-PhSH	100%	61%
8	No TFE	76%	60%

PC-1

PC-2

^aUsing 1,1,2,2-tetrachloroethane as the internal standard. ^bIsolated yield.

Supplementary Table 2: Evaluation of chlorodifluoromethylation with styrenes

0.2 mmol 0.4 mmol

+

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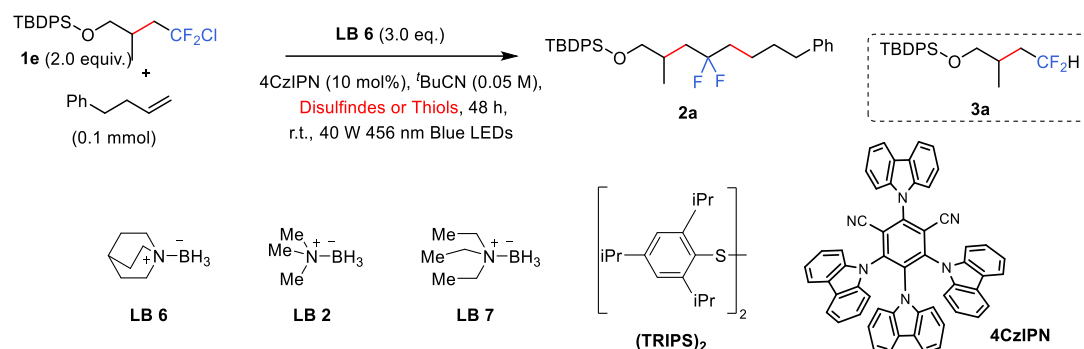
1t

2 mol% 4CzIPN sol.
 40 W 456 nm Blue LEDs
 6 h, r.t., Ar

Entry	Solvent	Conversion ^a	Yield ^a
1 ^b	--	100%	n.d.
2	DMSO	40%	20%
3	DMSO/H ₂ O (20/1)	100%	73% (70% ^c)
4	DMSO/H ₂ O (4/1)	100%	51%
5	MeCN/H ₂ O (20/1)	100%	15%

^aUsing PhCF₃ as the external standard; ^bCondition: Mes-Acr-Me⁺ClO₄⁻ (2 mol%), CHCl₃/TFE (9/1, 0.2 M), r. t., 18 h; ^cIsolated yield.

Supplementary Table 3: Evaluation of difluoromethylation with unactivated alkenes

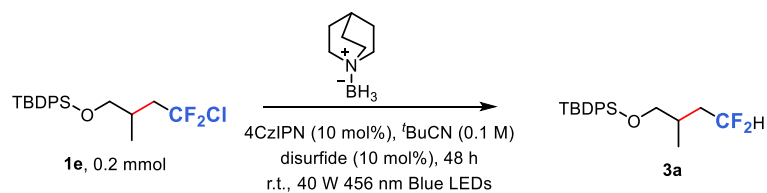


Entry	Disulfides (10 mol%) or Thiols (20 mol%)	Recovery of 1 ^a	Recovery of alkene ^a	Yield of 2 ^a	Ratio (2 / 3) ^a
1 ^c	PhSSPh	64%	24%	75%	1.25/1
2 ^d	PhSSPh	78%	35%	29%	1/1.27
3 ^e	PhSSPh	175%	20%	trace	--
4	PhSSPh	36%	9%	86%	1.23/1
5	(TRIPS) ₂	99%	60%	4%	1/23
6 ^f	PhSSPh	95%	17%	70%	2/1
7	PhSH	20%	<1%	95% (90%) ^b	2/1
8	^t BuSH	30%	<1%	94%	1.96/1
9	(ⁱ Pr) ₃ SiSH	81%	3%	64%	1.16/1
10	Et ₂ OCCH ₂ SH	54%	4%	86%	1.53/1
11	(3,5-diCF ₃)PhSH	36%	<1%	86%	2.15/1

^aUsing CH₂Br₂ and PhCF₃ as the external standards; ^bIsolated yield; ^c**LB 6** (2.0 equiv.); ^d**LB 2** (2.0 equiv.) instead of **LB 6**;

^e**LB 7** (2.0 equiv.) instead of **LB 6**; ^fAdding H₂O (50 equiv.).

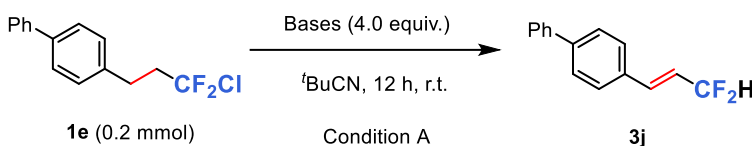
Supplementary Table 4: Evaluation of the dechlorination



Entry	Disulfides	L B 4 (equiv.)	Recovery of L B 4 ^a	Recovery of 1 ^a	Yield of 3 ^a
1	PhSSPh	1.5	0.68 equiv.	14%	44%
2	(TRIPS) ₂	1.5	0	16%	65% (62%) ^b
3	(TRIPS) ₂	2	0.2 equiv.	10%	65%
4	(TRIPS) ₂	3	1.4 equiv.	12%	68%
5	Without	--	0.16 equiv.	15%	35%

^aUsing CH₂Br₂ and PhCF₃ as the external standard; ^bIsolated yield.

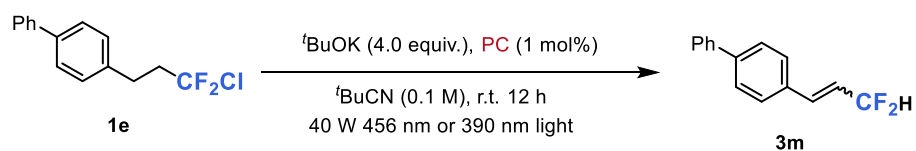
Supplementary Table 5: Evaluation of dehydrochlorination

			
Entry	Bases (4.0 equiv.)	Recovery of 1e ^a	Yield of 3j ^a
1	^tBuOK	0%	98% (95%) ^b
2	other bases ^c	> 90%	0%

^aUsing PhCF₃ as the external standard; ^bIsolated yield;

^cOther bases: NaOH, Na₂CO₃, NaHCO₃, K₃PO₄, K₂HPO₄, DBU.

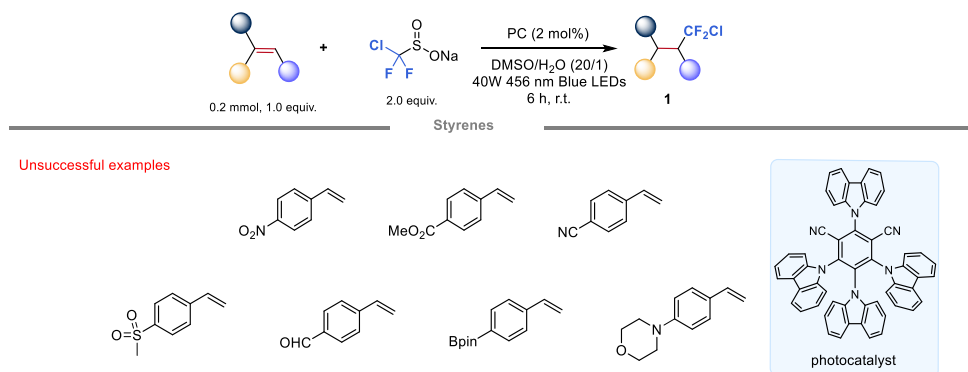
Supplementary Table 6: Evaluation of dehydrochlorination



Entry	PC (1 mol%)	EnT (Kcal/mol)	Recovery of 1e ^a	Yield of 3m (Z/E) ^a
1	4CzIPN	56.4	0	46% (1.3/1)
2 ^c	4CzIPN	56.4	30%	54% (1/99)
3	xanthone	70.0	0	44% (1/2)
4	benzophenone	69.1	0	60% (1/3)
5	fluorenone	50.5	0	55% (1/4.6)
6	benzil	53.3	0	60% (1/9)
7	Riboflavin	50.4	0	61% (1/2.4)
8	Ir(ppy)₃	55.2	10%	84% (1.7/1), 81% ^b
9 ^d	Ir(ppy) ₃	55.2	0	65% (2/1)
10	[Ir(ppy) ₂ (dtbbpy)]PF ₆	51.0	8%	43% (1.7/1)
11	[Ir(dFCF ₃ ppy) ₂ (bpy)]PF ₆	62.0	0	92% (1/11)

^aUsing PhCF₃ as the external standard; ^bIsolated yield; ^cAdding H₂O (50 equiv.); ^d24 h.

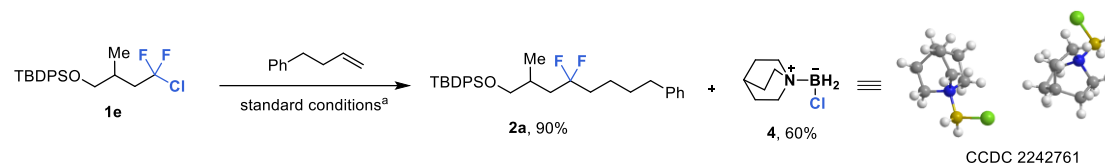
V. Unsuccessful examples of chlorodifluoromethylation



Supplementary Fig. 2: Unsuccessful examples

VI. Mechanistic investigation

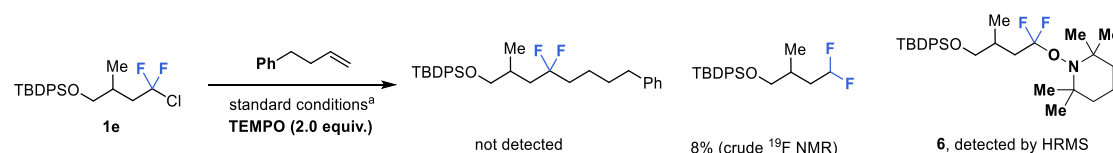
a) Identification of the reaction mass balance



Follow the general procedure C, L-BH₂Cl **4** was isolated by flash column chromatography over silica gel (white solid, 28.6 mg, 60%, m.p. 126.3-127.0 °C), determined by NMR and single crystal.

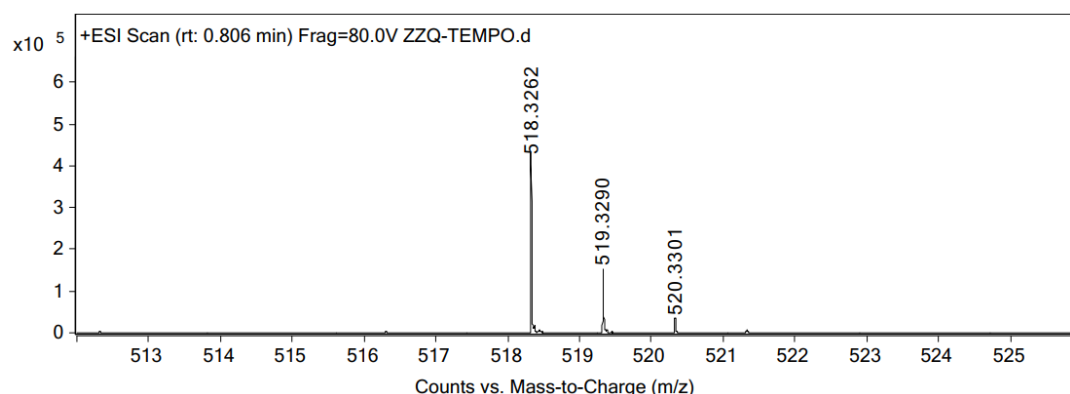
Compound **4** (m.p. 126.3-127.6 °C). ¹H NMR (400 MHz, CDCl₃) δ 3.27 – 2.89 (m, 6H), 2.80 – 1.94 (m, 3H), 1.89 – 1.61 (m, 6H). ¹¹B NMR (128 MHz, CDCl₃) δ -1.33 (t, *J* = 122.2 Hz). ¹³C NMR (126 MHz, CDCl₃) δ 50.4, 24.4, 20.6.

b) Radical trapping experiments



Following the general procedure C, adding 2.0 equivalents of TEMPO into the reaction mixture, the desired addition product was not detected, whereas the dechlorination and RCF₂H-TEMPO compounds was detected by ¹⁹F NMR or HRMS, indicating the formation of RCF₂ radical during the reaction process.

RCF₂H-TEMPO HRMS-ESI (m/z): Calcd for C₃₀H₄₆F₂NO₂Si⁺ [M+H]⁺ 518.3260, found 518.3262

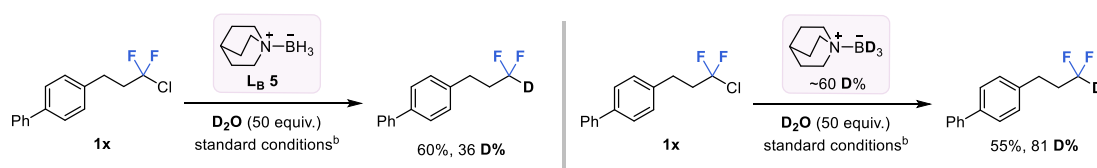


c) Radical clock experiments

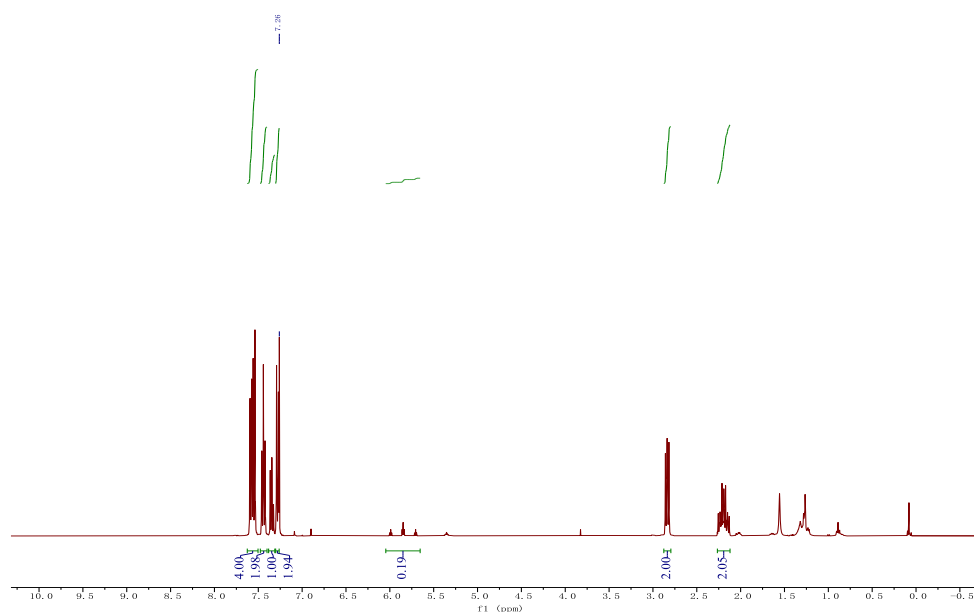


Following the general procedure **C**, the ring-opening product **5** (21.0 mg, white solid, m.p. 53.1-54.5 °C) was obtained in 57% yield. ¹H NMR (400 MHz, CDCl₃) δ 7.61 – 7.56 (m, 2H), 7.56 – 7.51 (m, 2H), 7.46 – 7.40 (m, 2H), 7.36 – 7.31 (m, 1H), 7.30 – 7.26 (m, 2H), 5.59 (s, 1H), 3.01 – 2.73 (m, 2H), 2.55 (t, J = 16.4 Hz, 2H), 2.22 – 2.03 (m, 5H), 1.84 – 1.73 (m, 2H), 1.54 – 1.41 (m, 1H), 1.29 – 1.16 (m, 2H), 0.89 (dd, J = 6.8, 5.0 Hz, 6H). ¹⁹F NMR (377 MHz, CDCl₃) δ -94.51 – -95.93 (m). ¹³C NMR (126 MHz, CDCl₃) δ 141.1, 140.2, 139.3, 130.8 (t, J = 4.1 Hz), 128.9, 127.8, 127.4, 127.3, 127.2, 124.6 (t, J = 242.8 Hz), 45.1 (t, J = 25.1 Hz), 39.8, 38.0 (t, J = 25.1 Hz), 32.3, 30.1, 29.3, 28.2 (t, J = 4.8 Hz), 26.6, 20.1, 19.8. HRMS-EI (m/z): Calcd for C₂₅H₃₀F₂⁺ [M]⁺ 368.2310, found 368.2314.

d) Deuterium labelling study

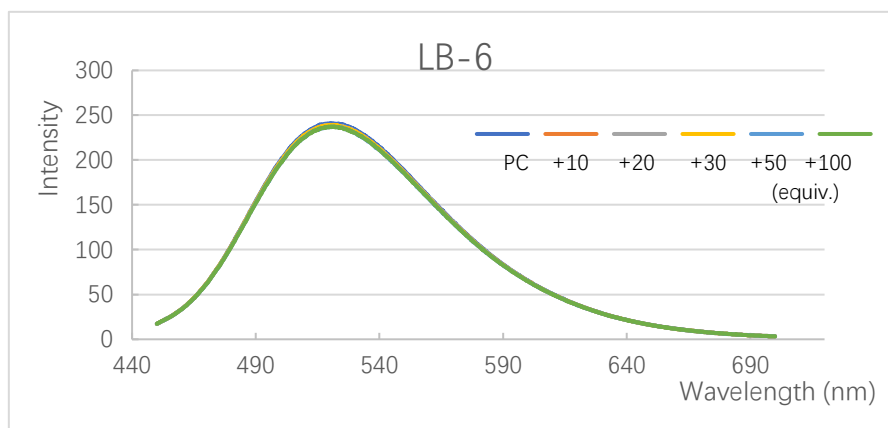


Following the general procedure **C**, Reaction 1) was added 50 equivalents of D₂O into the reaction mixture; Reaction 2) was added 50 equivalents of D₂O into the reaction mixture and used L-BD₃ (~ 60% D-inc.) with L-BH₃. The desired products were obtained in about 60% yield, however, the deuteration incorporation of the latter product was significantly higher than the former one (81 % or 36%, respectively).

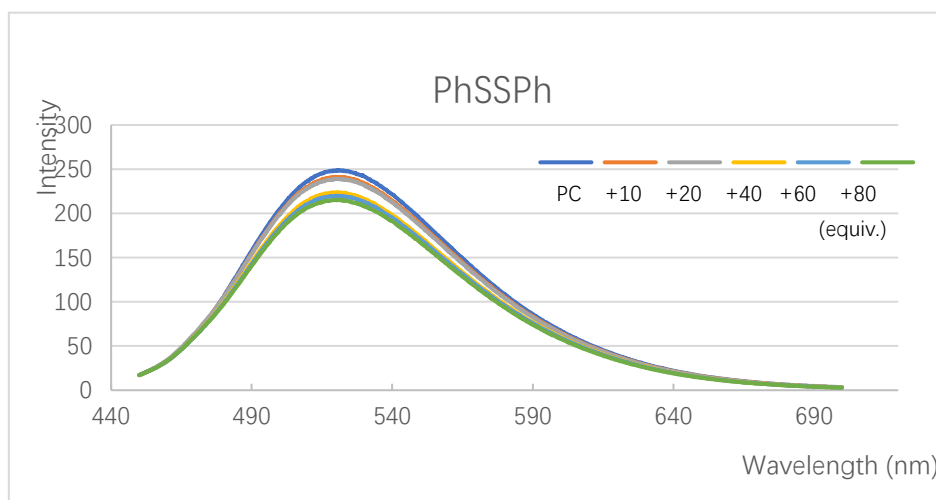


e) Stern-volmer fluorescence quenching studies

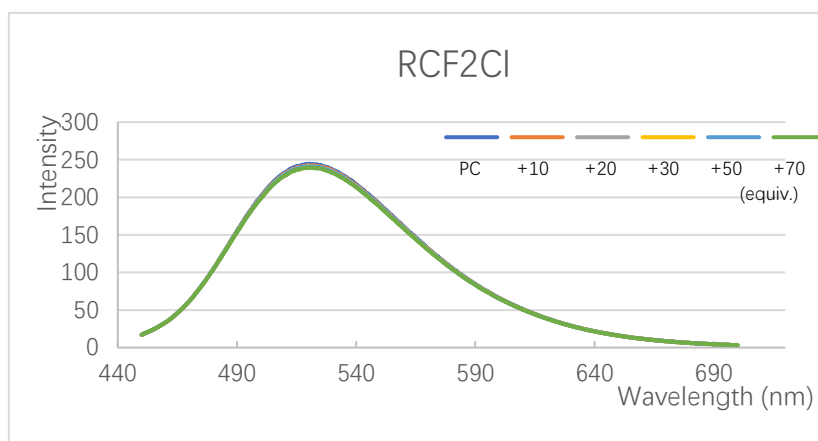
Stern-Volmer luminescence quenching experiments were carried out with freshly prepared solutions of PC (10^{-5} M) in tBuCN at room temperature. The solutions were irradiated at 440 nm and the luminescence was measured at 450 nm.



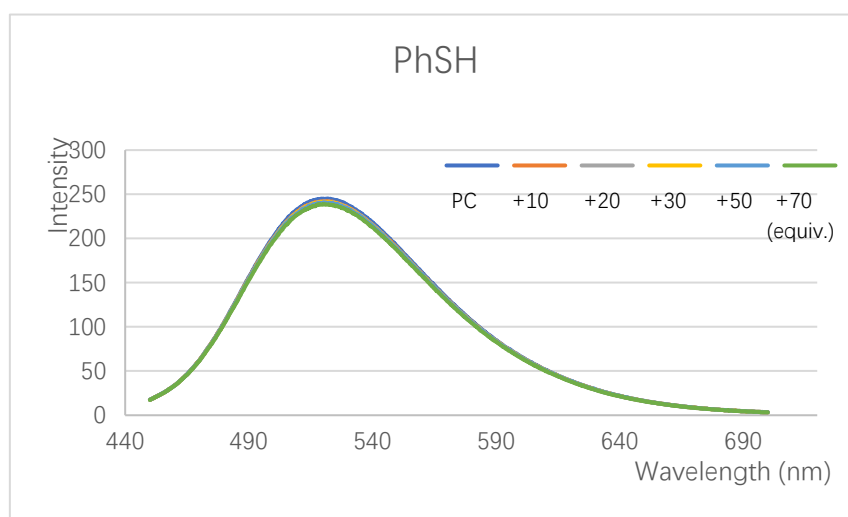
Supplementary Fig. 3: Fluorescence quenching study of 4CzIPN with different equivalents of **LB-6**



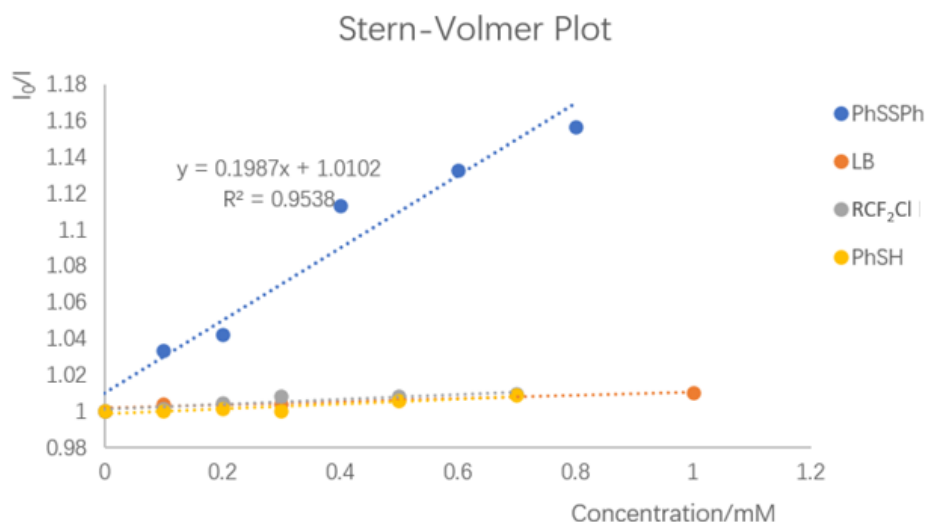
Supplementary Fig. 4: Fluorescence quenching study of 4CzIPN with different equivalents of **PhSSPh**



Supplementary Fig. 5: Fluorescence quenching study of 4CzIPN with different equivalents of **RCF₂Cl**



Supplementary Fig. 6: Fluorescence quenching study of 4CzIPN with different equivalents of **PhSH**



Supplementary Fig. 7: Combined quenching data.

f) Determination of photochemical quantum yields

Determination of Photochemical Quantum Yields Follow McMullen's procedure for photon flux⁷, the following solutions were prepared ahead of time:

1. Ferrioxalate solution A 0.15 M solution of potassium ferrioxalate was prepared by dissolving potassium ferrioxalate ($\text{K}_3\text{Fe}(\text{C}_2\text{O}_4)_3 \cdot 3\text{H}_2\text{O}$) (1.842 g, 3.75 mmol) with the 0.05 M sulfuric acid solution prepared in a 25 mL volumetric flask. Make every precaution to prepare and store the solution in the dark.
2. Developer solution 67.8 g of sodium acetate was dissolved in 500 ml of 0.5 M sulfuric acid. 5 g of 1,10- phenanthroline was added to this solution. Store in the dark.

To determine the photon flux of the Kessil lamp, 2.0 mL of the ferrioxalate solution was placed in a 10 mL microwave tube and irradiated at $\lambda = 456$ nm with an emission slit width of 10.0 nm. After irradiation, 10 μL aliquots of the solution were taken at different time points between 0.5 and 3 minutes of irradiation. This aliquot is immediately added to 5 mL of the developer solution and the flask is wrapped in aluminum foil. A blank sample is prepared by adding 10 μL of the ferrioxalate solution to 5 mL of developer solution. The solutions were left in the dark for one hour, eventually becoming bright red. Solutions were transferred to a separate cuvette and the absorbance spectrum of the $\text{Fe}(\text{phen})_3^{2+}$ complex was obtained. The absorbance at 510 nm ($\epsilon = 11,100 \text{ M}^{-1}\text{cm}^{-1}$) was measured for each sample. The conversion was calculated using eq 1.

$$\text{mol Fe}^{2+} = \frac{V_1 \cdot V_2 \cdot \Delta A}{V_2 \cdot l \cdot \epsilon} \quad \text{eq 1}$$

ΔA = the difference between the absorbance between the sample and the blank as measured at 510 nm.

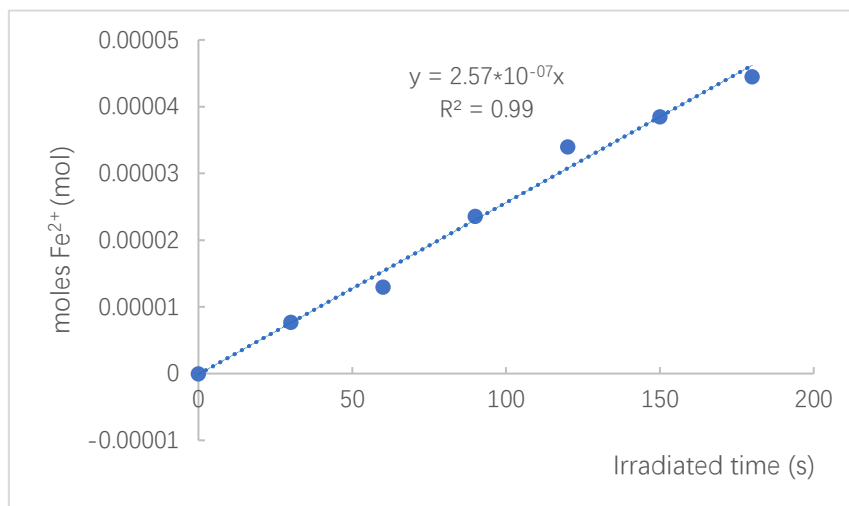
l = the path length of the cuvette (1 cm)

ϵ = the extinction coefficient of Fe(phen)_3^{2+} complex at 510 nm ($11,100 \text{ M}^{-1}\text{cm}^{-1}$)

V_1 = the total volume of the irradiated solution (2 mL; $2 \times 10^{-3} \text{ L}$)

V_2 = the volume of the aliquot removed from solution ($10 \mu\text{L}$; $1 \times 10^{-5} \text{ L}$)

V_3 = the volume that aliquots are diluted with (5 mL ; $5 \times 10^{-3} \text{ L}$)



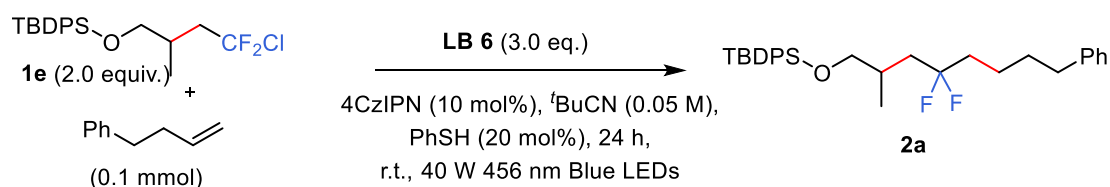
Supplementary Fig. 9: Compiled linear fits for the photon flux

A plot of moles Fe^{2+} as a function of time yields a linear equation with an intercept at zero. The value of the slopes collected is $2.57 \times 10^{-7} \text{ mol}^{-1}\text{s}^{-1}$. The photon flux can be calculated using **eq 2**.

$$\text{Photo flux} = \frac{\text{mol Fe}^{2+}}{\Phi \cdot t \cdot f} \quad \text{eq 2}$$

The documented quantum yield of the actinometer ($\Phi = 0.84$ at 458 nm)⁸ and f is the fraction of light absorbed at $\lambda = 456 \text{ nm}$ (0.95, vide infra)⁹. The photon flux in einsteins s^{-1} .

$$\text{Photo flux} = \frac{2.57 \times 10^{-7}}{0.84 \times 0.95} = 3.22 \times 10^{-7}$$



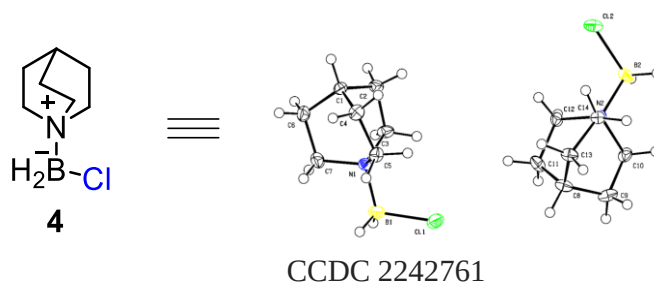
Following the general procedure **C**, the reaction time was shorted to 24 hours. The quantum yield was determined using **eq 3**. Essentially, all incident light ($f = 1$, vide infra) is absorbed by the 4CzIPN at the reaction conditions described above.

$$\Phi = \frac{\text{mol product}}{\text{flux} \cdot t \cdot f} \quad \text{eq 3}$$

Experiment: RCF₂Cl compound (**1e**, 0.2 mmol), but-3-en-1-ylbenzene (0.10 mmol), **LB-6** (0.3 mmol), 4CzIPN (0.01 mmol) and PhSH (0.02 mmol) in ^tBuCN (2.0 mL) after 36000 s yielded 15% of **2a**. $\Phi = 0.0013$.

$$\Phi = \frac{1.5 \times 10^{-5}}{3.22 \times 10^{-7} \times 36000 \times 1.00} = 0.0013$$

VII. X-Ray crystallographic data



Supplementary Table 7. Crystal data and structure refinement for M445.

Identification code	M445	
Empirical formula	C ₇ H ₁₅ B Cl N	
Formula weight	159.46	
Temperature	100(2) K	
Wavelength	0.71073 Å	
Crystal system	Monoclinic	
Space group	P2 ₁ /c	
Unit cell dimensions	a = 12.9872(8) Å	α = 90°.
	b = 12.2112(7) Å	β = 91.520(2)°.
	c = 10.7243(6) Å	γ = 90°.
Volume	1700.16(17) Å ³	
Z	8	
Density (calculated)	1.246 Mg/m ³	
Absorption coefficient	0.374 mm ⁻¹	
F(000)	688	
Crystal size	0.376 x 0.372 x 0.170 mm ³	
Theta range for data collection	2.528 to 28.282°.	
Index ranges	-17 ≤ h ≤ 17, -15 ≤ k ≤ 16, -14 ≤ l ≤ 14	
Reflections collected	41178	
Independent reflections	4222 [R(int) = 0.0448]	

Completeness to theta = 25.242°	99.9 %
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.7459 and 0.6996
Refinement method	Full-matrix least-squares on F ²
Data / restraints / parameters	4222 / 0 / 193
Goodness-of-fit on F ²	1.060
Final R indices [I>2sigma(I)]	R1 = 0.0406, wR2 = 0.1082
R indices (all data)	R1 = 0.0438, wR2 = 0.1112
Extinction coefficient	n/a
Largest diff. peak and hole	0.973 and -0.449 e.Å ⁻³

Supplementary Table 8. Atomic coordinates (x 10⁴) and equivalent isotropic displacement parameters (Å²x 10³)

for M445. U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
Cl(1)	1821(1)	7813(1)	5497(1)	29(1)
Cl(2)	3162(1)	2568(1)	9542(1)	26(1)
N(1)	3471(1)	8982(1)	6697(1)	16(1)
N(2)	1512(1)	3224(1)	7880(1)	14(1)
C(1)	4693(1)	9081(1)	8641(1)	20(1)
C(2)	4774(1)	7960(1)	8009(1)	21(1)
C(3)	4149(1)	7987(1)	6770(1)	23(1)
C(4)	3574(1)	9264(1)	9010(1)	23(1)
C(5)	2863(1)	9044(1)	7874(1)	20(1)
C(6)	4962(1)	9973(1)	7706(2)	26(1)
C(7)	4142(1)	9987(1)	6649(1)	24(1)
C(8)	470(1)	4868(1)	6995(1)	22(1)
C(9)	62(1)	3791(1)	6447(1)	26(1)
C(10)	813(1)	2867(1)	6813(1)	21(1)
C(11)	1606(1)	4975(1)	6675(1)	25(1)
C(12)	2223(1)	4092(1)	7394(1)	18(1)
C(13)	387(1)	4811(1)	8417(1)	21(1)
C(14)	869(1)	3726(1)	8876(1)	16(1)
B(1)	2753(1)	8998(1)	5456(2)	25(1)
B(2)	2123(1)	2159(1)	8362(2)	22(1)

Supplementary Table 9. Bond lengths [Å] and angles [°] for M445.

Cl(1)-B(1)	1.8882(18)
Cl(2)-B(2)	1.8925(17)
N(1)-C(3)	1.5018(16)
N(1)-C(7)	1.5066(18)
N(1)-C(5)	1.5073(17)
N(1)-B(1)	1.6047(19)
N(2)-C(14)	1.5033(15)
N(2)-C(10)	1.5067(16)
N(2)-C(12)	1.5083(16)
N(2)-B(2)	1.6021(18)
C(1)-C(6)	1.528(2)
C(1)-C(2)	1.5320(19)
C(1)-C(4)	1.5323(19)
C(1)-H(1)	1.0000
C(2)-C(3)	1.5386(19)
C(2)-H(2A)	0.9900
C(2)-H(2B)	0.9900
C(3)-H(3A)	0.9900
C(3)-H(3B)	0.9900
C(4)-C(5)	1.5330(19)
C(4)-H(4A)	0.9900
C(4)-H(4B)	0.9900
C(5)-H(5A)	0.9900
C(5)-H(5B)	0.9900
C(6)-C(7)	1.535(2)
C(6)-H(6A)	0.9900
C(6)-H(6B)	0.9900
C(7)-H(7A)	0.9900
C(7)-H(7B)	0.9900
C(8)-C(11)	1.530(2)
C(8)-C(9)	1.530(2)
C(8)-C(13)	1.5331(19)
C(8)-H(8)	1.0000
C(9)-C(10)	1.536(2)
C(9)-H(9A)	0.9900
C(9)-H(9B)	0.9900
C(10)-H(10A)	0.9900

C(10)-H(10B)	0.9900
C(11)-C(12)	1.5375(19)
C(11)-H(11A)	0.9900
C(11)-H(11B)	0.9900
C(12)-H(12A)	0.9900
C(12)-H(12B)	0.9900
C(13)-C(14)	1.5404(18)
C(13)-H(13A)	0.9900
C(13)-H(13B)	0.9900
C(14)-H(14A)	0.9900
C(14)-H(14B)	0.9900
B(1)-H(1A)	1.07(2)
B(1)-H(1B)	1.26(2)
B(2)-H(2C)	1.14(2)
B(2)-H(2D)	1.08(2)

C(3)-N(1)-C(7)	108.80(11)
C(3)-N(1)-C(5)	108.45(11)
C(7)-N(1)-C(5)	107.68(11)
C(3)-N(1)-B(1)	112.34(11)
C(7)-N(1)-B(1)	106.56(11)
C(5)-N(1)-B(1)	112.83(11)
C(14)-N(2)-C(10)	108.85(10)
C(14)-N(2)-C(12)	108.43(10)
C(10)-N(2)-C(12)	107.63(10)
C(14)-N(2)-B(2)	112.42(10)
C(10)-N(2)-B(2)	107.03(10)
C(12)-N(2)-B(2)	112.32(10)
C(6)-C(1)-C(2)	109.11(12)
C(6)-C(1)-C(4)	107.51(11)
C(2)-C(1)-C(4)	108.70(11)
C(6)-C(1)-H(1)	110.5
C(2)-C(1)-H(1)	110.5
C(4)-C(1)-H(1)	110.5
C(1)-C(2)-C(3)	108.82(11)
C(1)-C(2)-H(2A)	109.9
C(3)-C(2)-H(2A)	109.9
C(1)-C(2)-H(2B)	109.9

C(3)-C(2)-H(2B)	109.9
H(2A)-C(2)-H(2B)	108.3
N(1)-C(3)-C(2)	110.92(11)
N(1)-C(3)-H(3A)	109.5
C(2)-C(3)-H(3A)	109.5
N(1)-C(3)-H(3B)	109.5
C(2)-C(3)-H(3B)	109.5
H(3A)-C(3)-H(3B)	108.0
C(1)-C(4)-C(5)	108.93(11)
C(1)-C(4)-H(4A)	109.9
C(5)-C(4)-H(4A)	109.9
C(1)-C(4)-H(4B)	109.9
C(5)-C(4)-H(4B)	109.9
H(4A)-C(4)-H(4B)	108.3
N(1)-C(5)-C(4)	110.89(10)
N(1)-C(5)-H(5A)	109.5
C(4)-C(5)-H(5A)	109.5
N(1)-C(5)-H(5B)	109.5
C(4)-C(5)-H(5B)	109.5
H(5A)-C(5)-H(5B)	108.0
C(1)-C(6)-C(7)	109.01(11)
C(1)-C(6)-H(6A)	109.9
C(7)-C(6)-H(6A)	109.9
C(1)-C(6)-H(6B)	109.9
C(7)-C(6)-H(6B)	109.9
H(6A)-C(6)-H(6B)	108.3
N(1)-C(7)-C(6)	110.88(11)
N(1)-C(7)-H(7A)	109.5
C(6)-C(7)-H(7A)	109.5
N(1)-C(7)-H(7B)	109.5
C(6)-C(7)-H(7B)	109.5
H(7A)-C(7)-H(7B)	108.1
C(11)-C(8)-C(9)	108.23(12)
C(11)-C(8)-C(13)	108.70(12)
C(9)-C(8)-C(13)	108.06(12)
C(11)-C(8)-H(8)	110.6
C(9)-C(8)-H(8)	110.6
C(13)-C(8)-H(8)	110.6

C(8)-C(9)-C(10)	108.84(11)
C(8)-C(9)-H(9A)	109.9
C(10)-C(9)-H(9A)	109.9
C(8)-C(9)-H(9B)	109.9
C(10)-C(9)-H(9B)	109.9
H(9A)-C(9)-H(9B)	108.3
N(2)-C(10)-C(9)	110.29(11)
N(2)-C(10)-H(10A)	109.6
C(9)-C(10)-H(10A)	109.6
N(2)-C(10)-H(10B)	109.6
C(9)-C(10)-H(10B)	109.6
H(10A)-C(10)-H(10B)	108.1
C(8)-C(11)-C(12)	108.74(11)
C(8)-C(11)-H(11A)	109.9
C(12)-C(11)-H(11A)	109.9
C(8)-C(11)-H(11B)	109.9
C(12)-C(11)-H(11B)	109.9
H(11A)-C(11)-H(11B)	108.3
N(2)-C(12)-C(11)	110.49(10)
N(2)-C(12)-H(12A)	109.6
C(11)-C(12)-H(12A)	109.6
N(2)-C(12)-H(12B)	109.6
C(11)-C(12)-H(12B)	109.6
H(12A)-C(12)-H(12B)	108.1
C(8)-C(13)-C(14)	108.58(11)
C(8)-C(13)-H(13A)	110.0
C(14)-C(13)-H(13A)	110.0
C(8)-C(13)-H(13B)	110.0
C(14)-C(13)-H(13B)	110.0
H(13A)-C(13)-H(13B)	108.4
N(2)-C(14)-C(13)	110.63(10)
N(2)-C(14)-H(14A)	109.5
C(13)-C(14)-H(14A)	109.5
N(2)-C(14)-H(14B)	109.5
C(13)-C(14)-H(14B)	109.5
H(14A)-C(14)-H(14B)	108.1
N(1)-B(1)-Cl(1)	109.29(10)
N(1)-B(1)-H(1A)	104.4(11)

Cl(1)-B(1)-H(1A)	108.5(11)
N(1)-B(1)-H(1B)	119.4(9)
Cl(1)-B(1)-H(1B)	100.1(10)
H(1A)-B(1)-H(1B)	114.7(15)
N(2)-B(2)-Cl(2)	109.84(10)
N(2)-B(2)-H(2C)	107.7(10)
Cl(2)-B(2)-H(2C)	109.6(10)
N(2)-B(2)-H(2D)	109.1(11)
Cl(2)-B(2)-H(2D)	108.9(10)
H(2C)-B(2)-H(2D)	111.7(15)

Supplementary Table 10. Anisotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for M445. The anisotropic displacement factor exponent takes the form: $-2\pi^2 [h^2 a^{*2} U^{11} + \dots + 2 h k a^* b^* U^{12}]$

	U^{11}	U^{22}	U^{33}	U^{23}	U^{13}	U^{12}
Cl(1)	24(1)	24(1)	38(1)	-7(1)	-11(1)	4(1)
Cl(2)	20(1)	34(1)	22(1)	6(1)	-1(1)	8(1)
N(1)	15(1)	15(1)	19(1)	0(1)	0(1)	4(1)
N(2)	15(1)	13(1)	13(1)	-1(1)	1(1)	-1(1)
C(1)	20(1)	17(1)	22(1)	-2(1)	-5(1)	1(1)
C(2)	21(1)	17(1)	23(1)	-1(1)	-5(1)	5(1)
C(3)	22(1)	20(1)	26(1)	-7(1)	-7(1)	10(1)
C(4)	24(1)	25(1)	19(1)	-4(1)	2(1)	0(1)
C(5)	15(1)	22(1)	23(1)	-1(1)	4(1)	0(1)
C(6)	18(1)	21(1)	38(1)	4(1)	-1(1)	-4(1)
C(7)	24(1)	22(1)	28(1)	7(1)	2(1)	-3(1)
C(8)	25(1)	24(1)	18(1)	2(1)	0(1)	10(1)
C(9)	20(1)	39(1)	17(1)	-4(1)	-5(1)	5(1)
C(10)	24(1)	22(1)	16(1)	-4(1)	-3(1)	-4(1)
C(11)	29(1)	20(1)	26(1)	9(1)	4(1)	1(1)
C(12)	15(1)	18(1)	20(1)	3(1)	3(1)	-3(1)
C(13)	24(1)	23(1)	17(1)	-3(1)	0(1)	9(1)
C(14)	16(1)	20(1)	14(1)	-1(1)	2(1)	2(1)
B(1)	25(1)	25(1)	24(1)	2(1)	-6(1)	5(1)
B(2)	29(1)	16(1)	21(1)	1(1)	0(1)	6(1)

Supplementary Table 11. Hydrogen coordinates ($\times 10^4$) and isotropic displacement parameters ($\text{\AA}^2 \times 10^3$)

for M445.

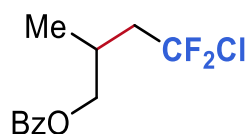
	x	y	z	U(eq)
H(1)	5165	9119	9392	24
H(2A)	4500	7384	8560	25
H(2B)	5504	7790	7850	25
H(3A)	4626	7992	6065	27
H(3B)	3718	7319	6699	27
H(4A)	3483	10026	9301	28
H(4B)	3400	8763	9699	28
H(5A)	2491	8346	7993	24
H(5B)	2347	9638	7794	24
H(6A)	5648	9826	7360	31
H(6B)	4987	10695	8127	31
H(7A)	3709	10650	6724	29
H(7B)	4482	10017	5835	29
H(8)	66	5502	6652	27
H(9A)	0	3848	5527	31
H(9B)	-628	3632	6772	31
H(10A)	420	2210	7060	25
H(10B)	1231	2670	6087	25
H(11A)	1863	5711	6911	30
H(11B)	1689	4878	5767	30
H(12A)	2727	3752	6835	22
H(12B)	2610	4434	8100	22
H(13A)	-345	4845	8649	26
H(13B)	754	5437	8810	26
H(14A)	1305	3864	9631	20
H(14B)	316	3210	9102	20
H(1A)	2324(16)	9747(18)	5520(19)	37
H(1B)	3149(15)	8834(18)	4418(18)	37
H(2C)	1548(15)	1597(17)	8820(18)	33
H(2D)	2481(15)	1766(17)	7577(18)	33

Supplementary Table 12. Torsion angles [°] for M445.

C(6)-C(1)-C(2)-C(3)	-51.00(15)
C(4)-C(1)-C(2)-C(3)	65.96(15)
C(7)-N(1)-C(3)-C(2)	65.96(15)
C(5)-N(1)-C(3)-C(2)	-50.90(15)

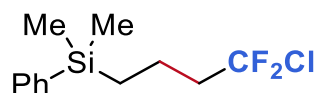
B(1)-N(1)-C(3)-C(2)	-176.29(12)
C(1)-C(2)-C(3)-N(1)	-12.87(16)
C(6)-C(1)-C(4)-C(5)	67.07(15)
C(2)-C(1)-C(4)-C(5)	-50.91(15)
C(3)-N(1)-C(5)-C(4)	66.54(14)
C(7)-N(1)-C(5)-C(4)	-51.04(14)
B(1)-N(1)-C(5)-C(4)	-168.35(12)
C(1)-C(4)-C(5)-N(1)	-13.28(16)
C(2)-C(1)-C(6)-C(7)	65.58(15)
C(4)-C(1)-C(6)-C(7)	-52.13(15)
C(3)-N(1)-C(7)-C(6)	-50.98(15)
C(5)-N(1)-C(7)-C(6)	66.37(14)
B(1)-N(1)-C(7)-C(6)	-172.33(12)
C(1)-C(6)-C(7)-N(1)	-12.51(17)
C(11)-C(8)-C(9)-C(10)	48.87(15)
C(13)-C(8)-C(9)-C(10)	-68.68(14)
C(14)-N(2)-C(10)-C(9)	48.26(14)
C(12)-N(2)-C(10)-C(9)	-69.06(13)
B(2)-N(2)-C(10)-C(9)	170.00(11)
C(8)-C(9)-C(10)-N(2)	17.06(16)
C(9)-C(8)-C(11)-C(12)	-67.78(15)
C(13)-C(8)-C(11)-C(12)	49.36(16)
C(14)-N(2)-C(12)-C(11)	-68.05(13)
C(10)-N(2)-C(12)-C(11)	49.54(14)
B(2)-N(2)-C(12)-C(11)	167.11(11)
C(8)-C(11)-C(12)-N(2)	15.90(16)
C(11)-C(8)-C(13)-C(14)	-67.46(15)
C(9)-C(8)-C(13)-C(14)	49.78(14)
C(10)-N(2)-C(14)-C(13)	-67.49(13)
C(12)-N(2)-C(14)-C(13)	49.33(13)
B(2)-N(2)-C(14)-C(13)	174.11(11)
C(8)-C(13)-C(14)-N(2)	15.47(15)
C(3)-N(1)-B(1)-Cl(1)	64.80(13)
C(7)-N(1)-B(1)-Cl(1)	-176.14(10)
C(5)-N(1)-B(1)-Cl(1)	-58.17(13)
C(14)-N(2)-B(2)-Cl(2)	-68.95(12)
C(10)-N(2)-B(2)-Cl(2)	171.59(9)
C(12)-N(2)-B(2)-Cl(2)	53.67(13)

VIII. Product characterizations



4-chloro-4,4-difluoro-2-methylbutyl benzoate (**1a**)

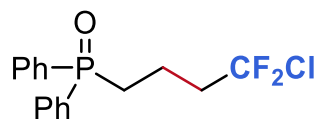
Following the general procedure **A**, the title compound (46.1 mg, colorless liquid) was obtained in 86% yield. **¹H NMR** (400 MHz, CDCl₃) δ 8.04 (dd, *J* = 8.4, 1.4 Hz, 2H), 7.74 – 7.53 (m, 1H), 7.52 – 7.42 (m, 2H), 4.37 – 4.06 (m, 2H), 2.59 (qd, *J* = 14.8, 4.9 Hz, 1H), 2.45 (dq, *J* = 12.4, 6.2 Hz, 1H), 2.29 (tdd, *J* = 14.8, 11.2, 7.6 Hz, 1H), 1.19 (d, *J* = 6.8 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.65 (ddd, *J* = 161.5, 15.0, 11.3 Hz), -49.10 (dt, *J* = 161.5, 14.9 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 166.5, 133.3, 130.1, 129.7 (t, *J* = 292.6 Hz), 129.7, 128.6, 68.5, 45.3, 29.3 (t, *J* = 2.0 Hz), 17.4. HRMS-EI (*m/z*): Calcd for C₁₂H₁₃ClF₂O₂⁺ [*M*]⁺ 262.0567, found 262.0567.



(4-chloro-4,4-difluorobutyl)dimethyl(phenyl)silane (**1b**)

Following the general procedure **A**, the title compound (37.2 mg, colourless liquid) was obtained in 71% yield.

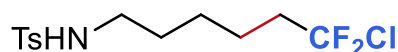
¹H NMR (400 MHz, CDCl₃) δ 7.55 – 7.48 (m, 2H), 7.41 – 7.34 (m, 3H), 2.35 – 2.24 (m, 2H), 1.69 – 1.60 (m, 2H), 0.84 – 0.78 (m, 2H), 0.31 (s, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.50 (td, *J* = 13.3, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 138.7, 133.6, 129.9 (t, *J* = 292.6 Hz), 129.2, 128.0, 45.4 (t, *J* = 23.2 Hz), 18.1 (t, *J* = 3.2 Hz), 15.2, -3.1. HRMS-EI (*m/z*): Calcd for C₁₁H₁₄ClF₂Si⁺ [*M*-15]⁺ 247.0516, found 247.0523.



(4-chloro-4,4-difluorobutyl)diphenylphosphine oxide (**1c**)

Following the general procedure **A**, the title compound (49.2 mg, white solid, m.p. 92.0-92.8 °C) was obtained in 75% yield,

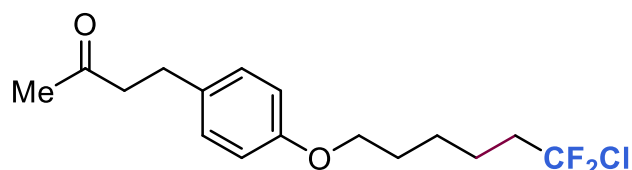
¹H NMR (400 MHz, CDCl₃) δ 7.87 – 7.63 (m, 4H), 7.59 – 7.41 (m, 6H), 2.51 – 2.39 (m, 2H), 2.38 – 2.29 (m, 2H), 2.01 – 1.90 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.57 (tt, *J* = 12.9, 2.1 Hz). **³¹P NMR** (162 MHz, CDCl₃) δ 31.58. **¹³C NMR** (126 MHz, CDCl₃) δ 132.5 (d, *J* = 99.1 Hz), 132.1 (d, *J* = 2.8 Hz), 130.8 (d, *J* = 9.4 Hz), 129.5 (td, *J* = 291.4 Hz, 1.2 Hz), 128.9 (d, *J* = 11.7 Hz), 42.4 (td, *J* = 24.4, 13.4 Hz), 28.8 (d, *J* = 71.8 Hz), 16.3 (q, *J* = 3.3 Hz). HRMS-EI (*m/z*): Calcd for C₁₆H₁₅ClF₂OP [*M*-H]⁺ 327.0512, found 327.0498.



N-(6-chloro-6,6-difluorohexyl)-4-methylbenzenesulfonamide (1d)

Following the general procedure **A**, the title compound (46.2 mg, colourless liquid) was obtained in 71% yield.

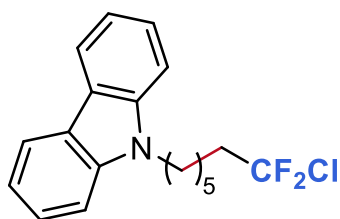
¹H NMR (400 MHz, CDCl₃) δ 8.00 – 7.67 (m, 2H), 7.39 – 7.23 (m, 2H), 4.80 (t, *J* = 6.1 Hz, 1H), 2.93 (q, *J* = 6.8 Hz, 2H), 2.42 (s, 3H), 2.29 – 2.11 (m, 2H), 1.57 – 1.41 (m, 4H), 1.39 – 1.28 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.65 (td, *J* = 13.0, 2.8 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 143.6, 137.0, 132.2 (t, *J* = 293.0 Hz), 129.9, 127.2, 42.9, 41.7 (t, *J* = 23.9 Hz), 29.3, 25.5, 22.9 (t, *J* = 3.0 Hz), 21.6. HRMS-EI (*m/z*): Calcd for C₁₃H₁₈ClF₂NO₂S⁺ [*M*]⁺ 325.0709, found 325.0707.



4-(4-((6-chloro-6,6-difluorohexyl)oxy)phenyl)butan-2-one (1ae)

Following the general procedure **A**, the title compound (41.4 mg, colourless liquid) was obtained in 65% yield.

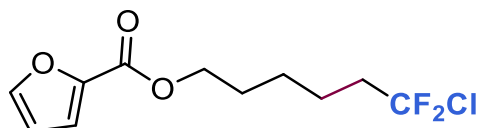
¹H NMR (400 MHz, CDCl₃) δ 7.13 – 7.05 (m, 2H), 6.85 – 6.76 (m, 2H), 3.94 (t, *J* = 6.3 Hz, 2H), 2.92 – 2.67 (m, 4H), 2.40 – 2.24 (m, 2H), 2.13 (s, 3H), 1.80 (dq, *J* = 7.8, 6.3 Hz, 2H), 1.75 – 1.63 (m, 2H), 1.61 – 1.51 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.57 (td, *J* = 12.9, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 208.3, 157.5, 133.2, 130.1 (t, *J* = 291.7 Hz), 129.4, 114.6, 67.6, 45.6, 41.9 (t, *J* = 23.8 Hz), 30.3, 29.1, 29.0, 25.4, 23.2 (t, *J* = 3.1 Hz). HRMS-EI (*m/z*): Calcd for C₁₆H₂₁ClF₂O₂⁺ [*M*]⁺ 318.1193, found 318.1196.



9-(7-chloro-7,7-difluoroheptyl)-9H-carbazole (1f)

Following the general procedure **A**, the title compound (55.6 mg, colourless liquid) was obtained in 83 % yield.

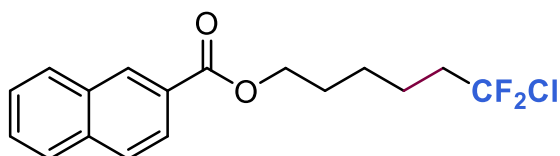
¹H NMR (400 MHz, CDCl₃) δ 8.14 (dt, *J* = 7.8, 1.0 Hz, 2H), 7.50 (ddd, *J* = 8.2, 7.0, 1.2 Hz, 2H), 7.44 – 7.39 (m, 2H), 7.27 (ddd, *J* = 8.0, 7.0, 1.0 Hz, 2H), 4.32 (t, *J* = 7.1 Hz, 2H), 2.32 – 2.16 (m, 2H), 1.91 (pd, *J* = 7.2, 4.0 Hz, 2H), 1.65 – 1.53 (m, 2H), 1.41 (p, *J* = 2.8 Hz, 4H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.58 (td, *J* = 13.2, 3.2 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 140.5, 130.0 (t, *J* = 291.9 Hz), 125.8, 123.0, 120.5, 118.9, 108.7, 43.0, 41.8 (t, *J* = 23.8 Hz), 28.9, 28.5, 27.1, 23.3 (t, *J* = 3.0 Hz). HRMS-EI (*m/z*): Calcd for C₁₉H₂₀ClF₂N⁺ [*M*]⁺ 335.1252, found 335.1254.



6-chloro-6,6-difluorohexyl furan-2-carboxylate (**1g**)

Following the general procedure **A**, the title compound (31.9 mg, colourless liquid) was obtained in 60% yield.

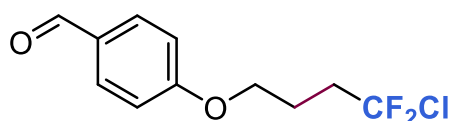
¹H NMR (400 MHz, CDCl₃) δ 7.57 (dd, *J* = 1.8, 0.9 Hz, 1H), 7.17 (dd, *J* = 3.5, 0.9 Hz, 1H), 6.51 (dd, *J* = 3.5, 1.8 Hz, 1H), 4.31 (t, *J* = 6.5 Hz, 2H), 2.60 – 2.12 (m, 2H), 1.85 – 1.74 (m, 2H), 1.73 – 1.63 (m, 2H), 1.58 – 1.46 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.63 (td, *J* = 12.9, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 158.9, 146.4, 130.0 (t, *J* = 291.6 Hz), 118.0, 112.0, 64.7, 41.8 (t, *J* = 23.9 Hz), 28.5, 25.2, 23.1 (t, *J* = 3.0 Hz). HRMS-EI (*m/z*): Calcd for C₁₁H₁₃ClF₂O₃⁺ [*M*⁺ 266.0516, found 266.0515.



6-chloro-6,6-difluorohexyl 2-naphthoate (**1ap**)

Following the general procedure **A**, the title compound (39.1 mg, white solid, m.p. 49.0-50.0 °C) was obtained in 60% yield.

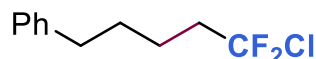
¹H NMR (400 MHz, CDCl₃) δ 8.60 (d, *J* = 1.6 Hz, 1H), 8.06 (dd, *J* = 8.5, 1.7 Hz, 1H), 7.96 (d, *J* = 8.1 Hz, 1H), 7.89 (d, *J* = 8.7 Hz, 2H), 7.65 – 7.51 (m, 2H), 4.40 (t, *J* = 6.5 Hz, 2H), 2.42 – 2.26 (m, 2H), 1.87 (dq, *J* = 8.4, 6.5 Hz, 2H), 1.74 (tt, *J* = 8.0, 6.3 Hz, 2H), 1.64 – 1.54 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.57 (td, *J* = 13.0, 2.8 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 166.9, 135.7, 132.6, 131.1, 130.0, 129.5, 128.4, 128.3, 127.9, 127.7, 126.8, 125.3, 64.9, 41.9 (t, *J* = 23.9 Hz), 28.6, 25.4, 23.2 (t, *J* = 3.1 Hz). HRMS-EI (*m/z*): Calcd for C₁₇H₁₇ClF₂O₂⁺ [*M*⁺ 326.0880, found 326.0878.



4-(4-chloro-4,4-difluorobutoxy)benzaldehyde (**1i**)

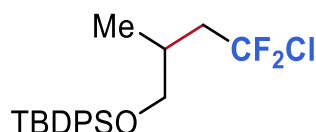
Following the general procedure **A**, the title compound (31.9 mg, colourless liquid) was obtained in 75% yield.

¹H NMR (400 MHz, CDCl₃) δ 9.89 (s, 1H), 7.84 (d, *J* = 8.8 Hz, 2H), 6.99 (d, *J* = 8.7 Hz, 2H), 4.12 (t, *J* = 6.0 Hz, 2H), 2.69 – 2.39 (m, 2H), 2.30 – 1.84 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.84 (td, *J* = 12.9, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 190.9, 163.7, 132.2, 130.4, 129.8 (t, *J* = 291.8 Hz), 114.8, 66.5, 38.8 (t, *J* = 24.7 Hz), 23.5 (t, *J* = 3.2 Hz). HRMS-EI (*m/z*): Calcd for C₁₁H₁₁ClF₂O₂⁺ [*M*⁺ 248.0410, found 248.0412.



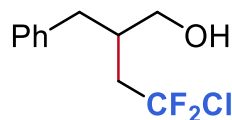
(5-chloro-5,5-difluoropentyl)benzene (**1j**)

Following the general procedure **A**, the title compound (34.0 mg, colorless liquid) was obtained in 78% yield. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.35 – 7.27 (m, 2H), 7.25 – 7.15 (m, 3H), 2.66 (t, J = 7.1 Hz, 2H), 2.41 – 2.22 (m, 2H), 1.79 – 1.62 (m, 4H). $^{19}\text{F NMR}$ (377 MHz, CDCl_3) δ -50.50 (td, J = 12.9, 2.7 Hz). $^{13}\text{C NMR}$ (126 MHz, CDCl_3) δ 141.8, 131.3 (t, J = 291.8 Hz), 128.6, 128.5, 126.1, 41.8 (t, J = 23.8 Hz), 35.7, 30.5, 23.0 (t, J = 3.0 Hz). HRMS-EI (m/z): Calcd for $\text{C}_{11}\text{H}_{13}\text{ClF}_2^+$ [M] $^+$ 218.0674, found 218.0669.



tert-butyl(4-chloro-4,4-difluoro-2-methylbutoxy)diphenylsilane (**1k**)

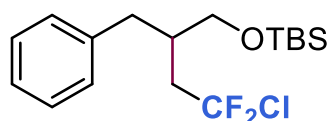
Following the general procedure **A**, the title compound (72.1 mg, colourless liquid) was obtained in 91% yield (5 mmol scale, 88% yield, 1.746 g). $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.68 – 7.61 (m, 4H), 7.47 – 7.35 (m, 6H), 3.57 (dd, J = 10.4, 4.5 Hz, 1H), 3.46 (dd, J = 10.1, 6.2 Hz, 1H), 2.74 – 2.59 (m, 1H), 2.18 – 2.04 (m, 2H), 1.07 (s, 9H), 1.04 (dt, J = 6.6, 1.0 Hz, 3H). $^{19}\text{F NMR}$ (377 MHz, CDCl_3) δ -46.83 (ddd, J = 159.0, 15.1, 9.3 Hz), (-48.43) – (-49.19) (m). $^{13}\text{C NMR}$ (126 MHz, CDCl_3) δ 135.7, 133.6, 130.4 (t, J = 292.5 Hz), 129.9, 127.9, 67.9, 44.9 (t, J = 22.9 Hz), 32.1, 27.0, 19.4, 17.1. HRMS-EI (m/z): Calcd for $\text{C}_{21}\text{H}_{28}\text{ClF}_2\text{OSi}^+$ [$\text{M}+\text{H}$] $^+$ 397.1561, found 397.1557.



2-benzyl-4-chloro-4,4-difluorobutan-1-ol (**1l**)

Following the general procedure **A**, the title compound (24.3 mg, colourless liquid) was obtained in 52% yield.

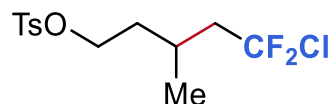
$^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.36 – 7.30 (m, 2H), 7.23 – 7.17 (m, 3H), 3.78 – 3.50 (m, 2H), 2.86 – 2.71 (m, 2H), 2.65 – 2.48 (m, 1H), 2.40 – 2.17 (m, 2H). $^{19}\text{F NMR}$ (377 MHz, CDCl_3) δ -47.31 – -47.95 (m), -48.11 – -48.69 (m). $^{13}\text{C NMR}$ (126 MHz, CDCl_3) δ 139.2, 130.2 (t, J = 292.3 Hz), 129.3, 128.7, 126.6, 63.3, 42.4 (t, J = 23.2 Hz), 38.4, 37.5. HRMS-EI (m/z): Calcd for $\text{C}_{11}\text{H}_{13}\text{ClF}_2\text{O}^+$ [M] $^+$ 234.0618, found 234.0616.



(2-benzyl-4-chloro-4,4-difluorobutoxy)(tert-butyl)dimethylsilane (**1m**)

Following the general procedure **A**, the title compound (64.1 mg, colourless liquid) was obtained in 92% yield.

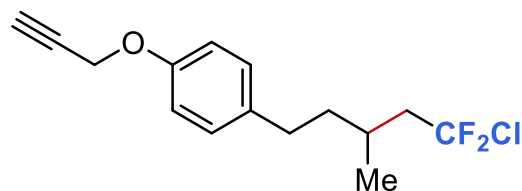
¹H NMR (400 MHz, CDCl₃) δ 7.35 – 7.26 (m, 2H), 7.26 – 7.16 (m, 3H), 3.71 – 3.36 (m, 2H), 2.84 – 2.67 (m, 2H), 2.64 – 2.47 (m, 1H), 2.34 – 2.17 (m, 2H), 0.93 (d, *J* = 0.9 Hz, 9H), 0.04 (d, *J* = 2.1 Hz, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.09 – -47.67 (m), -48.17 (dt, *J* = 160.0, 14.1 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 139.6, 130.4 (t, *J* = 292.5 Hz), 129.4, 128.5, 126.4, 63.0, 42.5 (t, *J* = 23.0 Hz), 38.6, 37.4, 26.0, 18.4, -5.4, -5.5. HRMS-EI (*m/z*): Calcd for C₁₇H₂₆ClF₂OSi⁺ [M-H]⁺ 347.1404, found 347.1409.



5-chloro-5,5-difluoro-3-methylpentyl 4-methylbenzenesulfonate (**1n**)

Following the general procedure **A**, the title compound (58.0 mg, colourless liquid) was obtained in 89% yield.

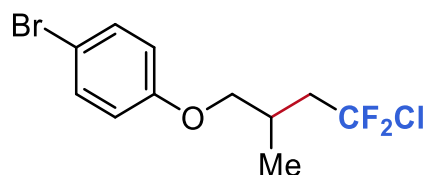
¹H NMR (400 MHz, CDCl₃) δ 7.91 – 7.61 (m, 2H), 7.50 – 7.33 (m, 2H), 4.08 (dd, *J* = 6.9, 5.9 Hz, 2H), 2.45 (s, 3H), 2.32 – 1.98 (m, 3H), 1.80 (dtd, *J* = 14.0, 6.8, 5.3 Hz, 1H), 1.62 – 1.49 (m, 1H), 0.97 (d, *J* = 6.7 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.39 (ddd, *J* = 160.9, 15.3, 11.0 Hz), -48.78 (dt, *J* = 161.2, 14.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 145.1, 133.1, 130.1, 129.7 (t, *J* = 292.7 Hz), 128.0, 67.9, 48.1 (t, *J* = 22.9 Hz), 35.5, 26.0 (t, *J* = 1.9 Hz), 21.8, 19.4. HRMS-EI (*m/z*): Calcd for C₁₃H₁₇ClF₂O₃S⁺ [M]⁺ 326.0550, found 326.0550.



1-(5-Chloro-5,5-difluoro-3-methylpentyl)-4-(prop-2-yn-1-yloxy)benzene (**1o**)

Following the general procedure **A**, the title compound (44.6 mg, colourless liquid) was obtained in 78% yield.

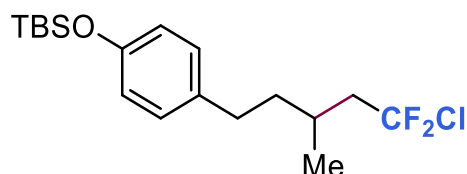
¹H NMR (500 MHz, CDCl₃) δ 7.14 – 7.06 (m, 2H), 6.94 – 6.88 (m, 2H), 4.67 (d, *J* = 2.4 Hz, 2H), 2.63 (ddd, *J* = 13.7, 6.8, 3.5 Hz, 1H), 2.59 – 2.52 (m, 1H), 2.51 (t, *J* = 2.4 Hz, 1H), 2.37 (qd, *J* = 14.9, 4.9 Hz, 1H), 2.17 (tdd, *J* = 15.1, 11.0, 7.8 Hz, 1H), 1.96 (hept, *J* = 6.9, 6.3 Hz, 1H), 1.74 – 1.65 (m, 1H), 1.58 – 1.51 (m, 1H), 1.08 (d, *J* = 6.7 Hz, 3H) ppm. **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.03 (ddd, *J* = 160.0, 15.8, 11.3 Hz), -48.56 (dt, *J* = 159.9, 14.9 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 156.0, 135.2, 130.2 (t, *J* = 292.6 Hz), 129.4, 115.0, 79.0, 75.5, 56.0, 48.4 (t, *J* = 22.5 Hz), 39.0, 32.2, 28.9, 20.0. HRMS-EI (*m/z*): Calcd for C₁₅H₁₇ClF₂O⁺ [M]⁺ 286.0931, found 286.0934.



1-bromo-4-(4-chloro-4,4-difluoro-2-methylbutoxy)benzene (**1p**)

Following the general procedure **A**, the title compound (48.0 mg, colourless liquid) was obtained in 77% yield.

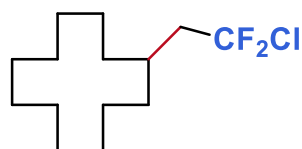
¹H NMR (400 MHz, CDCl₃) δ 7.43 – 7.28 (m, 2H), 6.91 – 6.63 (m, 2H), 3.99 – 3.52 (m, 2H), 2.66 (dtd, *J* = 15.5, 14.6, 5.0 Hz, 1H), 2.48 – 2.36 (m, 1H), 2.26 (tdd, *J* = 15.0, 11.3, 7.6 Hz, 1H), 1.18 (dt, *J* = 6.8, 1.0 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.51 (ddd, *J* = 160.9, 15.6, 11.6 Hz), -48.87 (dt, *J* = 161.2, 14.8 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 155.0, 132.4, 128.8 (t, *J* = 292.3 Hz), 116.4, 113.25, 71.9, 45.0 (t, *J* = 23.3 Hz), 29.7 (t, *J* = 2.2 Hz), 17.3. HRMS-EI (*m/z*): Calcd for C₁₁H₁₂BrClF₂O⁺ [*M*]⁺ 311.9723, found 311.9729.



tert-butyl(4-(5-chloro-5,5-difluoro-3-methylpentyl)phenoxy)dimethylsilane (**1q**)

Following the general procedure **A**, the title compound (57.2mg, colourless liquid) was obtained in 79% yield.

¹H NMR (500 MHz, CDCl₃) δ 7.04 – 7.00 (m, 2H), 6.78 – 6.73 (m, 2H), 2.60 (ddd, *J* = 13.7, 10.3, 5.8 Hz, 1H), 2.53 (ddd, *J* = 13.8, 10.2, 6.1 Hz, 1H), 2.43 – 2.31 (m, 1H), 2.16 (tdd, *J* = 15.2, 11.0, 7.9 Hz, 1H), 1.96 (h, *J* = 7.7, 7.2 Hz, 1H), 1.69 (ddt, *J* = 13.6, 10.2, 5.9 Hz, 1H), 1.58 – 1.49 (m, 1H), 1.07 (d, *J* = 5.6 Hz, 3H), 0.98 (s, 9H), 0.18 (s, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -46.96 (ddd, *J* = 159.9, 15.7, 11.0 Hz), -48.57 (dt, *J* = 159.8, 15.0 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 153.9, 134.7, 130.3 (t, *J* = 292.4 Hz), 129.3, 120.1, 48.4 (t, *J* = 22.4 Hz), 39.0, 32.3, 28.8, 25.9, 20.0, 18.4, -4.3. HRMS-EI (*m/z*): Calcd for C₁₈H₂₉ClF₂OSi⁺ [*M*]⁺ 362.1639, found 362.1642.

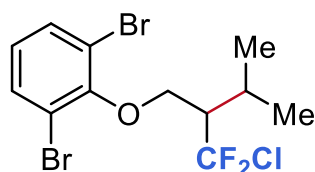


(2-chloro-2,2-difluoroethyl)cyclododecane (**1r**)

Following the general procedure **A**, the title compound (37.3 mg, colourless liquid) was obtained in 70% yield.

¹H NMR (400 MHz, CDCl₃) δ 2.22 (td, *J* = 14.3, 6.1 Hz, 2H), 1.94 (qt, *J* = 7.2, 3.4 Hz, 1H), 1.52 – 1.18 (m, 22H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.86 (td, *J* = 14.2, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 130.6 (t, *J* = 293.0 Hz), 46.8 (t, *J* = 22.1 Hz), 30.2, 29.5, 24.6, 24.1, 23.5, 23.4, 21.6. HRMS-EI (*m/z*): Calcd for C₁₄H₂₅ClF₂⁺ [*M*]⁺

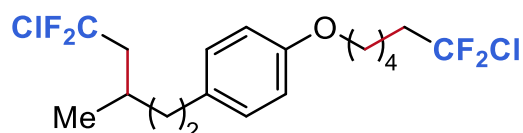
266.1607, found 266.1609.



1,3-dibromo-2-(2-(chlorodifluoromethyl)-3-methylbutoxy)benzene (**1s**)

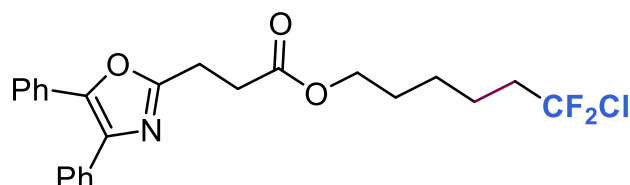
Following the general procedure **A**, the title compound (75.9 mg, colourless liquid) was obtained in 94% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.52 (d, J = 8.0 Hz, 2H), 6.89 (t, J = 8.0 Hz, 1H), 4.22 (qd, J = 9.5, 5.6 Hz, 2H), 2.89 (td, J = 12.1, 6.1, 5.0, 3.0 Hz, 1H), 2.48 (heptd, J = 7.1, 3.0 Hz, 1H), 1.23 (d, J = 7.1 Hz, 3H), 1.14 (d, J = 7.0 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -49.90 (d, J = 12.2 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 153.3, 133.0, 131.3 (t, J = 297.1 Hz), 126.9, 118.6, 69.2 (t, J = 3.6 Hz), 55.5 (t, J = 20.1 Hz), 27.2 (t, J = 1.8 Hz), 21.3, 19.0. HRMS-EI (m/z): Calcd for C₁₂H₁₃Br₂ClF₂O⁺ [M]⁺ 403.8984, found 403.8982.



1-(5-chloro-5,5-difluoro-3-methylpentyl)-4-((6-chloro-6,6-difluorohexyl)oxy)benzene (**1t**)

Following the general procedure **A**, the title compound (57.1 mg, colourless liquid) was obtained in 71% yield. **¹H NMR** (400 MHz, CDCl₃) δ 7.15 – 7.03 (m, 2H), 6.93 – 6.69 (m, 2H), 3.95 (t, J = 6.3 Hz, 2H), 2.68 – 2.49 (m, 2H), 2.43 – 2.28 (m, 3H), 2.23 – 2.11 (m, 1H), 2.03 – 1.92 (m, 1H), 1.81 (dq, J = 8.2, 6.4 Hz, 2H), 1.69 (dtt, J = 9.8, 6.0, 2.8 Hz, 3H), 1.61 – 1.50 (m, 3H), 1.08 (dt, J = 6.7, 1.1 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.00 (dd, J = 159.8, 2.4 Hz), -48.11 – -49.12 (m), -50.56 (d, J = 2.5 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 157.3, 134.1, 130.2 (t, J = 293.0 Hz), 130.1 (t, J = 291.8 Hz), 129.3, 114.6, 67.6, 48.4 (t, J = 22.4 Hz), 41.9 (t, J = 23.8 Hz), 39.1, 32.2, 29.1, 28.8, 25.4, 23.2 (t, J = 3.1 Hz), 20.0. HRMS-EI (m/z): Calcd for C₁₈H₂₄Cl₂F₄O⁺ [M]⁺ 402.1135, found 402.1133.

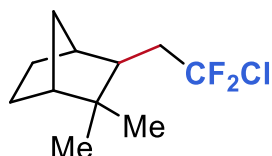


6-chloro-6,6-difluorohexyl 3-(4,5-diphenyloxazol-2-yl)propanoate (**1u**)

Following the general procedure **A**, the title compound (65.4 mg, colourless liquid) was obtained in 73% yield (5 mmol scale, 65% yield, 1.456 g).

¹H NMR (400 MHz, CDCl₃) δ 7.65 – 7.61 (m, 2H), 7.60 – 7.54 (m, 2H), 7.43 – 7.27

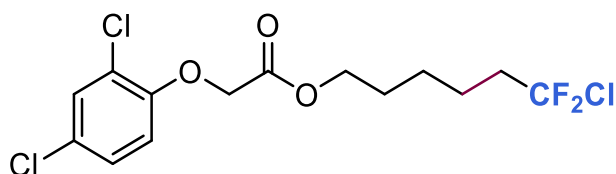
(m, 6H), 4.14 (t, $J = 6.5$ Hz, 2H), 3.19 (dd, $J = 8.0, 6.9$ Hz, 2H), 2.92 (dd, $J = 8.0, 6.9$ Hz, 2H), 2.32 – 2.07 (m, 2H), 1.74 – 1.48 (m, 4H), 1.42 (qd, $J = 8.5, 7.2, 3.9$ Hz, 2H). ^{19}F NMR (377 MHz, CDCl_3) δ -50.61 (td, $J = 12.9, 3.0$ Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 172.1, 161.9, 145.6, 135.2, 132.5, 130.0 (t, $J = 292.1$ Hz), 129.1, 128.8, 128.7, 128.6, 128.2, 128.0, 126.6, 64.5, 41.7 (t, $J = 24.0$ Hz), 31.3, 28.4, 25.1, 23.7, 23.1 (t, $J = 3.1$ Hz). HRMS-EI (m/z): Calcd for $\text{C}_{24}\text{H}_{25}\text{ClF}_2\text{NO}_3^+$ $[\text{M}+\text{H}]^+$ 448.1486, found 448.1483



3-(2-chloro-2,2-difluoroethyl)-2,2-dimethylbicyclo[2.2.1]heptane (**1v**)

Following the general procedure **A**, the title compound (31.1 mg, colourless liquid) was obtained in 70% yield.

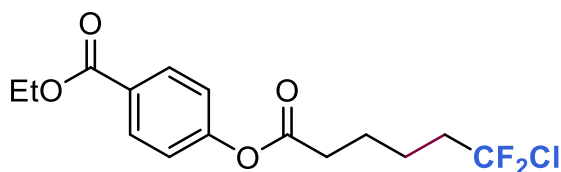
^1H NMR (400 MHz, CDCl_3) δ 2.40 – 2.17 (m, 2H), 1.81 – 1.71 (m, 2H), 1.65 (dtd, $J = 9.9, 3.3, 1.7$ Hz, 1H), 1.60 – 1.52 (m, 1H), 1.37 – 1.18 (m, 5H), 0.98 (s, 3H), 0.81 (s, 3H). ^{19}F NMR (377 MHz, CDCl_3) δ -47.60 (dd, $J = 158.7, 2.7$ Hz), -50.15 (dd, $J = 158.8, 2.8$ Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 130.8 (t, $J = 292.7$ Hz), 48.6, 45.3, 41.9, 39.2 (t, $J = 23.0$ Hz), 37.4, 37.1, 31.9, 24.7, 22.2, 20.4. HRMS-EI (m/z): Calcd for $\text{C}_{11}\text{H}_{17}\text{ClF}_2^+$ $[\text{M}]^+$ 222.0981, found 222.0977.



6-chloro-6,6-difluorohexyl 2-(2,4-dichlorophenoxy)acetate (**1w**)

Following the general procedure **A**, the title compound (67.3 mg, colourless liquid) was obtained in 90% yield.

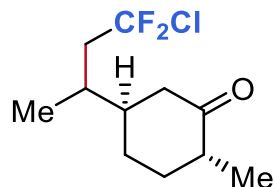
^1H NMR (400 MHz, CDCl_3) δ 7.33 (d, $J = 2.5$ Hz, 1H), 7.10 (dd, $J = 8.8, 2.6$ Hz, 1H), 6.71 (d, $J = 8.8$ Hz, 1H), 4.62 (s, 2H), 4.14 (t, $J = 6.5$ Hz, 2H), 2.48 – 2.00 (m, 2H), 1.86 – 1.41 (m, 4H), 1.33 (qd, $J = 8.2, 7.2, 3.5$ Hz, 2H). ^{19}F NMR (377 MHz, CDCl_3) δ -50.59 (td, $J = 13.0, 2.9$ Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 168.3, 152.5, 130.5, 129.9 (t, $J = 291.7$ Hz), 127.7, 127.3, 124.4, 114.8, 66.5, 65.2, 41.7 (t, $J = 23.9$ Hz), 28.3, 25.0, 23.0 (t, $J = 3.2$ Hz). HRMS-EI (m/z): Calcd for $\text{C}_{14}\text{H}_{15}\text{Cl}_3\text{F}_2\text{O}_3^+$ $[\text{M}]^+$ 374.0049, found 374.0055.



ethyl 4-((6-chloro-6,6-difluorohexanoyl)oxy)benzoate (**1x**)

Following the general procedure **A**, the title compound (58.8 mg, colourless liquid)

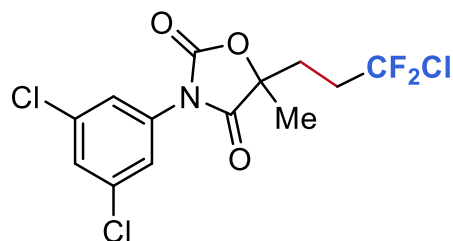
was obtained in 88 % yield. **¹H NMR** (400 MHz, CDCl₃) δ 8.10 – 8.05 (m, 2H), 7.18 – 7.13 (m, 2H), 4.37 (q, *J* = 7.1 Hz, 2H), 2.62 (t, *J* = 7.2 Hz, 2H), 2.42 – 2.28 (m, 2H), 1.90 – 1.80 (m, 2H), 1.79 – 1.70 (m, 2H), 1.38 (t, *J* = 7.1 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.67 (td, *J* = 12.7, 2.8 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 171.1, 165.9, 154.2, 131.3, 129.8 (t, *J* = 292.4 Hz), 128.2, 121.6, 61.2, 41.6 (t, *J* = 24.2 Hz), 34.0, 23.8, 22.9 (t, *J* = 3.2 Hz), 14.4. HRMS-EI (*m/z*): Calcd for C₁₅H₁₇ClF₂O₄⁺ [M]⁺ 334.0783, found 334.0786. Calcd for C₁₆H₂₃ClF₂O⁺ [M]⁺ 304.1400, found 304.1404.



(2R,5R)-5-(4-chloro-4,4-difluorobutan-2-yl)-2-methylcyclohexan-1-one (**1y**)

Following the general procedure **A**, the title compound (36.3 mg, d.r. = 1/1, colourless liquid) was obtained in 76% yield.

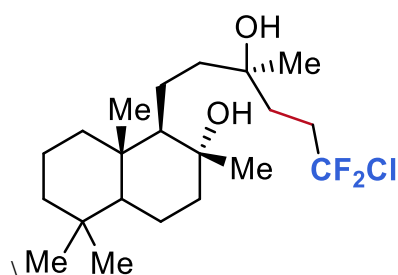
¹H NMR (400 MHz, CDCl₃) δ 2.48 – 2.25 (m, 3H), 2.20 – 2.05 (m, 3H), 2.02 – 1.88 (m, 1H), 1.87 – 1.70 (m, 2H), 1.59 – 1.42 (m, 1H), 1.40 – 1.26 (m, 1H), 1.03 (t, *J* = 6.4 Hz, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.23 (dd, *J* = 160.2, 2.8 Hz), -49.49 (ddd, *J* = 160.7, 63.7, 2.4 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 212.5, 212.4, 130.2 (t, *J* = 292.8 Hz), 46.1 (t, *J* = 22.7 Hz), 45.9 (t, *J* = 22.7 Hz), 45.5, 45.1, 45.0, 44.9, 44.0, 34.7, 34.7, 33.4, 29.2, 27.5, 16.4, 16.4, 14.4, 14.4. HRMS-EI (*m/z*): Calcd for C₁₁H₁₈ClF₂O⁺ [M+H]⁺ 239.1009, found 239.1011.



5-(3-chloro-3,3-difluoropropyl)-3-(3,5-dichlorophenyl)-5-methyloxazolidine-2,4-dione (**1z**)

Following the general procedure **A**, the title compound (72.7 mg, white solid, m.p. 114.0-114.7 °C) was obtained in 98% yield.

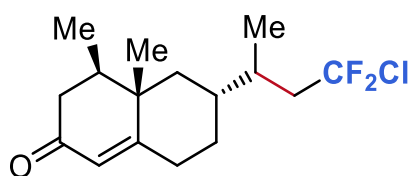
¹H NMR (400 MHz, CDCl₃) δ 7.45 (d, *J* = 1.8 Hz, 2H), 7.44 – 7.42 (m, 1H), 2.62 – 2.48 (m, 1H), 2.45 – 2.33 (m, 1H), 2.29 (ddt, *J* = 9.4, 5.9, 2.9 Hz, 2H), 1.71 (s, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.44 (tdd, *J* = 11.9, 5.6, 2.8 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 172.9, 151.9, 135.8, 132.4, 129.3, 128.6 (t, *J* = 291.4 Hz), 123.8, 84.2, 36.0 (t, *J* = 25.8 Hz), 30.7 (t, *J* = 3.2 Hz), 22.3. HRMS-EI (*m/z*): Calcd for C₁₃H₁₀Cl₃F₂NO₃⁺ [M]⁺ 370.9689, found 370.9691.



(1R,2R,8aS)-1-((R)-6-chloro-6,6-difluoro-3-hydroxy-3-methylhexyl)-2,5,5,8a-tetramethyldecahydronaphthalen-2-ol (**1aa**)

Following the general procedure **A**, the title compound (51.2 mg, white solid, m.p. 155.7-156.6 °C) was obtained in 65% yield.

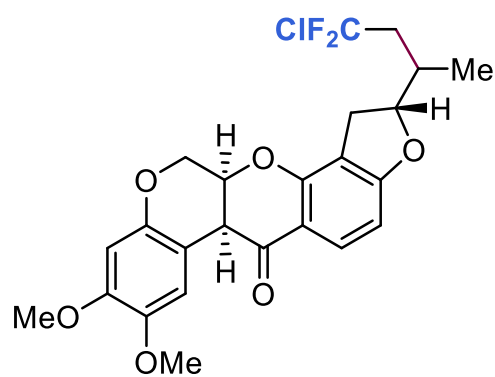
¹H NMR (400 MHz, CDCl₃) δ 2.42 (ttd, *J* = 14.8, 7.6, 5.9 Hz, 3H), 1.84 (dt, *J* = 12.1, 3.2 Hz, 1H), 1.75 – 1.50 (m, 8H), 1.47 – 1.22 (m, 5H), 1.19 – 1.09 (m, 8H), 0.98 – 0.90 (m, 1H), 0.86 (s, 3H), 0.79 (s, 3H), 0.78 (s, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -50.37 (td, *J* = 13.0, 3.6 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 130.7 (t, *J* = 291.2 Hz), 75.3, 71.8, 61.9, 56.2, 44.8, 44.5, 42.1, 39.8, 39.4, 37.0 (t, *J* = 24.0 Hz), 36.6, 33.5, 33.4, 25.67, 24.5, 21.6, 20.7, 18.9, 18.5, 15.5. HRMS-EI (*m/z*): Calcd for C₂₀H₃₅ClF₂O₂ [M-18]⁺ 376.2339, found 376.2345.



(4R,4aS,6R)-6-((S)-4-chloro-4,4-difluorobutan-2-yl)-4,4a-dimethyl-4,4a,5,6,7,8-hexahydronaphthalen-2(3H)-one (**1ab**)

Following the general procedure **A**, the title compound (36.5 mg, d.r. = 1/1, colourless liquid) was obtained in 60% yield.

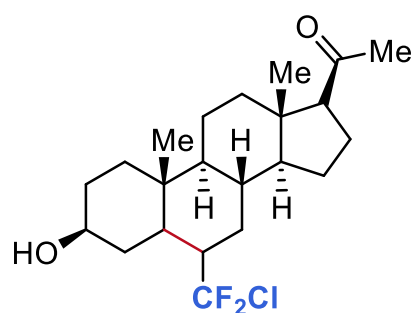
¹H NMR (400 MHz, CDCl₃) δ 5.75 (d, *J* = 1.8 Hz, 1H), 2.51 – 2.31 (m, 3H), 2.29 – 2.23 (m, 1H), 2.14 (tdd, *J* = 15.1, 8.3, 4.2 Hz, 1H), 2.05 – 1.67 (m, 6H), 1.19 (ddd, *J* = 13.2, 8.6, 4.3 Hz, 1H), 1.08 (d, *J* = 3.4 Hz, 3H), 1.04 – 0.92 (m, 7H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -47.08 (ddt, *J* = 160.1, 15.7, 11.6 Hz), -49.09 (ddt, *J* = 160.2, 99.6, 15.2 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 199.6, 170.4, 170.3, 130.4 (t, *J* = 292.7 Hz), 124.8 (d, *J* = 2.3 Hz), 46.3 (t, *J* = 22.4 Hz), 45.9 (t, *J* = 22.5 Hz), 42.5, 42.2, 40.7, 40.7, 40.6, 39.4, 39.3, 37.7, 37.6, 33.4, 33.1, 32.9, 29.9, 28.2, 17.0, 17.0, 16.7, 16.4, 15.1, 15.1. HRMS-EI (*m/z*): Calcd for C₁₆H₂₃ClF₂O⁺ [M]⁺ 304.1400, found 304.1404.



(2R,6aS,12aS)-2-(4-chloro-4,4-difluorobutan-2-yl)-8,9-dimethoxy-1,2,12,12a-tetrahydrochromeno[3,4-b]furo[2,3-h]chromen-6(6aH)-one (**1ac**)

Following the general procedure **A**, the title compound (72.0 mg, d.r = 1/1, colourless liquid) was obtained in 75% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.94 – 7.76 (m, 1H), 6.79 – 6.73 (m, 1H), 6.53 – 6.42 (m, 2H), 5.23 (t, *J* = 9.0 Hz, 0.5H), 5.06 (dt, *J* = 1.7, 1.0 Hz, 0.5H), 4.92 (qd, *J* = 3.0, 1.9 Hz, 1.5H), 4.87 – 4.64 (m, 0.5H), 4.64 – 4.54 (m, 1H), 4.17 (ddt, *J* = 12.0, 2.0, 1.1 Hz, 1H), 3.85 – 3.81 (m, 1H), 3.80 (d, *J* = 0.8 Hz, 3H), 3.75 (d, *J* = 1.7 Hz, 3H), 3.38 – 3.13 (m, 1H), 2.91 (ddd, *J* = 32.6, 15.8, 8.2 Hz, 1H), 2.78 – 2.44 (m, 0.5H), 2.33 – 2.15 (m, 1H), 1.76 (t, *J* = 1.2 Hz, 1.5H), 1.67 (s, 0.5H), 1.15 – 1.11 (m, 1H), 1.11 – 1.03 (m, 0.5H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -46.85 (dddd, *J* = 197.4, 161.7, 15.5, 9.1 Hz), -48.59 – -50.00 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 189.1, 189.0, 167.5, 167.1, 158.1, 158.0, 149.6, 149.6, 147.5, 144.0, 143.1, 130.2, 130.1, 129.9 (t, *J* = 292.5 Hz), 128.8 (t, *J* = 292.9 Hz), 113.5, 113.5, 113.4, 113.1, 112.9, 112.8, 112.7, 110.5, 110.4, 105.0, 104.9, 104.8, 101.0, 88.3, 88.0, 72.4, 72.3, 66.4, 66.4, 56.4, 56.0, 44.7, 44.3 (t, *J* = 23.4 Hz), 44.0 (t, *J* = 23.3 Hz), 34.6, 34.0, 31.4, 29.9, 29.2, 17.2, 15.8, 14.3. HRMS-EI (*m/z*): Calcd for C₂₄H₂₃ClF₂O₆ [*M*] 480.1146, found 480.1136.

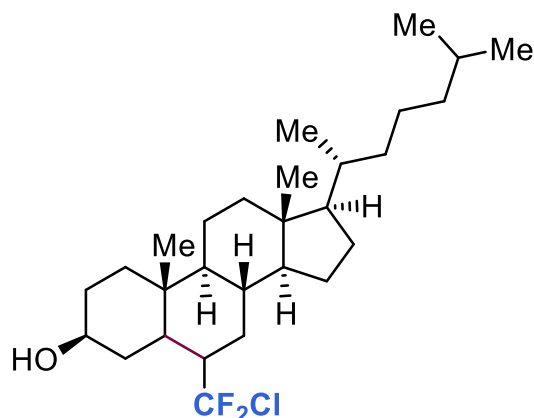


1-((3S,8R,9S,10R,13S,14S,17R)-6-(chlorodifluoromethyl)-3-hydroxy-10,13-dimethylhexadecahydro-1H-cyclopenta[a]phenanthren-17-yl)ethan-1-one (**1ad**)

Following the general procedure **A**, the title compound (72.3 mg, white solid, d.r. = 1/1, m.p. 163.0-164.6 °C) was obtained in 90% yield.

¹H NMR (400 MHz, CDCl₃) δ 3.45 (ddt, *J* = 14.8, 10.9, 5.1 Hz, 1H), 2.55 – 2.34 (m, 2H), 2.17 – 2.07 (m, 2H), 2.05 (s, 3H), 2.00 – 1.90 (m, 1H), 1.82 – 1.69 (m, 4H), 1.67 – 1.46 (m, 6H), 1.39 – 1.27 (m, 3H), 1.24 – 1.14 (m, 2H), 1.04 (dddd, *J* = 12.4, 10.7, 6.9, 1.5 Hz, 1H), 0.90 (td, *J* = 13.7, 12.8, 3.9 Hz, 1H), 0.83 (d, *J* = 3.6 Hz, 3H), 0.64

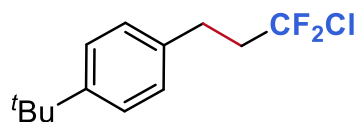
(dd, $J = 11.1, 4.1$ Hz, 1H), 0.57 (s, 3H). ^{19}F NMR (377 MHz, CDCl_3) δ -44.02 (d, $J = 154.6$ Hz), -46.12 (ddt, $J = 154.5, 29.7, 3.8$ Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 209.6, 133.6 (dd, $J = 303.0, 301.4$ Hz), 72.1, 63.8, 56.5, 55.0, 49.9, 49.7, 49.7, 49.6, 46.9, 44.3, 40.0, 39.0, 37.5, 37.5, 35.1, 33.1, 33.1, 32.1, 32.1, 31.6, 31.5, 24.5, 22.9, 21.2, 14.9, 14.8, 13.6. HRMS-EI (m/z): Calcd for $\text{C}_{22}\text{H}_{33}\text{ClF}_2\text{O}_2^+$ $[\text{M}]^+$ 402.2132, found 402.2136.



(3S,8S,9S,10R,13R,14S,17R)-6-(chlorodifluoromethyl)-10,13-dimethyl-17-((R)-6-methylheptan-2-yl)hexadecahydro-1H-cyclopenta[a]phenanthren-3-ol (**1ae**)

Following the general procedure **A**, the title compound (66.1 mg, d.r = 1/1, colourless liquid) was obtained in 70% yield.

^1H NMR (400 MHz, CDCl_3) δ 3.50 (dq, $J = 10.6, 6.7, 5.1$ Hz, 1H), 2.59 – 2.40 (m, 1H), 2.19 – 2.10 (m, 1H), 1.99 (dt, $J = 12.6, 3.5$ Hz, 1H), 1.92 – 1.75 (m, 5H), 1.70 – 1.44 (m, 7H), 1.42 – 1.20 (m, 7H), 1.19 – 1.04 (m, 7H), 1.00 – 0.82 (m, 14H), 0.68 (s, 3H). ^{19}F NMR (377 MHz, CDCl_3) δ -43.77 (d, $J = 153.9$ Hz), -45.96 (ddd, $J = 153.4, 30.2, 3.9$ Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 133.9 (dd, $J = 303.7, 300.6$ Hz), 72.3, 72.2, 56.4, 56.4, 55.2, 50.1, 49.9, 49.9, 49.7, 46.9, 42.8, 40.0, 40.0, 39.7, 37.6, 37.6, 36.3, 35.9, 35.1, 33.2, 33.2, 32.1, 32.1, 31.7, 28.3, 28.2, 24.3, 24.0, 23.0, 22.7, 21.3, 18.8, 14.9, 14.8, 12.3. HRMS-EI (m/z): Calcd for $\text{C}_{28}\text{H}_{47}\text{ClF}_2\text{O}^+$ $[\text{M}]^+$ 472.3278, found 472.3286.

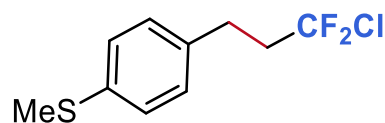


1-(tert-butyl)-4-(3-chloro-3,3-difluoropropyl)benzene (**1af**)

Following the general procedure **B**, the title compound (34.5 mg, colourless liquid) was obtained in 70% yield (5 mmol scale, 65% yield, 0.80 g).

^1H NMR (400 MHz, CDCl_3) δ 7.39 – 7.34 (m, 2H), 7.19 – 7.14 (m, 2H), 2.95 – 2.89 (m, 2H), 2.67 – 2.55 (m, 2H), 1.34 (s, 9H). ^{19}F NMR (377 MHz, CDCl_3) δ -51.23 (td, $J = 12.9, 2.8$ Hz). ^{13}C NMR (126 MHz, Chloroform- d) δ 149.6, 135.8, 129.4 (t, $J = 291.8$ Hz), 128.0, 125.6, 43.6 (t, $J = 23.7$ Hz), 34.4, 31.3, 28.9 (t, $J = 3.3$ Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 149.7, 136.0, 129.6 (t, $J = 291.8$ Hz), 128.1, 125.8, 43.8 (t, $J = 23.8$ Hz), 34.6, 31.5, 29.1 (t, $J = 3.3$ Hz). HRMS-EI (m/z): Calcd for $\text{C}_{13}\text{H}_{11}\text{ClF}_2^+$

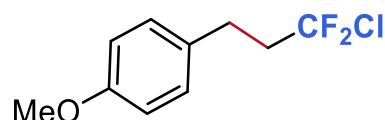
[M]⁺ 246.0981, found 246.0977.



4-(3-chloro-3,3-difluoropropyl)phenyl(methyl)sulfane (**1ag**)

Following the general procedure **B**, the title compound (29.2 mg, colourless liquid) was obtained in 62% yield (5 mmol scale, 60% yield, 0.71 g).

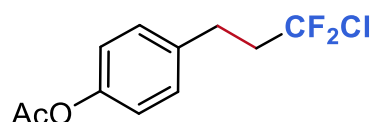
¹H NMR (400 MHz, CDCl₃) δ 7.25 – 7.16 (m, 2H), 7.16 – 7.08 (m, 2H), 2.99 – 2.85 (m, 2H), 2.68 – 2.52 (m, 2H), 2.48 (s, 3H). ¹⁹F NMR (377 MHz, CDCl₃) δ -51.17 (td, *J* = 12.6, 2.7 Hz). ¹³C NMR (101 MHz, CDCl₃) δ 136.7, 135.9, 129.4 (t, *J* = 292.2 Hz), 128.9, 127.3, 43.7 (t, *J* = 23.9 Hz), 29.1 (t, *J* = 3.3 Hz), 16.2. HRMS-EI (*m/z*): Calcd for C₁₀H₁₁ClF₂S⁺ [M]⁺ 236.0233, found 236.0236.



1-(3-chloro-3,3-difluoropropyl)-4-methoxybenzene (**1ah**)

Following the general procedure **B**, the title compound (25.5 mg, colourless liquid) was obtained in 68% yield.

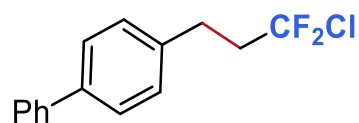
¹H NMR (500 MHz, CDCl₃) δ 7.15 – 7.11 (m, 2H), 6.90 – 6.83 (m, 2H), 3.80 (s, 3H), 2.91 – 2.85 (m, 2H), 2.62 – 2.52 (m, 2H). ¹⁹F NMR (377 MHz, CDCl₃) δ -51.16 (td, *J* = 12.9, 2.7 Hz). ¹³C NMR (126 MHz, CDCl₃) δ 158.5, 131.0, 129.5 (t, *J* = 292.2 Hz), 129.4, 114.3, 55.4, 44.0 (t, *J* = 23.7 Hz), 28.8 (t, *J* = 3.5 Hz). HRMS-EI (*m/z*): Calcd for C₁₀H₁₁ClF₂O⁺ [M]⁺ 220.0461, found 220.0460.



4-(3-chloro-3,3-difluoropropyl)phenyl acetate (**1ai**)

Following the general procedure **B**, the title compound (33.6 mg, colourless liquid) was obtained in 68% yield.

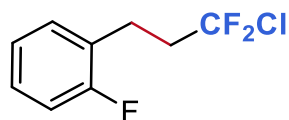
¹H NMR (400 MHz, CDCl₃) δ 7.25 – 7.17 (m, 2H), 7.07 – 6.99 (m, 2H), 2.96 – 2.88 (m, 2H), 2.68 – 2.51 (m, 2H), 2.30 (s, 3H). ¹⁹F NMR (377 MHz, CDCl₃) δ -51.30 (td, *J* = 12.6, 2.7 Hz). ¹³C NMR (126 MHz, CDCl₃) δ 169.7, 149.5, 136.6, 129.4, 129.3 (t, *J* = 294.2 Hz), 122.0, 43.7 (t, *J* = 23.9 Hz), 29.1 (t, *J* = 3.2 Hz), 21.3. HRMS-EI (*m/z*): Calcd for C₁₁H₁₁ClF₂O₂⁺ [M]⁺ 248.0140, found 248.0410.



4-(3-chloro-3,3-difluoropropyl)-1,1'-biphenyl (**1aj**)

Following the general procedure **B**, the title compound (31.9 mg, white solid, m.p. 63.5-64.2 °C) was obtained in 60% yield (5 mmol scale, 57% yield, 0.76 g).

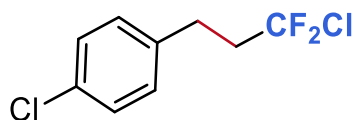
¹H NMR (400 MHz, CDCl₃) δ 7.72 – 7.58 (m, 4H), 7.58 – 7.48 (m, 2H), 7.48 – 7.40 (m, 1H), 7.35 (d, *J* = 8.3 Hz, 2H), 3.11 – 3.02 (m, 2H), 2.81 – 2.63 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.00 (td, *J* = 12.6, 2.7 Hz). **¹³C NMR** (101 MHz, CDCl₃) δ 140.9, 139.8, 138.0, 129.5 (t, *J* = 292.2 Hz), 128.9, 128.9, 127.5, 127.4, 127.1, 43.7 (t, *J* = 23.9 Hz), 29.3 (t, *J* = 3.4 Hz). HRMS-EI (*m/z*): Calcd for C₁₅H₁₃ClF₂⁺ [*M*]⁺ 266.0668, found 266.0670.



1-(3-chloro-3,3-difluoropropyl)-2-fluorobenzene (**1ak**)

Following the general procedure **B**, the title compound (24.1 mg, colourless liquid) was obtained in 58% yield.

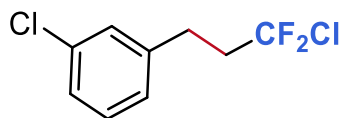
¹H NMR (400 MHz, CDCl₃) δ 7.29 – 7.17 (m, 2H), 7.14 – 7.00 (m, 2H), 3.13 – 2.80 (m, 2H), 2.74 – 2.48 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.44 (td, *J* = 12.6, 2.7 Hz), -118.49 – -118.55 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 161.3 (d, *J* = 245.7 Hz), 130.7 (d, *J* = 4.6 Hz), 129.4 (t, *J* = 292.1 Hz), 128.7 (d, *J* = 8.1 Hz), 126.0 (d, *J* = 15.6 Hz), 124.4 (d, *J* = 3.7 Hz), 115.7 (d, *J* = 21.8 Hz), 42.2 (t, *J* = 24.1 Hz), 23.6 – 23.5 (m). HRMS-EI (*m/z*): Calcd for C₉H₈ClF₃⁺ [*M*]⁺ 208.0261, found 208.0262.



1-chloro-4-(3-chloro-3,3-difluoropropyl)benzene (**1al**)

Following the general procedure **B**, the title compound (22.4 mg, colourless liquid) was obtained in 50% yield.

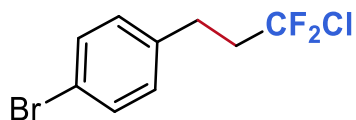
¹H NMR (400 MHz, CDCl₃) δ 7.31 – 7.27 (m, 2H), 7.16 – 7.12 (m, 2H), 2.94 – 2.88 (m, 2H), 2.64 – 2.51 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.26 (td, *J* = 12.5, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 137.4, 132.6, 129.8, 129.3 (t, *J* = 292.4 Hz), 129.0, 43.6 (t, *J* = 24.0 Hz), 29.1 (t, *J* = 3.4 Hz). HRMS-EI (*m/z*): Calcd for C₉H₈Cl₂F₂⁺ [*M*]⁺ 223.9966, found 223.9967.



1-chloro-3-(3-chloro-3,3-difluoropropyl)benzene (**1am**)

Following the general procedure **B**, the title compound (24.6 mg, colourless liquid) was obtained in 55% yield.

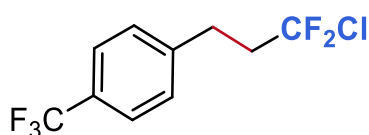
¹H NMR (400 MHz, CDCl₃) δ 7.29 – 7.18 (m, 3H), 7.10 (dt, *J* = 6.9, 1.8 Hz, 1H), 3.01 – 2.83 (m, 2H), 2.70 – 2.48 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.34 (td, *J* = 12.6, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 141.0, 134.6, 130.1, 129.22 (t, *J* = 291.6 Hz), 128.6, 127.1, 126.7, 43.4 (t, *J* = 24.2 Hz), 29.4 (t, *J* = 3.4 Hz). HRMS-EI (*m/z*): Calcd for C₉H₈Cl₂F₂⁺ [*M*]⁺ 223.9966, found 223.9969.



1-bromo-4-(3-chloro-3,3-difluoropropyl)benzene (**1an**)

Following the general procedure **B**, the title compound (24.1 mg, colourless liquid) was obtained in 55% yield.

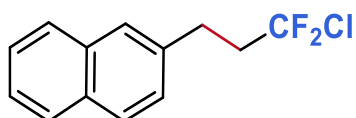
¹H NMR (400 MHz, CDCl₃) δ 7.74 – 7.35 (m, 2H), 7.16 – 6.95 (m, 2H), 3.26 – 2.72 (m, 2H), 2.76 – 2.33 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.27 (td, *J* = 12.6, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 138.0, 132.0, 130.2, 129.3 (t, *J* = 292.1 Hz), 120.7, 43.5 (t, *J* = 24.1 Hz), 29.1 (t, *J* = 3.6 Hz). HRMS-EI (*m/z*): Calcd for C₉H₈BrClF₂⁺ [*M*]⁺ 267.9460, found 267.9462.



1-(3-chloro-3,3-difluoropropyl)-4-(trifluoromethyl)benzene (**1ao**)

Following the general procedure **B**, the title compound (27.9 mg, colourless liquid) was obtained in 54% yield.

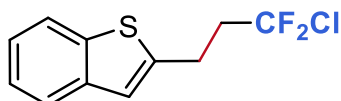
¹H NMR (400 MHz, CDCl₃) δ 7.59 (d, *J* = 8.1 Hz, 2H), 7.43 – 7.30 (m, 2H), 3.17 – 2.89 (m, 2H), 2.77 – 2.50 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.39 (td, *J* = 12.6, 2.9 Hz), -62.54. **¹³C NMR** (126 MHz, CDCl₃) δ 143.1, 129.3 (q, *J* = 32.6 Hz), 129.2 (t, *J* = 292.0 Hz), 128.9, 125.8 (q, *J* = 3.4, 2.9 Hz), 124.3 (q, *J* = 272.0 Hz), 43.3 (t, *J* = 24.3 Hz), 29.5 (t, *J* = 3.4 Hz). HRMS-EI (*m/z*): Calcd for C₁₀H₈ClF₅⁺ [*M*]⁺ 258.0229, found 258.0235.



2-(3-chloro-3,3-difluoropropyl)naphthalene (**1ap**)

Following the general procedure **B**, the title compound (19.2 mg, colourless liquid) was obtained in 40% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.86 – 7.79 (m, 3H), 7.67 (s, 1H), 7.57 – 7.43 (m, 2H), 7.34 (dd, *J* = 8.5, 1.8 Hz, 1H), 3.20 – 3.04 (m, 2H), 2.82 – 2.60 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.10 (td, *J* = 12.6, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 136.5, 133.7, 132.4, 129.5 (t, *J* = 292.0 Hz), 128.6, 127.8, 127.6, 126.8, 126.8, 126.4, 125.8, 43.7 (t, *J* = 23.9 Hz), 29.8 (t, *J* = 3.5 Hz). HRMS-EI (*m/z*): Calcd for C₁₃H₁₁ClF₂⁺ [*M*]⁺ 240.0512, found 240.0515.

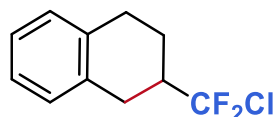


2-(3-chloro-3,3-difluoropropyl)benzo[b]thiophene (**1aq**)

Following the general procedure **B**, the title compound (19.7 mg, white solid, m.p.

71.1-72.0 °C) was obtained in 40% yield.

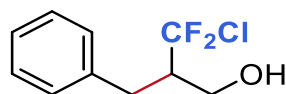
¹H NMR (400 MHz, CDCl₃) δ 7.93 – 7.54 (m, 2H), 7.42 – 7.24 (m, 2H), 7.08 (q, *J* = 1.0 Hz, 1H), 3.32 – 3.17 (m, 2H), 2.84 – 2.69 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -51.37 (td, *J* = 12.6, 2.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 142.2, 140.0, 139.5, 129.0 (t, *J* = 292.1 Hz), 124.5, 124.2, 123.2, 122.3, 121.7, 43.2 (t, *J* = 24.4 Hz), 24.9 (t, *J* = 3.7 Hz). HRMS-EI (*m/z*): Calcd for C₁₁H₉ClF₂S⁺ [M]⁺ 246.0076, found 246.0079.



2-(chlorodifluoromethyl)-1,2,3,4-tetrahydronaphthalene (**1ar**)

Following the general procedure **B**, the title compound (20.7 mg, colourless liquid) was obtained in 48% yield.

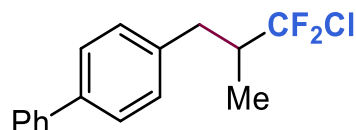
¹H NMR (400 MHz, CDCl₃) δ 7.17 – 7.04 (m, 4H), 3.05 (ddd, *J* = 15.8, 5.1, 1.9 Hz, 1H), 2.99 – 2.79 (m, 3H), 2.67 – 2.50 (m, 1H), 2.24 (ddt, *J* = 10.3, 5.2, 2.6 Hz, 1H), 1.72 (dtd, *J* = 13.0, 11.9, 5.8 Hz, 1H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -56.39 (ddd, *J* = 162.3, 9.2, 2.7 Hz), -56.86 – -57.48 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 135.6, 133.9, 129.3, 128.9, 126.4, 126.2, 46.0 (t, *J* = 22.8 Hz), 29.6 (t, *J* = 3.2 Hz), 28.6, 23.6 (t, *J* = 3.0 Hz). HRMS-EI (*m/z*): Calcd for C₁₁H₁₁ClF₂⁺ [M]⁺ 216.0512, found 216.0511.



2-benzyl-3-chloro-3,3-difluoropropan-1-ol (**1as**)

Following the general procedure **B**, the title compound (20.2 mg, colourless liquid) was obtained in 46% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.32 – 7.26 (m, 2H), 7.24 – 7.18 (m, 3H), 3.81 (dd, *J* = 12.2, 3.5 Hz, 1H), 3.69 (dd, *J* = 12.2, 5.2 Hz, 1H), 3.06 (dd, *J* = 13.9, 3.9 Hz, 1H), 2.80 (dd, *J* = 13.9, 10.3 Hz, 1H), 2.59 (qdt, *J* = 10.4, 5.2, 3.8 Hz, 1H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -52.39 (ddd, *J* = 19.3, 10.3, 2.8 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 137.9, 131.6 (t, *J* = 295.5 Hz), 129.3, 128.9, 127.0, 60.0 (t, *J* = 3.1 Hz), 53.8 (t, *J* = 19.6 Hz), 32.1 (t, *J* = 3.0 Hz). HRMS-EI (*m/z*): Calcd for C₁₀H₁₁ClF₂O⁺ [M]⁺ 220.0461, found 220.0466.

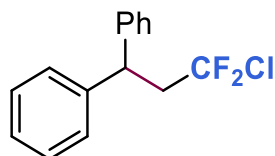


4-(3-chloro-3,3-difluoro-2-methylpropyl)-1,1'-biphenyl (**1at**)

Following the general procedure **B**, the title compound (39.0 mg, white solid, m.p. 60.0-60.8 °C) was obtained in 70% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.53 – 7.42 (m, 4H), 7.38 – 7.31 (m, 2H), 7.31 – 7.22 (m, 1H), 7.20 – 7.15 (m, 2H), 3.14 (dd, *J* = 13.1, 2.9 Hz, 1H), 2.56 – 2.45 (m, 1H), 2.41 (dd, *J* = 13.0, 10.7 Hz, 1H), 1.02 (d, *J* = 6.6 Hz, 3H). **¹⁹F NMR** (377 MHz,

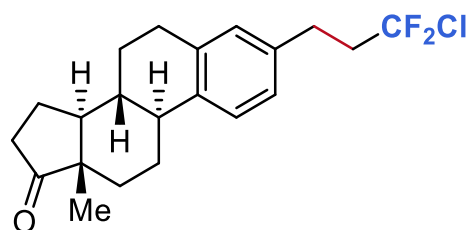
CDCl₃) δ -55.17 – -56.55 (m). ¹³C NMR (126 MHz, CDCl₃) δ 140.9, 139.7, 137.4, 132.8 (t, J = 294.5 Hz), 129.7, 128.9, 127.4, 127.4, 127.2, 46.7 (t, J = 21.6 Hz), 36.6 (t, J = 3.1 Hz), 13.6 (t, J = 3.3 Hz). HRMS-EI (m/z): Calcd for C₁₆H₁₅ClF₂⁺ [M]⁺ 280.0825, found 280.0830.



(3-Chloro-3,3-difluoropropyl)diphenylmethane (**1au**)

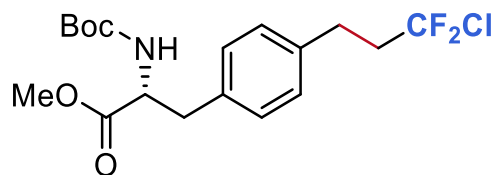
Following the general procedure **B**, the title compound (23.4 mg, colourless liquid) was obtained in 44% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.35 – 7.26 (m, 8H), 7.25 – 7.20 (m, 2H), 4.43 (t, J = 7.0 Hz, 1H), 3.16 (td, J = 12.9, 7.0 Hz, 2H) ppm. ¹⁹F NMR (377 MHz, CDCl₃) δ -48.50 (td, J = 13.0, 2.7 Hz). ¹³C NMR (126 MHz, CDCl₃) δ 143.0, 129.4 (t, J = 294.0 Hz), 128.9, 127.7, 126.9, 47.5 (t, J = 22.4 Hz), 46.5 (t, J = 2.0 Hz). HRMS-EI (m/z): Calcd for C₁₅H₁₃ClF₂⁺ [M]⁺ 266.0668, found 266.0670.



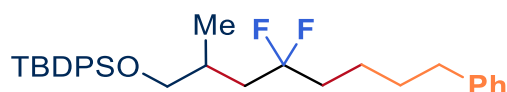
(8S,9R,13R,14R)-3-(3-chloro-3,3-difluoropropyl)-13-methyl-6,7,8,9,11,12,13,14,15,16-decahydro-17H-cyclopenta[a]phenanthren-17-one (**1av**)

Following the general procedure **B**, the title compound (40.3 mg, white solid, m.p. = 109.5–111.0 °C) was obtained in 55% yield. ¹H NMR (400 MHz, CDCl₃) δ 7.29 – 7.21 (m, 1H), 7.00 (dd, J = 8.1, 2.0 Hz, 1H), 6.95 (d, J = 2.0 Hz, 1H), 2.88 (ddd, J = 17.7, 8.8, 4.3 Hz, 4H), 2.65 – 2.36 (m, 4H), 2.30 (dt, J = 13.1, 6.5 Hz, 1H), 2.21 – 1.89 (m, 4H), 1.68 – 1.43 (m, 6H), 0.91 (s, 3H). ¹⁹F NMR (376 MHz, CDCl₃) δ -51.23 (td, J = 12.8, 2.8 Hz). ¹³C NMR (151 MHz, CDCl₃) δ 220.9, 138.2, 137.0, 136.4, 129.5 (t, J = 292.3 Hz), 129.1, 125.8, 125.8, 50.6, 48.1, 44.4, 43.7 (t, J = 23.7 Hz), 38.3, 35.9, 31.7, 29.5, 29.1 (t, J = 3.4 Hz), 26.6, 25.8, 21.7, 13.9. C₂₁H₂₆OF₂Cl⁺ [M]⁺ 367.1635, found 367.1639.



methyl (R)-2-((tert-butoxycarbonyl)amino)-3-(4-(3-chloro-3,3-difluoropropyl)phenyl)propanoate (**1aw**)

Following the general procedure **B**, the title compound (31.3 mg, colorless liquid) was obtained in 40% yield. **¹H NMR** (400 MHz, CDCl₃) δ 7.18 – 6.94 (m, 4H), 5.01 (d, *J* = 8.4 Hz, 1H), 4.56 (dt, *J* = 8.4, 5.9 Hz, 1H), 3.70 (s, 3H), 3.18 – 2.95 (m, 2H), 2.94 – 2.82 (m, 2H), 2.66 – 2.40 (m, 2H), 1.41 (s, 9H). **¹⁹F NMR** (376 MHz, CDCl₃) δ -51.24 (td, *J* = 12.8, 2.8 Hz). **¹³C NMR** (101 MHz, CDCl₃) δ 172.4, 155.1, 137.6, 134.5, 129.7, 129.4 (t, *J* = 292.1 Hz), 128.5, 80.0, 54.5, 52.3, 43.6 (t, *J* = 23.8 Hz), 38.0, 29.2 (t, *J* = 3.3 Hz), 28.4. HRMS-EI (*m/z*): Calcd for C₁₈H₂₅NO₄F₂Cl⁺ [*M*]⁺ 392.1440, found 392.1451.



tert-butyl((4,4-difluoro-2-methyl-8-phenyloctyl)oxy)diphenylsilane (**2a**)

Following the general procedure **C**, the title compound (44.5 mg, colourless liquid) was obtained in 90% yield.

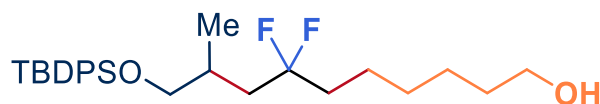
¹H NMR (400 MHz, CDCl₃) δ 7.70 – 7.63 (m, 4H), 7.48 – 7.34 (m, 6H), 7.33 – 7.24 (m, 2H), 7.24 – 7.15 (m, 3H), 3.57 – 3.41 (m, 2H), 2.65 – 2.61 (m, 2H), 2.20 – 2.08 (m, 1H), 2.00 (ddd, *J* = 10.9, 8.6, 5.4 Hz, 1H), 1.90 – 1.75 (m, 2H), 1.71 – 1.49 (m, 5H), 1.07 (s, 9H), 1.01 (d, *J* = 6.7 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -94.30 (ddtd, *J* = 240.2, 22.3, 17.0, 11.4 Hz), -96.07 (ddq, *J* = 240.2, 21.9, 15.9 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 142.3, 135.7, 133.9, 129.8, 128.5, 128.5, 127.8, 125.9, 125.8 (t, *J* = 240.8 Hz), 68.8, 39.3 (t, *J* = 24.5 Hz), 37.0 (t, *J* = 25.5 Hz), 35.9, 31.4, 31.0 (t, *J* = 2.7 Hz), 27.0, 22.3 (t, *J* = 4.6 Hz), 19.5, 17.8. HRMS-EI (*m/z*): Calcd for C₃₁H₄₀F₂OSi⁺ [*M*]⁺ 494.2811, found 494.2816.



9-((tert-butyldiphenylsilyl)oxy)-6,6-difluoro-8-methylnonyl 4-methylbenzenesulfonate (**2b**)

Following the general procedure **C**, the title compound (30.7 mg, colourless liquid) was obtained in 51% yield.

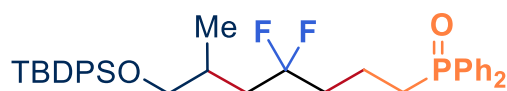
¹H NMR (400 MHz, CDCl₃) δ 7.83 – 7.74 (m, 2H), 7.69 – 7.59 (m, 4H), 7.46 – 7.29 (m, 8H), 4.02 (t, *J* = 6.4 Hz, 2H), 3.56 – 3.40 (m, 2H), 2.44 (s, 3H), 2.16 – 2.05 (m, 1H), 1.96 (td, *J* = 13.7, 12.4, 7.4 Hz, 1H), 1.81 – 1.59 (m, 4H), 1.47 – 1.28 (m, 5H), 1.05 (s, 9H), 0.99 (d, *J* = 6.7 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -94.75 (ddtd, *J* = 240.7, 22.2, 17.3, 11.5 Hz), -96.50 (ddq, *J* = 240.1, 22.3, 16.1 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 144.9, 135.7, 133.9, 133.3, 130.0, 129.8, 128.0, 127.8, 125.6 (t, *J* = 240.6 Hz), 70.4, 68.7, 39.4 (t, *J* = 24.5 Hz), 36.9 (t, *J* = 25.6 Hz), 31.0 (t, *J* = 3.0 Hz), 28.8, 27.0, 25.3, 21.9 (t, *J* = 4.7 Hz), 21.8, 19.4, 17.7. HRMS-ESI (*m/z*): Calcd for C₃₃H₄₄F₂O₄SSiNa⁺ [*M*+Na]⁺ 625.2590, found 625.2592.



10-((tert-butyldiphenylsilyl)oxy)-7,7-difluoro-9-methyldecan-1-ol (**2c**)

Following the general procedure **C**, the title compound (38.3 mg, colourless liquid) was obtained in 83% yield.

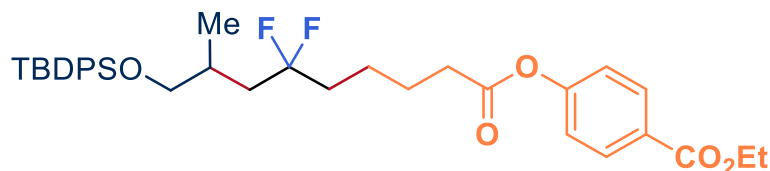
¹H NMR (400 MHz, CDCl₃) δ 7.70 – 7.65 (m, 4H), 7.50 – 7.35 (m, 6H), 3.65 (t, *J* = 6.6 Hz, 2H), 3.57 – 3.40 (m, 2H), 2.22 – 2.09 (m, 1H), 2.00 (tdd, *J* = 10.9, 5.4, 3.0 Hz, 1H), 1.89 – 1.73 (m, 2H), 1.65 – 1.54 (m, 3H), 1.54 – 1.45 (m, 2H), 1.41 – 1.34 (m, 4H), 1.07 (s, 9H), 1.01 (d, *J* = 6.7 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -94.32 (ddtd, *J* = 240.0, 22.2, 17.1, 11.4 Hz), -96.02 (ddq, *J* = 240.2, 21.9, 16.0 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 135.7, 133.9, 129.7, 127.8, 125.8 (t, *J* = 240.8 Hz), 68.8, 63.0, 39.3 (t, *J* = 24.6 Hz), 37.1 (t, *J* = 25.4 Hz), 32.7, 31.0 (t, *J* = 3.2 Hz), 29.3, 27.0, 25.7, 22.5 (t, *J* = 4.7 Hz), 19.4, 17.7. HRMS-EI (*m/z*): Calcd for C₂₇H₄₀F₂O₂SiNa⁺ [*M*+Na]⁺ 485.2658, found 485.2661.



(7-((tert-butyldiphenylsilyl)oxy)-4,4-difluoro-6-methylheptyl)diphenylphosphine oxide (**2d**)

Following the general procedure **C**, the title compound (46.6 mg, colourless liquid) was obtained in 77% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.74 (ddq, *J* = 11.4, 6.6, 1.3 Hz, 4H), 7.67 – 7.60 (m, 4H), 7.55 – 7.34 (m, 12H), 3.51 – 3.42 (m, 2H), 2.37 – 2.23 (m, 2H), 2.05 – 1.76 (m, 6H), 1.67 – 1.50 (m, 1H), 1.04 (s, 9H), 0.97 (d, *J* = 6.7 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -95.00 – -96.07 (m), -96.28 – -97.50 (m). **³¹P NMR** (162 MHz, CDCl₃) δ 31.92 (dp, *J* = 21.3, 10.1 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 135.7, 133.8 (d, *J* = 3.3 Hz), 132.9 (dd, *J* = 98.3, 1.7 Hz), 131.9 (d, *J* = 2.8 Hz), 130.9 (d, *J* = 9.2 Hz), 129.7, 128.8 (d, *J* = 11.6 Hz), 127.7, 125.2 (t, *J* = 241.8 Hz), 68.62, 39.52 (t, *J* = 24.3 Hz), 37.92 (td, *J* = 25.7, 13.7 Hz), 30.79 (t, *J* = 2.7 Hz), 29.54 (d, *J* = 72.0 Hz), 26.97, 19.39, 17.8, 15.1 (td, *J* = 4.5, 3.7 Hz). HRMS-ESI (*m/z*): Calcd for C₃₆H₄₄F₂O₂PSi⁺ [*M*+H]⁺ 605.2811, found 605.2812.

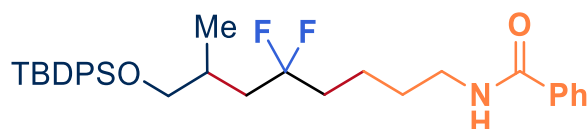


ethyl 4-((9-((tert-butyldiphenylsilyl)oxy)-6,6-difluoro-8-methylnonanoyl)oxy)benzoate (**2e**)

Following the general procedure **C**, the title compound (40.3 mg, colourless liquid) was obtained in 66% yield.

¹H NMR (400 MHz, CDCl₃) δ 8.11 – 8.03 (m, 2H), 7.69 – 7.62 (m, 4H), 7.47 – 7.34

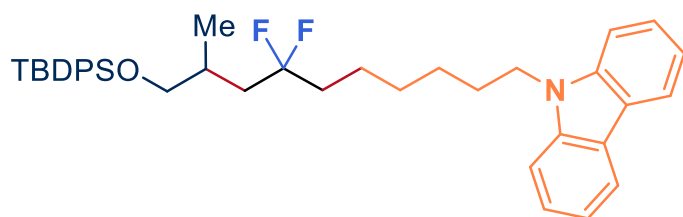
(m, 6H), 7.20 – 7.11 (m, 2H), 4.38 (q, $J = 7.1$ Hz, 2H), 3.57 – 3.42 (m, 2H), 2.59 (t, $J = 7.4$ Hz, 2H), 2.13 – 1.95 (m, 2H), 1.92 – 1.73 (m, 4H), 1.66 – 1.57 (m, 3H), 1.39 (t, $J = 7.1$ Hz, 3H), 1.06 (s, 9H), 1.01 (d, $J = 6.7$ Hz, 3H). **^{19}F NMR** (377 MHz, CDCl_3) δ -94.27 – -95.39 (m), -96.59 (ddq, $J = 240.7, 22.0, 15.8$ Hz). **^{13}C NMR** (126 MHz, CDCl_3) δ 171.4, 166.0, 154.4, 135.7, 134.9, 133.9, 131.3, 129.8, 127.9 (t, $J = 252.8$ Hz), 127.8, 121.7, 68.8, 61.2, 39.5 (t, $J = 24.5$ Hz), 36.8 (t, $J = 25.4$ Hz), 34.3, 31.0 (t, $J = 3.0$ Hz), 27.0, 24.7, 22.0 (t, $J = 4.2$ Hz), 19.5, 17.8, 14.5. HRMS-ESI (m/z): Calcd for $\text{C}_{35}\text{H}_{44}\text{F}_2\text{O}_5\text{SiNa}^+ [\text{M}+\text{Na}]^+$ 633.2818, found 633.2818.



N-(8-((tert-butyldiphenylsilyl)oxy)-5,5-difluoro-7-methyloctyl)benzamide (2f)

Following the general procedure **C**, the title compound (46.2 mg, colourless liquid) was obtained in 86% yield.

^1H NMR (400 MHz, CDCl_3) δ 7.65 (ddd, $J = 7.9, 1.6, 0.6$ Hz, 4H), 7.53 – 7.27 (m, 9H), 7.14 – 7.05 (m, 2H), 3.60 – 3.38 (m, 2H), 2.35 (t, $J = 7.5$ Hz, 2H), 2.23 – 2.07 (m, 1H), 1.98 (dt, $J = 12.4, 6.2$ Hz, 1H), 1.90 – 1.70 (m, 4H), 1.66 – 1.60 (m, 1H), 1.57 – 1.51 (m, 2H), 1.05 (s, 9H), 0.99 (d, $J = 6.7$ Hz, 3H). **^{19}F NMR** (377 MHz, CDCl_3) δ -94.71 (ddtd, $J = 240.3, 22.2, 17.0, 11.4$ Hz), -96.45 (ddq, $J = 240.5, 22.3, 16.1$ Hz). **^{13}C NMR** (126 MHz, CDCl_3) δ 135.7, 133.9, 129.8, 129.2, 127.8, 125.6 (t, $J = 241.1$ Hz), 124.4, 119.9, 68.8, 39.4 (t, $J = 24.6$ Hz), 37.6, 36.9 (t, $J = 25.6$ Hz), 31.0 (t, $J = 3.6$ Hz), 27.0, 25.3, 22.2 (t, $J = 4.7$ Hz), 19.5, 17.8. HRMS-ESI (m/z): Calcd for $\text{C}_{32}\text{H}_{41}\text{F}_2\text{NO}_2\text{SiNa}^+ [\text{M}+\text{Na}]^+$ 560.2767, found 560.2767.

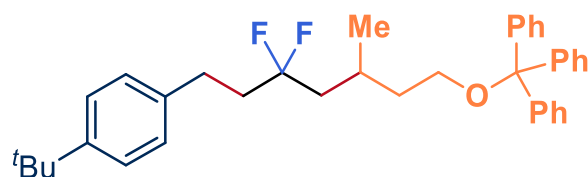


9-(10-((tert-butyldiphenylsilyl)oxy)-7,7-difluoro-9-methyldecyl)-9H-carbazole (2g)

Following the general procedure **C**, the title compound (36.7 mg, colourless liquid) was obtained in 60% yield.

^1H NMR (400 MHz, CDCl_3) δ 8.13 (dt, $J = 7.8, 1.0$ Hz, 2H), 7.71 – 7.60 (m, 4H), 7.53 – 7.35 (m, 10H), 7.25 (ddd, $J = 8.0, 7.0, 1.1$ Hz, 2H), 4.32 (t, $J = 7.2$ Hz, 2H), 3.65 – 3.30 (m, 2H), 2.19 – 1.96 (m, 2H), 1.90 (p, $J = 7.2$ Hz, 2H), 1.82 – 1.68 (m, 2H), 1.64 – 1.51 (m, 1H), 1.49 – 1.32 (m, 6H), 1.07 (s, 9H), 1.01 (d, $J = 6.7$ Hz, 3H). **^{19}F NMR** (377 MHz, CDCl_3) δ -94.31 (ddtd, $J = 240.3, 22.2, 17.1, 11.2$ Hz), -96.01 (ddq, $J = 240.3, 21.8, 16.0$ Hz). **^{13}C NMR** (126 MHz, CDCl_3) δ 140.5, 135.7, 133.9, 129.8, 127.8, 125.7, 123.9 (t, $J = 242.0$ Hz), 123.0, 120.5, 118.9, 108.7, 68.8, 43.1, 39.3 (t, $J = 24.5$ Hz), 37.0 (t, $J = 25.5$ Hz), 31.0 (t, $J = 2.9$ Hz), 29.4, 29.0, 27.3, 27.0, 22.4 (t, $J = 4.6$ Hz), 19.4, 17.7. HRMS-ESI (m/z): Calcd for $\text{C}_{39}\text{H}_{47}\text{F}_2\text{NOSi}^+ [\text{M}]^+$

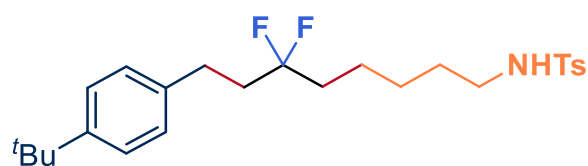
611.3389, found 611.3388.



(((7-(4-(tert-butyl)phenyl)-5,5-difluoro-3-methylheptyl)oxy)methanetriyl)tribenzene (2h)

Following the general procedure **C**, the title compound (44.8 mg, colourless liquid) was obtained in 83% yield.

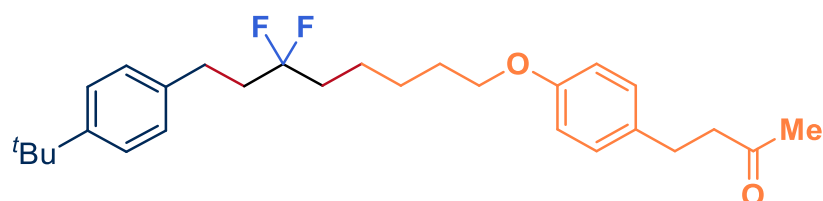
¹H NMR (400 MHz, CDCl₃) δ 7.47 – 7.41 (m, 6H), 7.34 – 7.28 (m, 6H), 7.27 – 7.19 (m, 5H), 7.14 – 7.09 (m, 2H), 3.18 – 3.03 (m, 2H), 2.83 – 2.71 (m, 2H), 2.20 – 1.97 (m, 3H), 1.95 – 1.59 (m, 3H), 1.55 – 1.43 (m, 1H), 1.33 (s, 9H), 0.92 (d, J = 6.7 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -94.73 (dtt, J = 241.1, 20.4, 13.3 Hz), -95.94 – -97.16 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 149.1, 144.5, 137.8, 128.8, 128.1, 127.9, 127.0, 125.6, 125.2 (t, J = 241.0 Hz), 61.4, 43.2 (t, J = 23.9 Hz), 39.0 (t, J = 25.3 Hz), 37.7, 34.5, 31.5, 28.1 (t, J = 4.8 Hz), 25.4 (t, J = 3.4 Hz), 20.8. HRMS-EI (m/z): Calcd for C₃₇H₄₂F₂O⁺ [M]⁺ 540.3198, found 540.3196.



N-(9-(4-(tert-butyl)phenyl)-6,6-difluorononyl)-4-methylbenzenesulfonamide (2i)

Following the general procedure **C**, the title compound (22.6 mg, colourless liquid) was obtained in 50% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.93 – 7.68 (m, 2H), 7.42 – 7.26 (m, 4H), 7.19 – 6.96 (m, 2H), 4.59 (t, J = 5.9 Hz, 1H), 2.93 (q, J = 6.9 Hz, 2H), 2.80 – 2.71 (m, 2H), 2.42 (s, 3H), 2.18 – 2.00 (m, 2H), 1.87 – 1.70 (m, 2H), 1.51 – 1.37 (m, 4H), 1.34 – 1.26 (m, 11H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.80 (p, J = 16.5 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 149.2, 143.6, 137.7, 137.1, 129.9, 128.1, 127.2, 125.6, 124.7 (t, J = 240.8 Hz), 43.1, 38.4 (t, J = 25.4 Hz), 36.4 (t, J = 25.4 Hz), 31.5, 29.5, 28.0 (t, J = 4.7 Hz), 26.4, 22.0 (t, J = 4.4 Hz), 21.6. HRMS-EI (m/z): Calcd for C₂₅H₃₅F₂NO₂S⁺ [M]⁺ 451.2351, found 451.2358.

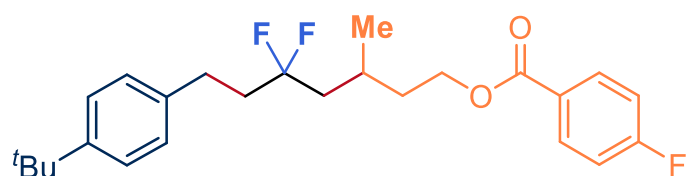


4-(4-((8-(4-(tert-butyl)phenyl)-6,6-difluorooctyl)oxy)phenyl)butan-2-one (2j)

Following the general procedure **C**, the title compound (32.4 mg, colourless liquid)

was obtained in 73% yield.

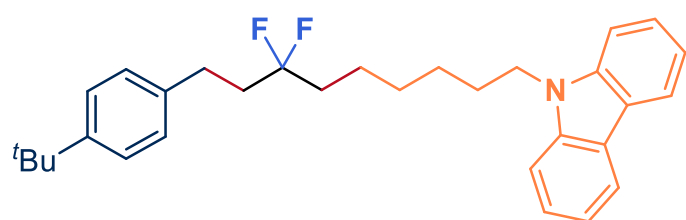
¹H NMR (400 MHz, CDCl₃) δ 7.37 – 7.29 (m, 2H), 7.18 – 7.04 (m, 4H), 6.88 – 6.75 (m, 2H), 3.93 (t, *J* = 6.4 Hz, 2H), 2.89 – 2.65 (m, 6H), 2.19 – 2.07 (m, 5H), 1.85 – 1.72 (m, 4H), 1.59 – 1.46 (m, 4H), 1.32 (s, 9H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.62 (p, *J* = 16.6 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 208.3, 157.5, 149.2, 137.8, 133.1, 129.3, 128.1, 125.6, 124.85 (t, *J* = 240.6 Hz), 114.6, 67.8, 53.6, 45.6, 38.4 (t, *J* = 25.4 Hz), 36.59 (t, *J* = 25.4 Hz), 31.5, 30.2, 29.2, 29.0, 28.0 (t, *J* = 4.8 Hz), 26.1, 22.3 (t, *J* = 4.5 Hz). HRMS-EI (*m/z*): Calcd for C₂₈H₃₈F₂O₂⁺ [*M*]⁺ 444.2834, found 444.2829.



7-(4-(tert-butyl)phenyl)-5,5-difluoro-3-methylheptyl 4-fluorobenzoate (2k)

Following the general procedure **C**, the title compound (29.4 mg, colourless liquid) was obtained in 70% yield.

¹H NMR (400 MHz, CDCl₃) δ 8.19 – 7.90 (m, 2H), 7.35 – 7.28 (m, 2H), 7.14 – 7.04 (m, 4H), 4.36 (td, *J* = 7.2, 6.8, 1.4 Hz, 2H), 2.82 – 2.72 (m, 2H), 2.21 – 2.01 (m, 3H), 1.99 – 1.86 (m, 2H), 1.83 – 1.62 (m, 2H), 1.31 (s, 9H), 1.09 (d, *J* = 6.6 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -96.39 (ddq, *J* = 48.7, 20.2, 15.9 Hz), -105.75 – -105.84 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 166.9, 165.3 (d, *J* = 113.9 Hz), 149.3, 137.6, 132.2 (d, *J* = 9.3 Hz), 128.1, 126.9 (t, *J* = 241.9 Hz), 125.6, 115.7 (d, *J* = 22.0 Hz), 63.1, 43.2 (t, *J* = 24.3 Hz), 39.1 (t, *J* = 25.2 Hz), 36.1, 31.5, 31.1, 28.1 (t, *J* = 4.9 Hz), 25.3 (t, *J* = 3.0 Hz), 20.7. HRMS-EI (*m/z*): Calcd for C₂₅H₃₁F₃O₂⁺ [*M*]⁺ 420.2271, found 420.2262.

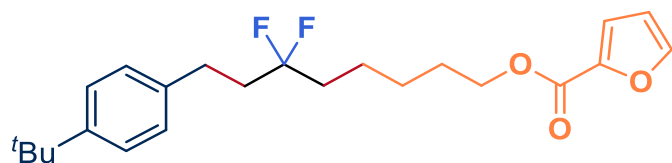


9-(9-(4-(tert-butyl)phenyl)-7,7-difluorononyl)-9H-carbazole (2l)

Following the general procedure **C**, the title compound (25.4 mg, colourless liquid) was obtained in 55% yield.

¹H NMR (400 MHz, CDCl₃) δ 8.10 (dt, *J* = 7.8, 1.0 Hz, 2H), 7.45 (ddd, *J* = 8.2, 7.0, 1.2 Hz, 2H), 7.39 (dt, *J* = 8.2, 1.0 Hz, 2H), 7.33 – 7.27 (m, 2H), 7.26 – 7.19 (m, 2H), 7.14 – 7.05 (m, 2H), 4.30 (t, *J* = 7.2 Hz, 2H), 2.77 – 2.68 (m, 2H), 2.14 – 1.96 (m, 2H), 1.95 – 1.69 (m, 4H), 1.48 – 1.32 (m, 6H), 1.30 (s, 9H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.60 (p, *J* = 16.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 149.2, 140.5, 137.8, 128.1, 125.7, 125.6, 124.9 (t, *J* = 240.7 Hz), 123.0, 120.5, 118.9, 108.7, 43.1, 38.3 (t, *J* = 25.5 Hz), 36.5 (t, *J* = 25.4 Hz), 34.5, 31.5, 29.3, 29.0, 28.0 (t, *J* = 4.6 Hz), 27.2, 22.4 (t,

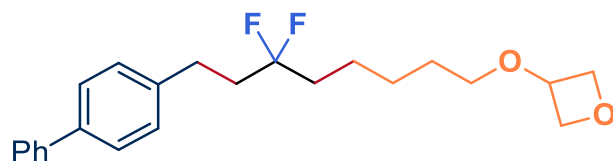
$J = 4.5$ Hz). HRMS-EI (m/z): Calcd for $C_{31}H_{38}F_2N^+$ $[M]^+$ 462.2967, found 462.2966.



9-(4-(tert-butyl)phenyl)-6,6-difluorononyl furan-2-carboxylate (**2m**)

Following the general procedure **C**, the title compound (23.5 mg, colourless liquid) was obtained in 60% yield.

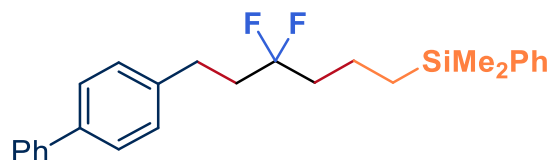
1H NMR (400 MHz, $CDCl_3$) δ 7.57 (dd, $J = 1.8, 0.9$ Hz, 1H), 7.36 – 7.29 (m, 2H), 7.17 (dd, $J = 3.5, 0.9$ Hz, 1H), 7.16 – 7.11 (m, 2H), 6.50 (dd, $J = 3.5, 1.7$ Hz, 1H), 4.31 (t, $J = 6.6$ Hz, 2H), 2.90 – 2.68 (m, 2H), 2.21 – 2.02 (m, 2H), 1.93 – 1.82 (m, 2H), 1.77 (dt, $J = 14.0, 6.8$ Hz, 2H), 1.57 – 1.42 (m, 4H), 1.31 (s, 9H). **^{19}F NMR** (377 MHz, $CDCl_3$) δ -98.74 (p, $J = 16.6$ Hz). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 158.9, 149.2, 146.4, 137.8, 128.1, 125.6, 124.79 (t, $J = 240.5$ Hz), 118.0, 112.0, 64.9, 38.4 (t, $J = 25.5$ Hz), 36.6 (t, $J = 25.3$ Hz), 34.5, 31.5, 28.7, 28.0 (t, $J = 4.8$ Hz), 25.9, 22.2 (t, $J = 4.7$ Hz). HRMS-EI (m/z): Calcd for $C_{23}H_{30}F_2O_3^+$ $[M]^+$ 392.2158, found 392.2166.



3-((8-([1,1'-biphenyl]-4-yl)-6,6-difluorooctyl)oxy)oxetane (**2n**)

Following the general procedure **C**, the title compound (15.0 mg, white solid, m.p. 49.3–50.5 °C) was obtained in 40% yield.

1H NMR (400 MHz, $CDCl_3$) δ 7.62 – 7.54 (m, 2H), 7.58 – 7.50 (m, 2H), 7.48 – 7.39 (m, 2H), 7.38 – 7.29 (m, 1H), 7.32 – 7.25 (m, 2H), 4.84 – 4.69 (m, 2H), 4.64 – 4.57 (m, 2H), 4.52 (qd, $J = 6.0, 4.8$ Hz, 2H), 3.35 (t, $J = 6.5$ Hz, 1H), 2.93 – 2.77 (m, 2H), 2.29 – 2.08 (m, 2H), 1.98 – 1.79 (m, 2H), 1.63 – 1.50 (m, 4H), 1.46 – 1.37 (m, 2H). **^{19}F NMR** (377 MHz, $CDCl_3$) δ -98.76 (p, $J = 16.5$ Hz). **^{13}C NMR** (126 MHz, $CDCl_3$) δ 141.0, 134.0, 139.4, 128.9, 128.8, 127.4, 127.3, 127.1, 124.8 (t, $J = 240.4$ Hz), 79.0, 72.3, 68.7, 38.4 (t, $J = 25.5$ Hz), 36.7 (t, $J = 25.3$ Hz), 29.6, 28.2 (t, $J = 4.8$ Hz), 26.1, 22.3 (t, $J = 4.4$ Hz). HRMS-EI (m/z): Calcd for $C_{23}H_{28}F_2O_2^+$ $[M]^+$ 374.2052, found 374.2053.

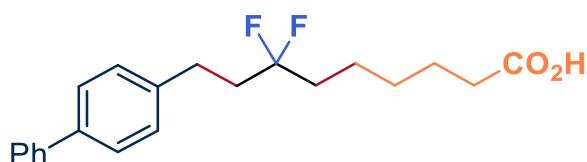


(6-([1,1'-biphenyl]-4-yl)-4,4-difluorohexyl)dimethyl(phenyl)silane (**2o**)

Following the general procedure **C**, the title compound (36.3 mg, colourless liquid) was obtained in 89% yield.

1H NMR (400 MHz, $CDCl_3$) δ 7.60 – 7.55 (m, 2H), 7.54 – 7.48 (m, 4H), 7.46 – 7.39

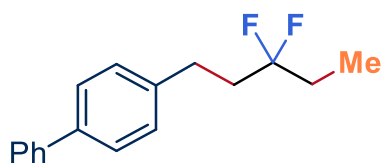
(m, 2H), 7.38 – 7.30 (m, 4H), 7.26 – 7.21 (m, 2H), 2.87 – 2.73 (m, 2H), 2.19 – 2.01 (m, 2H), 1.96 – 1.79 (m, 2H), 1.60 – 1.45 (m, 2H), 0.81 – 0.74 (m, 2H), 0.28 (s, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.49 (p, *J* = 16.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 141.1, 140.0, 139.3, 139.1, 133.7, 129.11, 128.9, 128.9, 128.0, 127.4, 127.3, 127.2, 124.7 (t, *J* = 240.8 Hz), 40.4 (t, *J* = 24.8 Hz), 38.4 (t, *J* = 25.5 Hz), 28.3 (t, *J* = 4.8 Hz), 17.1 (t, *J* = 4.6 Hz), 15.9, -3.0. HRMS-EI (*m/z*): Calcd for C₂₆H₃₀F₂Si⁺ [M]⁺ 408.2079, found 408.2080.



9-([1,1'-biphenyl]-4-yl)-7,7-difluorononanoic acid (**2p**)

Following the general procedure **C**, the title compound (30.5 mg, white solid, m.p. 112.0-113.0 °C) was obtained in 88% yield.

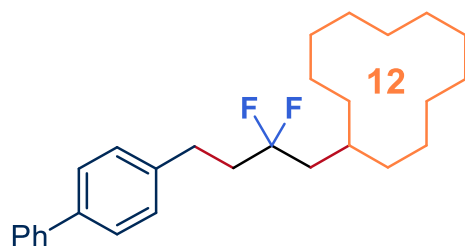
¹H NMR (400 MHz, CDCl₃) δ 7.60 – 7.55 (m, 2H), 7.55 – 7.51 (m, 2H), 7.46 – 7.40 (m, 2H), 7.37 – 7.30 (m, 1H), 7.30 – 7.25 (m, 2H), 2.88 – 2.79 (m, 2H), 2.37 (t, *J* = 7.4 Hz, 2H), 2.25 – 2.06 (m, 2H), 1.95 – 1.78 (m, 2H), 1.66 (p, *J* = 7.4 Hz, 2H), 1.58 – 1.48 (m, 2H), 1.44 – 1.35 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.83 (p, *J* = 16.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 179.0, 141.1, 140.0, 139.4, 128.9, 128.9, 127.4, 127.3, 127.2, 124.7 (t, *J* = 240.9 Hz), 38.4 (t, *J* = 25.4 Hz), 36.5 (t, *J* = 25.1 Hz), 33.8, 28.9, 28.3 (t, *J* = 4.7 Hz), 24.6, 22.2 (t, *J* = 4.3 Hz). HRMS-EI (*m/z*): Calcd for C₂₁H₂₄F₂O₂⁺ [M]⁺ 346.1739, found 346.1742.



4-(3,3-difluoropentyl)-1,1'-biphenyl (**2q**)

Following the general procedure **C**, the title compound (12.0 mg, colourless liquid) was obtained in 46% yield.

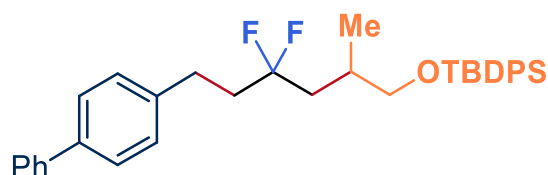
¹H NMR (400 MHz, CDCl₃) δ 7.61 – 7.52 (m, 4H), 7.47 – 7.41 (m, 2H), 7.37 – 7.32 (m, 1H), 7.31 – 7.27 (m, 2H), 2.90 – 2.82 (m, 2H), 2.25 – 2.08 (m, 2H), 1.92 (ddt, *J* = 23.9, 16.6, 7.5 Hz, 2H), 1.06 (t, *J* = 7.5 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -100.84 (p, *J* = 16.4 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 141.1, 140.1, 139.3, 128.9, 128.9, 127.4, 127.3, 127.2, 125.1 (t, *J* = 240.7 Hz), 38.0 (t, *J* = 25.5 Hz), 29.9 (t, *J* = 26.2 Hz), 28.2 (t, *J* = 5.1 Hz), 6.8 (t, *J* = 5.7 Hz). HRMS-EI (*m/z*): Calcd for C₁₇H₁₈F₂⁺ [M]⁺ 260.1371, found 260.1375.



4-(4-cyclododecyl-3,3-difluorobutyl)-1,1'-biphenyl (**2r**)

Following the general procedure **C**, the title compound (26.8 mg, white solid, m.p. 78.1–79.6 °C) was obtained in 65% yield.

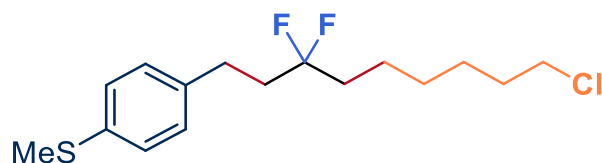
^1H NMR (400 MHz, CDCl_3) δ 7.60 – 7.52 (m, 4H), 7.43 (dd, J = 8.3, 6.9 Hz, 2H), 7.36 – 7.31 (m, 1H), 7.30 – 7.27 (m, 2H), 2.90 – 2.81 (m, 2H), 2.26 – 2.09 (m, 2H), 1.88 – 1.73 (m, 3H), 1.40 – 1.31 (m, 22H). ^{19}F NMR (377 MHz, CDCl_3) δ -96.12 (p, J = 17.1 Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 141.1, 140.1, 139.3, 128.9, 127.4, 127.3, 127.2, 125.3 (t, J = 241.8 Hz), 41.5 (t, J = 23.9 Hz), 39.1 (t, J = 25.7 Hz), 30.0, 29.0, 28.4 (t, J = 5.2 Hz), 24.7, 24.3, 23.5, 23.4, 21.7. HRMS-EI (m/z): Calcd for $\text{C}_{28}\text{H}_{38}\text{F}_2^+$ $[\text{M}]^+$ 412.2936, found 412.2922.



((6-([1,1'-biphenyl]-4-yl)-4,4-difluoro-2-methylhexyl)oxy)(tert-butyl)diphenylsilane (**2s**)

Following the general procedure **C**, the title compound (42.3 mg, colourless liquid) was obtained in 78% yield.

^1H NMR (400 MHz, CDCl_3) δ 7.70 – 7.66 (m, 4H), 7.61 – 7.57 (m, 2H), 7.57 – 7.51 (m, 2H), 7.49 – 7.32 (m, 9H), 7.30 – 7.26 (m, 2H), 3.64 – 3.43 (m, 2H), 2.86 (t, J = 8.6 Hz, 2H), 2.30 – 1.94 (m, 4H), 1.69 (dddd, J = 22.4, 14.7, 11.4, 8.2 Hz, 1H), 1.08 (s, 9H), 1.05 (d, J = 6.4 Hz, 3H). ^{19}F NMR (377 MHz, CDCl_3) δ -94.12 – -95.86 (m), -96.16 – -98.48 (m). ^{13}C NMR (126 MHz, CDCl_3) δ 141.1, 140.0, 139.3, 135.7, 133.9, 129.8, 128.9, 128.9, 127.8, 127.4, 127.3, 127.2, 124.3 (d, J = 241.4 Hz), 68.8, 39.6 (t, J = 24.3 Hz), 39.1 (t, J = 25.6 Hz), 31.1 (t, J = 2.9 Hz), 28.3 (t, J = 4.8 Hz), 27.0, 19.5, 17.8. HRMS-ESI (m/z): Calcd for $\text{C}_{35}\text{H}_{41}\text{F}_2\text{OSi}^+$ $[\text{M}+\text{H}]^+$ 543.2889, found 543.2893.



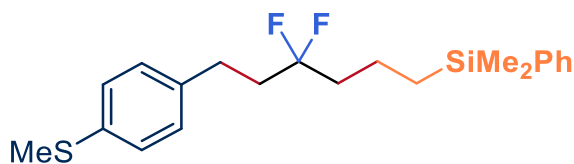
(4-(9-chloro-3,3-difluorononyl)phenyl)(methyl)sulfane (**2t**)

Following the general procedure **C**, the title compound (9.6 mg, colourless liquid) was obtained in 30% yield.

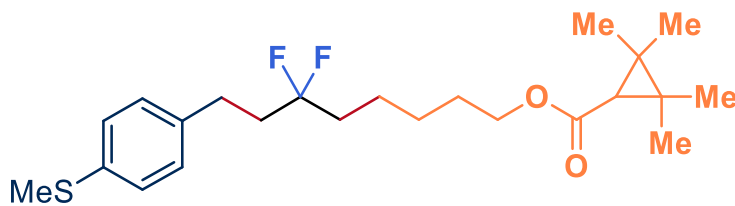
^1H NMR (400 MHz, CDCl_3) δ 7.24 – 7.18 (m, 2H), 7.15 – 7.09 (m, 2H), 3.54 (t, J = 6.7 Hz, 2H), 2.83 – 2.72 (m, 2H), 2.47 (s, 3H), 2.19 – 1.99 (m, 2H), 1.94 – 1.73 (m,

COc1ccc(cc1)CC(F)(F)CCOc2ccccc2

¹H NMR (400 MHz, CDCl₃) δ 7.31 – 7.26 (m, 2H), 7.23 – 7.19 (m, 2H), 7.15 – 7.11 (m, 2H), 6.95 (tt, *J* = 7.4, 1.1 Hz, 1H), 6.91 – 6.87 (m, 2H), 4.01 (t, *J* = 5.9 Hz, 2H), 2.84 – 2.76 (m, 2H), 2.47 (s, 3H), 2.23 – 1.97 (m, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -99.26 (p, *J* = 16.4 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 158.9, 137.8, 136.1, 129.6, 129.0, 127.4, 124.6 (t, *J* = 241.2 Hz), 121.0, 114.6, 67.0, 38.6 (t, *J* = 25.4 Hz), 33.5 (t, *J* = 25.6 Hz), 28.1 (t, *J* = 5.0 Hz), 22.6 (t, *J* = 4.7 Hz), 16.4. HRMS-EI (*m/z*): Calcd for C₁₉H₂₂F₂OS⁺ [*M*]⁺ 336.1359, found 336.1363.

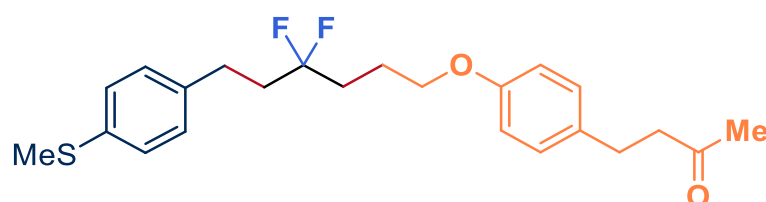


¹H NMR (400 MHz, CDCl₃) δ 7.53 – 7.48 (m, 2H), 7.39 – 7.33 (m, 3H), 7.23 – 7.17 (m, 2H), 7.12 – 7.06 (m, 2H), 2.75 – 2.68 (m, 2H), 2.47 (s, 3H), 2.13 – 1.93 (m, 2H), 1.93 – 1.78 (m, 2H), 1.58 – 1.45 (m, 2H), 0.82 – 0.72 (m, 2H), 0.28 (s, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.55 (p, *J* = 16.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 139.1, 138.0, 136.0, 133.7, 129.1, 129.0, 128.0, 127.4, 124.6 (t, *J* = 241.7 Hz), 40.4 (t, *J* = 24.7 Hz), 38.4 (t, *J* = 25.7 Hz), 28.1 (t, *J* = 5.0 Hz), 17.1 (t, *J* = 4.9 Hz), 16.4, 15.9, -3.0. HRMS-EI (m/z): Calcd for C₂₁H₂₈F₂SSi⁺ [M]⁺ 378.1644, found 378.1649.



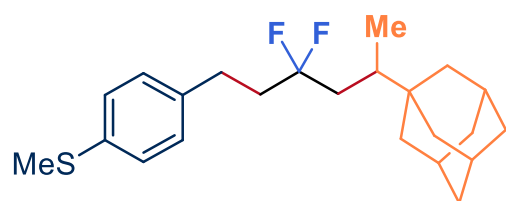
Following the general procedure C, the title compound (26.4 mg, colourless liquid)

¹H NMR (400 MHz, CDCl₃) δ 7.23 – 7.18 (m, 2H), 7.14 – 7.11 (m, 2H), 4.02 (t, *J* = 6.7 Hz, 2H), 2.82 – 2.70 (m, 2H), 2.47 (s, 3H), 2.18 – 2.01 (m, 2H), 1.92 – 1.77 (m, 2H), 1.70 – 1.57 (m, 2H), 1.57 – 1.47 (m, 2H), 1.45 – 1.38 (m, 2H), 1.24 (s, 6H), 1.18 (s, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.78 (p, *J* = 16.5 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 172.4, 137.9, 136.0, 129.0, 127.4, 124.7 (t, *J* = 240.9 Hz), 63.6, 38.4 (t, *J* = 25.4 Hz), 36.6 (t, *J* = 25.3 Hz), 35.9, 30.1, 28.7, 28.1 (t, *J* = 4.9 Hz), 26.0, 23.7, 22.2 (t, *J* = 4.4 Hz), 16.7, 16.4. HRMS-EI (*m/z*): Calcd for C₂₃H₃₄F₂O₂S⁺ [*M*]⁺ 412.2242, found 412.2246.



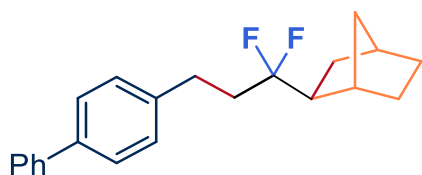
Following the general procedure **C**, the title compound (15.2 mg, colourless liquid) was obtained in 35% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.24 – 7.19 (m, 2H), 7.14 – 7.05 (m, 4H), 6.87 – 6.75 (m, 2H), 3.93 (t, *J* = 6.4 Hz, 2H), 2.88 – 2.80 (m, 2H), 2.79 – 2.67 (m, 4H), 2.47 (s, 3H), 2.19 – 2.03 (m, 5H), 1.94 – 1.71 (m, 4H), 1.63 – 1.43 (m, 4H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.74 (p, *J* = 16.7 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 208.3, 157.5, 137.9, 136.0, 133.1, 129.3, 129.0, 127.3, 124.7 (t, *J* = 240.8 Hz), 114.6, 67.8, 45.6, 38.4 (t, *J* = 25.5 Hz), 36.6 (t, *J* = 25.3 Hz), 30.2, 29.2, 29.0, 28.1 (t, *J* = 5.1 Hz), 26.1, 22.3 (t, *J* = 4.5 Hz), 16.4. HRMS-EI (*m/z*): Calcd for C₂₅H₃₂F₂O₂S⁺ [M]⁺ 434.2086, found 434.2078.



Following the general procedure **C**, the title compound (15.1 mg, colourless liquid) was obtained in 40% yield.

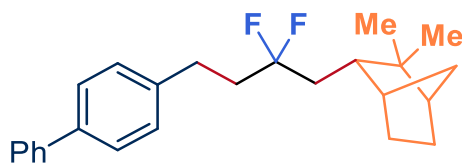
¹H NMR (400 MHz, CDCl₃) δ 7.25 – 7.17 (m, 2H), 7.17 – 7.09 (m, 2H), 2.77 (t, *J* = 8.5 Hz, 2H), 2.47 (s, 3H), 2.06 – 1.92 (m, 4H), 1.73 – 1.39 (m, 16H), 0.94 (d, *J* = 6.7 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -95.56 (dtdd, *J* = 239.5, 21.2, 14.1, 10.6 Hz), -97.70 (dq, *J* = 239.4, 19.6, 11.8 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 138.1, 136.0, 129.0, 127.4, 125.7 (t, *J* = 241.6 Hz), 39.2, 39.0, 38.8, 37.7, 37.6, 37.5, 37.4, 34.8, 28.8, 28.1 (t, *J* = 5.1 Hz), 16.4, 14.6. HRMS-EI (*m/z*): Calcd for C₂₃H₃₂F₂S⁺ [*M*]⁺ 378.2187, found 378.2200.



2-(3-([1,1'-biphenyl]-4-yl)-1,1-difluoropropyl)bicyclo[2.2.1]heptane (**2z**)

Following the general procedure **C** (adding 50 equiv. of H₂O), the title compound (20.6 mg, colourless liquid) was obtained in 63% yield.

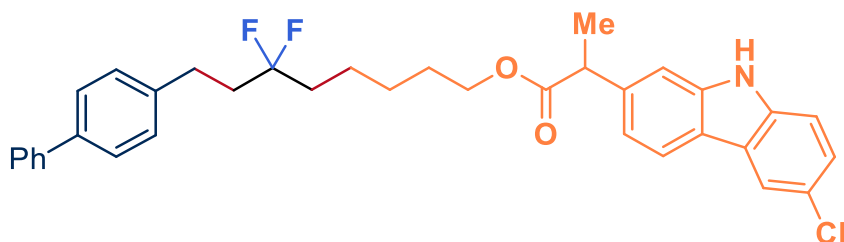
¹H NMR (400 MHz, CDCl₃) δ 7.62 – 7.57 (m, 2H), 7.57 – 7.52 (m, 2H), 7.48 – 7.41 (m, 2H), 7.38 – 7.34 (m, 1H), 7.31 – 7.27 (m, 2H), 2.96 – 2.80 (m, 2H), 2.51 – 2.42 (m, 1H), 2.31 (q, *J* = 2.8 Hz, 1H), 2.25 – 2.05 (m, 2H), 1.85 (dddd, *J* = 18.5, 15.5, 9.1, 6.4 Hz, 1H), 1.61 – 1.50 (m, 4H), 1.44 (ddd, *J* = 11.7, 8.9, 2.4 Hz, 1H), 1.16 (ddt, *J* = 19.2, 9.7, 1.8 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -99.20 – -104.70 (m), -105.19 – -108.96 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 141.1, 140.3, 139.3, 128.9, 127.4, 127.3, 127.2, 125.7 (t, *J* = 243.2 Hz), 47.9 (t, *J* = 23.9 Hz), 37.7 (t, *J* = 26.0 Hz), 37.6 (m), 36.9, 36.0, 32.6 (m), 30.8, 28.3, 28.1 (t, *J* = 4.9 Hz). HRMS-EI (*m/z*): Calcd for C₂₂H₂₄F₂⁺ [*M*]⁺ 326.1841, found 326.1842.



3-(4-([1,1'-biphenyl]-4-yl)-2,2-difluorobutyl)-2,2-dimethylbicyclo[2.2.1]heptane (**2aa**)

Following the general procedure **C** (adding 50 equiv. of H₂O), the title compound (24.7 mg, white solid, m.p. 44.0-44.8 °C) was obtained in 67% yield.

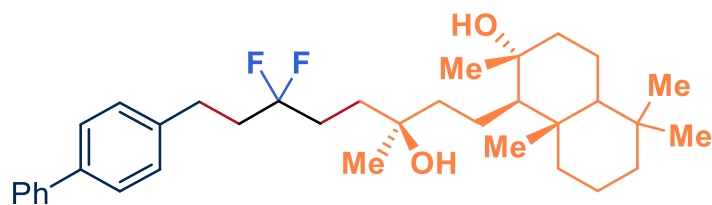
¹H NMR (400 MHz, CDCl₃) δ 7.62 – 7.57 (m, 2H), 7.56 – 7.52 (m, 2H), 7.47 – 7.41 (m, 2H), 7.38 – 7.32 (m, 1H), 7.31 – 7.27 (m, 2H), 2.92 – 2.80 (m, 2H), 2.27 – 2.09 (m, 3H), 1.96 – 1.74 (m, 3H), 1.72 – 1.62 (m, 2H), 1.61 – 1.51 (m, 1H), 1.40 – 1.23 (m, 3H), 1.20 (dt, *J* = 9.8, 1.7 Hz, 1H), 0.97 (s, 3H), 0.81 (s, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -95.59 – -96.68 (m), -97.38 – -98.48 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 141.1, 140.1, 139.3, 128.9, 127.4, 127.3, 127.2, 125.3 (t, *J* = 241.8 Hz), 48.7, 44.4, 42.4, 39.0 (t, *J* = 25.7 Hz), 37.2, 33.3 (t, *J* = 24.6 Hz), 32.1, 28.4 (t, *J* = 5.1 Hz), 24.8, 22.2, 20.4. HRMS-EI (*m/z*): Calcd for C₂₅H₃₀F₂⁺ [*M*]⁺ 368.2310, found 368.2306.



8-([1,1'-biphenyl]-4-yl)-6,6-difluorooctyl 2-(6-chloro-9H-carbazol-2-yl)propanoate
(**2ab**)

Following the general procedure **C** (adding 50 equiv. of H₂O), the title compound (25.8 mg, white solid, m.p. 67.1-69.0 °C) was obtained in 45% yield.

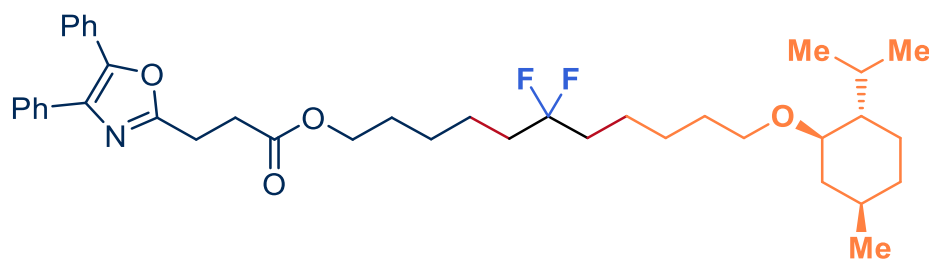
¹H NMR (400 MHz, CDCl₃) δ 8.13 (br, 1H), 8.03 – 7.83 (m, 2H), 7.64 – 7.57 (m, 2H), 7.57 – 7.52 (m, 2H), 7.48 – 7.40 (m, 2H), 7.37 – 7.27 (m, 4H), 7.26 – 7.22 (m, 2H), 7.19 (dd, *J* = 8.1, 1.5 Hz, 1H), 4.25 – 3.99 (m, 2H), 3.88 (q, *J* = 7.1 Hz, 1H), 2.87 – 2.66 (m, 2H), 2.16 – 1.95 (m, 2H), 1.80 – 1.64 (m, 3H), 1.59 (dd, *J* = 7.0, 2.8 Hz, 5H), 1.49 – 1.37 (m, 2H), 1.30 – 1.22 (m, 1H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.95 (p, *J* = 16.6 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 174.9, 141.0, 140.4, 139.9, 139.5, 139.3, 138.1, 128.9, 128.8, 127.4, 127.3, 127.1, 126.0, 125.1, 124.7 (t, *J* = 240.8 Hz), 124.4, 121.7, 120.7, 120.1, 119.8, 111.7, 109.7, 64.7, 46.1, 38.3 (t, *J* = 25.5 Hz), 36.5 (t, *J* = 25.3 Hz), 28.5, 28.2 (t, *J* = 5.0 Hz), 25.7, 22.0 (t, *J* = 4.5 Hz), 18.9. HRMS-APCI(*m/z*): Calcd for C₃₅H₃₅ClF₂NO₂⁺ [*M*]⁺ 574.2319, found 574.2320.



(1R,2R,8aS)-1-((S)-9-([1,1'-biphenyl]-4-yl)-7,7-difluoro-3-hydroxy-3-methylnonyl)-2,5,5,8a-tetramethyldecahydronaphthalen-2-ol (**2ac**)

Following the general procedure **C** (adding 50 equiv. of H₂O), the title compound (38.8 mg, colourless liquid) was obtained in 70% yield.

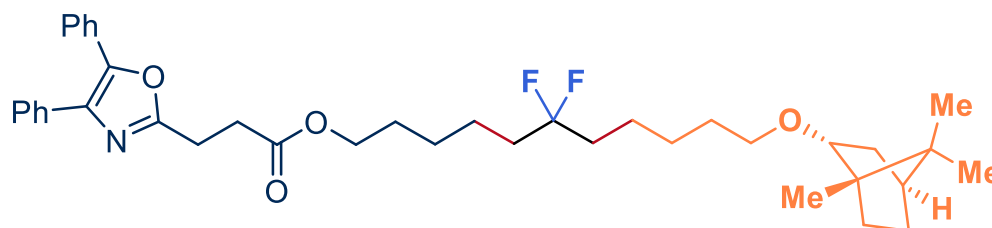
¹H NMR (400 MHz, CDCl₃) δ 7.61 – 7.55 (m, 2H), 7.56 – 7.51 (m, 2H), 7.43 (dd, *J* = 8.5, 6.9 Hz, 2H), 7.36 – 7.30 (m, 1H), 7.30 – 7.26 (m, 2H), 2.92 – 2.77 (m, 2H), 2.27 – 2.10 (m, 3H), 2.10 – 1.91 (m, 2H), 1.84 (dt, *J* = 12.1, 3.1 Hz, 1H), 1.71 – 1.48 (m, 8H), 1.47 – 1.31 (m, 5H), 1.22 – 1.11 (m, 8H), 0.99 – 0.89 (m, 2H), 0.87 (s, 3H), 0.79 (d, *J* = 2.3 Hz, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.73 (p, *J* = 16.4 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 141.1, 140.0, 139.3, 128.9, 127.4, 127.3, 127.1, 125.2 (t, *J* = 240.8 Hz), 75.1, 72.3, 62.0, 56.2, 44.7, 44.4, 42.1, 39.8, 39.3, 38.5 (t, *J* = 25.4 Hz), 35.5, 33.5, 33.3, 31.3 (t, *J* = 25.2 Hz), 28.3 (t, *J* = 5.0 Hz), 25.9, 24.4, 21.6, 20.6, 19.0, 18.5, 15.5. HRMS-EI (*m/z*): Calcd for C₃₆H₅₀F₂O⁺ [*M*-H₂O]⁺ 536.3830, found 536.3830.



6,6-difluoro-11-(((1R,2S,5R)-2-isopropyl-5-methylcyclohexyl)oxy)undecyl
3-(4,5-diphenyloxazol-2-yl)propanoate (**2ad**)

Following the general procedure **C** (adding 50 equiv. of H₂O), the title compound (35.1 mg, colourless liquid) was obtained in 55% yield.

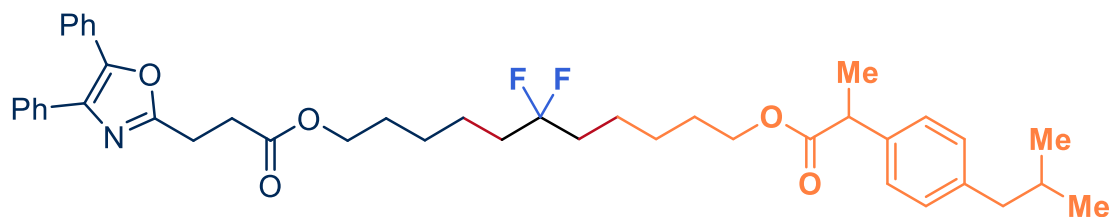
¹H NMR (400 MHz, CDCl₃) δ 7.65 – 7.60 (m, 2H), 7.59 – 7.55 (m, 2H), 7.40 – 7.28 (m, 6H), 4.13 (t, *J* = 6.6 Hz, 2H), 3.61 (dt, *J* = 9.1, 6.2 Hz, 1H), 3.25 (dt, *J* = 9.2, 6.6 Hz, 1H), 3.19 (dd, *J* = 8.1, 6.9 Hz, 2H), 2.99 (td, *J* = 10.5, 4.1 Hz, 1H), 2.91 (dd, *J* = 8.2, 6.9 Hz, 2H), 2.21 (qd, *J* = 7.0, 2.7 Hz, 1H), 2.10 – 2.03 (m, 1H), 1.87 – 1.69 (m, 4H), 1.69 – 1.53 (m, 6H), 1.50 – 1.28 (m, 9H), 1.23 – 1.13 (m, 1H), 0.96 (dd, *J* = 12.7, 3.2 Hz, 1H), 0.90 (dd, *J* = 9.0, 6.8 Hz, 6H), 0.86 – 0.80 (m, 2H), 0.76 (d, *J* = 6.9 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.11 (p, *J* = 16.6 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 172.2, 161.9, 145.6, 135.2, 132.5, 129.1, 128.8, 128.7, 128.6, 128.2, 128.0, 126.6, 125.3 (t, *J* = 240.1 Hz), 79.4, 68.4, 64.8, 48.5, 40.7, 36.5 (t, *J* = 25.4 Hz), 36.3 (t, *J* = 25.9 Hz), 34.8, 31.7, 31.3, 30.2, 28.6, 26.3, 25.9, 25.8, 23.7, 23.5, 22.5, 22.3 (t, *J* = 4.7 Hz), 22.1 (t, *J* = 4.4 Hz), 21.1, 16.4. HRMS-EI (*m/z*): Calcd for C₃₉H₅₄F₂NO₄⁺ [M+H]⁺ 638.4015, found 638.4011.



6,6-difluoro-11-(((1S,2R,4S)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-yl)oxy)undecyl 3-(4,5-diphenyloxazol-2-yl)propanoate (**2ae**)

Following the general procedure **C** (adding 50 equiv. of H₂O), the title compound (33.1 mg, colourless liquid) was obtained in 52% yield.

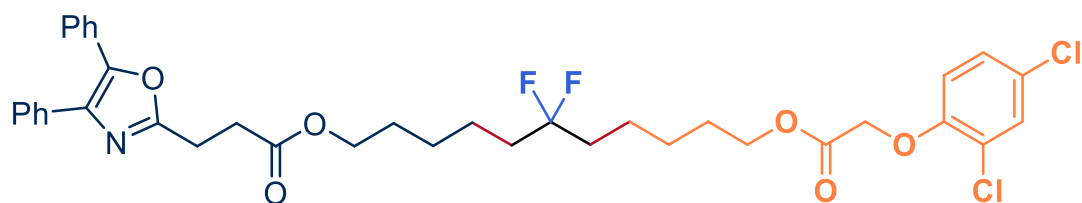
¹H NMR (400 MHz, CDCl₃) δ 7.59 – 7.52 (m, 2H), 7.51 – 7.46 (m, 2H), 7.33 – 7.21 (m, 6H), 4.05 (t, *J* = 6.6 Hz, 2H), 3.45 (ddd, *J* = 9.4, 3.4, 1.9 Hz, 1H), 3.35 (dt, *J* = 9.3, 6.4 Hz, 2H), 3.11 (dd, *J* = 8.1, 6.9 Hz, 2H), 2.84 (dd, *J* = 8.1, 6.9 Hz, 2H), 2.02 (dddd, *J* = 12.8, 9.5, 4.8, 3.2 Hz, 1H), 1.89 (ddd, *J* = 12.0, 9.7, 4.6 Hz, 1H), 1.78 – 1.63 (m, 4H), 1.62 – 1.51 (m, 4H), 1.51 – 1.44 (m, 2H), 1.44 – 1.34 (m, 4H), 1.34 – 1.24 (m, 4H), 1.18 – 1.07 (m, 2H), 0.91 (dd, *J* = 12.9, 3.2 Hz, 1H), 0.78 (s, 3H), 0.76 (s, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.02 (p, *J* = 16.6 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 172.2, 161.9, 145.5, 135.2, 132.5, 129.1, 128.8, 128.7, 128.6, 128.2, 128.0, 126.6, 125.3 (t, *J* = 240.6 Hz), 84.8, 69.8, 64.8, 49.3, 47.9, 45.1, 36.5 (d, *J* = 25.5 Hz), 36.5, 36.3 (d, *J* = 25.5 Hz), 31.3, 30.0, 28.6, 28.4, 26.8, 26.4, 25.9, 23.7, 22.3 (t, *J* = 4.0 Hz), 22.1 (t, *J* = 4.3 Hz), 19.9, 19.0, 14.2. HRMS-EI (*m/z*): Calcd for C₃₉H₅₂F₂NO₄⁺ [M+H]⁺ 636.3859, found 636.3851.



6,6-difluoro-11-((2-(4-isobutylphenyl)propanoyl)oxy)undecyl 3-(4,5-diphenyloxazol-2-yl)propanoate (**2af**)

Following the general procedure **C** (adding 50 equiv. of H₂O), the title compound (28.9 mg, colourless liquid) was obtained in 42% yield.

¹H NMR (500 MHz, CDCl₃) δ 7.66 – 7.61 (m, 2H), 7.59 – 7.55 (m, 2H), 7.38 – 7.30 (m, 6H), 7.20 (d, *J* = 8.1 Hz, 2H), 7.13 – 7.06 (m, 2H), 4.14 (t, *J* = 6.6 Hz, 2H), 4.06 (td, *J* = 6.6, 2.3 Hz, 2H), 3.68 (q, *J* = 7.2 Hz, 1H), 3.19 (dd, *J* = 8.1, 6.9 Hz, 2H), 2.92 (dd, *J* = 8.1, 6.9 Hz, 2H), 2.44 (d, *J* = 7.2 Hz, 2H), 1.85 (dq, *J* = 13.5, 6.8 Hz, 1H), 1.78 – 1.62 (m, 6H), 1.61 – 1.55 (m, 2H), 1.49 (d, *J* = 7.2 Hz, 3H), 1.48 – 1.34 (m, 6H), 1.27 (d, *J* = 8.2 Hz, 2H), 0.89 (d, *J* = 6.6 Hz, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.28 (p, *J* = 16.4 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 174.9, 172.1, 161.9, 145.5, 140.6, 138.0, 135.2, 132.5, 129.4, 128.8, 128.7, 128.6, 128.2, 128.0, 127.2, 126.6, 125.1 (t, *J* = 240.4 Hz), 64.7, 64.5, 45.3, 45.1, 36.3 (t, *J* = 25.6), 36.3 (t, *J* = 25.5), 31.3, 30.3, 29.8, 28.6, 28.5, 25.8, 25.7, 23.7, 22.5, 22.1 (t, *J* = 4.8 Hz), 22.0 (t, *J* = 4.6 Hz), 18.5. HRMS-EI (*m/z*): Calcd for C₄₂H₅₂F₂NO₅⁺ [*M*+H]⁺ 688.3808, found 688.3804.

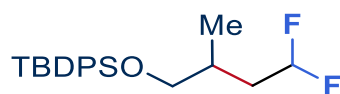


11-(2-(2,4-dichlorophenoxy)acetoxy)-6,6-difluoroundecyl 3-(4,5-diphenyloxazol-2-yl)propanoate (**2ag**)

Following the general procedure **C** (adding 50 equiv. of H₂O), the title compound (31.6 mg, colourless liquid) was obtained in 45% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.66 – 7.60 (m, 2H), 7.59 – 7.54 (m, 2H), 7.41 – 7.30 (m, 6H), 7.26 (s, 1H), 7.16 (dd, *J* = 8.8, 2.5 Hz, 1H), 6.77 (d, *J* = 8.8 Hz, 1H), 4.68 (s, 2H), 4.20 (t, *J* = 6.6 Hz, 2H), 4.13 (t, *J* = 6.6 Hz, 2H), 3.19 (dd, *J* = 8.2, 6.8 Hz, 2H), 2.91 (dd, *J* = 8.2, 6.8 Hz, 2H), 1.81 – 1.61 (m, 8H), 1.52 – 1.29 (m, 8H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -98.43 (p, *J* = 16.6 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 172.2, 168.3, 161.9, 152.6, 133.8, 130.5, 129.6, 129.0, 128.8, 128.7, 128.6, 128.2, 128.0, 127.7, 127.2, 126.6, 125.1 (t, *J* = 240.7 Hz), 124.4, 114.8, 66.5, 65.5, 64.8, 36.4 (t, *J* = 25.7 Hz), 36.3 (t, *J* = 25.5 Hz), 31.3, 28.6, 28.4, 25.9, 25.7, 23.7, 22.1 (t, *J* = 4.4 Hz), 22.0 (t, *J* = 4.6 Hz). HRMS-APCI (*m/z*): Calcd for C₃₇H₄₀Cl₂F₂NO₆ [*M*] 702.2195,

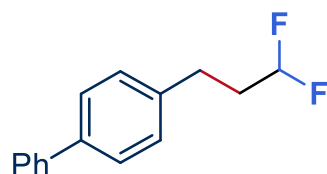
found 702.2202.



tert-butyl(4,4-difluoro-2-methylbutoxy)diphenylsilane (**3a**)

This compound is a known compound that has been reported in a previous study.^[5] Following the general procedure **D**, the title compound (44.9 mg, colourless liquid) was obtained in 62% yield.

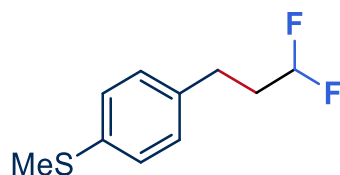
¹H NMR (400 MHz, CDCl₃) δ 7.58 – 7.51 (m, 4H), 7.40 – 7.26 (m, 6H), 5.82 (tt, J = 57.0, 4.9 Hz, 1H), 3.53 – 3.32 (m, 2H), 2.03 – 1.78 (m, 2H), 1.60 (dtdd, J = 20.4, 13.8, 7.4, 4.9 Hz, 1H), 0.96 (s, 9H), 0.87 (d, J = 6.7 Hz, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -113.70 (dddd, J = 281.2, 56.9, 20.7, 14.4 Hz), -115.12 (dddd, J = 281.3, 57.0, 21.5, 14.3 Hz).



4-(3,3-difluoropropyl)-1,1'-biphenyl (**3b**)

Following the general procedure **D**, the title compound (41.8 mg, colourless liquid) was obtained in 90% yield.

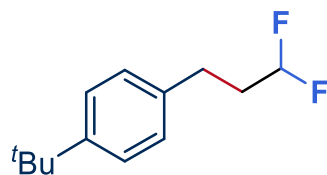
¹H NMR (400 MHz, CDCl₃) δ 7.65 – 7.52 (m, 4H), 7.48 – 7.41 (m, 2H), 7.39 – 7.32 (m, 1H), 7.31 – 7.27 (m, 2H), 5.85 (tt, J = 56.7, 4.5 Hz, 1H), 3.16 – 2.44 (m, 2H), 2.35 – 1.99 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -117.07 (dt, J = 56.5, 17.0 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 141.0, 139.6, 139.1, 128.9, 128.9, 127.5, 127.4, 127.2, 116.8 (t, J = 239.1 Hz), 35.8 (t, J = 21.1 Hz), 28.2 (t, J = 6.0 Hz). HRMS-EI (m/z): Calcd for C₁₅H₁₄F₂⁺ [M]⁺ 232.1058, found 232.1058.



(4-(3,3-difluoropropyl)phenyl)(methyl)sulfane (**3c**)

Following the general procedure **D**, the title compound (32.3 mg, colourless liquid) was obtained in 80% yield.

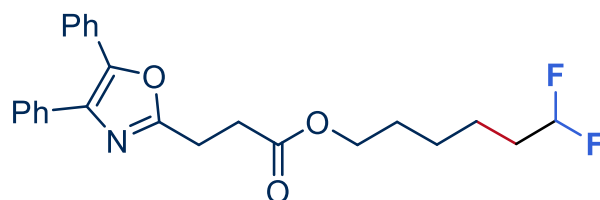
¹H NMR (400 MHz, CDCl₃) δ 7.25 – 7.19 (m, 2H), 7.17 – 7.09 (m, 2H), 5.80 (tt, J = 56.6, 4.5 Hz, 1H), 2.84 – 2.67 (m, 2H), 2.48 (s, 3H), 2.31 – 1.89 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -117.12 (dt, J = 56.6, 17.0 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 137.0, 136.4, 129.0, 127.3, 116.8 (t, J = 239.1 Hz), 35.8 (t, J = 21.0 Hz), 28.0 (t, J = 6.0 Hz), 16.3. HRMS-EI (m/z): Calcd for C₁₀H₁₂F₂S⁺ [M]⁺ 202.0622, found 202.0622.



1-(tert-butyl)-4-(3,3-difluoropropyl)benzene (**3d**)

Following the general procedure **D**, the title compound (38.2 mg, colourless liquid) was obtained in 90% yield.

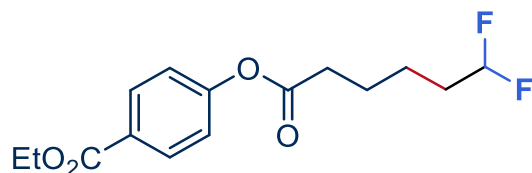
¹H NMR (400 MHz, CDCl₃) δ 7.28 – 7.24 (m, 2H), 7.12 – 7.02 (m, 2H), 5.73 (tt, *J* = 56.7, 4.5 Hz, 1H), 2.71 – 2.63 (m, 2H), 2.21 – 1.99 (m, 2H), 1.24 (s, 9H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -117.09 (dt, *J* = 56.5, 17.0 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 149.4, 136.9, 128.1, 125.7, 116.9 (t, *J* = 238.9 Hz), 35.8 (t, *J* = 21.0 Hz), 31.5, 28.0 (t, *J* = 5.9 Hz). HRMS-EI (*m/z*): Calcd for C₁₃H₁₈F₂⁺ [M]⁺ 212.1371, found 212.1371.



6,6-difluorohexyl 3-(4,5-diphenyloxazol-2-yl)propanoate (**3e**)

Following the general procedure **D**, the title compound (38.2 mg, colourless liquid) was obtained in 65% yield.

¹H NMR (400 MHz, CDCl₃) δ 7.68 – 7.60 (m, 2H), 7.60 – 7.51 (m, 2H), 7.40 – 7.31 (m, 6H), 5.76 (tt, *J* = 56.9, 4.5 Hz, 1H), 4.13 (t, *J* = 6.5 Hz, 2H), 3.19 (t, *J* = 7.4 Hz, 2H), 2.92 (t, *J* = 7.4 Hz, 2H), 1.78 (qdd, *J* = 13.1, 7.4, 3.1 Hz, 2H), 1.70 – 1.58 (m, 2H), 1.51 – 1.34 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -115.88 (dt, *J* = 56.8, 17.6 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 172.12, 161.9, 145.6, 135.2, 132.5, 128.8, 128.7, 128.6, 128.3, 128.0, 126.6, 117.3 (t, *J* = 238.8 Hz), 64.7, 34.0 (t, *J* = 20.6 Hz), 31.3, 28.6, 25.6, 23.7, 21.9 (t, *J* = 5.6 Hz). HRMS-EI (*m/z*): Calcd for C₂₄H₂₅F₂NO₃⁺ [M]⁺ 413.1797, found 413.1805.

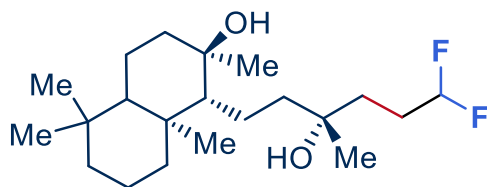


ethyl 4-((6,6-difluorohexanoyl)oxy)benzoate (**3f**)

This compound is a known compound that has been reported in a previous study.^[4] Following the general procedure **D**, the title compound (36.0 mg, colourless liquid) was obtained in 60% yield.

¹H NMR (400 MHz, CDCl₃) δ 8.22 – 7.93 (m, 2H), 7.18 – 7.13 (m, 2H), 5.84 (tt, *J* =

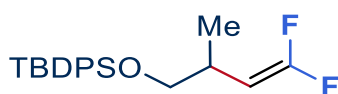
56.7, 4.4 Hz, 1H), 4.38 (q, $J = 7.1$ Hz, 2H), 2.62 (t, $J = 7.4$ Hz, 2H), 1.99 – 1.74 (m, 4H), 1.67 – 1.51 (m, 3H), 1.39 (t, $J = 7.1$ Hz, 3H). **^{19}F NMR** (377 MHz, CDCl_3) δ -116.03 (dt, $J = 57.2, 17.6$ Hz).



(1R,2R,8aS)-1-((R)-6,6-difluoro-3-hydroxy-3-methylhexyl)-2,5,5,8a-tetramethyldecahydronaphthalen-2-ol (**3g**)

This compound is a known compound that has been reported in a previous study.^[4] Following the general procedure **D**, the title compound (72.0 mg, colourless liquid) was obtained in 60% yield.

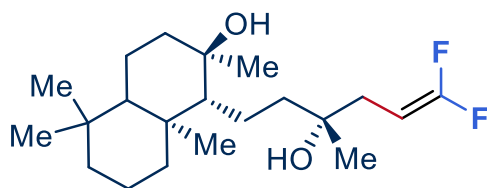
^1H NMR (400 MHz, CDCl_3) δ 5.84 (tt, $J = 57.2, 4.5$ Hz, 1H), 2.08 – 1.77 (m, 5H), 1.69 – 1.51 (m, 8H), 1.46 – 1.22 (m, 7H), 1.20 – 1.16 (m, 6H), 0.98 – 0.89 (m, 2H), 0.86 (s, 3H), 0.78 (d, $J = 2.3$ Hz, 6H). **^{19}F NMR** (377 MHz, CDCl_3) δ -115.55 (ddt, $J = 56.6, 19.4, 17.7$ Hz).



tert-butyl((4,4-difluoro-2-methylbut-3-en-1-yl)oxy)diphenylsilane (**3h**)

This compound is a known compound that has been reported in a previous study.^[6] Following the general procedure **E**, the title compound (26.6 mg, colourless liquid) was obtained in 37% yield.

^1H NMR (400 MHz, CDCl_3) δ 7.70 – 7.62 (m, 4H), 7.45 – 7.34 (m, 6H), 4.06 (ddd, $J = 25.8, 9.7, 2.9$ Hz, 1H), 3.50 (td, $J = 6.4, 1.0$ Hz, 2H), 2.57 (dddd, $J = 14.1, 7.3, 4.3, 1.2$ Hz, 1H), 1.06 (s, 9H), 1.04 (dt, $J = 6.9, 0.8$ Hz, 3H). **^{19}F NMR** (377 MHz, CDCl_3) δ -88.98 (d, $J = 47.7$ Hz), -90.19 (dd, $J = 47.8, 25.8$ Hz). **^{13}C NMR** (126 MHz, CDCl_3) δ 157.5 (d, $J = 286.7$ Hz), 135.7 (d, $J = 2.6$ Hz), 133.8 (d, $J = 5.4$ Hz), 129.8, 127.8, 81.2 (t, $J = 20.4$ Hz), 68.2 (t, $J = 2.6$ Hz), 31.4 (d, $J = 4.2$ Hz), 26.9, 19.4, 17.4 (t, $J = 2.3$ Hz).

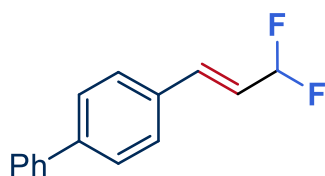


(1R,2R,8aS)-1-((R)-6,6-difluoro-3-hydroxy-3-methylhex-5-en-1-yl)-2,5,5,8a-tetramethyldecahydronaphthalen-2-ol (**3i**)

This compound is a known compound that has been reported in a previous study.^[5]

Following the general procedure **E**, the title compound (64.4 mg, white solid, m.p. 120.0-122.1 °C) was obtained in 90% yield.

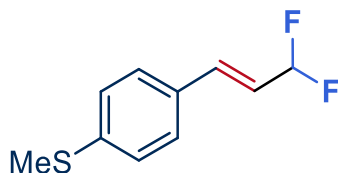
¹H NMR (400 MHz, CDCl₃) δ 4.21 (dtd, *J* = 25.5, 8.1, 2.7 Hz, 1H), 2.18 – 2.09 (m, 2H), 2.04 (dt, *J* = 8.1, 1.8 Hz, 2H), 1.77 (dt, *J* = 12.1, 3.2 Hz, 1H), 1.61 – 1.42 (m, 6H), 1.37 – 1.14 (m, 7H), 1.10 (d, *J* = 1.4 Hz, 7H), 0.91 – 0.84 (m, 1H), 0.79 (s, 3H), 0.72 (d, *J* = 2.1 Hz, 6H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -87.38 (dd, *J* = 45.5, 2.4 Hz), -90.86 (dd, *J* = 45.9, 25.4 Hz). **¹³C NMR** (126 MHz, CDCl₃) δ 158.2 (dd, *J* = 287.4, 285.4 Hz), 75.1, 74.4 (dd, *J* = 22.8, 21.2 Hz), 73.0, 61.9, 56.2, 44.5, 44.3, 42.1, 39.7, 39.4, 36.3 (d, *J* = 3.9 Hz), 33.5, 33.4, 25.7, 24.5, 21.6, 20.6, 18.9, 18.5, 15.5.



(Z)-4-(3,3-difluoroprop-1-en-1-yl)-1,1'-biphenyl (3j)

Following the general procedure **E**, the title compound (41.4 mg, white solid, m.p. 121.5-122.6 °C) was obtained in 95% yield.

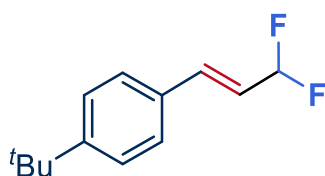
¹H NMR (400 MHz, CDCl₃) δ 7.63 (dd, *J* = 7.6, 1.5 Hz, 4H), 7.57 – 7.45 (m, 4H), 7.44 – 7.36 (m, 1H), 6.99 – 6.87 (m, 1H), 6.46 – 6.09 (m, 2H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -109.33 – -109.49 (m), -109.51 – -109.61 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 142.3, 140.4, 136.8 (t, *J* = 12.2 Hz), 133.5, 129.0, 127.9, 127.6, 127.1, 121.0 (t, *J* = 23.9 Hz), 115.6 (t, *J* = 233.6 Hz). HRMS-EI (*m/z*): Calcd for C₁₃H₁₈F₂⁺ [*M*]⁺ 230.0902, found 230.0896.



(E)-4-(3,3-difluoroprop-1-en-1-yl)phenyl(methyl)sulfane (3k)

Following the general procedure **E**, the title compound (36.8 mg, white solid, m.p. 50.5-51.3 °C) was obtained in 92% yield.

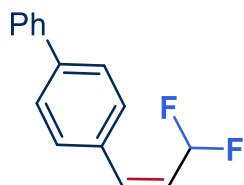
¹H NMR (400 MHz, CDCl₃) δ 7.64 – 7.30 (m, 2H), 7.29 – 7.14 (m, 2H), 6.95 – 6.65 (m, 1H), 6.50 – 5.91 (m, 2H), 2.50 (s, 3H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -109.22 – -109.34 (m), -109.41 – -109.46 (m). **¹³C NMR** (126 MHz, CDCl₃) δ 140.7, 136.6 (t, *J* = 12.2 Hz), 131.2, 127.7, 126.4, 120.2 (t, *J* = 23.9 Hz), 115.6 (t, *J* = 233.6 Hz), 15.5. HRMS-EI (*m/z*): Calcd for C₁₅H₁₂F₂⁺ [*M*]⁺ 200.0466, found 200.0463.



(*E*)-1-(tert-butyl)-4-(3,3-difluoroprop-1-en-1-yl)benzene (**3l**)

Following the general procedure **E**, the title compound (39.9 mg, colourless liquid) was obtained in 95% yield.

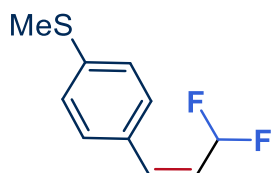
^1H NMR (400 MHz, CDCl_3) δ 7.47 – 7.30 (m, 4H), 6.95 – 6.80 (m, 1H), 6.44 – 6.06 (m, 2H), 1.35 (s, 9H). ^{19}F NMR (377 MHz, CDCl_3) δ -109.07 – -109.17 (m), -109.23 – -109.30 (m). ^{13}C NMR (126 MHz, CDCl_3) δ 152.9, 137.1 (t, J = 12.2 Hz), 131.8, 127.2, 125.9, 120.3 (t, J = 23.9 Hz), 115.8 (t, J = 233.3 Hz), 34.9, 31.3. HRMS-EI (m/z): Calcd for $\text{C}_{13}\text{H}_{16}\text{F}_2^+$ [M] $^+$ 210.1215, found 210.1215.



(*Z*)-4-(3,3-difluoroprop-1-en-1-yl)-1,1'-biphenyl (**3m**)

Following the general procedure **F**, the title compound (37.3 mg, Z/E = 1.7/1) was obtained in 81% yield.

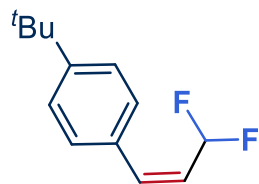
^1H NMR (400 MHz, CDCl_3) δ 7.73 – 7.55 (m, 4H), 7.53 – 7.44 (m, 2H), 7.44 – 7.37 (m, 3H), 7.03 – 6.92 (m, 1H), 6.43 (tdd, J = 55.4, 7.4, 0.9 Hz, 1H), 5.91 (dtd, J = 11.8, 8.5, 7.4 Hz, 1H). ^{19}F NMR (471 MHz, CDCl_3) δ -107.91 (d, J = 8.4 Hz), -108.02 (d, J = 8.7 Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 141.7, 140.3, 137.7 (t, J = 12.7 Hz), 133.5 (t, J = 2.1 Hz), 129.4, 129.0, 127.9, 127.5, 127.2, 123.9 (t, J = 26.2 Hz), 112.5 (t, J = 230.6 Hz). HRMS-EI (m/z): Calcd for $\text{C}_{15}\text{H}_{12}\text{F}_2^+$ [M] $^+$ 230.0902, found 230.0906.



(*Z*)-4-(3,3-difluoroprop-1-en-1-yl)phenyl(methyl)sulfane (**3n**)

Following the general procedure **F**, the title compound (28.0 mg, Z/E = 2.6/1) was obtained in 70% yield.

^1H NMR (400 MHz, CDCl_3) δ 7.37 – 7.02 (m, 4H), 6.89 – 6.72 (m, 1H), 6.26 (tdd, J = 55.4, 7.3, 0.9 Hz, 1H), 5.75 (dtd, J = 11.8, 8.6, 7.3 Hz, 1H), 2.43 (s, 3H). ^{19}F NMR (377 MHz, CDCl_3) δ -107.75 (d, J = 8.7 Hz), -107.90 (d, J = 8.8 Hz). ^{13}C NMR (126 MHz, CDCl_3) δ 140.0, 137.5 (t, J = 12.6 Hz), 131.1, 129.3, 126.3, 123.4 (t, J = 26.1 Hz), 112.5 (t, J = 230.6 Hz), 15.5. HRMS-EI (m/z): Calcd for $\text{C}_{10}\text{H}_{10}\text{F}_2\text{S}^+$ [M] $^+$ 200.0466, found 200.0466.



(Z)-1-(tert-butyl)-4-(3,3-difluoroprop-1-en-1-yl)benzene (3o)

Following the general procedure **F**, the title compound (31.5 mg, Z/E = 4.0/1) was obtained in 75% yield.

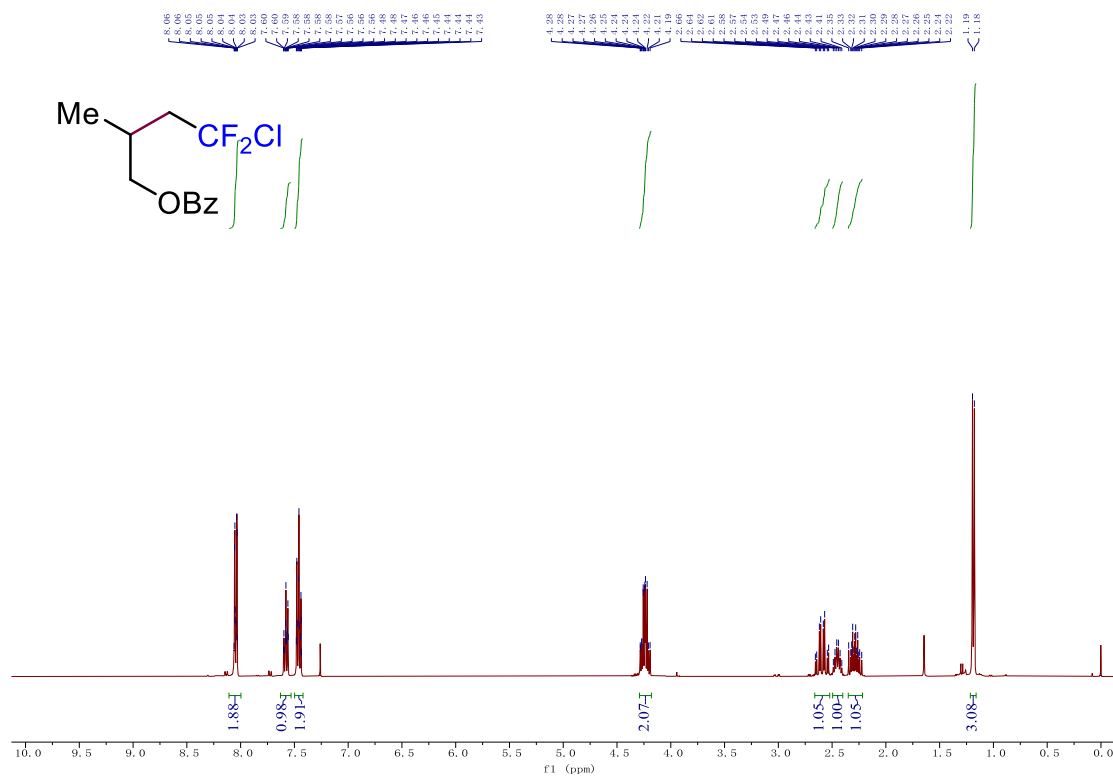
¹H NMR (400 MHz, CDCl₃) δ 7.51 – 7.27 (m, 2H), 7.24 – 7.05 (m, 2H), 6.84 (dd, *J* = 11.7, 1.0 Hz, 1H), 6.30 (tdd, *J* = 55.5, 7.4, 0.9 Hz, 1H), 5.74 (dtd, *J* = 11.8, 8.5, 7.4 Hz, 1H), 1.26 (s, 9H). **¹⁹F NMR** (377 MHz, CDCl₃) δ -107.85 (d, *J* = 8.3 Hz), -108.00 (d, *J* = 8.7 Hz). **¹³C NMR** (101 MHz, CDCl₃) δ 152.1, 138.0 (t, *J* = 12.6 Hz), 131.8 (t, *J* = 2.2 Hz), 128.8 (d, *J* = 1.8 Hz), 125.7, 123.3 (t, *J* = 26.1 Hz), 112.6 (t, *J* = 230.3 Hz), 34.8, 31.4. HRMS-EI (*m/z*): Calcd for C₁₃H₁₆F₂⁺ [*M*]⁺ 210.1220, found 210.1223.

IX. Supplementary references

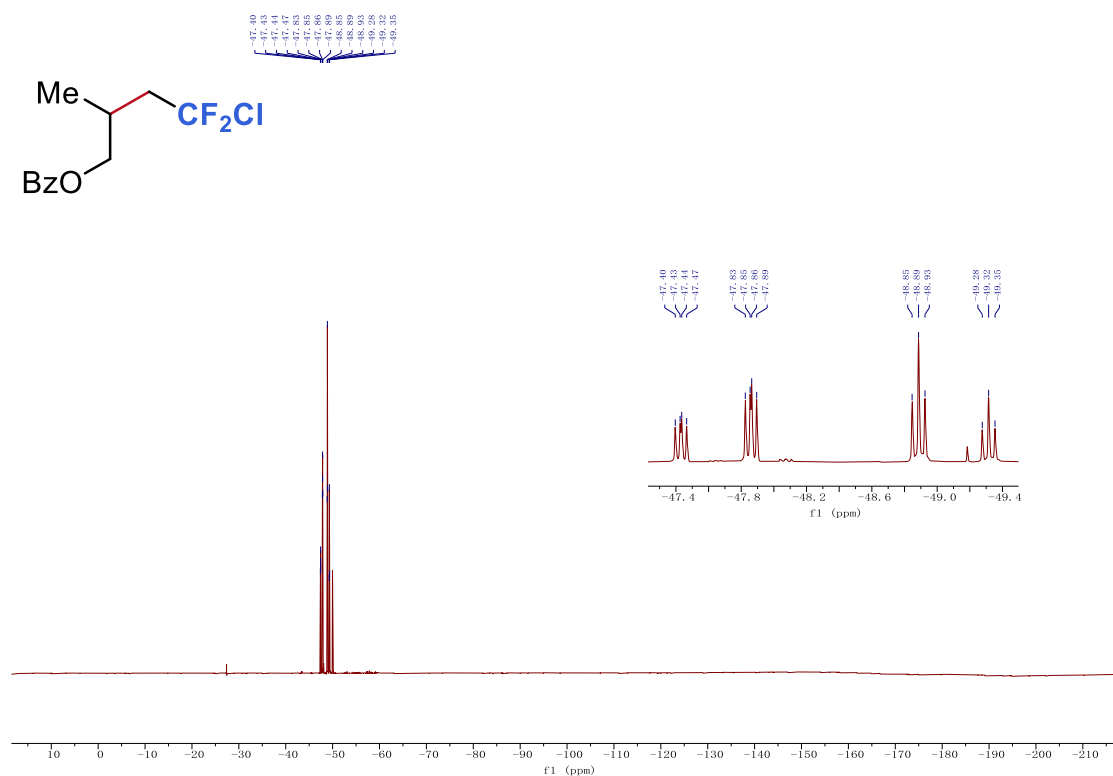
- [1] E. Falk, S. Makai, T. Delcaillau, L. Guertler, B. Morandi, Design and scalable synthesis of N-alkylhydroxylamine reagents for the direct Iron-catalyzed installation of medicinally relevant amines. *Angew. Chem., Int. Ed.* **2020**, *59*, 21064.
- [2] D. P. Wood, W. Guan, S. Lin, Titanium and cobalt bimetallic radical redox relay for the isomerization of N-Bz aziridines to allylic amides. *Synthesis* **2021**, *53*, 4213.
- [3] H. Huang, C. Yu, Y. Zhang, Y. Zhang, P. S. Mariano, W. Wang, Chemo- and Regioselective Organo-Photoredox catalyzed hydroformylation of styrenes via a radical pathway. *J. Am. Chem. Soc.* **2017**, *139*, 9799.
- [4] D. Meng, L. Li, A. Brown, J.-N. Desrosiers, S. Duan, C. M. Hayward, Z. He, J. Hu, T. Makowski, M. Maloney, S. Monfette, H. Perfect, J. L. Piper, M. D. Zhou, W. Widlicka, A radical chlorodifluoromethylation protocol for late-stage difluoromethylation and its application to an oncology candidate. *Cell Rep. Phys. Sci.* **2021**, *2*, 10349.
- [5] Z.-Q. Zhang, Y.-Q. Sang, C.-Q. Wang, P. Dai, X.-S. Xue, J. L. Piper, Z.-H. Peng, J.-A. Ma, F.-G. Zhang, J. Wu, Difluoromethylation of Unactivated Alkenes Using Freon-22 through Tertiary Amine-Borane-Trigged Halogen Atom Transfer. *J. Am. Chem. Soc.* **2022**, *144*, 14288–14296.
- [6] P. Salomon, S. Z. Zard, A Practical Source of Chlorodifluoromethyl Radicals. Convergent Routes to gem-Difluoroalkenes and -dienes and (2,2-Difluoroethyl)-indoles, -azaindoles, and -naphthols. *Org. Lett.* **2014**, *16*, 2926–2929.
- [7] Corcoran, E. B., McMullen, J. P., Lévesque, F., Wismer, M. K. & Naber, J. R. Photon equivalents as a parameter for scaling photoredox reactions in flow: translation of S239 photocatalytic C–N cross-coupling from lab scale to multikilogram scale. *Angew. Chem. Int. Ed.* **2022**, *59*, 11964–11968.
- [8] Demas, J. N., Bowman, W. D., Zalewski, E. F. & Velapoldi, R. A. Determination of the quantum yield of the ferrioxalate actinometer with electrically calibrated radiometers. *J. Phys. Chem.* **1981**, *85*, 2766–2771.
- [9] Hatchard, C. G., Parker, C. A. & Bowen, E. J. A new sensitive chemical actinometer - II. Potassium ferrioxalate as a standard chemical actinometer. *Proc. R. Soc. Lond. A* **1956**, *235*, 518–536.

X. NMR spectra for product characterization

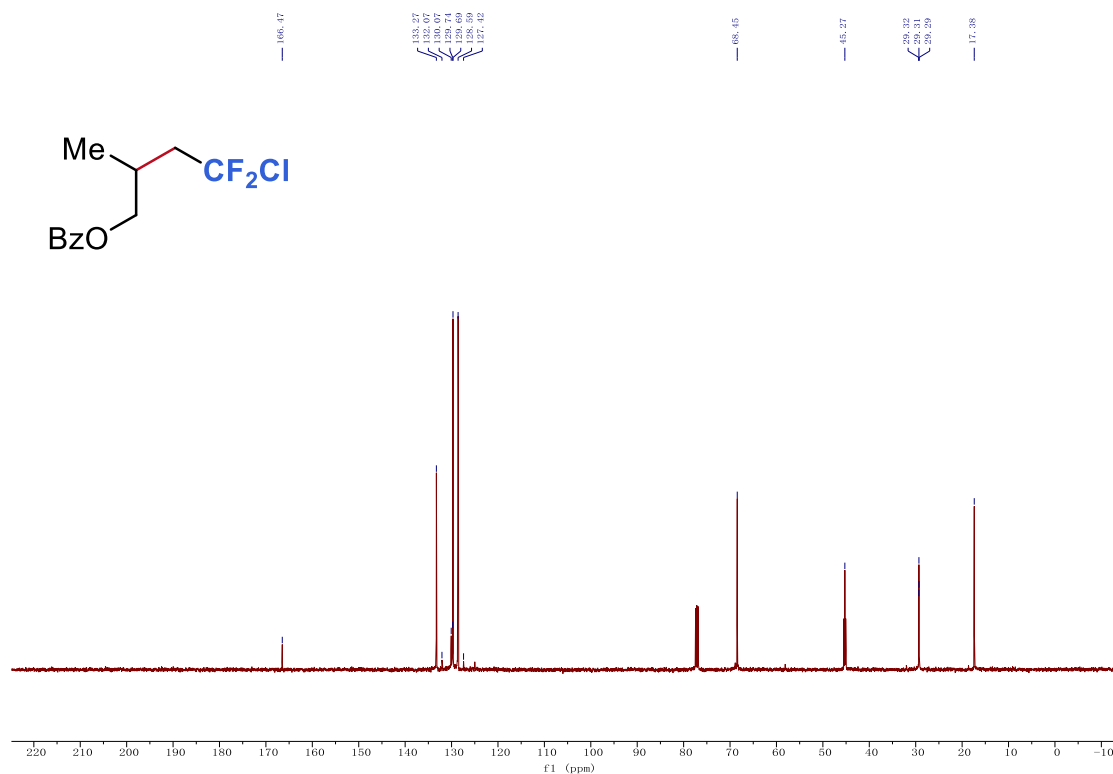
^1H NMR (400 MHz, CDCl_3) spectra for compound **1a**



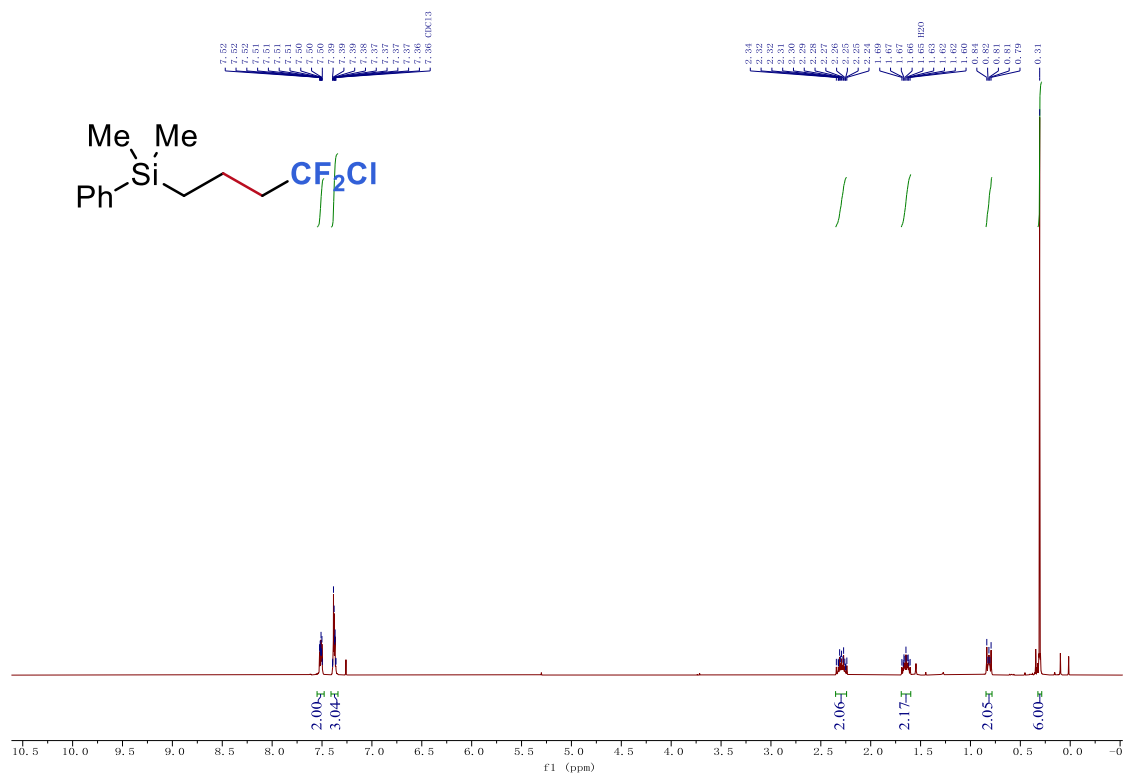
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1a**



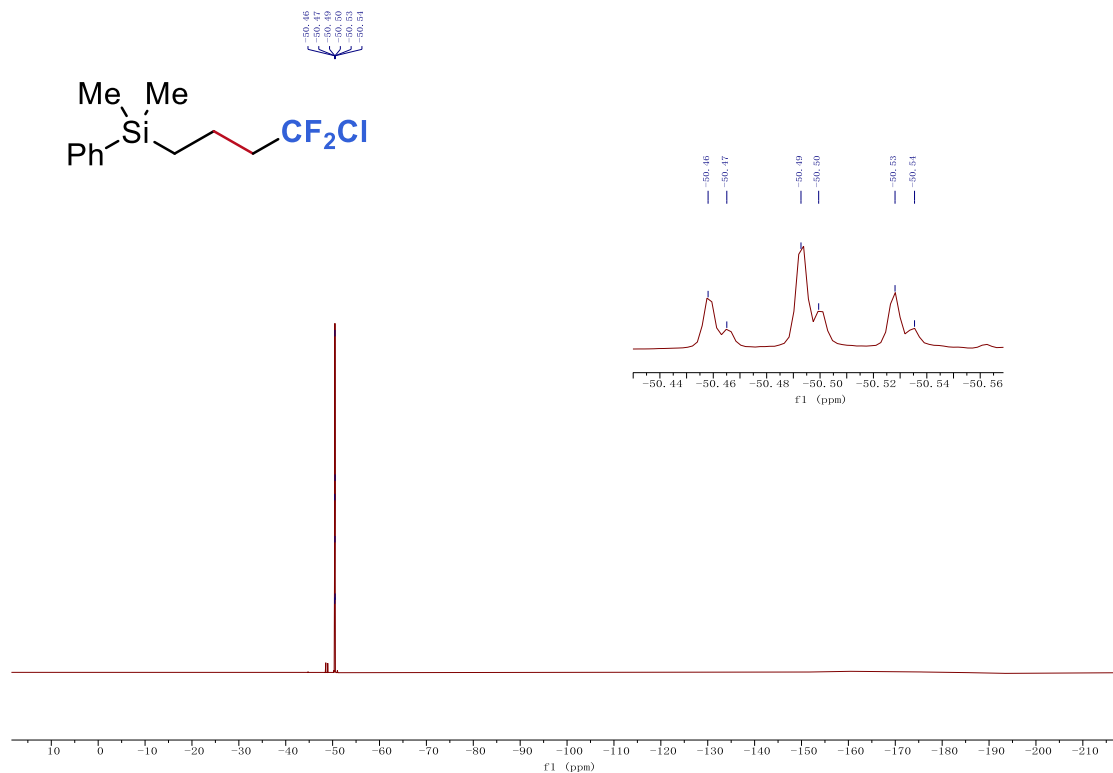
¹³C NMR (126 MHz, CDCl₃) spectra for compound 1a



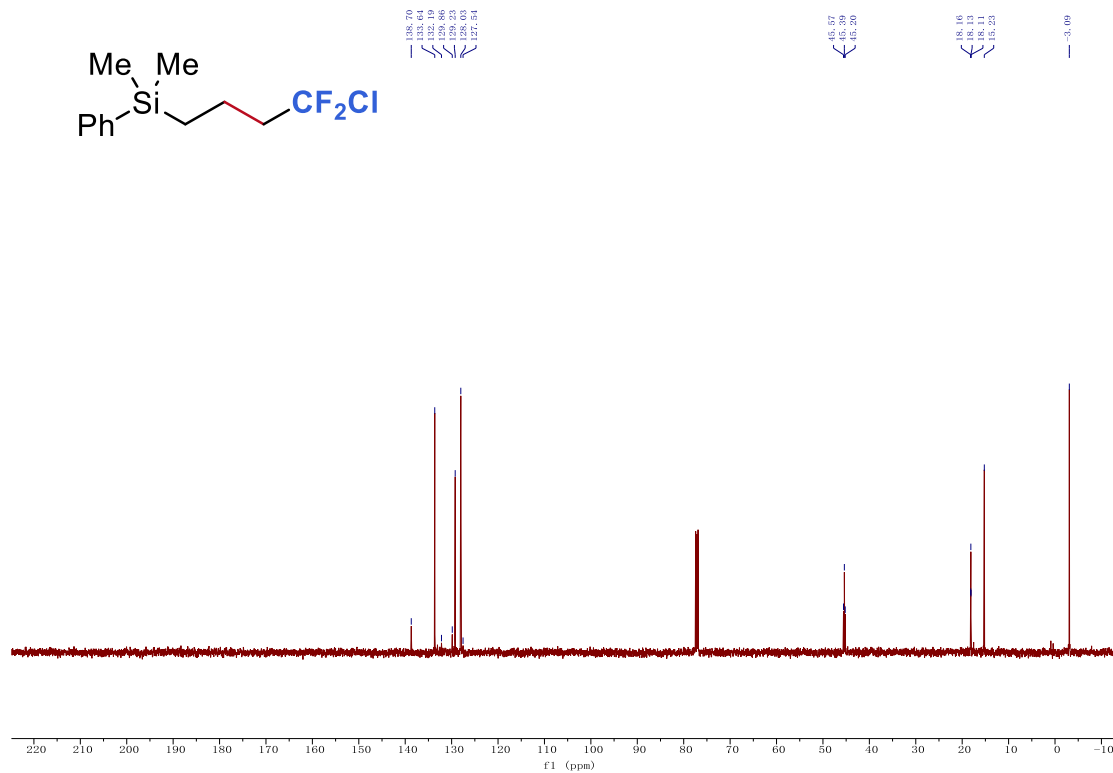
¹H NMR (400 MHz, CDCl₃) spectra for compound 1b



¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1b**



¹³C NMR (126 MHz, CDCl₃) spectra for compound **1b**



Chemical structure: c1ccccc1P(=O)(c2ccccc2)CCCl

¹H NMR spectrum (CDCl₃) data:

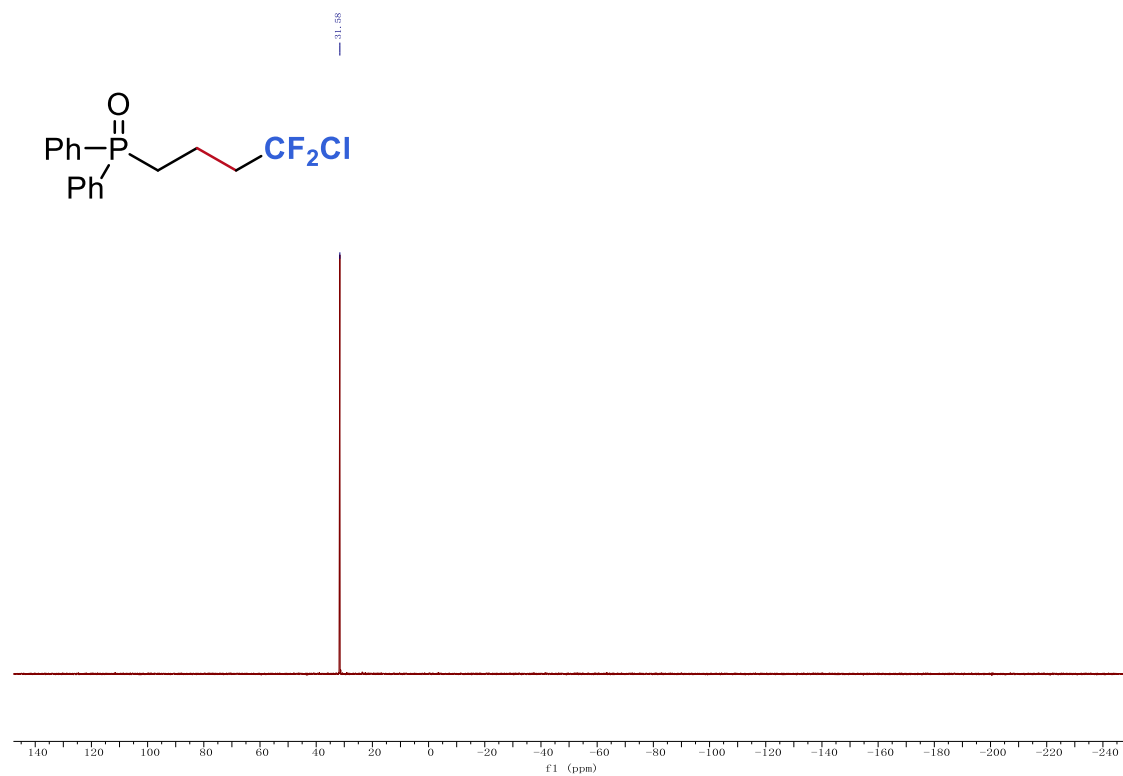
Chemical Shift (ppm)	Integration
7.65 - 7.76	3.85
7.53 - 7.63	5.87
2.49 - 2.59	1.93
1.91 - 2.01	2.01
2.41	2.41

Chemical structure: ClCCOP(=O)(c1ccccc1)c2ccccc2

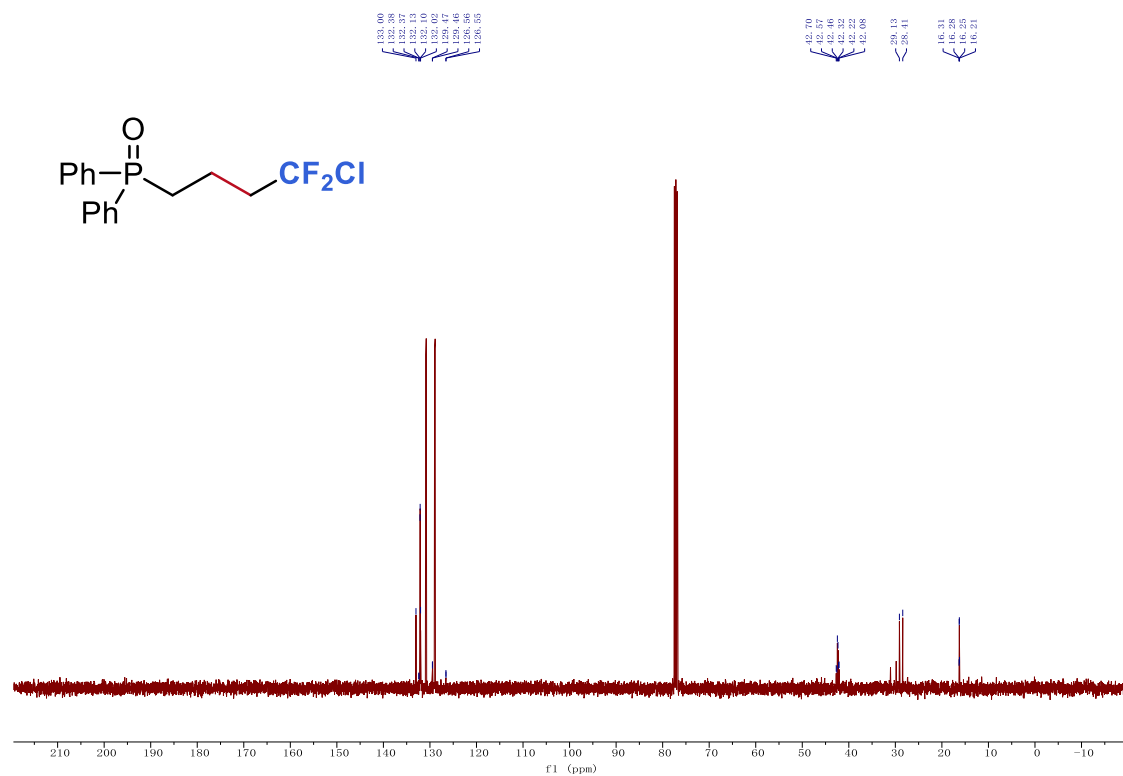
¹³C NMR spectrum (ppm):

- 50.55, -50.54, -50.54, -50.55, -50.56, -50.57, -50.60, -50.61, -50.61
- 50.53, -50.54, -50.56, -50.57, -50.59, -50.60, -50.61

³¹P NMR (162 MHz, CDCl₃) spectra for compound **1c**



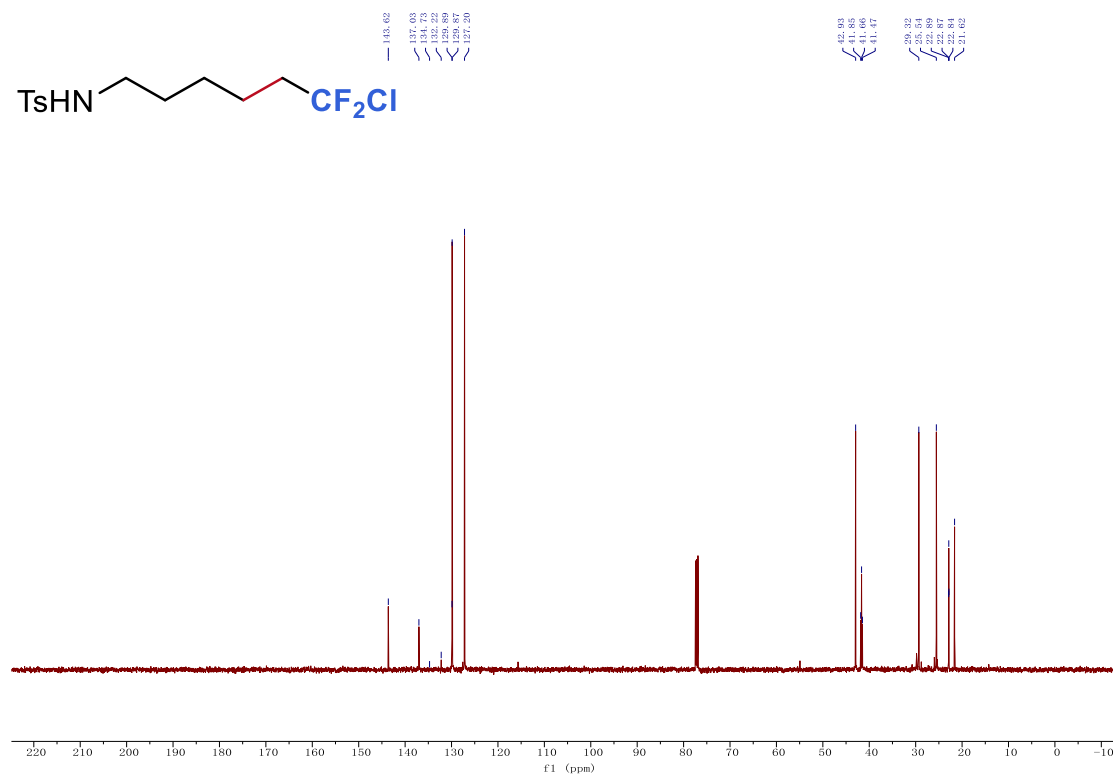
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1c**



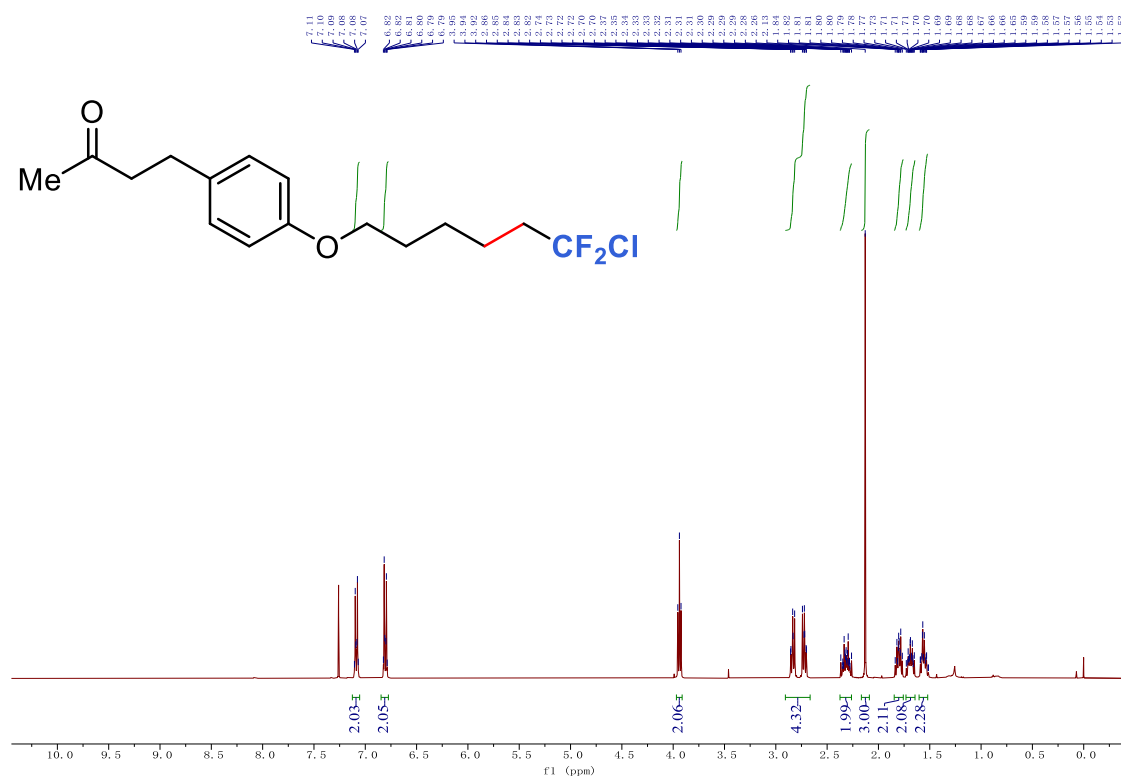
Chemical structure of 4-(chlorodifluoromethyl)butan-1-amine hydrochloride (CCCCN.[Cl-]) is shown. The structure is labeled with TsHN and CF_2Cl groups. The chemical shift range for the ^{19}F NMR spectrum is indicated as 19.05 to 89.05 ppm.

The ^{19}F NMR spectrum shows a single sharp peak at approximately -50.1 ppm, corresponding to the CF_2Cl group. The chemical shift range is indicated as 19.05 to 89.05 ppm.

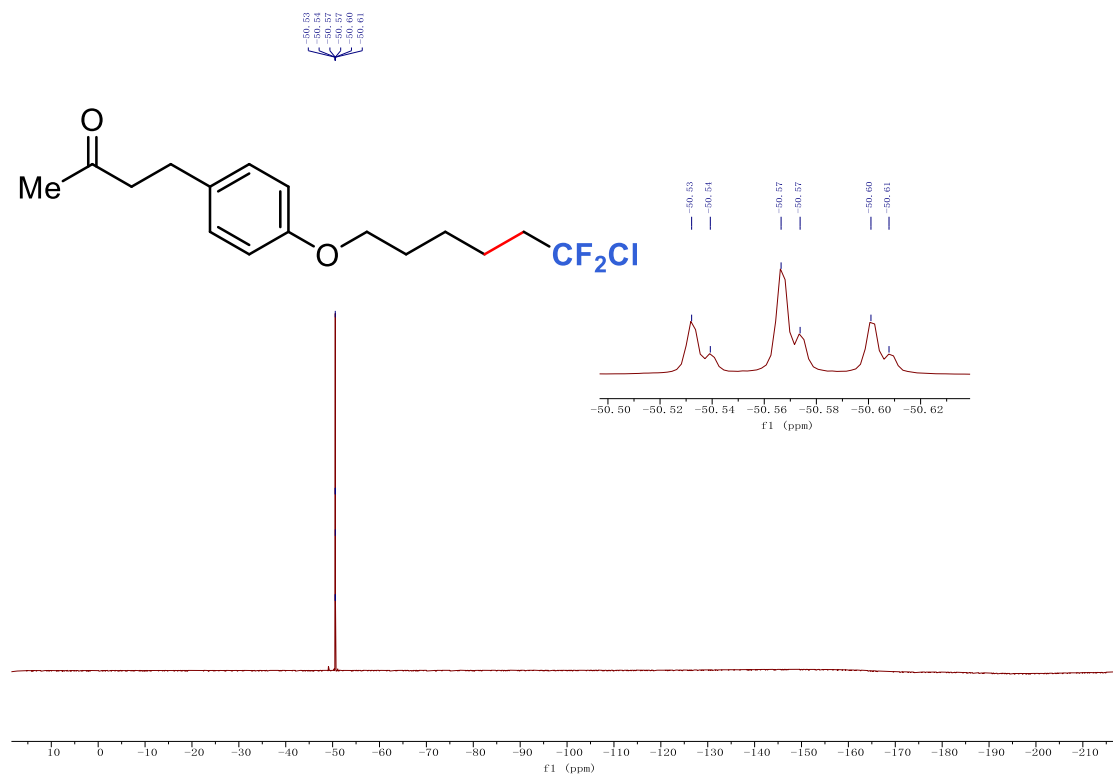
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1d**



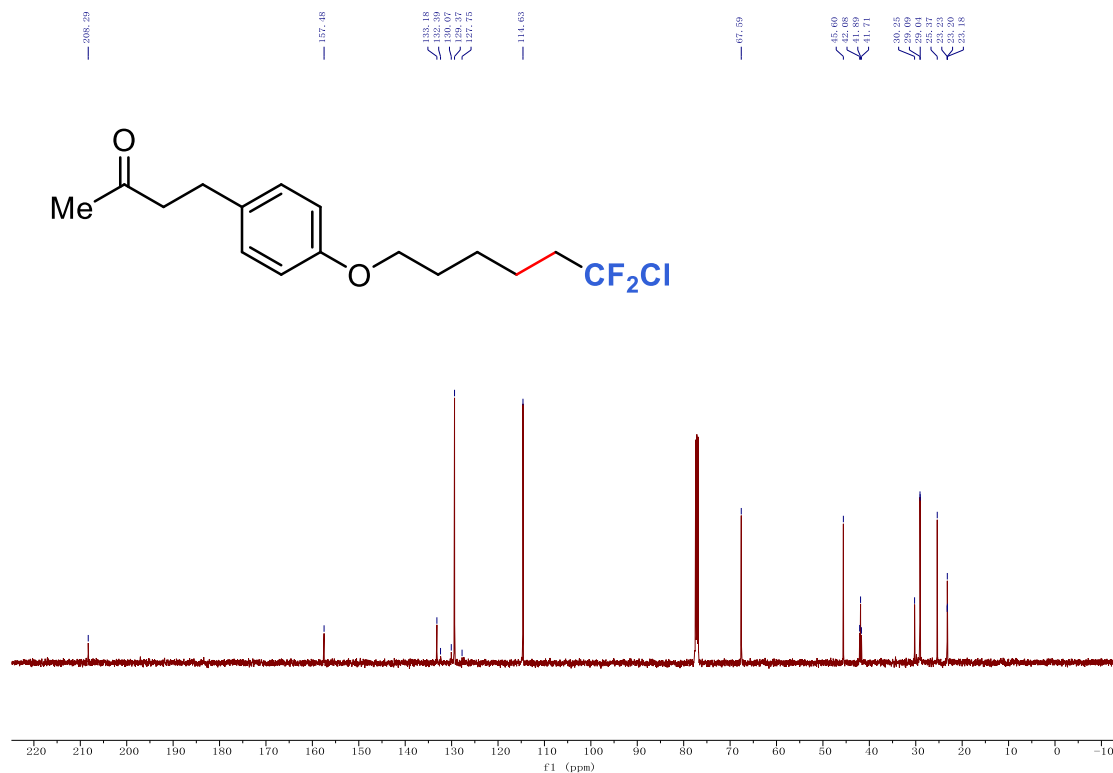
^1H NMR (400 MHz, CDCl_3) spectra for compound **1e**



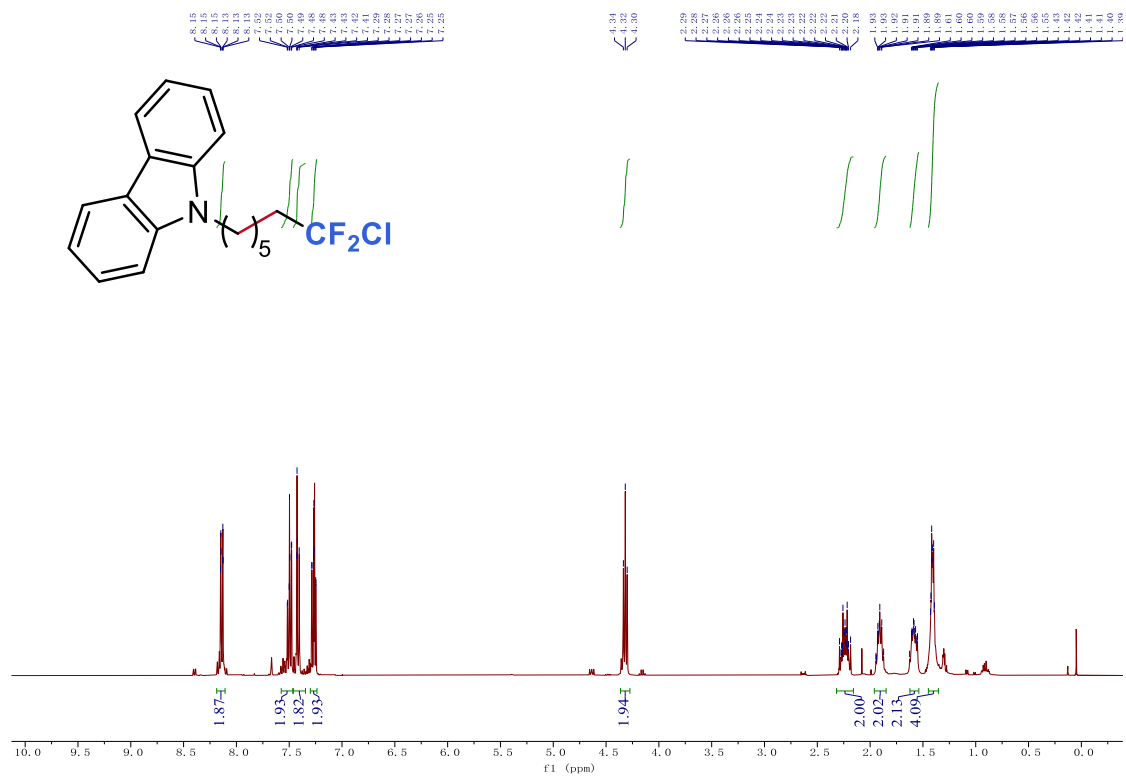
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1e**



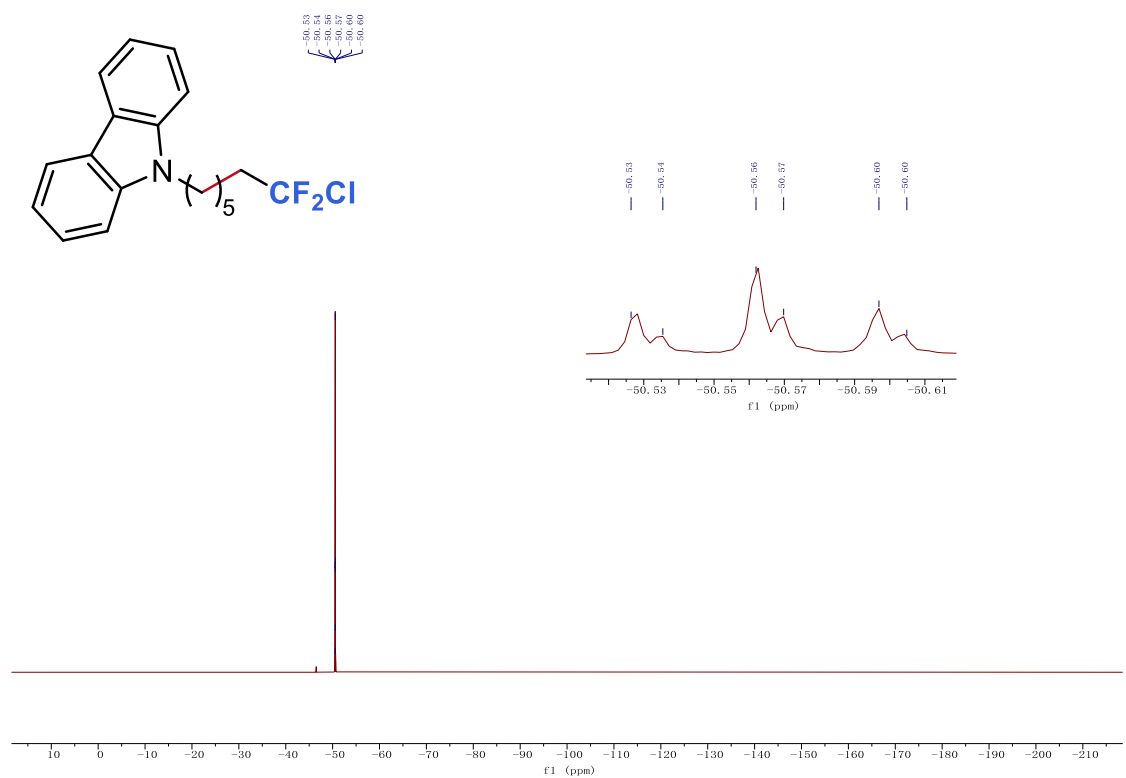
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1e**



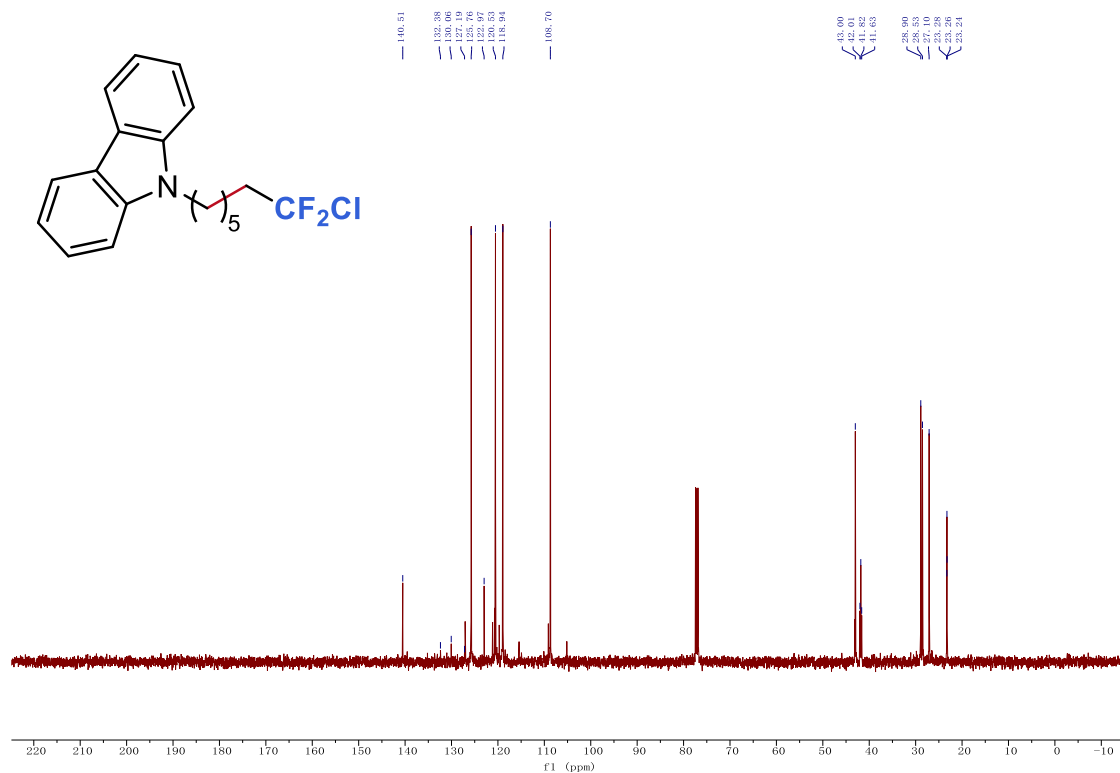
¹H NMR (400 MHz, CDCl₃) spectra for compound **1f**



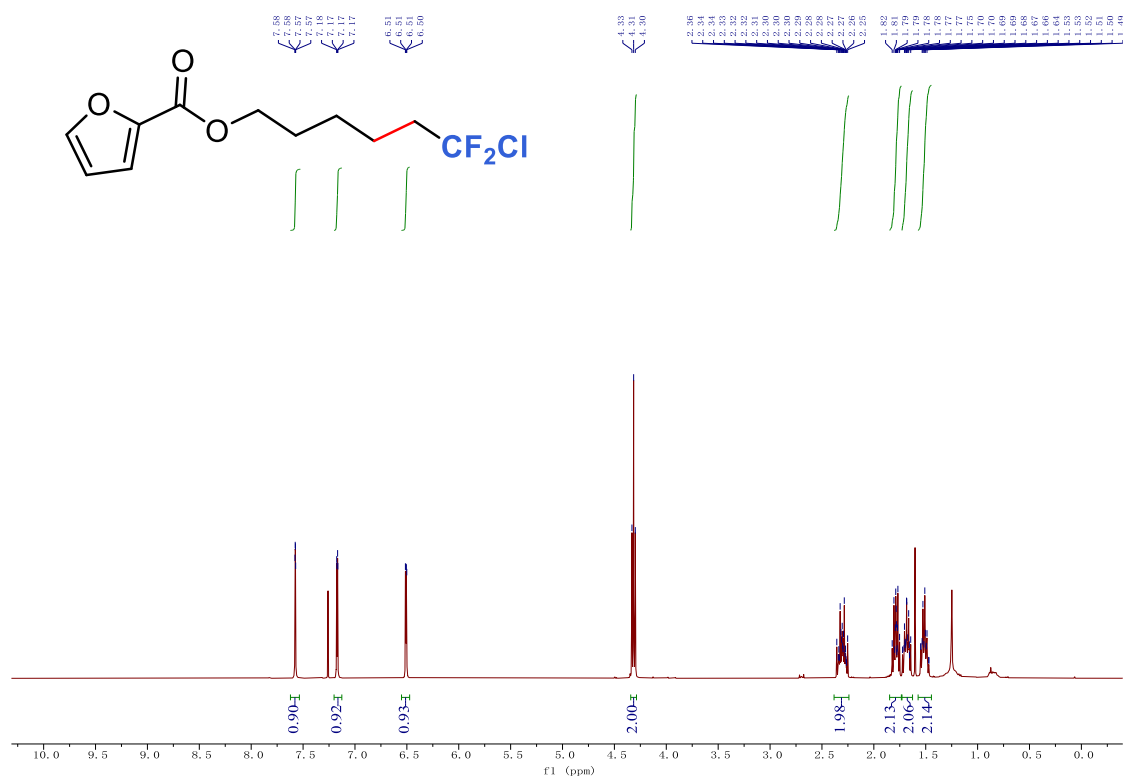
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1f**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1f**



^1H NMR (400 MHz, CDCl_3) spectra for compound **1g**

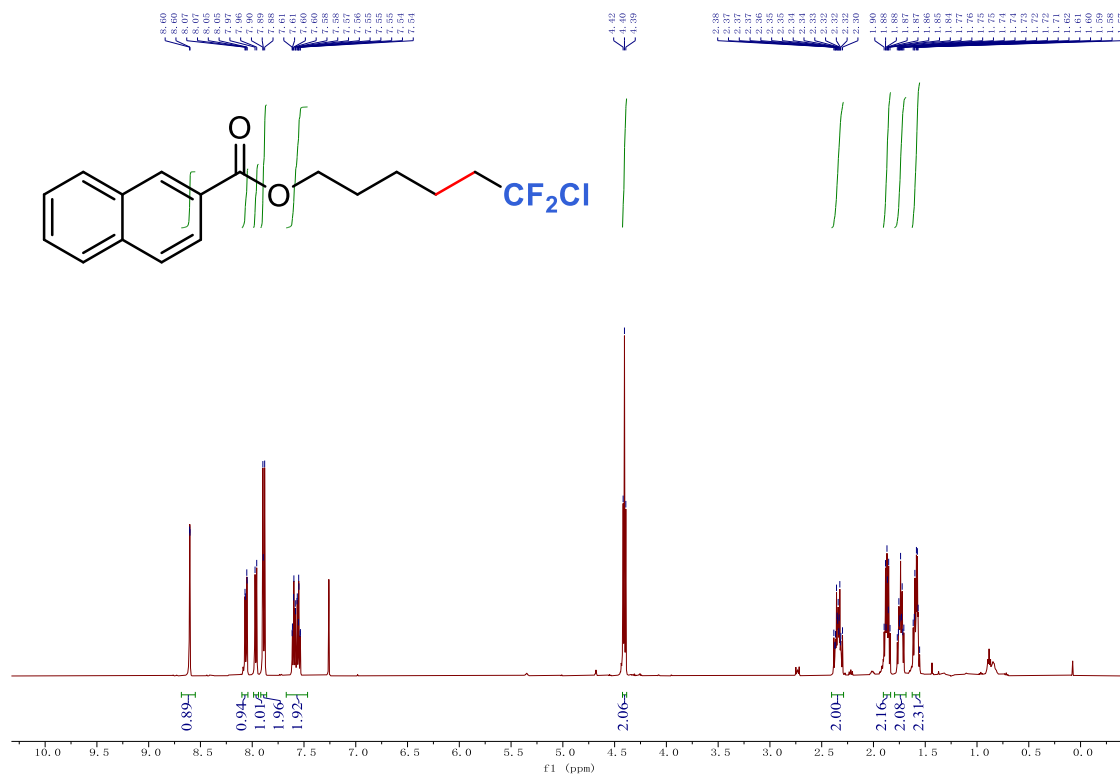


[illegible]

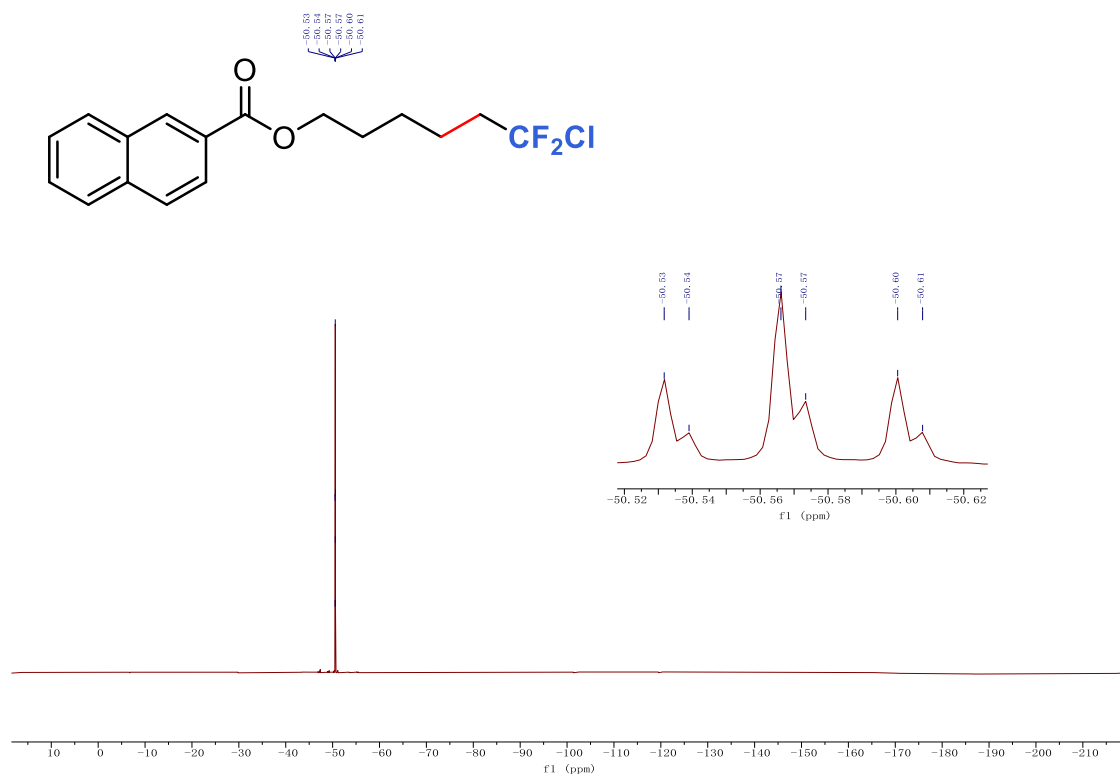
Chemical structure of 4-(2-(2-(2-(2-chloroethyl)ethyl)ethyl)oxy)but-3-en-2-yl)furan-2-carboxylate (1) is shown above its ¹³C NMR spectrum (200 MHz, CDCl₃). The spectrum displays peaks corresponding to the structure, with chemical shifts (ppm) labeled above the peaks:

Chemical Shift (ppm)
158.89
146.43
132.30
131.66
127.66
118.01
111.97
64.66
42.09
41.81
41.62
28.51
28.20
27.13
23.11
23.08

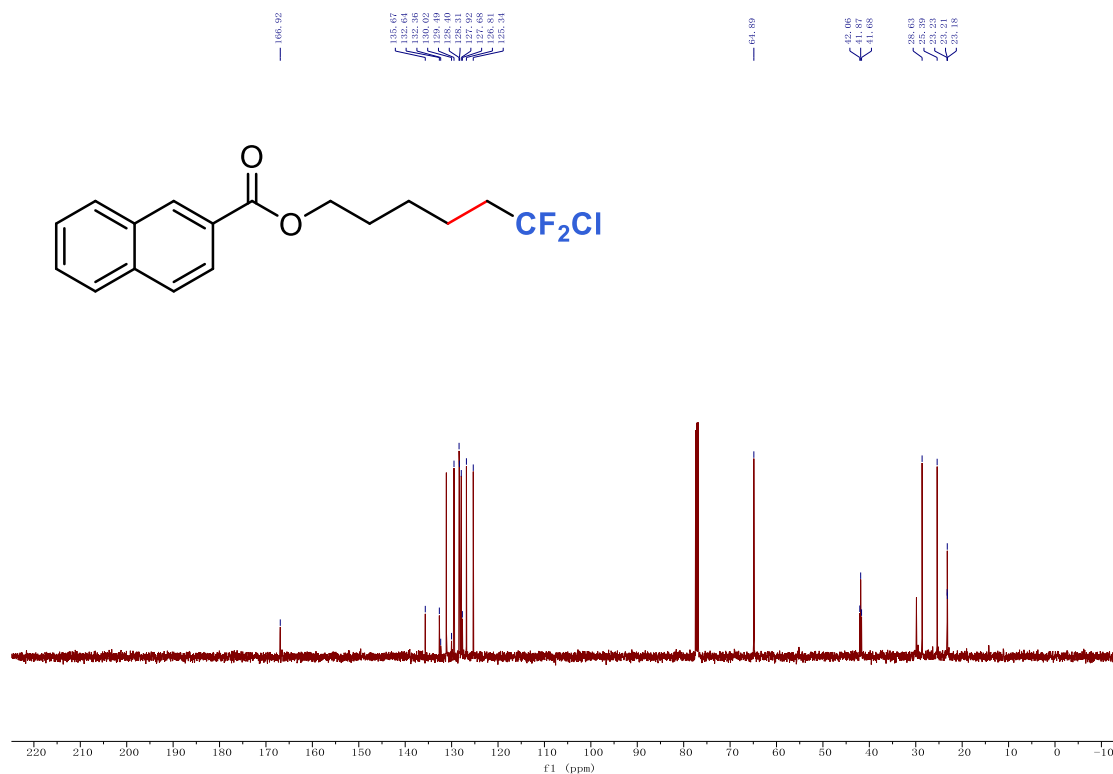
^1H NMR (400 MHz, CDCl_3) spectra for compound **1an**



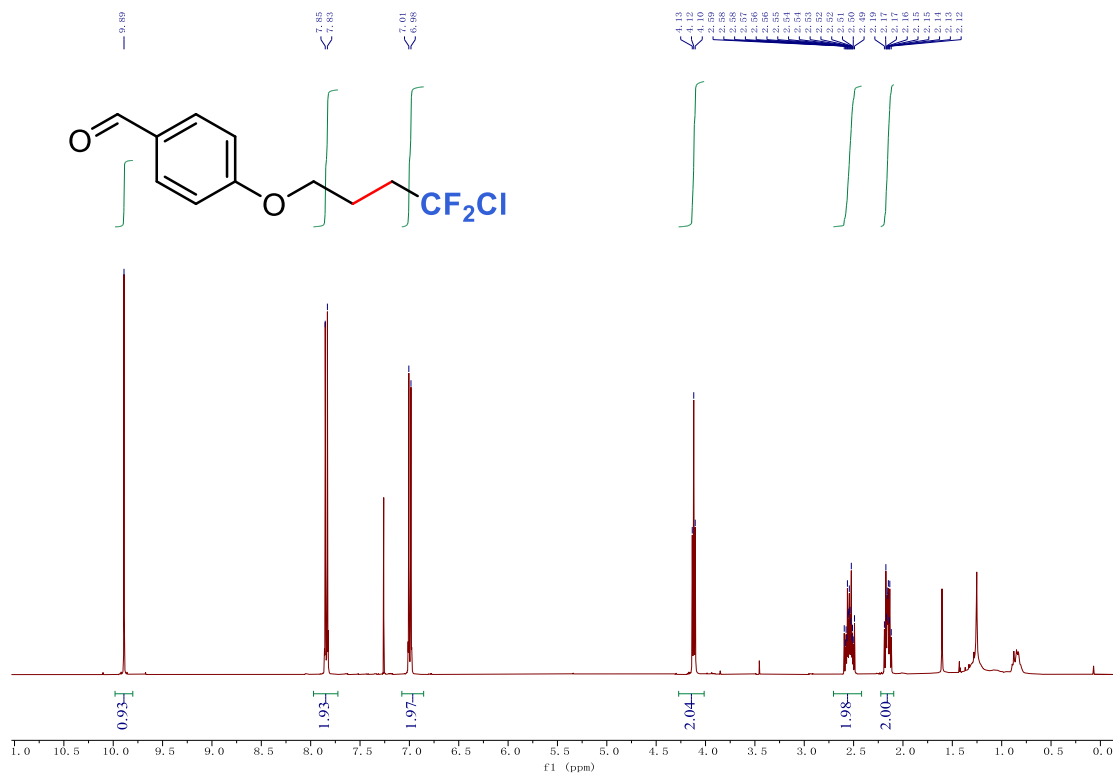
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1an**



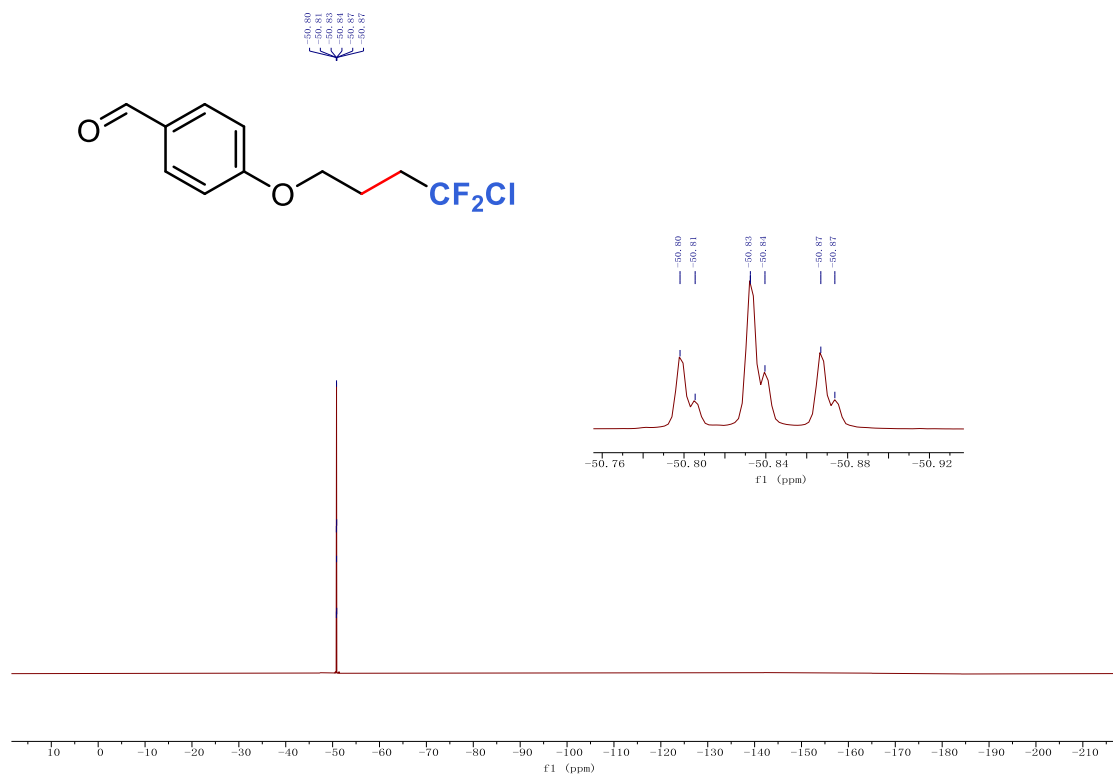
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1an**



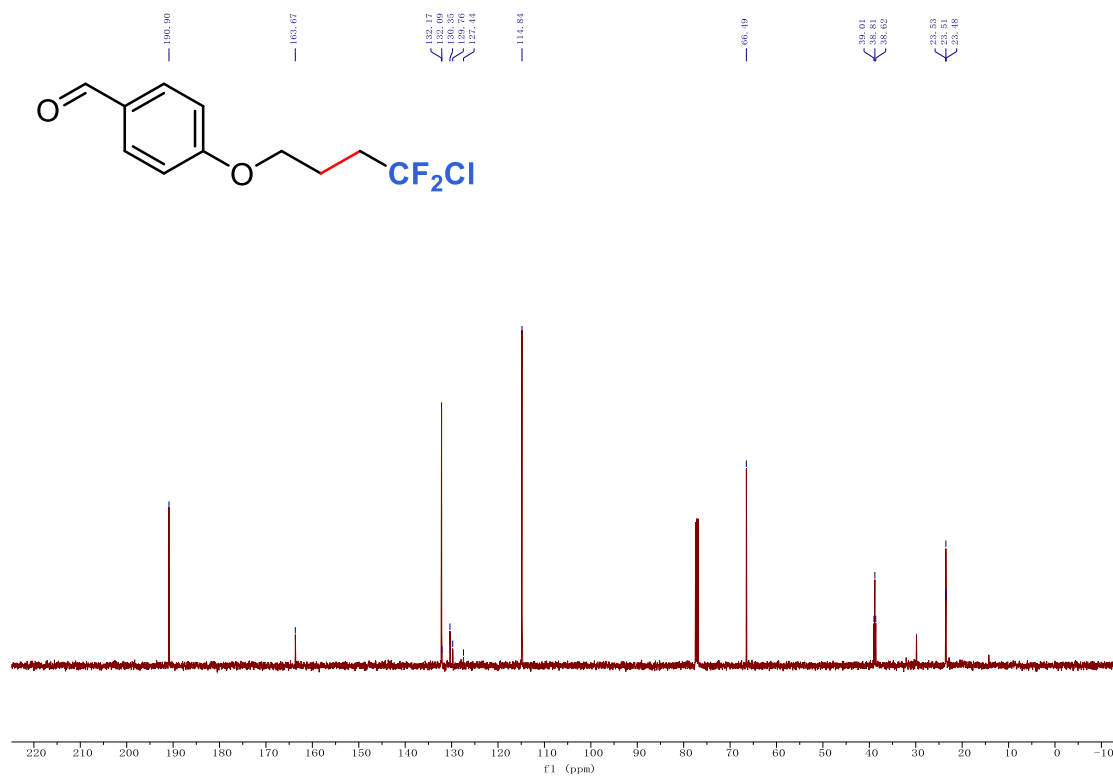
¹H NMR (400 MHz, CDCl₃) spectra for compound **1i**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1i**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1i**



Chemical structure: ClCCc1ccccc1

¹H NMR spectrum (CDCl₃) showing peaks for 1-chloro-4-phenylbutane. The x-axis is labeled f1 (ppm) and ranges from 10.0 to -0.5. The spectrum displays several peaks corresponding to the structure, with integration values indicated below the peaks.

Integration values (from left to right): 1.96, 2.83, 1.98, 2.00, 4.09.

Chemical structure: c1ccccc1CC[C@@H](C(F)(F)Cl)C(F)(F)Cl

¹⁹F NMR spectrum (ppm):

- Peak 1: -50.46
- Peak 2: -50.47
- Peak 3: -50.50
- Peak 4: -50.51
- Peak 5: -50.53
- Peak 6: -50.54

Integration: 1.00, 1.00, 1.00, 1.00, 1.00, 1.00

Chemical structure: c1ccccc1CCCF(=O)Cl

¹³C NMR spectrum (ppm):

- 141.84
- 132.41
- 130.66
- 128.96
- 128.49
- 127.72
- 126.09
- 42.02
- 41.83
- 41.64
- 35.66
- 30.50
- 25.86
- 23.04
- 23.02

13C NMR spectrum (ppm):

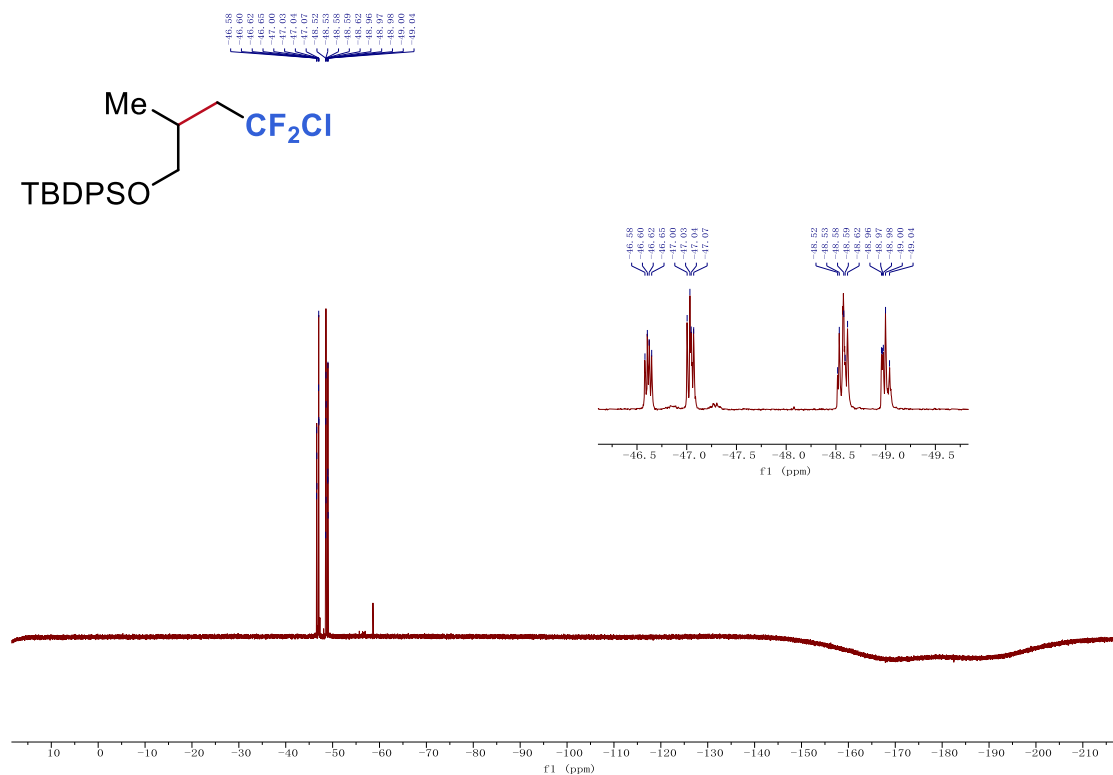
- 141.84
- 132.41
- 130.66
- 128.96
- 128.49
- 127.72
- 126.09
- 42.02
- 41.83
- 41.64
- 35.66
- 30.50
- 25.86
- 23.04
- 23.02

Chemical structure: CC(C)(C)Si(C1=CC=CC=C1)(C2=CC=CC=C2)OCC(Cl)C

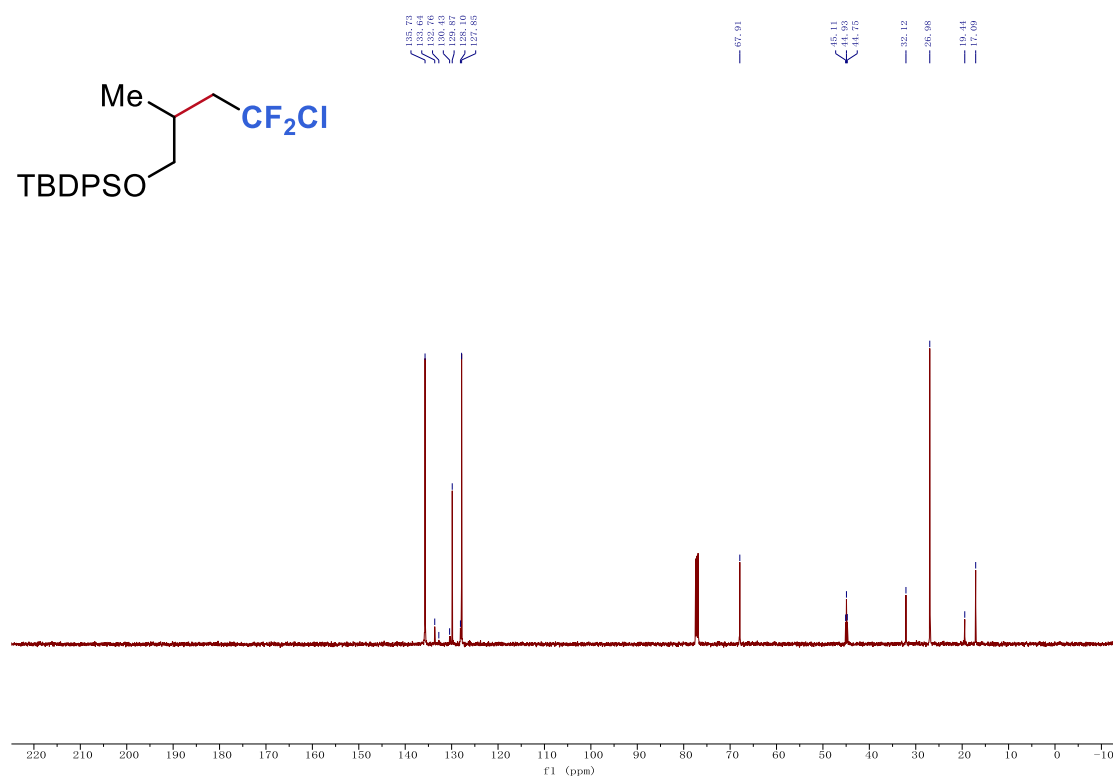
¹H NMR spectrum (ppm):

- 9.59, 9.58, 9.57, 9.56, 9.55, 9.54, 9.53, 9.52, 9.51, 9.50, 9.49, 9.48, 9.47, 9.46, 9.45, 9.44, 9.43, 9.42, 9.41, 9.40, 9.39, 9.38, 9.37, 9.36, 9.35, 9.34, 9.33, 9.32, 9.31, 9.30, 9.29, 9.28, 9.27, 9.26, 9.25, 9.24, 9.23, 9.22, 9.21, 9.20, 9.19, 9.18, 9.17, 9.16, 9.15, 9.14, 9.13, 9.12, 9.11, 9.10, 9.09, 9.08, 9.07, 9.06, 9.05, 9.04, 9.03, 9.02, 9.01, 9.00, 8.99, 8.98, 8.97, 8.96, 8.95, 8.94, 8.93, 8.92, 8.91, 8.90, 8.89, 8.88, 8.87, 8.86, 8.85, 8.84, 8.83, 8.82, 8.81, 8.80, 8.79, 8.78, 8.77, 8.76, 8.75, 8.74, 8.73, 8.72, 8.71, 8.70, 8.69, 8.68, 8.67, 8.66, 8.65, 8.64, 8.63, 8.62, 8.61, 8.60, 8.59, 8.58, 8.57, 8.56, 8.55, 8.54, 8.53, 8.52, 8.51, 8.50, 8.49, 8.48, 8.47, 8.46, 8.45, 8.44, 8.43, 8.42, 8.41, 8.40, 8.39, 8.38, 8.37, 8.36, 8.35, 8.34, 8.33, 8.32, 8.31, 8.30, 8.29, 8.28, 8.27, 8.26, 8.25, 8.24, 8.23, 8.22, 8.21, 8.20, 8.19, 8.18, 8.17, 8.16, 8.15, 8.14, 8.13, 8.12, 8.11, 8.10, 8.09, 8.08, 8.07, 8.06, 8.05, 8.04, 8.03, 8.02, 8.01, 8.00, 7.99, 7.98, 7.97, 7.96, 7.95, 7.94, 7.93, 7.92, 7.91, 7.90, 7.89, 7.88, 7.87, 7.86, 7.85, 7.84, 7.83, 7.82, 7.81, 7.80, 7.79, 7.78, 7.77, 7.76, 7.75, 7.74, 7.73, 7.72, 7.71, 7.70, 7.69, 7.68, 7.67, 7.66, 7.65, 7.64, 7.63, 7.62, 7.61, 7.60, 7.59, 7.58, 7.57, 7.56, 7.55, 7.54, 7.53, 7.52, 7.51, 7.50, 7.49, 7.48, 7.47, 7.46, 7.45, 7.44, 7.43, 7.42, 7.41, 7.40, 7.39, 7.38, 7.37, 7.36, 7.35, 7.34, 7.33, 7.32, 7.31, 7.30, 7.29, 7.28, 7.27, 7.26, 7.25, 7.24, 7.23, 7.22, 7.21, 7.20, 7.19, 7.18, 7.17, 7.16, 7.15, 7.14, 7.13, 7.12, 7.11, 7.10, 7.09, 7.08, 7.07, 7.06, 7.05, 7.04, 7.03, 7.02, 7.01, 7.00, 6.99, 6.98, 6.97, 6.96, 6.95, 6.94, 6.93, 6.92, 6.91, 6.90, 6.89, 6.88, 6.87, 6.86, 6.85, 6.84, 6.83, 6.82, 6.81, 6.80, 6.79, 6.78, 6.77, 6.76, 6.75, 6.74, 6.73, 6.72, 6.71, 6.70, 6.69, 6.68, 6.67, 6.66, 6.65, 6.64, 6.63, 6.62, 6.61, 6.60, 6.59, 6.58, 6.57, 6.56, 6.55, 6.54, 6.53, 6.52, 6.51, 6.50, 6.49, 6.48, 6.47, 6.46, 6.45, 6.44, 6.43, 6.42, 6.41, 6.40, 6.39, 6.38, 6.37, 6.36, 6.35, 6.34, 6.33, 6.32, 6.31, 6.30, 6.29, 6.28, 6.27, 6.26, 6.25, 6.24, 6.23, 6.22, 6.21, 6.20, 6.19, 6.18, 6.17, 6.16, 6.15, 6.14, 6.13, 6.12, 6.11, 6.10, 6.09, 6.08, 6.07, 6.06, 6.05, 6.04, 6.03, 6.02, 6.01, 6.00, 5.99, 5.98, 5.97, 5.96, 5.95, 5.94, 5.93, 5.92, 5.91, 5.90, 5.89, 5.88, 5.87, 5.86, 5.85, 5.84, 5.83, 5.82, 5.81, 5.80, 5.79, 5.78, 5.77, 5.76, 5.75, 5.74, 5.73, 5.72, 5.71, 5.70, 5.69, 5.68, 5.67, 5.66, 5.65, 5.64, 5.63, 5.62, 5.61, 5.60, 5.59, 5.58, 5.57, 5.56, 5.55, 5.54, 5.53, 5.52, 5.51, 5.50, 5.49, 5.48, 5.47, 5.46, 5.45, 5.44, 5.43, 5.42, 5.41, 5.40, 5.39, 5.38, 5.37, 5.36, 5.35, 5.34, 5.33, 5.32, 5.31, 5.30, 5.29, 5.28, 5.27, 5.26, 5.25, 5.24, 5.23, 5.22, 5.21, 5.20, 5.19, 5.18, 5.17, 5.16, 5.15, 5.14, 5.13, 5.12, 5.11, 5.10, 5.09, 5.08, 5.07, 5.06, 5.05, 5.04, 5.03, 5.02, 5.01, 5.00, 4.99, 4.98, 4.97, 4.96, 4.95, 4.94, 4.93, 4.92, 4.91, 4.90, 4.89, 4.88, 4.87, 4.86, 4.85, 4.84, 4.83, 4.82, 4.81, 4.80, 4.79, 4.78, 4.77, 4.76, 4.75, 4.74, 4.73, 4.72, 4.71, 4.70, 4.69, 4.68, 4.67, 4.66, 4.65, 4.64, 4.63, 4.62, 4.61, 4.60, 4.59, 4.58, 4.57, 4.56, 4.55, 4.54, 4.53, 4.52, 4.51, 4.50, 4.49, 4.48, 4.47, 4.46, 4.45, 4.44, 4.43, 4.42, 4.41, 4.40, 4.39, 4.38, 4.37, 4.36, 4.35, 4.34, 4.33, 4.32, 4.31, 4.30, 4.29, 4.28, 4.27, 4.26, 4.25, 4.24, 4.23, 4.22, 4.21, 4.20, 4.19, 4.18, 4.17, 4.16, 4.15, 4.14, 4.13, 4.12, 4.11, 4.10, 4.09, 4.08, 4.07, 4.06, 4.05, 4.04, 4.03, 4.02, 4.01, 4.00, 3.99, 3.98, 3.97, 3.96, 3.95, 3.94, 3.93, 3.92, 3.91, 3.90, 3.89, 3.88, 3.87, 3.86, 3.85, 3.84, 3.83, 3.82, 3.81, 3.80, 3.79, 3.78, 3.77, 3.76, 3.75, 3.74, 3.73, 3.72, 3.71, 3.70, 3.69, 3.68, 3.67, 3.66, 3.65, 3.64, 3.63, 3.62, 3.61, 3.60, 3.59, 3.58, 3.57, 3.56, 3.55, 3.54, 3.53, 3.52, 3.51, 3.50, 3.49, 3.48, 3.47, 3.46, 3.45, 3.44, 3.43, 3.42, 3.41, 3.40, 3.39, 3.38, 3.37, 3.36, 3.35, 3.34, 3.33, 3.32, 3.31, 3.30, 3.29, 3.28, 3.27, 3.26, 3.25, 3.24, 3.23, 3.22, 3.21, 3.20, 3.19, 3.18, 3.17, 3.16, 3.15, 3.14, 3.13

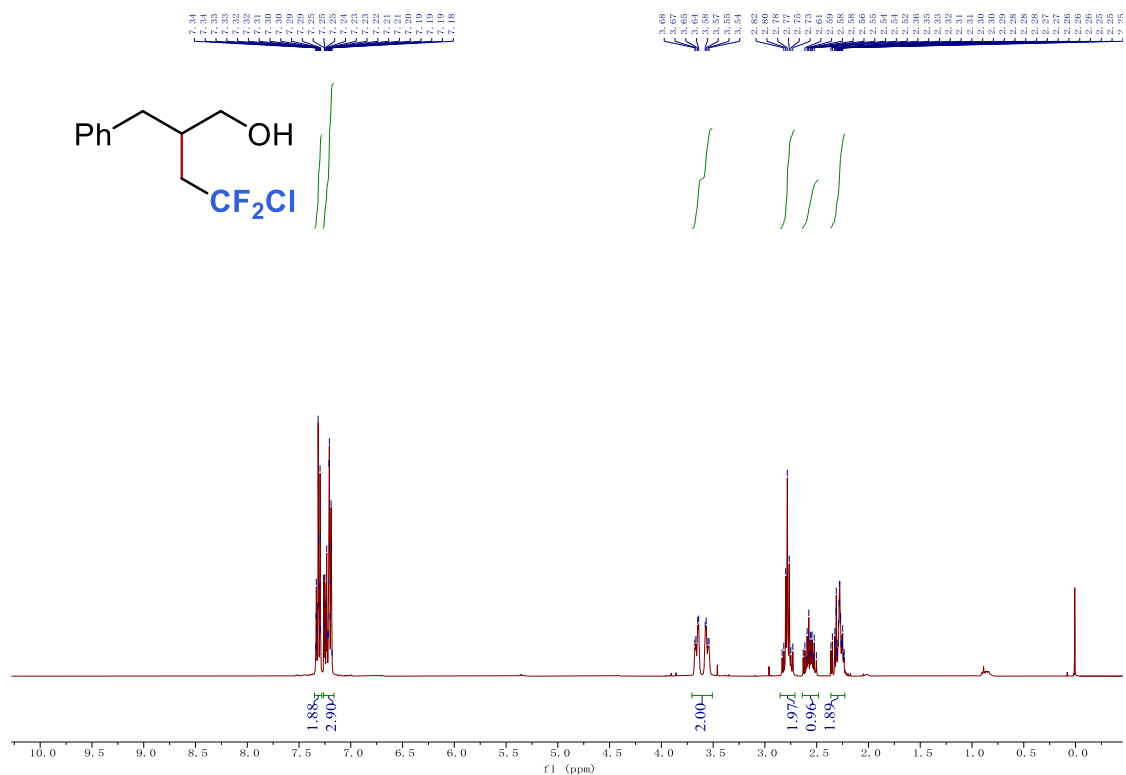
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1k**



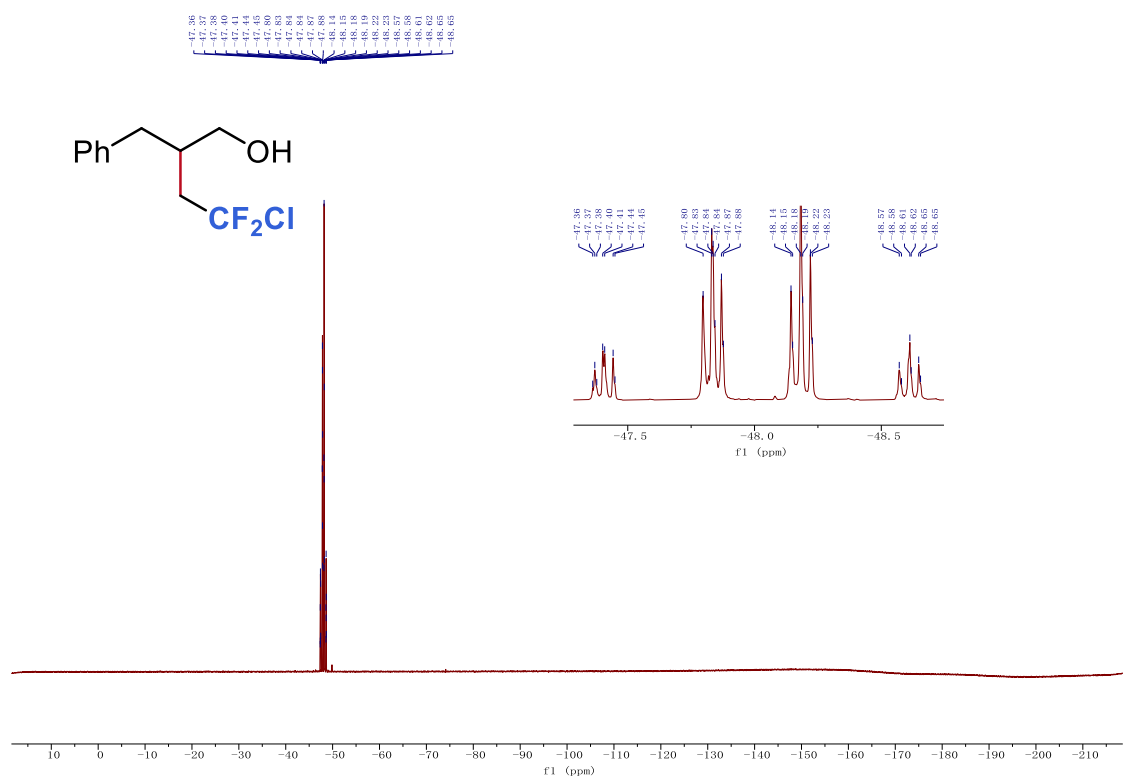
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1k**



^1H NMR (400 MHz, CDCl_3) spectra for compound **11**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **11**



Chemical structure of 1-(2-chloro-2-(chloromethyl)ethyl)benzene (1,1-dichloro-2-phenylethane) is shown above the ^{13}C NMR spectrum.

The spectrum displays peaks corresponding to the following chemical shifts (ppm):

- 139.19
- 132.55
- 129.71
- 129.53
- 128.71
- 128.60
- 126.90
- 65.28
- 42.55
- 42.37
- 38.36
- 37.45

The spectrum shows a complex set of peaks in the aromatic region (126-139 ppm), a peak at 65.28 ppm, and a cluster of peaks in the aliphatic region (37-43 ppm).

Chemical structure: ClC(F)(F)COCc1ccccc1

¹H NMR spectrum (ppm):

- 7.2-7.3 (m, 1.87H)
- 3.6-3.8 (m, 2.01H)
- 2.5-2.7 (m, 1.95H)
- 2.0-2.1 (m, 1.00H)
- 1.0 (s, 9.02H)
- 0 (s, 5.84H)

Chemical structure: ClCC(OCC1=CC=CC=C1)OCC1=CC=CC=C1

¹H NMR spectrum (400 MHz, CDCl₃):

- ~4.5 ppm (broad, 1H, OH)
- ~3.5 ppm (multiplet, 2H, CH₂-OTBS)
- ~2.5 ppm (multiplet, 2H, CH₂-CH₂-OTBS)
- ~1.5 ppm (multiplet, 2H, CH₂-CH₂-OTBS)

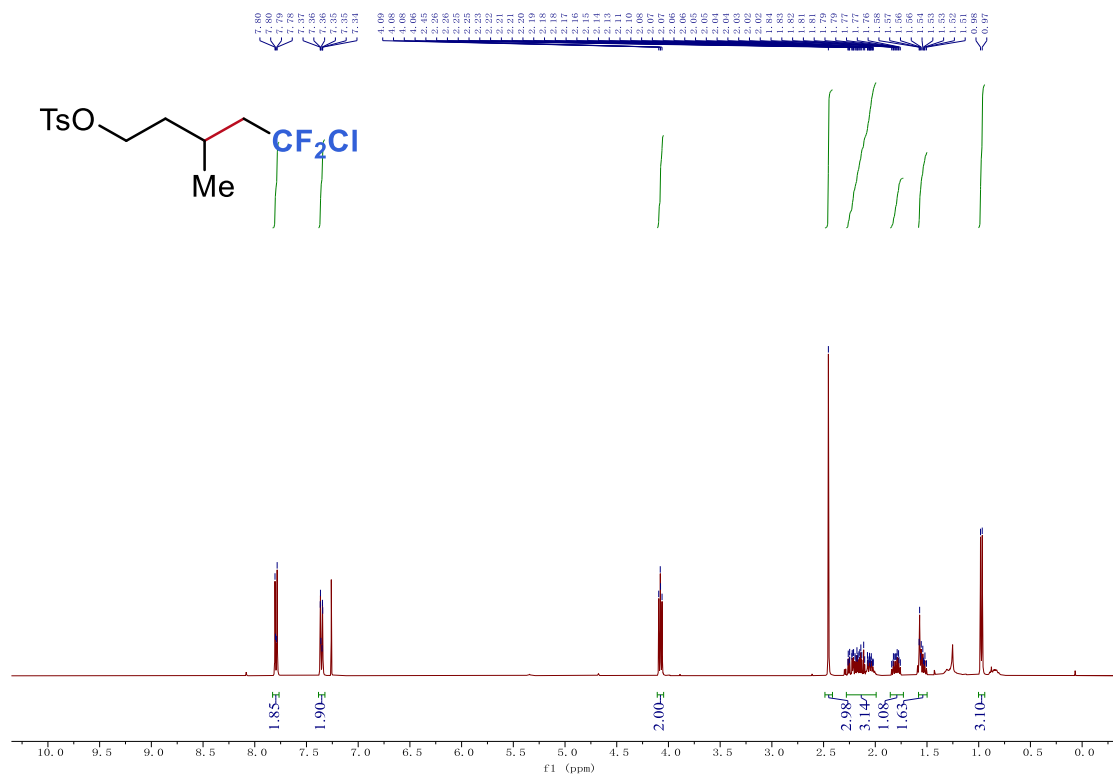
Chemical structure of the compound is shown above the spectrum:

CC(Cc1ccccc1)C(F)(F)Cl

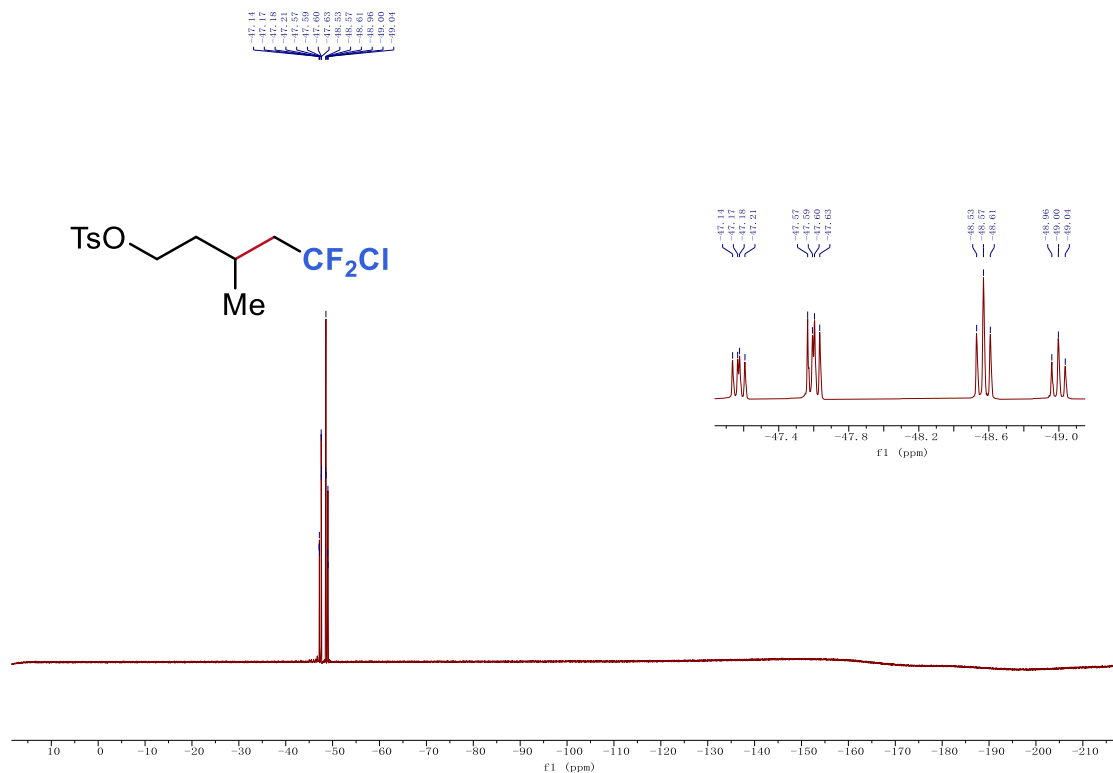
The spectrum displays the following peaks (ppm):

Peak (ppm)
138.62
132.75
129.63
129.43
128.54
128.00
126.41
63.01
42.71
42.52
42.34
38.60
37.42
26.01
18.39
-5.37
-5.15

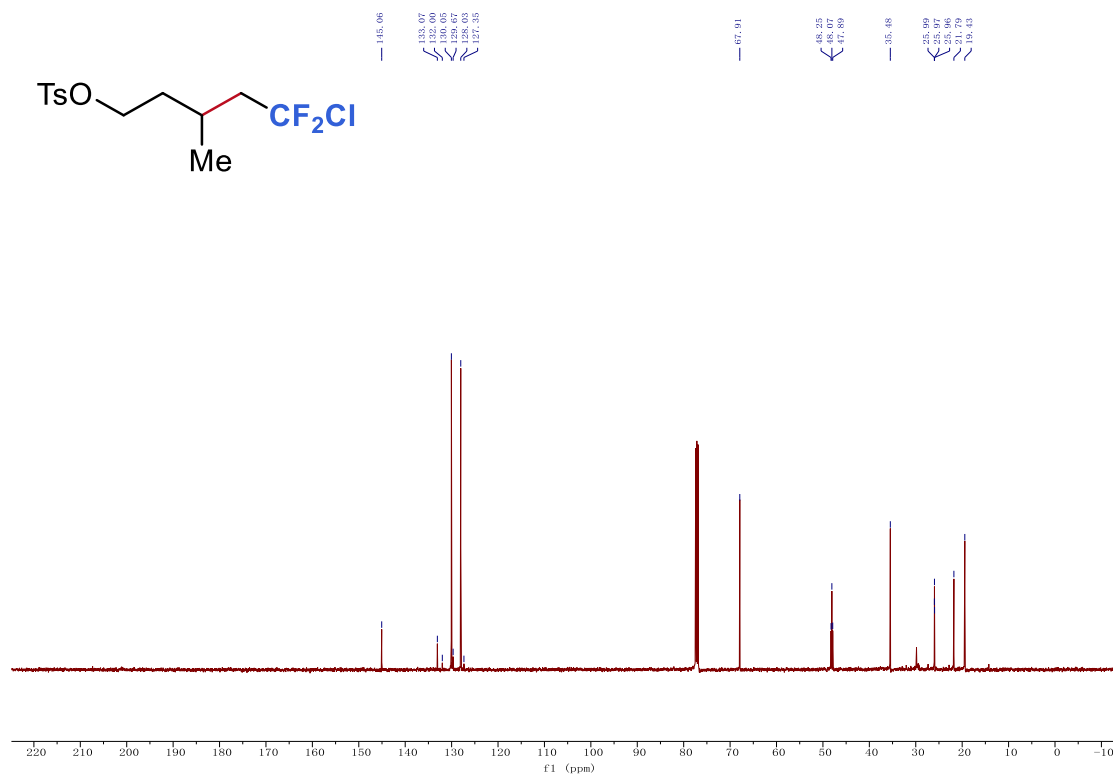
¹H NMR (400 MHz, CDCl₃) spectra for compound **1n**



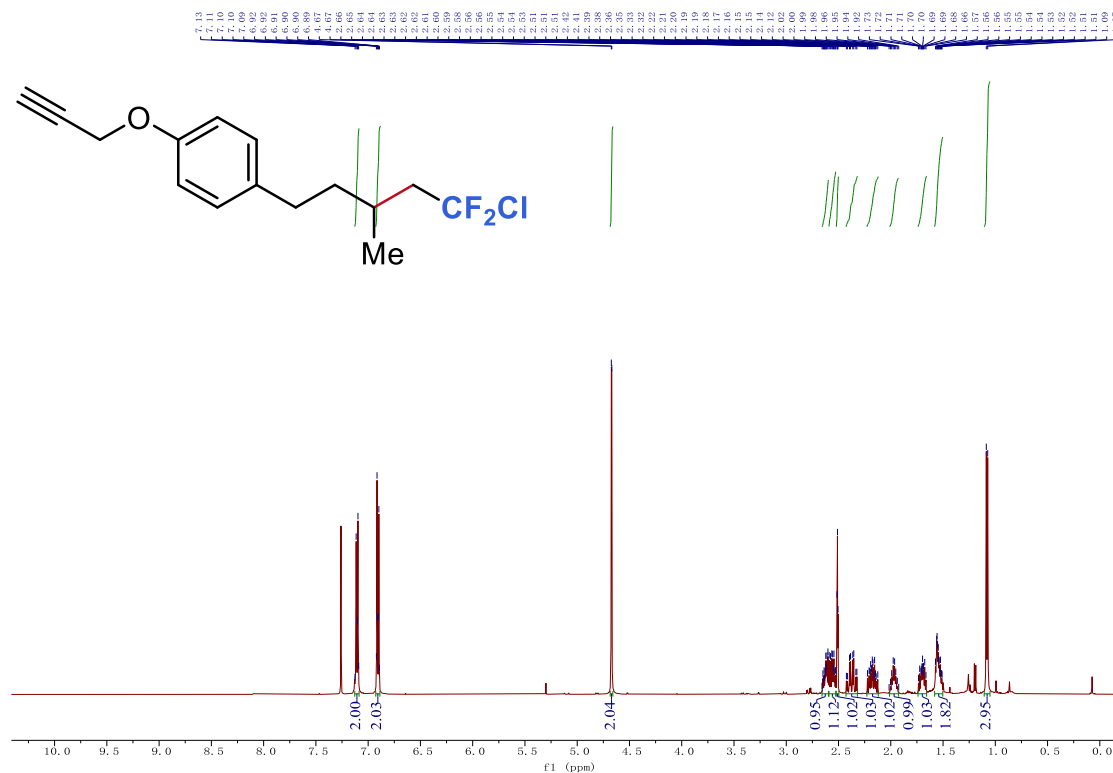
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1n**



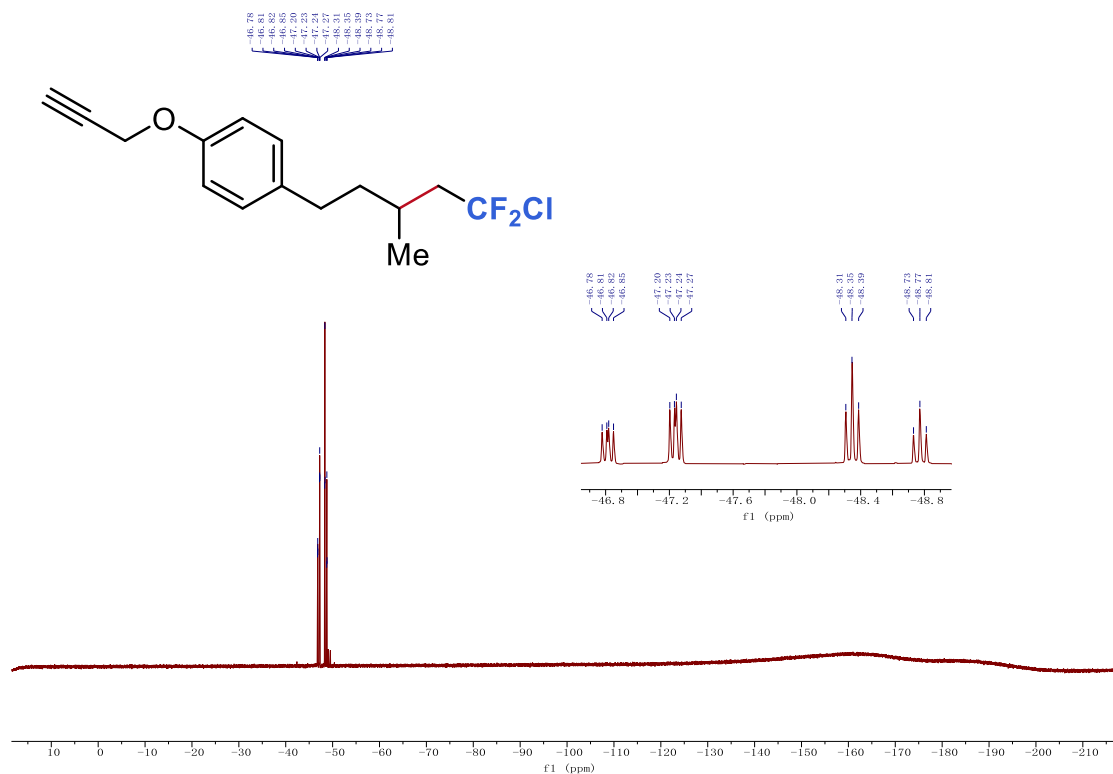
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1n**



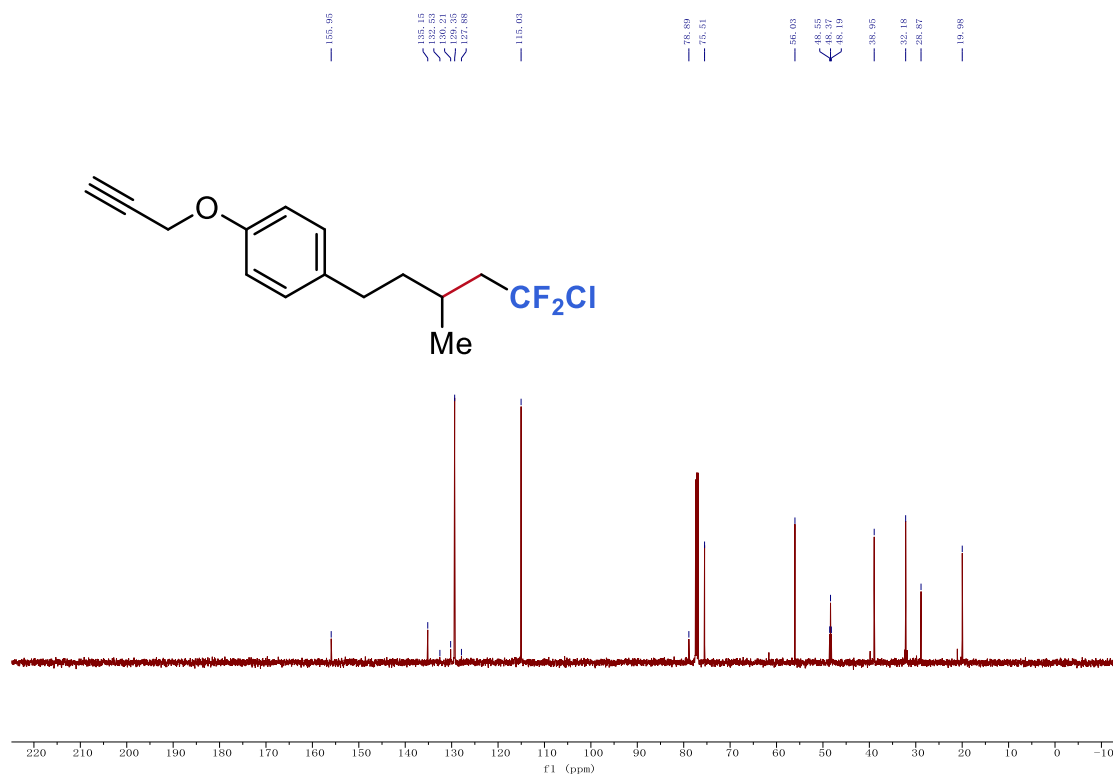
¹H NMR (400 MHz, CDCl₃) spectra for compound **1o**



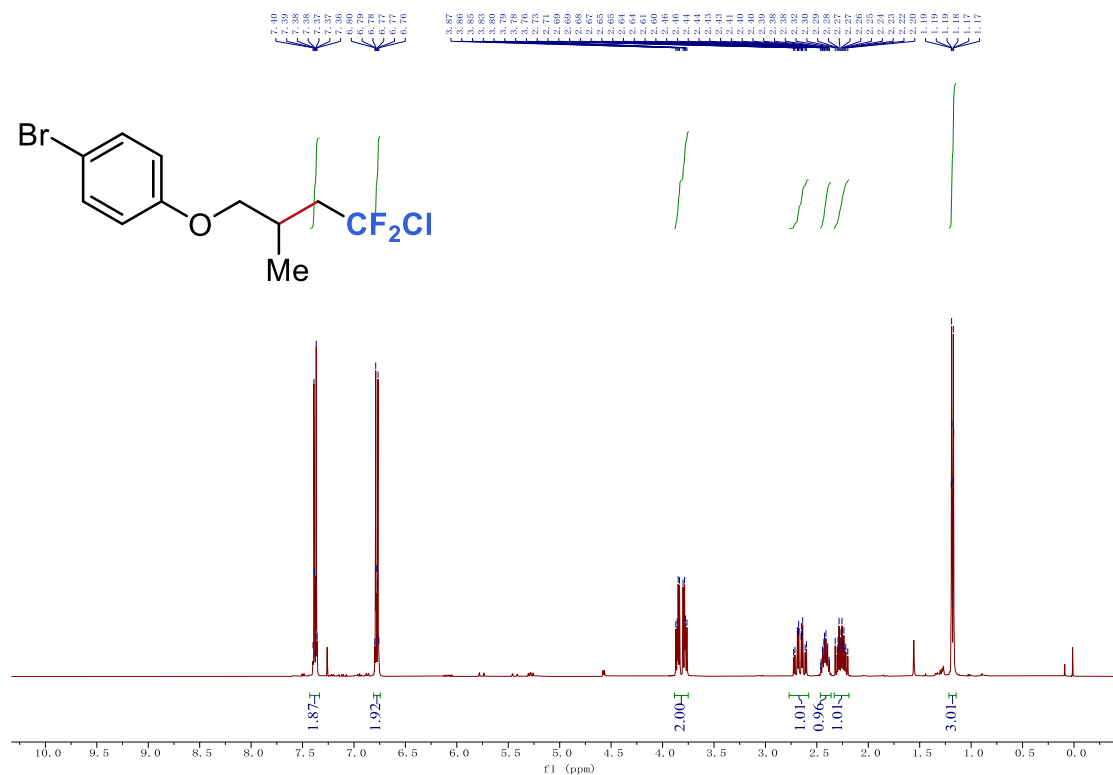
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1o**



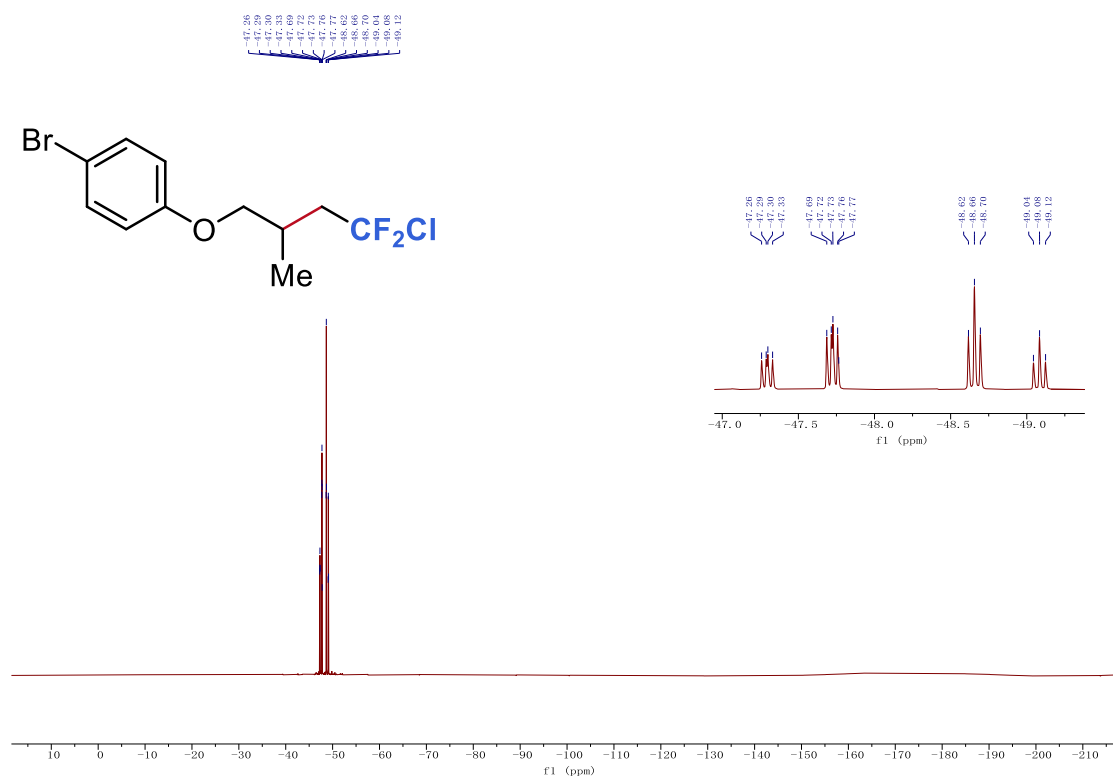
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1o**



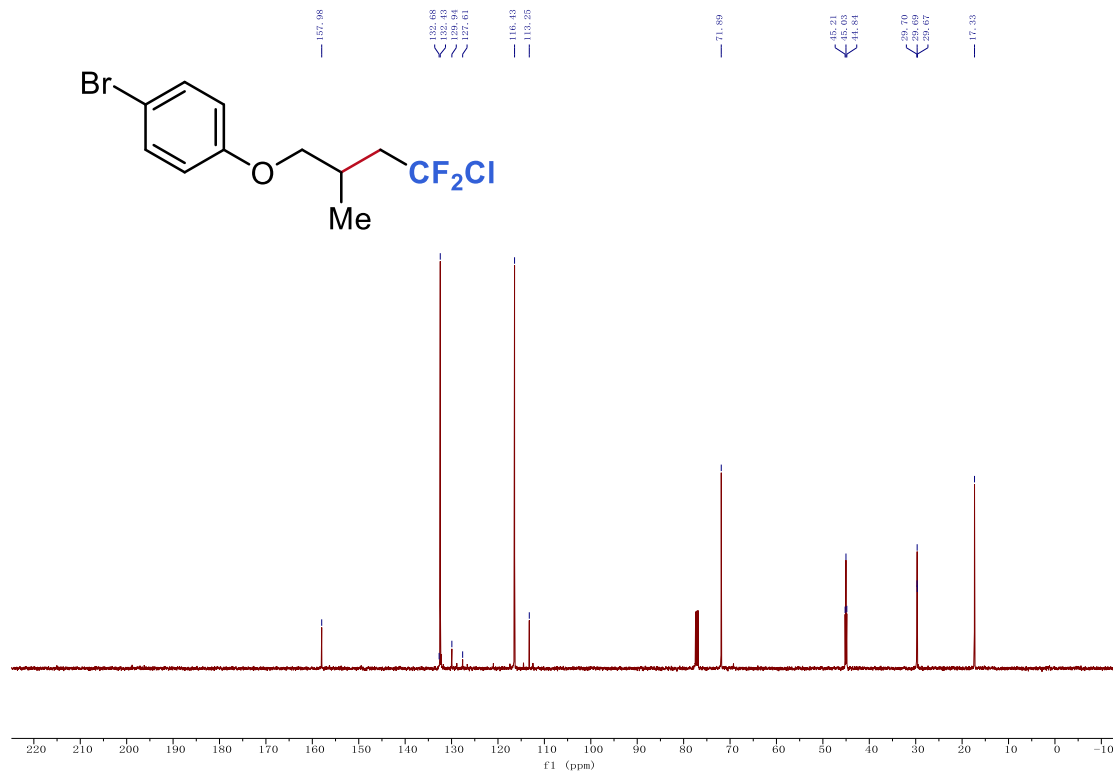
¹H NMR (400 MHz, CDCl₃) spectra for compound **1p**



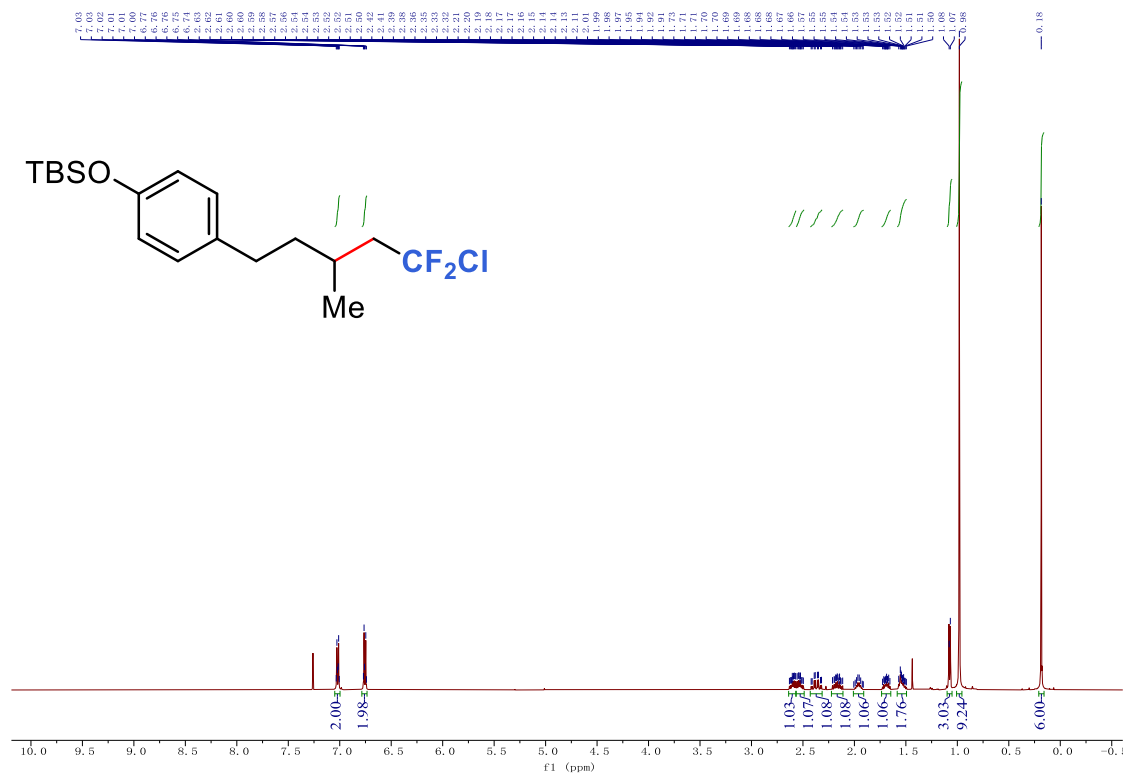
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1p**



¹³C NMR (126 MHz, CDCl₃) spectra for compound **1p**



¹H NMR (400 MHz, CDCl₃) spectra for compound **1q**



Chemical structure: CC(Cc1ccc(C(C)(C)C)cc1)CCl (Note: The structure in the image is (S)-1-(4-(tert-butyldimethylsilyl)phenyl)propan-1-yl dichloride, which is CC(Cc1ccc(C(C)(C)C)cc1)CCl with a TBSO group on the phenyl ring).

¹³C NMR spectrum (ppm):

Peak list (ppm): -46.72, -46.74, -46.76, -46.79, -47.14, -47.17, -47.18, -47.21, -48.22, -48.36, -48.40, -48.44, -48.48, -48.78, -48.82.

Inset peak list (ppm): -46.72, -46.74, -46.76, -46.79, -47.14, -47.17, -47.18, -47.21, -48.32, -48.36, -48.40, -48.74, -48.78, -48.82.

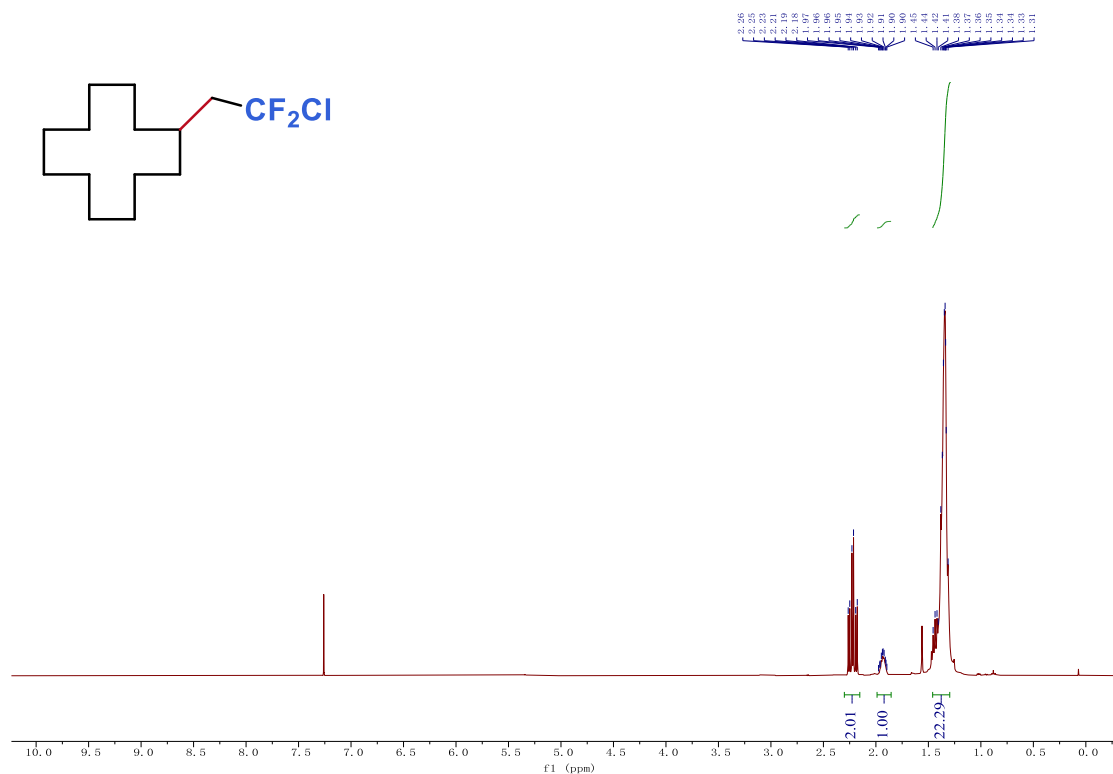
Chemical structure of the compound is shown above the spectrum:

CC(Cc1ccc(C(F)(F)F)cc1)C(F)(F)F

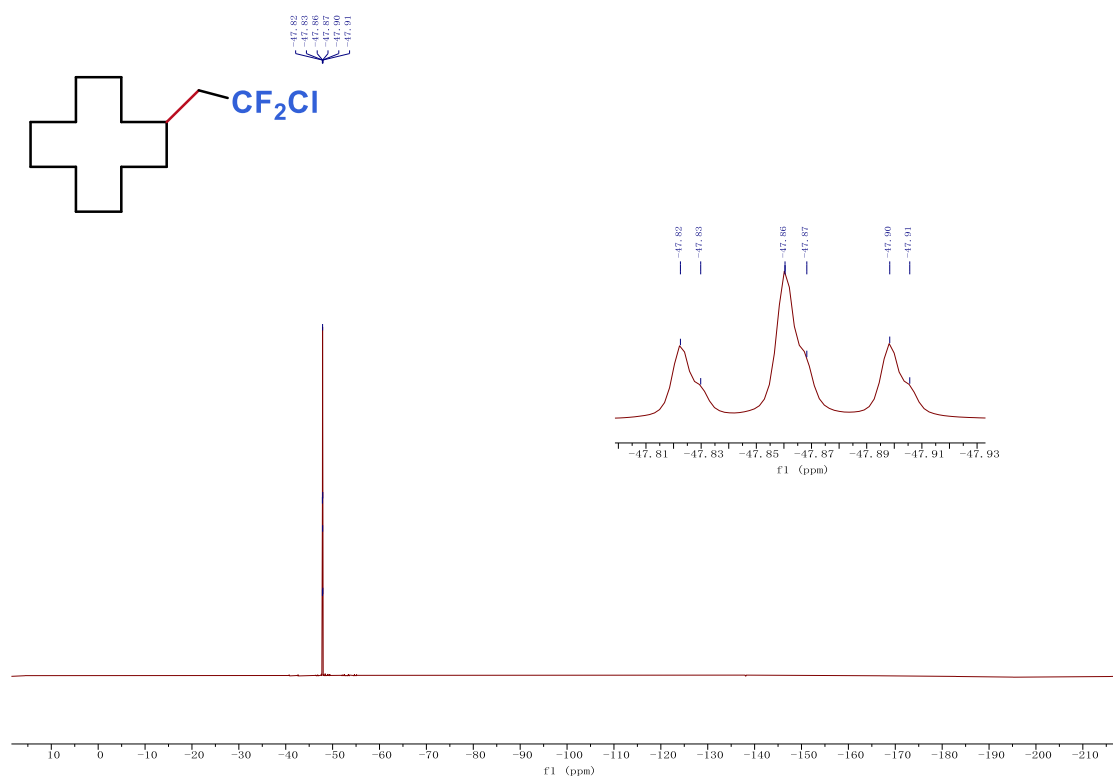
The spectrum displays several peaks corresponding to the chemical structure:

- Peak at 153.85 ppm: TBSO group.
- Peak at 134.70 ppm: Aromatic carbon.
- Peak at 126.09 ppm: Aromatic carbon.
- Peak at 77.00 ppm: Solvent (CDCl₃).
- Peak at 48.57 ppm: CH₂ group adjacent to the TBSO group.
- Peak at 25.85 ppm: Methyl group.
- Peak at 19.99 ppm: CH₂ group adjacent to the TBSO group.

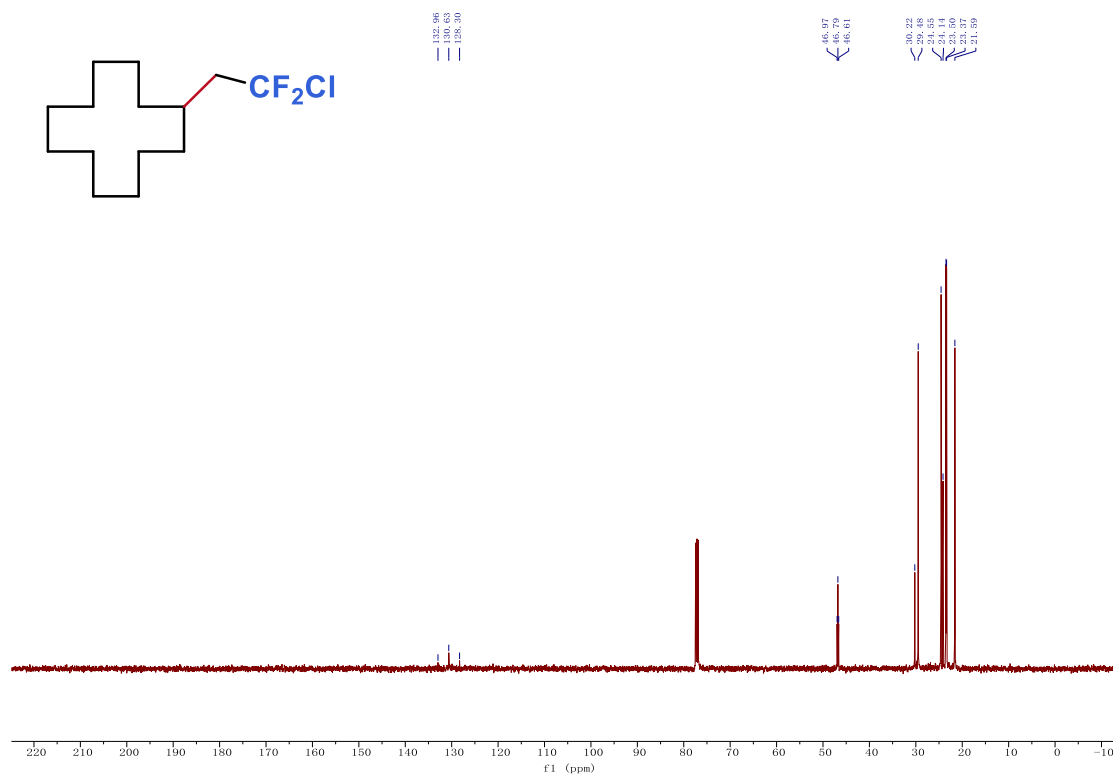
^1H NMR (400 MHz, CDCl_3) spectra for compound **1r**



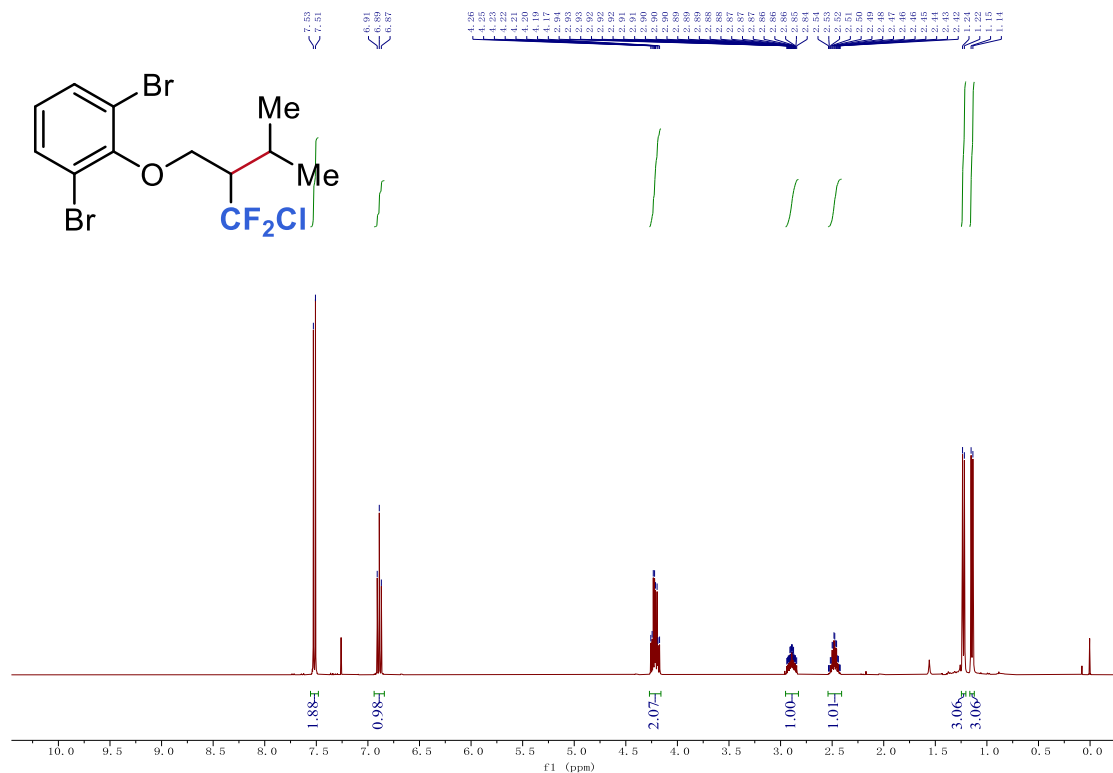
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1r**



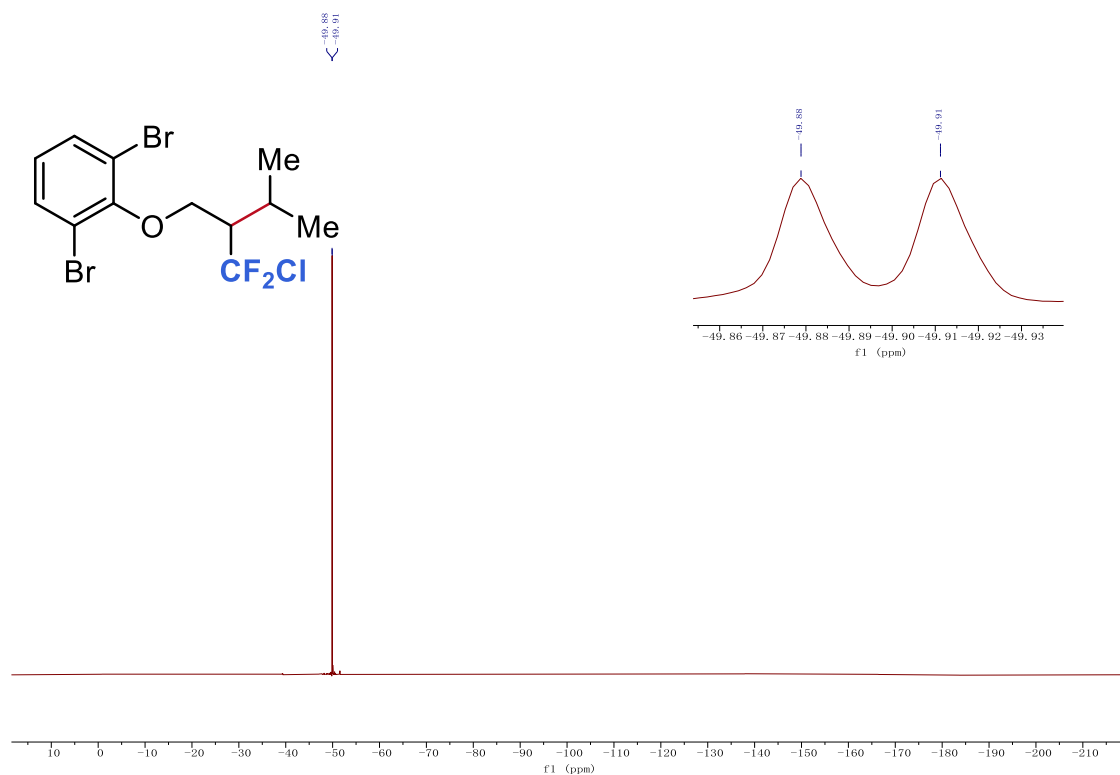
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1r**



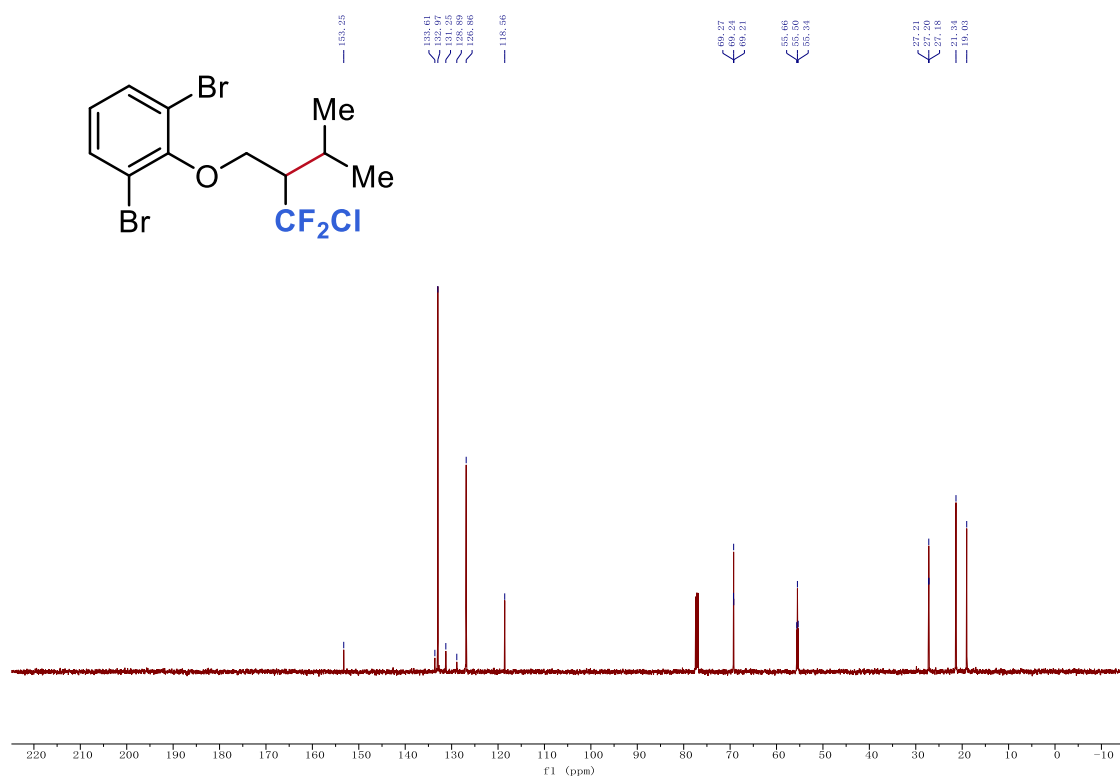
¹H NMR (400 MHz, CDCl₃) spectra for compound **1s**



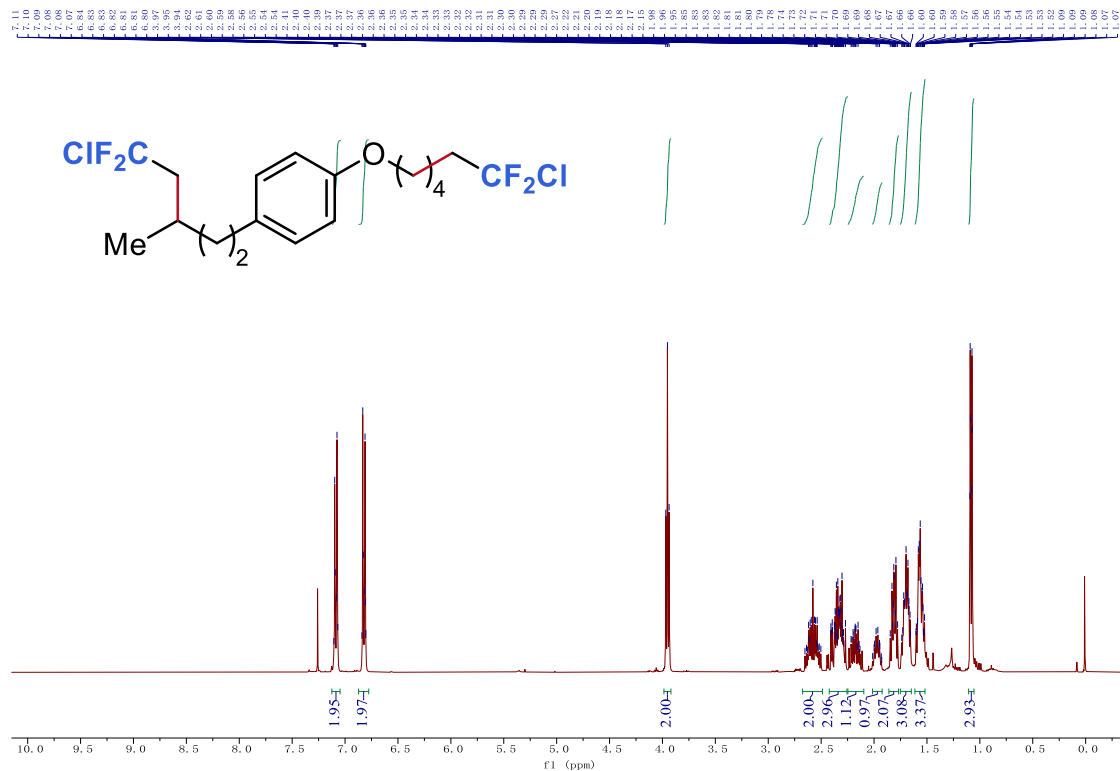
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1s**



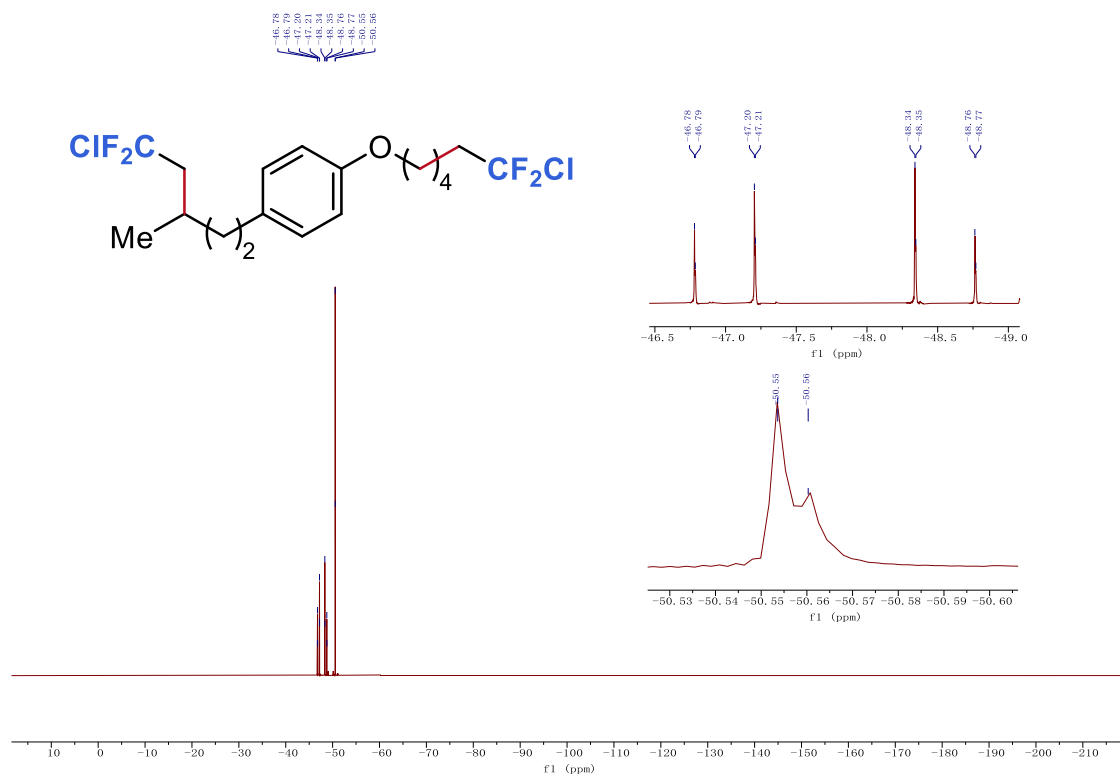
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1s**



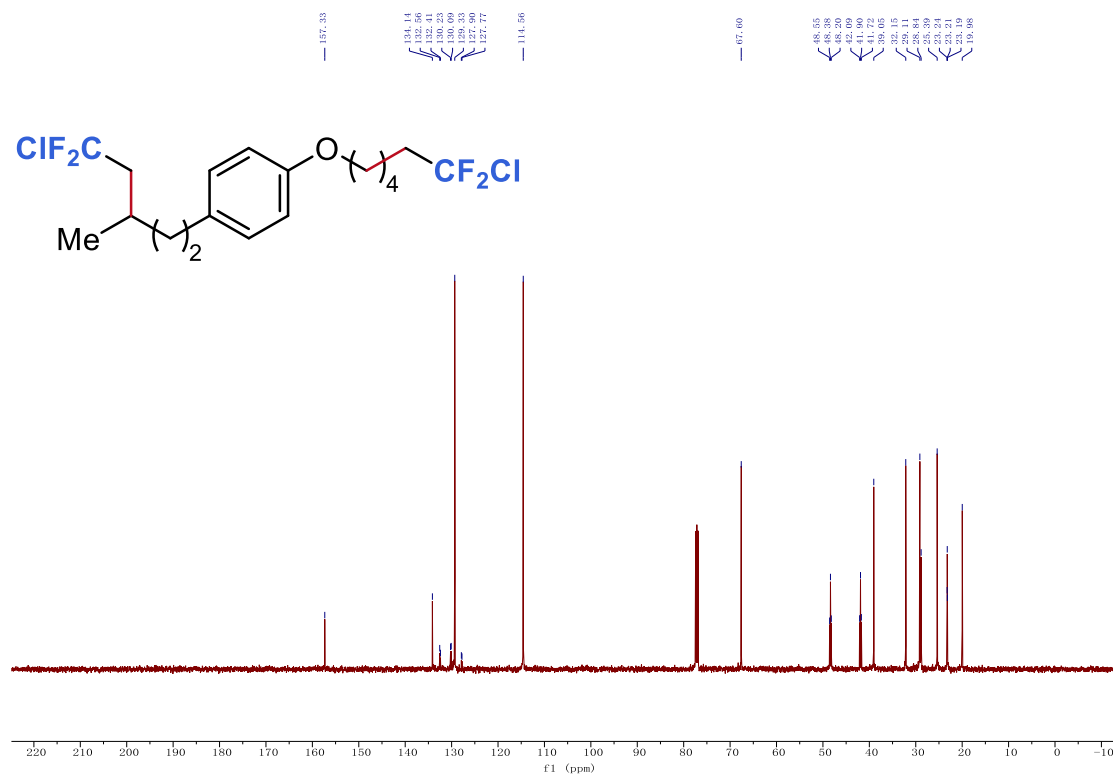
¹H NMR (400 MHz, CDCl₃) spectra for compound 1t



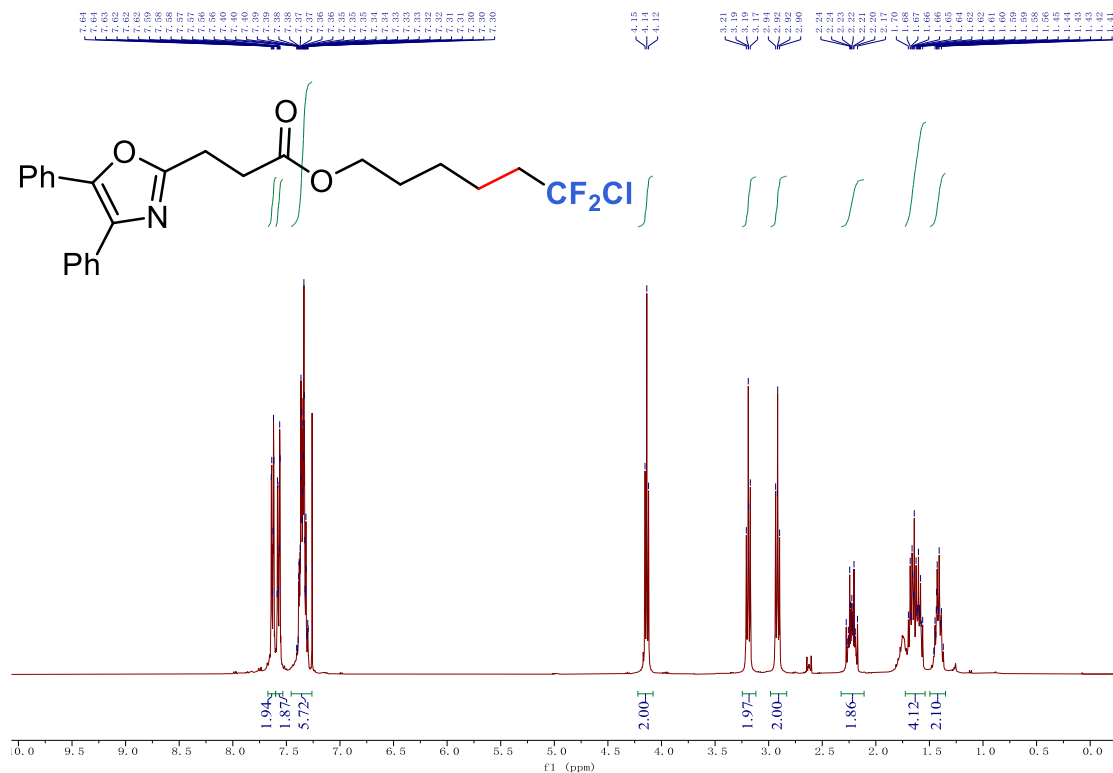
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound 1t



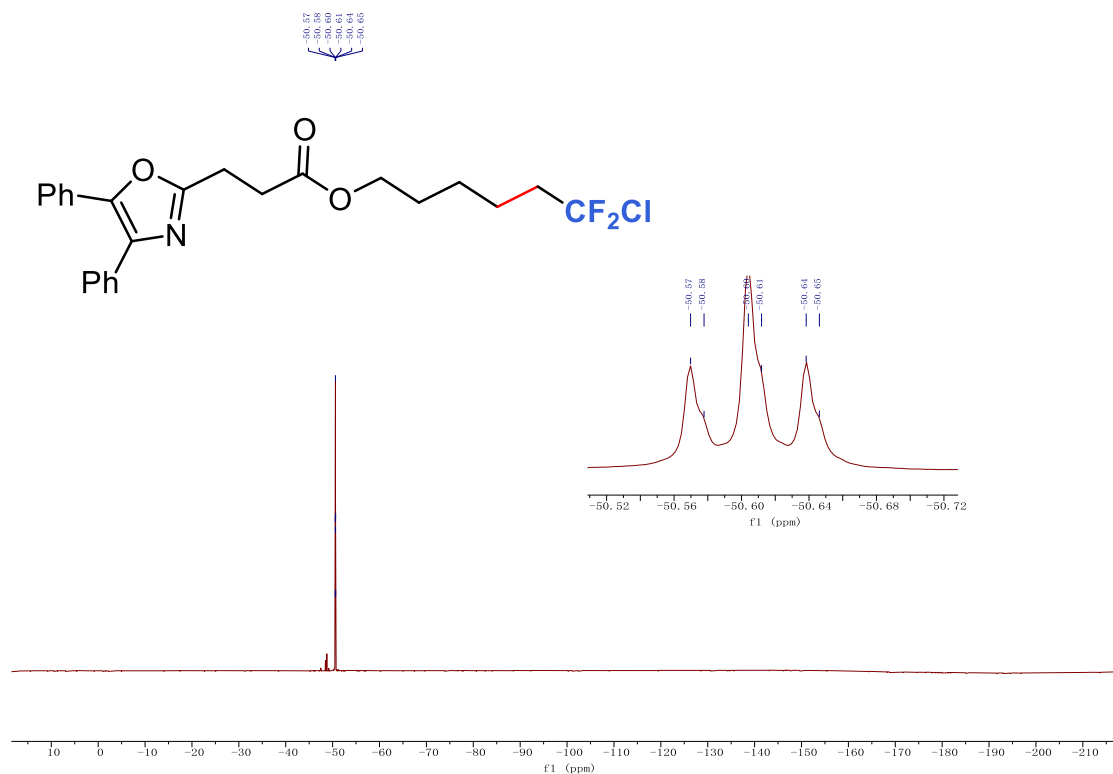
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1t**



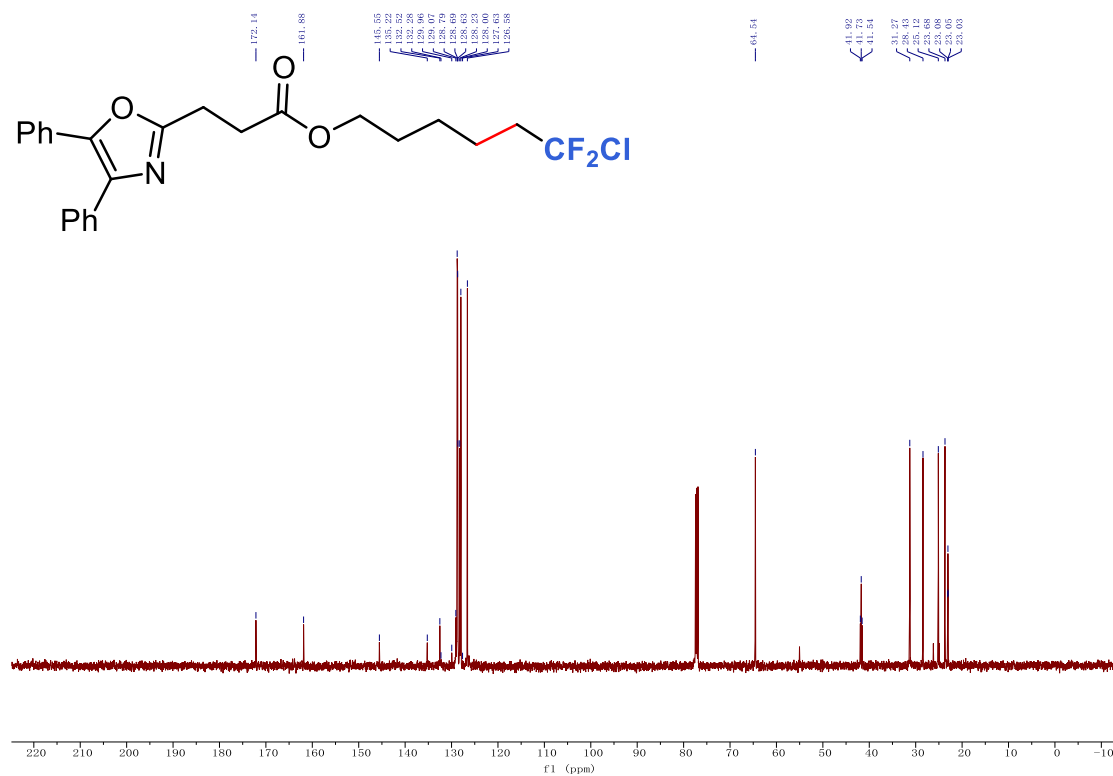
¹H NMR (400 MHz, CDCl₃) spectra for compound **1u**



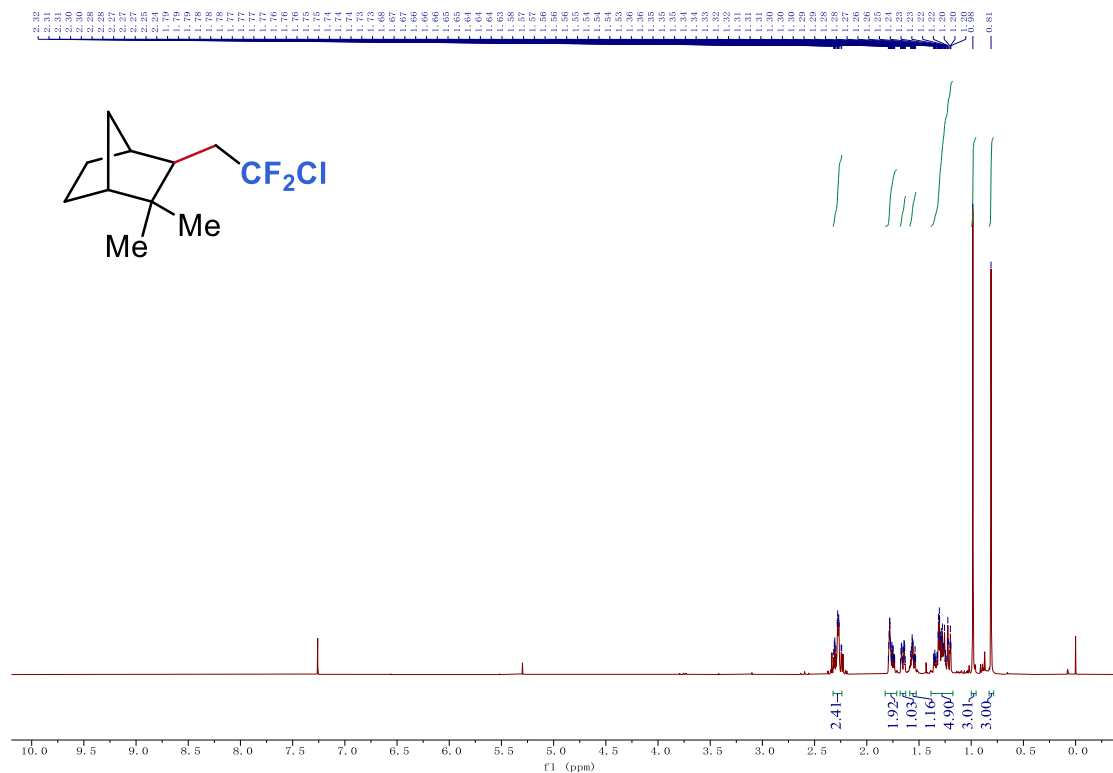
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1u**



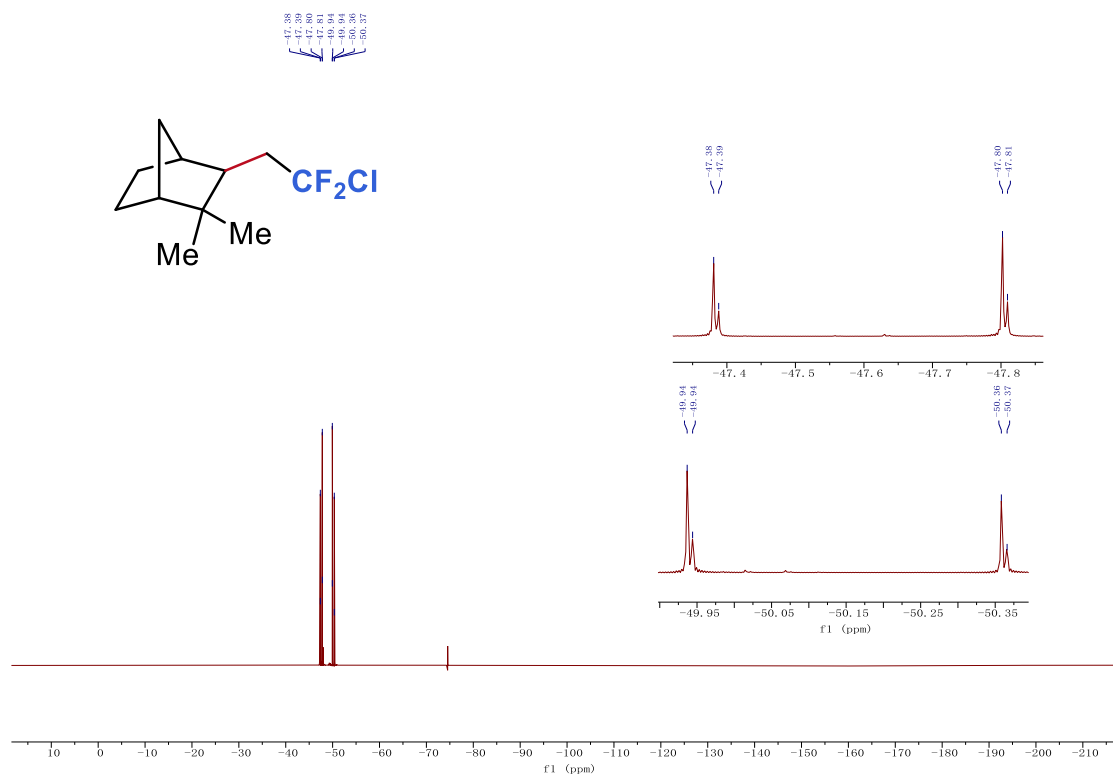
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1u**



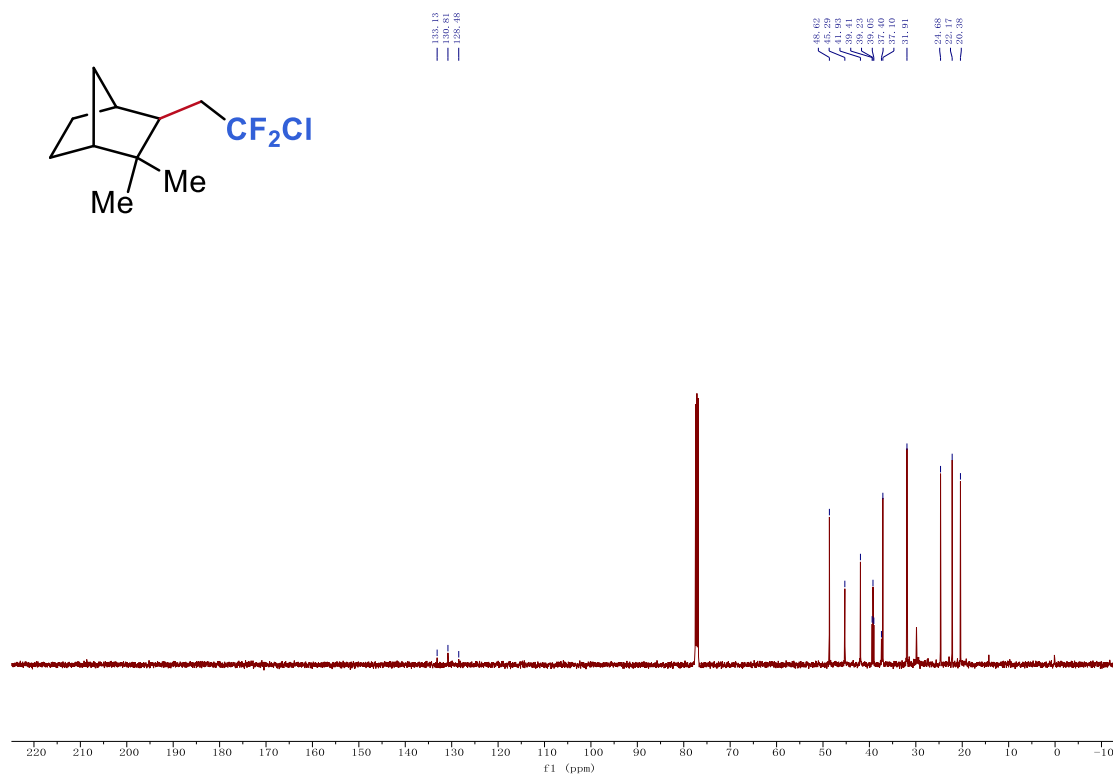
¹H NMR (400 MHz, CDCl₃) spectra for compound 1v



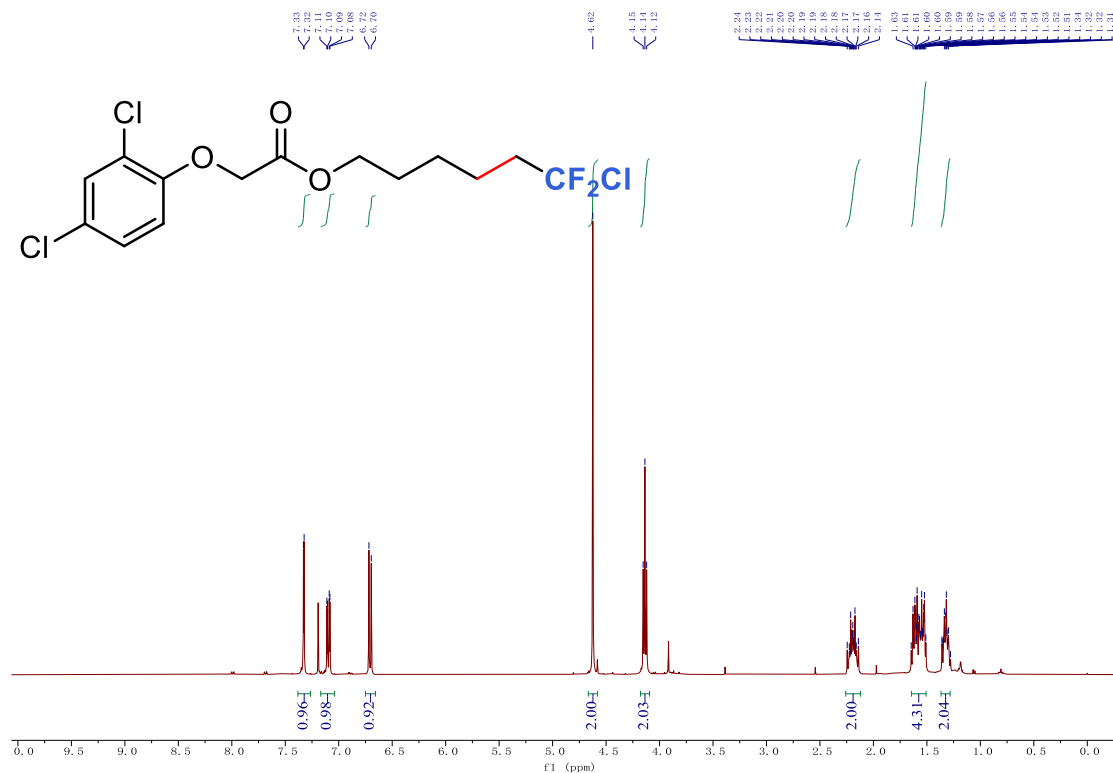
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound 1v



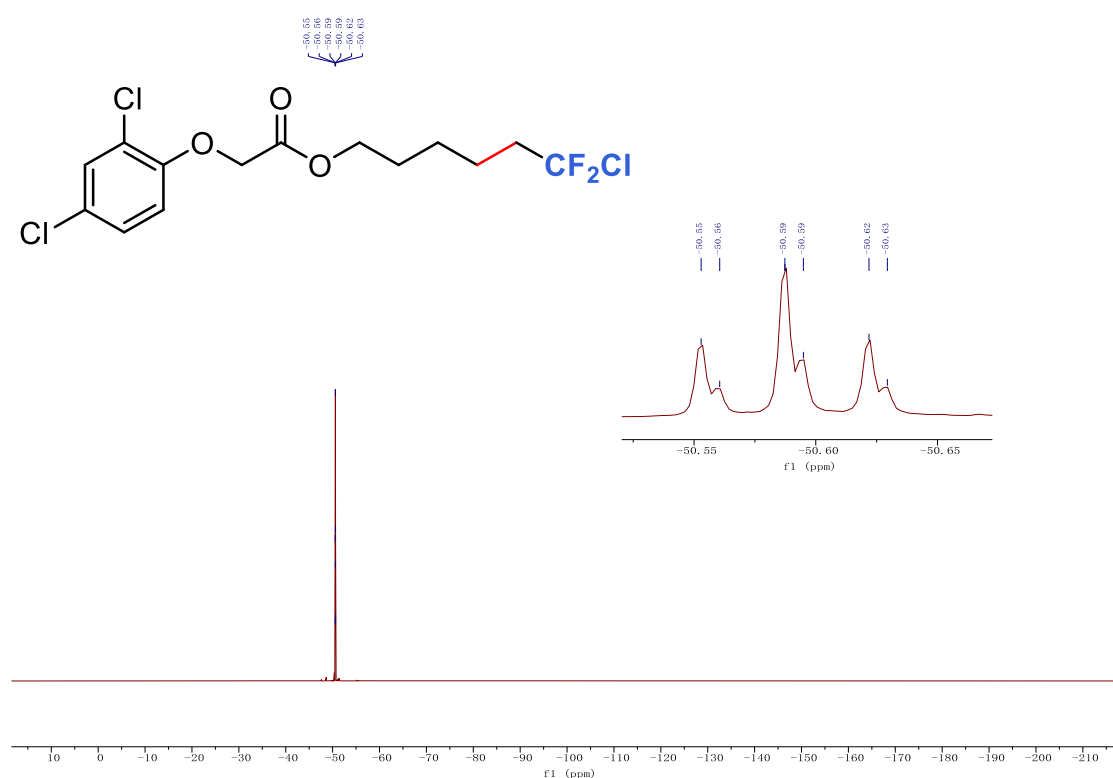
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1v**



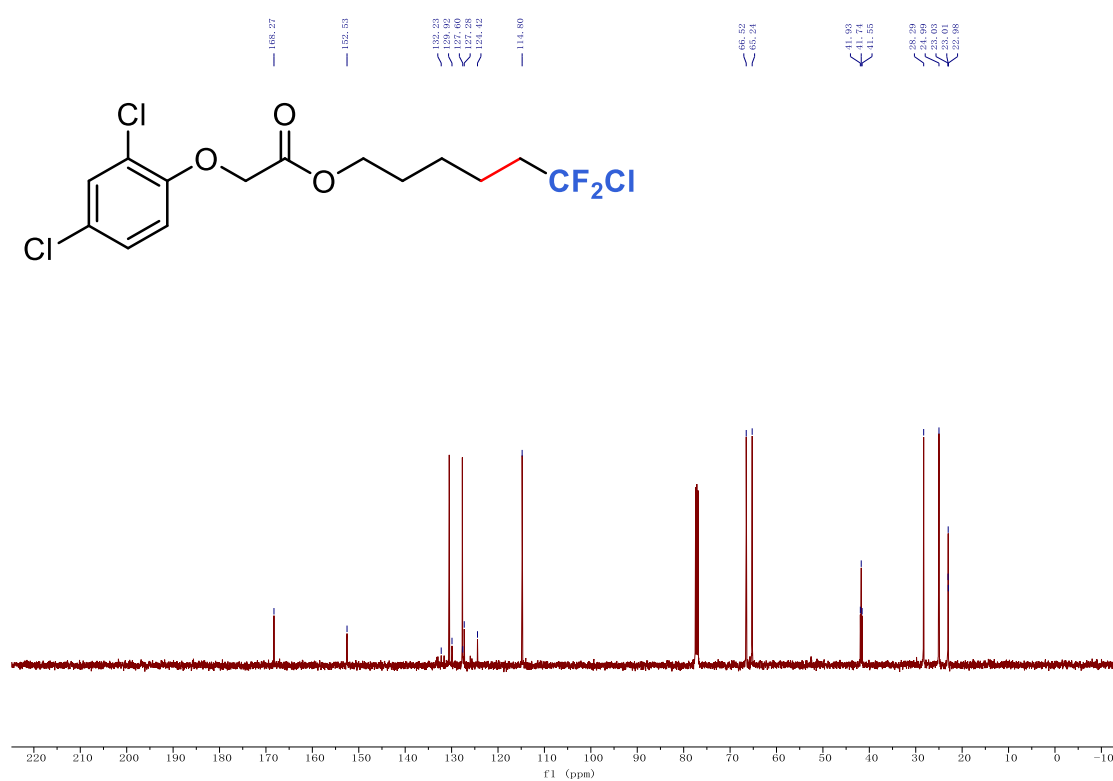
¹H NMR (400 MHz, CDCl₃) spectra for compound **1w**



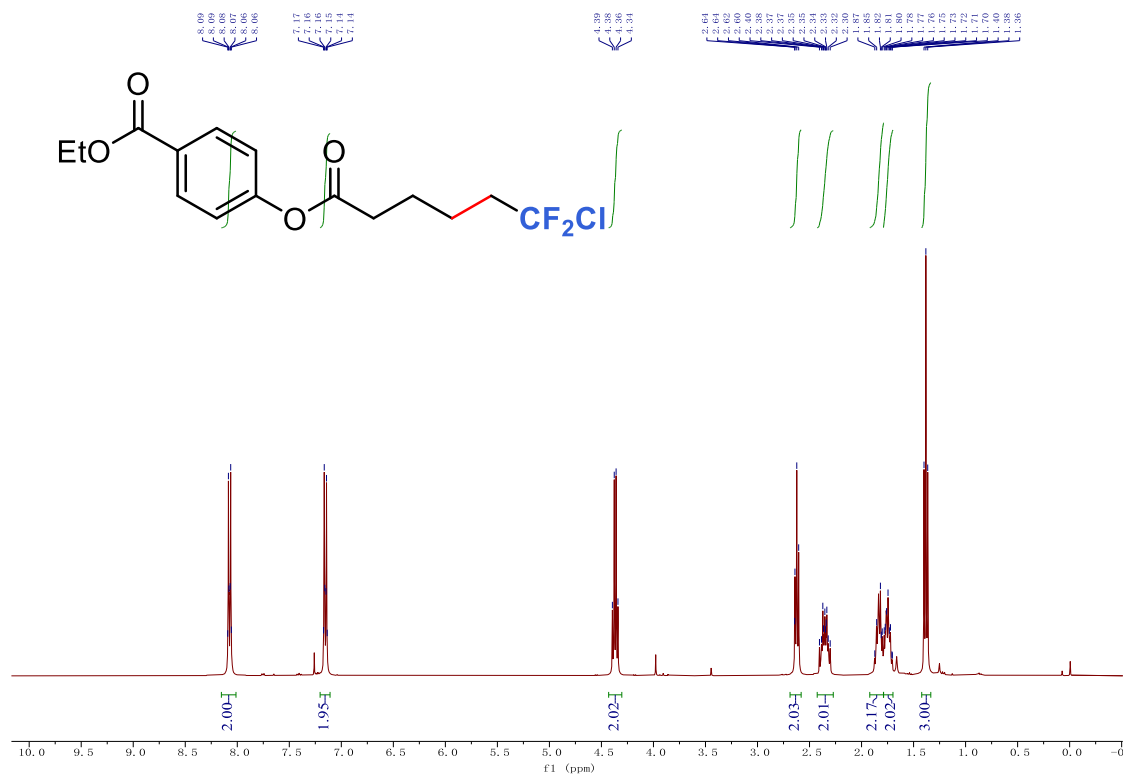
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1w**



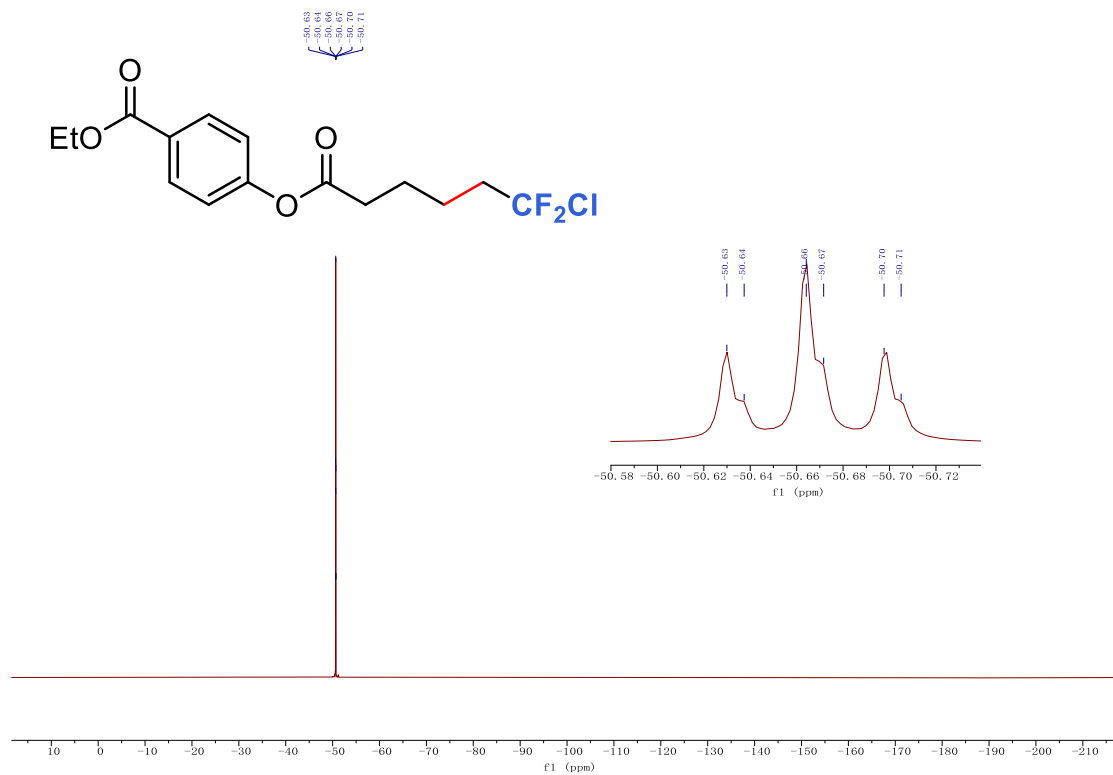
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1w**



^1H NMR (400 MHz, CDCl_3) spectra for compound **1x**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1x**



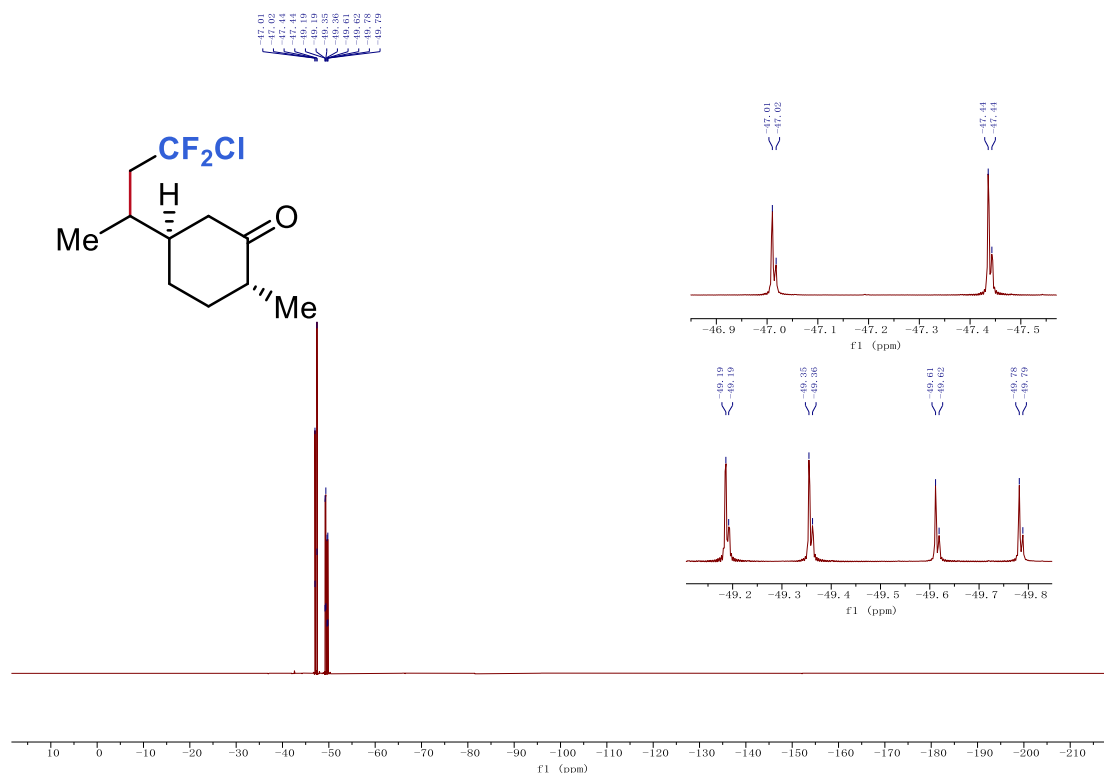
Chemical structure of the compound is shown above the spectrum. The compound is ethyl 4-(2-(2-(2-(2-chloro-2-fluoroethyl)oxy)acetoxy)phenyl)butanoate. The structure is labeled with CF_2Cl for the terminal group.

^1H NMR spectrum (400 MHz, $\text{DMSO}-d_6$) of the compound. The spectrum shows peaks corresponding to the structure, with chemical shifts (ppm) labeled above the peaks:

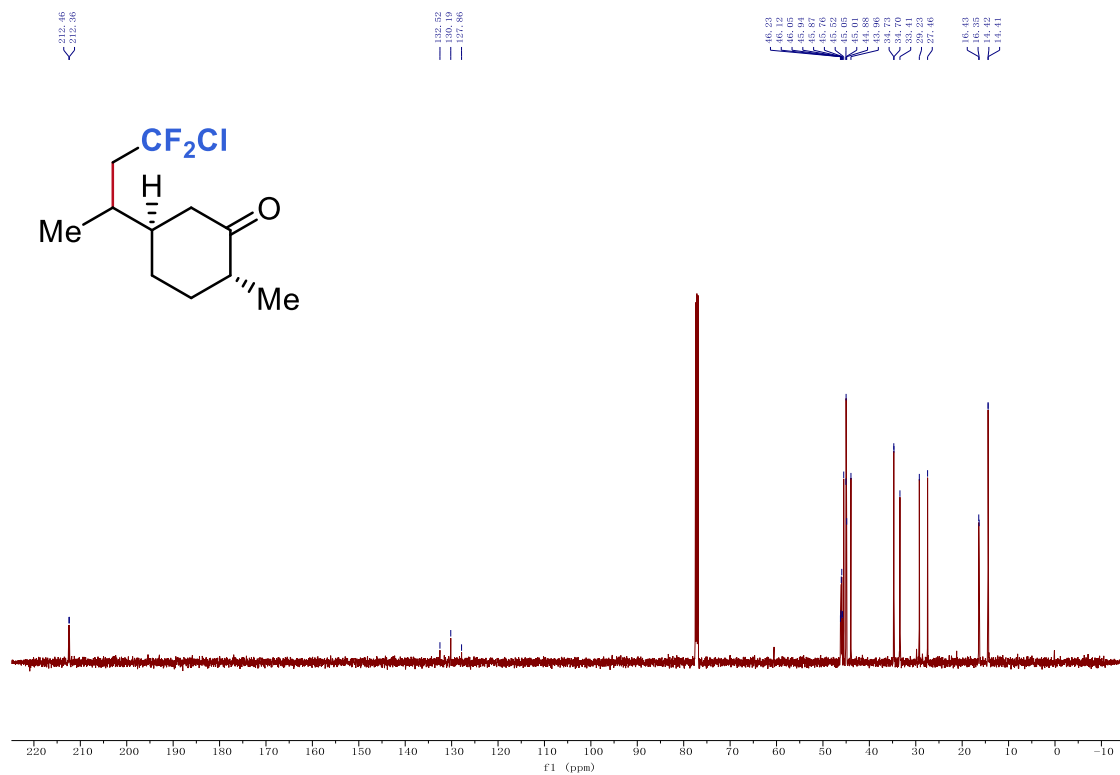
- 7.71, 7.67, 7.65, 7.60, 7.54, 7.24
- 3.32, 3.30, 3.25, 3.23, 3.20, 3.18, 3.14, 3.12, 3.08, 3.04, 3.02, 2.97, 2.95, 2.91, 2.89, 2.86, 2.84, 2.82, 2.80, 2.77, 2.75, 2.72, 2.70, 2.67, 2.65, 2.62, 2.60, 2.57, 2.55, 2.52, 2.50, 2.47, 2.45, 2.42, 2.40, 2.37, 2.35, 2.32, 2.30, 2.27, 2.25, 2.22, 2.20, 2.17, 2.15, 2.12, 2.10, 2.07, 2.05, 2.02, 2.00, 1.97, 1.95, 1.92, 1.90, 1.87, 1.85, 1.82, 1.80, 1.77, 1.75, 1.72, 1.70, 1.67, 1.65, 1.62, 1.60, 1.57, 1.55, 1.52, 1.50, 1.47, 1.45, 1.42, 1.40, 1.37, 1.35, 1.32, 1.30, 1.27, 1.25, 1.22, 1.20, 1.17, 1.15, 1.12, 1.10, 1.07, 1.05, 1.02, 1.00, 0.97, 0.95, 0.92, 0.90, 0.87, 0.85, 0.82, 0.80, 0.77, 0.75, 0.72, 0.70, 0.67, 0.65, 0.62, 0.60, 0.57, 0.55, 0.52, 0.50, 0.47, 0.45, 0.42, 0.40, 0.37, 0.35, 0.32, 0.30, 0.27, 0.25, 0.22, 0.20, 0.17, 0.15, 0.12, 0.10, 0.07, 0.05, 0.02, 0.00, -0.03, -0.05, -0.07, -0.10, -0.12, -0.15, -0.17, -0.20, -0.22, -0.25, -0.27, -0.30, -0.32, -0.35, -0.37, -0.40, -0.42, -0.45, -0.47, -0.50, -0.52, -0.55, -0.57, -0.60, -0.62, -0.65, -0.67, -0.70, -0.72, -0.75, -0.77, -0.80, -0.82, -0.85, -0.87, -0.90, -0.92, -0.95, -0.97, -1.00, -1.02, -1.05, -1.07, -1.10, -1.12, -1.15, -1.17, -1.20, -1.22, -1.25, -1.27, -1.30, -1.32, -1.35, -1.37, -1.40, -1.42, -1.45, -1.47, -1.50, -1.52, -1.55, -1.57, -1.60, -1.62, -1.65, -1.67, -1.70, -1.72, -1.75, -1.77, -1.80, -1.82, -1.85, -1.87, -1.90, -1.92, -1.95, -1.97, -2.00, -2.02, -2.05, -2.07, -2.10, -2.12, -2.15, -2.17, -2.20, -2.22, -2.25, -2.27, -2.30, -2.32, -2.35, -2.37, -2.40, -2.42, -2.45, -2.47, -2.50, -2.52, -2.55, -2.57, -2.60, -2.62, -2.65, -2.67, -2.70, -2.72, -2.75, -2.77, -2.80, -2.82, -2.85, -2.87, -2.90, -2.92, -2.95, -2.97, -3.00, -3.02, -3.05, -3.07, -3.10, -3.12, -3.15, -3.17, -3.20, -3.22, -3.25, -3.27, -3.30, -3.32, -3.35, -3.37, -3.40, -3.42, -3.45, -3.47, -3.50, -3.52, -3.55, -3.57, -3.60, -3.62, -3.65, -3.67, -3.70, -3.72, -3.75, -3.77, -3.80, -3.82, -3.85, -3.87, -3.90, -3.92, -3.95, -3.97, -4.00, -4.02, -4.05, -4.07, -4.10, -4.12, -4.15, -4.17, -4.20, -4.22, -4.25, -4.27, -4.30, -4.32, -4.35, -4.37, -4.40, -4.42, -4.45, -4.47, -4.50, -4.52, -4.55, -4.57, -4.60, -4.62, -4.65, -4.67, -4.70, -4.72, -4.75, -4.77, -4.80, -4.82, -4.85, -4.87, -4.90, -4.92, -4.95, -4.97, -5.00, -5.02, -5.05, -5.07, -5.10, -5.12, -5.15, -5.17, -5.20, -5.22, -5.25, -5.27, -5.30, -5.32, -5.35, -5.37, -5.40, -5.42, -5.45, -5.47, -5.50, -5.52, -5.55, -5.57, -5.60, -5.62, -5.65, -5.67, -5.70, -5.72, -5.75, -5.77, -5.80, -5.82, -5.85, -5.87, -5.90, -5.92, -5.95, -5.97, -6.00, -6.02, -6.05, -6.07, -6.10, -6.12, -6.15, -6.17, -6.20, -6.22, -6.25, -6.27, -6.30, -6.32, -6.35, -6.37, -6.40, -6.42, -6.45, -6.47, -6.50, -6.52, -6.55, -6.57, -6.60, -6.62, -6.65, -6.67, -6.70, -6.72, -6.75, -6.77, -6.80, -6.82, -6.85, -6.87, -6.90, -6.92, -6.95, -6.97, -7.00, -7.02, -7.05, -7.07, -7.10, -7.12, -7.15, -7.17, -7.20, -7.22, -7.25, -7.27, -7.30, -7.32, -7.35, -7.37, -7.40, -7.42, -7.45, -7.47, -7.50, -7.52, -7.55, -7.57, -7.60, -7.62, -7.65, -7.67, -7.70, -7.72, -7.75, -7.77, -7.80, -7.82, -7.85, -7.87, -7.90, -7.92, -7.95, -7.97, -8.00, -8.02, -8.05, -8.07, -8.10, -8.12, -8.15, -8.17, -8.20, -8.22, -8.25, -8.27, -8.30, -8.32, -8.35, -8.37, -8.40, -8.42, -8.45, -8.47, -8.50, -8.52, -8.55, -8.57, -8.60, -8.62, -8.65, -8.67, -8.70, -8.72, -8.75, -8.77, -8.80, -8.82, -8.85, -8.87, -8.90, -8.92, -8.95, -8.97, -9.00, -9.02, -9.05, -9.07, -9.10, -9.12, -9.15, -9.17, -9.20, -9.22, -9.25, -9.27, -9.30, -9.32, -9.35, -9.37, -9.40, -9.42, -9.45, -9.47, -9.50, -9.52, -9.55, -9.57, -9.60, -9.62, -9.65, -9.67, -9.70, -9.72, -9.75, -9.77, -9.80, -9.82, -9.85, -9.87, -9.90, -9.92, -9.95, -9.97, -10.00, -10.02, -10.05, -10.07, -10.10, -10.12, -10.15, -10.17, -10.20, -10.22, -10.25, -10.27, -10.30, -10.32, -10.35, -10.37, -10.40, -10.42, -10.45, -10.47, -10.50, -10.52, -10.55, -10.57, -10.60, -10.62, -10.65, -10.67, -10.70, -10.72, -10.75, -10.77, -10.80, -10.82, -10.85, -10.87, -10.90, -10.92, -10.95, -10.97, -11.00, -11.02, -11.05, -11.07, -11.10, -11.12, -11.15, -11.17, -11.20, -11.22, -11.25, -11.27, -11.30, -11.32, -11.35, -11.37, -11.40, -11.42, -11.45, -11.47, -11.50, -11.52, -11.55, -11.57, -11.60, -11.62, -11.65, -11.67, -11.70, -11.72, -11.75, -11.77, -11.80, -11.82, -11.85, -11.87, -11.90, -11.9

[illegible]

^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1y**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1y**



Chemical structure: CC1(C(=O)N(c2cc(Cl)cc(Cl)c2)OC1=O)CC(=O)O

¹H NMR spectrum (ppm):

- 7.56 (d, 1.76H)
- 7.48 (d, 0.89H)
- 2.43 (s, 1.00H)
- 2.41 (s, 1.00H)
- 1.71 (s, 3.00H)

The chemical structure is 2-(2,4-dichlorophenyl)-2-methyl-1-(2,2,2-trichloroethyl)hydantoin. The structure shows a central carbon atom bonded to a methyl group (Me), a 2,4-dichlorophenyl group, and a 2,2,2-trichloroethyl group. The 2,2,2-trichloroethyl group is highlighted in blue in the original image.

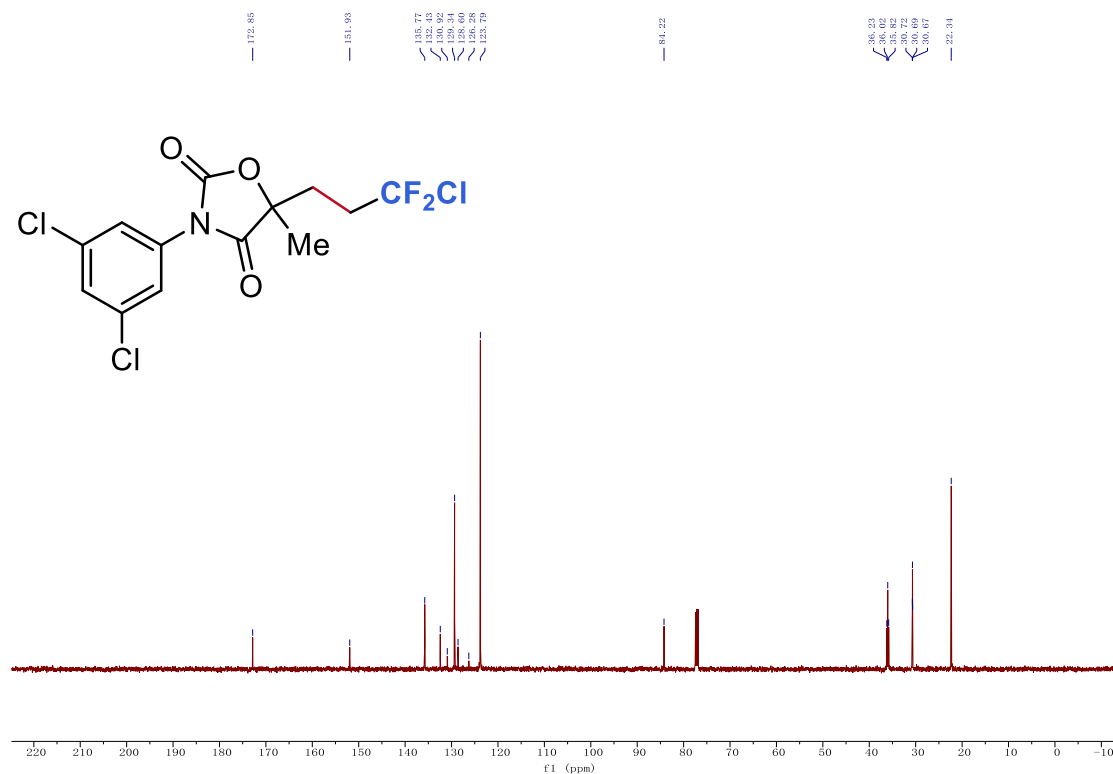
The ^{13}C NMR spectrum (top) shows the following chemical shifts (ppm):

- 51.39
- 51.40
- 51.41
- 51.42
- 51.43
- 51.44
- 51.45
- 51.46
- 51.47
- 51.48

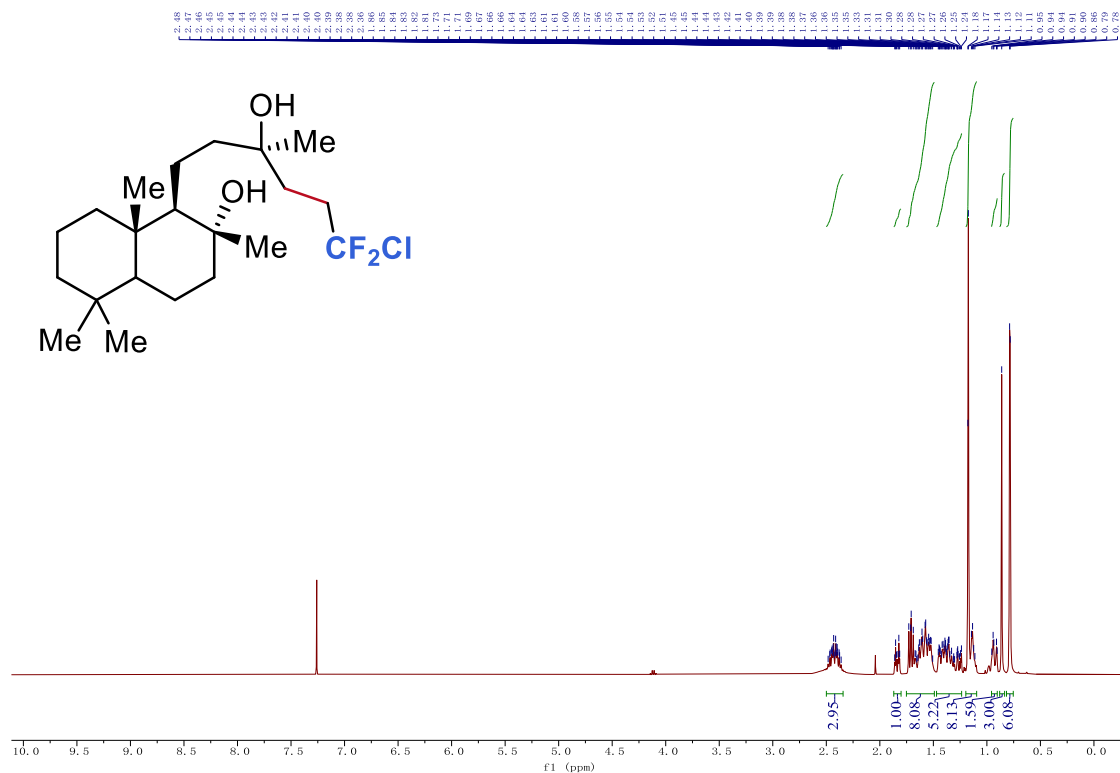
The spectrum (bottom) shows the following chemical shifts (ppm):

- 51.38
- 51.40
- 51.42
- 51.44
- 51.46
- 51.48
- 51.50

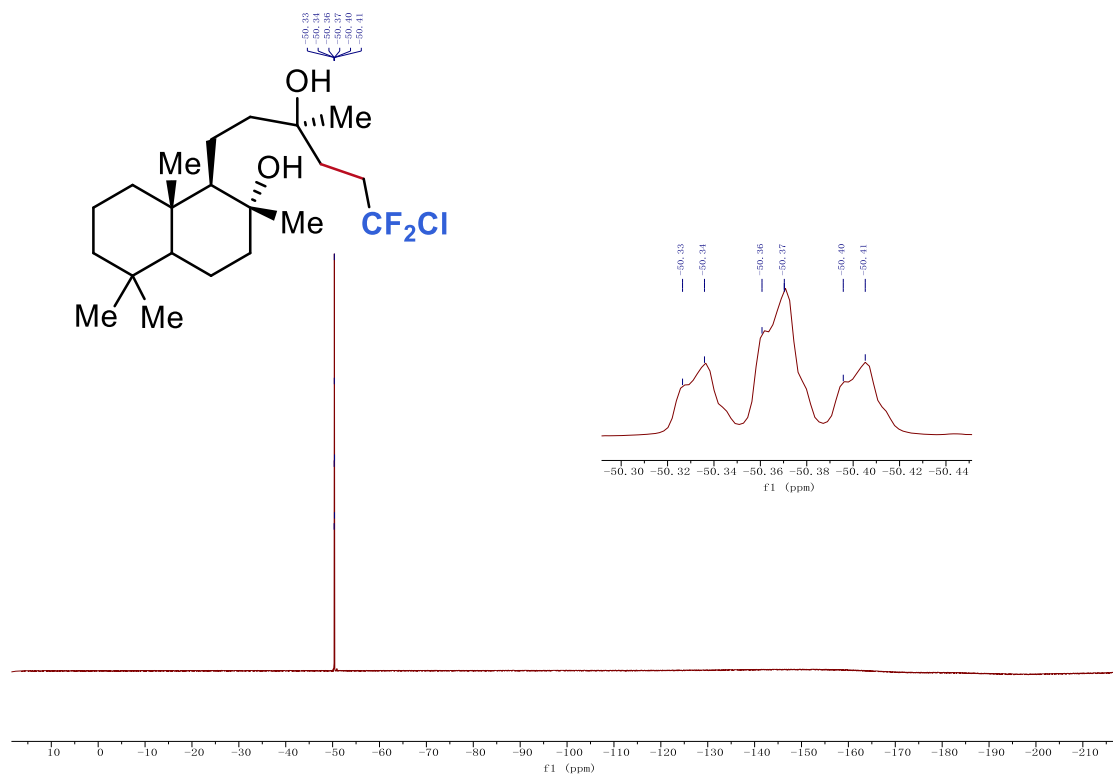
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1z**



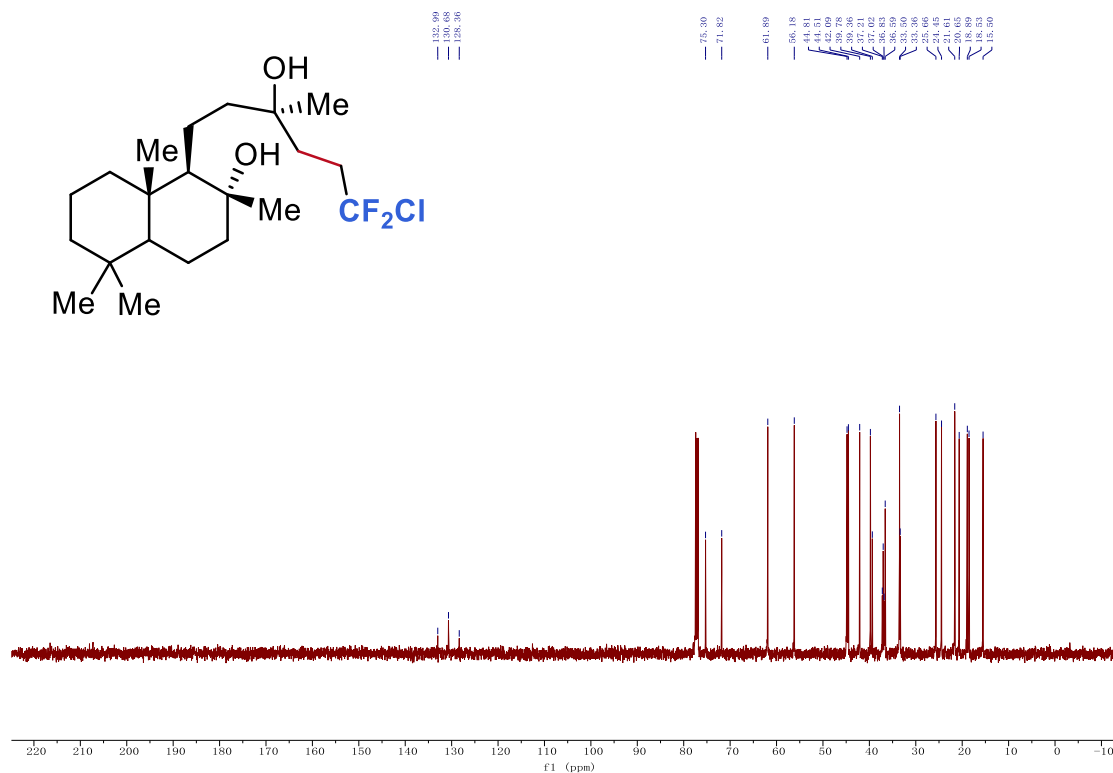
¹H NMR (400 MHz, CDCl₃) spectra for compound **1aa**



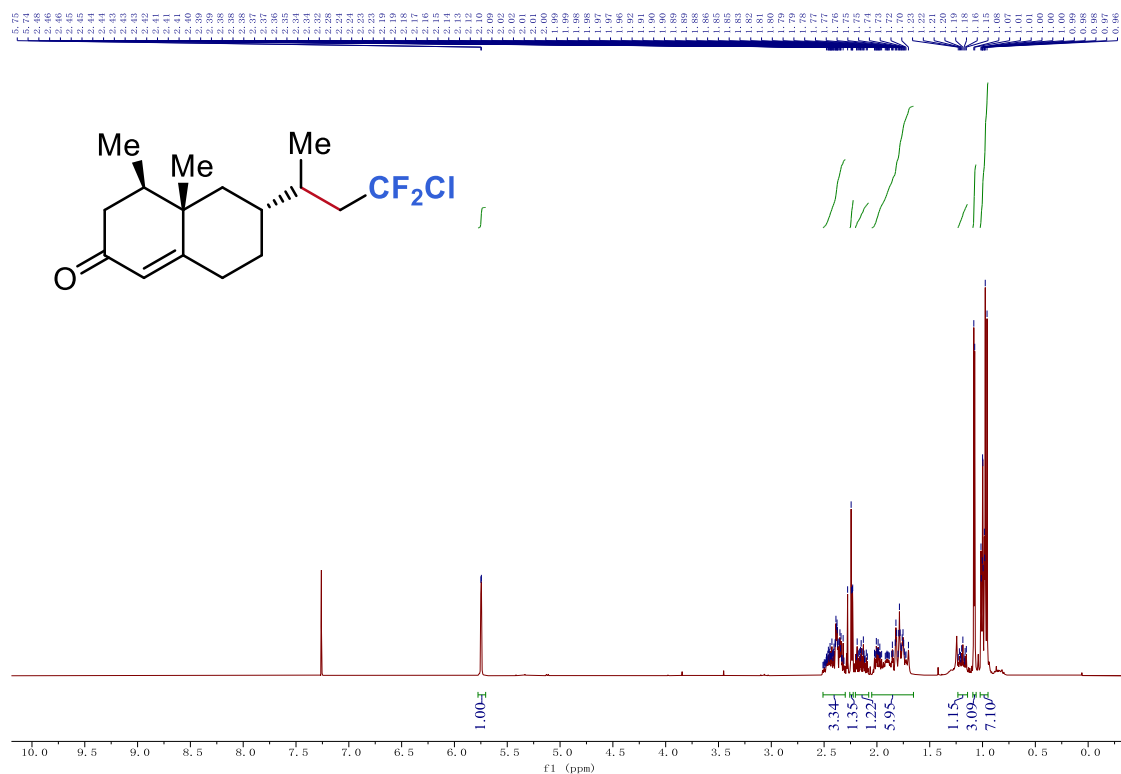
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1aa**



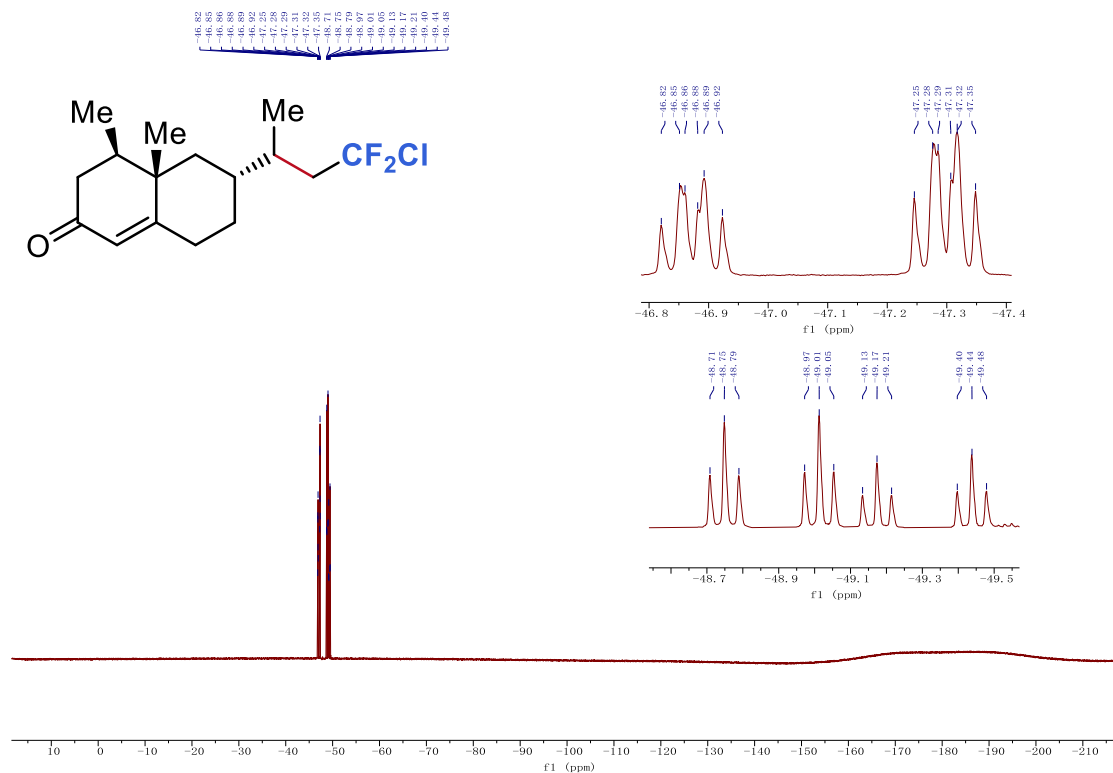
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1aa**



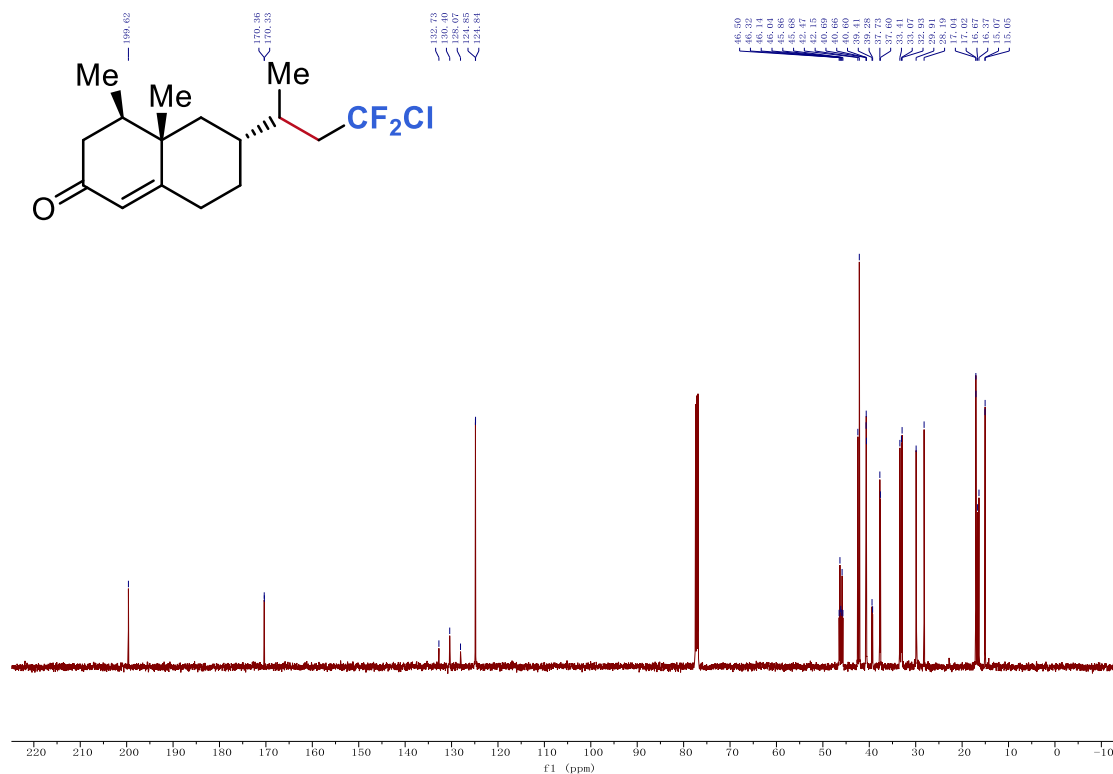
¹H NMR (400 MHz, CDCl₃) spectra for compound **1ab**



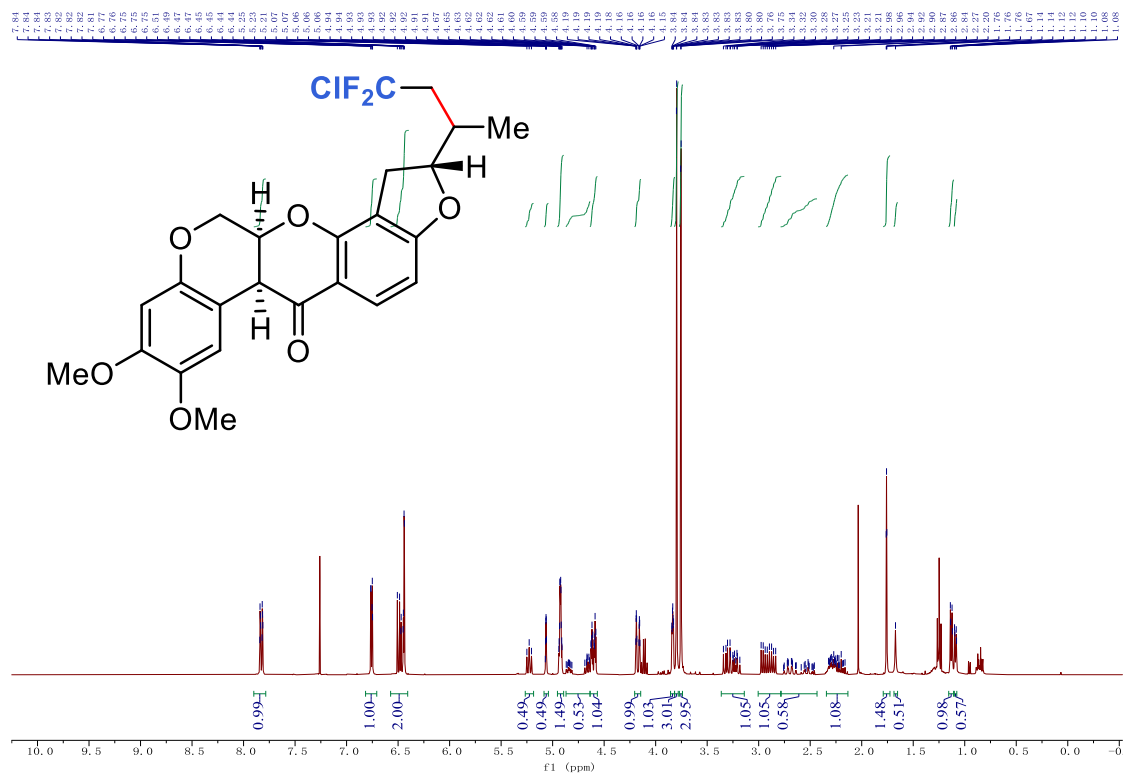
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1ab**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1ab**



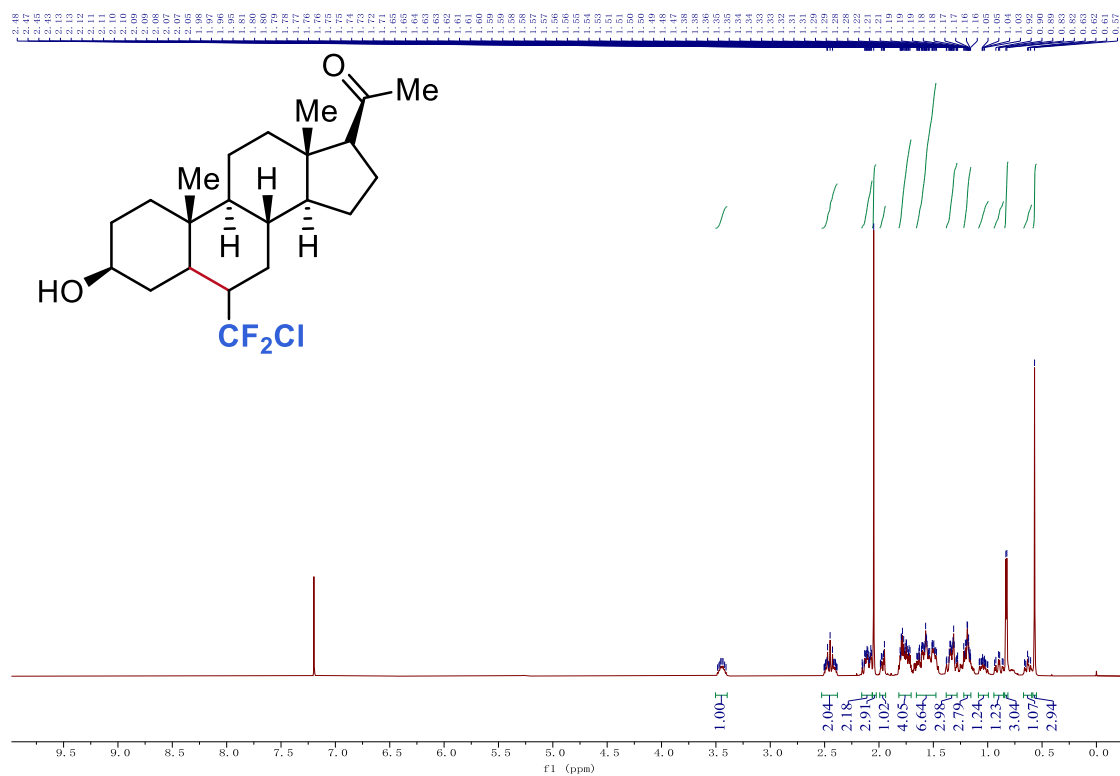
^1H NMR (400 MHz, CDCl_3) spectra for compound **1ac**



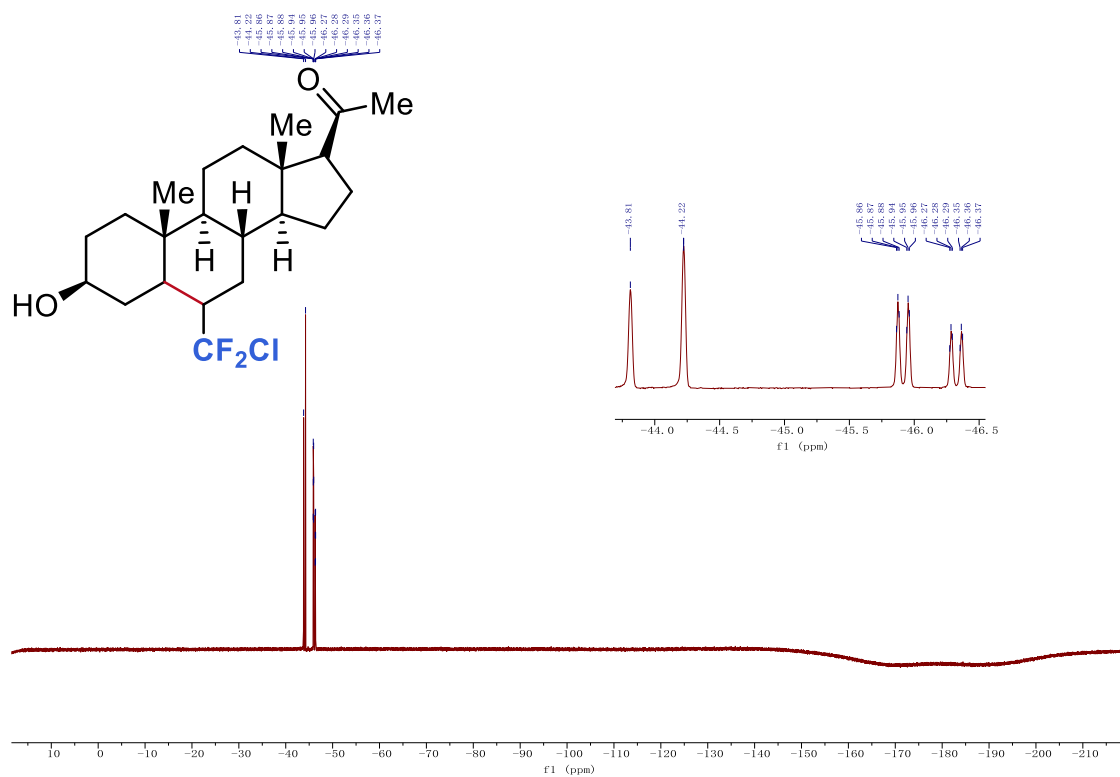
The chemical structure is a complex molecule featuring a benzodioxane core. It has a methoxy group (MeO) and a methyl group (Me). The structure is shown with stereochemistry. The two inset NMR spectra are 13C NMR spectra. The top inset shows peaks at -46.34, -46.37, -46.51, -46.77, -46.81, -46.84, -46.89, -46.91, -46.95, -47.29, -47.32, -47.35, -47.37, -47.38, -47.39, -47.40, -47.41, -47.42, -47.43, -47.44, -47.45, -47.46, -47.47, -47.48, -47.49, -47.50, -47.51, -47.52, -47.53, -47.54, -47.55, -47.56, -47.57, -47.58, -47.59, -47.60, -47.61, -47.62, -47.63, -47.64, -47.65, -47.66, -47.67, -47.68, -47.69, -47.70, -47.71, -47.72, -47.73, -47.74, -47.75, -47.76, -47.77, -47.78, -47.79, -47.80, -47.81, -47.82, -47.83, -47.84, -47.85, -47.86, -47.87, -47.88, -47.89, -47.90, -47.91, -47.92, -47.93, -47.94, -47.95, -47.96, -47.97, -47.98, -47.99, -48.00, -48.01, -48.02, -48.03, -48.04, -48.05, -48.06, -48.07, -48.08, -48.09, -48.10, -48.11, -48.12, -48.13, -48.14, -48.15, -48.16, -48.17, -48.18, -48.19, -48.20, -48.21, -48.22, -48.23, -48.24, -48.25, -48.26, -48.27, -48.28, -48.29, -48.30, -48.31, -48.32, -48.33, -48.34, -48.35, -48.36, -48.37, -48.38, -48.39, -48.40, -48.41, -48.42, -48.43, -48.44, -48.45, -48.46, -48.47, -48.48, -48.49, -48.50, -48.51, -48.52, -48.53, -48.54, -48.55, -48.56, -48.57, -48.58, -48.59, -48.60, -48.61, -48.62, -48.63, -48.64, -48.65, -48.66, -48.67, -48.68, -48.69, -48.70, -48.71, -48.72, -48.73, -48.74, -48.75, -48.76, -48.77, -48.78, -48.79, -48.80, -48.81, -48.82, -48.83, -48.84, -48.85, -48.86, -48.87, -48.88, -48.89, -48.90, -48.91, -48.92, -48.93, -48.94, -48.95, -48.96, -48.97, -48.98, -48.99, -49.00, -49.01, -49.02, -49.03, -49.04, -49.05, -49.06, -49.07, -49.08, -49.09, -49.10, -49.11, -49.12, -49.13, -49.14, -49.15, -49.16, -49.17, -49.18, -49.19, -49.20, -49.21, -49.22, -49.23, -49.24, -49.25, -49.26, -49.27, -49.28, -49.29, -49.30, -49.31, -49.32, -49.33, -49.34, -49.35, -49.36, -49.37, -49.38, -49.39, -49.40, -49.41, -49.42, -49.43, -49.44, -49.45, -49.46, -49.47, -49.48, -49.49, -49.50, -49.51, -49.52, -49.53, -49.54, -49.55, -49.56, -49.57, -49.58, -49.59, -49.60, -49.61, -49.62, -49.63, -49.64, -49.65, -49.66, -49.67, -49.68, -49.69, -49.70, -49.71, -49.72, -49.73, -49.74, -49.75, -49.76, -49.77, -49.78, -49.79, -49.80, -49.81, -49.82, -49.83, -49.84, -49.85, -49.86, -49.87, -49.88, -49.89, -49.90, -49.91, -49.92, -49.93, -49.94, -49.95, -49.96, -49.97, -49.98, -49.99, -50.00, -50.01, -50.02, -50.03, -50.04, -50.05, -50.06, -50.07, -50.08, -50.09, -50.10, -50.11, -50.12, -50.13, -50.14, -50.15, -50.16, -50.17, -50.18, -50.19, -50.20, -50.21, -50.22, -50.23, -50.24, -50.25, -50.26, -50.27, -50.28, -50.29, -50.30, -50.31, -50.32, -50.33, -50.34, -50.35, -50.36, -50.37, -50.38, -50.39, -50.40, -50.41, -50.42, -50.43, -50.44, -50.45, -50.46, -50.47, -50.48, -50.49, -50.50, -50.51, -50.52, -50.53, -50.54, -50.55, -50.56, -50.57, -50.58, -50.59, -50.60, -50.61, -50.62, -50.63, -50.64, -50.65, -50.66, -50.67, -50.68, -50.69, -50.70, -50.71, -50.72, -50.73, -50.74, -50.75, -50.76, -50.77, -50.78, -50.79, -50.80, -50.81, -50.82, -50.83, -50.84, -50.85, -50.86, -50.87, -50.88, -50.89, -50.90, -50.91, -50.92, -50.93, -50.94, -50.95, -50.96, -50.97, -50.98, -50.99, -51.00, -51.01, -51.02, -51.03, -51.04, -51.05, -51.06, -51.07, -51.08, -51.09, -51.10, -51.11, -51.12, -51.13, -51.14, -51.15, -51.16, -51.17, -51.18, -51.19, -51.20, -51.21, -51.22, -51.23, -51.24, -51.25, -51.26, -51.27, -51.28, -51.29, -51.30, -51.31, -51.32, -51.33, -51.34, -51.35, -51.36, -51.37, -51.38, -51.39, -51.40, -51.41, -51.42, -51.43, -51.44, -51.45, -51.46, -51.47, -51.48, -51.49, -51.50, -51.51, -51.52, -51.53, -51.54, -51.55, -51.56, -51.57, -51.58, -51.59, -51.60, -51.61, -51.62, -51.63, -51.64, -51.65, -51.66, -51.67, -51.68, -51.69, -51.70, -51.71, -51.72, -51.73, -51.74, -51.75, -51.76, -51.77, -51.78, -51.79, -51.80, -51.81, -51.82, -51.83, -51.84, -51.85, -51.86, -51.87, -51.88, -51.89, -51.90, -51.91, -51.92, -51.93, -51.94, -51.95, -51.96, -51.97, -51.98, -51.99, -52.00, -52.01, -52.02, -52.03, -52.04, -52.05, -52.06, -52.07, -52.08, -52.09, -52.10, -52.11, -52.12, -52.13, -52.14, -52.15, -52.16, -52.17, -52.18, -52.19, -52.20, -52.21, -52.22, -52.23, -52.24, -52.25, -52.26, -52.27, -52.28, -52.29, -52.30, -52.31, -52.32, -52.33, -52.34, -52.35, -52.36, -52.37, -52.38, -52.39, -52.40, -52.41, -52.42, -52.43, -52.44, -52.45, -52.46, -52.47, -52.48, -52.49, -52.50, -52.51, -52.52, -52.53, -52.54, -52.55, -52.56, -52.57, -52.58, -52.59, -52.60, -52.61, -52.62, -52.63, -52.64, -52.65, -52.66, -52.67, -52.68, -52.69, -52.70, -52.71, -52.72, -52.73, -52.74, -52.75, -52.76, -52.77, -52.78, -52.79, -52.80, -52.81, -52.82, -52.83, -52.84, -52.85, -52.86, -52.87, -52.88, -52.89, -52.90, -52.91, -52.92, -52

[illegible]

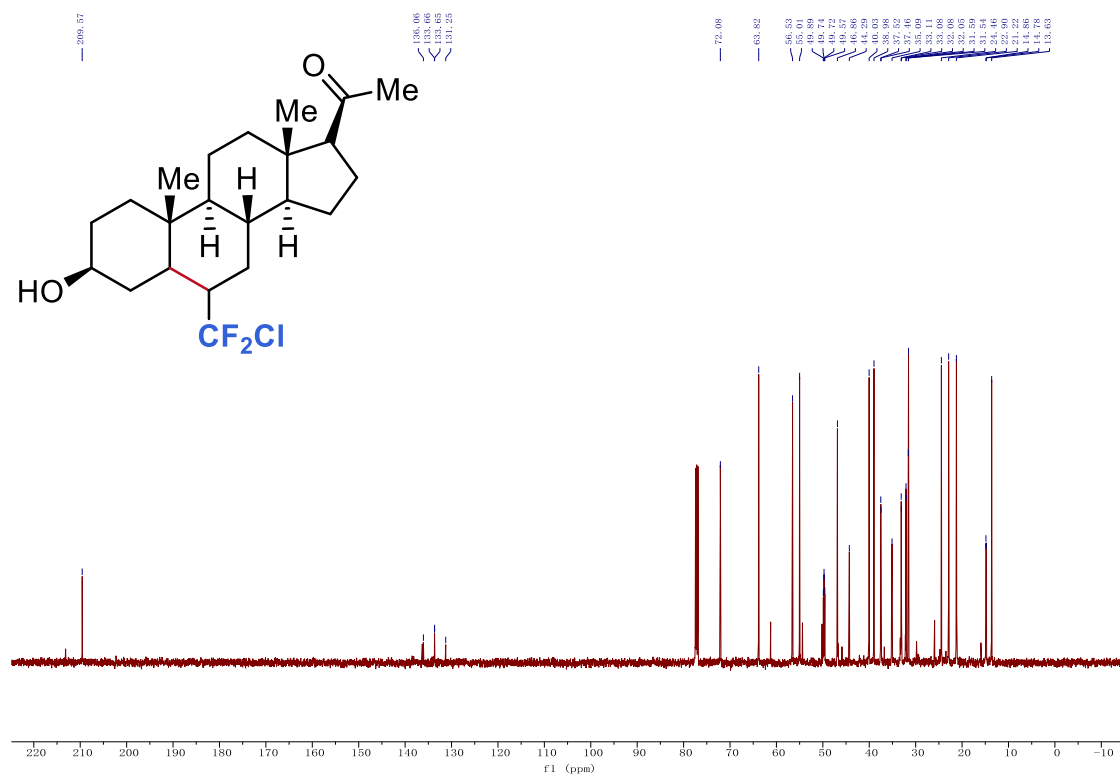
^1H NMR (400 MHz, CDCl_3) spectra for compound **1ad**



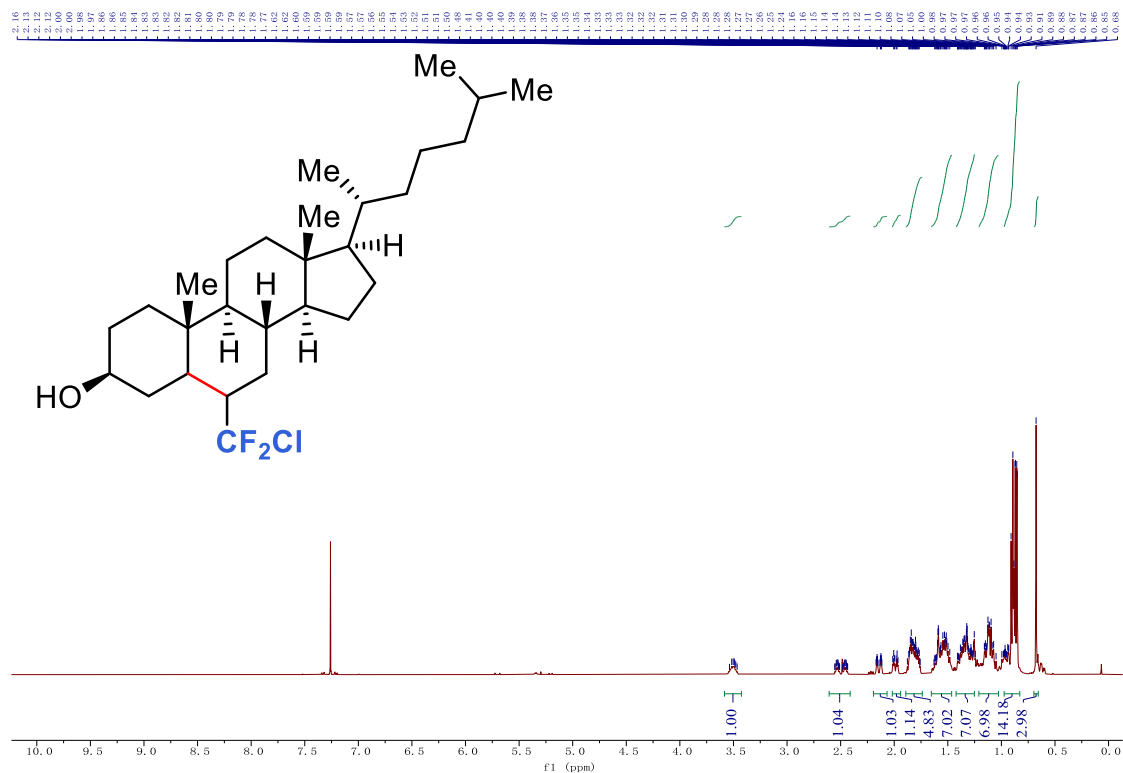
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1ad**



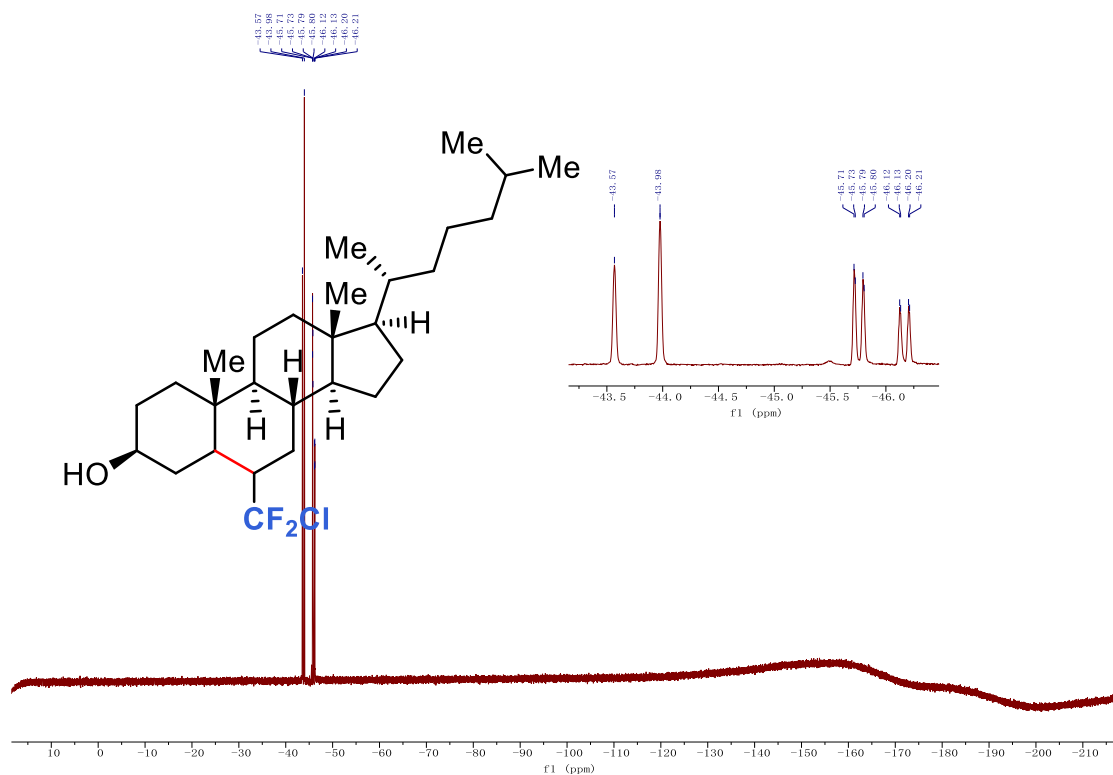
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1ad**



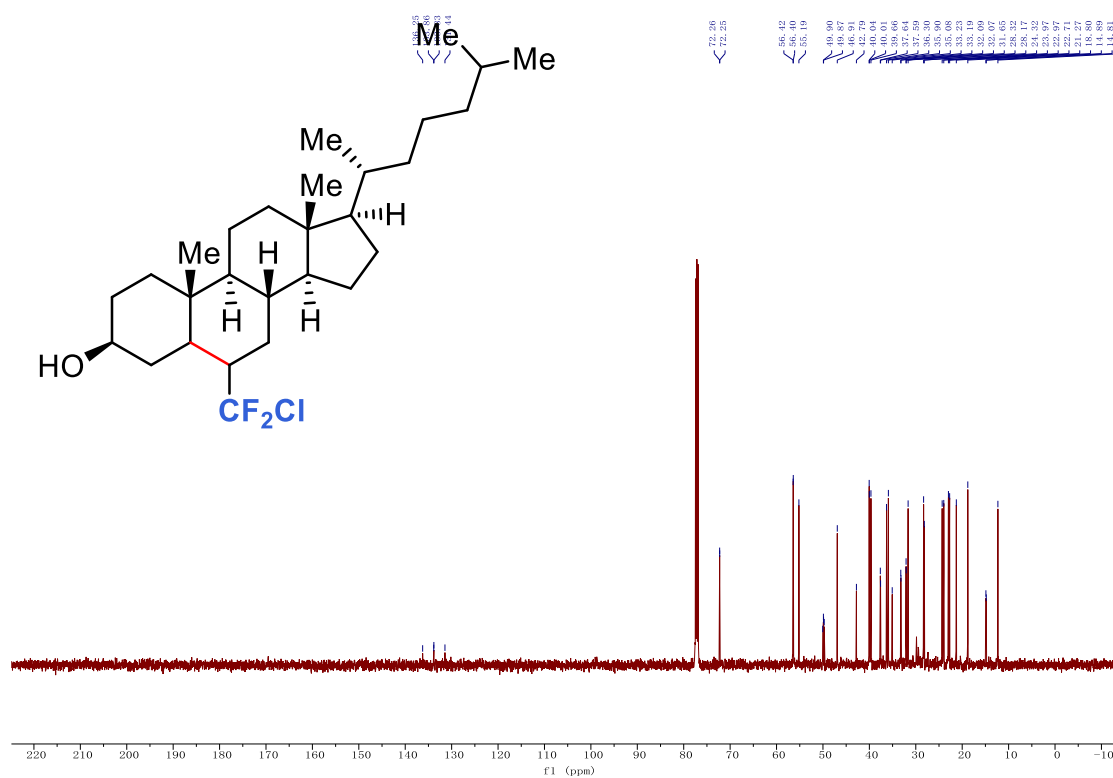
¹H NMR (400 MHz, CDCl₃) spectra for compound **1ae**



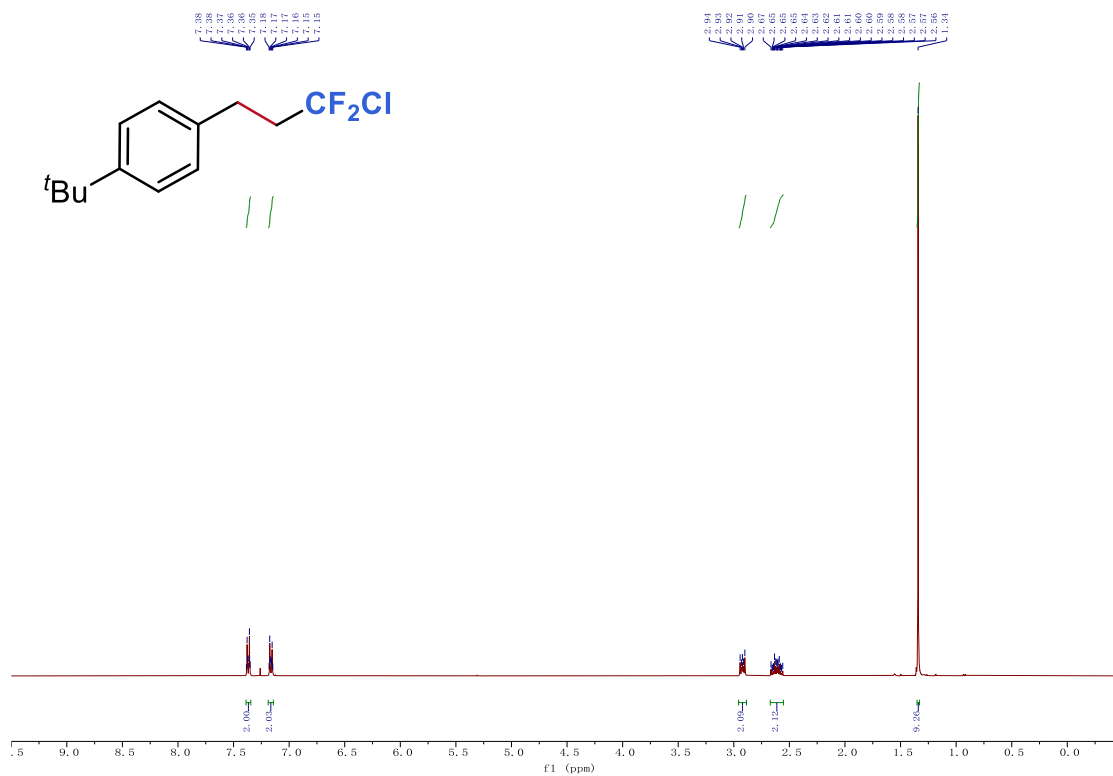
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1ae**



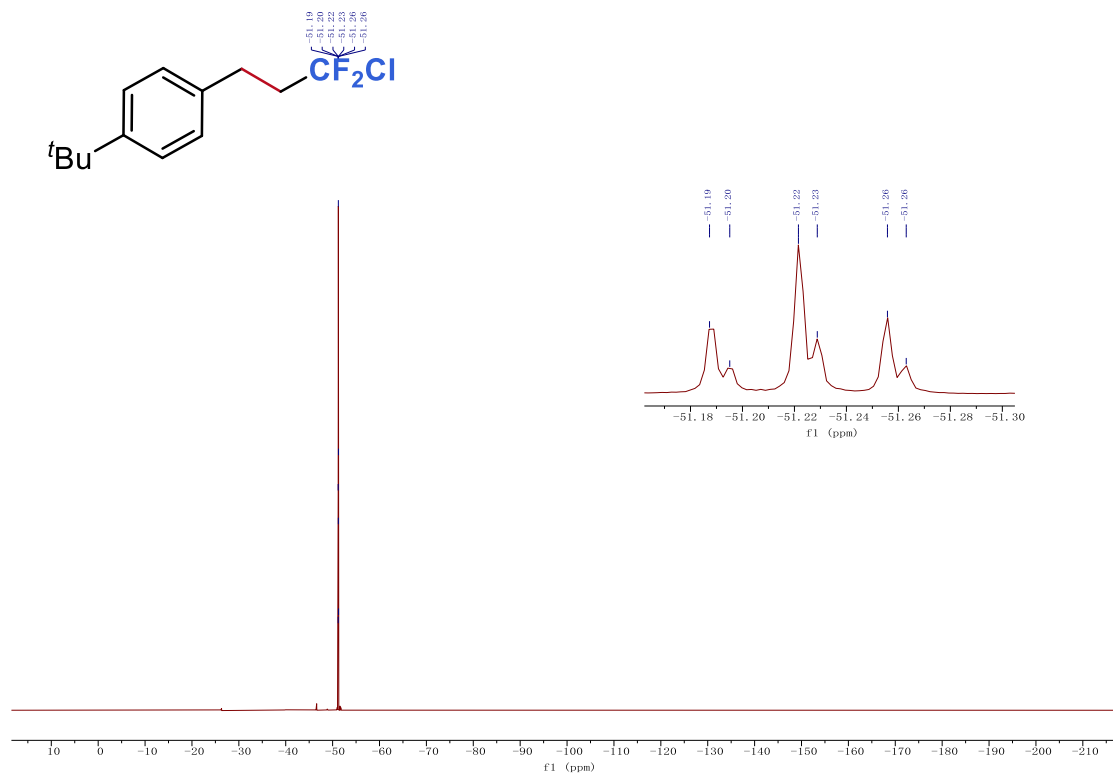
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1ae**



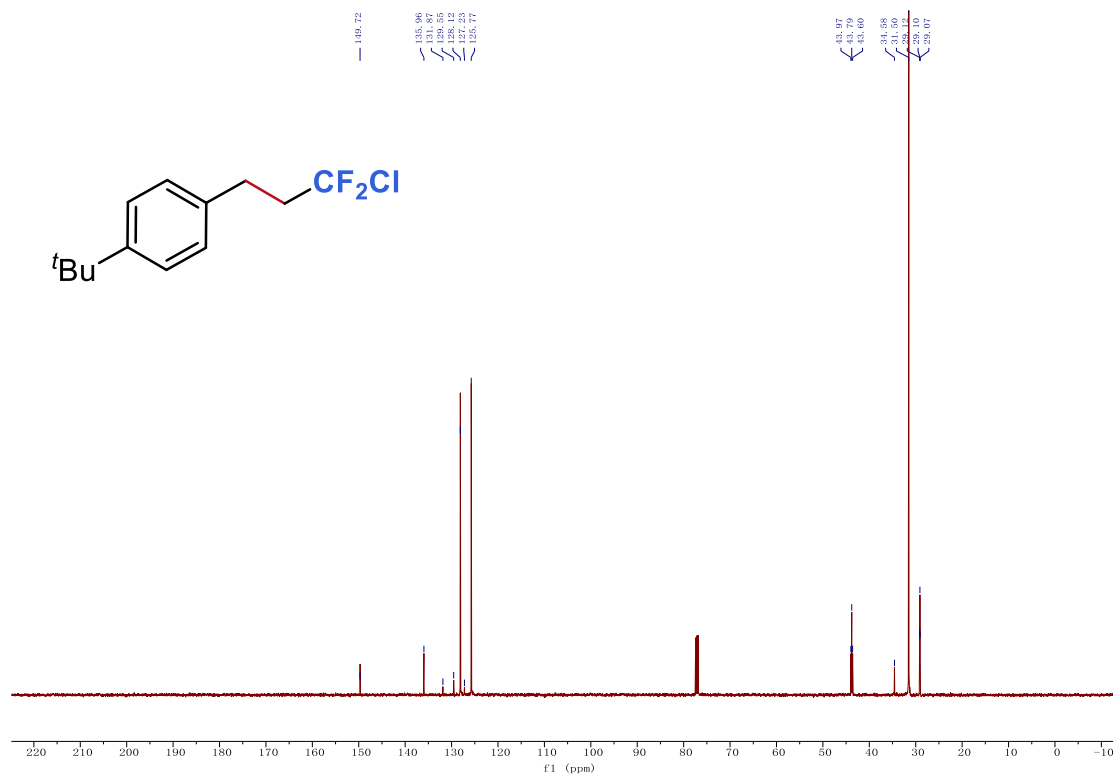
¹H NMR (400 MHz, CDCl₃) spectra for compound **1af**



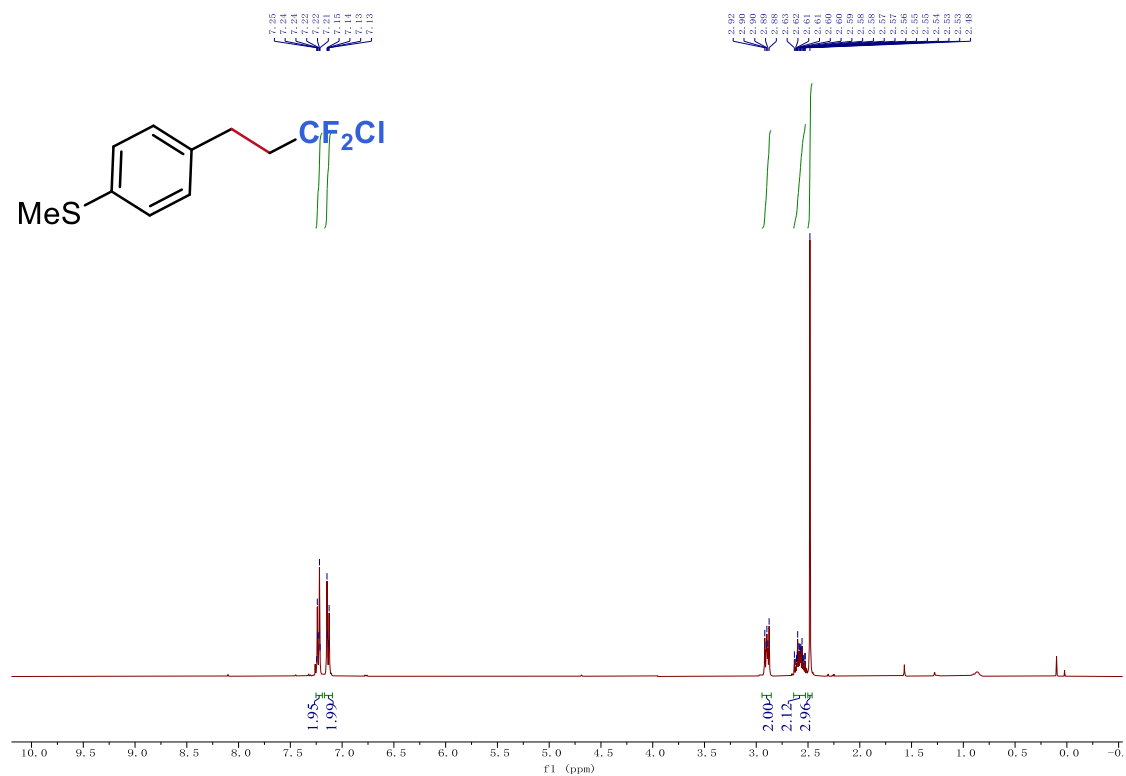
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1af**



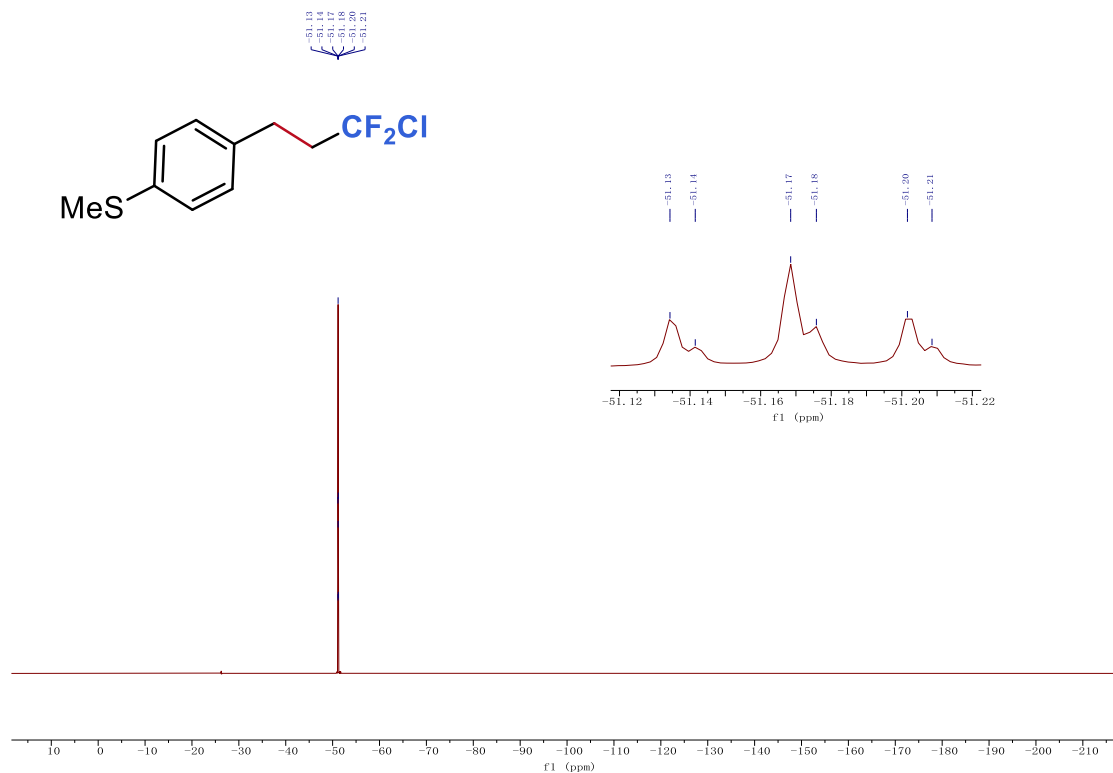
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1af**



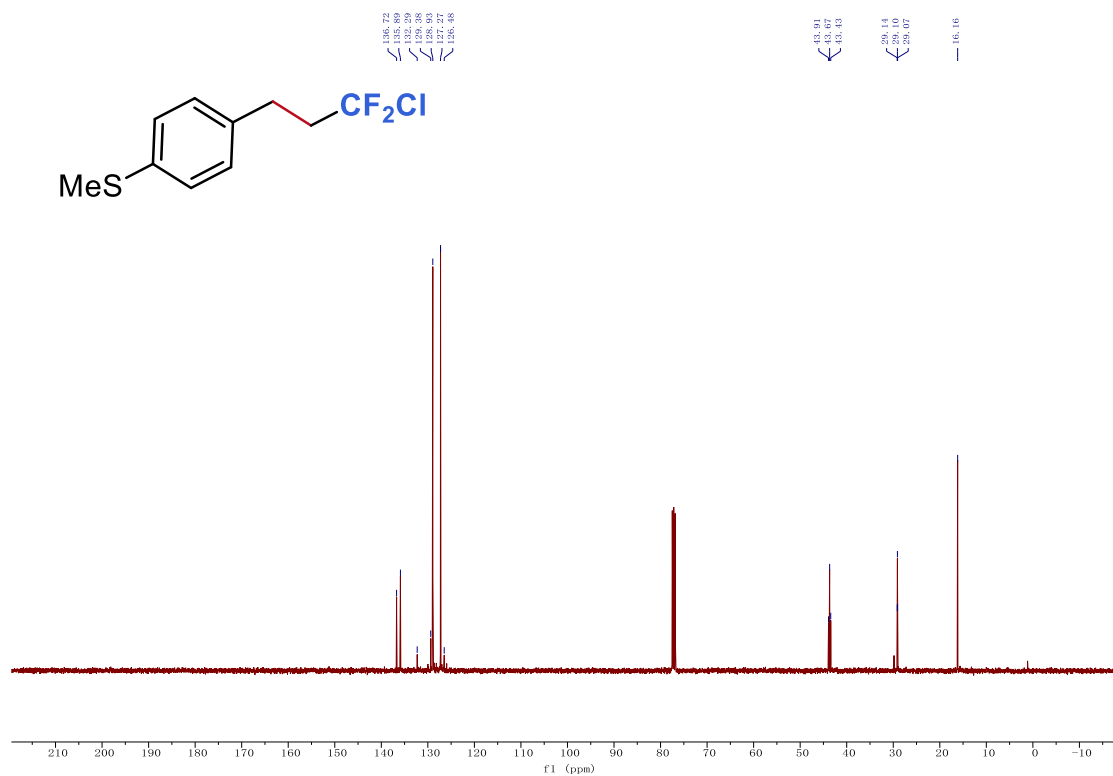
^1H NMR (400 MHz, CDCl_3) spectra for compound **1ag**



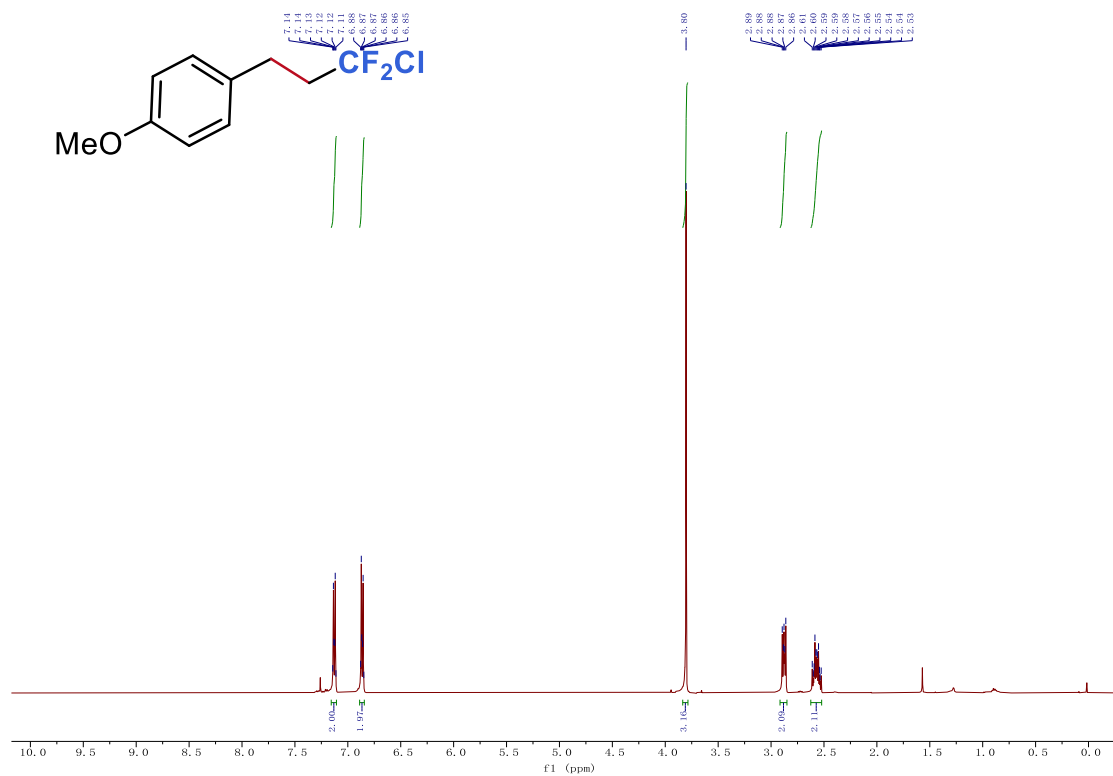
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1ag**



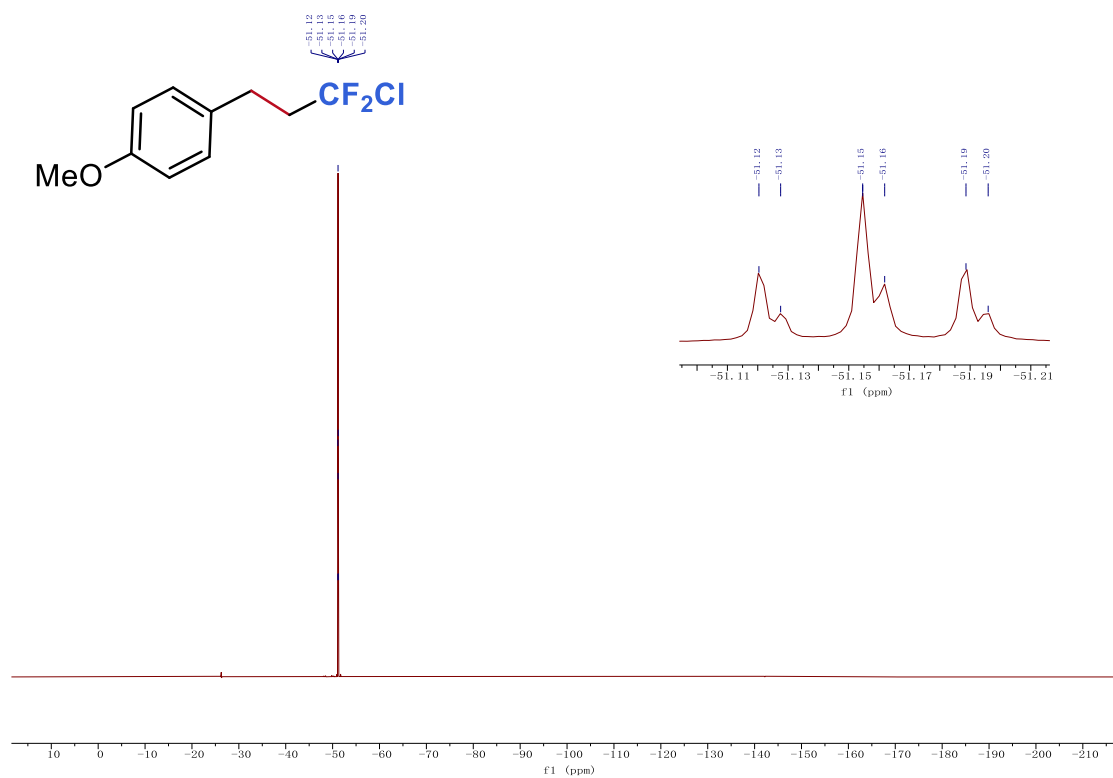
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1ag**



^1H NMR (400 MHz, CDCl_3) spectra for compound **1ah**



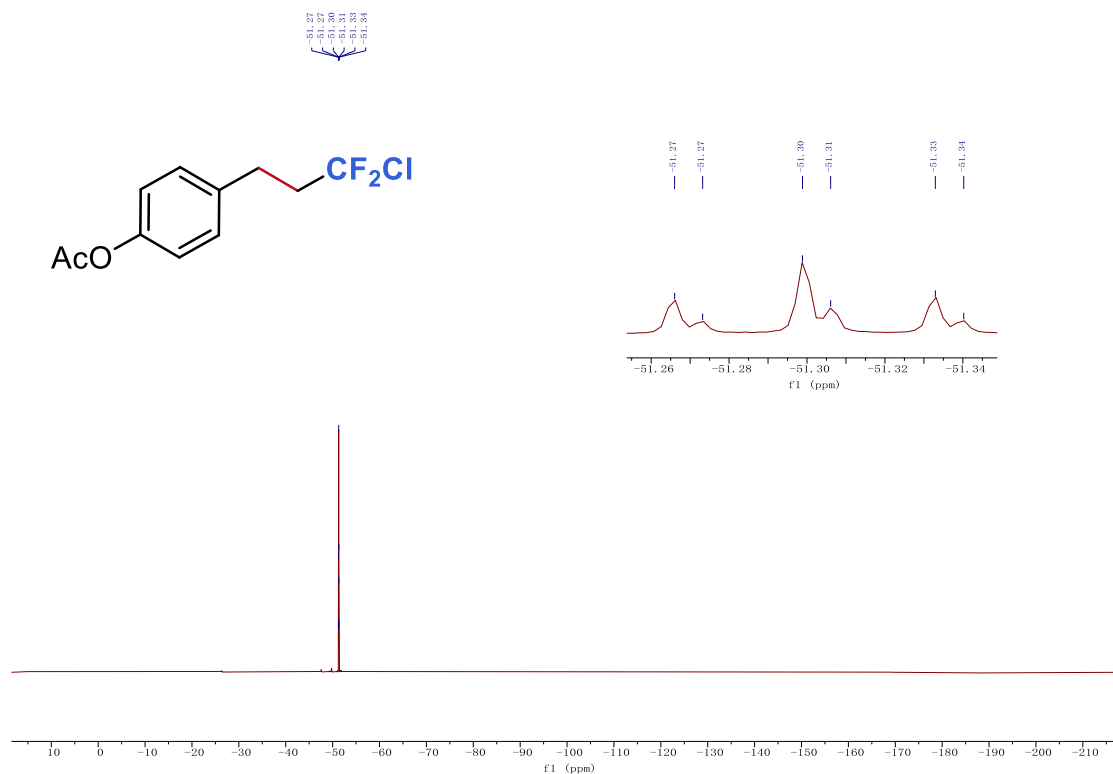
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1ah**



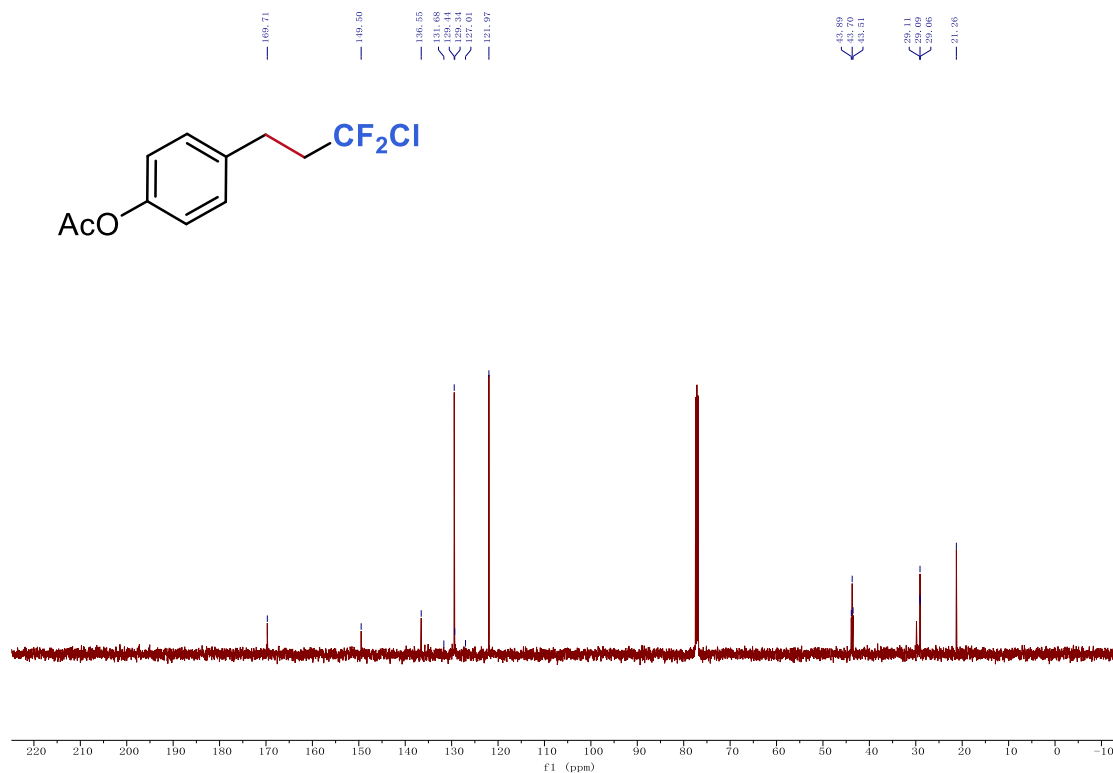
Chemical structure of 4-(benzyloxy)benzoic acid derivative (labeled 15b) is shown above the ¹³C NMR spectrum. The structure is a benzene ring with a methoxy group (MeO) at position 1 and a benzyloxy group (CH₂CH₂OC(=O)C₆H₄) at position 4. The ¹³C NMR spectrum (CDCl₃) displays peaks corresponding to the structure, with chemical shifts (ppm) labeled above the peaks: 158.48, 131.82, 131.04, 129.40, 127.18, 114.25, 55.41, 44.21, 44.02, 43.84, 28.82, 28.59, 28.71, and -10.00.

CC(=O)Oc1ccc(cc1)CC(F)(F)Cl

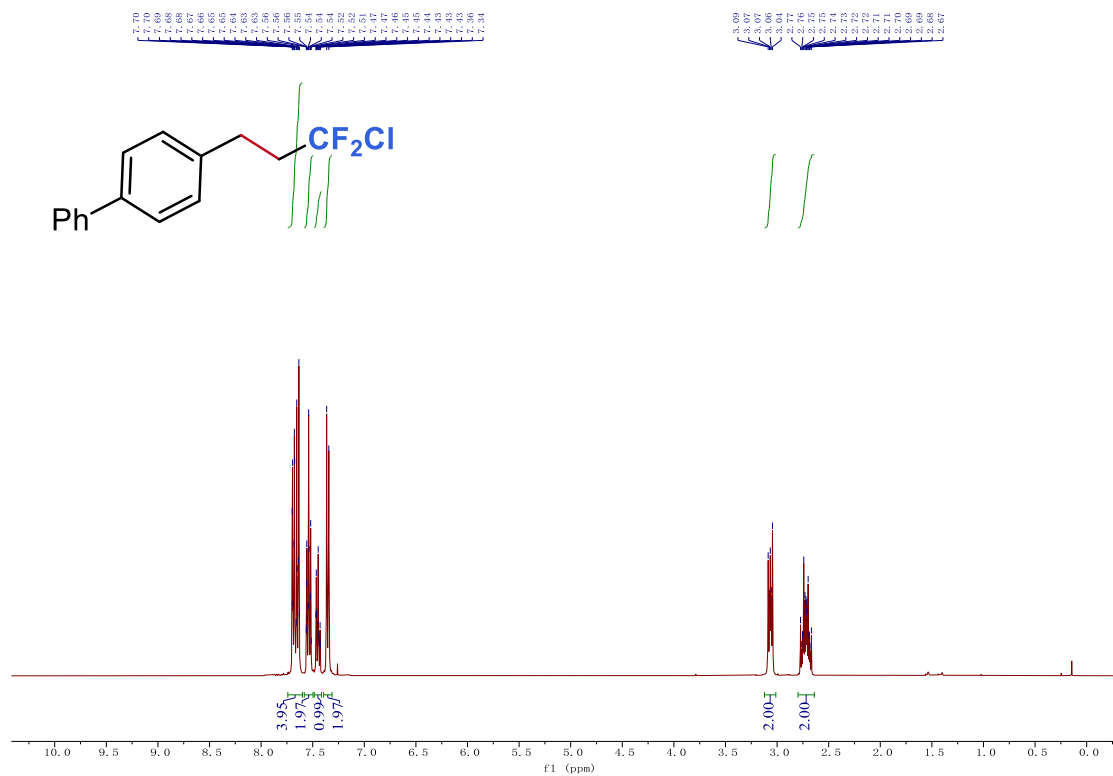
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1ai**



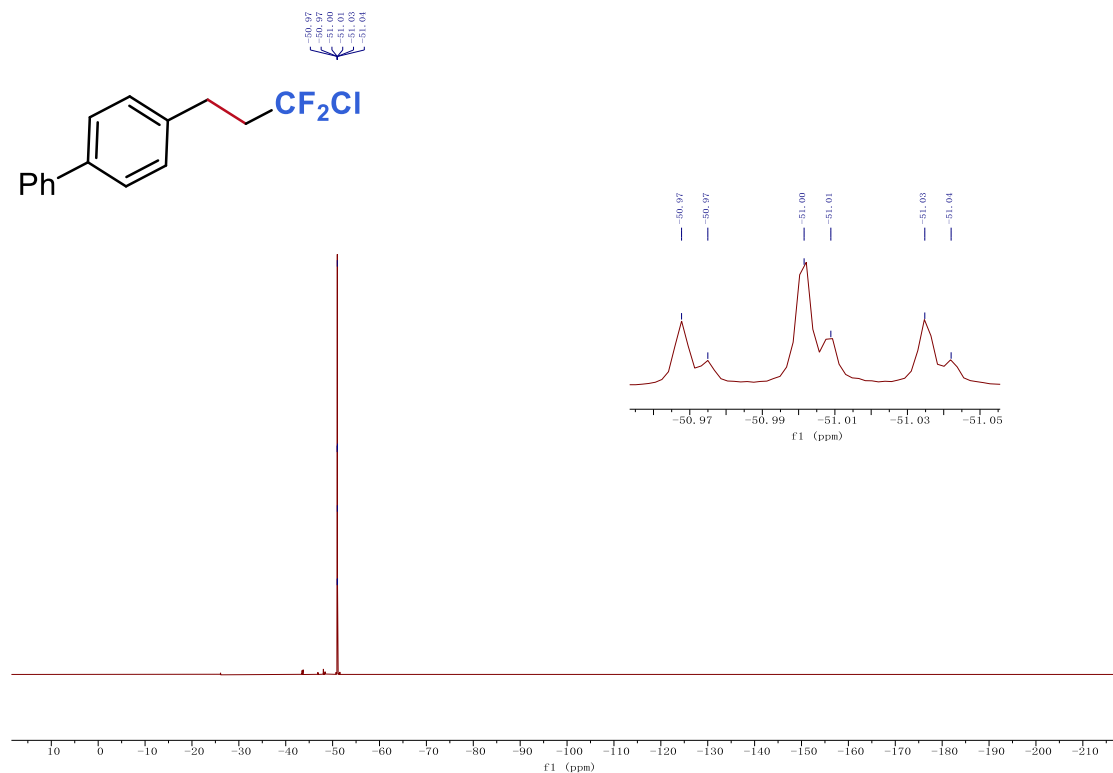
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1ai**



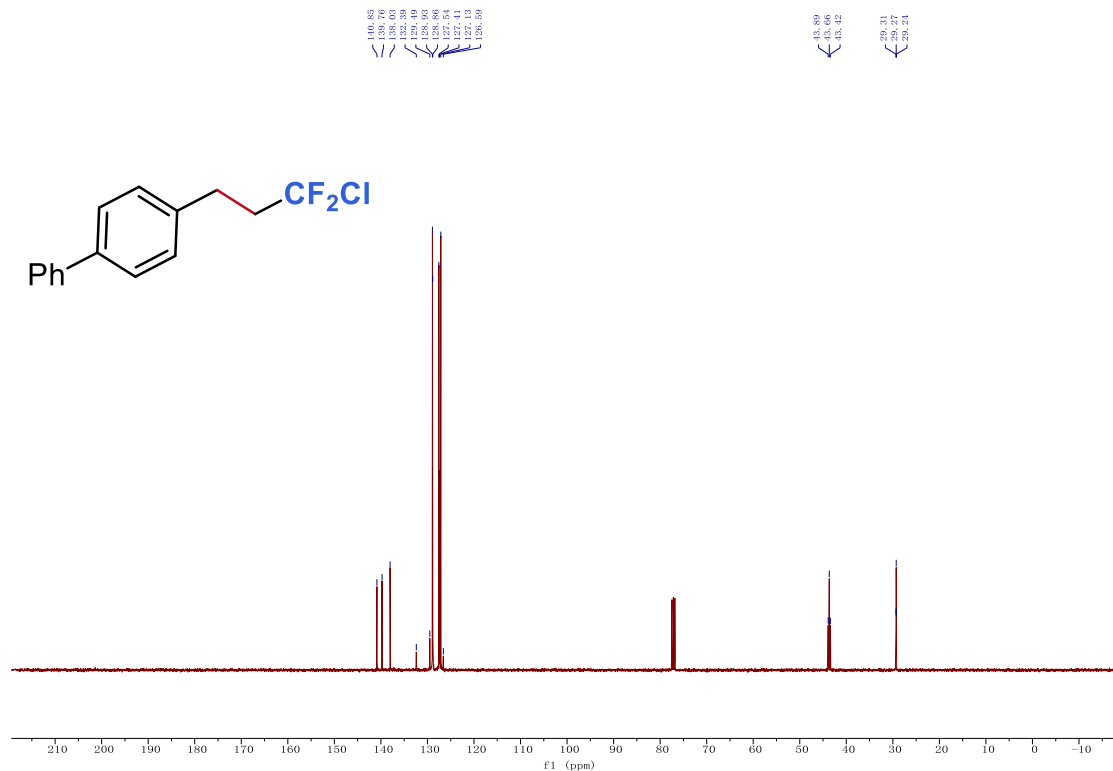
¹H NMR (400 MHz, CDCl₃) spectra for compound **1aj**



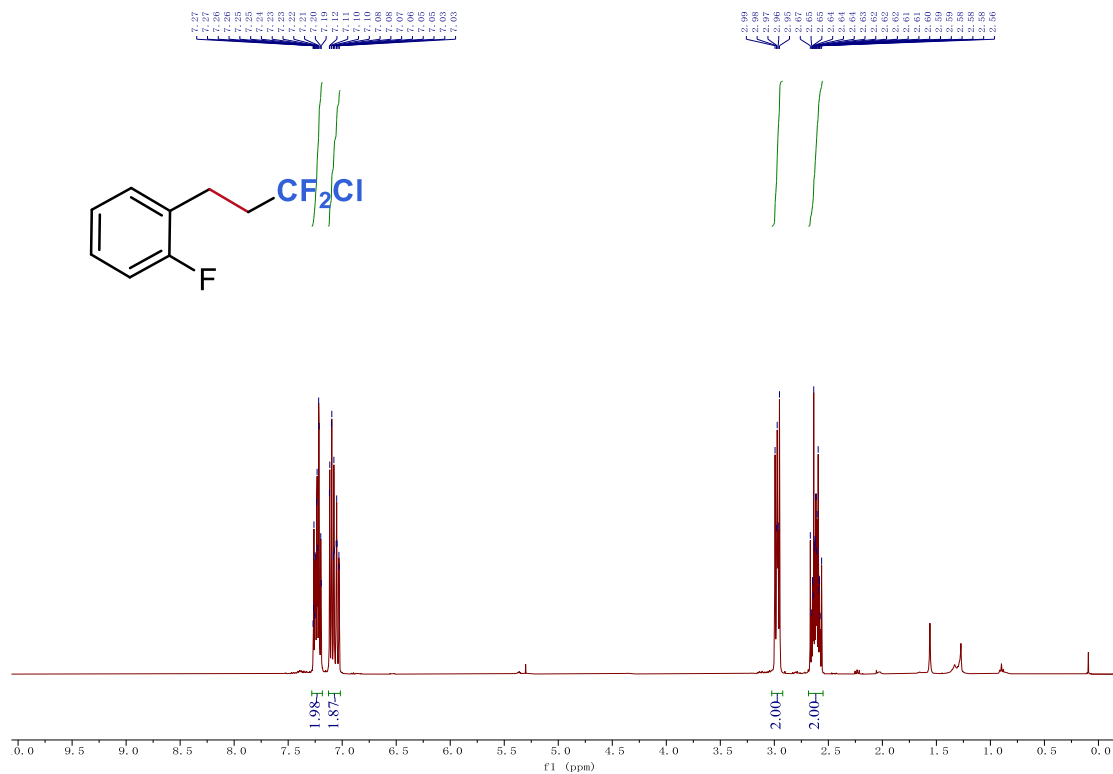
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1aj**



¹³C NMR (126 MHz, CDCl₃) spectra for compound **1aj**



¹H NMR (400 MHz, CDCl₃) spectra for compound **1ak**



Chemical structure: Fc1ccccc1CC(F)(F)Cl

^{13}C NMR spectrum (ppm):

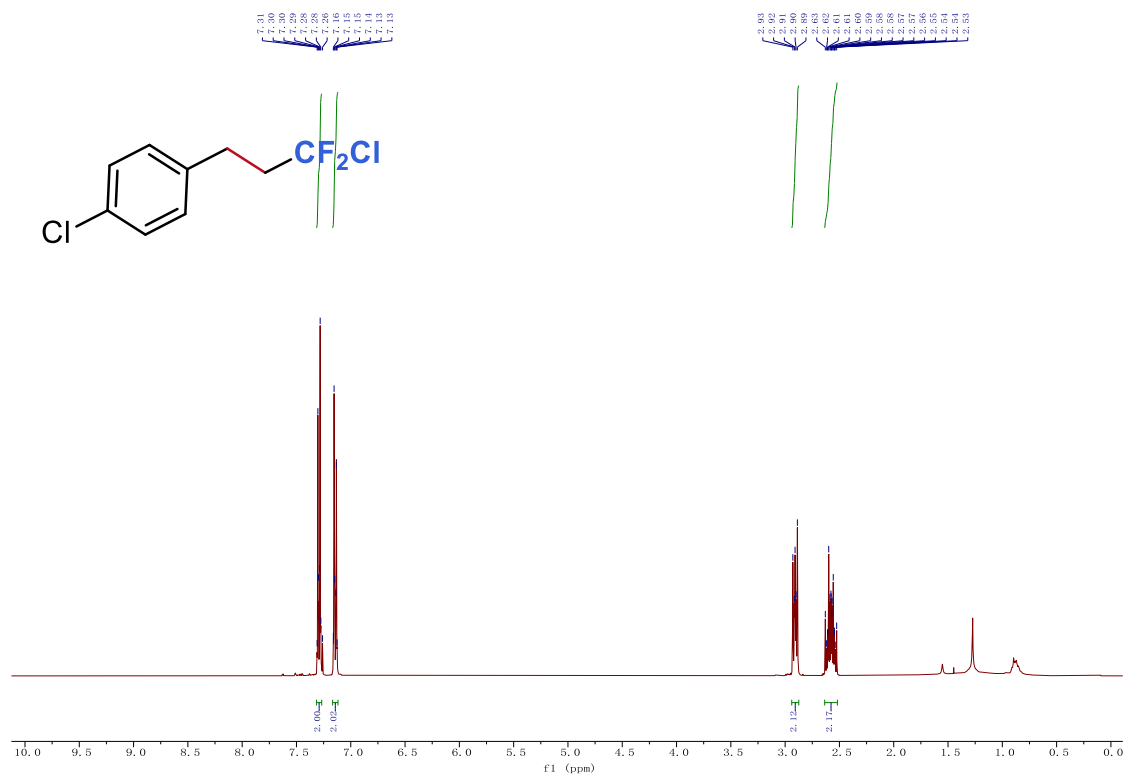
- 118.49, 118.51, 118.52, 118.53, 118.54, 118.55 (Aromatic carbons)
- 51.41, -51.44, -51.45, -51.47, -51.48 (Methylene carbons)
- 118.55 (Quaternary carbon)

Chemical structure of 2-(chlorodifluoromethyl)benzofuran (1): ClC(F)(F)c1ccccc1O

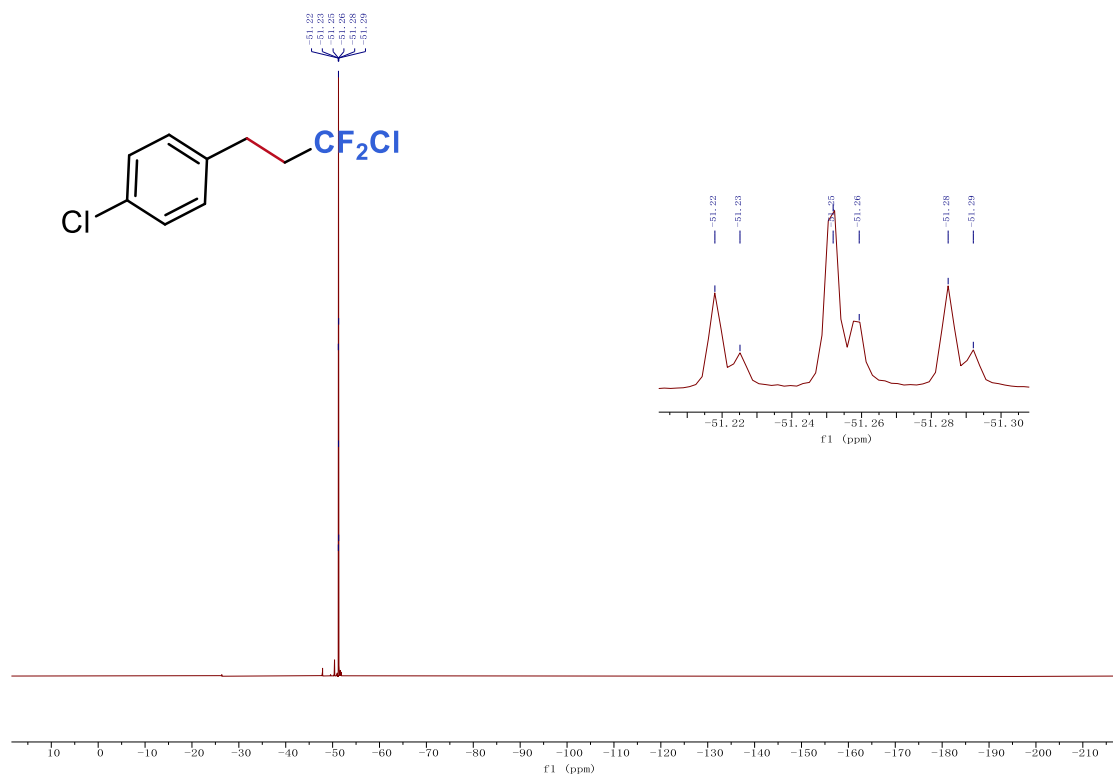
¹³C NMR spectrum (CDCl₃) showing peaks at the following chemical shifts (ppm): 162.25, 160.29, 133.70, 132.72, 130.69, 129.38, 129.08, 128.69, 127.06, 126.84, 125.89, 124.45, 122.72, 115.73, 115.56, 42.34, 42.15, 41.96, 23.61, 23.59, 23.55, 23.53.

The spectrum displays a series of peaks in the aromatic region (115-163 ppm) and a cluster of peaks in the aliphatic region (23-42 ppm). The peak at 162.25 ppm is assigned to the carbonyl carbon, and the peak at 41.96 ppm is assigned to the methoxy carbon.

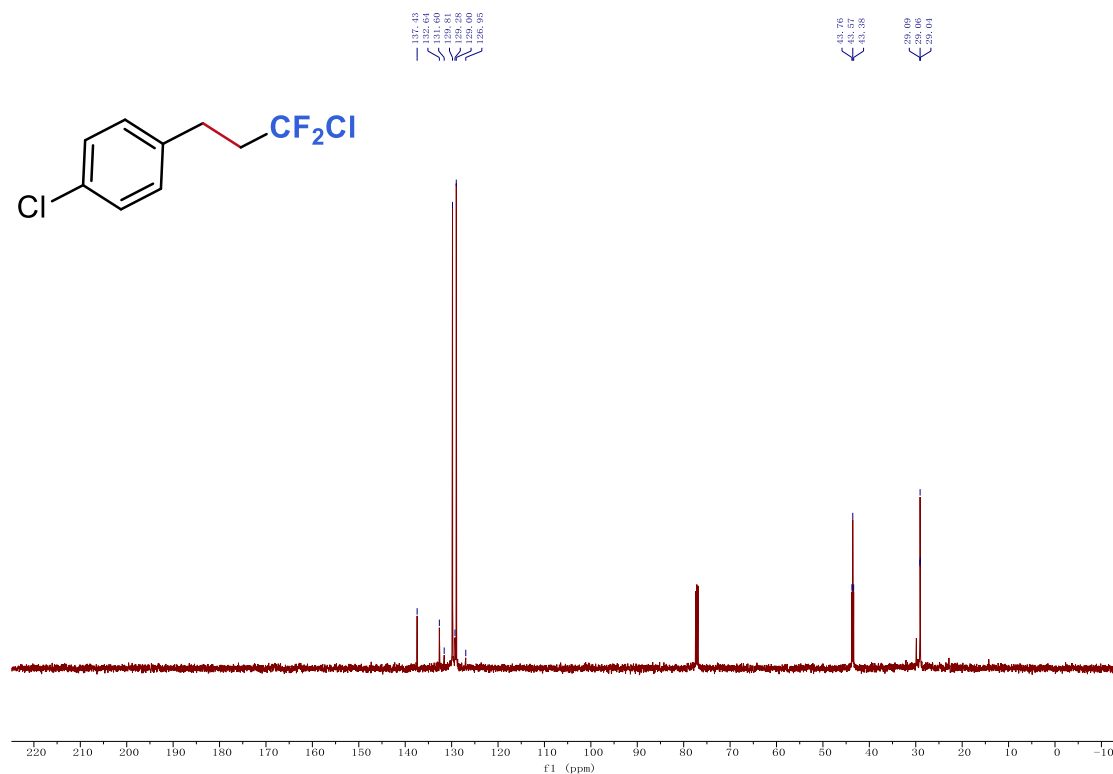
^1H NMR (400 MHz, CDCl_3) spectra for compound **1al**



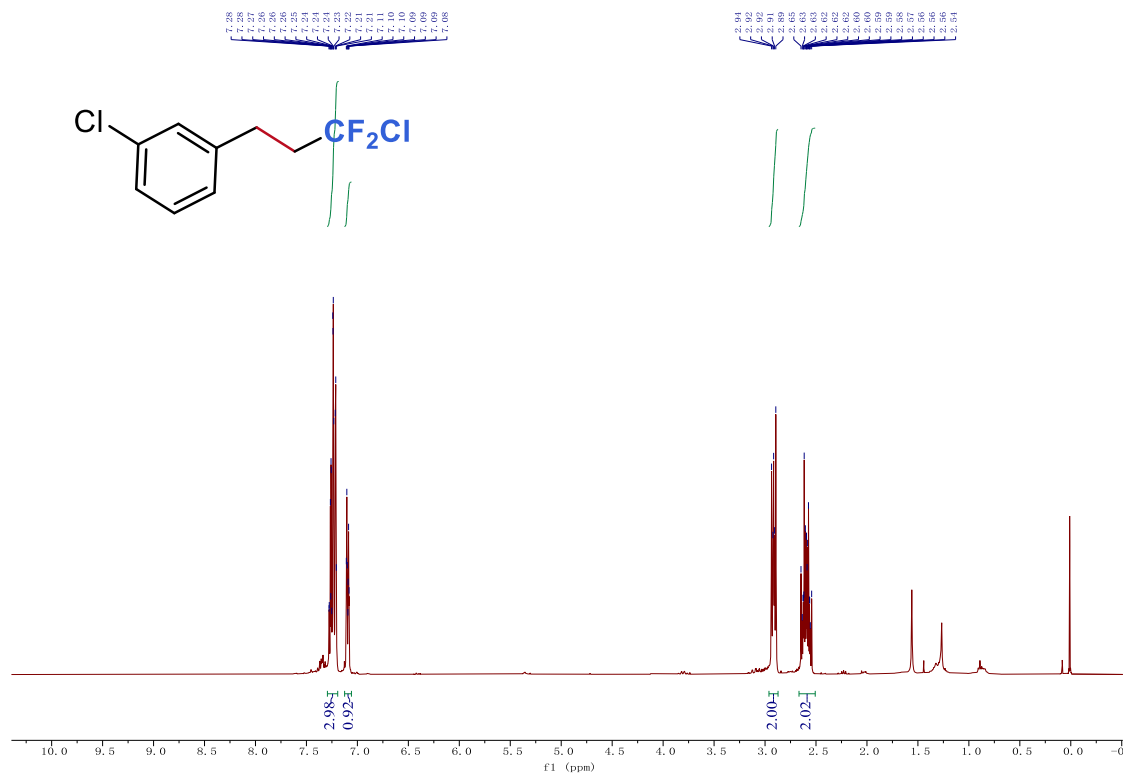
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1al**



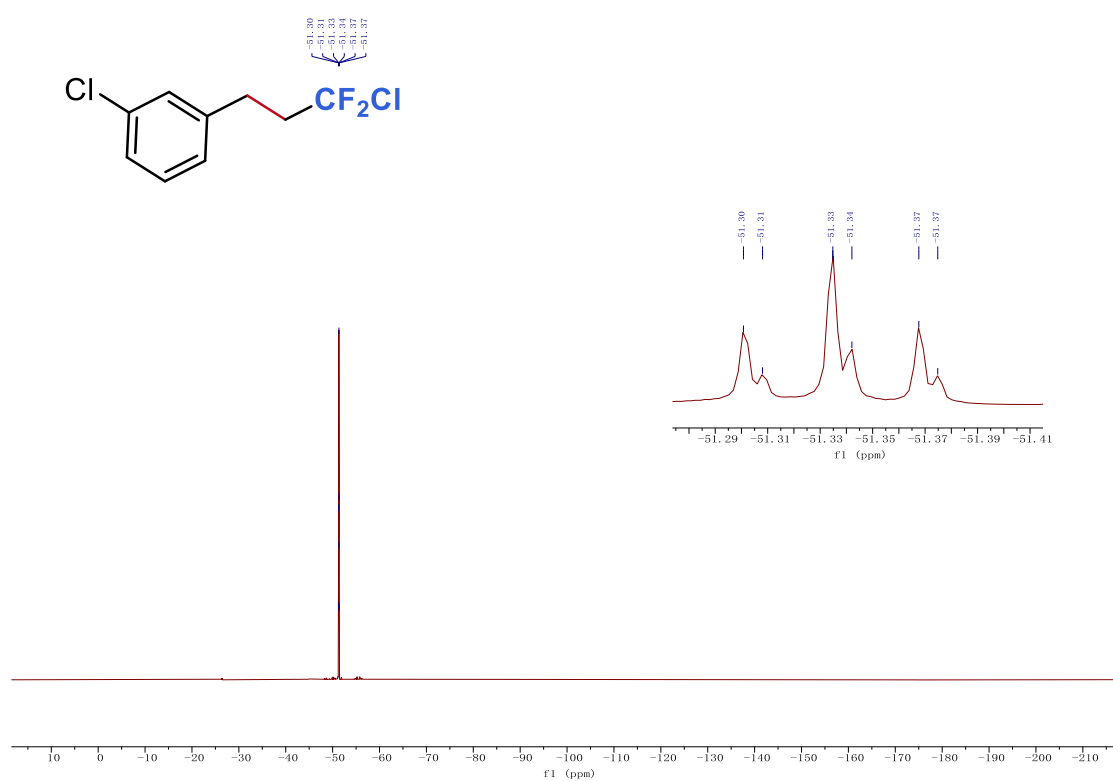
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1al**



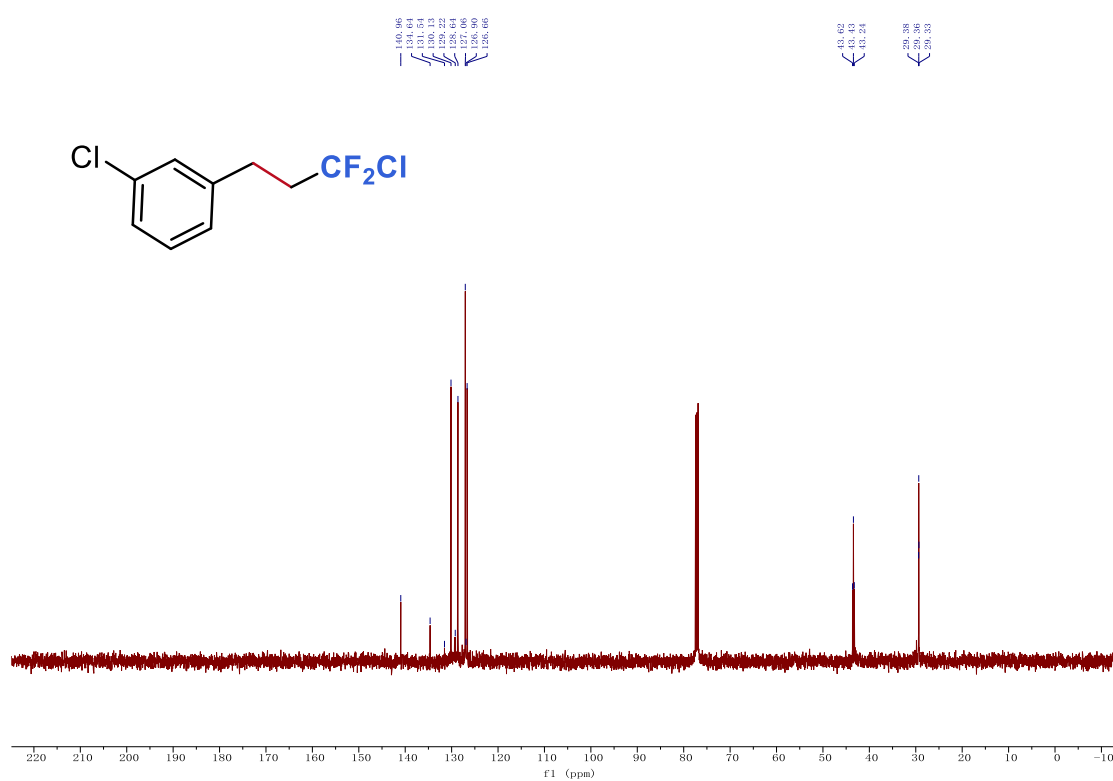
¹H NMR (400 MHz, CDCl₃) spectra for compound **1am**



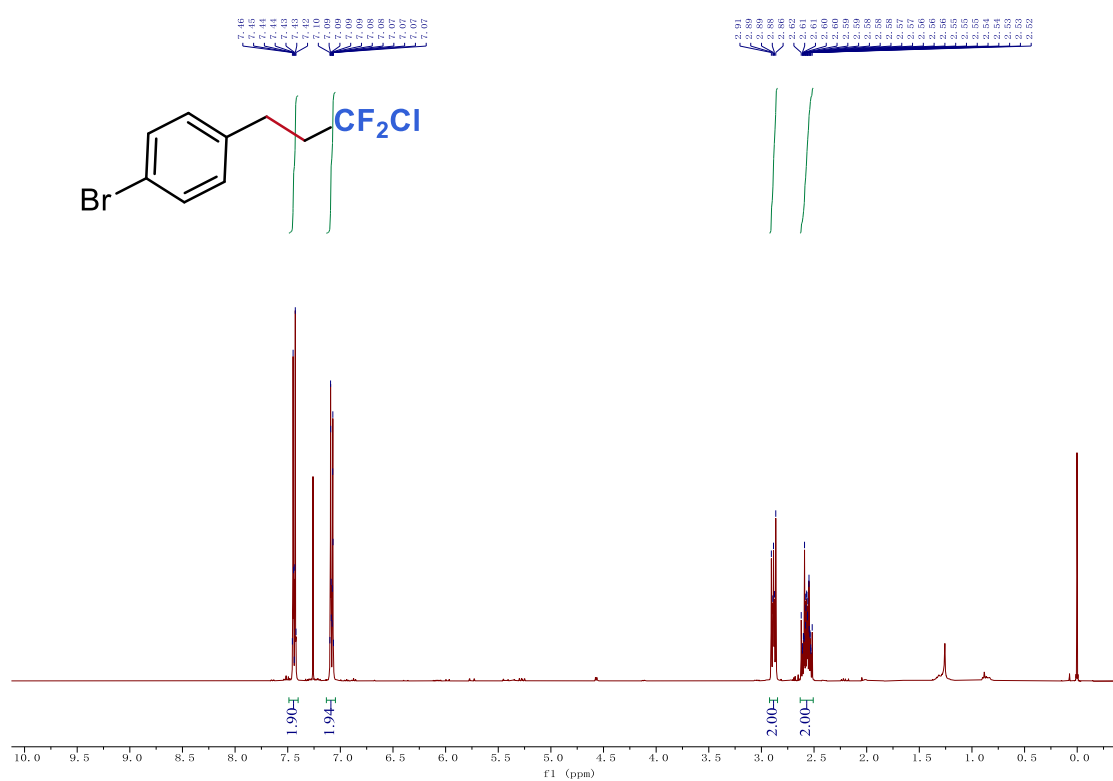
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1am**



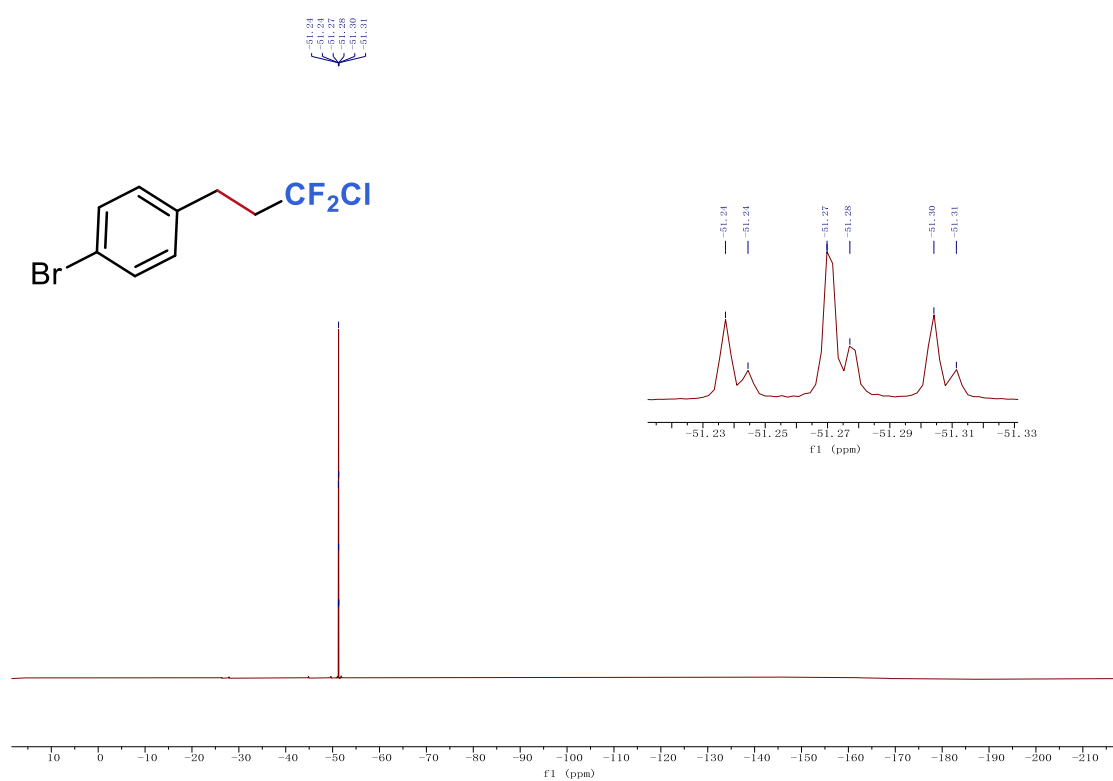
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1am**



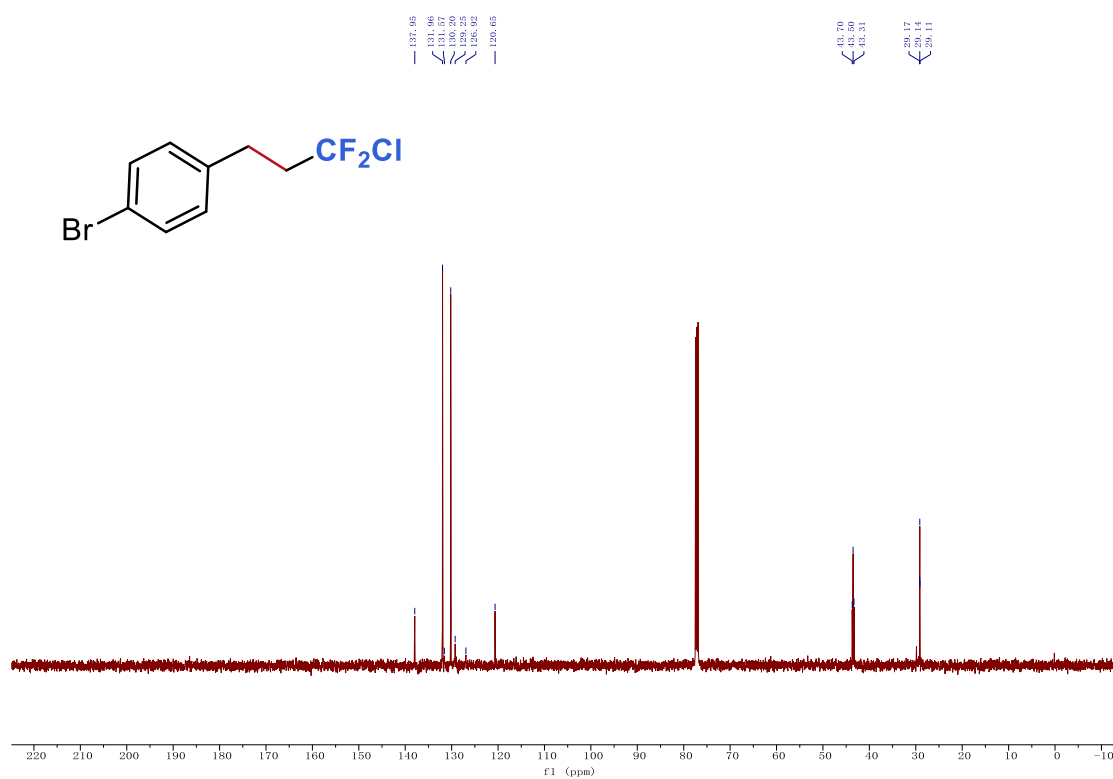
^1H NMR (400 MHz, CDCl_3) spectra for compound **1an**



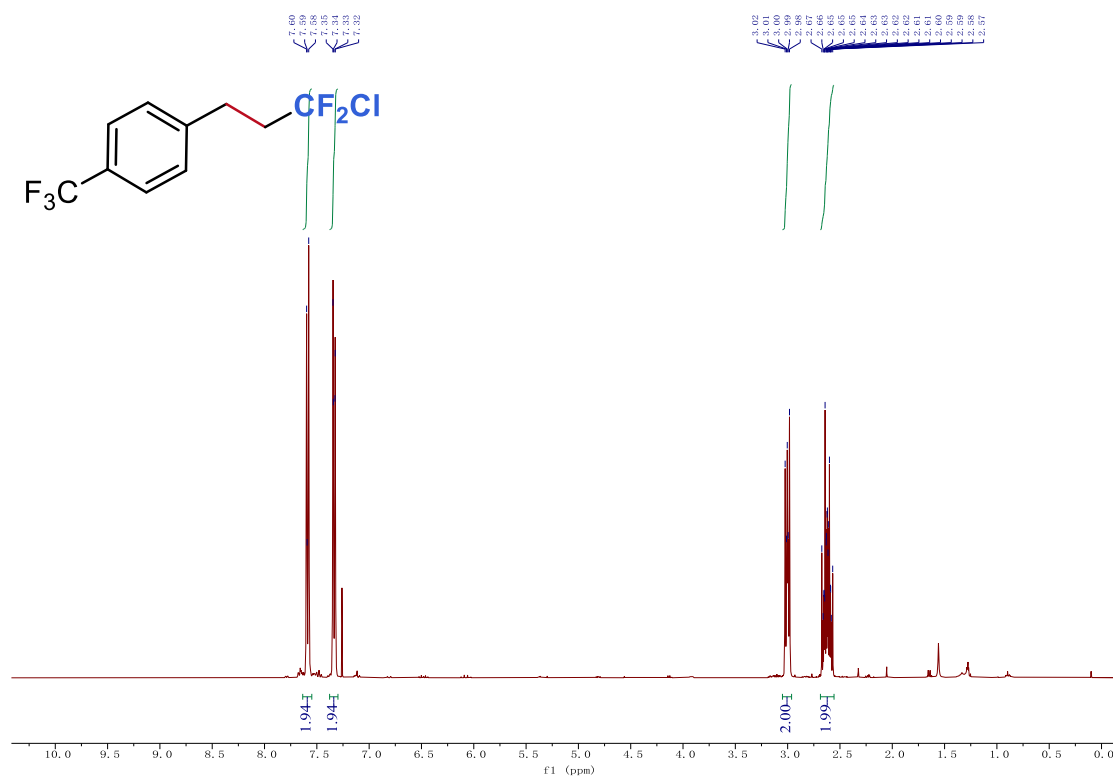
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1an**



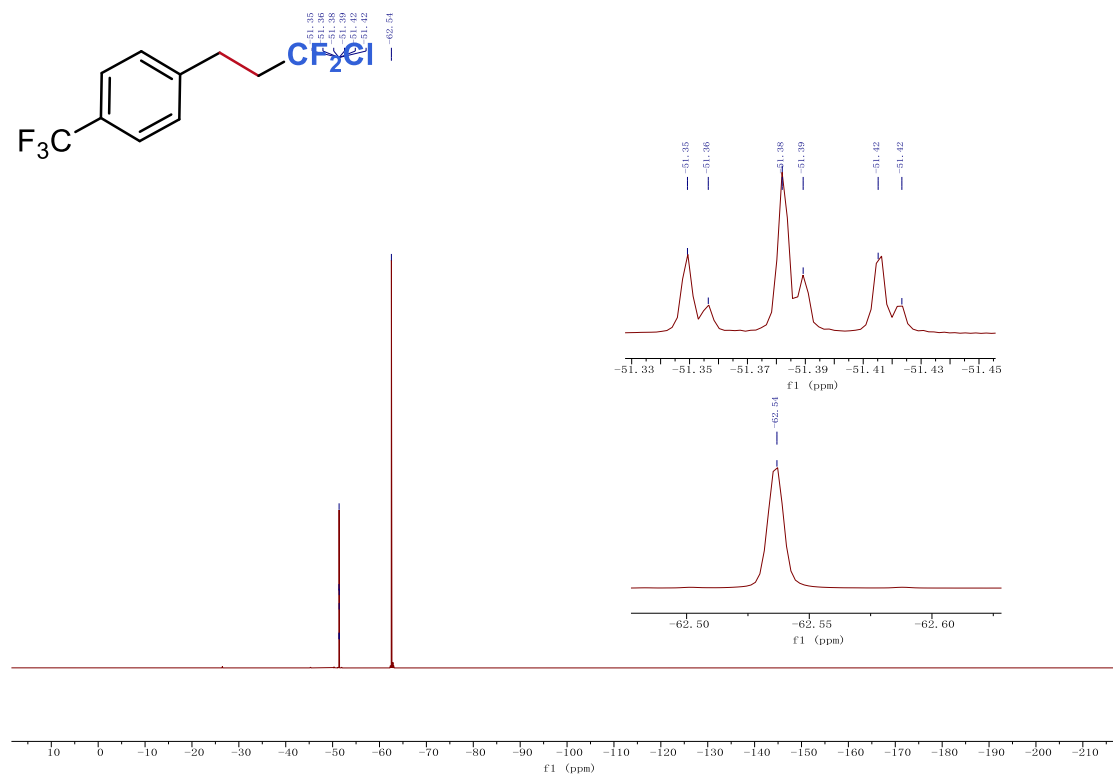
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1an**



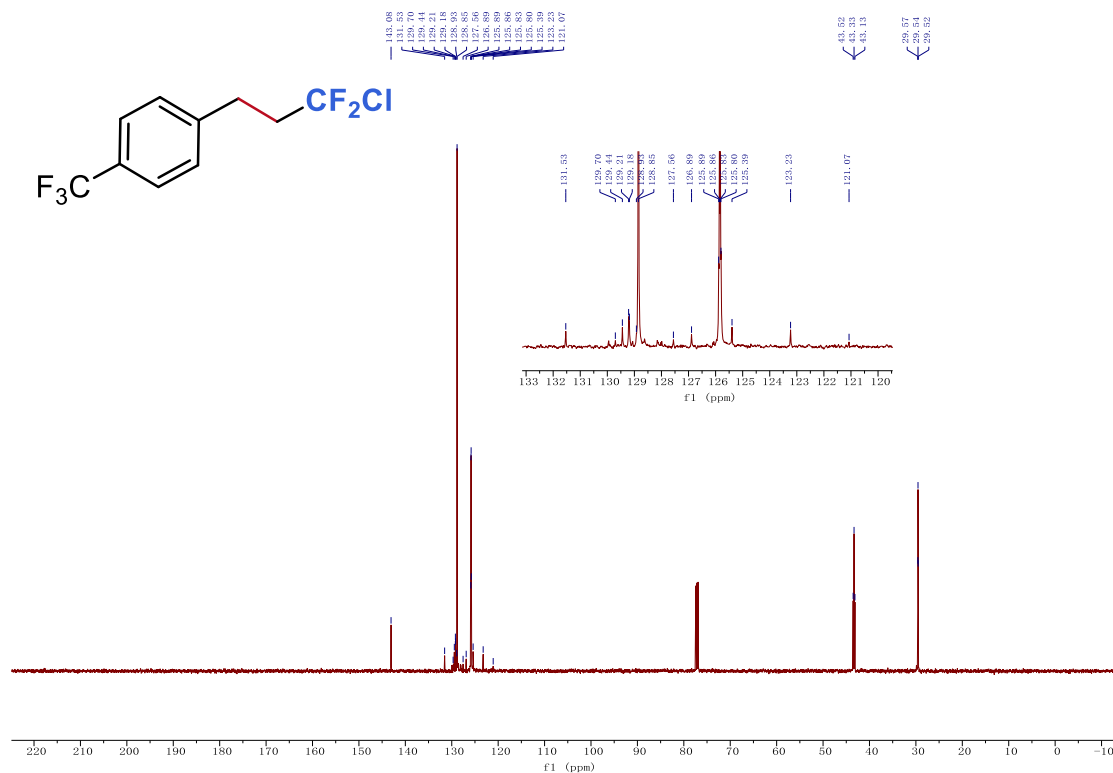
^1H NMR (400 MHz, CDCl_3) spectra for compound **1ao**



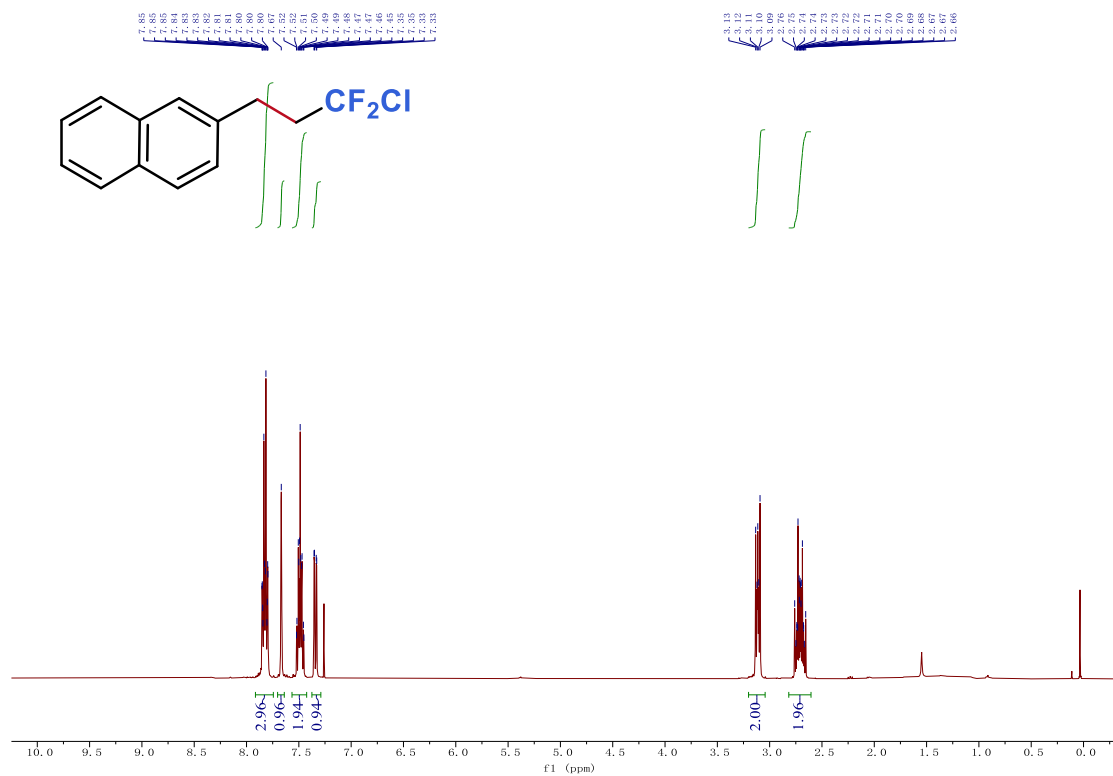
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound **1ao**



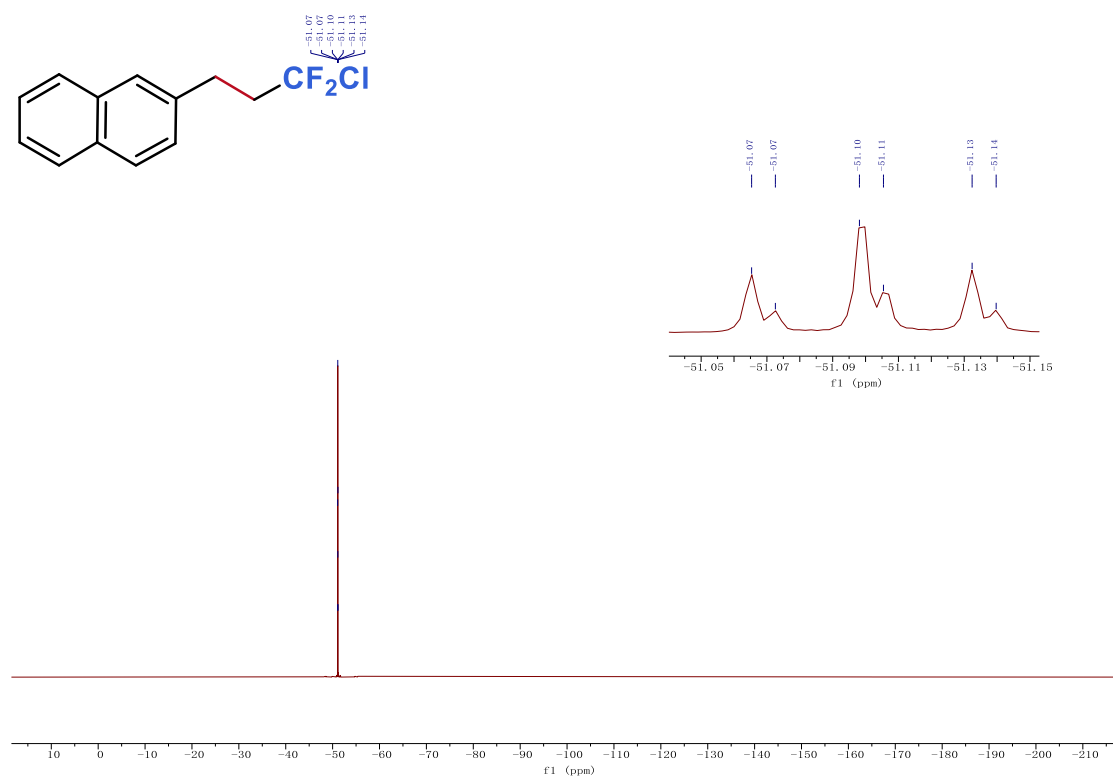
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1ao**



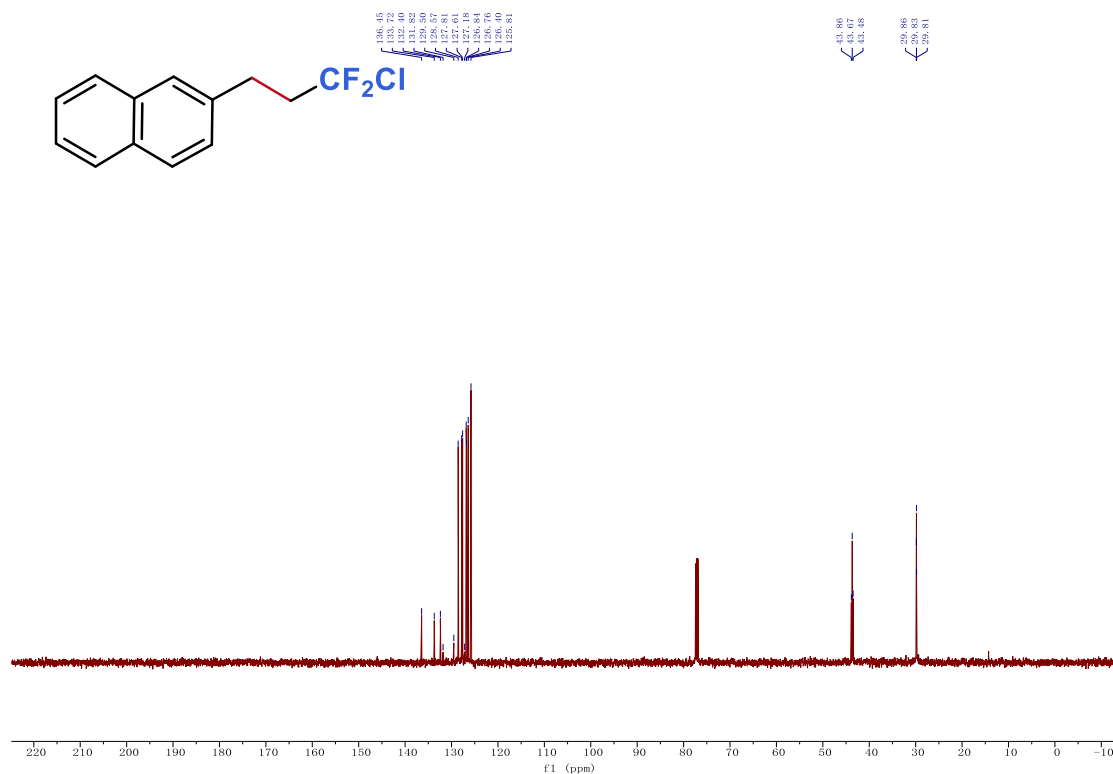
^1H NMR (400 MHz, CDCl_3) spectra for compound **1ap**



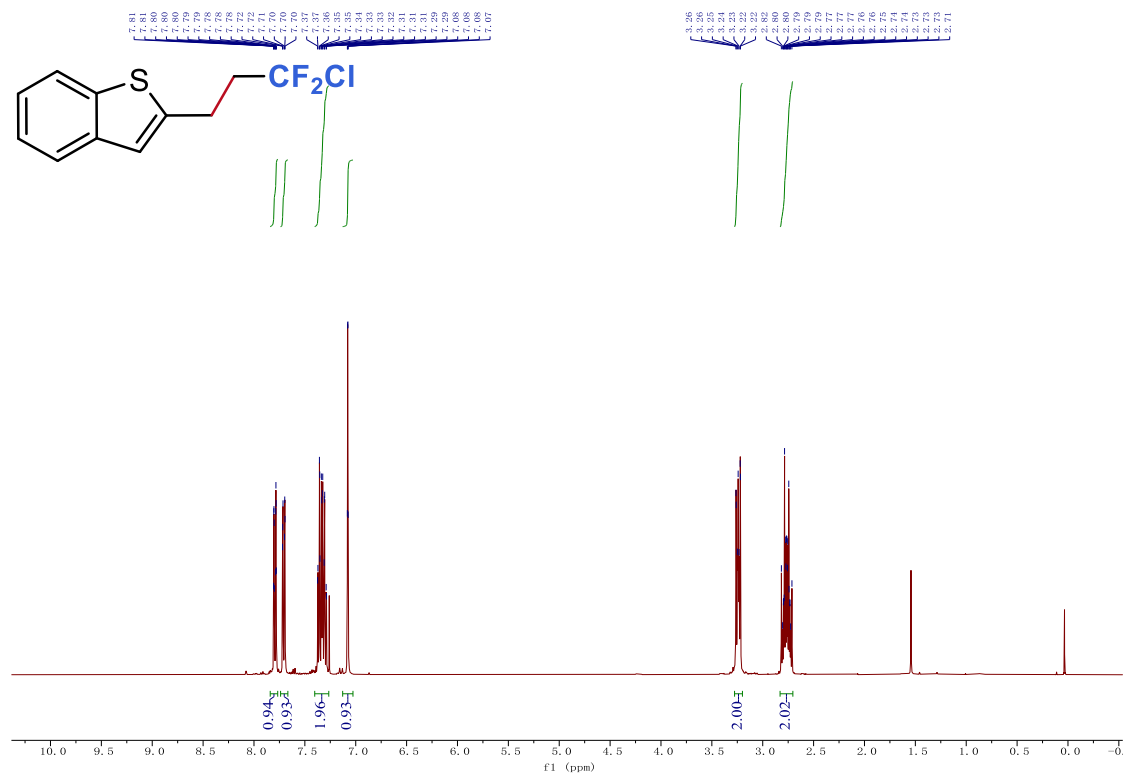
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1ap**



¹³C NMR (126 MHz, CDCl₃) spectra for compound **1ap**



¹H NMR (400 MHz, CDCl₃) spectra for compound **1aq**



Chemical structure: ClC(F)(F)c1cc2ccccc2s1

^{13}C NMR peak list (ppm):

- 125.33
- 125.33
- 125.33
- 125.36
- 125.37
- 125.37
- 125.40

Peak list (ppm):

- 125.33
- 125.33
- 125.36
- 125.37
- 125.39
- 125.40

Chemical structure: ClC(F)(F)c1ccc2ccccc2s1

¹³C NMR peaks (ppm):

- 142.15
- 140.01
- 139.17
- 138.89
- 138.99
- 126.08
- 125.94
- 125.94
- 125.18
- 123.18
- 122.30
- 122.30
- 121.70
- 43.49
- 43.24
- 43.00
- 24.93
- 24.89
- 24.68

¹H NMR spectrum of 1-(2-chloro-2-fluoroethyl)benzene

Chemical Structure: ClC(F)(C)Cc1ccccc1

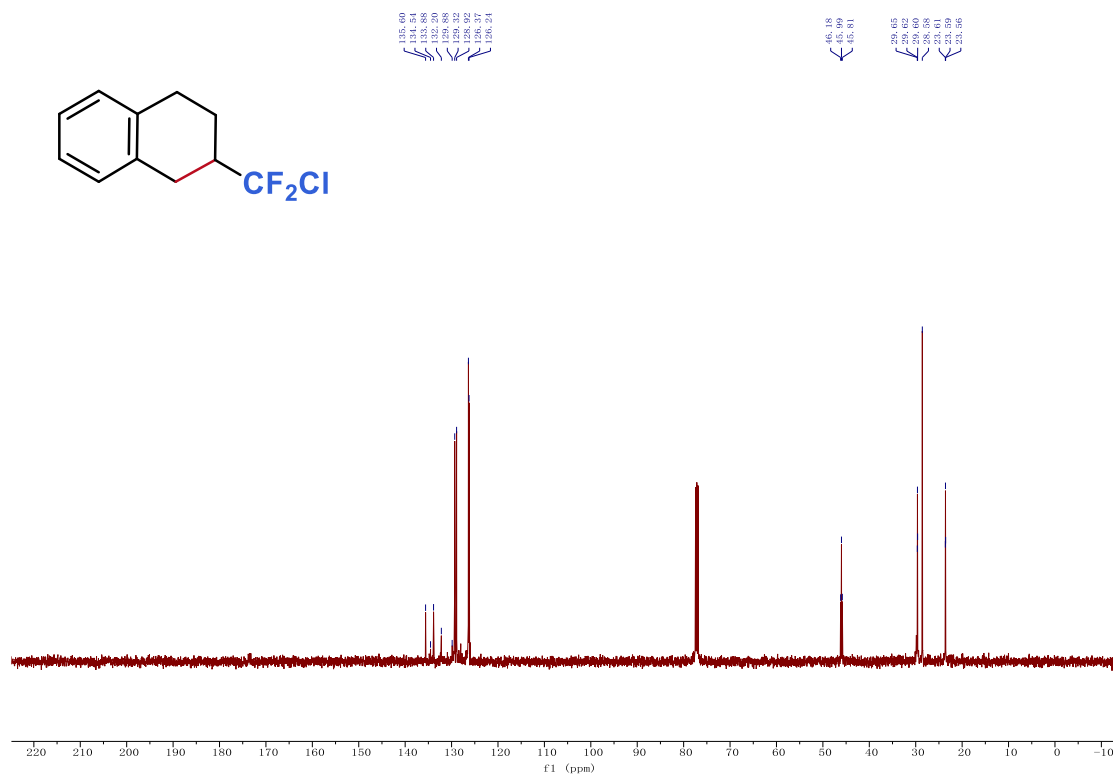
Peak Data:

Chemical Shift (ppm)	Multiplicity	Integration
7.15 - 7.11	m (aromatic)	3.88
2.55 - 2.70	quartet	1.04, 3.19, 1.00, 1.08
1.10	doublet	1.10

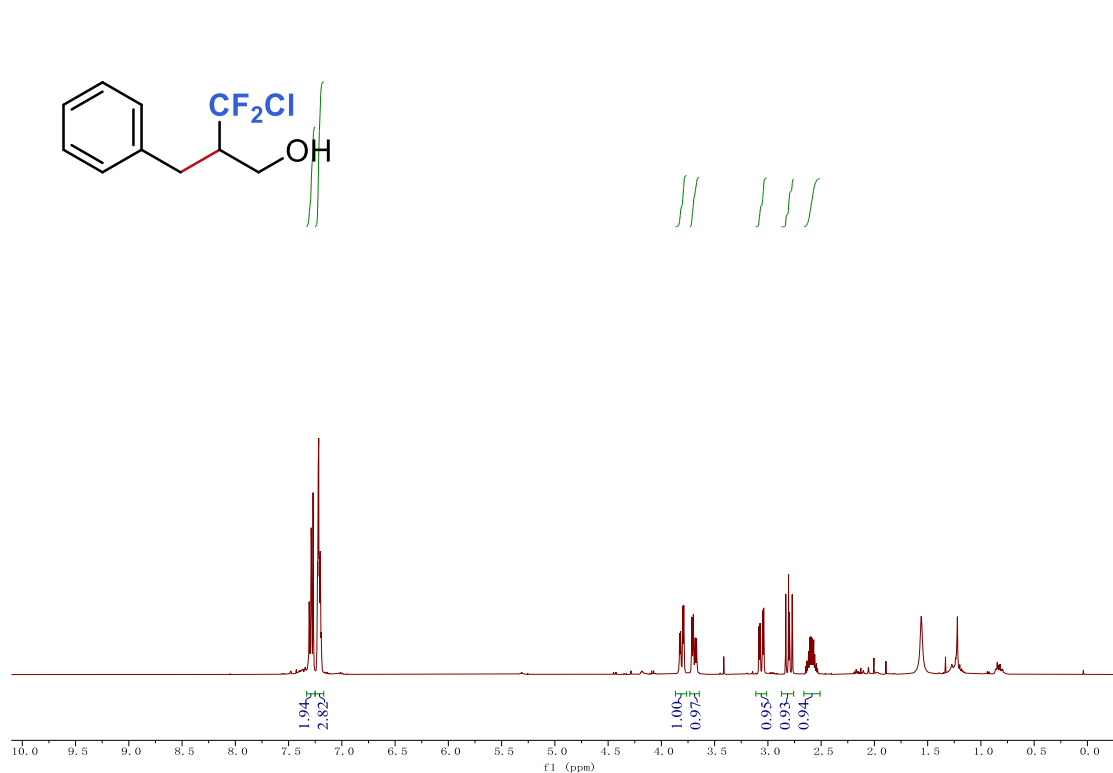
The main spectrum shows a large solvent peak at -56.1 ppm. The inset shows the following peak labels (ppm):

Peak Label (ppm)
-56.10
-56.12
-56.18
-56.19
-56.59
-56.61
-56.62
-56.84
-56.95
-56.97
-57.07
-57.38
-57.40
-57.41

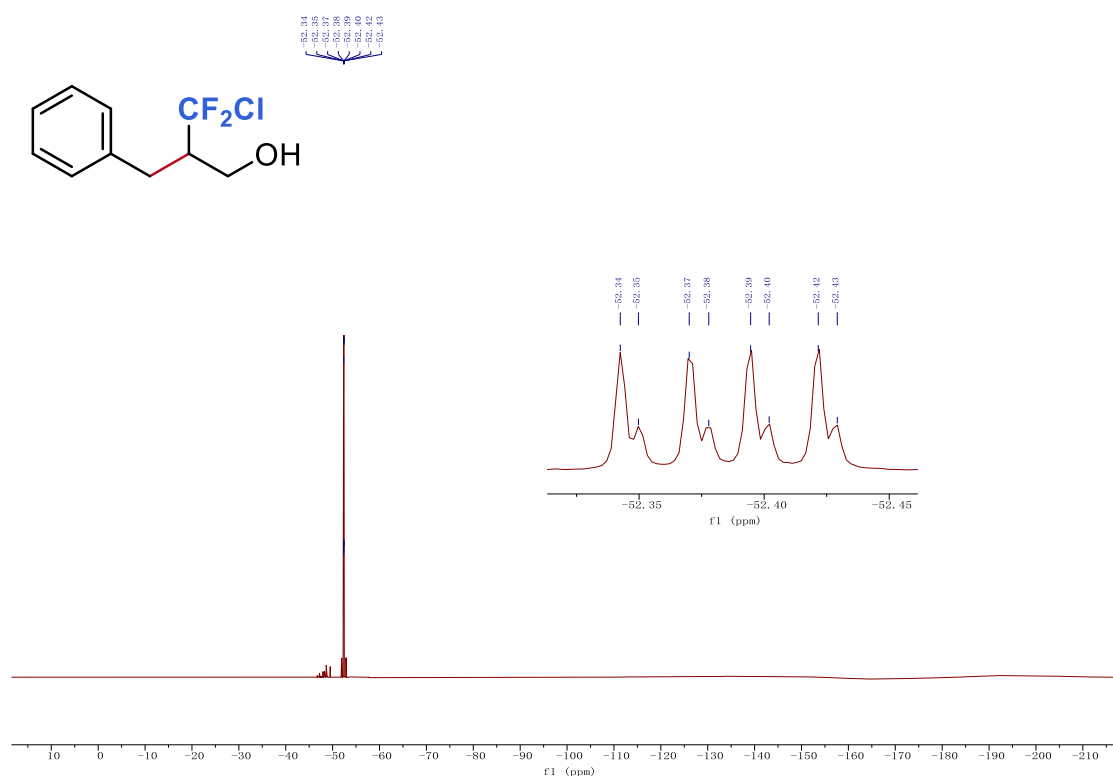
¹³C NMR (126 MHz, CDCl₃) spectra for compound **1ar**



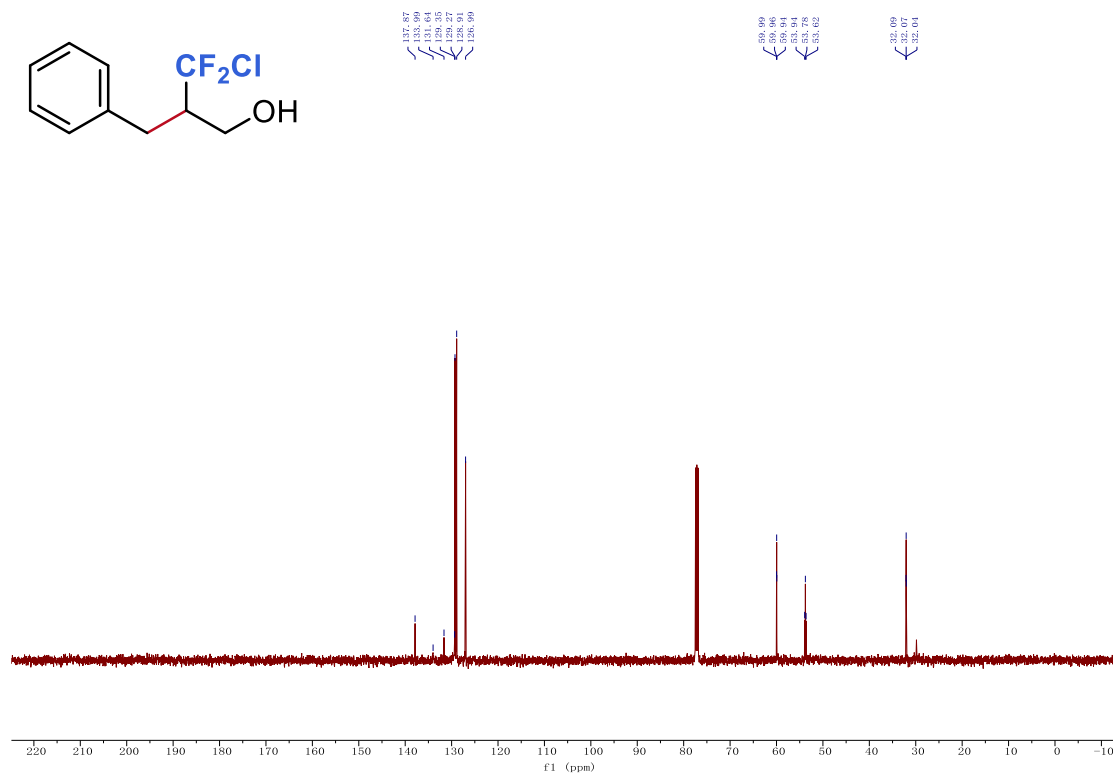
¹H NMR (400 MHz, CDCl₃) spectra for compound **1as**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1as**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1as**



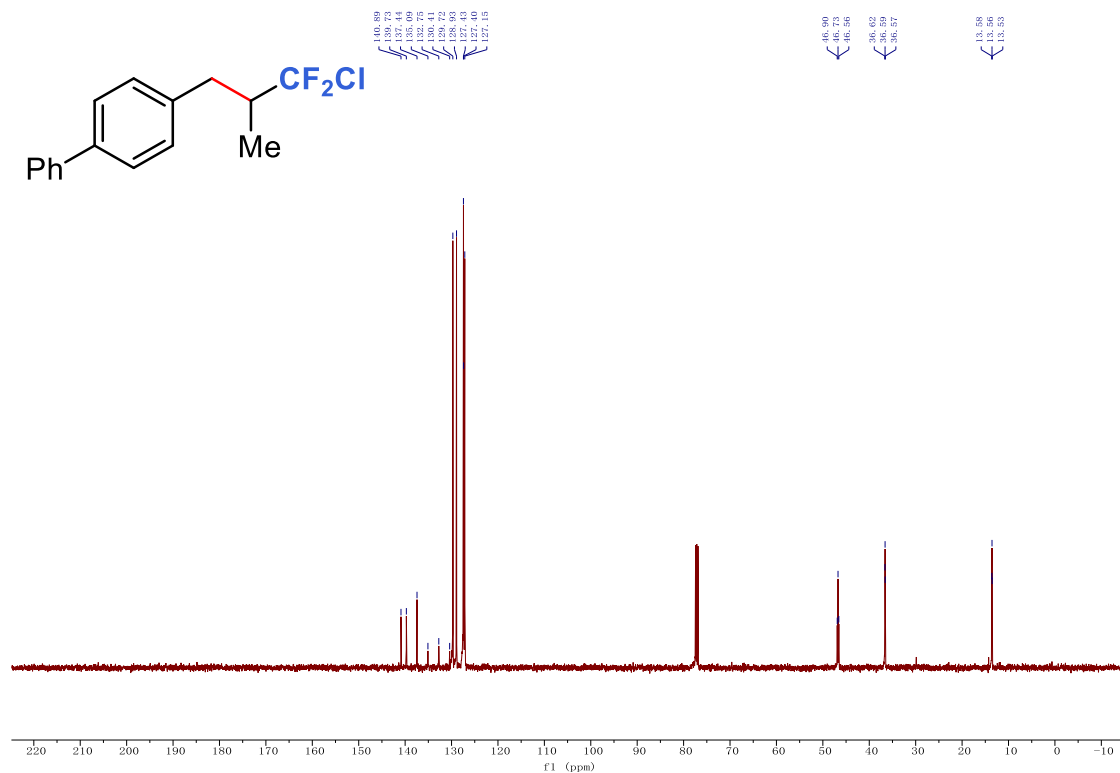
Chemical structure: CC(Cl)(F)Cc1ccc(cc1)/C=C/C

¹H NMR spectrum (400 MHz, CDCl₃) showing peaks from 0.0 to 10.0 ppm. Integration values are shown below the peaks.

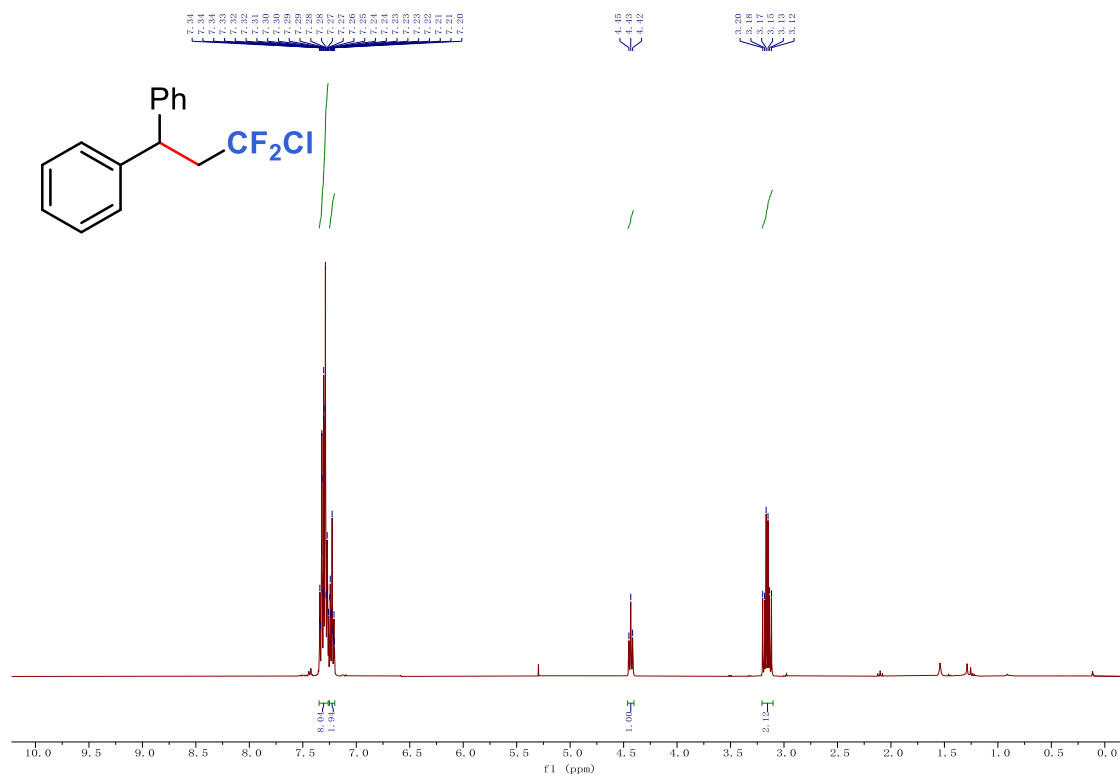
Chemical Shift (ppm)	Integration
7.45 - 7.55	3.93
7.35 - 7.45	1.94
7.25 - 7.35	1.00
7.15 - 7.25	2.02
6.60	-
4.80	1.00
2.45 - 2.55	0.95
2.35 - 2.45	1.01
1.00 - 1.10	2.98

Chemical structure of 1-(4-phenylphenyl)ethane-1,1-dichloroethane (Ph-CH₂-CHCl₂-Me) is shown above the spectrum. The spectrum displays a sharp peak at approximately 53 ppm, corresponding to the CDCl₃ solvent triplet. The x-axis is labeled f1 (ppm) and ranges from 10 to -210.

^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1at**



^1H NMR (400 MHz, CDCl_3) spectra for compound **1au**



Chemical structure: (S)-1-chloro-2-phenylethan-1-ol

^{13}C NMR spectrum (ppm):

- Full spectrum range: -120 to -210 ppm
- Inset range: -48.44 to -48.56 ppm
- Peak labels in inset (ppm): -48.46, -48.47, -48.49, -48.50, -48.53, -48.54

Chemical structure of 1-(benzyloxy)-2-(chlorodifluoromethyl)ethane (BOM-2-Cl) is shown above the ^{13}C NMR spectrum. The structure consists of a benzene ring attached to a CH_2 group, which is further attached to a CH group. This CH group is also attached to a CF_2Cl group. The ^{13}C NMR spectrum displays peaks corresponding to the carbon atoms in the molecule, with chemical shifts (ppm) labeled above the peaks: 142.97, 131.69, 128.35, 127.73, 127.01, 126.50, 77.00, 76.22, 75.34, 46.50, 46.18, and 46.17.

Chemical structure: CC12CCC(=O)C1[C@H]3[C@@H]4CCCC=C5C3=CC(=CC=C5)C[C@H]4C[C@@H]2C (Androstane derivative) with a CF_2Cl group.

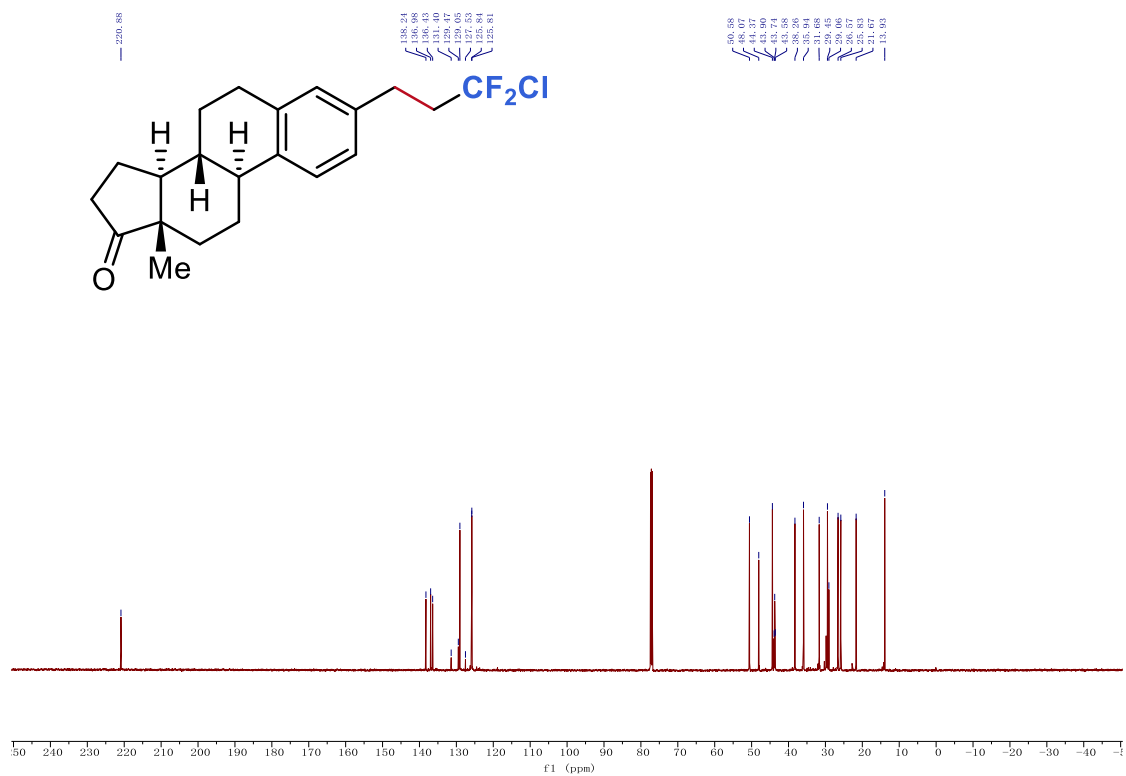
^1H NMR spectrum (ppm):

- 7.14 (d, 1.14H)
- 7.02 (d, 1.02H)
- 7.00 (d, 1.00H)
- 2.60 (t, 4.12H)
- 2.40 (m, 3.95H)
- 2.20 (m, 1.10H)
- 2.00 (m, 4.20H)
- 1.50 (m, 6.36H)
- 1.00 (m, 3.04H)

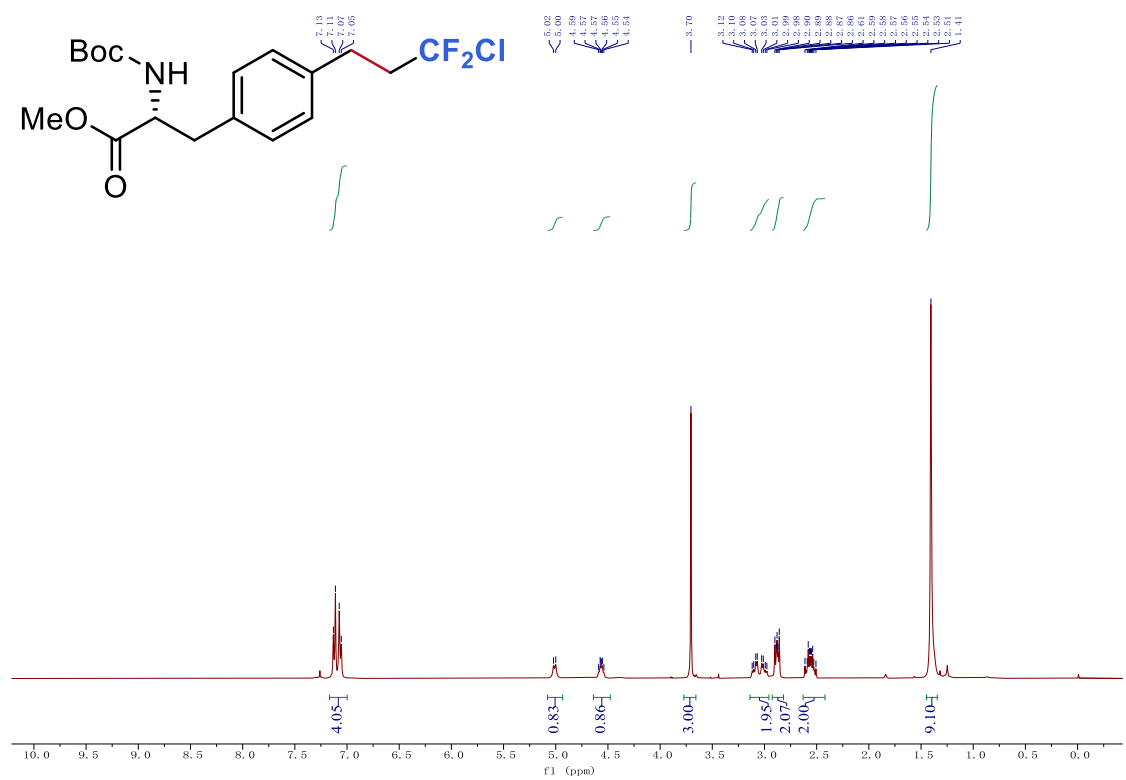
Chemical structure of 1-(2-chloro-2-fluoroethyl)-1-methyl-5-oxo-5,6,7,8-tetrahydronaphthalene-2-carboxylic acid. The structure shows a naphthalene ring system with a methyl group and a ketone group on the left, and a 2-chloro-2-fluoroethyl group on the right. The CF₂Cl group is highlighted in red.

¹³C NMR spectrum (f1 (ppm)) showing peaks at -51.19, -51.20, -51.23, and -51.27 ppm. The x-axis ranges from -120 to -210 ppm.

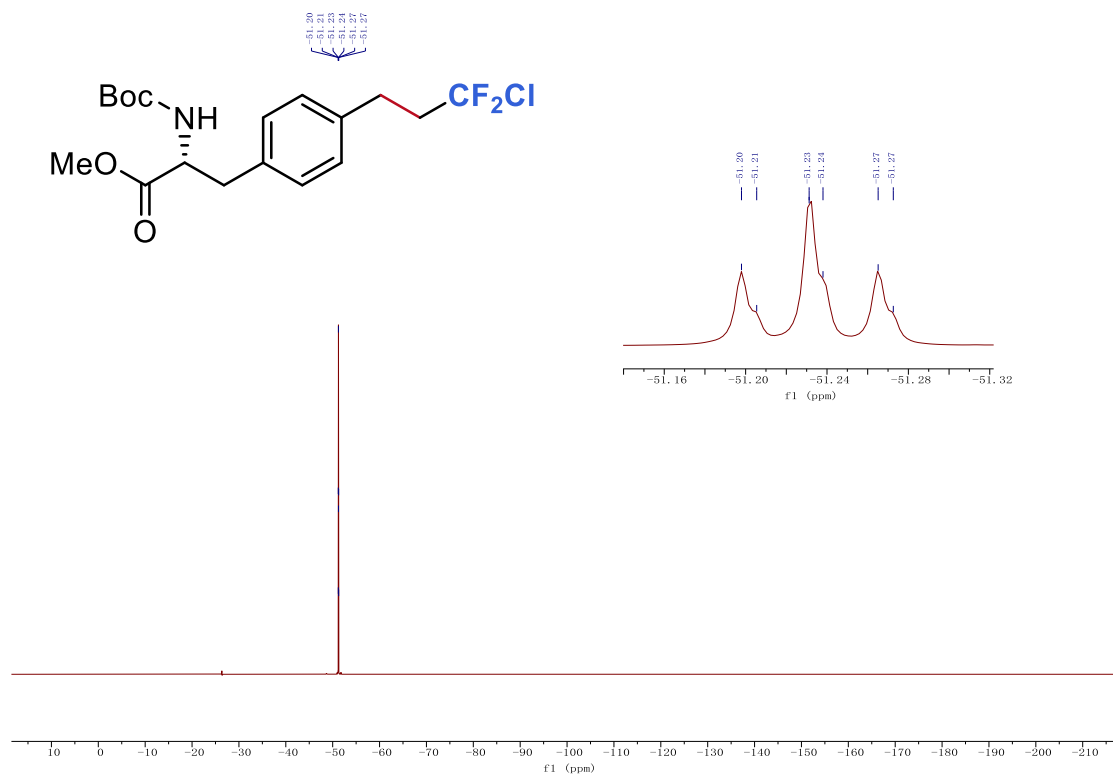
¹³C NMR (151 MHz, CDCl₃) spectra for compound **1av**



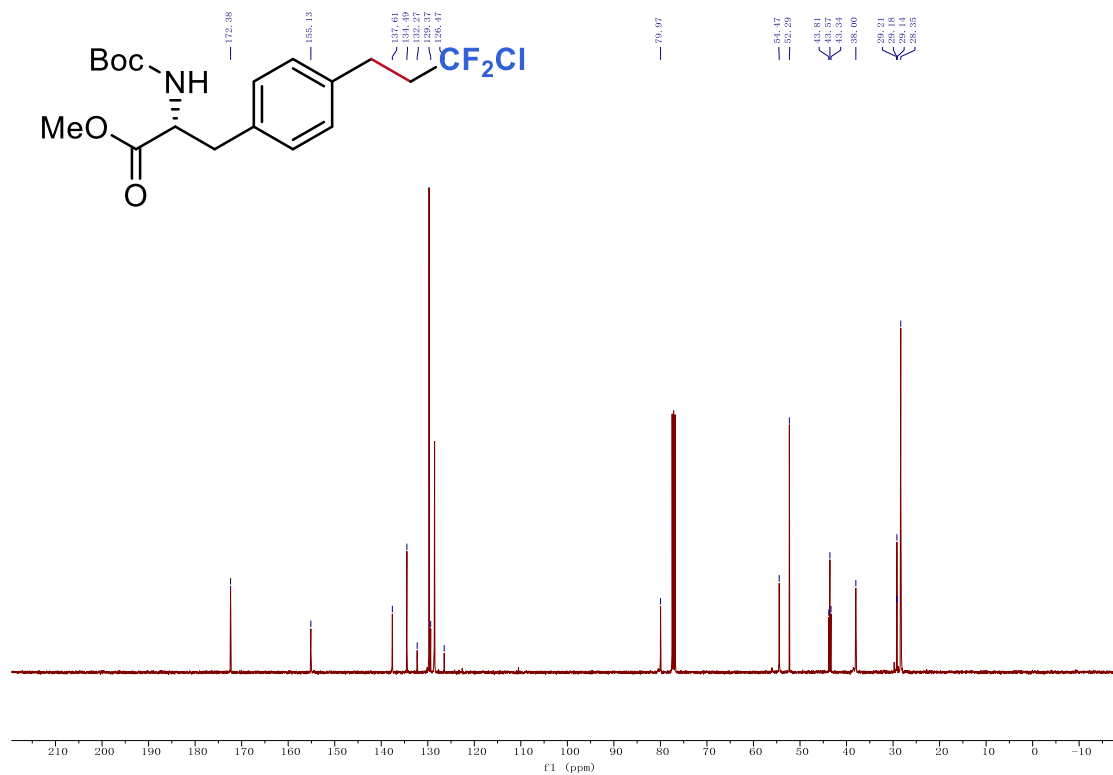
¹H NMR (400 MHz, CDCl₃) spectra for compound **1aw**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **1aw**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound **1aw**



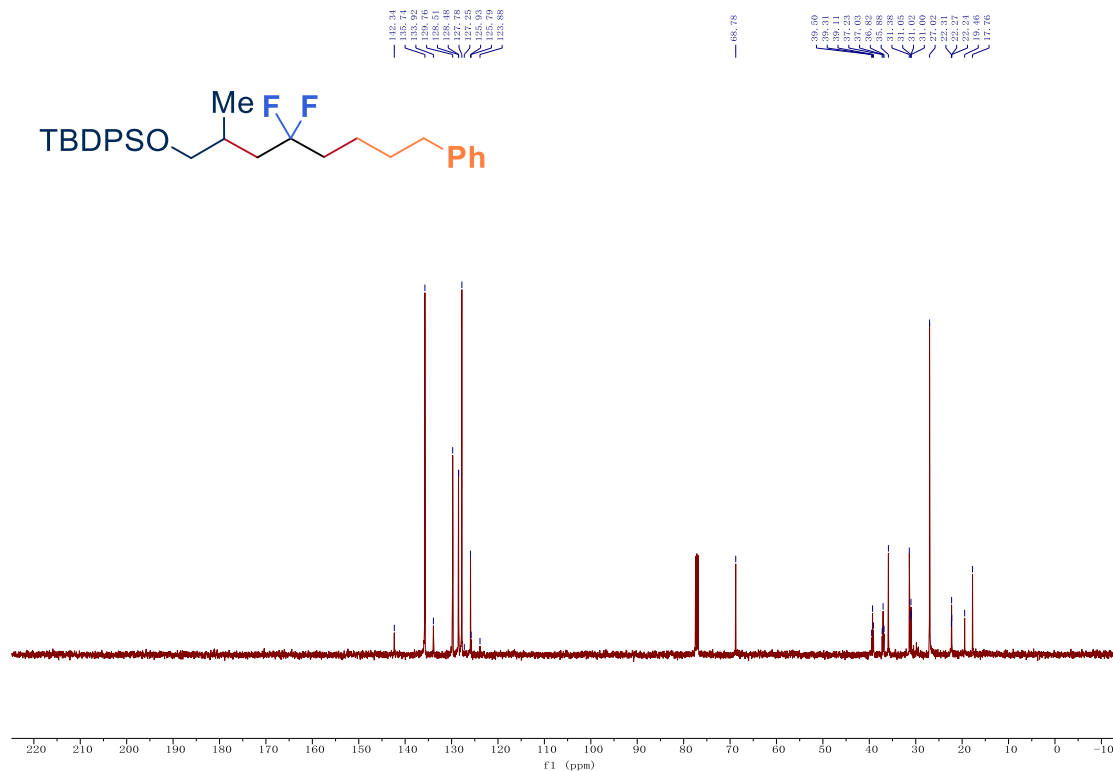
[illegible]

Chemical structure: 4-(trimethylsilyl)-5-phenylpent-1-ene

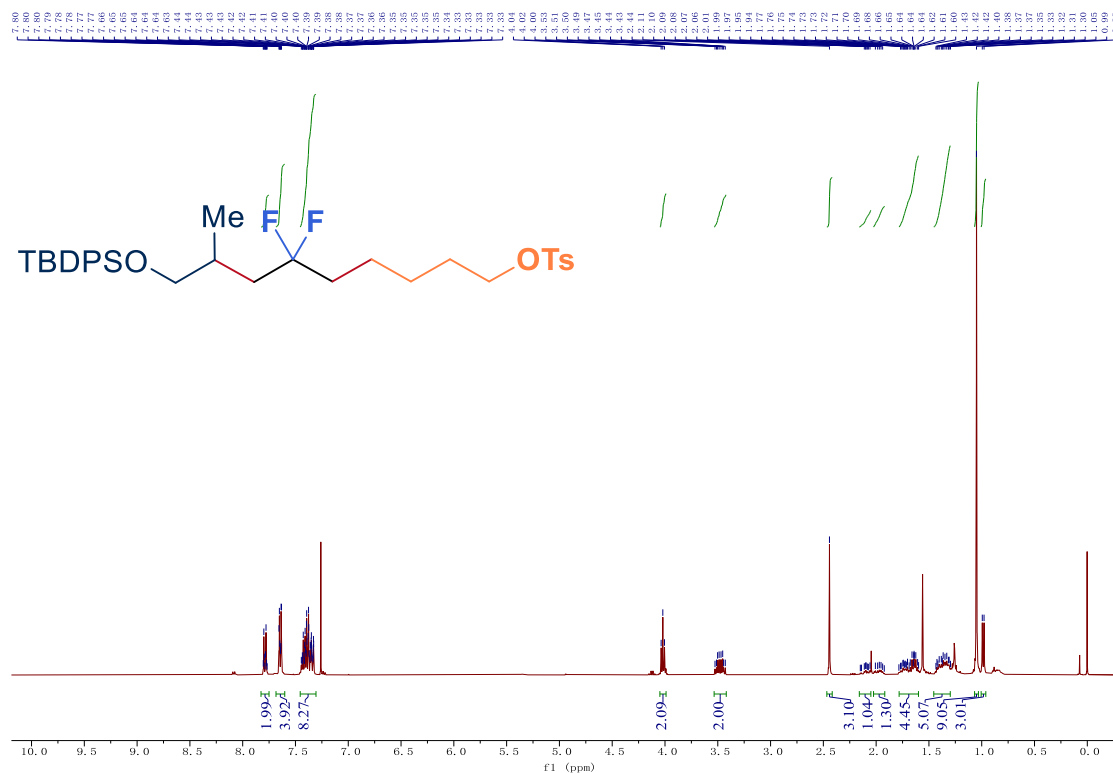
¹H NMR spectrum (400 MHz, CDCl₃):

- 6.10 - 6.50 ppm (m, 4H, vinyl protons)
- 5.10 ppm (d, 1H, methine proton)
- 7.20 - 7.40 ppm (m, 5H, phenyl protons)
- 0.10 ppm (s, 9H, trimethylsilyl methyl protons)

^{13}C NMR (126 MHz, CDCl_3) spectra for compound 2a



^1H NMR (400 MHz, CDCl_3) spectra for compound 2b



[illegible][illegible]

[illegible]

Chemical structure: CC(C)(C(F)F)CCCC(C)(C)O

¹H NMR spectrum (ppm):

- 93.91, -93.94, -93.97, -93.99, -94.02, -94.03, -94.06, -94.09
- 94.55, -94.59, -94.61, -94.64, -94.65, -94.68, -94.70, -94.73
- 95.61, -95.65, -95.69, -95.71, -95.73, -95.79
- 196.21, -196.29, -196.33, -196.34, -196.37, -196.39, -196.43

The chemical structure is 1-(2,2-difluoro-4-methyl-6-((trimethylsilyl)ethoxy)hex-5-yn-1-yl)ethanol. The structure shows a central carbon atom bonded to a methyl group (Me), two fluorine atoms (F), and a 6-((trimethylsilyl)ethoxy)hex-5-yn-1-yl chain. The chain consists of a 6-carbon aliphatic chain with a terminal hydroxyl group (OH) and a trimethylsilyl (TBDPSO) group. The chain is also substituted with a methyl group and two fluorine atoms.

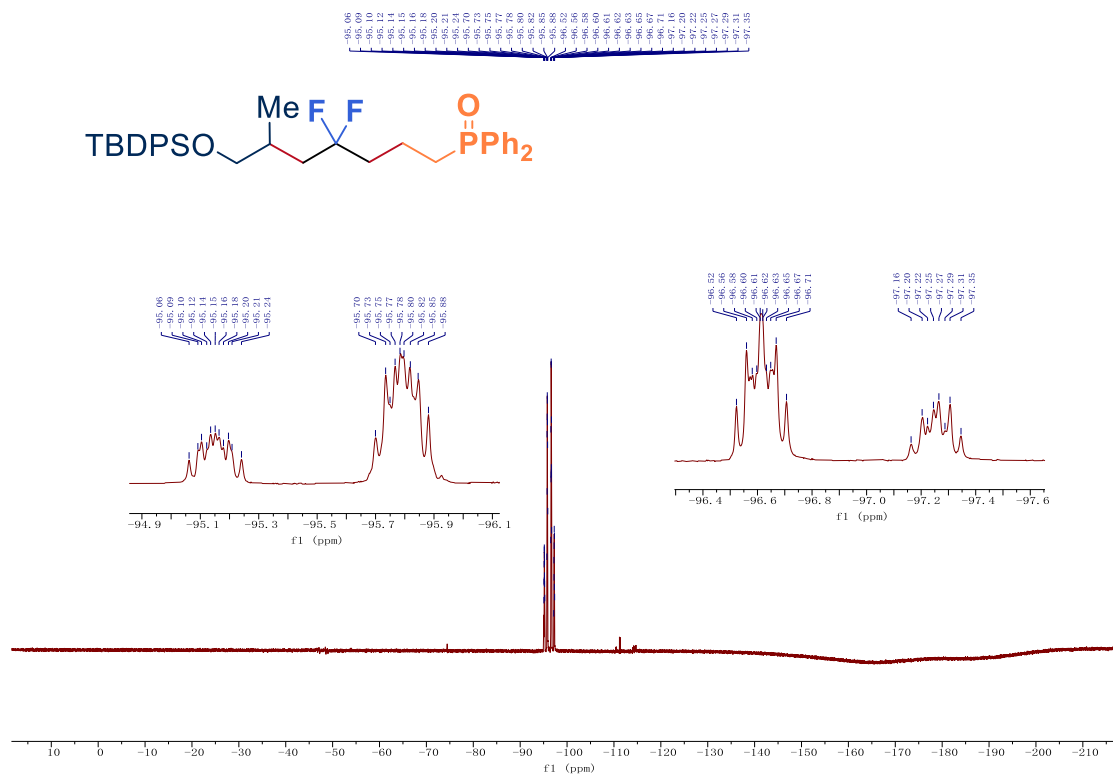
The ¹H NMR spectrum (400 MHz, CDCl₃) shows the following peaks (ppm):

- 7.26, 7.24, 7.22, 7.20, 7.18, 7.16, 7.14, 7.12, 7.10, 7.08, 7.06, 7.04, 7.02, 7.00, 6.98, 6.96, 6.94, 6.92, 6.90, 6.88, 6.86, 6.84, 6.82, 6.80, 6.78, 6.76, 6.74, 6.72, 6.70, 6.68, 6.66, 6.64, 6.62, 6.60, 6.58, 6.56, 6.54, 6.52, 6.50, 6.48, 6.46, 6.44, 6.42, 6.40, 6.38, 6.36, 6.34, 6.32, 6.30, 6.28, 6.26, 6.24, 6.22, 6.20, 6.18, 6.16, 6.14, 6.12, 6.10, 6.08, 6.06, 6.04, 6.02, 6.00, 5.98, 5.96, 5.94, 5.92, 5.90, 5.88, 5.86, 5.84, 5.82, 5.80, 5.78, 5.76, 5.74, 5.72, 5.70, 5.68, 5.66, 5.64, 5.62, 5.60, 5.58, 5.56, 5.54, 5.52, 5.50, 5.48, 5.46, 5.44, 5.42, 5.40, 5.38, 5.36, 5.34, 5.32, 5.30, 5.28, 5.26, 5.24, 5.22, 5.20, 5.18, 5.16, 5.14, 5.12, 5.10, 5.08, 5.06, 5.04, 5.02, 5.00, 4.98, 4.96, 4.94, 4.92, 4.90, 4.88, 4.86, 4.84, 4.82, 4.80, 4.78, 4.76, 4.74, 4.72, 4.70, 4.68, 4.66, 4.64, 4.62, 4.60, 4.58, 4.56, 4.54, 4.52, 4.50, 4.48, 4.46, 4.44, 4.42, 4.40, 4.38, 4.36, 4.34, 4.32, 4.30, 4.28, 4.26, 4.24, 4.22, 4.20, 4.18, 4.16, 4.14, 4.12, 4.10, 4.08, 4.06, 4.04, 4.02, 4.00, 3.98, 3.96, 3.94, 3.92, 3.90, 3.88, 3.86, 3.84, 3.82, 3.80, 3.78, 3.76, 3.74, 3.72, 3.70, 3.68, 3.66, 3.64, 3.62, 3.60, 3.58, 3.56, 3.54, 3.52, 3.50, 3.48, 3.46, 3.44, 3.42, 3.40, 3.38, 3.36, 3.34, 3.32, 3.30, 3.28, 3.26, 3.24, 3.22, 3.20, 3.18, 3.16, 3.14, 3.12, 3.10, 3.08, 3.06, 3.04, 3.02, 3.00, 2.98, 2.96, 2.94, 2.92, 2.90, 2.88, 2.86, 2.84, 2.82, 2.80, 2.78, 2.76, 2.74, 2.72, 2.70, 2.68, 2.66, 2.64, 2.62, 2.60, 2.58, 2.56, 2.54, 2.52, 2.50, 2.48, 2.46, 2.44, 2.42, 2.40, 2.38, 2.36, 2.34, 2.32, 2.30, 2.28, 2.26, 2.24, 2.22, 2.20, 2.18, 2.16, 2.14, 2.12, 2.10, 2.08, 2.06, 2.04, 2.02, 2.00, 1.98, 1.96, 1.94, 1.92, 1.90, 1.88, 1.86, 1.84, 1.82, 1.80, 1.78, 1.76, 1.74, 1.72, 1.70, 1.68, 1.66, 1.64, 1.62, 1.60, 1.58, 1.56, 1.54, 1.52, 1.50, 1.48, 1.46, 1.44, 1.42, 1.40, 1.38, 1.36, 1.34, 1.32, 1.30, 1.28, 1.26, 1.24, 1.22, 1.20, 1.18, 1.16, 1.14, 1.12, 1.10, 1.08, 1.06, 1.04, 1.02, 1.00, 0.98, 0.96, 0.94, 0.92, 0.90, 0.88, 0.86, 0.84, 0.82, 0.80, 0.78, 0.76, 0.74, 0.72, 0.70, 0.68, 0.66, 0.64, 0.62, 0.60, 0.58, 0.56, 0.54, 0.52, 0.50, 0.48, 0.46, 0.44, 0.42, 0.40, 0.38, 0.36, 0.34, 0.32, 0.30, 0.28, 0.26, 0.24, 0.22, 0.20, 0.18, 0.16, 0.14, 0.12, 0.10, 0.08, 0.06, 0.04, 0.02, 0.00.

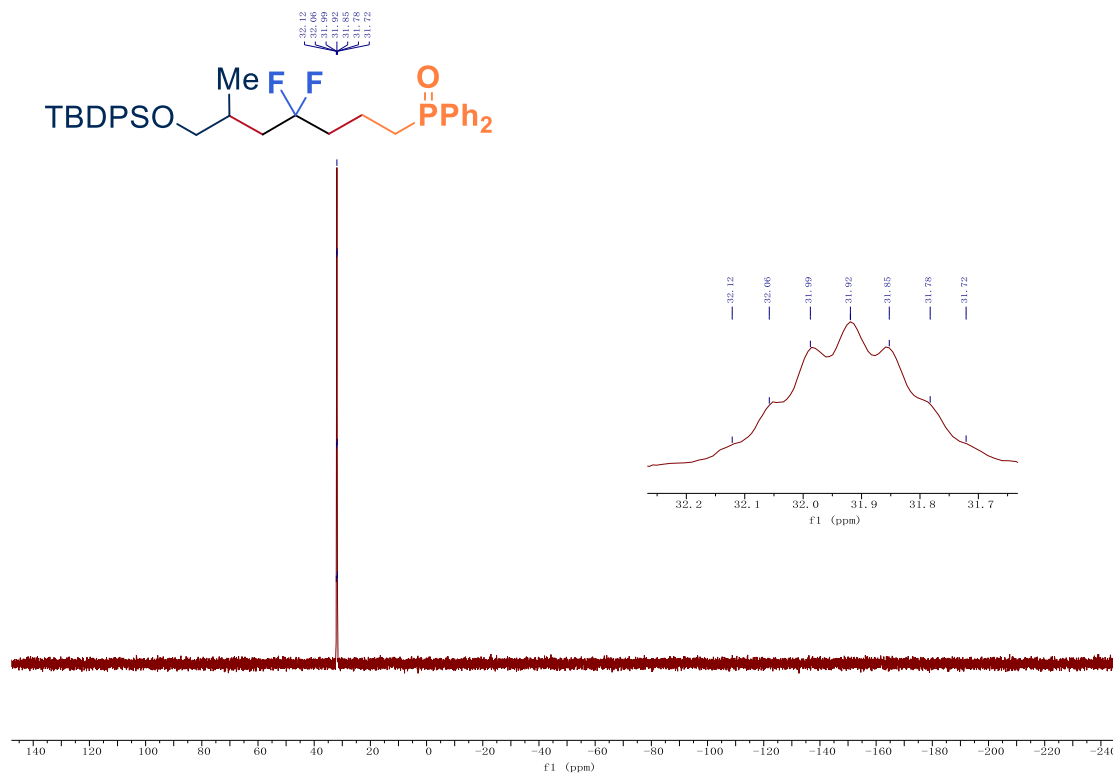
The image displays a ^1H NMR spectrum of (S)-1-(tert-butyldiphenylsilyl)-2,2-difluoro-4-oxopentane-3-ol. The chemical structure is overlaid on the spectrum, with atoms color-coded: blue for the TBDPSO group, red for the chiral center and its adjacent methylene, green for the difluoromethylene, and orange for the ketone and phenyl groups. The spectrum features several multiplets between 7.0 and 8.0 ppm (aromatic protons), a multiplet at 3.5 ppm (CH-OH), a doublet at 2.0 ppm (CH₂-C=O), and a complex multiplet between 1.0 and 2.5 ppm (tert-butyl and methylene protons). A sharp singlet at 1.0 ppm corresponds to the TMS reference peak. Integration values are provided below the baseline for each major peak group.

Chemical Shift (ppm)	Integration
7.5 - 7.8	4.00
7.2 - 7.5	3.95
7.0 - 7.2	11.90
3.5	2.00
2.0	2.09
1.5 - 2.5	6.47
1.0	1.09
1.0	9.01
1.0	3.00

^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2d**



^{31}P NMR (162 MHz, CDCl_3) spectra for compound **2d**



[illegible]

Chemical structure: CCOC(=O)c1ccc(cc1)COP(=O)(F)C(F)(C)Si(C)(C)C(C)(C)C

¹H NMR spectrum (ppm):

- 0.0 (s, 9H, TMS)
- 1.2 (q, 3H, CH₂CH₃)
- 1.4 (d, 3H, CH₂CH₃)
- 1.8 (s, 3H, CH₂CH₃)
- 2.5 (s, 3H, CH₂CH₃)
- 3.5 (s, 2H, CH₂CH₃)
- 4.5 (s, 2H, CH₂CH₃)
- 5.5 (s, 2H, CH₂CH₃)
- 6.5 (s, 2H, CH₂CH₃)
- 7.5 (s, 2H, CH₂CH₃)
- 8.0 (s, 2H, CH₂CH₃)

Chemical structure: CCOC(=O)c1ccc(cc1)OCC(C(F)(F)C)C(C)OSi(C)(C)C(C)(C)C

¹³C NMR peaks (ppm):

- 171.40
- 165.98
- 154.36
- 135.74
- 133.87
- 133.27
- 131.27
- 129.78
- 127.87
- 125.51
- 121.65
- 68.75
- 61.23
- 39.65
- 39.45
- 39.26
- 36.81
- 36.61
- 31.03
- 30.95
- 27.01
- 24.65
- 22.02
- 21.98
- 17.77
- 14.47

[illegible]

Chemical structure of compound 10: CC(C)(C)C(C)(F)FCCN1C=NC2=CC=CC=C21

¹H NMR spectrum (CDCl₃) of compound 10. The x-axis represents the chemical shift in ppm (f1), ranging from 0.0 to 10.0. The spectrum shows several peaks corresponding to the protons in the molecule.

Key peaks and their assignments (chemical shift in ppm):

- 1.83: Methyl protons of the tert-butyl group.
- 3.87: Methyl protons of the dimethylsilyl group.
- 9.80: Aromatic protons of the benzotriazole system.
- 2.75: Methyl protons of the dimethylsilyl group.
- 2.01: Methyl protons of the dimethylsilyl group.
- 2.01: Methyl protons of the dimethylsilyl group.
- 2.13: Methyl protons of the dimethylsilyl group.
- 2.00: Methyl protons of the dimethylsilyl group.
- 1.56: Methyl protons of the dimethylsilyl group.
- 6.27: Aromatic protons of the benzotriazole system.
- 9.02: Aromatic protons of the benzotriazole system.
- 2.97: Methyl protons of the dimethylsilyl group.

The chemical structure of compound 1 is shown at the top. It consists of a 2,2,2-trifluoroethyl group attached to a 4-(benzo[d]thiazol-2-yl)butyl chain, which is further substituted with a tert-butyldimethylsilyl (TBDPSO) group. The structure is labeled with 'Me' for the methyl group, 'F' for the fluorine atoms, and 'TBDPSO' for the silyl group.

The ^1H NMR spectrum is displayed below the structure. The x-axis represents the chemical shift in ppm, ranging from -10 to -210. The spectrum shows several peaks corresponding to the protons in the molecule. The peaks are labeled with their chemical shifts (ppm):

- 93.80, 93.85, 93.95, 93.98, 94.00, 94.03, 94.05, 94.07, 94.10, 94.12, 94.14, 94.16, 94.18, 94.20, 94.22, 94.24, 94.26, 94.28, 94.30, 94.32, 94.34, 94.36, 94.38, 94.40, 94.42, 94.44, 94.46, 94.48, 94.50, 94.52, 94.54, 94.56, 94.58, 94.60, 94.62, 94.64, 94.66, 94.68, 94.70, 94.72, 94.74, 94.76, 94.78, 94.80, 94.82, 94.84, 94.86, 94.88, 94.90, 94.92, 94.94, 94.96, 94.98, 95.00, 95.02, 95.04, 95.06, 95.08, 95.10, 95.12, 95.14, 95.16, 95.18, 95.20, 95.22, 95.24, 95.26, 95.28, 95.30, 95.32, 95.34, 95.36, 95.38, 95.40, 95.42, 95.44, 95.46, 95.48, 95.50, 95.52, 95.54, 95.56, 95.58, 95.60, 95.62, 95.64, 95.66, 95.68, 95.70, 95.72, 95.74, 95.76, 95.78, 95.80, 95.82, 95.84, 95.86, 95.88, 95.90, 95.92, 95.94, 95.96, 95.98, 96.00, 96.02, 96.04, 96.06, 96.08, 96.10, 96.12, 96.14, 96.16, 96.18, 96.20, 96.22, 96.24, 96.26, 96.28, 96.30, 96.32, 96.34, 96.36, 96.38, 96.40, 96.42, 96.44, 96.46, 96.48, 96.50, 96.52, 96.54, 96.56, 96.58, 96.60, 96.62, 96.64, 96.66, 96.68, 96.70, 96.72, 96.74, 96.76, 96.78, 96.80, 96.82, 96.84, 96.86, 96.88, 96.90, 96.92, 96.94, 96.96, 96.98, 97.00, 97.02, 97.04, 97.06, 97.08, 97.10, 97.12, 97.14, 97.16, 97.18, 97.20, 97.22, 97.24, 97.26, 97.28, 97.30, 97.32, 97.34, 97.36, 97.38, 97.40, 97.42, 97.44, 97.46, 97.48, 97.50, 97.52, 97.54, 97.56, 97.58, 97.60, 97.62, 97.64, 97.66, 97.68, 97.70, 97.72, 97.74, 97.76, 97.78, 97.80, 97.82, 97.84, 97.86, 97.88, 97.90, 97.92, 97.94, 97.96, 97.98, 98.00, 98.02, 98.04, 98.06, 98.08, 98.10, 98.12, 98.14, 98.16, 98.18, 98.20, 98.22, 98.24, 98.26, 98.28, 98.30, 98.32, 98.34, 98.36, 98.38, 98.40, 98.42, 98.44, 98.46, 98.48, 98.50, 98.52, 98.54, 98.56, 98.58, 98.60, 98.62, 98.64, 98.66, 98.68, 98.70, 98.72, 98.74, 98.76, 98.78, 98.80, 98.82, 98.84, 98.86, 98.88, 98.90, 98.92, 98.94, 98.96, 98.98, 99.00, 99.02, 99.04, 99.06, 99.08, 99.10, 99.12, 99.14, 99.16, 99.18, 99.20, 99.22, 99.24, 99.26, 99.28, 99.30, 99.32, 99.34, 99.36, 99.38, 99.40, 99.42, 99.44, 99.46, 99.48, 99.50, 99.52, 99.54, 99.56, 99.58, 99.60, 99.62, 99.64, 99.66, 99.68, 99.70, 99.72, 99.74, 99.76, 99.78, 99.80, 99.82, 99.84, 99.86, 99.88, 99.90, 99.92, 99.94, 99.96, 99.98, 100.00, 100.02, 100.04, 100.06, 100.08, 100.10, 100.12, 100.14, 100.16, 100.18, 100.20, 100.22, 100.24, 100.26, 100.28, 100.30, 100.32, 100.34, 100.36, 100.38, 100.40, 100.42, 100.44, 100.46, 100.48, 100.50, 100.52, 100.54, 100.56, 100.58, 100.60, 100.62, 100.64, 100.66, 100.68, 100.70, 100.72, 100.74, 100.76, 100.78, 100.80, 100.82, 100.84, 100.86, 100.88, 100.90, 100.92, 100.94, 100.96, 100.98, 101.00, 101.02, 101.04, 101.06, 101.08, 101.10, 101.12, 101.14, 101.16, 101.18, 101.20, 101.22, 101.24, 101.26, 101.28, 101.30, 101.32, 101.34, 101.36, 101.38, 101.40, 101.42, 101.44, 101.46, 101.48, 101.50, 101.52, 101.54, 101.56, 101.58, 101.60, 101.62, 101.64, 101.66, 101.68, 101.70, 101.72, 101.74, 101.76, 101.78, 101.80, 101.82, 101.84, 101.86, 101.88, 101.90, 101.92, 101.94, 101.96, 101.98, 102.00, 102.02, 102.04, 102.06, 102.08, 102.10, 102.12, 102.14, 102.16, 102.18, 102.20, 102.22, 102.24, 102.26, 102.28, 102.30, 102.32, 102.34, 102.36, 102.38, 102.40, 102.42, 102.44, 102.46, 102.48, 102.50, 102.52, 102.54, 102.56, 102.58, 102.60, 102.62, 102.64, 102.66, 102.68, 102.70, 102.72, 102.74, 102.76, 102.78, 102.80, 102.82, 102.84, 102.86, 102.88, 102.90, 102.92, 102.94, 102.96, 102.98, 103.00, 103.02, 103.04, 103.06, 103.08, 103.10, 103.12, 103.14, 103.16, 103.18, 103.20, 103.22, 103.24, 103.26, 103.28, 103.30, 103.32, 103.34, 103.36, 103.38, 103.40, 103.42, 103.44, 103.46, 103.48, 103.50, 103.52, 103.54, 103.56, 103.58, 103.60, 103.62, 103.64, 103.66, 103.68, 103.70, 103.72, 103.74, 103.76, 103.78, 103.80, 103.82, 103.84, 103.86, 103.88, 103.90, 103.92, 103.94, 103.96, 103.98, 104.00, 104.02, 104.04, 104.06, 104.08, 104.10, 104.12, 104.14, 104.16, 104.18, 104.20, 104.22, 104.24, 104.26, 104.28, 104.30, 104.32, 104.34, 104.36, 104.38, 104.40

Chemical structure of compound 10 is shown above the ^1H NMR spectrum. The structure features a carbazole moiety linked via a butyl chain to a 1,1-difluoro-2-methyl-3-(4-(carbazol-1-yl)butyl)butane derivative, which is further substituted with a TBDPSO group.

The ^1H NMR spectrum (ppm) displays the following peaks (chemical shifts) corresponding to the protons in the molecule:

- 6.85, 7.6 (Aromatic protons of the carbazole moiety)
- 4.35, 3.99, 3.95, 3.91, 3.86, 3.77, 3.72, 3.62, 3.58, 3.52, 3.41, 3.31, 3.01, 3.00, 2.95, 2.90, 2.85, 2.77, 2.58, 2.55, 2.48, 2.22, 2.14, 2.06, 1.96, 1.74 (Aliphatic protons of the butyl chain and the TBDPSO group)
- 1.40, 1.33, 1.30, 1.29, 1.27, 1.25, 1.23, 1.21, 1.20, 1.18, 1.08 (Aliphatic protons of the butyl chain)

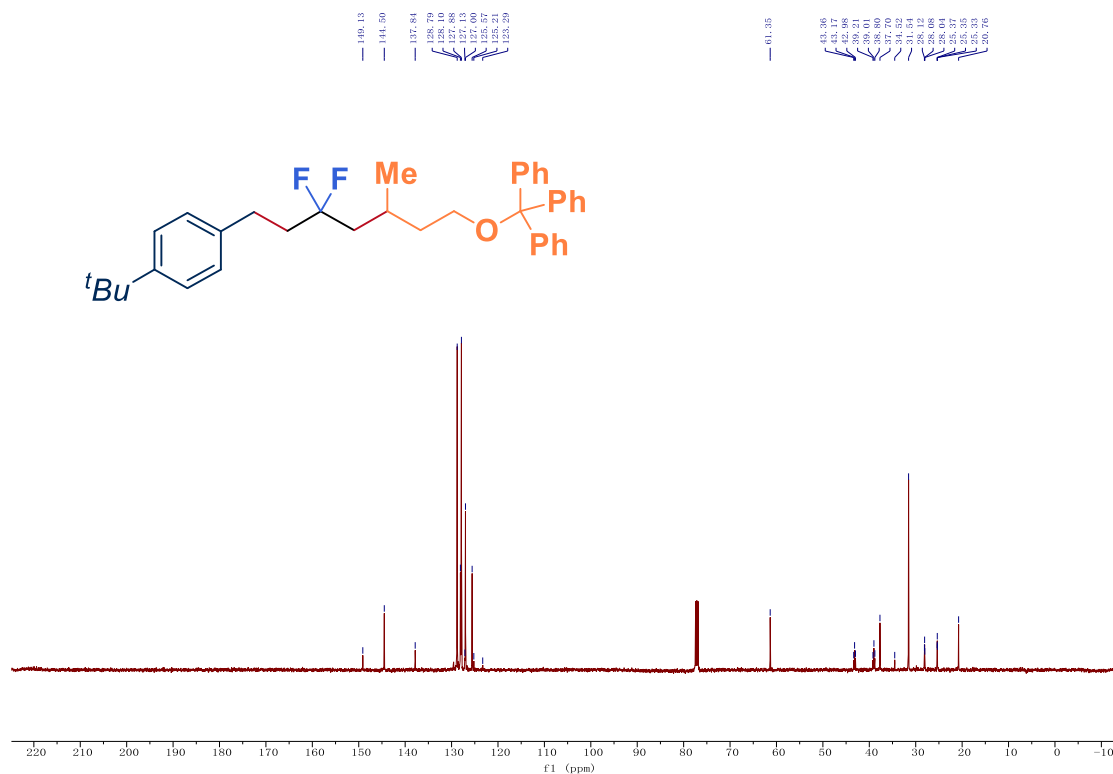
[illegible]

Chemical structure of compound 10: (4-tert-butylphenyl) 2,2-diphenyl-4,4-difluorobutanoate.

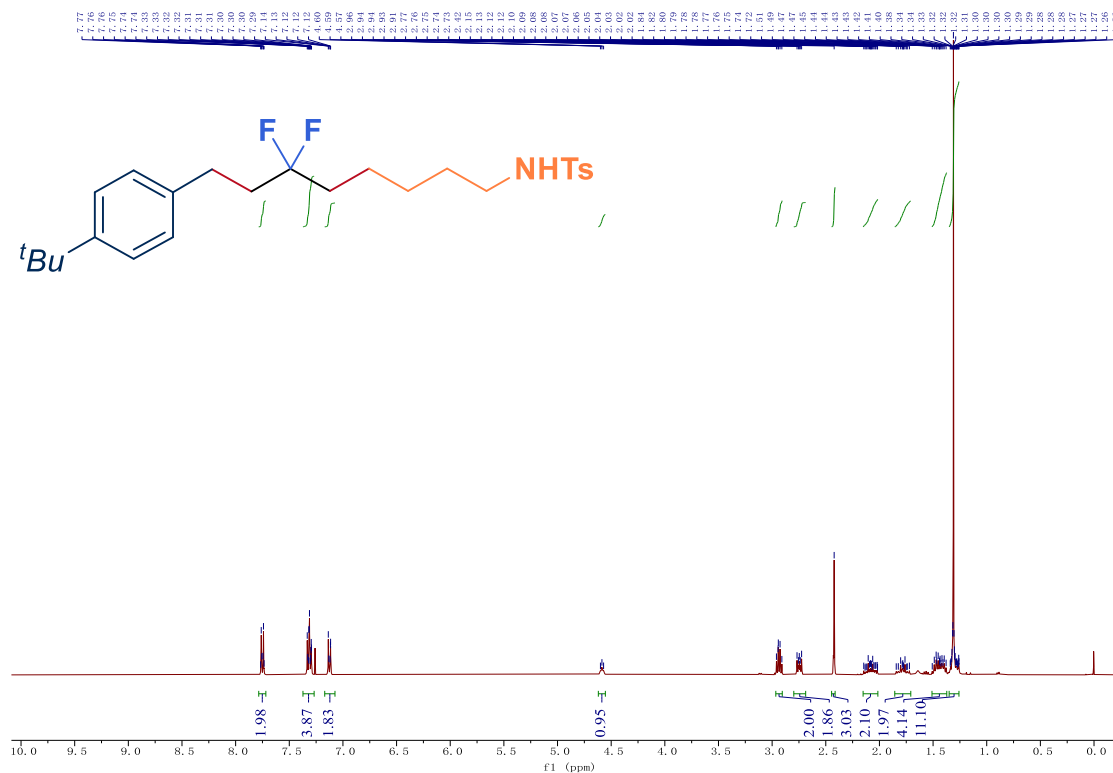
^{13}C NMR spectrum (CDCl₃) showing peaks from -98.8 to -93.3 ppm. The spectrum is divided into two regions: -95.2 to -94.3 ppm and -96.8 to -96.2 ppm.

Chemical structure of compound 10 is shown with carbon atoms numbered 1 to 10, corresponding to the peaks in the spectrum.

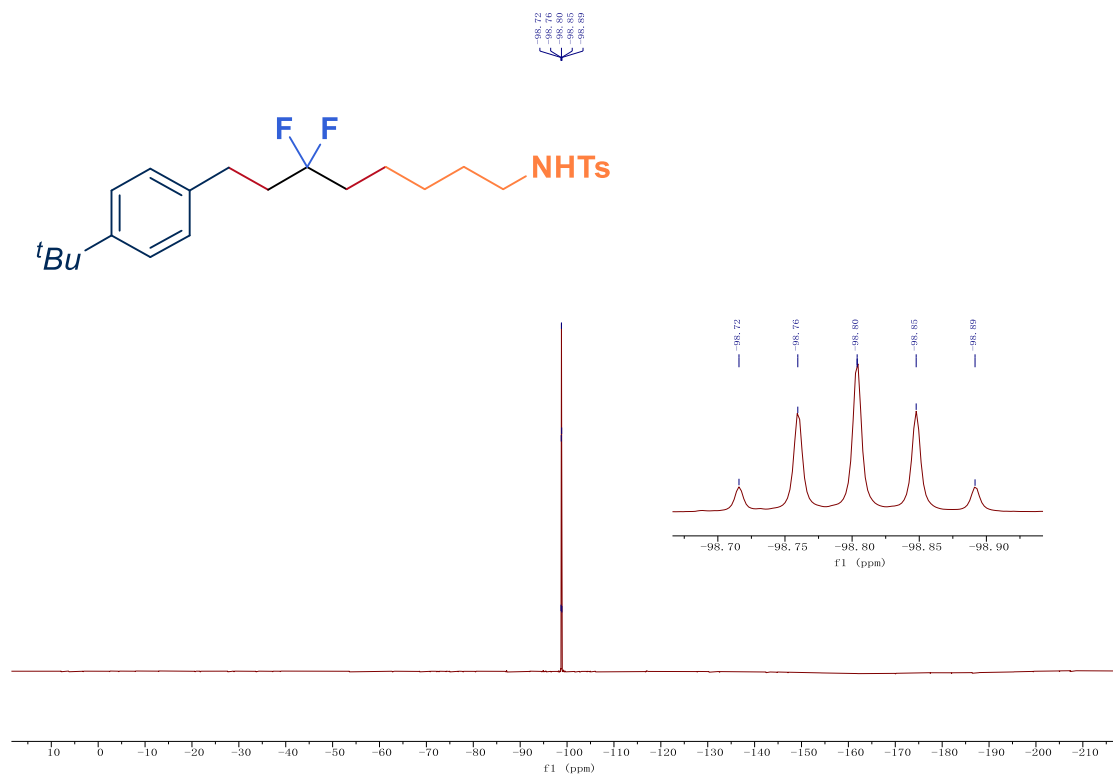
¹³C NMR (126 MHz, CDCl₃) spectra for compound **2h**



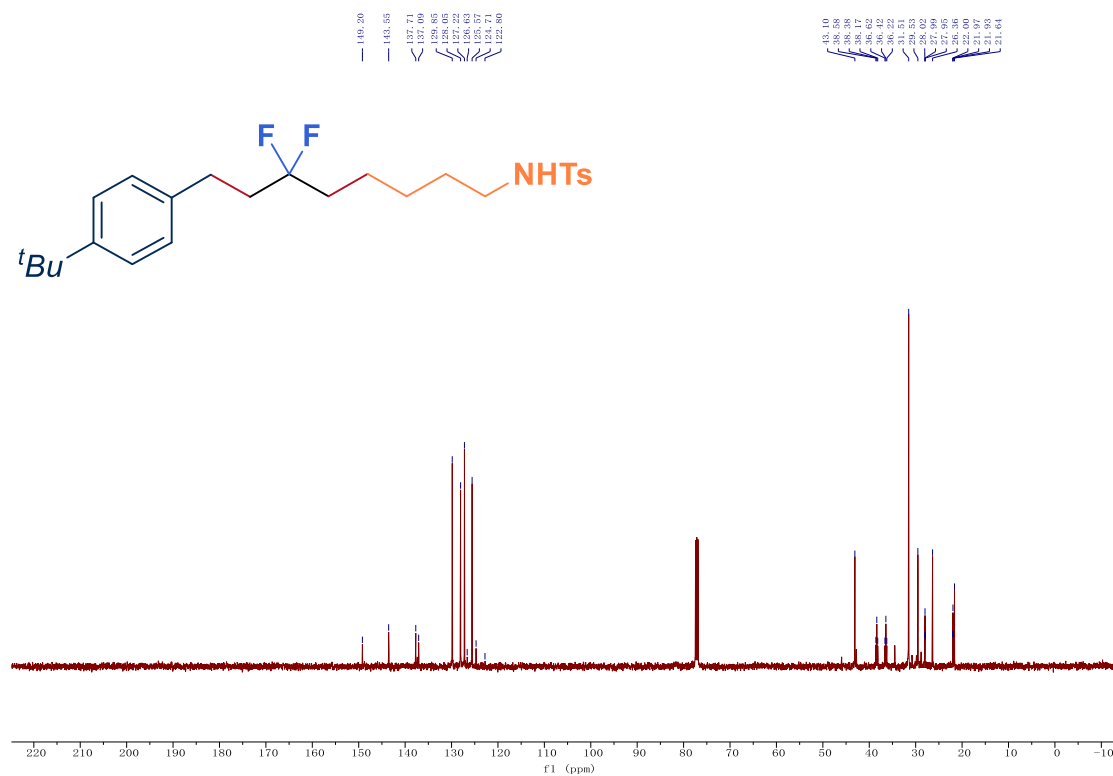
¹H NMR (400 MHz, CDCl₃) spectra for compound **2i**



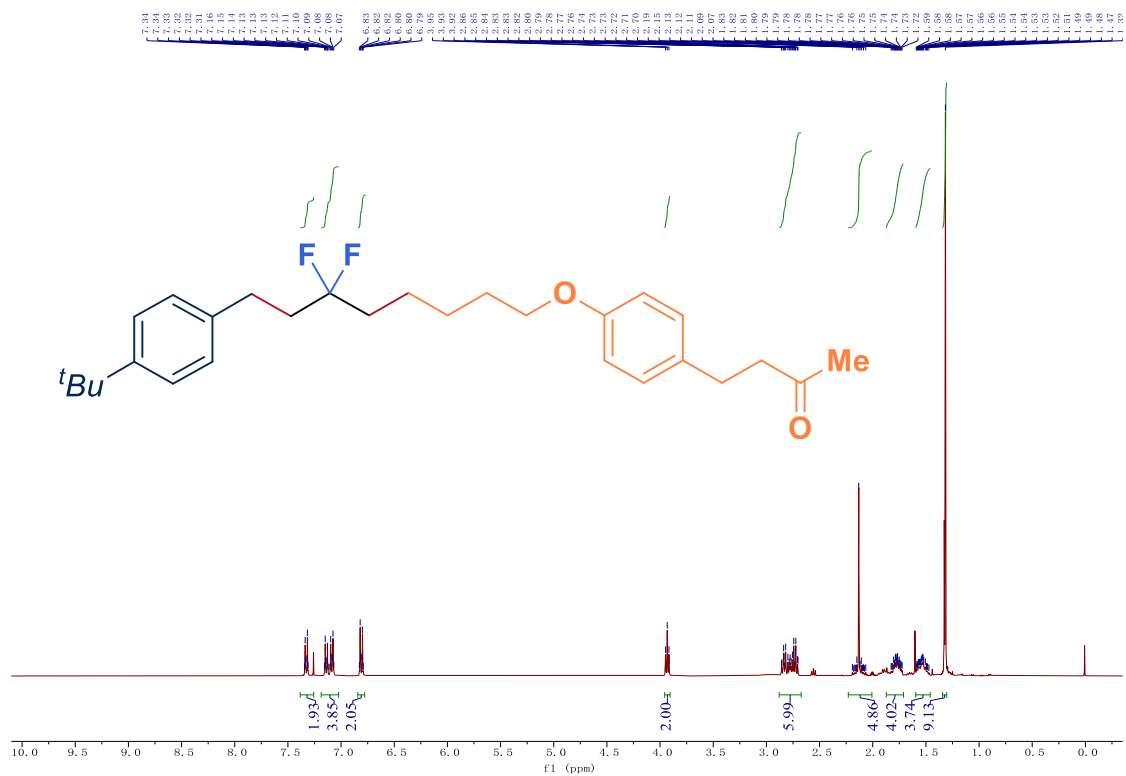
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2i**



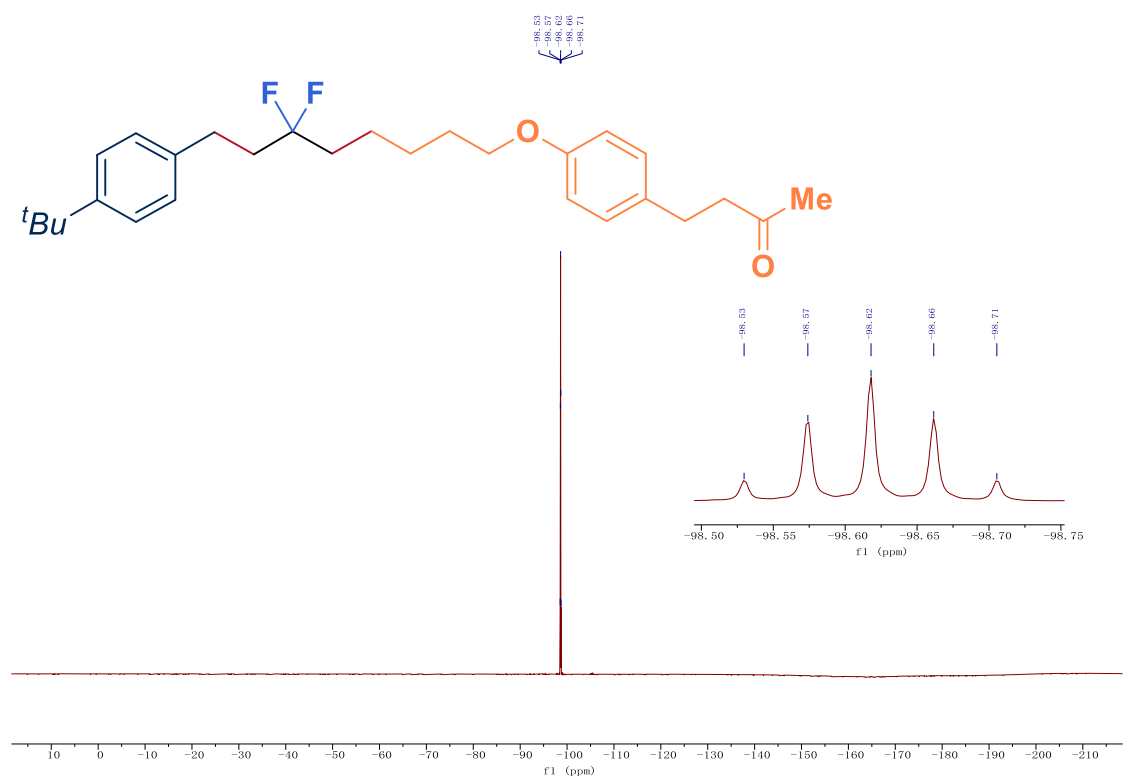
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2i**



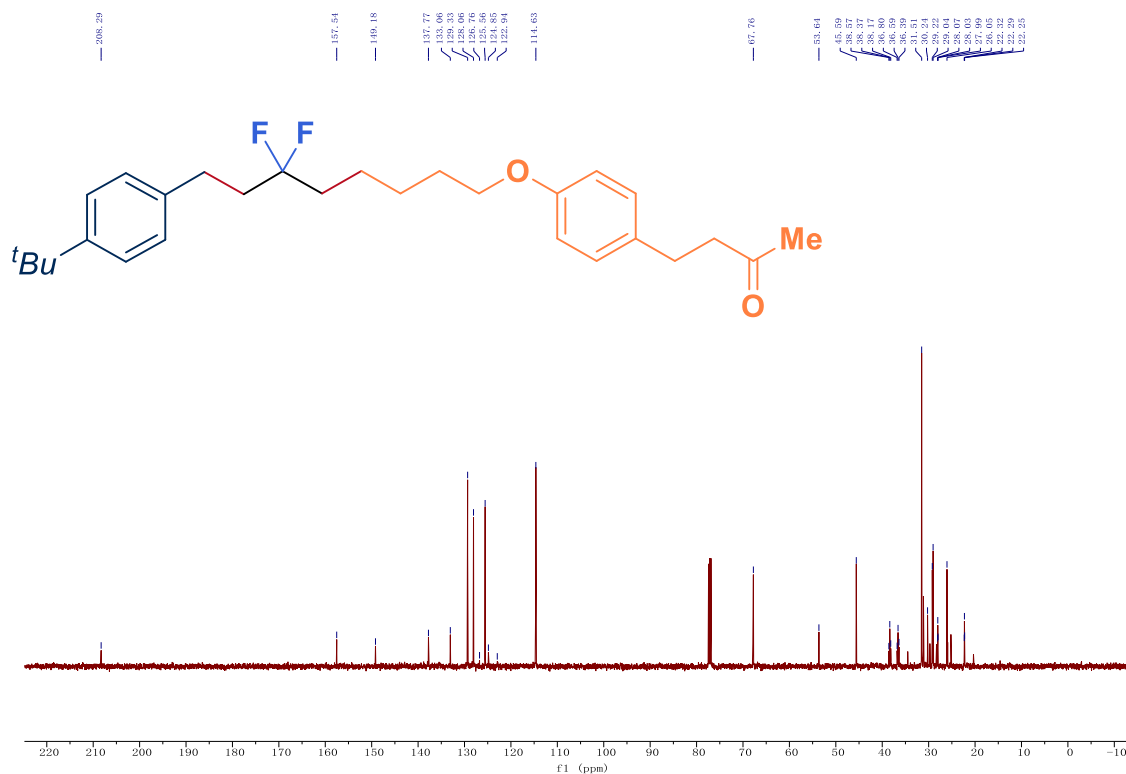
^1H NMR (400 MHz, CDCl_3) spectra for compound **2j**



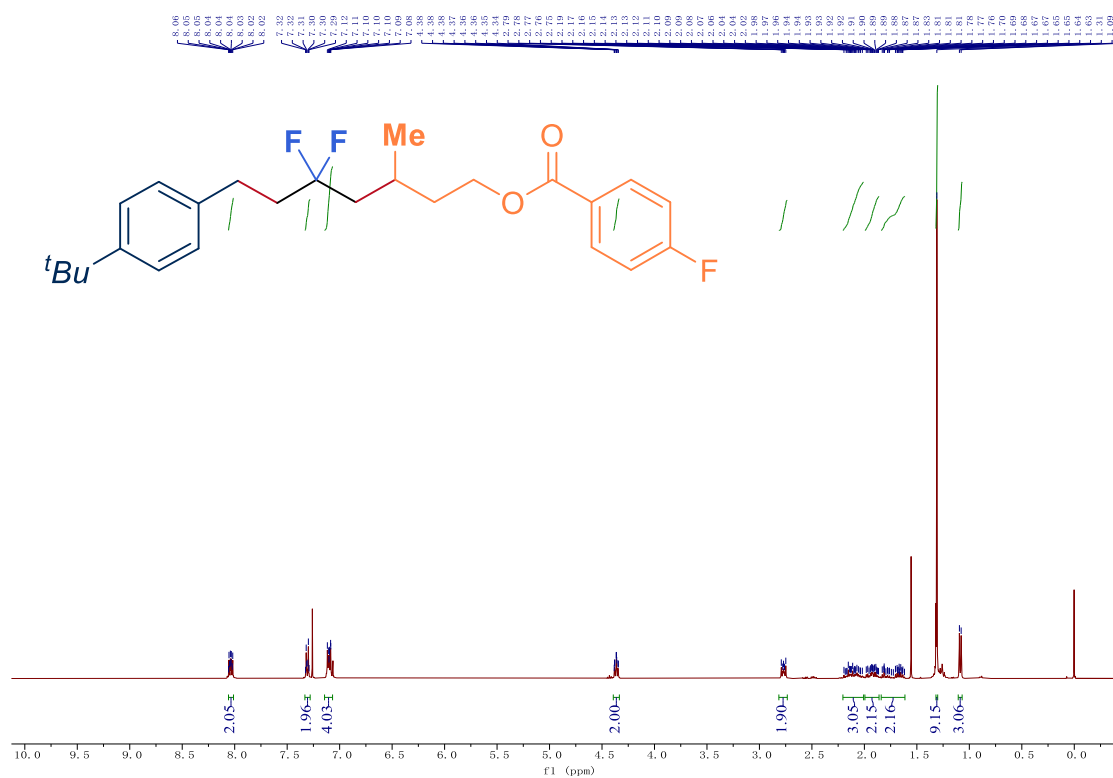
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2j**



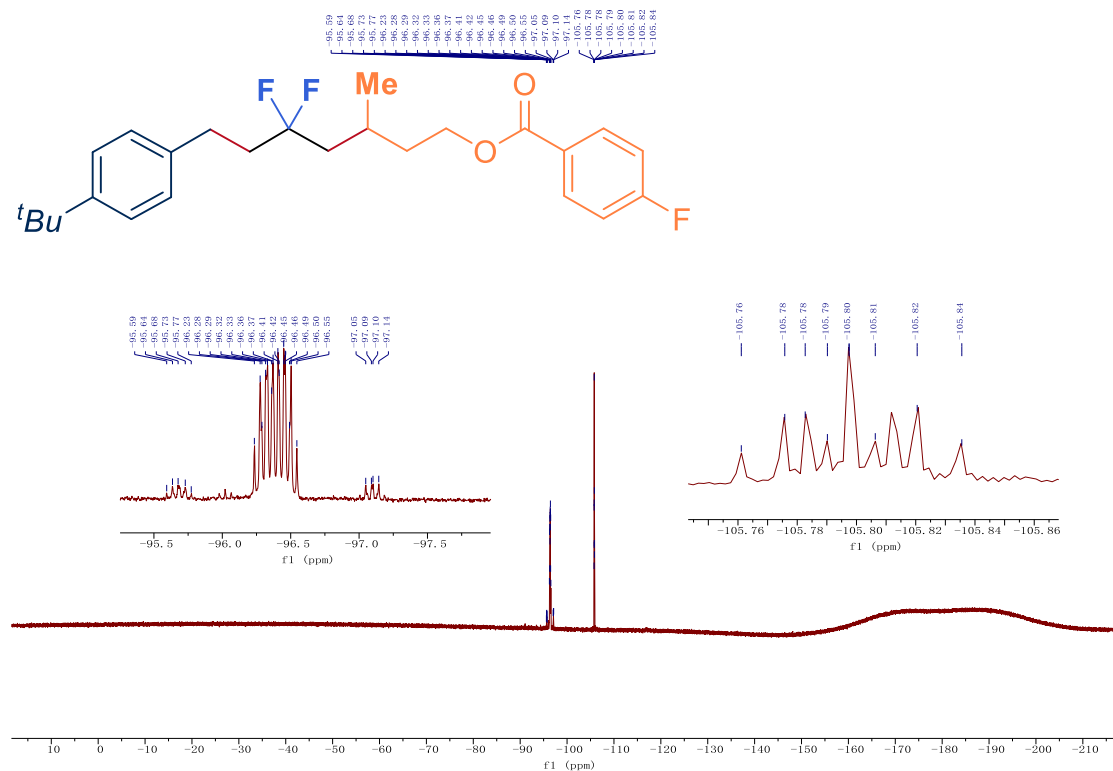
¹³C NMR (126 MHz, CDCl₃) spectra for compound 2j



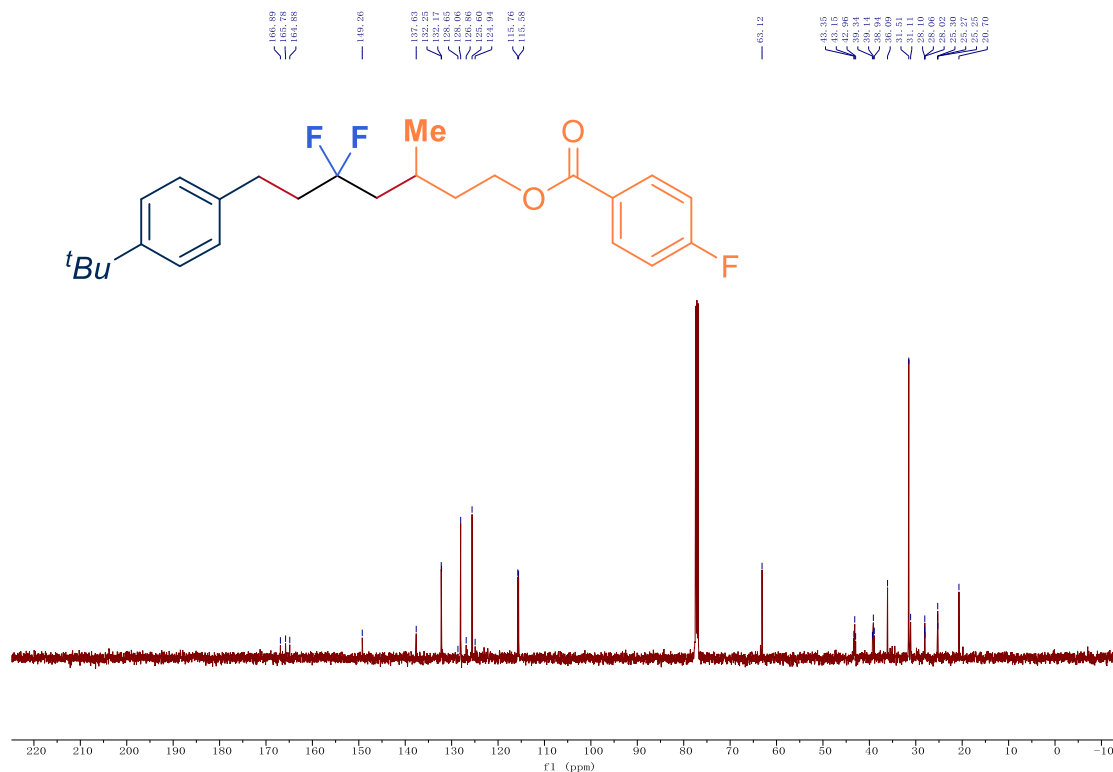
¹H NMR (400 MHz, CDCl₃) spectra for compound 2k



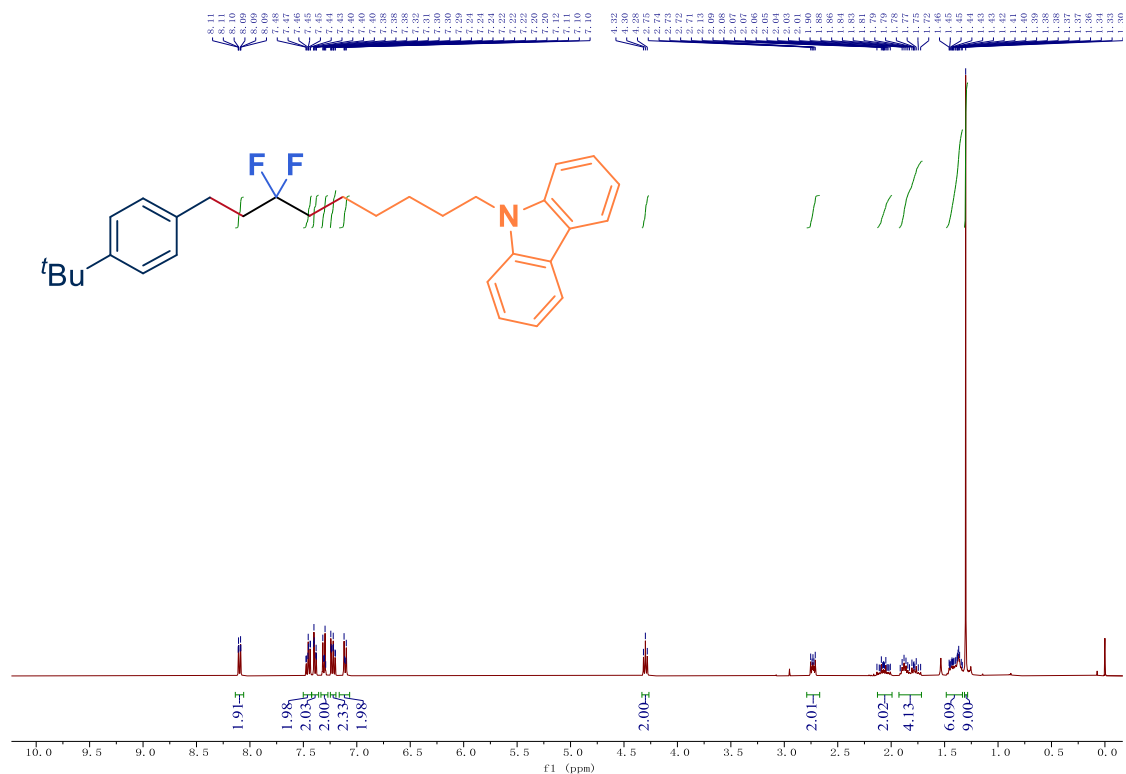
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2k**



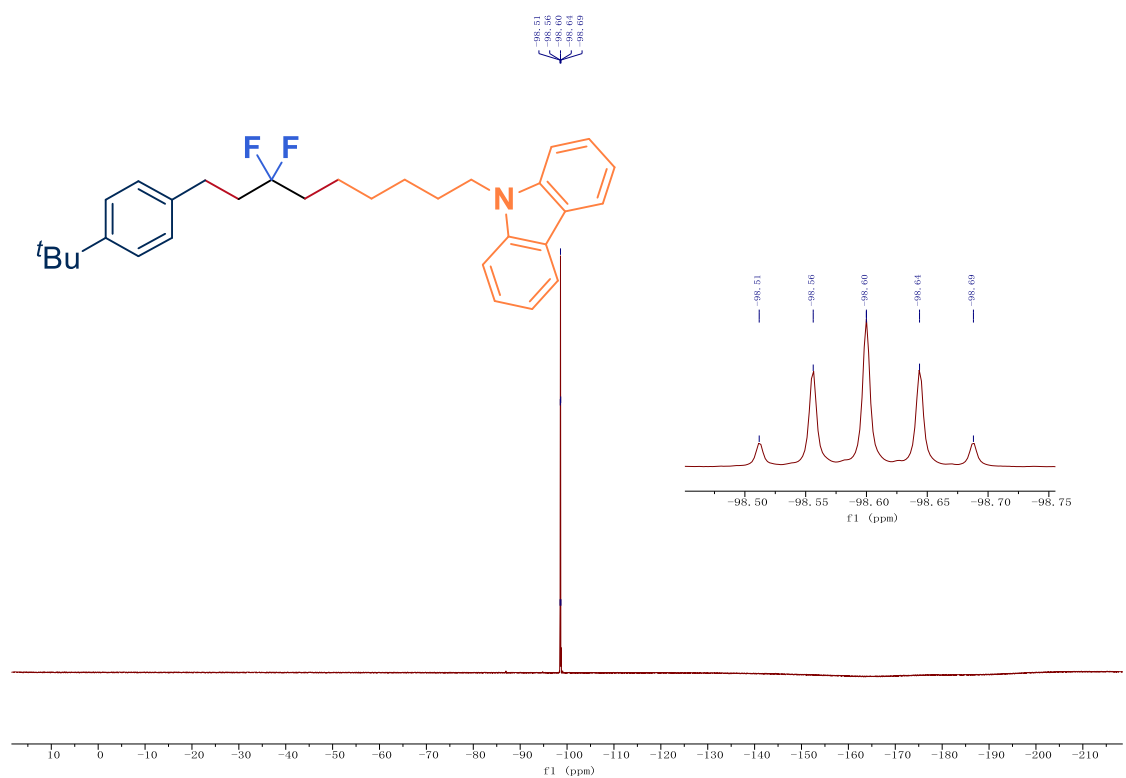
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2k**



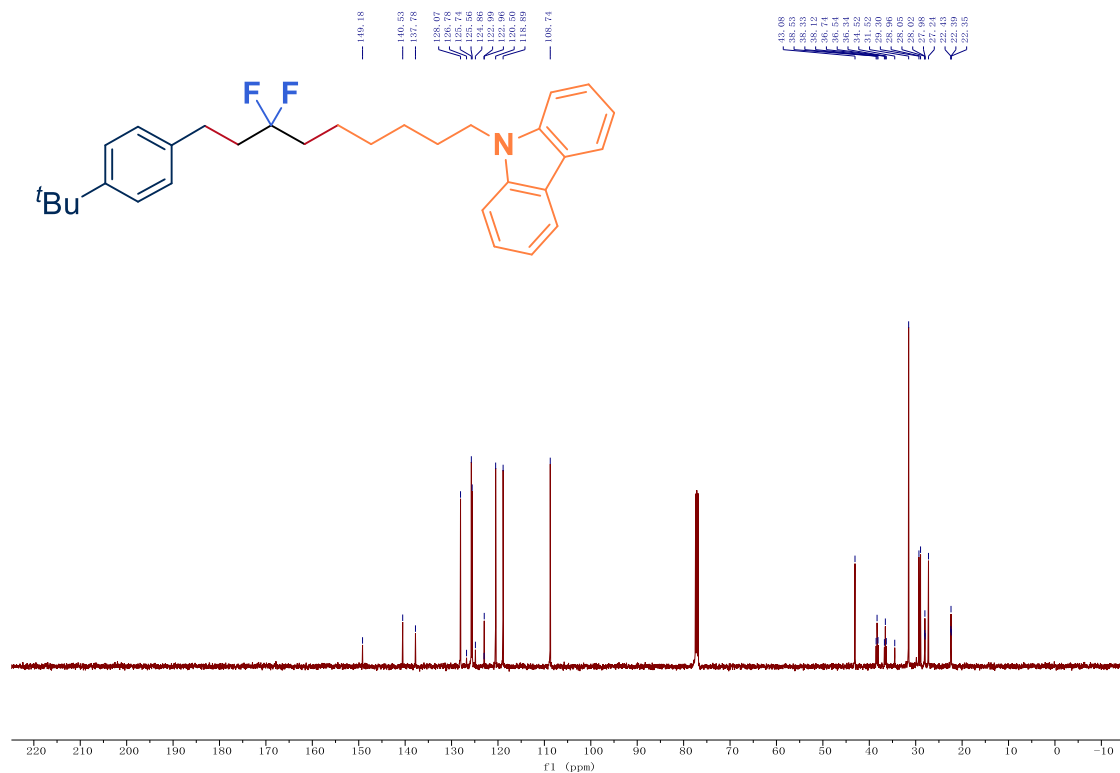
^1H NMR (400 MHz, CDCl_3) spectra for compound 21



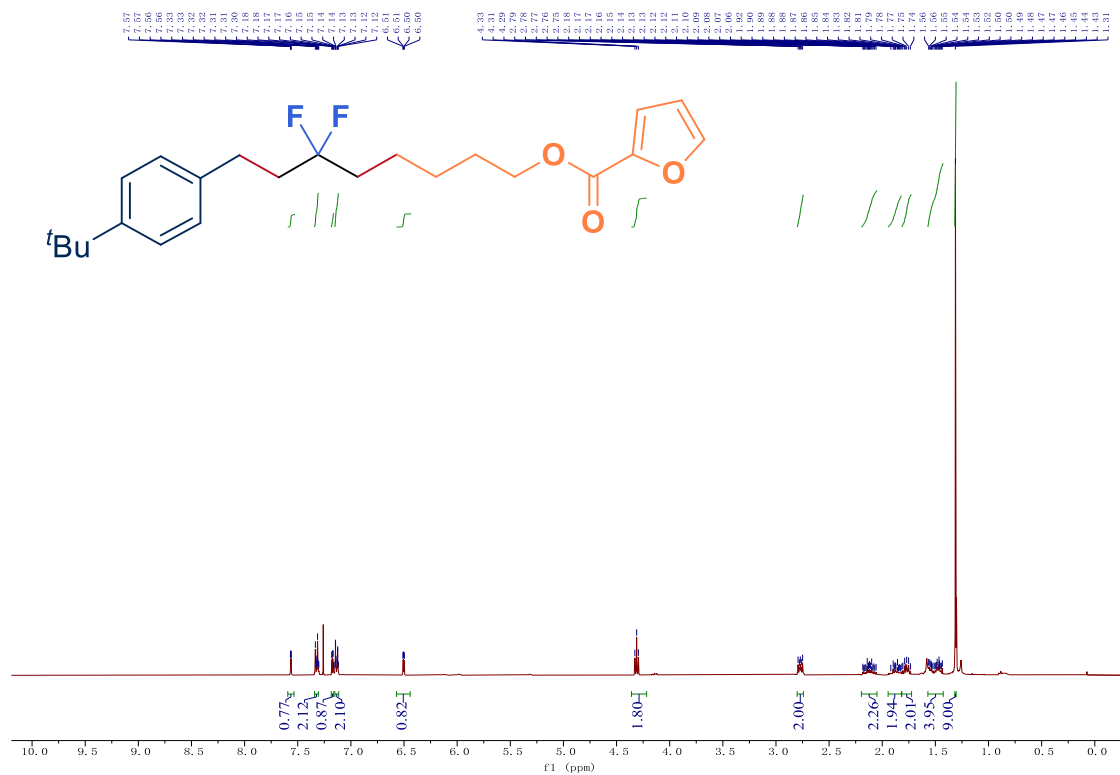
^{19}F NMR (377 MHz, CDCl_3) spectra for compound 21



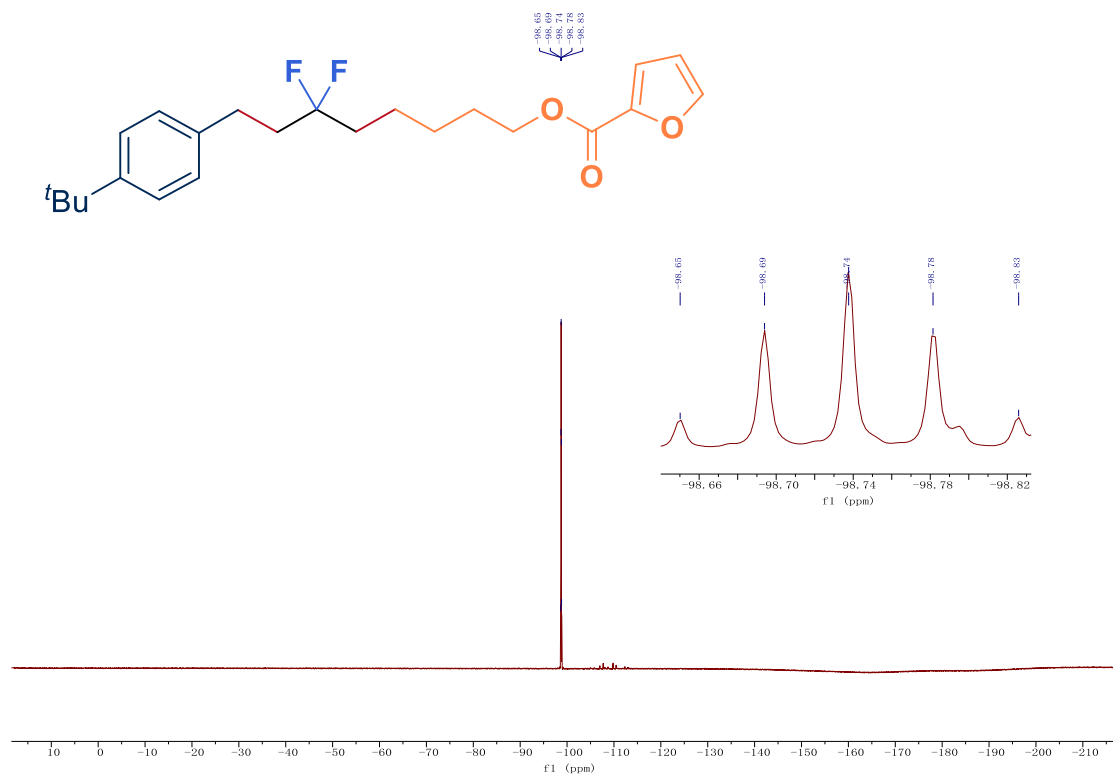
^{13}C NMR (126 MHz, CDCl_3) spectra for compound 2l



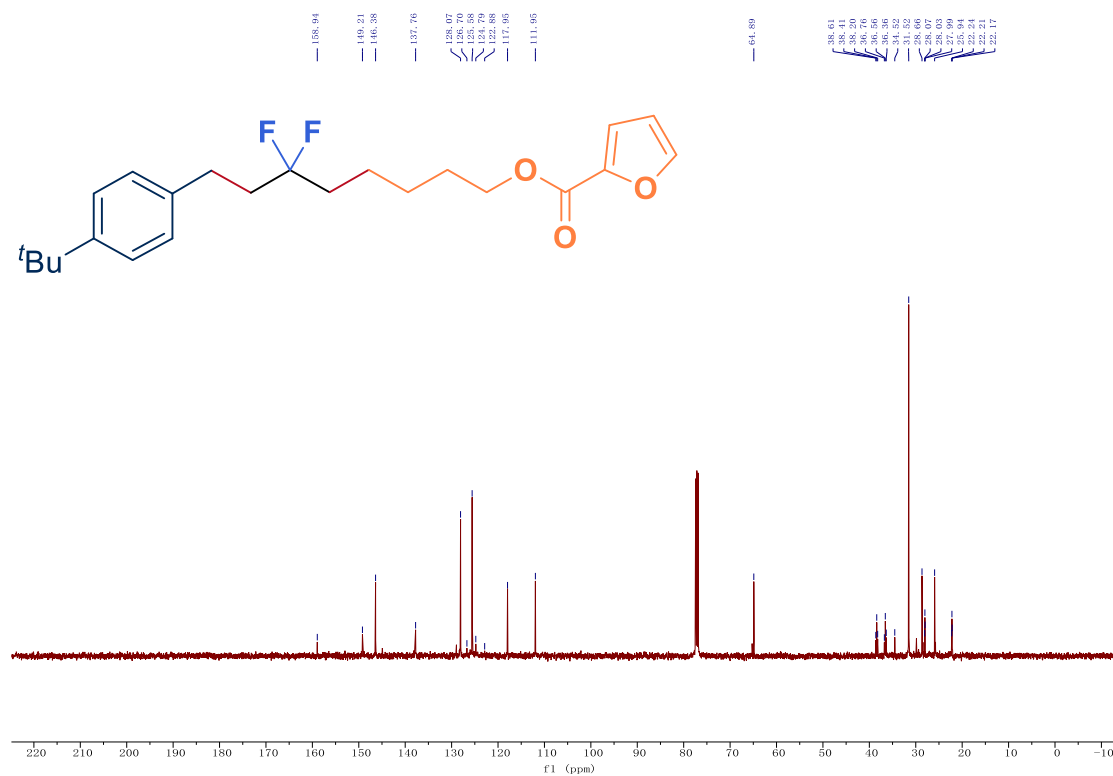
^1H NMR (400 MHz, CDCl_3) spectra for compound 2m



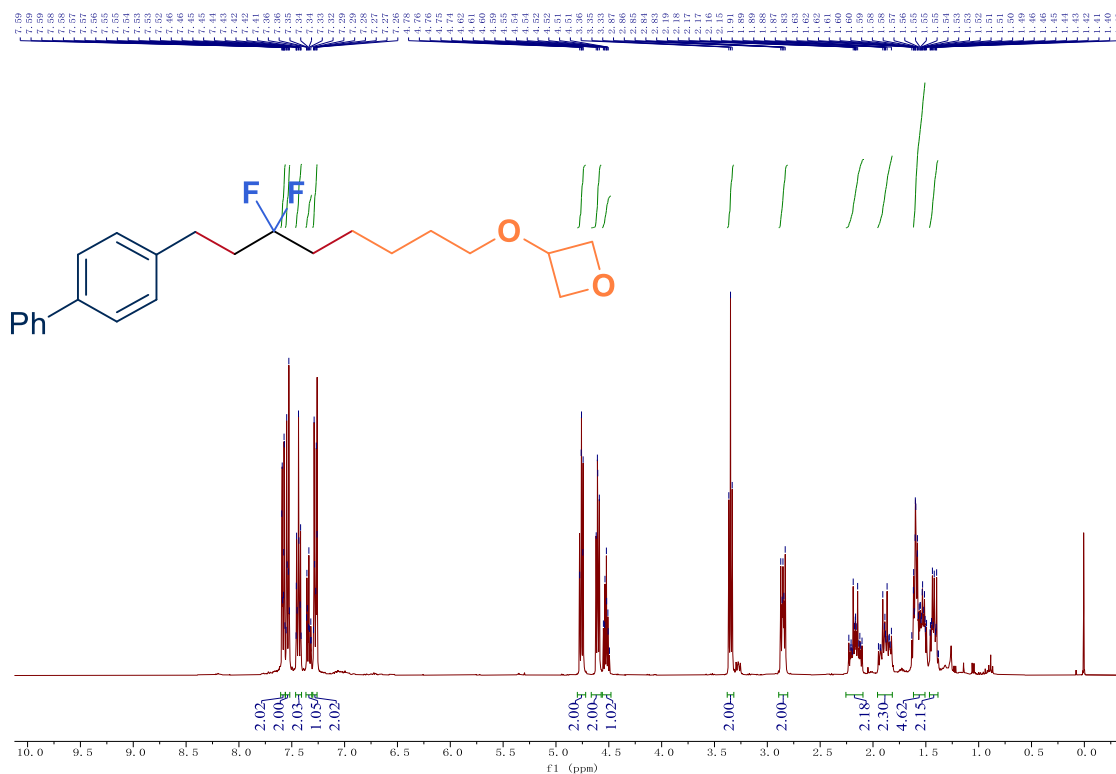
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2m**



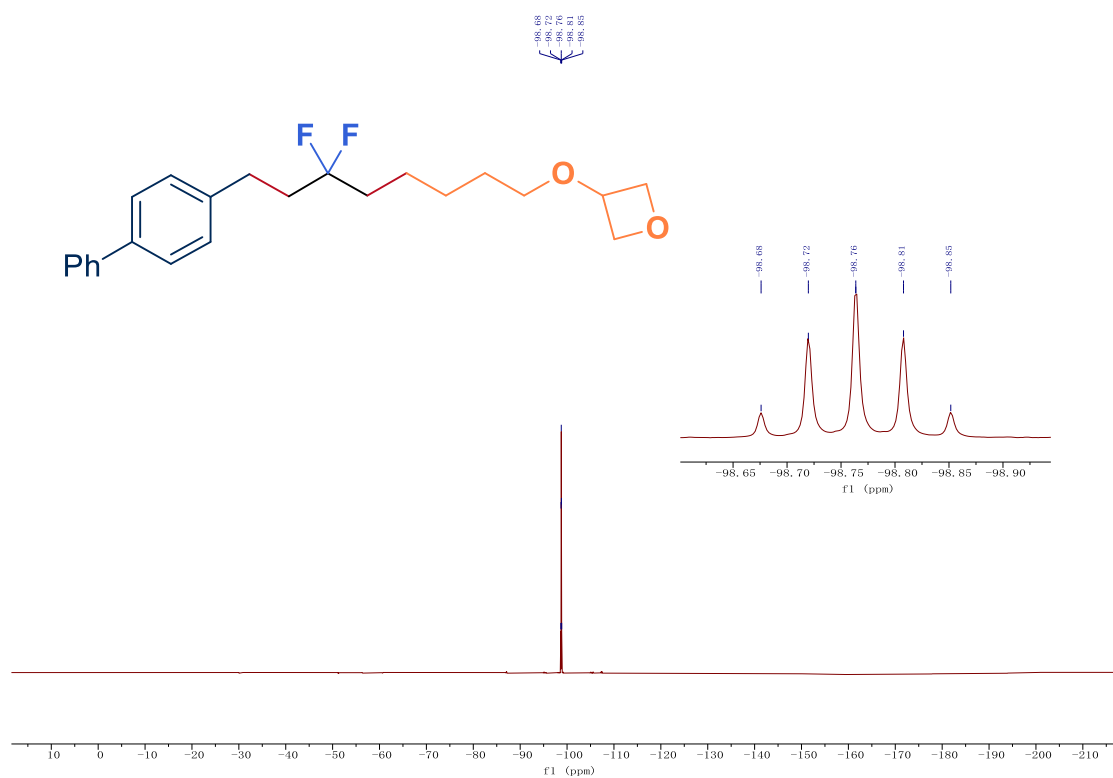
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2m**



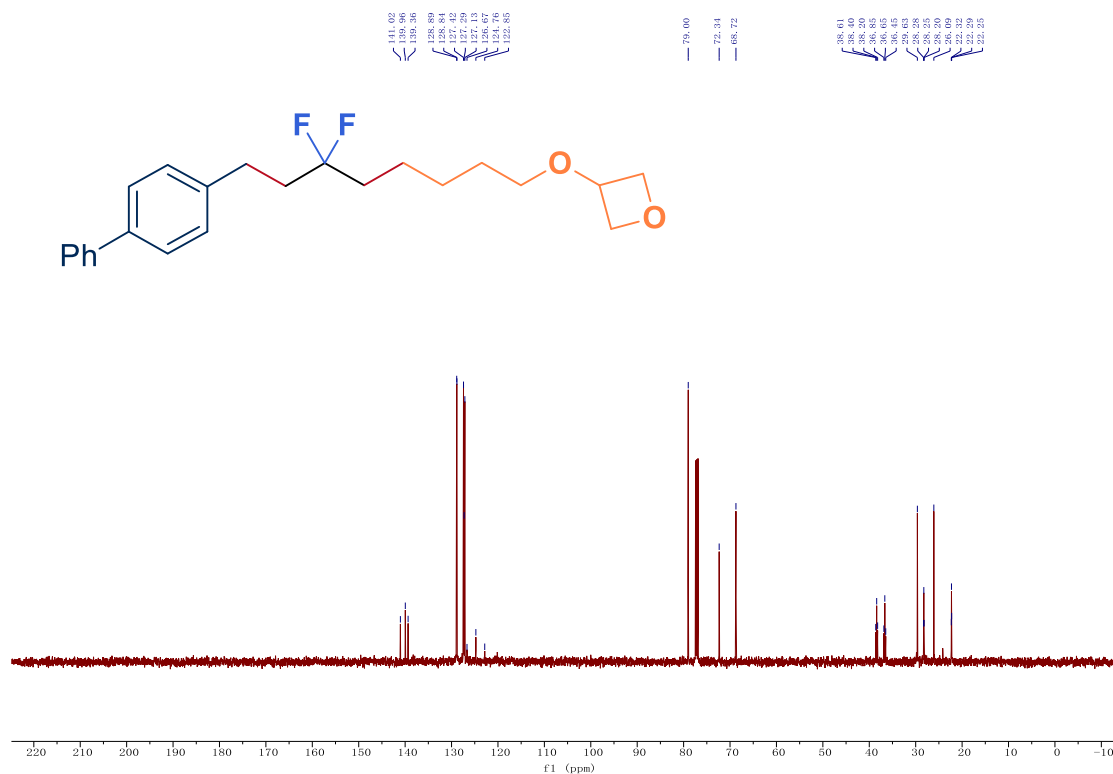
^1H NMR (400 MHz, CDCl_3) spectra for compound **2n**



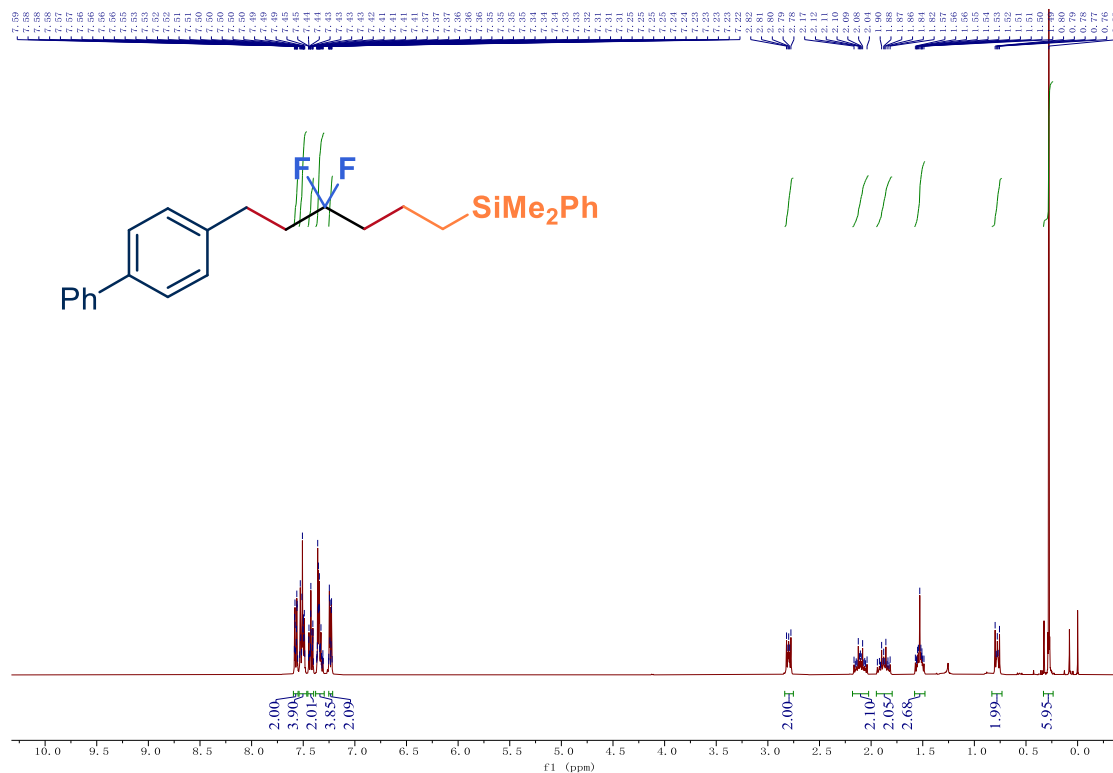
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2n**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound 2n



^1H NMR (400 MHz, CDCl_3) spectra for compound 2o



The chemical structure is 1-(4-phenylphenyl)-2,2-difluoro-3-(trimethylphenylsilyl)propane. It features a central 1,4-phenylene ring connected at the para position to a 4-phenylphenyl group. The other para position of this ring is connected to a 2,2-difluoro-3-(trimethylphenylsilyl)propyl chain. The trimethylphenylsilyl group is represented as SiMe₂Ph in orange.

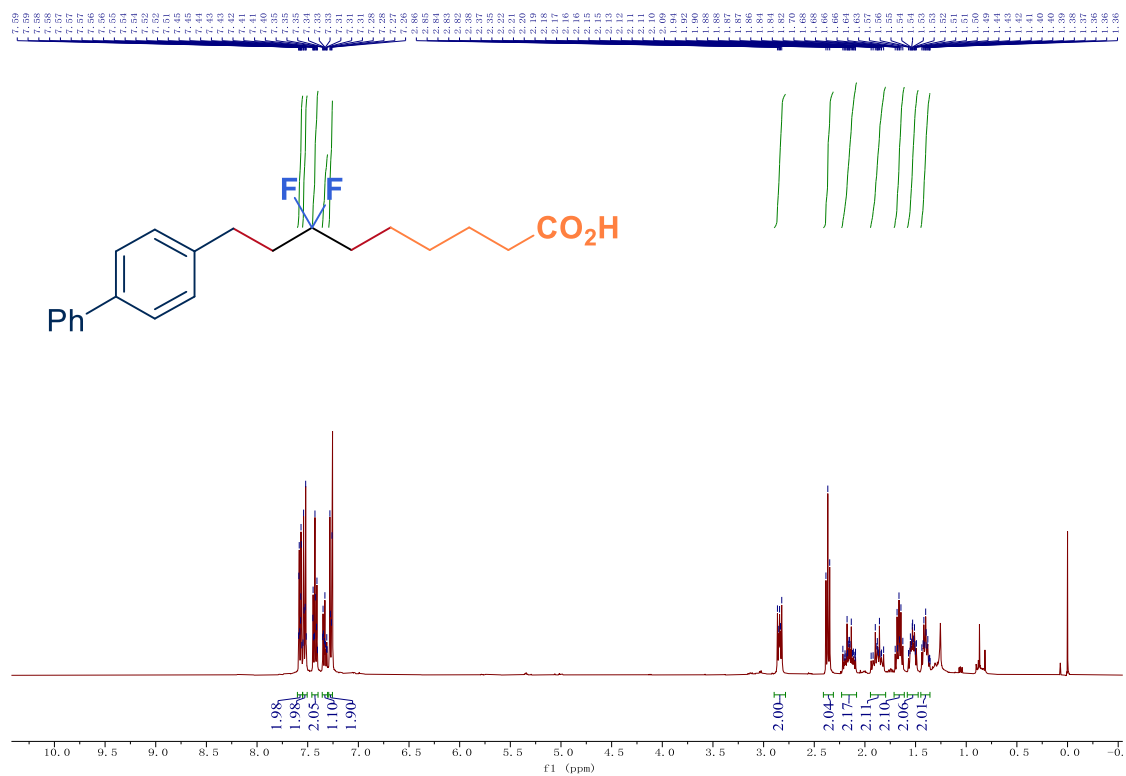
The ¹³C NMR spectrum (CDCl₃) shows a cluster of peaks between -98.3 and -98.6 ppm, with five peaks labeled at -98.40, -98.45, -98.49, -98.51, and -98.58 ppm. A smaller peak is visible at approximately -98.53 ppm. The x-axis ranges from -92.5 to -103.5 ppm.

Chemical structure: CC(C)(F)Cc1ccc(cc1)-c2ccccc2 (1,1-difluoro-2-(4-phenylphenyl)ethane-2-yltrimethylsilane)

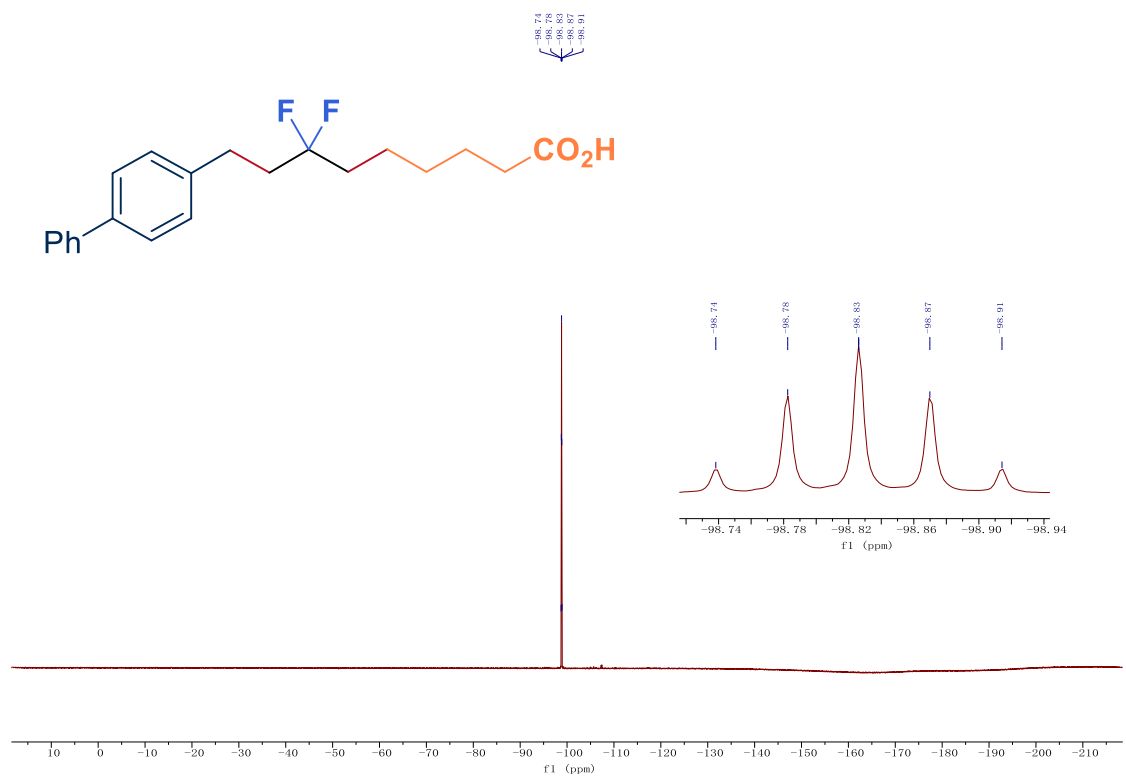
¹H NMR spectrum (CDCl₃) showing peaks for the compound. The x-axis is labeled f1 (ppm) and ranges from 220 to -10. The spectrum shows several peaks corresponding to the structure, with chemical shifts listed above the peaks:

- 7.27, 7.29, 7.32, 7.35, 7.38, 7.41, 7.44, 7.47, 7.50, 7.53, 7.56, 7.59, 7.62, 7.65, 7.68, 7.71, 7.74, 7.77, 7.80, 7.83, 7.86, 7.89, 7.92, 7.95, 7.98, 8.01, 8.04, 8.07, 8.10, 8.13, 8.16, 8.19, 8.22, 8.25, 8.28, 8.31, 8.34, 8.37, 8.40, 8.43, 8.46, 8.49, 8.52, 8.55, 8.58, 8.61, 8.64, 8.67, 8.70, 8.73, 8.76, 8.79, 8.82, 8.85, 8.88, 8.91, 8.94, 8.97, 9.00, 9.03, 9.06, 9.09, 9.12, 9.15, 9.18, 9.21, 9.24, 9.27, 9.30, 9.33, 9.36, 9.39, 9.42, 9.45, 9.48, 9.51, 9.54, 9.57, 9.60, 9.63, 9.66, 9.69, 9.72, 9.75, 9.78, 9.81, 9.84, 9.87, 9.90, 9.93, 9.96, 9.99, 10.02, 10.05, 10.08, 10.11, 10.14, 10.17, 10.20, 10.23, 10.26, 10.29, 10.32, 10.35, 10.38, 10.41, 10.44, 10.47, 10.50, 10.53, 10.56, 10.59, 10.62, 10.65, 10.68, 10.71, 10.74, 10.77, 10.80, 10.83, 10.86, 10.89, 10.92, 10.95, 10.98, 11.01, 11.04, 11.07, 11.10, 11.13, 11.16, 11.19, 11.22, 11.25, 11.28, 11.31, 11.34, 11.37, 11.40, 11.43, 11.46, 11.49, 11.52, 11.55, 11.58, 11.61, 11.64, 11.67, 11.70, 11.73, 11.76, 11.79, 11.82, 11.85, 11.88, 11.91, 11.94, 11.97, 12.00, 12.03, 12.06, 12.09, 12.12, 12.15, 12.18, 12.21, 12.24, 12.27, 12.30, 12.33, 12.36, 12.39, 12.42, 12.45, 12.48, 12.51, 12.54, 12.57, 12.60, 12.63, 12.66, 12.69, 12.72, 12.75, 12.78, 12.81, 12.84, 12.87, 12.90, 12.93, 12.96, 12.99, 13.02, 13.05, 13.08, 13.11, 13.14, 13.17, 13.20, 13.23, 13.26, 13.29, 13.32, 13.35, 13.38, 13.41, 13.44, 13.47, 13.50, 13.53, 13.56, 13.59, 13.62, 13.65, 13.68, 13.71, 13.74, 13.77, 13.80, 13.83, 13.86, 13.89, 13.92, 13.95, 13.98, 14.01, 14.04, 14.07, 14.10, 14.13, 14.16, 14.19, 14.22, 14.25, 14.28, 14.31, 14.34, 14.37, 14.40, 14.43, 14.46, 14.49, 14.52, 14.55, 14.58, 14.61, 14.64, 14.67, 14.70, 14.73, 14.76, 14.79, 14.82, 14.85, 14.88, 14.91, 14.94, 14.97, 15.00, 15.03, 15.06, 15.09, 15.12, 15.15, 15.18, 15.21, 15.24, 15.27, 15.30, 15.33, 15.36, 15.39, 15.42, 15.45, 15.48, 15.51, 15.54, 15.57, 15.60, 15.63, 15.66, 15.69, 15.72, 15.75, 15.78, 15.81, 15.84, 15.87, 15.90, 15.93, 15.96, 15.99, 16.02, 16.05, 16.08, 16.11, 16.14, 16.17, 16.20, 16.23, 16.26, 16.29, 16.32, 16.35, 16.38, 16.41, 16.44, 16.47, 16.50, 16.53, 16.56, 16.59, 16.62, 16.65, 16.68, 16.71, 16.74, 16.77, 16.80, 16.83, 16.86, 16.89, 16.92, 16.95, 16.98, 17.01, 17.04, 17.07, 17.10, 17.13, 17.16, 17.19, 17.22, 17.25, 17.28, 17.31, 17.34, 17.37, 17.40, 17.43, 17.46, 17.49, 17.52, 17.55, 17.58, 17.61, 17.64, 17.67, 17.70, 17.73, 17.76, 17.79, 17.82, 17.85, 17.88, 17.91, 17.94, 17.97, 18.00, 18.03, 18.06, 18.09, 18.12, 18.15, 18.18, 18.21, 18.24, 18.27, 18.30, 18.33, 18.36, 18.39, 18.42, 18.45, 18.48, 18.51, 18.54, 18.57, 18.60, 18.63, 18.66, 18.69, 18.72, 18.75, 18.78, 18.81, 18.84, 18.87, 18.90, 18.93, 18.96, 18.99, 19.02, 19.05, 19.08, 19.11, 19.14, 19.17, 19.20, 19.23, 19.26, 19.29, 19.32, 19.35, 19.38, 19.41, 19.44, 19.47, 19.50, 19.53, 19.56, 19.59, 19.62, 19.65, 19.68, 19.71, 19.74, 19.77, 19.80, 19.83, 19.86, 19.89, 19.92, 19.95, 19.98, 20.01, 20.04, 20.07, 20.10, 20.13, 20.16, 20.19, 20.22, 20.25, 20.28, 20.31, 20.34, 20.37, 20.40, 20.43, 20.46, 20.49, 20.52, 20.55, 20.58, 20.61, 20.64, 20.67, 20.70, 20.73, 20.76, 20.79, 20.82, 20.85, 20.88, 20.91, 20.94, 20.97, 21.00, 21.03, 21.06, 21.09, 21.12, 21.15, 21.18, 21.21, 21.24, 21.27, 21.30, 21.33, 21.36, 21.39, 21.42, 21.45, 21.48, 21.51, 21.54, 21.57, 21.60, 21.63, 21.66, 21.69, 21.72, 21.75, 21.78, 21.81, 21.84, 21.87, 21.90, 21.93, 21.96, 21.99, 22.02, 22.05, 22.08, 22.11, 22.14, 22.17, 22.20, 22.23, 22.26, 22.29, 22.32, 22.35, 22.38, 22.41, 22.44, 22.47, 22.50, 22.53, 22.56, 22.59, 22.62, 22.65, 22.68, 22.71, 22.74, 22.77, 22.80, 22.83, 22.86, 22.89, 22.92, 22.95, 22.98, 23.01, 23.04, 23.07, 23.10, 23.13, 23.16, 23.19, 23.22, 23.25, 23.28, 23.31, 23.34, 23.37, 23.40, 23.43, 23.46, 23.49, 23.52, 23.55, 23.58, 23.61, 23.64, 23.67, 23.70, 23.73, 23.76, 23.79, 23.82, 23.85, 23.88, 23.91, 23.94, 23.97, 24.00, 24.03, 24.06, 24.09, 24.12, 24.15, 24.18

^1H NMR (400 MHz, CDCl_3) spectra for compound **2p**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2p**



Chemical structure: OC(=O)CC(C(F)(F)C)Cc1ccc(cc1)c2ccccc2

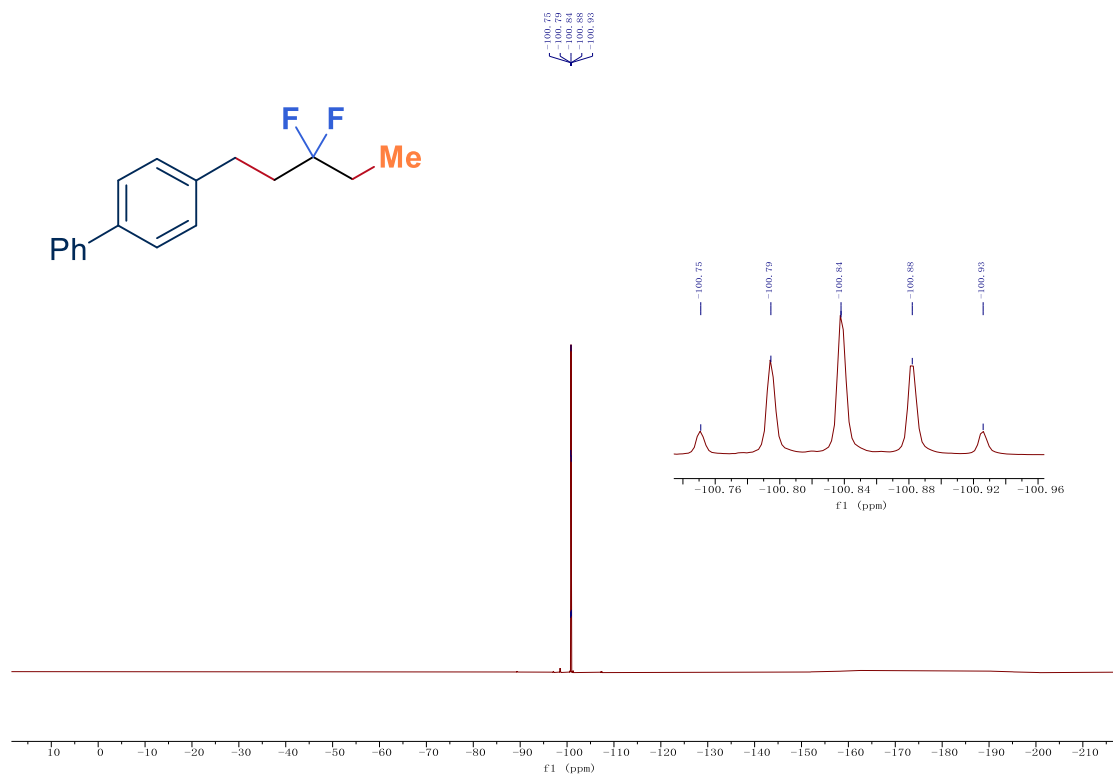
¹H NMR spectrum (400 MHz, DMSO-d₆) showing peaks and integration values:

Chemical Shift (ppm)	Integration
11.80 (s, 1H)	1.00
7.25-7.45 (m, 5H)	1.00
2.90 (m, 2H)	1.00
2.30 (m, 2H)	1.00
1.80 (m, 2H)	1.00

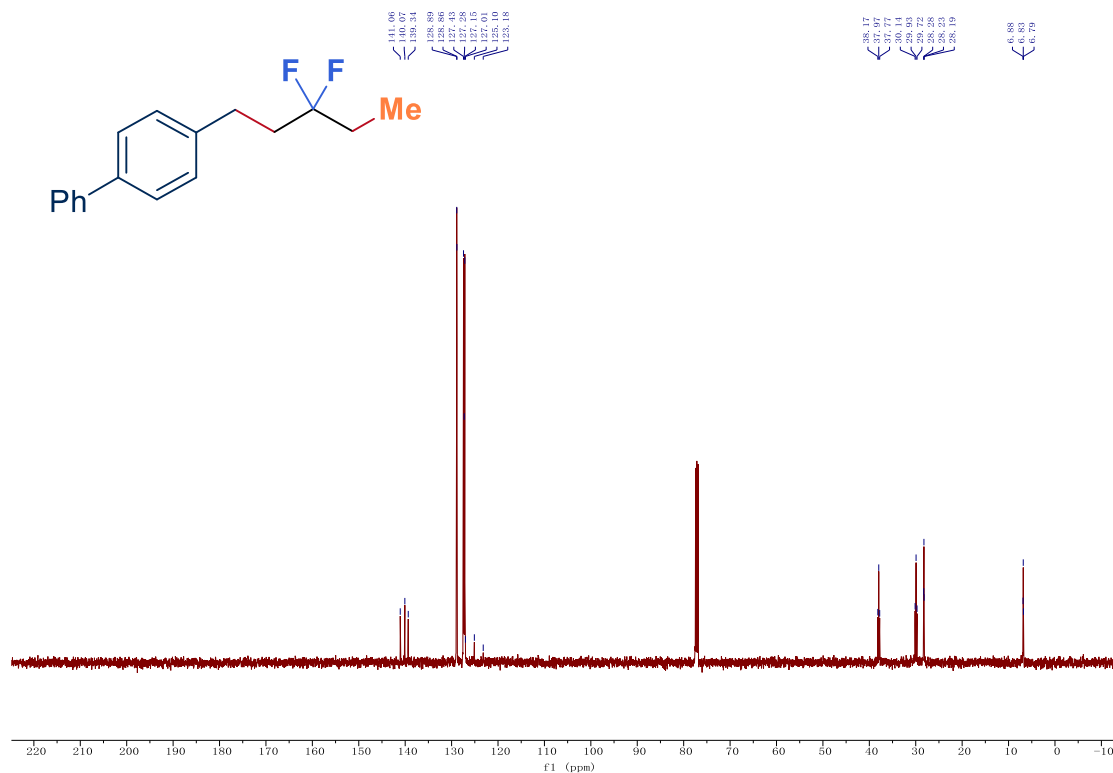
Chemical structure: CC(F)(F)C=Cc1ccc(cc1)C#C

¹H NMR spectrum (400 MHz, CDCl₃) showing peaks for the compound. The x-axis is labeled f1 (ppm) and ranges from 0.0 to 10.0. The spectrum displays several multiplets in the aromatic region (7.2-7.7 ppm), two multiplets in the alkyne region (2.1-2.3 ppm), and a singlet for the methyl group (1.1 ppm). Integration values are provided below the peaks: 4.00, 2.00, 0.99, 2.01, 2.00, 2.05, 1.88, and 2.79.

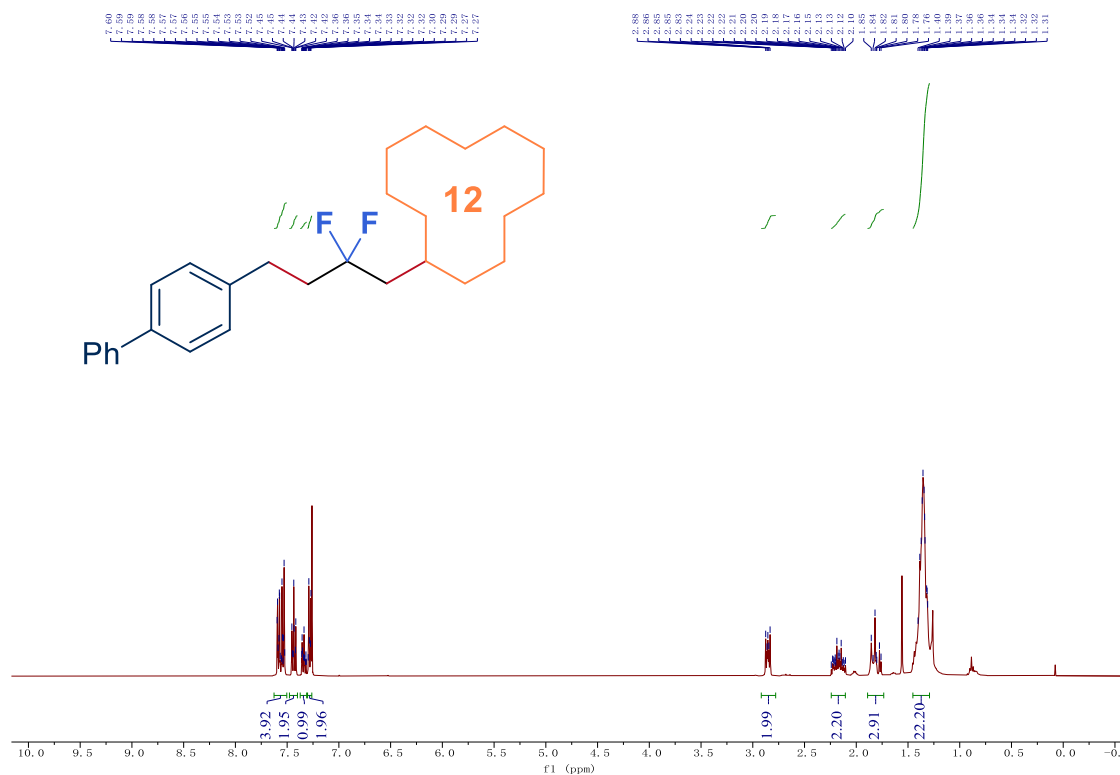
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2q**



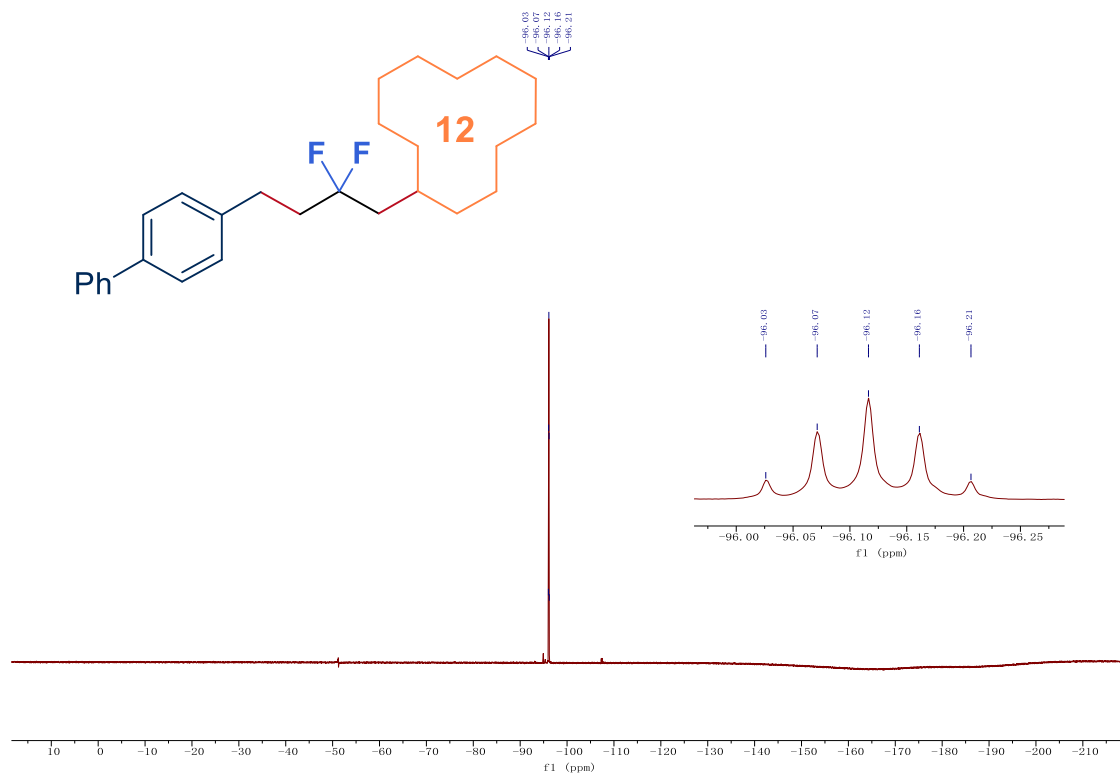
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2q**



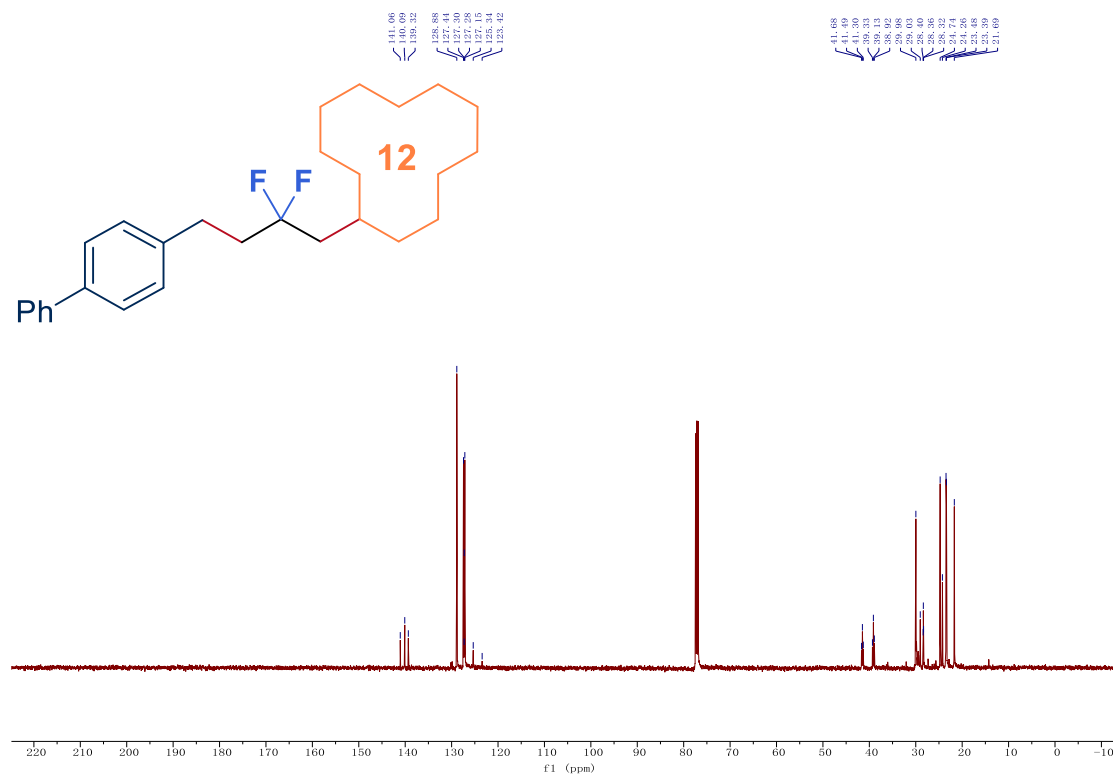
^1H NMR (400 MHz, CDCl_3) spectra for compound **2r**



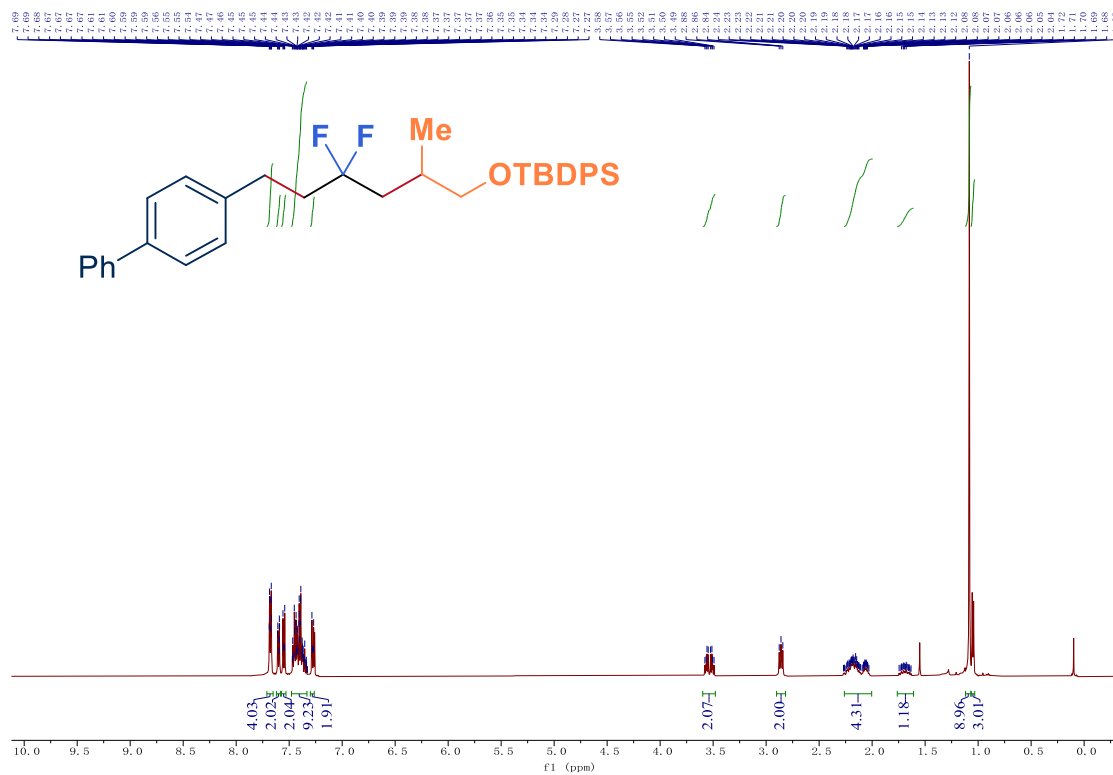
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2r**



¹³C NMR (126 MHz, CDCl₃) spectra for compound **2r**



¹H NMR (400 MHz, CDCl₃) spectra for compound **2s**



Chemical structure of OTBDPS (tert-butyldimethylphenylsilyl ether) is shown. The structure consists of a phenyl ring attached to a 1,1-difluoroethyl group, which is further attached to a 1-methoxy-2-methylpropyl group.

The ^{19}F NMR spectrum (ppm) is displayed below the structure, showing two main regions of peaks:

- Aromatic/Alkene Region (ppm):** -94.92, -94.94, -94.95, -94.98, -94.99, -95.01, -95.02, -95.04, -95.43, -95.45, -95.47, -95.53, -95.57.
- Aliphatic Region (ppm):** -96.65, -96.69, -96.72, -96.76, -96.80, -97.16, -97.20, -97.23, -97.24, -97.26, -97.28, -97.31.

Chemical structure of 4-(4-(dimethyl(2,2,2-trifluoroethyl)oxy)phenyl)phenol is shown above the ^{13}C NMR spectrum. The structure is color-coded: the phenyl ring is blue, the dimethyl(2,2,2-trifluoroethyl)oxy group is orange, and the trifluoroethyl group is blue.

The ^{13}C NMR spectrum (f1 (ppm)) displays the following chemical shifts (ppm):

- 141.08
- 140.02
- 138.74
- 135.74
- 133.87
- 132.87
- 128.90
- 128.87
- 127.28
- 127.43
- 127.06
- 125.23
- 123.31
- 68.78
- 39.79
- 39.59
- 39.39
- 39.19
- 38.99
- 38.86
- 31.06
- 29.84
- 29.30
- 28.27
- 27.02
- 19.46
- 17.78

Chemical structure: CSc1ccc(cc1)CC(F)(F)CCCl

¹H NMR spectrum (400 MHz, CDCl₃) data:

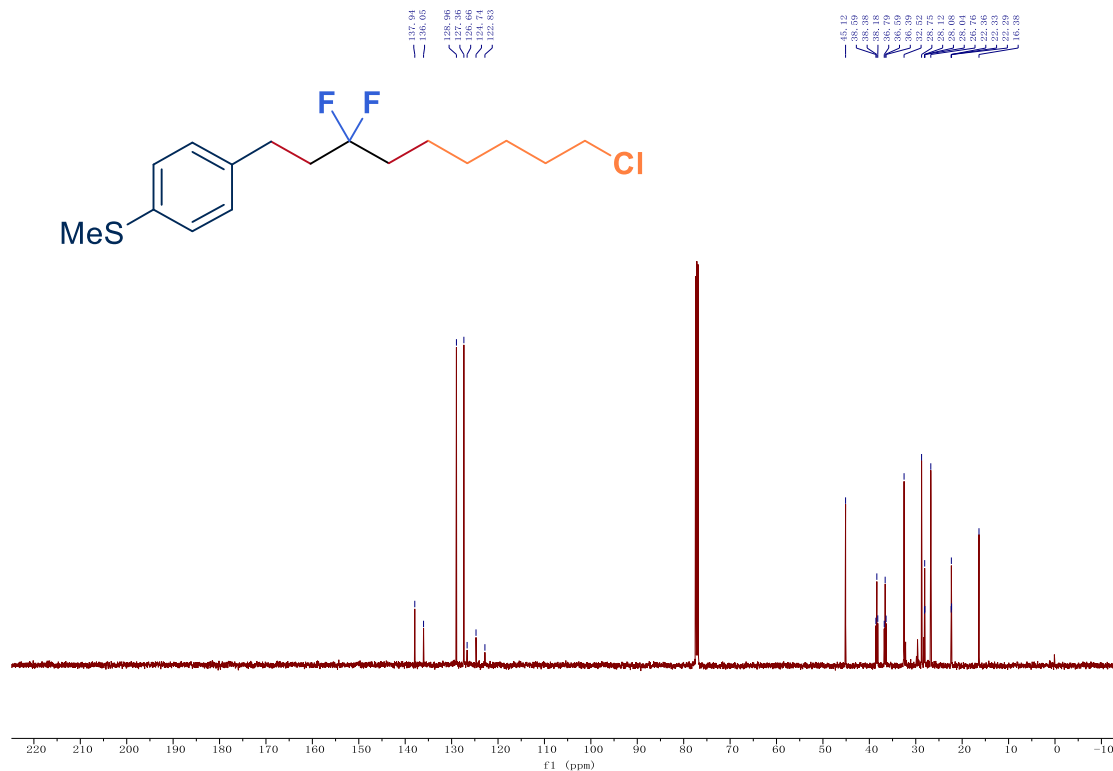
Chemical Shift (ppm)	Integration
7.10 - 7.15	1.80, 1.86
3.80	2.12
2.50	2.00, 2.96
1.30 - 2.10	2.05, 4.19, 4.09, 2.09
0.00	2.05, 4.19, 4.09, 2.09

CSc1ccc(cc1)CC(F)(F)CCCCl

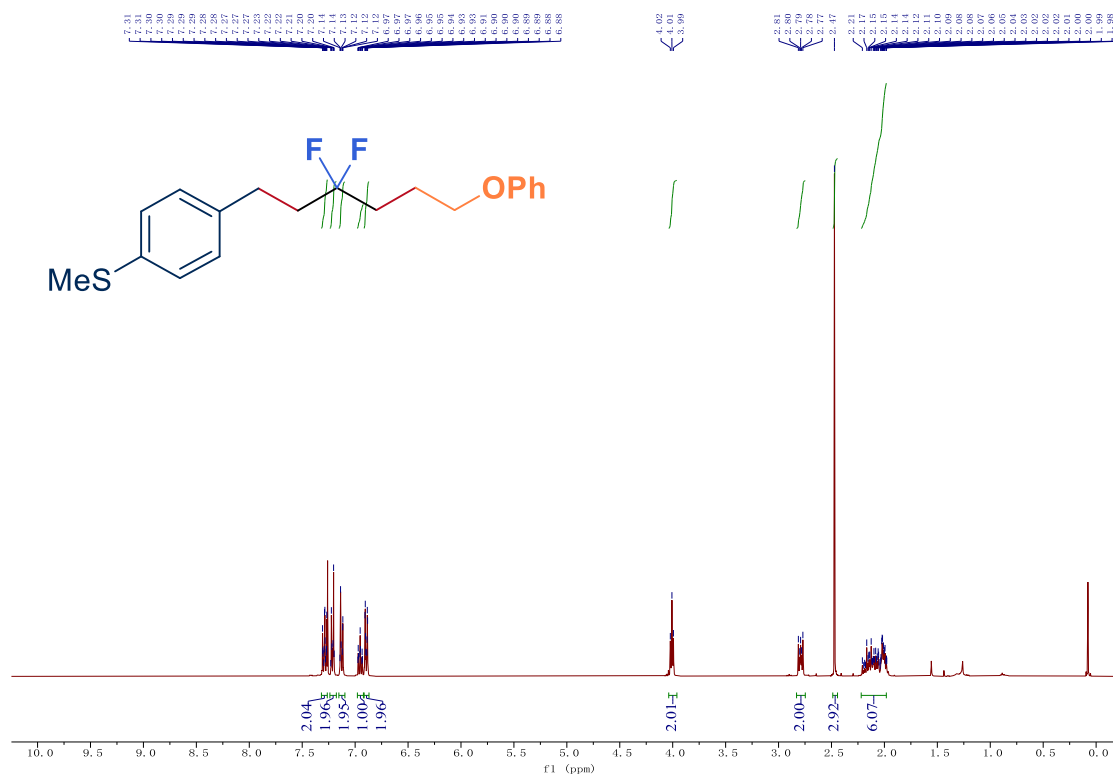
Chemical structure of 1-(4-methylthienyl)-2,2-difluoro-5-chloropentane. The structure shows a benzene ring with a methylthio group (MeS-) at the para position relative to a 2,2-difluoro-5-chloropentyl chain. The two fluorine atoms on the chiral carbon are highlighted in blue. The chemical shift range for the 19F NMR spectrum is indicated as -100.617 to -98.865 ppm.

19F NMR spectrum (ppm) showing five peaks corresponding to the fluorine atoms in the molecule. The peaks are labeled with their chemical shifts: -98.67, -98.71, -98.76, -98.80, and -98.85 ppm. The x-axis is labeled f1 (ppm) and ranges from -100 to -210 ppm.

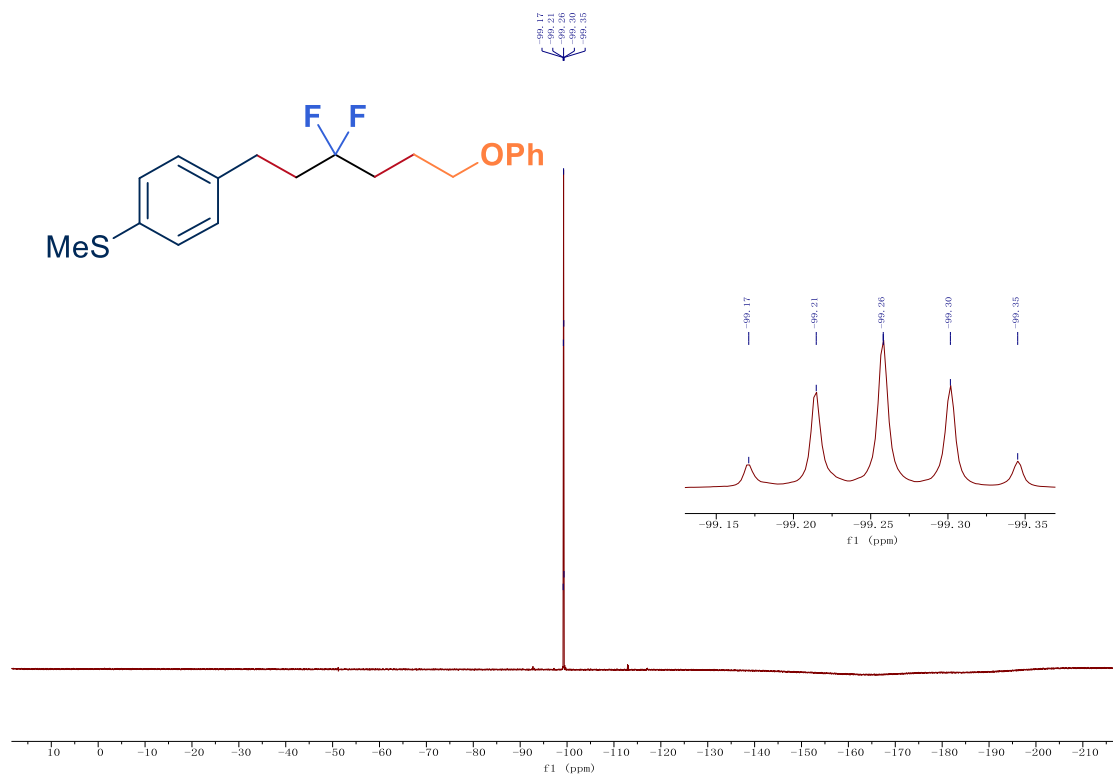
^{13}C NMR (126 MHz, CDCl_3) spectra for compound 2t



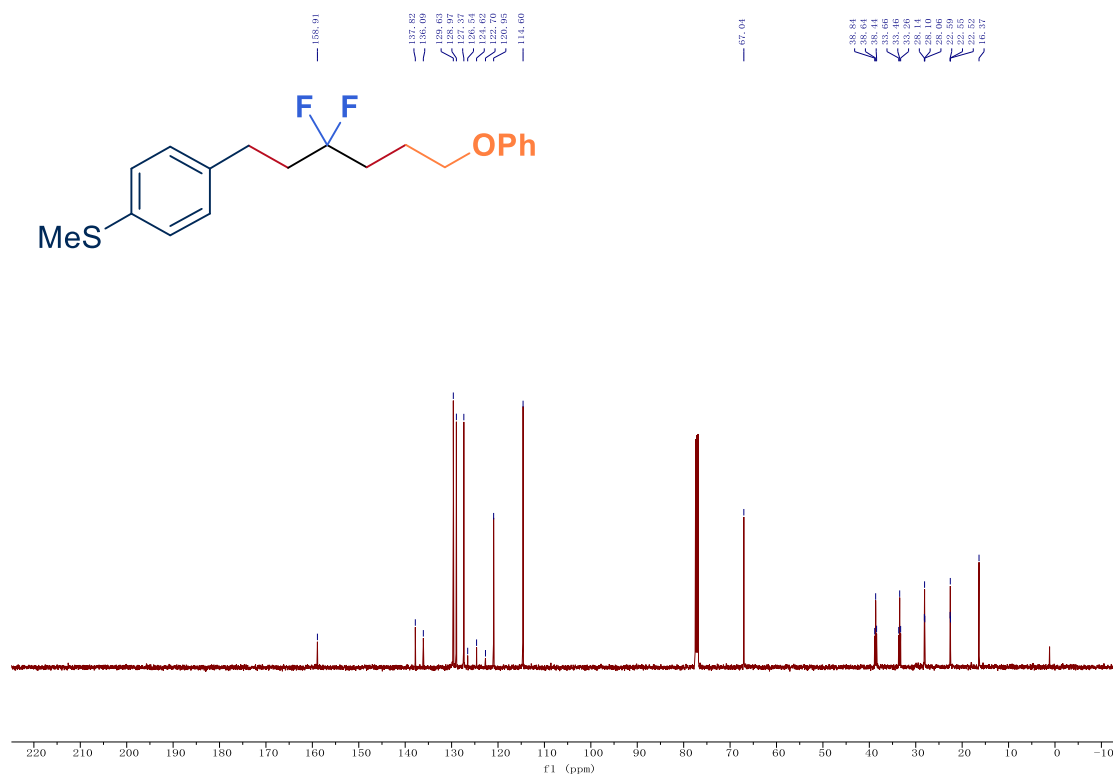
^1H NMR (400 MHz, CDCl_3) spectra for compound 2u



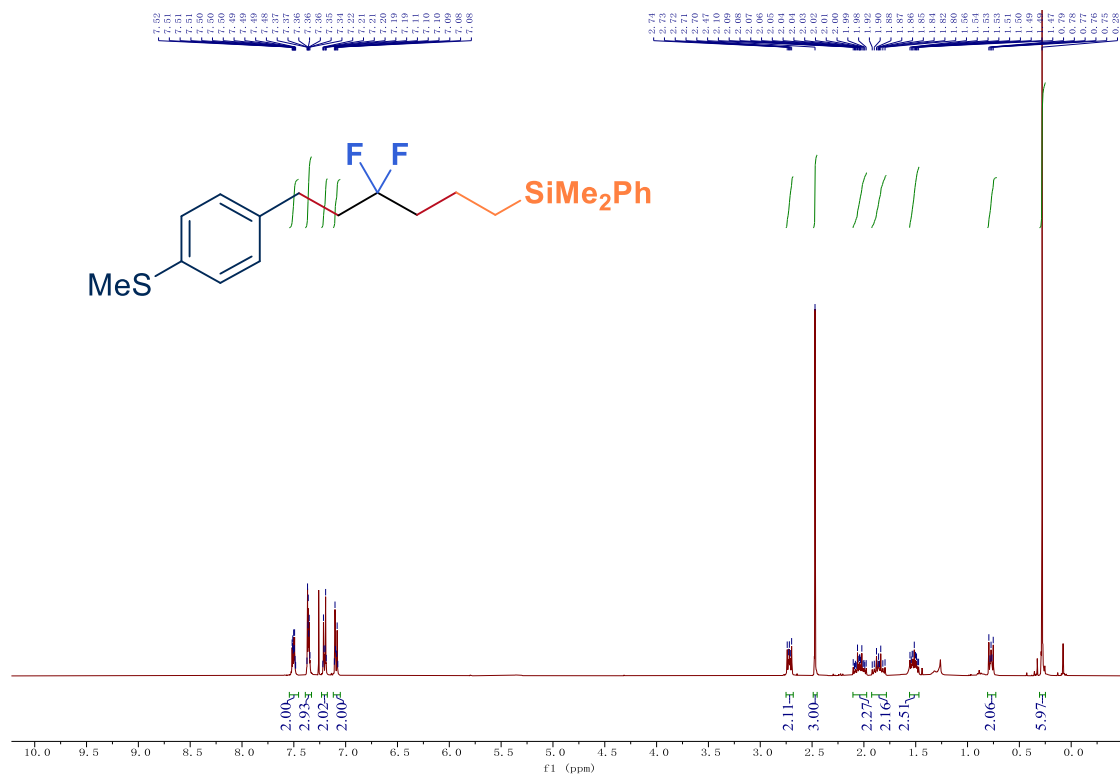
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2u**



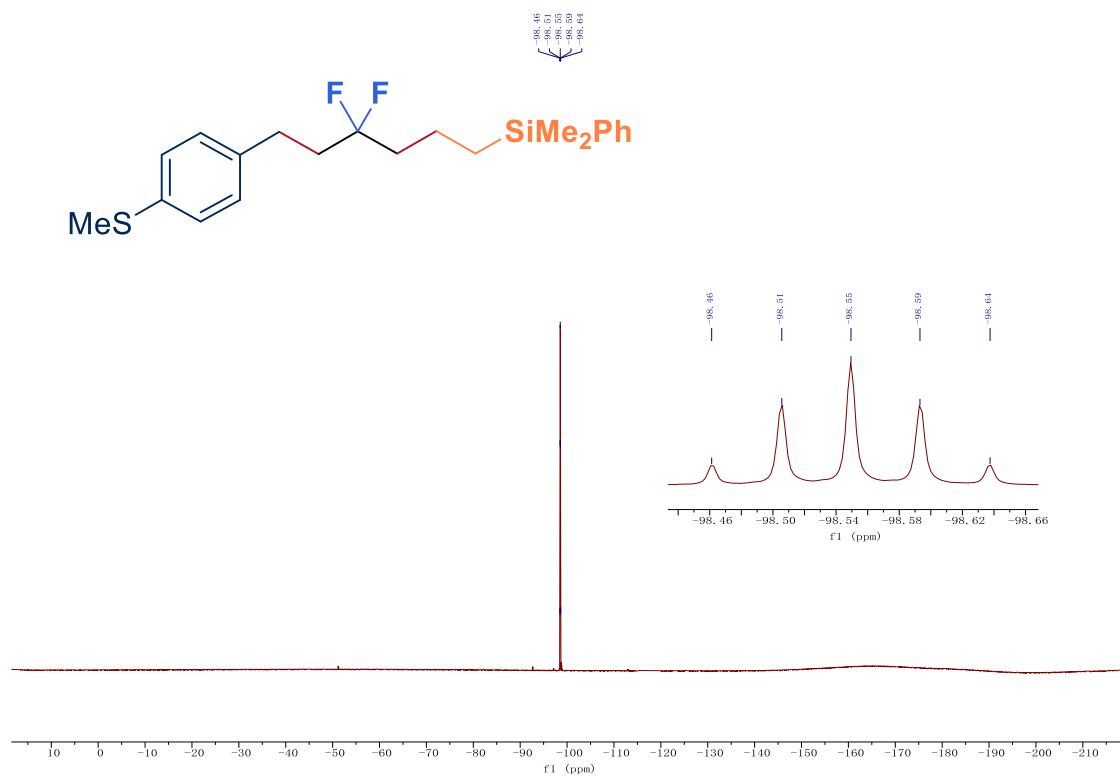
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2u**



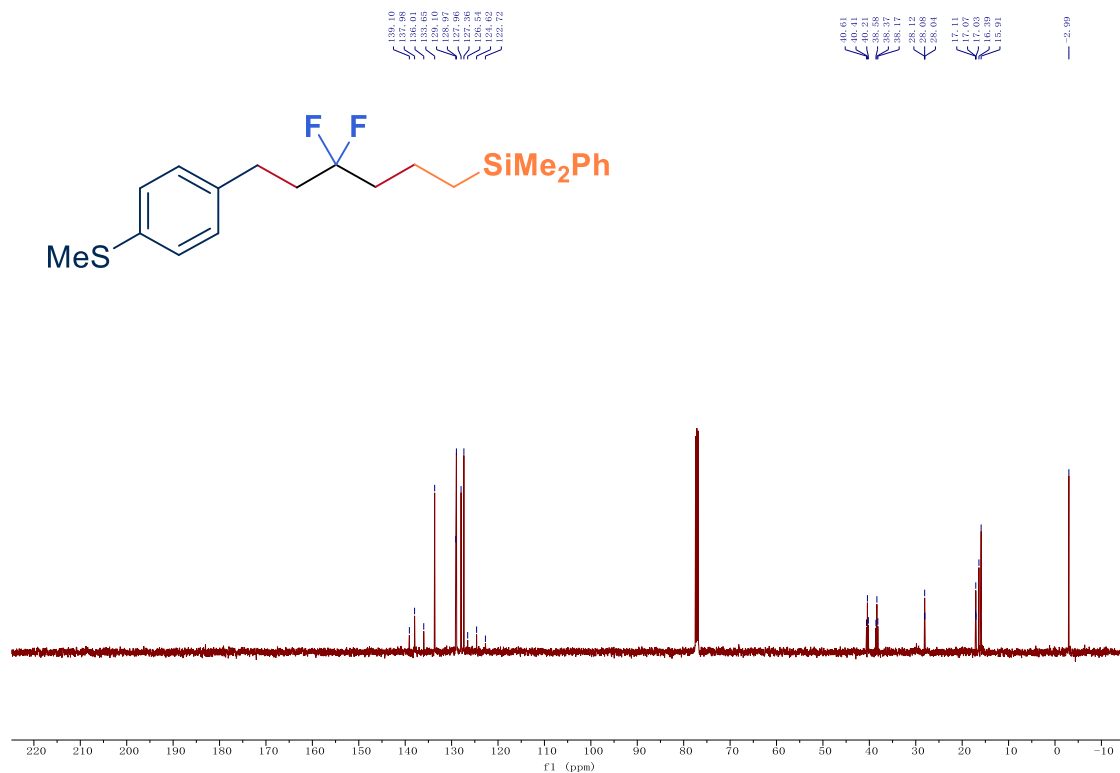
^1H NMR (400 MHz, CDCl_3) spectra for compound 2v



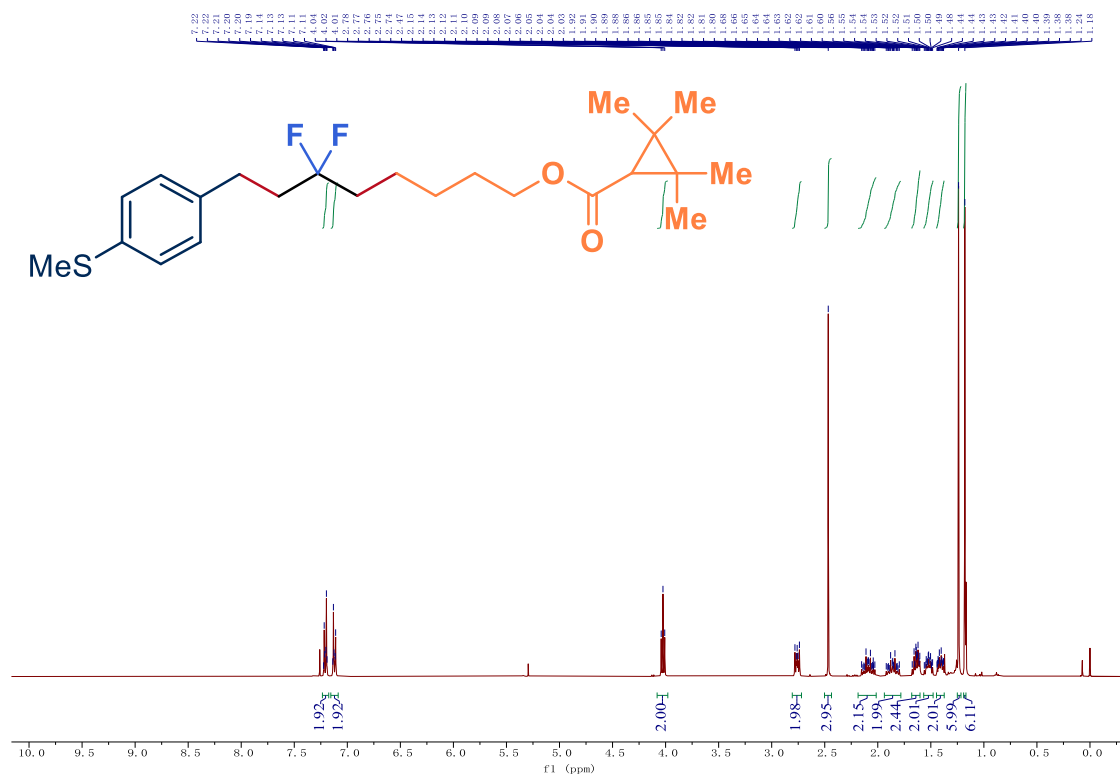
^{19}F NMR (377 MHz, CDCl_3) spectra for compound 2v



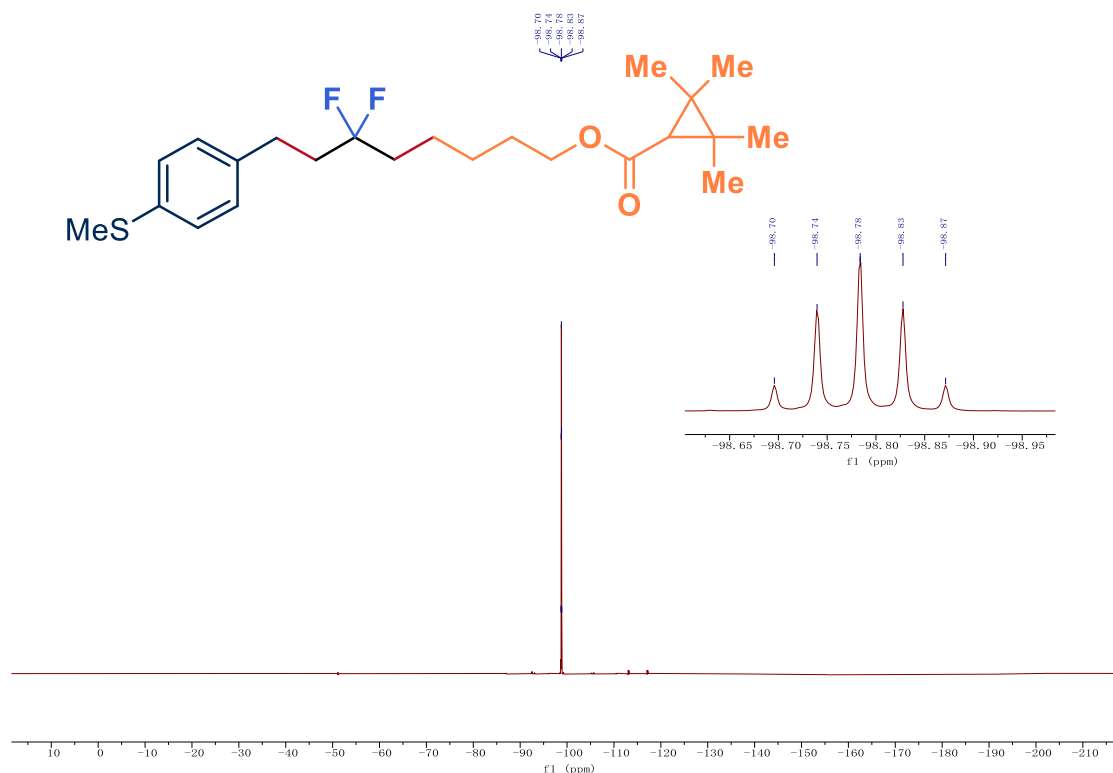
¹³C NMR (126 MHz, CDCl₃) spectra for compound **2v**



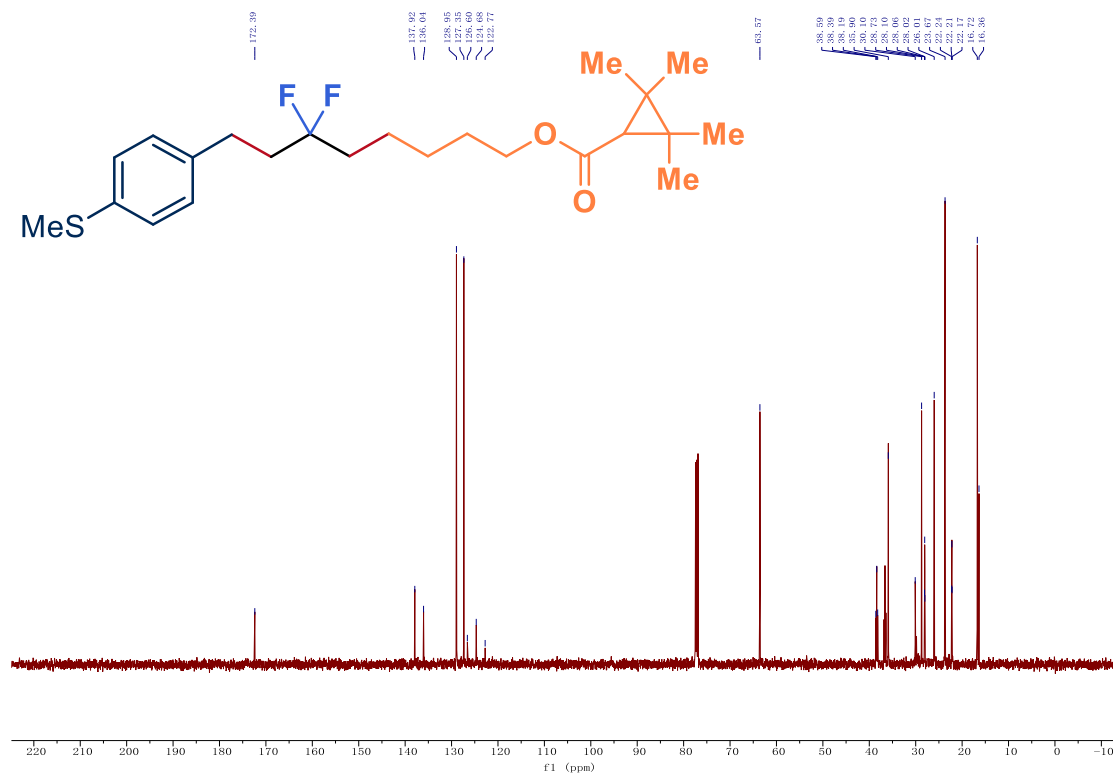
¹H NMR (400 MHz, CDCl₃) spectra for compound **2w**



¹⁹F NMR (377 MHz, CDCl₃) spectra for compound 2w



¹³C NMR (126 MHz, CDCl₃) spectra for compound 2w



Chemical structure: COc1ccc(cc1)C(F)(F)CCc2ccc(S)cc2

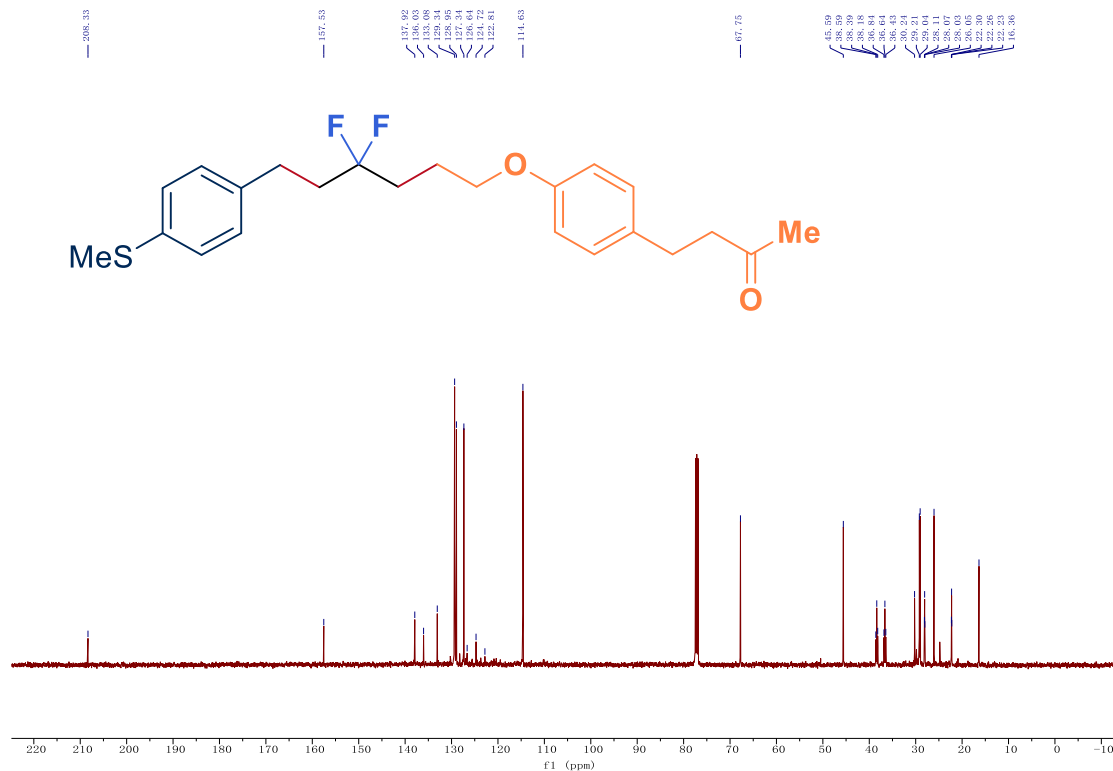
¹H NMR spectrum (400 MHz, CDCl₃) showing peaks from 0.0 to 10.0 ppm. The spectrum is color-coded to match the chemical structure: blue for the 4-methylthienyl group, orange for the 4-methoxyphenyl group, and red for the 2,2-difluoro-1-(4-methoxyphenyl)butane group.

Key peaks and integrations:

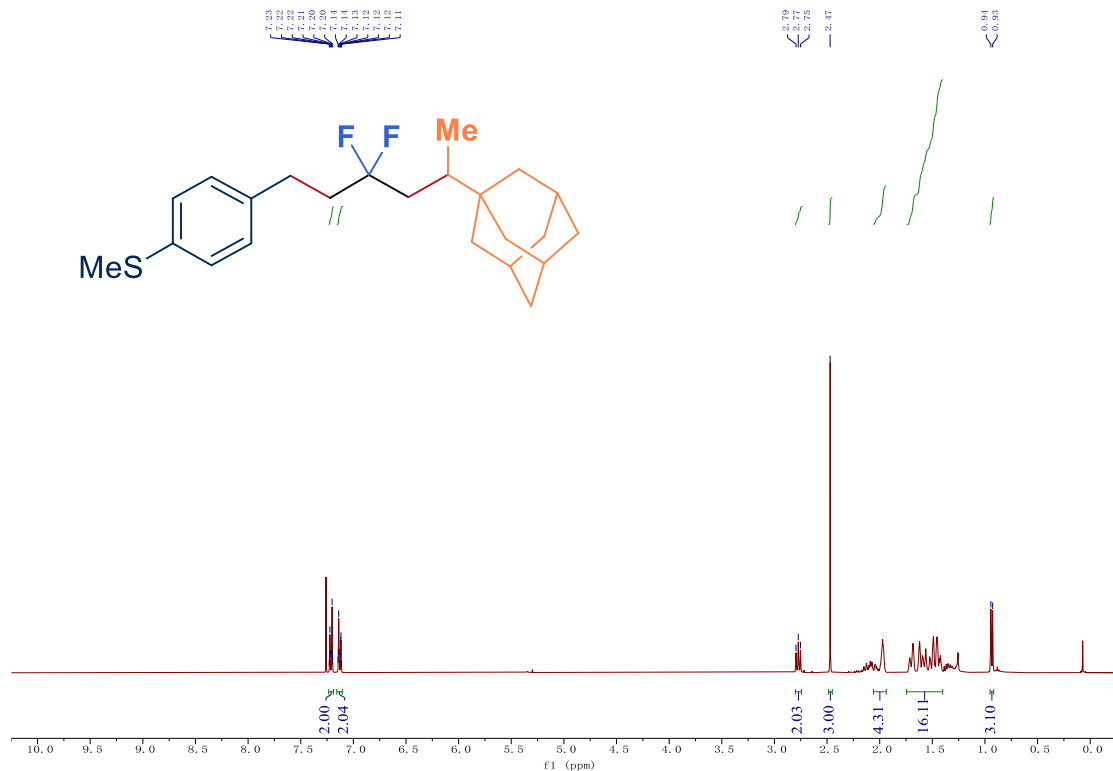
- 2.5 ppm (s, 3H, Me)
- 2.0 ppm (m, 3H, Me)
- 1.5 ppm (m, 3H, Me)
- 4.0 ppm (m, 2H, CH₂)
- 3.8 ppm (m, 2H, CH₂)
- 3.6 ppm (m, 2H, CH₂)
- 3.4 ppm (m, 2H, CH₂)
- 3.2 ppm (m, 2H, CH₂)
- 3.0 ppm (m, 2H, CH₂)
- 2.8 ppm (m, 2H, CH₂)
- 2.6 ppm (m, 2H, CH₂)
- 2.4 ppm (m, 2H, CH₂)
- 2.2 ppm (m, 2H, CH₂)
- 2.0 ppm (m, 2H, CH₂)
- 1.8 ppm (m, 2H, CH₂)
- 1.6 ppm (m, 2H, CH₂)
- 1.4 ppm (m, 2H, CH₂)
- 1.2 ppm (m, 2H, CH₂)
- 1.0 ppm (m, 2H, CH₂)
- 0.8 ppm (m, 2H, CH₂)
- 0.6 ppm (m, 2H, CH₂)
- 0.4 ppm (m, 2H, CH₂)
- 0.2 ppm (m, 2H, CH₂)
- 0.0 ppm (m, 2H, CH₂)

The chemical structure is 4-(4-methyl-2-((4-methylphenyl)difluoromethyl)ethoxy)benzoic acid. It consists of a central benzene ring with a methoxy group (MeO) at the 1-position, a methyl group (Me) at the 4-position, and a 2-((4-methylphenyl)difluoromethyl)ethoxy group at the 3-position. The 2-((4-methylphenyl)difluoromethyl)ethoxy group is highlighted in blue. The 13C NMR spectrum shows peaks at 168.65, 168.70, 168.74, 168.78, and 168.83 ppm, which are assigned to the carbonyl carbon of the benzoic acid group. The x-axis is labeled f1 (ppm) and ranges from -10 to -210.

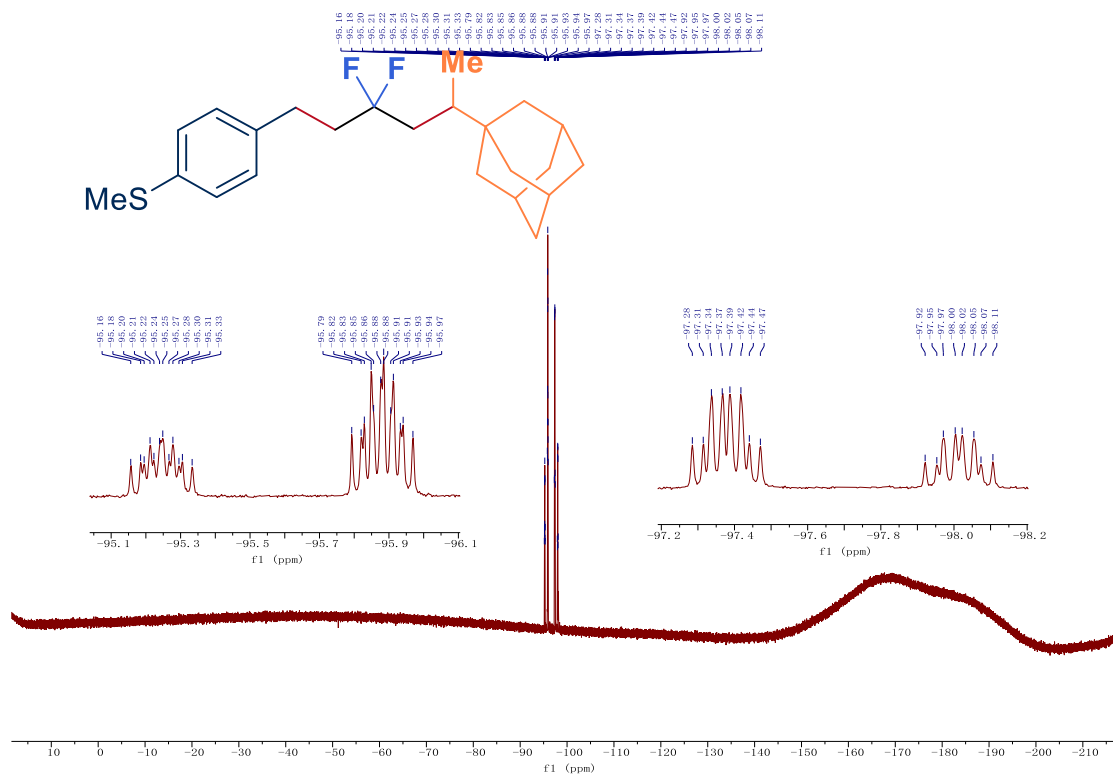
^{13}C NMR (126 MHz, CDCl_3) spectra for compound 2x



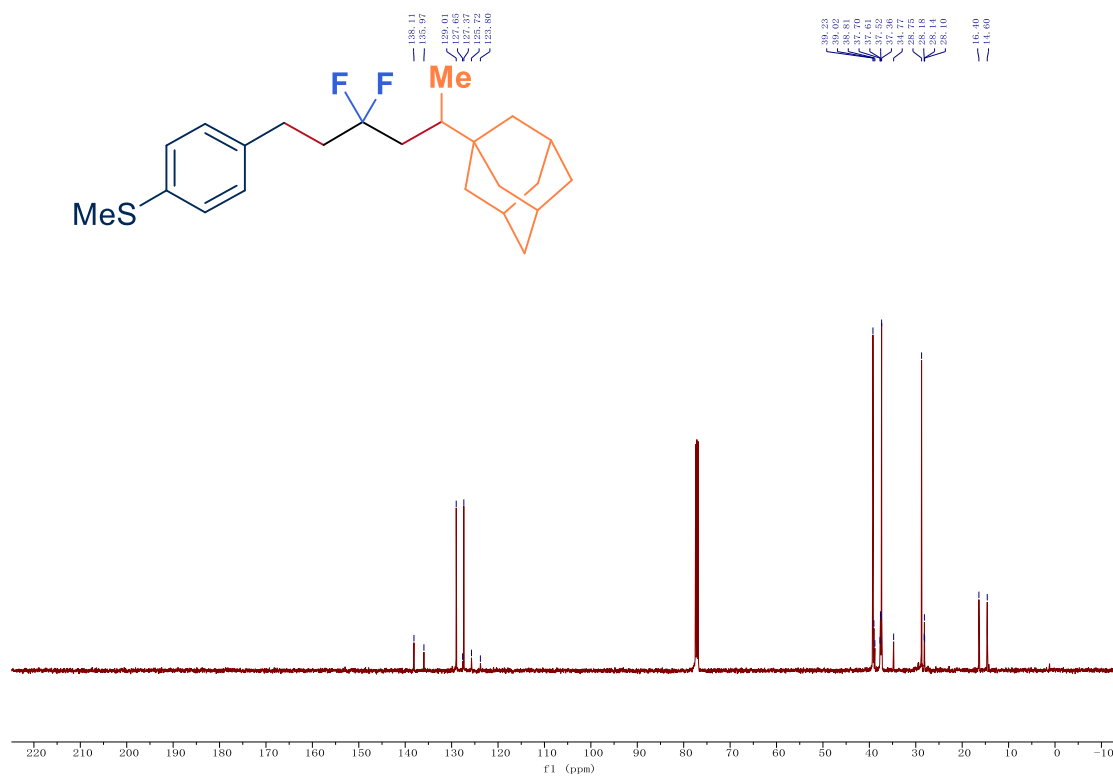
^1H NMR (400 MHz, CDCl_3) spectra for compound 2y



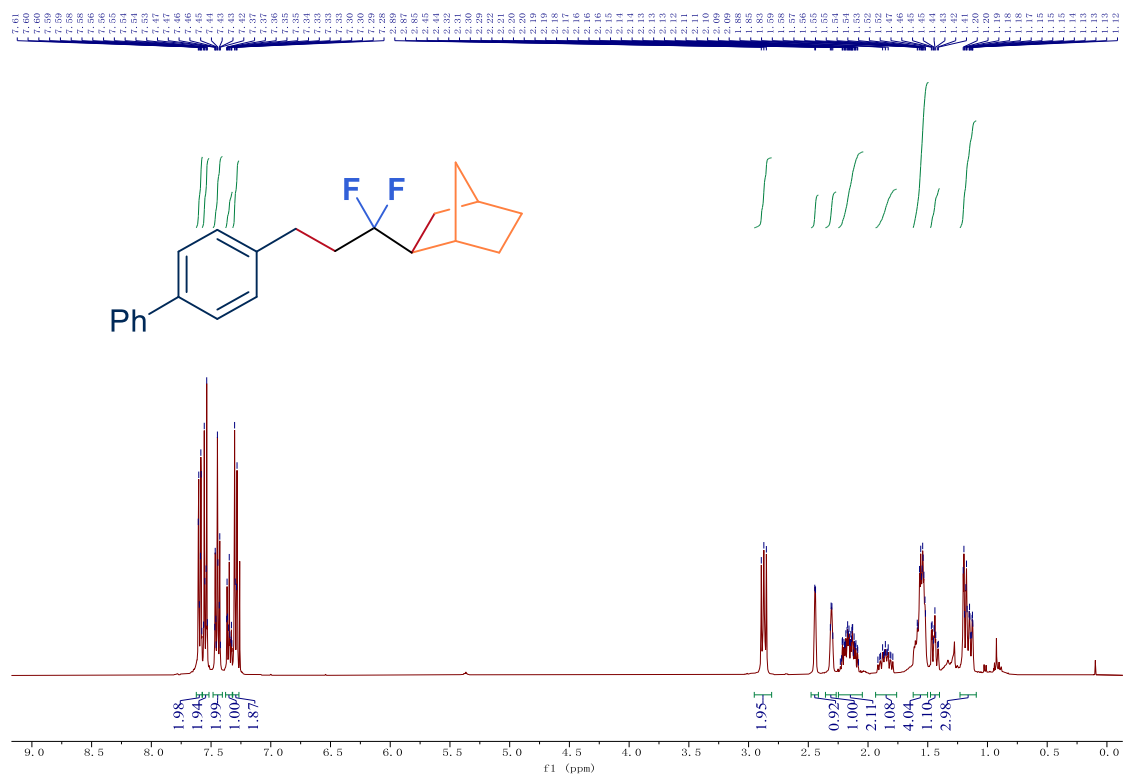
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound 2y



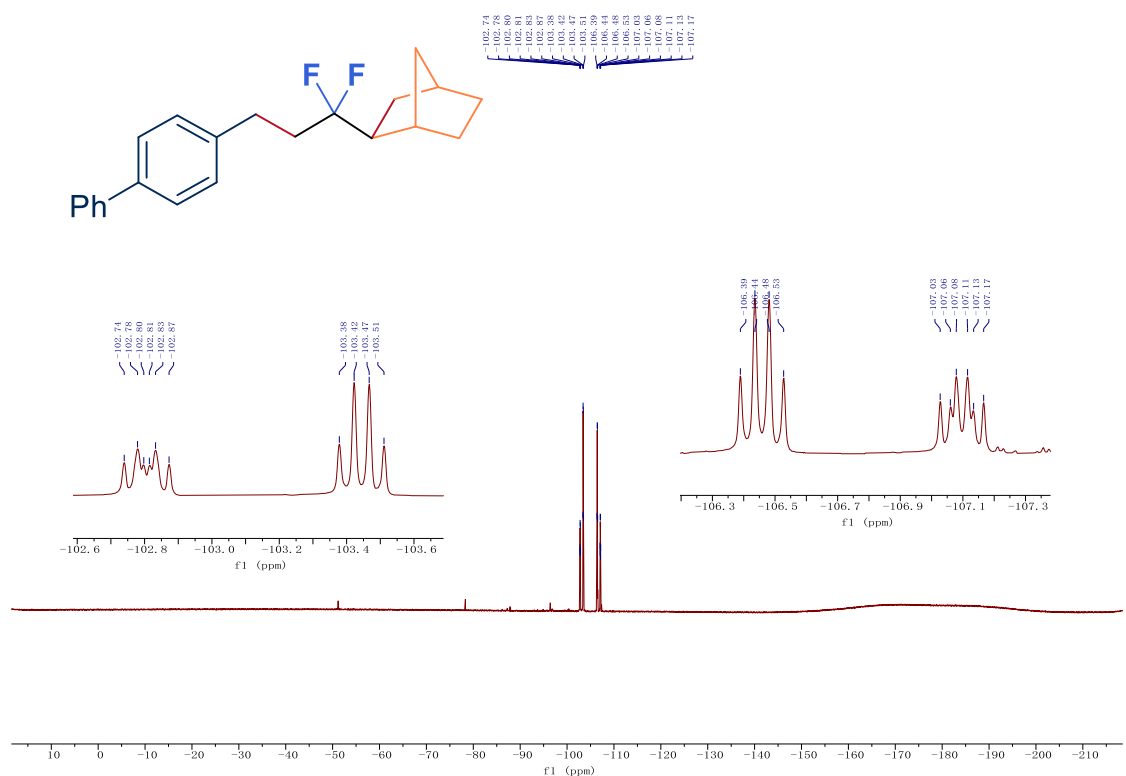
¹³C NMR (126 MHz, CDCl₃) spectra for compound 2y



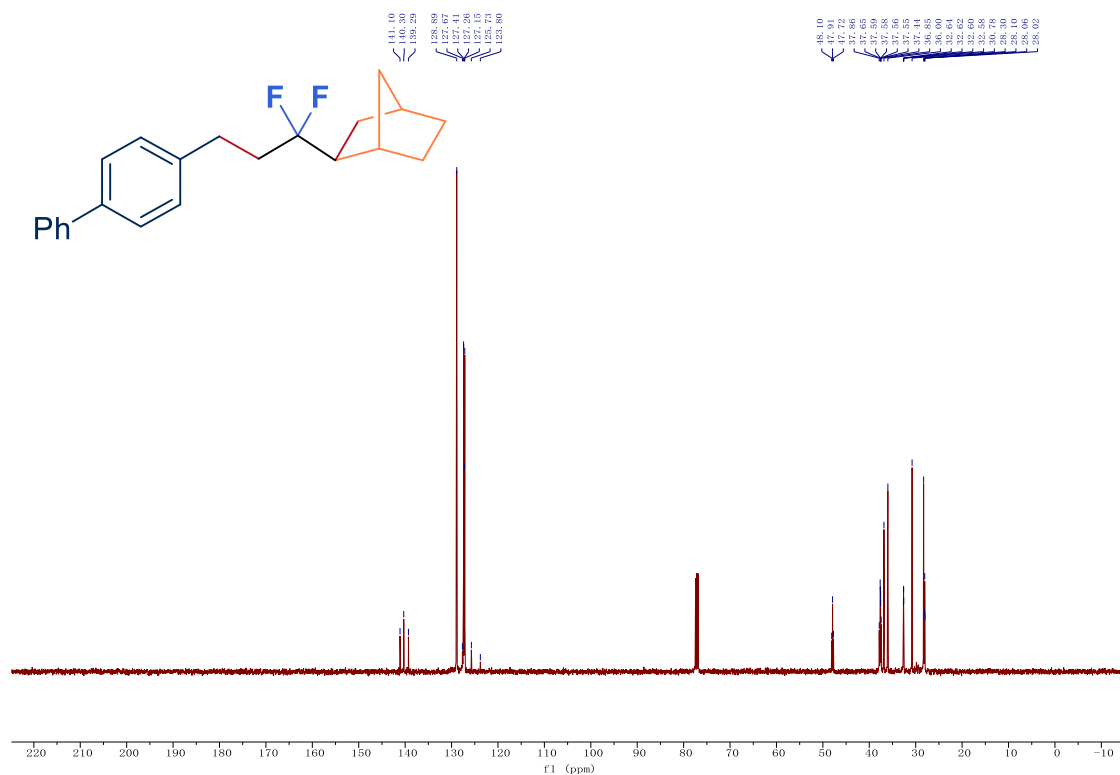
¹H NMR (400 MHz, CDCl₃) spectra for compound 2z



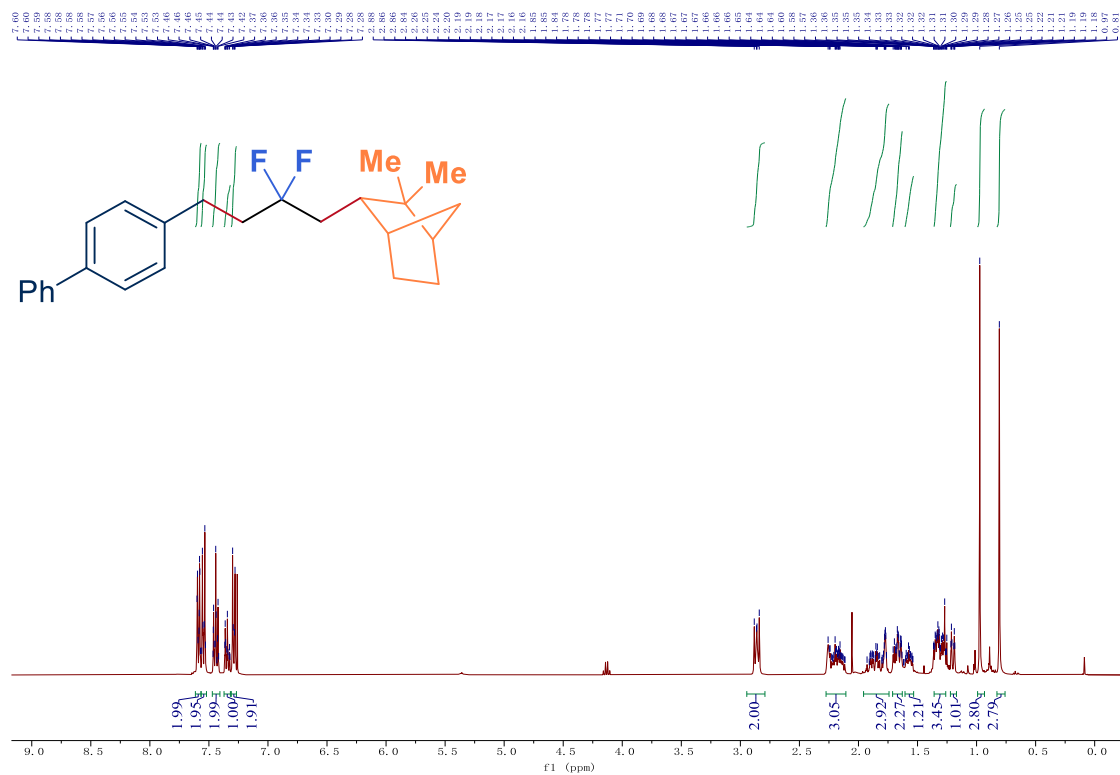
¹⁹F NMR (377 MHz, CDCl₃) spectra for compound 2z



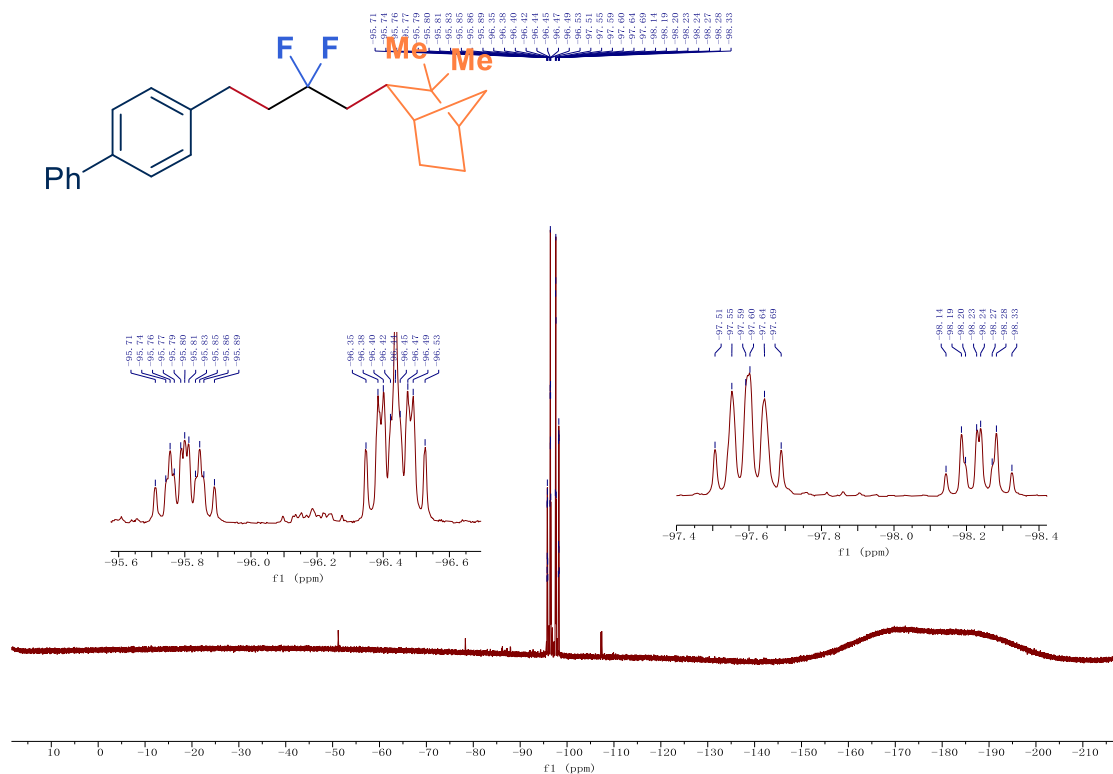
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2z**



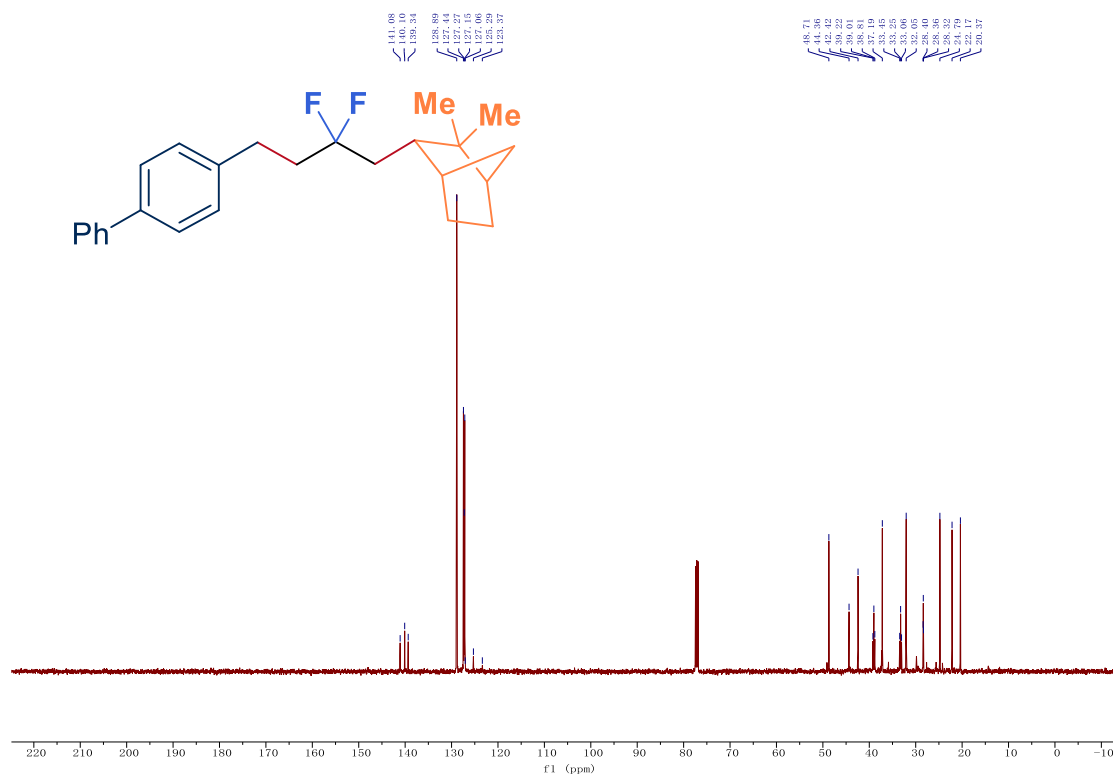
^1H NMR (400 MHz, CDCl_3) spectra for compound **2aa**



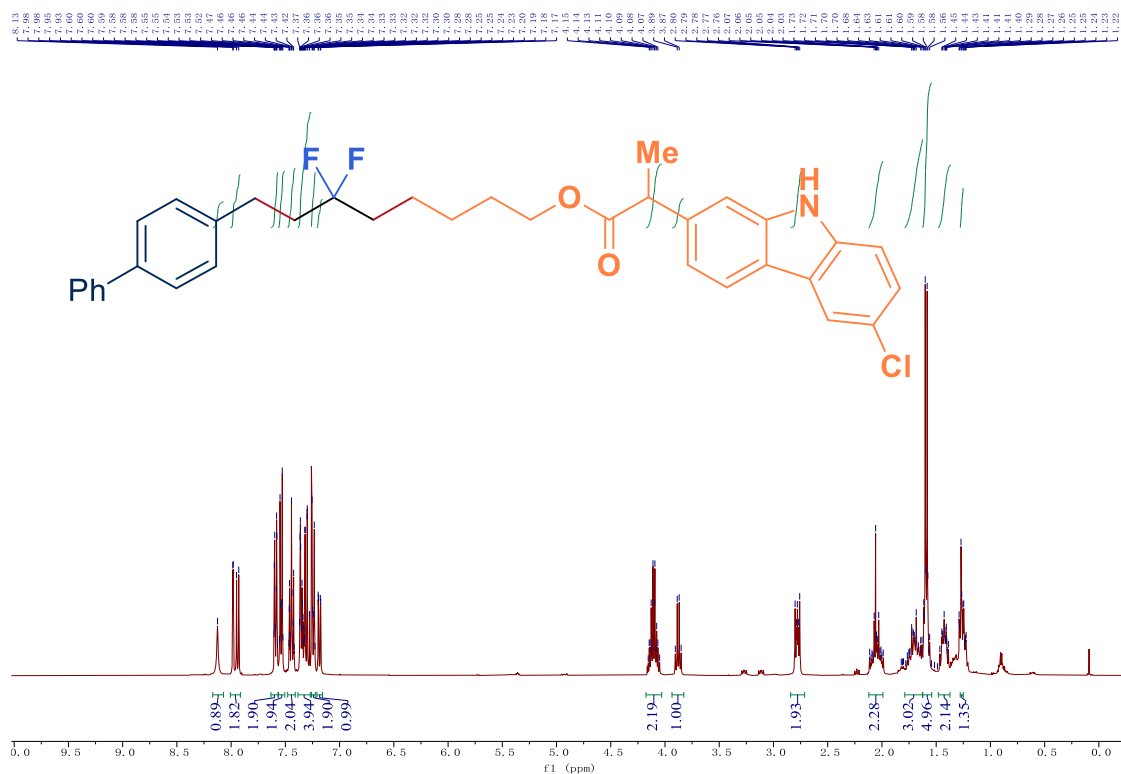
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2aa**



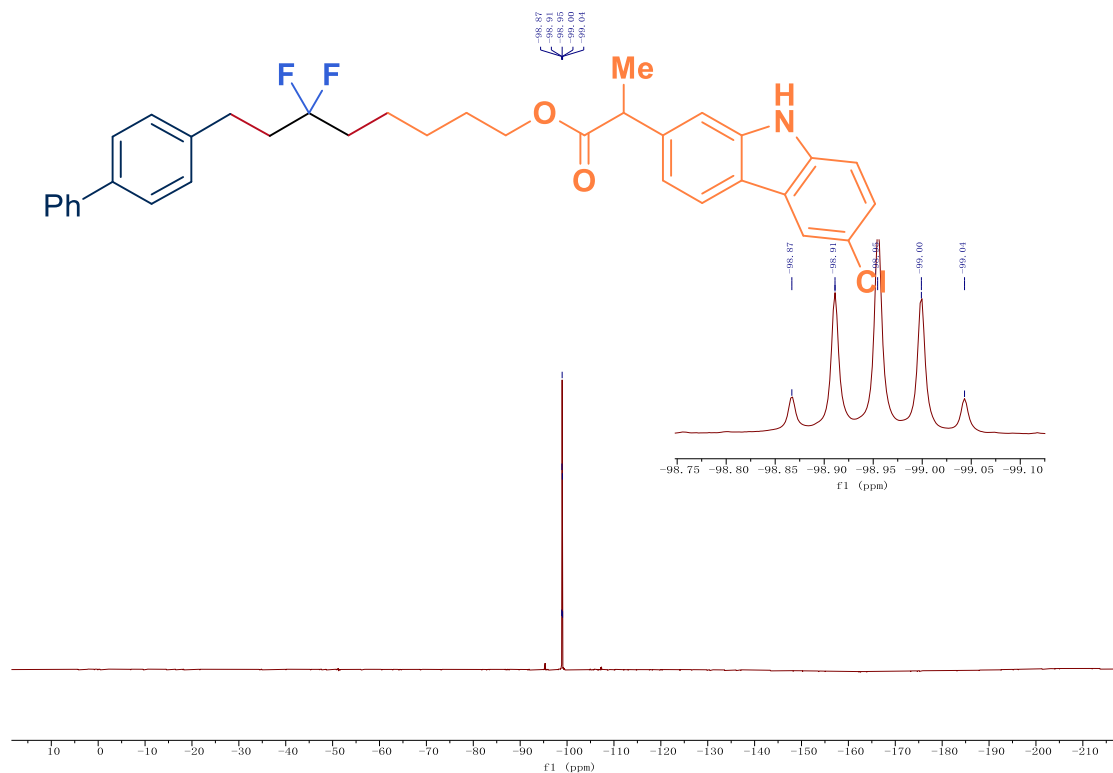
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2aa**



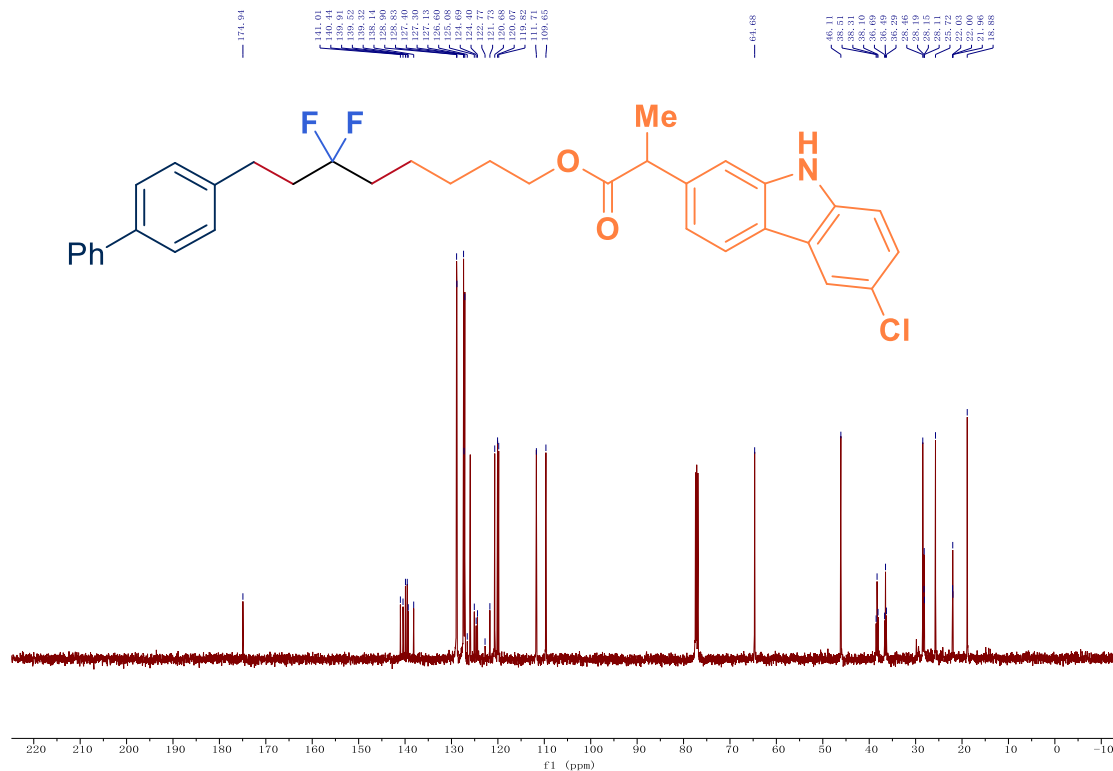
^1H NMR (400 MHz, CDCl_3) spectra for compound **2ab**



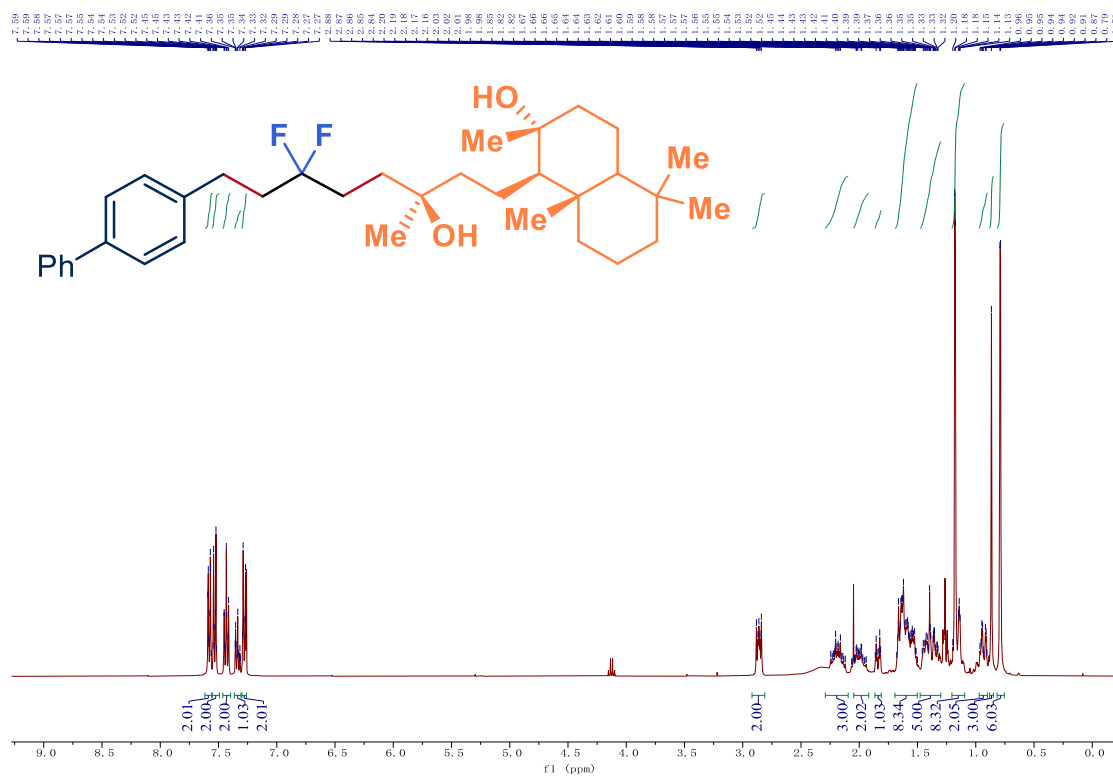
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2ab**



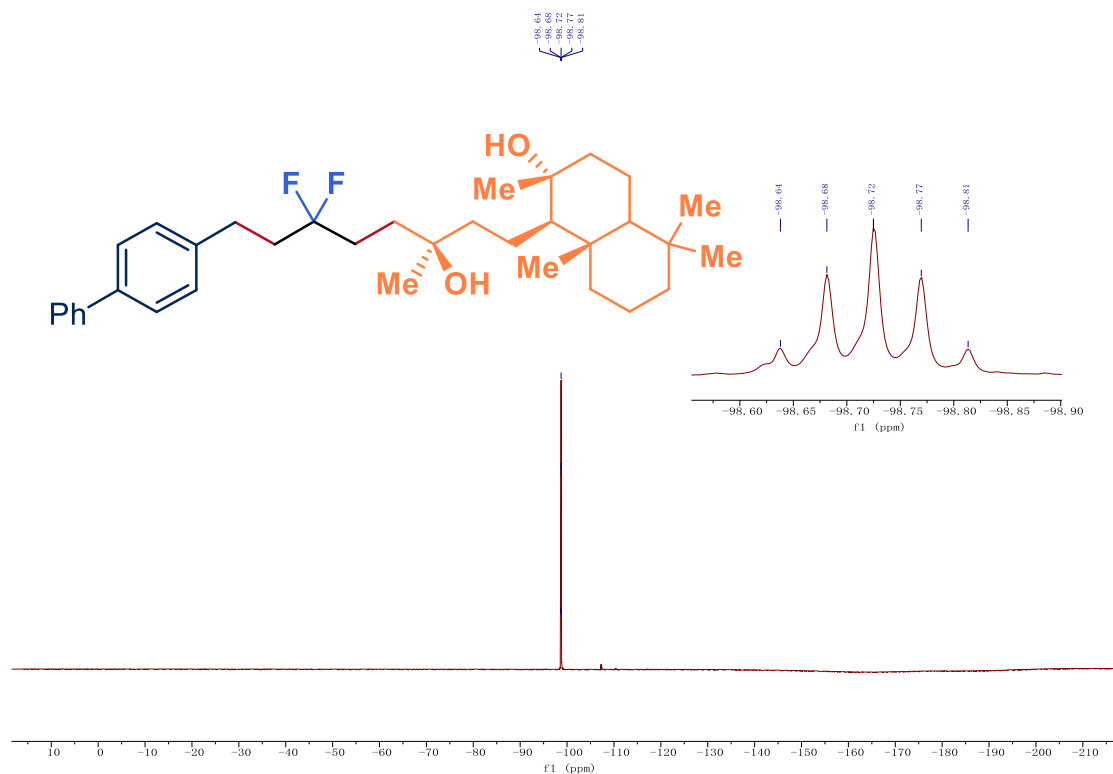
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2ab**



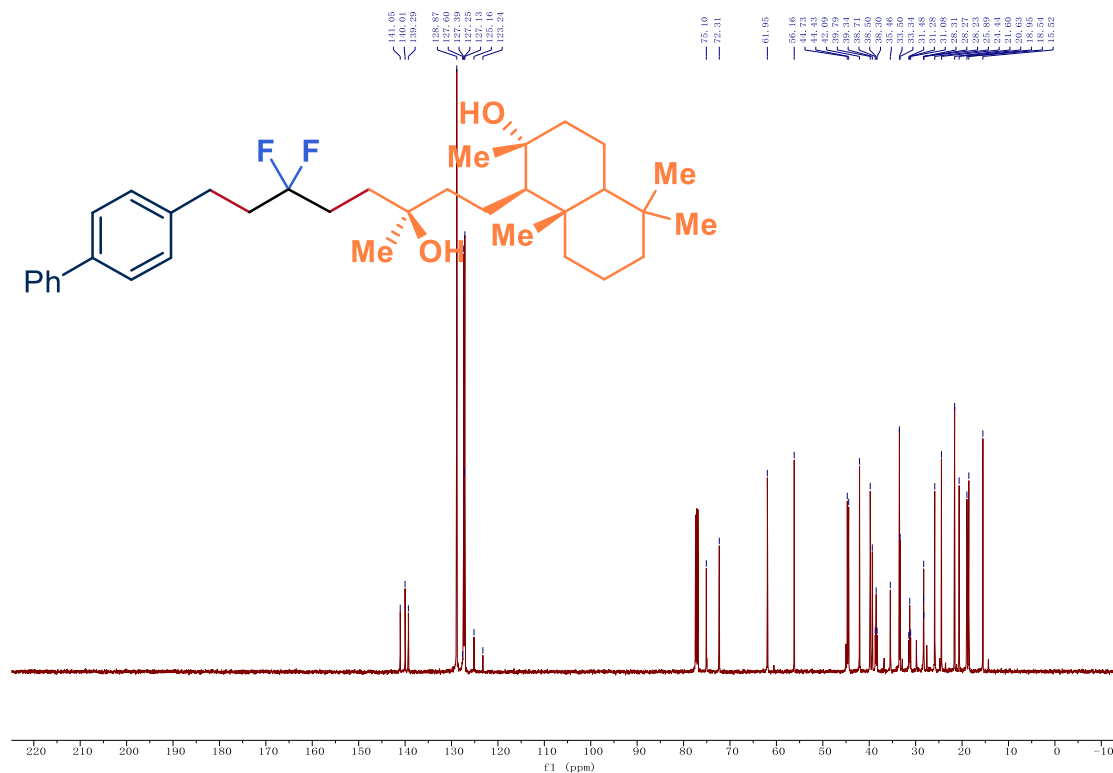
^1H NMR (400 MHz, CDCl_3) spectra for compound **2ac**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2ac**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound **2ac**



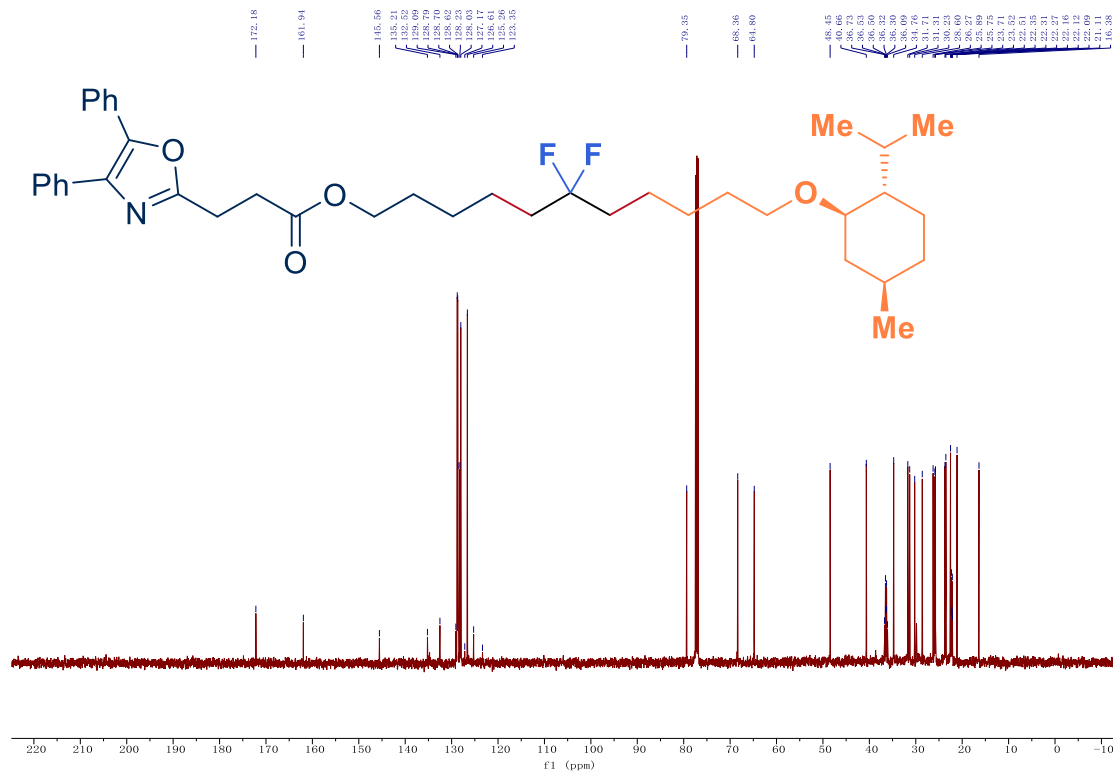
Chemical Structure of Compound 10: c1ccccc1c2nc(c3ccccc13)oc2C(=O)OCCc4ccc(F)c(F)c4OCC5C(C)CC(C)C5

¹H NMR Spectrum (CDCl₃):

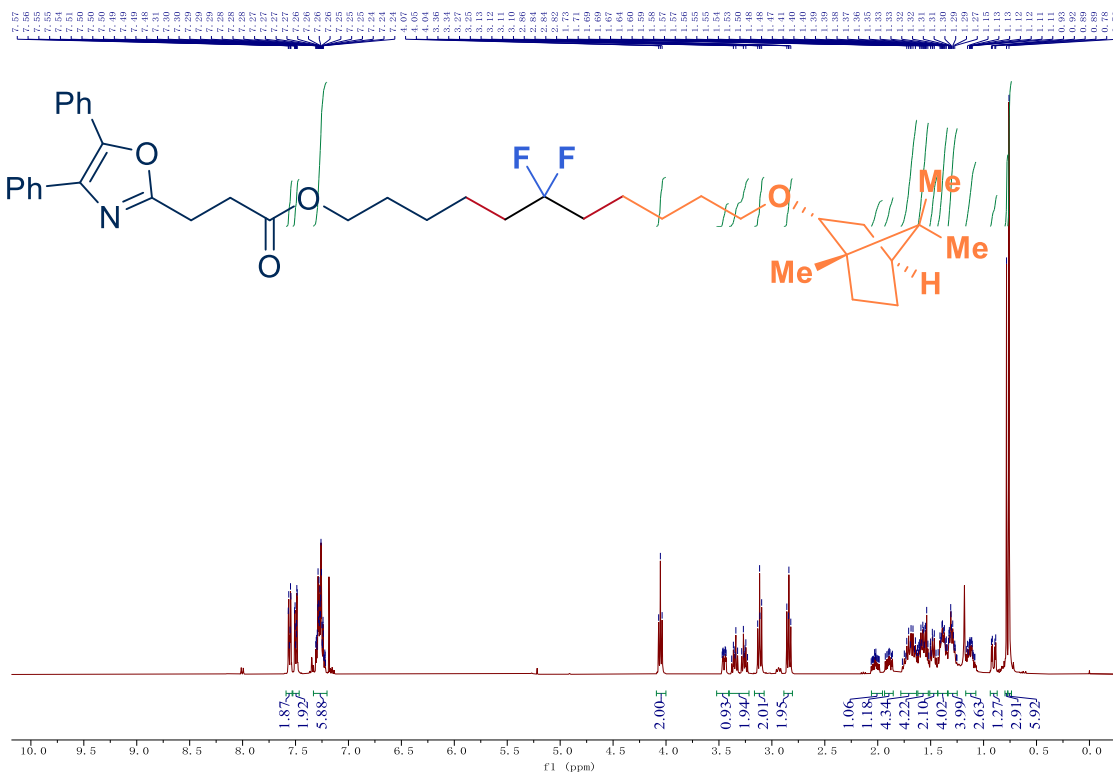
Chemical Shift (ppm)	Integration
7.50 - 7.55	1.83
7.45 - 7.50	1.88
7.35 - 7.45	5.70
4.15 - 4.25	1.96
3.85 - 3.95	1.00
3.25 - 3.35	0.97
3.15 - 3.25	1.93
3.05 - 3.15	1.00
2.95 - 3.05	1.94
2.05 - 2.15	1.03
1.95 - 2.05	1.03
1.75 - 1.85	4.04
1.65 - 1.75	6.57
1.55 - 1.65	9.09
1.45 - 1.55	1.28
1.35 - 1.45	0.92
1.25 - 1.35	6.17
1.15 - 1.25	2.03
1.05 - 1.15	3.02

Chemical structure of compound 10 is shown above the spectrum. The structure is a 1,2-diphenyl-1H-imidazole-3-carboxylate derivative, specifically 1,2-diphenyl-1H-imidazole-3-carboxylate, which is linked via an ester group to a 1,1-difluoro-2,2-dimethyl-3,4-dihydro-2H-pyran-3-yl group. The spectrum shows a reference peak at 0 ppm (TMS) and several peaks in the aromatic region (7.0-7.5 ppm) and a complex set of peaks in the aliphatic region (3.5-5.5 ppm). An inset shows a zoomed-in view of the aliphatic region with peak labels: 4.98.02, 4.98.11, 4.98.15, 4.98.19, 4.98.06, 4.98.11, 4.98.13, 4.98.14, and 4.98.15.

¹³C NMR (126 MHz, CDCl₃) spectra for compound **2ad**

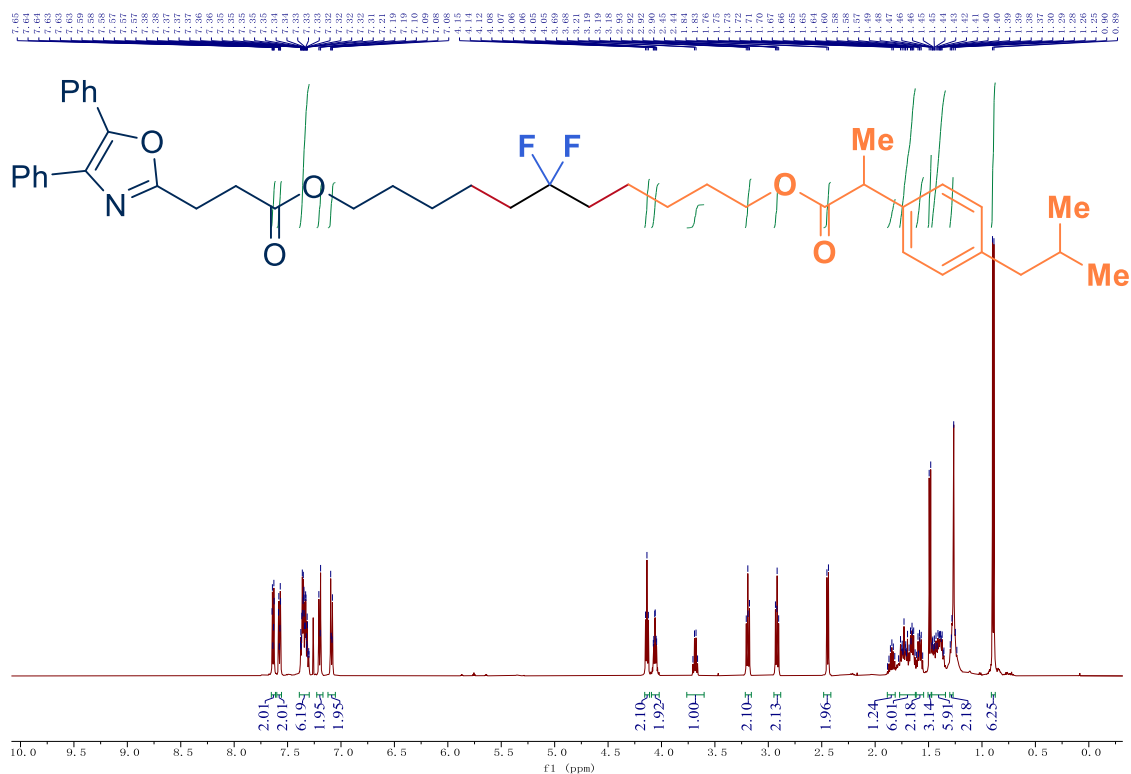


¹H NMR (400 MHz, CDCl₃) spectra for compound **2ae**

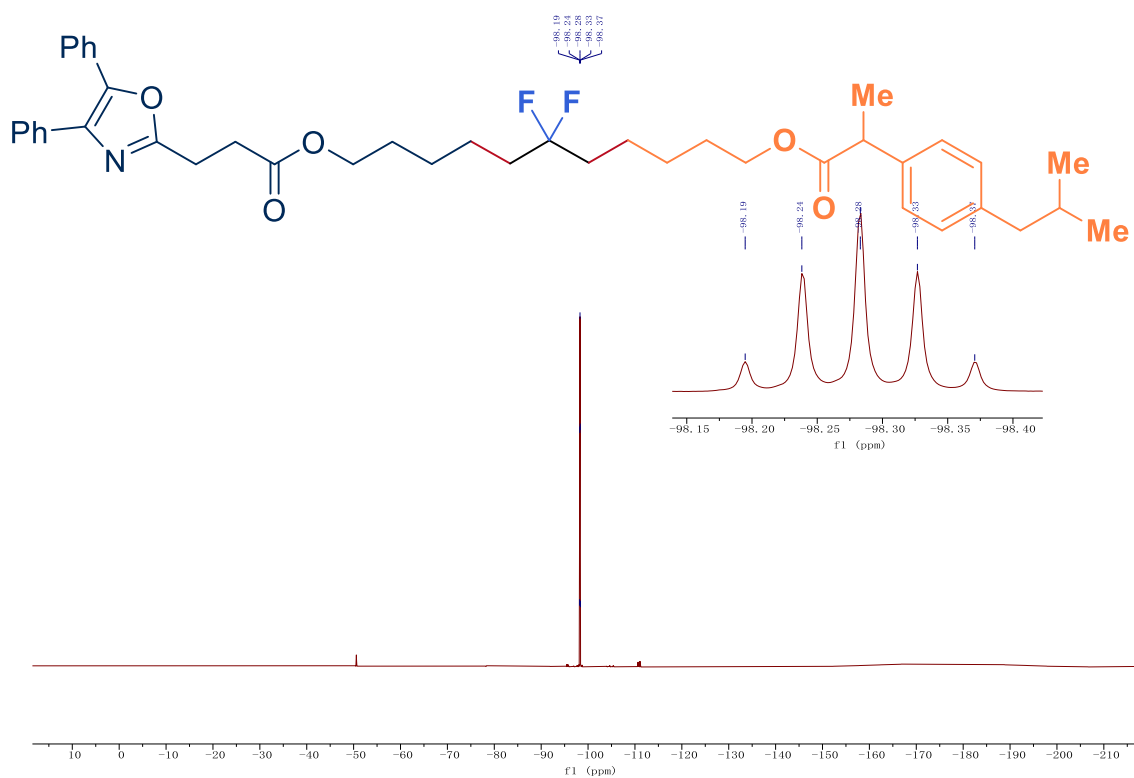


[illegible][illegible]

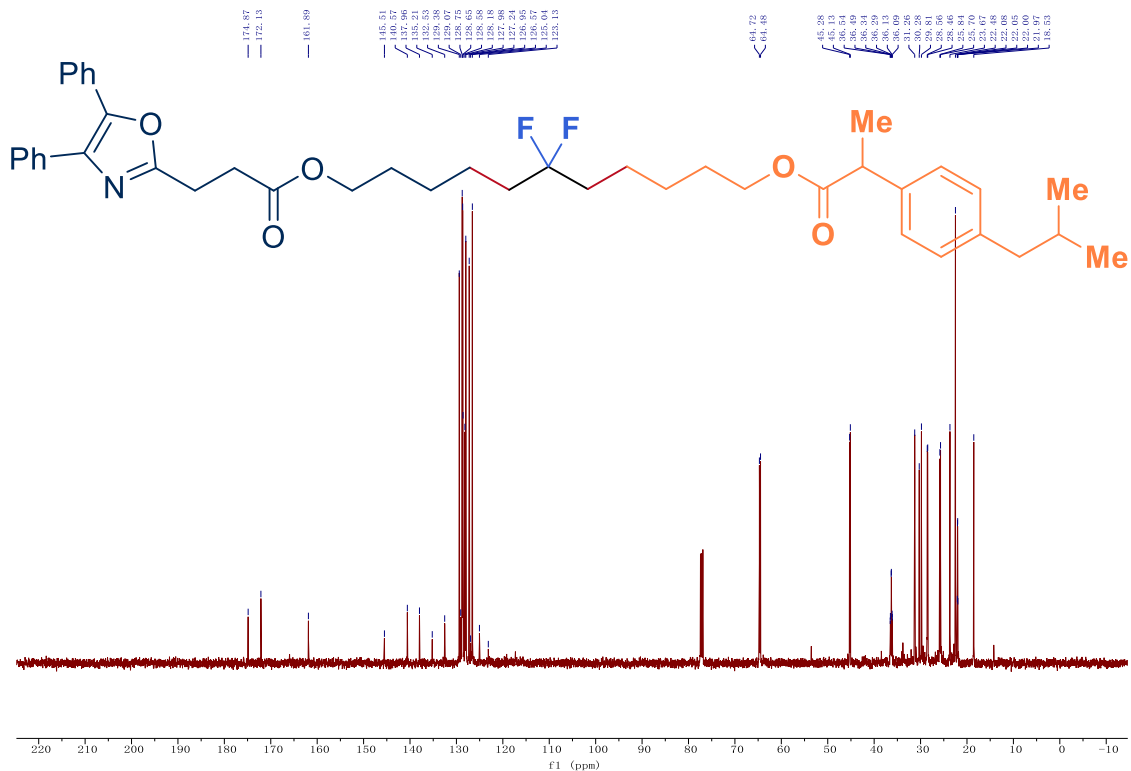
^1H NMR (400 MHz, CDCl_3) spectra for compound **2af**



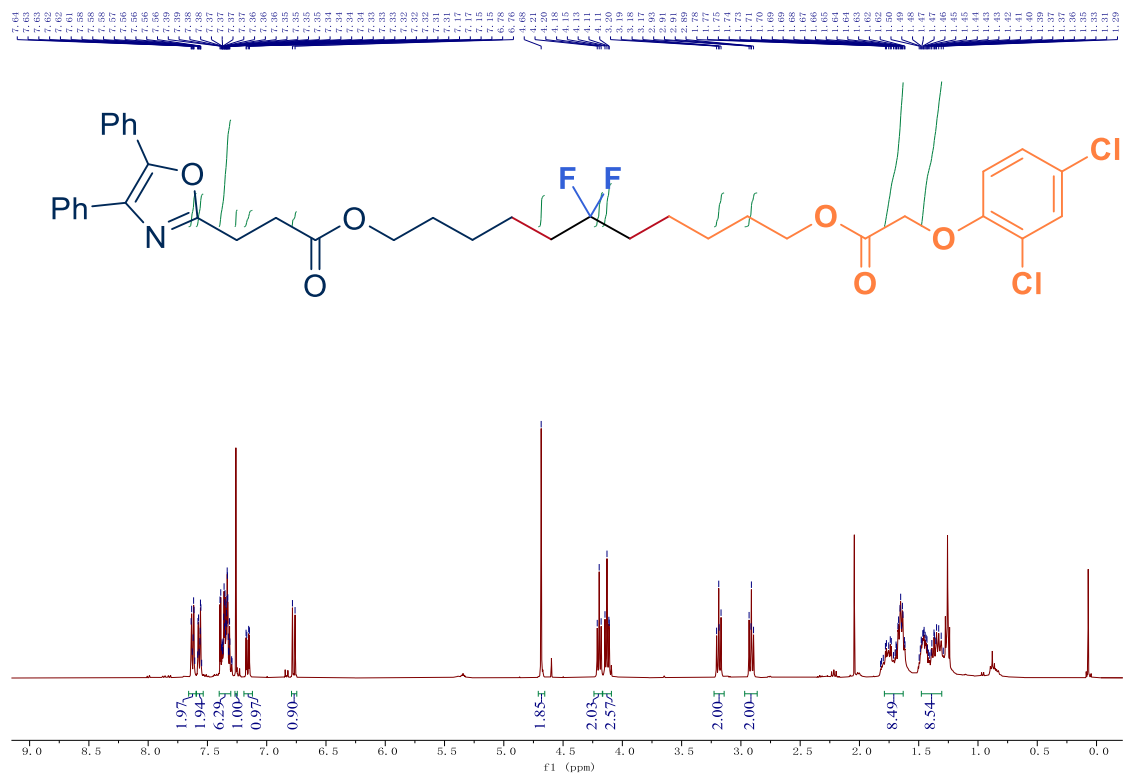
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2af**



¹³C NMR (126 MHz, CDCl₃) spectra for compound 2af



¹H NMR (400 MHz, CDCl₃) spectra for compound 2ag



Chemical structure of compound 10: c1ccccc1c2nc(cc2Oc3ccc(Cl)cc3)C(=O)OCC(F)(F)F

¹H NMR spectrum (CDCl₃) of compound 10. The spectrum shows peaks for the aromatic protons of the phenyl groups (7.2-7.4 ppm), the methylene protons of the butyrate chain (1.8-2.2 ppm), the trifluoromethyl protons (2.8 ppm), and the methoxy protons (3.7 ppm). The x-axis is labeled 'f1 (ppm)' and ranges from 0 to 10. The y-axis is labeled 'Intensity'.

Chemical structure of compound 10 is shown above the ^{13}C NMR spectrum. The structure consists of a 2,6-diphenylisoxazole-3-yl group linked via an ester to a 1,1-difluoro-4-(4,4-dichlorophenoxy)butyl chain.

The ^{13}C NMR spectrum (CDCl₃) shows the following chemical shifts (ppm):

- 172.19
- 168.30
- 161.9
- 132.36
- 130.83
- 129.61
- 129.02
- 128.61
- 128.41
- 127.68
- 126.99
- 125.05
- 123.13
- 114.82
- 66.54
- 65.47
- 64.75
- 39.62
- 39.12
- 39.57
- 39.87
- 40.00
- 40.14
- 40.28
- 40.44
- 40.59
- 40.72
- 40.88
- 41.14
- 41.27
- 41.41
- 41.54
- 41.68
- 41.82
- 41.96
- 42.11

[illegible]

Chemical structure: CC(F)(F)C(C)(C)OSi(C)(C)C(C)(C)C

¹H NMR spectrum (CDCl₃) showing peaks at approximately 7.2 ppm (TMS), 4.1 ppm (CH), and 1.2 ppm (CH₃).

Inset: ¹³C NMR spectrum (CDCl₃) showing peaks from -113.24 to -115.61 ppm.

Chemical Structure: 1-(4-phenylphenyl)-2,2-difluoroethane

¹H NMR Spectrum (CDCl₃):

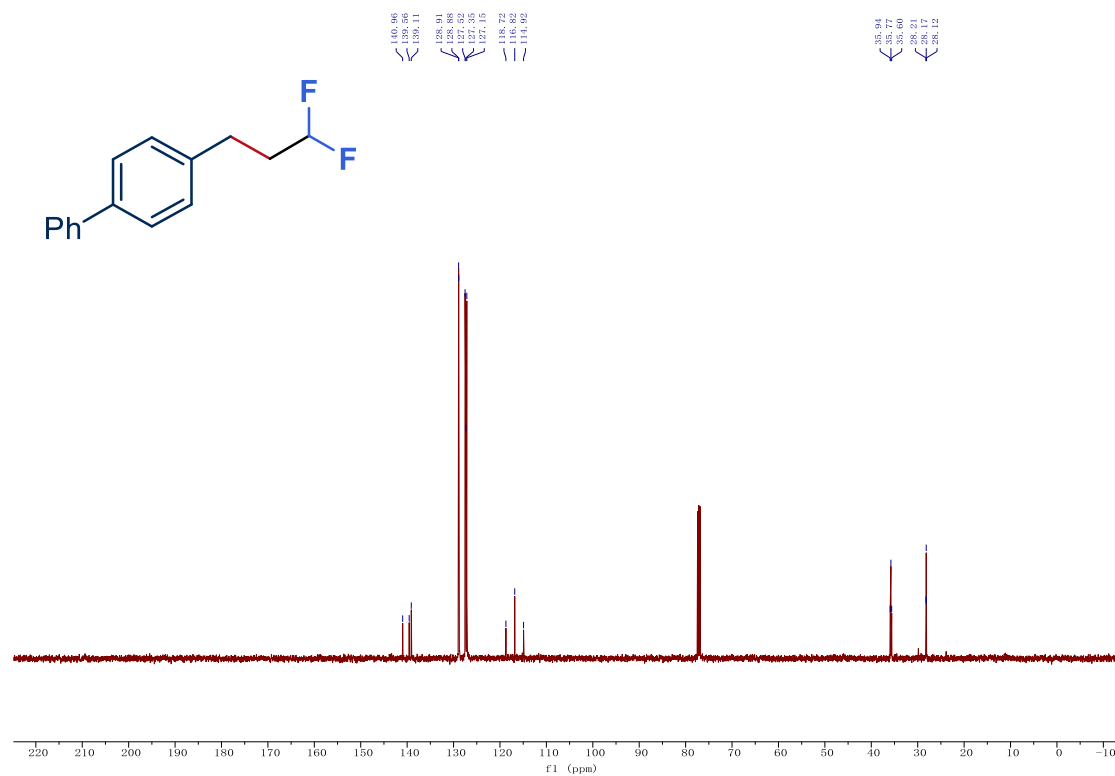
- Aromatic Region (7.1-7.7 ppm):** Multiple peaks with integration values: 4.04, 1.99, 1.04, 1.99.
- Methine Region (5.6-6.0 ppm):** Peaks with integration values: 1.00, 1.00.
- Methylene Region (2.0-2.3 ppm):** Peaks with integration values: 2.07, 2.08.
- Reference Peak (0 ppm):** TMS peak.

Chemical structure: OCCc1ccc(cc1)C(F)F

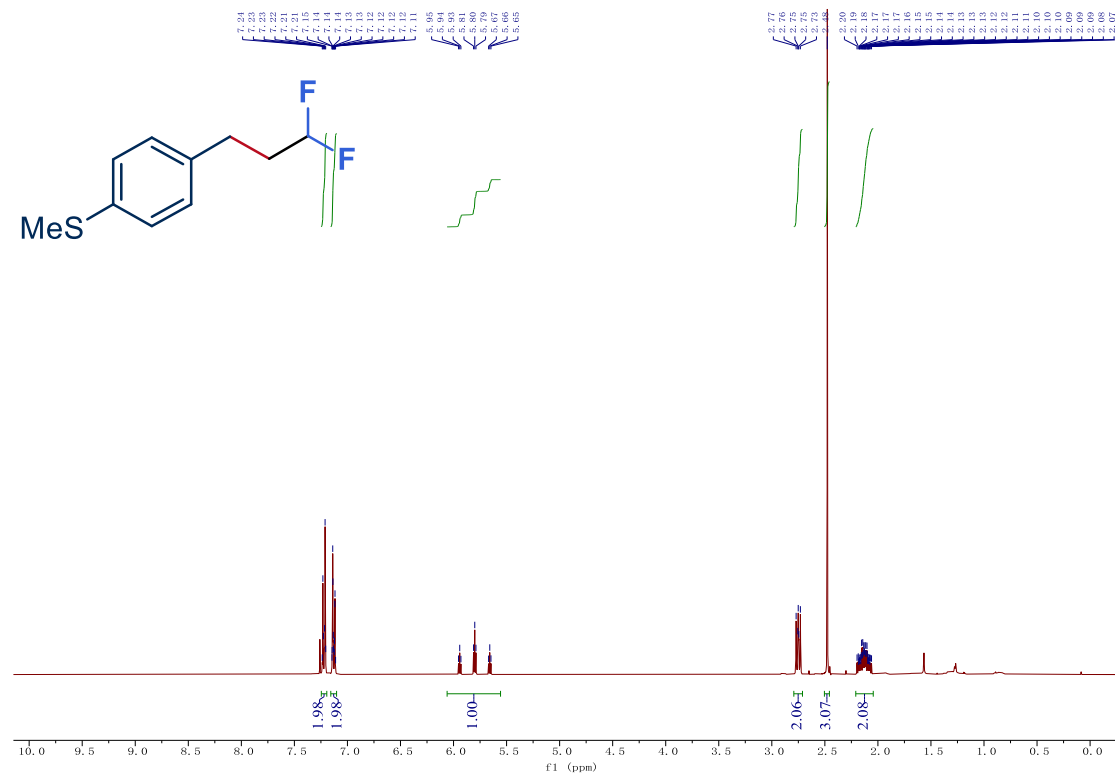
¹H NMR spectrum (DMSO-d₆) showing peaks for the compound. The x-axis represents the chemical shift in ppm, ranging from 0 to 10. The peaks are labeled with their chemical shifts and integration values.

Chemical Shift (ppm)	Integration
7.2 - 7.4	1.00
4.3	2.00
5.1	1.00

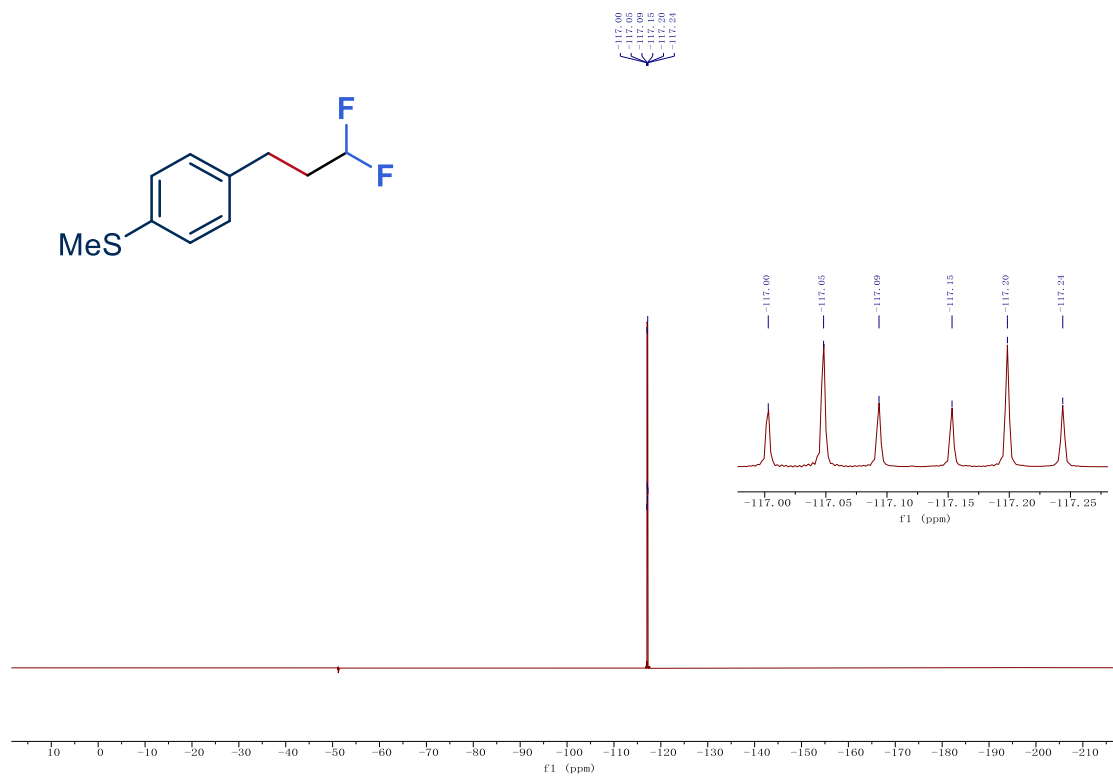
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **3b**



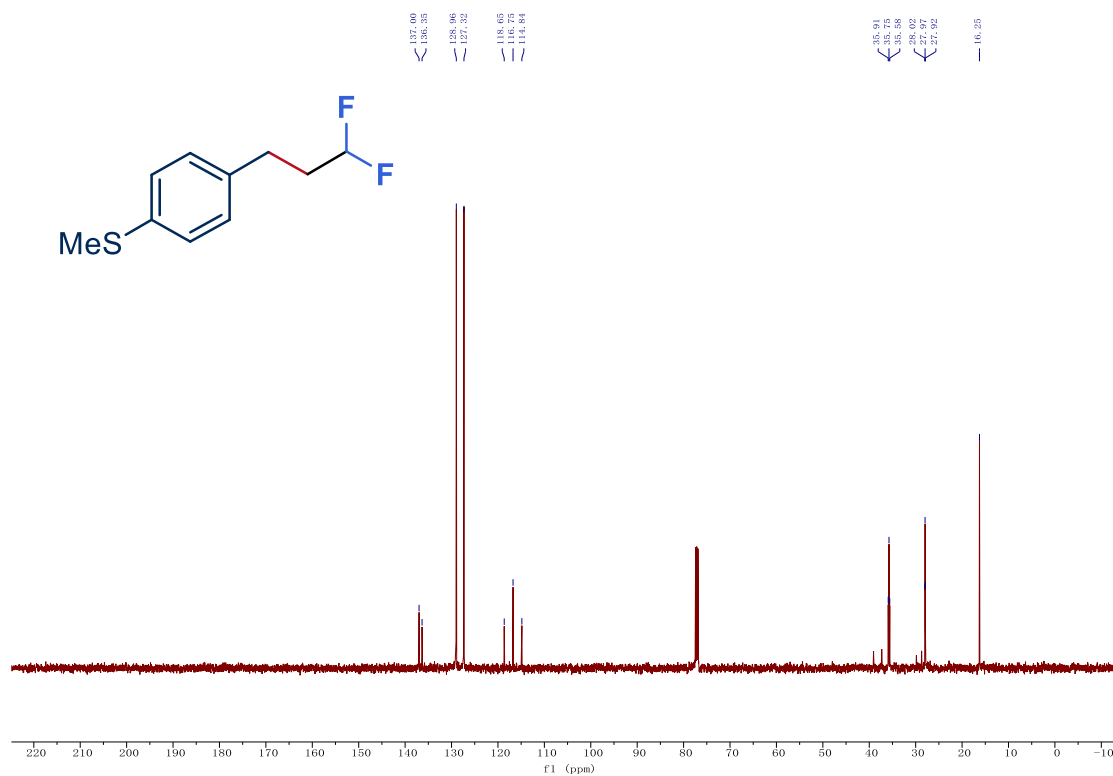
^1H NMR (400 MHz, CDCl_3) spectra for compound **3c**



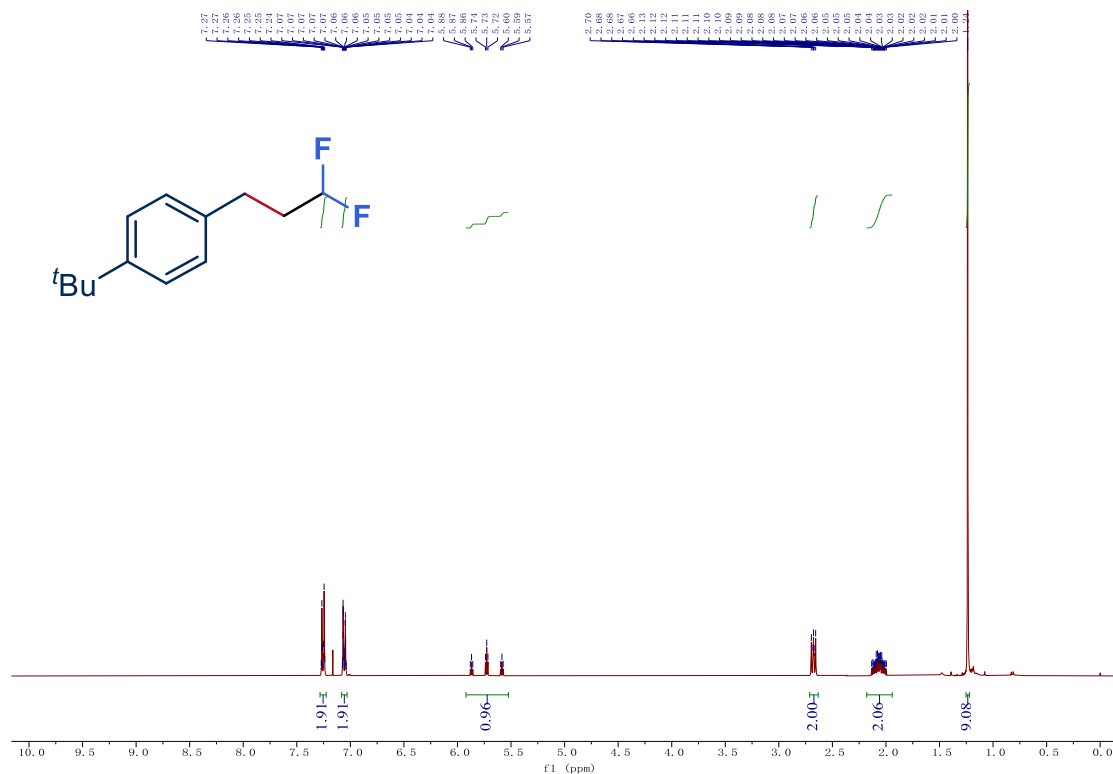
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3c**



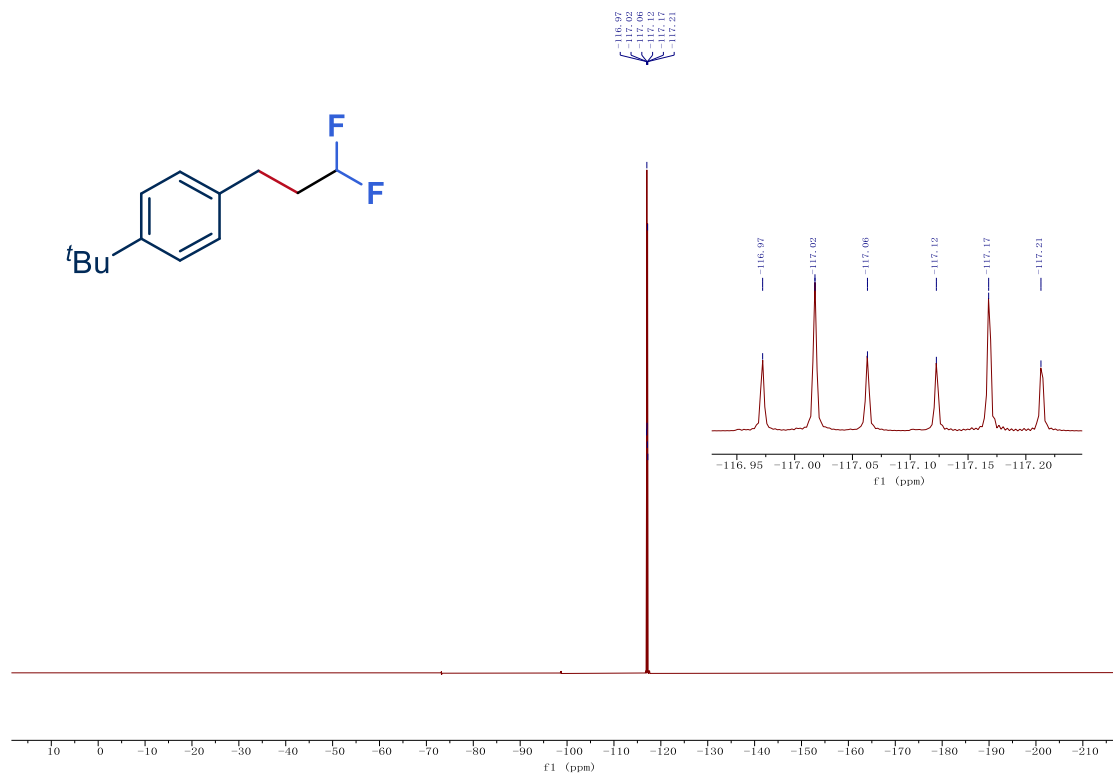
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **3c**



^1H NMR (400 MHz, CDCl_3) spectra for compound **3d**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3d**



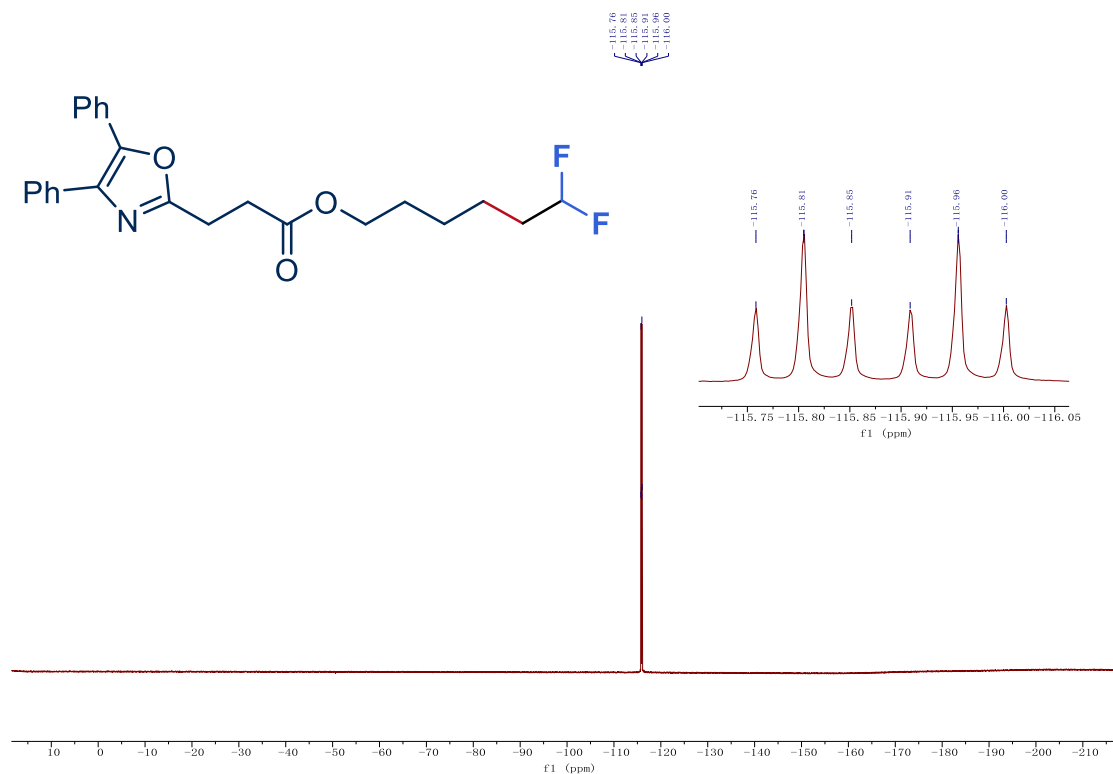
CC(C)(C)c1ccc(cc1)CC(F)(F)F

Chemical structure: c1ccccc1c2nc(CCC(=O)OCCF)oc2c3ccccc13

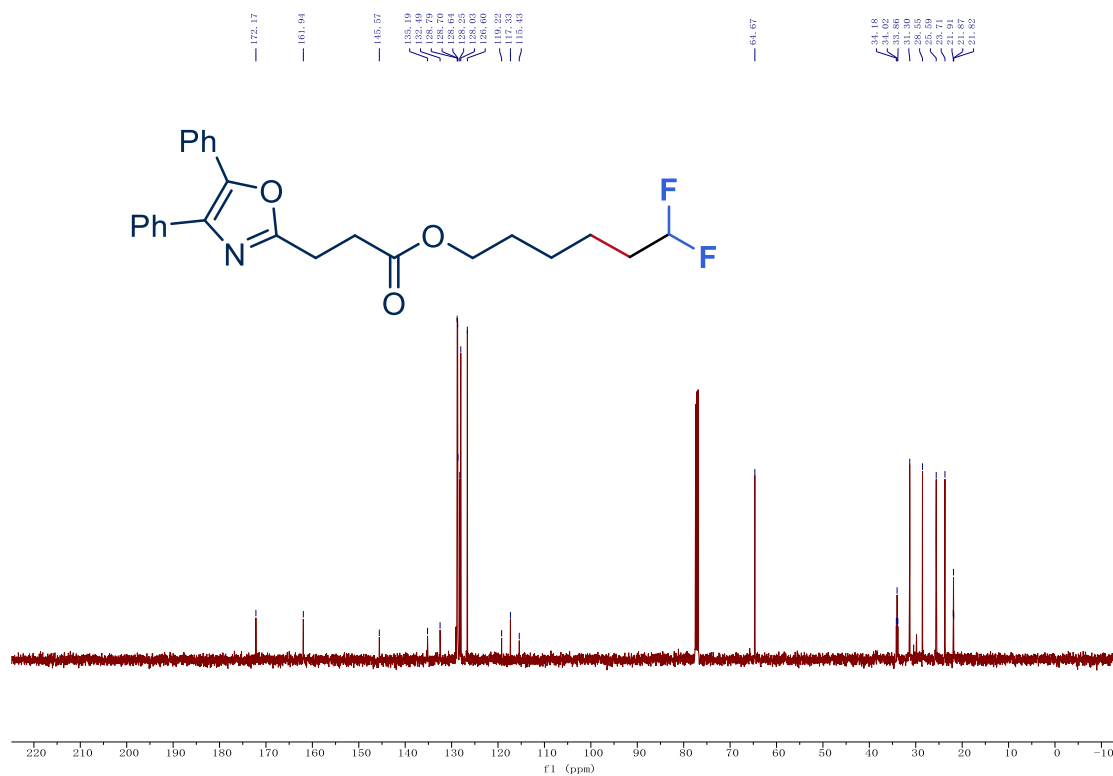
¹H NMR spectrum (400 MHz, CDCl₃) showing peaks and integrations:

- 7.64, 7.63, 7.62, 7.58, 7.57, 7.56, 7.39, 7.38, 7.37, 7.36, 7.35, 7.34, 7.33, 7.32, 7.31, 7.30, 5.90, 5.89, 5.76, 5.74, 5.61, 5.60 ppm (Aromatic protons, integration: 1.94, 1.92, 5.71)
- 5.60 ppm (Isoxazole CH₂, integration: 1.02)
- 4.13, 4.12 ppm (Ethoxy CH₂, integration: 2.00)
- 3.21, 3.17, 2.94, 2.92, 1.80, 1.79, 1.77, 1.75, 1.69, 1.65, 1.62, 1.47, 1.46, 1.45, 1.43, 1.41, 1.39, 1.38, 1.37 ppm (Difluoroethyl protons, integration: 1.97, 1.99, 2.27, 2.08, 4.28)

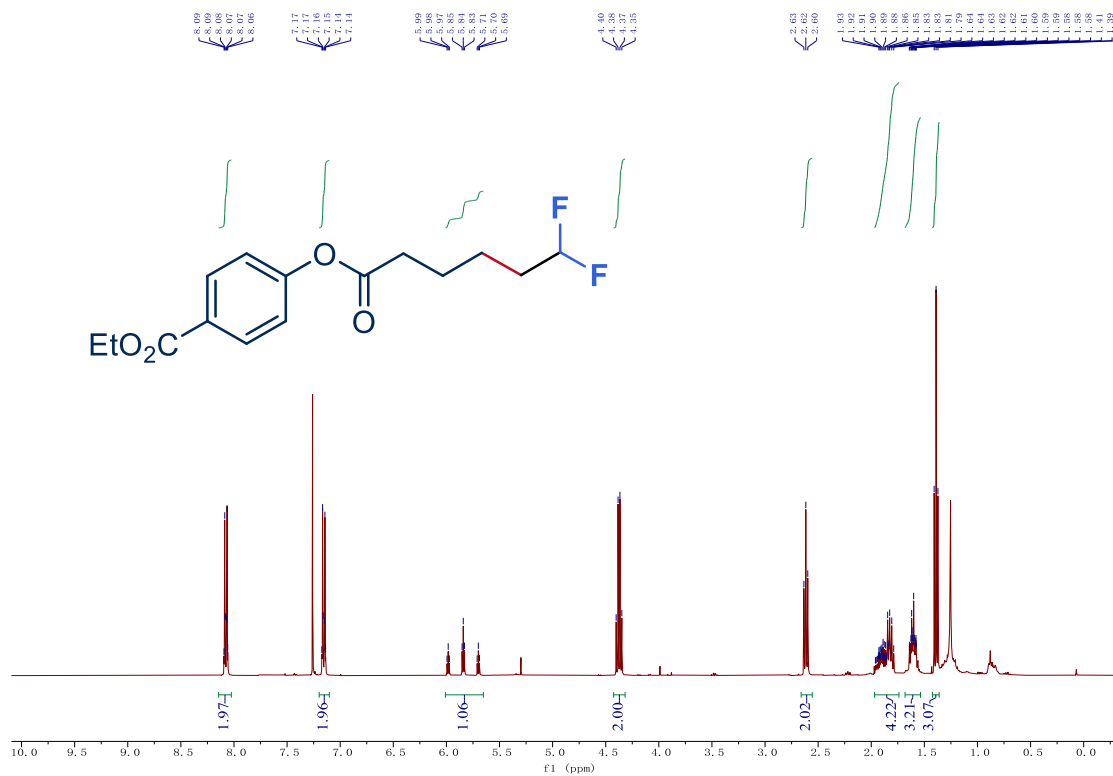
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3e**



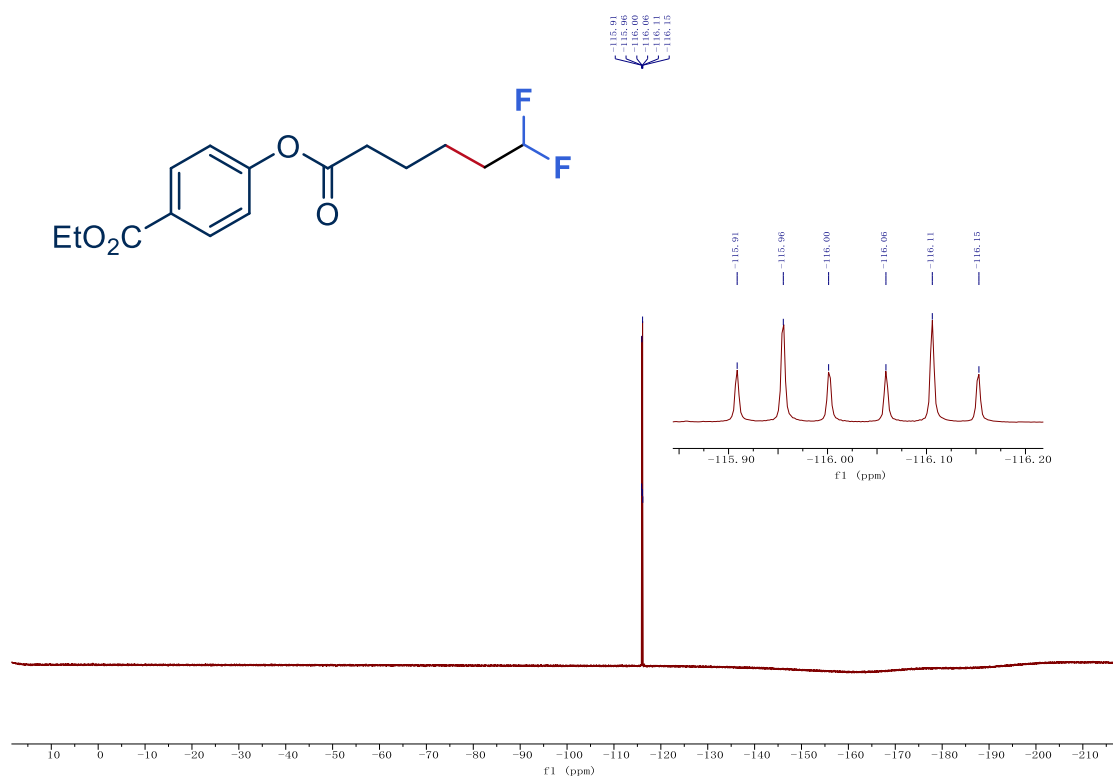
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **3e**



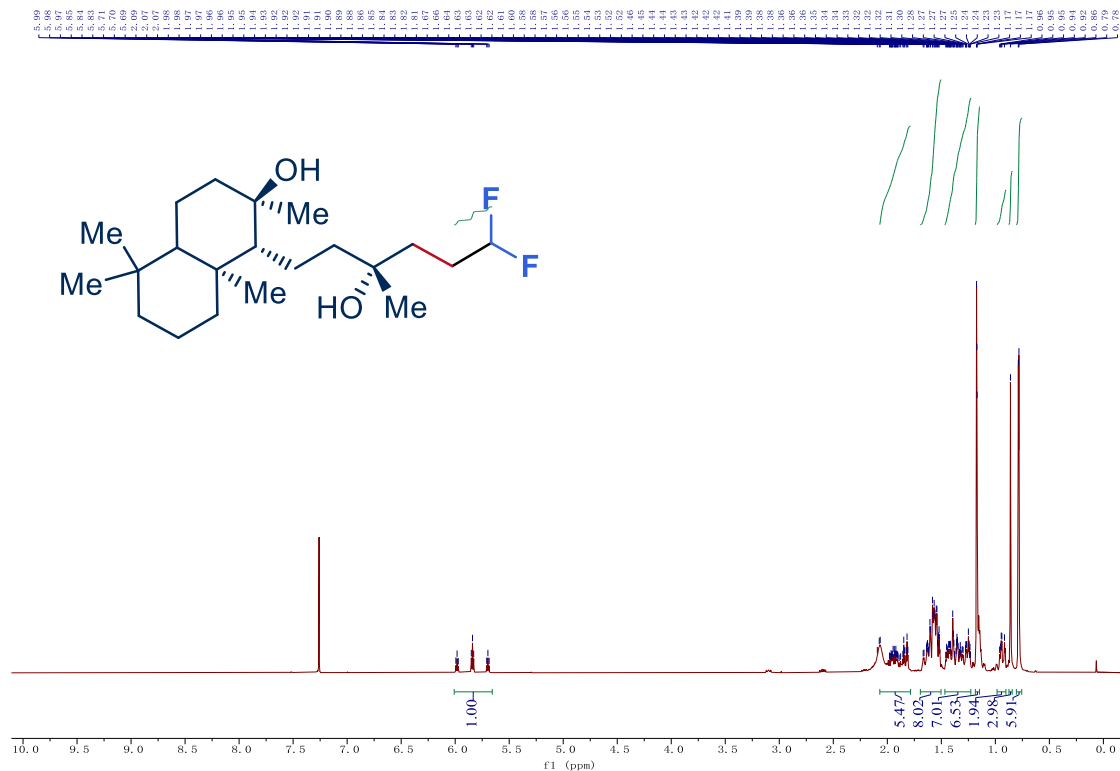
^1H NMR (400 MHz, CDCl_3) spectra for compound **3f**



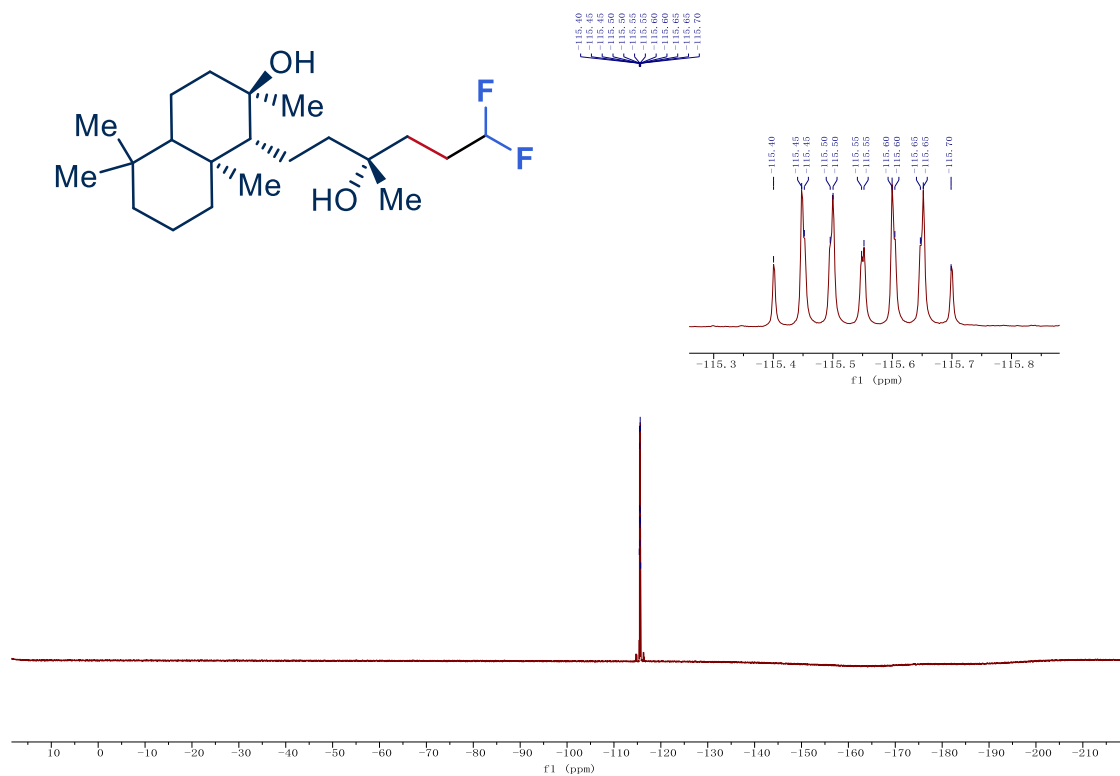
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3f**



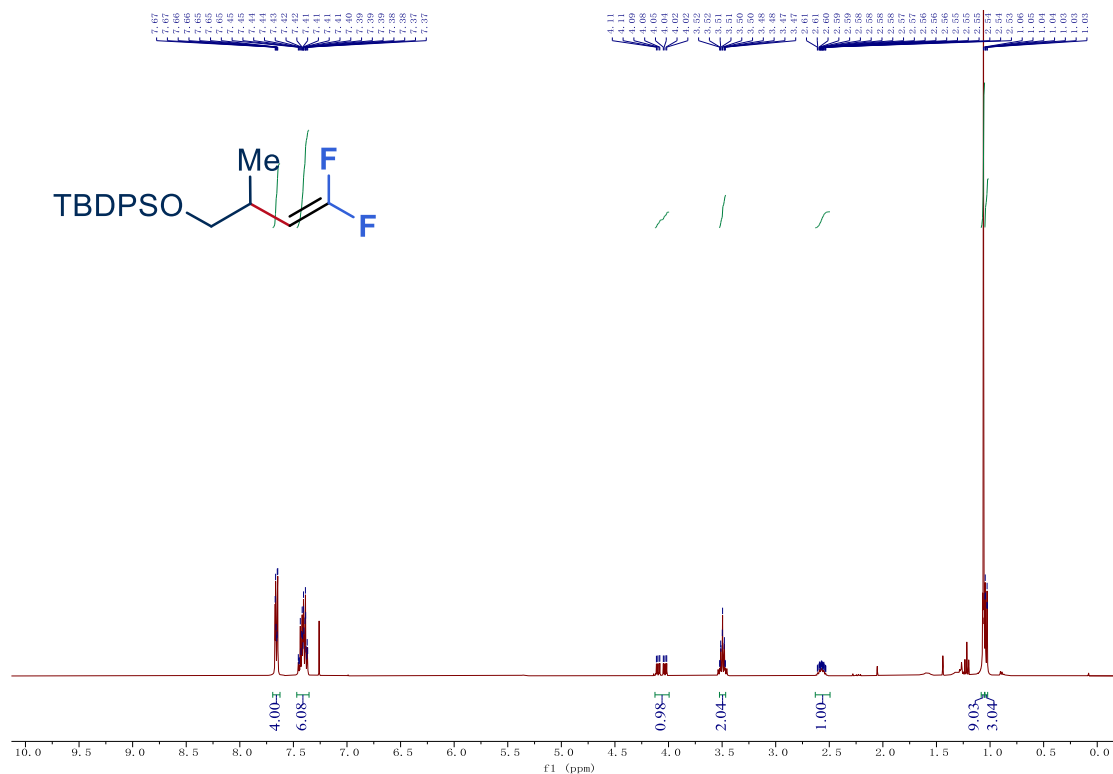
^1H NMR (400 MHz, CDCl_3) spectra for compound **3g**



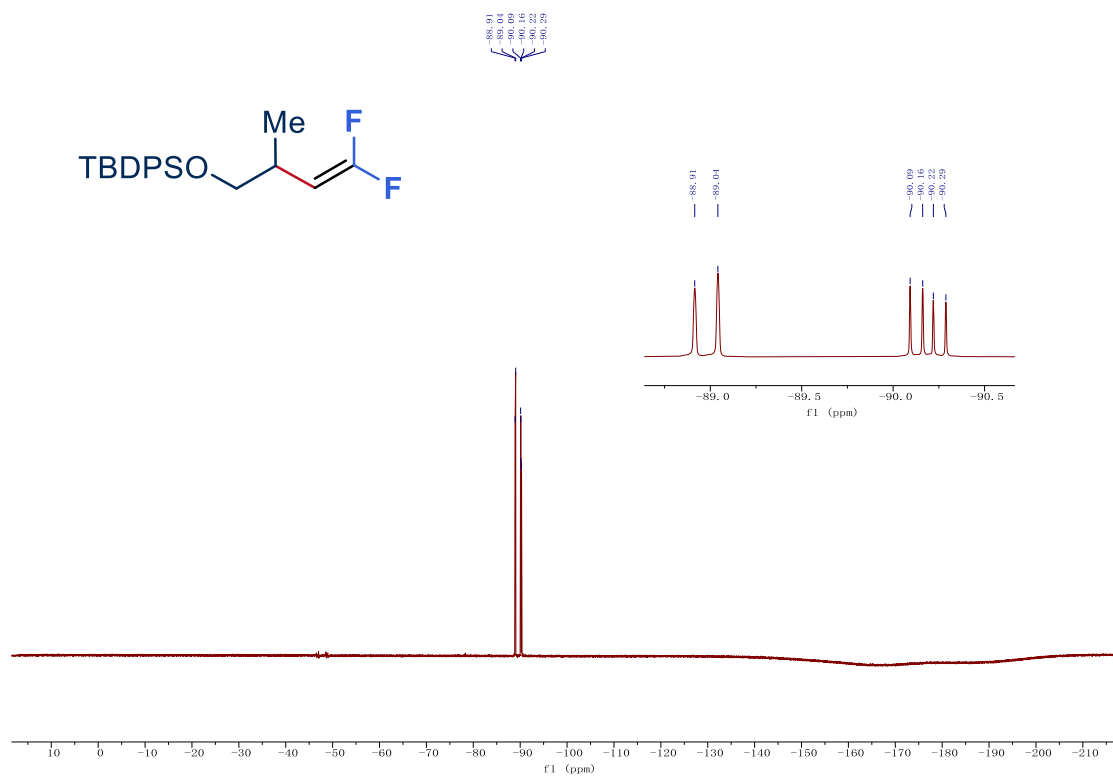
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3g**



^1H NMR (400 MHz, CDCl_3) spectra for compound **3h**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3h**



Chemical structure of (E)-1-(tert-butyldimethylsilyl)-3,3-difluorobut-2-ene is shown above the spectrum. The spectrum displays peaks corresponding to the structure, with chemical shifts (ppm) labeled above the peaks:

- 158.43, 156.36 (Carbonyl region)
- 135.75, 135.73, 133.84, 133.66, 129.79, 127.79 (Alkene region)
- 81.39, 81.23, 81.07 (Alkene region)
- 68.26, 68.24, 68.21 (Alkene region)
- 31.57, 31.33, 26.94 (Alkene region)
- 19.41, 17.45, 17.44, 17.42 (Alkene region)

1H NMR spectrum (400 MHz, CDCl₃) of (E)-1-(tert-butyldimethylsilyl)-3,3-difluorobut-2-ene. The spectrum shows peaks corresponding to the structure, with chemical shifts (ppm) labeled above the peaks:

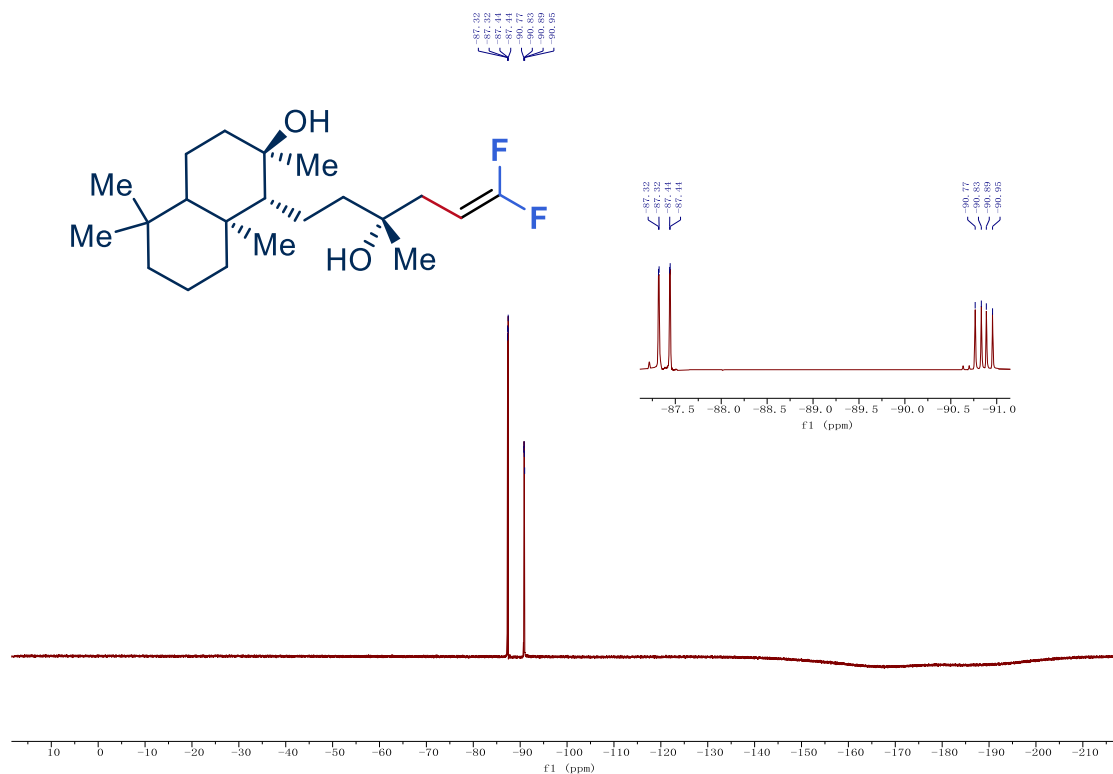
- 158.43, 156.36 (Carbonyl region)
- 135.75, 135.73, 133.84, 133.66, 129.79, 127.79 (Alkene region)
- 81.39, 81.23, 81.07 (Alkene region)
- 68.26, 68.24, 68.21 (Alkene region)
- 31.57, 31.33, 26.94 (Alkene region)
- 19.41, 17.45, 17.44, 17.42 (Alkene region)

Chemical structure of compound 10a is shown above the ^1H NMR spectrum. The structure is a complex polycyclic molecule with a decalin core, a hydroxyl group, and a side chain containing a hydroxyl group, a methyl group, and a vinyl fluoride group.

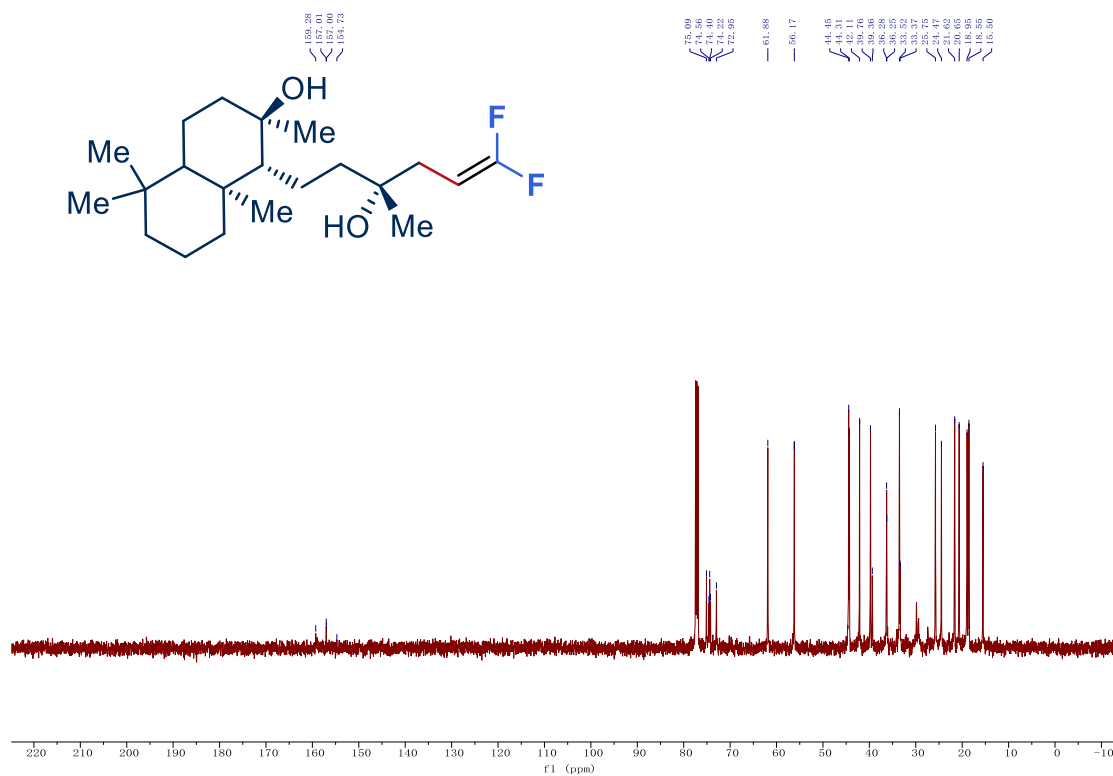
The ^1H NMR spectrum (CDCl₃) shows peaks from 0.5 to 4.3 ppm. Key peaks include a broad singlet for the hydroxyl group at ~7.2 ppm, a multiplet for the decalin protons between 1.5 and 2.5 ppm, and a doublet for the vinyl fluoride protons at ~4.2 ppm. Integration values are provided below the peaks.

Chemical Shift (ppm)	Integration
~7.2	1.00
~4.2	1.00
~2.0	1.98
~1.8	2.04
~1.6	1.10
~1.4	6.45
~1.2	7.26
~1.0	7.30
~0.8	1.39
~0.6	3.05
~0.4	6.04

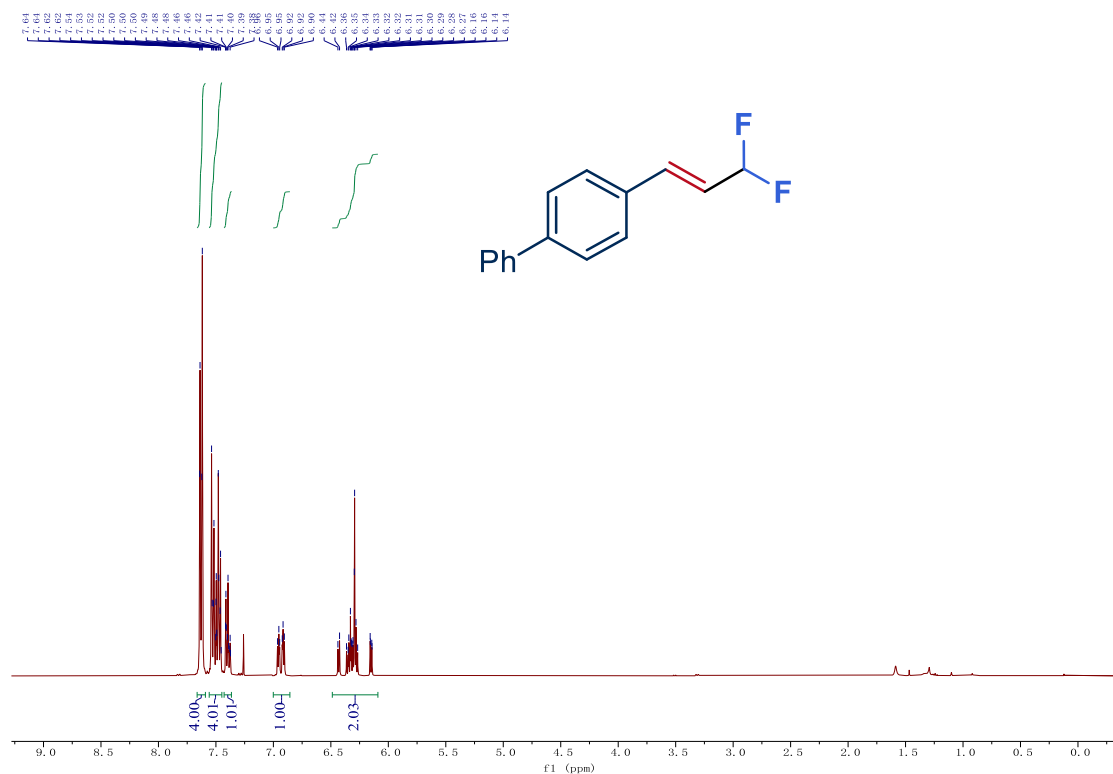
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3i**



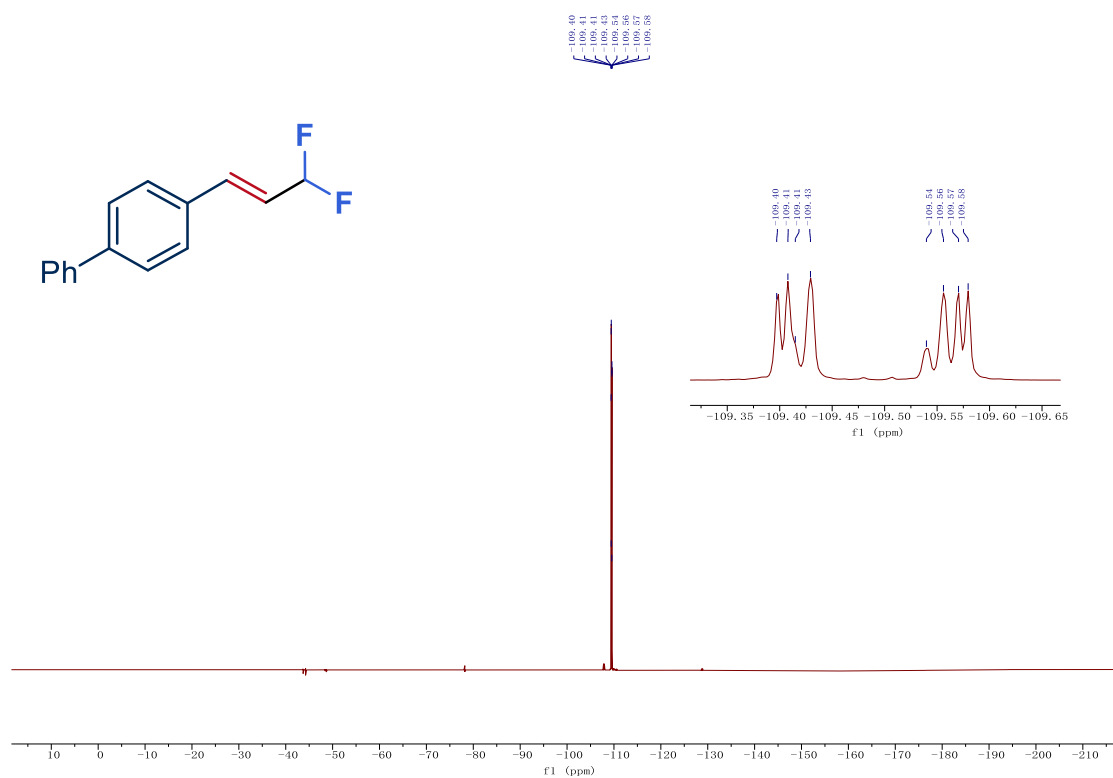
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **3i**



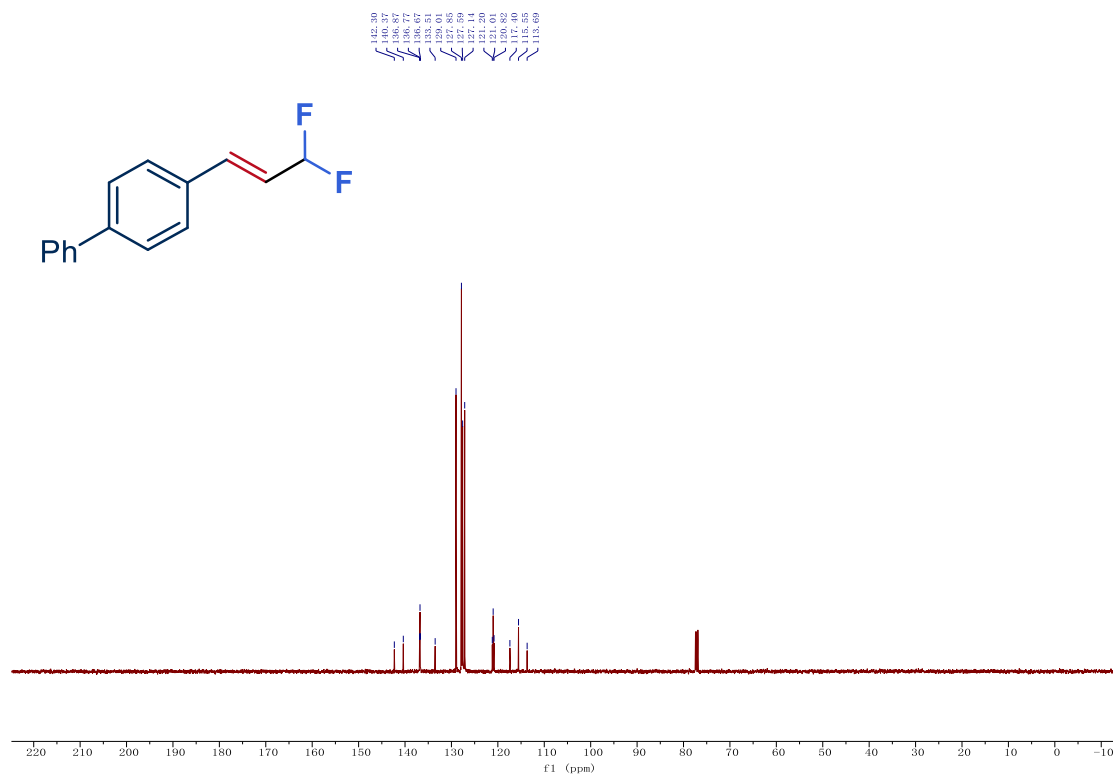
^1H NMR (400 MHz, CDCl_3) spectra for compound **3j**



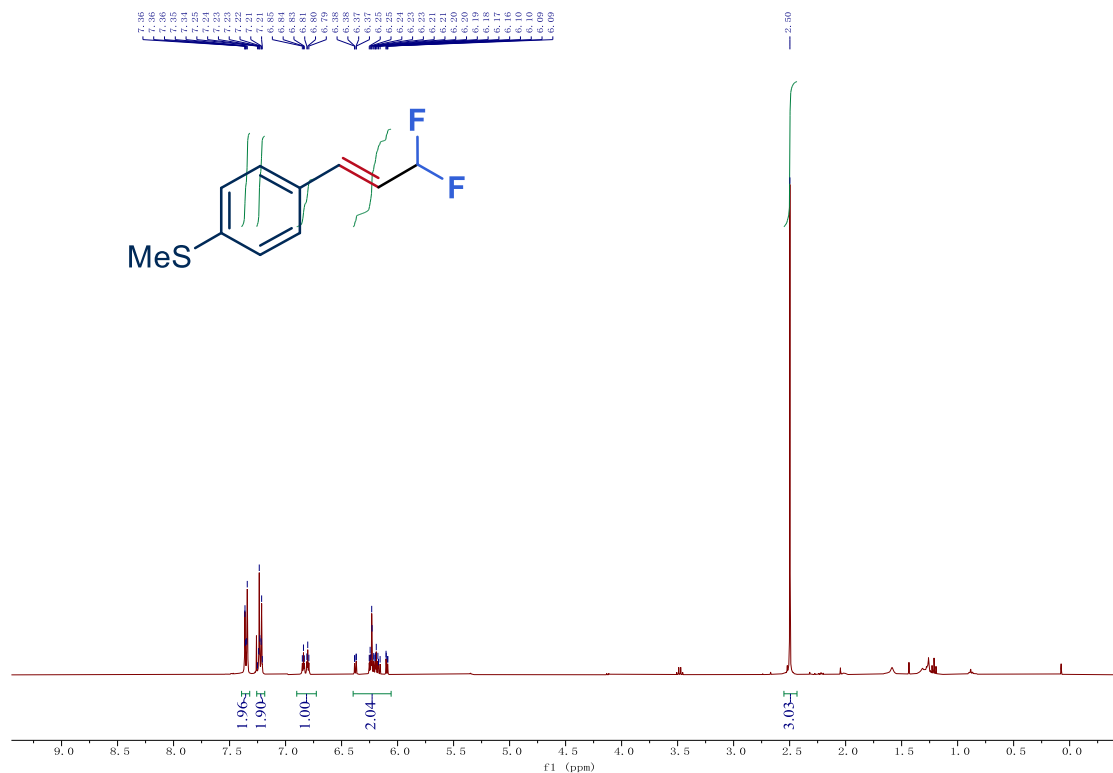
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **2j**



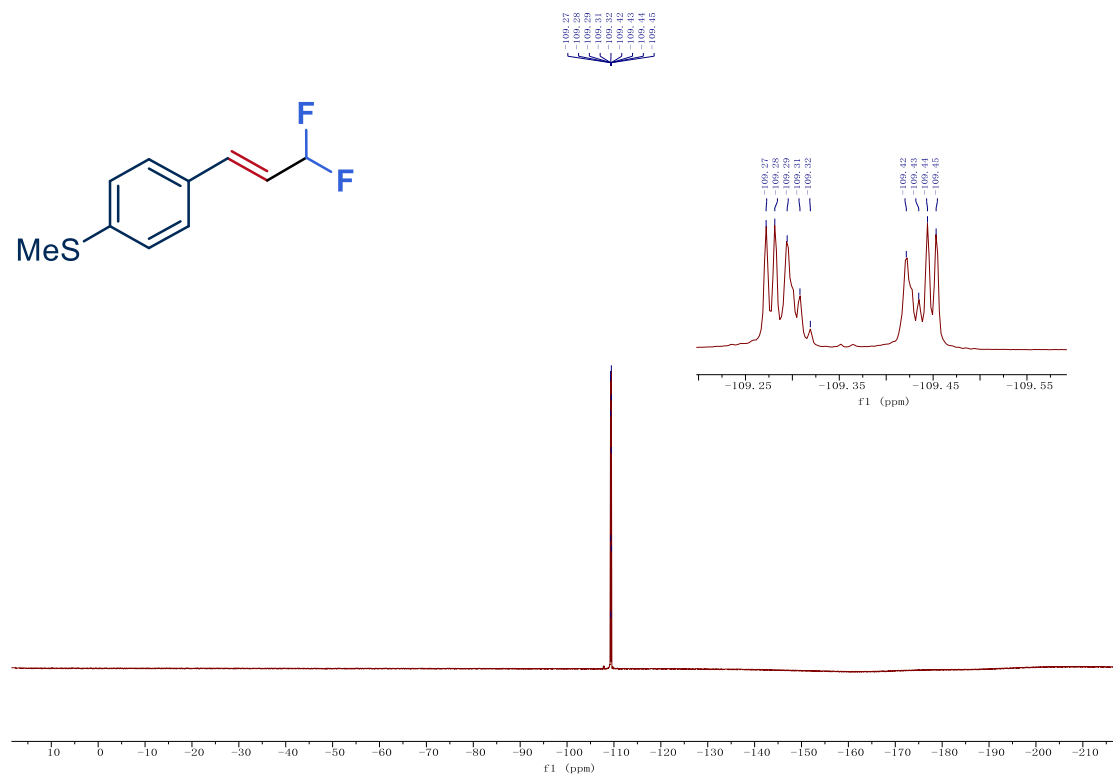
¹³C NMR (126 MHz, CDCl₃) spectra for compound 3j



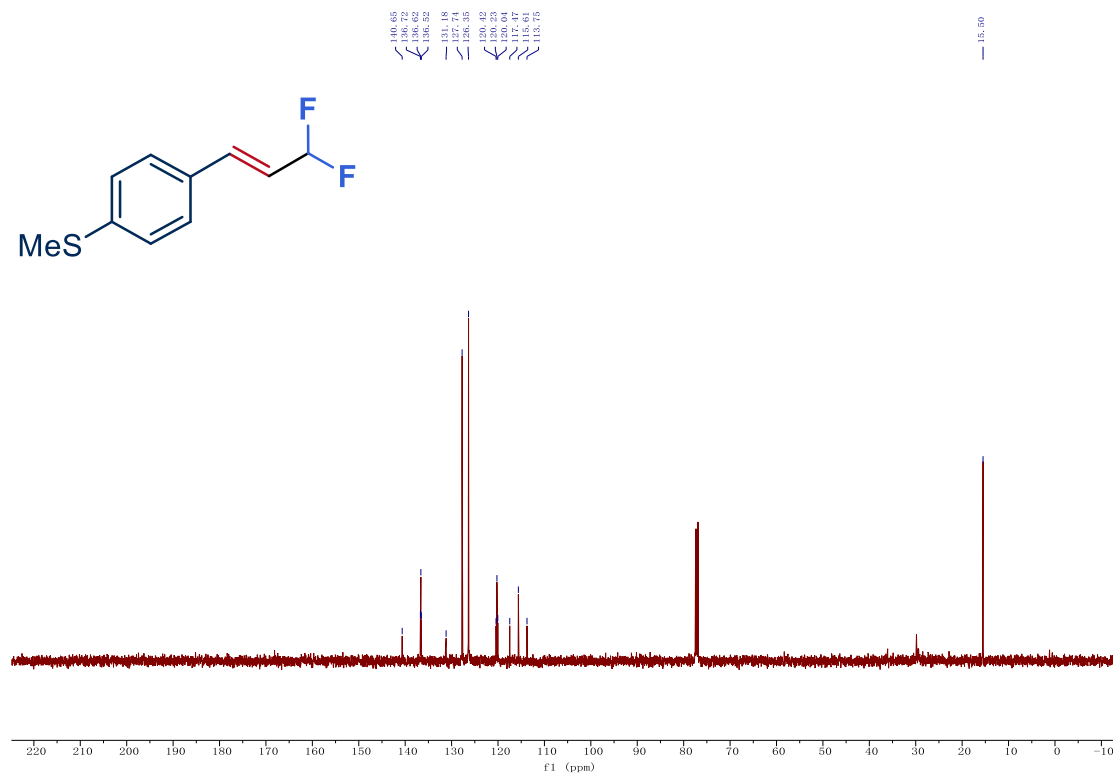
¹H NMR (400 MHz, CDCl₃) spectra for compound 3k



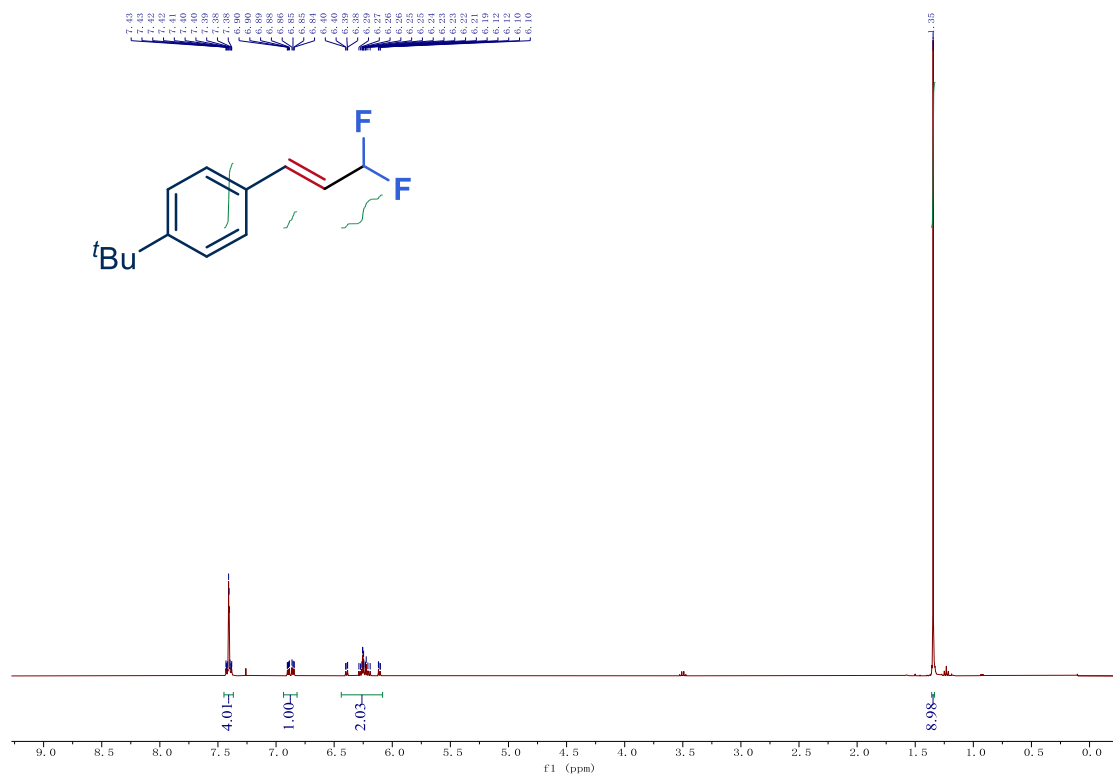
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3k**



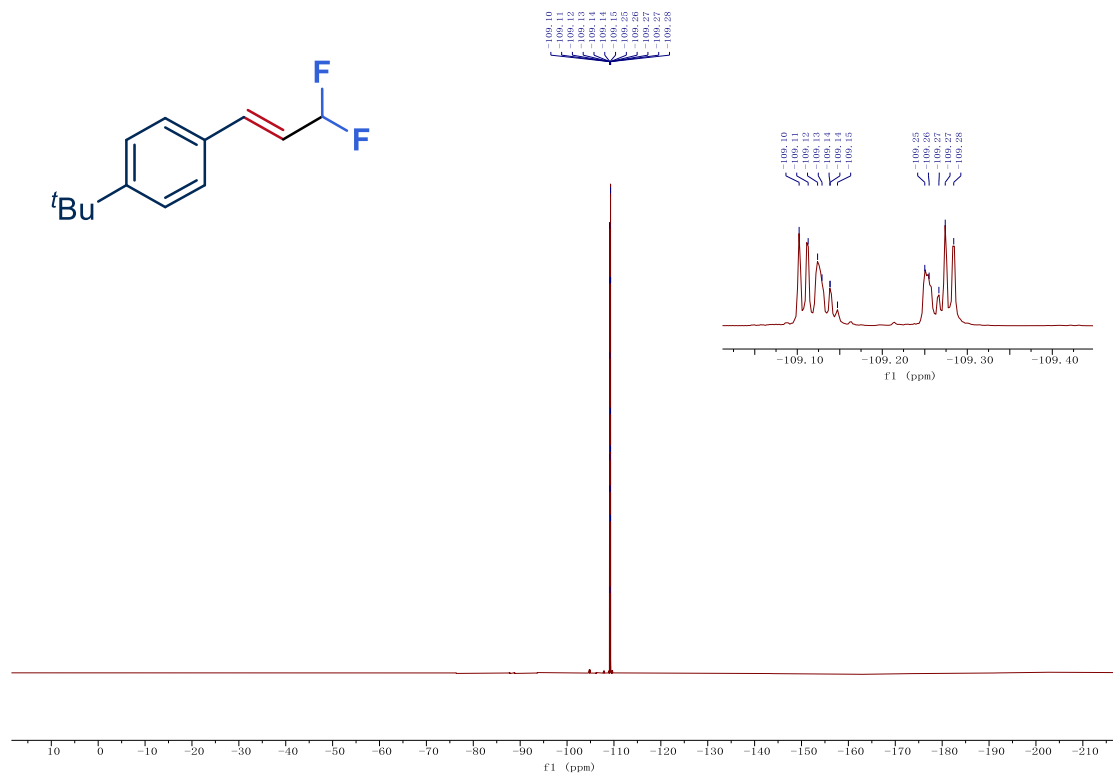
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **3k**



^1H NMR (400 MHz, CDCl_3) spectra for compound **3I**



^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3I**



Chemical structure: CC(C)(C)c1ccc(cc1)C=CC(F)F

¹³C NMR spectrum (ppm):

- 152.91
- 137.18
- 137.02
- 136.99
- 131.80
- 127.17
- 125.90
- 120.49
- 120.11
- 117.62
- 113.91
- 77.00 (triplet)
- 34.90
- 31.34

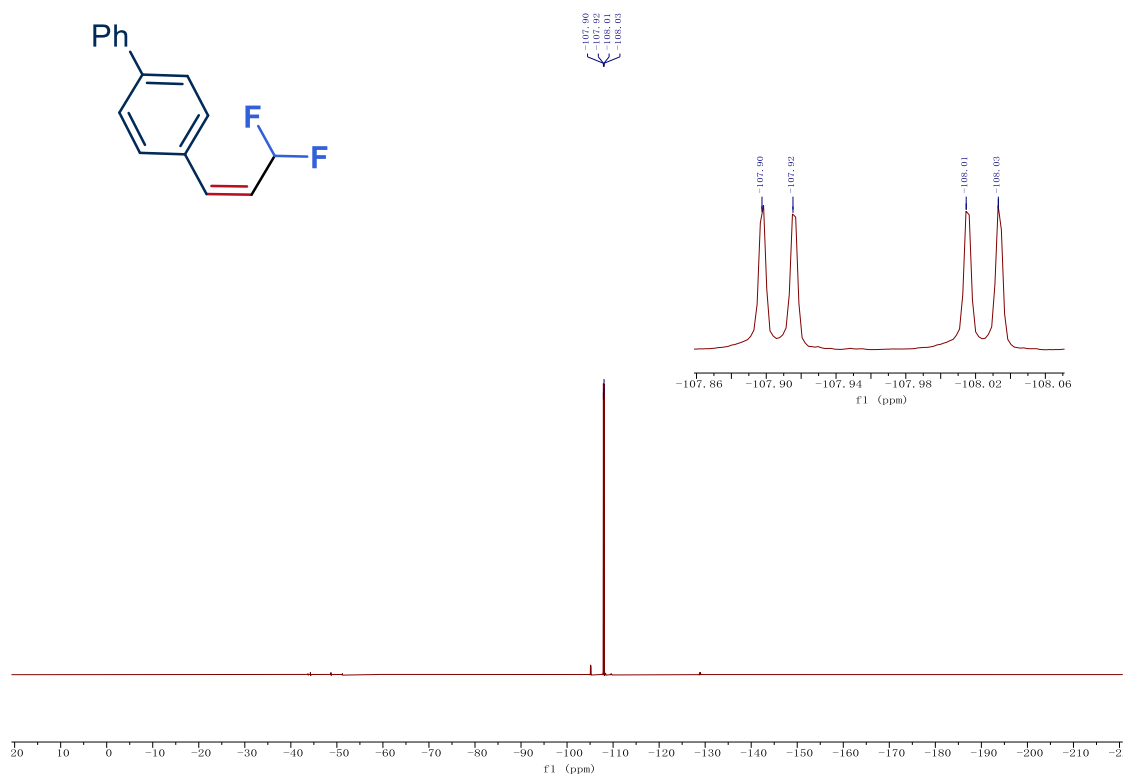
¹H NMR Spectrum (CDCl₃) of (E)-1-(4-phenylphenyl)ethene-1,1-difluoroethane

Chemical Structure: C=C(C(F)(F)F)c1ccc(cc1)-c2ccc(cc2)c3ccccc3

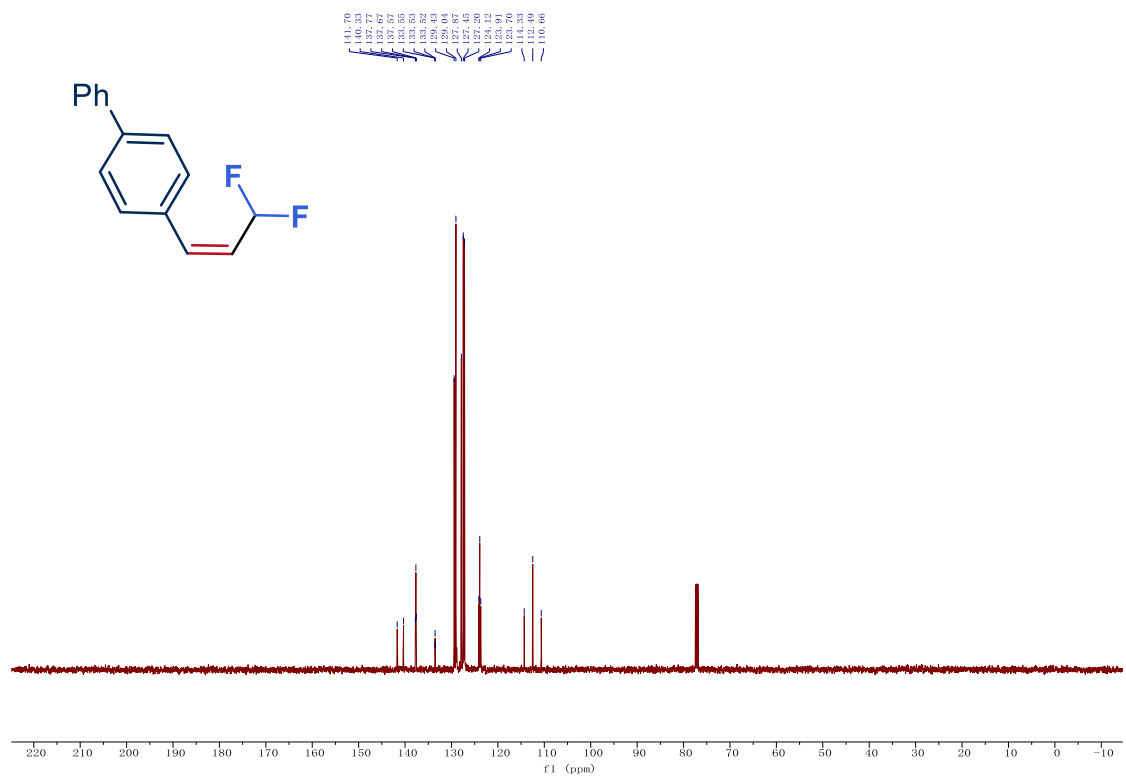
Peak Data:

Chemical Shift (ppm)	Integration
7.661, 7.657, 7.653, 7.649, 7.644, 7.639, 7.635, 7.632, 7.627, 7.622, 7.617, 7.612, 7.607, 7.602, 7.597, 7.592, 7.587, 7.582, 7.577, 7.572, 7.567, 7.562, 7.557, 7.552, 7.547, 7.542, 7.537, 7.532, 7.527, 7.522, 7.517, 7.512, 7.507, 7.502, 7.497, 7.492, 7.487, 7.482, 7.477, 7.472, 7.467, 7.462, 7.457, 7.452, 7.447, 7.442, 7.437, 7.432, 7.427, 7.422, 7.417, 7.412, 7.407, 7.402, 7.397, 7.392, 7.387, 7.382, 7.377, 7.372, 7.367, 7.362, 7.357, 7.352, 7.347, 7.342, 7.337, 7.332, 7.327, 7.322, 7.317, 7.312, 7.307, 7.302, 7.297, 7.292, 7.287, 7.282, 7.277, 7.272, 7.267, 7.262, 7.257, 7.252, 7.247, 7.242, 7.237, 7.232, 7.227, 7.222, 7.217, 7.212, 7.207, 7.202, 7.197, 7.192, 7.187, 7.182, 7.177, 7.172, 7.167, 7.162, 7.157, 7.152, 7.147, 7.142, 7.137, 7.132, 7.127, 7.122, 7.117, 7.112, 7.107, 7.102, 7.097, 7.092, 7.087, 7.082, 7.077, 7.072, 7.067, 7.062, 7.057, 7.052, 7.047, 7.042, 7.037, 7.032, 7.027, 7.022, 7.017, 7.012, 7.007, 7.002, 6.997, 6.992, 6.987, 6.982, 6.977, 6.972, 6.967, 6.962, 6.957, 6.952, 6.947, 6.942, 6.937, 6.932, 6.927, 6.922, 6.917, 6.912, 6.907, 6.902, 6.897, 6.892, 6.887, 6.882, 6.877, 6.872, 6.867, 6.862, 6.857, 6.852, 6.847, 6.842, 6.837, 6.832, 6.827, 6.822, 6.817, 6.812, 6.807, 6.802, 6.797, 6.792, 6.787, 6.782, 6.777, 6.772, 6.767, 6.762, 6.757, 6.752, 6.747, 6.742, 6.737, 6.732, 6.727, 6.722, 6.717, 6.712, 6.707, 6.702, 6.697, 6.692, 6.687, 6.682, 6.677, 6.672, 6.667, 6.662, 6.657, 6.652, 6.647, 6.642, 6.637, 6.632, 6.627, 6.622, 6.617, 6.612, 6.607, 6.602, 6.597, 6.592, 6.587, 6.582, 6.577, 6.572, 6.567, 6.562, 6.557, 6.552, 6.547, 6.542, 6.537, 6.532, 6.527, 6.522, 6.517, 6.512, 6.507, 6.502, 6.497, 6.492, 6.487, 6.482, 6.477, 6.472, 6.467, 6.462, 6.457, 6.452, 6.447, 6.442, 6.437, 6.432, 6.427, 6.422, 6.417, 6.412, 6.407, 6.402, 6.397, 6.392, 6.387, 6.382, 6.377, 6.372, 6.367, 6.362, 6.357, 6.352, 6.347, 6.342, 6.337, 6.332, 6.327, 6.322, 6.317, 6.312, 6.307, 6.302, 6.297, 6.292, 6.287, 6.282, 6.277, 6.272, 6.267, 6.262, 6.257, 6.252, 6.247, 6.242, 6.237, 6.232, 6.227, 6.222, 6.217, 6.212, 6.207, 6.202, 6.197, 6.192, 6.187, 6.182, 6.177, 6.172, 6.167, 6.162, 6.157, 6.152, 6.147, 6.142, 6.137, 6.132, 6.127, 6.122, 6.117, 6.112, 6.107, 6.102, 6.097, 6.092, 6.087, 6.082, 6.077, 6.072, 6.067, 6.062, 6.057, 6.052, 6.047, 6.042, 6.037, 6.032, 6.027, 6.022, 6.017, 6.012, 6.007, 6.002, 5.997, 5.992, 5.987, 5.982, 5.977, 5.972, 5.967, 5.962, 5.957, 5.952, 5.947, 5.942, 5.937, 5.932, 5.927, 5.922, 5.917, 5.912, 5.907, 5.902, 5.897, 5.892, 5.887, 5.882, 5.877, 5.872, 5.867, 5.862, 5.857, 5.852, 5.847, 5.842, 5.837, 5.832, 5.827, 5.822, 5.817, 5.812, 5.807, 5.802, 5.797, 5.792, 5.787, 5.782, 5.777, 5.772, 5.767, 5.762, 5.757, 5.752, 5.747, 5.742, 5.737, 5.732, 5.727, 5.722, 5.717, 5.712, 5.707, 5.702, 5.697, 5.692, 5.687, 5.682, 5.677, 5.672, 5.667, 5.662, 5.657, 5.652, 5.647, 5.642, 5.637, 5.632, 5.627, 5.622, 5.617, 5.612, 5.607, 5.602, 5.597, 5.592, 5.587, 5.582, 5.577, 5.572, 5.567, 5.562, 5.557, 5.552, 5.547, 5.542, 5.537, 5.532, 5.527, 5.522, 5.517, 5.512, 5.507, 5.502, 5.497, 5.492, 5.487, 5.482, 5.477, 5.472, 5.467, 5.462, 5.457, 5.452, 5.447, 5.442, 5.437, 5.432, 5.427, 5.422, 5.417, 5.412, 5.407, 5.402, 5.397, 5.392, 5.387, 5.382, 5.377, 5.372, 5.367, 5.362, 5.357, 5.352, 5.347, 5.342, 5.337, 5.332, 5.327, 5.322, 5.317, 5.312, 5.307, 5.302, 5.297, 5.292, 5.287, 5.282, 5.277, 5.272, 5.267, 5.262, 5.257, 5.252, 5.247, 5.242, 5.237, 5.232, 5.227, 5.222, 5.217, 5.212, 5.207, 5.202, 5.197, 5.192, 5.187, 5.182, 5.177, 5.172, 5.167, 5.162, 5.157, 5.152, 5.147, 5.142, 5.137, 5.132, 5.127, 5.122, 5.117, 5.112, 5.107, 5.102, 5.097, 5.092, 5.087, 5.082, 5.077, 5.072, 5.067, 5.062, 5.057, 5.052, 5.047, 5.042, 5.037, 5.032, 5.027, 5.022, 5.017, 5.012, 5.007, 5.002, 4.997, 4.992, 4.987, 4.982, 4.977, 4.972, 4.967, 4.962, 4.957, 4.952, 4.947, 4.942, 4.937, 4.932, 4.927, 4.922, 4.917, 4.912, 4.907, 4.902, 4	

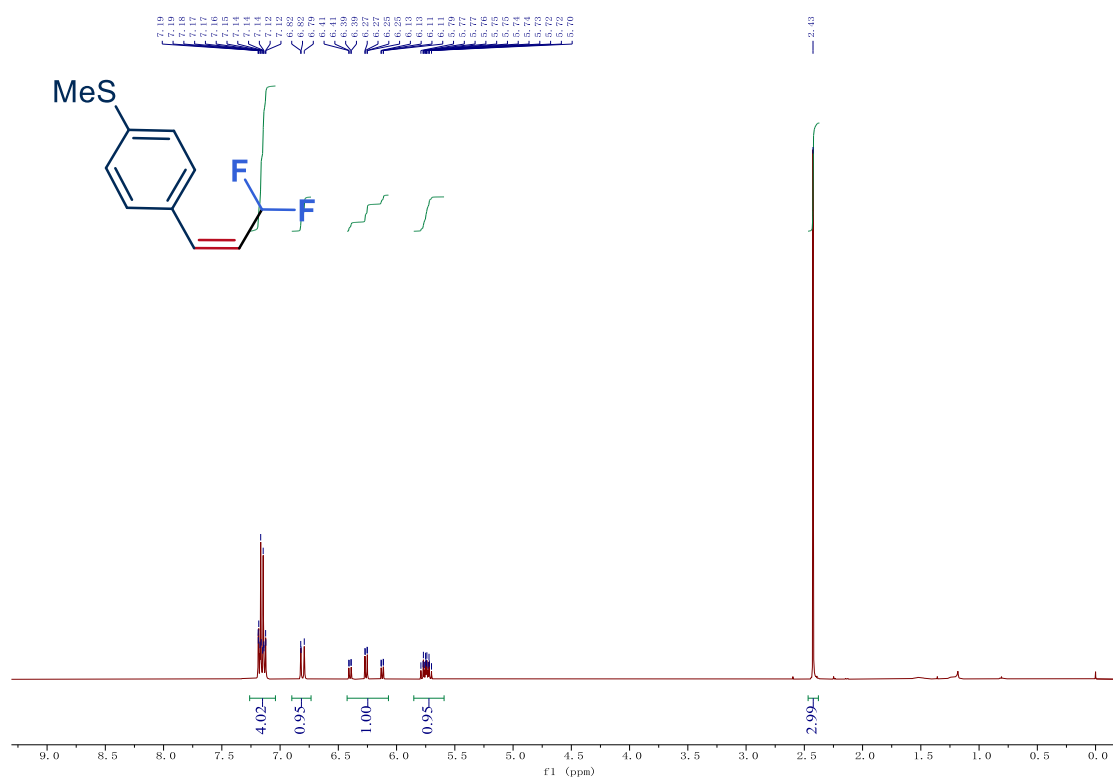
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3m**



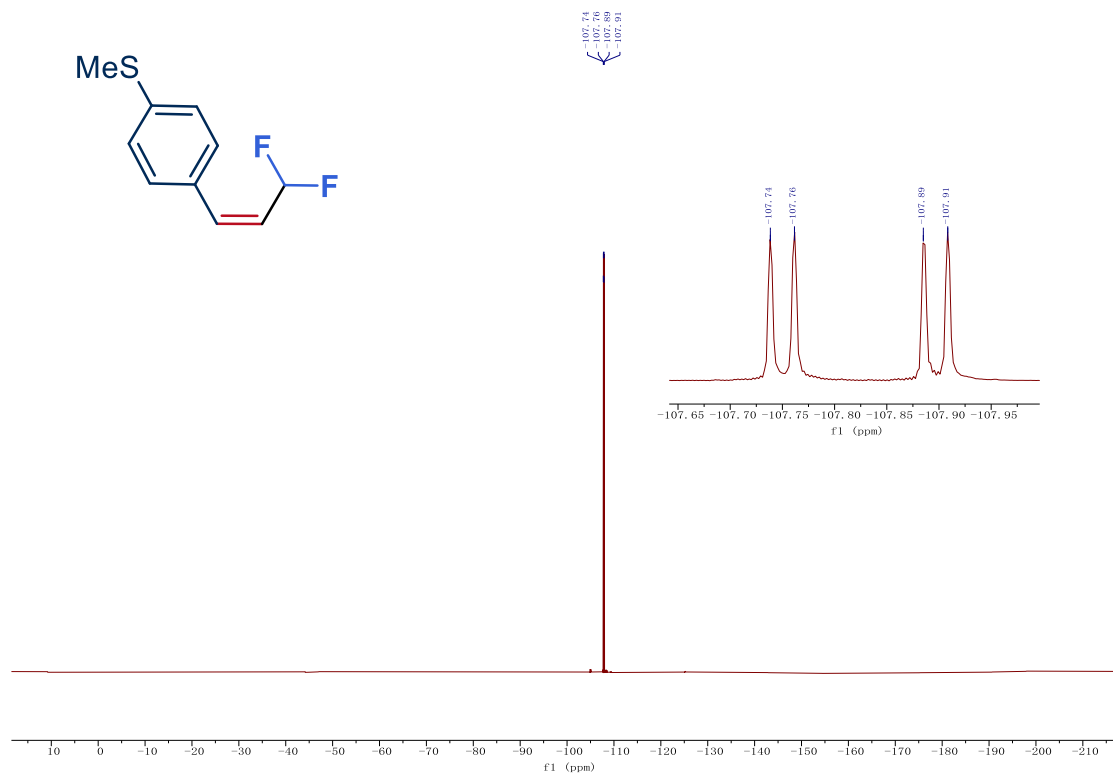
^{13}C NMR (126 MHz, CDCl_3) spectra for compound **3m**



¹H NMR (400 MHz, CDCl₃) spectra for compound 3n



¹⁹F NMR (377 MHz, CDCl₃) spectra for compound 3n



Chemical structure: Cc1ccc(cc1)/C=C(F)F

¹³C NMR peaks (ppm):

- 140.02
- 137.98
- 137.38
- 137.14
- 136.53
- 126.25
- 125.46
- 123.82
- 123.21
- 114.21
- 113.64
- 110.64
- 15.50

CC(C)(C)c1ccc(cc1)/C=C/C(F)F

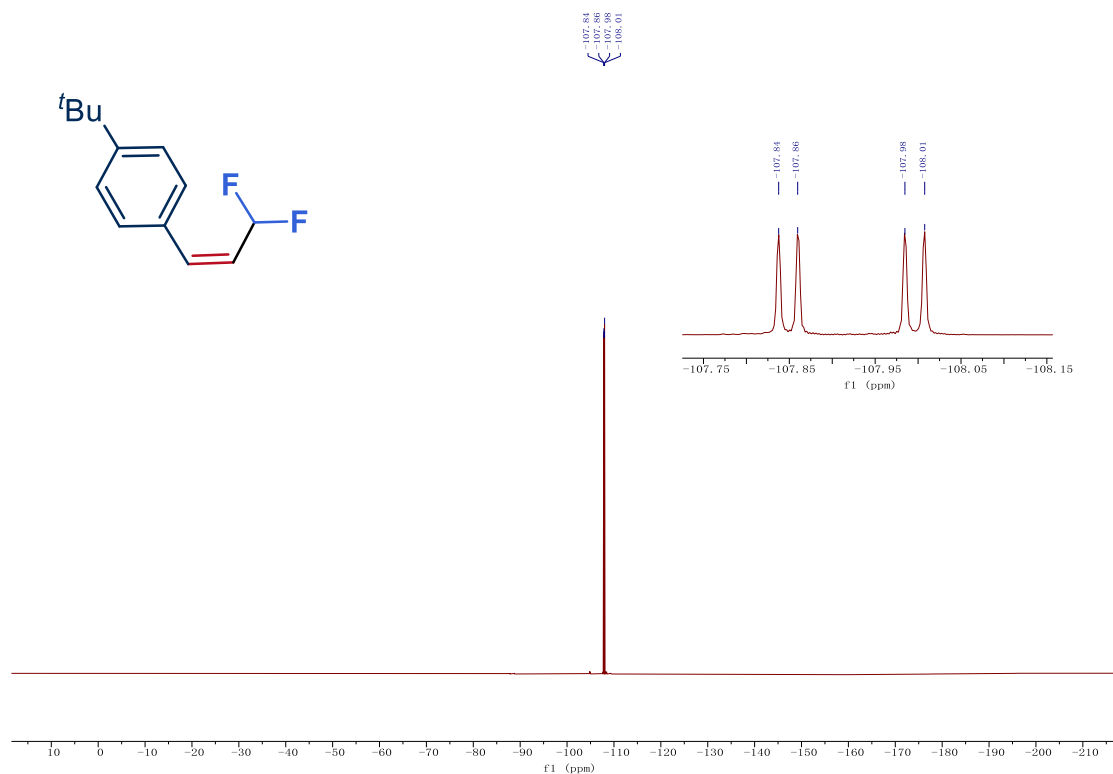
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5

7.335, 7.334, 7.333, 7.333, 7.333, 7.117, 7.117, 7.115, 6.886, 6.883, 6.883, 6.435, 6.435, 6.331, 6.331, 6.177, 6.177, 6.165, 6.165, 5.777, 5.776, 5.774, 5.774, 5.773, 5.772, 5.771, 5.771, 5.699

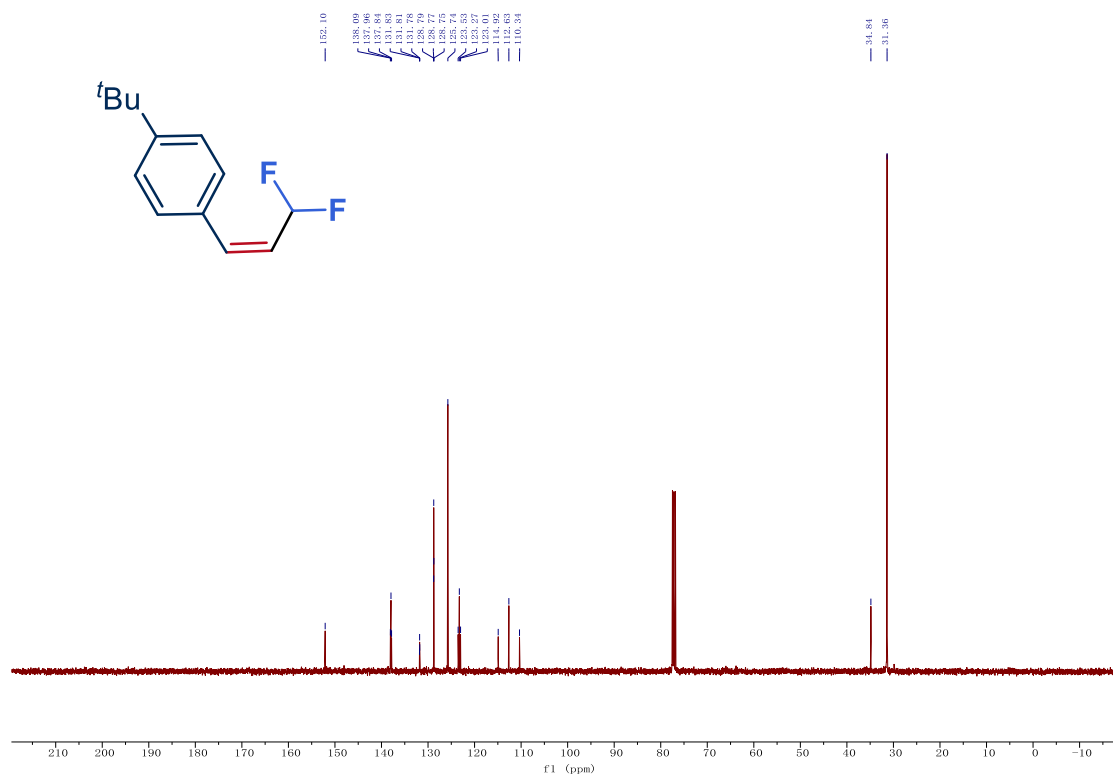
1.95, 2.06, 0.97, 1.00, 0.96, 9.05

f1 (ppm)

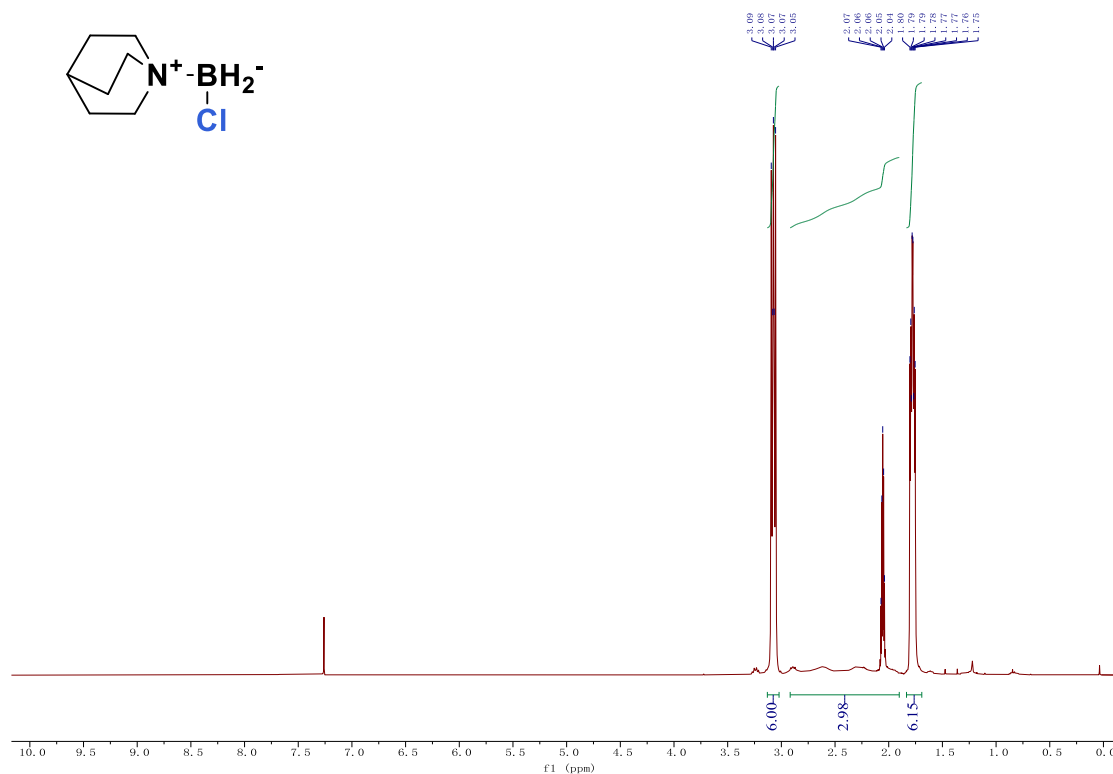
^{19}F NMR (377 MHz, CDCl_3) spectra for compound **3o**



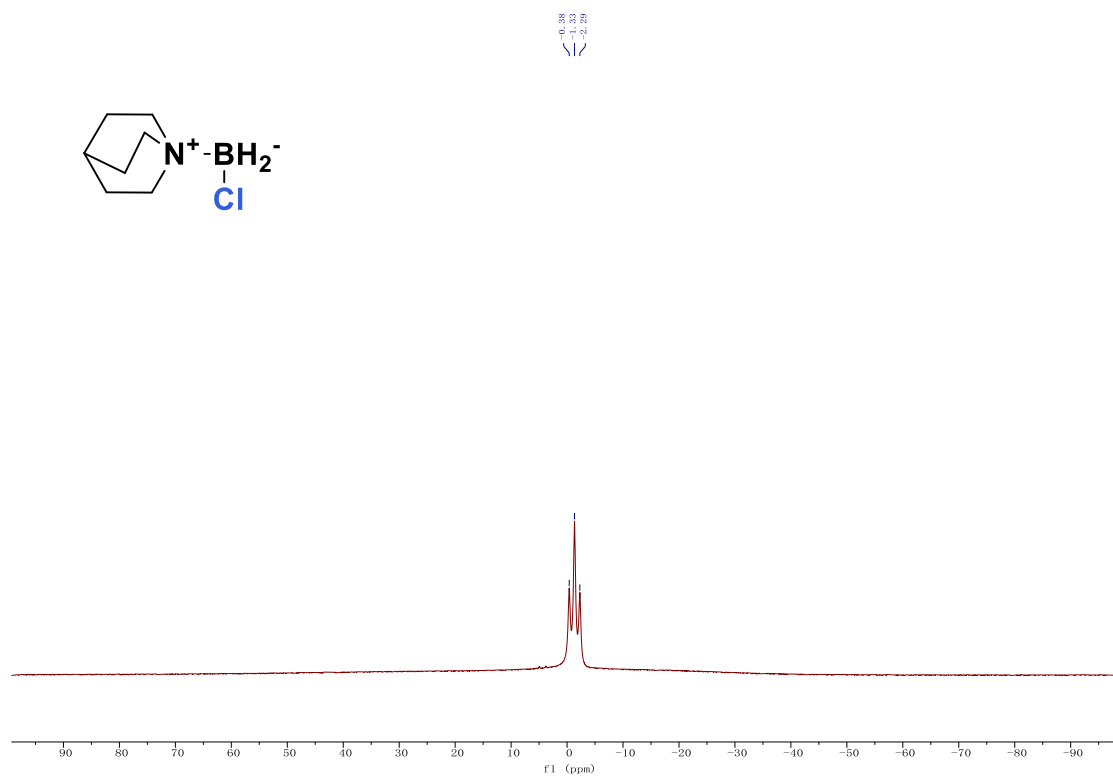
^{13}C NMR (101 MHz, CDCl_3) spectra for compound **3o**



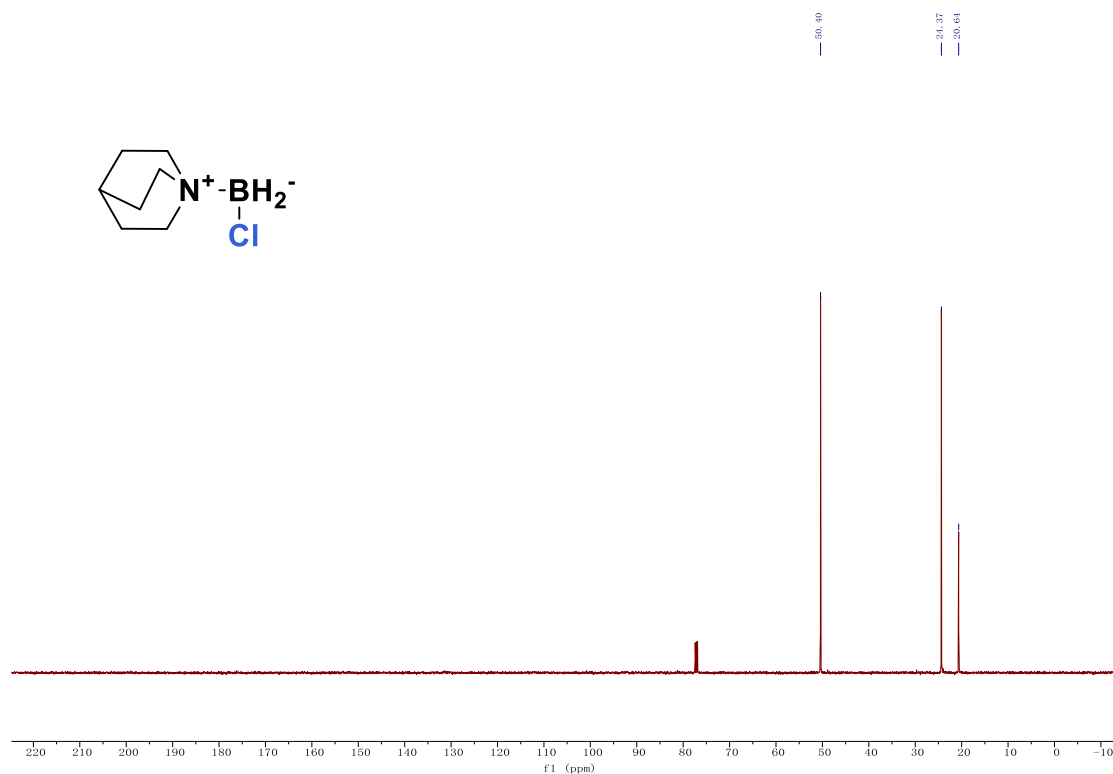
^1H NMR (400 MHz, CDCl_3) spectra for compound **4**



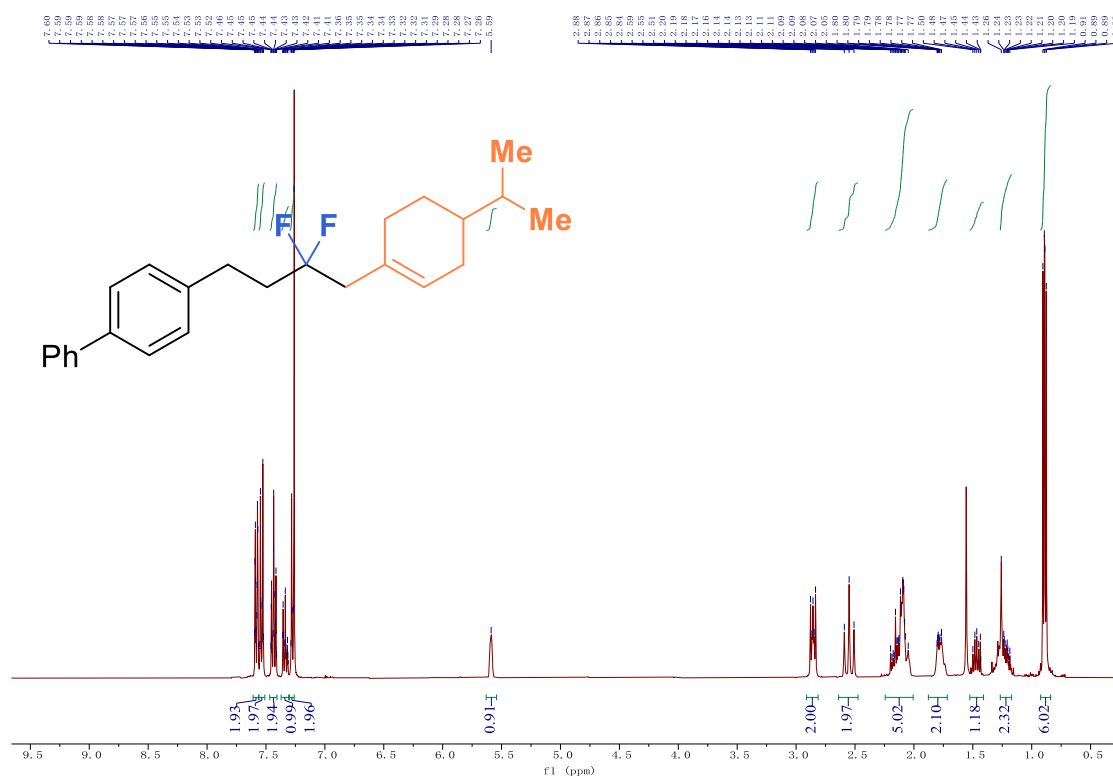
^{11}B NMR (128 MHz, CDCl_3) spectra for compound **4**



^{13}C NMR (126 MHz, CDCl_3) spectra for compound **4**



^1H NMR (400 MHz, CDCl_3) spectra for compound **5**



Chemical structure: CC1(C)CCN(CC1)CCc2ccc(cc2)

¹H NMR spectrum (CDCl₃) showing peaks at approximately 7.2 (m, 5H), 4.2 (m, 2H), 3.2 (m, 2H), 2.2 (m, 2H), and 1.2 (s, 3H). An inset shows the region from -94.6 to -96.2 ppm with several sharp peaks.

Chemical structure: CC(F)(F)CCc1ccc(cc1)C

¹³C NMR spectrum (ppm):

- 141.07
- 140.18
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