Electronic Supplementary Information

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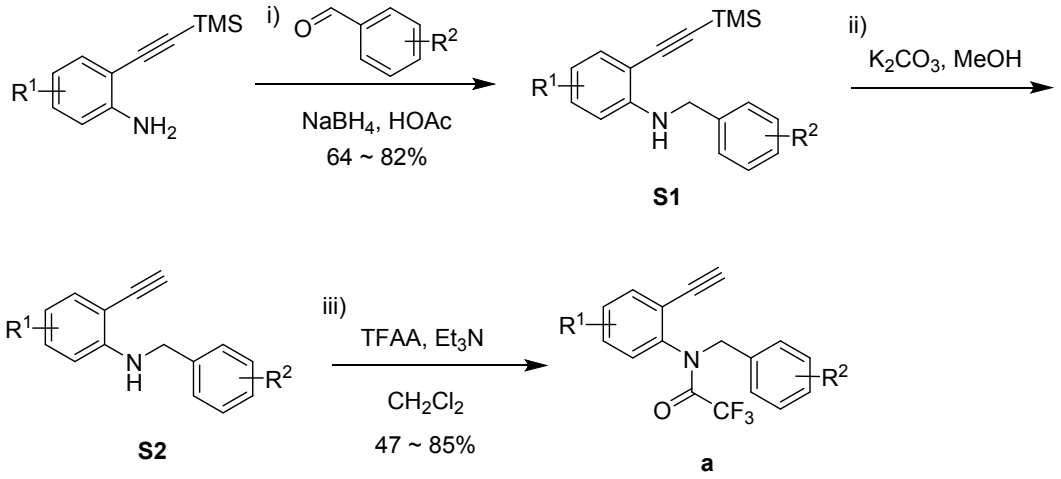
1. Experimental section

a) General information

All chemicals, unless otherwise noted, were purchased from commercial sources and were used without further purification. Unless stated otherwise, all reactions were carried out under nitrogen atmosphere. The substrates were synthesized according to the literature methods.[1-4] Irradiation with visible light was performed using blue LEDs illumination instruments (The actual output power density of the LEDs at 0.5 cm distance is 33.70 mW/cm^2 detected by CEL-NP2000-10 (Beijing CeauLight Co. Ltd., China) light power meter).

The nuclear magnetic resonance spectra were recorded on the Bruker Ascend™ 400 MHz NMR spectrometer and the Bruker Ascend™ 500 MHz NMR spectrometer with tetramethylsilane (TMS) as an internal standard. High resolution mass spectra were recorded using a Q Exactive mass spectrometer (Thermo Fisher Scientific, USA). X-Ray diffraction data of the single crystal were collected on XtaLAB PRO MM007HF DW.

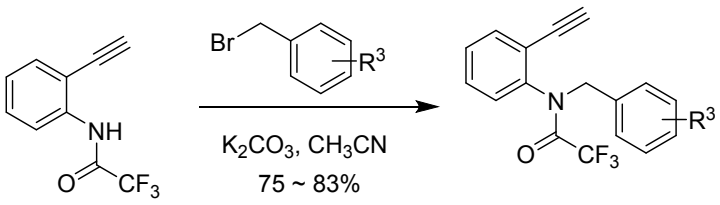
b) Methods for the synthesis of substrates



i) To a solution of 2-((trimethylsilyl)ethynyl)aniline (3 mmol, 1.0 equiv) in AcOH (7.0 mL) was added benzaldehyde (3.6 mmol, 1.2 equiv). The reaction was stirred at room temperature for 1 h and then cooled to 0 °C. The resulting mixture was then warmed to ambient temperature and stirred for 1 h before the addition of $NaBH_4$ (6 mmol, 2.0 equiv). NaOH (3 N, 30 mL) and ethyl acetate (30 mL) were added and the layers were separated. The aqueous phase was extracted twice with ethyl acetate. The combined organic phase was dried over Na_2SO_4, filtered and concentrated under reduced pressure to afford **S1**. The crude product **S1** were isolated by silica-gel column chromatography in excellent yield (64-82%).

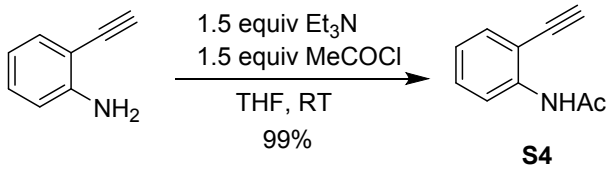
ii) **S1** was treated with K_2CO_3 (0.83 g, 6 mmol) in MeOH (20 mL) at room temperature for 1 h. MeOH was removed under reduced pressure. The residue was diluted with ethyl acetate (30 mL) and water (20 mL). The phases were separated and the aqueous phase was extracted twice with ethyl acetate. The combined organic solution was dried over $MgSO_4$, filtered, and concentrated under reduced pressure to afford **S2** as a light yellow oil. The crude product **S2** was used in the following step without purification.

iii) To a solution of **S2** in CH_2Cl_2 (15 mL) was added Et_3N (0.84 mL, 6.0 mmol) and trifluoroacetic anhydride (0.51 mL, 3.6 mmol). The reaction mixture was stirred at room temperature for 2 h and then concentrated under reduced pressure. The residue was chromatographed through silica gel eluting with ethyl acetate/hexanes to give the product (47-85%).



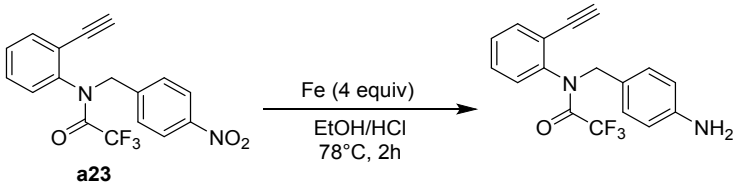
S3

Some of the substrates were synthesized using this method. To a solution of *N*-(2-ethynylphenyl)-2,2,2-trifluoroacetamide (1.0 equiv) in CH_3CN (0.2 M) was added K_2CO_3 (1.2 equiv), followed by benzyl bromide (1.2 equiv). The reaction mixture was stirred at 80 °C for 2 h, cooled to RT, and concentrated under reduced pressure. The residue was chromatographed through silica gel eluting with ethyl acetate/hexanes to give the product (75-83%).



S4

N-acetyl-*o*-ethynylaniline was synthesized using this method. To a solution of *o*-ethynylaniline (1 mmol, 117 mg), Et_3N (1.5 mmol, 0.206 mL) in THF (2 mL) was added acetyl chloride (1.5 mmol, 118mg) dropwise at room temperature. After the addition was complete, the reaction mixture was stirred for a further 30 minutes. The reaction was quenched by water (10 mL) and the resulting mixture was extracted with Et_2O (3×10 mL). The combined extracts were washed with brine, dried over sodium sulfate and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel to afford *N*-acetyl-*o*-ethynylaniline **S4** as a white solid (158.4 mg, 99% yield).

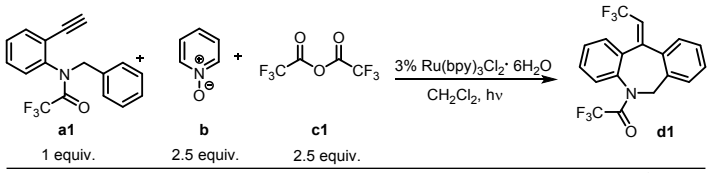


a23

To a solid of **a23** (696 mg, 2 mmol, 1 equiv) in ethanol (8 mL) were added iron powder (448 mg, 8 mmol, 4 equiv) and concd HCl (2 mL, 2.4mmol, 1.2 equiv). After 2 h of reflux, the mixture was cooled to room temperature and Na_2CO_3 was added by

portions until gas evolution ceased. After filtration over Celite, the filtrate was extracted with Et_2O and the combined organic fractions were washed with H_2O and a saturated solution of NaCl. The organic layer was then dried over Na_2SO_4, filtered, and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel to afford **a** (217 mg, 35 % yield).[5]

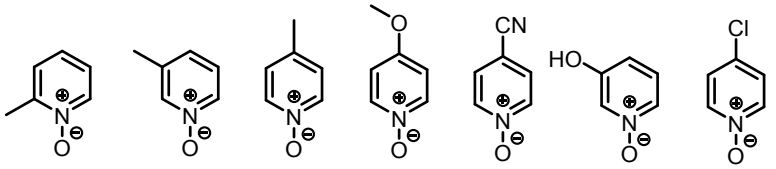
c) Table S1. Optimization of the reaction time[a]



Entry	Reaction time (h)	Yield (%)[b]
1	3	50
2	4	59
3	5	73
4	6	85
5	7	86
6	8	86

[a] Reaction conditions: 0.1 mmol **a1**, 3% $Ru(bpy)_3Cl_2 \cdot 6H_2O$, 0.25 mmol **b** and **c1** were dissolved in CH_2Cl_2, degassed for 15 min under N_2, 450 nm LEDs irradiation at room temperature; [b] isolated yields.

d) Scheme S1. Optimization of pyridine-*N*-oxide derivatives.



e) Crystal structure determination of d1

A suitable crystal of **d1** was mounted with glue at the end of a glass fiber. Data collection was performed with a XtaLAB PRO MM007-DW diffractometer system equipped with a RA-Micro7HF-MR-DW(Cu/Mo) X-ray generator and Pilatus3R-200K-A detector (Rigaku, Japan, Cu Kα, λ = 1.54178 Å). The structure was solved by direct methods (SHELXTL-97) and refined by full-matrix least-squares (SHELXTL-97)[6] refinements based on F^2. Anisotropic thermal parameters were applied to all non-hydrogen atoms. The hydrogen atoms were generated geometrically. Crystal data and structure refinement parameters are summarized in Table S2. CCDC No. 1936747.

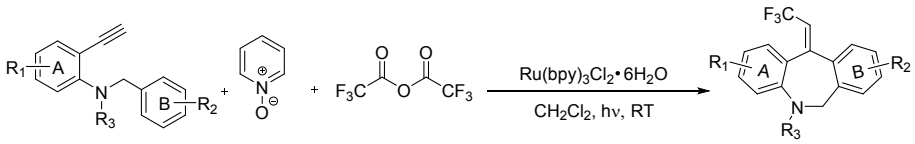
Single crystals suitable for X-ray diffraction were obtained by slow evaporation of a saturated solution of **d1** (methanol) in a loosely capped vial.

Table S2 Crystal data and structure refinement for d1

Identification code	**d1**
Empirical formula	$C_{18}H_{11}F_6NO$
Formula weight	371.28
Temperature/K	100
Crystal system	monoclinic
Space group	$P2_1/c$
a/Å	7.8518(2)
b/Å	15.2537(5)
c/Å	26.0789(7)
α/°	90
β/°	92.227(3)
γ/°	90
Volume/Å^3	3121.07(16)
Z	8
ρ_{calc}g/cm^3	1.580

μ/mm^{-1}	1.305
F(000)	1504.0
Crystal size/mm^3	0.3 × 0.1 × 0.05
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	6.714 to 148.6
Index ranges	$-7 \leq h \leq 9$, $-18 \leq k \leq 18$, $-31 \leq l \leq 32$
Reflections collected	18741
Independent reflections	6153 [R_{int} = 0.0419, R_{sigma} = 0.0286]
Data/restraints/parameters	6153/3/558
Goodness-of-fit on F^2	1.055
Final R indexes [I>=2σ (I)]	R_1 = 0.0521, wR_2 = 0.1340
Final R indexes [all data]	R_1 = 0.0587, wR_2 = 0.1378
Largest diff. peak/hole / e $Å^{-3}$	0.40/-0.22

f) General procedure for the photoreactions



The substrate (0.1 mmol, 1 equiv.), trifluoroacetic anhydride (0.25 mmol, 2.5 equiv.), pyridine *N*-oxide (0.25 mmol, 2.5 equiv.) and 3 mol% $Ru(bpy)_3Cl_2 \cdot 6H_2O$ were dissolved in 6.0 mL CH_2Cl_2 in a 15 mL reaction tube equipped with magnetic stirring bar, the reaction tube was sealed and the resulting mixture was deaerated with nitrogen for 15 min, then the reaction tube was irradiated by blue LEDs for 9 h. After reaction, the solvent was removed by rotary evaporation and purified by column chromatography on silica gel using petroleum ether/ethyl acetate as the eluent.

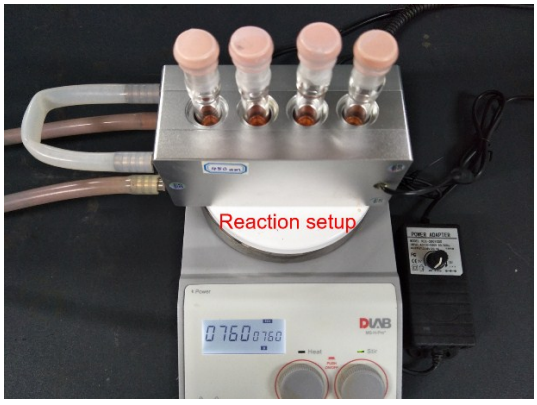
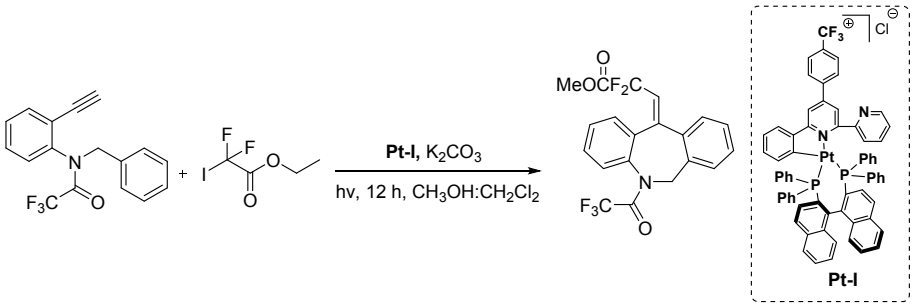
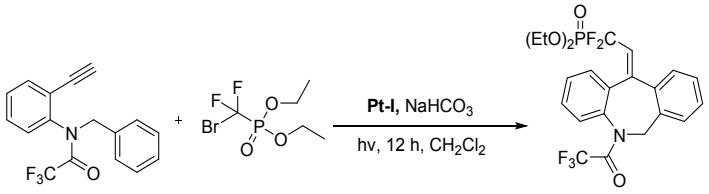


Figure S1. Reaction setup for general photoreactions.



The substrate (0.1 mmol, 1 equiv.), ethyldifluoroiodoacetate (0.2 mmol, 2 equiv.), Potassium carbonate (0.15 mmol, 1.5 equiv.) and the **Pt-I** complex (0.003 mmol, 3 mol%) were dissolved in 5.0 mL (CH_2Cl_2:CH_3OH=1:1) in a 15 mL reaction tube equipped with magnetic stirring bar, the reaction tube was sealed and the resulting mixture was deaerated with nitrogen for 15 min, then the reaction tube was irradiated

by blue LEDs for 12 h. After reaction, the solvent was removed by rotary evaporation and purified by column chromatography on silica gel using petroleum ether/ethyl acetate as the eluent.



The substrate (0.1 mmol, 1 equiv.), diethyl bromodifluoromethanephosphonate (0.2 mmol, 2 equiv.), sodium dicarbonate (0.15 mmol, 1.5 equiv.) and the **Pt-I** complex (0.003 mmol, 3 mol%) were dissolved in 5.0 mL CH_2Cl_2 in a 15 mL reaction tube equipped with magnetic stirring bar, the reaction tube was sealed and the resulting mixture was deaerated with nitrogen for 15 min, then the reaction tube was irradiated by blue LEDs for 12 h. After reaction, the solvent was removed by rotary evaporation and purified by column chromatography on silica gel using petroleum ether/ethyl acetate as the eluent.

g) Procedure for the gram-scale reaction

The substrate (3.4 mmol, 1 equiv.), trifluoroacetic anhydride (8.5 mmol, 2.5 equiv.), pyridine *N*-oxide (8.5 mmol, 2.5 equiv.) and 3 mol% $Ru(bpy)_3Cl_2·6H_2O$ were dissolved in 80 mL CH_2Cl_2 in a 250 mL reaction flask equipped with magnetic stirring bar, the flask was sealed and the resulting mixture was deaerated with nitrogen for 30 min, then the flask was irradiated by blue LEDs for 48 h. After reaction, the solvent was removed by rotary evaporation and purified by column chromatography on silica gel using petroleum ether/ethyl acetate as the eluent.

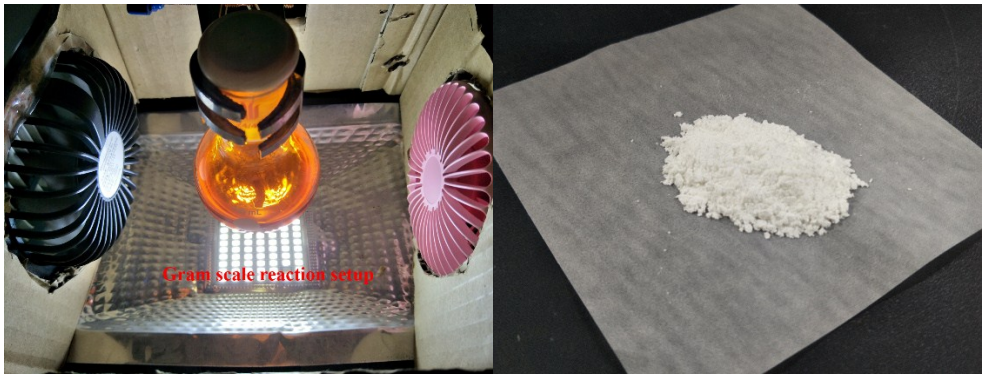
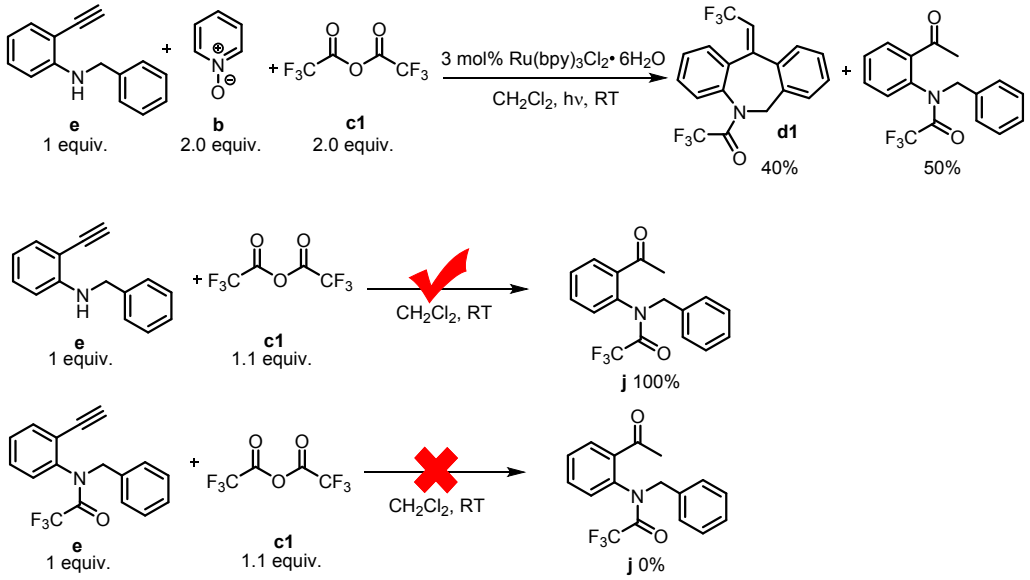
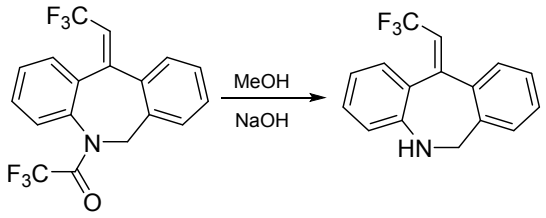


Figure S2. Gram scale reaction setup and product **d1**.

h) Scheme S2. Trifluoroacetic anhydride induced oxidation of triple bond.

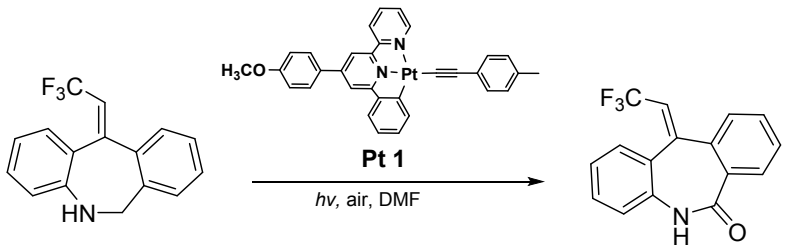


i) Procedures for further transformation of d1



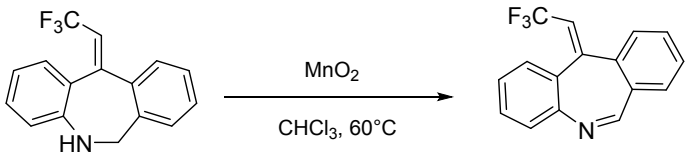
d1 **f** 90%

A white solid of **d1** (1.1 g, 2.8 mmol) in MeOH (150 mL) was cooled to 0 °C, and then 5 N NaOH solution (25 mL) was added slowly. This mixture was stirred for 1 h at room temperature. The residue mixture was concentrated under reduced pressure. This solution was then extracted with CH_2Cl_2 (2 × 20 mL). The combined organic phases were washed with brine and dried over sodium sulphate. The solvent was removed by rotary evaporation and purified by column chromatography on silica gel by using petroleum ether/ethyl acetate as eluent.[7]



f **g** 82%

The substrate **f** (0.1 mmol, 1 equiv) and **Pt 1** (0.00025 mmol, 0.0025 equiv) were dissolved in DMF (2 mL) in a 10 mL reaction tube equipped with magnetic stirring bar, and the resulting mixture was irradiated using blue LEDs at the ambient condition. After the substrate was completely converted (monitored by TLC), the reaction mixture was evaporated under reduced pressure until DMF was gone. Then diethyl ether (25 mL) and water (25 mL) were added to the residue. The organic layer was extracted with diethyl ether (3 × 25 mL). The combined organic phases were washed with brine and dried over sodium sulphate. The solvent was removed by rotary evaporation and purified by column chromatography on silica gel by using petroleum ether/ethyl acetate as eluent.[8]



f **h** 80%

To a solution of **f** (0.21 mmol, 1.0 equiv) in $CHCl_3$ (5 mL) was added MnO_2 (1.0 mmol, 5.0 equiv). The reaction mixture was heated for 1 h at 60 °C and cooled to room temperature. The solvent was removed by rotary evaporation and purified by column chromatography on silica gel by using petroleum ether/ethyl acetate as eluent.

j) Reaction Quantum Yield (Φ) Measurement[9-11]

1) Determination of the light intensity at 450 nm

The photon flux of the LED (λ_{max} = 450 nm) was determined by standard ferrioxalate actinometry. By dissolving potassium ferrioxalate hydrate (0.737 g) in H_2SO_4 (10 mL of a 0.05 M solution), a 0.15 M solution of ferrioxalate was prepared. By dissolving 1,10-phenanthroline (25 mg) and sodium acetate (5.63 g) in H_2SO_4 (25 mL of a 0.5 M solution), a buffered solution of 1,10-phenanthroline was prepared. Both solutions were stored in the dark. To determine the photon flux of the LED, a cuvette containing 1.0 mL ferrioxalate solution was irradiated for 90 s at λ_{max} = 450 nm. After irradiation, 0.175 mL phenanthroline solution was added to the cuvette and the mixture was allowed to stir in the dark for 1.5 h to allow the ferrous ions to completely coordinate to the phenanthroline. The absorbance of the solution was measured at 510 nm. A non-irradiated sample was also prepared and measured the absorbance at 510 nm. The results were shown as below:

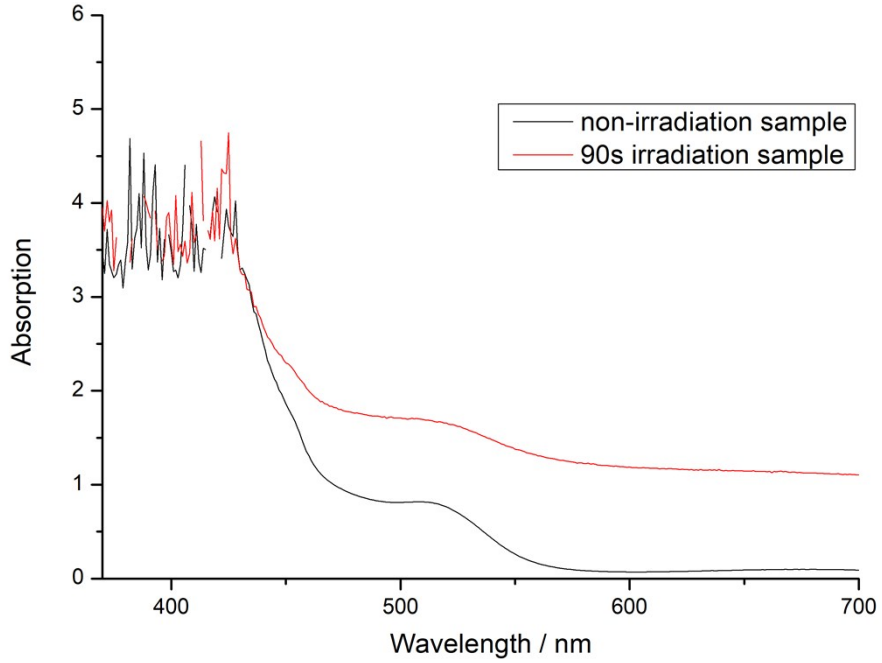


Figure S3. UV-vis spectrum of irradiation and non-irradiation sample.

Conversion was calculated using equation 1.

$$\text{mol } Fe^{2+} = \frac{V \bullet \Delta A(510\ nm)}{1 \bullet \varepsilon} \quad (1)$$

Where V is the total volume (0.001175 L) of the solution after addition of phenanthroline, ΔA is the difference in absorbance at 510 nm between the irradiated and non-irradiated solutions, 1 is the path length (1.0 cm), and ε is the molar absorptivity of the ferrioxalate actinometer at 510 nm (11100 $Lmol^{-1}cm^{-1}$). The photon flux can be calculated using equation 2.

$$\text{Photon flux} = \frac{mol\ Fe2+}{\Phi \bullet t \bullet f} \quad (2)$$

Where Φ is the quantum yield for the ferrioxalate actinometer at λ_{max} = 450 nm, t is the irradiation time, and f is the fraction of light absorbed at λ_{max} = 450 nm by the ferrioxalate actinometer. This value is calculated using equation 3 where A is the absorbance of the ferrioxalte solution at 450 nm. An absorption spectrum gave an A value of >3, indicating that the fraction of absorbed light (f) is > 0.999.

$$f = 1 - 10^{-A(450\ nm)}$$

The photon flux was thus calculated to be 1.05×10^{-9} einstein s^{-1}.

2) Determination of the reaction quantum yield

The degassed solution containing **a1** (0.1 mmol, 1 equiv.), trifluoroacetic anhydride (0.25 mmol, 2.5 equiv.), pyridine *N*-oxide (0.25 mmol, 2.5 equiv.) and 3 mol% $Ru(bpy)_3Cl_2 \cdot 6H_2O$ with magnetic stirring bar was constantly irradiated for 30 min. After irradiation, the yield of product **d1** was determined to be 9 mol% by ^1H NMR. The reaction quantum yield was determined using equation 4, where photon flux was determined as above described, t is the reaction time, f is the fraction of incident light absorbed by the reaction mixture. This value is calculated using equation 3 where A is the absorbance of the reaction mixture at 450 nm. An absorption spectrum of the reaction mixture shown as Figure S4 gave an A value of >3, indicating that the fraction of absorbed light (f) is > 0.999.

$$\Phi = \frac{mol\ of\ product\ formed}{photon\ flux \bullet t \bullet f} \quad (4)$$

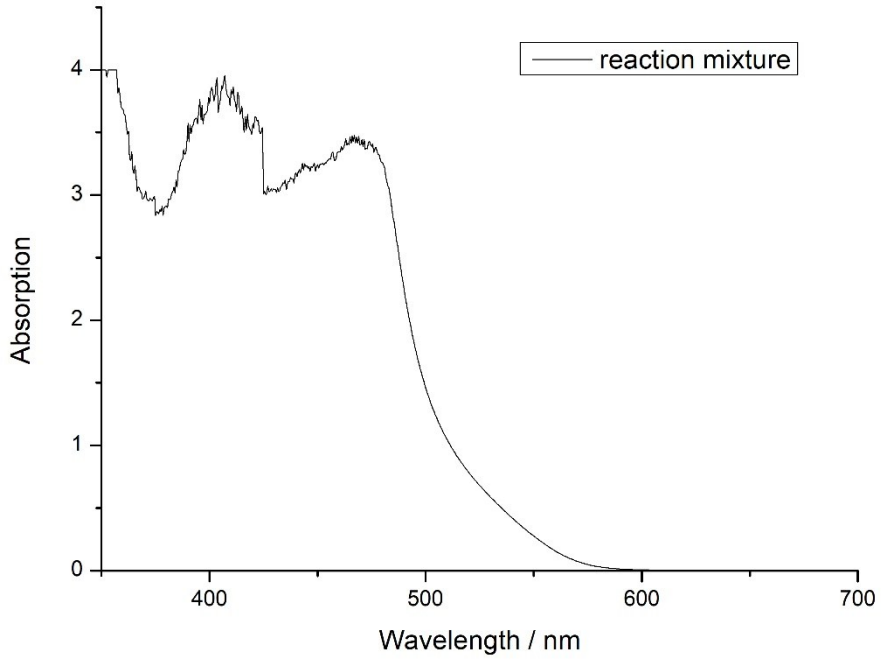


Figure S4. UV-vis spectrum of reaction mixture.

The reaction quantum yield (Φ) was determined to be 5.5, which is above unity, indicating that a radical chain propagation might be operative in this reaction.

k) References

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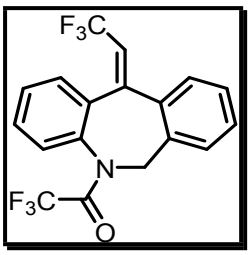
2. Characterization data of the products

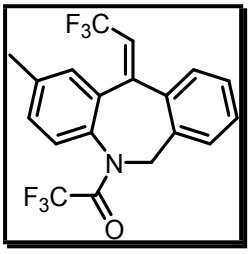


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.49 – 7.41 (m, 4H), 7.39 – 7.34 (m, 2H), 7.30 (t, *J* = 7.1 Hz, 1H), 7.16 (d, *J* = 7.5 Hz, 1H), 6.12 (q, *J* = 8.0 Hz, 1H), 5.98 (d, *J* = 17.1 Hz, 1H), 4.34 (d, *J* = 17.1 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.83 (q, *J* = 36.7 Hz), 148.56 (q, *J* = 5.0 Hz), 136.28 (s), 135.85 (s), 134.75 (s), 133.69 (s), 130.07 (s), 129.86 (s), 129.39 (s), 129.31 (s), 128.82 (q, *J* = 2.9 Hz), 128.05 (s), 127.93 (s), 126.69 (d, *J* = 2.5 Hz), 122.14 (q, *J* = 270.9 Hz), 120.18 (q, *J* = 34.4 Hz), 116.11 (q, *J* = 288.5 Hz), 50.62 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.18 (s, 3F), -67.90 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{11}F_6NONa$: 394.0643, found: 394.0631.

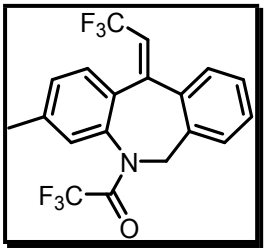


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.40 (dd, *J* = 7.6, 1.3 Hz, 1H), 7.35 (td, *J* = 7.4, 1.5 Hz, 1H), 7.31 – 7.28 (m, 1H), 7.24 (s, 2H), 7.20 (s, 1H), 7.14 (d, *J* = 7.5 Hz, 1H), 6.09 (q, *J* = 8.1 Hz, 1H), 5.96 (d, *J* = 17.1 Hz, 1H), 4.31 (d, *J* = 17.1 Hz, 1H), 2.39 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.97 (q, *J* = 36.5 Hz), 148.78 (q, *J* = 5.6 Hz), 139.67 (s), 136.09 (s), 134.95 (s), 133.76 (s), 133.19 (s), 130.60 (s), 129.78 (s), 129.26 (s), 129.20 (d, *J* = 2.5 Hz), 128.06 (s), 127.86 (s), 126.43 (d, *J* = 1.7 Hz), 122.20 (q, *J* = 272.2 Hz), 119.91 (q, *J* = 34.0 Hz), 116.16 (q, *J* = 288.5 Hz), 50.69 (s), 21.17 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.21 (s, 3F), -67.90 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{19}H_{13}F_6NONa$: 408.0799, found: 408.0786.

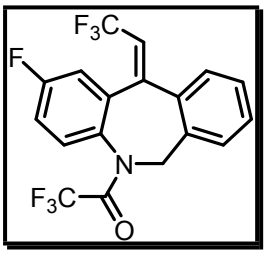


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.41 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.35 (td, *J* = 7.4, 1.5 Hz, 1H), 7.30 (d, *J* = 7.7 Hz, 2H), 7.23 (d, *J* = 7.9 Hz, 1H), 7.18 (s, 1H), 7.15 (d, *J* = 7.5 Hz, 1H), 6.11 (q, *J* = 8.1 Hz, 1H), 5.96 (d, *J* = 17.1 Hz, 1H), 4.33 (d, *J* = 17.0 Hz, 1H), 2.41 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.82 (q, *J* = 36.6 Hz), 148.66 (q, *J* = 5.6 Hz), 140.55 (s), 135.73 (s), 134.98 (s), 133.73 (s), 133.22 (s), 130.06 (s), 129.74 (s), 129.26 (s), 128.55 (q, *J* = 2.8 Hz), 128.05 (s), 127.86 (s), 127.08 (d, *J* = 1.7 Hz), 122.24 (q, *J* = 272.2 Hz), 120.00 (q, *J* = 34.0 Hz), 116.15 (d, *J* = 288.5 Hz), 50.67 (s), 21.16 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.10 (s, 3F), -67.86 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{19}H_{13}F_6NONa$: 408.0799, found: 408.0789.

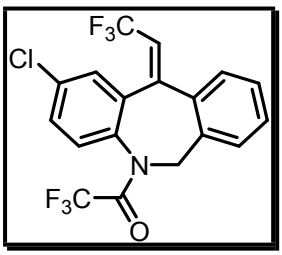


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.38 (dd, *J* = 13.2, 7.3 Hz, 3H), 7.31 (t, *J* = 7.4 Hz, 1H), 7.17 – 7.12 (m, 3H), 6.13 (q, *J* = 8.0 Hz, 1H), 5.97 (d, *J* = 17.1 Hz, 1H), 4.32 (d, *J* = 17.1 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 163.25 (s), 161.26 (s), 156.85 (q, *J* = 36.7 Hz), 147.37 (q, *J* = 5.0 Hz), 138.42 (d, *J* = 9.0 Hz), 134.14 (s), 133.57 (s), 131.84 (d, *J* = 2.6 Hz), 130.12 (s), 129.44 (s), 128.72 (d, *J* = 9.3 Hz), 128.08 (d, *J* = 3.4 Hz), 121.93 (q, *J* = 271.5 Hz), 120.70 (q, *J* = 34.6 Hz), 116.90 (q, *J* = 23.0 Hz), 116.06 (ddd, *J* = 24.5, 6.0, 3.0Hz), 116.04 (q, *J* = 289.2 Hz), 50.63 (s)

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.30 (s, 3F), -67.92 (s, 3F), -110.42 (s, 1F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}F_7NONa$: 412.0548, found: 412.0533.



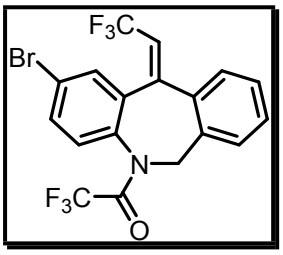
^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.44 – 7.39 (m, 3H), 7.37 (dd, *J* = 7.5, 1.2 Hz, 1H), 7.31 (t, *J* = 8.0

Hz, 2H), 7.16 (d, *J* = 7.6 Hz, 1H), 6.14 (q, *J* = 8.0 Hz, 1H), 5.97 (d, *J* = 17.1 Hz, 1H), 4.32 (d, *J* = 17.1 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.70 (q, *J* = 36.8 Hz), 147.22 (q, *J* = 5.6 Hz), 137.87 (s), 135.34 (s), 134.34 (s), 134.13 (s), 133.46 (s), 130.14 (s), 129.39 (s), 128.82 (q, *J* = 2.9 Hz), 128.15 (d, *J* = 2.5 Hz), 128.10 (d, *J* = 3.8 Hz), 121.95 (q, *J* = 270.9 Hz), 120.72 (q, *J* = 34.5 Hz), 116.04 (q, *J* = 289.8 Hz), 50.52 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.29 (s, 3F), -67.89 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}ClF_6NONa$: 428.0253, found: 428.0229.

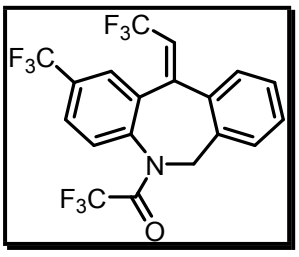


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.61 – 7.56 (m, 2H), 7.38 (ddd, *J* = 8.9, 5.6, 1.8 Hz, 2H), 7.33 – 7.29 (m, 1H), 7.24 (s, 1H), 7.16 (d, *J* = 7.4 Hz, 1H), 6.13 (q, *J* = 8.0 Hz, 1H), 5.97 (d, *J* = 17.2 Hz, 1H), 4.31 (d, *J* = 17.1 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.64 (q, *J* = 36.8 Hz), 147.07 (q, *J* = 5.6 Hz), 138.10 (s), 134.85 (s), 134.13 (s), 133.43 (s), 133.16 (s), 131.71 (q, *J* = 2.9 Hz), 130.14 (s), 129.37 (s), 128.36 (d, *J* = 1.8 Hz), 128.10 (d, *J* = 4.7 Hz), 123.23 (s), 121.93 (q, *J* = 272.2 Hz), 120.74 (q, *J* = 35.3 Hz), 116.00 (q, *J* = 288.5 Hz), 50.47 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.31 (s, 3F), -67.90 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}BrF_6NONa$: 471.9748, found: 471.9740.



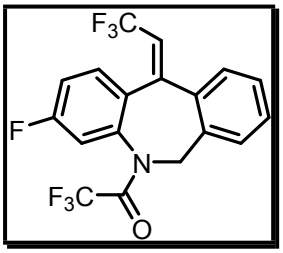
^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.75 (d, *J* = 8.2 Hz, 1H), 7.70 (s, 1H), 7.53 (d, *J* = 8.2 Hz, 1H), 7.45 – 7.38 (m, 2H), 7.36 – 7.32 (m, 1H), 7.18 (d, *J* = 7.5 Hz, 1H), 6.19 (q, *J* = 7.9 Hz, 1H), 6.01 (d, *J* = 16.9 Hz, 1H), 4.34 (d, *J* = 16.6 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.50 (q, *J* = 37.3 Hz), 147.11 (q, *J* = 5.5 Hz), 139.00 (s), 137.14 (s), 133.83 (s), 133.29 (s), 131.76 (q, *J* = 32.8 Hz), 130.28 (s), 129.39 (s), 128.26 (s), 128.10 (s), 127.53

(s), 127.16 (dd, *J* = 7.0, 3.5 Hz), 126.20 (t, *J* = 3.8 Hz), 123.20 (q, *J* = 273.4 Hz), 121.87 (q, *J* = 272.2 Hz), 121.16 (q, *J* = 35.3 Hz), 115.95 (q, *J* = 288.5 Hz), 50.40 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.36 (s, 3F), -62.90 (s, 3F), -67.94 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{19}H_{10}F_9NONa$: 462.0516, found: 462.0508.

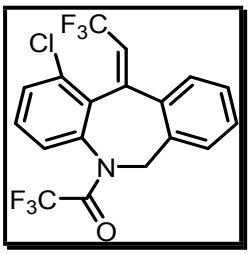


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.42 – 7.35 (m, 3H), 7.31 (t, *J* = 7.2 Hz, 1H), 7.18 – 7.12 (m, 3H), 6.15 (q, *J* = 8.0 Hz, 1H), 5.96 (d, *J* = 17.0 Hz, 1H), 4.34 (d, *J* = 17.0 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 163.80 (s), 161.80 (s), 156.57 (q, *J* = 37.0 Hz), 147.62 (q, *J* = 5.7 Hz), 137.06 (d, *J* = 9.8 Hz), 134.44 (s), 133.39 (s), 132.38 (d, *J* = 3.7 Hz), 132.30 (d, *J* = 5.0 Hz), 130.02 (s), 129.30 (s), 128.08 (d, *J* = 1.3 Hz), 122.07 (q, *J* = 272.2 Hz), 120.71 (q, *J* = 34.0 Hz), 116.72 (d, *J* = 21.4 Hz), 115.96 (q, *J* = 288.5 Hz), 114.46 (d, *J* = 21.7 Hz), 50.51 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.21 (s, 3F), -68.01 (s, 3F), -109.54 (s, 1F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}F_7NONa$: 412.0548, found: 412.0526.

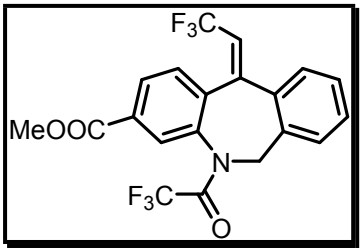


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.46 (ddd, *J* = 22.7, 7.9, 0.8 Hz, 2H), 7.37 (t, *J* = 7.9 Hz, 2H), 7.31 (dd, *J* = 18.5, 7.7 Hz, 2H), 7.14 (d, *J* = 7.6 Hz, 1H), 6.07 (q, *J* = 8.0 Hz, 1H), 5.99 (d, *J* = 17.2 Hz, 1H), 4.27 (d, *J* = 17.2 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.58 (q, *J* = 36.8 Hz), 143.16 (q, *J* = 5.5 Hz), 137.01 (s), 135.72 (s), 134.32 (s), 133.11 (s), 132.85 (d, *J* = 2.5 Hz), 130.49 (s), 130.15 (s), 129.94 (s), 129.38 (s), 128.03 (s), 127.71 (s), 125.18 (s), 121.75 (q, *J* = 271.5 Hz), 121.12 (q, *J* = 34.7 Hz), 116.02 (q, *J* = 288.5 Hz), 50.29 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -62.76 (s, 3F), -67.96 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}ClF_6NONa$: 428.0253, found: 428.0233.

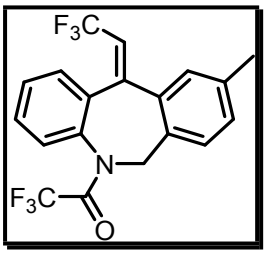


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 8.10 (dd, *J* = 8.0, 1.6 Hz, 1H), 8.05 (s, 1H), 7.49 (d, *J* = 8.0 Hz, 1H), 7.41 (d, *J* = 8.9 Hz, 1H), 7.37 (dd, *J* = 7.5, 1.5 Hz, 1H), 7.31 (t, *J* = 7.0 Hz, 1H), 7.16 (d, *J* = 7.6 Hz, 1H), 6.15 (q, *J* = 8.0 Hz, 1H), 6.00 (d, *J* = 17.2 Hz, 1H), 4.33 (d, *J* = 17.2 Hz, 1H), 3.95 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 165.31 (s), 156.69 (q, *J* = 36.9 Hz), 147.71 (q, *J* = 6.3 Hz), 140.82 (s), 136.06 (s), 134.01 (s), 133.52 (s), 132.16 (s), 130.49 (s), 130.17 (s), 129.40 (s), 129.07 (d, *J* = 3.0 Hz), 128.11 (d, *J* = 3.8 Hz), 121.96 (q, *J* = 272.2 Hz), 120.68 (q, *J* = 34.7 Hz), 116.00 (q, *J* = 288.5 Hz), 52.64 (s), 50.48 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.30 (s, 3F), -67.85 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{20}H_{13}F_6NO_3Na$: 452.0697, found: 452.0681.

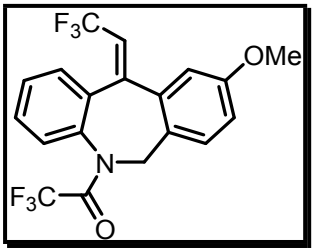


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.48 – 7.40 (m, 3H), 7.37 – 7.34 (m, 1H), 7.22 (s, 1H), 7.17 (d, *J* = 7.9 Hz, 1H), 7.03 (d, *J* = 7.9 Hz, 1H), 6.11 (q, *J* = 8.1 Hz, 1H), 5.94 (d, *J* = 16.9 Hz, 1H), 4.29 (d, *J* = 17.0 Hz, 1H), 2.36 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.79 (d, *J* = 36.5 Hz), 148.69 (dd, *J* = 11.3, 5.6 Hz), 137.72 (s), 136.37 (s), 135.83 (s), 134.55 (s), 130.65 (s), 130.60 (s), 129.97 (s), 129.72 (s), 129.32 (s), 128.75 (d, *J* = 3.0 Hz), 127.99 (s), 126.70 (d, *J* = 1.8 Hz), 122.19 (q, *J* = 270.9 Hz), 119.87 (q, *J* = 34.7 Hz), 116.11 (q, *J* = 288.5 Hz), 50.44 (s), 20.91 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.13 (s, 3F), -67.90 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{19}H_{13}F_6NONa$: 408.0799, found: 408.0783.

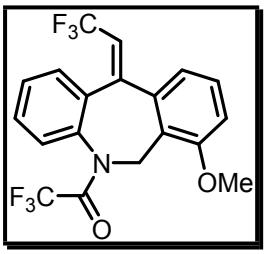


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.49 – 7.41 (m, 3H), 7.36 (d, *J* = 6.2 Hz, 1H), 7.08 – 7.04 (m, 1H), 6.91 (dq, *J* = 5.3, 2.7 Hz, 2H), 6.13 (q, *J* = 8.0 Hz, 1H), 5.90 (d, *J* = 16.7 Hz, 1H), 4.26 (d, *J* = 16.7 Hz, 1H), 3.84 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 158.89 (s), 156.74 (q, *J* = 36.7 Hz), 148.56 (q, *J* = 5.5 Hz), 136.03 (s), 135.84 (s), 135.66 (s), 130.05 (s), 129.31 (d, *J* = 4.9 Hz), 128.77 (d, *J* = 2.9 Hz), 126.71 (d, *J* = 1.7 Hz), 125.46 (s), 122.12 (q, *J* = 270.9 Hz), 120.20 (q, *J* = 34.7 Hz), 116.11 (q, *J* = 288.5 Hz), 115.62 (s), 114.28 (s), 55.55 (s), 50.15 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.18 (s, 3F), -67.89 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{19}H_{13}F_6NO_2Na$: 424.0748, found: 424.0736.

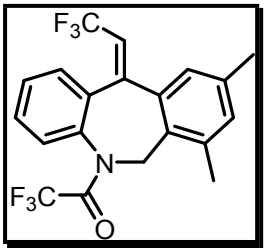


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.44 (ddd, *J* = 13.8, 6.9, 1.7 Hz, 2H), 7.37 (t, *J* = 7.1 Hz, 2H), 7.26 (t, *J* = 8.1 Hz, 1H), 6.99 (d, *J* = 7.8 Hz, 1H), 6.88 (d, *J* = 8.2 Hz, 1H), 6.13 (q, *J* = 8.1 Hz, 1H), 6.03 (d, *J* = 18.0 Hz, 1H), 4.11 (d, *J* = 18.0 Hz, 1H), 3.83 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.88 (q, *J* = 36.4 Hz), 156.84 (s), 148.42 (q, *J* = 5.6 Hz), 136.62 (s), 135.99 (s), 135.77 (s), 129.89 (s), 129.26 (s), 128.45 (d, *J* = 3.8 Hz), 128.31 (s), 126.66 (d, *J* = 1.8 Hz), 122.35 (s), 122.17 (q, *J* = 271.5 Hz), 121.21 (s), 119.73 (q, *J* = 34.3 Hz), 116.15 (q, *J* = 290.4 Hz), 110.82 (s), 55.63 (s), 46.88 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.34 (s, 3F), -67.85 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{19}H_{13}F_6NO_2Na$: 424.0748, found: 424.0730.

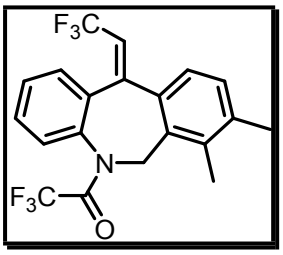


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.46 – 7.41 (m, 2H), 7.41 – 7.33 (m, 3H), 7.05 (d, *J* = 16.4 Hz, 2H), 6.11 (q, *J* = 8.1 Hz, 1H), 5.91 (d, *J* = 17.2 Hz, 1H), 4.09 (d, *J* = 17.2 Hz, 1H), 2.33 (s, 3H), 2.23 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.94 (q, *J* = 36.5 Hz), 149.22 (q, *J* = 5.6 Hz), 137.20 (s), 136.96 (s), 136.26 (s), 135.53 (s), 135.00 (s), 132.75 (s), 129.80 (s), 129.36 (s), 128.61 (s), 128.31 (d, *J* = 2.9 Hz), 128.06 (s), 126.48 (s), 122.25 (q, *J* = 271.5 Hz), 119.23 (q, *J* = 34.2 Hz), 116.13 (q, *J* = 288.5 Hz), 49.03 (s), 20.74 (s), 19.39 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.31 (s, 3F), -67.84 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{20}H_{15}F_6NONa$: 422.0956, found: 422.0945.

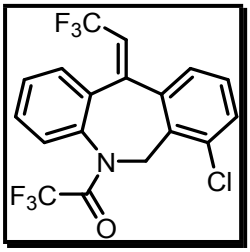


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.46 – 7.41 (m, 2H), 7.38 (d, *J* = 8.1 Hz, 2H), 7.14 (dd, *J* = 22.9, 8.0 Hz, 2H), 6.09 (q, *J* = 8.1 Hz, 1H), 5.98 (d, *J* = 17.1 Hz, 1H), 4.15 (d, *J* = 17.1 Hz, 1H), 2.30 (s, 3H), 2.16 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.97 (q, *J* = 36.6 Hz), 149.21 (dd, *J* = 11.3, 5.7 Hz), 138.82 (s), 137.09 (s), 135.51 (s), 134.74 (s), 133.09 (s), 131.48 (s), 129.80 (s), 129.34 (d, *J* = 12.3 Hz), 128.23 (d, *J* = 2.8 Hz), 127.03 (s), 126.33 (s), 122.29 (q, *J* = 270.9 Hz), 118.81 (q, *J* = 34.2 Hz), 116.13 (q, *J* = 288.5 Hz), 49.83 (s), 20.63 (s), 14.71 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.20 (s, 3F), -67.86 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{20}H_{15}F_6NONa$: 422.0956, found: 422.0940.

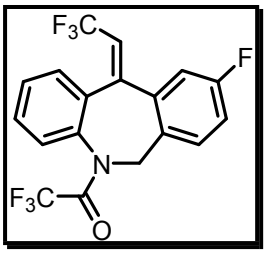


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.49 (tt, *J* = 7.5, 5.9 Hz, 2H), 7.42 (t, *J* = 8.1 Hz, 3H), 7.35 (dd, *J* = 7.8, 1.1 Hz, 1H), 7.29 (d, *J* = 7.7 Hz, 1H), 6.19 – 6.11 (m, 2H), 4.24 (d, *J* = 17.8 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.98 (q, *J* = 36.7 Hz), 147.69 (q, *J* = 5.6 Hz), 137.16 (s), 136.19 (s), 135.39 (s), 133.92 (s), 131.33 (s), 130.96 (s), 130.29 (s), 129.60 (s), 128.59 (s), 128.45 (d, *J* = 2.5 Hz), 128.14 (s), 126.72 (d, *J* = 1.8 Hz), 121.95 (q, *J* = 271.5 Hz), 120.50 (q, *J* = 34.6 Hz), 116.03 (q, *J* = 288.5 Hz), 49.45 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.59 (s, 3F), -67.92 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}ClF_6NONa$: 428.0253, found: 428.0243.

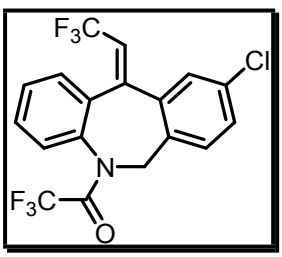


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.51 – 7.45 (m, 2H), 7.42 (s, 1H), 7.38 (d, *J* = 7.5 Hz, 1H), 7.16 – 7.12 (m, 2H), 7.07 (td, *J* = 8.2, 2.6 Hz, 1H), 6.14 (q, *J* = 7.9 Hz, 1H), 5.94 (d, *J* = 17.0 Hz, 1H), 4.29 (d, *J* = 16.9 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 161.69 (d, *J* = 248.2 Hz), 156.77 (q, *J* = 36.8 Hz), 147.49 (q, *J* = 5.0 Hz), 136.35 (d, *J* = 7.1 Hz), 135.82 (s), 135.53 (s), 130.37 (s), 129.91 (d, *J* = 8.2 Hz), 129.52 (s), 129.43 (d, *J* = 3.3 Hz), 128.90 (q, *J* = 2.9 Hz), 126.75 (d, *J* = 1.8 Hz), 121.95 (q, *J* = 272.2 Hz), 121.07 (q, *J* = 34.0 Hz), 116.93 (d, *J* = 21.4 Hz), 116.07 (q, *J* = 288.5 Hz), 115.90 (d, *J* = 22.9 Hz), 50.11 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.33 (s, 3F), -67.94 (s, 3F), -114.11 (s, 1F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}F_7NONa$: 412.0548, found: 412.0531.



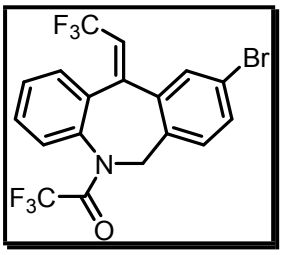
^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.49 – 7.44 (m, 2H), 7.42 (d, *J* = 5.0 Hz, 2H), 7.38 (d, *J* = 7.4 Hz,

1H), 7.32 (d, *J* = 8.3 Hz, 1H), 7.10 (d, *J* = 8.3 Hz, 1H), 6.15 (q, *J* = 7.9 Hz, 1H), 5.94 (d, *J* = 17.2 Hz, 1H), 4.29 (d, *J* = 17.3 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.81 (q, *J* = 36.9 Hz), 147.31 (q, *J* = 5.6 Hz), 136.21 (s), 135.74 (s), 135.60 (s), 133.49 (s), 132.23 (s), 130.38 (s), 129.78 (s), 129.54 (d, *J* = 7.4 Hz), 128.99 (s), 128.91 (q, *J* = 2.9 Hz), 126.78 (d, *J* = 1.7 Hz), 121.92 (q, *J* = 271.5 Hz), 121.06 (q, *J* = 34.7 Hz), 116.05 (q, *J* = 288.5 Hz), 50.15 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.36 (s, 3F), -67.94 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}ClF_6NONa$: 428.0253, found: 428.0239.

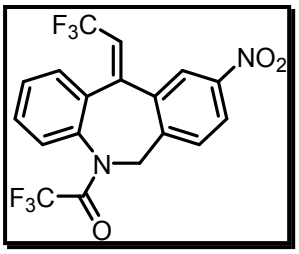


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.57 (d, *J* = 1.8 Hz, 1H), 7.49 – 7.44 (m, 3H), 7.41 (d, *J* = 7.3 Hz, 1H), 7.37 (d, *J* = 7.5 Hz, 1H), 7.03 (d, *J* = 8.3 Hz, 1H), 6.14 (q, *J* = 7.9 Hz, 1H), 5.92 (d, *J* = 17.2 Hz, 1H), 4.26 (d, *J* = 17.2 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.83 (q, *J* = 36.9 Hz), 147.15 (q, *J* = 5.6 Hz), 136.50 (s), 135.71 (s), 135.61 (s), 132.75 (s), 132.71 (s), 131.84 (s), 130.38 (s), 129.70 (s), 129.58 (s), 128.89 (q, *J* = 2.7 Hz), 126.77 (d, *J* = 1.7 Hz), 121.89 (q, *J* = 272.2 Hz), 121.34 (s), 121.10 (q, *J* = 35.3 Hz), 116.02 (q, *J* = 288.5 Hz), 50.20 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.34 (s, 3F), -67.94 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}BrF_6NONa$: 471.9748, found: 471.9733.



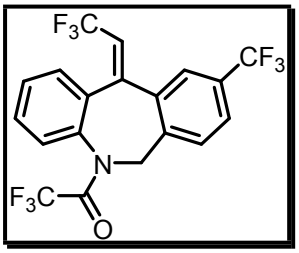
^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 8.32 (d, *J* = 2.2 Hz, 1H), 8.19 (dd, *J* = 8.5, 2.3 Hz, 1H), 7.53 – 7.48 (m, 2H), 7.47 – 7.45 (m, 1H), 7.41 (d, *J* = 7.5 Hz, 1H), 7.37 (d, *J* = 8.5 Hz, 1H), 6.26 (q, *J* = 7.7 Hz, 1H), 6.08 (d, *J* = 17.9 Hz, 1H), 4.41 (d, *J* = 17.8 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.97 (q, *J* = 37.1 Hz), 147.20 (s), 146.46 (q, *J* = 5.5 Hz), 141.08 (s), 136.16 (s), 135.58 (s), 135.05 (s), 130.80 (s), 129.89 (s), 129.52 (s), 129.08 (d, *J* = 2.9 Hz), 126.87

(d, J = 1.7 Hz), 124.38 (s), 124.15 (s), 122.41 (q, J = 35.3 Hz), 121.68 (q, J = 272.2 Hz), 115.94 (q, J = 288.5 Hz), 50.47 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.57 (s, 3F), -68.00 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{10}F_6N_2O_3Na$: 439.0493, found: 439.0480.

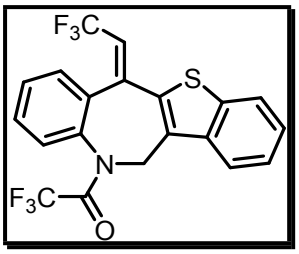


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.67 (s, 1H), 7.61 (d, J = 8.1 Hz, 1H), 7.51 – 7.43 (m, 3H), 7.39 (d, J = 7.4 Hz, 1H), 7.30 (d, J = 8.1 Hz, 1H), 6.19 (q, J = 7.8 Hz, 1H), 6.04 (d, J = 17.5 Hz, 1H), 4.37 (d, J = 17.5 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.93 (q, J = 36.9 Hz), 147.30 (q, J = 6.3 Hz), 137.81 (s), 135.68 (s), 135.53 (s), 135.45 (s), 130.52 (s), 130.44 (q, J = 32.8 Hz), 129.69 (s), 128.97 (d, J = 2.5 Hz), 128.86 (s), 126.79 (d, J = 1.7 Hz), 126.35 (q, J = 3.8 Hz), 126.21 (d, J = 2.5 Hz), 123.50 (q, J = 272.2 Hz), 121.81 (q, J = 272.2 Hz), 121.59 (q, J = 34.0 Hz), 115.99 (q, J = 288.5 Hz), 50.43 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.43 (s, 3F), -62.63 (s, 3F), -67.97 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{19}H_{10}F_9NONa$: 462.0516, found: 462.0501.

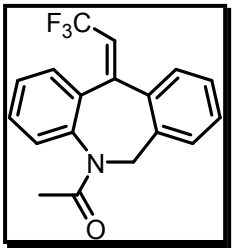


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.94 (d, J = 8.2 Hz, 1H), 7.79 (d, J = 8.0 Hz, 1H), 7.47 (t, J = 7.8 Hz, 4H), 7.43 – 7.36 (m, 2H), 6.31 (q, J = 8.0 Hz, 1H), 6.19 (d, J = 17.4 Hz, 1H), 4.38 (d, J = 17.4 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.82 (q, J = 36.8 Hz), 140.69 (q, J = 5.7 Hz), 138.64 (s), 137.34 (d, J = 15.7 Hz), 136.87 (s), 135.21 (s), 130.03 (s), 129.61 (s), 128.81 (s), 128.16 (s), 127.58 (s), 125.28 (d, J = 4.7 Hz), 122.71 (s), 122.46 (q, J = 272.2 Hz), 122.15 (s), 121.11 (q, J = 34.5 Hz), 116.07 (q, J = 288.5 Hz), 47.41 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -56.66 (s, 3F), -67.75 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{20}H_{11}F_6NOSNa$: 450.0363, found: 450.0355.

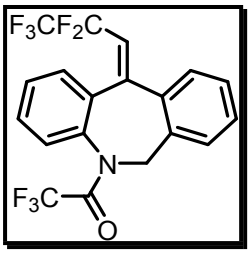


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.45 (ddd, *J* = 7.6, 6.1, 3.0 Hz, 1H), 7.41 – 7.38 (m, 2H), 7.32 (ddd, *J* = 7.5, 6.6, 5.6 Hz, 3H), 7.23 (d, *J* = 6.8 Hz, 1H), 7.14 (d, *J* = 7.6 Hz, 1H), 6.08 (q, *J* = 8.1 Hz, 2H), 4.15 (d, *J* = 18.8 Hz, 1H), 1.93 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 170.42 (s), 150.91 (q, *J* = 5.8 Hz), 138.88 (s), 137.16 (s), 135.81 (s), 135.12 (s), 130.34 (s), 129.54 (s), 128.83 (s), 128.64 (s), 128.52 (q, *J* = 2.5 Hz), 128.06 (s), 127.25 (s), 127.05 (s), 122.50 (q, *J* = 272.2 Hz), 119.36 (q, *J* = 34.0 Hz), 48.10 (s), 21.49 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -55.64 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{14}F_3NONa$: 340.0925, found: 340.0913.

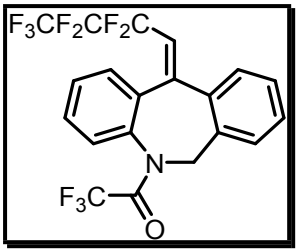


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.45 (ddd, *J* = 18.5, 10.9, 4.1 Hz, 4H), 7.38 (dd, *J* = 11.3, 3.6 Hz, 2H), 7.31 (t, *J* = 7.3 Hz, 1H), 7.16 (d, *J* = 7.6 Hz, 1H), 6.08 – 5.99 (m, 2H), 4.35 (d, *J* = 17.1 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.85 (q, *J* = 36.7 Hz), 151.20 (t, *J* = 4.5 Hz), 136.63 (s), 135.58 (s), 135.37 (s), 133.55 (s), 130.03 (s), 129.94 (s), 129.33 (s), 128.61 (t, *J* = 4.2 Hz), 128.04 (s), 127.94 (s), 126.68 (d, *J* = 1.7 Hz), 118.97 (m), 117. 20 (m), 116.11 (m), 113.8 (m), 50.48 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -67.95 (s, 3F), -85.22 (s, 3F), -106.10 (dt, *J* = 278.2, 7.5 Hz, 1F), -108.85 (dq, *J* = 278.2, 11.3 Hz, 1F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{19}H_{11}F_8NONa$: 444.0611, found: 444.0594.



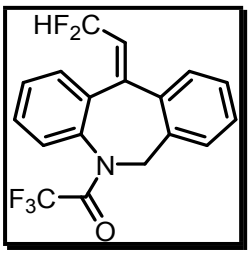
^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.46 (dd, *J* = 7.1, 2.7 Hz, 1H), 7.40 (dd, *J* = 15.6, 6.8 Hz, 4H), 7.32 (dd, *J* = 15.1, 7.9 Hz, 2H), 7.16 (d, *J* = 7.4 Hz, 1H), 6.06 (dd, *J* = 32.2, 16.1 Hz, 2H), 4.35 (d, *J* =

17.2 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.86 (q, *J* = 36.7 Hz), 151.11 (t, *J* = 4.6 Hz), 136.68 (s), 135.52 (s), 133.53 (s), 130.02 (s), 129.93 (s), 129.34 (s), 129.27 (s), 128.47 (s), 128.03 (s), 127.95 (s), 126.69 (d, *J* = 1.7 Hz), 118.14 (m), 117.15 (m), 115.75 (m), 114.74 (m), 111.71 (m), 50.43 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -67.96 (s, 3F), -80.21 (s, 3F), -106.10 (tt, *J* = 7.5, 3.2 Hz, 1F). -108.84 (ddd, *J* = 23.9, 10.8, 10.7 Hz, 1F), -126.98 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{20}H_{11}F_{10}NONa$: 494.0579, found: 494.0568.

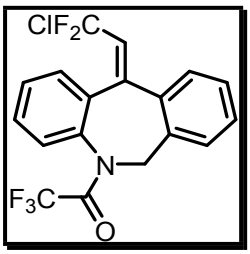


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.50 (dd, *J* = 12.9, 6.1 Hz, 2H), 7.44 (dd, *J* = 15.7, 7.5 Hz, 2H), 7.38 – 7.30 (m, 3H), 7.16 (d, *J* = 7.3 Hz, 1H), 6.23 – 6.17 (m, 1H), 6.02 – 5.79 (m, 2H), 4.37 (d, *J* = 16.9 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.25 (q, *J* = 36.2 Hz), 147.07 (t, *J* = 12.8 Hz), 136.62 (d, *J* = 15.1 Hz), 134.55 (s), 133.28 (s), 130.25 (s), 129.76 (s), 129.54 (s), 129.34 (s), 128.00 (s), 127.93 (s), 127.30 (d, *J* = 1.5 Hz), 125.26 (dd, *J* = 31.8, 22.4 Hz), 116.24 (q, *J* = 288.5 Hz), 112.81 (t, *J* = 230.7 Hz), 50.80 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -68.12 (s, 3F), -104.62 (ddd, *J* = 319.6, 56.4, 3.8 Hz, 1F), -103.14 (ddd, *J* = 319.6, 54.5, 9.4 Hz, 1F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{12}F_5NONa$: 376.0737, found: 376.0725.

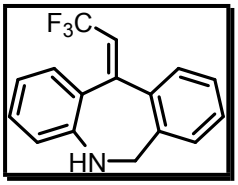


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.46 – 7.41 (m, 4H), 7.37 – 7.33 (m, 2H), 7.30 (t, *J* = 7.3 Hz, 1H), 7.15 (d, *J* = 7.5 Hz, 1H), 6.30 – 6.25 (m, 1H), 5.98 (d, *J* = 17.1 Hz, 1H), 4.33 (d, *J* = 17.1 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.83 (q, *J* = 36.6 Hz), 143.95 (d, *J* = 8.1 Hz), 136.48 (s), 135.82 (s), 134.80 (s), 133.78 (s), 129.88 (s), 129.74 (s), 129.30 (s), 128.83 (t, *J* = 3.8 Hz), 128.05 (s), 127.90 (s), 126.70 (s), 125.97 (s), 125.76 (d, *J* = 6.8 Hz), 121.55 (s), 116.11 (q, *J* = 288.5 Hz), 50.55 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -45.50 (dd, *J* = 159.8, 5.6 Hz, 1F), -47.31 (dt, *J* = 157.9, 13.2 Hz, 1F). -67.79 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{18}H_{11}ClF_5NONa$: 410.0347, found: 410.0338.

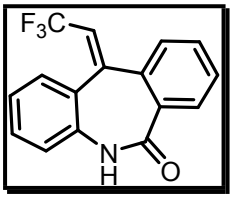


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.35 – 7.29 (m, 2H), 7.27 (d, *J* = 6.1 Hz, 1H), 7.23 (d, *J* = 7.8 Hz, 1H), 7.18 (d, *J* = 6.6 Hz, 1H), 7.09 (t, *J* = 7.7 Hz, 1H), 6.69 (t, *J* = 8.0 Hz, 1H), 6.51 (d, *J* = 8.2 Hz, 1H), 5.71 (q, *J* = 8.6 Hz, 1H), 4.81 (s, 1H), 3.94 (s, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 154.10 (q, *J* = 5.8 Hz), 144.26 (s), 142.18 (s), 135.54 (s), 131.12 (q, *J* = 3.6 Hz), 130.41 (s), 129.03 (s), 128.31 (s), 126.44 (s), 125.42 (d, *J* = 0.5 Hz), 122.89 (q, *J* = 271.5 Hz), 119.00 (s), 117.55 (s), 117.25 (s), 117.15 (q, *J* = 33.4 Hz), 46.99 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -56.17 (s, 3F).

HRMS (ESI) (m/z): $[M+H]^+$ called. for $C_{16}H_{13}F_3N$: 276.1000, found: 276.0992.

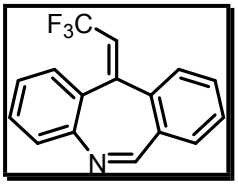


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 8.76 (s, 1H), 7.60 – 7.54 (m, 2H), 7.52 – 7.47 (m, 2H), 7.42 (ddd, *J* = 8.0, 4.5, 1.8 Hz, 2H), 7.33 (dt, *J* = 14.7, 7.0 Hz, 2H), 5.76 (q, *J* = 8.0 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 159.44 (s), 148.79 (q, *J* = 5.7 Hz), 143.40 (s), 141.84 (s), 132.18 (s), 130.44 (s), 129.38 (s), 129.23 (s), 128.81 (s), 127.80 (q, *J* = 3.0 Hz), 127.32 (s), 125.72 (d, *J* = 0.5 Hz), 122.23 (q, *J* = 271.2 Hz), 119.78 (q, *J* = 34.3 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -56.51 (s, 3F).

HRMS (ESI) (m/z): $[M+H]^+$ called. for $C_{16}H_{11}F_3NO$: 290.0793, found: 290.0782.

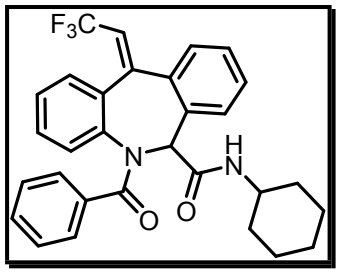


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 8.76 (s, 1H), 7.57 (ddd, *J* = 7.9, 7.1, 2.0 Hz, 2H), 7.52 – 7.48 (m, 2H), 7.42 (ddd, *J* = 8.0, 4.5, 1.7 Hz, 2H), 7.33 (dt, *J* = 13.5, 7.1 Hz, 2H), 5.76 (q, *J* = 8.0 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 159.44 (s), 148.77 (q, *J* = 5.7 Hz), 143.37 (s), 141.84 (s), 132.20 (s), 130.43 (s), 129.39 (s), 129.24 (s), 128.82 (s), 127.80 (q, *J* = 3.0 Hz), 127.33 (d, *J* = 2.9 Hz), 125.73 (s), 122.22 (q, *J* = 271.3 Hz), 119.79 (q, *J* = 34.4 Hz).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -56.52 (s, 3F).

HRMS (ESI) (m/z): $[M+H]^+$ called. for $C_{16}H_{11}F_3N$: 274.0844, found: 274.0829.

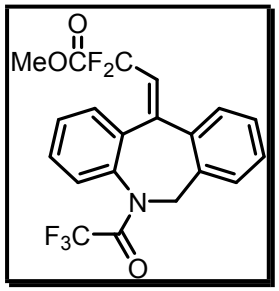


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.60 – 7.48 (m, 3H), 7.42 (qd, *J* = 7.3, 1.7 Hz, 2H), 7.35 (dtt, *J* = 6.5, 4.9, 1.5 Hz, 2H), 7.23 (dt, *J* = 17.9, 7.5 Hz, 4H), 7.10 (t, *J* = 7.8 Hz, 1H), 6.88 (s, 1H), 6.74 (d, *J* = 7.9 Hz, 1H), 6.25 (q, *J* = 8.3 Hz, 2H), 3.68 (qd, *J* = 10.3, 9.8, 4.1 Hz, 1H), 1.80 (dd, *J* = 11.6, 4.8 Hz, 1H), 1.75 – 1.52 (m, 4H), 1.32 (ddt, *J* = 22.2, 11.3, 5.8 Hz, 2H), 1.23 – 0.96 (m, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 172.70 (s), 167.60 (s), 150.52 (s), 137.10 (s), 135.38 (s), 134.68 (s), 134.14 (s), 133.69 (s), 130.90 (s), 130.63 (s), 129.87 (s), 129.52 (s), 129.50 (s), 129.24 (s), 128.73 (s), 128.37 (s), 127.96 (s), 127.77 (s), 122.50 (q, *J* = 270.9 Hz), 119.02 (q, *J* = 34.0 Hz), 61.69 (s), 47.96 (s), 33.00 (s), 32.74 (s), 26.91 (s), 25.39 (s), 24.53 (s), 24.50 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -56.02 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{30}H_{27}F_3N_2O_2Na$: 527.1930, found: 527.1923.



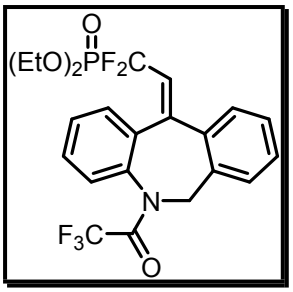
^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.47 – 7.40 (m, 4H), 7.35 (t, *J* = 7.3 Hz, 2H), 7.31 (d, *J* = 7.4 Hz, 1H), 7.15 (d, *J* = 7.5 Hz, 1H), 6.18 (t, *J* = 14.3 Hz, 1H), 6.00 (d, *J* = 16.9 Hz, 1H), 4.35 (d, *J* = 17.0 Hz, 1H), 3.93 (s, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 164.22 (t, *J* = 34.4 Hz), 156.85 (q, *J* = 36.5 Hz), 147.44 (t, *J* = 5.3

Hz), 136.96 (s), 135.72 (d, *J* = 8.6 Hz), 133.37 (s), 129.71 (s), 129.52 (s), 129.44 (s), 129.15 (s), 129.92 (s), 129.79 (s), 126.47 (s), 122.50 (t, *J* = 23.4 Hz), 116.11 (q, *J* = 288.0 Hz), 111.65 (t, *J* = 251.0 Hz), 53.73 (s), 50.55 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -67.81 (s, 3F), -94.81 (dd, *J* = 270.7, 7.5 Hz, 1F), -102.17 (dd, *J* = 270.7, 7.5 Hz, 1F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{20}H_{14}F_5NO_3Na$: 434.0792, found: 434.0774.



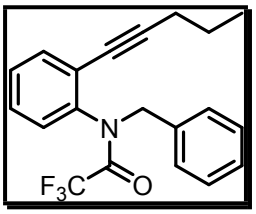
^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.65 – 7.62 (m, 1H), 7.42 – 7.38 (m, 3H), 7.30 (dd, *J* = 13.4, 6.1 Hz, 3H), 7.11 (d, *J* = 7.4 Hz, 1H), 6.12 (dd, *J* = 17.0, 13.9 Hz, 1H), 5.97 (d, *J* = 17.1 Hz, 1H), 4.35 – 4.26 (m, 5H), 1.40 (t, *J* = 7.0 Hz, 6H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.88 (q, *J* = 36.6 Hz), 147.28 (dd, *J* = 12.0, 8.2 Hz), 137.48 (s), 136.00 (s), 135.58 (s), 133.34 (s), 129.59 (s), 129.45 (s), 129.41 (s), 129.19 (s), 129.14 (s), 127.85 (s), 127.75 (s), 126.36 (d, *J* = 1.6 Hz), 122.00 (d, *J* = 14.2 Hz), 121.69 (d, *J* = 14.1 Hz), 116.78 (d, *J* = 220.0 Hz), 116.14 (q, *J* = 288.54 Hz), 64.88 (dd, *J* = 29.3, 6.9 Hz), 50.52 (s), 16.44 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -67.77 (s, 3F), -104.29 (ddd, *J* = 303.3, 108.5, 5.8 Hz, 1F), -106.89 (ddd, *J* = 303.1, 112.4, 8.2 Hz, 1F).

^{31}P NMR (162 MHz, $CDCl_3$) δ ppm = 6.44 (t, *J* = 110.16 Hz, 1P).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{22}H_{21}F_5NO_4PNa$: 512.1026, found: 512.1045.

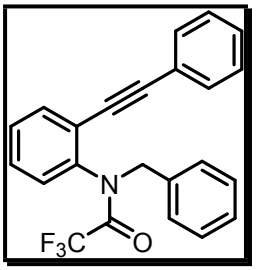


^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.51 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.30 (tt, *J* = 5.1, 2.3 Hz, 4H), 7.20 (dd, *J* = 6.5, 3.0 Hz, 2H), 7.14 (td, *J* = 7.7, 1.6 Hz, 1H), 6.72 (d, *J* = 7.9 Hz, 1H), 5.66 (d, *J* = 14.1 Hz, 1H), 4.27 (d, *J* = 14.0 Hz, 1H), 2.43 (t, *J* = 7.0 Hz, 2H), 1.69 – 1.61 (m, 2H), 1.07 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 157.17 (q, *J* = 35.8 Hz), 139.56 (s), 135.30 (s), 132.94 (s), 129.89 (s), 129.51 (s), 128.95, 128.51 (s), 128.07 (s), 127.67 (s), 123.91 (s), 116.37 (q, *J* = 288.6 Hz), 97.06 (s), 76.17 (s), 53.80 (s), 22.07 (s), 21.51 (s), 13.52 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -68.36 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{20}H_{18}F_3NONa$: 368.1540, found: 368.1523.

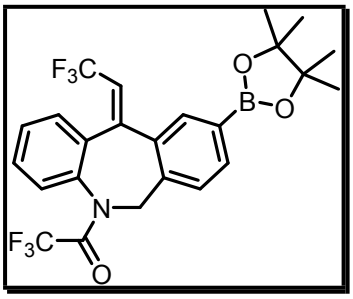


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.65 (dd, *J* = 7.8, 1.6 Hz, 1H), 7.55 (ddd, *J* = 5.1, 2.8, 1.6 Hz, 2H), 7.43 – 7.36 (m, 4H), 7.32 – 7.27 (m, 3H), 7.26 – 7.19 (m, 3H), 6.83 (d, *J* = 7.9 Hz, 1H), 5.72 (d, *J* = 14.0 Hz, 1H), 4.39 (d, *J* = 14.1 Hz, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 157.33 (q, *J* = 36.0 Hz), 139.67 (s), 135.12 (s), 132.76 (s), 131.75 (s), 130.02 (s), 129.53 (s), 129.14 (s), 129.02 (s), 128.58 (s), 128.52 (s), 128.16 (s), 123.30 (s), 122.31 (s), 116.41 (q, *J* = 288.5 Hz), 95.61 (s), 84.56 (s), 54.07 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -68.28 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{23}H_{16}F_3NONa$: 402.1085, found: 402.1083.



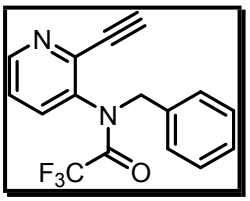
^{1}H NMR (500 MHz, $CDCl_3$) δ ppm = 7.83 (d, *J* = 1.1 Hz, 1H), 7.78 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.51 – 7.34 (m, 4H), 7.18 (d, *J* = 7.7 Hz, 1H), 6.21 (q, *J* = 8.0 Hz, 1H), 6.02 (d, *J* = 17.3 Hz, 1H), 4.36 (d, *J* = 17.4 Hz, 1H), 1.39 (s, 12H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.86 (q, *J* = 36.6 Hz), 148.26 (q, *J* = 5.7 Hz), 136.67 (s), 136.43 (s), 135.95 (s), 135.71 (s), 135.52 (s), 129.96 (s), 129.37 (s), 128.79 (d, *J* = 3.1 Hz), 127.38 (s), 126.63

(d, *J* = 2.1 Hz), 122.14 (q, *J* = 271.1 Hz), 120.30 (q, *J* = 34.3 Hz), 116.04 (q, *J* = 287.7 Hz), 84.23 (s), 50.72 (s), 24.86 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.05 (p, *J* = 7.6 Hz, 3F), -67.88 (q, *J* = 7.4 Hz, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{24}H_{22}F_6NO_3BNa$: 520.1500, found: 520.1513.

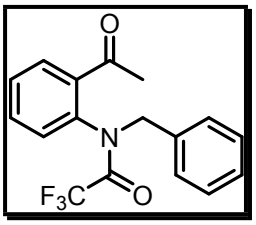


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 8.60 (dd, *J* = 4.8, 1.6 Hz, 1H), 7.36-7.26 (m, 3H), 7.20-7.12 (m, 3H), 7.06-7.00 (m, 1H), 5.76 (d, *J* = 14.2 Hz, 1H), 4.26 (d, *J* = 14.2 Hz, 1H), 3.46 (s, 1H).

^{13}C NMR (126 MHz, $CDCl_3$) δ ppm = 156.78 (q, *J* = 36.4 Hz), 150.41 (s), 142.05 (s), 137.80 (s), 137.14 (s), 134.44 (s), 129.48 (s), 128.84 (s), 128.54 (s), 123.20 (s), 116.10 (q, *J* = 288.5 Hz), 83.29 (s), 78.65 (s), 53.67 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -68.29 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{16}H_{11}F_3N_2ONa$: 327.0725, found: 327.0721.

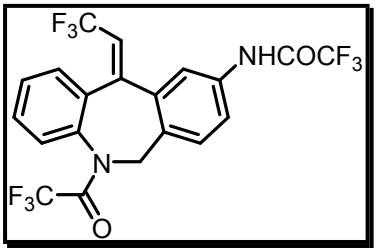


^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 7.81 (dd, *J* = 7.7, 1.5 Hz, 1H), 7.49 (td, *J* = 7.6, 1.2 Hz, 1H), 7.41 (td, *J* = 7.7, 1.6 Hz, 1H), 7.29 – 7.25 (m, 3H), 7.15 (dd, *J* = 6.8, 2.6 Hz, 2H), 6.85 (d, *J* = 7.8 Hz, 1H), 5.43 (d, *J* = 14.3 Hz, 1H), 4.33 (d, *J* = 14.3 Hz, 1H), 2.45 (s, 3H).

^{13}C NMR (101 MHz, $CDCl_3$) δ ppm = 198.14 (s), 156.65 (dd, *J* = 69.9, 34.4 Hz), 136.54 (s), 135.67 (s), 135.14 (s), 132.41 (s), 131.56 (s), 130.16 (s), 129.84 (s), 129.42 (s), 128.57 (s), 128.13 (s), 117.93 (s), 115.06 (s), 55.51 (s), 28.73 (s).

^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -68.30 (s, 3F).

HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{17}H_{14}F_3NO_2Na$: 344.0874, found: 344.0892.



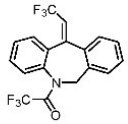
^{1}H NMR (400 MHz, $CDCl_3$) δ ppm = 8.07 (s, 1H), 7.73 (d, *J* = 2.2 Hz, 1H), 7.53 (td, *J* = 8.2, 2.0 Hz, 1H), 7.46 (ddd, *J* = 14.7, 7.4, 1.7 Hz, 2H), 7.42 – 7.36 (m, 2H), 7.17 (d, *J* = 8.4 Hz, 1H), 6.15 (q, *J* = 7.9 Hz, 1H), 5.95 (d, *J* = 17.4 Hz, 1H), 4.32 (d, *J* = 17.1 Hz, 1H).

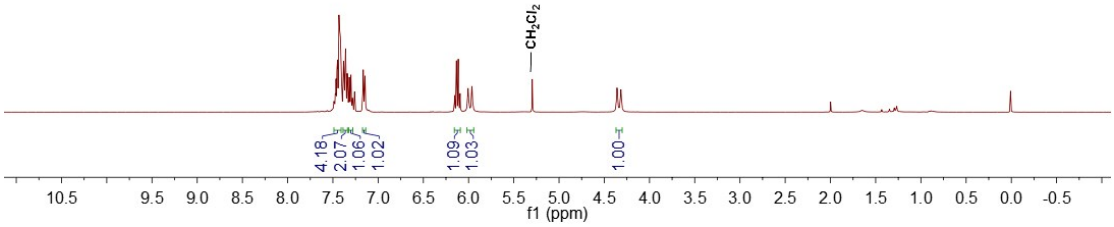
^{13}C NMR (101 MHz, $CDCl_3$) δ ppm = 156.91 (q, *J* = 37.0 Hz), 154.96 (q, *J* = 38.0 Hz), 147.54 (q, *J* = 5.6 Hz), 135.82 (s), 135.60 (s), 134.68 (s), 131.69 (s), 130.37 (s), 129.58 (s), 129.23 (s), 128.91 (d, *J* = 2.8 Hz), 126.74 (d, *J* = 1.8 Hz), 123.22 (s), 121.68 (s), 121.24 (q, *J* = 34.6 Hz), 120.94 (s), 116.02 (d, *J* = 287.7 Hz), 115.57 (q, *J* = 288.9 Hz), 100.03 (s), 50.28 (s).

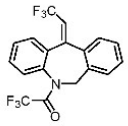
^{19}F NMR (376 MHz, $CDCl_3$) δ ppm = -57.34 (s, 3F), -67.92 (s, 3F), -75.67 (s, 3F).

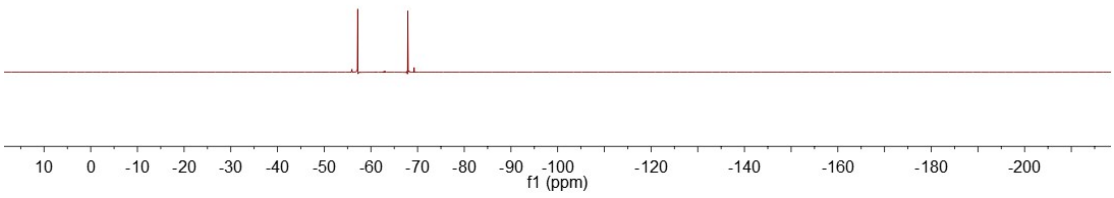
HRMS (ESI) (m/z): $[M+Na]^+$ called. for $C_{20}H_{11}F_9N_2O_2Na$: 505.0575, found: 505.0591.

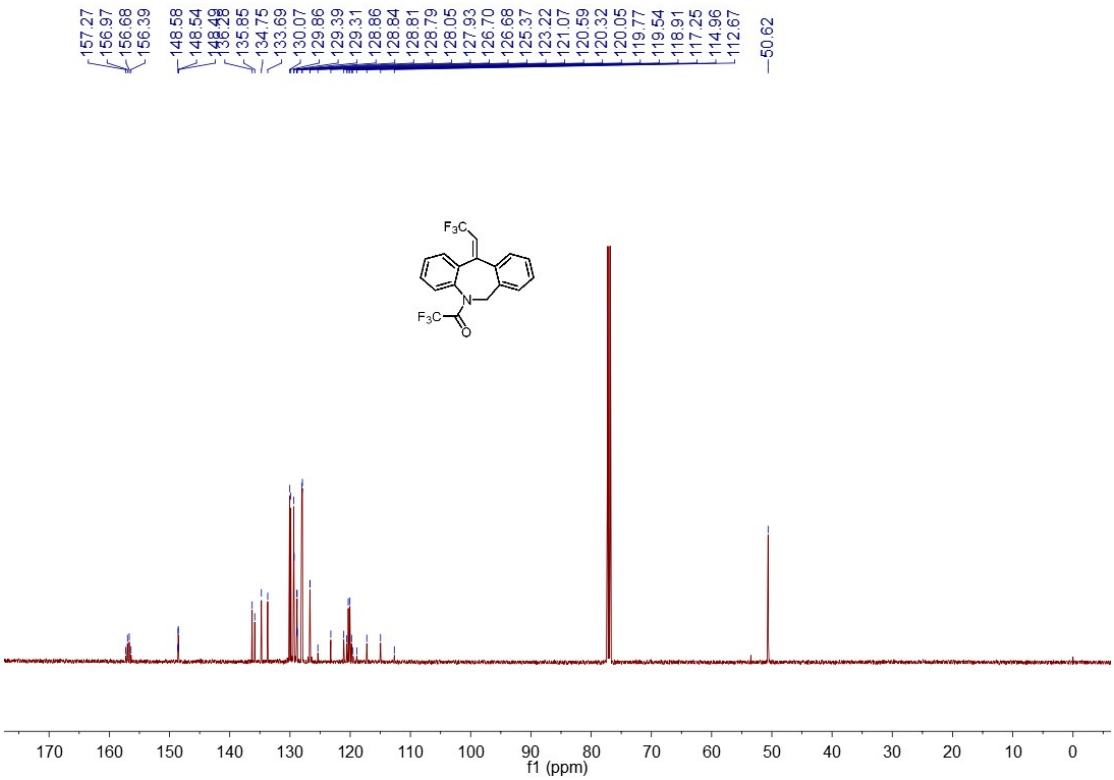
3. NMR spectra for the products







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128.79
128.05
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125.37
123.22
121.07
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120.32
120.05
119.77
119.54
118.91
117.25
114.96
112.67
50.62
F3C
N
F3C
O
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160
150
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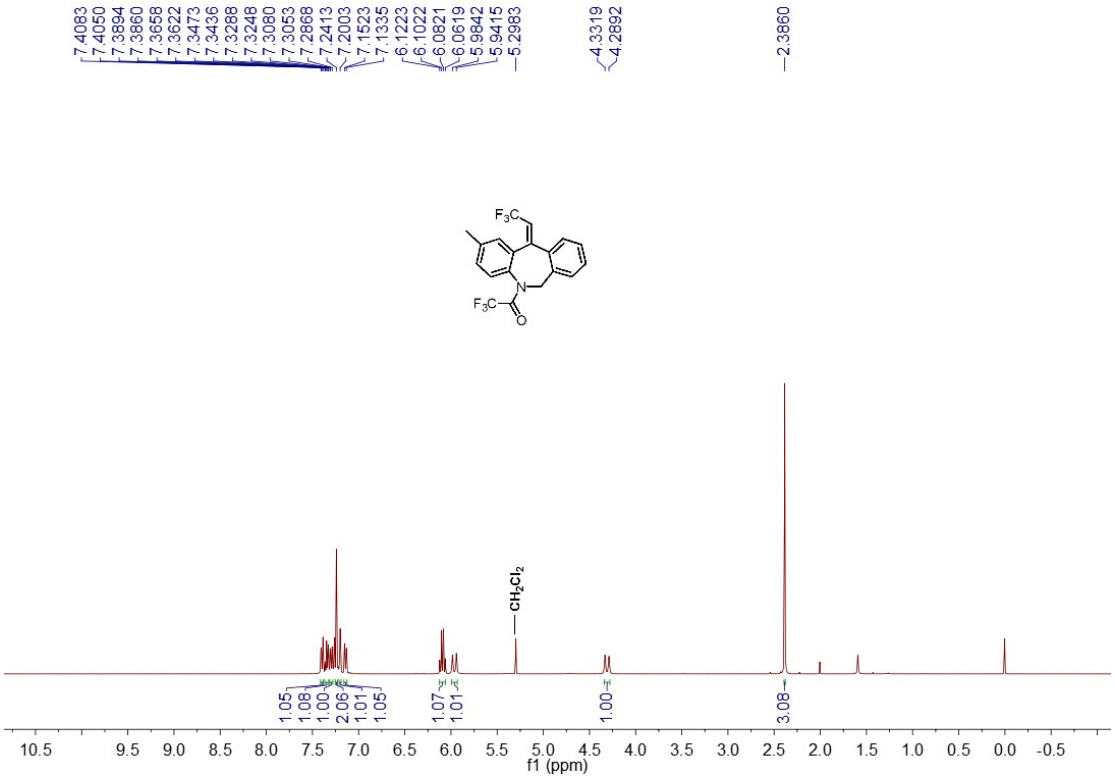
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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7.2868
7.2413
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F3C
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N
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1.00
2.06
1.01
1.05
1.07
1.01
1.00
3.08
10.5
9.5
9.0
8.5
8.0
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7.0
6.5
6.0
5.5
5.0
4.5
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0.5
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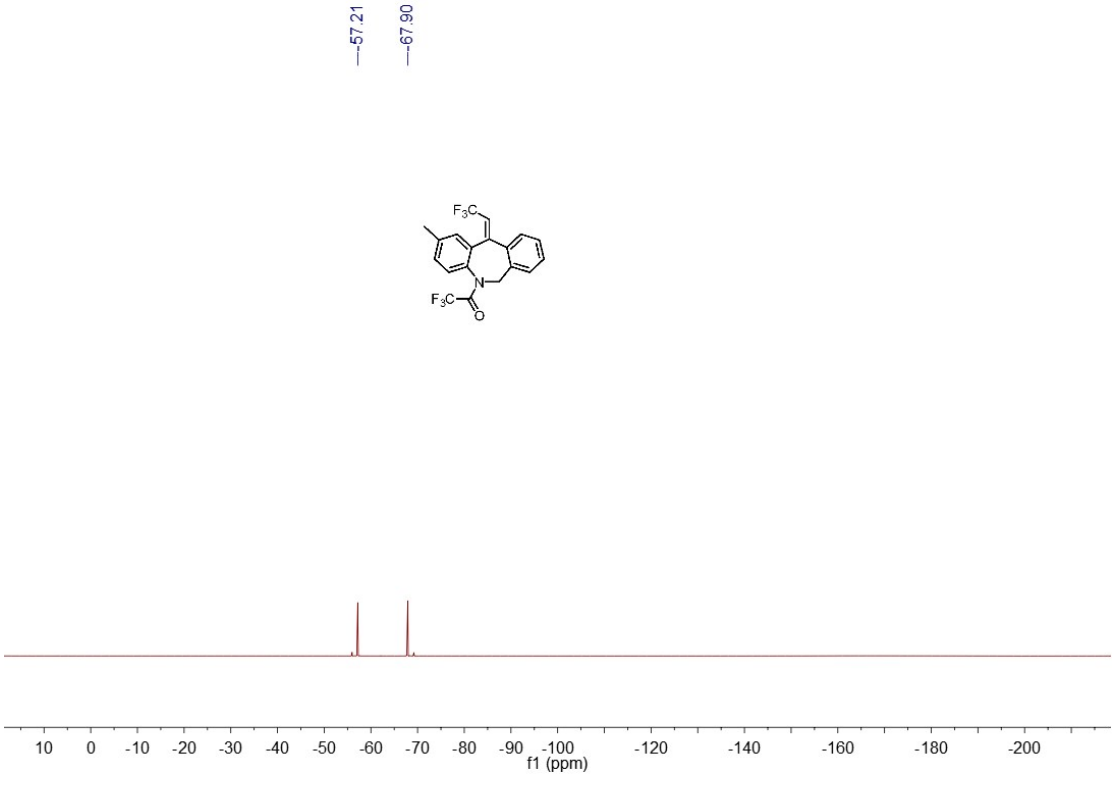
f1 (ppm)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-50
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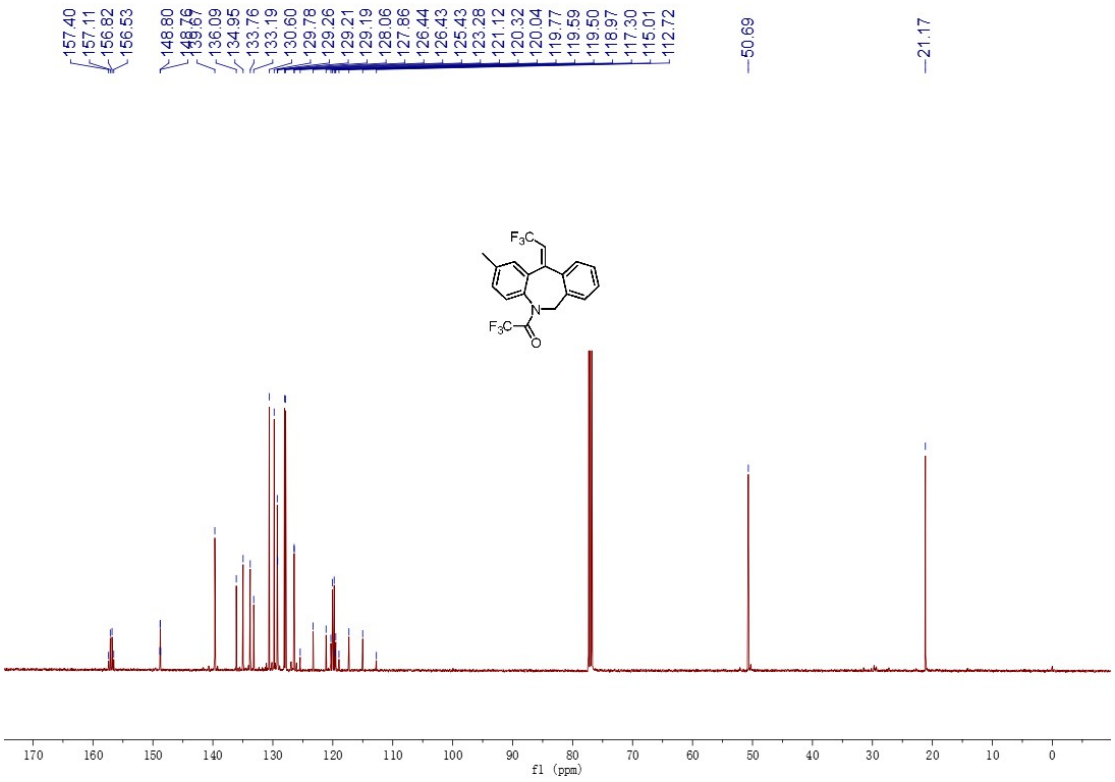
-120
-140
-160
-180
-200
f1 (ppm)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F3C
N
O
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130
120
110
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90
80
70
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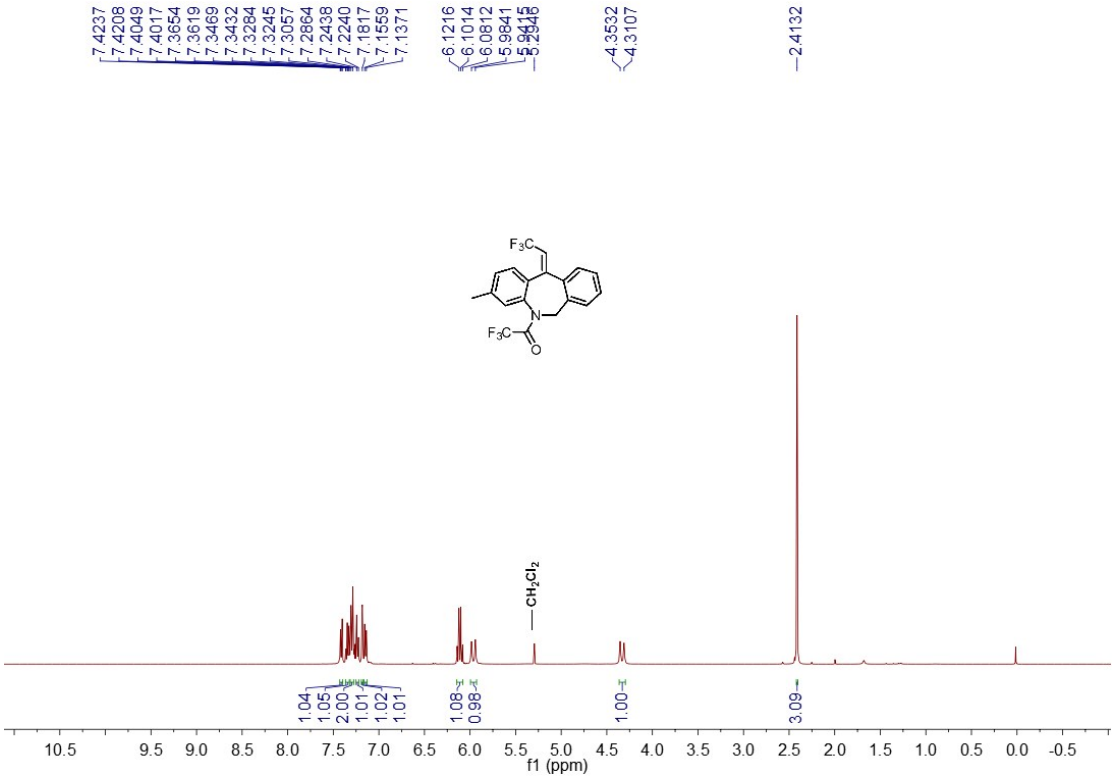
50
40
30
20
10
0
f1 (ppm)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5.2946
4.3532
4.3107
2.4132
F3C
F3C
N
O
CH2Cl2
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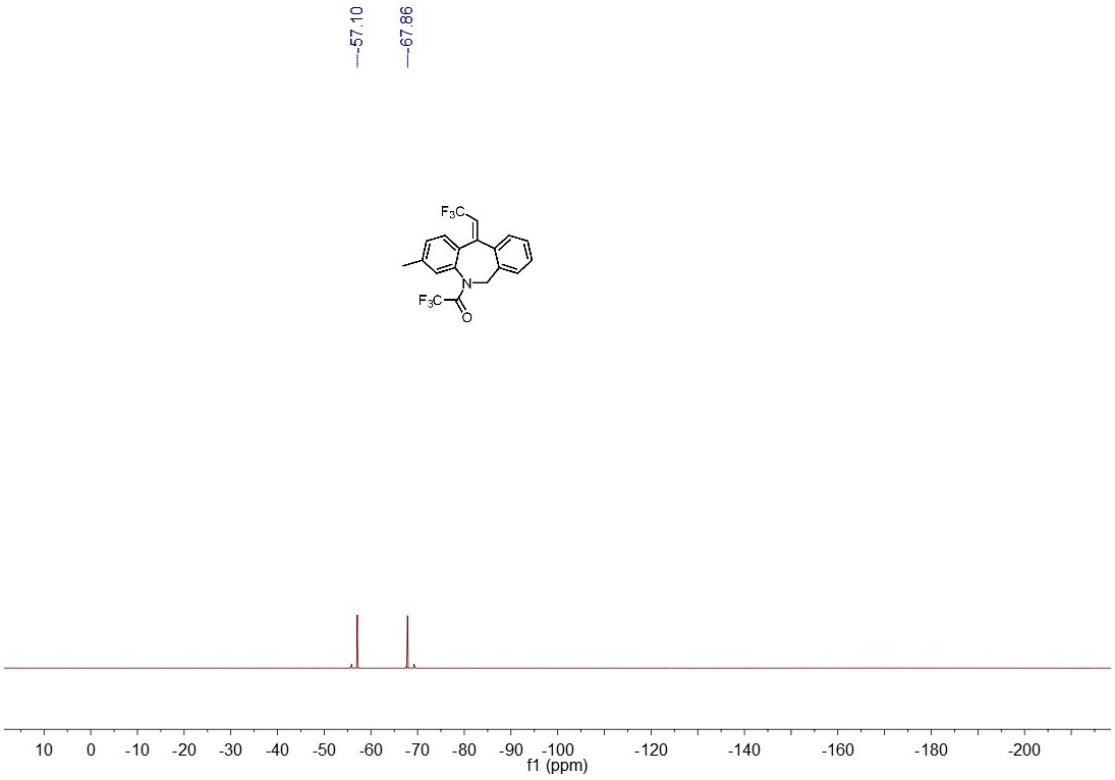
2.00
1.01
1.02
1.01
1.08
0.98
1.00
3.09
f1 (ppm)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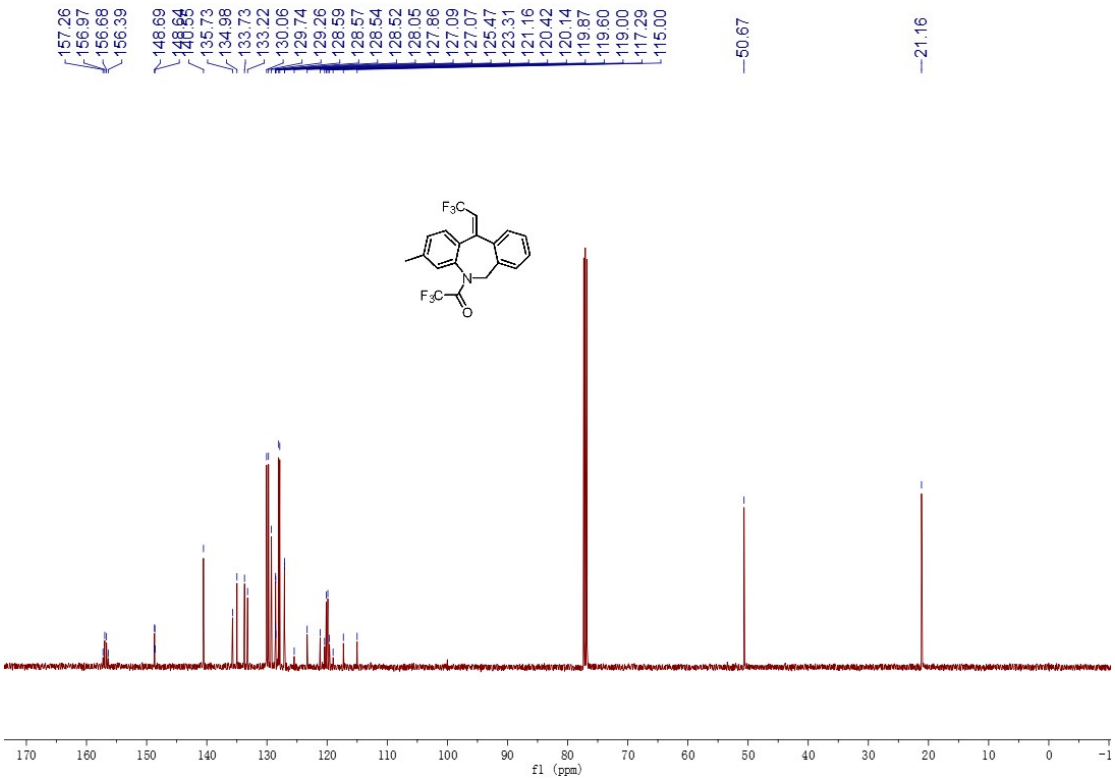
F3C
N
O
f1 (ppm)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115.00
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F3C
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160
150
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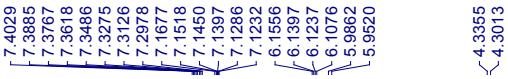
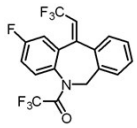
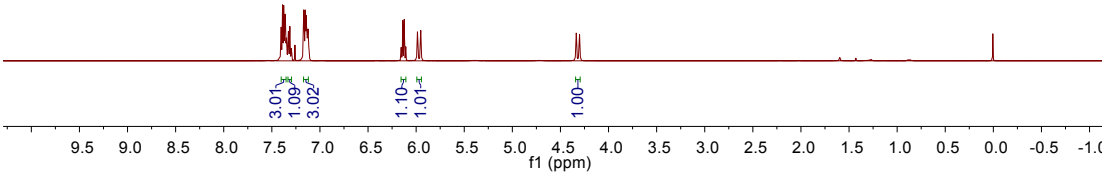
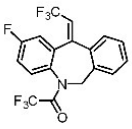
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)

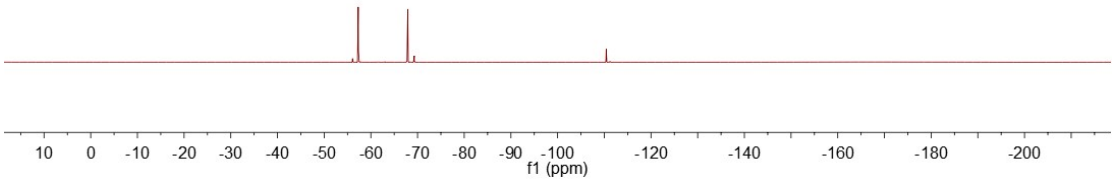

7.4029
7.3885
7.3767
7.3618
7.3486
7.3275
7.3126
7.2978
7.1677
7.1518
7.1450
7.1397
7.1286
7.1232
6.1556
6.1397
6.1237
6.1076
5.9862
5.9520
4.3355
4.3013

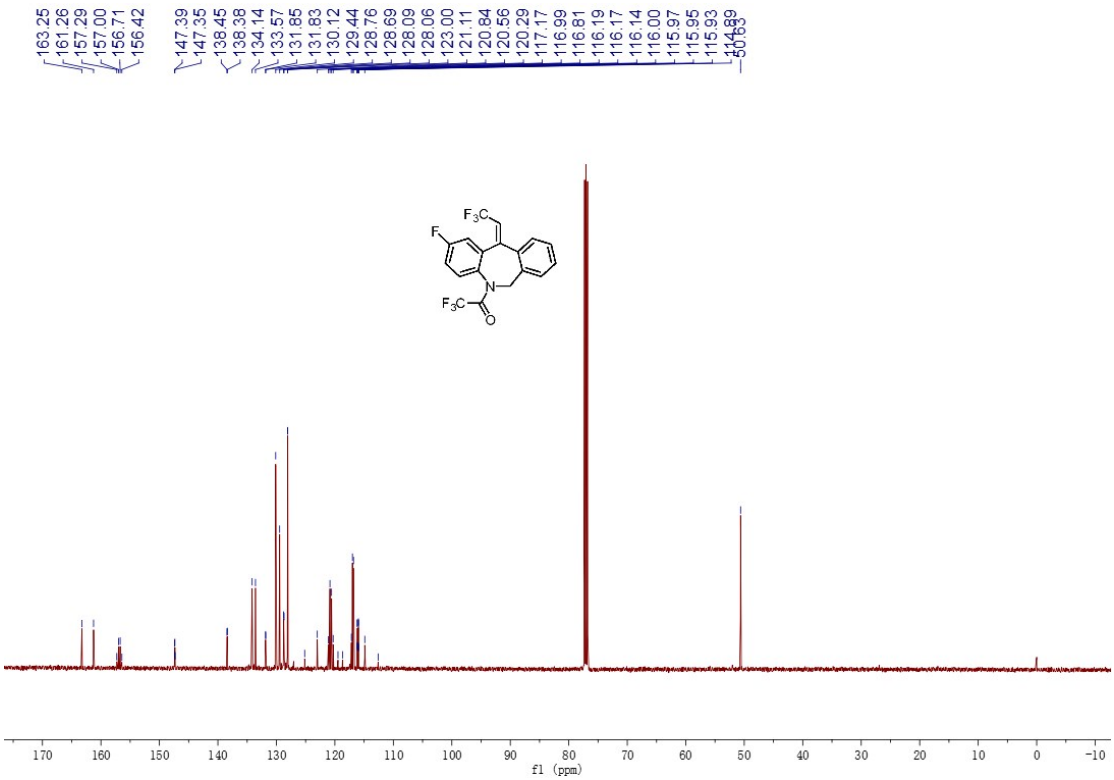

F3C
F
N
F3C
O

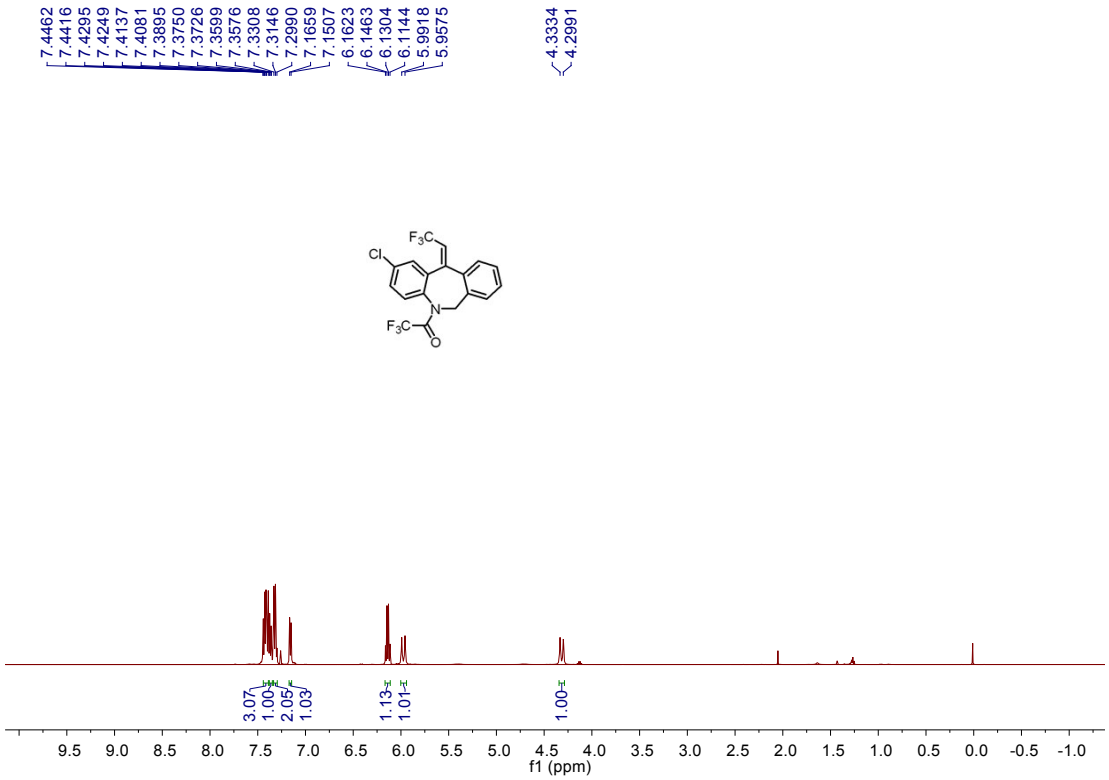

3.01
1.09
3.02
1.10
1.01
1.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

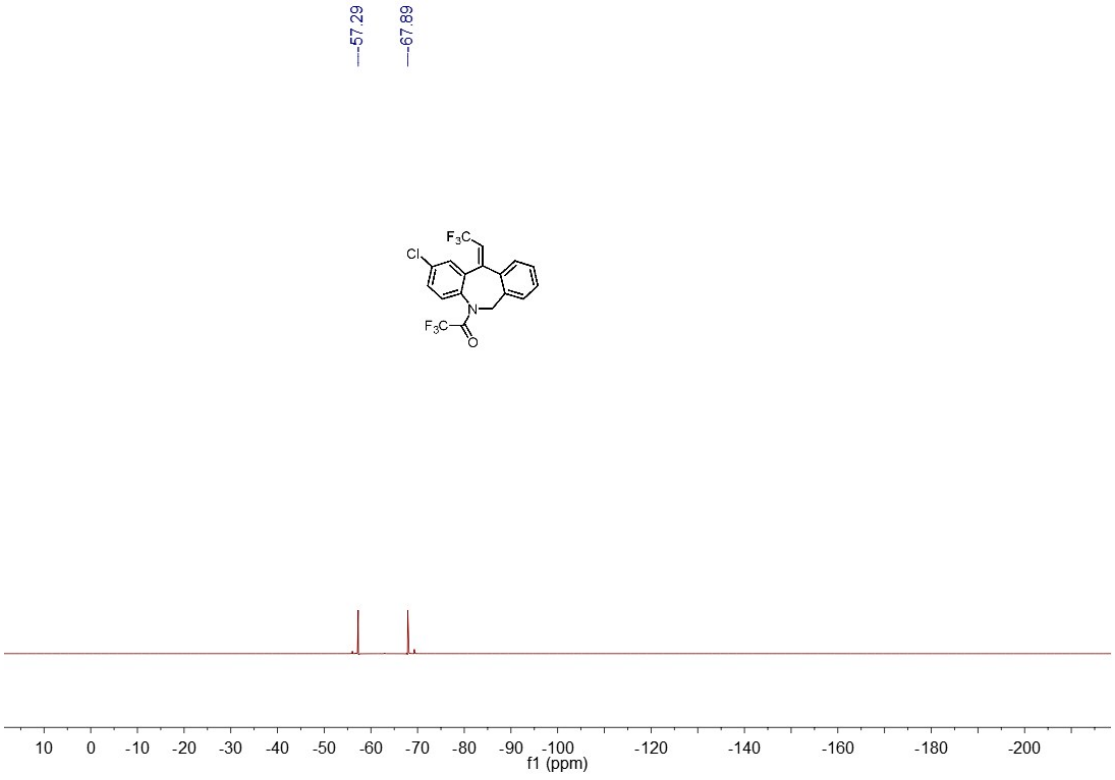

-57.30
-67.92
-110.42

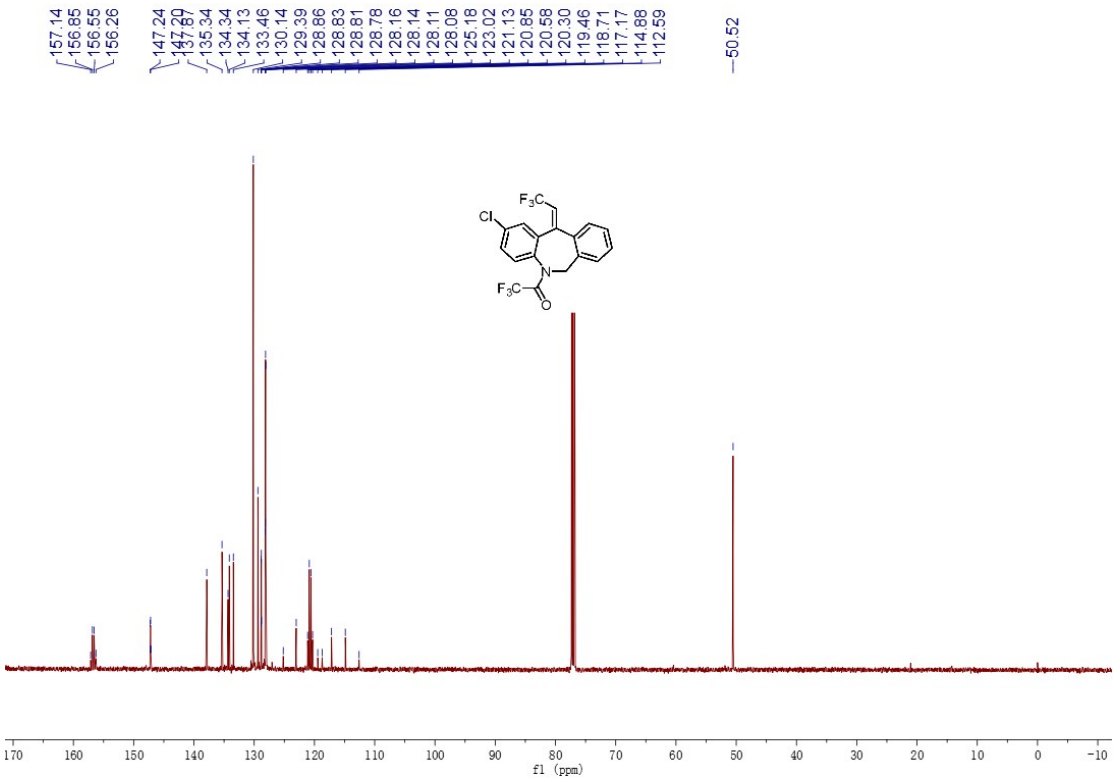

F3C
F
N
F3C
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)

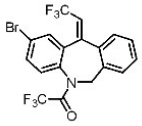

163.25
161.26
157.29
157.00
156.71
156.42
147.39
147.35
138.45
138.38
134.14
133.57
131.85
131.83
130.12
129.44
128.76
128.69
128.09
128.06
123.00
121.11
120.84
120.56
120.29
117.17
116.99
116.81
116.19
116.17
116.14
116.00
115.97
115.95
115.93
114.89
50.63
F3C
F
N
F3C
O
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

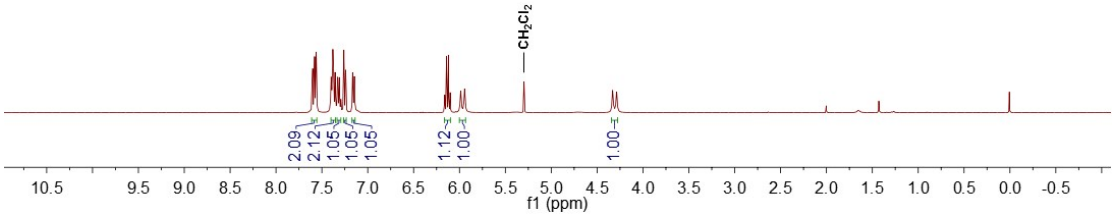

7.4462
7.4416
7.4295
7.4249
7.4137
7.4081
7.3895
7.3750
7.3726
7.3599
7.3576
7.3308
7.3146
7.2990
7.1659
7.1507
6.1623
6.1463
6.1304
6.1144
5.9918
5.9575
4.3334
4.2991
F3C
Cl
N
F3C
O
3.07
1.00
2.05
1.03
1.13
1.01
1.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


-57.29
-67.89
F3C
Cl
N
F3C
O
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)

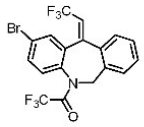

157.14
156.85
156.55
156.26
147.24
137.87
135.34
134.34
134.13
133.46
130.14
129.39
128.86
128.83
128.81
128.78
128.16
128.14
128.11
128.08
125.18
123.02
121.13
120.85
120.58
120.30
119.46
118.71
117.17
114.88
112.59
50.52
F3C
Cl
N
F3C
O
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

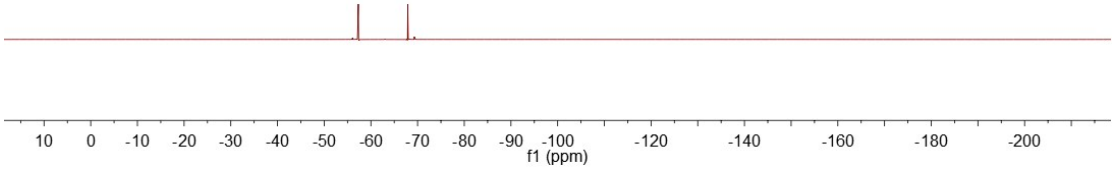

7.6052
7.5998
7.5844
7.5789
7.5630
7.3989
7.3938
7.3897
7.3803
7.3748
7.3715
7.3562
7.3526
7.3285
7.3104
7.2930
7.2416
7.1646
7.1460
6.1609
6.1410
6.1210
6.1011
5.9871
5.9443
5.2968
4.3307
4.2878

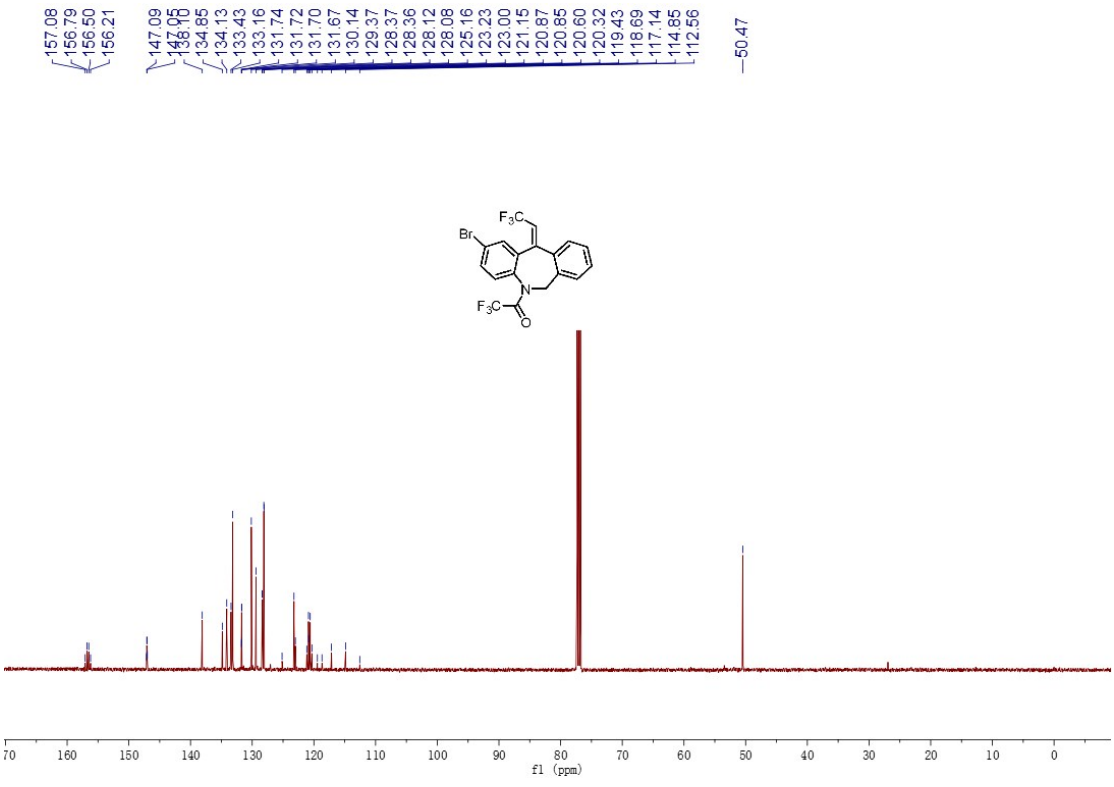

F3C
Br
N
F3C
O

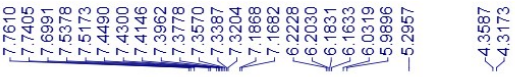

CH2Cl2
2.09
2.12
1.05
1.05
1.05
1.12
1.00
1.00
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

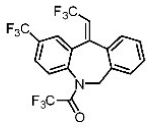

-57.31
-67.90

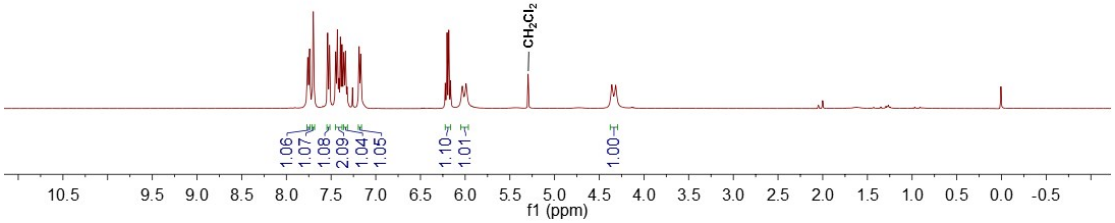

F3C
Br
N
F3C
O


10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-120
-140
-160
-180
-200
f1 (ppm)

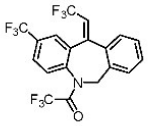

157.08
156.79
156.50
156.21
147.09
138.10
134.85
134.13
133.43
133.16
131.74
131.72
131.70
131.67
130.14
129.37
128.37
128.36
128.12
128.08
125.16
123.23
123.00
121.15
120.87
120.85
120.60
120.32
119.43
118.69
117.14
114.85
112.56
50.47
Br
F3C
F3C
O
N
f1 (ppm)

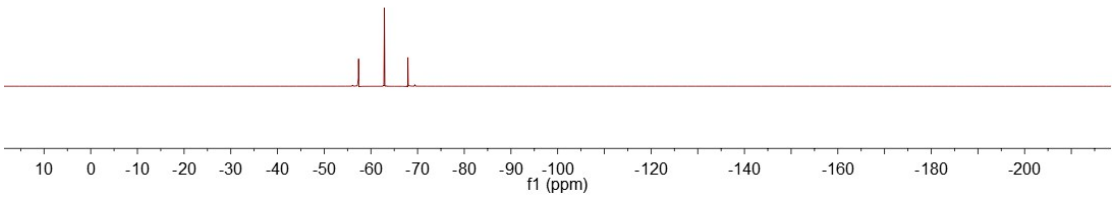

7.7610
7.7405
7.6991
7.5378
7.5173
7.4490
7.4300
7.4146
7.3962
7.3778
7.3570
7.3387
7.3204
7.1868
7.1682
6.2228
6.2030
6.1831
6.1633
6.0319
5.9896
5.2957
4.3587
4.3173

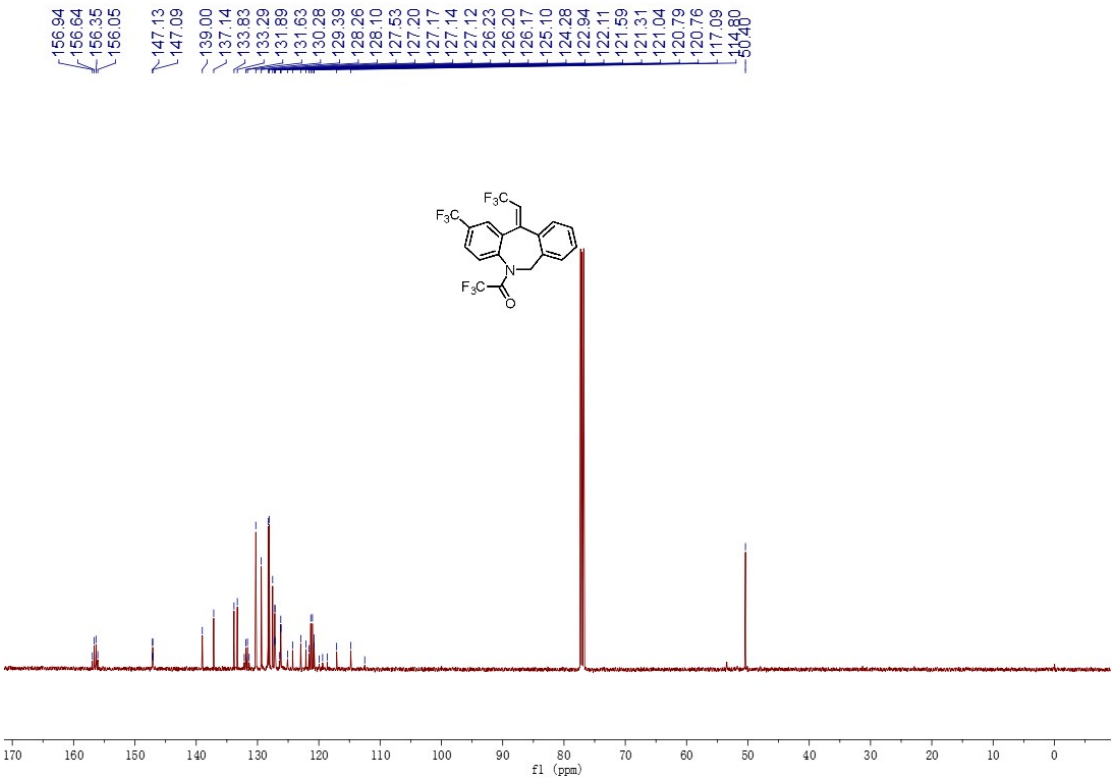

F3C
F3C
F3C
N
O


CH2Cl2
1.06
1.07
1.08
2.09
1.04
1.05
1.10
1.01
1.00
10.5
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
0.0
-0.5
f1 (ppm)

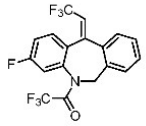

57.36
62.90
67.94

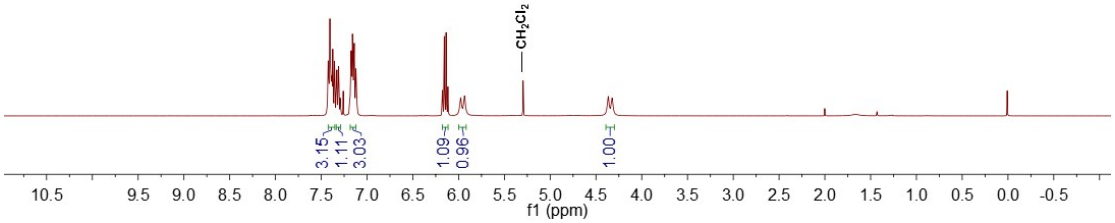

F3C
F3C
F3C
N
O


10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-120
-140
-160
-180
-200
f1 (ppm)

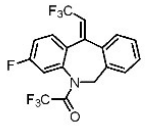

156.94
156.64
156.35
156.05
147.13
147.09
139.00
137.14
133.83
133.29
131.89
131.63
130.28
129.39
128.26
128.10
127.53
127.20
127.17
127.14
127.12
126.23
126.20
126.17
125.10
124.28
122.94
122.11
121.59
121.31
121.04
120.79
120.76
117.09
114.80
50.40
F3C
F3C
F3C
N
O
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

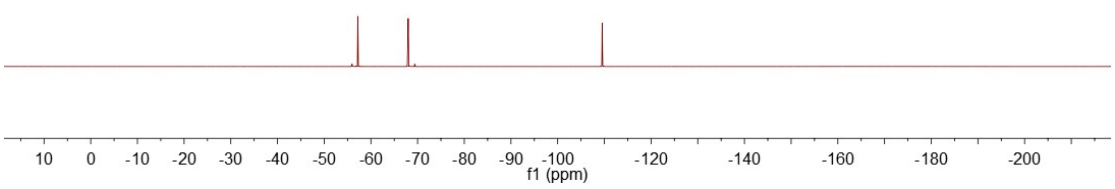

7.4244
7.4190
7.4054
7.3892
7.3826
7.3742
7.3707
7.3293
7.3112
7.2933
7.1871
7.1805
7.1734
7.1666
7.1597
7.1394
7.1211
6.1766
6.1566
6.1366
6.1165
5.9779
5.9354
5.2957
4.3660
4.3235

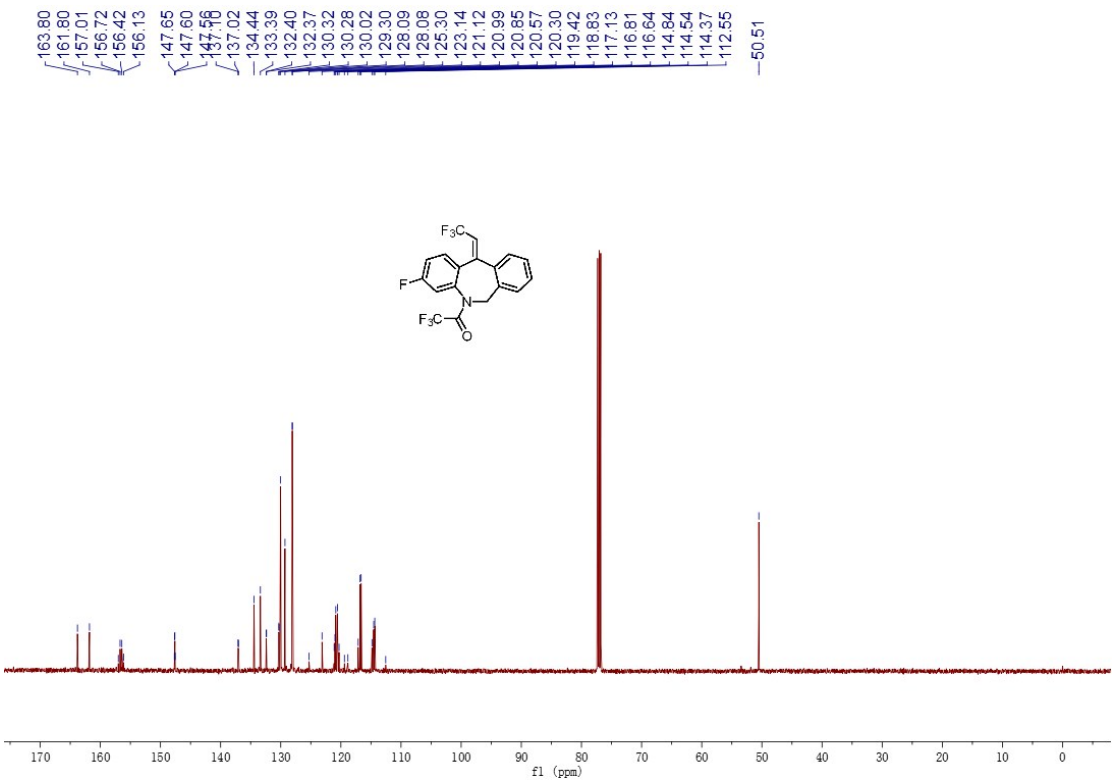

F3C
F
N
F3C
O


CH2Cl2
3.15
1.11
3.03
1.09
0.96
1.00
10.5
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
0.0
-0.5
f1 (ppm)

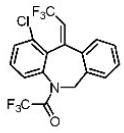

-57.21
-68.01
-109.54

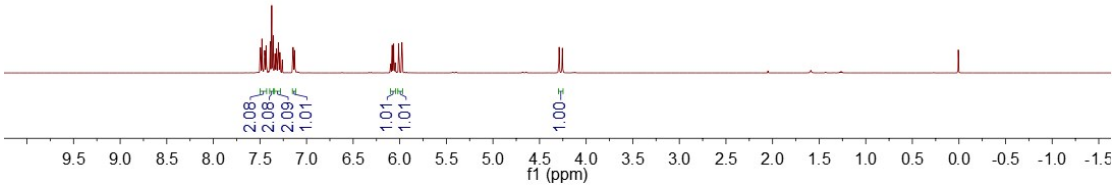

F3C
F
N
F3C
O


10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-120
-140
-160
-180
-200
f1 (ppm)

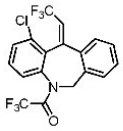

163.80
161.80
157.01
156.72
156.42
156.13
147.65
147.60
137.02
134.44
133.39
132.40
132.37
130.32
130.28
130.02
129.30
128.09
128.08
125.30
123.14
121.12
120.99
120.85
120.57
120.30
119.42
118.83
117.13
116.81
116.64
114.84
114.54
114.37
112.55
50.51
F3C
F
N
F3C
O
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

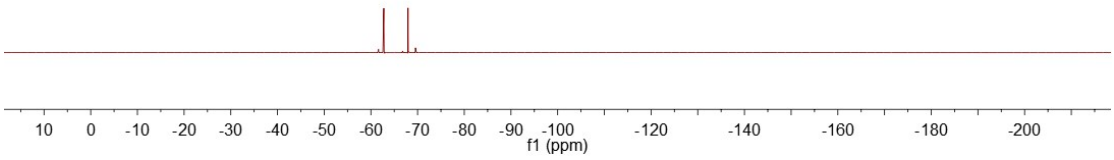

7.4954
7.4942
7.4792
7.4780
7.4496
7.4481
7.4344
7.4326
7.3897
7.3738
7.3579
7.3381
7.3235
7.3018
7.2859
6.0973
6.0813
6.0653
6.0493
6.0111
5.9767
4.2898
4.2554

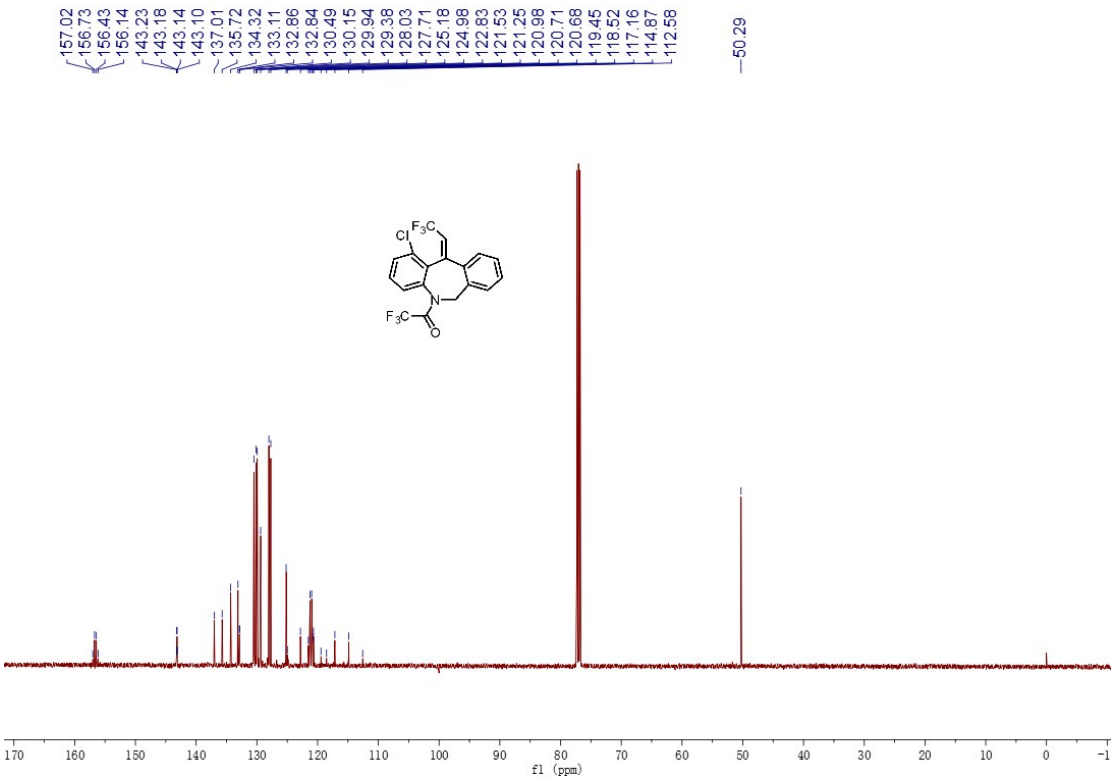

Cl
F3C
N
F3C
O

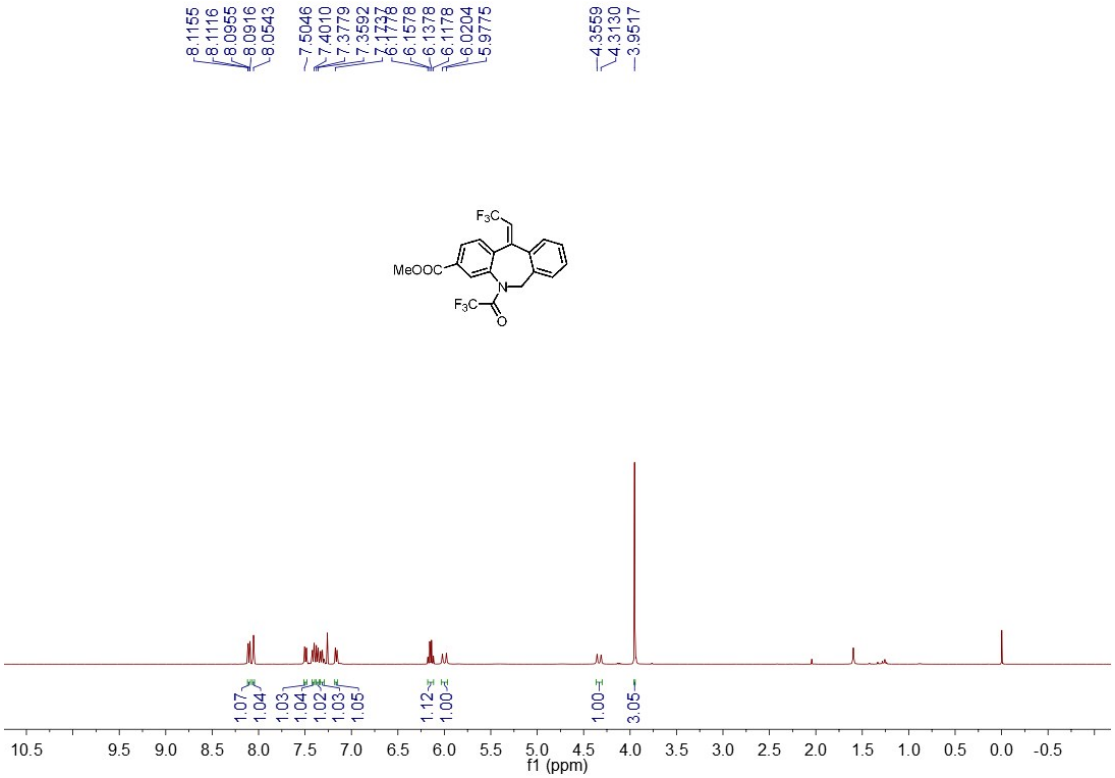

2.08
2.09
2.09
1.01
1.01
1.01
1.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0 -1.5
f1 (ppm)

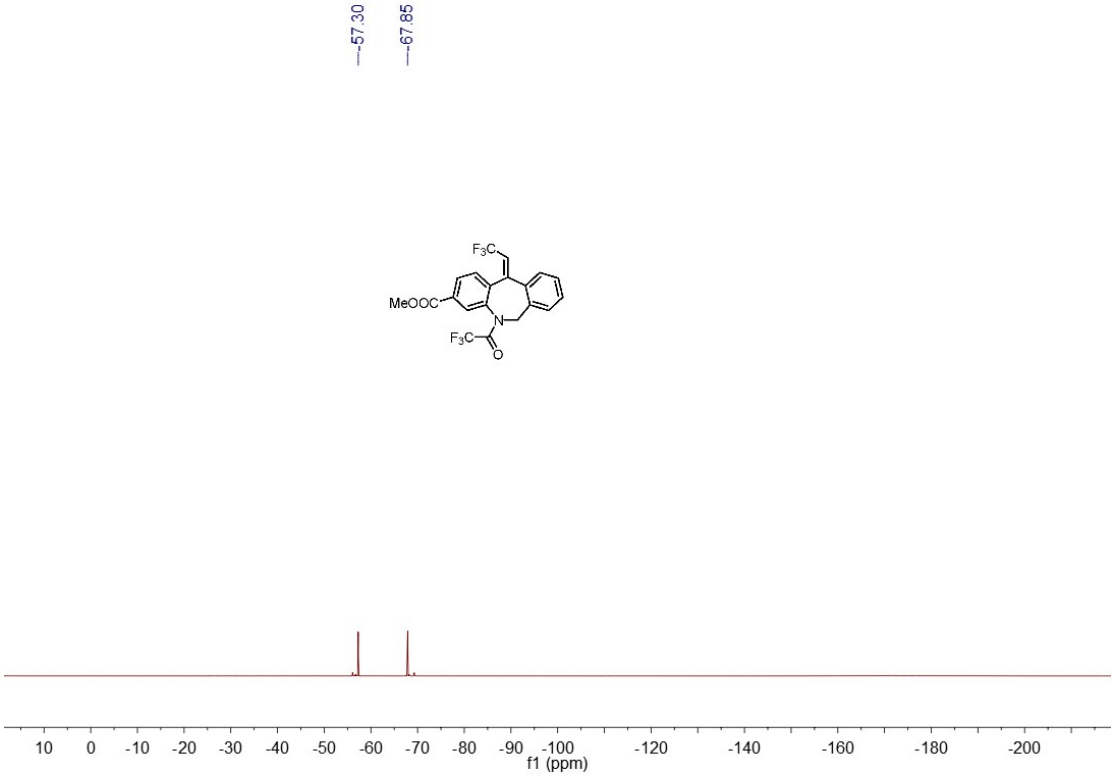

-62.76
-67.96

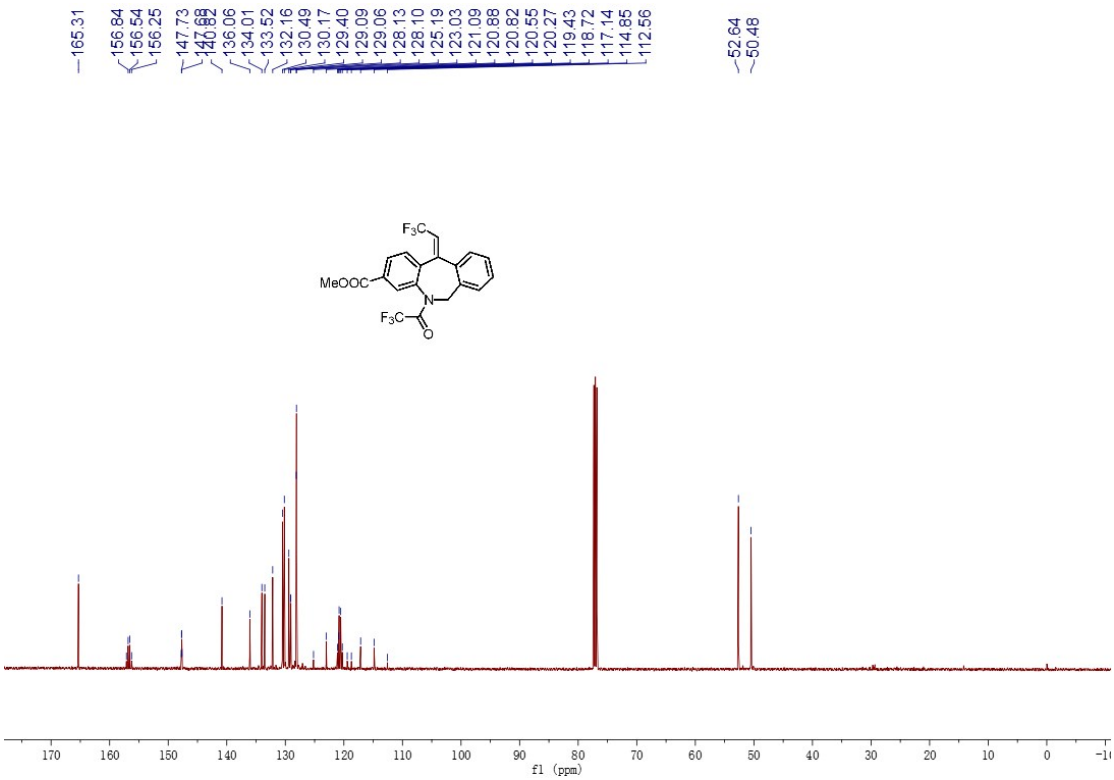

Cl
F3C
N
F3C
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)

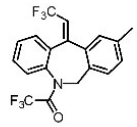

157.02
156.73
156.43
156.14
143.23
143.18
143.14
143.10
137.01
135.72
134.32
133.11
132.86
132.84
130.49
130.15
129.94
129.38
128.03
127.71
125.18
124.98
122.83
121.53
121.25
120.98
120.71
120.68
119.45
118.52
117.16
114.87
112.58
50.29
Cl
F3C
N
F3C
O
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)

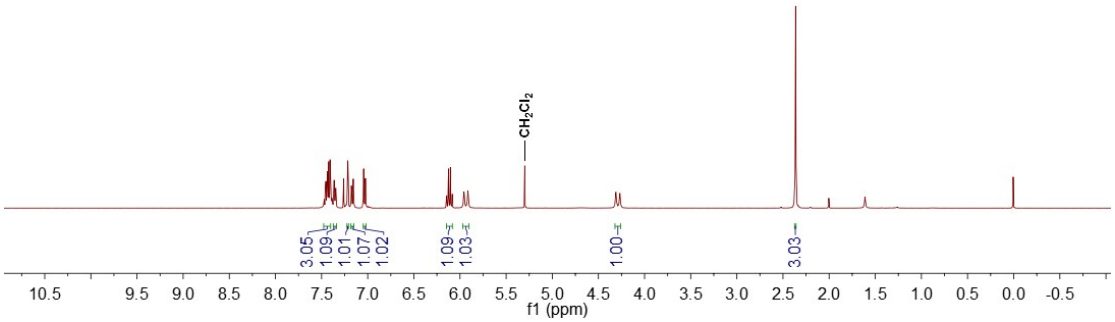

8.1155
8.1116
8.0955
8.0916
8.0543
7.5046
7.4010
7.3779
7.3592
6.1578
6.1378
6.1178
6.0204
5.9775
4.3559
4.3130
3.9517
F3C
MeOOC
N
F3C
O
1.07
1.04
1.03
1.04
1.02
1.03
1.05
1.12
1.00
1.00
3.05
f1 (ppm)


-57.30
-67.85
F3C
MeOOC
N
F3C
O
f1 (ppm)

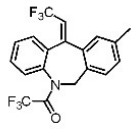

165.31
156.84
156.54
156.25
147.73
136.06
134.01
133.52
132.16
130.49
130.17
129.40
129.09
129.06
128.13
128.10
125.19
123.03
121.09
120.88
120.82
120.55
120.27
119.43
118.72
117.14
114.85
112.56
52.64
50.48
F3C
MeOOC
N
F3C
O
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

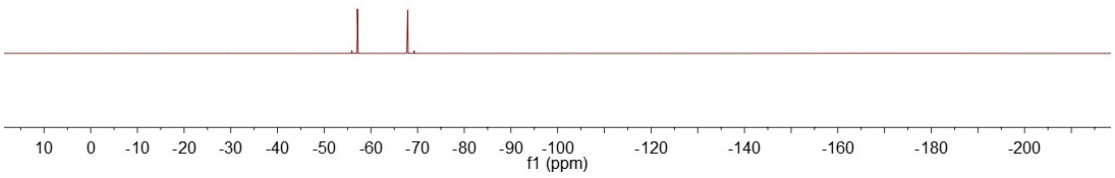

7.4765
7.4708
7.4590
7.4530
7.4417
7.4399
7.4349
7.4263
7.4222
7.4085
7.4054
7.3640
7.3484
7.3462
7.2159
7.1766
7.1569
7.0442
7.0246
6.1246
6.1044
6.0842
5.9569
4.3104
4.2680
2.3633

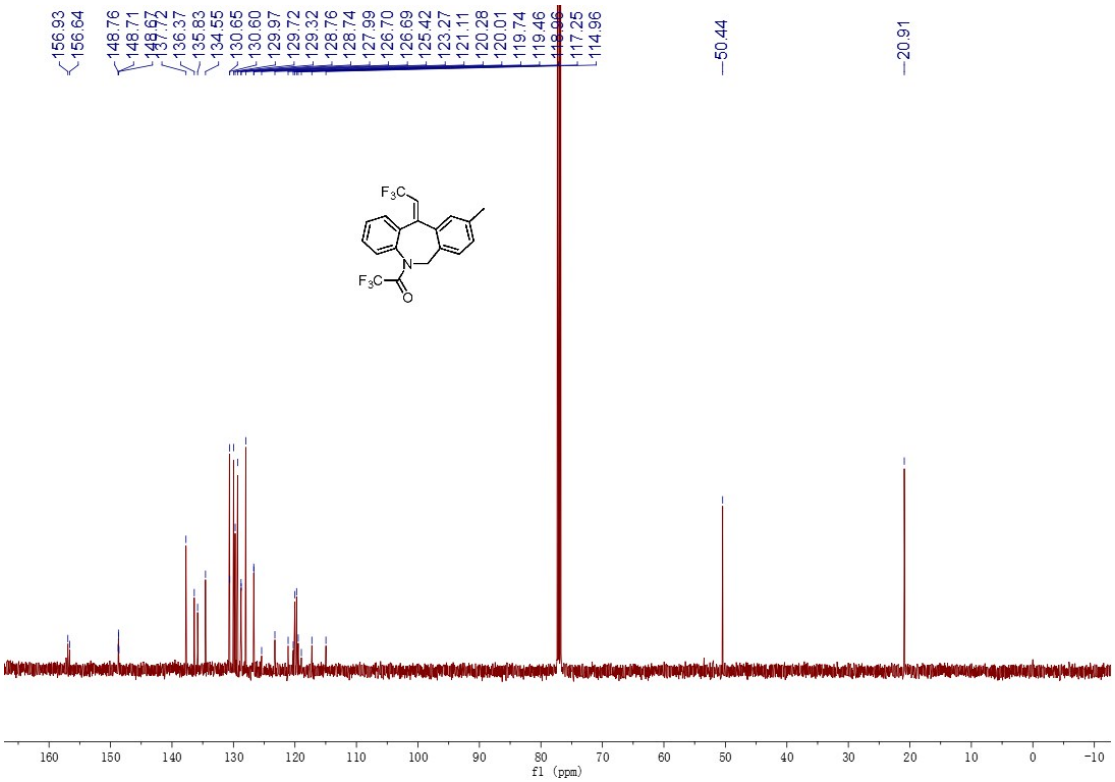

F3C
N
F3C
O

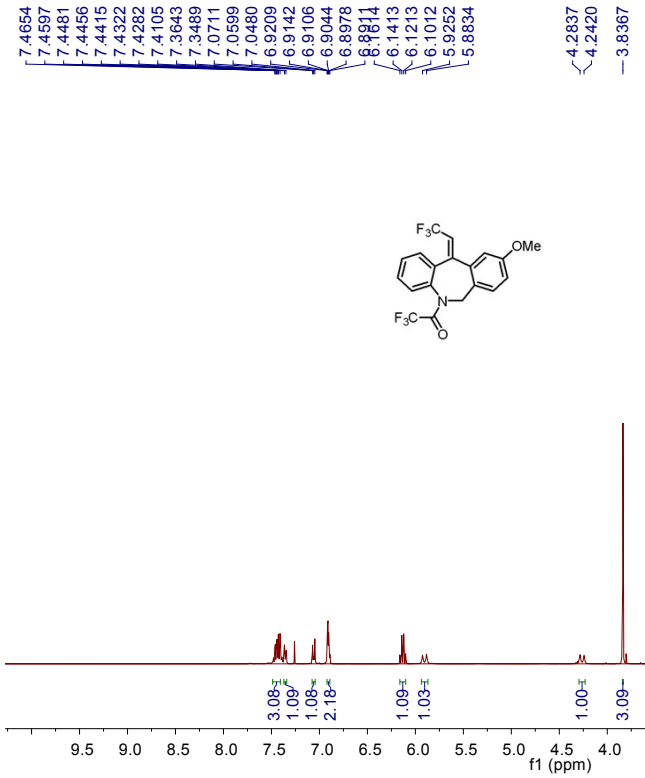

CH2Cl2
3.05
1.09
1.01
1.07
1.02
1.09
1.03
1.00
3.03
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f1 (ppm)

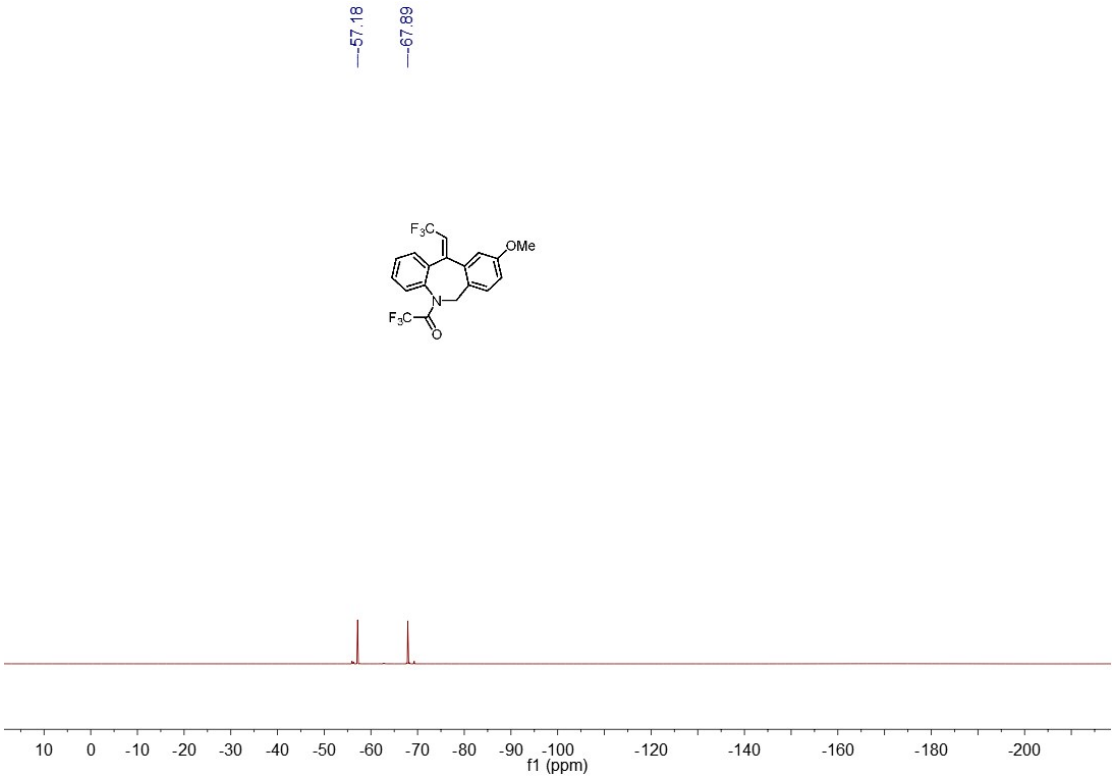

-57.13
-67.90

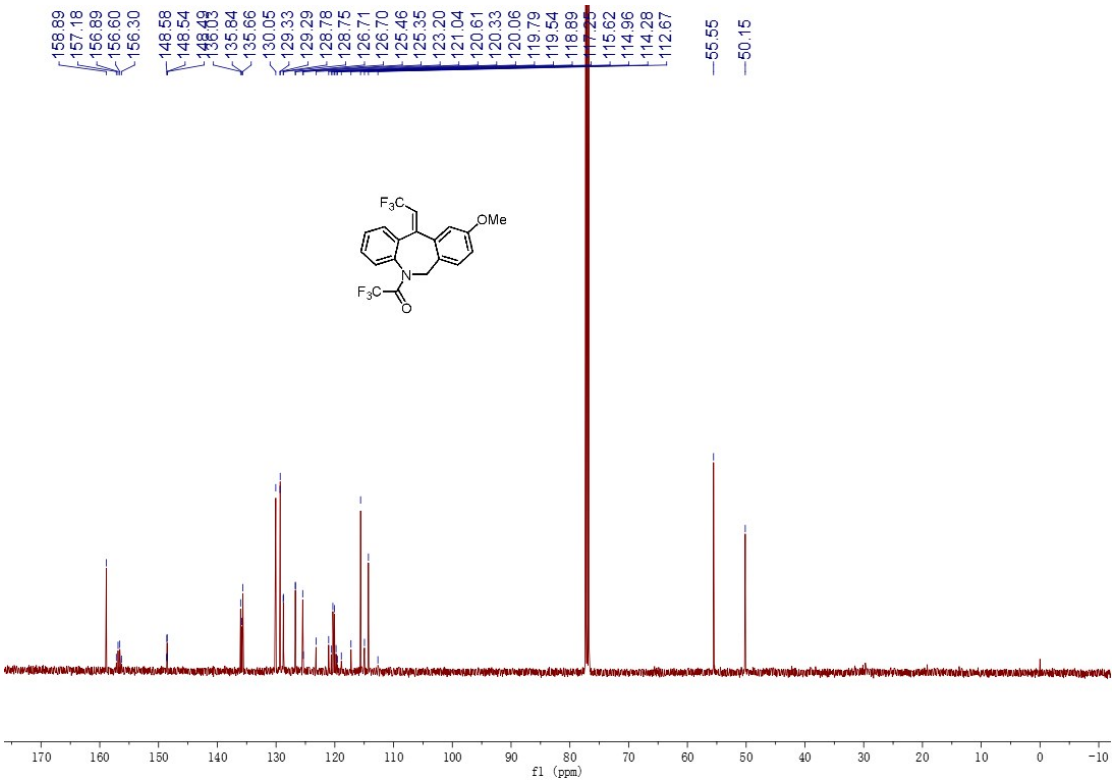

F3C
N
F3C
O

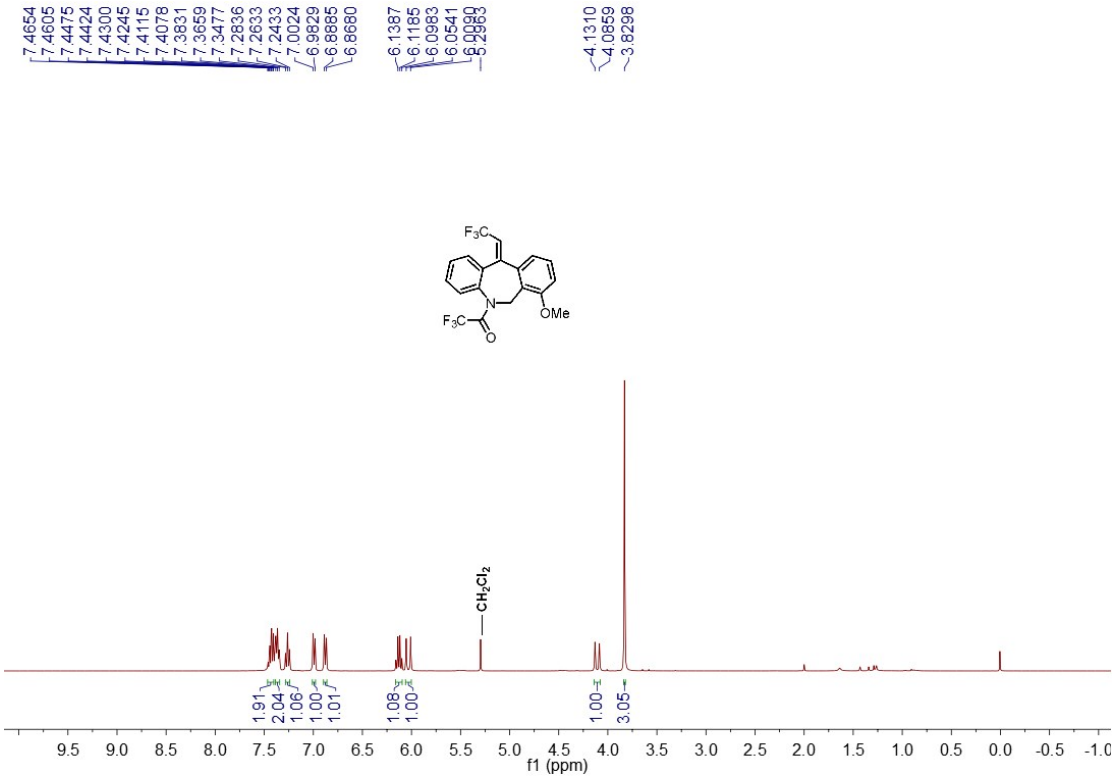

10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-120
-140
-160
-180
-200
f1 (ppm)

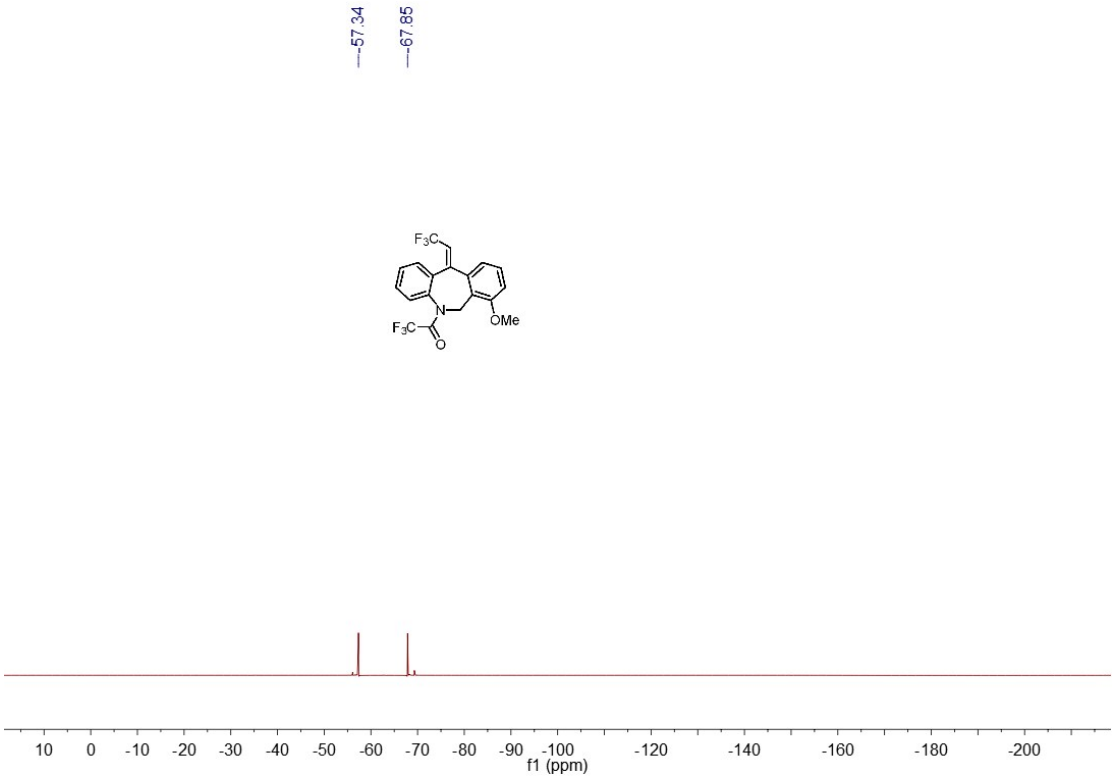

156.93
156.64
148.76
148.71
137.72
136.37
135.83
134.55
130.65
130.60
129.97
129.72
129.32
128.76
128.74
127.99
126.70
126.69
125.42
123.27
121.11
120.28
120.01
119.74
119.46
117.25
114.96
50.44
20.91
F3C
N
F3C
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

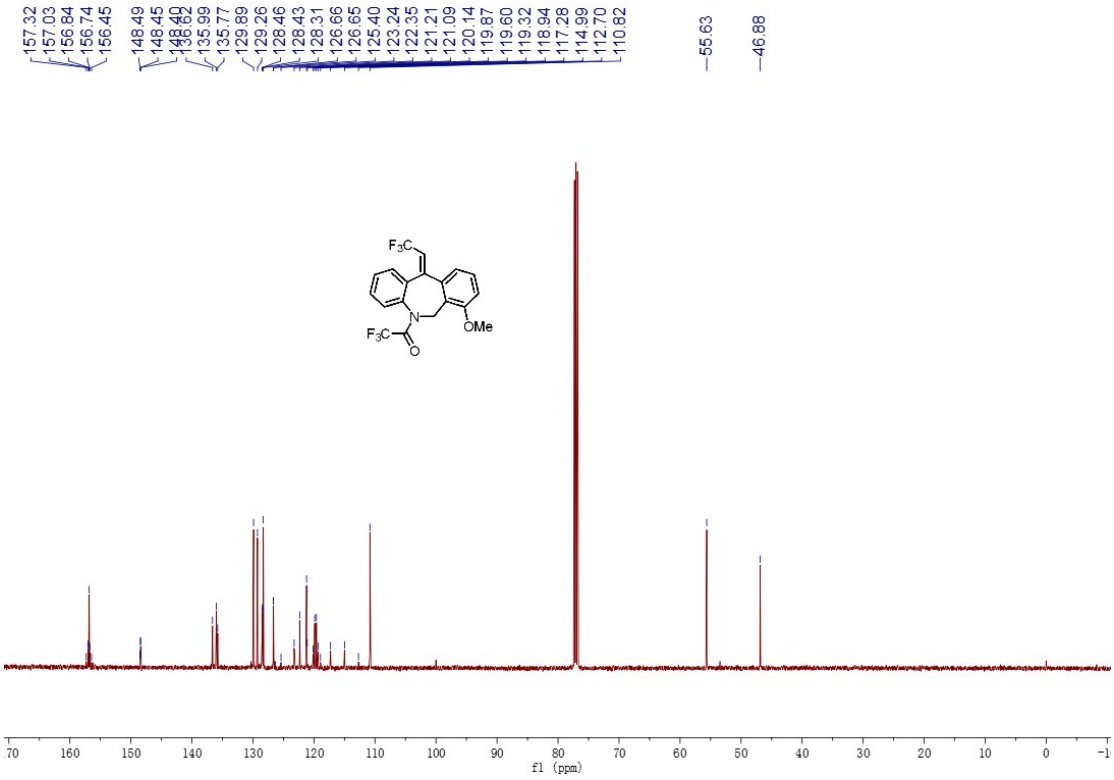

7.4654
7.4597
7.4481
7.4456
7.4415
7.4322
7.4282
7.4105
7.3643
7.3489
7.0711
7.0599
7.0480
6.9209
6.9142
6.9106
6.9044
6.8978
6.1413
6.1213
6.1012
5.9252
5.8834
4.2837
4.2420
3.8367
F3C
OMe
N
F3C
O
3.08
1.09
1.08
2.18
1.09
1.03
1.00
3.09
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


-57.18
-67.89
F3C
OMe
N
F3C
O
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)

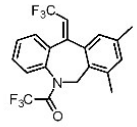

158.89
157.18
156.89
156.60
156.30
148.58
148.54
135.84
135.66
130.05
129.33
129.29
128.78
128.75
126.71
126.70
125.46
125.35
123.20
121.04
120.61
120.33
120.06
119.79
119.54
118.89
115.62
114.96
114.28
112.67
55.55
50.15
F3C
OMe
N
F3C
O
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

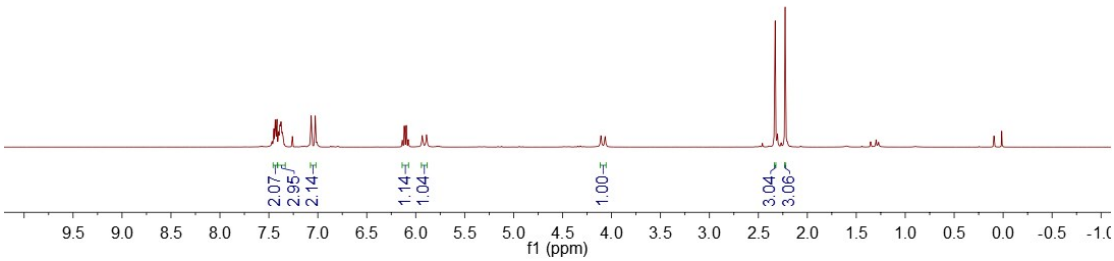

7.4654
7.4605
7.4475
7.4424
7.4300
7.4245
7.4115
7.4078
7.3831
7.3659
7.3477
7.2836
7.2633
7.2433
7.0024
6.9829
6.8885
6.8680
6.1387
6.1185
6.0983
6.0541
6.0090
5.2963
4.1310
4.0859
3.8298
F3C
F3C
O
N
OMe
CH2Cl2
1.91
2.04
1.06
1.00
1.01
1.08
1.00
1.00
3.05
f1 (ppm)


-57.34
-67.85
F3C
F3C
O
N
OMe
f1 (ppm)

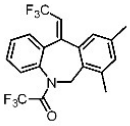

157.32
157.03
156.84
156.74
156.45
148.49
148.45
135.99
135.77
129.89
129.26
128.46
128.43
128.31
126.66
126.65
125.40
123.24
122.35
121.21
121.09
120.14
119.87
119.60
119.32
118.94
117.28
114.99
112.70
110.82
55.63
46.88
F3C
N
OMe
F3C
O
70
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

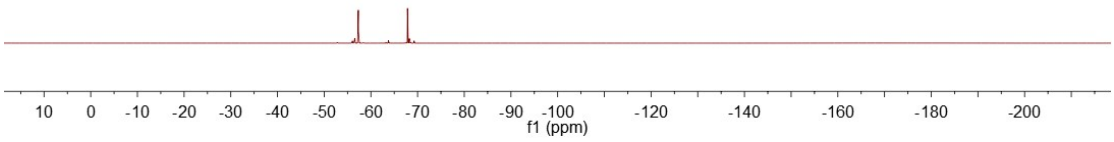

7.4531
7.4482
7.4357
7.4299
7.4212
7.4172
7.4032
7.3989
7.3891
7.3760
7.3622
7.3420
7.0672
7.0262
6.1366
6.1164
6.0961
6.0759
5.9330
5.8900
4.1079
4.0649
2.3284
2.2270

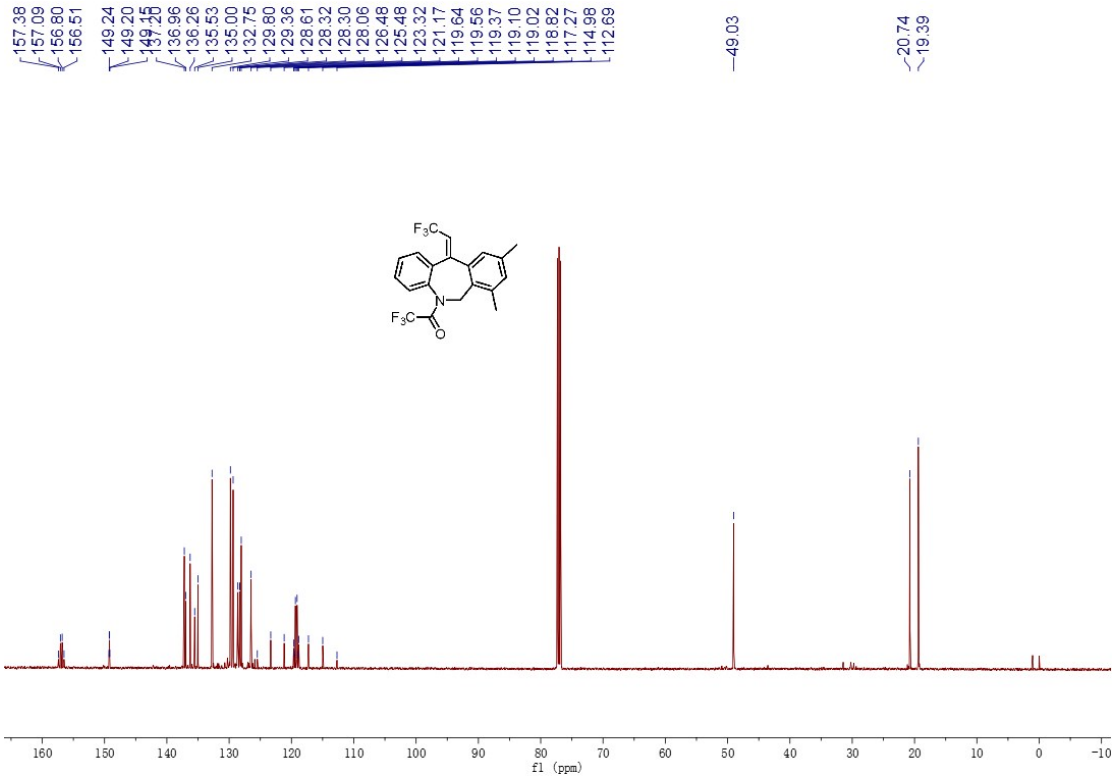

F3C
N
F3C
O

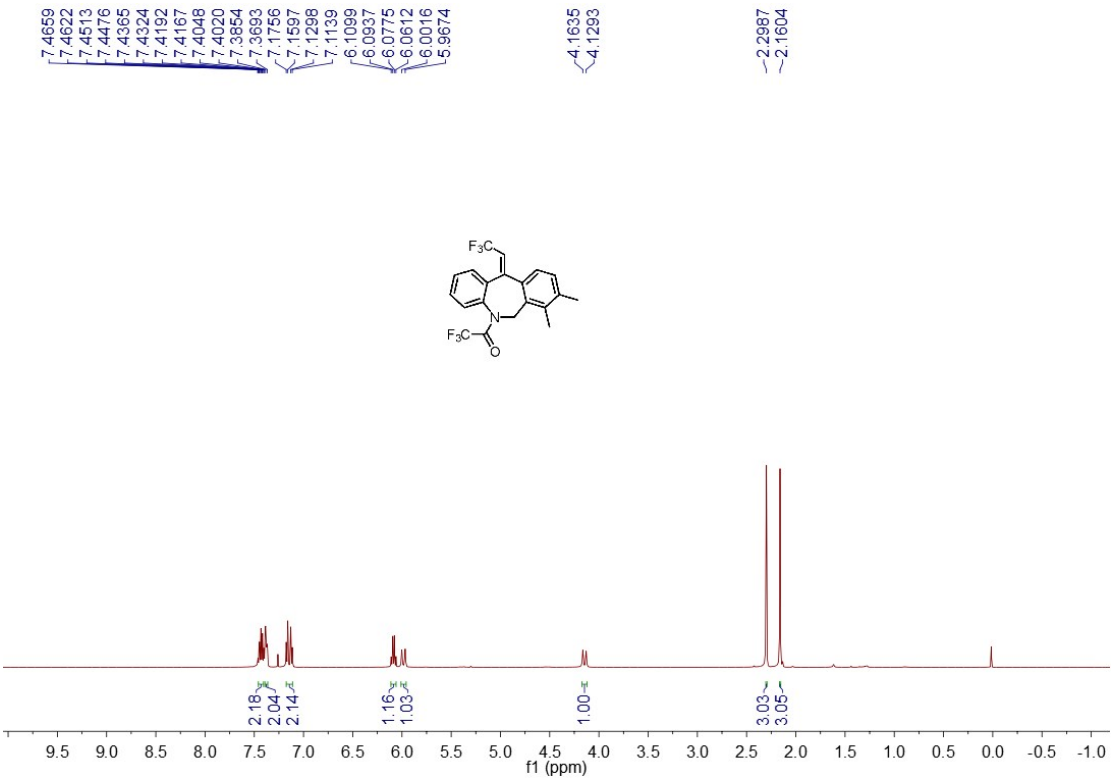

2.07
2.95
2.14
1.14
1.04
1.00
3.04
3.06
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

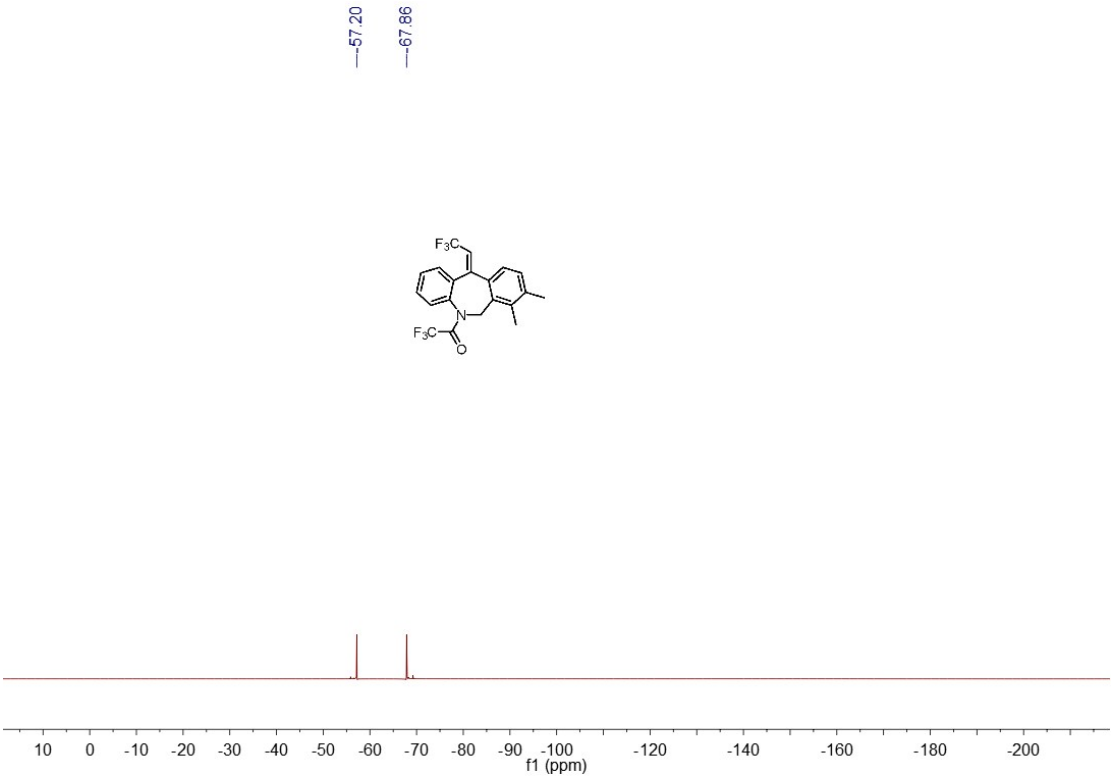

-57.31
-67.84

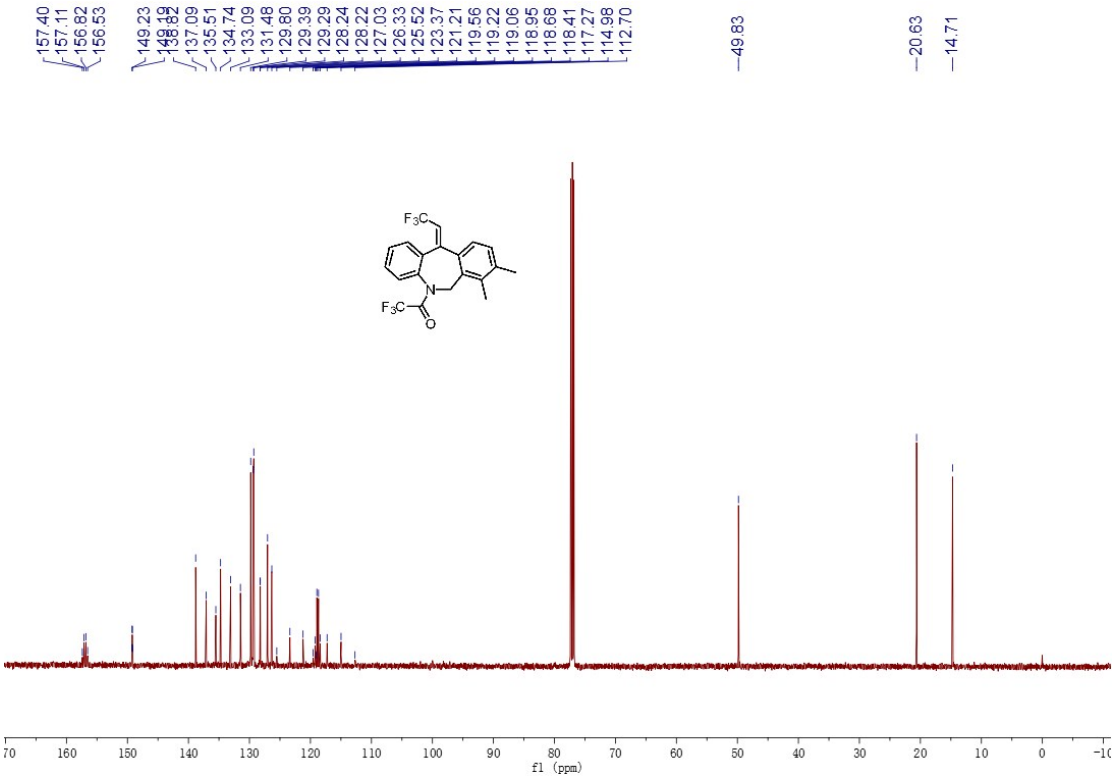

F3C
N
F3C
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)

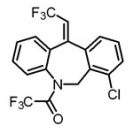

157.38
157.09
156.80
156.51
149.24
149.20
137.20
136.96
136.26
135.53
135.00
132.75
129.80
129.36
128.61
128.32
128.30
128.06
126.48
125.48
123.32
121.17
119.64
119.56
119.37
119.10
119.02
118.82
117.27
114.98
112.69
49.03
20.74
19.39
F3C
N
F3C
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

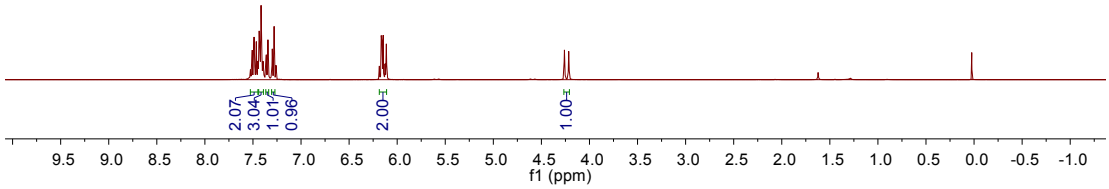

7.4659
7.4622
7.4513
7.4476
7.4365
7.4324
7.4192
7.4167
7.4048
7.4020
7.3854
7.3693
7.1756
7.1597
7.1298
7.1139
6.1099
6.0937
6.0775
6.0612
6.0016
5.9674
4.1635
4.1293
2.2987
2.1604
F3C
F3C
O
N
2.18
2.04
2.14
1.16
1.03
1.00
3.03
3.05
f1 (ppm)


-57.20
-67.86
F3C
F3C
O
N
f1 (ppm)

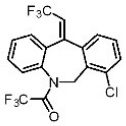

157.40
157.11
156.82
156.53
149.23
138.82
137.09
135.51
134.74
133.09
131.48
129.80
129.39
129.29
128.24
128.22
127.03
126.33
125.52
123.37
121.21
119.56
119.22
119.06
118.95
118.68
118.41
117.27
114.98
112.70
49.83
20.63
14.71
F3C
F3C
N
O
f1 (ppm)

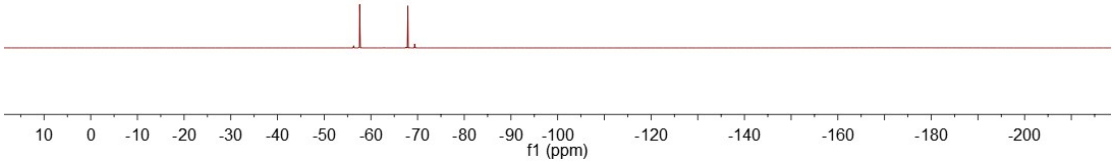

7.5118
7.5074
7.4933
7.4882
7.4831
7.4688
7.4650
7.4500
7.4351
7.4155
7.3949
7.3639
7.3610
7.3445
7.3416
7.2992
6.1657
6.1573
6.1459
6.1261
6.1126
4.2602
4.2156

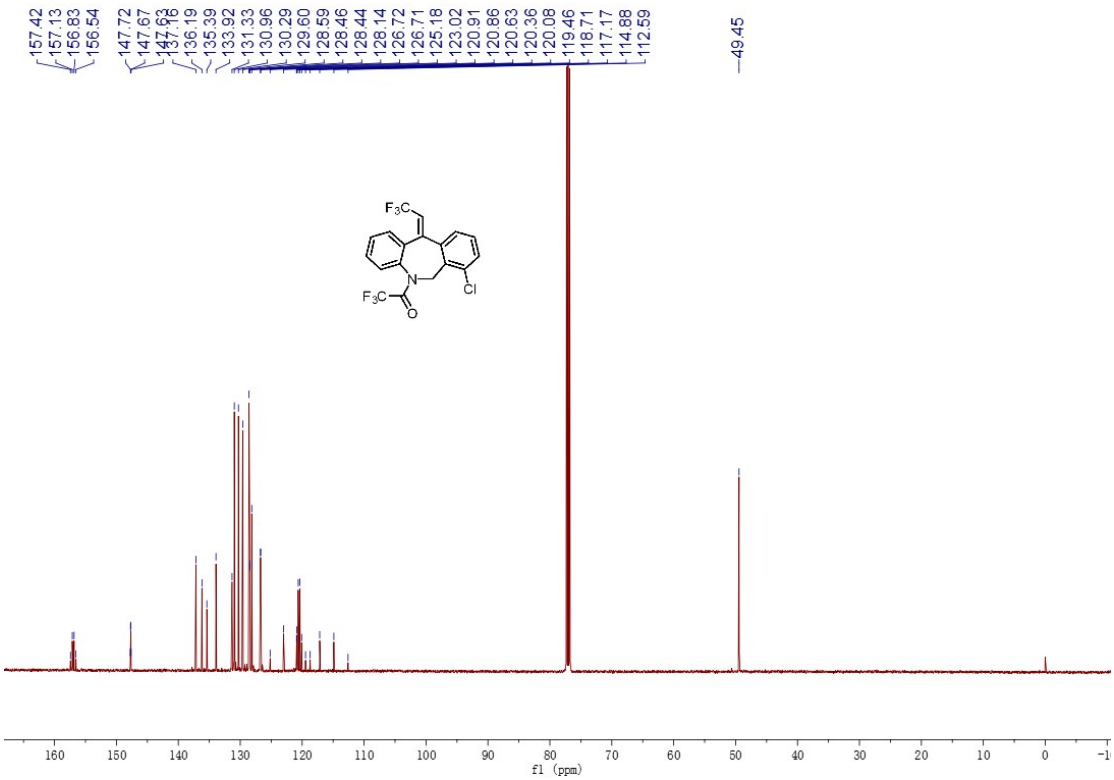

F3C
N
Cl
F3C
O


2.07
3.04
1.01
0.96
2.00
1.00
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 0.0 -0.5 -1.0
f1 (ppm)

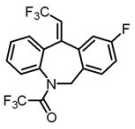

-57.59
-67.92

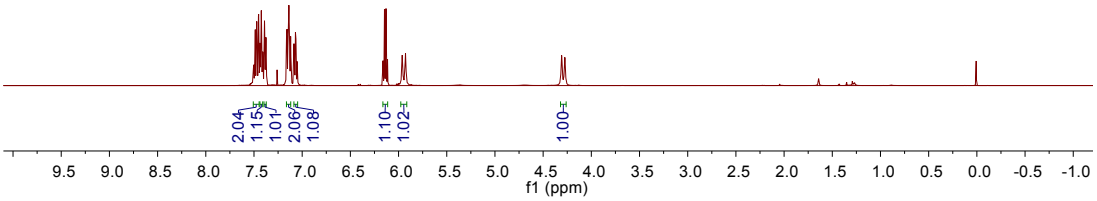

F3C
N
Cl
F3C
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)

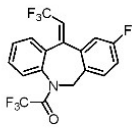

157.42
157.13
156.83
156.54
147.72
147.67
147.63
137.16
136.19
135.39
133.92
131.33
130.96
130.29
129.60
128.59
128.46
128.44
128.14
126.72
126.71
125.18
123.02
120.91
120.86
120.63
120.36
120.08
119.46
118.71
117.17
114.88
112.59
49.45
F3C
N
Cl
F3C
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

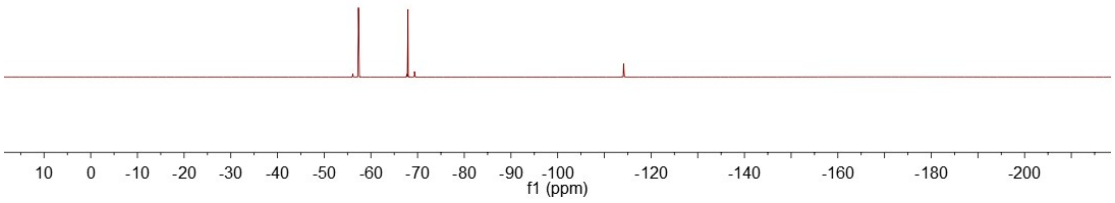

7.4903
7.4868
7.4755
7.4714
7.4538
7.4516
7.4242
7.3910
7.3760
7.1621
7.1571
7.1435
7.1379
7.1309
7.1197
7.0698
7.0649
6.1460
6.1302
6.1143
5.9618
5.9279
4.3081
4.2744

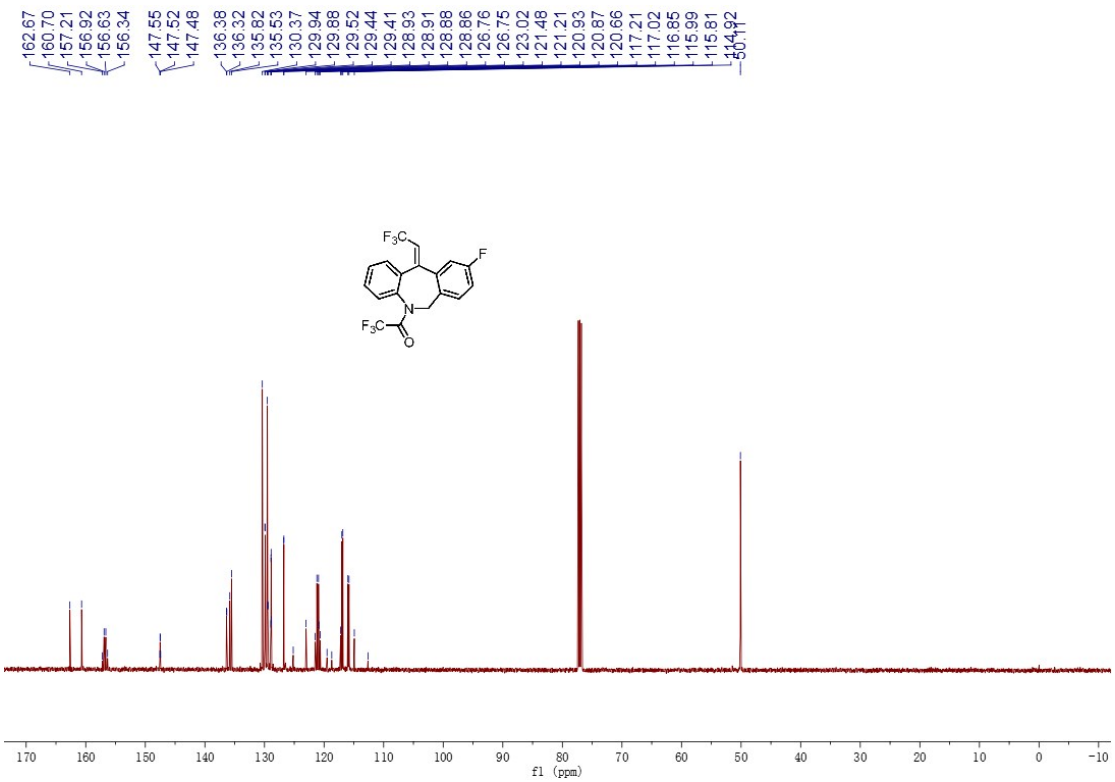

F3C
F
N
F3C
O


2.04
1.15
1.01
2.06
1.08
1.10
1.02
1.00
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 0.0 -0.5 -1.0
f1 (ppm)


57.33
67.94
114.11


F3C
F
N
F3C
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)


162.67
160.70
157.21
156.92
156.63
156.34
147.55
147.52
147.48
136.38
136.32
135.82
135.53
130.37
129.94
129.88
129.52
129.44
129.41
128.93
128.91
128.88
128.86
126.76
126.75
123.02
121.48
121.21
120.93
120.87
120.66
117.21
117.02
116.85
115.99
115.81
114.92
50.11
F3C
F
N
F3C
O
170
160
150
140
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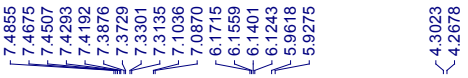
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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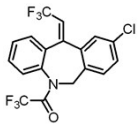
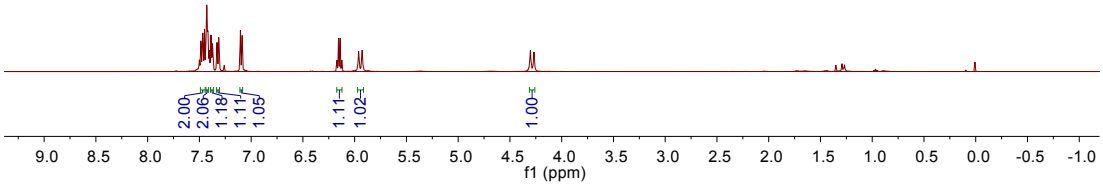
7.4675
7.4507
7.4293
7.4192
7.3876
7.3729
7.3301
7.3135
7.1036
7.0870
6.1715
6.1559
6.1401
6.1243
5.9618
5.9275
4.3023
4.2678


F3C
Cl
N
F3C
O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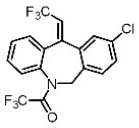
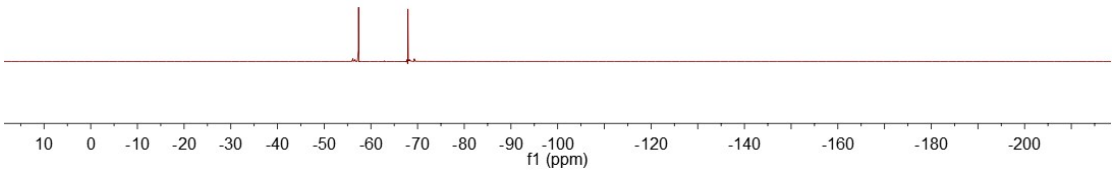
2.06
1.18
1.11
1.05
1.11
1.02
1.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


-57.36
-67.94


F3C
Cl
N
F3C
O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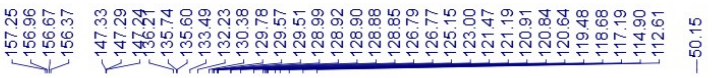
f1 (ppm)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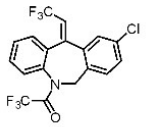
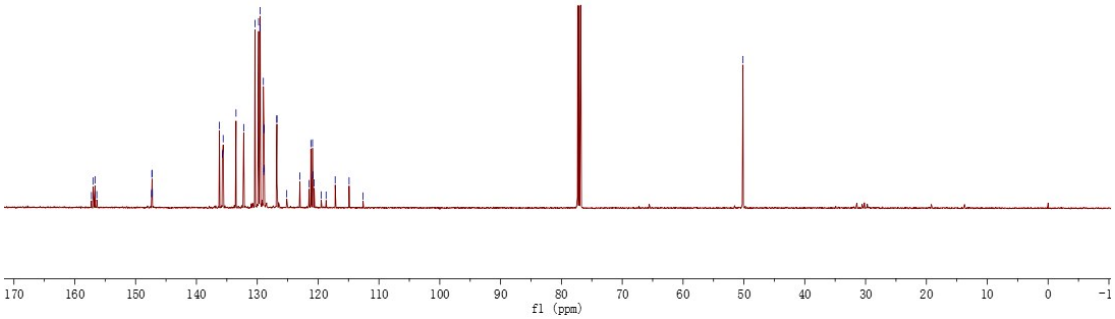
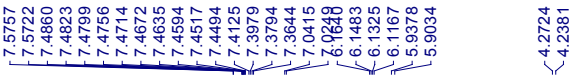
135.60
133.49
132.23
130.38
129.78
129.57
129.51
128.99
128.92
128.90
128.88
128.85
126.79
126.77
125.15
123.00
121.47
121.19
120.91
120.84
120.64
119.48
118.68
117.19
114.90
112.61
50.15


F3C
Cl
N
F3C
O


170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)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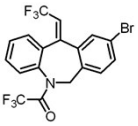
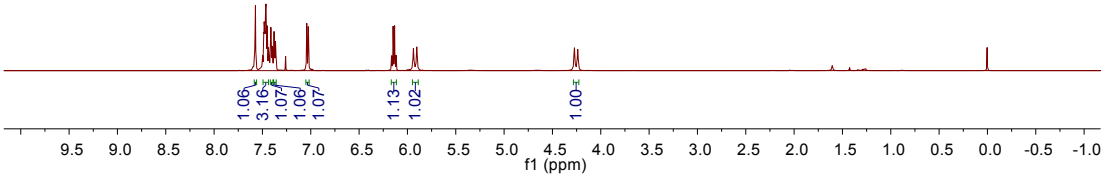
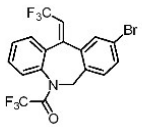
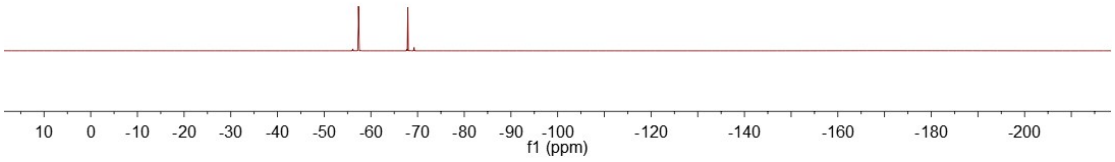
7.5722
7.4860
7.4823
7.4799
7.4756
7.4714
7.4672
7.4635
7.4594
7.4517
7.4494
7.4125
7.3979
7.3794
7.3644
7.0415
6.1483
6.1325
6.1167
5.9378
5.9034
4.2724
4.2381

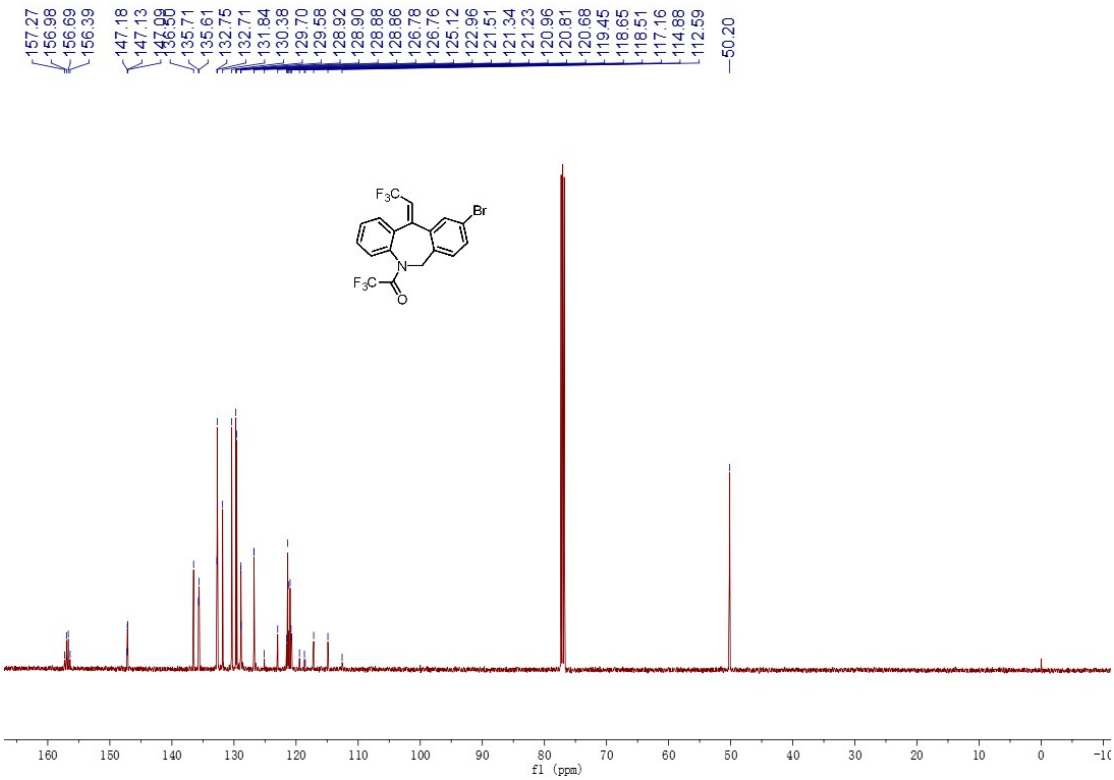

F3C
Br
N
F3C
O


1.06
3.16
1.07
1.06
1.07
1.13
1.02
1.00
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 0.0 -0.5 -1.0
f1 (ppm)


-57.34
-67.94


F3C
Br
N
F3C
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)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156.98
156.69
156.39
147.18
147.13
135.71
135.61
132.75
132.71
131.84
130.38
129.70
129.58
128.92
128.90
128.88
128.86
126.78
126.76
125.12
122.96
121.51
121.34
121.23
120.96
120.81
120.68
119.45
118.65
118.51
117.16
114.88
112.59
50.20
F3C
Br
N
F3C
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)


8.3210
8.3154
8.2048
8.1990
8.1835
8.1777
7.5105
7.5050
7.4864
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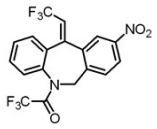
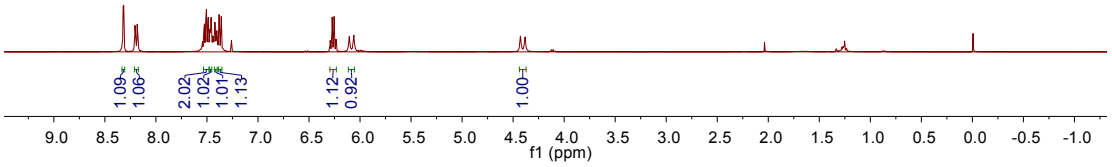
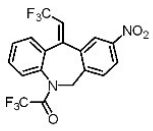
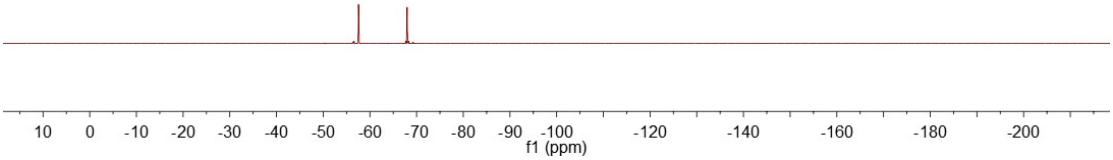
6.2345
6.1055
6.0609
4.4281
4.3835

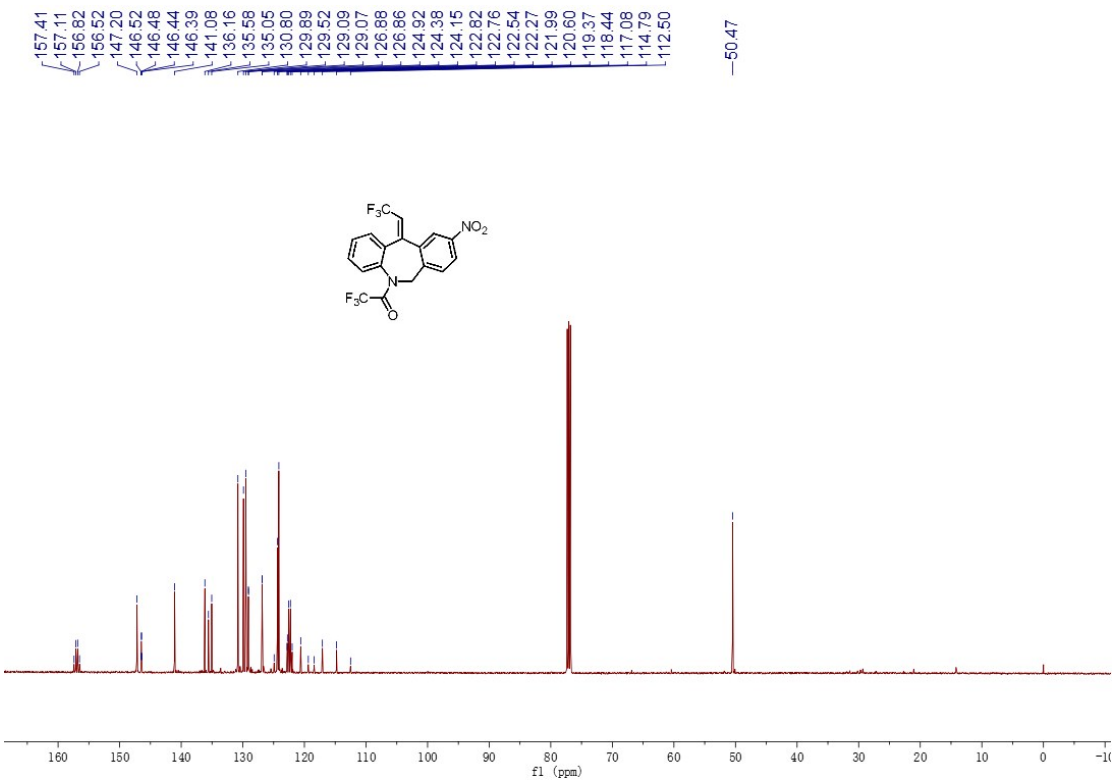

F3C
NO2
N
F3C
O


1.09
1.06
2.02
1.02
1.01
1.13
1.12
0.92
1.00
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 0.0 -0.5 -1.0
f1 (ppm)


-57.57
-68.00


F3C
NO2
N
F3C
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)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156.82
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147.20
146.52
146.48
146.44
146.39
141.08
136.16
135.58
135.05
130.80
129.89
129.52
129.09
129.07
126.88
126.86
124.92
124.38
124.15
122.82
122.76
122.54
122.27
121.99
120.60
119.37
118.44
117.08
114.79
112.50
50.47
F3C
NO2
F3C
O
N
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.6665
7.6210
7.6007
7.5258
7.5208
7.5078
7.5026
7.4902
7.4846
7.4681
7.4462
7.4272
7.4012
7.3828
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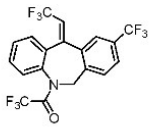
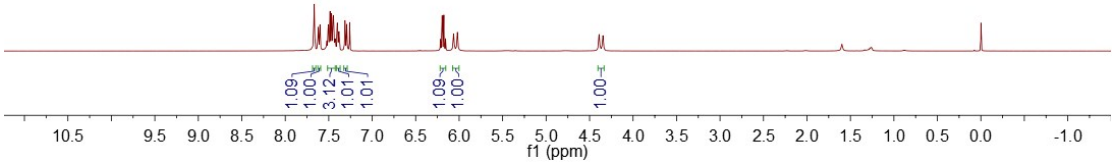
6.2151
6.1956
6.1760
6.1565
6.0637
6.0199
4.3901
4.3464


F3C
CF3
N
F3C
O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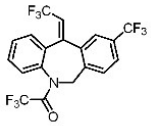
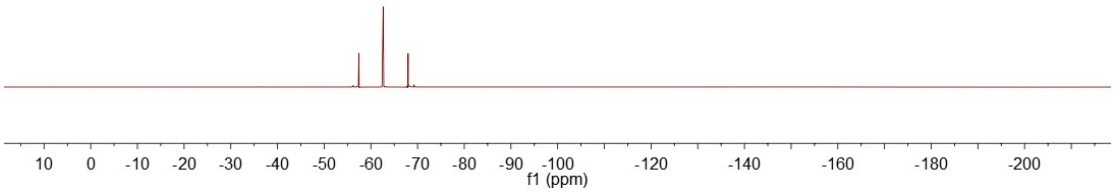
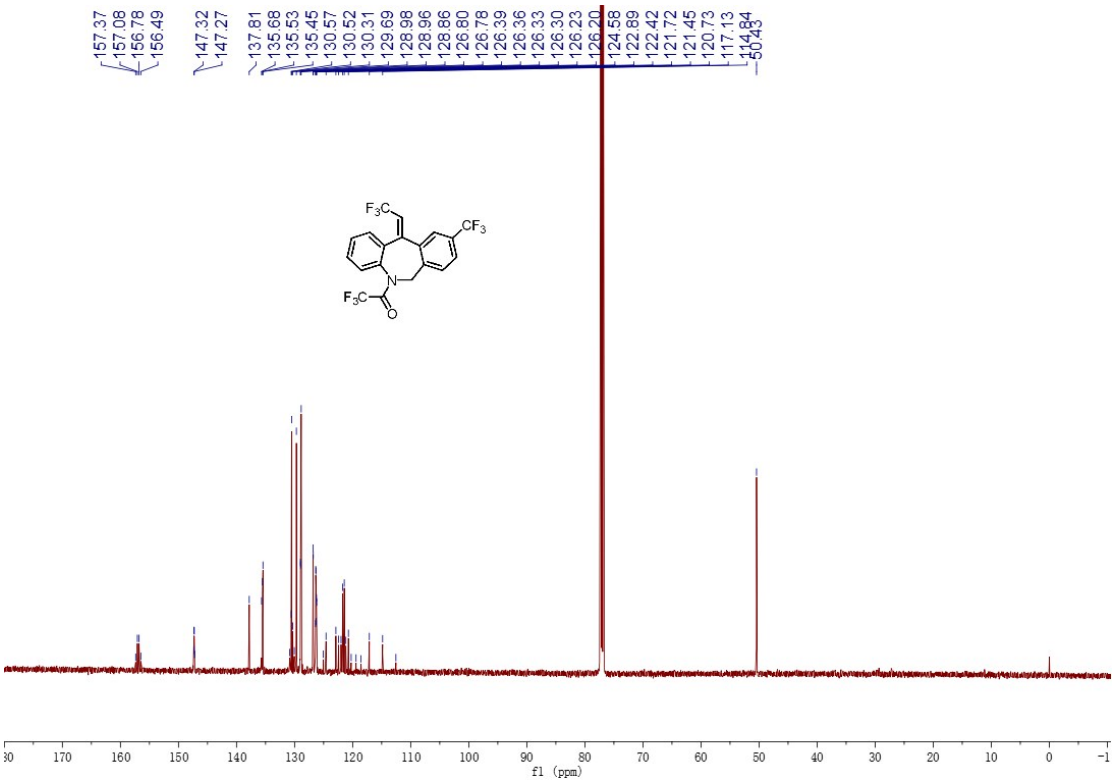
1.00
3.12
1.01
1.01
1.09
1.00
1.00
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-1.0
f1 (ppm)


57.43
62.63
67.97


F3C
CF3
N
F3C
O


10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-120
-140
-160
-180
-200
f1 (ppm)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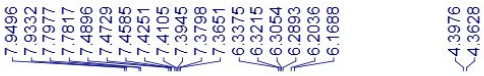
147.27
137.81
135.68
135.53
135.45
130.57
130.52
130.31
129.69
128.98
128.96
128.86
126.80
126.78
126.39
126.36
126.33
126.30
126.23
126.20
124.58
122.89
122.42
121.72
121.45
120.73
117.13
114.84
50.43
F3C
CF3
N
F3C
O
f1 (ppm)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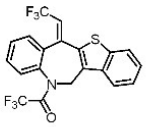
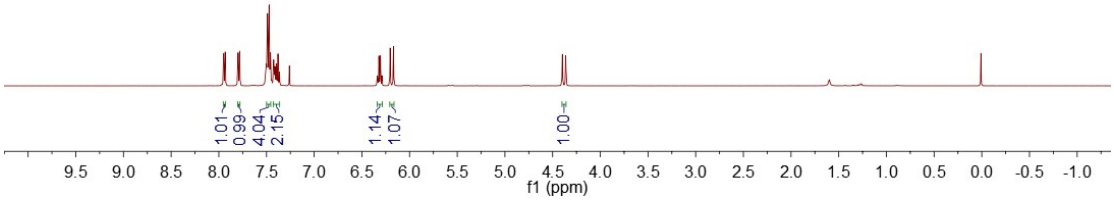
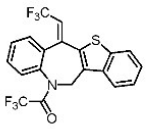
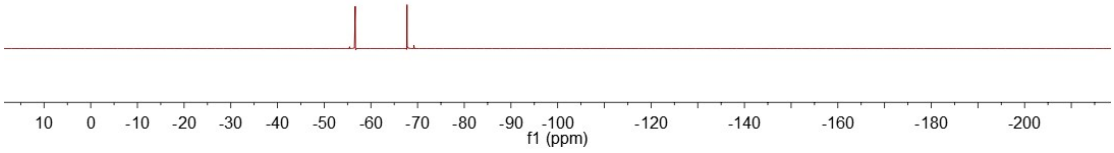
7.7817
7.4896
7.4729
7.4585
7.4251
7.4105
7.3945
7.3798
7.3651
6.3375
6.3215
6.3054
6.2893
6.2036
6.1688
4.3976
4.3628

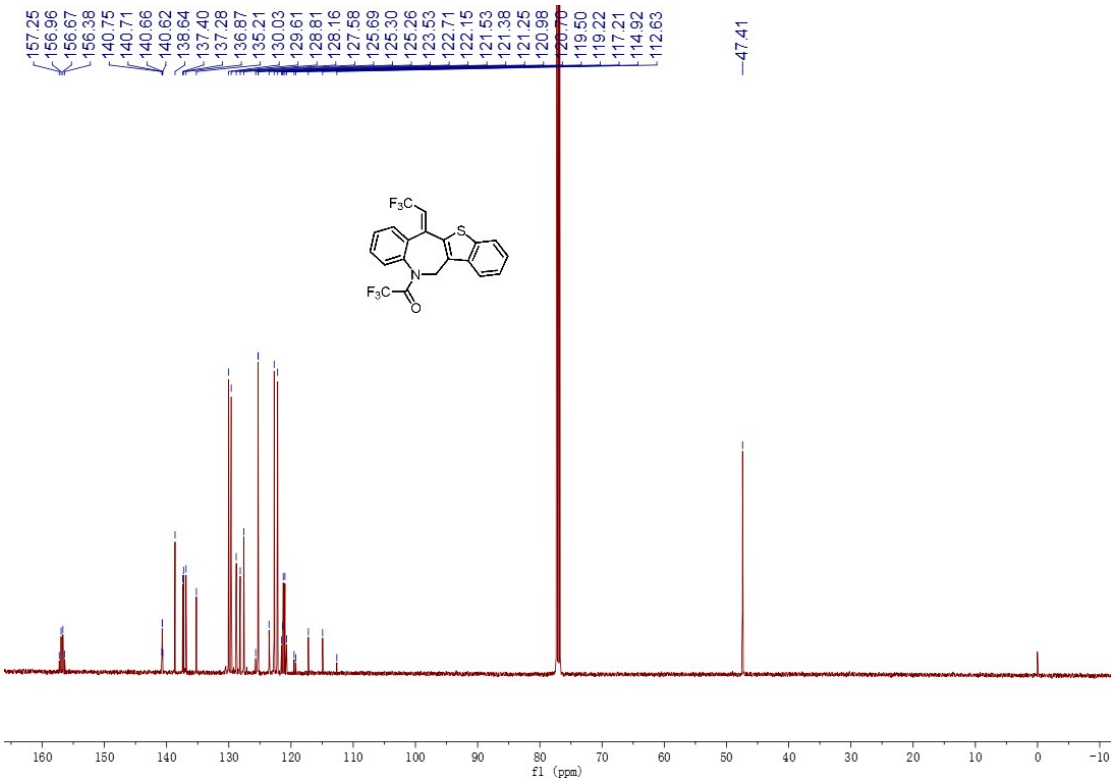

F3C
S
N
F3C
O


1.01
0.99
4.04
2.15
1.14
1.07
1.00
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 0.0 -0.5 -1.0
f1 (ppm)


-56.66
-67.75


F3C
S
N
F3C
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)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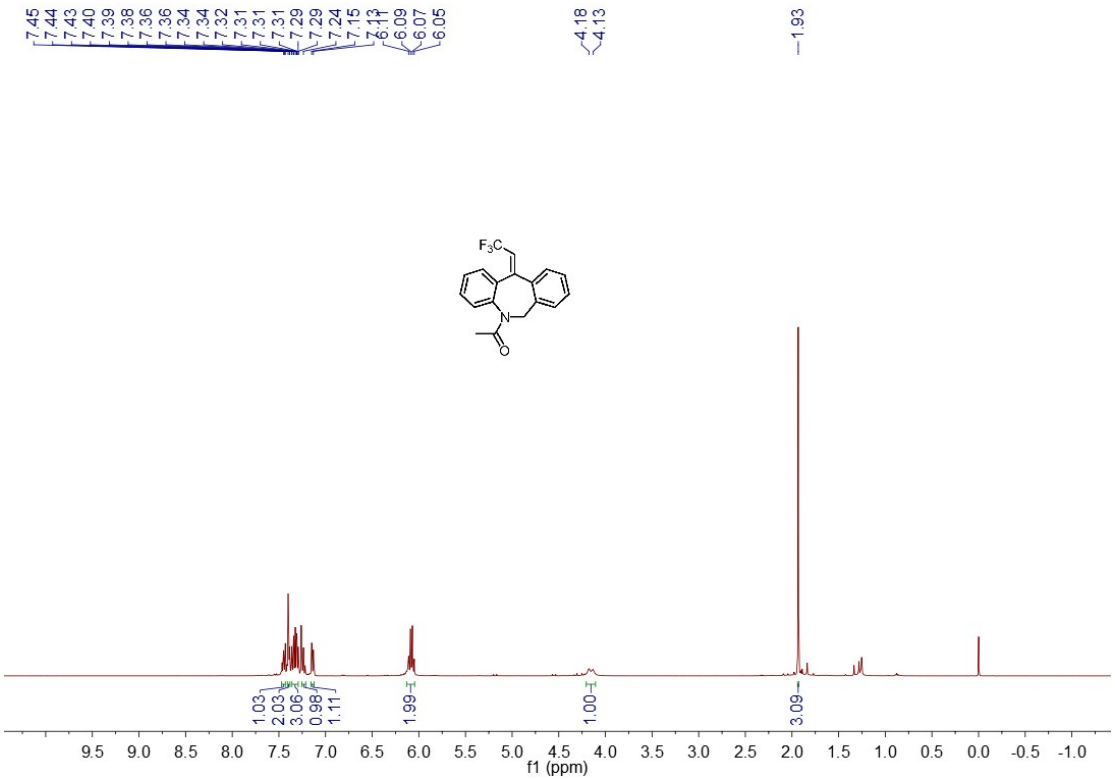
140.75
140.71
140.66
140.62
138.64
137.40
137.28
136.87
135.21
130.03
129.61
128.81
128.16
127.58
125.69
125.30
125.26
123.53
122.71
122.15
121.53
121.38
121.25
120.98
120.70
119.50
119.22
117.21
114.92
112.63
47.41
F3C
S
N
F3C
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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7.43
7.40
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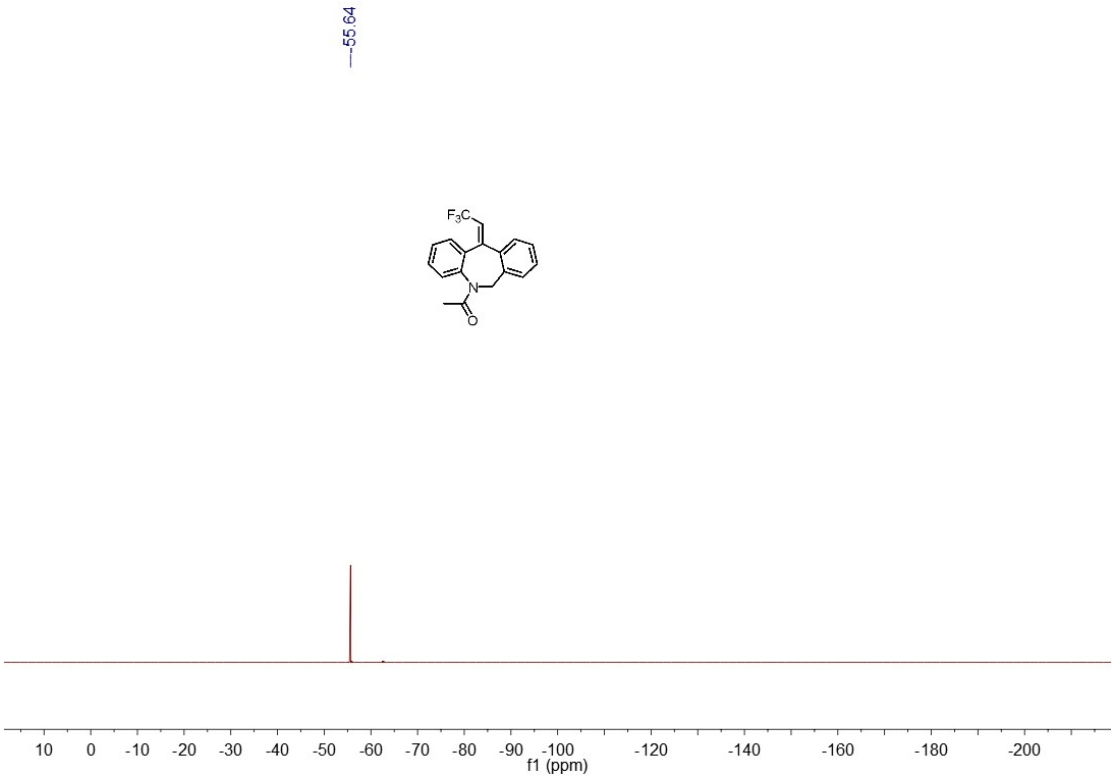
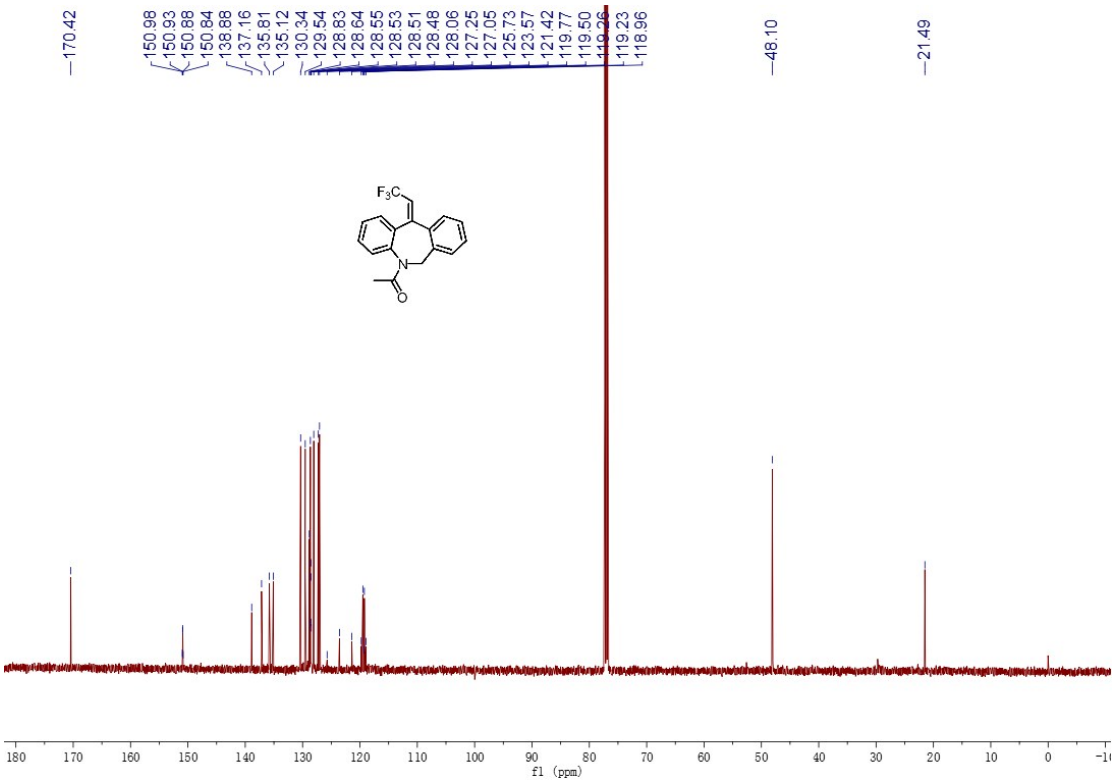
7.38
7.36
7.36
7.34
7.34
7.32
7.31
7.31
7.31
7.29
7.29
7.24
7.15
7.13
6.11
6.09
6.07
6.05
4.18
4.13
1.93
F3C
N
O
1.03
2.03
3.06
0.98
1.11
1.99
1.00
3.09
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


55.64
F3C
N
O
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)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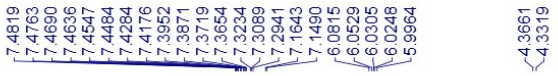
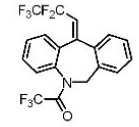
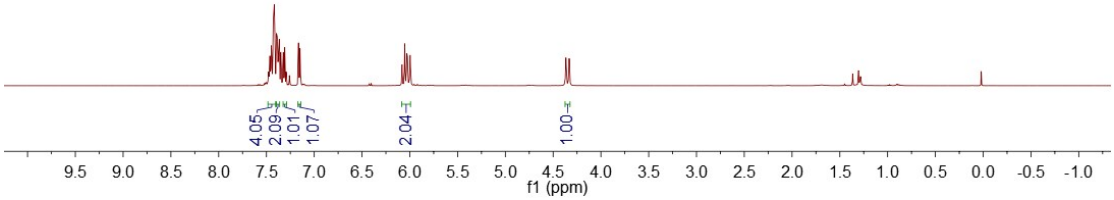
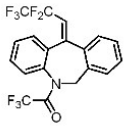
150.84
138.88
137.16
135.81
135.12
130.34
129.54
128.83
128.64
128.55
128.53
128.51
128.48
128.06
127.25
127.05
125.73
123.57
121.42
119.77
119.50
119.23
118.96
48.10
21.49
F3C
N
O
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

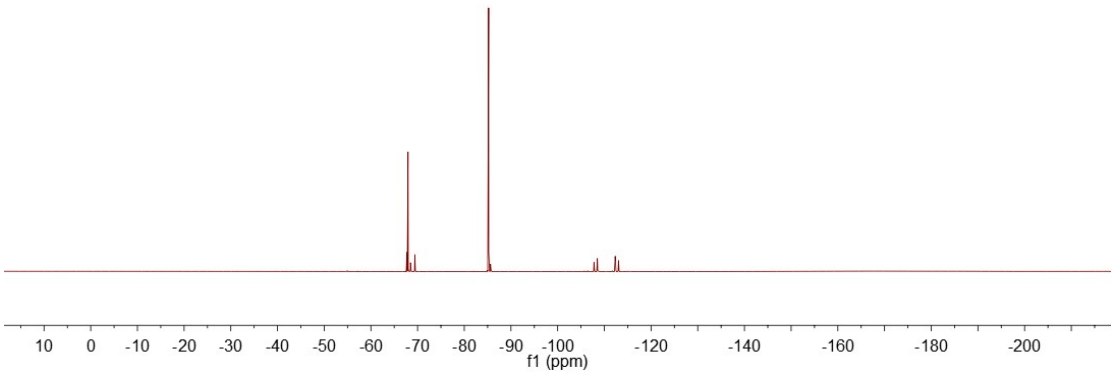

7.4819
7.4763
7.4690
7.4636
7.4547
7.4484
7.4284
7.4176
7.3952
7.3871
7.3719
7.3654
7.3234
7.3089
7.2941
7.1643
7.1490
6.0815
6.0529
6.0305
6.0248
5.9964
4.3661
4.3319

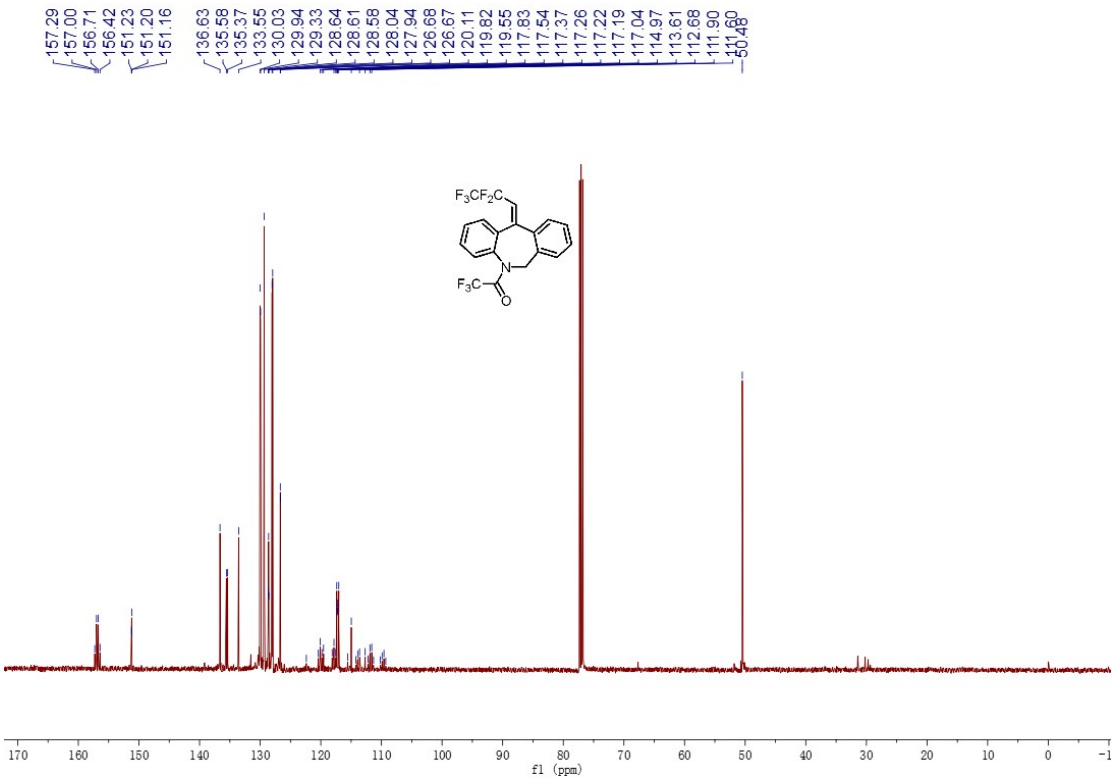

F3CF2C
F3C
N
O

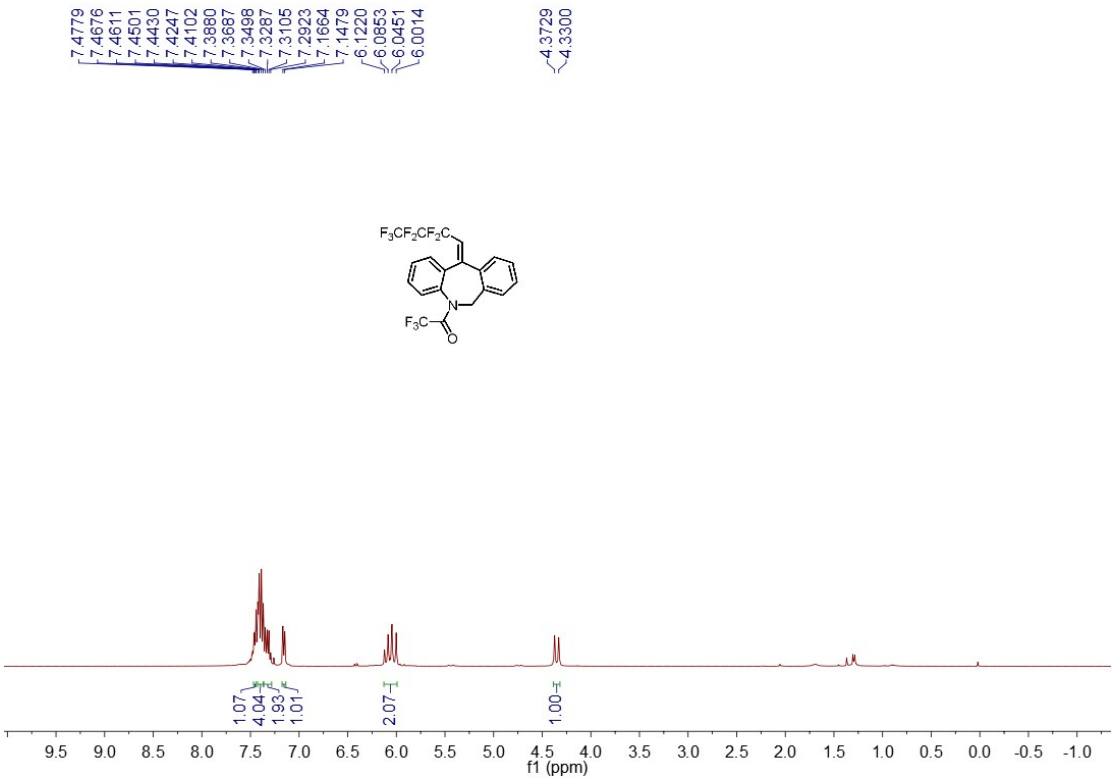

4.05
2.09
1.01
1.07
2.04
1.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

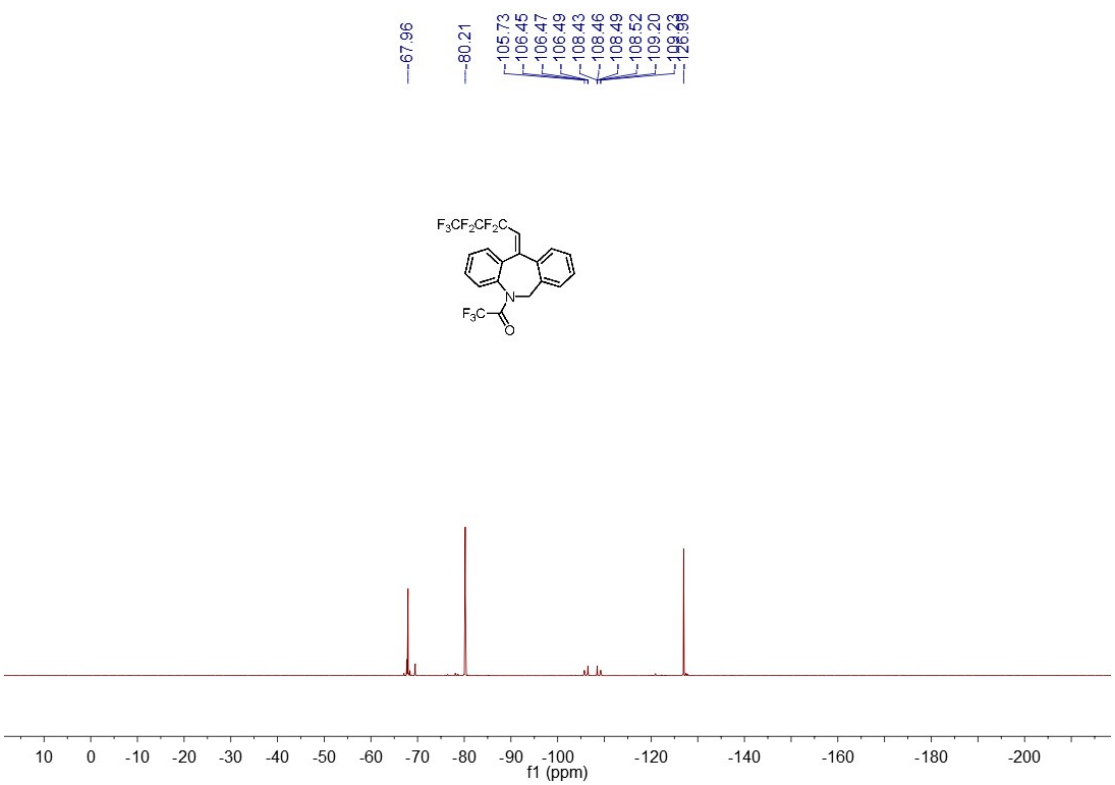

-67.95
-85.22
107.78
107.79
108.50
108.51
112.28
112.32
112.35
113.01
113.04
113.07

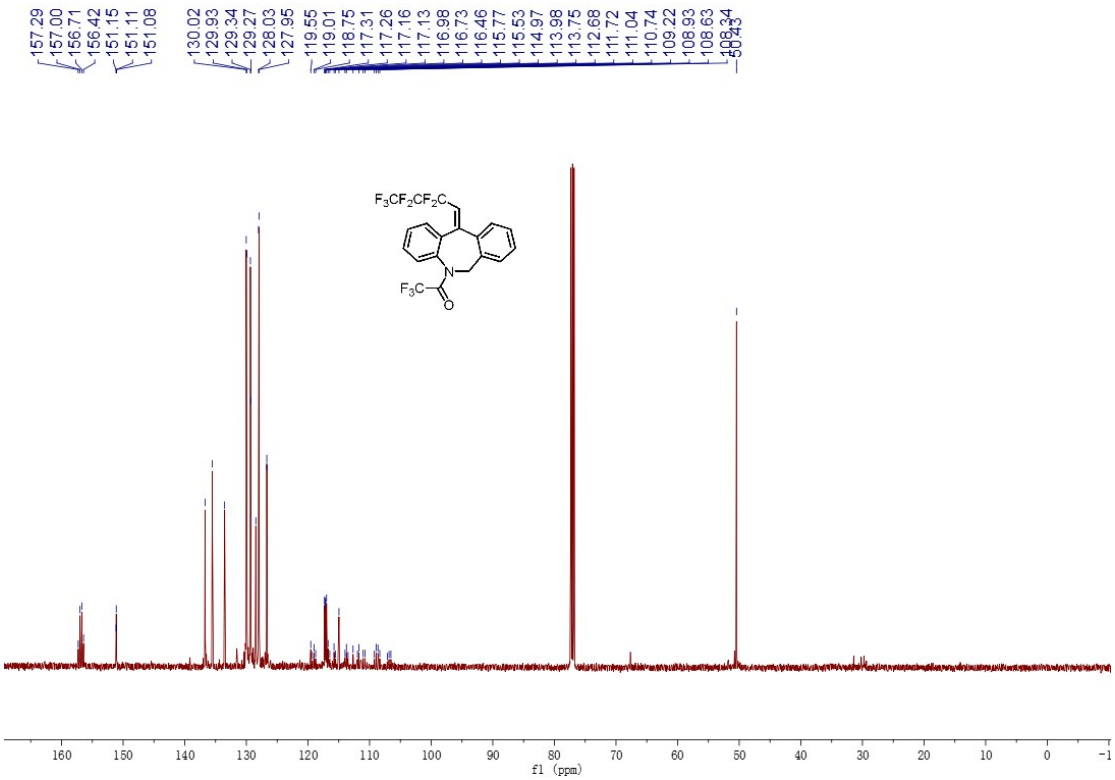

F3CF2C
F3C
N
O


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)


157.29
157.00
156.71
156.42
151.23
151.20
151.16
136.63
135.58
135.37
133.55
130.03
129.94
129.33
128.64
128.61
128.58
128.04
127.94
126.68
126.67
120.11
119.82
119.55
117.83
117.54
117.37
117.26
117.22
117.19
117.04
114.97
113.61
112.68
111.90
111.60
50.48
F3CF2C
F3C
O
N
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)


7.4779
7.4676
7.4611
7.4501
7.4430
7.4247
7.4102
7.3880
7.3687
7.3498
7.3287
7.3105
7.2923
7.1664
7.1479
6.1220
6.0853
6.0451
6.0014
4.3729
4.3300
F3CF2CF2C
F3C
O
N
1.07
4.04
1.93
1.01
2.07
1.00
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 0.0 -0.5 -1.0
f1 (ppm)


67.96
80.21
105.73
106.45
106.47
106.49
106.43
108.46
108.49
108.52
109.20
F3CF2CF2C
F3C
O
N
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)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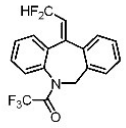
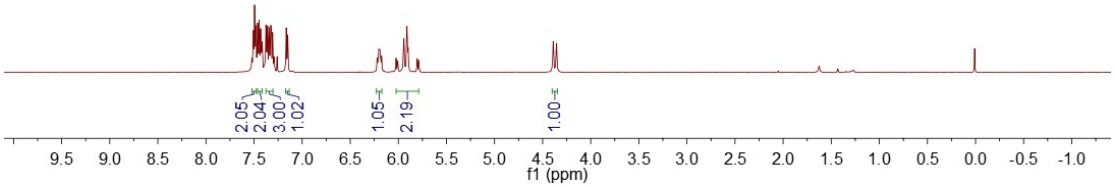
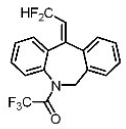
157.00
156.71
156.42
151.15
151.11
151.08
130.02
129.93
129.34
129.27
128.03
127.95
119.55
119.01
118.75
117.31
117.26
117.16
117.13
116.98
116.73
116.46
115.77
115.53
114.97
113.98
113.75
112.68
111.72
111.04
110.74
109.22
108.93
108.63
108.34
50.43
F3CF2CF2C
F3C
N
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)

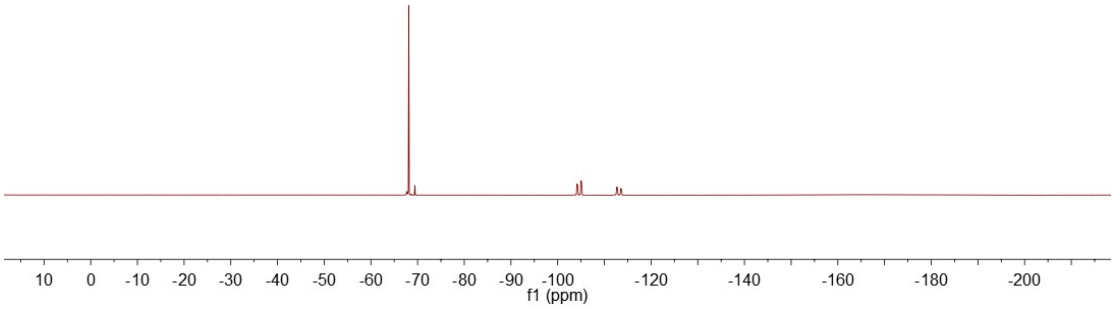

7.5205
7.5085
7.4949
7.4826
7.4630
7.4475
7.4312
7.4165
7.3764
7.3589
7.3439
7.3294
7.3259
7.3068
7.1651
7.1504
6.2194
6.2040
6.1968
6.1896
6.1742
6.0232
5.9426
5.9102
5.8982
4.3561

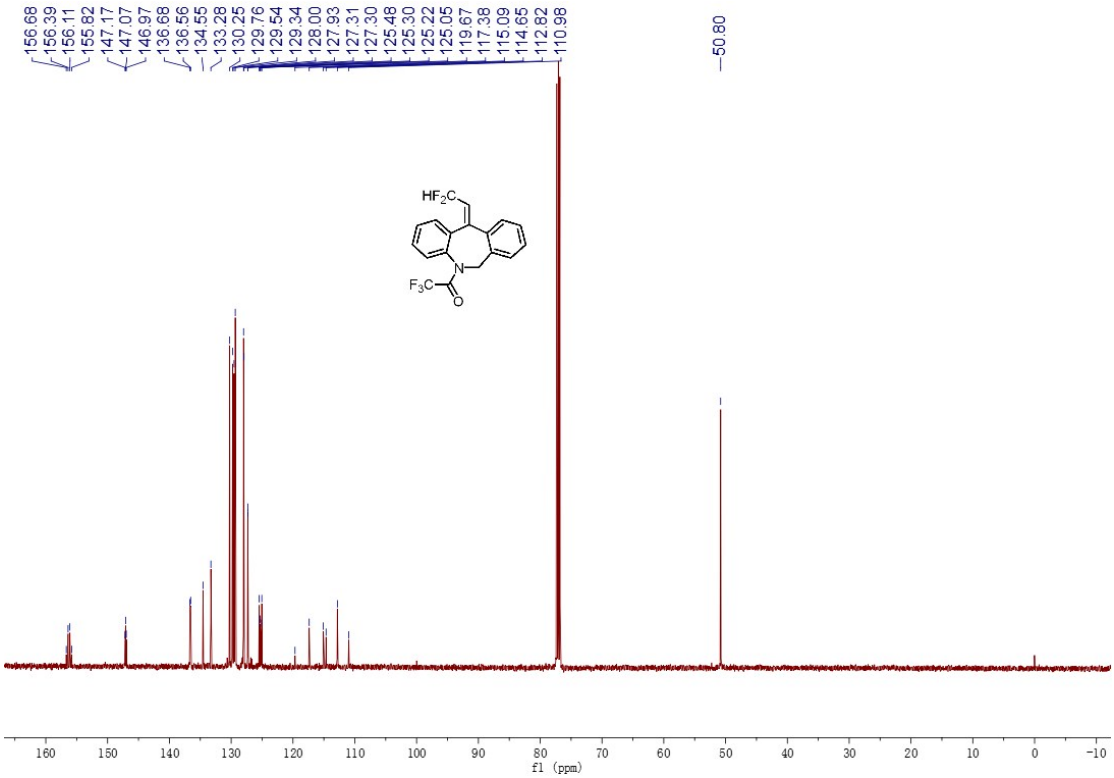

HF2C
F3C
O
N

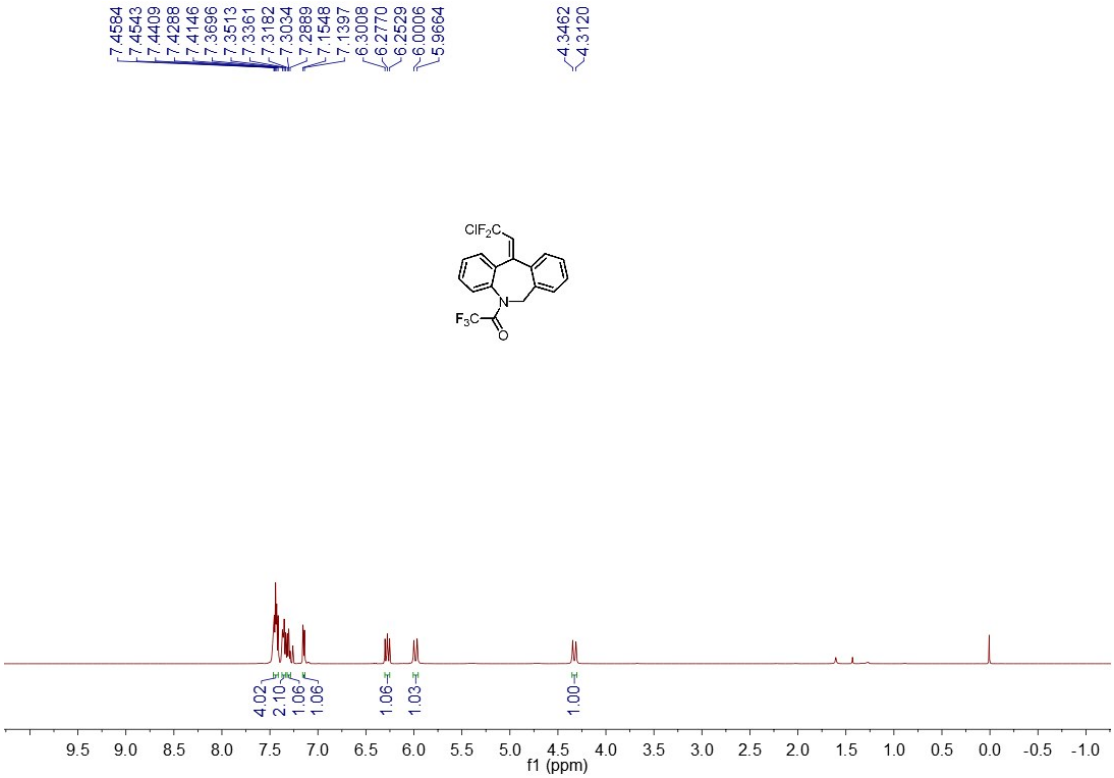

2.05
2.04
3.00
1.02
1.05
2.19
1.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)

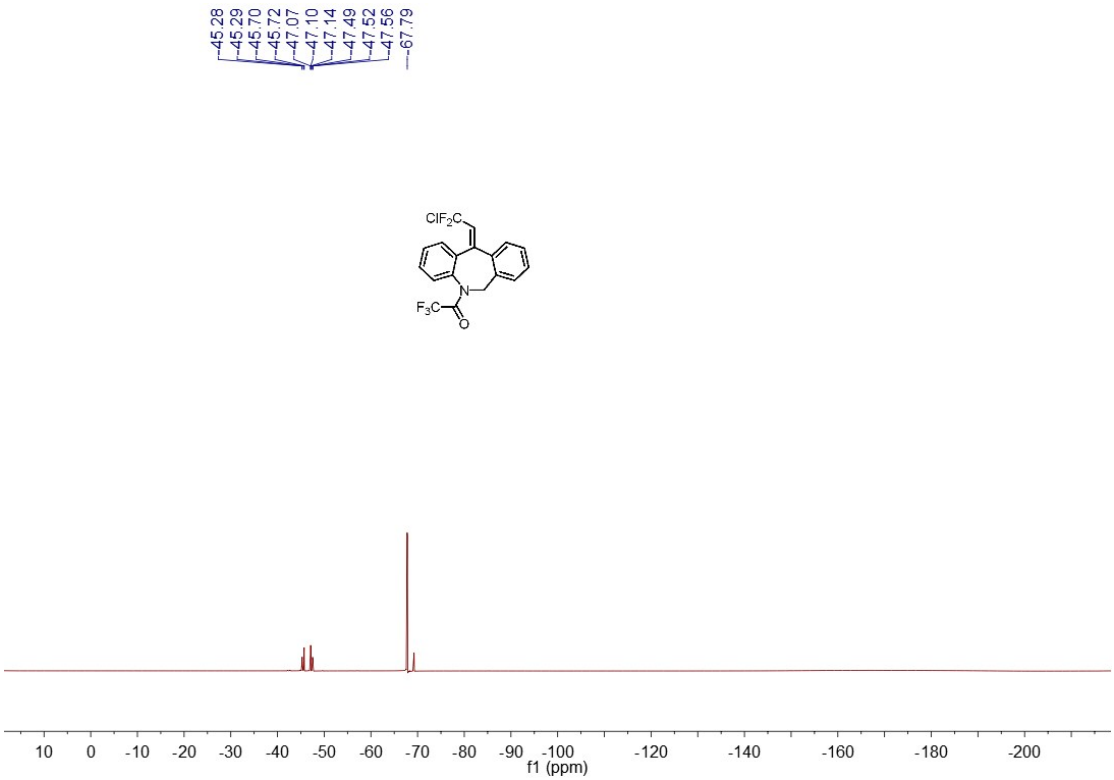

68.12
104.11
104.12
104.26
104.27
104.96
104.97
105.11
105.12
112.63
112.65
112.77
112.80
113.48
113.50
113.62
113.65

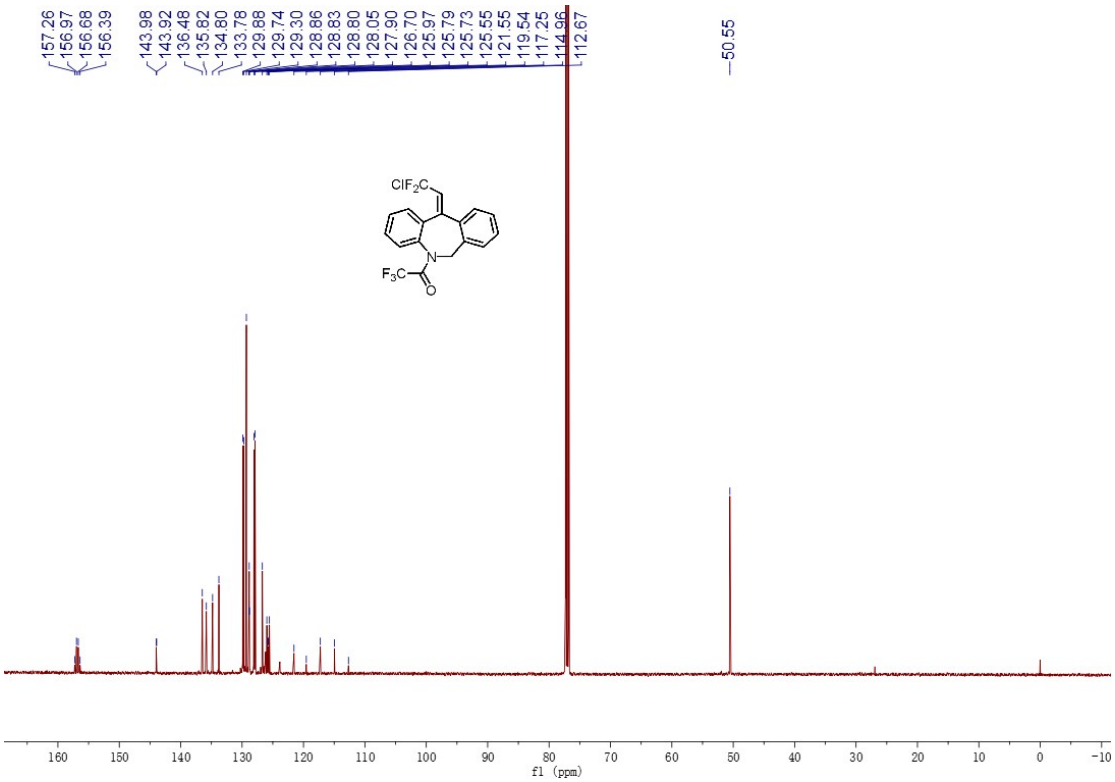

HF2C
F3C
O
N


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)

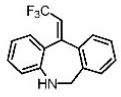

156.68
156.39
156.11
155.82
147.17
147.07
146.97
136.68
136.56
134.55
133.28
130.25
129.76
129.54
129.34
128.00
127.93
127.31
127.30
125.48
125.30
125.22
125.05
119.67
117.38
115.09
114.65
112.82
110.98
50.80
HF2C
F3C
N
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

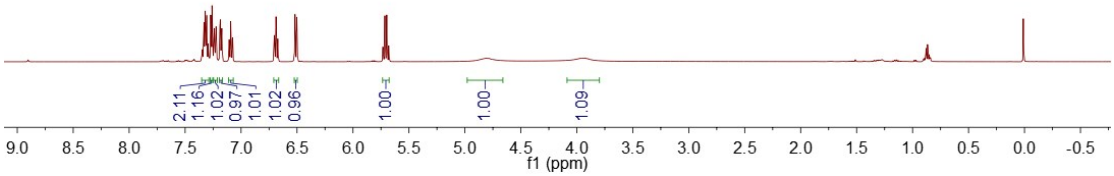

7.4584
7.4543
7.4409
7.4288
7.4146
7.3696
7.3513
7.3361
7.3182
7.3034
7.2889
7.1548
7.1397
6.3008
6.2770
6.2529
6.0006
5.9664
4.3462
4.3120
ClF2C
F3C
O
N
4.02
2.10
1.06
1.06
1.06
1.03
1.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1.0
f1 (ppm)


45.28
45.29
45.70
45.72
47.07
47.10
47.14
47.49
47.52
47.56
67.79
ClF2C
F3C
O
N
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)

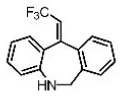

157.26
156.97
156.68
156.39
143.98
143.92
136.48
135.82
134.80
133.78
129.88
129.74
129.30
128.86
128.83
128.80
128.05
127.90
126.70
125.97
125.79
125.73
125.55
121.55
119.54
117.25
114.96
112.67
50.55
ClF2C
F3C
O
N
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

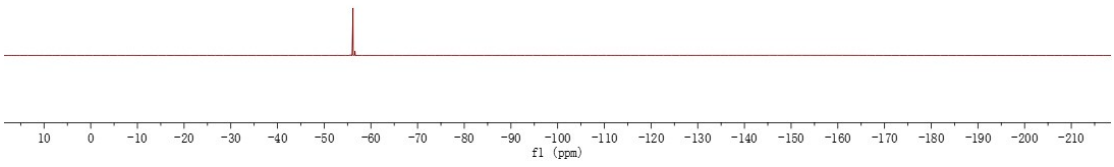

7.3347
7.3316
7.3216
7.3174
7.3100
7.3068
7.2719
7.2598
7.2395
7.2238
7.1854
7.1721
7.0926
7.0848
6.6878
6.6721
6.5180
6.5017
5.7325
5.7153
5.6980
5.6807
4.8135
3.9353

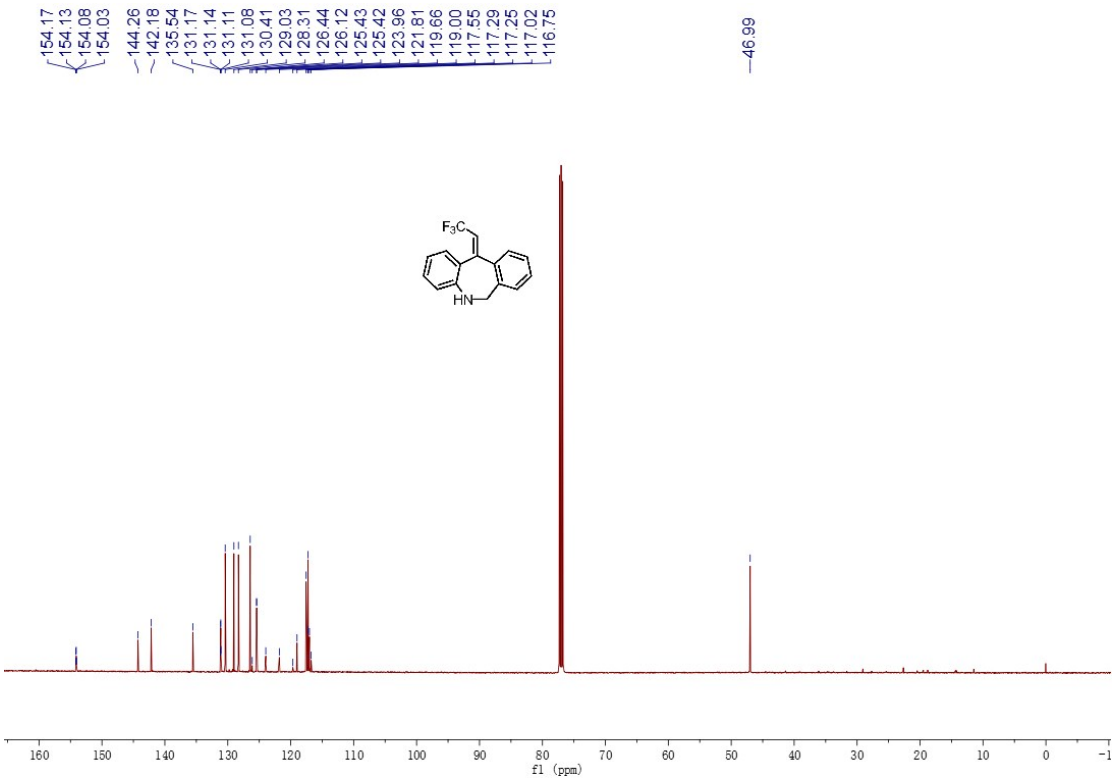

F3C
HN

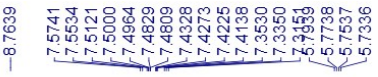

2.11
1.16
1.02
0.97
1.01
1.02
0.96
1.00
1.00
1.09
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

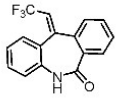

-56.17

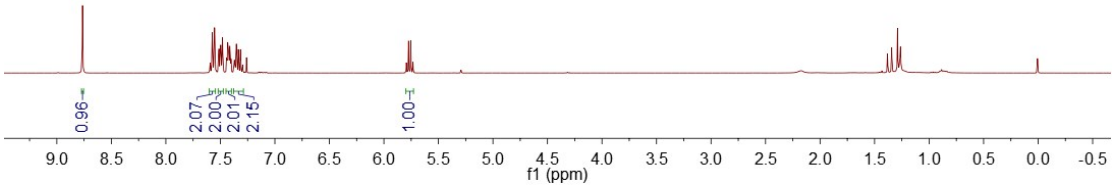

F3C
HN


10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

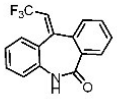

154.17
154.13
154.08
154.03
144.26
142.18
135.54
131.17
131.14
131.11
131.08
130.41
129.03
128.31
126.44
126.12
125.43
125.42
123.96
121.81
119.66
119.00
117.55
117.29
117.25
117.02
116.75
46.99
F3C
HN
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)

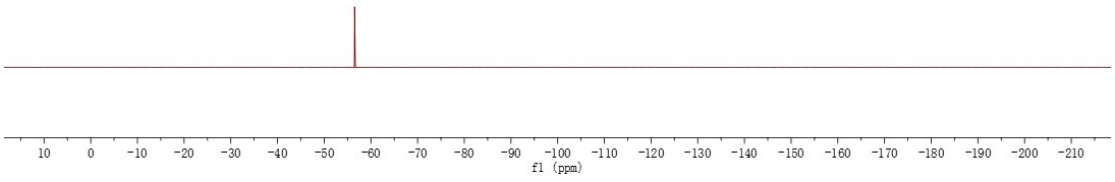

8.7639
7.5741
7.5534
7.5121
7.5000
7.4964
7.4829
7.4809
7.4328
7.4273
7.4225
7.4138
7.3530
7.3350
5.7738
5.7537
5.7336

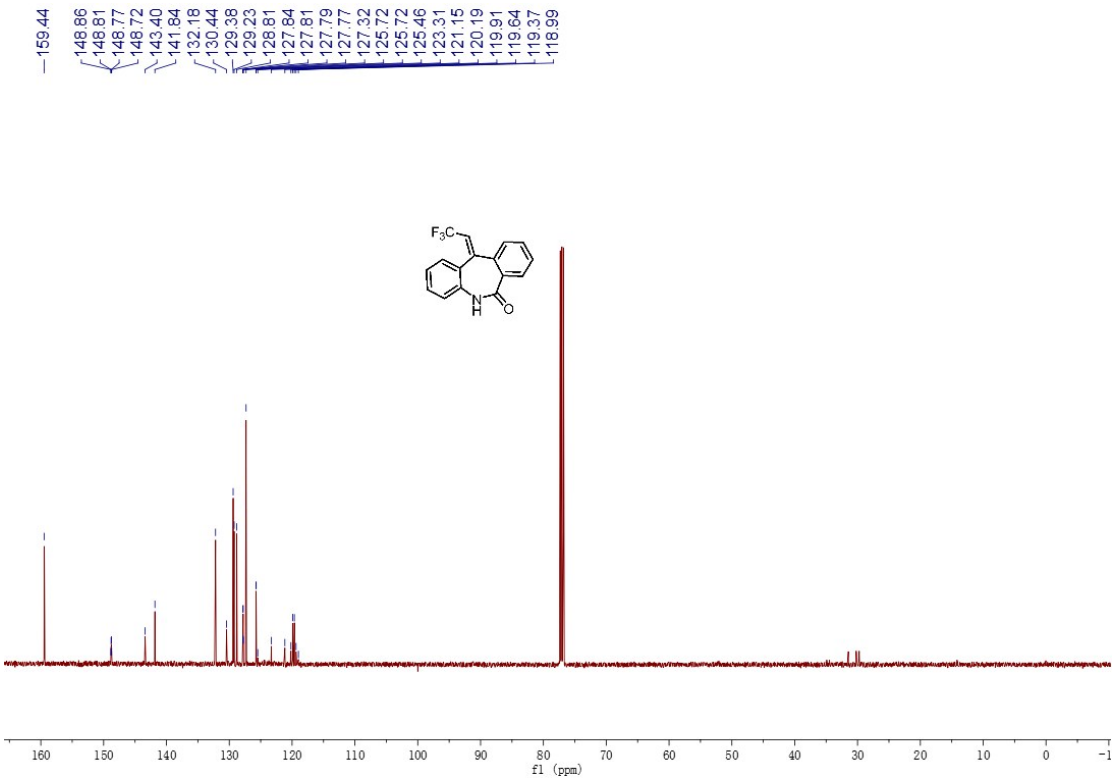

F3C
N
H
O


0.96
2.07
2.00
2.01
2.15
1.00
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
0.0
-0.5
f1 (ppm)

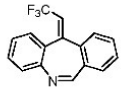

-56.51

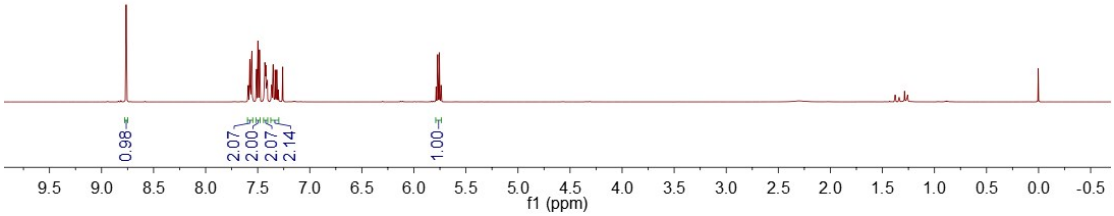

F3C
N
H
O

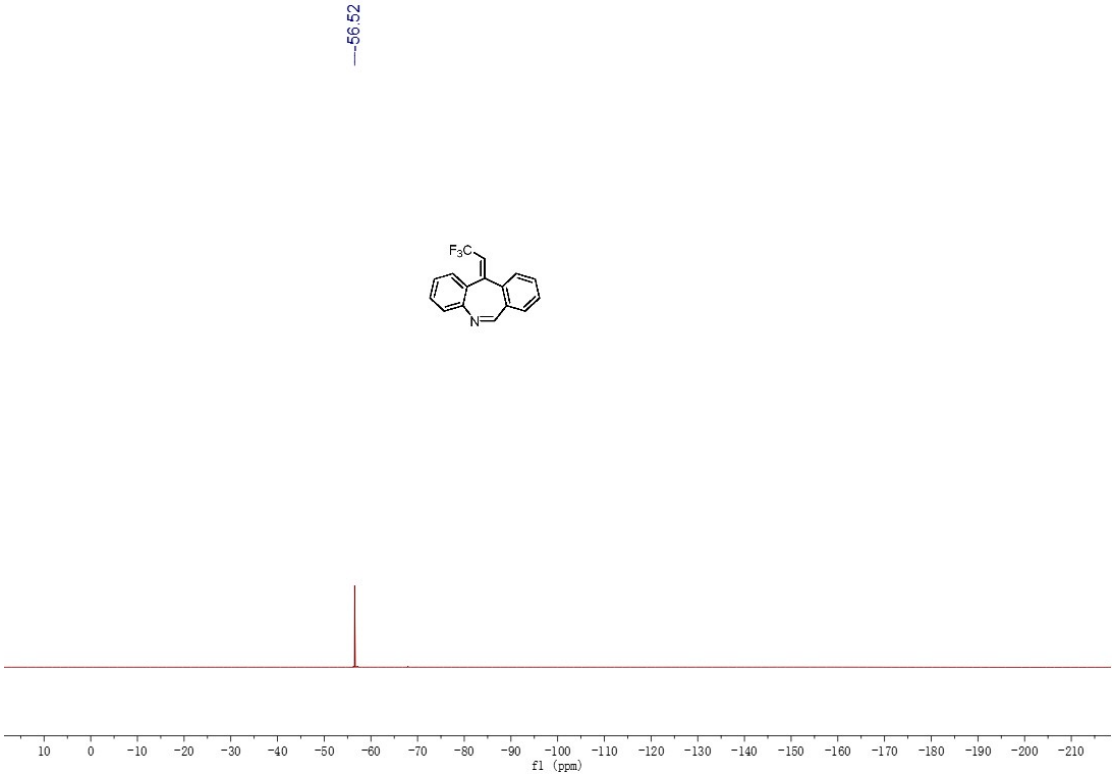

10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)


159.44
148.86
148.81
148.77
148.72
143.40
141.84
132.18
130.44
129.38
129.23
128.81
127.84
127.81
127.79
127.77
127.32
125.72
125.72
125.46
123.31
121.15
120.19
119.91
119.64
119.37
118.99
F3C
N
H
O
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)

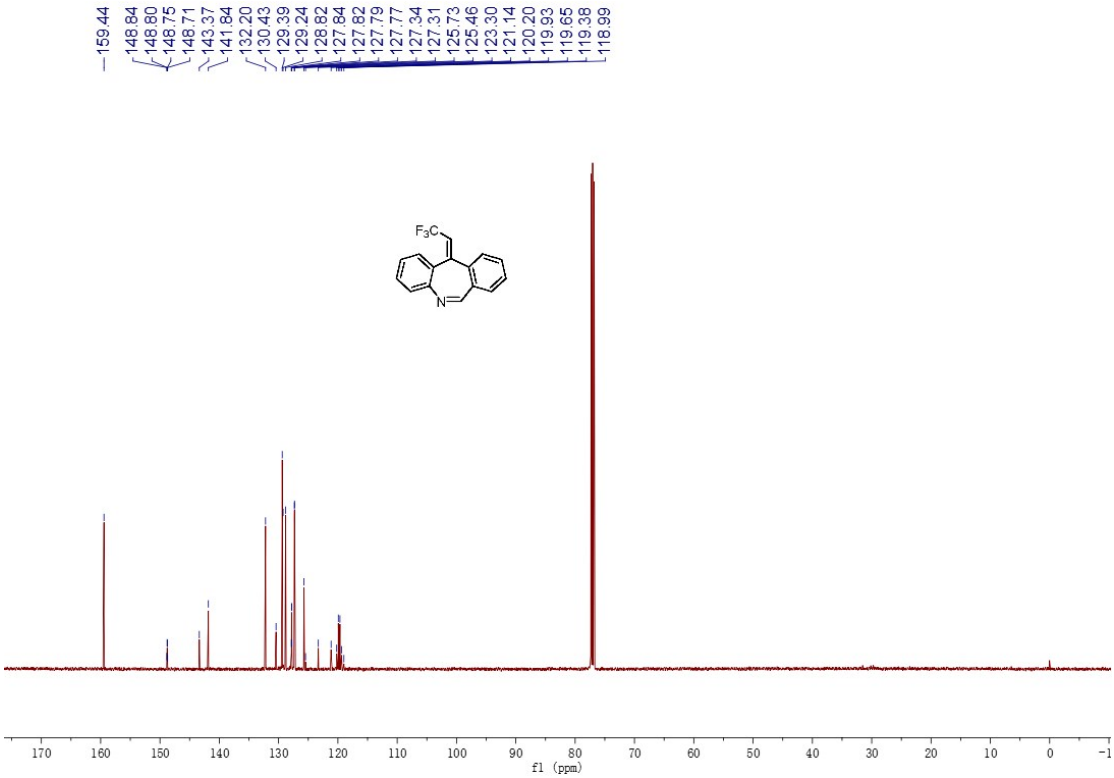

8.7636
7.5786
7.5759
7.5613
7.5559
7.4984
7.4829
7.4315
7.4263
7.4229
7.4162
7.3523
7.3327
7.3302
7.3162
7.3089
5.7709
5.7548
5.7387

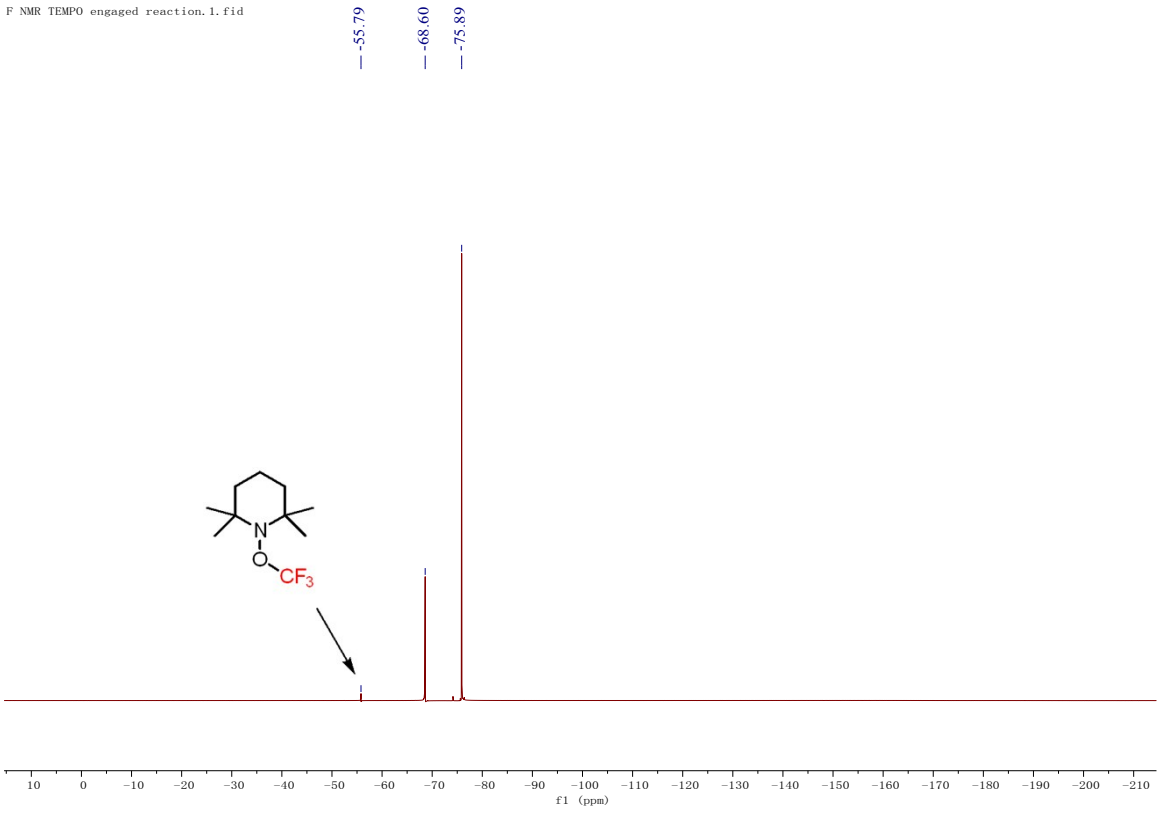

F3C
N


0.98
2.07
2.00
2.07
2.14
1.00
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 0.0 -0.5
f1 (ppm)

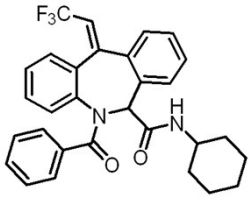

-56.52
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

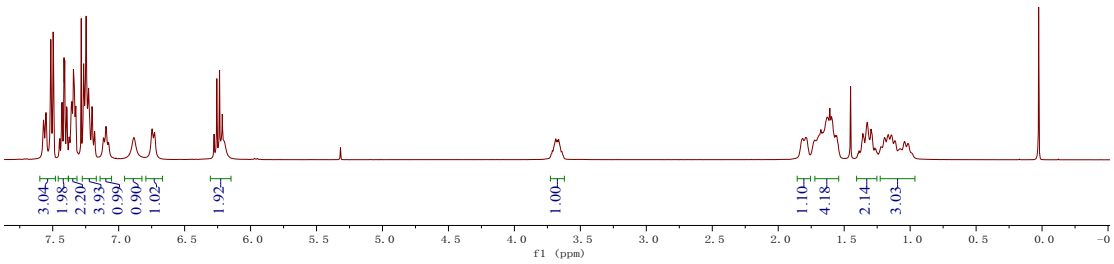
F3C
N

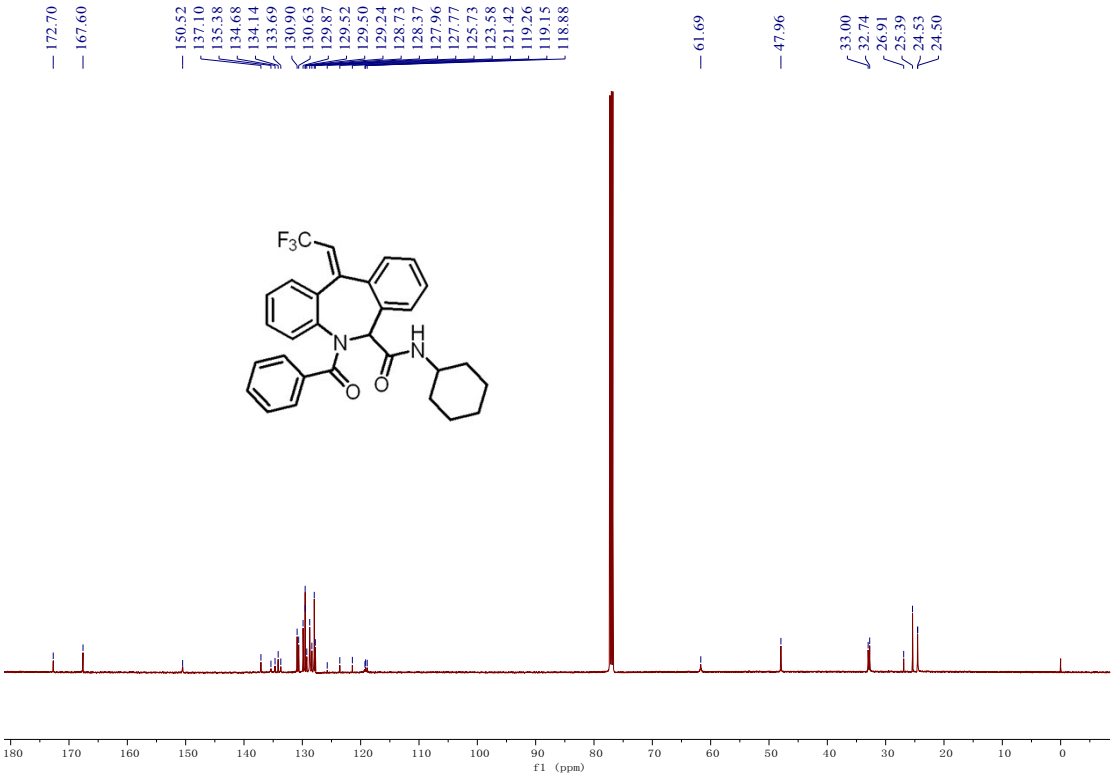

159.44
148.84
148.80
148.75
148.71
143.37
141.84
132.20
130.43
129.39
129.24
128.82
127.84
127.82
127.79
127.77
127.34
127.31
125.73
125.46
123.30
121.14
120.20
119.93
119.65
119.38
118.99
F3C
N
f1 (ppm)

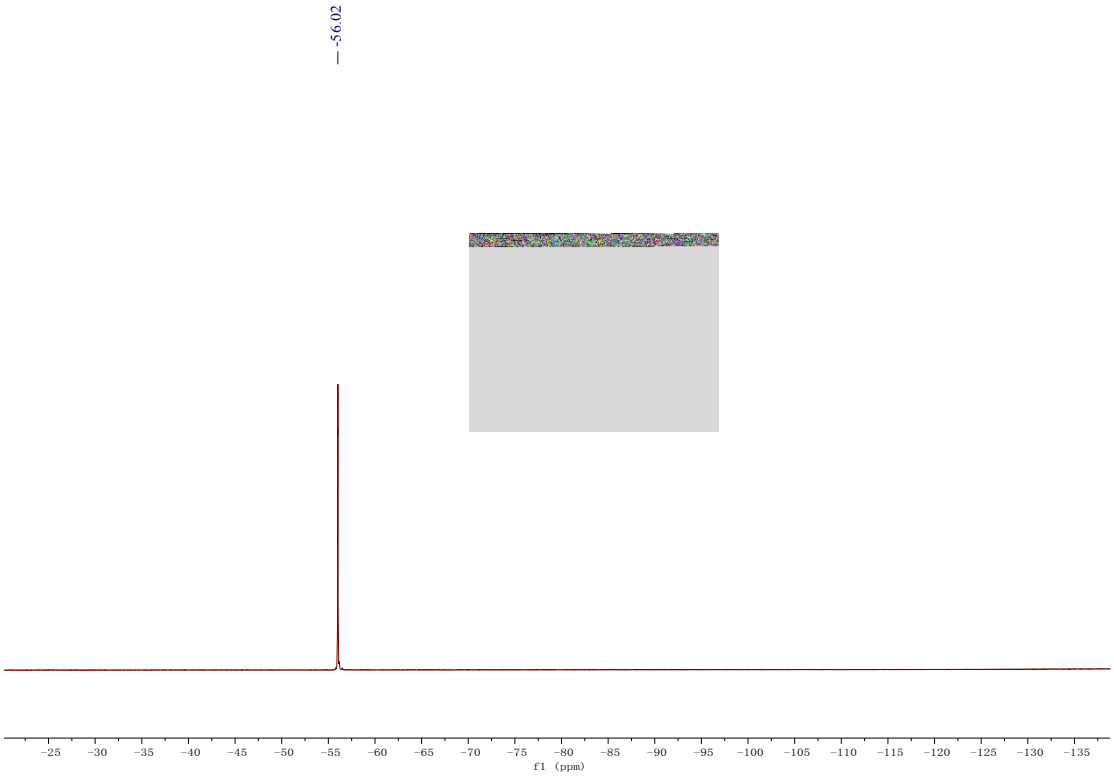

F NMR TEMPO engaged reaction.1.fid
-55.79
-68.60
-75.89
N
O
CF3
f1 (ppm)

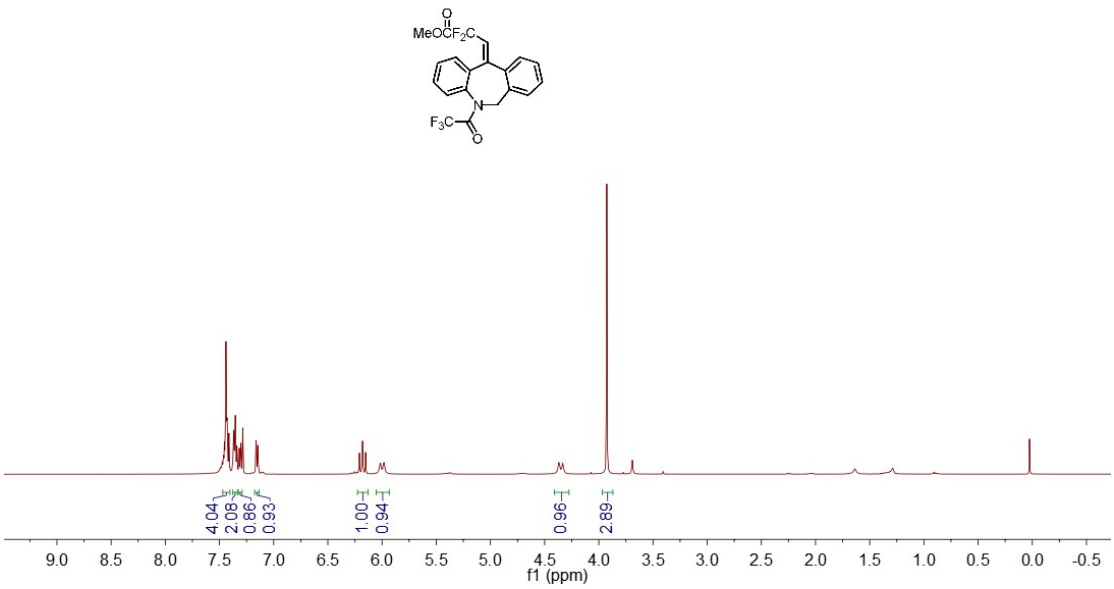

7.571
7.567
7.553
7.548
7.514
7.502
7.497
7.493
7.432
7.428
7.414
7.409
7.395
7.391
7.365
7.362
7.358
7.354
7.350
7.343
7.337
7.333
7.328
7.325
7.321
7.284
7.265
7.247
7.229
7.227
7.219
7.202
7.183
7.096
6.747
6.727
6.277
6.256
6.235
6.214
1.677
1.663
1.654
1.641
1.631
1.620
1.609
1.597
1.589
1.578
1.567
1.557
1.359
1.329
1.324
1.316
1.297
1.289
1.165
1.144

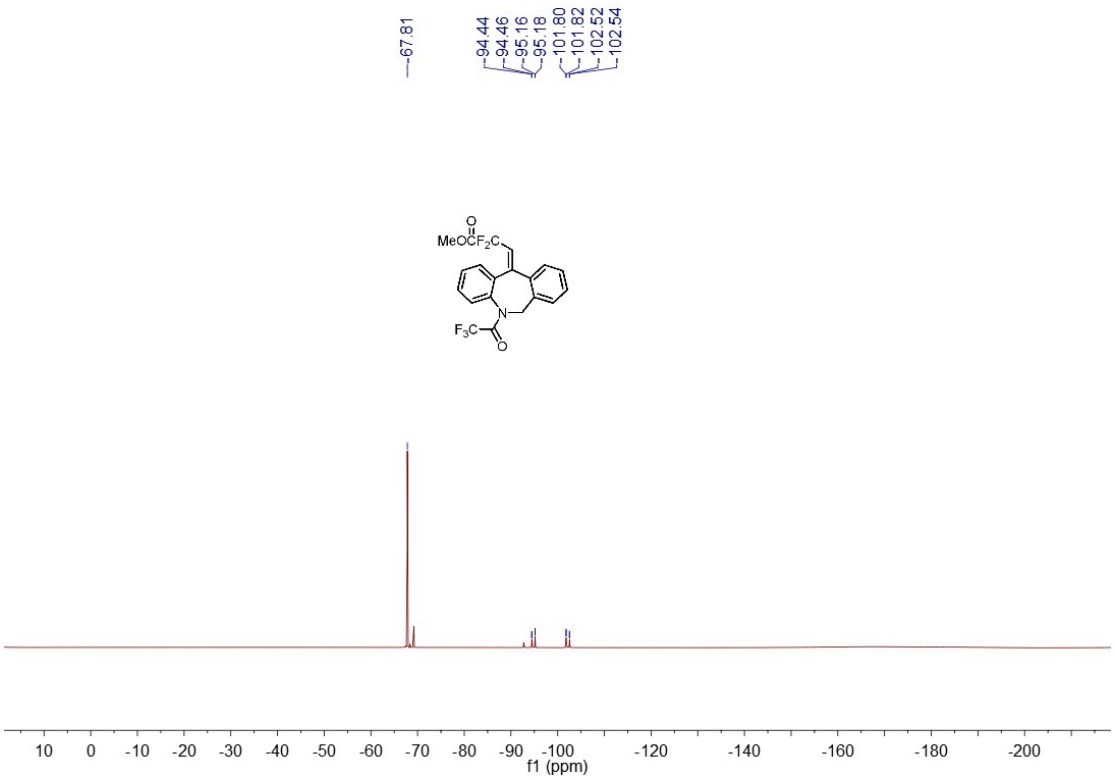

F3C
N
H
N
O
O

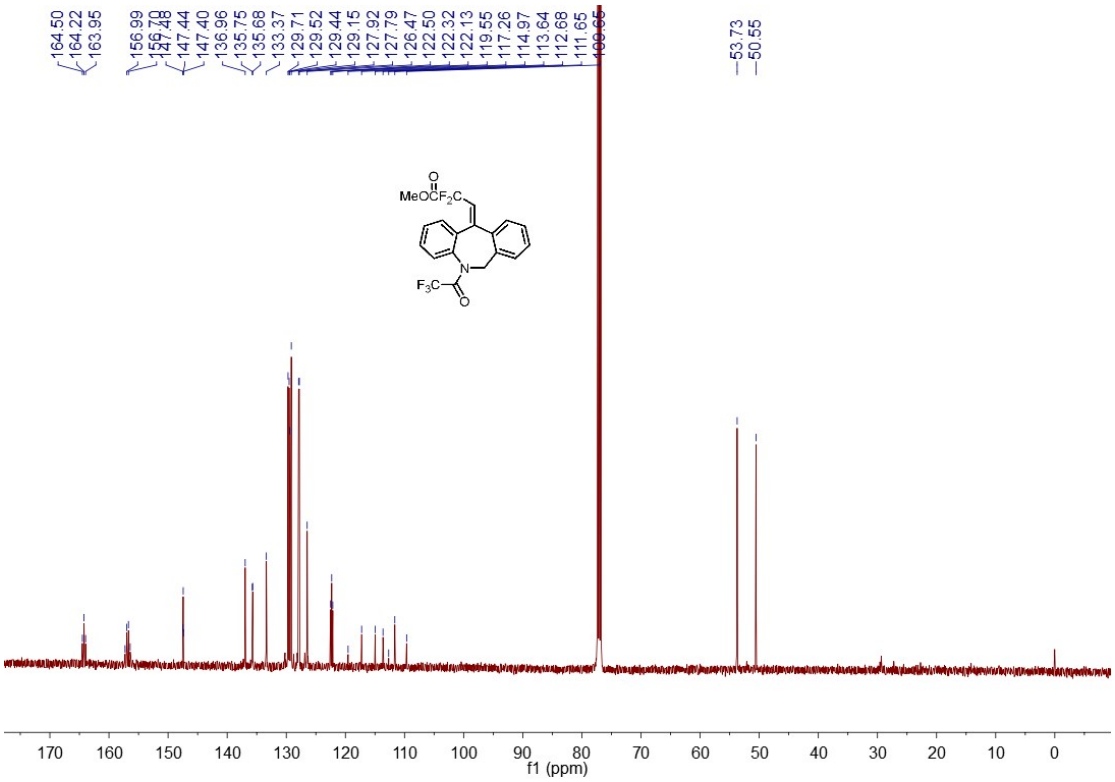

3.04
1.98
2.20
3.93
0.99
0.90
1.02
1.92
1.00
1.10
4.18
2.14
3.03
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

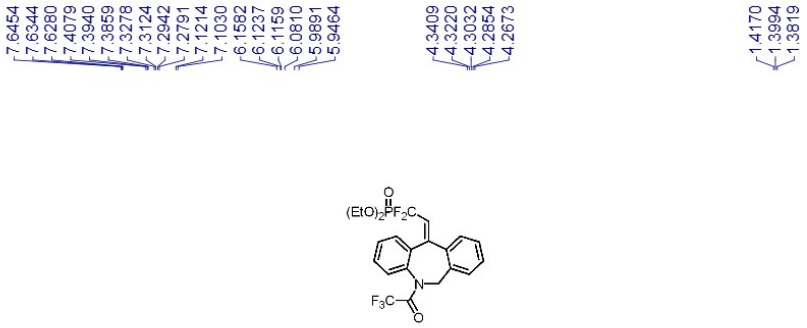

172.70
167.60
150.52
137.10
135.38
134.68
134.14
133.69
130.90
130.63
129.87
129.52
129.50
129.24
128.73
128.37
127.96
127.77
125.73
123.58
121.42
119.26
119.15
118.88
61.69
47.96
33.00
32.74
26.91
25.39
24.53
24.50
F3C
N
H
N
O
O
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

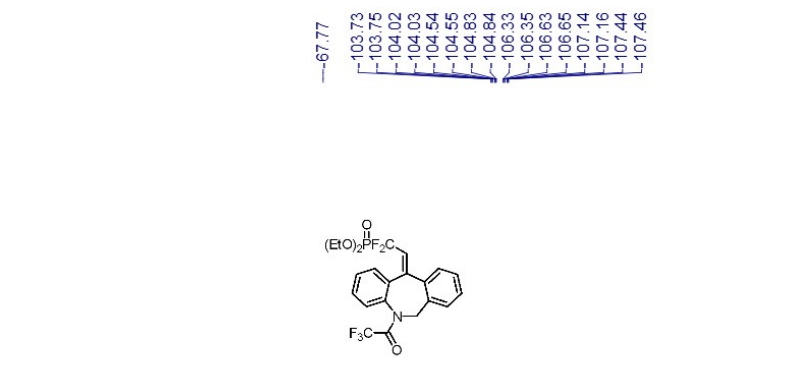

-56.02
-25 -30 -35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90 -95 -100 -105 -110 -115 -120 -125 -130 -135
f1 (ppm)

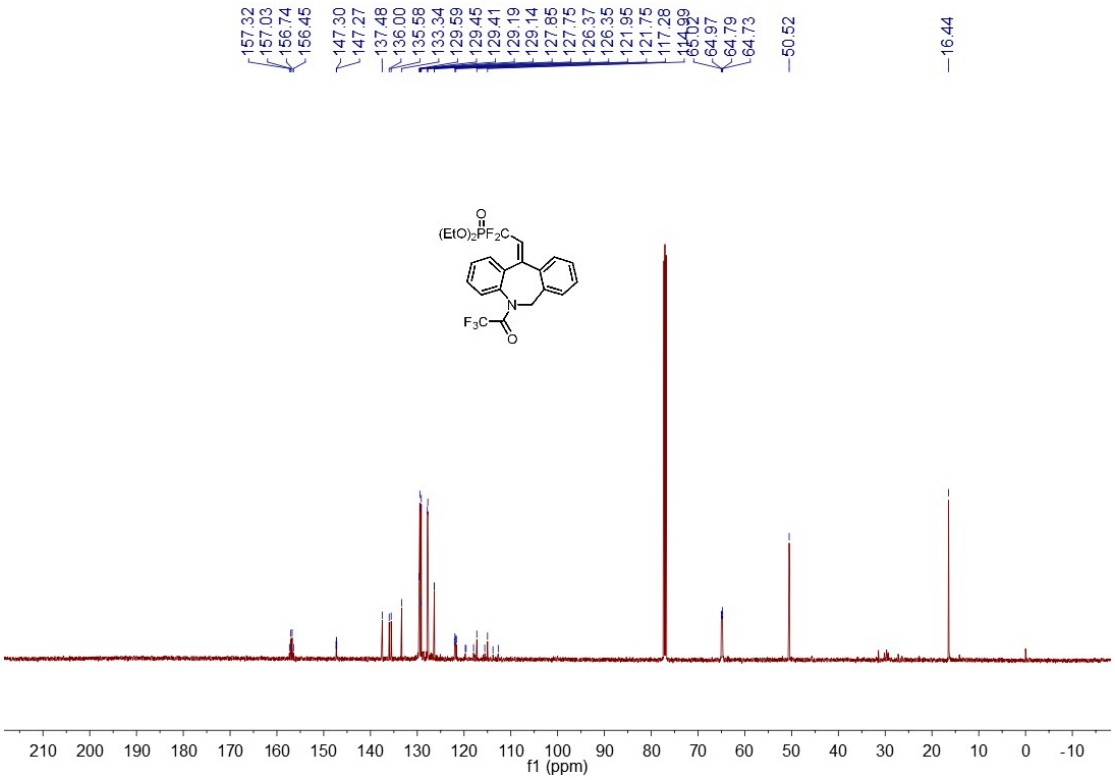

O
MeOCF2C
F3C
O
4.04
2.08
0.86
0.93
1.00
0.94
0.96
2.89
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

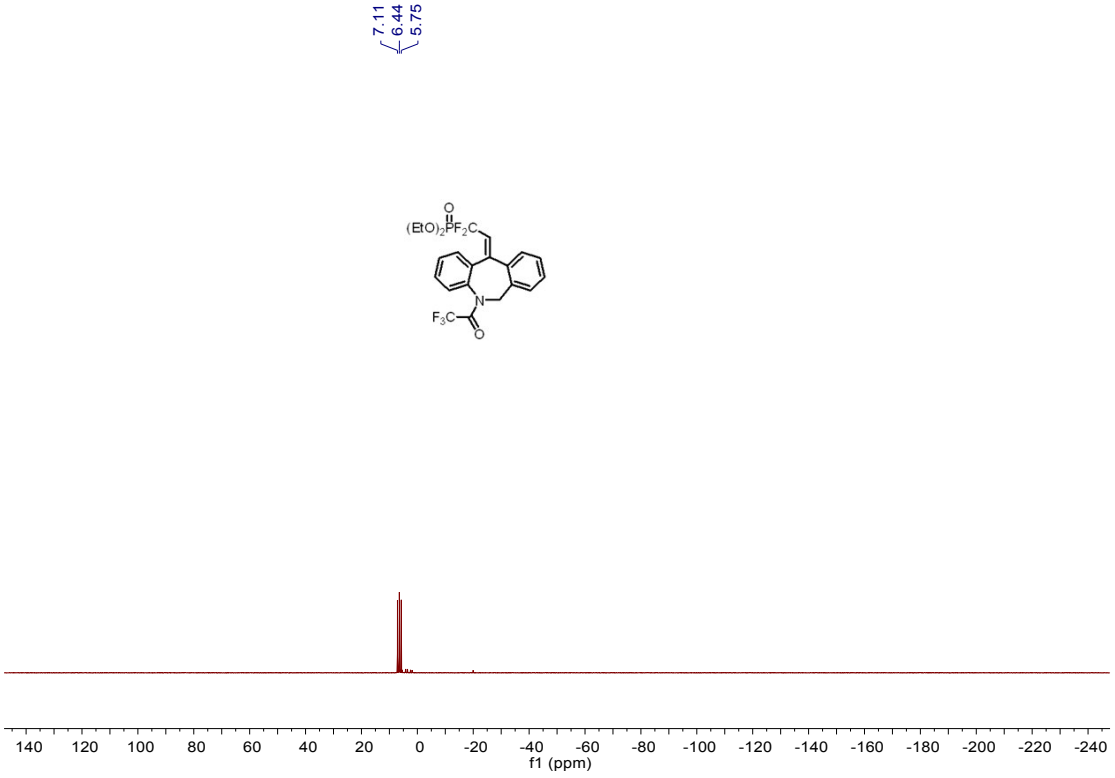

-67.81
-94.44
-94.46
-95.16
-95.18
-101.80
-101.82
-102.52
-102.54
MeOCF2C
F3C
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)


164.50
164.22
163.95
156.99
156.70
147.48
147.44
147.40
136.96
135.75
135.68
133.37
129.71
129.52
129.44
129.15
127.92
127.79
126.47
122.50
122.32
122.13
119.55
117.26
114.97
113.64
112.68
111.65
53.73
50.55
MeOCF2C
F3C
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


7.6454
7.6344
7.6280
7.4079
7.3940
7.3859
7.3278
7.3124
7.2942
7.2791
7.1214
7.1030
6.1582
6.1237
6.1159
6.0810
5.9891
5.9464
4.3409
4.3220
4.3032
4.2854
4.2673
1.4170
1.3994
1.3819
0.95
3.07
2.94
1.02
1.12
1.00
5.07
6.02
f1 (ppm)

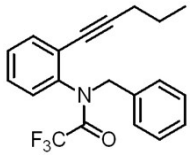

-67.77
103.73
103.75
104.02
104.03
104.54
104.55
104.83
104.84
106.33
106.35
106.63
106.65
107.14
107.16
107.44
107.46
f1 (ppm)

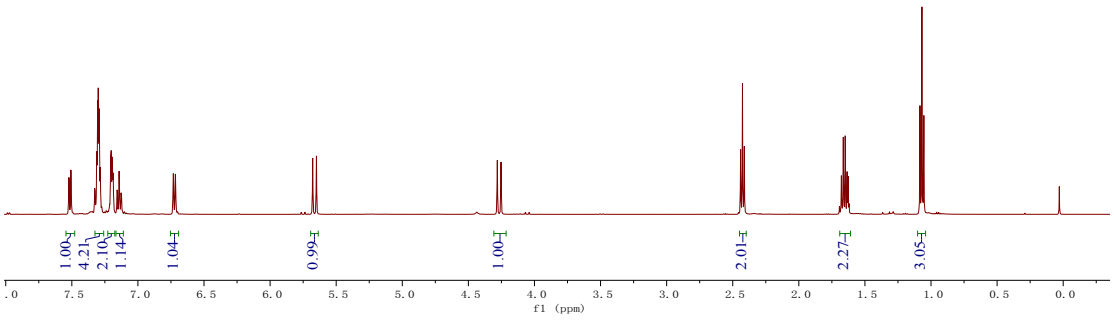

157.32
157.03
156.74
156.45
147.30
147.27
137.48
136.00
135.58
133.34
129.59
129.45
129.41
129.19
129.14
127.85
127.75
126.37
126.35
121.95
121.75
117.28
114.99
85.02
64.97
64.79
64.73
50.52
16.44
(EtO)2PF2C
F3C
N
O
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.11
6.44
5.75
(EtO)2PF2C
F3C
N
O
140 120 100 80 60 40 20 0 -20 -40 -60 -80 -100 -120 -140 -160 -180 -200 -220 -240
f1 (ppm)


7.523
7.520
7.508
7.505
7.328
7.325
7.312
7.310
7.305
7.300
7.294
7.291
7.284
7.206
7.202
7.195
7.187
7.158
7.155
7.143
7.140
7.127
7.124
6.732
6.716
5.678
5.650
4.281
4.253

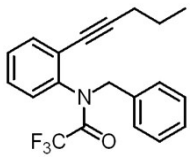

2.441
2.426
2.412
1.693
1.678
1.672
1.664
1.649
1.635
1.627
1.620
1.084
1.069
1.054

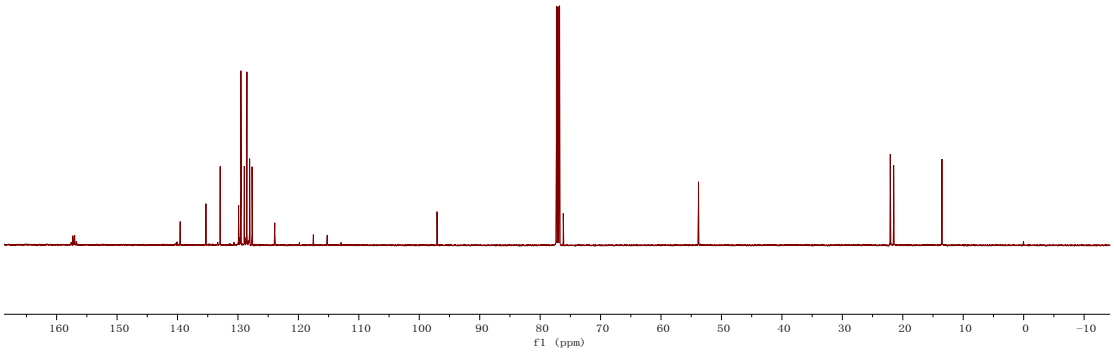

N
F3C
O

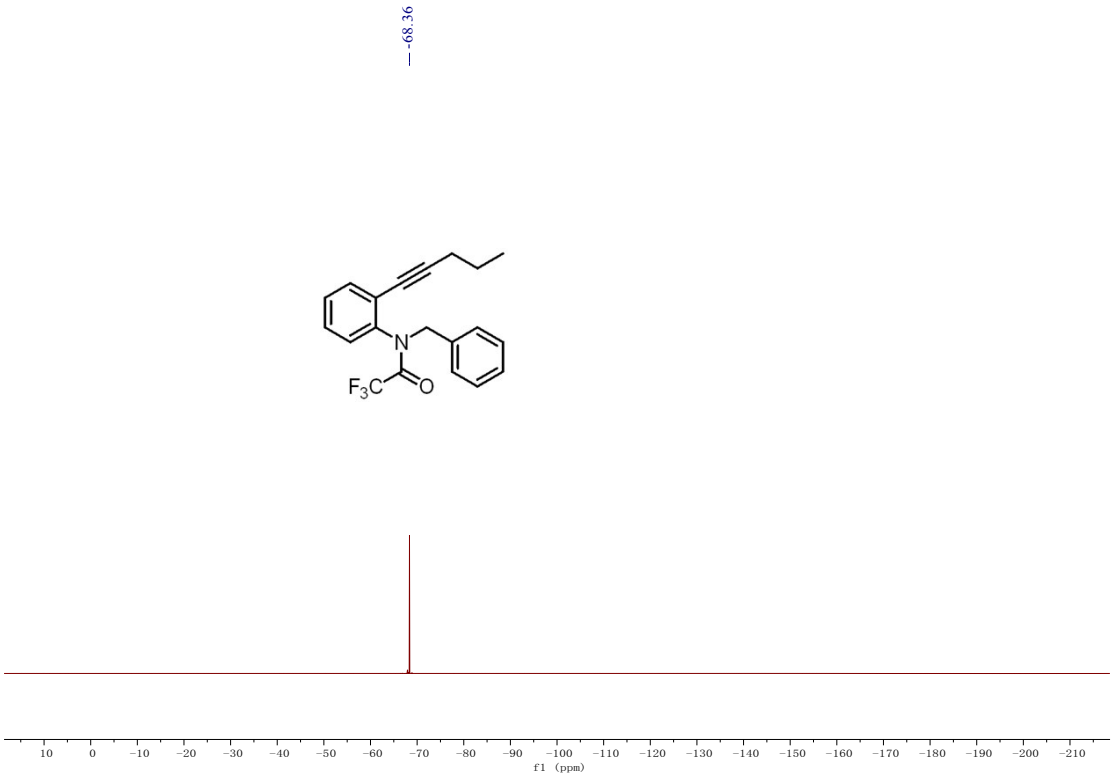

1.00
4.21
2.10
1.14
1.04
0.99
1.00
2.01
2.27
3.05
f1 (ppm)

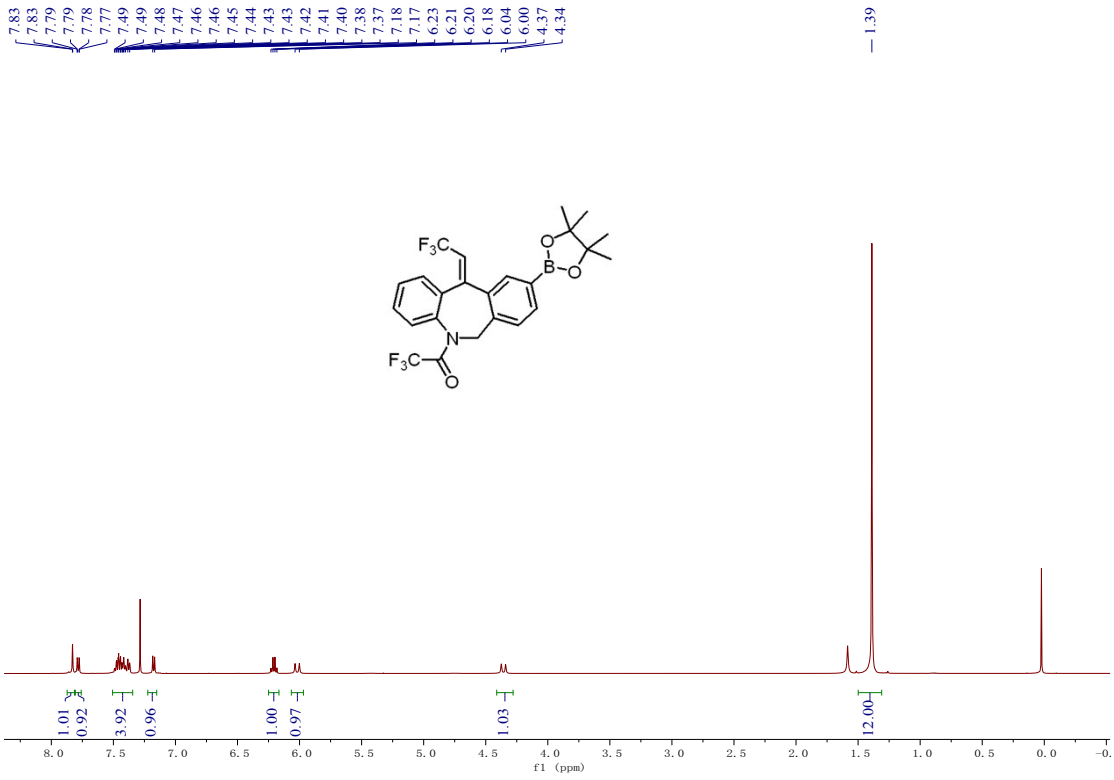

157.59
157.31
157.02
156.74
139.56
135.30
132.94
129.89
129.51
128.95
128.51
128.07
127.67
123.91
119.81
117.52
115.23
112.93

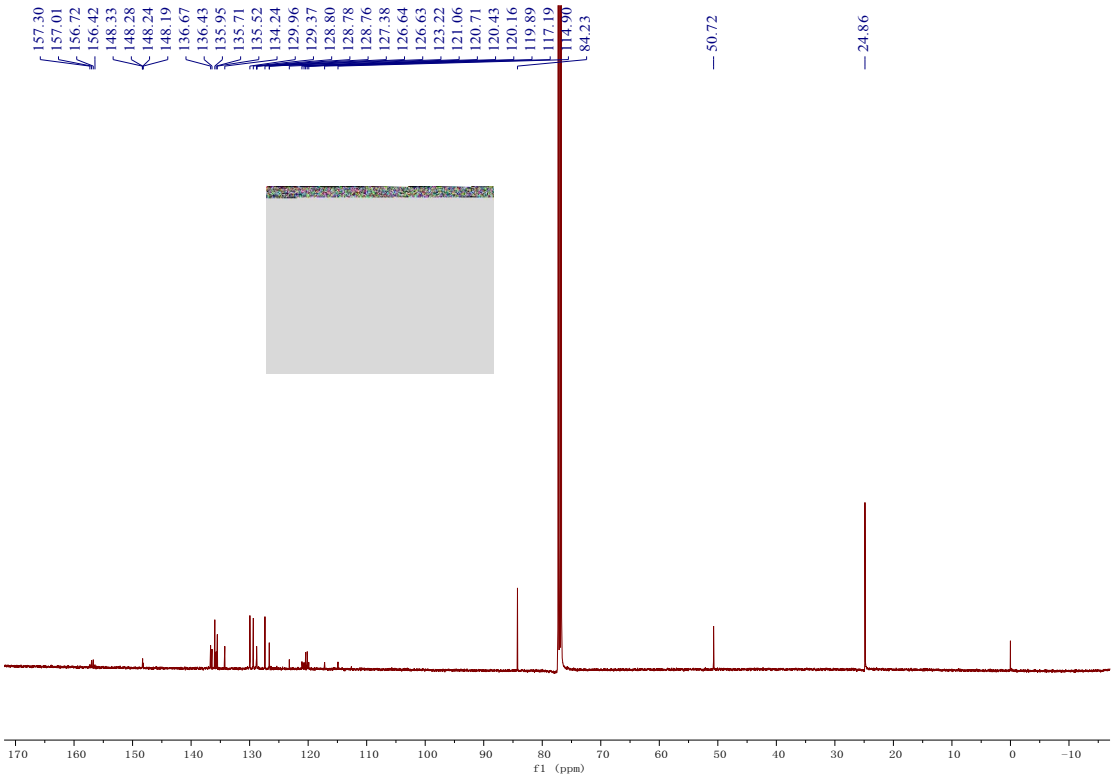

97.06
76.17
53.80
22.07
21.51
13.52

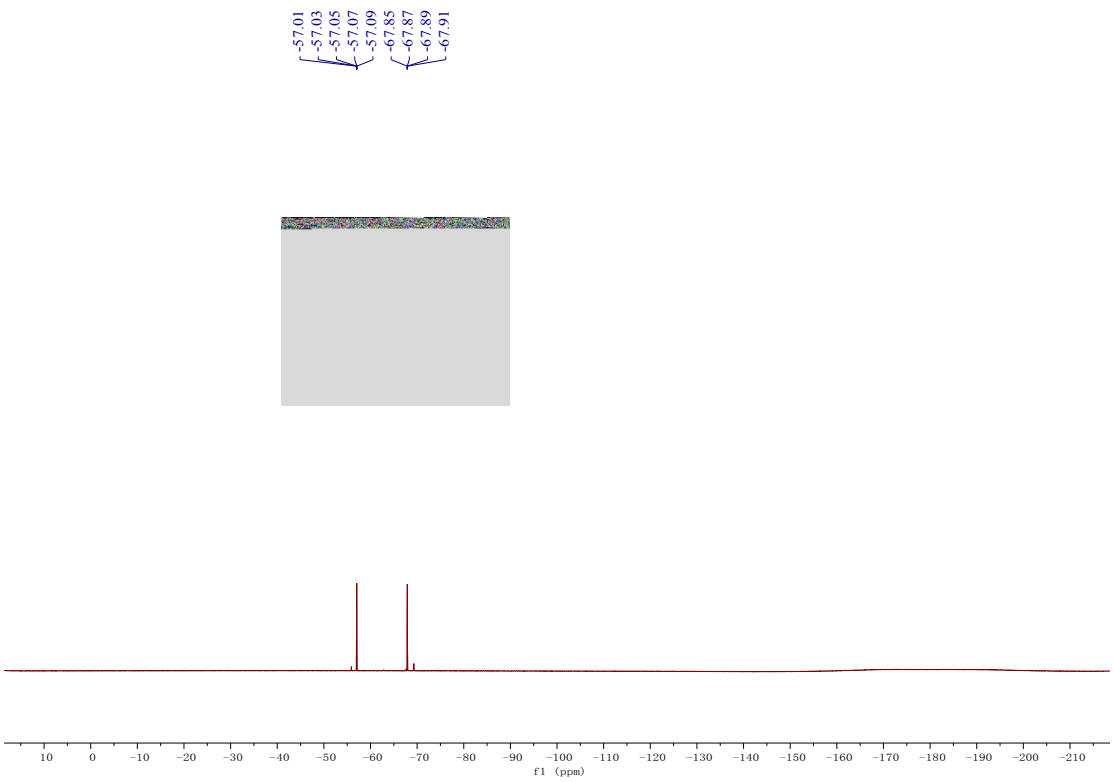

N
F3C
O


f1 (ppm)


-68.36
F3C
O
N
10 0 −10 −20 −30 −40 −50 −60 −70 −80 −90 −100 −110 −120 −130 −140 −150 −160 −170 −180 −190 −200 −210
f1 (ppm)


7.83 7.83 7.79 7.79 7.78 7.77 7.49 7.49 7.48 7.47 7.46 7.46 7.45 7.44 7.43 7.43 7.42 7.41 7.40 7.38 7.37 7.18 7.17 6.23 6.21 6.20 6.18 6.04 6.00 4.37 4.34
1.39
F3C
O
B
O
F3C
O
N
1.01 0.92 3.92 0.96 1.00 0.97 1.03 12.00
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 0.0
f1 (ppm)


157.30
157.01
156.72
156.42
148.33
148.28
148.24
148.19
136.67
136.43
135.95
135.71
135.52
134.24
129.96
129.37
128.80
128.78
128.76
127.38
126.64
126.63
123.22
121.06
120.71
120.43
120.16
119.89
117.19
114.90
84.23
50.72
24.86
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)


-57.01
-57.03
-57.05
-57.07
-57.09
-67.85
-67.87
-67.89
-67.91
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
−110
−120
−130
−140
−150
−160
−170
−180
−190
−200
−210
f1 (ppm)


7.66
7.66
7.65
7.64
7.56
7.56
7.55
7.55
7.54
7.54
7.54
7.53
7.43
7.42
7.41
7.41
7.40
7.40
7.39
7.39
7.37
7.37
7.31
7.30
7.29
7.29
7.29
7.28
7.28
7.25
7.25
7.24
7.23
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7.22
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7.21
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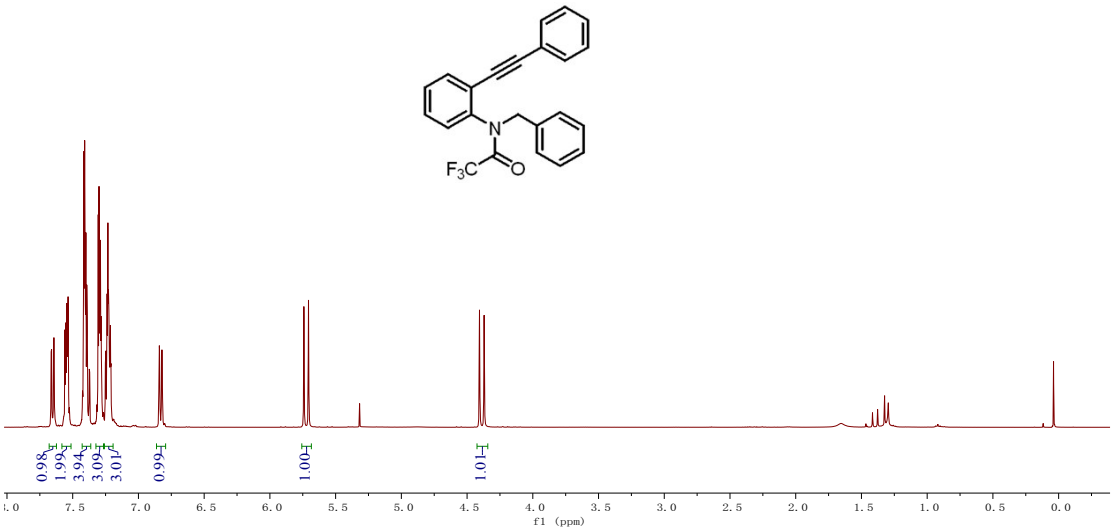
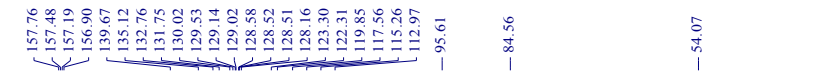
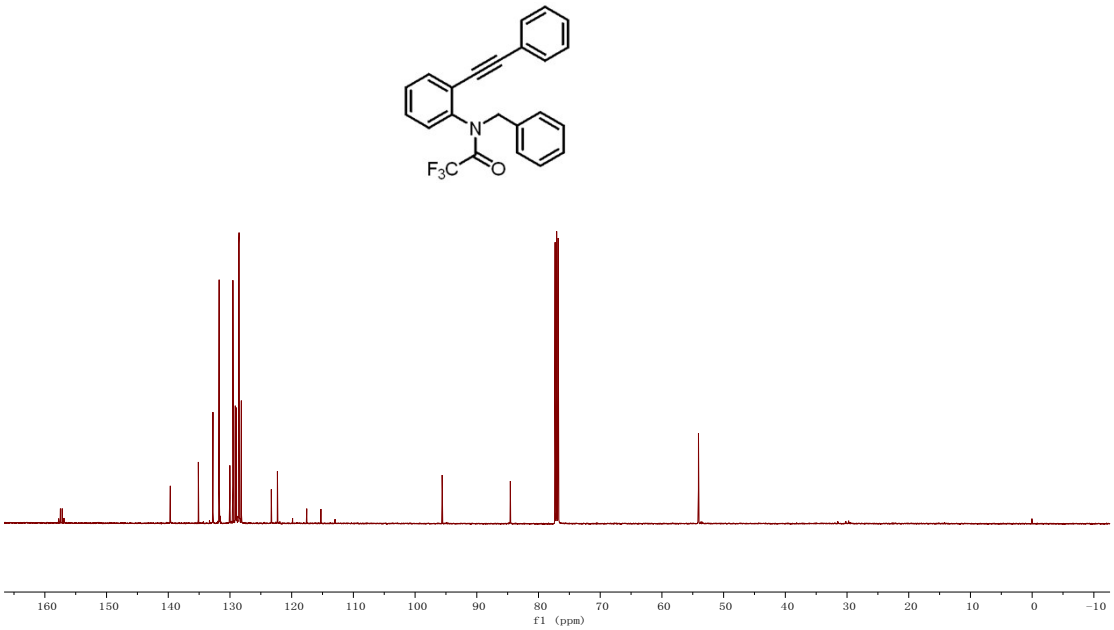
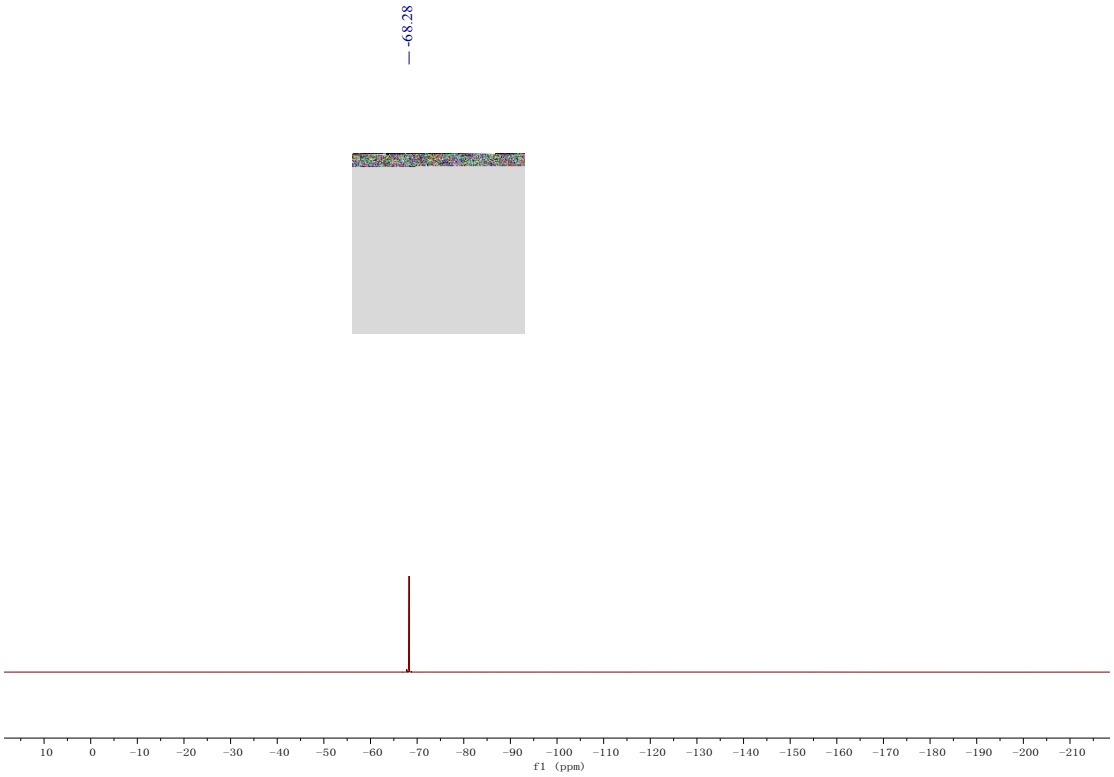
6.82
5.74
5.71
4.41
4.37

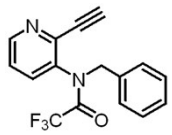

N
F3C
O
0.98
1.99
3.94
3.09
3.01
0.99
1.00
1.01
f1 (ppm)

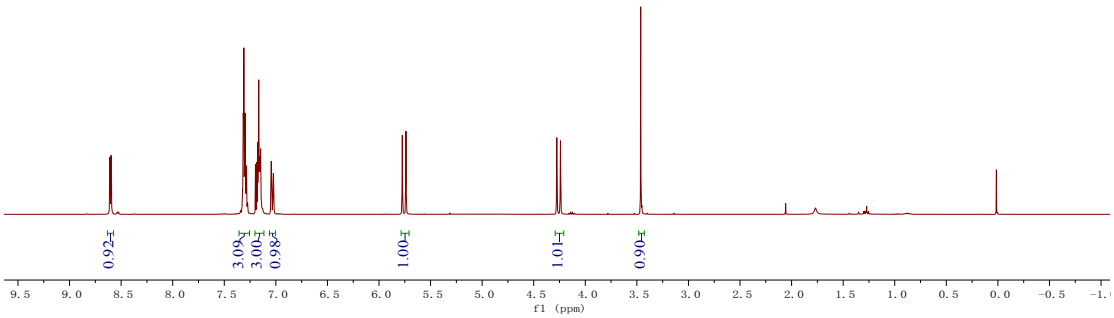

157.76
157.48
157.19
156.90
139.67
135.12
132.76
131.75
130.02
129.53
129.14
129.02
128.58
128.52
128.51
128.16
123.30
122.31
119.85
117.56
115.26
112.97
95.61
84.56
54.07

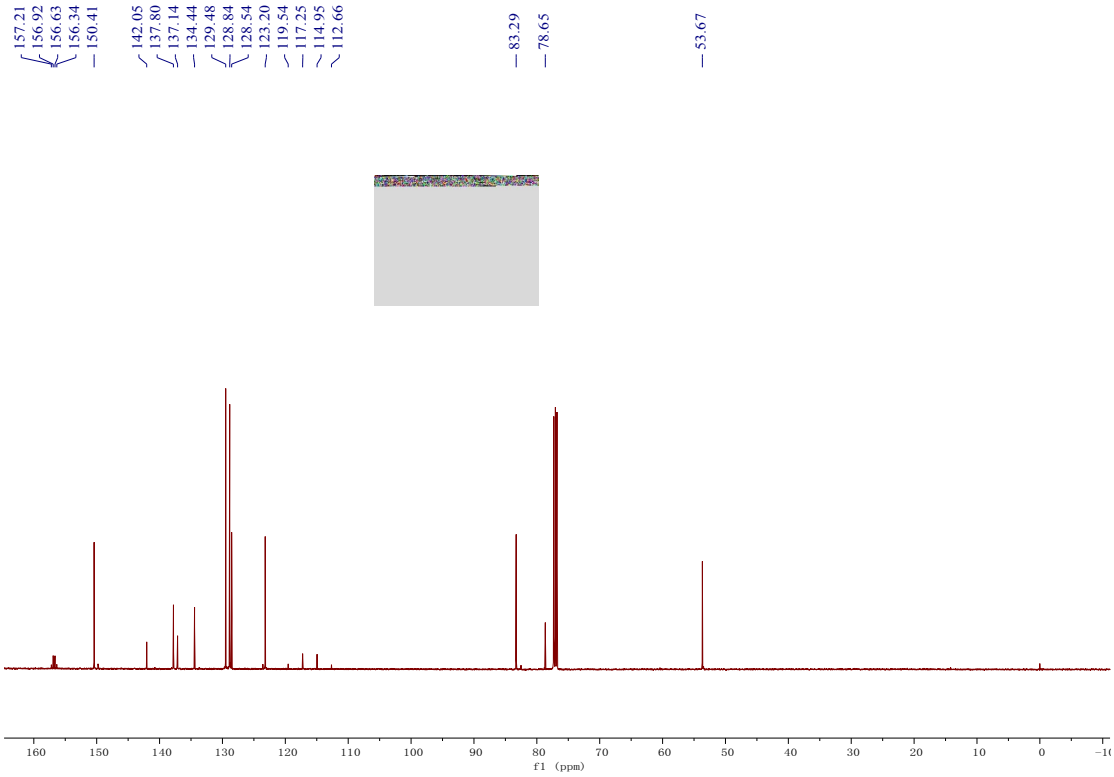

N
F3C
O
f1 (ppm)

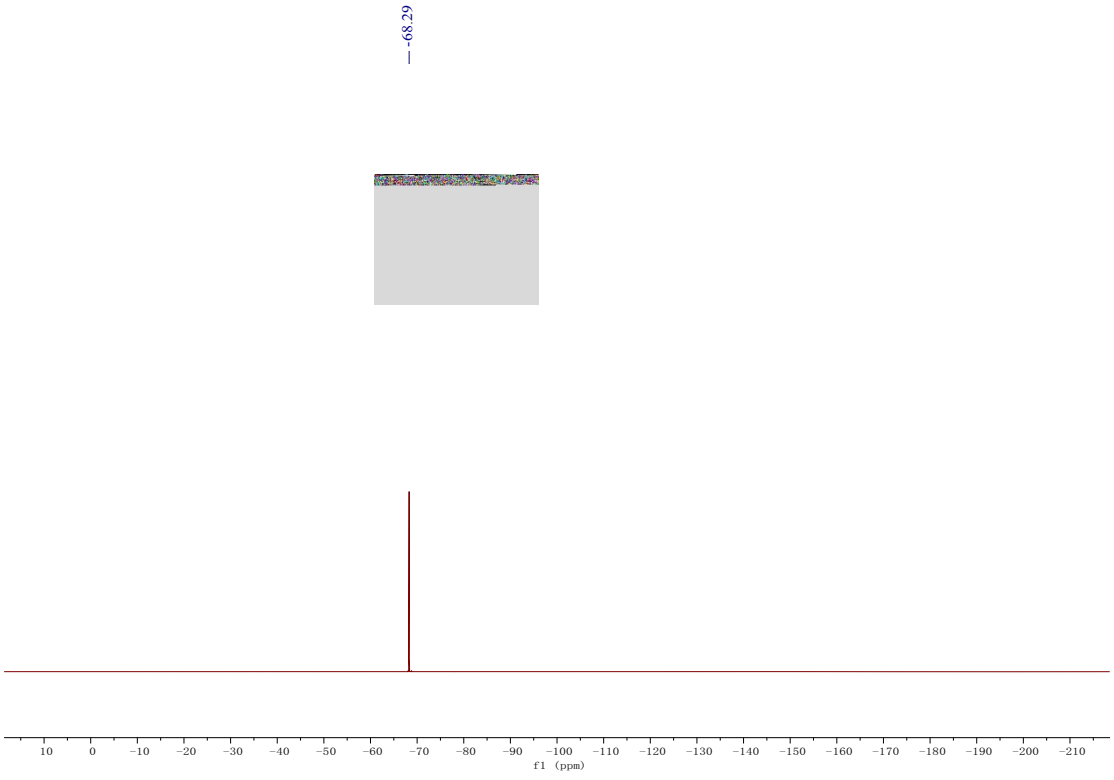

-68.28
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210
f1 (ppm)

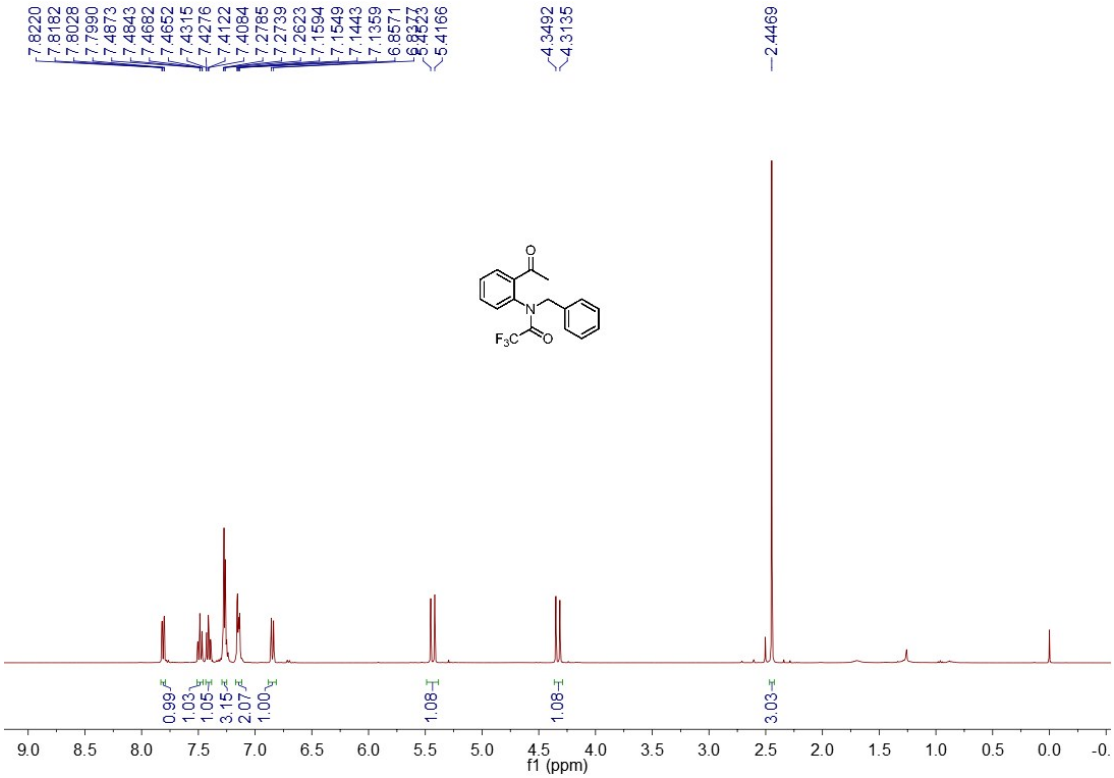

8.61
8.61
8.60
8.59
7.32
7.32
7.31
7.31
7.30
7.30
7.29
7.28
7.20
7.19
7.18
7.17
7.17
7.16
7.15
7.15
7.05
7.04
7.04
7.04
7.03
7.02
7.02
7.02
5.77
5.74
4.28
4.24
3.46

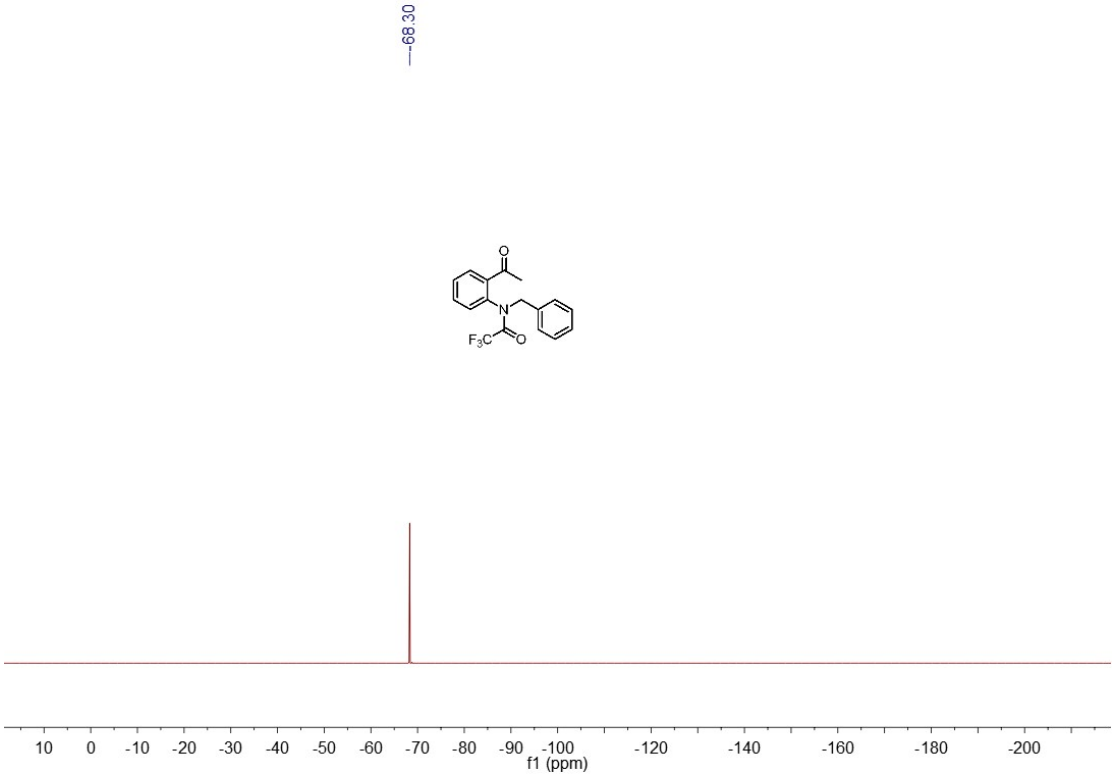

N
N
F3C
O

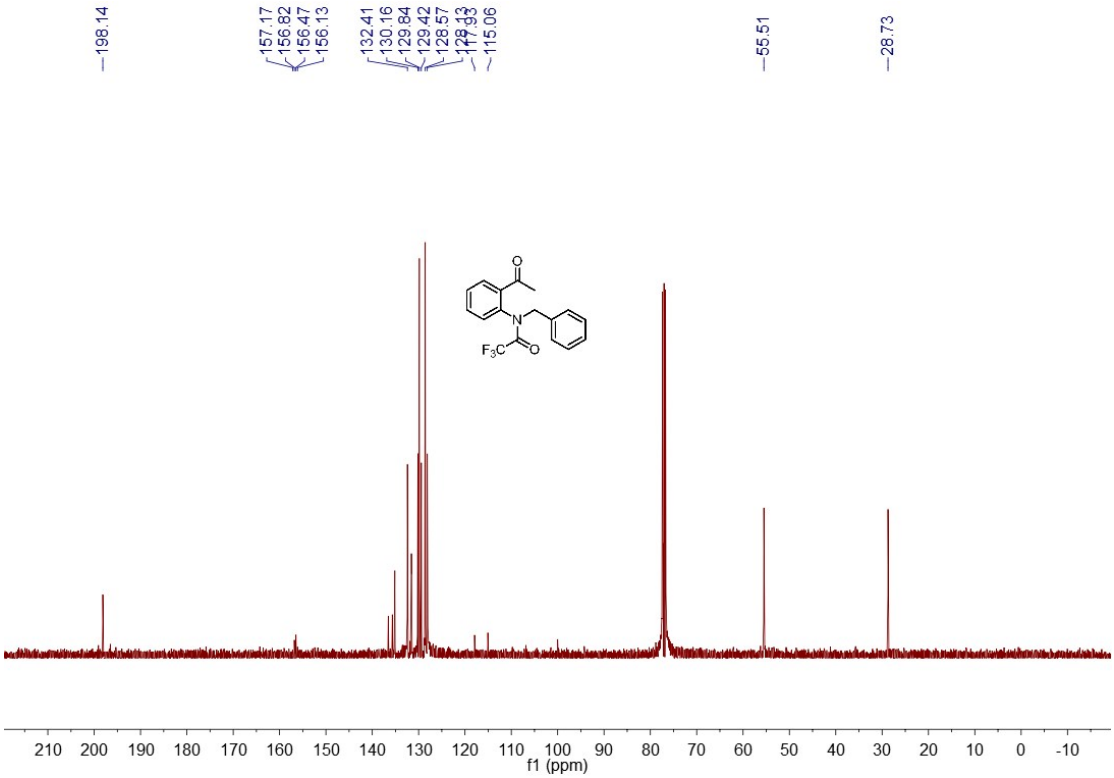

0.92
3.09
3.00
0.98
1.00
1.01
0.90
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)

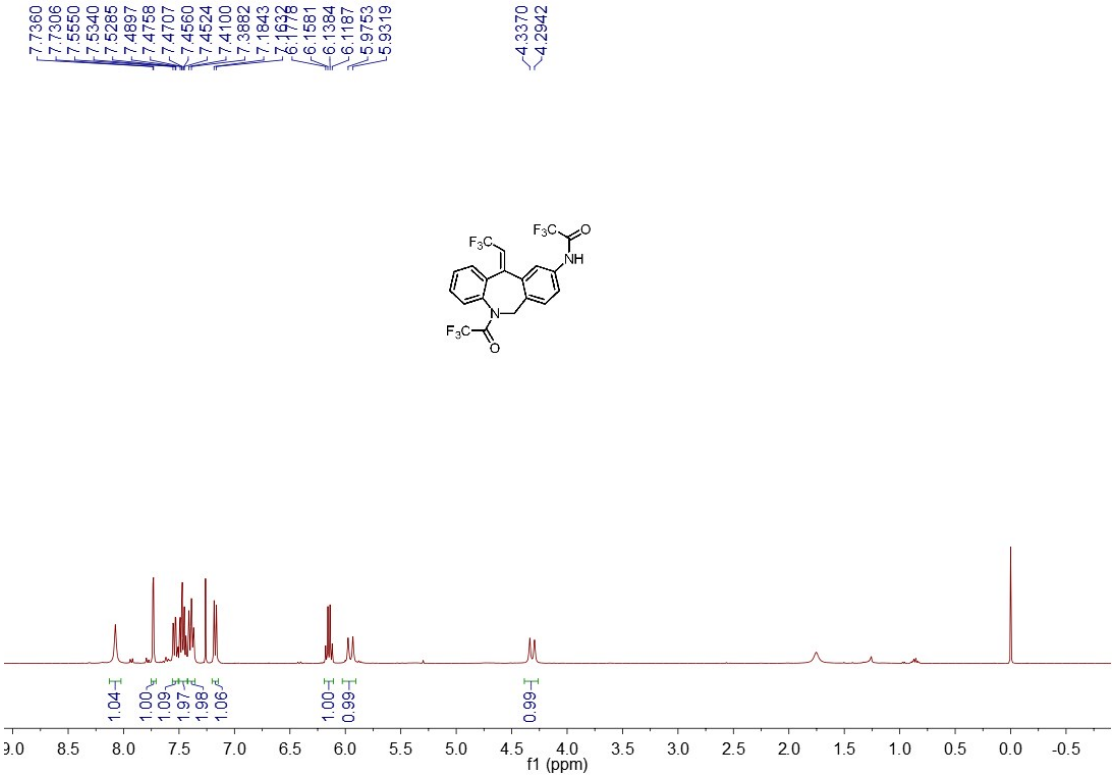

157.21
156.92
156.63
156.34
150.41
142.05
137.80
137.14
134.44
129.48
128.84
128.54
123.20
119.54
117.25
114.95
112.66
83.29
78.65
53.67
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

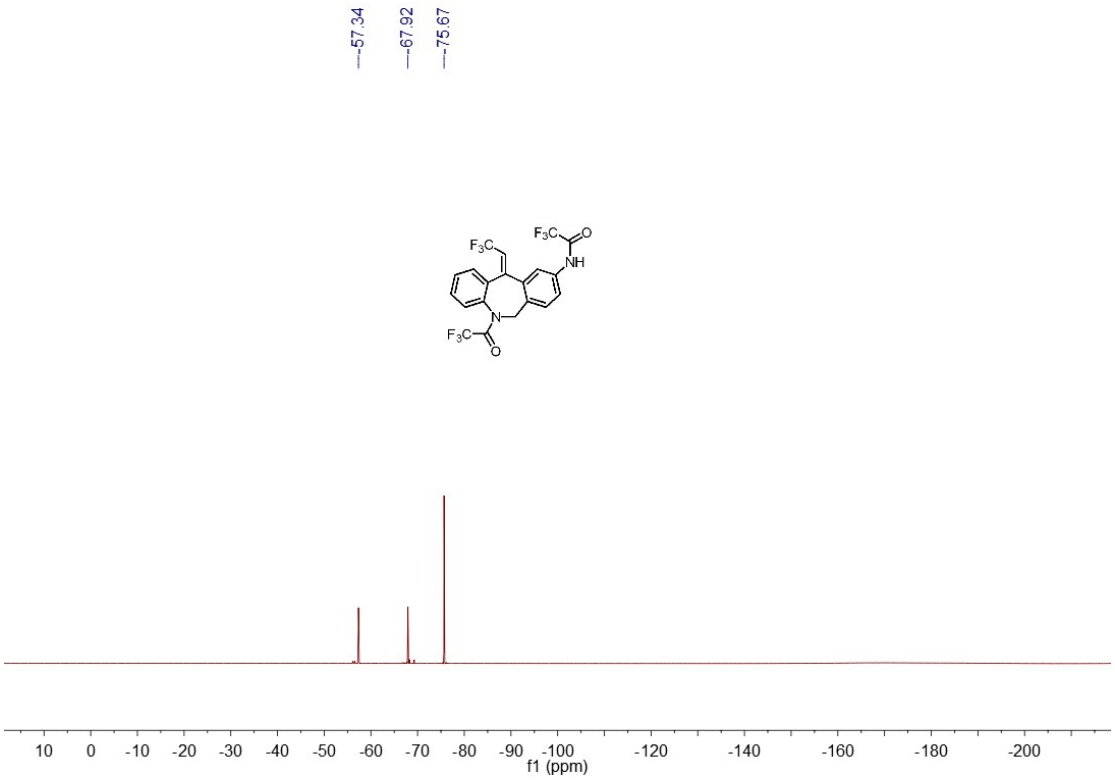

-68.29
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
-200
-210
f1 (ppm)

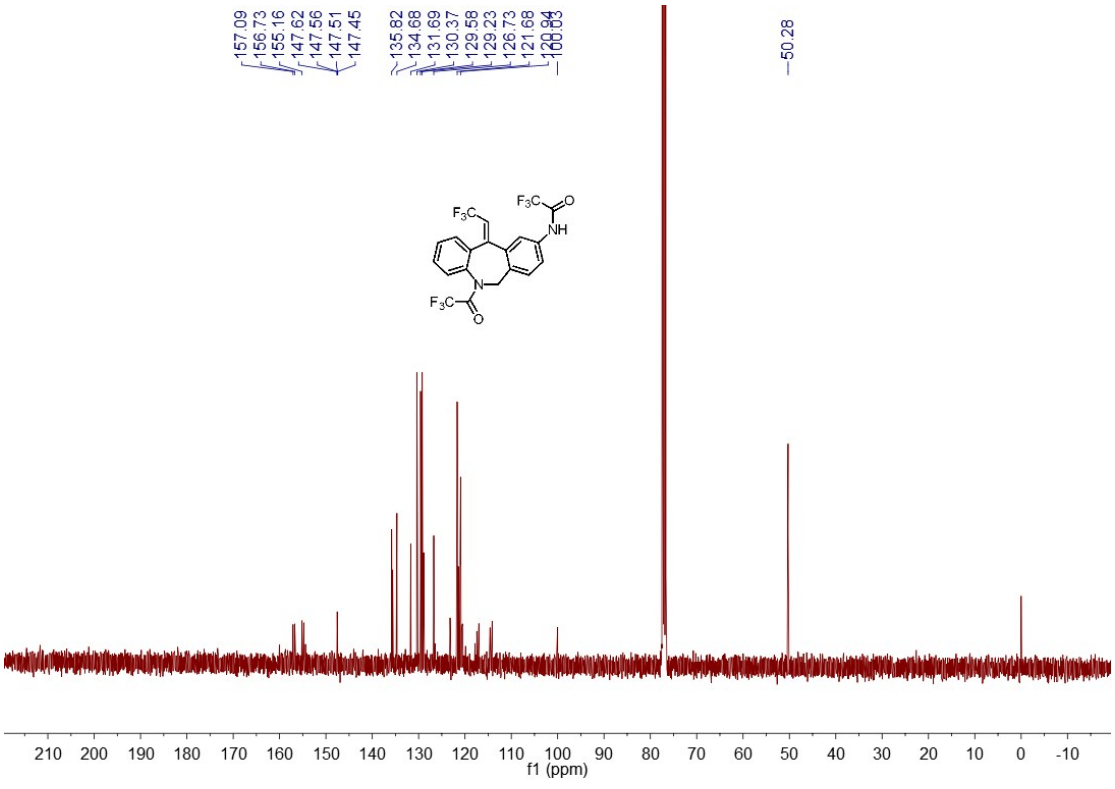

7.8220
7.8182
7.8028
7.7990
7.4873
7.4843
7.4682
7.4652
7.4315
7.4276
7.4122
7.4084
7.2785
7.2739
7.2623
7.1594
7.1549
7.1443
7.1359
6.8571
5.4166
4.3492
4.3135
2.4469
O
N
F3C
O
0.99
1.03
1.05
3.15
2.07
1.00
1.08
1.08
3.03
f1 (ppm)


-68.30
O
N
F3C
O
f1 (ppm)


198.14
157.17
156.82
156.47
156.13
132.41
130.16
129.84
129.42
128.57
128.13
117.93
115.06
55.51
28.73
O
N
F3C
O
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


7.7360
7.7306
7.5550
7.5340
7.5285
7.4897
7.4758
7.4707
7.4560
7.4524
7.4100
7.3882
7.1843
7.1632
6.1581
6.1384
6.1187
5.9753
5.9319
4.3370
4.2942
F3C
F3C
NH
N
F3C
O
1.04
1.00
1.09
1.97
1.98
1.06
1.00
0.99
0.99
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 0.0 -0.5
f1 (ppm)


-57.34
-67.92
-75.67
F3C
F3C
O
NH
N
F3C
O
10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -120 -140 -160 -180 -200
f1 (ppm)


157.09
156.73
155.16
147.62
147.56
147.51
147.45
135.82
134.68
131.69
130.37
129.58
129.23
126.73
121.68
-50.28
F3C
F3C
O
NH
N
F3C
O
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)