

Supporting Information

**Access to Pyrrolines and Fused Diaziridines by Selective Radical
Addition to Homoallylic Diazirines**

Zhigang Ma,^[a] # Xinxin Wu,^[a] # Haotian Li,^[a] Zhu Cao,^[b] and Chen Zhu*^[a,b]

Content

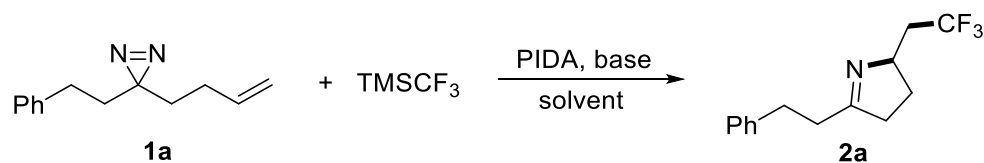
1. General experimental details	3
2. Reaction parameters survey and general procedures.....	3
2.1 For radical-mediated trifluoromethylation (Fig 2)	3
2.2 For radical-mediated difluoroalkylation (Fig 3).....	4
2.3 For radical-mediated sulfonylation (Fig 3).....	5
2.4 For radical-mediated hydrogenation (Fig 3).....	6
2.5 For radical-mediated phosphinylation (Fig 4).....	6
2.6 For radical-mediated reductive cyclization (Fig 5)	7
3. Preparation of starting materials.....	7
3.1 General method A	7
3.2 General method B.....	8
4. Product transformations.....	9
5. Mechanistic studies	11
5.1 Identification of intermediates (Fig 7).....	11
5.2 Cyclic voltammogram experiment	12
5.3 DFT calculations	13
6. References	14
7. Characterization of starting materials and products	14
8. NMR Spectra.....	35

1. General experimental details

All reactions were maintained under a nitrogen atmosphere unless otherwise stated. Commercially available reagents were used without further purification. DMF was distilled from NaH under reduced pressure, and THF was distilled from sodium. Infrared (FT-IR) spectra were recorded on a BRUKER VERTEX 70, ν_{\max} in cm^{-1} . ^1H -NMR spectra were recorded on a BRUKER AVANCE III HD (400 MHz) spectrometer. Chemical shifts are reported in ppm from tetramethylsilane with the solvent resonance as internal standard (CDCl_3 : δ 7.26). Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quadruplet, br = broad, m = multiplet), coupling constants (Hz) and integration. ^{13}C -NMR spectra were recorded on a BRUKER AVANCE III HD (100 MHz) spectrometer with complete proton decoupling. Chemical shifts are reported in ppm from tetramethylsilane with the solvent resonance as the internal standard (CDCl_3 : δ 77.16). ^{19}F -NMR spectra were recorded on a BRUKER AVANCE III HD (376 MHz) spectrometer, ^{31}P -NMR spectra were recorded on a BRUKER AVANCE III HD (162 MHz) spectrometer. High resolution mass spectrometry (HRMS) was measured with a GCT PremierTM and BRUKER micrOTF-Q III. Melting points were measured using INESA WRR and values are uncorrected.

2. Reaction parameters survey and general procedures

2.1 For radical-mediated trifluoromethylation (Fig 2)



Entry	Base	Solvent	T (°C)	Yield ^[a]
1	CsF	MeCN	0	71%
2	CsF	THF	0	9%
3	CsF	DCM	0	trace
4	CsF	MeOH	0	nr
5	CsF	acetone	0	trace
6	CsF	EA	0	15%
7	CsF	DMF	0	40%
8	CsF	MeCN	-10	62%
9 ^[b]	CsF	MeCN	0	70%
10 ^[c]	KF	MeCN	rt	52%
11	Cs ₂ CO ₃	MeCN	rt	15%

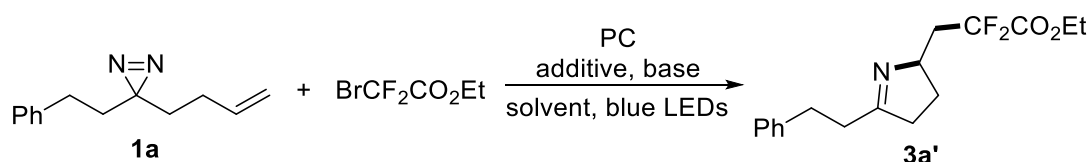
12	CsF	MeCN	0	trace ^[d]
13	CsF	MeCN	0	27% ^[e]

Table S1. Reaction conditions: **1a** (0.2 mmol), TMSCF₃ (0.6 mmol), (diacetoxyiodo)benzene (PIDA, 0.3 mmol) and base (0.3 mmol) in dry solvent (2.0 mL) were stirred vigorously (1300 rpm) under Ar atmosphere at indicated temperature for 1 h. [a] Yields of isolated product are given. [b] 3.0 mL MeCN. [c] Reaction for 12 h. [d] With 0.2 mmol of TMSCF₃. [e] With 0.4 mmol of TMSCF₃.

General procedure for the synthesis of **2**

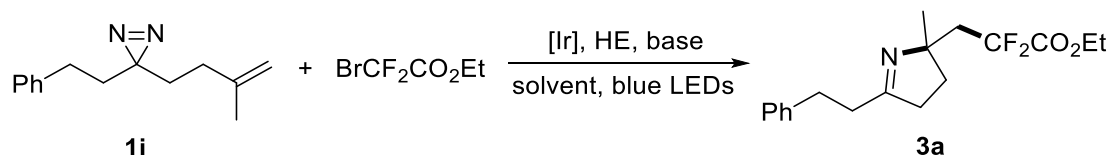
To a suspension of diazirine **1** (0.2 mmol), CsF (1.5 equiv., 45.6 mg) and PIDA (1.5 equiv., 96.6 mg) in dry acetonitrile (2.0 mL) was added TMSCF₃ (3.0 equiv, 88.6 μ L) dropwise at 0 °C. After the reaction mixture was stirred vigorously (1200 rpm) for 1 h at the same temperature, the reaction was quenched with water. The aqueous layer was extracted with EtOAc. The combined organic extracts were washed with brine and dried over anhydrous Na₂SO₄. After removal of solvents in vacuo, pyrroline **2** was isolated by flash column chromatography on silica gel.

2.2 For radical-mediated difluoroalkylation (Fig 3)



Entry	[Ir]	Base	Additive	Solvent	Yield ^[a]
1 ^[b]	<i>fac</i> -Ir(ppy) ₃	-	DIPEA	MeCN	13%
2 ^[b]	<i>fac</i> -Ir(ppy) ₃	-	HE	MeCN	33%
3 ^[b]	<i>fac</i> -Ir(ppy) ₃	K ₂ HPO ₄	HE	MeCN/H ₂ O (10:1)	20%
4	<i>fac</i> -Ir(ppy) ₃	K ₂ HPO ₄	HE	MeCN	48%
5	[Ir(ppy) ₂ (dtbbpy)]PF ₆	K ₂ HPO ₄	HE	MeCN	60%
6	Eosin Y	K ₂ HPO ₄	HE	MeCN	trace
7	Eosin Y-Na ₂	K ₂ HPO ₄	HE	MeCN	trace
8	<i>fac</i> -Ir(ppy) ₃	K ₂ CO ₃	HE	MeCN	41%
9	<i>fac</i> -Ir(ppy) ₃	K ₃ PO ₄	HE	MeCN	34%
10	<i>fac</i> -Ir(ppy) ₃	KH ₂ PO ₄	HE	MeCN	24%

Table S2. Reaction conditions: **1a** (0.2 mmol), ethyl bromodifluoroacetate (0.4 mmol), PC (2 mol %), additive (0.4 mmol) and base (0.4 mmol) in dry solvent (2.0 mL) under Ar atmosphere were irradiated under 5 W \times 2 blue LEDs for 12 h. [a] Yields of isolated products are given. [b] 1 mol % PC was used.



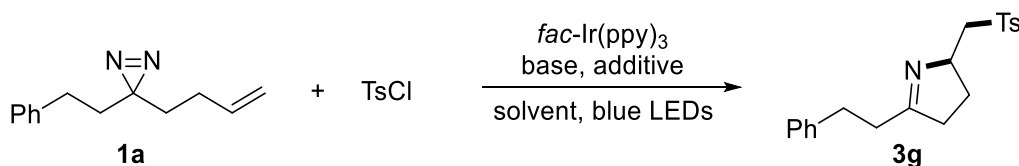
Entry	[Ir]	Base	Solvent	Yield ^[b]
1	<i>fac</i> -Ir(ppy) ₃	K ₂ HPO ₄	MeCN/H ₂ O (10:1)	58%
2	<i>fac</i> -Ir(ppy) ₃	K ₂ HPO ₄	MeCN	71%
3	[Ir(ppy) ₂ (dtbbpy)]PF ₆	K ₂ HPO ₄	MeCN	67%
4	<i>fac</i> -Ir(ppy) ₃	Na ₂ HPO ₄	MeCN	63%
5	<i>fac</i> -Ir(ppy) ₃	2,6-Lutidine	MeCN	76%

Table S3. Reaction conditions: **1i** (0.2 mmol), ethyl bromodifluoroacetate (0.4 mmol), PC (2 mol %), Hantzsch ester (0.4 mmol) and base (0.4 mmol) in dry solvent (2.0 mL) under Ar atmosphere were irradiated under 5 W × 2 blue LEDs for 12 h. [b] Yields of isolated product are given.

General procedure for the synthesis of 3a-3f

To a 4-mL oven-dried reaction vial was charged with **1** (0.2 mmol), *fac*-Ir(ppy)₃ (2 mol %) and Hantzsch ester (HE, 2 equiv.). The reaction vial was back-flushed with argon three times. Then dry MeCN (2.0 mL), alkylbromide (2 equiv.) and 2,6-lutidine (2 equiv.) was added to the reaction vial via syringe. The reaction mixture was vigorously stirred at rt for 12 h under the irradiation with 5 W × 2 blue LEDs (approximately 5 cm away from the light sources). After removal of solvents in vacuo, pyrroline **3** was isolated by flash column chromatography on silica gel.

2.3 For radical-mediated sulfonylation (Fig 3)



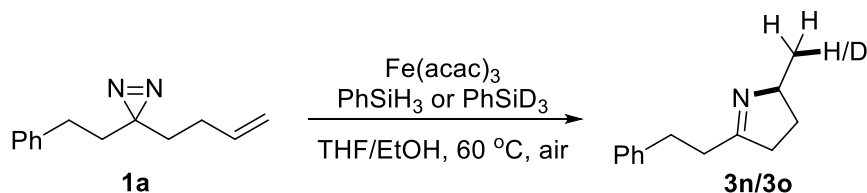
Entry	Base	Additive	Solvent	Yield ^[a]
1	Na ₂ HPO ₄	HE	MeCN	31%
2	Na ₂ HPO ₄	DIPEA	MeCN	45%
3	K ₂ HPO ₄	DIPEA	MeCN	44%
4	K ₂ HPO ₄	DIPEA	MeCN/H ₂ O (10:1)	79%
5	K ₂ HPO ₄	DABCO	MeCN/H ₂ O (10:1)	trace
6	K ₂ HPO ₄	Quinuclidine	MeCN/H ₂ O (10:1)	trace

Table S4. Reaction conditions: **1a** (0.2 mmol), TsCl (0.4 mmol), *fac*-Ir(ppy)₃ (2 mol %), additive (0.4 mmol) and base (0.4 mmol) in solvent (2.0 mL) under Ar atmosphere were irradiated under 5 W × 2 blue LEDs for 12 h. [a] Yields of isolated products are given.

General procedure for the synthesis of 3g-3m

To a 4-mL reaction vial was charged with **1** (0.2 mmol), *fac*-Ir(ppy)₃ (2 mol %), sulfonyl chloride (2 equiv.) and K₂HPO₄ (2 equiv.). The reaction vial was back-flushed with argon three times. Then MeCN (2.0 mL), H₂O (0.2 mL) and DIPEA (2 equiv.) were added to the reaction vial via syringe. The reaction mixture was vigorously stirred at rt for 12 h under the irradiation with 5 W × 2 blue LEDs (approximately 5 cm away from the light sources). After removal of solvents in vacuo, pyrroline **3** was isolated by flash column chromatography on silica gel.

2.4 For radical-mediated hydrogenation (Fig 3)

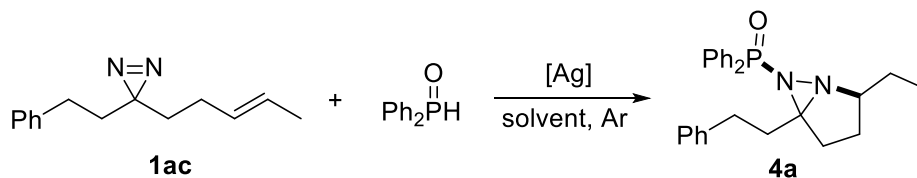


Reaction conditions: **1a** (0.2 mmol), PhSiH₃ or PhSiD₃ (0.4 mmol), Fe(acac)₃ (0.06 mmol) and EtOH (0.4 mmol) in THF (2.0 mL) under air at 60 °C.

General procedure for the synthesis of **3n** and **3o**

To a 4-mL oven-dried reaction vial was charged with **1a** (0.2 mmol), PhSiH₃ or PhSiD₃ (2 equiv.), Fe(acac)₃ (3 equiv.), EtOH (2 equiv.) and THF (2.0 mL). The reaction mixture was stirred at 60 °C under air. After removal of solvents in vacuo, pyrroline **3** was isolated by flash column chromatography on silica gel.

2.5 For radical-mediated phosphinoylation (Fig 4)



Entry	[Ag] (mol%)	Solvent	T (°C)	Time (h)	Yield ^[a]
1	AgNO ₃ (100)	MeCN	50	1	66%
2	AgNO ₃ (20)	MeCN	50	6	64%
3	AgOAc (20)	MeCN	50	72	11%
4	AgTFA (20)	MeCN	50	72	23%
5	AgOTf (20)	MeCN	50	72	44%
6	AgBF ₄ (20)	MeCN	50	72	40%
7	AgSbF ₆ (20)	MeCN	50	72	38%
8	Ag ₂ O (10)	MeCN	50	72	trace
9	Ag ₂ CO ₃ (10)	MeCN	50	72	trace
10	AgNO ₃ (20)	DMF	50	6	57%
11	AgNO ₃ (20)	DCE	50	6	61%

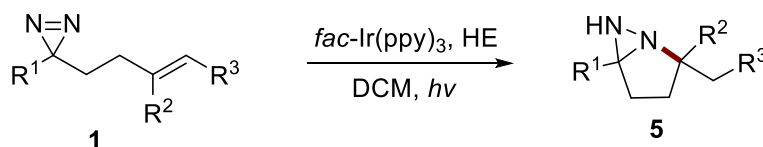
12	AgNO ₃ (20)	PhCF ₃	50	6	71%
13	AgNO ₃ (20)	EA	50	6	69%
14	AgNO ₃ (20)	DMSO	50	24	trace
15	AgNO ₃ (20)	EA	40	4	72%
16	AgNO ₃ (20)	EA	30	4	75%
17	AgNO ₃ (10)	EA	30	5	79%
18	AgNO ₃ (5)	EA	30	52	53%

Table S5. Reaction conditions: **1ad** (0.2 mmol), diphenylphosphine oxide (0.4 mmol) and silver catalyst in dry solvent (2.0 mL) under Ar atmosphere were stirred at indicated temperature. [a] Yields of isolated products are given.

General procedure for the synthesis of **4**

To a 4-mL oven-dried reaction vial was charged with **1** (0.2 mmol), diarylphosphine oxide (2 equiv.), and AgNO₃ (10 mol %). The reaction vial was back-flushed with argon three times. Then dry EtOAc (2.0 mL) was added to the reaction vial via syringe, and the reaction mixture was stirred vigorously at 30 °C. After removal of solvents in vacuo, fused diaziridine **4** was isolated by flash column chromatography on silica gel.

2.6 For radical-mediated reductive cyclization (Fig 5)



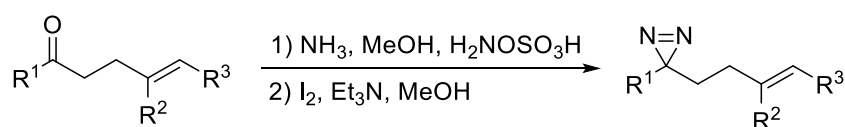
Reaction conditions: **1** (0.2 mmol), *fac*-Ir(ppy)₃ (0.004 mmol) and Hantzsch ester (0.4 mmol) in dry DCM (4.0 mL) under Ar irradiated with 5 W × 2 blue LEDs at rt for 4 h. Yields of isolated products are given.

General procedure for the synthesis of **5**

To a 8-mL reaction vial was charged with **1** (0.2 mmol), *fac*-Ir(ppy)₃ (2 mol %), and Hantzsch ester (2 equiv.). The reaction vial was back-flushed with argon three times. Then DCM (4.0 mL) was added to the reaction vial via syringe. The reaction mixture was vigorously stirred at rt for 4 h under the irradiation of 5 W × 2 blue LEDs (approximately 5 cm away from the light sources). After removal of solvents in vacuo, fused diaziridine **5** was isolated by flash column chromatography on silica gel.

3. Preparation of starting materials

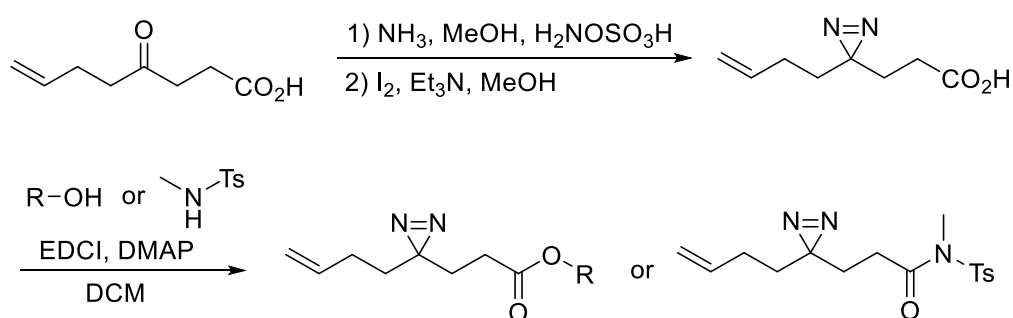
3.1 General method A



According to the reference,^[1] to a flask containing corresponding acetone (10 mmol, 1.0 equiv.) was added NH₃ (7 M in MeOH, 15 equiv., 21.4 mL) at -10 °C. The flask was sealed and the mixture was stirred at -10 °C for 4.5 h. Then a solution of hydroxylamine-*O*-sulfonic acid (H₂NOSO₃H, 1.3 equiv., 1.47 g) in anhydrous MeOH (7.4 mL) was added dropwise at -10 °C and the reaction mixture was stirred at -10 °C for 1 h in a sealed flask. Subsequently, the reaction mixture was allowed to warm to room temperature and stirred for 16 h. NH₃ was removed by gently blowing Ar through the suspension. The precipitate was removed by filtration through celite silica gel and the precipitate was washed with several portions of anhydrous MeOH (10 mL). The organic phase was treated with Et₃N (7.4 equiv., 10.3 mL) and cooled to 0 °C. I₂ was then added in small portions until a dark brown color persisted in the solution. And the reaction mixture was stirred at 0 °C for another 1 h to complete the oxidation of the diaziridine intermediate. The solution was then diluted with Et₂O and the mixture was washed with brine. The aqueous phase was extracted with Et₂O, the combined organic layer was dried over anhydrous Na₂SO₄, filtered and the solvent was removed under reduced pressure. The residue was purified by flash column chromatography on silica to afford the corresponding diazirine.

Substrate **1a-1d**, **1h-1af** were synthesized according to this method.

3.2 General method B



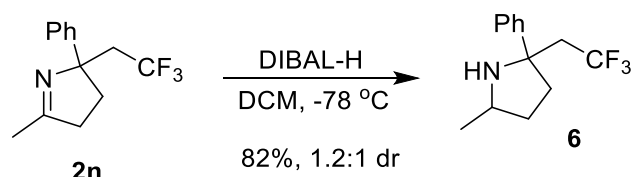
According to the references,^[2] to a flask containing 4-oxooct-7-enoic acid (10 mmol, 1.00 equiv.) was added NH₃ (7 M in MeOH, 15 equiv., 21.4 mL) at -10 °C. The flask was sealed and the mixture was stirred at -10 °C for 4.5 h. Then a solution of hydroxylamine-*O*-sulfonic acid (H₂NOSO₃H, 1.3 equiv., 1.47 g) in anhydrous MeOH (7.4 mL) was added dropwise at -10 °C and the reaction mixture was stirred at -10 °C for 1 h in a sealed flask. Subsequently, the reaction mixture was allowed to warm to room temperature and stirred for 16 h. NH₃ was removed by gently blowing Ar through the suspension. The precipitate was removed by filtration through celite silica gel and the precipitate was washed with several portions of anhydrous MeOH (10 mL). The organic phase was treated with Et₃N (7.4 equiv., 10.3 mL) and cooled to 0 °C. I₂ was then added in small portions until a dark brown color persisted in the solution. And the reaction mixture was stirred at 0 °C for another 1 h to complete the oxidation of the diaziridine intermediate. The solution was then diluted with Et₂O and the mixture was washed with 1 M HCl and then brine. The aqueous phase was extracted with Et₂O, the combined organic layer was dried over anhydrous Na₂SO₄, filtered and the solvent was

removed in vacuo. The residue was purified by flash column chromatography on silica gel to afford 3-(3-(but-3-en-1-yl)-3H-diazirin-3-yl)propanoic acid.

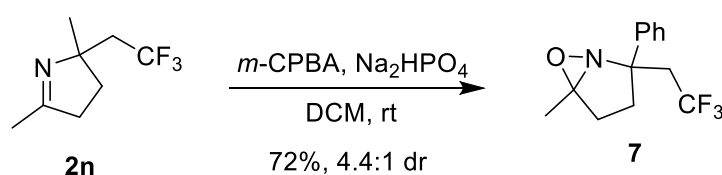
Next, to a flask containing the above 3-(3-(but-3-en-1-yl)-3H-diazirin-3-yl)propanoic acid (1.0 equiv.), DMAP (10 mol %), alcohol or amine (1.5 equiv.), DCM (0.5 M) was added 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide hydrochloride (EDCI, 1.5 equiv.) at 0 °C. The reaction mixture was stirred vigorously at room temperature overnight. The solution was then diluted with DCM and the mixture was washed with water. The aqueous phase was extracted with DCM, the combined organic layer was dried over anhydrous Na₂SO₄, filtered and the solvent was removed under reduced pressure. The residue was purified by flash column chromatography on silica gel to afford the corresponding diazirine.

Substrates **1e-1g** were synthesized according to this method.

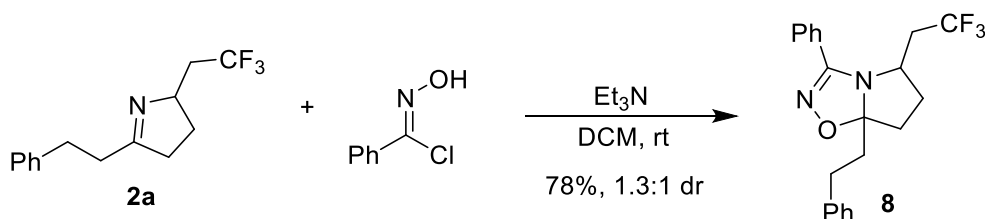
4. Product transformations



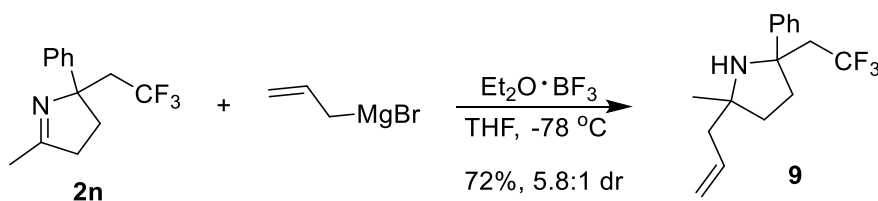
To a solution of **2n** (0.2 mmol, 48.3 mg) in DCM (2.0 mL) was added dropwise DIBAL-H (0.8 mmol, 4.0 equiv., 0.53 mL, 1.5 M in toluene) at -78 °C under N₂ atmosphere. The mixture was stirred at -78 °C for 4 h. The reaction was then quenched by adding a saturated NH₄Cl aqueous solution and diluted with Roche salt aqueous solution. The aqueous phase was extracted with DCM and combined organic layer was dried over anhydrous Na₂SO₄, filtered. After removal of the solvent in vacuo, compound **6** was isolated by flash column chromatography on silica gel.



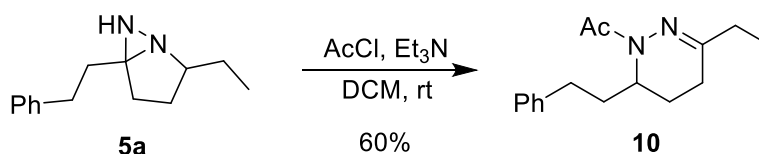
To a screw-cap vial equipped with a magnetic stirring bar were added **2n** (0.2 mmol, 48.3 mg), *m*-CPBA (0.3 mmol, 60.9 mg, 1.5 equiv.), Na₂HPO₄ (0.3 mmol, 42.6 mg, 1.5 equiv.) and DCM (2.0 mL). The mixture was stirred at rt for 2 h. The reaction was then diluted with water, extracted with DCM, and combined organic layer was dried over anhydrous Na₂SO₄, filtered. The solvent was removed in vacuo, and the crude product was purified by flash column chromatography on silica gel to generate product **7**.



To a screw-cap vial equipped with a magnetic stirring bar were added **2a** (0.1 mmol, 25.5 mg), *N*-hydroxybenzimidoyl chloride (0.15 mmol, 23.3 mg, 1.5 equiv.), Et_3N (0.2 mmol, 28.0 μL , 2.0 equiv.) and DCM (2.0 mL). The mixture was stirred at rt for 3 h. The solvent was removed in vacuo, and the crude product was purified by flash column chromatography on silica gel to give product **8**.



To a solution of **2n** (0.15 mmol, 48.3 mg) in THF (5.0 mL) at -78°C under N_2 atmosphere, $\text{Et}_2\text{O}\cdot\text{BF}_3$ (0.45 mmol, 56.8 μL , 3.0 equiv.) was added followed by the dropwise addition of allyl magnesium bromide (0.6 mmol, 3.0 equiv., 0.45 mL, 1.0 M in Et_2O). The reaction mixture was stirred at -78°C for 4 h and then quenched by adding a saturated NH_4Cl aqueous solution. The aqueous phase was extracted with Et_2O and combined organic layer was dried over anhydrous Na_2SO_4 , filtered. After removal of the solvent in vacuo, compound **9** was isolated by flash column chromatography on silica gel.



To a screw-cap vial equipped with a magnetic stirring bar were added **5a** (0.2 mmol, 43.3 mg), Et_3N (0.6 mmol, 41.6 μL , 3.0 equiv.), AcCl (0.6 mmol, 21.3 μL , 3.0 equiv.), and DCM (2.0 mL). The reaction mixture was stirred at rt for 3 h. The reaction was then diluted with water, extracted with DCM, and combined organic layer was dried over anhydrous Na_2SO_4 , filtered. The solvent was removed in vacuo, and the crude product was purified by flash column chromatography on silica gel to give product **10**.

5. Mechanistic studies

5.1 Identification of intermediates (Fig 7)

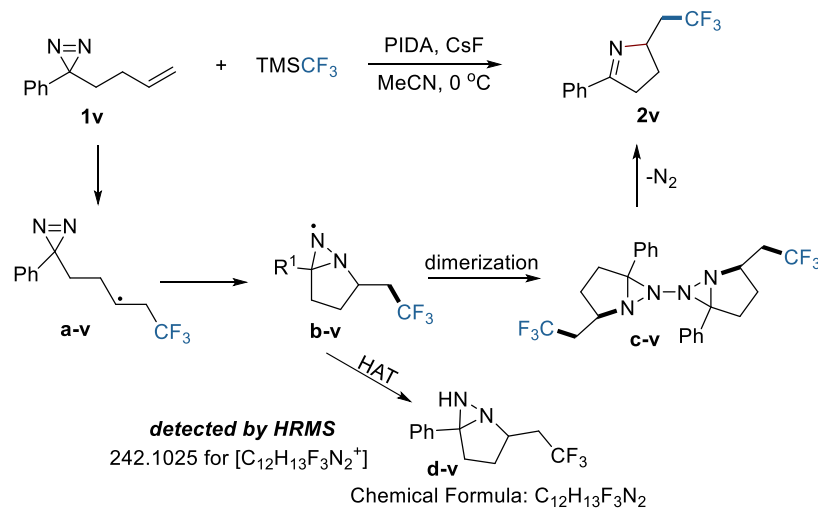


Fig. S1. Identification of intermediate.

Substrate **1v** was treated under standard conditions. After stirred under 0 °C for 5 min, the reaction mixture was used for the HRMS detection directly. Intermediate **d-v** calculated for $[C_{12}H_{13}F_3N_2]^+$ 242.1025, found 242.1036.

Elemental Composition Report

Page 1

Multiple Mass Analysis: 6 mass(es) processed - displaying only valid results

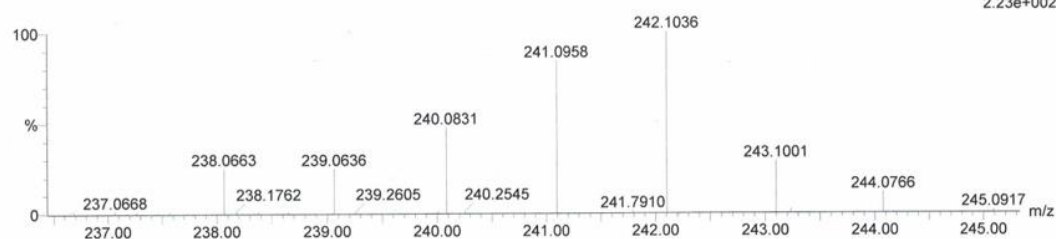
Tolerance = 30.0 PPM / DBE: min = -1.5, max = 50.0
Element prediction: Off

Monoisotopic Mass, Odd and Even Electron Ions
59 formula(e) evaluated with 4 results within limits (all results (up to 1000) for each mass)

Elements Used:
C: 0-12 H: 0-13 N: 0-2 F: 0-3

DEFAULT
MZG-3 322 (5.367)

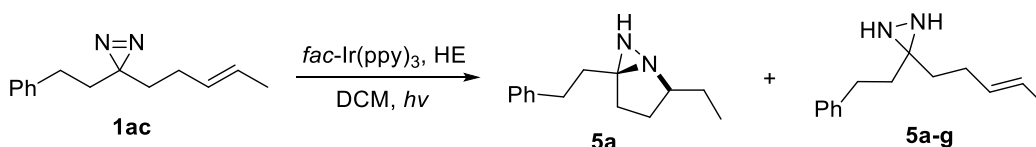
TOF MS EI+
2.23e+002



Mass	RA	Calc. Mass	mDa	PPM	DBE	i-FIT	Formula
238.0663	25.04	238.0718	-5.5	-23.1	8.0	72.8	C12 H9 N2 F3
240.0831	47.53	240.0874	-4.3	-17.9	7.0	190.0	C12 H11 N2 F3
241.0958	84.11	241.0953	0.5	2.1	6.5	115.1	C12 H12 N2 F3
242.1036	100.00	242.1031	0.5	2.1	6.0	19.1	C12 H13 N2 F3

Fig. S2. HRMS of **d-v**.

Intermediate **5a-g** was isolated in the following reaction (standard conditions in Fig. 5).



5a-g, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.29-7.25 (m, 2H), 7.20-7.16 (m, 3H), 5.52-5.38 (m, 2H), 2.73-2.69 (m, 2H), 2.12 (q, $J = 7.2$ Hz, 2H), 1.94-1.88 (m, 2H), 1.71 (q, $J = 8.4$ Hz, 2H), 1.65 (d, $J = 6.0$ Hz, 3H). $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 141.1, 129.9, 128.5, 128.1, 126.1, 125.9, 57.3, 38.1, 36.0, 30.9, 27.8, 17.8. **FT-IR**: ν (cm^{-1}) 2931, 1453, 1133, 965, 747, 698. **HRMS** [EI] calcd for $\text{C}_{14}\text{H}_{20}\text{N}_2[\text{M}]^+$ 216.1621, found 216.1630.

Elemental Composition Report

Page 1

Multiple Mass Analysis: 6 mass(es) processed - displaying only valid results

Tolerance = 2.0 PPM / DBE: min = -1.5, max = 50.0

Element prediction: Off

Monoisotopic Mass, Odd and Even Electron Ions

197 formula(e) evaluated with 3 results within limits (all results (up to 1000) for each mass)

Elements Used:

C: 0-14 H: 0-20 N: 0-2 80Se: 0-1 79Br: 0-1 81Br: 0-1

DEFAULT

ZQ-20231114 744 (12.404) Cm (738:745-(694:699+680:684))

TOF MS EI+
2.44e+003

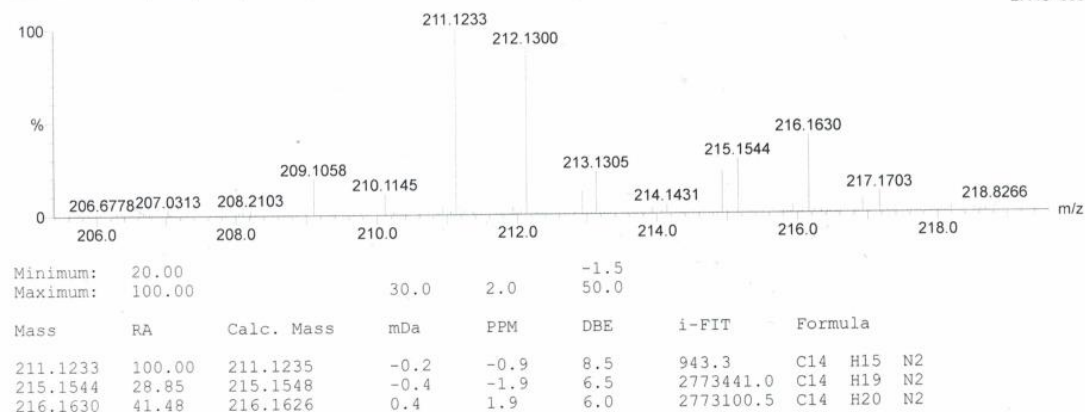


Fig. S3. HRMS of **5a-g**.

5.2 Cyclic voltammogram experiment

All voltammograms were taken at room temperature using a mesh platinum (Pt) counter electrode, a glassy carbon working electrode, and a saturated calomel (SCE) reference electrode. The conditions of the experiments were the following: an acetonitrile solution of 0.1 M tetrabutylammonium tetrafluoroborate (Bu_4NBF_4) and 0.01 M **1ac**, a scan rate of 0.1 V/s, and a negative initial scan direction. The reported potentials were averages over segments, and were taken at half-height of the cathodic peaks ($E_p/2$) of **1ac**, since all reductions were nonreversible.

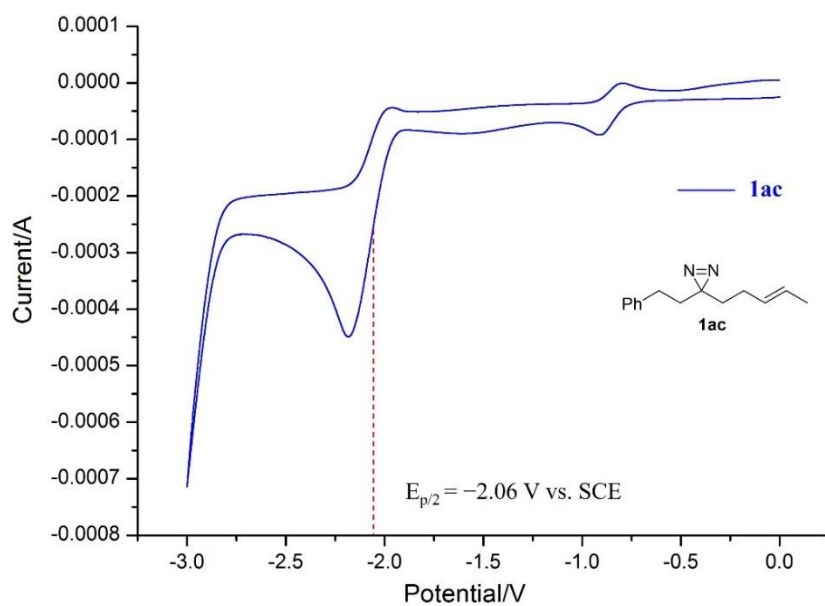


Fig. S4. cyclic voltammogram experiment.

We can conclude from the cyclic voltammogram experiment that $E_{p/2}$ of **1ac** is -2.06 V vs. SCE.

5.3 DFT calculations

Computational methods

All theoretical calculations were performed with Gaussian 09. Geometry optimizations and frequency computations were calculated by B3LYP functional together with the 6-31G(d) basis set.

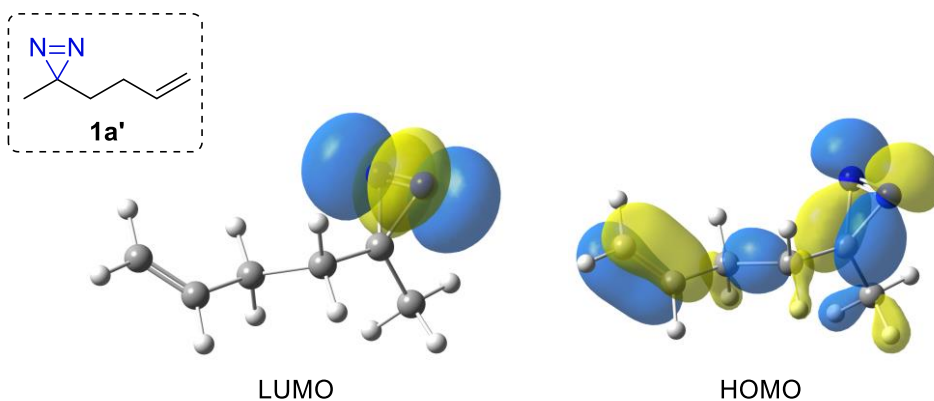


Fig. S5. LUMO and HOMO analysis of diazirine substrate

DFT-calculated Cartesian Coordinates.

1a'

C -0.03150400 0.07909300 -0.66827500

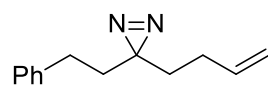
H	-0.24006000	-0.86786400	-1.17950800
H	-0.10042600	0.86890400	-1.42975900
C	-1.10734800	0.31265500	0.41814700
H	-0.88173000	1.25038900	0.94724100
H	-1.05210600	-0.49041900	1.16312600
C	-2.49580300	0.38621100	-0.15644400
H	-2.67160600	1.19145300	-0.87257400
C	-3.49140800	-0.45222400	0.13259300
H	-4.47435500	-0.35233100	-0.31998100
H	-3.36230400	-1.27080700	0.83811500
C	1.37997700	0.04965300	-0.11845000
N	1.78686000	-1.16215600	0.63546500
N	2.24124500	-1.09137700	-0.50960400
C	2.05968200	1.35258600	0.22913200
H	2.17628100	1.98003500	-0.66377300
H	1.47576500	1.92191600	0.96267800
H	3.05223500	1.17560700	0.65319700

6. References

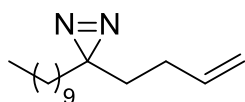
1. Pan, S., Jang, S.-Y., Wang, D., Liew, S. S., Li, Z., Lee, J.-S. & Yao, S. Q. A suite of “Minimalist” photo-crosslinkers for live-cell imaging and chemical proteomics: case study with BRD4 inhibitors. *Angew. Chem. Int. Ed.* 2017, **56**, 11816-11821.
2. (a) Kambe, T., Correia, B. E., Niphakis, M. J. & Cravatt, B. F. Mapping the protein interaction landscape for fully functionalized small-molecule probes in human cells. *J. Am. Chem. Soc.* **136**, 10777–10782 (2014); (b) Kleiner, P., Heydenreuter, W., Stahl, M., Korotkov, V. S. & Siebe, S. A. A Whole proteome inventory of background photocrosslinker binding. *Angew. Chem. Int. Ed.* 2017, **56**, 1396–1401.

7. Characterization of starting materials and products

7.1. Starting materials

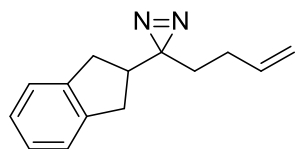


1a, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.29-7.24 (m, 2H), 7.20-7.13 (m, 3H), 5.77-5.67 (m, 1H), 5.02-4.96 (m, 2H), 2.40 (t, $J = 8.4$ Hz, 2H), 1.87-1.82 (m, 2H), 1.72-1.68 (m, 2H), 1.46 (t, $J = 8.0$ Hz, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 140.8, 137.1, 128.5, 128.3, 126.2, 115.4, 35.0, 32.4, 30.0, 28.5, 28.0. **FT-IR**: ν (cm^{-1}) 2923, 2855, 2360, 1583, 1497, 1453, 995, 914, 739, 697. **HRMS** [ESI] calcd for $\text{C}_{13}\text{H}_{16}\text{N}_2\text{Na}$ $[\text{M}+\text{Na}]^+$ 223.1206, found 223.1204.

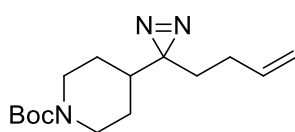


1b, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 5.79-5.69 (m, 1H), 5.04-4.96 (m, 2H), 1.88-1.83 (m, 2H), 1.46 (t, $J = 7.8$ Hz, 2H), 1.36 (t, $J = 8.0$ Hz, 2H), 1.31-1.24 (m, 15H), 1.09-1.07 (m,

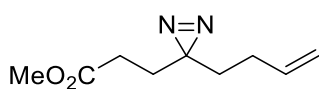
2H), 0.88 (t, $J = 6.6$ Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 137.2, 115.2, 32.9, 32.4, 31.9, 29.5, 29.5, 29.4, 29.3, 29.2, 28.6, 28.0, 23.8, 22.7, 14.1. **FT-IR:** ν (cm^{-1}) 2924, 2854, 2360, 2341, 1584, 1465, 993, 913, 721. **HRMS** [ESI] calcd for $\text{C}_{15}\text{H}_{29}\text{N}_2$ [$\text{M}+\text{H}$] $^+$ 237.2325, found 237.2335.



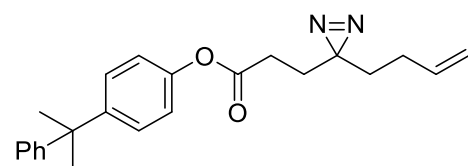
1c, colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 7.16-7.11 (m, 4H), 5.79-5.69 (m, 1H), 5.05-4.98 (m, 2H), 2.84 (dd, $J = 14.8$, 8.0 Hz, 2H), 2.72-2.64 (m, 1H), 2.58 (dd, $J = 14.8$, 8.0 Hz, 2H), 1.87-1.81 (m, 2H), 1.62-1.57 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 141.7, 137.0, 126.5, 124.3, 115.4, 42.5, 34.2, 31.4, 30.3, 27.8. **FT-IR:** ν (cm^{-1}) 2937, 2849, 2360, 2342, 1642, 1577, 1483, 1459, 996, 913, 742. **HRMS** [ESI] calcd for $\text{C}_{14}\text{H}_{16}\text{N}_2\text{Na}$ [$\text{M}+\text{Na}$] $^+$ 235.1206, found 235.1205.



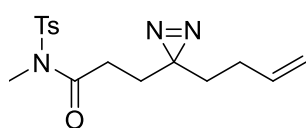
1d, colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 5.74-5.64 (m, 1H), 5.02-4.96 (m, 2H), 4.14-3.97 (m, 2H), 2.57 (t, $J = 12.0$ Hz, 2H), 1.77-1.71 (m, 2H), 1.61-1.44 (m, 5H), 1.42 (s, 9H), 0.97-0.85 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 154.6, 136.9, 115.4, 79.5, 38.8, 30.6, 30.2, 28.4, 27.6, 27.1. **FT-IR:** ν (cm^{-1}) 2977, 2933, 2855, 1689, 1419, 1365, 1239, 1154, 1011, 914. **HRMS** [ESI] calcd for $\text{C}_{15}\text{H}_{25}\text{N}_3\text{O}_2\text{Na}$ [$\text{M}+\text{Na}$] $^+$ 302.1839, found 302.1831.



1e, colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 5.78-5.67 (m, 1H), 5.04-4.97 (m, 2H), 3.67 (s, 3H), 2.11 (t, $J = 7.6$ Hz, 2H), 1.89-1.83 (m, 2H), 1.75 (t, $J = 7.6$ Hz, 2H), 1.52-1.48 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 172.7, 136.8, 115.5, 51.8, 32.2, 28.3, 28.2, 27.9, 27.8. **FT-IR:** ν (cm^{-1}) 2953, 2361, 2342, 1738, 1584, 1437, 1362, 1314, 1257, 1197, 1172, 995, 915. **HRMS** [ESI] calcd for $\text{C}_9\text{H}_{14}\text{N}_2\text{NaO}_2$ [$\text{M}+\text{Na}$] $^+$ 205.0947, found 205.0949.

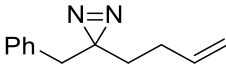


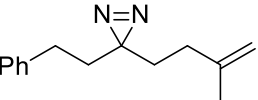
1f, colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 7.29-7.15 (m, 7H), 7.00-6.96 (m, 2H), 5.79-5.69 (m, 1H), 5.06-4.98 (m, 2H), 2.35 (t, $J = 7.6$ Hz, 2H), 1.91-1.84 (m, 4H), 1.67 (s, 6H), 1.57-1.53 (m, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 170.9, 150.2, 148.3, 136.8, 128.0, 127.8, 126.7, 125.7, 120.8, 120.7, 115.6, 42.7, 32.2, 30.8, 28.7, 28.2, 27.9, 27.8. **FT-IR:** ν (cm^{-1}) 2954, 2363, 2343, 1757, 1505, 1204, 1170, 1136, 1017, 914, 763, 700. **HRMS** [ESI] calcd for $\text{C}_{23}\text{H}_{26}\text{N}_2\text{NaO}_2$ [$\text{M}+\text{Na}$] $^+$ 385.1886, found 385.1885.

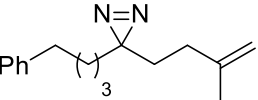


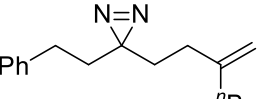
1g, colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 7.74 (d, $J = 8.2$ Hz, 2H), 7.34 (d, $J = 8.2$ Hz, 2H), 5.73-5.63 (m, 1H), 5.00-4.94 (m, 2H), 3.25 (s, 3H), 2.46-2.42 (m, 5H), 1.83-1.77 (m, 2H), 1.71 (t, $J = 7.6$ Hz, 2H), 1.42 (t, $J = 7.6$ Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 171.6, 145.0, 136.8, 135.9, 129.9, 127.3, 115.4, 33.0, 32.2,

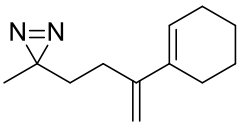
30.7, 27.8, 27.7, 21.5. **FT-IR:** ν (cm⁻¹) 2926, 2361, 2342, 1698, 1354, 1160, 1085, 989, 917, 813, 713, 665. **HRMS** [ESI] calcd for C₁₆H₂₁N₃NaO₃S [M+Na]⁺ 358.1196, found 358.1210.

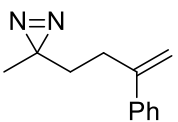
 **1h**, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.33-7.17 (m, 5H), 5.75-5.64 (m, 1H), 5.01-4.95 (m, 2H), 2.65 (s, 2H), 1.86-1.80 (m, 2H), 1.53-1.49 (m, 2H); **¹³C NMR** (100 MHz, CDCl₃) δ 137.0, 135.4, 129.4, 128.6, 126.9, 115.4, 40.1, 31.7, 29.1, 27.8. **FT-IR:** ν (cm⁻¹) 2916, 2360, 1642, 1583, 1496, 1454, 1437, 995, 913, 730, 698. **HRMS** [ESI] calcd for C₁₂H₁₄N₂Na [M+Na]⁺ 209.1049, found 209.1058.

 **1i**, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.31-7.15 (m, 5H), 4.73 (s, 1H), 4.65 (s, 1H), 2.44-2.40 (m, 2H), 1.81-1.70 (m, 4H), 1.67 (s, 3H), 1.54-1.50 (m, 2H); **¹³C NMR** (100 MHz, CDCl₃) δ 144.2, 140.8, 128.5, 128.2, 126.1, 110.5, 34.9, 31.6, 31.2, 30.0, 28.6, 22.4. **FT-IR:** ν (cm⁻¹) 2921, 2857, 2361, 2341, 1650, 1580, 1497, 1453, 889, 739, 697. **HRMS** [ESI] calcd for C₁₄H₁₈N₂Na [M+Na]⁺ 237.1362, found 237.1364.

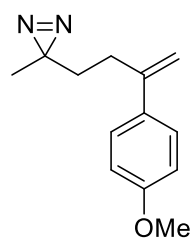
 **1j**, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.29-7.25 (m, 2H), 7.19-7.14 (m, 3H), 4.72 (s, 1H), 4.64 (s, 1H), 2.56 (t, *J* = 7.8 Hz, 2H), 1.80-1.76 (m, 2H), 1.66 (s, 3H), 1.61-1.53 (m, 2H), 1.51-1.47 (m, 2H), 1.40 (t, *J* = 7.4 Hz, 2H), 1.18-1.10 (m, 2H); **¹³C NMR** (100 MHz, CDCl₃) δ 144.3, 142.2, 128.3, 128.3, 125.7, 110.4, 35.7, 32.7, 31.6, 31.2, 30.9, 28.6, 23.5, 22.4. **FT-IR:** ν (cm⁻¹) 2934, 2858, 1650, 1582, 1496, 1453, 1375, 888, 744, 698. **HRMS** [ESI] calcd for C₁₆H₂₂N₂Na [M+Na]⁺ 265.1675, found 265.1683.

 **1k**, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.31-7.27 (m, 2H), 7.22-7.15 (m, 3H), 4.73 (s, 1H), 4.66 (s, 1H), 2.44-2.40 (m, 2H), 1.94 (t, *J* = 7.4 Hz, 2H), 1.79-1.69 (m, 4H), 1.55-1.19 (m, 2H), 1.38-1.26 (m, 4H), 0.90 (t, *J* = 7.0 Hz, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 148.3, 140.8, 128.5, 128.2, 126.1, 109.3, 35.8, 35.0, 31.3, 30.0, 29.9, 29.8, 28.6, 22.4, 13.9. **FT-IR:** ν (cm⁻¹) 2955, 2928, 2859, 2361, 2342, 1646, 1582, 1454, 889, 739, 697. **HRMS** [ESI] calcd for C₁₇H₂₅N₂ [M+H]⁺ 257.2012, found 257.2017.

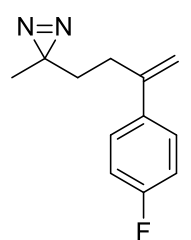
 **1l**, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 5.80 (t, *J* = 3.8 Hz, 1H), 4.98 (s, 1H), 4.80 (s, 1H), 2.14-2.09 (m, 6H), 1.69-1.63 (m, 2H), 1.59-1.55 (m, 2H), 1.53-1.49 (m, 2H), 1.02 (s, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 147.1, 135.3, 124.4, 109.2, 34.0, 27.8, 26.0, 25.9, 25.8, 22.9, 22.1, 19.9. **FT-IR:** ν (cm⁻¹) 2927, 2859, 1604, 1448, 1384, 919, 886, 851, 803. **HRMS** [ESI] calcd for C₁₂H₁₈KN₂ [M+K]⁺ 229.1102, found 229.1092.

 **1m**, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.37-7.25 (m, 5H), 5.29 (s, 1H), 5.07 (q, *J* = 1.2 Hz, 1H), 2.39-2.35 (m, 2H), 1.54-1.50 (m, 2H), 1.02 (s, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 147.1, 140.6, 128.4,

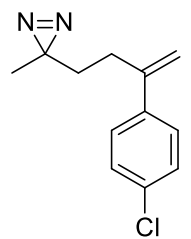
127.5, 126.0, 112.9, 33.2, 29.7, 25.7, 19.9. **FT-IR:** ν (cm⁻¹) 2924, 2859, 2360, 1628, 1575, 1494, 1444, 1385, 1028, 897, 777, 700. **HRMS** [ESI] calcd for C₁₂H₁₄N₂Na [M+Na]⁺ 209.1049, found 209.1058.



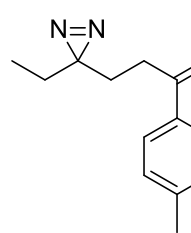
1n, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.31-7.28 (m, 2H), 6.87-6.84 (m, 2H), 5.23 (s, 1H), 4.99 (d, J = 0.8 Hz, 1H), 3.81 (s, 3H), 2.34 (t, J = 8.0 Hz, 2H), 1.53-1.49 (m, 2H), 1.01 (s, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 159.1, 146.3, 133.0, 127.1, 113.7, 111.3, 55.2, 33.2, 29.7, 25.7, 19.9. **FT-IR:** ν (cm⁻¹) 2952, 2837, 2361, 2342, 1608, 1511, 1456, 1287, 1246, 1179, 1033, 891, 834, 810. **HRMS** [ESI] calcd for C₁₃H₁₆N₂NaO [M+Na]⁺ 239.1155, found 239.1153.



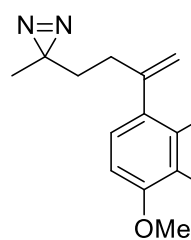
1o, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.34-7.28 (m, 2H), 7.03-6.97 (m, 2H), 5.23 (s, 1H), 5.05 (d, J = 1.2 Hz, 1H), 2.35-2.31 (m, 2H), 1.52-1.48 (m, 2H), 1.00 (s, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 162.3 (d, J_{C-F} = 244.9 Hz), 146.1, 136.7 (d, J_{C-F} = 3.4 Hz), 127.6 (d, J_{C-F} = 7.9 Hz), 115.2 (d, J_{C-F} = 21.2 Hz), 112.9, 33.1, 29.8, 25.6, 19.8; **¹⁹F NMR** (376 MHz, CDCl₃) δ -115.0 (s). **FT-IR:** ν (cm⁻¹) 2925, 1602, 1509, 1452, 1229, 1161, 898, 838. **HRMS** [EI] calcd for C₁₂H₁₃FN₂ [M]⁺ 204.1057, found 204.1059.



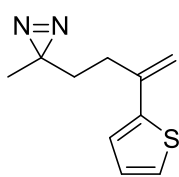
1p, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.31-7.27 (m, 4H), 5.28 (s, 1H), 5.08 (d, J = 1.2 Hz, 1H), 2.33 (td, J = 8.0, 1.2 Hz, 2H), 1.52-1.48 (m, 2H), 1.01 (s, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 146.0, 139.0, 133.3, 128.5, 127.3, 113.5, 33.1, 29.6, 25.6, 19.9. **FT-IR:** ν (cm⁻¹) 2949, 2924, 2360, 2342, 1492, 1096, 1012, 899, 834, 736. **HRMS** [EI] calcd for C₁₂H₁₃ClN₂ [M]⁺ 220.0762, found 220.0769.



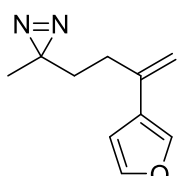
1q, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 7.25-7.23 (m, 2H), 7.12 (d, J = 8.0 Hz, 2H), 5.25 (s, 1H), 5.00 (s, 1H), 2.34 (s, 3H), 2.31-2.25 (m, 2H), 1.56-1.50 (m, 2H), 1.42 (q, J = 7.6 Hz, 2H), 0.66 (t, J = 7.6 Hz, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 146.9, 137.6, 137.3, 129.0, 125.8, 112.0, 31.6, 29.5, 29.4, 25.9, 21.1, 8.2. **FT-IR:** ν (cm⁻¹) 2970, 2923, 2360, 2342, 1626, 1576, 1514, 1457, 894, 824, 734. **HRMS** [ESI] calcd for C₁₄H₁₈N₂Na [M+Na]⁺ 237.1362, found 237.1370.



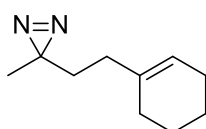
1r, colorless oil. **¹H NMR** (400 MHz, CDCl₃) δ 8.31-8.28 (m, 1H), 7.94-7.90 (m, 1H), 7.52-7.45 (m, 2H), 7.16 (d, J = 7.6 Hz, 1H), 6.77 (d, J = 7.6 Hz, 1H), 5.36 (d, J = 1.6 Hz, 1H), 5.08 (d, J = 1.6 Hz, 1H), 4.01 (s, 3H), 2.35 (t, J = 8.0 Hz, 2H), 1.52-1.48 (m, 2H), 0.98 (s, 3H); **¹³C NMR** (100 MHz, CDCl₃) δ 154.7, 147.3, 132.7, 132.1, 126.4, 125.6, 125.3, 125.0, 125.0, 122.2, 115.9, 103.0, 55.5, 33.0, 32.9, 25.7, 19.8. **FT-IR:** ν (cm⁻¹) 2938, 2839, 1585, 1462, 1236, 1088, 903, 819, 765. **HRMS** [EI] calcd for C₁₇H₁₈N₂O [M] 266.1419, found 266.1423.



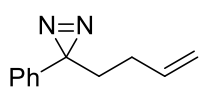
1s, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.17 (d, $J = 4.8$ Hz, 1H), 6.98-6.96 (m, 2H), 5.41 (s, 1H), 4.97 (s, 1H), 2.35 (t, $J = 8.0$ Hz, 2H), 1.66-1.62 (m, 2H), 1.05 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 144.6, 140.3, 127.4, 124.3, 123.3, 111.4, 33.5, 29.7, 25.6, 19.9. **FT-IR**: ν (cm^{-1}) 2924, 1619, 1440, 1227, 884, 829, 695. **HRMS** [EI] calcd for $\text{C}_{10}\text{H}_{12}\text{N}_2\text{S}$ [M] $^+$ 192.0716, found 192.0724.



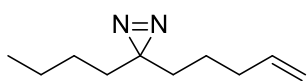
1t, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.40 (s, 1H), 7.36 (t, $J = 1.8$ Hz, 1H), 6.50-6.49 (m, 1H), 5.25 (s, 1H), 4.93 (d, $J = 1.2$ Hz, 1H), 2.21-2.17 (m, 2H), 1.63-1.59 (m, 2H), 1.04 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 143.3, 138.6, 138.1, 126.3, 110.6, 108.1, 33.2, 29.0, 25.7, 19.9. **FT-IR**: ν (cm^{-1}) 2925, 1637, 1450, 1165, 1070, 1025, 887, 872, 790, 734. **HRMS** [ESI] calcd for $\text{C}_{10}\text{H}_{12}\text{KN}_2\text{O}$ [M+K] $^+$ 215.0581, found 215.0586.



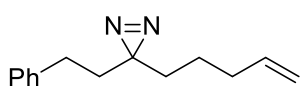
1u, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 5.39-5.39 (m, 1H), 1.97-1.96 (m, 2H), 1.84-1.77 (m, 4H), 1.62-1.50 (m, 4H), 1.44-1.40 (m, 2H), 0.99 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 136.2, 121.5, 32.7, 32.1, 28.2, 25.9, 25.2, 22.9, 22.4, 19.8. **FT-IR**: ν (cm^{-1}) 2925, 2857, 2836, 1590, 1448, 1439, 1384, 919, 801. **HRMS** [EI] calcd for $\text{C}_{10}\text{H}_{16}\text{N}_2$ [M] $^+$ 164.1308, found 164.1311.



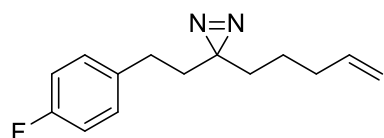
1v, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.34-7.24 (m, 3H), 6.96-6.93 (m, 2H), 5.84-5.74 (m, 1H), 5.07-4.99 (m, 2H), 2.09-1.98 (m, 4H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 138.8, 136.8, 128.3, 127.4, 125.6, 115.5, 29.6, 29.0, 28.1. **FT-IR**: ν (cm^{-1}) 2928, 1596, 1498, 1450, 991, 912, 749, 694. **HRMS** [EI] calcd for $\text{C}_{11}\text{H}_{12}\text{N}_2$ [M] $^+$ 172.0995, found 172.0996.



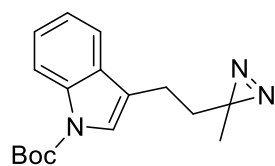
1w, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 5.76-5.66 (m, 1H), 5.00-4.92 (m, 2H), 2.01-1.95 (m, 2H), 1.37-1.32 (m, 4H), 1.27-1.14 (m, 4H), 1.09-1.01 (m, 2H), 0.84 (t, $J = 7.2$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 137.9, 115.0, 33.1, 32.6, 32.3, 28.7, 25.9, 23.1, 22.3, 13.8. **FT-IR**: ν (cm^{-1}) 2956, 2861, 1711, 1457, 1252, 1115, 911, 746. **HRMS** [ESI] calcd for $\text{C}_{10}\text{H}_{19}\text{N}_2$ [M+H] $^+$ 167.1543, found 167.1549.



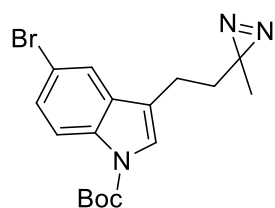
1x, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.31-7.28 (m, 2H), 7.23-7.15 (m, 3H), 5.78-5.68 (m, 1H), 5.03-4.96 (m, 2H), 2.43 (t, $J = 8.4$ Hz, 2H), 2.00 (q, $J = 7.1$ Hz, 2H), 1.73-1.69 (m, 2H), 1.39 (t, $J = 7.6$ Hz, 2H), 1.25-1.17 (m, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 140.7, 137.8, 128.4, 128.2, 126.1, 115.1, 35.0, 33.0, 32.2, 29.9, 28.6, 23.0. **FT-IR**: ν (cm^{-1}) 2934, 2860, 1583, 1454, 992, 912, 736, 697. **HRMS** [ESI] calcd for $\text{C}_{14}\text{H}_{18}\text{N}_2\text{Na}$ [M+Na] $^+$ 237.1362, found 237.1365.



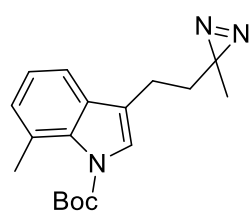
1y, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.12-7.09 (m, 2H), 6.99-6.94 (m, 2H), 5.77-5.67 (m, 1H), 5.02-4.95 (m, 2H), 2.40-2.36 (m, 2H), 2.02-1.96 (m, 2H), 1.69-1.65 (m, 2H), 1.39-1.35 (m, 2H), 1.23-1.15 (m, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 161.3 (d, $J_{\text{C-F}} = 242.6$ Hz), 137.7, 136.3 (d, $J_{\text{C-F}} = 3.3$ Hz), 129.6 (d, $J_{\text{C-F}} = 7.8$ Hz), 115.2 (d, $J_{\text{C-F}} = 20.1$ Hz), 115.1, 35.0, 33.0, 32.2, 29.1, 28.4, 23.0; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -117.1 (s). **FT-IR**: ν (cm^{-1}) 2930, 1509, 1222, 1158, 913, 825. **HRMS** [ESI] calcd for $\text{C}_{14}\text{H}_{18}\text{FN}_2$ [$\text{M}+\text{H}$] $^+$ 233.1449, found 233.1450.



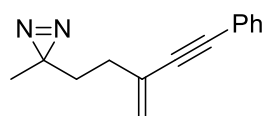
1z, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.11 (d, $J = 6.4$ Hz, 1H), 7.46 (d, $J = 8.0$ Hz, 1H), 7.36-7.28 (m, 2H), 7.24-7.20 (m, 1H), 2.56-2.52 (m, 2H), 1.80-1.76 (m, 2H), 1.66 (s, 9H), 1.06 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 149.7, 135.5, 130.2, 124.4, 122.4, 122.3, 119.5, 118.7, 115.3, 83.4, 33.9, 28.2, 25.7, 19.9, 19.4. **FT-IR**: ν (cm^{-1}) 2979, 1728, 1452, 1369, 1253, 1154, 1082, 766, 743. **HRMS** [ESI] calcd for $\text{C}_{17}\text{H}_{21}\text{N}_3\text{NaO}_2$ [$\text{M}+\text{Na}$] $^+$ 322.1526, found 322.1516.



1aa, white solid, mp. 75-76 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.98 (d, $J = 6.4$ Hz, 1H), 7.57 (d, $J = 1.6$ Hz, 1H), 7.40-7.35 (m, 2H), 2.50-2.46 (m, 2H), 1.79-1.75 (m, 2H), 1.66 (s, 9H), 1.06 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 149.3, 134.2, 131.9, 127.2, 123.5, 121.4, 118.8, 116.7, 115.8, 83.9, 33.8, 28.1, 25.6, 19.8, 19.3. **FT-IR**: ν (cm^{-1}) 2983, 1722, 1449, 1372, 1258, 1151, 1091, 1053, 857, 800, 766, 644. **HRMS** [ESI] calcd for $\text{C}_{17}\text{H}_{20}\text{BrN}_3\text{NaO}_2$ [$\text{M}+\text{Na}$] $^+$ 400.0631, found 400.0639.



1ab, light brown oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30 (d, $J = 6.0$ Hz, 2H), 7.19-7.11 (m, 2H), 2.64 (s, 3H), 2.56-2.52 (m, 2H), 1.80-1.76 (m, 2H), 1.65 (s, 9H), 1.08 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 149.5, 135.1, 131.6, 127.8, 125.6, 124.7, 122.9, 119.2, 116.2, 83.0, 34.0, 28.1, 25.7, 22.1, 19.8, 19.4. **FT-IR**: ν (cm^{-1}) 2977, 2930, 1741, 1343, 1252, 1220, 1153, 1045, 1028, 789, 756. **HRMS** [ESI] calcd for $\text{C}_{18}\text{H}_{23}\text{N}_3\text{NaO}_2$ [$\text{M}+\text{Na}$] $^+$ 336.1682, found 336.1694.



1ac, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.44-7.41 (m, 2H), 7.33-7.30 (m, 3H), 5.45 (s, 1H), 5.34 (s, 1H), 2.14 (t, $J = 8.0$ Hz, 2H), 1.68-1.64 (m, 2H), 1.06 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 131.6, 130.2, 128.3, 123.0, 121.9, 89.8, 88.9, 33.3, 31.7, 25.5, 19.9. **FT-IR**: ν (cm^{-1}) 2922, 1609, 1489, 1443, 1069, 900, 754, 690. **HRMS** [EI] calcd for $\text{C}_{14}\text{H}_{14}\text{N}_2$ [M] 210.1157, found 210.1160.

1ad, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 5.39 (s, 1H), 5.29 (s, 1H), 2.07 (t, $J = 8.0$ Hz, 2H), 1.62-1.58 (m, 2H), 1.08 (s, 21H), 1.02 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 130.5, 122.3, 106.6, 91.0, 33.2, 31.7, 25.5, 19.9, 18.6, 11.2. **FT-IR**: ν (cm^{-1}) 2943, 2866, 2143, 1462, 1385, 996, 901, 881, 675, 659. **HRMS** [ESI] calcd for $\text{C}_{17}\text{H}_{30}\text{KN}_2\text{Si}$ [$\text{M}+\text{K}$] $^+$ 329.1810, found 329.1809.

1ae, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.29-7.24 (m, 2H), 7.20-7.12 (m, 3H), 5.46-5.38 (m, 1H), 5.34-5.28 (m, 1H), 2.40 (t, $J = 8.2$ Hz, 2H), 1.80-1.74 (m, 2H), 1.70-1.62 (m, 5H), 1.41 (t, $J = 8.0$ Hz, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 140.8, 129.5, 128.4, 128.2, 126.1, 125.9, 35.0, 33.0, 29.9, 28.5, 26.8, 17.9. **FT-IR**: ν (cm^{-1}) 2919, 2855, 1582, 1496, 1453, 965, 746, 697. **HRMS** [EI] calcd for $\text{C}_{14}\text{H}_{18}\text{N}_2$ [M] 214.1470, found 214.1471.

1af, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.28-7.24 (m, 2H), 7.18-7.15 (m, 3H), 5.50-5.43 (m, 1H), 5.39-5.32 (m, 1H), 2.66 (t, $J = 7.8$ Hz, 2H), 2.33-2.27 (m, 2H), 1.89-1.83 (m, 2H), 1.39-1.35 (m, 2H), 0.98 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 141.9, 130.5, 129.2, 128.4, 128.2, 125.7, 35.9, 34.4, 34.3, 27.0, 25.6, 19.9. **FT-IR**: ν (cm^{-1}) 2924, 2853, 1602, 1496, 1452, 968, 745, 698. **HRMS** [ESI] calcd for $\text{C}_{14}\text{H}_{18}\text{N}_2\text{Na}$ [$\text{M}+\text{Na}$] $^+$ 237.1362, found 237.1355.

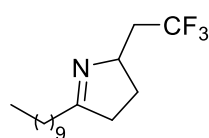
1ag, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.13 (m, 3H), 5.01-4.97 (m, 1H), 2.42-2.38 (m, 2H), 1.79-1.75 (m, 2H), 1.73-1.67 (m, 5H), 1.57 (s, 3H), 1.42-1.38 (m, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 140.8, 132.6, 128.5, 128.2, 126.1, 122.7, 35.1, 33.1, 30.0, 28.7, 25.7, 22.4, 17.6. **FT-IR**: ν (cm^{-1}) 2916, 2855, 1584, 1454, 747, 697. **HRMS** [EI] calcd for $\text{C}_{15}\text{H}_{20}\text{N}_2$ [M] 228.1626, found 228.1621.

1ah, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 5.54 (t, $J = 6.4$ Hz, 1H), 2.08-2.01 (m, 4H), 1.84 (t, $J = 8.0$ Hz, 2H), 1.74-1.68 (m, 2H), 1.48-1.39 (m, 6H), 1.00 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 143.1, 126.6, 34.2, 33.1, 32.7, 32.6, 28.2, 27.2, 26.7, 25.8, 19.8. **FT-IR**: ν (cm^{-1}) 2919, 2849, 1590, 1447, 1384, 1220, 965, 845. **HRMS** [EI] calcd for $\text{C}_{11}\text{H}_{18}\text{N}_2$ [M] 178.1470, found 178.1472.

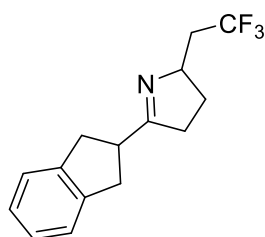
7.2. Products

2a, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.31-7.27 (m, 2H), 7.21-7.18 (m, 3H), 4.20-4.17 (m, 1H), 2.95-2.91 (m, 2H), 2.77-2.64 (m, 3H), 2.61-2.43 (m, 2H), 2.24-2.16 (m, 1H), 2.10-2.02 (m, 1H), 1.61-1.52 (m, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 178.6, 141.0, 128.4, 128.2, 126.4 (q, $J_{\text{C-F}} = 275.2$ Hz), 126.1, 66.4 (q, $J_{\text{C-F}} = 2.7$ Hz), 40.1 (q, $J_{\text{C-F}} = 26.8$ Hz), 38.0, 35.2, 32.6, 29.2; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -64.0

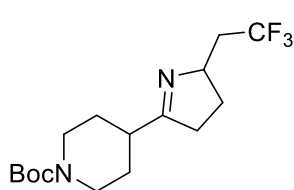
(s). **FT-IR:** ν (cm^{-1}) 2945, 2360, 2342, 1644, 1377, 1249, 1130, 1088, 1020, 840, 750, 699, 648. **HRMS** [ESI] calcd for $\text{C}_{14}\text{H}_{17}\text{F}_3\text{N}$ [$\text{M}+\text{H}$] $^+$ 256.1308, found 256.1318.



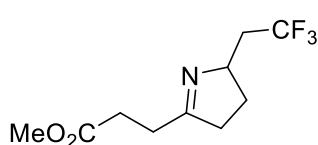
2b, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 4.19-4.12 (m, 1H), 2.79-2.68 (m, 1H), 2.62-2.44 (m, 2H), 2.35-2.30 (m, 2H), 2.24-2.16 (m, 1H), 2.14-2.00 (m, 1H), 1.61-1.52 (m, 3H), 1.29-1.25 (m, 14H), 0.87 (t, $J = 7.0$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 179.6, 126.4 (q, $J_{\text{C-F}} = 275.4$ Hz), 66.3 (q, $J_{\text{C-F}} = 2.5$ Hz), 40.1 (q, $J_{\text{C-F}} = 26.9$ Hz), 37.5, 33.8, 31.9, 29.5, 29.5, 29.4, 29.3, 29.3, 29.2, 26.4, 22.7, 14.1; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -64.0 (s). **FT-IR:** ν (cm^{-1}) 2925, 2855, 2360, 2342, 1644, 1377, 1249, 1136, 1090, 841, 649. **HRMS** [ESI] calcd for $\text{C}_{16}\text{H}_{29}\text{F}_3\text{N}$ [$\text{M}+\text{H}$] $^+$ 292.2247, found 292.2235.



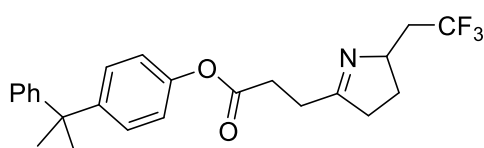
2c, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.23-7.20 (m, 2H), 7.18-7.15 (m, 2H), 4.23-4.16 (m, 1H), 3.48-3.40 (m, 1H), 3.24-3.17 (m, 2H), 3.11-3.04 (m, 2H), 2.84-2.70 (m, 1H), 2.66-2.47 (m, 2H), 2.28-2.20 (m, 1H), 2.15-2.03 (m, 1H), 1.65-1.56 (m, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 180.9, 142.1, 142.1, 126.5, 126.4 (q, $J_{\text{C-F}} = 275.3$ Hz), 124.4, 66.2 (q, $J_{\text{C-F}} = 2.6$ Hz), 43.3, 40.1 (q, $J_{\text{C-F}} = 26.9$ Hz), 36.8, 36.8, 35.9, 29.3; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -64.0 (s). **FT-IR:** ν (cm^{-1}) 2946, 2361, 2342, 1637, 1377, 1249, 1136, 1089, 743, 648. **HRMS** [ESI] calcd for $\text{C}_{15}\text{H}_{17}\text{F}_3\text{N}$ [$\text{M}+\text{H}$] $^+$ 268.1308, found 268.1295.



2d, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 4.19-4.13 (m, 3H), 2.78-2.56 (m, 4H), 2.52-2.43 (m, 2H), 2.24-2.16 (m, 1H), 2.11-2.02 (m, 1H), 1.81-1.77 (m, 2H), 1.60-1.47 (m, 3H), 1.44 (s, 9H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 181.0, 154.7, 126.3 (q, $J_{\text{C-F}} = 275.4$ Hz), 79.5, 66.2 (q, $J_{\text{C-F}} = 2.6$ Hz), 43.6, 40.5, 40.0 (q, $J_{\text{C-F}} = 27.0$ Hz), 35.4, 29.3, 29.2, 28.9, 28.4; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -64.0 (s). **FT-IR:** ν (cm^{-1}) 2976, 2934, 2361, 2342, 1688, 1423, 1366, 1250, 1165, 1138, 1090, 1012. **HRMS** [ESI] calcd for $\text{C}_{16}\text{H}_{25}\text{F}_3\text{N}_2\text{O}_2$ [$\text{M}+\text{Na}$] $^+$ 357.1760, found 357.1760.

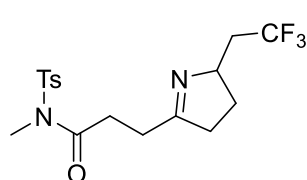


2e, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 4.21-4.14 (m, 1H), 3.68 (s, 3H), 2.75-2.48 (m, 7H), 2.25-2.17 (m, 1H), 2.11-2.02 (m, 1H), 1.65-1.56 (m, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 177.1, 173.3, 126.3 (q, $J_{\text{C-F}} = 275.2$ Hz), 66.4 (q, $J_{\text{C-F}} = 2.5$ Hz), 51.6, 40.0 (q, $J_{\text{C-F}} = 26.9$ Hz), 38.1, 30.3, 29.1, 28.3; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -64.1 (s). **FT-IR:** ν (cm^{-1}) 2955, 1736, 1249, 1130, 1097, 1019, 840, 644. **HRMS** [ESI] calcd for $\text{C}_{10}\text{H}_{15}\text{F}_3\text{NO}_2$ [$\text{M}+\text{H}$] $^+$ 238.1049, found 238.1044.

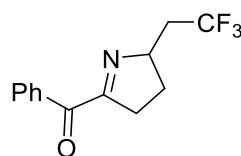


2f, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.28-7.15 (m, 7H), 6.96 (d, $J = 8.4$ Hz, 2H), 4.21-4.18 (m, 1H), 2.98-2.85 (m, 2H), 2.77-2.50 (m, 5H), 2.27-2.18 (m, 1H), 2.15-2.01 (m, 1H), 1.67 (s, 6H), 1.64-1.56 (m, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 177.0, 171.6,

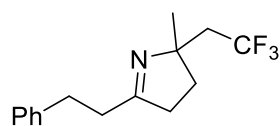
150.3, 148.5, 148.2, 128.0, 127.8, 126.7, 126.3 (q, $J_{C-F} = 275.3$ Hz), 125.7, 120.7, 66.4 (q, $J_{C-F} = 2.6$ Hz), 42.7, 40.1 (q, $J_{C-F} = 26.9$ Hz), 38.3, 30.8, 30.7, 29.2, 28.2; ^{19}F NMR (376 MHz, CDCl_3) δ -64.0 (s). **FT-IR:** ν (cm^{-1}) 2970, 2360, 2342, 1756, 1505, 1250, 1205, 1170, 1133, 1017, 840, 764, 700. **HRMS** [ESI] calcd for $\text{C}_{24}\text{H}_{26}\text{F}_3\text{NO}_2$ [$\text{M}+\text{Na}$] $^+$ 440.1808, found 440.1800.



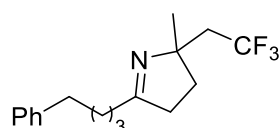
2g, colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 7.83 (d, $J = 8.2$ Hz, 2H), 7.33 (d, $J = 8.2$ Hz, 2H), 4.08-4.01 (m, 1H), 3.31 (s, 3H), 3.13-2.95 (m, 2H), 2.65-2.41 (m, 8H), 2.19-2.10 (m, 1H), 1.99-1.90 (m, 1H), 1.57-1.48 (m, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.1, 172.5, 144.7, 136.2, 129.7, 127.6, 126.3 (q, $J_{C-F} = 275.3$ Hz), 66.1 (q, $J_{C-F} = 2.6$ Hz), 40.0 (q, $J_{C-F} = 26.8$ Hz), 38.2, 33.0, 32.7, 29.1, 27.9, 21.5; ^{19}F NMR (376 MHz, CDCl_3) δ -64.0 (s). **FT-IR:** ν (cm^{-1}) 2952, 2361, 2342, 1699, 1354, 1249, 1160, 1131, 1085, 814, 711, 665. **HRMS** [ESI] calcd for $\text{C}_{17}\text{H}_{21}\text{F}_3\text{N}_2\text{O}_3\text{S}$ [$\text{M}+\text{Na}$] $^+$ 413.1117, found 413.1114.



2h', colorless oil (*Note:* The isolated imine **2h** was unstable, and underwent spontaneous oxidation under air during work-up to furnish **2h'**). ^1H NMR (400 MHz, CDCl_3) δ 8.21-8.19 (m, 2H), 7.62-7.58 (m, 1H), 7.49-7.45 (m, 2H), 4.60-4.52 (m, 1H), 3.15-3.06 (m, 1H), 3.01-2.83 (m, 2H), 2.40-2.27 (m, 2H), 1.78-1.68 (m, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 190.4, 174.2, 135.1, 133.7, 130.5, 128.4, 126.1 (q, $J_{C-F} = 275.2$ Hz), 68.9 (q, $J_{C-F} = 2.6$ Hz), 39.7 (q, $J_{C-F} = 27.6$ Hz), 36.3, 28.3; ^{19}F NMR (376 MHz, CDCl_3) δ -64.0 (s). **FT-IR:** ν (cm^{-1}) 2953, 1659, 1249, 1144, 1130, 1089, 917, 702, 644. **HRMS** [ESI] calcd for $\text{C}_{13}\text{H}_{13}\text{F}_3\text{NNaO}$ [$\text{M}+\text{H}$] $^+$ 278.0763, found 278.0770.

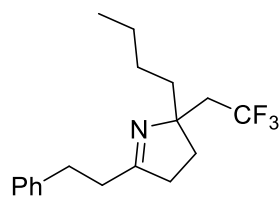


2i, colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.17 (m, 3H), 2.91 (t, $J = 8.0$ Hz, 2H), 2.65-2.61 (m, 2H), 2.58-2.43 (m, 3H), 2.30-2.18 (m, 1H), 2.01-1.93 (m, 1H), 1.78-1.72 (m, 1H), 1.26 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 175.9, 141.0, 128.4, 128.3, 126.3 (q, $J_{C-F} = 276.3$ Hz), 126.1, 72.4 (q, $J_{C-F} = 1.9$ Hz), 44.1 (q, $J_{C-F} = 26.0$ Hz), 37.8, 35.1, 34.1 (q, $J_{C-F} = 1.4$ Hz), 32.7, 26.8; ^{19}F NMR (376 MHz, CDCl_3) δ -60.5 (s). **FT-IR:** ν (cm^{-1}) 2969, 2938, 1645, 1364, 1258, 1151, 1089, 1044, 748, 698, 652. **HRMS** [ESI] calcd for $\text{C}_{15}\text{H}_{19}\text{F}_3\text{N}$ [$\text{M}+\text{H}$] $^+$ 270.1464, found 270.1463.

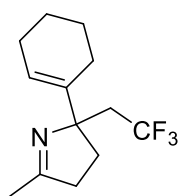


2j, colorless oil. ^1H NMR (400 MHz, CDCl_3) δ 7.29-7.25 (m, 2H), 7.19-7.15 (m, 3H), 2.63 (t, $J = 7.6$ Hz, 2H), 2.58-2.44 (m, 3H), 2.35-2.21 (m, 3H), 2.02-1.94 (m, 1H), 1.79-1.72 (m, 1H), 1.70-1.57 (m, 4H), 1.27 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 176.6, 142.3, 128.3, 128.3, 126.3 (q, $J_{C-F} = 276.3$ Hz), 125.7, 72.2 (q, $J_{C-F} = 1.7$ Hz), 44.2 (q, $J_{C-F} = 25.9$ Hz), 37.3, 35.6, 34.0 (q, $J_{C-F} = 1.6$ Hz), 33.5, 31.1, 26.9 (q, $J_{C-F} = 1.3$ Hz), 26.1; ^{19}F NMR (376 MHz, CDCl_3) δ -60.5 (s). **FT-IR:** ν (cm^{-1}) 2936, 2860, 1644, 1454, 1364, 1258, 1150, 1090, 839, 747, 698, 652. **HRMS** [ESI] calcd for

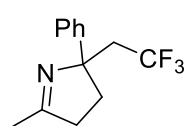
C₁₇H₂₃F₃N [M+H]⁺ 298.1777, found 298.1781.



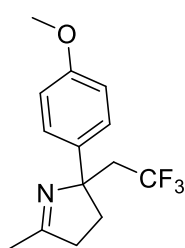
2k, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.29-7.26 (m, 2H), 7.22-7.16 (m, 3H), 2.97-2.85 (m, 2H), 2.65 (t, *J* = 7.8 Hz, 2H), 2.56-2.42 (m, 3H), 2.35-2.22 (m, 1H), 1.96-1.89 (m, 1H), 1.82-1.75 (m, 1H), 1.64-1.49 (m, 2H), 1.32-1.23 (m, 2H), 1.21-1.10 (m, 2H), 0.88 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 176.1, 141.0, 128.4, 128.2, 126.4 (q, *J*_{C-F} = 276.6 Hz), 126.1, 75.5 (q, *J*_{C-F} = 1.5 Hz), 42.9 (q, *J*_{C-F} = 25.6 Hz), 40.3, 38.3, 35.0, 32.7, 31.3 (q, *J*_{C-F} = 1.5 Hz), 25.7, 23.0, 14.0; ¹⁹F NMR (376 MHz, CDCl₃) δ -60.0 (s). **FT-IR**: ν (cm⁻¹) 2957, 2932, 2863, 2361, 2342, 1648, 1456, 1366, 1256, 1143, 1109, 748, 698, 654. **HRMS** [ESI] calcd for C₁₈H₂₅F₃N [M+H]⁺ 312.1934, found 312.1937.



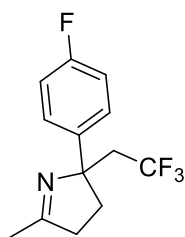
2l, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 5.64-5.62 (m, 1H), 2.60-2.40 (m, 4H), 2.06-1.96 (m, 9H), 1.68-1.50 (m, 4H); ¹³C NMR (100 MHz, CDCl₃) δ 174.3, 139.7, 126.2 (q, *J*_{C-F} = 276.9 Hz), 120.9, 78.8 (q, *J*_{C-F} = 1.8 Hz), 41.8 (q, *J*_{C-F} = 25.4 Hz), 38.8, 32.7 (q, *J*_{C-F} = 1.4 Hz), 25.2, 25.1, 23.0, 22.3, 19.7; ¹⁹F NMR (376 MHz, CDCl₃) δ -60.6 (s). **FT-IR**: ν (cm⁻¹) 2929, 1650, 1433, 1363, 1258, 1130, 1111. **HRMS** [ESI] calcd for C₁₃H₁₉F₃N [M+H]⁺ 246.1464, found 246.1463.



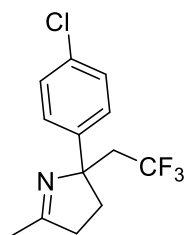
2m, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.45-7.42 (m, 2H), 7.34-7.30 (m, 2H), 7.26-7.21 (m, 1H), 2.76-2.63 (m, 3H), 2.58-2.40 (m, 2H), 2.33-2.25 (m, 1H), 2.12 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 175.2, 146.3, 128.3, 126.9, 125.8 (q, *J*_{C-F} = 277.0 Hz), 125.6, 77.8 (q, *J*_{C-F} = 1.8 Hz), 45.6 (q, *J*_{C-F} = 25.6 Hz), 39.2, 34.9 (q, *J*_{C-F} = 1.6 Hz), 19.8; ¹⁹F NMR (376 MHz, CDCl₃) δ -60.4 (s). **FT-IR**: ν (cm⁻¹) 2952, 2361, 2342, 1652, 1432, 1365, 1257, 1120, 1077, 1030, 762, 702. **HRMS** [ESI] calcd for C₁₃H₁₅F₃N [M+H]⁺ 242.1151, found 242.1149.



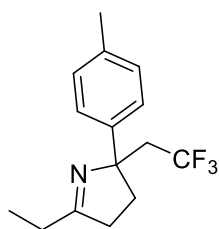
2n, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.36 (d, *J* = 8.8 Hz, 2H), 6.86 (d, *J* = 8.8 Hz, 2H), 3.79 (s, 3H), 2.73-2.60 (m, 3H), 2.57-2.48 (m, 1H), 2.43-2.36 (m, 1H), 2.32-2.24 (m, 1H), 2.10 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 174.8, 158.3, 138.3, 126.7, 125.8 (q, *J*_{C-F} = 277.0 Hz), 113.5, 77.3 55.2, 45.7 (q, *J*_{C-F} = 25.4 Hz), 39.2, 34.9 (q, *J*_{C-F} = 1.6 Hz), 19.8; ¹⁹F NMR (376 MHz, CDCl₃) δ -60.4 (s). **FT-IR**: ν (cm⁻¹) 2956, 2361, 2342, 1652, 1510, 1365, 1244, 1179, 1120, 1033, 830, 653. **HRMS** [ESI] calcd for C₁₄H₁₇F₃NO [M+H]⁺ 272.1257, found 272.1254.



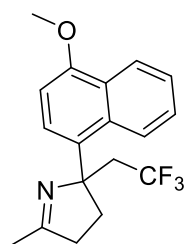
2o, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.44-7.39 (m, 2H), 7.04-6.98 (m, 2H), 2.72-2.50 (m, 4H), 2.46-2.39 (m, 1H), 2.29-2.22 (m, 1H), 2.12 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 175.3, 161.7 (d, $J_{\text{C-F}} = 244.0$ Hz), 141.9 (d, $J_{\text{C-F}} = 3.0$ Hz), 127.4 (d, $J_{\text{C-F}} = 7.9$ Hz), 125.7 (q, $J_{\text{C-F}} = 277.0$ Hz), 115.0 (d, $J_{\text{C-F}} = 7.9$ Hz), 77.3, 45.7 (q, $J_{\text{C-F}} = 25.7$ Hz), 39.2, 35.1, 19.8; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -60.4 (s, 3F), -116.1 (s, 1F). **FT-IR**: ν (cm^{-1}) 2950, 2361, 1651, 1508, 1366, 1258, 1224, 1120, 1097, 834. **HRMS** [ESI] calcd for $\text{C}_{13}\text{H}_{14}\text{F}_4\text{N}$ $[\text{M}+\text{H}]^+$ 260.1057, found 260.1061.



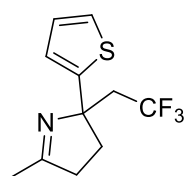
2p, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.38 (d, $J = 8.6$ Hz, 2H), 7.29 (d, $J = 8.6$ Hz, 2H), 2.71-2.49 (m, 4H), 2.45-2.38 (m, 1H), 2.27-2.19 (m, 1H), 2.11 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 175.5, 144.7, 132.7, 128.4, 127.1, 125.6 (q, $J_{\text{C-F}} = 277.0$ Hz), 77.4 (q, $J_{\text{C-F}} = 1.4$ Hz), 45.5 (q, $J_{\text{C-F}} = 25.8$ Hz), 39.2, 35.0 (q, $J_{\text{C-F}} = 1.2$ Hz), 19.8; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -60.3 (s). **FT-IR**: ν (cm^{-1}) 2954, 2361, 2342, 1650, 1492, 1257, 1120, 1103, 1014, 829. **HRMS** [ESI] calcd for $\text{C}_{13}\text{H}_{14}\text{ClF}_3\text{N}$ $[\text{M}+\text{H}]^+$ 276.0761, found 276.0766.



2q, colorless oil, $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.32 (d, $J = 8.0$ Hz, 2H), 7.13 (d, $J = 8.0$ Hz, 2H), 2.73-2.62 (m, 3H), 2.55-2.37 (m, 4H), 2.32 (s, 3H), 2.28-2.20 (m, 1H), 1.19 (t, $J = 7.6$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 179.2, 143.8, 136.4, 128.9, 125.9 (q, $J_{\text{C-F}} = 277.1$ Hz), 125.4, 45.6 (q, $J_{\text{C-F}} = 25.5$ Hz), 37.1, 34.6 (q, $J_{\text{C-F}} = 1.4$ Hz), 27.0, 20.9, 10.8; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -60.2 (s). **FT-IR**: ν (cm^{-1}) 2975, 2361, 2342, 1650, 1364, 1257, 1118, 812, 650. **HRMS** [ESI] calcd for $\text{C}_{15}\text{H}_{19}\text{F}_3\text{N}$ $[\text{M}+\text{H}]^+$ 270.1464, found 270.1460.

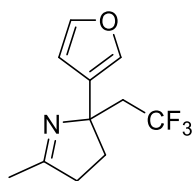


2r, white solid, mp. 96-97 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.38 (dd, $J = 8.2, 1.0$ Hz, 1H), 8.06 (d, $J = 8.4$ Hz, 1H), 7.77 (d, $J = 8.0$ Hz, 1H), 7.58-7.46 (m, 2H), 6.73 (d, $J = 8.4$ Hz, 1H), 3.99 (s, 3H), 3.22-3.10 (m, 1H), 2.95-2.74 (m, 3H), 2.64-2.56 (m, 1H), 2.43-2.35 (m, 1H), 2.20 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 174.2, 155.0, 135.1, 130.4, 126.8, 126.3 (q, $J_{\text{C-F}} = 277.4$ Hz), 126.3, 124.6, 124.5, 123.9, 123.4, 102.7, 78.0 (q, $J_{\text{C-F}} = 1.7$ Hz), 55.4, 43.9 (q, $J_{\text{C-F}} = 25.2$ Hz), 40.1, 34.4 (q, $J_{\text{C-F}} = 1.4$ Hz), 19.7; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -60.5 (s). **FT-IR**: ν (cm^{-1}) 2988, 2901, 2361, 2342, 1521, 1066, 669. **HRMS** [ESI] calcd for $\text{C}_{18}\text{H}_{19}\text{F}_3\text{NO}$ $[\text{M}+\text{H}]^+$ 322.1413, found 322.1414.

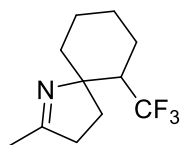


2s, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.21-7.19 (m, 1H), 6.96-6.93 (m, 2H), 2.91-2.65 (m, 4H), 2.44-2.40 (m, 2H), 2.09 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 175.7, 149.7, 126.6, 125.5 (q, $J_{\text{C-F}} = 276.8$ Hz), 124.3, 122.8, 76.2 (q, $J_{\text{C-F}} = 1.8$ Hz), 46.3 (q, $J_{\text{C-F}} = 25.8$ Hz), 39.7, 35.5 (q, $J_{\text{C-F}} = 1.7$ Hz), 19.5; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -60.5 (s). **FT-IR**: ν (cm^{-1}) 2924, 2342, 1619, 1440, 1385, 1227, 884, 852, 829, 695.

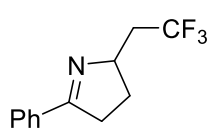
HRMS [ESI] calcd for C₁₁H₁₃F₃NS [M+H]⁺ 248.0715, found 248.0710.



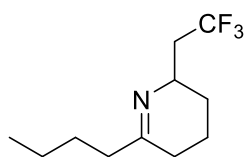
2t, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.37 (t, *J* = 1.4 Hz, 1H), 7.30 (s, 1H), 6.39 (s, 1H), 2.83-2.71 (m, 1H), 2.68-2.55 (m, 3H), 2.27-2.19 (m, 2H), 2.06 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 175.0, 143.3, 138.2, 130.1, 125.8 (q, *J*_{C-F} = 276.6 Hz), 109.0, 73.1 (q, *J*_{C-F} = 1.8 Hz), 44.9 (q, *J*_{C-F} = 25.8 Hz), 39.3, 34.3, 19.6; ¹⁹F NMR (376 MHz, CDCl₃) δ -60.4 (s). **FT-IR**: ν (cm⁻¹) 2954, 1649, 1365, 1258, 1126, 1070, 874, 792. **HRMS** [ESI] calcd for C₁₁H₁₃F₃NO [M+H]⁺ 232.0944, found 232.0945.



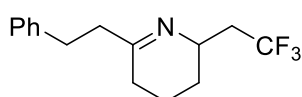
2u, light yellow oil. ¹H NMR (400 MHz, CDCl₃) δ 2.59-2.45 (m, 3H), 2.16-2.09 (m, 1H), 2.01-1.97 (m, 4H), 1.84-1.59 (m, 4H), 1.41-1.29 (m, 4H); ¹³C NMR (100 MHz, CDCl₃) δ 172.4, 127.7 (q, *J*_{C-F} = 280.6 Hz), 48.5 (q, *J*_{C-F} = 22.9 Hz), 40.3, 38.8, 27.6 (q, *J*_{C-F} = 1.8 Hz), 24.6, 23.6 (q, *J*_{C-F} = 2.8 Hz), 22.6, 19.5; ¹⁹F NMR (376 MHz, CDCl₃) δ -65.7 (s). **FT-IR**: ν (cm⁻¹) 2934, 2862, 1452, 1378, 1182, 1129, 1089, 1073, 732. **HRMS** [ESI] calcd for C₁₁H₁₇F₃N [M+H]⁺ 220.1308, found 220.1304.



2v, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.84-7.82 (m, 2H), 7.47-7.36 (m, 3H), 4.45-4.38 (m, 1H), 3.15-3.07 (m, 1H), 2.98-2.86 (m, 2H), 2.43-2.35 (m, 1H), 2.27-2.12 (m, 1H), 1.80-1.70 (m, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 173.7, 134.0, 130.8, 128.5, 127.7, 126.4 (q, *J*_{C-F} = 275.2 Hz), 67.0 (q, *J*_{C-F} = 2.7 Hz), 40.2 (q, *J*_{C-F} = 26.9 Hz), 35.4, 29.3; ¹⁹F NMR (376 MHz, CDCl₃) δ -64.0 (s). **FT-IR**: ν (cm⁻¹) 2947, 2360, 1616, 1379, 1343, 1249, 1135, 1090, 1012, 761, 692, 647. **HRMS** [ESI] calcd for C₁₂H₁₃F₃N [M+H]⁺ 228.0995, found 228.0986.

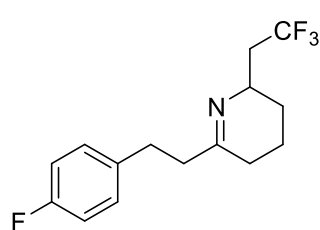


2w, colorless oil. ¹H NMR (400 MHz, CDCl₃) 3.70-3.58 (m, 1H), 2.75-2.61 (m, 1H), 2.20-2.09 (m, 4H), 1.96-1.91 (m, 1H), 1.81-1.73 (m, 1H), 1.65-1.59 (m, 1H), 1.54-1.46 (m, 2H), 1.37-1.28 (m, 4H), 0.91 (t, *J* = 7.2 Hz, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 172.3, 126.6 (q, *J*_{C-F} = 275.5 Hz), 52.6 (q, *J*_{C-F} = 2.9 Hz), 41.6 (q, *J*_{C-F} = 26.6 Hz), 40.7, 28.8, 28.5, 27.1, 22.5, 18.4, 13.9; ¹⁹F NMR (376 MHz, CDCl₃) δ -63.1 (s). **FT-IR**: ν (cm⁻¹) 2958, 2933, 1660, 1374, 1249, 1142, 1037. **HRMS** [ESI] calcd for C₁₁H₁₉F₃N [M+H]⁺ 222.1464, found 222.1462.

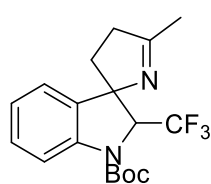


2x, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.29-7.25 (m, 2H), 7.20-7.16 (m, 3H), 3.70-3.60 (m, 1H), 2.86 (t, *J* = 8.0 Hz, 2H), 2.69-2.55 (m, 1H), 2.49-2.45 (m, 2H), 2.15-1.98 (m, 3H), 1.95-1.88 (m, 1H), 1.79-1.70 (m, 1H), 1.63-1.52 (m, 1H), 1.26-1.15 (m, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 171.0, 141.7, 128.4, 128.3, 126.6 (q, *J*_{C-F} = 275.5 Hz), 125.9, 52.6 (q, *J*_{C-F} = 2.8 Hz), 42.1, 41.5 (q, *J*_{C-F} = 26.6 Hz), 32.5, 29.2, 27.1, 18.4; ¹⁹F NMR (376 MHz, CDCl₃) δ -63.1 (s). **FT-IR**: ν (cm⁻¹) 2932, 1659, 1374, 1250, 1137, 1039,

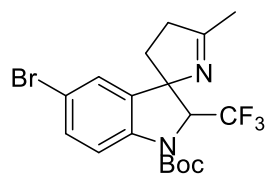
749, 699. **HRMS** [ESI] calcd for C₁₅H₁₉F₃N [M+H]⁺ 270.1464, found 270.1469.



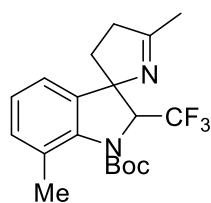
2y, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.16-7.13 (m, 2H), 6.97-6.93 (m, 2H), 3.70-3.60 (m, 1H), 2.84 (t, *J* = 8.0 Hz, 2H), 2.69-2.55 (m, 1H), 2.47-2.43 (m, 2H), 2.16-2.02 (m, 3H), 1.94-1.90 (m, 1H), 1.79-1.72 (m, 1H), 1.64-1.53 (m, 1H), 1.29-1.19 (m, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 178.8, 161.3 (d, *J*_{C-F} = 242.1 Hz), 137.3 (d, *J*_{C-F} = 3.1 Hz), 129.7 (d, *J*_{C-F} = 7.8 Hz), 126.6 (q, *J*_{C-F} = 275.5 Hz), 115.0 (d, *J*_{C-F} = 20.9 Hz), 52.7 (q, *J*_{C-F} = 2.8 Hz), 42.0, 41.5 (q, *J*_{C-F} = 26.6 Hz), 31.5, 29.3, 27.1, 18.4; ¹⁹F NMR (376 MHz, CDCl₃) δ -63.1 (s), -117.6 (s). **FT-IR**: ν (cm⁻¹) 2930, 1742, 1510, 1221, 1139, 1016, 824. **HRMS** [ESI] calcd for C₁₅H₁₈F₄N [M+H]⁺ 288.1370, found 288.1372.



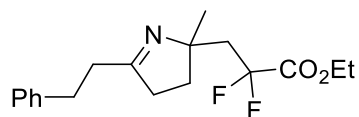
2z, colorless oil. ¹H NMR (400 MHz, CDCl₃) δ 7.79-7.67 (m, 1H), 7.27-7.23 (m, 1H), 7.06-6.97 (m, 2H), 4.75 (q, *J* = 8.0 Hz, 1H), 2.97-2.88 (m, 1H), 2.81-2.73 (m, 1H), 2.61-2.53 (m, 1H), 2.49-2.42 (m, 1H), 2.06 (s, 3H), 1.56 (s, 9H); ¹³C NMR (100 MHz, CDCl₃) δ 174.2, 151.7, 141.4, 135.3, 129.3, 124.6 (q, *J*_{C-F} = 283.2 Hz), 123.5, 121.8, 116.2, 82.4, 82.2, 68.7 (q, *J*_{C-F} = 28.0 Hz), 40.4, 28.2 (q, *J*_{C-F} = 2.9 Hz), 28.2, 19.6; ¹⁹F NMR (376 MHz, CDCl₃) δ -70.2 (s). **FT-IR**: ν (cm⁻¹) 2927, 1709, 1483, 1253, 1164, 1126, 868, 752. **HRMS** [ESI] calcd for C₁₈H₂₂F₃N₂O₂ [M+H]⁺ 355.1628, found 355.1641.



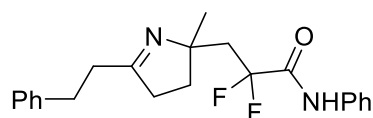
2aa, white solid, mp. 104-105 °C. ¹H NMR (400 MHz, CDCl₃) δ 7.62 (d, *J* = 8.8 Hz, 1H), 7.36 (dd, *J* = 8.4, 2.0 Hz, 1H), 7.13 (d, *J* = 2.4 Hz, 1H), 4.72 (q, *J* = 8.0 Hz, 1H), 2.96-2.88 (m, 1H), 2.82-2.74 (m, 1H), 2.60-2.53 (m, 1H), 2.45-2.38 (m, 1H), 2.08 (s, 3H), 1.55 (s, 9H); ¹³C NMR (100 MHz, CDCl₃) 175.0, 151.4, 140.7, 137.4, 132.1, 125.1, 124.4 (q, *J*_{C-F} = 288.3 Hz), 117.7, 115.8, 82.6, 82.2, 68.9 (q, *J*_{C-F} = 29.2 Hz), 40.4, 28.1, 28.1 (q, *J*_{C-F} = 3.5 Hz), 19.6; ¹⁹F NMR (376 MHz, CDCl₃) δ -70.2 (s). **FT-IR**: ν (cm⁻¹) 2951, 1361, 1248, 1161, 1136, 1121, 891, 840, 755, 700, 688, 661. **HRMS** [ESI] calcd for C₁₈H₂₁BrF₃N₂O₂ [M+H]⁺ 433.0733, found 433.0744.



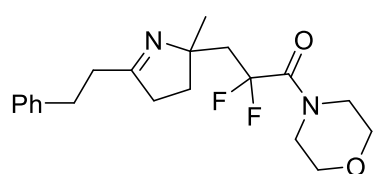
2ab, white solid, mp. 110-111 °C. ¹H NMR (400 MHz, CDCl₃) δ 7.09 (d, *J* = 8.0 Hz, 1H), 7.01 (t, *J* = 7.6 Hz, 1H), 6.89 (d, *J* = 7.6 Hz, 1H), 4.77 (q, *J* = 8.4 Hz, 1H), 2.95-2.86 (m, 1H), 2.78-2.70 (m, 1H), 2.52-2.44 (m, 1H), 2.39-2.34 (m, 4H), 2.04 (s, 3H), 1.54 (s, 9H); ¹³C NMR (100 MHz, CDCl₃) 173.9, 153.7, 141.2, 137.7, 131.3, 128.9, 125.3, 124.7 (q, *J*_{C-F} = 287.1 Hz), 119.0, 83.3, 82.0, 71.8 (q, *J*_{C-F} = 29.1 Hz), 40.4, 28.2, 27.8 (q, *J*_{C-F} = 2.6 Hz), 19.7, 19.6; ¹⁹F NMR (376 MHz, CDCl₃) δ -70.6 (s). **FT-IR**: ν (cm⁻¹) 2926, 1712, 1464, 1370, 1250, 1156, 1126, 878. **HRMS** [ESI] calcd for C₁₉H₂₃F₃N₂NaO₂ [M+Na]⁺ 391.1604, found 391.1613.



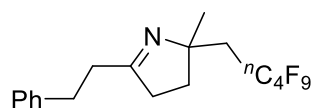
3a, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.17 (m, 3H), 4.30 (q, $J = 7.2$ Hz, 2H), 2.95-2.82 (m, 2H), 2.60-2.51 (m, 4H), 2.46-2.35 (m, 2H), 1.99-1.92 (m, 1H), 1.75-1.68 (m, 1H), 1.34 (t, $J = 7.2$ Hz, 3H), 1.25 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 176.1, 164.3 (t, $J_{\text{C-F}} = 32.3$ Hz), 141.2, 128.4, 128.2, 126.0, 115.9 (t, $J_{\text{C-F}} = 248.8$ Hz), 77.7 (t, $J_{\text{C-F}} = 2.8$ Hz), 62.6, 44.9 (t, $J_{\text{C-F}} = 21.4$ Hz), 37.6, 35.2, 34.9, 32.5, 27.6 (d, $J_{\text{C-F}} = 2.0$ Hz), 13.9; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -100.8 (d, $J = 263.2$ Hz, 1F), -102.2 (d, $J = 262.8$ Hz, 1F). **FT-IR**: ν (cm^{-1}) 2966, 2933, 1766, 1644, 1179, 1148, 1058, 750, 700. **HRMS** [ESI] calcd for $\text{C}_{18}\text{H}_{24}\text{F}_2\text{NO}_2$ [$\text{M}+\text{H}$] $^+$ 324.1770, found 324.1766.



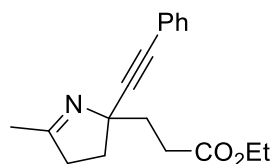
3b, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.52 (s, 1H), 7.60 (d, $J = 7.6$ Hz, 2H), 7.34 (t, $J = 7.8$ Hz, 2H), 7.26-7.14 (m, 4H), 7.04 (d, $J = 7.2$ Hz, 2H), 2.87-2.74 (m, 2H), 2.63-2.38 (m, 6H), 2.00-1.93 (m, 1H), 1.77-1.70 (m, 1H), 1.31 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 176.7, 162.4 (t, $J_{\text{C-F}} = 28.2$ Hz), 141.1, 136.6, 129.2, 128.4, 128.2, 126.0, 125.2, 120.0, 117.8 (t, $J_{\text{C-F}} = 252.4$ Hz), 72.5 (t, $J_{\text{C-F}} = 2.6$ Hz), 43.9 (t, $J_{\text{C-F}} = 21.6$ Hz), 37.5, 36.2, 35.2, 32.5, 27.8 (d, $J_{\text{C-F}} = 2.3$ Hz); $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -98.3 (d, $J = 259.1$ Hz), -102.3 (d, $J = 259.1$ Hz). **FT-IR**: ν (cm^{-1}) 2929, 2361, 1698, 1602, 1542, 1498, 1447, 1238, 1180, 1149, 1039, 751, 692. **HRMS** [ESI] calcd for $\text{C}_{22}\text{H}_{24}\text{F}_2\text{N}_2\text{NaO}$ [$\text{M}+\text{Na}$] $^+$ 393.1749, found 393.1749.



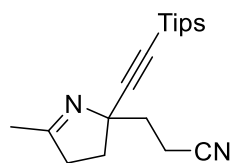
3c, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.17 (m, 3H), 3.72-3.63 (m, 8H), 2.92-2.88 (m, 2H), 2.63-2.33 (m, 6H), 2.04-1.96 (m, 1H), 1.77-1.70 (m, 1H), 1.28 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 175.5, 162.5 (t, $J_{\text{C-F}} = 29.0$ Hz), 141.1, 128.4, 128.2, 126.0, 119.0 (t, $J_{\text{C-F}} = 252.5$ Hz), 73.2, 66.7, 46.7 (t, $J_{\text{C-F}} = 5.8$ Hz), 44.2 (t, $J_{\text{C-F}} = 21.0$ Hz), 43.4, 37.7, 35.2, 34.9, 32.7, 27.5; $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -95.6 (d, $J = 275.6$ Hz), -96.7 (d, $J = 275.6$ Hz). **FT-IR**: ν (cm^{-1}) 2964, 2927, 2859, 1667, 1442, 1180, 1116, 1021, 752, 700. **HRMS** [ESI] calcd for $\text{C}_{20}\text{H}_{27}\text{F}_2\text{N}_2\text{O}_2$ [$\text{M}+\text{H}$] $^+$ 365.2035, found 365.2038.



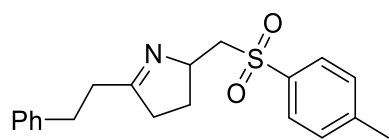
3d, yellow oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.17 (m, 3H), 2.94-2.90 (m, 2H), 2.66-2.62 (m, 2H), 2.60-2.41 (m, 3H), 2.25-2.11 (m, 1H), 2.01-1.93 (m, 1H), 1.85-1.79 (m, 1H), 1.30 (d, $J_{\text{C-F}} = 1.6$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 175.8, 140.9, 128.4, 128.3, 126.1, 73.1, 40.2 (t, $J_{\text{C-F}} = 19.9$ Hz), 37.9, 35.0, 34.7, 32.6, 27.0 (d, $J_{\text{C-F}} = 2.9$ Hz); $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -81.1 (t, $J = 9.6$ Hz, 3F), -110.1-113.5 (m, 2F), -124.7-124.8 (m, 2F), -125.7-125.8 (m, 2F). **FT-IR**: ν (cm^{-1}) 2970, 2361, 1646, 1351, 1218, 1132, 879, 737, 699. **HRMS** [ESI] calcd for $\text{C}_{18}\text{H}_{19}\text{F}_9\text{N}$ [$\text{M}+\text{H}$] $^+$ 420.1368, found 420.1371.



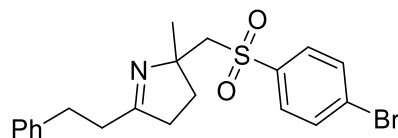
3e, yellow oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.43-7.40 (m, 2H), 7.28-7.27 (m, 3H), 4.12 (q, $J = 7.1$ Hz, 2H), 2.79-2.56 (m, 4H), 2.36-2.29 (m, 1H), 2.12-1.95 (m, 6H), 1.24 (t, $J = 7.0$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 175.6, 173.6, 131.7, 128.1, 128.0, 123.1, 91.5, 84.0, 73.2, 60.4, 39.0, 36.9, 36.8, 30.8, 19.9, 14.2. **FT-IR**: ν (cm^{-1}) 2979, 2930, 1730, 1644, 1375, 1288, 1177, 1025, 757, 692. **HRMS** [ESI] calcd for $\text{C}_{18}\text{H}_{22}\text{NO}_2$ $[\text{M}+\text{H}]^+$ 284.1645, found 284.1644.



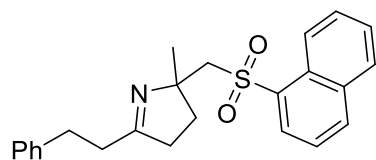
3f, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 2.78-2.68 (m, 3H), 2.62-2.54 (m, 1H), 2.33-2.26 (m, 1H), 2.09-1.87 (m, 6H), 1.06-1.05 (m, 21H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 176.4, 120.0, 108.5, 85.5, 73.0, 39.0, 37.6, 19.7, 18.6, 13.7, 11.1. **FT-IR**: ν (cm^{-1}) 2942, 2865, 2162, 1647, 1462, 996, 882, 675, 661. **HRMS** [ESI] calcd for $\text{C}_{19}\text{H}_{32}\text{N}_2\text{NaSi}$ $[\text{M}+\text{Na}]^+$ 339.2227, found 339.2231.



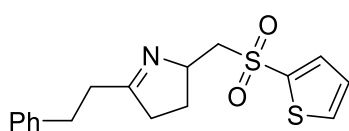
3g, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.81 (d, $J = 8.0$ Hz, 2H), 7.35 (d, $J = 8.0$ Hz, 2H), 7.28-7.25 (m, 2H), 7.20-7.14 (m, 3H), 4.32-4.26 (m, 1H), 3.67 (dd, $J = 14.0, 3.6$ Hz, 1H), 3.01 (dd, $J = 14.0, 10.0$ Hz, 1H), 2.84 (t, $J = 8.0$ Hz, 2H), 2.61-2.42 (m, 7H), 2.28-2.18 (m, 1H), 1.82-1.72 (m, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 179.2, 144.7, 141.0, 136.8, 129.8, 128.4, 128.2, 128.1, 126.1, 66.9, 61.4, 38.1, 35.1, 32.3, 28.7, 21.6. **FT-IR**: ν (cm^{-1}) 2923, 2361, 2342, 1598, 1313, 1301, 1288, 1143, 1086, 816, 755, 700. **HRMS** [ESI] calcd for $\text{C}_{20}\text{H}_{23}\text{NO}_2\text{S}$ $[\text{M}+\text{Na}]^+$ 364.1342, found 364.1352.



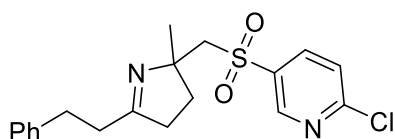
3h, white solid, mp. 64-65 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.75-7.67 (m, 4H), 7.28-7.24 (m, 2H), 7.18-7.15 (m, 3H), 3.44 (d, $J = 14.4$ Hz, 1H), 3.28 (d, $J = 14.4$ Hz, 1H), 2.87-2.73 (m, 2H), 2.62-2.52 (m, 4H), 2.46-2.38 (m, 1H), 1.83-1.76 (m, 1H), 1.34 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 177.0, 140.8, 140.4, 132.4, 129.3, 128.6, 128.4, 128.2, 126.1, 74.0, 65.0, 38.2, 35.0, 33.2, 32.3, 27.7. **FT-IR**: ν (cm^{-1}) 2968, 2923, 1572, 1306, 1274, 1142, 1083, 1065, 789, 722, 701. **HRMS** [ESI] calcd for $\text{C}_{20}\text{H}_{22}\text{BrNO}_2\text{S}$ $[\text{M}+\text{Na}]^+$ 442.0447, found 442.0437.



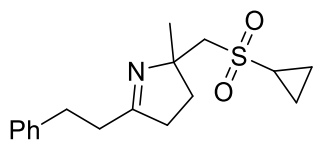
3i, colorless oil, $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.74 (d, $J = 8.8$ Hz, 1H), 8.28 (dd, $J = 7.2, 1.2$ Hz, 1H), 8.11 (d, $J = 8.4$ Hz, 1H), 7.96 (d, $J = 8.4$ Hz, 1H), 7.73-7.69 (m, 1H), 7.64-7.56 (m, 2H), 7.22-7.19 (m, 2H), 7.14-7.09 (m, 3H), 3.67 (d, $J = 14.0$ Hz, 1H), 3.38 (d, $J = 14.0$ Hz, 1H), 2.84-2.70 (m, 2H), 2.63-2.58 (m, 2H), 2.54-2.45 (m, 3H), 1.88-1.81 (m, 1H), 1.39 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 176.9, 140.9, 136.3, 135.0, 134.1, 129.9, 129.2, 128.7, 128.3, 128.2, 126.9, 126.0, 124.3, 124.1, 74.2, 64.5, 38.3, 34.9, 33.4, 32.3, 27.4. **FT-IR**: ν (cm^{-1}) 2921, 1308, 1273, 1154, 1115, 828, 804, 771, 759. **HRMS** [ESI] calcd for $\text{C}_{24}\text{H}_{26}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 392.1679, found 392.1665.



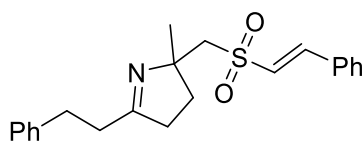
3j, colorless oil, $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.73-7.70 (m, 2H), 7.29-7.25 (m, 2H), 7.20-7.14 (m, 4H), 4.40-4.34 (m, 1H), 3.79 (dd, $J = 14.0, 3.8$ Hz, 1H), 3.14 (dd, $J = 14.0, 10.0$ Hz, 1H), 2.89-2.85 (m, 2H), 2.63-2.44 (m, 4H), 2.30-2.21 (m, 1H), 1.82-1.73 (m, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 179.4, 140.9, 140.8, 134.1, 134.0, 128.4, 128.2, 127.9, 126.1, 67.1, 62.8, 38.1, 35.1, 32.3, 28.7; **FT-IR**: ν (cm^{-1}) 2923, 2361, 2341, 1638, 1402, 1312, 1227, 1139, 1015, 725, 700. **HRMS** [ESI] calcd for $\text{C}_{17}\text{H}_{20}\text{NO}_2\text{S}_2$ $[\text{M}+\text{H}]^+$ 334.0930, found 334.0922.



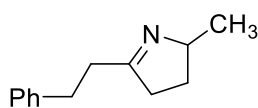
3k, yellow solid, mp. 68-69 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.84 (d, $J = 2.0$ Hz, 1H), 8.09 (d, $J = 8.4, 3.0$ Hz, 1H), 7.49 (d, $J = 8.4$ Hz, 1H), 7.29-7.25 (m, 2H), 7.19-7.16 (m, 3H), 3.45 (d, $J = 14.8$ Hz, 1H), 3.39 (d, $J = 14.8$ Hz, 1H), 2.85-2.69 (m, 2H), 2.64-2.51 (m, 4H), 2.42-2.34 (m, 1H), 1.85-1.78 (m, 1H), 1.33 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 177.4, 156.3, 149.5, 140.7, 138.3, 136.8, 128.4, 128.2, 126.1, 124.5, 73.9, 65.7, 38.1, 35.0, 33.5, 32.3, 27.8. **FT-IR**: ν (cm^{-1}) 2966, 2929, 1571, 1449, 1318, 1276, 1144, 1107, 790, 699. **HRMS** [ESI] calcd for $\text{C}_{19}\text{H}_{22}\text{ClN}_2\text{O}_2\text{S}$ $[\text{M}+\text{H}]^+$ 377.1085, found 377.1088.



3l, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.17 (m, 3H), 3.33 (d, $J = 14.4$ Hz, 1H), 3.27 (d, $J = 14.4$ Hz, 1H), 2.95-2.90 (m, 2H), 2.70-2.60 (m, 4H), 2.54-2.48 (m, 1H), 2.43-2.35 (m, 1H), 1.84-1.77 (m, 1H), 1.38 (s, 3H), 1.23-1.19 (m, 2H), 1.01-0.93 (m, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 177.3, 140.9, 128.4, 128.2, 126.1, 73.6, 62.8, 38.1, 35.1, 33.5, 32.5, 32.1, 27.8, 5.2, 4.9. **FT-IR**: ν (cm^{-1}) 2921, 1309, 1275, 1115, 828, 772, 759, 700. **HRMS** [ESI] calcd for $\text{C}_{17}\text{H}_{23}\text{NO}_2\text{S}$ $[\text{M}+\text{Na}]^+$ 328.1342, found 328.1340.

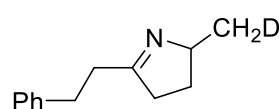


3m, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.52-7.48 (m, 3H), 7.42-7.36 (m, 3H), 7.26-7.15 (m, 3H), 7.10 (d, $J = 7.2$ Hz, 2H), 6.96 (d, $J = 15.2$ Hz, 1H), 3.36 (d, $J = 0.8$ Hz, 2H), 2.94-2.81 (m, 2H), 2.66-2.56 (m, 4H), 2.46-2.38 (m, 1H), 1.83-1.76 (m, 1H), 1.38 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 177.3, 142.2, 140.9, 132.4, 131.0, 129.0, 128.4, 128.3, 128.1, 127.7, 126.0, 73.7, 64.5, 38.2, 35.1, 33.5, 32.4, 28.0. **FT-IR**: ν (cm^{-1}) 2921, 1273, 1178, 1115, 827, 758. **HRMS** [ESI] calcd for $\text{C}_{22}\text{H}_{26}\text{NO}_2\text{S}$ $[\text{M}+\text{H}]^+$ 368.1679, found 368.1682.

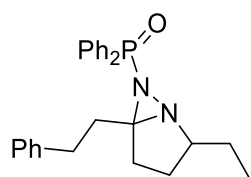


3n, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.22-7.17 (m, 3H), 4.08-4.02 (m, 1H), 2.95-2.91 (m, 2H), 2.65-2.61 (m, 2H), 2.57-2.37 (m, 2H), 2.11-2.02 (m, 1H), 1.41-1.31 (m, 1H), 1.25 (d, $J = 6.4$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 176.2, 141.4, 128.4, 128.2, 125.9, 67.7, 37.7, 35.4, 32.7, 30.6, 22.0. **FT-IR**: ν (cm^{-1}) 2960, 2926, 2361, 2342, 1642, 1454, 1077, 749, 699. **HRMS** [ESI] calcd for $\text{C}_{13}\text{H}_{18}\text{N}$ $[\text{M}+\text{H}]^+$ 188.1434,

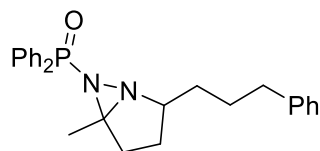
found 188.1444.



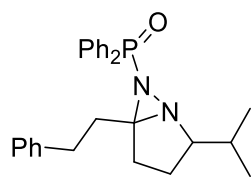
3o, yellow oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.22-7.17 (m, 3H), 4.07-4.00 (m, 1H), 2.95-2.90 (m, 2H), 2.64-2.60 (m, 2H), 2.52-2.39 (m, 2H), 2.09-2.04 (m, 1H), 1.41-1.32 (m, 1H), 1.23 (dt, $J = 6.8, 1.6$ Hz, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 176.2, 141.4, 128.4, 128.2, 125.9, 67.6, 37.7, 35.4, 32.7, 30.6, 21.7 (t, $J_{\text{C-D}} = 19.2$ Hz). **FT-IR**: ν (cm^{-1}) 2957, 2929, 2360, 1641, 1496, 1454, 1134, 1077, 748, 698. **HRMS** [ESI] calcd for $\text{C}_{13}\text{H}_{17}\text{DN}$ $[\text{M}+\text{H}]^+$ 189.1497, found 189.1503.



4a, white solid, mp. 110-111 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.09-8.04 (m, 2H), 7.96-7.91 (m, 2H), 7.55-7.38 (m, 6H), 7.22-7.18 (m, 2H), 7.13-7.08 (m, 3H), 2.94-2.87 (m, 1H), 2.76-2.69 (m, 1H), 2.58-2.38 (m, 3H), 2.33-2.28 (m, 1H), 1.80-1.71 (m, 1H), 1.67-1.61 (m, 1H), 1.40-1.30 (m, 1H), 1.04-0.86 (m, 2H), 0.55 (t, $J = 7.4$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 141.1, 133.2 (d, $J_{\text{C-P}} = 127.7$ Hz), 133.2 (d, $J_{\text{C-P}} = 124.9$ Hz), 132.0 (d, $J_{\text{C-P}} = 9.2$ Hz), 131.9 (d, $J_{\text{C-P}} = 2.9$ Hz), 131.8 (d, $J_{\text{C-P}} = 8.1$ Hz), 131.5 (d, $J_{\text{C-P}} = 2.6$ Hz), 128.5 (d, $J_{\text{C-P}} = 11.6$ Hz), 128.3, 128.2, 127.9 (d, $J_{\text{C-P}} = 12.8$ Hz), 125.8, 78.2 (d, $J_{\text{C-P}} = 8.7$ Hz), 68.1 (d, $J_{\text{C-P}} = 5.1$ Hz), 33.7 (d, $J_{\text{C-P}} = 3.4$ Hz), 32.4, 31.4 (d, $J_{\text{C-P}} = 3.5$ Hz), 26.4, 25.6, 11.4; $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 28.7 (s). **FT-IR**: ν (cm^{-1}) 2970, 2924, 1439, 1208, 1118, 971, 725, 697. **HRMS** [ESI] calcd for $\text{C}_{26}\text{H}_{29}\text{N}_2\text{NaOP}$ $[\text{M}+\text{Na}]^+$ 439.1910, found 439.1908.

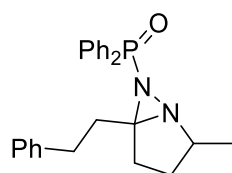


4b, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.99-7.91 (m, 4H), 7.55-7.40 (m, 6H), 7.23-7.20 (m, 2H), 7.15-7.11 (m, 1H), 6.98 (d, $J = 6.8$ Hz, 2H), 3.08-3.00 (m, 1H), 2.34-2.29 (m, 1H), 2.15-2.02 (m, 2H), 1.77-1.69 (m, 4H), 1.64-1.57 (m, 1H), 1.47-1.31 (m, 3H), 1.07-0.93 (m, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 142.2, 133.3 (d, $J_{\text{C-P}} = 131.2$ Hz), 133.0 (d, $J_{\text{C-P}} = 121.2$ Hz), 132.1 (d, $J_{\text{C-P}} = 9.1$ Hz), 131.8 (d, $J_{\text{C-P}} = 2.5$ Hz), 131.6 (d, $J_{\text{C-P}} = 8.0$ Hz), 131.6, 128.5 (d, $J_{\text{C-P}} = 11.6$ Hz), 128.2, 128.1 (d, $J_{\text{C-P}} = 12.8$ Hz), 128.0, 125.5, 74.6 (d, $J_{\text{C-P}} = 8.6$ Hz), 66.5 (d, $J_{\text{C-P}} = 5.3$ Hz), 35.5, 34.1 (d, $J_{\text{C-P}} = 3.8$ Hz), 32.4, 28.7, 26.9, 17.8 (d, $J_{\text{C-P}} = 3.8$ Hz); $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 29.4 (s). **FT-IR**: ν (cm^{-1}) 2930, 1438, 1211, 1122, 1108, 907, 725, 695. **HRMS** [ESI] calcd for $\text{C}_{26}\text{H}_{29}\text{N}_2\text{NaOP}$ $[\text{M}+\text{Na}]^+$ 439.1910, found 439.1924.

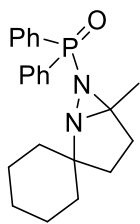


4c, white solid, mp. 163-164 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.09-8.07 (m, 2H), 8.00-7.95 (m, 2H), 7.52-7.42 (m, 6H), 7.22-7.18 (m, 2H), 7.14-7.08 (m, 3H), 2.80-2.69 (m, 1H), 2.62-2.51 (m, 2H), 2.48-2.31 (m, 3H), 1.80-1.64 (m, 2H), 1.48-1.38 (m, 1H), 0.99-0.91 (m, 1H), 0.66 (d, $J = 6.4$ Hz, 3H), 0.50 (d, $J = 6.4$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 141.2, 133.7 (d, $J_{\text{C-P}} = 122.1$ Hz), 133.3 (d, $J_{\text{C-P}} = 130.0$ Hz), 132.2 (d, $J_{\text{C-P}} = 9.1$ Hz), 131.9 (d, $J_{\text{C-P}} = 2.5$ Hz), 131.8 (d, $J_{\text{C-P}} = 8.1$ Hz), 131.6 (d, $J_{\text{C-P}} = 2.7$ Hz), 128.6 (d, $J_{\text{C-P}} = 11.6$ Hz), 128.3, 128.2, 128.0 (d, $J_{\text{C-P}} = 12.6$

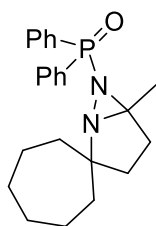
Hz), 125.8, 77.9 (d, $J_{C-P} = 8.5$ Hz), 73.6 (d, $J_{C-P} = 5.1$ Hz), 33.7 (d, $J_{C-P} = 3.4$ Hz), 32.4, 32.0, 31.6 (d, $J_{C-P} = 3.5$ Hz), 25.7, 20.6, 20.2; $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 27.9 (s). **FT-IR:** ν (cm^{-1}) 2952, 2915, 2866, 1437, 1206, 1125, 1069, 1015, 728, 699, 624. **HRMS** [ESI] calcd for $\text{C}_{27}\text{H}_{32}\text{N}_2\text{OP}$ [$\text{M}+\text{H}$] $^+$ 431.2247, found 431.2245.



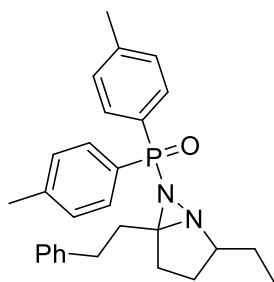
4d, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.10-8.05 (m, 2H), 7.94-7.89 (m, 2H), 7.56-7.39 (m, 6H), 7.22-7.18 (m, 2H), 7.14-7.07 (m, 3H), 3.18-3.09 (m, 1H), 2.68-2.53 (m, 2H), 2.50-2.40 (m, 2H), 2.33-2.27 (m, 1H), 1.83-1.74 (m, 1H), 1.65-1.59 (m, 1H), 1.41-1.31 (m, 1H), 0.61 (d, $J = 6.4$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 141.1, 133.3 (d, $J_{C-P} = 131.2$ Hz), 132.9 (d, $J_{C-P} = 121.6$ Hz), 132.0 (d, $J_{C-P} = 2.4$ Hz), 132.0 (d, $J_{C-P} = 9.2$ Hz), 131.9 (d, $J_{C-P} = 8.1$ Hz), 131.6 (d, $J_{C-P} = 2.7$ Hz), 128.6 (d, $J_{C-P} = 11.6$ Hz), 128.3, 128.2, 128.0 (d, $J_{C-P} = 12.8$ Hz), 125.8, 78.5 (d, $J_{C-P} = 8.7$ Hz), 61.6 (d, $J_{C-P} = 5.1$ Hz), 33.6 (d, $J_{C-P} = 3.5$ Hz), 32.5, 31.9 (d, $J_{C-P} = 3.6$ Hz), 27.9, 16.9; $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 29.1 (s). **FT-IR:** ν (cm^{-1}) 2971, 2929, 1735, 1438, 1207, 1122, 962, 726, 696. **HRMS** [ESI] calcd for $\text{C}_{25}\text{H}_{27}\text{N}_2\text{OP}$ [$\text{M}+\text{Na}$] $^+$ 425.1753, found 425.1757.



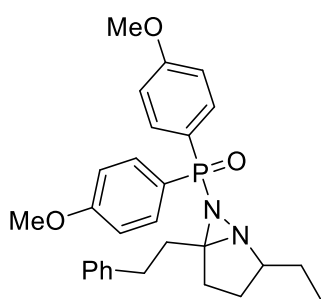
4e, white solid, mp. 145-146 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.99-7.94 (m, 2H), 7.92-7.86 (m, 2H), 7.55-7.37 (m, 6H), 2.30-2.25 (m, 1H), 1.84-1.70 (m, 5H), 1.56-1.50 (m, 2H), 1.40-1.14 (m, 6H), 1.02-0.81 (m, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 133.1 (d, $J_{C-P} = 120.9$ Hz), 133.0 (d, $J_{C-P} = 131.8$ Hz), 132.1 (d, $J_{C-P} = 9.1$ Hz), 131.7 (d, $J_{C-P} = 8.0$ Hz), 131.5 (d, $J_{C-P} = 2.8$ Hz), 128.4 (d, $J_{C-P} = 11.7$ Hz), 127.8 (d, $J_{C-P} = 12.8$ Hz), 73.6 (d, $J_{C-P} = 8.6$ Hz), 68.8 (d, $J_{C-P} = 4.8$ Hz), 35.1, 33.4, 33.2 (d, $J_{C-P} = 3.7$ Hz), 30.4, 25.6, 22.9, 22.7, 18.4 (d, $J_{C-P} = 3.8$ Hz); $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 29.6 (s). **FT-IR:** ν (cm^{-1}) 2950, 2929, 1438, 1212, 1115, 962, 908, 725, 694, 660. **HRMS** [ESI] calcd for $\text{C}_{22}\text{H}_{27}\text{N}_2\text{NaOP}$ [$\text{M}+\text{Na}$] $^+$ 389.1753, found 389.1752.



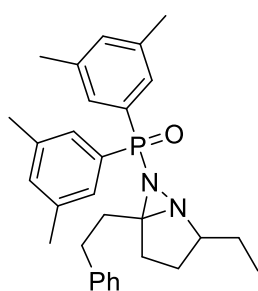
4f, white solid, mp. 139-140 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.98-7.93 (m, 2H), 7.86-7.81 (m, 2H), 7.55-7.51 (m, 1H), 7.49-7.42 (m, 3H), 7.41-7.36 (m, 2H), 2.26-2.20 (m, 2H), 1.75 (s, 3H), 1.70-1.51 (m, 4H), 1.43-1.18 (m, 6H), 1.11-1.02 (m, 2H), 0.97-0.91 (m, 1H), 0.72-0.66 (m, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 133.0 (d, $J_{C-P} = 131.1$ Hz), 132.7 (d, $J_{C-P} = 121.8$ Hz), 132.0 (d, $J_{C-P} = 9.2$ Hz), 131.8 (d, $J_{C-P} = 8.1$ Hz), 131.8 (d, $J_{C-P} = 3.1$ Hz), 131.4 (d, $J_{C-P} = 2.7$ Hz), 128.4 (d, $J_{C-P} = 11.7$ Hz), 127.9 (d, $J_{C-P} = 12.9$ Hz), 75.0 (d, $J_{C-P} = 8.6$ Hz), 72.7 (d, $J_{C-P} = 4.6$ Hz), 37.3, 36.0, 32.9 (d, $J_{C-P} = 3.7$ Hz), 32.6, 30.6, 30.2, 23.2, 22.9, 18.4 (d, $J_{C-P} = 3.9$ Hz); $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 30.2 (s). **FT-IR:** ν (cm^{-1}) 2926, 2849, 1437, 1209, 1124, 1030, 930, 729, 698, 654. **HRMS** [ESI] calcd for $\text{C}_{23}\text{H}_{30}\text{N}_2\text{OP}$ [$\text{M}+\text{H}$] $^+$ 381.2090, found 381.2094.



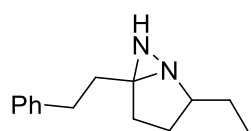
4g, white solid, mp. 109-110 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.93 (dd, $J = 10.6, 8.0$ Hz, 2H), 7.81 (dd, $J = 12.0, 8.0$ Hz, 2H), 7.28-7.25 (m, 2H), 7.22-7.18 (m, 4H), 7.13-7.09 (m, 3H), 2.94-2.86 (m, 1H), 2.74-2.68 (m, 1H), 2.58-2.39 (m, 3H), 2.37 (s, 3H), 2.35 (s, 3H), 2.33-2.27 (m, 1H), 1.79-1.70 (m, 1H), 1.67-1.60 (m, 1H), 1.40-1.32 (m, 1H), 1.08-1.01 (m, 1H), 0.96-0.85 (m, 1H), 0.57 (t, $J = 7.4$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 142.2 (d, $J_{\text{C-P}} = 2.8$ Hz), 141.7 (d, $J_{\text{C-P}} = 2.8$ Hz), 141.3, 132.0 (d, $J_{\text{C-P}} = 9.5$ Hz), 131.7 (d, $J_{\text{C-P}} = 8.5$ Hz), 130.2 (d, $J_{\text{C-P}} = 127.9$ Hz), 130.2 (d, $J_{\text{C-P}} = 129.3$ Hz), 129.2 (d, $J_{\text{C-P}} = 11.9$ Hz), 128.6 (d, $J_{\text{C-P}} = 13.1$ Hz), 128.3, 128.1, 125.7, 77.9 (d, $J_{\text{C-P}} = 8.6$ Hz), 77.2, 68.1 (d, $J_{\text{C-P}} = 5.1$ Hz), 33.7 (d, $J_{\text{C-P}} = 3.4$ Hz), 32.5, 31.4 (d, $J_{\text{C-P}} = 3.6$ Hz), 26.5, 25.7, 21.5 (d, $J_{\text{C-P}} = 5.8$ Hz), 11.4; $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 29.2 (s). **FT-IR**: ν (cm^{-1}) 2958, 2919, 2855, 1456, 1199, 1121, 1105, 1033, 972, 806, 713, 702, 661, 627. **HRMS** [ESI] calcd for $\text{C}_{28}\text{H}_{34}\text{N}_2\text{OP}$ $[\text{M}+\text{H}]^+$ 445.2403, found 445.2401.



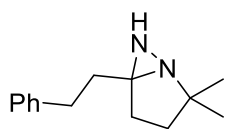
4h, white solid, mp. 122-123 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.99-7.94 (m, 2H), 7.86-7.81 (m, 2H), 7.23-7.19 (m, 2H), 7.14-7.10 (m, 3H), 6.99-6.91 (m, 4H), 3.82 (s, 3H), 3.82 (s, 3H), 2.94-2.87 (m, 1H), 2.74-2.67 (m, 1H), 2.58-2.36 (m, 3H), 2.32-2.26 (m, 1H), 1.79-1.60 (m, 2H), 1.39-1.29 (m, 1H), 1.09-0.88 (m, 2H), 0.60 (t, $J = 7.4$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 162.4, 162.1, 141.3, 133.8 (d, $J_{\text{C-P}} = 10.4$ Hz), 133.5 (d, $J_{\text{C-P}} = 9.3$ Hz), 128.4, 128.2, 125.8, 125.0 (d, $J_{\text{C-P}} = 137.8$ Hz), 124.9 (d, $J_{\text{C-P}} = 129.0$ Hz), 114.0 (d, $J_{\text{C-P}} = 12.5$ Hz), 113.5 (d, $J_{\text{C-P}} = 13.8$ Hz), 77.9 (d, $J_{\text{C-P}} = 8.6$ Hz), 68.1 (d, $J_{\text{C-P}} = 5.1$ Hz), 55.2, 33.7 (d, $J_{\text{C-P}} = 3.4$ Hz), 32.5, 31.4 (d, $J_{\text{C-P}} = 3.5$ Hz), 26.5, 25.8, 11.5; $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 29.0 (s). **FT-IR**: ν (cm^{-1}) 2960, 2934, 1595, 1500, 1292, 1247, 1124, 1106, 1022, 980, 833, 799, 702. **HRMS** [ESI] calcd for $\text{C}_{28}\text{H}_{34}\text{N}_2\text{O}_3\text{P}$ $[\text{M}+\text{H}]^+$ 477.2302, found 477.2295.



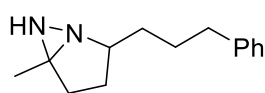
4i, white solid, mp. 147-148 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.65 (d, $J = 11.2$ Hz, 2H), 7.52 (d, $J = 12.4$ Hz, 2H), 7.22-7.18 (m, 2H), 7.14-7.08 (m, 5H), 2.93-2.86 (m, 1H), 2.73-2.67 (m, 1H), 2.58-2.41 (m, 3H), 2.35 (s, 6H), 2.31 (s, 6H), 2.29-2.24 (m, 1H), 1.78-1.60 (m, 2H), 1.42-1.31 (m, 1H), 1.08-0.86 (m, 2H), 0.58 (t, $J = 7.4$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 141.3, 138.1 (d, $J_{\text{C-P}} = 12.3$ Hz), 137.5 (d, $J_{\text{C-P}} = 13.4$ Hz), 133.0 (d, $J_{\text{C-P}} = 129.1$ Hz), 133.0 (d, $J_{\text{C-P}} = 120.5$ Hz), 133.6 (d, $J_{\text{C-P}} = 2.8$ Hz), 133.1 (d, $J_{\text{C-P}} = 2.8$ Hz), 129.6 (d, $J_{\text{C-P}} = 9.2$ Hz), 129.4 (d, $J_{\text{C-P}} = 8.1$ Hz), 128.4, 128.2, 125.7, 78.0 (d, $J_{\text{C-P}} = 8.6$ Hz), 68.1 (d, $J_{\text{C-P}} = 5.1$ Hz), 33.6 (d, $J_{\text{C-P}} = 3.4$ Hz), 32.5, 31.5 (d, $J_{\text{C-P}} = 3.6$ Hz), 26.6, 25.6, 21.3, 21.2, 11.5; $^{31}\text{P NMR}$ (162 MHz, CDCl_3) δ 29.8 (s). **FT-IR**: ν (cm^{-1}) 2955, 2921, 1455, 1216, 1124, 1012, 875, 855, 695. **HRMS** [ESI] calcd for $\text{C}_{30}\text{H}_{37}\text{N}_2\text{NaOP}$ $[\text{M}+\text{Na}]^+$ 495.2536, found 495.2538.



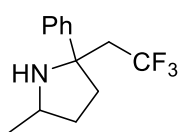
5a, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.20-7.18 (m, 3H), 2.95-2.88 (m, 1H), 2.76 (t, $J = \text{Hz}$, 2H), 2.23-2.15 (m, 2H), 2.00-1.92 (m, 1H), 1.80-1.68 (m, 2H), 1.62-1.55 (m, 1H), 1.51-1.40 (m, 1H), 1.27-1.17 (m, 1H), 0.98 (t, $J = 7.4 \text{ Hz}$, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 141.1, 128.5, 128.2, 126.1, 67.8, 66.6, 37.5, 31.7, 29.7, 26.4, 25.7, 11.9. **FT-IR**: ν (cm^{-1}) 3207, 2961, 2931, 1454, 1379, 1269, 967, 747, 701. **HRMS** [ESI] calcd for $\text{C}_{14}\text{H}_{21}\text{N}_2$ $[\text{M}+\text{H}]^+$ 217.1699, found 217.1707.



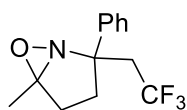
5b, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.17 (m, 3H), 2.78 (t, $J = 8.2 \text{ Hz}$, 2H), 2.16-1.98 (m, 3H), 1.88-1.80 (m, 1H), 1.49-1.41 (m, 1H), 1.33-1.28 (m, 1H), 1.23 (s, 3H), 1.06 (s, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 141.1, 128.5, 128.2, 126.1, 67.9, 63.7, 37.7, 33.2, 31.8, 29.0, 26.0, 25.2. **HRMS** [ESI] calcd for $\text{C}_{14}\text{H}_{21}\text{N}_2$ $[\text{M}+\text{H}]^+$ 217.1699, found 217.1703.



5c, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.16 (m, 3H), 3.08-3.01 (m, 1H), 2.72-2.61 (m, 2H), 2.17-2.12 (m, 1H), 1.88-1.64 (m, 3H), 1.60-1.48 (m, 5H), 1.29-1.20 (m, 2H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 142.5, 128.4, 128.2, 125.6, 65.0, 64.9, 36.1, 32.3, 31.7, 29.3, 27.0, 21.6. **FT-IR**: ν (cm^{-1}) 2928, 2859, 1453, 747, 698. **HRMS** [ESI] calcd for $\text{C}_{14}\text{H}_{20}\text{N}_2\text{Na}$ $[\text{M}+\text{Na}]^+$ 239.1519, found 239.1512.

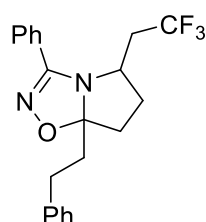


6, dr = 1.2:1, colorless oil. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.49-7.42 (m, 2H, two isomers), 7.35-7.30 (m, 2H, two isomers), 7.25-7.21 (m, 1H, two isomers), 3.52-3.43 (m, 0.45H) & 3.25-3.16 (m, 0.55H) (two isomers), 2.77-2.56 (m, 2H, two isomers), 2.33-2.26 (m, 0.67H) & 2.20-2.11 (m, 1.66H) & 1.84-1.76 (m, 0.67H) (two isomers), 2.02-1.97 (m, 1H, two isomers), 1.45-1.35 (m, 1H) (two isomers), 1.18 (t, $J = 6.4 \text{ Hz}$, 3H, two isomers); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 146.4 & 145.1 (two isomers), 128.2 & 128.1 (two isomers), 126.7 & 126.6 (two isomers), 125.9 (q, $J_{\text{C-F}} = 277.0 \text{ Hz}$) & 125.9 (q, $J_{\text{C-F}} = 276.9 \text{ Hz}$) (two isomers), 125.9 & 125.7 (two isomers), 65.0 (q, $J_{\text{C-F}} = 1.3 \text{ Hz}$) & 64.9 (q, $J_{\text{C-F}} = 1.4 \text{ Hz}$) (two isomers), 53.0 & 52.5 (two isomers), 46.9 (q, $J_{\text{C-F}} = 25.3 \text{ Hz}$) & 44.5 (q, $J_{\text{C-F}} = 24.6 \text{ Hz}$) (two isomers), 39.4 & 39.0 (two isomers), 32.5 & 32.4 (two isomers), 22.3 & 22.2 (two isomers); $^{19}\text{F NMR}$ (376 MHz, CDCl_3) δ -60.2 (s) & -60.3 (s) (two isomers). **FT-IR**: ν (cm^{-1}) 2962, 1364, 1119, 1031, 764, 701, 648. **HRMS** [ESI] calcd for $\text{C}_{13}\text{H}_{17}\text{F}_3\text{N}$ $[\text{M}+\text{H}]^+$ 244.1308, found 244.1304.

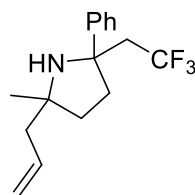


7, dr = 4.4:1, white solid, mp. 66-67 °C. $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 7.46-7.40 (m, 2H, two isomers), 7.32-7.18 (m, 3H, two isomers), 2.95-2.61 (m, 1.63 H) & 2.55-2.41 (m, 0.37 H) (two isomers), 2.39-2.19 (m, 2H, two isomers), 2.12-1.90 (m, 0.37H) & 1.80-1.66 (m, 1.63H) (two isomers), 1.59 (s, 0.55H) & 1.46 (s, 2.45H) (two isomers); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 143.7 & 138.6 (two isomers), 128.5 & 128.3 (two isomers), 127.9 & 127.3 (two isomers), 126.7 & 126.0 (two isomers), 125.6 (q, $J_{\text{C-F}} = 276.2 \text{ Hz}$) & 125.2 (q, $J_{\text{C-F}} = 277.1 \text{ Hz}$)

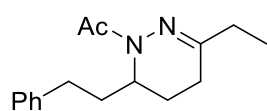
(two isomers), 88.8 & 87.2 (two isomers), 72.2 (q, $J_{C-F} = 1.5$ Hz) & 71.3 (q, $J_{C-F} = 1.9$ Hz) (two isomers), 43.7 (q, $J_{C-F} = 27.0$ Hz) & 30.8 (q, $J_{C-F} = 41.1$ Hz) (two isomers), 30.1 & 29.7 (two isomers), 30.1 & 29.6 (two isomers), 18.8 & 18.7 (two isomers); **^{19}F NMR** (376 MHz, CDCl_3) δ -59.9 (s) & -60.5 (s) (two isomers). **FT-IR:** ν (cm^{-1}) 2984, 1723, 1449, 1259, 1241, 1151, 1124, 1054, 856, 800, 698, 649. **HRMS** [ESI] calcd for $\text{C}_{13}\text{H}_{15}\text{F}_3\text{NO}$ $[\text{M}+\text{H}]^+$ 258.1100, found 258.1099.



8, dr = 1.3:1, white solid, mp. 64-65 °C. *Major isomer:* **^1H NMR** (400 MHz, CDCl_3) δ 7.70-7.68 (m, 2H), 7.50-7.42 (m, 3H), 7.29-7.25 (m, 2H), 7.22-7.16 (m, 3H), 3.84-3.79 (m, 1H), 2.89-2.80 (m, 2H), 2.53-2.35 (m, 2H), 2.30-2.13 (m, 3H), 2.10-2.00 (m, 2H), 1.87-1.82 (m, 1H); **^{13}C NMR** (100 MHz, CDCl_3) δ 158.8, 141.6, 130.9, 128.9, 128.4, 128.3, 127.8, 126.3, 125.9, 125.5 (q, $J_{C-F} = 275.5$ Hz), 109.3, 58.6 (q, $J_{C-F} = 2.8$ Hz), 42.4, 38.7 (q, $J_{C-F} = 27.1$ Hz), 35.9, 29.9, 28.8; **^{19}F NMR** (376 MHz, CDCl_3) δ -63.7 (s). **FT-IR:** ν (cm^{-1}) 2950, 1393, 1248, 1160, 1136, 1120, 906, 755, 700, 688. **HRMS** [ESI] calcd for $\text{C}_{21}\text{H}_{21}\text{F}_3\text{N}_2\text{NaO}$ $[\text{M}+\text{Na}]^+$ 397.1498, found 397.1505.

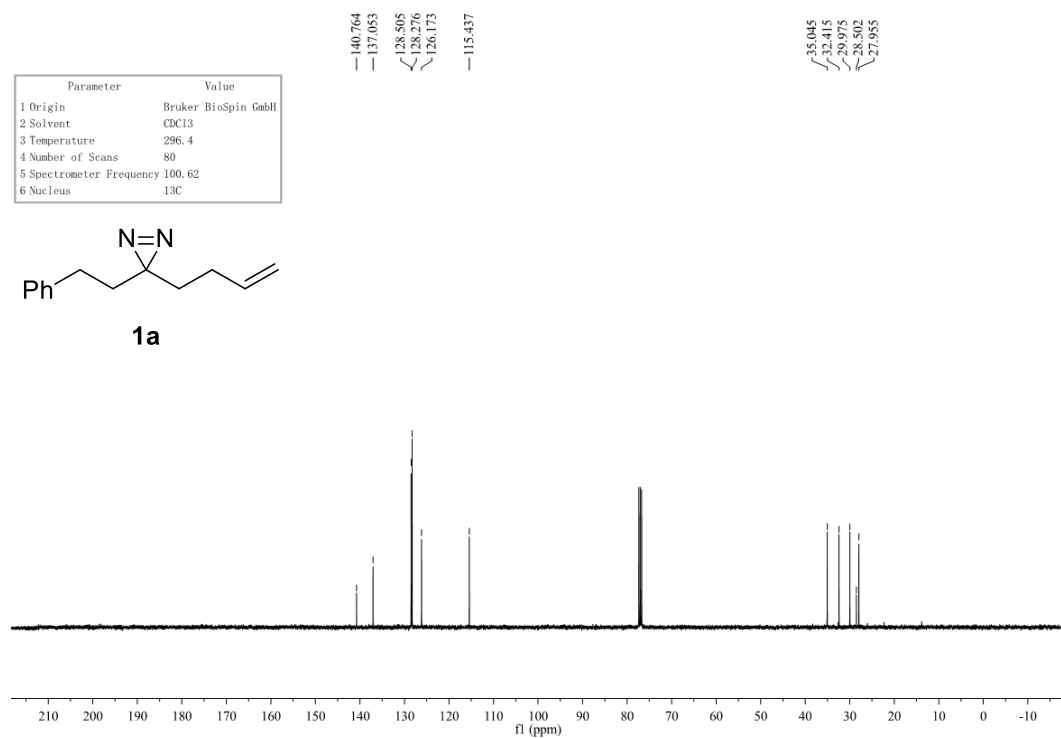
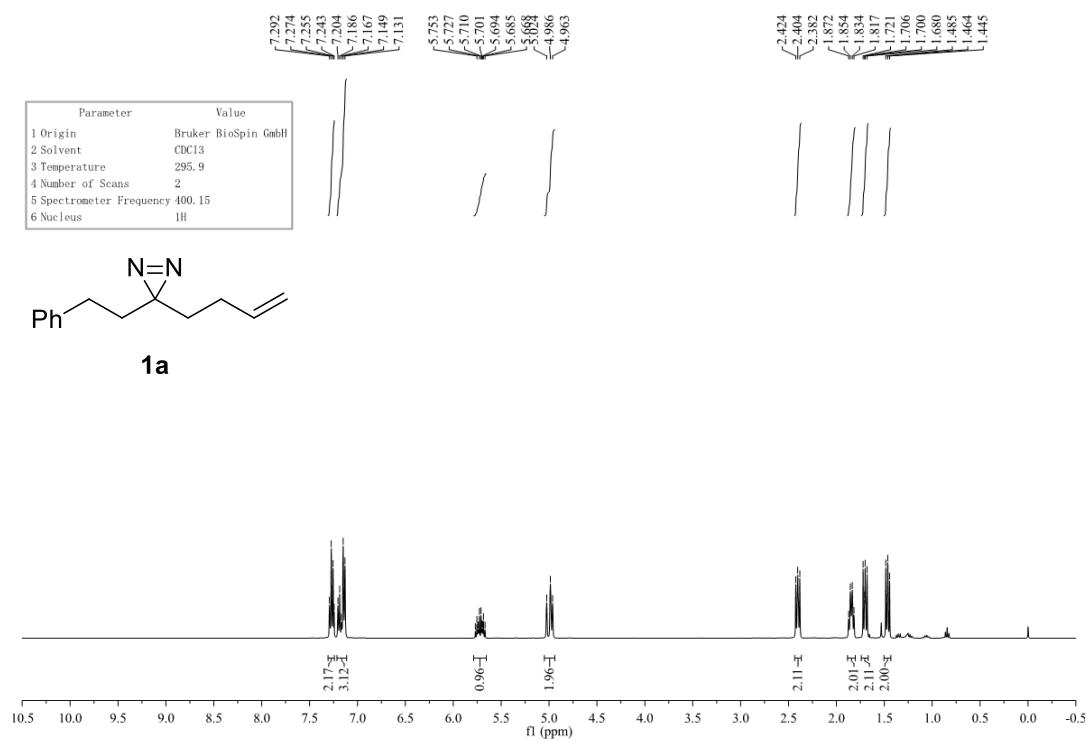


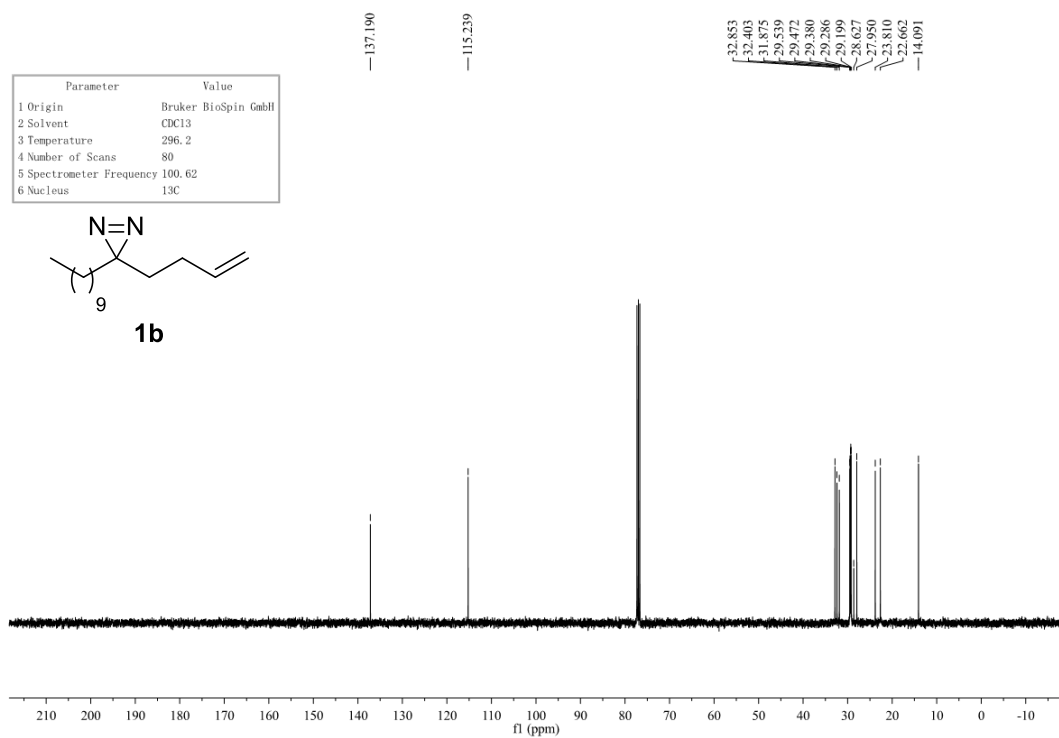
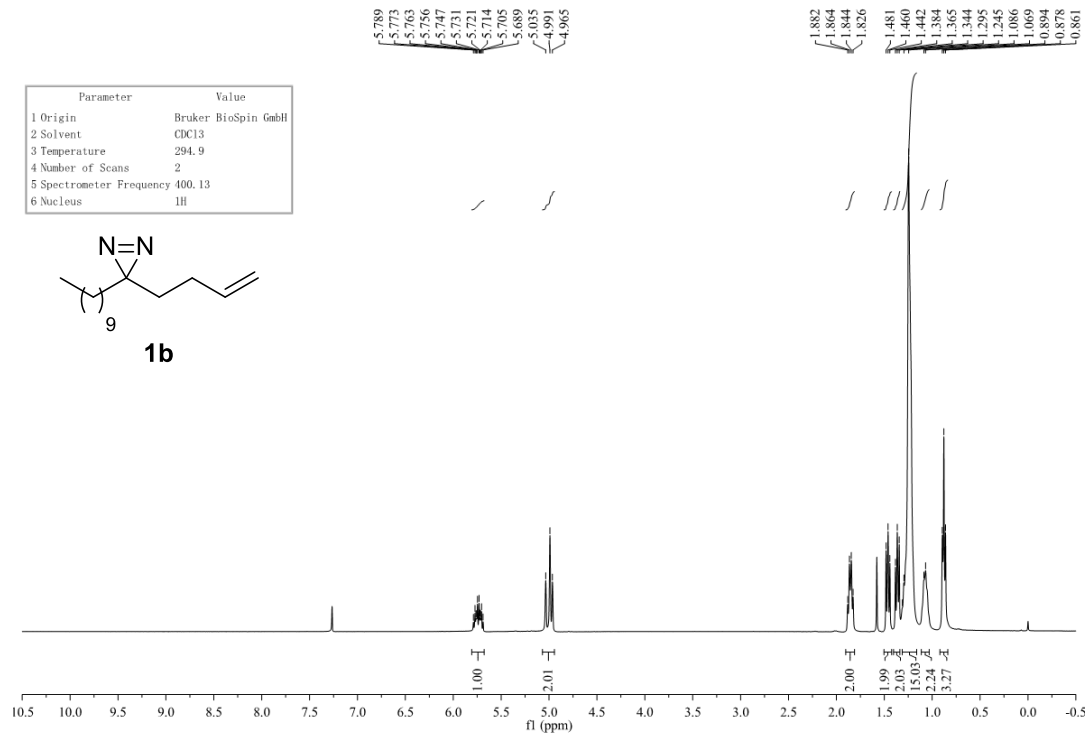
9, dr = 5.8:1, light yellow oil. **^1H NMR** (400 MHz, CDCl_3) δ 7.44-7.32 (m, 2H, two isomers), 7.26-7.22 (m, 2H, two isomers), 7.18-7.13 (m, 1H, two isomers), 5.88-5.70 (m, 1H, two isomers), 5.06-4.85 (m, 2H, two isomers), 2.65-2.44 (m, 2H, two isomers), 2.29-2.12 (m, 2H, two isomers), 1.98 (d, $J = 7.2$ Hz, 1.70 H) & 1.74-1.67 (m, 0.30H) (two isomers), 1.60 (t, $J = 7.2$ Hz, 1.57H) & 1.50-1.43 (m, 0.35 H) (two isomers), 1.15 (s, 2.56H) & 0.97 (s, 0.44H) (two isomers); **^{13}C NMR** (100 MHz, CDCl_3) δ 146.8 & 146.8 (two isomers), 135.6 & 135.1 (two isomers), 128.0 (two isomers), 126.5 (two isomers), 125.8 (q, $J_{C-F} = 277.1$ Hz) (two isomers), 125.9 (two isomers), 117.9 & 117.3 (two isomers), 64.9 & 64.9 (two isomers), 61.6 (two isomers), 48.3 & 47.9 (two isomers), 47.1 (q, $J_{C-F} = 24.6$ Hz) (two isomers), 38.6 & 38.4 (two isomers), 37.2 & 36.6 (two isomers), 28.9 & 28.8 (two isomers); **^{19}F NMR** (376 MHz, CDCl_3) δ -60.1 (s) & -60.1 (s) (two isomers). **FT-IR:** ν (cm^{-1}) 2962, 1361, 1258, 1118, 1078, 914, 702. **HRMS** [ESI] calcd for $\text{C}_{16}\text{H}_{21}\text{F}_3\text{N}$ $[\text{M}+\text{H}]^+$ 284.1621, found 284.1612.

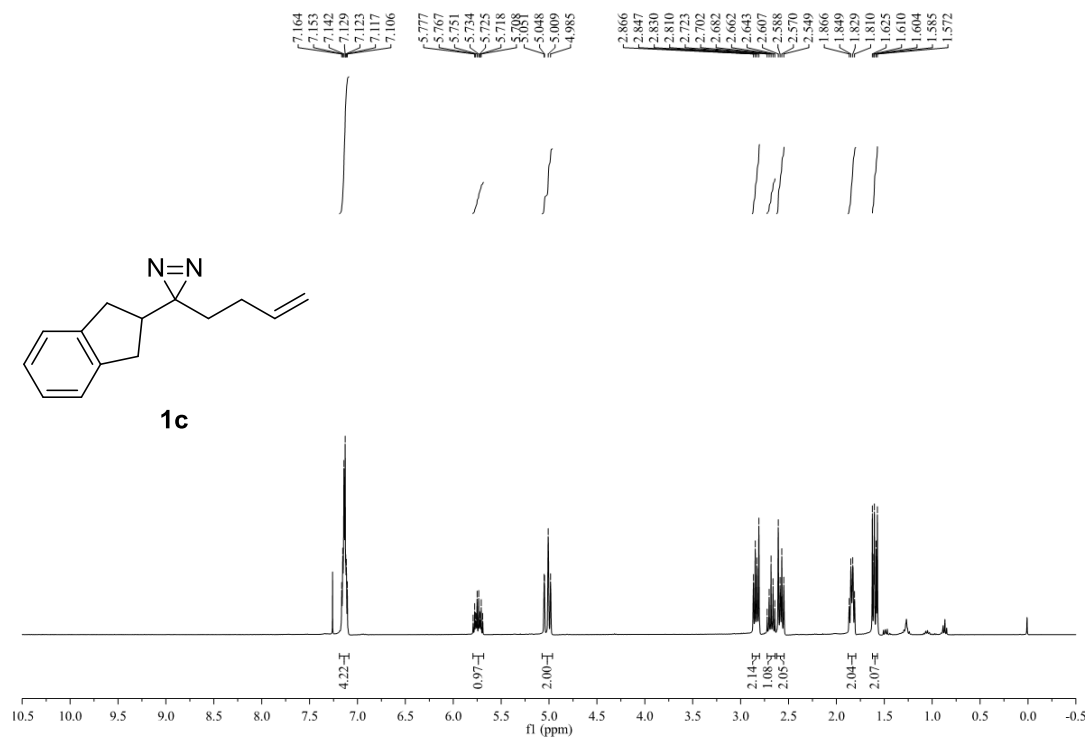


10, light yellow solid, mp. 66-67 °C. **^1H NMR** (400 MHz, CDCl_3) δ 7.30-7.26 (m, 2H), 7.21-7.17 (m, 3H), 4.61-4.57 (m, 1H), 2.91 (t, 2H, $J = 7.8$ Hz, 2H), 2.54 (t, $J = 7.8$ Hz, 2H), 2.25 (s, 3H), 2.16-1.98 (m, 2H), 1.91-1.86 (m, 1H), 1.68-1.58 (m, 1H), 1.54-1.46 (m, 1H), 1.34-1.26 (m, 1H), 0.87 (t, $J = 7.4$ Hz, 3H); **^{13}C NMR** (100 MHz, CDCl_3) δ 171.5, 151.0, 141.3, 128.3, 128.3, 126.0, 47.2, 39.2, 32.3, 23.0, 21.8, 21.4, 19.5, 10.2. **FT-IR:** ν (cm^{-1}) 2930, 1722, 1656, 1371, 1344, 1259, 1210, 1151, 800. **HRMS** [ESI] calcd for $\text{C}_{16}\text{H}_{22}\text{N}_2\text{NaO}$ $[\text{M}+\text{Na}]^+$ 281.1624, found 281.1621.

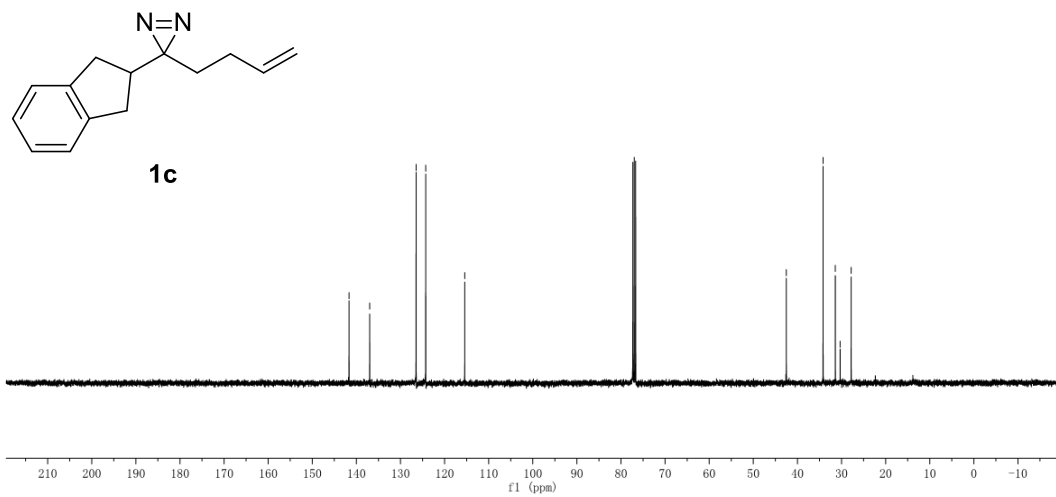
8. NMR Spectra

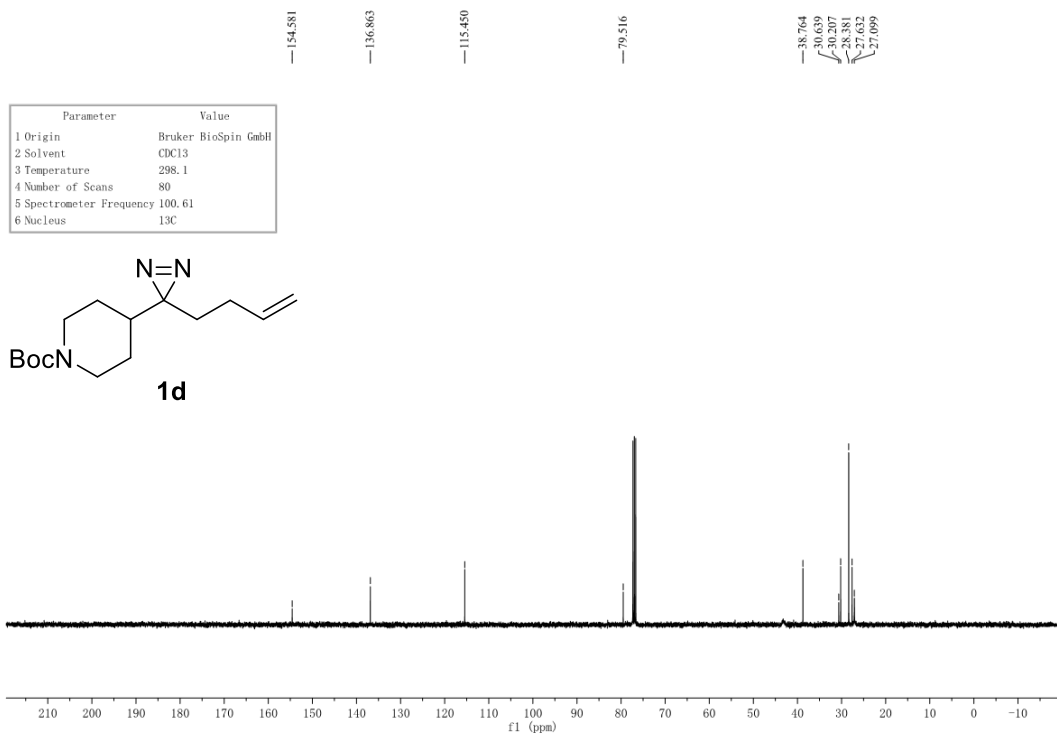
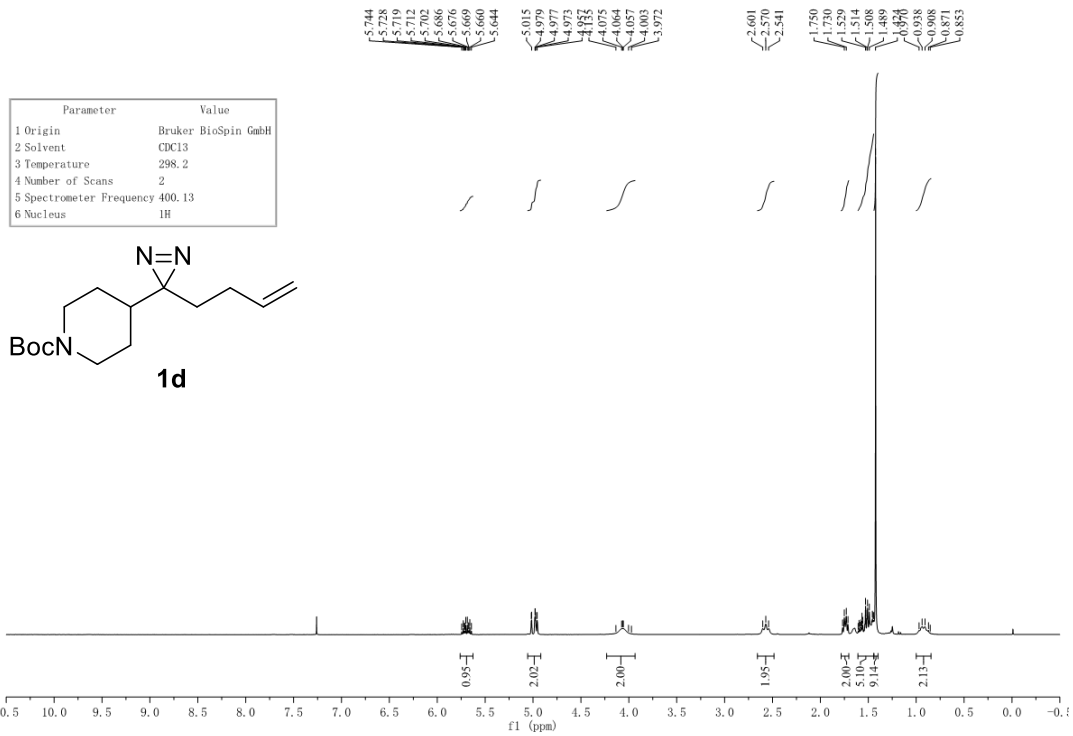


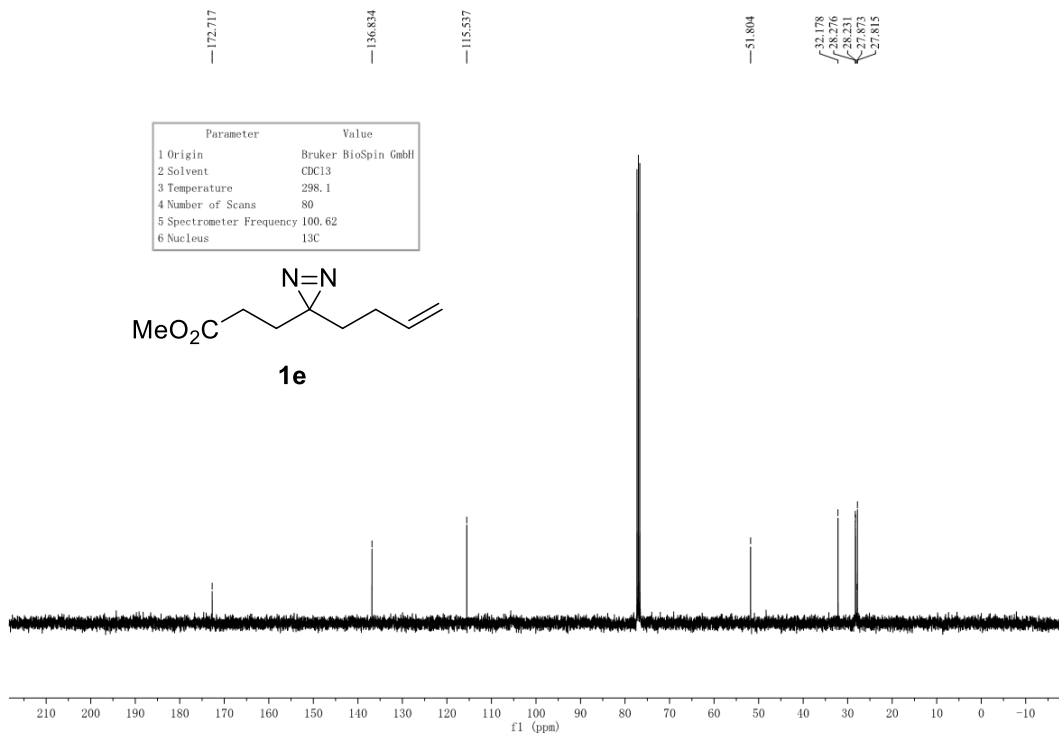
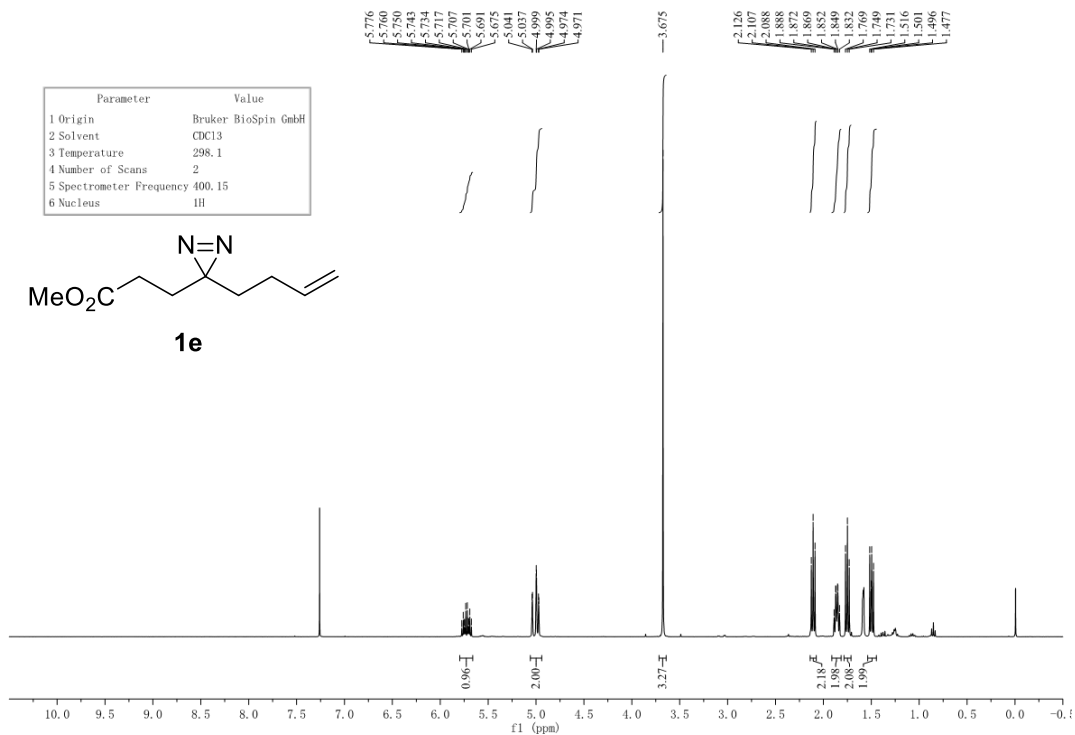


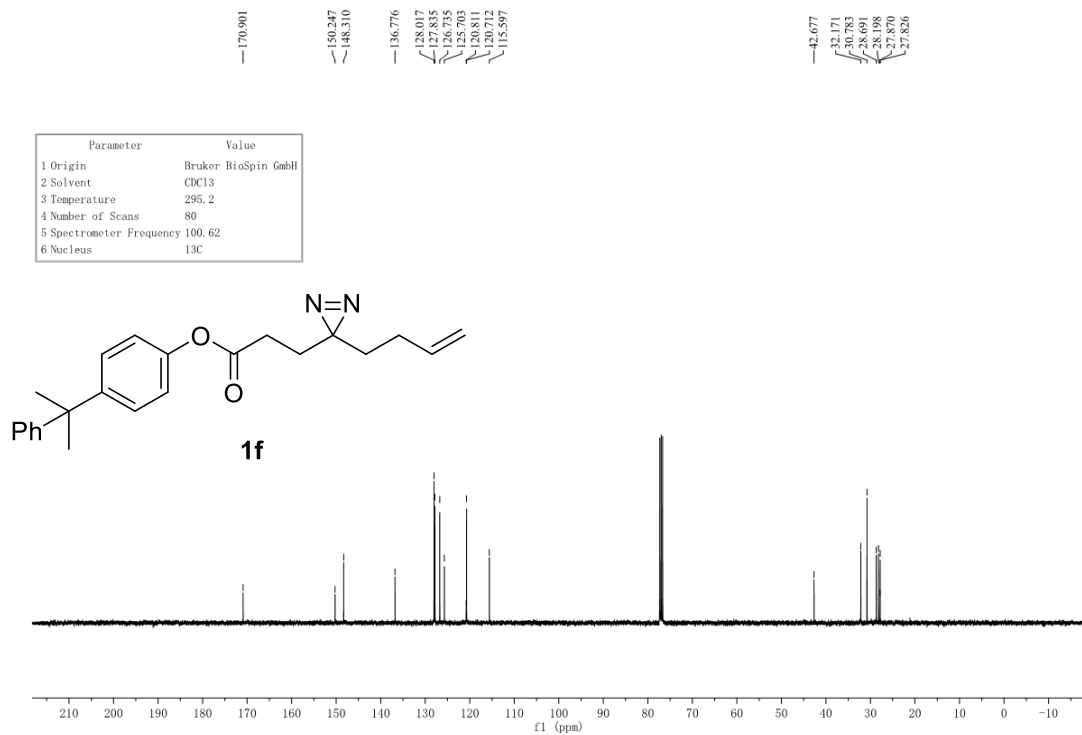
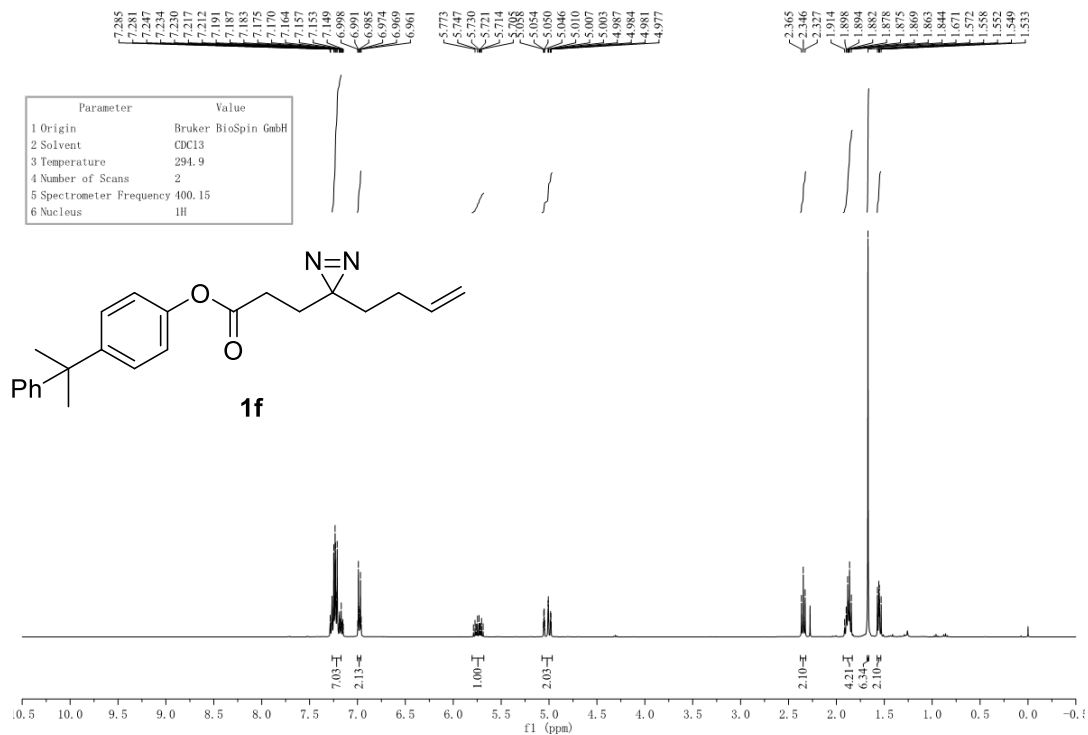


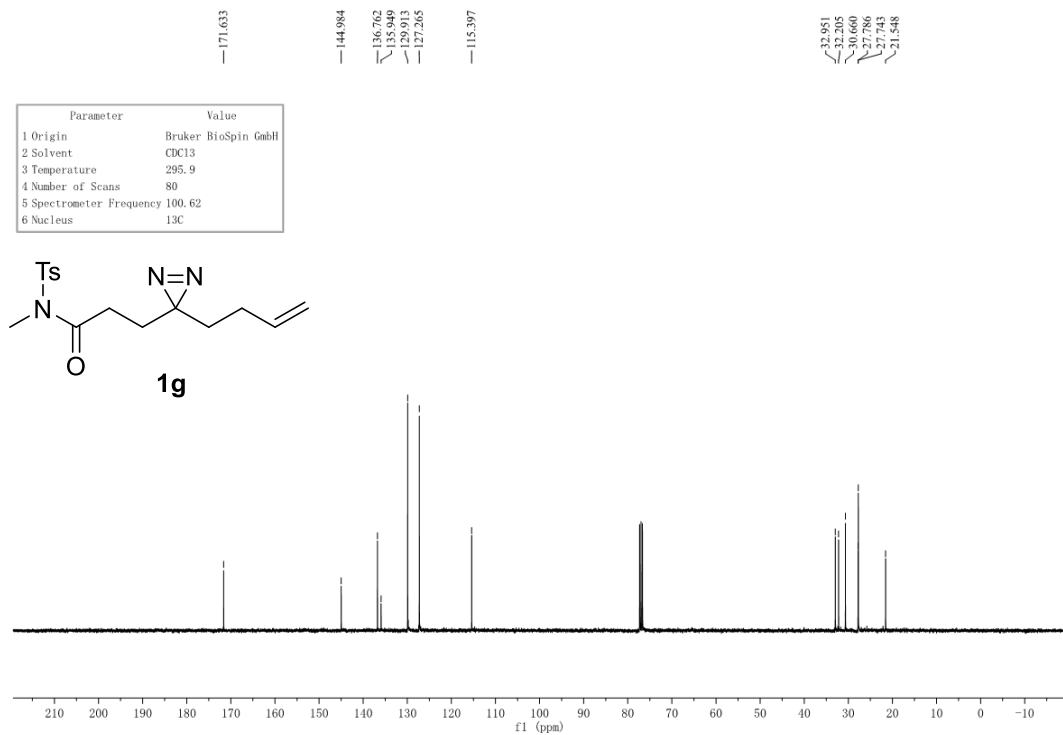
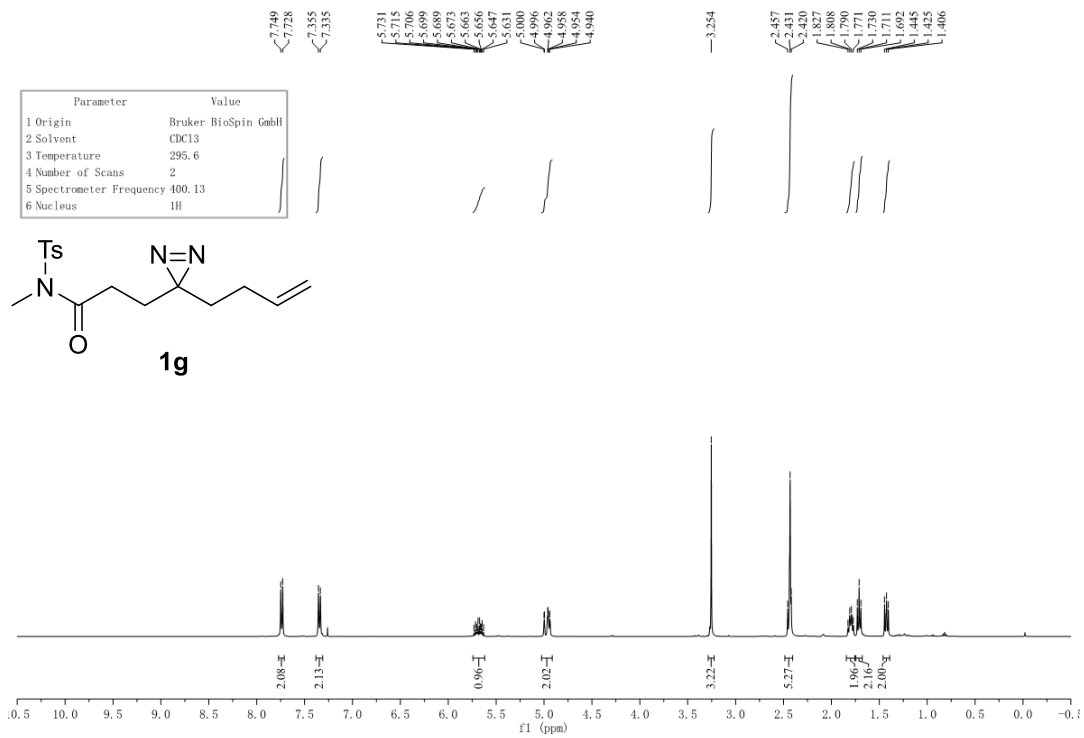
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C

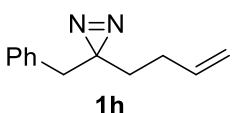
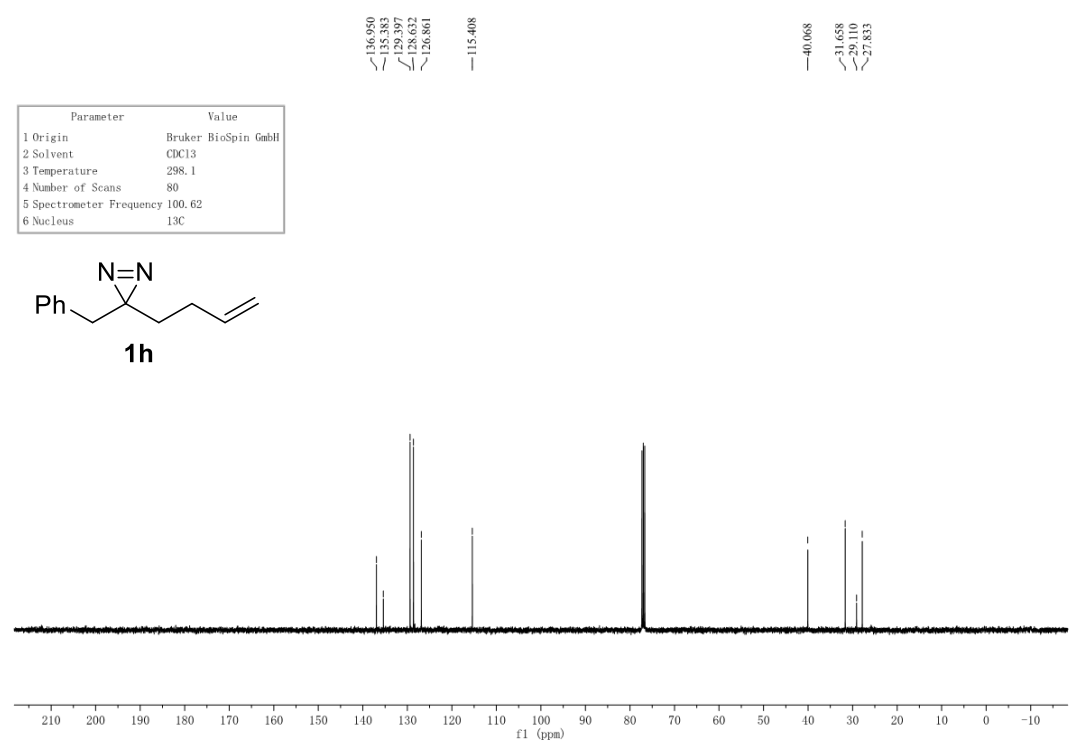
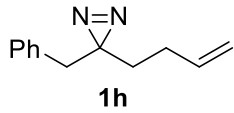
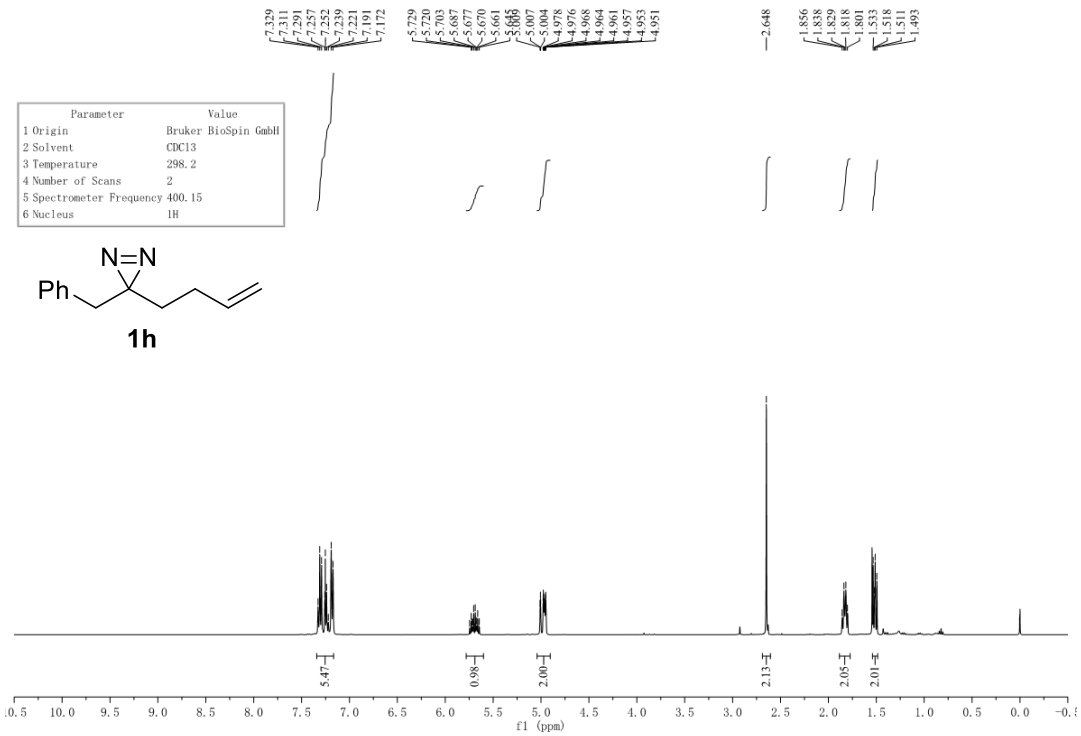


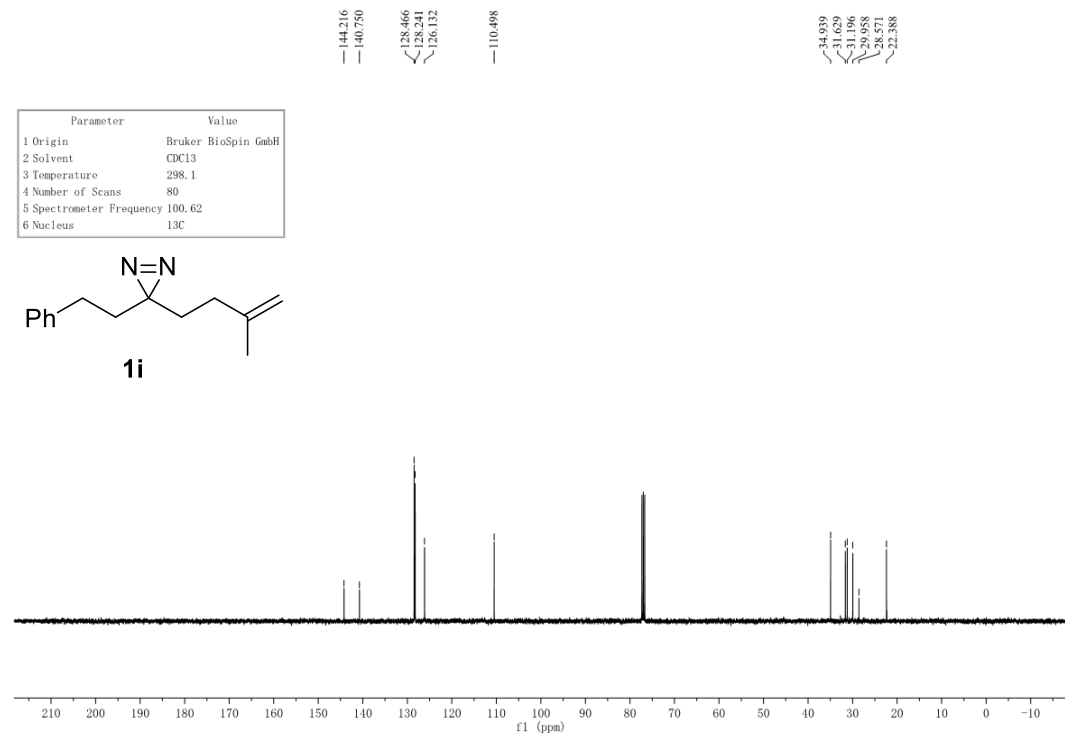
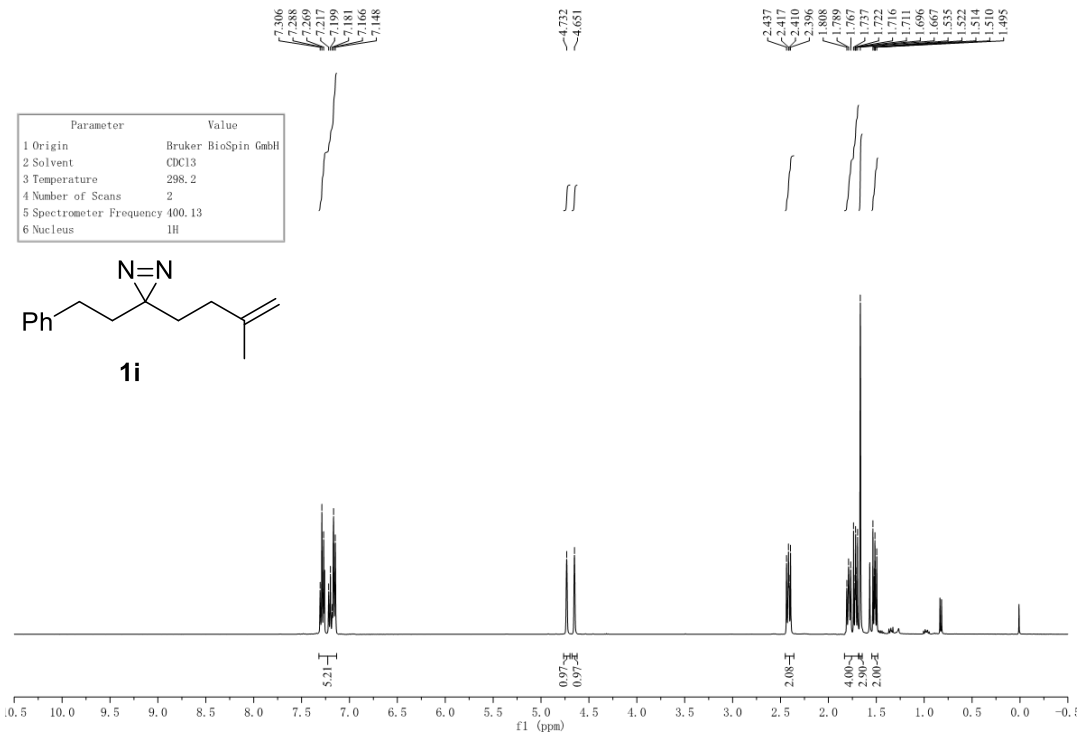


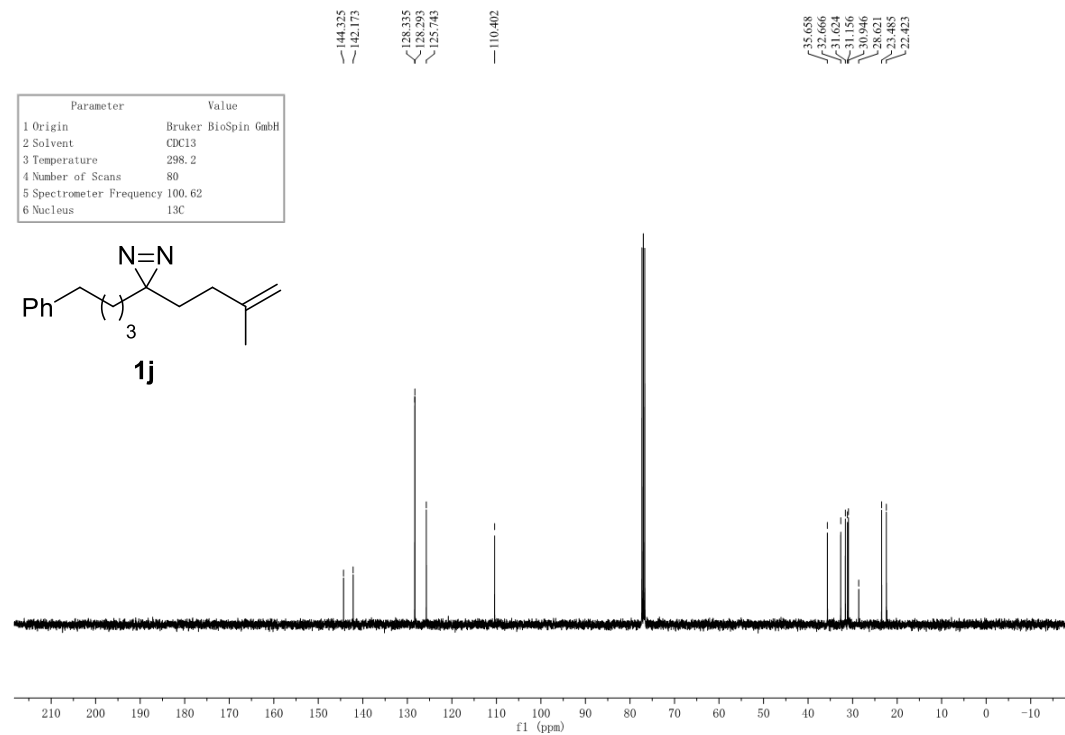
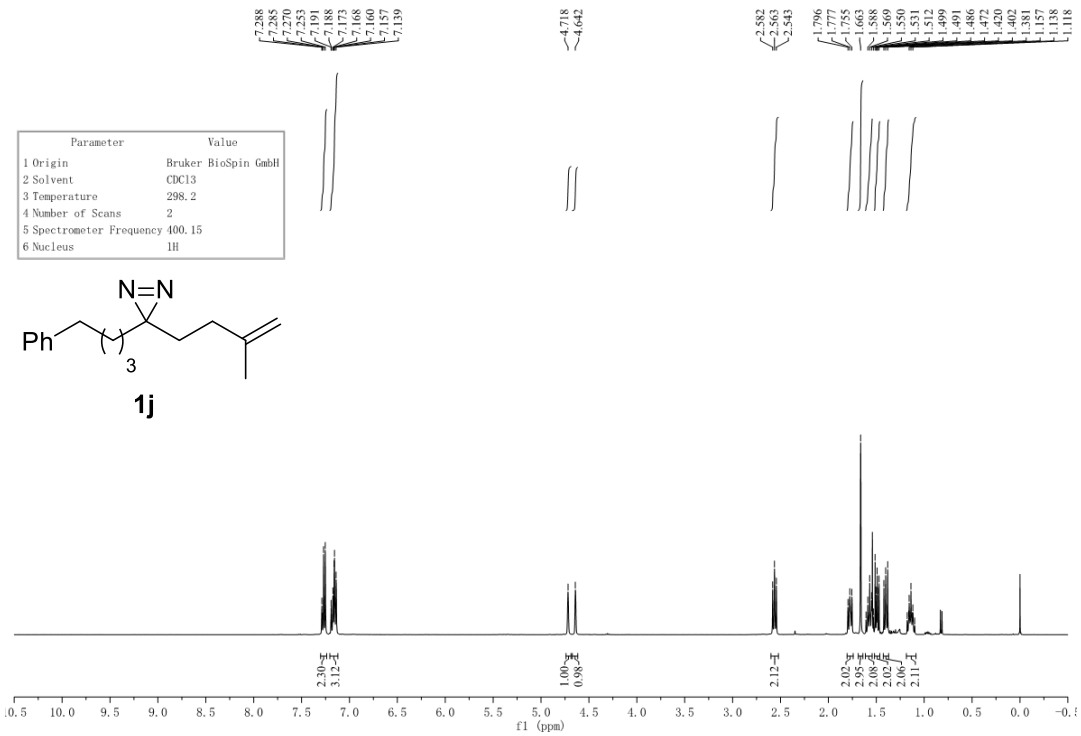


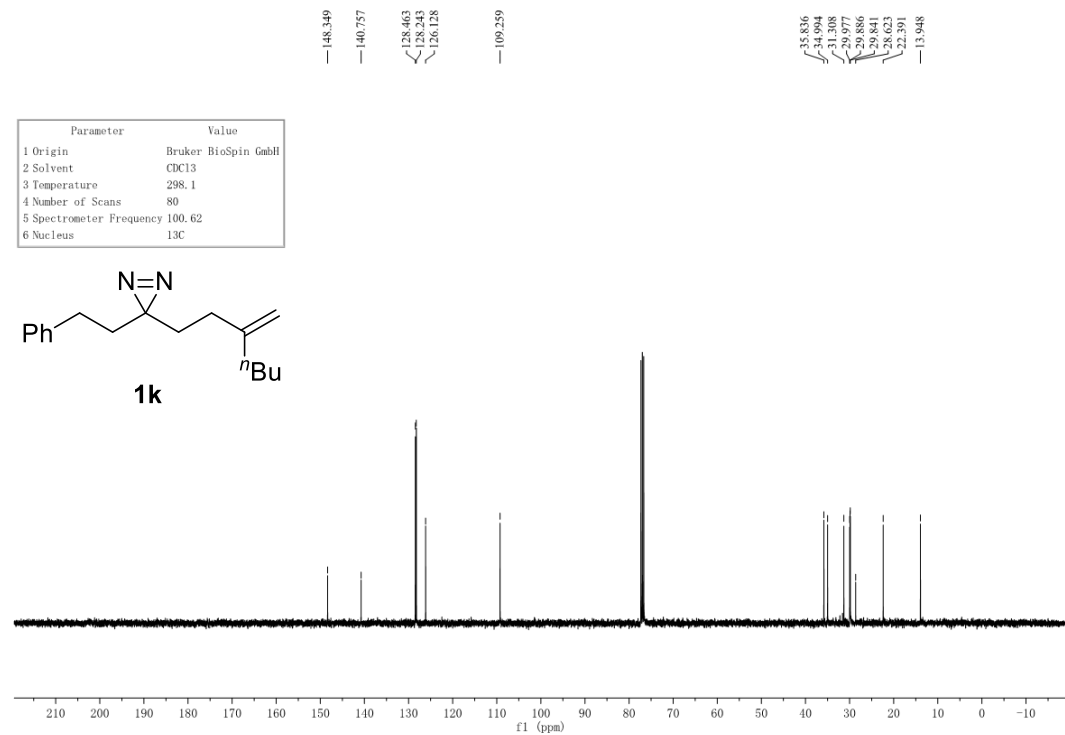
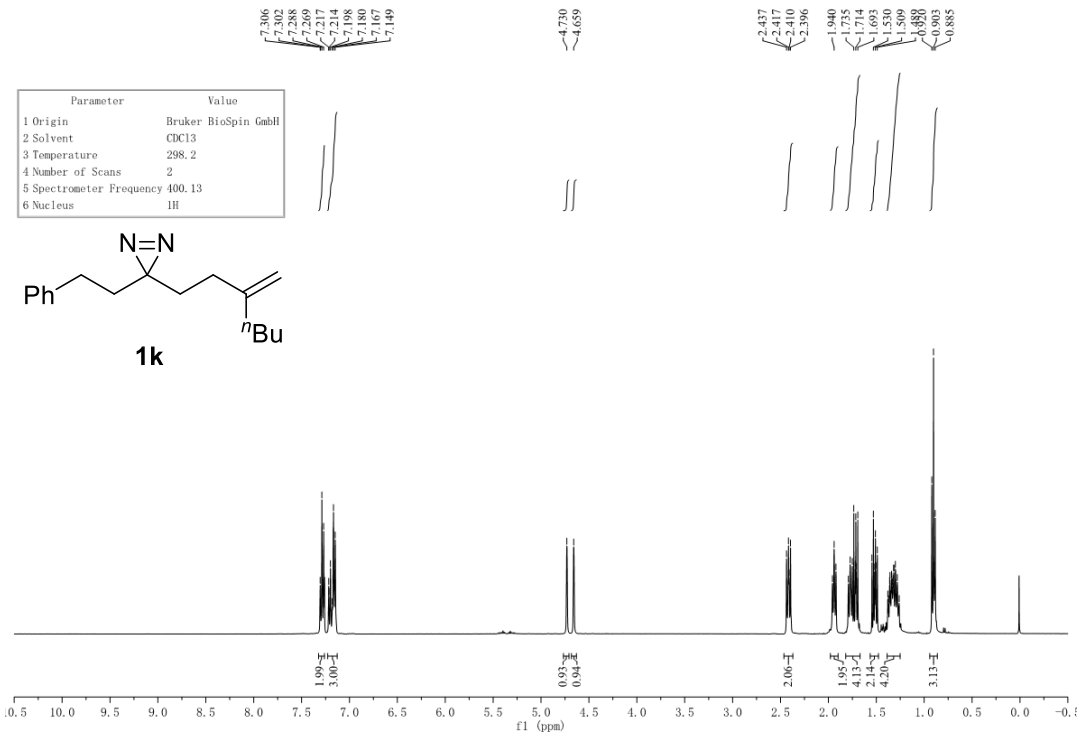




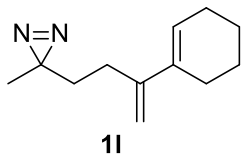




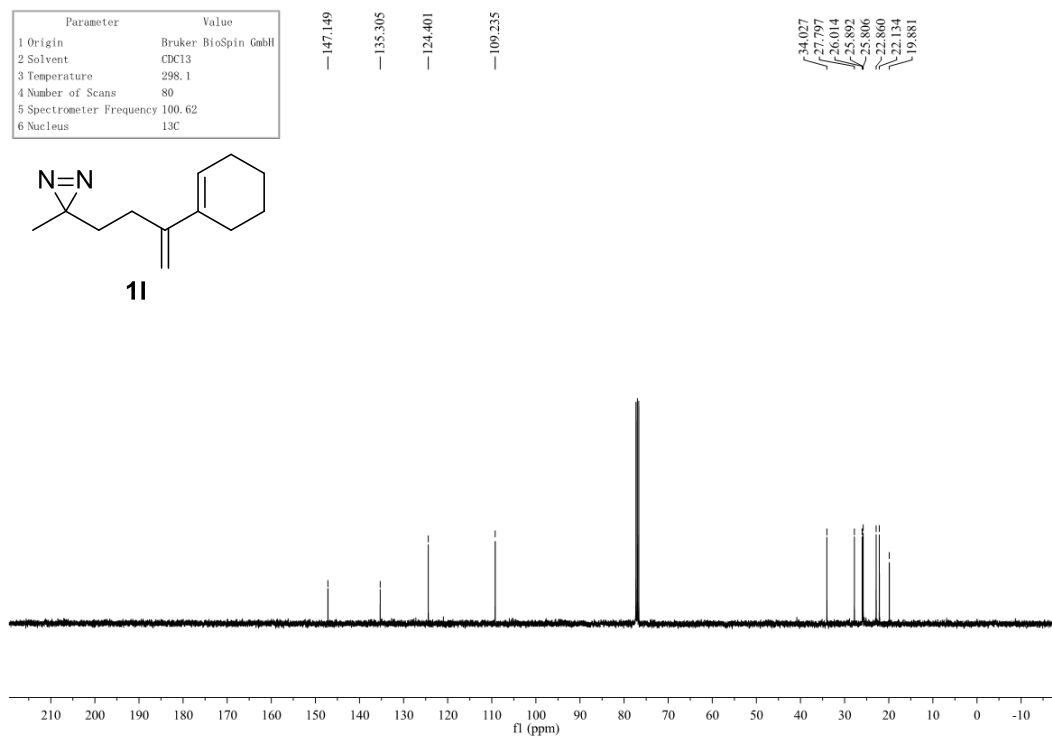
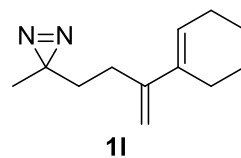


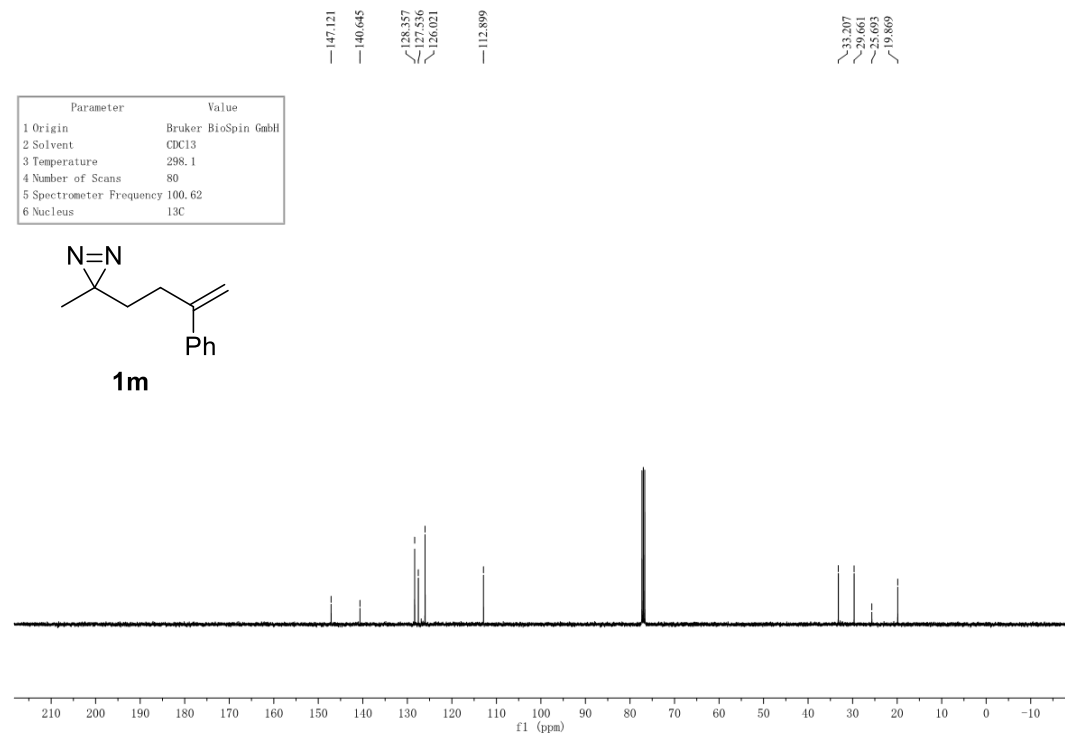
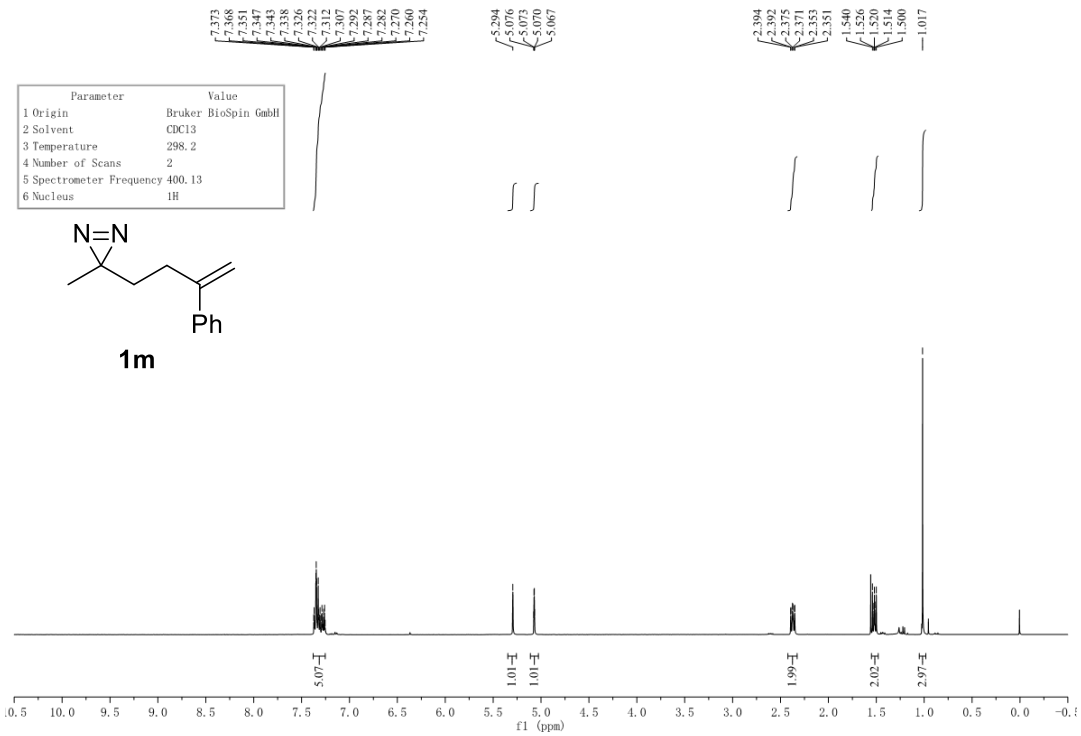


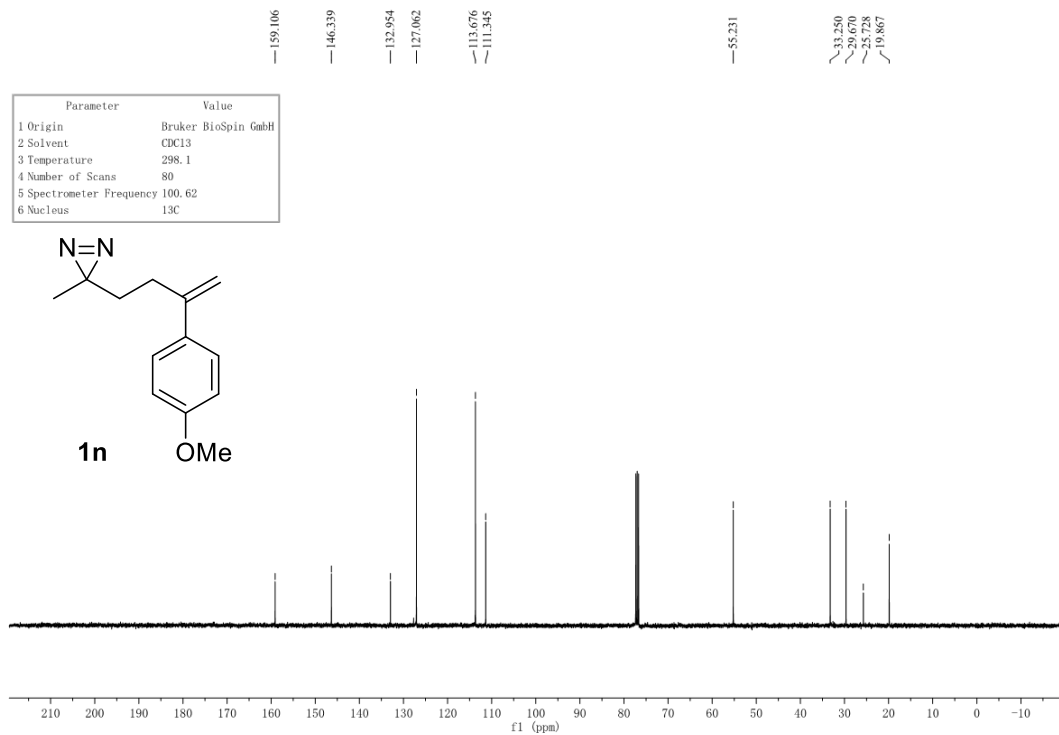
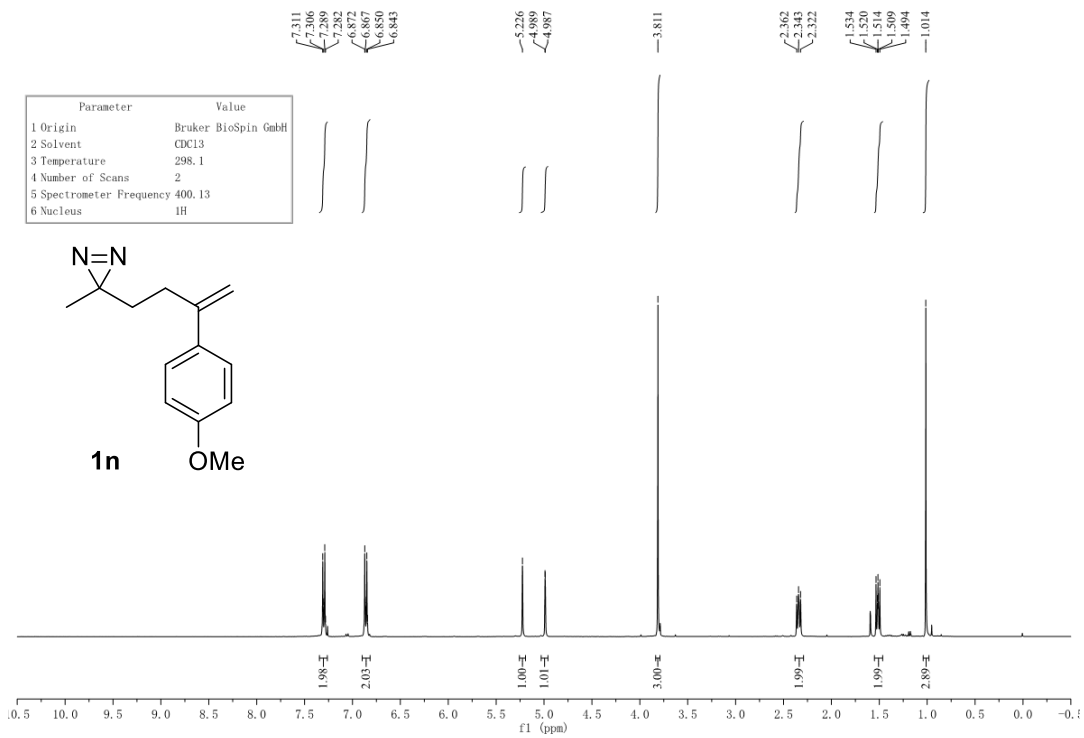
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H

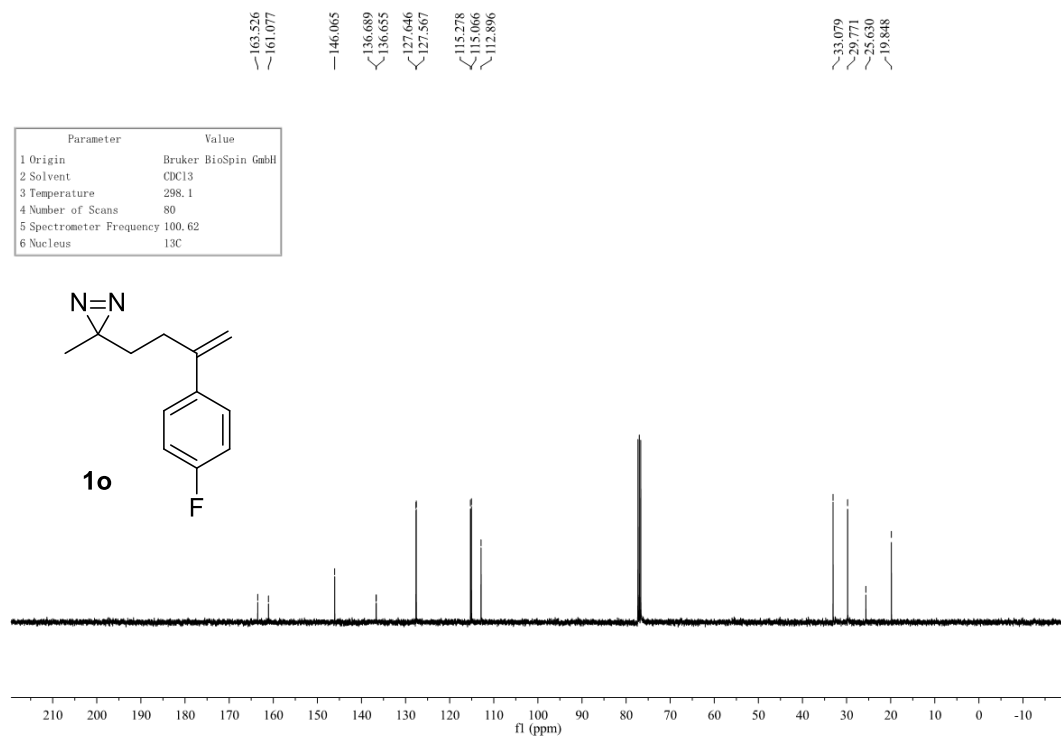
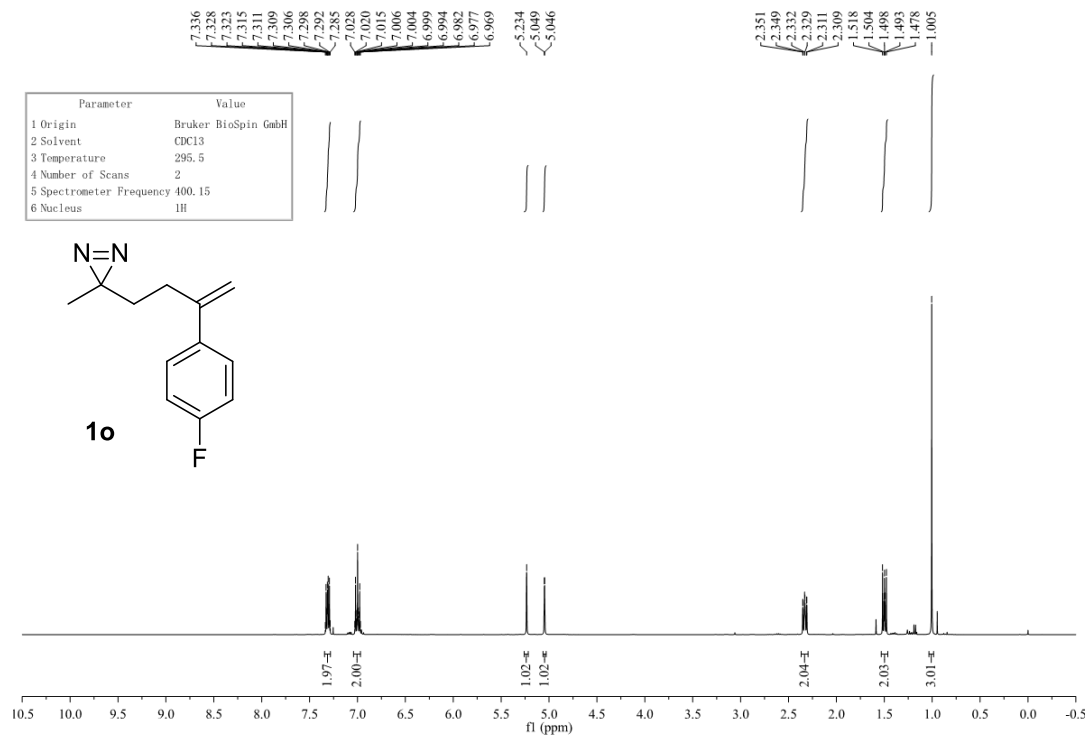


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C

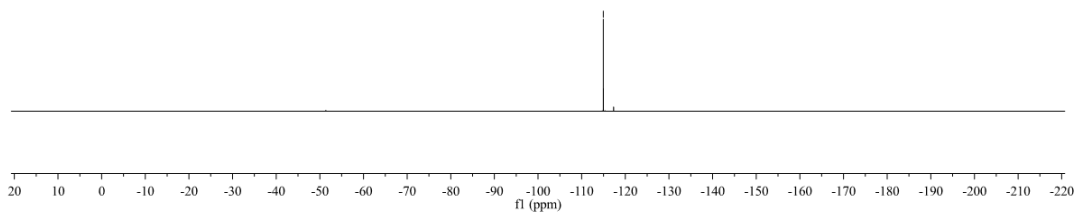
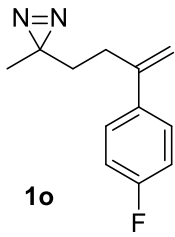




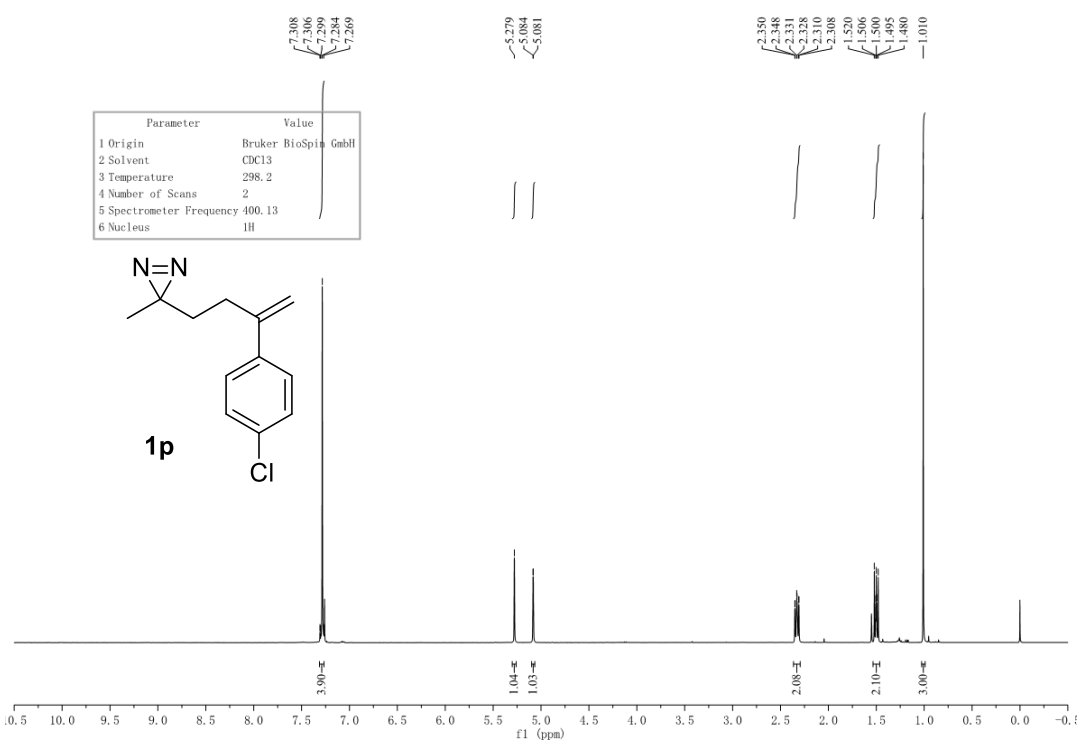
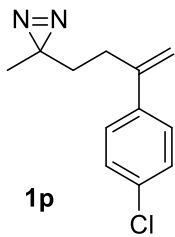


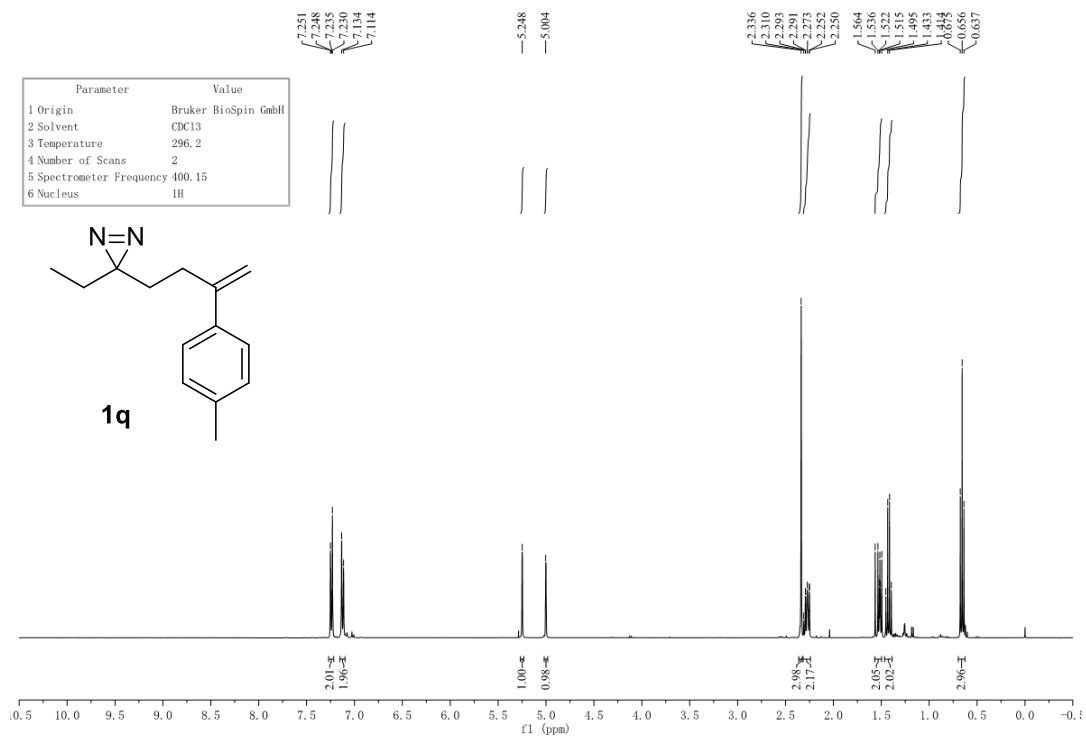
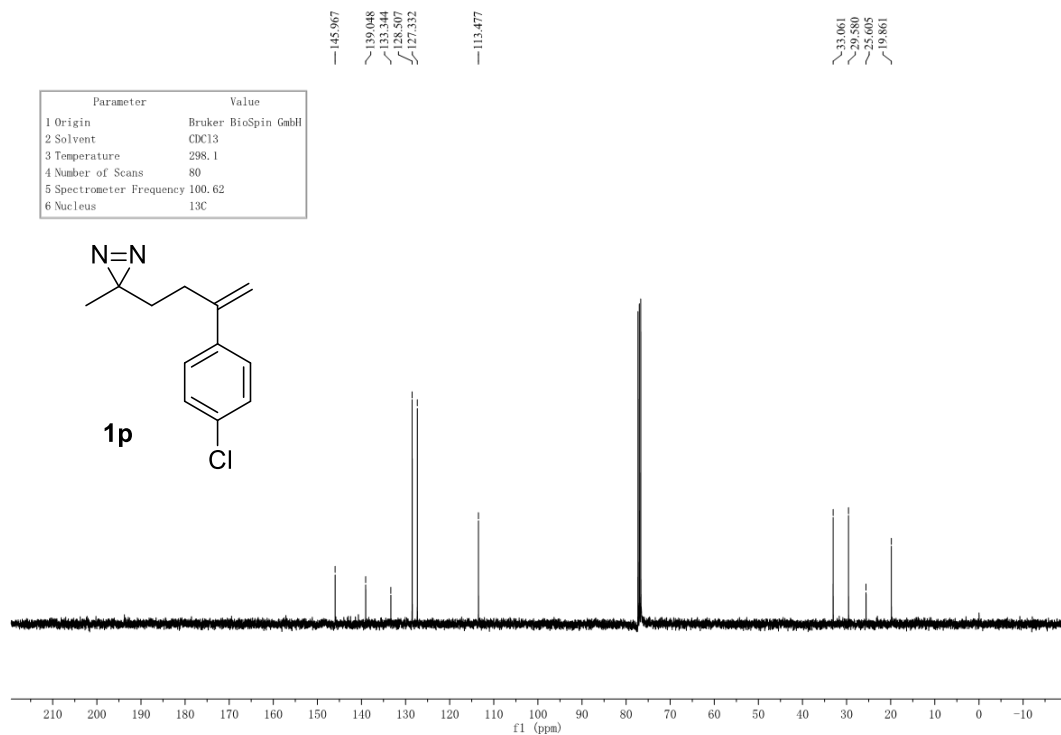


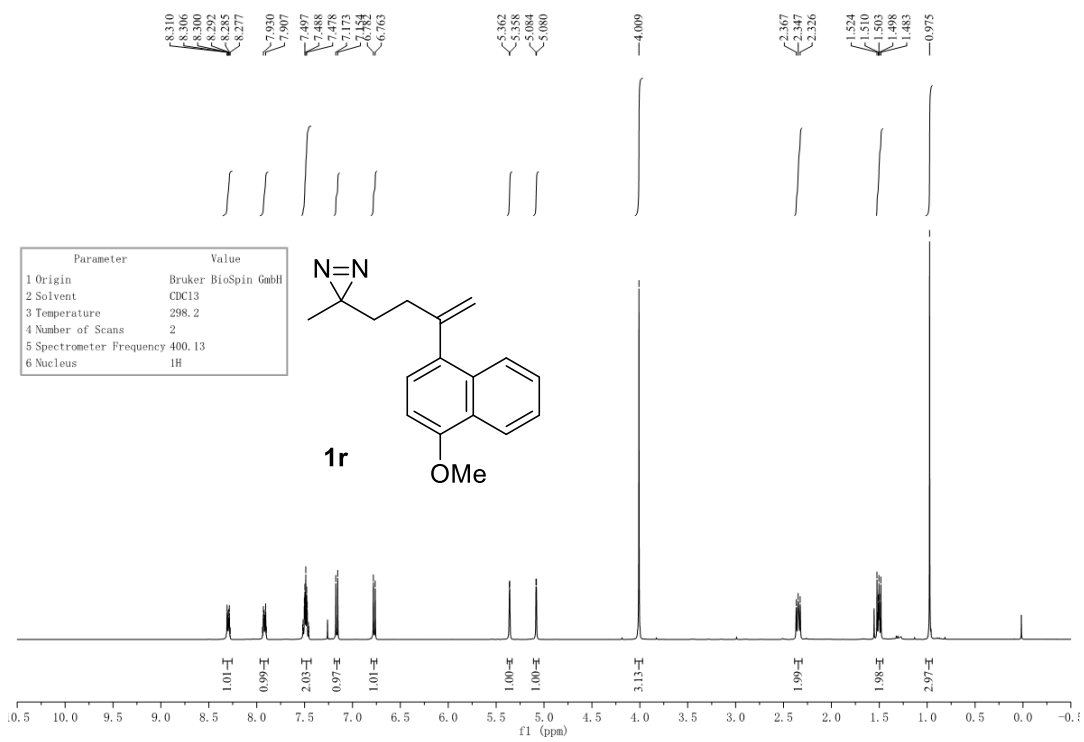
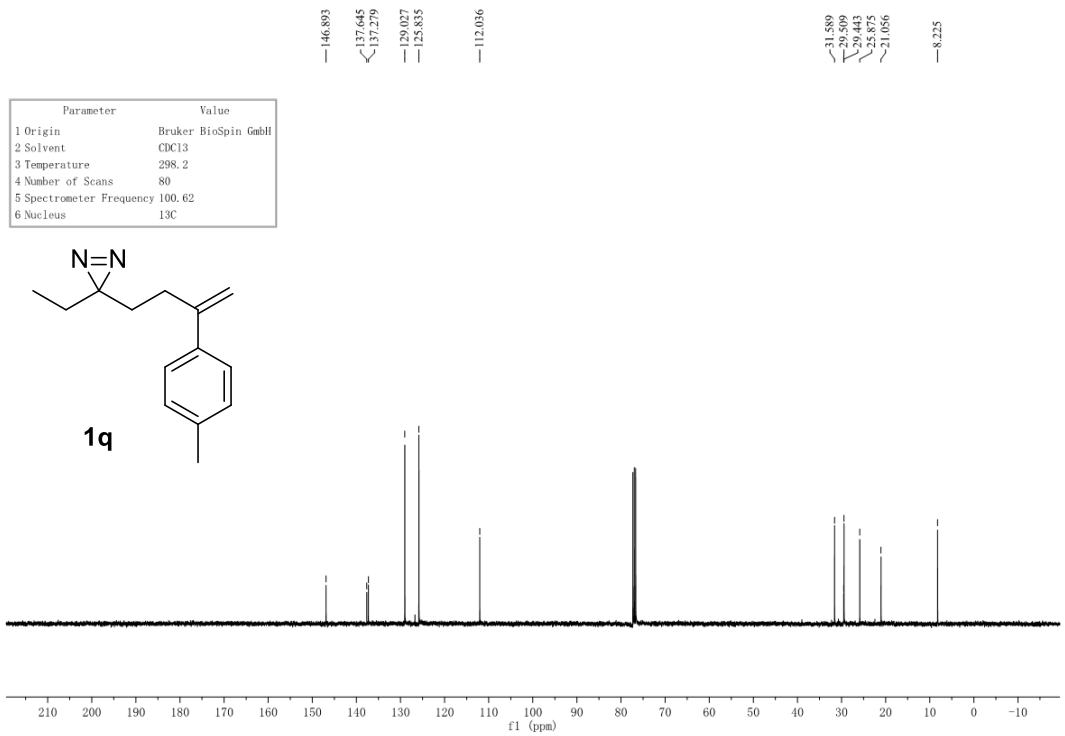
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.5
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

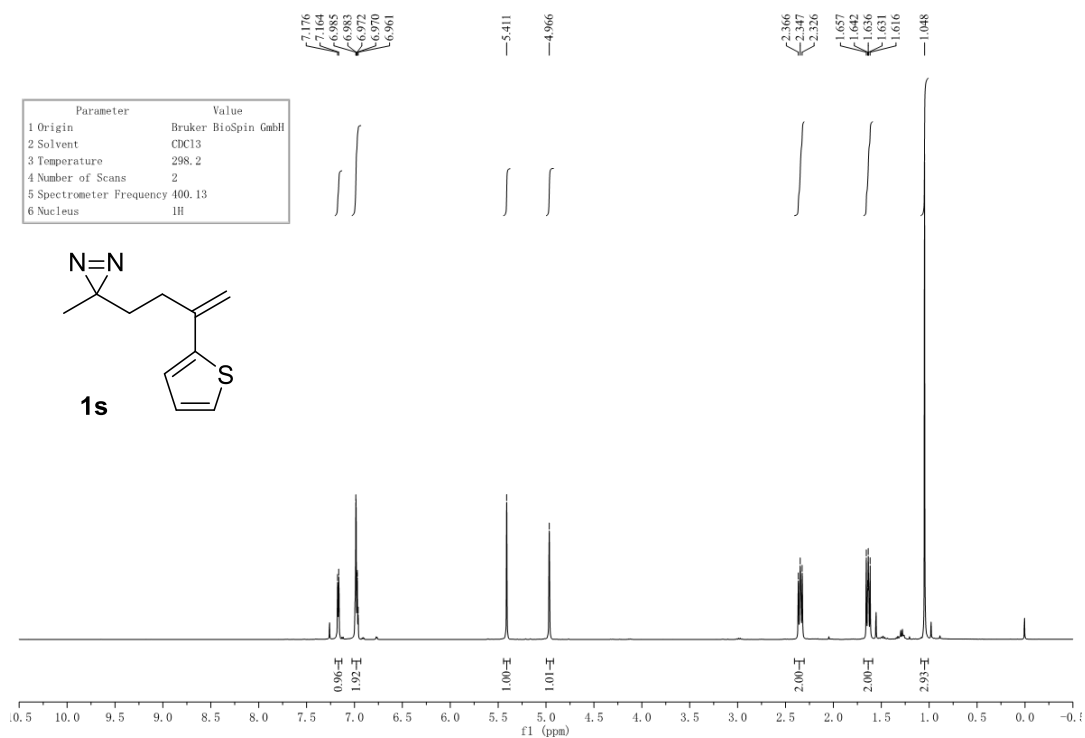
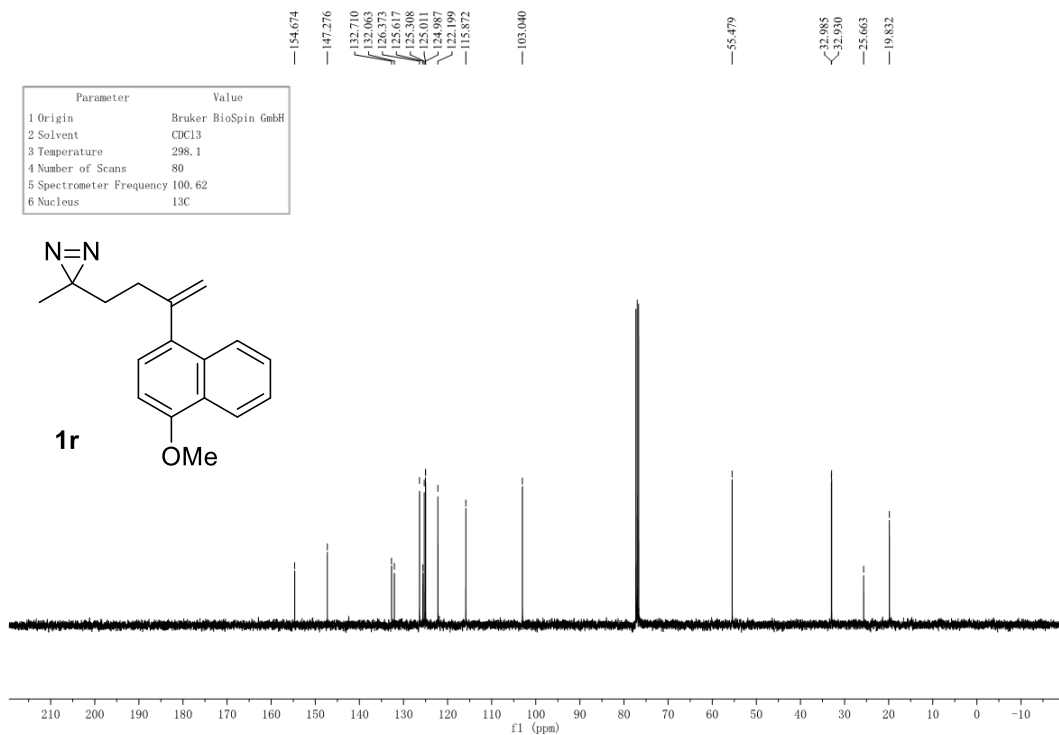


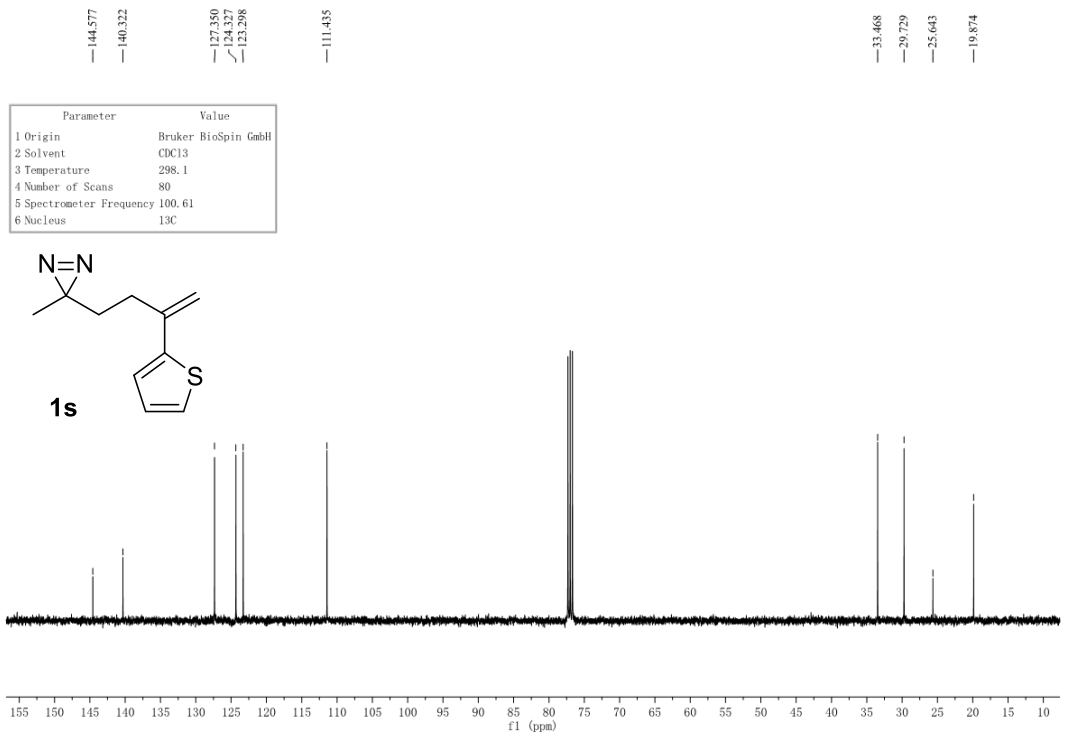
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H







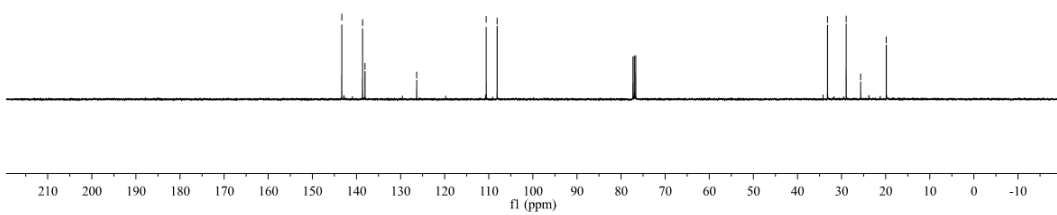
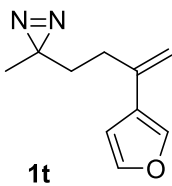




Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C

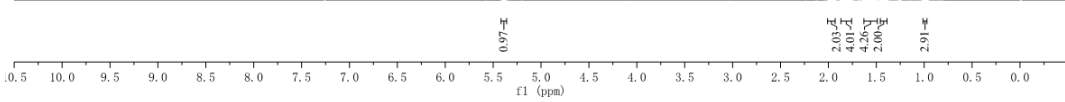
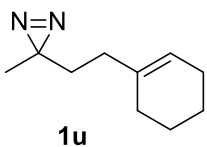
143.319
138.620
138.069
126.343
110.581
108.096

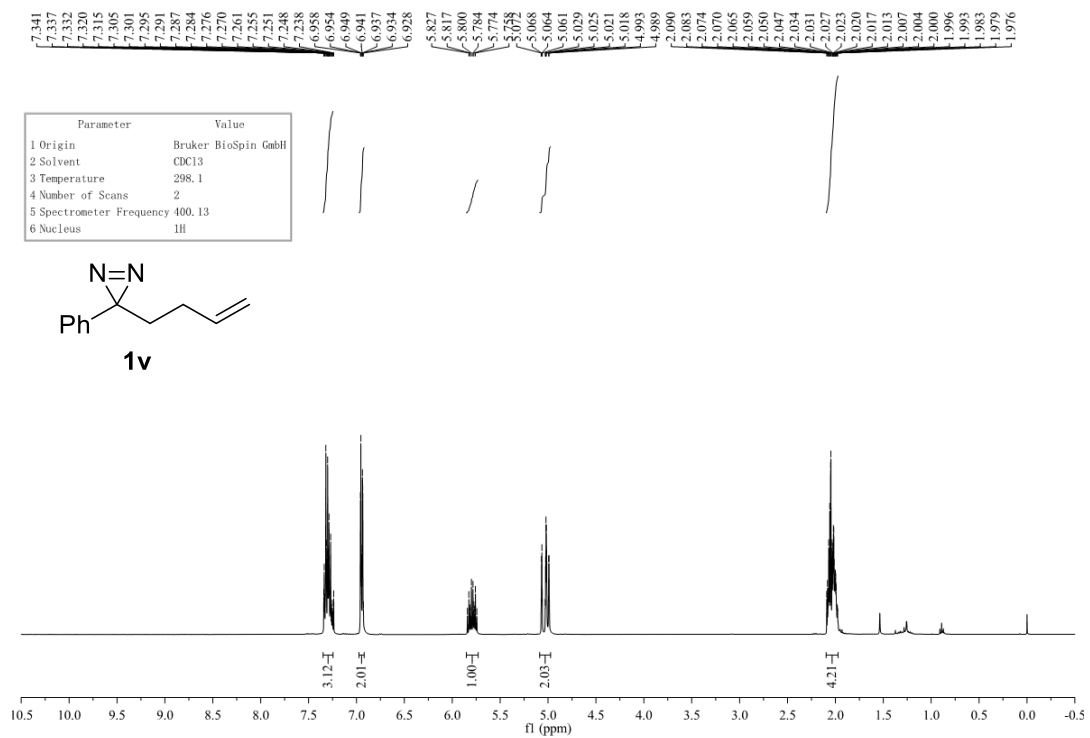
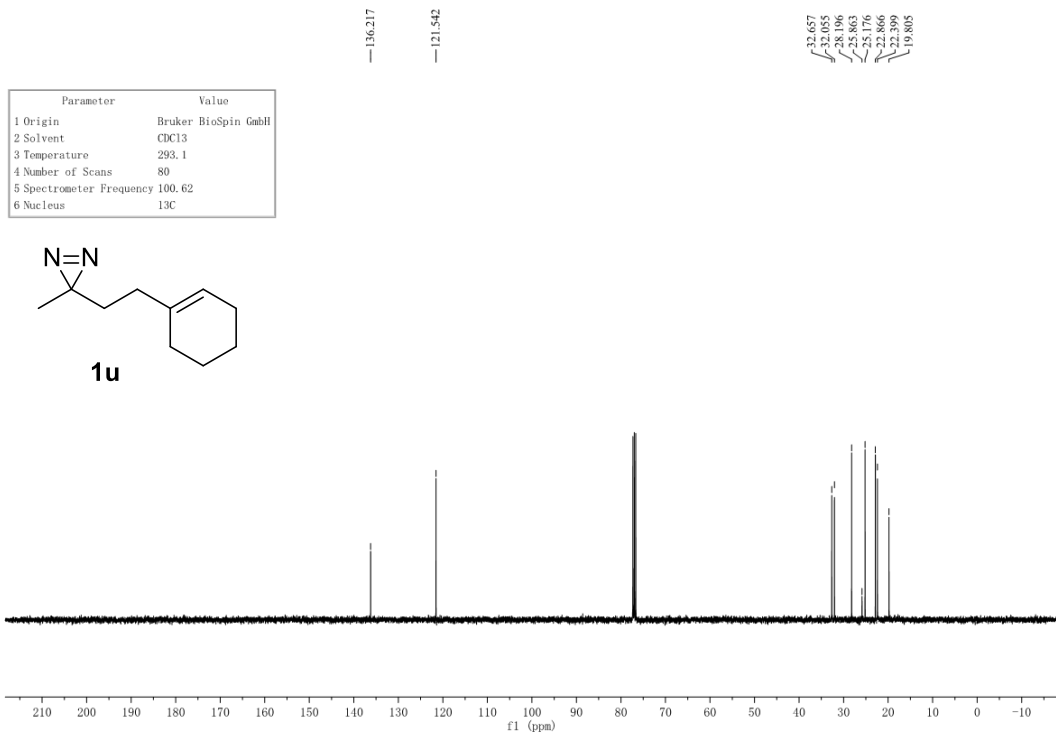
33.197
28.960
25.682
19.873



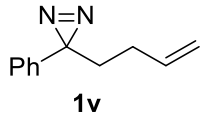
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	292.7
4 Number of Scans	16
5 Spectrometer Frequency	400.15
6 Nucleus	1H

5.392
5.389
5.386
1.971
1.966
1.961
1.957
1.839
1.817
1.794
1.773
1.622
1.598
1.594
1.580
1.569
1.563
1.558
1.555
1.551
1.540
1.536
1.526
1.521
1.513
1.444
1.430
1.423
1.419
0.992



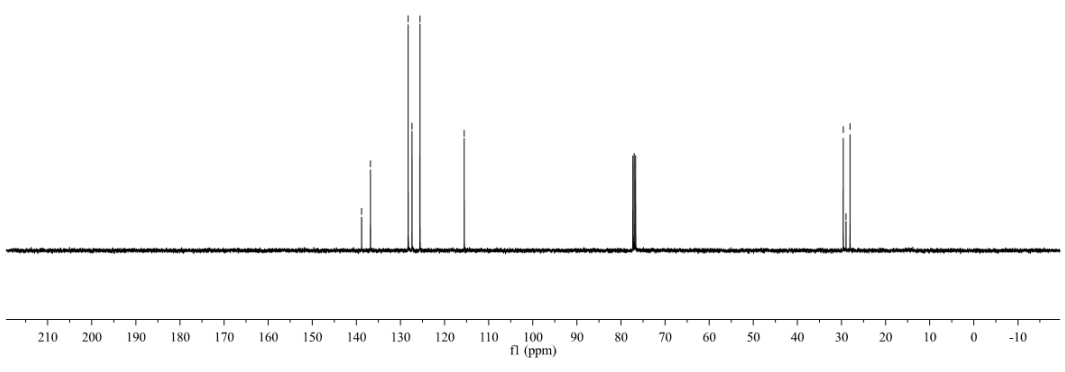


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	40
5 Spectrometer Frequency	100.62
6 Nucleus	13C

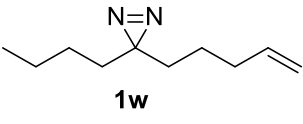


138.809
136.807
128.258
127.386
125.582
115.543

29.609
28.976
28.068

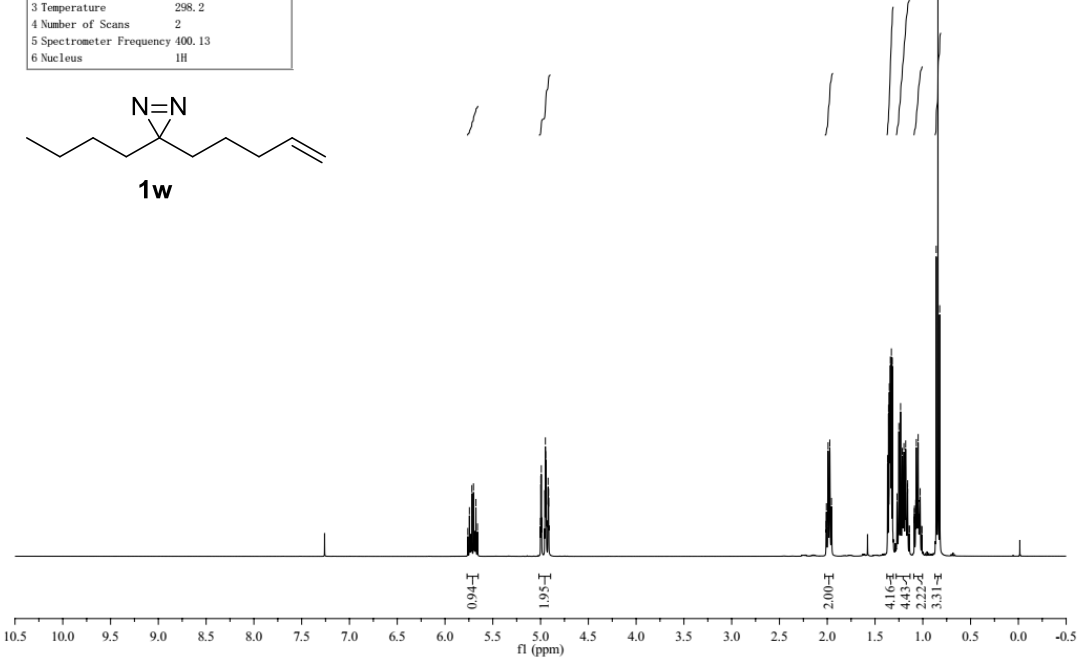


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H

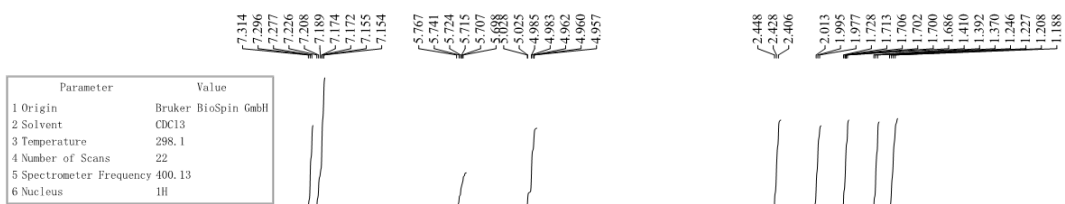
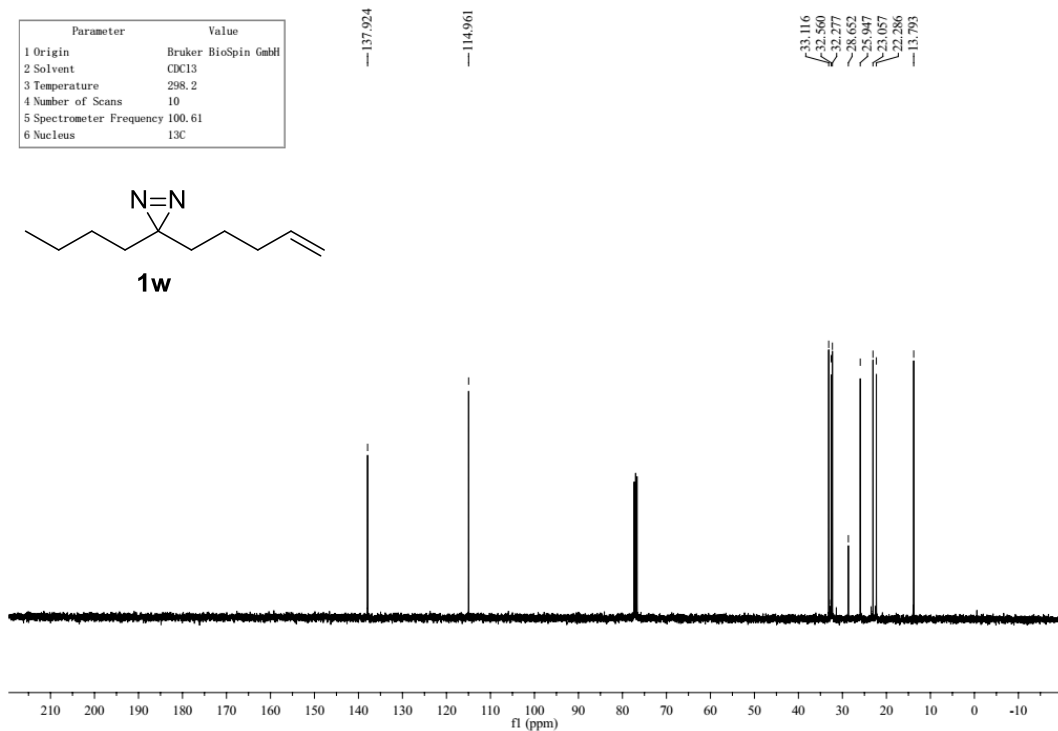
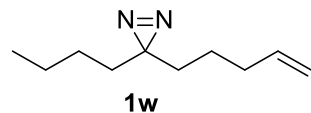


5.761
5.745
5.719
5.702
5.677
5.660
5.001
4.997
4.992
4.950
4.946
4.921
4.918
4.916

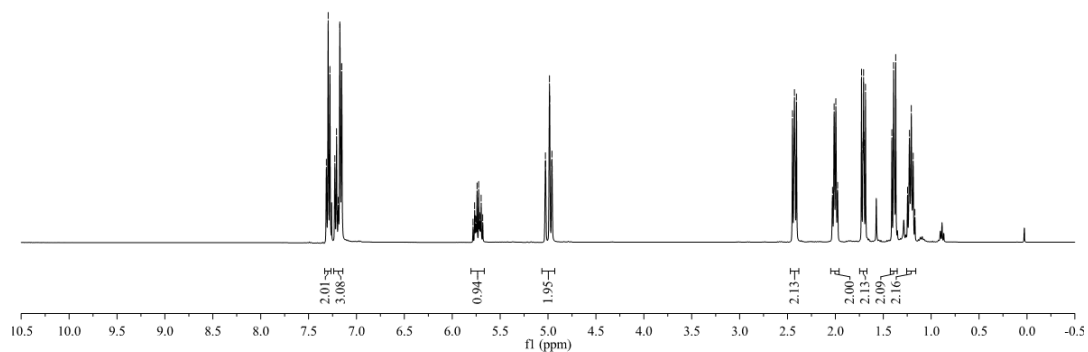
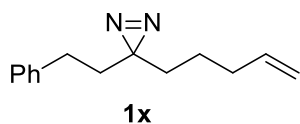
2.012
2.009
2.006
1.991
1.973
1.959
1.956
1.952
1.359
1.351
1.340
1.329
1.319
1.251
1.232
1.179
1.068
1.049
0.880
0.842
0.823



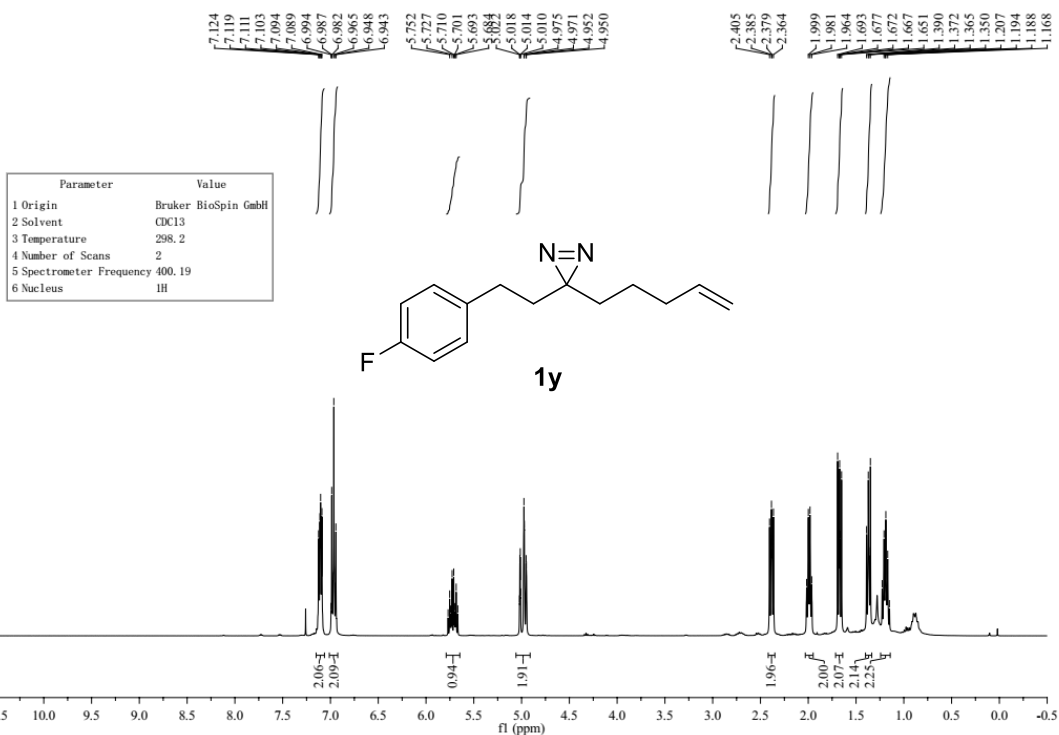
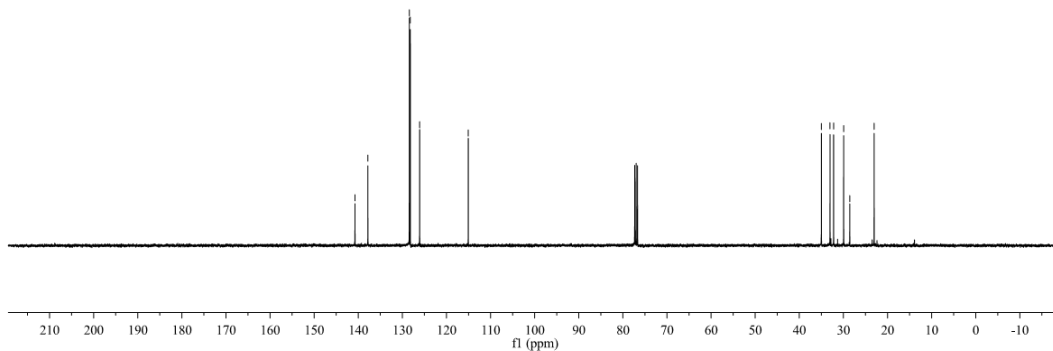
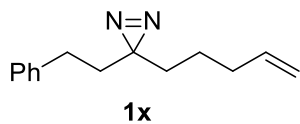
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	10
5 Spectrometer Frequency	100.61
6 Nucleus	13C

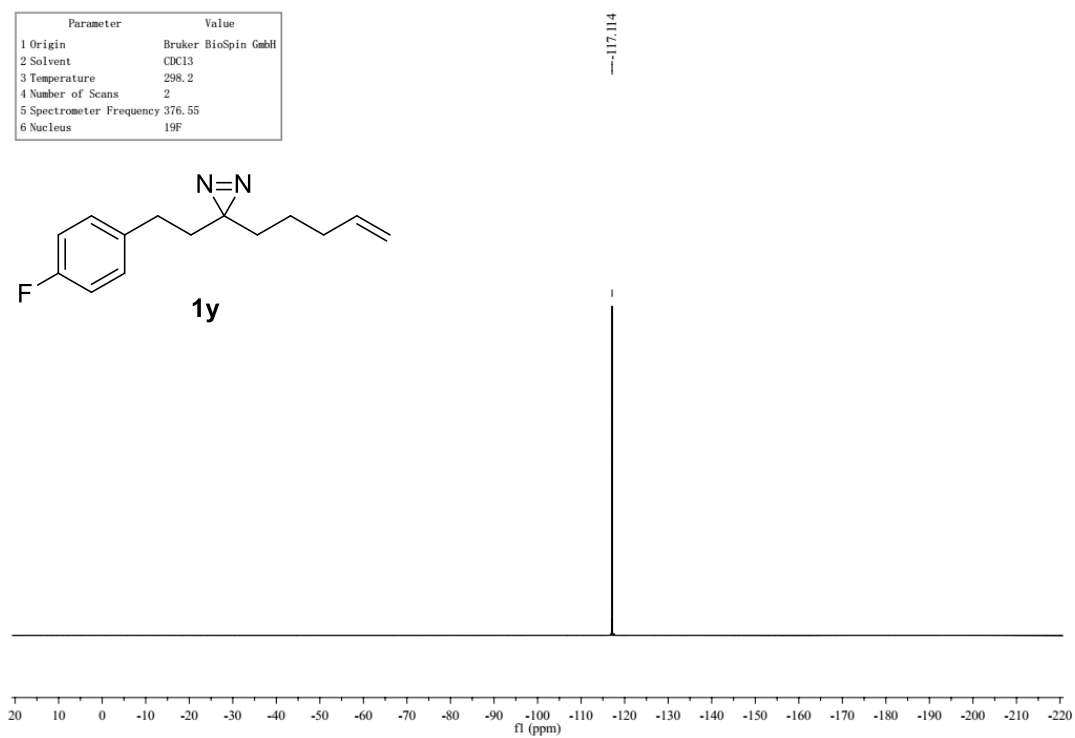
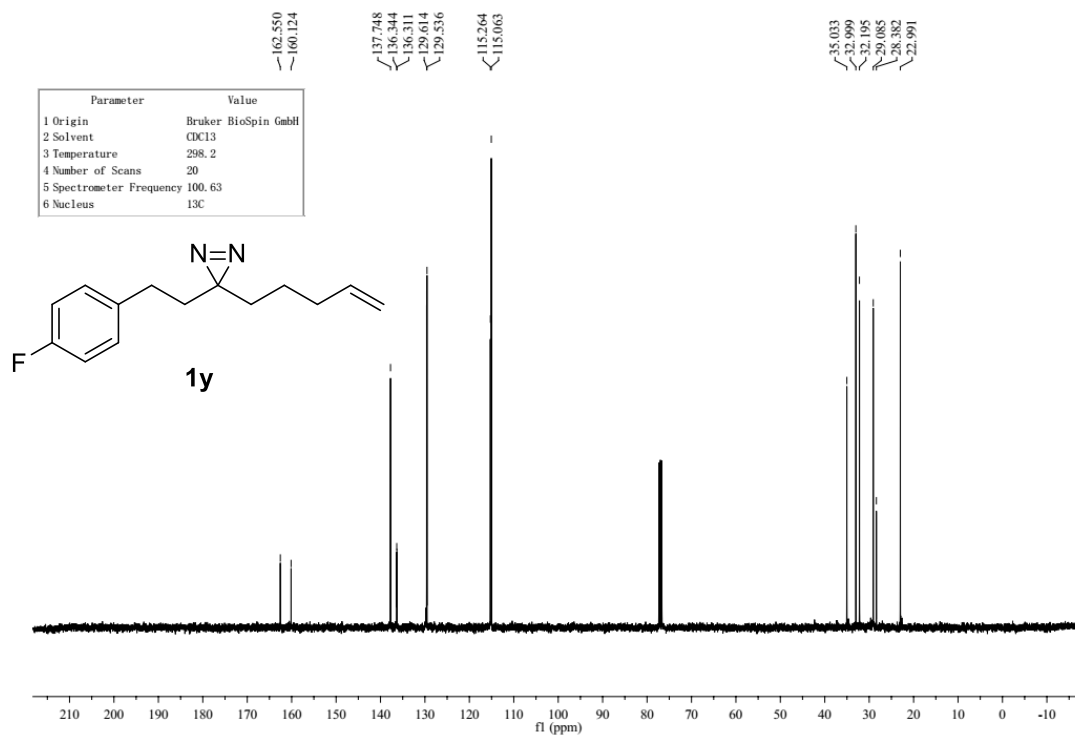


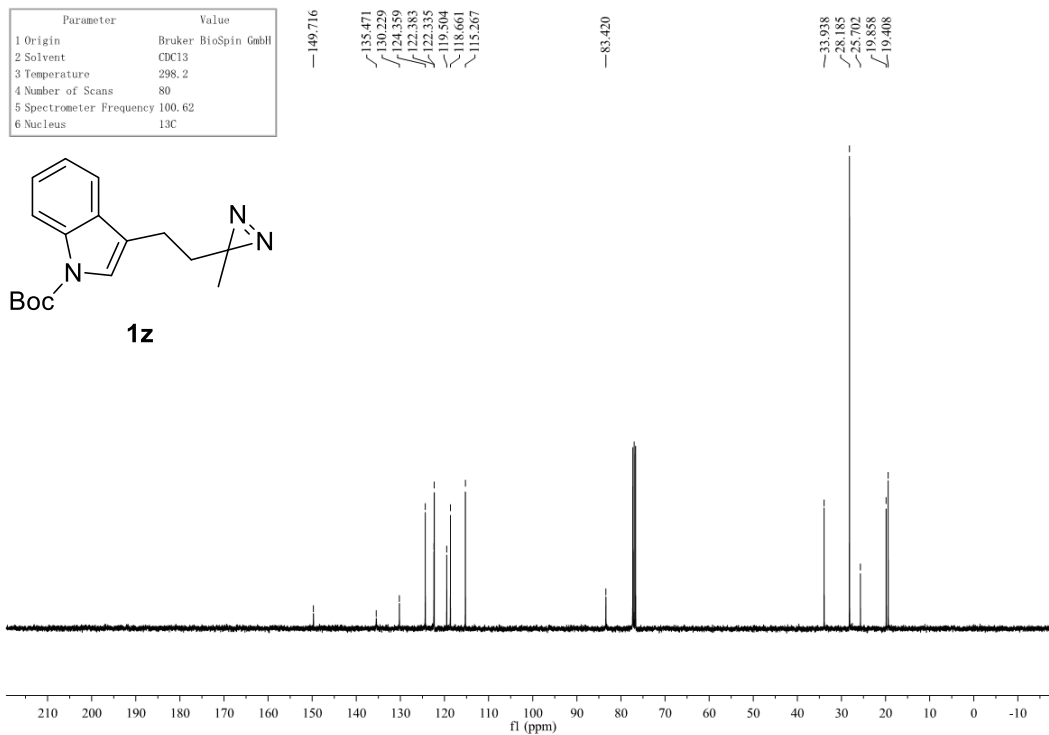
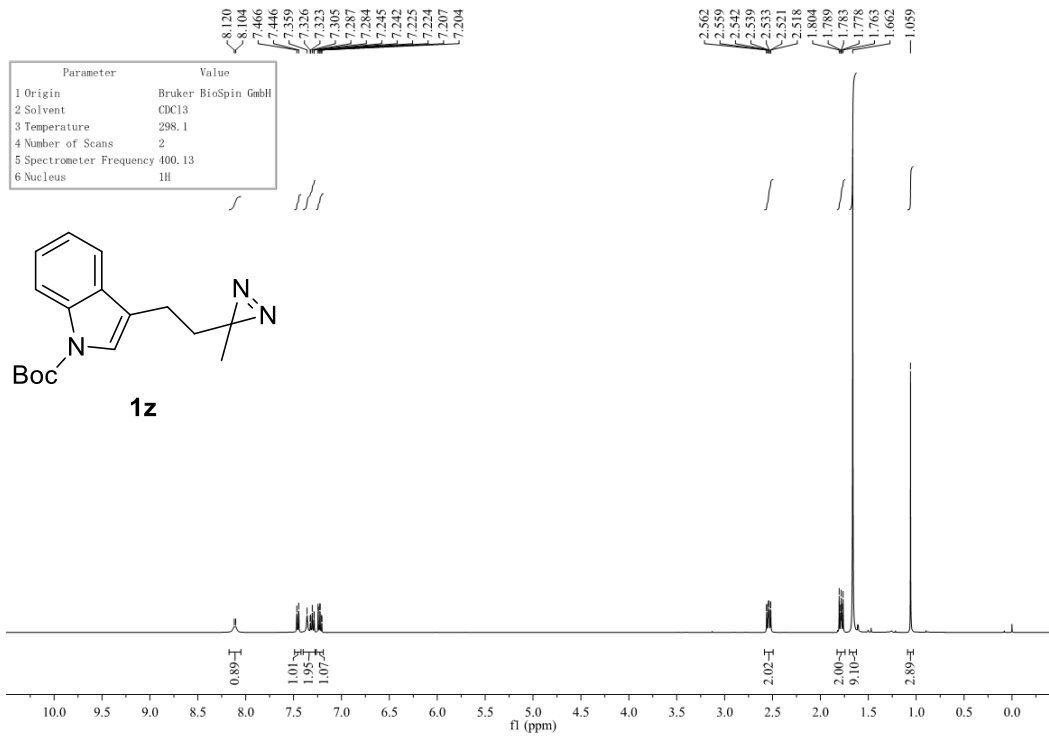
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	22
5 Spectrometer Frequency	400.13
6 Nucleus	1H

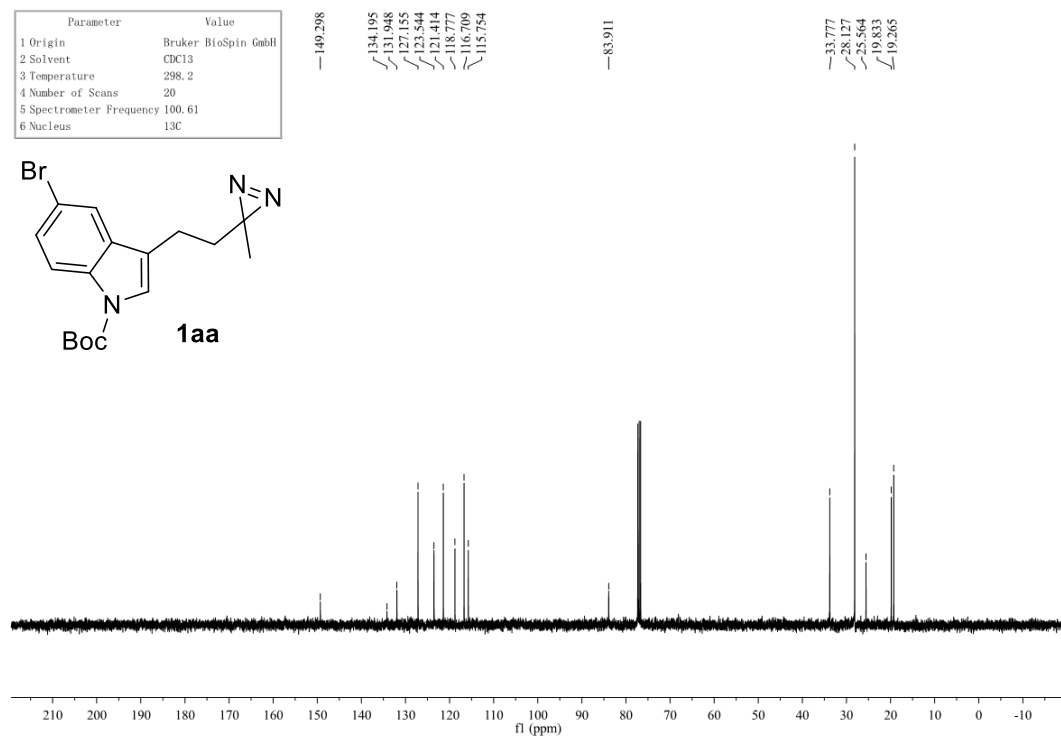
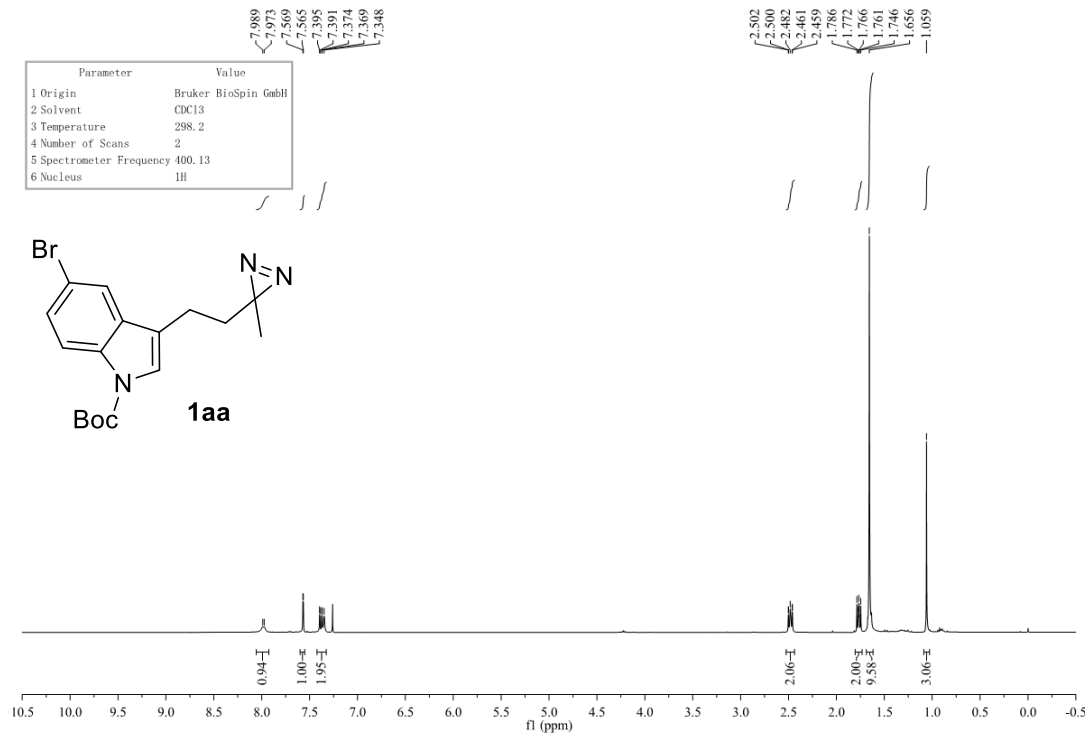


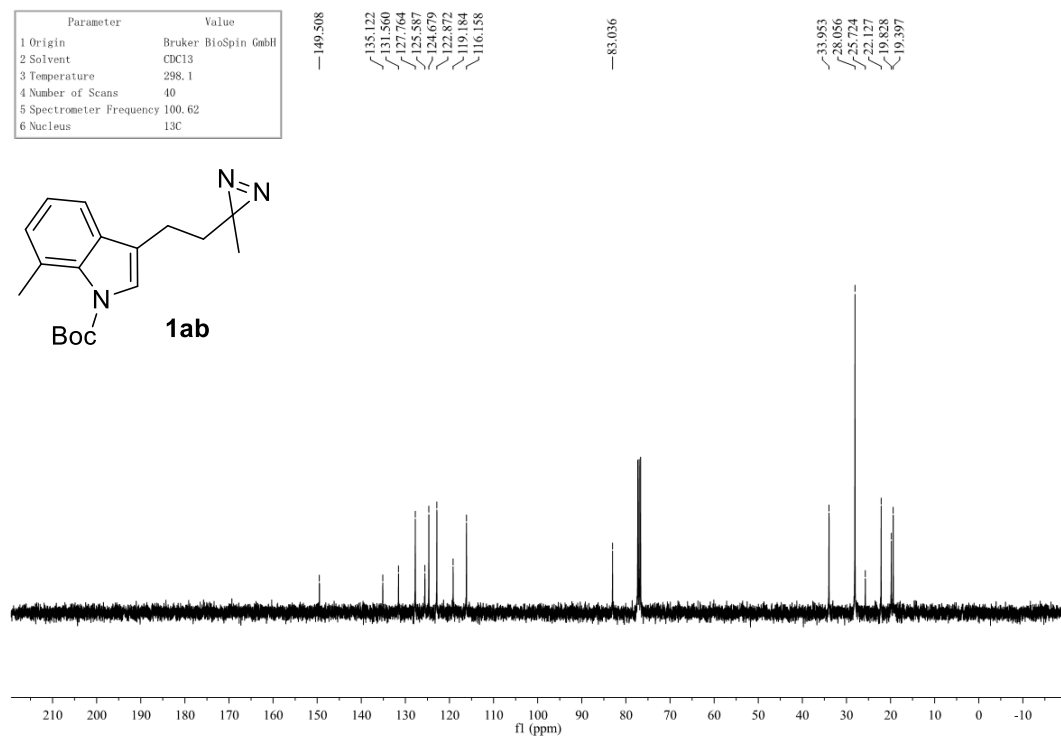
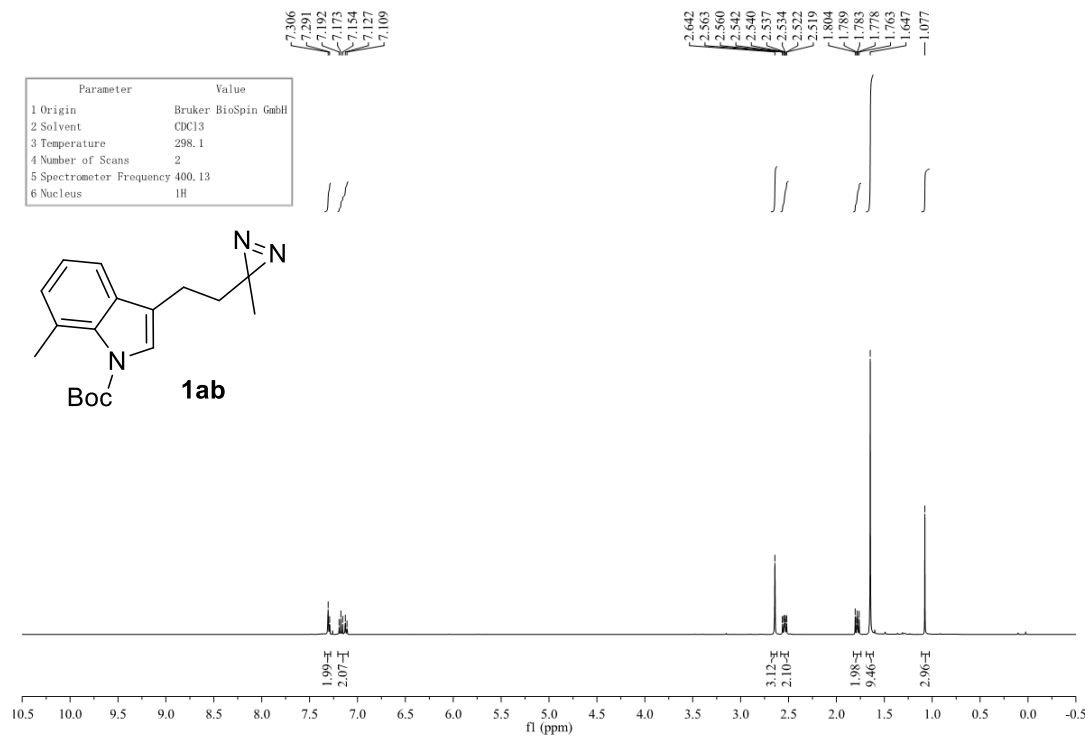
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C

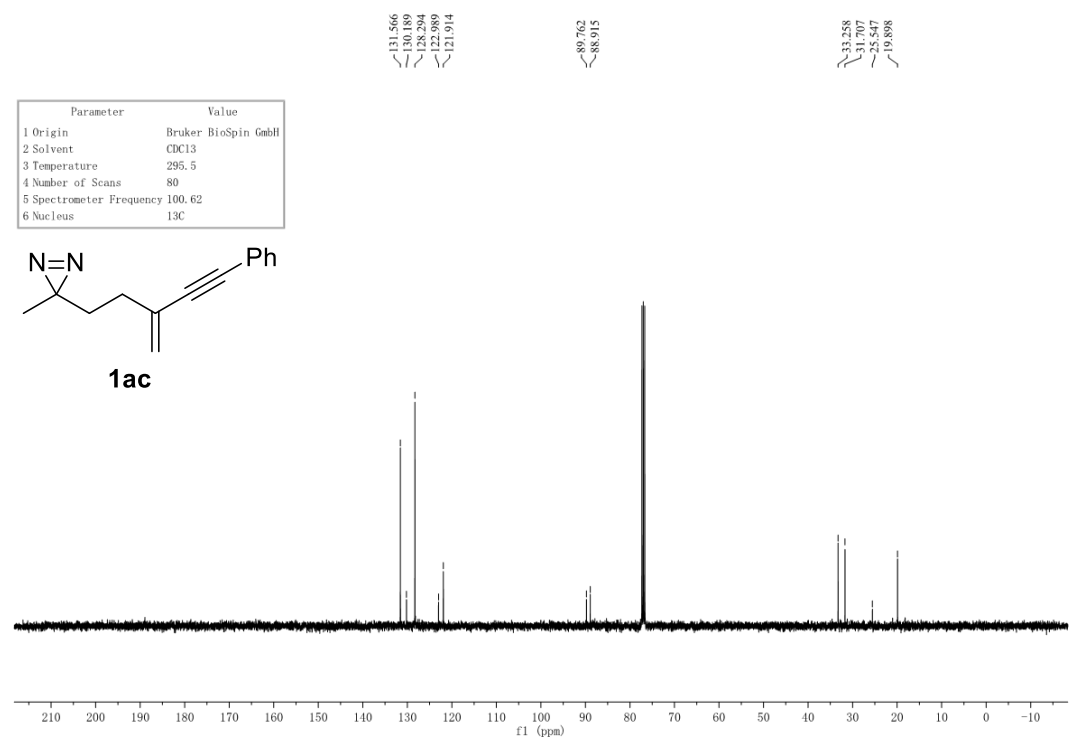
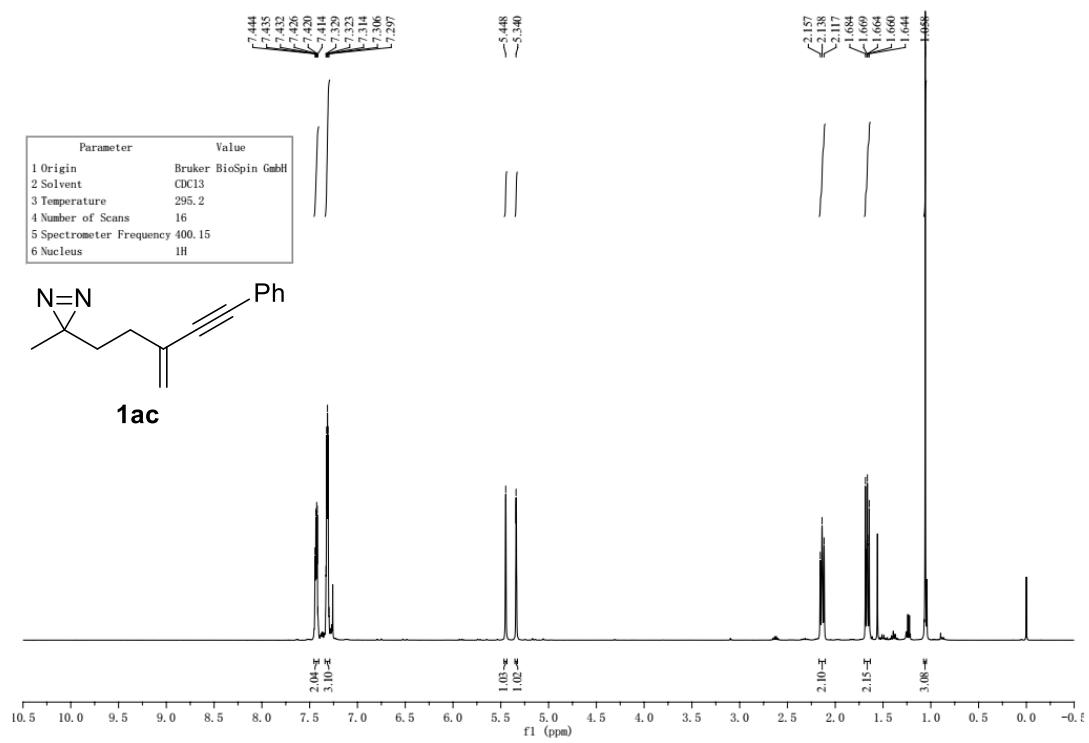




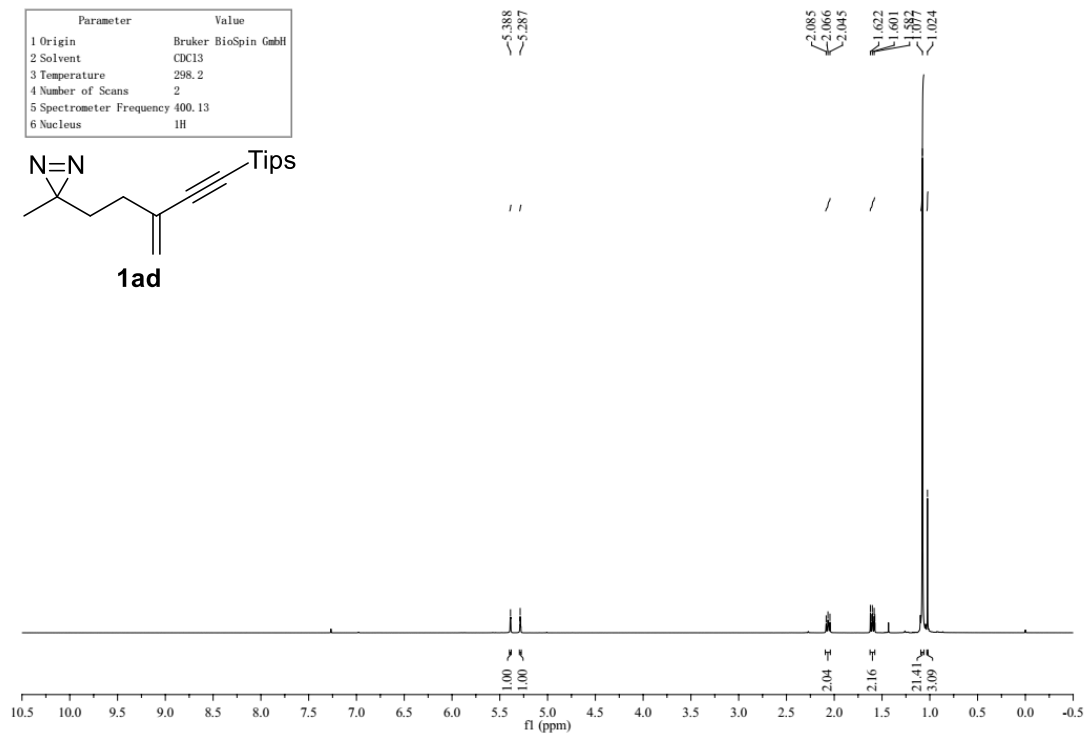
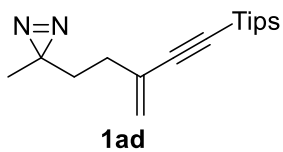




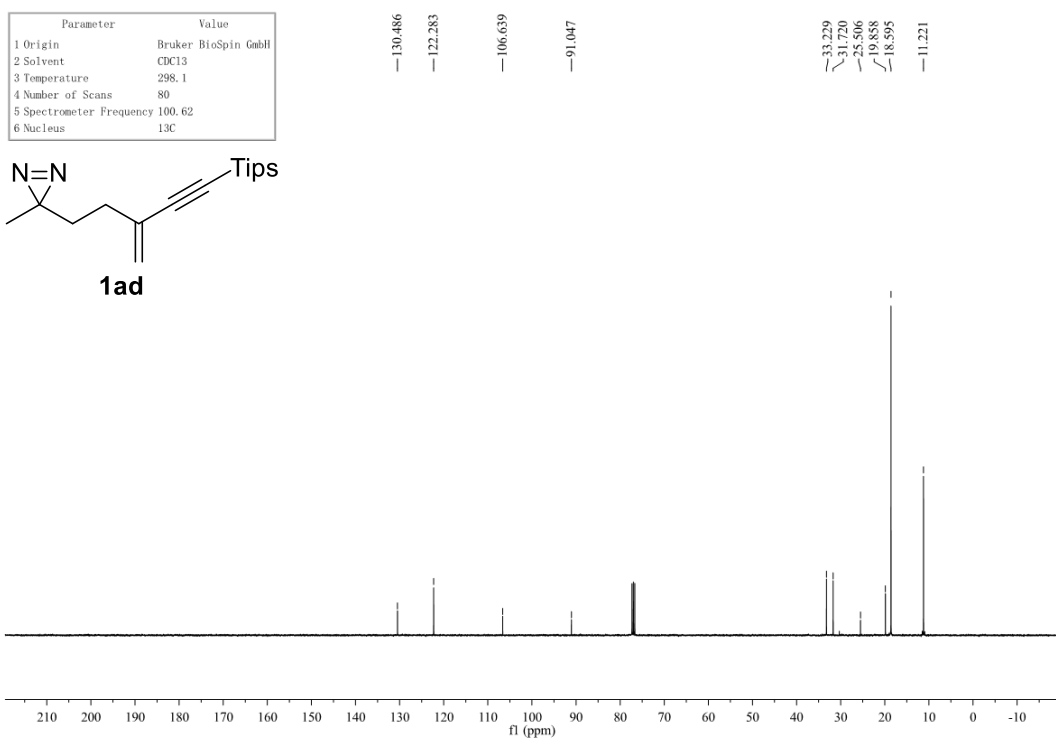
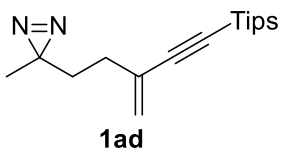


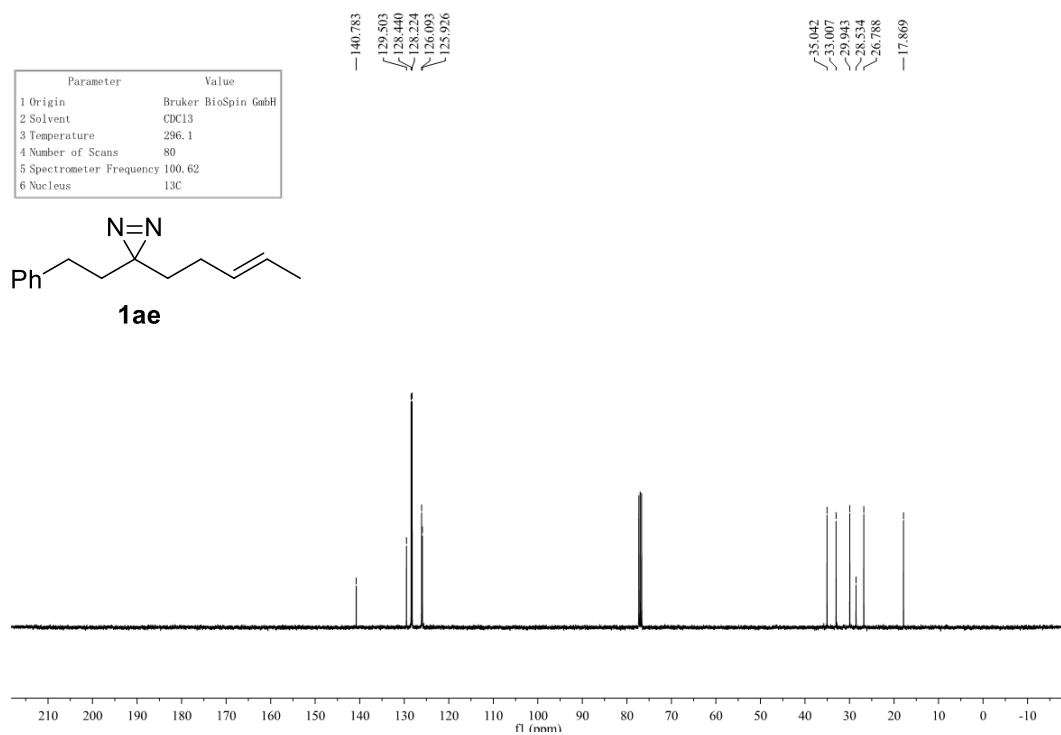
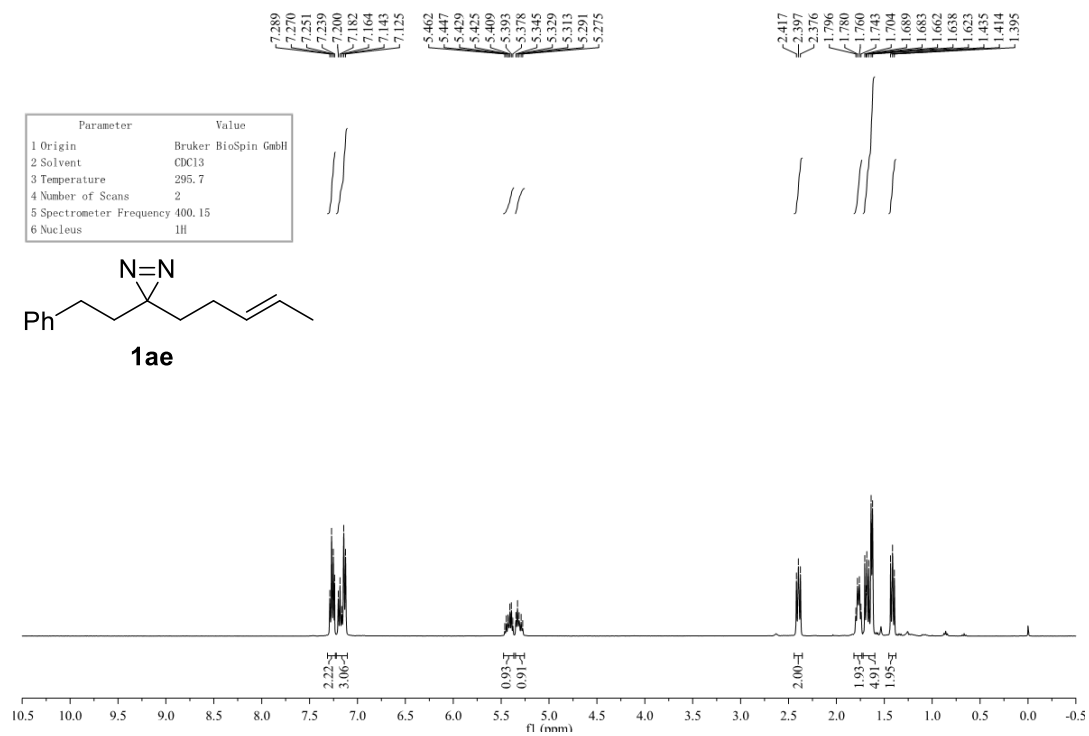


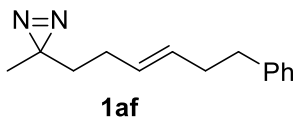
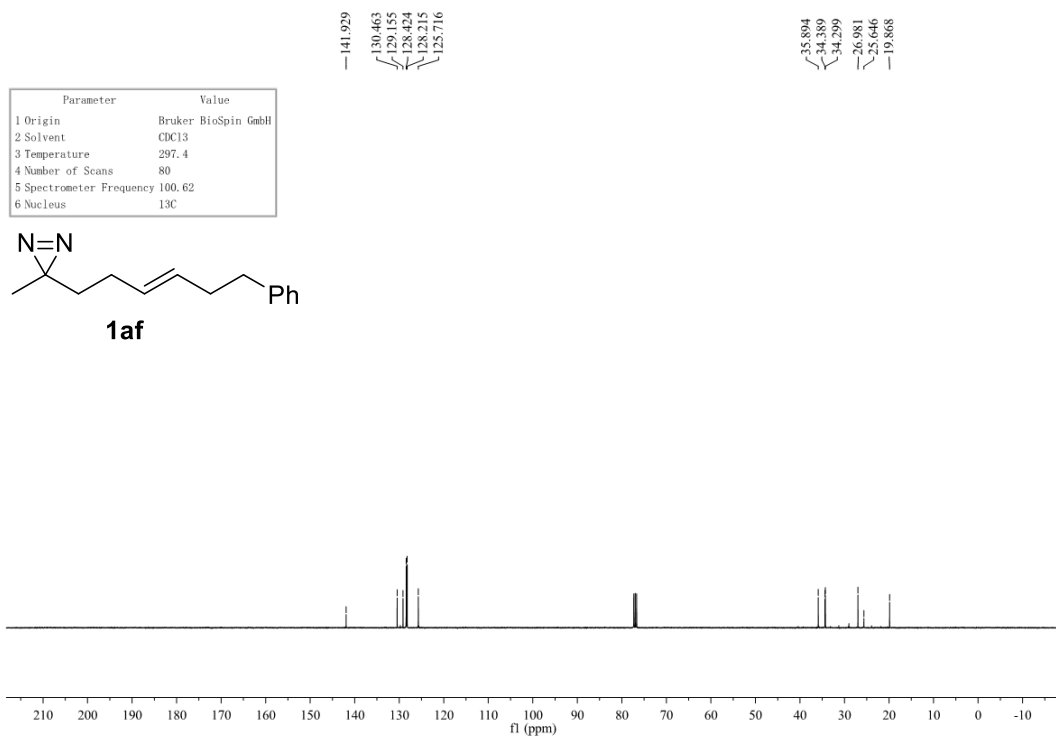
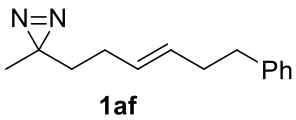
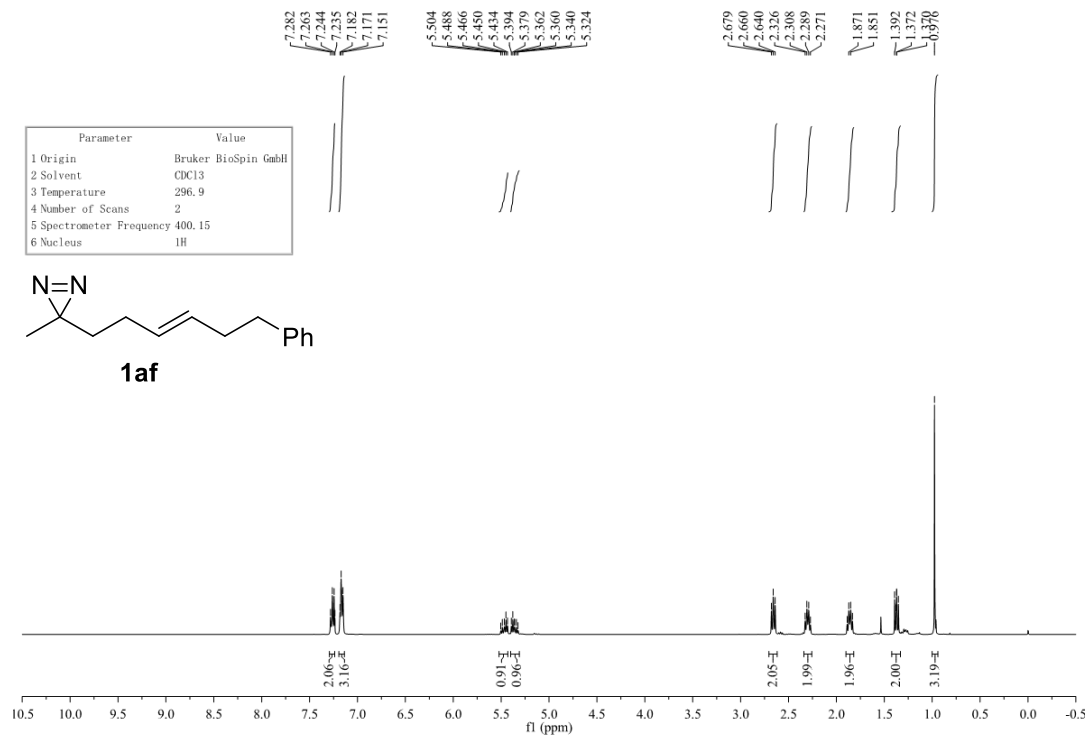
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H

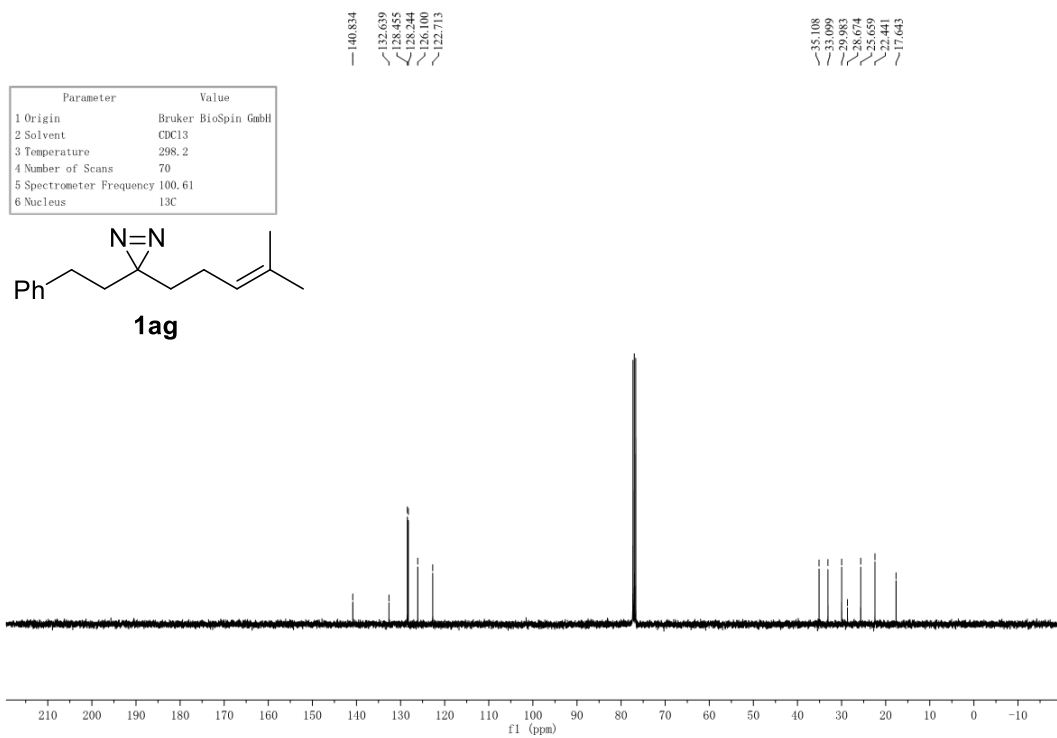
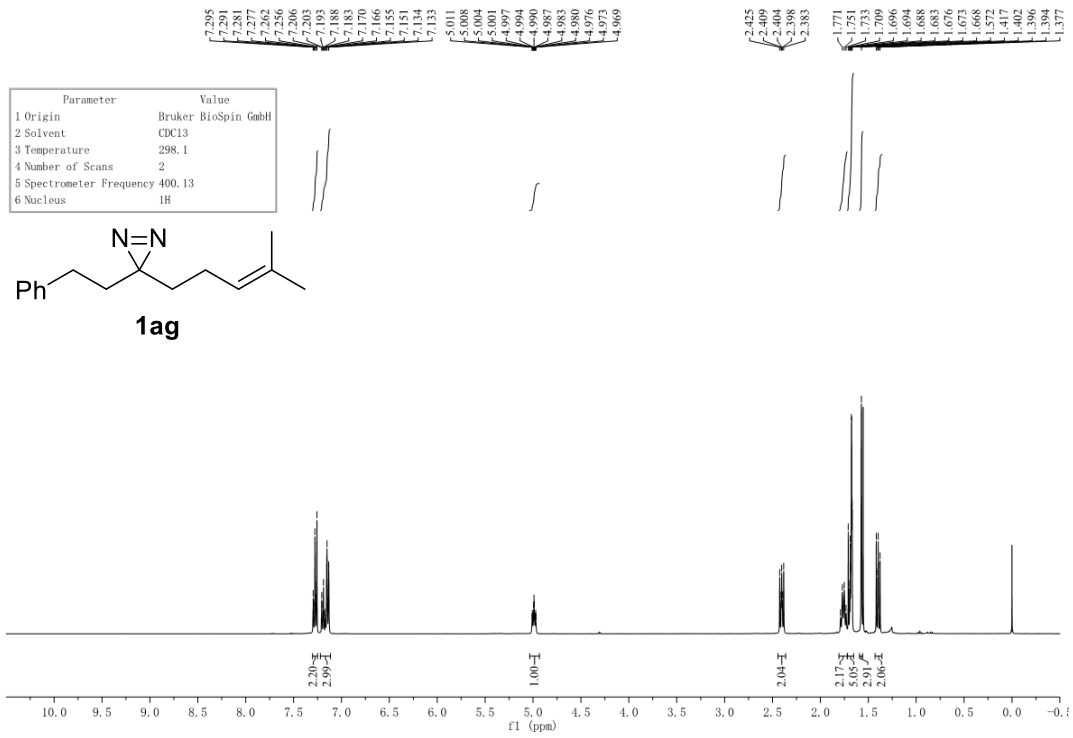


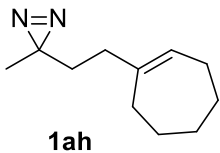
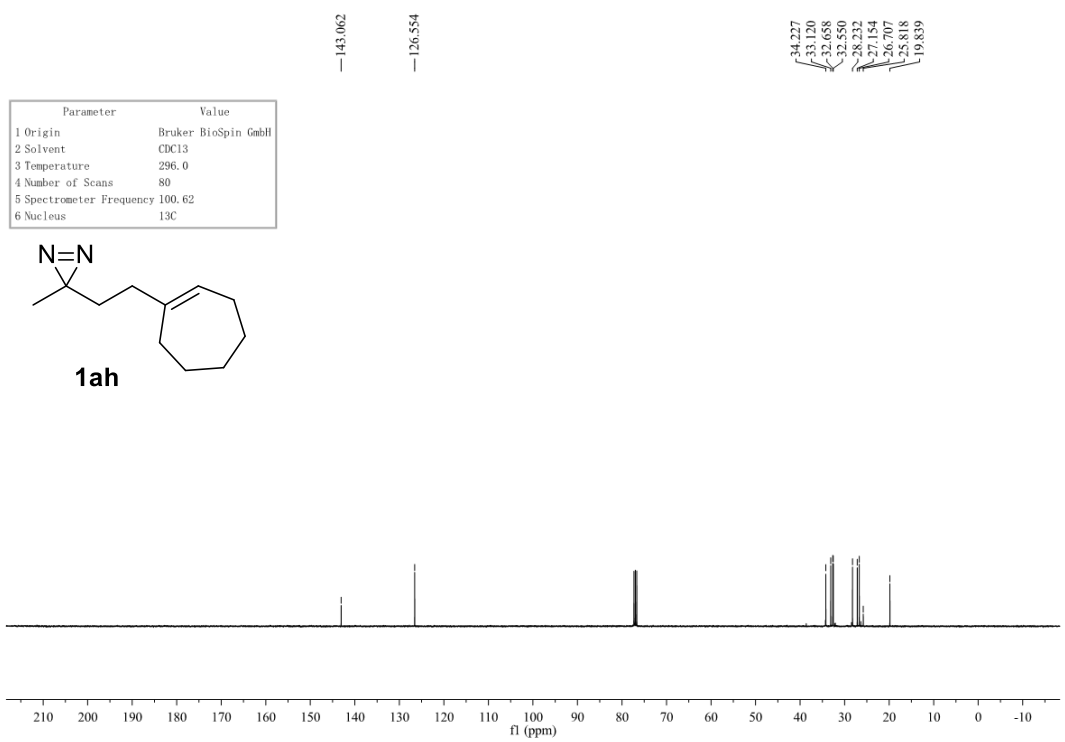
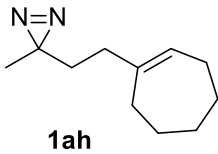
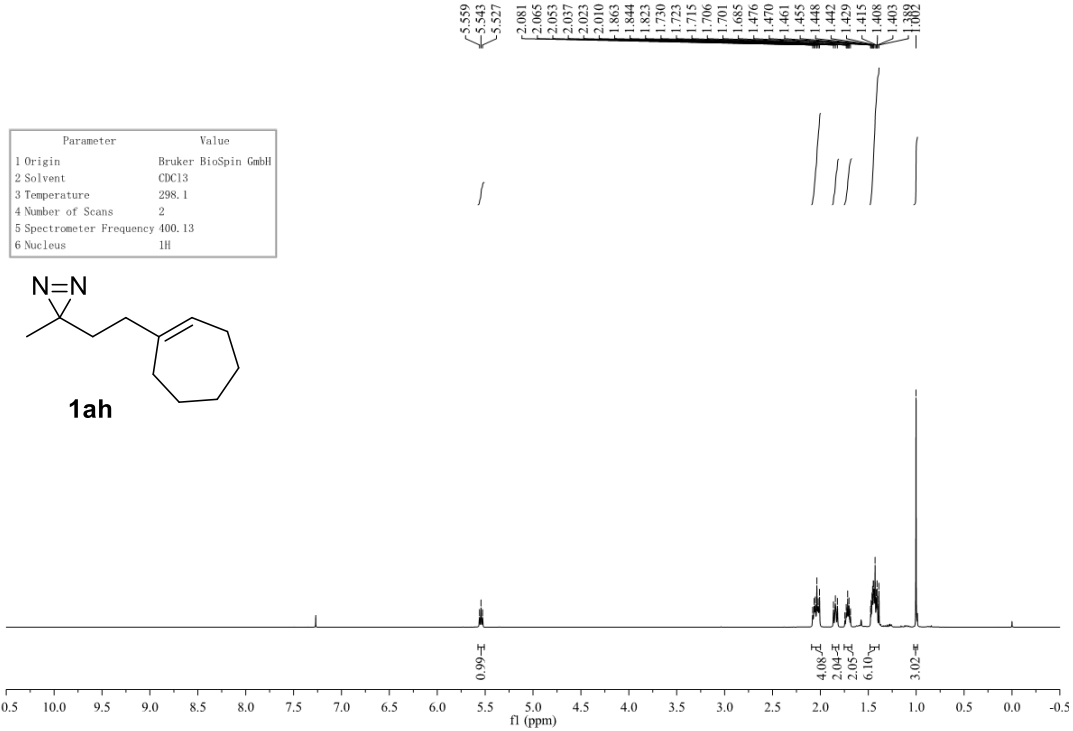
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C

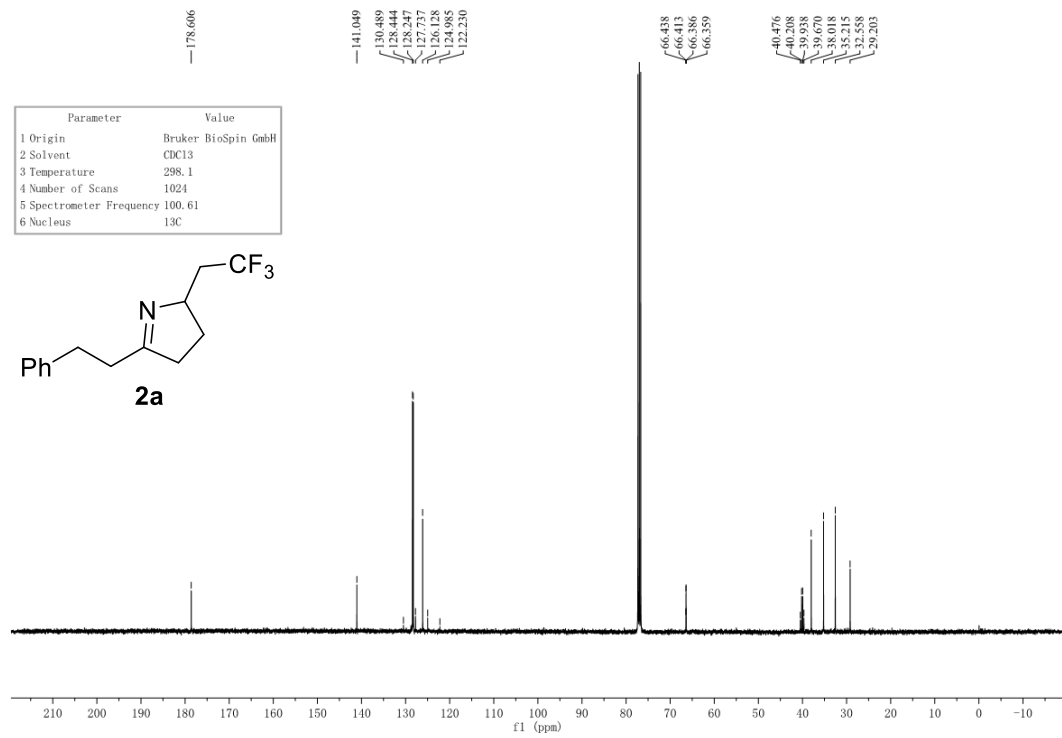
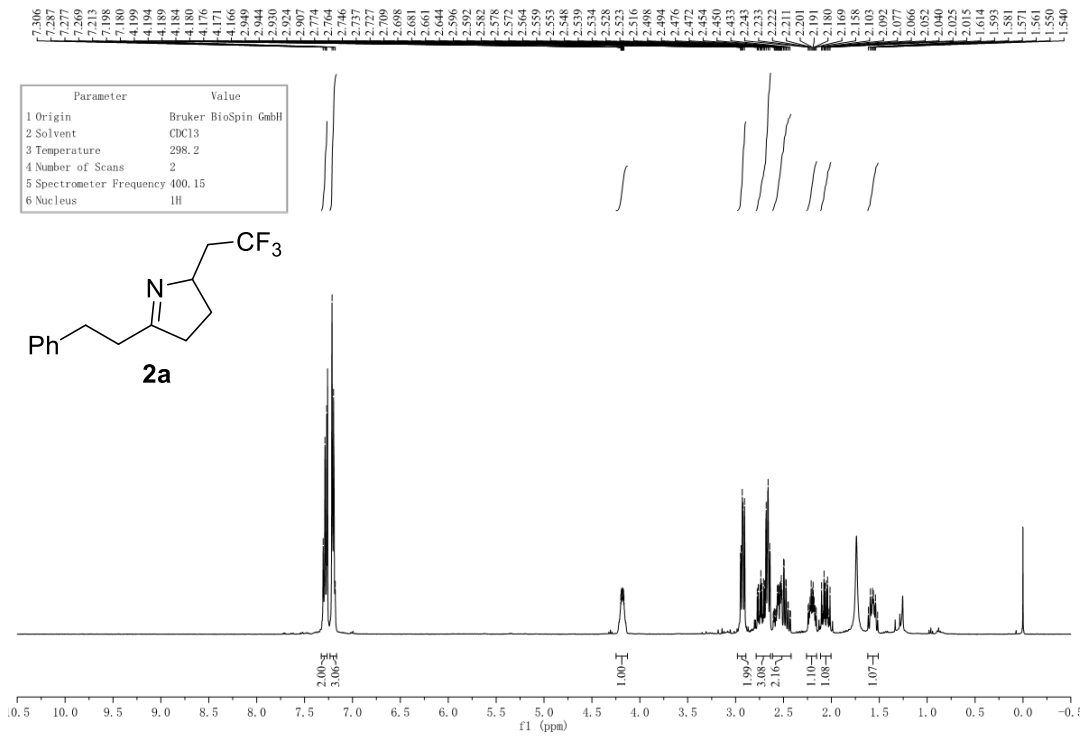




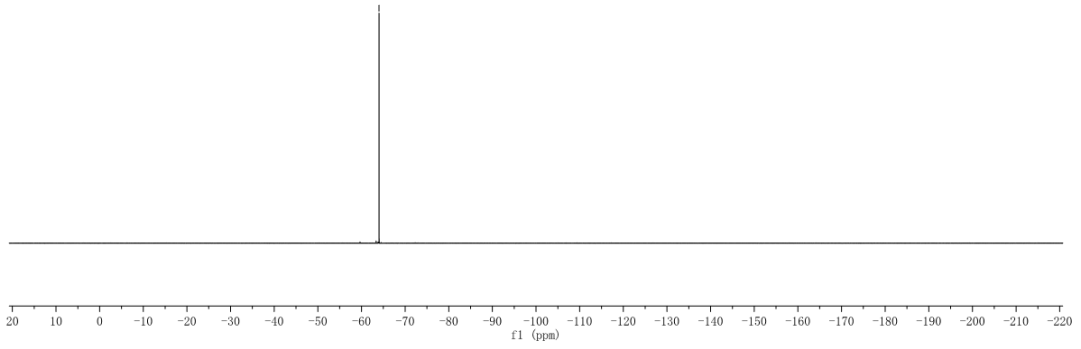
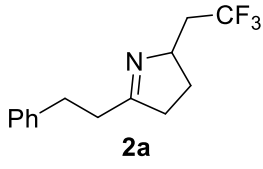






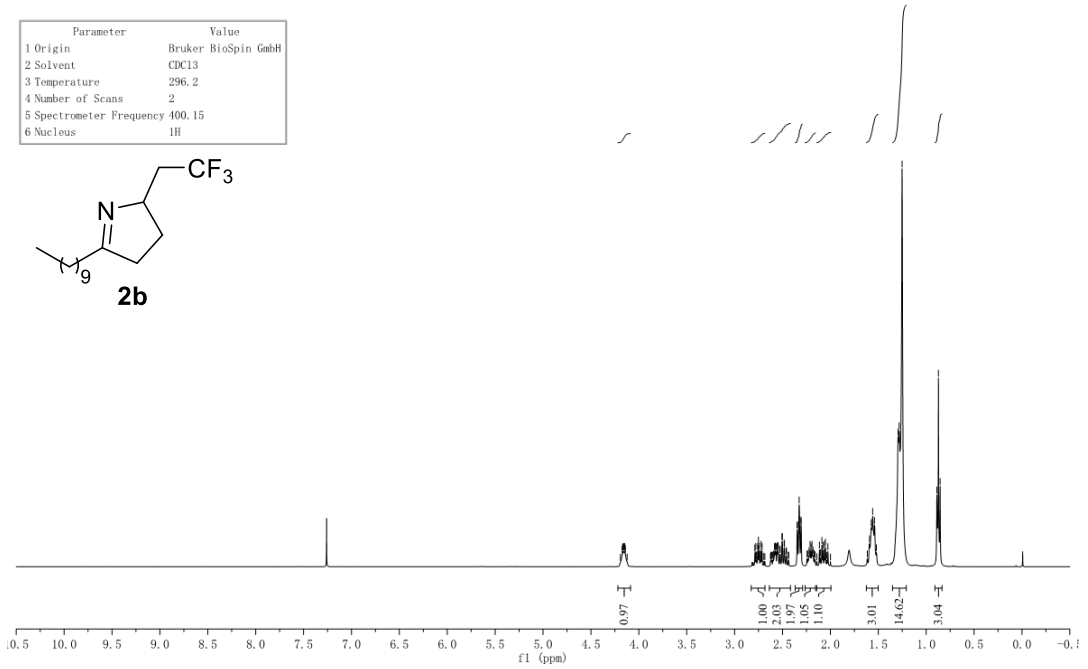
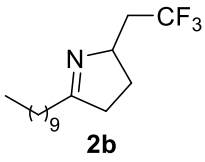


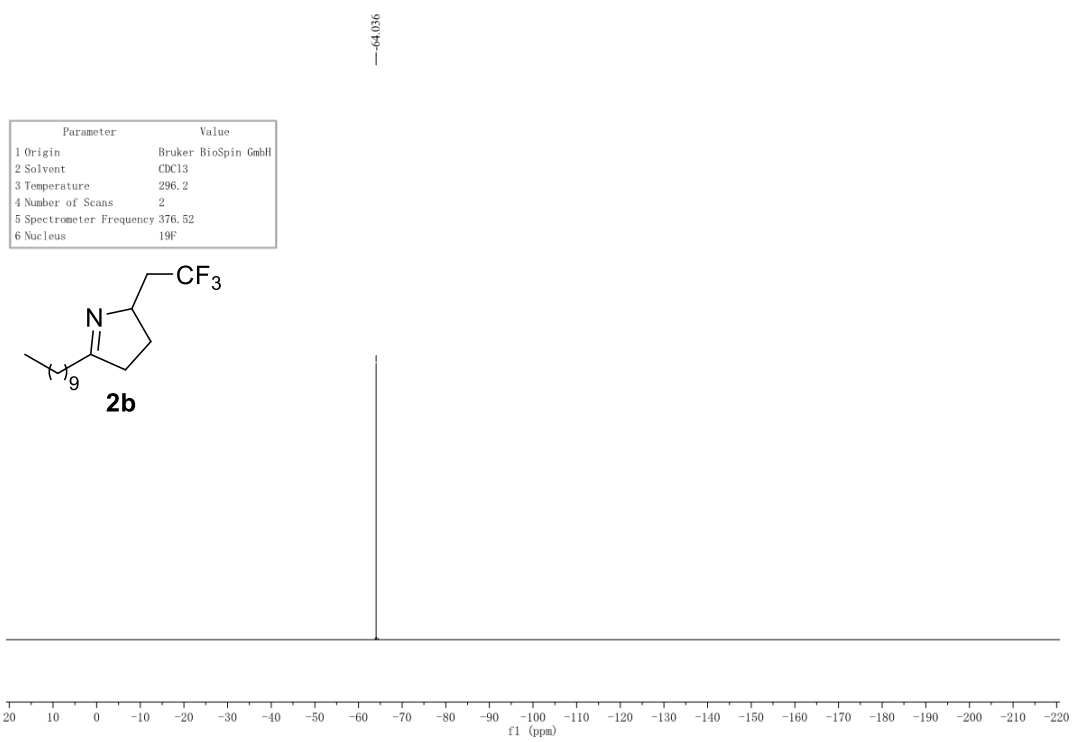
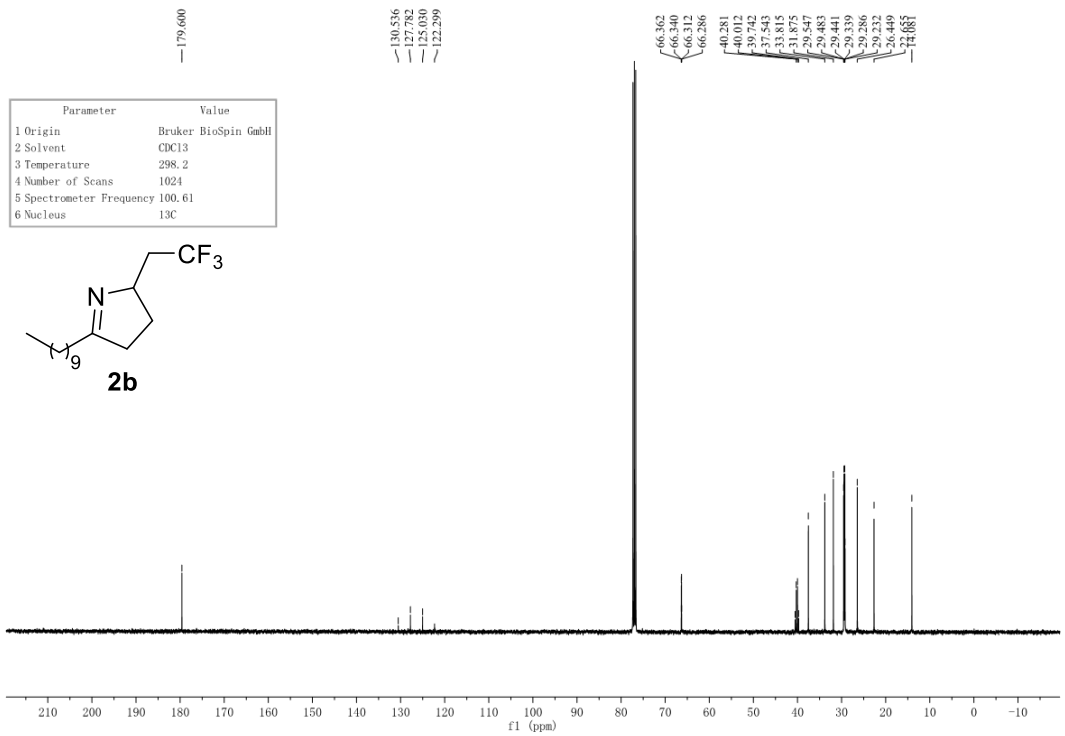
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

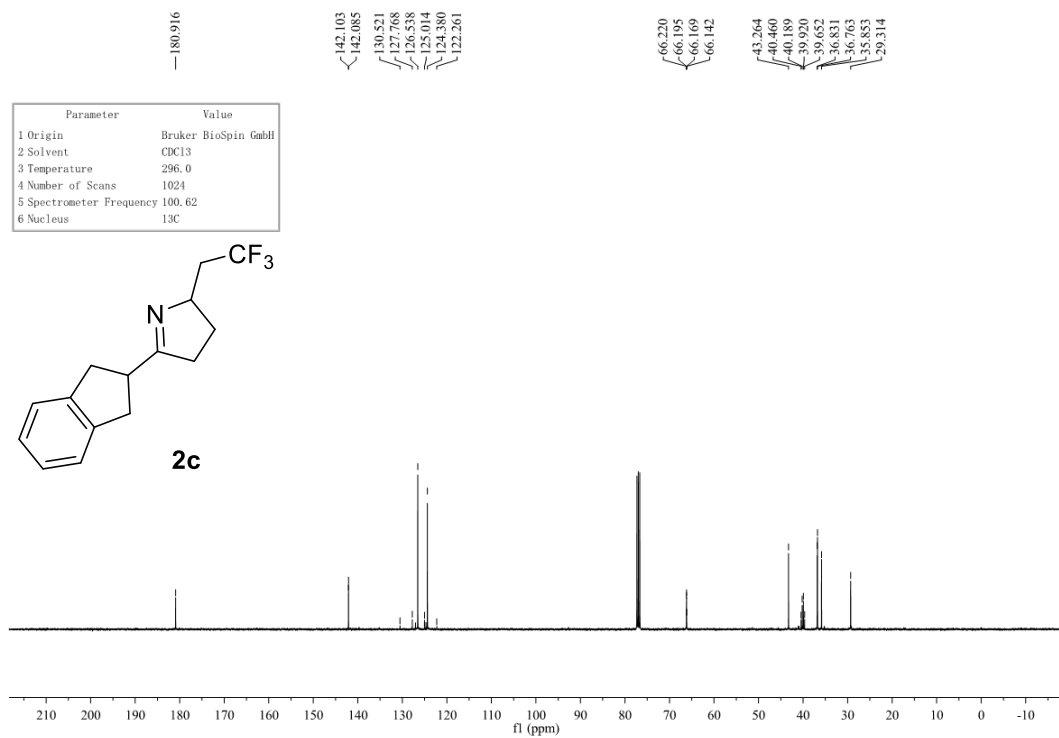
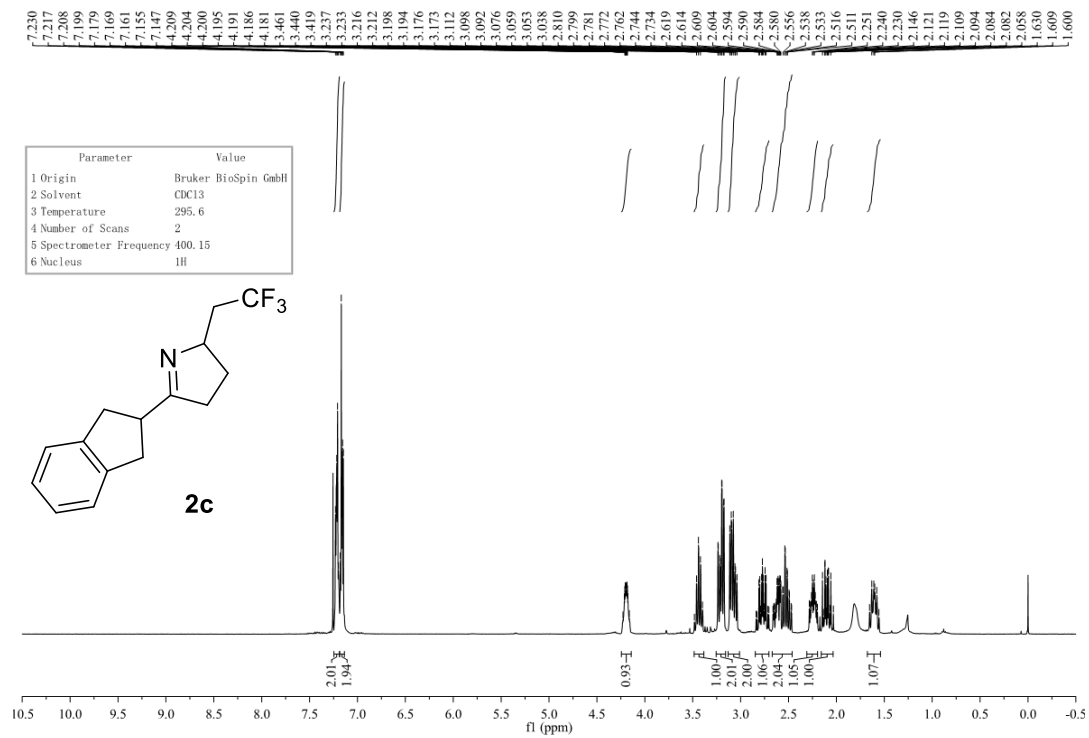


4.174
4.169
4.164
4.159
4.155
4.150
4.145
4.141
3.766
2.779
2.770
2.760
2.752
2.742
2.731
2.723
2.715
2.622
2.616
2.612
2.601
2.597
2.591
2.583
2.575
2.573
2.568
2.558
2.554
2.548
2.544
2.528
2.516
2.505
2.501
2.483
2.479
2.462
2.458
2.440
2.434
2.427
2.344
2.326
2.308
2.305
2.244
2.234
2.224
2.212
2.202
2.192
2.182
2.170
2.160
2.114
2.104
2.088
2.078
2.063
2.052
2.036
2.026
1.914
1.894
1.573
1.559
1.539
1.520
1.293
1.282
1.186
1.182
0.872
0.854

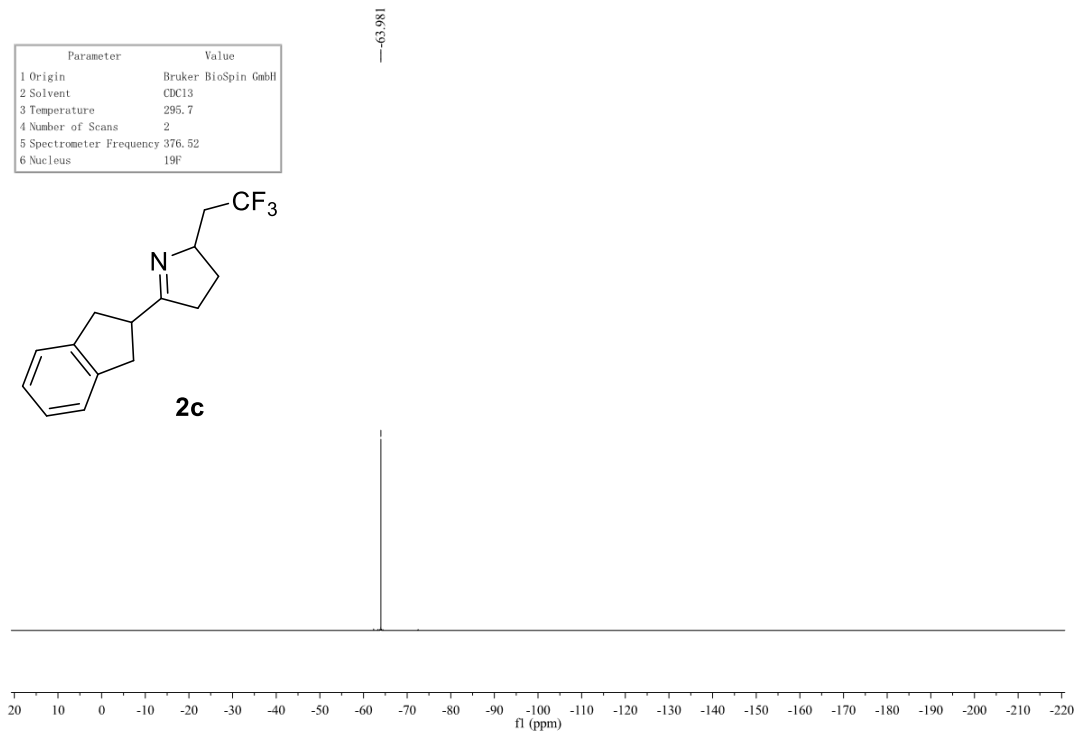
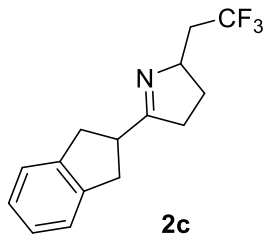
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.2
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H



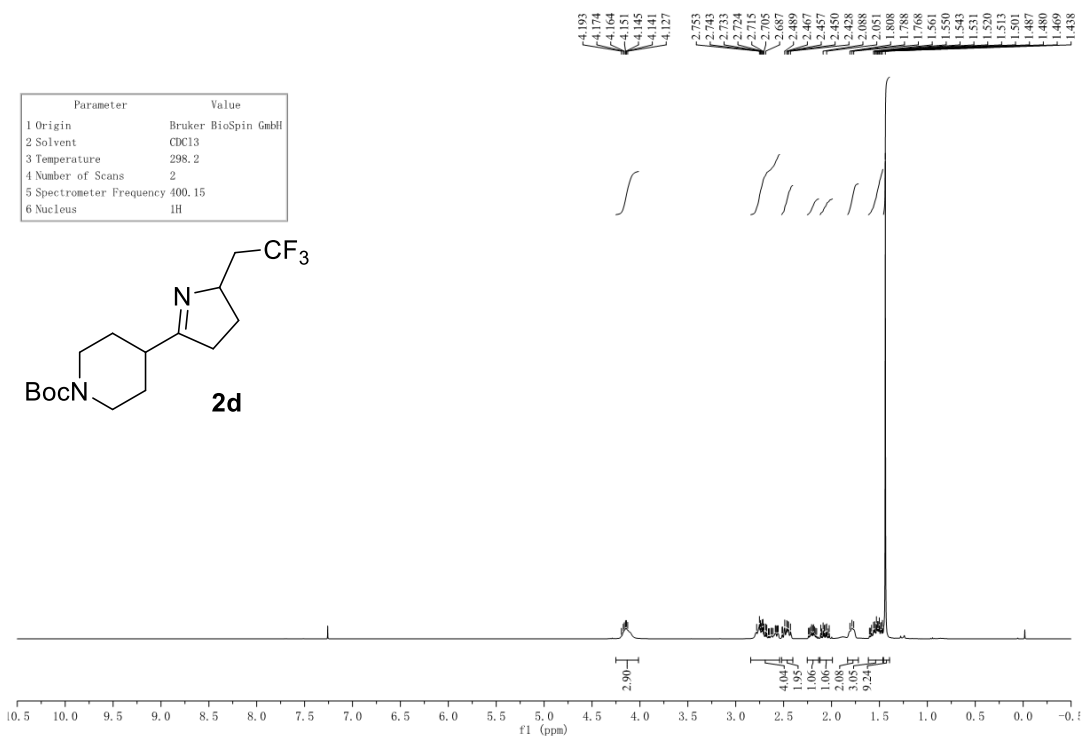
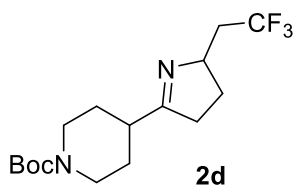


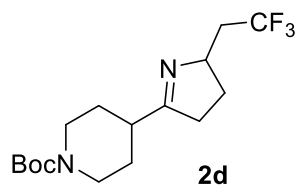
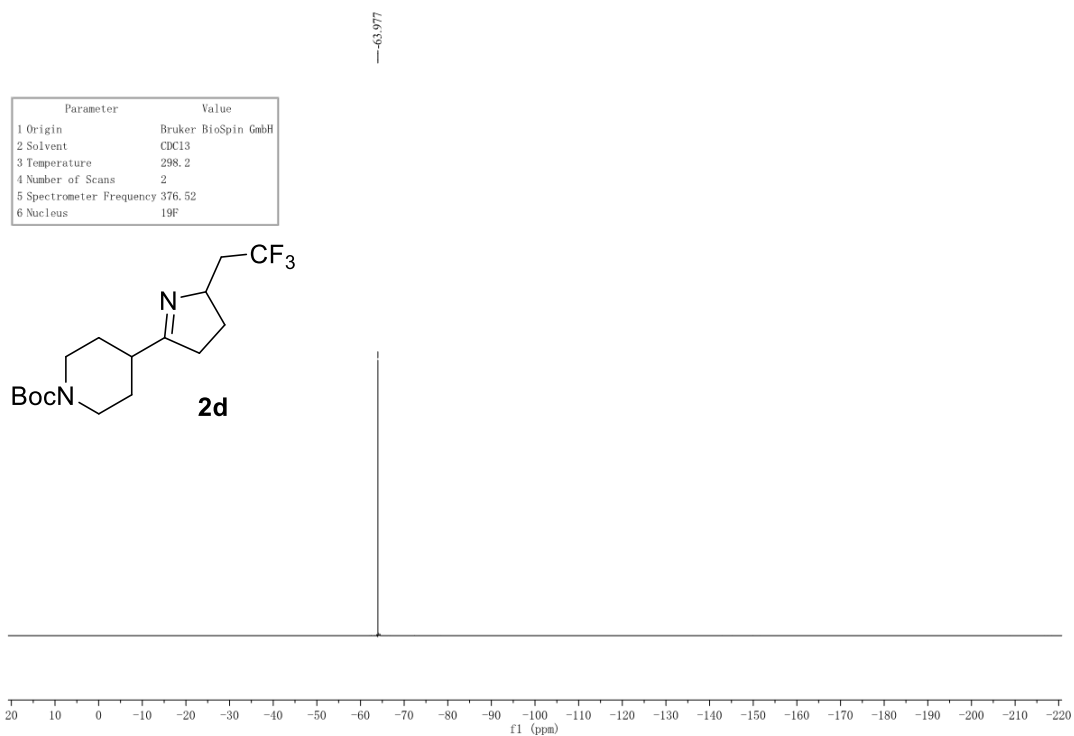
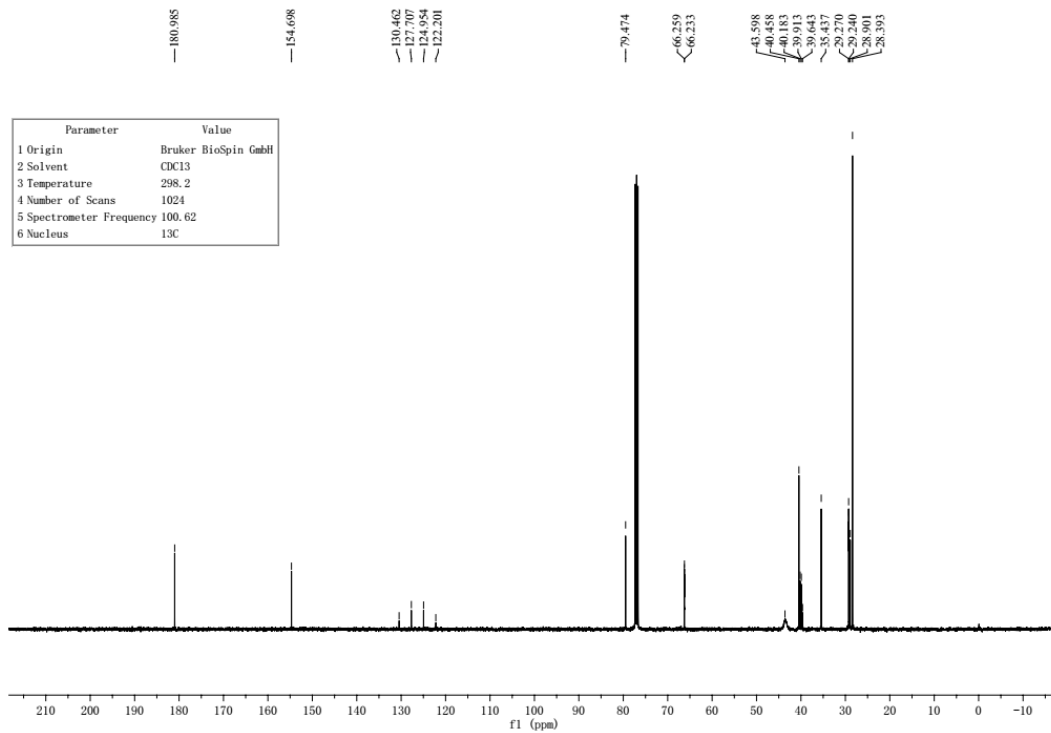


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.7
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

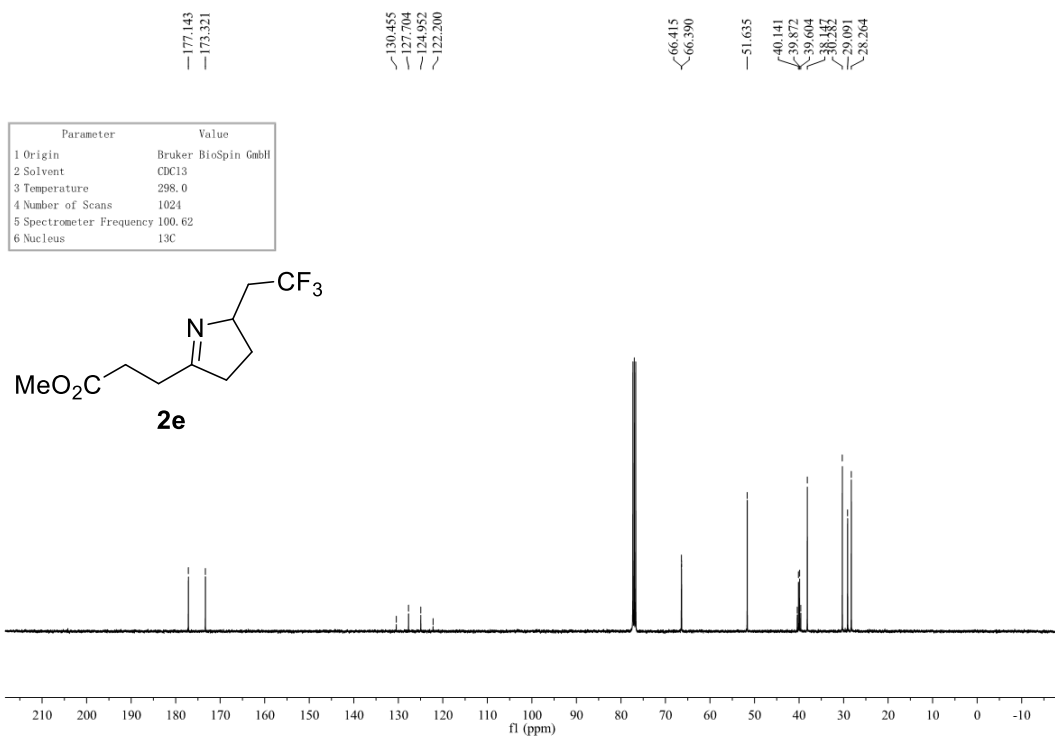
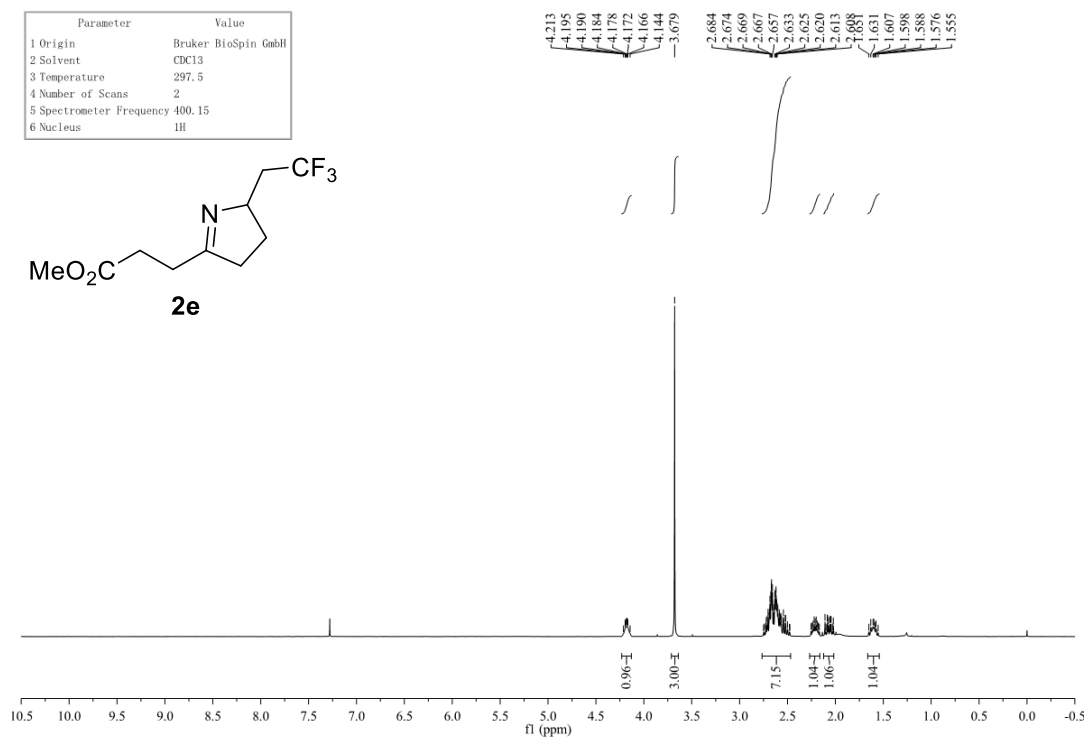
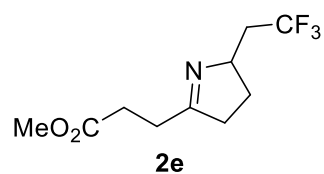


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

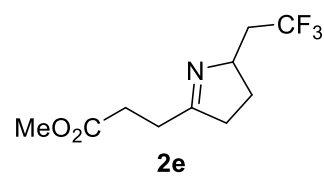




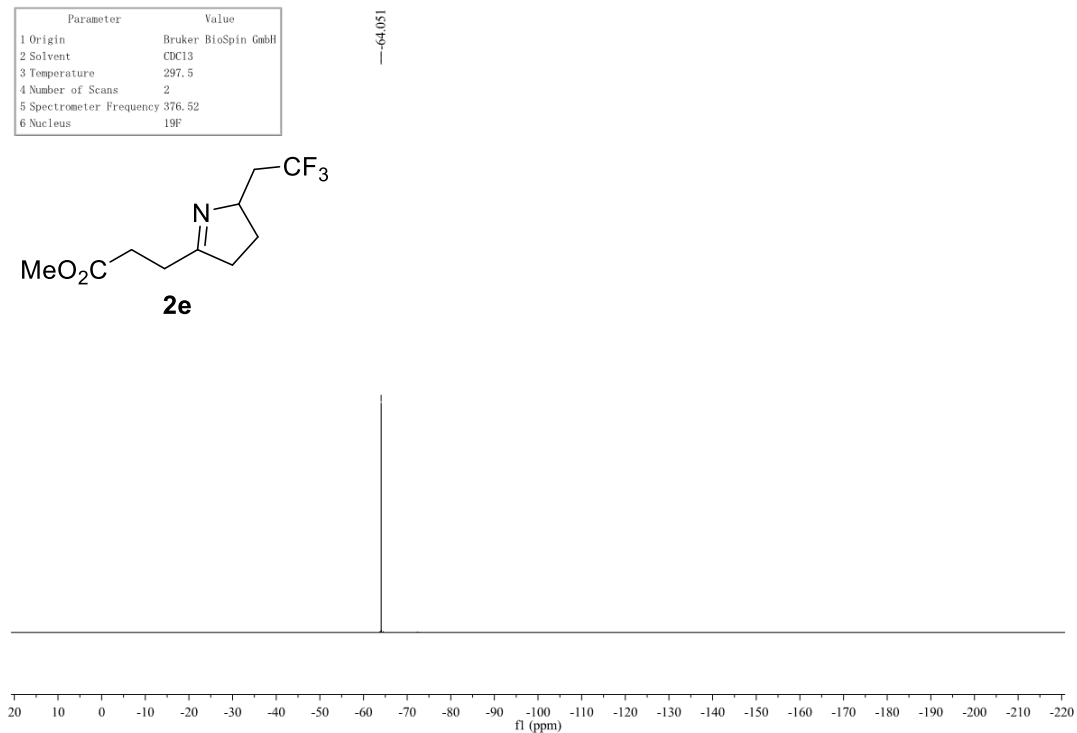
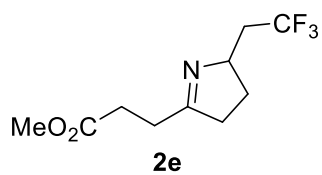
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.5
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	¹ H



Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.0
4 Number of Scans	1024
5 Spectrometer Frequency	100.62
6 Nucleus	¹³ C

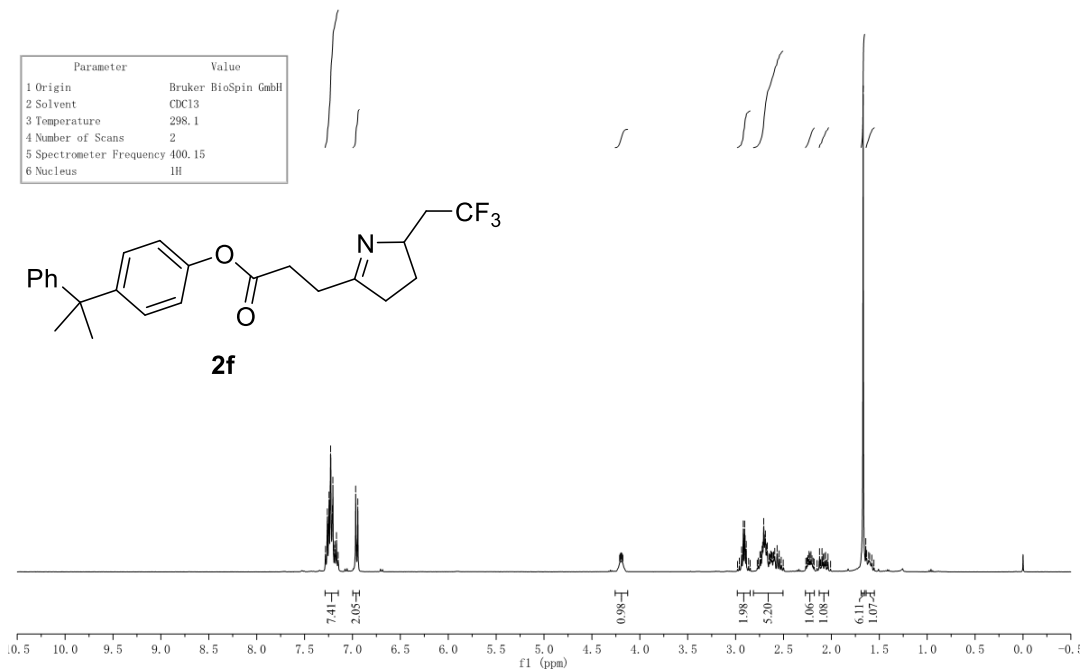
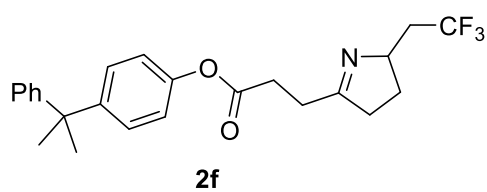


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.5
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F



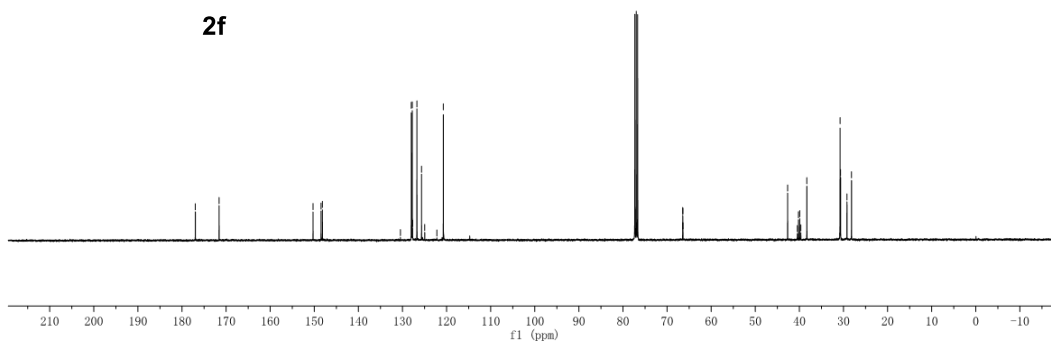
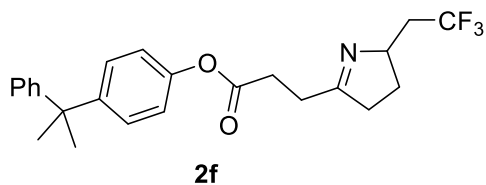
7.282
7.262
7.250
7.244
7.228
7.209
7.204
7.187
7.166
7.149
6.966
6.945
4.211
4.206
4.200
4.186
4.189
4.183
4.177
2.961
2.937
2.919
2.906
2.891
2.890
2.864
2.774
2.762
2.745
2.734
2.724
2.717
2.706
2.694
2.689
2.677
2.669
2.651
2.640
2.633
2.628
2.622
2.618
2.608
2.603
2.592
2.567
2.546
2.524
2.502
2.266
2.255
2.245
2.234
2.223
2.213
2.203
2.191
2.181
2.123
2.113
2.098
2.086
2.071
2.061
2.046
2.036
1.669
1.641
1.632
1.600
1.578
1.556

Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H



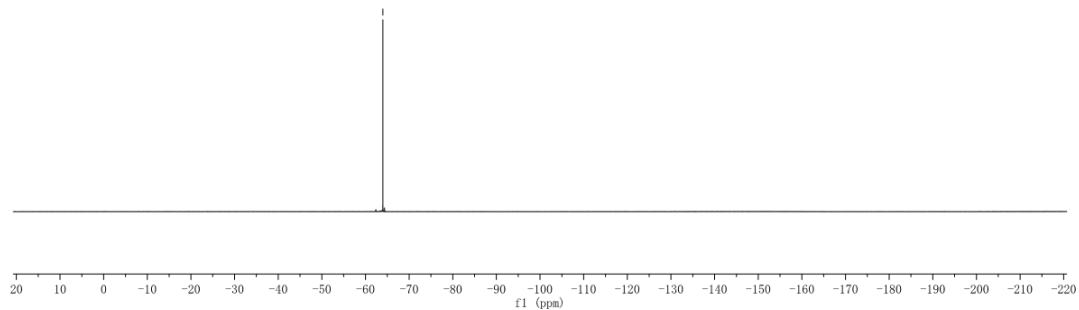
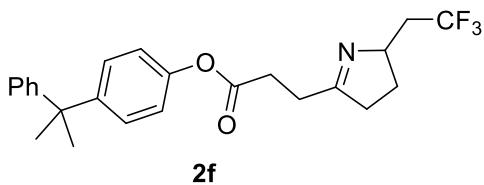
176.980
 171.597
 150.293
 148.475
 148.160
 130.469
 128.006
 127.735
 127.715
 126.719
 125.686
 124.963
 122.209
 120.741
 66.483
 66.458
 66.432
 66.405
 42.671
 40.481
 39.442
 39.042
 39.673
 38.308
 30.787
 30.668
 29.219
 28.192

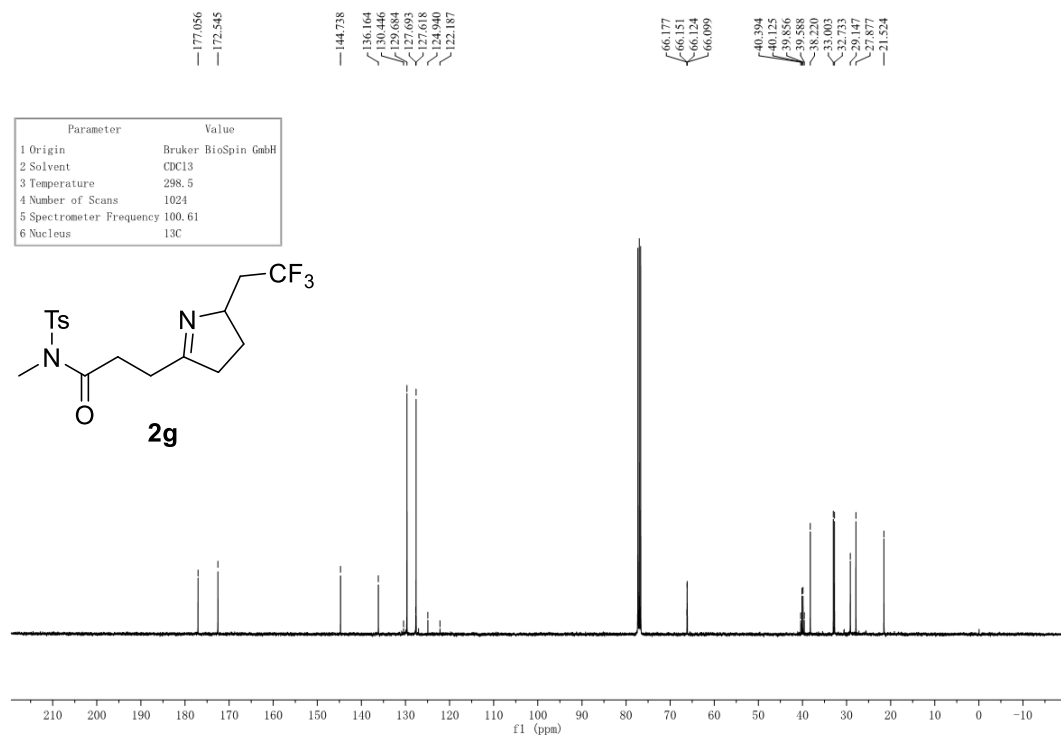
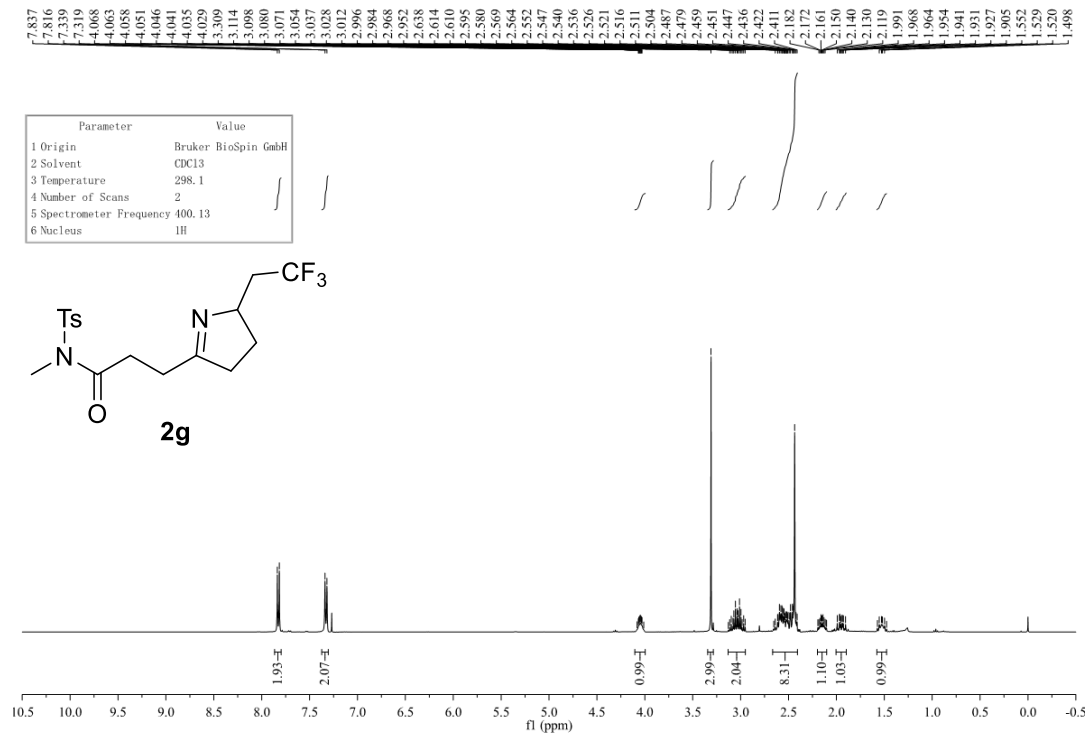
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	1024
5 Spectrometer Frequency	100.61
6 Nucleus	13C

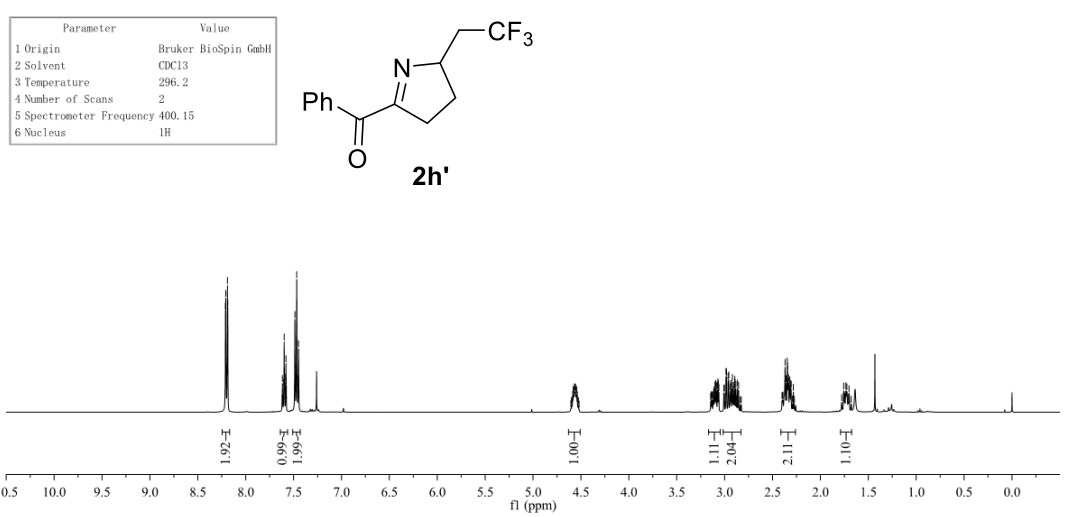
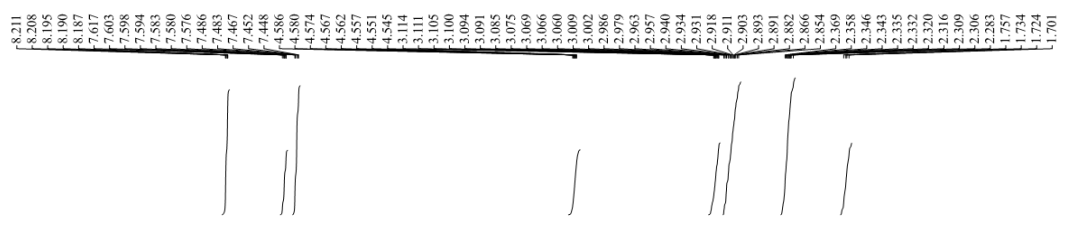
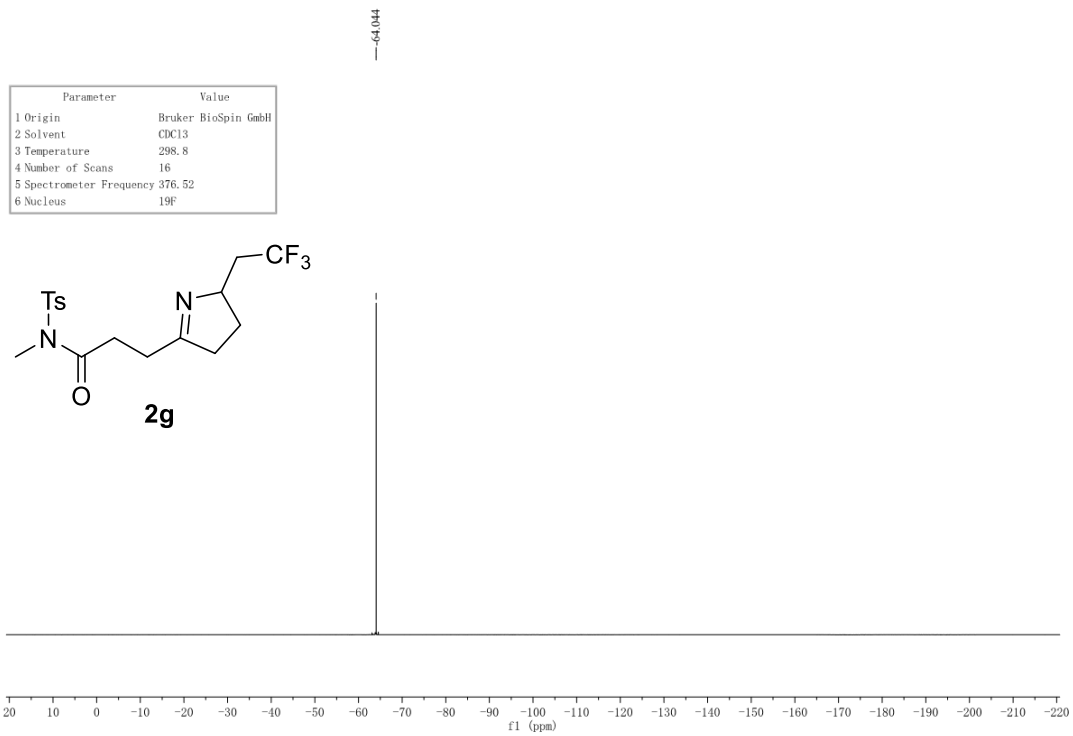


-63.978

Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F







190.374

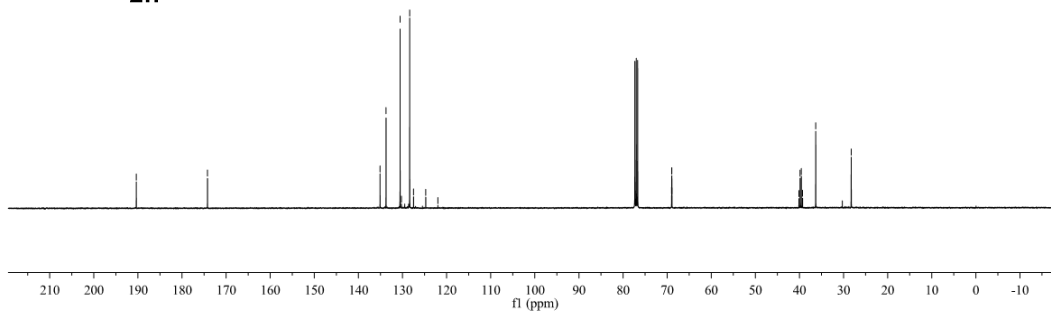
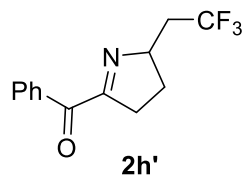
174.226

135.098
133.743
130.549
130.245
128.382
127.493
124.740
121.988

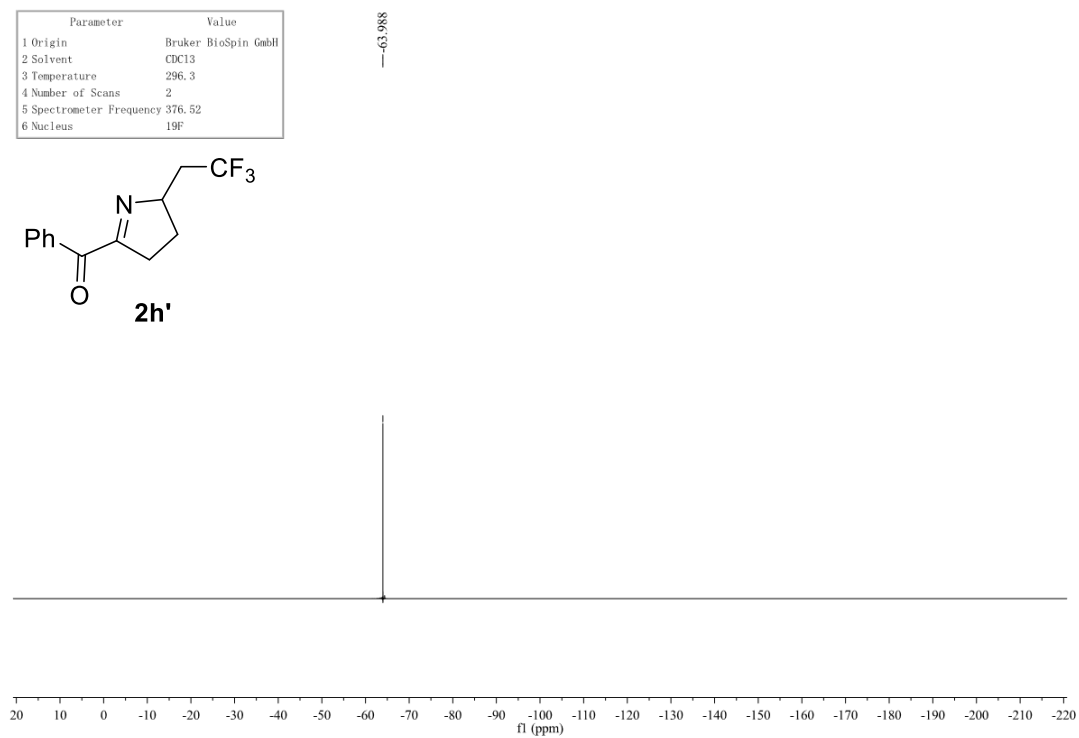
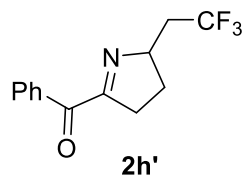
68.988
68.962
68.935
68.909

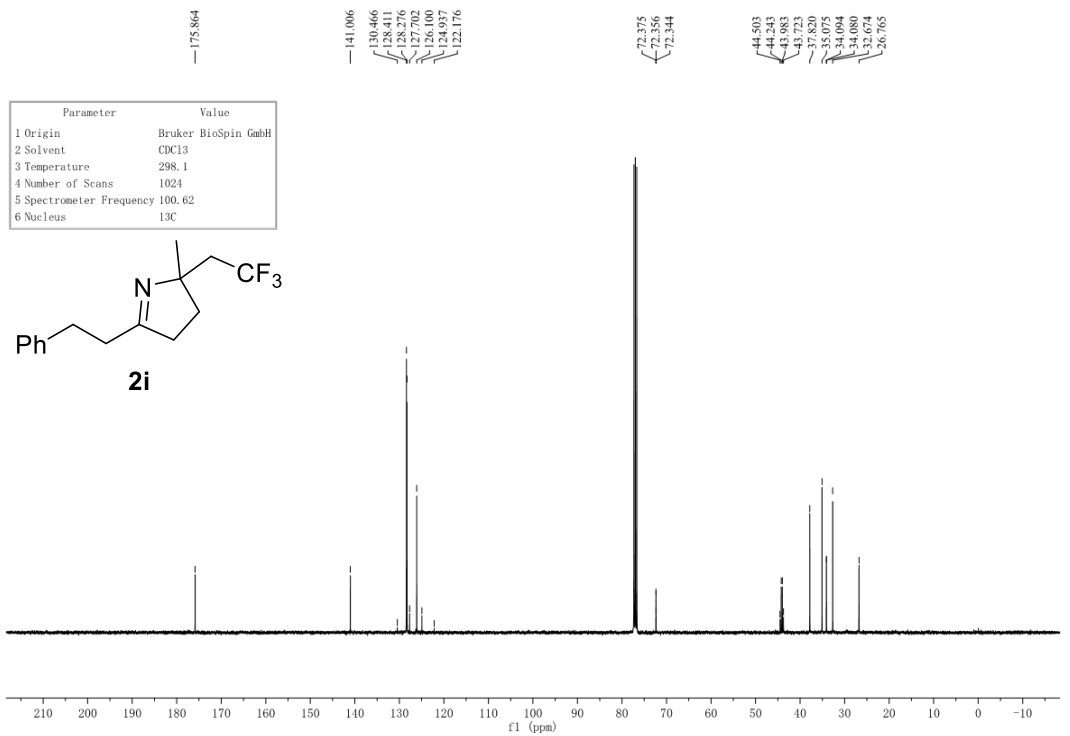
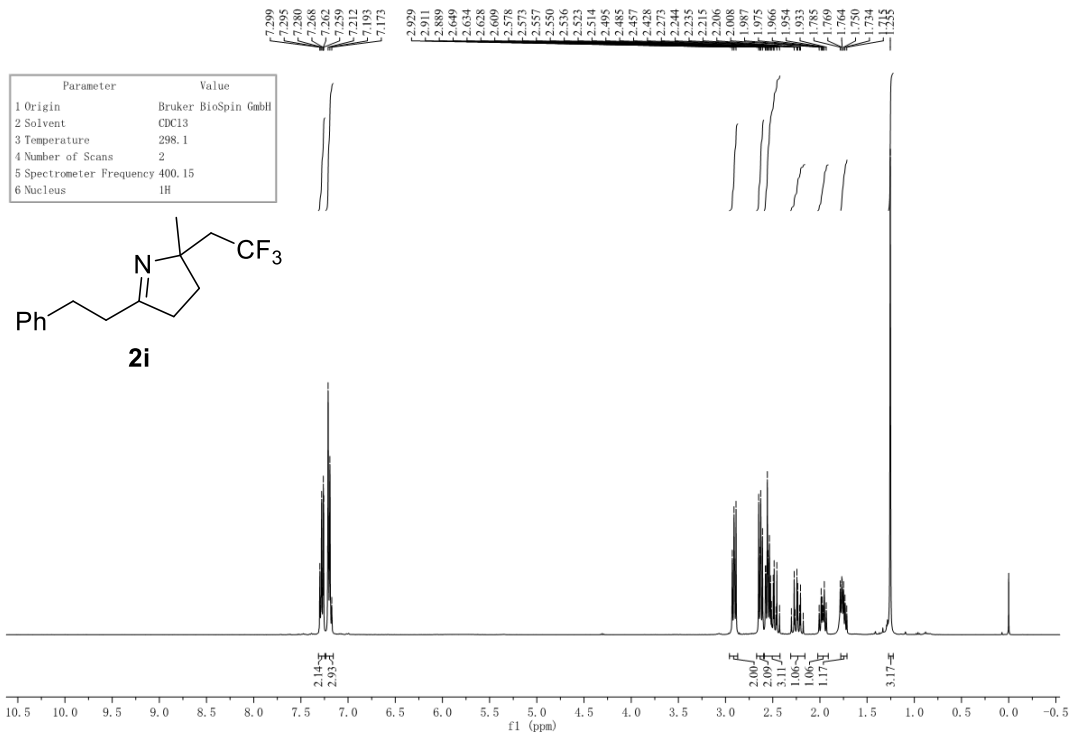
40.125
39.850
39.574
39.297
36.308
28.259

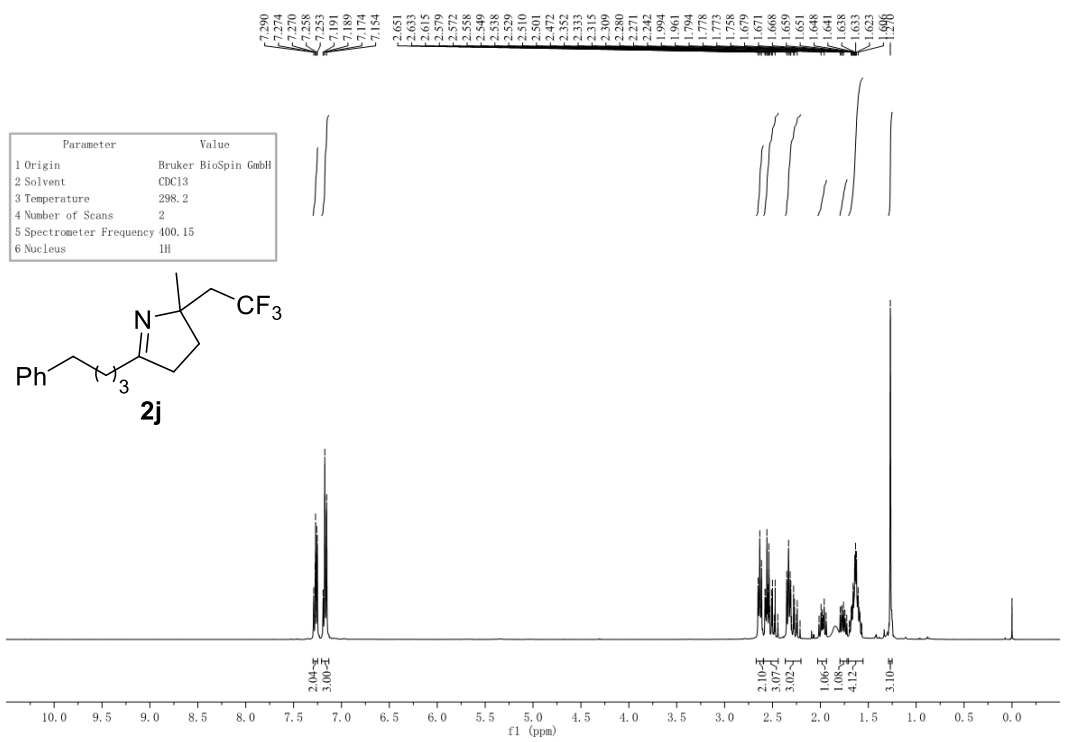
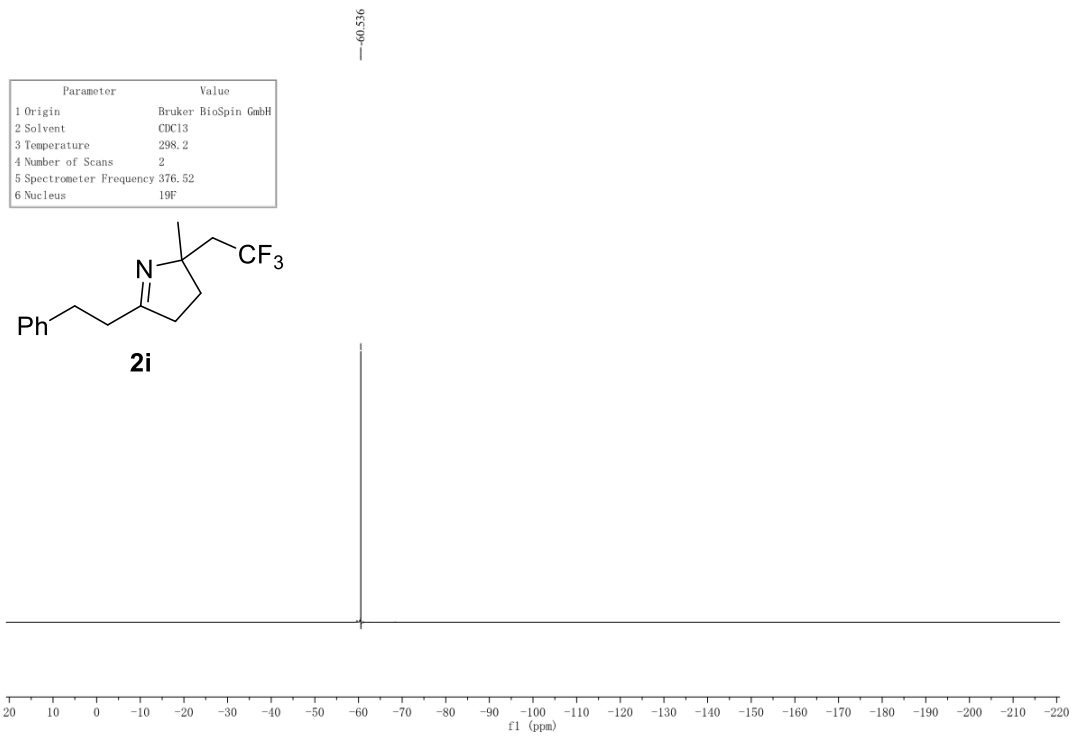
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	1024
5 Spectrometer Frequency	100.61
6 Nucleus	13C

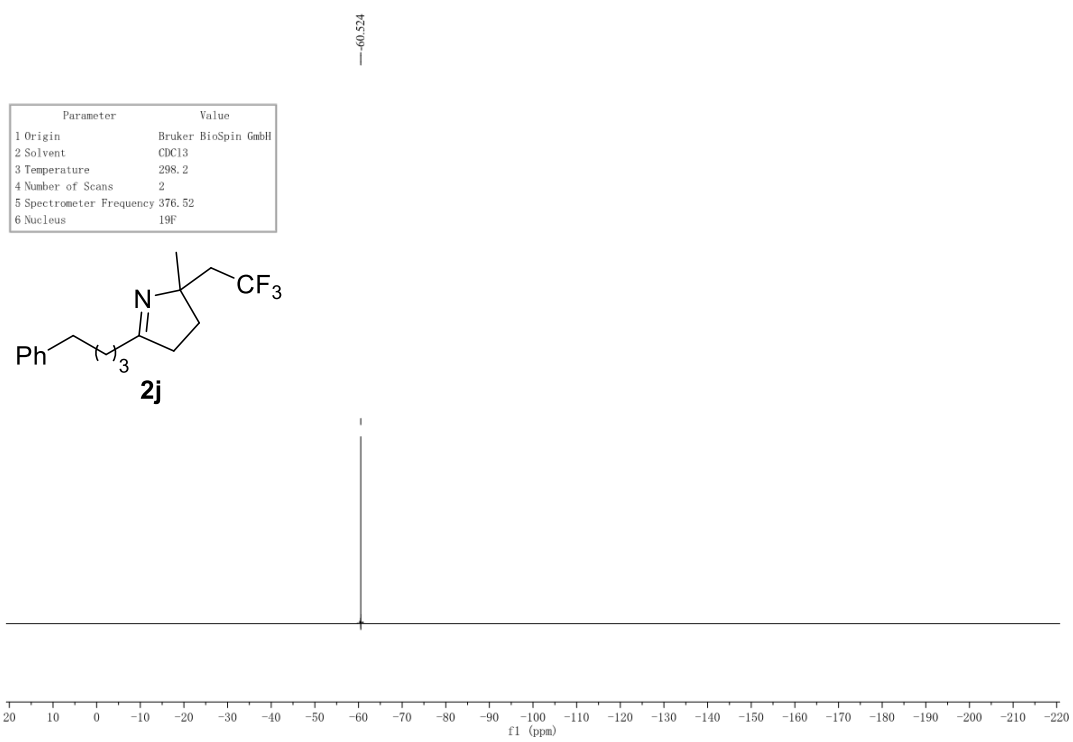
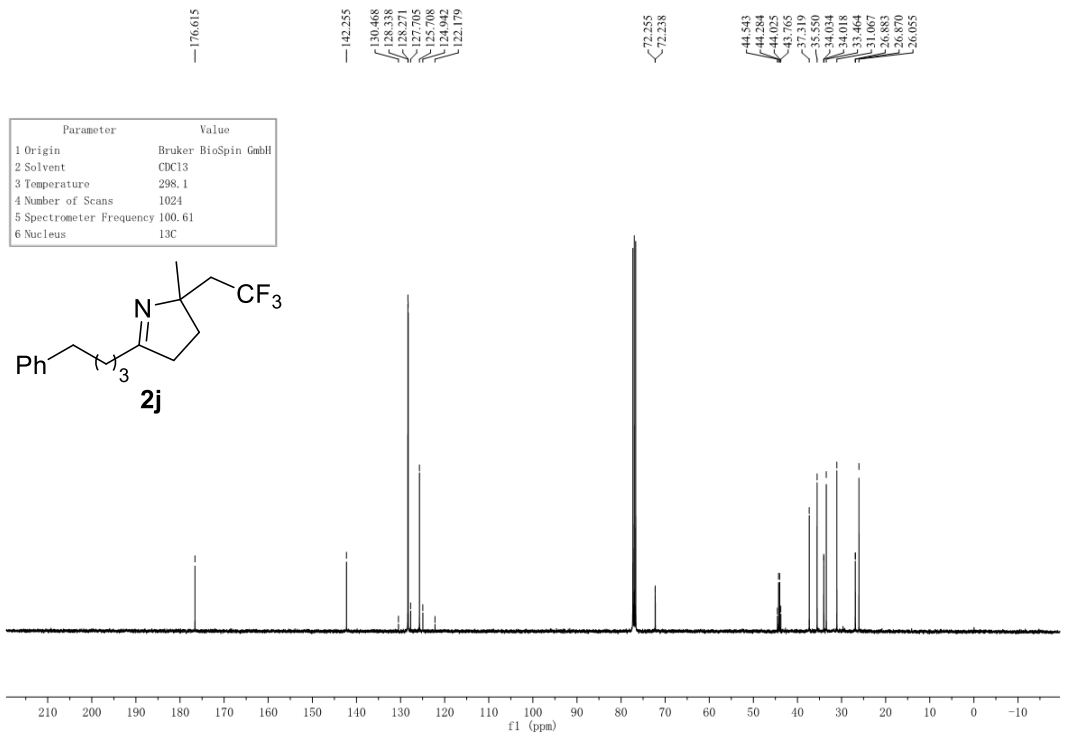


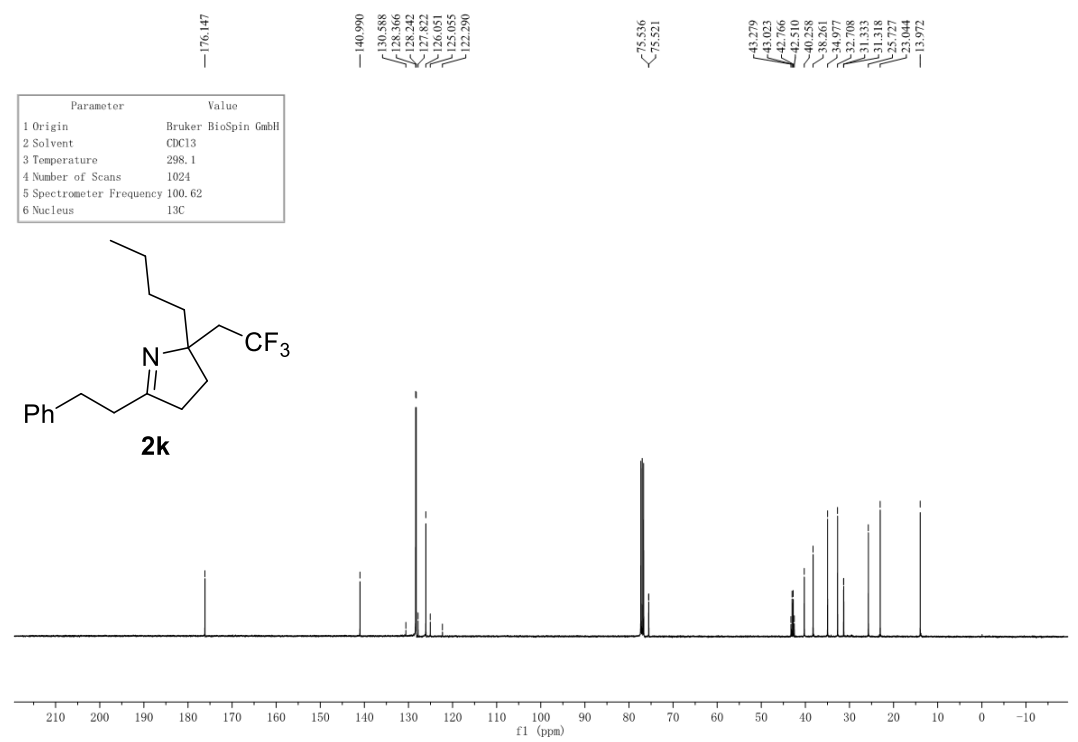
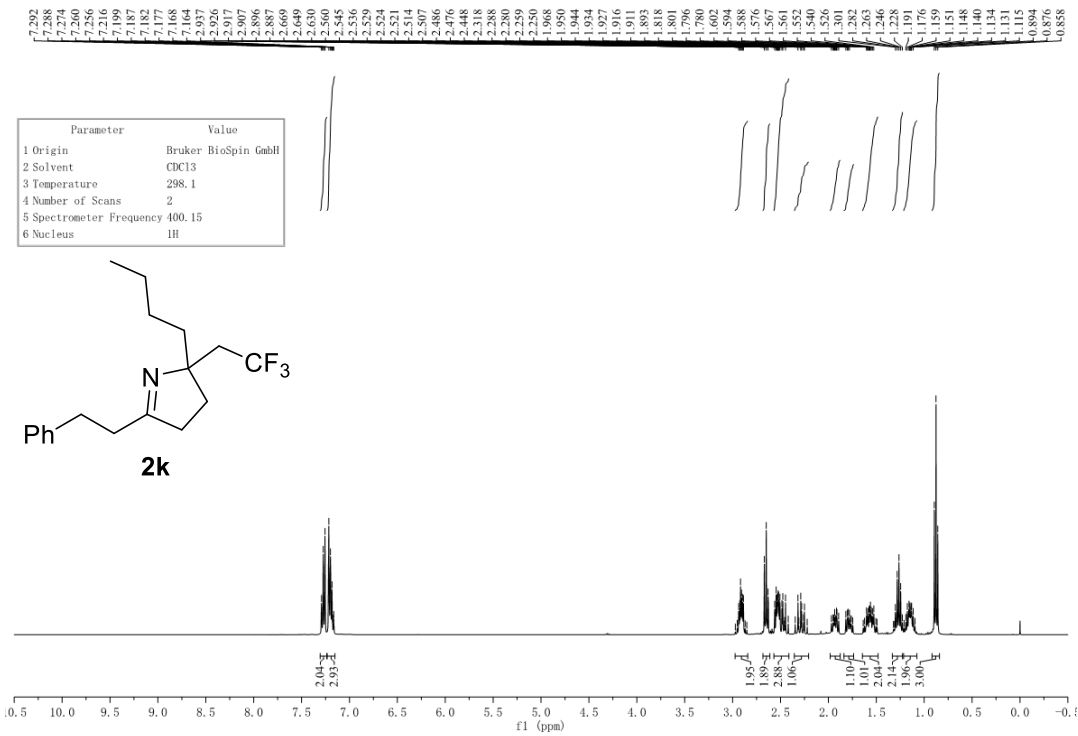
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.3
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

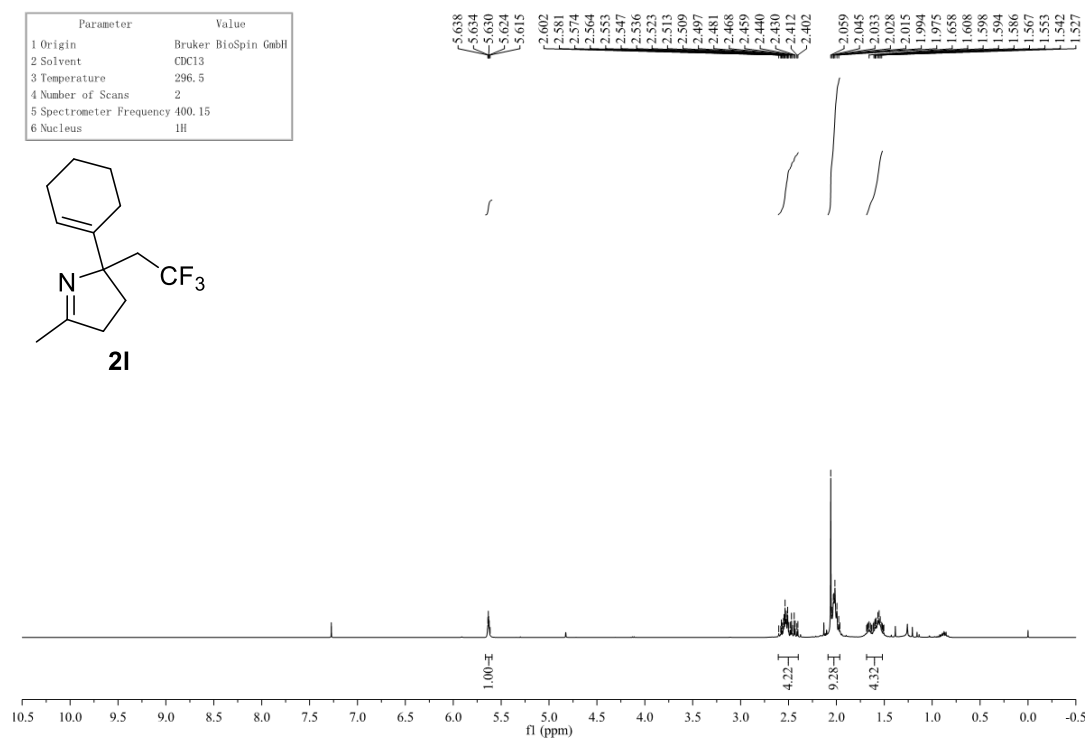
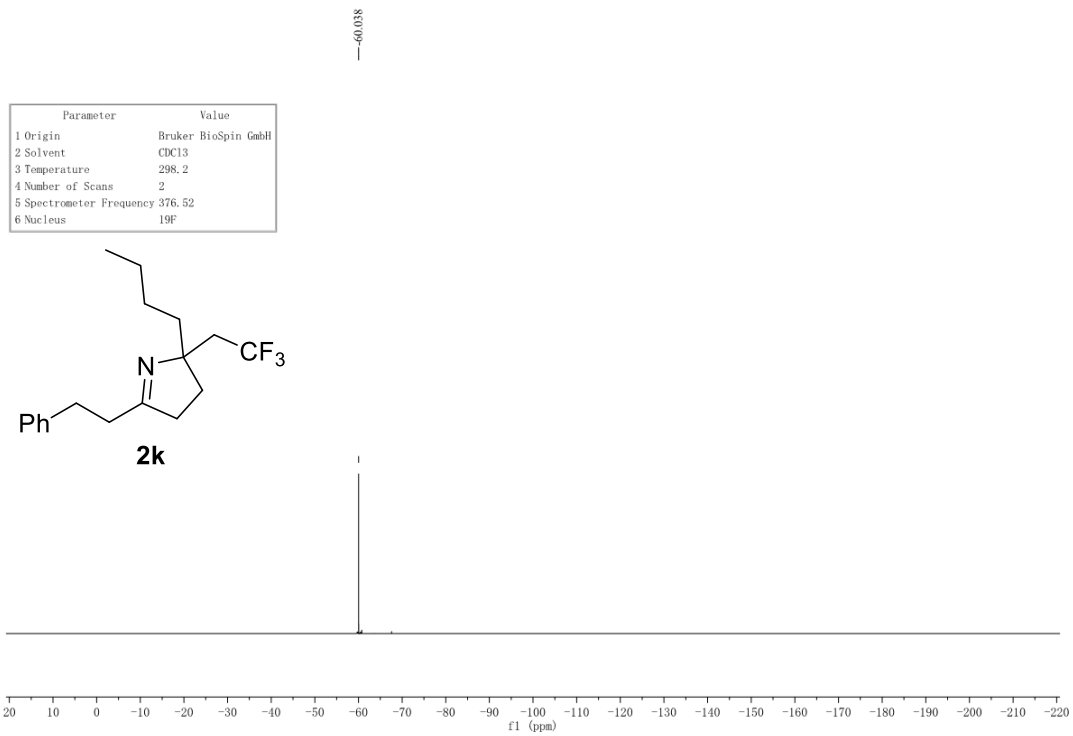


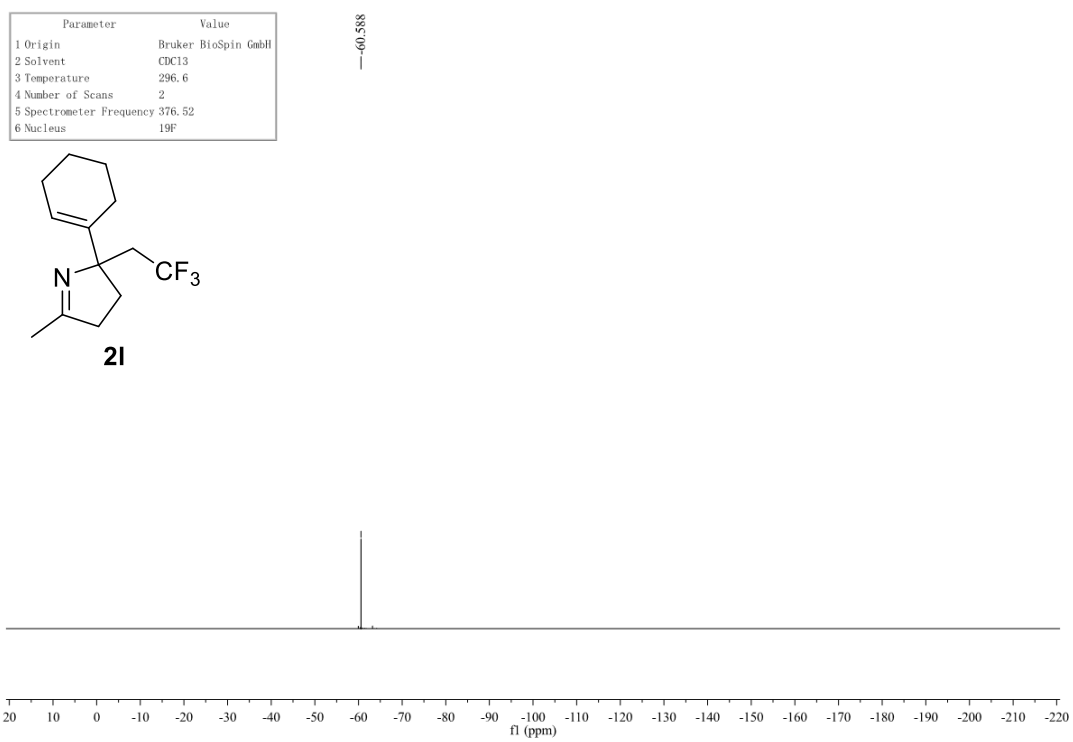
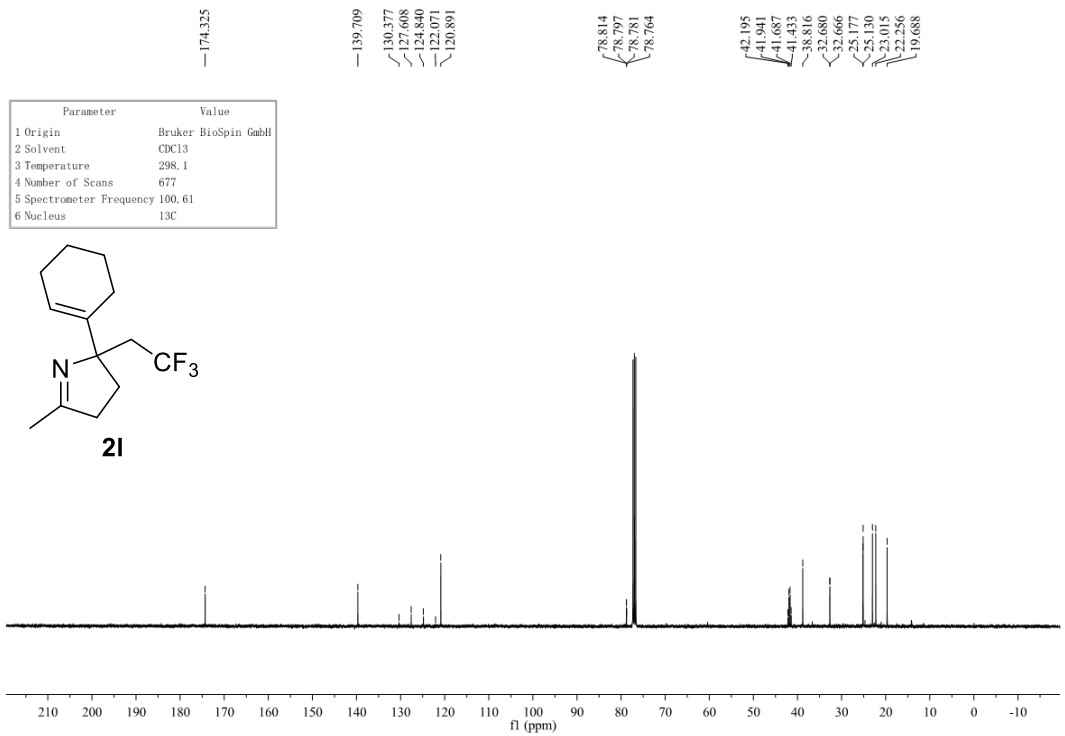


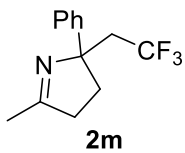
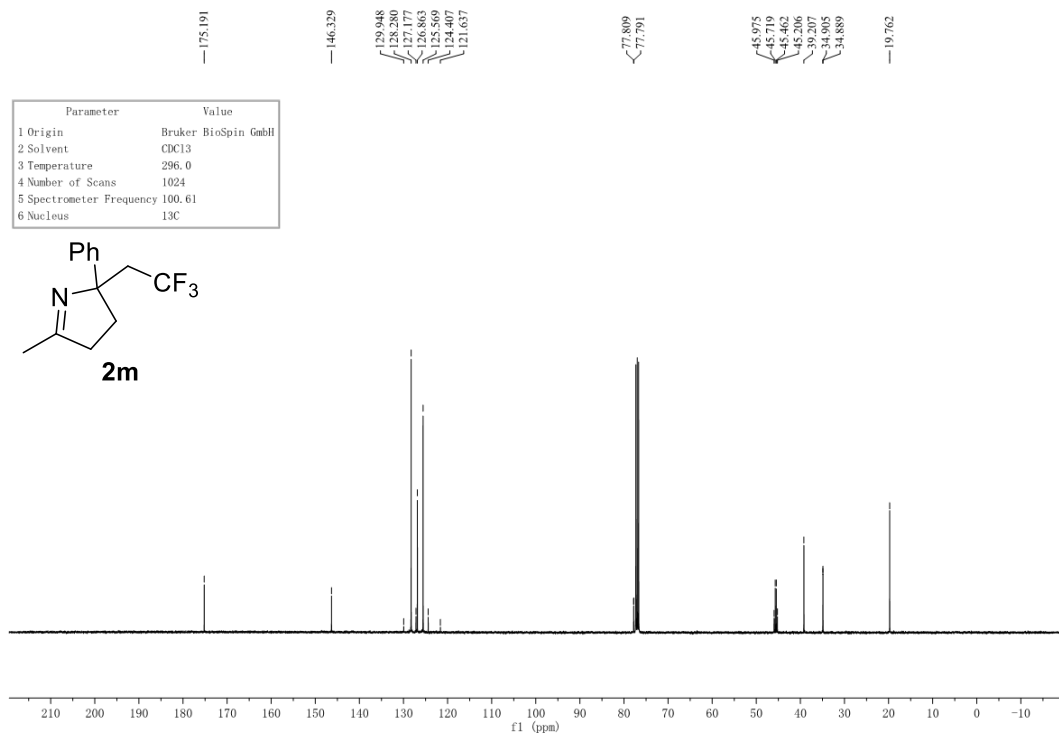
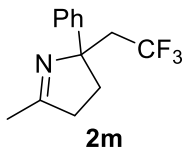
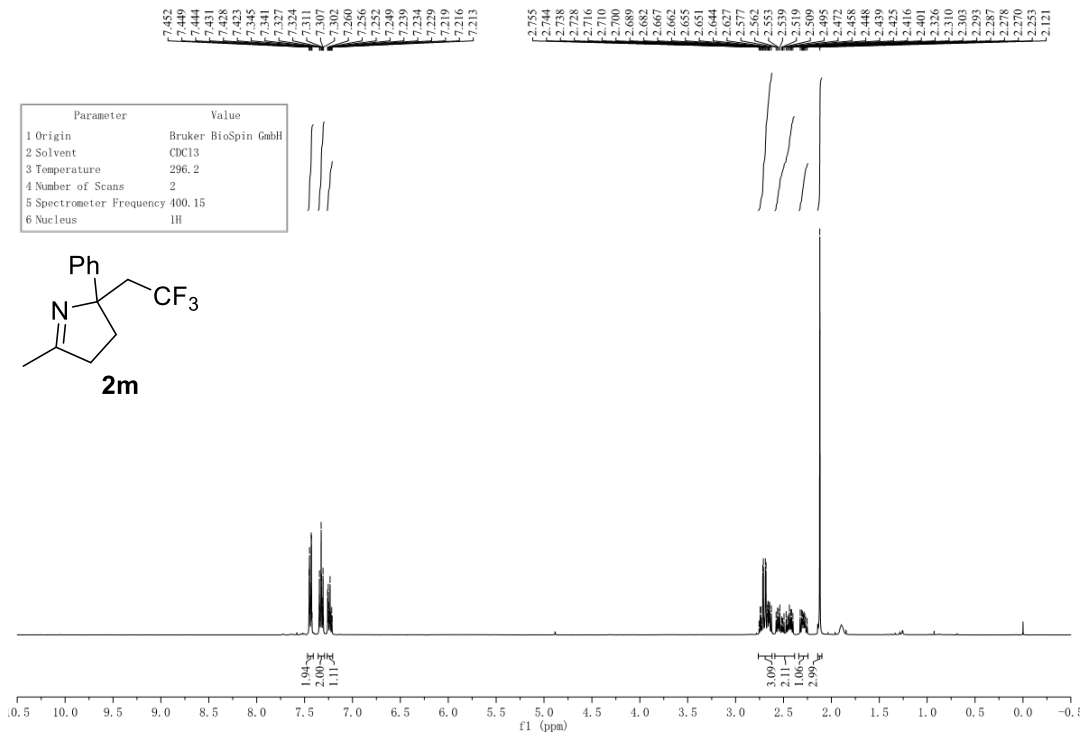




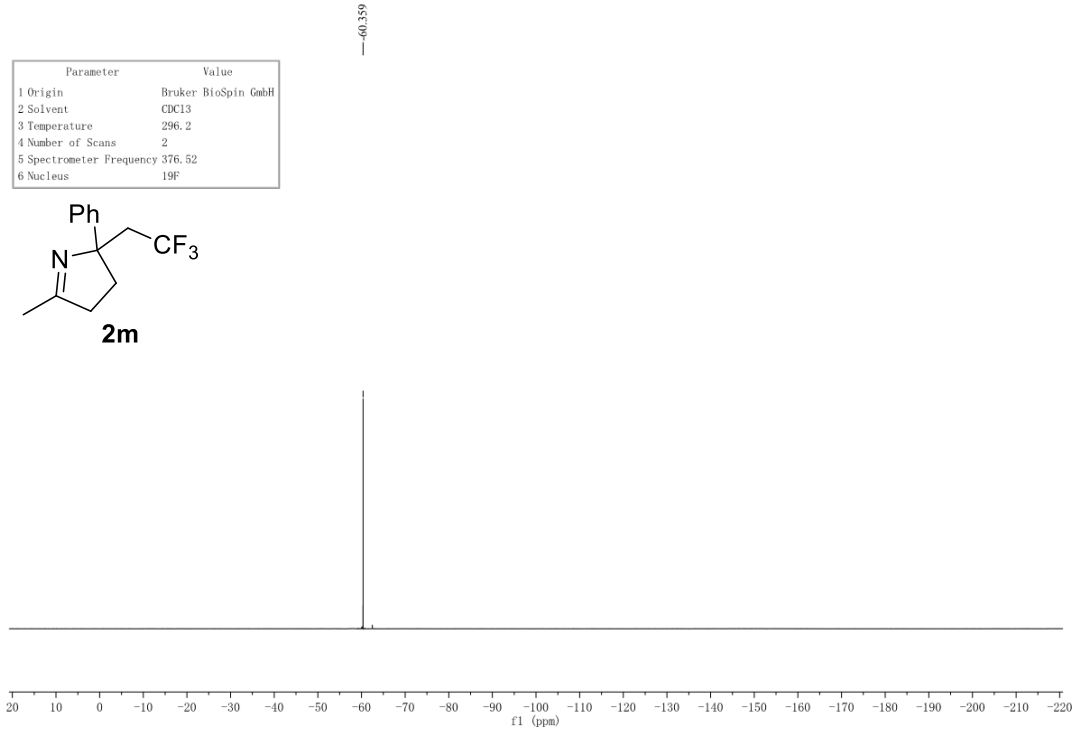
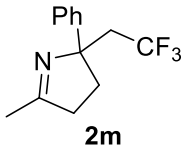




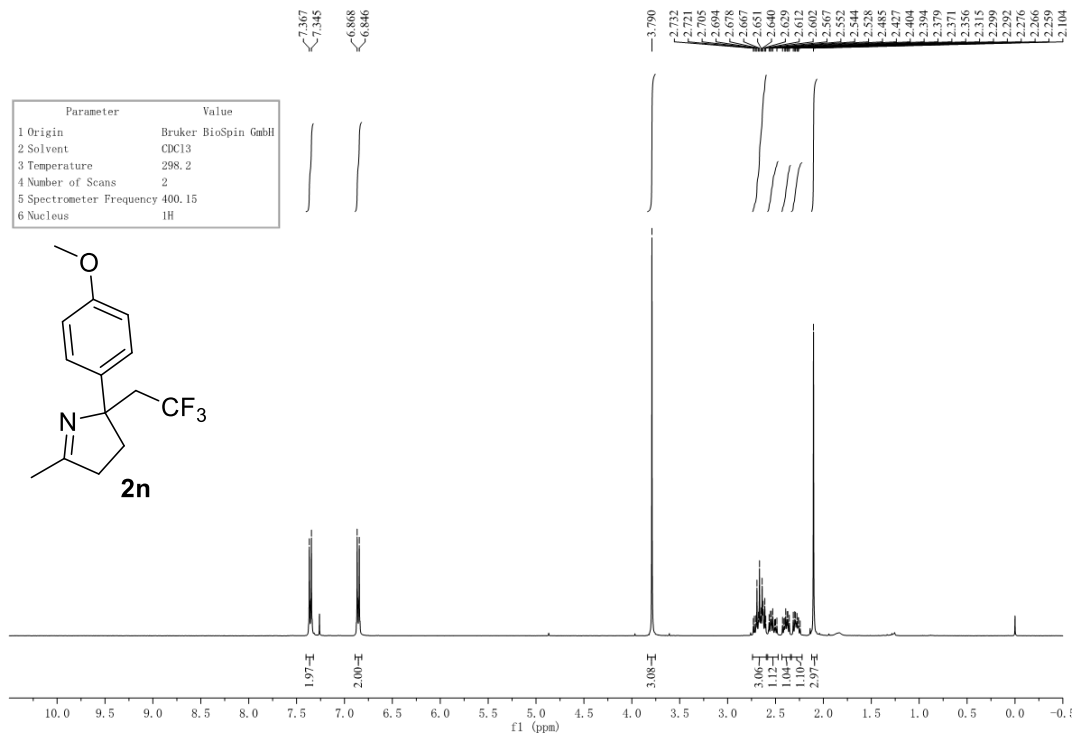
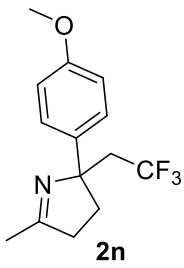


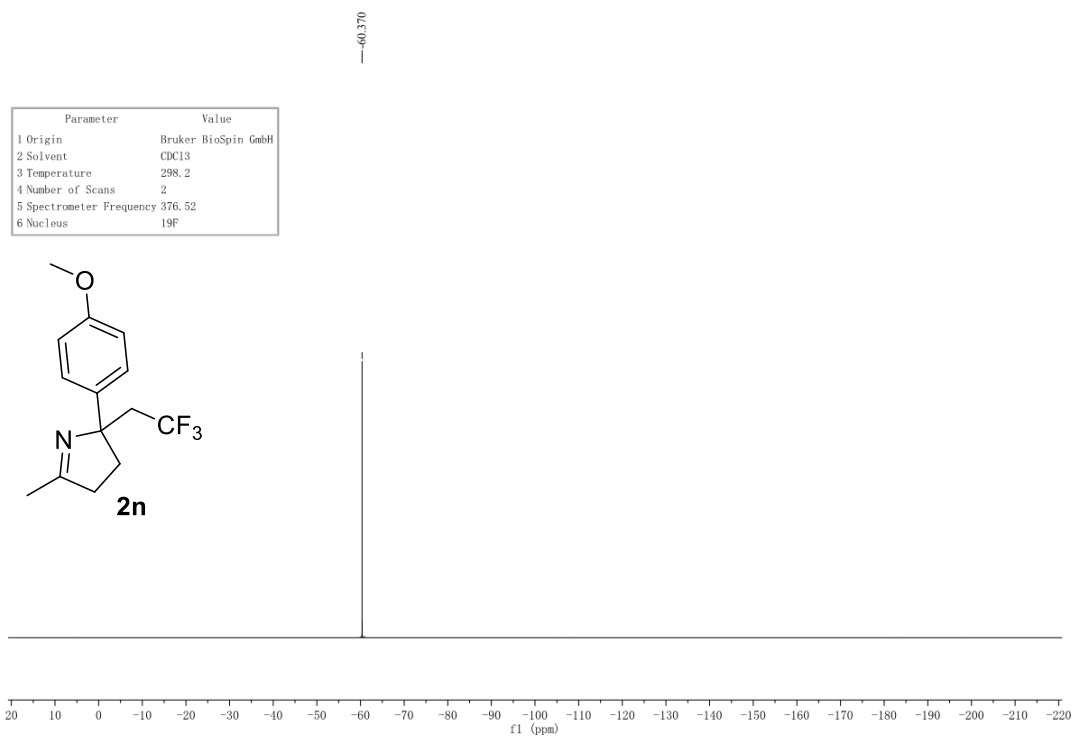
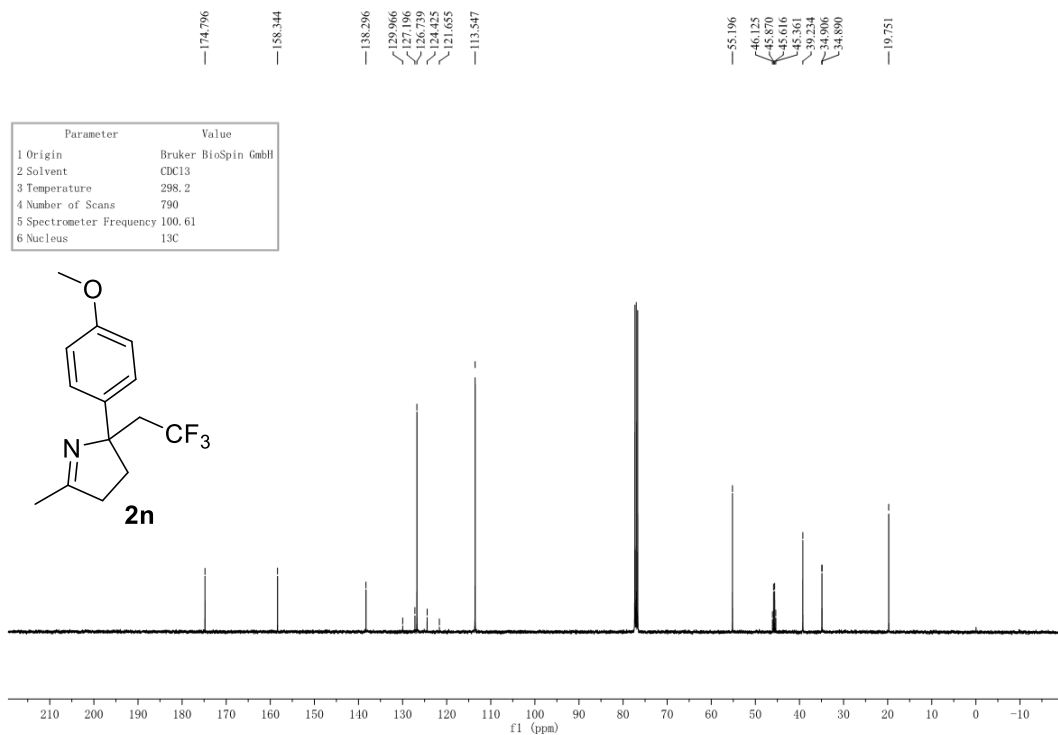


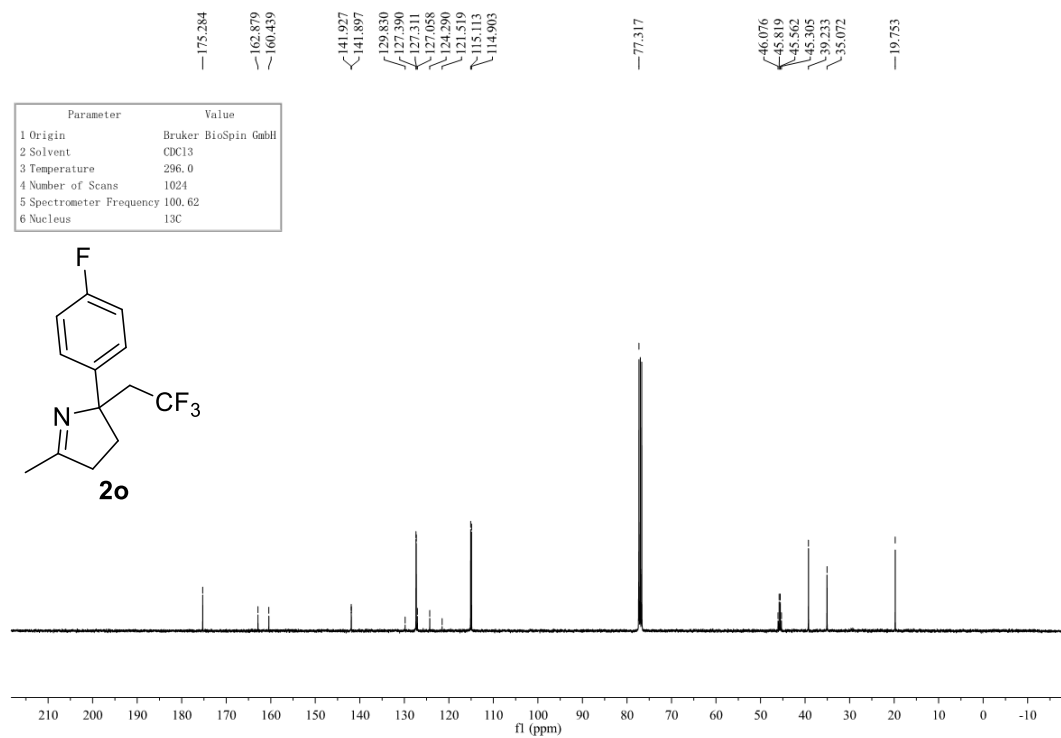
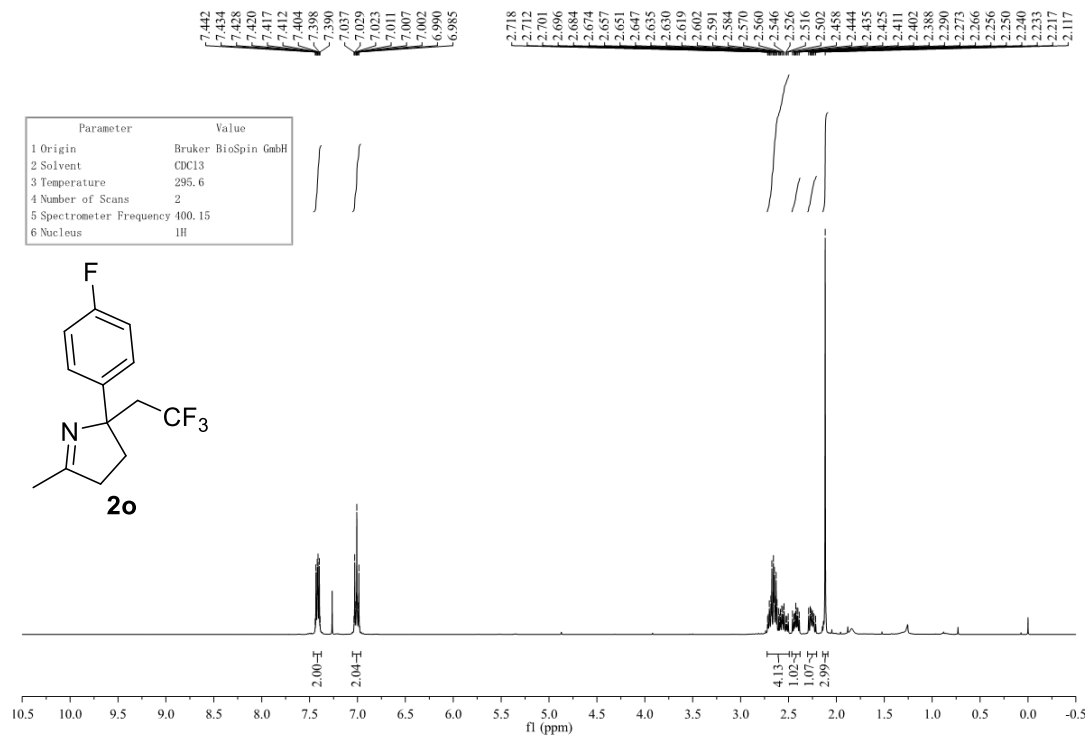
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.2
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

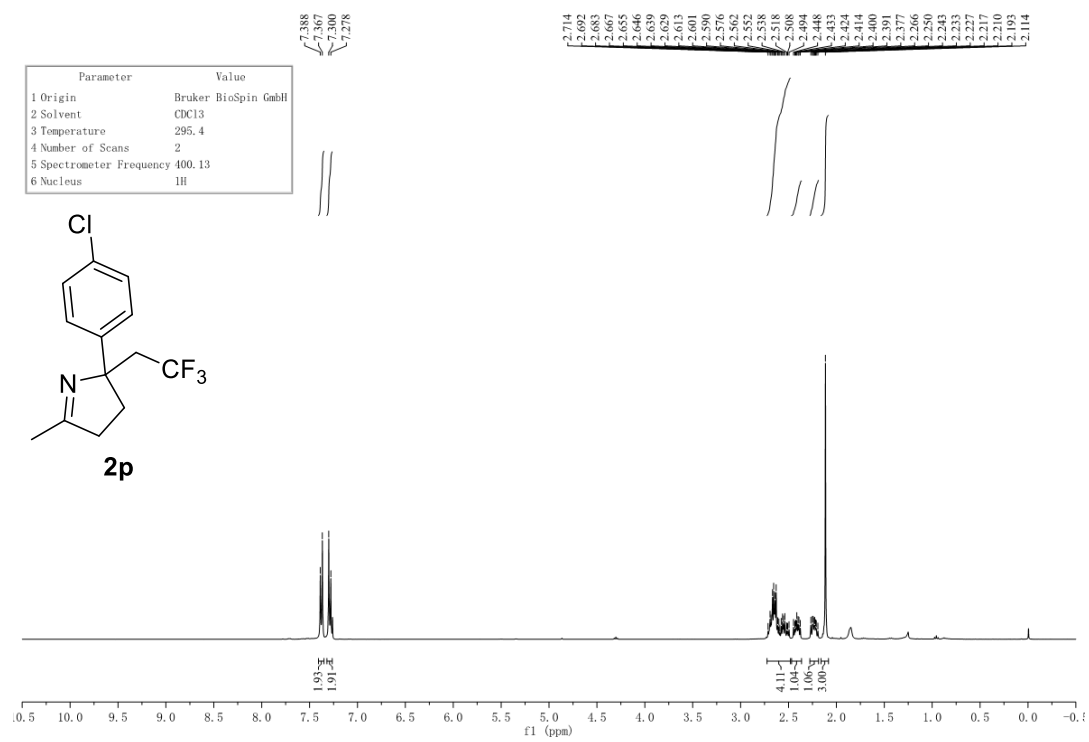
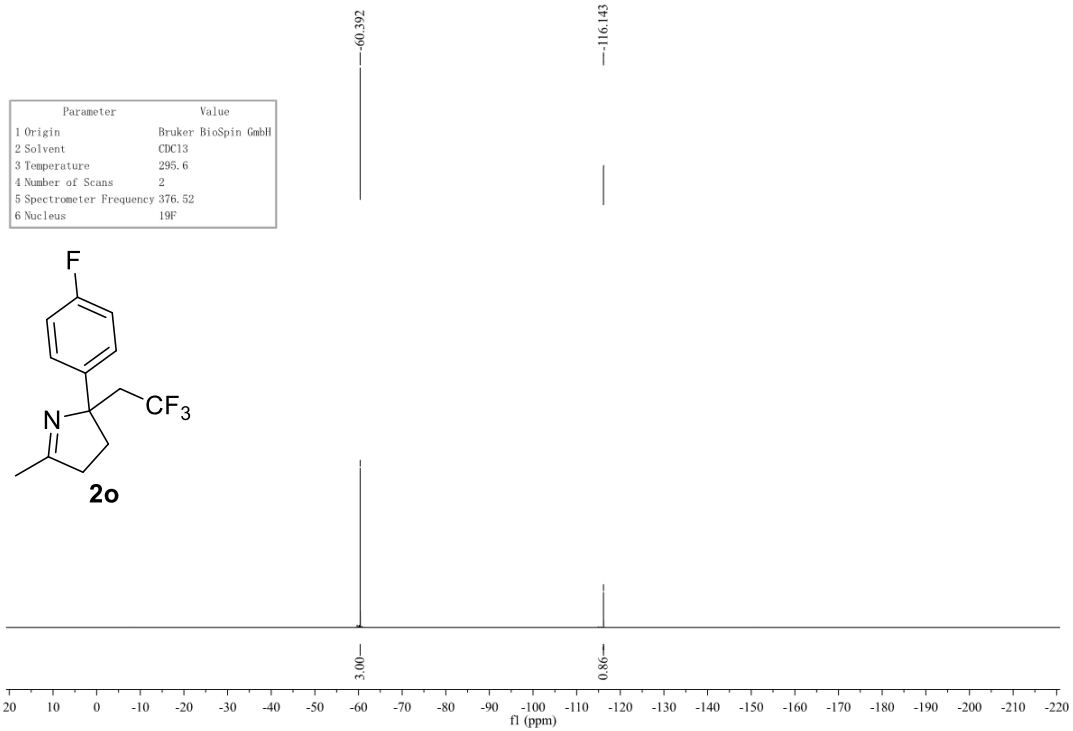


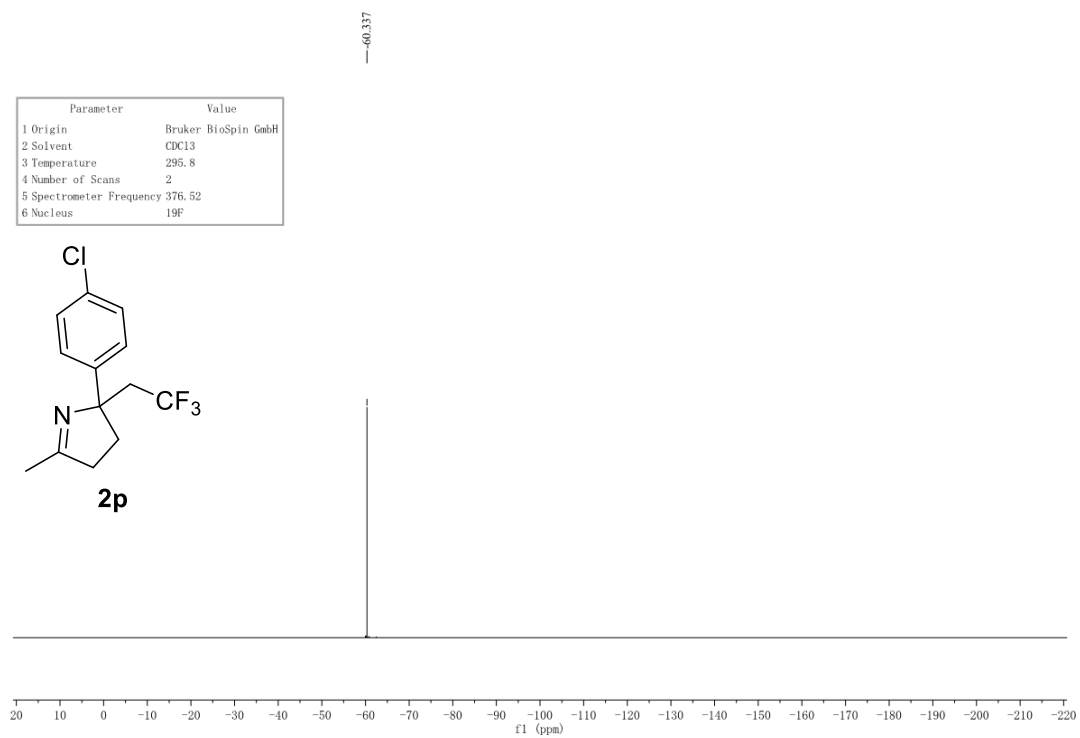
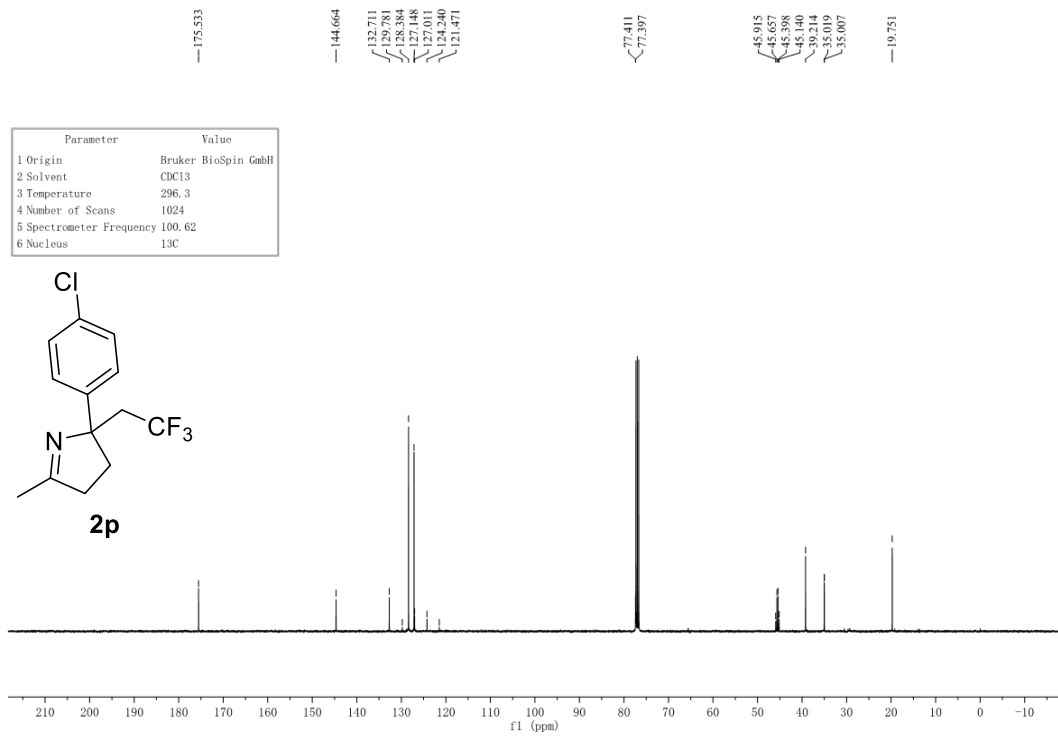
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

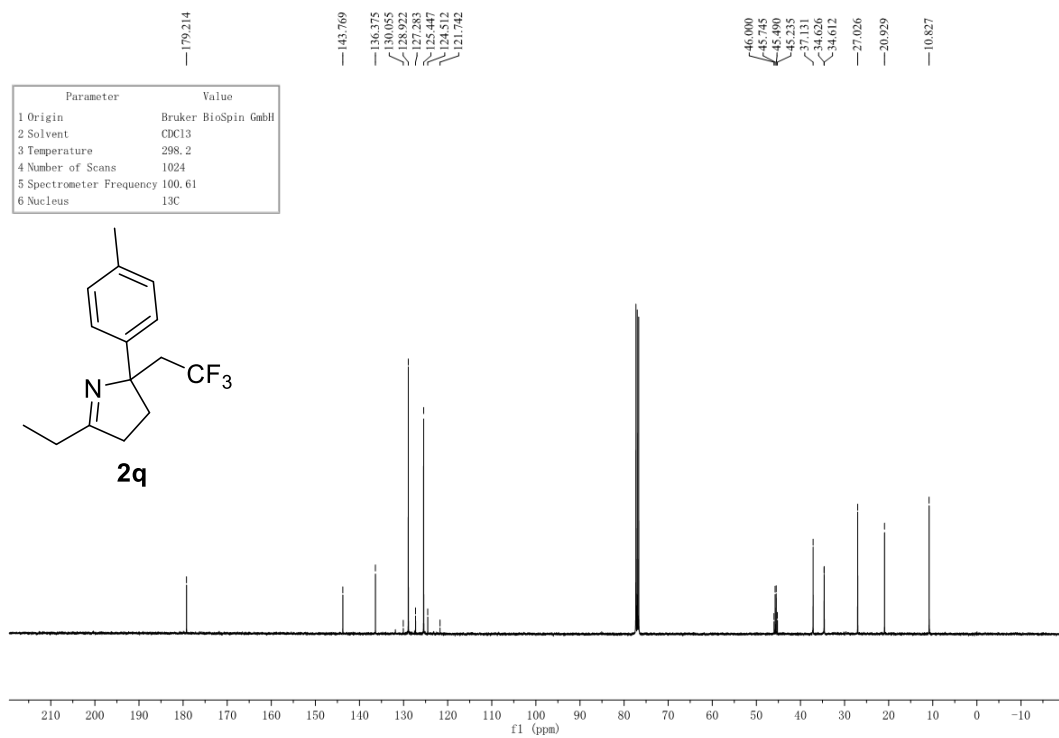
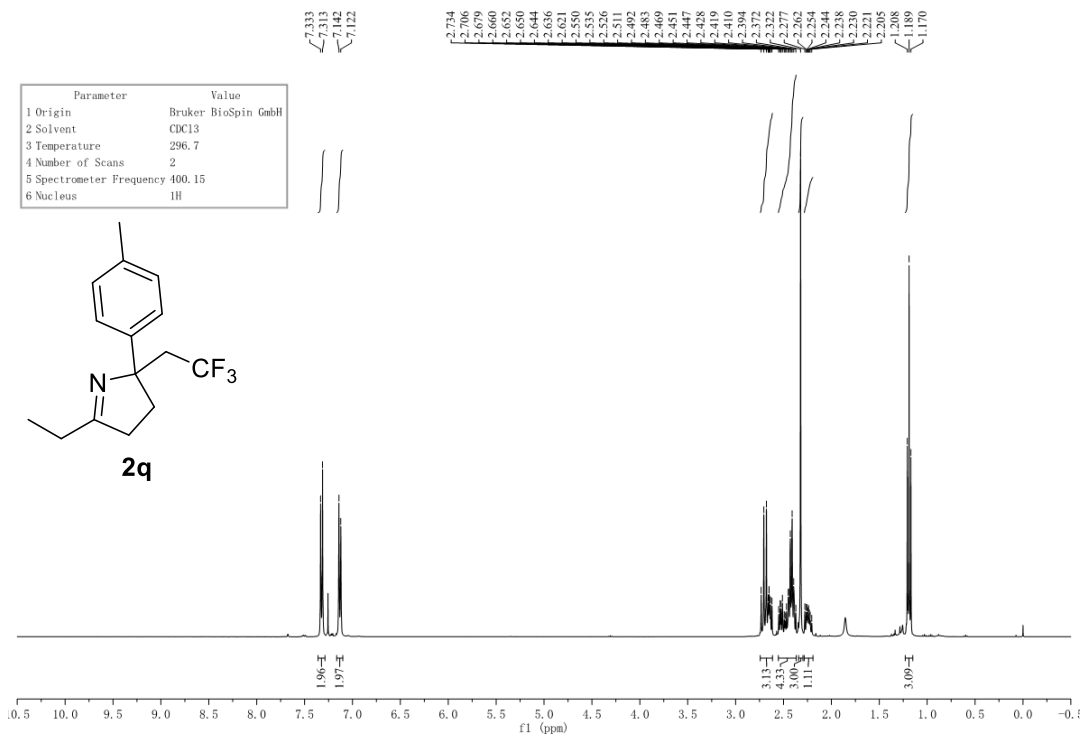


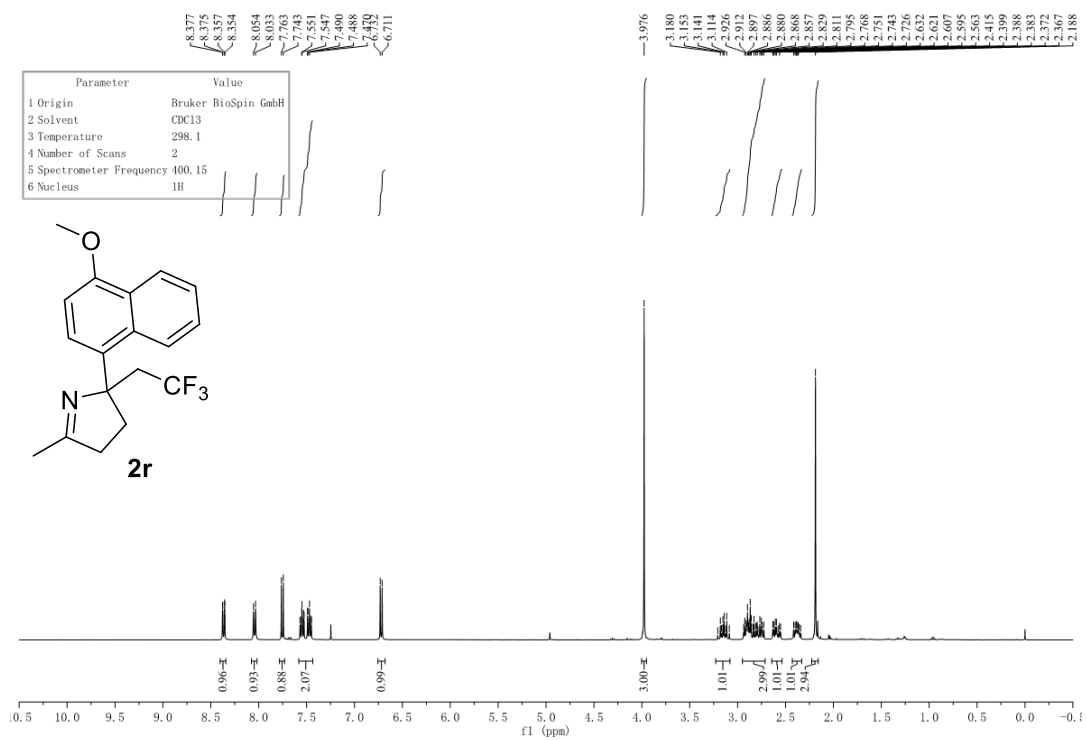
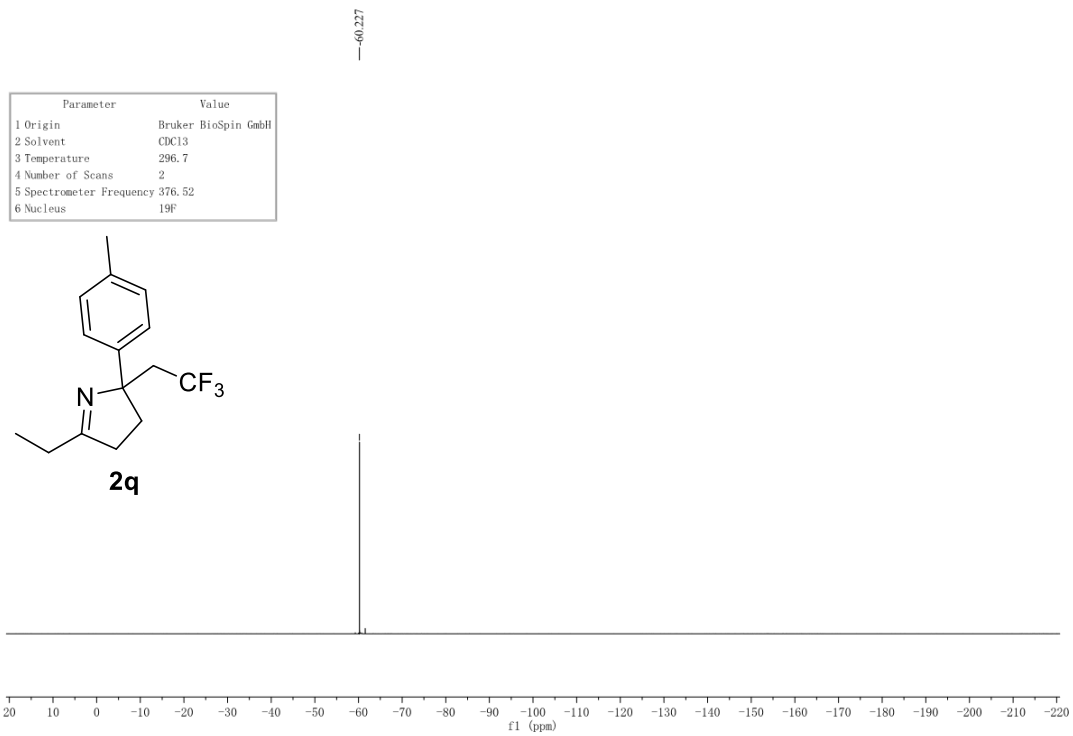


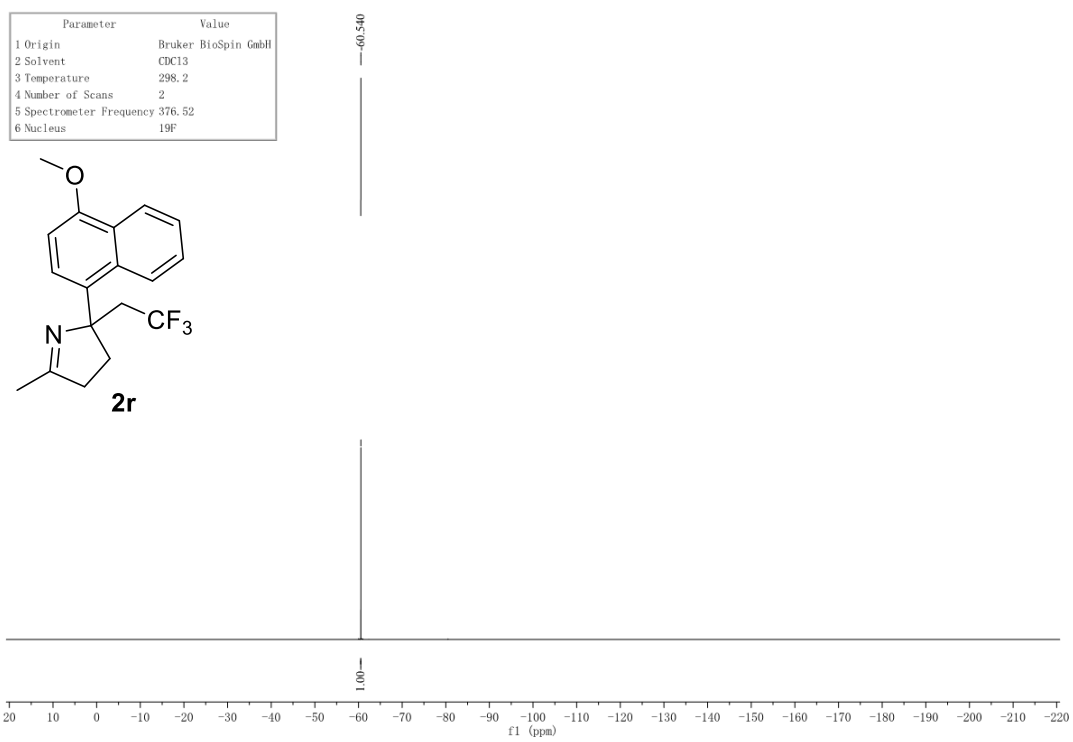
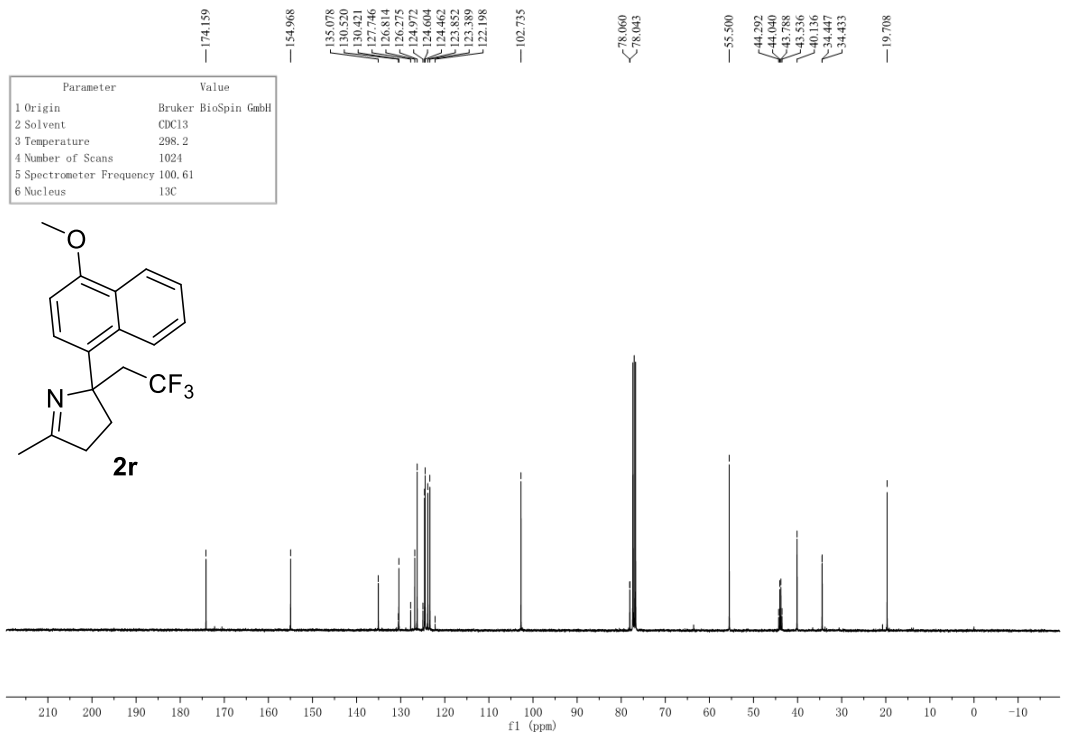


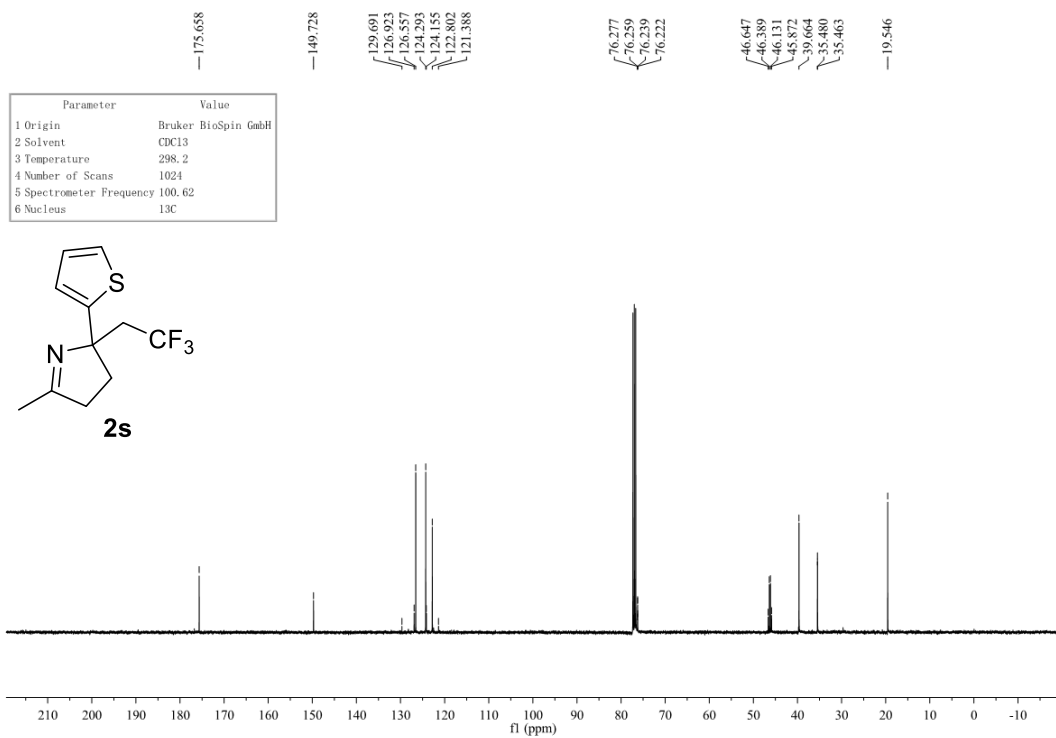
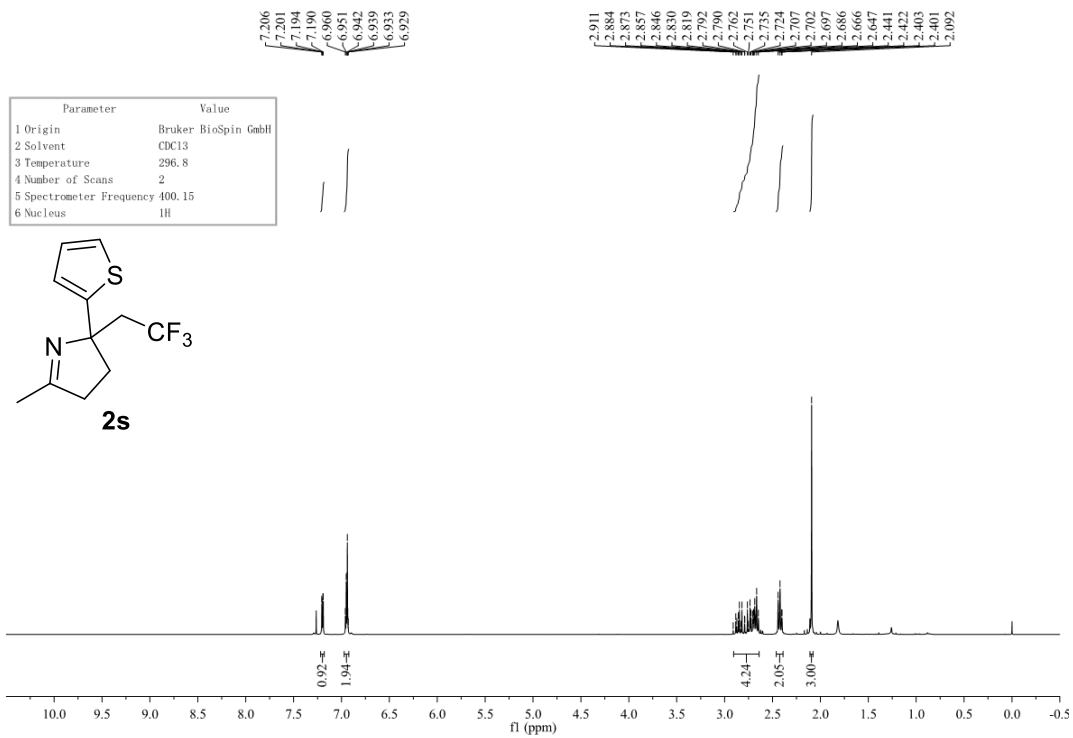


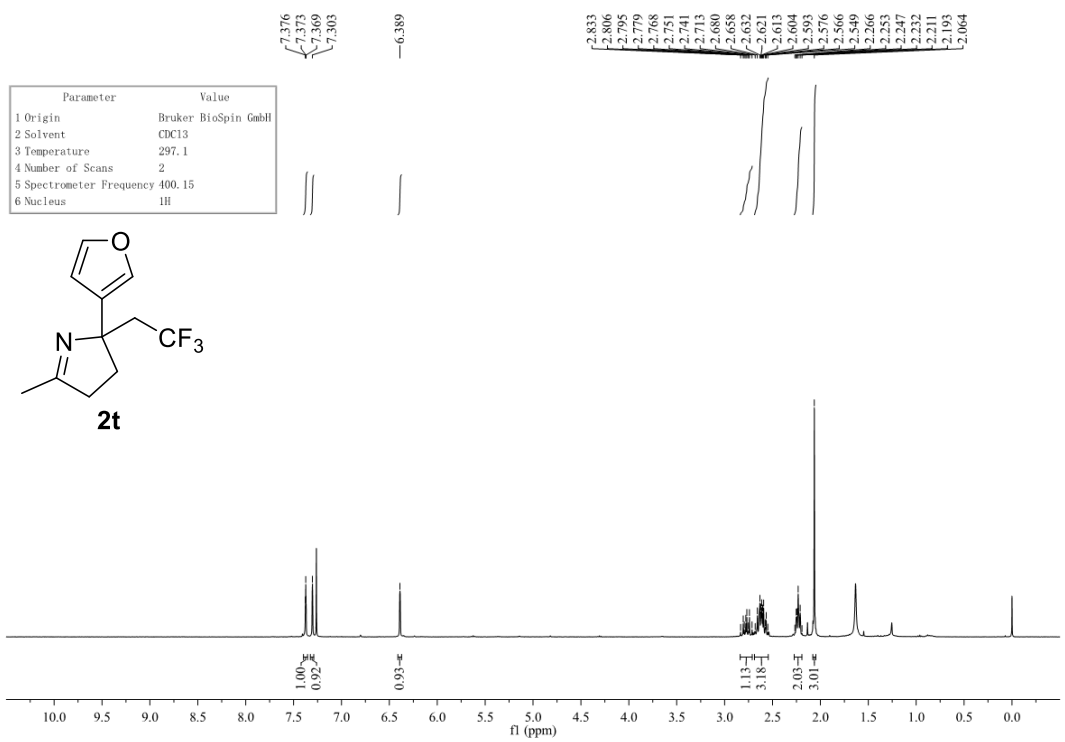
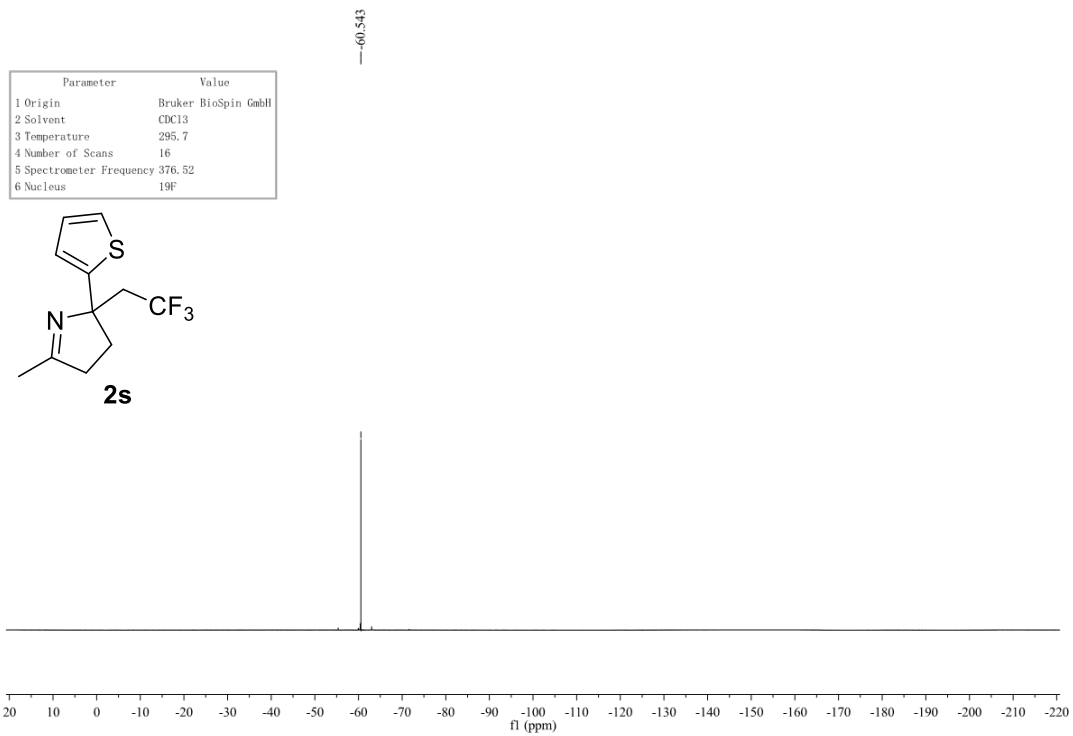


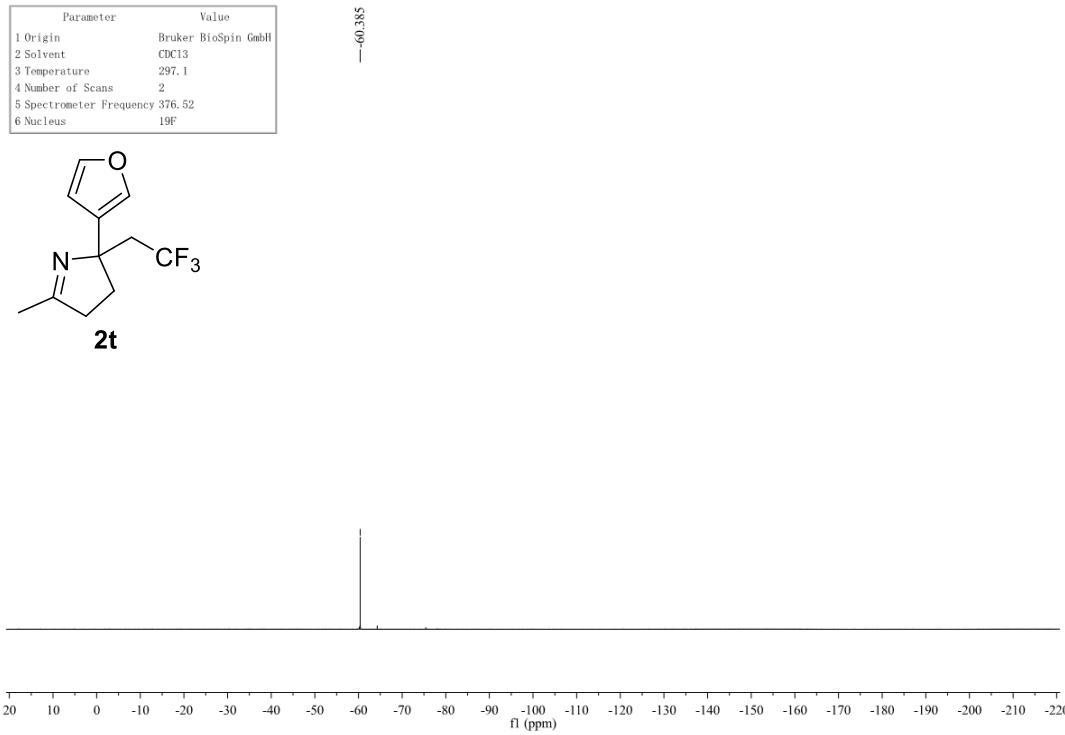
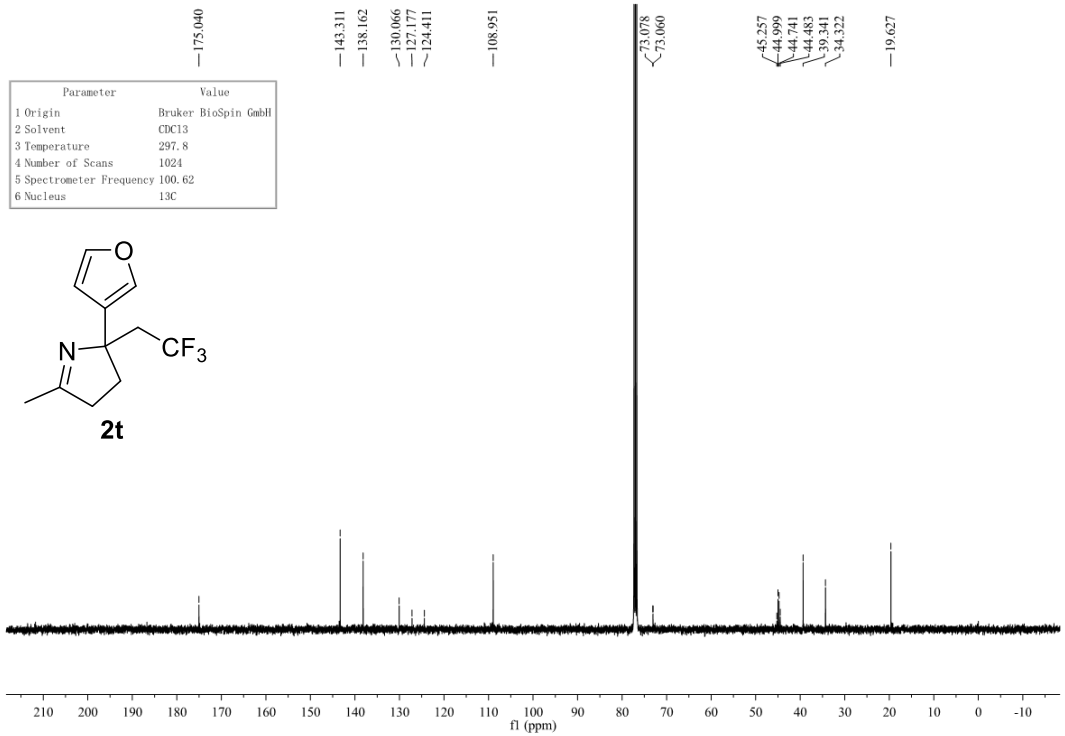


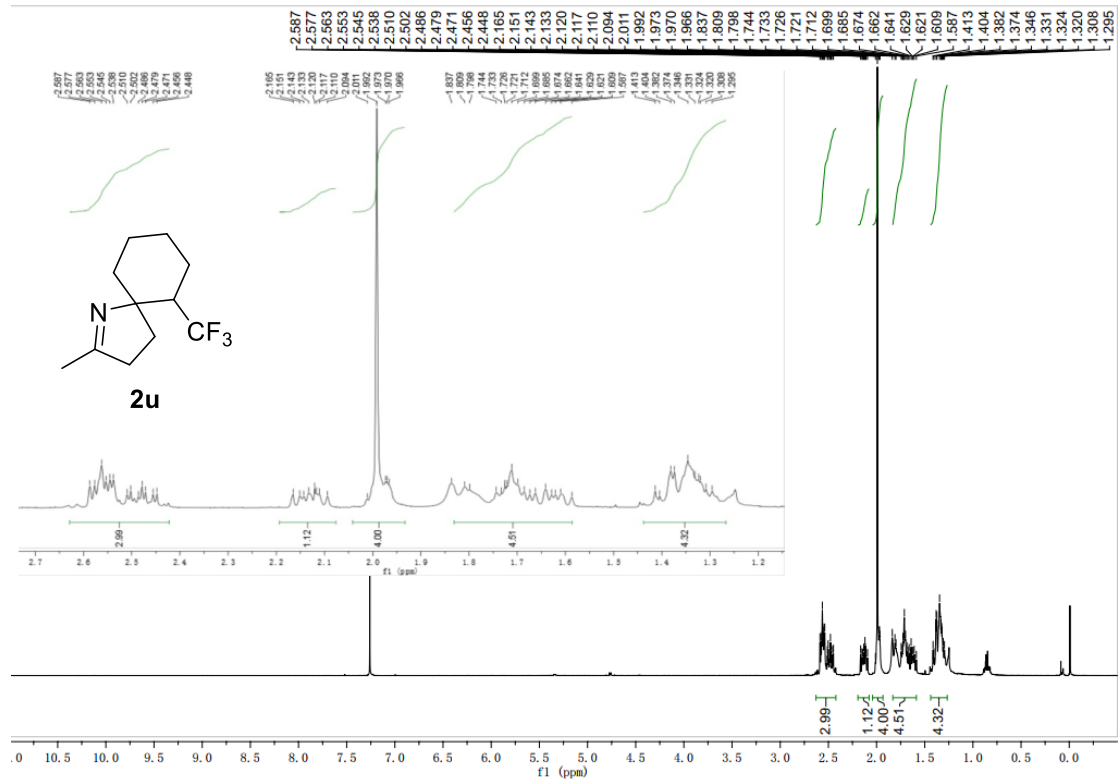




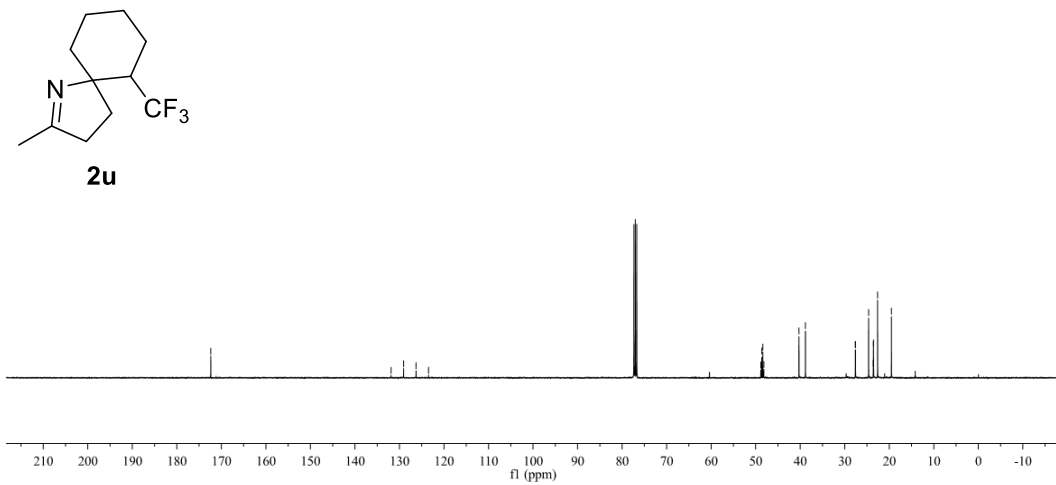




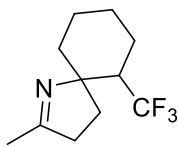




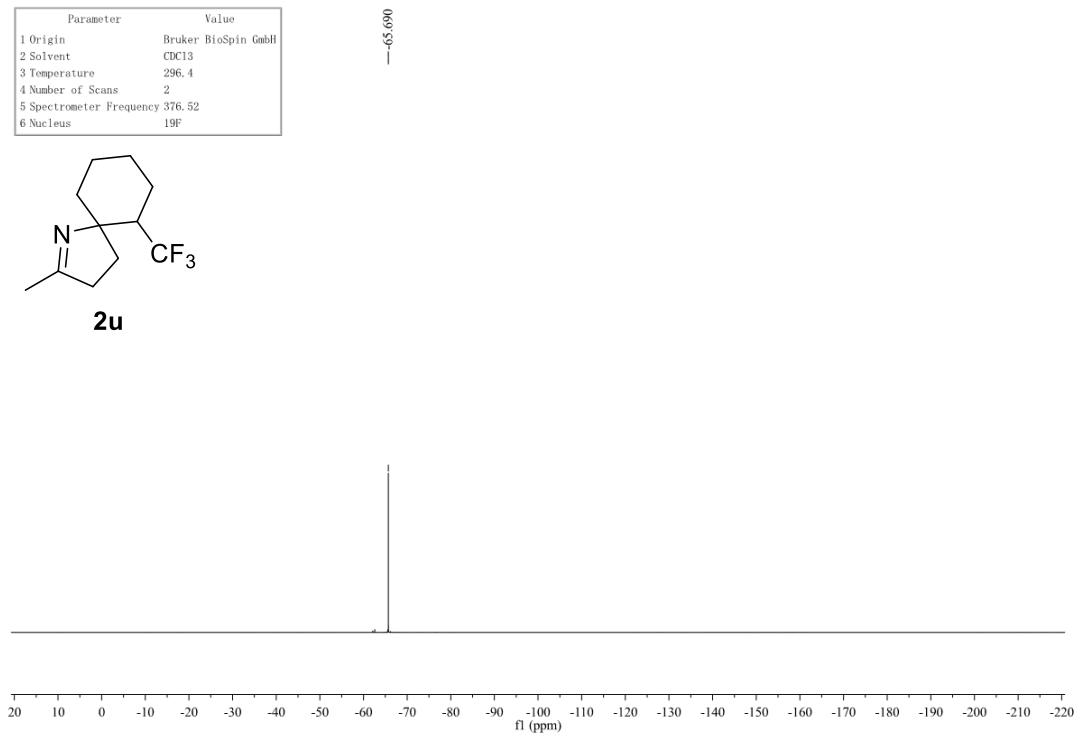
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.4
4 Number of Scans	1024
5 Spectrometer Frequency	100.62
6 Nucleus	13C



Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.4
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

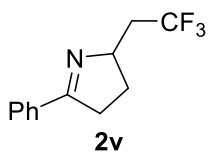


2u

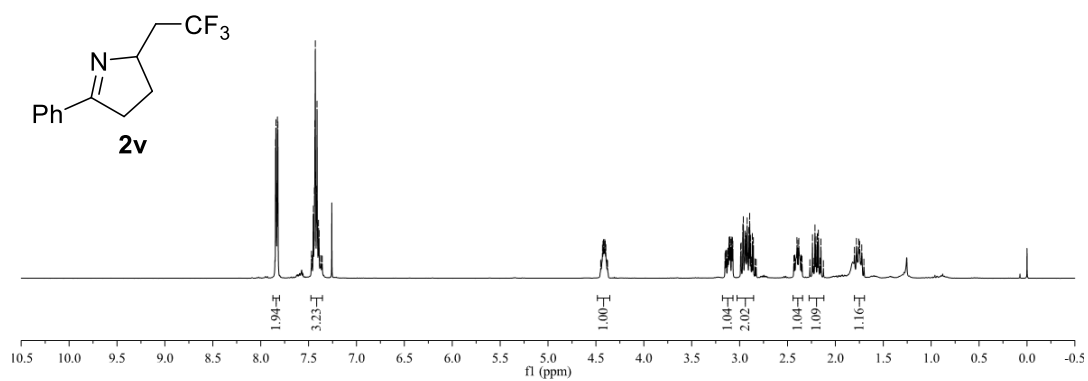


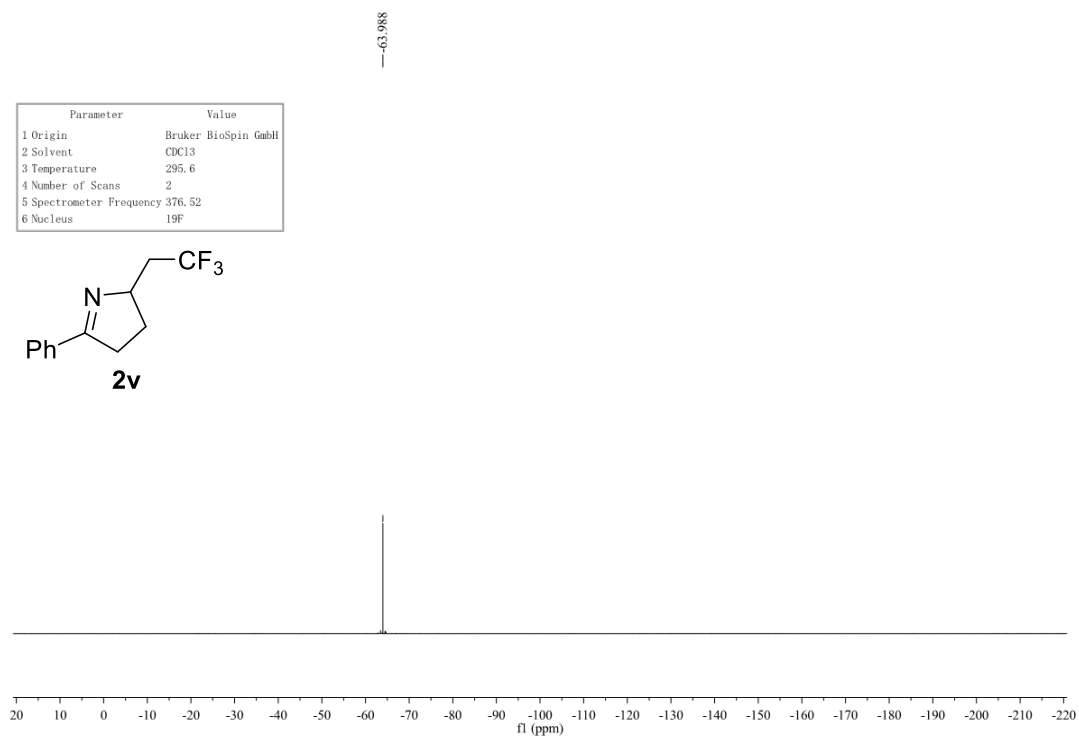
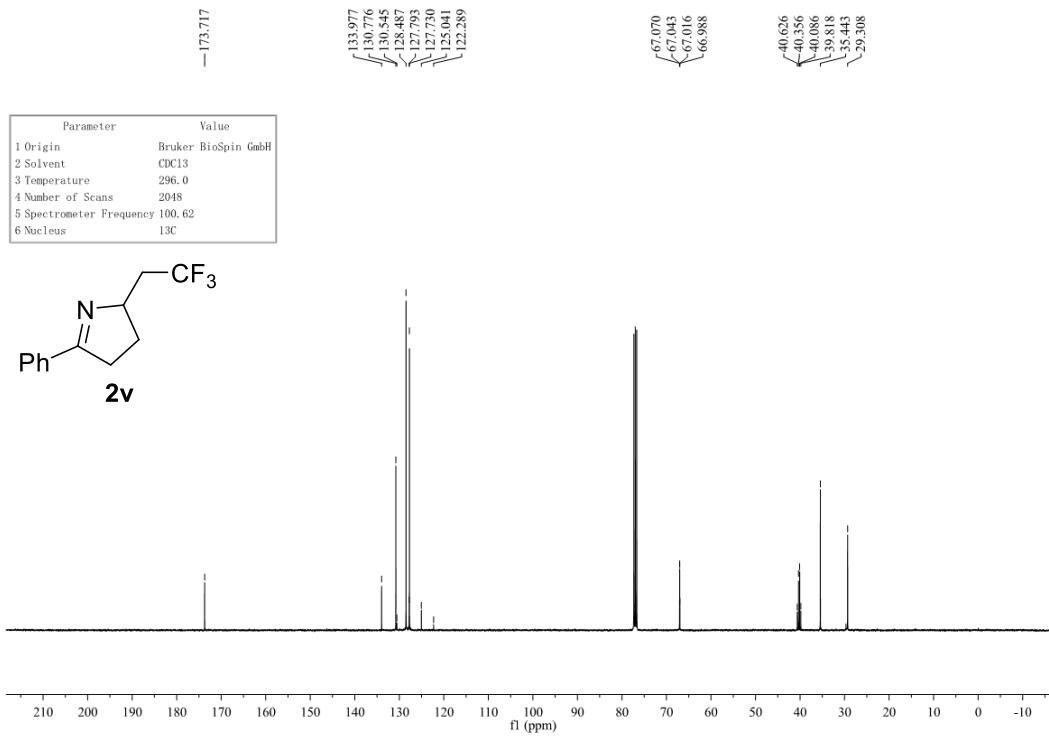
7.845
7.841
7.830
7.825
7.821
7.469
7.450
7.443
7.439
7.434
7.430
7.426
7.419
7.415
7.412
7.390
7.386
7.380
4.432
4.426
4.421
4.415
4.408
4.402
4.397
3.147
3.143
3.138
3.128
3.122
3.118
3.112
3.110
3.105
3.100
3.095
3.085
3.080
3.075
3.070
2.989
2.984
2.966
2.961
2.944
2.939
2.932
2.922
2.913
2.903
2.895
2.884
2.884
2.866
2.856
2.851
2.831
2.820
2.240
2.213
2.203
2.188
2.177
2.151
1.801
1.780
1.756
1.747
1.725

Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.6
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

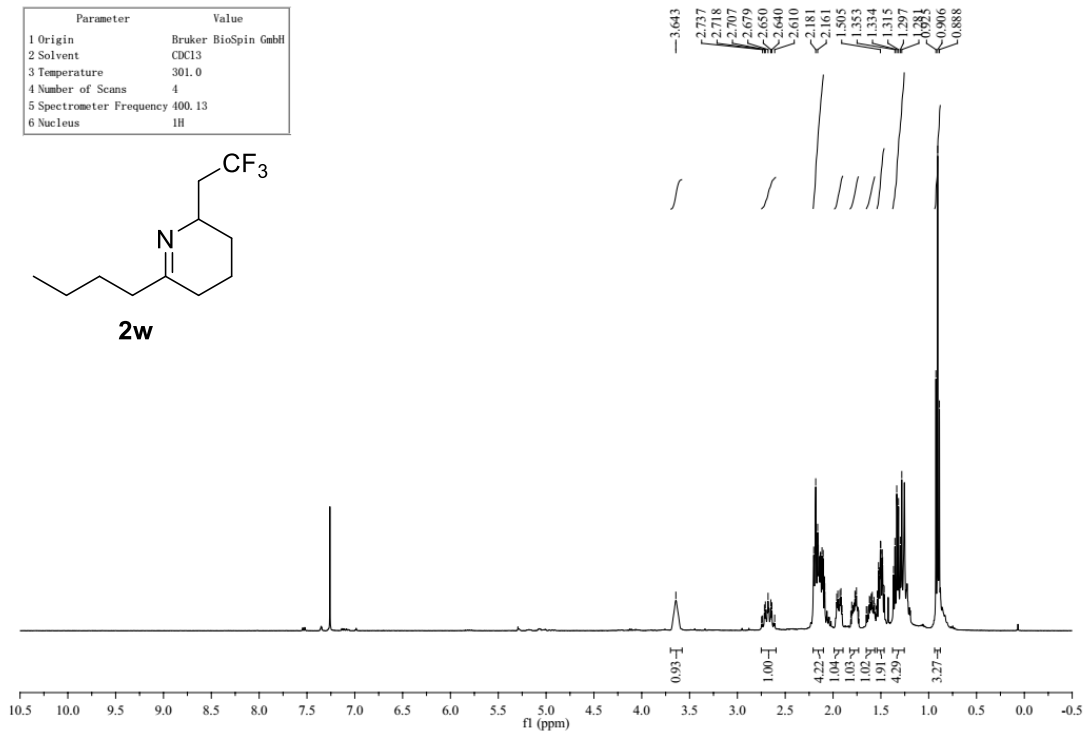
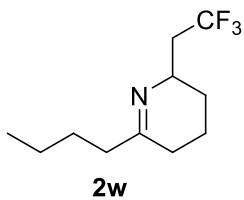


2v

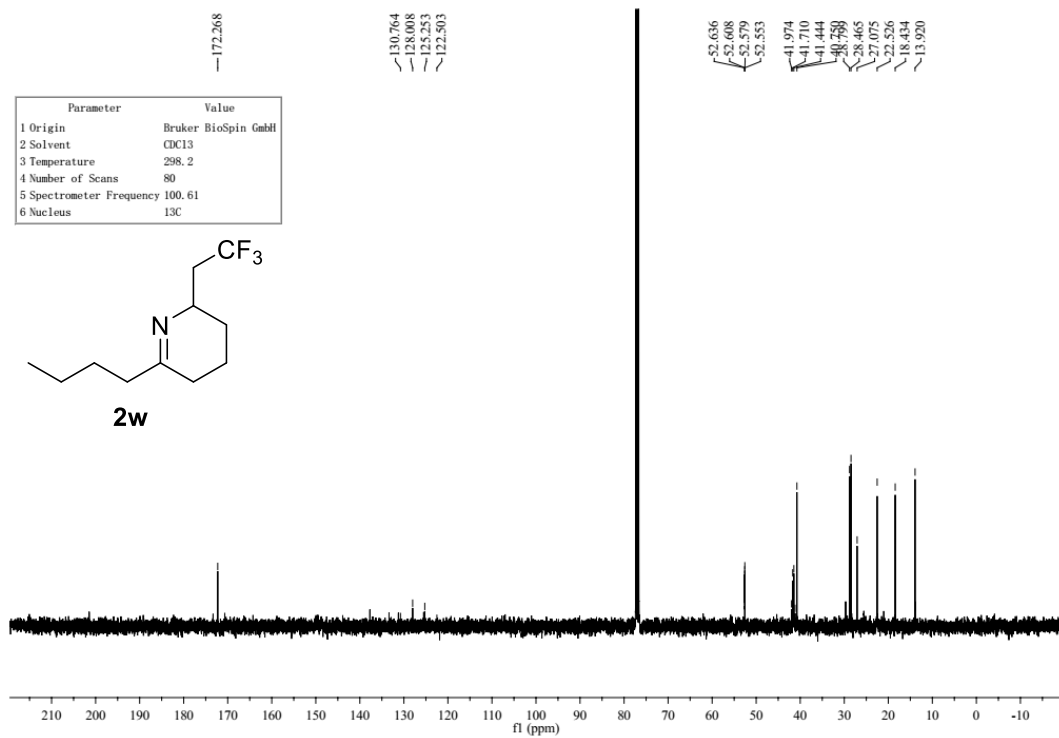
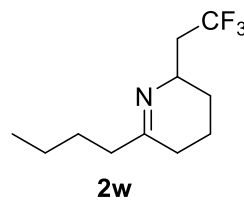




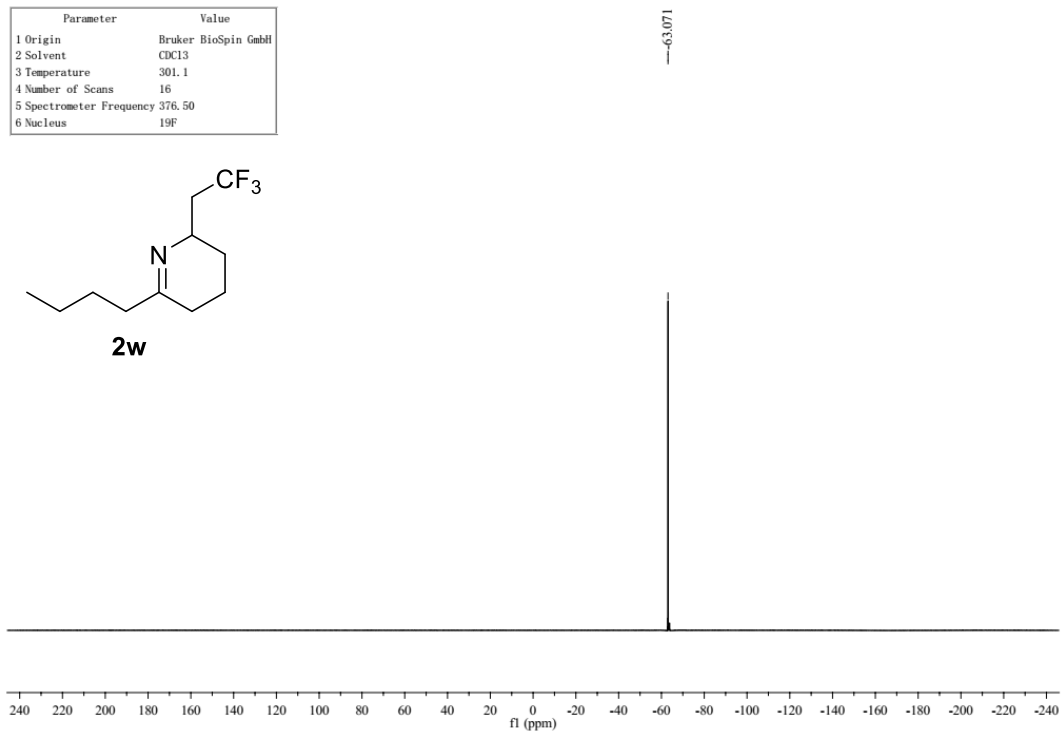
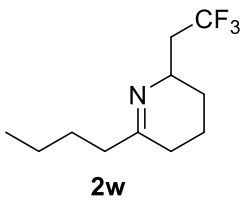
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	301.0
4 Number of Scans	4
5 Spectrometer Frequency	400.13
6 Nucleus	¹ H



Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	80
5 Spectrometer Frequency	100.61
6 Nucleus	¹³ C

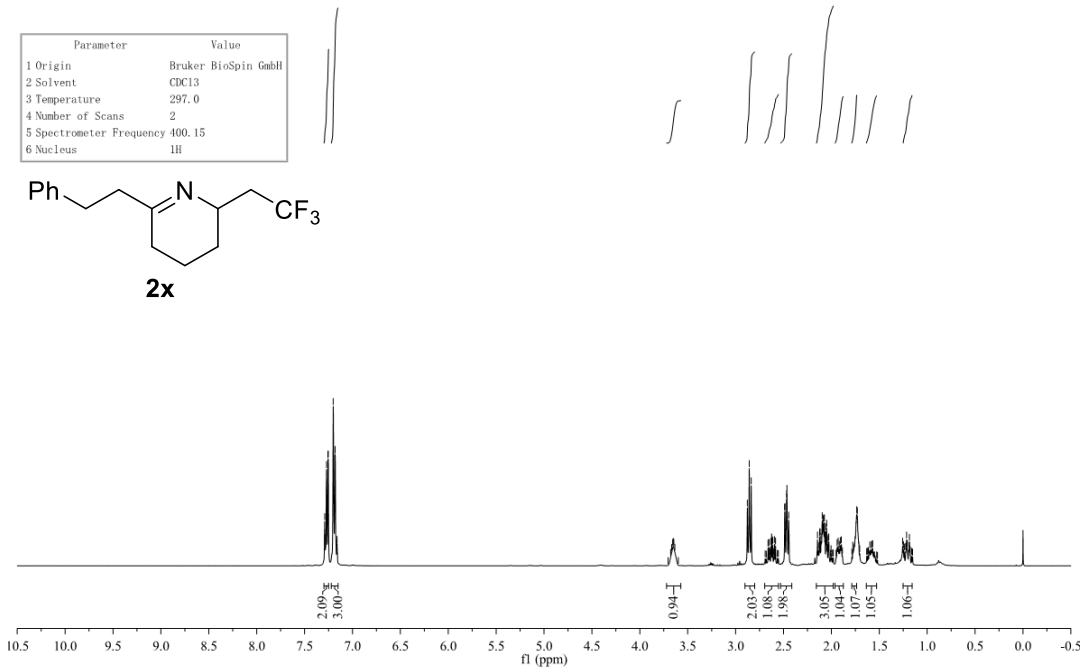
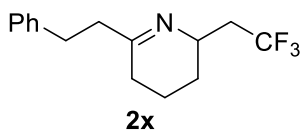


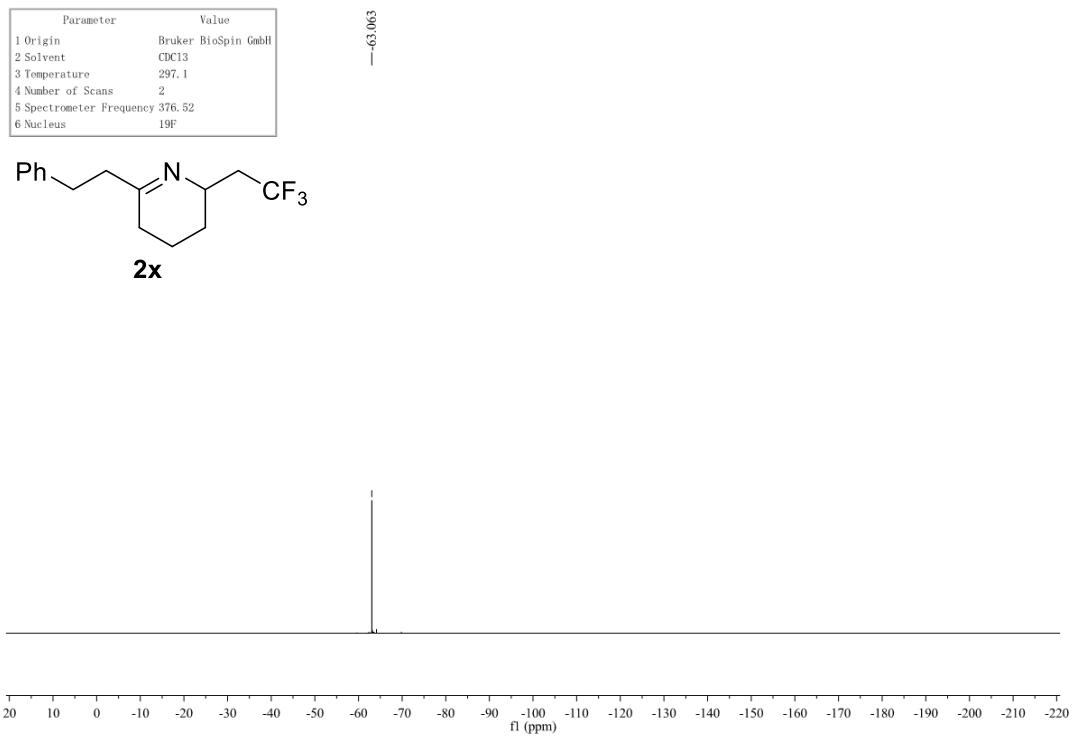
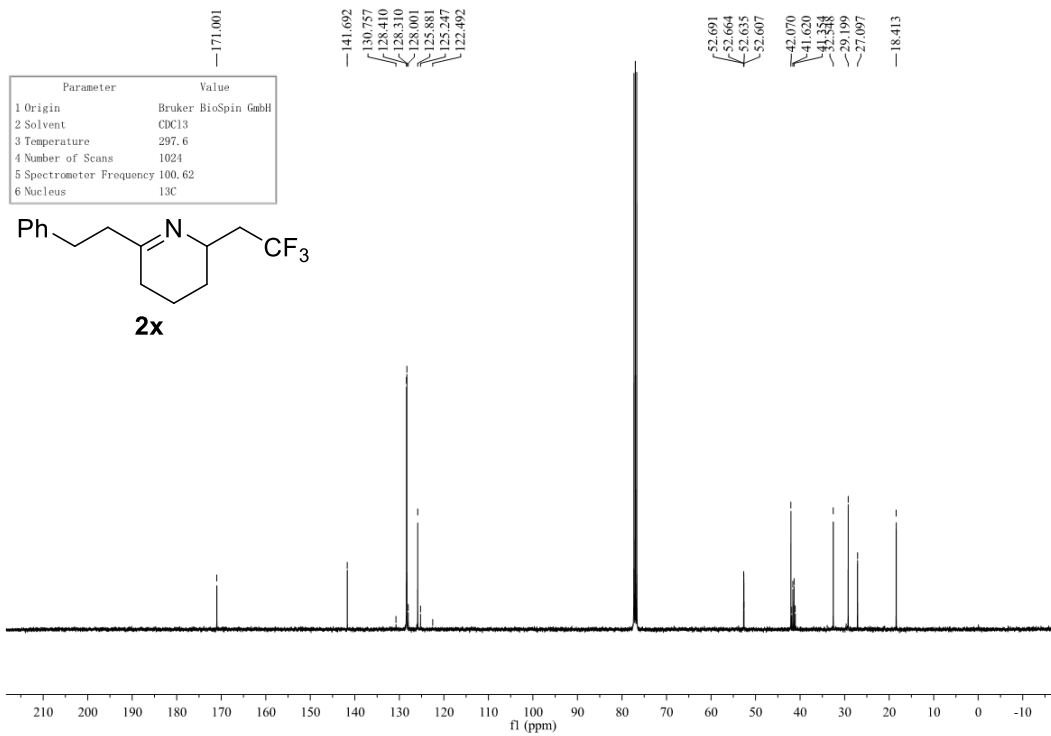
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	301.1
4 Number of Scans	16
5 Spectrometer Frequency	376.50
6 Nucleus	19F

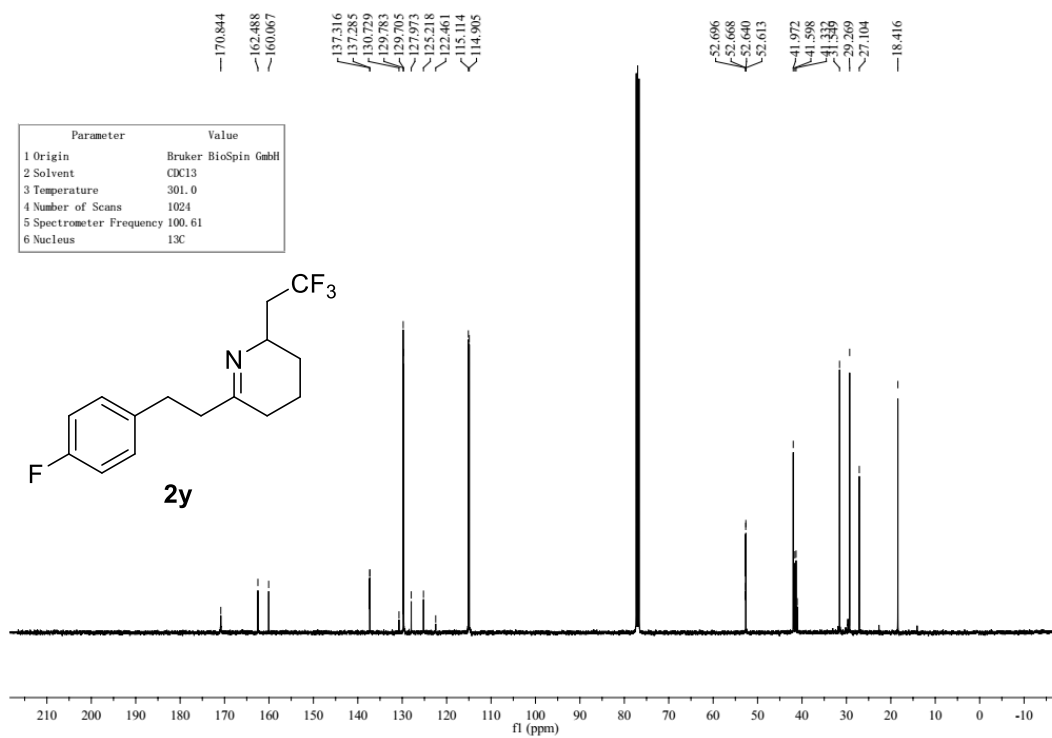
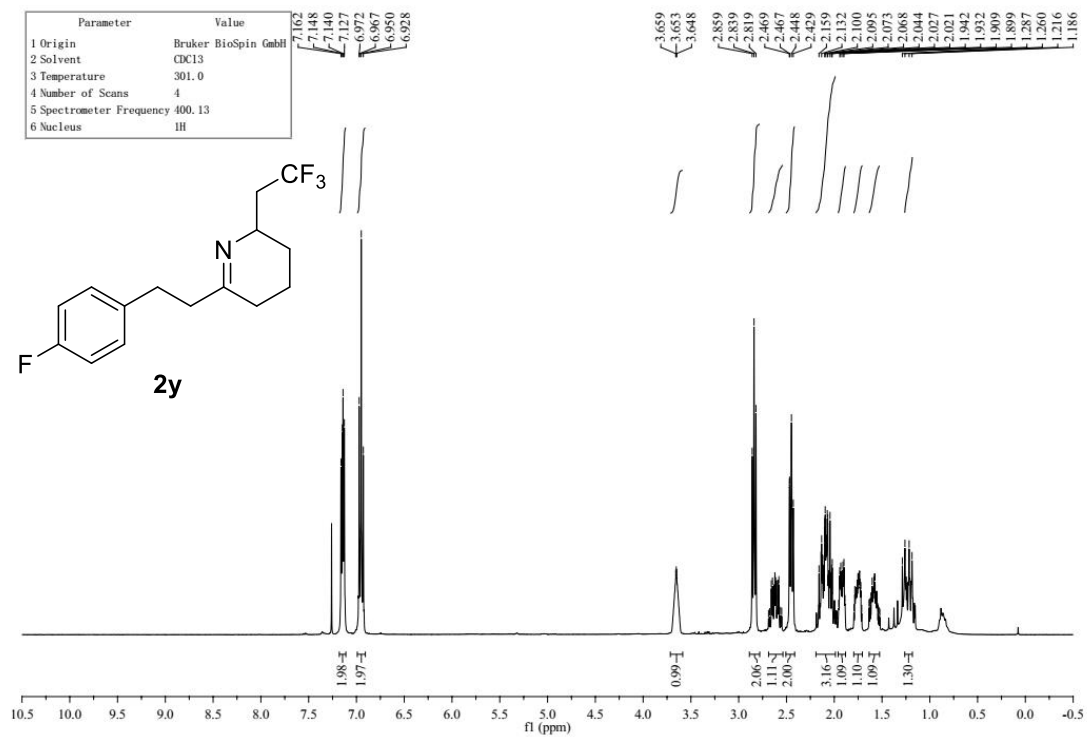


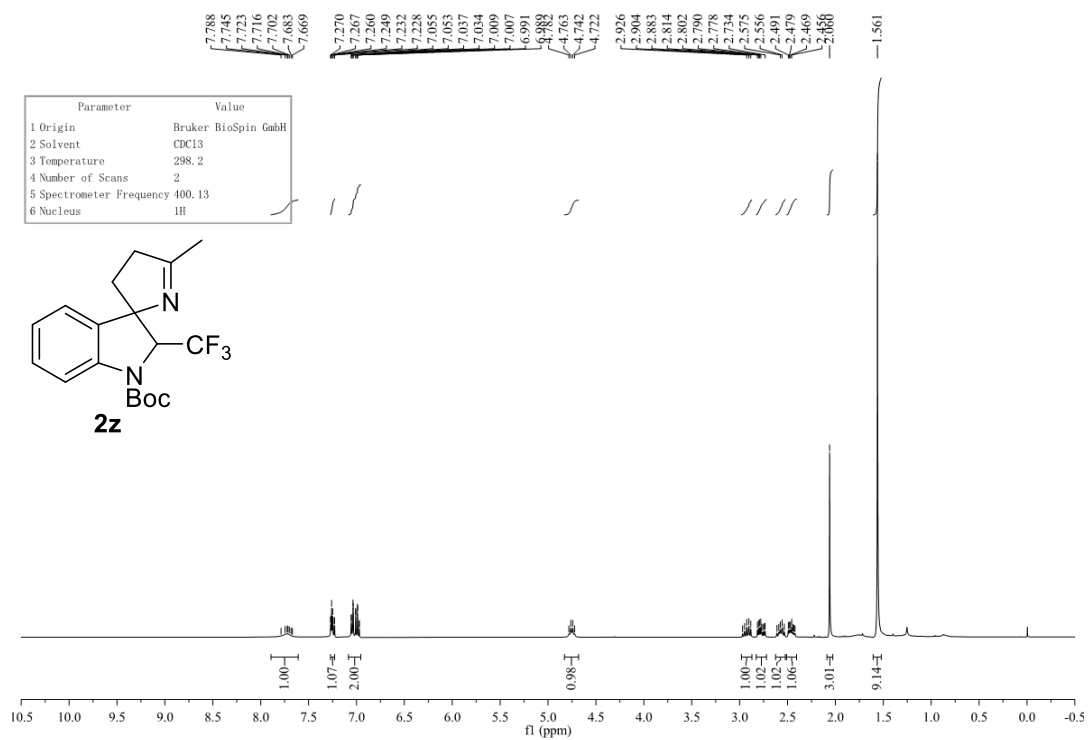
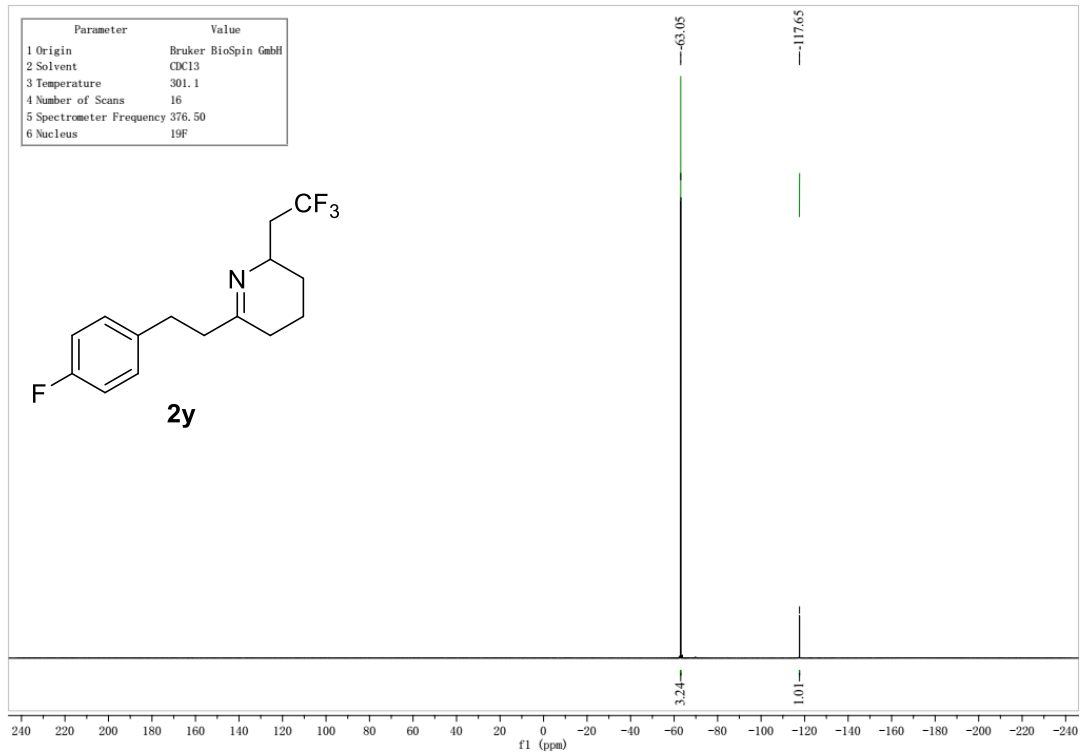
7.290
7.286
7.271
7.256
7.253
7.201
7.183
7.181
7.164
7.161
3.667
3.656
3.651
3.646
3.634
3.631
3.627
3.623
3.620
3.613
3.594
3.583
3.487
3.484
3.473
3.468
3.464
3.446
2.146
2.135
2.123
2.118
2.113
2.108
2.096
2.086
2.081
2.073
2.067
2.058
2.050
2.043
2.033
2.027
1.940
1.929
1.918
1.907
1.896
1.877
1.776
1.750
1.598
1.581
1.578
1.569
1.256
1.248
1.239
1.224
1.215
1.209
1.191
1.185

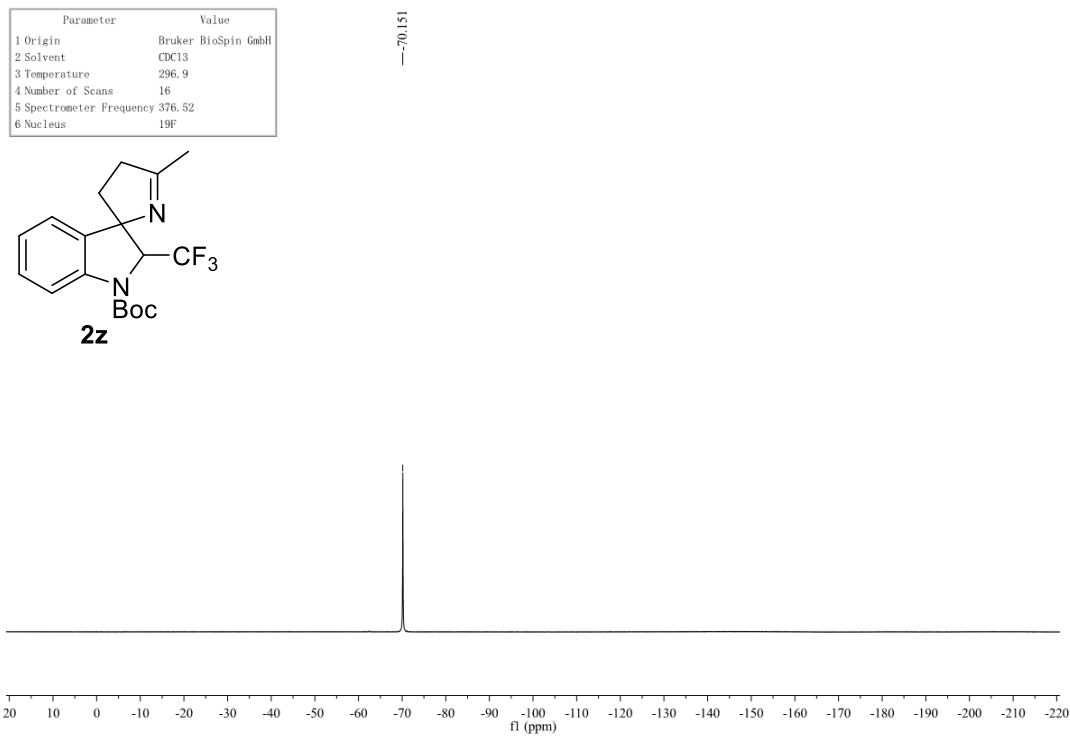
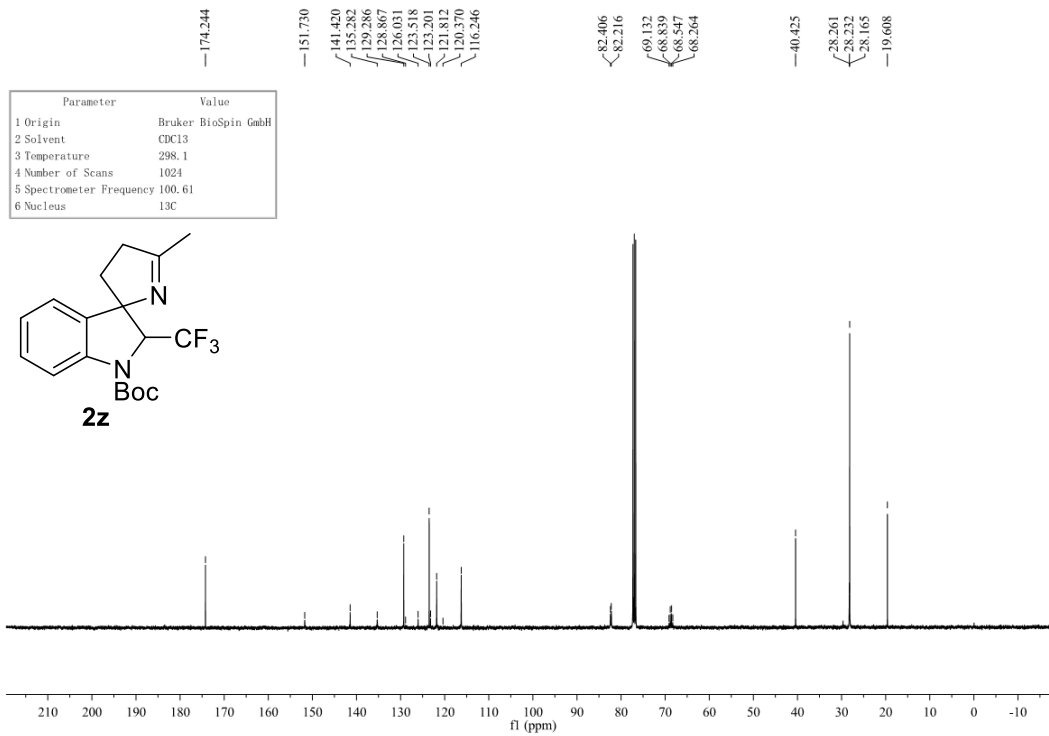
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.0
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

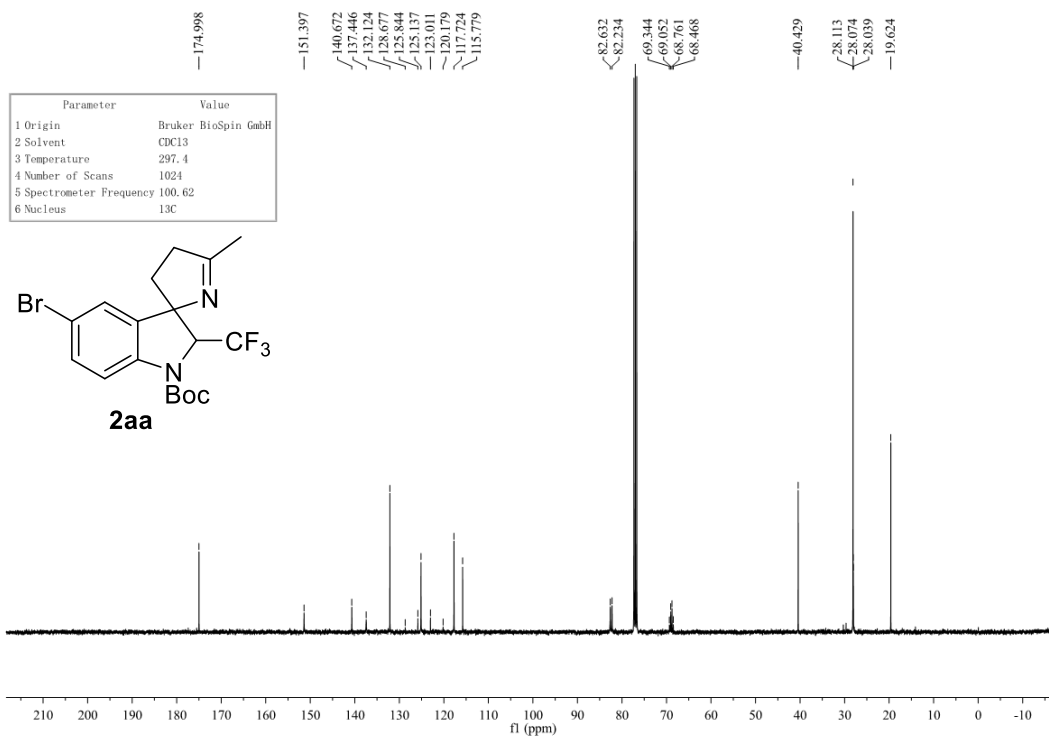
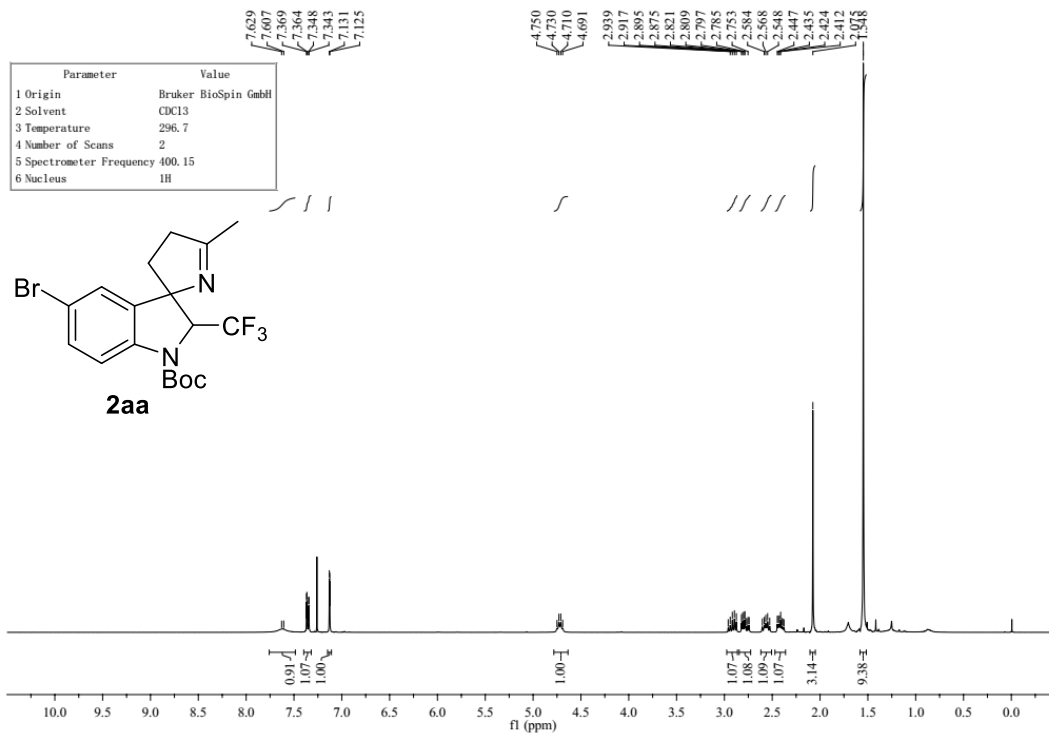




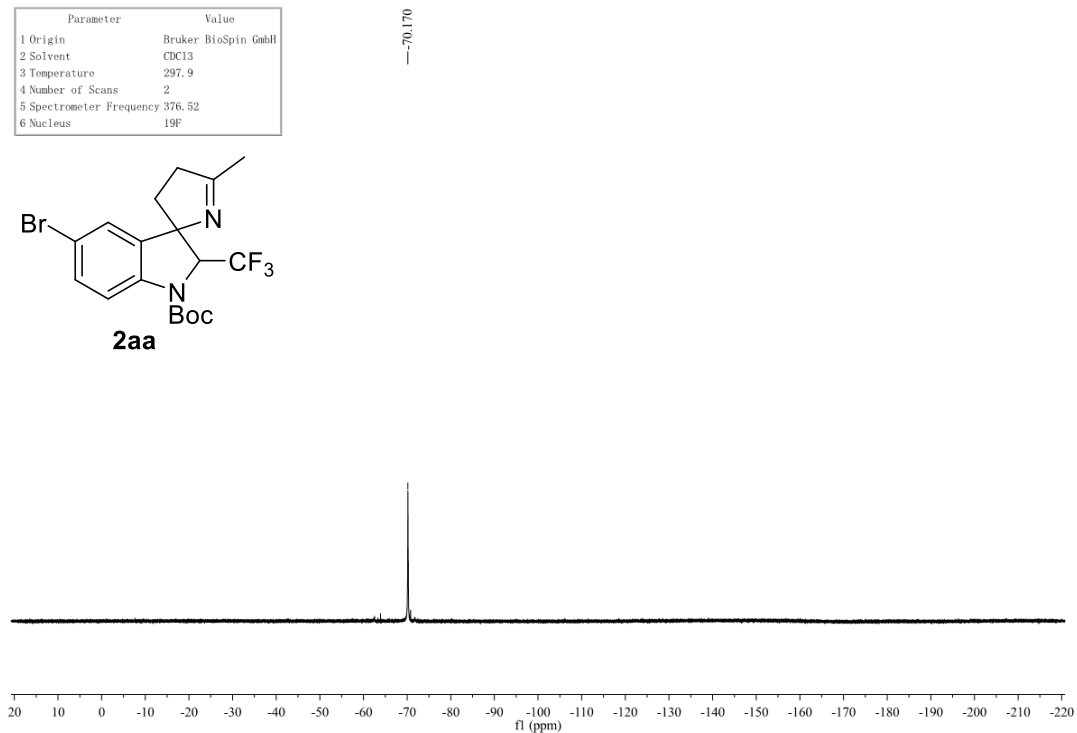
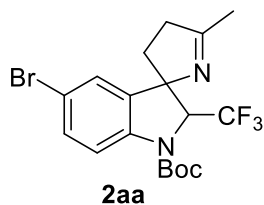




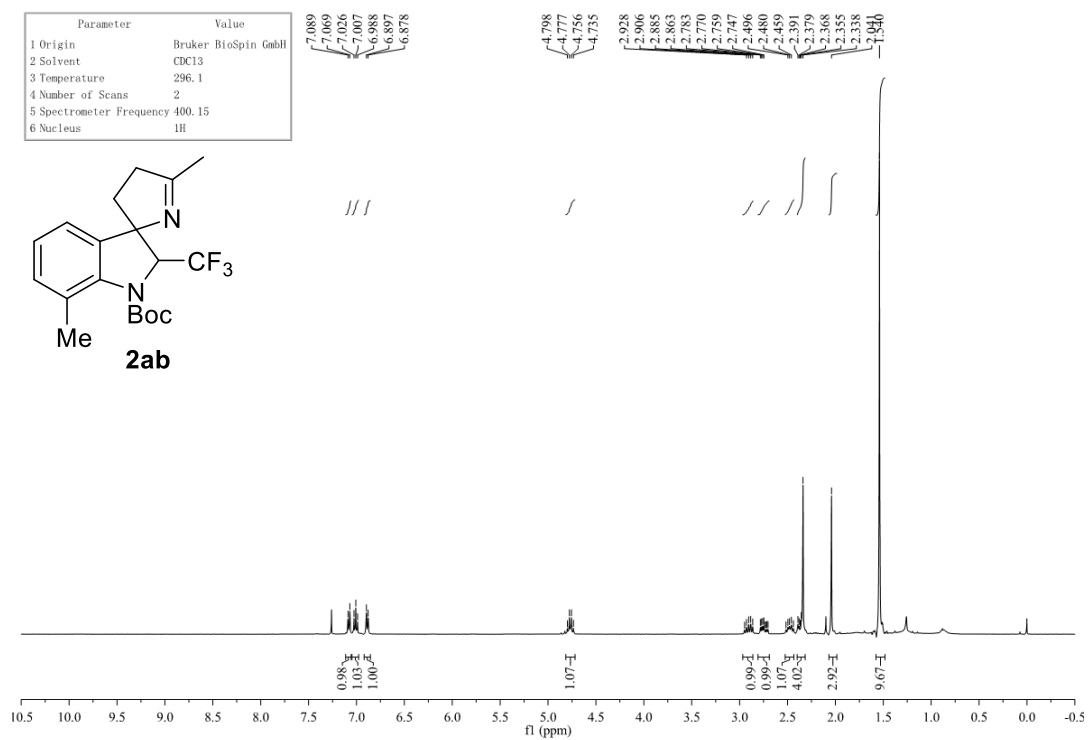
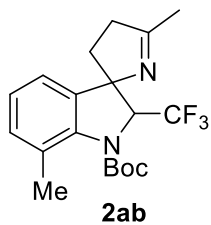


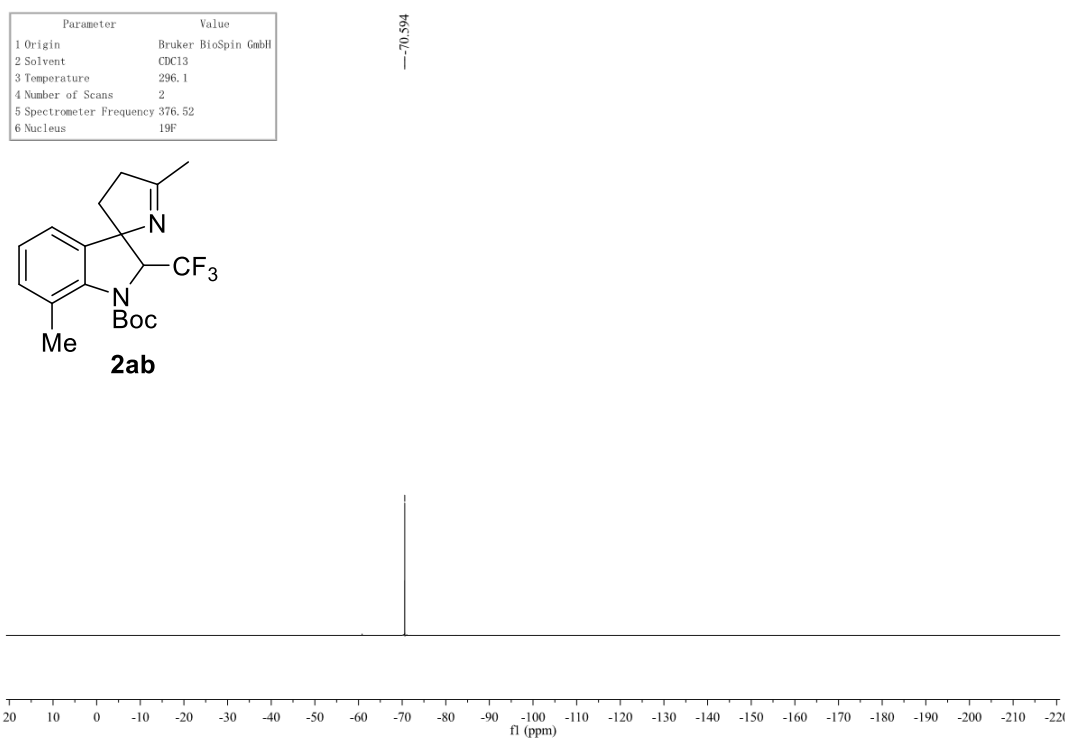
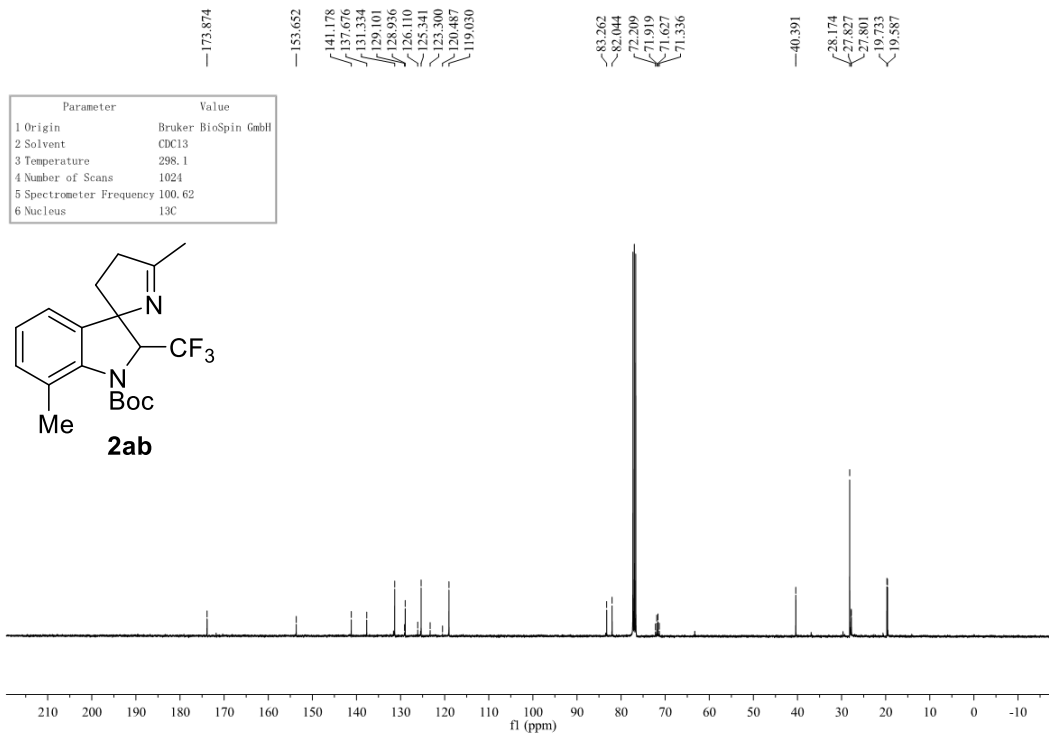


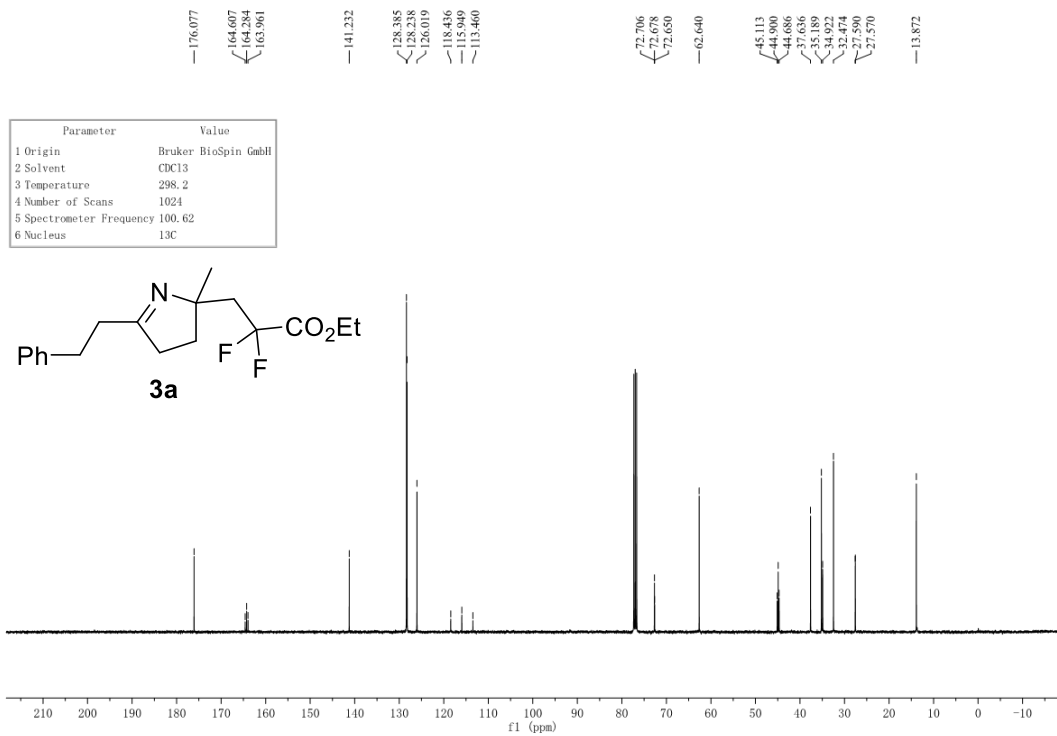
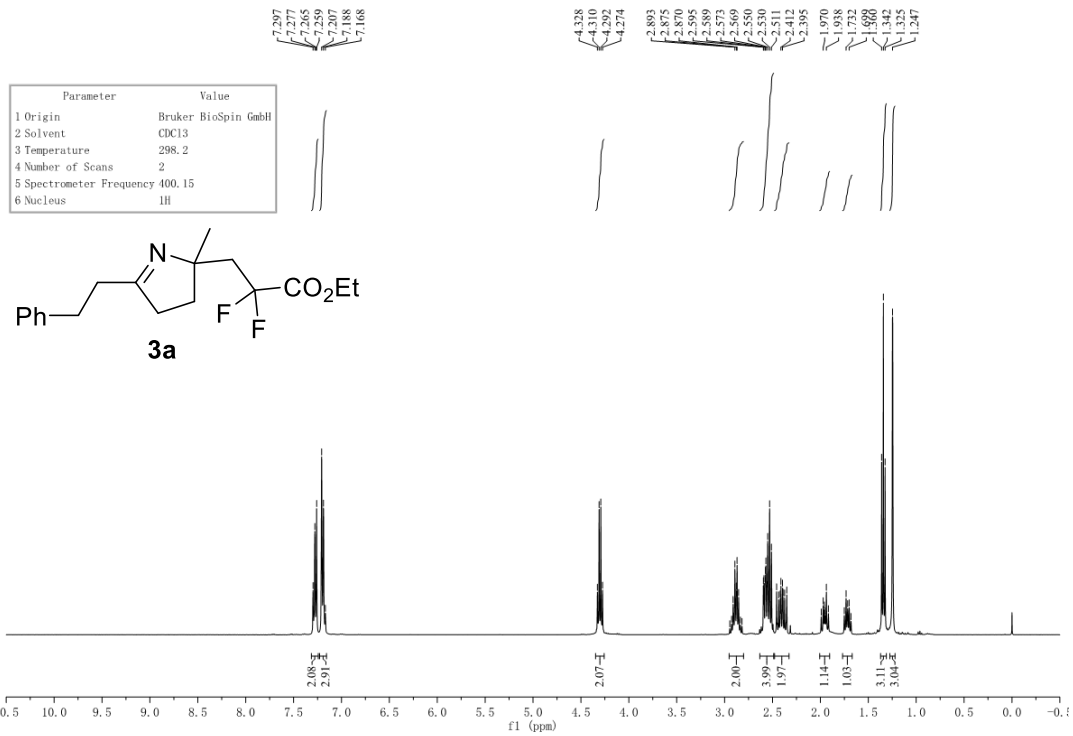
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.9
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F



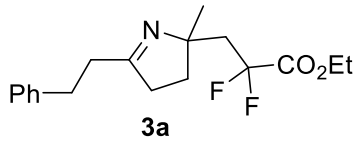
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.1
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H



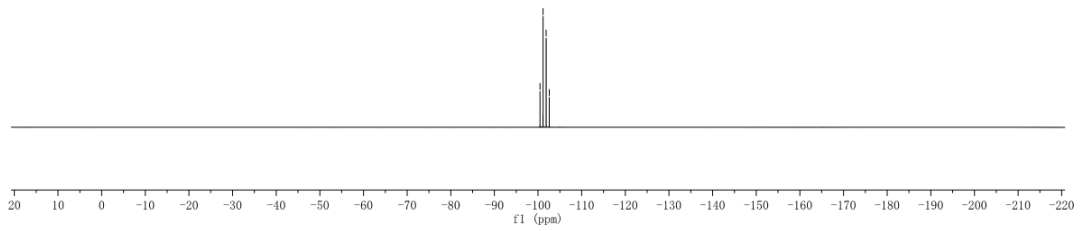




Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F



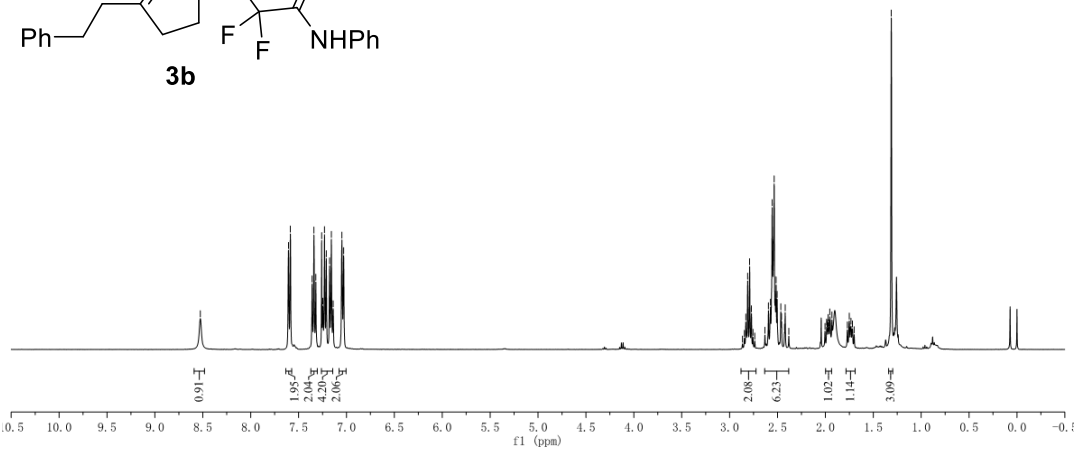
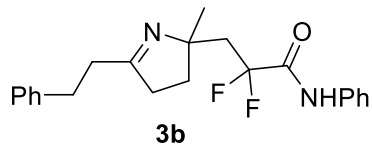
100.548
-101.148
-101.863
-102.562

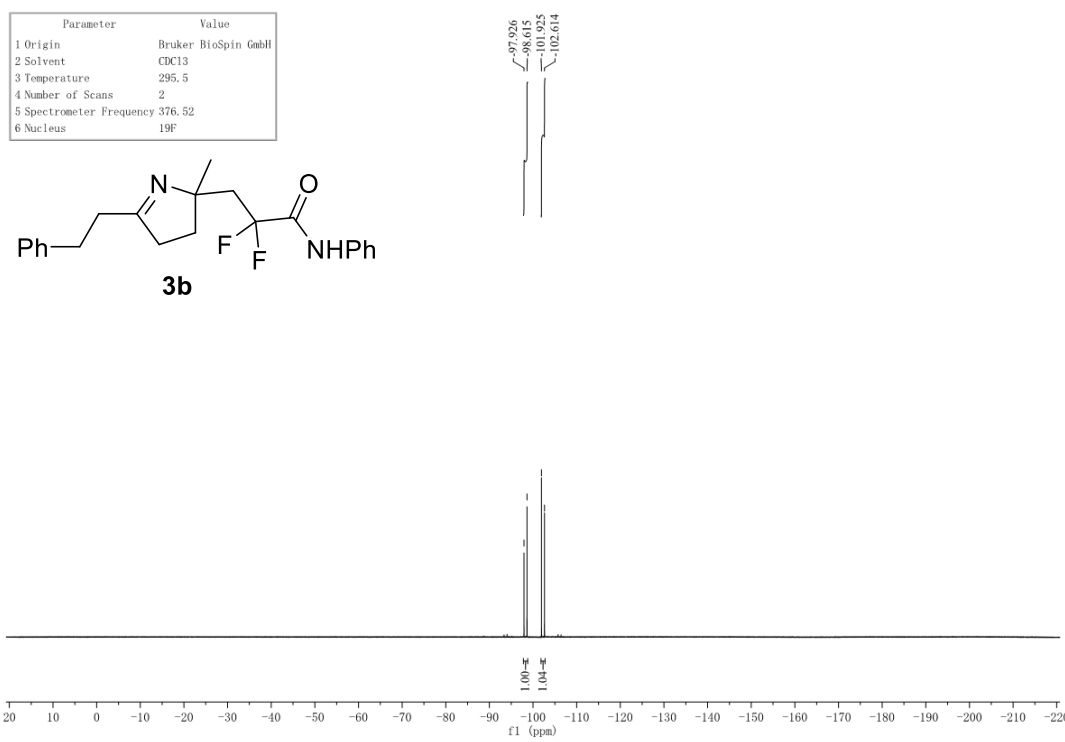
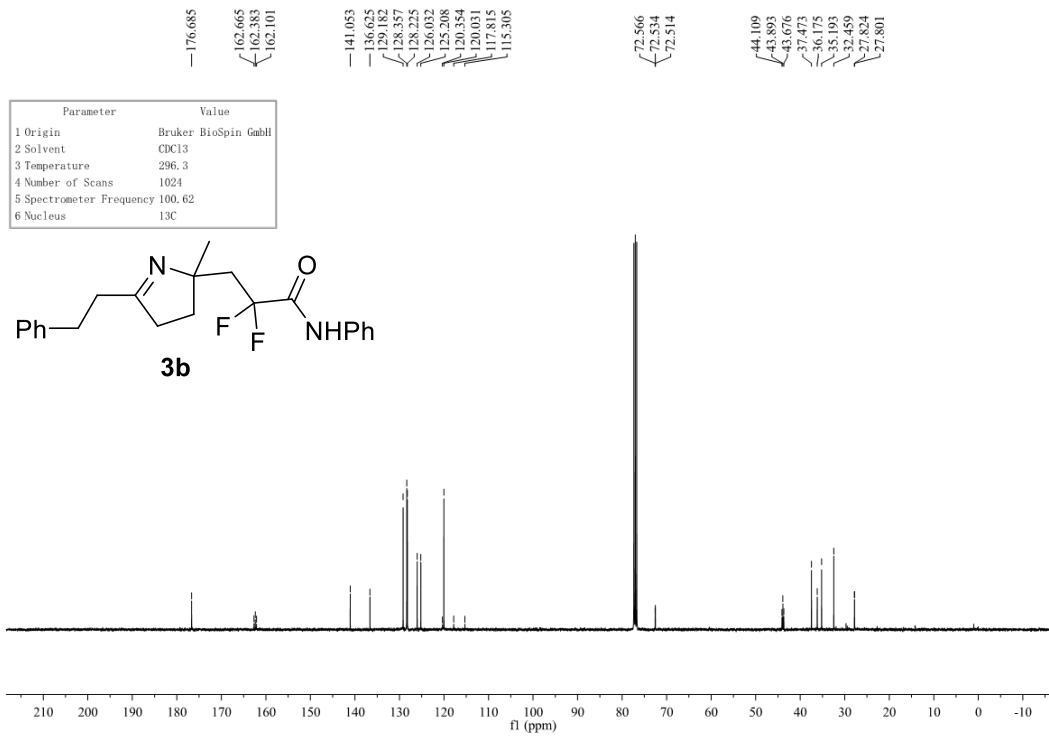


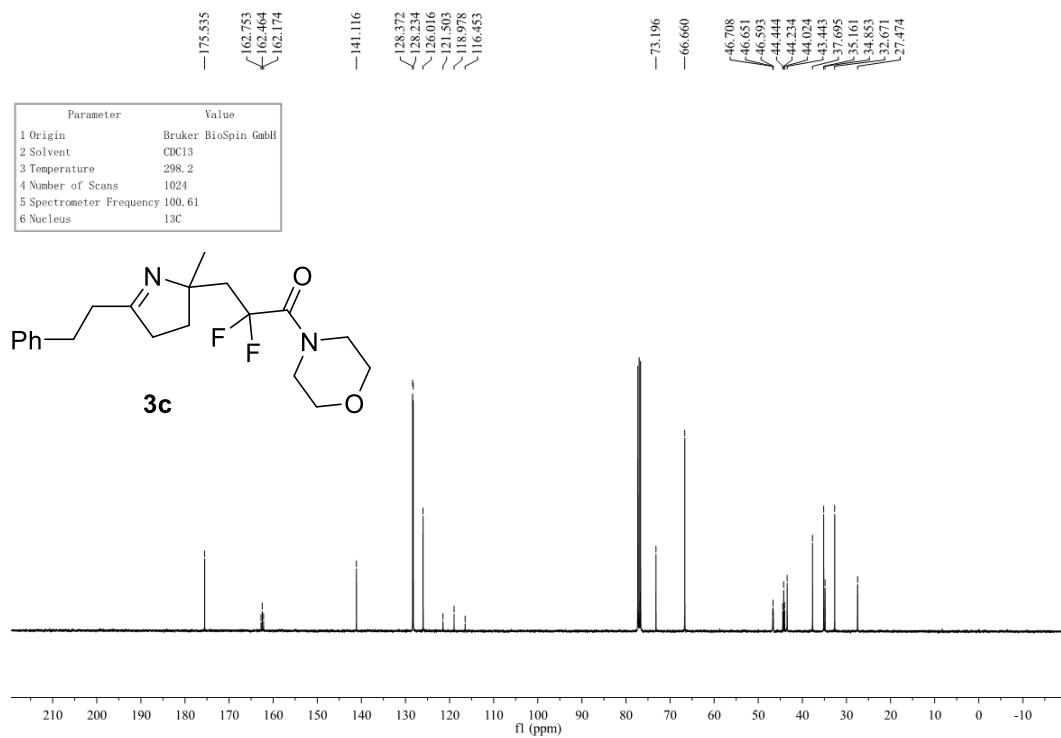
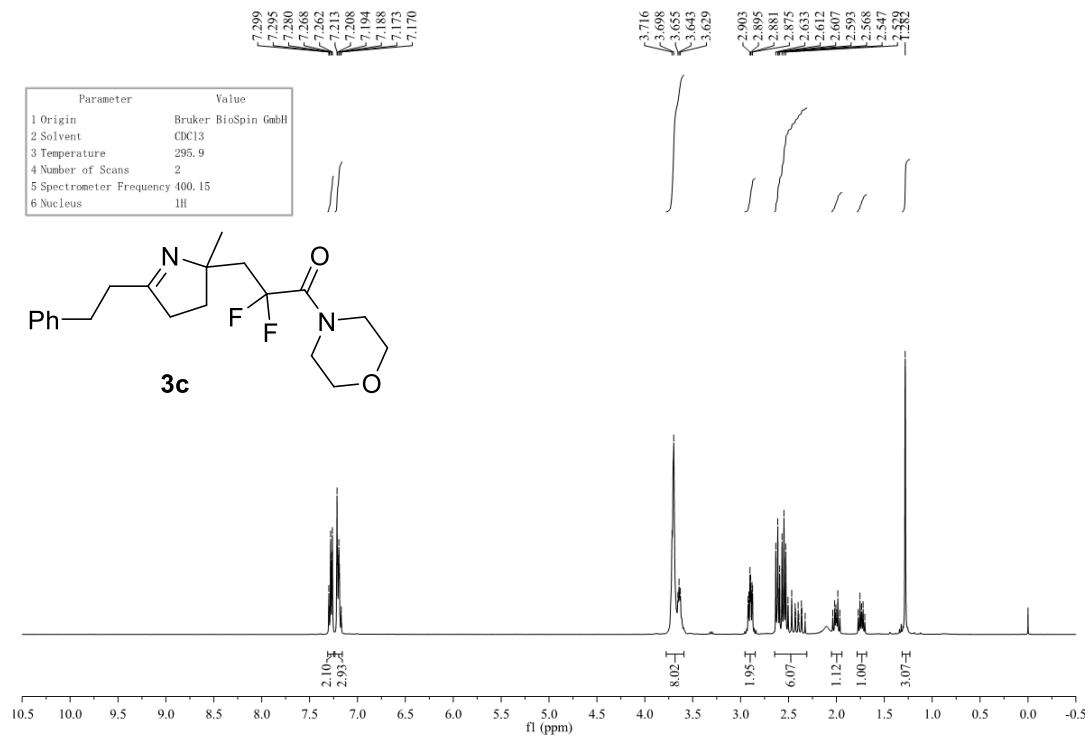
8.525
7.605
7.586
7.540
7.340
7.330
7.259
7.247
7.229
7.211
7.176
7.138
7.108
7.048
7.030

2.866
2.845
2.831
2.811
2.791
2.772
2.757
2.737
2.717
2.694
2.573
2.556
2.535
2.524
2.515
2.504
2.488
2.427
2.420
2.382

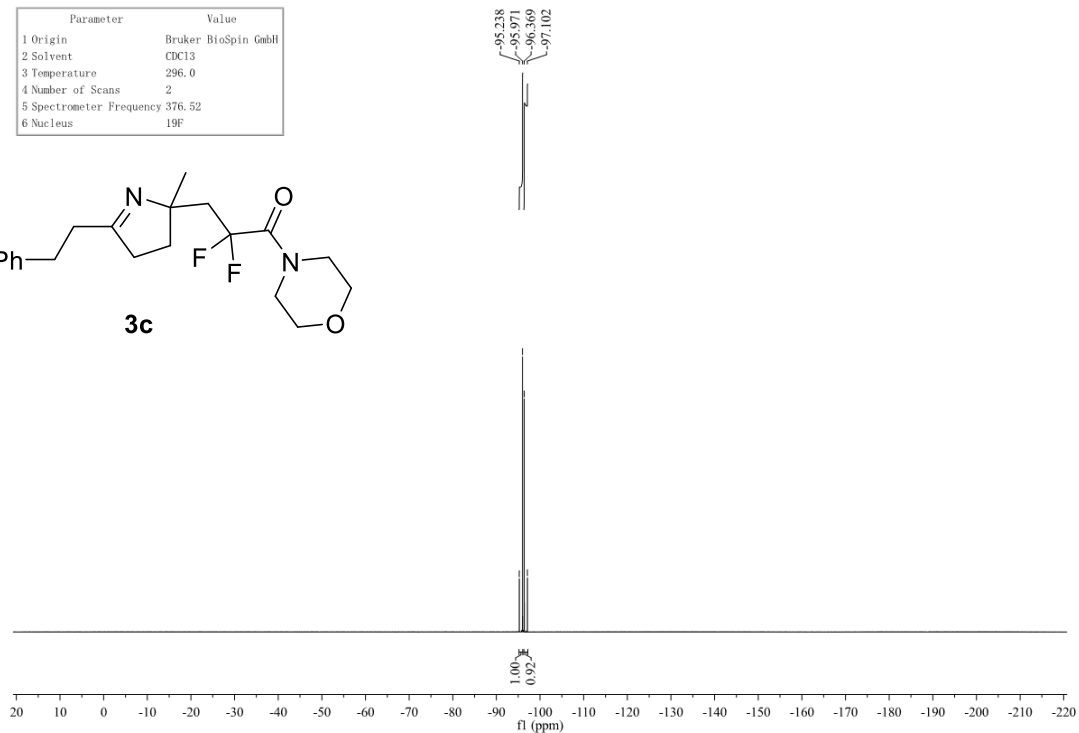
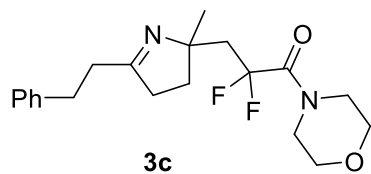
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.5
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H



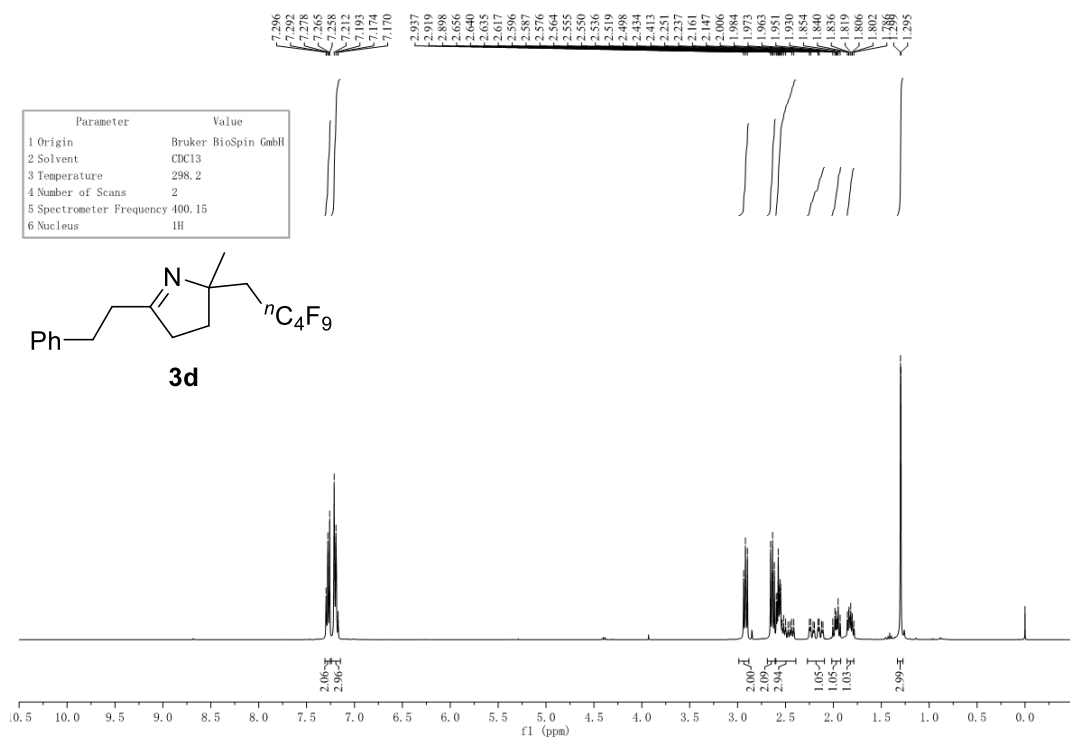
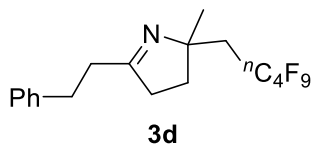


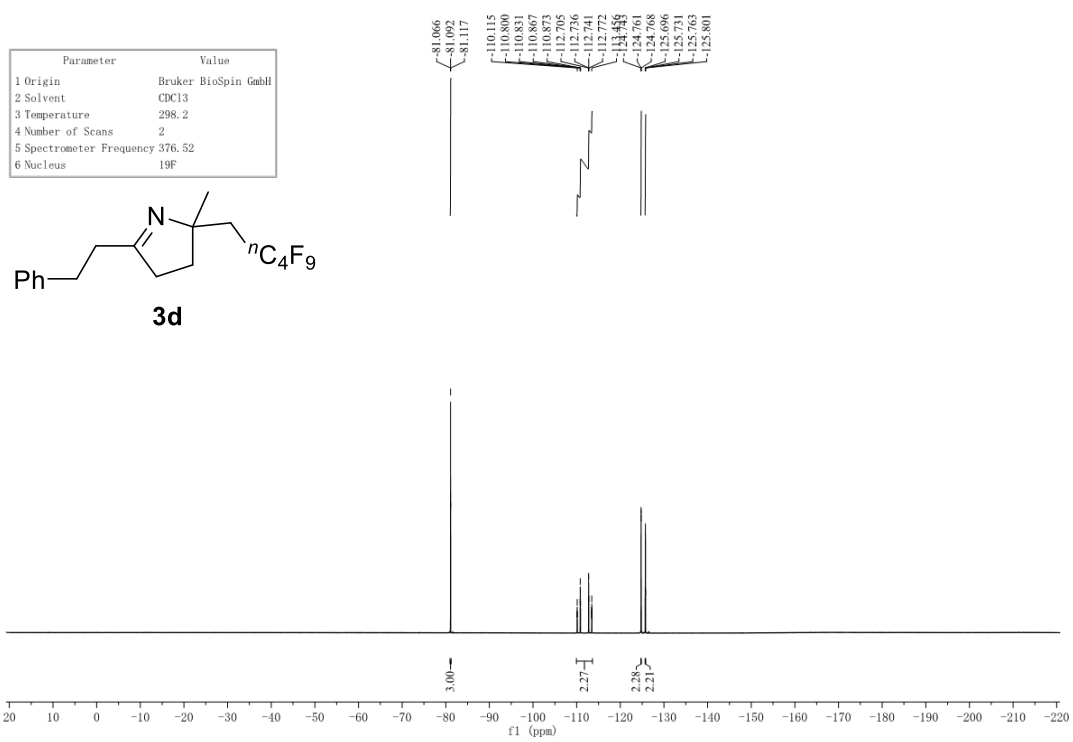
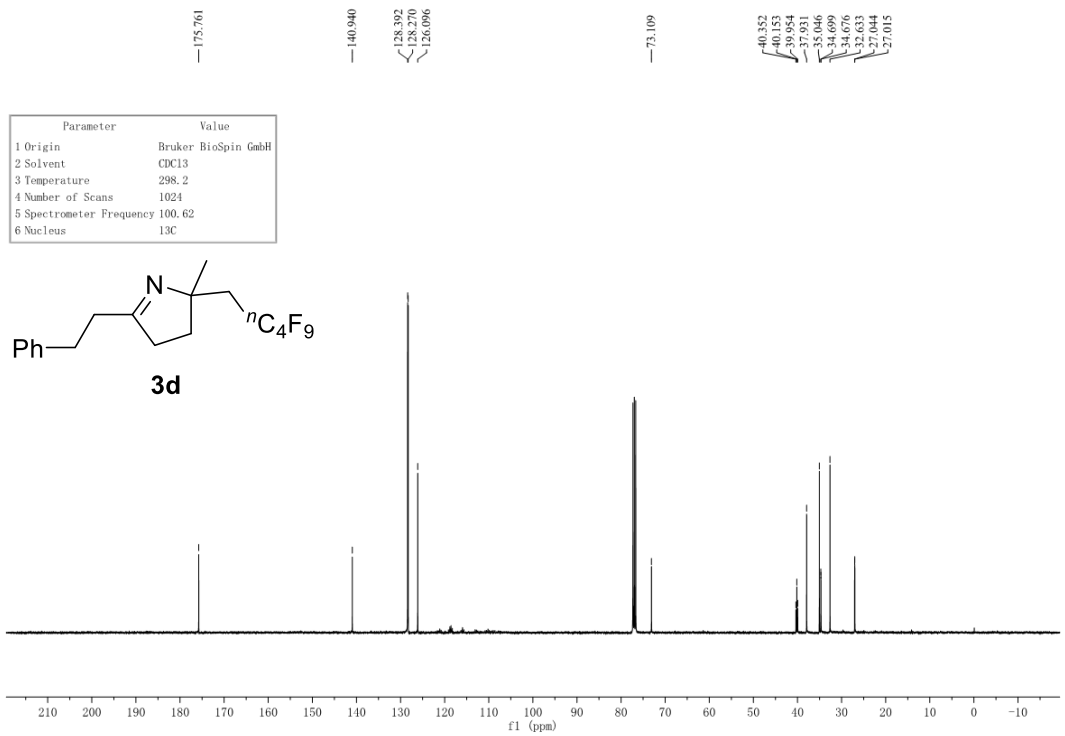


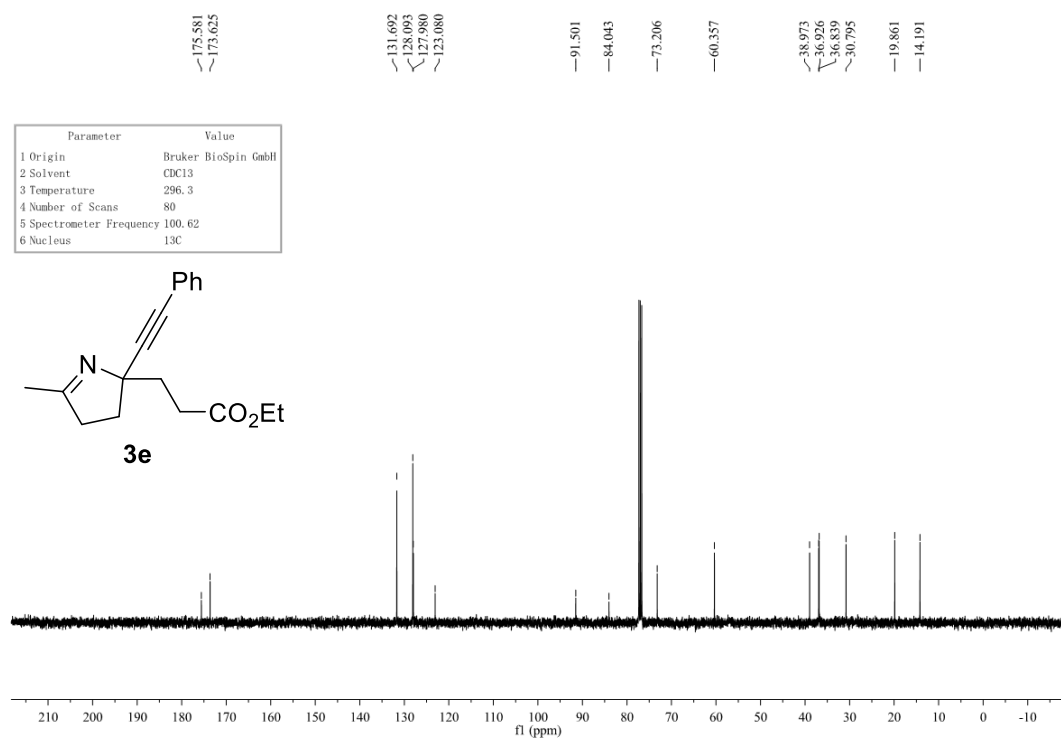
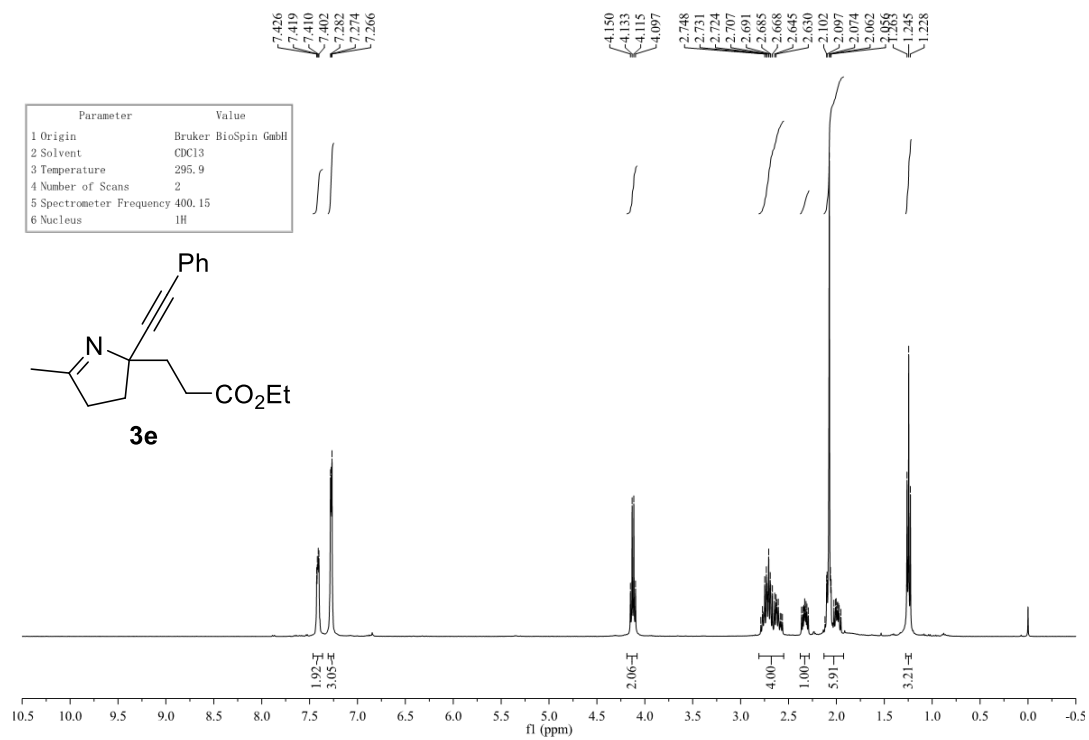
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.0
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

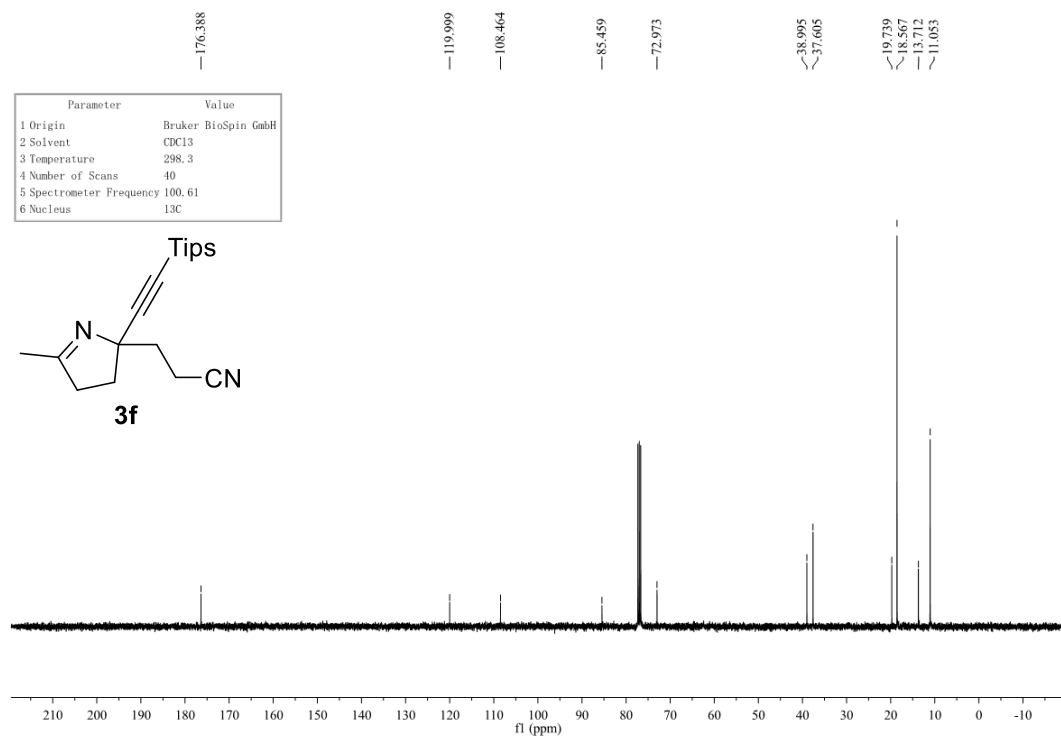
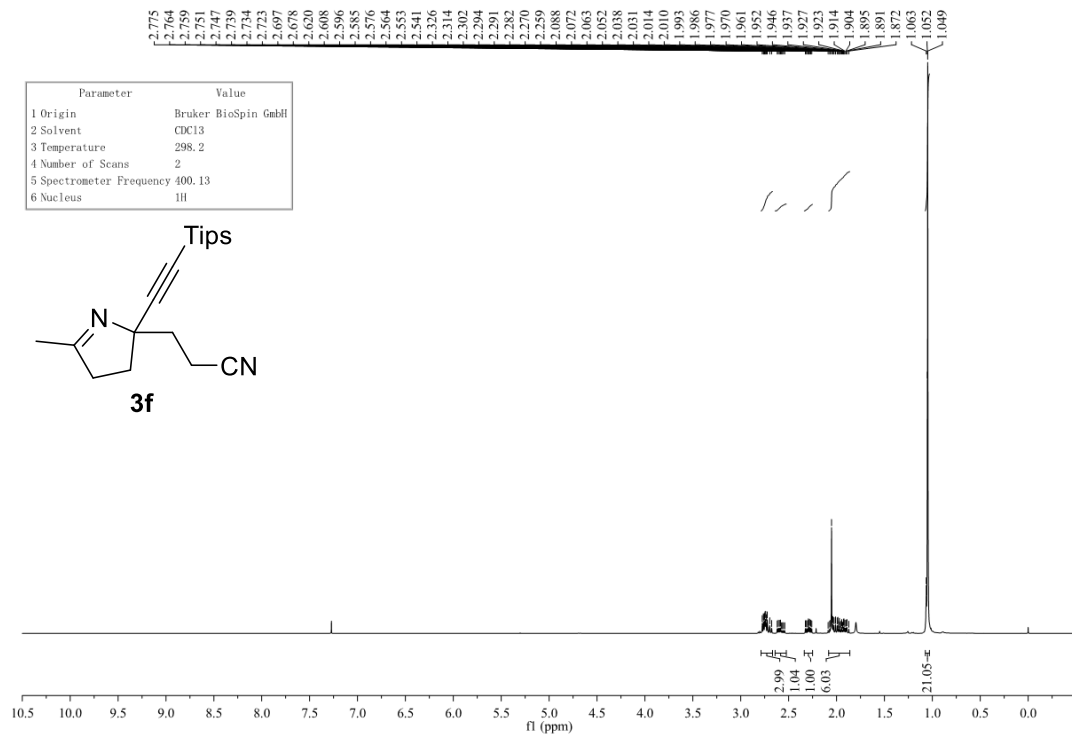


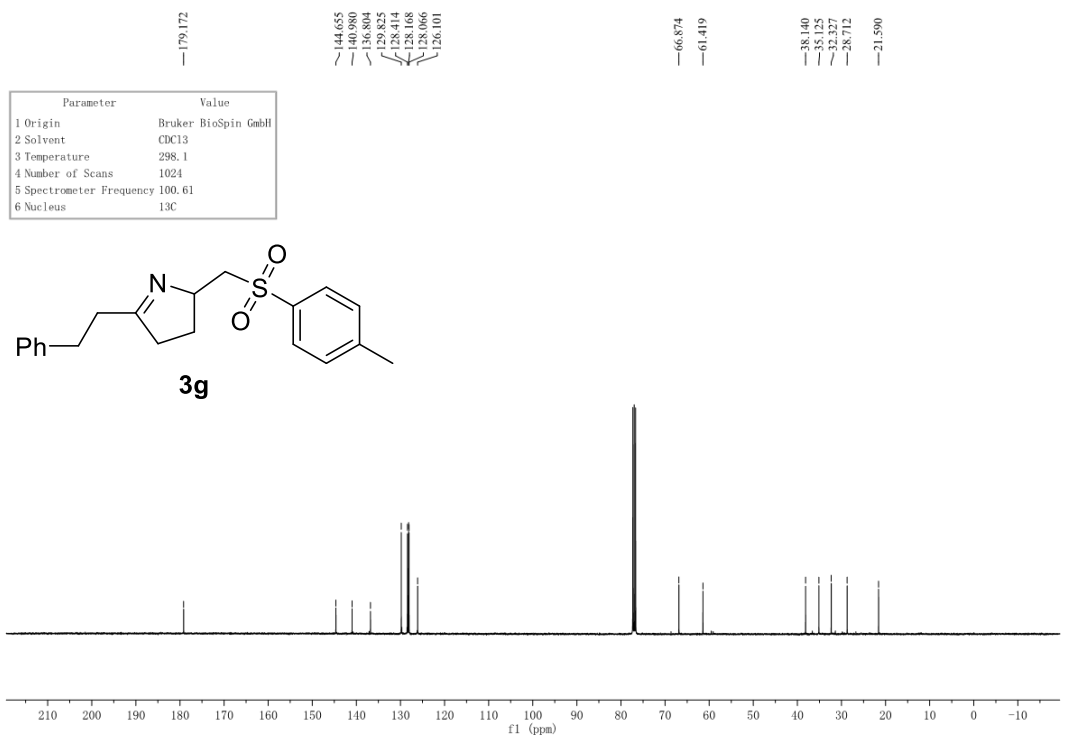
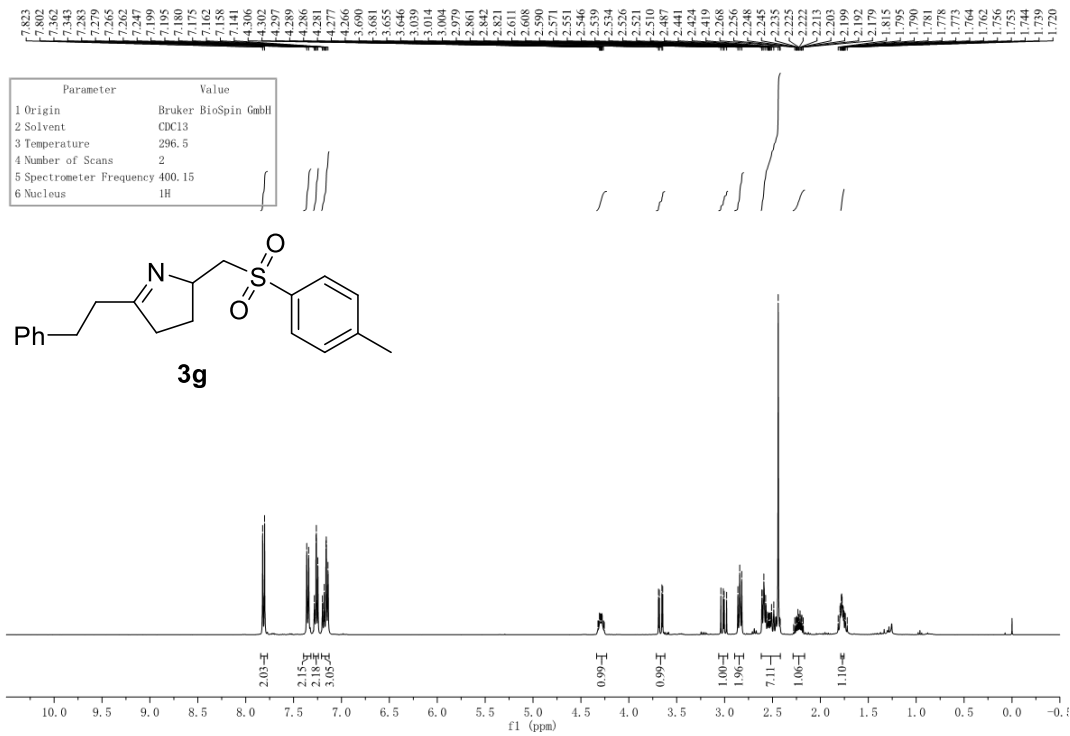
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

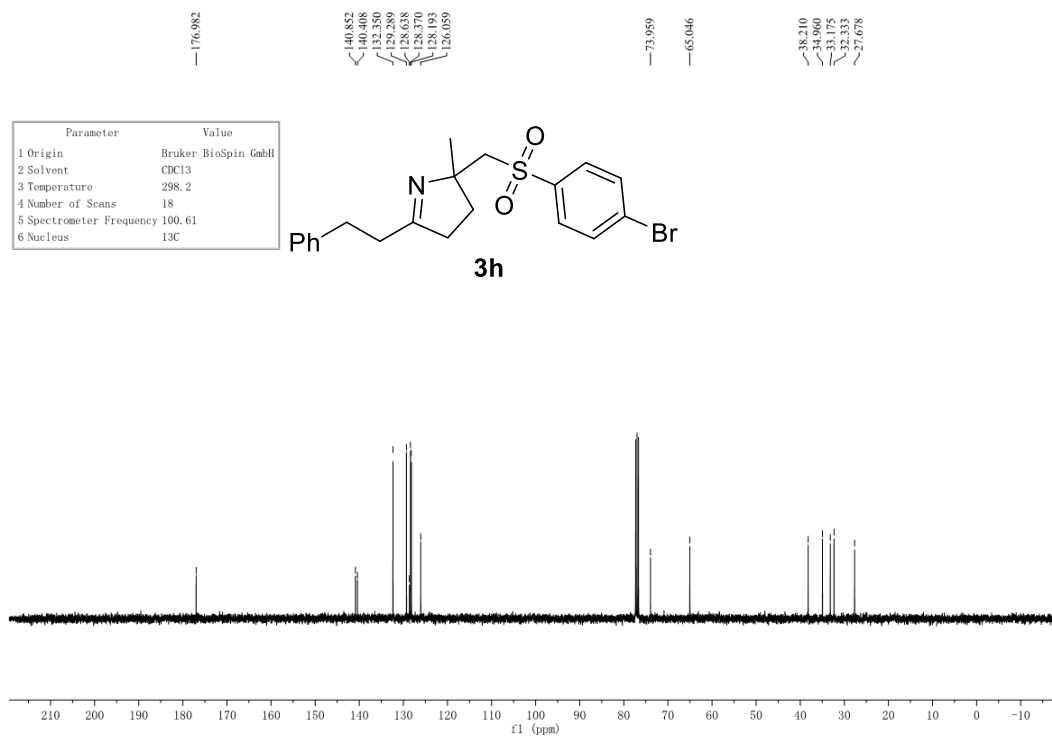
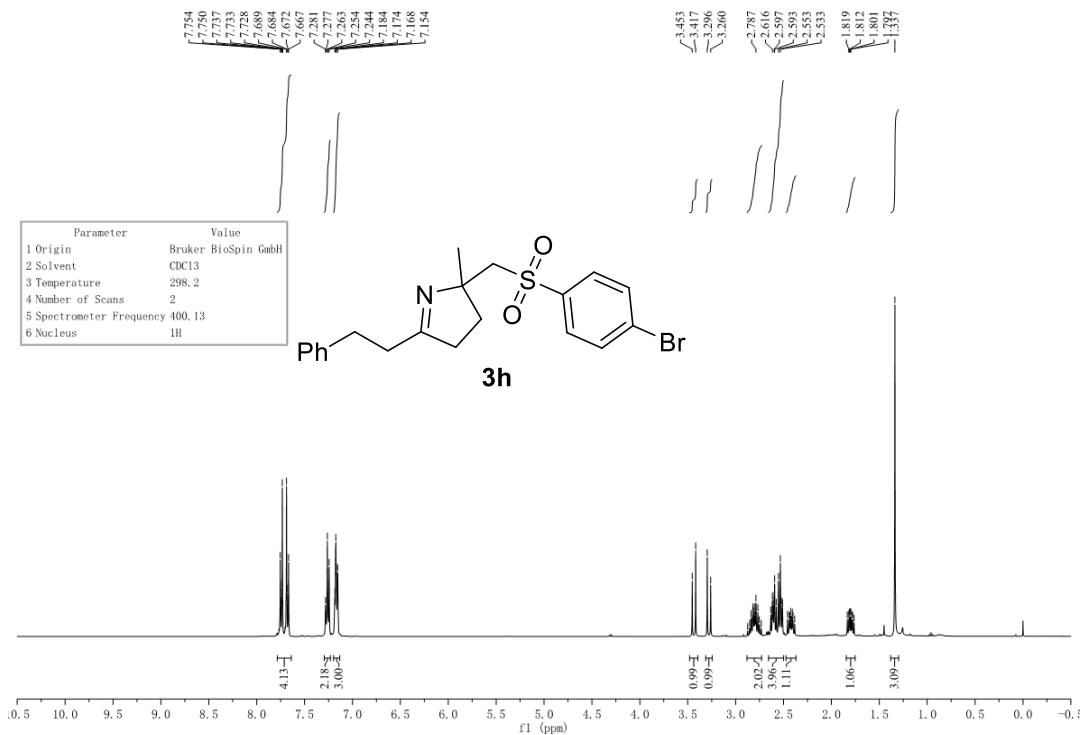


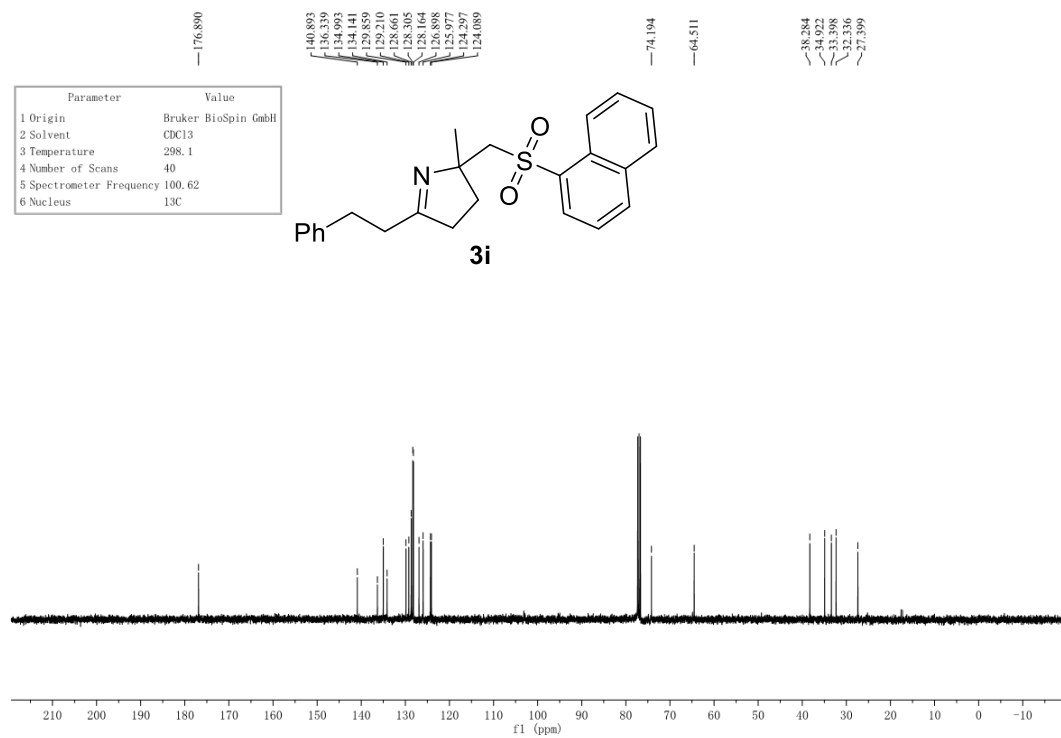
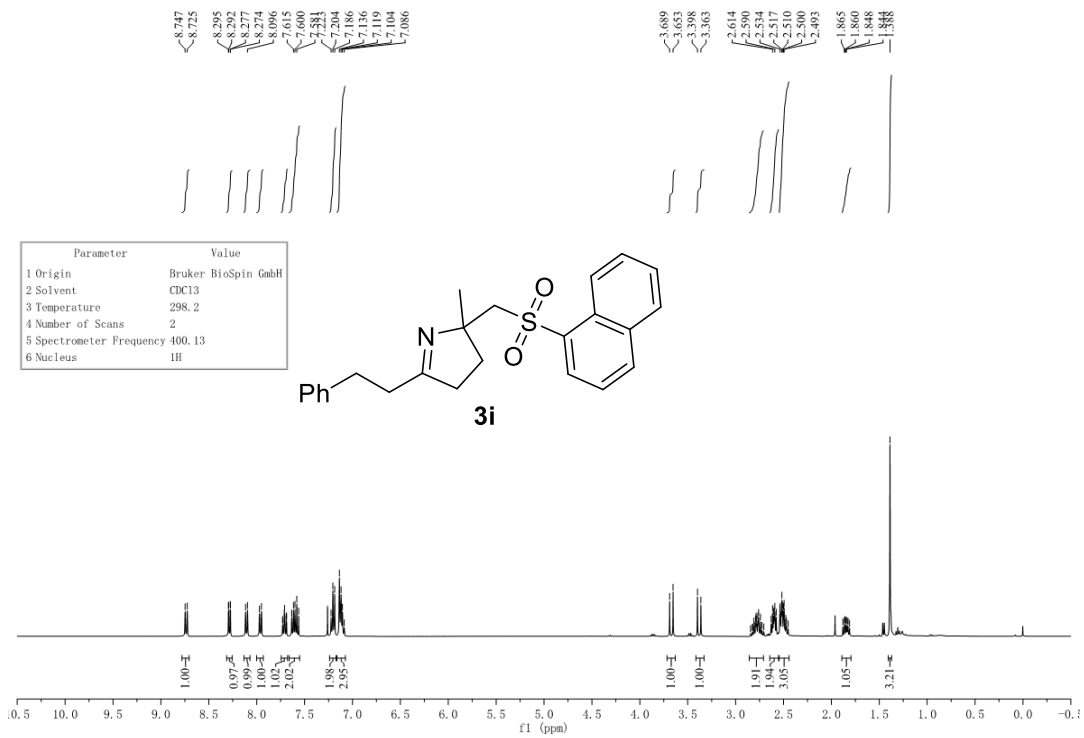


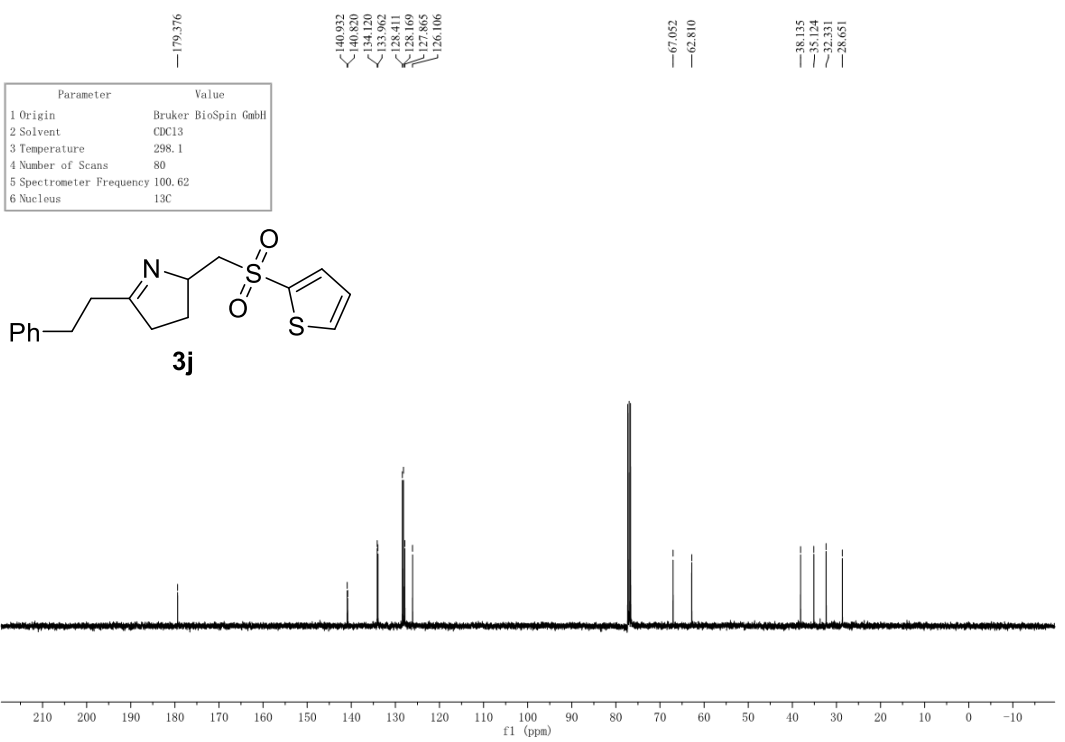
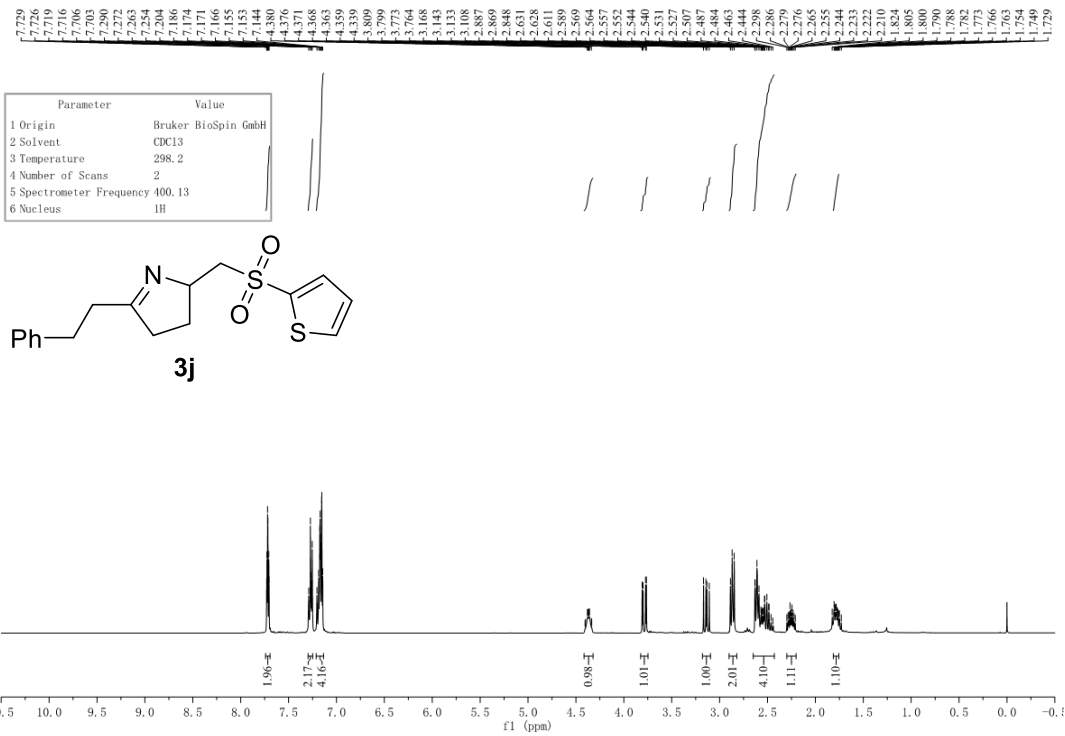


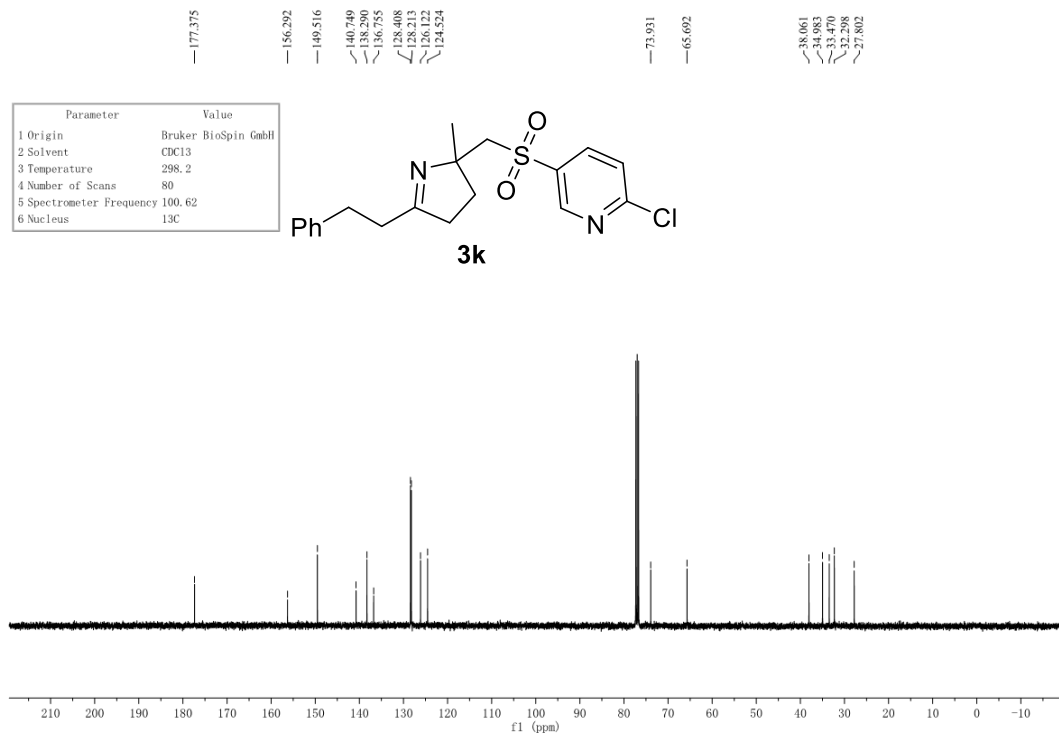
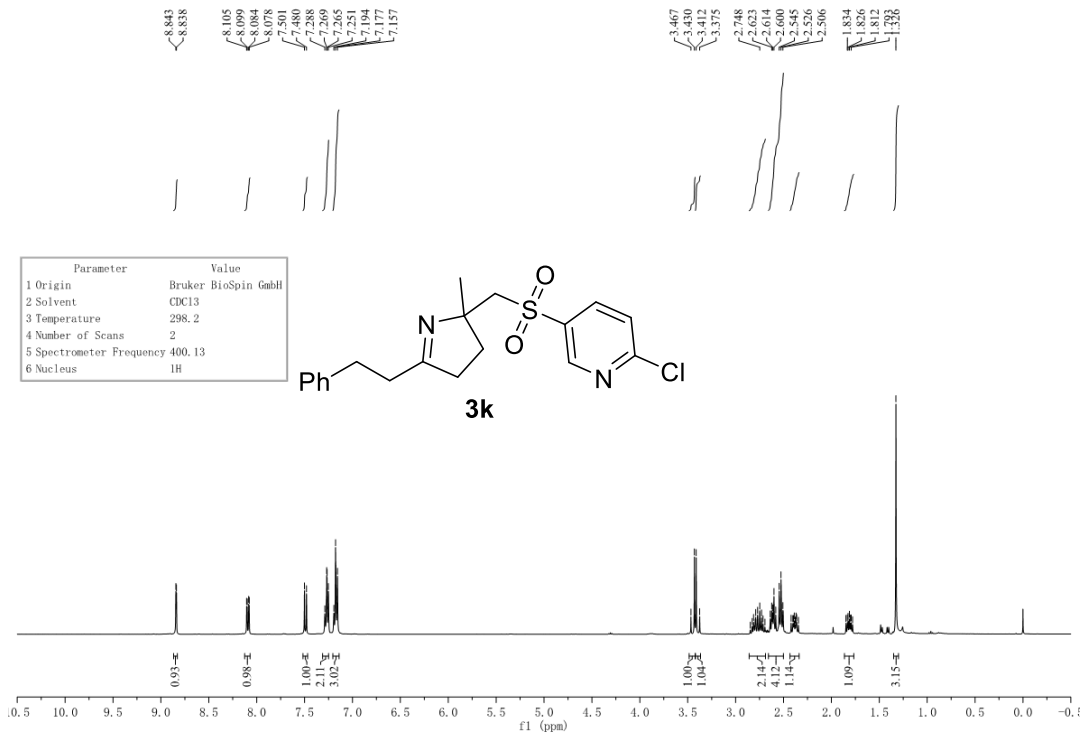


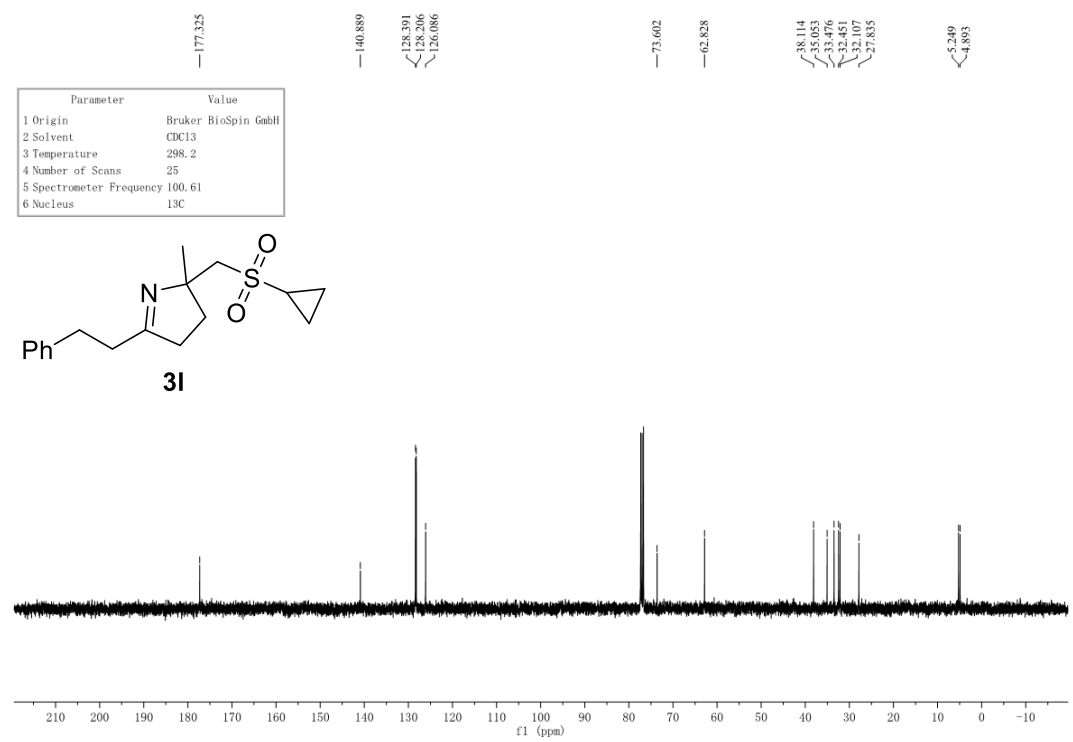
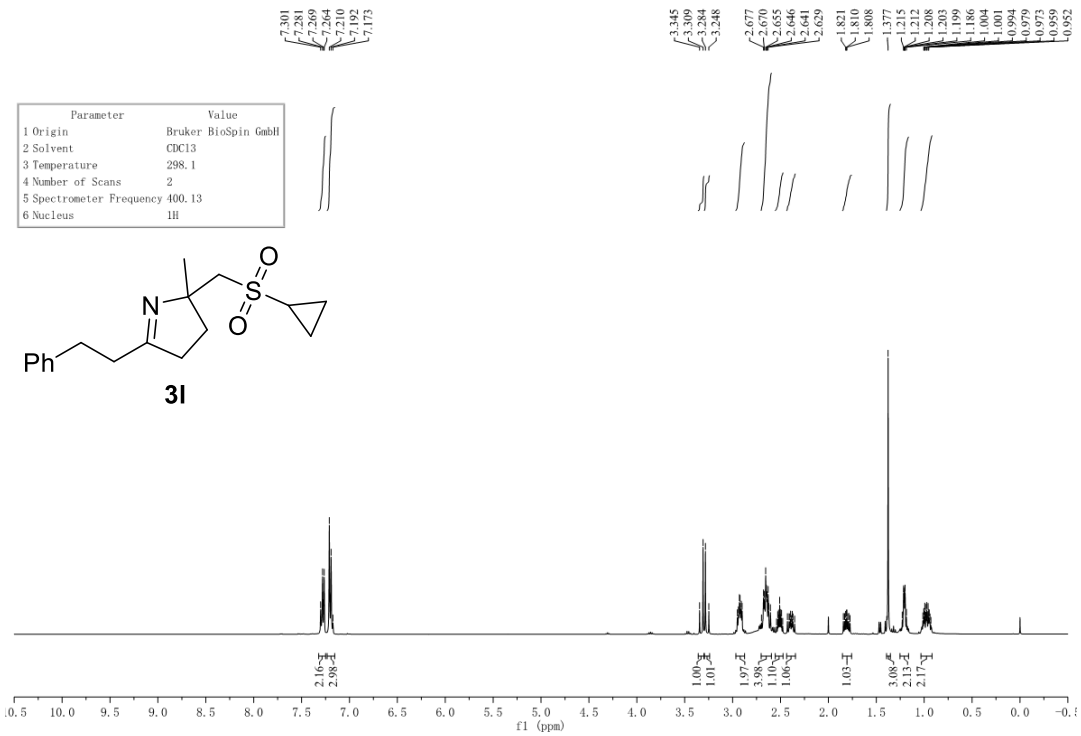


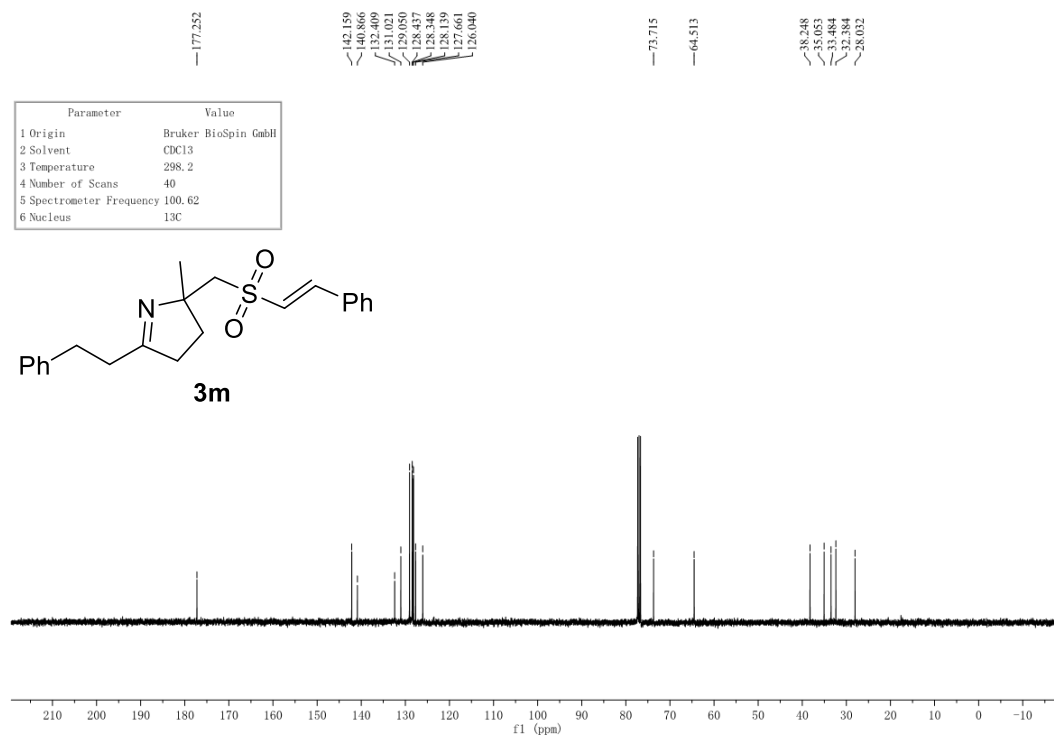
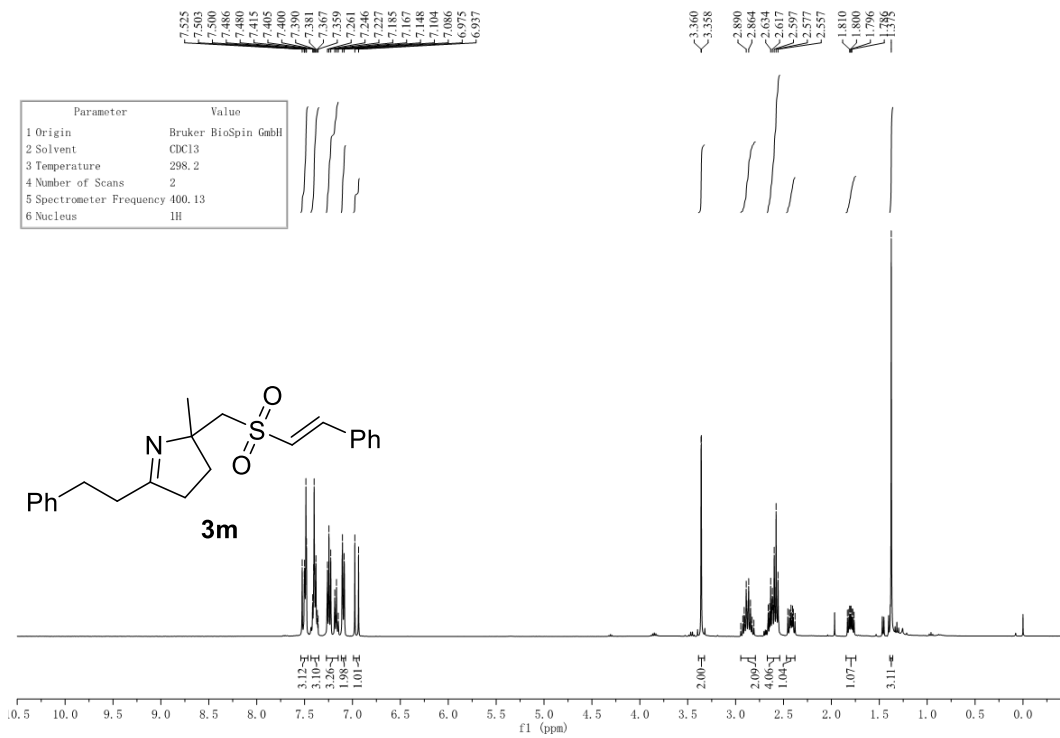


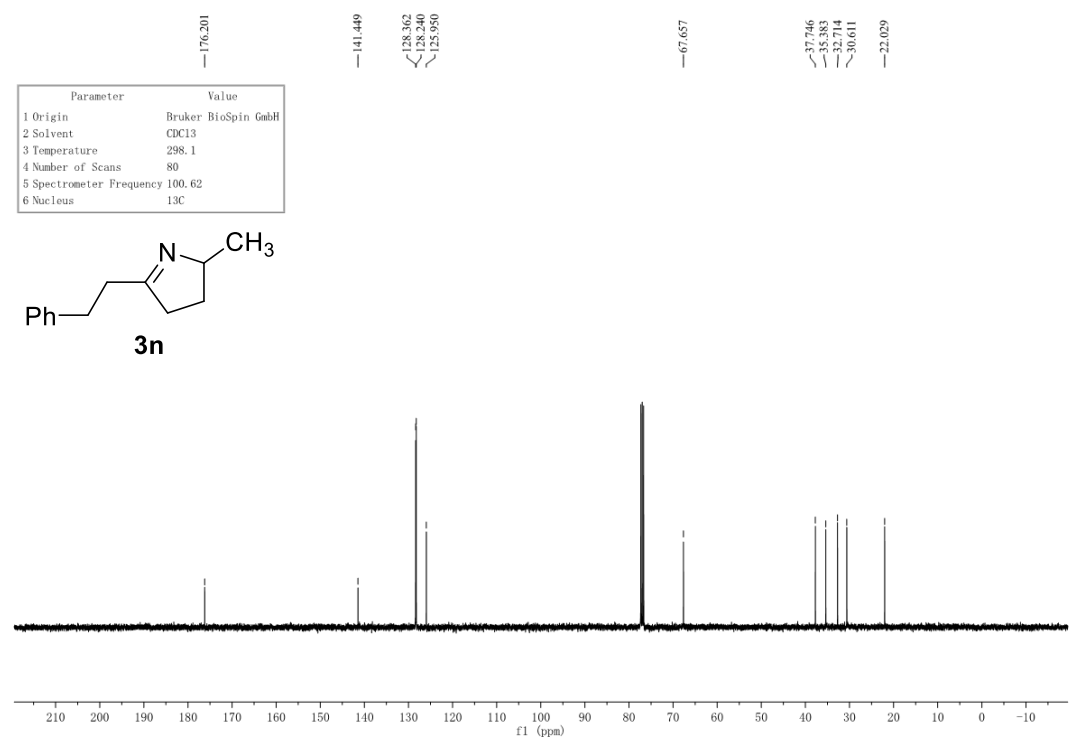
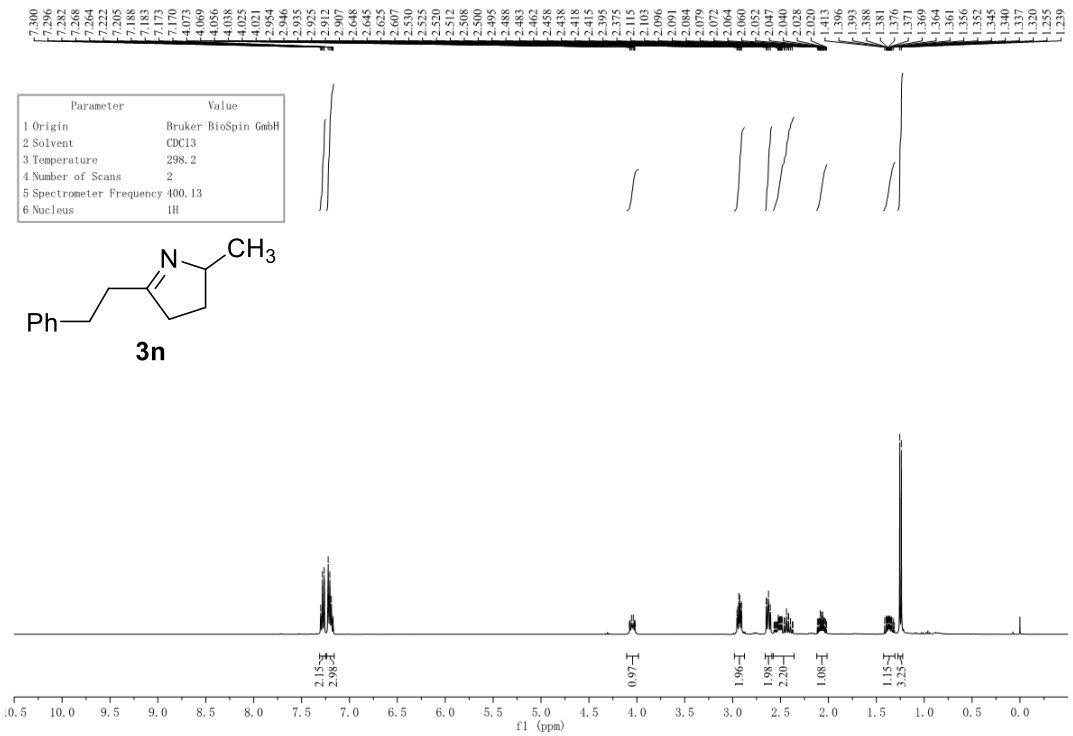


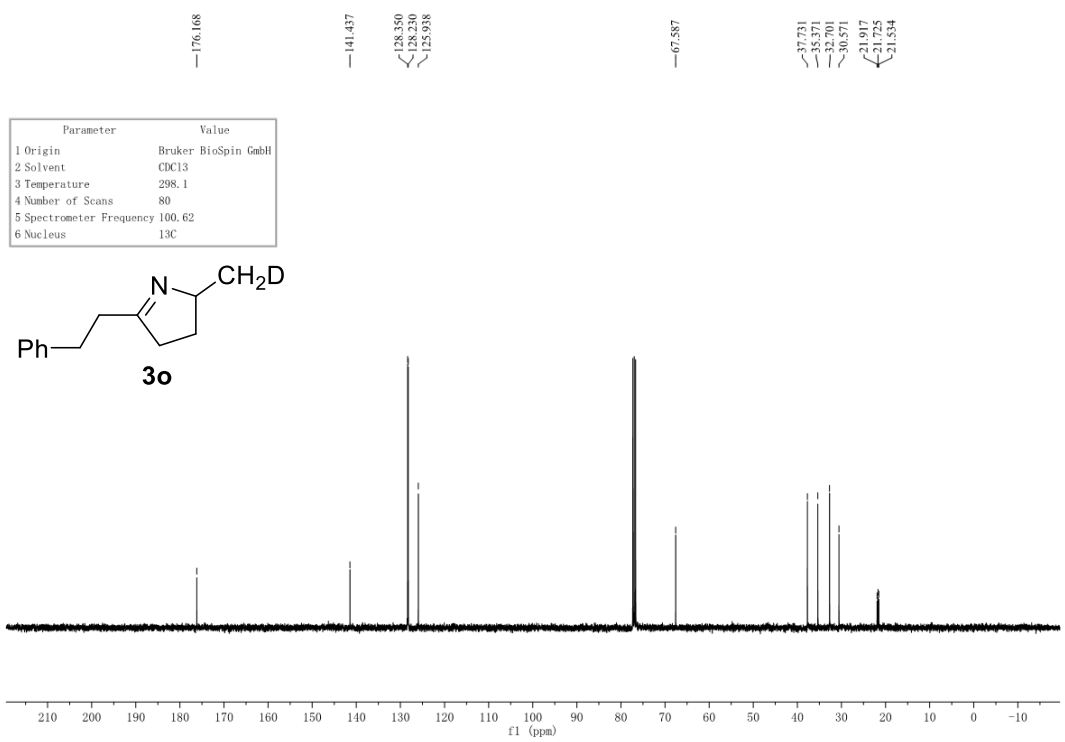
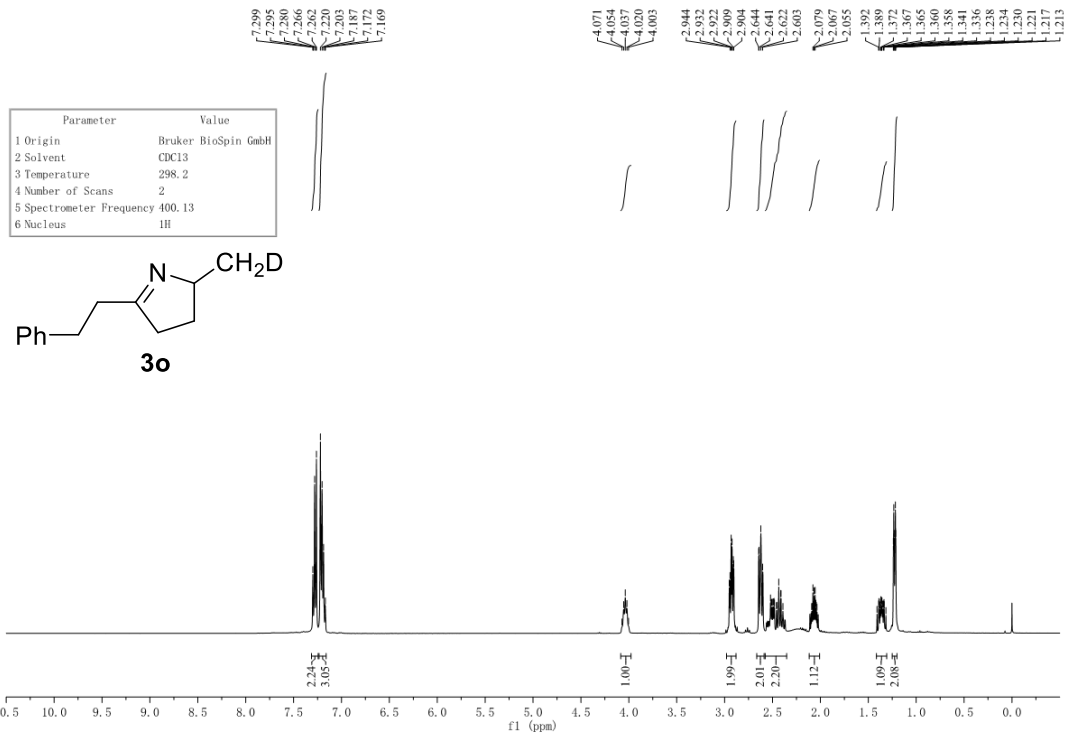


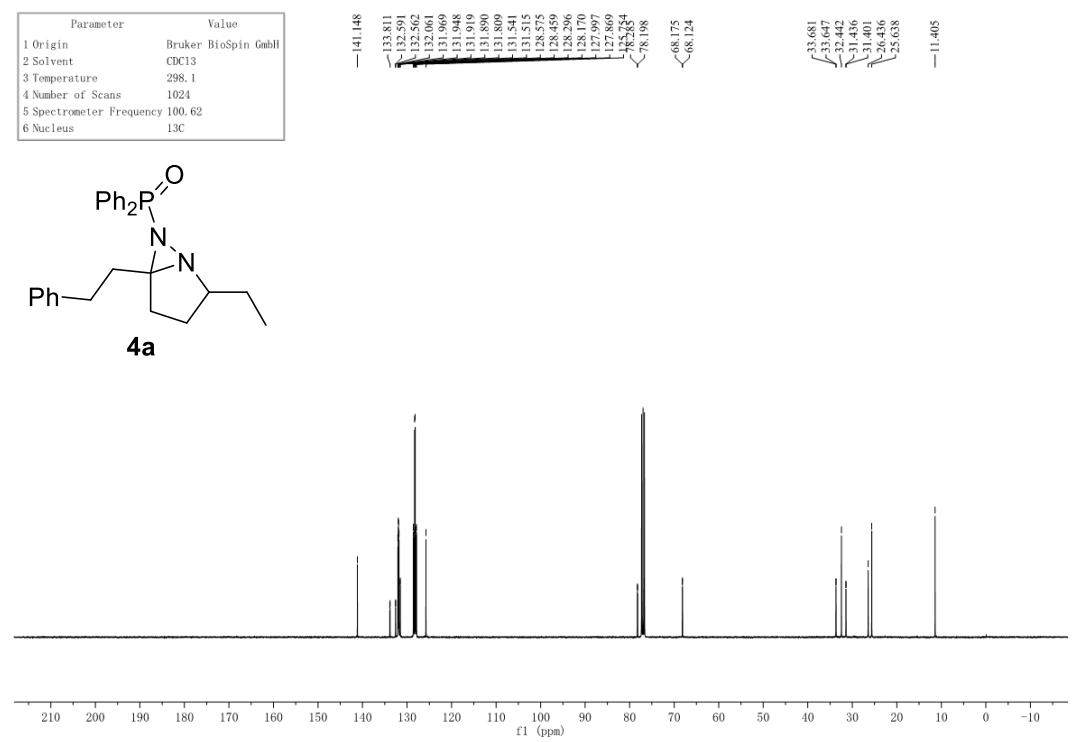
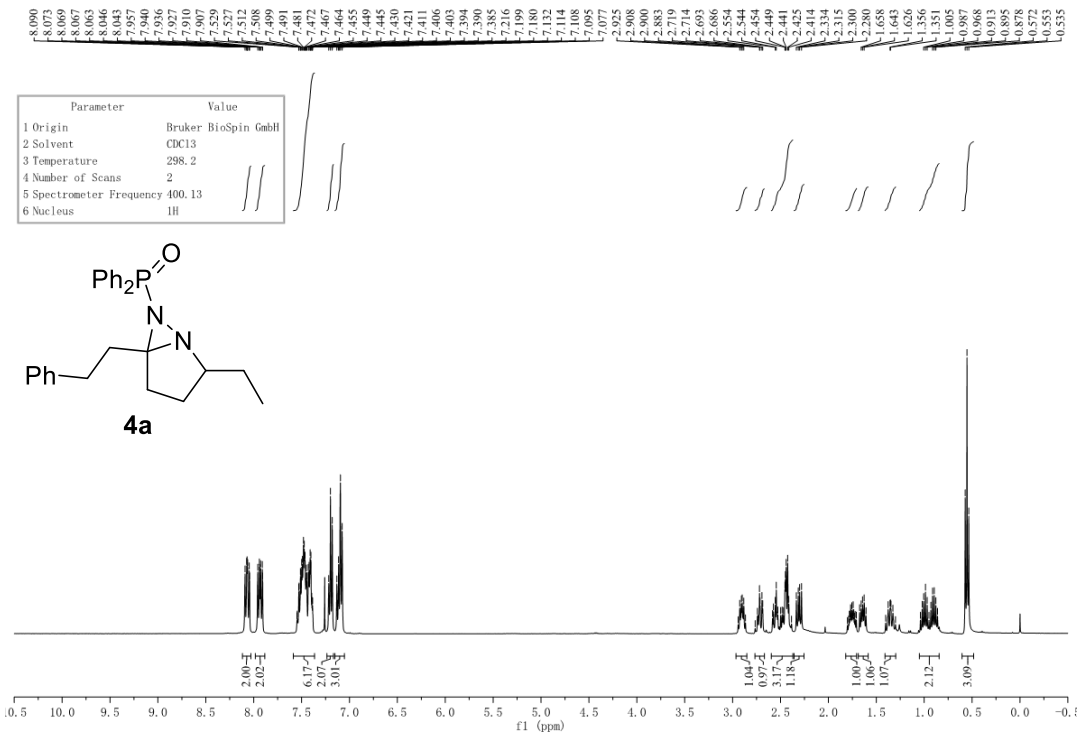






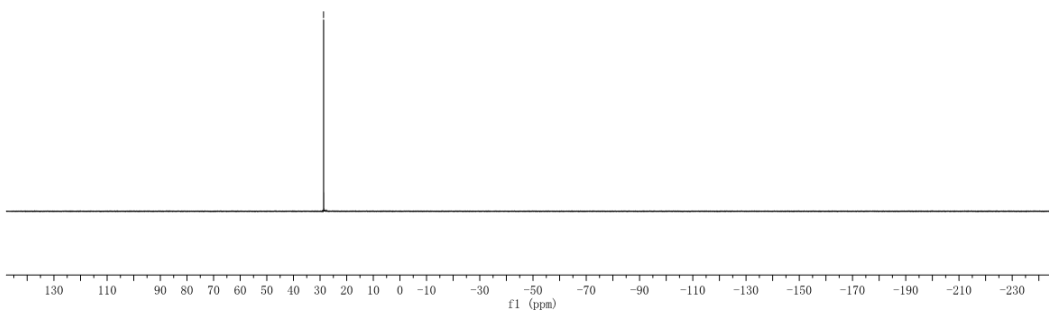
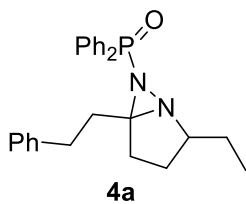






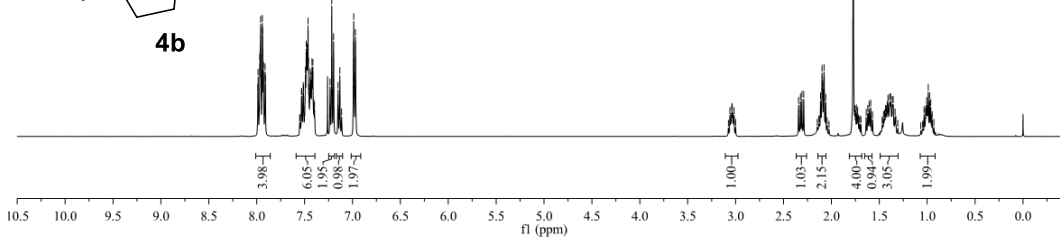
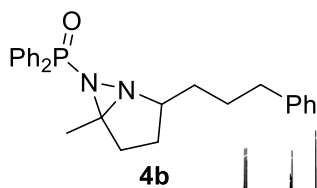
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.3
4 Number of Scans	2
5 Spectrometer Frequency	161.97
6 Nucleus	31P

-28.666

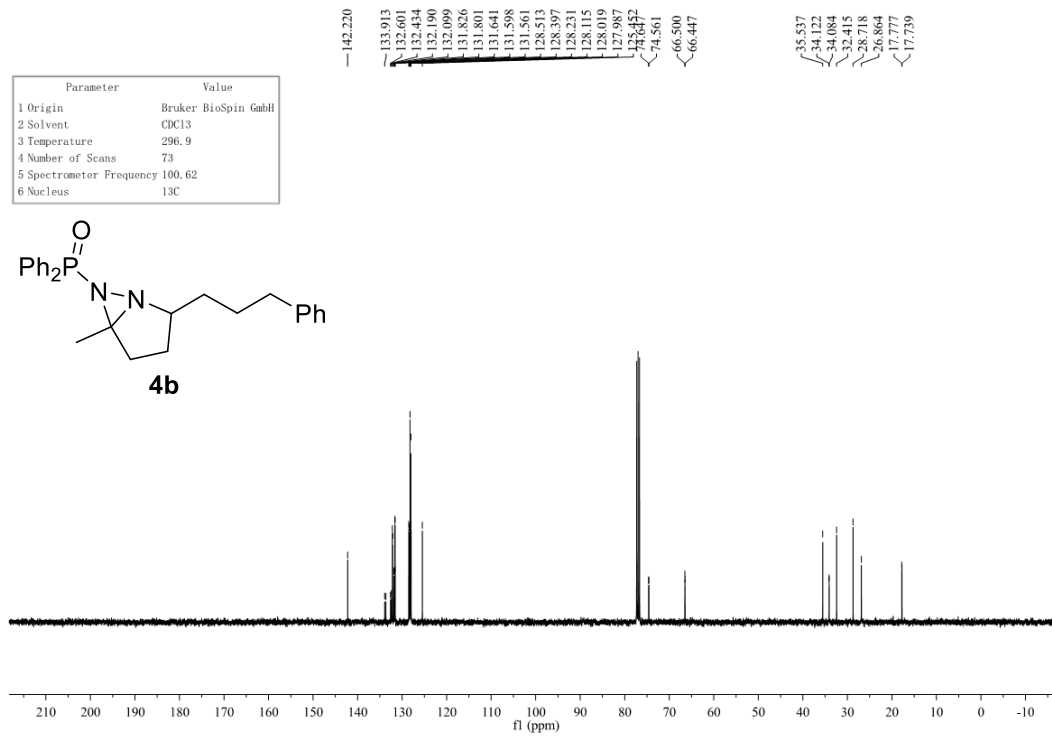
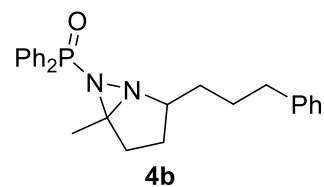


7.988
7.985
7.968
7.959
7.941
7.938
7.932
7.929
7.912
7.908
7.852
7.829
7.814
7.811
7.491
7.485
7.477
7.472
7.468
7.466
7.460
7.456
7.451
7.446
7.441
7.432
7.426
7.422
7.417
7.413
7.405
7.401
7.396
7.234
7.216
7.197
7.150
7.132
7.132
6.986
6.969
3.041
3.035
2.343
2.323
2.308
2.289
2.113
2.098
2.092
2.077
2.060
1.772
1.738
1.620
1.586
1.586
1.418
1.409
1.391
1.380
1.363
1.355
1.103
1.006
0.999
0.989
0.974
0.963

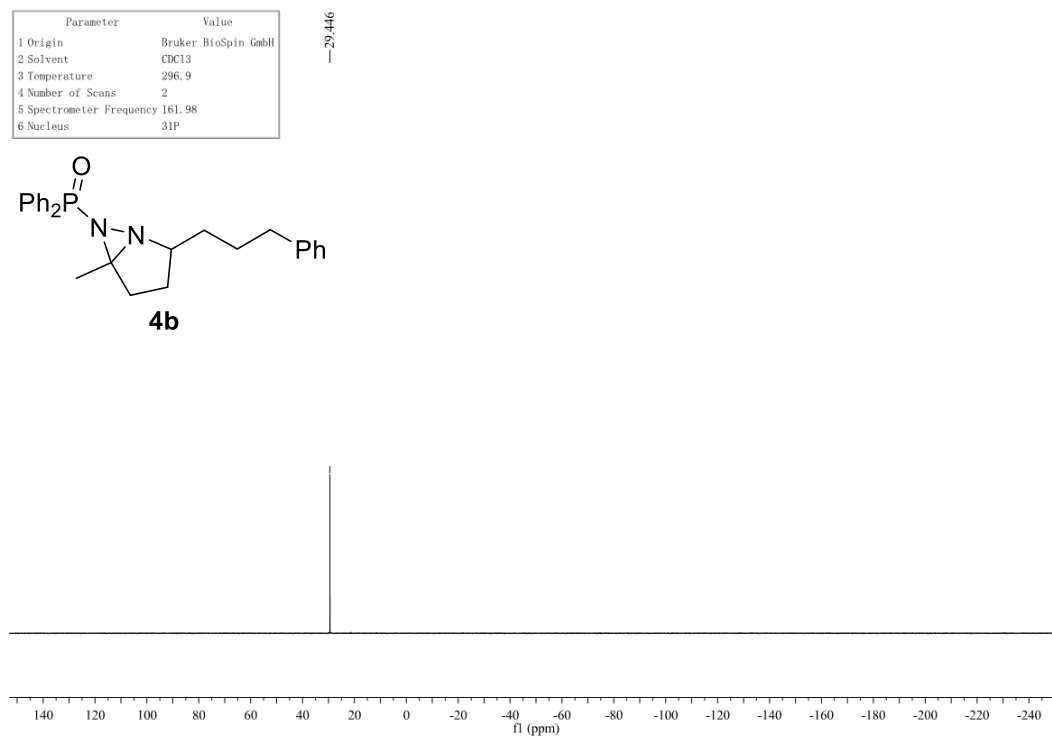
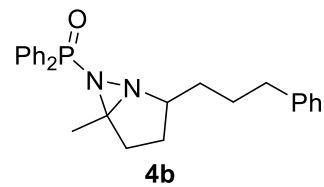
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.8
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

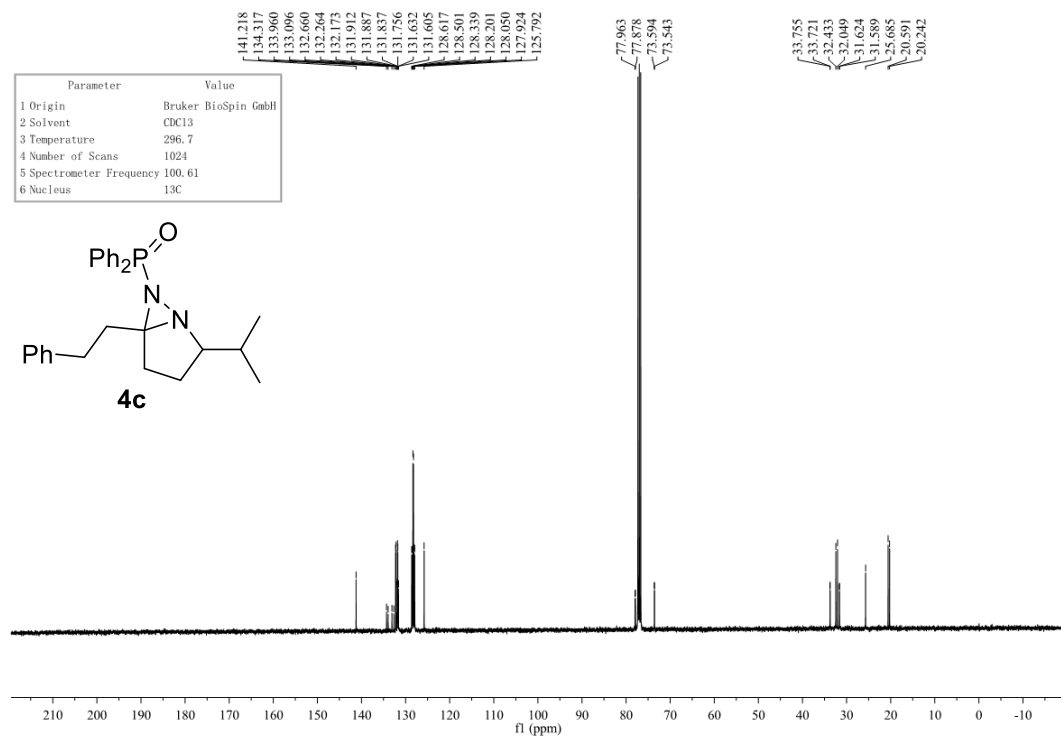
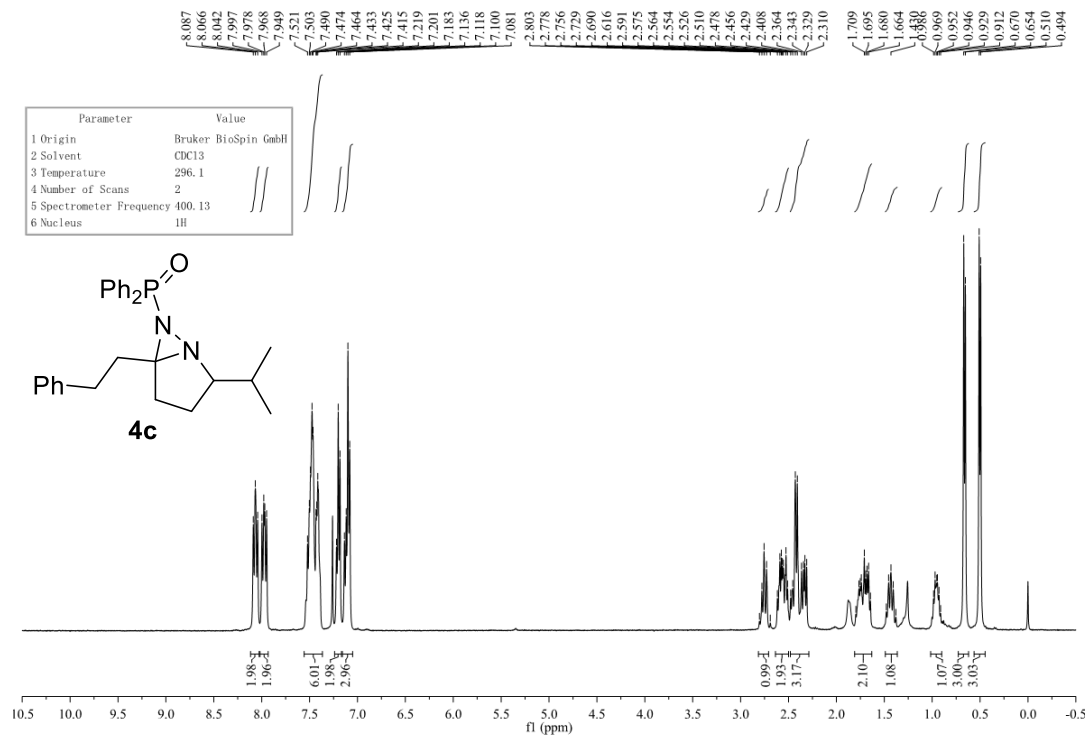


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.9
4 Number of Scans	73
5 Spectrometer Frequency	100.62
6 Nucleus	13C

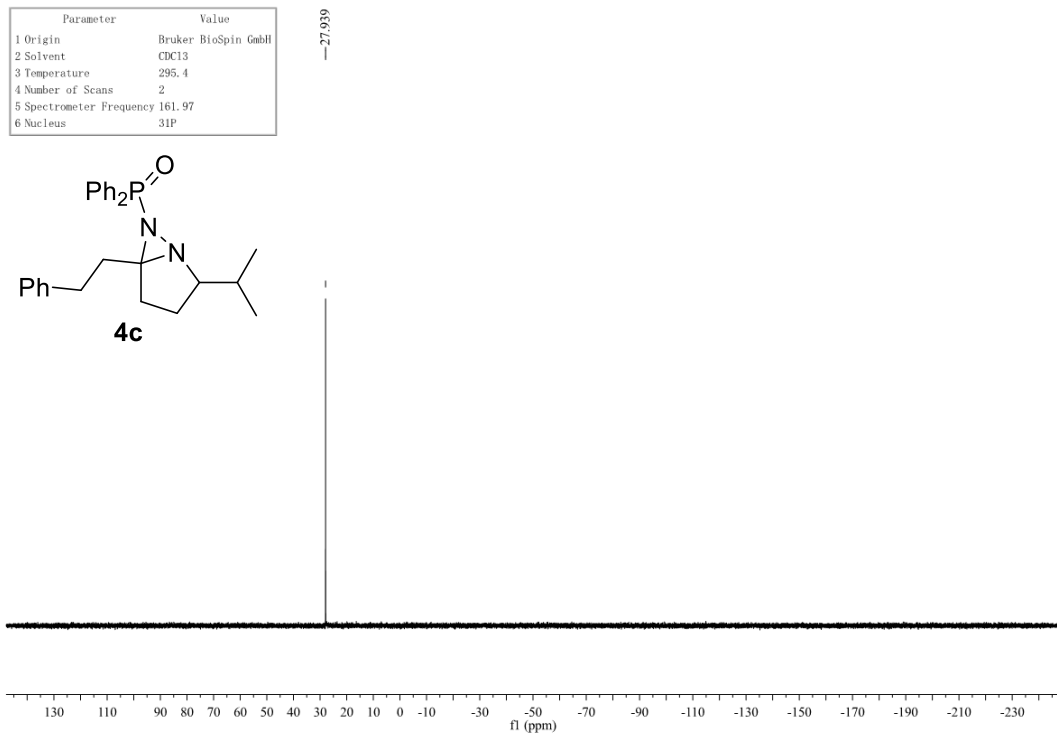
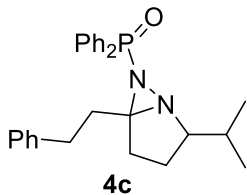


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.9
4 Number of Scans	2
5 Spectrometer Frequency	161.98
6 Nucleus	31P



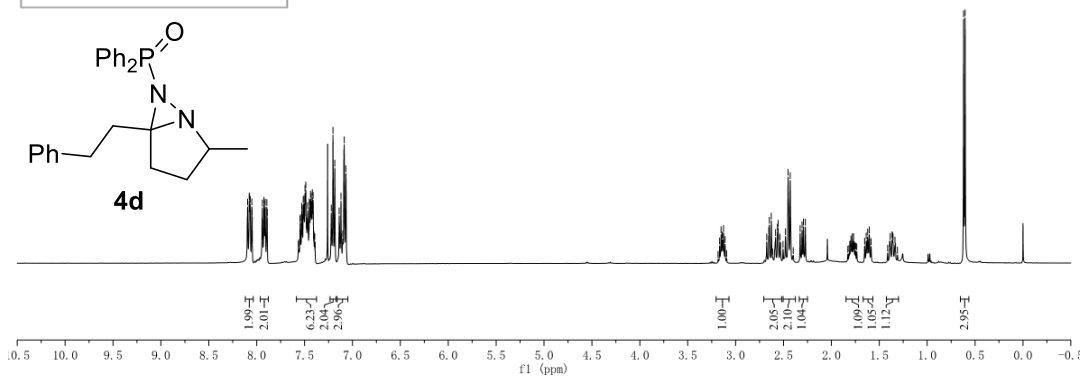
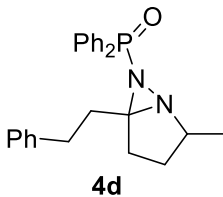


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.4
4 Number of Scans	2
5 Spectrometer Frequency	161.97
6 Nucleus	31P

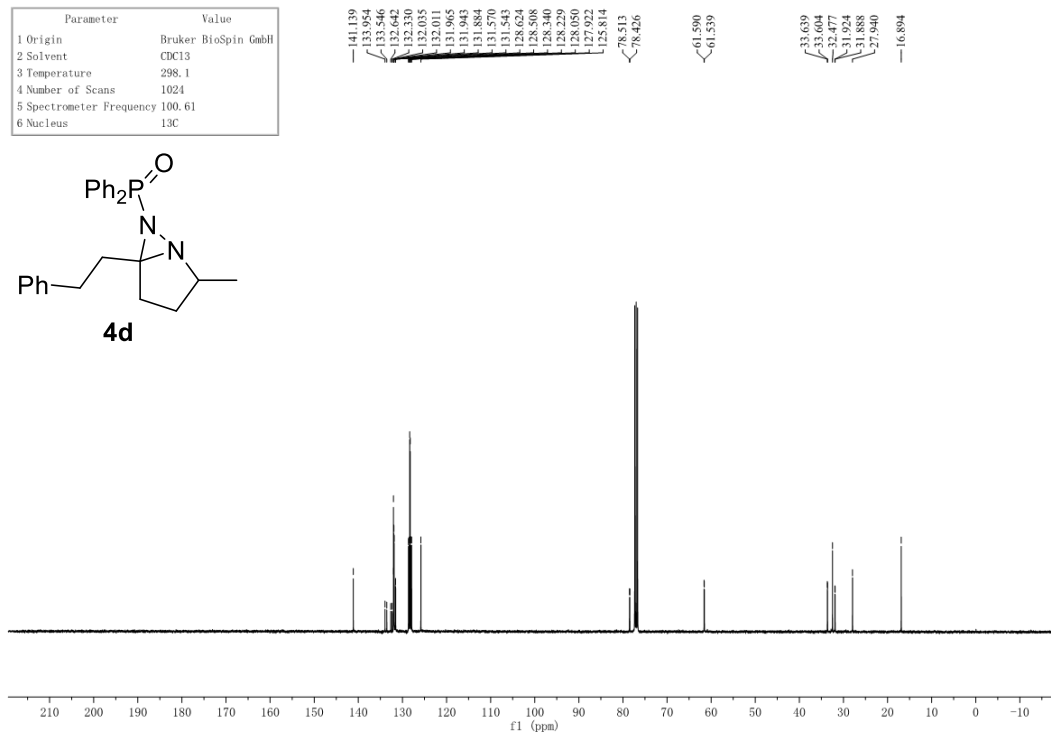
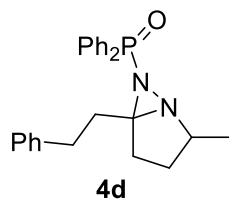


8.095
8.078
8.074
8.068
8.051
8.047
7.941
7.924
7.910
7.911
7.894
7.890
7.847
7.544
7.529
7.526
7.516
7.506
7.495
7.491
7.487
7.479
7.474
7.467
7.466
7.446
7.438
7.429
7.424
7.419
7.415
7.411
7.408
7.398
7.394
7.221
7.204
7.185
7.138
7.120
7.115
7.102
7.089
7.086
7.069
-3.151
-3.142
-3.135
-3.135
-3.135
-2.675
-2.654
-2.648
-2.627
-2.583
-2.563
-2.536
-2.536
-2.479
-2.452
-2.430
-2.326
-2.307
-2.292
-2.272
-2.272
-1.769
-1.636
-1.622
-1.605
-1.387
-1.367
-1.362
-1.332
-1.020
-0.604

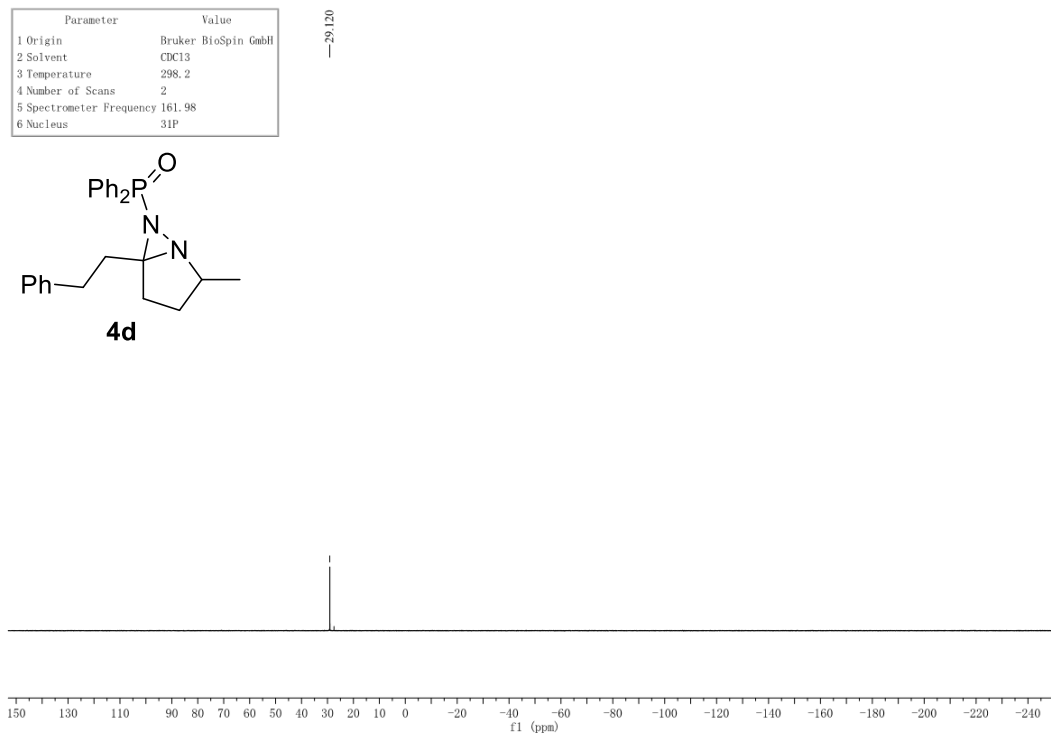
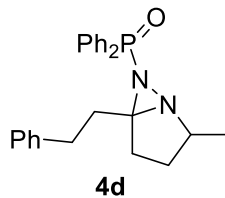
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H

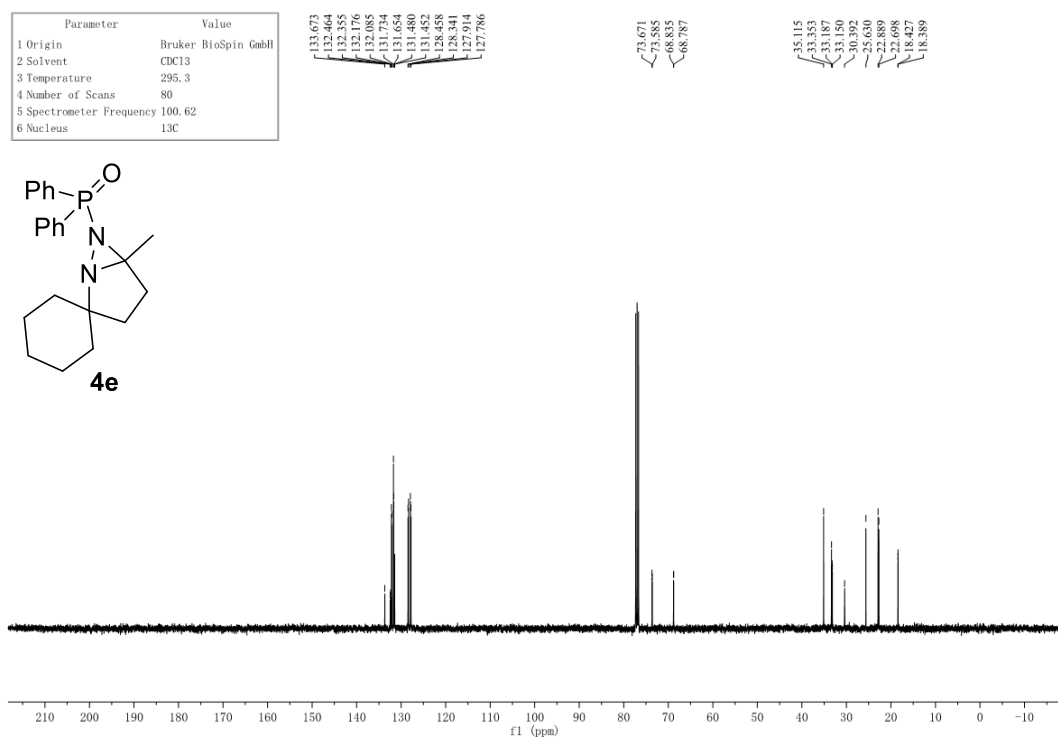
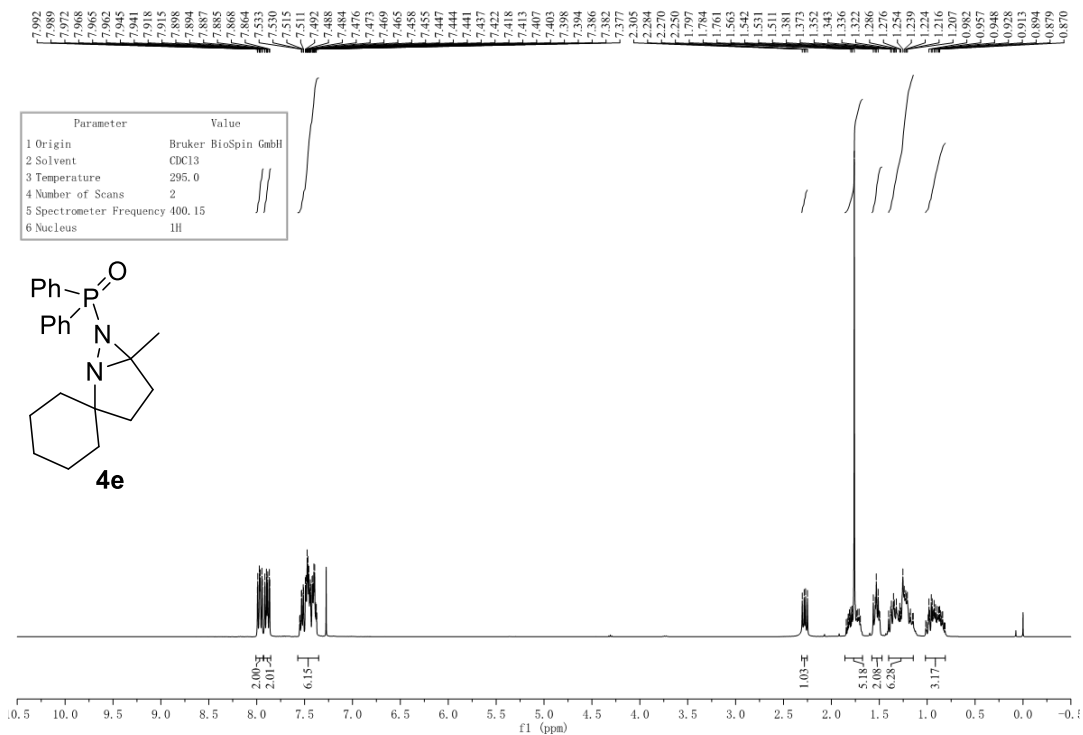


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	1024
5 Spectrometer Frequency	100.61
6 Nucleus	13C

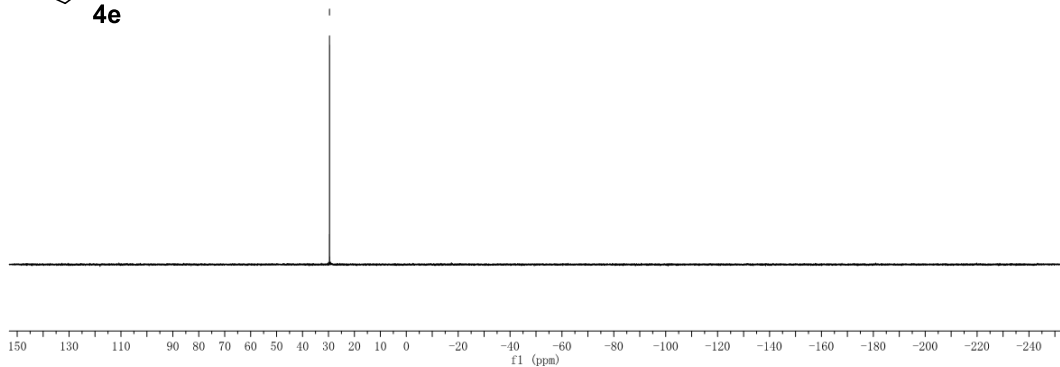
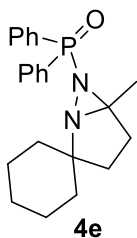


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	161.98
6 Nucleus	31P



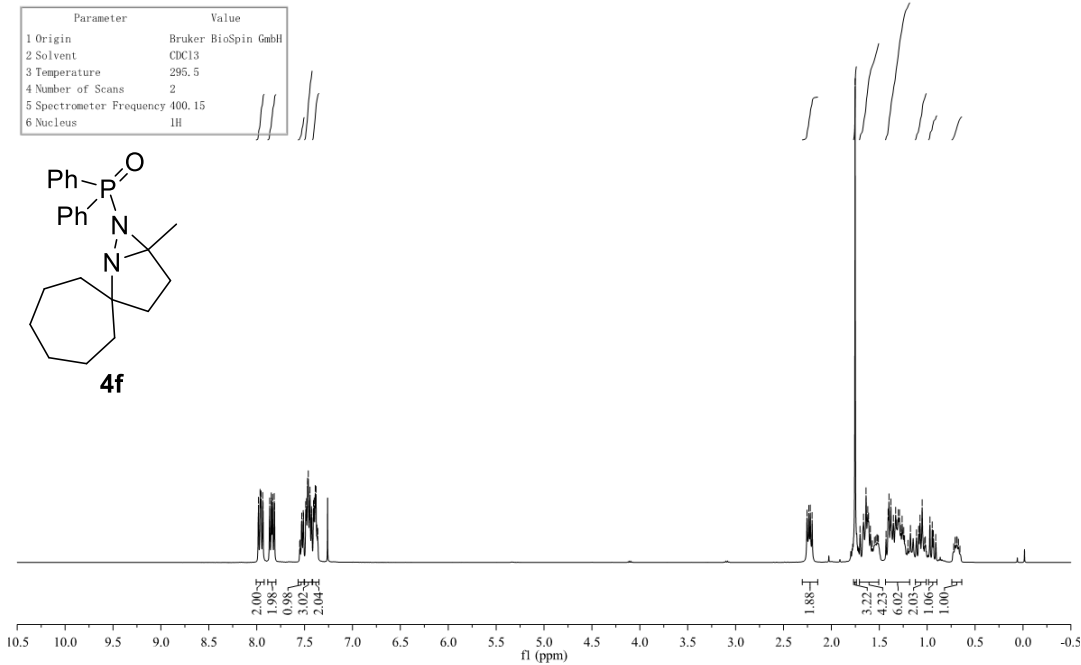
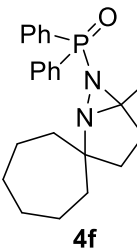


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.1
4 Number of Scans	2
5 Spectrometer Frequency	161.98
6 Nucleus	31P



7.981
7.964
7.960
7.954
7.937
7.933
7.864
7.847
7.843
7.834
7.817
7.813
7.530
7.514
7.511
7.488
7.480
7.469
7.464
7.443
7.428
7.425
7.407
7.399
7.388
7.384
7.380
7.372
7.367
7.363
2.255
2.236
2.220
2.201
1.753
1.701
1.664
1.638
1.620
1.611
1.592
1.536
1.524
1.517
1.509
1.430
1.408
1.399
1.379
1.353
1.329
1.317
1.301
1.298
1.278
1.266
1.244
1.236
1.175
1.112
1.089
1.075
1.053
1.071
1.047
1.036
1.011

Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.5
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

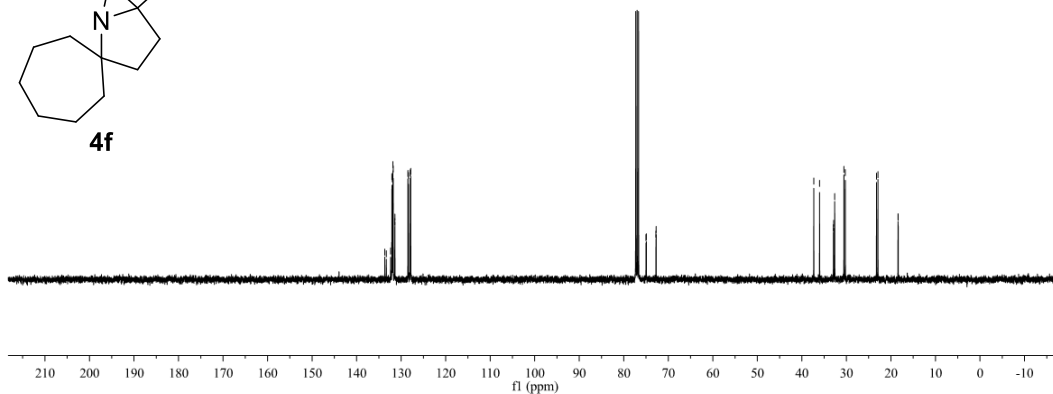
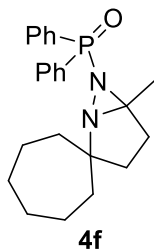


133.678
133.319
132.367
132.101
132.070
131.978
131.863
131.846
131.815
131.782
131.430
131.403
128.477
128.360
127.986
127.857

75.014
74.928
72.771
72.725

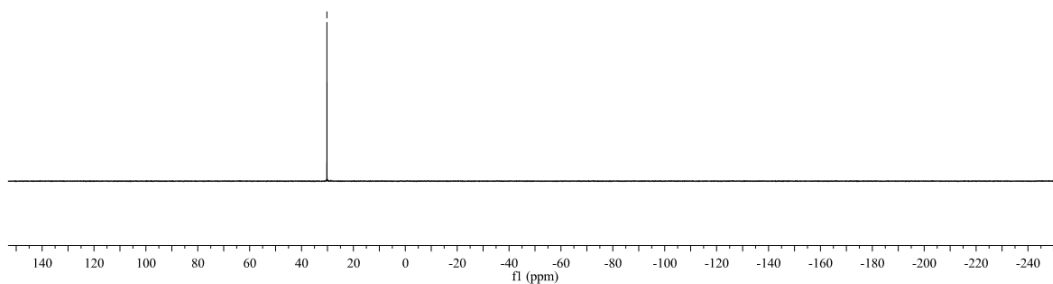
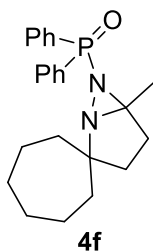
37.331
36.030
32.906
32.809
32.632
30.535
30.434
23.248
22.918
18.412
18.375

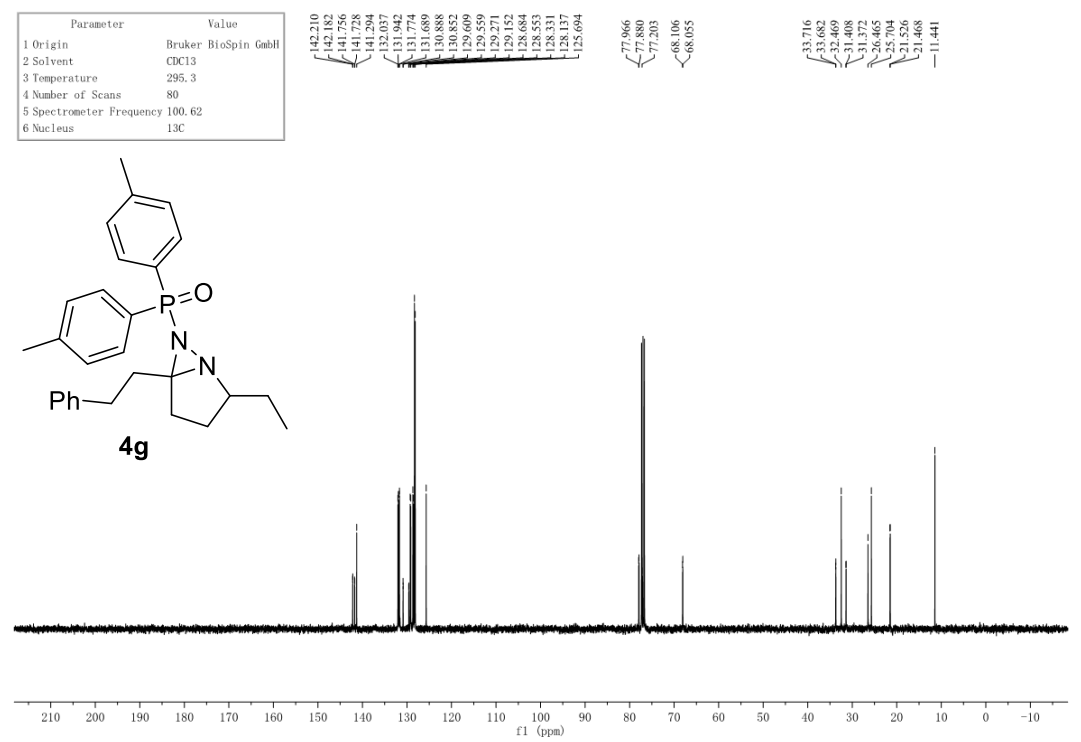
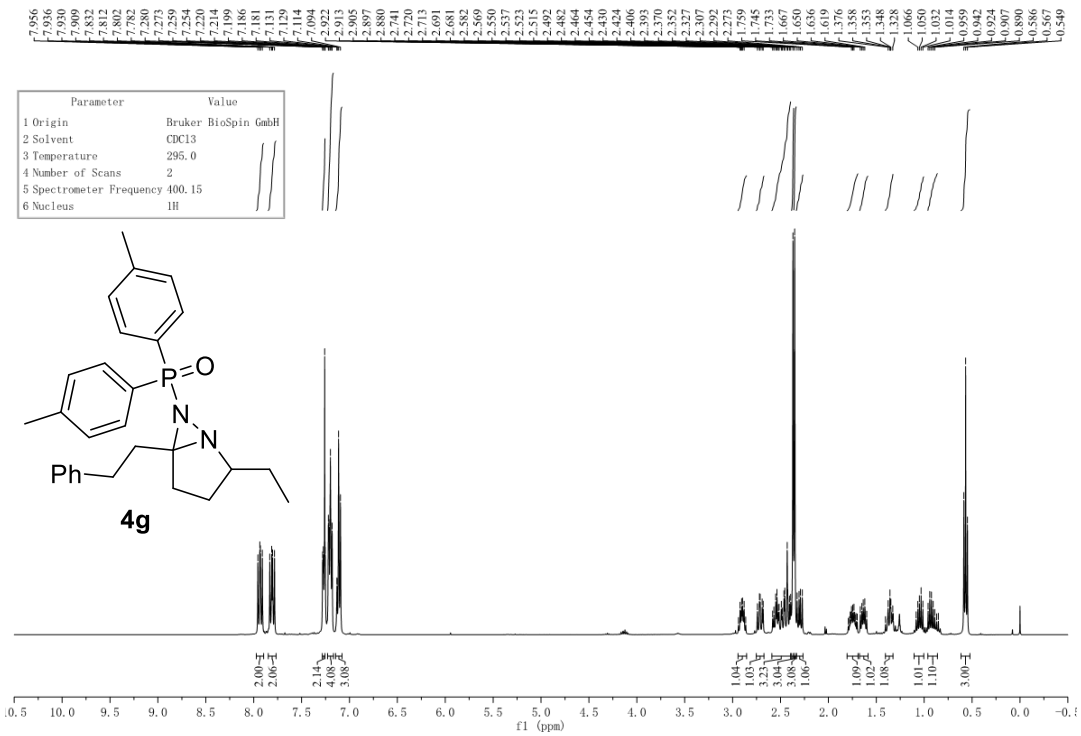
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.0
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C



Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.8
4 Number of Scans	2
5 Spectrometer Frequency	161.98
6 Nucleus	31P

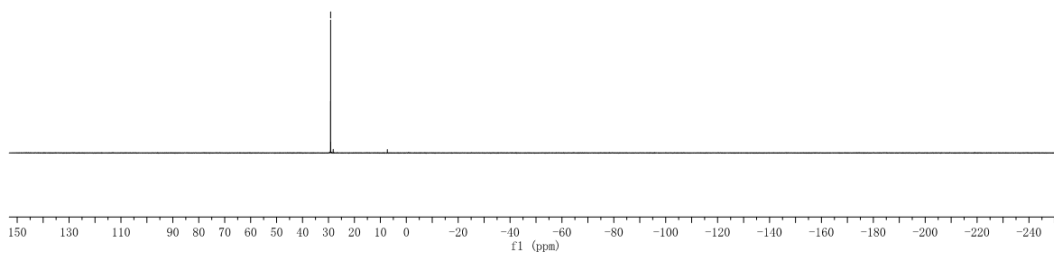
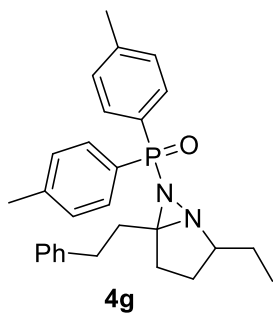
30.225





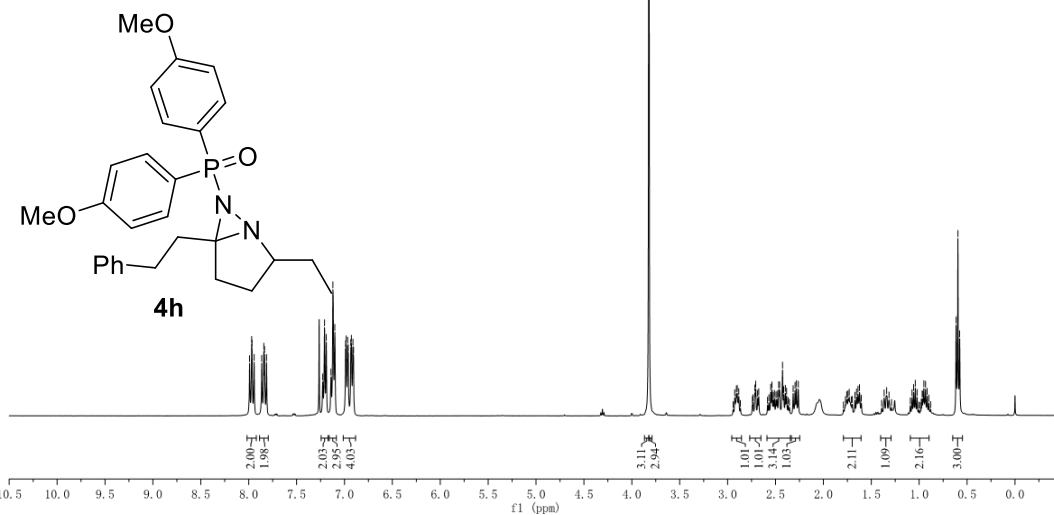
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.1
4 Number of Scans	2
5 Spectrometer Frequency	161.98
6 Nucleus	31P

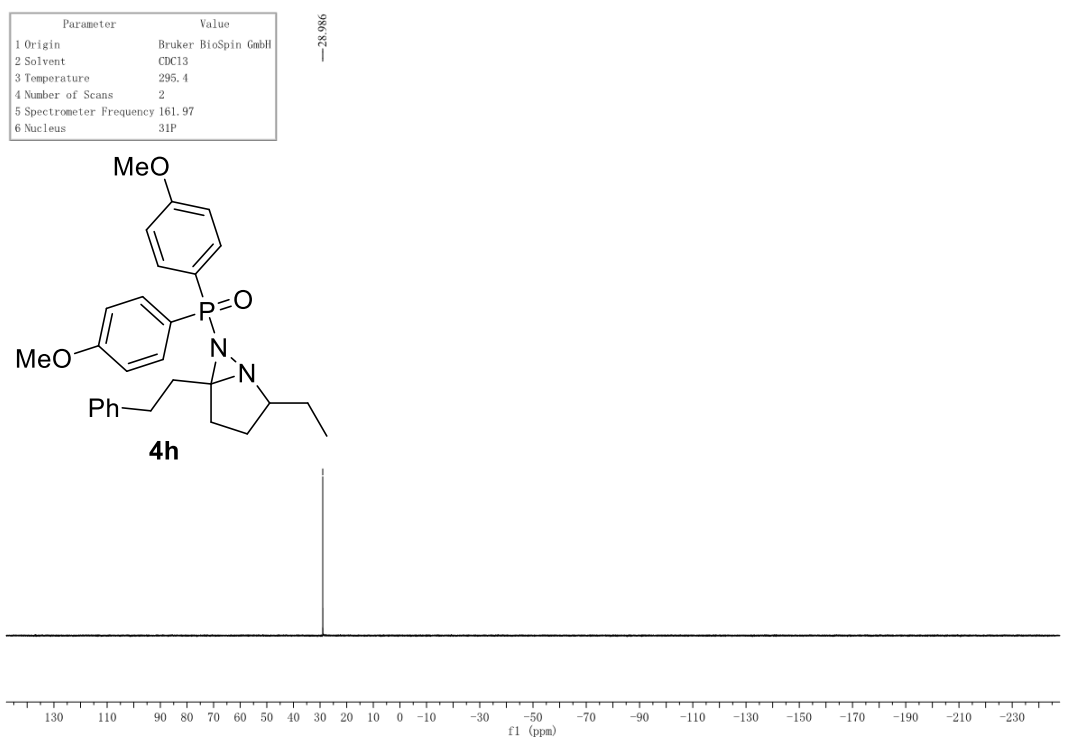
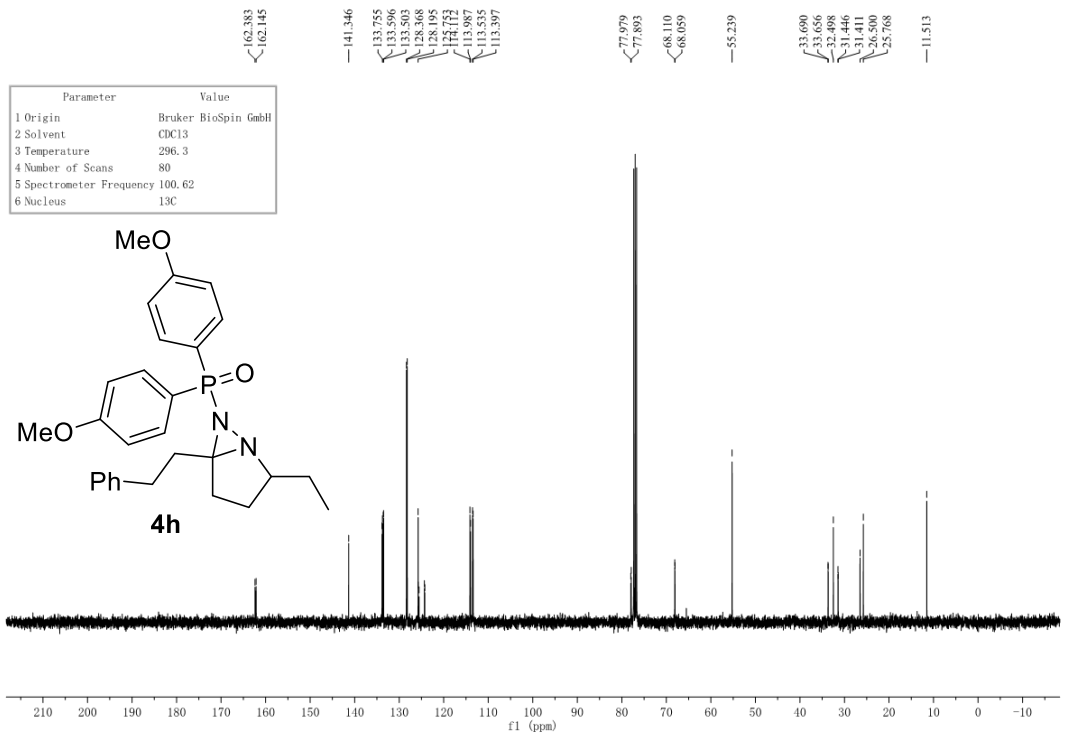
-29.199

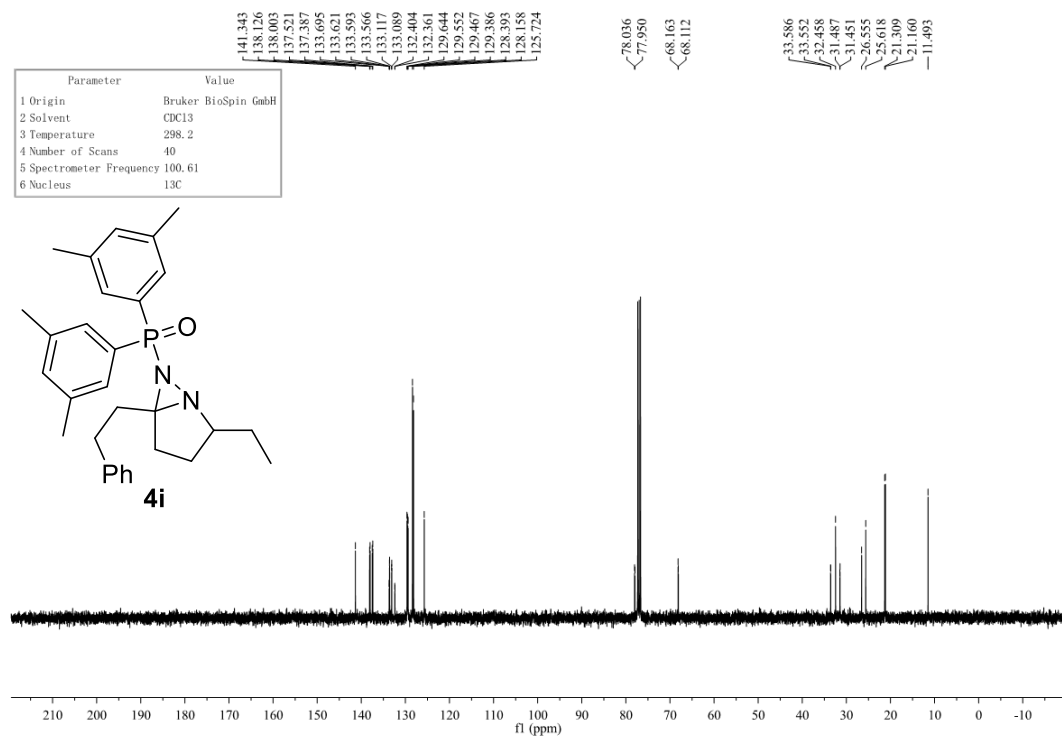
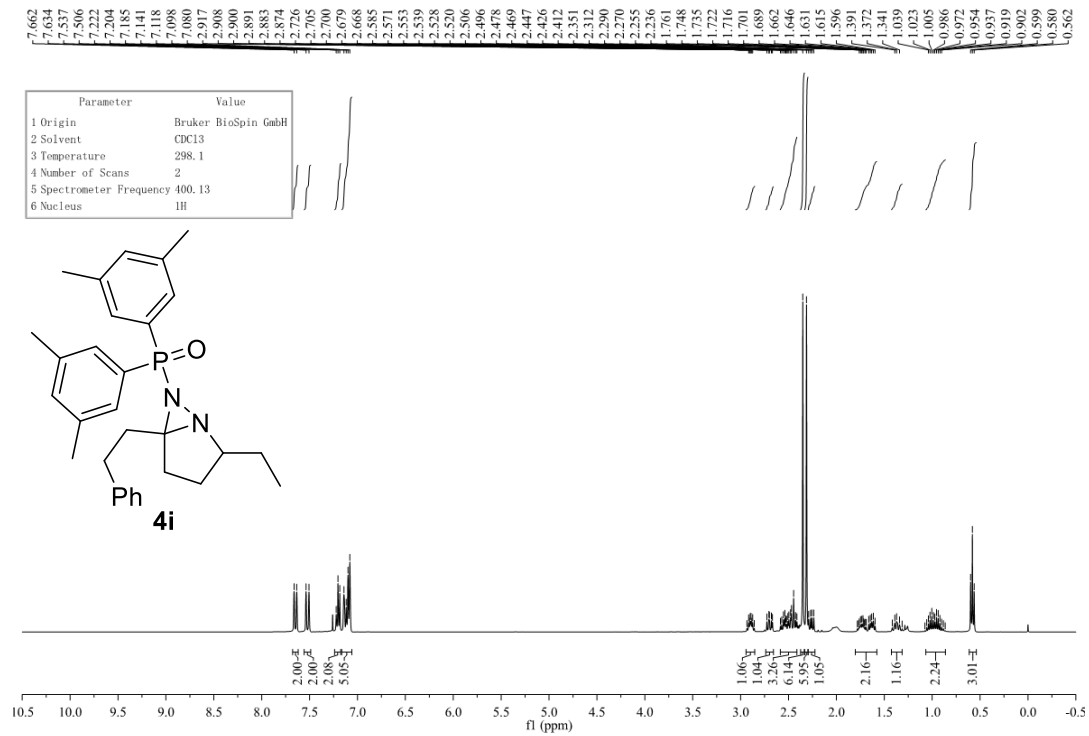


7.091
7.069
7.066
7.043
7.864
7.842
7.835
7.814
7.799
7.709
7.190
7.141
7.121
7.101
6.988
6.983
6.967
6.951
6.934
6.928
6.912
6.906
5.820
5.824
5.815
5.808
2.908
2.900
2.883
2.883
2.735
2.715
2.706
2.686
2.686
2.666
2.569
2.550
2.537
2.523
2.511
2.495
2.483
2.466
2.457
2.427
2.414
2.397
2.385
2.316
2.316
2.286
2.286
2.262
2.262
1.757
1.743
1.731
1.698
1.670
1.654
1.654
1.623
1.604
1.365
1.340
1.316
1.316
1.074
1.038
1.022
1.022
0.969
0.960
0.951
0.934
0.917
0.899
0.885
0.896
0.578

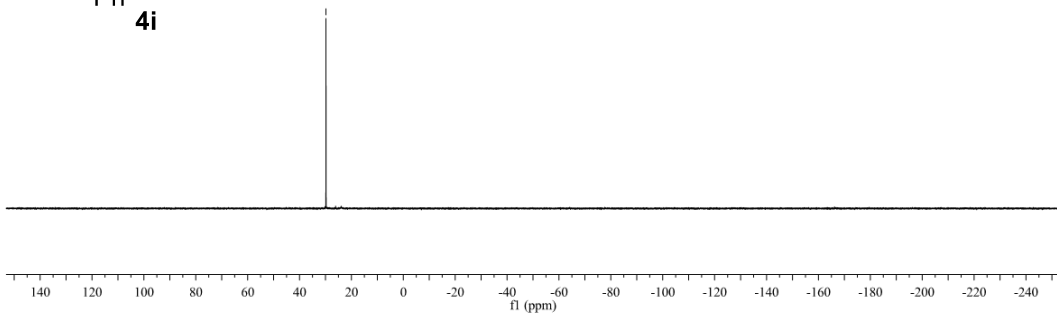
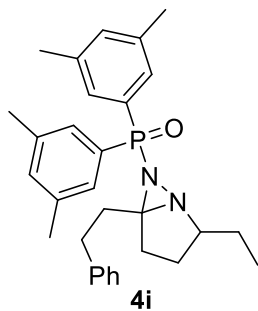
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.4
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H





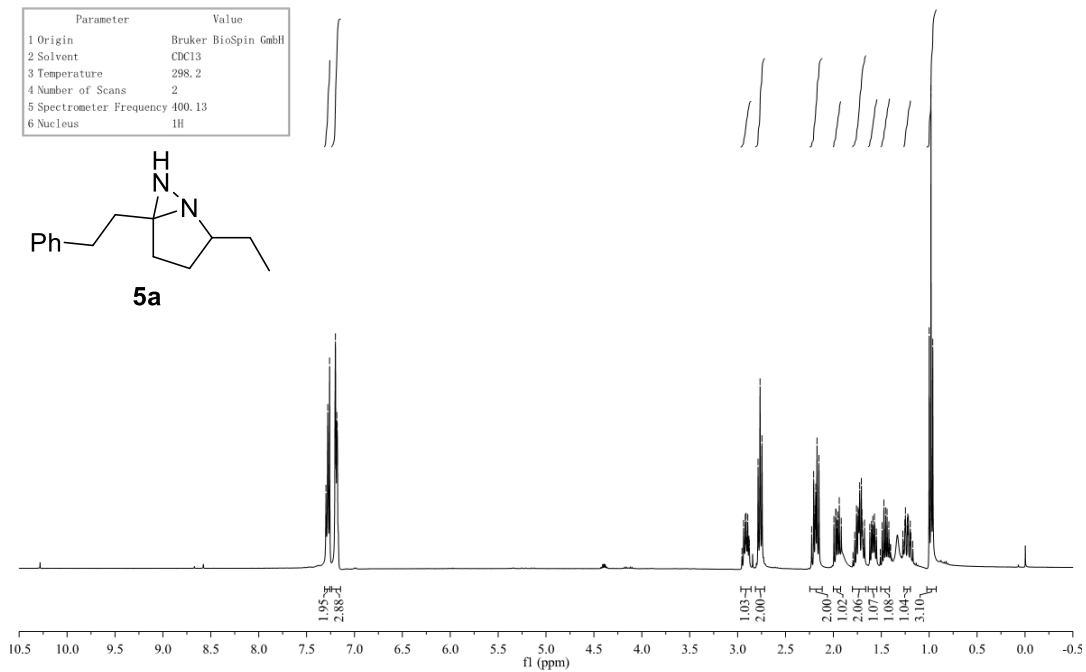
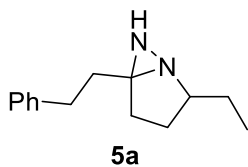


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	295.8
4 Number of Scans	2
5 Spectrometer Frequency	161.98
6 Nucleus	31P

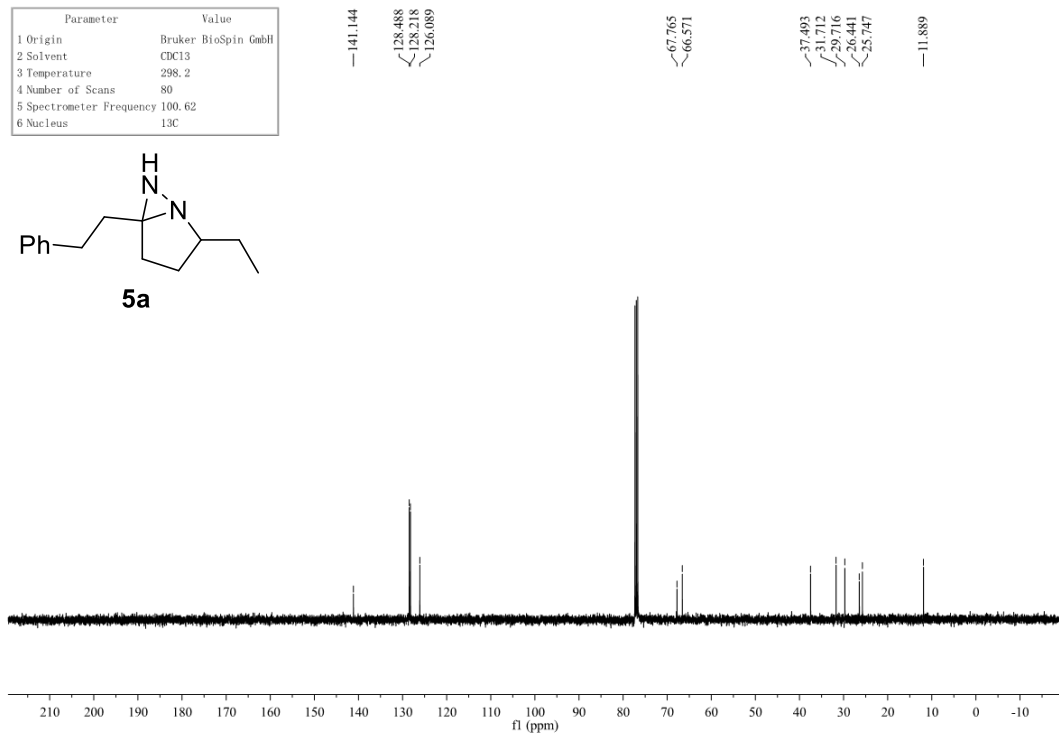
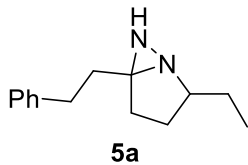


7.298
7.279
7.279
7.260
7.199
7.192
7.185
7.180
7.937
2.929
2.920
2.912
2.903
2.894
2.885
2.882
2.878
2.766
2.746
2.727
2.206
2.192
2.184
2.171
2.151
1.995
1.976
1.972
1.959
1.953
1.939
1.918
1.777
1.759
1.742
1.735
1.725
1.708
1.702
1.696
1.690
1.619
1.603
1.599
1.588
1.582
1.571
1.551
1.491
1.473
1.455
1.459
1.441
1.416
1.377
1.354
1.248
1.244
1.228
1.223
1.218
1.202
1.197
1.191
1.000
-0.982
-0.963

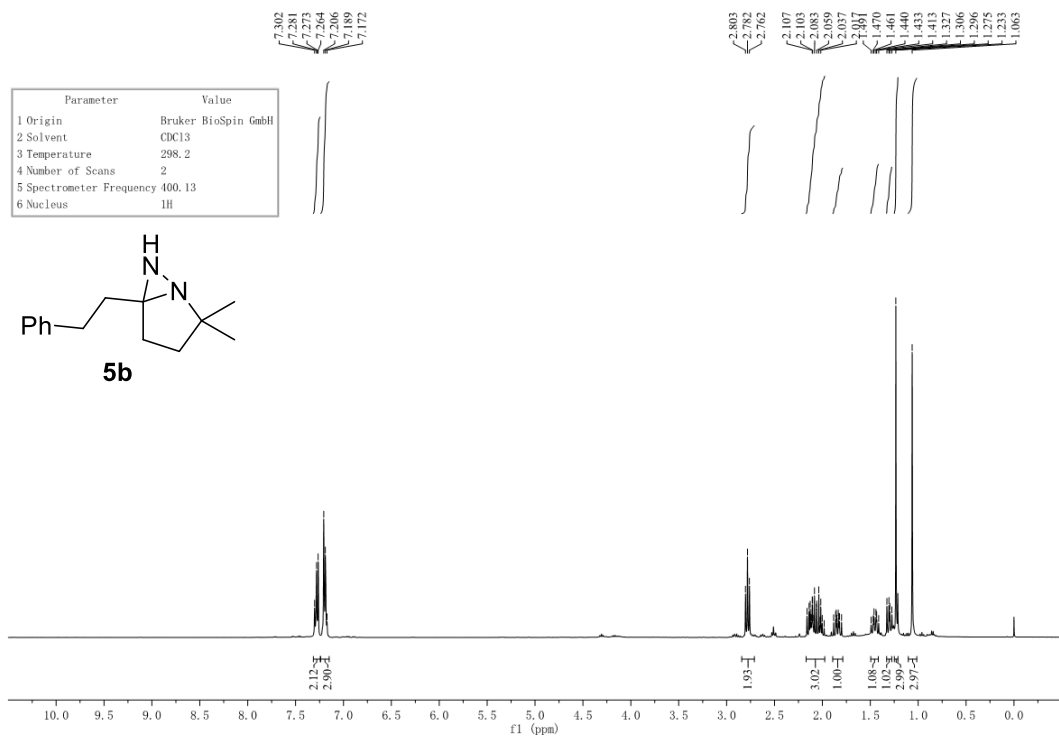
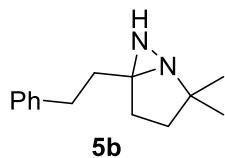
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H



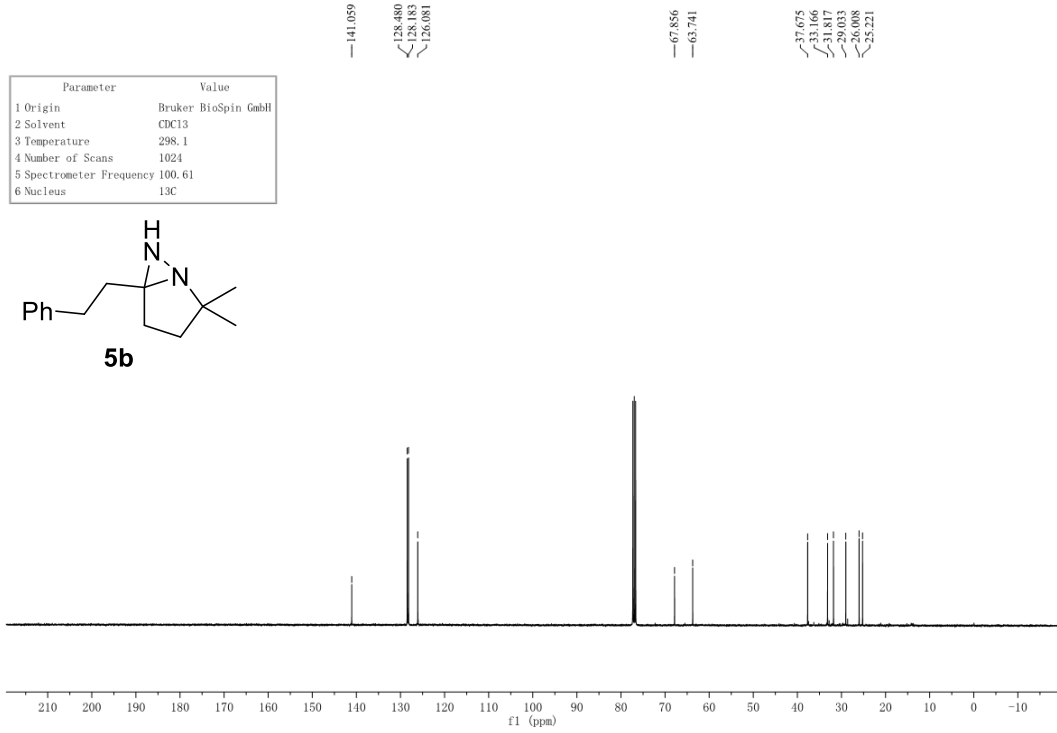
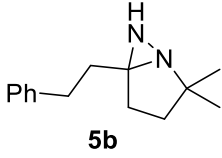
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C



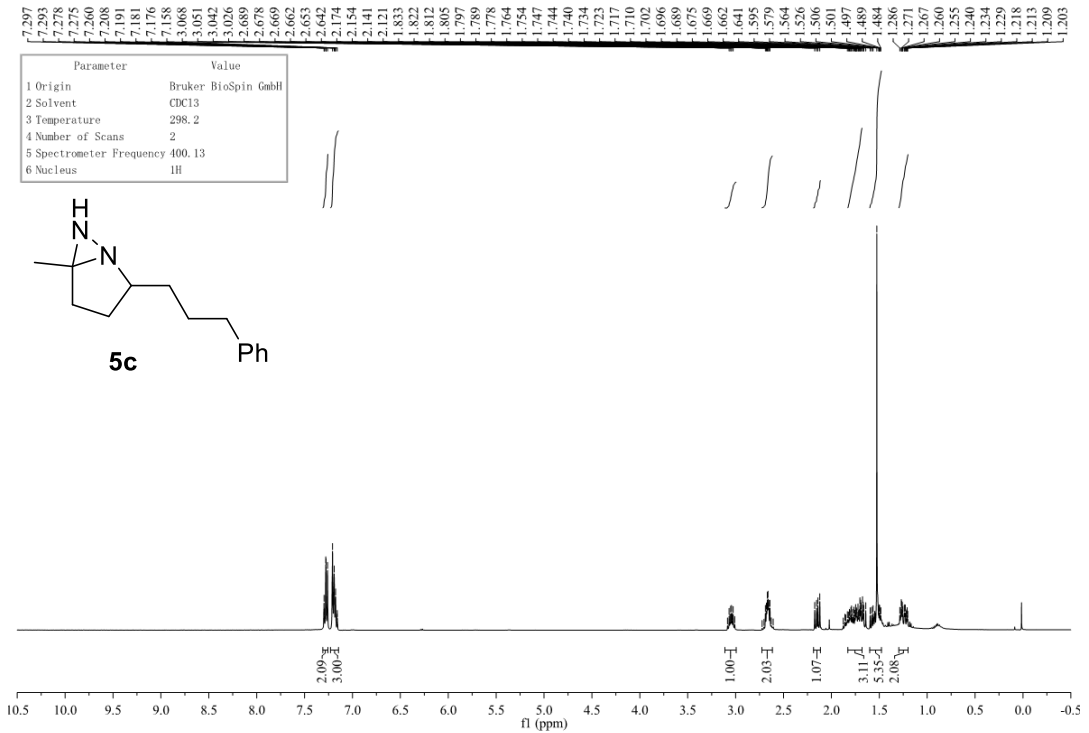
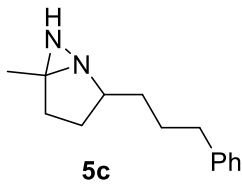
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H



Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	1024
5 Spectrometer Frequency	100.61
6 Nucleus	13C

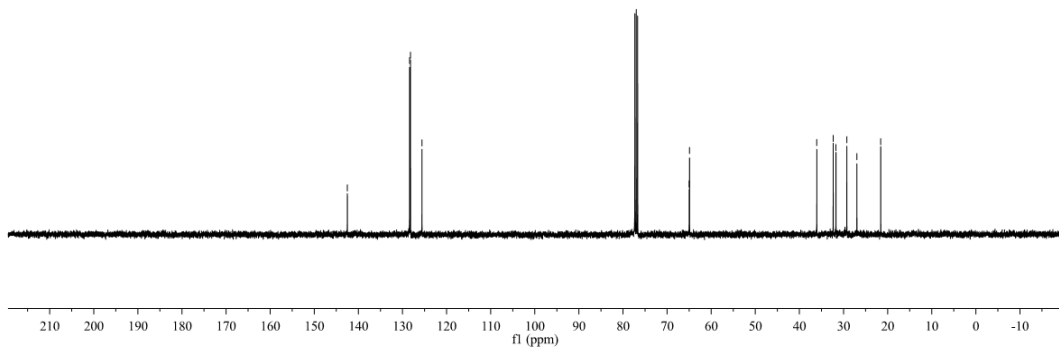
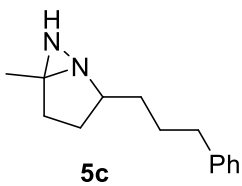


Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.2
4 Number of Scans	2
5 Spectrometer Frequency	400.13
6 Nucleus	1H



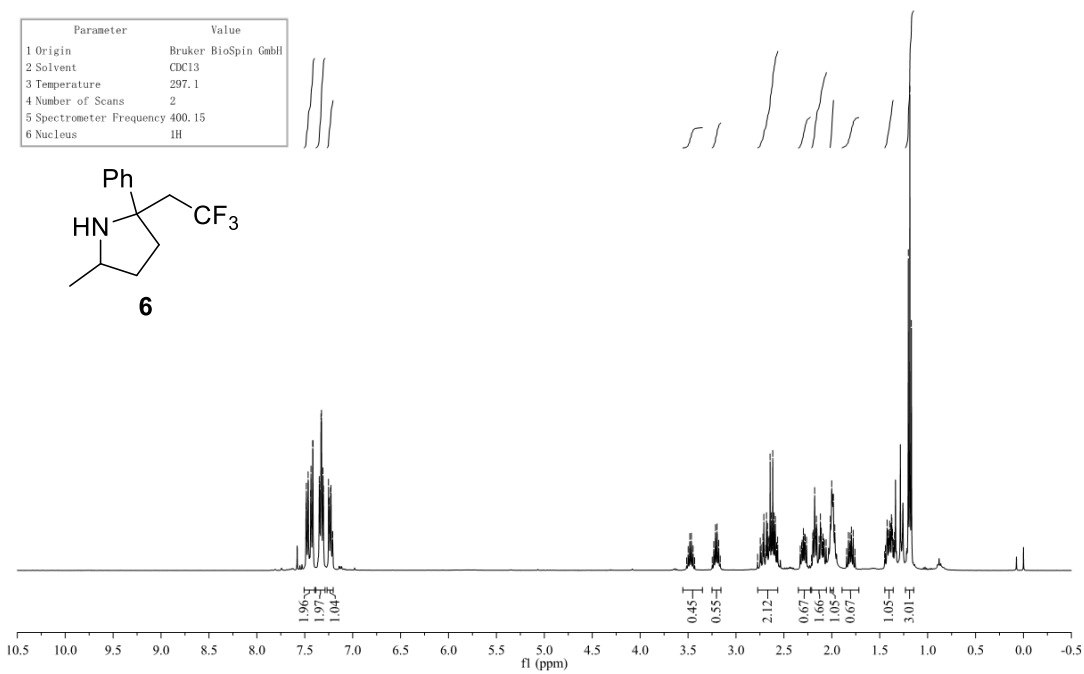
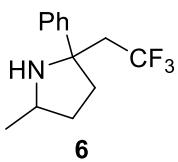
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	298.1
4 Number of Scans	80
5 Spectrometer Frequency	100.62
6 Nucleus	13C

142.503
 128.385
 128.186
 125.580
 65.002
 64.912
 36.062
 32.346
 31.719
 29.238
 26.979
 21.564



7.486
 7.483
 7.465
 7.438
 7.435
 7.416
 7.415
 7.348
 7.343
 7.330
 7.325
 7.309
 7.305
 7.252
 7.248
 7.245
 7.241
 7.230
 7.220
 7.211
 7.208
 3.481
 3.465
 3.214
 3.197
 2.719
 2.709
 2.681
 2.671
 2.653
 2.643
 2.629
 2.616
 2.602
 2.589
 2.297
 2.283
 2.278
 2.198
 2.192
 2.179
 2.171
 2.160
 2.132
 2.118
 2.109
 2.091
 2.015
 2.000
 1.987
 1.984
 1.968
 1.826
 1.808
 1.795
 1.775
 1.726
 1.423
 1.418
 1.409
 1.397
 1.386
 1.377
 1.373
 1.366
 1.346
 1.201
 1.185
 1.169

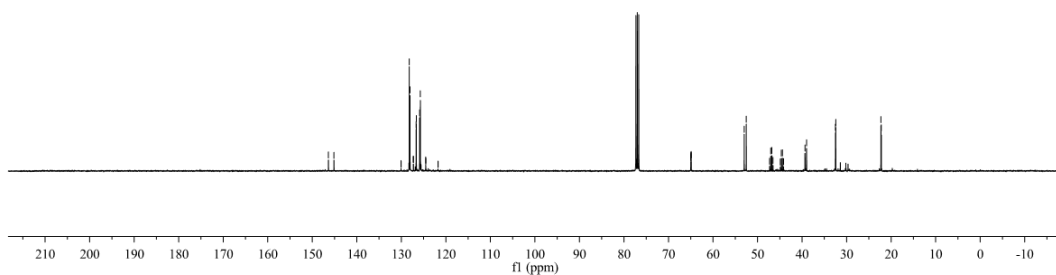
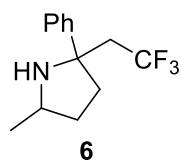
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.1
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H



Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.6
4 Number of Scans	1024
5 Spectrometer Frequency	100.62
6 Nucleus	13C

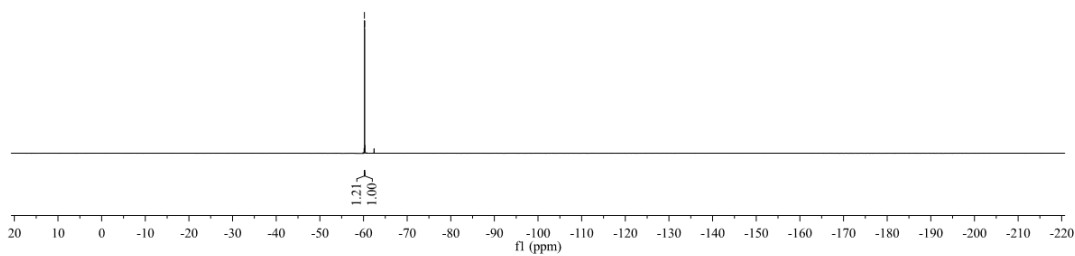
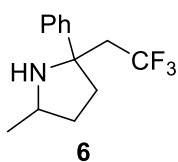
146.371
145.130
130.072
130.047
128.218
128.058
127.301
127.279
126.680
126.635
125.884
125.729
124.533
124.509
121.763
121.739

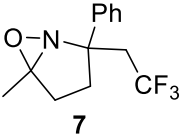
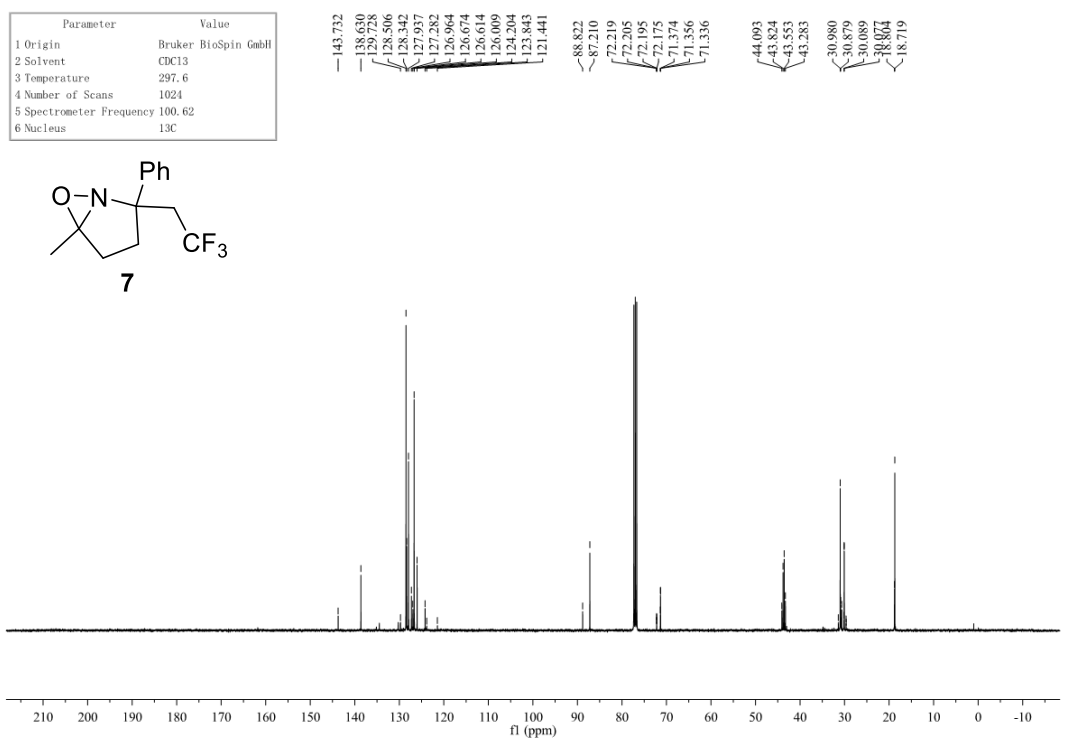
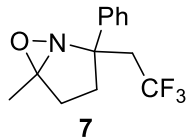
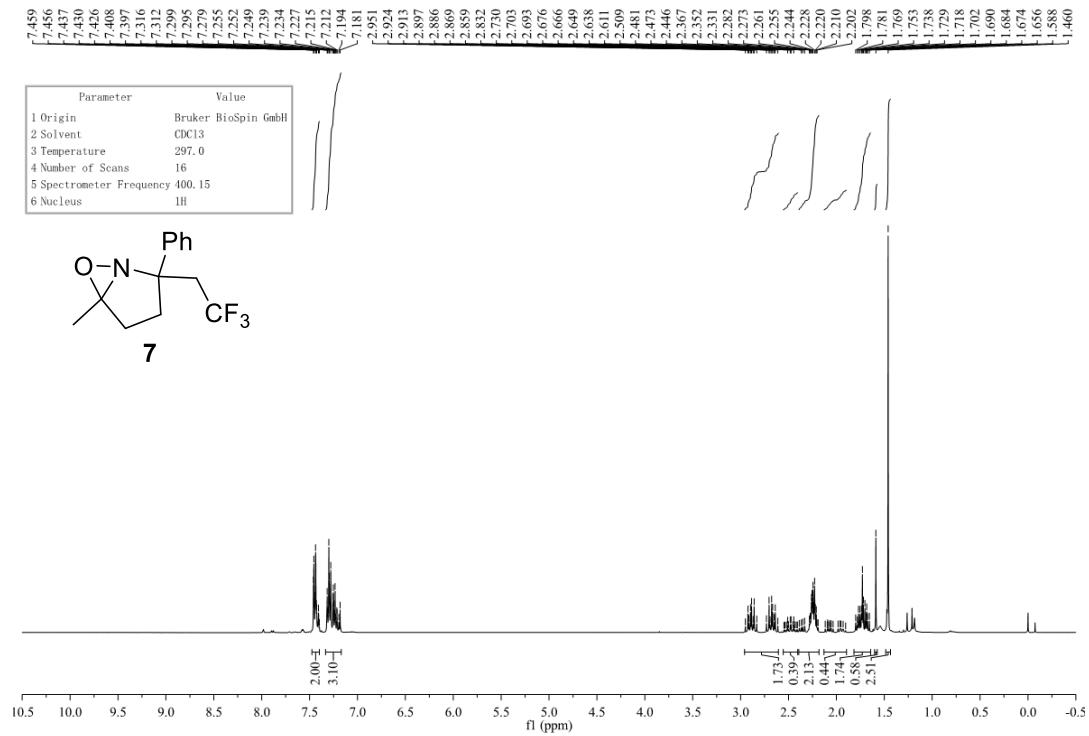
64.091
64.078
64.012
64.898
52.097
52.535
47.039
46.777
44.405
39.352
38.997
32.503
32.288
22.214



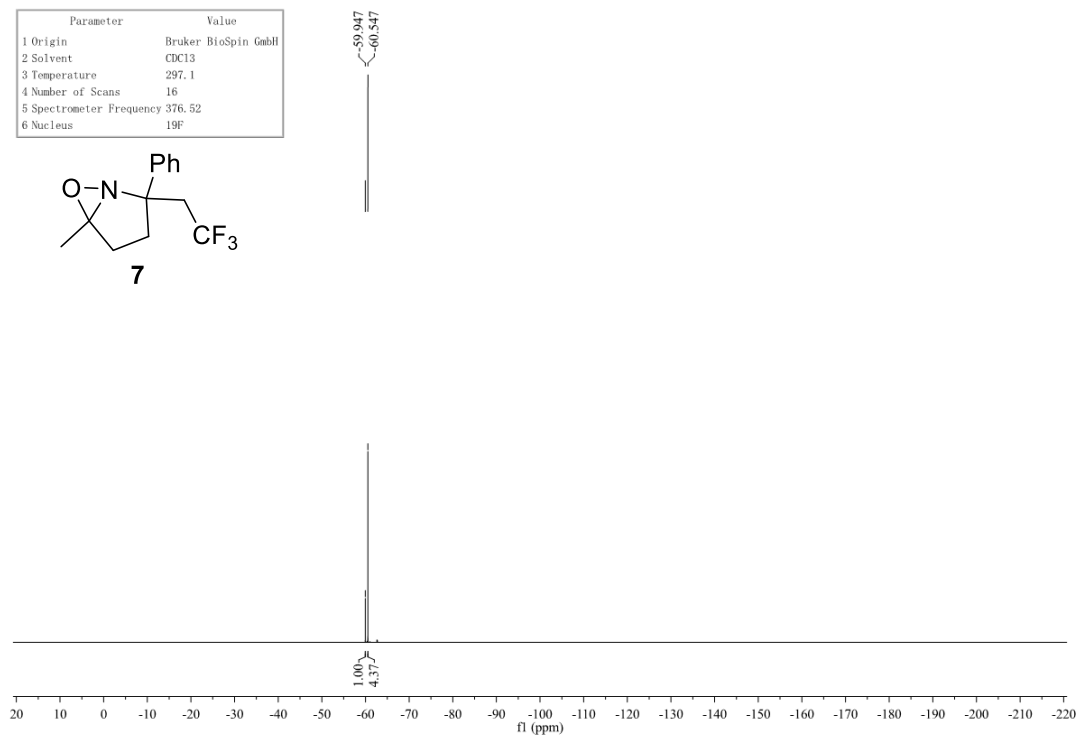
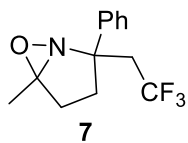
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.1
4 Number of Scans	2
5 Spectrometer Frequency	376.52
6 Nucleus	19F

60.227
60.275



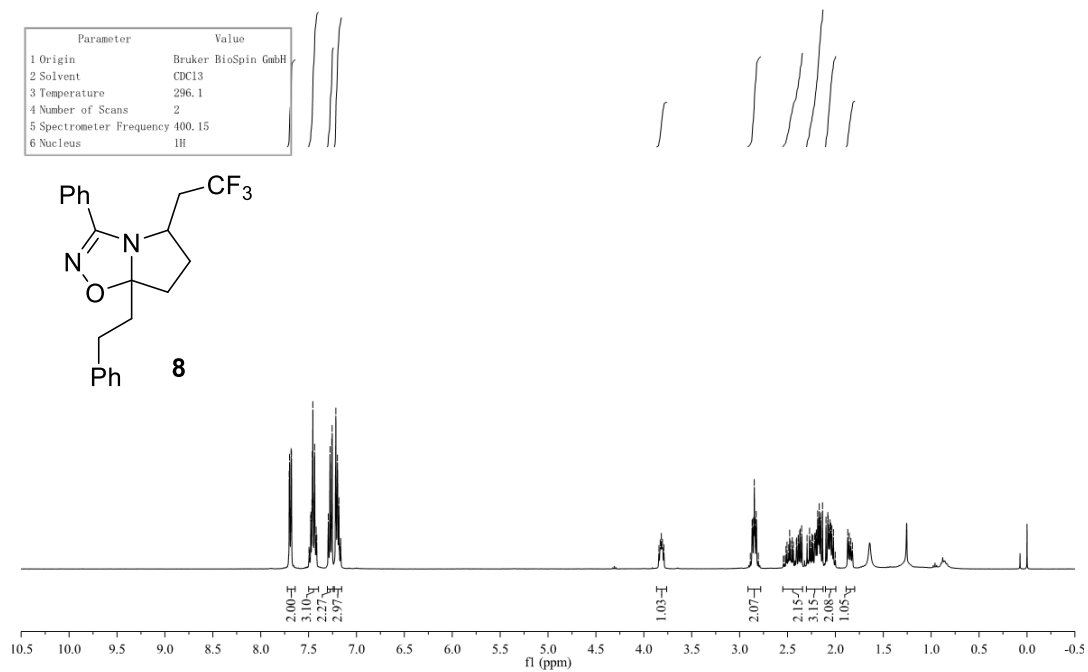
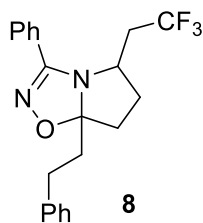


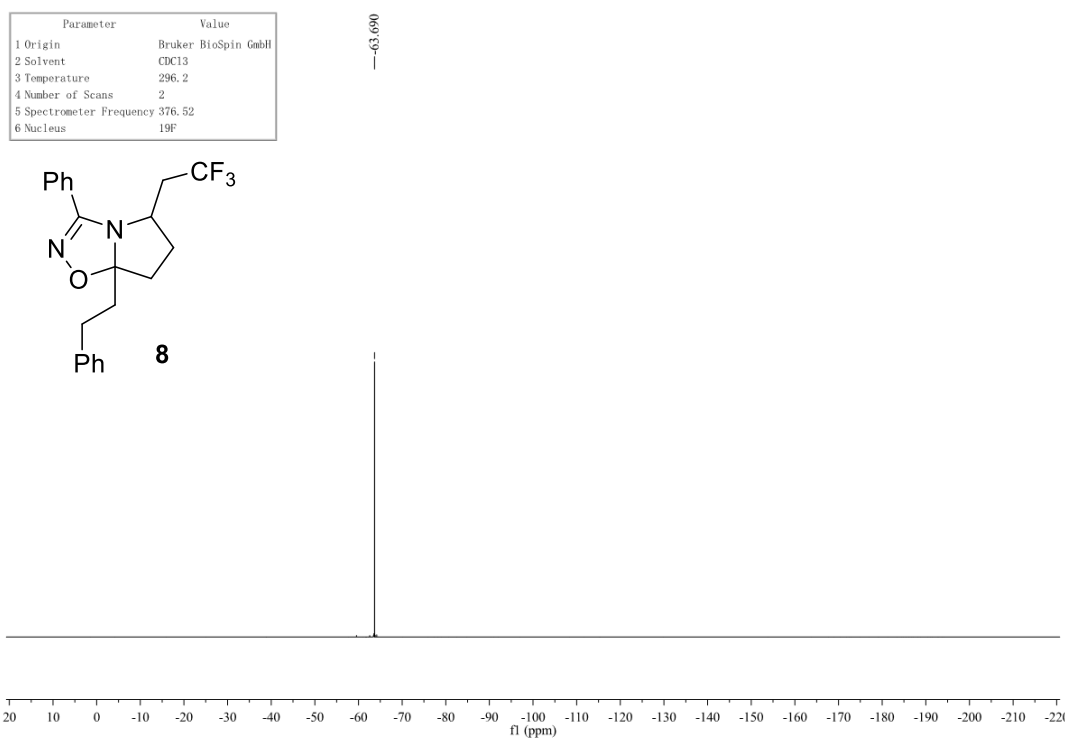
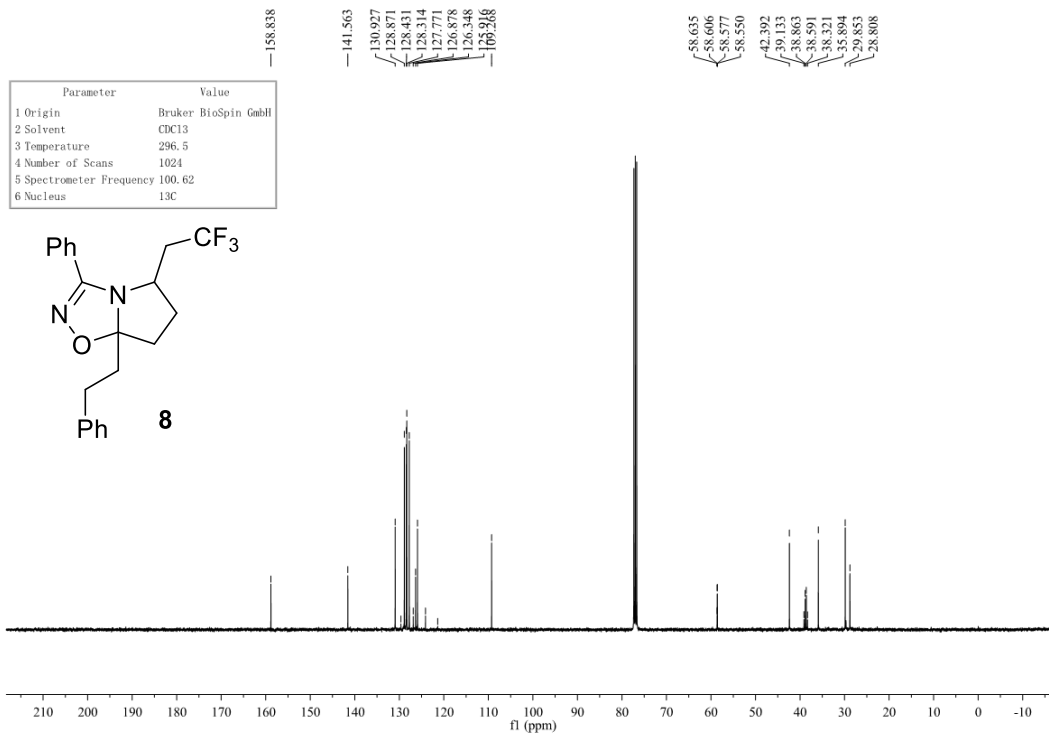
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.1
4 Number of Scans	16
5 Spectrometer Frequency	376.52
6 Nucleus	19F



7.702
7.699
7.695
7.688
7.683
7.678
7.477
7.476
7.469
7.464
7.460
7.455
7.451
7.443
7.440
7.437
7.431
7.415
7.396
7.376
7.262
7.258
7.254
7.216
7.198
7.188
7.183
3.817
2.870
2.865
2.854
2.847
2.839
2.839
2.827
2.477
2.450
2.403
2.388
2.384
2.372
2.368
2.353
2.295
2.270
2.245
2.233
2.216
2.211
2.208
2.199
2.196
2.185
2.181
2.166
2.162
2.152
2.152
2.134
2.098
2.079
2.075
2.063
2.056
2.048
2.037
2.021
1.871
1.855

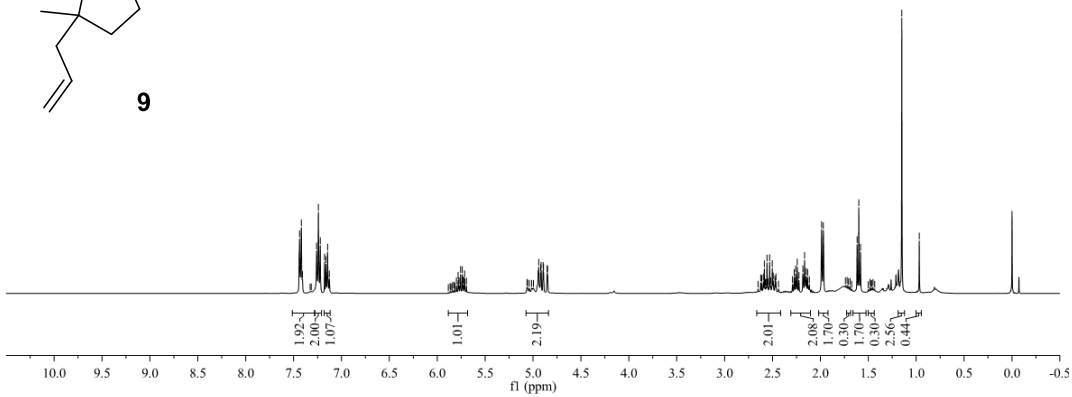
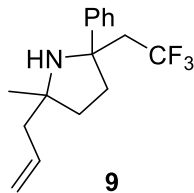
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.1
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H





7.438
7.419
7.408
7.260
7.241
7.222
7.177
7.163
7.145
7.127
5.800
5.782
5.775
5.763
5.757
5.739
5.732
5.714
5.714
5.696
5.663
5.087
4.941
4.920
4.915
4.895
4.891
4.852
4.848
2.623
2.613
2.596
2.586
2.575
2.568
2.558
2.548
2.530
2.520
2.503
2.492
2.475
2.470
2.465
2.291
2.274
2.258
2.241
2.224
2.183
2.165
2.148
2.134
2.114
1.987
1.969
1.739
1.721
1.707
1.690
1.617
1.599
1.581
1.482
1.464
1.451
1.150
0.968

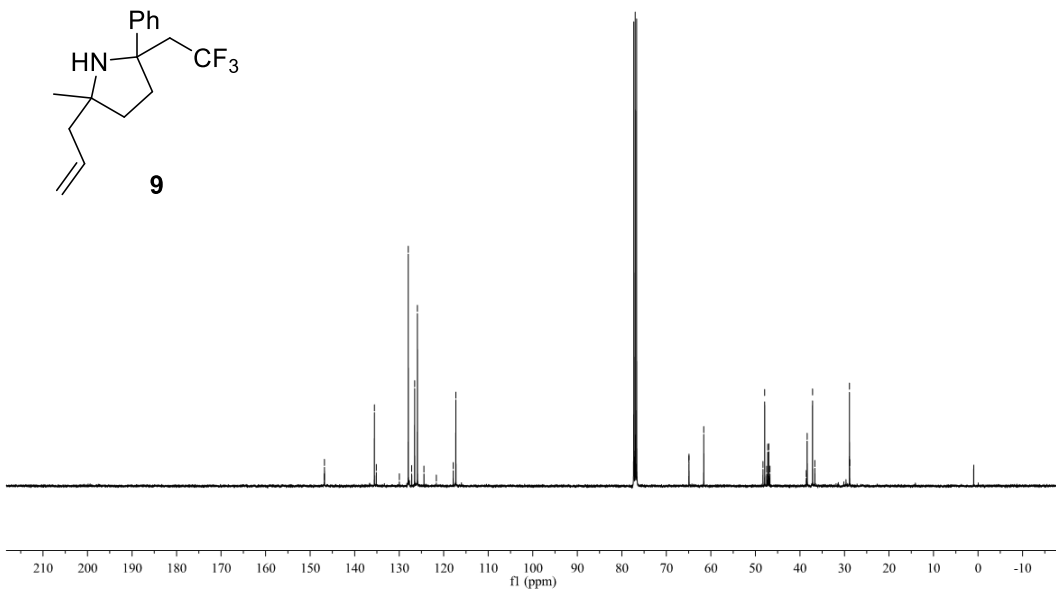
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.1
4 Number of Scans	2
5 Spectrometer Frequency	400.15
6 Nucleus	1H

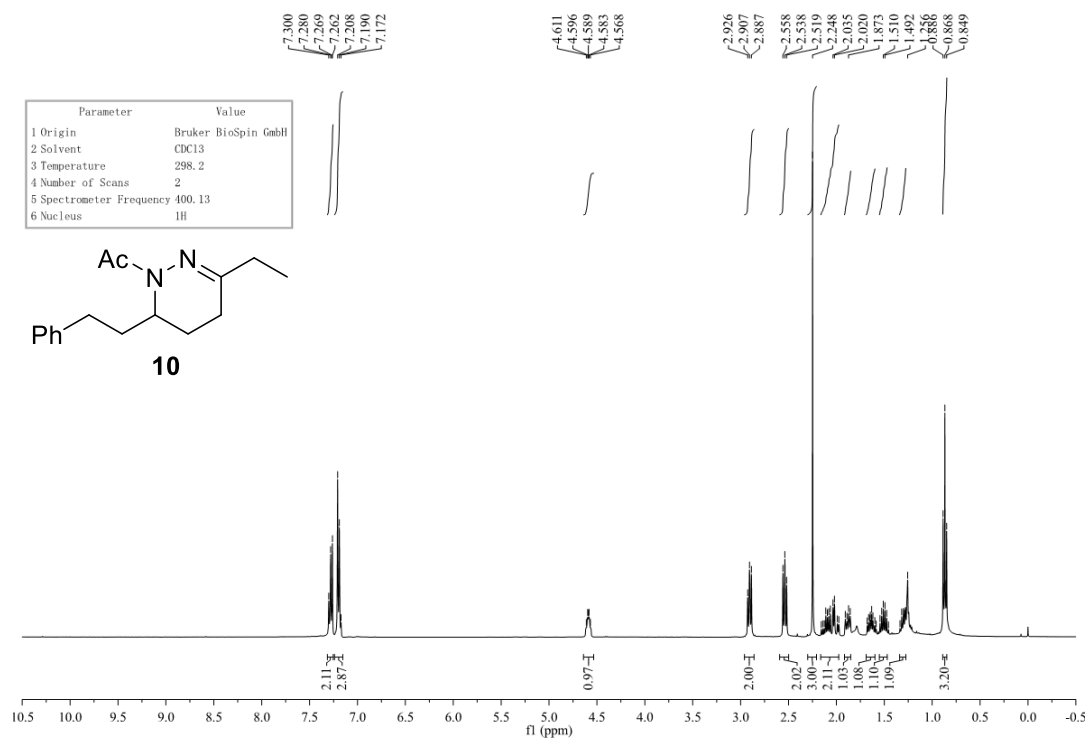
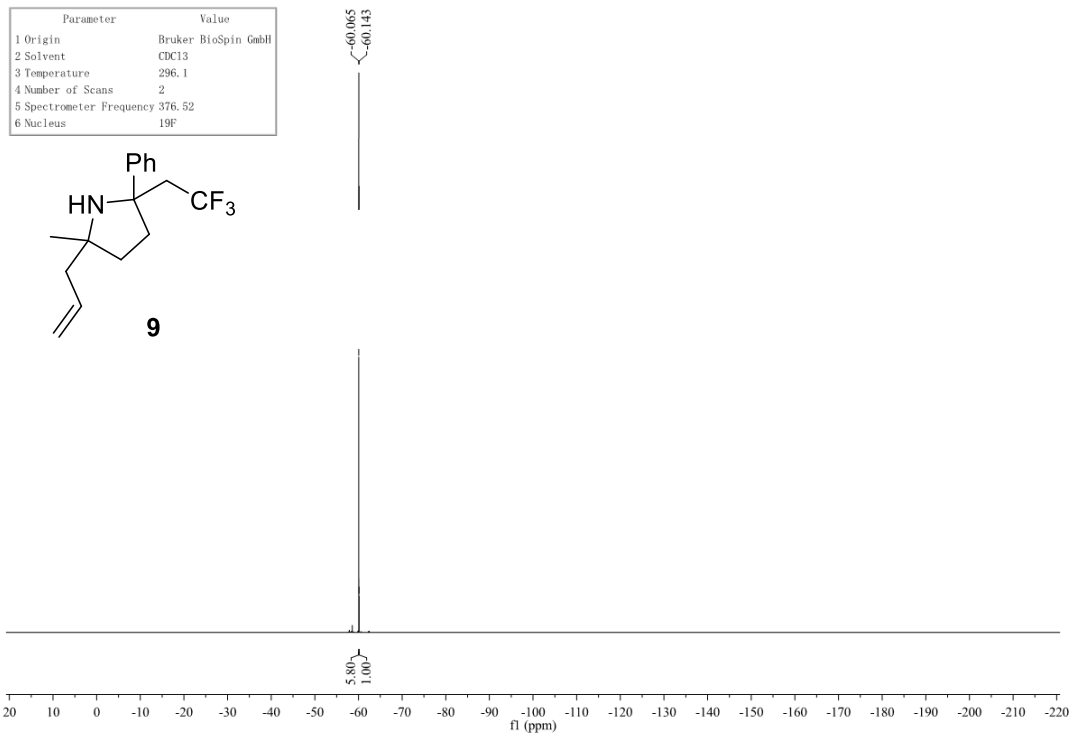


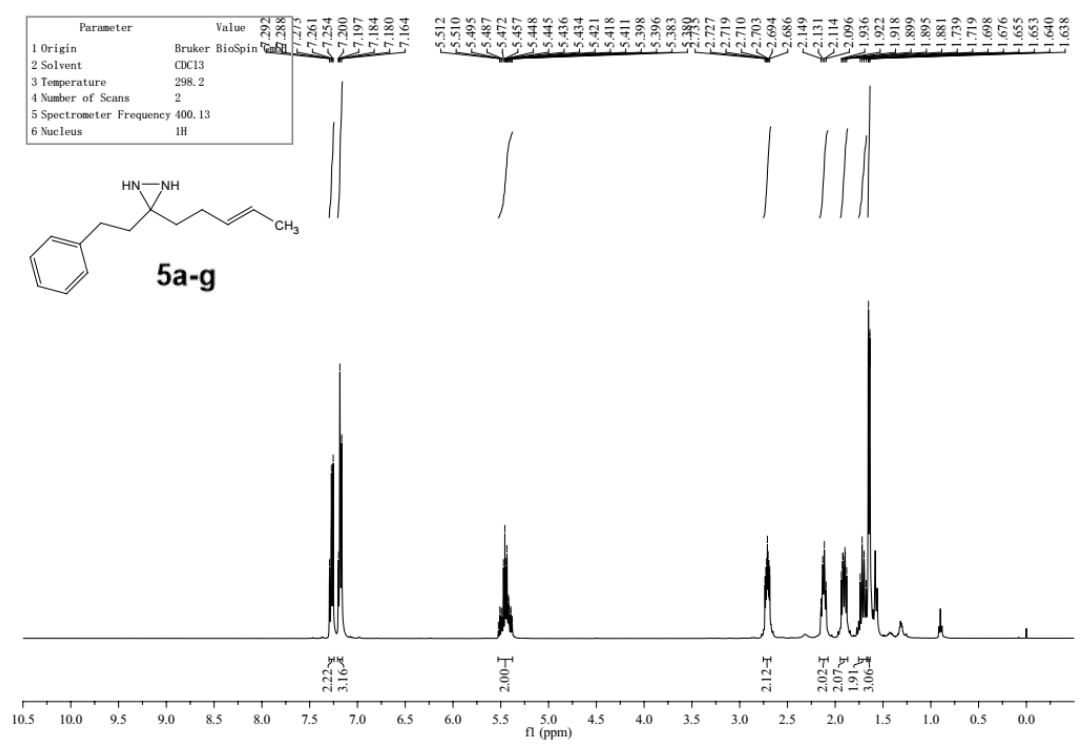
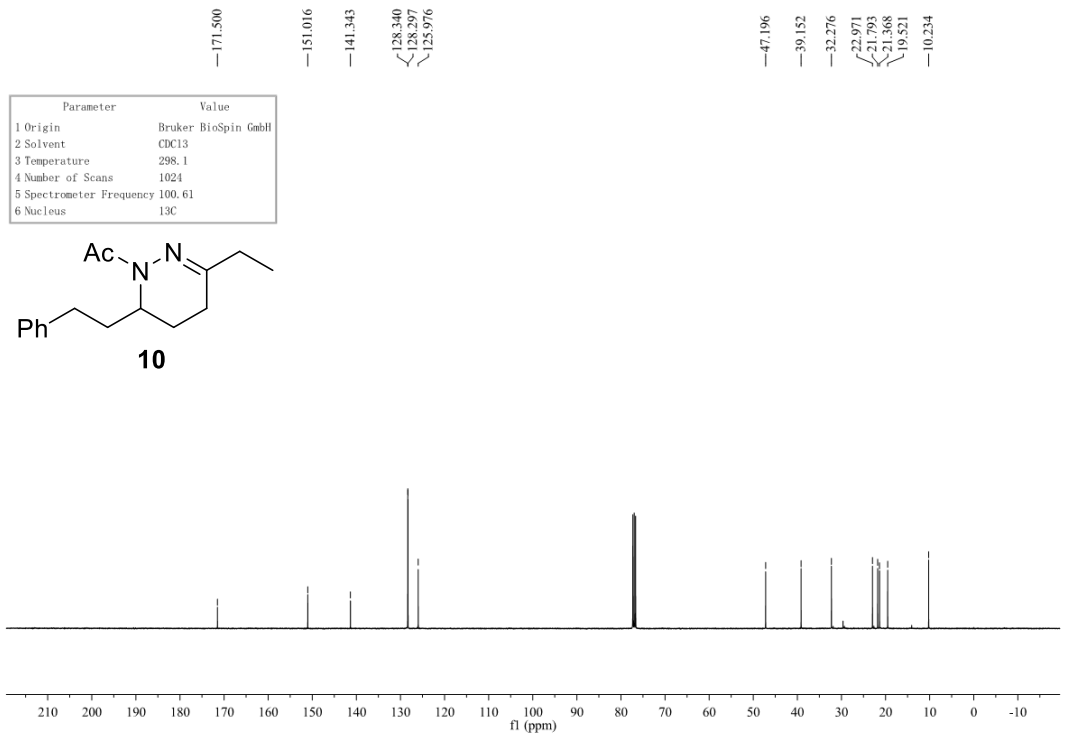
Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	296.8
4 Number of Scans	1024
5 Spectrometer Frequency	100.62
6 Nucleus	13C

146.843
146.785
135.576
135.144
129.973
127.964
127.203
126.527
125.912
124.452
121.661
117.866
117.283

64.938
64.927
61.597
48.309
47.916
47.233
46.988
38.385
37.693
28.877
28.829







Parameter	Value
1 Origin	Bruker BioSpin GmbH
2 Solvent	CDCl3
3 Temperature	297.2
4 Number of Scans	80
5 Spectrometer Frequency	100.61
6 Nucleus	13C

141.081
 129.904
 128.461
 128.142
 126.961
 125.870

57.301

38.073
 36.020
 30.938

27.762
 17.839

